INMARSAT Thrane & Thrane TT3008D small dish antenna analysis and evaluation

Matthias DD1US Rev 1.0 April 22nd 2024

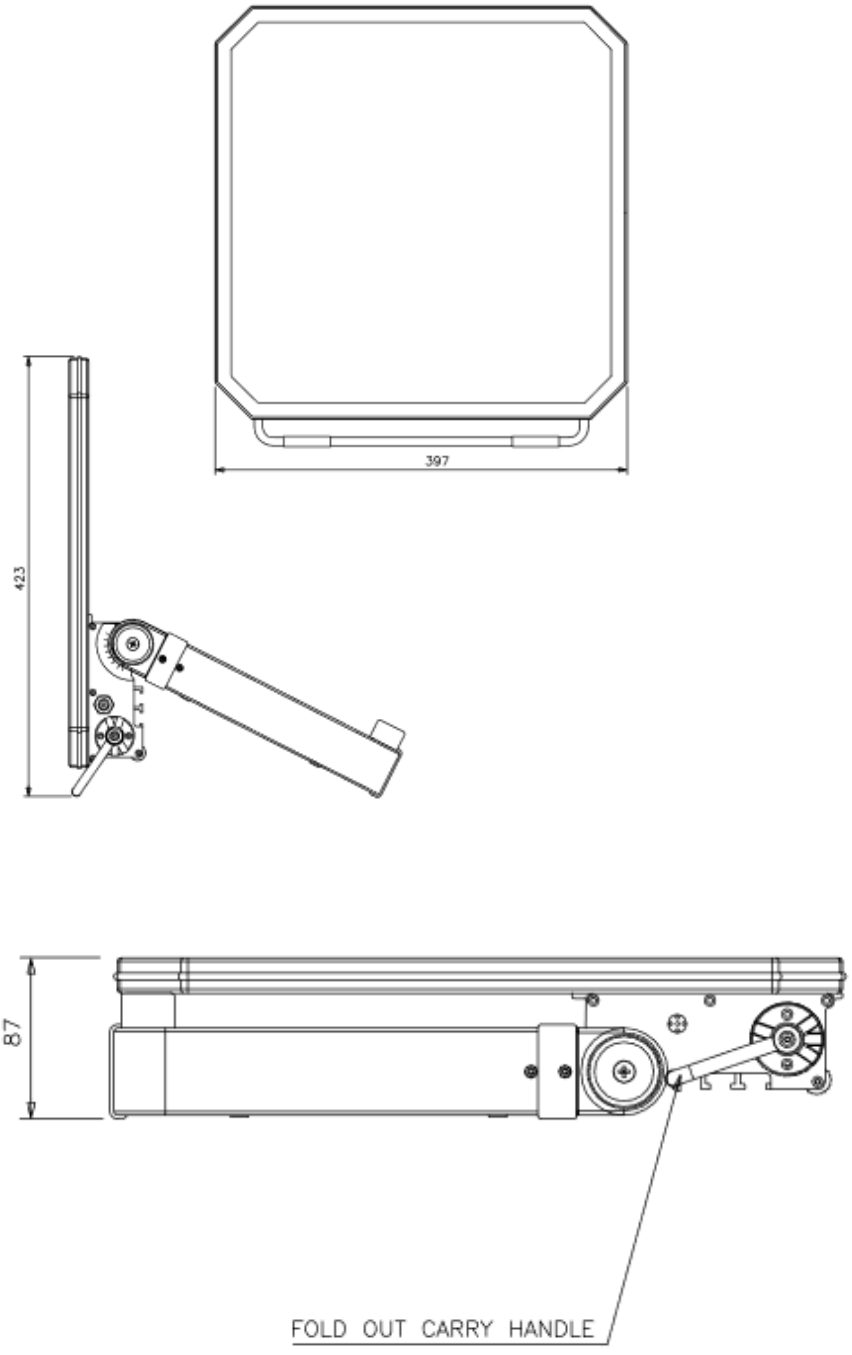
The TT-3008D Small Dish antenna consists of a compact flat antenna element and a supporting frame. The HPA-LNA is mounted on the back of the antenna element. The fold out frame and handle provides support for all angels from 0˚to 90˚elevation angle. An indicator label on the side provides indication of the elevation angle. A compass is provided to indicate Azimuth angle. This is a compact flat panel RHCP antenna for INMARSAT operations. The transceiver fits within the antenna mounting frame. The Antenna must be aligned to the relevant satellite before use.

Specifications of the TT-3008D Small Dish antenna:

Polarization:	RHCP
Transmit frequency range:	1626.5-1660.5 MHz
Receive frequency range:	1525.0-1559.0 MHz
G/T:	better than -7dB/K
Antenna gain:	17..19dBi
Transmit EIRP:	19..25 dBW (16QAM), 8..14 dBW (OQPSK), 14 dBW (BPSK)
EIRP stability:	within 1dB of nominal
Transceiver Power Supply:	9.5 V - 20 VDC
Maximum current:	7A
Power consumption RX idle:	<0.8W
Power consumption TX:	80W max.
Connectors:	50Ohm TNC/female
Operating temperature range:	-35°C…+55°C
Storage temperature range:	-40°C…+80°C
Relative Humidity: IME:	95% non-condensing at +40°C
Spray:	Solid droplets from any direction.
Salt spray corrosion:	Coastal conditions.
Ice Survival:	Up to 25mm of ice (non operational).
Rain:	50mm/h. with a wind of 55km/hr, droplets size 0.5 to 4.5 mm.
Wind:	180 km/h. Pole mount (operation).
Solar Radiation:	UV @ 54W/m2IR @ 500W/ m2V
Vibration Survival:	Random 5-20 Hz 0.05 g^2/Hz, 20-150 Hz -3dB/Oct. (1.7g RMS).
Vibrations Operational:	Random 5-20 Hz 0.02 g^2/Hz, 20-150 Hz -3dB/Oct. (1.05g RMS)
Mechanical Shock:	20g/11ms half-sine.
Dimension:	Opened: 87mm x 397mm x 397mm (HxWxD)
Weight:	3.65 kg

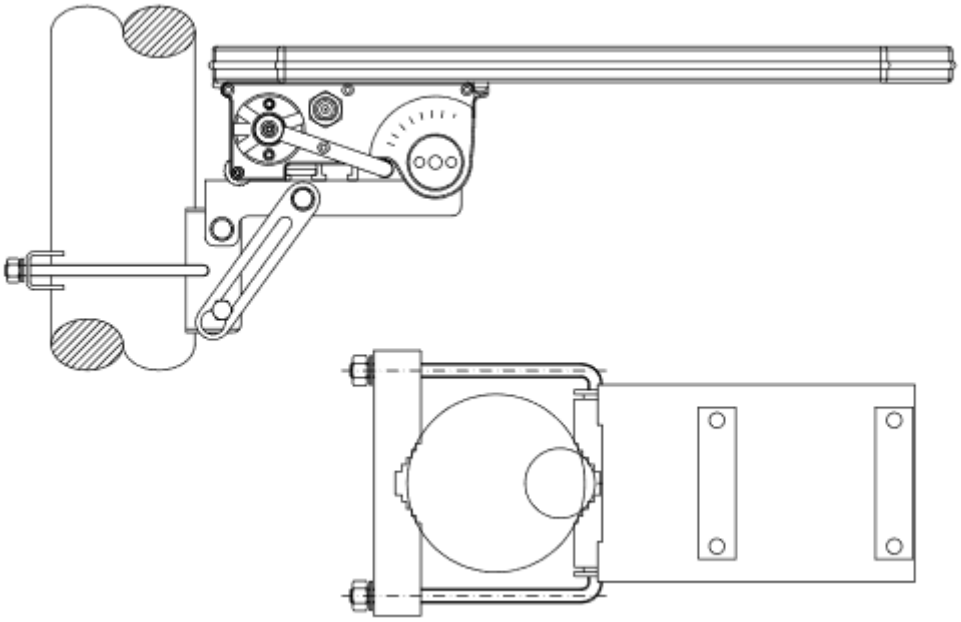
Portable Setup (No tools required):

- Point the antenna towards the horizon, such that the compass is in a horizontal position.
- Rotate the antenna in azimuth to the approximate compass angle.
- Adjust the elevation of the antenna to the approximate elevation, using the indicator label as a guide.
- Fine align antenna for optimum reception
- Tighten knurled adjustment fasteners to lock antenna into position.



Pole Mount (tool required: 10mm spanner)

- Fit Pole Mount Bracket onto the Front-End Unit (FEU), securing with a 10mm spanner in four positions.
- Fit the bracket onto the pole. Suitable pole size is 30mm - 76mm.
- Adjust the Azimuth angle by rotating the antenna around the pole and then tighten fasteners using a 10mm spanner.
- Ensure the elevation struts are placed into position. Adjust elevation angle and tighten fasteners using a 10mm spanner.
- Using the feedback from either the handset display or the buzzer in the Front-End-Unit adjust both azimuth and elevation to optimise the signal strength and lock the fastening screws to secure the antenna in position.



Notes:

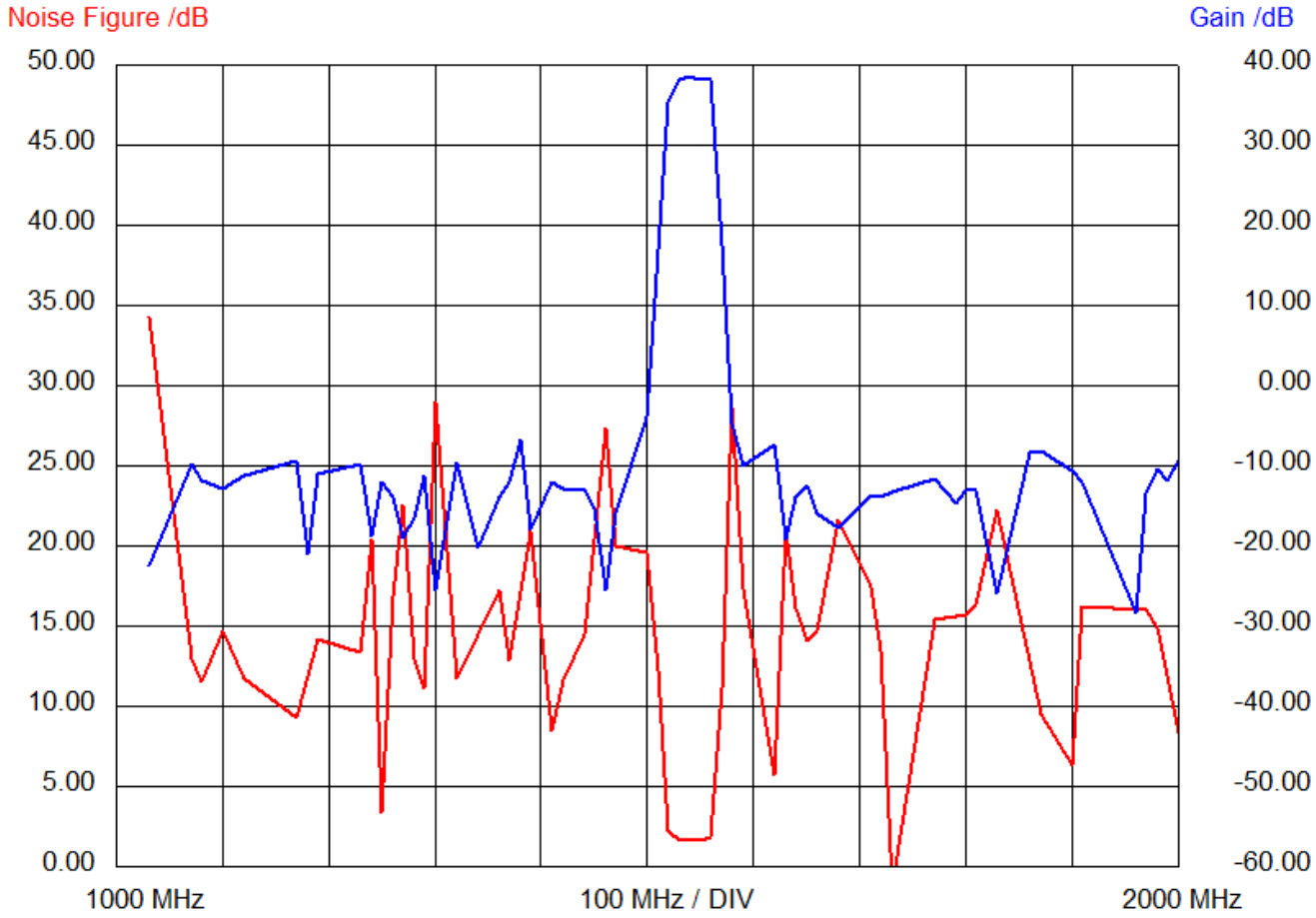
- The antenna radiates RF signals during a call. Therefore, a safety distance must be observed. Allow a passage distance of approx. 2 meters from the antenna. The radiated signal is strongest on the focal line of the antenna and drops off quickly! The antenna can be secured to the ground by loading the frame with sandbags, bricks or other suitable weights. Keep the front panel of the antenna free from obstructions!
- Precise adjustments of the antenna will make it possible for the RF power amplifier to reduce the transmitted power automatically to the required minimum for a reliable satellite connection. This will result in an extension of the battery capacity with up to 30%, depending on the exact application.

Pictures of the unit:

Measurements:

The antenna itself can be easily unscrewed from the frontend unit and thus the low noise amplifier including the bandpass section of the duplex filter can be separated.

I measured gain and noise figure of the LNA including the bandpass filter:

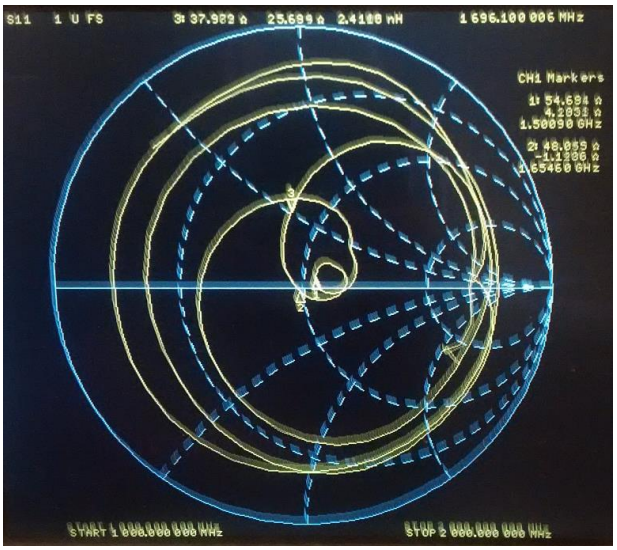


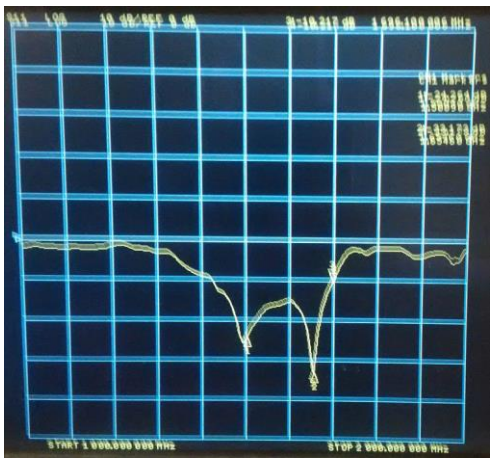
In the specified receive frequency range the gain is about 38dB and the noise figure better than 1.7dB. This is an excellent value as it includes the losses of the duplex filter.

Here is a table showing gain and noise figure close to the INMARSAT receive band (green):

Frequency	Gain	NF
1500 MHz	-3.88 dB	19.63 dB
1510 MHz	16.95 dB	12.31 dB
1520 MHz	35.36 dB	2.24 dB
1530 MHz	38.16 dB	1.69 dB
1540 MHz	38.64 dB	1.64 dB
1550 MHz	38.29 dB	1.62 dB
1560 MHz	38.12 dB	1.86 dB
1570 MHz	17.69 dB	11.18 dB
1580 MHz	-4.72 dB	28.67 dB
1590 MHz	-9.92 dB	17.34 dB

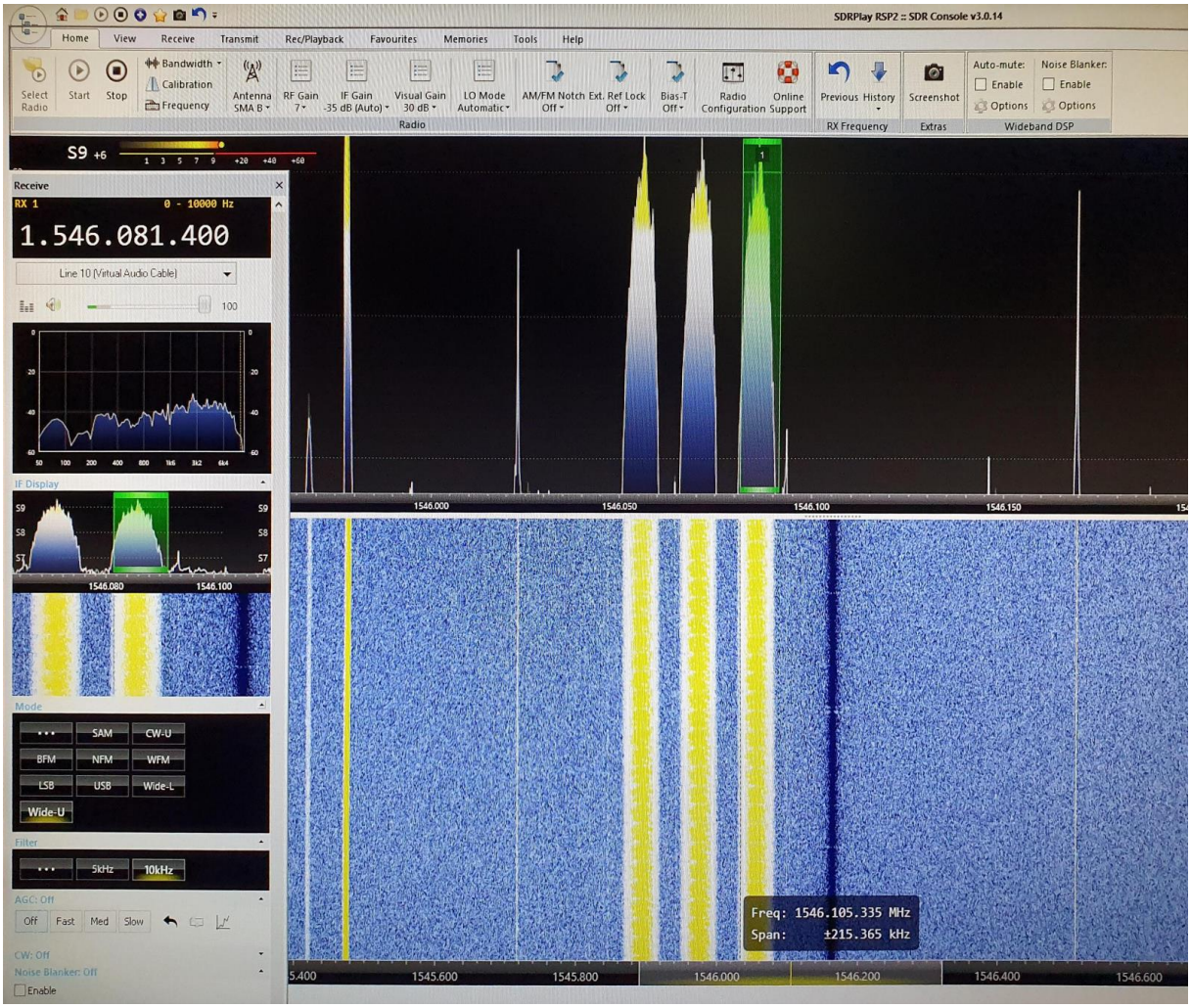
I also measured the return loss of the antenna without the frontend module attached. The antenna has an SMA jack which makes the measurement easy. Please excuse the poor screenshots.





There are two resonances: one for RX with a return loss RL=24dB @1500MHz and another one for TX with a return loss RL=33dB @1650MHz.

Here is a screenshot of a reception with this antenna, which I kindly received from a happy user of such an antenna.



In summary, this is an excellent antenna. It is very portable and the bay inside provides plenty of space for instance for a SDR receiver and a rechargeable battery to power the LNA and the SDR. For portable operations using a laptop only a single USB cable is needed to connect the PC to the SDR inside the antenna bay.

I always appreciate comments and will be happy to answer questions.

Kind regards

Matthias DD1US dd1us@amsat.org www.dd1us.de