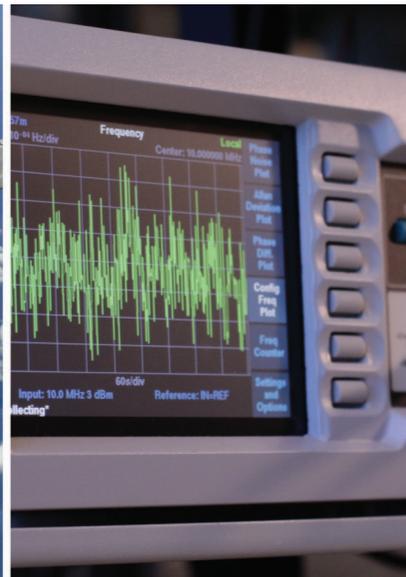


## Portfolio of High-Performance Rubidium Oscillators



Rubidium Miniature Atomic Clock (MAC)  
SA.31m, SA.33m, SA.35m

XPRO Rubidium Oscillator

Precision Rubidium Oscillator  
SA.22c

# Portfolio of High-Performance Rubidium Oscillators

## General Overview

Microsemi, a leading global supplier of rubidium clocks, has over a 40 year commitment to produce the smallest, lightest, and highest-performing clocks in the industry. Microsemi® developed the first small form-factor rubidium atomic clocks in the early 1970's. This was the first of many developments that enabled a world where ultra-precise timekeeping could be used for applications such as communications, navigation, signal processing, test and measurement systems, aerospace/defense, and high resolution spectroscopy.

A rubidium clock is basically a crystal oscillator locked to an atomic reference. The rubidium physics package serves as a passive discriminator, producing an error signal that varies in magnitude and sense as a function

of the difference in frequency between the applied RF excitation and the atomic resonance. Rubidium is a small, low weight and low cost atomic standard that is quickly activated. It delivers good phase noise performance, exhibits low G force sensitivity, and operates in a wide temperature range. These advantages make it an ideal alternative to quartz technology. Rubidium clocks provide rapid operational stability after turn on, exhibit better long term aging characteristics, and are less susceptible to physical effects.

Today Microsemi's family of rubidium atomic clocks continues this legacy, finding usage in synchronization applications, holdover applications, and as a stand-alone frequency reference.

## Rubidium Miniature Atomic Clock (MAC) - SA.31m, SA.33m & SA.35m

### Product Overview

The Microsemi MAC marks a major step forward in the evolution of rubidium atomic clocks. Based on a new generation of atomic clock technology, the MAC family has a completely new physics package that enables unprecedented miniaturization in a rubidium clock. It is ideal for applications requiring high performance, small size, and low power consumption, all in an economical and easily adaptable package.

Microsemi has leveraged significant advances in physics miniaturization and integration to design the world's first commercially available Coherent Population Trapping (CPT) or laser based clock. The SA.3Xm series has the physical dimensions and packaging of a small ovenized crystal oscillator (OCXO), measuring 51 mm X 51 mm (2" X 2")

and standing at a mere 18 mm (0.7") of height. The high performance, small size, and low power of only 5 Watts at 25°C allow the SA.3Xm to support a wide range of timing and synchronization applications, from telecom networks to test and measurement devices.

### SA.31m

The SA.31m is targeted for applications where an economical solution for frequency stability is required, such as UMTS (WCDMA) or LTE. It can be used as an independent frequency source for base stations to enable transition from costly TDM Backhaul transport to economic and efficient Ethernet transport.

### SA.33m

The SA.33m has superior aging and tempco, better stability, and better phase noise than the SA.31m. The SA.33m may be deployed in existing rubidium applications, such as extended holdover for LTE and LTE-A.

### SA.35m

The SA.35m is the premium grade of the SA.3Xm family. It has the best aging, tempco, and stability performance of all the versions of the MAC family. It is ideally suited for extended holdover and test and measurement applications.



Microsemi invented portable atomic timekeeping with QUANTUM™, the world's first family of miniature and chip scale atomic clocks. Choose QUANTUM™ class for best-in-class stability, size, weight and power consumption.



## XPRO Rubidium Oscillator

### Product Overview

The XPRO, Microsemi's highest performance rubidium oscillator, is designed for a wide range of telecommunications and test and measurement applications. The XPRO is a drop-in replacement for the LPRO, which has been widely installed in wireless base station applications, RF test equipment and other applications where an embedded high performance oscillator is required. XPRO is ideally suited for extended holdover applications in defense, communications, and test and measurement market applications.

The XPRO leverages many years of proven rubidium atomic physics with an advanced digital electronics architecture to provide an exceptionally stable oscillator that meets the most demanding performance requirements. With its low profile and standard connector interface, the XPRO is designed for ease of integration into time and frequency systems.

The XPRO is designed for long operating periods without maintenance. The XPRO, with a  $5E-11$  per month aging, will maintain  $1E-9$  frequency accuracy for 10 years or longer without recalibration. A low aging rate option is available that will provide  $1E-11$  per month aging providing an even more robust reference source. Standard outputs are 10MHz, 1PPS and a rubidium lock status bit.



## SA.22c Precision Rubidium Oscillator

### Product Overview

Microsemi's SA.22c is the culmination of significant advances in physics miniaturization and integration.

The SA.22c's low power consumption and full-spectrum temperature operation, combined with its compact board mounted configuration, make rubidium performance accessible to a wide range of synchronization applications, from telecom networks to handheld test and measurement devices. It has ideal performance for CDMA networks and Stratum II synchronization for central office and network nodes.

The SA.22c can be disciplined to a precision 1PPS reference input (such as GPS) or it can operate by itself as a precision stand-alone reference when hold-over is needed. The SA.22c's outputs include 1PPS as well as ACOMOS square wave output frequencies of 1.544, 2.048, 5, 9.8304, 10, 10.24, 10.29, 13, or 15 MHz.

The SA.22c can communicate through its serial port to provide dynamic frequency control and selection and to

enable or disable outputs. The SA.22c can be queried for such information as serial number, operating hours, operating temperature, event history, self-test and other performance indicators.



## Performance Summary of Microsemi High-Performance Rb Oscillators

Product	SA.22c AP1	SA.35m	SA.33m	SA.31m	XPRO
Size (volume)	203 cm <sup>3</sup> /12.4 in <sup>3</sup>	46cm <sup>3</sup> /2.8 in <sup>3</sup>			454cm <sup>3</sup> /27.75 in <sup>3</sup>
Power (W) @ 25°C	10	5			8.5 to 13
Phase Noise (dBc/Hz)					
1 Hz	≤ -72	≤ -70	≤ -70	≤ -65	≤ -80
10 Hz	≤ -90	≤ -87	≤ -87	≤ -85	≤ -90
100 Hz	≤ -128	≤ -114	≤ -114	≤ -112	≤ -128
1 KHz	≤ -140	≤ -130	≤ -130	≤ -130	≤ -145
10 KHz	≤ -148	≤ -140	≤ -140	≤ -140	≤ -155
Aging (monthly)	<±4E-11	<±1E-10	<±1E-10	<±3E-10	<±5E-11 or <±1E-11
TempCo (-10°C to 75°C)	<1E-10	<1E-10	<1.5E-10	<1E-9	<6E-10
Allan Deviation					
1s	≤3E-11	≤3E-11	≤3E-11	≤5E-11	≤1E-11
10s	≤1E-11	≤1.6E-11	≤1.6E-11	≤2.5E-11	≤3.2E-12
100s	≤3E-12	≤8E-12	≤8E-12	≤1E-11	≤1E-12

## Applications for High-Performance Rubidium Oscillators

Microsemi's line of rubidium atomic clocks are ideal for frequency reference, synchronization and hold over applications and applications where synchronization or precision frequency is required with no external physical

connection. Their excellent short-term stability and low temperature coefficients make them ideal for synchronization applications, while their low aging rates make them outstanding time bases.

Military/Aerospace	Research/Medical	Navigation	Instrumentation	Telecom	Broadcasting
<ul style="list-style-type: none"> <li>Space Ground Control Frequency Referencing</li> <li>Electronic Warfare</li> <li>Communications</li> <li>Guidance</li> <li>Secure communication</li> <li>Navigation</li> </ul>	<ul style="list-style-type: none"> <li>Time base for precision frequency measurements</li> <li>Frequency reference for imaging                             <ul style="list-style-type: none"> <li>MRI</li> <li>High resolution spectroscopy</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Holdover</li> <li>Anti-jamming</li> <li>Guidance</li> </ul>	<ul style="list-style-type: none"> <li>Precision Frequency reference for                             <ul style="list-style-type: none"> <li>Test equipment</li> <li>Frequency calibration standard</li> </ul> </li> <li>Time base for precision frequency measurements</li> </ul>	<ul style="list-style-type: none"> <li>Base Station Hold-over                             <ul style="list-style-type: none"> <li>LTE-TDD/CDMA/WiMAX</li> </ul> </li> <li>Free-running frequency source                             <ul style="list-style-type: none"> <li>GSM/UMTS/LTE-FDD</li> </ul> </li> <li>NTP/PTP clocks</li> <li>Network clocks and synchronization</li> </ul>	<ul style="list-style-type: none"> <li>Transmitter frequency reference                             <ul style="list-style-type: none"> <li>HDTV</li> <li>DAB-DVB</li> <li>AM/FM</li> <li>ATSC</li> <li>ISDB-T</li> </ul> </li> </ul>

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MS9-05-14