Collins Bartholomew - Mobile Coverage Explorer

Mobile Coverage Explorer is a representation of the area covered by mobile networks around the world. It is supplied as raster data which has been created from submissions made directly to Collins Bartholomew or the GSMA from network operators who provide roaming detail for inclusion in the GSMA's Network Coverage Maps web application. This data is supplemented with coverage created from OpenCellID, the world's largest open database of cell towers.

Change of Format

For the 2020 release of data, the data format has been changed from vector to raster. The reasons for this change are:
- Some polygons are becoming too complicated in their depiction of detailed areas of coverage. Consequently, any analysis or rendering is taking much longer than is necessary compared with using raster data.
- Raster datasets do not suffer from vector topology errors
- The use of raster pyramids can greatly increase rendering speeds when viewing areas of coverage
- Sources used to compile the global datasets are raster based
- It has been possible to retain different classes of signal strengths when compiling the raster. This was difficult when compiling the vector-based coverage.
- Other global datasets, particularly from academic institutions, are raster-based

One disadvantage to the change of format is that it is no longer possible to show where country coverages overlap. For this reason, rasters for each country's coverage are now also included in the data supply.

The coverage data is supplied in two folders to differentiate the two sources of data – Data_MCE and Data_OCI.

Data_MCE

Data in the Data_MCE folder has been sourced directly from the network operators. However, not every operator has submitted data and so there are inevitable gaps in coverage. The following table shows the percentage number of operators in the latest release that have submitted their coverage data compared to the total number of operators who are members of the GSMA with licences for each technology.

Technology	% Operator Submissions
2G	48
3G	49
4G	26
5G	1

In 2019, 99 operators submitted new data for inclusion in the MCE datasets.

There are two folders in Data_MCE:

Global – Contains the merged global coverages. The file naming convention is
MCE_Global<Technology>_<DataRelease> where technology is either '2G', '3G', '4G', or '5G'.

ByCountry – Contains subfolders for 2G, 3G, 4G, and 5G technologies. Each subfolder contains rasters depicting the network coverage in each country. A country is not defined by its border extent but rather by the coverage supplied by network operators with licences in that country. Countries are identified using their ISO 3166-1 code, and the file naming convention is
MCE_<ISO2Code><Technology>_<DataRelease>

Operators are asked to submit strong and variable signal strengths as defined below:

Network Type	Strong/Indoor	Variable/Outdoor
2G (GSM)	Greater than -92 dBm	-92 to -100 dBm
3G (UMTS)	Greater than -92 dBm	-92 to -100 dBm
4G (LTE)	Greater than -105 dBm	-105 to -120 dBm
5G	Not yet classified	Not yet classified

However, the data received from operators often does not include signal strength information or does not follow the above guidelines. Therefore, whilst the rasters retain the strong and variable distinctions, this inconsistency must be understood by the user.

The cell values in the MCE rasters are as follows: 1 – strong signal strength
2 – variable signal strength

Data_OCI

Data in the Data_OCI folder has been created using OpenCellID tower locations. These derived locations have been used as the centre points of a radius of coverage: 12 kilometres for GSM networks, and 4km for 3G and 4G networks. No 5G data yet exists in the OpenCellID database. These circles of coverage from each tower have then been merged to create an overall representation of network coverage. The following limitations are noteworthy:

- The values for the radius of coverage from the tower locations are based on information within operator submissions with a tendency towards minimum values.
- Tower locations are derived from data collected from mobile phone users and so the coverage tends to be concentrated along routes and built-up areas.
- Only a small number of Android or Blackberry apps collect data and so the coverage tends to be concentrated in countries where certain apps are popular.
- The derived coverage does not take account of obstructing factors such as terrain variations

Because of these limitations, the OCI data is intended to fill the gaps where network operators have not yet submitted coverage data and should be viewed as an approximation only.

Further information on OpenCellID tower locations can be found at their What Is OpenCellID and Glossary pages.

It should also be noted that, despite online documentation from the likes of ITU and mcc-mnc.com, it is difficult to match the MNC codes within the OpenCellID database to the correct network operator due to variations in operator names or the names of their parent companies. Every effort has been made to match the correct codes to operators where possible.

There are two folders in Data_OCI:

Global – Contains the merged global coverages. The file naming convention is OCI_Global<Technology>_<DataRelease> where technology is either '2G', '3G', or '4G'.

ByCountry – Contains subfolders for 2G, 3G, and 4G technologies. Each subfolder contains rasters depicting the network coverage in each country. A country is not defined by its border extent but rather by the coverage created from operator networks in each country. Countries are identified using their ISO 3166-1 code, and the file naming convention is OCI_<ISO2Code><Technology>_<DataRelease>

The cell values in the OCI rasters are as follows: 1 – approximate coverage

Data Format

The data is made available in GeoTIFF 2-BIT raster format with pre-built pyramids. The map projection used is Web Mercator (EPSG:3857), with a nominal resolution of approximately 260 metres on the ground at the equator.

Colourmaps showing strong and variable coverages where relevant are included with each raster.

If you have a requirement for data in a different format or map projection, then please contact us.

Metadata

Information on the individual networks included in the MCE and OCI data folders is provided as an Excel spreadsheet called Mobile Coverage Explorer Metadata.xlsx. The columns in the spreadsheet are as follows:

OPERATOR_ID – a unique numerical identifier assigned to each network operator
NAME – the name of the network operator
CNTRY_ISO2 - the ISO 3166-1 country code used to describe the territory that the mobile network covers
COUNTRY - country name, in English, according to Collins Bartholomew's naming policy
MCE_<Technology> -   A date indicates that this network is included in the MCE coverage data. The date is when the operator's coverage data was last updated. The format is DD/MM/YYYY.
OCI_<Technology> - A 'Y' indicates that this network is included in the OCI coverage data.

If an operator is not listed in the spreadsheet then they have not submitted coverage data to Collins Bartholomew and are not identified in the OpenCellID database.

Changelog

As the method of processing the operator data submissions has evolved so too has this aggregated coverage. The following are the main changes between the annual releases:

- From 2010, Collins Bartholomew became the exclusive mapping partner for the GSMA. Datasets prior to this date were processed by previous partners and are available as a separate "Legacy" data product.
- From release 201312, metadata files (*Inclusions_<technology>_<date>*) are included.
- From release 201412, the data resolution was increased from ~ 1km to ~ 260m at the equator.
- From release 201512, the coverage polygons have been split by a 10x10 degree grid.
- From release 201612, the coverage polygons have included extra SOURCE and CNTRY_COV attributes.
- From release 201612, country attributes are used to identify the origin country of the operator rather than delineating country extents.
- From release 201712, if a polygon has SOURCE = 'Legacy_2009Q1' then all other attributes are null.
- From release 201712, the OP_STATUS attribute was removed from the Inclusions metadata since it was not necessarily a true reflection of all the technology types available.
- From release 201812, the LEGACY_2009Q1 data which was previously included in the main files has been removed as it is now 10 years old. Instead, the data now includes coverage derived from the OpenCellID open database.
- From release 201812, the main file names have been changed from Global_*<technology>_<date>* to MCE_*<technology>_<date>* to differentiate the Mobile Coverage Explorer data from the OpenCellID data.
- Release 201912 is renamed 2020 to depict the year of release
- From release 2020, the data format changed from vector to raster

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Additional Information

Collins Coverage

Collins Coverage is a web-based roaming coverage map service made available through Collins Bartholomew's partnership with the GSMA. Using the latest mapping technology, Collins Coverage combines up-to-date world base maps with unique mobile network coverage data provided by operators from around the world. These seamless roaming coverage maps are delivered straight to network operators' corporate web pages to help them tell their users where they can use their phones when abroad.

Collins Bartholomew

Collins Bartholomew has been in the business of map production for over 175 years and has a worldwide reputation for providing a high-quality custom and digital mapping service to a variety of markets, as well as delivering an extensive list of published products for its own parent, HarperCollins Publishers.

GSMA

The GSMA represents the interests of the worldwide mobile communications industry. Spanning 219 countries, the GSMA unites nearly 800 of the world's mobile operators, as well as more than 200 companies in the broader mobile ecosystem, including handset makers, software companies, equipment providers, Internet companies, and media and entertainment organisations. The GSMA is focused on innovating, incubating and creating new opportunities for its membership, all with the end goal of driving the growth of the mobile communications industry. It also produces the premier industry events including Mobile World Congress in Barcelona and Mobile Asia Congress.

OpenCellID

OpenCellID is the world's largest collaborative community project that collects GPS positions of cell towers, used free of charge, for a multitude of commercial and private purposes.

The OpenCellID project was primarily created to serve as a data source for GSM localisation. As of October 2017, the database contained almost 36 million unique GSM Cell IDs. More than 75,000 contributors have already registered with OpenCellID, contributing millions of new measurements every day in average to the OpenCellID database.

OpenCellID provides 100% free Cell ID data under a Creative Commons Attribution-ShareAlike 4.0 International License. The OpenCellID database is published under an open content license with the intention of promoting free use and redistribution of the data.