

USB Preamplifier with Switchable Thru Path

U7229G: 500 MHz to 67 GHz

U7229M: 50 to 110 GHz



Key Features

- Switchable thru path for ultimate convenience in test flexibility and calibration
- Automatic gain correction value with temperature compensation and transfer of calibration data (noise figure and S-parameters) through USB plug and play features for improved noise figure measurements with Keysight analyzers
- Excellent noise figure and gain to improve system measurement accuracy and minimizes uncertainty
- Rugged and portable design for benchtop measurement or remote front-end applications

Benchtop/Remote Front-End Use

Benchtop/Remote Front-End Use In many RF systems, noise figure is known as a key parameter for characterizing a receiver and its ability to detect weak incoming signals combined with self-generated noise. The presence of these signals are typically low level, so adding a reliable preamplifier will greatly increase the sensitivity of your measurement system.

The Keysight Technologies, Inc. U7229G/M USB amplifiers are designed to increase signal analyzer sensitivity for measuring low-level signals by reducing instrument noise figure. Reduced instrument noise figure also reduces noise figure measurement uncertainty in most cases. Powered on a USB platform, compact and portable, the USB amplifiers eliminate the need for an external power supply and is ideal for either benchtop measurements or on remote front-end applications.

The U7229G/M is supported by PNA-X

Improve Noise Figure Measurements

Adding a amplifier to a noise figure measurement system can significantly reduce the overall system noise figure. The total system noise is dominated by the noise figure of the amplifier.

$$F_{new} = F_{pa} + \frac{F_{sys} - 1}{G_{pa}}$$

Where F and G are noise figure and amplifier gain, both in linear terms.

$$NF_{sys} = 10 \log (F_{sys}) \text{ in dB}$$

For systems with a single amplifier, where the gain of the amplifier is greater than or equal to the spectrum analyzer noise figure, the system noise figure is approximately equal to the noise figure of the amplifier.

Increase Sensitivity and Speed

Measurement system sensitivity for measuring low-level signals can be improved by adding a amplifier. Alternatively, boosting the sensitivity of your signal or spectrum analyzer with the U7229G/M USB amplifiers can provide a means for achieving a faster measurement speed. An analyzer with low noise figure allows you to use a wider resolution bandwidth yet achieve the same sensitivity. Sweep times can improve one hundred times for each decade increase in bandwidth. The U7229GM USB amplifiers have gain and noise figure characteristics that optimize dynamic range and sensitivity.

Specifications

Specifications refer to the performance standards or limits against which the U7229G/M USB amplifiers are tested. Typical characteristics are included for additional information only and they are not specifications. Those are denoted as “typical”. Specifications subject to change.

Gain path specifications	U7229G		U7229M	
Frequency range	500 MHz to 67 GHz (Usable up to 70 GHz)		50 to 110 GHz	
Parameter	Specifications	Typical	Specifications	Typical
Gain (dB)	0.5 to 2 GHz: > 24.1 2 to 20 GHz: > 20.7 20 to 40 GHz: > 21.2 40 to 60 GHz: > 18.6 60 to 67 GHz: > 14.1	0.5 to 2 GHz: 26.4 2 to 20 GHz: 22.2 20 to 40 GHz: 22.5 40 to 60 GHz: 20.4 60 to 67 GHz: 16.5 67 to 70 GHz: 14.2	50 to 60 GHz: > 18.4 60 to 70 GHz: > 20.1 70 to 90 GHz: > 18.0 90 to 100 GHz: > 19.6 100 to 110 GHz: > 18.3	50 to 60 GHz: 20.9 60 to 70 GHz: 23.4 70 to 90 GHz: 22.4 90 to 100 GHz: 26.6 100 to 110 GHz: 23.3
Input return loss (dB)	0.5 to 1 GHz: > 5.7 1 to 47 GHz: > 10 47 to 67 GHz: 4.6	0.5 to 1 GHz: 6.7 1 to 47 GHz: 11.8 47 to 67 GHz: 7.6 67 to 70 GHz: 5.0	50 to 110 GHz: > 6.0	50 to 110 GHz: 8.9
Output return loss (dB)	0.5 to 1 GHz: > 7.1 1 to 35 GHz: > 12.5 35 to 45 GHz: > 10 45 to 67 GHz: > 4.6	0.5 to 1 GHz: 8.4 1 to 35 GHz: 14.9 35 to 45 GHz: 13.1 45 to 67 GHz: 6.8 67 to 70 GHz: 6.6	50 to 60 GHz: > 5.0 60 to 80 GHz: > 8.8 80 to 100 GHz: > 5.6 100 to 110 GHz: > 3.4	50 to 60 GHz: 7.5 60 to 80: 13.0 80 to 100 GHz: 10.4 100 to 110 GHz: 7.1
Noise figure (dB)	-	0.5 to 2 GHz: 10.6 2 to 40 GHz: 9.2 40 to 50 GHz: 9.9 50 to 60 GHz: 11 60 to 67 GHz: 13.3 67 to 70 GHz: 20.1	-	50 to 60 GHz: 14.3 60 to 100 GHz: 13.0 100 to 110 GHz: 14.3
Reverse isolation (dB)	-	0.5 to 20 GHz: 55.9 20 to 40 GHz: 50.5 40 to 70 GHz: 38.3	-	50 to 110 GHz: 44.9
Input P1dB (dBm)	-	0.5 to 2 GHz: -16.4 2 to 40 GHz: -16.0 40 to 67 GHz: -17.7 67 to 70 GHz: -5.4	-	50 to 70 GHz: -21 70 to 90 GHz: -23.6 90 to 110 GHz: -29.9
Output P1dB (dBm)	-	0.5 to 30 GHz: 9.4 30 to 60 GHz: 5.9 60 to 67 GHz: 3.2 67 to 70 GHz: -5.4	-	50 to 60 GHz: 1.2 60 to 90 GHz: 3.9 90 to 110 GHz: -0.8
Survival input power (dBm)	+ 10	-	+ 4	-
Gain temperature coefficient (dB/°C)	-	- 0.15 dB/ °C	-	- 0.3 dB/ °C

*Specifications are tested and measured with an operating temperature of 25°C

*U7229G: Noise figure is measured via cold source method, with N5247B with E29 option

*U7229M: Noise figure is measured via Y-Factor method, with N9042B UXA Signal Analyzer, VDI SAX downconverter module and VDI noise source

Thru path specifications	U7229G		U7229M	
Frequency range	500 MHz to 67 GHz (Usable up to 70 GHz)		50 to 110 GHz	
Parameter	Specifications	Typical	Specifications	Typical
Insertion loss (dB)	0.5 to 45 GHz: $< 0.047 \times F \text{ (GHz)} + 3$ 3.02 @ 500 MHz 5.13 @ 45 GHz 45 to 58 GHz: $< 0.237 \times F \text{ (GHz)} - 5.55$ 5.13 @ 45 GHz 8.21 @ 58 GHz 58 to 67 GHz < 8.21	0.5 to 45 GHz: $< 0.048 \times F \text{ (GHz)} + 2.2$ 2.22 @ 500 MHz 4.38 @ 45 GHz 45 to 58 GHz: $< 0.202 \times F \text{ (GHz)} - 4.69$ 4.38 @ 45 GHz 7.00 @ 58 GHz 58 to 67 GHz < 7.00	50 to 90 GHz: < 14.2 90 to 110 GHz: $< 0.525 \times F \text{ (GHz)} - 31.65$ 15.6 @ 90 GHz 26.1 @ 110 GHz	50 to 90 GHz: < 12.0 90 to 110 GHz: $< 0.4 \times F \text{ (GHz)} - 24$ 12.0 @ 90 GHz 20.0 @ 110 GHz
Input return loss (dB)	0.5 to 1 GHz: > 9.4 1 to 48 GHz: > 12.3 48 to 67 GHz: > 5.3	0.5 to 1 GHz: 10.7 1 to 48 GHz: 14.8 48 to 67 GHz: 7.4 67 to 70 GHz: 3.3	50 to 60 GHz: > 4.4 60 to 80 GHz: > 8.0 80 to 110 GHz: > 4.9	50 to 60 GHz: 7.2 60 to 80 GHz: 11.0 80 to 110 GHz: 8.0
Output return loss (dB)	0.5 to 1 GHz: > 9.3 1 to 30 GHz: > 13.5 30 to 48 GHz: > 11.6 48 to 67 GHz: > 4.8	0.5 to 1 GHz: 10.6 1 to 30 GHz: 15.1 30 to 48 GHz: 15.6 48 to 67 GHz: 6.9 67 to 70 GHz: 10.1	50 to 60 GHz: > 4.9 60 to 80 GHz: > 8.3 80 to 100 GHz: > 5.5 100 to 110 GHz: 4.1	50 to 60 GHz: 7.1 60 to 80 GHz: 11.6 80 to 100 GHz: 8.5 100 to 110 GHz: 6.7

*Specifications are tested and measured with an operating temperature of 25°C

Note: Applies to all models and specifications. For the first, second and subsequent frequency band, the last frequency test point is $\leq$ (inclusive) the frequency point.

Example for U7229M gain: 0.5 to 2 GHz (inclusive) until the last point which is $\leq$ 2 GHz with the specification of 24.1. If it is $\geq$ 2 GHz (example 2.0001 GHz), the specification refers to the next frequency range of 2 to 20 GHz with the specs of 20.7

Supplemental Specifications

	U7229G	U7229M
Data Storage	Flash	Flash
Bias voltage and current	5 V @ 877 mA	5 V @ 370 mA
Power consumption	4.385 W	1.85 W
Pin depth	0 to -0.002 in	0 to -0.002 in
Connector	1.85 mm male	1.00 mm male

Typical Performance

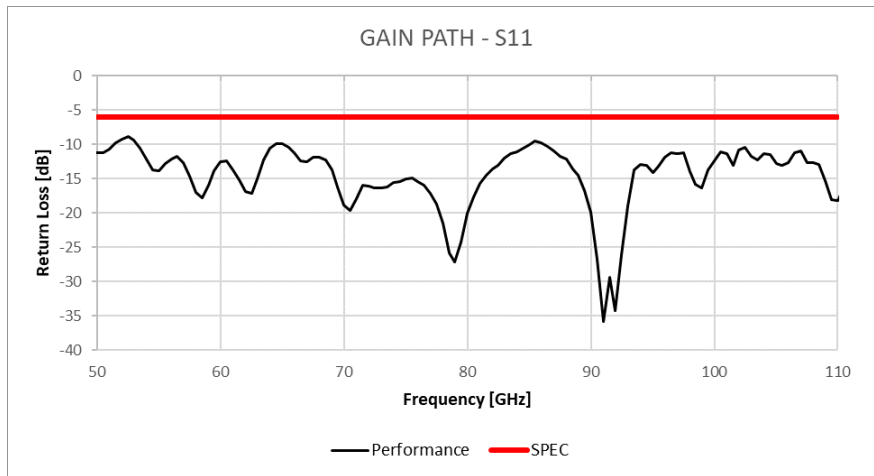


Figure 1. U7229M return loss (dB), gain path

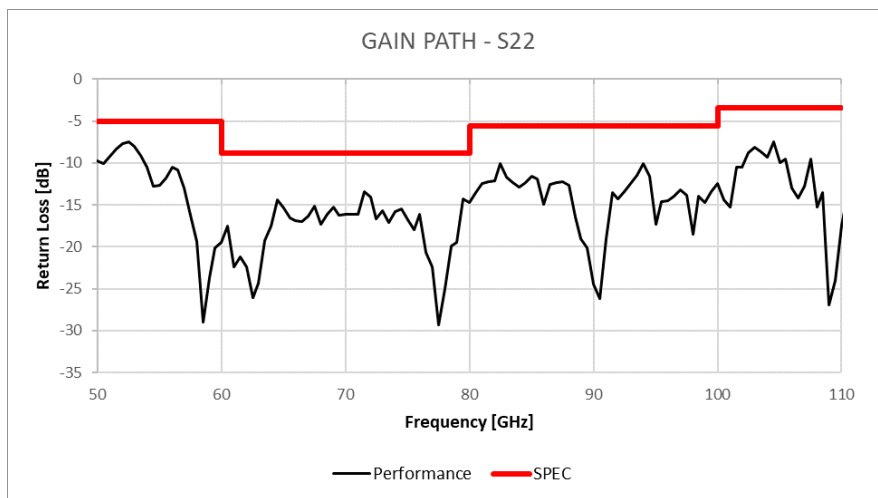


Figure 2. U7229M return loss (dB), gain path

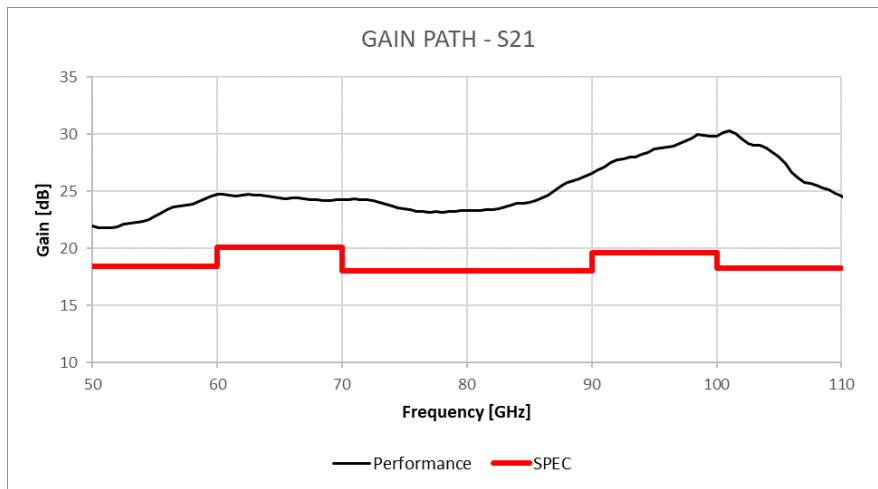


Figure 3. U7229M gain, gain path

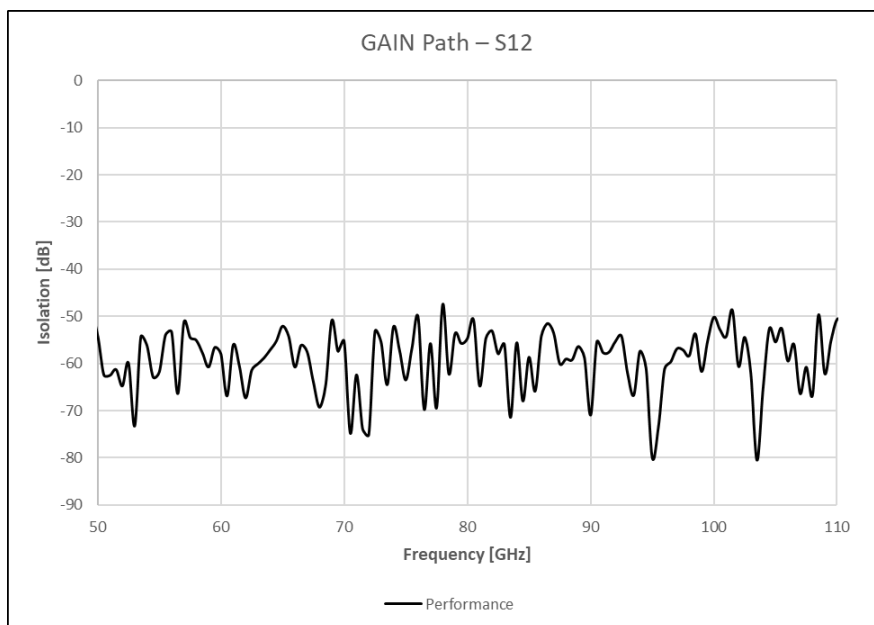


Figure 4. U7229M isolation, gain path

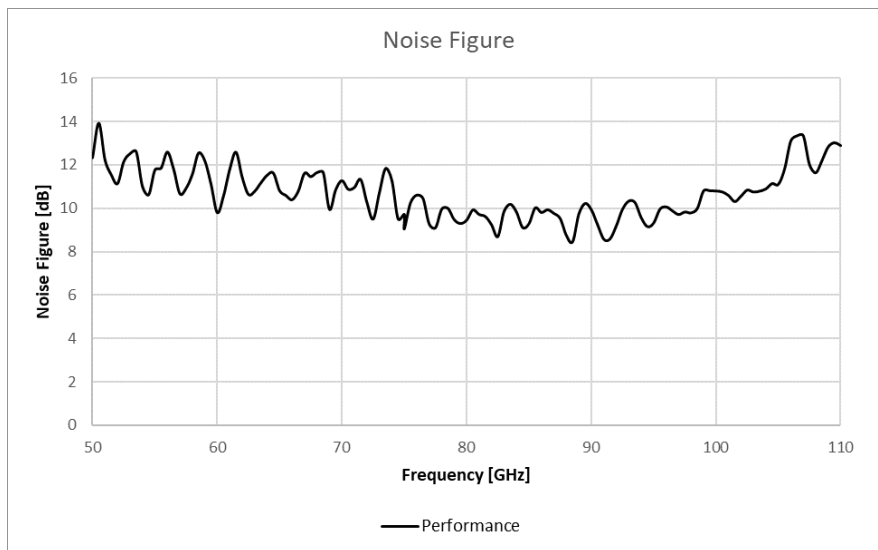


Figure 5. U7229M noise figure

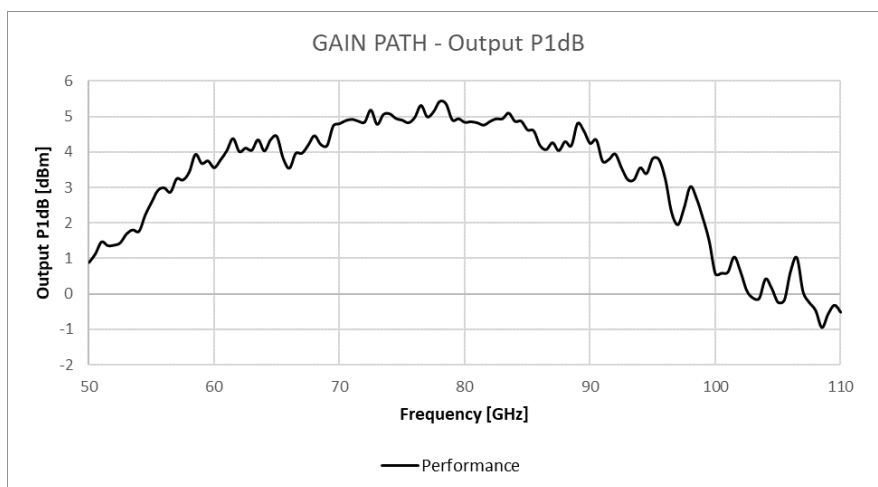


Figure 6. U7229M output P1dB, gain path

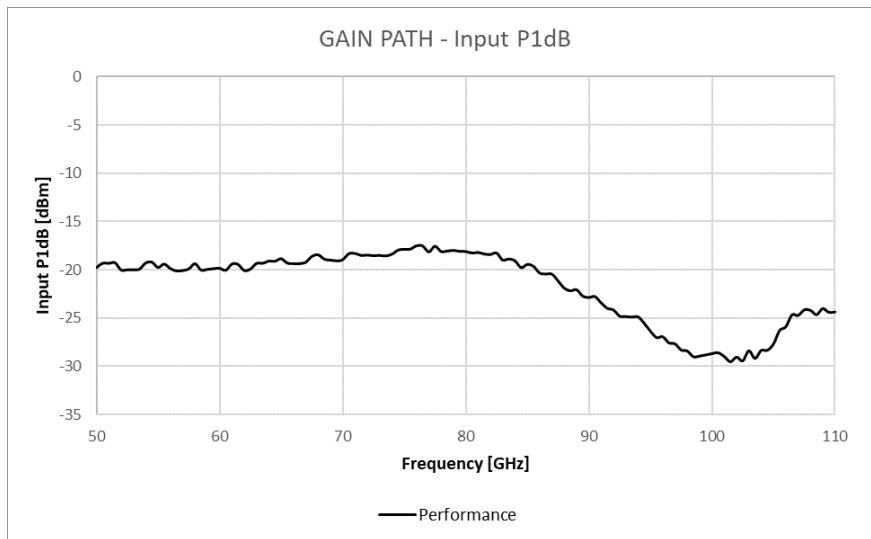


Figure 7. U7229M input P1dB, gain path

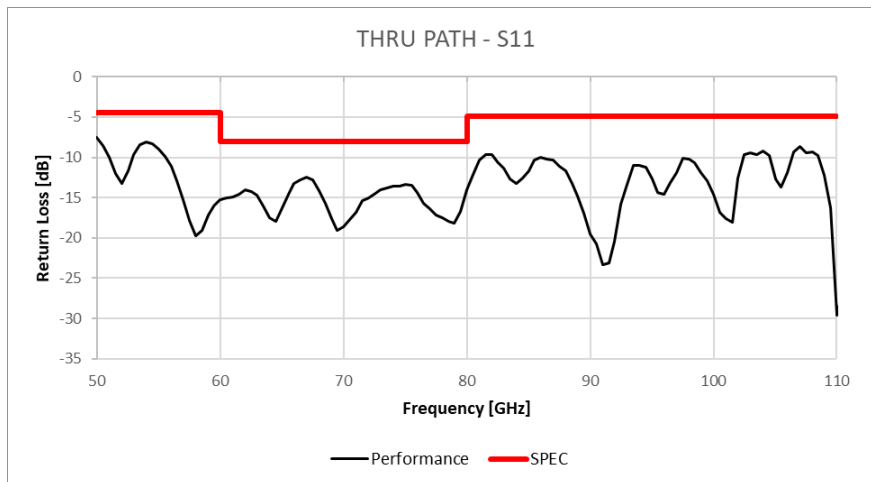


Figure 8. U7229M return loss, thru path

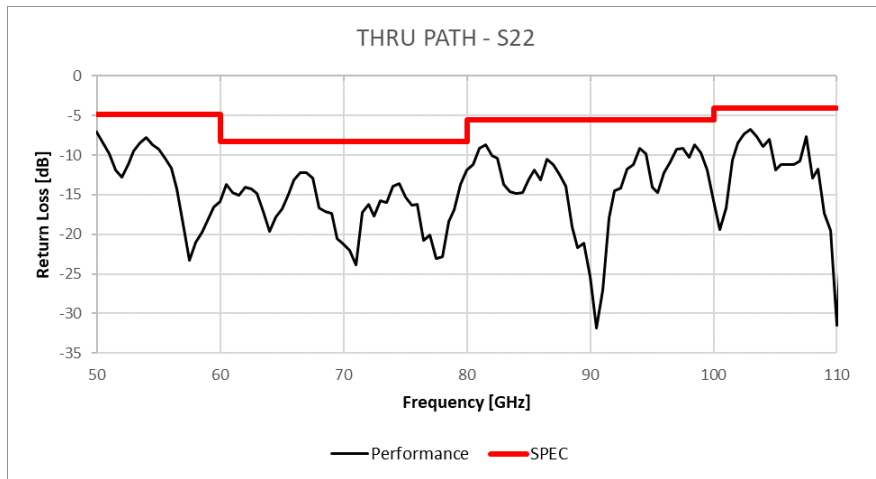


Figure 9. U7229M return loss, thru path

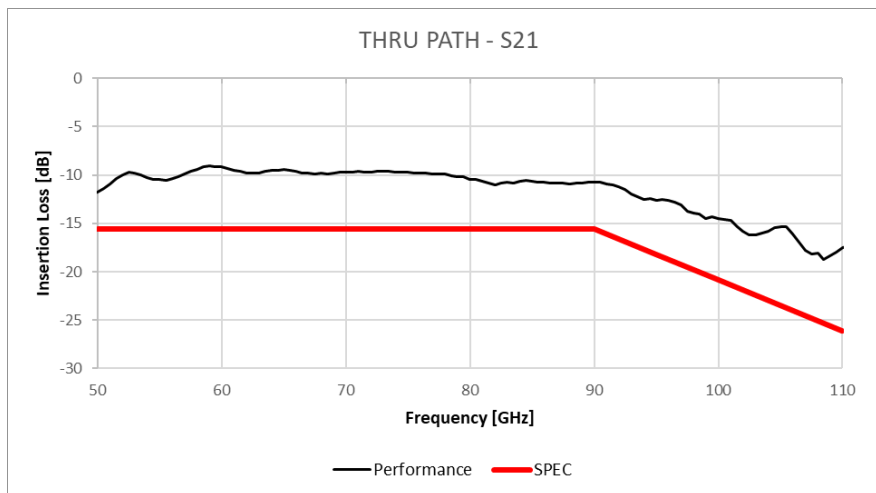


Figure 10. U7229M insertion loss, thru path

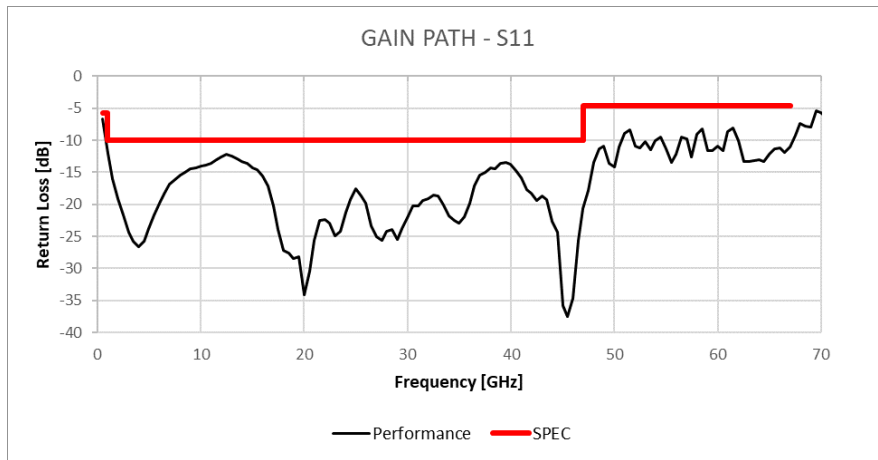


Figure 11. U7229G return loss, gain path

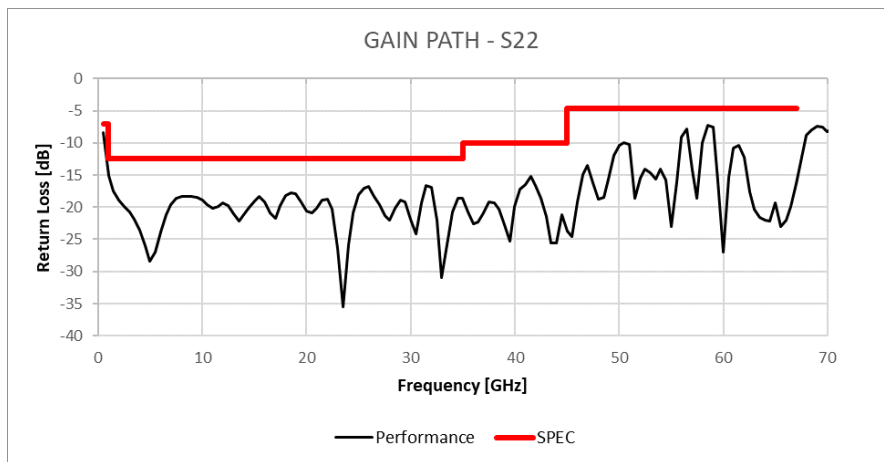


Figure 12. U7229G return loss, gain path

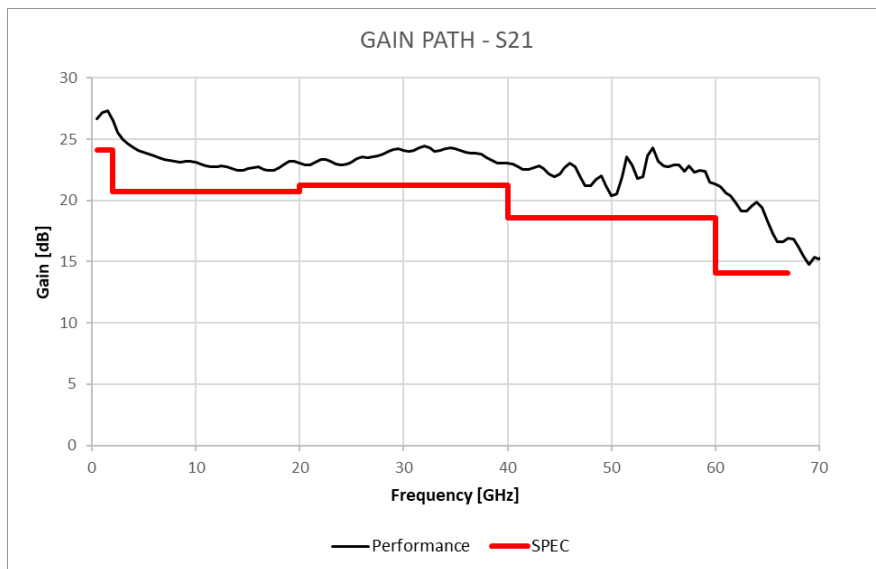


Figure 13. U7229G gain, gain path

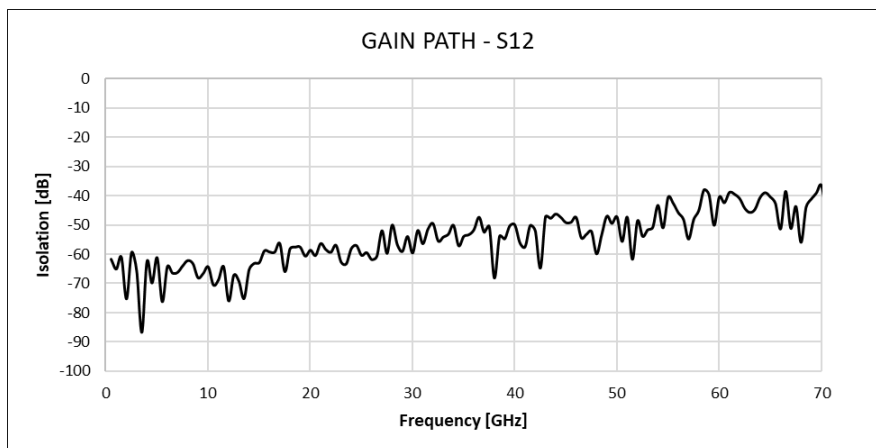


Figure 14. U7229G isolation, gain path

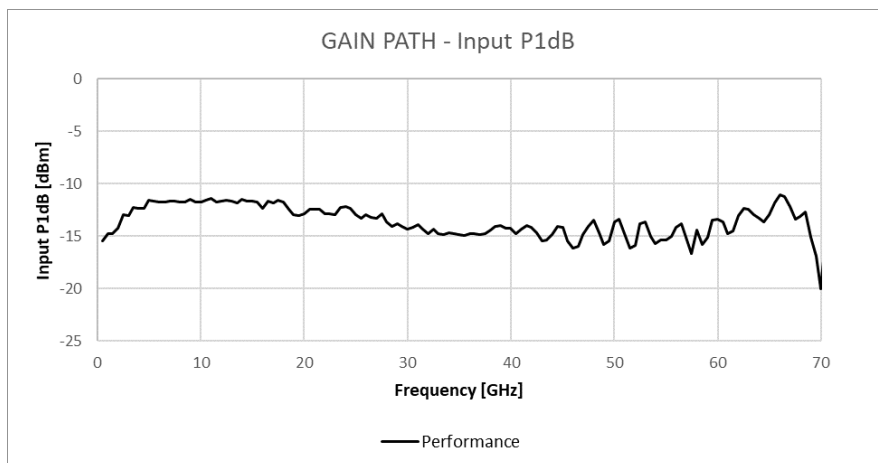


Figure 15. U7229G input P1dB, gain path

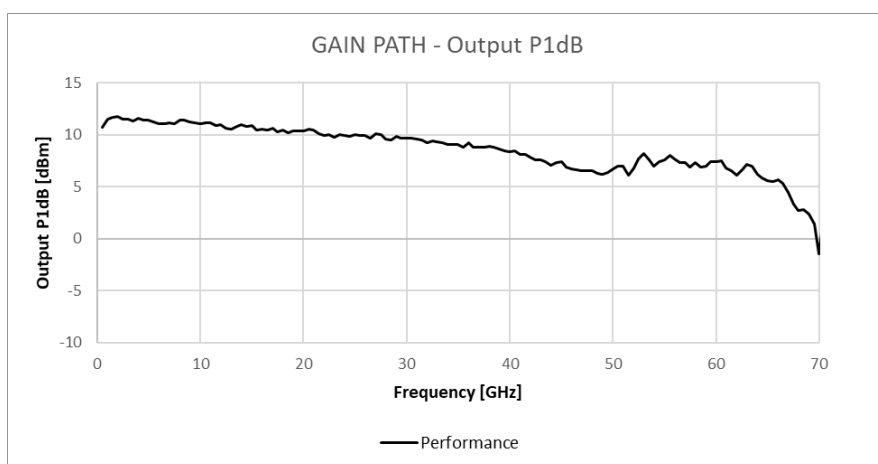


Figure 16. U7229G output P1dB, gain path

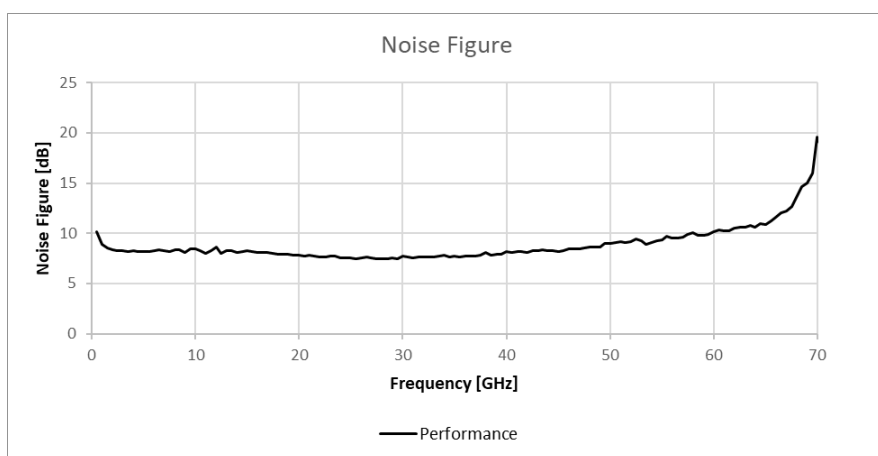


Figure 17. U7229G noise figure

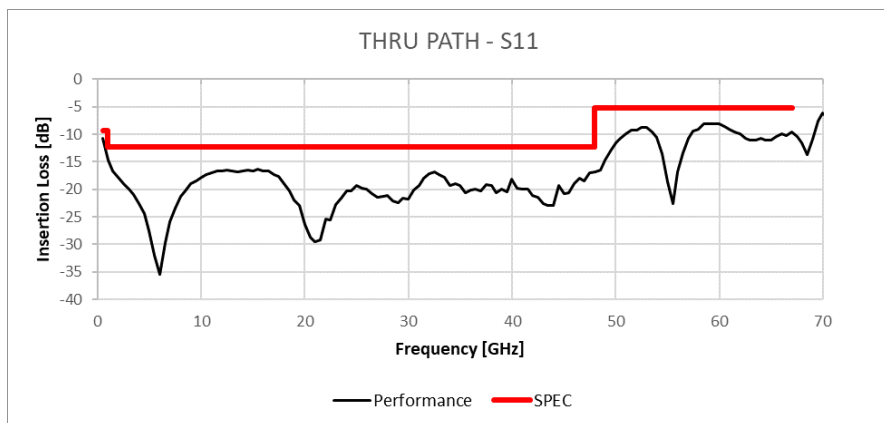


Figure 18. U7229G insertion loss, thru path

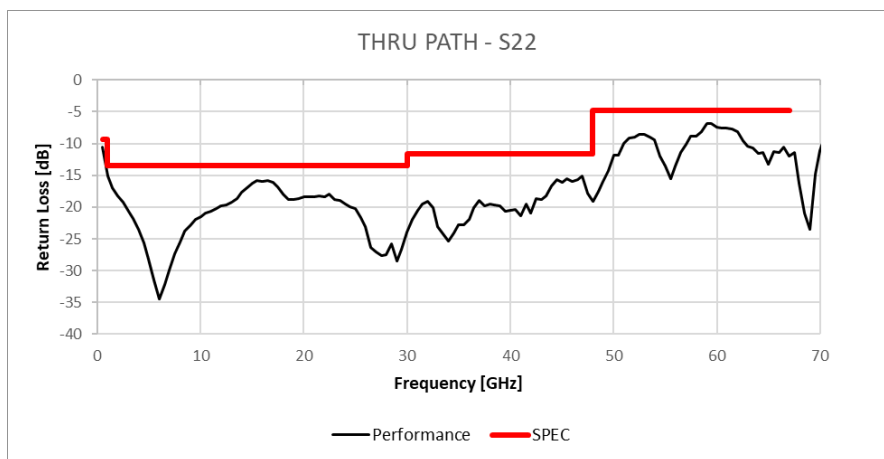


Figure 19. U7229G return loss, thru path

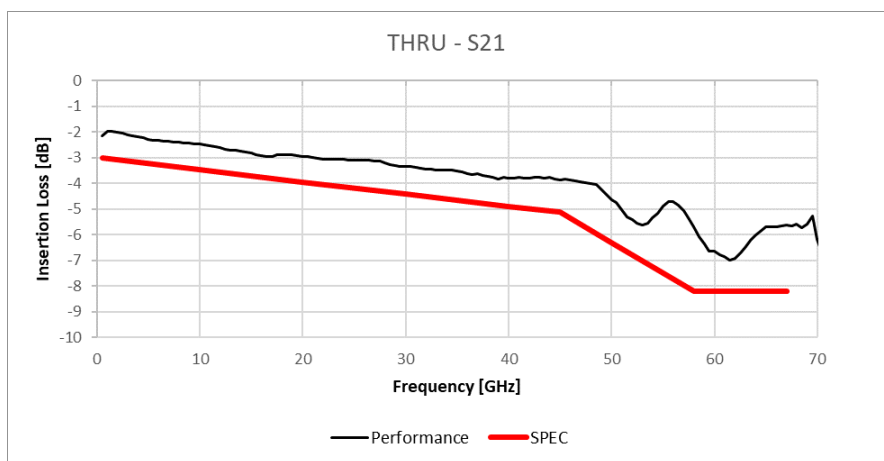


Figure 20. U7229G insertion loss, thru path

Environmental Specifications

Samples of this product have been type tested in accordance with the Keysight Environmental Test Manual and verified to be robust against the Environmental stresses of Storage, Transportation and End-use; those stresses include, but are not limited to, temperature, humidity, shock, vibration and altitude conditions. The primary source of Keysight Environmental Test standards is the International Electrotechnical Commission (IEC) standards.

Parameter	
Temperature	Operating condition: 0 °C to 55 °C Storage condition: -40 °C to 70 °C
Humidity	Operating condition: Up to 95% RH at 40 °C (non-condensing)
Condensation	23°C/50% RH to 40°C/95% RH
Shock	End-use handling shock: ΔV : 1.6 m/s (60 in/s) $\pm 5\%$, duration Transportation shock: 50 g, ΔV : 8.56 m/s $\pm 10\%$
Vibration	Operating random vibration: 5-500 Hz, 0.21 Grms Survival Swept Sine Vibration: 5 Hz-500 Hz-5 Hz, 0.75 g Survival random vibration: 5-500 Hz, 2.41 g Packaging Drop: 48" drop height
Altitude	Operating: 4,600 meters (15,092 feet) Non-operating: 4,600 meters (15,092 feet)
ESD immunity	Contact discharge: 4 kV per IEC 61000-4-2 Air discharge: 8 kV per IEC 61000-4-2

Mechanical Dimensions

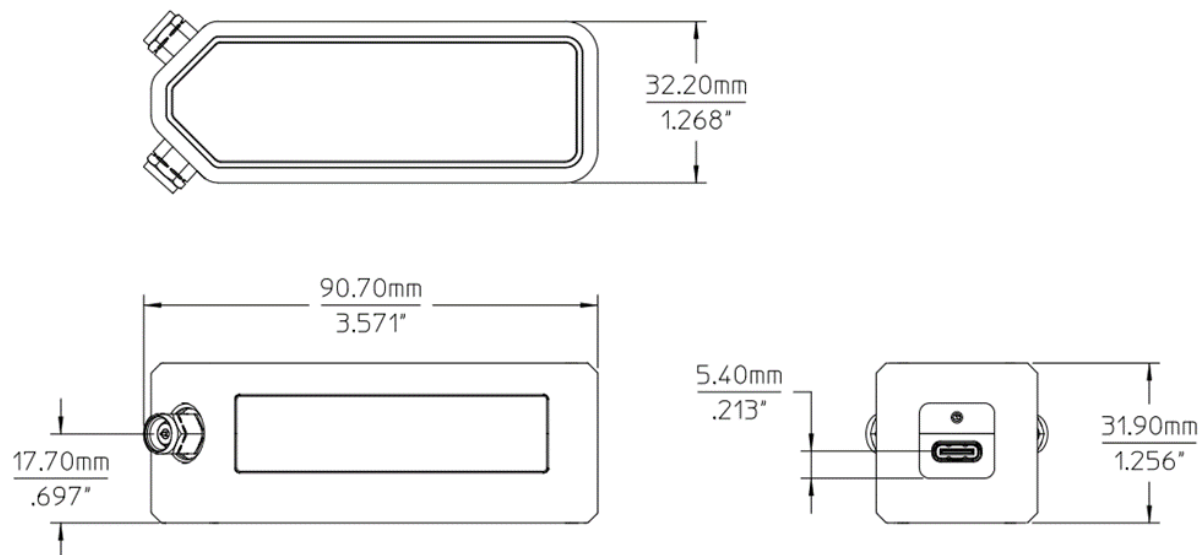


Figure 21. Mechanical dimension of U7229G

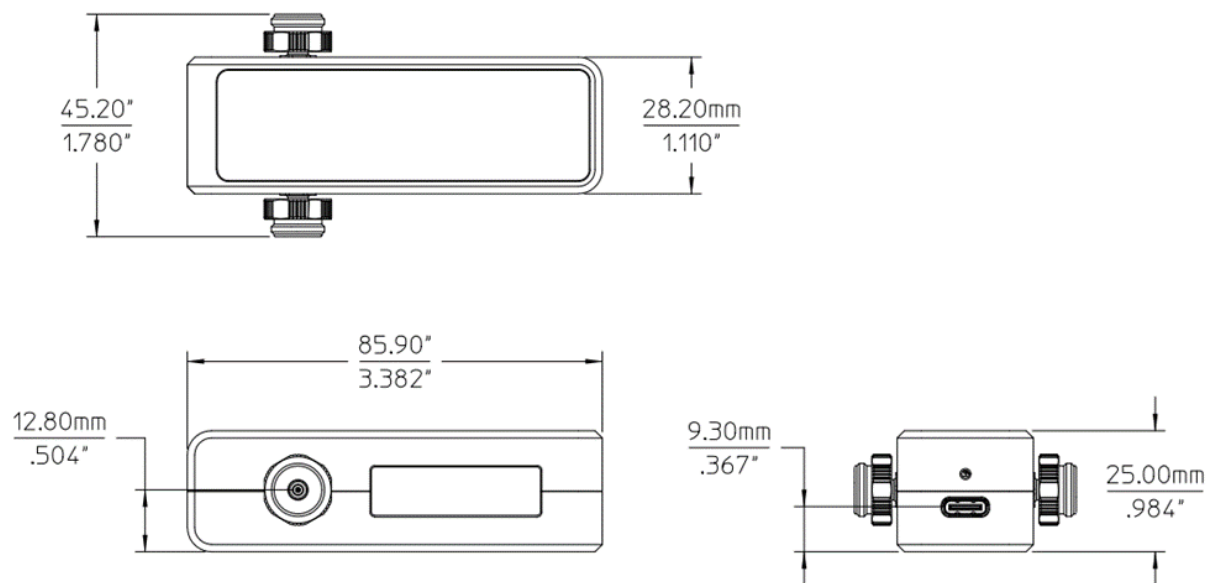


Figure 22. Mechanical dimension of U7229M

Ordering Information

Model / option	Description
U7229G	500 MHz to 67 GHz, USB amplifier with switchable thru path
U7229M	50 to 110 GHz, USB amplifier with switchable thru path

*The USB amplifier ship with 1 unit of Cable-Assembly USB 3.2 Gen1 Type-A-Male to Type-C-Male