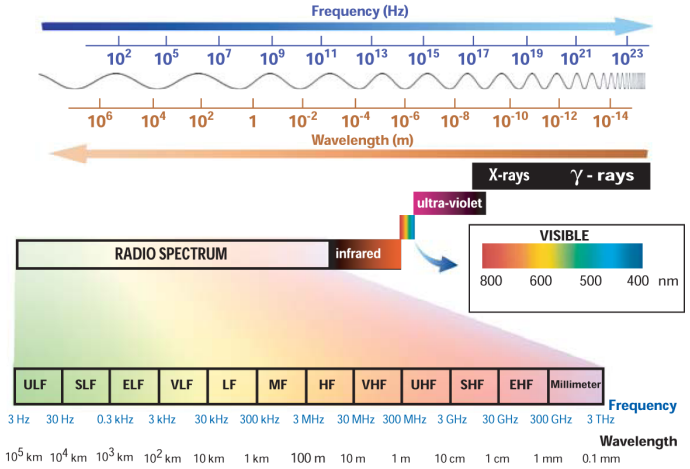
The electromagnetic spectrum

Electromagnetic waves carry electromagnetic energy through space. In empty space, they propagate at the speed of light. The basic properties (defined by Maxwell's equations) are identical over all of the electromagnetic spectrum that has been investigated so far, i.e., from millihertz to 10^{24} Hz. Each decade of the electromagnetic spectrum below the millimeter-wave range of frequencies (10^{12} Hz) is divided into designated ranges, with their acronyms indicated below. The URSI domain of activities stops slightly above 10^{14} Hz (optical communications).



ULF = Ultra Low Frequency
Geophysical prospecting

SLF = Super Low Frequency
Power transmission
Submarine communication

ELF = Extremely Low Frequency
Telephone
Audio
geophysics

VLF = Very Low Frequency
Navigation
Positioning
Naval communication

LF = Low Frequency
Radiobeacons for aircraft
Standard frequency and time signal

MF = Medium Frequency
Maritime communication
Radio broadcasting (AM)
Radiobeacons for aircrafts
Amateur radio

HF = High Frequency
Maritime communication
Aeronautical communication
International short wave comm.
Amateur radio

VHF = Very High Frequency
TV boadcasting
Air traffic control communication
Radio broadcasting (FM)
Amateur radio
Mobile communication
Police communication

UHF = Ultra High Frequency
Cellular phone
Taxi radio
TV broadcasting
Mobile satellite communication
Radar

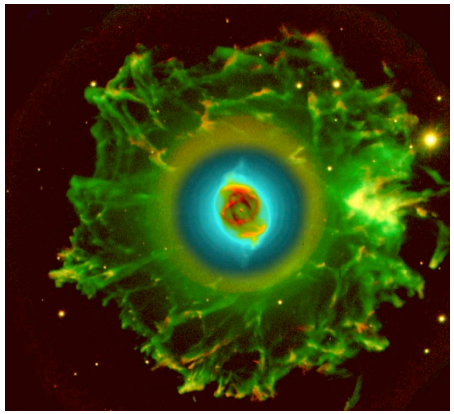
SHF = Super High Frequency
Satellite communication
Satellite broadcasting
Radar
Radio astronomy
Radio LAN

EHF = Extremely High Frequency
Radio astronomy
Satellite communication
Fixed wireless access
Radar
Remote sensing

Millimeter
Astronomy
Meteorology

IR = infrared
Heating
Night vision
Optical communication

Visible light
Optical communication



For more information, including contact addresses, please visit the SNRV website

www.radiovetenskap.kva.se

Illustrations:
Aurora Borealis - Torbjörn Lövgren IRF
Electromagnetic spectrum - URSI
SAQ - Gustaf Björkström Länsmuseet Varberg
A star is dying - Chalmers/OSO
APEX, Atacama Pathfinder EXperiment - Chalmers/OSO

SNRV

Svenska Nationalkommittén för Radiovetenskap

The Swedish National Committee of URSI

KUNGL. VETENSKAPS-AKADEMIEN
THE ROYAL SWEDISH ACADEMY OF SCIENCES

U.R.S.I.

International cooperation – URSI

The International Union of Radio Science (URSI, Union Radio-Scientifique Internationale) was founded in 1919, i.e. the early days of radio telegraphy. Since that time radio science has matured to encompass the fields of radio, telecommunication and the electronic sciences, all of which have dramatically altered modern life. A number of Nobel prizes have been awarded to scientists actively involved i radio science; the Swedish laureate Hanne Alfvén was awarded the physics prize in 1970.

The objective of URSI is to stimulate and to coordinate, on an international basis, studies in the fields of radio, telecommunication and electronic sciences through scientific and technical symposia and publications and by organizing and participating in international scientific committees. Radio, television, cellular telephones, computers and the Internet all have developed from the fields of science associated with the URSI Commissions.

Swedish activities – SNRV

The Swedish National Committee of URSI (SNRV, Svenska Nationalkommittén för RadioVetenskap), was founded by the King in Council in 1931. For SNRV, working under the auspices of the Royal Swedish Academy of Sciences (Kungl Vetenskapsakademien, KVA), statutes are laid down to promote research and education within its discipline, in particular by

- representing Sweden in URSI
- cooperating with neighbouring science disciplines
- advising universities on research and education matters
- being an expert body to KVA

KVA appoints about 20 members, scientists and engineers, for a term of three years. SNRV may appoint honorary and co-opted members, at present over a hundred, to ten sections serving as important networks for information and cooperation. The predominant activities of SNRV lie within these sections. The SNRV section chairs are officials in the URSI Commissions.

Transatlantic radio communications have changed since 1925; the preelectronic and still working VLF station SAQ at Grimeton, UNESCO world heritage, has been superseded by the mobile phone.

SNRV cooperates with the Nordic Radio Society (NRS, Nordiska RadioSamfundet), a foundation with the purpose of stimulating radio communication research, development, systems design and equipment production. The NRS overall aim is to keep the Nordic countries amongst the world-leading nations within the field. NRS was founded in 1985.

To fulfil their mission, SNRV and NRS sponsor conferences, symposia, seminars and workshops. Since 1949, SNRV har arranged the multidisciplinary RVK (Radio-Vetenskaplig Konferens, later renamed RadioVetenskap och Kommunikation). NRS har arranged events since 1986.

URSI Commissions – SNRV Sections

A. The **Electromagnetic Metrology Commission** promotes research and development in the field of measurement standards, calibration and measurement methodologies. The commission fosters accurate and consistent measurements to support research, development and exploitation of electromagnetic technologies across the spectrum.

B. The **Fields and Waves Commission** studies the behavior of electromagnetic fields in a general sense. Its research focuses on analytical, numerical and measurement techniques to understand electromagnetic phenomena. Practical projects are the development of antennas and antenna arrays and the propagation of waves in special materials.

C. The **Radio-Communication Systems and Signal Processing Commission** investigates techniques to transport information along telecommunication systems by studying new radio access and protocols as well as signal and image processing techniques for many kinds of communications systems such as mobile phones, telecom networks and wireless broadband.

D. The **Electronics and Photonics Commission** concentrates on electronic and photonic devices permitting the development of the digital computer, television and mobile communications. Examples of such devices are semiconductor lasers, optical fibers and integrated circuits.

E. The **Electromagnetic Environment and Interference Commission** deals with noise and interference, natural or man-made, which have effects on the performance of electronic systems such as computers, control systems, radio, TV and navigation instruments. Due to our increasing dependence on electronic systems, deliberately caused interference, Intentional EMI, is receiving special attention.

F. The **Wave Propagation and Remote Sensing Commission** encourages research on electromagnetic wave propagation through the various layers of the geosphere and biosphere. Remote-sensing techniques use satellites to probe and monitor our environment (air, sea, land and vegetation).

G. The **Ionospheric Radio and Propagation Commission** focuses on the propagation of electromagnetic waves in this medium and in ionized media in general. Space weather influences the ionosphere in many ways having adverse effects on telecommunication and navigation.

H. The **Waves in Plasmas Commission** studies the generation, propagation and interactions of waves in space plasmas. Being electrically conducting, the ionosphere strongly affects electromagnetic waves passing through it. Of particular interest is the interaction of low-frequency natural and artificial electromagnetic waves with the medium such as the ionosphere and radiation belts.

J. The **Radio Astronomy Commission** is concerned with the observation and interpretation of radio emissions from celestial objects and the technology and techniques involved. One of its tasks is to support efforts to ensure that radio observations are free from man-made interference.

K. The **Electromagnetics in Biology and Medicine Commission** studies the interaction of electromagnetic fields with biological systems. e.g. the exposure to electromagnetic radiation from radar, power lines or cell phones. These effects may be harmful, but also bear great potential in medical use.