Doc./Annex Nr.

Original: STG(03)02 Rev. 4

SEAMCAT UPGRADE 2003

Upgrade Specifications

Status: Approved for submission to Software Developer

Version: 17 September 2003

European Radiocommunications Office & SE PT 21/SEAMCAT Technical Group

Page left blank

TABLE OF CONTENTS

1 BACKGROUND TO SEAMCAT UPGRADE

The SEAMCAT® (current software version 2.1.0) is a software tool based on the Monte-Carlo simulation method, which permits statistical modelling of different radio interference situations. The SEAMCAT may be instrumental in various radio spectrum engineering studies, notably:

- Sharing and compatibility studies between radiocommunications systems in the same or adjacent frequency bands;
- Evaluation of transmitter and receiver masks;
- Evaluation of limits for certain system parameters, e.g. unwanted emissions (spurious and out-of-band), blocking or intermodulation levels.

The current version of SEAMCAT tool is a result of development between 1997-2002 under the auspices of European Conference of Postal and Telecom Administrations (CEPT), as a co-operation project between National Regulatory Authorities in CEPT countries, industry and the ERO. The project was formally established under the name of SEAMCAT Memorandum of Understanding (SEAMCAT MoU) and managed by the SEAMCAT Management Committee (SMC). Since the termination of SEAMCAT MoU in September 2002, the maintenance of SEAMCAT software is transferred to ERO.

Since its inception, the SEAMCAT was and remains a non-commercial software distributed by ERO free-of-charge.

While the current version of SEAMCAT is extensively used in CEPT technical bodies and elsewhere, its certain deficiencies and limitations became obvious, especially in relation to modeling of innovative radiocommunications systems, such as CDMA.

Therefore the Working Group Spectrum Engineering (WGSE) of CEPT has decided in May 2003 to proceed with the upgrade of current SEAMCAT version 2.1.0. This upgrade (referred to as “Upgrade 2003”) should address elimination of certain noted deficiencies and errors in current version as well as introduction of new functionalities, primarily the one allowing modeling of CDMA systems.

A special group was created to assist ERO in formulating technical specifications for the upgrade, named SEAMCAT Technical Group (STG). STG is reporting to SE Project Team 21 and through the latter to WGSE.

Any inquiries with regards to the SEAMCAT Upgrade 2003 and this document may be addressed to ERO at:

ERO / Attn: A. Medeisis
Nansensgade 19
DK-1366 Copenhagen
Denmark
Tel: +45 33 89 63 12
Fax: +45 33 89 63 30
E-mail: medeisis@ero.dk

2 FUNCTIONAL UPGRADE 2003

This section lists the required changes to be implemented to the current version of the SEAMCAT tool (software version 2.1).

The main aims of 2003 upgrade are:

- To eliminate certain deficiencies identified in software version 2.1, see sub-section 2.1;
- To provide a further enhancement of User Interface, in particular by means of graphical representation of interference scenario and simulation progress, see sub-section 2.2;
- To implement new functionalities, like CDMA and possibly other new services capability.

The content of this document was prepared taking note of the original Functional Design Document for SEAMCAT Phase I+, therefore some terminology and software module references are related to that original document.

2.1 Deficiencies of SEAMCAT version "2.1.0" that need to be corrected

2.1.1 Library import control

In current version of the SEAMCAT, when exporting the library, also the default elements (DEFAULT_ANT, etc.)are saved. When then trying to import such library file, the stored names of the default elements collide with the names of the default elements already in store, and the import function fails.

Now this has to be overcome by manual editing of the exported library file or the internal library before the import function, deleting the elements with the same names.

Requirement: to introduce additional control during the library import function, which would check the names of the imported library elements, and if them being the same as for some of already stored elements, it would e.g. modify the name of imported elements (say making it DEFAULT_ANT**2**, etc) or somehow else avoid collision.

2.1.2 Names of the export/import files

In current version of the SEAMCAT, all export files have the same extension ".txt", which often causes problem during the exchange of these files, when people e.g. mistaken scenario file for report, or library, etc.

Requirements:

- to introduce distinctive extensions for at least scenario export files (e.g. ".sce"), library export files (e.g. ".lib") and may be also reports (e.g. ".rep"). The extensions may be anything, for example, another variant may be ".sms" for scenarios, ".sml" for libraries, ".smr" for reports;
- At the import, the "Open file" window of the SEAMCAT should be selecting only amongst the files with relevant extension (e.g. "Import scenario" should be displaying only files with the scenario file extension and so on). However, there should be a manually switchable option

for displaying all files, so that e.g. “txt” files saved with earlier SEAMCAT version may be imported.

2.1.3 Bug with discrete uniform in scenario export

When exporting scenario, the discrete uniform distribution for any parameter is actually saved just as “Uniform”.

Requirement: To be corrected to save the proper type of distributions.

Requirement: To double-check the process of saving other types of distribution during scenario export.

2.1.4 Entry of user-defined (stair) distribution function

When user defined (stair) distribution function is entered, but without 0 (zero) value, programme returns the warning.

Requirement:The warning should appear only in the “not complete 1” case.

2.1.5 Remove consistency check for constant path distance factor

When the path distance factor for any of the links is set to constant, the programme returns warning “inappropriate distribution type”.

Requirement: The setting of path distance factor to constant should be allowed, no warning should appear in such cases.

2.1.6 Add consistency check for time percentage in P.1546 model

When setting time percentage for the P.1546 model to above 50%, no warning appears although the P.1546 is not valid for time percentages above 50%.

Requirement: to add a consistency check for the time percentage parameter.

2.1.7 Editorials

(1) In Help file, in the description of Hata model there is a missing α power index after the (log(d)) in frequency range 150-1500 MHz.

Requirement: to check if it is not missing in the source code; to correct the Help file description.

(2) In Help file, where it describes the import/export of antenna patern, it currently says that files should contain couples of “(value, cumulated probability)”, which is not correct.

Requirement: to replace with clarification that the antenna pattern import/export data should be made of couples (azimuth, corresponding antenna gain).

(3) In Interfering link scenario, “It->Vr” tab, the name of the tab and the relative location selection menu optiuons do not correspond to the logic that the reference for describing relative location always lies on the relevant element of victim link.

Requirement: name of the tab to be changed to “Vr->It”; in the “Relative location/Mode” selection menu, references to “ITx->VRx”, “ITx->WTx”, “WRx->VRx” and “WRx->WTx” should be changed to “VRx->ITx”, “WTx->ITx”, VRx->WRx” and WTx->WRx” accordingly, to reflect that the reference for describing location is always on the relevant element of a victim link.

(4) When opening the “Path distance factor” selection window in scenario definition, the appearing window itself bears the name “Path distance”.

Requirement: “factor” should be added to the window name, so that it would read “Path distance factor”.

(5) In Victim link scenario, “Victim receiver/Reception characteristics” field, there is a parameter incorrectly named “Power control max threshold (dB)”, which is not related to an actual power control process, but rather explains the dynamic range of receiver.

Requirement: to change the name of that parameter to “Receive power dynamic range (dB)”.

(6) The export files produced by latest SEAMCAT versions still beared the references to SEAMCAT version 2.0.3.

Requirement: the export files should be generated with the correct reference to current version.

2.1.8 Update the implementation of in-built P.1546 model

The ITU-R Rec. P.1546 is set to be revised 2003, see Doc. SE21(03)22. There are also misinterpretations of different parameters used in the model, as well as missing possibility to enter the parameter describing “local clutter height around the receiver antenna”.

Requirements:

- to update the implementation of P.1546 model in the revised SEAMCAT;
- when P.1546 model is selected, to add a field for entering the “Local clutter height at the receiver”. This parameter, if entered, then should be used in calculation of local clutter correction factor. If this parameter is not entered, the programme should continue to be assuming the default local clutter values dependant on selected environment (urban, rural, etc), as it is provided in current version;
- in the propagation model selection window, the notes should be added describing what antenna height references would be assumed when different models are selected:
    - when P.1546 model is selected the note should state: “Note that the P.1546 model assumes that the specified height of transmitting antenna is height above local clutter (effective height of antenna). The receiver antenna height is above ground and the correction for local clutter height will be applied by the programme.”
    - When Hata model is selected the note should state: “Note that the Hata model assumes that the specified antenna heights of transmitter and receiver are heights above ground.”

- In the antenna height selection window(-s) the note should be added "Note that the assumed antenna height definition (above ground, above local clutter, effective antenna height) will depend on the selected propagation model."

2.1.9 Memory management during batch operation

When the batch calculations are completed, it appears that the assigned operating memory slot is not released. So if few batch operations are performed, operations become slower and eventually may even stop, unless the operating system has an inherent ability to assign more dynamic memory.

Requirement: to investigate the memory management during batch operations and to improve it as appropriate.

2.1.10 Break-downs when using the User-defined propagation model

When the calculations are done using the User-defined propagation model, the SEAMCAT exhibits long processing time, excessive use of memory and occasionally break down a simulation after few iterations.

Requirement: the operation when using the User-defined propagation model should be investigated and improved to make it stable and slowing down the calculations significantly. This function is also a subject for implementation through the externally configurable modules (e.g. COM/Active X objects, discussed elsewhere).

2.1.11 Batch operation inconsistency

When performing the batch calculations, sometimes users observe random appearance of clearly erroneous calculation results (e.g. extremely out-of-order probability of interference). When then repeating calculations for that particular entry, the calculated result returns to "normal", consistently obtainable value.

Requirement: to review the process of calling and initiating the batch entries and make it more robust, eliminate possible causes of erroneous operation.

2.1.12 Intermodulation calculations

(1) When calculating the effect of intermodulation ($iRSS_{intermod}$ vector), the resulting intermodulation field strength is presented relative to the victim receiver's noise floor. This then causes erroneous calculation of probability of interference, because the ICE assumes that the selected interfering field strength vectors are expressed in absolute (dBm) values.

Requirement: to correct the final calculation of $iRSS_{intermod}$ in the EGE to make it expressed in absolute terms (formula to be revised accordingly).

(2) In current version of SEAMCAT it is very difficult to consider intermodulation interference from two co-located Interfering transmitters, with a given statistical distribution of distance between Victim receiver and those two co-located Interfering transmitters. This is because the interfering systems are described independently of each other also in terms of trialling their positioning with respect to victim system.

Requirement: to improve the possibilities of calculating intermodulation interference via establishing option of "Co-located Interfering transmitters", which would automatically set the trialled relative position of second (or more) Interfering transmitter (relative to the Victim receiver) equal to that of the first (reference) Interfering transmitter.

2.2 Graphical interface

The idea behind the graphical interface for SEAMCAT is to improve the user friendliness of SEAMCAT by providing some visual means for the users to comprehend, to intuitively better understand the modelled scenario, to get a feeling of whether the scenario properly reflects the actual deployment of the modelled radio systems.

Proposal is to have a separate graphical window, which is launched every time when the simulation starts. The graphical interface window identifies the calling scenario by e.g. listing the name of the activating workspace, plus may be some time stamp, etc.

Then the graphical interface starts plotting the trialled by SEAMCAT EGE positions of all involved parts of modelled radio systems: It(-s), Vr(-s), Wt(-s), Wr(-s), based on the coordinates of mutual positioning used in the EGE when calculating field strengths. The scale of the positioning may be selected automatically, and approximately, so that some of the objects may even fall outside of the plotted field.

The graphical signs selected to display the relevant transceivers are not important, it is enough to provide explanation in a form of a legend placed somewhere on the screen.

In order to avoid congestion of the screen with e.g. 20000 (typical number of modelled events) transceivers, some convention may be used, e.g. that only the results of the first 50-100 trials are depicted on the graphical interface. Such number should be sufficient to give an idea on positioning of transceivers: scale and zones of spread, kind of distribution.

One possible vision for such graphical interface is provided in Fig. 1 below:

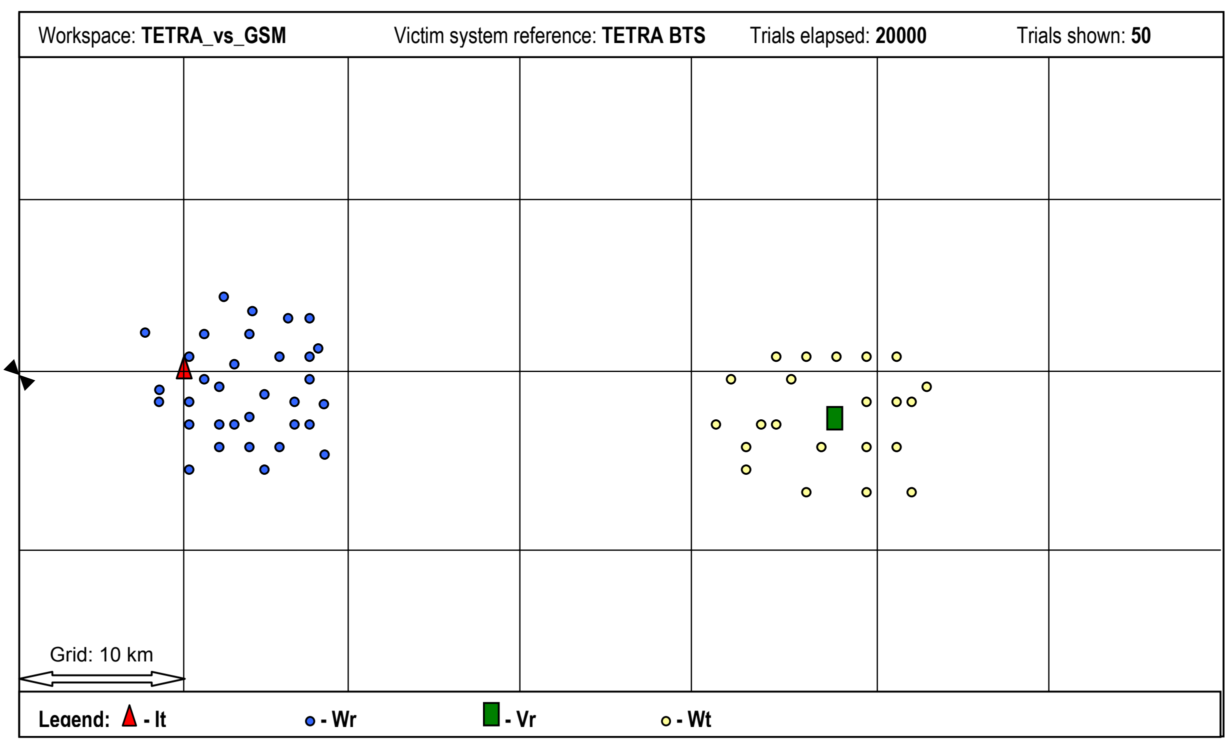


Fig. 1. Illustrative example of graphical interface for SEAMCAT

Example on Fig. 1 shows a simple scenario with one victim and one interfering system. However graphical interface should be capable of displaying multiple interfering systems as well as any additional structural elements introduced in an upgraded SEAMCAT, such as multi-cell structure of modeled networks elements.

2.3 Other user interfacing improvements

2.3.1 Additional parameter in batch list

Currently it is possible to set the batch function using three defining parameters. Request had been received to add one more defining parameter (e.g. to cater for definition of receiver using frequency, sensitivity, bandwidth and blocking parameters).

Requirement: to explore possibility of either adding a fourth parameter to the batch list or having an option of user-defined number of batch parameters.

2.3.2 Duplicating Batch List

Currently, the Batch list selection window, opened by “Workspace/Batch” menu option, allows either to create a new batch file, or to open/delete an existing one.

It was requested to add “Duplicate” function, so that the existing batch file may be duplicated, much the same as it is possible in workspace, library or interfering link selection windows. The duplication of batch files may be useful e.g. if user wants to use the same batch sequence, but with different workspace.

Requirement: To add “Duplicate” function to the Batch file selection window.

2.3.3 Export of calculation results in MS Excel format

Currently, the calculation results may be exported as ASCII text files or in addition as MS Word 97 file for reports. However it was observed that users often transfer tabular results of SEAMCAT calculations for post processing in MS Excel programme. In particular this is seen useful for analyzing results of multiple simulations in Batch.

Requirement: to add possibility of exporting/saving tabular calculation results (signal vectors, results of multiple batch simulations, other) as an MS Excel format (the one before the latest version of Excel) file.

2.3.4 Automated generation of multiple interfering systems

In the current version of SEAMCAT, when wishing to create multiple interfering systems, the user have to enter all additional interferers manually. This process is assisted by “Duplicate” function in the Interfering link selection window. When the interfering systems are identical, the user may use that “Duplicate” function to produced a required number of replicas of original interfering system, but still then has to open each of the created interfering link descriptors and modify the distinguishing information (e.g. manually specify different locations for those interfering links).

It was suggested that often user needs to use the many identical interfering links for evaluation of interference within the system, form e.g. multiple evenly spaced identical cells. In that case, the process of generating such multiple interferers may be automated in a way that software would automatically modify the positioning information of duplicated interfering links, so that they would be placed at a certain structural pattern, for example the ring of n-tier cells in the hexagonal cellular structure.

Example provided below in Fig. 2 shows the generation of multiple interfering systems in a scenario of intra-system interference that considers co-channel interference to a base station (Vr) from mobile terminals (It) in surrounding cells at a given frequency re-use distance D.

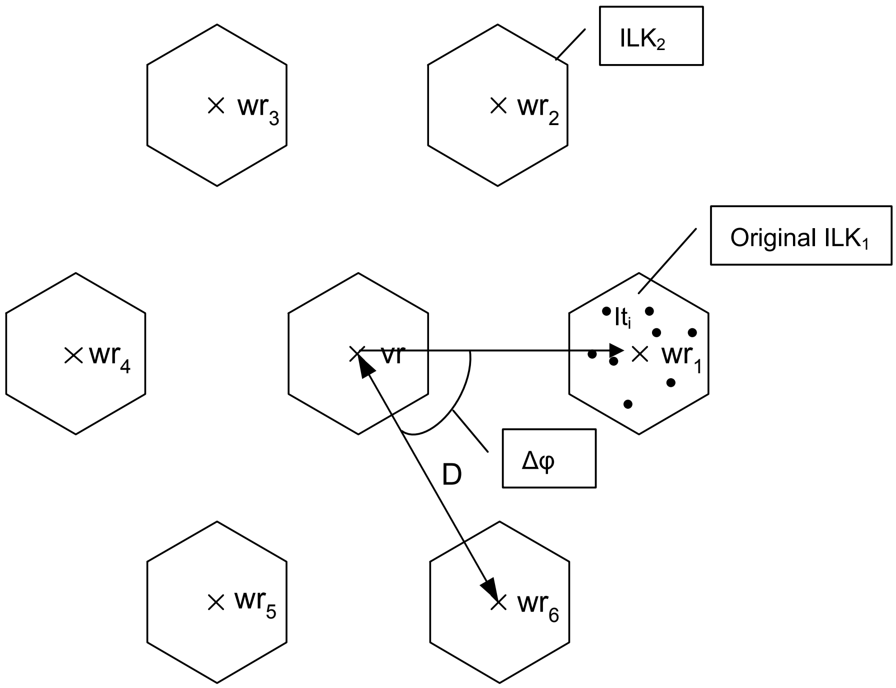


Fig. 2. Example of automatically generated multiple interfering cells spaced at frequency re-use distance D and displacement angle Δφ from victim cell

<u>Requirement:</u> to add the function of automated generation of multiple interfering systems (links) as described above. This function should be called from the “Scenario/Interfering Link” selection window.

2.4 CDMA capabilities

The original SEAMCAT concept was developed for traditional radiocommunications networks, employing the FDMA and TDMA technologies with reasonably static deployment configurations. However, the arrival of CDMA networks, which will form the basis for future 3G public mobile telephony networks. Means that the CDMA technology is likely to be used increasingly. The current evidence is that the CDMA technology will be used also in the PMR/PAMR networks, traditionally dominated by the analogue FM technology.

Therefore it is of paramount importance to build the CDMA analysis capabilities into SEAMCAT, to make it suitable for compatibility and sharing analysis involving those future CDMA networks.

The required theory and algorithms of CDMA analysis are presented in depth in section 3.

2.5 Other…

3 CDMA-ENABLED ALGORITHMS FOR SEAMCAT

3.1 General principles

The process of system simulation and interference evaluation for CDMA systems shall be based on these main principles:

- The interference criteria for CDMA system as a victim shall be the rate of dropped calls, in other words – the excess outage of served user terminals due to the introduction of external interfering signal, while other parameters (e.g. instantaneous path loss) are fixed for the particular snapshot of Monte-Carlo simulation run;

[Editorial note: This assumption should be at least valid for the uplink case, its applicability to downlink case should be additionally checked, thus may be revisited]

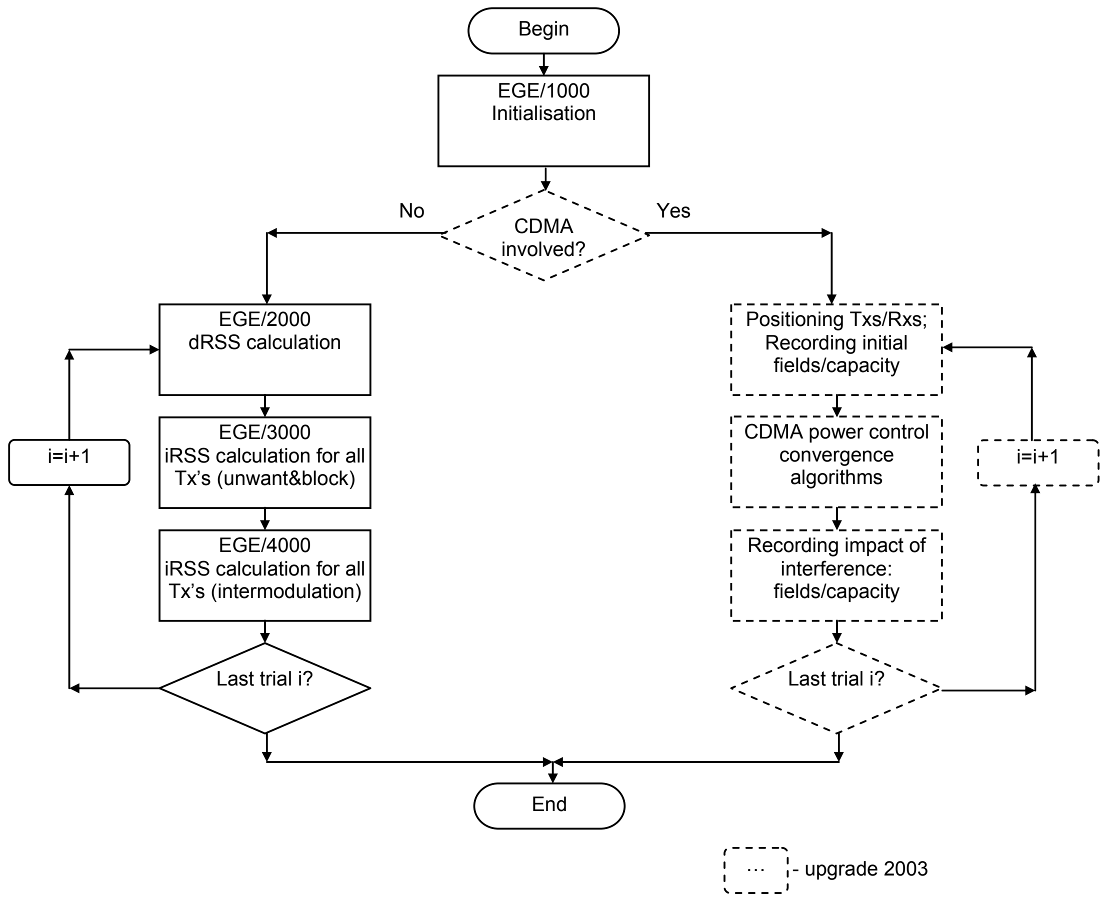
- As it is in current version of the SEAMCAT, only one direction of interference will be considered at a time, e.g. either interference to user terminals (impact on downlink) or interference to base stations (impact on uplink) shall be considered in a given simulation scenario.

As a first stage of implementing CDMA functionality in SEAMCAT, the following simplifications shall be assumed during this upgrade:

- Initially only one traffic mode will be considered at a time, i.e. all simulated user terminals assumed having one mode. As a priority, the specifications for voice mode operation shall be implemented. Once this is achieved, at further stages the scope may be broadened to include data traffic and, eventually, mix of various traffic modes.
- Initially the impact of interference into CDMA (CDMA as victim) and interference from CDMA (CDMA as interferer) shall be evaluated on simulated service/powers in one reference CDMA cell. However, for the sake of performing the power control function, this single reference CDMA cell shall be augmented by the software with a certain number of surrounding cells as described in the following sections. However, these aucillary cells will be used only for CDMA power control algorithm, but not for the interference analysis itself. Thus the secondary impact of external interference to those surrounding cells in CDMA-victim scenario will be disregarded in this first stage of CDMA implementation, but may be included at later stages.

3.2 Macro-level Event Generation Engine algorithms

Diagram below illustrates the general way in which the CDMA functionality may be added to the current EGE algorithm (ref. section 6.1 of SEAMCAT Phase I+ Functional Design Document).



Corresponding algorithm would be the following :

1. Initialization of coverage and simulation radius used in the simulation (EGE/1000)
2. For each trial if only non-CDMA systems are considered, the following sequence is performed :
   - 2.1. Calculation desired Received Signal Strength (EGE/2000),
   - 2.2. Calculation interfering Received Signal Strength due to unwanted emissions and blocking (EGE/3000),
   - 2.3. Calculation of interfering Received Signal Strength due to intermodulation products (EGE/4000).
3. For each trial where one or more CDMA systems are involved, the new algorithm becomes:
   - 3.1. Positioning of all transmitters and receivers in accordance with scenario, calculation/recording of initial field strengths/capacity, as relevant;
   - 3.2. Performing the power control convergence in CDMA systems, depending on whether CDMA system is victim, interferer or both;

3.3. Calculating/recording the resulting field strengths/capacity change with stabilised CDMA system(-s).

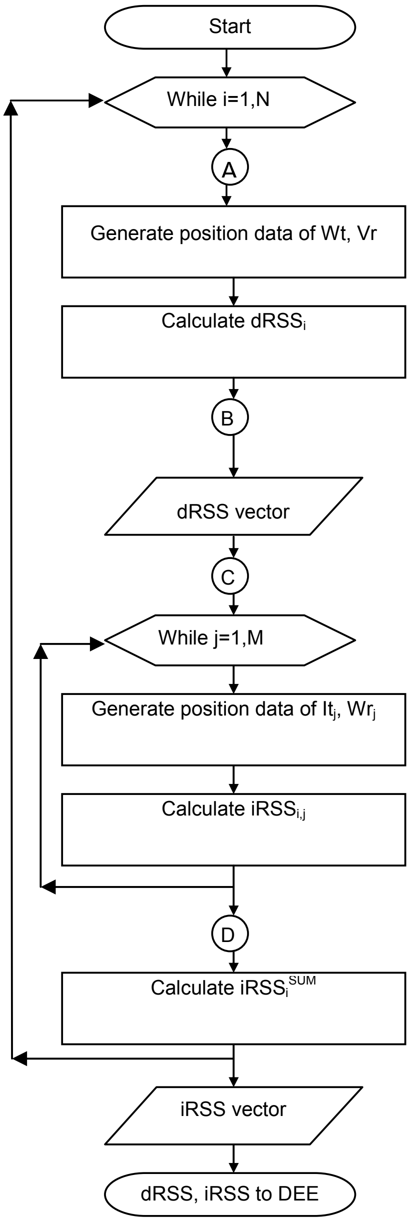
Note: This implies that the EGE/1000 function may need some adjustment to prepare for eventual subsequent run of CDMA modules and that new EGE functions for CDMA systems should be developed.

The programme flow of those new CDMA modules may be combined with relevant parts of original EGE functions, especially when one of the simulated radio systems is a non-CDMA system. The latter case would allow using original EGE functions to position/analyse that non-CDMA system. Clearly this will depend on whether the CDMA system is victim, interferer, or both, as shown in the algorithms below.

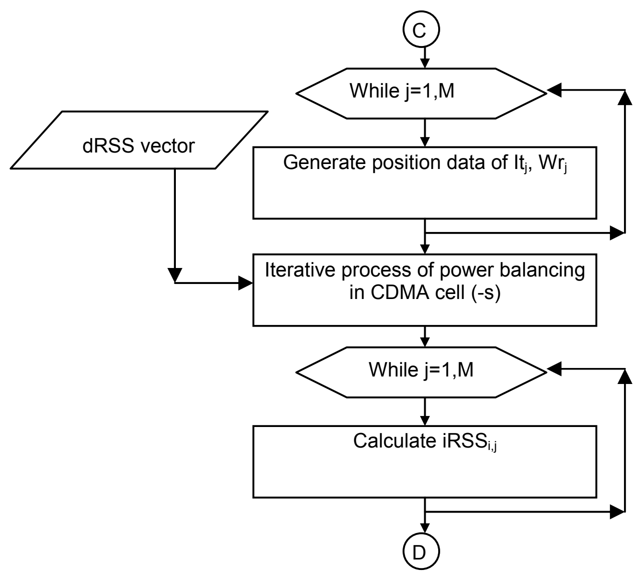
Note that only one interfering system is shown in the algorithms below for simplicity purposes.

Case 1: CDMA vs. non-CDMA: CDMA as interferer

Existing SEAMCAT algorithm



Required changes/additions



Changes to sub-sequent SEAMCAT engines (DEE, ICE)

may not be necessary in this case

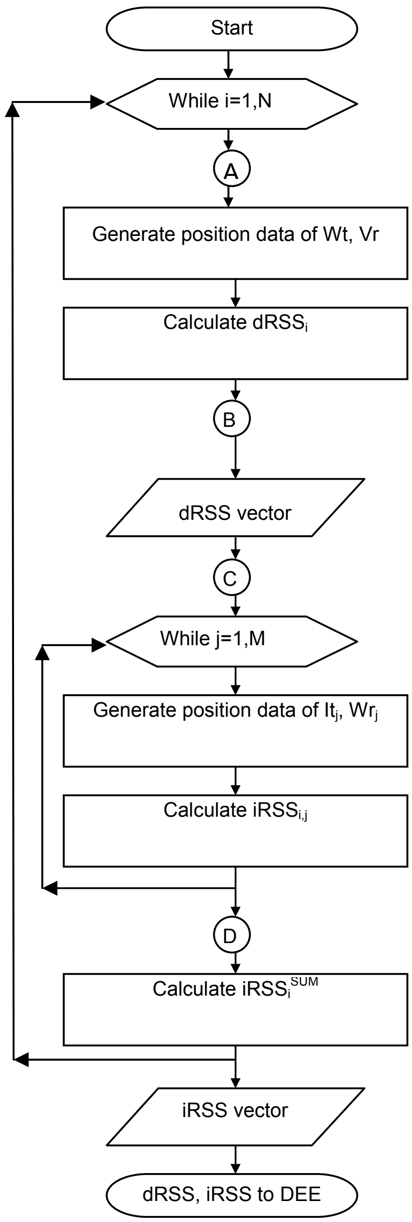
Where:

N – number of EGE events

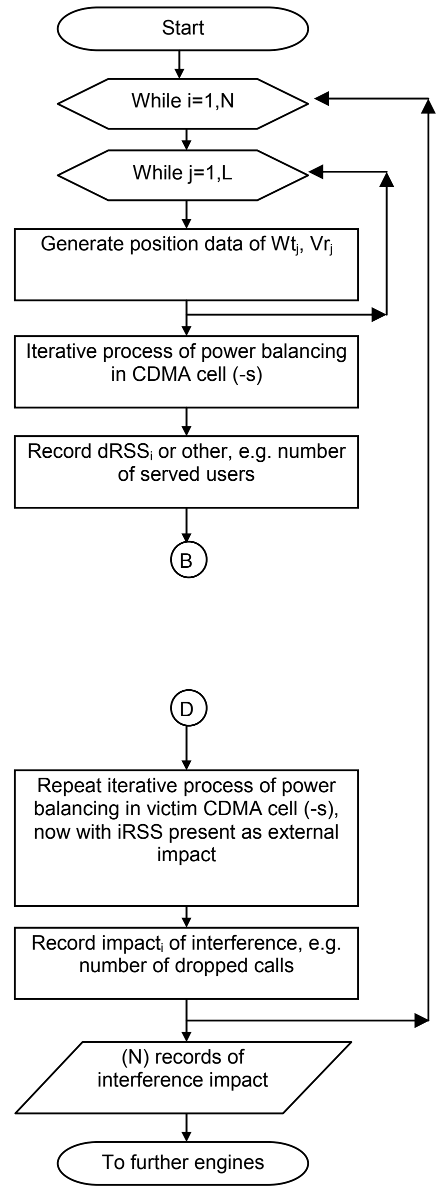
M – number of active interferers (or active CDMA terminals)

Case 2: CDMA vs. non-CDMA: CDMA as victim

Existing SEAMCAT algorithm



Required changes/additions



Changes to sub-sequent SEAMCAT engines (DEE, ICE)

should be necessary in this case

Where:

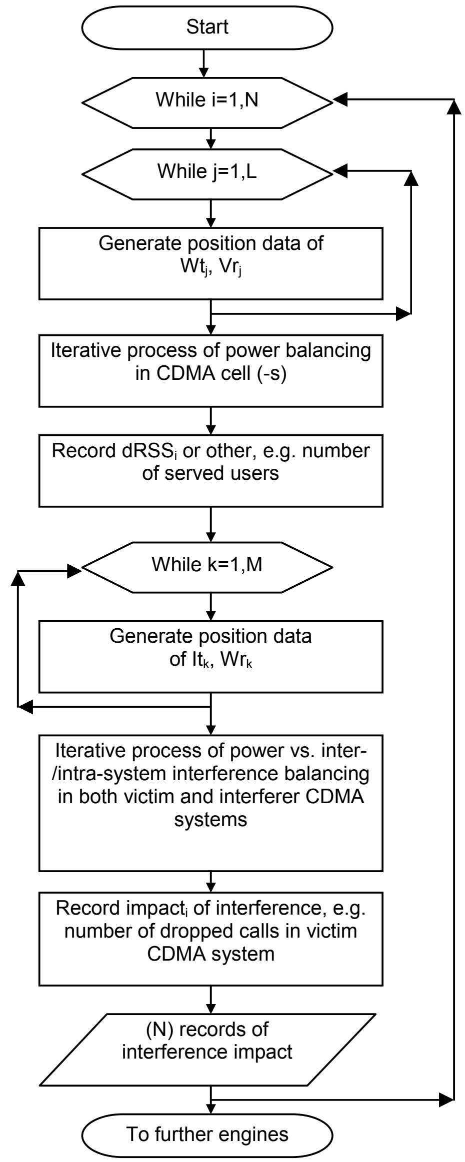
N – number of EGE events

M – number of active interferers

L – number of active terminals in victim CDMA system

Case 3: CDMA vs. CDMA

Required new algorithm



Changes to further SEAMCAT engines (DEE, ICE)

should be necessary in this case

Where:

N – number of EGE events

M – number of active terminals in interfering CDMA system

L – number of active terminals in victim CDMA system

3.3 Detailed algorithm concepts for CDMA-enabled SEAMCAT

3.3.1 Defining CDMA system

The description of CDMA system (one modeled cell) in a SEAMCAT scenario shall be done in accordance with the current procedures, functions and data collection windows as it is done in current version of SEAMCAT. In that way, if CDMA cell is a victim, it will be described using “Scenario/Victim link” function, with specifying either the base station or remote terminals (depending on the considered direction of interference) as Victim Receivers. If CDMA cell is an interferer, it will be described using “Scenario/Interfering link” function, specifying either base station or remote terminals as Interfering transmitter(-s).

However, the additional option will be made available, allowing user to mark the Victim system, or Interfering system, or both as CDMA systems. Selection of this option, would open additional parameter entry fields, which would describe the additional parameters required for performing CDMA power control algorithm and other CDMA-specific functions:

- Number of generated cells;
- Power control parameters;
- CDMA traffic mode;
- Etc.

Then when the software comes to perform power control function, based on that additional information it will generate a set of auxiliary CDMA cells around the modeled cell, see Fig. 3 below. These auxiliary cells will be then used for performing the CDMA power control/balancing process.

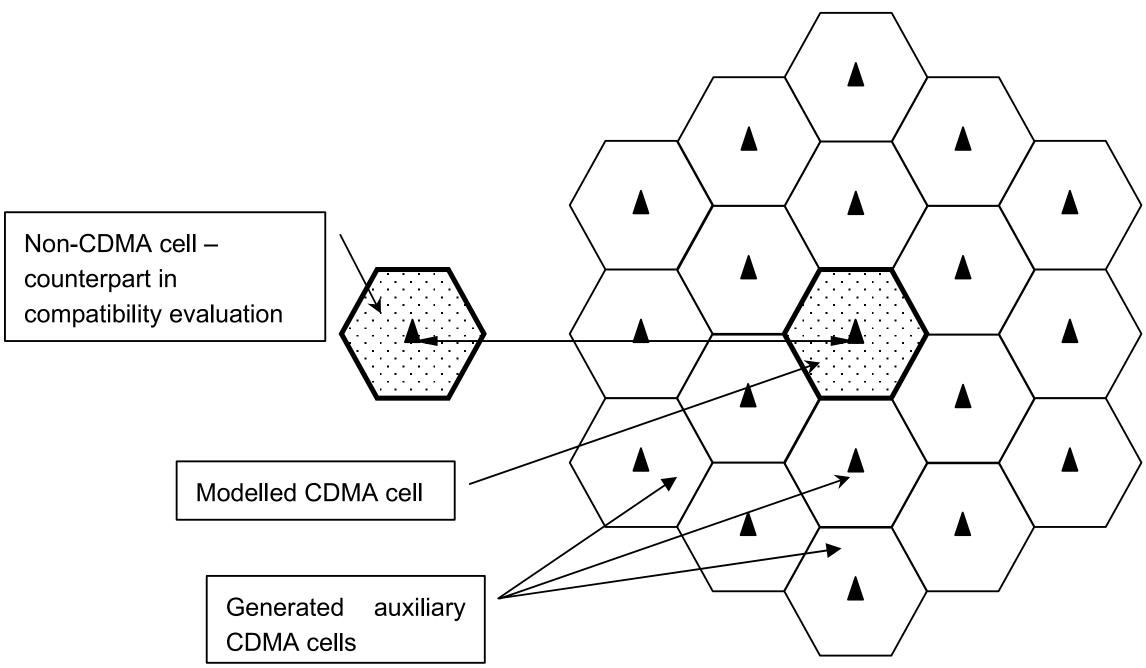


Fig. 3. Creating auxiliary cells around a modeled CDMA cell

3.3.2 Generating user terminals

The current version of SEAMCAT considers only one user terminal per snapshot in Victim system. When victim system is the CDMA system, then the required number of user terminals shall be generated in each snapshot, thus allowing to perform the power control function and evaluate the number of user terminals that may be served by the base station before and after the interference impact.

Of three options available in current SEAMCAT for calculation of cell radius (user-defined, noise-limited, traffic-limited), the traffic-limited option shall be disabled for CDMA systems, due to their inherent soft capacity limits.

3.3.3 Performing power control

[TBD, pending contributions from Lucent, Qualcomm]

3.3.4 Assessing excess outage due to interference

[TBD]

4 REQUIREMENTS TO SOFTWARE DESIGN

4.1 Operating systems, self-sufficiency of the software, compiler

The upgraded SEAMCAT software should be designed to operate at least on the computers with operating system Microsoft Windows NT4/2000/XP and onwards.

The software should be developed to operate as a fully self-sufficient executable programme, that is no other additional software than the SEAMCAT itself would have to be required/installed on a computer to make SEAMCAT fully functional.

The source code shall be compilable on the commonly used commercial compilers, such as Microsoft Visual C++ and Borland C++ and preferably should be transportable between different compilers. In any case, the software developer shall specify as a part of it's proposal:

- the version of compiler which will be used;
- statement with regard to expected transportability of the source code to different compilers;
- any other software that would be required for compilation of the developed source code.

As a final product, the software developer shall provide to ERO the source code and the installation package for installation of compiled executable files. The re-compilation of provided source code at ERO will be part of the final acceptance procedure.

4.2 Downward compatibility

The upgraded SEAMCAT software should be able to import and perform calculations with the export files (scenario export files, library export files, distribution/parameter description export files) generated by previous version (2.1.0) of the SEAMCAT.

4.3 Software architecture

Currently the SEAMCAT had been implemented as integrated self-sufficient software for operation on stand-alone computers, and this remains the minimum essential requirement for the upgraded software.

However, the software developer shall provide a quotation for including additional functional improvements to upgraded SEAMCAT software, which would make it capable of:

- A single computer with low computational and memory resources being able to run SEAMCAT (over LAN or Internet) on a powerful machine (server). This would imply that the requesting computer may need to be connected to the server only during the initialization of the simulations and after they are completed, for collection of results;
- Distributing the computational task between several computers, each having low computational and memory resources, thus providing improvement to computation speed via aggregation of resources;

- Extension of current SEAMCAT functionality to interrupt simulation in the main programme (allowing close down the programme, switch off computer and then re-start the simulation from the place it was interrupted at a later time, when computer is switched on again), to make it available also during the batch calculations.

4.4 Enabling use of COM/Active X objects

The software developer shall provide a quotation for making the upgraded SEAMCAT software capable of dynamically attaching/reconfiguring the externally generated COM/Active X objects. These objects would be used for those parts/modules of the simulation algorithms, which are likely to evolve in the future or may be dependent on user or type of simulated radio system.

Examples of software modules where use of dynamically re-attachable COM/Active X modules may justified is the implementation of propagation model (thus allowing evolutionary upgrades of in-built models or developing of additional user-defined models), implementation of power control in CDMA systems, etc.

Making the upgraded SEAMCAT software COM/ActiveX-enabled would also require the development of a software module/function for testing of the externally produced COM/ActiveX objects on their compatibility with their intended SEAMCAT insertion place.

4.5 Modular testing requirements

Due to the foreseen complexity of the software, required to implement the specified algorithms, the software design should be performed in a way, which would allow gradual testing and acceptance of the functional software modules.

To ensure the process of later operational software testing, e.g. for credibility check by third parties, for localization of suspected bugs, etc, the finally completed version of the software shall have an option for control (upon user request) of all intermediate calculations (operational/temporary variables containing results of calculations by different software modules/elements/sub-routines). This may be e.g. done via the user-switchable option of producing complete log file during calculations, switchable “debug” mode, etc. When switching such option, it should be allowed to select several depth levels (number of controlled functions) for debugging/control.

4.6 Installation setup

The installation setup shall address following requirements:

- Upgrade from current version to new version without loss of existing data (libraries) and through a user-friendly scheme i.e. avoiding manual operations such as file copying.
- ??

5 ANNEX 1: PROPOSALS PENDING DISCUSSION

This Annex presents a proposal from EADS Telecom that was received by STG and agreed as candidate for incorporation into the list of upgrade specifications, on equal priority with the evolutions already contained therein. However this proposal was left outside for the time being, pending further clairifications and discussion of how the suggested algorithm could be incorporated into the current SEAMCAT architecture.

5.1 Directive and adaptive antennas

The current SEAMCAT version offers the possibility to define the pattern of a base station directive antenna. This pattern can be set in a fixed direction (wt azimuth of the following figure).

This can be easily done if we are interested by a single BS transmitter in a given direction and some interfering transmitter located all around this BS, which, in this case, is also considered as the wanted receiver of interfering links. In the following, we will only consider the case where the victim receiver is a base station.

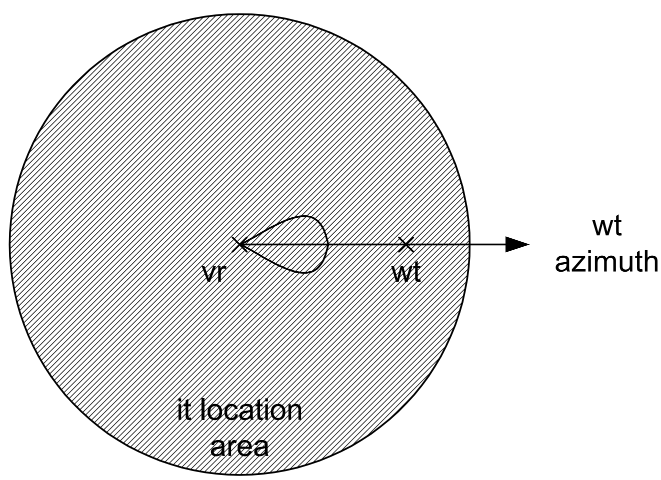


Figure A1.1: Example of directive antenna use

The restriction with the current SEAMCAT version is that in a SDMA (Spatial Division Multiple Access) system the processed antenna pattern is dependant of the location of the wanted transmitter and of the relative location of the interfering transmitters all around the victim base station. The following evolution concerns only intra-system interference, i.e. interference level on a victim receiver caused by several interference transmitters. Inter-system interference calculation can be performed with a mean antenna gain value.

If we consider a SDMA system, the antenna pattern is time-variant: the processing result is function of the wanted transmitter location and of the interfering transmitter locations. **In this case, the antenna pattern could be defined by:**

- **a gain (G_{max}) in an angle (a) centred on the direction of the wanted transmitter and a mean gain (G_{mean}) in the other directions (see figure below).**
- **N, the maximum number of closest interfering transmitters to take into account**
- **the angle (b) in which the interferers are located and the additionnal attenuation (att) to be considered in this direction**

The following figures illustrate this kind of SDMA antenna pattern. No "graphical" import is requested.

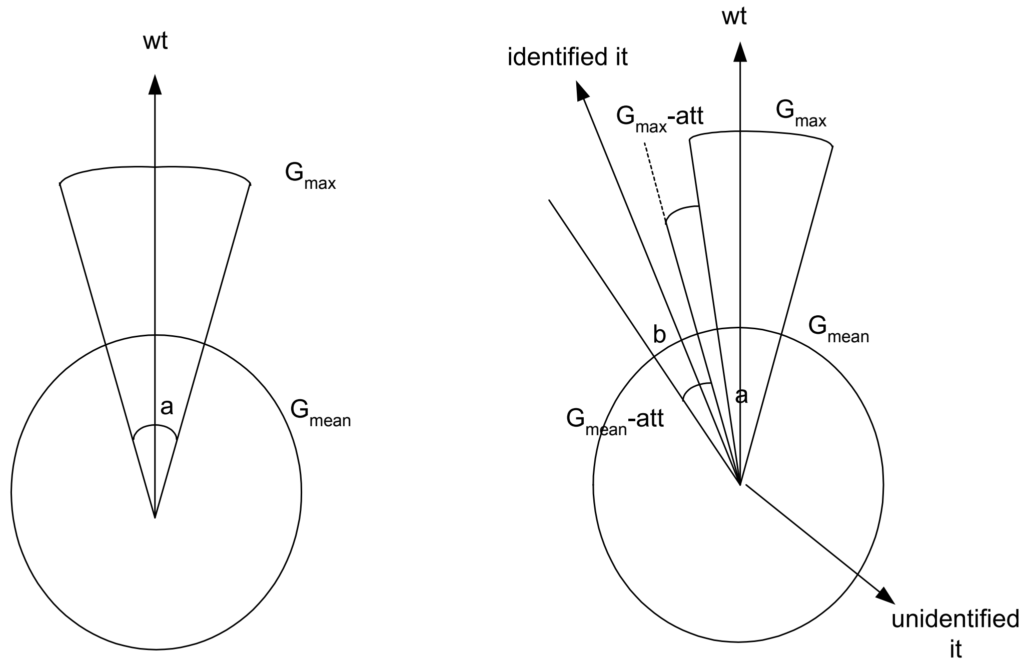


Figure A1.2: SDMA antenna pattern (left without It /right with an identified It and an unidentified It)

This SDMA antenna pattern shall be used as explained below:

- **For each Monte-Carlo trial (wt transmitter location and all interfering transmitter locations definition), the N closest interfering transmitter shall be identified. In the following, these transmitters will be called identified transmitter.**
- **For each identified transmitter a G_{mean}-att antenna gain shall be applied in order to take into account the victim receiver antenna. This antenna gain shall also be applied for any other interfering transmitter located a b angle around the direction of an identified transmitter. If the wanted transmitter is located in the b angle around the direction of an identified transmitter a G_{max}-att shall be used.**
- **For the unidentified it the G_{mean} antenna gain shall be used.**

Moreover if we want to simulate a complete SDMA network, the automation of the cellular network creation presented above is requested. In this case, the problem can not be simplified as already explained for a single BS network. **It means that the antenna pattern azimuth shall be linked for each occurrence to the direction of the victim receiver – wanted transmitter link.**