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Version 1.01

Scintec Flat Array Sodars

Site Preparation Manual

SFAS, MFAS, XFAS

including RASS RAE1
and windRASS

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1 SITE SELECTION

When setting up a sodar with optional (wind)RASS system, the following siting aspects should be considered:

1.1 Environmental noise

Since the sodar evaluates acoustic backscatter signals of very small amplitude, it is important to operate the instrument in a quiet environment. In particular, this refers to noise in the range of the frequencies sensed, i.e. the selected operation frequencies. Typical noise sources are: machines and engines (such as air conditioning units), traffic, airplanes, wind at obstacles (whispering trees), and birds or other wildlife.

Antenna enclosures reduce the susceptibility to noise sources close to the ground. Therefore noisy environments will require a large acoustic enclosure.

RASS and windRASS measurements are not sensitive to environmental noise.

1.2 Sound emitted by Sodar

A sodar emits strong audible sound pulses which might disturb persons in the vicinity of the antenna during operation or nearby residents. This should be kept in mind when selecting a site near buildings or public areas. The potentially disturbing noise generated by the sodar and (wind)RASS mainly stems from the antenna sidelobes. This noise can be significantly reduced by using an antenna enclosure or even more by using a freestanding enclosure. Also, an installation of the sodar on platforms several meters above the ground can reduce the emitted noise. In the shaded mode, due to sidelobe suppression, the antenna generally emits less noise than in the non-shaded mode.

1.3 Fixed echoes

Higher obstacles like buildings, trees or hills within the sensing range of the sodar may reflect sound pulses and disturb the measurements. This effect is called "fixed echo", "ground clutter" or "passive noise". It is the most common source of problems with sodar measurements in general.

Even though Scintec Flat Array Sodars have implemented fixed echo identifications and corrections, fixed echoes nevertheless may result in limitations of the measurement capability or accuracy. With fixed echoes, typically a reduction of the measured wind velocities is observed due to the (usually) zero velocity of the reflecting surfaces at the respective height or distance. In addition, increased backscatter values typically result.

The first choice to eliminate fixed echoes is the use of a large acoustic enclosure. In many cases, increasing the installation height of the antenna can also help. Generally, the antenna should be operated in shaded mode when there are fixed echoes. Rotating the antenna, using other emission angles or changing the operation frequencies are also standard procedures to reduce the fixed echo amplitudes (see Figure 1). This, however, requires a careful investigation of sodar returns with different antenna orientations and operation parameters.

RASS and windRASS measurements are not sensitive to ground clutter.

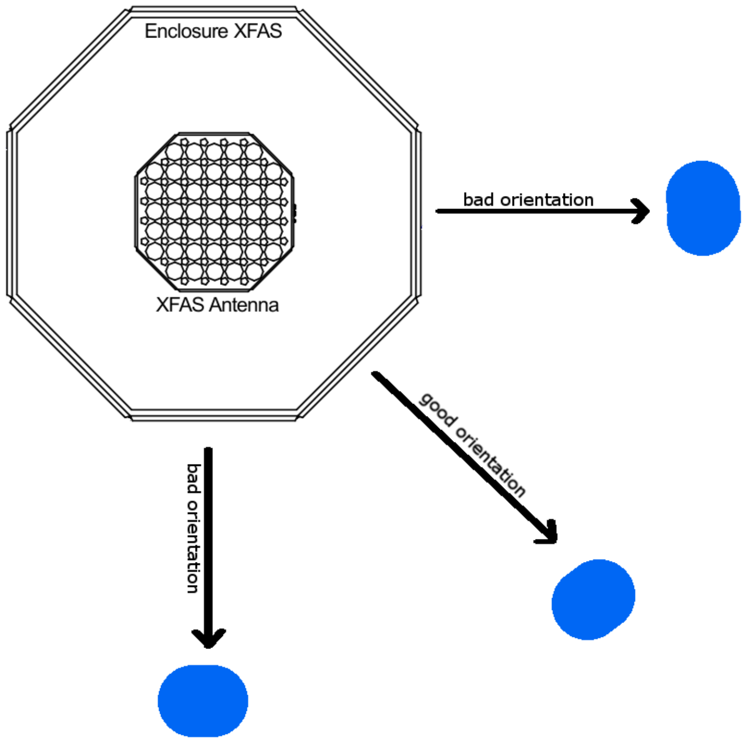

Figure 1: Orientation of the Sodar antenna to reduce interference from potential fixed echoe sources (marked in blue)

1.4 Resonant objects

Potentially disturbing resonances are caused by small (usually metal) objects close to the antenna. For example a tiny resonant antenna used for remote data transmission close to the acoustic beam may respond to an acoustic pulse for a fraction of a second and strongly deteriorate all sodar data below 100 m or 200 m measurement height.

Because resonances are strongest when stimulated with exactly the emitted frequency and the emitted frequencies vary during operation, a resonance tends to generate a too low wind speeds, as with fixed echoes. Therefore resonances and fixed echoes often have an identical appearance in measured data.

Even very weak resonances are potentially troublesome. Hence do not place any metal objects inside or above the acoustic enclosure. Sometimes you can check the resonances of a metal object by slightly hitting it with a pen. If you here the weakest tone afterwards, this object can be considered a potential cause of serious measurement errors.

Resonance problems are very common with metal platforms or trailers even if the resonance objects are outside the acoustic enclosure or below the antenna. The construction of a sufficiently damped trailer or platform is a major task and needs a careful design and testing procedure. Note that most trailers or metal platforms built for sodar applications fail the initial testing. This does not mean it is impossible to build a suitable trailer or platform but it will need more time and effort than you may have expected.

2 SITE PREPARATION

2.1 Different sodar configurations

Depending on the sodar model, with or without RASS extension and the type of enclosure, different area sizes and surface characteristics are required. Figure 2 shows the different enclosure types that are available (shown for SFAS). The small enclosure is attached directly to the sodar antenna (only available for SFAS and MFAS). The large enclosure exists of 8 (SFAS) or 16 (MFAS/XFAS/RASS) panels and is placed around the sodar or RASS antenna. The support stand is used to elevate the sodar antenna from the ground. The attached electronic compartment is used to store the outdoor units and the enclosure is directly attached to the support stand.

Small enclosure **Large enclosure** **Support stand with enclosure**

Figure 2: Different SFAS enclosure types

2.2 Dimension of the installation area

Choose an unobstructed area for the sodar system with at least the following size:

Sodar	Enclosure	Area size: Sodar	Area size: Sodar with RASS	Area size: Sodar with windRASS
SFAS	with small enclosure with large enclosure with support stand and enclosure	1.0 x 1.0 m 3.5 x 3.5 m 6.1 x 6.1 m	9.1 x 13.5 m	n/a 9.2 x 9.2 m 9.2 x 9.2 m
MFAS	with small enclosure with large enclosure with support stand and enclosure	2.0 x 2.0 m 9.0 x 9.0 m 9.0 x 9.0 m	9.1 x 13.5 m	n/a 9.2 x 9.2 m 9.2 x 9.2 m
XFAS	with large enclosure with support stand and enclosure	9.1 x 9.1 m 9.6 x 9.6 m	9.1 x 13.5 m 9.6 x 13.5 m	n/a

Dimensions of the installation area of the different sodar configurations are shown in the Appendix.

2.2.1 External cable connection

The outdoor units are connected to the sodar antenna and placed outside the acoustic enclosure (Figure 3) or in the electronic compartment of the support stand (Figure 4). The following cables connect these outdoor units to an external power supply and the control PC:

- Sodar power supply cable, 10 m
- RASS power supply cable, 10 m
- Heating power supply cable, 10 m (optional)
- RS232 (10 m) or RS485 (100 m) cable connecting the SPU with the control PC.

The power supply cables need to be connected to a power supply which is provided by the customer.

The wiring diagram for the sodar with large enclosure is shown in Figure 3. The wiring diagram for the sodar with support stand is shown in Figure 4. Be aware that the electronic compartment is located in a height of 75 cm (XFAS) or 100 cm (SFAS, MFAS) above the surface.

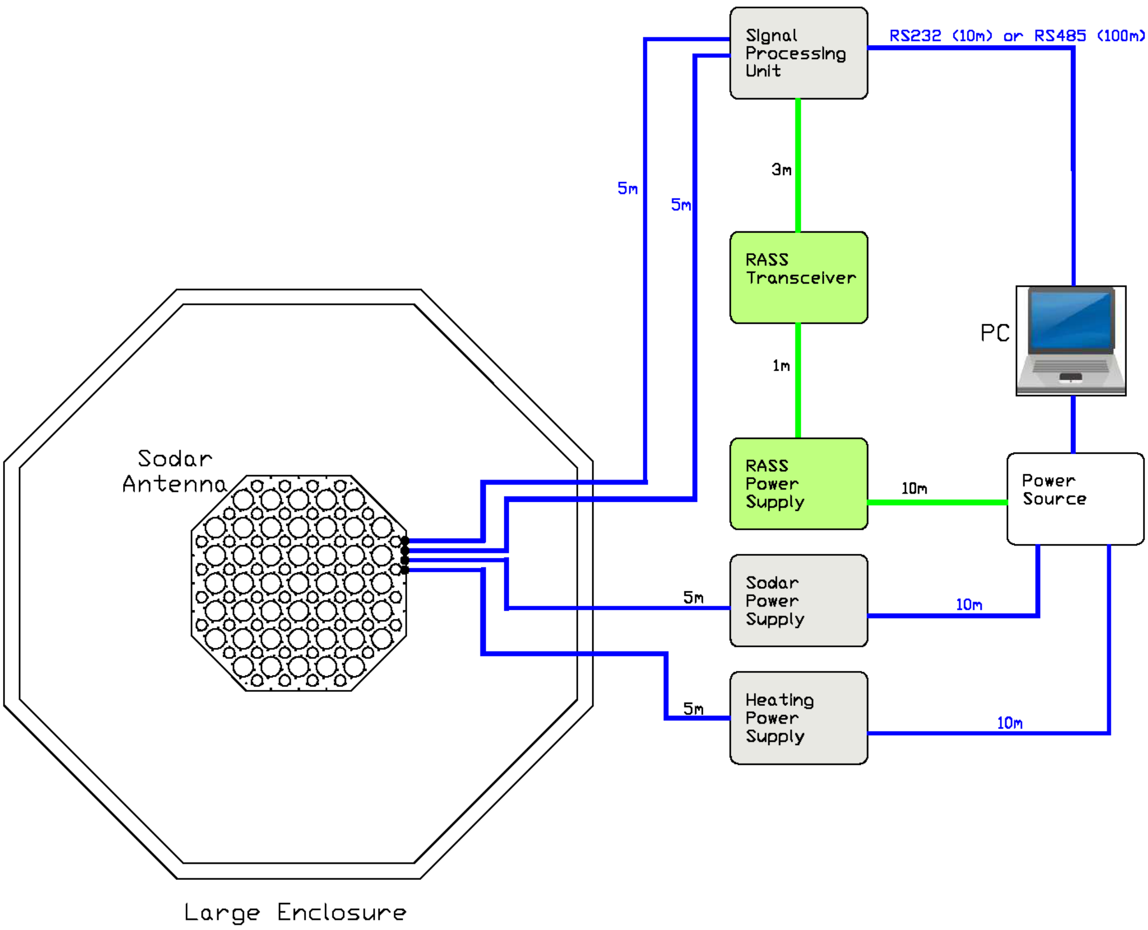

Figure 3: External wiring scheme for the XFAS with large enclosure

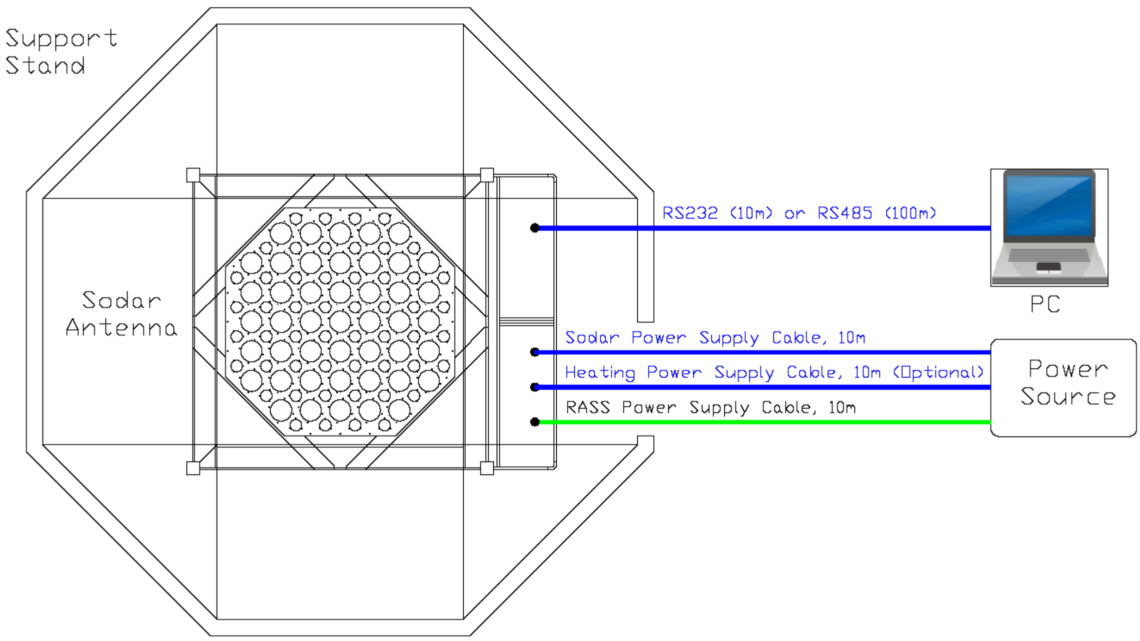

Figure 4: External wiring scheme for the XFAS with support stand and enclosure

2.3 Surface characteristics

2.3.1 Horizontal flatness

The surface must be flat and even (horizontal). The maximum deviations from the true horizontal for the following positions are:

- Anchor point of the guy wires +/- 20 mm
- Position of the large enclosure +/- 5 mm
- Position of the sodar antenna +/- 2 mm

If the installation is permanent, it is recommended to use a concrete base foundation for the sodar with optional (wind)RASS system. The thickness and concrete reinforcement required for this foundation must be engineered to adjust for the soils present at the site. Unstable soils like sand, tundra or expansive soils require special accommodations in foundation design.

2.3.2 Carrying and Hauling Capacity

The surface must be able to carry the load of the antenna and the large enclosure or support stand. The minimum carrying capacities are:

	SFAS	MFAS	XFAS
Sodar antenna	1 kg / cm²	1 kg / cm²	3 kg / cm²
Large enclosure	3 kg / cm²	3 kg / cm²	3 kg / cm²
Support stand including sodar antenna and enclosure	0.25 kg / cm²	0.5 kg / cm²	1 kg / cm²

The surface must be able to hold the guy wire anchors and to mount the enclosure base panels. The minimum hauling capabilities of the guy wire anchors and the enclosure base panel mounting points are:

- Guy wire anchors 500 kg (or 5000 N)
- Large enclosure base 200 kg (or 2000 N)

2.3.3 Suitable surface mounting screws and anchors

The tent pegs shipped with the enclosure are only for low wind speeds and temporary installation and will not provide sufficient stability in every kind of surface. For example, they cannot be used in sand or mud.

The customer must provide guy wire anchors fitting the ground surface. The guy wire anchors must hold the guy wires having a diameter of 5 mm. The guy wire anchors, when mounted to the ground by the customer, must provide the surface hauling capacity specified in the paragraph above.

The customer must provide enclosure base panel mounting screws fitting the type of ground surface. The screws must have a diameter between 8 mm and 10 mm. The screws, when mounted to the ground by the customer, must provide the surface hauling capacity specified above.

2.4 Example of permanent sodar installation

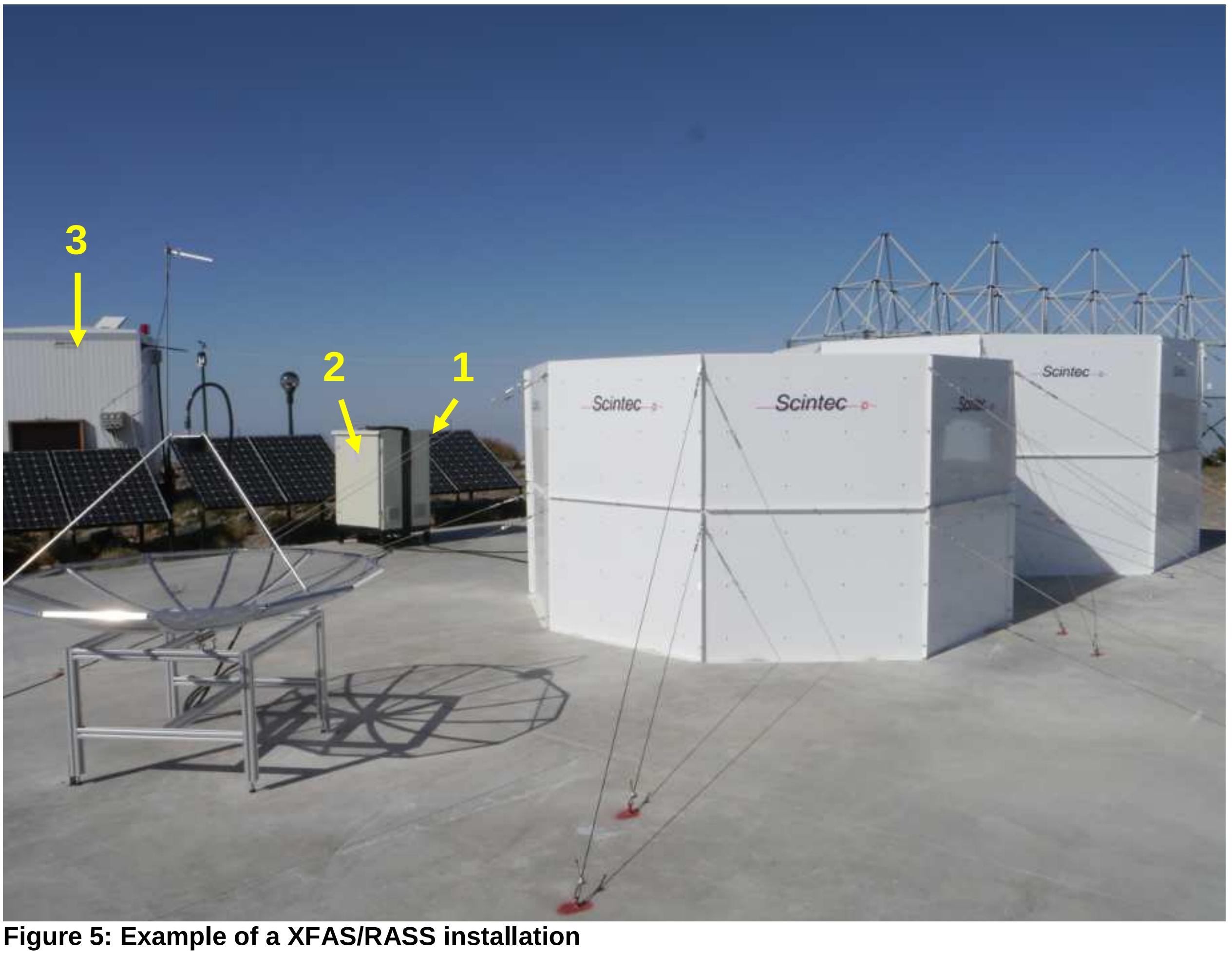

Figure 5: Example of a XFAS/RASS installation

Figure 5 shows an example of a permanent XFAS/RASS installation with large enclosures. The system is mounted on a horizontally levelled concrete platform. The outdoor units are stored in two small cabinets (1 and 2):

1. cabinet no. 1 holds the sodar SPU and the sodar power supply,
2. cabinet no. 2 holds the RASS Transceiver and the RASS power supply.

The APRun control PC is located in the air-conditioned container (3). Also, the main power source is provided from this container.

Figure 6: Sodar and RASS antenna cables

Figure 6 shows the cables connecting the RASS and sodar antenna with the SPU and RASS Transceiver. A cable conduit is drilled in the concrete platform to guide the antenna cables underneath the enclosure.

APPENDIX A SODAR/RASS OVERALL DIMENSIONS

A.1 SFAS with RASS

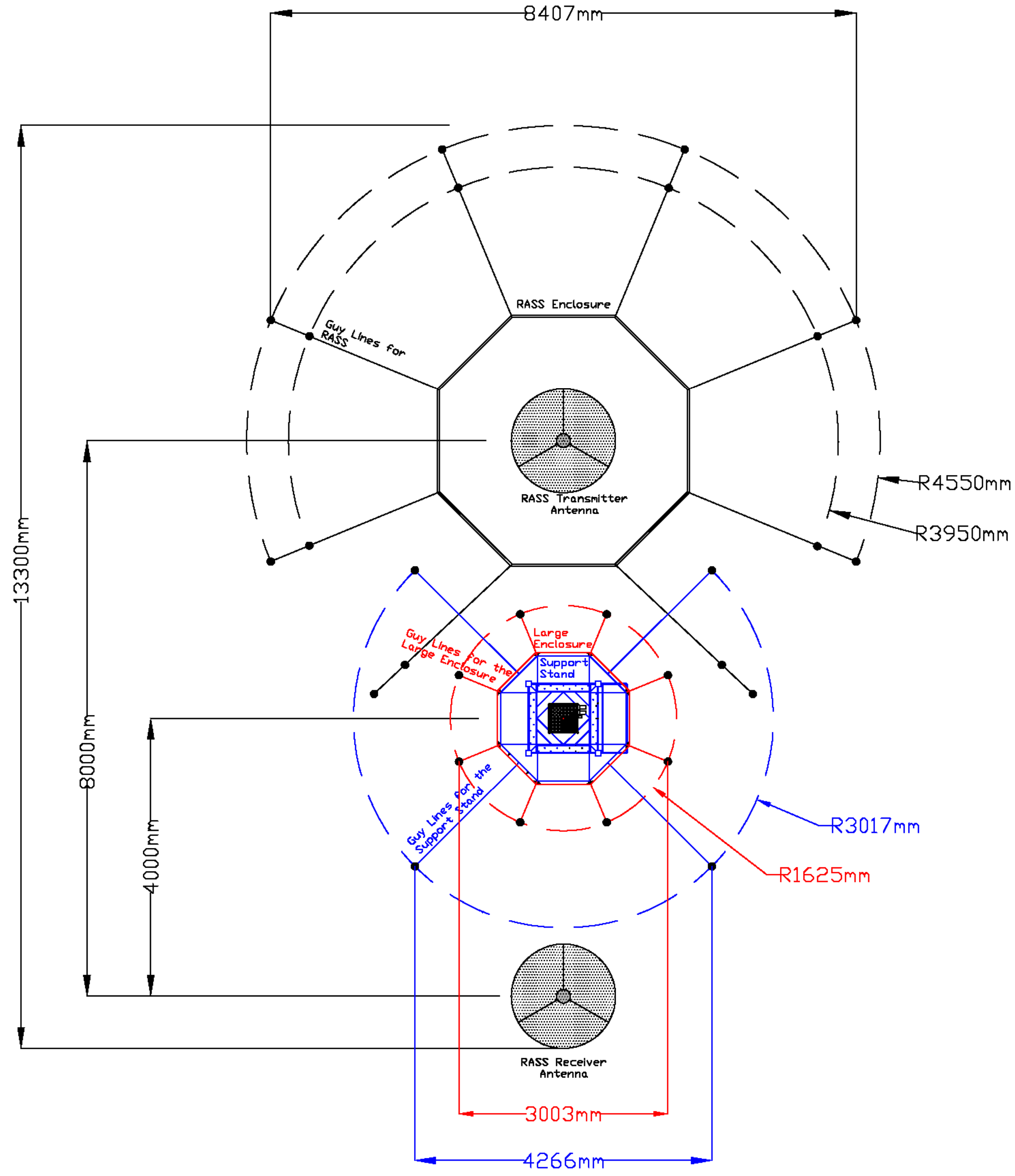

Figure 7: Overall dimension of SFAS/RASS system with large enclosure (red) or support stand (blue)

A.2 SFAS with windRASS

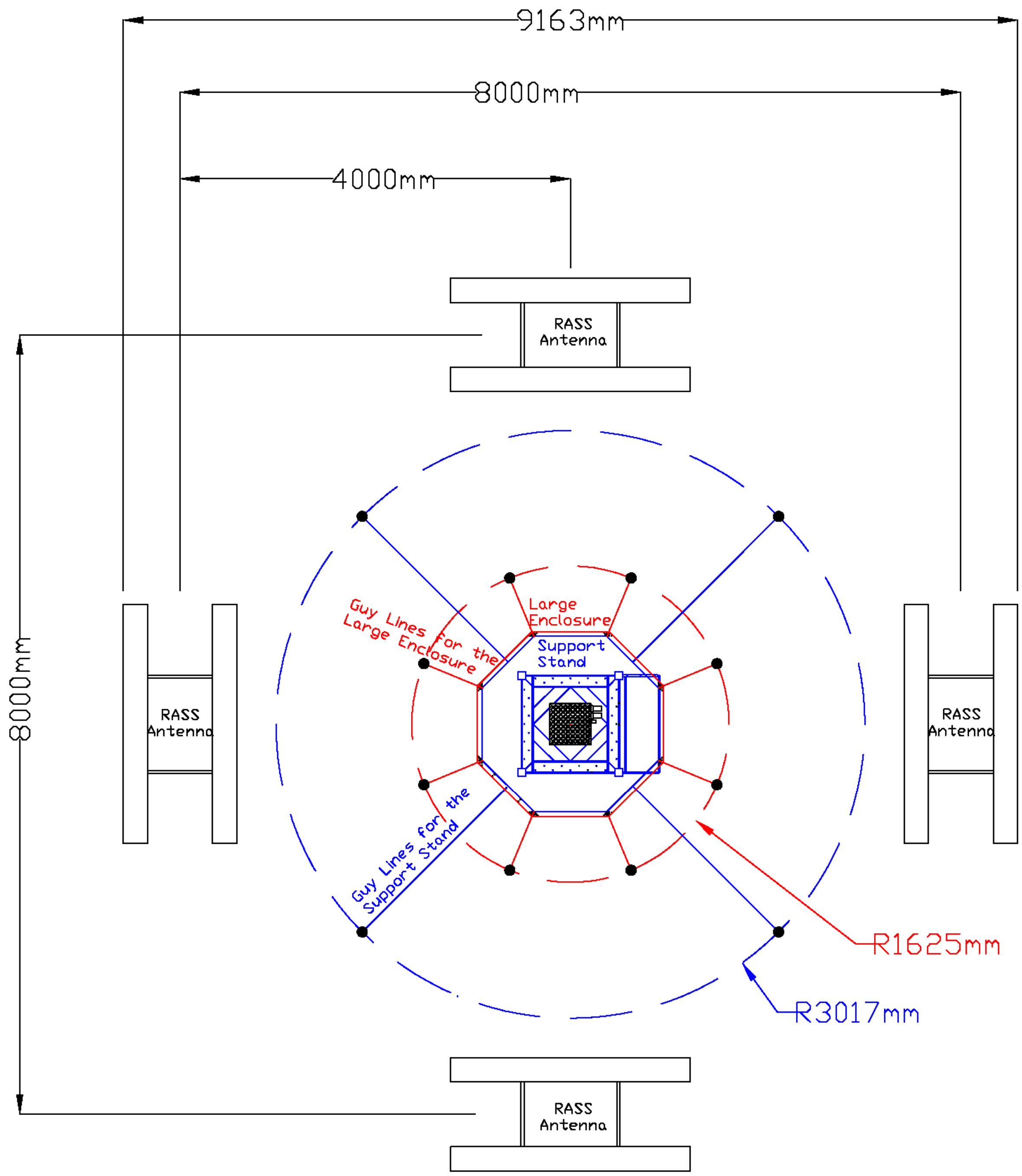

Figure 8: Overall dimension of SFAS/windRASS system with large enclosure (red) or support stand (blue)

A.3 MFAS with RASS

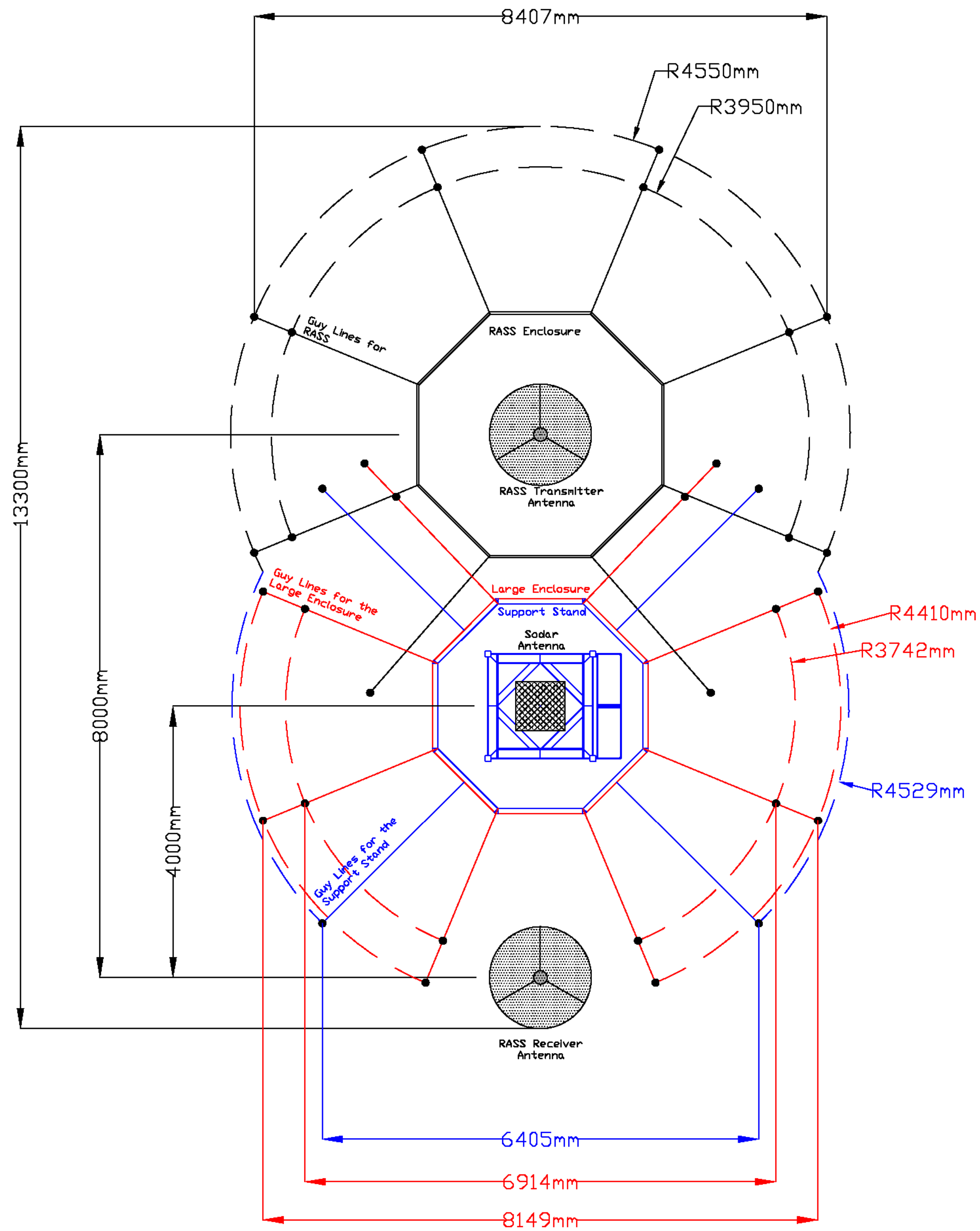

Figure 9: Overall dimension of MFAS/RASS system with large enclosure (red) or support stand (blue)

A.4 MFAS with windRASS

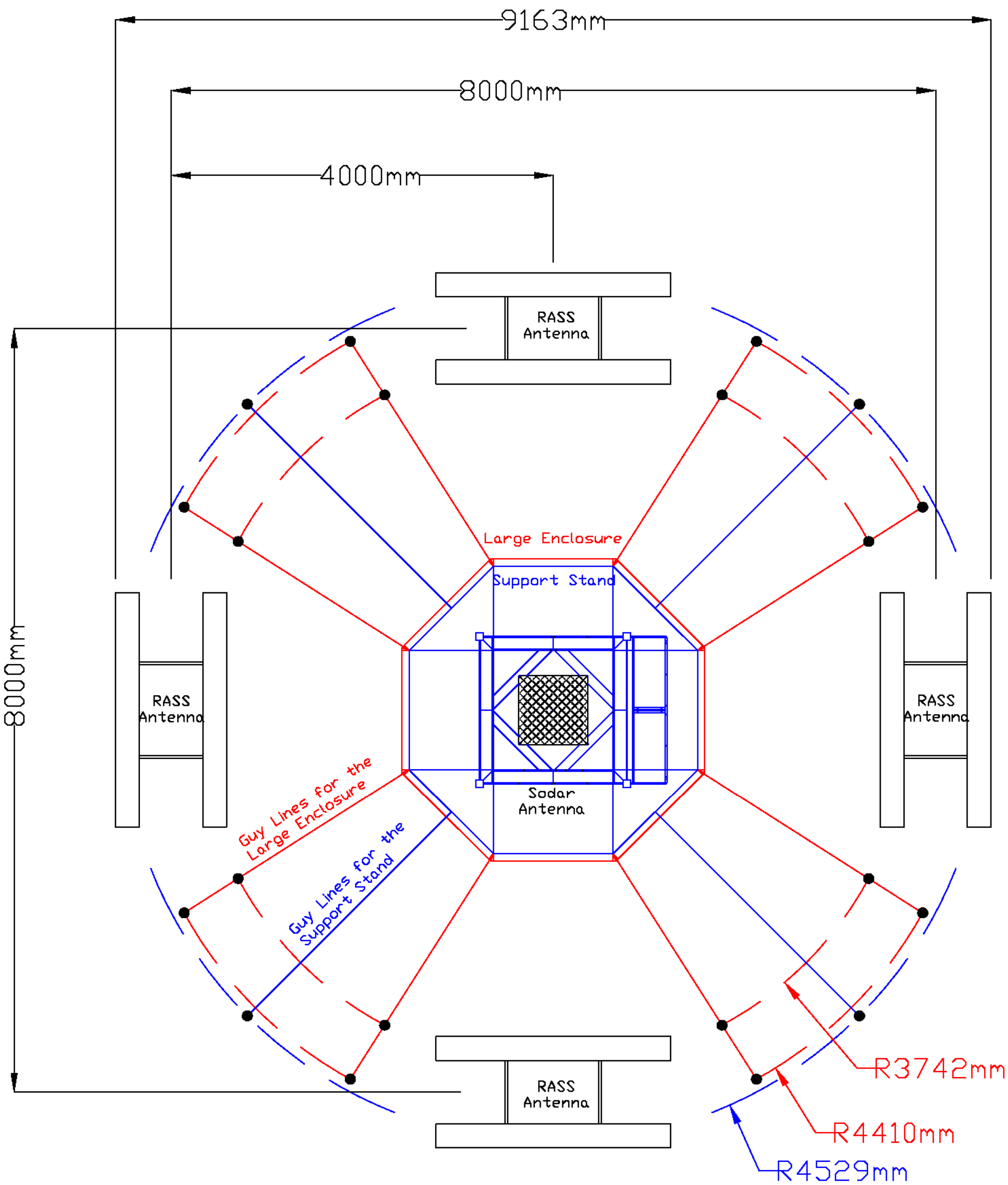

Figure 10: Overall dimension of MFAS/windRASS system with large enclosure (red) or support stand (blue)

A.5 XFAS with RASS

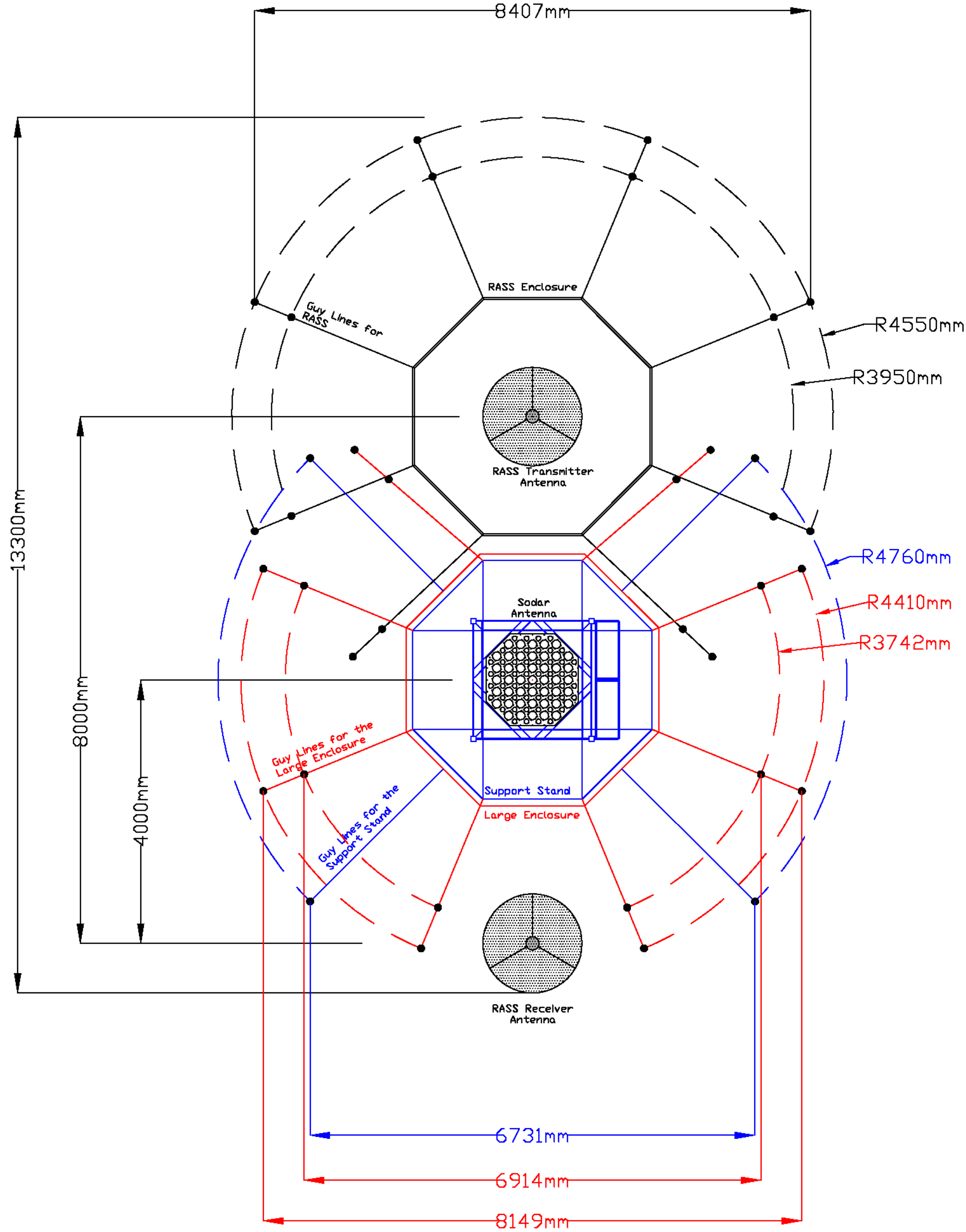

Figure 11: Overall dimension of XFAS/RASS system with large enclosure (red) or support stand (blue)