# Mobile Device Trends

## An analysis of GCF device certifications in 2015

*By combining conformance and interoperability tests undertaken in laboratories with field trials on multiple live commercial networks, GCF Certification verifies the interoperability of mobile phones, wireless or IoT devices across different network elements and infrastructure equipment from different suppliers.*

*Hundreds of different devices are certified each year. An analysis of GCF's certification listings provides insights into current trends within the mobile device market.*

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# Introduction to GCF

**Founded in 1999, the Global Certification Forum (GCF) has established and now maintains a certification scheme as a benchmark of interoperability of mobile phones and other wireless devices with mobile networks.**

Defined collectively by operators, manufacturers and the test industry, GCF Certification comprises interoperability and conformance testing complimented by field trials on live networks.

GCF Operator Members serve billions of customers in markets all over the world. More than 70 companies participate in GCF as Manufacturer Members. Another dozen companies are Associate Manufacturer Members producing wirelessly connected devices incorporating GCF-certified embedded modules.

Common, rigorous and trusted certification criteria provide a platform for the harmonization of the acceptance testing schemes maintained by different operators. By minimising unnecessary duplication, GCF Certification reduces acceptance testing overheads and contributes to improved economies of scale for device manufacturers. The scheme provides a consistent framework for certifying any mobile device: from a relatively simple single-mode, single-band handset to sophisticated multi-mode, multi-band smartphones, tablets and wireless routers or IoT/M2M devices.

A certified, multimode, multiband device will be relevant to a wide pool of operators and MNVO's, even if they have with diverse network infrastructures. Manufacturers can therefore offer a certified device to multiple national markets - and target a much larger universe of potential users. In territories where operators are not directly involved in supporting devices into the market, distributors can reduce their after-sales service overheads by selecting products that have been shown to meet a globally recognised benchmark of conformance and interoperability.

Originally developed for GSM, GCF Certification has been extended to 3G UMTS (WCDMA), plus HSPA enhancements, LTE and enhanced bandwidth LTE-Advanced exploiting Carrier Aggregation. The scheme also facilitates successful international roaming and has been extended to cover standards-based client applications such as RCS.

On 1 December 2014, GCF integrated the certification of CDMA2000 devices into the scheme.

Key GCF milestones

| Date | Event |
|---|---|
| 1999 | GCF Founded |
| May 2000 | Certification of first device – GSM |
| Feb 2006 | First 3G device certified |
| Jun 2008 | First HSDPA device certified |
| Aug 2008 | First HSUPA device certified |
| March 2011 | First LTE FDD device certified |
| September 2011 | First LTE TDD device certified |
| October 2012 | First dual-mode FDD/TDD LTE device certified |
| October 2013 | Certification for client applications introduced |
| December 2014 | First CDMA2000 devices certified. |

# GCF Device Certifications

Certified devices are listed on the GCF website at
http://www.globalcertificationforum.org/Application/onlinecertification/terminallist/

A list of certified modules suitable for adding mobile connectivity to other products and qualifying for GCF's optimised certification system can be found here: http://www.globalcertificationforum.org/devices/certified-modules-devices.html

Note: Data used in this report is based on published certifications during the relevant calendar year. Where certification testing is completed in advance of the planned launch date for the device, GCF procedures allow the manufacturer to defer publication by up to 90 days. As a result, some devices that were certified in one calendar year may be counted in the subsequent year.

# Executive Summary

**This annual review of Mobile Device Trends is based on an analysis of Global Certification Forum device certifications published during 2015. The analysis provides insights into the mobile devices being requested by operators and end-users across markets worldwide.**

Total certifications increased 0.7 per cent from 536 in 2014 to a record 540 devices in 2015.

## LTE

The proportion of GCF-Certified devices incorporating LTE rose to 68.5 per cent, up from corresponding figures of 53 per cent in 2014 and 39 per cent in 2013.

370 devices incorporated LTE: 369 incorporated FD-LTE, 133 supported TD LTE while just one device supported TD LTE but not FD LTE. A total of 82 category 6 LTE-Advanced devices were certified.

Two additional FD-LTE bands were brought with GCF Certification during the year: Band 12, the US Lower SMH-A/B/C 700 MHz band and Band 28, the Asia-Pacific Telecommunity (APT) 700 MHz band plan.

By the end of 2015, GCF enabled the certification of LTE devices in 18 discrete FD-LTE bands and four TD-LTE bands. This diversity of bands means that the number of potential inter- and intra-band Carrier Aggregation (CA) combinations is enormous. GCF has developed a flexible certification framework which will enable manufacturers to demonstrate their devices will work effectively in CA band combinations actually deployed by operators.

## 3G

456 of the 540 devices certified in 2015 incorporated 3G UMTS. This represented 84 per cent of all certified devices.

The penetration of HSDPA increased by one percentage point to 84 per cent in 2015. Penetration of HSUPA increased by 1.5 points to 77.5 per cent.

Dual-Carrier HSDPA was incorporated in 44 per cent of certified devices in 2015, up from 42 per cent in 2014 and 17 per cent in 2013. The small increase probably reflects the significant increase in LTE penetration.

## GSM

In 2009, 100 per cent of certified devices incorporated GSM. Since then, the penetration of GSM across all devices has been declining gradually. The rate of decline accelerated slightly in 2015: 87 per cent of all devices incorporated GSM in 2015, down from 94 per cent in 2014 and 97 per cent of devices in 2013. EDGE penetration also declined from a peak of 82.5 per cent in 2014 to 77 per cent. Nevertheless, 30 devices (or 5.6 per cent of all devices) were GSM-only.

## CDMA

2015 marked the first full year of CDMA device certification within GCF. A total of 34 CDMA-capable devices were certified, up from four in 2014.

The 15 CDMA-only device certifications will have contributed to the slight acceleration in the decline of GSM penetration.

## Multi-mode devices

Manufacturers' preference for developing products suitable for a variety of markets and network environments is reflected by the fact that nearly 87 per cent of all certified devices incorporated more than one bearer technology.

93 per cent of GSM devices incorporated 3G while 95.5 per cent of 3G devices incorporated GSM.

55.5 per cent of all certified devices incorporated GSM, 3G and LTE. More than 81 per cent of LTE devices also supported GSM and 3G. 57 per cent of all devices (83 per cent of LTE devices) supported LTE, HSDPA and HSUPA.

Multi-mode capability was also a characteristic of most CDMA devices: 91 per cent of CDMA devices incorporated LTE and 56 per cent incorporated LTE, 3G and GSM.

# "Average" GCF Certified device

**If the total number of band/technology combinations are averaged across all devices, in 2015 the hypothetical "average" GCF-Certified device incorporated 3.2 GSM bands, 2.9 3G bands and 3.6 FD LTE bands and 0.3 TD LTE bands.**

The number of LTE bands in the average GCF-Certified device has trebled since 2013: the average device now incorporates more bands for LTE operation than for any other mobile technology.

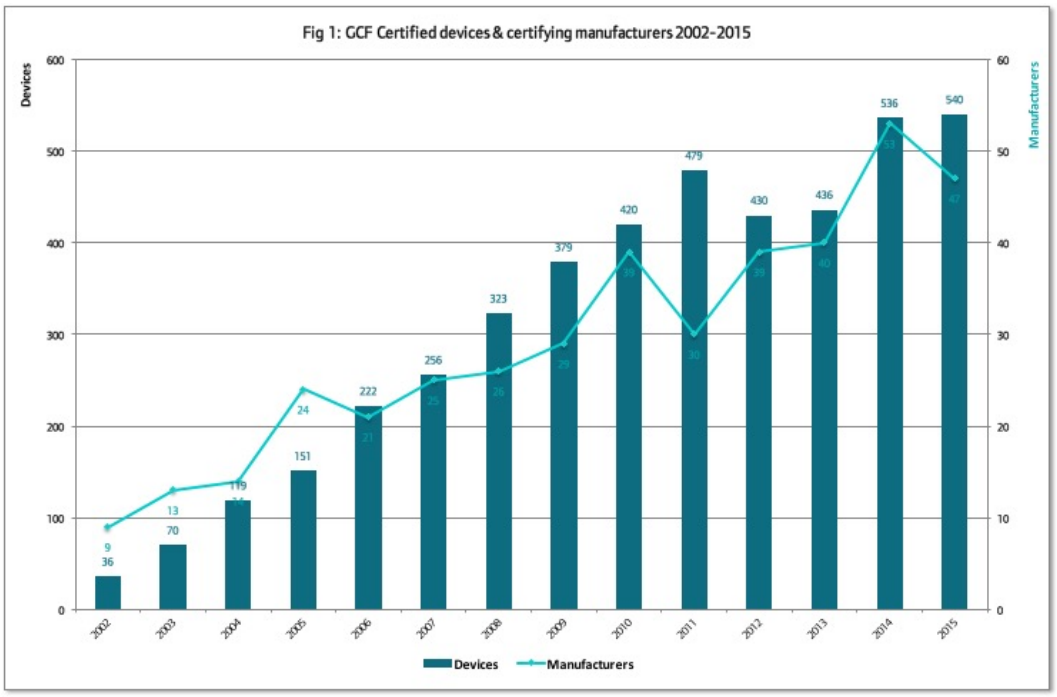
| Number of bands in "average" GCF-certified device (all devices) | | | | |
|---|---|---|---|---|
| | 2012 | 2013 | 2014 | 2015 |
| GSM | 3.5 | 3.5 | 3.5 | 3.2 |
| 3G | 2.2 | 2.6 | 2.7 | 2.9 |
| FD LTE | 0.3 | 1.2 | 2.3 | 3.6 |
| TD LTE | 0.0 | 0.0 | 0.1 | 0.3 |

When LTE-capable devices are analysed separately, there is a continuing trend towards more highly integrated multi-mode, multi-band LTE devices. Across the 370 LTE devices certified during 2015, the average number of FD LTE bands per certified device rose to 5.3, up from 4.4 in 2014 and 3.1 in 2013.

| Number of LTE bands in "average" GCF-certified LTE device | | | | |
|---|---|---|---|---|
| | 2012 | 2013 | 2014 | 2015 |
| FD LTE | 1.9 | 3.1 | 4.4 | 5.3 |
| TD LTE | 0.06 | 0.06 | 0.1 | 0.4 |

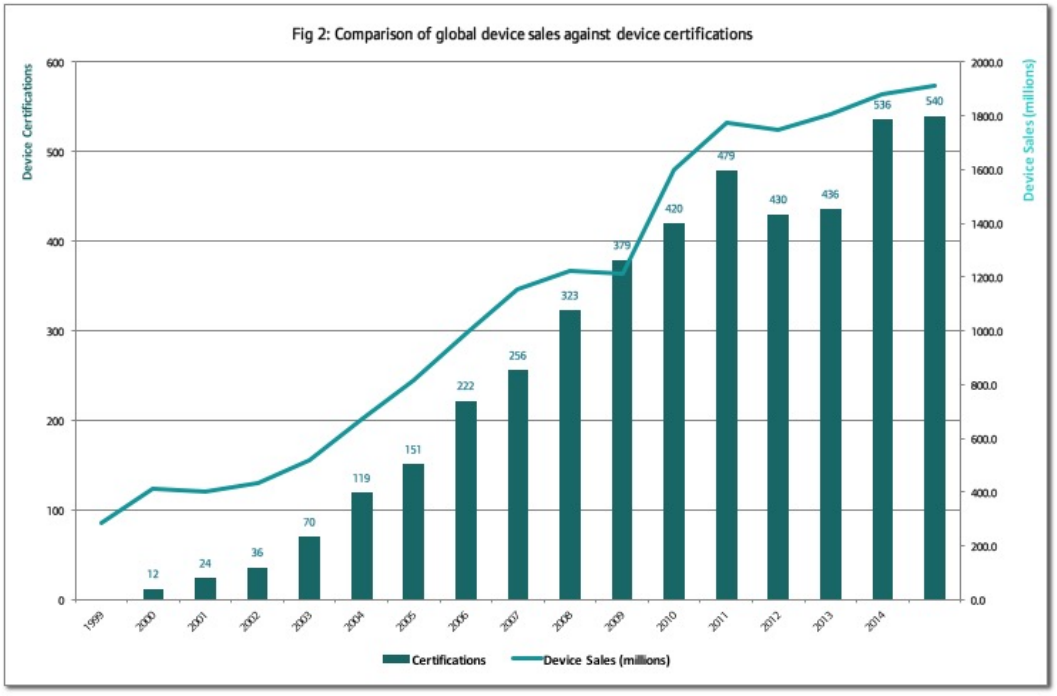
# GCF Certifications by year

**540 mobile phone and wireless device models were certified in 2015 compared with 536 in 2014. 47 manufacturers certified devices during the year. (Fig 1)**




Total certifications were up 0.7 per cent compared with 2014.

Comparing the total volume of certifications with "Worldwide Manufacturer Sales to End Users of Mobile Terminal Devices", reported each year by Gartner suggests a relationship between the choice of devices in the global market and overall market size (Fig 2).



† Device sales source: "Gartner Worldwide Manufacturer Sales to End Users of Mobile Terminal Devices"

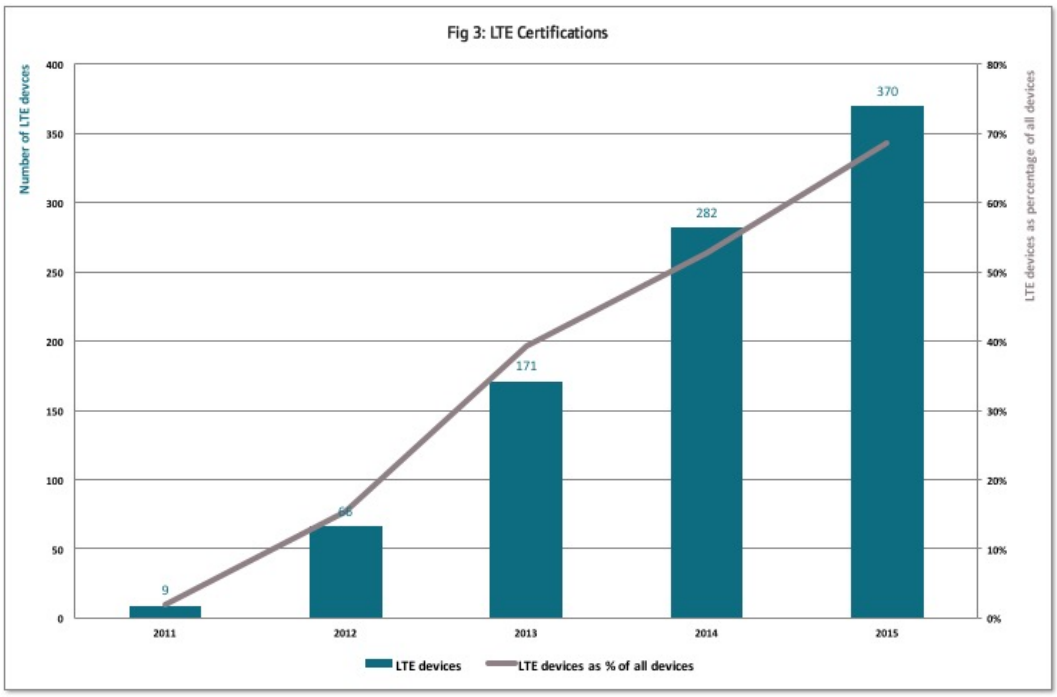
[Gartner put the pause in the growth of sales in 2008/09 to the collapse in consumer confidence in many developed economies in the wake of the 2008 financial crisis.]

# LTE growth continues

**370 LTE devices were certified in 2015, up 31 per cent compared with 282 in 2014 (Fig 3).**

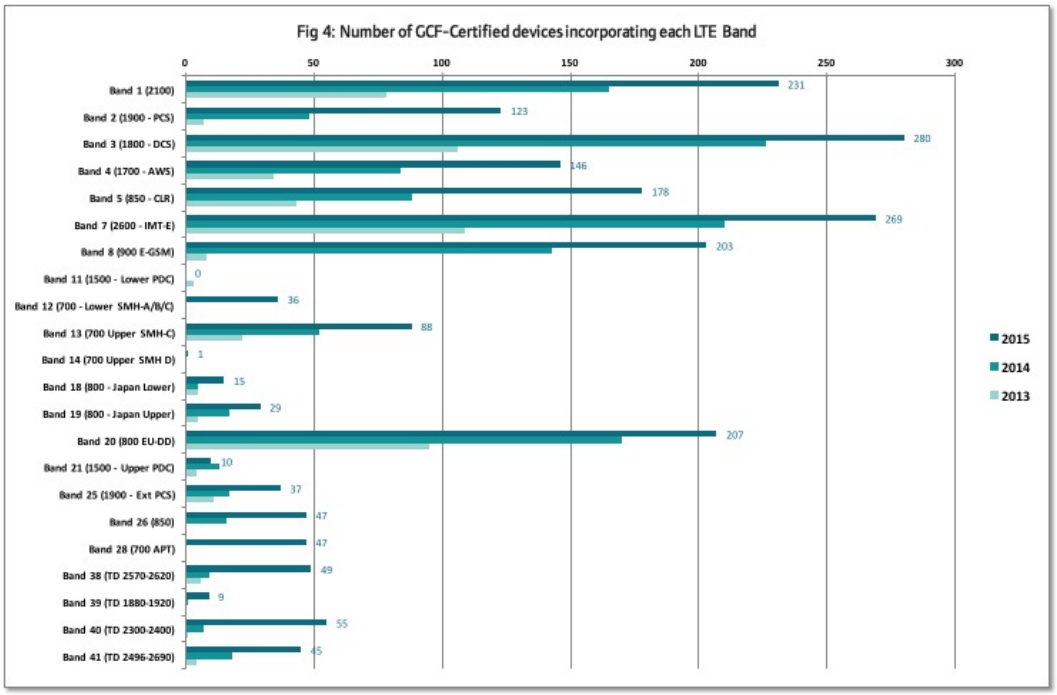
The proportion of GCF-Certified devices incorporating LTE continues to rise steadily, from just under 53 per cent in 2014 to 68.5 per cent in 2015.

369 devices incorporated FD-LTE and 133 supported TD LTE.  Just one single device supported TD LTE but not FD LTE.




Reflecting the diversity of bands in which LTE is being deployed worldwide, GCF Certification expanded to encompass a total of 18 FDD and four TDD bands by the end of 2014. The two new FD-LTE bands activated in GCF Certification during the year were Band 12, the US Lower SMH-A/B/C 700 MHz band and Band 28, the Asia-Pacific Telecommunity (APT) 700 MHz band plan.

During 2015, devices were actually certified in 17 FDD bands and four TDD bands (Fig 4).  Three FD LTE Bands - 28 (APT 700), 12 (US Lower SMH-A/B/C 700 MHz) and 14 (US Upper SMH D 700 MHz) – were incorporated in certified devices for the first time.




Band 3 (1800 MHz) was the most commonly implemented LTE band featuring in 280 devices (76 per cent of LTE devices, 52 per cent of all devices.) Band 7 (2600 MHz) was the second most common LTE band followed by Band 1 (2100 MHz) , Band 20 (the European 800 MHz band) and Band 8 (900 MHz.). The APT 700 band was implemented in 47 bands in its first year as part of GCF Certification.

# LTE becomes increasingly multi-band

**The number of bands implemented in LTE devices continued to increase strongly during 2015.**

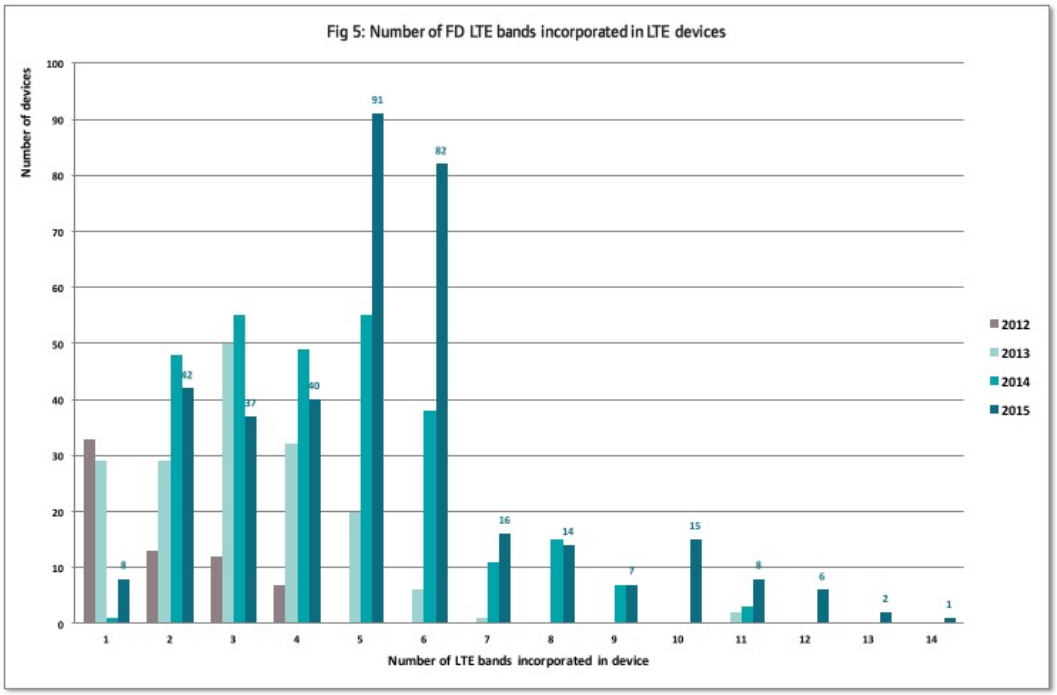
Of the 369 devices incorporating FDD LTE, 319 (86 per cent) incorporated three or more LTE bands (Fig 5). 32 devices incorporated 10 or more FD LTE bands. One device supported 14 FD LTE bands.

The "average" FD LTE device incorporated 5.26 bands.

TD LTE featured in a total of 113 devices, up from 33 in 2014. The "average" TD LTE device incorporated 1.4 bands.

112 devices supported both FDD and TDD operation. Of these 60 per cent were capable of simultaneous FD and TD operation.

For LTE-capable devices as a whole, the "average" device incorporated 5.7 bands across FD and TD variants of the technology.




82 category 6 LTE-Advanced devices were certified – 15 per cent of all devices and 22 per cent of LTE devices.

With the implementation of more LTE bands, intra-band and inter-band Carrier Aggregation is being deployed to offer faster data services. GCF is actively extending the certification scheme to support the roll-out of Carrier Aggregation in the two- and three-downlink (2DL and 3DL) band combinations being requested by the market.

87 LTE devices featured IMS Packet Switched Voice Support (VoLTE).

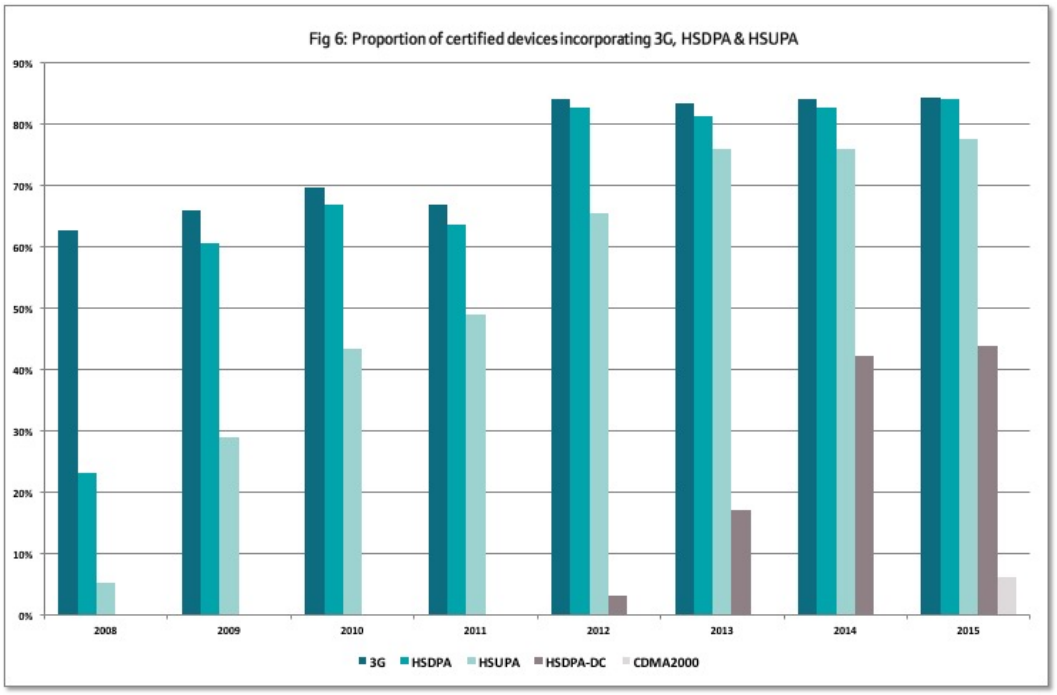
307 of the 369 FDD LTE devices also incorporated HSPA and EDGE.

# HSPA penetration continues to increase in 3G devices

**At 84 per cent, the penetration of 3G across all devices remained stable compared with 2014.**

HSDPA penetration grew incrementally from 82.5 per cent in 2014 to 84 per cent of all devices (99.5 per cent of 3G devices) in 2015. Implementation of HSUPA increased by 1.5 points to 77.5 per cent of all devices (92 per cent of 3G devices) (Fig 6). 307 devices incorporated HSDPA, HSUPA and LTE.

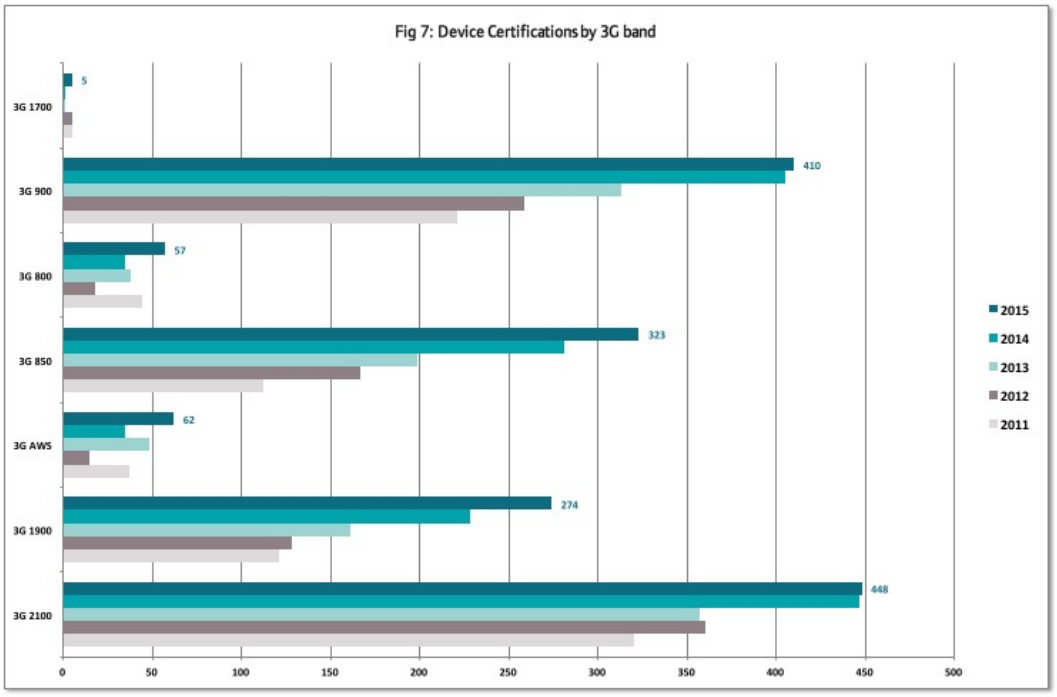
In 2015, 237 devices incorporated Dual Carrier HSPA (52 per cent of 3G, 44 per cent of all certified devices). This compared with 226 in 2014 when Dual Carrier functionality was certified in 42 per cent of all devices.




136 devices supported 3G but not LTE. There was a single 3G-only device among the 2015 certifications.

448 of the 540 certified devices (83 per cent of all devices and 98 per cent of 3G-capable devices) incorporated the 2100 MHz band.

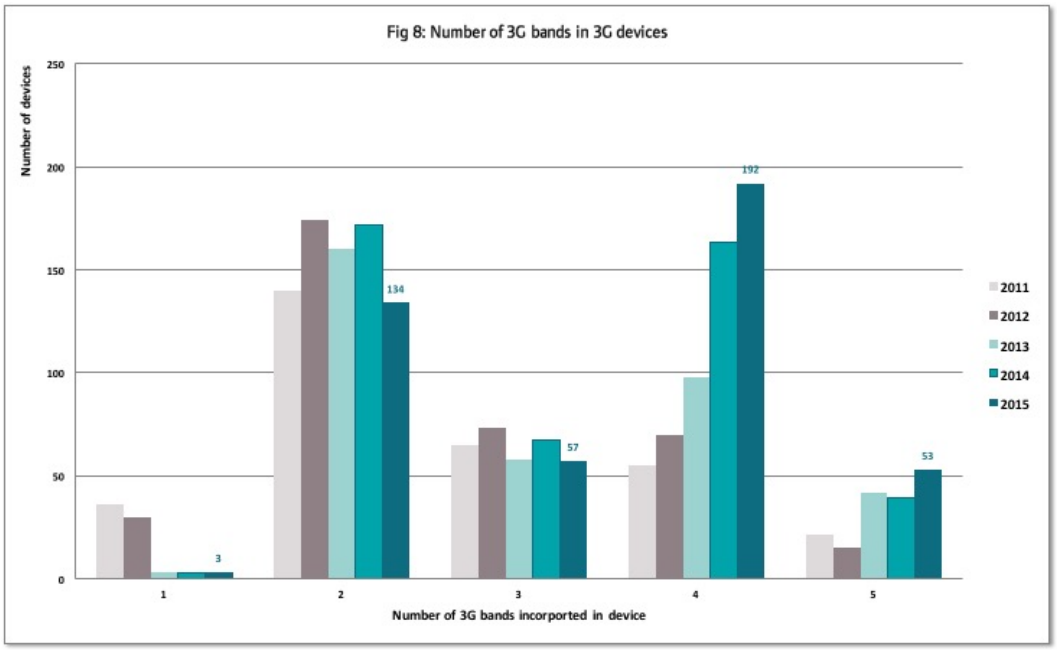
The 900 MHz band was the second most frequently implemented 3G band – in some 410 devices (76 per cent of all devices and 90 per cent of all 3G devices.) (Fig 7).




323 devices (71 per cent of 3G devices) incorporated the most commonly implemented US 3G band – 850 MHz.

# Multi-band 3G remains the norm

**99 per cent of 3G devices (or 84 per cent of all certifications) incorporated two or more 3G bands (Fig 8).**




410 devices (76 per cent of all certifications or 90 per cent of 3G devices) combined 3G in the 2100 MHz and 900 MHz bands.

At least one US 3G band featured in 268 devices (50 per cent of all certifications, 59 per cent of 3G)  208 devices incorporated two US 3G bands of which 60 incorporated three.

# Rate of decline of GSM accelerates

**The penetration of GSM declined from 94 per cent of certified devices in 2014 to 87 per cent in 2015. (Fig 9).**

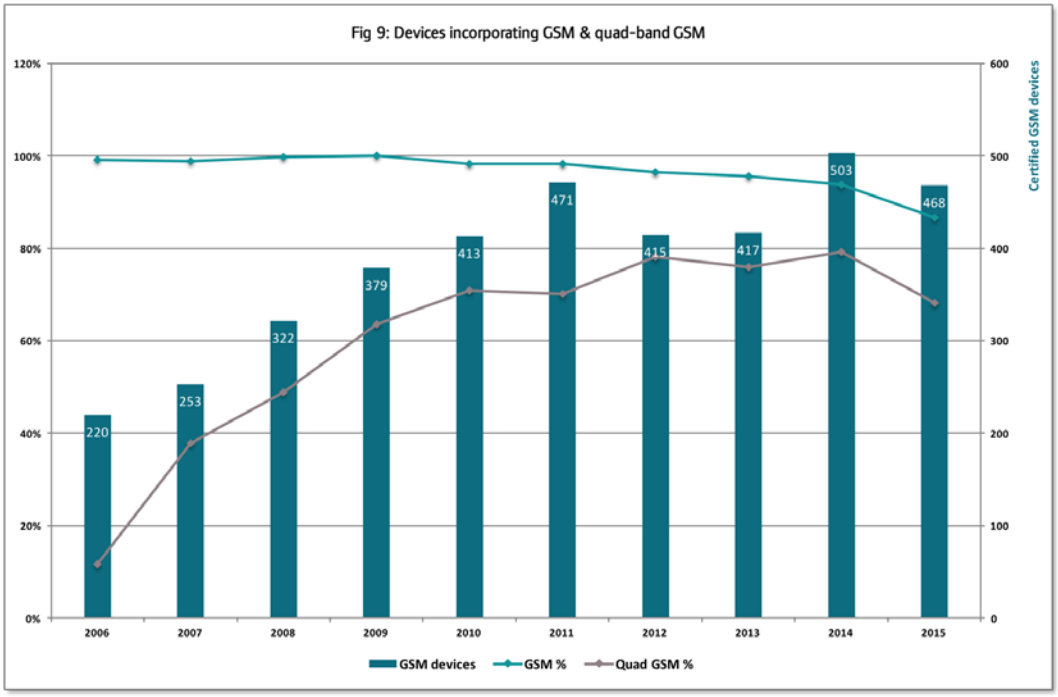
GSM featured in 100 per cent of GCF Certified devices in 2009. The start of the decline in GSM penetration began with the launch of early LTE devices, several of which were single-mode, LTE-only.  The commencement of CDMA device certification in GCF will account for at least part of the increase in the rate of decline.

The incidence of quad-band GSM also declined in 2015 having risen in 2014.

30 devices (5.5 per cent of the total) were GSM-only.

418 devices incorporated EDGE: (77.5 per cent of all devices and 89 per cent of all GSM-capable devices) compared with 442 (82 per cent of all devices) in 2014.

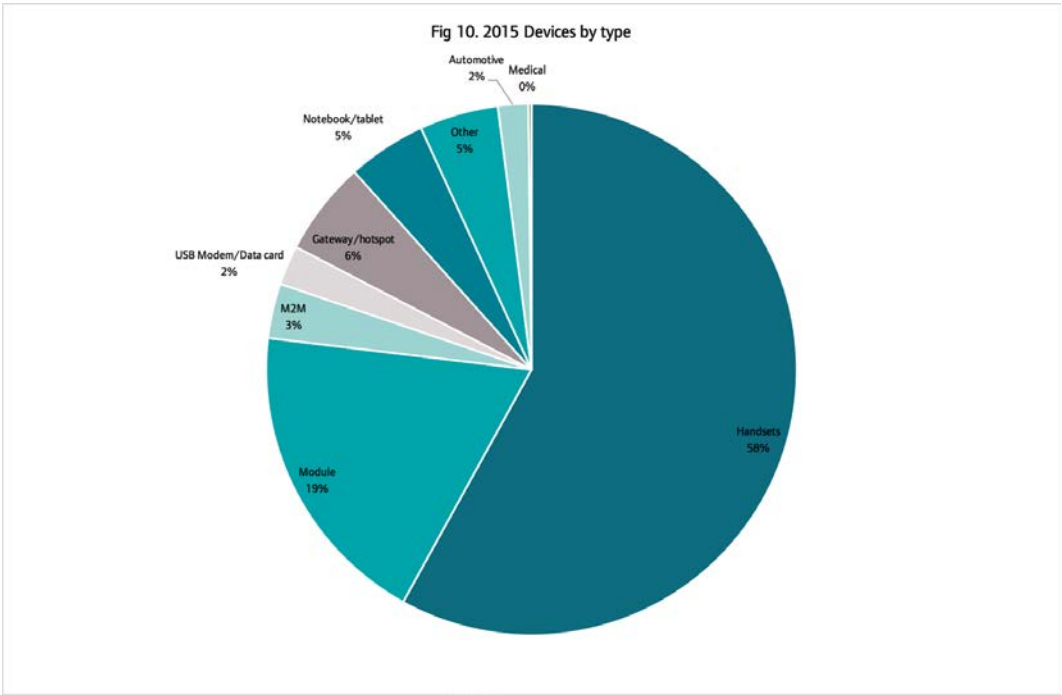
The relative decline in EDGE presumably reflects the high penetration of 3G/HSDPA and increasing availability of LTE.




# 2015 certified devices by type

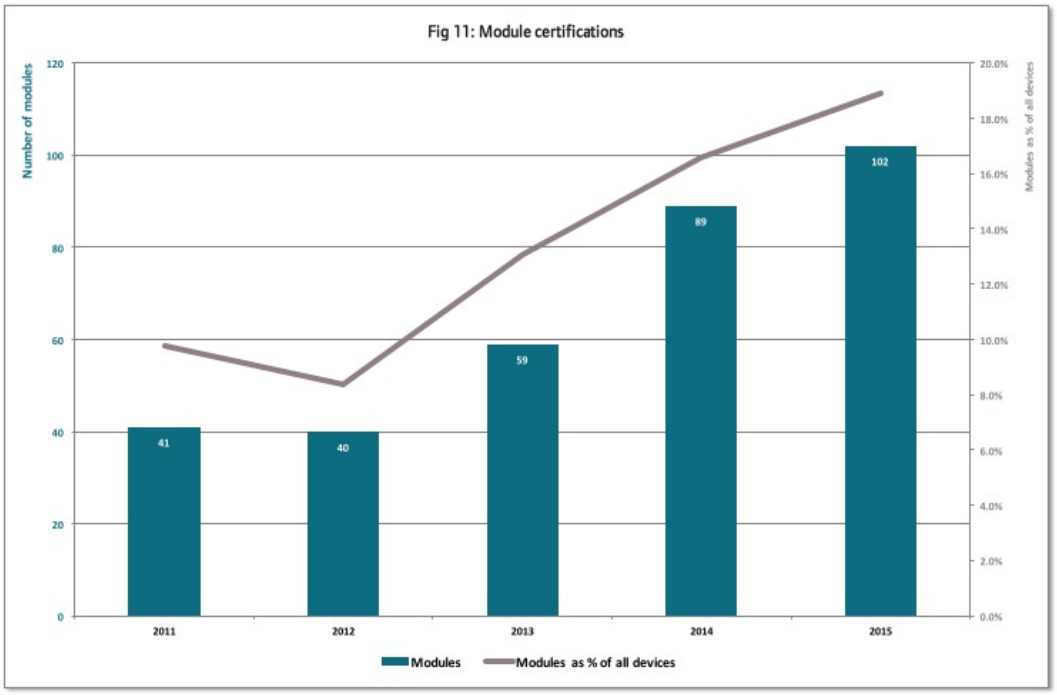
**Handsets represented 58 per cent of certified devices in 2015. Wireless modules were the second largest category, accounting for nearly a fifth of certified devices (19 per cent, up from 17 per cent in 2014 and 13 per cent in 2013).**

Notebooks/Tablets fell from 12 per cent in 2014 to five per cent in 2015 while the number of uncategorised devices increased from three per cent to five per cent, suggesting an increase in the diversity of certified devices. A wider range of device categories have been established during the year and will form the included in the 2016 Device Analysis.



# Increasing demand for wireless modules

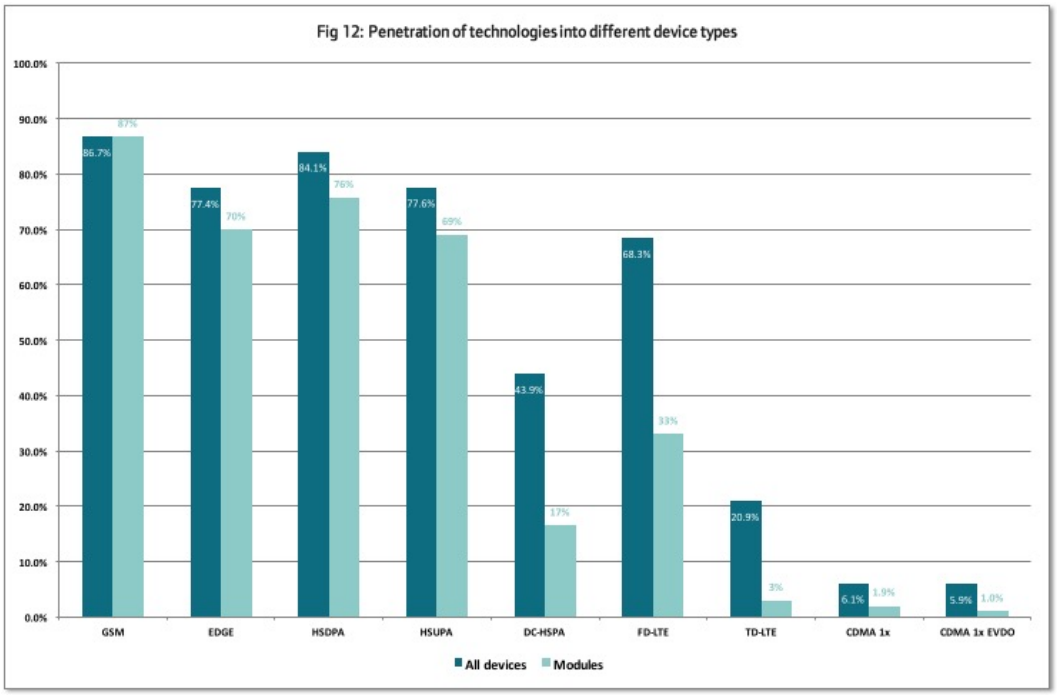
**The volume of module certifications grew for the fourth consecutive year (Fig 11) reflecting growing activity worldwide in the fields of M2M and Internet of Things. 16 manufacturers certified modules during 2015 compared with 15 in 2014.**




While 77 per cent of modules incorporate more than one wireless bearer technology, there is clear evidence that devices offering specific rather than universal connectivity are being offered to the market.

For example, 13 modules (12.5 per cent of the device segment) were GSM-only while 10 were FD-LTE-only. One other module offered CDMA 1x in just one band (450 MHz).

As with certified devices generally, the variety of multi-mode, multi-band modules available continues to expand.



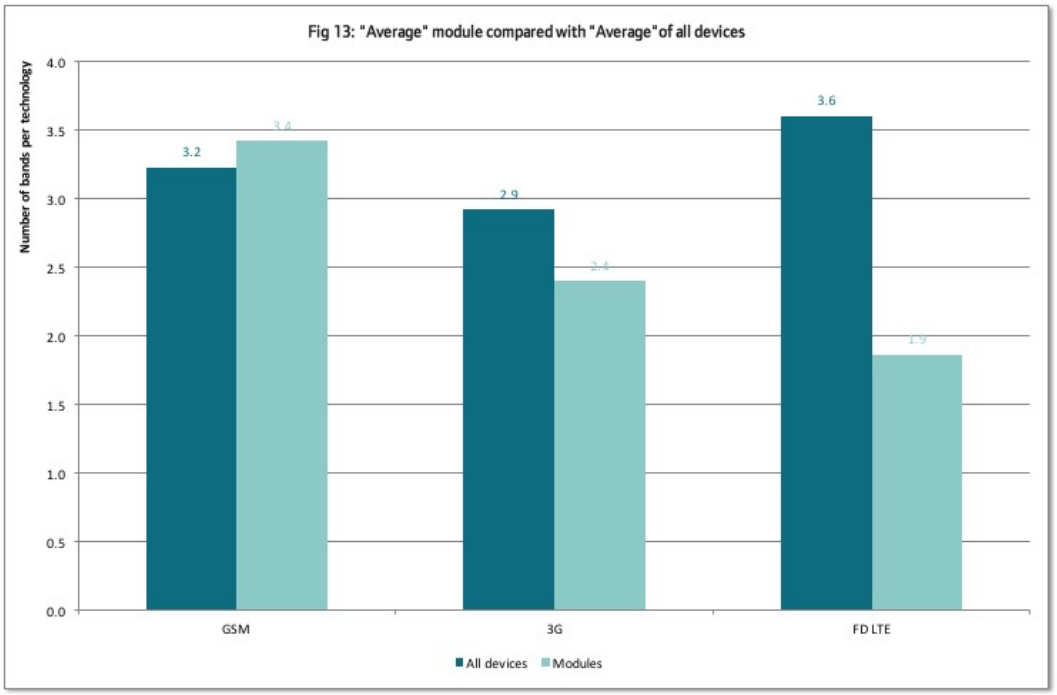

72 per cent of modules incorporated both GSM and 3G.

68 per cent of modules incorporated both the 2100 MHz and 900 MHz bands. 28 per cent of modules feature at least two US bands and 17.5 per cent include three. Seven modules supported six 3G bands.

34 modules (a third of the module segment) featured FD-LTE while 24 featured more than three bands and seven offered support for 10 or more bands.

Judging by the bands incorporated, the US is currently driving the market for high performance modules: the US AWS band appeared in 25 of the 34 FD-LTE modules. Band 13, the US Upper SMH C 700 MHz band, featured in 24 modules.

50 per cent of LTE-capable modules also supported GSM, EDGE, 3G, HSDPA and HSUPA. (Of these, one module also offered CDMA2000 EVDO.)




# Conclusion

Mobile devices continue to increase in complexity as manufacturers develop products supporting multiple wireless technologies across multiple bands which can be marketed globally. Certification helps these manufacturers target the global market, and generate valuable economies of scale that benefit the entire mobile eco-system, by ensuring their devices can connect over diverse networks worldwide.

In 2015, several certified devices supported as many as 25 different bands across five bearer technologies. Across all certified devices, the average device supported 10 different bands. Bringing these sophisticated multi-mode, multi-band devices to markets worldwide would be significantly more time-consuming and expensive without an industry-defined certification scheme.

A fifth of certified devices are now modules designed to add mobile connectivity to an increasingly wide variety of other products such as laptops, vehicles, M2M, enterprise and consumer electronics devices that are becoming part of the Internet of Things.

For end-users, Certification identifies devices that will meet their expectations by functioning correctly in normal daily use on their home network and when roaming internationally.

## MORE INFORMATION

For more information on GCF and the benefits of certification, please visit www.globalcertificationforum.org

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