Ham Satting

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1. Introduction

What is Ham Satting?

Ham Satting is a comprehensive satellite tracking application designed specifically for Amateur Radio (Ham Radio) operators who engage in satellite communications. The app provides real-time satellite tracking, pass predictions, contact logging, and comprehensive grid locator mapping functionality.

Who Should Use This App?

- Amateur Radio Operators with valid licensing
- Satellite Communication Enthusiasts
- ARISS Operators (Amateur Radio on the ISS)
- Grid Square Hunters working towards VUCC awards

Key Features at a Glance

Real-Time Satellite Tracking

- Visualize amateur radio satellites with arrows on the map
- Track many amateur radio satellites with icons in real-time
- Color-coded directional arrows showing satellite position and elevation

Comprehensive Pass Predictions

- Detailed pass predictions (AOS, LOS, duration, azimuth, elevation)
- Countdown timer showing time until each pass
- Timeline visualization for multiple passes
- Pass quality indicators (Excellent/Good/Fair/Poor)
- Export predictions as images or CSV files

AR Doppler Shift Correction

- Real-time Doppler frequency correction during satellite passes
- Mode-specific correction logic (SSB, CW, APT, FM)
- Live frequency updates every 2 seconds
- Visual blinking indicator when Doppler correction is active

Satellite Selection Colors

The satellite list uses a color-coding system to indicate each satellite's capabilities:

- FM/SSB/APT satellites: white label
- SSTV-capable (non-FM): blue label — if also FM-based, blue dot next to name
- SSDV-capable (non-FM): green label — if also FM-based, green dot next to name
- Digital-capable (non-FM): orange label — if also FM-based, orange dot next to name

Smart API Management

- Automatic pause of satellite tracking when navigating away from map
- API hit counter with visual bar chart showing daily usage
- Warning alerts at 80% and 100% of daily API limit
- Prevents accidental API limit hits and saves battery

Interactive Map Features

- Maidenhead grid squares at all zoom levels
- Current GPS location and saved QTH
- Real-time satellite tracking with footprint visualization
- Grid Hunters mode to visualize worked grids from your QSO log

QSO Management

- Save satellite contacts to local database
- Filter and search by callsign or satellite
- Export complete QSO list via email or file sharing
- Automatic grid square extraction for Grid Hunters

Smart Notifications

- Schedule alerts for upcoming satellite passes
- Background notifications (with proper battery settings)
- Customizable alert timing (minutes before pass)
- Visual and audio notification options

SSTV/SSDV Audio Recording

- Record satellite SSTV and SSDV audio directly from AR tracking
- Smart filename format: SatName_SSTV/SSDV_Date_Time_FreqkHz.wav
- Automatic Doppler-corrected frequency in filename
- Supports both SSTV and SSDV capable satellites

Digital Mode Recording

- Record APRS, FSK packet, and GMSK digital mode audio directly from AR tracking
- DIGI button (orange) appears for digital-capable satellites alongside SSTV and SSDV buttons
- Doppler-corrected frequency for UHF downlinks; nominal frequency for VHF (below 300 MHz)
- Filename format: SatName_Digital_Date_Time_FreqkHz.wav

Compass Pass Visualization

- Interactive compass dialog showing satellite pass trajectory
- Download and share pass images with watermark
- Local time display in-app, UTC in exported images
- Square format export for clean sharing

2. Getting Started

First-Time Setup (IMPORTANT!)

When you first open Ham Satting, you'll see a welcome dialog. Follow these steps carefully:

Step 1: Navigate to Settings

Tap the Settings icon at the bottom navigation bar (gear icon)

Step 2: Enter Your Default Values

Configure these essential settings:

1. Default Grid Location (e.g., LL93eo33)
- Enter your home station's Maidenhead grid square
- Can be 4, 6, or 8 characters
- Example formats: LL93, LL93eo, LL93eo33

2. Default Callsign (e.g., A46UNX)
- Your amateur radio callsign

3. Default Email
- For support and exporting QSO logs

Step 3: Get Your N2YO API Key (REQUIRED)

Important: Pass predictions and satellite map tracking require a free API key from N2YO.
- Visit: https://www.n2yo.com/api/
- Sign up for a free account
- Get your API key
- Paste it into the N2YO API Key field in Settings then press Save

Step 4: Set Minimum Pass Angle

- Min Pass Angle: 0° (shows all passes, even low ones)
- Higher values (e.g., 15°) filter out low elevation passes
- Recommendation: Start with 0° and adjust based on your horizon

Step 5: Select Satellites

Scroll down to the Satellite Settings section and enable the satellites you want to track. Popular Amateur Radio Satellites:
- ISS, SO-50, IO-86, AO-91, AO-73, PO-101, RS-44 and more
- **Tip:** Enable 3-5 satellites initially to avoid overwhelming data.

Step 6: Android Battery Optimization (CRITICAL!)

For notifications to work in the background on Android:
- Go to your phone's Settings → Apps → Ham Satting → Battery
- Select "Unrestricted" or "Don't optimize"

3. Interactive Map & Grid Locator

Understanding the Map Page

The Map page (first icon in bottom navigation) is the heart of Ham Satting. It shows:

- Maidenhead grid square overlay
- Real-time satellite positions
- Your current location
- Saved QTH location
- ISS and other satellites footprint (radio coverage area)
- ISS and other satellites ground tracking
- Directional arrow to satellites selected and highlighted

Map Controls (Right Side)

1. Satellite Toggle (Purple Icon)

- ON (Dark Purple): Shows all enabled satellites in real-time
- OFF (Gray): Hides satellites
- Small progress indicator appears during updates
- **Smart Pause:** Automatically pauses when you navigate away to save API calls and battery
- **Tip:** Turn off when not needed to save battery

2. Grid Toggle (Purple Icon)

- ON (Dark Purple): Shows Maidenhead grid squares
- OFF (Gray): Hides grid overlay
- Grid automatically adjusts detail based on zoom level

3. API Hit Counter

Visual bar chart at the top of the screen showing your daily N2YO API usage:

- Displays current usage as percentage and count (e.g., "80% (800/1000)")
- Green bar: 0-79% usage - Safe
- Yellow bar: 80-99% usage - Warning
- Red bar: 100% usage - Limit reached
- Automatic reset at UTC midnight
- Prevents API key reuse after changes

Real-Time Satellite Tracking

Satellite Icons

Each satellite appears as a colored circle with:

- Satellite name (short version, e.g., "SO-50")
- Altitude in km
- Velocity in km/s (at high zoom)

Directional Arrow

A color-coded arrow points from your location toward the satellite:

- Green Arrow: Elevation > 10° (Excellent visibility)
- Orange Arrow: Elevation 0-10° (Difficult, near horizon)
- Red Arrow: Below horizon (Not visible)
- The arrow appears at 1/4 distance between you and the satellite

4. AR Tracking & Recording

What is Doppler Shift?

As a satellite moves toward or away from you, its radio frequency shifts due to the Doppler effect. This shift can be several kHz, causing you to miss contacts if your radio frequency isn't adjusted. Ham Satting now provides real-time Doppler correction during AR tracking!

How to Access AR Doppler

- Navigate to the Map page
- Enable satellite tracking (purple icon)
- Tap on a satellite to highlight it
- Tap the "Track in AR" button
- Point your phone at the satellite using the on-screen guidance

Doppler Features

Real-Time Frequency Correction

- Updates every 2 seconds with current Doppler shift
- Shows corrected TX (transmit) and RX (receive) frequencies
- Frequencies rounded to nearest 1 kHz for radio convenience
- Zero extra API calls - uses existing position data

Mode-Specific Logic

Doppler correction is applied based on the satellite's operating mode:

Mode	Doppler Correction	Reason
FM VHF (2m)	❌ No	Wide bandwidth
FM UHF (70cm)	✅ Yes	Narrower bandwidth
SSB	✅ Yes	Very narrow (~3 kHz)
CW	✅ Yes	Extremely narrow
APT (Weather)	✅ Yes	Precise freq needed

Visual Indicators

- **Blinking Orange Circle:** Appears when Doppler correction is active
- **Phone Alignment Panel:** Shows TX and RX frequencies with Doppler applied
- **Alignment Arrows:** Guide you to point at the satellite correctly
- **Phone Pitch Indicator:** Shows elevation angle for precise pointing

Using Doppler Correction

- Start AR tracking for your selected satellite
- Point your phone at the satellite using the alignment guides
- Watch for the blinking orange circle (Doppler active)
- Read the corrected TX and RX frequencies from the phone panel
- Set your radio to the displayed frequencies
- Make your contact with perfect frequency alignment!

SSTV/SSDV Audio Recording

- Ham Satting can record satellite audio directly during AR tracking for later SSTV or SSDV decoding.

How to Record

- While in AR tracking mode, look for the SSTV button (right side) or SSDV button (left side)
- The SSTV button appears for SSTV-capable satellites (e.g., ISS, IO-86, UmKA-1)
- The DIGI button (orange) appears for digital-capable satellites (e.g., KNACKSAT-2, BOTAN, SPIRONE) — all three buttons (SSTV, SSDV, DIGI) stack on the right side of the screen
- Some satellites support both modes (e.g., Lobachevsky)
- Tap the button to start recording - it will pulse to indicate active recording
- Tap again to stop recording
- Only one mode can be active at a time — all other mode buttons hide while one is active

Recording File Format

Audio files are saved with a descriptive filename:

- Format: {ShortName}_{SSTV|SSDV}_{Date}_{Time}_{FreqkHz}kHz.wav
- Example: RS40S_SSTV_2026-02-16_18-42-03_437625kHz.wav
- Example: ISS_SSTV_2026-02-16_20-15-30_145800kHz.wav
- The frequency includes Doppler correction at the time of recording
- The short satellite name is extracted automatically from the full name:
- "UmKA-1 (RS40S)" becomes RS40S
- "GALAPAGOS-UTE-SWSU (HC1PX)" becomes HC1PX
- "ISS" stays as ISS (no parentheses, uses full name)

SSDV Mode

SSDV (Slow Scan Digital Video) is a digital image transmission mode used by some amateur satellites. Unlike SSTV which is analog, SSDV uses packet-based digital encoding.

SSDV vs SSTV

- SSTV: Analog image transmission - decoded from audio waveforms
- SSDV: Digital image transmission - uses packet-based digital encoding
- Some satellites transmit SSTV, some SSDV, and some both

AR Display in SSDV Mode

- TX Panel: Shows "SSDV Mode" indicator in red when SSDV is active
- RX Panel: Shows SSDV frequency with real-time Doppler correction
- The SSDV button pulses while recording is active

SSDV-Capable Satellites

AO-123, Lobachevsky, SilverSat, CroCube, LASARsat, GEOSCAN 1-6, Vizard Ion, TUSUR GO, INNOSAT16, INNOSAT3

Digital Mode

Ham Satting can record digital-mode satellite audio during AR tracking for later decoding using packet radio software (APRS clients, Direwolf, etc.).

Digital vs SSTV/SSDV

SSTV/SSDV: encodes images into audio or digital packets — decoded by the built-in SSTV Decoder or external apps
Digital: packet-based encoding (APRS, FSK, GMSK) — decoded by external packet software

AR Display in Digital Mode

TX Panel: shows TX frequency (orange background) if satellite has uplink, or "Digi Mode" (red) if receive-only
RX Panel: shows downlink frequency with Doppler for UHF; nominal for VHF (below 300 MHz)
The DIGI button pulses green while recording is active

Digital-Capable Satellites

KNACKSAT-2, BOTAN, e-kagaku-1, PARUS-T2, SPIRONE, HO-113 (XW-3), SNUGLITE-3 HANA, D-STAR ONE iSat, D-STAR ONE Sparrow, ISS (APRS channel), IO-86 (APRS channel)

5. Satellite Pass Predictions

Understanding Satellite Passes

A satellite "pass" occurs when a satellite moves across your sky. Key terms:

- **AOS (Acquisition of Signal):** When satellite rises above your horizon
- **LOS (Loss of Signal):** When satellite sets below your horizon
- **Max Elevation:** Highest angle during the pass
- **Duration:** Length of the pass (typically 2-10 minutes)
- **Azimuth:** Direction (0° = North, 90° = East, etc.)
- **Time Until:** ★ NEW - Countdown showing how long until the pass starts

Understanding Pass Cards

Each pass prediction card now displays:

- Pass number and satellite name
- Max elevation and quality indicator (Excellent/Good/Fair/Poor)
- **Time Until badge** (green) - Shows countdown like "2h 30m" or "15m"
- AOS and LOS times in local time and UTC
- Duration of the pass
- AOS and LOS azimuth directions
- TX, RX, Mode, and Tone information (if available)
- Notification bell icon for scheduling alerts

Time Until Display Formats

Time Remaining	Display Format	Example
> 1 day	Days + Hours	2d 5h
1-24 hours	Hours + Minutes	3h 45m
1-60 minutes	Minutes only	25m
< 1 minute	Less than	<1m
Pass started	Status	Started

Compass Pass Visualization

- View and export detailed pass trajectory visualizations by tapping on a pass prediction card.
- The compass shows the satellite's path across your sky with AOS direction, max elevation point, and LOS direction
- Displays pass trajectory in local time while viewing in the app
- Close button (X) in the corner to dismiss the dialog

Exporting Pass Images

- Download Icon: Save the pass visualization to your photo gallery
- Share Icon: Share directly to other apps with "Generated by Ham Satting" watermark
- Exported images use UTC time (not local time) for universal reference
- Images are exported as square format with satellite name on one line, grid/date/time on another

Exporting Predictions

Screenshot Export

- Button: "Save Screenshot"
- Captures entire prediction view as image
- ★ **NEW:** Time Until countdown is included in the exported image
- Saved to your device's gallery/photos
- Great for sharing with your ham radio club

CSV Export

- Button: "Export CSV"
- Creates comma-separated file
- ★ **NEW:** Includes "Time_Until" column showing countdown to each pass
- Can open in Excel, Google Sheets, etc.
- Perfect for detailed planning and spreadsheet integration

6. QSO Logging & Management

What is a QSO?

A QSO is an amateur radio contact. Ham Satting lets you log satellite QSOs with detailed information.

Logging a New QSO

Navigate to New QSO (fourth icon in bottom navigation).

Required Fields:

- Worked Callsign - The callsign you contacted (e.g., 9A1CAL)
- Worked GRID - Their Maidenhead grid square (e.g., JN86dm)
- Date - Format: YYYYMMDD (e.g., 20251115)
- Time - Format: HH:MM:SS in UTC (e.g., 14:30:00)
- Satellite - Which satellite was used (e.g., SO-50)
- Mode - Operating mode (e.g., FM, USB, LSB, CW)
- TX Band & Frequency - Your transmit band and frequency
- RX Band & Frequency - Your receive band and frequency

7. SSTV Decoder

The SSTV (Slow Scan Television) Decoder allows you to decode images from audio recordings of SSTV transmissions. These transmissions are commonly used by satellites like the ISS and amateur radio operators to send images over radio frequencies.

Accessing the SSTV Decoder

Navigate to the SSTV Decoder from the main menu or the Tools section.

Supported SSTV Modes

Ham Satting supports the following SSTV transmission modes:

Robot Modes (YCrCb color format):

- Robot 36: 320x240 pixels
- Robot 72: 320x240 pixels

Scottie Modes (RGB color format):

- Scottie 1: 320x256 pixels
- Scottie 2: 320x256 pixels
- Scottie DX: 320x256 pixels

Martin Modes (RGB color format):

- Martin 1: 320x256 pixels
- Martin 2: 320x256 pixels

PD Modes (YCrCb color format):

- PD 90: 320x256 pixels
- PD 120: 640x496 pixels
- PD 160: 512x400 pixels
- PD 180: 640x496 pixels
- PD 240: 640x496 pixels

How to Decode an SSTV Image

- Tap “Browse File” to select a WAV audio file containing the SSTV signal
- Select the correct mode from the dropdown menu

If you don’t know the mode, try Robot 36 first (most common)
ISS commonly uses PD 120 or PD 180
Try different modes if the image appears distorted

- The image will decode automatically after selecting the file
- Use the adjustment controls if the image needs fine-tuning (see below)
- Tap “Reset” to return all adjustments to default values

Adjustment Controls

SHIFT (-100 to +100 pixels)
Moves the image horizontally. Use this if you see color bars on the left or right edges of the decoded image.

- Positive values shift the image right
- Negative values shift the image left

SLANT (-2.0 to +2.0 ms)
Corrects diagonal skewing of the image. Use this if the image appears tilted like a parallelogram. This adjusts timing drift per scan line.

- Positive values correct clockwise skew
- Negative values correct counter-clockwise skew

START (0 to 5000 ms)
Adjusts where in the audio file decoding begins. Use this if colors are misaligned or you see noise at the start of the image. Increase this value to skip past the leader tone and VIS code.

Viewing the Decoded Image

- Pinch to zoom in/out on the decoded image
- Double-tap to reset zoom level
- Swipe to pan when zoomed in

Saving and Sharing

Save to Gallery:
Tap the green download button to save the decoded image to your photo gallery. Images are saved with “SSTV_Decoded_” prefix and timestamp.

Share:
Tap the blue share button to share the decoded image directly to other apps. The shared image includes a “Generated by Ham Satting” watermark.

Clear:
Tap the red X button to clear the current image and start fresh.

Tips for Best Results

Recording Quality:

- Record SSTV audio at 44100 Hz sample rate
- Use WAV format for best quality
- Avoid audio clipping (keep levels below maximum)
- Minimize background noise during recording

Mode Selection:

- ISS commonly uses PD 120 or PD 180
- Amateur radio operators often use Robot 36 or Scottie 1
- If unsure, try different modes until the image looks correct

Common Issues and Solutions:
Problem: Colored vertical bars on edges
Solution: Adjust the Shift slider, or try a different SSTV mode

Problem: Image is diagonally skewed
Solution: Adjust the Slant slider

Problem: Colors are completely wrong or misaligned
Solution: Increase the Start offset, or try a different SSTV mode

Problem: Image is too noisy or unclear
Solution: The original recording may have poor signal quality. Try recording with better reception.

Supported Audio Formats

- WAV (recommended)
- MP3
- M4A
- AAC
- OGG
- FLAC

8. Settings & Configuration

Default Values Section

- **Default Grid Location -** Your home station grid square (4, 6, or 8 characters)
- **Default Callsign -** Your amateur radio callsign
- **Default Email -** For support and exports
- **N2YO API Key -** REQUIRED for all satellite functionalities
- **Min Pass Angle -** Minimum elevation to show in predictions

Slider Controls

- All sliders now include +/- circle buttons for precise value adjustment
- Tap - to decrease or + to increase in small increments
- Especially useful for Min Pass Angle fine-tuning

API Management

API Hit Counter Settings

- **Location:** Top of screen (visual bar chart)
- **Daily Limit:** 1000 API calls per day (N2YO free tier)
- **Warning at 80%:** Yellow bar when you reach 800 calls
- **Alert at 100%:** Red bar when you reach 1000 calls
- **Auto Reset:** Counter resets at UTC midnight
- **Key Protection:** Detects and prevents API key reuse after changes

Smart Pause Settings

- **Auto-Pause:** Automatically pauses tracking when navigating away from map
- **Auto-Resume:** Resumes tracking when returning to map
- **Triggers:** Tab switching, navigation to Settings, QSO Log, etc.
- **State Preservation:** Returns exactly as you left it
- **Benefit:** Prevents wasting API calls and saves battery

9. Troubleshooting

API Counter Issues

Problem: Counter stuck at 100%

Solution:
- The counter automatically resets at UTC midnight
- You can also change your API key in Settings to reset immediately
- Wait until midnight UTC or use a different API key

Problem: Smart Pause not working

Solution:
- Update to the latest version
- Smart Pause works automatically - no settings needed
- If API calls continue when navigating away, report bug to support

Doppler Not Showing

Problem: No blinking orange circle in AR mode

Solution:
- Check satellite mode - FM VHF (2m) doesn't show Doppler (not needed)
- Doppler only applies to SSB, CW, APT, and FM UHF modes
- Ensure you're pointing at the satellite (use alignment arrows)
- Wait 2 seconds for frequency update

Problem: Doppler frequencies seem wrong

Solution:
- Frequencies are rounded to nearest 1 kHz for radio convenience
- Doppler shift can be ±3 to 10 kHz depending on satellite speed and frequency
- This is normal behavior - use the corrected frequencies on your radio

SSDV/SSTV Recording Issues

Problem: SSDV button not appearing in AR mode

Solution:
- Not all satellites support SSDV - check if your satellite is SSDV-capable
- SSDV button only appears for satellites in the SSDV frequency database
- SSDV and SSTV buttons hide each other when one mode is active
- Return to normal mode first before switching between SSTV and SSDV

Problem: Recording file not found

Solution:
- Recordings are saved as WAV files in the app's documents directory
- Check that you have sufficient storage space on your device
- Ensure you tapped the button to stop recording (it should stop pulsing)

Digital Mode Recording Issues

Problem: DIGI button not appearing in AR mode
Solution: Verify the satellite is in the digital list (KNACKSAT-2, BOTAN, SPIRONE, SNUGLITE-3 HANA, etc.)
Problem: DIGI button disappears after tapping SSTV or SSDV
Solution: Only one mode can record at a time; SSTV and SSDV buttons hide while DIGI is active — stop DIGI recording first

Time Until Not Updating

Problem: Countdown not changing

Solution:

- Time Until is calculated when predictions are fetched
- Refresh your predictions to get updated countdowns
- The countdown does not auto-update in real-time
- Tap "Get Passes" again to recalculate

10. Frequently Asked Questions

Q: How does AR Doppler Shift work?

A: AR Doppler Shift calculates the frequency offset caused by the satellite's motion relative to you. It updates every 2 seconds using the satellite's velocity (calculated from position deltas) and applies mode-specific correction. For SSB and CW, this is critical as even a few kHz can cause missed contacts.

Q: Why doesn't FM VHF show Doppler correction?

A: FM VHF (2-meter band) has a wide enough bandwidth (~10-15 kHz) that Doppler shift doesn't significantly affect reception. However, FM UHF (70cm), SSB, CW, and APT modes do need correction due to their narrower bandwidths.

Q: Does Smart Pause drain battery?

A: No! Smart Pause actually SAVES battery by stopping satellite position updates when you're not looking at the map. It also prevents wasting your daily API calls.

Q: What happens when I hit the API limit?

A: At 80% (800 calls), you'll see a yellow warning bar. At 100% (1000 calls), the bar turns red and you won't be able to make more API requests until UTC midnight when it resets automatically. You can also change your API key to reset immediately.

Q: How often does Time Until update?

A: Time Until is calculated at the moment you fetch predictions. It doesn't auto-update in real-time. To get fresh countdown times, simply refresh your predictions by tapping "Get Passes" again.

Q: What is the difference between SSTV and SSDV?

A: SSTV (Slow Scan Television) is an analog image transmission mode that encodes images into audio tones. SSDV (Slow Scan Digital Video) is a digital packet-based image format. Some satellites use SSTV (like ISS, IO-86), some use SSDV (like AO-123, SilverSat), and some support both (like Lobachevsky).

Q: How do I record satellite audio for SSTV/SSDV decoding?

A: While in AR tracking mode, tap the SSTV or SSDV button (depending on the satellite's capability). The button will pulse while recording. Tap again to stop. The audio is saved as a WAV file with the satellite name, mode, date, time, and Doppler-corrected frequency in the filename.

Q: Can I use both SSTV and SSDV at the same time?

A: No. Only one mode can be active at a time. When SSTV recording is active, the SSDV button is hidden, and vice versa. Stop the current recording before switching modes.

Q: What is Digital Mode in Ham Satting?

A: Digital mode covers packet radio modes such as APRS digipeating, FSK 9600 bps, and GMSK beacons — used by CubeSats for telemetry and data relay. Unlike SSTV/SSDV which encode images, digital satellites transmit data packets decoded by external software such as APRS clients or Direwolf.

Q: How do I record a digital-mode satellite pass?

A: While in AR tracking, tap the DIGI button (orange circle). It will pulse green while recording. Tap again to stop. The file is saved as SatName_Digital_Date_Time_FreqkHz.wav.

Q: Can I record SSTV/SSDV and Digital simultaneously?

A: No. Only one mode can record at a time. Stop any active recording before tapping another mode button.

Q: How does the compass pass visualization work?

A: Tap on any pass prediction card to open an interactive compass dialog showing the satellite's trajectory across your sky. You can download or share the visualization as an image with a watermark. The in-app view shows local time, while exported images use UTC.

General Questions

Q: Is the app free?

A: Yes, completely free! You need a free N2YO API key for pass predictions and tracking multiple satellites.

Q: How often does satellite data update?

A: Satellite positions update every 0.5 seconds (twice per second) for smooth real-time tracking when satellite tracking is enabled.

Q: What does "pass quality" mean?

A:

- **Excellent:** Max elevation >50° - Perfect passes high overhead, very strong signals
- **Good:** Max elevation 30-50° - Good elevation, strong signals
- **Fair:** Max elevation 15-30° - Moderate elevation, decent signals
- **Poor:** Max elevation <15° - Low elevation, weak signals, may be difficult

11. Support & Contact

Getting Help

In-App Support

- **User Manual -** About page → "Open User Manual"
- **Contact Support -** About page → "Contact Support" (Developer responds within 24-48 hours)

Social Media

- X: @Unixeer
- Instagram: @unixeer
- TikTok: @unixeer
- UpScrolled: @Unixeer

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- Amateur Radio Community - Continuous support and feedback
- N2YO.com - Satellite tracking API

12. Legal & Copyright

Disclaimer

Provided 'as is' without warranty. Developer assumes no liability. Predictions are for informational purposes only. Always verify satellite schedules and orbital data before critical operations.

Privacy

Ham Satting:

- Stores all data locally on your device
- Does NOT collect or transmit personal information
- N2YO API requests only include satellite names and location coordinates
- Email and callsign are stored locally only

73 from A46UNX - RF for Life!

Developed with Flutter & Dart for smooth performance.

Future updates are unstoppable and inevitable.

End of User Manual