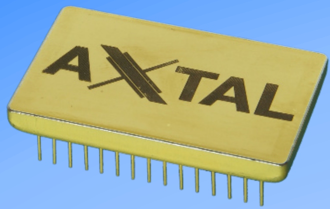
AXTAL ADVANCED XTAL PRODUCTS

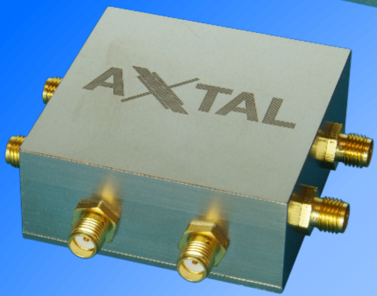
a Q-TECH Company

CATALOG

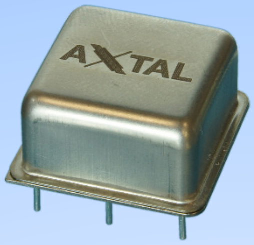
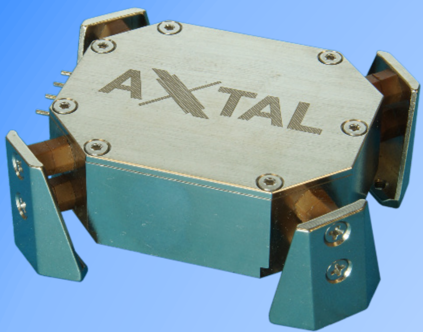
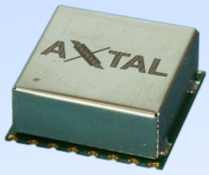
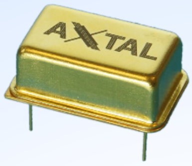
Issue 01/2024

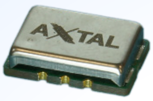
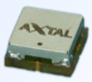
EXPERTS FOR CUSTOMIZED FREQUENCY CONTROL PRODUCTS

Base Line OCXO
Ultra-Low Noise OCXO
TCXO Line
Vibration Insensitive Oscillators
Crystal Products for Space
GHz Crystal-Controlled Sources
PLL Oscillator Modules
Gated Crystal Oscillators
Frequency Distribution Units
Frequency Reference Units
Atomic Clocks
Masterclocks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Designed and Manufactured in Germany

AXTAL ADVANCED XTAL PRODUCTS
a Q-TECH Company

AXTAL is …

About AXTAL

- **“AXTAL”** stands for ”**A**dvanced **XTAL** Products” , where **"XTAL"** is a common abbreviation of "crystal".
- **AXTAL** was founded in 2003 by Bernd and Brigitte Neubig as privately-owned company. Since 2023 the AXTAL GmbH is an independent subsidiary of ***Q-Tech Corporation***, a US-based leading supplier of high-reliability crystal oscillators. AXTAL is EN 9100 certified since 2024. Company location is in Mosbach/Baden in Southern Germany.
- **AXTAL’s** core business comprises advanced Frequency Control Products (FCP), i.e. mainly customized crystal oscillators and frequency & timing modules.
- **AXTAL’s** main focus is on High-Reliability Oscillators and Frequency Control Modules with high requirements for environmental conditions, ultra-low noise performance, very high stability and frequency generation up into the GHz range for applications like microwave communication, test equipment, radar, military, aerospace and space.
- **AXTAL** incorporates the full value chain including R&D, design, manufacturing, screening and testing of our products from samples to production quantities completely in-house.

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Product Range

- OCXO – BASE LINE
- OCXO – ULTRA-LOW NOISE LINE
- TCXO – LINE
- VIBRATION INSENSITIVE OSCILLATORS
- CRYSTAL PRODUCTS FOR SPACE
- CRYSTAL PRODUCTS FOR NEW SPACE
- GHz CRYSTAL-CONTROLLED SOURCES
- PLL OSCILLATOR MODULES
- GATED CRYSTAL OSCILLATORS
- FREQUENCY DISTRIBUTION UNITS
- FREQUENCY REFERENCE UNITS
- MASTERCLOCKS

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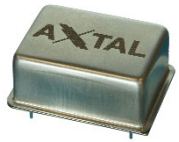
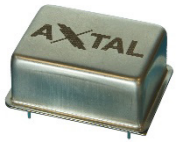
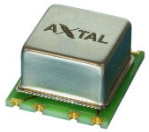
OCXO – BASE LINE

Model							
	THD	-	 AXIOM20/25	 AXIOM30/35	 AXIOM70/75	 AXIOM40/45	 AXIOM40/45HS
	SMD	 AXIOM114	 AXIOM120/125	 AXIOM10/15	 AXIOM170/175	 AXIOM140/145	-
Frequency range / Output		10 ~ 100 MHz	5 ~ 160 MHz – Sine wave/HCMOS				10 MHz
Stability		±5 ppb	±0.5 ~ ±500 ppb				±0.05 ~ ±0.4 ppb
Temperature range		-40°C ~ +85°C	-55°C ~ +105°C				-40°C ~ +80°C
Supply voltage		3.3 V	3.3 ~ 15 V				5 ~ 12 V
Features		Smallest OCXO Hermetically sealed	Base Line – Add your custom requirements like Phase Noise, G-Sensitivity, ADEV etc. and define your specific model via the option codes				Ultra-High Stability DOCXO
Size	THD	-	20 x 13 mm (CO 02)	20 x 20 mm (CO 41)	25 x 25 mm (CO 43)	36 x 27 mm	36 x 27 mm
	SMD	9 x 14 mm	22.7 x 15.1 mm	25 x 22 mm (CO 28)	27.8 x 27.8 mm	41 x 30 mm	-

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Connectorized Models

Model	AXIOM90	AXIOM95	AXIOM95LP	AXIOM5050	AXIOM5050M	AXIOM5050ULN
						
Frequency range	10 ~ 40 MHz	5 ~ 160 MHz				
Stability	±0.5 ~ ±50 ppb	±10 ~ ±500 ppb				
Temperature range	-55°C ~ +95°C					
Supply voltage	3.3 ~ 15 V	5 ~ 15 V				
Feature	High Stability	High Stability	Low Profile	Low Noise	Multiple Outputs	Ultra-Low Noise
	All models available with Ultra-Low Noise Option and Low G-Sensitivity					
Size	54 x 40 x 19 mm SMA Feedthrough	54 x 40 x 19 mm SMA Feedthrough	54 x 40 x 13 mm SMA (Option) Feedthrough	50 x 50 x 21 mm SMA Feedthrough	50 x 50 x 21 mm SMA 2 ~ 6 Ports Feedthrough	50 x 50 x 21 mm SMA Feedthrough

More connectorized OCXOs with specialized features see also Vibration-Isolated Oscillators and GHz Crystal-Controlled Oscillators

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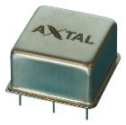
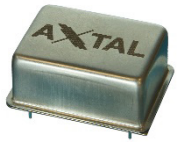
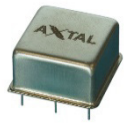
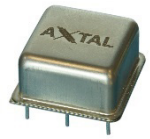
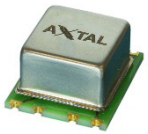
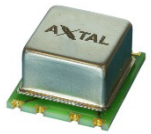
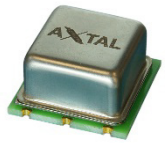
OCXO – ULTRA-LOW NOISE LINE

Model		AXIOM35LN	AXIOM75LN	AXIOM45ULN	AXIOM35ULN	AXIOM75ULN	AXIOM5050ULN
	THD						
	SMD	 AXIOM15LN	 AXIOM175LN	 AXIOM145ULN	 AXIOM15ULN	 AXIOM175ULN	AXIOM5050ULN
Frequency range		10 MHz			50 ~ 160 MHz		
Phase noise [dBc/Hz] at 10 MHz or 100 MHz		-100 1 Hz -130 10 Hz < -155 Floor	-110 1 Hz -140 10 Hz < -165 Floor	-115 1 Hz -143 10 Hz < -170 Floor	-105 10 Hz -137 100 Hz < -170 Floor	-105 10 Hz -137 100 Hz < -175 Floor	-110 10 Hz -140 100 Hz < -180 Floor
Stability		±5 ppb			±25 ppb		±100 ppb
Temperature range		-55°C ~ +95°C					
Supply voltage		5 ~ 12 V	12 ~ 15 V				
Size	THD	20 x 20 mm (CO 41)	25 x 25 mm (CO 43)	36 x 27 mm (CO 08) 7-pin	20 x 20 mm (CO 41)	25 x 25 mm (CO 43)	50 x 50 x 21 mm SMA Feedthrough
	SMD	25 x 22 mm (CO 28)	27.8 x 27.8 mm	41 x 30 mm	25 x 22 mm (CO 28)	27.8 x 27.8 mm	

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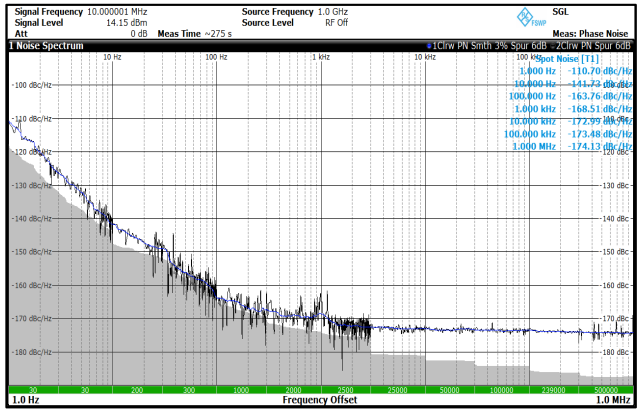
Phase Noise Characteristics

10 MHz

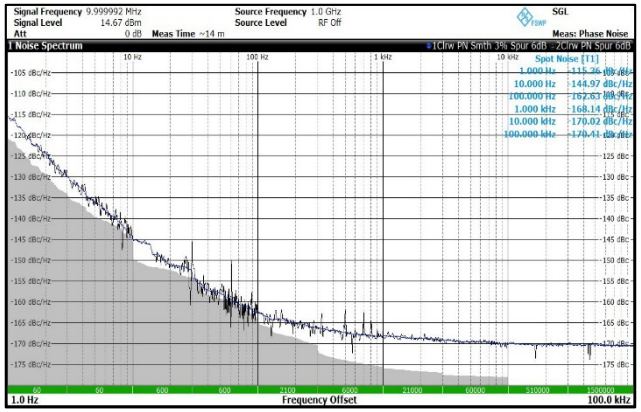
AXIOM75LN
AXIOM175LN

-110 dBc/Hz @ 1 Hz
-140 dBc/Hz @ 10 Hz
-160 dBc/Hz @ 100 Hz
-170 dBc/Hz @ 1 kHz
-173 dBc/Hz @ ≥10 kHz



AXIOM45ULN-C
AXIOM145ULN-C

-115 dBc/Hz @ 1 Hz
-143 dBc/Hz @ 10 Hz
-160 dBc/Hz @ 100 Hz
-167 dBc/Hz @ 1 kHz
-170 dBc/Hz @ ≥10 kHz

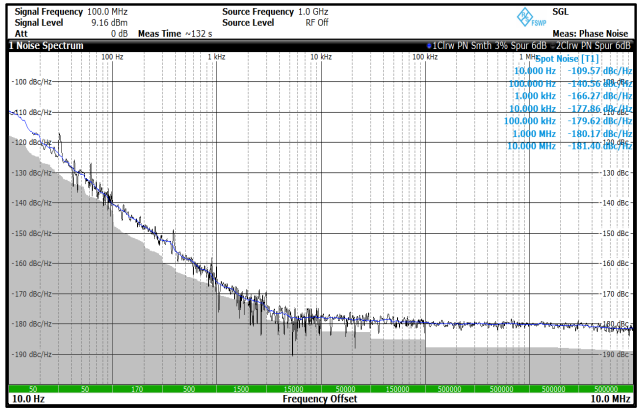


100 MHz

AXIOM75ULN-E
AXIOM175ULN-E

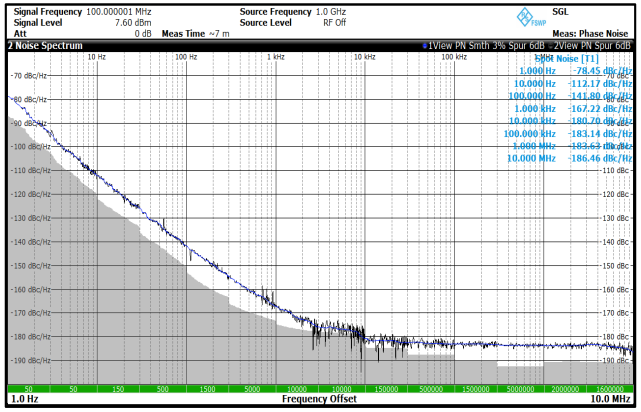
-108 dBc/Hz @ 10 Hz
-138 dBc/Hz @ 100 Hz
-165 dBc/Hz @ 1 kHz
-175 dBc/Hz @ ≥10 kHz

AXIOM15ULN
AXIOM35ULN
< -170 dBc/Hz @ ≥10 kHz



AXIOM5050ULN-E

-80 dBc/Hz @ 1 Hz
-110 dBc/Hz @ 10 Hz
-140 dBc/Hz @ 100 Hz
-167 dBc/Hz @ 1 kHz
-180 dBc/Hz @ 10 kHz
-183 dBc/Hz @ ≥100 kHz



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TCXO – LINE

Models						
	Wide range of SMD & THD packages from **5x3.2 mm** up to **20x20 mm**					
Frequency range	**10 ~ 50 MHz** (small SMD packages) / **5 ~ 200 MHz** (other packages)					
Output waveform	CSW / Sine wave / HCMOS / PECL / LVDS					
Stability	**±0.05 ~ ±2 ppm**					
Temperature range	**-40°C ~ +85°C** (standard range) / **-55°C ~ +95°C** (wide range) / **-60°C ~ +125°C** (ultra-wide range)					
Supply voltage	**1.8 ~ 3.3 V** (other voltages available on request)					
Special features	Very High Frequency Stability **±50 ppb**	Very Wide Temperature Range **-60°C ~ +125°C**	Ultra-Low G-Sensitivity **< 0.2 ppb/g**	Ultra-Low Phase Noise Floor **-180 dBc/Hz**	Ultra-Low Phase Jitter **10 fs**	New Space Application (Space COTS) **50 krad (TID)**
Series	Various AXLE Series	AXLE **WT** Series AXLE **LG** Series	AXLE **LG** Series AXLE **HF** Series	AXLE **HF** Series	AXLE **HF** Series	AXLE **S** Series
Availability	Use of different TCXO-IC technologies and manufacturers allows good ability to deliver.					

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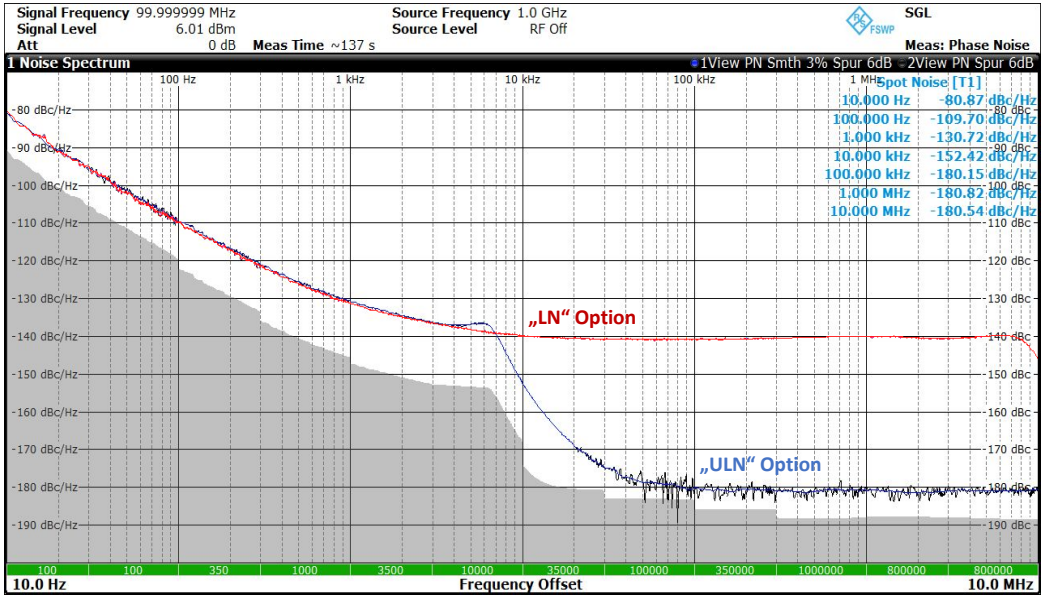
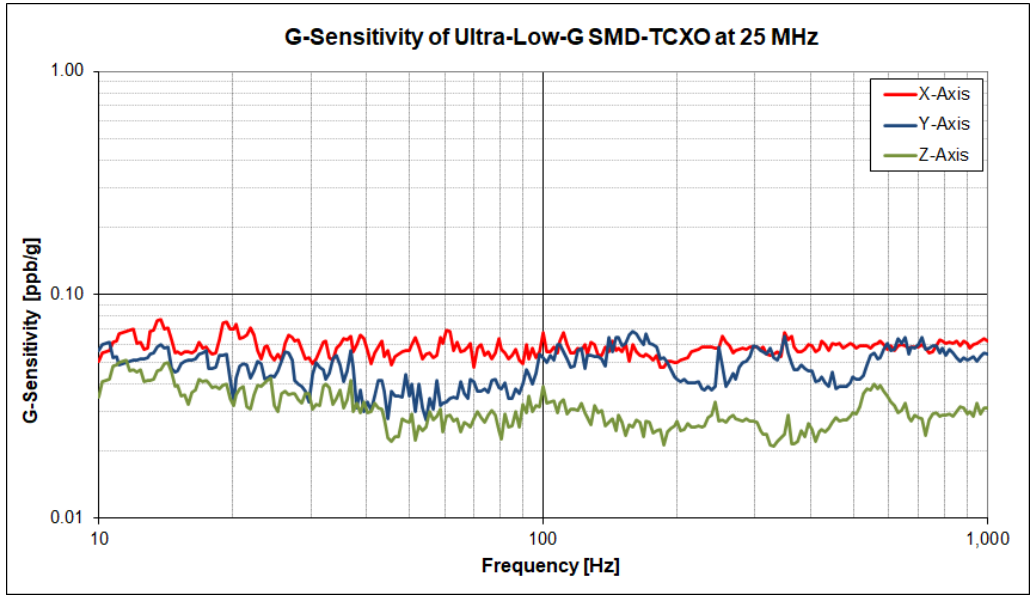
Performance Examples

Phase Noise HF-Series



RMS phase jitter (12 kHz ~ 20 MHz): “ULN” Option = 10 fs – “LN” Option = 700 fs

G-Sensitivity



G-Sensitivity measured with flat random vibration profile of 0.1 g²/Hz

More High Frequency TCXOs see also PLL Oscillator Modules and GHz Crystal-Controlled Oscillators

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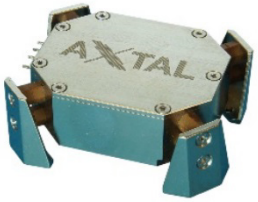
VIBRATION INSENSITIVE LINE

Model		 AXLE LG Series	 AXIOM75LG	 AXE238	 AXIOM210	 AXIOM220	 AXIOM260
Oscillator type		Low G-Sensitivity TCXO	Low G-Sensitivity OCXO	Vibration-Isolated SPXO	Vibration-Isolated OCXO		
Features		High mechanical shock resistance	High mechanical shock resistance	Very high random vibration levels	Best Vibration Performance	Multiplied with Dual Output Option	Legacy model
G-Sensitivity [ppb/g] *		< 0.250	0.250	0.004	0.001	0.001	0.015
Frequency range		10 ~ 50 MHz	50 ~ 125 MHz	10 ~ 150 MHz	50 ~ 150 MHz	150 ~ 450 MHz	50 ~ 150 MHz
Phase noise [dBc/Hz]	Static	-115 100 Hz -160 Floor	-135 100 Hz -175 Floor	-135 100 Hz -170 Floor	-137 100 Hz -180 Floor	-130 100 Hz -170 Floor	-130 100 Hz -165 Floor
	Vibration **	-90 100 Hz -110 1 kHz	-95 100 Hz -115 1 kHz	-90 100 Hz -150 1 kHz	-115 100 Hz -155 1 kHz	-105 100 Hz -145 1 kHz	-90 100 Hz -140 1 kHz
	@	50 MHz	100 MHz	100 MHz	100 MHz	200 MHz	100 MHz
Stability		±500 ppb	±10 to ±300 ppb	±50 ppm	±10 to ±300 ppb		
Supply voltage		3.3 V	12~15 V				
Size		5x3.2 or 7x5 mm SMD	25 x 25 x 13 mm THD	38 x 38 x 19 mm SMA / Feedthrough	50 x 50 x 30 mm SMA / Feedthrough	70 x 70 x 40 mm SMA / Feedthrough	58 x 48 x 27 mm Feedthrough

** G-Sensitivity at 1 kHz offset* *** Flat random vibration profile 0.01 g²/Hz, 10~2000 Hz*

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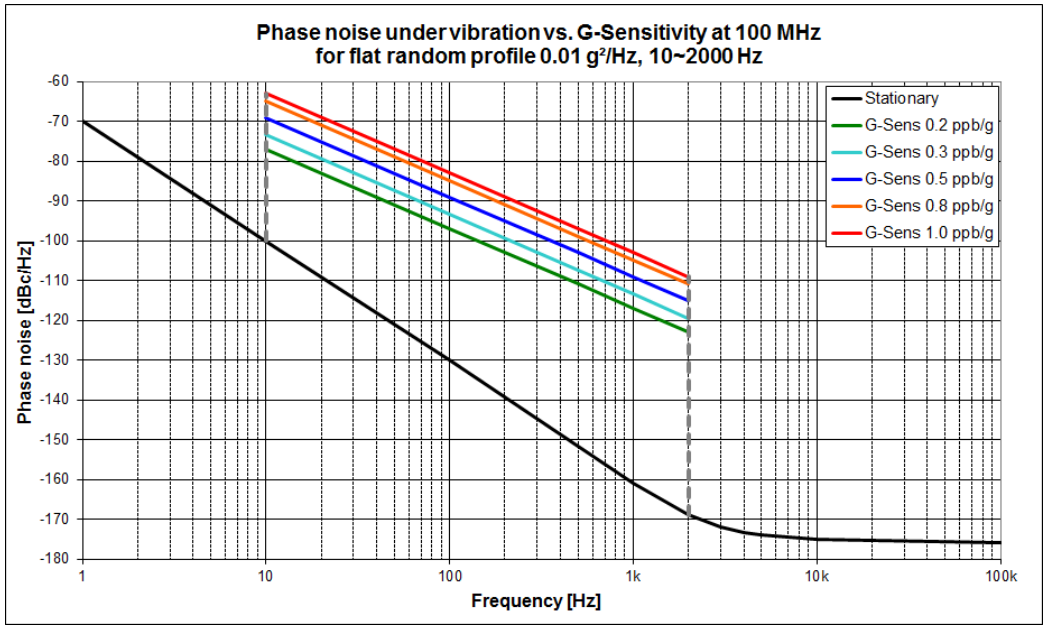
Performance Characteristics

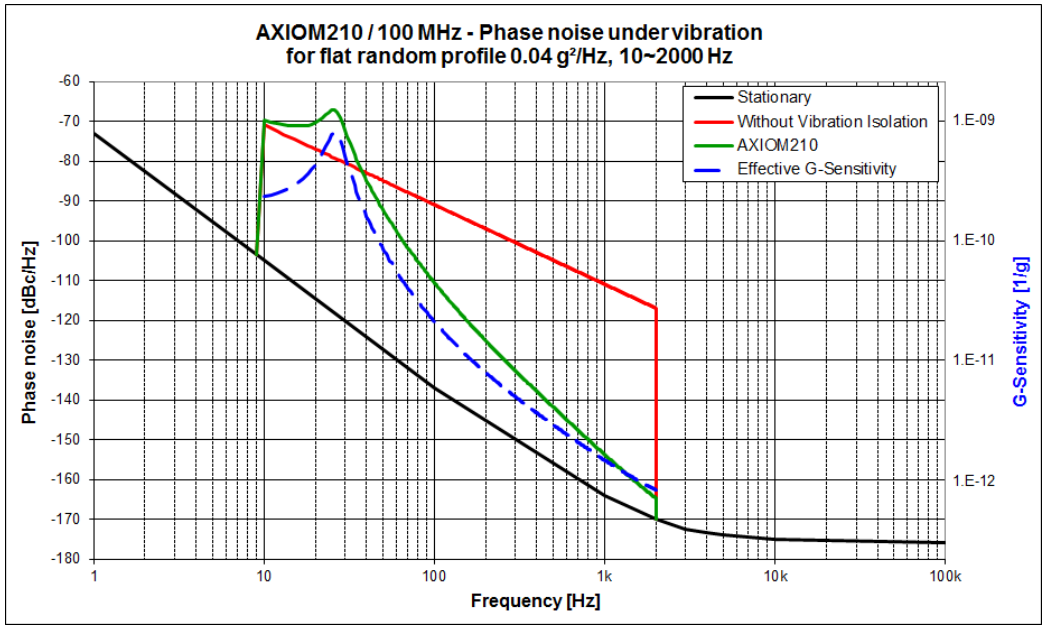
AXIOM75LG



Phase noise under random vibration for flat profile PSD = 0.01 g²/Hz, 10~2000 Hz

- Double PSD results in 3 dB worse phase noise
- Withstands very high vibration levels >1 g²/Hz
- High mechanical shock resistance

AXIOM210



Phase noise under random vibration for flat profile PSD = 0.04 g²/Hz, 10~2000 Hz

- Withstands very high vibration levels >1 g²/Hz above 50 Hz
- Phase noise under vibration -155 dBc/Hz @ 1 kHz
- Isometric behaviour under vibration
- High mechanical shock resistance
- Internal vibration isolation – Insensitive to cabling

You name your vibration requirements – We compute the possible phase noise performance
Isolation absorber systems can be designed and tailored to your application requirements

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CRYSTAL PRODUCTS FOR SPACE

Model	 AXIS45S	*Coming soon*  AXIOM5050S	 AXIOM6060		 MQF4021S
Product type	VCXO	OCXO	OCXO		Crystal Filter
Category	Classical Space (ECSS Class 1)				
Features	Wide pulling range & high linearity options	Ultra-Low Noise Ultra-High Stability (USO)	ESA EPPL Ultra-Low Noise		High filter slope and out-of-band attenuation
Radiation hardness	100 krad (TID) – SEE > 90 MeV·cm²/mg – SEL immune				
Frequency range	10 ~ 100 MHz	10 MHz	80 ~ 125 MHz		10 ~ 100 MHz
Output	Sine wave				50 Ohm
Stability	±10 ppm	±1 ppb	±50 ppb		±20 ppm
Temperature range	-30°C to +70°C	-30°C to +70°C			-40°C to +85°C
Supply voltage	5 V	12 V			-
Manufacturing	MIL-PRF-55310 Product Level “S” – ECSS-Q-ST-70-08C/38C				
Size	21 x 13 mm (CO 02)	50 x 50 x 30 mm SMA / FT	60 x 60 x 30 mm SMA / Micro-D	60 x 60 x 30 mm SMA / FT	40 x 21 mm SMD Package

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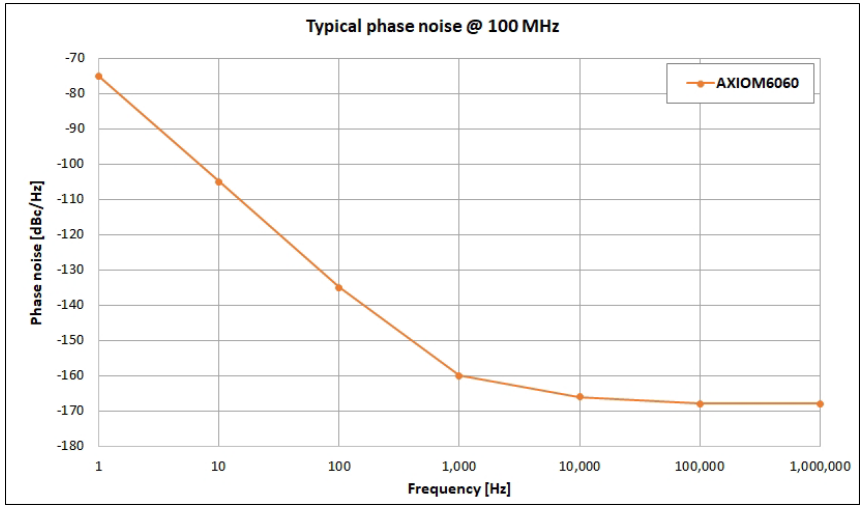
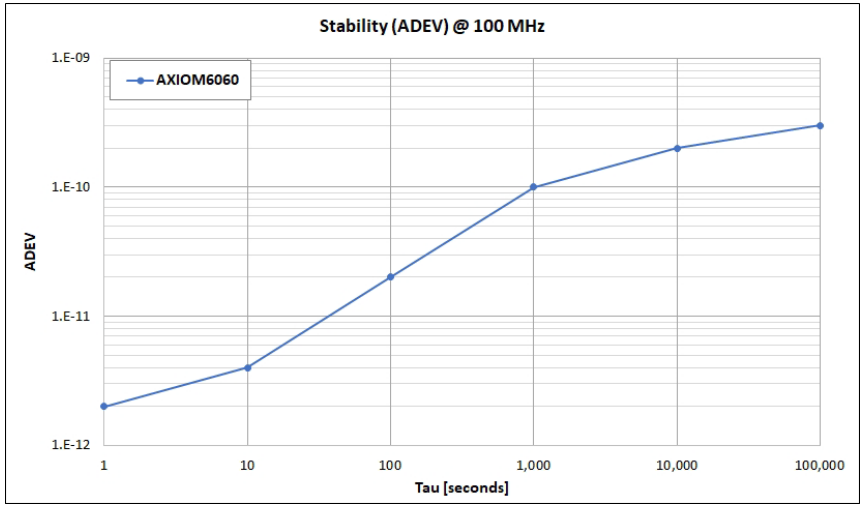
Performance and Manufacturing

Phase noise Performance





Design, Manufacturing and Quality

Space COTS "New Space Category"	Class 1 "Classical Space Category"
Specially selected commercial components & materials (COTS) / Suitable semiconductor technology for improved radiation hardness	Component selection based on ECSS-Q-ST-60C Class 1
	Material selection based on ECSS-Q-ST-70C / ECSS-Q-70-71
Quartz crystal with High Q material (Low inclusion & etch channel density)	Quartz crystal based on ESCC3501 with swept material
Manufacturing IAW ECSS-Q-ST-70-08C / ECSS-Q-ST-70-38C	
-	ESA certified personnel in Clean-Room environment (ISO Class 3)
Pre-cap inspection (Optional)	Pre-cap inspection of Crystal & Oscillator
-	Destructive Physical Analysis DPA (Optional)
Manufacturing IAW MIL-PRF-55310 Product Level "S" including	
Screening, Group-B	Screening, Group A-, B- and C-inspection
Full traceability of all critical components (Quartz, Semiconductors & PCB)	Complete traceability of all components, materials and manufacturing steps

Heritage

- **Geostationary (weather) satellites:** Feng Yun 2G China, DSO Singapore
- **International Space Station ISS**: ACES (Atomic Clock Ensemble in Space)
- **NCLE (NL-China Low Frequency Explorer) – Earth-Moon L2 Orbit**
- **LARA/ExoMars Mission (ESA)**: Communication Link Earth-Mars
- **And others**

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CRYSTAL PRODUCTS FOR NEW SPACE

Model	 AXLE5032S	 AXLE5032S-H	 AXLE7050S	 AXLE7050S-H	 AXIS45SH
Product type	TCXO				VCXO
Category	New Space (Space COTS) – Customizable to match mission requirements				
Features	LEO and New Space Applications - Low Noise & High Stability Radiation tested (TID & SEE) – Different product levels available				
Radiation hardness	40 krad (TID) – SEL immune				
Frequency range	10 ~ 50 MHz				10 ~ 100 MHz
Output	CSW	HCMOS	CSW	HCMOS	Sine wave
Stability	±1 ppm				±5 ppm
Temperature range	-40°C to +85°C				-30°C to +70°C
Supply voltage	3.3 V				3.3 ~ 5 V
Manufacturing	MIL-PRF-55310 Product Level “S” or tailored to customer requirements				
Size	5 x 3.2 mm SMD Ceramic	5 x 3.2 mm SMD Ceramic	7 x 5 mm SMD Ceramic	7 x 5 mm SMD Ceramic	20 x 13 mm (CO 02)

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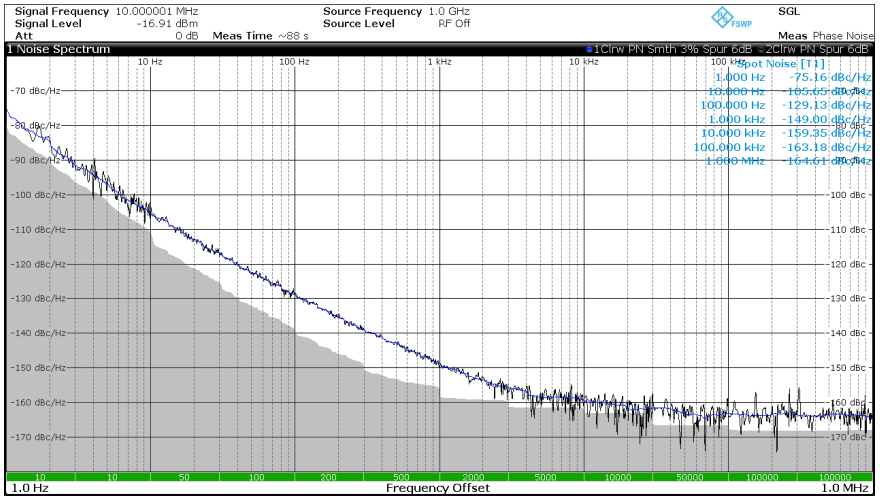
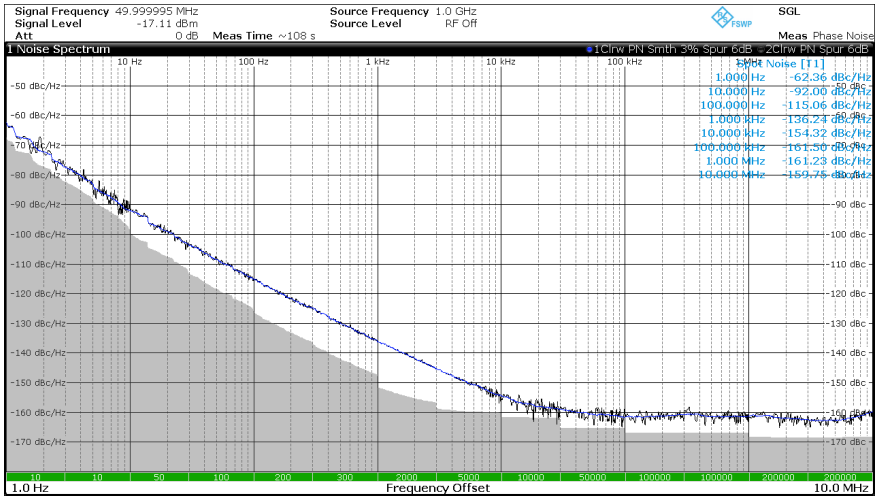
Performance and Manufacturing

TCXO Phase noise Performance



10 MHz



50 MHz

Design, Manufacturing and Quality

Space COTS "New Space Category"	Class 1 "Classical Space Category"
Specially selected commercial components & materials (COTS) / Suitable semiconductor technology for improved radiation hardness	Component selection based on ECSS-Q-ST-60C Class 1
	Material selection based on ECSS-Q-ST-70C / ECSS-Q-70-71
Quartz crystal with High Q material (Low inclusion & etch channel density)	Quartz crystal based on ESCC3501 with swept material
Manufacturing IAW ECSS-Q-ST-70-08C / ECSS-Q-ST-70-38C	
-	ESA certified personnel in Clean-Room environment (ISO Class 3)
Pre-cap inspection (Optional)	Pre-cap inspection of Crystal & Oscillator
-	Destructive Physical Analysis DPA (Optional)
Manufacturing IAW MIL-PRF-55310 Product Level "S" including	
Screening, Group-B	Screening, Group A-, B- and C-inspection
Full traceability of all critical components (Quartz, Semiconductors & PCB)	Complete traceability of all components, materials and manufacturing steps

Heritage

- **PLATiNO Satellite Platform:** 10 MHz Ultra-Low Noise OCXO
- **One Sat Satellite Platform:** 100 MHz Ultra-Low Noise OCXO
- **LEO & New Space Missions:** ESA, DSO Singapore, South-Korea etc.
- **Many other Cube and Small Satellite Missions**

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CRYSTAL PRODUCTS FOR NEW SPACE

Model	 AXIOM70SL	 AXIOM75SL	 AXIOM75SH	 AXIOM75SHM	 AXIOM3838S
Product type	OCXO				
Category	New Space (Space COTS) – Customizable to match mission requirements				
Features	LEO and New Space Applications - Ultra-Low Noise & High Stability Radiation tested – Different product levels available				
Radiation hardness	10 krad (TID)	40 krad (TID) – SEL immune / SET insensitive			
Frequency range	10 MHz	10 MHz	80 ~ 125 MHz	130 ~ 400 MHz	10 MHz
Output	HCMOS	Sine wave			
Stability	±10 ppb	±10 ppb	±50 ppb	±50 ppb	±10 ppb
Temperature range	Standard -30°C to +70°C / Custom -40°C to +85°C				
Supply voltage	8 ~ 12 V				
Manufacturing	MIL-PRF-55310 Product Level “S” or tailored to customer requirements				
Size	25 x 25 mm (CO 43)	25 x 25 mm (CO 43)	25 x 25 mm (CO 43)	25 x 25 mm (CO 43)	38 x 38 x 19 mm SMA / FT

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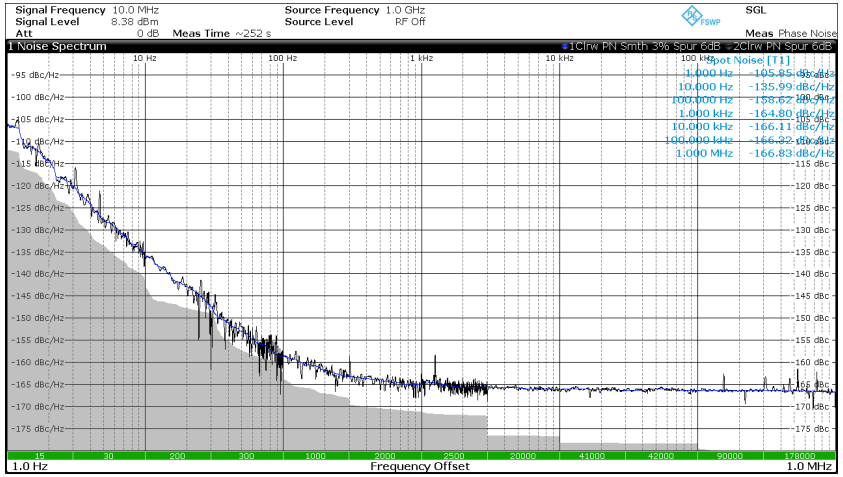
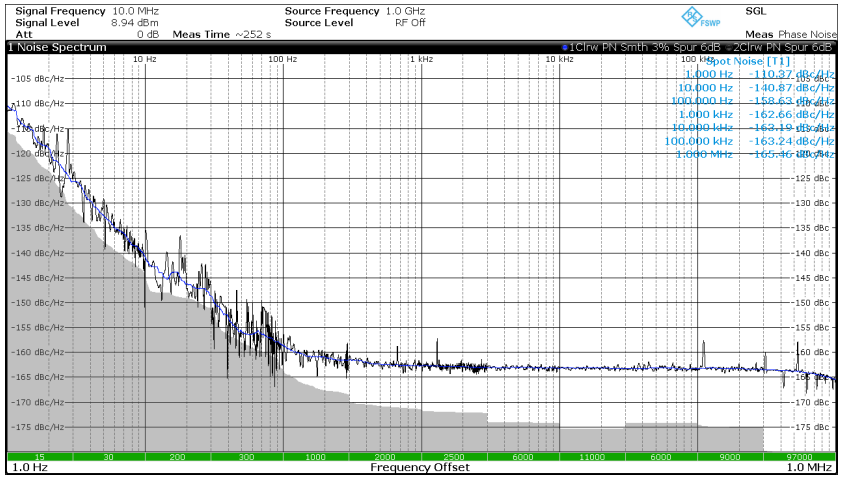
Performance

OCXO Phase noise Performance @ 10 MHz

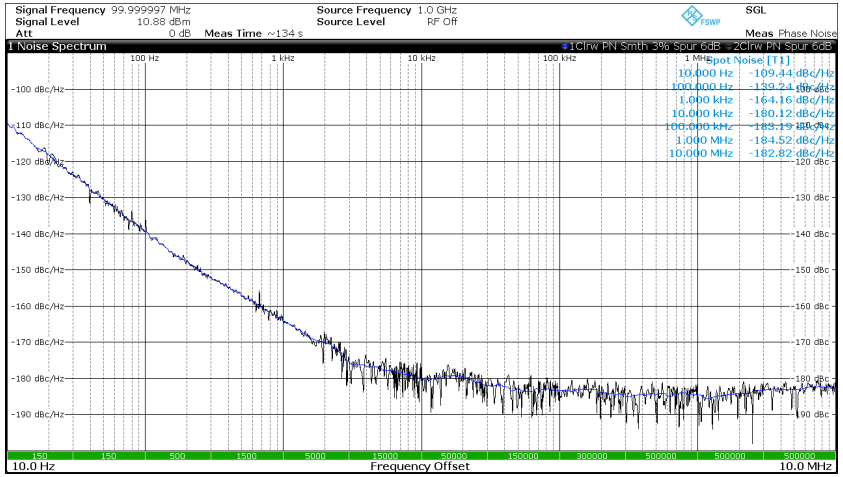


70SL Series

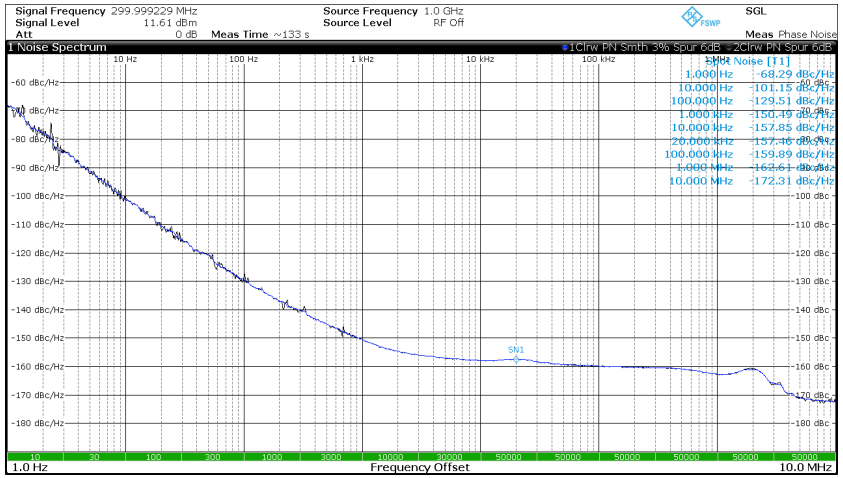


75SL Series

OCXO Phase noise Performance @ 100 MHz and 300 MHz



SH 100 MHz



SHM 300 MHz

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AXTAL ADVANCED XTAL PRODUCTS
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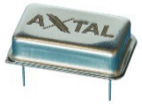
GHz CRYSTAL-CONTROLLED SOURCES

Model	AXPS10	AXPS20	AXGX75	AXGX90	AXE/AXIS/AXLE1000
					
Oscillator type	PSO (SAW)		SPXO		SPXO / VCXO / TCXO
Frequency generation	Fundamental		Frequency Multiplication		
Frequency range	950 ~ 1532 MHz				300 ~ 1300 MHz
Stability	±350 ppm		±30 ppm		±0.5 ~ ±30 ppm
Temperature range	-40°C ~ +85°C				
Supply voltage	5 V		12 V		
Feature	Gated versions for Air Traffic Control (IFF) available				Low Noise
Size	20 x 13 mm (CO 30) SMD	20 x 13 mm (CO 02) THD	25 x 25 mm (CO 43) THD	54 x 40 x 19 mm SMA Feedthrough	54 x 40 x 19 mm SMA Feedthrough

More GHz Sources with specialized features see also Gated Crystal Oscillators and PLL Oscillator Modules

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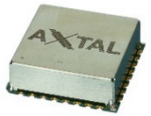
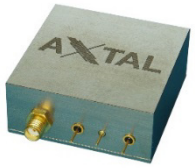
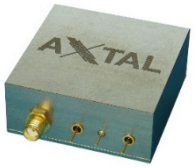
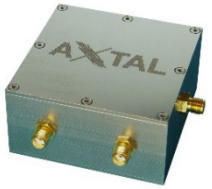
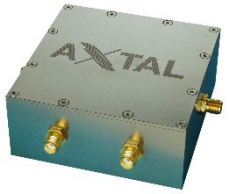
High Stability GHz Sources

Model	 AXLE130	 AXLE175	 AXLE2000	 AXIOM450	 AXIOM1000	 AXIOM2000	 AXIOM2700
Oscillator type	TCXO			OCXO			
Frequency generation	Internal PLL / Frequency Multiplication			Frequency Multiplication / Mixed			
Frequency range	500 ~ 2500 MHz	500 ~ 2500 MHz	1 ~ 8 GHz	160 ~ 500 MHz	300 ~ 1500 MHz	10 ~ 3200 MHz	10 ~ 7000 MHz
Stability	±0.5 ppm			±100 ppb			
Temperature range	-40°C ~ +85°C						
Supply voltage	5 V		12 V				
Feature	Low Noise Small size	Low noise Gated version & High output level available	SHF	Ultra-Low Noise Small size	Ultra-Low Noise	Ultra-Low Noise Multiple outputs Customizable	Ultra-Low Noise Multiple outputs Customizable
Size	20 x 20 x 8 mm 16 leads SMD	25 x 25 x 8 mm 32 leads SMD	50 x 50 x 21 mm SMA Feedthrough	36 x 27 mm (CO 08) THD	50 x 50 x 21 mm SMA Feedthrough	60 x 60 x 30 mm 3x SMA Feedthrough	70 x 70 x 30 mm 3x SMA Feedthrough

For other GHz Sources with specialized features see also Gated Crystal Oscillators and PLL Oscillator Modules

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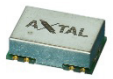
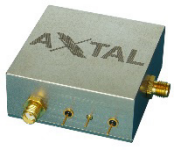
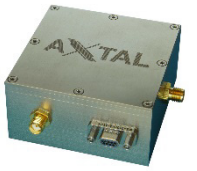
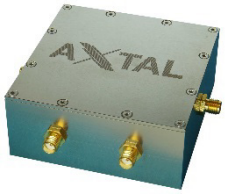
PLL OSCILLATOR MODULES

Model		 AXON20	 AXON1000	 AXON2500	 AXPLT2500	 AXPLO10/100	 AXPLO2600	 AXPLO2700
Internal oscillator type		VCXO	VCO		TCXO	OCXO		
Frequency	Output	50 ~ 160 MHz	300 ~ 3000 MHz	1 ~ 8 GHz	1 ~ 8 GHz	10 ~ 160 MHz	10 ~ 3000 MHz	10 ~ 7000 MHz
	Input	5 ~ 100 MHz						
Stability (Free-running)		±10 ppm	±10 MHz	±10 MHz	±1 ppm	±10 ppb	±100 ppb	±100 ppb
Temperature range		-20°C ~ +70°C				-10°C ~ +60°C		
Supply voltage		3.3~5 V	12~15 V					
Features		Low Noise Small Size	Internal TCXO reference available	SHF	SHF High Stability	Ultra-Low Noise PN Clean-up High stability	UHF Ultra-Low Noise High stability Programmable	UHF/SHF Ultra-Low Noise Multiple outputs Customizable
Size		20 x 13 mm (CO 29) SMD	54 x 40 x 19 mm SMA Feedthrough	50 x 50 x 21 mm SMA Feedthrough	50 x 50 x 21 mm SMA Feedthrough	54 x 40 x 19 mm SMA Feedthrough	60 x 60 x 30 mm 2x SMA Micro-D	70 x 70 x 30 mm 4x SMA Micro-D

You name your requirements – We find or design you a customized module

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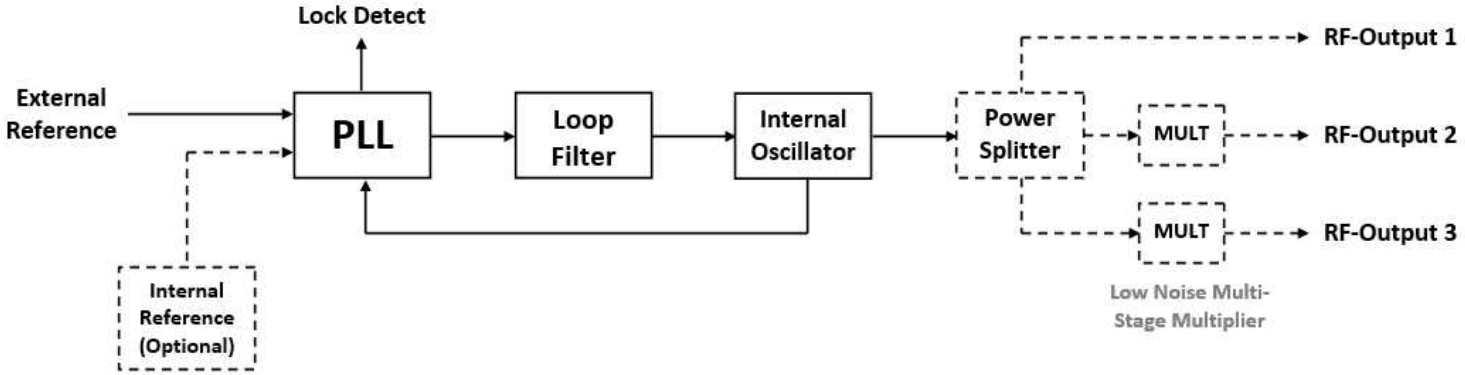
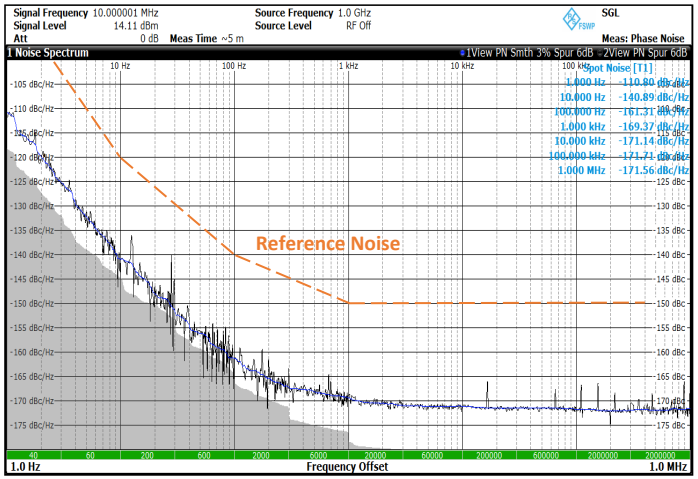
General Block Diagram & Performance Examples

General Block Diagram PLL Oscillator Modules

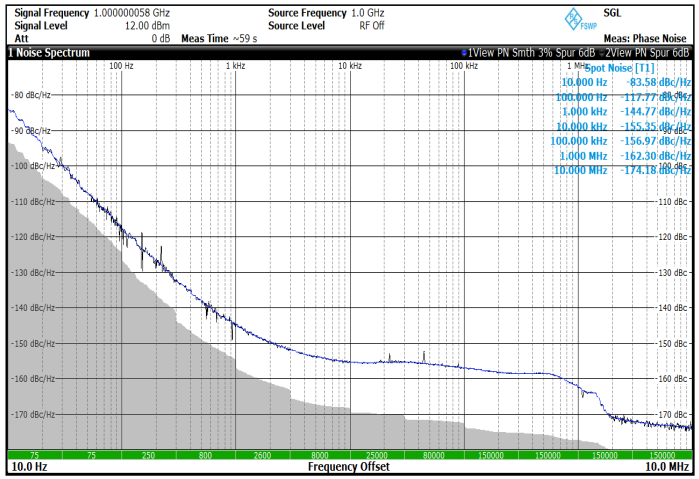


- PLL Phase Noise Performance can be tailored to your specific requirements
- Fully customizable modules available
- Phase coherence of all outputs guaranteed due phase-locking or frequency multiplication
- Programmable versions available

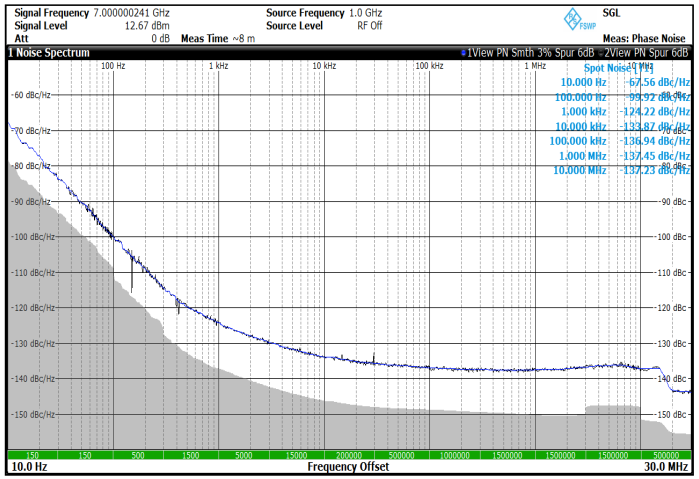
Performance Examples



AXPLO10 – Clean-up (locked to 10 MHz)



AXPLO2600 - 1000 MHz (x10) locked to 10 MHz



AXPLO2700 - 7000 MHz (x70) locked to 10 MHz

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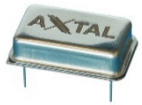
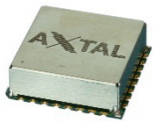
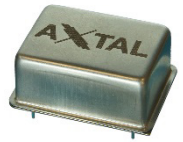
GATED CRYSTAL OSCILLATORS

Model	AXGS10	AXGS20	AXGT175	AXGX75	AXGX90	AXG2X45G	AXGS4530G
							
Oscillator type	GSO (SAW)		GXO			Dual-GXO	GSO (SAW)
Frequency range	950 ~ 1532 MHz (Standard Frequencies 1030 MHz, 1090 MHz and 1532 MHz)						
Stability	±350 ppm		±1 ppm	±30 ppm			±200 ppm
Temperature range	-40°C ~ +85°C						-55°C ~ +100°C
Supply voltage	5 V			12 V			
Feature	Small size Low Profile		Compact size High stability	Compact size High stability	Connectorized High stability	Dual Switchable Frequency	MIL-PRF-55310 Multiple outputs
Size	20 x 13 mm (CO 30) SMD	20 x 13 mm (CO 02) THD	25 x 25 x 8 mm 32 leads SMD	25 x 25 mm (CO 43) THD	54 x 40 x 19 mm SMA Feedthrough	36 x 27 mm (CO 08) THD	45 x 30 x 5 mm DIL 30 leads NiAu finish

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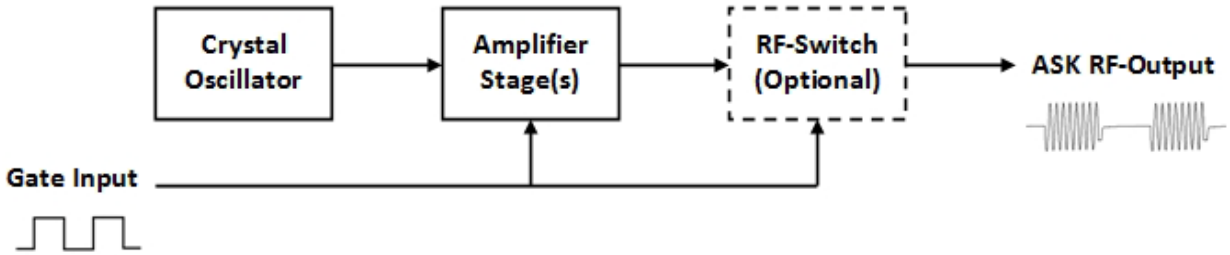
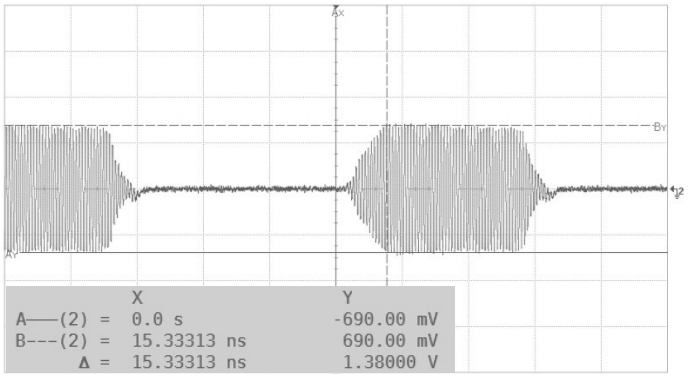
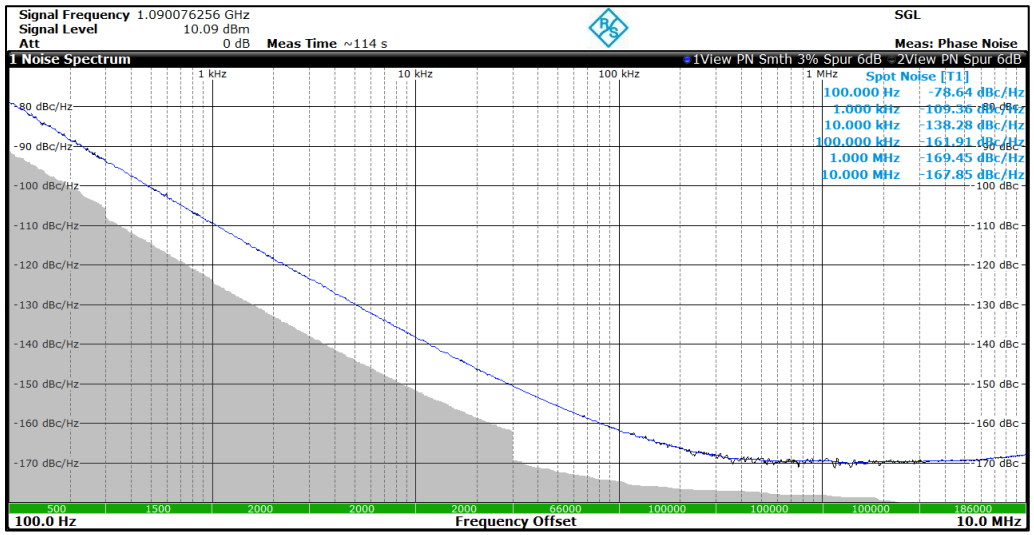
Block Diagram & Performance Examples

Block Diagram Gate Function (ASK)

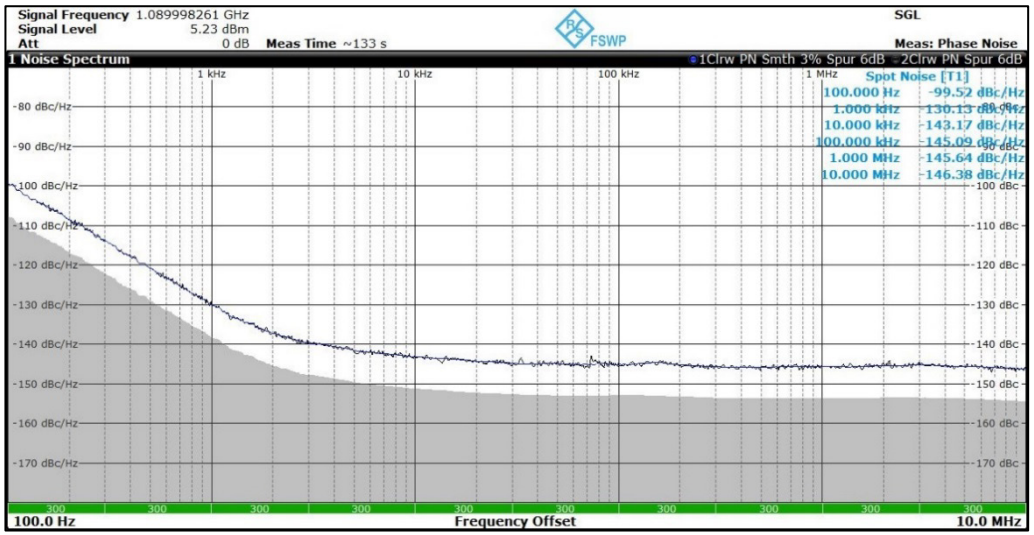




Performance Examples



AXGS20 – 1090 MHz (SAW Oscillator)



AXGX90 – 1090 MHz (Crystal Oscillator)

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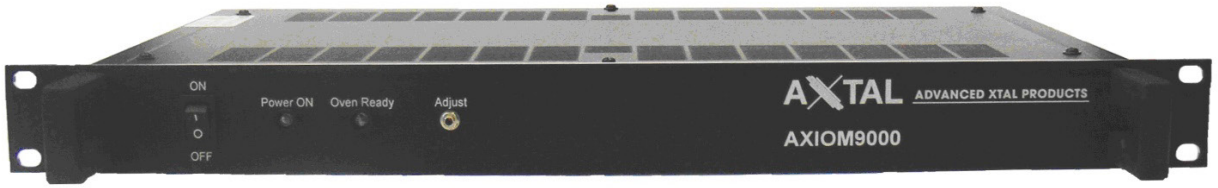
FREQUENCY REFERENCE UNITS
9000 Series - 19” Rack Modules



Model	AXIOM9000 Very High Stability Ultra-Low Noise Reference (D)OCXO	AXDO9000 AXIOM9000 Reference with integrated low-noise distribution amplifier	AXGPS9000 GPS-disciplined Ultra-Low Noise OCXO Frequency Reference	AXRB9000 Very High Stability Ultra-Low Noise Rubidium Frequency Reference
Stability / Phase noise at 10 MHz [dBc/Hz]	2E-12 1 s -110 1 Hz 5E-12 10 s -140 10 Hz 8E-12 100 s -157 100 Hz 1E-11 1E3 s -167 1 kHz 5E-11 1E4 s -170 10 kHz 1E-10 1E5 s -170 100 kHz	2E-12 1 s -110 1 Hz 5E-12 10 s -140 10 Hz 8E-12 100 s -150 100 Hz 1E-11 1E3 s -160 1 kHz 5E-11 1E4 s -165 10 kHz 1E-10 1E5 s -165 100 kHz	8E-12 1 s -110 1 Hz 1E-11 10 s -140 10 Hz 1E-11 100 s -160 100 Hz 4E-12 1E3 s -170 1 kHz 1E-12 1E4 s -173 10 kHz 1E-13 1E5 s -173 100 kHz	1E-11 1 s -100 1 Hz 3E-12 10 s -140 10 Hz 1E-12 100 s -155 100 Hz 1E-12 1E3 s -165 1 kHz 1E-12 1E4 s -170 10 kHz 1E-12 1E5 s -170 100 kHz
Features	▪ Very High Stability ▪ Ultra-Low Phase Noise ▪ Very Low Aging ▪ Up to 3 isolated outputs for frequency distribution ▪ Cascadable with AXDA9000 distribution amplifier	▪ Very High Stability ▪ Ultra-Low Phase Noise ▪ Very Low Aging ▪ 4 to 16 isolated outputs for frequency distribution	▪ GPS-disciplined Very High Long-term Stability ▪ Ultra-Low Phase Noise ▪ 10 MHz & 1PPS Output ▪ RS-232 Interface / NMEA-0183 ▪ Cascadable with AXDA9000/9100 distribution amplifiers	▪ Very High Long-term Stability ▪ Ultra-Low Phase Noise ▪ 1PPS & 10 MHz distribution amplifiers integrated ▪ External 1PPS disciplining ▪ RS-232 Interface for Monitoring ▪ Cascadable with AXDA9000/9100 distribution amplifiers
Operation	AC Supply 100 ~ 240 V (47 ~ 63 Hz) / Operating temperature range -10°C ~ +60°C			
Size	Slim 19” Rack - 1 HU			

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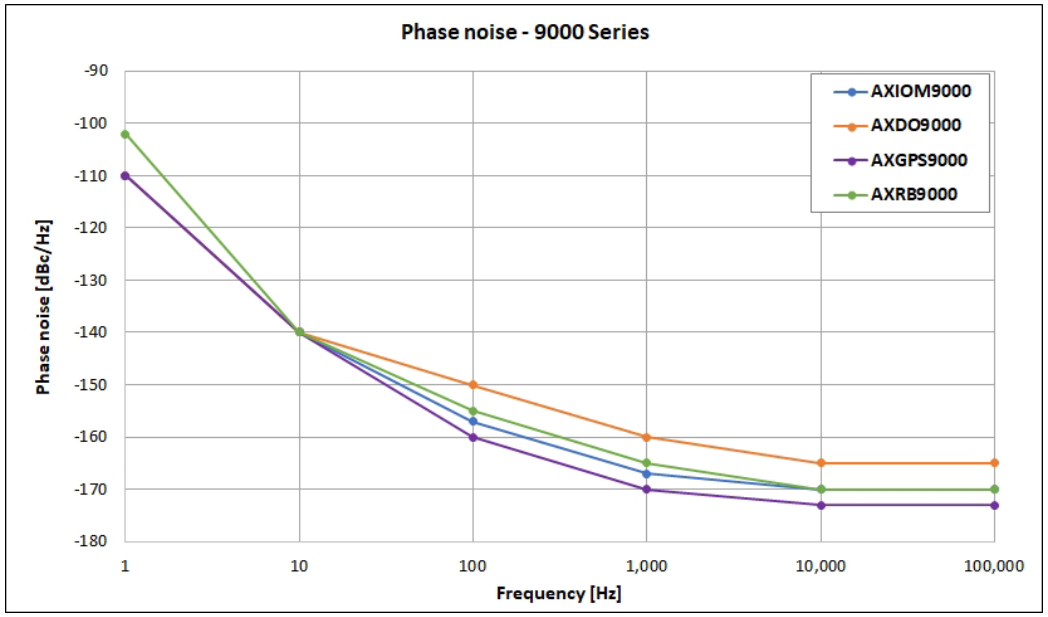
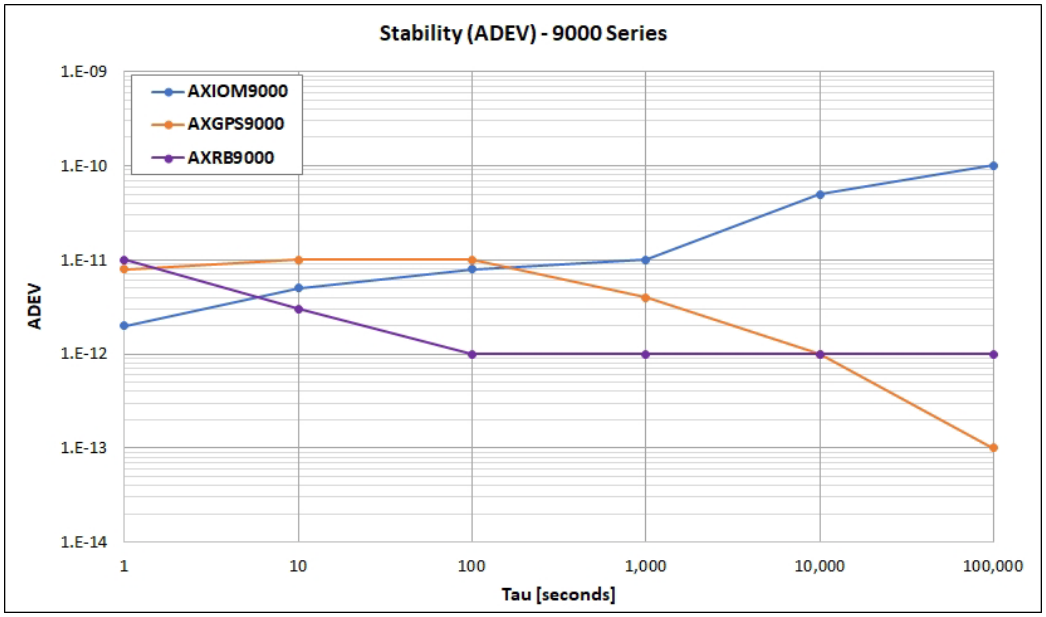
9000 Series Performance

Phase Noise



Stability (ADEV) & Holdover



Time	AXIOM9000	AXGPS9000	AXRB9000
8 hours	1 µs	100 ns	30 ns
24 hours	10 µs	1 µs	90 ns
3 days	100 µs	10 µs	260 ns
10 days	900 µs	100 µs	900 ns
1 month	8 ms	1 ms	2.6 µs

Typical Holdover Performance

See also our
Distribution Amplifiers AXDA9000 Series for 1PPS and 10 MHz distribution
AXPLO10 & AXDA9200-CU for 10 MHz Phase Noise Clean-up

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AXTAL ADVANCED XTAL PRODUCTS
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FREQUENCY DISTRIBUTION UNITS

Model	AXDA9000 Low Noise Selective Distribution Amplifier	AXDA9100 1PPS Pulse Distribution Amplifier	AXDA9200-CU Clean-up Module with 10 MHz & 1PPS Pulse Distribution Amplifier	AXTAL References Cascadable with AXDA Series
Frequency	5 ~ 100 MHz (Fixed)	1PPS	10 MHz / 1PPS	**OCXO AXIOM9000** **GPSDO AXGPS9000** **Rubidium AXRB9000** **Rubidium AXRB Series** **Cesium AXCS Series** Combinable with Phase Noise Clean-up Modules **AXPLO10** **AXDA9200-CU**
Features	▪ Ultra-Low Phase Noise ▪ Up to 16 outputs ▪ Very high isolation: reverse/inter-channel ▪ Standard frequencies: 5, 10 and 100 MHz	▪ High Speed ▪ Up to 16 outputs ▪ TTL/HCMOS level ▪ Low pulse delay with very low variation between ports	▪ Phase Noise Clean-up of 10 MHz ▪ Ultra-Low Phase Noise ▪ 1 to 4 distribution amplifiers for 10 MHz and 1PPS (optional)	
Operation	AC Supply 100 ~ 240 V (47 ~ 63 Hz) / Operating temperature range -10°C ~ +60°C			
Size	Slim 19” Rack - 1 HU			

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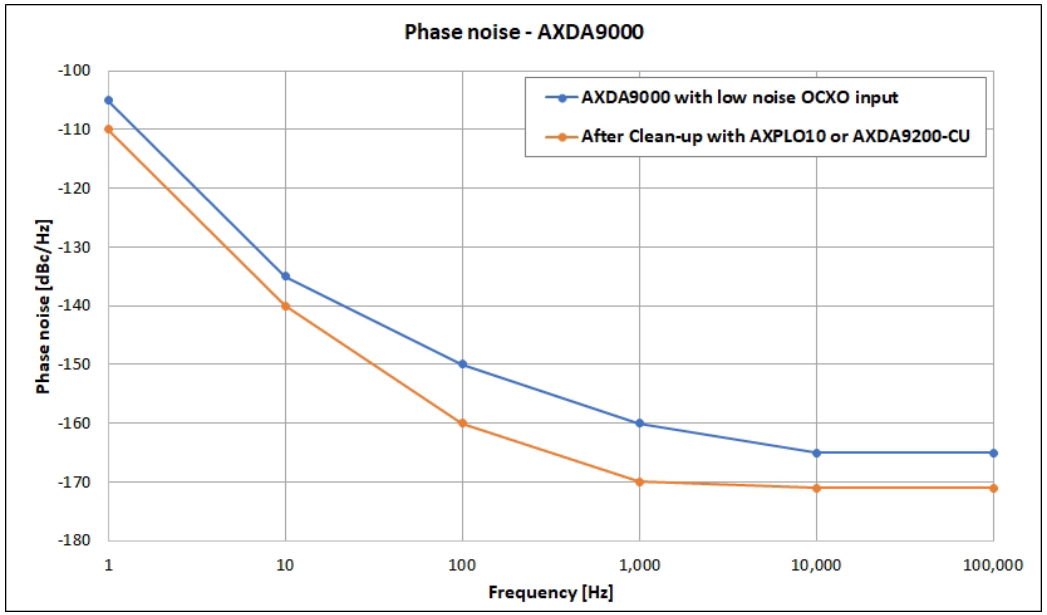
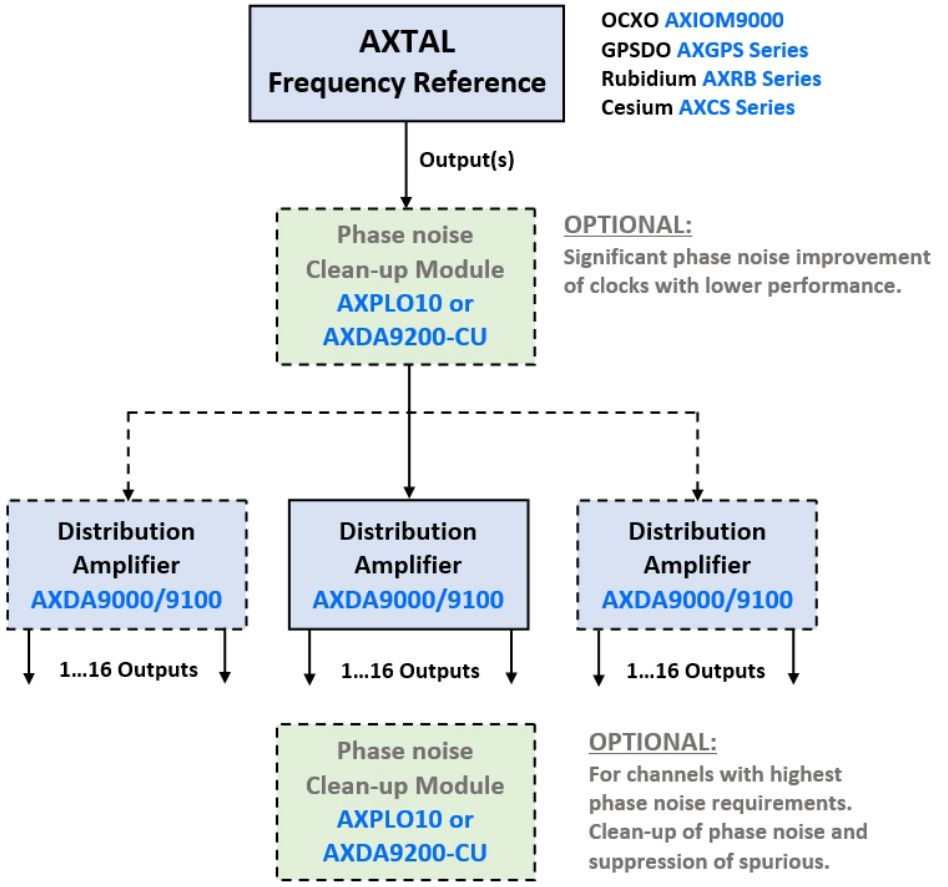
Phase Noise Performance & Block Diagram

Phase Noise Performance



AXPLO10 / AXDA9200-CU Clean-up modules also suppress spurious due to external interferences and can be used at the input of the AXDA9000 or at the output of channels with high requirements for phase noise and spectral purity.

Frequency Distribution Block Diagram



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FREQUENCY REFERENCE UNITS
Rubidium Atomic Clocks

Model	AXCPT1040	AXRB1031	AXRB1031H	AXRB1021	AXRB9000
					
Technology	CPT Atomic Clock	Rubidium			
Short-term stability	1E-10 1 sec 2E-11 10 sec 5E-12 100 sec	5E-11 1 sec 1E-11 10 sec 4E-12 100 sec	5E-11 1 sec 1E-11 10 sec 4E-12 100 sec	3E-11 1 sec 5E-12 10 sec 3E-12 100 sec	1E-11 1 sec 3E-12 10 sec 1E-12 100 sec
Long-term stability	1E-11 / day	5E-12 / day		1E-12 / day	< 1E-12 / day
Phase noise at 10 MHz [dBc/Hz]	-100 10 Hz -125 100 Hz -140 1 kHz	-100 10 Hz -130 100 Hz -135 1 kHz	-100 10 Hz -130 100 Hz -135 1 kHz	-110 10 Hz -140 100 Hz -150 1 kHz	-140 10 Hz -160 100 Hz -165 1 kHz
Features	▪ Smallest Miniature Atomic Clock ▪ CPT Technology for high reliability ▪ Low Power Consumption ▪ Replacement for Microchip CSAC SA.45s	▪ Compact Miniature Rubidium ▪ Sine wave ▪ Low cost ▪ Low power consumption ▪ PCB mountable ▪ Compatible with OCXO package	▪ AXRB1031 features ▪ 5 V Supply ▪ HCMOS output ▪ Replacement for Microchip SA.3Xm and SA5X	▪ High Stability ▪ RS-232 Interface for Control & Monitoring ▪ Replacement for obsolete Microchip X72 and SA.22c, but using standard connectors	▪ Very High Stability ▪ Ultra-Low Noise ▪ 1PPS & 10 MHz distribution amps integrated ▪ External 1PPS disciplining ▪ RS-232 Interface for Control & Monitoring
Supply	3.3 V / 1.5 W	12~15 V / 6 W	5 V / 6 W	12~18 V / 8 W	AC 230 V / 30 W
Size	45 x 36 x 14.5 mm THD Package	51 x 51 x 25 mm THD Package	51 x 51 x 25 mm THD Package	89 x 76 x 28 mm Connectorized	19” Rack - 1 HU

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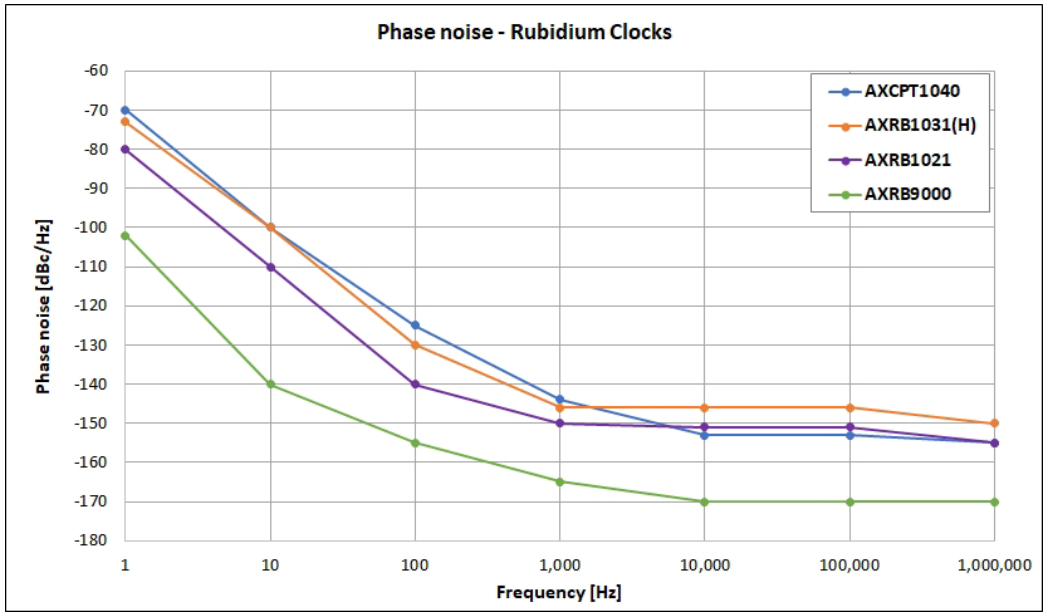
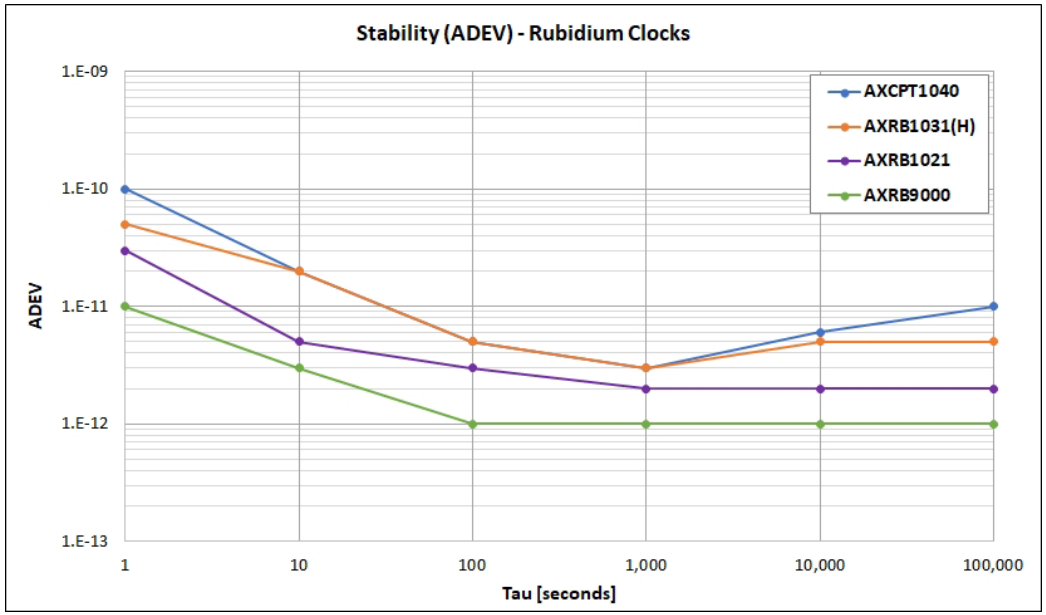
Rubidium Performance

Phase noise



Stability (ADEV)



See also our
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AXPLO10 & AXDA9200-CU for 10 MHz Phase Noise Clean-up

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MASTERCLOCKS

Customized Masterclocks for the most demanding Timing and Frequency Generation Systems

Expertise	AXTAL designs and manufactures fully-customized Masterclocks in accordance with your requirements. With our highest class of oscillators from Ultra-Low Noise OCXOs up to Atomic Clocks we offer supreme clock performance in a wide frequency range using state-of-the-art technology.
Applications	▪ Timing Systems for Particle Accelerators ▪ Ground Station Reference Systems for Space Applications ▪ Sophisticated Frequency Distribution Systems ▪ Frequency Conversion, Jitter Attenuation and Clock Translation ▪ Scientific Applications
Features	▪ Ultra-Low Phase Noise and Phase Jitter, Very High Frequency Stability ▪ Frequency Conversion and Synthesis up to 7 GHz ▪ Multiple Outputs for Synchronization & Frequency Distribution ▪ Monitor & Control Functions via RS-232, LAN or USB ▪ High Reliability (optional redundancy and watch-dog function)

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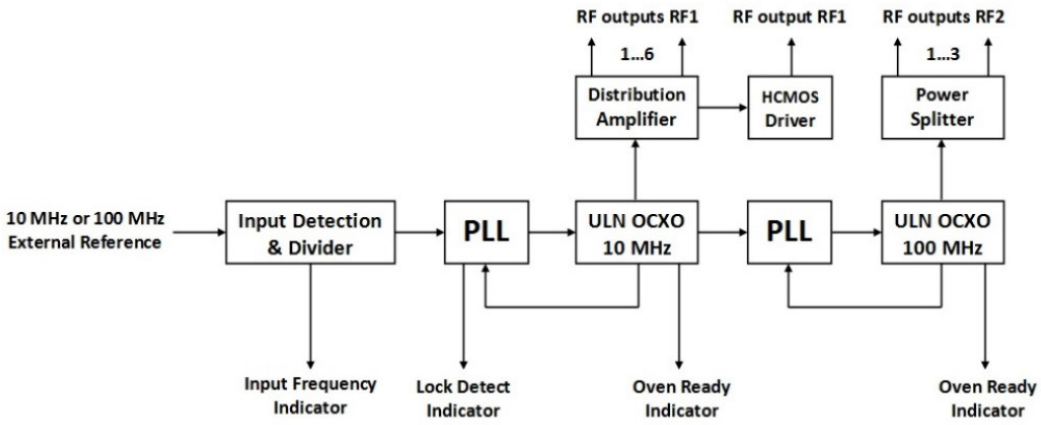
Performance Examples

AXPLO9000-21

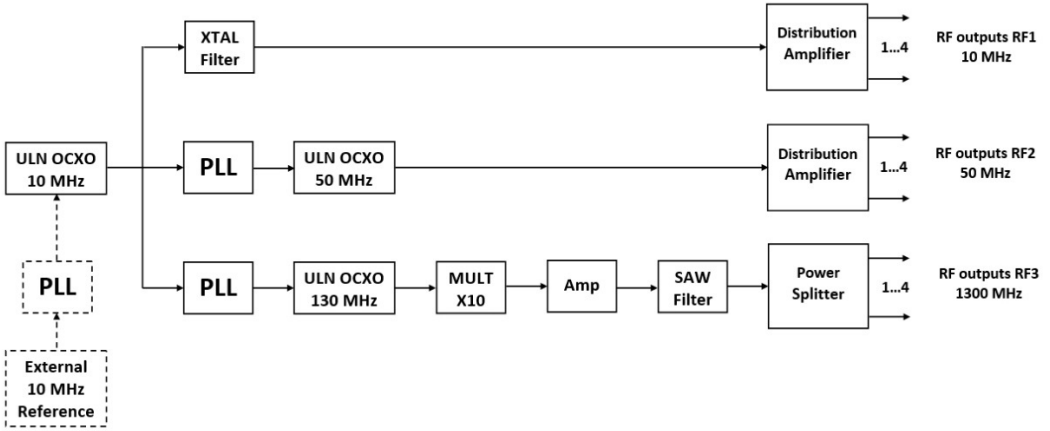


Masterclock with multiple Ultra-Low Noise Outputs at 10 MHz and 100 MHz

- All outputs are phase coherent
- Multiple outputs for 10 MHz and 100 MHz
- Very High Frequency Stability: 20 ppb/year (free-running)
- Ultra-Low Phase Noise (close-in and noise floor)
- Optional External Reference Input: 10 MHz or 100 MHz
- High Reliability for Safety Critical Application
- Phase noise performance:

10 MHz		100 MHz	
-112 dBc/Hz	1 Hz	-110 dBc/Hz	10 Hz
-142 dBc/Hz	10 Hz	-140 dBc/Hz	100 Hz
-157 dBc/Hz	100 Hz	-170 dBc/Hz	1 kHz
-167 dBc/Hz	1 kHz	-177 dBc/Hz	10 kHz
<-170 dBc/Hz	Floor	<-183 dBc/Hz	Floor

AXPLO9000-22



Masterclock with multiple Ultra-Low Jitter Outputs at 10, 50 and 1300 MHz

- All outputs are phase coherent (locked to 10 MHz)
- Multiple outputs for 10 MHz, 50 MHz and 1300 MHz
- Ultra-Low RMS Phase Jitter: **50 fs (1 Hz ~ 100 MHz)**
- Ultra-Low Phase Noise (close-in and noise floor)
- Optional External Reference Input: 10 MHz
- Monitor Interface
- Phase noise performance:

10 MHz		50 MHz		1300 MHz	
-118 dBc/Hz	1 Hz	-102 dBc/Hz	1 Hz	-75 dBc/Hz	1 Hz
-145 dBc/Hz	10 Hz	-115 dBc/Hz	10 Hz	-86 dBc/Hz	10 Hz
-160 dBc/Hz	100 Hz	-128 dBc/Hz	100 Hz	-105 dBc/Hz	100 Hz
-167 dBc/Hz	1 kHz	-163 dBc/Hz	1 kHz	-136 dBc/Hz	1 kHz
<-170 dBc/Hz	Floor	<-175 dBc/Hz	Floor	-150 dBc/Hz	10 kHz
				<-160 dBc/Hz	Floor

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