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# INTERNATIONAL CIVIL AVIATION ORGANIZATION

A UN SPECIALIZED AGENCY



# Frequency Finder

## *SSR II Code Module*

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**Workshop/Training on  
“Frequency Finder 2023” application**

**Lima, Perú | 29 May to 02 June 2023**

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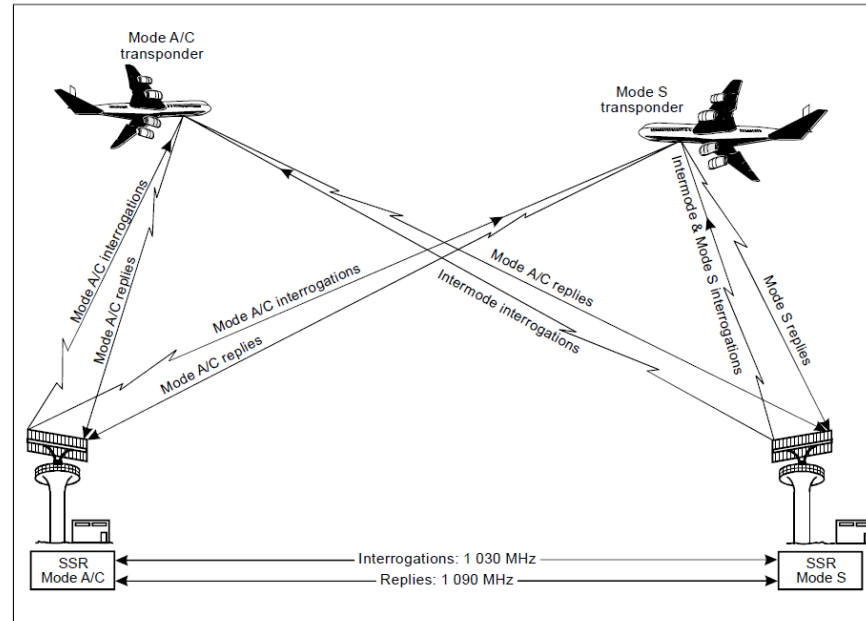
# RECONNECTING THE WORLD



## Planning Criteria for SSR Mode S II Code

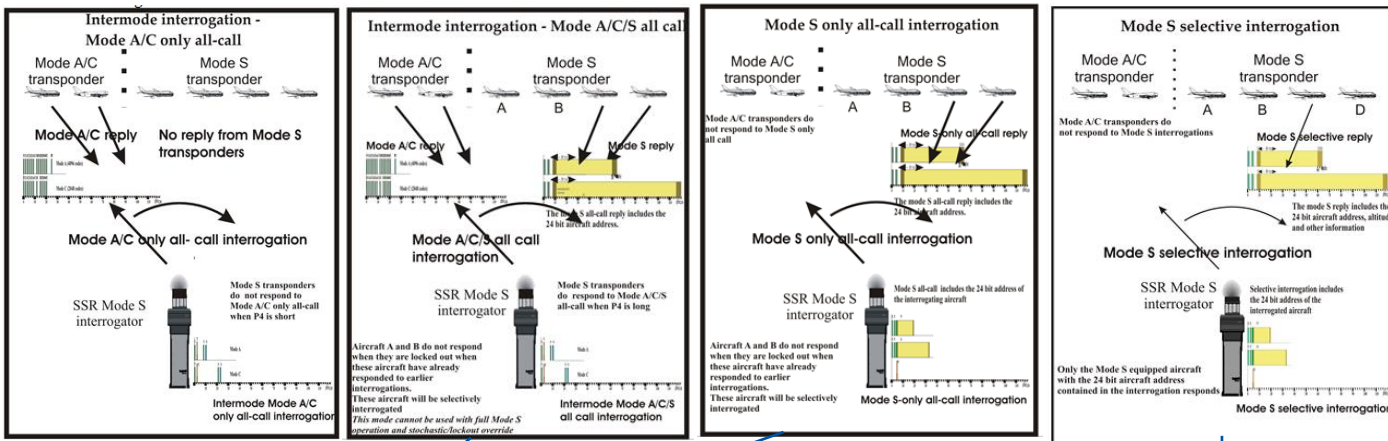


## Introduction- SSR Operation





## Introduction- SSR Mode S Operation



All call activities

Roll call activities

### SSR MODE S

|          |           |          |           |          |           |          |
|----------|-----------|----------|-----------|----------|-----------|----------|
| All call | Roll call | All call | Roll call | All call | Roll call | All call |
|----------|-----------|----------|-----------|----------|-----------|----------|

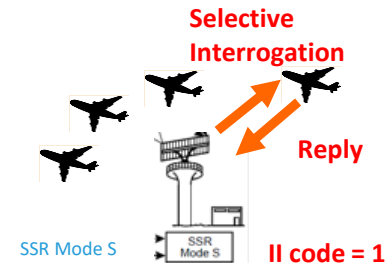
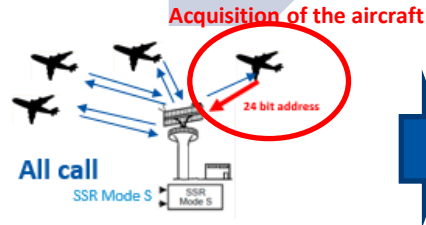
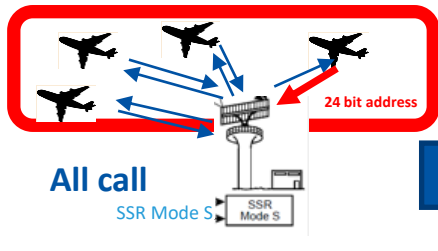


## How SSR Mode S interrogator acquire all aircraft in coverage

### Mode A/C and Mode S activities (All call)

To perform surveillance of SSR Mode A/C equipped aircraft  
To acquire new Mode S aircraft  
24 bit address and  
Position of the aircraft

### Mode S **selective Interrogation** (Roll call)





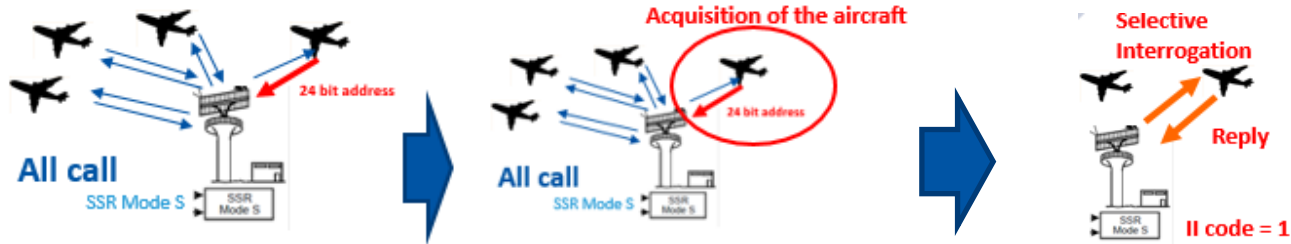
## Selective addressing

*Both the SSR Mode S ground station and the aircraft are capable of identifying each other.*

Aircraft side : 24 bit address is required

Then...what should be used for ground side???

**IC codes are required**





## What is IC codes

The SSR Mode S ground station is identified by its interrogator code (IC), which can either be an Interrogator Identifier (II) code or a Surveillance Identifier (SI) code.

Four bits are available for 16 different II codes.

- II code 0 requires special handling.
- **II codes 1-15 for assignment to fixed Mode S ground stations with overlapping coverage.**

***Frequency Finder is the tool to manage those II codes.***

In some regions certain II codes have been reserved for specific purposes and are not available for general assignment.

For aircraft complying with the provisions of Annex 10, Volume IV, Amendment 73 (or later) an additional 63 codes known as SI codes can be used, which adds significant complexity required for the assignment and operation with SI codes.



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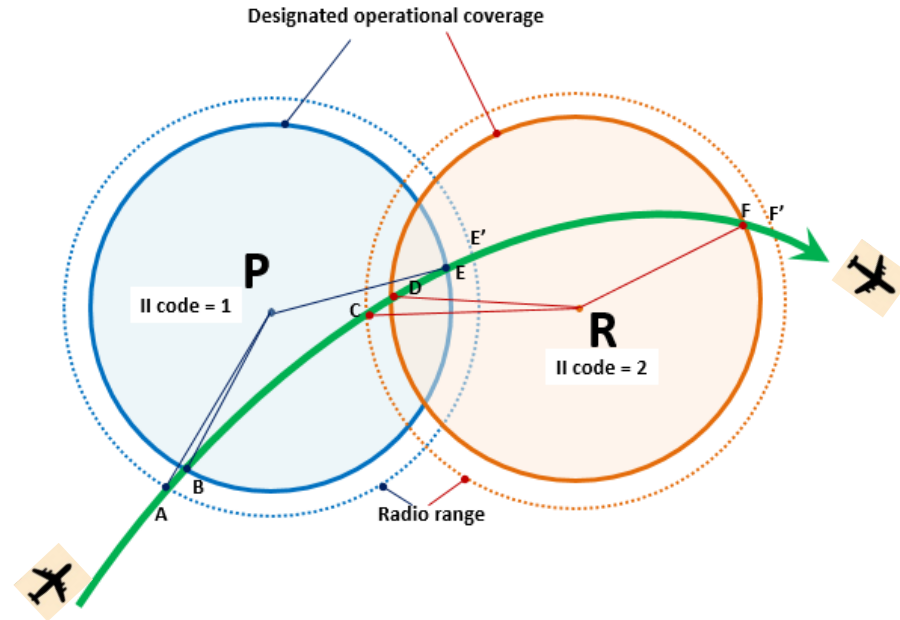


## Coordination of II codes of adjacent SSR Mode S interrogators

- When adjacent Mode S ground stations have overlapping designated operational coverage
- Between adjacent States and regions
- Should coordinate with other authorities such as Military radars...

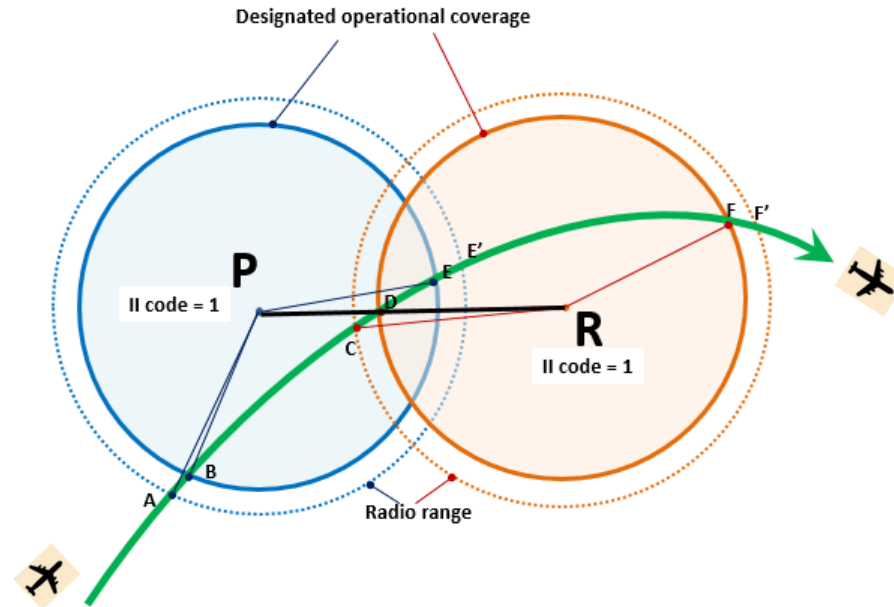


## Process for II code acquisition and lock-out



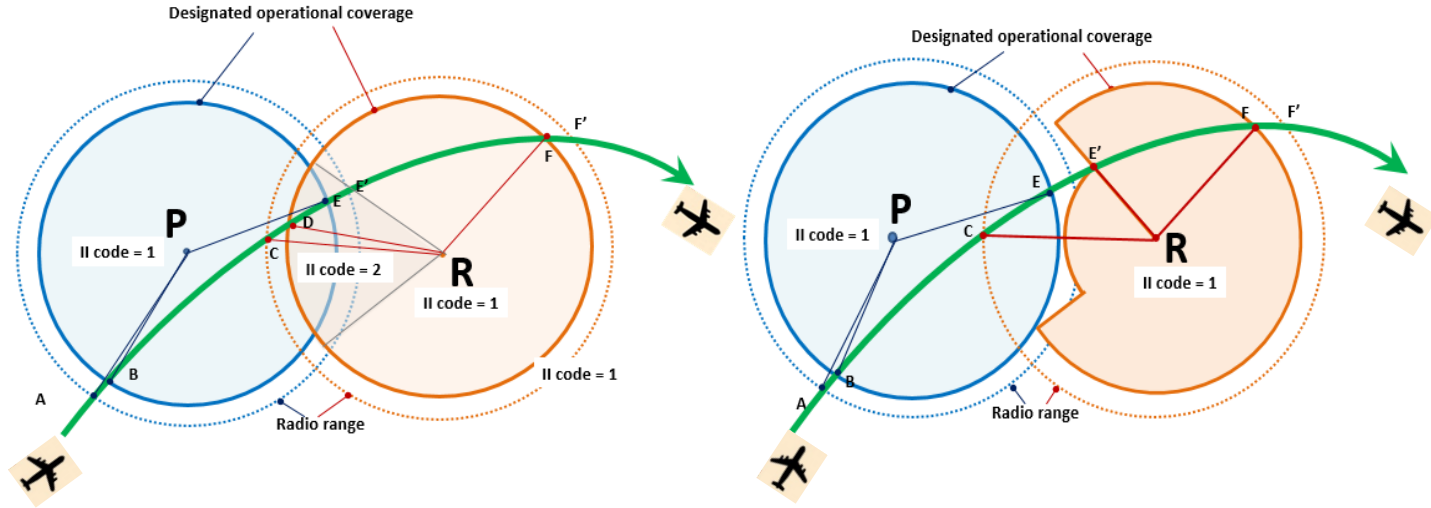


## SSR Mode S interrogator clustering (interrogators with same II code)



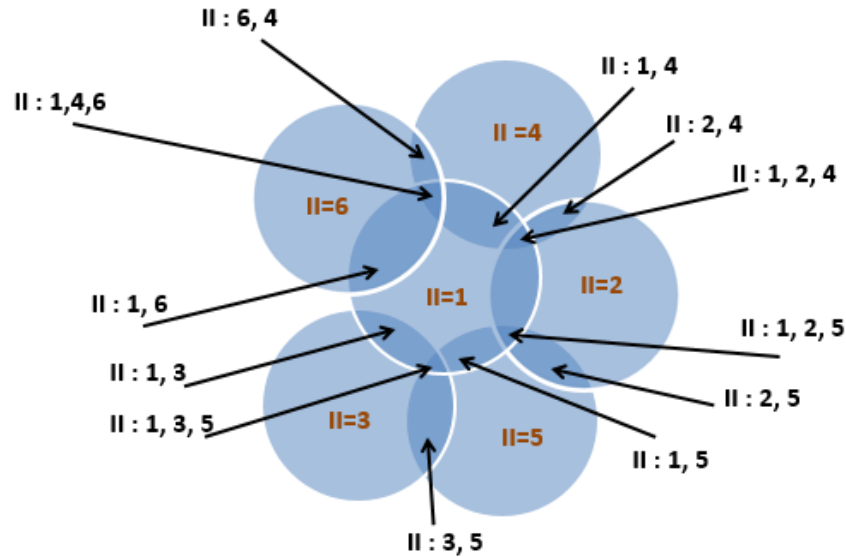


## Sectorized use of II codes





## Practical examples of Interrogator Identifier code assignments





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**RECONNECTING THE WORLD**



# Frequency Finder

## *SSR II Code Module*



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# RECONNECTING THE WORLD

## Start page and SSR Home page



Start



Start page

① Click "SSR"



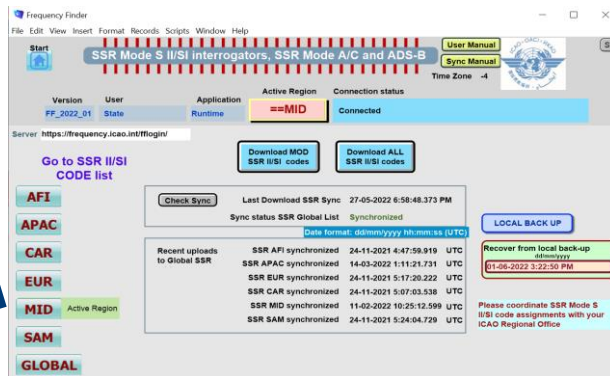
② Select "your region"

Home



Home page

② Click "your region"



③ "Integrity Check" will start  
– See Next slide



## Main functions on the window SSR Table

### Regular and new functions – NewMod Facility and Test Mode Facility

Frequency Finder

File Edit View Insert Format Records Scripts Tools Window Help

State Active Region ==AFI SSR Table SSR Table SSR Table SSR Table SSR Table State User Manual Sync Manual ST

Halt Return Mode S code list: 1 record # 537 total 59 found

Start Home GLOBAL AFI Delete Record

SELECT Query

**NEW**

New/Mod Facility TEST Mode S Facility Summary test results

CANCEL NEW Facility ADD Facility MODIFY Facility

Cancel Single Mode S Facility Found Mode S Facilities

Special Functions - Export submissions -

US KEY REGION SSR code COUNTRY LATITUDE LONGITUDE DOC (NM) Cluster ATS Unit served Interrogator RE

| US     | KEY REGION | SSR code | COUNTRY  | LATITUDE       | LONGITUDE                | DOC (NM) | Cluster | ATS Unit served | Interrogator | RE     |
|--------|------------|----------|----------|----------------|--------------------------|----------|---------|-----------------|--------------|--------|
| E 5000 | AFI        | 01       | Benin    | BEN Cotonou    | 06D21'31" N 002D22'59" E | 200      |         |                 | Il only      |        |
| E 5119 | AFI        | 04       | Benin    | BEN Cotonou    | 06D21'31" N 002D22'59" E | 88       |         |                 | Il only      |        |
| E 5100 | AFI        | 00       | BOTSWANA | BOT Gaborone   | 24D32'33" S 025D55'52" E | 200      |         |                 | Il only      | Sir Se |
| E 5101 | AFI        | 00       | BOTSWANA | BOT Letlhakane | 21D22'37" S 025D35'21" E | 200      |         |                 | Il only      | Letlha |





## Main functions on the window SSR Table Regular and new functions – New facility

State: [redacted] Active Region ==APAC NEW/MOD SSR

Start Home Go to Regional SSR list Delete draft facilities

total found 544 1 View Summary calculations Save

Mapping Save as

KEY D 63779610 US DN New assignment STA

REGION [redacted]

COUNTRY [redacted] AFG

NAME location [redacted]

LATITUDE 30 D 22 ' 45 " N

LONGITUDE 060 D 49 ' 27 " E

REMARK Test ICAO

Cluster [redacted]

Select Text\_SSR [redacted]

Test 6

The selected SSR Mode S II Code is compatible 32

FIR [redacted]

4

Enter [circular] coverage

Set in the field "Set Coverage" the range (NM) of the SSR or ADS-B facility.

Click "Enter" to set all sectors for the coverage to the specified

Set Coverage

250

Cancel

Enter

5

Print on map

Do you want to print to results of the compatibility calculations on a map with Google Earth.

Click "Print" to print the calculation results on a map.

Click "No Print" in case no calculation results are to be printed on a map.

Click "Terminate" to terminate the compatibility calculations

Terminate

No Print

Print



## Main functions on the window SSR Table Regular and new functions – Mod / Add Facility

File Edit View Insert Format Records Scripts Tools Window Help

State Active Region ==AFI NEW/MOD SSR NEW/MOD SSR NEW/MOD SSR NEW/MOD SSR User Manual Sync Manu

Start Home  
total found  
544 1

Go to Regional SSR list

View Summary calculations

Mapping

Delete draft facility

Save as draft facility

Save as registered facility

### NEW/MOD SSR

Mode S II, Mode S SI, A/C, ADS-

Go to S:

**KEY** D 2162 US DR Mod assignment

**REGION**

**COUNTRY**

**NAME location**

**LATITUDE** 05 D 56 | 37 | N

**LONGITUDE** 116 D 03 | 40 | E

**REMARK** System Identifier: 092; 15 JAN 2019

Cluster

Select Text\_SSR

**Test**

The selected SSR Mode S II Code is NOT compatible

**FIR**

**STATION**

**DOC**

**COVERAGE** 250 NM

|          |     |          |     |
|----------|-----|----------|-----|
| Sector1  | 250 | Sector13 | 250 |
| Sector2  | 250 | Sector14 | 250 |
| Sector3  | 250 | Sector15 | 250 |
| Sector4  | 250 | Sector16 | 250 |
| Sector5  | 250 | Sector17 | 250 |
| Sector6  | 250 | Sector18 | 250 |
| Sector7  | 250 | Sector19 | 250 |
| Sector8  | 250 | Sector20 | 250 |
| Sector9  | 250 | Sector21 | 250 |
| Sector10 | 250 | Sector22 | 250 |
| Sector11 | 250 | Sector23 | 250 |
| Sector12 | 250 | Sector24 | 250 |

Re-calculate test points

PolyID

**SEARCH**

Mode S II Search Range Start End  
01 15

**START SEARCH**

MAX II/SI codes 10

FOUND II/SI codes 0

Searching

Selected II code

Test II/SI Code

| Mode Code | Margin               |
|-----------|----------------------|
| FF1       | <input type="text"/> |
| FF2       | <input type="text"/> |
| FF3       | <input type="text"/> |
| FF4       | <input type="text"/> |
| FF5       | <input type="text"/> |
| FF6       | <input type="text"/> |
| FF7       | <input type="text"/> |
| FF8       | <input type="text"/> |
| FF9       | <input type="text"/> |
| FF10      | <input type="text"/> |

ATS Unit 1 KK ACC

ATS Unit 2

ATS Unit 3

ATS Unit 4

Search range 01...15

Blocked



## Main functions on the window SSR Table

### Regular and new functions – Mod / Add Facility

State: [ ] Active Region: ==AFI NEW/MOD SSR NEW/MOD SSR NEW/MOD SSR NEW/MOD SSR User Manual Sync Manual ST

Start Home Go to Regional SSR list Delete draft facility **NEW/MOD SSR** Mode S II, Mode S SI, A/C, ADS- Mapping View Summary calculations Save as draft facility Save as registered facility Go to SSR Codes

total 544 found 1

**KEY** D 2162 US DR Mod assignment **STATION**

**REGION** **COUNTRY** **NAME location** **LATITUDE** 05 D 56 37 N **LONGITUDE** 116 D 03 40 E **REMARK** System Identifier: 092: 15 JAN 2019 **Cluster** **Select Text\_SSR** **Test** **Margin (NM)** 76 **The selected Mode S II Code is compatible**

**DOC** **COVERAGE** 250 NM

|         |     |          |     |
|---------|-----|----------|-----|
| Sector1 | 250 | Sector13 | 250 |
| Sector2 | 250 | Sector14 | 250 |
| Sector3 | 250 | Sector15 | 250 |
| Sector4 | 250 | Sector16 | 250 |
| Sector5 | 250 | Sector17 | 250 |
| Sector6 | 250 | Sector18 | 250 |

**SEARCH** **Mode Code** **Margin**

|      |       |     |
|------|-------|-----|
| FF1  | II 03 | 76  |
| FF2  | II 09 | 59  |
| FF3  | II 13 | 374 |
| FF4  |       |     |
| FF5  |       |     |
| FF6  |       |     |
| FF7  |       |     |
| FF8  |       |     |
| FF9  |       |     |
| FF10 |       |     |

**Matching codes**

|      |    |
|------|----|
| SI-A | 03 |
| SI-B | 19 |
| SI-C | 35 |
| SI-D | 51 |
| II   | 03 |

**SSR/ADS Mode** Mode S II code **6**

**SSR II or SI Code** 03 **4**

**Interrogator capability** II only

**Search completed** 03 **Tested**

Print on map Do you want to print the results of the compatibility calculations on a map with Google Earth. Click "Print" to print the calculation results on a map. Click "No Print" in case no calculation results are to be printed on a map. Click "Terminate" to terminate the compatibility calculations

Terminate No Print Print



## Main functions on the window SSR Table (cont'd) Regular and new functions - Mapping

Frequency Finder

File Edit View Insert Format Records Scripts Tools Window Help

State  **SSR Table** **SSR Table** **SSR Table** **SSR Table** **SSR Table** State **User Manual** **Sync Manual** **ST**

Return Mode S code list: 1 record #  
 GLOBAL 538 total  
 AFI 60 found  
 Delete Record

SELECT  
 Query  
 New/Mod Facility  
 TEST Mode S Facility  
 Summary test results  
 MAPPING  
 Export facilities to file  
 Special Functions  
 Cancel  
 Single Station  
 Found Stations  
 - Export submissions -

US  KEY REGION  SSR code  COUNTRY  LATITUDE  LONGITUDE  DOC (NM)  Cluster  ATS Unit served  Interrogator  RT

| US     | KEY REGION | SSR code  | COUNTRY       | LATITUDE  | LONGITUDE    | DOC (NM) | Cluster | ATS Unit served | Interrogator | RT |
|--------|------------|-----------|---------------|-----------|--------------|----------|---------|-----------------|--------------|----|
| E 5007 | AFI        | II 03     | Chad          | 12D08'10" | N 015D02'36" | E 200    |         |                 | II only      |    |
| E 5008 | AFI        | II 01     | Comoros       | 11D32'08" | S 043D16'32" | E 200    |         |                 | II only      |    |
| E 5009 | AFI        | II 03     | Congo         | 04D14'06" | S 015D15'41" | E 200    |         |                 | II only      |    |
| E 5010 | AFI        | II 03     | Cote d'Ivoire | 05D15'33" | N 003D55'53" | W 200    |         |                 | II only      |    |
| E 5103 | AFI        | II 14     | ETHIOPIA      | 08D58'36" | N 038D47'53" | E 200    |         |                 | II only      |    |
| E 5011 | AFI        | II 04     | Gabon         | 00D27'39" | N 009D24'44" | E 200    |         |                 | II only      |    |
| E 5012 | AFI        | II 04     | Ghana         | 05D36'43" | N 000D10'04" | W 200    |         |                 | II only      |    |
| E 5013 | AFI        | II 05     | Ghana         | 09D33'24" | N 000D51'59" | W 200    |         |                 | II only      |    |
| E 5014 | AFI        | ADS ADS-B | Guinea        | 09D34'36" | N 013D37'37" | W 200    |         |                 | ADS          |    |
| E 5015 | AFI        | ADS ADS-B | Guinea        | 10D26'46" | N 009D14'18" | W 200    |         |                 | ADS          |    |
| E 5016 | AFI        | ADS ADS-B | Guinea        | 11D20'25" | N 012D17'24" | W 200    |         |                 | ADS          |    |
| E 5017 | AFI        | ADS ADS-B | Guinea        | 07D48'53" | N 008D42'16" | W 200    |         |                 | ADS          |    |
| E 5018 | AFI        | ADS ADS-B | Guinea        | 08D37'06" | N 011D03'01" | W 200    |         |                 | ADS          |    |
| E 5019 | AFI        | II 03     | Guinea-Bissau | 11D54'15" | N 015D38'53" | W 200    |         |                 | II only      |    |
| E 5115 | AFI        | II 03     | ICAO TEST AFI | 38D38'38" | N 001D03'01" | W 100    |         |                 | II only      |    |

frdeglat  **SSR Mode S Interrogator Identifier (II) Code and Surveillance Identifier (SI) code list, SSR Mode A/C and ADS-B**



## Main functions on the window SSR Table (cont'd) Regular and new functions - Query

File Edit View Insert Format Records Scripts Tools Window Help

| KEY | REGION | SSR code | NAME location | LATITUDE | LONGITUDE | DOC (NM) | Cluster | ATS Unit served          |     |  |
|-----|--------|----------|---------------|----------|-----------|----------|---------|--------------------------|-----|--|
| DN  | D      | 5127     | AFI           |          |           |          |         |                          |     |  |
| E   | 5000   | AFI      | II            | 01       | Benin     | BEN      | Cotonou | 06D21'31" N 002D22'59" E | 200 |  |
| F   | 6410   | AFI      | II            | 04       | Benin     | BEN      | Cotonou | 06D21'31" N 002D22'59" E | 88  |  |

**Enter your QUERY**

Query Database

REGION: ==AFI Country code: [ ] Select SSR Mode: ADS

COUNTRY: [ ] No country selected [R] Select SSR Code: II

NAME location: [ ] No location selected [R]

Select criteria for the query from the fields in the box Query Database:

1. Select geographic parameters (Region, Country Location) first, if required
2. Select SSR Mode (II or SI or A/C or ADS-B), if required
3. Select SSR Code, if required
4. Click **FIND**

Use this window to only enter criteria for your query

Region: ==APAC  
Country: N/A  
Location: N/A  
SSR Mode (II, SI, A/C or ADS-B): N/A  
SSR Mode S Code: N/A

Last Query - parameters  
[Modify/redo] last find

Click here to use the parameters of your most recent query; you can modify these parameters in the box "Query Database"

Frequency Finder has been activated for the Region ==AFI



## Main functions on the window SSR Table (cont'd)

### Regular and new functions – Export submissions

The screenshot shows the SSR Table application interface. The 'Export submissions' dialog box is open, displaying the following text:

<110> Open excel file

An Excel file will be created containing your submissions which you can attach later to an email message to the Regional Office.

Click "Open" to look at and save the Excel file  
Click "Cancel" to cancel.

Notes:  
1. The Excel file is saved in the folder C:/Frequency Finder/Save Submissions of your computer.  
2. From this folder you can attach the Excel file to your email to the Regional Office.

Buttons: Cancel, Open

The screenshot shows the SSR Table application interface with the 'Export submissions' dialog box open. A blue arrow points from the 'Open' button in the dialog box to the 'Export submissions' button in the application interface. Below the application interface, a screenshot of an Excel file is shown, containing the following data:

| A       | B       | C       | D       |
|---------|---------|---------|---------|
| Sector1 | Sector2 | Sector3 | Sector4 |
| 200     | 200     | 200     | 200     |
|         |         |         |         |
|         |         |         |         |
|         |         |         |         |
|         |         |         |         |

The Excel file is named 'SSR AFI ZZA 02-05-2022 70338 PM.xlsx' and is located in the folder 'C:/frequencyfinder/SaveSubmissions'.



## Main functions on the window SSR Table (cont'd)

Regular and new functions – Export facilities to file

The screenshot shows the 'Frequency Finder' application window. The main area displays a table of SSR records. A dropdown menu is open over the 'Export facilities to file' button, showing options: 'Cancel', 'Ctry/Loc/II Code', and 'II Code/Ctry/Loc'. A red arrow points from the dropdown menu towards the bottom of the screen.

| KEY    | REGION | SSR code | COUNTRY  | NAME location | LONGITUDE  | DOC (NM) | Cluster | ATS Unit served | Interrogator | RI     |
|--------|--------|----------|----------|---------------|------------|----------|---------|-----------------|--------------|--------|
| E 5000 | AFI    | 01       | Benin    | Cotonou       | 002D22'59" | E 200    |         |                 | II only      |        |
| E 5119 | AFI    | 04       | Benin    | Cotonou       | 002D22'59" | E 88     |         |                 | II only      |        |
| E 5100 | AFI    | 00       | BOTSWANA | Gaborone      | 025D55'52" | E 200    |         |                 | II only      | Sir Se |
| E 5101 | AFI    | 00       | BOTSWANA | Lethakane     | 025D35'21" | E 200    |         |                 | II only      | Letha  |
| E 5102 | AFI    | 00       | BOTSWANA | Maun          | 023D25'47" | E 200    |         |                 | II only      | Maun   |

The screenshot shows the 'SSR Mode S Interrogator Identifier (II) Code list' window. It features a search bar with 'Filename\_SSR: 2022 5 10 AFI 133512' and 'Date\_SSR: 10 May 2022'. A dropdown menu is open over the 'Select Export Format' button, showing options: 'Export FMP (FileMaker 12)', 'Export Excel', 'Export XML', 'Export CSV', and 'Export PDF (not in runtime)'. A red arrow points from the dropdown menu towards the bottom of the screen.

Filename\_SSR: 2022 5 10 AFI 133512  
Date\_SSR: 10 May 2022

EXPORT SSR Table (Mode S II, Mode S SI, A/C and AD)

Sort order: Country-Location-II/SI Code

| KEY    | REGION | SSR II/SI code | COUNTRY | NAME location | LATITUDE     | LONGITUDE    |
|--------|--------|----------------|---------|---------------|--------------|--------------|
| D 5127 | AFI    | 01             |         |               |              |              |
| E 5000 | AFI    | 01             | Benin   | BEN Cotonou   | 002D22'59" N | 002D22'59" E |
| E 5119 | AFI    | 04             | Benin   | BEN Cotonou   | 002D22'59" N | 002D22'59" E |



## Main functions on the window SSR Table (cont'd)

Regular and new functions – Export facilities to file

**SSR Mode S Interrogator Identifier (II) Code list**

Select Sort Order    Filename\_SSR 2022 5 10 AFI 133512    **EXPORT SSR Table (Mod**  
Date\_SSR 10 May 2022    Print    Set print landscape

Go to Regional SSR Table    Sort order: Country-Location-II/SI Code

KEY    REGION    SSR II/SI code    COUNTRY    NAME location    LATITUDE

200 Sector6 200 Sector7 200 Sector8 100 Sector9 50 Sector10

SaveExcel

Share    View

Paste    Move to >    Delete >    New folder    Properties    Select all    Select none    Invert selection

Organize    New    Open    Select

« FrequencyFinder » SaveExcel    Search SaveExcel

Name    Date modified    Type

SSR\_II\_Code\_Ctry\_2022 5 10 AFI 133512.xlsx    10/05/2022 1:36 PM    Microsoft Excel

Page Layout    Formulas    Data    Review    View    Tell m    Chou...    Share

10    Conditional Formatting >    Cells    Editing

Alignment    Number    Format as Table >    Cell Styles >

Styles

fx    SSR II\_SI

|  | B           | C  | D    |
|--|-------------|----|------|
|  | SSR II code | DR | Key  |
|  | 01          | E  | 5127 |
|  | 04          | E  | 5000 |
|  | 00          | E  | 5119 |
|  |             | E  | 5100 |



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**RECONNECTING THE WORLD**



***QUESTIONS?***



## Background information

### Refer to Annex 10 Volume 4

2.1.2.1.1 Recommendation.— Administrations should coordinate with appropriate national and international authorities those implementation aspects of the SSR system which will permit its optimum use.

2.1.2.1.2 The assignment of interrogator identifier (II) codes, where necessary in areas of overlapping coverage, across international boundaries of flight information regions, shall be the subject of regional air navigation agreements.

2.1.2.1.3 The assignment of surveillance identifier (SI) codes, where necessary in areas of overlapping coverage, shall be the subject of regional air navigation agreements.

Note.— The SI lockout facility cannot be used unless all Mode S transponders within coverage range are equipped for this purpose.

2.1.3.3.1 Requirements for mandatory carriage of SSR Mode S transponders shall be on the basis of regional air navigation agreements which shall specify the airspace and the airborne implementation timescales.



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## Background information

### Annex 10 Volume 4

3.1.2.11.6 Lockout coordination. A Mode S interrogator shall not be operated using all-call lockout until coordination has been achieved with all other operating Mode S interrogators having any overlapping coverage volume in order to ensure that no interrogator can be denied the acquisition of Mode S-equipped aircraft.

Note.— This coordination may be via ground network or by the allocation of interrogator identifier (II) codes and will involve regional agreements where coverage overlaps international boundaries.

Etc.....



## Background information

- Refer to Doc 9924 Aeronautical Surveillance Manual for more details related to:
  - SSR Mode S
  - ADS-B
  - ACAS
  - Multilateration (MLAT) etc...

***Also for your convenience, we provided “Appendix J Chapter 8 of the Unedited version of second edition of Doc 9924 ” during the workshop.***



Thank You!

