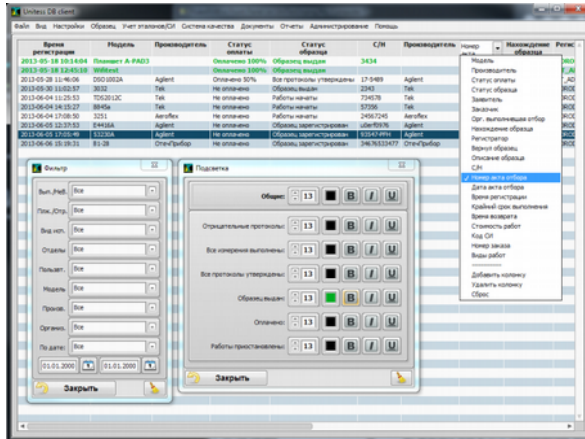


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1. All-round automation in laboratory



Application:

- automation of workplaces for verification/calibration of measuring and testing equipment, including using own resources;
- automation of the laboratory workflow and management;
- maintenance of the electronic document flow;
- analysis of laboratory activities;
- machine vision application.

Often, in the conditions of significant workloads the laboratory workflow is not organized properly, there is no clear operating procedure, and methods for monitoring the work performance are imperfect. For example, the head of laboratory doesn't know how many samples were received, what load of employees is, he can't predict the timing of performance for specific types of work either.

In addition to the operational management of laboratory, the head has to analyze and predict the following:

- financial efficiency of individual departments;
- terms of specific works performance;

- staff workload;
- payback of standards.

In most laboratories, the quality of the work depends entirely on the performers, since it is simply impossible to control the timing and quality with large amount of work.

The laboratory management and automation system UniTesS is designed to solve these problems. The UniTesS meets the requirements of ISO/IEC 17025-2007 standard and helps to improve the quality of work and increase throughput of the laboratory. UniTesS takes over a part of the routine work of employees, allowing them to focus most of their attention on the key and most crucial aspects.

Today, the market offers a variety of software for recordkeeping of measuring equipment, accounting, electronic document flow, and task managers.

In many cases, the operation of these programs and databases is associated with numerous problems:

- all information is scattered and contained in different databases;
- it is necessary to fill several databases;
- all software has different user interfaces and functional capabilities;
- workstations generate protocols using different templates.

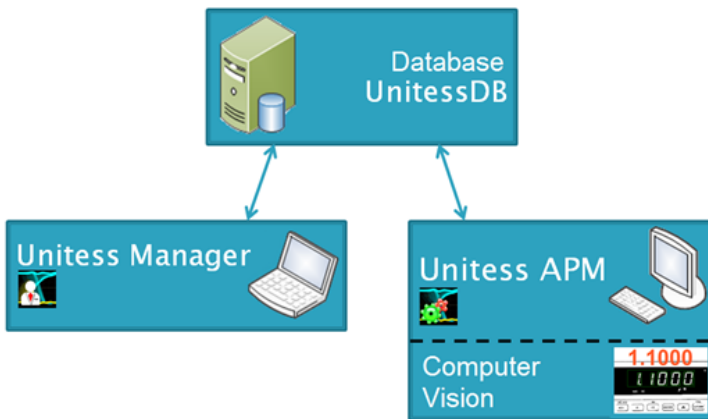
The modern manager wants to see all the statistics on the performed work, workload of employees, finance, and this is impossible without maintaining a single database in the laboratory. Employees should clearly know the tasks and timelines. The manager needs constantly monitor the load of his employees, evaluate the work results and optimize tasks.

General description of UniTesS

Structurally UniTesS consists of:

- UniTesS DB database deployed on the enterprise server;
- UniTesS Manager client software;
- UniTesS Workstation software with optional machine vision module.

UniTesS block scheme

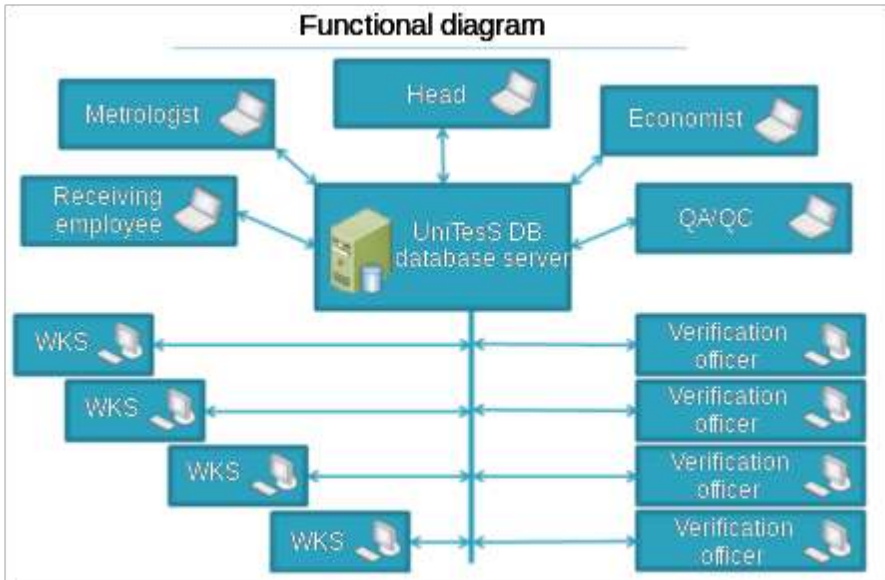


UniTesS DB is a laboratory database, containing all information concerning performed work, employees, organizational structure, own standard instruments/measuring equipment, documents, etc., providing electronic document flow and production process.

UniTesS Manager provides access of employees to the database depending on the permissions and allows registering new tasks, monitoring work flow, generating database reports, and performing administration and configuration.

UniTesS Workstation intended for automated verification, measuring instruments calibration and testing of various equipment.

[UniTesS Workstation MV](#) is the machine vision option allowing reading the indications from the instrument screens which are not equipped with control interfaces.



Functionally, UniTesS unites a variety of both automated and non-automated verification and calibration workstations, as well as the workplace of the head, employees responsible for quality and measuring instruments, metrologist, economist, etc. Since UniTesS has a flexible access control system for each specific laboratory, it is possible to implement any functional application scheme. For example, one employee has to register the samples, another assigns the tasks and deadlines, the third to monitor and receive reporting documents, the fourth just perform the tasks, the fifth to check/sign/approve the reports.

UniTesS DB

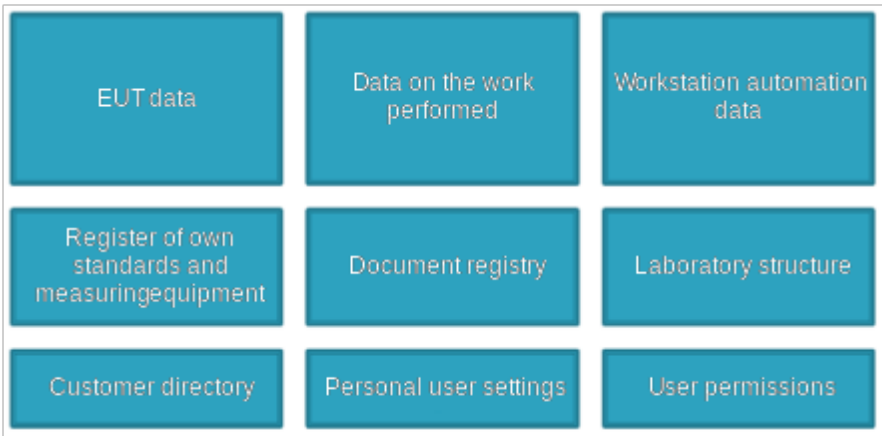
The core of the UniTesS system is a database designed for:

- operating data storage;
- data analysis;
- providing the production process and electronic workflow.

A centralized database server makes the software scalable within the enterprise, which allows you to create any number of workstations with support of all available functions. Moreover, you can organize remote operation with the database. Users can get access to any database information from any workstation. In this case, all users always receive up-to-date information. The UniTesS DB database also has enhanced backup and archiving capabilities.

UniTesS DB contains a wide range of information that fully characterizes all aspects of the laboratory activities:

- test sample information: model, manufacturer, serial number; code of measuring equipment, payment information, registration and return time, execution deadlines, department, responsible person, sample movement;
- data on the performed work: test reports history, who and when have performed the work, checked and approved test reports, attached photos (of sample, the instrument screen), scanned and uploaded materials, employee comments;
- automation data: scripts for UniTesS workstation, protocol templates, work types register;
- register of own standard instruments and measuring equipment: manufacturer, supplier, department/responsible person, verification/maintenance/calibration data, cost data;
- documents register: the procedures of verification, calibration, measurements, metrological certification, operation manuals, technical regulation, etc. (the user can add documents of any types).
- enterprise/laboratory structure: departments, positions, employees;
- directories: customers, manufacturers;
- personal user's settings;
- setting of data access permissions.



User authentication and access control provide a high level of data security, which is one of the main advantages of the UniTesS DB database.

The information stored in a single database is conveniently to analyze using filtering and highlighting. Using the built-in SQL-designer it is possible to receive reports on various criteria.

The UniTesS DB database supports the following workflow stages (some optional):

- sample registration;
- definition of work type;
- assignment of terms and task performer;
- work performance;
- performance control;
- protocols verification and approval;
- returning of test sample and issue of test report.

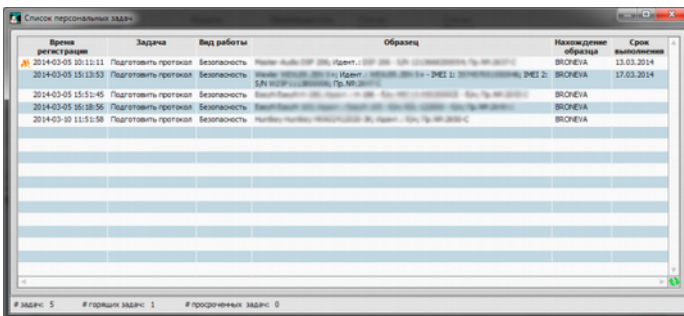
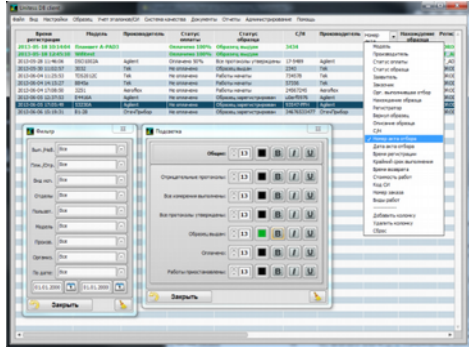
UniTesS Manager

UniTesS Manager Software in conjunction with the UniTesS DB database is designed to organize electronic workflow, production process automation, work performance control and analysis of laboratory activities.

UniTesS Manager displays information from the database in a convenient form and allows you to filter data by various criteria, sort,

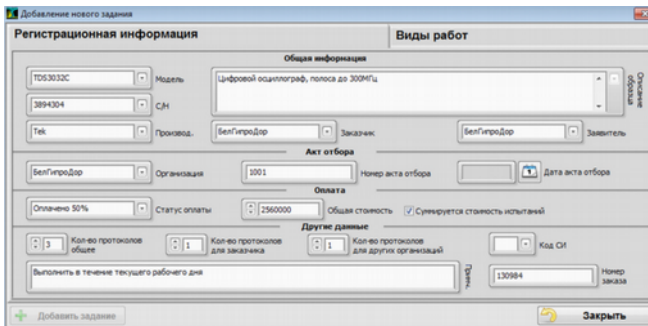
"highlight" information with the color in accordance with the personal user settings.

UniTesS Manager shows to the user a list of personal tasks: for example, perform the work, check or approve test reports.



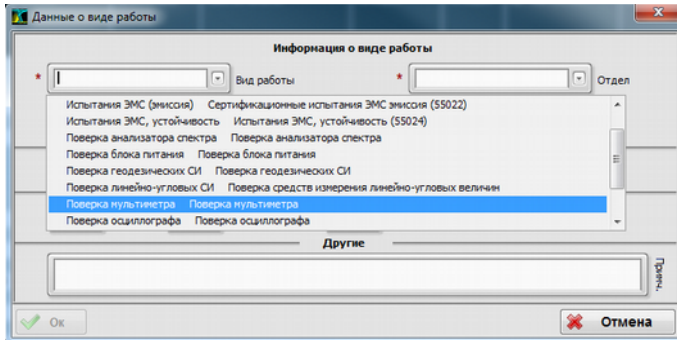
Three following statuses can be assigned for each task: normal, burning or overdue.

Registration of test samples in the database is carried out by the means of UniTesS Manager.



For each sample can be assigned several types of work. The information concerning the test sample becomes available for all users as

soon as it is entered into the database. The head can assign employee responsible for work performance, and set deadlines. At the same time, the assigned task is instantly displayed in the list of personal tasks of the assigned employees.

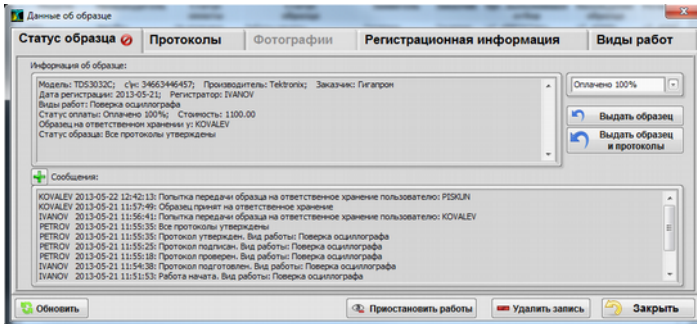


UniTesS Manager allows viewing all the information concerning the test sample:

- data on the performed work;
- test reports history;
- who and when have performed the task;
- who and when have checked/approved report;
- photos and materials in any format;
- employees' comments;
- movement of the test sample across the enterprise.

UniTesS Manager also allows working with other data from the database:

- register of own standards and measuring equipment;
- documents register;
- directories: customers, manufacturers;
- enterprise/laboratory structure: departments, positions, employees;
- data for automation.



UniTess Manager supports numerous auxiliary functions:

- centralized software updating;
- user settings saving;
- creating new forms and types of reports or editing existing ones using the SQL-constructor;
- flexible information access level settings.

UniTess Workstation

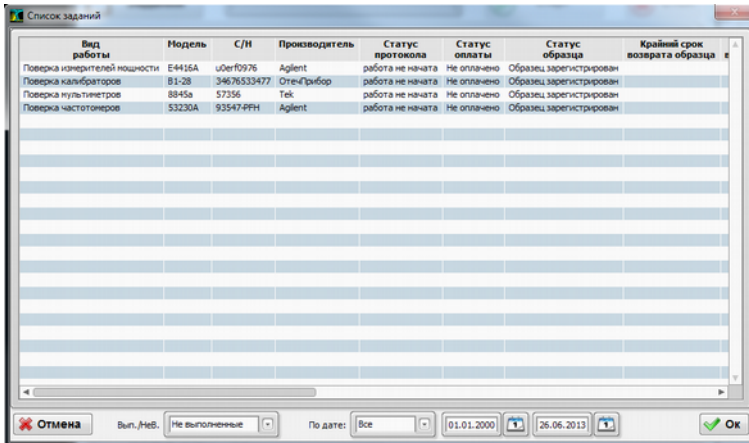
UniTess Workstation software is designed for automated execution of verification, measuring instruments calibration and testing of various purposes equipment. UniTess Workstation allows implementing any measurement procedures and can work with any equipment via following interfaces: USB, RS232, GPIB/IEEE-488, Ethernet.

Параметр	Напряжение, В	К-т отклонения, В/дел.	Допустимое знач. погрешн. у.д.
коэффициент отклонения	0,000	200	0,000
	0,013	50	1,000
	0,033	100	2,000
	0,06	200	4,000
	0,15	500	1,200
	0,3	1000	2,000
	0,6	2000	4,000
	1,5	5000	1,200
	3	1	2,400
	6	2	4,800
	15	4	9,600
	30	8	19,200
	60	16	38,400
	120	32	76,800
	240	64	153,600
	480	128	307,200
	960	256	614,400
	1920	512	1228,800
	3840	1024	2457,600
	7680	2048	4915,200
	15360	4096	9830,400
	30720	8192	19660,800
	61440	16384	39321,600
	122880	32768	78643,200
	245760	65536	157286,400
	491520	131072	314572,800
	983040	262144	629145,600
	1966080	524288	1258291,200
	3932160	1048576	2516582,400
	7864320	2097152	5033164,800
	15728640	4194304	10066329,600
	31457280	8388608	20132659,200
	62914560	16777216	40265318,400
	125829120	33554432	80530636,800
	251658240	67108864	161061273,600
	503316480	134217728	322122547,200
	1006632960	268435456	644245094,400
	2013265920	536870912	1288490188,800
	4026531840	1073741824	2576980377,600
	8053063680	2147483648	5153960755,200
	16106127360	4294967296	10307921510,400
	32212254720	8589934592	20615843020,800
	64424509440	17179869184	41231686041,600
	128849018880	34359738368	82463372083,200
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	515396075520	137438953472	329853488332,800
	1030792151040	274877906944	659706976665,600
	2061584302080	549755813888	1319413953331,200
	4123168604160	1099511627776	2638827906662,400
	8246337208320	2199023255552	5277655813324,800
	16492674416640	4398046511104	10555311626649,600
	32985348833280	8796093022208	21110623253299,200
	65970697666560	17592186044416	42221246506598,400
	131941395333120	35184372088832	84442493013196,800
	263882790666240	70368744177664	168884986026393,600
	527765581332480	140737488355328	337769972052787,200
	1055531162664960	281474976710656	675539944105574,400
	2111062325329920	562949953421312	1351079888211148,800
	4222124650659840	1125899906842624	2702159776422297,600
	8444249301319680	2251799813685248	5404319552844595,200
	16888498602639360	4503599627370496	10808639105689190,400
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	135107988821114880	36028797018963968	86469112845513523,200
	270215977642229760	72057594037927936	172938225691027046,400
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	1080863910568919040	288230376151711744	691752902764108185,600
	2161727821137838080	576460752303423488	1383505805528216371,200
	4323455642275676160	1152921504606846976	2767011611056432742,400
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	34587645138205409280	9223372036854775808	22136092888451461939,200
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	553402322211286548480	147573952589676412928	354177486215223391347,200
	1106804644422573096960	295147905179352825856	708354972430446783694,400
	2213609288845146193920	590295810358705651712	1416709944860893567388,800
	4427218577690292391840	1180591620717411303424	2833419889721787134777,600
	8854437155380584783680	2361183241434822606848	5666839779443574269555,200
	17708874310761169567360	4722366482869645213696	11333679558887148539110,400
	35417748621522339134720	9444732965739290427392	22667359117774297078220,800
	70835497243044678369440	18889465931478580854784	45334718235548594156441,600
	141670994486089356738880	37778931862957161709568	90669436471097183312883,200
	283341988972178713477760	75557863725914323419136	18133887294219436662576,400
	4533471823554859415644160	151115727451828646838272	36267774588438873325152,800
	9066943647109718331288320	302231454903657293676544	72535549176877746650305,600
	181338872942194366625760	604462909807314587353088	145071098353755493300611,200
	362677745884388733251520	1208925819614629174706176	290142196707510986601222,400
	7253554917687774665030560	2417851639229258349412352	580284393415021973202244,800
	14507109835375549330061120	4835703278458516698824704	1160568786830043946404489,600
	29014219670751098660122240	9671406556917033397649408	2321137573660087892808979,200
	58028439341502197320224480	19342813113834066795298816	46422751473201757856179598,400
	116056878683004394640448960	38685626227668133590597632	92845502946403515712339998,800
	232113757366008789280897920	77371252455336267181195264	185691005892807035446799976,400
	4642275147320175785617959840	154742504910672534362390528	371382011785614070893599952,800
	9284550294640351571233999840	309485009821345068724781056	7427640235712281141787199905,600
	1856910058928070354467999760	618970019642690137449562112	1485528047142456283575599911,200
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	742764023571228114178719990560	2475880078570760549798248448	5942112188569825135502399944,800
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	297105609428491256715119992240	9903520314283042199192993792	23768448754279301342220799776,400
	474211218856982513550239994480	1980704062856608439385998784	47536897508558602684444799552,800
	950736837713965067110079991120	3961408125713216878771997568	950736837713965067110079991120

UniTess Workstation performs a list of operations described in the *script* file. *Script* is a text file that contains a sequence of actions that implements the measurement procedure. Scripts for UniTess Workstation are developed using the programming language “*Unites Script Language*”.

The language is specifically designed for automation in metrology and allows implementing all the functions necessary for automation: instrument

control, mathematical calculations, comparisons, data report, etc. Language is simplified for faster learning. It's unnecessary to think about the data types, interaction with databases, report generating during the script development.

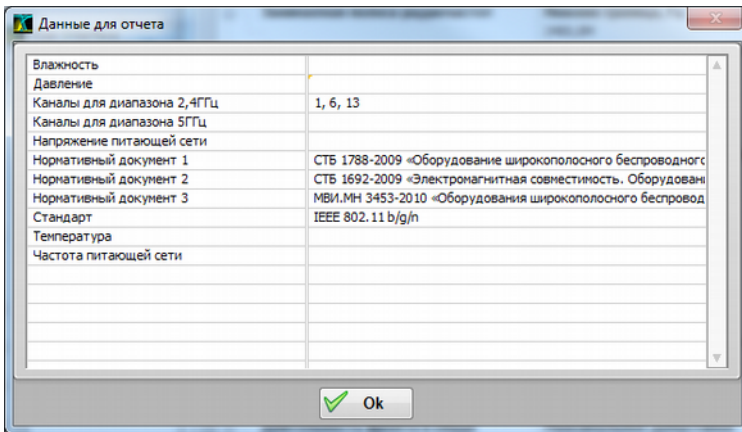


Вид работы	Модель	С/Н	Производитель	Статус протокола	Статус оплаты	Статус образца	Крайний срок возврата образца
Проверка конденсаторов мощности	E4415A	u0erf0976	Agilent	работа не начата	не оплачено	Образец зарегистрирован	
Проверка калибраторов	B1-28	34676533477	Отел/Грибор	работа не начата	не оплачено	Образец зарегистрирован	
Проверка мультиметров	8845a	57356	Tek	работа не начата	не оплачено	Образец зарегистрирован	
Проверка частотомеров	53230A	93547-PFH	Agilent	работа не начата	не оплачено	Образец зарегистрирован	

Using our own programming language, we standardized automated workstation developing process.

For the performer UniTesS Workstation is a software with extremely simple user interface with three buttons: "get the task list", "start work", "suspend work".

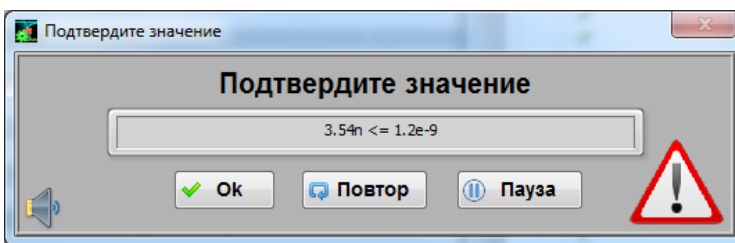
After the task selection, the software shows to the user the list of measured parameters with points and tolerances. At this stage, user can change the volume of verification. After clicking the "Start" button, the user will be prompted to fill in the data for the report.



The entered data will be directly included into the report. For example, you can specify: the measurement conditions, standard and reference instruments applied, etc.

Further, UniTesS Workstation controls the standard instruments and verified equipment, reads the indications, calculates uncertainty, compares the value with the threshold and sends the data to the report. If necessary, messages or queries are displayed for the users (rewire the circuit, connect the equipment).

If the result is out of specification, UniTesS Workstation will prompt to confirm the value or repeat the measurement.



After the script execution, the software displays to the user the final conclusion and generates a report in Word and/or PDF formats, all measurement results are stored in the database.

Workstation with partial automation

You can consider partial automation if you use instruments **without control interfaces** in your laboratory. In this case UniTesS Workstation displays for the user the connection scheme, text, and requests the data from the devices in the interactive mode.

Advantages of partial automation in interactive mode:

- low development cost;
- efficiency improving by 30-50%;
- automatic report generation;
- reduced requirements for qualification;
- automatic uncertainty calculation;
- the possibility of implementing any procedures.

Example of Workstations for verification/calibration:

- multimeters/voltmeters/clamps;
- oscilloscopes;
- power supplies;
- spectrum analyzers;
- LF, HF generators;
- frequency counters;
- power meters;
- linear-angled measuring instruments.

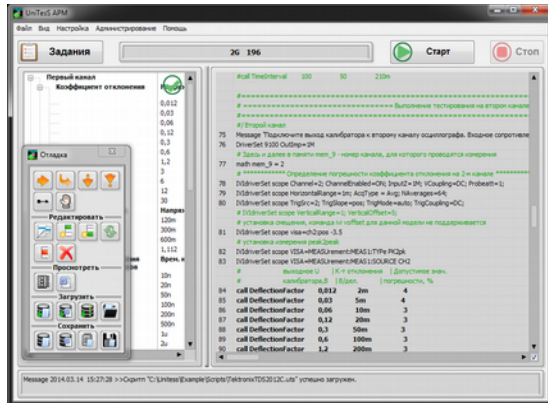
Example of Workstations for conformity assessment:

- measurements of radio communication equipment radio interface parameters: LTE, UMTS, GSM, cdma 2000, WiFi, Bluetooth for compliance with international and regional regulatory documents;
- emission measurements;
- immunity tests;
- safety tests.

UniTess APM + Opt. Debug

UniTess Workstation supports debugging mode for script editing and development the new ones. Functions will be familiar to anyone who has worked with programming environments.

The script debugging mode allows freely change the logic of work, procedure, control points and tolerances. The customer can develop new workstations on his own.



UniTess Workstation allows:

- implementing complex procedures using a variety of standard instruments;
- controlling devices by the following interfaces: USB, RS232, GPIB, Ethernet;
- reading and recognizing the indications from the instrument screens, that don't support control interfaces, using the machine vision module UniTess Workstation MV;
- controlling outdated equipment using the IEEE-488 interface (for example, voltmeter V1-28);
- generating reports in MS Word and PDF formats;
- implementing different operation modes: automatic, semi-automatic or interactive.

2. UniTesS Ambient Measurement conditions monitoring system

UniTesS Ambient is a centralized environmental conditions monitoring and recording system based on radio channel for calibration and testing laboratories. UniTesS Ambient is part of the management and automation system in the UniTesS laboratory.



Key features:

- LoRa radio channel with range up to 5 km;
- thermo hygrometer battery lifetime up to 3 years;
- high accuracy: $\pm 0,3\text{ C}^\circ$, $\pm 1,7\%$, $\pm 0,01\text{ kPa}$;
- the system is installed without construction works;
- does not require internet, Wi-Fi, and Ethernet networks.

Thermo hygrometers UniTesS THB 1 are designed for temperature, humidity and pressure measurements. Data is displayed on the E-ink display and transmitted to the server via the LoRa radio channel. The interval of measuring and data transmitting is determined by the system administrator. The information is stored in the UniTesS DB database. All collected data is available to users through the UniTesS Manager software. If you have installed UniTesS Workstation software, all the data will automatically record in the test, verification or calibration reports.

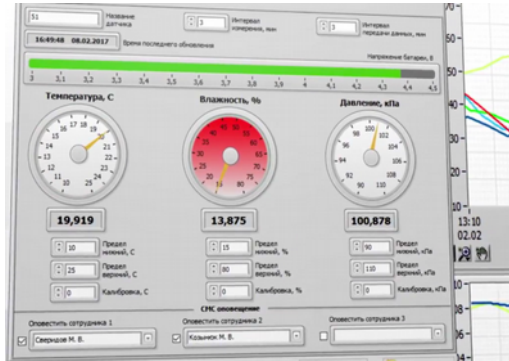
You can set the following alerts when the parameters are out of range:

- SMS messages to mobile phone;
- indication on the thermohygrometer display;
- indication in software.

The system provides automatic generation of the electronic log "Measurement conditions registration log" in accordance with ISO/IEC 17025.

Benefits:

- just hang your thermohygrometer on the wall;
- there is no need to deploy Wi-Fi, Ethernet networks or perform other construction works;
- no internet connection required;
- one receiver for the entire building;
- user interface of software and complete documentation in Russian and English.



UniTess THB 1 thermohygrometers specifications

- E-Ink display with indication of current measurement information, settings, thresholds and indication of exceeding the threshold values by color inversion;
- full compliance with EN 300 220-1;
- configurable over the air;
- the best Honeywell sensors inside;
- temperature measurement error:
 - 5 – 40 C° max. 0,3 C°;
 - Δ 10 C° max. 0,1 C° (after calibration);
- humidity measurement error:
 - 10 – 90 % max. 1,7 %;
- pressure measurement error:
 - 86 – 106 kPa max. 0,1 kPa



Standard delivery set:

- UniTesS THB 1 Thermal Hygrometer Kit;
- UniTesS BS LoRa base station;
- software kit.

Options:

- central server;
- GSM modem.
- CO2 sensors;
- sensors for analyzing the quality of the power network with a voltage of 220 V;
- integration with air conditioning system.

3. List of workstations

Workstation name	Description ¹
<i>For the department of electrical measurements</i>	
Multimeters verification using the machine vision	<p><u>Standard instruments:</u> Fluke 55xx, 9100, Transmille 30xx</p> <p><u>Verified instruments:</u> without restrictions, since the indications from the display of the verified instrument are read using the machine vision.</p>
Multimeters calibration using machine vision	<p><u>Standard instruments:</u> Fluke 55xx, 9100, Transmille 30xx</p> <p><u>Calibrated instruments:</u> without restrictions, since the indications from the display of the verified instrument are read using the machine vision.</p>
Desktop voltmeters verification using machine vision	<p><u>Standard instruments:</u> Fluke 55xx, 9100, Transmille 30xx</p> <p><u>Verified instruments:</u> without restrictions, since the indications from the display of the verified instrument are read using the machine vision.</p>
Desktop voltmeters calibration using machine vision	<p><u>Standard instruments:</u> Fluke 55xx, 9100, Transmille 30xx</p> <p><u>Calibrated instruments:</u> without restrictions, since the indications from the display of the verified instrument are read using the machine vision.</p>
Verification of voltmeters via interface	<p><u>Standard instruments:</u> Fluke 55xx, 9100, Transmille 30xx</p> <p><u>Verified instruments:</u> B7: 53, 54, 57, 62, 64, 65, 68, 72, 73, 78, 80, 81, 82, 84 Agilent: 344xx, 3458, E141x, U2741, U3606x, L4411A Instek: GDM-8x4x Keithley: 3706x, 200xx Tektronix: TX1, TX3, DMM40x0</p>

	<p>Rigol: DM3051, DM3058, DM3068 Teradyne: Ai-760-DMM, Ai-760B-DMM Wavetek: 1362S</p>
Verification of high-precision voltmeters via interface	<p><u>Standard instruments:</u> Fluke 57xx <u>Verified instruments:</u> Agilent: 3458 Fluke: 8508A Transmille: 8071, 8081</p>
Calibration of high-precision voltmeters via interface	<p><u>Standard instruments:</u> Fluke 57xx <u>Calibrated instruments:</u> Agilent: 3458 Fluke: 8508A Transmille: 8071, 8081</p>
Pointer instrument verification in the interactive mode	<p><u>Standard instruments:</u> H4-100 The software automatically sets the verification point and asks the user to adjust the value of the calibrator (with the mouse scrolling), so that the arrow points exactly to the division. <u>Verified instruments:</u> without restrictions (for example: C4312, C4315, C4353)</p>
Verification of calibrators via interface	<p><u>Standard instruments:</u> Fluke 8508A. <u>Verified instruments:</u> _ Fluke: 5500, 5502, 5520, 5522, 9100 Transmille 30xx</p>
Calibration of calibrators via interface	<p><u>Standard instruments:</u> Fluke 8508A. <u>Calibrated instruments:</u> Fluke: 5500, 5502, 5520, 5522, 9100, 6100 Transmille 30xx</p>
Verification of calibrators H4 via interface	<p><u>Standard instruments:</u> Fluke 8508A. <u>Verified instruments:</u> _ H4-6; H4-7; H4-11; H4-12; H4-16; H4-17</p>
Verification of the B1-28 calibrator by the interface	<p><u>Standard instruments:</u> B1-18, Fluke 5720A, Fluke 8508A. <u>Verified instruments:</u> B1-28 <i>Automatic calibration is performed before verifica-</i></p>

	<i>tion</i>
Verification of universal calibrators in interactive mode	<u>Standard instruments:</u> Fluke 8508A <u>Verified instruments:</u> without restrictions, since the verified calibrator is controlled by the user in accordance with the software commands
Verification of power quality analyzers via interface	<u>Standard instruments:</u> Fluke 5520A, Fluke 6100A + 6101A <u>Verified instruments:</u> Fluke: 43B, 434, 435 XIOKI: 3196, 3197 Analyst: 2Q, 3Q ELSPEC: G 4400, G 4500
Verification of power supplies in the interactive mode and via interface	<u>Standard instruments:</u> AKIP-7501, Extech 380820, ATH-8185, TDS2012C, Agilent 34410A, AKIP-1125, GPT-79803 <u>Instruments verified via interface:</u> Agilent: 603x, 66xxx, N57xx, N67xx, E36xx, N87xx Agilent: E43xx, U27xx, N69xx, N79xx, N89xx Ametek: XEL xxx , XG xxx, XG/XTR xxx R&S: NGPT18, NGPT7, NGPT35, NGPX, HMC804 Tektronix: PS2520, PS2521 Rigol: DP8xxx, DP1308, DP1116A Keithley: 230xx Kepco: BOP xxx, KLP xxx, ABC xxx, BHK xxx Kikusui: PAT-Txx, KDS6-0.02TR, PMxx, PBZxx, PMX MagnaPower: PQx , TSx , MSx , MTx , DPx , XR , SL Matsusada: PRK xxx, PRKJ xxx, VOL xxx, VOLJ xxx American Reliance: PPS xxx Elgar: DLM xxx, DCS xxx, RFP xxx TTi: QPX1200, PLP xxx, CPX xxx, QL xxx Xantrex: HPD , XFR , XHR , XPD , XT , XDC <u>Instruments verified in interactive mode:</u> without

	restrictions, since the verified power supply is controlled by the user in accordance with the software commands
Automated software system for automation of the capacitance standard	<p><u>Standard instruments:</u> Andeen-Hagerling AH2700A и AH11A.</p> <p><u>Contents of delivery:</u> the switching unit BK 8×2 and automation software.</p> <p><u>Switching unit specification:</u></p> <ul style="list-style-type: none"> - channel number – 8; - thermo-emf – 0,5 μV; - maximum switching voltage – 200 V; - maximum switching current – 0,5 A; - maximum switching power – 10 W; - expected lifetime – $1 \cdot 10^8$; - closed contact resistance – 0,1 Ω; - open contact resistance – $1 \cdot 10^{12}$ Ω; - capacitance – 0,2 pF; - inductance at a frequency of 1 kHz – 1.1 μH. - impedance - 50 Ohm.
Automated software system for automation of the voltage standard	<p><u>Standard instruments:</u> Fluke 5720, 8508, 5790, Agilent 34420, 3458</p> <p><u>Contents of delivery:</u> the switching unit and automation software.</p> <p><u>Switching unit specification:</u></p> <ul style="list-style-type: none"> - channel number – 6 inputs, 3 outputs; - an independent system for monitoring the correct relay operation; - thermo-emf – 0,2 μV, typical – 0.15 μV; - closed contact resistance – max. 0,15 Ω; - open contact resistance – min. $1 \cdot 10^{12}$ Ω; - maximum switching power – max. 10 W; - insulation withstand voltage – 1 kV at a frequency of 50 Hz; - maximum switching voltage: max. 500 V - switching delay: max. 1 ms

		<ul style="list-style-type: none"> - operating life: min. 10 years; - switching number in normal conditions without applied voltage – min. 10⁷.
<i>For the radio measurements department</i>		
Oscilloscopes verification interface	via	<p><u>Standard instruments:</u> Fluke 9500, 9100, 55xx with oscilloscope option</p> <p><u>Verified instruments:</u></p> <p>Tektronix: TDS, TPS, TBS, MSO, DPO, DSA, MDO Agilent: DSO, DSA, MSO, DC, DP, U, M, 54xxx LeCroy: WaveMaster, WaveSurfer, WavePro LeCroy: WaveRunner, 940, 950, 960, LTxxx Rigol: 1074Z, DS1104Z, DS1074Z-S, DS1104Z-S, Rigol: MSO1104Z, MSO1074Z, DS1204B Rigol: DS6xxx, DS2xxx, DS4xxx, Fluke: 123, 124, 125 R&S: RTO, RTM20xx Yokogawa: DL9xxx, DL6xxx, SB5xxx, DLM2xxx.</p>
Spectrum analyzers verification interface	via	<p><u>Standard instruments:</u> R&S SMB100A, Anritsu MG3694C</p> <p><u>Verified instruments:</u></p> <p>Agilent: E440x, E4411, N9320x, N90xxA, N9340B Agilent: N1996A, E444xA, E740xA, E934xC R&S: FSL, FSP, FSU, FSQ, FSG, FSV, FSW RIGOL: DSA10xxx, 805x, 810x, 815x GoodWill: GSP030x Keithley: 28x0</p>
RF generators verification interface and in interactive mode	via interface and in	<p><u>Standard instruments:</u> Agilent: E4448A, 53152A, Anritsu ML2488B</p> <p><u>Instruments verified via interface:</u></p> <p>Agilent: E44xx, N518x, N517xx, N518x, E82xx, Agilent: N9310, N516x, N517x, N518x, N82xx R&S: SMA, SMB, SMF, SMU200A, SMATE200A, R&S: SMJ100A, AMU200A Giga-tronics: GT2XXX, GT25XXX Keithley: 2910, 2920</p>

	<p>Rigol: DSG3060 DSG3030 <u>Instruments verified in interactive mode:</u> without restrictions, since the verified generator is controlled by the user in accordance with the software commands.</p>
<p>Verification of G5 type generators in interactive mode</p>	<p><u>Standard instruments:</u> any oscilloscope Agilent, Tektronix, LeCroy, Regol with bandwidth wider than 500 MHz <u>Instruments verified in interactive mode:</u> without restrictions, since the verified generator is controlled by the user in accordance with the software commands.</p>
<p>Wattmeters verification using machine vision and via interface</p>	<p><u>Standard instruments:</u> Anritsu MG3694C, SMB100A <u>Instruments verified by the interface:</u> Agilent: N191x, N8262, N93xx, N192x, U200x, E44xx Agilent: 848x, N432, U848x, N8262, N432 Anritsu: ML24xx, MA24106 R&S: NRVD, NRVS JDSU: MAP-200 OPM <u>Verified instruments (machine vision):</u> without restrictions, since the indications from the display of the verified instrument are read using the machine vision.</p>
<p>Frequency counters verification using machine vision and via interface</p>	<p><u>Standard instruments:</u> Anritsu MG3694C, SMB100A <u>Instruments verified by the interface:</u> Agilent: 5313x, 532xx Fluke: PM6685x Tektronix: FCA30xx, FCA31xx <u>Verified instruments (machine vision):</u> without restrictions, since the indications from the display of the verified instrument are read using the machine vision.</p>
<p>UniTesS RF</p>	<p><u>Software for microwave accessories calibration:</u></p>

Correction	The software allows calibrating microwave cables, adapters, attenuators with accuracy of 0.05 dB. The software controls the spectrum analyzer, microwave generator and generates calibration tables and graphs for specified frequency ranges. Software supplied with drivers for your hardware.
<i>Verification of other measuring instruments</i>	
Pressure gauges verification in semiautomatic mode	<u>Standard instruments:</u> CRYSTAL XP2i At the software command, user sets the required pressure using the sensor (according to the verified instrument), the exact value is read from CRYSTAL XP2i and entered into report. <u>Verified instruments:</u> without restrictions
Verification of acoustic meters, vibration meters and spectrum analyzers	<u>Standard instruments:</u> Agilent 34401, Generator DS360. <u>Verified instruments:</u> “Ecophizika”, “Oktava”
Creation of calibration reports in interactive mode	The software is designed for automated uncertainty calculation according to the set script and to generate calibration report and certificate of calibration. The software prompts the user for the measured values and performs calculations in accordance with the script.
Verification of pH meters in interactive mode	<u>Standard instruments:</u> voltage comparator P3003, resistor bank P333, liquid thermostat NBE, РЭ ед. pH class 2 according to GOST 8.135, thermometer TL-4 PH meters verification: HI 8314, HI 9025, HI 221, PH 211, PH 213, HI 83141, HI 9321, HI 931400, HI 8424, HI 2215, HI 2211.
Dynamometer wrenches verification	<u>Standard instruments:</u> verification/calibration equipment TTT, ISO 3000 <u>Verified instruments:</u> dynamometric wrenches (torque).

	<p>It's possible to check the bidirectional wrenches. The user selects automatic or manual calculation of the actual torque values when the script starts. Operator also selects an error calculating formula based on the dynamometer wrench specifications. The software controls the actions of the verification officer in the interactive mode and prompts the data required for calculation; the results are automatically filled into the verification report and certificate.</p>
<i>Products testing within the conformity assessment</i>	
GSM tests	<p><u>Instrument:</u> Anritsu MT8820 Testing of the user equipment for compliance with the GSM application rules. GSM/GPRS/EDGE parameters measurements in 900 and 1800 bands. Power class 4 (900 MHz) and 1 (1800 MHz). Measurements of spurious emissions using a spectrum analyzer.</p>
UMTS tests	<p><u>Instrument:</u> Anritsu MT8820 Testing of the user equipment for compliance with the UMTS application rules. Measurements of the UMTS R99 and HSDPA parameters for the 2100 MHz band. Power class E2. Measurements of spurious emissions using a spectrum analyzer.</p>
GSM and UMTS set	<p>UMTS and GSM software package Test report of 51 pages!</p>
LTE tests	<p><u>Instrument:</u> Anritsu MT8820. Frequency bands: 2.6GHz FFD, 800MHz FDD, 2.6GHz TDD, 2.3GHz TDD. Measurement of spurious emissions using a spectrum analyzer.</p>
WiFi and Bluetooth	<p><u>Instrument:</u> spectrum analyzer Agilent, R&S.</p>

tests	The measurement procedure in accordance with ETSI EN 300 328 and ETSI EN 301 893 Frequency bands are 2.4 GHz and 5 GHz.
Spurious emission measurements	<u>Instrument:</u> spectrum analyzer Agilent, R&S You can set any frequency bands, radio filters, detectors, sweep time, limits, and so on.
Measurements of conducted and radiated emission according to technical regulations of the Customs Union 020	<u>Instrument:</u> R&S FSL6 with quasi-peak detector. The software controls the auxiliary equipment (CDNs, antenna mast, rotary table, etc.) and spectrum analyzer (measuring receiver). The software conducts primary measurement using peak and average detector, frequencies with a potential limit exceeding are measured by a quasi-peak detector, taking into account the current connection scheme (cable attenuation, camera calibration factor, antenna gain factor), after that the software generates a test report.
Immunity to the radio-frequency electromagnetic field test	<u>Instrument:</u> Anritsu MG3740A up to 6 GHz, amplifier Ophir 7002, field probe HI-6005 The software automatically measures the calibration factor of the camera using the field sensor, generator and amplifier. The software controls the equipment to generate the required field strength in the given frequency range based on obtained calibration data.
Harmonics and flicker measurement	<u>Instrument:</u> Flicker and harmonic meter TTI HA1600A The software controls the measuring equipment, reads the measured values, compares it with the requirements and generates a test report.
GNSS receiver testing	Automated workstation for measurement of GPS/GLONASS-receiver parameters in ERA-GLONASS equipment in accordance with GOST 55534. <u>Instrument:</u> R&S SMBV100A

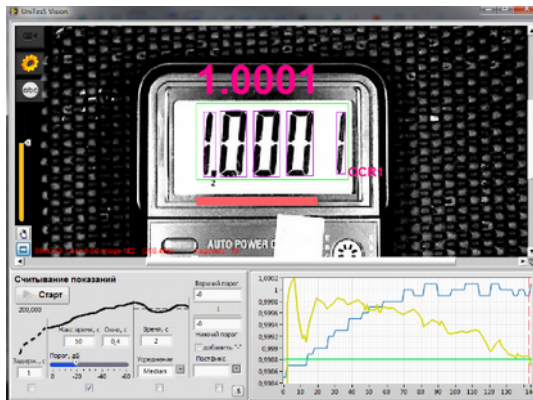
GSM\UMTS testing	Automated workstation for measuring the parameters of GSM\UMTS-modem in ERA-GLONASS equipment in accordance with GOST 55533. <i>Instrument:</i> R&S CMU200
<i>Other automation</i>	
Automation of the workstations assessment reports generation on compliance with the requirements for working conditions.	The software prompts the measured data, compares it with the limit values, and creates a report. The list of parameters and the form of the report can be changed by the customer. Allows you to reduce the time of documents preparing by 80% and significantly reduces the amount of errors.
Automation of field strength measurement from radio engineering objects according to Sanitary Rules and Regulations	<i>Instrument:</i> Anritsu MS2720T. The software controls the spectrum analyzer, measures the field strength for different polarizations, takes into account the attenuation in the cables, the antenna gain factor, calculates the energy flux density, generates a report with the measurement coordinates, calculated energy flux density, measurement error and final conclusion.

1 The list of standards and measuring instruments can be changed. The list of verified parameters is given in the workstations description on the website www.unitess.ru.

All workstations perform instruments verification in full compliance with the approved procedures. UniTesS Workstation controls the standard instruments via interfaces, reads the indication from the verified instrument, performs the required calculations and compiles the report. Instruments verification workstation generates the verification reports, and certificates. Calibration workstation generates: calibration report, calibration certificate. The calibration report contains: measurement conditions, a table of standard instruments, tables with results, absolute error, uncertainty budget, expanded uncertainty.

4. Machine vision UniTesS Vision

UniTesS Vision is the machine vision module for UniTesS Workstation designed to automate verification/calibration of instruments without control interfaces.



UniTesS Vision allows reading the indications from the instrument screens with displays of any type:

- LCD;
- LED;
- gas-discharge;
- seven-segment;
- graphic.



The indication reading process consists of four steps:

- fixed delay between setting the point on the standard instrument and starting the reading;
- the convergence algorithm determines the moment when the readings on the instrument screen are stable;
- sampling for a certain time and calculating the mean-square or mean arithmetic value;

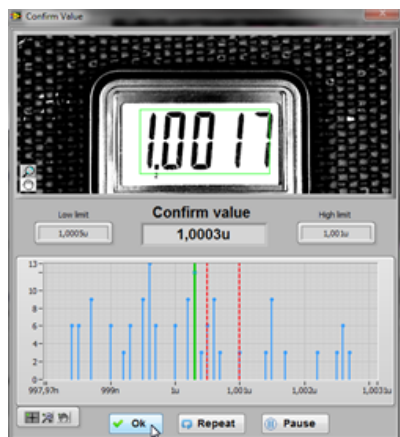
– confirmation of a negative result in case of exceeding the tolerance limit.

Most software for automation of measuring processes (for example, Fluke Metcal) reads one indication at a fixed time, which increases the process time as a whole and reduces the reliability of the information read in case of unstable readings. In some instruments (for example, multimeters), the voltage measurement is very fast (<1 sec.), and the measurement of the large resistance is very slow (~ 15 sec.).

The algorithm of convergence determines the moment of establishing the readings on the device display. The developed algorithm works like a human brain: the software algorithm estimates the rate of process change, selects the size of analyzed the floating window and waits until the process speed stops changing. The algorithm is invariant to the number of digits. User sets the threshold in decibels (dB).

After completion of the convergence algorithm, UniTesS Workstation MV samples the values within a specified time and performs statistical processing (RMS, average, median, max, min). If the read value is outside the tolerance, UniTesS Workstation MV displays a message to the user whether he agrees with the result or if the point needs to be checked again.

Our recognition algorithm has been tested on a huge amount of different devices, but for the case of some rare type of indicator we have provided training mode.



5. Workstation for verification “Oktava”, “Ecophizika” sound level meters



UniTesS Sound Level Meter is an automated workstation for checking sound level meters designed to measure sound pressure levels in the air.

Verified instruments:

- Oktava-101A, Oktava 110A, Oktava 110A-ЭКО, Ecophizika, Ecophizika-110A

Standard instruments:

- Stanford DS360

Benefits:

- Accelerates the verification time by 2-4 times.
- Fully complies with verification procedures.
- Automatically generates reports and certificates.
- Approved and operated in BelGIM.

The workstation automatically verifies the sound level meters in accordance with:

- GOST 17187-2;
- GOST R 53188.3-2010;
- IEC 61672-3:2006;
- "Verification procedure for sound level meter-spectrum analyzer "Oktava-101";
- "Verification procedure 4381-003-76596538-06";
- "PKDU.411000.005MP";
- " PKDU.411000.001.02 MP";
- "ABMP.411171.007 MP".

UniTesS Sound Level Meter is developed on the basis of UniTesS workstation automation system and has an open architecture that allows the user:

- modify measurement scripts and report templates by its own;
- validate the program operation.

Verification time in manual and automatic mode:

Instrument type	Manual	Automatically
Oktava-101A	≈ 12 hours	≈ 5 hours
Oktava 110A	≈ 7 hours	≈ 2 hours
Oktava 110A-ECO	≈ 4 hours	≈ 1 hour
Ecophizica	≈ 4 hours	≈ 1 hour
Ecophizica -110A	≈ 4 hours	≈ 1 hour

Our solutions significantly increase labor productivity and at the same time guarantee the correctness of the methods implementation with automated generation of reports and certificates.

Contents of delivery:

- DVDs kit with UniTesS software
- a set of verification scripts;
- ECO-DIN-DOUT adapter;
- adapter USB - RS-232 – 2 pcs.;

- kit of RS-232 adapters;
- documentation.

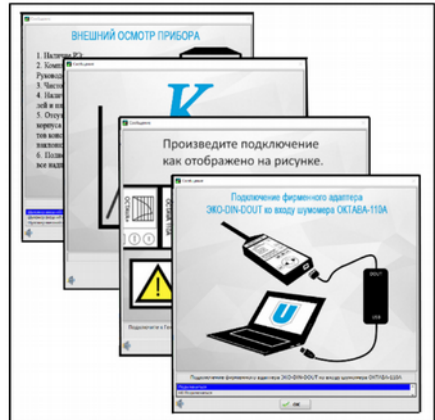
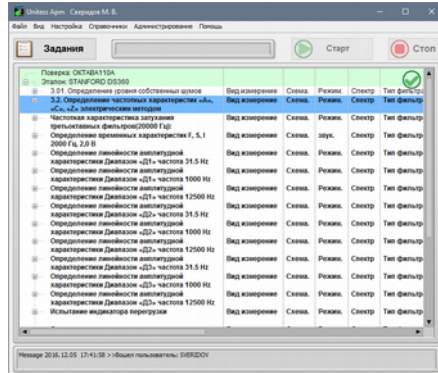
Optionally, the delivery package may include: laptop or all-in-one PC, printer, training services on the customer's site.

The software interface and all documentation are in Russian and English.

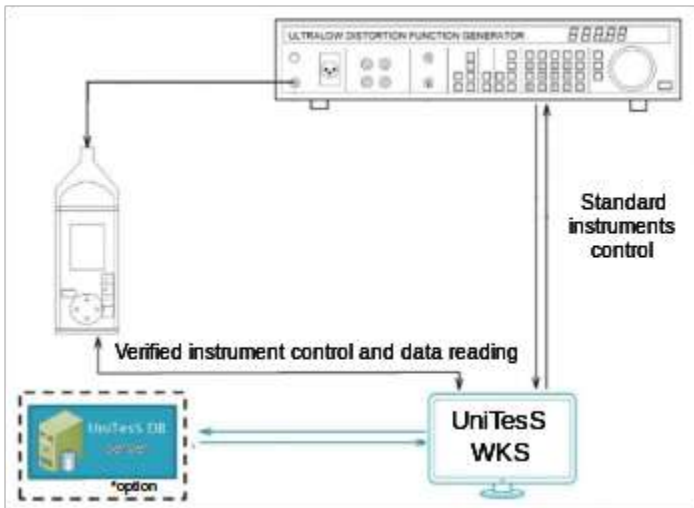
The user sees the list of measured parameters in Russian or English and can change the list of parameters to be verified.

During the script execution, the software displays detailed instructions to the user.

All our software is certified and meets the requirements: MI 2955-2010 GSI, GOST R ISO / IEC 12119-2000, GOST ISO IEC 14764-2002, etc.



Connection diagram



List of verified parameters:

- noise floor;
- determination of frequency characteristics "A", "C", "Z" by the electric method and by the field;
- checking of the measuring range switch error;
- amplitude response linearity;
- overload indicator test;
- main attenuation of octave (one-third octave) filters;
- frequency response of octave (one-third octave) filters attenuation;
- time-domain characteristics of F, S, I;
- level linearity during the scale range switching, etc.

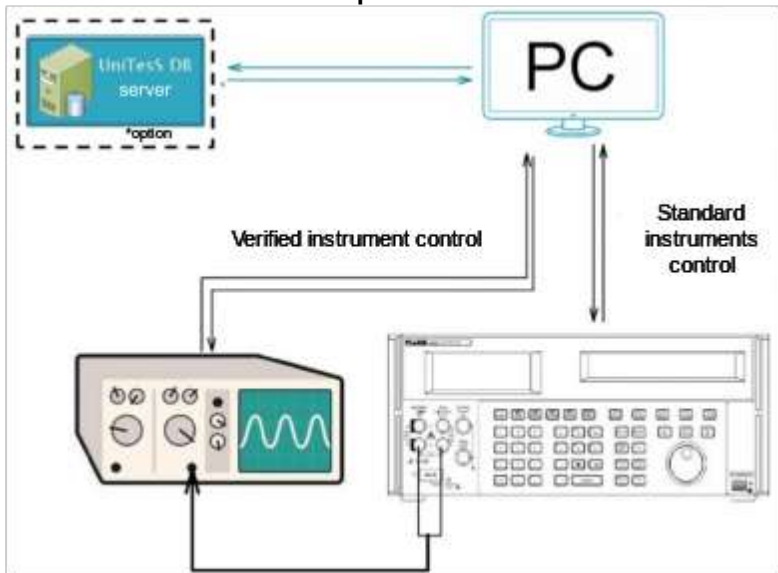
The list of verified instruments can be expanded on the customer request: SVAN-979, SVAN-958, SVAN-959, SVAN-945, SVAN-943, SVAN-912, SV102, ALGORITHM-01, ALGORITHM-03, ALGORITHM-05, ALGORITHM-111.

6. Workstation for oscilloscopes verification via interface

Purpose:

- Automation of digital oscilloscopes verification via interface.
- Reports generation and storage.

Workstation for oscilloscopes verification



The oscilloscopes verification could be a complex task, the solution of which requires considerable time and money. Such work often requires controlling and interpreting the results by a qualified operator, and the multichannel measuring instruments currently available on the market usually require tedious wires switching. Full automation provides the ability to verify even modern ultra-high-performance multichannel oscilloscopes without operator involvement.

Standard instruments:

- Fluke 9500, 9100, 55xx with oscilloscope option.

Verified instruments:

- Tektronix: TDS, TPS, TBS, MSO, DPO, DSA, MDO
- Agilent: DSO, DSA, MSO, DC, DP, U, M, 54xxx
- LeCroy: WaveMaster, WaveSurfer, WavePro
- LeCroy: WaveRunner, 940, 950, 960, LTxxx
- Rigol: 1074Z, DS1104Z, DS1074Z-S, DS1104Z-S, Rigol: MSO1104Z, MSO1074Z, DS1204B
- Rigol: DS6xxx, DS2xxx, DS4xxx,
- Fluke: 123, 124, 125
- R&S: RTO, RTM20xx
- Yokogawa: DL9xxx, DL6xxx, SB5xxx, DLM2xxx

The workstation allows verifying the following oscilloscope parameters*:

- Error of deviation factor.
- Periodic signal bandwidth.
- Transient response rise time.
- Error of the scan factor, and time interval measurements.
- Input impedance.

Optionally for Fluke 12x: voltage, resistance, capacitance, frequency.

* *The list of verified parameters can be expanded.*

Features:

- The verification time is about 15-20 minutes.
- Instruments control via following interfaces: USB, RS232, GPIB/IEEE-488, Ethernet.
- Accurate observance of verification procedures.
- Generation of reports in Word and PDF formats.
- Users authentication and access rights differentiation.
- It is possible to carry out all-round automation in the laboratory (database, electronic document flow, set of workstations).
- Different modes of operation, such as: automatic, semi-automatic or interactive.

Benefits:

- Significant verification speed increase.
- Electronic reports generation and storage.
- High qualification is not required to operate with standard instruments.
- Full compliance with the verification procedure and objectivity of the measurement results.
- Reduction of standard instruments and measuring equipment payback periods.
- Metrological database connection feature for providing all-round automation in the laboratory.

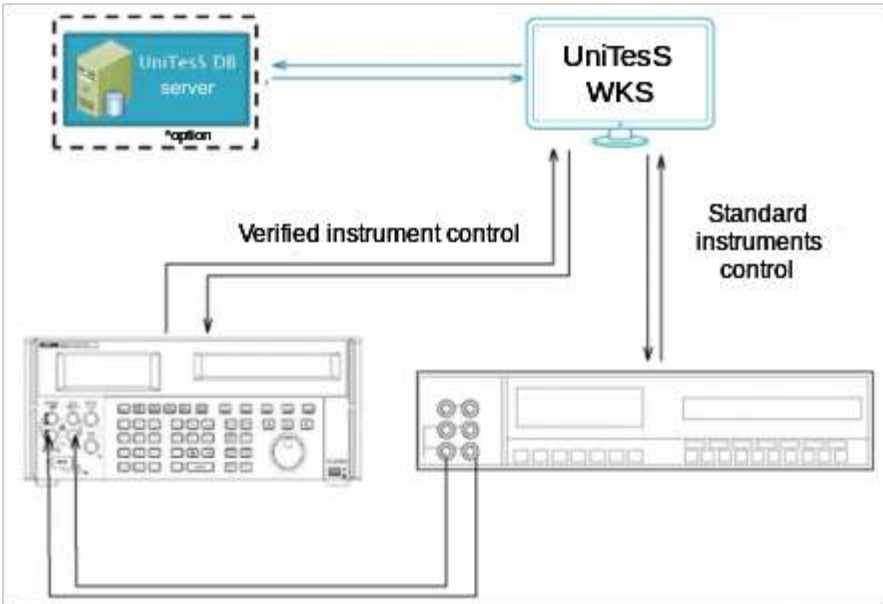
Implemented workstation

7. Workstation for calibrator verification via interface

Purpose:

- Automation of calibrator verification procedure via interface.
- Report generation and storage.

Workstation for calibrator verification



Standard instruments*:

- Fluke 8508A, 5790A
- Agilent 3458A

** The list of standards can be extended by the customer demand*

Verified instruments*:

- Fluke: 5500, 5502, 5520, 5522, 9100
- Transmille 3010, 3010R, 3041, 3041R, 3041TR, 3050, T3050R, 3050TR

** The list of verified calibrators can be extended by the customer demand*

Parameters verified in automatic mode **:

- DC voltage
- AC voltage
- Direct current
- Alternating current
- AC power
- DC power
- Resistance (2-wire/4-wire)
- Thermocouple simulation
- Simulation of resistance thermometers

Parameters verified in semi-automatic mode **:

- Frequency
- Capacitance
- Inductance
- Phase angle

** Depends on the features and additional modules of the standard instruments.

Workstation performs complete setting of the calibrator under test in a semi-automatic mode. Further, the operator receives instructions for setting up the standard instruments and request to enter the measured value in the appeared window. The workstation performs all the necessary mathematical calculations, checks whether the measured values are within the tolerance and enter them into report.

(With the availability of control interfaces for standard instruments, capacitance, inductance and frequency measurements can be performed in fully automatic mode).

Features:

- Control of reference and measuring instruments using the following interfaces: USB, RS232, GPIB / IEEE-488, Ethernet.
- Generation of reports in Word and PDF formats.
- Users authentication and access rights differentiation.

- It is possible to carry out all-round automation in the laboratory (database, electronic document flow, set of workstations).
- Different modes of operation, such as: automatic, semi-automatic or interactive.

Benefits:

- Significant verification speed increase.
- Electronic reports generation and storage.
- High qualification is not required to operate with standard instruments
- Full compliance with the verification procedure and objectivity of the measurement results
- Reduction of standard instruments and measuring equipment payback periods
- Metrological database connection feature for providing all-round automation in the laboratory

Implemented workstation

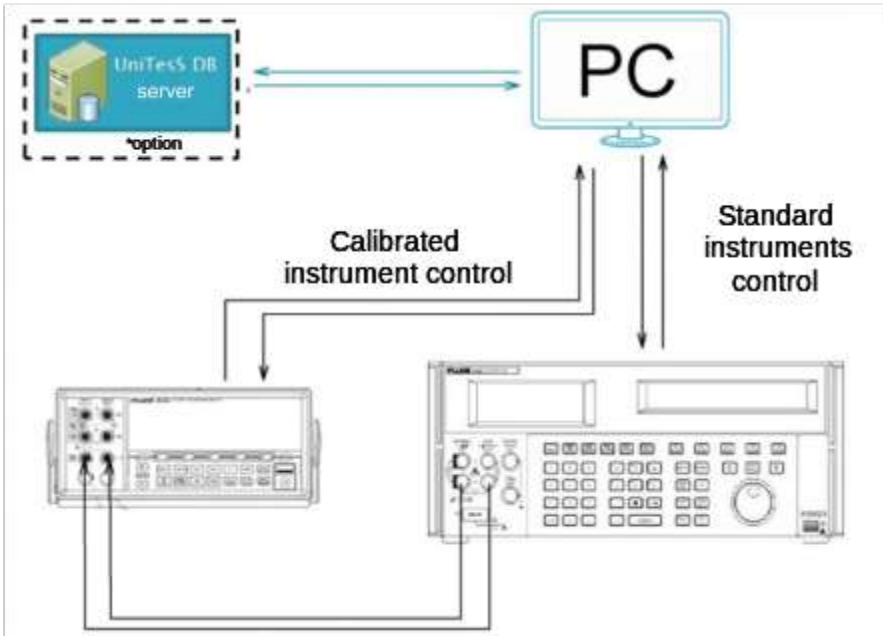


8. Workstation for voltmeter verification via interface

Purpose:

- Automation of digital voltmeters verification procedure via interface.
- Report generation and storage.

Workstation for voltmeter verification



Standard instruments*:

- Fluke 55xx, 57xx
- Anritsu 9100
- Transmille 30xx
- H4-17, H4-101, B1-28

Verified instruments*:

- B7: 53, 54, 57, 62, 64, 65, 68, 72, 73, 78, 80, 81, 82, 84
- Agilent: 344xx, 3458, E141x, U2741, U3606x, L4411A

- Instek: GDM-8x4x
- Keithley: 3706x, 200xx
- Tektronix: TX1, TX3, DMM40x0
- Rigol: DM3051, DM3058, DM3068
- Teradyne: Ai-760-DMM, Ai-760B-DMM
- Wavetek: 1362S

** The list of instruments can be extended on customer demand*

Verified parameters:**

- DC/AC voltage
- DC/AC current
- Resistance of a 2-wire circuit
- Resistance of a 4-wire circuit
- Period
- Frequency
- Temperature

***depends on features and optional modules of the standard instruments*

Features:

- The voltmeter verification time is about 15-20 minutes.
- Control of standard and measuring instruments using the following interfaces: USB, RS232, GPIB / IEEE-488, Ethernet.
- Generation of reports in Word and PDF formats.
- Users authentication and access rights differentiation.
- It is possible to carry out all-round automation in the laboratory (database, electronic document flow, set of workstations).
- Different operation modes, such as: automatic, semi-automatic or interactive.

Benefits:

- Significant verification speed increase.
- Electronic reports generation and storage.

- High qualification is not required to operate with standard instruments.
- Full compliance with the verification procedure and objectivity of the measurement results.
- Reduction of standard instruments and measuring equipment payback periods.
- Metrological database connection feature for providing all-round automation in the laboratory.
- The workplace is based on the UniTesS workstation software.

Implemented workstation

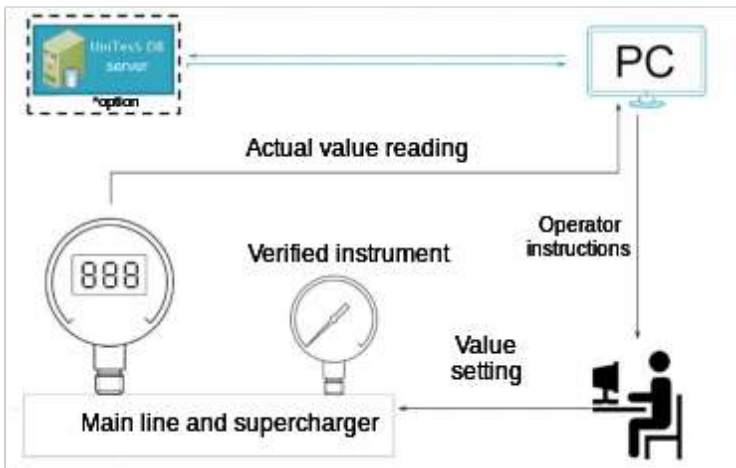


9. Workstation for verification of pressure gauges in semi-automatic mode

Purpose:

- Automation of analog pressure gauges verification without interface in semi-automatic mode.
- Report generation and storage.

Workstation for verification (calibration) of pressure gauges



The verification is carried out in a semi-automatic mode, which allows you to verify any pressure gauges, including without interface and with an analogue scale.

The UniTesS Workstation software step-by-step prompts the user to perform the following actions:

1. Select the instrument class, and used unit of measurement;
2. Input the pressure limit of instrument scale and first digitized point;
3. Using a hand-held sensor, set the pressure proposed by the UniTesS system (indications are read from the interface of reference pressure gauge).

At the end of verification, the software automatically generates the report using specified template with all necessary calculations, as well as certificate of the established form.

Standard instruments:

- CRYSTAL XP2i
- BETA Gauge P.I.
- METRAN 517 etc.

Verified instruments:

- without restrictions.

Verified and calculated parameters:

- pressure (indication in any units),
- variation.

Features:

- Workstation for calibration of pressure gauges can be supplied with the standard instruments and press.
- Verified instruments control using following interfaces: USB, RS-232(422,485), GPIB/IEEE-488, Ethernet.
- Generation of reports and certificates in Word and PDF formats.
- Different operation modes, such as: automatic, semi-automatic or interactive.

Benefits:

- Reduction of verification time due to automatic calculations and report generation.
- Electronic reports generation (Word and PDF) and storage in the UniTesS database.
- Strict adherence to verification/calibration procedures.
- Reducing the requirements for the verification officer qualification.
- Full compliance with the verification procedure and objectivity of the measurement results.

- Reduction of standard instruments and measuring equipment payback periods.
- Metrological database connection feature for providing all-round automation in the laboratory.

Implemented workstation

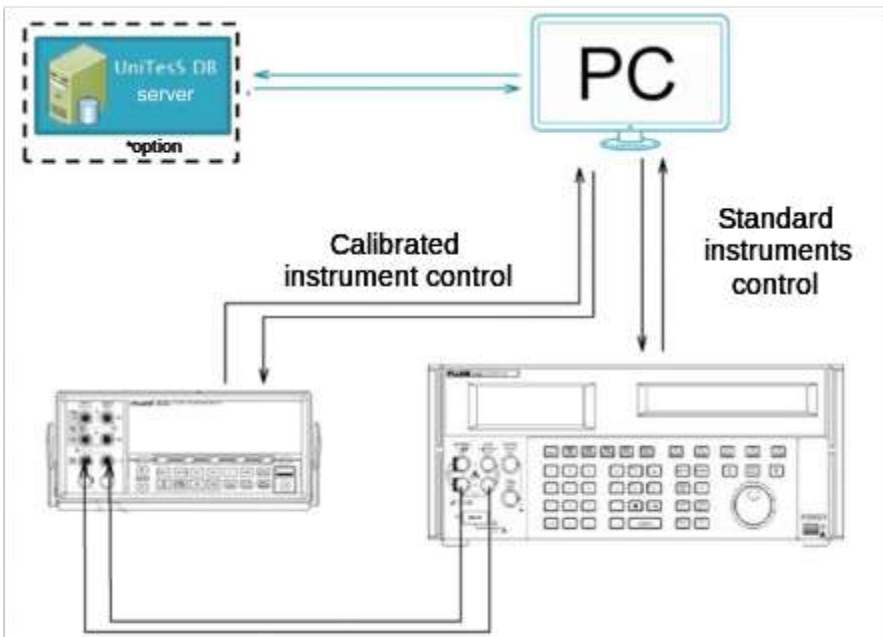


10. Workstation for calibration of high precision voltmeters via interface

Purpose:

- Automation of high precision voltmeters calibration via interface.
- Report generation and storage.

Workstation for calibration of high precision voltmeters



Standard instruments:

- Fluke 57xx

Calibrated instruments*:

- Agilent: 3458
- Fluke: 8508A
- Transmille: 8071, 8081

**The instrument list can be extended on customer demand*

Calibrated parameters:**

- DC/AC voltage
- DC/AC current
- Resistance of a 2-wire circuit
- Resistance of a 4-wire circuit
- Period
- Frequency
- Temperature

***depends on features and optional modules of the standard instruments*

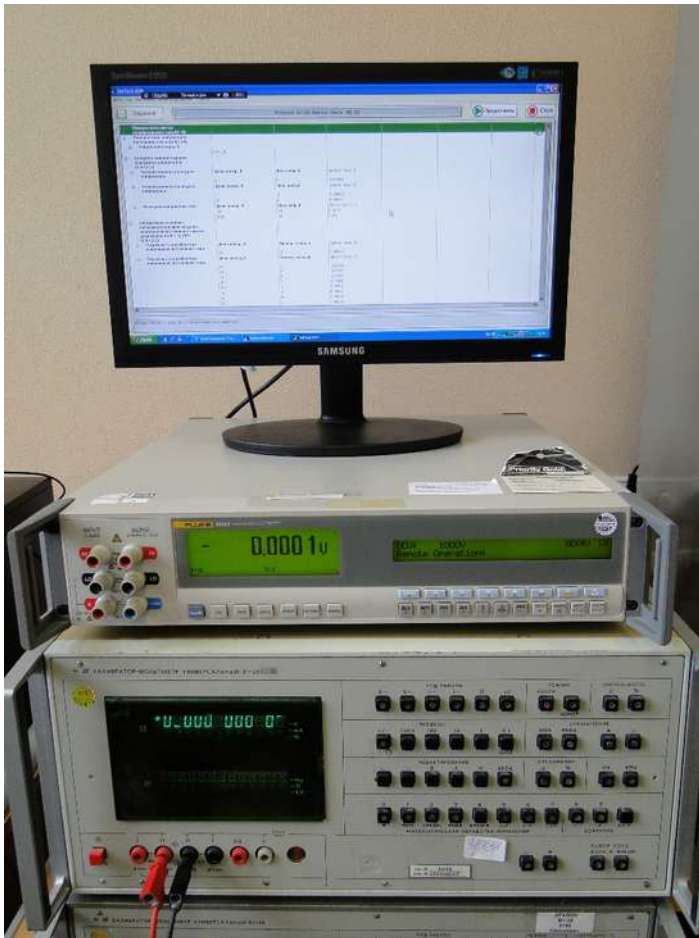
Features:

- Full uncertainty and probabilities calculation.
- Control of standard and measuring instruments via following interfaces: USB, RS232, GPIB / IEEE-488, Ethernet.
- Report generation in Word and PDF formats.
- Users authentication and access rights differentiation.
- It is possible to carry out all-round automation in the laboratory (database, electronic document flow, set of workstations).
- Different operation modes, such as: automatic, semi-automatic or interactive.

Benefits:

- Significant calibration speed increase.
- Electronic reports generation and storage.
- High qualification is not required to operate with standard instruments.
- Full compliance with the verification procedure and objectivity of the measurement results.
- Reduction of standard instruments and measuring equipment payback periods.
- Metrological database connection feature for providing all-round automation in the laboratory.
- The workplace is based on the UniTesS workstation software.

Implemented workstation



11. Measuring the GLONASS and GPS navigation modules parameters



UniTesS GNSS 1022 is 24-channel GLONASS and GPS navigation systems signal simulator. The simulator is designed for automated testing and verification of navigation receivers.

The simulator can be used for testing the GPS/GLONASS receivers as a part of ERA GLONASS system according to GOST 55534.

Customers receive a wide range of options for measuring antenna parameters and scalar network analysis.

The workstation can be delivered in a complete set with all the necessary equipment and fixtures as well as full training on measuring techniques and workstation operating rules.

The GNSS signals simulator UniTesS GNSS 1022 (hereinafter referred to as the Simulator) is designed for automated testing and verification of GPS/GLONASS navigation receivers using conducted and radio connection, as well as for measuring antenna parameters and scalar network analysis in the range up to 6 GHz.

The simulator operation principle is based on the navigation field generation as a set of navigation signals:

- The satellite navigation system GLONASS with the stadiometric codes of standard accuracy (OF) in frequency range L1;
- The satellite navigation system GPS with the stadiometric codes of standard accuracy C/A in frequency range L1.

Simulator specification:

- satellites number 12 GPS + 12 GLONASS;
- simulation modes point, scenario;

- dynamic range from -20 to -150 dBW;
- level accuracy $\leq \pm 1,0$ dB;
- frequency error $\leq 1 \cdot 10^{-9}$
- pseudo-range error:
 stadimetric code phase $\leq 0,5$ m
 pseudovelocity $\leq 0,01$ m/s

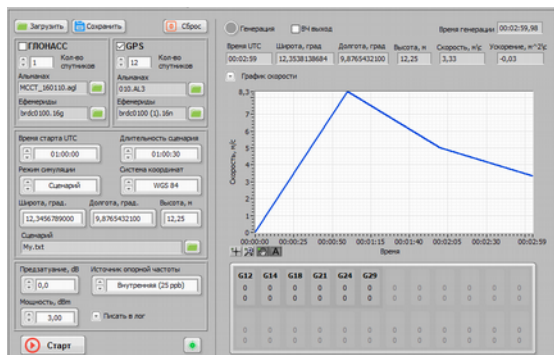
Optionally, simulators can be supplied with the UniTesS workstation software for measurements automation. The generators operate under the control of a built-in PC with the following parameters: Windows 7, 8GB DDR3, Intel Core i7-4170, HDD SSD 120GB. The size of the integrated monitor is 24 inches.

The simulator controls by the UniTesS GNSS Generator software.

The functionality of the UniTesS GNSS Generator software:

- simplified user interface;
- simultaneous generation of up to 12 GPS satellites and up to 12 GLONASS satellites;
- receiver motion simulation with the indication of velocities and accelerations;
- almanac and ephemeris files loading.

UniTesS GNSS Generator contains all the necessary settings for navigation receivers testing and verification. Thus, it's very easy to use, which distinguishes it from similar products that require considerable effort to learn and correct use.

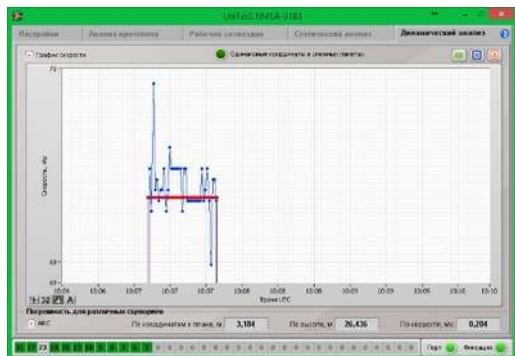


The simulator has a wide range of options:

- UniTesS Antenna Studio software for antenna parameters measurement and scalar network analysis;
- UniTesS Workstation software with scripts for automation of all measurements and reports generation;
- UniTesS NMEA-0183 software for navigation receiver data analysis and calculation of accuracy characteristics, including according to GOST 55534;
- UniTesS PTZ - rotary device with dielectric table;
- measuring antenna P6-23M;
- absorbing material for measuring site;
- a set of necessary microwave cables and adapters for the working place.

UniTesS NMEA0183

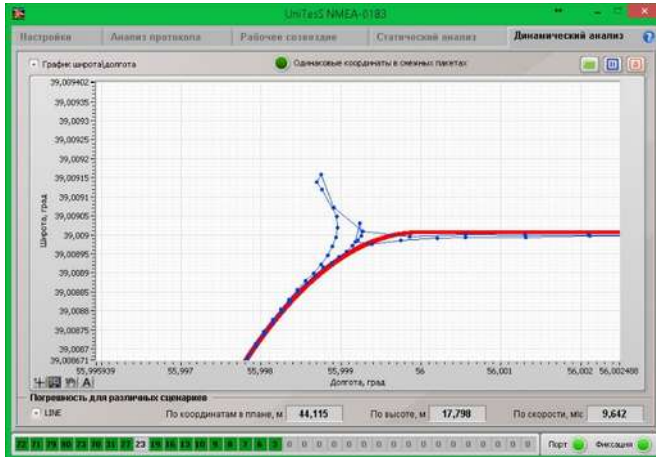
UniTesS NMEA-0183 is an independent software product that can be used in manual mode separately from the workstation. The software allows real-time processing of NMEA-messages from the receiver, displays information in a convenient form, and automatically calculates the coordinate determination error.



UniTesS NMEA-0183 features:

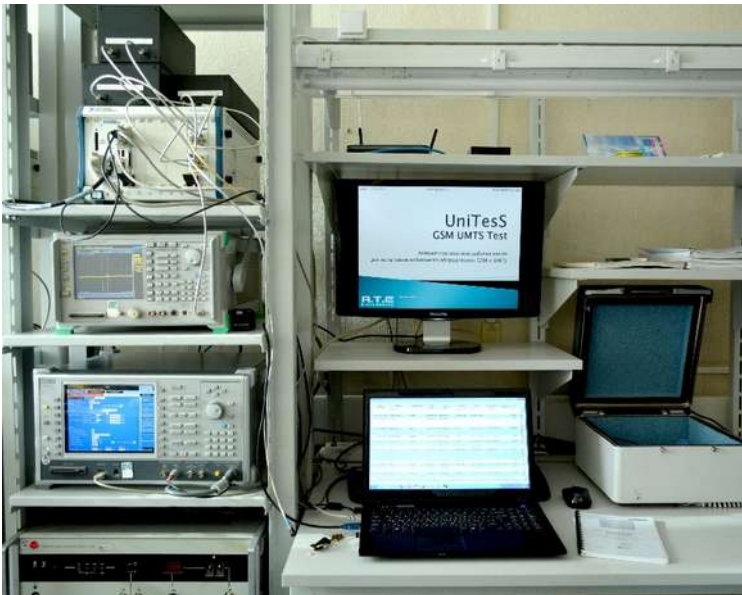
- parsing and logging of NMEA-messages of the receiver;
- measurement of protocol time parameters in accordance with GOST 55534;
- the level of satellites signals received by the receiver in real time.
- error calculation in dynamic and static mode;

- allows to carry out tests in accordance with GOST 55534 in automatic mode using UniTesS Workstation software and corresponding special script.



12. Test bench for GSM, UMTS, LTE, Wi-Fi and Bluetooth testing

UniTesS CST is a certification tests of radio communication devices on a turn-key basis!



EUTs: mobile phones, base stations, GSM, UMTS, LTE repeaters; Wi-Fi equipment a\b\g\n\ac, Bluetooth.

Standards: STB 1356, STB 1788, STB 1692.

We offer services for the creation of a test laboratory on a turn-key basis:

- equipment delivery;
- full automation of measurements and report generation;
- development of measurement procedure and further approval by the national service of legal metrology;

- development of a testing laboratory quality system in accordance with ISO 17025;
- employee training: quality system procedures, measuring procedures, uncertainty calculation;
- laboratory management automation;
- accreditation of the laboratory.

Supported communication standards:

- GSM\GPRS\EDGE,
- UMTS R99\HSDPA\HSUPA\HSPA\HSPA+,
- LTE\LTE-A,
- Wi-Fi a\b\g\n\ac,
- Bluetooth.

Support of the ETSI standards, and normative documents of Russian Federation:

- ETSI TS 151 010, ETSI TS 134 121, ETSI TS 134 121, 3GPP TS 36.521-1.
- Application rules for GSM, UMTS, LTE, Wi-Fi, Bluetooth.

The measuring system is based on the National Instruments equipment with the PXI architecture. The concept of "Soft defined measurements" allows virtually unlimited expansion of the list of supported communication standards.

Our solutions based on NI equipment are successfully used by market leaders:

- BelGISS;
- Giprosvyaz;
- Bellis;
- Svyaz-Sertifikat.

The advantages of owning a test lab for vendors:

- Operative base stations testing without organization of factory tests.
- Significant cost cut out and time saving on the testing of mobile phones, laptops, tablets etc.

- The possibility of accreditation in other countries in order to recognition of test reports.

General measuring system technical description

System structure:

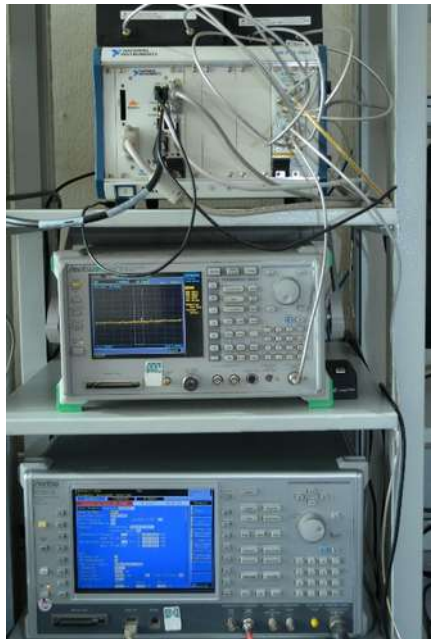
- cellular network simulator;
- measuring system NI PXI with software UniTesS;
- a set of rejector filters to expand the dynamic range during the spurious emissions measurements;
- a reference Wi-Fi access point for the test network organization;
- microwave switching system and a set of calibrated microwave accessories.

The system is equipped with all necessary equipment and accessories for testing: a set of microwave cables, adapters, couplers and other auxiliary equipment.

The cellular network simulator is designed for testing of GSM, UMTS, LTE subscriber equipment and is used to establish a connection and control the radio channel. To reduce the project price, it is possible to replace the simulator with the base station of the vendor.

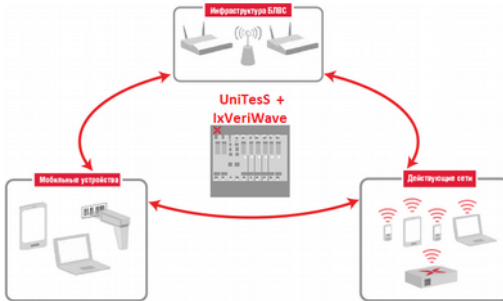
The NI PXI measuring system with UniTesS software allows you to measure all the necessary radio spectrum parameters in accordance with the standards.

All equipment with a microwave switch is installed in a single rack.





13. Hardware and software system for measuring the Wi-Fi network quality



UniTesS Wi-Fi SLA is an automated workstation for generating/analyzing the traffic of Wi-Fi clients to assess the quality of the services provided by the SLA.

UniTesS Wi-Fi SLA workstation includes IxVeriWave measuring

equipment, UniTesS Workstation software for measuring and reporting automation and UniTesS DB database for storing results and subsequent analysis.

UniTesS Wi-Fi SLA allows you to perform tests using specified scenarios in a fully automatic mode, excluding the human factor. Considering the large amount of processed data and necessary calculations, this is practically the only adequate method for conducting such tests.

Brief description of the UniTesS Wi-Fi SLA technical capabilities

The UniTesS Wifi SLA is optimal tool for measuring the performance of Wi-Fi and operational readiness assessment of the wireless local area networks (WLAN).

Using the hardware-software system UniTesS Wi-Fi SLA you can simulate a real network, evaluate the operation of existing network and test its various operation scenarios.

The system provides traffic generation for simulation real networks and their operating conditions, as well as simulating of changing factors, such as distance to the access point, association with it (it is possible to simulate the customers roaming), and interference.

Analysis of network performance for determining QoE indicators, compatibility, scalability, and for identifying and eliminating potential problems.

Unlike traditional survey of the network deployment location, load testing of the network allows determining the true network readiness to mobility support, make a substantiate choice among the products of different manufacturers, design the network and evaluate the planned changes.

Provision of testing services (TaaS) with the participation of Wi-Fi-solutions testing experts.

The UniTesS Wi-Fi SLA solution allow determining the maximum performance of WLANs, devices and applications in realistic operating conditions and helps to assess the impact of future changes on network performance. A wide range of load units and test suites (as part of this solution) provides various testing needs, including the definition of:

- QoE indicators;
- client devices compatibility;
- quality of VoIP services;
- parameters of performing numerous roaming procedures between access points;
- transmission quality of standard and high definition video;
- correctness of the dynamic frequency selection procedure;
- the performance of the WLAN with usage scenarios of these networks, that are typical for different industries - health care, retail trade, education, etc.

The system has a portable design and can be used while working at a distance.

14. Hardware and software system for electroshock devices testing



The UniTesS ESW Test workstation is designed to measure the electrical parameters of electric shock equipment for compliance with the requirements of IEC 62792 and STB GOST R 50940 (GOST R 50940).

The workstation allows measuring electrical parameters and, based on the obtained results, generating a test report with the calculation of the uncertainty in fully automatic mode.

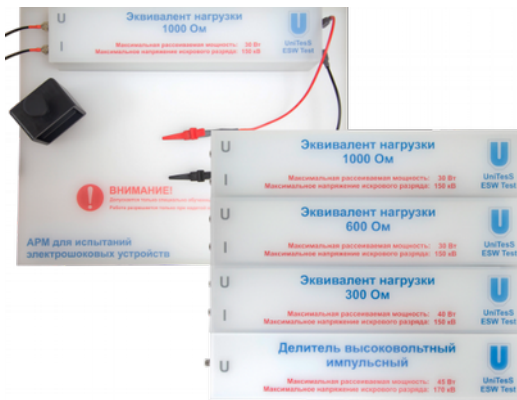
The workstation is made as a stand-alone test bench with a measuring instrument UniTesS ESW210, measuring platform, a set of dummy loads and auxiliary equipment. The measuring instrument with the installed UniTesS APM software allows measuring all necessary electrical parameters of electroshock devices in a fully automated mode with the generation of a test report after the test.

Measuring device is controlled by a mouse and keyboard.

The main measuring instrument is the UniTesS ESW210 with the following metrological characteristics:

- channel number: 2;
- frequency band: 200 MHz;
- sampling frequency: 1 GHz;
- spurious free dynamic range (SFDR) at 100 kHz: 52 dB;
- level resolution: 8 bit;
- input impedance: 1 M Ω .

Workstation measuring platform and a set of dummy loads



The measuring platform is a high-voltage protective surface. The connection to the loads is carried out using alligator clips and high-voltage low-inductance wires. The delivery package also includes an adapter with a mechanical clamp for electrical shock apparatus of "flashlight" type, without protruding electrodes.

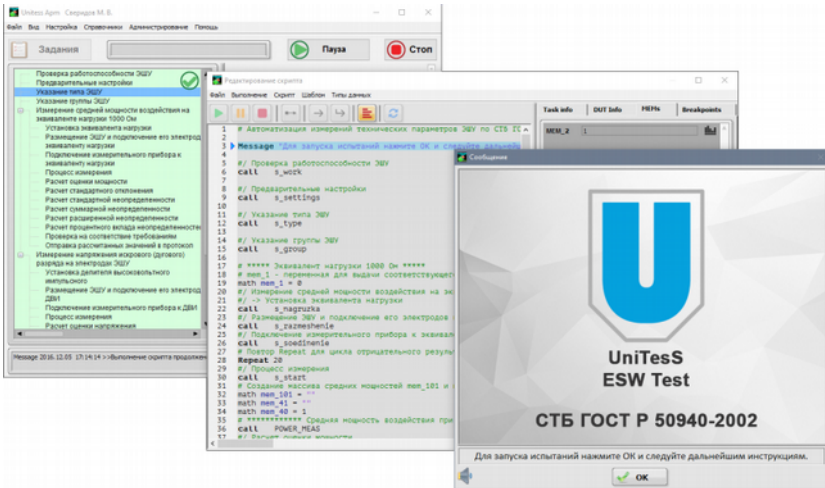
Workstation structure:

- measuring instrument UniTesS ESW210 with installed software.
- measuring platform;
- set of dummy loads 300, 600, 1000 Ω with non-inductive resistors;
- high voltage pulse divider;
- coaxial cables;
- connecting wires with alligator clips;
- adapter for electrical shock apparatus of "flashlight" type.

UniTesS ESW Test workstation allows measuring the following **electrical parameters** in accordance with IEC 62792, STB GOST R 50940 (GOST R 50940):

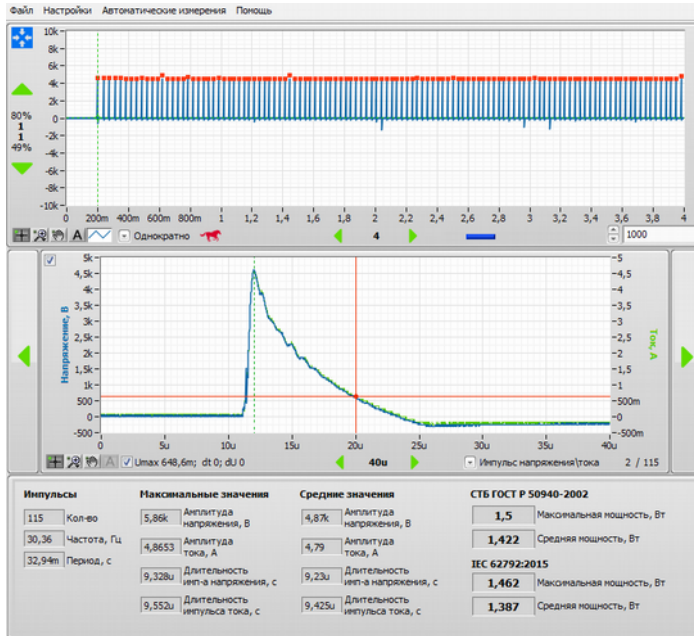
- average power;
- maximum power;
- voltage of spark (arc) discharge;

- the average amplitude level of current and voltage pulses;
- the absolute amplitude level of the current and voltage pulses;
- duration of current and voltage pulses;
- signal frequency;
- signal period.



Measurement of the electrical shock apparatus parameters is a rather complicated procedure, since in accordance with the current procedures it is necessary to record a signal for at least 3 seconds with a maximum sampling frequency. After that it is necessary to calculate the parameters of each pulse.

UniTesS ESW Test software is used to simplify and automate the measurement procedure described above:

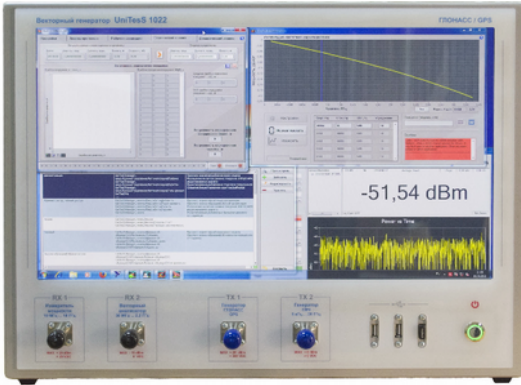


The software has a range of automatic operation modes in which all settings are automatically matched to the current signal parameters.

Benefits of UniTesS ESW Test:

- delivery of workstation with a full set of measuring and auxiliary equipment;
- compliance with the requirements of STB GOST R 50940 (GOST R 50940) and IEC 62792;
- simple and convenient software interface;
- fast user training;
- full automation of measurements and calculations;
- uncertainty calculation;
- automatic test report generation based on measurement results;
- database for results storage.

15. Scalar network analyzer UniTesS SNA M1



Scalar network analyzer UniTesS SNA M1 is designed for high-precision measurements and documentation of microwave circuits metrological characteristics in the range up to 18 GHz.

It contains a highly stable microwave generator with an operating range up to 20 GHz and a high-precision power meter with an operating range up to 18 GHz.

Measurements of frequency response using the substitution method provides attenuation measurements in the entire frequency range with a maximum error of 0.05 dB and an average error of 0.01 dB.

The instrument is used to calibrate microwave cables, attenuators, bridges, power dividers and couplers.

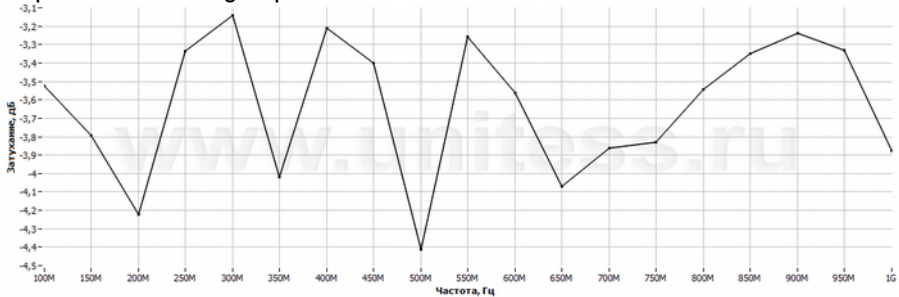
The power meter allows measuring the power of pulse and modulated signals.

To ensure minimum microwave measurements errors over a wide frequency range in test and calibration laboratories, it is necessary to take into account attenuation in cables, couplers, non-linearity of attenuators, etc. Connection of samples to measuring instruments could be carried out using different microwave cables, the signal attenuation of these cables significantly increases with the frequency growth.

Different attenuators, couplers, power dividers, switches have a nonlinear frequency response. In case of complex connection schemes, the total attenuation can be quite significant, for example from 20 to 40 dB, and it depends on the frequency. Often, engineers calibrate the path at one or more frequencies, using the available generator and spectrum analyzer, and take into account these values during the measurements. This method significantly increases the measurement error, since the measured values of

the cables attenuation lie in the range from 0.1 to 3-5-10 dB, and the uncertainty of the calibration (the error of the generator and analyzer) may range from 1-3 dB. Thus, the measurement error is correlated with the measured value, it is also necessary to take into account the operator's error and a small number of points.

An example of significant nonlinearity of the attenuator frequency response in the range up to 1 GHz.



The maximum values deviation is more than 1 dB.

Thus, even if you purchase high-precision measuring instruments, but do not take into account the nonlinearity of the measuring path frequency response, you will not get accurate measurements results!

To solve the above problem, we suggest to use the substitution method: at the first step you need to connect the generator output to the power meter input (connectors on the front panel of the device) with the reference cable and measure the amplitude response (normalization). At the second step, you need consistently connect the measured device or accessory to the reference cable and measure the frequency response again (measurements). Further, the software subtracts one frequency response from another and obtains the frequency response of the measured device. Normalized frequency response consists of the sum of the following frequency responses: power meter and generator (frequency response unevenness) and the reference cable. The described method of frequency response measurements allows eliminating these factors.

The UniTesS RF Correction software for frequency response measurements automation allowing to measure and record the frequency response of the circuits quickly. The software can generate files in the

required format for the further upload to spectrum analyzers and signal generators.

Scalar network analyzer UniTesS SNA M1 (hereinafter referred to as analyzer) is mainly used in testing and calibration laboratories for high-precision calibration of microwave equipment in the frequency range up to 18 GHz.

The analyzer operates under the control of an integrated controller with the following specifications: Windows 7, 8GB DDR3, Intel Core i3-4170, HDD 500GB. The size of the built-in monitor is 22 inches.

The analyzer contains:

- microwave generator up to 20 GHz;
- microwave power meter up to 18 GHz;
- controller with UniTesS RF Correction software.

Power meter specifications:

- frequency range 10 MHz ... 18 GHz;
- dynamic range - 40 ... + 20 dBm;
- SWR:

10 MHz - 150 MHz	> 22,12 dB
150 MHz - 2 GHz	> 24,94 dB
2 GHz - 12 GHz	> 20,08 dB
12 GHz - 18 GHz	> 19,08 dB
Linearity	< 3% (± 0.13 dB)
- calibration factor:

10 Hz	< 2.3% (± 0.10 dB)
50 MHz - 18 GHz.	< 1.5% (± 0.07 dB)
- temperature compensation

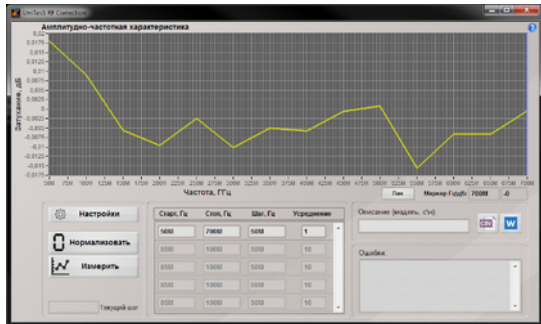
0 °C ... 50 °C	<1,4% ($\pm 0,06$ dB)
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Specifications of the UniTesS 1022 microwave generator:

- frequency range 10 MHz ...20 GHz;
- frequency accuracy $1 \cdot 10^{-6}$;
- output power up to 10 dBm;
- power error 0.8 dB.

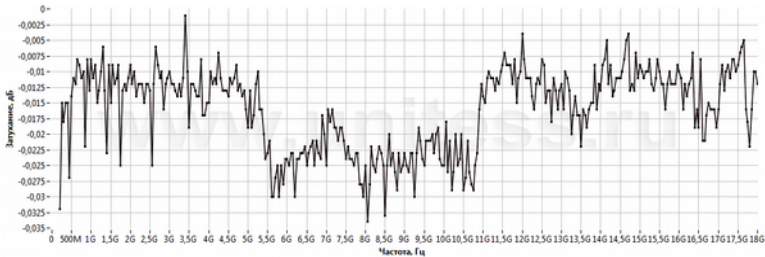
Due to the high stability of the microwave oscillator and the power meter, the analyzer provides amplitude response measurements in the entire frequency range with a peak error of 0.05 dB and an average error of 0.01 dB.

Measurements of the amplitude response are carried out using the substitution method: at the first step you need to connect the generator output to the power meter input (connectors on the front panel of the device) with the reference cable from the delivery set and measure the amplitude response (normalization). At the second step, you need consistently connect the measured device or accessory to the reference cable and measure the frequency response (measurement) again. Further, the software subtracts one frequency response from another and obtains the frequency response of the measured device.



Normalized frequency response consists of the sum of the following frequency responses: analyzer and generator (frequency response unevenness) and the reference cable. The described method of frequency response measurements allows eliminating these factors.

To assess the accuracy of the system (software + generator + analyzer), you can perform normalization and measurements on one reference cable. Ideally, you should see a flat line with minimal fluctuations, characterizing the short-term instability of generating and measuring of signal power. The figure below shows the frequency response obtained on a reference cable without measured device.



Obviously, the maximum error (deviation from 0) is 0.035 dB. Thus, we can say that the subsequent calibration of the equipment will pass with a maximum error of no more than 0.05 dB, which is a very high accuracy.

If necessary to improve further accuracy, it is possible to perform a number of sequential scans with subsequent averaging, which allows minimizing the effect of short-term power instability, both the generator and the power meter.

№	А	В	С	D
1	Коррекция			
2	Частота, Гц	Коэф. затухания, дБ		
3	10000000	0.236		
4	15000000	0.151		
5	20000000	0.134		
6	25000000	0.213		
7	30000000	0.199		
8	35000000	0.186		
9	40000000	0.286		
10	45000000	0.285		
11	50000000	0.320		
12	55000000	0.407		
13	60000000	0.454		
14	65000000	0.522		
15	70000000	0.627		
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