Messenger Flight Spare OCXO Thermal Vacuum Test Results – Rev 0

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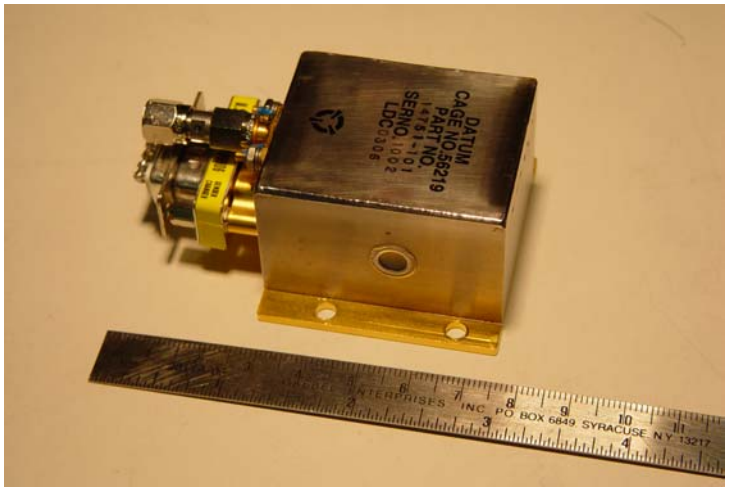
NASA GSFC, Code 924

Aug 15, 2003

MESSENGER Precision 5MHz Clock Oscillator

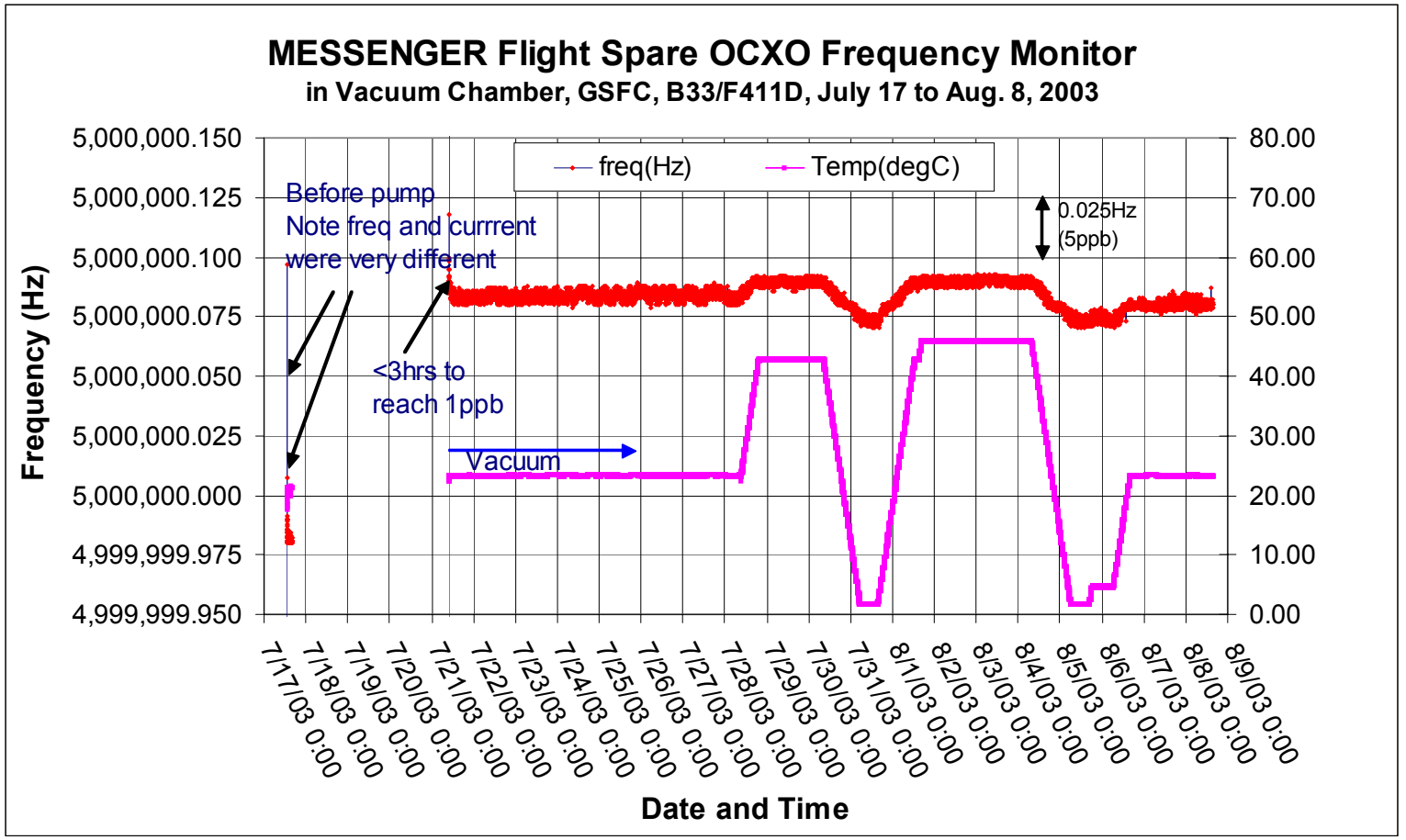
- Oven Controlled Crystal Oscillator (OCXO) used in MESSENGER spacecraft IEM, one prime one cold spare
- Part # 14751-101, by Datum (now Symmetricom) Timing, Test & Measurement Division,
- Spec per "Specification for the MESSENGER Integrated Electronics Module Oscillator", APL Document # 7384-9049, Rev A, released 8-19-2002.
- Other related documents:
  - "Thermal Analysis for the Datum Model No. 9600B/9700B Oven Controlled Oscillator", July 10, 2002, Datum document # 0400-533, Rev A
  - "Generic Structural Analysis, Datum 9600B/9700B", July 10, 2002, Datum document # 0400-534, Rev A
  - Nondisclosure Agreement between Datum and NASA GSFC, dated July 16, 2002.
- One of the flight spare units was shipped to NASA GSFC for testing and characterization and the results reported here



Unit tested at NASA GSFC:
Serial Number 1002;
Weight: 160.5 g;
Power consumption at 25 deg C:
0.75 Watts in vacuum;
3.75 Watts in air.

OCXO Frequency vs. Time and Temperature

July 21 – Aug 8, 2003

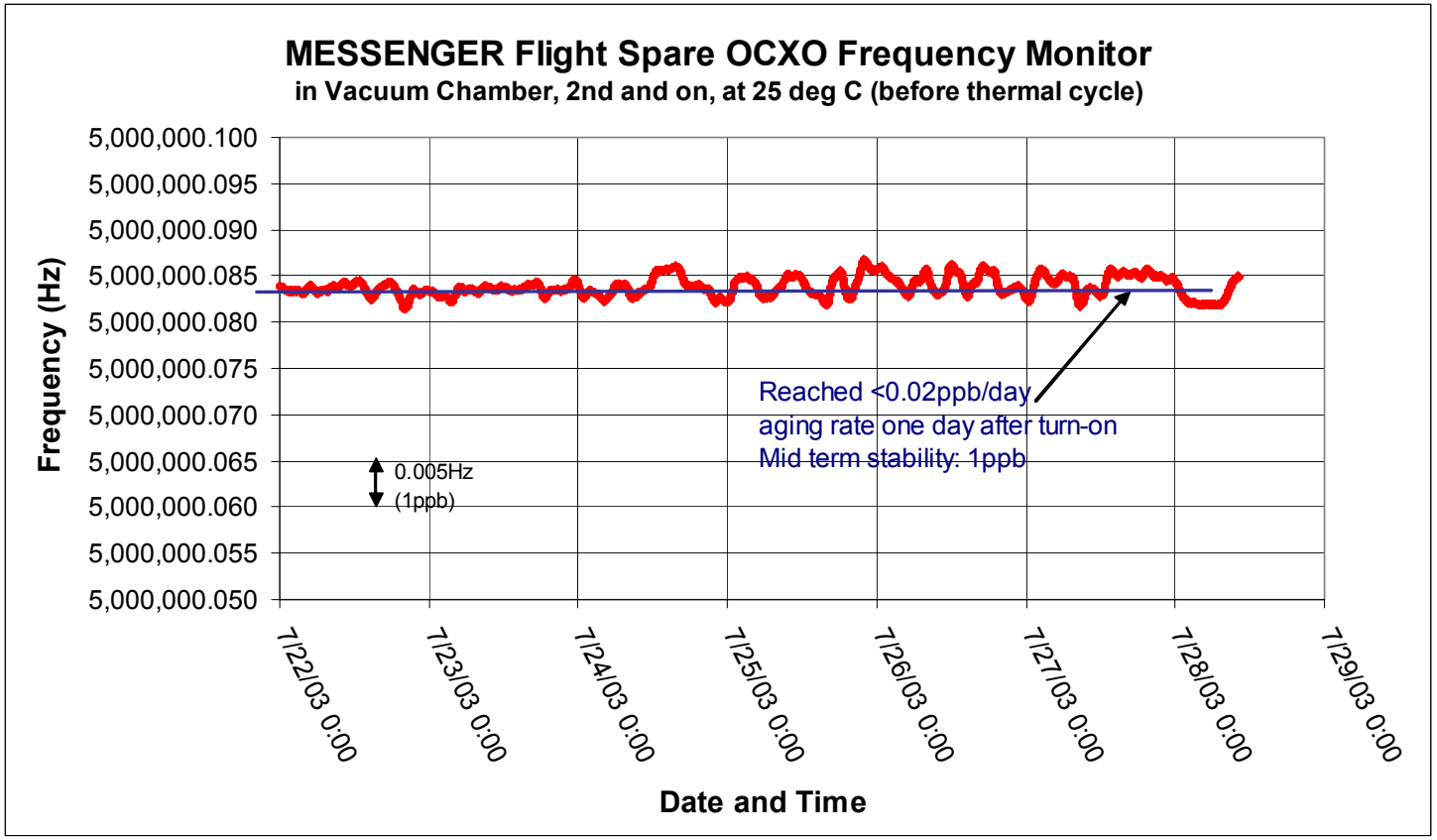


- Note the OCXO frequency differed by ~20ppb in Vacuum than in air.

X. Sun, 8-15-03

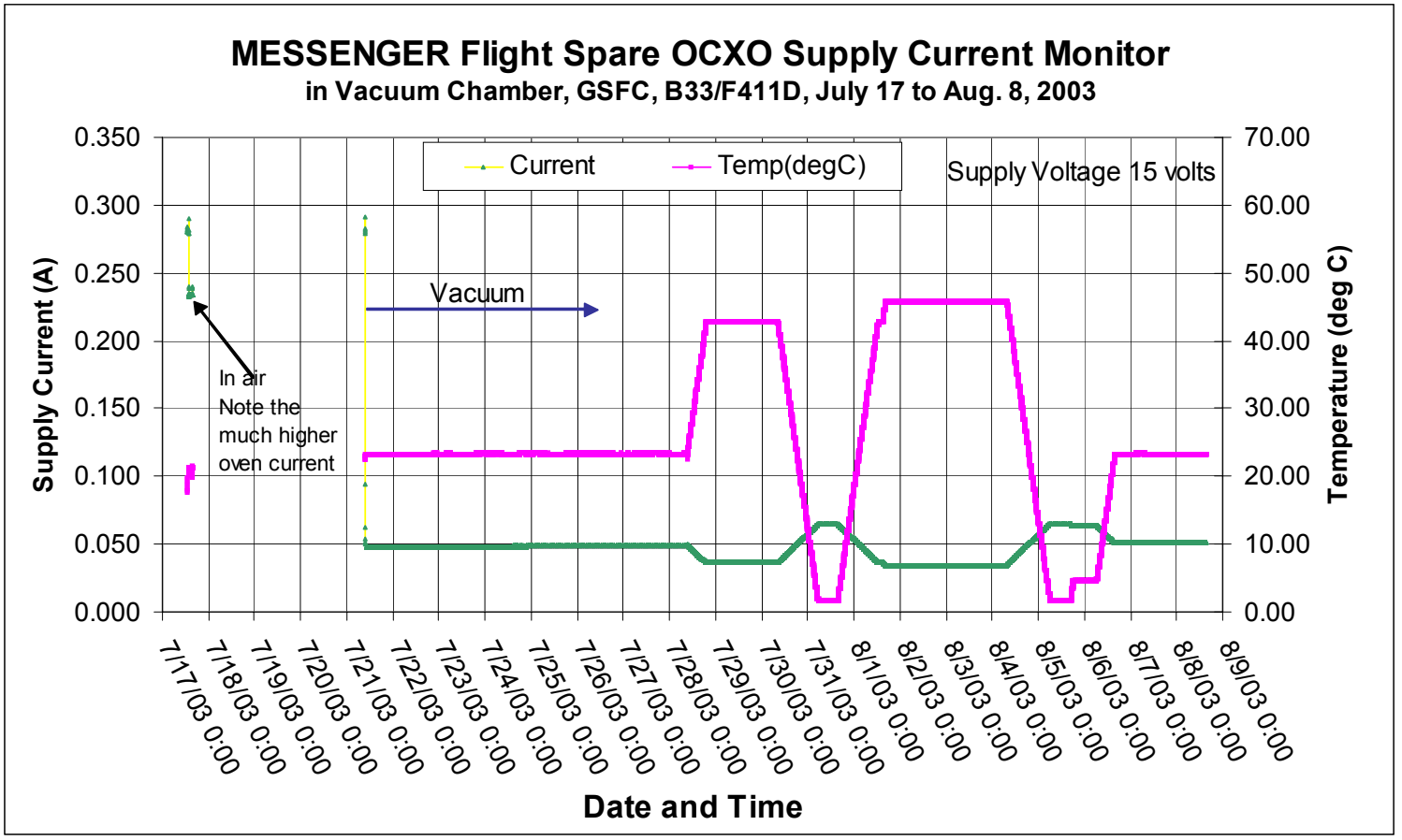
OCXO Frequency vs. Time and Temperature – cont'ed

July 21 – Aug 8, 2003



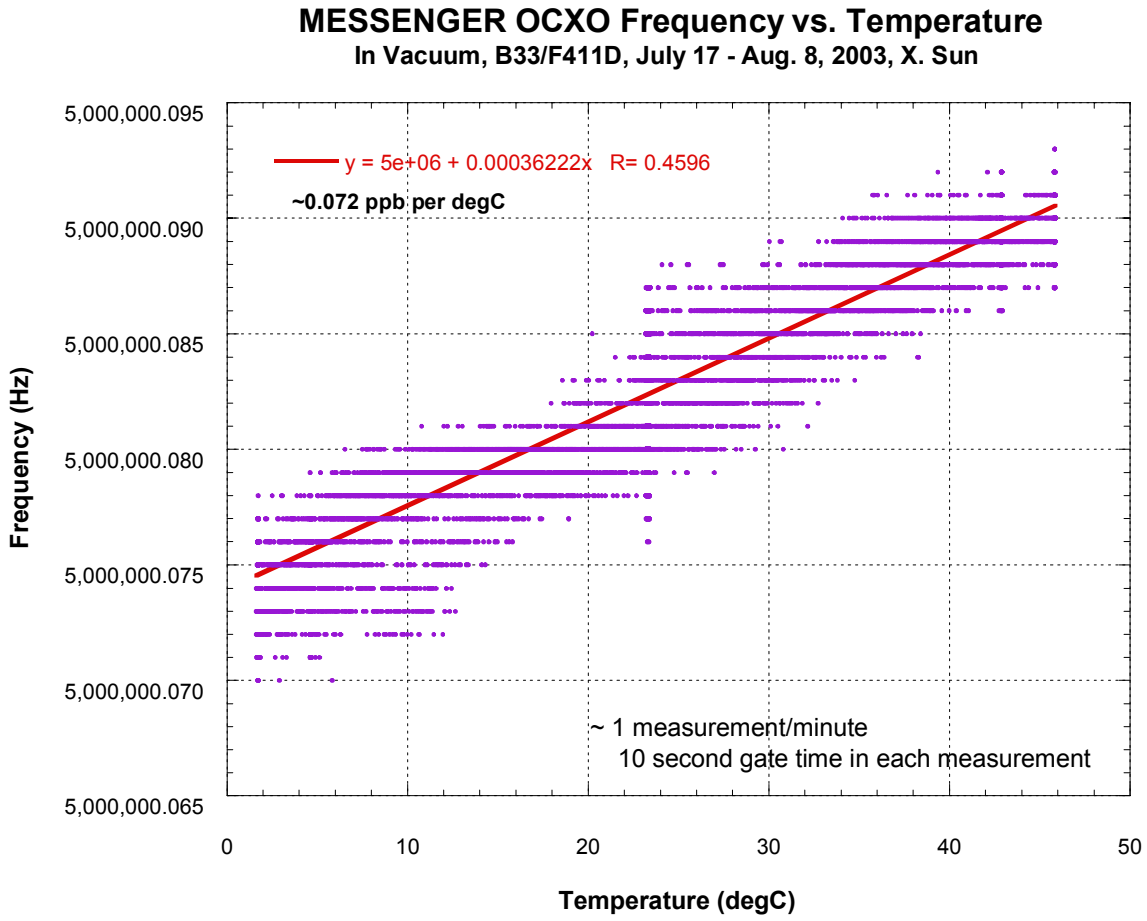
OCXO Supply Current vs. Time and Temperatgure

July 21 – Aug 8, 2003



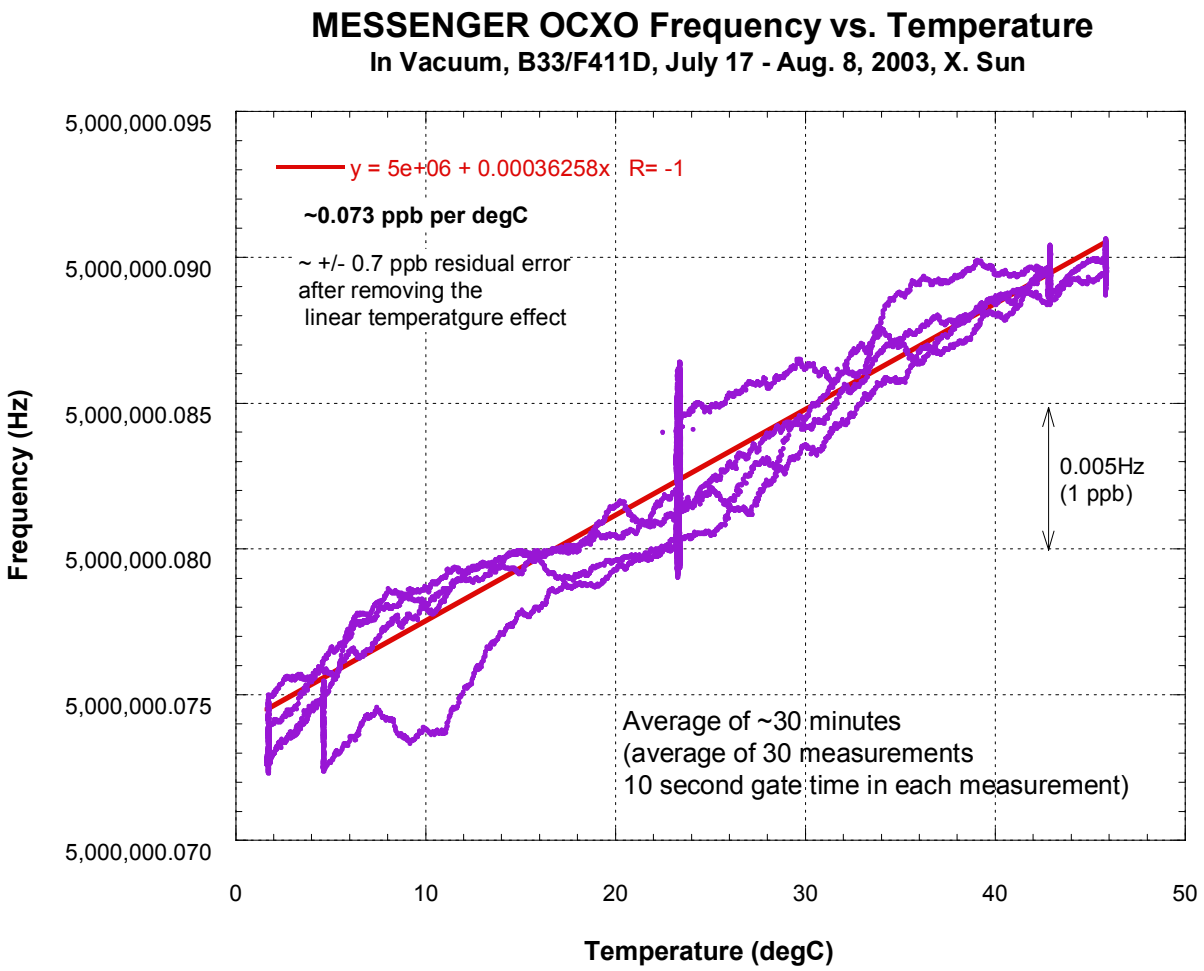
- Note the OCXO supply current was ~1/5 that in in air.

OCXO Frequency vs. Temperature



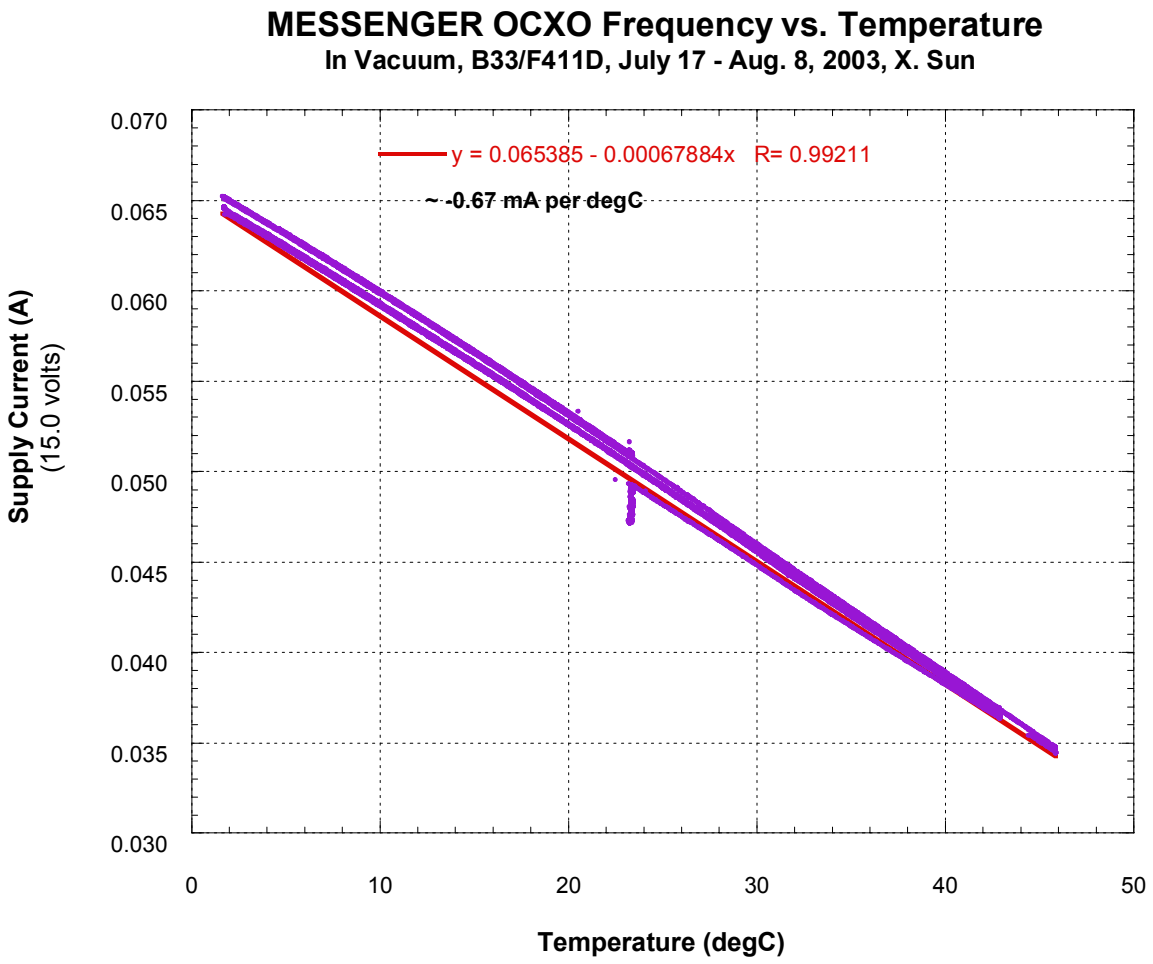
X. Sun, 8-15-03

OCXO Frequency vs. Temperature – cont'ed



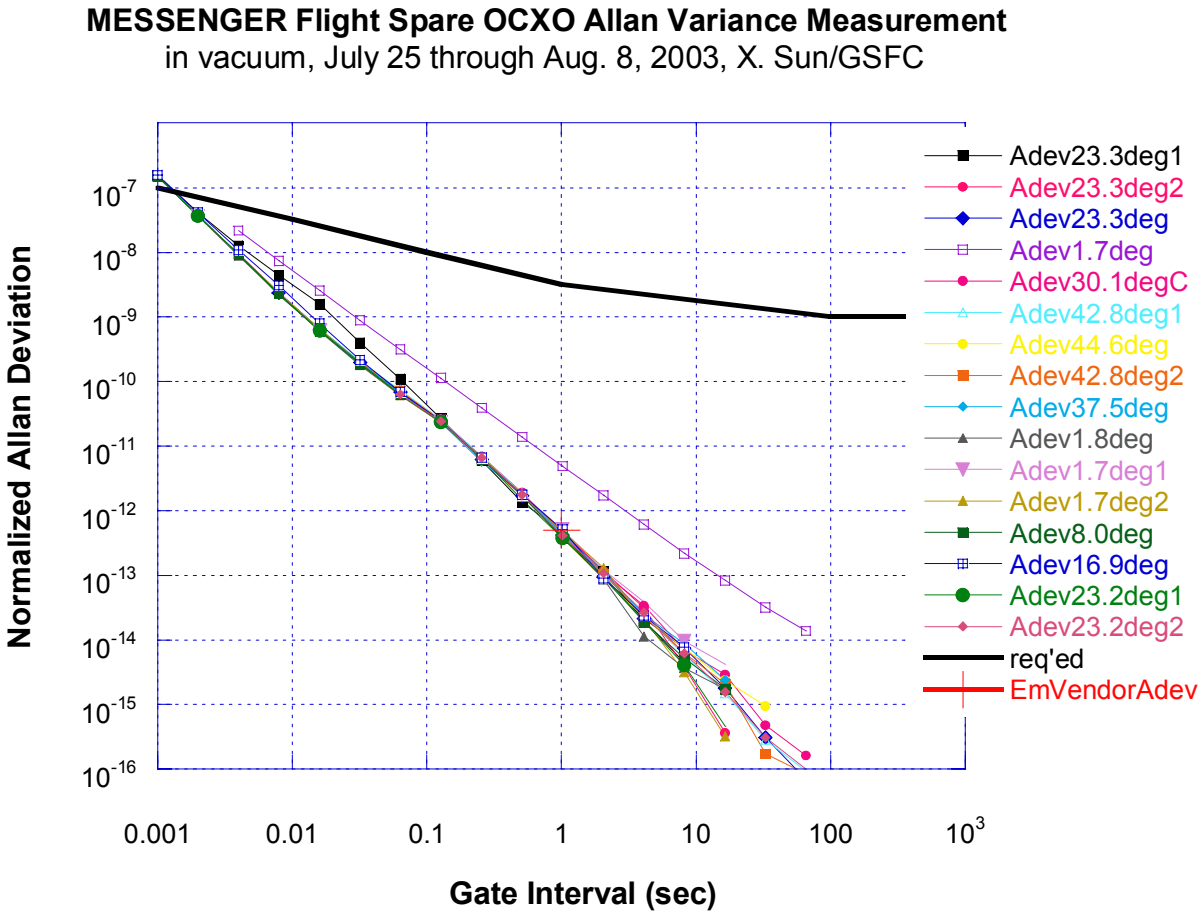
X. Sun, 8-15-03

OCXO Supply Current vs. Temperature



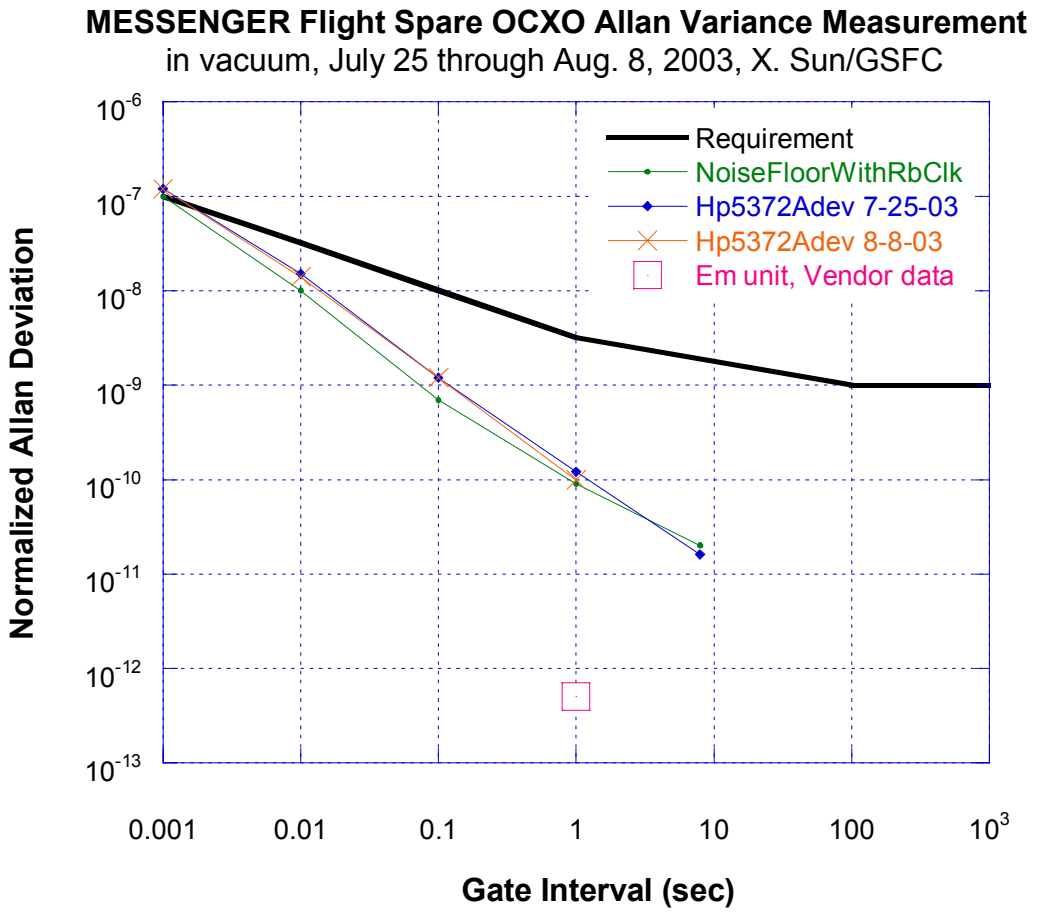
X. Sun, 8-15-03

Normalized Allan Deviations



- Measurement accuracy limited by the test setup;
- Value at tau=1ms slightly above the original spec, 1.5e-7 vs. 1.0e-7, but deemed acceptable as the resultant ranging error is still much less than other error source.

Normalized Allan Deviations – cont'ed

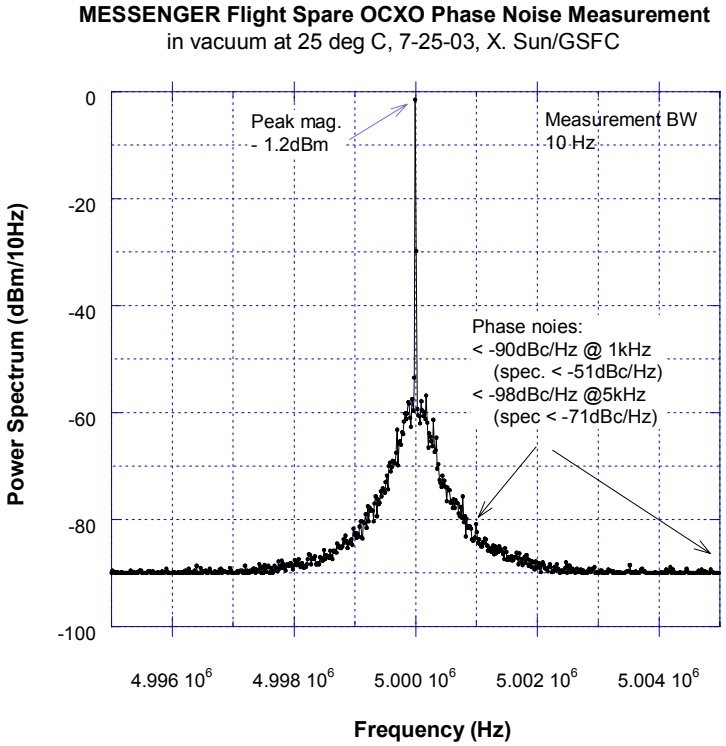


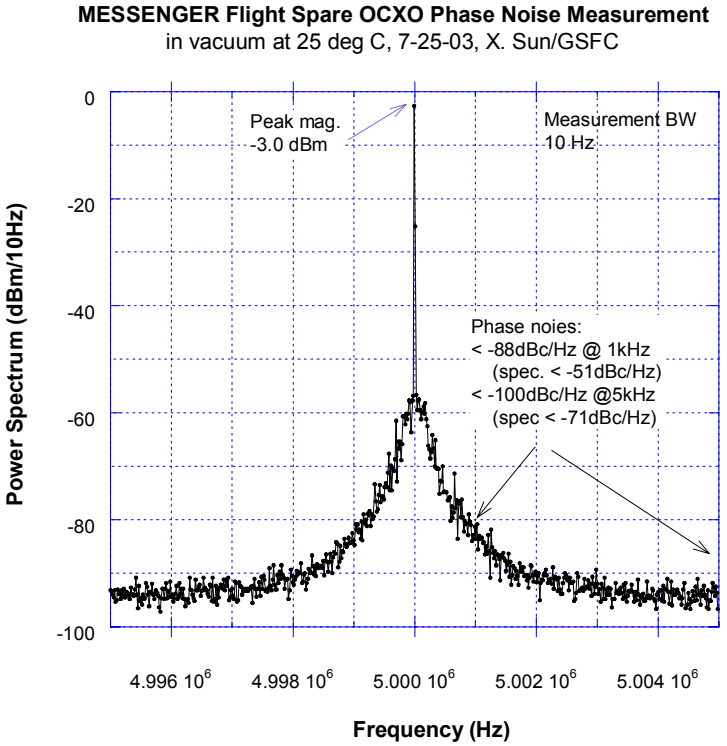
• Measurement accuracy limited by the HP5372A time interval analyzer (more reliable but less accurate than GT650 used to obtain the previous data.

X. Sun, 8-15-03

OCXO Phase Noise Measurements

- beginning and end of the TVAC test

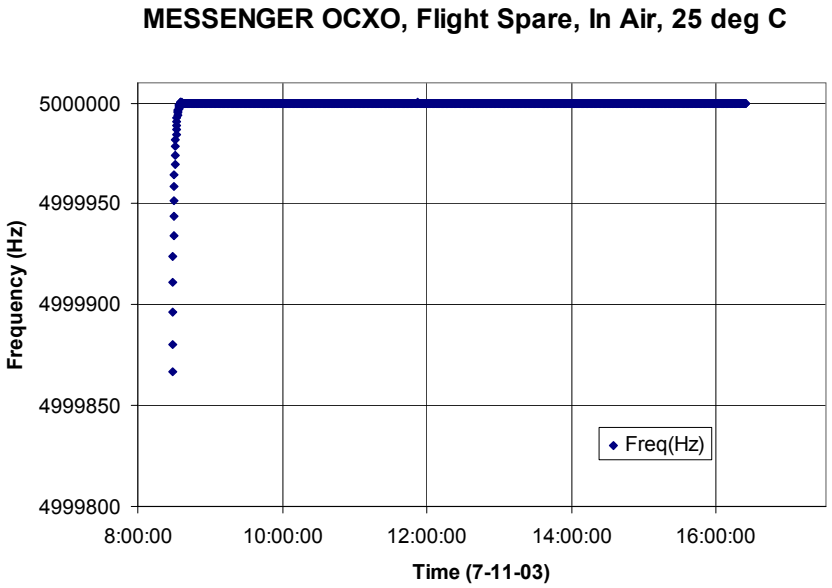


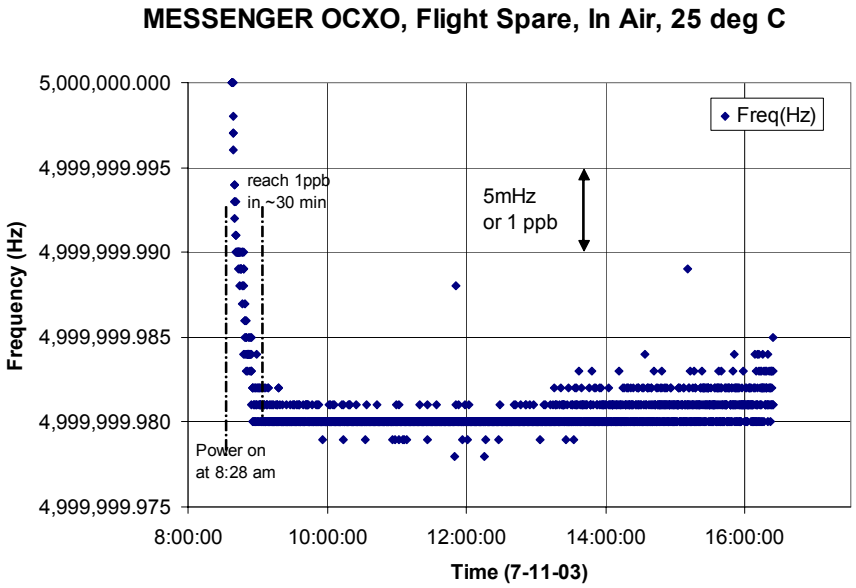


X. Sun, 8-15-03

OCXO Start-up Characteristics

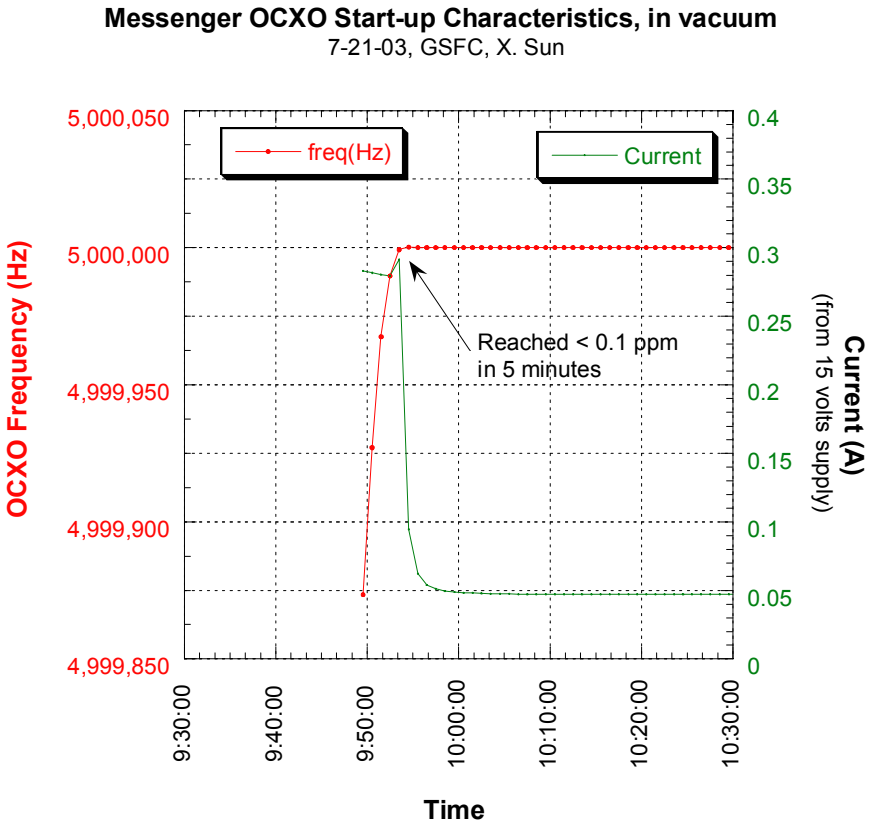
- in air, 7-11-03

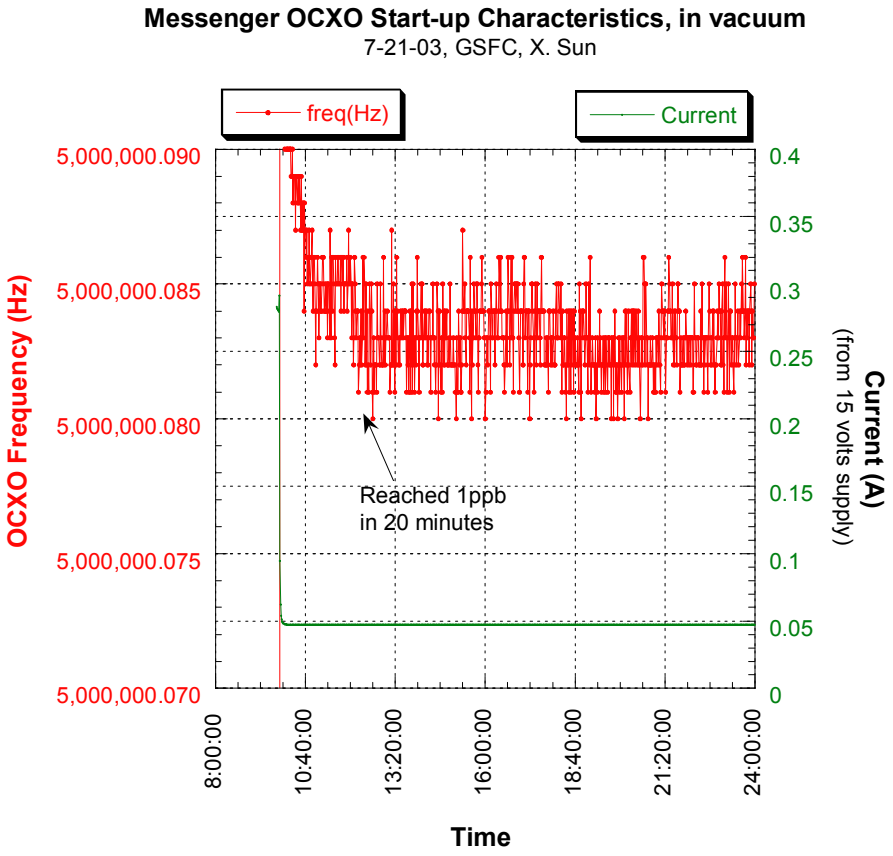




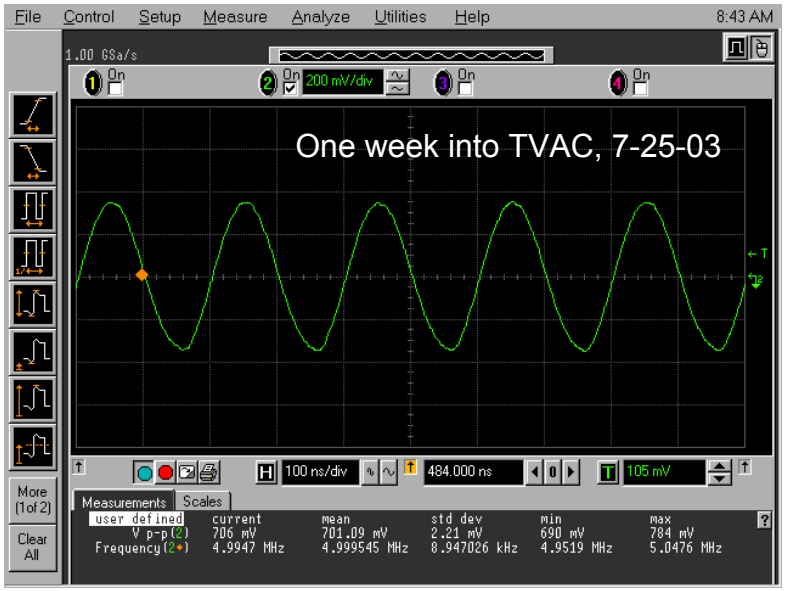
OCXO Start-up Characteristics

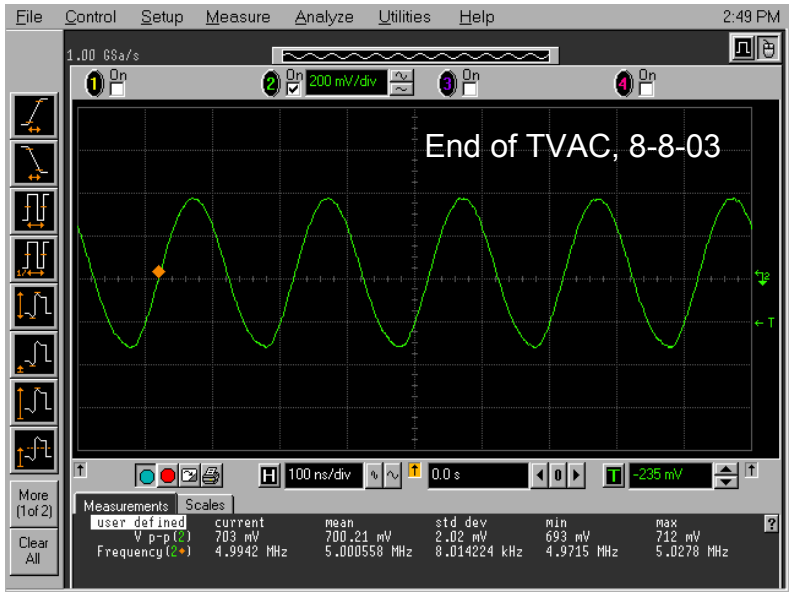
- in vacuum, 7-21-03





Messenger OCXO Output Waveforms





The actual OCXO output level should be about 6.5dB (a factor of 2.1) higher (6dB power splitter and 0.5dB cable and miscellaneous losses).