

Fylingdales Co-ordination Tool

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- The co-ordination tool
- Operating the tool
 - A step by step guide
- An opportunity to load your own data and use the tool

Fylingdales co-ordination

What is RAF Fylingdales?

- Opened in 1962, RAF Fylingdales is primarily a Ballistic Missile Early Warning Station, with a secondary duty of detecting, reporting and tracking satellite launches and orbits.
- The famous 'golf ball' radomes have now been replaced by the pyramid-like Solid State Phased Array Radar (SSPAR).
- Location: **SE866976**
- The radar has 3 faces which point approximately:
 - **North (A)**
 - **South West (B)**
 - **South East (C)**



Fylingdales co-ordination

Why do we do it?

- The spectrum at 420 to 450 MHz is shared between civil and military use. Military use includes the Fylingdales radar.
- There is a Memorandum of Understanding between Ofcom and the Ministry of Defence to ensure that the field strength levels received at Fylingdales do not exceed those measured in October 2003.
- Ofcom has established the predicted field strength levels received at Fylingdales from the civil use of the spectrum in October 2003. This forms the basis for the reference networks that define the interference rights of licences offered at 422 to 424 MHz.
- It will be a licence condition that all networks operating in the spectrum 422 to 424 MHz must pass co-ordination with Fylingdales prior to deployment.

Fylingdales co-ordination

The reference network

- The reference network was created for 2 reasons.
 - Firstly it created a standard network that could be split between the spectrum packages equally.
 - Secondly it demonstrates that it would be possible to deploy networks nationally with an increased density in urban areas
- 40km exclusion zone.
 - 40km is based on the area where civil deployments will be effected by the operation of the radar.
 - Once the spectrum is licensed it may be possible to consider a relaxation of the zone if the baseline is not compromised.



The co-ordination tool

About the tool

- PMR services within UHF1 also have to undergo co-ordination with Fylingdales.
- A new assignment tool, MASTS, for PMR bands was already under development.
- It was decided that the co-ordination should be included within this project and that the tool must be flexible enough to cope with the auctioned spectrum use.
- MASTS has been developed by ATDI based on their ICS Telecom radio propagation software tool. Macros have been used to automate the process alongside a customised database to store the necessary data.
- Currently this is a stand alone application. This functionality is included within Ofcom's project Unify and it is Ofcom's intention to provide remote access to the tool for licensees.

The co-ordination tool

What it does

What the tool DOES	What the tool DOES NOT do
<ul style="list-style-type: none">• Predicts interference into Fylingdales and tests against the interference rights defined within the licence• Fulfils the Fylingdales co-ordination requirement of the licence	<ul style="list-style-type: none">• Network planning• Predict interference into other networks• Co-ordinate with other MoD uses of the spectrum• Ensure compliance to all technical licence conditions• Predict interference from the radar into the stations co-ordinated

The co-ordination tool

How it works

- The field strength and the direction of arrival of the signal in both horizontal and vertical planes at Fylingdales are calculated for each station being co-ordinated.
- An algorithm is called that sums the contributions from all stations into the relevant faces of the radar.
- The result for each face of the radar is compared with the corresponding result for the licensee's reference network giving a margin in decibels.
- If the result is positive the network falls within the interference allowance. If the result is negative the interference allowance is exceeded. The result must be positive for all three faces for the network to pass co-ordination.

Operating the tool

- Importing site data into the tool
- Exclusion zone assessment
- Calculation of levels at the radar
- Co-ordination calculations
 - Tagging records
 - Selecting reference networks
 - Calculate current margins

Importing site data into the tool

File format

- The import file must be a comma delimited text file containing the following 9 fields of data for each transmission.

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9
Site Reference	NGR	ERP	Antenna Height	Transmit Frequency	Azimuth	Horizontal Antenna Pattern	Site Reference	Network Reference
Limited to 10 characters It must be unique	Alphanumeric field The letters must be capitals	Watts	Metres	Megahertz	Degrees	Filename including extension "xxx.SPH"	Limited to 10 characters It must be unique	Limited to 25 characters Used for sorting data

- The default for Column 7 is "Omni.SPH".
- Example:
 Site1a,TQ300800,25,20,421.05,180,Tetra120.SPH,Site1a,NetworkA
 Site2,SU500200,20,18,421.55,0,Omni.SPH,Site2,NetworkA

Importing site data into the tool

Import sites on to the map

Select **UHF1**
Menu

Choose
Import Data

Select file to
import ①

Click **Import**
on map ②

Click
Close ③

Selecting the file to import:

- Click ...
- The standard windows Open File dialogue box will appear.
- Select the file you wish to import.
- Click OK.

The sites are now loaded and can be seen on the map.

Importing site data into the tool

Exporting the sites into the database

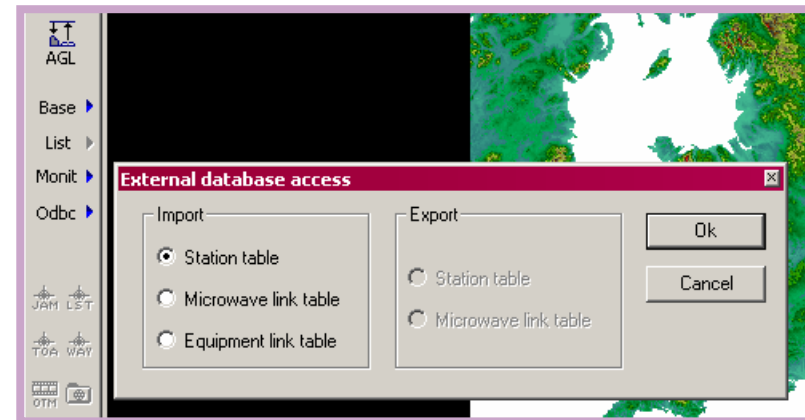
Select **UHF1**
Menu

Choose
Export Data

To check that the sites have been loaded into the database.

- Click **Odbc**, located $\frac{2}{3}$ of the way down the left hand side of the screen.
- Ensure the **Import Station Table** button is selected.
- Click **OK**.

Details of the stations loaded into database can be seen in the window that opens.



STATION

Change... DAD - C:\MASTS\Databases\Test_Database\MASTS.mdb - MASTS_DB

CallSign	x	y	CSys	Power	Antenna	Freq	AZIMUTH	Antenna_nameH	Info (1)	Info (2)
L1-NI11	90000	530000	4NGR	25	20	420 MHz	0	115H.SPH		
L1-S23	330000	750000	4NGR	25	20	420 MHz	190	115H.SPH		
L1-S60	210000	870000	4NGR	25	20	420 MHz	0	115H.SPH		
L1-UK1	224000	664000	4NGR	25	20	420 MHz	0	115H.SPH		
L1-UK102	347000	395000	4NGR	25	20	420 MHz	0	115H.SPH		
L1-UK129	371000	407000	4NGR	25	20	420 MHz	150	115H.SPH		
L1-UK145	335000	419000	4NGR	25	20	420 MHz	90	115H.SPH		
L1-UK163	383000	269000	4NGR	25	20	420 MHz	270	115H.SPH		

Buttons: Refresh, Print, Print setup..., Tag selection, Close

reference file name: ODBCSTATION.INI

Operating the tool

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 - Calculate current margins

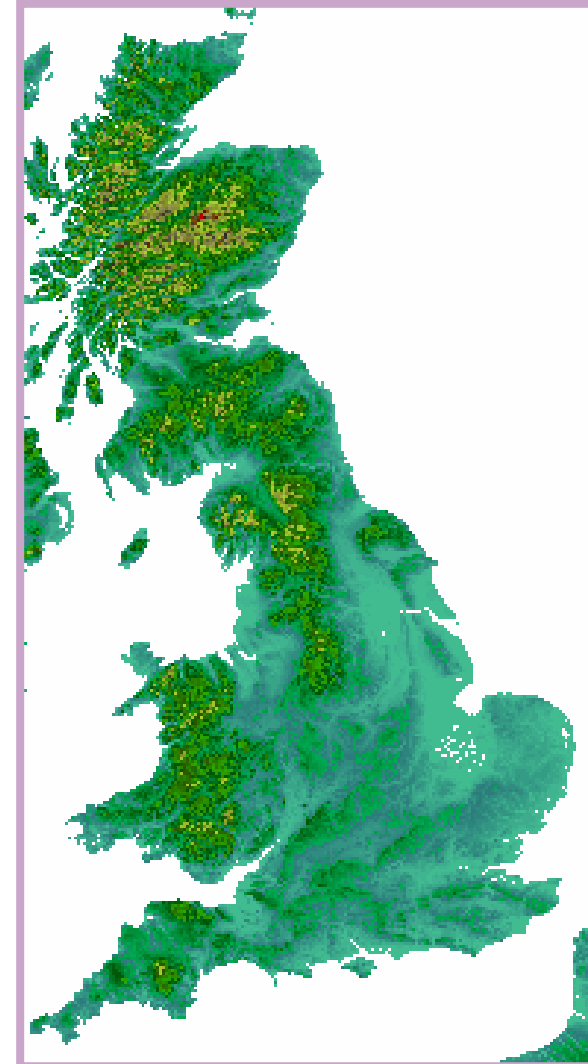
Exclusion zone assessment

Select **UHF1**
Menu

Choose
Delete Stations

**All the sites have been deleted
from the map.**

- This step is important because the exclusion zone calculation is carried out within the database, not on the screen.
- We will load only the stations that pass the test back onto the map to carry out the necessary calculations into the radar. Therefore any failures will not be considered.



Exclusion zone assessment

Running the assessment

Select **UHF1**
Menu

Choose
Exclusion Zone Assessment

An excel spreadsheet will be opened, this will list any sites that are located within the exclusion zone.

Microsoft Excel - ZoneClearance.csv

File Edit View Insert Format Tools Data Window Help

Arial 10 B I U

A1 Zone Clearance Calculations

	A	B	C	D	E	F	G	H	I	J	K
1	Zone Clearance Calculations										
2	Zone Clearance Failed during clearance check of Exclusion zone 'Fylingdales' (Radius of zone is '40000.00' meters)										
3	UniqueID	Frequency	Coord X	Coord Y	Distance from zone center						
4	L2-UK11	421	471600	496000	15085.1						
5											
6											
7											
8											
9											
10											
11											

ZoneClearance

Draw AutoShapes

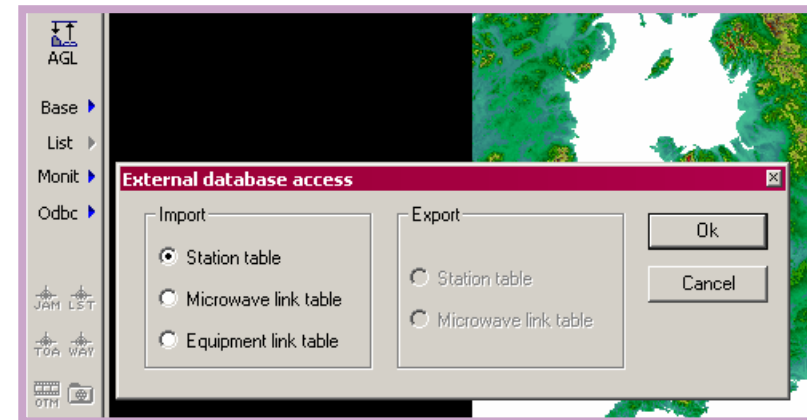
Ready

Exclusion zone assessment

Database entry

A pass/fail result will be stored in the database, to check:

- Click the **Odbc** link and select **Import Station Table**.
- **Scroll right** to show the **ZoneClearance** column.
- **Pass** or **fail** will be stored for each entry.



Power	Antenna	Freq	AZIMUTH	Antenna_nameH	Info (1)	Info (2)	STATUS	ZoneClearance	NETID
25	20	421 MHz	0	115H.SPH	L1-NI11		1	pass	Auction-Lo
25	20	421 MHz	180	115H.SPH	L1-S23		1	pass	Auction-Lo
25	20	421 MHz	0	115H.SPH	L1-S60		1	pass	Auction-Lo
25	20	421 MHz	0	115H.SPH	L1-UK1		1	pass	Auction-Lo
25	20	421 MHz	0	115H.SPH	L1-UK102		1	pass	Auction-Lo
25	20	421 MHz	150	115H.SPH	L1-UK129		1	pass	Auction-Lo
25	20	421 MHz	90	115H.SPH	L1-UK145		1	pass	Auction-Lo
25	20	421 MHz	270	115H.SPH	L1-UK163		1	pass	Auction-Lo
25	20	421 MHz	0	115H.SPH	L2-UK11		1	fail	Auction-Lo

Operating the tool

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Calculation of levels at the radar

Filtering the database

Access the database using the **Odbc** button

Click the heading of the data field you wish to filter

Select **Filter... ①**

DOA_at_FYL	ZoneClearance
0	Fail
257.85	Pass
189.11	Pass
145.47	Pass
220.48	Pass
330.51	Pass
0	Fail
330.51	Pass
257.85	Pass
189.11	Pass
145.47	Pass
220.48	Pass

Column

Title of column: Retrieved Displayed

Column width (pixels):

Field description:

Ordering: Ascending Rank Descending

Formatting:

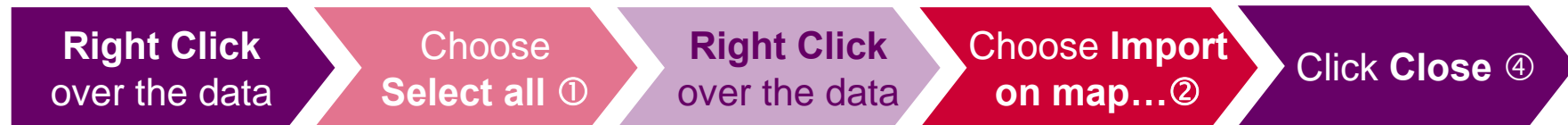
Greater than...
 Greater or equal to...
 Less than...
 Less or equal to...
 Equal to...
 Different from...
 Like...
 Not Like...
 Null or empty
 Not empty

OK Cancel

A screen will open which allows you to set conditions against selected parameter

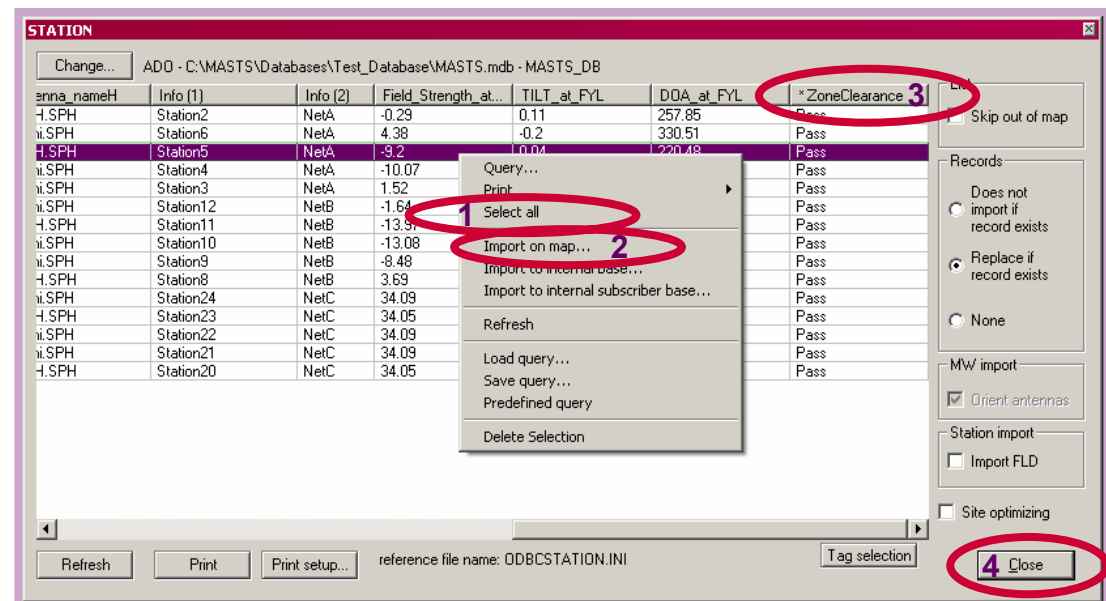
Calculation of levels at the radar

Selecting records in the database



- **Select all** will select the records returned by the filter applied.
- Note where the filter is applied an asterisk appears in the column heading ③

When the Station screen is closed the selected stations appear on the map.



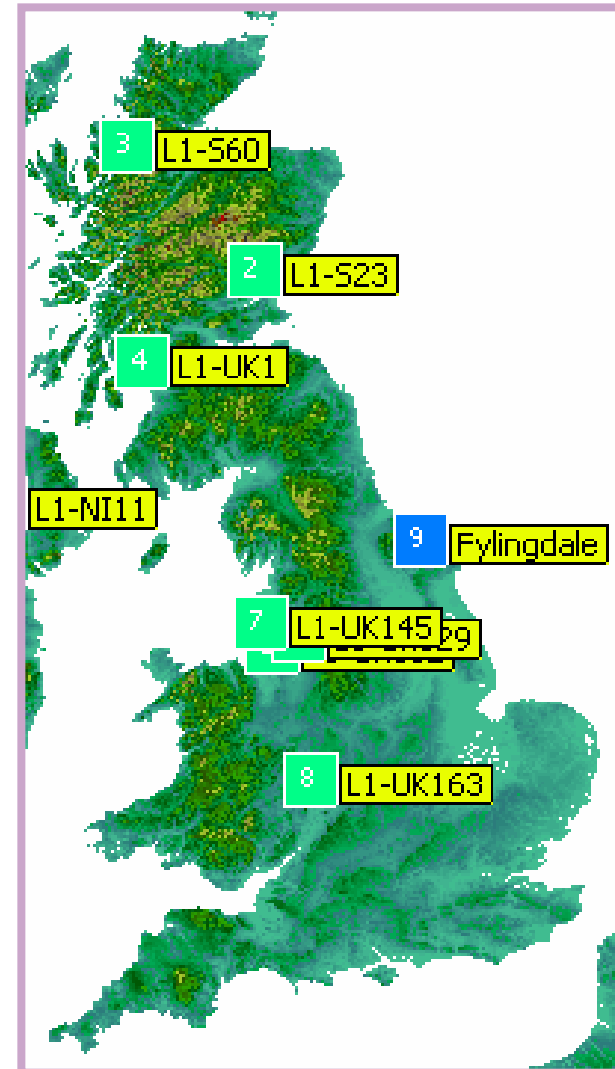
Calculation of levels at the radar

Add Fylingdales to the map

Select **UHF1**
Menu

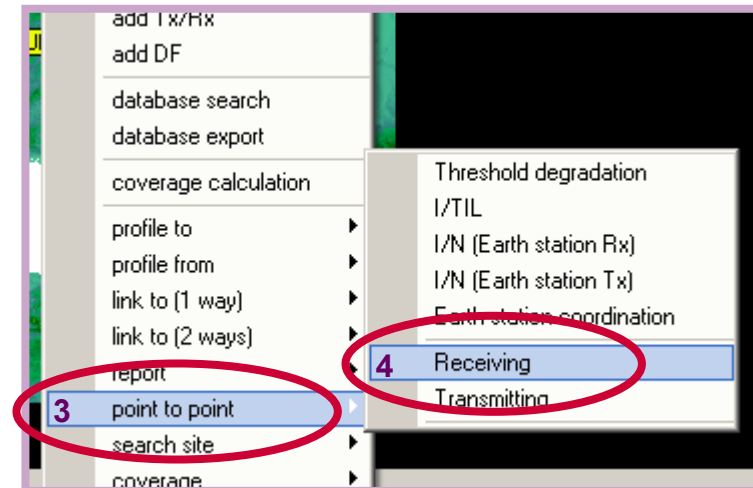
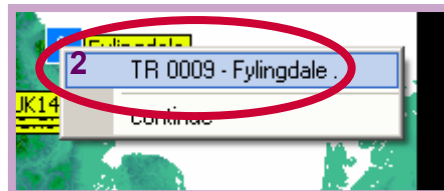
Choose
Add Fylingdales

A blue square labelled
Fylingdale will appear on the
map in addition to the
stations loaded earlier.



Calculation of levels at the radar

Received signal levels at Fylingdales



Calculation of levels at the radar

Transferring levels into the database

A box labelled **Report** will appear

Click List ①

An excel form will appear

Click **COPY TO MASTS DATABASE** ②

Report

STATION Fylingdales (0009) RECEIVING

FSR includes Rx antenna discrimination

Transmitter	#	FSR (dBu)	Pr (dBm)	Distance (m)	Frequency (MHz)	Path
Reference	0001	-37.4	-164.9	398120.58	420	FS
Reference	0002	-29.8	-157.3	297139.70	420	FS
Reference	0003	-50.5	-178.1	464004.31	420	FS
Reference	0004	-38.8	-166.4	311051.12	420	FS
Reference	0005	-8.5	-136.1	173366.66	420	FS
Reference	0006	-5.8	-133.3	146996.60	420	FS
Reference	0007	-9.3	-136.8	170856.67	420	FS
Reference	0008	-18.7	-146.2	251162.10	420	FS

Power sum: -130.25 dBm / -2.41 dBu

Printer: \\PRINTING\RH-3\LJ4050-04 Print Setup... Print 1 List Quit

COPY Fylingdales fieldstrength and direction of arrival data to MASTS database

2 COPY TO MASTS DATABASE

Exit

COPY TO REFERENCE DATABASE

COPY TO MASTER REFERENCE DATABASE

6 Reference LI-UK129 -15.05 -142.58 420 231.85 0.45

The levels for each site have now been loaded into the database.

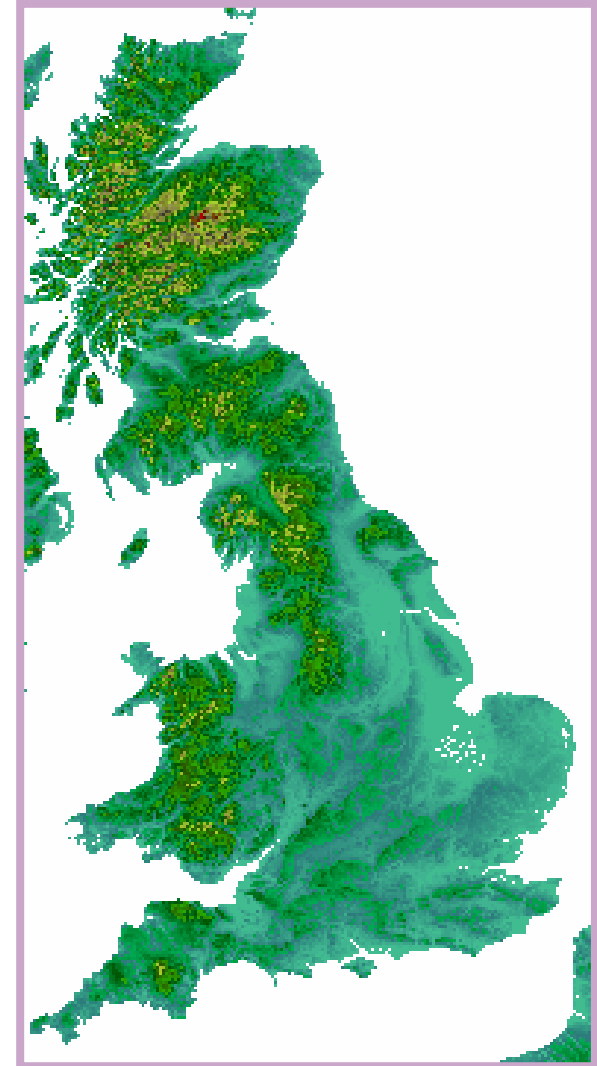
Calculation of levels at the radar

Select **UHF1**
Menu

Choose
Delete Stations

All the sites have been deleted
from the map.

- From this point on all calculations are undertaken within the database.

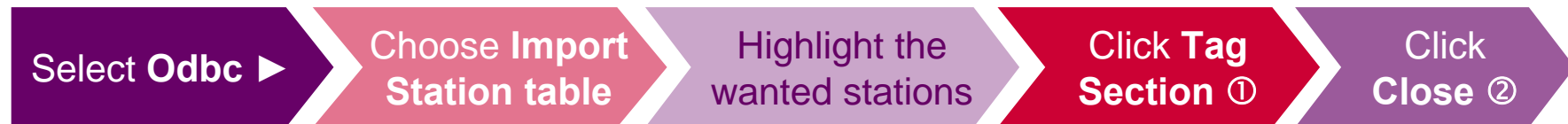


Operating the tool

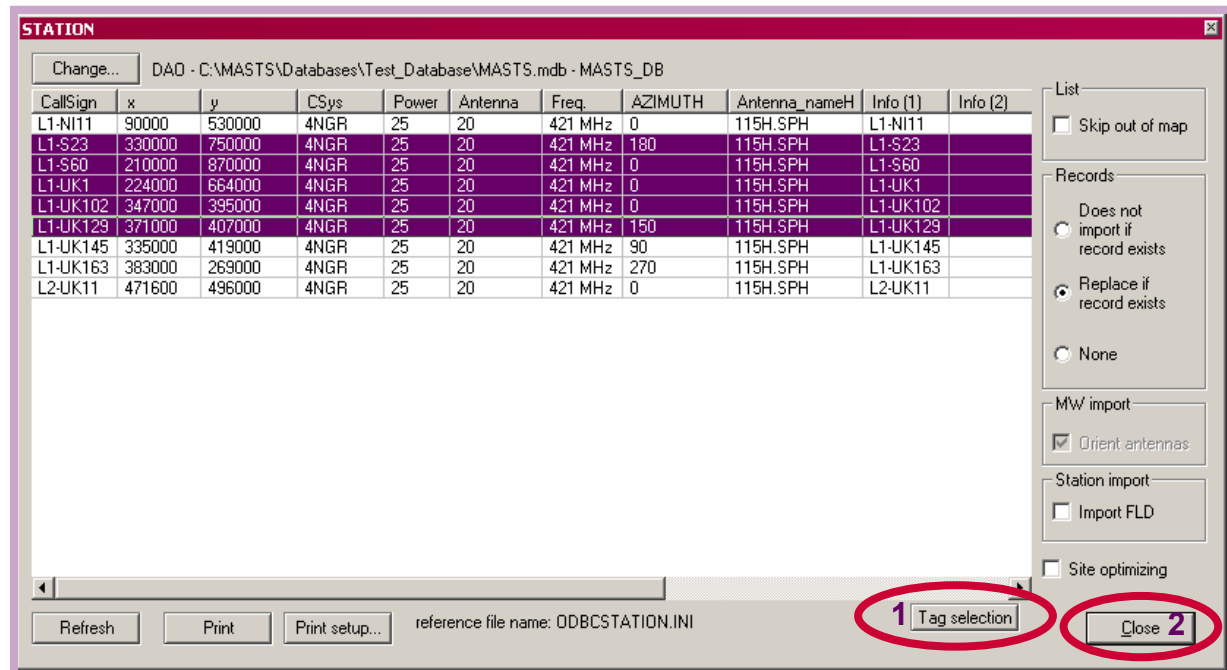
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 - Retrieving results

Co-ordination calculations

Tagging records



- In the database the selected tagged records will have STATUS set to 1, those not selected STATUS will be set to 0
- Only those recorded with STATUS set to 1 will be considered in the co-ordination calculation



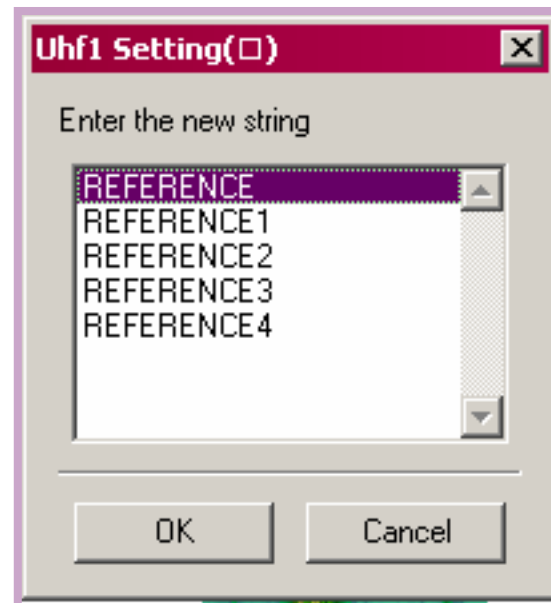
Co-ordination calculations

Selecting reference network



Selecting the correct reference network:

- **Reference1:** a single lot
- **Reference2:** two lots
- **Reference3:** three lots
- **Reference4:** all lots



Co-ordination calculations

Calculate current margins

Select **UHF1** Menu

Choose **Calculate current margins**

An excel sheet will appear

Close excel

Pass:

- All values for Current Margin A, B and C must be positive.

Fail:

- Any values for Current Margin A, B and C are negative.

	A	B	C	D	E	F	G	H	I	
1										
2										
3										
4	UHF1 Calculation Summary									
5	Reference Dataset Used -		UHF1_REFERENCE_DB							
6	Selection -		Tagged							
7	Number of Records in selection =		984							
8	Address = REFERENCE									
9	Dataset Compared -		MASTS_DB							
10	Selection -		ALL							
11	Number of Records in selection =		9							
12										
13										
14	Current Margin									
15	A =	11.42354243	B =	-3.53239	C =	11.42354				
16										
17										
18										
19										

Co-ordination calculations

Retrieving results

Select **UHF1** Menu

Choose **Retrieve Results**

An excel workbook will appear

Save results as necessary

The excel workbook will contain two pages of data:

- **Results (UHF1)**
- **Network data (MASTS_DB)**

The screenshot shows a Microsoft Excel window titled 'Microsoft Excel - MASTS.xls'. The active sheet is 'MASTS_DB' and the selected cell is 'UHF1'. The spreadsheet content is as follows:

	A	B	C	D	E	F	G
1	Ofcom OFFICE OF COMMUNICATIONS						
2	PASS						
3							
4							
5	UHF1 Calculation Summary						
6	Reference Dataset Used -		UHF1_REFERENCE_DB				
7	Selection -		Tagged				
8	Number of Records in selection =		984				
9	Address = REFERENCE1						
10	Dataset Compared -		MASTS_DB				
11	Selection -		Tagged				
12	Number of Records in selection =		5				
13							
14							
15	Current Margin		A =	13.73	B =	19.29	C = 24.97
16							
17							

Examples to try using test data

- NetA with Reference1
 - A: 13.73 B: 19.29 C: 24.97
- NetB with Reference1
 - A: 19.56 B: 15.57 C: 28.14
- NetB with Reference2
 - A: 22.57 B: 18.58 C: 31.15
- NetC with Reference4
 - A: -1.71 B: -8.65 C: -1.72
- NetC without stations **Station20** and **Station21** with Reference4
 - A: 0.50 B: -6.43 C: 0.50

Any Questions?

Any Comments?

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Thank you for coming