# USB-5681 Specifications

2025-03-13

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# USB-5681 Specifications

## Definitions

***Warranted*** specifications describe the performance of a model under stated operating conditions and are covered by the model warranty.

***Characteristics*** describe values that are relevant to the use of the model under stated operating conditions but are not covered by the model warranty.

- ***Typical*** specifications describe the performance met by a majority of models.
- ***Nominal*** specifications describe an attribute that is based on design, conformance testing, or supplemental testing.

Specifications are ***Typical*** unless otherwise noted.

## Conditions

Minimum or maximum specifications are warranted under the following conditions unless otherwise noted.

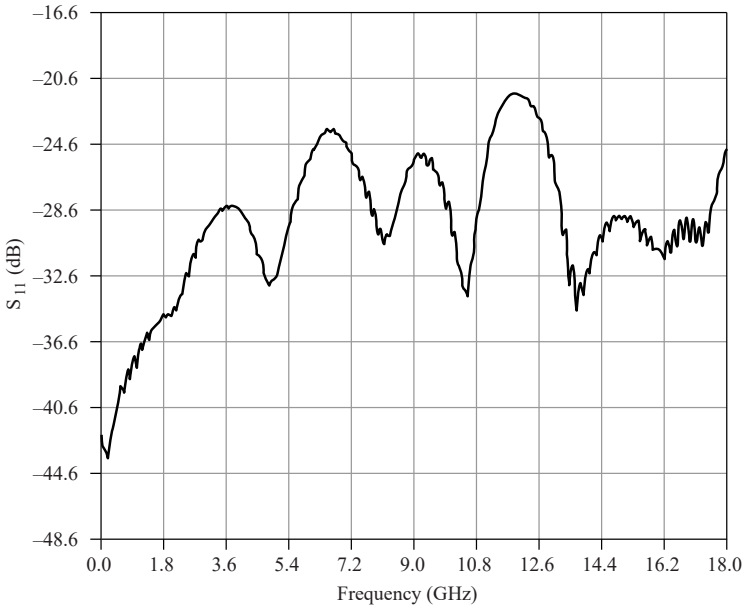
- 1 hour warm-up time at ambient temperature
- Calibration cycle maintained
- Temperature 0 °C to 55 °C

## General

| | |
|---|---|
| Frequency range | 10 MHz to 18 GHz |
| Input range | - 40 dBm to +20 dBm |
| **Input return loss** | |

| | |
|---|---|
| 10 MHz to <150 MHz | >22.12 dB |
| 150 MHz to 2 GHz | >24.94 dB |
| >2 GHz to 12 GHz | >20.08 dB |
| >12 GHz to 18 GHz | >19.08 dB |

**Figure 1.** Power Meter Return Loss, Measured




| **Measurement range** | |
|---|---|
| Range 1 | .+20 dBm to -7 dBm, typical |
| Range 2 | -7 dBm to -40 dBm, typical |
| Signal-channel bandwidth | 50 kHz |

# Uncertainty

| | |
|---|---|
| Linearity | <3% (±0.13 dB) |
| **Calibration factor**[1] | |
| 10 MHz | <2.3% (±0.10 dB) |
| 50 MHz to 18 GHz | <1.5% (±0.07 dB) |
| **Noise**[2] | |
| Measurement range 1 | <8 µW (-21 dBm) |
| Measurement range 2 | <40 nW (-44 dBm) |
| **Zero set**[3] | |
| Measurement range 1 | <1 µW |
| Measurement range 2 | <3 nW |
| **Zero drift**[4] | |
| Measurement range 1 | <0.5 µW |
| Measurement range 2 | < 3 nW |
| Temperature compensation (0 °C to 50 °C) | <1.4% (±0.06 dB) |

| **Effect of digital modulation**[5] | |
|---|---|
| Power level ≥18 dBm | <1.4% (±0.06 dB) |
| Power level <18 dBm | <0.5% (±0.02 dB) |

# System

| Measurement | Average power |
|---|---|
| Measurement resolution | 0.01 dB |
| Offset range | -100 dB to +150 dB |

| **Averaging** | |
|---|---|
| Averaging mode | Auto, repeat |
| Number of averages (repeat)[6] | 1 to 40,000 |

| **Auto-averaging** | |
|---|---|
| Resolution[7] | 1 dB, 0.1 dB, 0.01 dB, 0.001 dB |
| Source | Time Slot mode: 1 to 128 slots; Scope mode: 1 to 1,024 data points |

# Continuous Mode

| | |
|---|---|
| Duty cycle correction | 0.01% to 100% |
| Aperture time | 0.01 ms to 300 ms |
| Measurement time[8] | (***Number of Averages*** × a) + b, where a and b depend on the aperture time, as shown in the following table. |

**Table 1.** Measurement Time Variables

| Aperture Time | a (ms) | b (ms) |
|---|---|---|
| 0.01 | 2 | 6.5 |
| 0.1 | 2.3 | 6.5 |
| 1 | 5.4 | 7.1 |
| 10 | 35.8 | 20.5 |
| 100 | 331 | 164 |

# Scope Mode

| | |
|---|---|
| Capture time | 0.01 ms to 300 ms |
| Data points | 1 to 1,024 |
| Resolution | 0.01 ms |
| Measurement time[9] | (***Capture Time*** × 6.69) + (***Data Points*** × 0.36 ms) + 13.6 ms |

## Time Slot Mode

| | |
|---|---|
| Maximum number of slots | 128 |
| Slot width | 0.01 ms to 100 m |
| Maximum capture time | 300 ms (***Slot Width*** × ***Number of Slots***) |
| Resolution | 0.01 ms |
| **Exclusion periods**[10] | |
| Start exclusion | 0 ms to 100 ms |
| End exclusion | 0 ms to 100 ms |

## Trigger

| | |
|---|---|
| Source[11] | Immediate, external, internal, software |

## Internal Trigger

| | |
|---|---|
| Range | -20 dBm to +20 dBm |
| Level accuracy | ±0.5 dB, typical |

| | |
|---|---|
| Slope | Positive or negative |
| Delay range | -5 ms to 10 s |
| Delay resolution | 10 µs |

## External Trigger

| | |
|---|---|
| Impedance | 100 kΩ |
| Type | TTL/CMOS |
| Slope | Positive or negative |
| Delay range | -5 ms to 10 s |
| Delay resolution | 10 µs |
| Voltage high threshold | 2.0 V, typical |
| Voltage low threshold | 1.2 V, typical |
| Hysteresis | 0.8 V, typical |
| Maximum voltage | ±20 V |

| | |
|---|---|
| Minimum pulse width | 7.5 µs[12] |

## Maximum Damage Levels

| | |
|---|---|
| Maximum DC voltage at RF port | ±20 V |
| Absolute power | +30 dBm |

## DC Power Requirements (5 V) from Host USB

| | |
|---|---|
| Typical current | 450 mA |

**Caution** You can impair the protection provided by the USB-5681 if you use it in a manner not described in this document.

## Calibration

| | |
|---|---|
| Interval | 1 year; calibration interval starts with the date the product is put into service by the customer |

## Physical Characteristics

| | |
|---|---|
| Dimensions | 25 mm × 45 mm × 110 mm, excluding RF connector and silicone cover |
| Weight | 230 g (0.51 lb) |

# Environmental

Specifications in this document are guaranteed under the following specified environmental conditions unless otherwise stated.

| | |
|---|---|
| Maximum altitude | 4,600 m (at 25 °C ambient temperature) |
| Pollution Degree | 2 |

Indoor use only.

## Operating Environment

| | |
|---|---|
| Ambient temperature range | 0 to 50 °C (Tested in accordance with MIL-PRF-28800F (Class 3).) |
| **Relative humidity range[13] (noncondensing)** | |
| At 50 °C | 45% |
| At 40 °C | 75% |
| At 30 °C | 95% |

## Storage Environment

| | |
|---|---|
| Ambient temperature range | -40 °C to +71 °C (Tested in accordance with MIL-PRF-28800F (Class 3).) |

| | |
|---|---|
| Relative humidity range | 5% to 95%, noncondensing (Tested in accordance with MIL-PRF-28800F (Class 3).) |

## Shock and Vibration

| | |
|---|---|
| Operating Shock | 30 g peak, half-sine, 11 ms pulse (Tested in accordance with MIL-PRF-28800F.) |
| **Random Vibration** | |
| Random vibration nonoperating | 10 Hz to 500 Hz, Power spectral density 0.03 $g^2$/Hz (Tested in accordance with MIL-PRF-28800F.) |

# Compliance and Certifications

## Safety Compliance Standards

This product is designed to meet the requirements of the following electrical equipment safety standards for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA C22.2 No. 61010-1

**Note** For safety certifications, refer to the product label or the Product Certifications and Declarations section.

## Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 61326-1 (IEC 61326-1): Class A emissions; Basic immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- EN 55022 (CISPR 22): Class A emissions

- EN 55024 (CISPR 24): Immunity
- AS/NZS CISPR 11: Group 1, Class A emissions
- AS/NZS CISPR 22: Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions

**Note** In the United States (per FCC 47 CFR), Class A equipment is intended for use in commercial, light-industrial, and heavy-industrial locations. In Europe, Canada, Australia, and New Zealand (per CISPR 11), Class A equipment is intended for use only in heavy-industrial locations.

**Note** Group 1 equipment (per CISPR 11) is any industrial, scientific, or medical equipment that does not intentionally generate radio frequency energy for the treatment of material or inspection/analysis purposes.

**Note** For EMC declarations, certifications, and additional information, refer to the Product Certifications and Declarations section.

## CE Compliance CE

This product meets the essential requirements of applicable European Directives, as follows:

- 2014/35/EU; Low-Voltage Directive (safety)
- 2014/30/EU; Electromagnetic Compatibility Directive (EMC)
- 2011/65/EU; Restriction of Hazardous Substances (RoHS)
- 2014/53/EU; Radio Equipment Directive (RED)
- 2014/34/EU; Potentially Explosive Atmospheres (ATEX)

## Product Certifications and Declarations

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for NI products, visit ni.com/product-certifications, search by model number, and click the appropriate link.

# Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the ***Engineering a Healthy Planet*** web page at ni.com/environment. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

### EU and UK Customers

- **Waste Electrical and Electronic Equipment (WEEE)**—At the end of the product life cycle, all NI products must be disposed of according to local laws and regulations. For more information about how to recycle NI products in your region, visit ni.com/environment/weee.

### 电子信息产品污染控制管理办法（中国RoHS）

- **中国RoHS**— NI符合中国电子信息产品中限制使用某些有害物质指令(RoHS)。关于NI中国RoHS合规性信息，请登录 `ni.com/environment/rohs_china`。(For information about China RoHS compliance, go to `ni.com/environment/rohs_china`.)