



# 4415

## Digital Cesium Frequency Standard

### KEY FEATURES

- Cesium Accuracy
- Microprocessor Control
- Comprehensive State of Health Indicators
- Remote Monitoring and Control Via Telemetry
- Low Power Ion Pump Only Mode
- Compact Size
- Qualified for Launch and Operation in Space
- Ten Year Operational Life

Symmetricom's 4415™ Cesium Frequency Standard is a compact, self-contained module that produces accurate, stable and spectrally pure sinusoidal signals. The 4415 satisfies system applications with stringent requirements for precision time and frequency in ground based satellite communication systems, telecommunications synchronization systems and satellite-based timing systems.

The instrument uses the technology of Symmetricom's 5045A, a second generation, microprocessor controlled, cesium module found extensively in commercial communications and timing applications. It combines the 5045A's capabilities with the ruggedness of a Symmetricom space qualified cesium to create a robust frequency standard with impressive performance that can also satisfy the need for extended life operation in space.

An environmentally hardened microprocessor supports the 4415's primary frequency lock loop servo and several background servos that control signal gain, level of interrogating microwave power and C-field. The 4415 exhibits virtually no environmental sensitivity.

Other key features include:

- Adaptive servos that compensate for temperature, aging and the effects of radiation
- Wide dynamic range circuits that provide long life without the need for external intervention
- Comprehensive diagnostics that continuously measure the state of the clock and digital telemetry of measured parameters
- Rugged mechanical construction will withstand launch conditions
- Comprehensive thermal design permits continuous operation in a vacuum environment
- Designed and constructed to withstand harsh radiation space environment
- Designed in reliability based on stress and worst case analysis performed
- Component rating in accordance with MIL-STD-1547
- Component selection in accordance with MIL-STD-1546B, MIL-STD-975 and PPL-21, Grade1
- MTBF of 350K hours per MIL-HDBK-217



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## 4415 Specifications

### ELECTRICAL SPECIFICATIONS

- Output accuracy: 1.0E-11
- Retrace (reproducibility): 2.0E-12
- Output frequency
  - Nominal (In-orbit frequency): 10.23 MHz
  - Adjustment range:  $\pm 1.0E-9$
  - Adjustment resolution: 1.0E-15
- Frequency change
  - Operating temperature:  $<5.0E-14/^\circ\text{C}$
  - DC magnetic field:  $<1.0E-12/\text{gauss}$
  - Power supply: 1.3E-13/Volt
- Stability – averaging time(s)
 

1	1.0E-11
10	6.0E-12
100	2.0E-12
1,000	6.0E-13
10,000	2.0E-13
100,000	6.0E-14
1,000,000	6.0E-14
- Additive SSB phase noise – (1 Hz Bandwidth) Offset from carrier
 

1	-85dBc
10	-110dBc
100	-140dBc
1,000	-150dBc
10,000	-155dBc

- Spectral purity
 

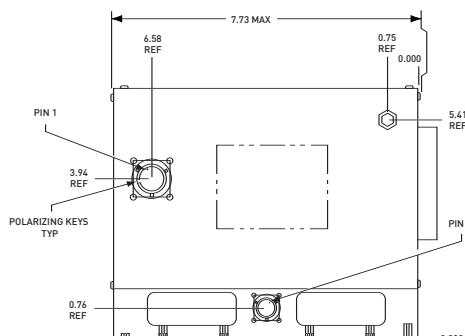
Harmonics:	<-30dBc
Spurious, 5 KHz – 10 MHz:	<-85dBc
Spurious, 10 MHz – 20 MHz:	-50dBc
- Sinusoidal RF-outputs
 

Amplitude:	18 $\pm 1.5$ dBm
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- Power requirements
 

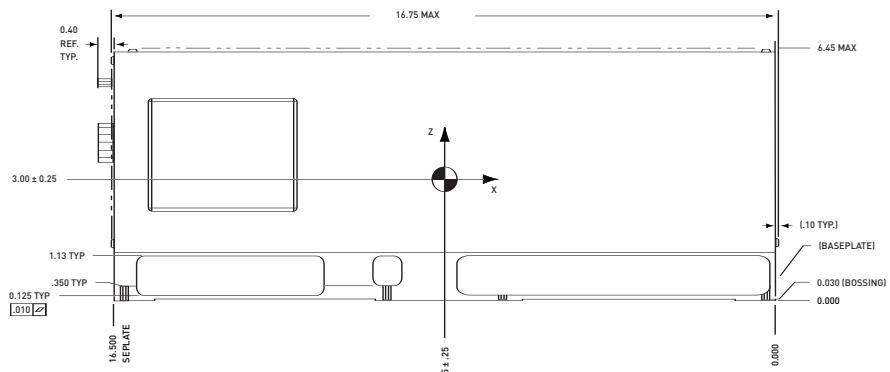
Input voltage range:	24 to 32 Volts
Warm up power:	50 Watts
Operating power:	33 Watts
- Dimensions
 

Height:	6.25" (15.87 cm)
Width:	7.5" (19.05 cm)
Depth:	16.50" (41.91 cm)
- Environmental
 

Operating temperature:	10°C to 40°C
Radiation:	100 Krad (Si)
Random vibration:	12gs rms
- Weight: <33 lbs. (15.1 kg)



Front View



Side View



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