OSA-3700 Passive Hydrogen Maser

Passive Hydrogen Maser Frequency Standard

Modern Time and Frequency applications, such as Metrology, Time Scale, Time comparison, Deep Space mission + VLBI require highly stable frequency references.

Meeting such stringent specifications requires the implementation of a Primary Frequency Reference that generates signals with an accuracy better than 1E-12, at all times, and very high frequency stability (typ $s_y(t)$ # $7x10^{-13}$ $t^{-1/2}$ in the time domain.

Generally, this can be achieved using Cesium or Hydrogen Maser clock technology, often combined with GPS receivers as backup sources.

Unlike off-air receivers, Maser clocks are autonomous, self-contained primary references immune from external influences.

Passive Frequency Standard OSA-3700 PHM is the number one alternative to a high performance reference when state of the art stability and competitive accuracy are needed at a reasonable price.

OSA-3700 PHM can be used as an integral part in automated systems such as automatic ground station receivers. The working and monitoring parameters of the instrument are accessible for read and write operations through the internal interface RS-232

Main applications are:

- Time and frequency measurement equipment
- Astronomy and space applications
- Satellite ground station
- Reference for test equipment and measuring quality of GPS driven oscillators.

OSA-3700 PHM highlights:

- Extremely stable frequency reference based on Hydrogen atom transition.
- Altemative technology to cesium reference sources.
- Far cheaper than active hydrogen Maser.
- Low cost hydrogen refurbishment.
- 5 / 10 / 100 MHz and 1 PPS standard outputs.
- Low phase noise output.
- Digital control and monitoring of all operations on LCD display.
- RS-232C.
- 10 minutes batteries backup.
- 3 years warranty on Physics package.
- Expected lifetime: 20 years.

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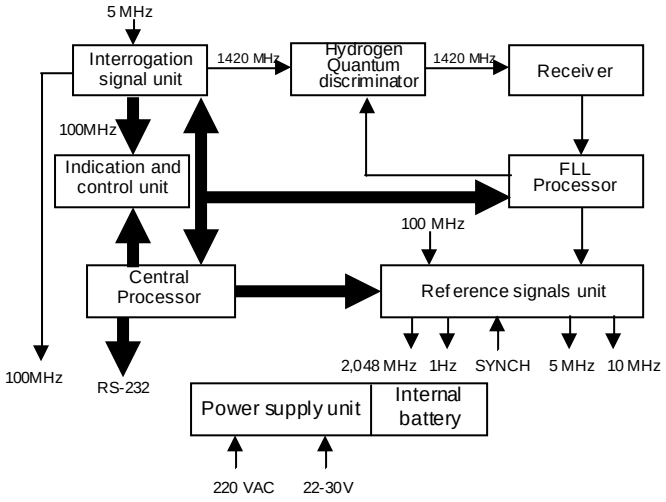
SWATCH GROUP ELECTRONIC SYSTEMS

OSA-3700 Passive Hydrogen Maser

Principle of operation

Hydrogen Maser principle of operation is based on quartz oscillator frequency locked to the frequency line of hydrogen atom emission of the discriminator (see bellow). The influence of the discriminator RF-cavity frequency fluctuation on emission line is eliminated by RF-cavity frequency adjustment to quartz oscillator frequency.

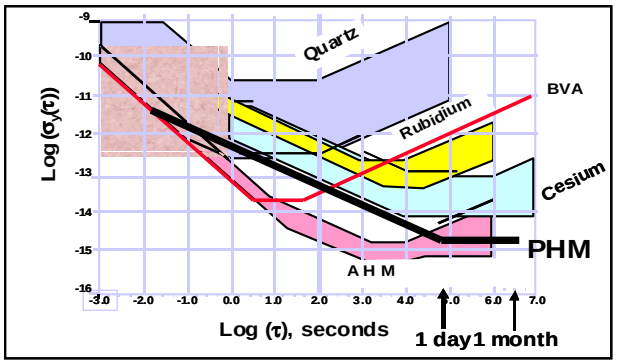
As discriminator energy level emitted by hydrogen atoms is less than the sum of loss energy, FM excitation signal is introduced into the discriminator cavity to provide spectral line indication and frequency adjustment, controlled by the FLL processor.



The interrogation signal with the frequency of 1420.405 MHz is separated directly in the discriminator cavity. Due to the interaction of the FM interrogation signal with atom line and resonator cavity, signal is converted into AM signal.

The FLL processor produces signals to control the frequency of oscillator, which is tuned locked to the frequency of the hydrogen atoms spectrum line.
In case of failure of external power supply, internal batteries will maintain normal operation for a period of at least 10 minutes.

Typical Allan Variance characteristic compared from various frequency sources.



Characteristics

Internal reference:

Type:	Passive Hydrogen Frequency Standard
Frequency accuracy:	± $3x10^{-13}$ (for any +/-2.5°C in 0 to+40°C)
Frequency corrector:	Resolution $1x10^{-14}$ in $1x10^{-10}$ range ± 2°C
Frequency stability:	
➢ 1 second:	$7x10^{-13}$
➢ 10 seconds:	$2x10^{-13}$
➢ 100 seconds:	$7x10^{-14}$
➢ 3600 seconds:	$2x10^{-14}$
	1 day: $5x10^{-15}$
➢ Magnetic sensitiveness:	< $2x10^{-14}$ (1/Oersted)
➢ Long term frequency drift less than 5 10^{-14} par month during the first 18 months of continuous operation	
➢ Temperature coefficient	< $5x10^{-15}$ (1/°C)
➢ Frequency reproducibility	$1x10^{-13}$

Output signals:

- ➢ 5 MHz / 10MHz / 100MHz, 1Vrms ± 0.2V, 50 ohms
- ➢ 1PPS, positive polarity TTL level, 50 ohms

Phase noise (at 5 MHz output) dB/Hz:

➢ 10 Hz :	-130
➢ 100 Hz :	-140
➢ 1000 Hz :	-150

Control Monitoring and Warm up:

- ➢ Digital control and monitoring of all operating parameters on LCD display
- ➢ RS-232 Interface
- ➢ Warm up time: 8 hours

Environment :

➢ Operational Temp :	+5°C to +40°C
➢ Storage Temp:	0°C to +50°C
➢ Humidity:	< 80% (max 35°C)
➢ EMC:	Meets EN50081-1, EN50082-1
➢ Safety :	Meets EN61010-1 (1993) /A2 (1995)
➢ Expected lifetime:	20 years

Electrical / Mechanical:

➢ Voltage:	220 VAC (100-240V) / 50-60 Hz and 27VDC (22-30V)
➢ Power consumption:	max 80W
➢ Internal batteries:	for 10 min. working time
➢ Dimension:	200x470x555 (HxWxD)
➢ Weight :	31 kg

Oscilloquartz reserves the right to change all specifications contained herein at any time without prior notice.

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