



Persistent Inquiry Approval (PIA) - Geolocation General Description

1. **GNSS chipset Model:** Quectel LC76G
2. **Quectel LC76G GNSS** chips is selected because of the following reason
 - a. High Accuracy with Multi-Constellation Support
 - i. Supports GPS, GLONASS, BDS, Galileo, QZSS
 - ii. Enables faster fix time and better accuracy, even in urban or obstructed areas
 - iii. Horizontal accuracy: ~2.0 m (autonomous)
 - b. Regulatory Compliance Support:
 - i. Used in Fortinet Access Points for FCC AFC compliance in 6 GHz band
 - ii. Provides trusted location data required for automated frequency coordination
 - c. Reliable in Real-World Testing
 - i. Tested with 5,000+ samples at indoor and outdoor locations
 - ii. 95% Confidence Accuracy:
 - d. Advanced Anti-Jamming Capabilities
 - i. Built-in LNA and active interference cancellation
 - ii. Enhances stability in high-interference environments
3. **Device Operation Scenarios:**
 - a. **Indoor Scenario** – FortiAP-441K / FortiAP-443K
 - i. Installation Environment
 1. Installed **inside buildings**, potentially near windows, balconies, or under roofing.
 - ii. Operation Workflow: upon power-on
 1. The GPS module initializes and starts acquiring valid geolocation data (using **Quectel LC76G**).
 2. The device extracts location data from **NMEA GGA**.
 3. These values are used to build a **location JSON file** for the **AFC (Automated Frequency Coordination)** request.
 - iii. 6 GHz Radio Behavior
 1. FortiAP-441K is with internal antenna and supports **LPI (Low Power Indoor)** mode during AFC wait state and FortiAP-443K with external antenna supports SP mode only.
 2. FortiAP-441K 6 GHz radio enabled in LPI mode until AFC response received and FortiAP-443K 6GHz radio is disabled during the AFC wait time.
 - b. **Outdoor Scenario:**
 - i. Installation Environment

1. Mounted **outdoors**, including rooftops or poles, with clear sky visibility.
 2. Uses **internal GNSS L1 antennas**.
- ii. Operation Workflow:
- At startup
1. The Quectel LC76G GNSS module acquires satellite data (U.S. GPS + EU Galileo only).
 2. Location (GGA) is captured and sent to the AFC system.
 3. The device requests a 6 GHz channel list using this verified data.
- iii. **6 GHz Radio Behavior:**
1. **LPI mode not applicable** to outdoor models per FCC regulations.
 2. 6 GHz radio is **disabled** until a valid channel list is returned by AFC.
 3. Once the list is received, the device activates 6 GHz operation accordingly

4. Technical Methodology for Geolocation Determination:

The device determines its geographic position using satellite-based positioning technology. It relies exclusively on signals from **U.S. GPS** satellite constellations, which are compliant with FCC requirements for geolocation under 6 GHz AFC regulations.

The positioning method used is **satellite-based triangulation**, which requires signals from **at least four satellites** to compute a three-dimensional position fix (latitude, longitude, and altitude). The embedded **GNSS module** continuously receives time-stamped signals from visible satellites and uses these to calculate the device's current position through trilateration techniques.

The position data includes:

- Horizontal coordinates (latitude and longitude)
- Altitude
- Estimated accuracy (horizontal and vertical uncertainty)

To ensure accuracy and reliability, the device collects multiple data points and selects valid fixes based on confidence thresholds (e.g., dilution of precision, satellite count). Only when a valid position fix is available will the system proceed to request channel authorization from the AFC system.

5. Satellite Signal Reception for Indoor Use Devices:

To ensure reliable satellite signal reception in indoor environments, the device employs one or more of the following methods:

The indoor models are equipped with internal GPS antenna and option for the external GPS antenna.



- **Optimized Installation Placement:** The Indoor AP when using internal GPS antennas the device is **installed close to a window or balcony** to maximize exposure to the sky and improve line-of-sight access to satellites.
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- **External GPS Antenna Extension:** The indoor AP with external GPS antennas, the antenna can be connected via a cable and extended to a location with better satellite visibility, such as near a **window** or through a cable routed to the **roof or exterior wall**.

These installation practices are necessary to obtain valid and accurate geolocation data, which is required for AFC operation. Devices will not initiate 6 GHz operation unless sufficient and valid satellite data is received.

6. **Additional strategies to improve the Geolocation Accuracy:** Fortinet AP can only rely on GNSS chips to provide geolocation information. We select data with smaller errors to request channel data from the AFC server.

To enhance geolocation accuracy, customers may adopt several practical strategies, such as:

- **Strategic Device Placement:** Installing the device in locations with minimal obstructions (e.g., near windows or outdoors) to improve satellite visibility.
- **Use of High-Gain or Low-Noise Antennas:** Employing antennas with better reception characteristics to strengthen weak satellite signals.
- **Environmental Optimization:** Avoiding installations near metal structures or dense concrete walls that can degrade signal quality.
- **Post-Processing:** In fixed-location deployments, position data may be averaged or refined using repeated measurements over time to improve accuracy before submission to AFC.

7. **Daily and after a power cycle operation and AFC confirmation:**

Fortinet Access Points (APs) are intended for deployment in fixed locations. Upon power-up, once valid geolocation data is acquired from the GNSS module, the AP initiates communication with the AFC system to obtain allowable operating channels. Although the AP continues to receive real-time GNSS data, this updated geolocation is not used for AFC operations unless the device is manually restarted. This ensures that AFC queries are consistently based on a known, fixed installation location. If the AP is physically relocated, a reboot is required to update the geolocation used for AFC compliance.