

PMI MODEL DD-24-SMF IS A HIGH SPEED, HIGH SENSITIVITY DIODE DETECTOR REQUIRING NO BIAS AND OFFERING EXCELLENT TEMPERATURE STABILITY, WITH A RISE TIME OF LESS THAN 20 NANoseconds. THE FREQUENCY RANGE IS 2 TO 4 GHz.



September 12, 2022

Designed By: PMI Engineering

Tested By: Y Li

Inspected and Approved By: J. Peacher

Outline Drawing

DESCRIPTION:

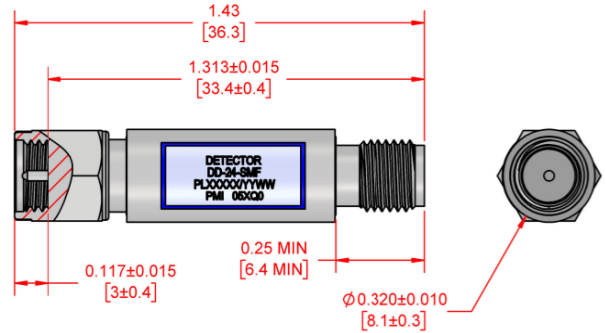
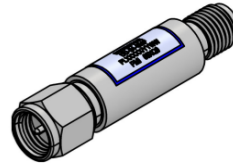
PMI MODEL DD-24-SMF IS A HIGH SPEED, HIGH SENSITIVITY DIODE DETECTOR REQUIRING NO BIAS AND OFFERING EXCELLENT TEMPERATURE STABILITY, WITH A RISE TIME OF LESS THAN 20 NANOSECONDS. THE FREQUENCY RANGE IS 2 TO 4 GHz.

SPECIFICATIONS:

- FREQUENCY RANGE:..... 2 TO 4 GHz
 - VSWR IN:..... 2.5:1 MAX (MEASURED @ -23 dBm)
 - FREQUENCY FLATNESS:..... ±0.5 dB
 - RISE TIME:..... 20 ns MAX
 - VOLTAGE SENSITIVITY:..... 1000 mV/mW
 - TANGENTIAL SENSITIVITY:..... -50 dBm @ 2 MHz VIDEO BANDWIDTH (WITH 2 dB NOISE FIGURE AMPLIFIER)
 - VIDEO CAPACITANCE:..... 47 pF NOM
 - OUTPUT VOLTAGE:..... POSITIVE
 - MAX INPUT POWER:..... +20 dBm MAX
 - CONNECTORS:..... SMA (M) RF INPUT / SMA (F) VIDEO OUTPUT
 - FINISH:..... NICKEL PLATED
 - SIZE:..... (L) 1.43" x (W) 0.32" x (H) 0.38"
- ALL SPECIFICATIONS ARE TESTED WITH A HIGH IMPEDANCE TERMINATION AND WITH AN INPUT OF -20 dBm UNLESS OTHERWISE SPECIFIED.

ENVIRONMENTAL RATINGS:

- TEMPERATURE:..... -54°C TO +85°C (OPERATING)
-65°C TO +100°C (STORAGE)
- ALTITUDE (NON-OP):..... MIL-STD-202, METHOD 105, TEST COND. 40,000 FEET
- ALTITUDE (OPERATING):..... MIL-STD-202, METHOD 105, TEST COND. 8,000 FEET
- VIBRATION (NON-OP):..... MIL-STD-202, METHOD 204, TEST COND. A
- SHOCK (NON-OP):..... MIL-STD-202, METHOD 213, TEST COND. A
- HUMIDITY AND MOISTURE RESISTANCE:..... MIL-STD-202, METHOD 106
- SALT-SEA ATMOSPHERE:..... MIL-STD-202, METHOD 101, TEST COND. B, USING A 5% SALT SOLUTION
- HIGH TEMPERATURE:..... MIL-STD-810, METHOD 501, PROCEDURE II, THE DEVICE SHALL BE OPERATED FOR A PERIOD OF 4 HOURS AT HIGH TEMPERATURE
- LOW TEMPERATURE:..... MIL-STD-810, METHOD 502, PROCEDURE I, EXCEPT MAINTAIN FOR 12 HOURS AT LOW TEMPERATURE
- THERMAL SHOCK:..... MIL-STD-810, METHOD 503, PROCEDURE I, EXCEPT LOW TEMP. SHALL BE -45.6°C
- FUNGUS:..... MIL-STD-810, METHOD 508, PROCEDURE I



ZONE	REV	DESCRIPTION	DATE	APPROVED
	A1	ORIGINAL RELEASE	2/22/2012	
	B1	SEE ECN #22-0122	9/26/2012	

NOTE: SPECIFICATIONS WILL VARY OVER TEMPERATURE
NOTE: THE ABOVE SPECIFICATIONS ARE SUBJECT TO CHANGE OR REVISION

PMI CONFIDENTIAL AND PROPRIETARY

APPROVALS		DATE	TITLE	
DRAWN	M. HANKEN	2/22/2012	OUTLINE	
REDRAWN			DD-24-SMF	
ISSUED			SIZE	FECHM NO.
			B	05XQ0
				DWG NO.
				27044160
			SCALE	SHEET
			3:1	1 OF 1

Dimensional Inspection

Item	Dimension	Measurement
1	1.43" +/- 0.02"	1.427"
2	0.25" Min	0.321"
3	Dia: 0.320" +/- 0.010"	0.319"

Outline Specifications & Test Data

TEST ITEM NO.	PARAMETERS	SPECIFIED VALUE	Test Results			
			Input Power	-54°	+25°	+85°
1	Frequency Range	2 to 4 GHz		2 to 4 GHz		
2	VSWR In @ -23dBm	2.5:1 MAX. ¹	-23 dBm	1.94:1	1.94:1	1.99:1
3	Frequency Flatness	±0.5 dB ^{1,2}	-30 dBm	±0.33dB	±0.34dB	±0.28dB
			-25 dBm	±0.29dB	±0.33dB	±0.27dB
			-20 dBm	±0.31dB	±0.36dB	±0.31dB
			-15 dBm	±0.41dB	±0.46dB	±0.4dB
4	Rise Time	20 ns MAX. ^{4,5,6}	20 dBm	11 ns		
5	Voltage Sensitivity	1000 mV/mW @ -20dBm Input ^{3,4}	-20 dBm	1100 mV/mW	1178 mV/mW	1229 mV/mW
6	Tangential Sensitivity	-50 dBm (2 MHz Video Bandwidth with 2 dB Noise Figure Video Amp) ^{4,5,6}	-50 dBm	-50 dBm See Plot		
7	Output Capacitance	47 pF NOM		47 pF		
8	Output Voltage	Positive		Positive		
9	Input Power	+20 dBm Max.		+20 dBm		

Additional Customer-Specific Specifications & Test Data

VSWR In	1.5:1, -30 to -20 dBm ¹ 2:1, -20 to -15 dBm ¹	-30 to -20 dBm	2.1:1	2.1:1	2.2:1
		-20 to -15 dBm	3:1	3.1:1	3.2:1
Voltage Sensitivity	1000-1168 mV/mW from -30 to -15 dBm, 2 to 4 GHz ¹	-30 to -15 dBm	643-886 mV/mW	738-931 mV/mW	808-968 mV/mW
Figure of Merit	100-169 from -30 to -20dBm ^{4,5}	-30 dBm	102		
		-25 dBm	104		
		-20 dBm	114		
Deviation from Square Law Response	1.2-1.7 dB increase in power from -17 dBm input produces 3dB increase in voltage ^{1,4}	-17dBm	1.3 dB Power Increase	1.36 dB Power Increase	1.42 dB Power Increase
Temperature Stability	±0.15 dB at 3 GHz from -20 to +50°C ^{1,2}	-30 dBm	±0.62 dB		
		-25 dBm	±0.45 dB		
		-20 dBm	±0.39 dB		
		-15 dBm	±0.24 dB		
	±0.5 dB over 2-4 GHz from -20 to +50°C ^{1,2}	-30 dBm	±0.91 dB		
		-25 dBm	±0.73 dB		
		-20 dBm	±0.7 dB		
		-15 dBm	±0.64 dB		

¹ Measured with 300Ω termination

² (mV in dB scale min to max)/2

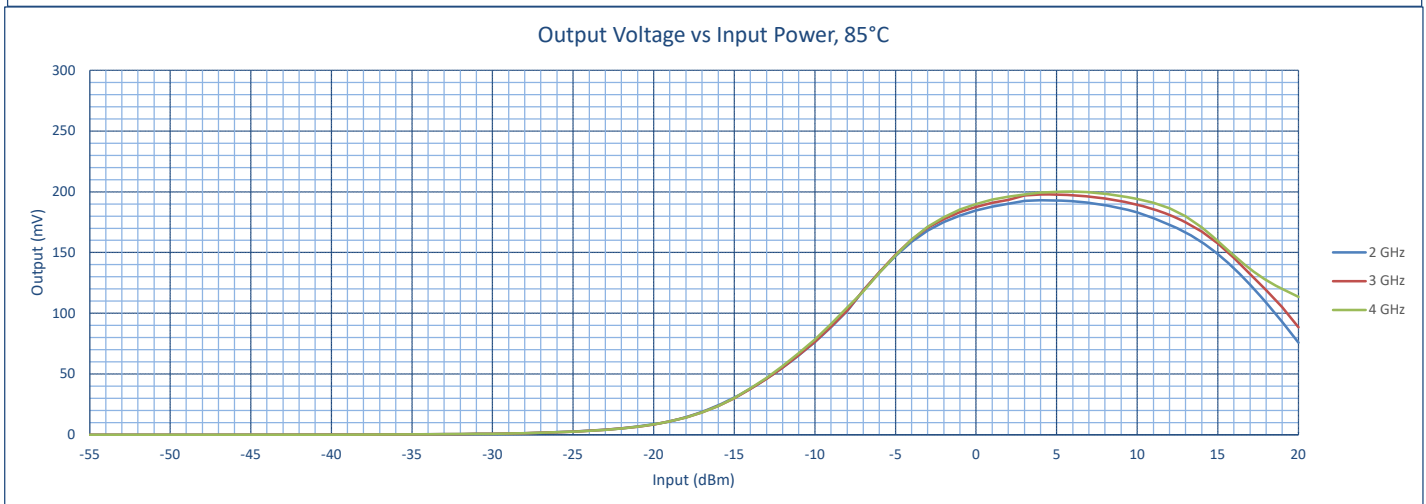
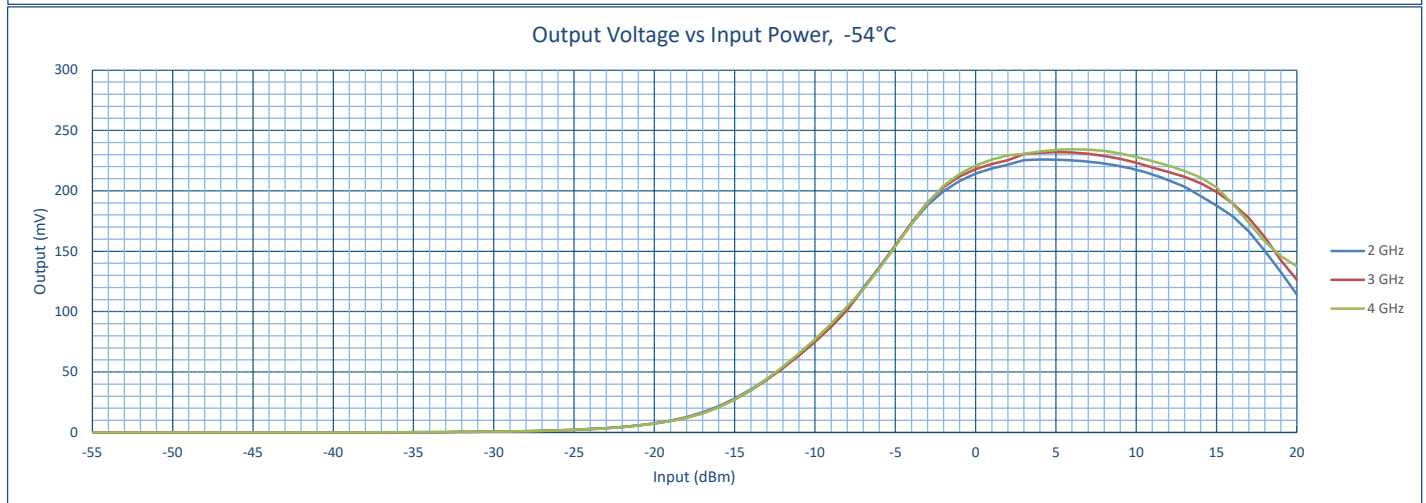
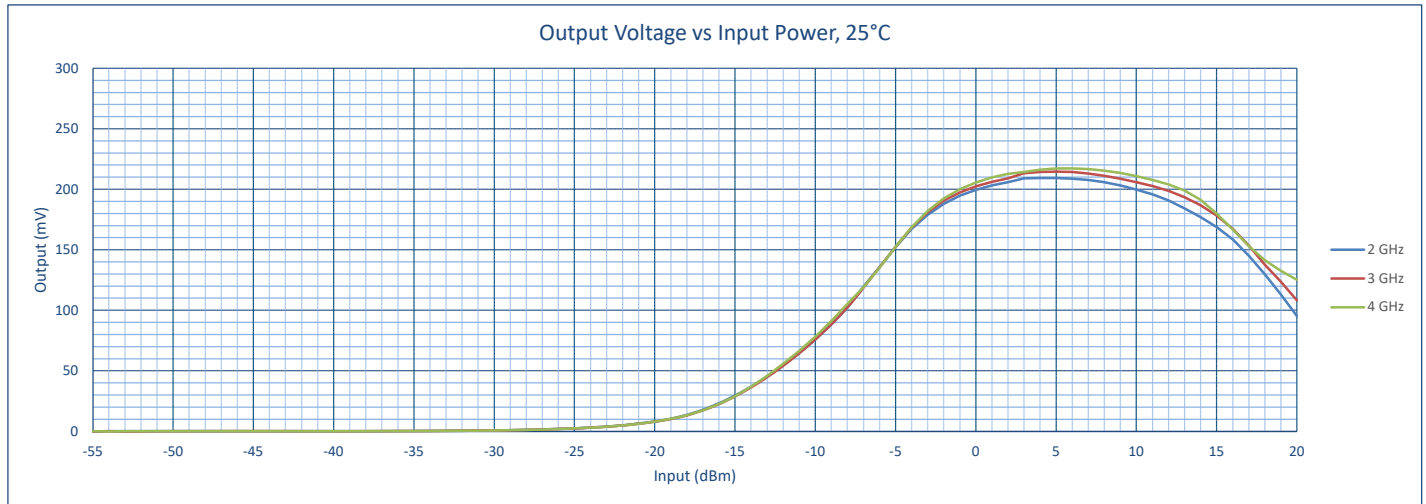
³ Measured with open-circuit termination

⁴ Measured at 2GHz

⁵ Measured at 25°C

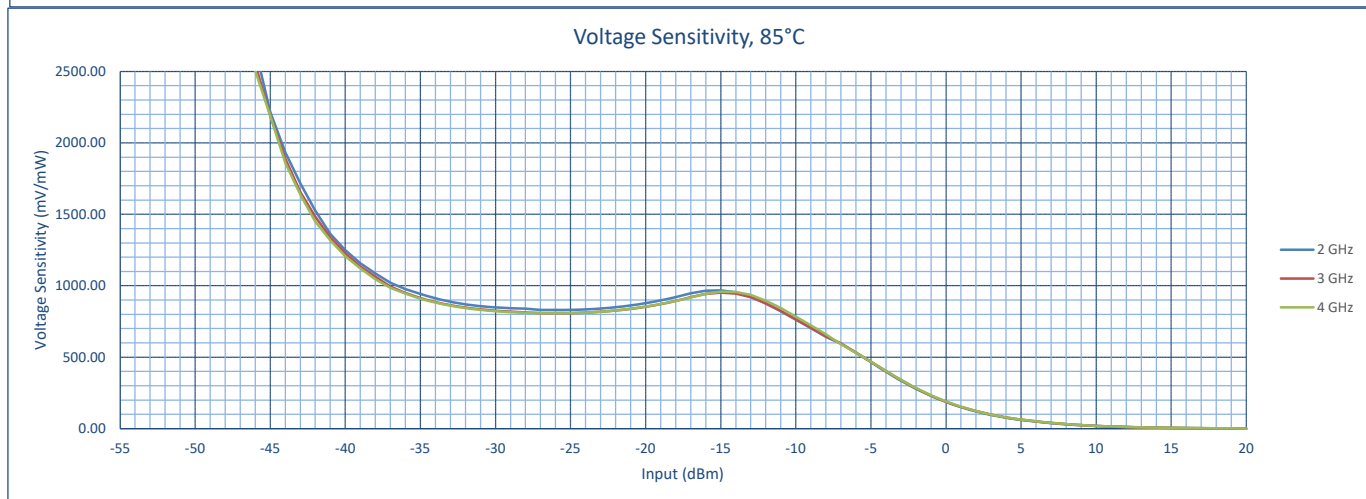
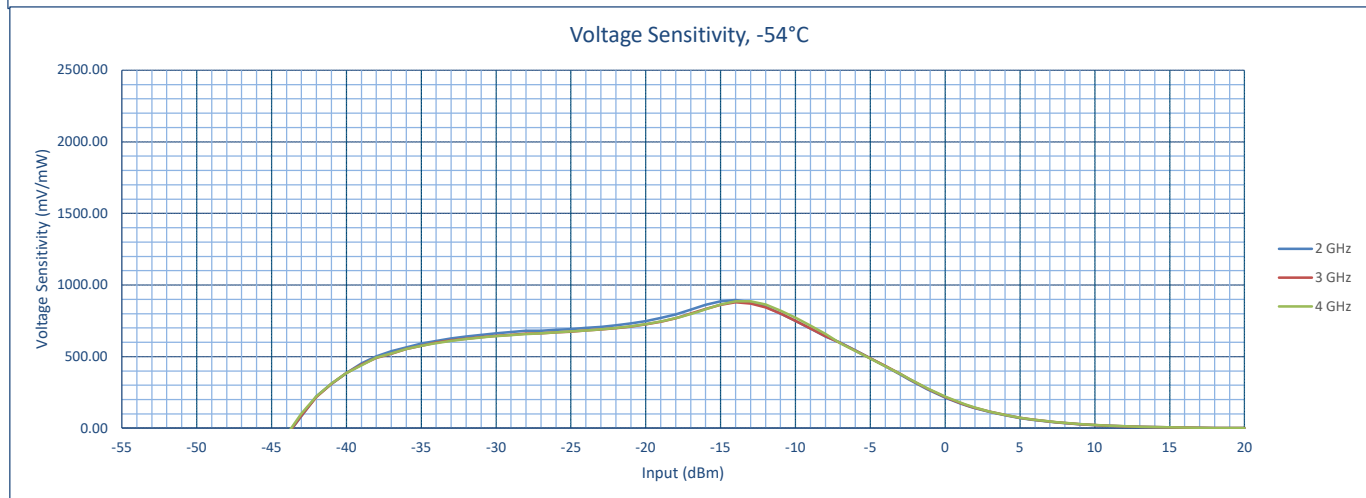
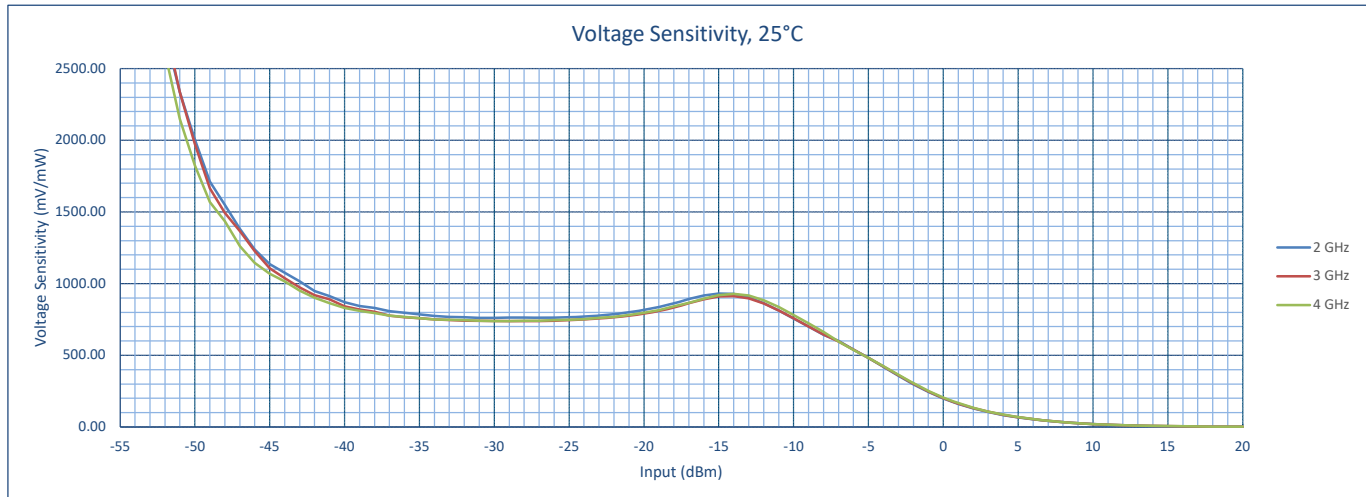
⁶ Measured with 100Ω termination

Typical Characteristics For DD-24-SMF

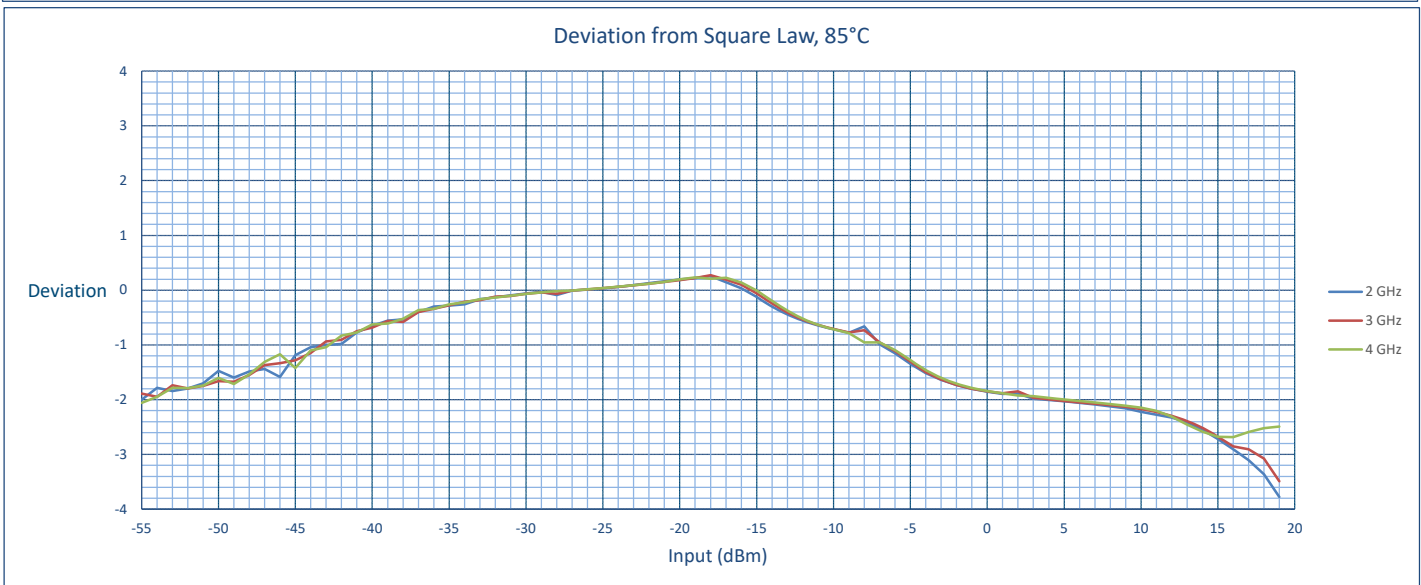
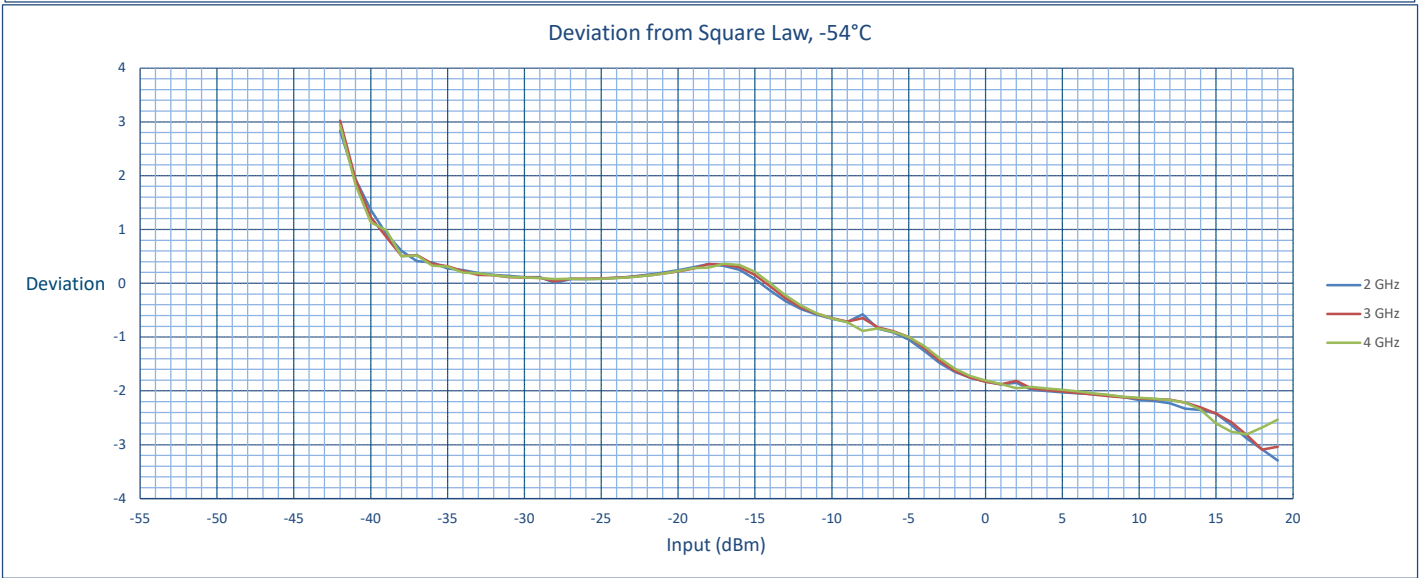
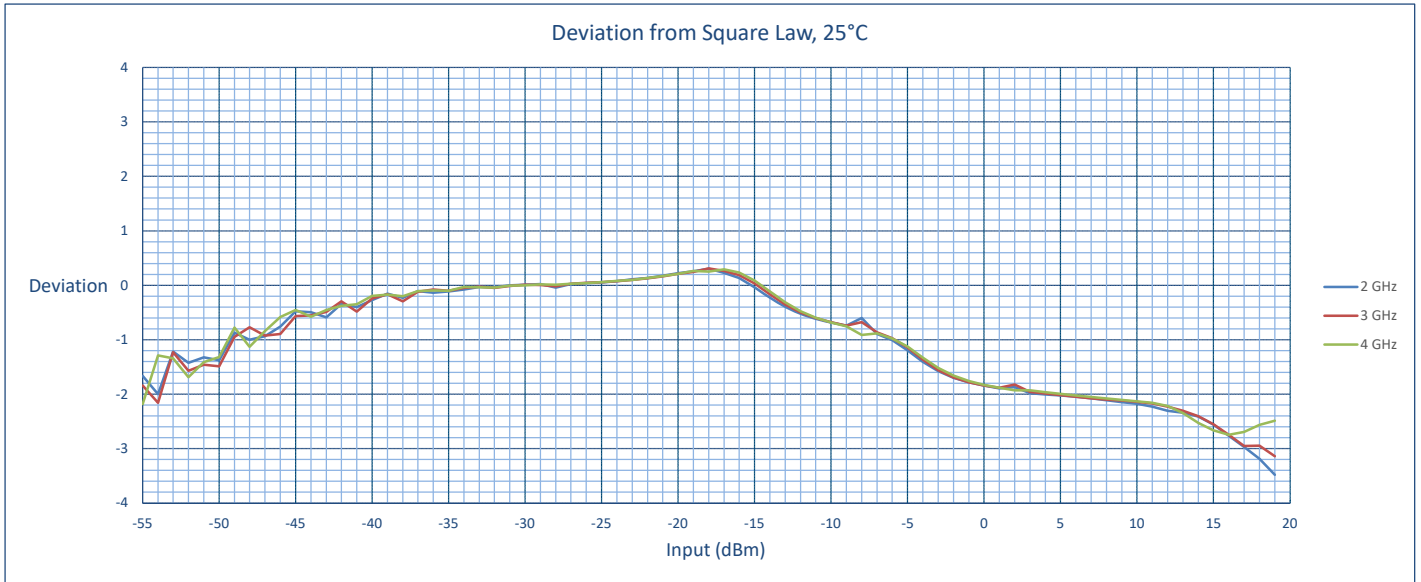


***Output with 300Ω termination**

Typical Characteristics For DD-24-SMF



***Output with 300Ω termination**



Definitions:

At a deviation of 0, at the particular input power, a 1 dB increase in power input results in a 2 dB increase in output mV

At a deviation of -1.5, at the particular input power, a 1 dB increase in power input results in a 2-1.5 or 0.5 dB increase in output mV

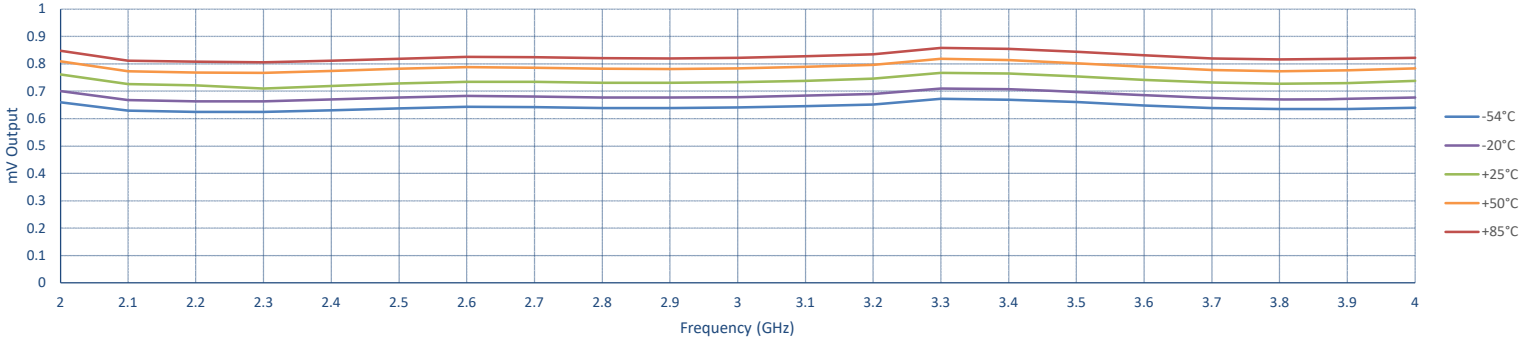
**Typical Characteristics
For
DD-24-SMF**

Figure of Merit, 25°C

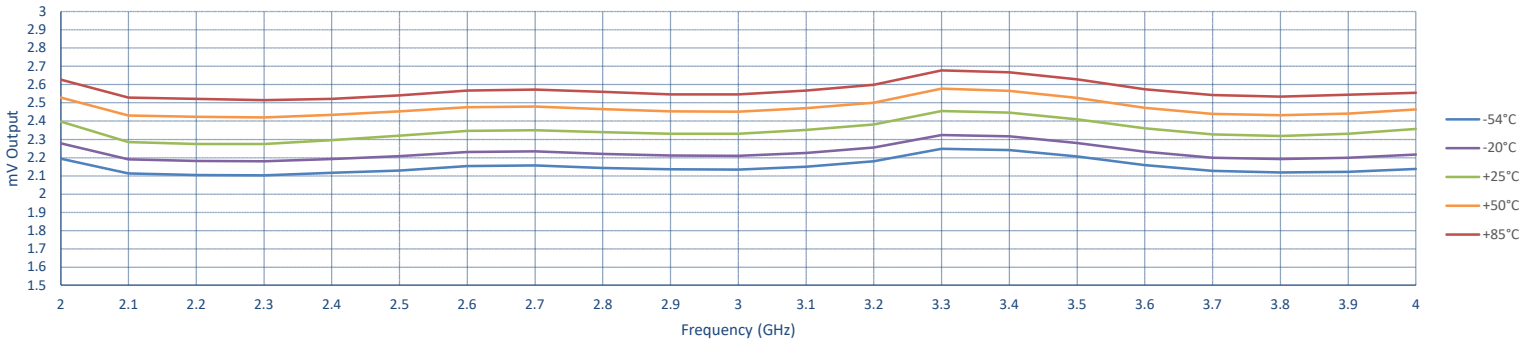
Frequency (GHz)	Power input (dBm)	Open circuit voltage reading (mV)	Voltage reading with tuned load resistance (mV)	Rv - Tuned load resistance (Ω)	K - Open circuit voltage sensitivity (mV/mW)	Figure of merit K/\sqrt{Rv}
2	-20	13.92	6.65	150.2	1392	113.6
4	-20	14.05	6.67	150.2	1405	114.6
2	-25	3.92	1.98	141	1240	104.4
4	-25	3.94	1.99	141	1246	104.9
2	-30	1.21	0.63	141	1210	101.9
4	-30	1.2	0.62	141	1200	101.1

**Typical Characteristics
For
DD-24-SMF**

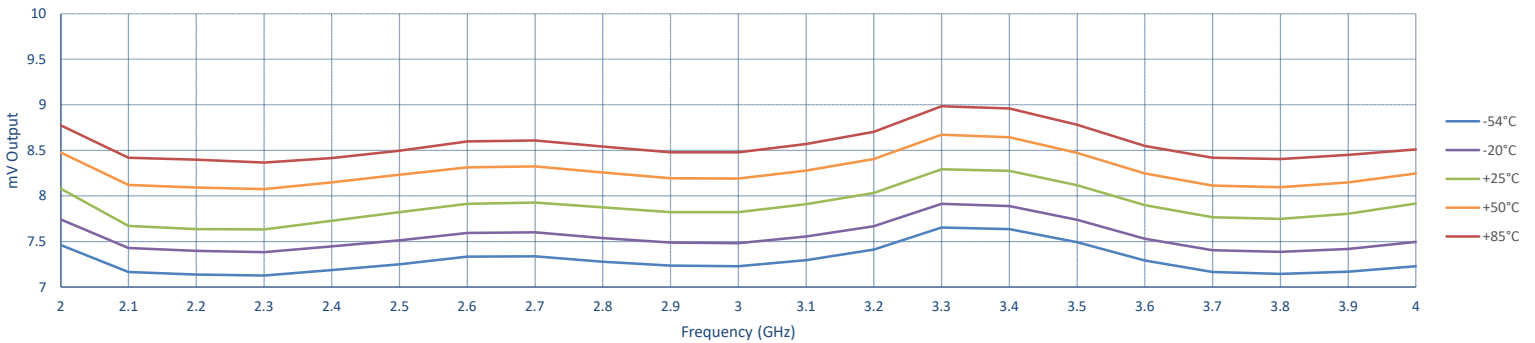
Frequency Flatness at -30dBm Input Power



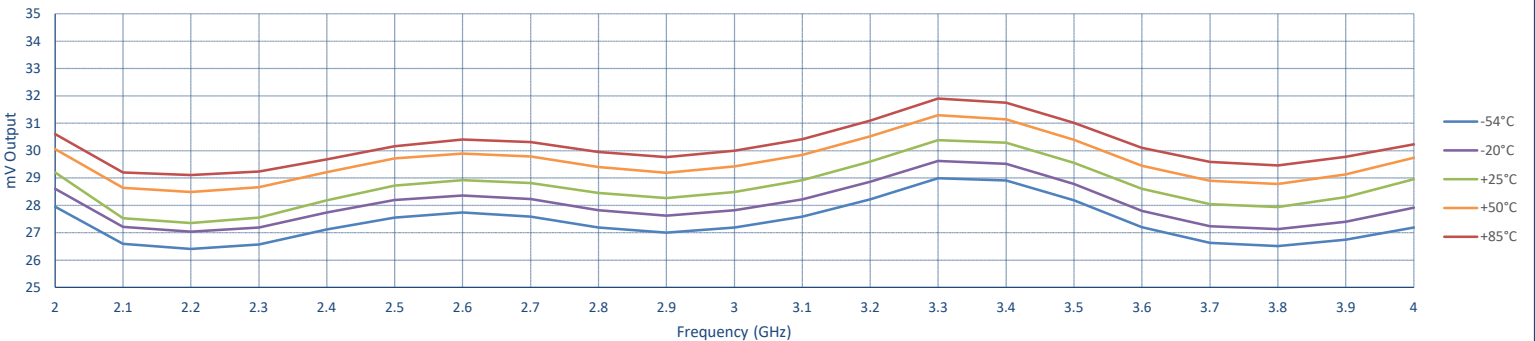
Frequency Flatness at -25dBm Input Power



Frequency Flatness at -20dBm Input Power

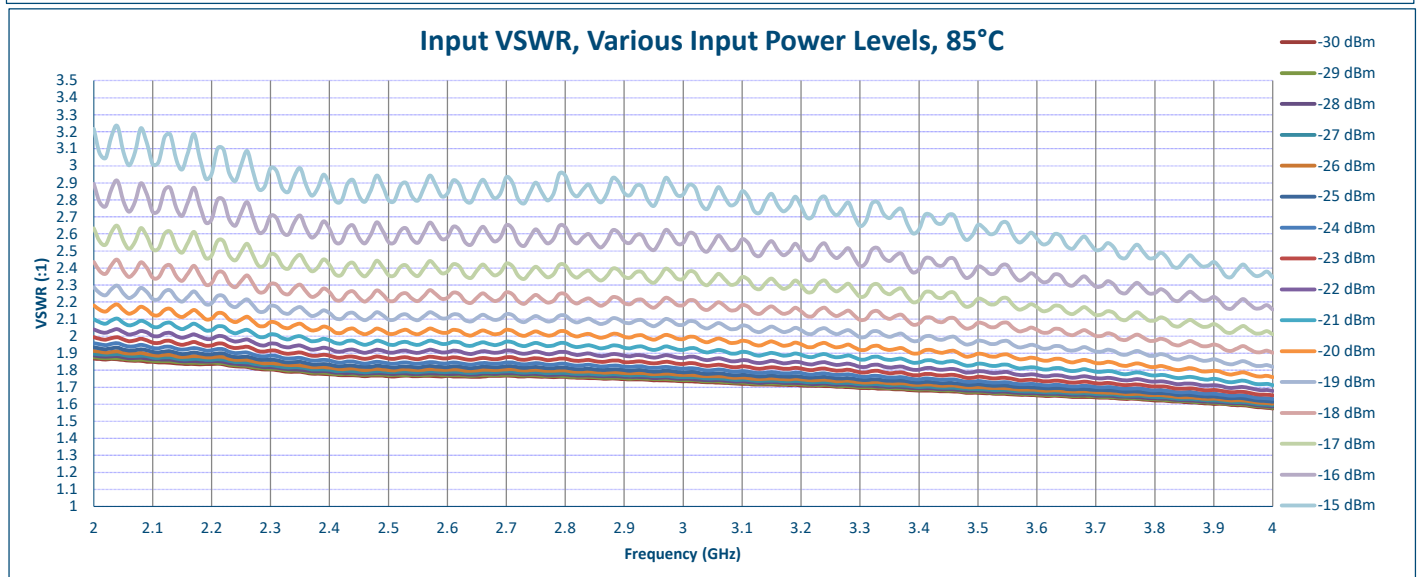
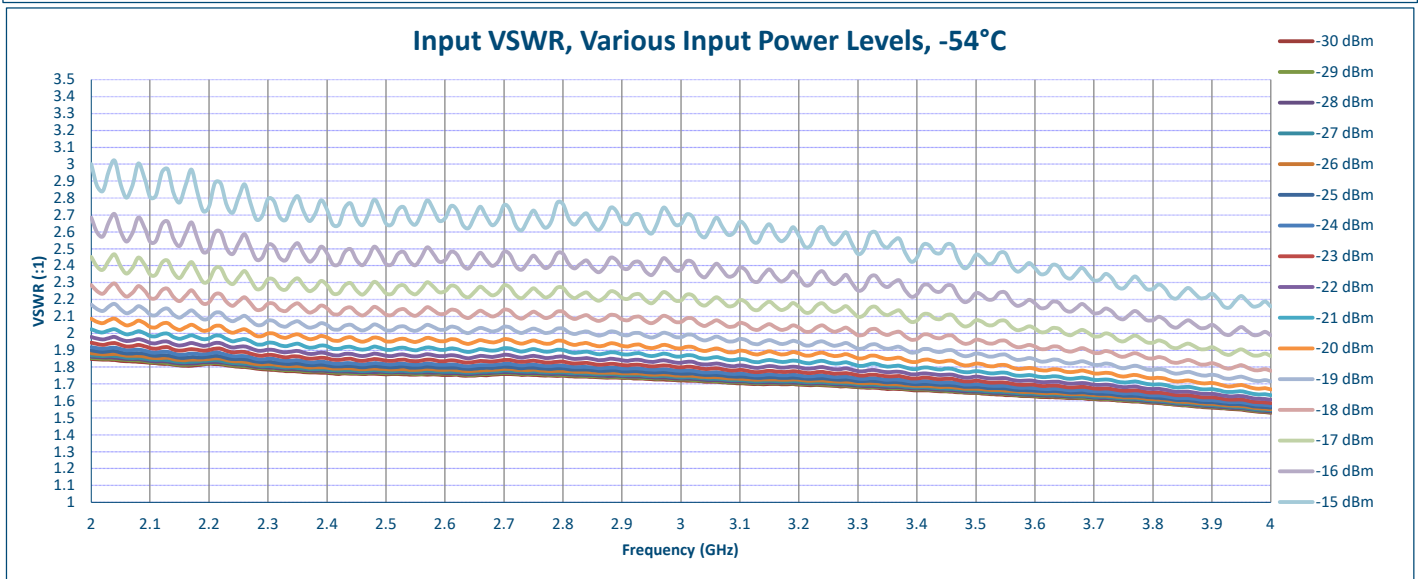
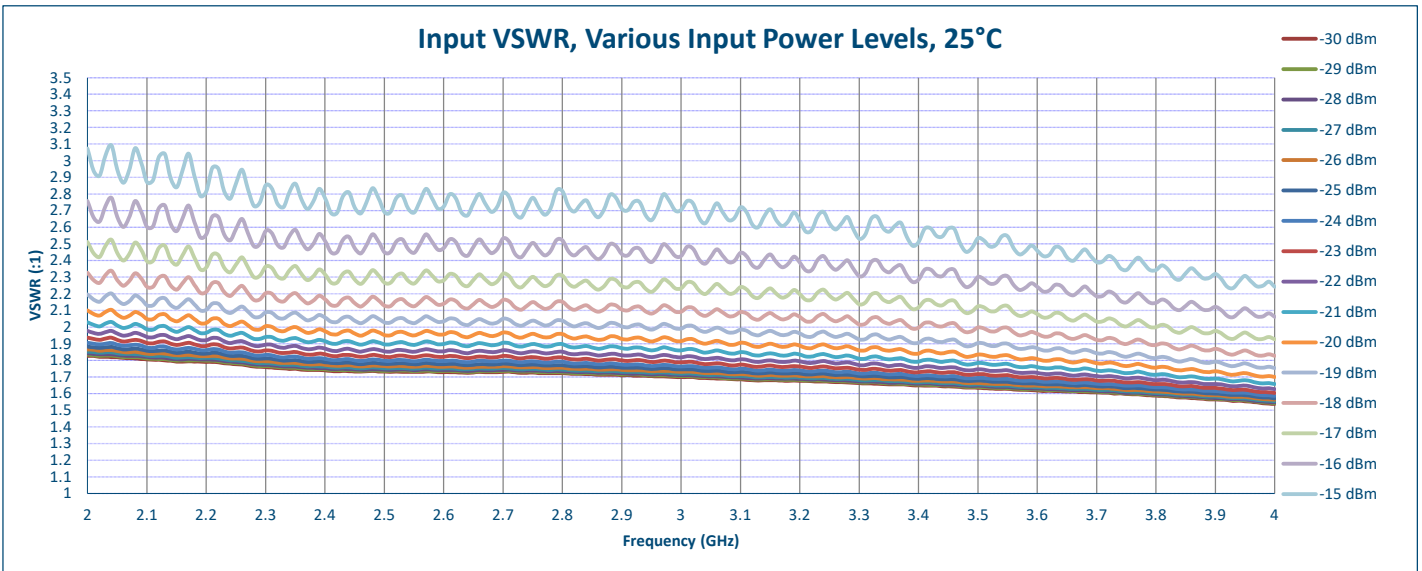


Frequency Flatness at -15dBm Input Power



***Output with 300Ω termination**

Typical Characteristics
For
DD-24-SMF

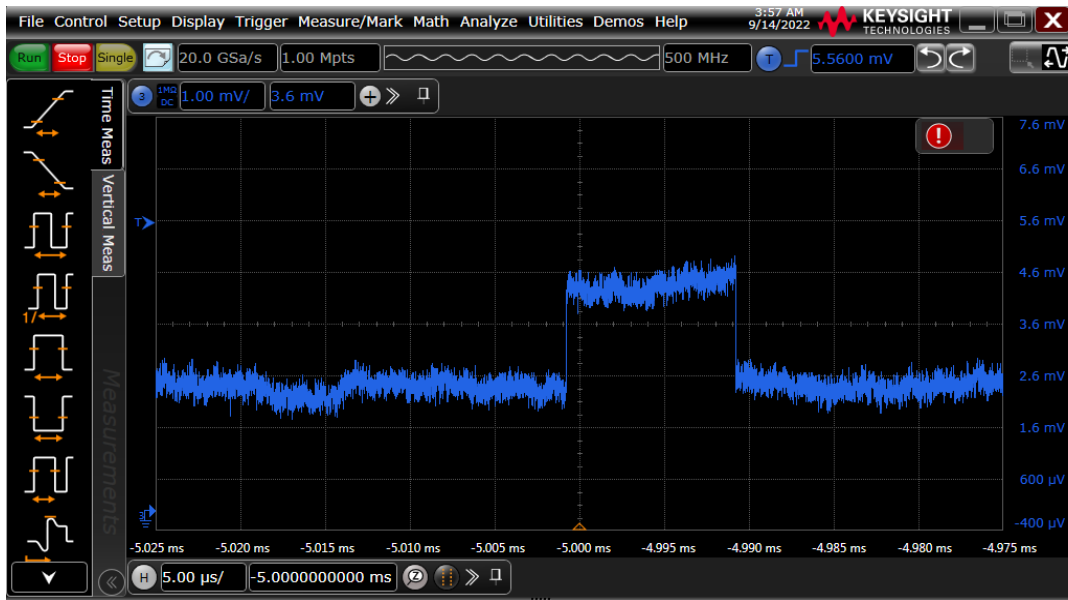


*Output with 300Ω termination

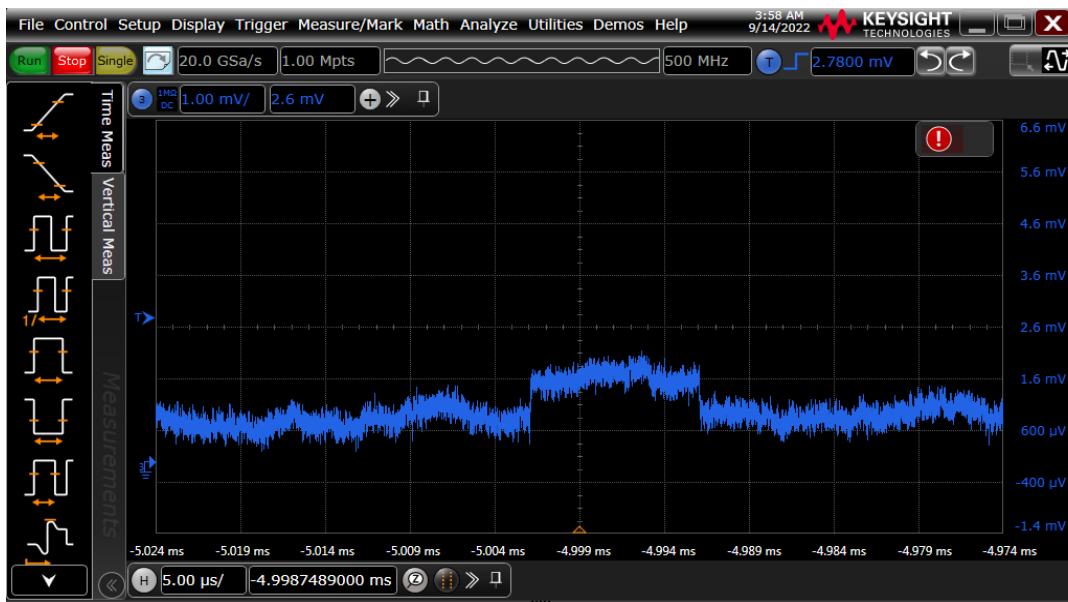
Typical Characteristics
For
DD-24-SMF

Tangential Sensitivity

-50dBm Input Pulse to Amplifier



-55dBm Input Pulse to Amplifier

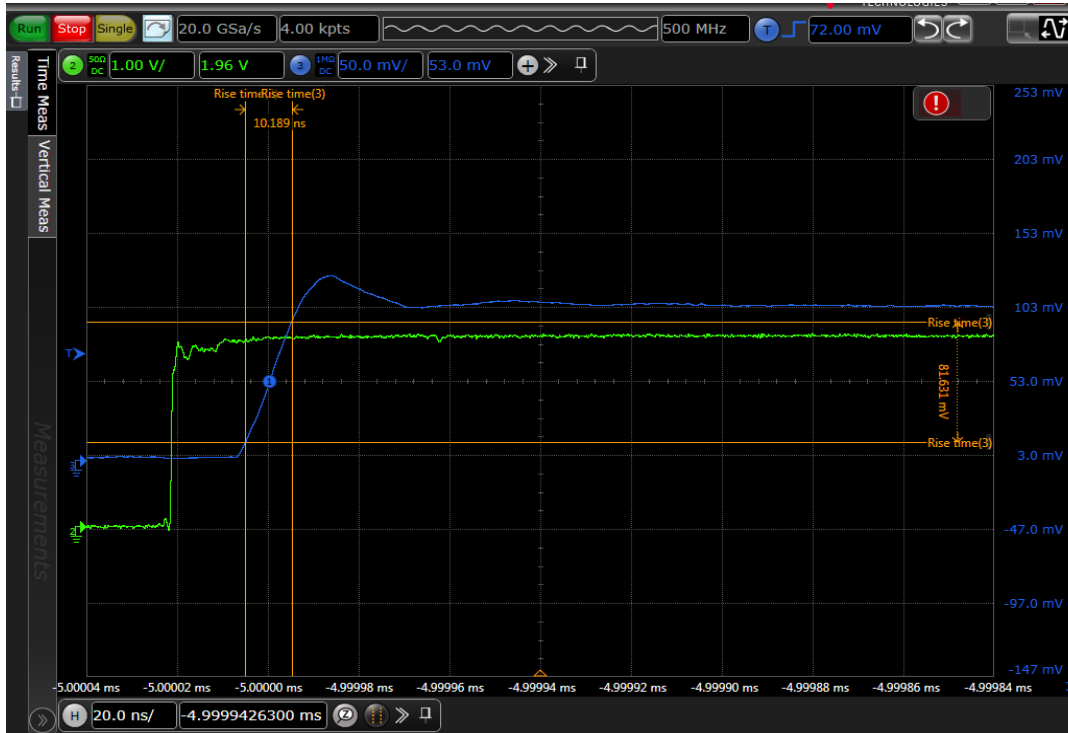


Amplifier PMI Model PEC-26-1G2G-3R0-25-15-SFF

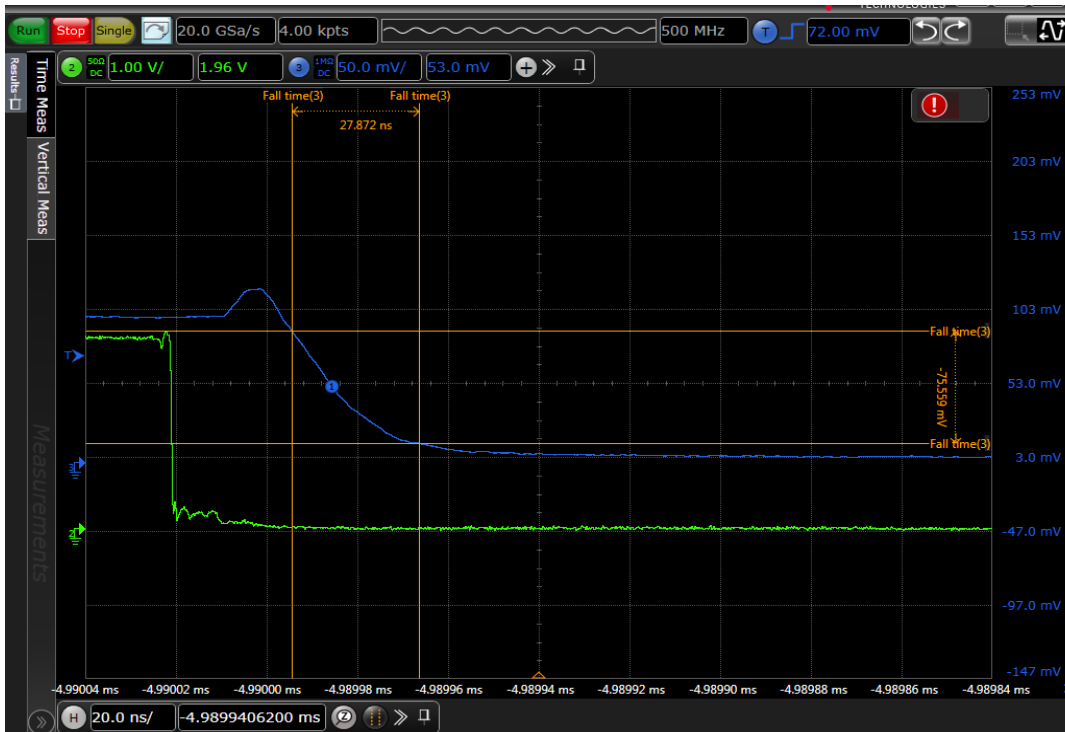
*Output with 100Ω termination

Typical Characteristics For DD-24-SMF

Rise Time



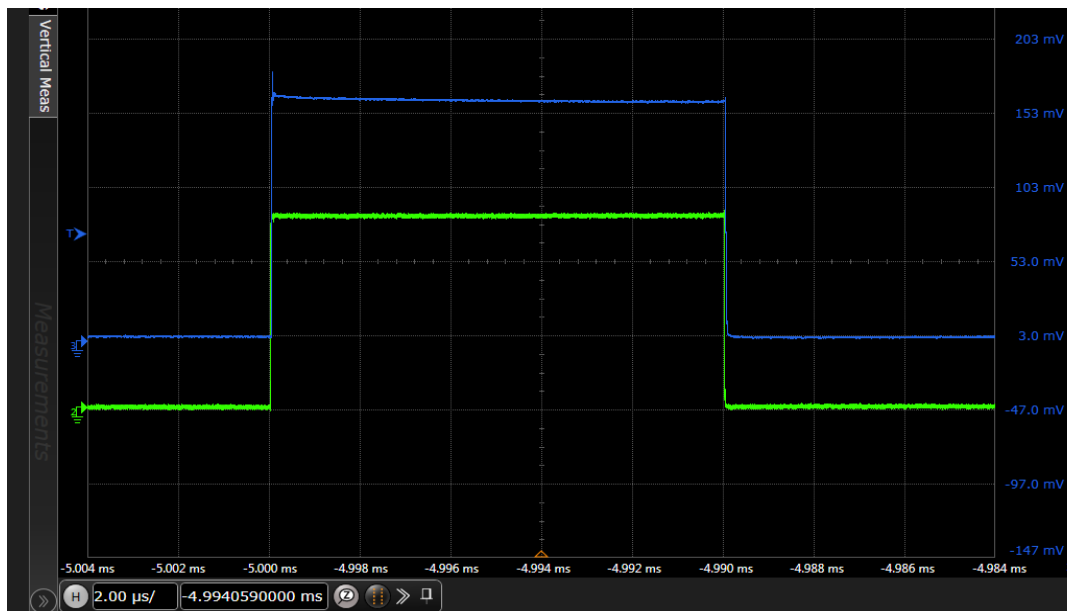
Fall Time



Green - Pulse
Blue - Detector Output

*Output with 100Ω termination

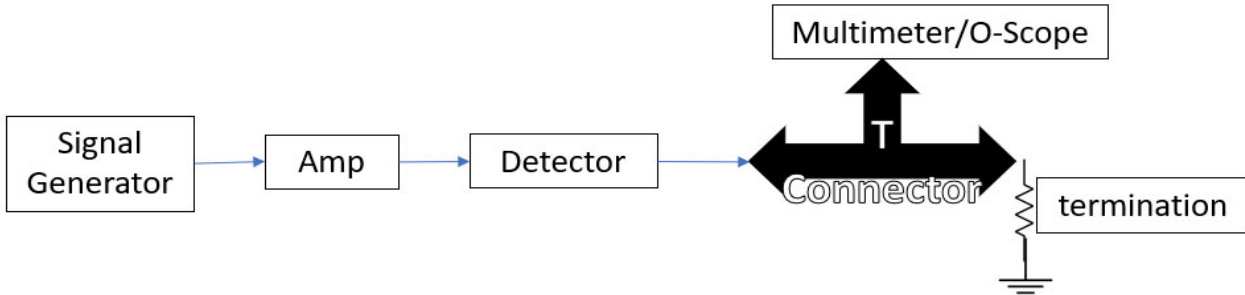
Typical Characteristics For DD-24-SMF Full Pulse



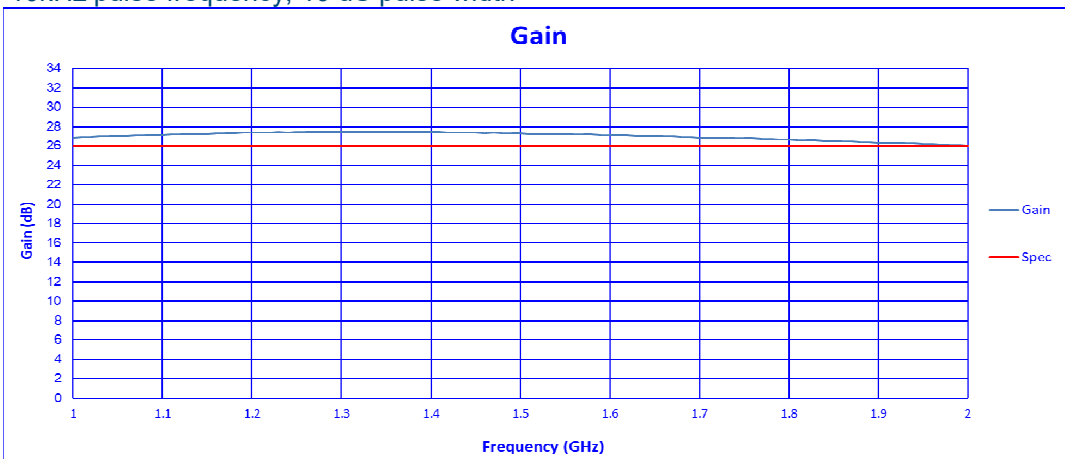
*Output with 100Ω termination

Typical Characteristics
For
DD-24-SMF

Appendix A: TSS Calculations and Test Setup



- | | |
|---|-----------------|
| 1. Multimeter to Measure DC offset with amplifier on and signal generator off | 0.0035935 mv |
| 2. Multimeter to Measure Detector output with amplifier on and signal generator on at -50 dBm CW @ 2GHz | 2.1756884 mv |
| 3. Oscilloscope to measure AC RMS noise voltage with amplifier on and signal generator off | 0.863 mv |
| 3. S/N calculated as $20 \cdot \log(\text{Detector output} - \text{DC offset}) / \text{rms noise}$ | 8.0173602 dB |
| 4. TSS Calculated as $-50 - (\text{SNR} - 8) / 2$ | -50.00868 dBm |
| 5. Calculation confirmed with O-scope screen captures with signal generator pulsing -50 dBm at 10kHz pulse frequency, 10 uS pulse width | See Plots Above |



Amplifier Data

