



HOWTO - Use the GCC (Global Country Code) Library

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Summary

The GCC (Global Country Code) is a mandatory component that is used in RadioDNS Hybrid Radio Lookups for FM, DAB, DAB+. Without the GCC, the lookup cannot take place, and an IP connection cannot be made.

The GCC is formed by combining two elements - the ECC (Extended Country Code) and the Country Code (the first nibble of an RDS PI code or 16bit DAB/DAB+ SId code). The ECC was defined because the range of values of Country Code is not sufficient to uniquely identify every country. Whilst the Country Code is mandatory and transmitted frequently, the ECC code is not mandatory for broadcasters to transmit, and may only be repeated infrequently. (The ECC is an integral part of a 32bit SId for DAB/DAB+, as the first two nibbles).

The GCC library specifies a method for creating the GCC from the ISO country code of the device's current location and the Country Code received from RDS PI or DAB/DAB+ SId code. The ISO country code can be determined using standard techniques such as GeoIP or GPS location detection.

Important!



The ECC provided in the transmission from the broadcaster always takes priority over a GCC calculated by this library. This library exists to handle situations where ECC is not received in a timely manner, if at all. If an ECC is received at any time, it must be immediately used to construct a RadioDNS Lookup, the results of which are more authoritative than those provided by this library.

Integrating the GCC Library

Client devices are strongly recommended to implement the GCC library if they are able to determine the ISO country code of their current location. The nature of ECC transmission means it's not possible to determine when the ECC code will be broadcast, if at all. Implementing an indeterminate length wait when acquiring a service can dramatically slow down the RadioDNS Hybrid Radio Lookup process, and so access to hybrid functionality.

The Indeterminate Nature of ECC

ECC is an optional value, which is transmitted repetitively in:

- RDS Data Group 1A
- DAB/DAB+ FIG 0/9

The relevant rules of implementation for RDS and DAB suggest that ECC should be transmitted at intervals of 60 seconds (FM-RDS) and 1 second (DAB/DAB+), but this is not mandatory, and in any event, a transmission may be missed due to poor reception quality.

Waiting 60 seconds in order to perform a RadioDNS Lookup is not an optimal user experience. We recommend implementing the GCC Library in your device, and a logic flow as follows:

Example

:

The device has the ISO country code of its current location.

The user selects a service, and the Country Code (CC) is received.

Wait 1 second for reception of the ECC code. If the ECC is received within this 1 second, construct the GCC using the ECC and Country Code as normal.

The GCC Library is called to determine the GCC for the current ISO country and Country Code.

This GCC¹ is used to perform a RadioDNS Lookup and receives a CNAME¹ value.

Subsequently, the ECC code may be received from the transmission, and is used to create an updated GCC².

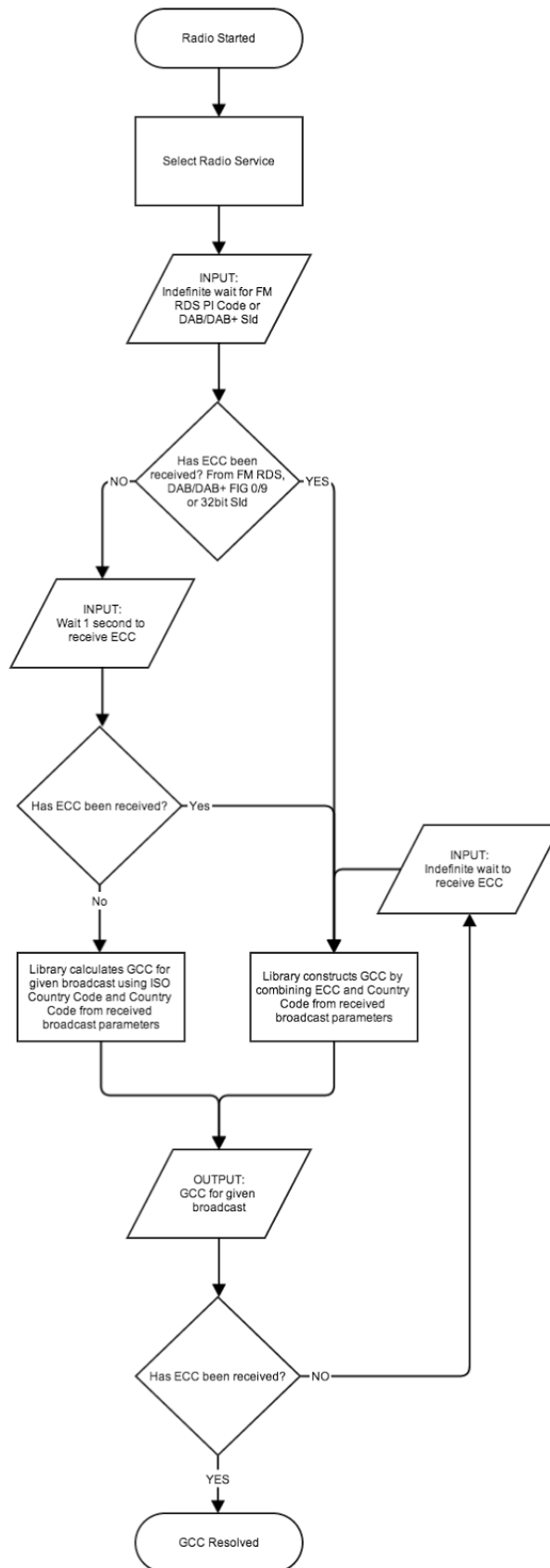
If GCC¹ and GCC² are equal, no action need be taken

If GCC¹ and GCC² are not equal, GCC² is used to perform a RadioDNS Lookup and receives a CNAME² value.

If the CNAME¹ and CNAME² are equal, no action need be taken.

Otherwise, all RadioDNS Hybrid Radio applications should be restarted, using the CNAME² value to resolve application locations.

Flowchart - Acquiring GCC using the GCC Library



Cross Border Radio Services

The GCC library also takes into account the possibility of cross border signals - that is, radio services being received from country A when located in country B.

Example

:

The receiver determines it is in France, ISO country code : `fr`

The receiver determines it is receiving a service on `91.1` MHz with PI code: `4100`

The GCC Library will take into account that the Country Code `4` is used by a number of countries (Israel, Switzerland, Vatican, Cambodia, Madagascar, Mauritania, Uganda, Falkland Islands, Martinique, USA, Australian, Pakistan, Western Samoa).

From this list, it will determine that Switzerland is the country closest to France, and thus the most likely GCC is `4e1` (Switzerland).

The library will return a GCC of `4e1`.

The RadioDNS Lookup can now proceed with the values:

```
09110.4100.4e1.fm.radiodns.org
```

Important!



There may be more than one GCC returned by the library. In certain circumstances, the country of origin may still be ambiguous. It is left to the device to define alternative methods of narrowing the GCC down to a single value, which may use more detailed positioning information than is assumed to be available in the library.

Using the Library

The library should be imported to your project according to your development environment.

Using data received by the device, the relevant values must first be set on an instance of the `Resolver` class, before then calling `resolveGCC()`.

Methods available for setting data are as follows:

```
void setIsoCountryCode(String isoCountryCode)
void setExtendedCountryCode(String ecc)
void setRdsPiCode(String rdsPi)
void setDabSid(String dabSid)
```

To complete the resolution the following method should be called.

```
List<Result> resolveGCC()
```

The four values which can be set (in upper or lower case) are:

1. An ISO 3166 two-letter country code representing the country the radio device is physically located within. This could be obtained using GPS or cell-triangulation etc (2 character string)
2. The ECC received from broadcast (2 character hexadecimal string)
3. The RDS PI Code received from FM broadcast (4 character hexadecimal string)
4. The DAB SID received from DAB broadcast (4 or 8 character hexadecimal string)

If a 32-bit (8 character hexadecimal) DAB Sid is provided it is the only value which needs to be set.

In all other cases a combination of the first or second values, and third or fourth values must be set for a successful resolution.

The method returns a list of `Result` objects each of which include the Global Country Code (GCC) for the country matching the Country Code / ECC and RDS PI Code / DAB Sid combination. In most cases the list will contain only one result, however more may be returned in some cases.

Example:

```
Resolver resolver = new Resolver();

try {

    Resolver resolver = new Resolver();
    resolver.setIsoCountryCode("CH");
    resolver.setRdsPiCode("4479");

    List<Result> resultList = resolver.resolveGCC();
    Result result = resultList.get(0);

    System.out.println("GCC: " + result.gcc);

} catch (ResolutionException e) {
    e.printStackTrace();
}
```

In the above example the radio device has located itself within Switzerland (CH), but the first nibble of the received RDS PI is not Switzerland's Country ID of '4'. Here the library would return a Global Country Code of 'de0', having identified the FM broadcast as a German station and assuming the

radio device must be near the border.

Acquiring an ISO Country Code

It is outside the scope of this document to specify how to acquire an ISO Country Code for the device's current location.

Approaches might include requesting GPS-style information from the device, referencing the mobile/cellular network, or using a GeolIP reverse lookup service.

Troubleshooting

Multiple GCCs returned

In some cases multiple GCCs will be returned when there is more than one possible GCC result for the given input parameters. In these cases it is up to the device to define alternative methods of narrowing the GCC down to a single value, which may use more detailed positioning information than is assumed to be available in the library.

The supplied ISO Country Code is not recognised

An ISO Country Code has been supplied which does not appear in the table.

No match found in lookup table

A GCC could not be resolved for the given combination of broadcast parameters and location data. The country in which the listener is located does not use the supplied broadcast Country Code and nor do any of its neighbours.

Illegal Argument

The given input diverges from that expected. See the method and value definitions above for more information on the expected form of the arguments.

Illegal State

Successful GCC resolution prevented by missing values. Set the correct combinations of values as described above before calling `resolveGCC()`.

Library Mechanics

The process uses a table of broadcast country codes, ISO Country Codes, and adjacent countries in order to identify the correct GCC to use. The full table and explanation can be found in the RadioDNS specification.