Calculation of Inductive Loop Interference Range (CILIR)

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This program calculates the interference range of an inductive loop system from the measured magnetic field strength at a given measuring range according to the propagation model given in the ERC Report 069.
For the calculation data about the groundwave propagation from the ITU-R Recommendation PN.368-7 has to be entered, as well as the noise field strength, which has been derived from the ITU-R Recommendation P.372. These data is supplied with this program in two graphics.

The program is written in ANSI C and is, as source file, platform independent. Compiled versions are available for the Acorn RISC OS and for DOS-PC platforms.
The application consists of the following files:

DOS/Windows version: CILIR110.EXE
CILIR110.C
Manual.pdf
E_1kW.pdf
Noise.pdf

MANUAL

The following **input** data are requested by the program:

1. `Do you want to save the result in a logfile,`

   `which can be imported in a text editor for printing,(y/n)?.`

   When typed in "y" or "Y" the program will output a logfile with the filename "LOGFILE". If necessary the filename can be renamed afterwards, or transferred to a different directory.

The following data are retained in memory. In the next calculation run these values are displayed as default values, which can be entered by only hitting "ENTER" or "RETURN".

2. `Input frequency in kHz.`

   The working frequency of the inductive loop system.

3. `Input the magnetic field strengthlimit in dBµA/m.`

4. `Input the measuring distance in meter.`

5. Is the victim receiver at groundlevel (groundwave propagation)(Y), or airborne (free space propagation) (N)?

In case of groundlevel:

6. Input E_1kW@1km according ITU-R PN.368-7.

This is the asymptotic field strength value according ITU-R PN.368-7 that a 1 kWerp transmitter generates at a distance of 1 km by the given type of ground and frequency. It can be derived from table 1 (file E_1KW.HTM or E_1KW.CSV) by interpolation, or from figure 1 (file E_1KW. GIF or E_KW.WMF). In the propagation model this parameter is called "$E_{asymptote,40}$". A type of ground has to be choosen.

In the generic case "Land" is appropiate.

The 20 to 40 dB/decade roll-off transition distance is calculated from the difference between the 1 km values of *E_1kW*, which is on the 40 dB/decade asymptote, and *E_1kW_asymptote* (=109.5 dBµV/m), which is on the 20 dB/decade asymptote.

In case of airborne question 6 is skipped.

7. Is the interference range limited by a service defined interference level (Y), or by the noise level (N):

For some radio services, e.g. the broadcasting service, a maximum interference level is known, or can be derived from a garanteed minimum field strength and required Signal/ Noise Ratio. (Question 8).
For the other services a noise level has to be entered. (Question 9).

8. Input the max. acceptable interference level in dBµV/m:

Or:

9. Input E_noise in 2.7 kHz bandwidth in dBµV/m.

The noise field strength, derived for a bandwidth of 2.7 kHz from the data of CCIR 322-3 and CCIR 258-4. These field strength levels are collected in figure 2 (file NOISE.GIF or NOISE.WMF).
A choise has to be made for the high "80%", medium "50%", or low "20%" level, or one of the environmental manmade noiselevels, depending on the type of radio service which has to be protected.

10. Input the bandwidth of the victim receiver in Hz.

The actual bandwidth of the receivers of the radio service must be entered here. For SSB telephony the correct value is 2.7 kHz. For most telegraphy and data communication modes smaller bandwidths are used, while for shortwave broadcasting a bandwidth of 5 kHz is appropiate.

11. `Is the interference broadband (Y), or single frequency (N)?.`

The characteristics of the interfering inductive loop signal, especially the bandwidth, can be an important factor. The field strength level, as given in 3, is determined using a measuring receiver with quasi-peak weighting and a bandwidth of 9 kHz (200 Hz in the range 9 - 150 kHz).
In a victim receiver, with a smaller bandwidth than that of the measuring receiver, less interfering signal power is received in case that the interfering signal has a bandwidth wider then the actual receiver bandwidth. Also the detector in the victim receiver may have a response which is depending on the characteristics of the interfering signal.
To a limited extend these effects can be compensated for by adding a *bandwidth ratio* factor in dB to the noise level.
In the generic case, or when the bandwidth of the interfering signal is not wider than the victim receiver bandwidth, or in case of an unmodulated carrier, *single frequency* should be entered. In that case 0 dB is used as bandwidth ratio factor.

Output

1. In case of groundwave:

```
The 20/40 dB/decade transition distance :....  m.
```

2. In case of broadband interference:

```
Broadband interference; bandwidth ratio: ....  dB.
```

3. `The field strength at the measuring position is maximal in the coplanar direction.`

or

`The field strength at the measuring position is maximal in the coaxial direction.`

Depending on whether the measuring distance is longer or shorter than 2.354 * the radian wavelength.

4. Magnetic dipole moment.

The equivalent magnetic dipole moment, calculated from the magnetic field strength at the measuring distance.

5. The Effective radiated power.

The effective radiated power, calculated from the magnetic dipole moment and the frequency, expressed in dB over 1 kW, as well as in nanowatts.

6. The interference range extends into the 40 dB/dec. range.

or

The interference range is limited to the 20 dB/dec. roll-off range.

The interference range is between 2.354*radian wavelength and the 20->40 dB/decade transition distance.
or

The interference range is close to the near field range.

The interference range is between the radian wavelength and 2.354*radian wavelength.

or

The interference range is inside the near field range.

The interference range is smaller than the radian wavelength.

7. The groundwave interference range.

or

The free space interference range.

The result of the calculation.

8. Do you want to do another calculation (Y), or to exit (N):

By entering "Y" the calculation will start again. The formerly entered values will act as default values in the next calculation.

Copyright position.

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