



Measurement solutions



2018

## About us

Smitek specializes in engineering, development and production of automated testing facilities for retranslation units, receiver-transmitter units, components and antennas. In particular, our company produces robotic positioning equipment for use in research of various antenna characteristics. Combined with anechoic chambers our company creates measuring systems for measuring antenna pattern, gain and other antenna parameters, radiolocation characteristics of objects, properties of materials and equipment testing.

Our company has utilized and brought into practice different antenna measuring techniques: far-field region technique, collimator technique and near-field techniques (planar, cylindrical and spherical scanning) in continuous and pulse operation modes.

It is notable that our company provides turn-key solutions, i.e. completes all work stages: agrees technical requirements with the customer, engineering, development, production, shipping the equipment to customer's site, assembly and start-up works, acceptance testing, type approval testing, customer's staff training.

Antenna parameters measurement systems are meant for measuring all types of antennas: passive antennas, phased antenna arrays, active phased antenna arrays and digital antenna arrays, both in reception and transmission modes. Furthermore, our company also specializes in production of systems for RCS and deflection properties of materials testing.

Apart from the systems our company produces and supplies separate components: antennas and probe antennas, scanners (for planar, helical and spherical scanning), positioning mounts, collimators, cable assemblies, switch matrixes, amplifiers, work stations.

Our company also supplies anechoic chambers produced by Russian as well as foreign manufacturers.

As of current measuring systems produced by our company are operated at more than 20 sites. The systems have successfully been attested and certified as measuring tools.

Our company accommodates its own production facility to manufacture, monitor and assemble positioning tools, RF and electrotechnical products. In 2016 our company gained the Skolkovo resident status, as well as the status of Technopolis Moscow resident.

Production capacity of the company include complete production cycle of positioning mounts, scanners, antennas and collimators: blank production area (metal cutting, welding stations, annealing furnaces), powder coating area, precision milling area, metrological laboratory and product assembly area. Over 2000 m<sup>2</sup> production space. The production facility is situated in Moscow.

To maintain the equipment produced by our company we have a constant stock of components used in our products (reduction units, slides, bearings, engines). This way we can swiftly carry out change or repair.



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# 1. Positioners

- Precision positioners produced by Smitек company
- High movement speed
- Backlash of less than 1 angular minute
- Positioning accuracy of less than 0,01 deg
- Quiescent and dynamic loads calculation system
- Absolute encoders
- Reliable components produced by industry leaders
- Documented C++ software control protocols

Positioners are used for far-field antenna parameters measurement as well as for antenna under test positioning adjustment at near-field measurement.

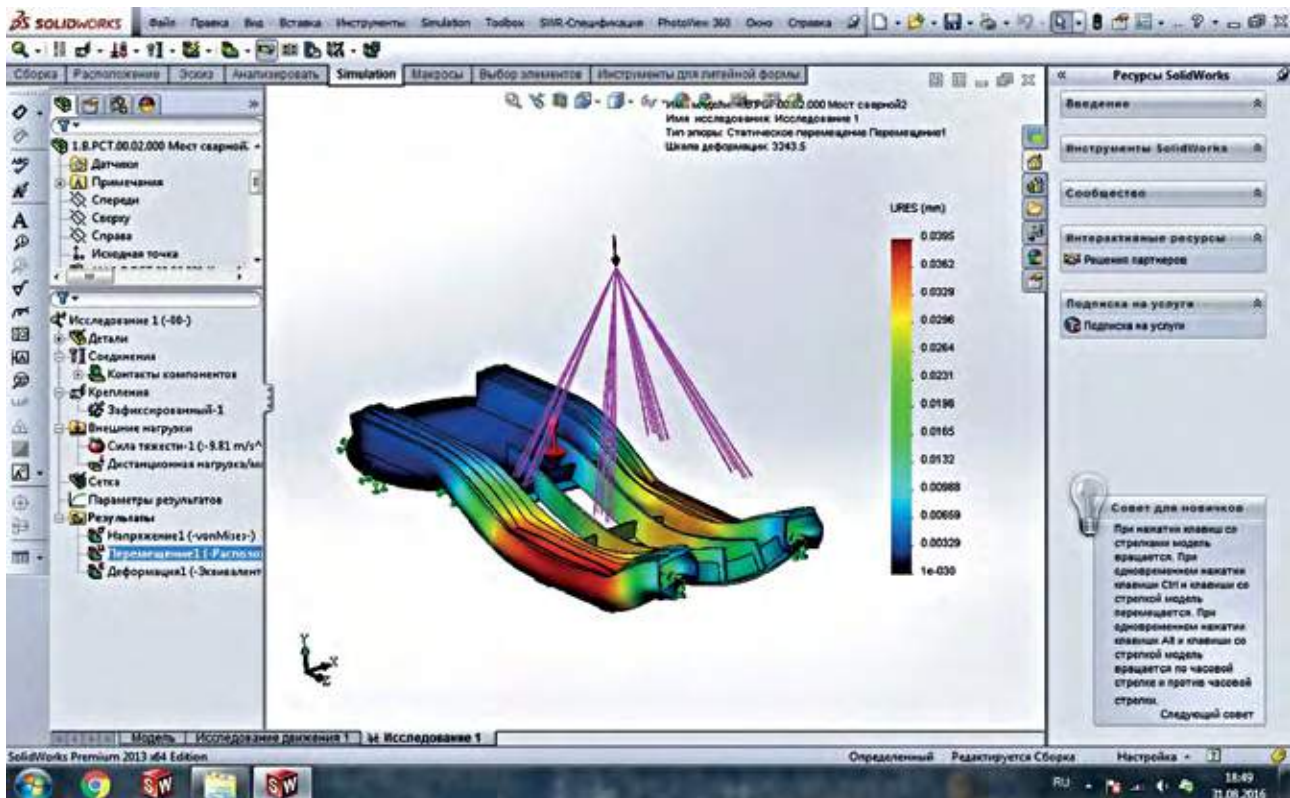
The design uses precision bearings, gears, and servo-motors from globally acknowledged industry leaders.

All positioners employ absolute encoders with resolution of 4 million pulse per revolution as position detectors, which helps achieve positioning accuracy. Implementation of standby power

supply units makes it possible to monitor change of position even when the controlling unit power is off, this way displacement of absolute coordinates is avoided and operator can always be sure that the position coordinates value is correct.

All positioners are designed according to engine, gears and bearing loads as well as the loads applied directly to the load-bearing frame of the positioned, this way positioning inaccuracies due to frame deformation under loads are brought to minimum.

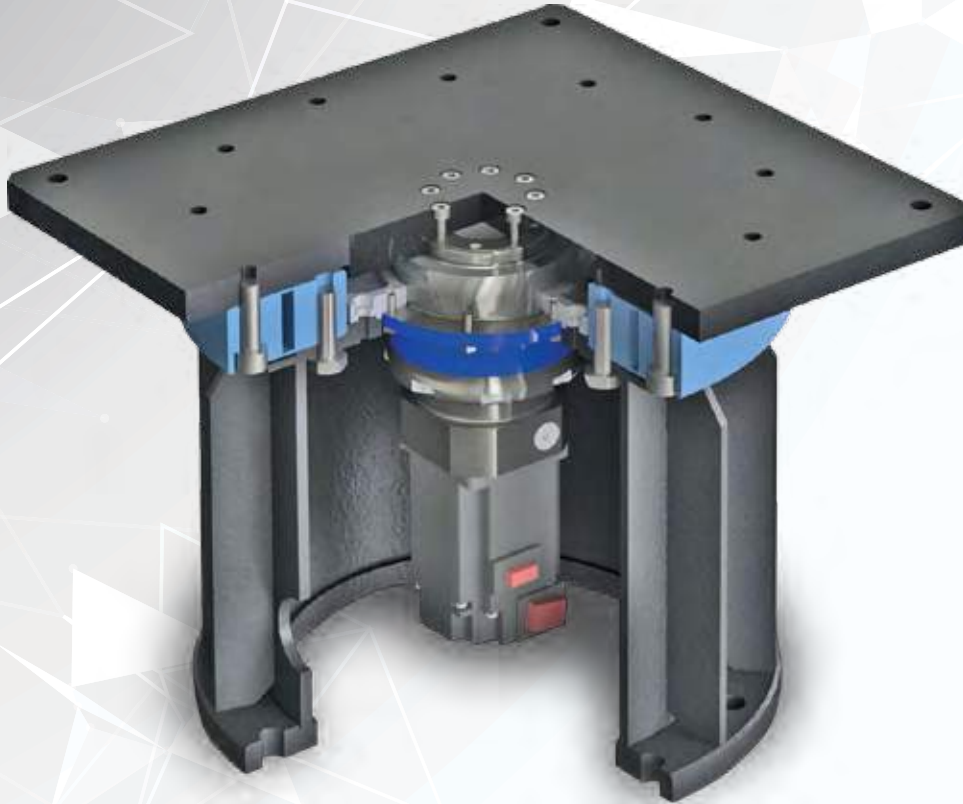
## Example of load estimation in SolidWorks software



Our company provides documented program protocol to manage the positioning tools to use positioners for different user applications (test equipment, object tracking etc.) устройствами позиционирования.

## PS-AZ series azimuth positioners

Smitek company presents azimuth positioner series PS-AZ designed for loads from 50 to 10 000 kg. For use in near and far field antenna parameters measuring as well as for precision positioning of objects under test.



### Characteristics

Parameter	Positioner model				
	PS-AZ-100	PS-AZ-300	PS-AZ-1000	PS-AZ-3000	PS-AZ-10000
Maximum vertical load, kg	100	300	1000	3000	10000
Nominal speed, rpm	20	16	10	5	3
Positioning inaccuracy, deg	0.01	0.01	0.01	0.01	0.01
Angular backlash, min	1	1	1	3	3
Travel range in azimuth, deg	0-360	0-360	0-360	0-360	0-360
Maximum tilting torque, kgm	100	200	500	1000	5000
Driver input power, kWt	1.2	1.2	1.2	1.2	2
Measurements, mm	350×350×350	400×400×350	500×500×430	600×600×430	800×800×500

### System configuration

Basic configuration includes positioner and controller executed in 19 inch high frame 4U with rack-mounting feature. Connection interface Ethernet. Power supply 220 V.

### Measuring options

**Option PS-RME**

adds absolute optical encoder on a rotary faceplate with 10 angular second accuracy.

**Option PS-SLIDE**

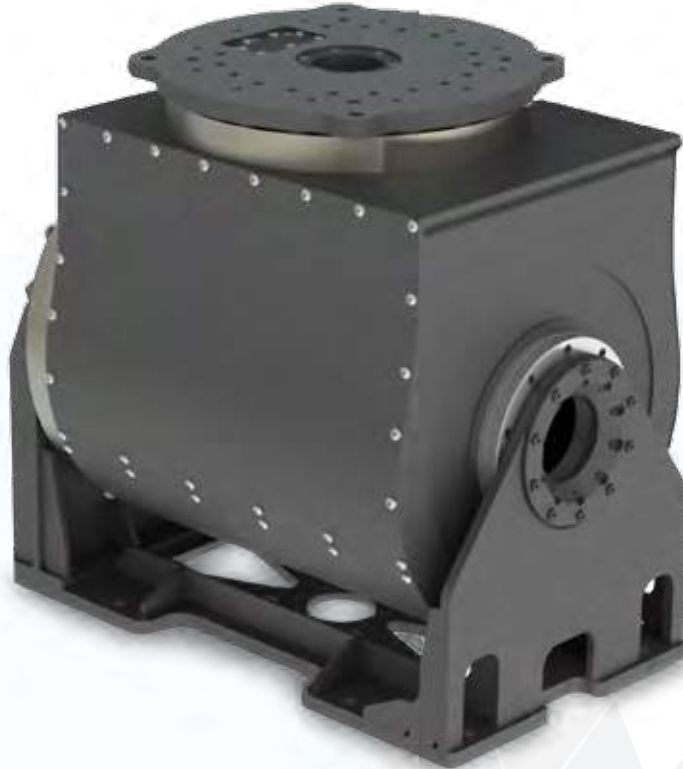
linear motion slides (configuration is defined according to PS-SLIDE series linear motion slide catalogue)

**Option PS-OTD**

outdoor execution

## PS-AZ/EL series azimuth-elevation positioners

Smitek company presents azimuth over elevation positioner series PS-EL-AZ for loads ranging from 50 to 5 000 kg. For use in near and far field antenna parameters measuring as well as for precision positioning of objects under test.



### Characteristics

Параметр	Positioner model				
	PS-AZ-EL-20	PS-AZ-EL-60	PS-AZ-EL-200	PS-AZ-EL-600	PS-AZ-EL-4000
Maximum vertical load, kg	50	300	600	1000	5000
Maximum stabilizing torque in elevation, Nm	200	600	1700	6000	40 000
Nominal speed, rpm	10	8	8	3	3
Travel range in azimuth, deg	0-360	0-360	0-360	0-360	0-360
Travel range in elevation, deg	From -90 to 90	From -90 to 90	From -90 to 90	From -90 to 90	From -90 to 90
Positioning inaccuracy, deg	0.01	0.01	0.01	0.03	0.03
Angular backlash, min	1	1	1	3	3
Maximum tilting torque, kgm	100	200	500	1000	1000
Driver input power, kWt	1.8	2	3.2	4	4
Measurements, diameter-height, mm	300×300×400	400×400×500	450×600×900	600×700×700	800×900×900

### System configuration

Basic configuration includes positioner and controller executed in 19 inch high frame 4U with rack-mounting feature. Connection interface Ethernet. Power supply 220 V.

### Measuring options

**Option PS-RME**

adds absolute optical encoder on a rotary faceplate with 10 angular second accuracy.

**Option PS-SLIDE**

linear motion slides (configuration is defined according to PS-SLIDE series linear motion slide catalogue)

**Option PS-OTD**

outdoor execution

**\* Custom production according to customer's parameters is available!**

## PS-AZ-SL-EL-PL series 4-axis positioners

KSmitek company produces and provides four-axis positioners rotating in azimuth, polarization, elevation and linear motion of PS-AZ-SL-EL-PL series designed for a range of loads from 50 to 1000 kg.

For use in near and far field antenna parameters measuring as well as for precision positioning of objects under test.



### Characteristics

Parameter	Positioner model			
	PS-AZ-SL-EL-PL-20	PS-AZ-SL-EL-PL-60	PS-AZ-SL-EL-PL-200	PS-AZ-SL-EL-PL-600
Maximum vertical load, kg	50	300	600	1 000
Maximum stabilizing torque in elevation, Nm	200	600	1 700	6 000
Nominal speed, rpm	10	8	8	3
Travel range in azimuth, deg	0-360			
Travel range in elevation, deg	From -90 to 90			
Travel range in polarization, deg	From -90 to 90			
Positioning inaccuracy, deg	0.01	0.01	0.01	0.03
Angular backlash, min	1	1	1	3
Maximum tilting torque, kgm	100	200	500	1 000
Linear motion range, mm	From 0 to 1000	From 0 to 1000	From 0 to 1000	From 0 to 1000
Driver input power, kWt	1.2	2	3.2	4
Measurements, diameter-height, mm	300×300×400	400×400×500	450×600×900	600×700×700

### System configuration

Basic configuration provides a positioner together with a controller executed in 19 inch high frame 9U with rack-mounting feature. Connection interface Ethernet. Power supply 220 V.

### Measuring options

#### Option PS-RME

adds absolute optical encoder on a rotary faceplate with 10 angular second accuracy.

#### Option PS-SLIDE

linear motion slide units (configuration is defined according to PS-SLIDE series linear motion slide units catalogue)



## PS-SLD series linear motion slide units

Smitek company presents PS-SLD series linear motion slide units designed for a range of loads from 500 to 10 000 kg. For use in near and far field antenna parameters measuring as well as for precision positioning of objects under test.



### Characteristics

Parameter	Positioner model			
	PS-SLD-500	PS-SLD-2000	PS-SLD-5000	PS-SLD-1000
Maximum vertical load, kg	500	2000	5000	10,000
Maximum tilting torque, Nm	2000	6000	10,000	20,000
Nominal speed, m/min	25	15	8	5
Maximum Z travel length range, m	From 1 to 20	From 1 to 20	From 1 to 20	From 1 to 20
Positioning inaccuracy, mm	0.1	0.1	0.1	0.1
Maximum tilting torque, kgm	100	200	500	1000
Driver	1.2	2	2	2
input power, kWt	100	200	500	1000
Measurements, width-height, mm	1,2	2	2	2
Габариты, диаметр-высота мм	600×200	600×200	1100×400	1100×400

### System configuration

Basic configuration provides a positioner together with a controller executed in 19 inch high frame 4U with rack-mounting feature. Connection interface Ethernet. Power supply 220 V.

### Measuring options

#### Option PS-RME –

adds absolute optical encoder on a rotary faceplate with 10 µm/m accuracy.

## PSR series 5-axis positioners

Antenna parameters far-field measurement has not only obvious advantages concerning the fact that there is no need to carry out complex mathematical operations, but also a range of requirements to bench elements resulting from necessity of precision positioning of the product under test in several (2-6) spatial axes. Therewith, one of the most complex things in

multi-axis positioners is the above azimuth slider. It should have minimal bend under vertical and moment loads with hangout from attachment point to azimuth axis. Our company is the first in industry to develop a mechanism with an additional bearing of 2 m radius which takes substantial moment load off the slider. This leads to much less slider bending.

- PSR series positioner axes quantity – up to 5 (optional – up to 6).



## Composition

- Lower slider for positioner linear coordinate movement.
  - As a rule, it is used for displacement nearer\farther from collimator or for installing a positioner into the spot suitable for antenna mounting.
- Azimuth rotation axis
- Horizontal slider above azimuth.
  - As a rule, it is used for mounting the antenna in the phase center in azimuth rotation.
- Vertical slider on horizontal slider above azimuth.
  - As a rule, it is used for convenience of antenna mounting at human scale height. It is also used for volume radiation pattern measurement with 3-axis movement interpolation for antenna installation in the phase center at elevation movement.
- Elevation.
- Rotation axis in polarization.

## Features

The product is unique in the global market. The positioner has an outer slew ring that provides the second attachment point for the horizontal slider above azimuth. This substantially rises ruggedness of the slider and allows executing a slider with more than 1200 mm travel with minimal bending of the frame under the weight of the antenna under test.

The device employs self-produced precision mechanics, precision electronics, optical encoders, servo technics, radio technics as well as mathematical and software algorithms.

The positioner allows setting up compound or sequence multi-axis movement for volume scanning when antenna remains in the phase center.

## Competitive advantages

### Implementation of such kinematics has a range of substantial advantages:

1. Lower requirements to positioner basis as the weight is distributed on a wider area and moment loads get substantially lower.
2. Substantial decrease of bending allows for a more accurate positioner set-up in benches with collimators.
3. Ability to work with antennas of different weight without sacrifice of accuracy.
4. Volume scanning with antenna kept in the phase center.

## Cost advantage

Lower costs of the chamber base. testing cycle due to volume scanning with antenna being always positioned in the phase center (no need to carry out additional calculations).

## Characteristics

Parameter	Positioner model			
	PS-SL-AZ-SL-EL-PL-20	PS-SL-AZ-SL-EL-PL-60	PS-SL-AZ-SL-EL-PL-200	PS-SL-AZ-SL-EL-PL-600
Maximum vertical load, kg	50	300	600	1000
Maximum stabilizing torque in elevation, Nm	200	600	1700	6000
Nominal speed, rpm	10	8	8	3
Travel range in azimuth, deg	0-360			
Travel range in elevation, deg	From -90 to 90			
Travel range in polarization, deg	From -90 to 90			
Positioning inaccuracy, deg	0.01	0.01	0.01	0.03
Angular backlash, min	1	1	1	3
Maximum tilting torque, kgm	100	200	500	1000
Linear motion range, mm	From 0 to 1000	From 0 to 1000	From 0 to 1000	From 0 to 1000
Driver input power, kWt	2	3	3	3

## 2. Antenna parameters near-field measuring scanners

### Systems based on PSN series planar scanners

- Scan range from 1 to 20 m
- Positioning accuracy in axes X and Y is 0,005 mm/m
- Accurate incline adjustment in horizontal and vertical axes
- Modular design with capability of widening the scan range
- Absolute optic encoders of linear motion with 5  $\mu$ m accuracy



#### Description

PSN series planar scanners are used for antenna parameters measuring with the help of amplitude and phase measurement technique in the near field, frequency range up to 40 (110) GHz.

#### Advantages

Key parameters for planar scanners are positioning accuracy and movement velocity. Combined with adjustment devices PSN series scanners provide positioning accuracy of 0,005 mm/m, which corresponds with industrial standards for high-end positioning devices. PSN series scanner movement velocity is 2000 mm/min, thus combined with automated data acquisition and control RL-BEAM provides leading values in antenna measurement time.

Latest linear absolute optic encoders are used in the product which makes it possible to eliminate inaccuracies connected with tower manufacturing faults and angular backlash of the reducing gear.

Absolute encoders together with non-volatile position memory system reduces start-up time up to less than 1 minute.

Unique position adjustment and latching system as well as rugged steel construction allow to preserve adjustment accuracy characteristics for a longer period of time if compared with similar aluminum constructions.

## Characteristics

Модель	PSN-150	PSN-200	PSN-300	PSN-400	PSN-500	PSN-1000
Model	1,5×1,5	2×2	3×3	4×4	5×5	10 (up to 20)×10
Scanning range, m	1 - 40 GHz	1 - 40 GHz	1 - 40 GHz	1 - 40 GHz	1 - 40 GHz	1 - 40 GHz
Frequency range	0.03	0.03	0.06	0.08	0.1	0.2
Planarity, mm (RMSD)	0.01	0.01	0.02	0.03	0.035	0.05
Positioning accuracy, mm	30 kg					
Maximum load limit, kg	10					
Scanning velocity, m/min	< 600	< 750	< 850	< 1000	< 1500	< 3000
Weight, kg						

\* It is possible to manufacture other sizes of scanning range, maximum load limit and frequency range

## System configuration

Basic configuration provides a positioner together with a controller executed in 19 inch high frame 6U/9U with rack-mounting feature. Connection interface Ethernet. Power supply 220 V. Consumption not more than 3 kWt.



## Measuring options

Option PSN-ZRoll –

automated probe rotation in polarization system 0 – 360 deg.

Option PSN-ZMW –

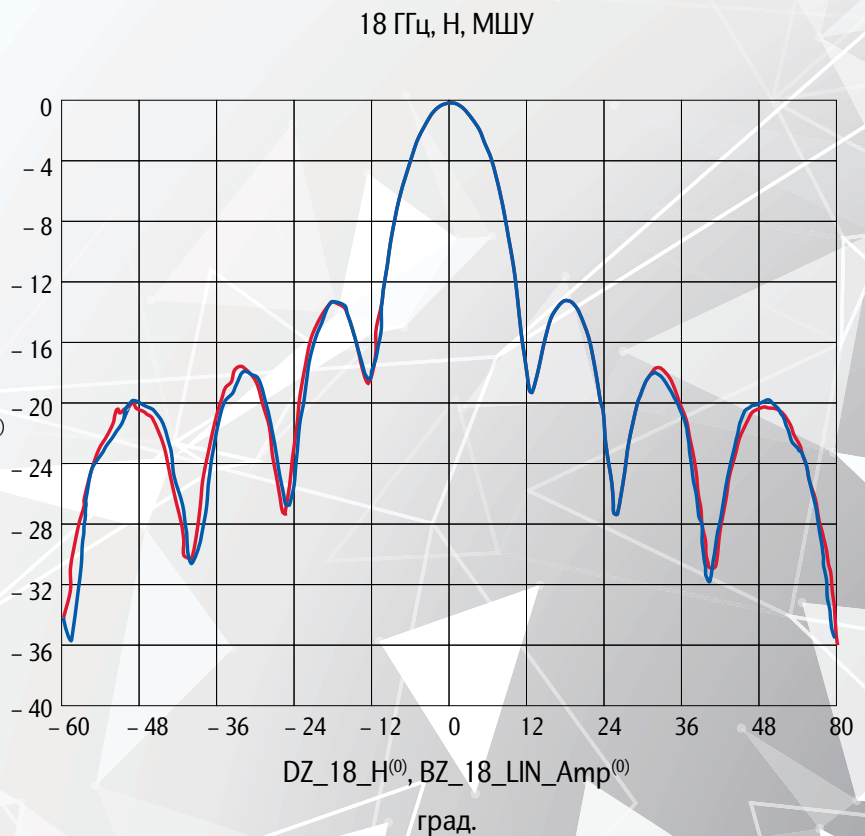
unit for probe movement in axis Z in the range from 0 to 800 mm.

Option PSN-ZMW2 –

unit for probe movement in axis Z in the range from 0 to 1600 mm.

Radiation pattern comparison results for a reference horn antenna that was measured in the far-field and the same antenna measured with PSN series planar scanner in the near field with conversion to the far field, frequency 18 GHz.

дБ DZ\_18\_H<sup>(1)</sup>  
BZ\_18\_LIN\_Amp<sup>(1)</sup>



## Systems based on PSX series portal frame scanners

### PSX series portal-frame scanner for near-field antenna measurement

Portal-frame scanner provides high-accuracy positioning of the device (antenna, laser probe) according to four space coordinates. Probes or technological devices move on a steady carriage above the object positioned for test or production operations. Objects under test can be antenna arrays, integrated radar systems and satellite repeaters. For those objects the scanner allows to measure radiation patterns and gain and carry out alignment of antenna arrays

Presented system is also capable of measuring large-scale products that require control of geometrical adjectives (paraboloid antennas, active electronically scanned arrays and other objects.) For such objects the scanner functions as highly accurate no-contact type coordinate measuring machine (with laser probe attached to the carriage).

**Scanner measurements up to 15×8×6m (L×W×H).**

**Scanner measurements up to 15 × 8 × 6 м (L × W × H).**



### Features of the scanner

The product is unique in the global market. Scanner has a bridge-frame construction with two tandem axes in horizontal movement coordinate (tower movement) and in vertical movement as well (upward and downward movement of the connection strap). Scanner is able to carry out linear 3-axis movement interpolation as well as calibration measurements to improve movement accuracy.

Scanner system is capable of horizontal, vertical, inclined and spherical scanning.

The device employs self-produced precision mechanics, laser probes, precision electronics, optical encoders, servotechnics, radiotechnics as well as complex mathematical and software algorithms.

## Competitive advantages

### Implementation of such kinematics has a range of substantial advantages:

1. Effective volume of the scope of movement area gets drastically larger due to vertical movement of the connection strap without necessity to add the axis of the slide block movement (vertical movement axis on the basis of a separate constructional part).
2. Absence of a slide block results in substantially lower weight of the connection strap, which improves dynamic characteristics - movement velocity and permitted value of accelerations/brakes of the technological device (antenna, detector).
3. Lower requirements to needed ceiling height.
4. This is a multi-purpose device that can be used for various production tasks (antenna measurements and coordinate metrology).
5. Movement interpolation functions allow to set movement patterns differing from linear ones (inclined, spherical, cylindrical etc.)
6. Bench calibration feature improves accuracy of movement.
7. Implementation of planar and spherical scanning in one bench.
8. Ability to work with antennas of different heights ranging from 100 mm to 6000 mm without staple clamps.
9. No need to align the antenna array under test to scanner, no need to use positioner for the antenna under test.



## Cost advantage

### Cost advantage for consumer:

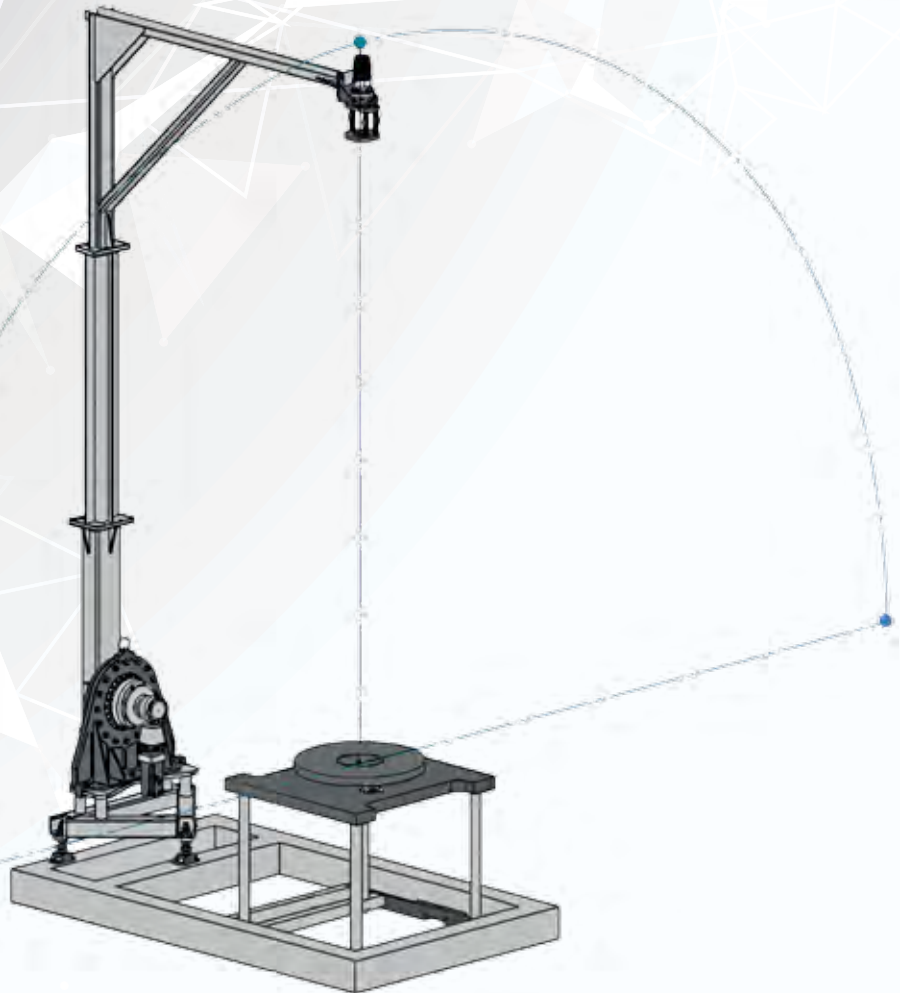
- Lower requirements to selling height allows to reduce construction and building equipment costs for 10-15%.
- Higher operation velocity improves production efficiency for 15-20%.
- Possibility to work with objects of different heights and purposes allows to unify the system also for different tasks, which increases overall equipment effectiveness (effectiveness value is estimated for each customer)
- Conserving on staple lift, positioner and specialized fixturing.

## Characteristics

Model	PSX-X-2000	PSX-X-3000	PSX-X-4000	PSX-X-5000	PSX-X-6000
Scanning range, X-Y, m	(from 2 to 20) × 2	(from 2 to 20) × 3	(from 2 to 20) × 4	(from 2 to 20) × 5	(from 2 to 20) × 6
Frequency range	1 - 50 GHz	1 - 50 GHz	1 - 50 GHz	1 - 50 GHz	1 - 50 GHz
Planarity, mm (RMS)	0.03	0.06	0.08	0.1	0.2
Accuracy of linear coordinate positioning, mm	0.01	0.02	0.03	0.035	0.05
Maximum load limit, kg	100				
Scanning velocity, m/min	10				

## Systems based on arch scanners

- Scanning radius from 0,5 to 4 m.
- Positioning accuracy in angular coordinates 0,02 deg.
- Accurate incline adjustment in antenna pointing.
- Use of optical absolute encoders.
- Прецизионные сканеры Российского производства.



### Description

PSA-ARCH series arch scanners are designed for antenna measurement with spherical near-field scanning within frequency range up to 40 (110) GHz.

### Advantages

Ability to draw radiation pattern in wide angle sector 180 deg. Suitable for measuring antennas with low gain and wide radiation pattern.

### Characteristics

Model	PSA-ARCH-50	PSA-ARCH-100	PSA-ARCH-200	PS-ARCH-300	PS-ARCH-400
Scanning radius, m	0.5	1	2	3	4
Frequency range	0,5 – 40 GHz	0,5 - 40 GHz	0,5 - 40 GHz	0,5 - 40 GHz	0,5 - 40 GHz
Antenna positioning accuracy, deg	0.02	0.02	0.06	0.08	0.1
Antenna positioning accuracy, mm	0.1	0.1	0.1	0.1	0.1
Maximum load limit, kg	20 kg				
Scanning velocity, deg/sec	5				
Weight, kg	< 200	< 250	< 450	< 500	< 600

### Measuring options

**Option PSA-ZRoll**

automated probe rotation in polarization system 0 – 360 deg.

**Option PS-AZ**

measured antenna rotation positioner.



## 3. Systems for measuring reflective and dielectric properties of materials

Dielectric materials characteristics measurement can provide crucially important information for many electronic applications. For example, insulation losses, Например, потери в изоляции кабеля, substrate resistance or dielectric resonator frequency are directly connected with dielectric properties. This information is also useful for ferrite properties improvement, radiation absorbers and case construction. The newest applications in aerospace, automotive, food and medical industry can also use the advantages of knowledge of dielectric properties.

Smitek, OJSC produces measurement systems for studying parameters of materials using free space technique, coaxial probe technique, parallel plates technique, coaxial/waveguide transmission lines technique and resonant chambers technique.

### System based on pendulum scanner and dielectric and dielectric table

- Scanning radius from 1 to 4 m.
- Positioning accuracy in angular coordinates 0,02 deg.
- Accurate incline adjustment in antenna pointing.
- Use of optical absolute encoders.

### Description

PSA-ARCH pendulum scanners are designed to measure parameters of reflective properties of materials by measuring reflection parameter using single antenna method S11 and dual antenna technique S21 up to 40 (110) GHz. System configuration may include a single pendulum positioner as well as two pendulum positioners functioning in a synchronous manner.

Pendulum scanner size is chosen according to frequency range measurement criteria and sample size. Mandatory requirement for such measurements involves positioning of measurement antennas in the far-field relative to measured sample location.

### Advantages

- Modulus of reflection coefficient, RCS measurement of flat and volume objects.
- Measurement of inverse diffraction matrix
- Ability to measure absorption properties of materials at one-way measurement when two pendulum positioners (S21) are horizontally oriented
- Construction of graphs for angular dependence of reflective properties of materials
- High accuracy and scanning velocity in comparison with traditional arch system



### Characteristics

Model	PSA-ARCH-200	psa-arch-300	PS-ARCH-400
Scanning radius, m	2	3	4
Frequency range	0,5 - 40 GHz	0,5 - 40 GHz	0,5 - 40 GHz
Antenna positioning accuracy, deg	0.06	0.08	0.1
Antenna positioning accuracy, mm	0.1	0.1	0.1
Maximum load limit, kg		20	
Scanning velocity, deg/sec		5	
Weight, kg	< 450	< 500	< 600

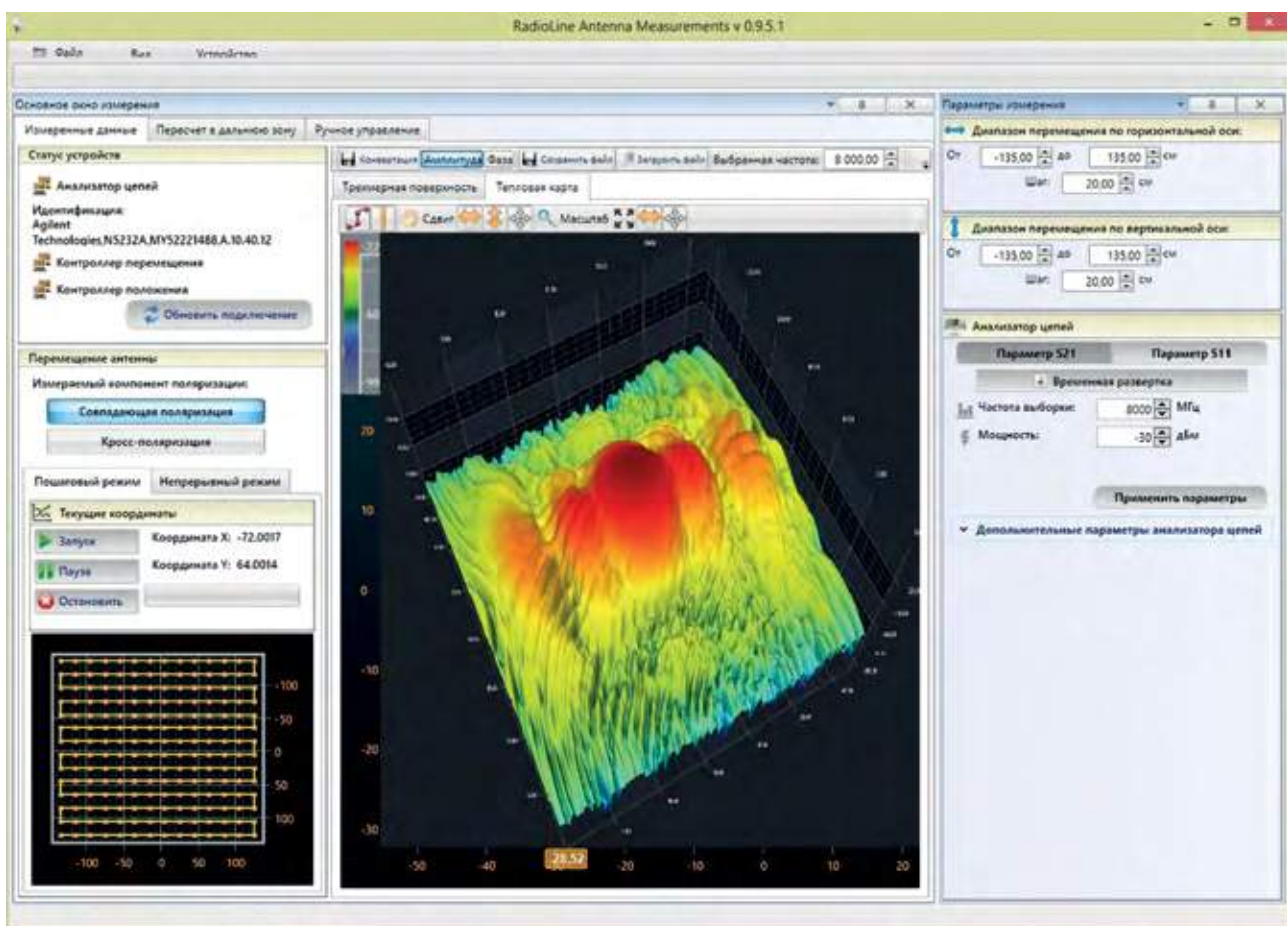
### Measuring options

**Option PSA-ZRoll**  
**Option PS-AZ**

automated probe rotation in polarization system 0 – 360 deg.  
measured antenna rotation positioner.

## 4. Software for antenna measurement

RL-BEAM-NF software for antenna parameters measurement in the near field



RL-BEAM-NF software is developed by Smitex company for antenna measurement, it is a multithread application that performs following functions:

- control of the measurement system and positioner in use
- scanning and data acquisition synchronization
- mathematical data processing, measurement results storage and view
- measurement reports automated generation in compliance with the customer's form and requirements

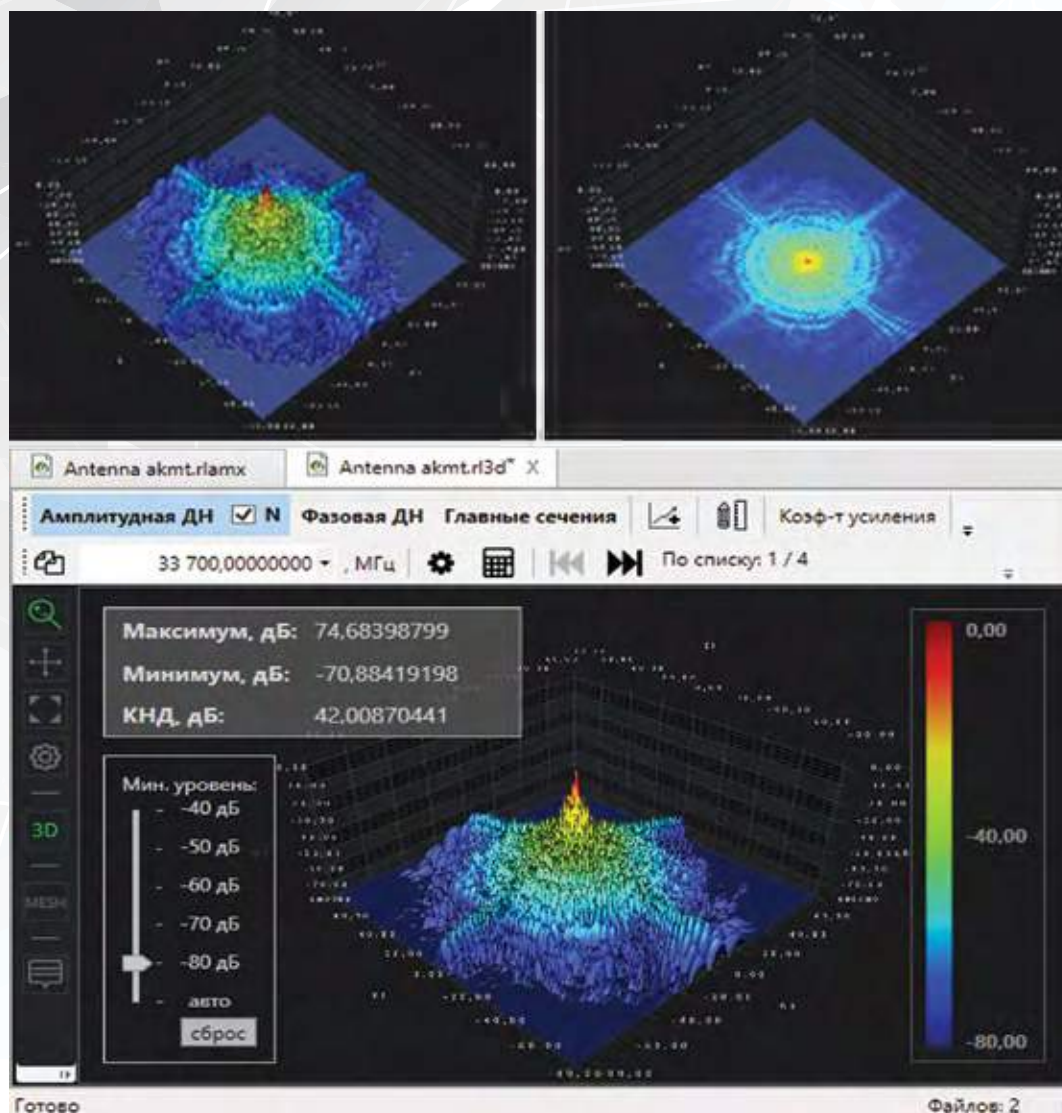
### Measured parameters

- Amplitude-phase distribution in the near field
- Amplitude radiation pattern, phase radiation pattern in the far field (volume 3D diagrams)
- Far-field amplitude radiation pattern and phase radiation pattern basic cutset
- Gain
- Directivity
- Polarization characteristics
- Phase center



# SMITEK

## RL-BEAM-FF software for antenna parameters measurement in the far field



**RL-BEAM-FF software is developed by Smittek company for antenna measurement, it is a multithread application that performs following functions:**

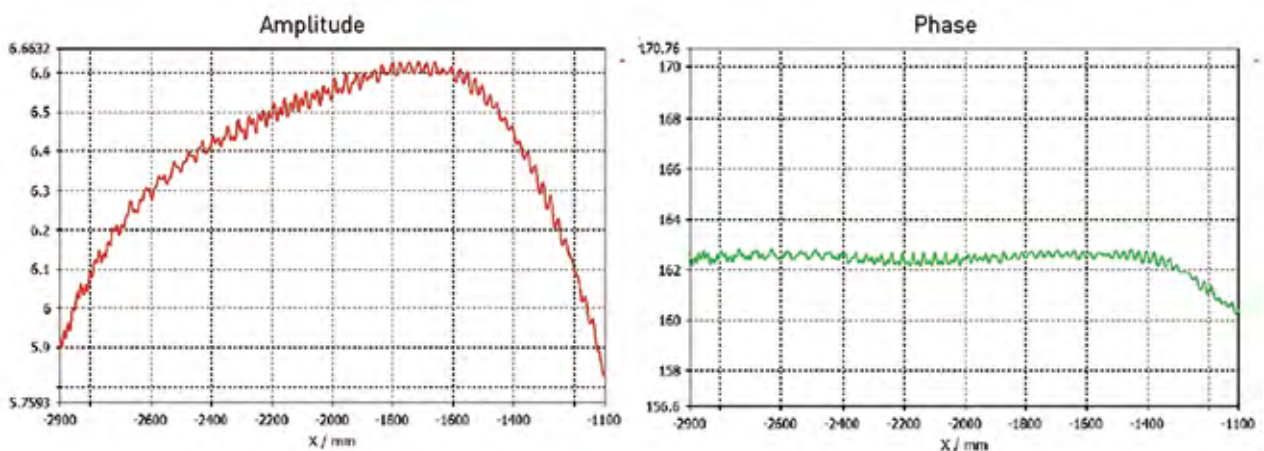
- control of the measurement system and positioner in use;
- scanning and data acquisition synchronization;
- mathematical data processing, measurement results storage and view;
- measurement reports automated generation in compliance with the customer's form and requirements.

### Measured parameters

- Amplitude radiation pattern, phase radiation pattern in the far field (volume 3D diagrams)
- Far-field amplitude radiation pattern and phase radiation pattern basic cutset
- Gain
- Directivity
- Polarization characteristics
- Phase center

## 5. Reflectors

CLR series rolled-edge reflectors for far-field benches



Smitek company has launched production of rolled-edge reflectors. As of current maximum size is 3,6x3,6 meters with quiet zone of 1,8 meters.

Reflectors are made of more than 250 mm thick milled aluminum panels. Reflector frame is also made of aluminum, which provides thermal symmetry of the construction. The design does not suggest any adjustment elements for segment connection, which substantially lowers requirements for reflector maintenance. All elements are milled on precision 5-axis machine with 15  $\mu\text{m}/\text{m}$  precision, which provides the highest quality of the working surface

### Characteristics

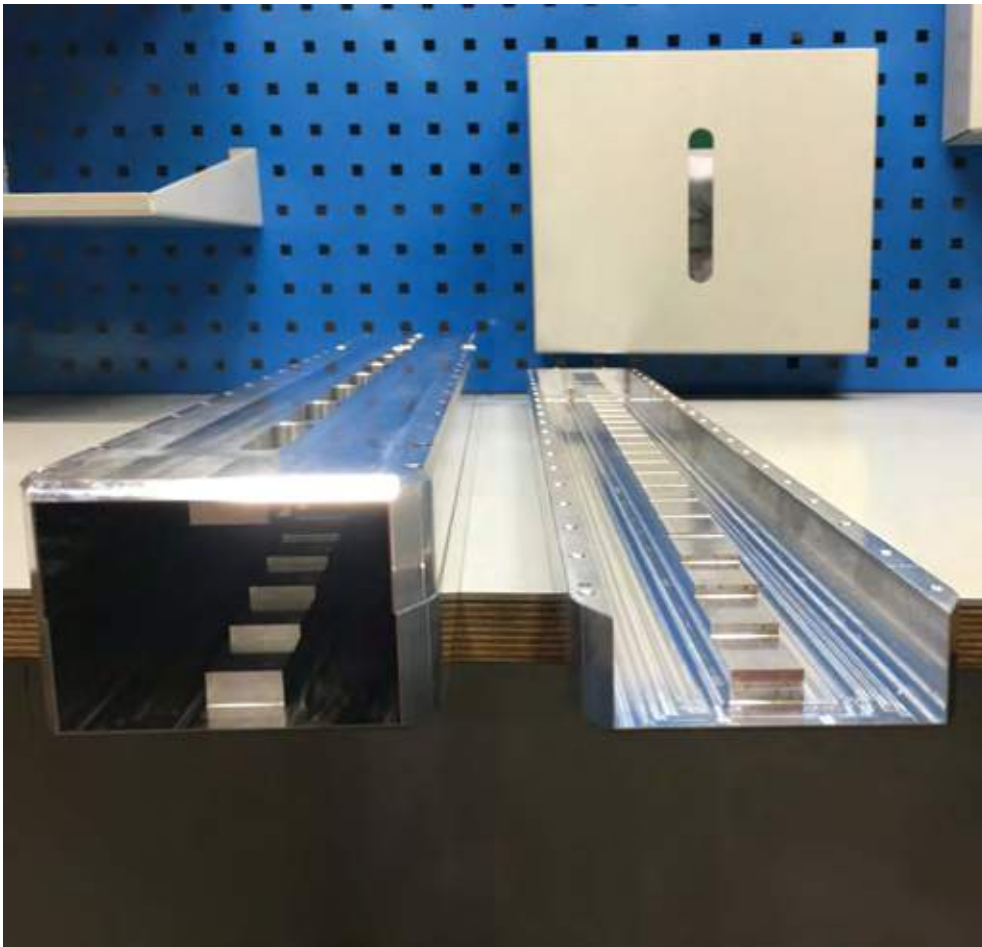
Model	CLM-240	CLM-300	CLM-360
Reflector measurements,m	2.4 × 2.4	3 × 3	3.6 × 3.6
Frequency range, GHz	3 - 110	2 - 110	1 - 110
Quiet zone size, m	1 × 1	1.5 × 1.5	1.8 × 1.8
Amplitude ripple, dB	0.5	0.5	0.5
Amplitude taper, dB		< 0.8	
Phase ripple, deg		< 8	
Weight, kg	2160	2900	3600

## 6. Probes for near-field measurement

Special probes need to be used for antenna parameters measurement in the near field, these probes are open-ended waveguides. We have developed probe series based on H-shaped waveguides with superior standing-wave ratio parameters.

### Characteristics

Parameter	Model				
	ZND-1-2	ZND-2-4	ZND-4-8	ZND-8-18	ZND-18-40
Frequency range, GHz	1-2	2-4	4-8	8-18	18-40
Connector	N-type	SMA	SMA	SMA	2.92
Standing-wave ratio	1.5	1.6	1.6	1.7	1.8
Weight, kg	14	3	1.6	0.7	0.4



## 7. Turn-key antenna sites

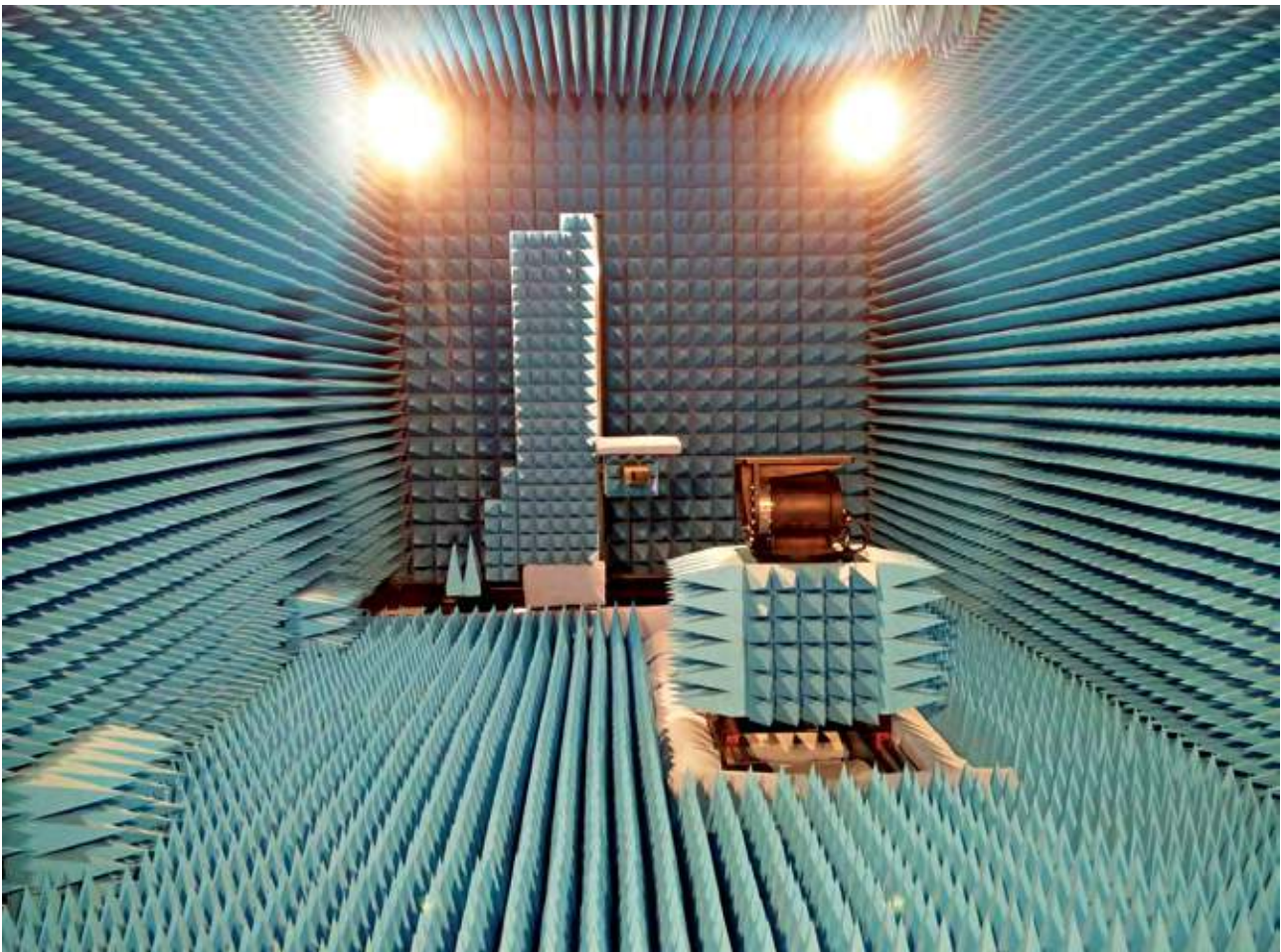
Smitek company designs, manufactures, supplies and installs not only separate parts of measurement systems but also functionally complete antenna sites. This approach allows to minimize customer's risks connected with further integration of purchased equipment into unified measurement system, complexity of designing and estimating necessary parameters for the future site when one of components is unknown or not purchased.

### **Anechoic chambers**

Antenna parameters measurements are carried at specially equipped sites. Antenna sites can be outdoor and indoor sites. Outdoor sites usually feature anechoic chambers. Anechoic chamber is a room tiled with radar-absorbent material to reduce reflections from chamber walls and create conditions similar to «free-space» conditions in a specified zone of the chamber (anechoic zone).

Smitek company in partnership with Frankonia company offer solutions based on module systems, which allows to assemble anechoic chambers according to customer's dimensions. Standard components and units adapted for installation into sections provide maximum flexibility in potential chamber sizes.

### **Anechoic chamber with installed PS-AZ/EL series positioner and planar scanner.**



**Network analyzer is the measurement center of an antenna site, this component controls positioner devices, and measurement unit, acquires, processes and analyzes measurement results.**

In its work Smitek company prefers to use vector network analyzers of PNA product family from Keysight Technologies (the USA). Programming convenience, high data flow rate to PC, wide option range and high accuracy are the main reasons we chose these

devices. That being said, standard warranty period is 3 years. Vector network analyzers are used in antenna parameters testing, PCB control benches, in material parameters measurement and in other areas. PNA product family includes PNA-L, PNA and PNA-X series.



### Advanced operation speed

Use of COM/DCOM functions provides exceptionally high data flow rate from network analyzers. Connection to local area network through via built-in interface LAN 10/100 allows to install PC at a distance from measurement equipment. Those functions combined make distance testing possible and reduce testing time. Option 118 adds fast sweeping mode Fast CW and provides data acquisition speed of more than 400000 pts/s from five measurement receivers simultaneously.

### Pulse mode measurement

In PNA/PNA-X aeries network analyzers Option 021 (adds pulse modulator to the first internal source) and Option 025 (adds four pulse generators) provide pulse HF signal measurement capability in pulse mode antenna testing. Combined with option 008 they improve measurement capabilities of PNA/PNA-X series network analyzers in pulse mode, providing point-in-pulse measurement at pulse duration of less than 33 ns.



## 8. PTS system for payload system and transmit/receive modules testing



- Fully automated system for testing RF parameters of transmit/receive tracks.
- More than 10 measurement types, more than 30 measured parameters
- Unique methods of track calibration and correction
- Automated recorection for calibration plane surface displacement and distortion elimination inside the track.
- The highest testing velocity in the market

### Description

PTS series payload and PCB testing system offers the highest quality and velocity in RF parameters testing of repeaters in frequency range up to 40 GHz with automated track recorection and in frequency range up to 50 GHz with traditional track calibration.

### PTS series payload and PCB testing system provides the following parameter measurements:

- Input/output saturation level - measurement inaccuracy 0.2 dB
- Input/output compression point level - measurement inaccuracy 0.2 dB
- Gain ratio - measurement inaccuracy 0.2 dB
- Noise ratio - measurement inaccuracy 0.2 dB
- Amplitude frequency characteristic in linear gain mode - measurement inaccuracy 0.2 dB
- Amplitude frequency characteristic in gain saturation mode - measurement inaccuracy 0.2 dB
- Amplitude frequency characteristic compression point - measurement inaccuracy 0.2 dB
- Phase noise - measurement inaccuracy 0.3 dB
- Group delay/Group delay ripple - measurement inaccuracy of less than 0,5 ns
- Signal to noise ratio - measurement inaccuracy 0.4 dB
- Beacon frequency and power measurement
- Tertiary and quintic ntermodulation distortion - measurement inaccuracy 0,2 dB
- Out-of-band radiation
- Input/output reverse losses
- Digital frequency modulation error vector (vector generator added to the system)



## Advantages

At repeater parameters measurement choice of the measurement system is defined by its accuracy and operation speed.

One of the key points in repeater measurement is large dimensions of the device under test as well as necessity to perform tests inside a climatic chamber, which makes using long RF cables with high losses and a range of connection adapters a must. Under such conditions the factor of systematic calibration error of the system grows due to inaccuracies in connector plugging and track characteristics distortion. PTS series payload and PCB testing system employs unique patented methods of calibration and track distortion elimination, which allows to get the lowest inaccuracy values in the industry.

Another critical factor is measurement speed and logging of results. PTS series payload and PCB testing system offers cutting-edge software adapted to Russian language RL-NAS version 2.0, it creates measurement status files that contain calibration data, devices settings parameters etc., which allows to minimize system set-up time. RL-NAS software automates measurement process using custom settings of the measurement cycle order; client/server computing allows to log results with a display of repeater parameters configuration.

System configuration flexibility provides for testing of repeaters with various channel numbers from 1 to 70 on the input and from 1 to 70 on the output.

## Characteristics

Model	PTS-130	PTS-260	PTS-400	PTS-500
Frequency range	10 MHz - 13 GHz	10 MHz - 26 GHz	10 MHz - 40 GHz	10 MHz - 50 GHz
Stimulus signal maximum level	+13 dBm	+13 dBm	+12 dBm	+10 dBm
Dynamic range at transmit parameters measurement	130 dB	130 dB	125 dB	120 dB
Inaccuracy at transmit parameters measurement	0.2 dB		0.5 dB	

## System configuration

- В базовой конфигурации система позволяет тестировать следующие параметры:
- Input/output saturation level
- Input/output compression point level
- Gain ratio
- Amplitude frequency characteristic in linear gain mode
- Amplitude frequency and phase frequency characteristics in gain saturation mode
- Amplitude frequency and phase frequency characteristics in compression point
- Input/output reverse losses

## Measuring options

**Option PTS-NF**

adds noise ratio measurement function

**Option PTS-PN**

adds measurement of off-band radiation phase noise function

**Option PTS-MY**

adds beacon parameters measurement function

**Option PTS-GVZ**

adds group delay measurement function

**Option PTS-SNR**

adds measurement of off-band radiation signal to noise ratio function

**Option PTS-IMD**

adds measurement of intermodulation distortion function

**Option PTS-VSG**

adds measurement of digital modulation error vector function

## Hardware options

**Option PTS-MatrixIN**

adds switch matrix for input signal routing (number of channels is decided by the customer)

**Option PTS-MatrixOUT**

adds switch matrix for output signal routing (number of channels is decided by the customer)

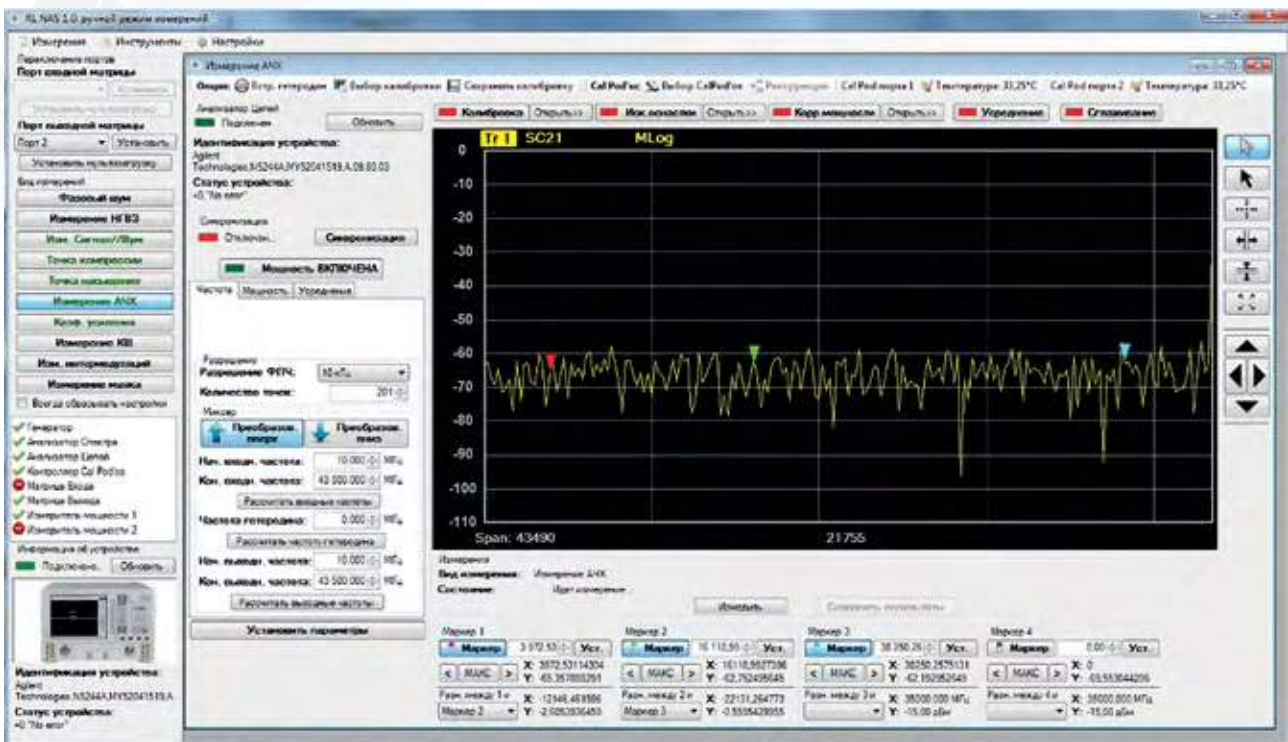
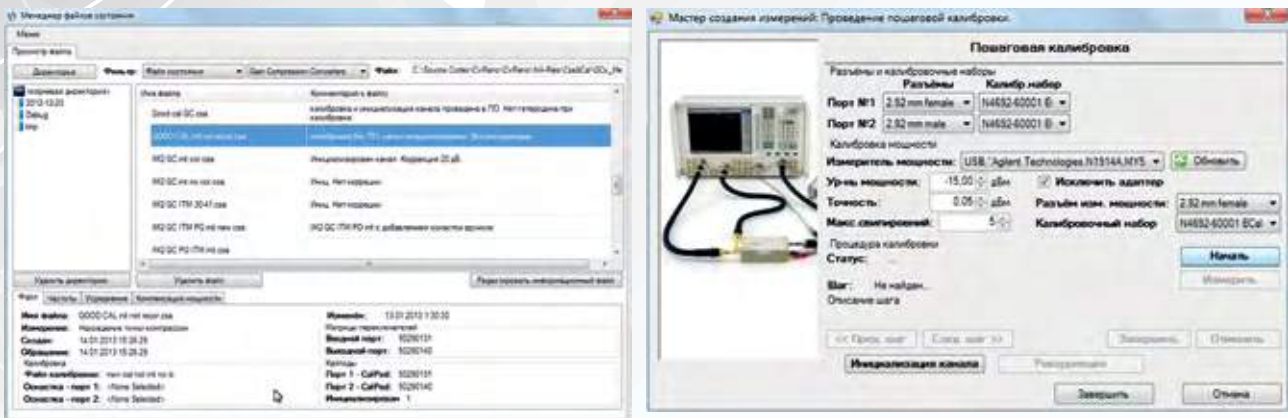
**Option PTS-AutoCAL**

adds automated calibration and recorection of RF track parameters (number of calibrated channels is decided by the customer)

## Software

The system integrates specialized RL-NAS software that performs the following functions:

- Measurement process automation
- Measurement data processing, documentation and storage
- Devices settings and backup copies saving
- Calibration data and system status database
- Acquired data mathematical treatment
- Device under test control
- Device mnemonic diagram display



## 9. Separate units of special-purpose products control and diagnostic bench

**Smitek company designs and manufactures Separate units of special-purpose products control and diagnostic benches according to customer's technical requirements.**

**In 2017-2018 we have successfully accomplished the following projects:**

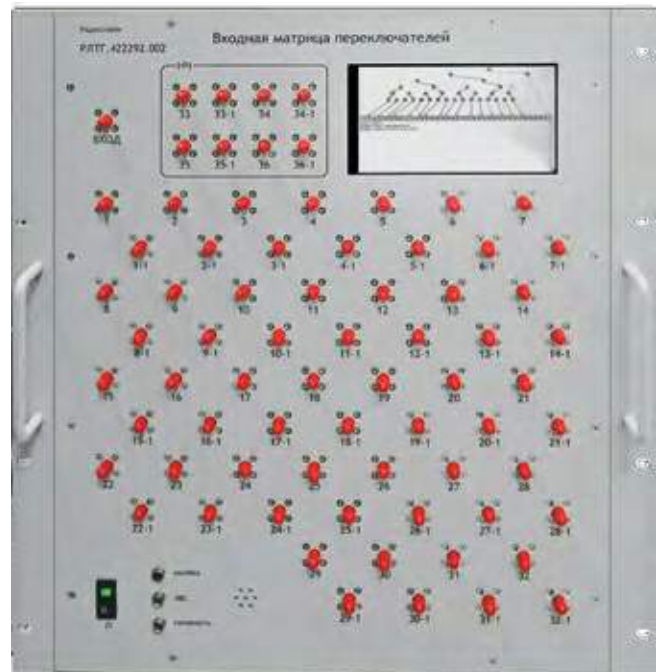
- TRA-130** Hardware-software system for transmit-receive devices with sum-difference channels parameters testing (РЛТГ.425820.021), produced by Smitek (Russia)
- TRA -019** Automated measuring and computing system for antenna-feeder devices parameters testing . TRA.425820.019, produced by Smitek (Russia)
- TRA -015** Automated measuring and computing system for receiver devices parameters testing . TRA.425820.015, produced by Smitek (Russia)
- TRA -017** Automated measuring and computing system for transmit devices parameters testing . TRA.425820.017, produced by Smitek (Russia)
- PPM-430** Hardware-software system for parallel automated calibration of multi-channel transmit-receive modules with digital K-band control, РЛТГ. 422293.012, produced by Smitek (Russia)
- PPM-130** Hardware-software system for parallel automated calibration of multi-channel transmit-receive modules with digital x-band control, РЛТГ. 422293.004, produced by Smitek (Russia)

**Please turn to Smitek company staff for further information on functional capabilities and technical characteristics of the benches.**



## 10. RF switch matrices

- RF switch matrices produced by Smittek company with different configurations: 1-4, 1-8, 1-16, 1-32, 2-4, 2-8, 2-16 etc.
- Switching scheme and switching protocol display representation
- Capability to function as an independent device
- Remote configuration, control, software update
- Background sound and tactile control options
- Frequency range up to 110 GHz
- Waveguide execution available.





**Automated testing facilities  
for retranslation units,  
receiver-transmitter units,  
components and antennas.**





## Measuring solutions catalogue



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