

▶ strictly confidential

Attracting Tomorrow



ICM-45686 Accel VRE

InvenSense

A TDK Group Company
MEMS Sensors Business Group
Sensor Systems Business Company

Summary

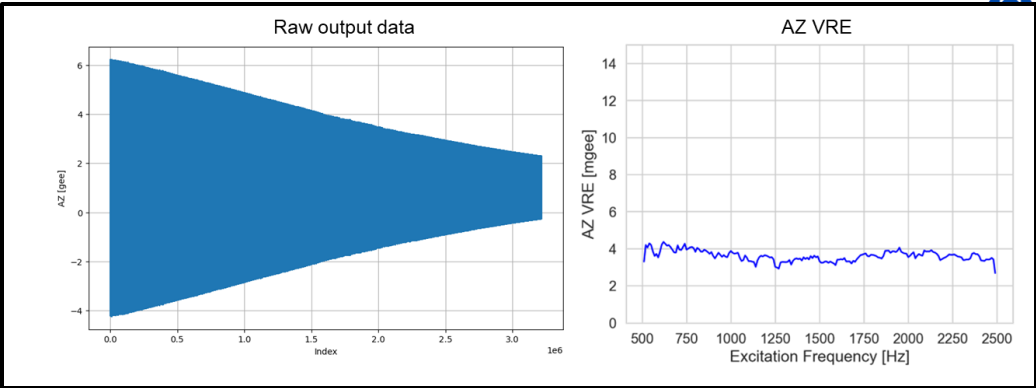
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- **Content:**
 - Analysis of raw data from ICM 45686, how to reproduce VRE plots from Raw data
 - VRE plots collected by TDK comparing ICM 40609-D to ICM 45686
- **Conclusion:**
 - ICM 45686 has a superior VRE performance compared to ICM 40609-D

Analysis of Raw Data

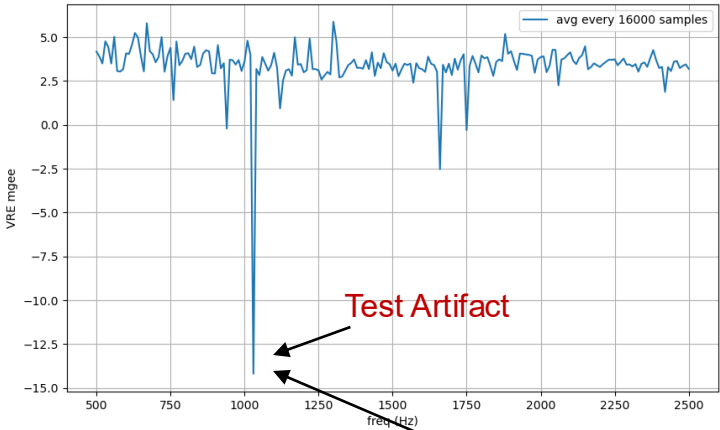
Input Vibration:

- 4gee RMS amplitude (this amplitude is regulated using LDV)
- Sweep freq from 500-2500Hz with 10Hz Steps
- At each step, collected 16,000 samples (critical to keep the input vibration frequency fixed)

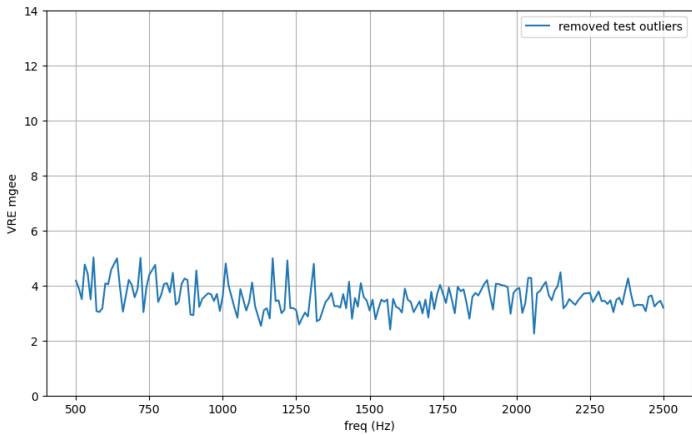


Data Processing Method

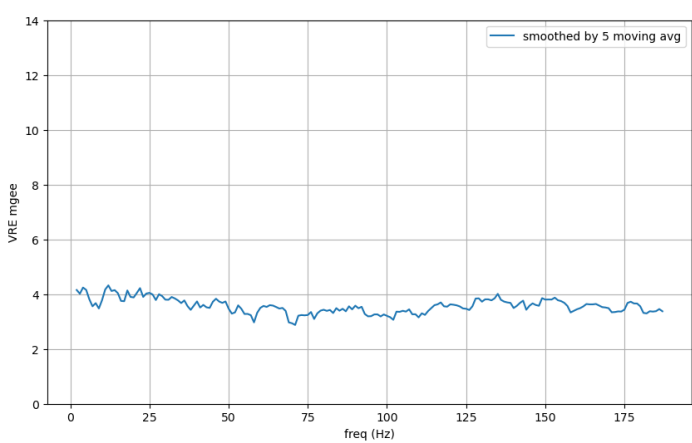
1. Avg each N=16000 samples and subtract 0gee offset



2.Remove outliers using your preferred method

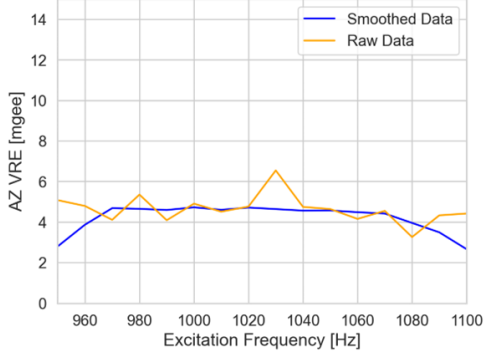


3. Apply moving avg of 5



- Test artifacts can occur due to various reasons (e.g. glitches in the control system)
 - Test artifacts can be identified by retesting part or sharpness of the vibration peak
- Retest around 950-1100Hz showed that peak identified in top left image is a test artifact

Retest around 950-1100 Hz:



TDK's VRE measurement ICM-45686 vs ICM-40609-D

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- Test procedure:
 - ▢ Apply 4gee RMS vibration in XYZ direction 50Hz to 5,000Hz at 10Hz steps
 - ▢ LPF is disabled
 - ▢ Collect raw unfiltered data from sensor
 - ICM-45686: FS=ODR=6.4kHz, collect data for 2.5sec, 16,000 samples per frequency step
 - ICM-40609-D : FS=ODR=8kHz, collect data for 2.5sec, 20,000 samples per frequency step
 - ▢ VRE plots are generated according to the method described in the previous slide

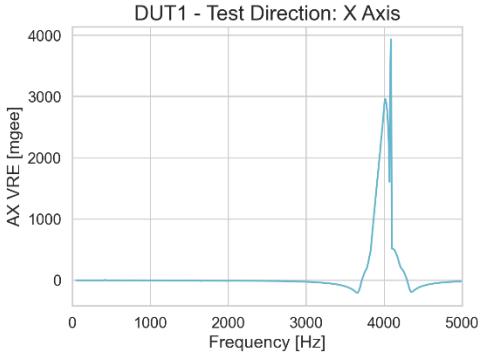
Direction
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X

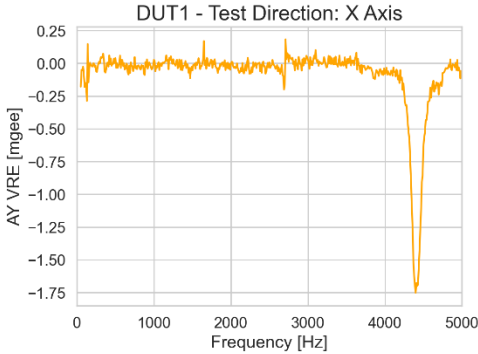
Y

Z

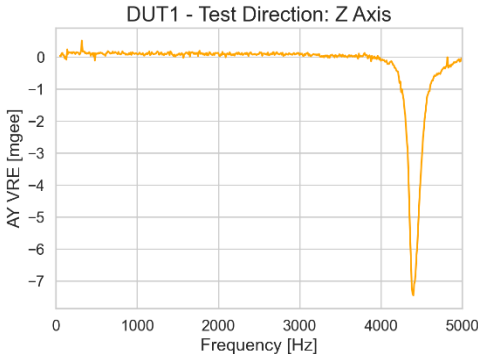
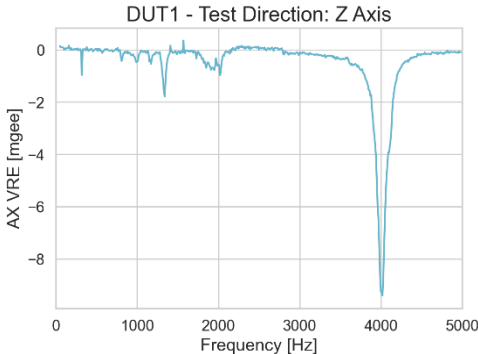
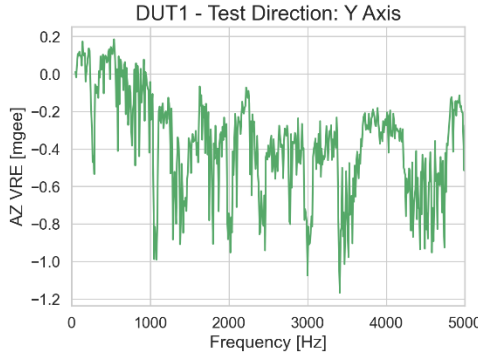
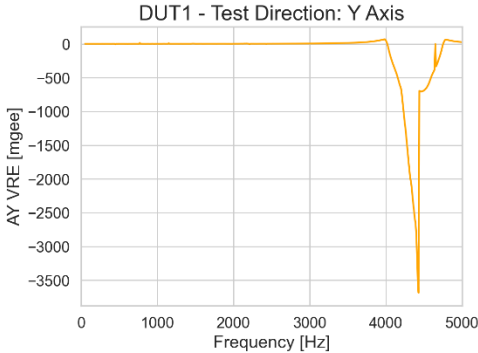
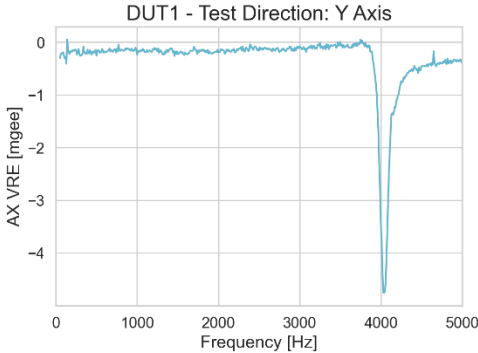
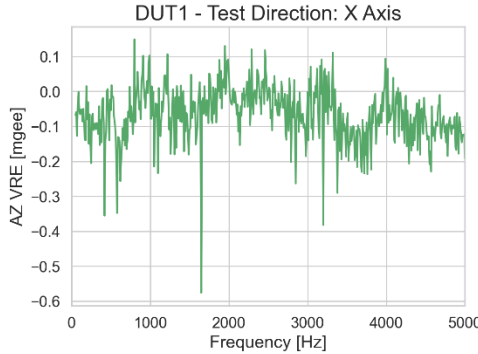
AX



AY



AZ



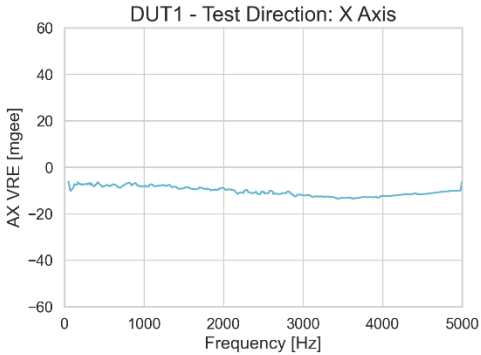
Direction
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X

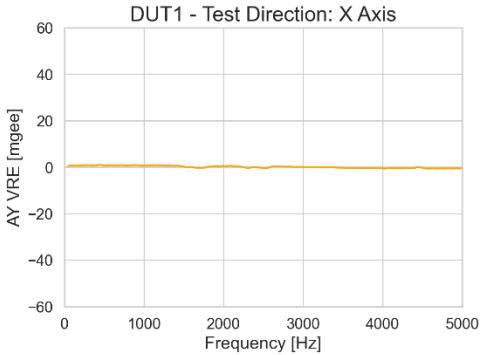
Y

Z

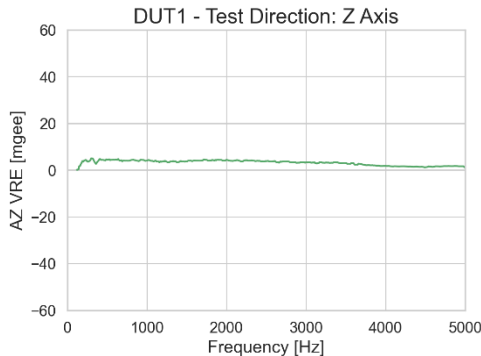
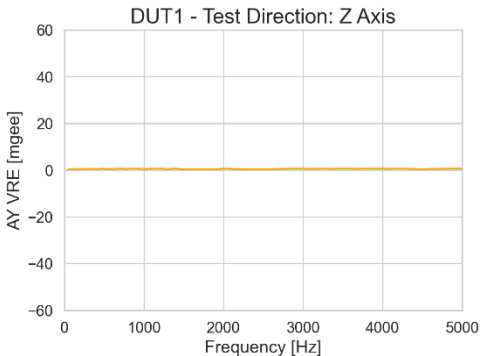
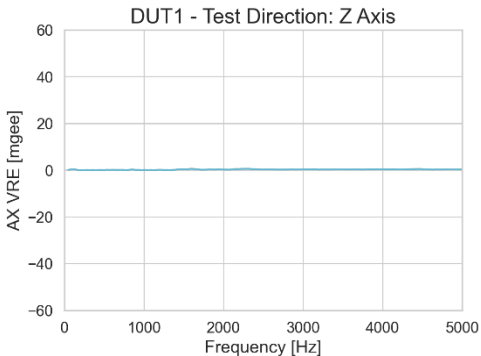
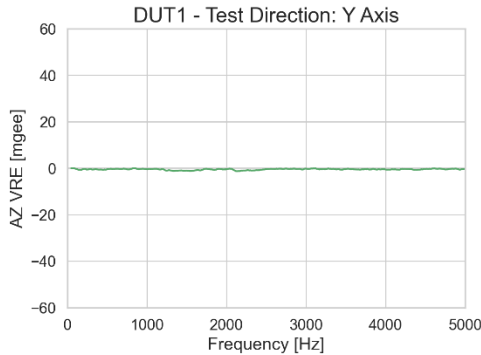
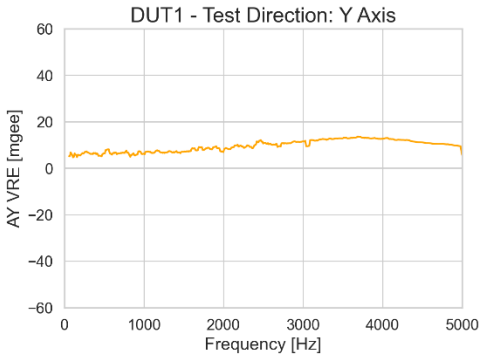
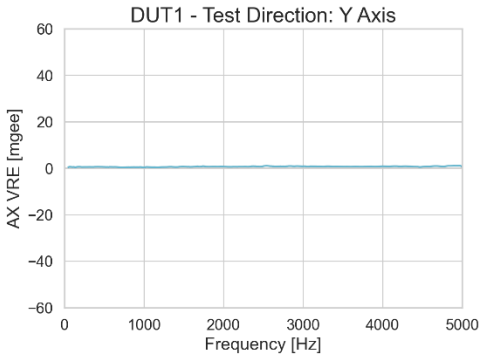
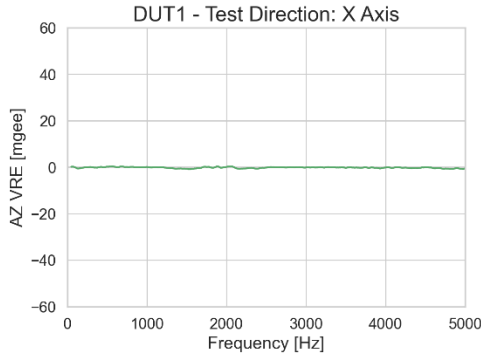
AX



AY

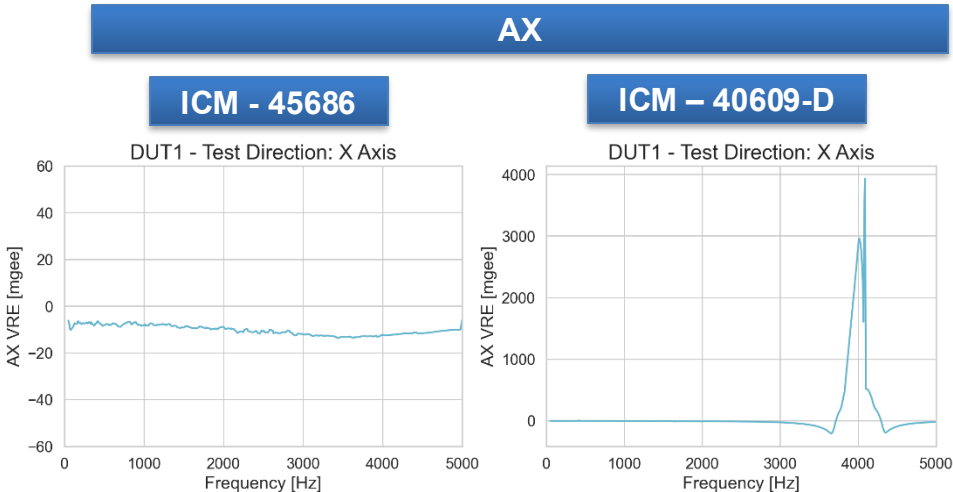


AZ

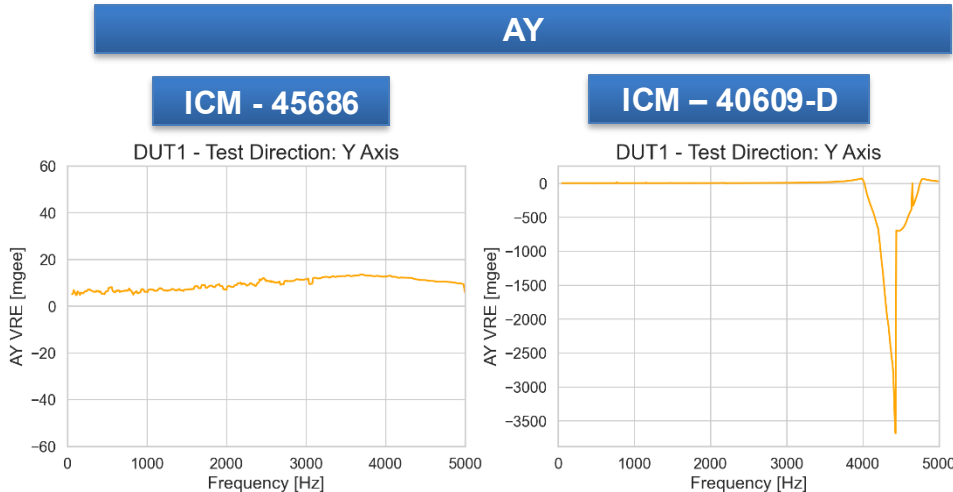


Comparison between ICM-45686 and ICM-40609-D

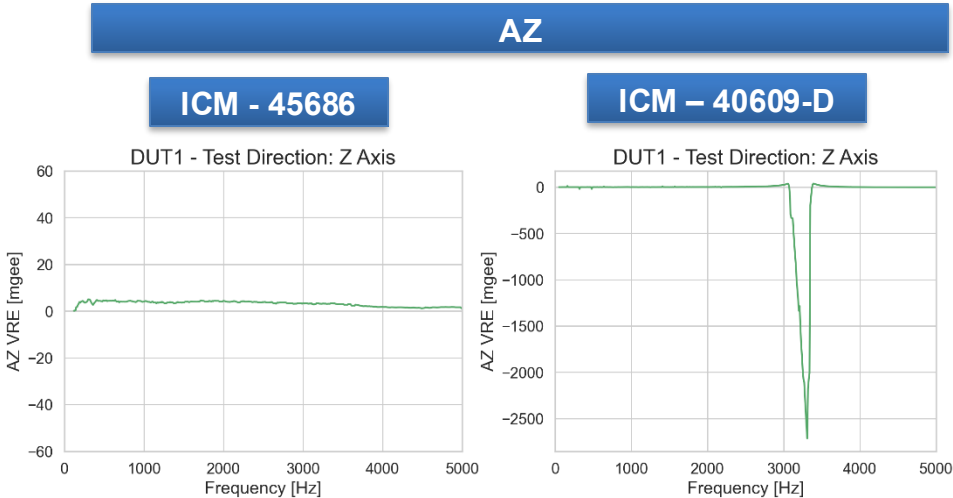
Direction X



Direction Y



Direction Z





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Sensor outputs at No vibration

This information is used to calculate VRE as described on slide 3

ICM-45686	X direction	Y direction	Z direction
AX Output [mgee]	-999.5569	-11.3948	2.5361
AY Output [mgee]	-0.9158	1000.2408	3.4096
AZ Output [mgee]	9.4294	11.8651	1009.2933

ICM-40609-D	X direction	Y direction	Z direction
AX Output [mgee]	-1003.9949	8.5375	21.378
AY Output [mgee]	-2.8902	996.129	3.4551
AZ Output [mgee]	-0.1787	-8.194	985.0328