Introduction in SEAMCAT

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Introduction in SEAMCAT

- SEAMCAT Project
- What is SEAMCAT?
- What SEAMCAT is NOT?
- Simulation sequence
- Applicability of SEAMCAT

Spectrum engineering challenges

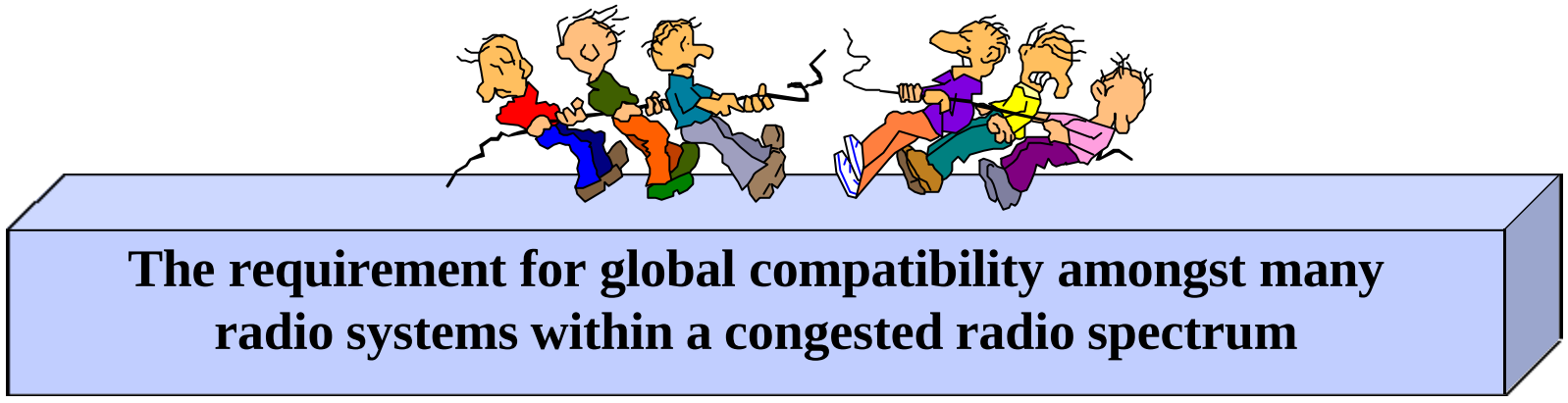
increasing penetration of the existing radio applications

introduction of new radio applications

regulatory

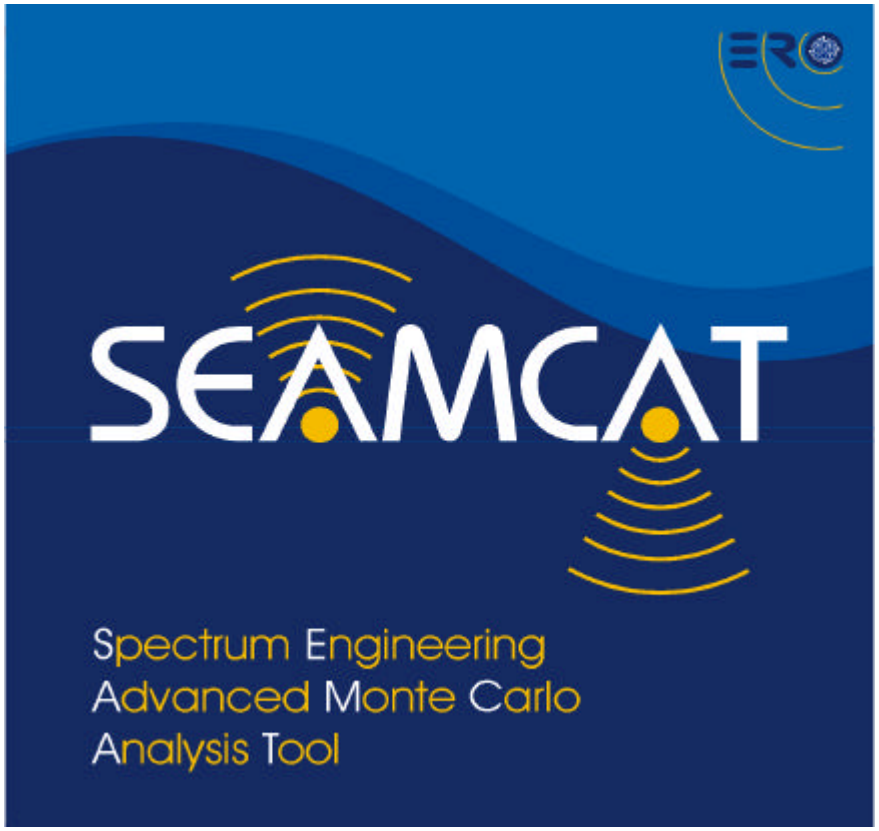
technological

economic considerations

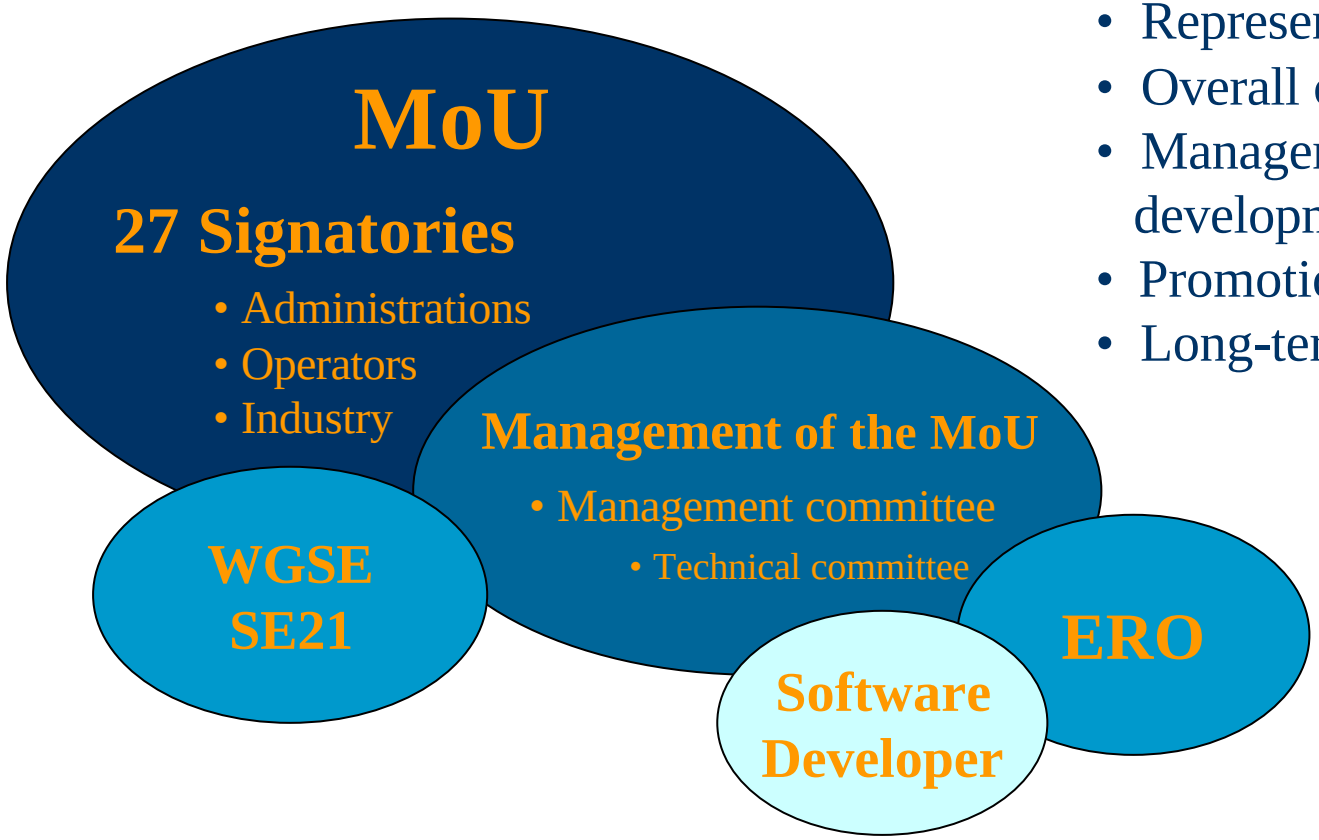


The requirement for global compatibility amongst many radio systems within a congested radio spectrum

Solution ?


SEAMCAT
Spectrum Engineering
Advanced Monte Carlo
Analysis Tool

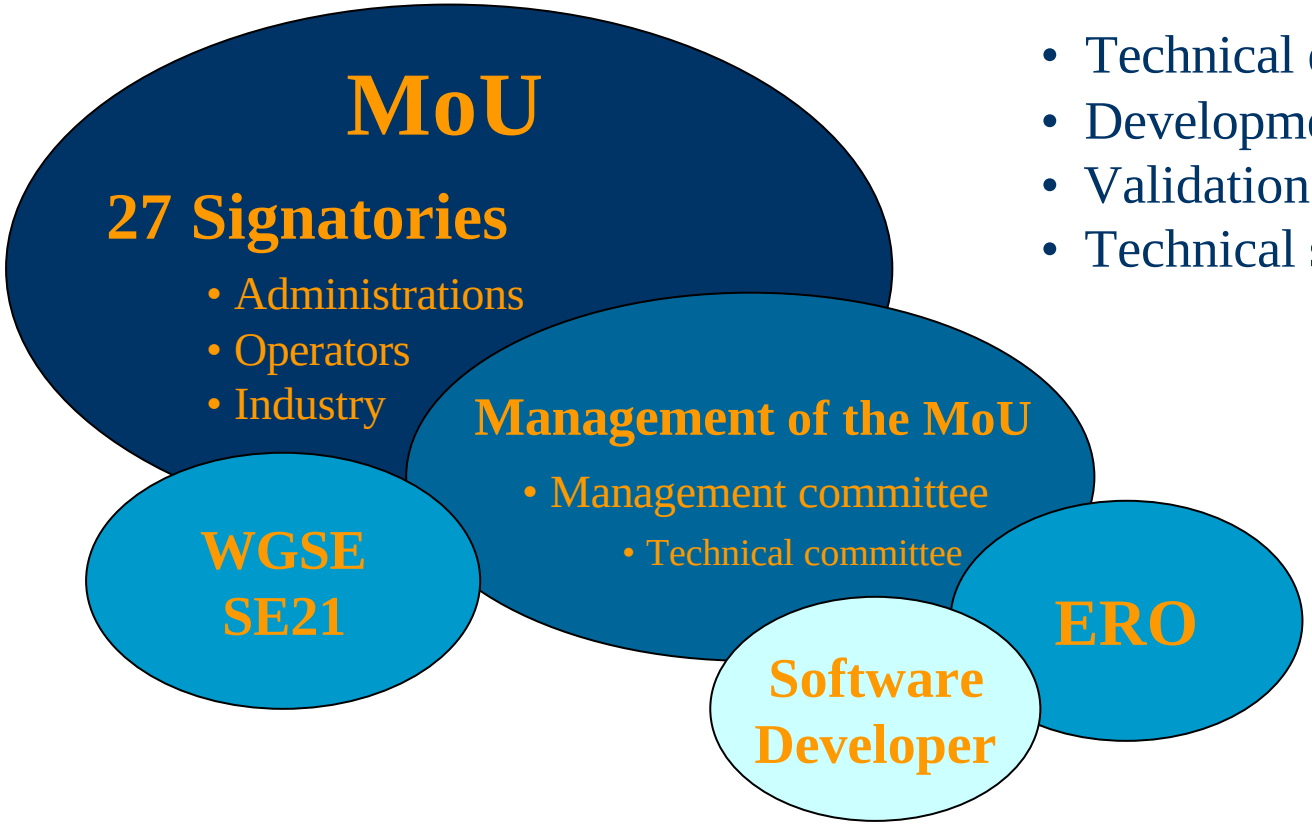
SEAMCAT Project (1)



Management Committee

- Represents all MoU members
- Overall control of the project
- Management of the software development
- Promotion of SEAMCAT
- Long-term strategy

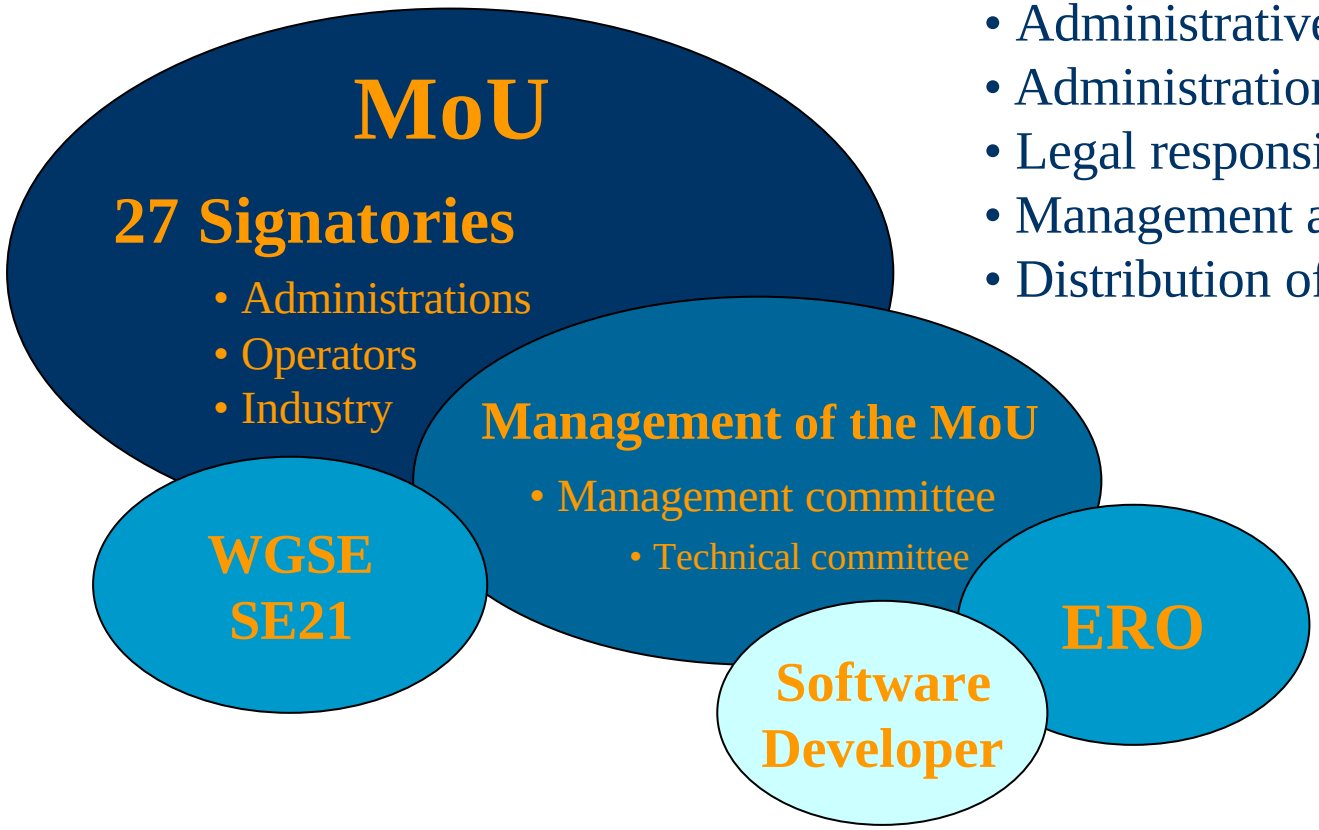
SEAMCAT Project (2)



Technical Committee

- Technical expertise
- Development of specifications
- Validation of software
- Technical support for the users

SEAMCAT Project (3)



Role of the ERO

- Administrative and technical support
- Administration of the MoU
- Legal responsibility
- Management and information hub
- Distribution of SEAMCAT

MoU members

Administrations

Radiocomm. Agency UK
ANFR, France
RegTP, Germany
Ministry of Communications, Italy
ICP, Portugal
NP&TA, Sweden
NTA, Denmark
Radiocomm. Agency , The Netherlands
OFCOM, Switzerland
Czech Telecommunications Office
FICORA, Finland
Norwegian P&T Authority
Institute for Telecommunications, Croatia

Industry

Deutsche Telekom AG, Germany
France Télécom, France
Telecom Italia, Italy
Swisscom AG, Switzerland
British Telecom, UK
TéléDiffusion de France
ICO Services Ltd, UK
Motorola Labs, France
Ericsson Radio Systems AB, Sweden
Matra Communications, France
TRT Lucent Technologies, France
Nortel Fixed Wireless Access, UK
Nokia, Finland
Siemens, Italy

SEAMCAT Project - current activities

- Upgrade of the software (Phase 1+)
- Support for the users
- Promotion of SEAMCAT
- Preparation of a future arrangement
  - maintenance
  - further development

What is SEAMCAT ?

- **Software implementation of a Monte Carlo methodology**
- **Generic compatibility analysis tool able to:**
  - quantify the interference levels
  - take into account a statistical nature of the received signal
  - address any interference scenario irrespectively of the type of victim and interfering radio system
- **Windows 32 product**
- **Public domain software**

What SEAMCAT is NOT ?

- Planning tool for any radio system or service
- Equipment design tool
- System optimisation tool

Monte Carlo simulation method

The Monte-Carlo simulation method is based upon the principle of taking samples of random variables from their defined probability density functions (also called distributions).
The user inputs distributions of possible values of the parameters, and the software uses them to extract samples (also called trial or snapshot).

Then, for each trial SEAMCAT calculates the strength of the interfering and the desired signal and stores them as arrays.

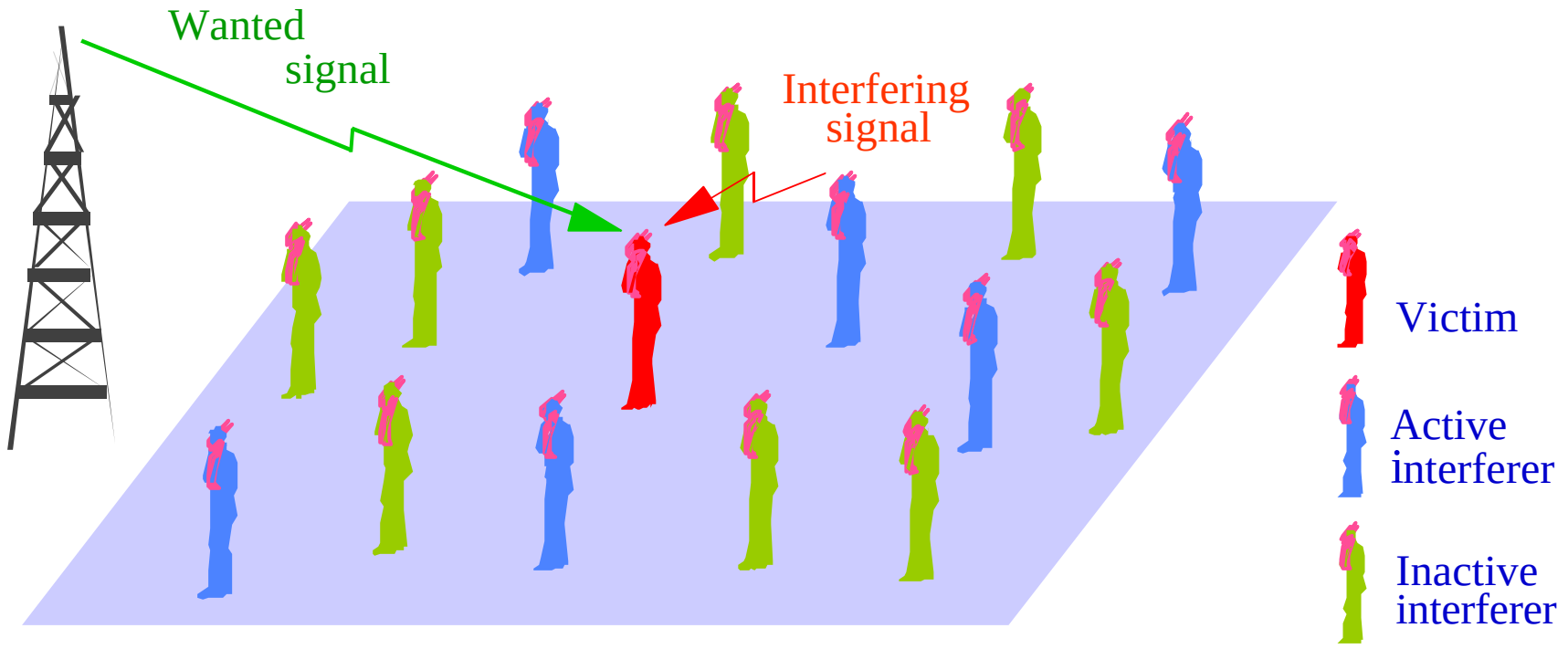
The software derives the probability of interference taking into account the quality of the receiver in a known environment and the calculated signals.

Monte Carlo simulation method (2)

- **Statistical modelling of the real situation**
- **Flexibility in the description of interference scenario**
  - Interfering and victim system parameters
  - Propagation
  - Frequency and spatial and temporal distribution of users
- **All mechanisms of interference are taken into account (unwanted emission, blocking, intermodulation)**
- **Both sharing and adjacent band compatibility analysis**
- **Natural and widely used methodology**

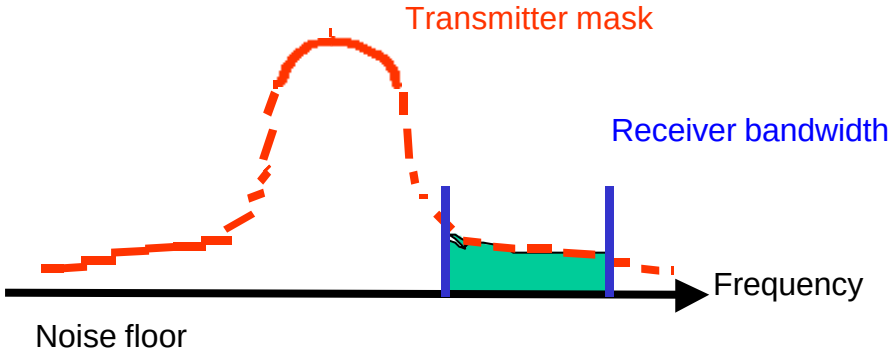
Basic principles

Simulation of the actual radio environment

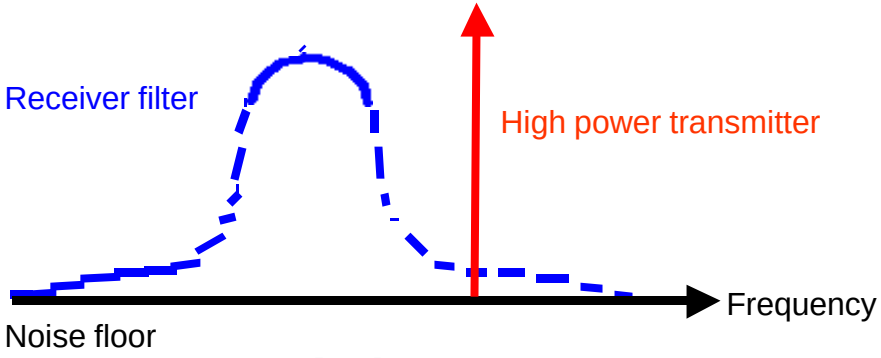


Basic principles (2)

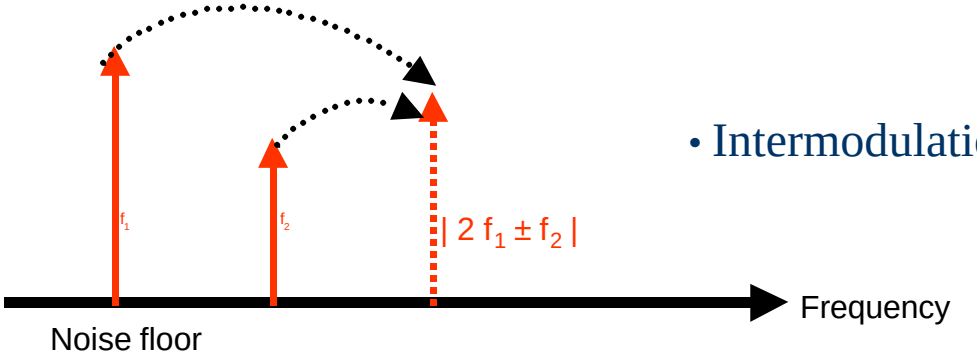
Taking account of the characteristics of both victim and interfering system, it is possible to evaluate the interference due to:



• Unwanted emission



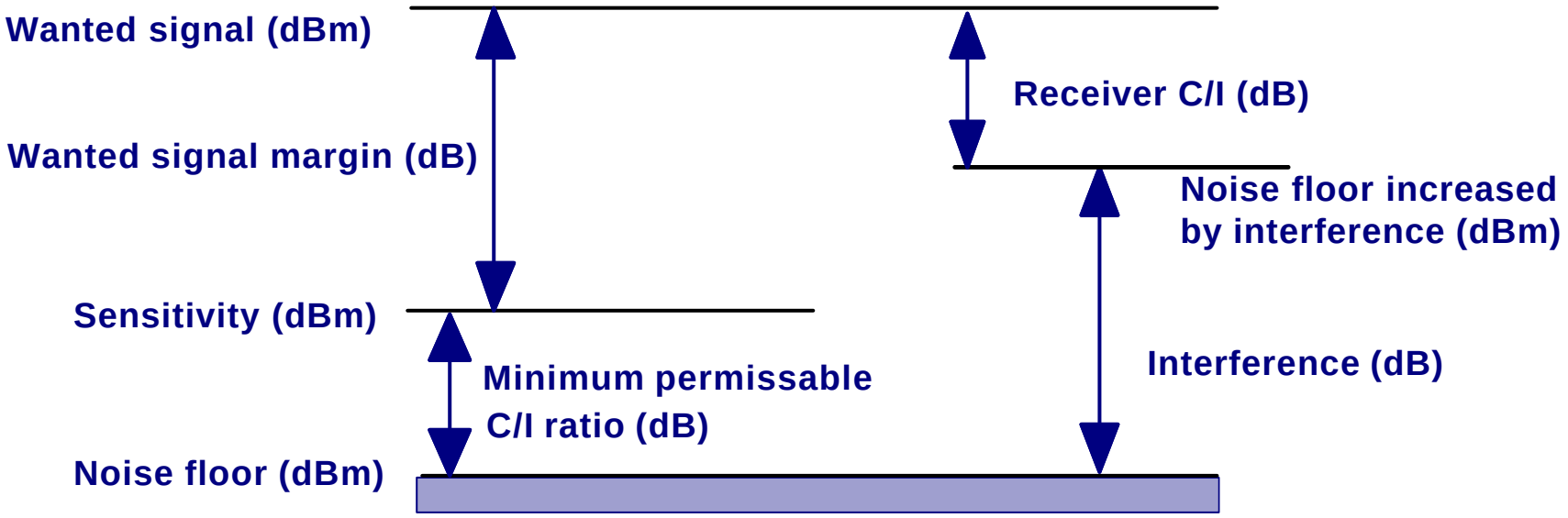
• Blocking



• Intermodulation

Basic principles (3)

SEAMCAT performs many trials and through evaluation of the protection criteria, e.g. C/I ratio, determines whether interference occurs.

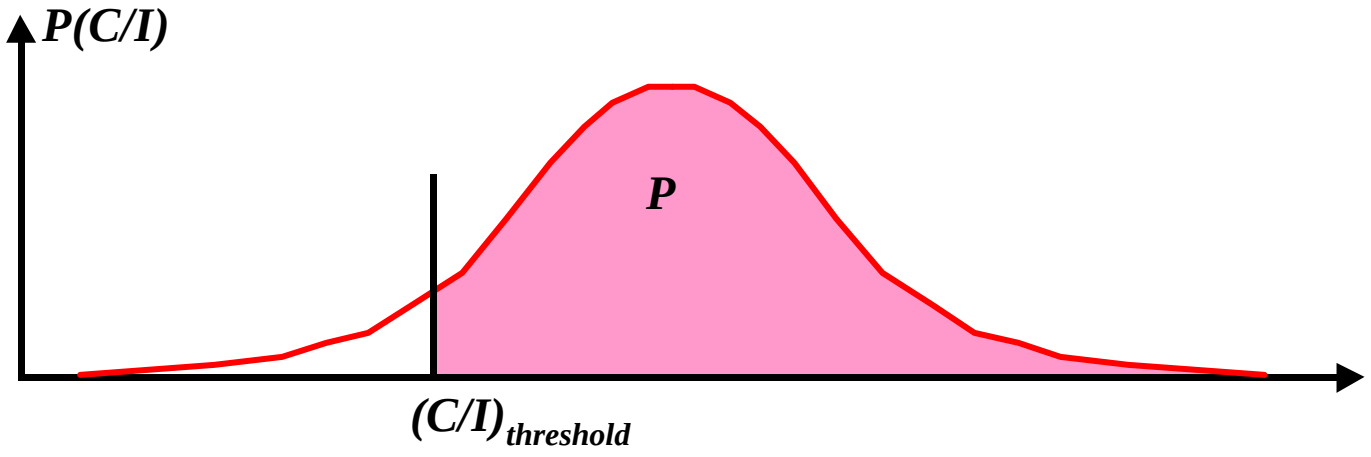


Basic principles (4)

The traditional 'minimum coupling loss' method evaluates interference in a similar way, but only for a single worst case event.

By taking account of thousands of random events, **SEAMCAT** produces a realistic probability of interference.

$$P = P\left[C/I > (C/I)_{treshold} \middle| C > Sensitivity\right]$$

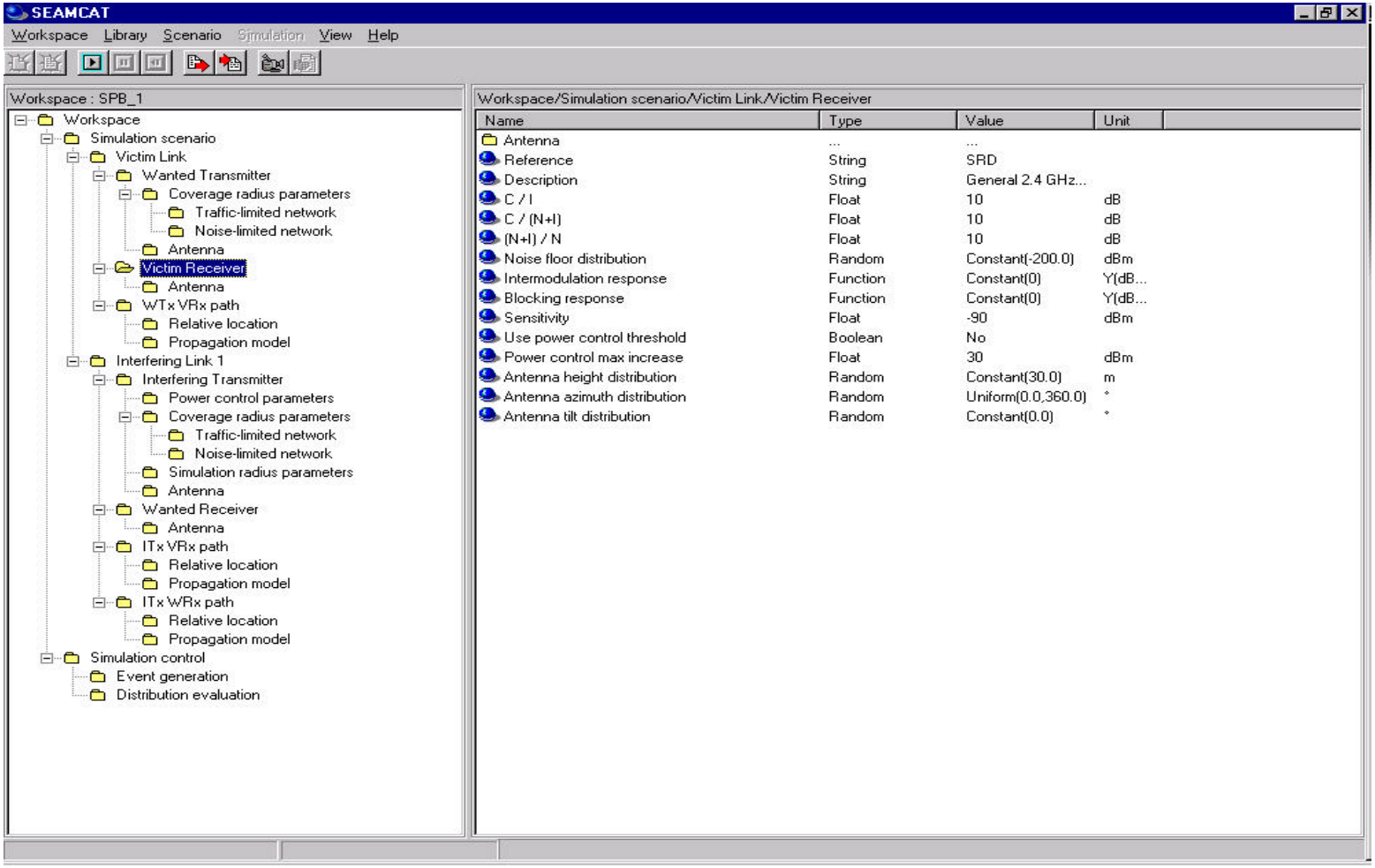


Creation of interference scenario

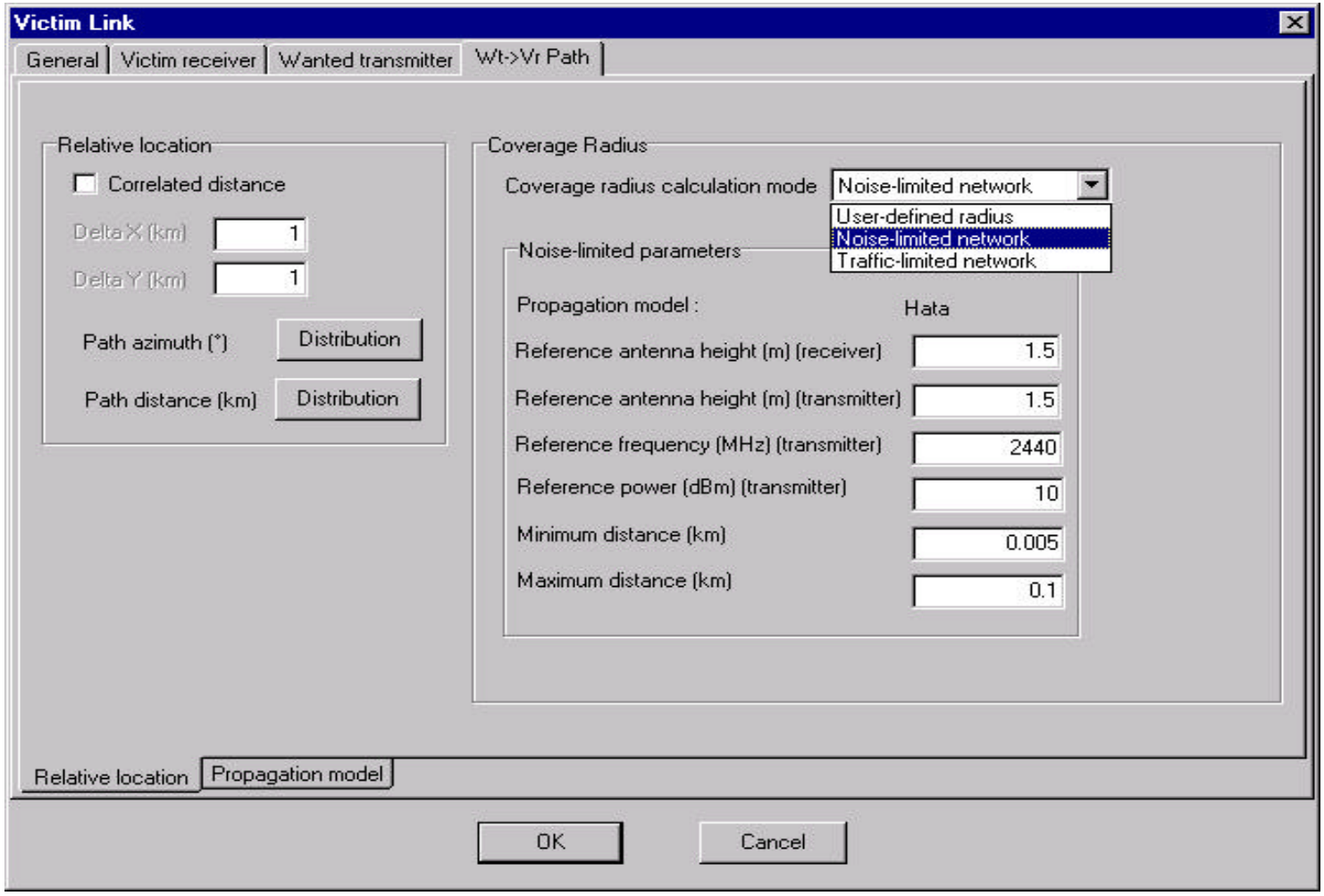
(Description of interference situation)

- *Victim link*
- *Interfering link(s)*
- *Appropriate definition of*
  - **Propagation model including slow fading**
  - **Deployment**
  - **Transmitter and receiver behaviour**
- *Cell size dependent on traffic or path loss*
- *Power control*

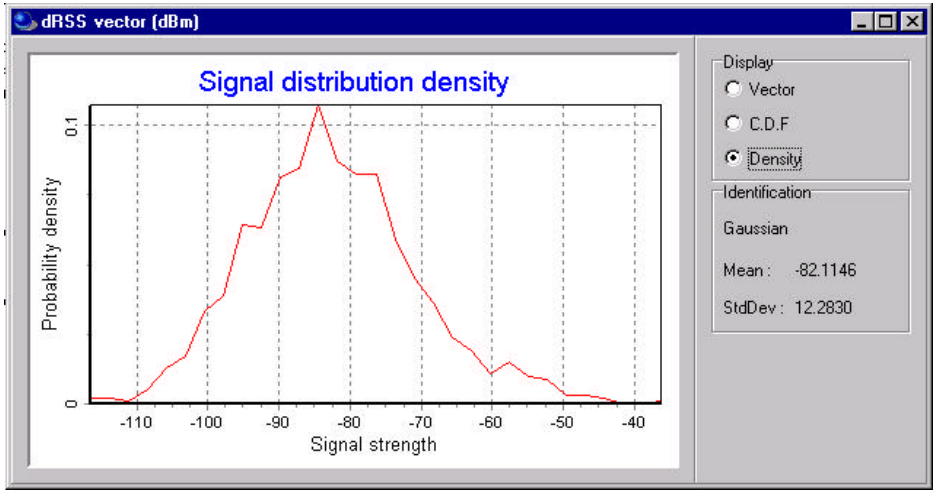
SEAMCAT user interface - workspace

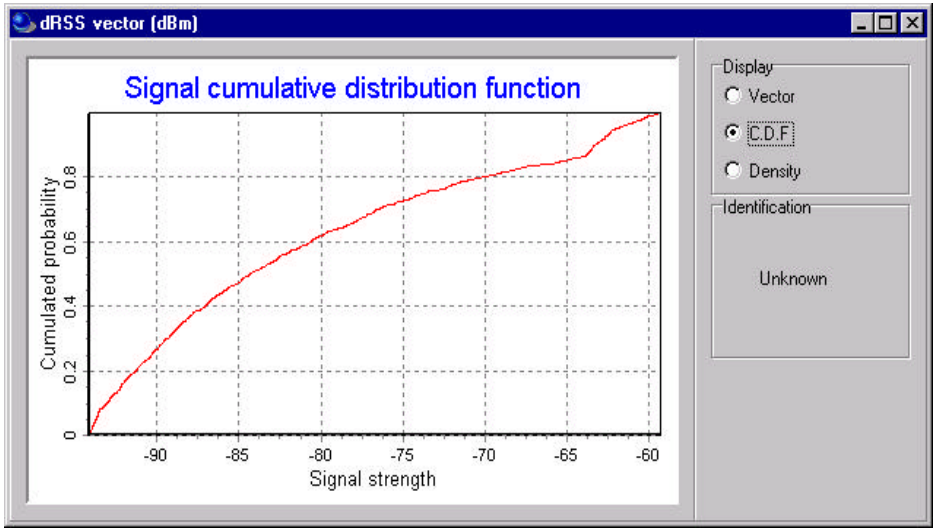


Definition of interference scenario



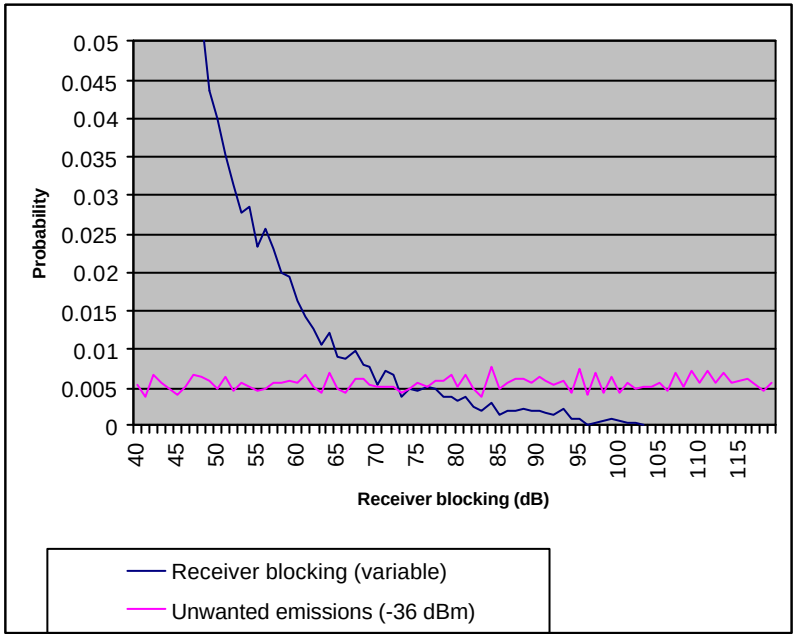
Results of simulation



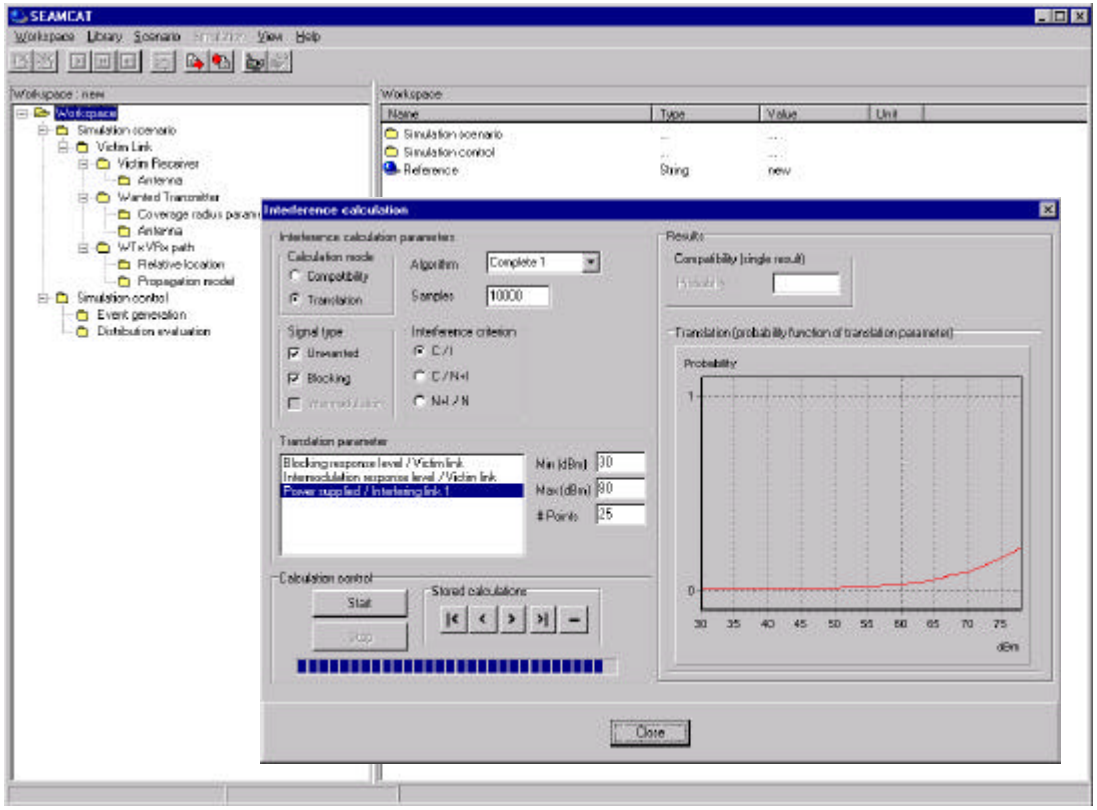


Event generation results:

- Generated signals
- Coverage radius calculation results
- Correlation information



Results of simulation (2)



Interference calculation:

- **Compatibility:**
  - single probability of interference to occur
- **Translation mode**:
  - probability of interference as a function of the variation of selected transmitter or receiver parameter values

Presentation of results

- Immediate availability on screen
- Comprehensive report in the form of MS Word document

Applicability of SEAMCAT (1)

- **Simulation of the real interference scenarios**
- **Full flexibility in definition of:**
  - interfering and victim systems
  - propagation conditions
  - frequency, temporal and spatial distribution of users
- **Compatibility studies for shared or adjacent frequency bands**
  - identification of sharing / compatibility issues
  - frequency separation (guard band)
  - frequency arrangement

Applicability of SEAMCAT (2)

- **Evaluation or radio equipment parameters**
  - transmitter emission mask
  - receiver susceptibility
  - density of interfering transmitters
- **Evaluation of limits of parameters**
  - spurious emission
  - blocking level
  - intermodulation level

Studies carried out using SEAMCAT

Completed

ITU-R TG8/1:	PCS1900/IMT2000 for duplex direction
CEPT SE7:	TETRA/GSM at 915 MHz TETRA/FM PMR in the 400 MHz
CEPT SE19:	FS/FSS sharing study

Ongoing

CEPT SE24:	Compatibility of Bluetooth with other existing and proposed radiocommunication systems in the 2.45 GHz frequency band
CEPT SE27:	Compatibility between digital PMR and tactical radio relay systems in the 900 MHz frequency range

Additional information about SEAMCAT

- SEAMCAT User documentation
- On-line help - printable file in-built in SEAMCAT
- ERC Report 68 (revised in 2001)
- Additional documentation
- ERO web site (***www.ero.dk***) ***SEAMCAT for download***