R&S®EDST300
TACAN/DME STATION TESTER

Maintenance checks and signal-in-space analysis on TACAN and DME stations

Product Brochure
Version 03.00

ROHDE&SCHWARZ
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AT A GLANCE

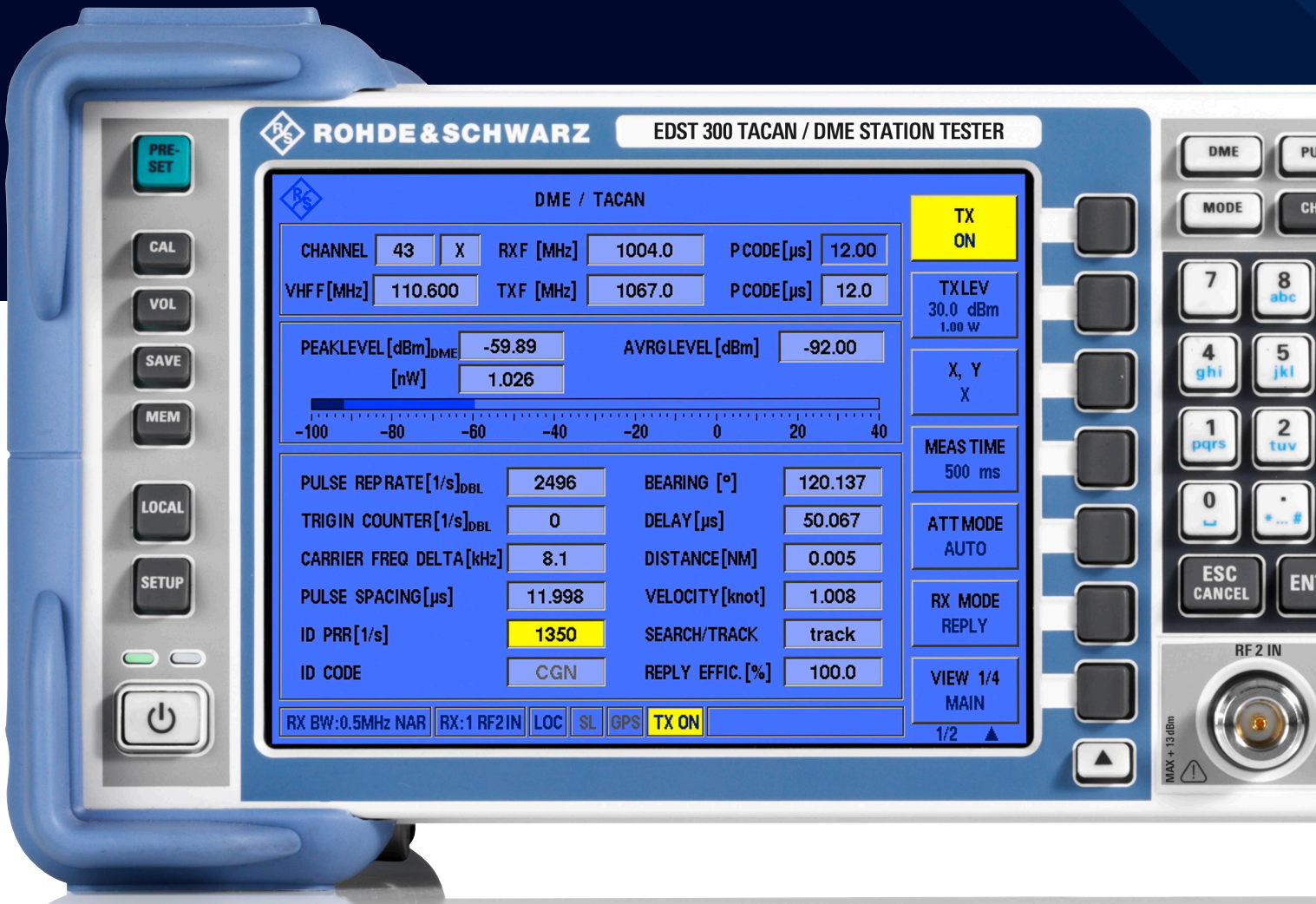
The R&S®EDST300 TACAN/DME station tester is an analyzer designed for commissioning, testing and servicing pulsed terrestrial navigation systems. Its wide dynamic range and compact design make the R&S®EDST300 ideal especially for wired and field measurements on TACAN and DME ground stations.

The R&S®EDST300 provides high-precision stimulus and analysis functions for terrestrial pulsed navigation signals in the frequency range from 960 MHz to 1215 MHz. It performs the TX/RX measurements required for TACAN and DME ground stations in line with the relevant civil and military standards accurately and efficiently.

The R&S®EDST300 can precisely determine characteristic parameters such as peak power, main delay, reply efficiency, and can decode the identifier of the ground station to be tested. The instrument also measures the parameters of TACAN stations (R&S®EDST-K1 option) and performs in-depth pulse analysis (R&S®EDST-K2 option).

The modular design of the R&S®EDST300 provides a high degree of flexibility to adapt it to the task at hand. An interrogator (R&S®EDST-B2 option) with adjustable output power (–80 dBm to +30 dBm peak power) is available for RX measurements. An internal battery (R&S®EDST-B3 option) and a test antenna (R&S®EDST-Z1) deliver maximum flexibility when carrying out field measurements.

Featuring a flat menu structure and a straightforward result representation on a 6.5" TFT color display, the R&S®EDST300 offers exceptional ease of operation. Measured data can be exported to a control system via remote control (LAN), or stored on a USB flash drive.



BENEFITS

Commissioning and regular maintenance checking of TACAN and DME ground stations

- Precise on-channel peak power and frequency measurements
- Analysis of TACAN/DME spectrum
- Detailed analysis of TACAN bursts
- Automated pulse shape analysis
- Detailed analysis of station identifier
- Efficient on-channel sensitivity measurement
- Interrogation loading test
- Adjacent-channel measurement and decoder rejection
- High-precision measurement of reply delay and reply delay variation

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Signal-in-space analysis on TACAN and DME stations

- Efficient analysis in the field
- High dynamic range
- Modulation and signal analysis on TACAN ground stations
- Site environment analysis
- Battery-operated field measurements

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User-friendly design and application-specific extras

- Detailed analysis in line with relevant standards
- Compact, robust design for stationary and mobile applications
- Remote control via LAN interface
- Exporting measurement data via USB data logger
- Power measurements using an external power sensor
- Maintenance, repair and service

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KEY FACTS

- High-precision TX/RX measurements on TACAN and DME systems (in line with ICAO Annex 10, ICAO Doc. 8071, MIL-STD-291C and STANAG 5034)
- All required measurements with a single instrument
- High dynamic range (110 dB) and precise peak power measurements
- Precise, efficient measurement of characteristic TACAN/DME parameters (main delay < 50 ns, bearing < 0.2°)
- Detailed, automated time domain analysis
- Extremely compact with internal battery

COMMISSIONING AND REGULAR MAINTENANCE CHECKING OF TACAN AND DME GROUND STATIONS

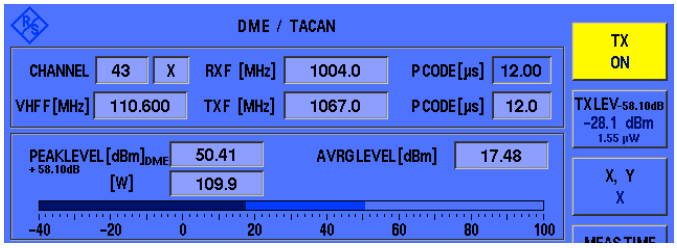
Precise on-channel peak power and frequency measurements

The R&S®EDST300 delivers high-precision measurements of the pulse peak power and carrier frequency of the overall system (e.g. by using a directional coupler connected to the system's RF output) and of individual modules of the system, making external power sensors and frequency counters superfluous. The analyzer can determine the attenuation caused by the directional coupler and the RF cabling without using a network analyzer. Transducer tables are generated, and the power reading will be directly referenced to the system's RF output.

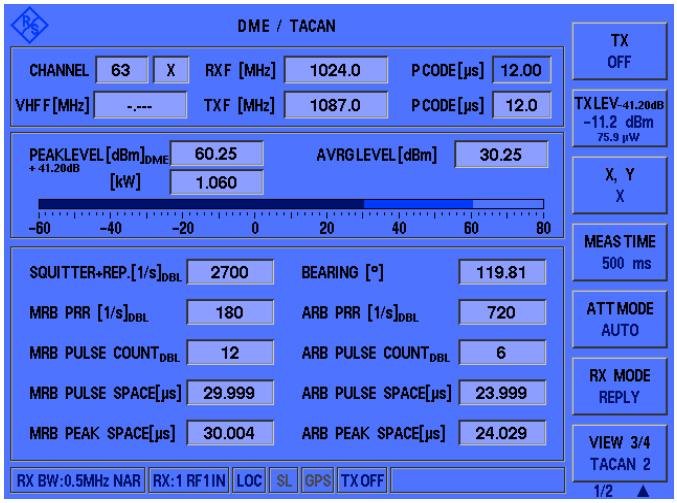
Analysis of TACAN/DME spectrum

To check the spectrum emitted from a TACAN/DME system, the signal power is measured within the stipulated bandwidth of 500 kHz at ±800 kHz and ±2 MHz offset from the center frequency.

Peak power measurements with level correction.



Analysis of main and auxiliary reference bursts (MRB, ARB).



Detailed analysis of TACAN bursts

Analyzing a TACAN system requires a measurement effort far exceeding that for DME systems. The R&S®EDST-K1 TACAN analysis option expands the R&S®EDST300 to include measurement functions for fully analyzing TACAN signals. The main reference burst (MRB) and the auxiliary reference bursts (ARB) can be analyzed and their pulse repetition rate, pulse count and pulse spacing determined.

The R&S®EDST300 has trigger inputs that make it possible to measure the control signals from the system. The TACAN analysis option is therefore ideal for commissioning and servicing stationary and mobile TACAN stations.

Automated pulse shape analysis

In addition to numerical result display, the R&S®EDST300 with the R&S®EDST-K2 pulse shape analysis option provides automatic time domain analysis of the TACAN and DME pulses (on a linear or logarithmic scale). Pulse rise and decay times, pulse peak variation, pulse duration and the spacing between the pulse pairs can be automatically determined. Additional marker and trigger functions are available for more in-depth analyses, e.g. predistortion measurements on transmitter output stages.

Detailed analysis of station identifier

The R&S®EDST300 decodes the TACAN/DME station identifier and measures its parameters fully automatically. It displays the ID pulse repetition rate, ID code and the dash and dot lengths.

Efficient on-channel sensitivity measurement

The R&S®EDST-B2 interrogator option for the R&S®EDST300 features a wide output power range (–80 dBm to +30 dBm). Via a directional coupler (coupling factor of e.g. 40 dB), the output power of the interrogation pulses transmitted to the TACAN/DME system's RF port can be reduced to a range of e.g. –10 dBm to –120 dBm. This allows the precise determination of the sensitivity of a TACAN/DME station at the center frequency and at ±100 kHz offset from the center frequency as stipulated by the standard. The sensitivity of a station can be determined by lowering the interrogator's transmit power until the reply efficiency drops to 70%. Using the instrument's built-in AF frequency counter, the sensitivity limit of a TACAN/DME system can also be determined at the system's AF trigger outputs.

Interrogation loading test

The pulse repetition rate for the interrogation pulses sent by the R&S®EDST300 can be increased to 6000 pulse pairs per second. Users can thus measure a ground station's receiver sensitivity variation with interrogation load.

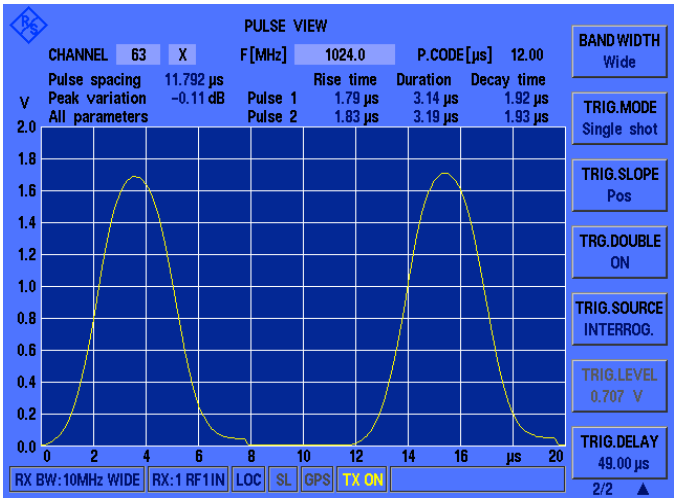
Adjacent-channel measurement and decoder rejection

A system's immunity against interrogation pulses in adjacent channels can be determined by carrying out a sensitivity measurement at ±800 kHz offset from the center frequency. By varying the pulse code (pulse spacing) for the interrogation pulses, it can be verified that the system sends a reply only to valid pulses and ignores invalid ones.

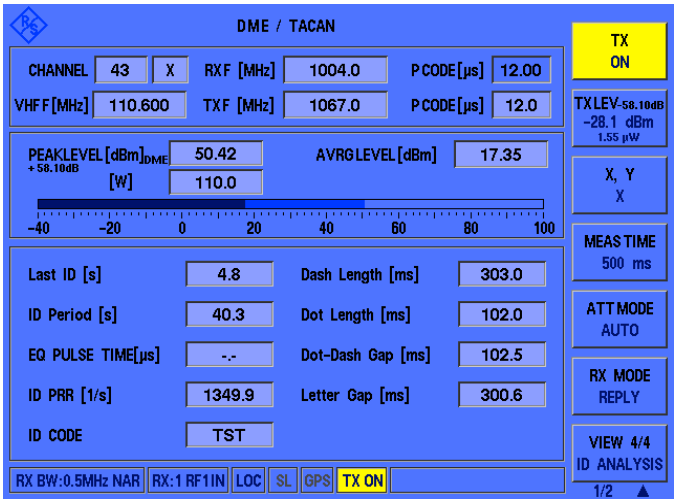
High-precision measurement of reply delay and reply delay variation

The R&S®EDST-B2 interrogator function in combination with digital signal processing makes it possible to measure the reply delay (main delay) with high precision. This means that service personnel no longer depends on performing time measurements with an oscilloscope connected to the system's video test outputs. The R&S®EDST300 can also determine the reply delay variation as a function of the interrogator pulse level by varying the interrogator's transmit power in a range from e.g. –10 dBm to –120 dBm (using a directional coupler with a coupling factor of e.g. 40 dB).

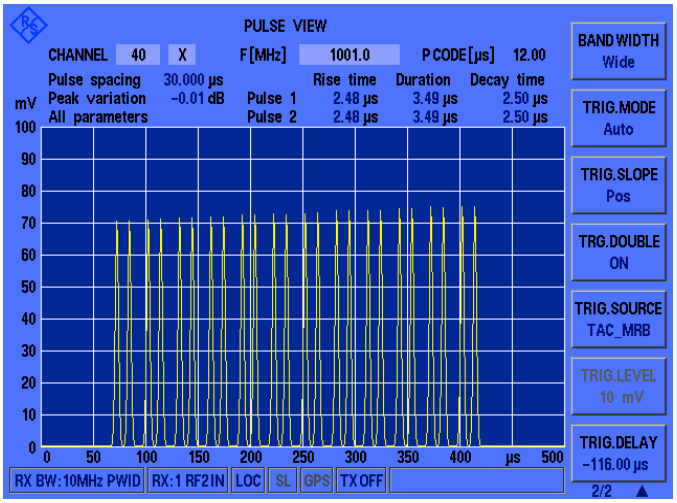
Pulse shape analysis with R&S®EDST-K2.



Analysis of station identifier.



Time domain analysis of an MRB burst with R&S®EDST-K2.



SIGNAL-IN-SPACE ANALYSIS ON TACAN AND DME STATIONS

Efficient analysis in the field

The R&S®EDST300 comes with an optional test antenna (R&S®EDST-Z1). Using this antenna, the R&S®EDST300 can perform diverse signal-in-space measurements. In this way, range accuracy and many more system parameters such as signal strength in space, spacing between pulse pairs, reply efficiency and TACAN station bearings can be determined. Due to the directional characteristics of the test antenna, multipath effects are minimized.

High dynamic range

With a high dynamic range of 110 dB and excellent shielding of the instrument housing, the R&S®EDST300 also delivers stable readings in environments that are subject to interference. Thanks to its low noise figure, the R&S®EDST300 offers excellent input sensitivity of –100 dBm (RF input 2). This allows highly accurate measurements even at large distances from the TACAN/DME ground station.

Modulation and signal analysis on TACAN ground stations

Equipped with the R&S®EDST-K1 TACAN analysis option, the instrument not only supplies the MRB and ARB information, but also delivers the TACAN bearing with a deviation as small as < 0.2°. Moreover, it measures the modulation depth and modulation frequency of the 15 Hz and 135 Hz AM signal components, and determines the MRB/15 Hz and ARB/135 Hz phase relationships.

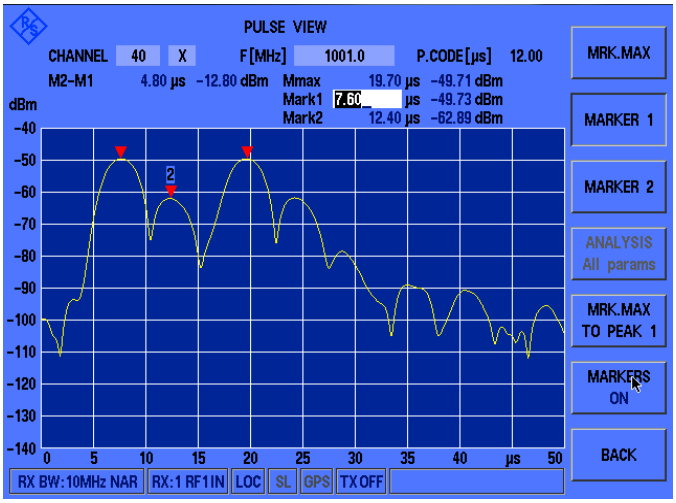
Site environment analysis

The time domain analysis function provided by the R&S®EDST-K2 option makes it possible to examine in detail the reflections of pulses transmitted by a TACAN/DME station and to analyze the amplitude and phase relationships between the direct pulse and the reflected pulses.

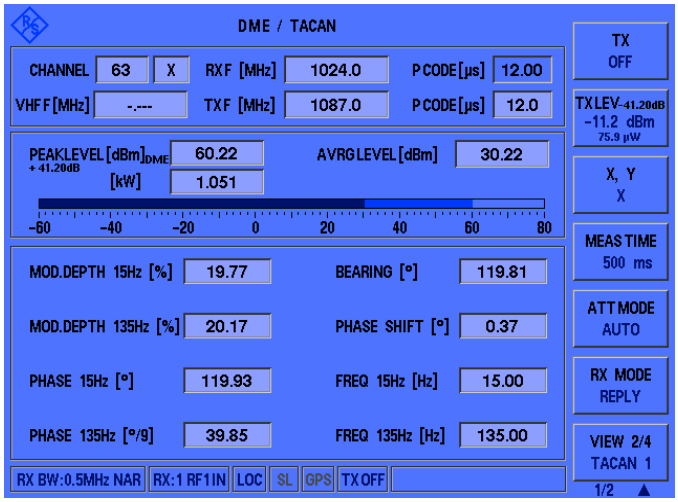
Battery-operated field measurements

For field measurements, the R&S®EDST300 can be powered from a built-in battery (R&S®EDST-B3 option). The battery allows more than 2.5 hours of operation with the interrogator switched on (+30 dBm peak power). The battery is recharged within four hours.

Time domain analysis of direct and reflected pulses.



Analysis of TACAN bearing and modulation data.



USER-FRIENDLY DESIGN AND APPLICATION-SPECIFIC EXTRAS

Detailed analysis in line with relevant standards

ICAO Annex 10, ICAO Doc. 8071, MIL-STD-291C and STANAG 5034 specify exactly how to service TACAN and DME systems. The high flexibility of the R&S®EDST300 makes it possible to perform all required measurements with a single instrument.

Compact, robust design for stationary and mobile applications

The R&S®EDST300 comes in a robust housing, which makes it ideal for measurements in the field. At the same time, the instrument offers lab quality accuracy. Accessories include a rugged, wheeled transport case (R&S®EDS-Z2) and a test antenna (R&S®EDST-Z1), making day-to-day service work easier.

Remote control via LAN interface

The R&S®EDST300 can be controlled manually via its front panel or remotely via LAN. The remote control capability allows measurement tasks to be automated, with the R&S®EDST300 being controlled from a PC or a mobile device.

Exporting measurement data via USB data logger

The USB data logger of the R&S®EDST300 makes it easy to transfer measurement data to an external storage medium without the need for additional software. The data can then be evaluated and graphically displayed in the lab using spreadsheet software.

Power measurements using an external power sensor

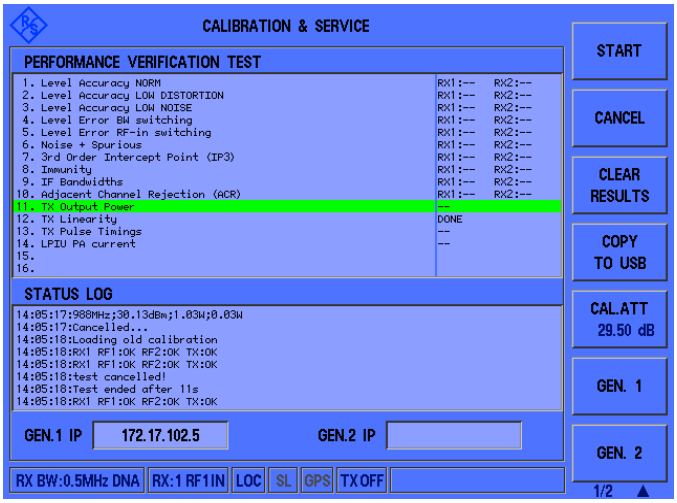
For reference measurements requiring very high accuracy, a power sensor from the R&S®NRP family can be connected to the R&S®EDST300 USB port. Results delivered by the power sensor are displayed on the R&S®EDST300.

Maintenance, repair and service

The modular design of the R&S®EDST300 and its mechanical ruggedness make the instrument very easy to service. The service manual provides complete instructions for troubleshooting and servicing (module replacement and calibration). The R&S®EDST-Z10 verification test software included in the R&S®EDST300 guides users through the required steps and performs time-consuming adjustments automatically.

Results of power measurements delivered by an R&S®NRP-Z81 power sensor.

Performance verification test.



R&S®EDS-Z2 rugged, wheeled transport case.

SPECIFICATIONS IN BRIEF

Specifications in brief		
Frequency range		960 MHz to 1215 MHz
Reference frequency, internal		
Aging per year		≤ 1 ppm
TX power measurement (R&S®EDST300 analyzer)		
Measurement range (peak detector)	autorange mode	
	RF input 1	–80 dBm to +30 dBm
	RF input 2	–100 dBm to +10 dBm
Peak level deviation	standard TACAN signal in line with MIL-STD-291C or standard DME signal in line with ICAO Annex 10, RF input 1, level range 15 dBm to 25 dBm, 95% confidence level, +20°C to +30°C	0.3 dB
Transponder delay/distance measurement		
Input level range	RF input 1	–80 dBm to +30 dBm (nom.)
Deviation	–70 dBm to +30 dBm, RF input 1, measurement time ≥ 200 ms, PRR ≥ 100/s, 95% confidence level	≤ 50 ns, ≤ 7.5 m (nom.), ≤ 0.005 NM (nom.)
TACAN analysis (R&S®EDST-K1 option, export license required)		
Input level range	RF input 1	–80 dBm to +30 dBm
Bearing		
Deviation	–70 dBm to +30 dBm, RF input 1, standard TACAN signal in line with STANAG 5034, modulation depth of 15 Hz and 135 Hz signals = 21%, measurement time ≥ 1 s	< 0.2°
Bearing acquisition time		< 3 s
Pulse shape analysis (time domain, R&S®EDST-K2 option)		
Resolution bandwidth	selectable	0.5 MHz, 10 MHz (nom.)
Reference level		–70 dBm to +30 dBm
Trace functions		clear/write, average, max. hold
Trigger		
Trigger source		level/external/DME pulse/interrogator, MRB/ARB trigger source
Trigger delay		–500 µs to +8000 µs
Pulse shape analysis	pulse 1, pulse 2	rise time, duration, decay time
Deviation		< 0.05 µs (nom.)
Pulse spacing		
Deviation		< 0.05 µs
RX measurement (R&S®EDST300 generator, R&S®EDST-B2 option)		
Output power		–80 dBm to +30 dBm
Output power step size		0.1 dB
Level uncertainty	+20°C to +30°C	< 1 dB, 0.5 dB (typ.)
Pulse rate	default mode	5 Hz to 6000 Hz in 1 Hz steps
	ICAO compliant mode, search/track	5 Hz to 150 Hz/5 Hz to 30 Hz in 1 Hz steps
Pulse counter		
Frequency range		2 Hz to 1 MHz
Uncertainty		< 1 Hz (nom.)
Test antenna		
Gain		11 dBi (nom.)
Front-to-rear ratio		> 26 dB (nom.)

Specifications in brief		
General data		
Power supply		
Rated voltage	base unit	20 V to 28 V DC
	external power supply	100 V to 240 V AC (±10%)
Battery operating time	with R&S®EDST-B3 option (new, fully charged battery)	> 2.5 h
Dimensions	W × H × D	342 mm × 157 mm × 266 mm (13.46 in × 6.18 in × 10.47 in) (¾ 19", 3 HU)
Weight	fully equipped (incl. R&S®EDST-B2 and R&S®EDST-B3), without external power supply	7.2 kg (15.9 lb)

ORDERING INFORMATION

Designation	Type	Order No.
Base unit		
TACAN/DME station tester	R&S®EDST300	5202.9009.02
Hardware options		
Interrogator	R&S®EDST-B2	5202.9509.02
Internal battery	R&S®EDST-B3	5202.7187.02
Additional interfaces	R&S®EDST-B6	5202.9167.02
Software options		
TACAN analysis, export license required	R&S®EDST-K1	5202.9515.02
Pulse shape analysis	R&S®EDST-K2	5202.9521.02
Accessories		
DME test antenna	R&S®EDST-Z1	5202.9538.02
Antenna mast (monopole)	R&S®EDST-Z8	1330.0295.02
Verification test	R&S®EDST-Z10	5202.9544.02
Rugged transport case	R&S®EDS-Z2	5202.8202.02
Documentation of calibration values	R&S®DCV-2	0240.2193.10

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- Technical startup/application development/integration
- Training
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- Customized and flexible
- Uncompromising quality
- Long-term dependability

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ISO 9001

Certified Environmental Management
ISO 14001

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R&S®EDST300 TACAN/DME Station Tester
Data without tolerance limits is not binding | Subject to change