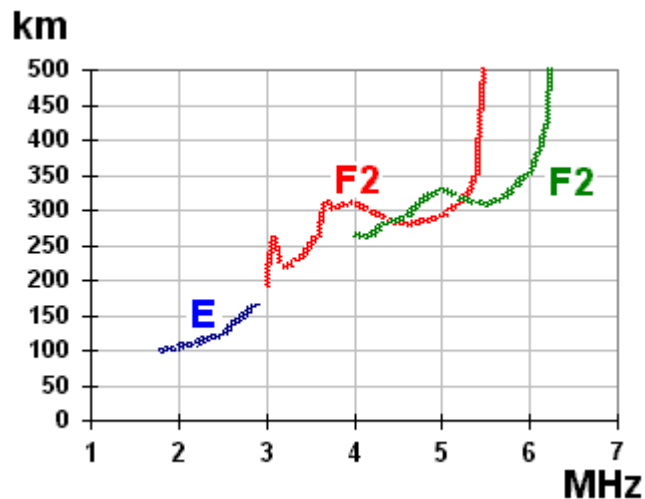


PFRR Digisonde

RF Experiment Narrative

The DPS4D is a digital ionosonde device, called a Digisonde. The Digisonde sends short pulses of RF energy in a vertical direction into the ionosphere. These pulses are sent at various frequencies throughout the shortwave bands. The magnetic and electrical conditions of the ionosphere determine which frequencies are returned and which are absorbed. A typical ionosonde produces an output called an ionogram:



The DPS4D Digisonde is a very sophisticated version of the ionosonde, which provides additional information such as directionality, MUF (Maximum Useable Frequency) and TEC (Total Electron Content). Obviously these ionospheric effects are very localized, thus the requirement for multiple instruments. Because these instruments span such a large frequency band, special care must be taken to avoid interference with other radio services.

In the USA the licensing of Ionosondes is described by the National Telecommunications and Information Administration (NTIA) "Manual of Regulations and Procedures for Federal Radio Frequency Management (the so-called "Red Book") , */May 2010 Revision of the January 2008 Edition/*". This can be found online at: <http://www.ntia.doc.gov/osmhome/redbook/redbook.html> Specifically, sections 2.3.8 and 8.2.21-8.2.22 and 9.2.2 pertain to sounders.

Below is a list of currently operating Digisonde stations operating within the USA.

USAF, Millstone Hill, MA	USAF, Alpena, MI	USAF, Wallops Island, VA
USAF, Eglin AFB, FL	U. of Florida, FL	Idaho National Lab, ID
NOAA, Boulder, CO	U. of Texas, Austin, TX	USAF, Lualualei, HI
NOAA, Ramey AFB, PR	USAF, Eareckson AFB, AK	USAF, Eielson, AFB, AK
USAF, Kwajalein, Marshall Islands		USAF, Wake Island
USAF, Guam	U. of Alaska, HAARP, Gakona, AK	

The Lowell DPS4D digisonde is compliant with all current FCC requirements, including the ability to selectively turn off certain frequencies should RF interference occur.

In addition to these, there are currently more than 50 ionosonde systems operating internationally.

The University of Alaska has been operating the Gakona system for several years without incident. The proposed PFRR system will also be operated by University of Alaska personnel.

Science Justification

An ionosonde system for multipoint measurements of the Arctic space environment during a historic solar cycle.

a) Support of operational systems including shortwave radio communications and OTH radar systems. This support can be in the form of predictions of propagating frequencies at given times and locations in the future (i.e. over the ensuing month) or provision of real-time updates. (Updated as often as 15 minutes) to detect current conditions so that system operating parameters can be optimized

b) Scientific research to enable better predictions of ionospheric conditions and to understand the plasma physics of the solar-terrestrial interaction of the earth's atmosphere and magnetic field with the solar wind.

The areas of research pursued by users of the more sophisticated features of the Digisonde sounders include polar cap plasma drift, auroral phenomena, equatorial spread-F and plasma irregularity phenomena and sporadic E-layer composition. [Buchau et al., 1985; Reinisch 1987 and Buchau and Reinnisch 1991]. There may be some driving technological needs (e.g. commercial or military uses) in some of these efforts, but many are simply basic research efforts aimed at better understanding the manifestations of plasma physics provided by nature.

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