Part No: ADFGP.50A.07.0100C

Description:
Embedded Active GNSS Dual Stacked Patch Antenna with 100mm of 1.37 & IPEX MHFI

Features:
Embedded Dual Patch, Dual Feed 4-Pin Assembly
Covering Bands:
- GPS/QZSS (L1/L2)
- GPS/QZSS/IRNSS (L5)
- Galileo (E1/E5a/E5b)
- GLONASS (G1/G2/G3)
- BeiDou (B1/B2a/B2b)

Low Axial Ratio
Cable: 100mm of 1.37mm
Connector: IPEX MHFI (U.FL)
Dimensions: 50 x 50 x 16.8mm
RoHS & Reach Compliant
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The ADFGP.50A, with Taoglas Sure Technology, is a precision-engineered active dual patch, dual-feed antenna for GPS (L1/L2/L5), GLONASS (G1/G2/G5), Galileo (E1/E5a/E5b) and BeiDou (B1/B2). The antenna comes mounted on a 50*50 mm PCB (ground plane). It consists of two stacked patches, 50mm, and 40mm in width and is 16.8mm thick. It has been tuned and tested on a 50*50mm ground plane specifically for GPS L1: 1575.42MHz, L2: 1227.6MHz and L5: 1176.45MHz as well as the GLONASS, Galileo, BeiDou and IRNSS bands shown in Section 2.

Each patch element uses two orthogonal feeds that are combined in a hybrid coupler to ensure optimal axial ratio. The antenna exhibits excellent gain and good radiation pattern stability leading to a reliable GNSS fix in areas of weaker signal strength. All these elements combined ensure the best possible positional accuracy for your device.

Both patch elements have a dual pin feed to ensure a low axial ratio and should be used in conjunction with a hybrid coupler. The ADFGP.50A includes LNAs and front-end SAW filters to reduce out of band noise, such as from nearby cellular transceivers. It offers better protection from nearby radiated power surges and greatly reduces the probability of damaging your GNSS receiver from nearby transmissions.

**Features:**

- Multi-GNSS, high-performance antenna
- Excellent signal to noise ratio (C/N0)
- Good 2DRMS and fast TTFF
- Axial ratio < 2dB typ. across all bands
- Phase stability provides excellent Phase Center Variation (PCV)
Benefits:

- Excellent positional accuracy
- Great for use in difficult environments
- Multiband improves the receiver’s position estimation in terms of accuracy and reliability
- Ideal antenna solution for multiband RTK systems.

The ADFGP.50A is connected via an IPEX MHFI connector and works well without modifications in most environments, however, it can be tuned and optimized for different ground planes and enclosures if required. It is manufactured and tested in a TS16949 first tier automotive approved facility.

Typical applications include:

- High accuracy positioning and navigation systems
- UAVs, Robotics & Autonomous Vehicles
- Micro-Mobility Solutions
- Mapping & GIS
- Transportation & Telematics
- Precision Agriculture
- Public Safety, Search & Rescue
- RTK Systems

Custom antenna modifications are subject to possible NRE and minimum order quantity. For further information or support to test and integrate Taoglas Sure technology please contact your regional Taoglas customer support team.
## GNSS Frequency Bands Covered

<table>
<thead>
<tr>
<th>Constellation</th>
<th>L1</th>
<th>L2</th>
<th>L5</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS</td>
<td>■</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GLONASS</td>
<td>G1</td>
<td>G2</td>
<td>G3</td>
</tr>
<tr>
<td>Galileo</td>
<td>E1</td>
<td>E5a</td>
<td>E5b</td>
</tr>
<tr>
<td>BeiDou</td>
<td>B1</td>
<td>B2a</td>
<td>B2b</td>
</tr>
<tr>
<td>QZSS (Regional)</td>
<td>L1</td>
<td>L2C</td>
<td>L5</td>
</tr>
<tr>
<td>IRNSS (Regional)</td>
<td>L5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SBAS</td>
<td>L1/E1/B1</td>
<td>L5/B2a/E5a</td>
<td>G1</td>
</tr>
</tbody>
</table>

*SBAS systems: WASS(L1/L5), EGNOS(E1/E5a), SDCM(G1/G2/G3), SNAS(B1,B2a), GAGAN(L1/L5), QZSS(L1/L5), KAZZ(L1/L5).*

---

**GNSS Bands and Constellations**
## GNSS Electrical

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>1176.45</th>
<th>1227.6</th>
<th>1561</th>
<th>1575.42</th>
<th>1602</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSWR (max.)</td>
<td>2.0:1</td>
<td>2.0:1</td>
<td>2.0:1</td>
<td>2.0:1</td>
<td>2.0:1</td>
</tr>
<tr>
<td>Efficiency (%)</td>
<td>39.1%</td>
<td>43.7%</td>
<td>51.3%</td>
<td>62.8%</td>
<td>57.5%</td>
</tr>
<tr>
<td>Peak Gain at Zenith (dBi)</td>
<td>0.7</td>
<td>1.6</td>
<td>2.4</td>
<td>3.4</td>
<td>3.2</td>
</tr>
<tr>
<td>Axial Ratio (dB)</td>
<td>2.6</td>
<td>1.9</td>
<td>1.9</td>
<td>1.8</td>
<td>1.4</td>
</tr>
<tr>
<td>Group Delay</td>
<td>11</td>
<td>11</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>PCO (cm)</td>
<td>1</td>
<td>1.1</td>
<td>1.1</td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>PCV (cm)</td>
<td>6</td>
<td>9</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Polarization</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>RHCP</td>
</tr>
<tr>
<td>Impedance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50Ω</td>
</tr>
</tbody>
</table>

Note. The patch antenna test with hybrid coupler XC1400P-03S

## LNA and Filter Electrical Properties

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>1176.45</th>
<th>1227.6</th>
<th>1561</th>
<th>1575.42</th>
<th>1602</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSWR (max.)</td>
<td>2.0:1</td>
<td>2.0:1</td>
<td>2.0:1</td>
<td>2.0:1</td>
<td>2.0:1</td>
</tr>
<tr>
<td><a href="mailto:Gain@1.8V">Gain@1.8V</a> (Typ.)</td>
<td>24.1dB</td>
<td>24.6dB</td>
<td>23.6dB</td>
<td>24.2 dB</td>
<td>23.7 dB</td>
</tr>
<tr>
<td><a href="mailto:Gain@3.0V">Gain@3.0V</a> (Typ.)</td>
<td>24.1dB</td>
<td>24.6dB</td>
<td>23.7dB</td>
<td>24.2 dB</td>
<td>23.8 dB</td>
</tr>
<tr>
<td><a href="mailto:Gain@5.5V">Gain@5.5V</a> (Typ.)</td>
<td>24.2dB</td>
<td>24.6dB</td>
<td>23.7dB</td>
<td>24.2 dB</td>
<td>23.8 dB</td>
</tr>
<tr>
<td><a href="mailto:Noise@1.8V">Noise@1.8V</a> (Typ.)</td>
<td>5.15 dB</td>
<td>3.97 dB</td>
<td>2.74 dB</td>
<td>2.68 dB</td>
<td>2.72 dB</td>
</tr>
<tr>
<td><a href="mailto:Noise@3.0V">Noise@3.0V</a> (Typ.)</td>
<td>5.15 dB</td>
<td>4.13 dB</td>
<td>2.75 dB</td>
<td>2.67 dB</td>
<td>2.74 dB</td>
</tr>
<tr>
<td><a href="mailto:Noise@5.5V">Noise@5.5V</a> (Typ.)</td>
<td>5.12 dB</td>
<td>4.03 dB</td>
<td>2.72 dB</td>
<td>2.77 dB</td>
<td>2.81 dB</td>
</tr>
</tbody>
</table>

Power consumption@1.8V (Typ.) | 17.95 mA |
Power consumption@3.0V (Typ.) | 18.02 mA |
Power consumption@5.5V (Typ.) | 18.05 mA |

## Total Specification (Through Antenna, SAW Filter and LNA)

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>1176.45</th>
<th>1227.6</th>
<th>1561</th>
<th>1575.42</th>
<th>1602</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain@3V (dBi)</td>
<td>24.8</td>
<td>26.2</td>
<td>26.1</td>
<td>27.6</td>
<td>27</td>
</tr>
<tr>
<td>Output Impedance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50 Ω</td>
</tr>
<tr>
<td><strong>Mechanical</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimensions</td>
<td>50 x 50 x 16.8mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connector</td>
<td>IPEX MHFI (U.FL)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable</td>
<td>Coaxial Cable ø1.37: Length 100mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>95.5g</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Environmental</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation Temperature</td>
<td>-40°C to 85°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-40°C to 85°C</td>
</tr>
<tr>
<td>Humidity</td>
<td>Non-condensing 65°C 95% RH</td>
</tr>
</tbody>
</table>
3. **Antenna Characteristics**

### 3.1 Return Loss

![Return Loss Graph]

### 3.2 Efficiency

![Efficiency Graph]
3.3 Average Gain

![Average Gain Graph]

3.4 Peak Gain

![Peak Gain Graph]
3.5 Axial Ratio

X-Z

Y-Z
4. Radiation Patterns

4.1 Test Setup
4.2 1176.45MHz 3D and 2D Radiation Patterns

<table>
<thead>
<tr>
<th>XY Plane</th>
<th>XZ Plane</th>
<th>YZ Plane</th>
</tr>
</thead>
</table>

- **XY Plane**
  - **X**
  - **Y**
  - **Z**
  - 1176.45MHz

- **XZ Plane**
  - **X**
  - **Y**
  - **Z**
  - 1176.45MHz

- **YZ Plane**
  - **X**
  - **Y**
  - **Z**
  - 1176.45MHz

(dBi)
### 4.3 1227.6MHz 3D and 2D Radiation Patterns

![3D Radiation Pattern](image)

<table>
<thead>
<tr>
<th>XY Plane</th>
<th>XZ Plane</th>
<th>YZ Plane</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="XY Plane" /></td>
<td><img src="image" alt="XZ Plane" /></td>
<td><img src="image" alt="YZ Plane" /></td>
</tr>
</tbody>
</table>

- **XY Plane**
  - **X**
  - **Z**
  - **1227.6MHz**

- **XZ Plane**
  - **X**
  - **Z**
  - **1227.6MHz**

- **YZ Plane**
  - **X**
  - **Z**
  - **1227.6MHz**

- **(dB)**
  - **-40**
  - **-30**
  - **-20**
  - **-10**
  - **0**
  - **10**
  - **20**
  - **30**
  - **40**

- **Frequency**
  - **1227.6MHz**
### 1561MHz 3D and 2D Radiation Patterns

![3D Radiation Pattern](image)

<table>
<thead>
<tr>
<th>XY Plane</th>
<th>XZ Plane</th>
<th>YZ Plane</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="XY Plane Graph" /></td>
<td><img src="image" alt="XZ Plane Graph" /></td>
<td><img src="image" alt="YZ Plane Graph" /></td>
</tr>
</tbody>
</table>

#### XY Plane

- **X**
- **Y**
- **Z**
- **X**
- **Y**
- **Z**

#### XZ Plane

- **X**
- **Z**
- **X**
- **Z**

#### YZ Plane

- **Y**
- **Z**
- **Y**
- **Z**
### 4.5 1575.42MHz 3D and 2D Radiation Patterns

![3D and 2D Radiation Patterns](image)

<table>
<thead>
<tr>
<th>XY Plane</th>
<th>XZ Plane</th>
<th>YZ Plane</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="XY Plane Diagram" /></td>
<td><img src="image" alt="XZ Plane Diagram" /></td>
<td><img src="image" alt="YZ Plane Diagram" /></td>
</tr>
</tbody>
</table>

- **XY Plane**
  - X-axis (1575.42MHz)
  - Y-axis
  - dB (dBi)
  - Angles: 0°, 90°, 180°, 270°

- **XZ Plane**
  - Z-axis (1575.42MHz)
  - X-axis
  - dB (dBi)
  - Angles: 0°, 90°, 180°, 270°

- **YZ Plane**
  - Z-axis (1575.42MHz)
  - Y-axis
  - dB (dBi)
  - Angles: 0°, 90°, 180°, 270°
4.6 1602MHz 3D and 2D Radiation Patterns

![3D and 2D Radiation Patterns](image)

<table>
<thead>
<tr>
<th>XY Plane</th>
<th>XZ Plane</th>
<th>YZ Plane</th>
</tr>
</thead>
</table>

- **XY Plane**
  - **X**
  - **Y**
  - 1602MHz

- **XZ Plane**
  - **Z**
  - **X**
  - 1602MHz

- **YZ Plane**
  - **Z**
  - **Y**
  - 1602MHz

(dBi)
5. LNA Characteristics

5.1 Block Diagram (Active Antenna)

![Block Diagram](image)

5.2 LNA Gain

![LNA Gain Graph](image)

- L1-BAND-S12(1.8V)
- L1-BAND-S12(3.0V)
- L1-BAND-S12(5.5V)
- L2-BAND-S12(1.8V)
- L2-BAND-S12(3.0V)
- L2-BAND-S12(5.5V)
- 1176.45MHz
- 1227.6MHz
- 1575.42MHz
- 1561MHz
- 1602MHz
5.3 Noise Figure @3.0V

![Graph of Noise Figure @3.0V](image)
6. Field Test Results

6.1 Rooftop test

In this section Taoglas will present the field test result for ADFGP.50 antenna. The test was performed when the antenna was mounted on a static rooftop test set up in an open sky environment for at least 6 hours.

Taoglas will show the field test results using the following receiver:

1. **U-blox ZED-F9P**
   
   **Receiver features:**
   - Multi-band RTK with fast convergence times and reliable performance
   - Nav. update rate RTK up to 20 Hz
   - Position accuracy = RTK 0.01 m + 1 ppm CEP

<table>
<thead>
<tr>
<th>Test Condition</th>
<th>Correction Service</th>
<th>CEP (50%)</th>
<th>DRMS (68%)</th>
<th>2DRMS (95-98.2%)</th>
<th>TTFF (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free Space</td>
<td>RTK DISABLED</td>
<td>56.42 cm</td>
<td>73.23 cm</td>
<td>146.46 cm</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>RTL ENABLED</td>
<td>0.9 cm</td>
<td>1.08 cm</td>
<td>2.16 cm</td>
<td>15</td>
</tr>
<tr>
<td>30x30 cm Ground Plane</td>
<td>RTK DISABLED</td>
<td>46.69 cm</td>
<td>58.83 cm</td>
<td>117.65 cm</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>RTL ENABLED</td>
<td>0.8 cm</td>
<td>0.96 cm</td>
<td>1.93 cm</td>
<td>12</td>
</tr>
</tbody>
</table>

**Positioning Accuracy Table (2D Accuracy)**

**RTK Availability**
- Free space
  - No RTK
  - Float
  - Fixed
- 30x30 cm ground plane
  - No RTK
  - Float
  - Fixed
### 7. Mechanical Drawing (Units: mm)

**NOTE:**

1. Shielding case area □□□
2. Soldermask area □□□
3. All material must be RoHS compliant.
4. The connector orientation has a fixed position to the antenna as per drawing.

**Table: Components Details**

<table>
<thead>
<tr>
<th>Name</th>
<th>P/N</th>
<th>Material</th>
<th>Finish</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patch</td>
<td>0134250200000</td>
<td>Plastic</td>
<td>Clear</td>
<td>1</td>
</tr>
<tr>
<td>1.37 Coated Cable</td>
<td>3004150300000A</td>
<td>PEP</td>
<td>Gray</td>
<td>1</td>
</tr>
<tr>
<td>PDB MFR12314-11N-07</td>
<td>2045110000000A</td>
<td>Brass</td>
<td>Au Plated</td>
<td>1</td>
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<tr>
<td>PCB</td>
<td>02112321400010</td>
<td>Composite F.R</td>
<td>Green</td>
<td>1</td>
</tr>
<tr>
<td>Shielding Case</td>
<td>0005110000000A</td>
<td>SPE</td>
<td>Sr Plated</td>
<td>1</td>
</tr>
</tbody>
</table>

**Details:**
- **DATE:** 2019/05/13
- **MATERIAL:** mm
- **FINISH:**
- **SCALE:** 2/1
- **TITLE:** GPS/L1/2, 4 Pin Dual Feed Active Antenna 100mm 1.37 IPEX MFR1
8. Packaging

1pcs ADFGP.50A.07.0100C per small PE Bag
Weight: 100g

100pcs ADFGP.25A.07.0060A per Large PE Bag
Dimensions: 370*370*300 mm
Weight: 11Kg
## Changelog for the datasheet

**SPE-19-8-133 – ADFGP.50A.07.0100C**

### Revision: C (Current Version)

<table>
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<th>Changes</th>
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<tbody>
<tr>
<td>Date</td>
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<tr>
<td>Changes Made by</td>
<td>Victor Pinazo</td>
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### Previous Revisions

#### Revision: A

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<tr>
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<td>Jack Conroy</td>
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#### Revision: B

<table>
<thead>
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<td>Date</td>
<td>2020-03-02</td>
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<tr>
<td>Changes Made by</td>
<td>Yu Kai Yeung</td>
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