Ref. Ares(2024)4017554 - 04/06/2024

ANNEX II + III: TECHNICAL SPECIFICATIONS + TECHNICAL OFFER

Contract title: Supply of Equipment for Mersin ITS SAP **p 1 /…**
Publication reference: EC-NEAR/ANK/2024/EA-OP/0047

Columns 1-2 should be completed by the contracting authority
Columns 3-4 should be completed by the tenderer
Column 5 is reserved for the evaluation committee
Annex III - the contractor's technical offer
The tenderers are requested to complete the template on the next pages:

- Column 2 is completed by the contracting authority shows the required specifications (not to be modified by the tenderer),
- Column 3 is to be filled in by the tenderer and must detail what is offered (for example the words ‘compliant’ or ‘yes’ are not sufficient)
- Column 4 allows the tenderer to make comments on its proposed supply and to make eventual references to the documentation

The eventual documentation supplied should clearly indicate (highlight, mark) the models offered and the options included, if any, so that the evaluators can see the exact configuration. Offers that do not permit to identify precisely the models and the specifications may be rejected by the evaluation committee.
The offer must be clear enough to allow the evaluators to make an easy comparison between the requested specifications and the offered specifications.
The Tenderer should avoid copying the specifications required from Column 2 to specifications offered in Column 3. Column 3 shall be filled by the Tenderer with the exact/real specification for the offered supplies.
Each offered supplies must be stated with brand / product name, product version and product/part number. The tenderer shall identify model and manufacturer of each individual item in their technical offer. Offers that do not permit to identify clearly and precisely the existence of the items with all the proof documents and/or certifications requested through this annex may be rejected by the evaluation committee.

Abbreviations

ABS	Anti-Lock Braking System
ASR	Acceleration Slip Regulation
CMOS sensor	Complementary metal–oxide–semiconductor, the active-pixel sensor
EBS	Electronic braking system
EC	European Commission
ECE	Economic Commission of European
ERA	End Recipient of Assistance- Mersin Metropolitan Municipality
EU	European Union
FOV	Field of view
HVAC	Heating Ventilation Air Conditioning
IEC	International Electro technical Commission
IP	Internet Protocol
ISO	International Standards Organization
IT	Information Technology
KM	Kilo Meter
KPI	Key Performance Indicator
KW	Kilo Watt
KWH	Kilo Watt Hour
Lux	Illuminance
M	Meter
MB	Megabyte
Mm	Millimeter
MMM	Mersin Metropolitan Municipality
Nm	Newton Meter
PVC	Polyvinyl Chloride
SORT	Standardized On Road Test
TS	Turkish Standards
UNECE	United Nations Economic Commission of Europe
V	Volts
VFOV	Vertical field of view

1. General Requirements

1.1. Offered supplies must be provided complete with necessary accessories and/or parts to ensure that the supplied items can operate to required technical and quality specifications.

1.2. The contractor is fully responsible for proper connections of supplied items to existing infrastructure for smooth installation and operation.

1.3. The type of voltage in Türkiye is 220 V (mono phase) and 380 V (tri phase + neutral). All hardware must be suitable or adapted for direct connection to the standard power outlets in Türkiye. The type of electrical outlets generally installed in Türkiye is the type with 2 side mounted earthing poles (EUROPLUG). All plugs of all goods will have to fit exactly. The contractor shall evaluate the supplied current, the quality of the current and the fluctuations of the current and take the necessary precautions to avoid damage to the equipment.

1.4. The supplies must be compliant with CE standards. Wherever reference is made in the technical specifications to specific standards and codes to be met, provisions of the latest edition or revision of the relevant standards in effect, shall apply, unless otherwise stated in this technical specification.

1.5. The supplies should comply with the regulations concerning safe operation, energy saving and environmental safety, in line with the policies or the practical measures in use within the European Union (EU) and Türkiye.

1.6. During the installation of supplied items, the contractor will be responsible for providing measures for any Health & Safety risks associated with supplies provided.

1.7. For Lot 3 – Electric Bus and Charging station;

system components and whole system must be compatible with each other "as a whole". Any compatibility problems between items must be resolved by the contractor at no additional cost to Mersin Metropolitan Municipality (MMM) and the Contracting Authority.

1.8. All offered supplies must be suitable for operation in climatic conditions in place of delivery (please refer to "Draft Contract and Special Conditions, including annexes").

2. Technical Documents to be provided during the implementation period

2.1. Please refer to Article 14 of Special Conditions of the Contract.

2.2. Please refer to Article 31 of Special Conditions of the Contract for obligatory documents needed for the Provisional Acceptance.

3. Installation and Commissioning Requirements

3.1. Please refer to the Article 25 of Special Conditions of the Contract.

3.2. The contractor shall make available all tools, materials and equipment required for transport, assembling, installation and commissioning.

3.3. The contractor shall provide all tools and equipment needed for testing of supplies.

3.4. The contractor shall perform starting-up, installation and commissioning of the supplies by trained and authorized personnel in accordance with Article 29 of Special Conditions.

3.5. Consumptions on site during the installation and commissioning shall be borne by the contractor.

3.6. Subscription for all utility connections such as internet, electricity, water, etc. to relevant authorities shall be under a responsibility of MMM.

3.7. Full assembly and complementary engineering related to the installation and put into operation will be borne by the contractor including integration of other software / hardware (already existing or to be procured under this operation).

Connection to main electrical, mechanical, water, air and/or gas supplies from the equipment to the existing infrastructure shall be done according to the rules and regulations of Türkiye. Recovering any damage to building structure that may occur during the installation of goods is under the responsibility of the contractor.

3.8. Any other components which are not explicitly mentioned under Lot 1, Lot 2 and Lot 3 but required for fully functioning of the system shall be provided by the contractor during installation and commissioning.

3.9. All software must be delivered in electronic version. All software must be licensed to MMM.

3.10. All data shall be stored in Türkiye in accordance with Presidential Decree No:2019/12 published on 30823 numbered, 06.07.2019 dated Official Gazette. All the user data entered, collected, or produced shall be the sole property and under ownership of MMM.

4. Health and Safety

4.1. The contractor shall be fully responsible for applying the Health and Safety procedures in accordance with the legislation published by Republic of Türkiye, Ministry of Labor and Social Security during the manufacturing, delivering, assembling, installation, commissioning and testing. Moreover, the contractor shall be responsible for advising MMM and the Contracting Authority of any Health and Safety risks associated with supplies provided and suitable protective measures.

4.2. Supplies shall be designed to operate safely taking into account the characteristics of the terrain and its surroundings, atmospheric and meteorological conditions, any possible structures, and obstacles located in the vicinity either on the ground or in the air in such a way as to cause no nuisance or pose no danger under operation or servicing conditions or in the event of an operation to rescue persons.

5. Training Requirements

5.1. Following installation and commissioning of supplies, the contractor shall provide trainings for MMM staff.

5.2. The tenderers shall include in their offer a training plan according to requirements in this Technical Specifications (duration, topics provided in tables hereunder are requested as minimum). The contractor (if required) may extend training durations and topics covered.

5.3. Trainings shall be realized in Turkish or English with simultaneous translation when necessary.

5.4. Trainings shall be provided by qualified instructors.

5.5. All necessary accessories, materials and documentation for the trainings shall be provided by the contractor.

5.6. Unless otherwise required, trainings shall be realized in MMM facilities.

5.7. The trainings shall be recorded by the contractor and provided as a separate media to MMM for future use.

Lot No.		Min. no. of training days	Max. no. of participants	Content of the trainings
Lot 1	IT Equipment & Software	3	10	For both Lots: Trainings shall include theoretical training and applied training. The trainings shall cover topics including but not limited to: • Overview and terminology; • Basic usage training; • Maintenance and troubleshooting; • User interface and software; • Health and safety requirements.
Lot 2	Traffic Management System Equipment	2	10	
Lot 3	Electric Bus and Charging station	10	200	The contractor shall organize theoretical and practical training sessions, in the designated locations and times determined by MMM, with the presence of authorized technical personnel. The contractor shall provide the following trainings to 200 participants: • Driver Training: 3 (three) days • Vehicle Tracking Interface Training: 2 (two) days • Technical Training: 5 (five) days (training content is provided below) + post-training competence assessment and certification shall be conducted. • Training on technical specifications of all equipment related to the vehicle (transmission components, bodywork, air conditioning, battery, charging, route indicator, etc.) • Introduction of all systems related to the vehicle (electrical, electronic, hydraulic, pneumatic, etc.) • The training on charging units and their usage shall be provided immediately before the Provisional Acceptance. • Practical application of necessary tests and adjustments. • Teaching methods for monitoring, identifying, and resolving malfunctions. • Theoretical and practical training on repair, maintenance, and troubleshooting of charging equipment. "Driver Training" and "Vehicle Tracking Interface Training" shall be provided prior to the Provisional Acceptance. The maintenance and repair training shall be conducted within a program determined by MMM and communicated to the contractor.

				The contractor shall ensure the presence of an interpreter with sufficient technical knowledge and experience if the training is conducted by foreign instructors. During the training sessions, the responsibility for any kind of malfunction or damage that may occur on the vehicle shall lie with the contractor. The contractor shall bear all expenses related to these training sessions, including travel, accommodation, meals, and fees.

6. Warranty requirements

6.1. Please refer to Article 32 and Article 33 of Special and General Conditions of the Contract and Warranty Regulation of Turkish Law as published on Official Gazette no.29029 dated 13.06.2014.

6.2. Only original or approved by the manufacturer(s) spare parts should be used in any repair service.

6.3. For all Lots the tenderer shall provide a list of spare parts for informative purposes only.

LOT 1 – IT Equipment & Software

Lot 1 will contribute to achieving the Implementation of "**Mersin Sustainable and Resilient Intelligent Transport Systems (ITS) Strategy and Action Plan 2035 (Mersin ITS SAP)"** by upgrading and supplying the necessary hardware and software systems in accordance with Mersin Transport Master Plan (MTMP) and as identified by the collective analyses and prior works of the Transportation and IT Departments of MMM earlier. IT equipment and software will be deployed in the Traffic Control Management Room. All items will be allocated for the Traffic Management and monitoring platform including Public Transportation Systems Software, and all associated software applications.
Lot 1 will provide the following main upgrades/novelties and benefits, particularly in terms of public transportation:

- Reliability and High Availability
- Performance Optimization
- Security and Data Protection
- Scalability and Flexibility
- Operational Management
- Automation and Orchestration
- Backup Management
- Data Storage

Consisting of:

- Item 1.1 - Server;
- Item 1.2 - Storage;
- Item 1.3 - Spine switch;
- Item 1.4 - San switch;
- Item 1.5 - Tor switch;
- Item 1.6 - Log Management and Correlation Software (SIEM);
- Item 1.7 - Next Generation Firewall;
- Item 1.8 - Advanced Load Balancing (Load Balancer), Advanced Web Application Firewall (WAF).

1. Item number	2. Specifications required	3. Specifications offered	4. Notes, remarks, ref to documentation	5. Evaluation committee's notes
1.1	**Server**			

1. Item number	2. Specifications required	3. Specifications offered	4. Notes, remarks, ref to documentation	5. Evaluation committee's notes
	Manufacturer's name; product model/type:			
	Country of origin:			
	Quantity: 16			
1.1.1	The server shall be rack type.			
1.1.2	The central processing units of the server shall be able to run on 64-bit architecture.			
1.1.3	The server shall have at least 2 physical processor sockets.			
1.1.4	The server shall have 2 Intel Gold or equivalent processors with minimum working speed of 2.2 GHz.			
1.1.5	Each processor shall have at least 32 cores.			
1.1.6	Each processor shall have at least 39MB L3 cache memory.			
1.1.7	The server shall have minimum 1024 GB DDR4 or RAM, with minimum 3200MT/s speed.			
1.1.8	The server shall support ECC, Patrol Scrubbing and Demand features.			
1.1.9	The server shall have at least 32 memory slots.			
1.1.10	The server shall support the following as minimum; • 8x2.5" disks, • The main board shall have SAS/SATA and NVMe support,			

1. Item number	2. Specifications required	3. Specifications offered	4. Notes, remarks, ref to documentation	5. Evaluation committee's notes
	• 22x 2.5" hot-swap hybrid NVMe/ SATA / SAS drive bays and 2x2.5" hot-swap SATA/SAS drive bays.			
1.1.11	The server shall have at least 2 hard drives of 2.5" SSD type, each with minimum capacity of 480GB. NVME (Non-Volatile Memory Express) disks shall be hot-swappable.			
1.1.12	The server shall have SAS RAID controller with minimum 8 GB cache memory and 12Gb/s speed with flash protection as minimum. RAID controller shall support RAID1/10/5/6/60 and able to control the highest number of disks the main board supports.			
1.1.13	The server shall have 2x1Gbit RJ45 ethernet ports as minimum. Ethernet cards shall be onboard.			
1.1.14	The server shall have 2x10 Gbit ethernet port with 10Gbit-SR SFP+ optics as minimum.			
1.1.15	The server shall support 1Gbit RJ45 standard interface for remote access and management port as minimum.			
1.1.16	The server shall have 2 FC HBAs as minimum, each with a single port and a speed of 32Gbps as minimum.			
1.1.17	The server shall have 8 PCIe Gen4 expansion slots as minimum.			
1.1.18	The server shall have n+1 redundant power supply, each with a capacity of 1400W as minimum, which must be hot-swappable during operation. The power supplies shall have 80 PLUS Titanium certifications.			

1. Item number	2. Specifications required	3. Specifications offered	4. Notes, remarks, ref to documentation	5. Evaluation committee's notes
1.1.19	The servers shall support hot-swap function for cooling units.			
1.1.20	The server shall have an integrated management module and the following features shall be provided: • Management module shall allow to change BIOS settings, IP configuration and boot device information. • The embedded capabilities of the server management processor shall be used without need to install a separate management software. • Management module shall provide remote access for performing the administrative activities of the server. • Server configuration management shall be possible with the management processor. • Power control of the server, power limitation, control of health conditions, firmware updates, adding virtual media shall be possible.			
1.1.21	The server management module shall; • have HTML5 support and the system shall be able to be managed without installing any agents or plugins, • be able to manage the RAID card on the server, RAID configuration of the disks that will be added to the server later, and increase its capacity by adding disks to the existing RAID groups, • be able to control the integrity and safety of the BIOS and firmware files with security certificates, • have a secure non-volatile memory on the hardware to stop the attacks.			
1.1.22	The server shall have a provisioning tool. The server shall allow pre-operating system installations. Operating			

1. Item number	2. Specifications required	3. Specifications offered	4. Notes, remarks, ref to documentation	5. Evaluation committee's notes
	system shall be integrated with DVD reader, USB memory or network.			
1.1.23	Automatic failure notification system shall be activated for servers, hardware information shall be accessed through an online portal. The server management processor shall monitor the health status of the servers and alarms will be generated in case of failure.			
1.1.24	The server shall have LED or TFT screens.			
1.1.25	The server shall be able to be turned on and off remotely with the virtual power feature. Even if the operating system is down or the server is turned off, the server management processor shall be accessible.			
1.1.26	The server shall support virtual media feature, USB stick, CD, DVD connected to a remote computer.			
1.1.27	Power consumption reports, instant power usage, and temperature conditions of the servers shall be observed on the screen.			
1.1.28	The server management processor shall be able to limit the power consumption at a certain level.			
1.1.29	The server shall support logging of management processors, regardless of operating system, power on /off, reset, successful-unsuccessful login attempts.			
1.1.30	The memory, processor and disk units of the server shall have the Pre-Failure feature.			
1.2	**Storage**			

1. Item number	2. Specifications required	3. Specifications offered	4. Notes, remarks, ref to documentation	5. Evaluation committee's notes
	Manufacturer's name; product model/type:			
	Country of origin:			
	Quantity: 2			
1.2.1	It shall be possible to replace parts such as disks, power supplies, fans etc. while the system is running.			
1.2.2	The storage unit shall have minimum 32 GB of DRAM-based cache.			
1.2.3	The storage unit shall support FC or iSCSI or SAS protocols for server connections, without need of additional gateways or licenses.			
1.2.4	The interface of the storage unit between the disk shelves shall be 12Gbps SAS.			
1.2.5	The storage unit shall have 3 SSD disks, each of which is at least 960GB, on the data storage system as minimum.			
1.2.6	The storage unit shall have 45 NL-SAS disks of 20TB 7200 rpm each as minimum.			
1.2.7	The storage unit shall support RAID10 (or 1/0), RAID5 and RAID6 protection levels.			
1.2.8	The storage unit shall support the installation of at least 260 disks in the size of 2.5" and 3.5". Supported disk types shall include SSD, SAS, NL-SAS and their SED options.			
1.2.9	The storage unit shall support 5 PB of gross capacity as minimum.			
1.2.10	The storage unit shall support 700TB of available space as minimum.			

1. Item number	2. Specifications required	3. Specifications offered	4. Notes, remarks, ref to documentation	5. Evaluation committee's notes
1.2.11	The storage unit shall have automatic data tiering that supports 3 layers (SSD, SAS, NL-SAS/SATA) as minimum.			
1.2.12	The storage unit shall have 8 server connection ports, each of which supports at least 32 Gbps bandwidth and allows fiber channel connection as minimum, or 8 at least 25 Gb SFP+ server connection ports that can be used for iSCSI as minimum.			
1.2.13	The storage unit shall support asynchronous, replication.			
1.2.14	The storage unit shall be able to take snapshots and clones and restore from these copies. The redirect-on-write method shall be used.			
1.2.15	The storage unit shall have thin provisioning feature.			
1.2.16	The movements of data between layers shall be in transferable form.			
1.2.17	Management software with graphical interface shall be provided together with the external data storage system.			
1.2.18	Status information shall be seen including but not limited to: • System alarms, • free space, • capacity information, • hardware status, • LUN configurations.			
1.2.19	Additions shall be made to virtual disk groups used in the system without interruption of access.			

1. Item number	2. Specifications required	3. Specifications offered	4. Notes, remarks, ref to documentation	5. Evaluation committee's notes
1.2.20	In the storage unit, logical areas (LUNs) with a capacity of 128TiB shall be able to be created and shall support at least 64 server connections.			
1.2.21	The storage unit shall have 1000 LUNs as minimum and shall be able to be created in the data storage unit.			
1.2.22	The storage unit shall have the feature of notifying the system administrator by e-mail in case of a malfunction.			
1.3	**Spine Switch**			
	Manufacturer's name; product model/type:			
	Country of origin:			
	Quantity: 2			
1.3.1	The spine switch shall have at least 48 SFP+ ports.			
1.3.2	The spine switch shall have minimum 48 pieces 10GBase-SR or 10GBaseLR transceiver modules.			
1.3.3	The spine switch shall have 8GB of RAM as minimum.			
1.3.4	The spine switch shall support at least VRRP or above.			
1.3.5	There shall be a protocol support such as Multi Chassis Link aggregation, which is required for two switches of the same type to work active-active at the layer 2.			

1. Item number	2. Specifications required	3. Specifications offered	4. Notes, remarks, ref to documentation	5. Evaluation committee's notes
1.3.6	The spine switch shall support IEEE 802.1Q (4,000 VLAN ID) VLAN ID marking and 4000 port based VLANs.			
1.3.7	The spine switch shall support the IEEE 802.1D Spanning Tree protocol.			
1.3.8	The spine switch shall support IEEE 802.1W Rapid Convergence/Reconfiguration Spanning Tree protocol.			
1.3.9	The spine switch shall support Remote Span.			
1.3.10	The spine switch shall support VXLAN.			
1.3.11	The spine switch shall support Layer 3 forwarding. The device shall be licensed with the latest licensing model of the relevant family. Dynamic routing protocols shall be licensed and available to be supported, including OSPF and BGP. The switch shall be able to provide these features when used alone. without additional external device for these protocols to work.			
1.3.12	The spine switch shall support the next generation IPv6.			
1.3.13	The spine switch shall have redundant power supply support.			
1.4	**San Switch**			
	Manufacturer's name; product model/type:			
	Country of origin:			

1. Item number	2. Specifications required	3. Specifications offered	4. Notes, remarks, ref to documentation	5. Evaluation committee's notes
	Quantity: 2			
1.4.1	The SAN switch shall support speeds up to 4Gbps as minimum.			
1.4.2	The SAN switch shall be upgraded to at least 24 ports to be active.			
1.4.3	The height of the SAN switch shall be 1U maximum.			
1.4.4	The SAN switch shall support redundant power supplies and shall be able to operate with the same redundant power supplies.			
1.5	**Tor Switch**			
	Manufacturer's name; product model/type:			
	Country of origin:			
	Quantity: 2			
1.5.1	The Tor switch shall have 48 SFP+ ports as minimum.			
1.5.2	The Tor switch shall have 48 pieces 10GBase-SR or 10GBaseLR transceiver modules as minimum.			
1.5.3	The Tor switch shall have 2GB of RAM as minimum.			
1.5.4	The Tor switch shall support at least VRRP or above.			

1. Item number	2. Specifications required	3. Specifications offered	4. Notes, remarks, ref to documentation	5. Evaluation committee's notes
1.5.5	The Tor switch shall have a protocol support such as Multi Chassis Link aggregation, which is required for two switches of the same type to work active-active at the layer2.			
1.5.6	The Tor switch shall support for IEEE 802.1Q (4,000 VLAN ID) VLAN ID marking and 4000 port based VLANs shall be supported.			
1.5.7	The Tor switch shall support the IEEE 802.1D Spanning Tree protocol.			
1.5.8	The switch shall support Remote Span.			
1.5.9	The Tor switch shall support the IEEE 802.1W Rapid Convergence/Reconfiguration Spanning Tree protocol.			
1.5.10	The switch shall support Layer 3 forwarding. The switch shall be licensed with the latest licensing model of the relevant family. Dynamic routing protocols shall be licensed and available to be supported, including OSPF and BGP. The switch shall be able to provide these features when used alone. without additional external device for these protocols to work.			
1.5.11	The switch shall be support for next generation IPv6.			
1.5.12	The switch shall have redundant power supply support on it.			
1.6	**Log Management and Correlation Software (SIEM)**			
	Manufacturer's name; product model/type:			

1. Item number	2. Specifications required	3. Specifications offered	4. Notes, remarks, ref to documentation	5. Evaluation committee's notes
	Country of origin:			
	Quantity: 2			
1.6.1	The SIEM shall provide centralized management of all components and administrative functions from a single web-based user interface.			
1.6.2	Through the central management interface, the SIEM shall be able to define role-based access by device group or network range.			
1.6.3	The SIEM shall have a real-time and historical correlation feature.			
1.6.4	The SIEM shall be able to monitor the live traffic log from users and servers.			
1.6.5	The SIEM shall enable the system administration to define role-based access to the various functional areas of the solution. This should include the ability to restrict a user's access right to certain functions of the solution that do not fall within the scope of the user's role, including but not limited to administration, reporting, event filtering and dashboard viewing.			
1.6.6	The SIEM shall support integration with 3rd party directory systems (Active Directory, LDAP etc.) as an authentication method.			
1.6.7	The SIEM shall correlate all of its collected logs.			
1.6.8	The SIEM shall have integrated flow collection feature from active network devices. The system must support netflow and flow aggregation.			

1. Item number	2. Specifications required	3. Specifications offered	4. Notes, remarks, ref to documentation	5. Evaluation committee's notes
1.6.9	The SIEM shall allow to add a full-range packet capture and case analysis feature by adding licenses/devices.			
1.6.10	The system shall provide a suitable API for future expansions and integration with other 3rd party solutions.			
1.6.11	The system shall support automatic updating of configuration information including but not limited to; security classification updates, provider's rule updates, device support.			
1.6.12	The system shall have automatic backup / disaster recovery feature without the need for third party devices and solutions.			
1.6.13	The system shall be capable of presenting multiple dashboards that can be adapted to meet the specific needs of different users of the system.			
1.6.14	The system shall provide ready-to-use sample dashboards including but not limited to; threat management, compliance management.			
1.6.15	The system shall maintain a database of all assets discovered on the network. • The asset data should contain information learned from the information gathered about the relevant asset, including followings but not limited to: system attributes, network attributes, vulnerability status. • The database shall allow to edit the attributes (e.g., department, location, etc.) where they cannot be learned. • The user shall be able to search the database.			

1. Item number	2. Specifications required	3. Specifications offered	4. Notes, remarks, ref to documentation	5. Evaluation committee's notes
1.6.16	The system shall have network flow monitoring and analysis capability at L7 level with additional license/device.			
1.6.17	The system shall be able to collect logs from an unlimited number of log sources.			
1.6.18	The system shall have the "User Behavior Analysis (UBA)" competency supported by machine learning technology. • The system shall be capable of determining risky users by analysing logs and network traffic. • Risk scores shall be assigned to user accounts and risky user behaviours shall be tracked on a dashboard. • The system shall be able to create alarm (offence) records automatically for user accounts with a risk score above a certain level. • The UBA solution must have a user credential matching feature. The data from Active Directory , Reference Table or CSV file shall be transferred to the system and the UBA shall be taught which accounts belong to a user ID.			
1.6.19	The system shall be able to offer free applications developed by the manufacturer and third parties, and these applications should be easily downloaded and used via an application sharing platform.			
1.6.20	The system shall enable data re-access, aggregation, separation, filtering and analysis in a transparent manner across all distributed components.			
1.6.21	The system shall support operation as "software only", "hardware device" or "virtual machine" .			

1. Item number	2. Specifications required	3. Specifications offered	4. Notes, remarks, ref to documentation	5. Evaluation committee's notes
1.6.22	The system shall offer the ability to effectively store and compress the collected data.			
1.6.23	The system shall support industrial log collection methods at least syslog, WMI, JDBC, SNMP, Checkpoint LEA.			
1.6.24	The system shall support log analysis of identity for network and users including but not limited to usernames, IP addresses, hostnames and log source device of different brands of devices located throughout a network.			
1.6.25	The system shall have the ability to save/store the normalized and original raw format of the event log for evidence-seeking purposes.			
1.6.26	The system shall provide near real-time analysis of events.			
1.6.27	The system shall provide a long-term trend analysis of events.			
1.6.28	The system shall provide alerts based on observed anomalies and behavior changes in network and security events.			
1.6.29	The system shall support and maintain a historical record of user authentication activity based on the entity.			
1.6.30	The system shall provide templates for easy creation and delivery of reports at many levels, ranging from activities to business topics.			
1.6.31	The system shall provide a "Dashboard" for quick visualization of security and network information.			
1.6.32	The system shall provide alerts based on security threats observed from monitored devices.			

1. Item number	2. Specifications required	3. Specifications offered	4. Notes, remarks, ref to documentation	5. Evaluation committee's notes
1.6.33	The system shall provide alerts based on observed anomalies and behavioral changes in network activity (stream) data.			
1.7	**Next Generation Firewall**			
	Manufacturer's name; product model/type:			
	Country of origin:			
	Quantity: 2			
1.7.1	The firewall shall be offered as one unit product that works as a hardware and software-based solution.			
1.7.2	The firewall shall have 8 (eight) 10/100/1000 Mbps Copper ports, the ports required for redundancy (HA) and management on the device will be located on the device separately from the data (network) ports that are requested to be given on the firewall as minimum.			
1.7.3	The firewall shall have IPsec VPN throughput 2.5 Gbps as minimum.			
1.7.4	The firewall shall support at least 500,000 maximum sessions.			
1.7.5	The firewall shall have a redundant power supply.			
1.7.6	The firewall shall be able to monitor the network traffic between Layer-4 and Layer-7 of the OSI Model.			
1.7.7	The firewall shall be able to hide many IPs in one or more address ranges in the local network behind a single address if desired, or hide each range behind another single			

1. Item number	2. Specifications required	3. Specifications offered	4. Notes, remarks, ref to documentation	5. Evaluation committee's notes
	address if desired, or it should have one-to-one address translation feature (NAT).			
1.7.8	The system shall support Dynamic Routing protocols at least OSPF, BGP, RIP.			
1.7.9	IPv4 and IPv6 policy-based routing shall be possible on the firewall.			
1.7.10	The system shall support site to site and client to site IPSEC VPN.			
1.7.11	The system shall send logs to its own private central management system.			
1.8	**Advanced Load Balancing (Load Balancer), Advanced Web Application Firewall (WAF)**			
	Manufacturer's name; product model/type:			
	Country of origin:			
	Quantity: 2			
1.8.1	The load balancer shall include static and dynamic load balancing to eliminate single points of failure. Application proxies give protocol awareness to control traffic for the most important applications. Distributions coming to servers shall be able to be distributed among different servers via the Load Balancer, and it shall provide high availability (HA) for the services.			
1.8.2	The load balancer shall track the dynamic performance levels of servers in a group, ensuring that applications are not just always on, but also are easier to scale and manage.			

1. Item number	2. Specifications required	3. Specifications offered	4. Notes, remarks, ref to documentation	5. Evaluation committee's notes
1.8.3	The system shall support simple integration using industry standards at least SNMP, syslog.			
1.8.4	The system shall proactively defend applications against automated attacks by bot and other attack tools. This prevents layer 7 DoS attacks, web scraping, and brute-force attacks. Proactive bot defense helps identify and mitigate attacks before they cause damage to the site.			
1.8.5	The system shall have throughput is 70 Gbps L7.			
1.8.6	The system shall have 16 CPU as minimum.			
1.8.7	The system shall have 128 GB DDR Memory as minimum.			
1.8.8	The system shall have 8 x 10G/1G RJ45 ports as minimum			
1.8.9	The system shall have Redundant Power Supply.			

LOT 2 – Traffic System Equipment

The aim of this project is to create a dynamic master plan structure and transport modeling by combining all transport data in Mersin via the Integrated Mobility Management and Monitoring Platform and the big data analysis program.

Within this project, data from smart intersections, stop, route and passenger information of buses and minibuses, data from vehicles (canbus, km, etc.) will be collected to analyze daily passenger and vehicle movement plans. In addition, it will be possible to make periodic and seasonal data-based interactive planning as well as disaster situations. With the analysis method in question, variables such as the density of minibuses, profitability, and efficiency of buses will be calculated, allowing data-based decision-making in line with the scenarios to be created.

Consisting of:

Item 2.1 – Passenger Counting Sensor;

Passenger Counting Sensor aims at accurately monitoring and analyzing passenger ridership to enable data-driven decision making, and enhance efficiency and passenger experience in public transport within Mersin. The objectives of the system are mainly:

- Installing passenger counting sensors in buses/minibuses/Dolmuş to accurately track and record passenger boarding and alighting events in real-time.
- Providing accurate and reliable information on passenger occupancy levels and travel patterns to enable data-driven decision-making and to enhance operational efficiency by optimizing route planning, scheduling, and resource allocation based on passenger demand.
- Improving passenger experience by reducing overcrowding and enabling demand driven service availability.

The contractor shall be responsible for the supply, installation, and configuration of Passenger Counting Sensors including:

- Installation and calibration of sensors in buses/minibuses/Dolmuş to accurately detect and record passenger count data.
- Supplying suitable Passenger Counting Sensor and MNVR devices compatible with buses/minibuses/Dolmuş' specifications and infrastructure.
- Integration with existing onboard systems and/or central software platforms for data transmission and analysis.
- Data processing and reporting functionalities to generate insights on passenger ridership patterns, peak hours, and route performance.

Item 2.2 – Mobil Network Video Recorder (MNVR);

Mobil Network Video Recorder (MNVR) aims at recording and storing video footage from mobile surveillance cameras in vehicles in public transport within Mersin. The objectives are mainly;

- Ensure reliable storage and retrieval of video data for security, safety, and surveillance purposes in vehicles.

- Enable remote access and monitoring of video feeds for real-time situational awareness and incident response.
- Enhance transportation safety and security through effective video surveillance and evidence collection.

The contractor shall be responsible for the supply, installation, and configuration of MNVR including:

- Supply of Mobile NVR hardware units with sufficient storage capacity and processing power.
- Installation and integration of Mobile NVR units with existing surveillance camera systems in vehicles.
- Configuration of network connectivity for remote access and monitoring of video feeds.
- Implementation of storage management protocols to ensure efficient use of storage space and data retention policies.

1. Item number	2. Specifications required	3. Specifications offered	4. Notes, remarks, ref to documentation	5. Evaluation committee's notes
2.1	**Passenger Counting Sensor** The sensor shall be installed to the buses and Dolmuş in order to count the passengers.			
	Manufacturer's name; product model/type:			
	Country of origin:			
	Quantity: 2594			
2.1.1	The sensor shall detect and count getting on and getting off passengers.			
2.1.2	The sensor shall be capable of counting passengers at a speed consistent with typical boarding and alighting rates, with minimal latency.			

2.1.3	The sensor shall have a wide detection range to cover the entry and exit points of bus doors effectively. The sensor shall detect the passenger density in the vehicle while the vehicle is in motion and transmit it to the data center on a stop basis.			
2.1.4	The sensor shall support at least 1080p 30 fps 1920x1080 resolution.			
2.1.5	The sensor shall be designed to operate on the bus's electrical system, with voltage compatibility and power consumption optimized for onboard use. The sensor’s power consumption shall be less than 24W.			
2.1.6	The sensor shall support HTTP/ HTTPS, NTP, IPv4 or fully comply with ITxPT minimum standard (inventory, APC, time, GNSS).			
2.1.7	The sensor's working temperature shall cover the range of -30°C to +60°C.			
2.1.8	The sensor shall support Web Interface.			
2.1.9	The sensor shall have IP65 or higher to provide protection against dust ingress and water spray.			
2.1.10	The sensor shall be compatible with various bus door designs or ceiling.			

2.1.11	The sensor shall support standard communication interfaces for buses (such as RS485, RS232, or CAN bus) for seamless integration with onboard systems and data transmission.			
2.1.12	The sensor shall have real-time data transmission capability via wired or wireless connection (e.g., Wi-Fi, Bluetooth) to onboard or offboard data storage and processing systems.			
2.1.13	The sensor shall comply with privacy regulations by anonymizing passenger data and ensuring that no personally identifiable information is collected or stored.			
2.1.14	The sensor shall have at least following maintenance features; -Self-diagnosis capabilities -Easy access for cleaning and servicing.			
2.1.15	The sensor shall be at least 1 / 2.8 〃 2M pixel CMOS type.			
2.1.16	The sensor shall have at least M12- 2.7 mm lens. The FOV shall be at least 120° and VFOV shall be at least 62,5°.			
2.1.17	The signal/noise ratio of the sensor shall not be less than 50 dB.			

2.1.18	The sensor shall have a minimum of 3 meters infrared (IR) support.			
2.1.19	The sensor shall have high accuracy rate of at least 90% in counting passenger boarding and alighting events to provide reliable data for transportation planning and management.			
2.1.20	The sensor shall generate and transmit the alarms to the center in case of emergency and abnormal events.			
2.1.21	The sensor shall comply with following standards as minimum: EN50155 - IEC60068-2-7EH – IP66 – EN50102 – ROHS – FCC – EMC – CE standards.			
2.2	**Mobil Network Video Recorder (MNVR)**			
	Manufacturer's name; product model/type:			
	Country of origin:			
	Quantity: 1546			
2.2.1	MNVR shall support 4 IP channels.			
2.2.2	MNVR video output shall support 1 ch CVBS and 1 ch VGA.			

2.2.3	MNVR shall support H264/H265 video compression			
2.2.4	MNVR shall support 3G or 4G network and optional to support WIFI.			
2.2.5	MNVR shall support 1 × 2.5" SATA HDD or SSD,			
2.2.6	MNVR shall support at least 1 × SIM card slot, 1 × USB2.0, 1 × RS232; 2 × RS485, 1 × CAN and at least 4-channel input and 1-channel output, 1-channel pulse speed detection and optional control panel (monitor)			
2.2.7	MNVR's operating temperature shall cover the range of -30°C to +60°C, and operating humidity shall be between 10% to 90%.			
2.2.8	MNVR shall have shock-proof and vibration-resistant design to withstand the harsh conditions of vehicle environments.			
2.2.9	MNVR shall have a built-in GPS module for accurate location tracking			
2.2.10	MNVR shall have compatibility with vehicle power systems (12V or 24V DC) for direct integration into the vehicle's electrical system.			
2.2.11	MNVR shall comply with industry standards and certifications such as			

	EN50155 /ROHS /FCC / EMC / CE standards.			
2.2.12	MNVR shall have compatibility with mobile applications or web-based interfaces for remote access to live video feeds and playback of recorded footage. It shall have multi-user access with role-based permissions to ensure secure access control.			
2.2.13	MNVR shall have software development kit and application programming interface support in order to integrate with the software of different manufacturers and shall also allow changes to be made on the firmware.			
2.2.14	MNVR shall have support for event-based recording triggered by predefined events such as motion detection, G-force impact, or external alarm signals.			

LOT 3 – Electric bus and charging station

Consisting of:

- Item 3.1 – Electric bus;
- Item 3.2 – Charging station.

I. Technical documentation to be provided by the tenderer / the contractor:

The following documentations shall be provided by the tenderer/contractor:

- **The concept design** of Items 3.1 and 3.2 in DWG and PDF format;
- **The detailed design** of Items 3.1 and 3.2 in DWG and PDF format;
- **As-built design** of Items 3.1 and 3.2 in DWG and PDF format after issuance of the Provisional Acceptance.

The tenderer/contractor documents shall also include:

- Document describing the brand, model, type, and technical specifications of electric bus and charging units;
- "Information Form" containing technical details of the electric bus;
- Schematic technical drawings containing measurements of the electric bus's passenger entrance floor height, measured from the level of the road surface when the vehicle is empty, including dimensions of all passenger doors on the vehicle;
- The interior layout plan of the electric bus;
- Dimensions of all passenger doors in the vehicle;
- Different views regarding the number and design of windows;
- Bus interior layout plans;
- Detailed information about the placement of the system and technical features (cooling capacity, compressor power, amount of gas, type of gas, flow rate of cold and hot air that can be given to the indoor environment) during the manufacture of the vehicle;
- Detailed technical report on electric buses, including their cruising capability, consumption values, calculation methods, and conditions (including performance report of 380 km cruising capability with 100% charged battery);
- Copy of the original type approval certificate which contains the brand, type and commercial name of the offered electric buses, showing that they have been homologated in the M3 category by a competent authority in one of the EU member states;

- The test report that the batteries and/or electric buses have successfully passed the safety tests required by ECE-R100.2 or international equivalent standards obtained from independent test organizations.
- Detailed description of the organization of the proposed maintenance service during the warranty period including the name of the authorized service provider.
- The tenderer shall provide the SORT-2 test report of the batteries approved by an independent accredited organization along with their offers.
- The tenderer shall prepare and submit periodic maintenance schedules in the technical offer that show which maintenance activities will be carried out at which kilometers during the warranty period.
- During the warranty period, periodic maintenance shall be carried out by the contractor according to the intervals specified in the technical documents.

Other documentation to be provided by the contractor:

- Original certificate of origin documents;
- Operation and maintenance manuals - all supplies must be offered with the original set of operation and maintenance manuals in English and Turkish languages (if commercially available). If manuals are not in Turkish language, a “Quick Guide” in Turkish shall be supplied;

II. Design and manufacture:

- Charging Unit: The infrastructure of the system provided by MMM shall be able to charge up to 14 vehicles at the same time.
- Passenger Information Screen: The contractor shall obtain the approval of MMM on the selection and characteristics of the screen.
- Vehicle tracking interface: The contractor shall create a web-based “Vehicle Tracking Interface “for tracking purposes, which shall be commissioned after delivery, and shall make them available to MMM during the warranty coverage.
- For the vehicle tracking interface, the design of the interface functions and screen shall be carried out after the contract, by MMM and the contractor.
- CCTV: If MMM wishes to install additional cameras, the contractor shall provide needed infrastructure support. All maintenance, and failure intervention forms of the camera recording system, as well as the computer software and equipment for accessing the computer and camera recording system (connection cable, connection converter, etc.), shall be supplied by the contractor included in the bid price and delivered to MMM in a working manner.
- The costs of the transmission of information via GPRS shall be borne by the contractor during the warranty period.
- Special Security Equipment Component: All components containing special security equipment shall comply with the criteria specified in the "Regulation on the Manufacturing, Modification, and Assembly of Vehicles" published in the Official Gazette dated 26.10.2016 and numbered 29869 within the scope of the circular of the Ministry of Interior of the Republic of Turkey. A Device Compliance Certificate shall also be obtained from the UKOME General Assembly of Mersin Metropolitan Municipality for all system components as required by the same circular (in the first batch product delivery). A Device Compliance Certificate is required for Vehicle Tracking System, Video Recording Device, Emergency Alarm Button, and IP Camera Components.Vehicle Tracking System, Video Recording Device, Emergency Alarm Button, and IP Camera, 4G / LTE Router-Gateway device, Mobile NVR Driver Monitor,

Vehicle Telemetry Device, are components that will be integrated into and work on the same screen with the vehicle tracking system used in the inventory of Mersin Metropolitan Municipality and Mersin Intelligent Transportation Data Processing System (MAVIS).

- **System Installation / Mounting / Cabeling (Wiring) For The Electronic Components:**

  The Vehicle Tracking System, Validator, Video Recording Device, and other electronic products shall be plug-and-play type. The necessary connection parts for mounting the devices on the bus shall be designed, taking into account the vehicle's ergonomics and the driver's field of view.

- Armored CAT6 cables terminated with RJ-45 connectors shall be used. There will be a minimum of 60 cm cable slack at both ends.
- The vehicle computer power cable will be drawn directly from the battery terminal to the distribution panel and terminated as 24V after passing through a dedicated fuse for the vehicle computer.
- All devices used in the vehicle, such as Embedded PC, Vehicle tracking device, Cameras, MNVR device, Passenger information screens, Route display screens, Announce system, etc., will have all electrical protections against overcurrent and overvoltage.

III. Inspection and acceptance

Inspection during production

- The compliance of items with the technical specifications shall be determined by the technical personnel appointed by MMM, in accordance with the provisions and procedures set forth in the ”Regulation on Inspection, Examination, and Acceptance Procedures for Procurements” in effect.
- Total 2 inspections shall be conducted at the contractor’s production facilities.
- In the first inspection; the cataphoresis operations in the karasor section, and in the second inspection; the electrical, electronic and mechanical parts in the production line will be inspected.
- Expenses including travel (international flight & innercity travel), accommodation and meals for at least 5 technical personnel of MMM shall be covered by the contractor.

Acceptance

- Inspection and acceptance procedures shall be carried out in accordance with the ”Regulation on Inspection, Testing, and Acceptance Procedures for Procurement” in effect.
- Inspection and acceptance procedures shall be conducted by the previously established Inspection and Acceptance Commission.
- Inspection and acceptance procedures shall not be carried out until all goods are supplied to MMM by the contractor.
- Upon the contractor’s notification to MMM that the goods are ready for delivery in accordance with the documentation, MMM shall commence inspection and CA shall commence the **Provisional Acceptance** procedures.
- Needed examinations (including laboratory) shall be carried out if deemed necessary by the Inspection and Acceptance Commission in Mersin own laboratories or laboratories belonging to other public institutions or in private laboratories if needed.

- All costs related to laboratory examinations (including whether the results are positive or negative) shall the responsibility of the contractor.
- **Final Acceptance** shall be made after the expiry of the warranty period.
- A mobile repair team shall be employed to intervene in technical failures that may occur during the transportation of vehicles to the place to be indicated by MMM.
- All costs relating to any permission, licensing, certification, testing, calibration, or other documentation of the supplies shall be borne by the contractor.

License plate and registration

- For the issuance of license plates for the vehicles, an expense of all documents required for the traffic registration procedures shall be the responsibility of the contractor.
- In the case of vehicles being imported from abroad, an expense of all documents required for customs procedures, including license plates, shall be borne by the contractor.

IV. Delivery

Delivery time

The contractor shall deliver Electric Buses and Charging Units within 300 calendar days from the date of the contract, in a ready-to-use condition. The entire supply shall be delivered in a single installment within the specified delivery period.

Delivery location

The contractor shall deliver Electric Buses and Charging Units to MMM Transportation Directorate Public Transportation Branch Directorate Bus Garage.

All transportation and installation expenses related to electric buses and charging units shall be covered by the contractor.

Commissioning requirements for Items 3.1 and 3.2

Full commissioning shall be borne by the contractor.

Consumptions on-site during the commissioning shall be borne by the contractor.

The contractor shall make available to himself all tools, materials, and equipment required for transport, assembling, installation, and commissioning.

The contractor shall provide all tools and equipment needed for the testing of supplies.

The contractor shall perform onsite commissioning of the supplies by trained and authorized personnel including unloading, furnishing to designated location, unpacking, assembling, and connection to the main supply, and removal of packing materials from the site per Article 29 of Special Conditions.

Connection to main electrical, mechanical, water, air, and/or gas supplies from the existing infrastructure shall be made by the contractor according to the rules and regulations of Türkiye.

Application to relevant authorities for a subscription to utility connections such as electricity, water, and others shall be the responsibility of the MMM.

All software shall be delivered and installed in electronic version. All software shall be licensed. to MMM.

V. Operation / Detection of type defect and sanctions

In the event of the recurrence of the same malfunction in transmission components, installations, electronic controls, suspension systems, brake systems, bodywork, chassis, electric motors, main and auxiliary power systems, electrical systems, steering systems, charging systems, batteries, air conditioning systems, CCTV, passenger information, and other units and/or specific parts (up to 5 occurrences per vehicle within a year), the malfunctioning part/system shall be considered as a type defect. In such cases, the contractor shall be responsible for replacing parts/equipment and any other affected parts, covering all labor and material costs.

The faulty products that fall under type defects shall be replaced with improved parts. In cases where the parts have been improved or undergone version changes, even if they are not considered type defects by the manufacturer, replacement shall be carried out with the approval of MMM.

The contractor shall respond in writing to the written notification made by MMM regarding the "Type Defect" issue within a maximum of 30 (thirty) calendar days.

Type defects shall be addressed within a reasonable plan acceptable to MMM.

VI. Health & Safety

The contractor shall be fully responsible for applying the Health and Safety procedures in accordance with the legislation published by the Republic of Türkiye Ministry of Family, Labor, and Social Services during the manufacturing, delivery, assembling, installation, commissioning, and testing. Moreover, the contractor will be responsible for advising MMM of any Health & Safety risks associated with supplies provided and of suitable protective measures.

Supplies shall be designed to operate safely taking into account the characteristics of the terrain and its surroundings, atmospheric and meteorological conditions, structures, and obstacles located in the vicinity either on the ground or in the air in such a way as to cause no nuisance or pose no danger under any operational or servicing conditions or in the event of an operation to rescue persons.

The contractor shall comply with all national and international standards related to manufacturing.

Substances used for the manufacturing and repair of electric buses and charging stations should not be harmful to the health of employees engaged in the operation, repair, and maintenance of electric buses and charging stations. Examples of such materials are; insulation materials, friction materials, paints, gaskets, diverse fluids, and others.

Asbestos and asbestos-containing material, carcinogenic materials, lead (PB), and polyvinyl chloride (PVC) are prohibited from use on public transport vehicles.

VII. Warranty requirements

Item 3.1 and 3.2 shall be under warranty by the contractor for at least 5 (five) years. All kinds of repairs, maintenance, and tire operations (including replacement and puncture repair) of the vehicles during the 5-year warranty period shall be the responsibility of the contractor and related costs shall be borne by the contractor.

The entire body and body parts of the vehicle (chassis and frame, seat frame, etc.) shall have a 10-year warranty from the provisional acceptance against wear, rust, corrosion and paint defects.

Only original or approved by the manufacturer(s) spare parts should be used in any repair service. The contractor shall keep an adequate stock of original spare parts to ensure smooth operation during the repair and maintenance processes of the vehicles. All kinds of spare parts, and consumables (except vehicle tires), shall be covered by the warranty.

The equipment needed for maintenance and repair operations of the bus, such as control, test equipment, diagnostic device for electric motors and gearbox, vehicle-specific hand tools, etc., shall be delivered to MMM as “2 set for 14 vehicles” 1 (one) year before the warranty end date.

Line editing and loading software shall be provided with the delivery of the vehicles. The contractor should provide available software updates during the warranty period.

During the warranty period, the contractor shall have a roadside assistance team for vehicles that break down during the trip.

During the warranty period, all scheduled maintenance, consumable replacements, and repair services for the vehicles shall be performed by the contractor’s technical team at MMM’s workshop. The contractor shall provide sufficient number of technical personnel for the maintenance operation.

All spare parts used for repair and maintenance services shall be original parts compatible with the vehicle.

The contractor is responsible for repairing the malfunctions that cannot be repaired at the workshops, and repairing them at the vehicle manufacturing plant. If the repair is not possible, the contractor is obliged to replace the faulty equipment with a new one.

During the warranty period, if a malfunction covered by the warranty occurs for the same reason in more than 10% of the same device, unit, equipment, component, or part within the last 12 months, the malfunction shall be considered as a type defect / chronic malfunction.

For equipment, units, devices, parts, and others determined to be chronically defective, the contractor shall carry out needed reinforcements, modification, material replacement, renewal, disassembly, and assembly operations for all vehicles within the specified period.

The contractor shall be responsible for any equipment (devices, materials, components, etc.) sourced from aftermarket suppliers and used on the vehicles during the manufacturing or warranty period. Any problems arising from such equipment shall be the sole responsibility of the contractor.

The maintenance and repair work carried out by the contractor shall be monitored by MMM.

To keep track of statistical information such as maintenance, breakdowns, and materials, detailed information entry into the software used by the contractor shall be performed.

The “opening of a fault record" and "closing of a fault record” process shall be carried out by the MMM.

During the warranty period, periodic maintenance shall be carried out by the contractor according to the intervals specified in the technical documents. The contractor shall prepare maintenance schedules for these maintenance activities and submit them to MMM in advance.

After delivery, if the equipment such as electronic fare collection, fleet tracking, and management system belonging to MMM is installed on the electric buses, the technical personnel to be assigned by the contractor shall be present during the assembly period and installation to be carried out shall not affect the warranty.

All technical infrastructure and systems for remote monitoring and reporting shall be installed. Remote monitoring shall be ensured via the Can bus system and GPRS.

The batteries, the electric motor and gearbox shall be under warranty by the contractor for at least 5 (five) years (except in cases of accidents and vandalism). In this regard, the contractor shall submit the warranty document.

The batteries shall ensure an 84% maintained state of charge within warranty period. The capacity of the battery shall enable the bus to travel at least 380 km under SORT-2 conditions with the air condition system off by the end of the 5-year warranty period. Battery packs that are found to be degraded more than the rates specified in the contractor's technical proposal (Please refer to Section *I. Technical documentation to be provided by the tenderer / the contractor*) shall be replaced by the contractor free of charge.

Capacity measurements of the battery shall be made every year during the warranty period and shall be submitted to MMM. These measurements shall be recorded and the battery packs that do not meet the conditions and are found to have deteriorated that shall adversely affect the daily cruising distance km figures shall be replaced by the contractor.

When the batteries show any malfunction or complete economic life within the warranty period, disposal procedures shall be carried out by the contractor, and the contractor shall not charge any fee. After the 5-year battery warranty period is over, the disposal procedures shall be carried out by MMM.

The charging stations shall be fully compatible with the designated Fleet Management System (FMS). The compatibility shall encompass seamless integration, allowing for effective communication and data exchange between the charging stations and the Fleet Management System. The charging stations shall support the necessary protocols and interfaces as specified by the Fleet Management System to ensure optimal functionality.

All charging stations covered by this agreement shall possess the capability to communicate instantly with the Fleet Management System. This instant communication shall enable real-time monitoring, control, and data retrieval from the charging stations without any significant delay. The communication process shall adhere to industry standards for efficiency and reliability.

The Fleet Management System shall have the capability to instantly retrieve comprehensive and up-to-date information from each charging station within the network. This information shall include but is not limited to charging status, energy consumption, operational diagnostics, and any relevant data necessary for effective fleet management. The charging stations shall be equipped with the necessary sensors and communication modules to facilitate this instant information retrieval.

All charging stations shall be specifically designed and configured to meet the unique requirements of fleet management. This includes the ability to adapt to varying usage patterns, scalability to accommodate growing fleets and resilience to handle diverse charging demands. The charging stations shall also support remote management and diagnostics to ensure proactive maintenance and troubleshooting capabilities within the fleet management framework.

The charging stations shall comply with relevant industry standards for communication protocols, interoperability, and cybersecurity to facilitate seamless integration with the Fleet Management System. This compliance is essential to ensure a robust and secure ecosystem for fleet electrification.

The charging stations shall be designed with future technological advancements in mind, allowing for software updates and enhancements to maintain compatibility with evolving Fleet Management System requirements. This future-proofing shall ensure a sustainable and adaptable charging infrastructure for the continued effectiveness of the fleet electrification initiative.

The guarantee of the air conditioning system is included in the bus guarantee and shall not be shorter than the bus guarantee period.

VIII. Fleet availability

Fleet availability refers to the operational availability rate of 12 vehicles in the Availability Fleet and shall be calculated daily.

The contractor's technical team is responsible for ensuring that 90% of the vehicles are ready for service on weekdays and Saturdays, and 85% on Sundays and public holidays. Vehicles with non-warranty reasons (driver-related, vandalism, terrorism, natural disasters, epidemics, traffic accidents, etc.) will not be included in the 90% and 85% calculations.

The list of vehicles ready for service, which is updated until 05:00, will be provided to the MMM by 05:30. The contractor's technical team shall control of each vehicle received by the MMM and keep records every morning. Periodic maintenance schedules shall be prepared taking into account the fleet availability rates.

A maximum of 2 vehicles shall be reserved for maintenance or breakdown activities, all remaining vehicles shall be included in the total number of vehicles for the Availability rate. The availability ratio shall be found by subtracting the number of vehicles that cannot be put into operation from the total number of vehicles and dividing the number obtained by the total number of vehicles.

Example:

If 2 of the 14 vehicles that should be ready for operation today could not be put into operation due to maintenance or malfunction, the availability rate shall be calculated as (14-2) / 12 = 0.90, that is, 90%.

Availability rate shall not be lower than 90% for each day.

It shall not be accepted for the contractor's after-sales service team to make inter-vehicle or in-vehicle spare parts changes to ensure availability. The contractor shall keep a sufficient variety and quantity of spare parts ready for the Service in its own stock.

1. Item number	2. Specifications required	3. Specifications offered	4. Notes, remarks, ref to documentation	5. Evaluation committee's notes
3.1	**12-Meter Electric Bus (The Bus):** **(M3 Category, Class I, Single-Deck, Low-Floor (CE))** **Quantity: 14** **Origin**			
3.1.1	**Dimensions of Vehicle**			
3.1.1.1	The external width of the bus shall not exceed 2,550 mm.			
3.1.1.2	The length of the bus shall be between 12,000 mm ± 4%.			
3.1.1.3	The height of the bus shall not exceed 3,400 mm (including the air conditioning unit).			
3.1.1.4	The internal height of the bus shall be a minimum of 2,200 mm.			
3.1.1.5	The maximum loaded weight of the bus shall be compatible with Road Traffic Regulations of Republic of Türkiye			
3.1.1.6	All dimensions of the bus shall comply with Regulation **AB/1230/2012** and **ECE R107** for "**Class I**" vehicles. The vehicle category shall be **M3, Class I.**			
3.1.2	**Electric Motor**			
3.1.2.1	The electric motor shall have a central system or hub.			
3.1.2.2	The maximum power output of the electric motor shall be at least 240 kW.			
3.1.2.2	The maximum torque of the electric motor shall be at least 2700 Nm.			
3.1.2.3	The electric motor shall have at least an IP69K protection rating according to IEC 60529 standard.			

3.1.2.4	The voltage of the electric motor shall be in the range of DC 700/400V.			
3.1.2.5	The control of the engine temperature shall be done by sensors. In the event of overheating of the engine and simultaneous failure of the cooling system, the bus engine shall be protected. In the event of a temperature increase, the engine protection system shall be activated and transmitted to the drive diagnostic screen as fault information.			
3.1.2.6	Even while using the highest power and torque, there shall be no problems due to overheating of the motor. The bus shall have a cooling system to prevent heating problems.			
3.1.2.7	When the bus is loaded at the highest level of carrying capacity with the air conditioning system off, it shall be able to accelerate continuously on the straight road until the charge rate is reduced to 30%, at least 70 km/h.			
3.1.2.8	The operation of the electric motor(s) shall be controlled through an electronic control unit (ECU), integrated with the bus's electronic management system provided over the Controller Area Network (CAN).			
3.1.3	**Energy Storage System (ESS) Battery**			
3.1.3.1	The electric system shall be equipped with a rechargeable battery-based ESS (Energy Storage System). The system shall prevent charge levels from falling less than 20% of total capacity.			
3.1.3.2	The battery shall be Li-ion types; LFP or LTO.			
3.1.3.3	The ESS of the bus shall be enclosed within a structurally protective housing. The enclosure of the batteries shall isolate them from external contact to mitigate high-voltage risks.			

3.1.3.4	The bus shall be equipped with a fire detection and early warning system compliant with ECE R100 for batteries.			
3.1.3.5	The capacity of the battery shall enable the bus to travel a minimum of 380 km per full charge under SORT 2 conditions with the air condition system off.			
3.1.3.6	Battery Charging Time with a 180 kW DC Plug-in charging unit; 1. Charging simultaneously two buses with a 180kW charging unit shall not exceed 5 hours. 2. The time for charging a single bus at a charging station shall not exceed 3.5 hours			
3.1.3.7	Battery temperatures shall be continuously monitored on the driver's display or through telematics services while the vehicle is in operation or during charging.			
3.1.3.8	The battery shall be heat-resistant and non-explosive.			
3.1.3.9	High-voltage warning and safety labels shall be affixed to the exterior of the ESS enclosure.			
3.1.3.10	The battery system shall be supported by an additional cooling system.			
3.1.3.11	If battery temperatures exceed the critical threshold while the vehicle is in operation or during charging, the driver and the operations center shall be immediately notified through telematics services, and arrangements shall be made for the vehicle to be safely moved to a designated area.			
3.1.3.12	Battery voltages shall be measured and recorded annually by the contractor.			

3.1.3.13	All high-voltage electrical cables/channels shall be marked in high-contrast color (bright orange).			
3.1.3.14	The charge status of the battery shall be displayed on the driver's panel.			
3.1.3.15	The bus shall be equipped with a range warning system that alerts the driver when the battery capacity drops below 20%. The range warning system shall direct the driver to reach the charging unit.			
3.1.3.16	There will be two charging input sockets on the right front and left front of the vehicle.			
3.1.4	**Battery Management System**			
3.1.4.1	When the battery reaches 100% charge, the charging process shall automatically stop and provide audio/visual warnings			
3.1.4.2	The bus shall be equipped with a battery management system that monitors the operation of the batteries and communicates with the central vehicle management system via the Can-Bus.			
3.1.4.3	The battery management system shall perform at least the following monitoring and reporting functions: - state of charge, including notification of critical levels. - temperature, including notification of critical levels. - current and charging rate. - detection of faults.			
3.1.4.4	If a PLUG-IN connection is made to the bus, the control system shall detect it, and the movement of the bus shall be restricted.			

3.1.4.5	The battery management system shall generate and record at least the following statistical information: □ Energy consumption per kilometer □ Total charge/discharge count for the battery □ Average full charge time □ Historical data on charging times and quantities □ Number of balancing operations and their durations, etc.			
3.1.5	**Charging System (on the Vehicle)**			
3.1.5.1	The bus shall be charged using DC charging for the ESS batteries.			
3.1.5.2	Charging connection points shall be accessible through an external access panel on the vehicle.			
3.1.5.3	The charging system shall use a wired-plug-in type.			
3.1.5.4	Charging socket shall be CCS Combo 2 type and compliant with IEC 62196-2 standards.			
3.1.5.5	Charging sockets on the vehicle shall have an IP56 protection rating when plugged in.			
3.1.5.6	Vehicle charging sockets shall have a minimum IP65 protection rating on an inner area of the vehicle charging inlet against dust and water and possess international certifications such as VDE or equivalent.			
3.1.5.7	Charging socket cannot be disconnected without interrupting the power supply during charging.			
3.1.5.8	The contractor shall submit a process/calculation report for the charging procedure.			
3.1.6	**Steering System**			
3.1.6.1	The steering system shall comply with ECE-R79 regulations.			

3.1.6.2	The steering wheel shall be located on the left side of the vehicle, according to the direction of the vehicle going forward, and integrated with the driver's dashboard.			
3.1.6.3	The bus shall be equipped with a hydraulic or electro-hydraulic steering system, and the operating algorithm of the steering pump used shall be speed-sensitive.			
3.1.6.4	The steering wheel used shall be ergonomically designed, ensuring that it does not obstruct the driver's view of the vehicle's instrument panel and road conditions.			
3.1.6.5	The position of the steering wheel shall be adjusted in the up-down and forward-backward directions.			
3.1.6.6	The turning circle radius of the vehicle shall not exceed 11,350 mm from curb to curb			
3.1.6.7	The steering wheel shall have a spare air reservoir that shall open the brakes or a mechanism that shall perform this function when the vehicle needs to be towed with the engine not running,			
3.1.7	**Axle System**			
3.1.7.1	The front system shall be independent type: 2 air bellows, 2 shock absorbers.			
3.1.7.2	Maximum front axle capacity shall be at least 7,500 kg.			
3.1.7.3	The rear system shall design for low-floor bus concepts, stabilized electric portal axles, or rigid axles			
3.1.7.4	Maximum rear axle capacity shall be at least 11,500 kg.			
3.1.8	**Tires**			
3.1.8.1	Tires shall comply with the provisions of ECE-R54 and ECE-R117 regulations.			
3.1.8.2	Tires shall be suitable for use on city buses.			

3.1.8.3	The manufacturing date of the tires shall not exceed six (6) months from the date of vehicle delivery.			
3.1.8.4	Tires shall be silica-reinforced, steel-belted, and tubeless type.			
3.1.8.5	Tires shall be M+S (Mud and Snow) all-season type for city use.			
3.1.8.6	Tire dimensions shall be 275/70 R22.5.			
3.1.8.7	Tires shall have a Tire Pressure Monitoring System (TPMS).			
3.1.9	**Brakes**			
3.1.9.1	The vehicle shall have at least following brake systems; • operational service brake (foot brake), • hand brake, • parking brake, • EBS (Electronic Brake System) or equivalent, • ABS (Anti-lock Braking System) or equivalent, • ASR (Anti-Slip Regulation) or equivalent, • ESP (Electronic Stability Program) or equivalent systems.			
3.1.9.2	The main brakes shall be electro-dynamic and the braking force shall be generated when the motor enters regenerative braking mode, which allows the vehicle's speed to be reduced efficiently.			
3.1.9.3	The brake system shall comply with international standards (UN ECE R13, UN ECE R90, 71/320 EEC).			
3.1.9.4	The brake pad values and wear rates shall be visible in real time through the diagnostic device and the vehicle dashboard. An alert shall be displayed on the dashboard when the brake pads reach a critical wear level.			

3.1.9.5	The brake pedal shall activate the regenerative braking system first. This action includes motor braking which prevents the brake pads from being worn out. In case the regenerative braking function cannot provide sufficient deceleration, the main brakes shall be automatically activated. Regenerative braking shall be active during braking or when the vehicle is in idle position in motion.			
3.1.9.6	The operating brake will be able to control the wheels on all axles simultaneously. In case of a malfunction in one of the circuits in the double-circuit braking system, the other circuit functions will continue until the vehicle becomes safe. A malfunction in one brake system will not affect the other brake systems.			
3.1.9.7	The hand brake shall be located next to the driver and easily accessible. The parking brake on the driven (rear) axle shall be activated by a brake lever or button in the driver's cabin. The bus shall have covers allowing the pneumatic accumulator to be bypassed (tow condition).			
3.1.9.8	If the vehicle is stationary and the handbrake is not activated while the engine is not running, the system shall give an audible and visual warning to the driver and continue to give warnings until the handbrake is activated.			
3.1.9.9	The low-pressure pneumatic brakes shall be automatically engaged when the bus is in an idle position (i.e. at the traffic lights, bus stop, etc.).			
3.1.9.10	When the doors are open, the vehicle shall not move even if the accelerator pedal is pressed. The transmission system (gearbox) shall behave as if it is neutral.			

3.1.9.11	When the bus stops, the parking brake shall be activated automatically. The parking brake shall not disengage until the doors are closed and the accelerator pedal is pressed. The parking brake shall also be controlled with a separate button.			
3.1.9.12	The bus shall have hill start assist to prevent roll-back during uphill starts.			
3.1.9.13	The brake system shall include the following features for safe operation, valve arrangements, expansion tanks, pressurized air tanks, air cooling system, and air dryer.			
3.1.9.14	The brake system shall operate silently and shall not disturb the environment while in operation.			
3.1.9.15	Electronic devices and installations used for control of the brake system shall be resistant to external electromagnetic effects.			
3.1.9.16	Repair kits for all valves in the air system shall be described in the spare parts catalogs.			
3.1.10	**Suspension**			
3.1.10.1	The bus shall have an electronically controlled Air Suspension System, Kneeling (Tilting), and body Lowering-Raising system.			
3.1.10.2	The suspension system shall be capable of providing sufficient strength and suspension at full load and in all road conditions. A constant height shall be maintained under all loads.			
3.1.10.3	The air bellows' piston in the suspension system shall have long-term corrosion resistance. The air bellows shall be protected against dirt and damage and shall be easily replaceable.			
3.1.10.4	The suspension system shall have a function that allows the vehicle height to be lowered or raised by a minimum of 50 mm from the ground using a button on the front panel.			

3.1.10.5	Front air suspension shall be the independent type and consist of two hydraulic telescopic shock absorbers and two pneumatic bellows (air cylinders) with one electronically controlled body levelling valve.			
3.1.10.6	Rear air suspension shall consist of four hydraulic telescopic shock absorbers and four pneumatic bellows (air cylinders) with two electronically controlled body levelling valves.			
3.1.10.7	The suspension system shall have air-bellows and be reinforced with shock absorbers.			
3.1.10.8	The suspension system shall have an electronically controlled automatic function to dampen the vehicle's movements if the battery is installed on the vehicle roof. This function shall adjust the vehicle's level based on its speed to ensure safe driving.			
3.1.11	**Pressurized Air System (Pneumatic System)**			
3.1.11.1	The bus shall have a pneumatic system that supplies the systems required to operate with air, such as brakes and doors, and this equipment shall provide compressed air from the compressor.			
3.1.11.2	The air compressors shall be capable of producing enough air for the system and all be of the same type and brand.			
3.1.11.3	The air compressor shall have a safety valve to provide air evacuation to prevent long-term operation under overload and therefore malfunctions.			
3.1.11.4	The air compressor shall be driven by an electric motor, it shall automatically stop and start working depending on the predicted pressure value.			

3.1.11.5	The time to reach the required operating pressure shall be a maximum of 8 minutes, while the suspension and braking system empty the compressed air tanks. When the compressor is not working, the pressures of the fully loaded tanks shall not fall below the safety limits before at least 8 brake strokes.			
3.1.11.6	The system shall have an automatic valve system that drains the accumulated water in the compressed air tanks.			
3.1.11.7	The system shall have an air dryer with a replaceable filter and an automatic water discharge system in the air dryer.			
3.1.11.8	The system shall have multi-way valves that regulate the pressure of the air coming from the compressor and distribute it to the valve and air tanks. These multi-way valves shall be located as a group in a section that can be easily intervened.			
3.1.11.9	The air inlet vent of the air intake system shall be located that shall not be affected by pollution and shall have a pre-filter. Easily accessible air jacks hidden in the front and rear bumpers of the vehicle will be positioned to supplement the vehicle air system with external air in case of malfunction or accident. The air jacks shall be compatible with the MMM's tow trucks and rescuers.			
3.1.12	**Exterior Panels**			
3.1.12.1	The covers used on the exterior of the body frame shall be corrosion-resistant and smooth.			
3.1.12.2	The joining technique used between the covers and profiles shall not damage the corrosion protection of the sheet metals and profiles.			

3.1.12.3	Corrosion-preventive sealant and seam sealer shall be applied between the surfaces where the chassis and body elements are joined and overlapped.			
3.1.12.4	The exterior panels joining technique shall be waterproof.			
3.1.12.5	All hatches that comply with ECE R107 that are on the roof of the bus shall be equipped with dampers.			
3.1.12.6	Covers shall be placed for maintenance and repair of the components.			
3.1.12.7	These covers shall be easily opened and closed.			
3.1.12.8	Advertising panels shall be placed at the size of 75x185 on both the left and right front exterior side, and 70x85 on both left and right rear side of the bus. Advertising panels: • shall be made of corrosion resistant material; • shall be waterproof; • shall have transparent protective cover.			
3.1.13	**Chassis and Body**			
3.1.13.1	The chassis frame shall be suitable for low-floor buses and shall be durable, and resistive to torsion, breaking, bending, buckling and corrosion.			
3.1.13.2	All of the insulation materials shall comply with the latest version of regulation ECE R-118.			
3.1.13.3	The body frame surface shall be free of protrusions and burrs and shall have as smooth a surface as possible.			
3.1.13.4	The frame shall have a 10-year warranty against corrosion.			
3.1.13.5	The frame profiles used in the body shall be of at least St 44 or at least 14.003 quality. The frame shall be coated with cataphoresis (cathodic dip coating).			

3.1.13.6	On the upper left and right side of the front mask, there shall be 22mm inner diameter pipes to hold cylindrical shape flagpoles. These pipes shall be positioned to attach the flags easily.			
3.1.13.7	There shall be support profiles suitable for lifting the vehicle with a jack at appropriate points of the chassis. There shall be appropriate markings at these points.			
3.1.13.8	The covers used to cover the body frame shall be corrosion-resistant and smooth.			
3.1.13.9	Trim parts used inside the bus shall be compatible with the visual integrity and appearance of the vehicle.			
3.1.13.10	The materials used in the interior covers of the vehicle must not impair the visual appearance, the covers cannot be removed by the passengers, and they must not create noise or vibration during the operation.			
3.1.13.11	The chassis profiles inside the fender shall be isolated to prevent the accumulation of mud and water.			
3.1.14	**Doors**			
3.1.14.1	There shall be three (3) passenger doors on the right side of the bus. These doors shall consist of 2 wings that open inward sliding on the tracks. The bus doors shall be per ECE R107.			
3.1.14.2	At the middle door, an electrically insulated ramp should be installed, complying with Directive Rule 107 of the UNECE which allows getting of wheelchairs for people with disabilities and baby carriages with a minimum load capacity of 300 kg.			

3.1.14.3	Handrails placed inside the doors shall both protect the door glasses and allow the passengers to hold them. Therefore, these handles shall be securely fastened to the door and free of burrs.			
3.1.14.4	Visual and audible door-closing warning signals shall be placed on the vehicle. Each door shall be marked as an emergency exit.			
3.1.14.5	All doors shall be pneumatically or electronically controlled (i.e., servo), and open inward. The door speed shall be a maximum of 3-4 seconds.			
3.1.14.6	The front door wings shall have an independent and synchronized opening and closing mode. After independent operation, both doors must operate in synchronization. The front door wing shall have defogging resistance.			
3.1.14.7	There shall be an audible and visual warning on the driver's front display panel indicating that the doors are open. The warning light shall be separate for each door.			
3.1.14.8	If any of the bus doors are open, the vehicle shall not move. While the bus is in motion, the doors shall not open even if the driver presses the door open button. With all doors closed, the vehicle shall not move unless the accelerator pedal is pressed by the driver, even if all conditions favor the vehicle's mobility.			
3.1.14.9	The edges of the door frame shall be surrounded by rubber or similar material.			

3.1.14.10	All passenger doors shall be equipped with an emergency opening system; o In an emergency, if the pneumatic air system and/or electrical system fails, passenger doors can be manually opened from inside or outside the passenger compartment. o Emergency door buttons shall be mounted internally and externally for each door and shall be easily accessible. When the bus is moving at 5 km/h or faster, manual opening of the doors shall not be possible.			
3.1.14.11	The door safety system shall also be supported by sensors. If the sensors detect an obstacle between the door wings, the safety system stops the doors from closing and allows the door to open, and a warning displays on the driver dashboard.			
3.1.14.12	Except for the front entrance door, which is used for passenger entering, there shall be illuminated "STOP" warning lights with at least two (2) warning lamps on the upper part of other doors to indicate passengers exiting. During door opening and closing, an audible warning shall be given, and the door area shall be automatically illuminated when the door is opened. The illumination shall turn off when the door is closed.			
3.1.14.13	To assist passengers in entering and exiting, there will be a lighting lamp on the outside of all doors that is activated when the door is opened.			
3.1.15	**Windows and Glasses**			
3.1.15.1	The bus windows shall comply with the 92/22/EEC regulation, have an ECE-R43 certification, and bear the "E" marking.			

3.1.15.2	The windshield shall have resistance for sufficient defrosting and defogging to ensure the driver's visibility in all climatic conditions.			
3.1.15.3	The driver's left-side window shall be in two pieces and shall have a sliding opening window. The exterior rear-view mirror on the driver's left side shall be fixed and have resistances on it. Resistances will be parallel to the vehicle floor.			
3.1.15.4	All window and door glasses shall be securely fixed, completely and durably sealed, and manufactured free from rattling/vibration while the bus is in motion or the motor is running.			
3.1.15.5	All passenger windows in the vehicle shall have dark glasses with enough light transmittance to prevent the passengers from being disrupted by sunlight. The windows shall provide at least 50% light transmittance into the vehicle and a maximum of 58% heat transfer.			
3.1.15.6	The glasses shall be designed in a way that does not obstruct the visibility of mirrors. Precautions shall be taken against fogging and other similar conditions.			
3.1.15.7	Emergency exit windows shall comply with the ECE-R107 technical regulations.			
3.1.15.8	There will be at least two semi-open, transom or split windows on the right and left sides of the bus.			
3.1.16	**Windshield Wipers and Sunshades**			
3.1.16.1	The front windshield wipers shall be driven by at least one electric motor located in the center and this motor shall have at least two speed modes. The wipers on the right and left sides of the front windshield shall receive their motion from these motors.			

3.1.16.2	There shall be a windshield washer system on the front windows. The windshield washer system has at least 5 liters fluid capacity reservoir and is easily accessible. The water spray nozzles shall be located on the wiper blades.			
3.1.16.3	The driver's protection from sunlight shall be ensured by the presence of easily adjustable sunshades on the left side and front windshield, providing sufficient protection. The sunshades shall be electrically controlled.			
3.1.16.4	The material of the sunshades shall be dust-repellent, dark-colored, and designed not to disturb the driver even in bright sunlight.			
3.1.16.5	In case the sunshades are found insufficient in blocking sunlight, the MMM may request the application of dark window film, not covering the right rear-view mirrors, with a width of 30-40 cm on the upper parts of the front and, if available, side corner windows.			
3.1.16.6	There shall be rain sensors on the vehicles.			
3.1.17	**Mirrors**			
3.1.17.1	There shall be adjustable convex mirrors on the front right and front left sides of the vehicle, providing visibility of the sides and rear.			
3.1.17.2	Exterior rearview mirrors shall comply with EU standards (2003/97/EC) and shall be heated, electronically adjustable, and replaceable.			
3.1.17.3	The right mirror should be in line of sight through the windshield and the left mirror should be in line of sight through the driver's side window.			
3.1.17.4	There shall be one convex interior rear-view mirror in the vehicle.			
3.1.17.5	The front right exterior rear-view mirror shall show blind spots.			

3.1.17.6	The mirror attachment brackets shall be covered with an appropriate-looking plastic or similar material and shall have an elegant design like coach buses.			
3.1.17.7	Exterior rear-view mirrors shall be repairable and compatible with the washing brushes.			
3.1.17.8	The mirrors shall comply with the provisions of ECE-R46.			
3.1.18	**Interior Lighting and Headlights**			
3.1.18.1	All the vehicle interior and exterior lights, including high beam, low beam, daytime running lights, and front fog lights shall be LED.			
3.1.18.2	All the LED lamps used shall comply with IEC performance and safety standards.			
3.1.18.3	With all lights on, the illumination intensity for each passenger seat shall be a minimum of "100 Lux."			
3.1.18.4	All interior lighting shall be arranged on two circuits and shall be controllable in stages.			
3.1.18.5	Door lighting lamps shall turn on when all bus doors are opened and turn off when doors are closed.			
3.1.18.6	Interior lighting shall not create reflections that hinder the driver's visibility.			
3.1.18.7	The vehicle shall have LED marker lights (side marker lights) and license plate lamps.			
3.1.18.8	LED daytime running lights shall be present on the vehicle. These lights shall activate when the motor is "on" position or when the motor is running.			
3.1.18.9	Interior lighting for the driver's area, passenger entry, and passenger compartment shall be individually controllable.			

3.1.18.10	When the front door is opened by the driver, the front area and validator device lighting shall turn on, and they shall turn off when the door is closed. The driver shall have manual control over the lighting in the front area at any time.			
3.1.18.11	There shall be LED warning lights on the doors indicating that the passenger is getting off.			
3.1.19	**Driver Cabin**			
3.1.19.1	The driver's cabin shall be monoblock and designed from heat-resistant, fireproof, impact-resistant, and solid polycarbonate material.			
3.1.19.2	The driver's door shall be magnetically locked and designed to prevent outside access.			
3.1.19.3	The cabin, the door, and all its mechanisms shall be reinforced appropriately.			
3.1.19.4	The design of the cabin shall be submitted to the approval of the MMM.			
3.1.19.5	The panels used in the cabin shall not obstruct the driver's view of the front door, windshield, and rear-view mirrors.			
3.1.19.6	The driver cabin shall be designed in a way that does not hinder the driver's easy exit in case of emergency situations.			
3.1.19.7	The left side wall of the cabin shall have reliable insulation.			
3.1.19.8	The lining shall be waterproof, dirt-repellent, and capable of maintaining its shape independently of temperature, mechanical, and other effects.			
3.1.19.9	Inside the driver's cabin at a suitable location, there shall be a USB input for charging mobile phones and a compartment for the driver to store his personal belongings without affecting vehicle operation.			

3.1.19.10	There shall be a transparent, hinged advertising and information panel, approximately 50x70 cm in size located on the rear panel of the driver's cabin.			
3.1.19.11	Inside the driver's cabin, there shall be: • a plastic document holder (for insurance policies, documents, etc.), • a hanger for the driver, • a cup holder located in a place accessible to the driver. These accessories shall not disrupt the visual integrity of the cabin and hinder the driver.			
3.1.19.12	The driver's cabin shall have a door at the driver's seat level, and the upper part of the door shall be transparent (tempered glass, fiberglass, or composite), removable if needed and designed not to be affected by light reflections.			
3.1.20	**Driver Seat**			
3.1.20.1	The driver's seat shall be modern, ergonomically designed and equipped with the following features and specifications: o Height-adjustable, o self-levelling air suspension, o Adjustable vertical shock absorber. o Horizontal adjustment. o Seat tilt adjustment. o Backrest adjustment. o Armrests.			
3.1.20.2	The driver seat shall have a three-point safety belt.			
3.1.20.3	The seat belt shall comply with the ECE-R14 and R16 regulations.			
3.1.20.4	An audible warning shall be issued if the safety belt is not fastened, and the sound shall continue until the belt is fastened.			

3.1.21	**Dashboard, Electrical Equipment and Controls**			
3.1.21.1	The dashboard, keys, indicators, and other control lights and devices shall be protected against dust and water droplets (Protection class IP54).			
3.1.21.2	The dashboard shall comply with the ECE R121 regulation.			
3.1.21.3	There shall be at least 2 keys or remote controls for each bus.			
3.1.21.4	○ There shall be an emergency button located in the driver's cabin, within easy reach of the driver and when this button is pressed motor shall stop, ○ Driver's compartment lighting shall be lit when the hazard light function, interior lighting lamps mid two buttons or the first stage of the interior lighting system are activated.			
3.1.21.5	There shall be a button for opening and closing the front door located at an appropriate location outside the vehicle. When the front door is opened from the outside, the lamp in the driver's cabin shall be briefly lit up.			
3.1.21.6	There shall be a button for driver cabin lighting.			
3.1.21.7	There shall be a button for parking, head, and fog lights.			
3.1.21.8	There shall be an illuminated button for door opening and closing.			
3.1.21.9	There shall be an emergency flasher system button.			
3.1.21.10	There shall be a button for defrosting the driver's window and mirror.			
3.1.21.11	It shall be designed to deactivate automatically after frost and fog on the glass have been removed.			
3.1.21.12	There shall be a DNR keypad.			
3.1.21.13	There shall be a button for the parking brake.			

3.1.21.14	When the doors are closed, the door buttons shall be off.			
3.1.21.15	When a passenger presses the stop button, the nearest door's button turns on, and the light of the button continues to light when the doors are open.			
3.1.21.16	The driver shall have easy access to the buttons.			
3.1.21.17	The instrument panel shall comply with modern industry standards. All displays and dashboards shall be illuminated with LEDs. Indicators may be displayed on the digital screen. The control panel shall include at least: o Speedometer/odometer, o Brake circuit air pressure indicator, o Electric motor temperature indicator, o Lighting device indicator, o Door opening and closing indicator, o Energy storage system (ESS) battery charge status (%), o Instant energy consumption (kWh/km), o Average energy consumption for the current trip (kWh/km), o EBS indicator, o Park brake indicator, o Fog light indicator, o Brake pad wear indicator			

3.1.21.18	The control panel shall have an active "red STOP" warning sign together with at least the following red indicators: o Low pressure in the brake line, o High-temperature warning for the ESS cooling system o High-temperature warning for the electric motor o Coolant level warning in the cooling system (ESS or traction motor) o Fire warning in the ESS system o Fire warning in the electric motor o High voltage short circuit warning			
3.1.21.19	In case of battery charging failure, a visual message shall be displayed on the dashboard, or a warning light and an audible alarm shall be activated.			
3.1.21.20	• There shall be a button for raising and lowering the vehicle height. • There shall be an air conditioning control panel. • There shall be a destination sign control panel. • When the bus is turned off without engaging the parking brake, an audible signal shall be heard.			
3.1.21.21	The turning signals, horn and wiper actuation shall be on the steering column.			
3.1.22	**Vehicle Navigation Capability (Speed Limiter and Climbing Capability**)			
3.1.22.1	The bus shall be equipped with a speed limiter calibrated not to exceed a maximum speed of 80 km/h.			
3.1.22.2	The bus's climbing capability shall be at least 18%.			

3.1.22.3	This speed limiter shall not be deactivated or altered.			
3.1.22.4	Buses shall have a rear parking sensor with an audible warning to assist in reversing manoeuvres. The sound of the parking sensor shall not be confused with the sound of the reverse gear warning.			
3.1.23	**Bumpers**			
3.1.23.1	The bumpers of the vehicle shall be three-part, made of elastic material, and connected to the front and rear parts of the bus chassis frame. They shall be impact-resistant and easy to service, made of reinforced fiberglass, or other composite material.			
3.1.23.2	There shall be connection places at the front and rear per the 77/389/EEC regulation for towing the vehicle to be used when necessary. Therefore, a front and rear bumper shall be designed suitable for the tow bars.			
3.1.23.3	The front bumper of the vehicle shall be designed with integrated fog lights.			
3.1.24	**Low Voltage Batteries**			
3.1.24.1	The bus shall be equipped with low voltage batteries with a minimum capacity of 2x12V and 200Ah each.			
3.1.24.2	The batteries shall be of heavy-duty type, and they shall be in a closed cabinet attached to the chassis frame of the bus.			
3.1.24.3	The batteries shall be placed on slide rails to facilitate easy installation and removal.			
3.1.24.4	The batteries shall be maintenance-free according to TS EN 50342-1 or DIN 72311 standards.			

3.1.24.5	The battery compartment shall be isolated from the passenger cabin with airtight panels.			
3.1.24.6	The battery compartment shall be protected against external environmental impacts, located away from units with heat emission, equipped with a ventilation system, and suitable for securely connecting the batteries.			
3.1.24.7	The battery compartment shall be isolated in a manner that is not affected by acids and gases, and there shall be liquid and gas discharge.			
3.1.24.8	The ceiling of the battery compartment shall have the necessary clearance to prevent the battery terminals from touching it. When the battery slides are pulled out, all battery cell covers should be easily accessible.			
3.1.24.9	Inside the battery cabinet, there shall be a main switch that isolates the accumulators from all electrical installations of the bus.			
3.1.25	**Floor Covering**			
3.1.25.1.	The floor shall be flat and smooth and have no raised parts, elements, or sharp edges that may cause discomfort or injury to passengers.			
3.1.25.2	The floor shall be made of durable, waterproof, and non-combustible plywood with a minimum thickness of 10 mm.			
3.1.25.3	The wheel arches, floor and side walls shall be covered with the sprayed 2-component urethane material.			
3.1.25.4	The floor covers' material shall be smooth, and their handles shall be recessed.			

3.1.25.5	The floor covering shall be robust, wear-resistant, waterproof, non-slip (WBP or EN 314 Class 3), and non-combustible with a minimum number of seams.			
3.1.25.6	All the isolation material shall comply with ECE R118 regulation and their certificate shall be provided.			
3.1.25.7	Adhesive welding shall be applied to the joints.			
3.1.25.8	All corners and protruding parts of the floor (steps, platforms, floor covers, edges, etc.) shall be protected with tear-resistant plates or strips, securely fastened.			
3.1.25.9	The inner cabin surface shall be covered with light-colored, stain-resistant, easily cleanable panels.			
3.1.25.10	The interior of the vehicle shall be covered with non-slip PVC flooring, and the color of the floor covering shall be decided by the MMM.			
3.1.25.11	The floor covering shall be extended upward to prevent the side walls from being affected by water.			
3.1.26	**Accessibility Ramp**			
3.1.26.1	There shall be a foldable type of ramp system that is operated electrically by the driver ramp on the second door that enables orthopedically disabled passengers to enter and exit the bus.			
3.1.26.2	The ramp shall carry a minimum load of 300 kg.			
3.1.26.3	All aspects of the ramp on the bus shall comply with ECE R107 regulations.			
3.1.26.4	The ramp shall be able to be used easily by everyone. There shall be a handle on the ramp to open and close, and this operation should not require a second tool.			

3.1.26.5	The surface of the ramp shall be anti-slip, and all the edges shall be covered with yellow-black stripes.			
3.1.26.6	When the ramp is deployed, an accessibility sign shall appear on the rear destination sign and warn the traffic visually.			
3.1.27	**Entrance Area**			
3.1.27.1	The construction of entrances, including connection points, welds, and hardware, shall be made of durable and corrosion-resistant materials with high-quality protection against wear and aggressive substances.			
3.1.27.2	The entrance area floor shall be marked with a contrasting color.			
3.1.28	**Interior Trim**			
3.1.28.1	The interior of walls and ceiling shall be made of non-flammable, dirt-resistant, waterproof, and easily washable plastic materials.			
3.1.28.2	There shall be thermal and sound insulation on the side walls and the roof of the bus. The materials used shall comply with the accepted international norms, which are harmless to human health.			
3.1.28.3	The roof shall be made of corrosion-resistant material designed not to retain rainwater.			
3.1.28.4	All internal cabinets shall be secured with pass-through locks and rubber seals.			
3.1.28.5	The side wall linings in the passenger area shall have reinforced protection against mechanical damage.			
3.1.28.6	The color scheme of the passenger area shall be determined and approved by the MMM before production starts.			
3.1.28.7	The holes drilled into the roof shall be sealed with appropriate materials and/or components to prevent water leakage inside the bus.			
3.1.29	**Hand poles**			

3.1.29.1	All the hand poles in the bus shall be stainless-steel and provide 10 years of corrosion warranty.			
3.1.29.2	The hand poles placed on the seats and at the passenger area shall ensure the safety of elderly, disabled, and pregnant passengers.			
3.1.29.3	High-quality stainless-steel hardware and brackets shall be used to fasten the hand poles to the floor. All the components and materials used shall be free of burrs.			
3.1.29.4	Countersunk screws shall be used for fixing the hand poles.			
3.1.29.5	Hand poles shall be designed to minimize the loads.			
3.1.29.6	The passenger compartment shall be equipped with a minimum of eight (8) evenly distributed USB charging points, and the driver's compartment shall have one (1) USB charging point. USB charging points shall be located on the interior side panels of the vehicle (in locations that do not obstruct passenger ingress or egress).			
3.1.30	**Passenger Seats**			
3.1.30.1	The seats in the low-floor area of the bus shall be fixed to the side walls (console system).			
3.1.30.2	Passenger carrying capacity: The bus shall have a total passenger capacity of at least 65 including minimum of 27 seated, and 1 disabled.			
3.1.30.3	At least 4 seats shall be accessible without steps.			
3.1.30.4	Seats designated for disabled passengers shall have fabric covers (backrest and seat) with elderly, disabled, pregnant, and passengers with children patterns on them.			
3.1.30.5	Seat dimensions shall comply with ECE R107.			

3.1.30.6	There shall be sufficient space between seats and partitions for seated passengers' legs and feet. Seat frames shall be made of galvanized steel or a similar corrosion-resistant material. Seats shall be fixed with stainless steel hardware.			
3.1.30.7	Seats shall be of an anatomical type and shall not have rough or sharp edges. Seats and seatbacks shall be made of reinforced plastic attached to the frame.			
3.1.30.8	Seat covers shall be made of soft, shape-retaining, waterproof, dirt-repellent, heat-resistant, scratch-resistant, and wear-resistant material.			
3.1.30.9	Removal and installation of the seat backrests and cushions shall be easy to do, made of water-resistant material, and nail-type to prevent detachment during travel.			
3.1.30.10	The design and color of seats and covers shall be determined and approved by the MMM among the alternatives shown by the Contractor before the production starts.			
3.1.30.11	Seat materials shall have a high ignition point, low burning rate, and comply with 95/28/EC or UN/ECE R-118 standards.			
3.1.31	**Passenger Area**			
3.1.31.1	There shall be a spacious area for standing passengers in front of the second door. In the passenger area, there shall be at least one space for wheelchairs. In the wheelchair area, there shall be at least one foldable seat mounted on the side wall of the bus and a built-in stop-request button suitable for wheelchair users. Stop-request buttons shall provide visual and audible signals to the driver.			

3.1.31.2	In the wheelchair area, there shall be two double-locking safety belts for securing the wheelchair. A soft wall shall be placed in the opposite direction of traffic for wheelchair placement and safety. Wheelchair positioning and safety shall comply with ECE R107 regulation.			
3.1.31.3	In areas designated for disabled passengers, an "Information Sign" (also written in Braille alphabet) shall be provided, the content of which shall be determined by the MMM.			
3.1.31.4	A sign indicating the number of seats and the maximum number of standing passengers allowed shall be placed between the front door and the rear door in a place visible to passengers.			
3.1.31.5	Signs on the vehicle shall clearly state that buses can be used by disabled passengers.			
3.1.32	**Air-conditioning and Ventilation**			
3.1.32.1	The vehicles shall have air conditioning suitable for heavy usage and climate conditions. It shall have ventilation and cooling functions. The passenger area shall be equipped with an integrated heating, cooling, and ventilation system. The system shall ensure even distribution of hot and cold air throughout the passenger area. The system shall automatically adjust the interior temperature according to the set temperature value.			
3.1.32.2	The driver's cabin shall be heated and ventilated separately from the passenger area, or the driver shall be able to adjust the climate control system from the control unit. Ventilation for the driver's cabin shall also be manually controllable.			

3.1.32.3	The control panel shall be adjustable between 18°C - 26°C, with adjustments made in one-degree increments or at least 3 different modes defined according to predetermined temperature degrees.			
3.1.32.4	The compressor drive of the air conditioner shall be provided by a separate electric motor. The cooling system shall be activated and deactivated under all conditions			
3.1.32.5	The cooling capacity of the system with fresh air shall be at least total 30 kW including passenger's area and driver's compartment.			
3.1.32.6	The air conditioning unit shall be able to process both the inside air and external fresh air by cooling it after processing, and it shall provide fresh air circulation inside the vehicle.			
3.1.32.7	There shall be a separate air conditioning system with a minimum capacity of 3.5 kW for the driver's compartment. The cooling process can be performed by the air conditioning compressor or a separate electric compressor system.			
3.1.32.8	All fan motors in the system shall be brushless type for quiet operation and ease of maintenance.			
3.1.32.9	The refrigerant used in the system shall comply with the current standards and regulations in Türkiye.			
3.1.32.10	The air conditioning unit shall have suction and pollen filters. These filters shall be washable.			
3.1.32.11	As a support for the air conditioning system, the vehicle's glasses shall have a feature that refract the sunlight (reduce its effect), have low heat transmittance, and provide thermal insulation. This feature of the glasses shall not reduce the amount of light entering the vehicle below the legal limit.			

3.1.32.12	Measures shall be taken to prevent fogging of the right and left rear-view mirror areas, the front windshield, the driver's side sliding and fixed glass, and the front corner windows, if any. The driver's view shall not be obstructed due to fog and moisture.			
3.1.32.13	The bus shall have a preheater.			
3.1.32.14	The bus shall have an air purification system.			
3.1.32.15	To provide heating, the interior of the vehicle shall be equipped with electric "convectors" powered by heat pumps, located in front of and under the seating areas, or on the sides.			
3.1.32.16	There shall be a separate air duct inside the roof covers along the length of the passenger area to evenly distribute conditioned air throughout the passenger area. This air duct shall be designed to provide air outlet to the passenger area at specific intervals.			
3.1.32.17	The placement of electronic products inside the air ducts will not prevent or reduce the distribution of the air produced by the air conditioner. The heat produced by the electronic products inside the air duct will not adversely affect the cooling system and will not reduce the heating degree.			
3.1.32.18	To increase the performance of the air conditioner, there will be air curtains on the windowsills and doors.			
3.1.32.19	The use of air conditioning shall not affect the number of passengers carried and the maximum bus speed.			
3.1.32.20	The system shall automatically adjust the ambient temperature according to the temperature value set by the driver. The setting temperature of the air conditioner shall be digitally monitored by the driver from the control panel via a digital display.			

3.1.32.21	HVAC system shall not be activated during the charging process.			
3.1.32.22	The heating system will be designed as a hybrid to prevent a decrease of the long-distance range of the vehicle during the cold winter months.			
3.1.32.23	The grilles at the driver's cabin shall allow the flow rate to be adjusted.			
3.1.33.	**Front Digital Destination Sign**			
3.1.33.1.	The screen shall consist of interconnected LED modules.			
3.1.33.2	The LED display pixel density shall be at least 6944 pixels/m2.			
3.1.33.3	The LED display shall have a light intensity of at least 30,000 cd/m2.			
3.1.33.4	The LED display shall be capable of displaying all colors (full color) (minimum 16 million colors).			
3.1.33.5	The LED display shall consist of pixels spaced no more than 12 mm apart and it shall be minimum 20x144 resolution.			
3.1.33.6	The LED display shall be produced using 3in1 SMD LED (1R1G1B) pixel technology.			
3.1.33.7	The LEDs used in the LED display shall be original LEDs produced by companies that manufacture the recognized LED chip and encapsulate it.			
3.1.33.8	The originality of the LEDs shall be documented with a delivery note received directly from the manufacturer.			
3.1.33.9	The lifetime of the LEDs used in the LED display shall be at least 100,000 hours.			
3.1.33.10	LEDs on the LED display shall operate using a scanning method.			
3.1.33.11	The LED driver integrated circuit shall have a fault detection feature for short or open circuit conditions of the LEDs.			

3.1.33.12	The LED display or the used driver integrated circuit shall have a temperature monitoring feature, and when extreme temperature levels are reached, the system shall protect itself.			
3.1.33.13	The LED display shall consist of modules, and these modules shall be interconnected using locking type connectors.			
3.1.33.14	In modules, a double-layer PCB structure shall be used to prevent performance loss of the electronic unit in case of overheating or extreme cooling.			
3.1.33.15	The LED display power circuit shall be capable of operating between -20°C and +65°C.			
3.1.33.16	The LED display power circuit shall operate at relative humidity levels of 10% to 90%.			
3.1.33.17	The LED display power circuit shall have a self-protection feature in case of short circuit, overloading, excessive voltage, and extreme temperature rise.			
3.1.33.18	The LED display cabinets shall contain an LED fault detection electronic board and a communication card (Receiver Card) to be determined by the MMM.			
3.1.33.19	There shall be an LED indicating that communication is present on each receiver card.			
3.1.33.20	An LED fault detection card shall be used to detect the fault status of each LED on the LED display.			
3.1.33.21	The LED fault detection card shall work in coordination with the receiver card.			
3.1.33.22	Each LED fault detection card shall be addressable via DISPLAY.			
3.1.33.23	All cabinets on the LED display shall be openable from the rear, and all kinds of service to the LED display shall be provided in this way.			
3.1.33.24	LED display cabinets shall be made of aluminium.			

3.1.33.25	An ambient light sensor shall be used on the LED display to automatically adjust the brightness level according to external light levels if desired. There shall be an ambient light sensor for automatically adjust the brightness level of LED display according to external light levels.			
3.1.33.26	There shall be manual brightness adjustment for LED display.			
3.1.34	**Right and Rear Digital Destination Signs**			
3.1.34.1	There shall be 2 display panel on the right side and rear panel capable of displaying line numbers, line names, and bus stop names; – On the right side panel, (side panel could consist of 2 parts) have an minimum resolution of 16x128 LEDs with a maximum pixel pitch of 10 mm, – On the rear panel, have a minimum resolution of 16x32 LEDs with a maximum pixel pitch of 10 mm. – The LED colour on the right side and rear panel shall be amber colour. – On the right side and rear panels shall meet the other requirements specified in the technical specification for digital line indicator panels, except for pixel density and LED spacing.			
3.1.34.2	The right-side panel shall display the line number and the names of the bus stops on the route, while the rear panel shall only display the line number and the wheelchair symbol when the wheelchair ramp is deployed.			
3.1.35	**Destination Signs' General Specifications**			

3.1.35.1	Line indicators shall have a remote management and access module that allows fleet management center, located remotely and independently of the bus, to send commands to enter line information or publish information when the driver does not open the line indicator, does not enter the line code, or enters it incorrectly.			
3.1.35.2	The installation and disassembly of line indicators shall be easy and shall protect against moisture, water, dust, and vibrations caused by road and vehicle conditions. Energy cables shall not be visible from the outside and shall be isolated from passenger intervention.			
3.1.35.3	The bus's departure time shall be displayed on the front and side panels of the vehicle.			
3.1.35.4	LEDs used shall be SMD or 'Through Holes' LEDs with a minimum viewing angle of 120 degrees.			
3.1.35.5	The stop codes and names online indicators in all three directions shall be legible day and night.			
3.1.35.6	The line encoder shall have a TCP, RS485, or RS232 communication module, and line information shall be transferred to the system through these channels and via Wi-Fi or USB (All lists will be transferred as ASCII, Hex, or BINARY Plain Text). *The protocol for changing the content of the sign and the broadcast information using RS485 or RS232 shall be provided to the MMM in document form.			
3.1.35.7	At any time, unplanned sign messages can be sent to the line encoder via Wi-Fi (line information sent from the center), TCP, and RS232,			
3.1.35.8	The line encoder shall be able to store the line and route information received from the vehicle's mobile PC in its memory.			

3.1.35.9	In case of the vehicle PC malfunctioning, route codes shall be manually entered into the line encoder, and the line encoder shall have its own screen.			
3.1.35.10	A USB RS485 or RS232 connection cable shall be properly routed between the vehicle PC and the line encoder.			
3.1.35.11	Loading lines into the sign system and updating new line information shall be quick and easy via USB, Wi-Fi, TCP, RS232, or RS485 on the vehicle computer.			
3.1.35.12	Electronic devices and installations used in the sign and encoder system shall be isolated from electromagnetic effects coming from the external environment.			
3.1.35.13	When the vehicle is stopped and restarted, the last entered route information shall be active.			
3.1.35.14	Remote access (Wi-Fi and internet) to vehicles shall be provided, allowing bulk loading of lines to specific vehicles. Security measures shall be taken to prevent security vulnerabilities.			
3.1.35.15	Security protocols against unauthorized access shall be at the highest level for wireless Wi-Fi and internet-based remote connections.			
3.1.35.16	The main power supplies of the sign system shall be protected against short circuits and high voltage by automatic fuses.			
3.1.36	**Destination Signs' Software Specifications**			
3.1.36.1	The software shall be user-friendly, based on Windows or Linux, and available in Turkish.			
3.1.36.2	Remote access shall be provided to the control part of the line indicators.			
3.1.36.3	The LED screen software shall allow for automatic or manual adjustment of the light intensity.			
3.1.36.4	The LED screen software shall allow for remote fault detection from the center.			

3.1.36.5	The software shall support multiple languages, with priority given to Turkish language support.			
3.1.36.6	The software shall have remote on/off control support from the center.			
3.1.36.7	The LED screen software shall include an event scheduling program, allowing users to determine how and when a display will start.			
3.1.36.8	The LED screen software shall support time and date.			
3.1.37	**Announcement System**			
3.1.37.1	To ensure a homogeneous sound level and passenger comfort inside the vehicle, there shall be an adequate number of speakers, at least 6, and one fixed microphone for the vehicle's driver to address passengers.			
3.1.37.2	The microphone to be used shall be located next to the driver and shall be adjustable in various ways (such as gooseneck).			
3.1.37.3	Additionally, the microphone shall be of the dynamic type.			
3.1.37.4	There shall be an on/off button on the microphone to activate it.			
3.1.37.5	The nominal impedance value shall be at least 90 ohms.			
3.1.37.6	It shall operate within a temperature range of at least -20°C to +80°C.			
3.1.38	**Speaker Specifications**			
3.1.38.1	It should operate at 20 W under normal conditions and be capable of reaching a maximum of 30 W.			
3.1.38.2	It must have a response range of 20 Hz-20 kHz (full range).			
3.1.38.3	Each speaker should have a minimum impedance value of 4 ohms.			
3.1.38.4	The total impedance value of the installed speaker system should be 4 ohms.			

3.1.38.5	EMI shielded cables shall be used in the speaker installation.			
3.1.38.6	There shall be a noise suppressor filter to prevent interference and noise in the audio system. It should also have protection against overvoltage and overcurrent.			
3.1.39	**Sound Amplifiers**			
3.1.39.1	It should provide stereo inputs and outputs. Outputs should be terminal type, while inputs should be RCA type or socket type.			
3.1.39.2	It must be operable from the electronic control unit of the bus.			
3.1.39.3	The sound amplifier should operate in the range of at least 40 Hz-20 kHz.			
3.1.39.4	The audio system shall be powered from the low battery system, and the operating voltage or voltage range of the audio system should be compatible with the battery voltage.			
3.1.39.5	It shall be capable of delivering 2x25W of power from each output. The speaker output should be at least 4 ohms.			
3.1.39.6	The sound amplifier shall not be connected to the vehicle start, and it shall be turned on separately with a button.			
3.1.39.7	It shall have short-circuit protection, overvoltage, and overcurrent protection.			
3.1.39.8	The left channel of the sound amplifier shall supply power to the right-side speakers, and the right channel shall supply power to the left side speakers.			
3.1.39.9	It shall internally contain electrical noise prevention equipment.			
3.1.39.10	An anti-shock coil shall be calculated and installed according to the electrical system of the vehicles.			
3.1.39.11	There shall be a noise suppressor filter to prevent interference and noise in the audio system.			

3.1.40	**In-Vehicle Passenger Information LCD/LED Display**			
3.1.40.1	To inform passengers in real-time on public transport vehicles, there shall be in-vehicle industrial LCD screens capable of exchanging and managing information with a central system containing time, vehicle speed, weather, news, stop information, map-based visual information, and driver information, etc.			
3.1.40.2	It should support multimedia (advertisements, public service announcements).			
3.1.40.3	The passenger information screen should be structurally designed for moving vehicles and should be approved for use in moving vehicles with EN-50155 or relevant MIL STD or E-Mark certification.			
3.1.40.4	The proposed in-vehicle industrial LCD monitors should be at least 19” in LCD technology and equipped with LED backlighting. Each vehicle should have two double-sided screens in the middle of the vehicle and one inward-facing screen at the rear. The screens in the middle of the vehicle should be designed to be front/back.			
3.1.40.5	The installation locations for the screen system must be approved by the MMM before installation.			
3.1.40.6	There will be no button to turn off the LCD screens in the vehicle. The LCD screens will operate with the vehicle start/stop.			
3.1.40.7	The screens will be installed in a way that is visible to passengers and will not obstruct passenger movement, boarding, or disembarking.			

3.1.40.8	The energy cables, video cables, and connections of the in-vehicle industrial monitors will be protected in a way that is not visible from the outside, does not disrupt the visual appearance of the vehicle, and cannot be interfered with by passengers.			
3.1.40.9	Necessary cabling will be done for the power supply of the screens, and an automatic fuse will be placed on the power line.			
3.1.40.10	The screens should have 15D-Sub VGA, HDMI, or DVI signals inputs. If necessary, GA/DVI, VGA/HDMI, or DVI/HDMI converter connectors will be provided by the contractor.			
3.1.40.11	The proposed in-vehicle industrial monitors should be compatible with the Mobile PC. The image output from the Mobile PC will be distributed to all screens via Image Distribution devices.			
3.1.40.12	The installation should be carried out in a way that there is no flickering, interference, or color distortion in the image during screen operation.			
3.1.40.13	All screens shall have the same synchronized image. The necessary infrastructure will be provided by the contractor.			
3.1.40.14	Plug & Play feature shall be available.			
3.1.40.15	Since the in-vehicle industrial monitor shall operate with low voltage battery, it must have a wide operating range of at least 9-36 VDC.			
3.1.40.16	The screen resolution will be at least full HD 1920x1080 pixels and in a 16:9 aspect ratio.			
3.1.40.17	It shall have power protection mode.			
3.1.40.18	The brightness of the in-vehicle industrial monitor shall be at least 300 cd/m2.			
3.1.40.19	The contrast ratio shall be at least 1000:1.			
3.1.40.20	Cables shall be shielded.			

3.1.40.21	The screens shall be protected with at least IP54 standard from the outside.			
3.1.40.22	The in-vehicle industrial monitor shall support at least 8-bit, 16.7 million colors.			
3.1.40.23	The response time of the in-vehicle industrial monitor shall be a maximum of 15 ms.			
3.1.40.24	Operating temperature shall be at least 0 ºC to +50 ºC, and non-operating temperature shall be -20 ºC to +60 ºC.			
3.1.40.25	The viewing angle of the in-vehicle industrial monitor shall be at least in horizontal (left/right) 89°/89° (typical) and in vertical (up/down) 80°/80° (typical).			
3.1.40.26	All the consumables that may be necessary during the installation of the screens shall be provided by the contractor company.			
3.1.40.27	The active usage life shall be at least 30,000 hours.			
3.1.40.28	There shall be at least 4 mm thick anti-reflective tempered glass protection on all screens to prevent them from impacts.			
3.1.41	**Vehicle Tracking System**			
3.1.41.1	Vehicle tracking system shall provide real-time vehicle location/status tracking internally. The system shall be able to generate information such as location, speed, date & time, direction, and total distance. Automatic tracking of information such as position, direction of movement, and instantaneous speed shall be possible.			

3.1.41.2	The system shall provide information on position and date/time when the bus operated. Device parameter programming should be possible via port connection or from the center. If the device lost the GPRS connection, the systemshall be able to store at least 3000 location data in its memory and transmit them to the relevant center when the vehicle status data transmission frequency decreases.			
3.1.41.3	The frequency of sending information shall be adjustable based on change in time or location. The frequency shall be a minimum of 3 seconds. Information updates shall be possible through queries.			
3.1.41.4	The system shall be able to control route violation and at least 3 route shall be defined. The system shall remain active for at least 5 hours, when electric motor is turned off.			
3.1.41.5	Speed sensitivity shall be a maximum of 0.1 meters per second.			
3.1.41.6	Location accuracy shall be maximum 2.5 meters.			
3.1.42	**Video Recording Device**			
3.1.42.1	There shall be 2 separate Mobile Network Video Recorder (MNVR) devices connected to the each vehicle. These MNVR devices shall have with a minimum of 16 (minimum 8 IP + 8 Analog) outputs.			
3.1.42.2	The system shall be capable of capturing the front and rear exterior areas of the vehicle, along with a screen for viewing this footage. During normal operation of the vehicle, the screen shall display the interior view of the cabin, and when the reverse gear is engaged, the rear view of the vehicle will be projected onto the screen.			

3.1.42.3	The MNVR device shall comply with EN-50155 or relevant MIL STD or E-Mark certification.			
3.1.42.4	The storage hardware of the MNVR shall be resistant to vibration and the movement of the vehicle in order to ensure the security of data records.			
3.1.42.5	The MNVR device shall be able to copy the recordings to a specified IP address automatically.			
3.1.42.6	The MNVR device shall have either internal or external backup power, ensuring that recording files are not affected by any power outages.			
3.1.42.7	The MNVR device shall have an ignition module and this module shall enable the device to be operated together with the vehicle. The MNVR device shall continue to operate normally for 6 hours, when electric motor is turned off. The MNVR device shall be able to continue recording at least of 3 hours.			
3.1.42.8	When the memory of the MNVR device is full, it should overwrite old recordings starting from the first recordings.			
3.1.42.9	In the event of an alarm, the MNVR device should have a pre-alarm feature of 1 second to 30 seconds in the recording.			
3.1.42.10	In the event of an alarm, the MNVR device should have a post-alarm feature of 1 second to 10 minutes in the recording.			

3.1.42.11	The MNVR device shall support following features: - show recordings and searches based on Date & Time and Record Type. - Allow Fast Forward, Rewind, and Image Playback. - The video playback type shall be Video or Video & Audio. - Watermark feature.			
3.1.42.12	The MNVR device shall have a minimum 4 TB hard disk capacity.			
3.1.42.13	The MNVR device shall be operate between -10°C and +55°C temperature and between 10% and 90% humidity.			
3.1.43	**Indoor IP Camera**			
3.1.43.1	The camera shall be designed for vehicles. The camera's image sensor shall be designed to capture stable images in moving environments. It shall provide clear audio quality, and the video transmission shall be uninterrupted during data transmission.			
3.1.43.2	The camera shall be capable of capturing the interior of the vehicle.			
3.1.43.3	The camera shall automatically adjust itself to varying light conditions and provide optimal performance in day and night lighting conditions.			
3.1.43.4	The camera shall have a Watermark feature.			
3.1.43.5	The camera shall be capable of recording ambient audio. The camera shall be able to trigger an alarm, in case of network disconnection or IP address conflicts.			
3.1.43.6	The camera shall support impact resistance according to IEC60068-2-75Eh, 50J; EN50102, EN50155, and IK08.			

3.1.43.7	The camera shall comply with the IP66-67 and IEC Standard 60529.			
3.1.43.8	The camera shall be certified with the EN50155 standard.			
3.1.43.9	The camera system shall consist of at least 8 cameras and all cameras should produce clear and understandable sound. The camera shall have internal or external (if external, it should be attached to the camera) microphones to record audio along with video footage.			
3.1.43.11	All cameras shall record to the on-board MNVR device. The necessary infrastructure (power cables, data cables, etc.) shall be done by the contractor.			
3.1.44	**Exterior Camera**			
3.1.44.1	The exterior camera shall have electronic shutter (automatic), black and white, and automatic white balance features.			
3.1.44.2	The camera shall receive power from the Dashcam.			
3.1.44.3	The camera shall certified with an E-Mark certificate.			
3.1.44.4	The camera shall comply with IK08 standard as minimum.			
3.1.44.5	The camera shall be certified with the IP69K certificate.			
3.1.44.6	The camera shall be mountable on the outside of the vehicle and shall comply a minimum of IP69K rating to withstand outdoor conditions.			
3.1.44.7	The camera's image sensor shall be developed to capture stable images in moving environments and shall be at least 1/2.8 2.13 MP or larger Progressive Scan CMOS, SONY CMOS, or Aptina sensor.			

3.1.44.8	The camera shall be capable of providing images at resolutions 1920 × 1080 and 1280 x 720 pixels as minimum.			
3.1.44.9	The camera shall have a fixed lens of at least 2.2mm M12@ F2.0, FOV: HFOV: 152°, VFOV: 83°, DFOV: 180°.			
3.1.44.10	The camera shall be able to provide color images at a minimum illumination of 0Lux (IR on) and switch to black/white in lower light conditions.			
3.1.44.11	The camera shall support IR LEDs, and when the IR LEDs are active, it shall provide images at 0 Lux with an illumination distance of at least 10-15 meters.			
3.1.44.12	The camera shall have an M12 4-pin connector and shall be able to prevent interference caused by vehicle vibrations.			
3.1.44.13	The camera shall be able to operate within a temperature range of -40°C to 70°C and a humidity level of 90% RHG.			
3.1.44.14	The cables used for the MNVR connection of cameras shall have ECE R.118/03 flame resistance certification.			
3.1.45	**Driver Behavior Analysis Camera**			
3.1.45.1	The Driver Behavior Analysis Camera shall have at least; - 1/4 1.3 MP CMOS sensor with a resolution of 1280 x 720 pixels. - 0 lux at f/1.6 illumination.			
3.1.45.2	The camera shall have an electronic shutter (automatic), support black and white mode, and have automatic white balance.			
3.1.45.3	The camera shall receive power from the Dashcam.			
3.1.45.4	The operating temperature range of the camera shall be at least -40°C to +70°C.			

3.1.45.5	The camera shall support at least following features: - Smoking Warning - Fatigue, Drowsiness (Yawning) Warning - Driver Absence Warning - Phone Usage Warning			
3.1.45.6	All alerts received from the camera shall be displayed as alarms on the monitoring and reporting screen. Historical alarms shall be listed as reports when needed.			
3.1.45.7	The camera shall be certified with an E-Mark certificate.			
3.1.45.8	The camera shall be connected to the MNVR system and shall be monitored in real-time from the Fleet Management Center of the MMM through the Mersin Smart Transportation System (MAVIS).			
3.1.46	**Emergency Button**			
3.1.46.1	Emergency buttons shall have protective covers and be distributed evenly throughout the vehicle, one in the driver's cabin and at least one every 4 meters in the passenger area.			
3.1.46.2	The emergency button shall send signals to the Fleet Management Center at regular intervals for half an hour, after being pressed.			
3.1.47	**Temperature Sensor**			
3.1.47.1	There shall be a minimum of 2 temperature sensors.			
3.1.47.2	The temperature sensor shall be digital and not require calibration. The sensor shall have an operational range between -55°C and +125°C, with the capability to measure temperatures between -10°C and +85°C with an accuracy of ±0.1°C.			
3.1.47.3	The sensor shall be able to measure within the distance of 12 meters.			

3.1.47.4	The temperature measurement value shall be converted into a 12-bit digital format within a maximum of 750 ms.			
3.1.48	**4G / LTE Router-Gateway**			
3.1.48.1	The router shall have at least 1 port with a speed of 1000/100/10 Mbps for Uplink/Downlink Ethernet connectivity.			
3.1.48.2	The router shall have at least 1 port with a speed of 100/10 Mbps for configuration and device settings.			
3.1.48.3	The router shall have an integrated 4G LTE modem that supports Download/Upload speeds of 150/50 Mbps.			
3.1.48.4	The router shall be able to operate within a voltage range of 8-60 VDC and have electrical protection features.			
3.1.48.5	The router shall have at least 4 digital input and 4 digital output ports.			
3.1.48.6	The router shall have an integrated GPS/GNSS locator.			
3.1.48.7	The router shall have at least 1 RS232 and 1 RS485 port.			
3.1.48.8	The router's connections for GSM & GPS antennas shall be through SMA ports, supporting both internal and external antenna connections.			
3.1.48.9	The router cover shall be made of self-cooling aluminum material and have thermal conductivity.			
3.1.48.10	Router connectivity can be expanded with an integrated multi-switch, supporting up to 8 connections.			
3.1.48.11	The SIM card slot shall be securely locked and designed to withstand vibrations.			
3.1.49	**Vehicle Telemetry System**			

3.1.49.1	The system shall be integrated with the Fleet Management Center or Mersin Smart Transportation Data Processing System (MAVIS) currently in use in the inventory of Mersin Metropolitan Municipality's vehicles and shall be operated on the same screen.			
3.1.49.2	All electronic control units shall be connected through a data network (Can-Bus) and/or Vehicle Computer.			
3.1.49.3	The system shall be able to provide information and comparison regarding the buses' battery life, economic, and safe driving scores among the fleet, and the same information shall be available for detailed analysis on a vehicle-by-vehicle basis.			
3.1.49.4	The system shall generate Technical Performance report including information on mileage range and travel and consumption summary for the selected date as minimum. The report shall provide comparison of scores between buses			
3.1.49.5	The map shall be displayed in full screen, and when alarms on the map are clicked, alarm information shall be retrievable.			
3.1.49.6	Travel and Consumption Summary Information shall be able to be displayed in full screen.			
3.1.49.7	The system shall provide detailed information through graphical representation on the Report Analysis screen.			

3.1.49.8	The system shall be provide at least following data, but not limited to: • Engine revolution (rpm) • Engine Load and Torque Values • Vehicle Speed • Engine Fault Signal and Details • Brake Fault Signal and Details • Brake Pedal Position (%) • Battery (Electric) Consumption Value (km/h) (Total charge amount and remaining amount) • Ignition Position On/Off • Hand Brake Position (On/Off) • Total Driving Time • Tire Pressures (low pressure warning) • Door status (Open/Close) • Milage Information (km) • Range Information			
3.1.50	**Industrial Mini embedded PC**			
3.1.50.1	The PC shall have at least following features but not limited to: • Processor: ARM Cortex-A7 Dual-Core 1.0GHz • Graphics Processor: Arm Mali400 MP2 GPU • RAM: 1GB DDR2 SDRAM • Storage: 8GB Memory eMMC iNAND • Display Ports: 1 VGA or HDMI port			
3.1.50.2	The PC dimensions shall be maximum 14cm x 11 cm x 4 cm considering the mounting locations on the vehicle.			

3.1.50.3	The PC shall support Embedded Debian 7.5 and Android 4.2.2 Jelly Bean operating system as minimum.			
3.1.50.4	The operating temperature range of the PC shall be at least -20°C to +70°C.			
3.1.50.5	The PC shall have at least following features but not limited to: • Serial Ports: 1 RS-232 Serial Port, 1 TTL 5V Serial Port, and 1 RS-485 • Built-in GPS Module and External Antenna • Wi-Fi: WIFI (802.11b/g/n) • Ethernet: 1 x LAN (10/100 Mbps) • USB: 1 USB 2.0 port • SD Card Slot: 1 x eMMC Slot • RTC (Real-Time Clock): Built-in RTC • Micro SD Card: 16 GB capacity • Power Socket:(9-36 Volt – GND) • Audio Socket: (Speaker + / Speaker - / Speaker Gnd / Mic / Mic Gnd) • Wireless: Minimum support for 3G/4.5G LTE.			
3.1.50.6	The SIM card slot shall be resilient to vibration.			
3.1.51	**Driver Control Screen**			
3.1.51.1	The system shall be able to connect with the Fleet Management Center and voice communication shall be possible.			
3.1.51.2	The screen dimensions shall be a minimum of 185mm x 128mm x 34.9mm. The size shall be at least 7 inches.			
3.1.51.3	The screen shall be TFT or LCD screen with multifunctional touchscreen.			
3.1.51.4	The screen shall have a rear-view camera input and a rear-view signal detection port			

3.1.51.5	The screen shall have a numeric keypad with numbers 0-9.			
3.1.51.6	The screen shall support PAL/NTSC system.			
3.1.51.7	The resolution shall be a minimum of 800 x 480 pixels and support at least 16:9 format.			
3.1.51.8	The screen shall comply with IP53.			
3.1.52	**Advanced Vehicle Camera With Driving Assistance and Blind Spot Monitoring Camera**			
3.1.52.1	The system shall provide audible or visual warning in the event of a collision risk with vehicles and objects in front during driving.			
3.1.52.2	The system shall provide audible or visual warning in the event of a collision risk with pedestrians and objects when turning right.			
3.1.52.3	The system shall provide audible or visual warning in the event an uncontrolled lane change to the right.			
3.1.52.4	The system shall be integrated into the MNVR device.			
3.1.53	**Safety Indicators and Emergency Exits**			
3.1.53.1	In the driver's cabin, there shall be 1 (one) first aid kit and hanging point according to DIN 13164 standards.			
3.1.53.2	Each bus shall have 2 (two) triangular reflectors and warning flags.			
3.1.53.3	Each bus shall have 2 (two) wheel blocks.			
3.1.53.4	Each bus shall have 1 (one) fire extinguisher with a CO2 propellant of 6 kg each, suitable for TS 862-7 EN 3-7 + A1 directive, located near the driver's cabin in a suitable place.			
3.1.53.5	The keys or remote control for vehicle interior and exterior covers shall be the same type, and 2 (two) sets of keys or remote controls shall be provided per vehicle.			

3.1.53.6	The "Safety Exits" on the vehicle shall be in the number specified in the ECE-R107 technical regulation and shall meet the minimum dimensions.			
3.1.53.7	Necessary markings ("EMERGENCY EXIT" text, instructions, etc.) shall be made around the Safety Exits, and standard breaking hammers with cord and retraction mechanism shall be mounted.			
3.1.53.8	Warning labels shall be placed in locations inside the vehicle and shall be visible. The content (e.g., "Reserved for Pregnant Women," "Reserved for Veterans," "Ring the bell before your stop," "Move to the rear of the bus," etc.) and locations of these warning labels will be communicated to the Contractor by the MMM during the manufacturing phase.			
3.1.54	**Emergency, Equipment, Safety And Environment**			
3.1.54.1	Emergency window-breaking hammers shall be available throughout the bus, and these hammers shall be equipped with cords for easy access.			
3.1.54.2	Fire-resistant materials shall be used in the bus. Fire safety shall comply with the requirements stipulated by laws and regulations. It shall be in compliance with EU Directive 95/28/EC.			
3.1.54.3	The bus shall comply at least following safety standards; -UN ECE R66, -R118.			
3.1.55	**Internal - External Vehicle Markings and Labels**			
3.1.55.1	Any additional signs and labels that need to be present in the buses, beyond the standard requirements, shall be prepared according to samples provided by the MMM and placed in appropriate places.			

3.1.55.2	The texts to be present in the vehicles shall be designed according to the MMM's request and subject to MMM’s approval before their production.			
3.1.55.3	The front of the vehicles shall bear the inscription "Mersin Metropolitan Municipality" and the logo. Logo and inscription numbers shall be provided separately by the MMM.			
3.1.55.4	Disabled signs and other warning signs shall be placed inside the vehicles.			
3.1.56	**Internal - External Vehicle Markings and Labels**			
3.1.56.1	Any additional signs and labels that need to be present in the buses, beyond the standard requirements, shall be prepared according to samples provided by the MMM and placed in appropriate places.			
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3.1.56.4	Disabled signs and other warning signs shall be placed inside the vehicles.			
3.1.57	**Vehicle Paint and Color**			
3.1.57.1	The interior grab rails of the buses shall be painted in a color and pattern approved by the MMM.			
3.1.57.2	The buses shall be painted in a color and pattern approved by the MMM.			
3.1.57.3	The applied paint shall be resistant to corrosion and decay.			

3.1.57.4	The exterior paint and design of the vehicle provided by the Contractor in at least 5 different visual designs and submitted to MMM for approval.			
3.2	**Charging Units** **Quantity: 7** **Origin**			
3.2.1	The charging unit shall be equipped to charge 2 buses at the same time within a maximum 5 hours.; o The total charging capacity of each charging unit shall be a minimum of 180 kW. When 2 buses are charged simultaneously, the charging capacity shall be divided in a way that allows for equal and efficient charging.			
3.2.2	Charging units shall be the CCS Combo 2 type and compliant with IEC 61851-1/23, IEC61851-24 / DIN70121 / ISO15118-1/2/3 ed1 (incl. V2ICP/VDV261 support) EMC: IEC61851-21-2 standards.			
3.2.3	Charging units shall have the capability to fast and slow (gradual) charge, complying with IEC 62196-3 standards (fast charging equals maximum power charging capacity).			
3.2.4	Charging stations, adaptors, extensions, cabling, and sockets shall comply with EN/IEC 61851 Electric Vehicle Conductive Charging Systems regulations or equivalent international regulations.			
3.2.5	Charging unit shall comply with ECE R10 and EMC IEC 61000 standards.			
3.2.6	Charging unit shall include output short-circuit protection, reverse polarity connection protection, and protection against high voltage and high temperatures, overcurrent, and overvoltage.			

3.2.7	Charging plugs shall be the type 2 and mode 3 according to 3-phase IEC 62196-3 standards.			
3.2.8	Charging unit shall be capable of operating in all weather conditions and have electrical insulation with a Ui value of no less than 1000V.			
3.2.9	Charging unit shall have the capability to communicate with the vehicles. At least following information shall be monitored: • battery charge-discharge status, • voltage-current values, • approximate charging times, • current battery level, • energy drawn per vehicle (kWh), • energy drawn per station (kWh), • voltages, battery and charging station fault information.			
3.2.10	Charging unit shall have an accessible Emergency Stop Button to cut off power. Pressing the emergency stop button shall trigger a warning.			

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