



Innovative Drone Solutions Pty. Ltd.
T/A Sixarms

M300 - Getting Started Guide

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Prelude

This guide is intended to familiarise yourself with the assembly and operations of the Airborne Radio Measurement System (ARMS) flown on the DJI M300 RTK remotely piloted aircraft. This guide assumes you are familiar with the assembly and flight envelope of the DJI M300 RTK. If instruction is required on the DJI M300's assembly or operations, please refer to the DJI M300 RTK) User Manual.



1. Assembling the ARMS Receiver onto the M300



1.1. ARMS Assembly

For this manual we will refer the RF IN side of the ARMS Receiver as the front and the AUX side of the ARMS Receiver as the rear. Remove the top, front 5 screws from the ARMS RF receiver using a Phillips head screwdriver. Locate the 3D printed antenna mount and screw it into the top of the ARMS RF receiver using the M3 screws and allen key provided. Mount the metal ARMS mount to the top accessory mount of the M300 using the M2.5 screws and a Phillips head screwdriver. Pass the Velcro strap through the slot on the side of the metal ARMS mount from the underside through to the topside. Ensure the loop side of the Velcro is facing towards the outside of the mount/M300. Place the ARMS receiver onto the metal mount. The screws that hold the baseplate on the receiver will sit inside the elongated holes on the metal mount so that the ARMS receiver will sit flush with the base of the metal mount. Pull the Velcro strap over the ARMS Receiver and through the top antenna mount. Pass the Velcro strap through the slot on the metal mount and tighten. Press the hook side of the Velcro onto the loop side to secure the ARMS Receiver to the M300.

1.2. Antenna

Identify the correct antenna for the frequency that is intended to be measured. The following table is a guide for the correct antenna selection.

Antenna	Frequency Measured (MHz)
	0.09-30MHz
	70-230MHz

	<p>470-800MHz</p>
	<p>700-6000MHz</p>

To attach the antenna to the antenna mount on top of the ARMS Receiver, the thumb screw on the rear of the antenna must be unscrewed. Pass the threaded section at the rear of the antenna through the hole at the top of the antenna mount. Firmly screw the thumb screw back onto the rear of the antenna to secure it to the mount. The star shape built into the antenna mount and antenna allows the antenna to be mounted either vertically or horizontally, depending on the polarity of the antenna to be measured.

Screw one of the black 2.4GHz WiFi antennas onto the WiFi-1 port at the front of the box and another onto the WiFi-2 port at the rear of the box.

1.3. Cables & Attenuation

Determine the attenuation required for the antenna measurement. Below is the sequence that should be followed when attaching the antenna to attenuation and the ARMS receiver.

Antenna – Attenuation – RF Cable – Attenuation – DC Block – ARMS Receiver

Attenuation can be removed as required.

Locate the VGA – USB-C cable and attach the VGA end to the AUX port on the rear of the ARMS Receiver. Attach the USB-C end to the DJI M300 RTK's USB-C port. This port can be found underneath the rubber cover on the top of the M300 as highlighted in figure 1.

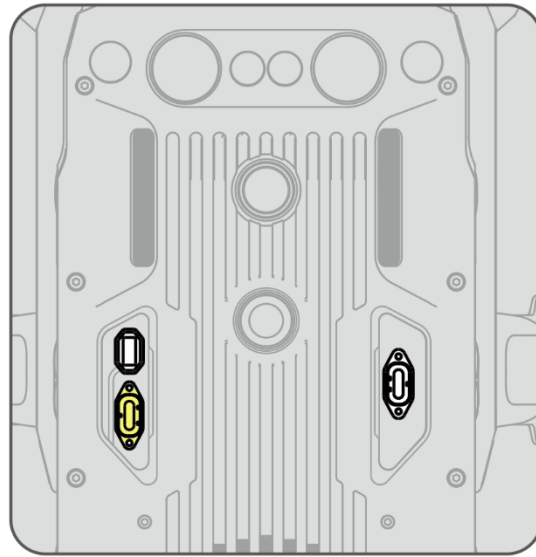


Figure 1 – Yellow Shaded Area Shows USB-C Port

The M300 is now equipped with the ARMS Receiver and is ready for the field work to begin.

2. Arriving at a New Site

When arriving at a new site there are a few things that should be considered. The take-off and Landing area should be in an open area and clear of all hazard. Consider barriers or cones to avoid having vehicles or persons from entering the operating area. The return to home height should be set at an altitude that will clear any surrounding obstacles.

2.1. Setting Up the RTK Base Station

The RTK base station will need to have a direct line of sight to the controller to ensure the RTK corrections are not lost during flight. The RTK Base Station should also have an unobstructed view of the sky in order to prevent the GNSS signals from being blocked.

Surveyors marking paint can be used to mark a cross underneath the base station. This is not a necessity but if the base station is required to be moved, it can be set up in the same location as before which won't require the tower base to be re-surveyed. The base station position must be saved under the frequent coordinates manager in the DJI Pilot App before it can be moved from that position.

2.2. Setting Up N-trip

Using N-trip requires an internet connection on the DJI M300 RTK's controller but reduces the need to travel with the DRTK-2 base station and tripod. It also gives the benefit of not needing to resurvey the base of the tower's height and GPS position if the DRTK-2's base station is moved which reduces workload when returning to remeasure.

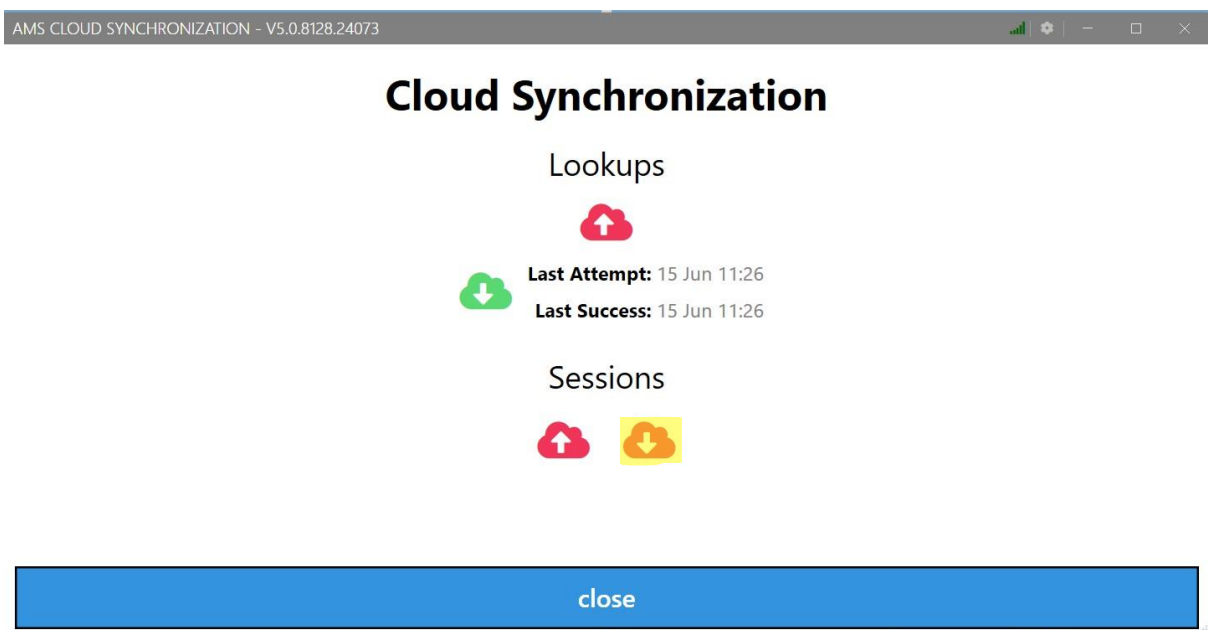
- Power on the Remote Controller and DJI M300 RTK.

- Ensure there is a connection between the controller and M300.
- Open the Pilot App and enter the manual flight screen.
- Press on the 3 horizontal dots located on the top right-hand side of the screen to open the menu.
- Tap on “RTK”.
- Select the “RTK Service Type” and set it to “Custom Network RTK”.
- Enter the N-trip host and port.
- Input your account and password details.
- Enter the mountpoint that is closest to your location.
- Press save to link with the server and wait for a RTK Fix to ensure the RTK module is ready.

2.3. Choosing a New Session

There are two methods to creating a new site in AMS. The first method is by manually planning the session in AMS directly through the Planning Tab on the homepage.

The second method is syncing a session from the cloud. To do this click on the “Control” tab at the top of the AMS homepage. Scroll down to “Cloud” and click on “Sync”. The AMS Cloud Synchronisation screen will open. Click on the download from cloud icon as shown below in yellow. Find the session to be synced and click on the cloud icon located next to the created date. This will automatically import the session which can then be found in the AMS planning and preflight page.



Receive Log

Already Received
 Hidden

STATUS	NAME	CREATED DATE	
	gg (Sixarms Internal)	14/06/2022 10:32:48 AM	
	dddd (Sixarms Internal)	14/06/2022 10:24:38 AM	
	ARN - Mt Tamborine - DAB - Vpol (Sixarms Internal)	17/05/2022 2:03:40 PM	
	Channel Order Testing (Sixarms Internal)	6/05/2022 1:31:16 PM	
	Wolffdene DTV Pre (Clone) (Sixarms Internal)	21/03/2022 4:40:05 PM	
	Coplick Sports (Sixarms Internal)	15/02/2022 12:18:35 PM	
	TXA - Artarmon PV - DAB - Vpol (Sixarms Internal)	22/01/2022 7:54:49 PM	

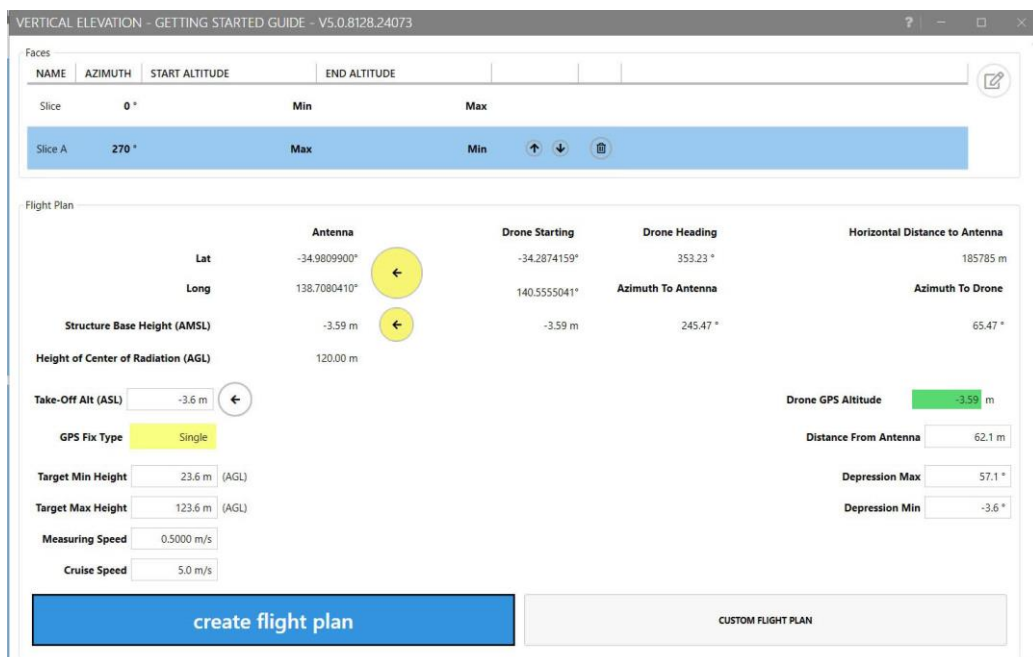
import file

close

2.4. Surveying the Base Altitude and GPS Location of the Antenna

To survey the base of the tower, ensure the DJI M300 RTK has a RTK Fix. Move the DJI M300 to the base of the tower. The M300 should be positioned underneath the antenna that is going to be measured.

Under the RTK menu in DJI Pilot, the Latitude and Longitude will be the reference point for the position of the antenna and the Ellipsoidal Height will be the reference height for the Structure Base Altitude. These positions can either be transferred into AMS manually via the planning page under location for Lat and Long and under Antenna for Structure Base Height or simply under the Flight Plan page in AMS by clicking on the arrow button underneath Antenna Lat, Long and Structure Base Height as highlighted in yellow in Figure 2. This must be done when the M300 is under the antenna and has a RTK Fix.



VERTICAL ELEVATION - GETTING STARTED GUIDE - V5.0.8128.24073

Faces	NAME	AZIMUTH	START ALTITUDE	END ALTITUDE
	Slice	0°	Min	Max
	Slice A	270°	Max	Min

Flight Plan

	Antenna	Drone Starting	Drone Heading	Horizontal Distance to Antenna
Lat	-34.9809900* ←	-34.2874159*	353.23°	185785 m
Long	138.7080410* ←	140.5555041*	Azimuth To Antenna	Azimuth To Drone
Structure Base Height (AMSL)	-3.59 m ←	-3.59 m	245.47°	65.47°
Height of Center of Radiation (AGL)	120.00 m			
Take-Off Alt (ASL)	-3.6 m ←			Drone GPS Altitude: -3.59 m
GPS Fix Type	Single			Distance From Antenna: 62.1 m
Target Min Height	23.6 m (AGL)			Depression Max: 57.1°
Target Max Height	123.6 m (AGL)			Depression Min: -3.6°
Measuring Speed	0.5000 m/s			
Cruise Speed	5.0 m/s			

create flight plan

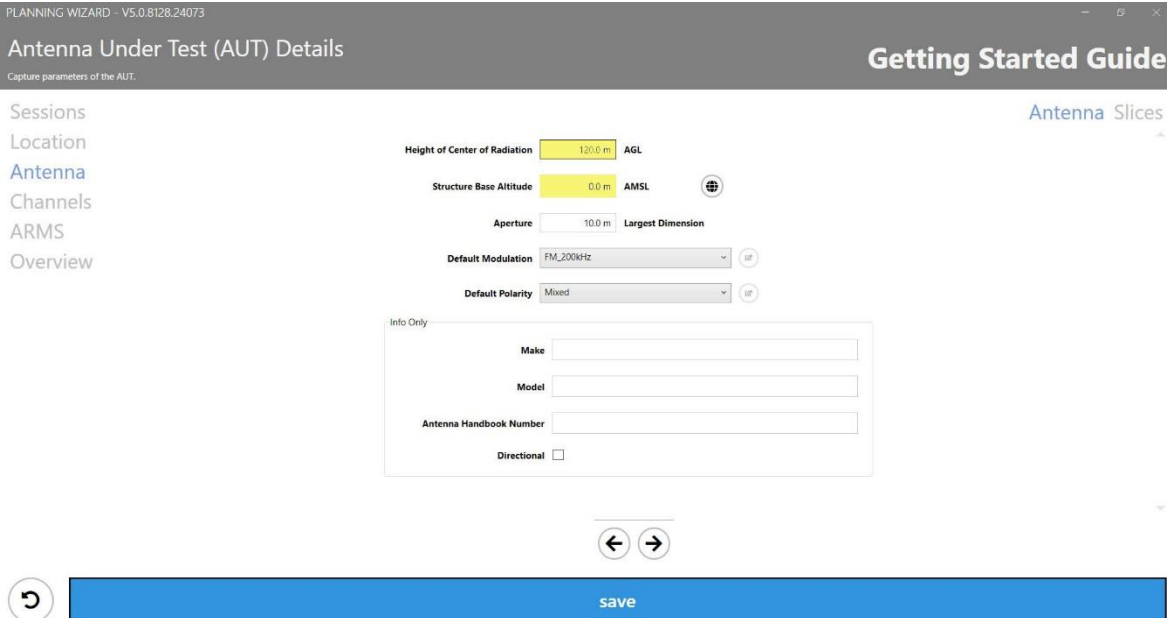
CUSTOM FLIGHT PLAN

Figure 2

2.5. Surveying the Antenna Height Above Base Altitude

If you have accurate drawings of the antenna’s height on the tower, this can be inputted into the Antenna planning page under Height of Centre of Radiation.

If you do not have a known antenna height or access to the base of the tower to survey it, a slightly different workflow is needed. If the antenna height isn’t known, the structure base altitude must be set to the take-off height. This is found in the RTK settings menu on the M300 controller. The Ellipsoidal Height is read when the M300 is in the take-off position. A flight is then conducted to climb to the height of the antennas centre of radiation. You can use the FPV camera to line this up. Note the height as read on the altimeter as this height is inputted into the antenna height in the Antenna Planning Page in AMS. It is important that the take-off height or position does not change for all subsequent flights if this method is used.



PLANNING WIZARD - V5.0.8128.24073

Antenna Under Test (AUT) Details Getting Started Guide

Capture parameters of the AUT.

Sessions
Location
Antenna
Channels
ARMS
Overview

Antenna Slices

Height of Center of Radiation: 120.0 m AGL

Structure Base Altitude: 0.0 m AMSL

Aperture: 10.0 m Largest Dimension

Default Modulation: FM_200kHz

Default Polarity: Mixed

Info Only

Make: _____

Model: _____

Antenna Handbook Number: _____

Directional:

← →

↻ save

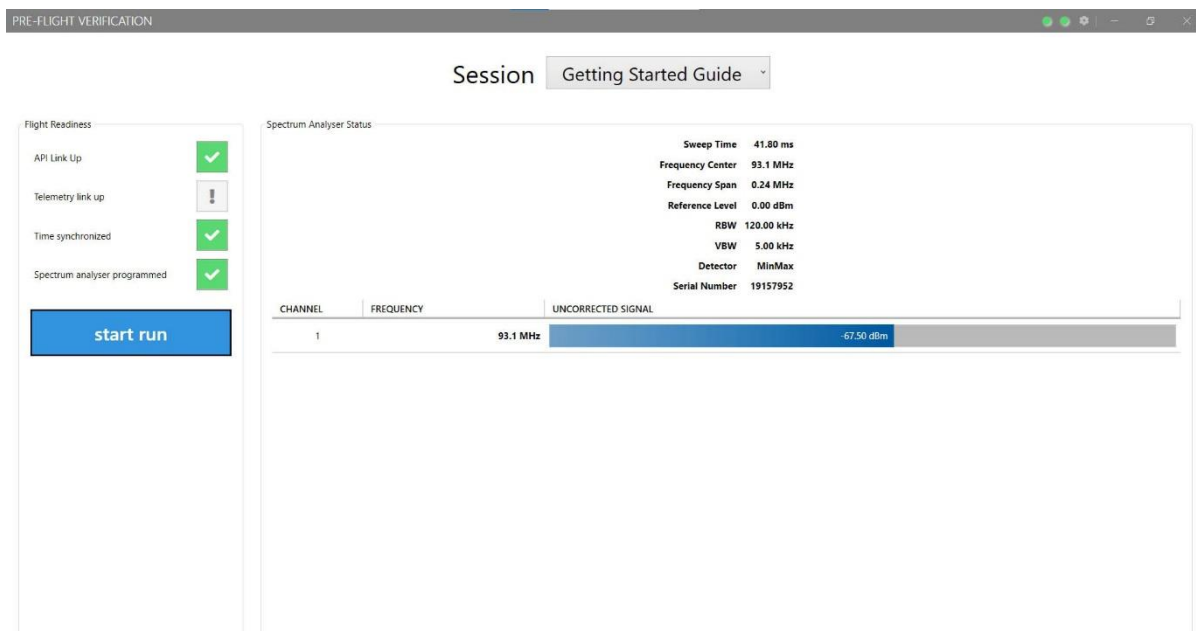


The image above shows the COR for this DAB Antenna as seen through the fpv camera.

2.6. Recording an AMS Data Session

2.6.1. Pre-flight Verification

We are now ready to begin Pre-Flight Verification. On the home screen of AMS, click on Pre-Flight. Select the session that applies to the antenna you are measuring. Using your computers network settings, connect to SixArms Wi-Fi. Once the connection is successful, the API Link Up box will turn from a red exclamation point to a green ticked box. If required, synchronize the time by clicking on the red box next to “Time Synchronized”, select new time and click apply. The spectrum analyser can now be programmed by clicking on the red box next to “Spectrum Analyser Programmed”, clicking “Suggest” and “Apply”. Click “Start Run”, choose the run type in the drop-down menu and click “Select”. Note that a vertical elevation flight must be completed first to find the depression angle of the beam tilt. The horizontal azimuth is flown at this depression angle.



2.6.2. Programming Flight Plan

2.6.2.1. Programing a Vertical Elevation Flight

For a vertical elevation flight, add in the faces in the order you wish to fly them in. Select the start and end altitude you want each face to fly from and to. For example, you could fly from the minimum height to maximum on one face, traverse to the next face and fly from the maximum height down to the minimum height and so on. There may be cases where you would want to avoid flying at a minimum altitude from point to point due to obstacles. For this scenario the first face may end on a minimum altitude and the second face may start at a maximum altitude so that the M300 can fly diagonally to the next point and above the obstacle.

VERTICAL ELEVATION - GETTING STARTED GUIDE - V5.0.8128.24073

NAME	AZIMUTH	START ALTITUDE	END ALTITUDE
Slice	0 °	Min	Max
Slice A	270 °	Max	Min

	Antenna	Drone Starting	Drone Heading	Horizontal Distance to Antenna
Lat	-34.9809900°	-34.2874159°	353.23 °	185785 m
Long	138.7080410°	140.5555041°	Azimuth To Antenna	Azimuth To Drone
Structure Base Height (AMSL)	-3.59 m	-3.59 m	245.47 °	65.47 °
Height of Center of Radiation (AGL)	120.00 m			
Take-Off Alt (ASL)	-3.6 m			Drone GPS Altitude -3.59 m
GPS Fix Type	Single			Distance From Antenna 62.1 m
Target Min Height	23.6 m (AGL)			Depression Max 57.1 °
Target Max Height	123.6 m (AGL)			Depression Min -3.6 °
Measuring Speed	0.5000 m/s			
Cruise Speed	5.0 m/s			

create flight plan CUSTOM FLIGHT PLAN

Once the drone GPS altitude is stable and highlighted in green, click on the arrow to set the take-off altitude.

Determine the radius that you would like to fly from the antenna and enter it into the distance from antenna.

VERTICAL ELEVATION - GETTING STARTED GUIDE - V5.0.8128.24073

NAME	AZIMUTH	START ALTITUDE	END ALTITUDE
Slice	0°	Min	Max
Slice A	270°	Max	Min

Flight Plan

	Antenna	Drone Starting	Drone Heading	Horizontal Distance to Antenna
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Target Max Height	123.6 m (AGL)			Depression Min -3.6°
Measuring Speed	0.5000 m/s			
Cruise Speed	5.0 m/s			

create flight plan CUSTOM FLIGHT PLAN

Set the target min and max height that you wish to fly from and to respectively. This can be done by either setting the altitudes on the left-hand side, or alternatively by setting the depression angle from the antennas' centre of radiation on the right-hand side of the screen.

VERTICAL ELEVATION - GETTING STARTED GUIDE - V5.0.8128.24073

NAME	AZIMUTH	START ALTITUDE	END ALTITUDE
Slice	0°	Min	Max
Slice A	270°	Max	Min

Flight Plan

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Target Max Height	123.6 m (AGL)			Depression Min -3.6°
Measuring Speed	0.5000 m/s			
Cruise Speed	5.0 m/s			

create flight plan CUSTOM FLIGHT PLAN

Enter the speed you want the M300 to fly when measuring data and cruising between points.

VERTICAL ELEVATION - GETTING STARTED GUIDE - V5.0.8128.24073

NAME	AZIMUTH	START ALTITUDE	END ALTITUDE
Slice	0°	Min	Max
Slice A	270°	Max	Min

Flight Plan

	Antenna	Drone Starting	Drone Heading	Horizontal Distance to Antenna
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Target Max Height	123.6 m (AGL)			Depression Min -3.6°
Measuring Speed	0.5000 m/s			
Cruise Speed	5.0 m/s			

create flight plan CUSTOM FLIGHT PLAN

Attach the USB Type A to USB Type A cable from the USB port in the top of the M300 controller to a vacant USB port on your computer. Swipe down from the top of the M300 controllers' screen to open quick settings on the M300 controller. Tap USB and use USB to transfer files. Then in AMS, click create flight plan. This will save the mission onto the M300 Controller.

2.6.2.2. Programing a Horizontal Azimuth Flight

For a Horizontal Azimuth flight, add in the face you want the orbit to begin and end at. Leave the altitude at Min and Min.

Once the drone GPS altitude is stable and highlighted in green, click on the arrow to set the take-off altitude.

Determine the radius that you would like to fly from the antenna and enter it into the distance from antenna.

Set the height using the depression angle measured from the vertical elevation flights.

Enter the speed you want the M300 to fly when measuring data and cruising.

Attach the USB Type A to USB Type A cable from the USB port in the top of the M300 controller to a vacant USB port on your computer. Swipe down from the top of the screen to open quick settings on the M300 controller. Tap USB and use USB to transfer files. Then in AMS, click create flight plan. This will save the mission onto the M300 Controller.

2.6.3. Accessing the Flight Plan

To access the flight plan just created;

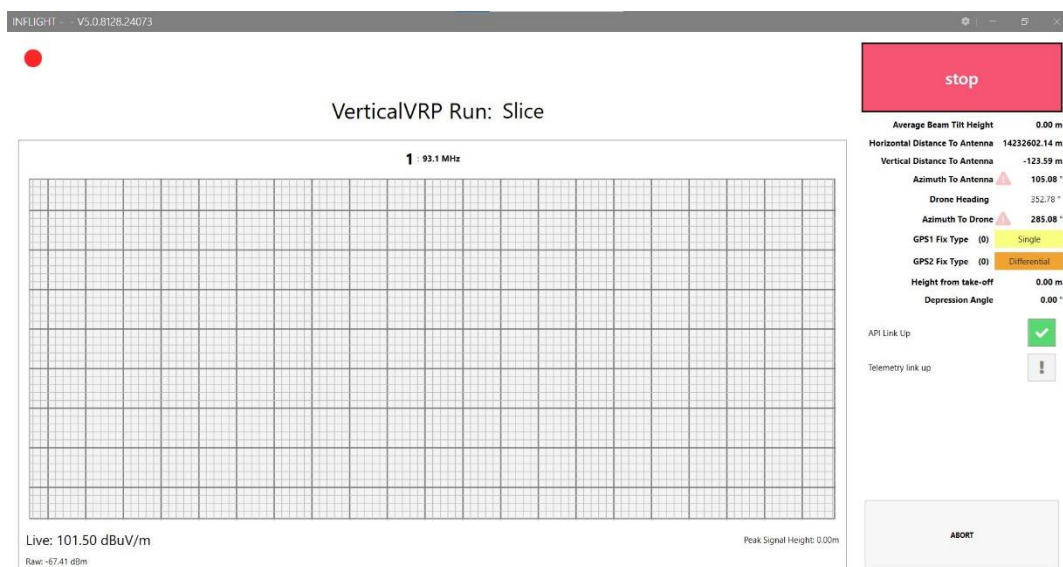
- Tap Mission Flight on the DJI Pilot home screen.
- Tap KML Import.
- Tap Waypoint.
- Choose Internal Storage
- Tap DJI
- Find the flight plan created and select it. This will import the flight plan into the Library where you can select it for flight.

2.6.4. Start Recording in AMS

To begin recording RF data, ensure the ARMS configuration is correct in AMS. Use this step to ensure the antenna is mounted in the correct orientation then press start record.

3. Flying Operations

Before taking off, ensure that the RAW RF data at the bottom left-hand side of the screen is updating and the drone heading located on the centre of the right-hand side of the screen moves when the drone is moved. Take off manually and perform your inflight control checks. Then fly the M300 to a safe area away from obstacles and tap the play button on the left-hand side of the screen. The M300 will prompt you to upload the mission, move to the start point and fly the mission.

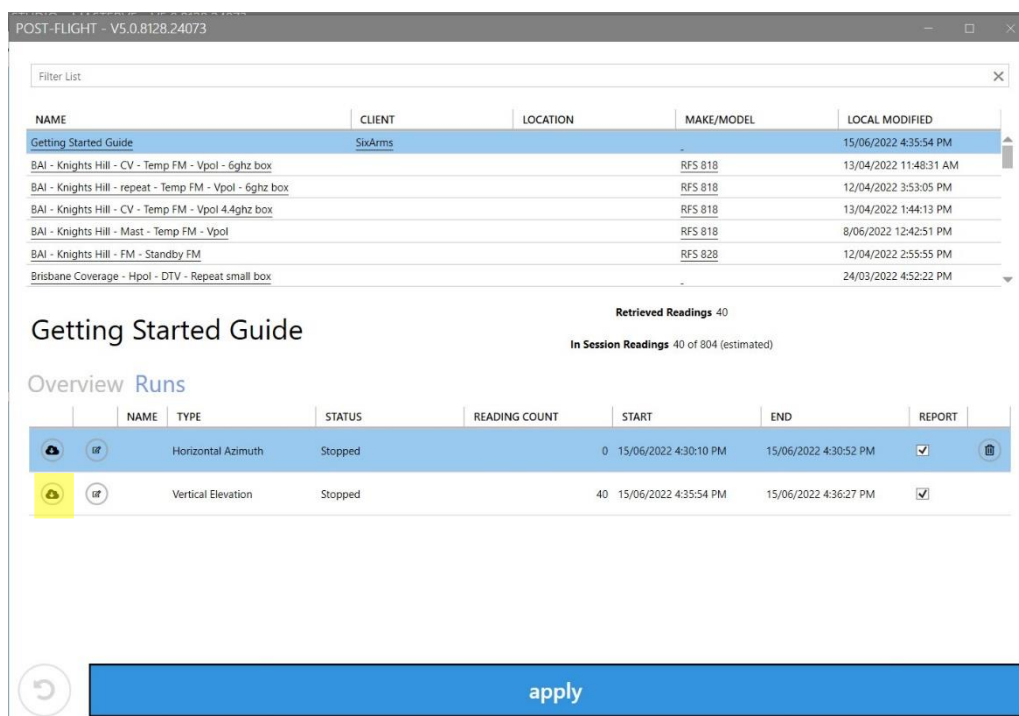


Upon completion of the mission, rotate the drone away from the antenna at least 90 degrees to avoid any unwanted RF measurements and return the M300 back to the landing area. Once landed, make sure the SixArms Wi-Fi is still connected or reconnect if it isn't. Confirm the Raw RF data is updating in the bottom left-hand side of the screen and press the red stop button to stop recording. Do not power off the M300 until you have completed the Post Processing synchronization.

4. Post Flight

Once you have stopped recording, AMS will prompt you to run or close post processing. Click on the Run button and AMS will synchronize the RF data from the ARMS receiver, save a preliminary report in a word file and export the raw data in an excel file. These reports can be found in your PCs Documents folder.

If AMS fails to process data, it can be done manually by clicking on the post flight button on the homepage of AMS. Selecting the session to be processed. Under the “Overview” tab, the session can be synchronised, exported or reported. If you would like to synchronise individual flights within a session this can be done by clicking on the “Runs” tab and clicking on the cloud icon as shown in yellow below.



The updated data can then be reported and exported from the “Post Flight” page.

5. Syncing Data to the Cloud

This session can now be synced to the cloud for remote access of the data captured. Click on the “Control” tab found on the AMS home screen. Scroll down to “Cloud” and click on “Sync”. Under sessions click on the upload to cloud icon as shown below.

Cloud Synchronization

Lookups



Last Attempt: 15 Jun 11:26

Last Success: 15 Jun 11:26

Sessions



close

Under the “Send” tab, find the session to be uploaded and click on the upload to cloud icon on the right side of the screen.