



TTSG Datasheet

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1. Overview

The TTSG (Tunnel Test Signal Generator) is a multi-channel RF signal generation instrument designed for testing and troubleshooting freight rail tunnel systems.

The system provides internally generated RF test signals and supports routing of both internal and external signals to multiple front-panel output ports under software control.

Key Features

- Four integrated synthesized signal generators
- Independent frequency and power control per signal
- 16-channel RF output architecture
- Per-port attenuation control (0 to 31.5 dB, 0.5 dB steps)
- Internal and external signal routing per output port
- Integrated monitoring port for all outputs
- CW, fixed-frequency operation
- Windows-based configuration interface
- 1RU rack-mount form factor

2. System Description

The TTSG provides four internally generated RF signals covering VHF AAR, VHF PTC, and UHF DP/ETD bands.

Signals can be routed to front-panel outputs under software control. Each output port may be configured to use either internally generated signals or externally applied signals from corresponding RF input ports.

Per-port attenuation allows independent output level control across all channels.

3. RF Sign Generation and Passing

Signal Generators

- 2 × VHF AAR band synthesizers (7.5 kHz step size)
- 1 × VHF PTC synthesizer (217–222 MHz, 6.25 kHz steps)
- 1 × UHF DP/ETD synthesizer (452–453 MHz, 457–458 MHz, 6.25 kHz steps)

Signal Characteristics

Table 1 Signal Characteristics

Parameter	Value
Output Type	CW (continuous wave), fixed frequency
Nominal Maximum Output Power	+11 dBm

Maximum Output Power (Measured)

Table 2 Output Power

Band	Output Power (Typ)	Variation
VHF AAR 1 (Simplex)	+10.93 dBm	±1.21 dB
VHF AAR 2 (MRAS)	+11.10 dBm	±1.64 dB
VHF PTC	+11.08 dBm	±1.53 dB
UHF	+10.95 dBm	±1.45 dB

Output power is adjustable for each signal from 0 to -16.5 dB of max. This control is independent of the output level control. This allows for matching internally generated levels to match signals that pass through during normal operation.

Output Level Control

Table 3 Output Level Control

Parameter	Value
Attenuation Range	0 to 31.5 dB
Resolution	0.5 dB
Control	Independent per port

Monitoring Port

Provides a coupled representation of all output signals.

Table 4 Monitoring Port

Band	Coupling	Variation
VHF AAR	-28.2 dB	±0.2 dB
VHF PTC	-27.8 dB	±0.2 dB
UHF	-27.6 dB	±0.2 dB

Signal Routing

- Each output port may be configured for:
 - Internal signal sources
 - External input signals
- External signals applied to front-panel inputs pass through to outputs based on user configuration

4. RF Interfaces

Front Panel Ports

Table 5 Front Panel Ports

Interface	Quantity	Type
RF Inputs	16	SMA Female
RF Outputs	16	SMA Female
Monitor Port	1	SMA Female

Surface Coverage Outputs

- 8 ports
- 4 per side of tunnel
- One internally generated signal per port

Tunnel Section Outputs

- 8 ports
- Each port carries all four internally generated signals

5. Front Panel LEDs

- One Red/Green LED per output port
- Red indicates signal generator tied to output
- Green indicates that input is tied to output

6. Configuration Interface

The TTSG is controlled via a Windows-based application.

- **Connection:** USB to 3.5 mm communication cable (front panel)
- **Control Functions**
 - Enable/disable of all test signals
 - Frequency and output power control per signal
 - Independent attenuator control per output port
 - Selection of internal or external signal per port
 - Firmware update

7. Frequency Accuracy

Table 6 Frequency Accuracy

Parameter	Value
Reference Oscillator Accuracy	±25 ppm

Measured frequency variation under nominal conditions is approximately ±2 ppm.

8. Power Requirements

Table 7 Power Requirements

Parameter	Value
Input Voltage	12 VDC
Idle Current	125 mA
Operating Current	2.5 A (all synthesizers active)

9. Power Interface

- Rear-panel DC input
- Rear-panel illuminated power switch

10. Controls

Rear Panel

- Power switch (illuminated)
- Reset (momentary)
- Bootloader (momentary, for firmware update)

11. Mechanical

Table 8 Mechanical

Parameter	Value
Form Factor	1RU rack mount
Depth	12 inches (including connections)

12. General Notes

- All RF ports are 50 Ω nominal impedance
- Output power values are typical at maximum setting
- Variation values represent approximately 2σ (n = 5 units)
- Monitoring port coupling is tightly controlled for consistent measurement

13. Ordering Information

Model: TTSG

Part Number: 100022