

Test experiment to prove the RT-70 transmission system applicability for solving space debris exploration problems

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Radio telescope RT-70, Ukraine, Evpatoria



Fig. 1

References

(RT-70 implementation, radar experiments)

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3. I.E. Molotov, A.A.Kovalenko, V.V. Samodurov et al. International Low-frequency very long baseline interferometry network project milestones, Astronomical and Astrophysical Transactions. 2003. v.22, N4-5, p. 743-752.
4. Konovalenko A., Falkovich I., Lytvynenko L. et al. Radar VLBI investigations using RT-70 radio telescope. Radiophysics and Radioastronomy, 2005, v.10, p.20-44
5. Alexandrov Yu., Andrejanov B., Babakin N. et al. Radioastron (Project “Spectrum-R”) –radiotelescope is large than the Earth, Reports of S.A. Lavochkin Association, 2011, №3, p.11-18.
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The UTR-2 radio telescope, N-S arm (1.8 km×60m)

$f = 8...32 \text{ MHz}$, $A_{\text{eff max}} = 150\,000 \text{ sq.m}$

Fig. 2

The RadioAstron is an international space
VLBI project

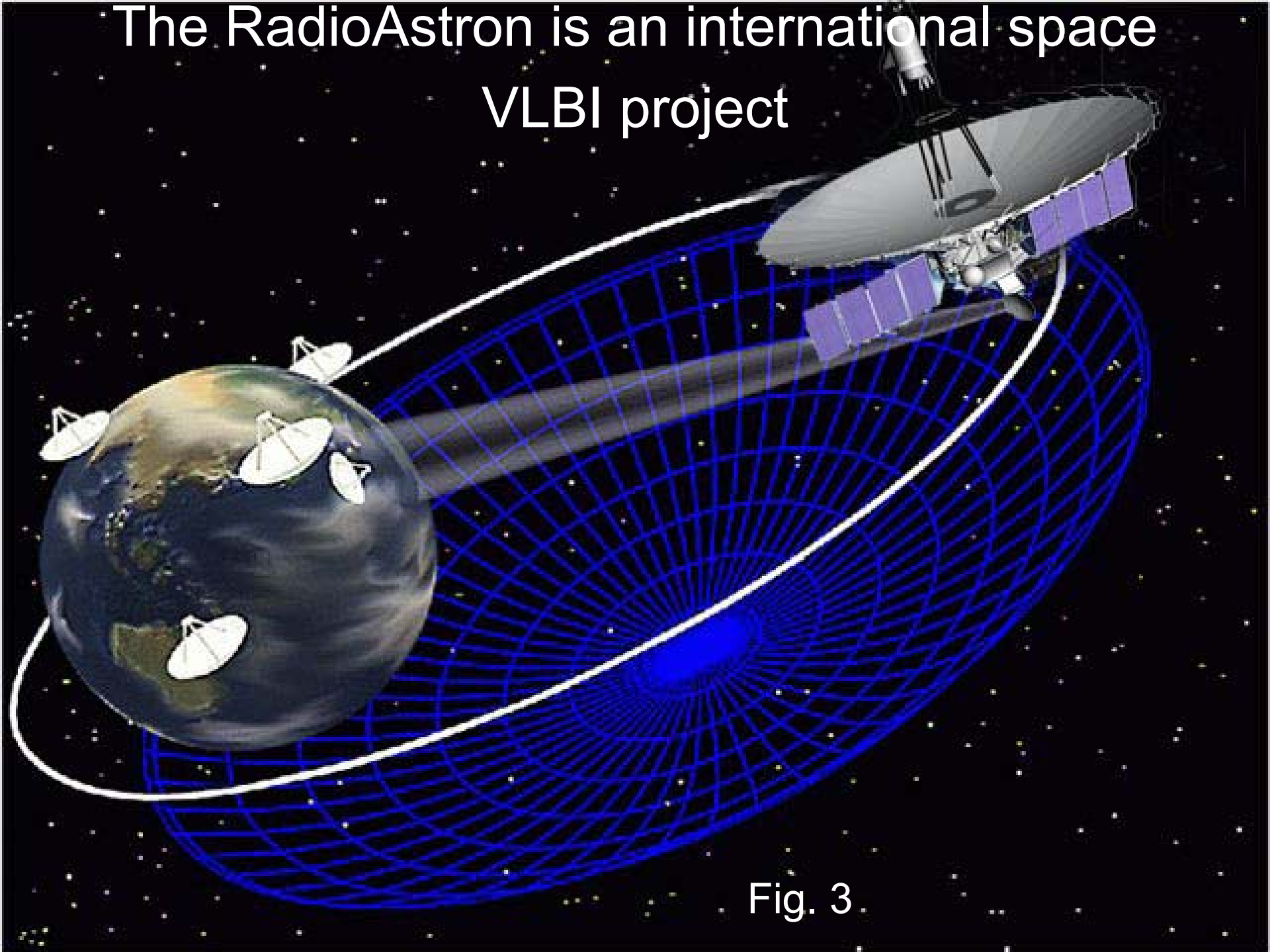


Fig. 3

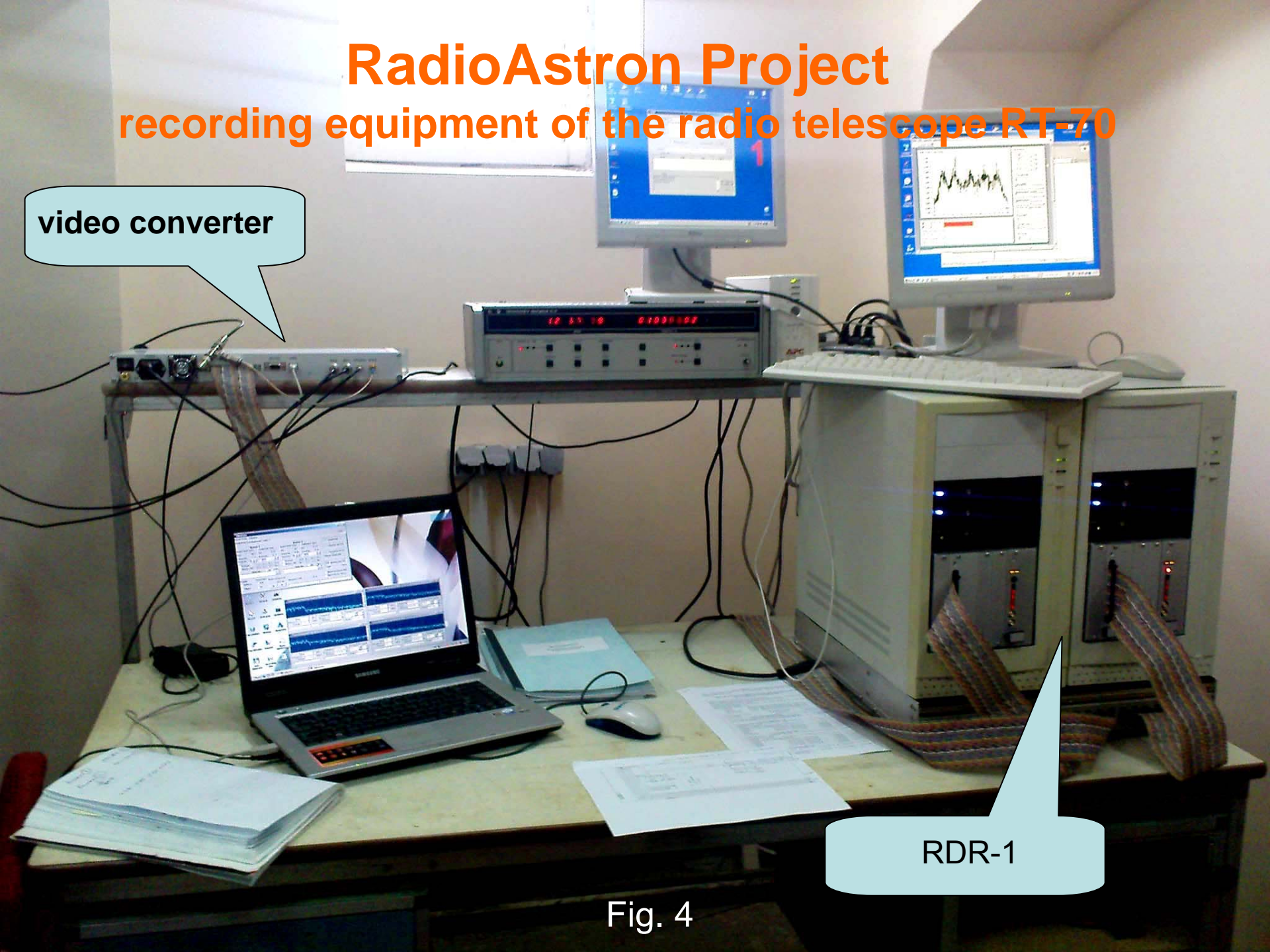
RadioAstron Project

recording equipment of the radio telescope RT-70

video converter

RDR-1

Fig. 4



Project RadioAstron

Characteristics of receiving equipment

	327 MHz (92 cm)	1,6 GHz (18 cm)	4,8 GHz (6 cm)	22 GHz (1,35 cm)
Frequencies	300 – 350 MHz	1,38-1,72 GHz	4,6-5,1 GHz	18-26 GHz
Frequensy Band (MHz)	50	340	500	8000
Sensitivity, dBW	-134,6	-132,5	-130,8	-129
Intermediate frequency, MHz	160±20	160±20	160±20	160±20
Effective Area, sq.m.	900±350	1900± 250	2230± 250	600
Beam Width, ang.min.	52	11	3,5	0,7
System Temperature,K	2500	50	35	300

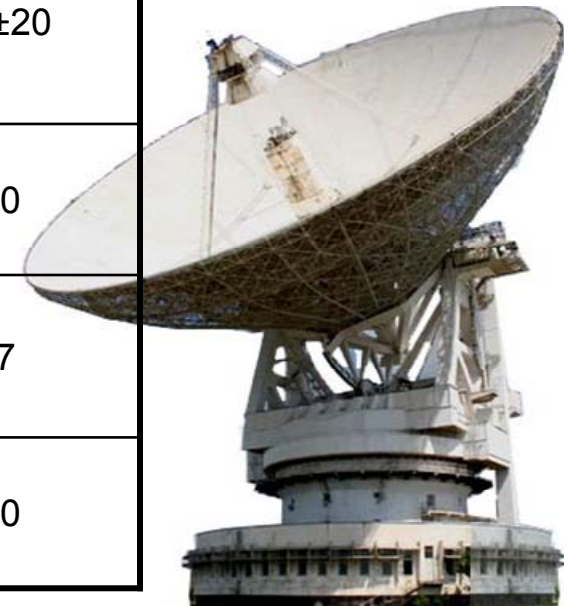


Fig. 5

First interferometric response of RT-70 - SRT-10

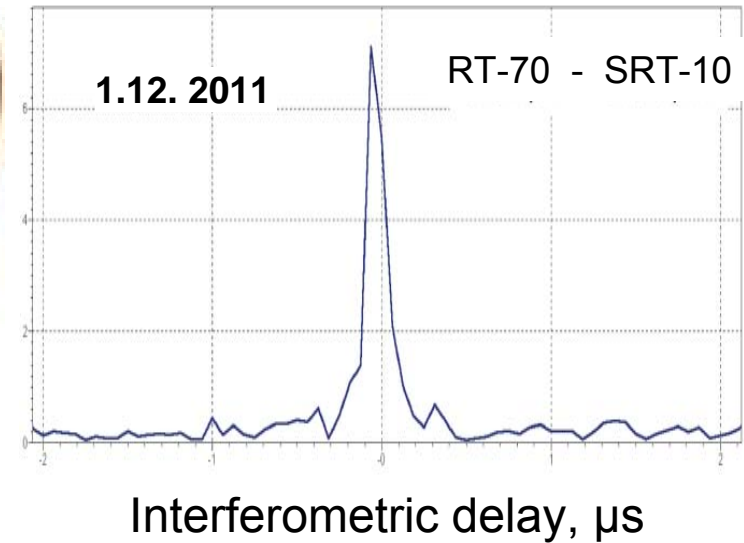
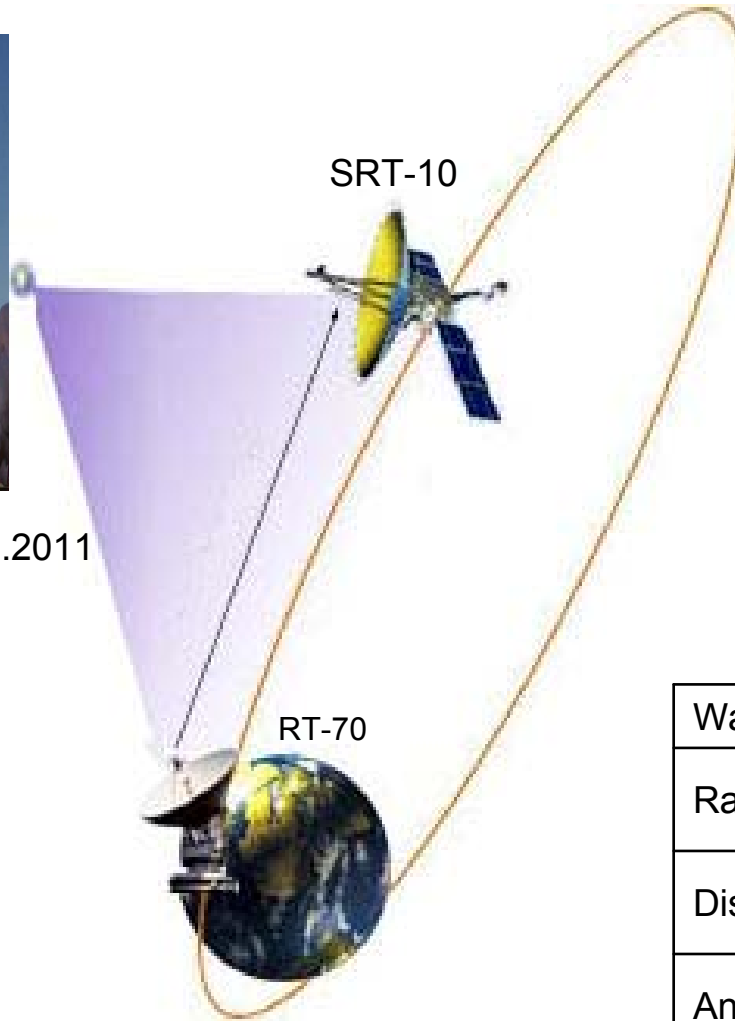
Project RadioAstron



The Launch on 18.07.2011



Radio telescope RT-70



Wavelength	6 cm
Radiosource	Active galaxy BL Lac
Distance	50 000 km
Angular resolution	240 arc. μs

Fig. 6

Radar studies of space debris on Radio telescope RT-70

19-20 April 2012

Objects of space debris

Name	Internat. ID	NORAD ID	RCS
SL-6 R/B	75063D	08018	7.1776
SL-12 R/B	95063D	23720	5.0118
RADUGA 9	81069A	12618	7.9433
OPTUS B1	92054A	22087	28.2172
Gorizont-19	89081A	20263	7.9433
ESIAFI 1	81018A	12309	22.0984
Ekran 1	76107A	09503	3.9810

Schedule of experiment Debris 12.1

Name	April, 19 (UT)	April, 20 (UT)
SL-6 R/B	16:40-17:30	-
SL-12 R/B	-	12:40-13:30
RADUGA 9	17:30-18:20	11:00-11:50
OPTUS B1	18:20-19:10	14:20-15:10
Gorizont-19	19:10-20:00	-
ESIAFI 1	-	11:50-12:40
Ekran 1	-	13:30-14:20

Regime of transmission:

Central frequency of radar is 5010.024 MHz.

Polarization is right circular polarization (RCP).

Power – 30 KW

5 antennas take part in experiment:

Evpatoria,

Urumqi, Medicina, Simeiz, Ventspils

April 19:

- first 10 min - raising of power;
- 10 min - carrier frequency 5010.024 MHz.
- last 5 min - LFM.

April 20:

- first 10 min - raising of power;
- 10 min - carrier frequency 5010.024 MHz.
- last 5 min - linear frequency modulation (LFM).

The LFM parameter:

deviation frequency 512 kHz, period 1 ms.

Fig. 7

RT-70 transmitter ($f=5$ GHz, $P_{\max}=200$ kW)



Fig. 8

Spectra of the transmitted signal by RT-70 (Apr.2012)

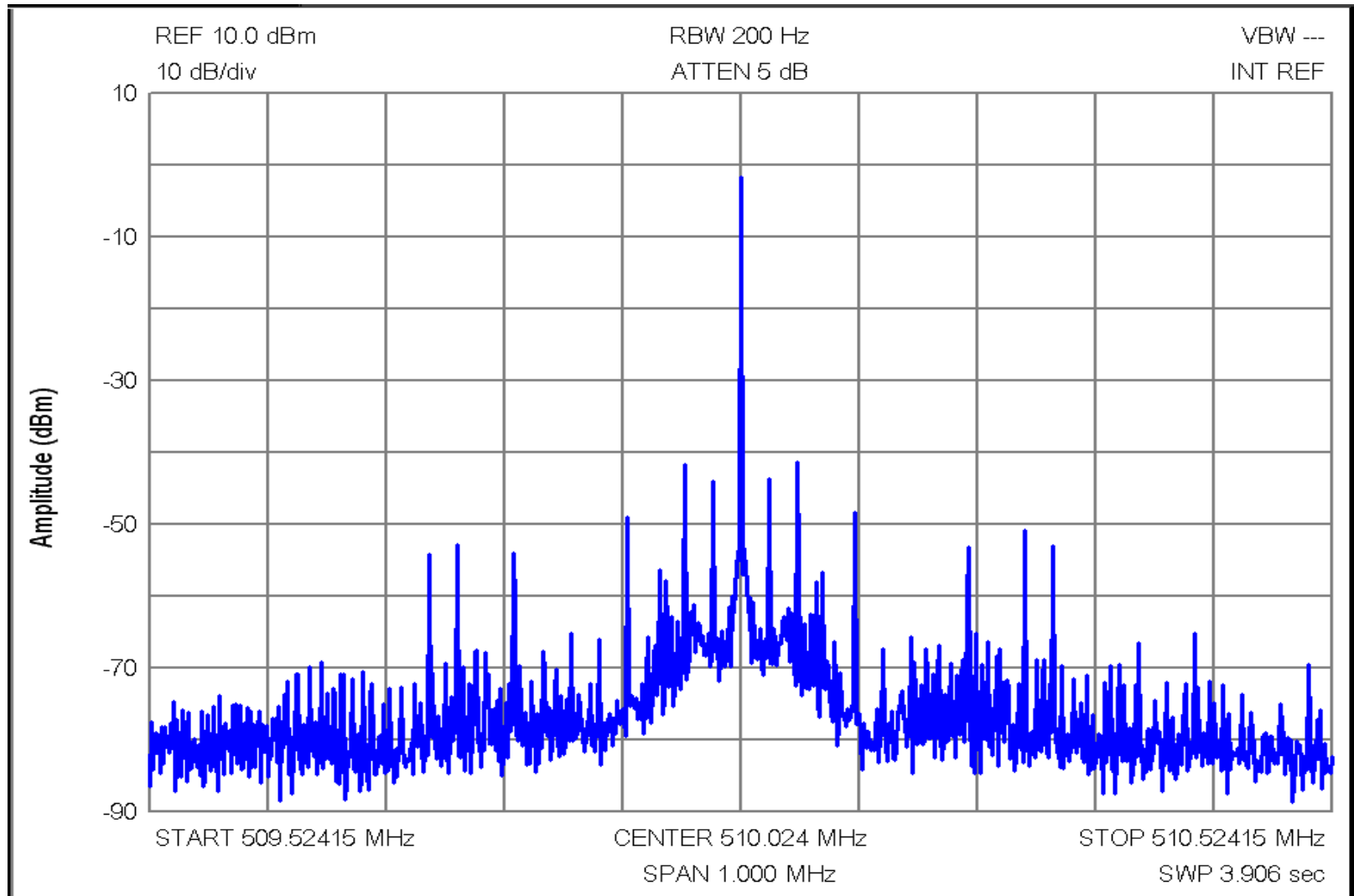
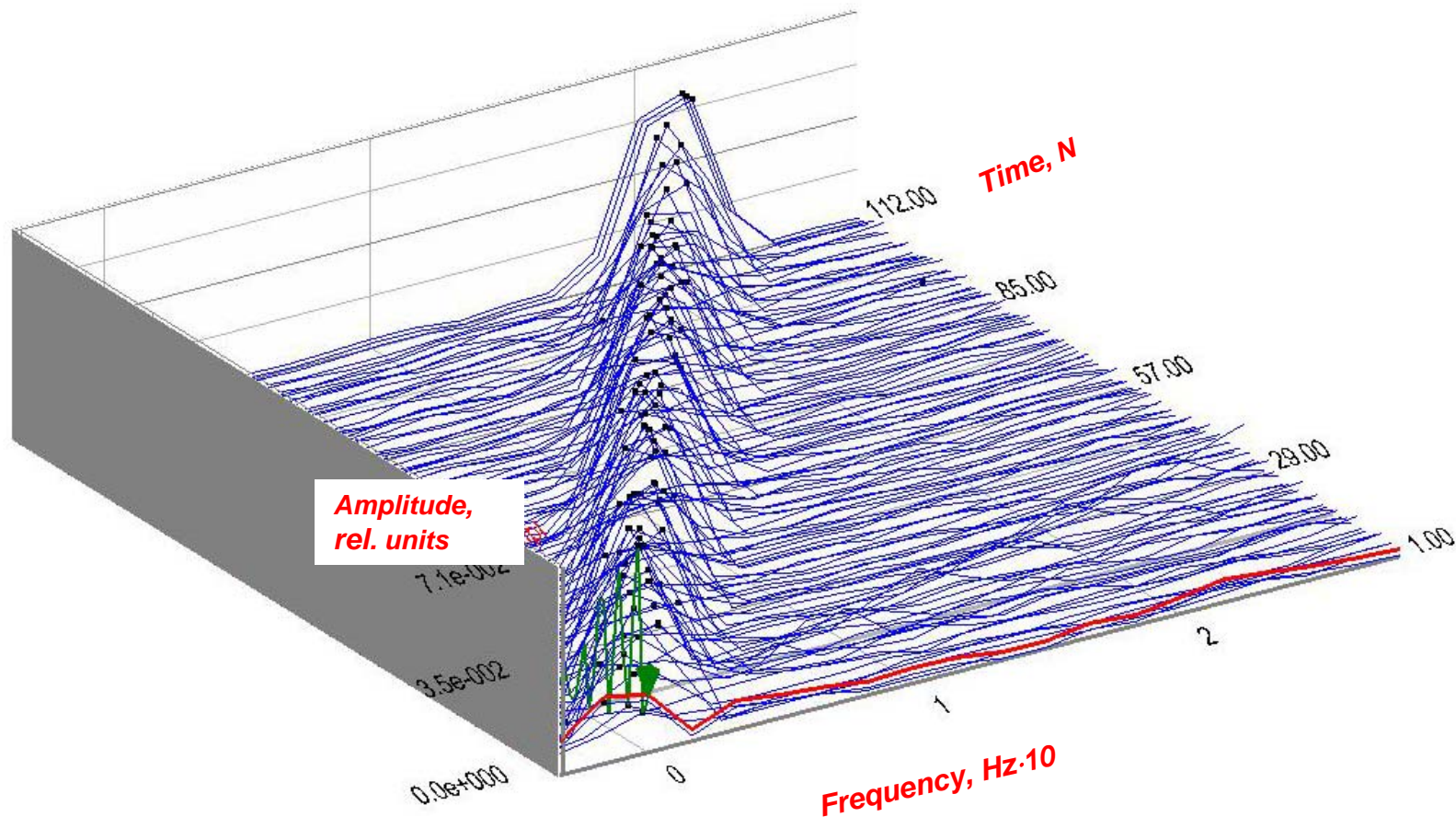


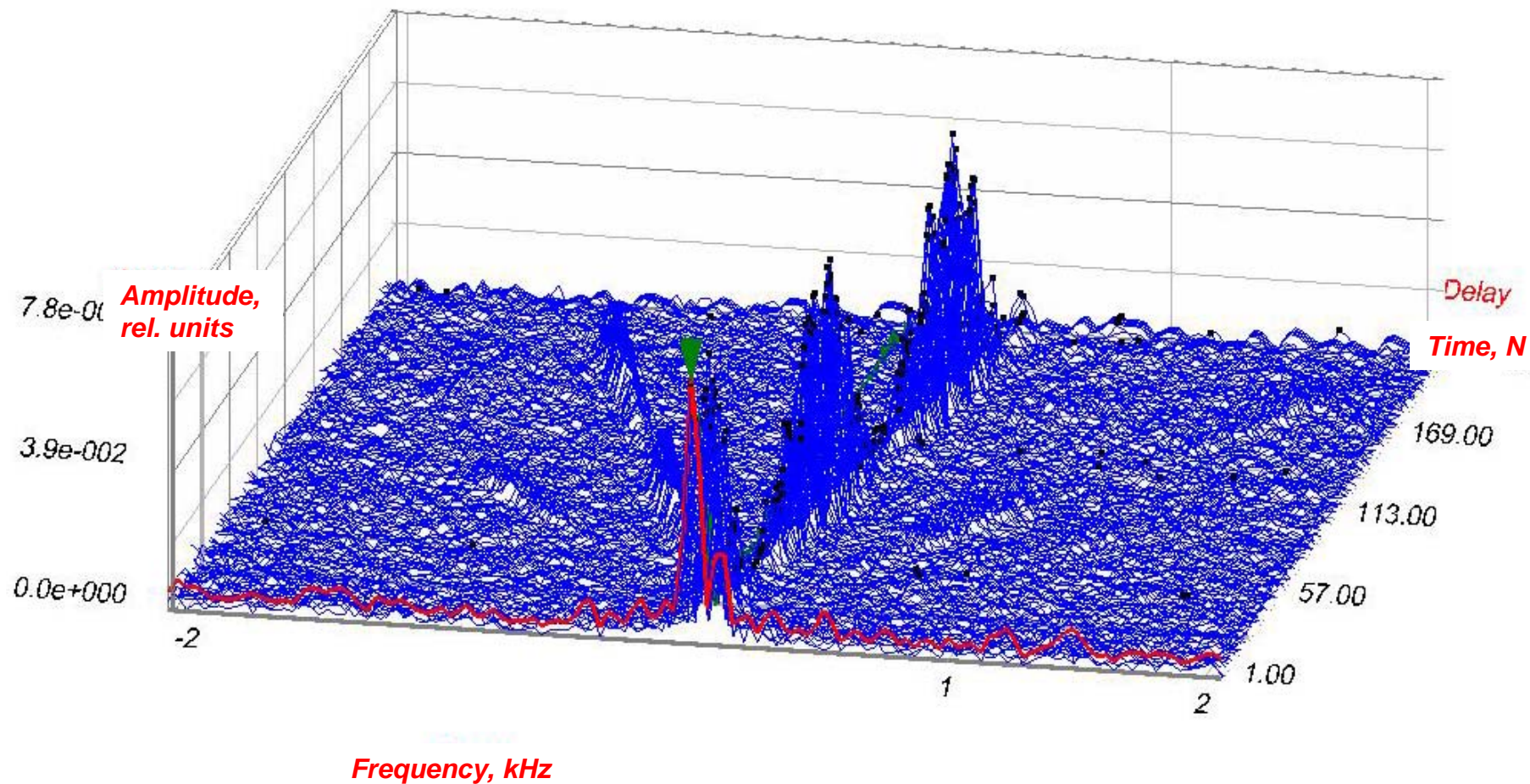
Fig. 9



**Power spectrum of interferometer response on echo from object 09503.
April, 20, 2012; 13:46 UT.**

RT-70, Evpatoria (transmission) and RT-32, Ventspils (receiving)

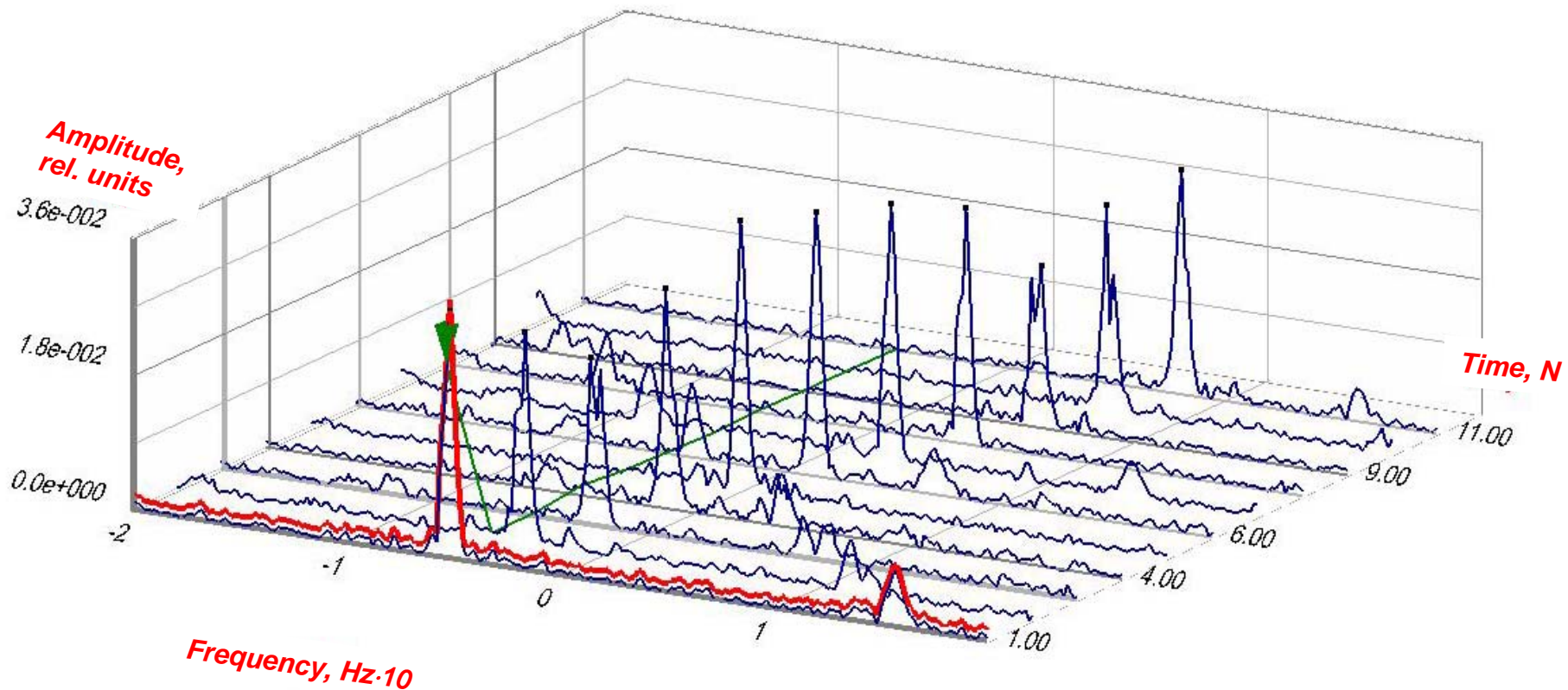
Fig. 10



Power spectrum of interferometer response on echo from object 12618. April, 20, 2012; 11:32 UT.

RT-70, Evpatoria (transmission) and RT-32, Ventspils (receiving)

Fig. 11



**Power spectrum of interferometer response on echo from object 20263.
April, 19, 2012; 19:40 UT.**

RT-70, Evpatoria (transmission) and RT-32, Ventspils (receiving)

Fig. 12