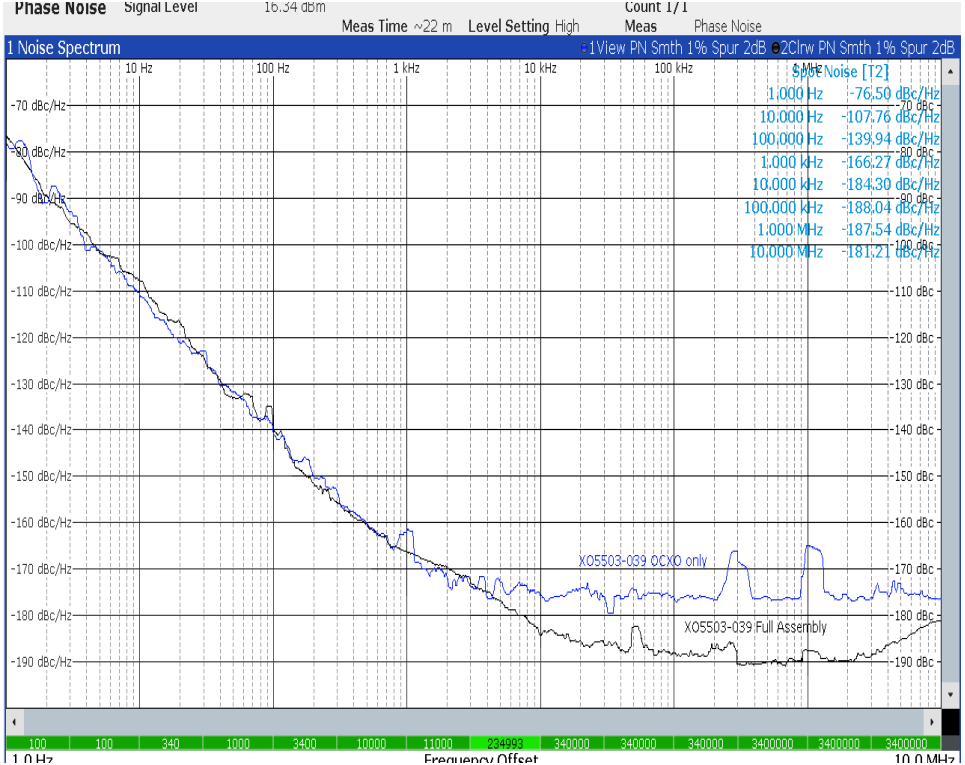


Mtron™
Innovative RF Solutions

Electronic Vibration Compensated OCXO (e-Vibe®)



OCXOs with SC-cut Resonators



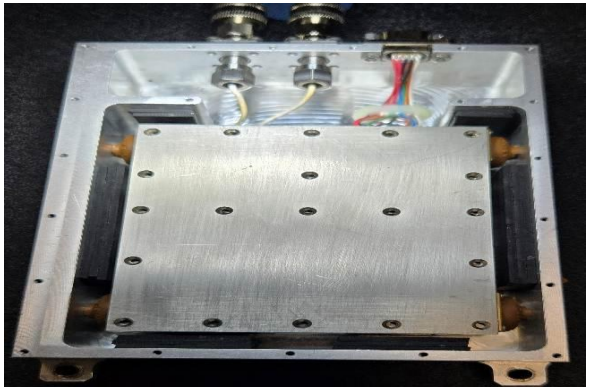
SC-cut resonators have very low g-sensitivity compared with AT-cut resonators - as low as 0.2ppb/g worst case axis

Low g-sensitivity reduces vibration-induced phase noise in OCXOs

Market demands for acceleration sensitivity in the magnitude of 1E-12 in dynamic conditions.

- Mechanical Isolation
- Electronic compensation - **Mtron's e-Vibe®**
- Combination of mechanical isolation and electronic compensation

Mechanically Isolated OCXOs



Low frequency resonance due to isolators

Vibration isolation is dominant above isolators resonant frequency

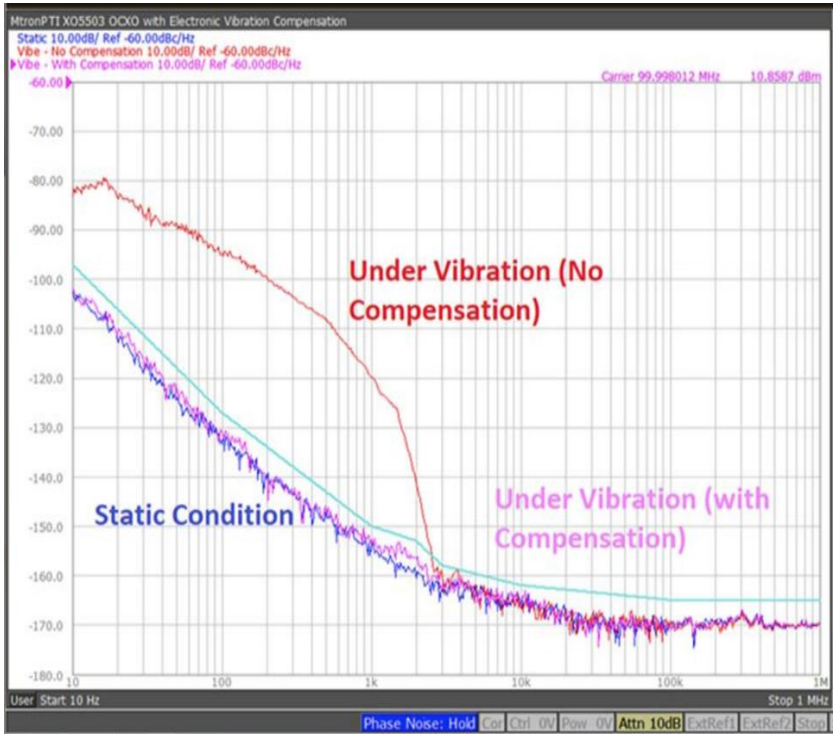
Temperature sensitive

Fatigue over time

Expensive approach

Bulkier: Size and Weight

e-Vibe® Oven-Controlled Crystal Oscillator



Reduces phase noise degradation under dynamic environments

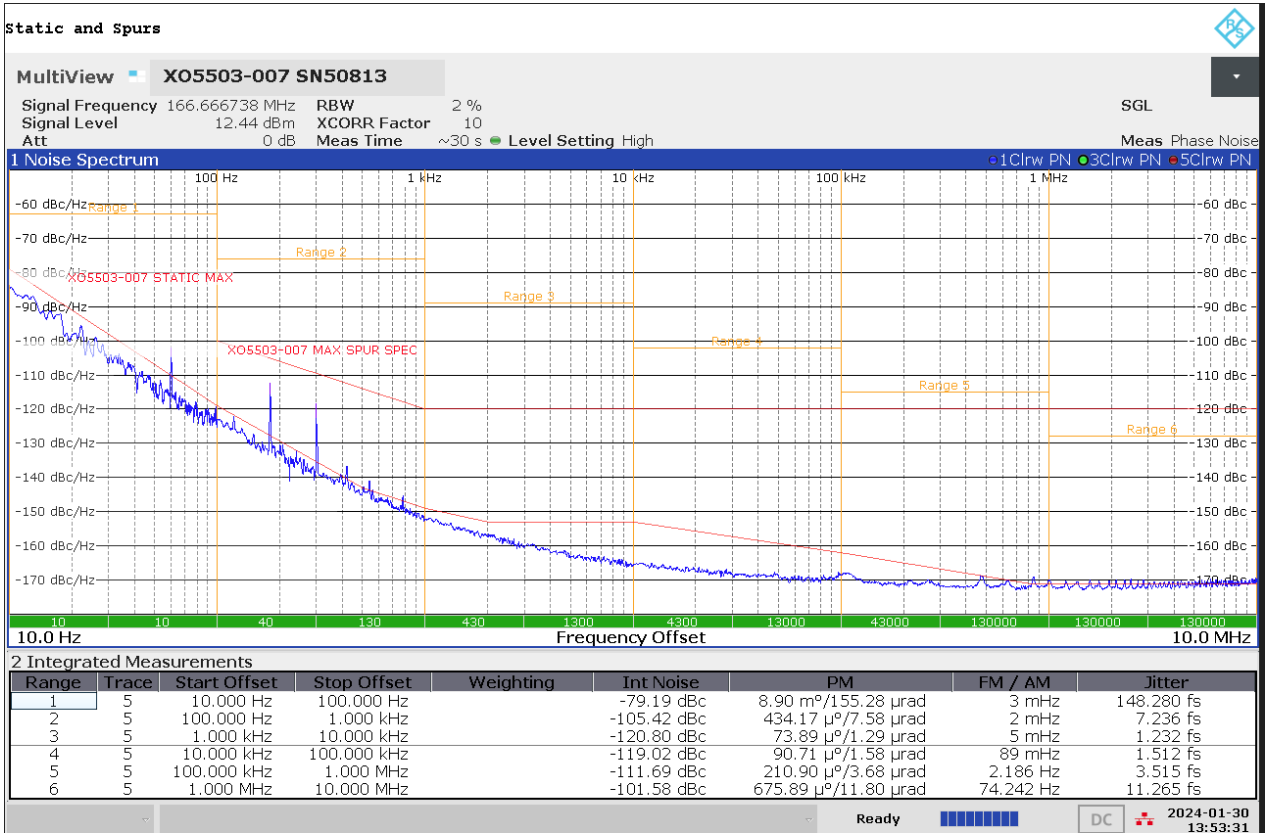
Hard mounted – no isolators - no low frequency vibration

Smaller size and weight

Less expensive compared to mechanical isolated OCXOs

Data from 166 MHz e-Vibe® OCXO

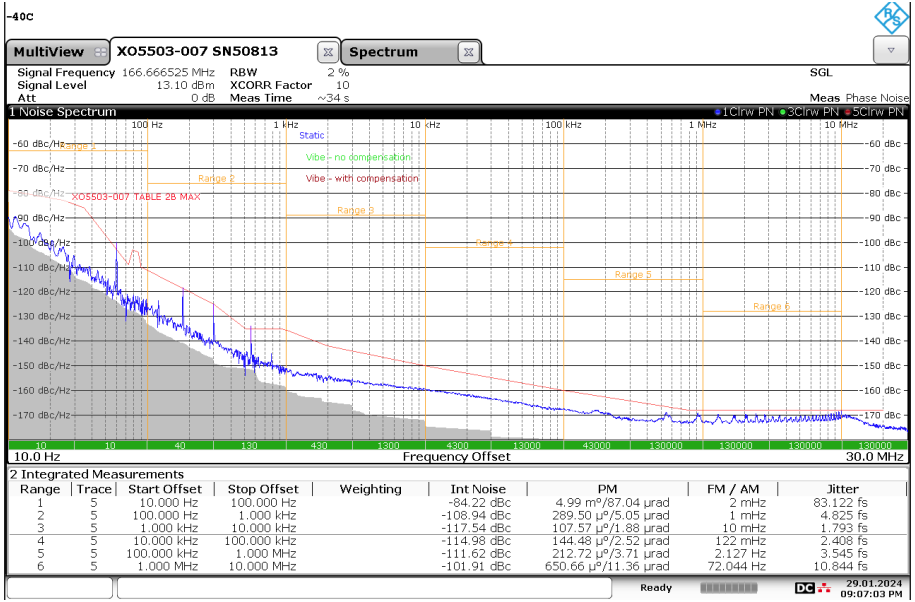
Static Phase Noise
@ Room Temp

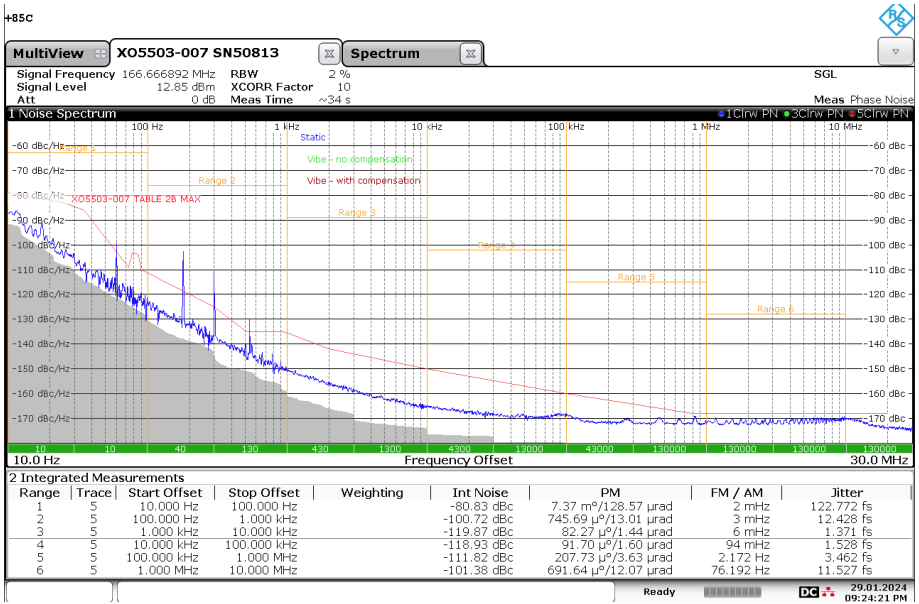


166 MHz e-Vibe® OCXO

Data shared for reference only

Static Phase Noise
@ -40C and +85C



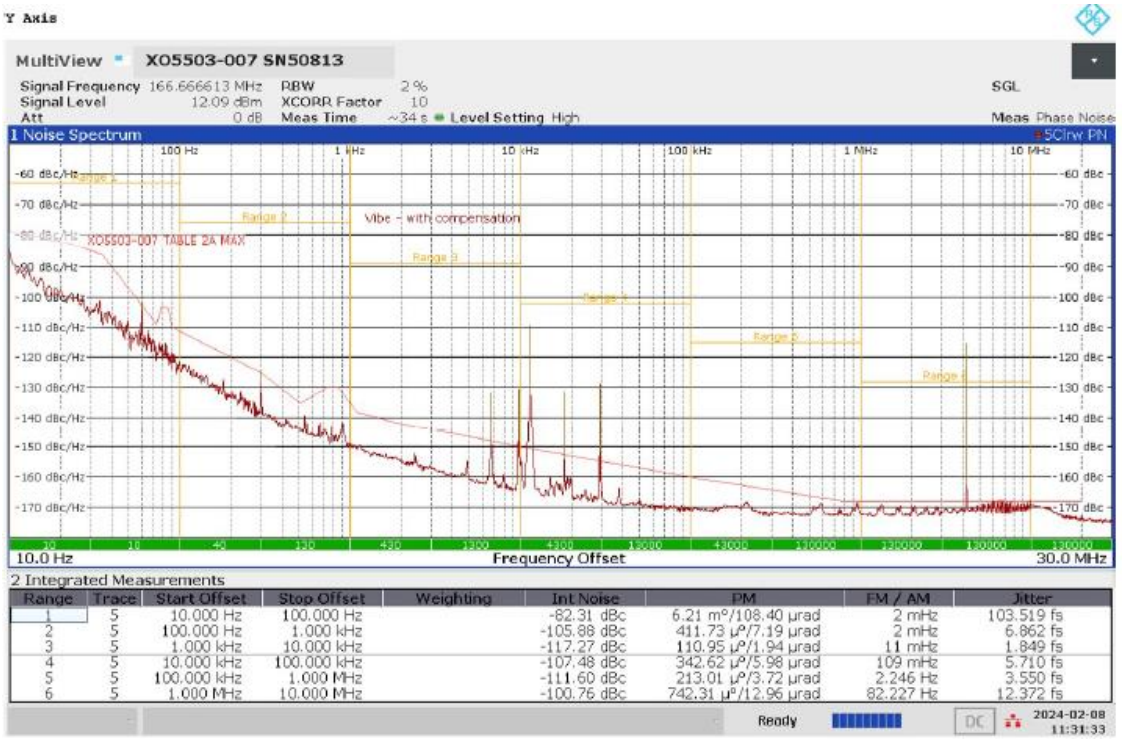


Measured Data from 166MHz e-Vibe® OCXO

Data shared for reference only

Table 2a Vibration profile

Offset (Hz)	Vibration (g^2/Hz)
10	0.010
25	0.220
35	0.220
73	0.005
78	0.020
86	0.020
90	2.5E-3
300	15.0E-6
510	10.0E-6
720	5.0E-3
860	5.0E-3
1100	30.0E-6
2000	15.0E-6



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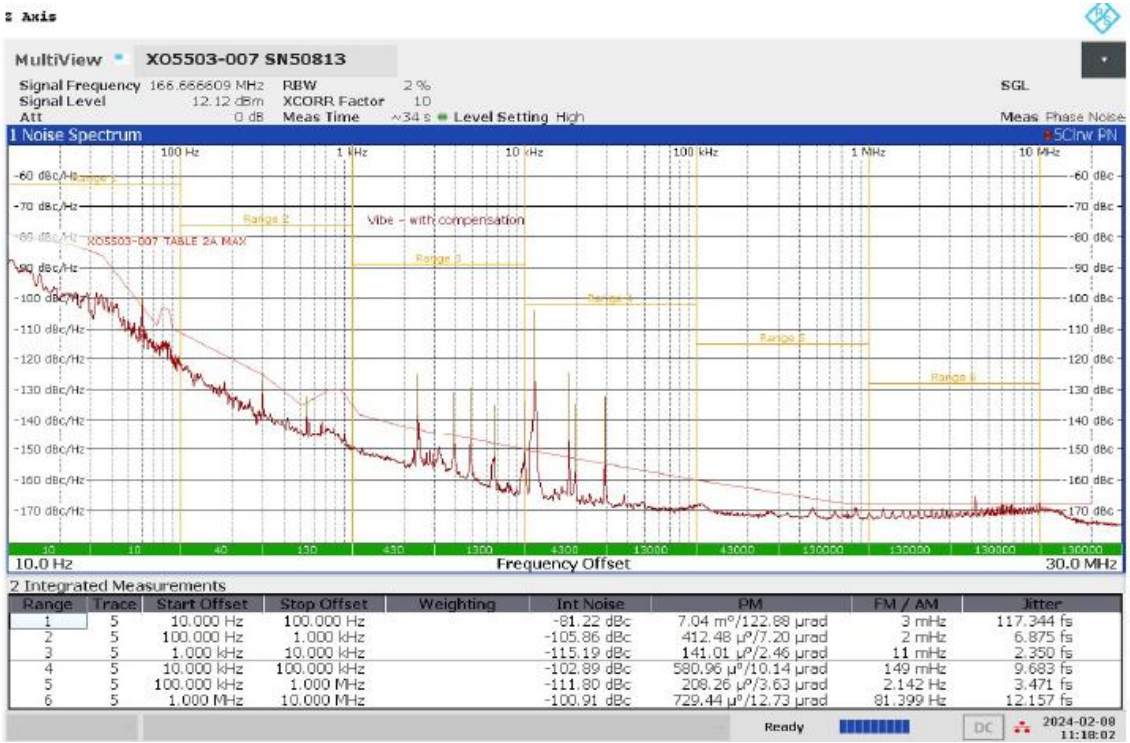

Measured Data from 166MHz e-Vibe® OCXO

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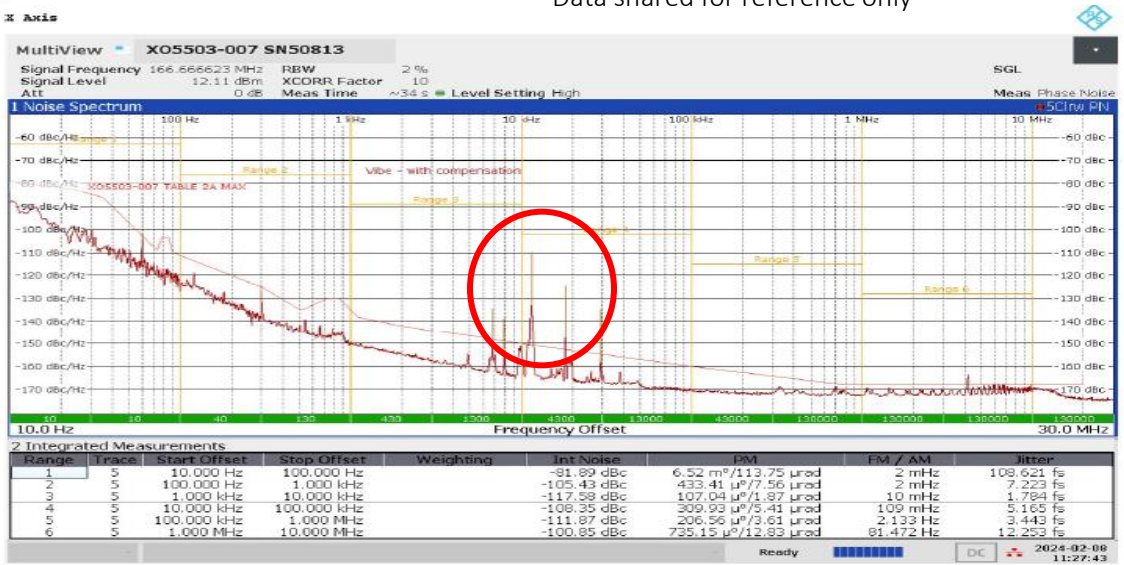
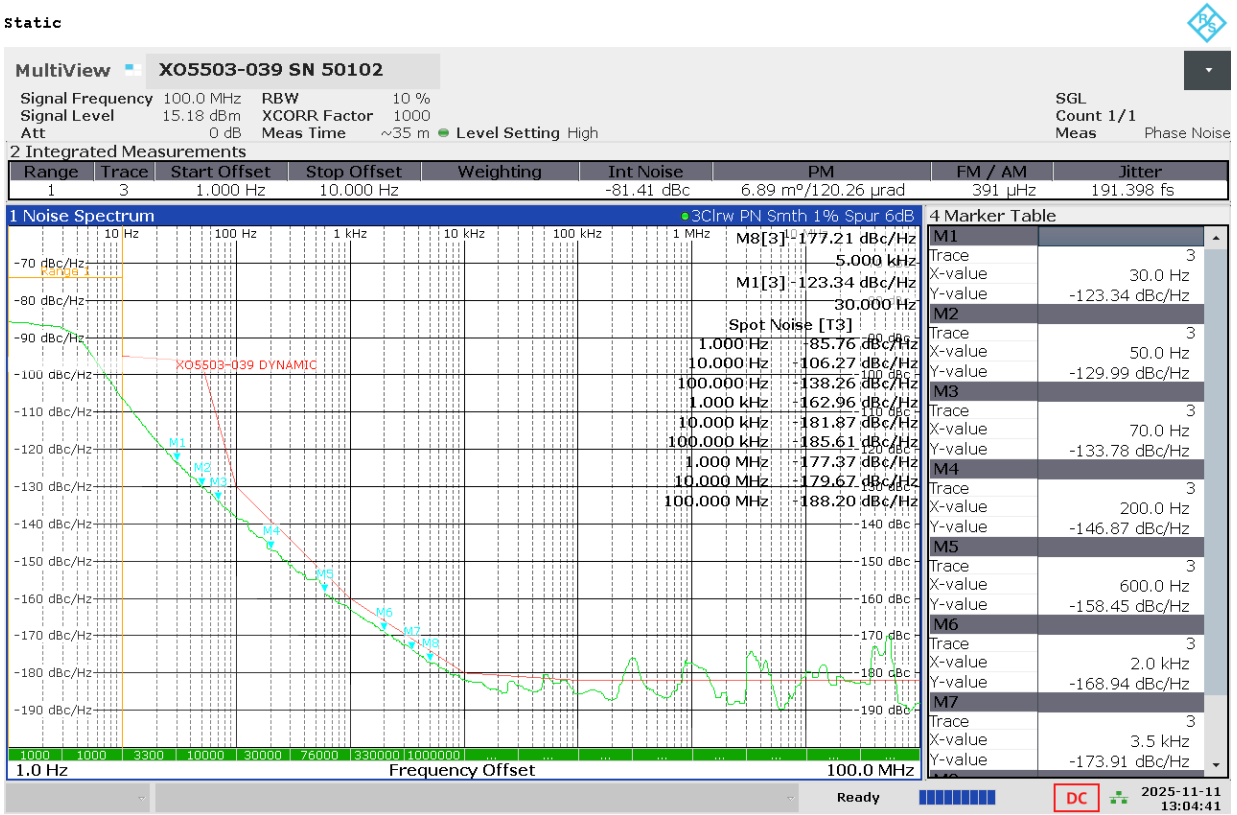


The spurs seen under vibration (circled above) are test system related and not from the DUT

The spurs are seen when DUT is installed on the shaker and the amplifier is turned on, even if the unit is not being shaken. Spurs are due to shaker EMI

Measured Data from 100MHz e-Vibe® OCXO with Integrated PLL

Static Phase Noise



Measured Data from 100MHz e-Vibe® OCXO with Integrated PLL

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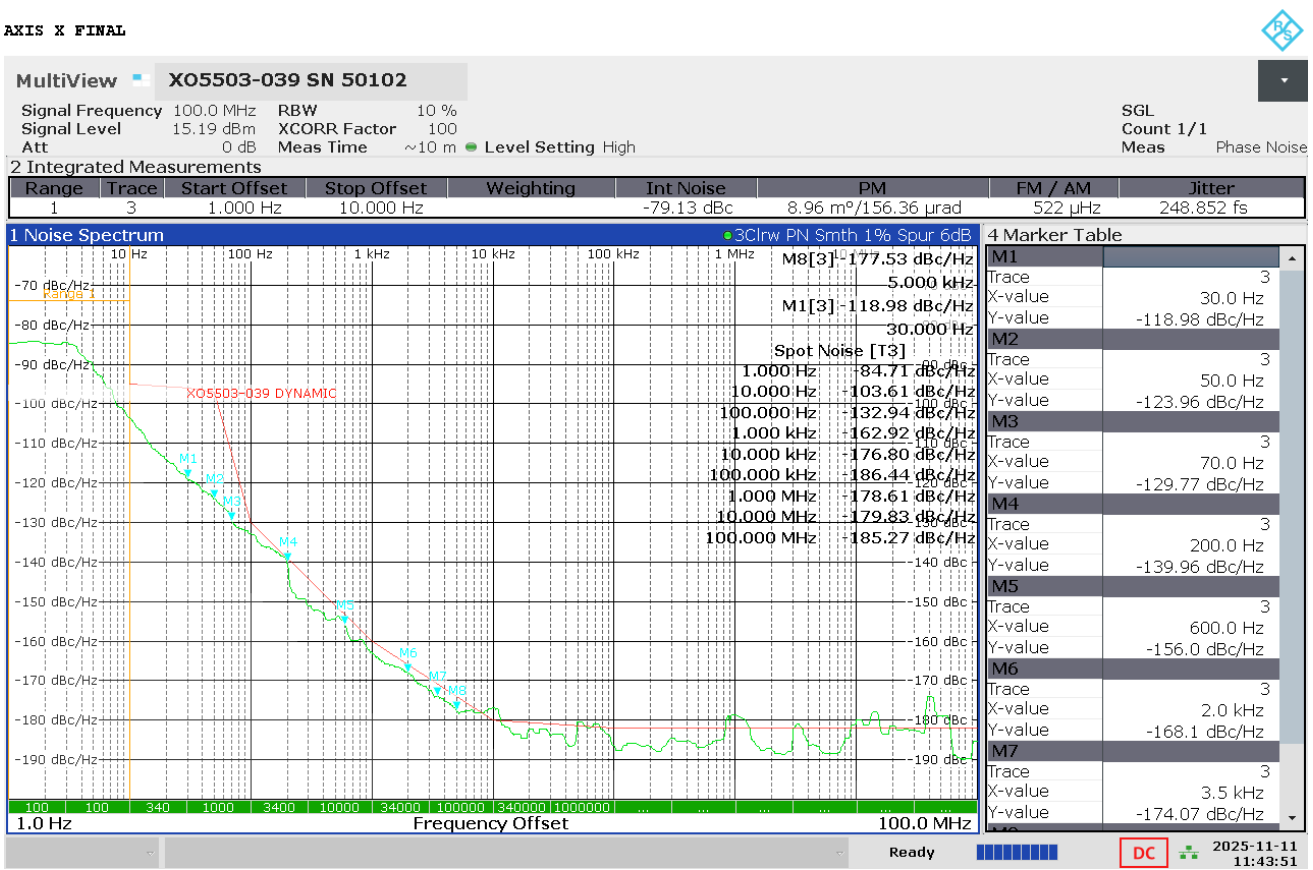
Dynamic Phase Noise X-axis

Random Vibration Profile	
Offset Frequency (Hz)	g^2/Hz
2	1.00×10^{-3}
4	1.00×10^{-3}
4	1.80×10^{-3}
60	1.80×10^{-3}
70	1.00×10^{-3}
200	1.00×10^{-3}
210	1.00×10^{-5}
300	1.4289×10^{-5}
500	3.96354×10^{-5}
600	1.0231×10^{-4}
610	1.0231×10^{-4}
688	5.9×10^{-7}
764	2.4037×10^{-5}
1000	4.00×10^{-6}
1075	8.74137×10^{-7}
1726	2.27379×10^{-7}
1837	2.00×10^{-6}
2000	2.635×10^{-6}
3000	2.064×10^{-6}
4000	1.736×10^{-6}
5000	1.518×10^{-6}
10000	1.00×10^{-6}



Measured Data from 100MHz e-Vibe® OCXO with Integrated PLL

Dynamic Phase Noise Y-axis

Random Vibration Profile	
Offset Frequency (Hz)	g^2/Hz
2	1.00×10^{-3}
4	1.00×10^{-3}
4	1.80×10^{-3}
60	1.80×10^{-3}
70	1.00×10^{-3}
200	1.00×10^{-3}
210	1.00×10^{-5}
300	1.4289×10^{-5}
500	3.96354×10^{-5}
600	1.0231×10^{-4}
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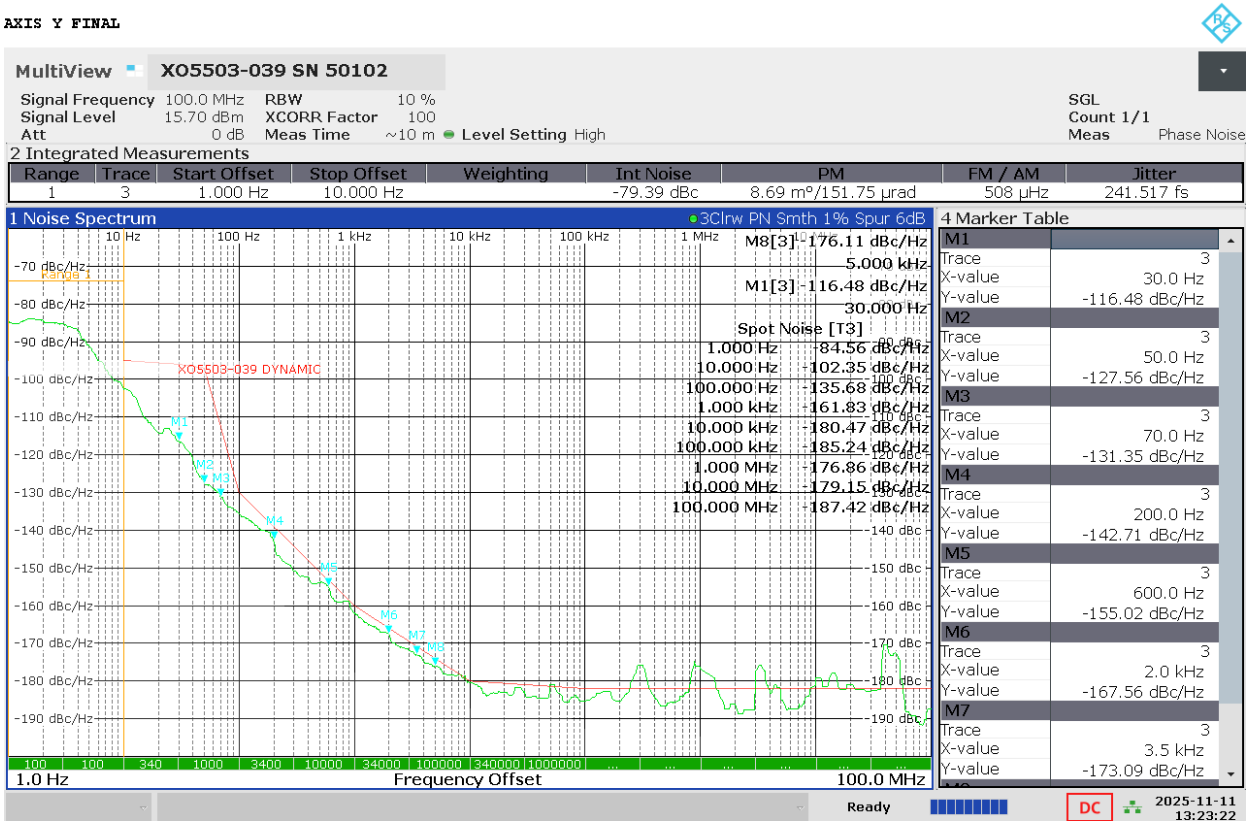

Measured Data from 100MHz e-Vibe® OCXO with Integrated PLL

Dynamic Phase Noise
Z-axis

Random Vibration Profile	
Offset Frequency (Hz)	g^2/Hz
2	1.00×10^{-3}
4	1.00×10^{-3}
4	1.80×10^{-3}
60	1.80×10^{-3}
70	1.00×10^{-3}
200	1.00×10^{-3}
210	1.00×10^{-5}
300	1.4289×10^{-5}
500	3.96354×10^{-5}
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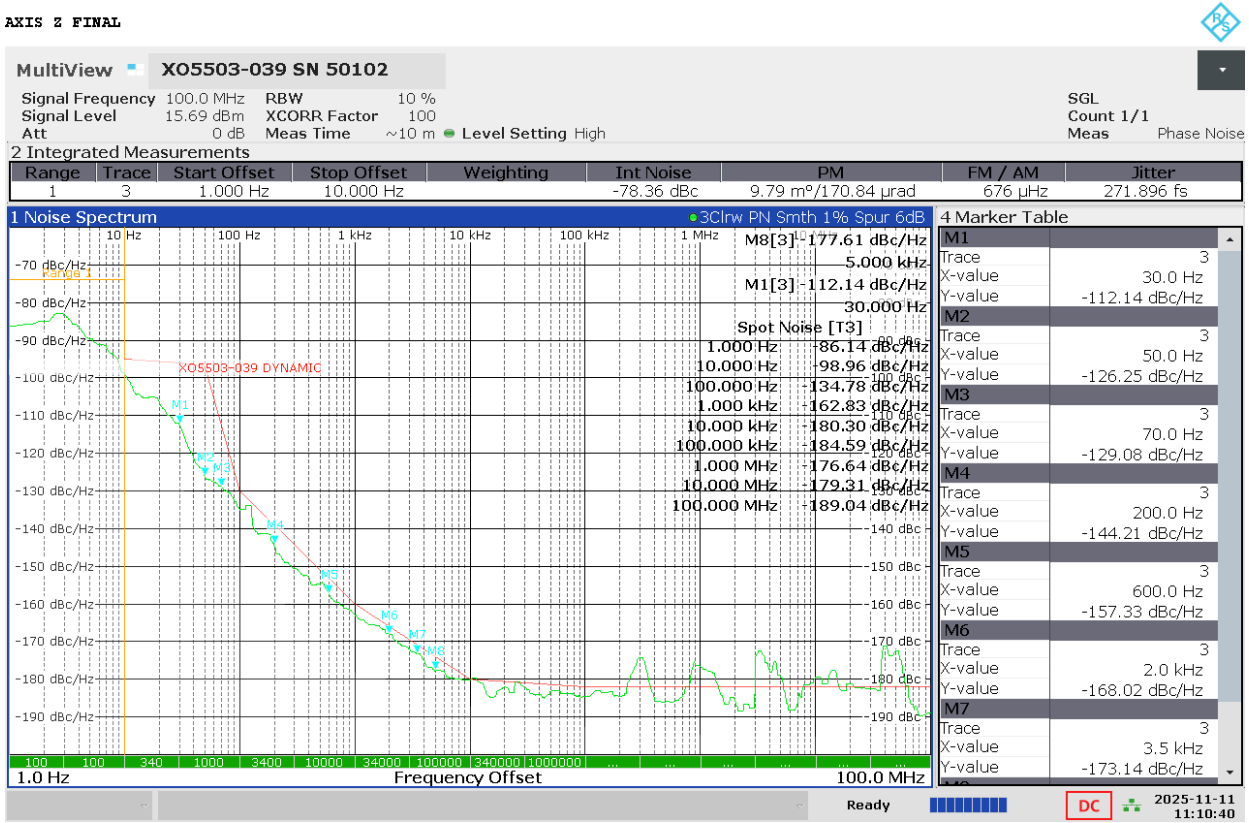
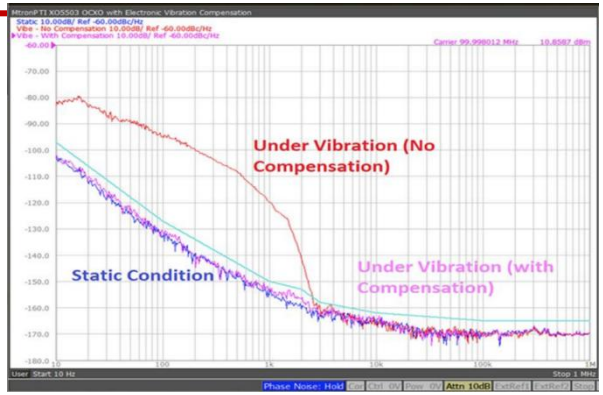


e-Vibe® OCXO Legacy



Best In Class Oscillator Compensation for effects of Vibration

Introduced 10 MHz version in 2016

100 MHz version introduced in 2020

166.666667 MHz introduced in 2023

125 MHz introduced in 2025

160MHz, 1.6GHz, 2.0GHz, 4.0GHz in development

Markets served are mostly for demanding dynamic radar applications

Quartz resonator and oscillator produced at Mtron's operation in Orlando, FL

e-Vibe™ Series OCXO Heritage		
Output Frequency	**Application**	**Total Grms of Vibration Profile**
10 MHz	Marine Satellite Communication equipment	4.1 Grms
10 MHz	Airborne EW	6.0 Grms
100 MHz	Airborne EW	4.8 Grms
100 MHz	Airborne long-range guided weapon	4.1 Grms
100 MHz	Ground mobile radar	2.1 Grms
100 MHz	Shipboard radar	<1.0 Grms
166.66667 MHz	Airborne radar	2.8 Grms
125 MHz	Airborne	3.1 Grms

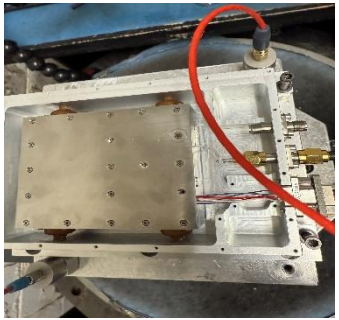
e-Vibe® Solutions - Evolution

10MHz e-Vibe ®
2'x2"x0.8"

100MHz e-Vibe ®
2'x1.5"x0.8"

4GHz S-band Clock Distribution
Assembly
125MHz e-Vibe ®

166.66667MHz e-Vibe ®
2'x2"x0.8"



100MHz e-Vibe ®
+ Mechanical isolation
Integrated with PLL

Mtron™
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Thank You!