SLICES
Spanish node and 6G experimentation

SLICES National Roadshow
3 October, 2023, Madrid, Spain

Carlos J. Bernardos, UC3M
cjbc@it.uc3m.es

SLICES-ES

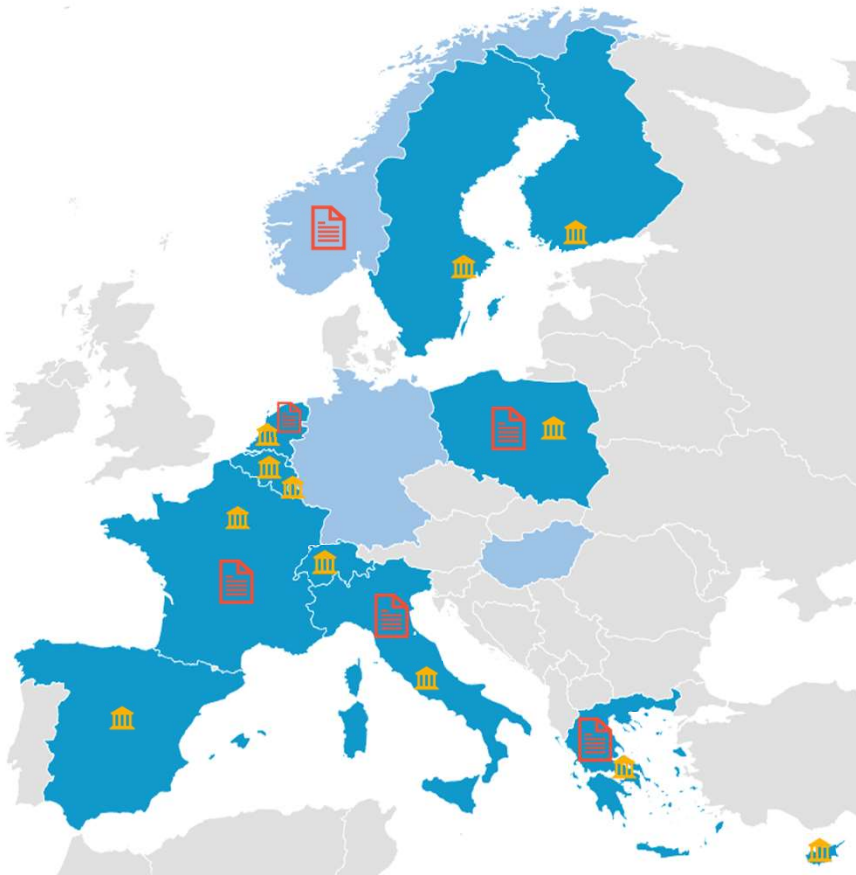# 6G Research Infrastructures?

Outline

- Background
  - SLICES-RI
  - SLICES-ES
  - Intro to SLICES-Madrid: built based on our service experience

- SLICES-Madrid
  - General service: extended SLICES blueprint
  - One more thing…

Background

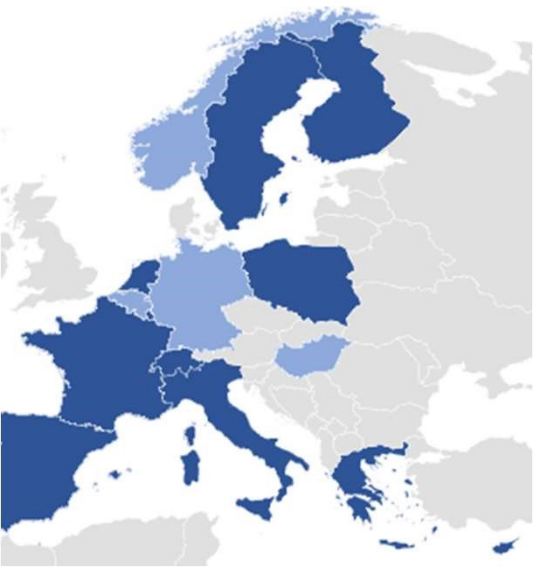# SLICES for research on Digital Infrastructures

Initiated in 2017, **25 partners** from 15 countries:

- **12 political support** from National Ministries 🏛️

- included in **6 national roadmaps** 📄

SLICES will enable **scientific excellence and breakthrough** and will **foster innovation in the ICT domain**, strengthening the **impact of European research**, while contributing to European agenda to address **societal challenges**, and in particular, the twin transition to a sustainable and digital economy.

Current status of the partnership

SLICES
ESFRI successful application – 2020

slices RI

Current status of the partnership

SLICES-ES: https://slices-es.eu/

SLICES-Madrid

SLICES-Euskadi

SLICES-Madrid:
built based on our experience providing services

- UC3M and IMDEA Networks have a remarkable record of research projects and initiatives providing services to the scientific community:
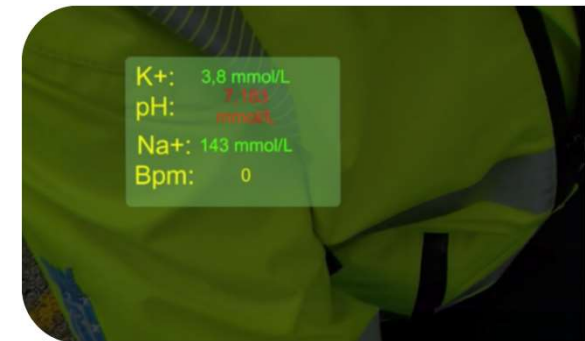
  - **5TONIC** (as presented by Juan Carlos García): **private** initiative, leader in Europe, reference lab internationally, EU digital hub

  - **Multiple EU and ES funded projects** focused on experimentation and/or provision of services to external parties

An example: the emergency use case of SAMUR

slicesRI

SLICES-Madrid

SLICES Spanish node and 6G experimentation

SLICES-Madrid

- ## What is SLICES-Madrid?
  - Main site of SLICES-ES, managed by UC3M and IMDEA Networks
  - Focused on 6G+ experimentation

- ## First general service based on an (extended) SLICES blueprint
  - Baseline 5G+ mobile network supporting Open RAN and leveraging open source frameworks
  - Several SLICES sites already supporting it, including SLICES-ES
  - Designed to provide flexibility in RAN, Edge, Core location and capabilities, and (open) data collection
  - SLICES-Madrid will focus on Deterministic Networking and Integrated Sensing and Communications

slices**RI**

RAN NETWORK

CORE NETWORK LTE+NR

docker

OPEN AIR INTERFACE 5G

SRS SOFTWARE RADIO SYSTEMS

O-RAN ALLIANCE

USRP UHD

5G SA SETUP WITH N310

UE SIMUL

Open5GS

OPEN AIR INTERFACE 5G

USRP UHD

AMARI SIMBO

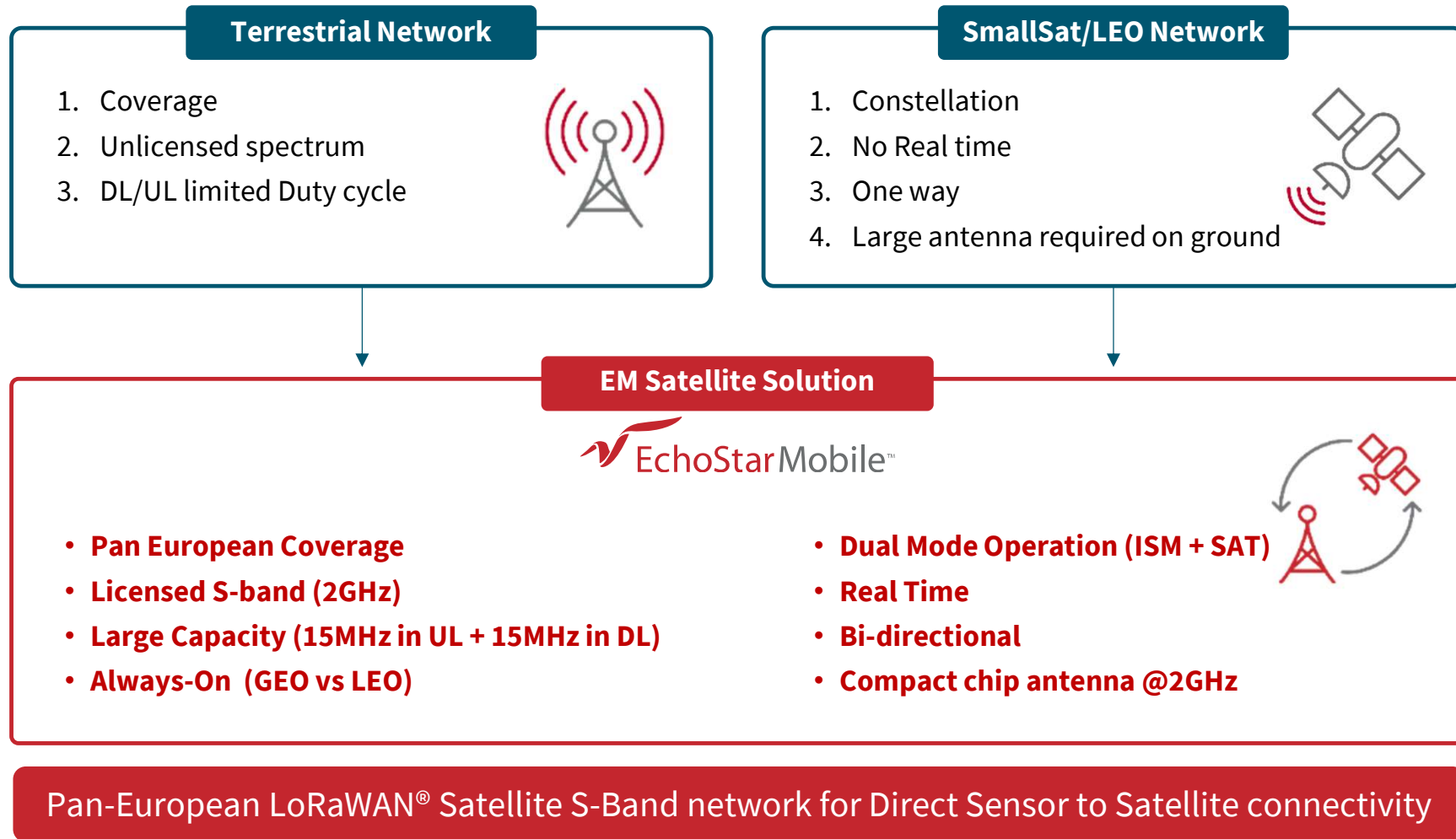5G NSA SETUP WITH B210 and N310

One more thing…

SLICES-ES Sat-IoT Research Infrastructure

- We are proud to annouce our first SLICES-ES service!!
 - Offered by SLICES-Madrid node

Material courtesy of:

EchoStarMob

SLICES Spanish node and 6G experimentation

14

Key Challenges in Today IoT Landscape

Terrestrial Network

1. Coverage
2. Unlicensed spectrum
3. DL/UL limited Duty cycle

SmallSat/LEO Network

1. Constellation
2. No Real time
3. One way
4. Large antenna required on ground

EM Satellite Solution

EchoStar Mobile™

- **Pan European Coverage**
- **Licensed S-band (2GHz)**
- **Large Capacity (15MHz in UL + 15MHz in DL)**
- **Always-On (GEO vs LEO)**

- **Dual Mode Operation (ISM + SAT)**
- **Real Time**
- **Bi-directional**
- **Compact chip antenna @2GHz**

Pan-European LoRaWAN® Satellite S-Band network for Direct Sensor to Satellite connectivity

SLICES-ES Sat-IoT experimentation for research

First Pan-European IoT network for **Direct Sensor-to-Satellite** communications in licensed S-band

ECHOSTAR 21

EU COVERAGE
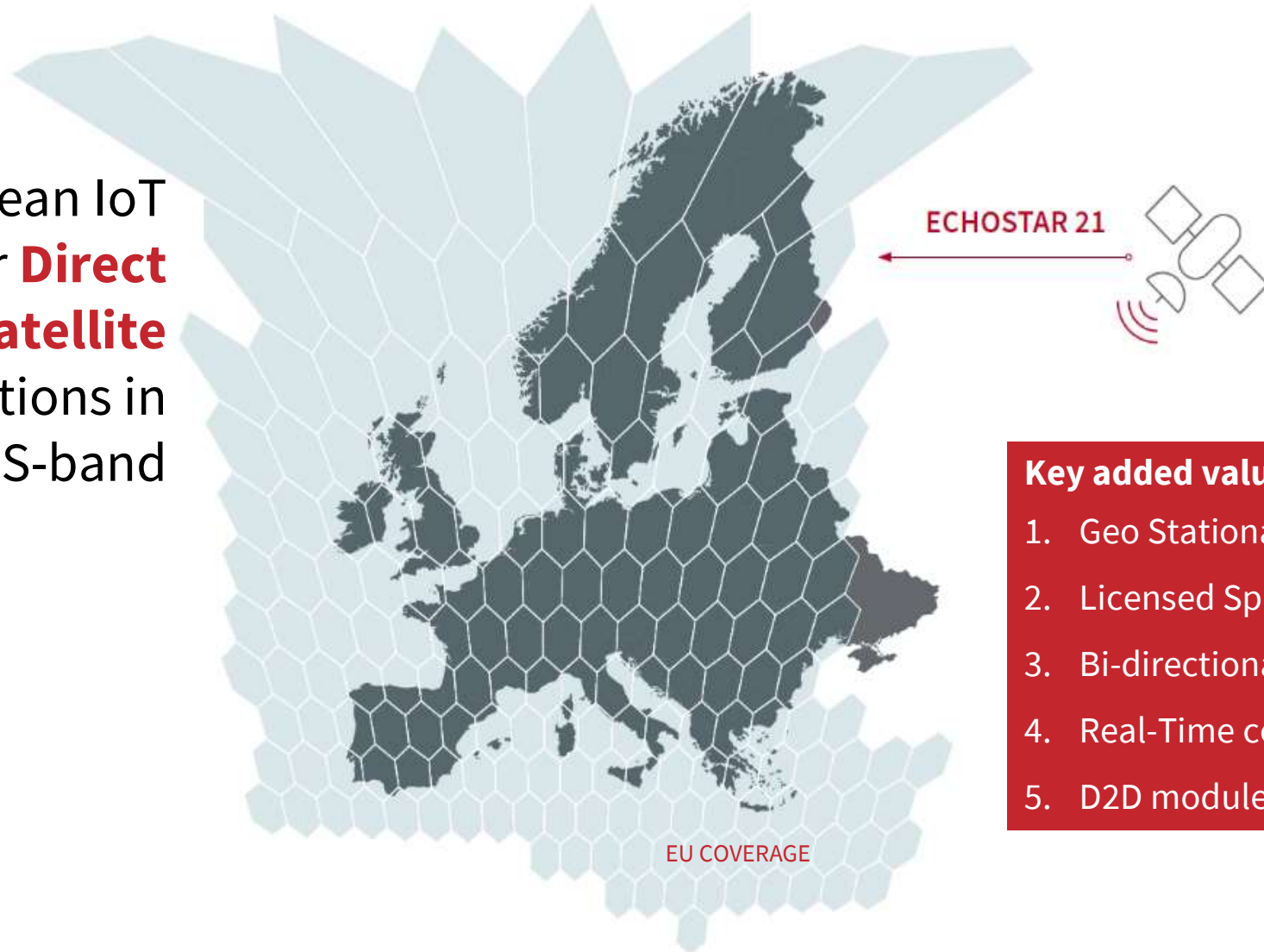
Key added values

1. Geo Stationary Satellite
2. Licensed Spectrum
3. Bi-directional connectivity
4. Real-Time communications
5. D2D module homologation

SLICES-ES Sat-IoT Technology Highlights

## Fully homologated radio module

- Support both S-band (satellite) and ISM (terrestrial) spectrum
- Compliance with LoRaWAN standards
- Low Power Consumption
- Embedded E2E data encryption with secure hardware key injected in the chipset in factory

PCB Ceramic Antenna

- Polarization: linear
- Frequency: 1980-2020MHz(Tx) / 2170-2200MHz(Rx)
- Gain: 1.0dBi
- Size: 30 x 67 mm
- coaxial U.FL connectors

Integrated OEM EM2050

- NUCLEO board STM32WB55 with Arduino Uno R3 shield layout
- S-Band PCB Antennas
- SMA-F Connectors for ISM operation and GPS
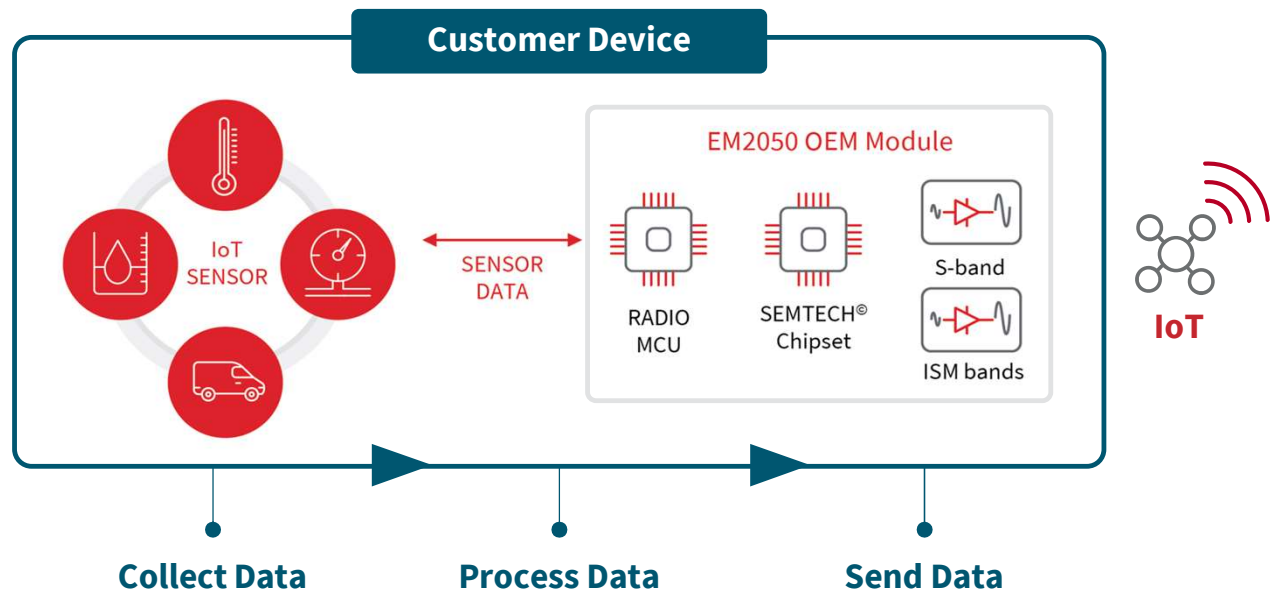- Setting via AT commands

EM2050 Module

EMAS100 Antenna

EVK Evalua

32mm

47 mm

67 mm

30 mm
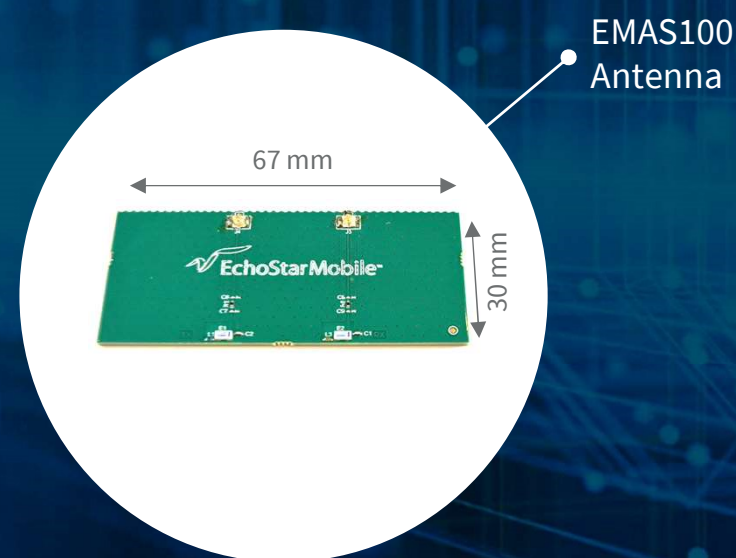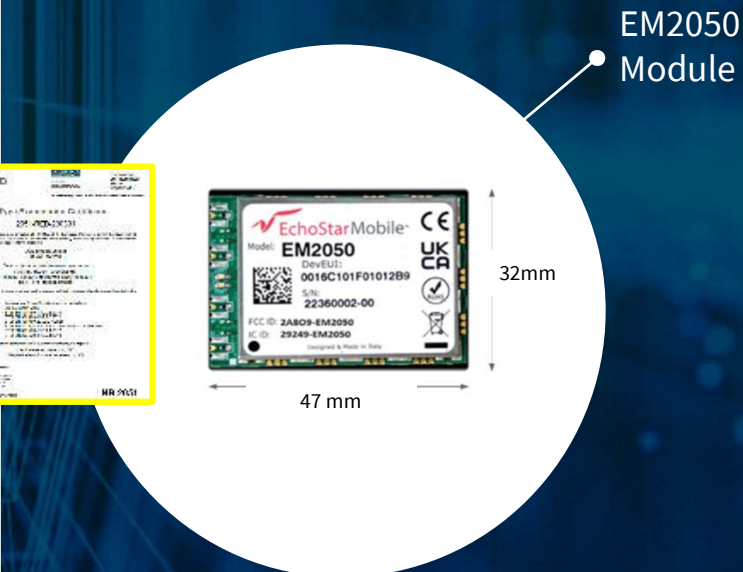
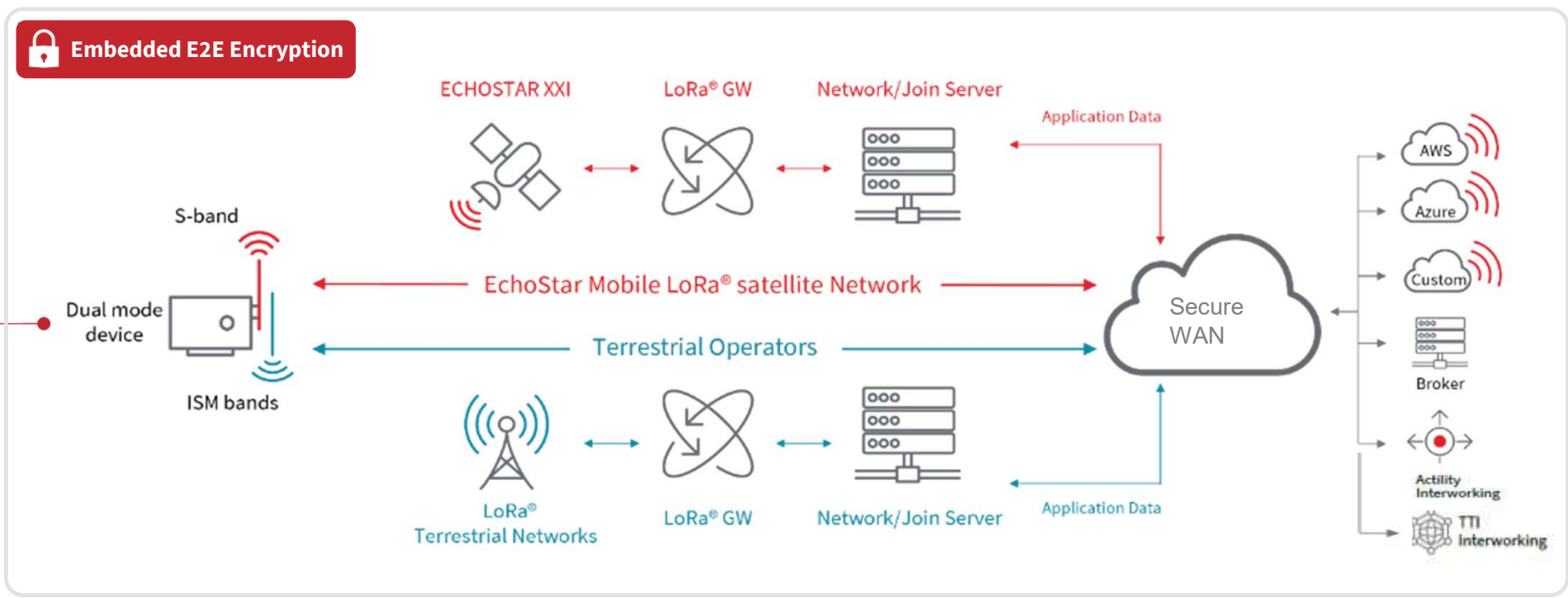# SLICES-ES Sat-IoT EM2050 Dual Mode Module

Dim 47x32x4mm

EM2050

- Low power using LoRa®/LoRa®-FHSS modulation
- Real time bi-directional connectivity
- Based on latest Semtech radio chipset LR1120
- LoRa® satellite module on licensed S-Band (2GHz) @27 dBm
- LoRa® terrestrial module on ISM bands
  - EU868 @14 dBm
  - US915 @22 dBm
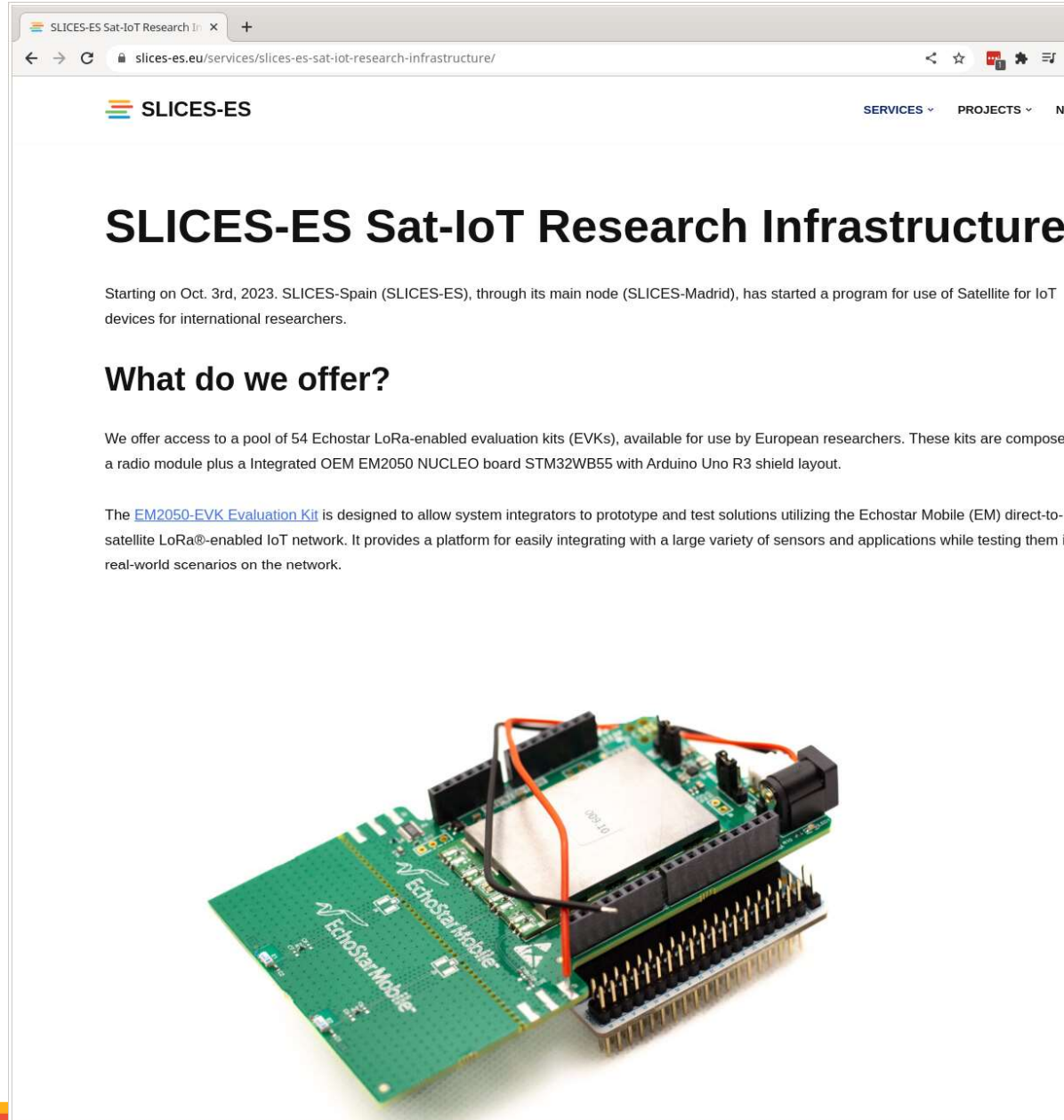- Homologated for ETSI, UKCA, FCC and ISED Market

Customer Device

IoT SENSOR

SENSOR DATA

EM2050 OEM Module

RADIO MCU — SEMTECH© Chipset — S-band / ISM bands

IoT

Collect Data → Process Data → Send Data

SLICES-ES Sat-IoT EM Network Architecture

EM2050 module homologated for CE, UK, FCC and IC

GEO launched in June 2017 +15y lifecycle

NS designed and realized on LoRaWAN specs in 2022

Agile integrat with AS and c service with RESTful APIs

🔒 **Embedded E2E Encryption**

ECHOSTAR XXI → LoRa® GW → Network/Join Server → Application Data

S-band

Dual mode device

ISM bands

EchoStar Mobile LoRa® satellite Network

Terrestrial Operators

LoRa® Terrestrial Networks → LoRa® GW → Network/Join Server → Application Data

Secure WAN

AWS
Azure
Custom
Broker
Actility Interworking
TTI Interworking

SLICES-ES Sat-IoT Research Infrastructure

- **What do we offer?**
  - Access to a pool of 54 Echostar LoRa-enabled experimentation devices
  - Composed of a radio module plus an IntegratedOEM EM2050 NUCLEO board STM32WB55 with Arduino Uno R3 shield layout

- **How do we provide access?**
  - Lease of devices in batches from 1 to 10 devices (larger batches can be negotiated), in slots from 1 to 6 months (longer periods can be negotiated)
  - Free for research use, only shipment (also to return them) needs to be covered by the researchers
  - Access to technical documentation on how to use the devices
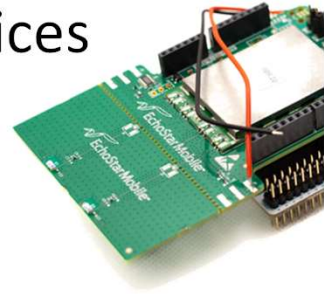
slicesRI

SLICES-ES Sat-IoT

- More information available on our website:
  - https://slices-es.eu/
  - Including a request form

- We already got a request for an experiment with drones for maritime inspection of port access

Thank you

www.slices-ri.eu
https://slices-es.eu/

slicesRI

SLICES-ES

www.slices-ri.eu