MTI
MTI-MILLIREN TECHNOLOGIES, INC.

CESIUM ATOMIC CLOCK

AS9100 / ISO9001 Certified

Low G-Sensitivity

Low G Sensitivity Cesium Atomic Frequency Reference Assembly for Airborne Applications

MTI introduces the next generation of atomic references for rugged military and airborne applications that combines Cesium Atomic Clock performance with MTI's patented Low g sensitivity DOCXO in a small outline hermetically sealed package. The Precision Reference generates a highly accurate frequency (typically better than 5E-11 after 24hrs) with very low phase noise performance in dynamic environments. The device is also capable of locking to an external frequency reference or GPS. The entire assembly uses less than 16W at -40°C (total continuous power) and offers fast warm-up of less than 9min. to an accuracy better than 4E-10 at -40°C (reference time 30 min.). RS-422 provides communication, control and status reporting along with wired RS-422 level status outputs. Thermal interface allows for use with minimal direct airflow such as encountered at high altitudes. Multiple options are available to offer a customized, high performance next generation Atomic Frequency Reference.

Applications

- Low G Sensitivity for rugged military applications
- Airborne and Shipboard
- Ground and Satellite Communications
- Secure Communication Links
- Rubidium Clock Replacement

Electrical Performance and Features

Frequency Outputs: 5MHz (qty 3) & 80 MHz (qty 7)
Supply Voltage: 12VDC and 15VDC
Warm Up Power Consumption: 12VDC, 24 W Max. ; 15VDC, 4W Max.
Phase Noise: See phase noise graphs
Continuous Power Consumption: 12VDC, 12W, 15VDC, 3.75W @ -40°C
Operating Temperature: -40°C to +71°C, Non-Operating -55°C to +90°C
Temperature Stability: 4.5E-10 (Reference=Internal Cesium)
Magnetic Sensitivity: 2E-11/Gauss (Reference=Internal Cesium)
Aging (Max), Internal CS Locked: Per Day 3.0E-11, Per Month 3.0E-10, Per Year 1.0E-09, (after 30 days continous operation, reference=Internal Cesium)
Acceleration Sensitivity : Better than 1.0E-10/g/axis (For Ultra Low G Options, consult factory)
Retrace: Better than 5.0E-11 after 2 hours (Reference=Internal Cesium)
Warm Up Time/Stabilization time: Less than 9 minutes at -40°C to 4.0E-10 (reference time 30 min.)
Allan Deviation: 1s 7.0E-12, 10s 7.0E-12, 100s 1.0E-11, 1000s 8.0E-12 (Reference=Internal Cesium)
Atomic Standard: Internal Cesium Clock
Radiation Hardened: Total Dose Gamma, Total Dose Neutron, Prompt Dose Gamma, Prompt Dose Neutron
EMI and EMP: EMI and EMP protected
Ruggedized Design: For high shock and vibration airborne environments
Serial Interface: RS-422 serial communication, user command and control set
Selectable Reference: Using hardware Bit or software serial communications port selectable internal Cesium, external 5MHz-10 MHz, 1PPs, or optional internal GPS receiver.
Bit Function Options: Hardware using 3 differential pairs (RS-422 levels) or software serial communication port (RS-422)
Auto Calibration: Internal CS Auto Calibration from external reference, Manual Calibration resolution better than 1.0E-12
Hermetically Sealed Chassis: Per MIL-STD-202 Method 112, Test Condition D
Connectors: RF outputs, 9 SMA Female connectors, RF input, 1 SMA Female, all SMA connectors are field replaceable, Power-BIT-COMM -DIFF PAIR 5MHz on 31pin Micro-D
Package Dimensions: 6.0"x6.8"x1.5", weight 3.25lbs
MIL-STD-188: Compliant

*Parameters can be modified to meet specific application requirements

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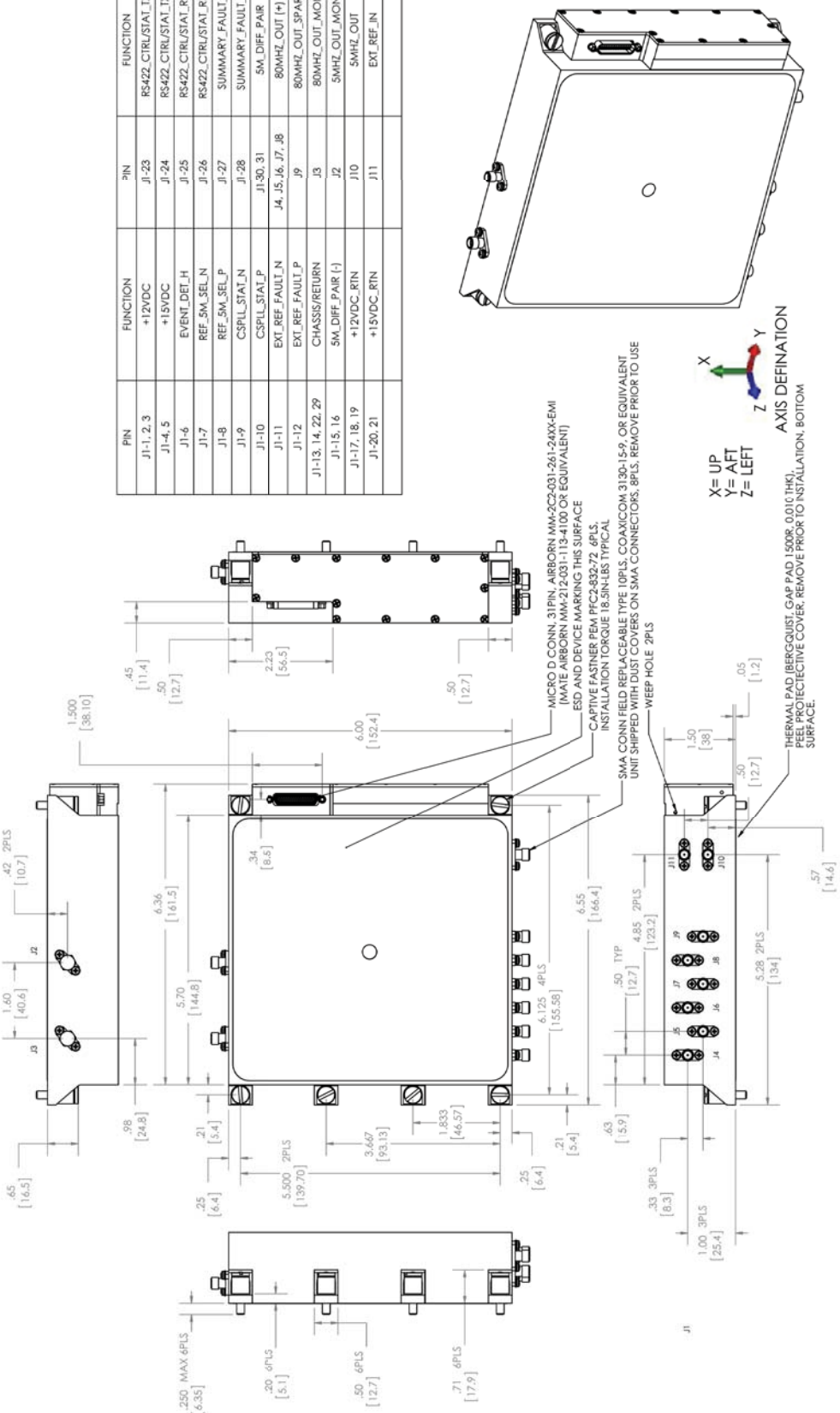
Mechanical Outline

PIN	FUNCTION
J1-1, 2, 3	+12VDC
J1-4, 5	+15VDC
J1-6	EVENT_DET_H
J1-7	REF_5M_SEL_N
J1-8	REF_5M_SEL_P
J1-9	CSPLL_STAT_N
J1-10	CSPLL_STAT_P
J1-11	EXT_REF_FAULT_N
J1-12	EXT_REF_FAULT_P
J1-13, 14, 22, 29	CHASSIS/RETURN
J1-15, 16	5M_DIFF_PAIR (-)
J1-17, 18, 19	+12VDC_RTN
J1-20, 21	+15VDC_RTN

PIN	FUNCTION
J1-23	RS422_CTRL/STAT_TX_P
J1-24	RS422_CTRL/STAT_TX_N
J1-25	RS422_CTRL/STAT_RX_P
J1-26	RS422_CTRL/STAT_RX_N
J1-27	SUMMARY_FAULT_P
J1-28	SUMMARY_FAULT_N
J1-30, 31	5M_DIFF_PAIR
J4, J5, J6, J7, J8	80MHZ_OUT (+)
J9	80MHZ_OUT_SPARE
J3	80MHZ_OUT_MON
J2	5MHZ_OUT_MON
J10	5MHZ_OUT
J11	EXT_REF_IN



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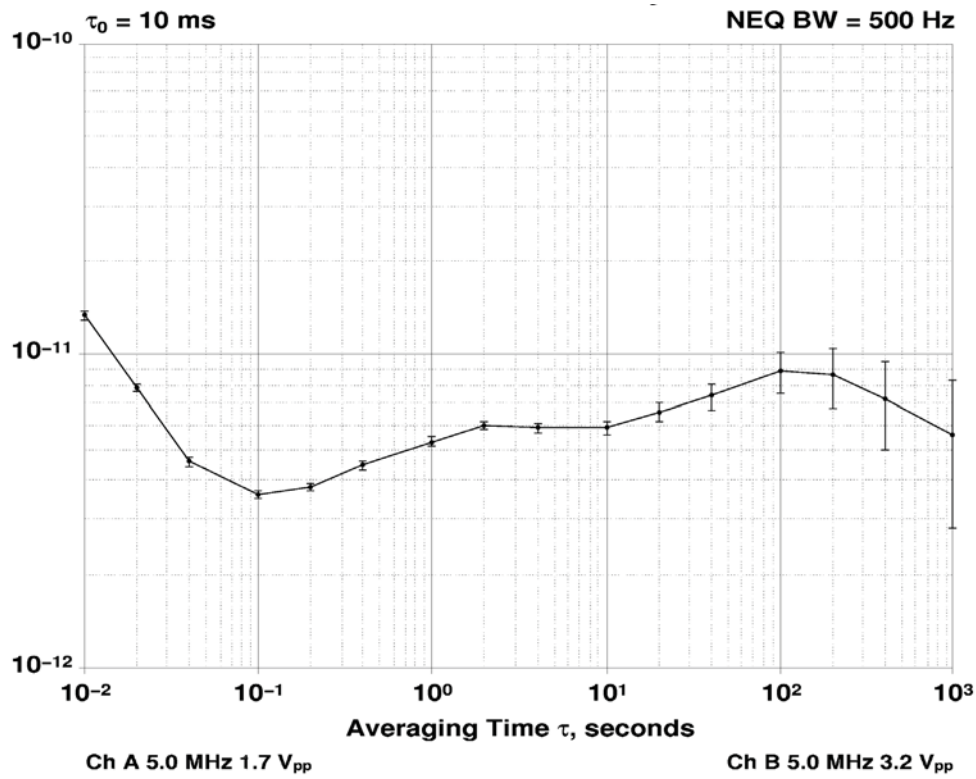
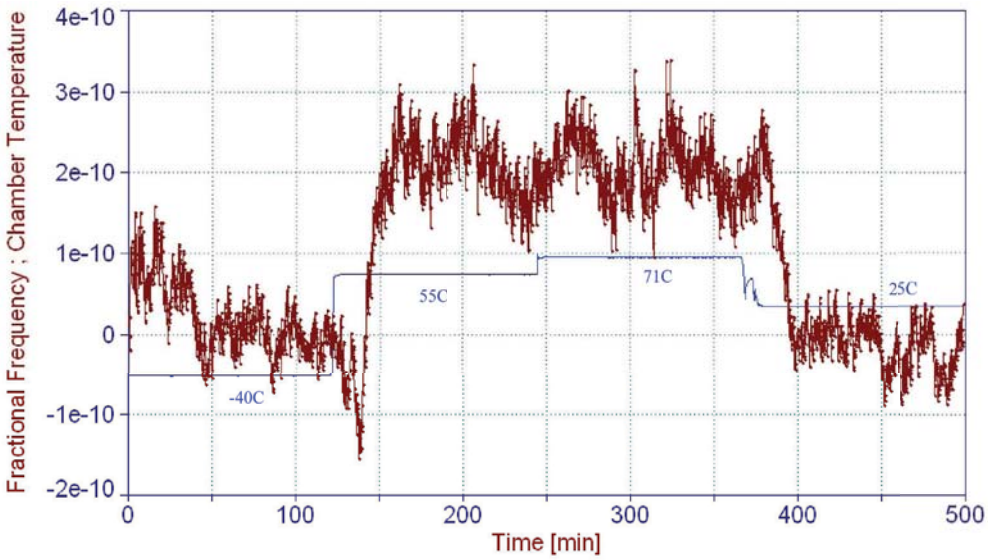
Allan Deviation



- Instantaneous Phase
- 2 sources Noise

Thermal Stability



- Temperature steps: -40°C; 55°C; 71°C; 25°C
- Soak Time at each step: 2 hours

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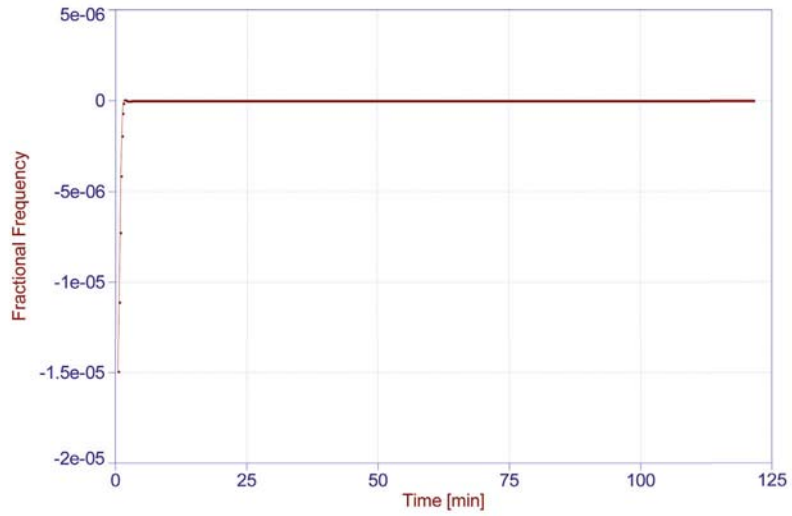
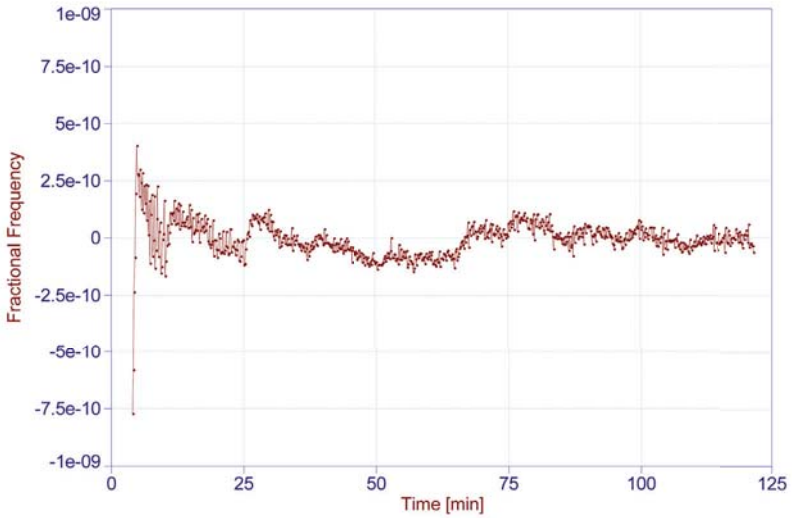
Warm-Up Characteristics



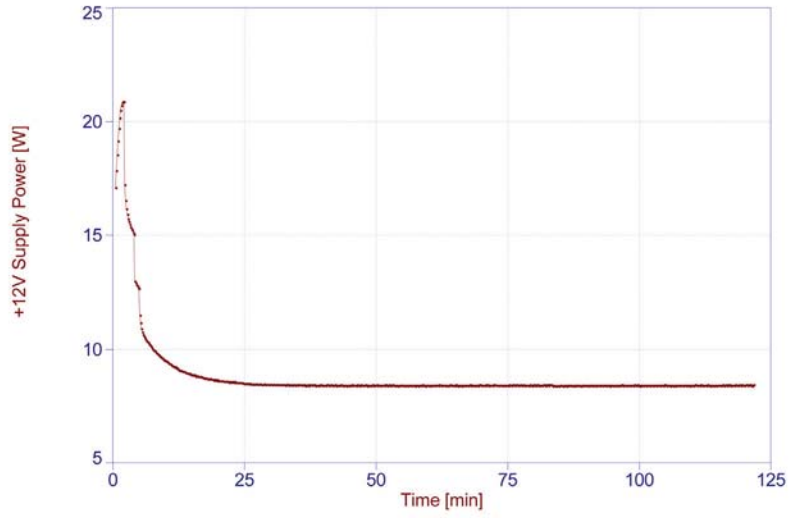
Warm-Up @ 25°C (Full Span)

- Time to ±1E-7=1.46min
- Time to ±5E-8=1.52min
- Time to ±4E-10=4.86min



Warm-Up @ 25°C (Zoom)

- Time to ±1E-7=1.46min
- Time to ±5E-8=1.52min
- Time to ±4E-10=4.86min



Warm-Up @ -40°C

- Pmax =20.9W
- Psteady=8.45W

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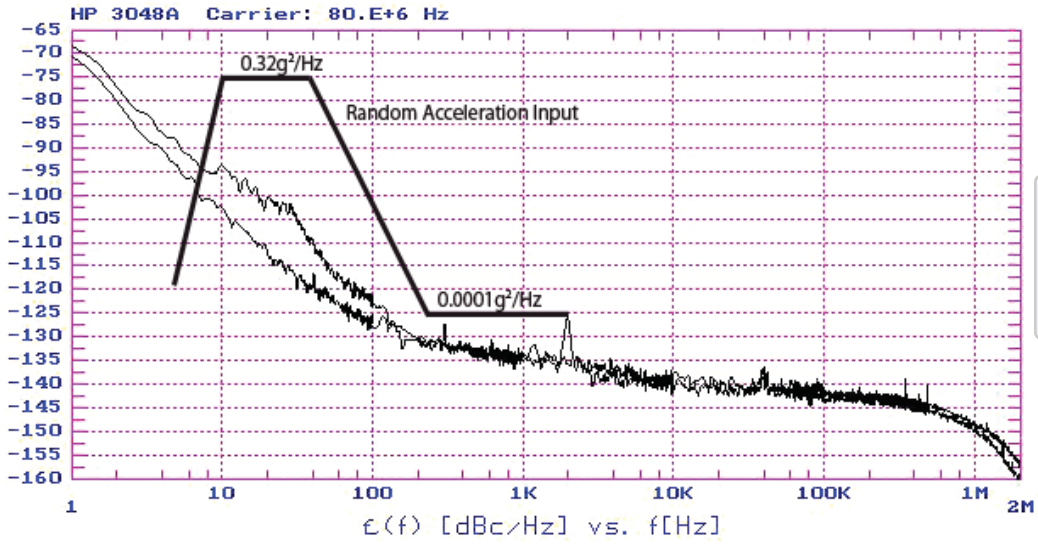
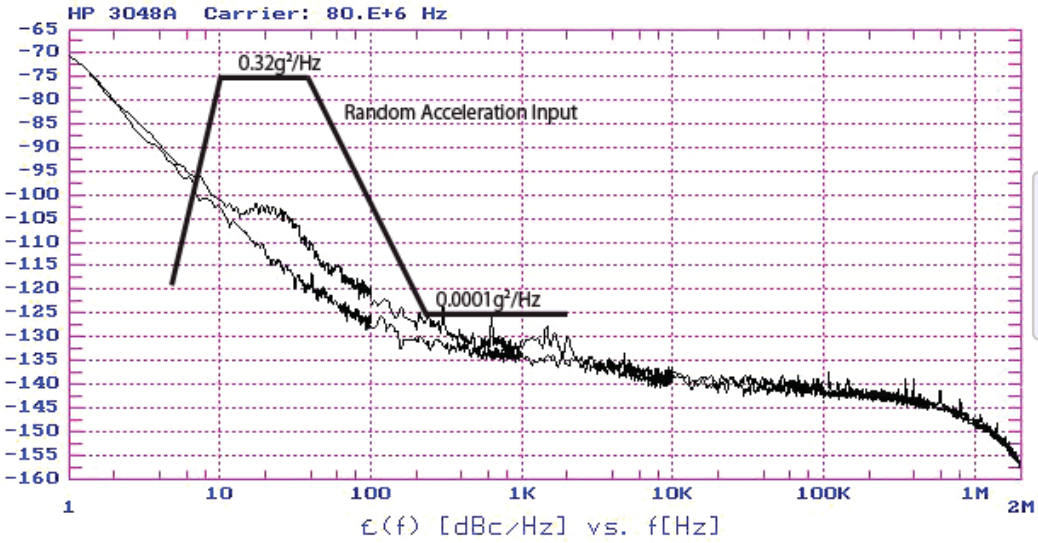
Phase Noise under Random Vibration



80MHz Output Xaxis
Static/Vibration Performance
with applied PSD profile



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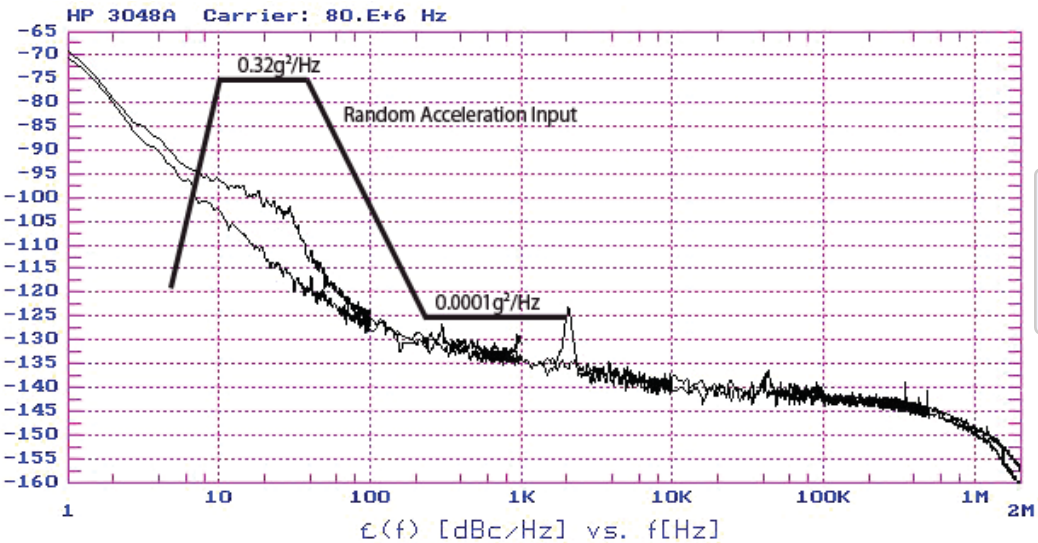

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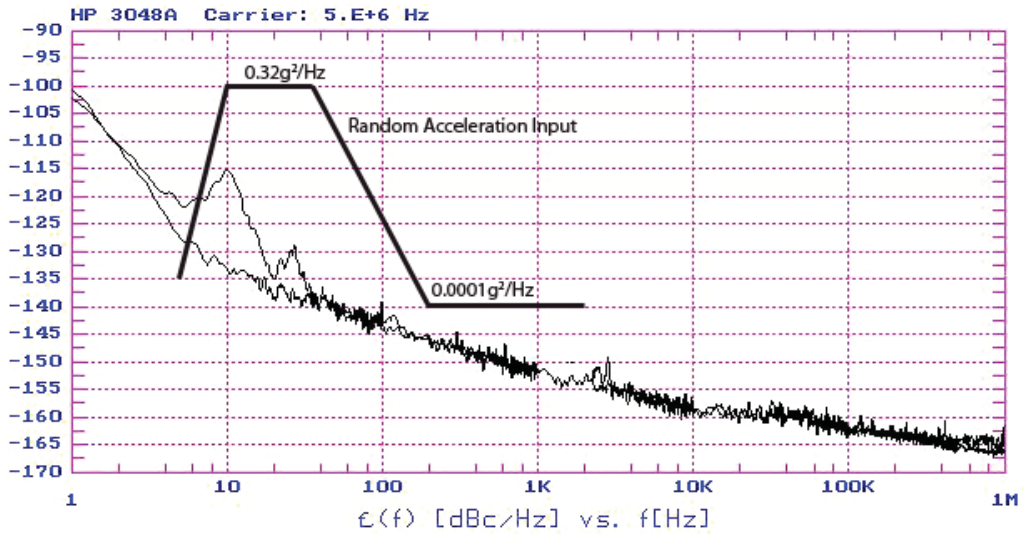

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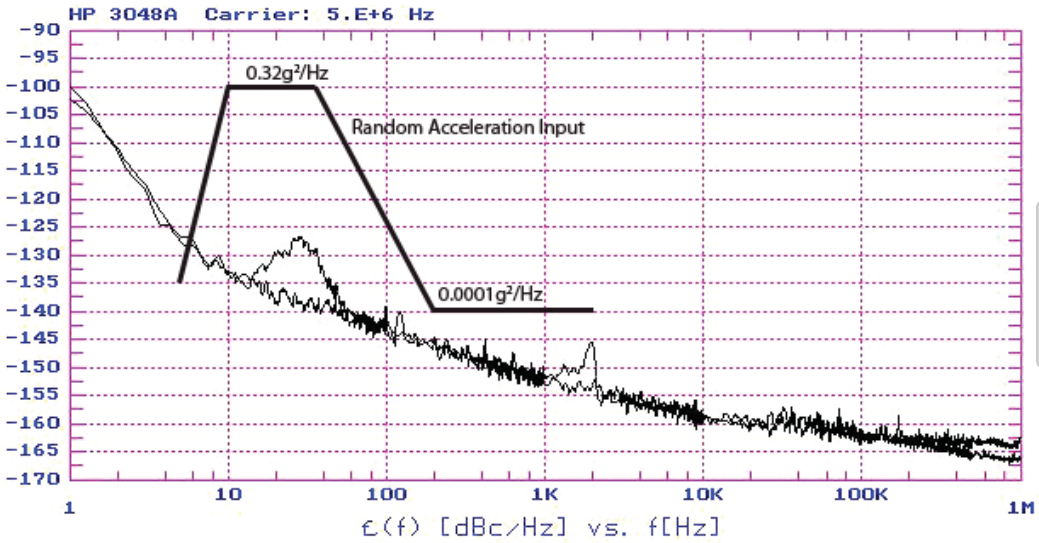

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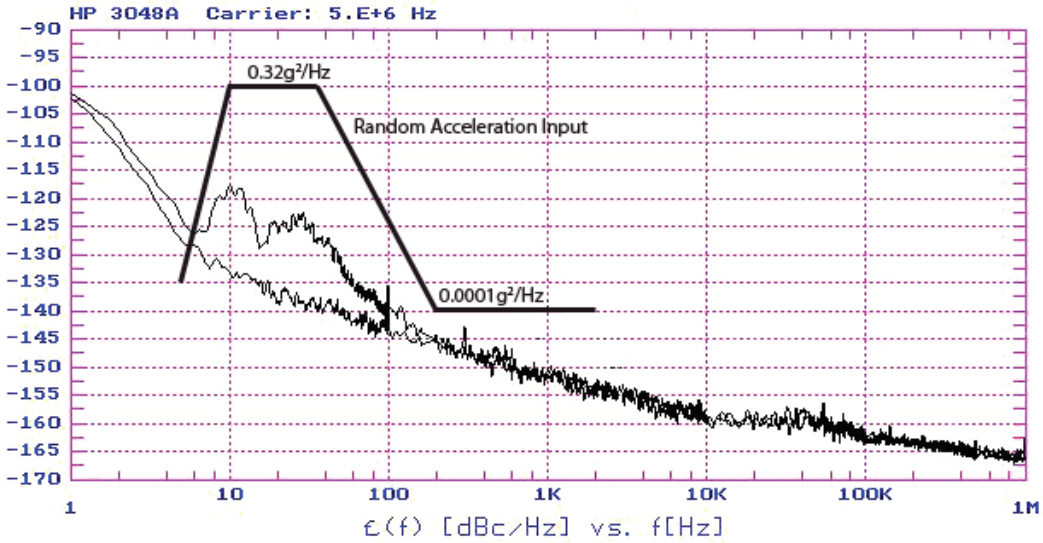

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