Input/output data for the ASAPS kernel V1.3 software

Input Data

The input data that the ASAPS kernel requires from the User, in order to perform propagation calculations, are:

1. The date for which the calculation is required.
2. The locations of the transmitting and receiving antennas.
3. The T index (equivalent sunspot number) for the prediction.
4. A set of specified frequencies for testing.
5. The minimum acceptable takeoff angle for the propagation modes.
6. The transmitter output power in watts.
7. The receiver bandwidth in hertz.
8. The required SNR for the specified receiver bandwidth.
9. The environmental noise spectral density at 3 MHz for calculating the total noise at receiver location. This is specified by either a numerical value in units of dBW/Hz, or by an integer index between 1 and 4 that indicates one of the four ITU-R categories (business, residential, rural, quiet rural), or by a value of 0 which indicates that the environmental noise is to be set to –204 dBW/Hz, i.e., effectively ignored.
10. The minimum percentage probability of ionospheric support for the propagation modes.
11. The antenna gain patterns for the transmitting and receiving antennas. Each of these patterns consists of a two-dimensional array of gain values, for a set of frequencies and radiowave takeoff angles, in the direction of the bearing between the antennas. The data for these patterns consist of:
    i. An antenna frequency set, which does not need to be the same as the frequencies for the calculations.
    ii. A set of antenna takeoff angles.
    iii. The antenna gain values (in units of dBi) for each antenna frequency and takeoff angle.

    If the antenna is isotropic, the gain is 0 dBi for all angles so no gain pattern data are required.

All of these input data are passed to the ASAPS kernel through C++ data structures.

Output Data

The output data, which are available to the User from the ASAPS kernel, are:

1. The ground range and bearings between the two terminals of the circuit.
2. For each of the specified frequencies:
    i. The frequency value.
    ii. The radio noise power density at the receiver.
3. For each propagation mode supported by the ionosphere:
    i. The mode identifier (e.g., 1E, 2F, etc.);
    ii. The Upper Decile Frequency (UDF), i.e., the frequency with a 10% probability of ionospheric support;

iii. The median Maximum Usable Frequency (MUF), i.e., the frequency with a 50% probability of ionospheric support;

iv. The Optimum Working Frequency (OWF), i.e., the frequency with a 90% probability of ionospheric support;

v. The Absorption Limiting Frequency (ALF), i.e., the lower limit of the usable frequency band, taking into account signal attenuation due to absorption (and the effects of E-layer screening for F modes);

vi. The radio noise power density at the UDF, MUF, OWF and ALF at the receiver;

vii. For each of the specified frequencies:

    1. The probability of ionospheric support;
    2. The elevation angle of the emitted radiowave;
    3. The total pathloss between the two terminals of the circuit;
    4. Group delay between the two terminals of the circuit;

    If a frequency is not supported by the ionosphere, the probability, elevation angle and pathloss values are set to zero and the group delay is set to a negative value.

4. For the Best Usable Frequency (BUF) from the specified frequency set:

    i. The BUF mode identifier (e.g., 1E, 2F, etc.);

    ii. The BUF frequency value;

    iii. The BUF probability of ionospheric support;

    iv. The BUF signal-to-noise ratio, takeoff angle, pathloss and group delay;

    v. The BUF radio noise field strength (in dBμV/m/Hz x 100) at the receiver;

    vi. The UDF, MUF, OWF and ALF for the BUF mode;

    vii. The radio noise power density at the UDF, MUF, OWF and ALF for the BUF mode.

All of these parameters are in C++ data structures.