SOLUTION 4G/PMR AIR LYNX

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1 Tactical and Terminal Networks

1.1 Positioning

INSOLTECH is positioned as an integrator and official provider of 4G / LTE infrastructure solutions from the French manufacturer AIR-LYNX manufactured in France. The software is of French design.
AIR-LYNX has chosen to design a specific product range that is adapted to improve performance, in particular the majority of market players, who have chosen to take over materials designed for the general public to address the PMR / PPDR market In terms of security and resilience. This voluntary approach enabled him to:

- To achieve extremely compact solutions for emission infrastructures (ePC / eNodeB), which are therefore adapted to the context of "projected network"

- Integrate natively in these devices communications functions adapted to professional users (Push to Talk, Real-time video shared in the speech group, geolocation and point-to-point telephony, gateways to PMR networks, etc.)

- To compensate for the weaknesses of the 3GPP LTE standard by adding communication and resiliency mechanisms, anticipating the functions of future 3GPP releases, while following the evolutions of the standard.

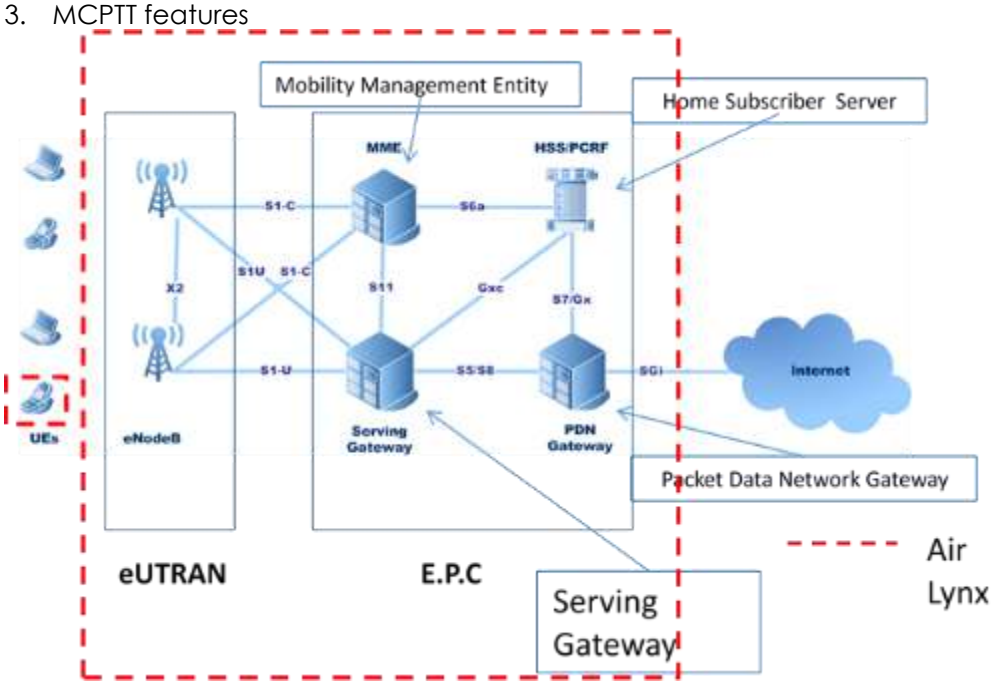
All of these products are subject to an ongoing certification procedure with ANSSI for an EAL3 + (Restricted information) level.
Our Air-lynx supplier is part of the Fed4PMR consortium, thus ensuring the interoperability in the world of the PMR dedicated to safety.

1.2 Simple architecture

The core of the AIR-LYNX product architecture is a compact, 19-inch rack-mounted, compact radio site that combines all the hardware and software needed to deliver LTE PMR communications. This product, reference ALB 11000, a product proposed for all 3 uses, which includes an EPC network core, an ENodeB macro base station and MCPTT, audio, video and geolocation application servers (see figure below), is available in A wide variety of frequency bands, as well as broadband (for example, communications between 700 and 960 MHz). Equipped with a 2x20 Watts MIMO radio head, an AIR-LYNX site allows important coverages

The ALB11300 wideband version makes it possible to group all the channels even non-continuous.
The AIR-LYNX equipment is based on a product with the particularity of grouping in a single unit all the components of a 4G LTE network, namely:

1. eNode B
2. L'EPC
3. MCPTT features



ALB 11300 option large wideband 700

From the outset, the product was designed to meet operational requirements for the private market. We have therefore deliberately introduced several major principles which are totally absent from the other LTE solutions currently available on the world market, namely:

1. Resilience.
2. Scalability.
3. Operational efficiency.
4. Easy opening to other standards of radio-communication.
5. Optimal use of open source

To these great founding principles of our product, we considered imperative the strict respect of the standard and the perfect follow-up of its future evolutions. It is fair to say that no current solution on the market achieves such objectives. In technological terms we opted for the Software Defined Radio product. This choice gives the AIRLYNX solution unmatched flexibility and scalability.

1.3 résilience

The LTE standard does not incorporate resilience in the sense that it is generally understood in the professional radiocommunication sector. Many PMK systems and standards have for decades embraced so-called "decentralized intelligence" principles. This principle requires that a system has a certain level of redundancy or fault tolerance. For operational uses, the loss of a site is usually a major failure. This loss can be caused either by a failure of the equipment or by the loss of the intersite links.

In order to effectively remedy the loss of a site, it is essential that it contain a local controller with a database of its subscribers kept up to date in real time. This path has been successfully explored by a large number of standards and manufacturers in the field of professional radio communication.

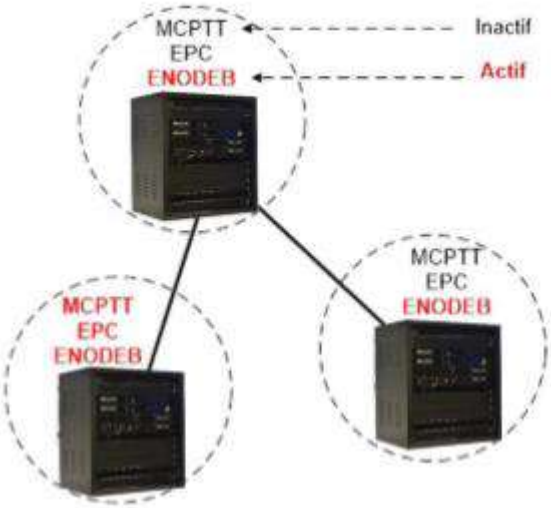
A LTE radio site is composed of one or more "eNodeB" base stations (evolvedNode B) which, unlike professional systems, does not have any form of local intelligence. These "eNodeB" base stations are generally connected to the core network "EPC" via a "backhaul" network through a standardized interface "S1" supporting protocols and data streams S1-AP / SCTP to the MME (Mobility Management Entity) for signaling traffic and the S1-U / GTP_U protocol to the S-GW (Serving Gateway) for user traffic of mobile terminals.
The entire system intelligence contained in the network core "EPC", a base station disconnected from its interface S1 will be totally isolated from the rest of the system and consequently not operational.

Air-Lynx equipment meets standards and does not introduce proprietary protocols or functionality into products.

We therefore opted for the addition of an "EPC" per site so that they locally find all the functionalities available in LTE 4G. The mechanism of resilience in fact by algorithms of election and distribution of the intelligence which are property of AIR-LYNX. This solution adds to the standard a function of resilience in all points comparable to those used in the field of professional networks while not introducing any specific interface.

1.4 Scalability

This choice is also relevant in the scalability registry. With the addition of a core network per site, it is possible to upgrade a single-site network to a multi-site system with extensive coverage. Just add new sites. This gives the customer the possibility to flexibly increase the coverage capacity of his system, as shown in the figure below. In addition, the system has a total redundancy at the core of the network and assuming the loss of an S1 link between the sites, the isolated base station allows the local traffic to be dumped..



1.5 Operational efficiency.

Our solution thus constituted allows the realization of tactical networks that can be deployed in a few minutes. The tactical solution represents the mono site version of our equipment. In order to allow the fastest possible startup, the system relies on the use of Linux-based servers equipped with solid-state drives. These discs are at the same time more resistant because they do not possess any mechanical moving parts and are also faster than their magnetic equivalents. Initialization of the system itself taking less than five minutes to which it is necessary to add the time of deployment of the telescopic mat for example. The figure below shows the tactical version of the product.

1.6 Spécifications

Transmission :
FDD ou TDD
Mimo 2x2
Bandwidth : 1.4/3/5/10/20 MHz

Cover
Power: 40W (2x43dBm mimo)
Mono ou multisite
Indoor ou outdoor

Standard
Conforme à la release 3gpp release 12

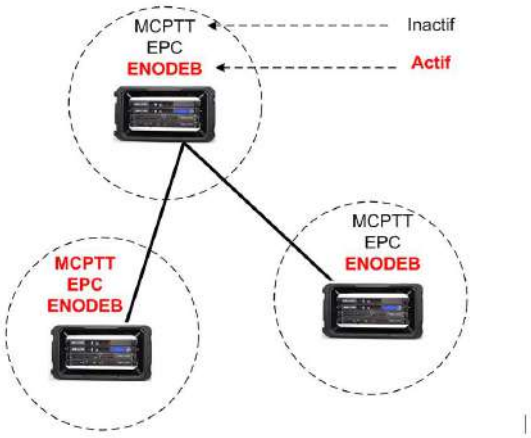
other :
Receiver Noise figure <5 dB
Peak Data Rate DL@100 Mbit/s, UL@50 Mbit/s
Latence RTT 30 ms on NAS access
Group call setup < 500 ms
Connecteurs Duplex 7-16
Alimentation 230 VAC / 48 VDC
Applications interface Gigabit Ethernet
Package 4U package robuste transportable
Taille package 978x333x625 mm
Weight 40 kg, depending on RF power
Température -30 to +50 °C

Possibility of setting up a tactical bubble in less than 5 minutes:

- ✓ In a single light vehicle
- ✓ Power requirement 600 w max

1.7 Simplifying deployment

AIR-LYNX bubbles will self-organize.



Répartition automatique des rôles dans un réseau fixe 4G LTE AIR-LYNX

Automatic distribution of roles in a 4G LTE AIR-LYNX fixed network.

In this case, it is not necessary to have more than one ePC or several application servers. Thus, the functional entities that no longer serve will be deactivated, being careful to give the most up-to-date information to those that will be chosen to remain active. This "AIR-LYNX" mechanism is added above the 3GPP protocol layers to complete the Functions origin.
Bonus: This mechanism is reversible. A projected network of three sites undergoes a rupture of an intersite link ... the system is reorganized to heal. If necessary, a cell may be isolated and remain fully functional. The LTE PMR AIR-LYNX devices therefore have a native "isolated site" degraded mode.
AIR-LYNX equipment is resilient and self-healing.
Deployments, redeployments and the consequences of operational accidents are therefore simplified.
The management of each bubble can be done locally or centrally.
The AIR-Lynx solution can interface with a hypervisor for the management of network events.

INSOLTECH Proposes to integrate solutions of mats according to the need of use of the tactical bubbles, as well integrated in vehicles with a telescopic pneumatic mast.

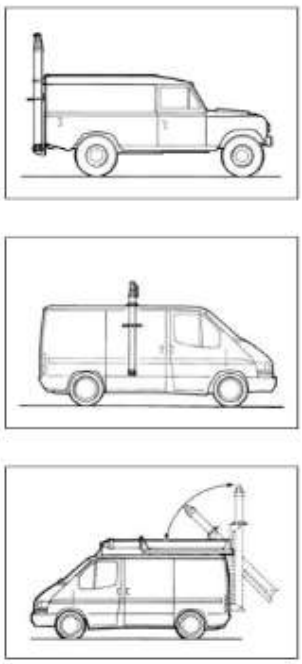


Figure 1 : the different types of mounting on vehicles

Or the supply of manual mat:.

Figure 2 : Les différents types de mats possibles

Item	Cat. No.	Description	Qty
1	6196	Mast Unit PU 6	1
2	6105	Base	1
3a	15166	Picket (Standard)	3
3b	3484	Picket (Alternative) (not shown)	(3)
4	6409	Spike	2
5	B0021	Hammer	1
6	6336	Picket Radius Line	1
7	6729	Lower Guy Assembly	2
8	6730	Lower Guy Assembly with Anchor	1
9	6731	Upper Guy Assembly	3
10a	6251	Equipment Box	1
10b	7933	Equipment Bag (Alternative) (not shown)	(1)
11	6411	Canvas Cover	1
12	6421	Set of Tools	1
13	6733	Cross-pin, spare (not shown)	2

The height of the mats for vehicle or manual can rise up to 15 meters.
INSOLTECH proposes to integrate the bubble, including power supply with Li-ion battery, redundant converters, recharges for terminals, in vehicles.
Regarding the deployment outside a vehicle, INSOLTECH can provide tactical solutions allowing the supply of energy in a continuous and silent way.

It is possible to deploy with the same sense of simplicity a network of several sites with a WIMESH transport network for example.

1.8 Terminals ALS14000 rugged 100% European

The AIR-LYNX-based solution supports all existing 4G smartphones that meet the standard and frequency. It must be based on Android OS to receive client software to support the native MCPTT features.

lynx dédié

INSOLTECH propose le terminal AIR ALS14000 durci aux forces de sécurité :

SPECIFICATION ALS 14000

- QUALCOMM SNAPDRAGON 801

SYSTEME D'EXPLOITATION

- Android ™ 5.0 Lollipop

MEMORY

- 2GB RAM
- 16GB de mass memory
- Extension micro SD

SECURITE

- Sécurisation secteur boot
- Intégrité du runtime
- VPN Mobile (optionel)
- firewall
- secure data storage for user credentials and encryption keys

- encrypted mass memory
- detection of falsification

DISPLAY

- • 5 "Full HD (1080 * 1920) LCD tactile capacitif
- Can be used with gloves
- Operates in wet conditions

BATTERy

- Li-Ion 2420mAh

LTE

- 3GPP rel10 (LTE Advanced)
- FDD Cat4, DL 150 Mbit/s, UL 50 Mbit/s
- IMS, VoLTE Band configuration: US: B2 (1900), B4 (1700), B5 (850), B12/B17 (700), B13 (700), B14 (700) EU: B3 (1800), B7 (2600), B20 (800)& Carrier Aggregation
- UMTS/HSPA
- 3GPP R99 384/384kbps
- 3GPP rel8, HSPA+, 42 Mbps/5.76 Mbps Band configuration: US: B2 (1900), B4 (1700), B5 (850) EU/APAC: B1 (2100), B8 (900)
- GSM/GPRS/EDGE 850/900/1800/1900 MHz

other

• Wi-Fi 802.11 a / b / g / n / ac
• Bluetooth 4.0
• NFC (en option)

CAPTORS

• Gyroscope 3D
• Accélérometer 3D
• Magnétometer 3D
• Proximity sensor
• Ambient Light Detector
• Barometer

INTERFACES

- USB3.0
- Ecran sans fil
- Double SIM

PUSH-TO-TALK (PTT)

- Button PTT

GEO LOCALISATION

- aGPS/Glonass

PICTURE&VIDEO

- Caméra principal 8 MP with autofocus & flash LED
- Camera front 2MPcapture vidéo and play HD

AUDIO

- High-performance loudspeaker (100dBSPL)
- Multi-microphone with active noise cancellation
- headset and microphone
- Connector headset 3,5 mm

SPECIFICATION HARDWARE

- 141 mm x 75,5 mm x 13,5 mm
- weight 180g
- IP67
- Impact résistant MIL-STD-810G
- magnésium frame
- liquid silicon protection
- -10 ° C ... + 55 °

1.9 Capacité de fourniture et référence

INSOLTECH s'appuie sur la capacité d'Air-Lynx sur la fourniture et le soutien en cas de nécessité :
Dans le cadre d'un partenariat entre SNCF et Air-Lynx, plusieurs bulles LTE ont été mises en œuvre et en particulier tout récemment les deux sociétés ont déployé sur les emprises de Gare du Nord et Saint-Denis des sites fixes et mobiles 4G-LTE Air-Lynx à l'occasion de l'EURO 2016, ce qui en fait un des tout premiers déploiements sur le territoire français.

Par ailleurs Air-Lynx a reçu plusieurs commandes d'intégrateurs pour livrer des bulles au Ministère de la Défense ou pour intégrer ces bulles dans des environnements critiques. Les montants et les nombres sont des informations confidentielles protégées par des NDA. Ces livraisons ont intégré également des terminaux ALS14000.

Enfin Air-Lynx est partenaire du projet Fed4PMR qui a pour objectif d'étudier et de concevoir la prochaine génération de réseaux mobiles hybrides pour les besoins de services de sécurité et de contribuer à la normalisation de cette technologie. En particulier ce projet doit permettre d'étudier et de valider par l'expérimentation opérationnelle un système de communication PMR très haut débit hybride utilisant la norme 4G/LTE et s'appuyant sur plusieurs types de réseaux d'accès (réseau public d'opérateur, réseau dédié 4G/LTE, réseau déployable 4G/LTE). Ce projet est porté par le groupe THALES et regroupe 8 autres sociétés ainsi qu'un laboratoire de recherche. Son démarrage s'est effectué en février 2016 et durera 36 mois avec plusieurs expérimentations tout au long du projet sur de vrais théâtres d'opérations. Au sein de ce projet, Air-Lynx est responsable de la fourniture des réseaux déployables 4G/LTE ainsi que de passerelles entre le réseau déployable et le réseau régalien ainsi qu'entre le réseau déployable et les réseaux existants utilisant la technologie Tetra.

Il est rappelé qu'Air-Lynx est membre du 3GPP et dispose d'un salarié qui participe activement aux travaux du 3GPP (en particulier SA6).

Air-Lynx dispose d'un ensemble d'outillages et d'équipements de tests permettant le développement de cette gamme de produits (analyseur de protocoles, analyseur de spectre, simulateurs et équipements terminaux,…) assurant, au-delà de la capacité niveau 2 d'INSOLTECH.

Aujourd'hui les composants utilisés pour la fabrication n'ont pas de délai d'approvisionnement critique (supérieur à 3 mois) et les livraisons au titre des projets n'exigent pas de constitution de stock. Si, dans le cas d'un accord cadre qui conduirait à la livraison de quantités de produits avec des délais critiques, Air-Lynx pourrait approvisionner certains composants en avance et constituer un stock de façon à réduire les délais en cas d'augmentation de besoins suite à une crise.

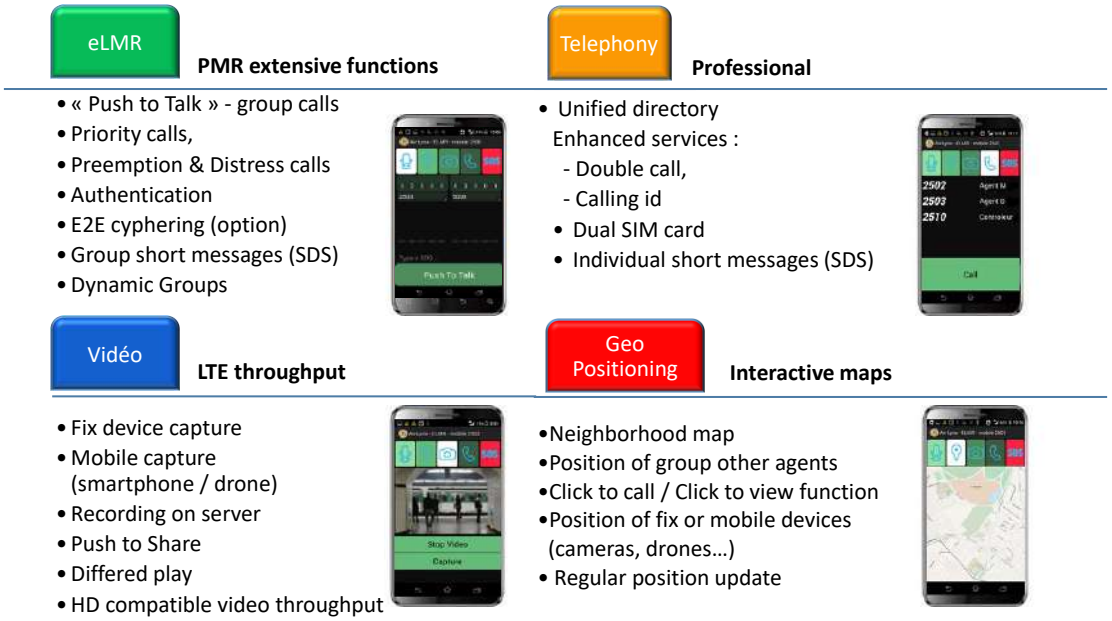
La capacité actuelle de l'équipementier est de 5 bulles / jour et peut passer à 10 bulles/jour avec un préavis de 6 semaines.

2 Applications et sécurité

Each AIR-LYNX radio site hosts MCPTT-type application servers allowing users under its coverage (and even if the site is isolated from the rest of the world):

- Push to Talk services, allowing multiple groups to be watched, priority management, speaker identification, group SMS, dynamic grouping calls, and more. In short: everything that the TETRA / TETRAPOL standard offers in this field
- Point-to-point telephony services in the fleet of connected terminals with presence detection, individual SMS, priority management between PTT and telephony
- Mobile geolocation services and sensors on a map repository (not connected to the Internet, the maps being on the local server)
- Video streaming, video capture and recording, and a particularly useful service: sharing real-time video in the talkgroup (we call it "Push To Share"),
- Management of the user authentication of the services by encryption https and MD5.

These services are accessible to external application users (via APIs) as well as to smartphone users who have installed the dedicated CALM (Client Air Lynx Mobile) application.



Interfaces API (Ethernet) allowing external applications to interoperate with AIR-LYNX application services. This can be useful for interfacing an external dispatcher, or a dedicated video surveillance network. These APIs can be used without adding hardware.

The AIR-LYNX system has a free open interface allowing the development of third-party applications. This interface is accompanied by an API delivered to the customer on request.

This choice allows the client or its service providers to develop third-party applications without the need for prior authorization from AIR LYNX or purchase of development licenses.

In this case, it is not necessary to have more than one ePC or several application servers. In this way, functional entities that no longer serve will automatically deactivate, taking care to give the most up-to-date information to those that will be chosen to remain active.

This patented "Air-Lynx" solution is added above the 3GPP protocol layers to complete the SO.N. functions. And already incorporates Isolated E-UTRAN Operation for Public Safety (IOPS) mechanisms under discussion for integration with Release 14 within the 3GPP.

Bonus : This mechanism is reversible. A projected network of three sites undergoes a rupture of an intersite link ... the system is reorganized to heal. If necessary, a cell may be isolated and remain fully functional. The LTE PMR AIR-LYNX devices therefore have a native "isolated site" degraded mode.

Air-Lynx equipment is resilient and self-healing. They work equally well with their integrated components ePC or MCPTT as well as with ePC or MCPTT central or regal components.

3 Passerelle vers les systèmes bandes étroites

The system has optional interfaces to other radio systems such as analog, DMR, TETRA or TETRAPOL networks.
INSOLTECH offers gateways LTE PMR networks AIR- to heterogeneous networks. AIR-LYNX integrates in its offer:

- Hardware gateways in 19 "format, 1U high, allowing interface with TETRA, TETRAPOL, VOIP, analogic radio, etc ....
- Gateways allow grouping of LTE PMR group calls and TETRA or TETRAPOL group or conference calls.

Passerelle d'interfonctionnement LTE TETRA

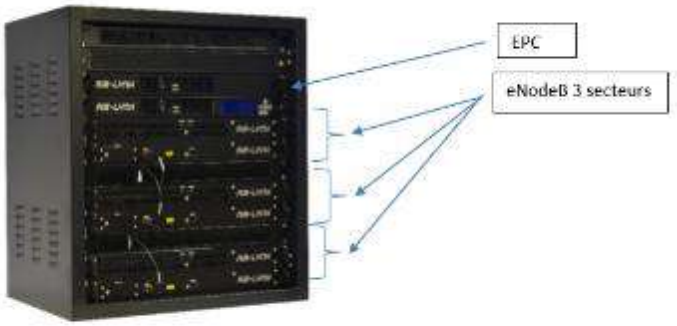
These software or hardware interfaces can be directly integrated into AIR-LYNX bubbles or tactical networks.
In addition, AIR-LYNX APIs are used by manufacturers of dispatch and network interworking solutions,
The links between the bubbles of different technologies and the bridge can be done in 3 ways:

- 100% by radio link (useful in case it is difficult to connect to the analogue core)
- 100% by wired link
- Mixed link (radio + wired)

-

4 Permanent Critical Communications Network Access Service

On fixed radio sites, we can propose the indoor version with 3 sectors composed of 3 enodeB with a transmission power of 40W (2x43dBm mimo



The Air-Lynx ALF12000 is compatible with 28 PPDR (2x3 MHz and 2x5MHz).
This ALF12000 product is made up of hardware and software sub-assemblies that are common to the ALB11000 range of projectable radio bubble products. Indeed the difference between the products lies only in a different mechanical packaging.
The ALB11000 and ALF12000 can be used simultaneously to:

- To reduce the validation times of the products and the overall system,
- Facilitate overall maintenance through the use of common hardware sub-assemblies (mainly identical replacement lots),
- To simplify the evolution of products (release 3GPP 13, 14 ...) by the implementation of a common software.

We can offer WImesh collection transport solutions to link the fixed sites to the transport network