AccuBeat Ltd.

Accurate Frequency & Time

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AccuBeat is a leading provider of Accurate Frequency and Timing solutions used in Defense, HLS, Aerospace, Communications and other industries. Based on Rubidium Atomic Clock or OCXO technology with optional GPS disciplining, AccuBeat's products achieve the highest levels of accuracy and reliability and are deployed by IDF, the USAF, Project Galileo, Tier 1 Telecommunication companies and many other sensitive Military, HLS, Infrastructure and Government programs worldwide.

AccuBeat provides COTS and customized, ruggedized products and solutions and we work closely with the customer to provide the exact requirements for each project. AccuBeat's Time and Frequency centers are battle-proven in numerous tactical applications, including combat planes, UAVs, transport aircraft, helicopters, ships, missile platforms and ground mobile vehicles.

With more and more devices, systems and platforms relying on data from GNSS, these environments are prone to jamming, spoofing, interference and other time related cyber-attacks. AccuBeat has developed solutions and systems that can detect and identify threats to the GNSS system and ensure continuous and uninterrupted accurate timekeeping and synchronization even in a GPS denied or threatened environment. AccuBeat solutions protect critical infrastructure, telecoms, HLS and Defense equipment and ensure continued operations where other systems fail.

AccuBeat's highly professional and experienced team of managers, PhDs, engineers and technicians provide on-time solutions to all our customers' needs, applying years of know-how and experience to the development and manufacture of the most demanding and most accurate Rubidium based clocks.

"Fast is fine, but accuracy is everything"
(Xenophon, 430–354 BC)

Q.A System

- AS9100 Rev C
- ISO 9001:2008

AccuBeat's Product Line

- Rubidium Frequency Standards (stand alone and miniature PCB mountable)
- GNSS Disciplined Rubidium/OCXO Time & Frequency Centers
- Portable Calibration Suitcase
- Solutions for GPS-Denied environments
- NTP/PTP Time Servers
- Redundancy Switches & Distributors
- Oven Controlled Crystal Oscillators

Line of Business

• Atomic Clocks • Accurate Frequency & Time Systems • GPS Disciplined Solutions • Protection in a GPS-denied envirionment

Established: 1994

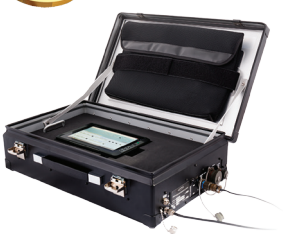
AR133 - Rubidium Standard

AR51A-07 with Vibration Tray

Nano Atomic Clock

AR76 - Rack Mounted Solutions

AR51A-09 - Time & Frequency Center



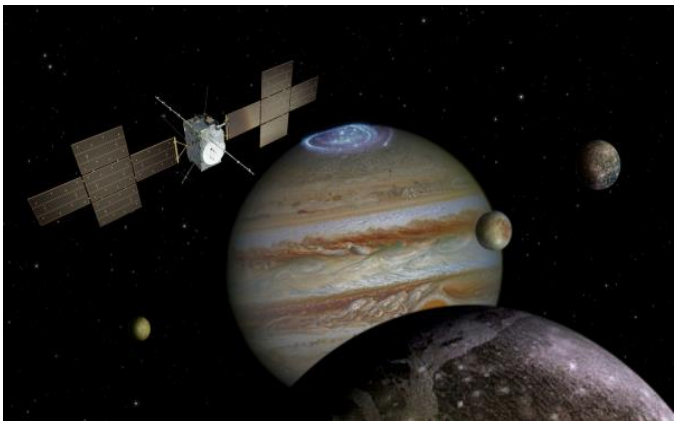
AR50 - Calibration Case

"Fast is fine, but accuracy is everything"
(Xenophon, 430–354 BC)

Ultra Stable Oscillator (USO)

for Deep Space Exploration

AccuBeat is proud to introduce its Ultra Stable Oscillator (USO) specially designed for Deep Space exploration programs. AccuBeat's USO has a frequency stability (ADEV) of 1E-13 in the range of 1-1000 seconds and will be deployed by the European space Agency (ESA) in their prestigious **JUICE** (Jupiter Icy Moons Explorer) mission. The space qualified USO *will serve as the central source of timing for communications in the mission and will be an integral part of a radio science occultation experiment* that will probe Jupiter's atmosphere by following the phase variations of the radio waves passing through the atmosphere while the spacecraft transmits to earth using AccuBeat's ultra-high stability frequency source.



AccuBeat's USO is a high-stability quartz crystal oscillator utilizing a high Q crystal resonator and high temperature stability in the range of 100µ kelvin. The USO designed by AccuBeat, has an Allan Deviation *almost 5 times better than the required spec of 5E-13 at integration constants of 1 to 1000 seconds*, making it **the most stable oscillator of its type designed for deep space exploration.** (See detailed specs on next page).

JUICE is the flagship project of the European Space Agency and in May 2022, the spacecraft will set off on an almost 600 million Km journey to Jupiter, where it will arrive in 2030. For three and a half years, JUICE will sweep around the giant planet, exploring its turbulent atmosphere, enormous magnetosphere, and tenuous set of dark rings, as well as studying its three largest icy moons - Europa, Ganymede and Callisto *all with the help of AccuBeat's USO designed for Deep Space Exploration.* "The goal is to investigate whether there are liquid oceans under these icy crusts which might harbour organic components or even life" says Vincent Poinsignon, the JUICE project manager. AccuBeat's USO is currently being integrated into the JUICE spacecraft by AIRBUS.

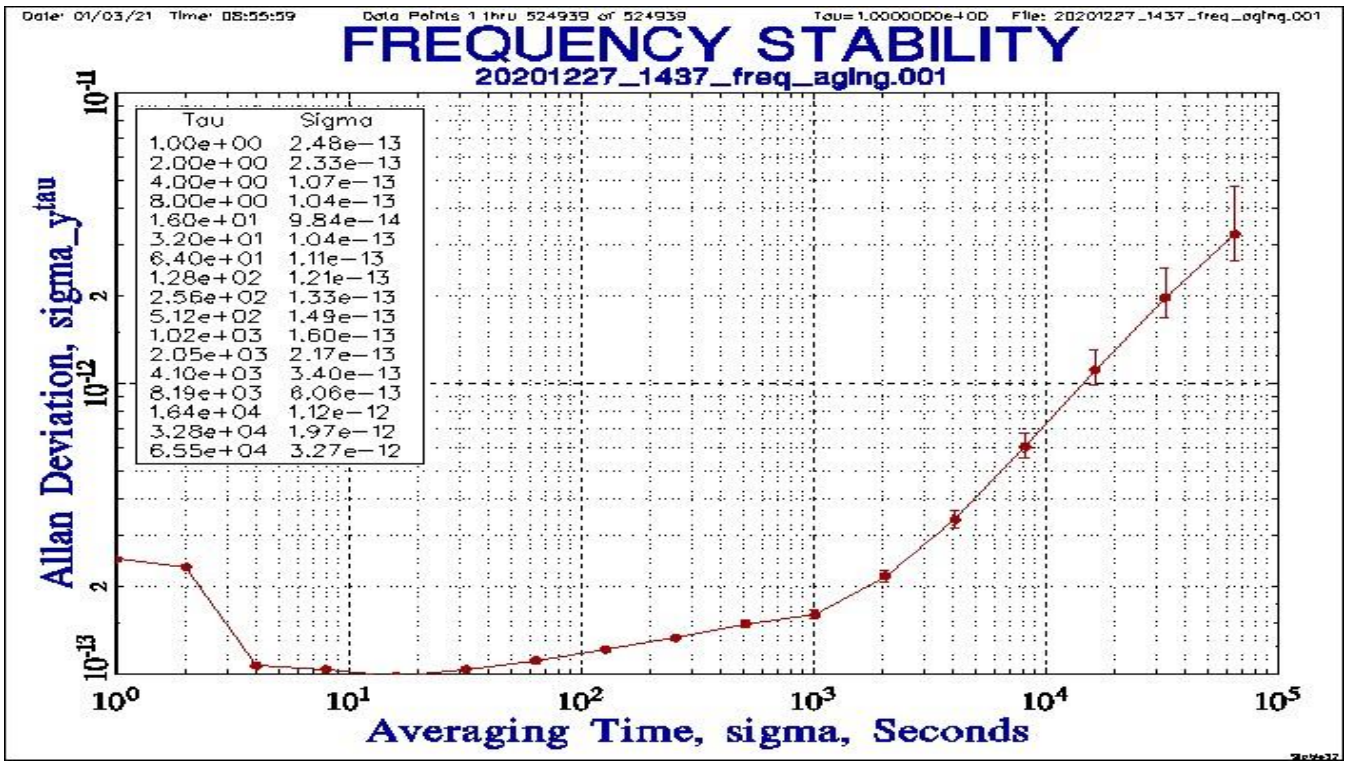
Ultra Stable Oscillator (USO)

for Deep Space Exploration

Main Specifications and Performance

Frequency Stability (ADEV)	5E-13 @ 1 sec
	5E-13 @ 10 sec
	5E-13 @ 100 sec
	6E-13 @ 1000 sec
Phase Noise	-80 dDc/Hz @ 1 Hz
	-100 dDc/Hz @ 10 Hz
	-117 dDc/Hz @ 100 Hz
	-119 dDc/Hz @ ≥1000 Hz
Frequency Aging	<7E-11 in 24 Hours
Temperature Range	
Operational:	-20ºC to +50ºC
Non Operational:	-30ºC to +60ºC
EMC	
Per ESA JUI-EST-SYS-EID-001	

Power Requirements	
Nominal (steady-state under vacuum) power input	≤6.5W
Peak power allocation (warm-up)	≤8W
Input Voltage	
Nominal Input Voltage	+28.0 Vdc ± 0.14V
Input Voltage Range	+26.5 to +29.0 Vdc
Inrush current (peak current)	≤1 A
Functional Specifications	
Nominal frequency (f0) for 2 outputs	57.51852 MHz
Signals Characteristics	
Source impedance	50 Ω
RF level	+0 dBm ± 1.0 dB
Harmonics of f0	≤ -30 dBc
Harmonics of f0/12	≤ -30 dBc
Spurious	≤ -80 dBc above 10 kHz from carrier



Dimensions:	132.6 (W) x 120 (D) x 105 (H) mm	Weight:	≤ 2 Kg
Total Ionizing dose within the USO enclosure:		50 krad (Si)	
TVAC:	The unit is specified to 10-5 torr for performance over the operational temperature -20ºC to +50ºC		

Rubidium Clock

AR81A - 00

6 Outputs

Key Features

- *Ultra high stability: 2E-12@10,000 Sec*
- *Ultra low phase noise: -94dBc@1Hz, -150dBc@1kHz*
- *Aging: 5E-11/month*
- *6 outputs of 10MHz sine wave*
- *High MTBF: > 500,000 Hrs @ 25°C*
- *Supply Voltage: 90-260 VAC*

Description

The AR-81A is a 1U, 19" rack-mount ultra high stability and ultra low phase noise Rubidium Frequency Standard.

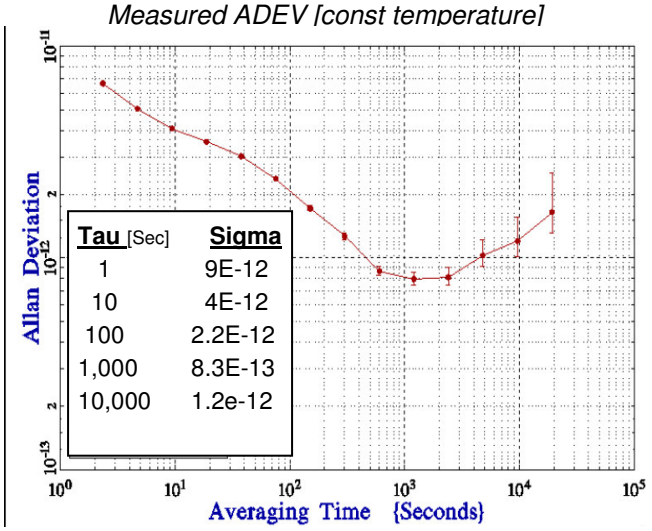
The unit offers six 10MHz outputs.

The unit includes two hot redundant power supplies for high MTBF (>500,000 Hrs @25℃).

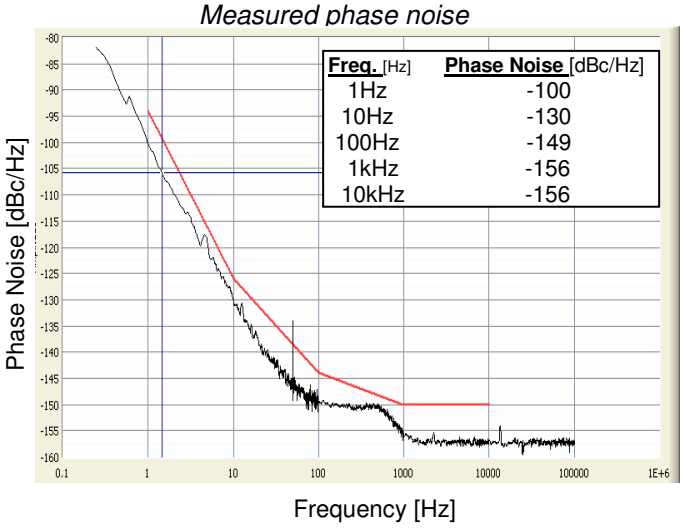
BIT status showed by the front panel LEDs and via RS-232 communication port.

Frequency calibration available via RS-232.

Measured ADEV [const temperature]



Measured phase noise

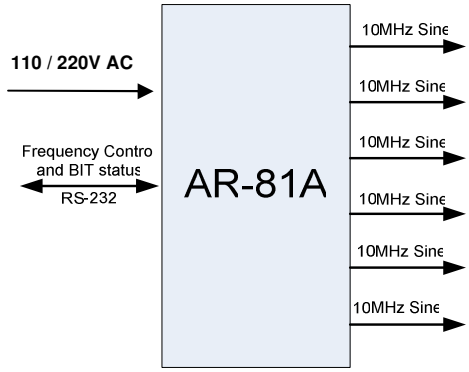


Applications

❖ Ground segment clock for Satellite Navigation Programs like Galileo ❖ Scientifics & Calibration ❖ Wireline & Wireless communication

SPECIFICATIONS

All specs are at room temperature, quiescent conditions, sea level ambient unless otherwise specified

Input & Outputs		
Outputs	○ 6 outputs of 10MHz sine wave	
Monitor & Control	○ Communication channel for monitoring and frequency adjustment ○ Standard: RS-232 ○ Protocol: 1 start bit, 8 data bits, 1 stop bit ○ Rate: 1200 baud	

Performance			
		Specification	**Measured performance (*)**
Frequency	**Long Term Stability**	<5E-11 / monthly <5E-10 / yearly	
	Short Term Stability	<3E-11 @ 1sec <1E-11 @ 10sec <3E-12 @ 100sec <2.5E-12 @ 1000sec <2E-12 @ 10000sec	9E-12@1Sec 4E-12@10sec 2.2E-12@100Sec 8.3E-13@1,000Sec 1.2E-12@10,000Sec
	Temperature Stability	< 3E-10 / 0℃ to +50℃	
	Phase Noise	<-94 dBc/Hz @ 1Hz <-126 dBc/Hz @ 10Hz <-144 dBc/Hz @ 100Hz <-150 dBc/Hz @ 1KHz <-150 dBc/Hz @ 10KHz	-100 dBc/Hz @ 1Hz -130 dBc/Hz @ 10Hz -149 dBc/Hz @ 100Hz -156 dBc/Hz @ 1KHz -156 dBc/Hz @ 10KHz
	Harmonics	< -40 dBc	-44dBc
	Spurious @ 100kHz	< - 60 dBc	-100dBc
	Warm-up	Time to lock : < 5 min	3.2 min
		Time to <1E-9: < 8 min	5 min
	Level	1Vrms (11-14 dBm)	
	Retrace	±5E-11	
	Accuracy @ shipment	< ±5E-11	
	Maximum clock drift	±10E-9 Sec / Sec	
	Magnetic Field	DC (±2 gauss)	
	Magnetic Sensitivity	< 4E-11 / gauss	

(*) AccuBeat commitment is only for the specification not for the measured performance.

Power Supply		
AC	90-260 VAC, 47/63 Hz (standard) – Automatic switching	
Power Consumption	@ steady state	< 25W
	@ start (<5 min)	< 45W

SPECIFICATIONS *(continue)*

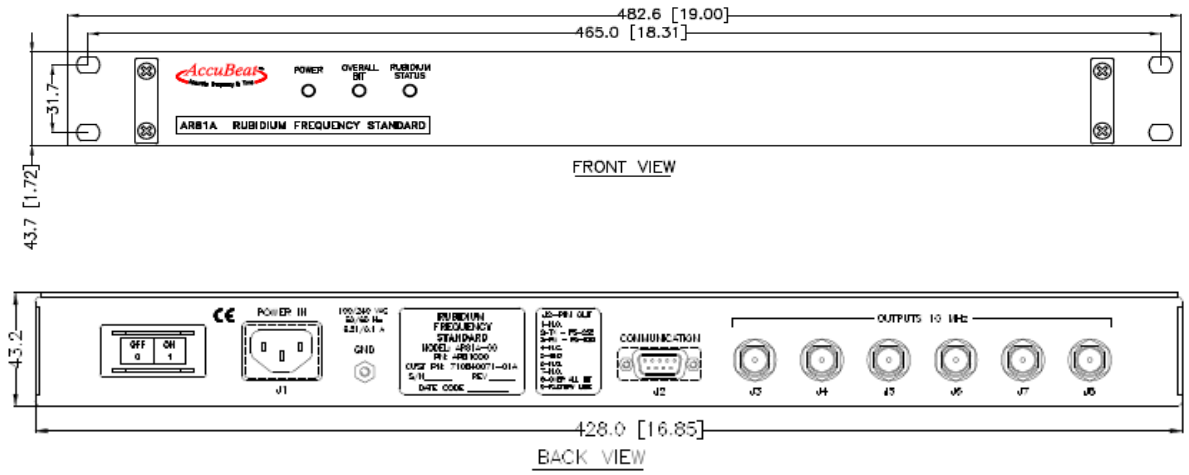
All specs are at room temperature, quiescent conditions, sea level ambient unless otherwise specified

LEDs indicators	
LED Indications	3 LEDS on the front panel: Power, overall BIT and Rubidium Status

Dimensions & Weight		
19" x 1U Rack Mount	Size	43.7mm (H) x 367mm (L = depth) x 482.6mm (W)
	Weight	< 4 kg

Environmental	
CE Compliance	EN61000-6-3 : 2001 Emission test EN55022 Class B EN61000-6-1 : 2001 Immunity tests (EN55024) EN60950: Safety standard
Operating Temperature	0℃ to +50℃
Storage Temperature	-40℃ to +70℃
Humidity	Up to 95%, non-condensed
Altitude (Operating)	0 to 6000 m (0 to 19685 feet)
Vibration & Shocks (Non operating)	Transportation Vibration & Shocks
MTBF (GB@25ºC)	507,000 Hours
MTBF (GB@33ºC)	477,000 Hours

Mechanical ICD



Electrical ICD		
Connector	Description	Type
J1	Power supply - 110/ 220 VAC	IEC320 C14 Inlet, Male
J2	Communication - RS-232 channel	D-Type, 9 pin, Female
J3-J8	Frequency output - OUT 1~ 6	TNC Female

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