

NATIONAL RADIO ASTRONOMY OBSERVATORY
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MEMORANDUM

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SUBJECT: Patent Application

We have invented a technique to generate high-level broadband millimeter-wave noise. The noise source can be used in many millimeter-wave applications. It has a potential market in millimeter-wave electronics, material evaluation and characterization, and, in particular, in the Fourier Transform Infrared Spectrometer (FT-IR) industry. The purpose of this memo is to request that AUI/NRAO consider filing a patent application for this invention.

Currently, there are no usable high-level noise sources available in the 3.5 to 10 wavenumbers (100 to 300 GHz) range. We invented this noise source mainly for testing and calibrating ALMA band 3 (86-116 GHz) and ALMA band 6 (211-270 GHz) SIS receivers and materials. As shown in Figure 1, it consists of a microwave solid-state noise source followed by microwave power amplifiers, a frequency multiplier and a feed horn. Initial evaluation of this noise source has revealed the following useful features:

1. The noise source uses only solid-state and waveguide components, is reasonably compact, affordable and practical for most millimeter-wave applications.
2. It can be operated using the standard bench-top DC power supplies.
3. The noise source can be switched on and off electronically.
4. It has good stability, repeatability and reliability.
5. As shown in Figure 2, one source can cover a multi-octave band (2 to 15 wavenumbers, *i.e.*, 60 to 450 GHz).
6. It produces an extremely high level of noise, roughly two orders of magnitude higher than the noise emitted from the standard Mercury arc lamp.
7. The technique can be applied to generate high-level noise into the Terahertz range (30 wavenumbers and higher).

There are thousands of FT-IR spectrometers currently being used worldwide. Due to the lack of available sources in the millimeter-wave range, these instruments are usually not operable below 300 GHz. The noise source we invented will, for the first time, open the entire millimeter-wave spectrum for users of FT-IR spectrometers, making the FT-IR spectrometer an extremely powerful research and development tool which can be used in many industries. Therefore, we believe the Observatory should consider filing a patent application for this invention.

S.-K. PAN 4/29/97
REV. 12/7/00

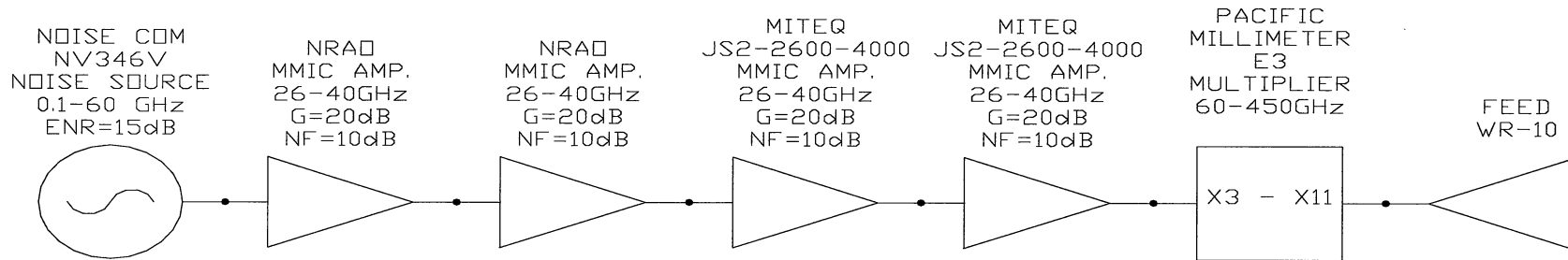


Figure 1. Block diagram of the solid-state millimeter-wave noise source.

Bruker IFS 66V FTS

— Mercury arc lamp 10mm dia aperture — Solid state source W3 6mm aperture
— Solid state source E3 6mm aperture — Solid state source E3 10mm aperture

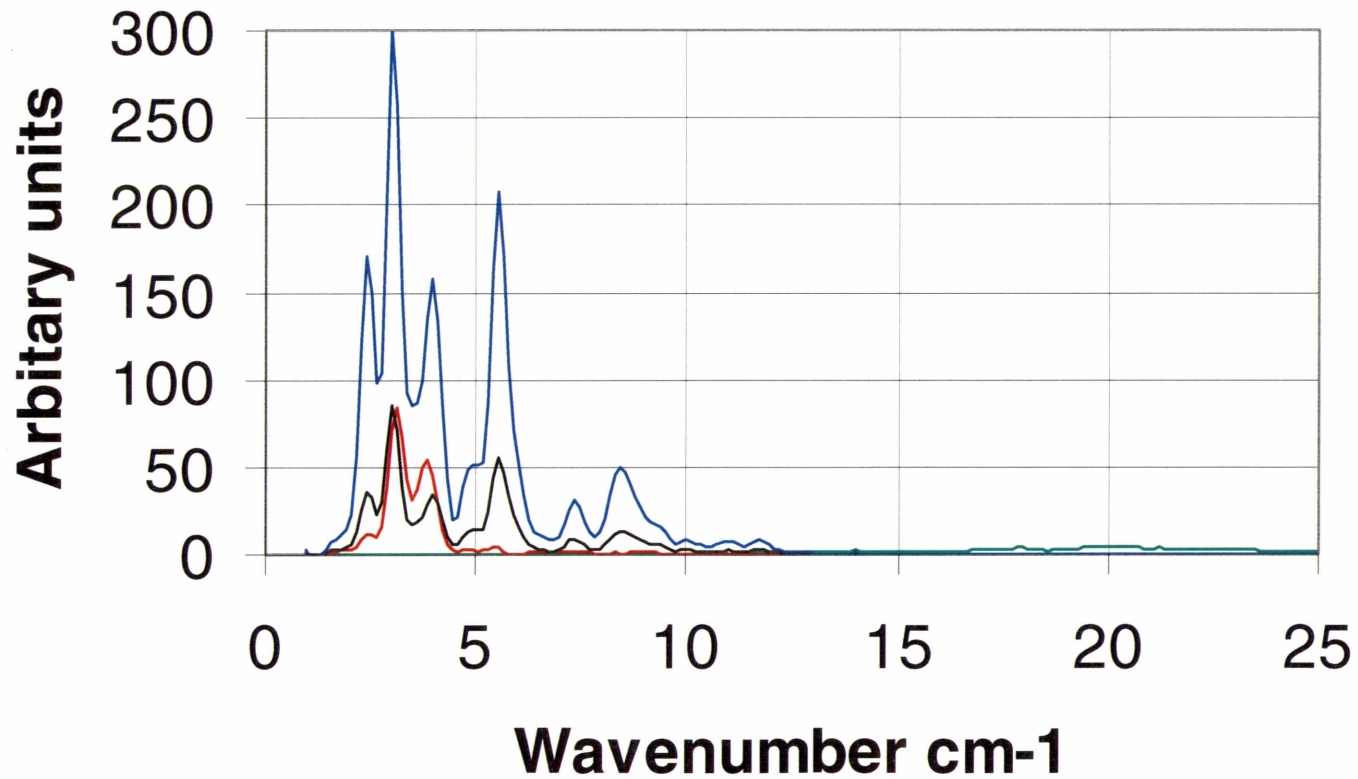


Figure 2. Comparison of output of the noise source with mercury arc lamp.