



Long-Range Air Surveillance Radar "Resonance-NE" for Ballistic Missile Early Warning System & Low Observable Targets Detection



A O R S O B O R N E X P O R T

Z A O S R C R E S O N A N C E



Multi-Role Long-Range
Air Surveillance Radar "Resonance-NE"
for Ballistic Missile Early Warning System
& Low Observable Targets Detection



"Resonance-NE" is a VHF, coherent, all-round coverage, standby-mode radar equipped with a phased antenna array.

Recent advances in the field of radiolocation, computer science and digital signal processing underlie **"Resonance-NE"** development.

The Radar features a high degree of operational compatibility and modular design

Radar "Resonance-NE" OPERATION PRINCIPLE



The principle of radio waves reflection from air objects underlies the radar operation that provides for sharp increase in RCS of cruise missiles and stealth targets.

Such phenomenon makes "STEALTH" technology in the range of the radar «Resonance-NE» operation **INEFFECTIVE !**

Radar «Resonance-NE» Purpose

- 1. Automatic surveillance, detection, tracking, IFF and classification of air targets in a wide range of velocities, from subsonic to hypersonic, low observable and with low RCS, including those employing “Stealth” technology under active ECM and natural noise.**
- 2. Air objects coordinates automatic measuring.**
- 3. The combat missions solution for semi-automatic guidance .**
- 4. Tracks initiation and forecast of ballistic target point of impact .**
- 5. Determination of bearing on jammer.**
- 6. IFF and flight data acquisition of the air targets equipped with Mark-XII (when radar is equipped with IFF “Lira-VME”)**

The Radar Ensures

The radar detects, tracks and recognizes the following types of air targets:



BALLOONS



AIRCRAFTS



HELICOPTERS



CRUISE MISSILES



HYPERSONIC CRUISE MISSILES

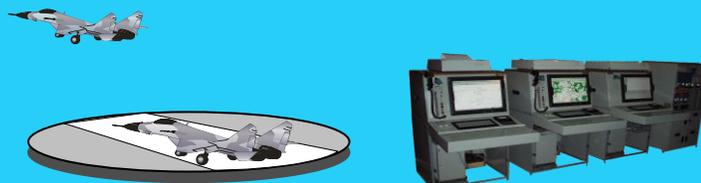


BALLISTIC MISSILES

Transfers targets data to
CP in Responsibility Area



Air Defence Missile Systems (ADMS)



Fighter Guidance Control Post



Air Traffic Management Systems

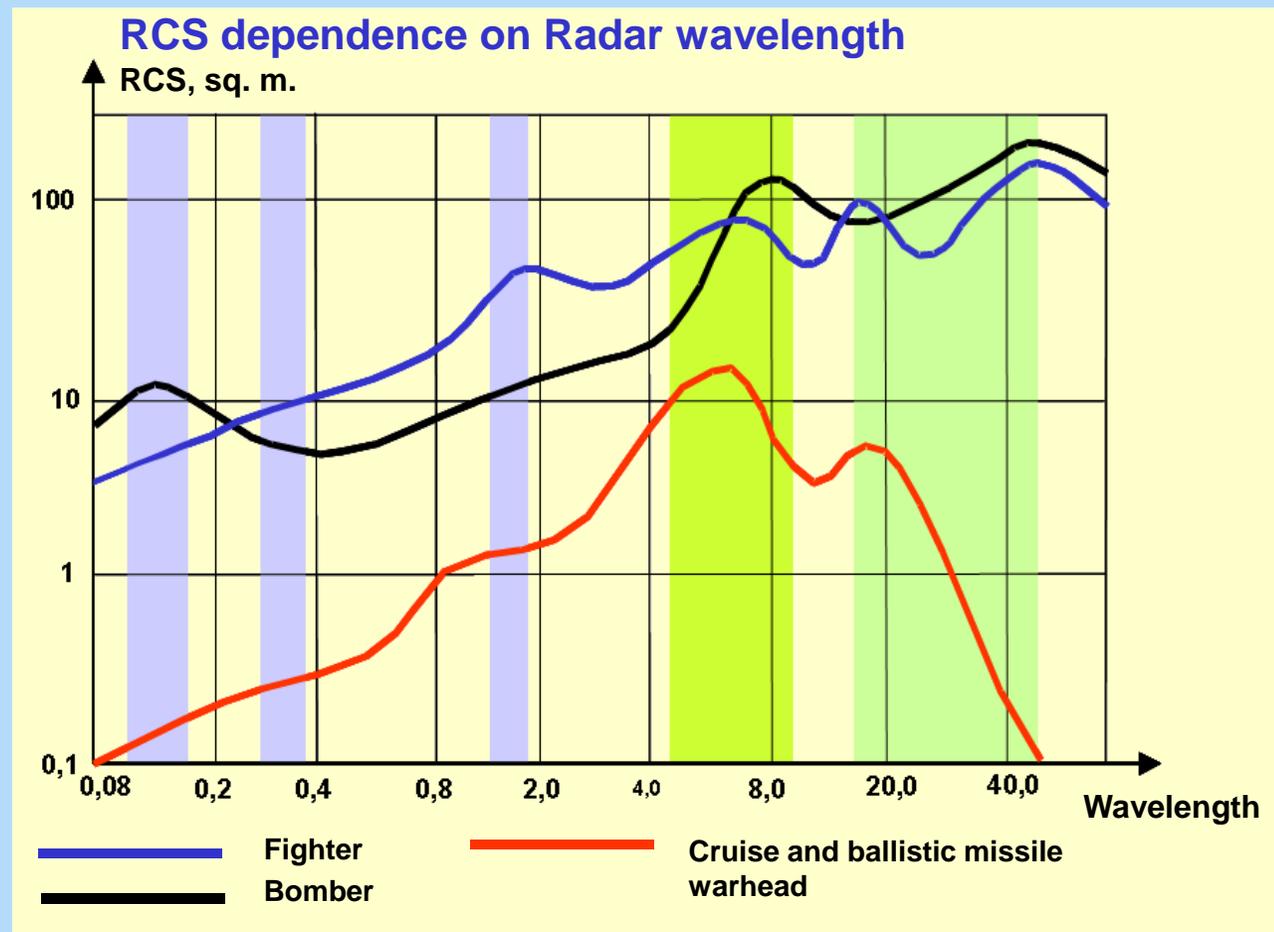
“Resonance-NE” Radar Special Features

“Resonance-NE” is a long-range, low observable targets detection radar, which uses effect of radio waves resonant reflection, with phased antenna array, designed with the latest advances in electronics.



The principle of radio waves resonance reflection from aircraft objects that leads to a sharp increase of the radar cross section (RCS) for cruise missiles, including those manufactured by stealth technology, is applied in the radar "Resonance-NE" operation.

Such phenomenon makes “STEALTH” technology in the range of the “Resonance-NE” radar operation **INEFFECTIVE !**



Ordinary radars

Resonance Radars

Over-the-horizon radars

RADAR CROSS-SECTION

RCS for those radars which employ resonance reflection effect

RCS for those radars which employ Rayleigh light scattering effect



Radar "Resonance-NE" Basic Characteristics

Frequency Range – Metric (VHF)

Coverage:

in range..... 10-1100 km;
in azimuth..... 360 deg.;
in elevation..... 1,5 – 80 deg.

Coordinates measurement accuracy:

Range..... 300 m;
Azimuth..... 1,5 deg.;
Elevation..... 1,5 deg.;
elocity..... 2 m/sec

Fighter Detection Range at the Altitude of 10 000 m.....350 km

Number of Detected Target Routes...300

Data Update Rate... ≤ 10 sec

Power Consumption < 120 kVA

Mean Time Between Failures > 1500 h

Mean Time to Repair...0,5 h

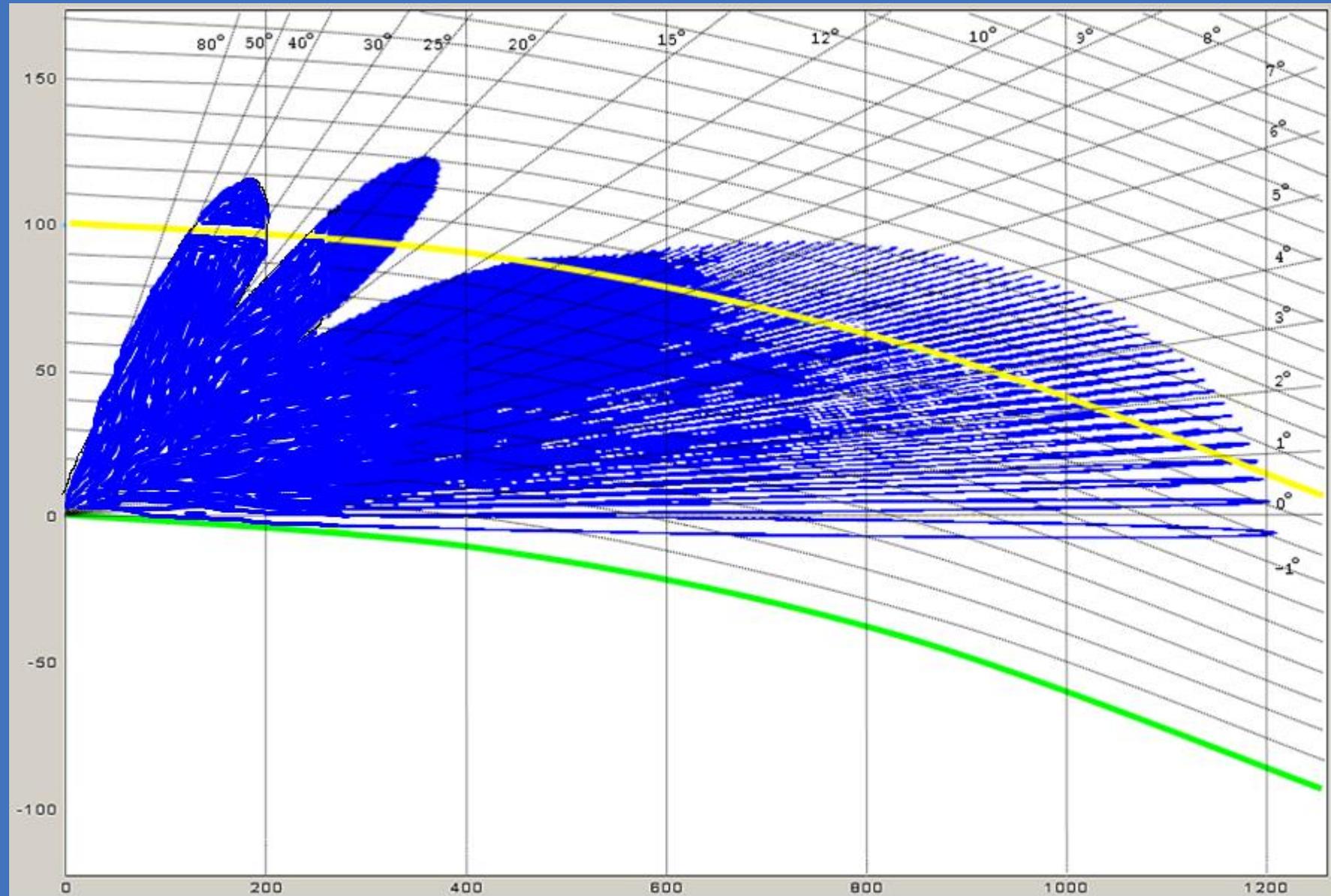
Duty Crew...3

“Resonance-NE” Radar Operational Modes

№ 1 - “Aerodynamic” - the mode of optimal detection and tracking of aerodynamic targets and not optimal - of ballistic targets.

№ 2 - “Ballistic” - the mode of optimal detection and tracking of ballistic targets and not optimal – of aerodynamic targets.

Detection Zone of "Resonance-NE" Radar in elevation plane



Radar “Resonance-NE” Maximum Detection Range at Different Altitudes*

Radar site height– 100 m

σ_u (m ²) $\lambda=10$ cm	Target type	σ_u (m ²) $\lambda=6$ m	Target flight altitude, m				
			100	500	1000	5000	10 000
0,001	Mini UAV	1,0	31	52	78	124	169
0,05	Cruise missile	15,0	47	85	115	232	321
0,1	Tactical strike aircraft type F-117	25,0	49	89	118	240	327
1	Strategic bomber type B-2	30,0	51	92	122	247	337
20	Strategic bomber type B52	70,0	53	94	124	250	342
50	Passenger airbus	120,0	55	96	126	253	347

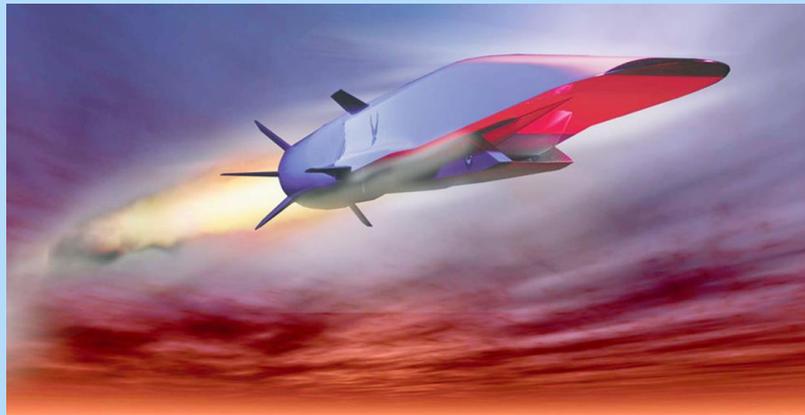
Radar site height - 1000 m

σ_u (m ²) $\lambda=10$ cm	Target type	σ_u (m ²) $\lambda=6$ m	Target flight altitude, m				
			100	500	1000	5000	10 000
0,001	Mini UAV	1,0	61	95	118	145	254
0,05	Cruise missile	15,0	98	126	176	256	384
0,1	Tactical strike aircraft type F-117	25,0	110	159	203	310	421
1	Strategic bomber type B-2	30,0	116	177	215	366	473
20	Strategic bomber type B52	70,0	120	180	219	371	480
50	Passenger airbus	120,0	124	184	222	375	486

* detection range is calculated without taking into account the influence of the underlying surface

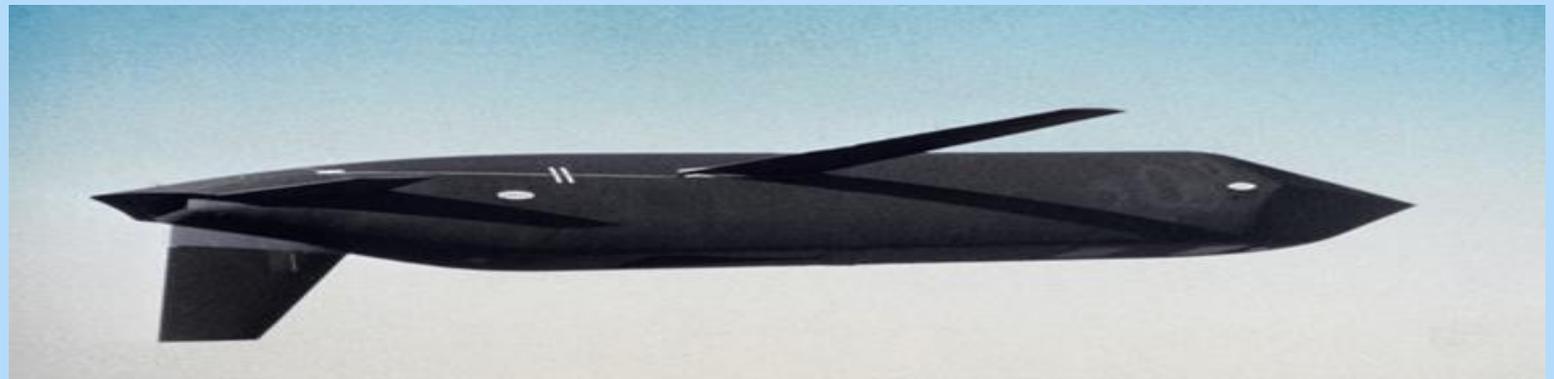
Air Targets Classification

High resolution and aircraft radial velocity measurement accuracy (1...1,5 m/sec) provide for a strong probability of air and accurate quantification. targets classification



Data Update Rate

High data update rate (≤ 10 sec) provided by space electronic scan not bounded by antenna rotation and Doppler digital methods of data procession, makes it possible to track high-speed (hypersonic) targets.



Noise Protection

JAMMING PROTECTION

- 1. Long-wavelength range, in which the number of active jammers is limited (35 - 70 MHz).**
- 2. Dual-frequency radar equipment operation mode in each surveillance sector.**
- 3. Monitoring of jamming conditions during one tact of radar operation.**
- 4. Automatic detection of frequencies occupied by active interference, bearing on this interference, power level of interference and bandwidth interference.**
- 5. Automatic search for frequencies free from active interference.**
- 6. Automatic (semi-automatic) frequency agility of radar equipment at operating frequencies free from active interference (350 frequencies).**
- 7. Automatic protection against special jamming: non-synchronous impulse noise, broadband impulse noise, "continuous wave" type interference.**
- 8. Presence of a mode for blanking a zone of space occupied by interference.**
- 9. Narrow bandpass and large dynamic range of radar receivers (at least 136 dB).**
- 10. Automatic control of the target detection threshold depending on the overall interference situation in the detection zone.**

PROTECTION AGAINST PASSIVE INTERFERENCE

- 1. Coherent-filtering signal processing (passive interference suppression factor - not less than 70 dB).**
- 2. Suppression of side lobes of the autocorrelation function in the process of digital signal processing.**
- 3. Semi-automatic rejection of clutters with speed noise.**

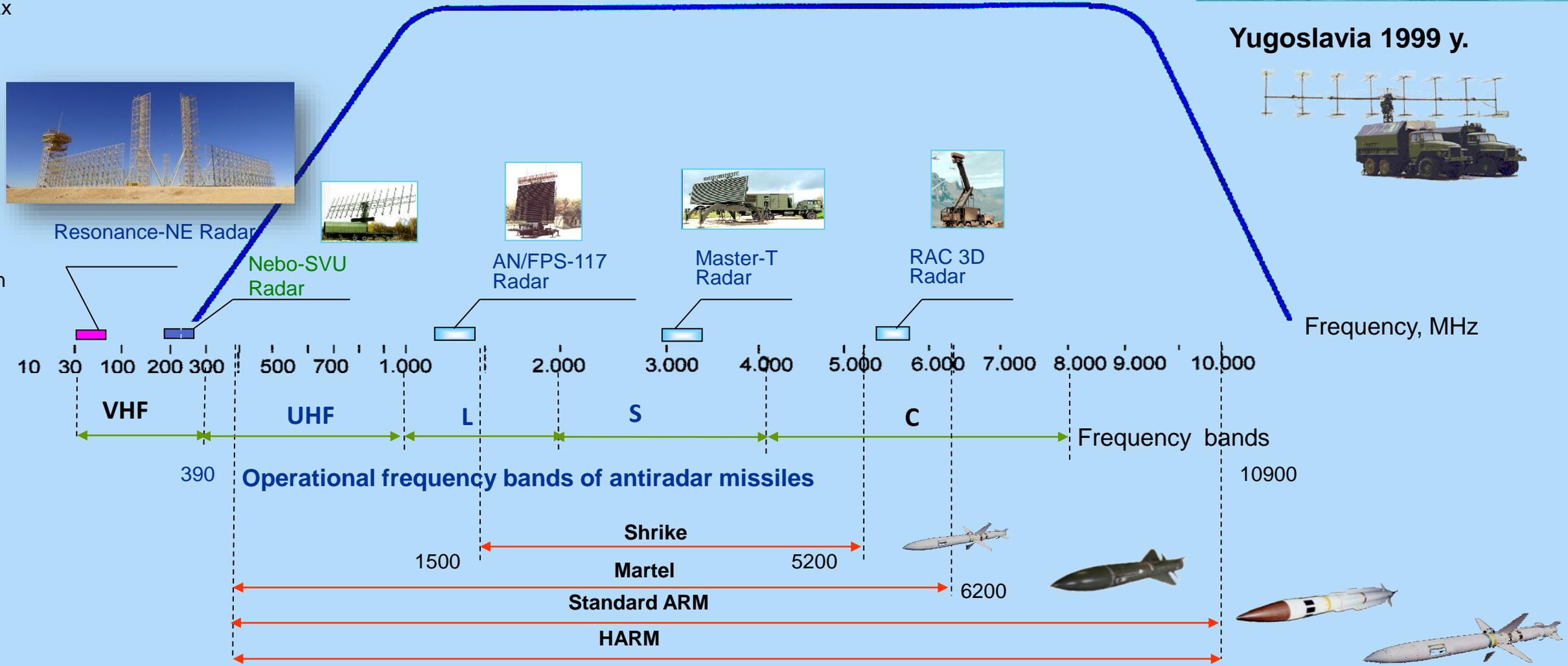
Radar Protection against anti-radar missiles



Measure of STEALTH-technology effectivity

max

min



Yugoslavia 1999 y.



Resonance-NE Radar



Nebo-SVU Radar



AN/FPS-117 Radar



Master-T Radar



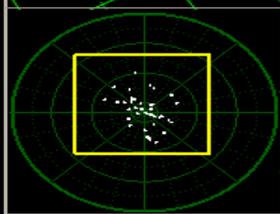
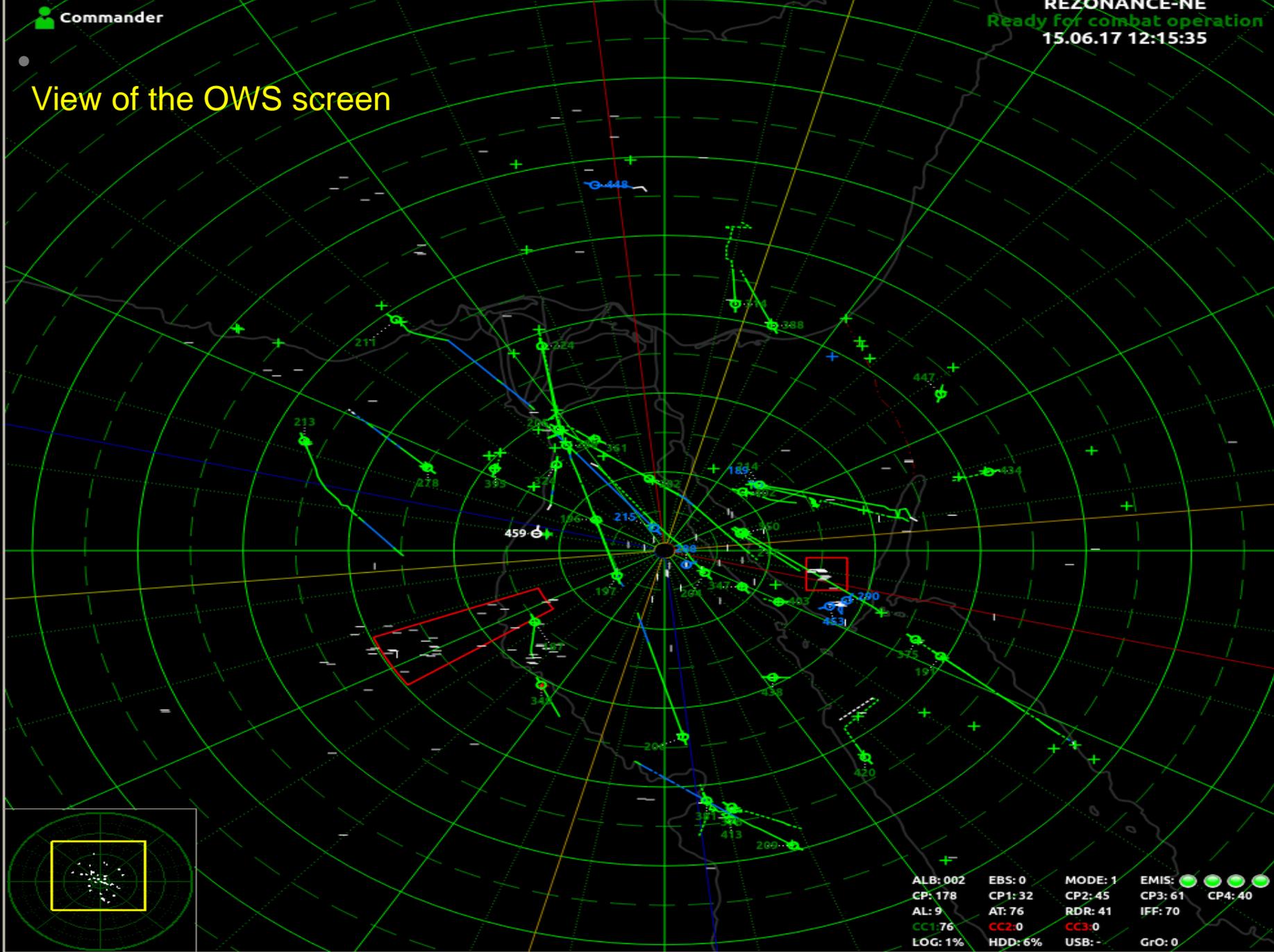
RAC 3D Radar



Commander

REZONANCE-NE
Ready for combat operation
15.06.17 12:15:35

View of the OWS screen



Modes Procession Functions Settings

General IFF RDR Interf Frequencies

Authorization
Users

Unit name
REZONANCE-NE

Interface language English

Measuring system
 Metric Anglo-American
 Altitude km hm m
 Range km m
 Velocity km/h m/s
 Cursor coordinates Polar

Graphics
 Trajectory length
 0.00 km

Brightness
 Grid 200
 CP 200
 ET 200
 Statics 105
 Maps -51

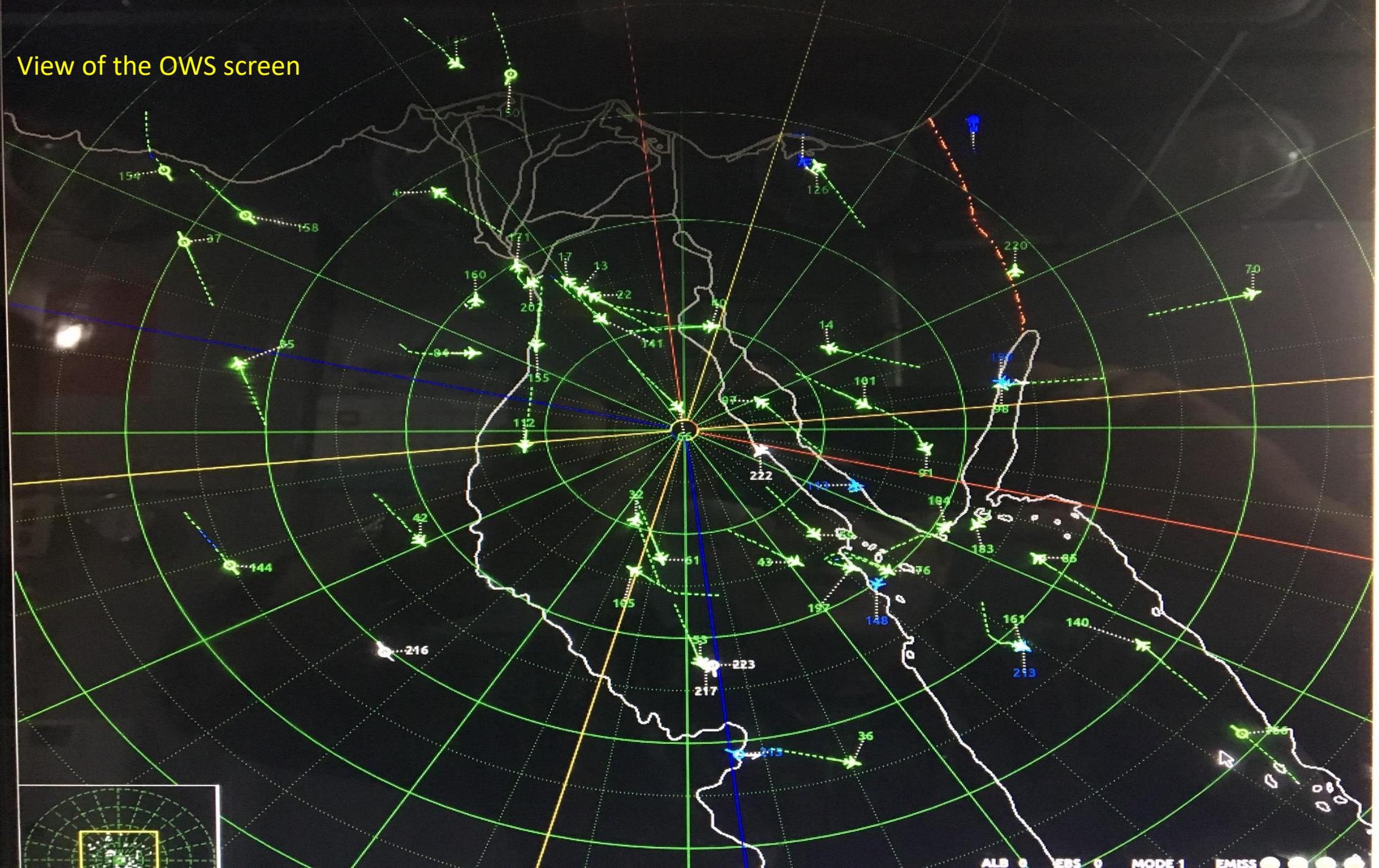
Opacity
 RRC 100

RRC Guidance

Nº UNo	A° C°	D, V	H, TCI	AmpldB Code.
349 00000	214.5 335.4	206.77 117.69	2.60 P	24 1010101000
350 00000	73.4 308.2	75.16 192.26	6.70 P	20 1010101000
361 00000	335.0 118.2	156.07 78.29	2.90 P	27 0010101000
364 00000	321.7 225.0	193.71 107.48	- H	0 1111111111
372 00000	336.9 349.4	309.10 227.90	- P	0 1111111111
375 00000	115.3 309.1	263.47 212.56	10.70 P	27 1010101000
376 00000	168.9 306.3	331.65 158.81	6.60 7	24 00100001000
378 00000	303.4 326.6	149.22 52.70	- P	0 1111111111
381 00000	172.8	319.54	6.20	27

PT CC1 TMI 15.06.17 12:15:35

View of the OWS screen



View of the OWS Screen - Complete Forms of Targets

Number	80
Unified number	0
CC1 number	0
CC2 number	0
Range	370.82 km
Azimuth	301.4°
Measur. alt.	11.60 km
Barometr. alt.	11.27 km
Course	131.3°
Velocity	877.47 km/h
Class	P
IFF	Civil
Output to CC	SC:1, 3
Sources	RDR, IFF
1 code	-
2 code	-
3A code	1630
S code	00065939

CC1 number	0
CC2 number	0
Range	83.37 km
Azimuth	198.7°
Measur. alt.	11.20 km
Barometr. alt.	10.88 km
Course	125.6°
Velocity	854.14 km/h
Class	P
IFF	Civil
Output to CC	SC:1, 3
Sources	RDR, IFF
1 code	-
2 code	-
3A code	1661
S code	04920814

Number	389
Unified number	0
CC1 number	0
CC2 number	0
Range	289.78 km
Azimuth	116.8°
Measur. alt.	11.10 km
Barometr. alt.	10.97 km
Course	311.9°
Velocity	851.46 km/h
Class	P
IFF	Civil
Output to CC	SC:1, 3
Sources	RDR, IFF
1 code	-
2 code	-
3A code	4575
S code	07405638

Modes: **Mode 1**

PA power: 1-4 (Green/Red bars)

PA emission: 1-4 (Green/Red bars)

IFF: 1-4 (Green bars)

Functions: **Mode 2**

N W: 1-4 (Radio buttons)

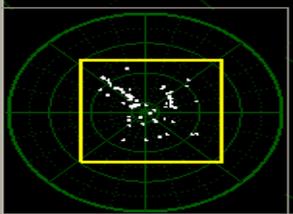
Settings

Aut.	Man.	Assigned frequencies F1	Assigned frequencies F2
<input type="checkbox"/>	Sector1	51.3 (6 dB)	55.5 (1 dB)
<input type="checkbox"/>	Sector2	49.4 (6 dB)	50.4 (0 dB)
<input type="checkbox"/>	Sector3	37 (5 dB)	40 (3 dB)
<input type="checkbox"/>	Sector4	48.7 (6 dB)	50.2 (1 dB)

Frequency sorting: noise number

ALBs:

RRC		Guidance				
Nº UNo	A* C*	D, V _r	H, TCI	Ampl.dB	Code.	
80	301.4 131.3	370.82 877.47	11.60 P	15	1010100010	
85	298.8 242.4	194.54 170.69	2.70 H	29	1010101010	
88	155.1 261.0	344.67 783.62	11.10 P	28	1010101010	
98	65.2 325.2	224.70 801.90	11.20 P	22	1010101010	
122	138.7 141.7	164.05 476.78	- P	0	1111111111	
127	198.7 125.6	83.37 854.14	11.20 P	29	1010101010	
136	73.8 219.2	250.35 729.24	9.80 P	15	0000000010	
159	320.7 320.6	482.22 805.73	- P	0	1111111111	
160	314.8 160.9	106.15 792.39	7.80 P	26	1010101010	
161	300.4 224.1	196.18 170.57	1.70 H	18	1010100000	
168	322.7 309.4	291.79 787.75	- P	0	1111111111	
178	227.9 185.1	165.61 802.44	10.70 P	18	1010101010	
200	176.9 352.5	353.05 878.78	- P	0	1111111111	



ALB: 001 EBS: 0 MODE: 1 EMIS: 1 1 1 1
 CP: 175 CP1: 47 CP2: 54 CP3: 16 CP4: 58
 AL: 7 AT: 68 RDR: 40 IFF: 66
 CC1: 69 CC2: 0 CC3: 52
 LOG: 1% HDD: 6% USB: - GrO: 0

OWS Screen view - maneuvering target

REZONANS-NE
Ready for combat operation
23.11.16 12:09:28

Number	34
Unified number	0
CC1 number	0
CC2 number	0
Measur. alt.	6.00 km
Barometr. alt.	6.00 km
Course	114.7°
Velocity	1161.38 km/h
Class	p
IFF	Foe
Output to CC	SC:1, 2
Sources	TIP
1 code	-
2 code	-
3A code	7124
S code	-

Modes
Procession
Functions
Settings

Mode 1
Mode 2

	PA power	PA emission	N	W
1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="radio"/>	<input type="radio"/>
2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="radio"/>	<input type="radio"/>
3	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="radio"/>	<input type="radio"/>
4	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="radio"/>	<input type="radio"/>
IFF	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> RT

Frequencies setting

Aut.	Man.	Assigned frequencies F1	F2
<input type="checkbox"/>	Sector 1	53 (6) dB	56.7 (0) dB
<input type="checkbox"/>	Sector 2	46 (6) dB	37.7 (0) dB
<input type="checkbox"/>	Sector 3	35.4 (6) dB	40.6 (0) dB
<input type="checkbox"/>	Sector 4	50.4 (9) dB	38.7 (6) dB

Frequency sorting noise number

ALBs

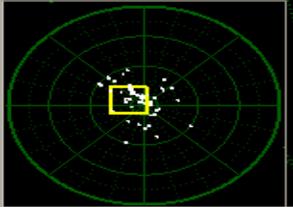
Polar
Cartesian

Delete
Delete all

Apply

RRC Guidance

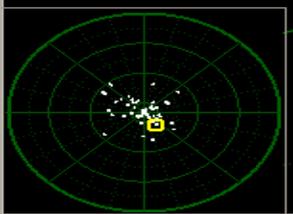
Nº UNo	A° C°	D, km V, km/h	H, km TCI	Ampl. dB Code det.



AL: 21 AT: 78 CP: 484 LOG: 28% MODE: 1 EMIS: ● ● ● ●
 CP1: 85 CP2: 169 CP3: 49 CP4: 181
 CC1: 78 CC2: 78 CC3: 0

OWS screen view - fighter tracking

REZONANS-NE
Ready for combat operation
23.11.16 12:44:12



Modes Procession Functions Settings

Rejection zones

	Sector 1	Sector 2	Sector 3	Sector 4
Doppler velocity (0-100), m/s	5,0	5,0	5,0	5,0
PS1	5,0	5,0	5,0	5,0
PS2	5,0	5,0	5,0	5,0
Rejection range (0-1200.00 km)	1200,00	1200,00	1200,00	600,00
PS1	1200,00	1200,00	1200,00	600,00
PS2	1200,00	1200,00	1200,00	600,00
Detection thresholds (up to 25.5), dB	13,5	11,9	13,5	12,9
PS1	13,5	11,9	13,5	12,9
PS2	13,0	11,5	12,3	12,3

Apply

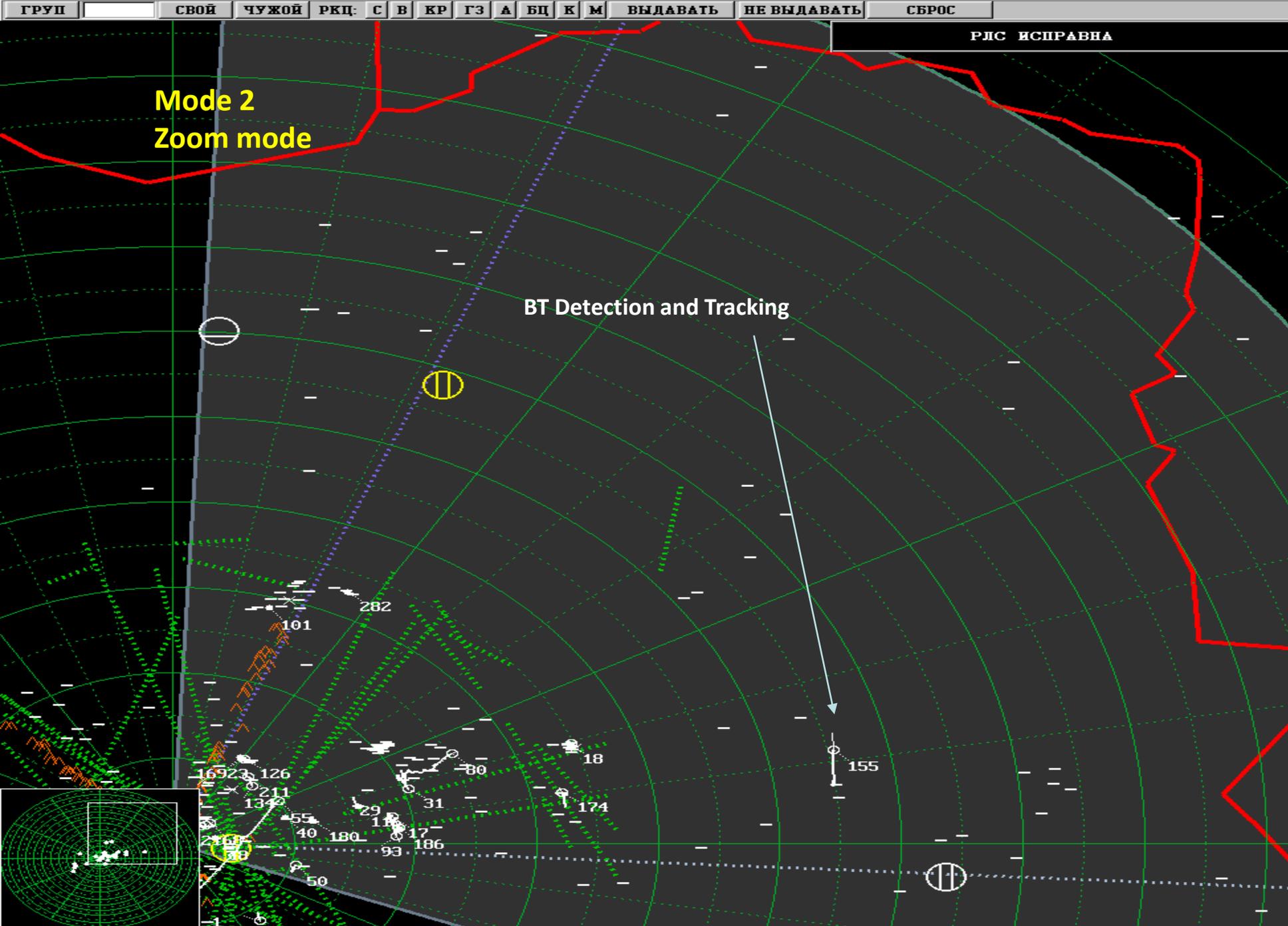
Jamming protection

	Sector 1	Sector 2	Sector 3	Sector 4
AN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PN	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
WSL	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PN	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
WSL	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

RRC Guidance

Nº UNo	A° C°	D,km V,km/h	H,km TCI	Ampl.dB Code det.
181 00000	143.6 324.2	163.22 1101.06	8.60 P	1 0000000000
446 00000	142.7 326.4	163.87 1067.36	8.90 P	1 0000000000

AL: 24 AT: 80 CP: 404 LOG: 29% MODE: 1 EMIS: ● ● ● ●
 CP1: 80 CP2: 211 CP3: 65 CP4: 48
 CC1: 80 CC2: 80 CC3: 81



Mode 2
Zoom mode

BT Detection and Tracking

ГРУПП СВОЙ ЧУЖОЙ РКЦ: С В КР ГЗ А БЦ К М ВЫДАВАТЬ НЕ ВЫДАВАТЬ СБРОС

РЛС ИСПРАВНА

БОЕГОТОВ

08:41:14 03.07.2012

РМО2 - ПОДЧИНЁННЫЙ

Resonance-NE

РЕЖИМЫ РАБОТЫ...

ЧАСТОТА...

ОБРАБОТКА...

СОПРЯЖЕНИЕ...

ФУНКЦИОНАЛЬНОЕ МЕНЮ...

ВКЛЮЧИТЬ РЕГИСТРАЦИЮ

ПФ ФН + - ВСЕ

ГР ВЫСОТА

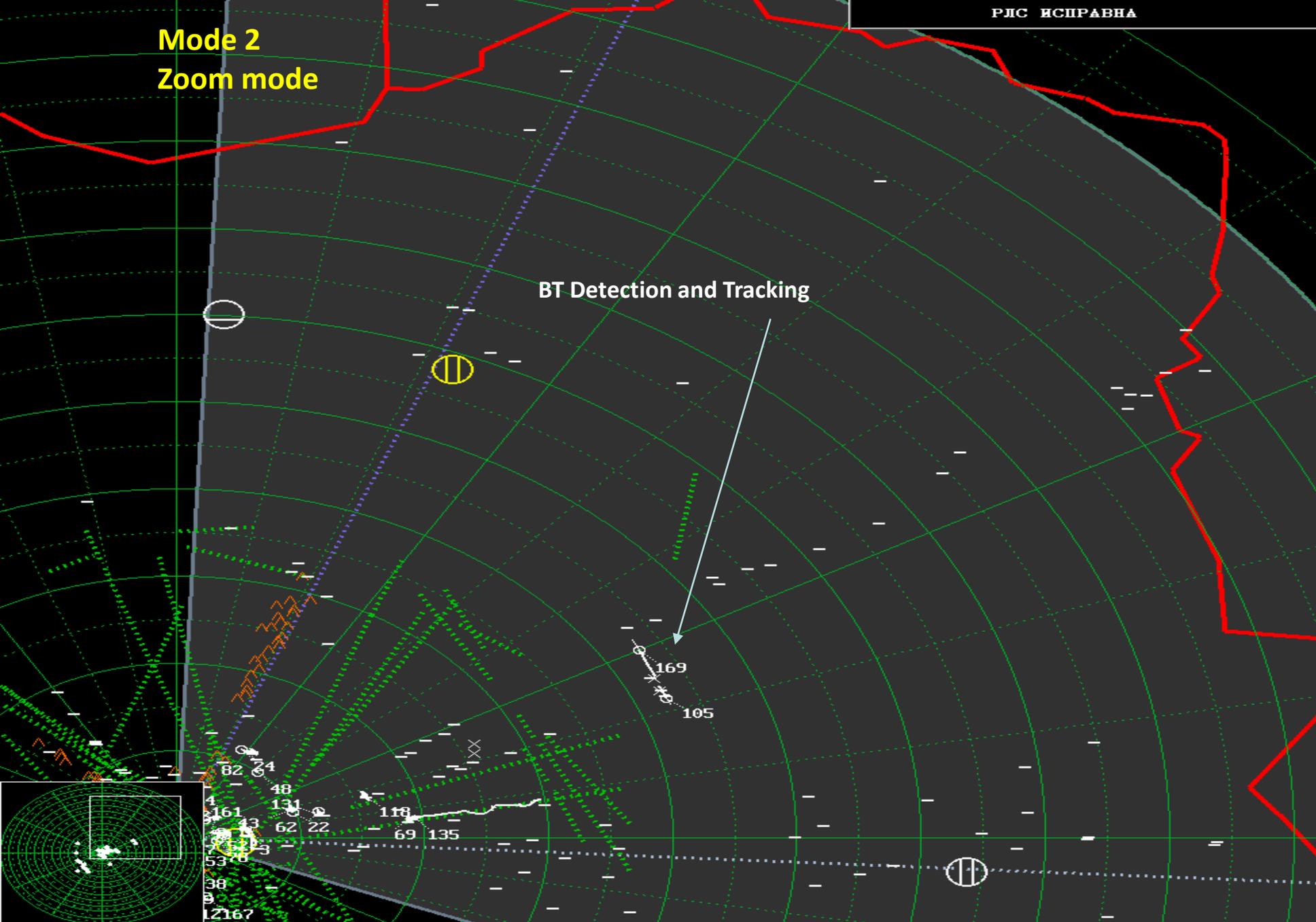
Нтр V, км/ч	Az, гр C, гр	D, км РКЦ	H, км Коя	T
155	078°20'	554.4	1.7	-
9000	358°19'	БЦ	1	

А:055°04'21" Д:605.80км М100 М400 М600 М1200 ЛУПА КТ ЭТ № ВЕКТ ФОРМ ИСТ СТАТ БЛАНК ЗОНА П/А ВВОД

РЕЖИМ ВЫБОРА ПФ

Mode 2
Zoom mode

РЛС ИСПРАВНА



09:19:02 03.07.2012

РМО2 - ПОДЧИНЕННЫЙ

Resonance-NE

РЕЖИМЫ РАБОТЫ...

ЧАСТОТА...

ОБРАБОТКА...

СОПРЯЖЕНИЕ...

ФУНКЦИОНАЛЬНОЕ МЕНЮ...

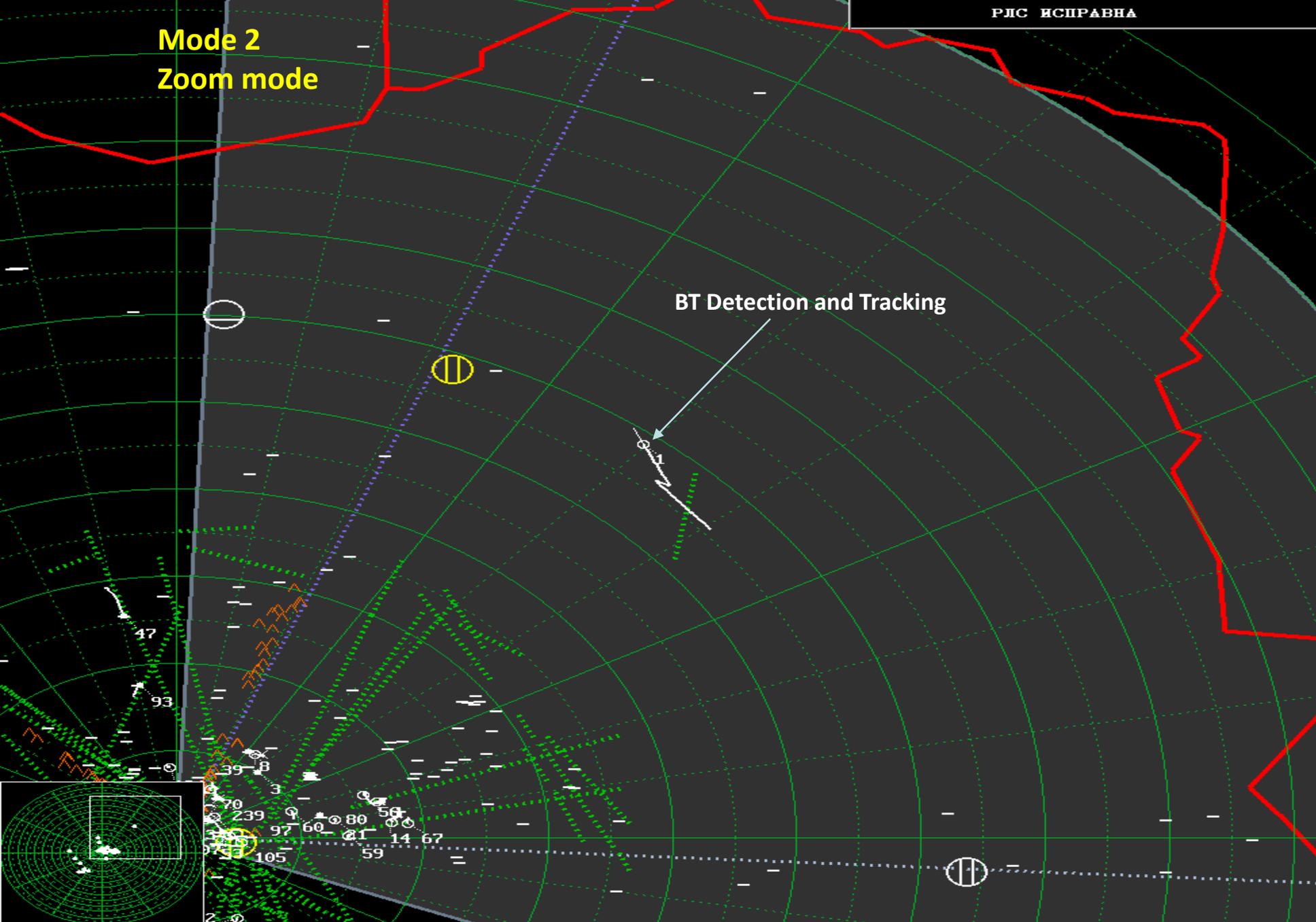
ВКЛЮЧИТЬ РЕГИСТРАЦИЮ

ПФ ФН + - ВСЕ
ГР ВЫСОТА

Нтр V, км/ч	Az, гр C, гр	D, км РКЦ	H, км Коя	T
105 3149	067°56' 154°53'	425.8 -	28.4 1	-
169 5577	059°55' 337°17'	430.3 ГЗ	24.5 1	-

Mode 2
Zoom mode

РЛС ИСПРАВНА



09:53:29 03.07.2012

РМО2 - ПОДЧИНЁННЫЙ

Resonance-NE

РЕЖИМЫ РАБОТЫ...

ЧАСТОТА...

ОБРАБОТКА...

СОПРЯЖЕНИЕ...

ФУНКЦИОНАЛЬНОЕ МЕНЮ...

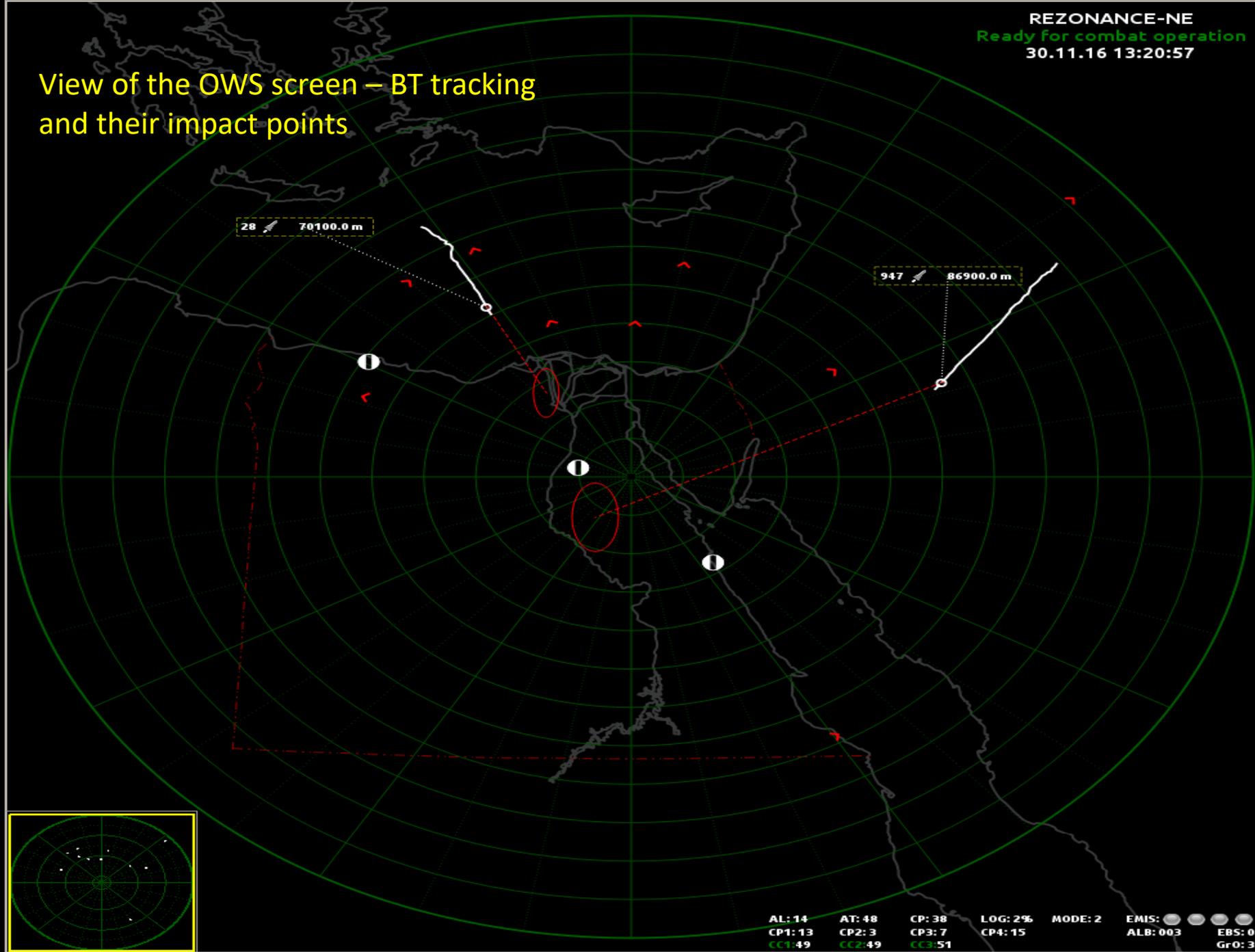
ВКЛЮЧИТЬ РЕГИСТРАЦИЮ

ПФ ФН + - ВСЕ
ГР ВЫСОТА

Нтр V, км/ч	Az, гр C, гр	D, км РКЦ	H, км Коя	T
1	039°47'	587.6	31.5	-
9062	336°22'	БЦ	1	

View of the OWS screen – BT tracking and their impact points

REZONANCE-NE
Ready for combat operation
30.11.16 13:20:57



Modes Procession Functions Settings

Mode 1 Mode 2

	PA power				PA emission				N	W	
1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
3	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
4	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
IFF	<input checked="" type="checkbox"/>										

Frequencies setting Assigned Frequencies

Aut.	Man.	Sector	F1	F2
<input type="checkbox"/>	<input type="checkbox"/>	Sector 1	48.7 (6 dB)	49.4 (0 dB)
<input type="checkbox"/>	<input type="checkbox"/>	Sector 2	36.1 (0 dB)	36.8 (0 dB)
<input type="checkbox"/>	<input type="checkbox"/>	Sector 3	49 (6 dB)	48.3 (0 dB)
<input type="checkbox"/>	<input type="checkbox"/>	Sector 4	35.9 (5 dB)	50.4 (3 dB)

Frequency sorting noise number

ALBs

Polar Cartesian

Delete Delete all

Apply

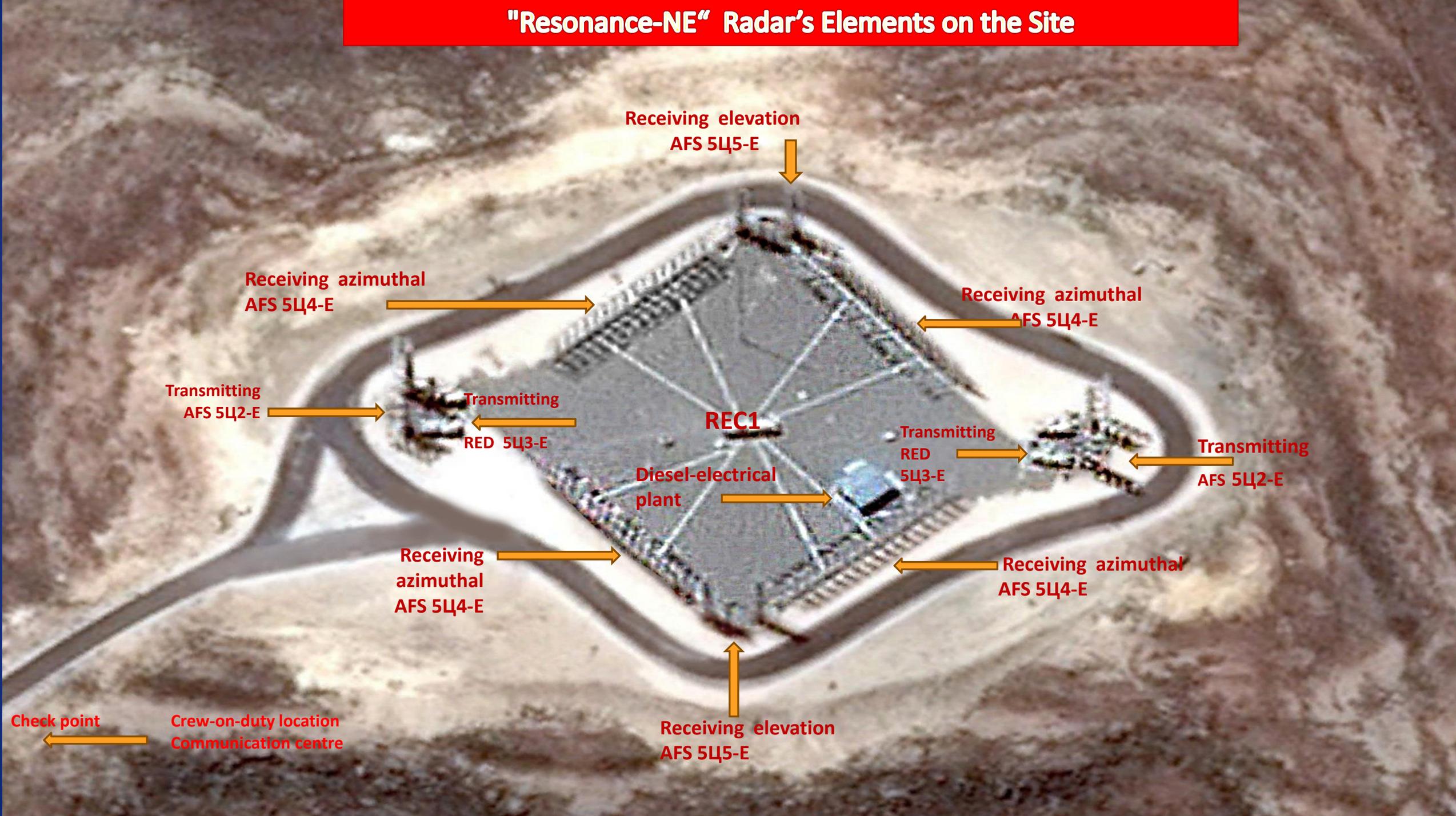
RRC Guidance

Nº UNo	A° C°	D,km V,m/s	H,m TCI	Ampl.dB Code det.
28 00000	327.6 152.2	522.30 2982.83	70100.0 BT	1 1111111111
947 00000	67.8 216.7	646.04 4094.60	86900.0 BT	1 1111111111

AL: 14 AT: 48 CP: 38 LOG: 2% MODE: 2 EMIS:
 CP1: 13 CP2: 3 CP3: 7 ALB: 003 EBS: 0
 CC1: 49 CC2: 49 CC3: 51 Gro: 3

137.1°, 1548.90 km 1200 km AFC CI SS CS CP ET Beam Trail Form Objects Selection RCS PT CC3 TMI 30/11/16 13:20:57

"Resonance-NE" Radar's Elements on the Site



Receiving elevation
AFS 5Ц5-E

Receiving azimuthal
AFS 5Ц4-E

Receiving azimuthal
AFS 5Ц4-E

Transmitting
AFS 5Ц2-E

Transmitting
RED 5Ц3-E

REC1

Diesel-electrical
plant

Transmitting
RED 5Ц3-E

Transmitting
AFS 5Ц2-E

Receiving
azimuthal
AFS 5Ц4-E

Receiving azimuthal
AFS 5Ц4-E

Receiving elevation
AFS 5Ц5-E

Check point

Crew-on-duty location
Communication centre

SUSTAINABILITY AND SURVIVABILITY OF "RESONANCE-NE" RADAR

Sustainability and survivability of "Resonance-NE" radar in conditions of the enemy fire is provided by:

- the impossibility of targeting anti-radar missiles at the radiated signal of the radar (the frequency of the radiated signal of the "Resonance-NE" radar goes beyond the operating frequency range of the anti-radar missiles);
- the impossibility of engagement a large number of elements of the antenna-feeder system of the meter range with one ammunition due to their separation over a large area (100x100 m) and low density;
- duplication of radar modules representing completely independent stations (up to 4 radar modules can be deployed at one position) and redundancy of blocks and systems in each module;
- the possibility of continuing the radar operation with the destruction of a significant number of elements of antenna arrays;
- carrying out measures for radar equipment masking and sheltering.

Types of Shelters for the Radar "Resonance-NE"



Types of Shelters for the Radar "Resonance-NE"



Radar “Resonance-NE” consists of the antenna-feeder system (AFS), the power amplifier, data receiving, procession and transmission complex, which are all located at the site of 100x100 m in size.

The power amplifier and the data receiving, procession and transmission complex are arranged in containers.

The elevation antenna system is essentially an antenna with a stationary phased antenna array, composed of eight antenna elements which are arranged upright.

Antenna elements are fixed on a common mast of 25 m in size.

Antenna gain – 18 dB.

General view of the receiving AFS

The receiving azimuth AFS is essentially a flat antenna array composed of cross-shaped vibrators, located in front of an aperiodic reflector.

The antenna array consists of 16 vertical rows of vibrators, 4 antenna elements in each row.

Horizontal antenna curtain aperture is 40 m,

Vertical height - 12.5 m.

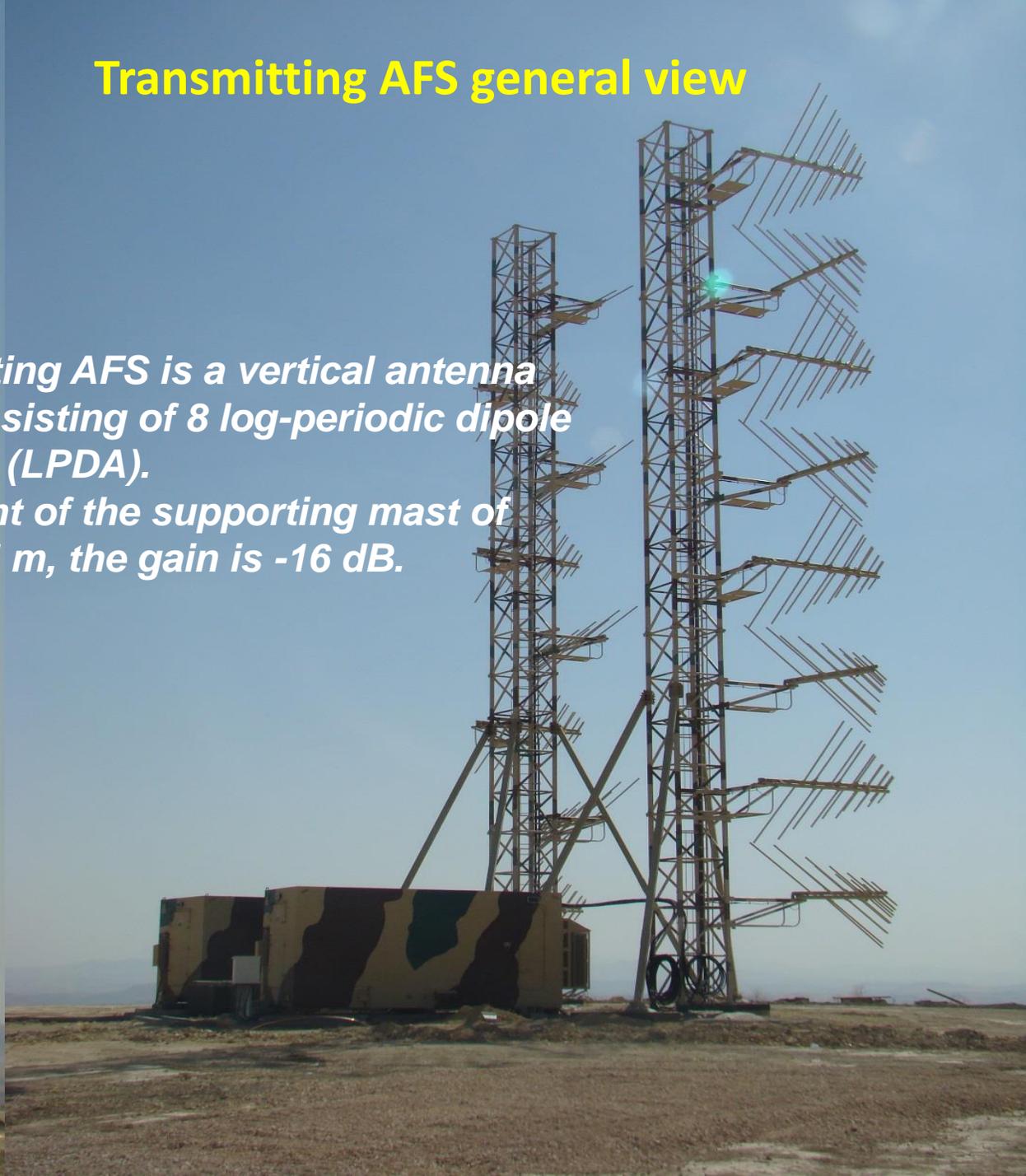
Gain - 24 dB.



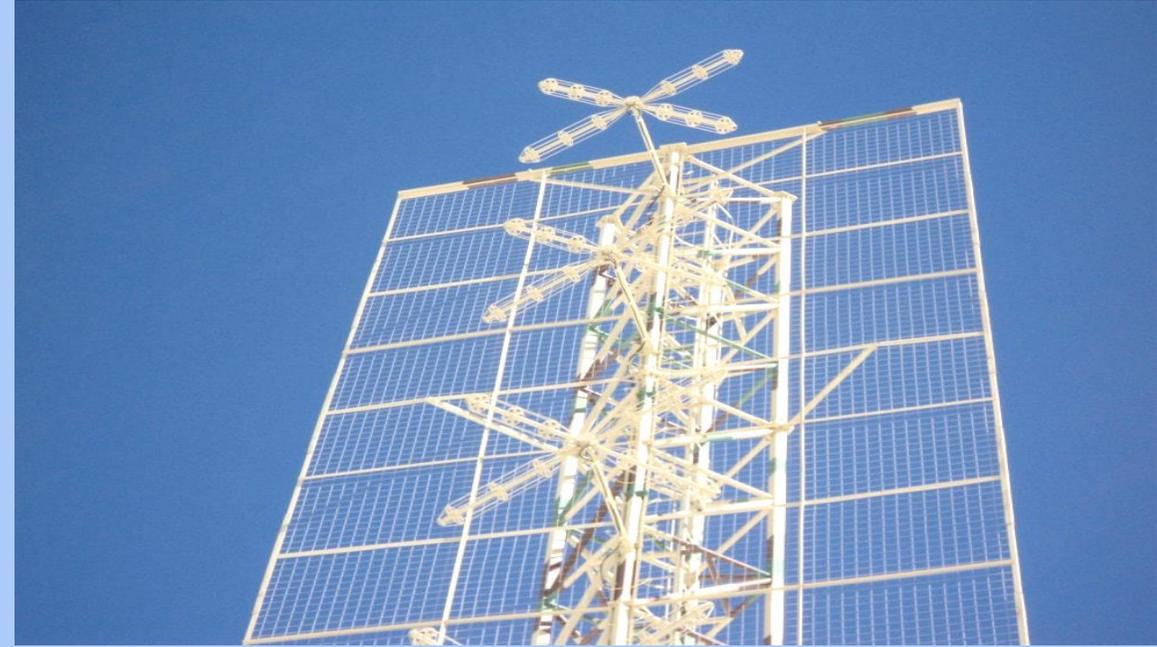
Transmitting AFS general view

Transmitting AFS is a vertical antenna array consisting of 8 log-periodic dipole antennas (LPDA).

The height of the supporting mast of AFS is 25 m, the gain is -16 dB.



Radar “Resonance-NE” Operational Characteristics



The radar “Resonance-NE” can operate under the following climatic conditions:

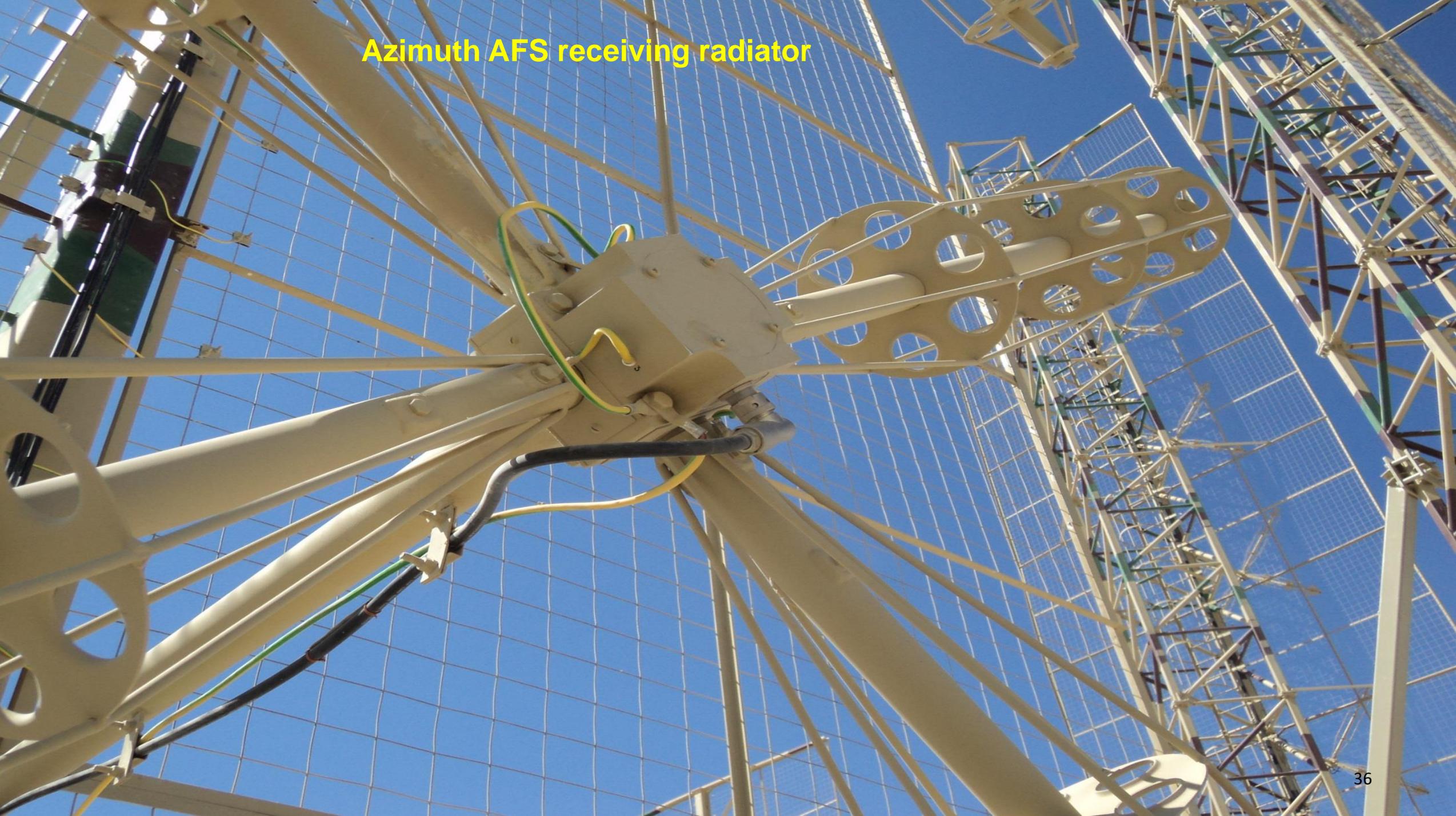
- wind force – up to **50** m/s;
- glazed frost – up to **15** mm in thickness;
- temperature – **50°C ÷ + 60°C**;
- moisture – up to **95%** at 25°C;
- precipitation density – up to **300** mm/h;
- dust density – up to 5 g/m³ ;
- salt fog - **33 ± 3** gr/l

Radar “Resonance-NE” is equipped with highly-efficient embedded lightning and pulse overvoltage protection

AFS 5L2-E transmitting radiator



Azimuth AFS receiving radiator





**Radio Electronic Complex (REC) General View
from the inside**

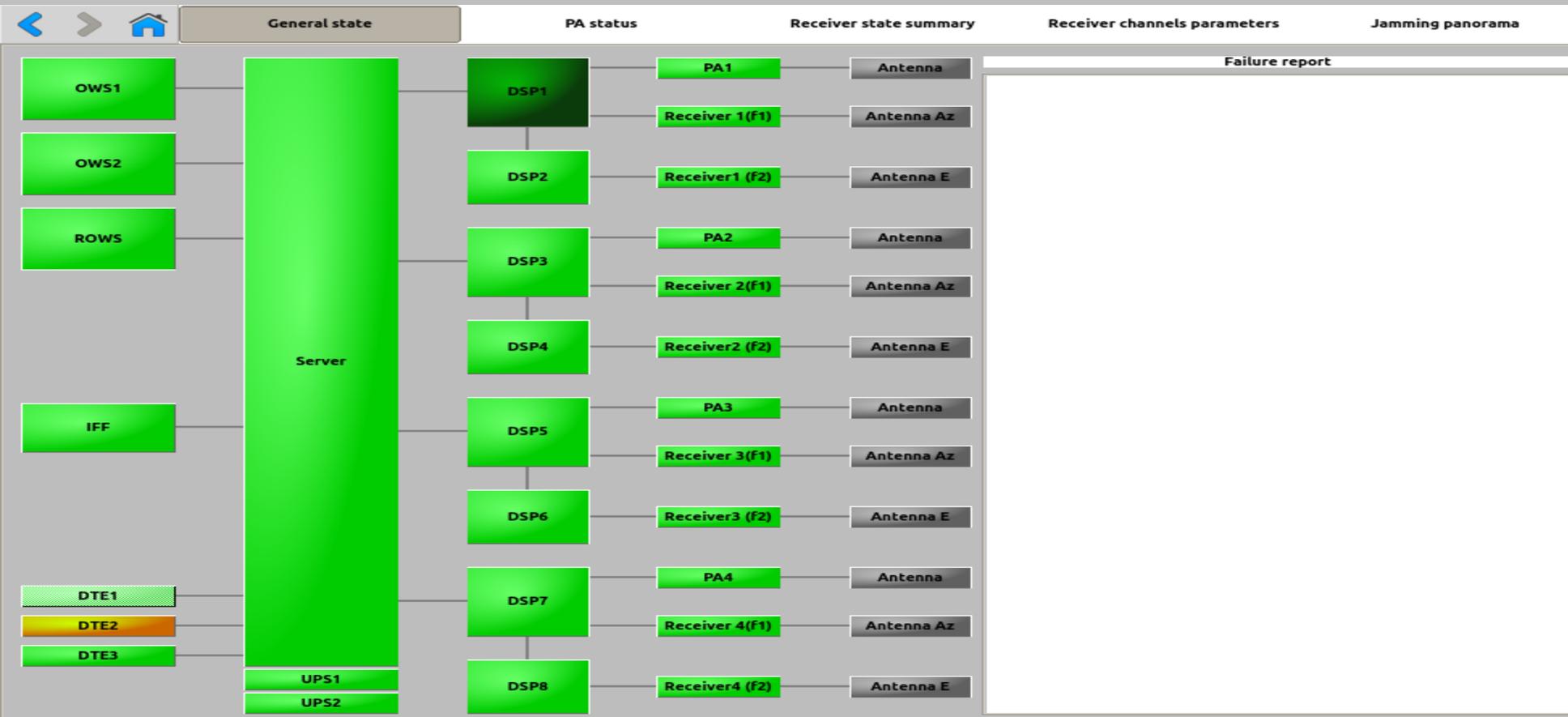
The Radar Operator's Work Station (OWS) View





General view of the device power amplification from the inside

Radar "Resonance-NE" Technical State Symbolic Circuits



Failure report

Empty area for reporting system failures.

Modes
Procession
Functions
Settings

Mode 1
Mode 2

	PA power				PA emission				N	W
1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>							
2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>							
IFF	<input checked="" type="checkbox"/>									

Frequencies setting	Assigned frequencies	
	F1	F2
<input type="checkbox"/> Sector1	51.3 (6 dB)	55.5 (0 dB)
<input type="checkbox"/> Sector2	49.4 (6 dB)	50.4 (0 dB)
<input type="checkbox"/> Sector3	37 (5 dB)	40 (4 dB)
<input type="checkbox"/> Sector4	48.7 (6 dB)	50.2 (1 dB)

Frequency sorting: noise number

ALBs

Polar
Cartesian

Delete
Delete all

Apply

RRC
 Guidance

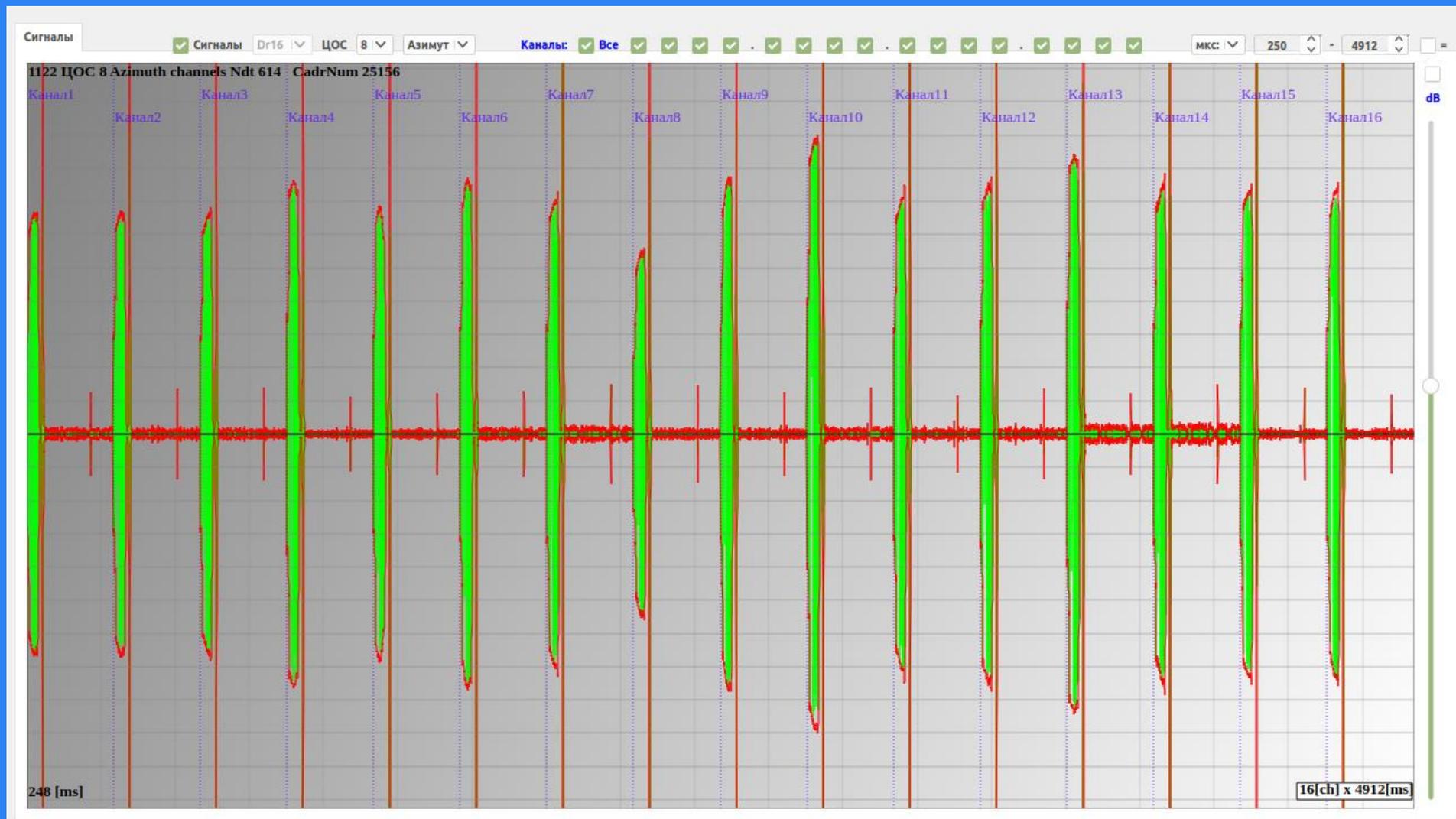
Nº UNo	A° C°	D, V	H, TCI	Ampl.dB Code.

Communication state
Interface with CC1

Communication state		DTE state		
Commander	Transmission initialization	Ready	Data delivery	Data receiving
Message receiving	Message delivery	Physical connection	Logical connection	

Protocol type: Polyana
 RX packets: 4640
 RX errors: 0
 TX packets: 48740
 TX errors: 6
 TX expired: 492
 Delay: 2290 ms

View of receiving channels status on the OWS screen in format - oscilloscope



Ground-based Interrogator «Lira-VME»

GIR «Lira-VME» is intended to:

operate in the international secondary radar system RBS controlling air traffic, and radar discrimination system MARK XII

GIR«Lira-VME» ensures:

in RBS system – detection and tracking of AO responding in modes 3/A, C, S, and obtaining data on flight barometrical altitude and Air object ID number;
in radar discrimination system MARK XII – IFF in modes 1, 2, 3/A, 4 (provided GIR is equipped with cryptographic hardware operating in MARK XII system).



GIR “Lira-VME” Basic Parameters

Frequency band – X-band

Coverage:

range..... 600 km;
azimuth..... 360 deg.;
elevation..... 45 deg.

Coordinates measurement accuracy:

range..... 50 m;
azimuth..... 6 min;

Number of detected target routes ...200

Data update rate ... ≤ 10 s

Power consumption < 10 kW

Mean time between failures -1500 h

Mean time to repair ...0,5 h

Crew...3 officers .

ADVANTAGES of «RESONANCE-NE» RDR and GIR «LIRA-VME» INTEGRATION

Joint use of GIR «Lira-VME» with the radar «Resonance-NE» reinforces the radar with extra combat capabilities within the GIR coverage area, viz.:

detection and tracking of air objects (AO) responding in modes 3/A, C, S of the RBS system and obtaining data on air object's flight barometrical altitude and ID number;

air objects IFF in the MARK XII radar IFF system, in modes 1, 2, 3/A, 4 (provided GIR is equipped with cryptographic hardware operating in MARK XII system);

enhanced accuracy of RDR «Resonance-NE» altitude value determination ;

enhanced accuracy of RDR «Resonance-NE» azimuth and range values measurement;

enhanced resolution of RDR «Resonance-NE» in range and azimuth;

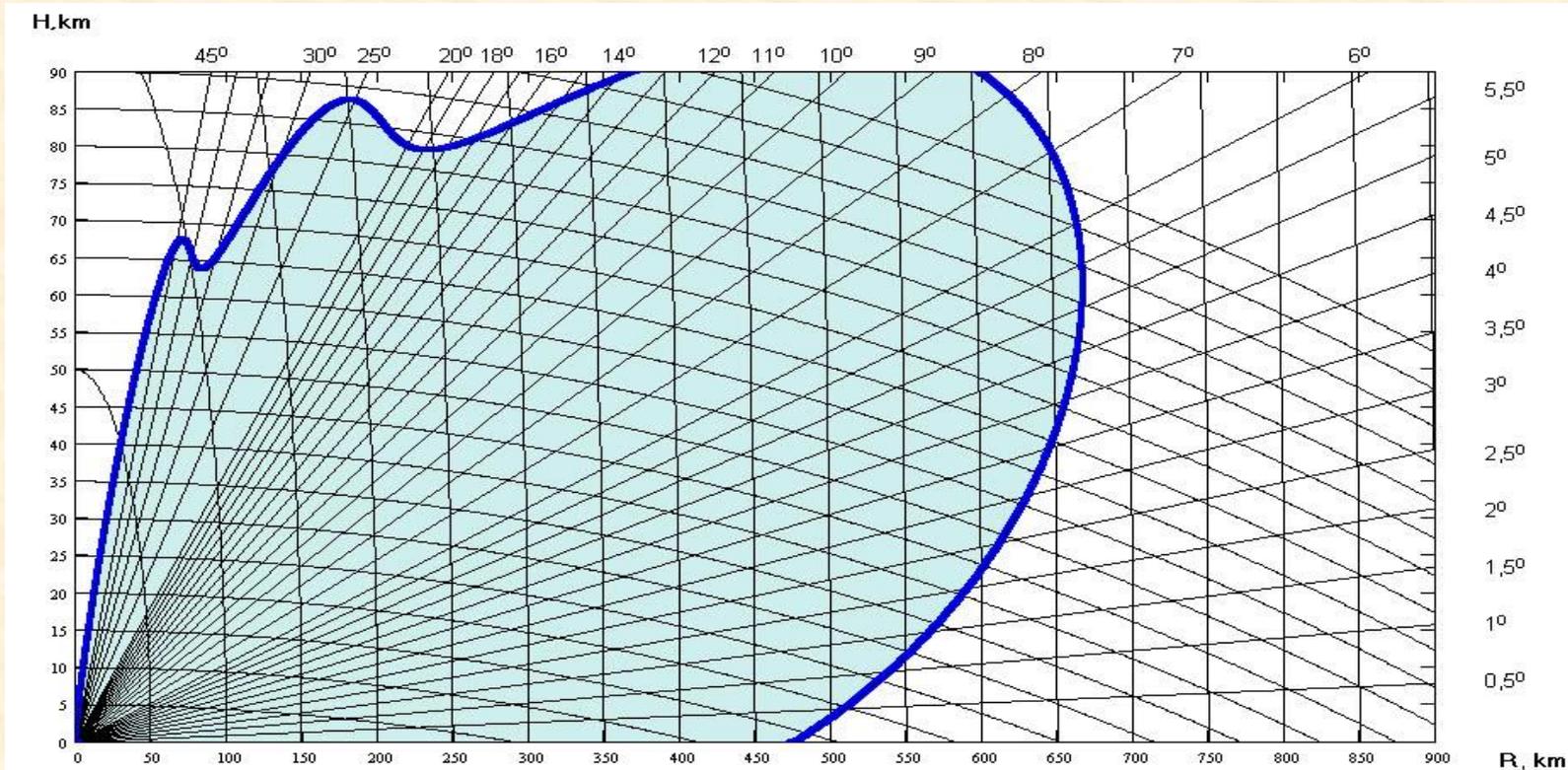
improvement in air objects detection and tracking quality;

improvement in air objects classification quality;

enhanced jamming protection due to complex application of different waveband radar equipment;

enhanced credibility of aerial targets intelligence systems and data completeness due to the mutual complement of combat capabilities of RDR “Resonance-NE” and GIR “Lira-VME”.

GIR “LIRA-VME” DETECTION ZONE



GIR “Lira-VME” is powered from 380/220 V 50 Hz mains.

GIR design and hardware construction provide:

- average service life of at least 15 years;**
- MTBF not less than 20 000 hours;**
- average recovery time not more than 30 minutes;**
- maximum wind speed at which the antenna rotates 35 m / s.**

To ensure GIR operability under different climatic conditions and wind loads, it can be equipped with radar dome 8.05.

Radome 8.05 specifications are as follows:

- diameter – 11,5 m;**
- height– 8,65 m;**
- weight – 12 600 kg;**
- max wind velocity – 70 m/s**

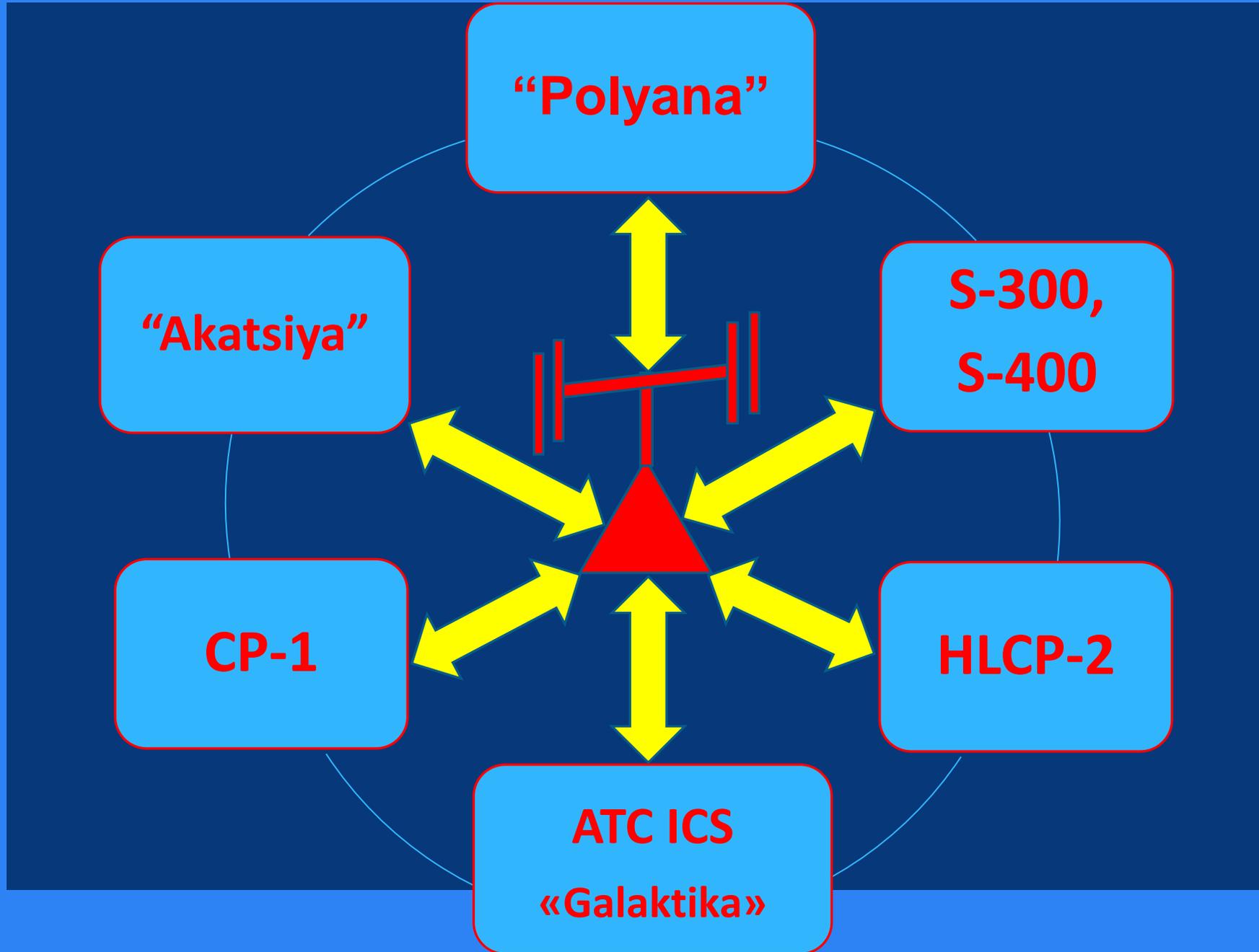
“RESONANCE-NE» RADAR STRONG ASPECTS

- long range of air targets detection;**
- all-altitude of air targets detection;**
- wide band of target detection and tracking velocities, including hypersonic ones;**
- high resolution (measurement accuracy) in velocity;**
- targets classification;**
- ballistic target tracking and forecast of its point of impact;**
- high rate of space surveillance;**
- high probability of detection of all target classes, including stealth ones;**
- precise target quantification in groups;**
- high jamming protection;**
- determination of flight data and IFF of air objects operating in Mark-XII system;**
- capability of semiautomatic target aiming at objects;**
- capability of interface with different ACS systems;**
- high reliability and continuous operation period;**
- modular design of the equipment;**
- low cost of production;**
- low cost of crew training and operation.**

OPTIONS OF THE RADAR “RESONANCE-NE” OPERATION USE

1. Radar of early detection of aerodynamic targets attack and early warning to Air Defence command posts about ballistic missile attack.
2. Radar that provides anti-aircraft complexes with airborne information.
3. Multifunctional alert radar intended for detection of a wide range of air targets and providing information on the air situation for various types of command posts.
4. Radar that creates continuously operating all-altitude air targets detection lines along the border.
5. Basic radar intended for creation of radar reconnaissance system in the area (direction, sector) of air defense.

"RESONANCE-NE" RADAR INTERFACE OPTIONS



“Resonance-NE” Radar Training Centre



“Resonance-NE” Radar Training Centre





**Multi-Role Long-Range Air Surveillance Radar "Resonance-NE"
for Ballistic Missile Early Warning System & Low Observable
Targets Detection**



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