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# MX-HUB

Spec V1.2

*An All-in-one 4G/5G LAN-in-a-Box Solution*

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# 1. General Description & Features

The MX-HUB is an integrated all-in-one and customizable 4G LTE and 5G NR network in a box (NiB) solution, ready to be plugged and connect 4G/5G/IoT terminals. It supports multi-cell, multi-mode backhauling, and customized edge services extensions allowing to rapidly deploy a 4G/5G network in three different operational modes: standalone, relay, and mesh networks.

MX-HUB features low-cost, low power, small form factor, light-weight, portable and modular design allowing to be battery powered and be embeded it into another system such as drones or robots. It is an ideal solution for many private 4G/5G network use-cases ranging from IoT, public safety network, enterprise secured/isolated network, and connected robots and UAV.

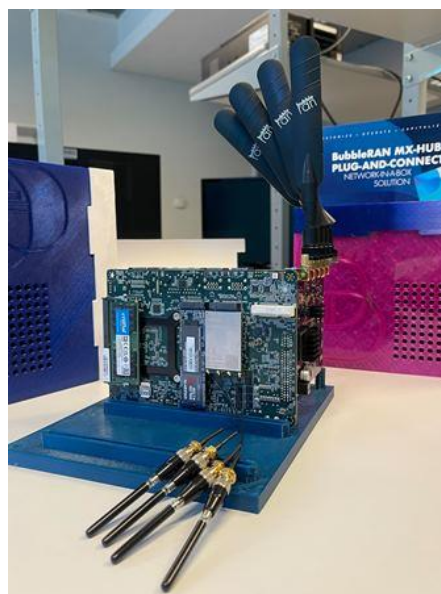
**Services:** High-speed data connectivity, Personalized and Secure Edge service, Network Manager.

**Mode of Operations:** standalone, relay, and mesh.

**Interface:** 4G/5G/WiFi/Eth backhaul, IP/NG/O1/E2, Command-line interface.

**Environment:** Snap (Application Container).

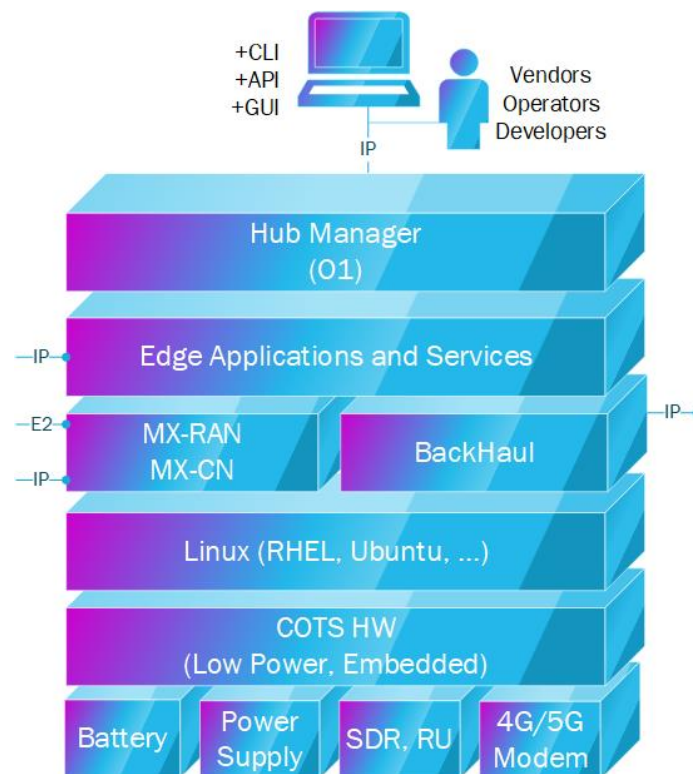
The BubbleRAN MX-HUB hardware platform is composed of an industrial-grade embedded mother board (intel W CPU) under Ubuntu or RHEL low latency kernel or Ubuntu, (2) a PCI-e SDR or a Remote eCPRI RRH, with antenna and accessories, and (3) optionally an 4G/5G backhaul enabled by a Quectel UEs and SIM cards.



## 2. Software Stack

The software stack of the BubbleRAN is shown below. It includes industrial 4G/5G software-based stack with a set of local services. The components are:

- **HUB Network Manager:** managing the network and backhaul services and exposing command line interface;
- **Edge Applications and Services:** a set of local and customized services;
- **MX-RAN/MX-CN:** 4G LTE/5G NR networking stacks;
- **Backhaul:** 4G/5G/WiFi/Eth backhaul interfaces to external networks or to other MX-Hub when meshing (up to 2 hops).



### MAIN FEATURES

1. User interfaces including CLI
2. Network full life-cycle management including reconfiguration
3. Support for O-RAN E2 and O1 interfaces
4. Lightweight 4G/5G core network with IMS (VoLTE/VoNR)
5. uRLLC & xMBB slices with customized edge services
6. standalone, and relay operations. Meshing is currently supported up to 2 nodes.
7. RF options:
  - a. Custom sub-6GHz frequency with a PCI-E SDR cards (default)
  - b. On Request: PCI-e NiC to remote RU connection with eCPRI split 8, or Split 7.2.



# 3. Hardware

## 3.1. PC SPEC: STANDARD, BOOSTED, EXTREME PROFILES

| Features                           | Value   |
|------------------------------------|---|
| <b>Format HxLxW</b>                | No PCIe card: 80mmx230mmx190mm<br>With PCIe card: 160mmx230mmx190mm |
| <b>Number of PCIe SDR Cards</b>    | 1 (depending on the configuration)                                  |
| <b>Weight</b>                      | 1.5 kg  |
| <b>CPU</b>                         | Typical: Xeon W-11865MRE  |
| <b>RAM</b>                         | Typical: 32GB   |
| <b>DISK</b>                        | Typical: SSD 128GB, 2 SATA ports available                          |
| <b>Ethernet</b>                    | Typical: 1x2.5Gb, 1x1Gb   |
| <b>WWAN</b>                        | 1 M.2 B-key 3052 for COTS UE + 1 SIM card slot                      |
| <b>USB3.2</b>                      | 4 distinct ports  |
| <b>PCI-e Gen 4</b>                 | 1 slot x8 (SDR or 25Gbps cards)                                     |
| <b>Power supply voltage Input:</b> | 100 - 240V AC   |
| <b>Power Consumption</b>           | Typical: 40W  |
| <b>Operating System</b>            | Ubuntu  |

### 1.1. PCI-E SDR SPEC

| Features              | Value  |
|-----------------------|--|
| <b>Power Supply</b>   | 12 V DC input                                |
| <b>RF coverage</b>    | 500MHz – 6.0 GHz (up/down convertor for FR2) |
| <b>RF Bandwidth</b>   | 200KHz – 100 MHz                             |
| <b>Range</b>          | 30 meter (with No PF)                        |
| <b>Operation Mode</b> | FDD and TDD                                  |
| <b>MIMO</b>           | 2x2 or 4x4                                   |

For other radio frontend, please contact us for more information.





## 2. Multi-X Radio Access Network (RAN)

### 2.1. ENB AND NG-ENB SPEC

| Features                            | Value  |
|-------------------------------------|--|
| <b>3GPP Release</b>                 | 16   |
| <b>Frequency bands</b>              | All bands. TDD and FDD   |
| <b>Bandwidth</b>                    | 1.4, 3, 5, 10, 15 and 20   |
| <b>Transmission Mode</b>            | 1 (single antenna) to 10 (MIMO 4x4)  |
| <b>Modulation and Coding Scheme</b> | Up to 1024QAM in DL and 256QAM in UL   |
| <b>AS Integrity and Encryption</b>  | Snow3G and AES   |
| <b>Handover</b>                     | S1, X2, Intra ng-eNodeB, NG, Xn<br>EPS to 5GS handover support                       |
| <b>eNodeB Network Interfaces</b>    | S1AP and GTP-U, X2AP between eNodeBs, NGAP and GTP-U to 5GC, XnAP between ng-eNodeBs |

### 2.2. GNB SPEC

| Features                         | Value  |
|----------------------------------|--|
| <b>3GPP Release</b>              | 16   |
| <b>Frequency Bands</b>           | FDD/TDD FR1  |
| <b>Bandwidth</b>                 | Up to 50 MHz   |
| <b>MIMO</b>                      | 2x2  |
| <b>Subcarrier Spacing</b>        | Data subcarrier spacing: 15, 30,60, KHz<br>SSB subcarrier spacing: 15, 30, 120 KHz |
| <b>Supported Modes NSA, SA</b>   | NSA and SA   |
| <b>Handover</b>                  | Intra gNodeB, NG, Xn and 5GS to EPS HO   |
| <b>Use-case</b>                  | eMBB, uRLLC,   |
| <b>eNodeB Network Interfaces</b> | NG interface (NGAP and GTP-U) to 5GC<br>XnAP between gNodeBs                       |



## 3. Multi-X Core Network (CN)

### 3.1. 4GC SPEC

| Features                           | Value   |
|------------------------------------|---|
| <b>3GPP Release</b>                | 16  |
| <b>Network elements</b>            | MME, SGW, PGW, HSS, ePDG, PCRF                  |
| <b>AS integrity and encryption</b> | Snow3G and AES                                  |
| <b>IP version</b>                  | IPv4, IPv6                                      |
| <b>QoS</b>                         | LTE QCI, TFT, and Dedicated Bearer              |
| <b>Handover</b>                    | Intra-MME and and EPS 5GS IRAT handover support |
| <b>Network</b>                     | S1AP, GTP-U, RX to IMS, S6A, S13                |

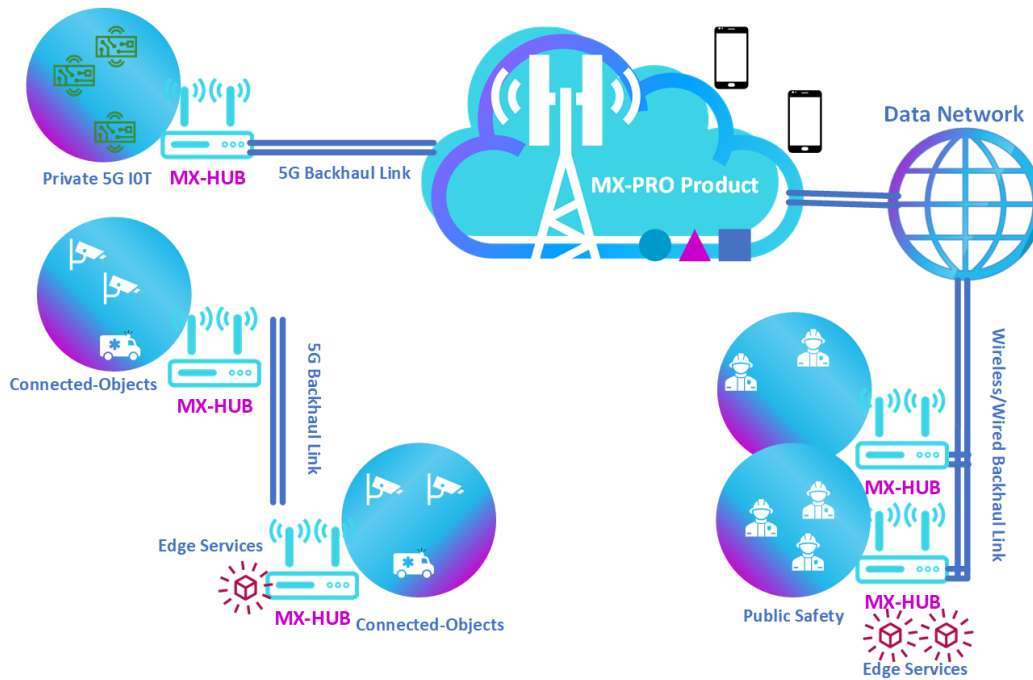
### 3.2. 5GC SPEC

| Features                           | Value  |
|------------------------------------|--|
| <b>3GPP Release</b>                | 16   |
| <b>Network elements</b>            | AMF, AUSF, SMF, UPF, UDM, NSSF, IMS                              |
| <b>AS integrity and encryption</b> | Snow3G and AES   |
| <b>IP version</b>                  | IPv4, IPv6, and unstructured PDUs support                        |
| <b>QoS</b>                         | Configurable QFI   |
| <b>PDU Session</b>                 | Multi PDU sessions support                                       |
| <b>Handover</b>                    | intra-AMF and 5GS to EPS IRAT support                            |
| <b>Slicing</b>                     | Multiple Slice (shared or dedicated NF)                          |
| <b>Network</b>                     | NG, Rx to IMS, N12 to AUSF, N8 to UDM, N17 to 5G-EIR, N50 to CBC |



## 4. Deployment Options

Figure below shows different deployment Options of MX-HUB. ...



Some available deployment options and use cases are:

- Coverage extension for Broadband or IoT.
- Private 5G with any backhaul including public or private 5G.
- Data collection in non-covered area with a nomad network.
- Quickly deployed on demand coverage and edge services.
- Autonomous wireless meshed networks for fleets of connected objects.



We are helping organizations to seamlessly build, customize, and operate their private 4G/5G infrastructure by consolidating open RAN and cloud-native architectures with a green MANO/SMO offering more than 10x efficiency and delivery cycle with lower carbon footprint for a wide range of R&D and enterprise use-cases from the lab to the production environment.

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