

Low Noise Master Oscillator LNMO

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Introduction

In 2010, the European Space Agency (ESA) has identified the need for an European Master Oscillator ITAR free solution with improvement of phase noise behavior and qualified against space environment. SpectraTime successfully proposed a competitive design based on SC-cut crystal oscillator and a contract for development and qualification test was signed. After a short overview of the LNMO design, this paper presents the test results of the qualification tests conducted at the end of the development in 2012/2013. The objective was to validate the design of the Low Noise Master Oscillator versus space environment. The final results demonstrate the full compliance with the ESA requirements.

LNMO electrical design overview

Crystal definition

In order to reach all the LNMO specified performances, a SC cut overtone 3 swept is selected as crystal resonator, the preference is given to the crystal in the HC37U holder.

Oscillator and power amplifier

- Colpitts oscillator buffered by a common base stage
- Common base output power amplifier

The final scheme is selected to have the best phase noise results.

Voltage regulation

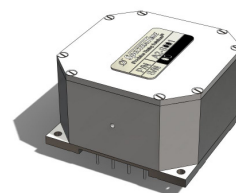
The voltage regulation uses a Zener reference diode filtered by a low pass filter and buffered by an operational amplifier and a transistor. The voltage regulation is completed with low pass RC filter at each stage level.

Oven loop regulation

The oven loop is a proportional integer regulation in order to generate a larger gain in the loop without oscillation and minimize the loop error.

LNMO Mechanical design overview

The external dimensions are 50 x 50 x 30 mm without the electrical connections. The mass is 100 g.



Qualification test performed on LNMO EQM Model

For the qualification and characterisation under simulated space environment, 6 EQM have been manufactured and have been split in two groups:

- one group dedicated to radiation tests
- one group dedicated to environmental tests