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On the THERMO*p*Y*lae* Hellenic radio telescope radio silent Site

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Abstract

THERMO*p*Y*lae* is the name of the upcoming Hellenic Radio telescope. The infrastructure is a 30m parabolic, beam waveguide antenna on an alt-azimuth mount. The Radio telescope is not a purchased or constructed instrument, but a converted redundant telecoms antenna. The project, while not having the high cost of construction - purchase, generously offers Greece the benefits of having a radio telescope worldwide. We report on very preliminary RFI measurements of the site, where **THERMO***p*Y*lae* is situated.

Index Terms— THERMOpYlae, RFI, radio telescope

1 Introduction

The telecom antenna is located in Thermopile Telecommunication Station (see Figure 1) at the south-eastern point of Europe in the region of Skarfeia. The area is the historical site of the battle between Leonidas and his 300 and Darios the persian king and his troops. Hence the name of the Dish.

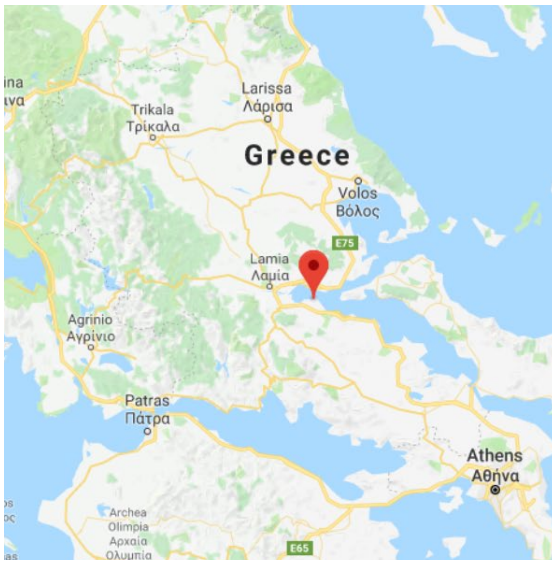


Figure 1. The location of the Thermopile Telecommunicaton Sta;on (38°49'20.74"N 22°41'9.51"E) owned by the Hellenic Telecommunication Company OTE (from Gizani & Veldes, 2018)

The instrument has an alt-azimuth, wheel and-track, Cassegrain beam-waveguide antenna, an electric-servo dual train for anti-backlash drive system, transmission (~6 GHz) and reception(~4 GHz) frequency in the C-band, primary mirror diameter ~30m and sub-reflector diameter ~2.9m. Its azimuth working range is between –180º to +180º, about the centre of azimuth travel and its elevation range between 2º to 92º.

The effort described is not attempted for the first time eg. (DeBoer & Steffes, 1999). Currently such antennas are being transformed around the world and especially in Africa. Woodburn, et al., 2015 (see also references therein), has succeeded the conversion of an identical antenna to the Hellenic, but newer. The antenna is cituated in Warkworth, New Zealand. The complete expertise of the conversion to be applied in the Hellenic Antenna is obtained since the end of May 2019.

Radio astronomical observations will be kicked off by using the existing C-band feed system, installing a dual polarization 6 GHz receiver with low noise amplifiers and making pointing and sensitivity amplitude and phase measurements and adjustments. A receiver bandwidth of 300MHz is adequate for professional observations. When functional, **THERMO***p*Y*lae* will perform single dish as well as interferometric total intensity and polarization observations.

The presence of the Hellenic antenna in the VLBI interferometer fills in the inner region of the UV structure hence enhancing large scale structure of the radio source. The radio infrastructure also provides some of the largest baselines supporting higher angular resolution.

2 Preliminary RFI measurements

Preliminary RFI measurements were performed in mid May 2019, using an omni-directional antenna and a keysight spectrum analyser model N9915A (https://www.keysight.com/), while we were physically changing the position of the spectrum analyzer (SA) around the antenna, at points A (North), B (East), C (South) and D (West), as shown in Figure 2.

We have searched the frequency band 0 -18 GHz using the N9917A portable spectrum analyzer by Keysight Technologies.

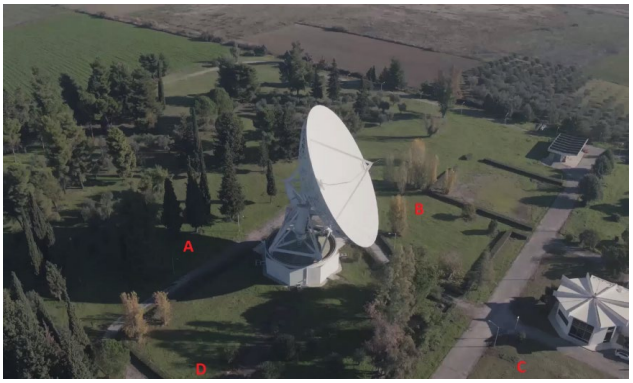
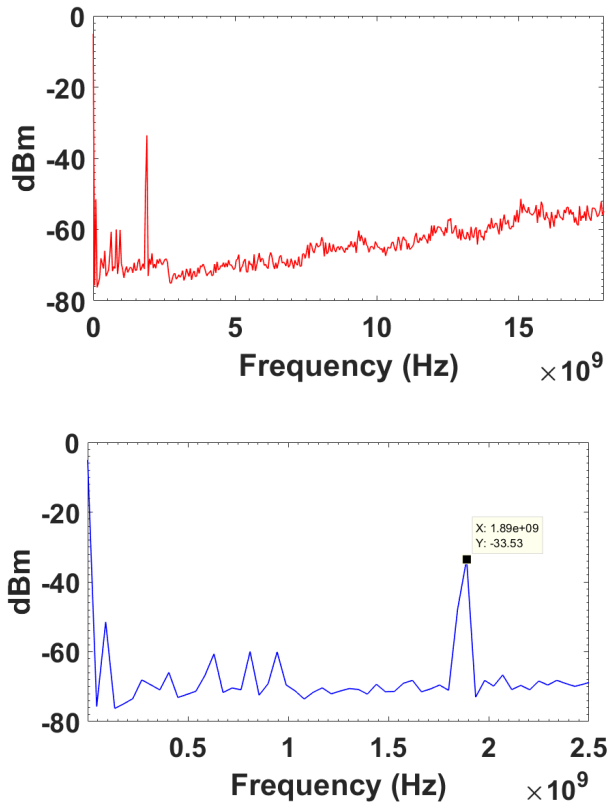


Figure 2. A panoramic view of the **THERMO***p*Y*lae* location with the positions for the RFI measurements denoted in red.

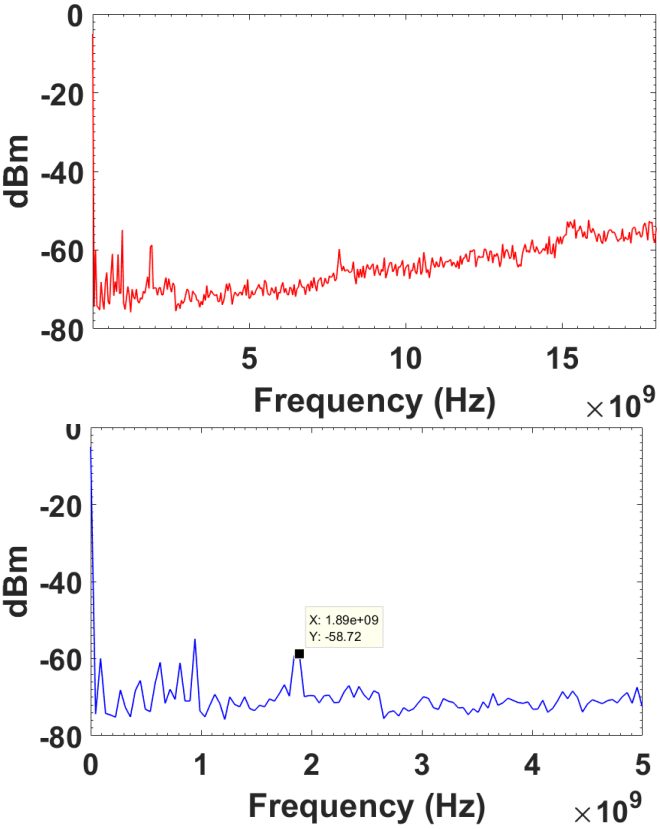
3 Results

Figure 2 presents the results from the methodology described in Section 2. The RFI measurement positions are shown from top (A) to bottom (D) in the respective panels.

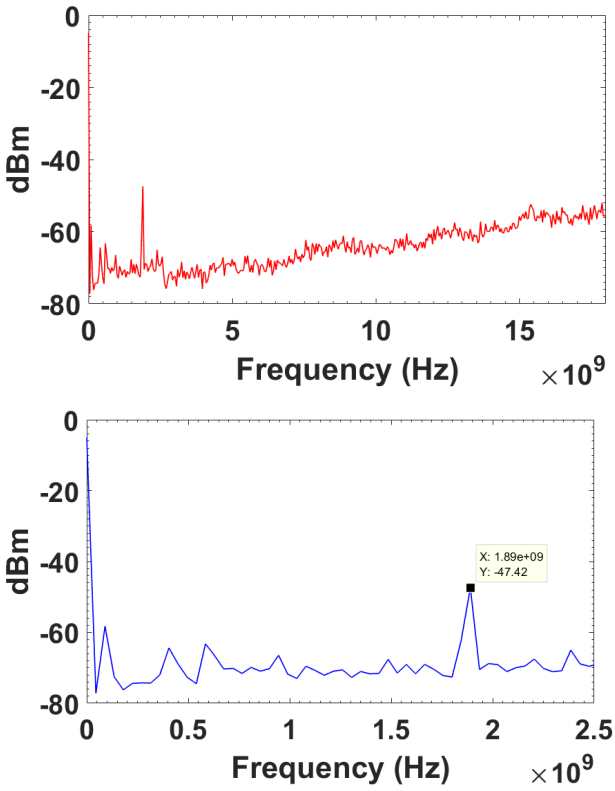
• Position A



• Position B



• Position C



• **Position D**

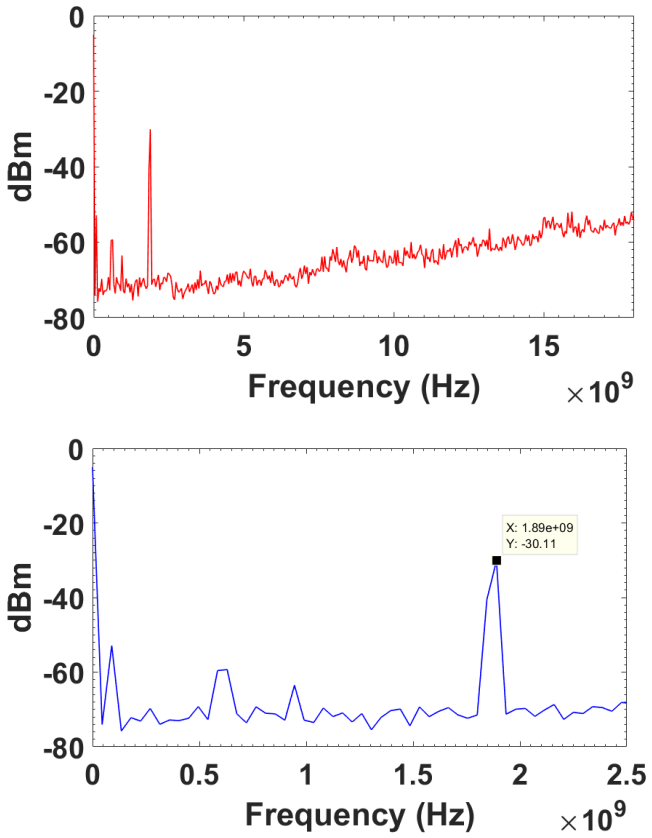


Figure 2. *Left panels*. The panel at each position of interest presents the measurements for frequency band 0-18 GHz (red line), *Right panels*. The panels show the RFI signal we recorded at 1.89 GHz (blue line). At position A we have measured –33dBm, at B –58.72dBm, at C –47.42dBm and at D –30.11dBm.

The RFI signal at ~ 1.9GHz, indicates a measurement very close to the frequency band used for mobile telecommunications. Figure 3 shows the time evolution diagram (waterfall) for this RFI signal. It is clear from this diagram that this signal was stable over time.

4 Discussion

Results from all 4 positions in Figure 2 for mid May 2019, showed records of RFI signals in the L-band, at frequency ~ 1.9 GHz. This frequency is very close to the frequency band used for mobile telecommunications.

During checking of the antenna motion (early November) we have connected the LNA again to the spectrum analyzer. An RFI detection was received of unknown origin (see Fig. 3 for a hint of it). This RFI was not detected in the observations of mid-May, but this could be because of the difference in time (morning in early November as opposed to afternoon in mid-May). The RFI remained independently of the direction of the dish, but increased towards SW.

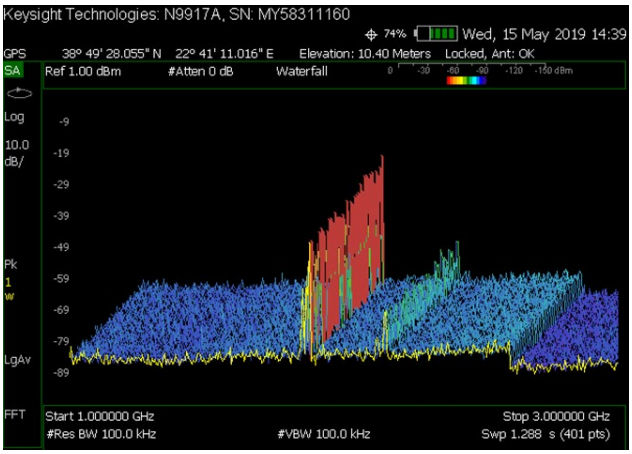


Figure 3. Time evolution diagram (waterfall) for the RFI signal at 1.9 GHz.

The RFI measurements we took are crude. We are in the process of installing the system for performing continuous measurements for detailed RFI monitoring using a directional antenna. We are working towards describing the RFI environment of **THERMO***pY*l*ae* also capturing any transient interference.

5. Acknowledgements

The Scientific Team would like to acknowledge the Telecommunication Company OTE, which not only shared the telecommunication's infrastructure, but also is responsible for the cleaning, lubrication and greasing of the mechanical parts. The Company also provides electricity and Security of the instrument.

References

[1] DeBoer David, R. and Steffes, Paul G., "Performance and uses of a refurbished 30-m former satellite communications antenna:The Georgia Tech Woodbury Research Facility", *Radio Science*, **34**, 4, August 1999, pp. 991-1003

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