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HIGH FREQUENCY ACTIVE AURORAL RESEARCH PROGRAM

University of Alaska Fairbanks
GEOPHYSICAL INSTITUTE

Date: August 3, 2022

To: Amateur Radio & Radio Astronomy Communities

From: HAARP Program Office

Subject: Notice of Transmission

The High-frequency Active Auroral Research Program (HAARP) will be conducting a research campaign from Aug. 8 to Aug. 14, with operating times specified in the table below. Operating frequencies will vary, but all HAARP transmissions will be between 2.8 MHz and 10 MHz. Actual transmit days and times are highly variable based on real-time ionospheric and/or geomagnetic conditions. All information is subject to change.

This campaign is being conducted in support of the 2023 Polar Aeronomy & Radio Science Summer School. Some examples of the experiments are generation of artificial field aligned irregularities, scintillation at VHF and UHF in an artificially altered ionosphere, mapping of the auroral electrojet structure, modulation of the conductivity of the D-region ionosphere, and production of SLF, ULF and VLF emissions by pulsing the HAARP HF transmission on and off. Experiments benefiting from amateur radio support or having citizen science applications are noted below.

Date	Aug. 8	Aug. 9	Aug. 10	Aug. 11	Aug. 12	Aug. 13	Aug. 14
Times (UTC)	1800-0400	1900-0530	2030-0500	*Inactive*	1630-0130	2030-0730	2030-0730

Ghosts In The Airglow (GITAG) – The final part of a three-part transmission art project funded by the Canada Council for the Arts, mixing audio and images at the boundary between Earth's atmosphere and outer space. For Composition No. 3, Christie has invited contributions from other artists including, Vladyslav Atavin, José Alejandro Rivera, Sarah Nance, Rasu-Yong Tugen, Geneviève D'Ortun, and T. D. Walker. This composition also includes Morse code transmissions created by turning the HAARP pulse on and off. Another new experiment being tried in this composition is the creation of a drawing in the waterfall.

As a citizen science experiment to learn more about propagation, shortwave listeners from around the world are invited to tune in and submit reception reports in exchange for QSL cards. Transmission frequencies will be listed on the project's new website www.ghostsintheairglow.space, and reception reports can be submitted using the online form which is also on the website. For those who do not have access to shortwave radio equipment, the project will also be streamed live on the home page of the project's website. There are frequently two frequencies transmitted simultaneously, and as such there are two videos embedded side by side (one for each frequency) that can be viewed simultaneously.

A supplement accompanies this Notice of Transmission that provides general information for HAARP Radio Enthusiasts as well as some information on the application of software defined radio receivers in detecting, demodulating and monitoring HAARP transmissions.

For more information on PARS, please see: https://www.uaf.edu/news/polar-aeronomy-and-radio-science-summer-school-returns-to-haarp.php

For updates on ionospheric conditions in Gakona, please consult ionograms from the HAARP Diagnostic Suite: https://haarp.gi.alaska.edu/diagnostic-suite

Supplement to HAARP Notice of Transmission

General Information for HAARP Radio Enthusiasts:

1) The HAARP Ionospheric Research Instrument (IRI) transmits only in the frequency range 2.695 to 9.995 MHz, with certain frequencies blocked out as specified in the FCC license for call sign WI2XFX. The emission bandwidth may be up to 46 kHz wide depending on the frequency and experiment.
2) The types of modulation vary with the experiment requirements. Some emission designators are 16K0M0N, 26K0P0N, 40K5A3N, 43K0H0N, 46K0F3N, and 46K0N0N. Emission designators are not specified in HAARP experiments.
3) Most experiments depend on ionospheric and geomagnetic conditions that are mostly unpredictable. The transmission frequencies for a given experiment may change to track changes in those conditions with little or no notice.
4) A scheduled experiment that depends on certain ionospheric or geomagnetic conditions may be rescheduled or cancelled if the required conditions do not occur.
5) The IRI may be setup to simultaneously transmit two modulated or unmodulated carriers depending on the experiment requirements.
6) *To request a HAARP QSL card*, send reception reports to: HAARP, P.O. Box 271, Gakona, Alaska 99586 USA. Please note that due to the volume of requests received, it may take some time to respond to your request.
7) Additional information can be found on the HAARP webpage at: https://haarp.gi.alaska.edu/

Monitoring HAARP IRI transmissions with a Software Defined Radio Receiver:

1) Listeners with an SDR receiver capable of 8 MHz bandwidth can monitor the entire frequency band noted above;
2) Most IRI transmissions *Start* and *End* on the minute; that is, when HH:MM:SS = HH:MM:00, where HH is the UTC hour, MM is the minute and SS is the second;
3) When a carrier is seen to pop up on the SDR's displayed spectra, the listener can identify the center frequency using the SDR software and then reduce the bandwidth to further monitor, demodulate or analyze the signal;
4) If two SDRs are available, one can be used in a wideband mode to locate the signals and the other can be used in a narrowband mode to analyze, demodulate or monitor the signals;
5) Since the maximum emission bandwidth is 46 kHz (±23 kHz), SDRs with a 50 kHz bandwidth setting are able to monitor the entire modulated signal after it is located. The center frequency may be stepped through a range of frequencies or may change according to experiment requirements to another, far removed frequency;
6) Not all experiments use the full 46 kHz bandwidth, some use only a pure carrier and some use single sideband;
7) Radio propagation conditions and the IRI beam direction will affect the reception of the IRI transmissions or cause a fadeout at the receiver location. Propagation conditions and beam directions can change significantly and rapidly during an experiment;
8) Some experiments require the IRI beam to be pointed along the local magnetic zenith. This means the beam is pointed parallel to the local magnetic field lines, or approximately 75° elevation and 16° east of north;
9) Although the HAARP IRI transmits only in the HF range (see above), the transmissions can and some experiments are designed to generate SLF, ULF, and VLF emissions in the D/E-region ionosphere. Modulated heating of the D/E-region electrons by the HF transmissions in turn modulates the plasma conductivity, which generates a *virtual antenna* at altitudes between 70 and 85 km. Emissions up to 20 kHz have been demonstrated but most are below a few kilohertz. These low frequency emissions can propagate in the Earth-Ionosphere Waveguide or by other mechanisms, depending on frequency, and conceivably can travel great distances.