**Network Clock Technical Specifications**

1. **Introduction**

The purpose to of this tender is to modernize the Network clock and synchronization solution.

MIC2 is seeking to obtain 2 new main Grand Master Clock providing NTP, clock and synchronization for all its current network elements in addition to cater for the 5G future network requirements.

1. **Main technical requirement**

2 new T-GM (Telecom Grand Master Clock) are to be provided, each collocated and connected with one P router, working in main and standby mode

The 2 locations where these 2 new T-GM will be located are referred to as main sites.

* The connection with the IPBB P routers is IP based connection; both IPv4 and IPv6 are needed.
* Additional connections such as E1, STM1, 2Mbps, 2 MHz and 10MHz are needed to integrate with all existing network elements and should be available with the proposed solution.
* Minimum of 5 GE ports per clock
* The connections with the P routers is over 1G SM (1310nm) ports
* The solution should be capable to serve all MIC2’s network elements:

In total, each clock should support a minimum of 4000 connected network elements.

In case the number of connected elements cannot be served by one clock, additional T-GM should be added to the solution; these additional T-GMs can be either collocated at the main sites or implemented at remote sites.

* Clock should support Inband management
* Both clocks should be of the same model and specifications.
* Each clock should have redundant controllers
* Each clock should have redundant power supply
* Should be mountable in a 19 inch rack
* The solution should be capable to serve all MIC2’s network elements including but not limited to:
  + All current and future 2G, 3G, LTE and 5G sites
  + All CS and PS Network Elements
  + All IT servers

### T-GM should support PTP G-8275.1 (Precision Time Protocol) and SyncE (Synchronous Ethernet) and NTP.

### Frequency, Time and Phase synchronization should be supported.

### Support 1588v2 and G8275.2

### Clock accuracy:

Time synchronization: +-1.5 us

Frequency synchronization: +-50 ppb

Phase sync ± 1.5 µs for 5G TDD

For 5G FDD with CPRI interfaces +-250µs accuracy and pktSel2wayTE < 125 µs

5G FDD with eCPRI interfaces and 5G TDD: ITU-T network limits ITU-T G.8271.1 for FTS/multicast and ITU-T G.8271.2 for PTS/unicast

At BTS input (backhaul Ethernet interface):16 ppb in frequency sync mode (ToP-F) if not used as time source, otherwise (phase sync mode) long-term FFO average value of zero with respect to UTC

* In addition to the GNSS input and Cesium input, the clock should be capable to take input from BITS clock, E1 clock, IEEE 1588V2 clock, synchronous Ethernet (SyncE) clock, 1PPS+TOD clock, IEEE 1588V2+SyncE clock
* Should support SNTP (Simple Network Time Protocol)
* Time sources need to be traceable to UTC
* Support at least one PTP unicast connections per BTS

### The provided clock should comply with Primary Reference Time Clock (PRTC) Class A (100 ns) and Class B (40 ns).

### The clock should be multi-band and multi-constellation:

### Each clock should be connected to 2 different GNSS (Global Navigation Satellite System): GPS as main and either GLONASS, [Galileo](https://www.google.com/search?sca_esv=8ce8be85696c52dc&rlz=1C1GCEU_enLB1012LB1012&cs=0&q=galileo&stick=H4sIAAAAAAAAAOMwVGI0jhJILyhWSMwpSS3KSyzJLEst_sUo4B4QjCrExBHv6hfiGRIZv4GF8RULpxC7u4-_n2Nw8CsWfi5e_XR9Q8N0g9ziJAtjw1csvELcjlWl6YkKbjmpqSUQ1Yk5mTmp-a9YWIWYgYa_YuEQYnNKzUzJL33FwifE45yTmlgUkFiSAZYDqgfrzMxHmJ5sXG5eXFhhBFbumVeSmpOTGZyRmQY0nluI0z83L7OkKDG5GKEhw7gsydi4vAJsXHBibnFiUSJCNi8-p9ywojAHIZJtbGSUlGEQv4iVPR3i2FtskgxuUmtjju7bP1fxk_XOBWIe0xeE3Ohvd1q4BwCSStIiOwEAAA&sa=X&ved=2ahUKEwiV5t-fkICFAxVITEEAHZcUAdsQ7fAIegUIABCCAQ) or BeiDou as redundant

### For the GPS, receiver should be capable to operate on L1, L2 and L5 bands

### The new GPS L1C Band should be supported whenever it’s broadcasted by 20 or more satellites

### Each clock should be equipped with an inbuilt oscillator along with a robust holdover.

### Additional external Cesium Atomic time and frequency reference clock source for each of the 2 T-GM, located at the main sites, in order to provide an alternative input in case the GNSS signal is lost.

### In case the provided solution required the implementation of remote T-GM to cater for the number for network elements, these additional locations does not require the presence of cesium clocks.

### The proposed clock solution should be capable of delivering clock reference for up to 40 days in case the GPS signal is lost.

### The clock should be equipped with anti-jam CPRA (Controlled Radiation Pattern) antennas to reject/attenuate false or overwhelming signals.

### Should support multiple clock output (2Mbps, 2MHz, 10MHz, 1GE,…)

### The clock should be equipped with a GNSS firewall for jamming and spoofing protection

### The clock or firewall should have an alarm and performance monitoring for the GPS reception quality and the generated clock quality

### The firewall should be equipped with a redundant power supply.

* Security (for all provided equipement):
* Security on management layer (Access Lists for controlling Access to the Appliance, Authentication to console via TACACS+ or RADIUS,…)
* AAA integration (Centralized management, Multiple Privilege Levels,…)
* All product and Software versions to be the latest.
* Guarantee of a minimum 6 years before reaching the end of support date.
* Only DC power supply is to be provided.
* Implementation, integration and service reshuffle from current equipment to the new clock should be included.

The service migration shall cover all connected and active network elements on the current devices

* Vendor shall ensure that the activities related to the scope of this RFP will have no impact on the current network traffic or customers experience.
* The Vendor is fully responsible to replace any damaged network devices that occurs during the dismantling/implementation process.
* Passive equipment along with their implementation (GPS antennas and their related cables, cabinets/racks, patch panels, patch cords, ODF,…) should be included
* Power cables, lugs, circuit breakers and cable trays should be included along with their implementation.
* Custom clearance should be fully handled by the clearance (DDP).
* The Vendor shall be responsible for providing the warehouse for the equipment to be installed throughout the complete project duration.
* The Vendor shall be responsible for delivering the equipment to site from their own warehouse.
* The PIP time line should be completed with the minimum amount of time taking into consideration the latest possible start and finish times for project activities, the uncertainties, the risks and assumptions (less than 6 months from PO issuance)
* The offer should include a responsibility matrix clearly splitting the role of the bidder and the operator. This matrix shall be reviewed and approved by MIC2.
* The vendor’s Implementation proposal should cover but not limited to the following: installation, dismantling, service migration, configuration, integration, interoperability…

noting that integration with the 5G entities should be done by the vendor as part of the same technical/commercial offer and contract and without any additional fees, whenever MIC2 5G network is ready

* In case it appeared, after the vendor solution deployment, that there are any missing features or requirements that are needed to ensure the adequate synch/clock/time functionality or requirements for a good functionality of MIC2’s existing network entities and future 5G entities, then the supplier needs to ensure without any additional expense such requirements to make sure that MIC2’s existing and future 5G network entities are getting the right and required clock/synch/time source for their optimal performance and QoE.
* Equipment delivery time shall be less than 90 days from PO issuance.
* Proposal includes satisfactory minimum number of resources with their qualifications & proposed organization structure during implementation and support, which is subject to MIC2 approval.
* Spare Parts Management:
  + In case the spares are managed by the vendor:

Vendor to insure hardware availability in Lebanon for all type of equipment and to handle the repair process

* In case the spares are managed by MIC2:

7% of the requested HW should be provided as spares and included in the BoQ, or to ensure at least 1 spare part is available for any HW that might cause impact on the service, whichever number is higher. The spares BoQ should be separate from the main BoQ

* Trainings for the proposed solution should be included in the offer (each course should be delivered in 2 sessions)
* Knowledge transfer and provide the appropriate training program to have MIC2 engineers acquiring the needed knowledge and expertise and receiving the relevant hands-on knowledge transfer
* Optional solutions, products and services are not accepted.

Vendor needs to present his one and best solution for the requested requirement.

1. **Management System**

* The vendor needs to include all NMS requirements in his solution and offer covering FM, PM, CM, inventory, security, account management, system diagnostics, software management, and administration parts along with the necessary NBI licenses and features in addition to MML automated commands and inventory features
* Virtual servers are highly recommended, vendor will supply all needed requirements (licenses, SW) to host the solution in Touch’s virtual environment.

Note that the preferable virtual environment is based on Openstack.

In case the needed virtual resources cannot be accommodated by our current platforms, then dedicated servers need to be delivered for this solution.

* Integration with Touch’s Active Directory.
* Various KPI measurement such as GNSS received level, number of connected satellites, clock source status, alarms history storage up to 3 months

1. **Support, SLAs and KPIs:**

* 4 years support for all above new HW/SW. The warranty period starts after signing the PAC for both sites.
* Support coverage is 24 hours a day, 7 Days a week including holidays
* Local support team available in Lebanon ready for immediate site intervention if needed.
* Health check Assessment: to audit all configuration changes that occurred on the network and validate it with best practices, Health check to be conducted twice per year.
* All software patch/updates/releases/upgrades should be included, delivered and installed once available during the support period.
* On-site visits (environmental check and preventive maintenance to be conducted twice a year)
  + System availability time [%] >99.999%
  + For P1 (Critical/Emergency) incidents, response time 1 hour, restoration time 3 hours, and resolution time 6 hours
  + For P2 (Major) incidents, response time 3 hour, restoration time 6 hours, and resolution time 24 hours
  + For P3 (Non Service Impacting) incidents, restoration time 24 hours, and resolution time 5 calendar days

1. **Documentation**

The documentation shall include the following items:

* High level design solution description covering the implementation and the migration procedure
* Vendor should propose standard acceptance procedures for the offered solution, to be reviewed and validated by MIC2.
* Detailed Service Connectivity Matrix, needed for the service reshuffling shall be delivered only to the winner of the RFP.

This Matrix shall be built by the winner of the RFP following site surveys and configuration files exported from the current clock systems.

* Layout showing the used ports along with the card types inserted in every slot. Layout should also show the remaining number of empty ports or slots.
* Data sheets, technical specifications and manuals.
* Roadmap for both Hardware and Software
* List of all the features and licenses supported by the hardware and highlighting which are included in the offer
* Qualifications (CV) & proposed organization structure during implementation and support.
* The winner of the RFP shall present detailed planning documents and low level implementation and migration solution documents during the preparation period and before the start of implementation.
* The winner of the RFP, and following the site surveys should present:
  + Floor layout showing the location of the new equipment racks in each site
  + Power consumption per site
  + Heat Dissipation per site

1. **References**

* Bidder should mention references for the deployment of the proposed solution in a renowned mobile operator environment with live 4G and 5G network. Minimum 3 references.
* Bidder should have at least 3 years of experience in the deployment, operation and maintenance of a renowned mobile operator network clock.
* Details of the reference need to be provided: Operator, Country, implemented equipment models and date of implementation.