



SY3 System Users Manual



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GENERAL SAFETY SUMMARY

Please review the following safety precautions carefully before putting the system into operation, so as to avoid any personal injury or damage to the instrument and any product connected to it. To prevent potential hazards, please use the instrument only as specified in this manual.

Use the Proper Power Cord

Use only the power cord designed for the instrument and authorized by your local country.

Ground the Instrument

The instrument is grounded through the protective earth lead of the power cord. To avoid electric shock, it is essential to connect the earth terminal of the power cord to the protective earth terminal before connecting any inputs or outputs.

Connect the Antenna Correctly

When connecting the SY3 Antenna to the SY3 Analytics Tower, ensure that all connections are fastened securely. Utilize both screws on the DB-25 connector to prevent accidental disconnection of the cable during use.

Observe All Terminal Ratings

To avoid fire or shock hazard, observe all ratings and markers on the system and check your manual for more information about ratings before connecting the instrument.

Do Not Operate Without Covers

Do not operate the system with covers or panels removed.

Do Not Insert Anything into Vent Holes

Do not insert anything into the vent holes on the system to avoid damaging components.

Avoid Circuit or Wire Exposure

Do not touch exposed junctions and components when the unit is powered.

Keep Well Ventilated

Inadequate ventilation may cause an increase of temperature or damage to the system. Please keep the system well ventilated and inspect the intake and vent holes regularly.

Do Not Operate with Suspected Failures

If you suspect damage to the system has occurred, have it inspected by qualified service personnel before further operation. Any maintenance, adjustment, or replacement, especially to circuits or accessories, must be performed by SteppIR authorized personnel.

Keep Product Surfaces Clean and Dry

To avoid the influence of dust and/or moisture in the air, please keep the surface of the device clean and dry.

Electrostatic Prevention

Operate the instrument in an electrostatic discharge protective environment to avoid damage induced by static discharges. Always ground both the internal and external conductors of cables to release static before making connections.

GENERAL SAFETY SUMMARY

Operate Only Within an EMC Chamber

Under normal operations, this system emits high levels of RF radiation. The system is intended to be used in an EMC chamber only, to prevent personal injury or damage to instruments.

Maintain a Proper Distance Between Antenna Elements and Conductive Surfaces

High voltages on the elements can occur when operating the antenna with an amplifier. All conductive surfaces, such as the walls, ceiling, or floor of the EMC chamber, should be kept at least 15" (38 cm) from the antenna elements to avoid arcing.

Observe Antenna Power Ratings

The SY3 antenna is rated to **2500 Watts at 2.5 : 1 VSWR**. Operating at higher RF power or higher VSWR values can result in damage to the system.

Burn Prevention

The SY3 Antenna enclosure underside surface may be hot during and immediately after transmitting. Use caution when handling the device to avoid burns.

Trip Hazard

The system components are connected via long lengths of cable. Use caution when moving between components to avoid tripping and causing personal injury or damage to the equipment.

Handling Safety

Please handle with care during transportation to avoid tipping or dropping the system components to avoid personal injury or damage to the equipment.

This product is intended to be used and operated exclusively within an EMC chamber by trained professionals. If the product is used in a manner not specified by the manufacturer the protection may be impaired.

SY3 SYSTEM ASSEMBLY: SY3 STAND

Section 1:

The SY3 Stand allows for quick levelling and adjustments of the SY3 Antenna. It uses a PanaVise head to tilt the SY3 Antenna between horizontal and vertical polarizations, as well as four leveling feet for fine tuned control.

Figure 1 demonstrates how the four legs are inserted into the base of the antenna. Be sure that the four set screws are loosened enough or removed (utilizing a 3/16" hex (Allen) key) so that they do not block the passageway for the four legs. Insert the leg until it bottoms out inside of the hole on the stand base. Orient the legs such that the leveling feet are facing the ground (leveling foot surface should be parallel to stand base surface).

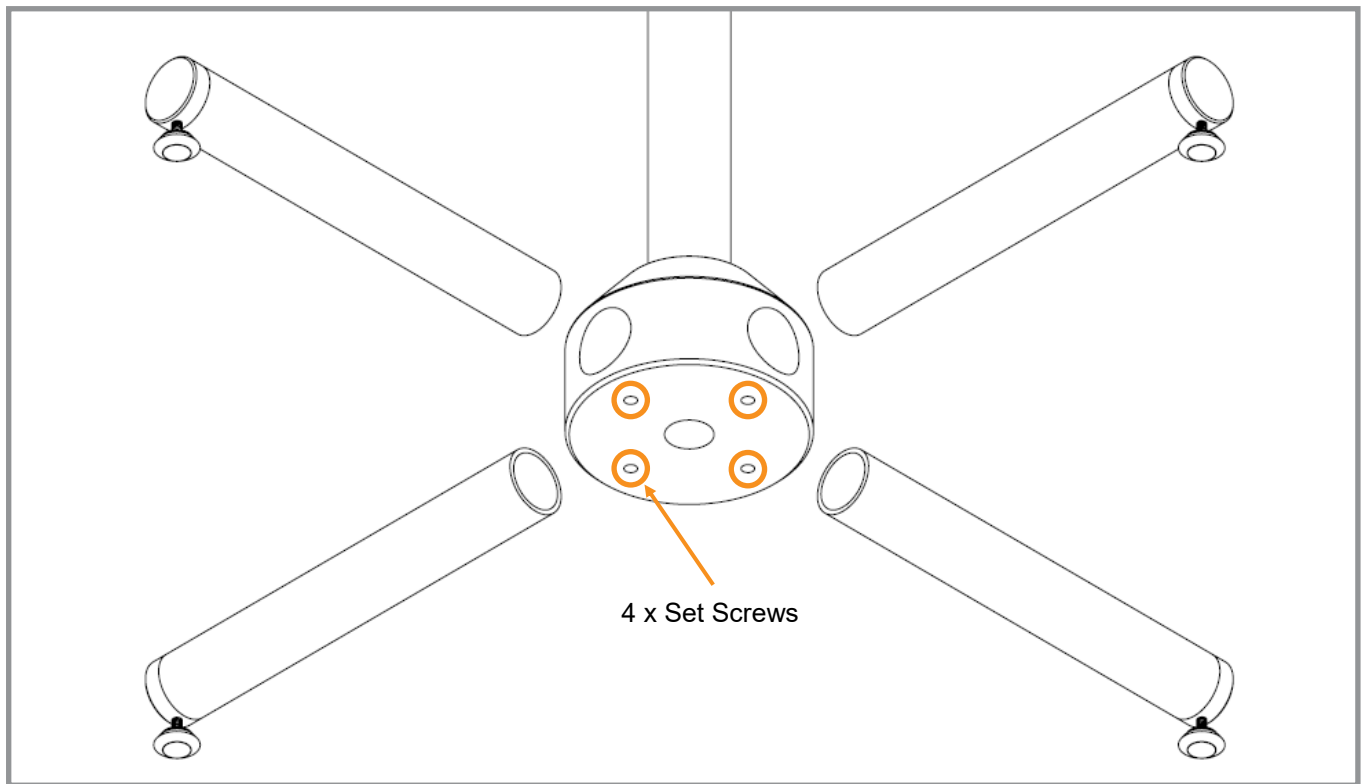


Figure 1

SY3 SYSTEM ASSEMBLY: SY3 STAND

Using a 3/16" hex (Allen) key, secure the four legs by tightening the set screws as shown in **Figure 2**. Ensure that the leveling feet are facing the ground as shown in **Figure 1** on the previous page before tightening.

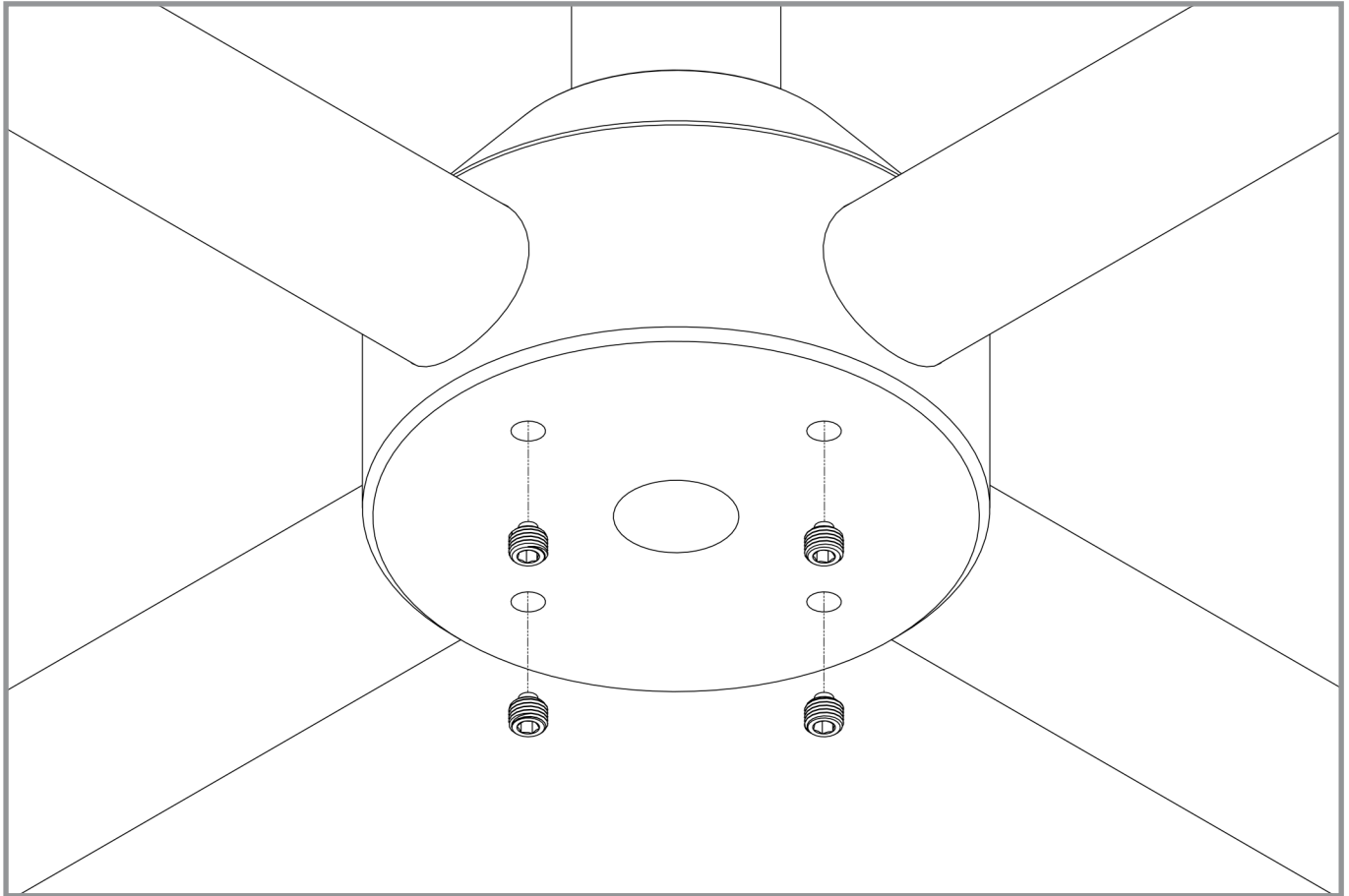


Figure 2

SY3 SYSTEM ASSEMBLY: SY3 ANTENNA

Section 2:

The SY3 Antenna boom is attached to the PanaVise mount using four Phillips head screws. These screws are fastened into the SY3 Antenna boom during shipping.

Remove the four mounting screws from the bottom of the antenna boom, as shown in **Figure 3**.

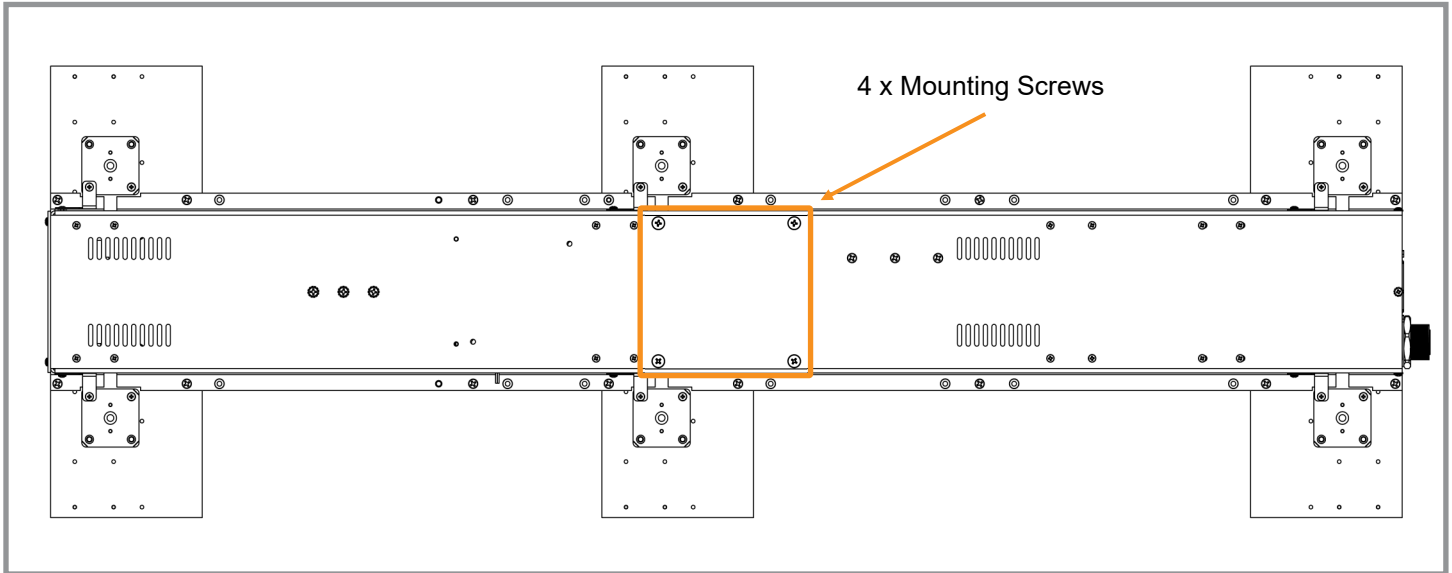


Figure 3

Place the antenna boom on top of the PanaVise Mount, and secure it in place using the four mounting screws, as shown in **Figure 4**. Be sure that the **knob on the PanaVise Mount is facing the front of the antenna** (opposite of the coaxial connector), this ensures that the antenna will rotate to vertical polarization properly with the elements on the right side closer to ground.

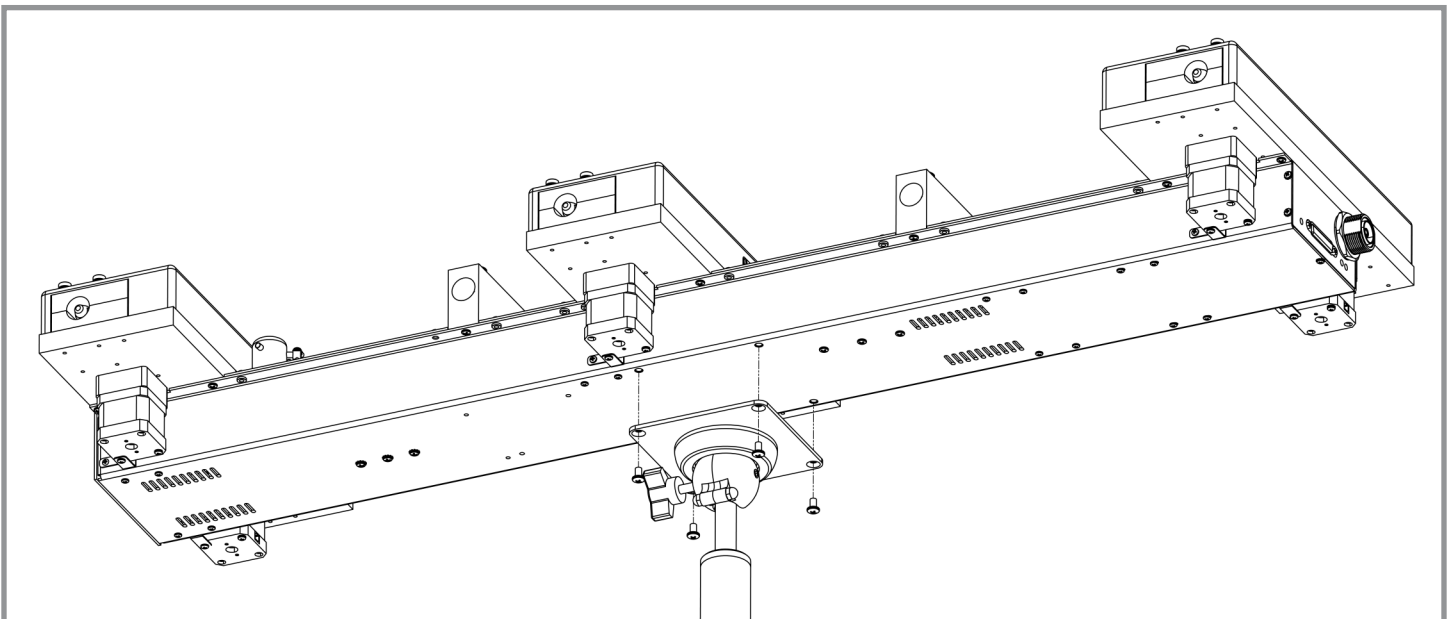


Figure 4

SY3 SYSTEM ASSEMBLY: SY3 ANTENNA

Remove the two black plastic thumbscrews on the center element, and insert a straight element fiberglass support tube into each side of the center element, as shown in **Figure 5**.

Make sure each fiberglass support is fully seated within the element.

Reinstall each plastic thumbscrew, fastening them against the fiberglass support tube .

Do not overtighten! Doing so may crush or otherwise damage the fiberglass support tube.

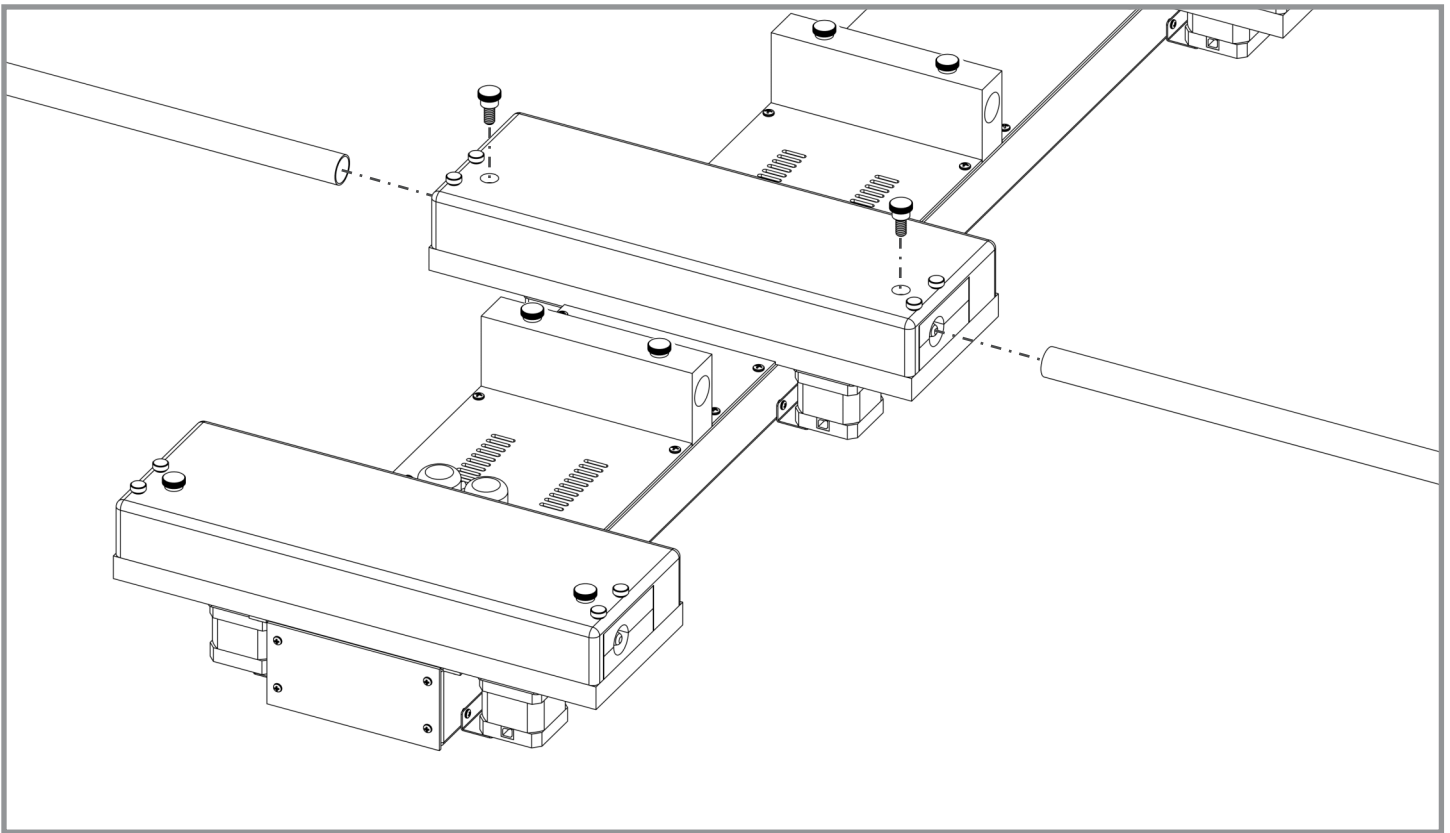


Figure 5

SY3 SYSTEM ASSEMBLY: SY3 ANTENNA

Remove the four black plastic thumbscrews on the front element and gray return support block, insert a folded element fiberglass support assembly into each side of the elements, as shown in **Figure 6**. The folded element fiberglass supports are **not** symmetrical, please refer to **Figure 7** on the next page for the correct orientation. The long side of the folded element fiberglass supports will go into the gray return support block.

Make sure each fiberglass support is fully seated within the element and that the sweep is level with the surface of the boom.

Reinstall each plastic thumbscrew, fastening them against the fiberglass support tube.

Do not overtighten! Doing so may crush or otherwise damage the fiberglass support tube.

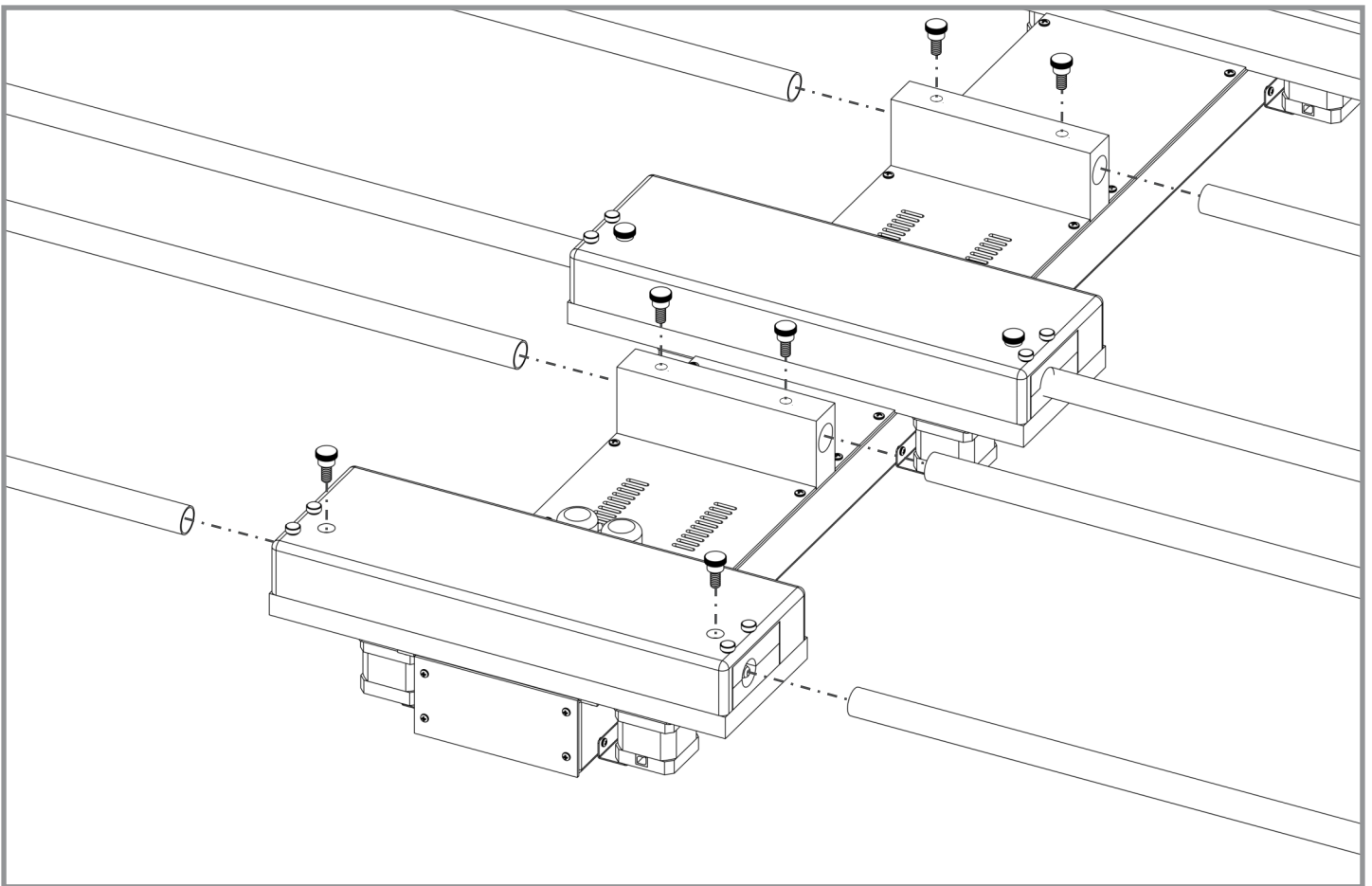


Figure 6

SY3 SYSTEM ASSEMBLY: SY3 ANTENNA

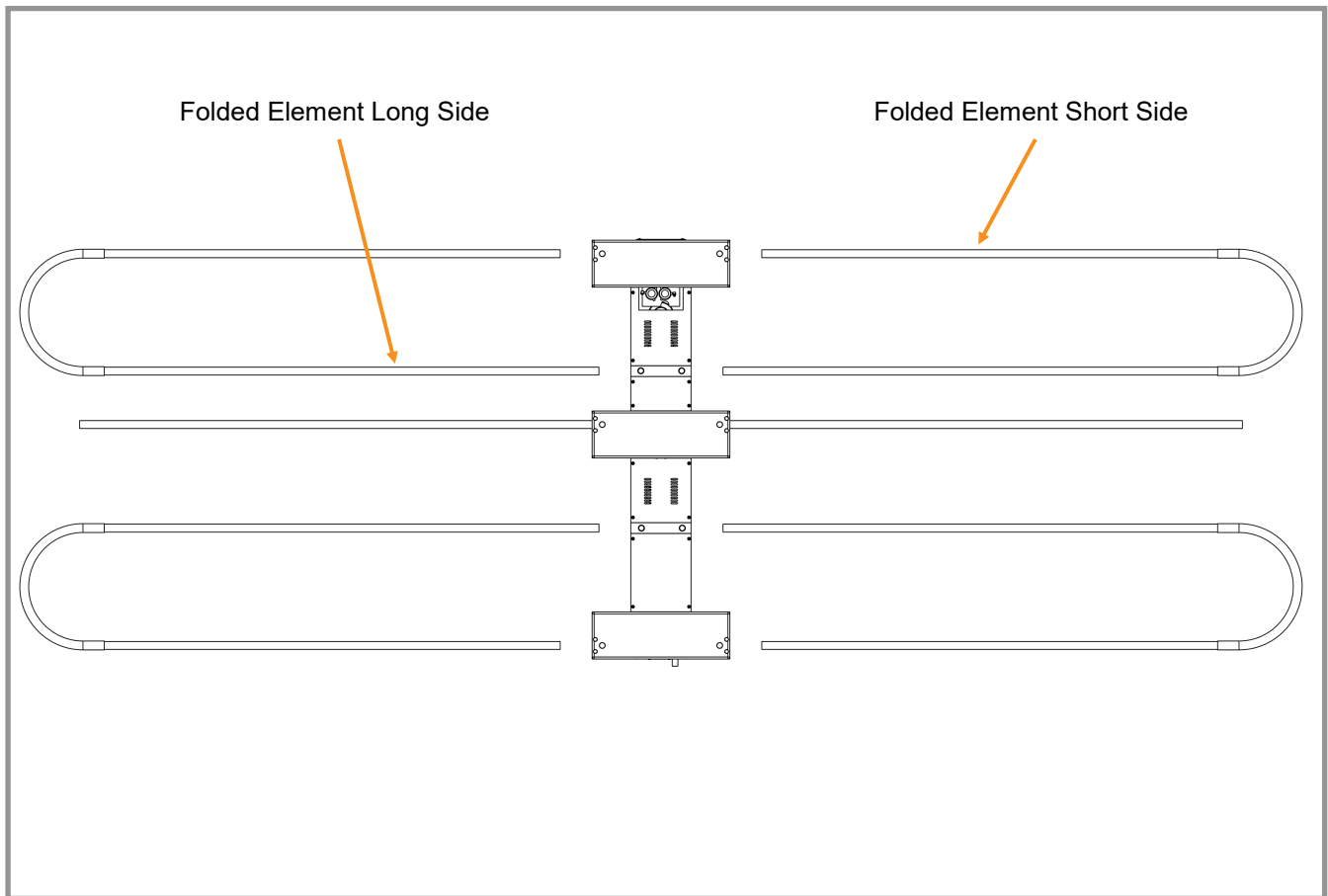


Figure 7

SY3 SYSTEM ASSEMBLY: RECEIVE ANTENNA AND STAND

Section 3:

The SY3 System uses a 0.03—1 GHz Biconical Antenna and non-conductive stand to measure and optimize for signal strength while tuning.

Figure 8 demonstrates how the non-conductive stand is assembled

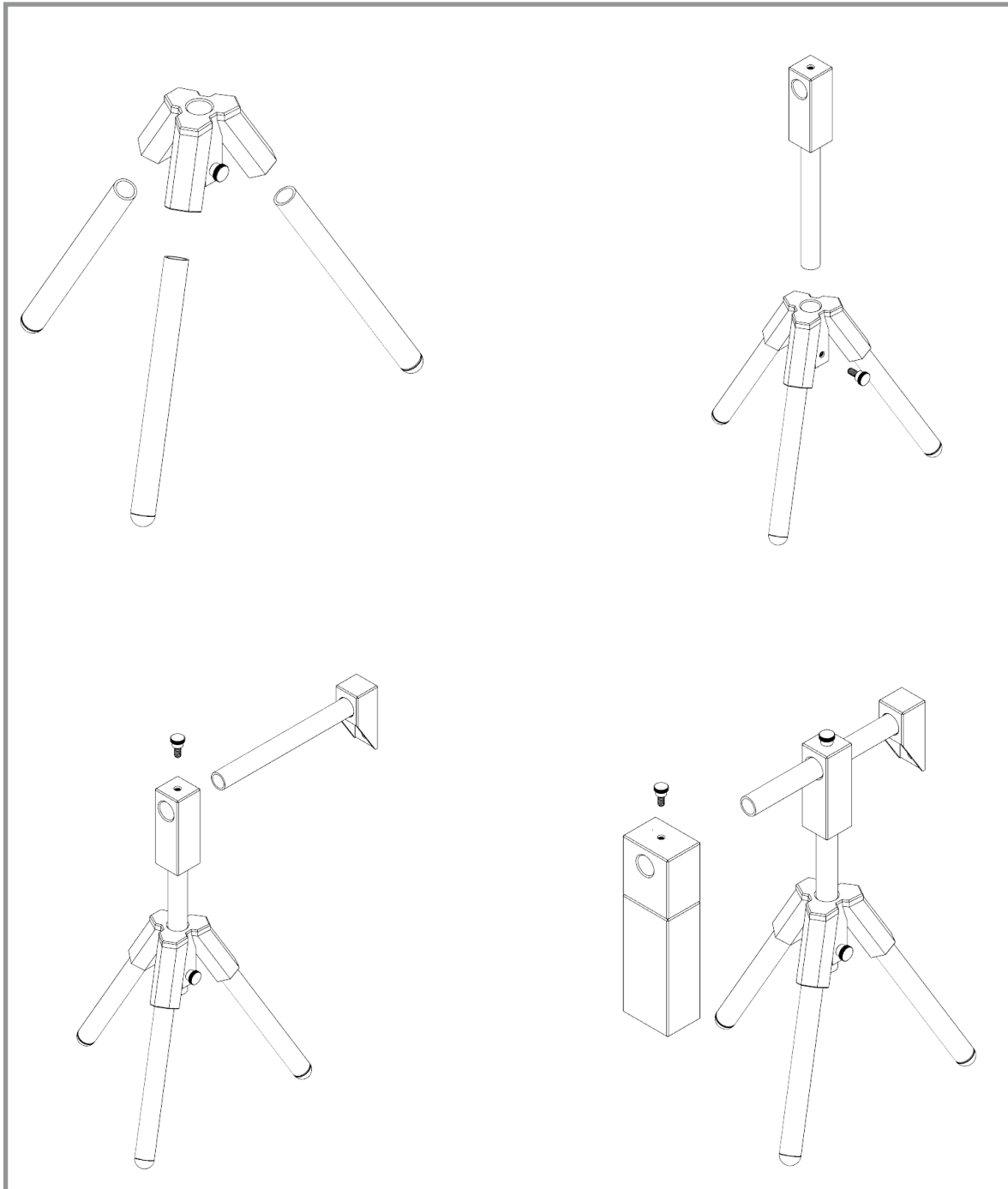


Figure 8

SY3 SYSTEM ASSEMBLY: RECEIVE ANTENNA AND STAND

Fasten the Receive Antenna to the stand's horizontal arm using the black plastic thumbscrew, as shown in **Figure 9**.

Adjust the Receive Antenna position and counterweight as needed.

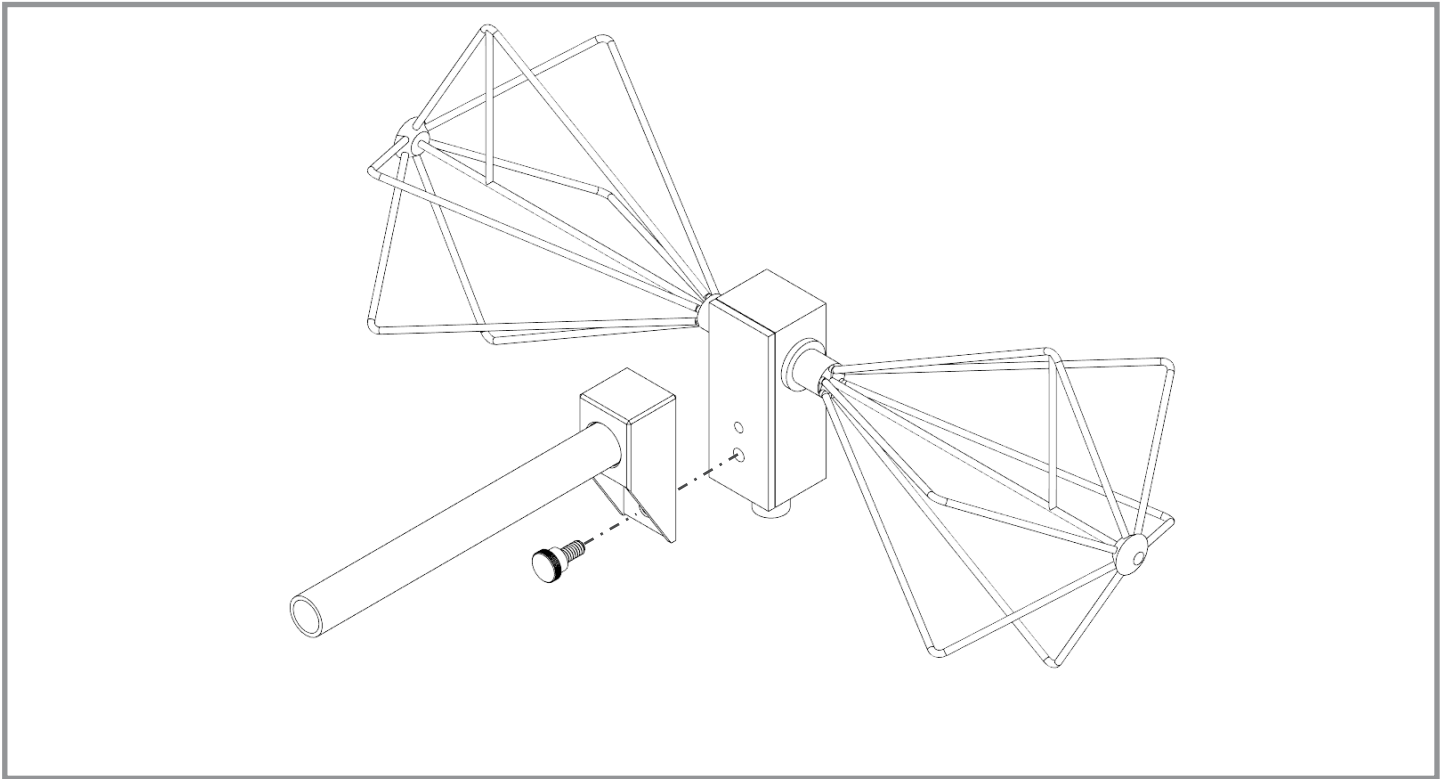


Figure 9

SY3 SYSTEM USER GUIDE: THEORY OF OPERATION

Section 4:

The SY3 System uses a mechanically adjustable antenna and analytics tower to determine optimal antenna lengths for a given frequency in a given environment.

Before use, the SY3 system is calibrated to the EMC chamber that it is in, essentially "auto tuning" the antenna. This process takes approximately 2.5-3 hours, and needs to be repeated for both horizontal and vertical polarization.

The auto tuning process takes place with the SY3 Antenna and mini biconical receive antenna inside of the EMC chamber, and the analytics tower outside of the EMC chamber. The SY3 Antenna will be placed 90cm away from the edge of the bench and centered on the bench. The mini biconical receive antenna will be placed on the test bench similarly to how the E-field probe would be placed, 10cm inset from the edge of the bench (1m from center of receive antenna to center of the first element on the SY3 Antenna), and 30cm above the surface of the bench.

With the coax connected to their respective antenna's and control cable connected to the SY3 Antenna, the system will tune for low VSWR and high signal strength, optimizing for the entire 30-200MHz frequency range.

Once the auto tuning process is completed, you will remove the receive antenna from the room, setup your E-field probe(s) and perform MIL-STD-461G, RS103 from 30-200MHz in the polarization you just tuned in. Once the test has been completed in that polarization, you may setup for the next polarization to tune the system again. We recommend performing the test immediately after tuning to ensure you do not move the antenna's position which would affect the results.

SY3 SYSTEM USER GUIDE: SETUP HARDWARE FOR TUNING

Section 5:

When tuning, the SY3 System uses 3 separate components:

1. The SY3 Antenna
2. The Mini-Bicon Receive Antenna
3. The analytics tower and cables

The SY3 Antenna

The SY3 Antenna should be placed inside of the EMC chamber **90cm** from the edge of the bench, and centered on the bench, as described in MIL-STD-461G, RS 103.

This measurement should be taken from the center of the front element fiberglass support tube.

In the Horizontal Polarization, the center of the front element tube should be **145cm (57")** from the ground of the chamber as shown in **Figure 10**. This height has been determined through testing in many different EMC chambers. While it is a recommended height, you may test different heights if you find the results from the tune unsatisfactory. This height adjustment can be made using the knob on the stand. The antenna can then be levelled side to side using the knob on the PanaVise attachment. The antenna can be levelled front to back using the adjustable feet on the stand.

In the Vertical Polarization, the bottom of the looped element fiberglass support tube should ideally be at least **43cm (17")** from the floor and ceiling of the chamber as shown in **Figure 11**. It must be **at least 25.4cm (10")** from the floor and ceiling of the chamber to avoid performance loss. Ensure that you have positioned the antenna with its right side elements closer to the ground.

If the height/position of the antenna is changed after the initial auto tuning process, in either polarization, the antenna must be re-tuned to this new height/position.

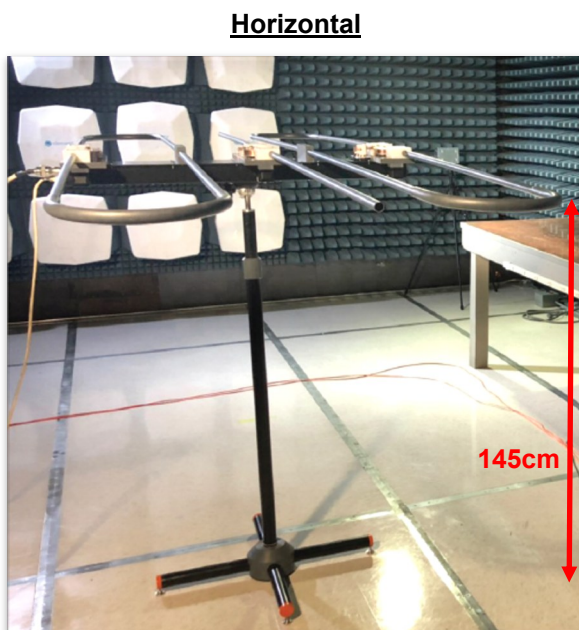


Figure 10



Figure 11

The Receive Antenna

The Mini-Bicon Receive Antenna should be placed inside of the EMC chamber **10cm** back from the edge of the bench and **30cm** above the ground plane, as described in MIL-STD-461G, RS 103. This is measured from the center body of the Mini-Bicon Receive Antenna, in horizontal and vertical polarization as shown in **Figure 12** and **Figure 13**. The polarization of the Receive Antenna should match the polarization of the SY3 Antenna as shown in **Figure 14**. We recommend that the Receive Antenna should also be positioned **61cm (24")** to the right of the centerline of the SY3 Antenna when in horizontal polarization as shown in **Figure 15** on the next page. In vertical polarization the Receive Antenna should be positioned on the centerline of the SY3 Antenna as shown in **Figure 14**.

After extensive testing, we found that this placement yielded best results in our test chambers.

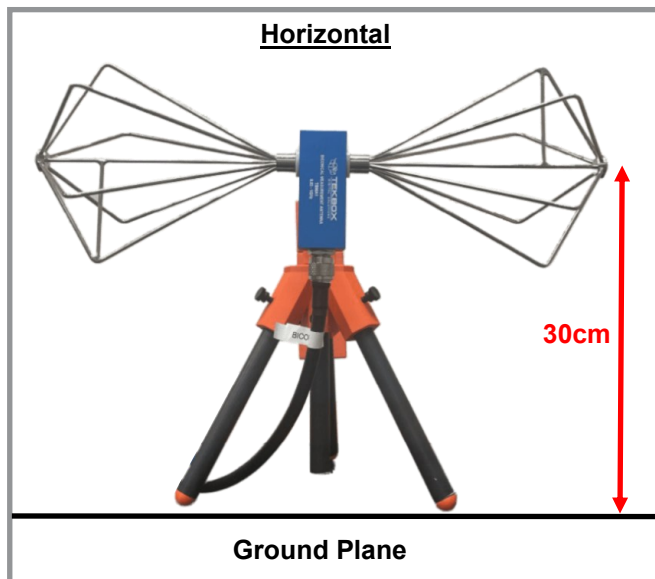


Figure 12

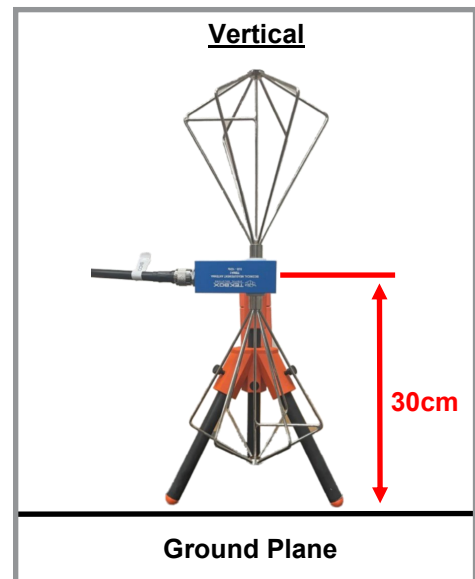


Figure 13

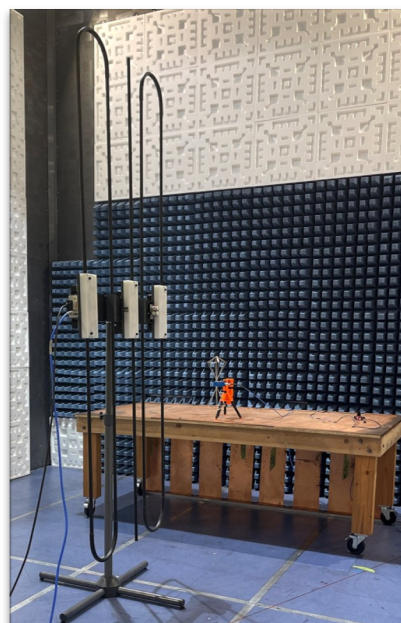


Figure 14

The Analytics Tower

The Analytics Tower must be placed outside of the EMC chamber. The Analytics Tower connects to the SY3 Antenna using a N-Type to N-Type (or 7/16 DIN depending on version of the antenna) low loss coaxial cable and the DB-25 Control Cable. The Analytics Tower connects to the Receive Antenna using a BNC (or N-Type depending on the version of the Analytics Tower) to N-Type low loss coaxial cable. The coaxial cable is not provided, but can be purchased separately, as many labs have their own cables available in house. **If you purchased the optional tuning cable kit, be sure that these coaxial cables are only used for tuning the system and NOT used for the MIL-STD-461G, RS 103 test. They are not rated to the 2500W power limit of the system.**

The Receive Antenna must be connected to the “PROBE” or “RECEIVE” port (depending on the version of the Analytics Tower) on the OptimizIR EMC, and the SY3 Antenna must be connected to the “ANTENNA” or “OUTPUT” port (depending on the version of the Analytics Tower) on the OptimizIR EMC. Double check these connections!

If the SY3 Antenna is being used in a new location, it is necessary to create a new “Antenna Configuration” for both the Horizontal and Vertical Polarization.

Figure 15 below is a diagram of how your horizontal polarization setup will look as a top down view.

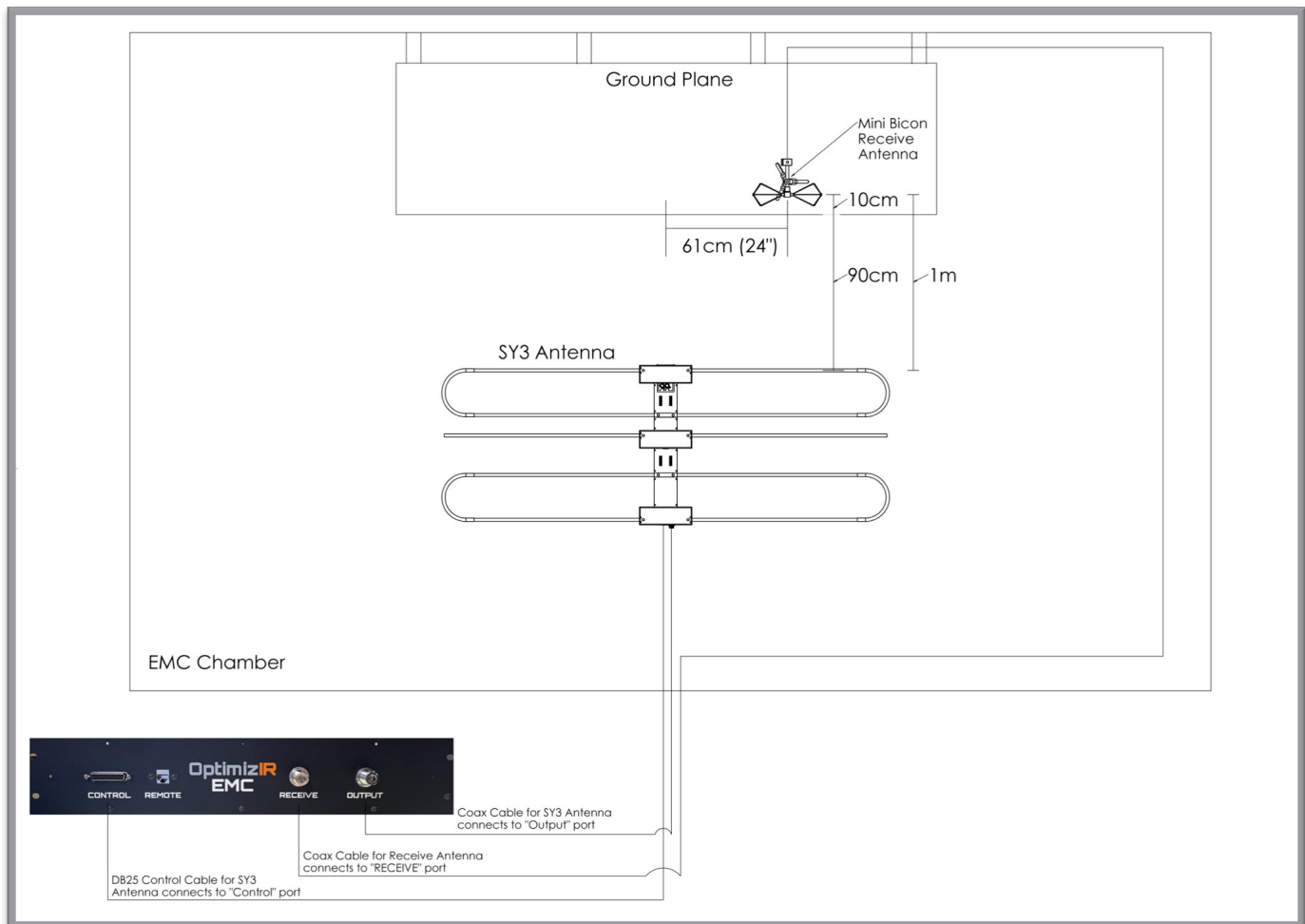


Figure 15

SY3 SYSTEM USER GUIDE: USER INTERFACE OVERVIEW

Section 6:

Creating, selecting, and modifying an antenna configuration is done using the OptimizIR EMC on the Analytics Tower. After the device is powered on, you will see the interface shown in **Figure 16**.

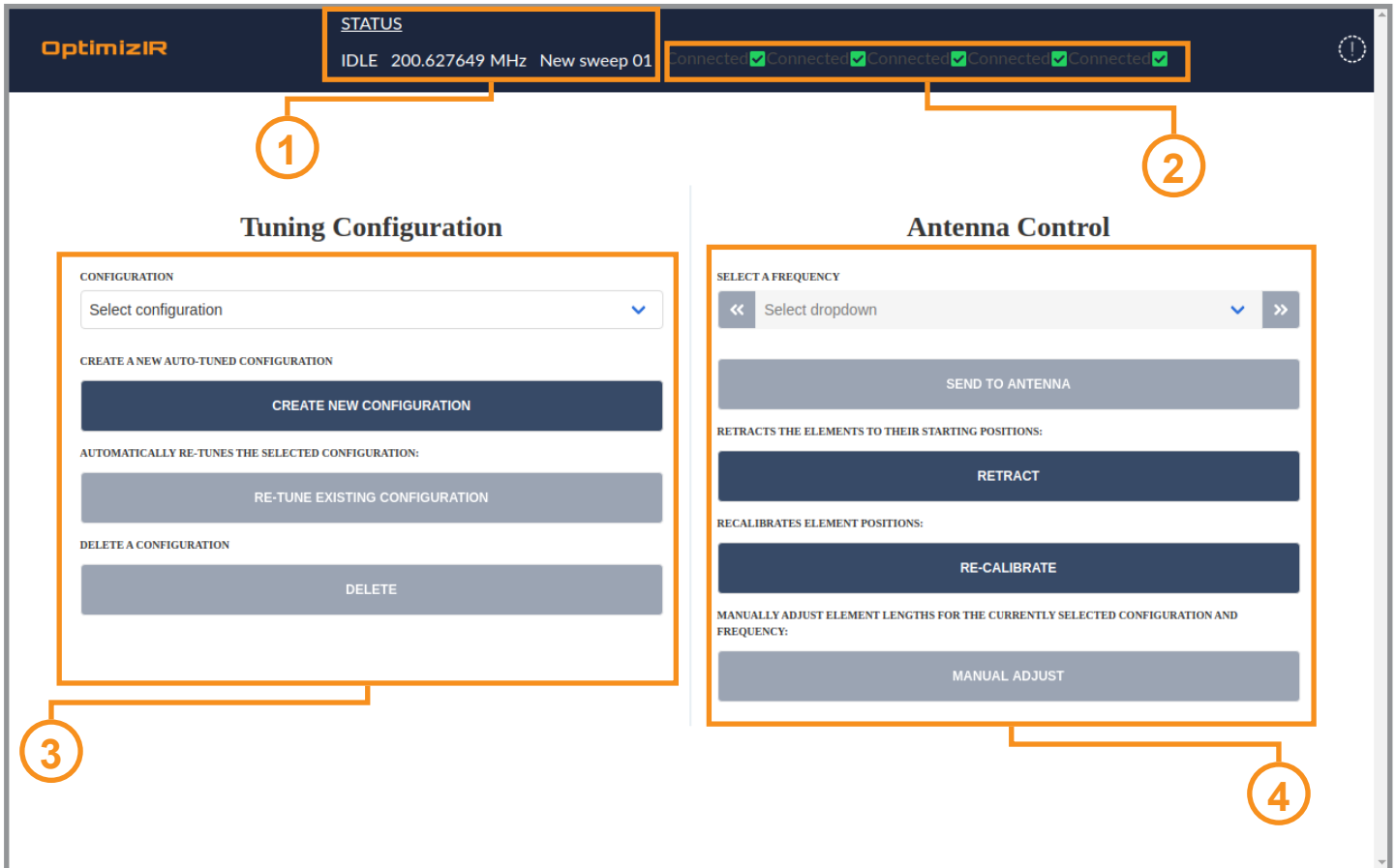


Figure 16

1. Status Menu. Shows current device state, frequency, and configuration.
2. Connection Status.
3. Configuration Control. Select, create, and delete configurations.
4. Antenna Control. Go to a specific frequency, retract or recalibrate elements, or fine tune element lengths.

SY3 SYSTEM USER GUIDE: STARTING A TUNE

Section 7:

Create a new tune by selecting the “**CREATE NEW CONFIGURATION**” button on the left side of the screen, as shown on the previous page in **Figure 16**. Enter a descriptive name (include the polarization in the name) and select the proper tuning preset, according to the polarization of the antenna, as shown in **Figure 17**.

Horizontal and Vertical Presets use different parameters when tuning the SY3 System. Selecting an incorrect preset for your antenna’s polarization can lead to poor antenna performance!

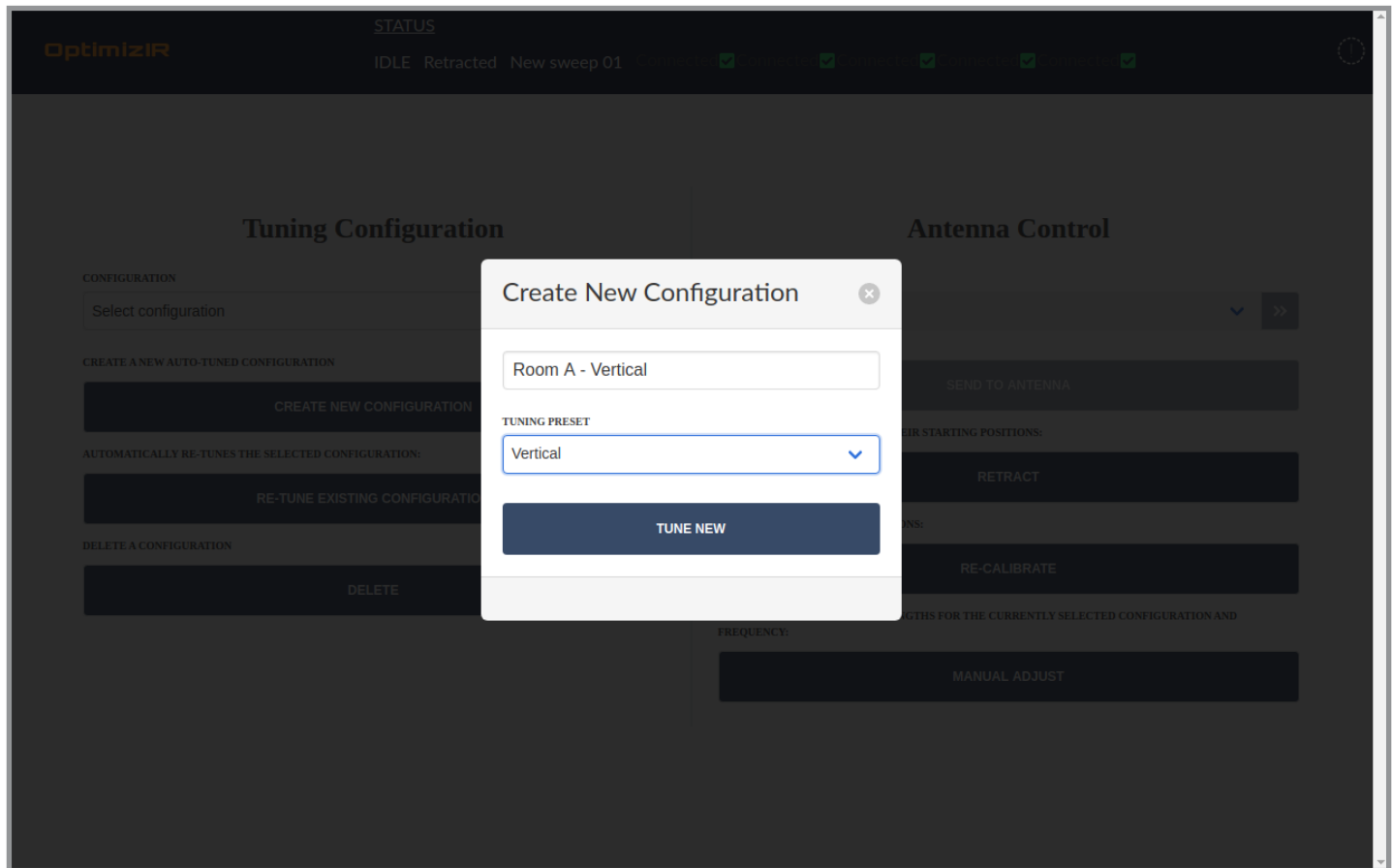


Figure 17

Press the “**TUNE NEW**” button to begin the tuning process. The OptimizIR EMC will update to show the time and percentage remaining, as shown in **Figure 18** on the next page. The tuning process takes approximately 2.5-3hrs, but may vary due to additional computational time. The tune can also be canceled from this screen.

*This cancellation requires confirmation, to avoid accidental interruptions (**Figure 19**).*

Once the tuning process has completed, the OptimizIR EMC will automatically return to the screen shown on **Figure 16**. It is now possible to select the newly created tune/configuration and begin testing.

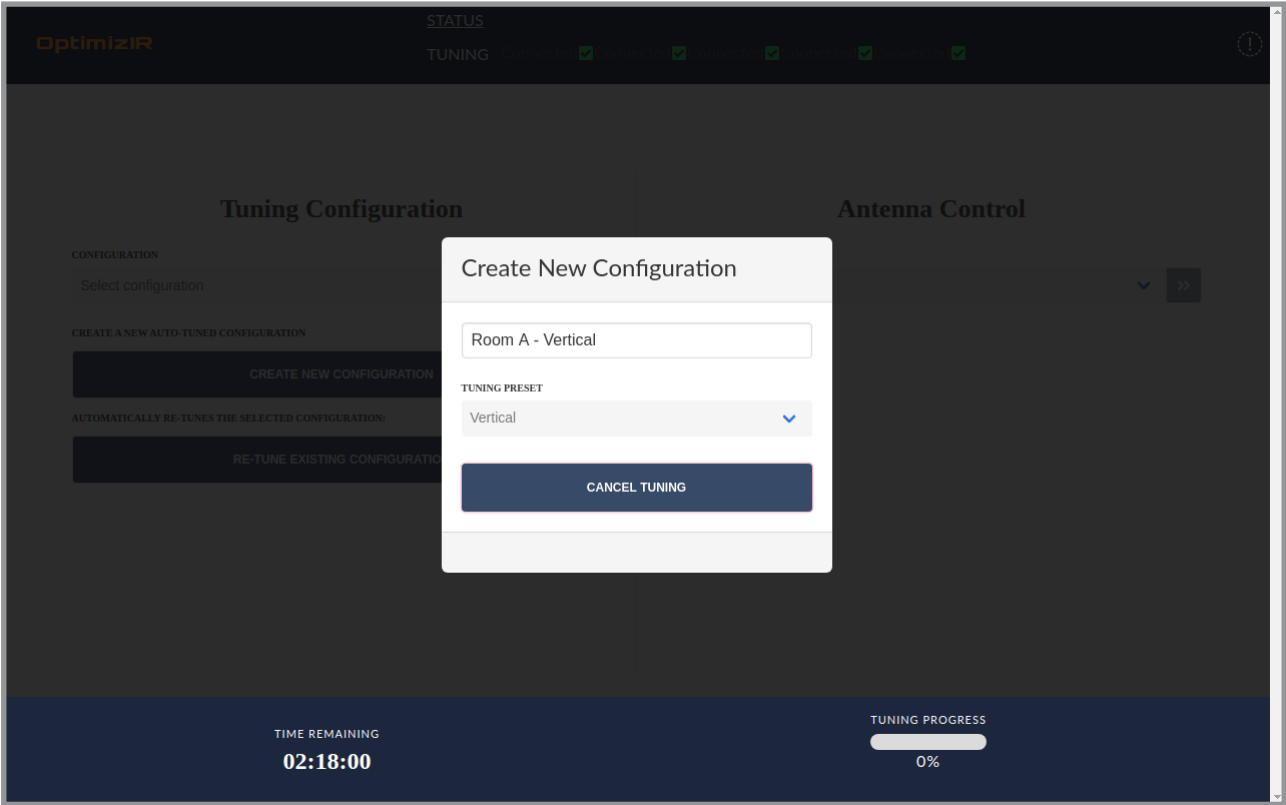


Figure 18

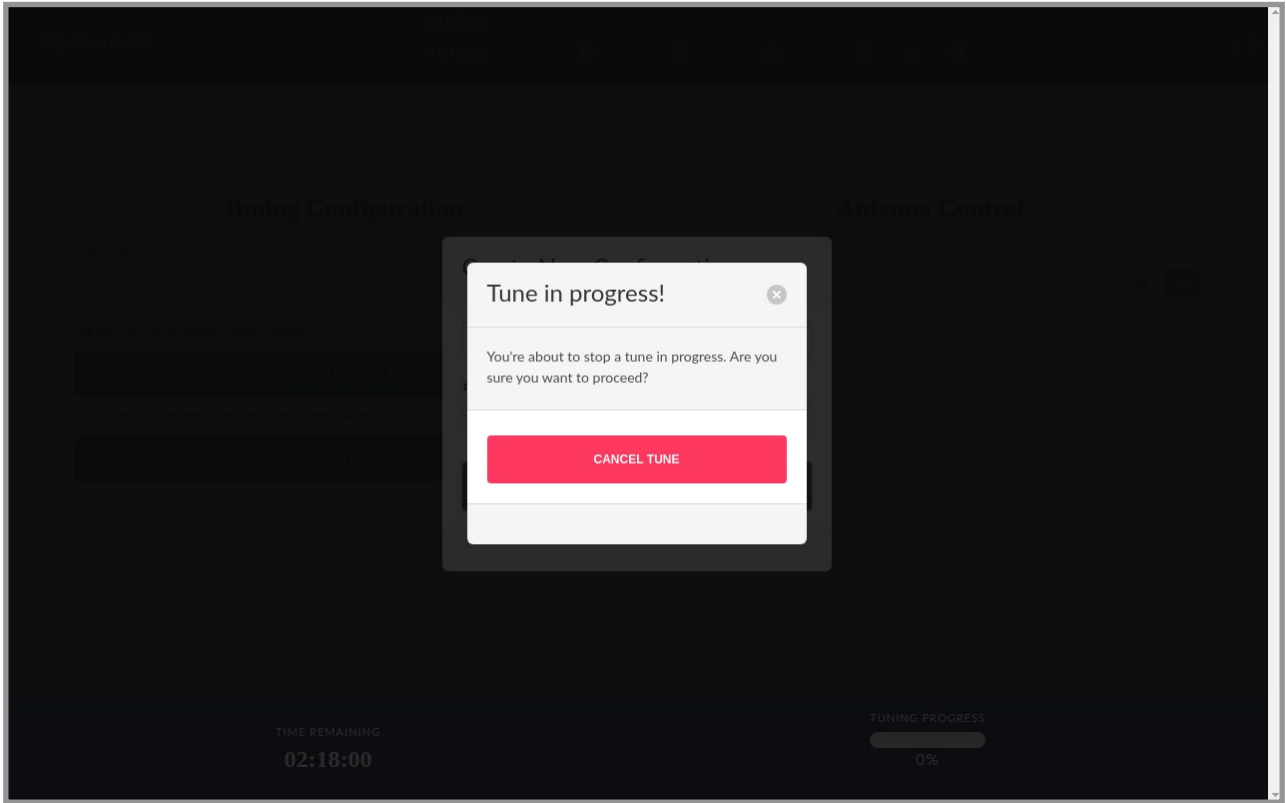


Figure 19

SY3 SYSTEM USER GUIDE: SETUP FOR TESTING

Section 8:

When testing, the SY3 System uses 4 separate components:

1. The SY3 Antenna
2. The Analytics Tower and control cable
3. Coaxial Cable for the SY3 Antenna
4. E-Field Probe(s)

The Mini Bicon Receive Antenna and associated coaxial cable need to be removed from the EMC chamber.

The SY3 Antenna

The SY3 Antenna should be in the same location and polarization as the antenna configuration that it is using. It is recommended to perform the test directly after the tune to ensure the antenna position is unchanged.

Moving the antenna to another location and polarization will cause an increase in VSWR and reduced antenna performance.

The Analytics Tower

The Analytics Tower should only have the DB-25 control cable connected during testing. This cable is necessary for controlling the SY3 Antenna element lengths. The Analytics Tower should still be located outside of the EMC chamber during the testing process.

To prevent damage while testing, disconnect all coaxial cables from the OptimizIR EMC while testing.

Coaxial Cable for the SY3 Antenna

Coaxial cables that are suitable for high power are **not** provided with the SY3 system. **If you purchased the optional tuning cable kit, be sure that these coaxial cables are NOT used for the MIL-STD-461G, RS 103 test. They are not rated to the 2500W power limit of the system. It is the customers responsibility to use a coaxial cable for the SY3 Antenna during the RS 103 test that is suitable for at least 2500W in the 30-200MHz frequency range.** Connect the proper coaxial cable from the SY3 Antenna to your amplifier.

E-Field Probe(s)

Optimal placement of field probes will vary depending on the frequency and polarization of the SY3 Antenna. We recommend the use of multiple field probes to accurately map the field generated by the SY3 Antenna, if possible.

In Horizontal Polarization:

We recommend positioning the field probe(s) up to **48"** to the right of the SY3 Antenna from **30-75 MHz** and **18"** to the right of the SY3 Antenna from **75-200 MHz**.

In Vertical Polarization:

We recommend positioning the field probe(s) **0 - 6"** to the right or left of the SY3 Antenna from **30-200 MHz**.

Optimal E-field probe position will depend on the chamber geometry and resulting SY3 antenna configurations. Your experience may vary so it may be necessary to experiment with the E-field probe placement if you cannot reach the desired 200V/m field.

SY3 SYSTEM USER GUIDE: MANUALLY TESTING

Section 9:

If you do not have the SY3 system integrated with TILE! or your own proprietary testing software, you will need to perform the test manually. In order to perform the test manually you will need to send the antenna to a test frequency, apply RF power to the antenna at the correct frequency, measure the E-field, turn off RF power to the antenna, then send the antenna to the next test frequency, and repeat.

It is highly recommended to integrate the SY3 system to TILE! or your own proprietary testing software to reduce the time of the test, prevent transmitting while the antenna is moving, prevent high power being applied during high VSWR situations, and an overall better user experience. For additional information on integrating the SY3 system with TILE! or your own proprietary software please visit <https://steppir.com/e-series/> or contact SteppIR directly.

To begin the manual testing procedure select the appropriate configuration using the dropdown shown in **Figure 20**.

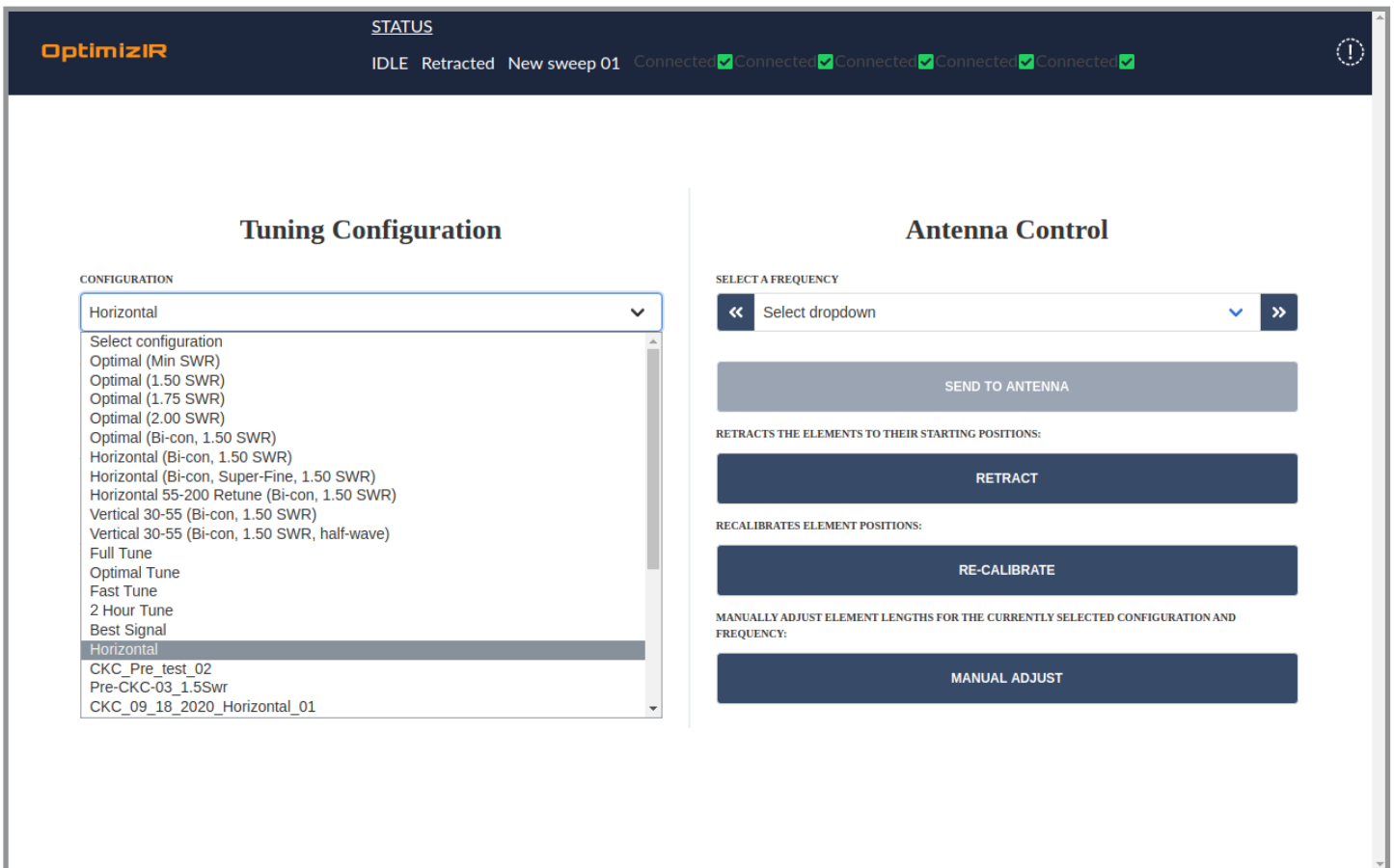


Figure 20

Select the appropriate frequency using the dropdown shown in **Figure 21**. You can also change frequencies by clicking the “<<” or “>>” buttons shown below.

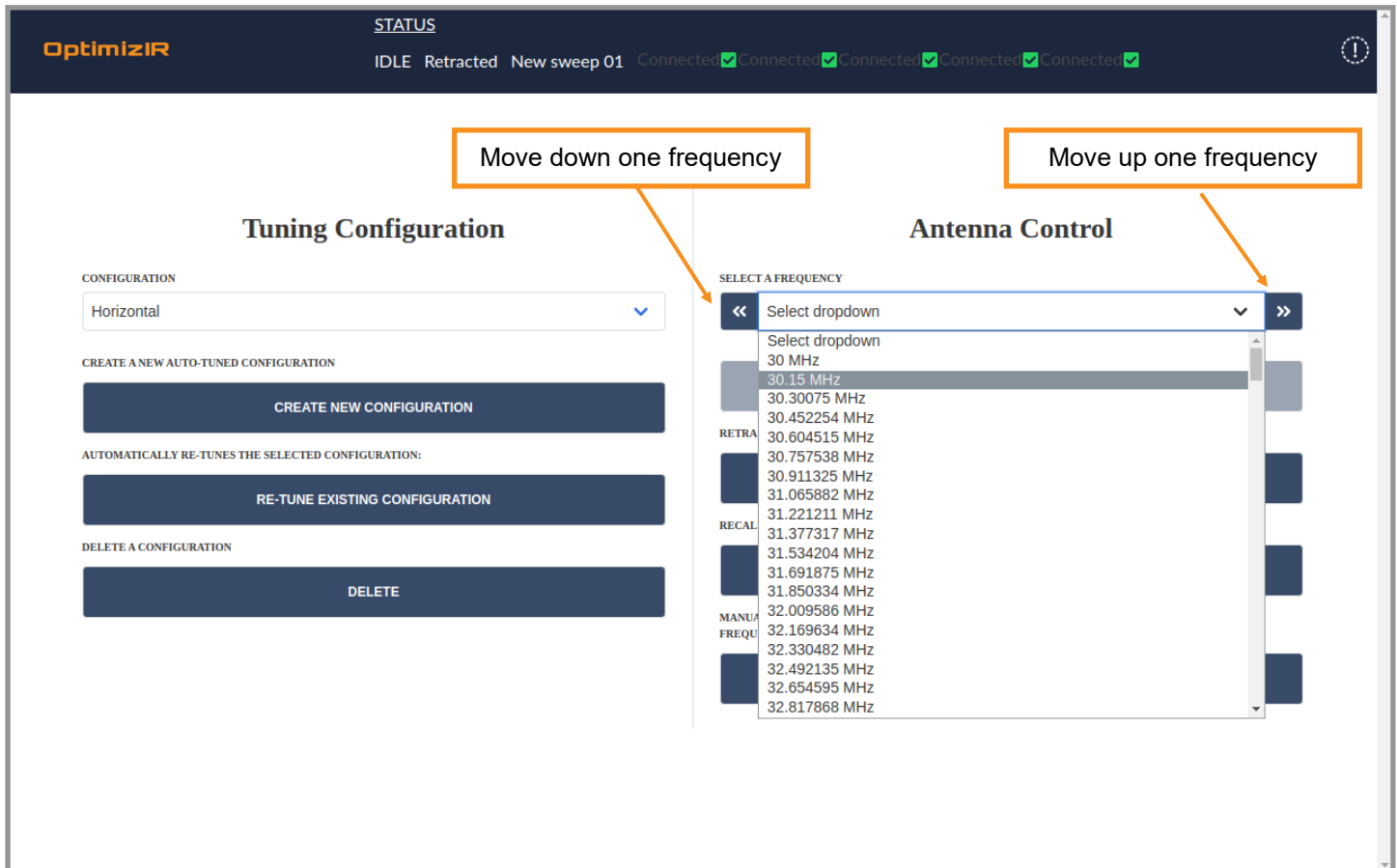


Figure 21

After selecting a configuration and a frequency, click the **“SEND TO ANTENNA”** button to instruct the antenna to adjust its elements to the correct length.

*Figure 22 shows the interface **before** pressing “SEND TO ANTENNA”. Though the selected configuration is “Horizontal” and the selected frequency is “30.757 MHz”, the Status Menu shows that the antenna is “Retracted”.*

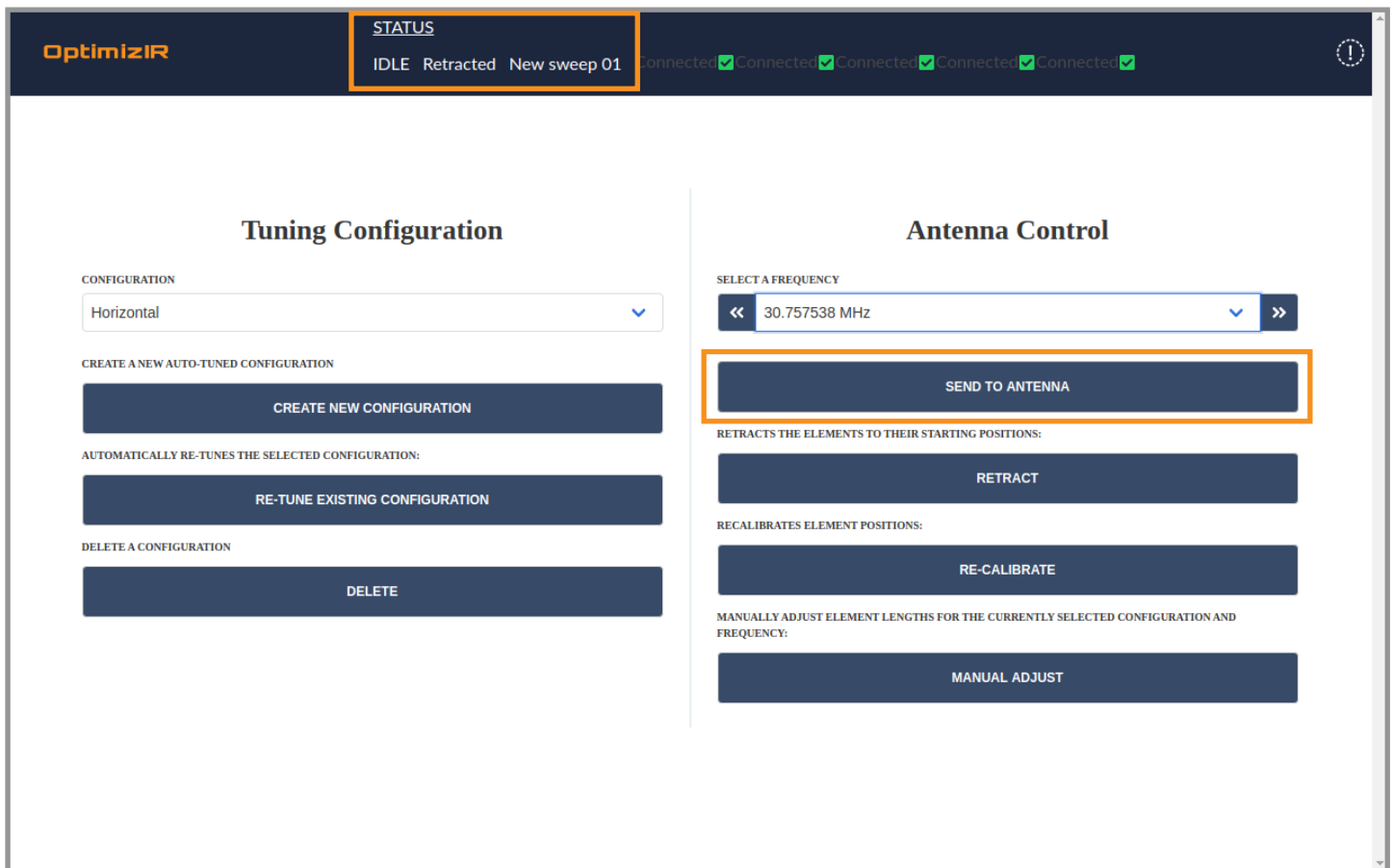


Figure 22

When **“SEND TO ANTENNA”** is clicked, the interface will show that the SY3 Antenna is adjusting (**Figure 23**), then will show the new Configuration and Frequency on the Status Menu when done (**Figure 24**).

*The Status Menu can only track the SY3 Antenna element lengths while the OptimizIR EMC is powered on. After loss of power or on first start, it is recommended to use the **“RE-CALIBRATE”** button to regain positional data.*

SY3 SYSTEM USER GUIDE: MANUALLY TESTING

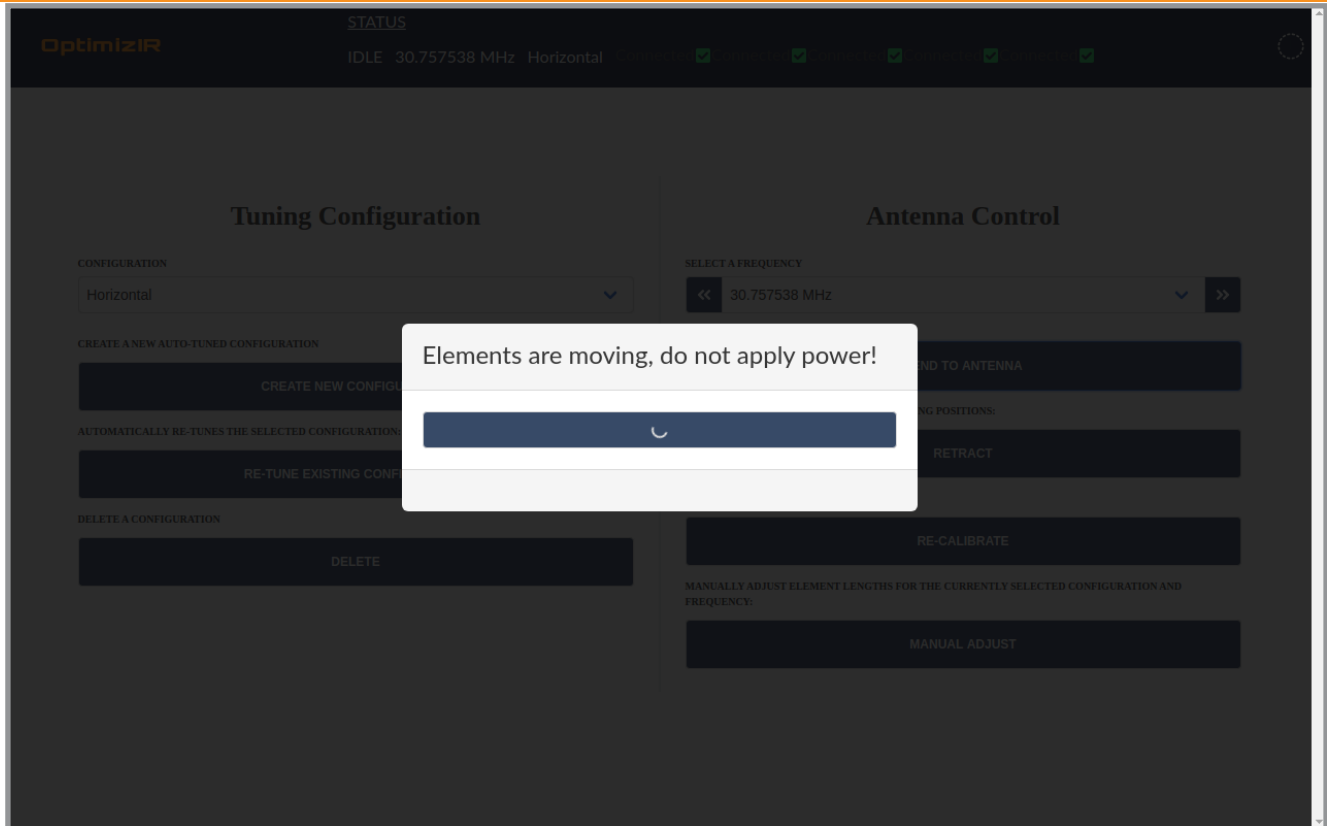


Figure 23

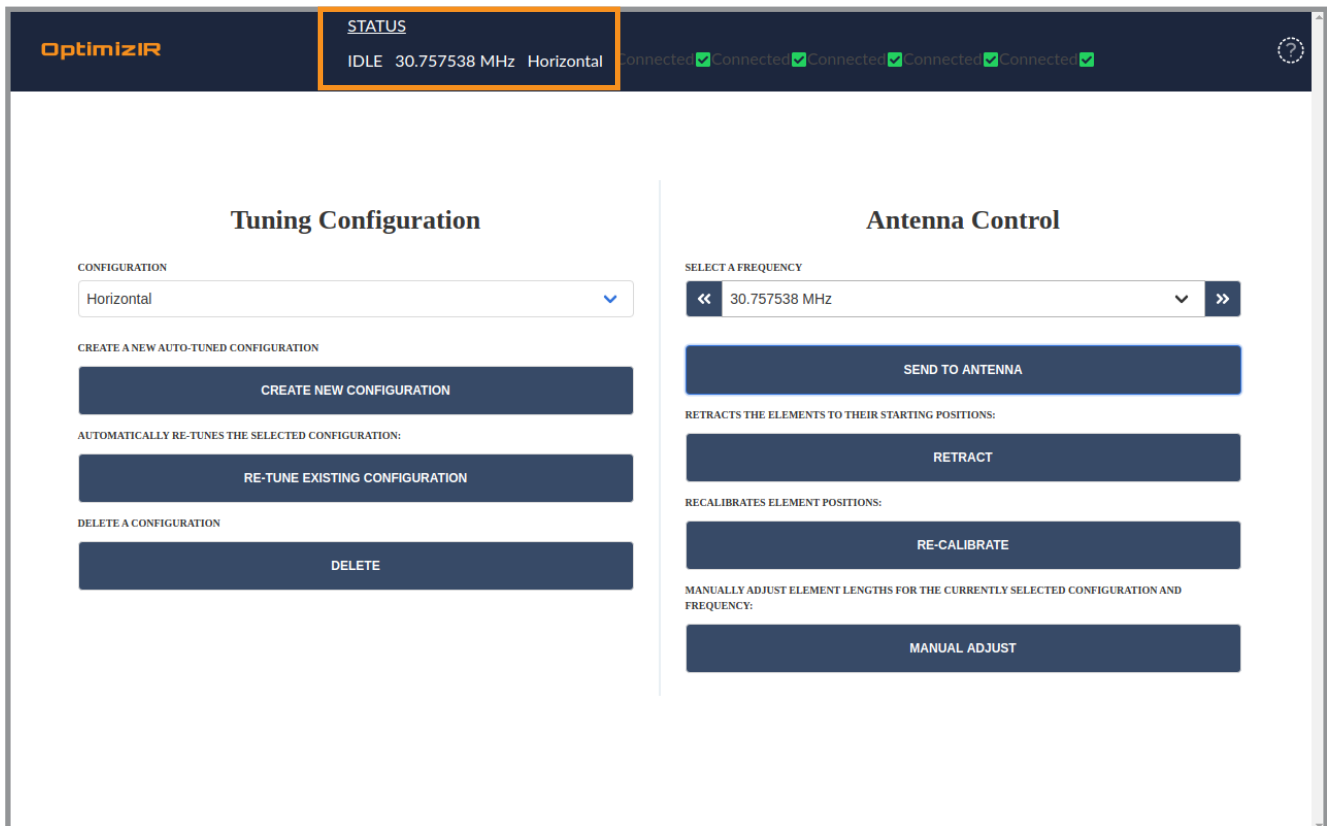


Figure 24

SY3 SYSTEM USER GUIDE: MANUALLY TESTING

Now that the SY3 Antenna has been sent to a test frequency, it is time to apply RF power to the system. It is recommended to start off applying low RF power (100W) to verify that the antenna has lower than 2.5 : 1 VSWR. If the VSWR is lower than 2.5 : 1 then you may start increasing RF power until you have reached the 200V/m E-field. Do not exceed 2500W output on your amplifier or you run risk of damaging the SY3 Antenna.

If you cannot reach the required 200V/m E-field then it is recommended to test different probe positions as the antenna's beamwidth changes throughout its frequency range.

Before applying high RF power to the SY3 Antenna, you must ensure that the proper configuration is loaded and that the antenna is sent to the same frequency that the amplifier is outputting. Be sure to never apply power to the SY3 Antenna while the elements are moving (while changing frequencies). Failing to do either of these will result in a mis-matched antenna with high VSWR, and may damage your system!

During testing, we highly recommend monitoring the VSWR of the SY3 antenna. If the VSWR goes above 2.5 : 1 SWR, we recommend reducing RF power, and ensuring that you are using the correct configuration. If high VSWRs persist, it is recommended to Re-Calibrate the antenna. After a Re-Calibrate function has been performed and high VSWRs persist, you may need to tune the SY3 antenna again to create a new configuration. If high VSWRs persist after multiple tunes, please contact SteppIR directly to assist in troubleshooting.

