MISSATO PROJECT

Final Presentation – ESTEC
Date: 23rd January 2020
MISSATO PROJECT GOAL

To develop a series of precision GNSS receiving antennas for the mobility applications, asset tracking and general IoT

- **Product 1** - Active Quad Helix - An Active Quad Helix Wideband receiving antenna covering E1, L1, G1, L2, G2, E6, E5a, L5, E5b, G3, B1, B1-2, B2, and B3

- **Product 2** - Active Polymer Composite E1, L1, G1, L2, G2, E5a, L5, B1, and B1-2 Stacked Patch - An active Polymer Composite E1, L1, G1, L2, G2, E5a, L5, B1, and B1-2 Stacked Patch

- **Product 3** - Active Ceramic L1, L2, and L5 Stacked Patch - An active Ceramic E1, L1, G1, L2, G2, E5a, L5, B1, B1-2 Stacked Patch

- **Product 4** - Passive Ceramic L2 Patch - A single pin passive ceramic patch

- **Product 5** - Passive Ceramic E5a (L5) Patch - A single pin Passive E5a, L5 Ceramic patch

- **B1** - BeiDou centre frequency 1561.1 MHz
- **B2** - BeiDou centre frequency 1207.14 MHz
- **B3** - BeiDou centre frequency 1268.52 MHz
- **E1** - Upper L-Band 1559 MHz - 1591 MHz (Galileo)
- **E5a** - Lower L-Band 1164 MHz - 1189 MHz (Galileo)
- **E5b** - Lower L-Band 1189 MHz - 1214 MHz (Galileo)
- **E6** - Lower L-Band 1260 MHz - 1300 MHz (Galileo)
- **G1** - Upper L-Band 1593 MHz - 1610 MHz (GLONASS)
- **G2** - Lower L-Band 1237 MHz - 1254 MHz (GLONASS)
- **G3** - Lower L-Band 1189 MHz - 1214 MHz (GLONASS)
- **L1** - Upper L-Band 1564 MHz - 1587 MHz (GPS)
- **L2** - Lower L-Band 1215 MHz - 1239.6 MHz (GPS)
- **L5** - Lower L-Band 1164 MHz - 1189 MHz (GPS)
Active Quad Helical

RHCP @ 1176 MHz

RHCP @ 1575 MHz

RHCP @ 1227 MHz
Active Polymer Composite

RHCP @ 1176 MHz

RHCP @ 1575 MHz

RHCP @ 1227 MHz
Active Ceramic Stack

RHCP @ 1215MHz

RHCP @ 1176MHz

RHCP @ 1575MHz
L5 Passive Patch

RHCP @ 1176 MHz
L2 Passive Patch

RHCP @ 1227MHz
## Target KPIs

<table>
<thead>
<tr>
<th>KPI</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verify Carrier to noise density ratio (C/No) when satellite in view</td>
<td>Above 10 dB-Hz</td>
</tr>
<tr>
<td>Deviation from location influenced by Doppler effect – location deviation by degree of elevation – We will compare to SBAS post processing to assess accuracy</td>
<td>Between +/- 3 meters</td>
</tr>
<tr>
<td>Number of satellites in view</td>
<td>Minimum of 3</td>
</tr>
<tr>
<td>Verify Satellite visibility (azimuth, elevation)</td>
<td>% visibility at 30° above horizon</td>
</tr>
</tbody>
</table>
Verifying antenna performance

Using the multi-band Septentrio Receivers (Stacked Ceramic Examples)
Carrier to Noise ratio > 40dB/Hz
Deviation of location

* SBAS services not available at US test location
Mean Number of satellites in view by Constellation

- Stacked Polymer Antenna
- Quad Helical Antenna
- Stacked Ceramic Antenna
- L5 Antenna
- L2 Antenna

Mean Number of satellites in view by constellation

- Beidou
- Galileo
- GLONASS
- GPS
Mean Satellite Visibility above and below 30 degrees
The effects of heavy rain on location accuracy

- In general, the Stacked Ceramic has performed better than the other active antennas.
- Despite the results we found that heavy rain significantly affected its performance.

<table>
<thead>
<tr>
<th></th>
<th>Mean Deviation With SBAS (Meters)</th>
<th>Deviation with SBAS during heavy Rain (Meters)</th>
<th>Deviation factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>L2</td>
<td>0.66</td>
<td>1.3</td>
<td>1.97</td>
</tr>
<tr>
<td>L5</td>
<td>0.77</td>
<td>1.49</td>
<td>1.94</td>
</tr>
<tr>
<td>Stacked Ceramic</td>
<td>1.5</td>
<td>8.4</td>
<td>5.60</td>
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</tbody>
</table>
Next Steps and commercialization planning

Target Markets

• Mobility/Automotive
  • Tier 1 Automotive suppliers
  • Micro-mobility market (precision tracking of e-scooters/e-bikes/communal vehicles)
  • Address V2X market – (to include eCall regulation)
  • Fleet management
  • Vehicle Asset tracking
  • UAVs and Drone market
  • Precision tracking (high value & with augmentation services)
  • Agri-market
  • Maritime market

• Channel Sales
  • Channels & Partners (Digi-key, Mouser, EBV)
  • Web and CRM sales
Benefits derived through the NAVISP programme

- The funding allowed us explore the use of state of the art multi-band receivers resulting in the use of the Septentrio products which proved to be very useful and versatile in the reception of multi-band GNSS signals.

- The funding allows us develop and test the multi-band antennas with specific reference to potential precision GNSS applications.

- The funding allowed us verify the effects of satellite based augmentation services in three countries and four deployment environments.

- The funding will allow us register IPR for specific design outcomes.