

# Mobile Device Trends

An analysis of GCF device certifications in 2016

*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 vendors.*

*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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**Global Certification Forum**

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# Introduction to GCF

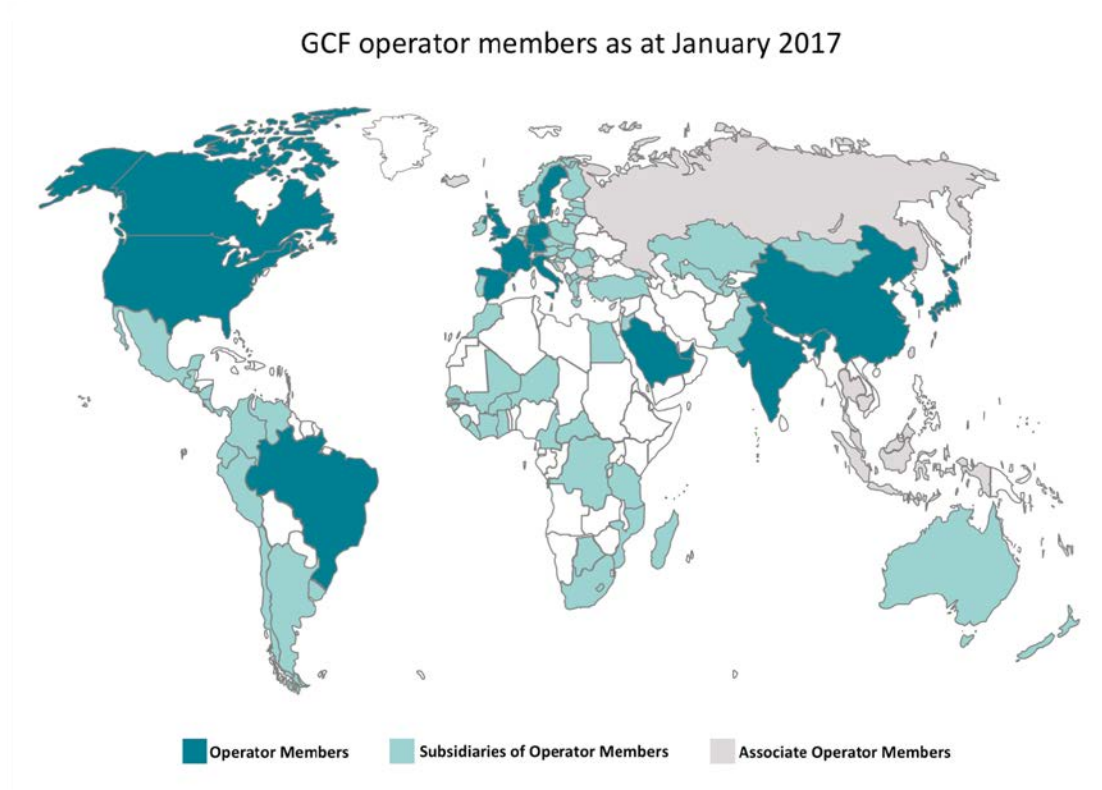
**Founded in 1999, the Global Certification Forum (GCF) is the global benchmark of interoperability for mobile phones and other devices that incorporate mobile connectivity.**

GCF Certification is based on test cases defined by recognised standards organisations. The scheme delivers a pragmatic but robust testing regime that is agreed collectively by operators, manufacturers and the test industry to meet market needs,

GCF Certification comprises interoperability and conformance testing complemented by field trials on live networks.

As of January 2017, nearly 100 device manufacturers are participating in GCF.

The scheme is also recognised by operators with interests in markets worldwide (Fig 1). Collectively, these operators invest billions of dollars in marketing devices each year.



*Fig 1*

Common, rigorous and trusted certification criteria promote harmonization of operator acceptance testing schemes. By minimising duplication, GCF Certification can reduce 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 simple single-mode low-cost handset to sophisticated multi-mode, multi-band smartphones, tablets and wireless routers.

By adopting GCF Certification into its quality management system, a manufacturer can significantly expand the size of the market it can target: a certified, multi-mode, multi-band device will be relevant to the customers of multiple network operators worldwide. In national markets where operators are not directly involved in the marketing of devices, distributors can reduce

their after-sales service overheads by prioritising 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 cover 3G UMTS (WCDMA), HSPA, 4G LTE, LTE-Advanced and LTE-Advanced Pro with its enhanced bandwidth performance delivered by Carrier Aggregation. The scheme underpins international roaming and also covers standards-based client applications such as RCS and NFC applications.

In December 2014, GCF expanded and became the recognised certification scheme for CDMA2000 devices.

In February 2017, GCF introduced Platform Certification to help designers and manufacturers develop new products around pre-certified functionality. By promoting the re-use of test results and certification, product development can be streamlined and the total testing costs for an end-device manufacturer will be reduced.

#### 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.
December 2016	Certification of first device supporting Carrier Aggregation
February 2017	Platform Certification introduced

## 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 at: <http://www.globalcertificationforum.org/devices/certified-modules-devices.html>

# Executive Summary

This annual review of Mobile Device Trends is based on an analysis of Global Certification Forum device certifications published during 2016. The analysis provides insights into the mobile technologies and functionalities being requested by operators and end-users across markets worldwide.

Comparing respected third-party market data with the GCF database of certified devices suggests that 65 per cent of the smartphones sold in Q3 2016 were GCF-certified.

A record 58 manufacturers certified a total of 471 devices in 2016.

## Multi-mode devices

The need to support end-users served by operators whose network infrastructures include more than one generation of mobile technology is reflected by the fact that 89 per cent of all devices certified in 2016 incorporated more than one bearer technology. 64 per cent of devices incorporated three or more technologies.

Pre-launch testing is required to demonstrate that each individual bearer technology is performing correctly and that the incorporated technologies interwork with each other to be able to offer end-users seamless operation when moving between areas covered by different technologies. GCF's widely recognised certification framework is the most cost-effective way of robustly testing these core, but complex, communications capabilities.

An upside of such complexity is that certified multi-mode, multi-band devices can be sold in multiple territories, thereby improving economies of scale for manufacturers.

As new technologies are introduced and GCF certification matures, the total number of technologies and bands in the "average" certified device increases even as the oldest technologies start to decline.

Number of bands in "average" GCF-certified device (all devices)					
	2012	2013	2014	2015	2016
GSM	3.5	3.5	3.5	3.2	3.1
3G	2.2	2.6	2.7	2.9	3.1
FDD-LTE	0.3	1.2	2.3	3.6	4.6
TDD-LTE	0.0	0.0	0.1	0.3	0.6

In 2016, 60 per cent of all certified devices incorporated GSM, 3G and LTE.

## LTE

By the end of 2016, GCF enabled the certification of LTE devices in 18 FDD-LTE bands and five TDD-LTE bands.

The proportion of GCF-certified devices incorporating LTE rose to 76 per cent, up seven percentage points from corresponding figures of 69 per cent in 2015.

370 devices incorporated LTE: 369 incorporated FDD-LTE, 133 supported TD LTE.

With such a wide diversity of bands, the number of potential inter- and intra-band Carrier Aggregation (CA) combinations is enormous. GCF has developed a flexible certification framework which enables manufacturers to demonstrate their devices will work effectively in CA band combinations deployed by operators on their networks. Certification of Carrier Aggregation was enabled in November 2016 and the feature was first certified the following month.

VoLTE support was certified in 23 per cent of LTE devices (84 models).

### 3G (UMTS/WCDMA)

3G was certified in 85 per cent of all 2016 certifications.

The penetration of HSDPA increased to 85 per cent. HSUPA was a feature of 81 per cent of all devices certified in 2016.

Dual-Carrier HSDPA was incorporated in 49 per cent of certified devices, up from 44 per cent in 2015.

### GSM

The penetration of GSM across all devices continued its gradual decline during the year. However, GSM was still a feature of 84 per cent of all certified devices. 25 GSM-only devices (or 5.6 per cent of all devices) were brought to market.

EDGE penetration is also in decline as manufacturers focus on enhancing 3G or offering LTE. From a peak of 82.5 per cent in 2014, EDGE was incorporated in 77 per cent of devices in 2016.

### CDMA

Certification of CDMA2000 devices increased from 34 in 2015 (the first full year of CDMA device certification within GCF) to 43 (nine per cent of devices) in 2016.

## GCF Certifications by year

**A record 58 manufacturers certified devices during 2016, up from 47 in 2015 (Fig 2). A total of 471 mobile phones and wireless devices were certified during 2016.**

The emphasis that the market currently places on premium “flagship” smartphone devices may account for the fall in the volume of certifications in 2016.

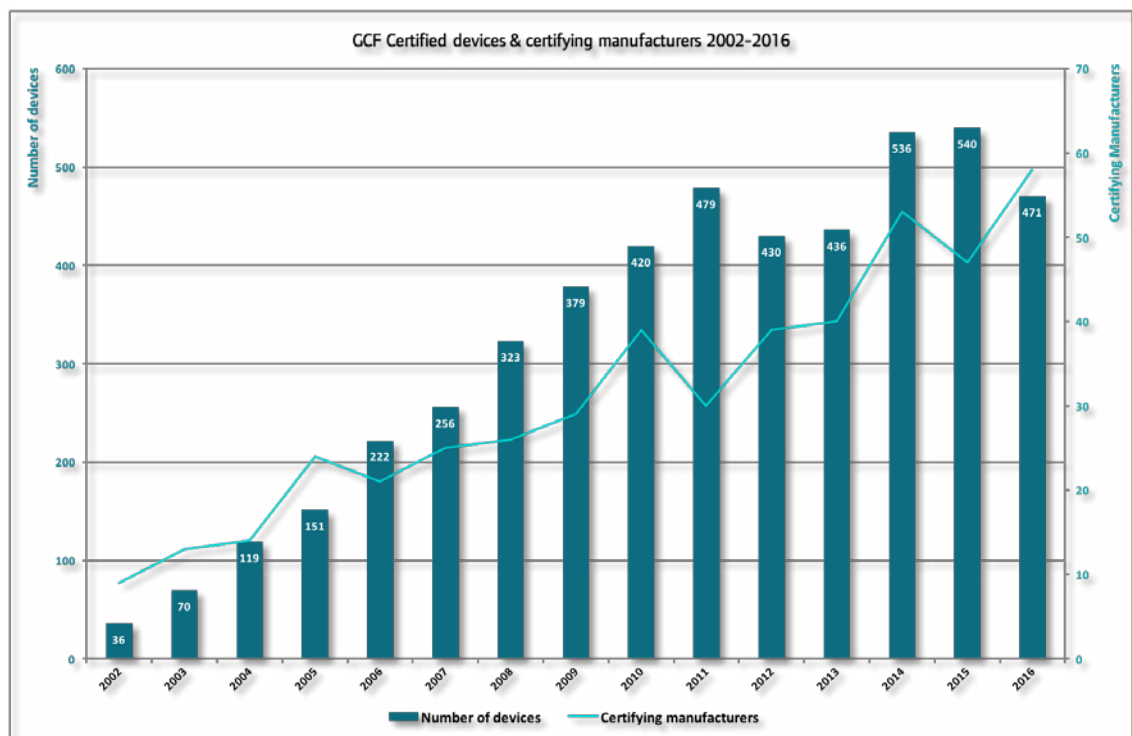


Fig 2

Certification benefits manufacturers of any size. Seven manufacturers certified twenty devices or more. 33 manufacturers certified three devices or fewer.

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 3). (NB: Gartner hadn’t published a corresponding figure for 2016 as this edition of the Device Analysis went to press.)

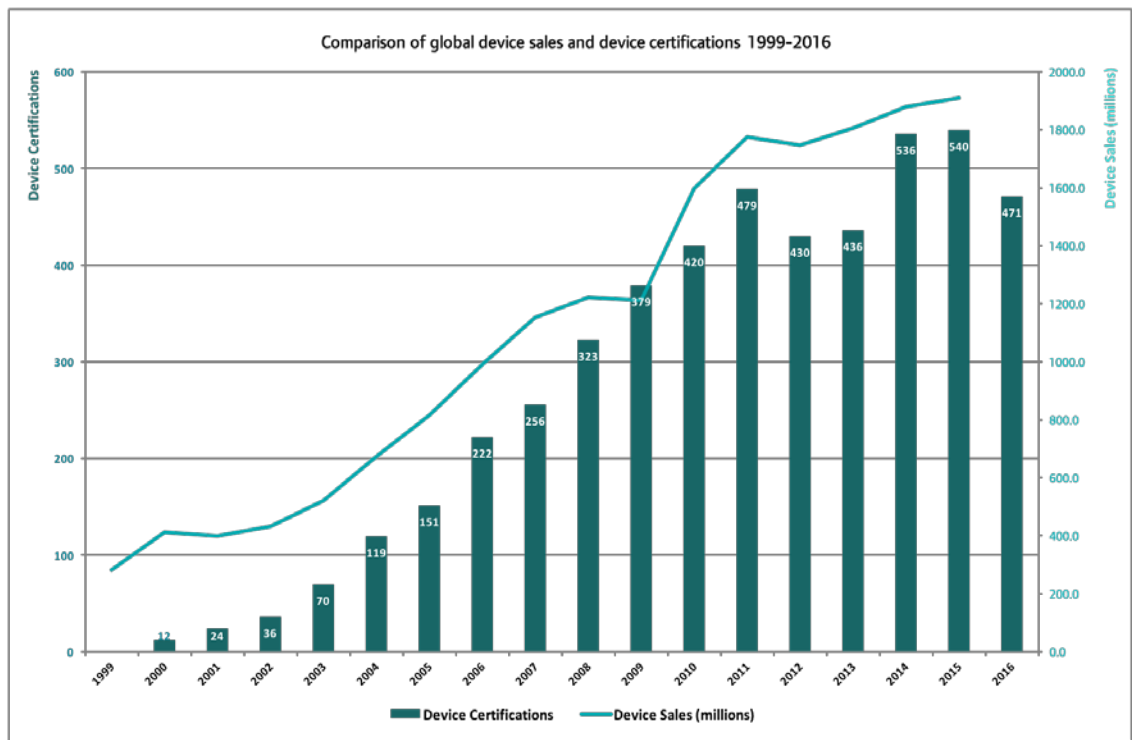


Fig 3

<sup>†</sup> Device sales source: “Gartner Worldwide Manufacturer Sales to End Users of Mobile Terminal Devices”

[Gartner attributed 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 September 2008 international banking crisis.]

## Mobile technologies certified in 2016

3G UMTS (WCDMA) has now overtaken GSM as the most commonly certified mobile technology (Fig 4). 3G was a feature of 86 per cent of all certified devices in 2016, ahead of HSDPA certified in 85 per cent of devices and GSM in 84 per cent.

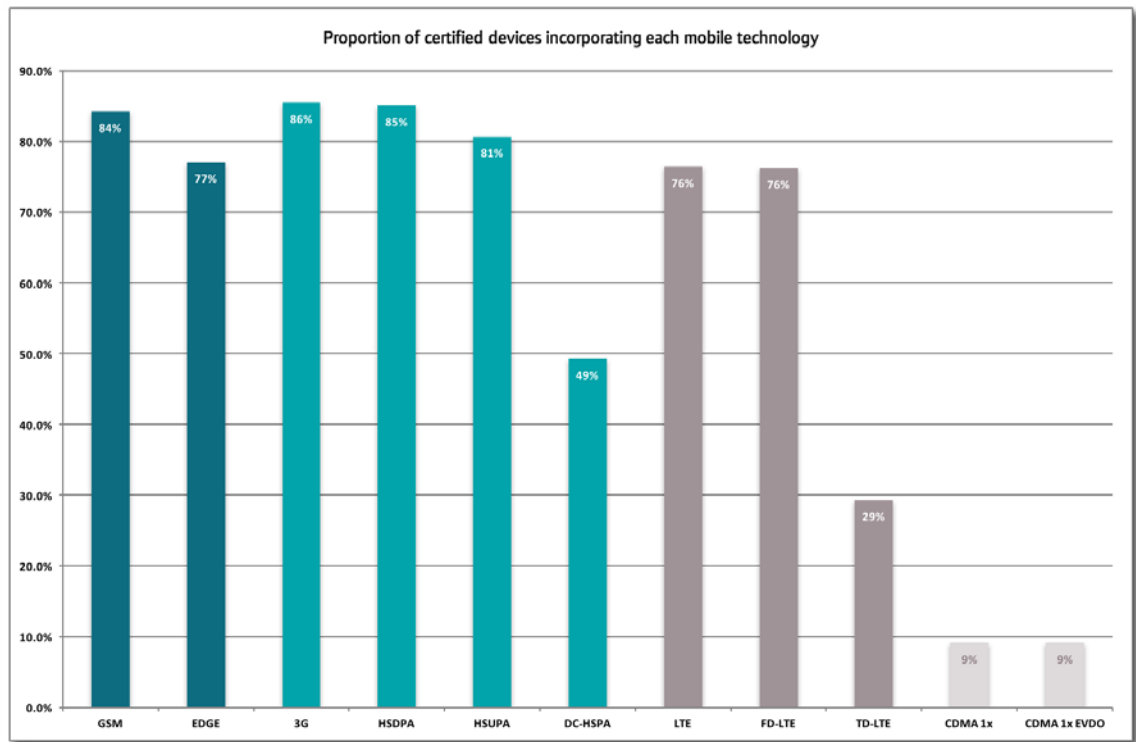


Fig 4

HSUPA was certified in 81 per cent of devices and penetration of Dual-Carrier HSPA has risen to nearly half all certified devices.

The penetration of LTE continues to grow: the technology was certified in 76 per cent of all certified devices.

By the end of 2016, 18 FDD-LTE and five TDD-LTE bands had been brought within the scope of GCF Certification.

All but one of the 360 certified LTE devices incorporated FDD-LTE. TDD-LTE was a feature of nearly a third of certified devices.

Many operators started to roll-out Carrier Aggregation onto their networks during 2016. The commercial availability of validated test platforms allowed the functionality to be activated within the GCF scheme in November 2016.

The feature was first certified in two devices in December 2016. Both devices supported Carrier Aggregation across 18 band combinations. The incidence of Carrier Aggregation in certified devices is expected to increase substantially in 2017.

Only 51 devices (11 per cent of all certifications) were single-mode (Fig 5). Of these, 25 were GSM devices, 25 were LTE and one was CDMA2000.

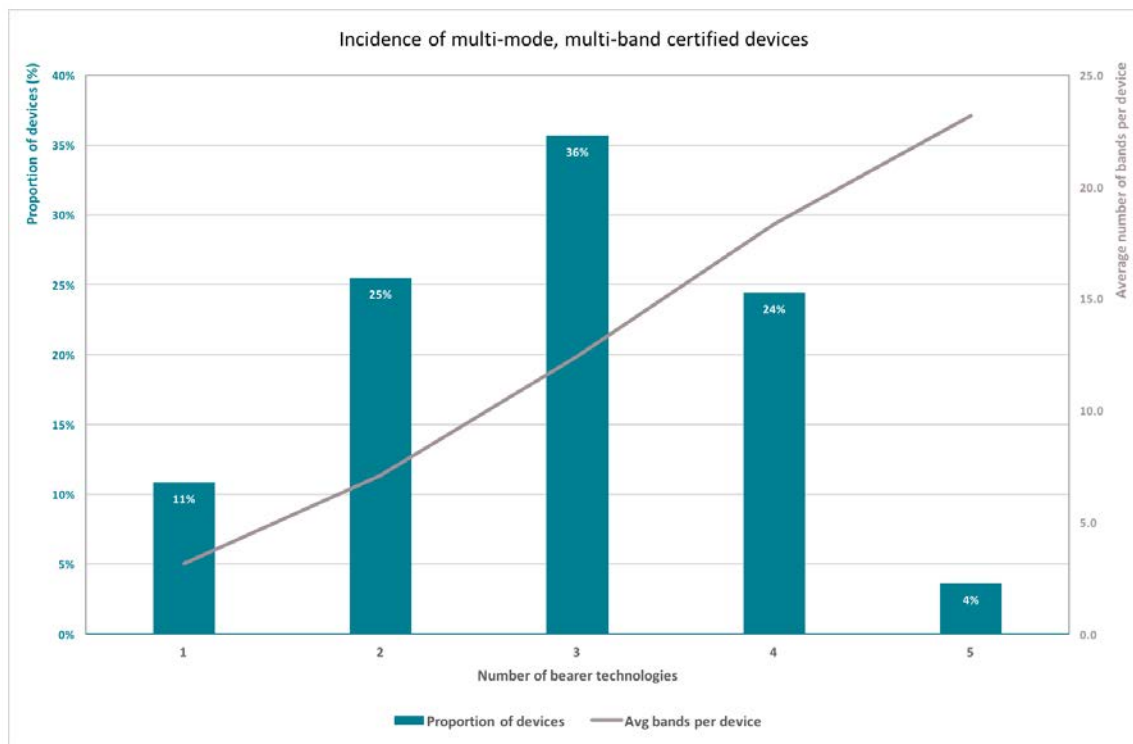


Fig 5

Single-mode devices still tend to be multi-band: the average single-mode device incorporated 3.1 bands. The only single-mode, single-band device certified in 2016 was an LTE smart watch.

Across all certifications, the “average” certified device incorporated 2.8 bearer technologies and was capable of operating across 12 frequency bands.

64 per cent of certified devices incorporated three or more bearer technologies.

Four per cent of certifications (17 devices) incorporated five bearer technologies and an average of 23.2 bands. Five of the devices in this group incorporated 27 different bands – the highest number of bands incorporated in individual devices in 2016.

## 2016 certified devices by type

Half of all devices certified in 2016 were smartphones. Wireless modules, designed to allow mobile connectivity to be added to other products, were the second largest category accounting for 17 per cent of certifications. Five percent of certified devices were feature phones (fig 6).



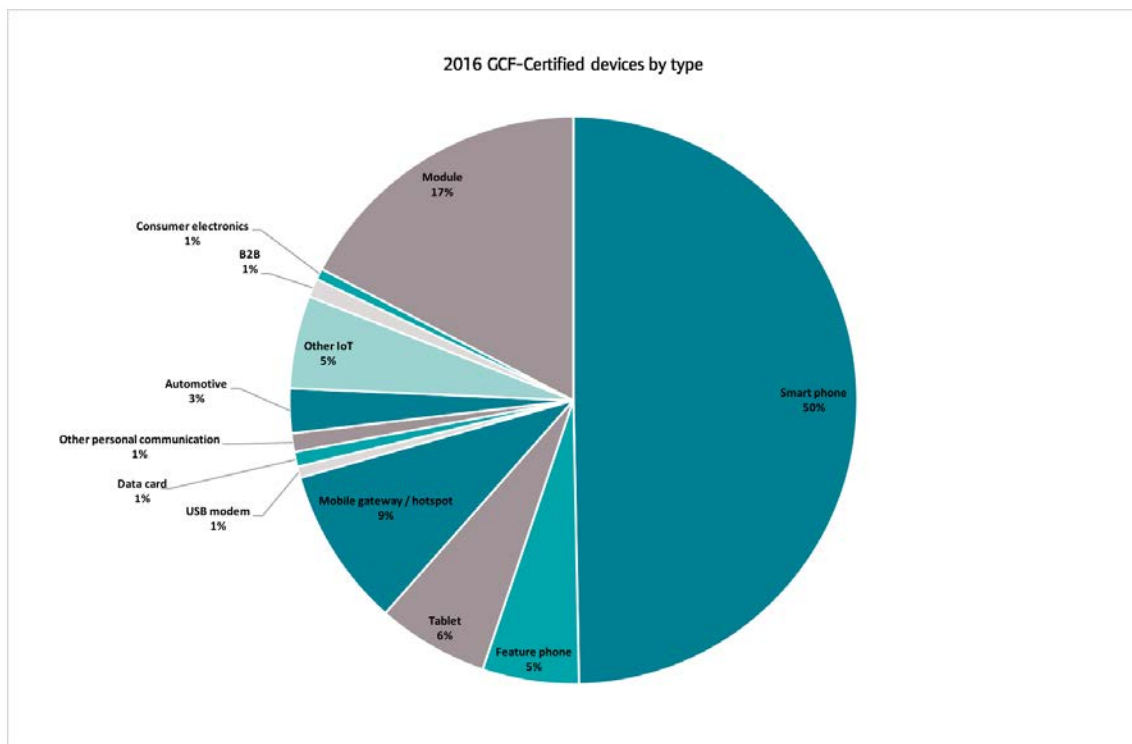


Fig 6

The mobile gateway/portable hotspot category expanded to nearly a tenth of all certifications. The popularity and versatility of this type of device may account for the absence of any laptops/notebooks with embedded mobile connectivity in the 2016 certifications.

Devices that enable personal communications – smartphones, feature phones, tablets, mobile gateways/portable hotspots, USB modems, data cards etc. – made up 73 per cent of all certified devices.

Nearly a tenth of products certified in 2016 could be described as M2M / IoT devices and many of the certified modules are designed for M2M or IoT applications. The volume of M2M / IoT certifications is likely to increase in 2017 as certification of the 3GPP LPWA technologies CAT-M1 and NB-IoT is introduced into GCF during the year. The third 3GPP LPWA technology, EC-GSM-IoT, could also be brought within GCF Certification if requested by members.

## Industry maintains its focus on LTE

**LTE remains a major priority for the mobile industry as operators migrate mobile broadband customers to more efficient 4G networks.**

LTE was certified in 76 per cent of all devices, up from just under 69 per cent in 2015 (fig 7).

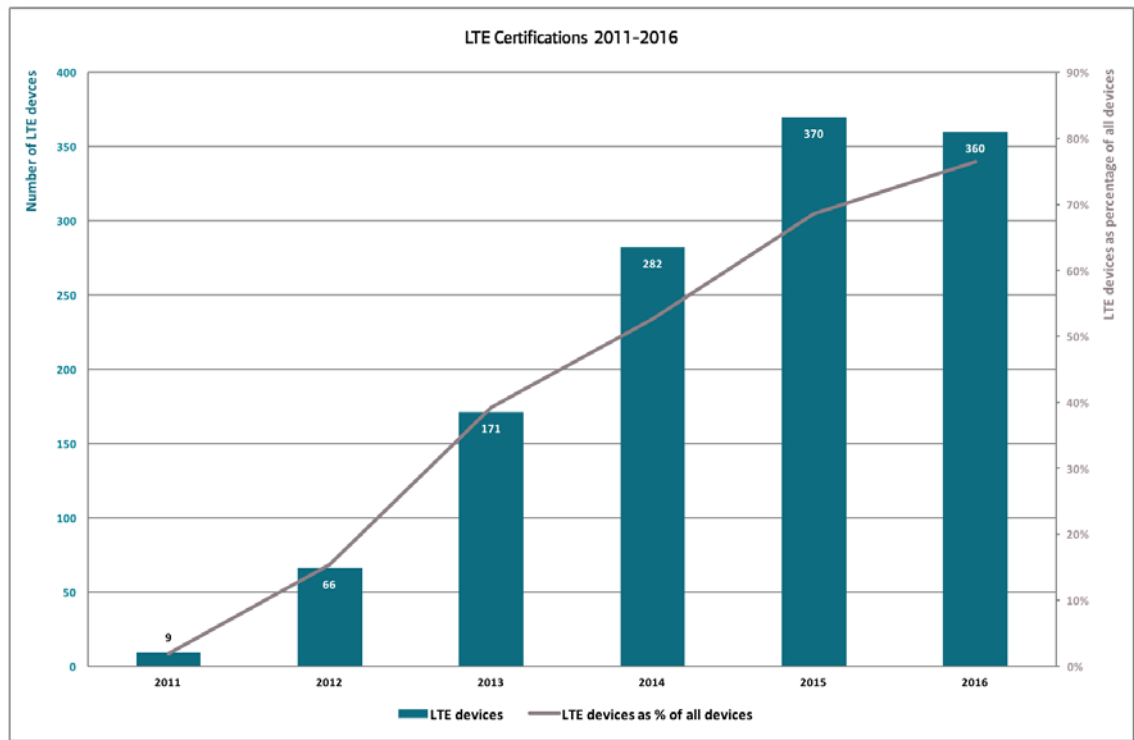


Fig 7

138 devices (29 per cent of all certifications, 38 per cent of LTE devices) supported TDD-LTE. (All certified TDD-LTE devices also supported FDD-LTE.)

98 devices (27 per cent of LTE devices) were certified as supporting simultaneous FFD and TDD operation.

VoLTE operation was certified in 23 per cent of LTE devices (84 models).

## Multi-band devices for LTE markets worldwide

During 2016, devices were certified in 17 FD bands and four TD bands (Fig 8).

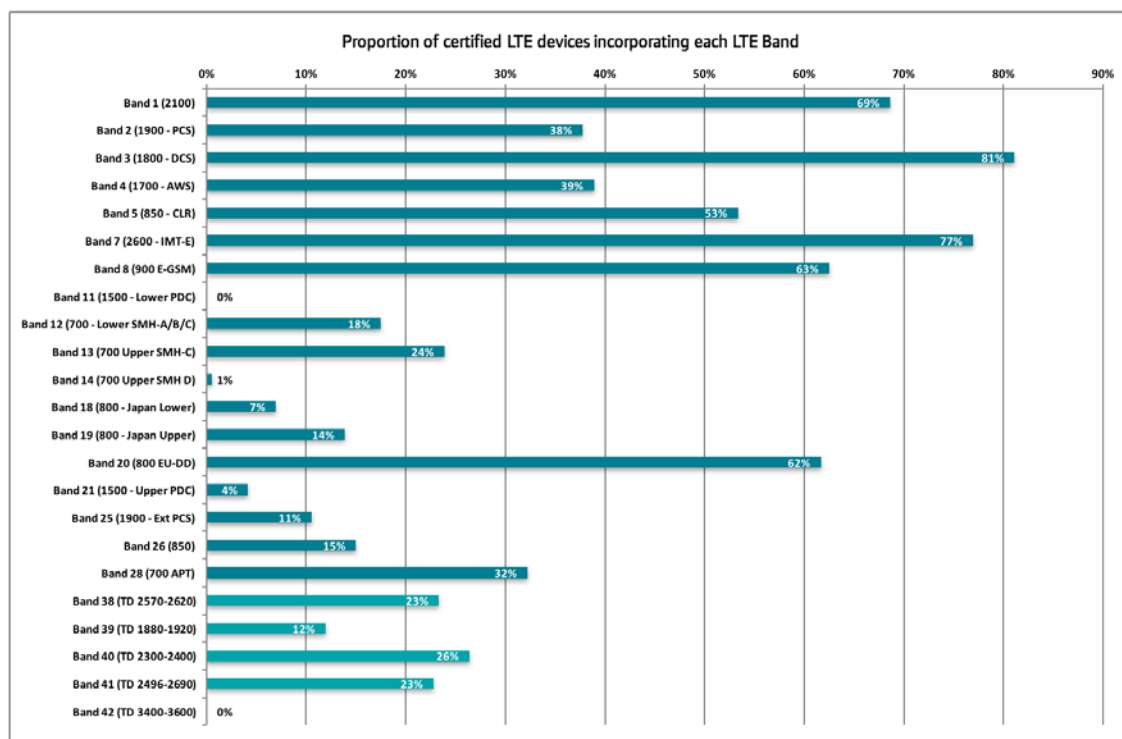


Fig 8

The Device Analysis suggests that former GSM spectrum is being “re-farmed” to LTE. Two GSM bands feature among the four most commonly certified LTE bands – Band 3 (1800 MHz) and Band 8 (900 MHz).

Band 3 remains the most commonly certified LTE band and featured in 292 devices (81 per cent of LTE devices, 62 per cent of all devices.)

Band 7 (2600 MHz) was the second most certified LTE band, incorporated in 277 devices (77 per cent of LTE devices), followed by Band 1 (2100 MHz) in 247.

Band 20, the 800 MHz “European Digital-Dividend” band, is also widely certified and featured in 62 per cent of LTE devices.

Bands 2 and 4 – 1900 MHz (former PCS band) and 1700/2100 MHz (AWS) – are the most commonly certified bands relevant to the US. They feature in nearly four in ten LTE devices.

Band 28, the 700 MHz APT 700 band, which has been allocated by major markets in Latin America and Asia Pacific including Brazil, Argentina, Japan, Korea, India, the Philippines, Australia and New Zealand was certified in nearly a third LTE devices.

The number of certified bands in LTE devices continued to increase during 2016. Of the 359 devices incorporating FDD-LTE, 335 (93 per cent of LTE devices) incorporated three or more LTE bands (Fig 9).

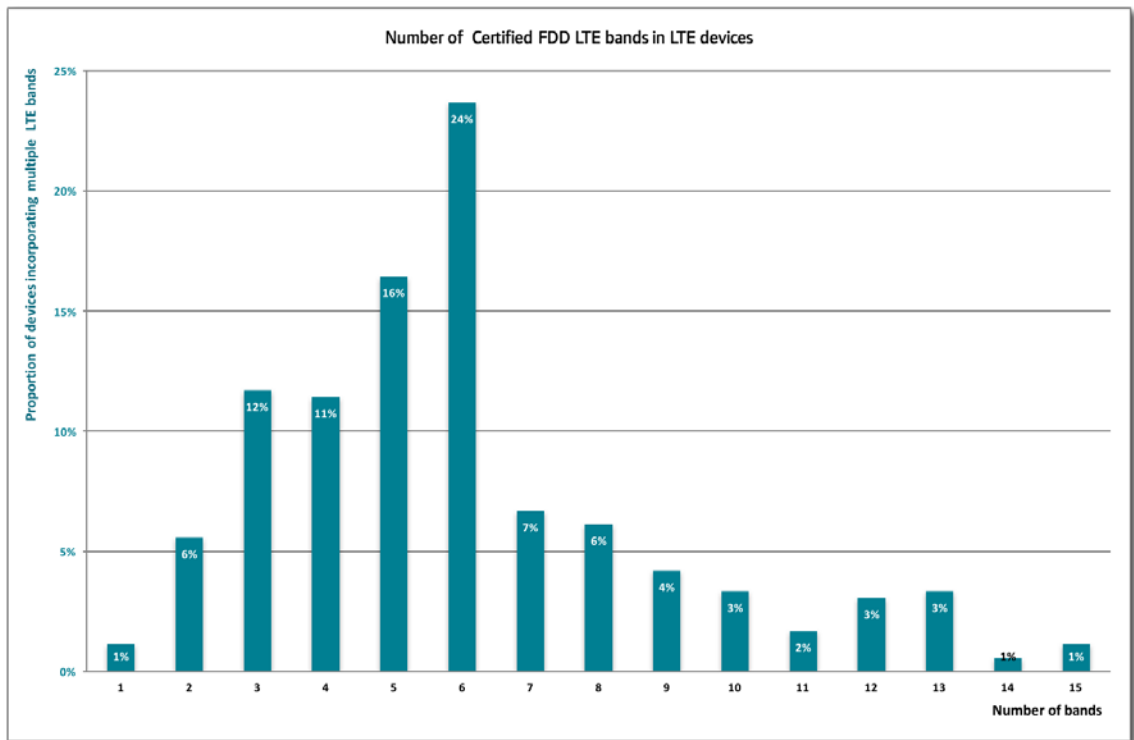


Fig 9

47 devices (13 per cent of LTE devices) incorporated 10 or more FDD-LTE bands. Four devices supported 15 FDD-LTE bands.

Certification is the only practical way of undertaking effective pre-launch testing of devices incorporating so many bands and destined for diverse markets.

The “average” LTE device incorporated 6.1 FDD-LTE bands, up from 5.3 in 2015.

## HSPA penetration continues to grow

**The penetration of 3G UMTS (WCDMA) across all devices increased from 84 per cent in 2015 to 86 per cent in 2016.**

Notwithstanding the growing penetration of LTE, manufacturers and operators continue to deliver incremental enhancements to the performance of 3G.

Certification of HSDPA grew incrementally from 84 per cent in 2015 to 85 per cent of all devices (and nearly 100 per cent of 3G devices) in 2016. HSUPA was certified in 81 per cent of all devices (94 per cent of 3G devices).

Dual Carrier HSPA was certified in 232 devices (49 per cent of all devices, 58 per cent of 3G devices). By comparison, 52 per cent of 3G devices supported DC-HSPA in 2015.

HSDPA, HSUPA and LTE were certified together in 302 devices. 86 devices supported 3G but not LTE.

All 3G devices were certified in two or more 3G bands (Fig 10). 245 3G devices (61 per cent of 3G devices) were certified in four or more 3G bands.

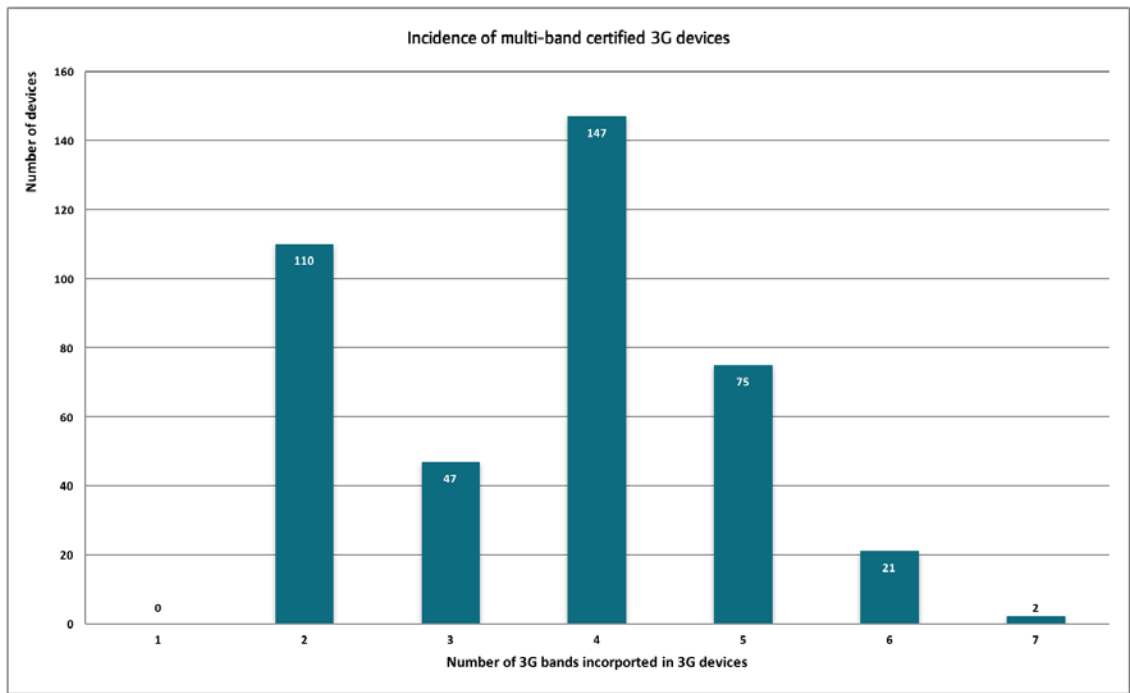


Fig 10

396 of the 471 certified devices (84 per cent of all devices and 98 per cent of 3G-capable devices) were certified in the 2100 MHz band (fig 11).

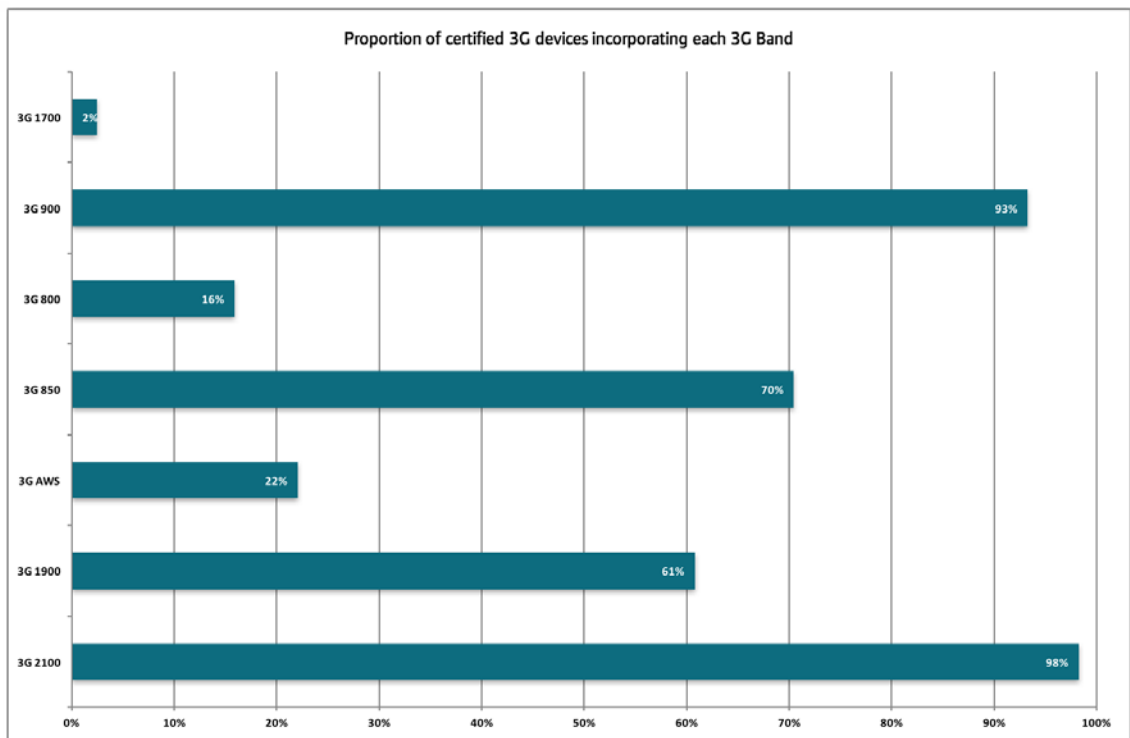


Fig 11

The 900 MHz band was the second most frequently certified 3G band – in some 376 devices (80 per cent of all devices and 93 per cent of all 3G devices.). All these devices also incorporated the 2100 MHz band.

The most commonly certified US 3G band was 850 MHz which featured in 284 devices (70 per cent of 3G devices).

At least one US 3G band was certified in 239 devices (51 per cent of all certifications, 59 per cent of 3G).

## Decline of GSM continues, but gradually

The penetration of GSM declined from 87 per cent of certified devices in 2015 to 84 per cent in 2016. (Fig 12).

GSM featured in 100 per cent of GCF Certified devices in 2009. GSM penetration began to decline with the launch of early LTE devices, several of which were single-mode, LTE-only.

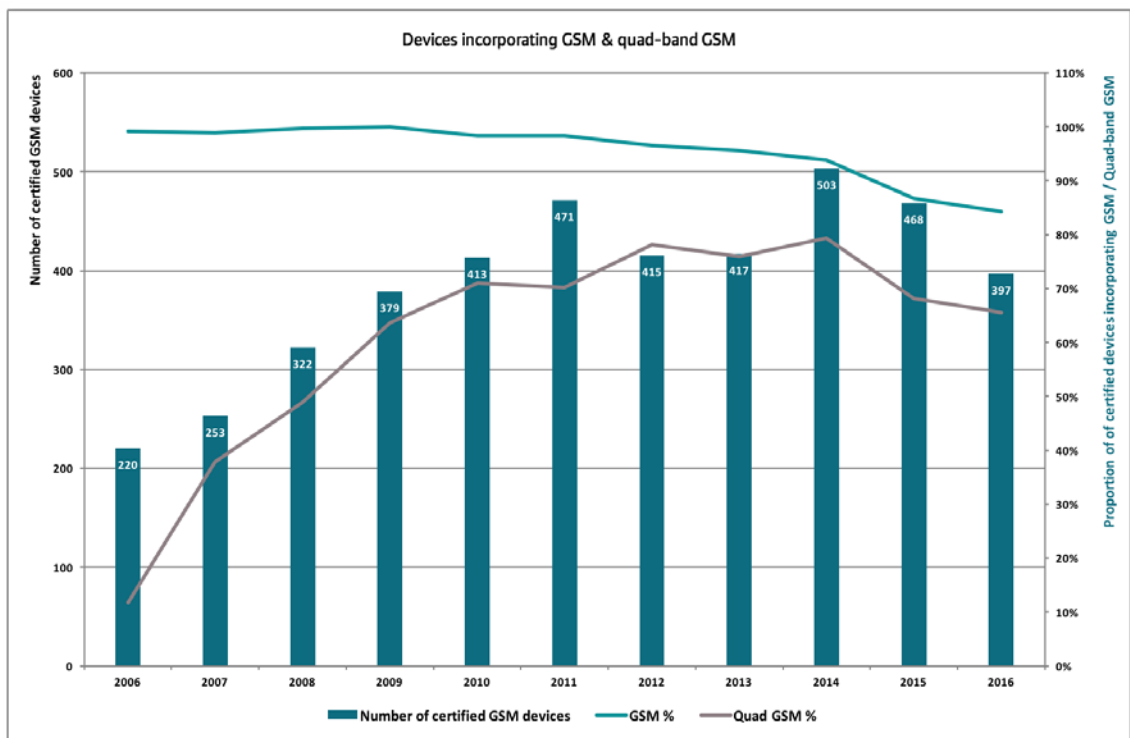


Fig 12

25 certified devices (5 per cent of all certifications) were GSM-only.

EDGE was certified in 363 devices (77 per cent of all devices and 91 per cent of all GSM-capable devices).

## Wireless modules

Module certifications declined in 2016 after four years of consecutive growth (Fig 13). 16 manufacturers certified modules during 2016: two specialist module manufacturers were among GCF's top 10 manufacturers by volume of device certifications.

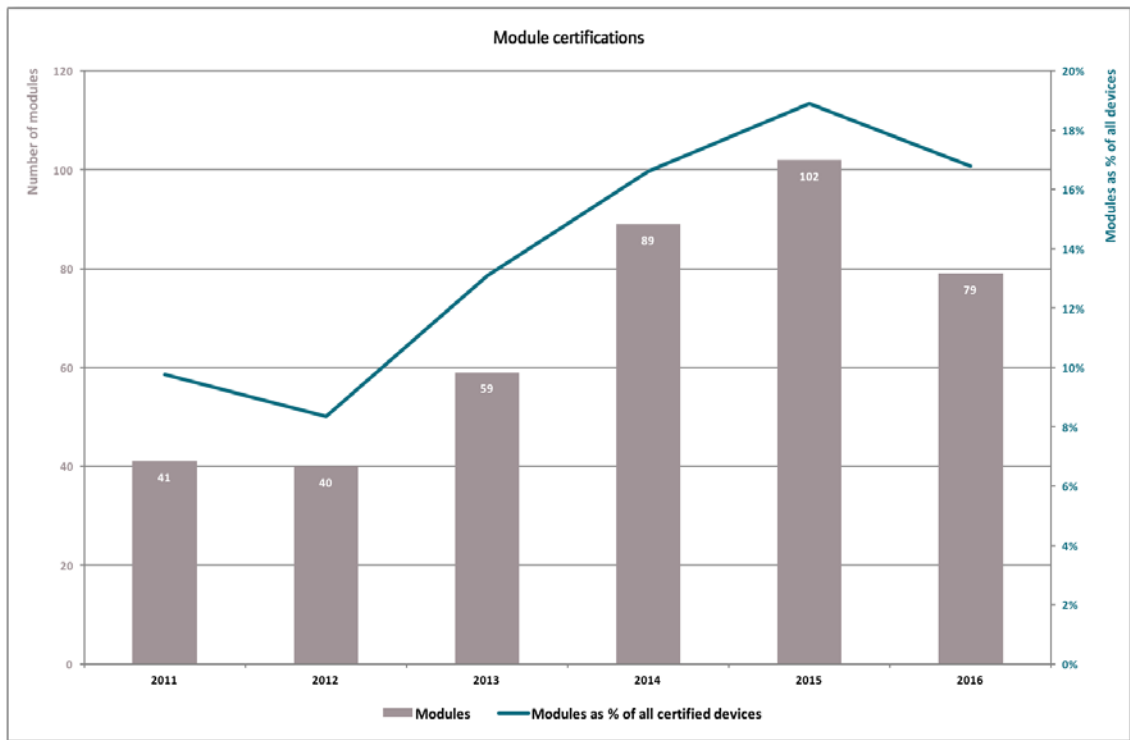


Fig 13

As with certified devices generally, a variety of multi-mode, multi-band modules are currently being offered to the market.

Compared with all certified devices, modules tend to incorporate fewer bearer technologies (Fig 14). For example, 51 per cent of modules are dual-mode while the corresponding figure across all devices was 25 per cent.

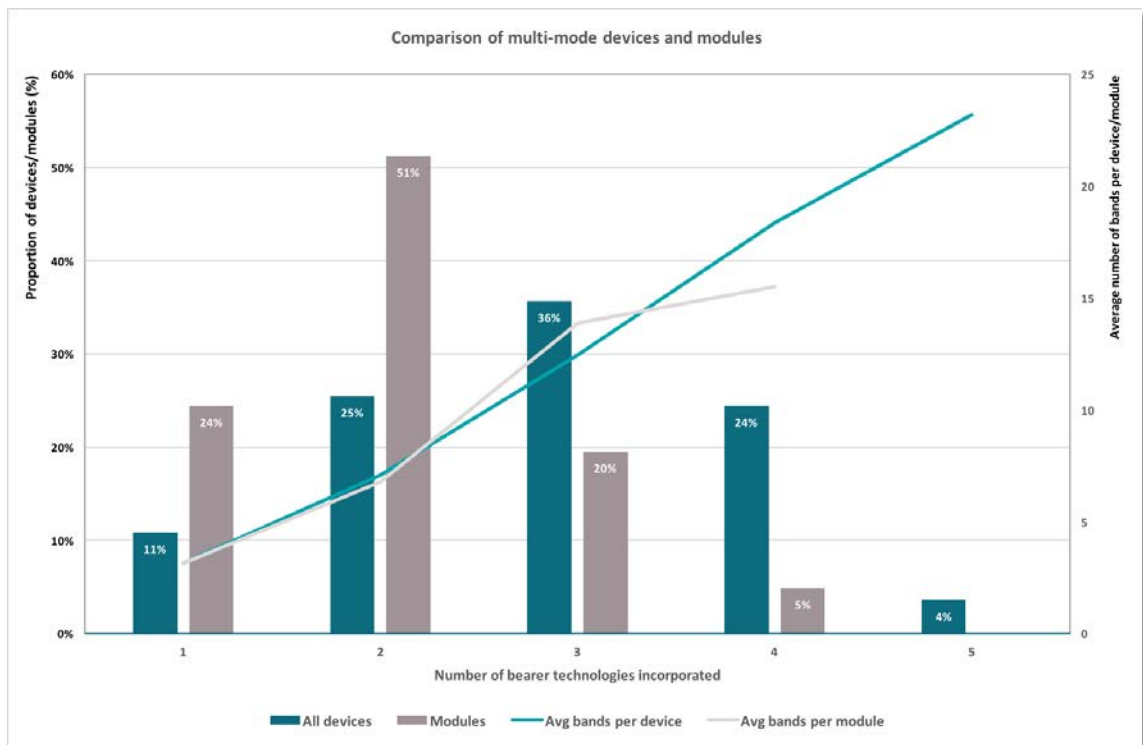


Fig 14

Only four of the 82 modules incorporated more than three certified technologies. These operated across an average of 15.5 bands per device. Across all certifications, four technology devices typically operated across an average of 18.3 bands.

No modules incorporated five technologies in 2016

GSM was still the technology most commonly certified in modules in 2016, featuring in 79 per cent of the 82 certifications (Fig 15).

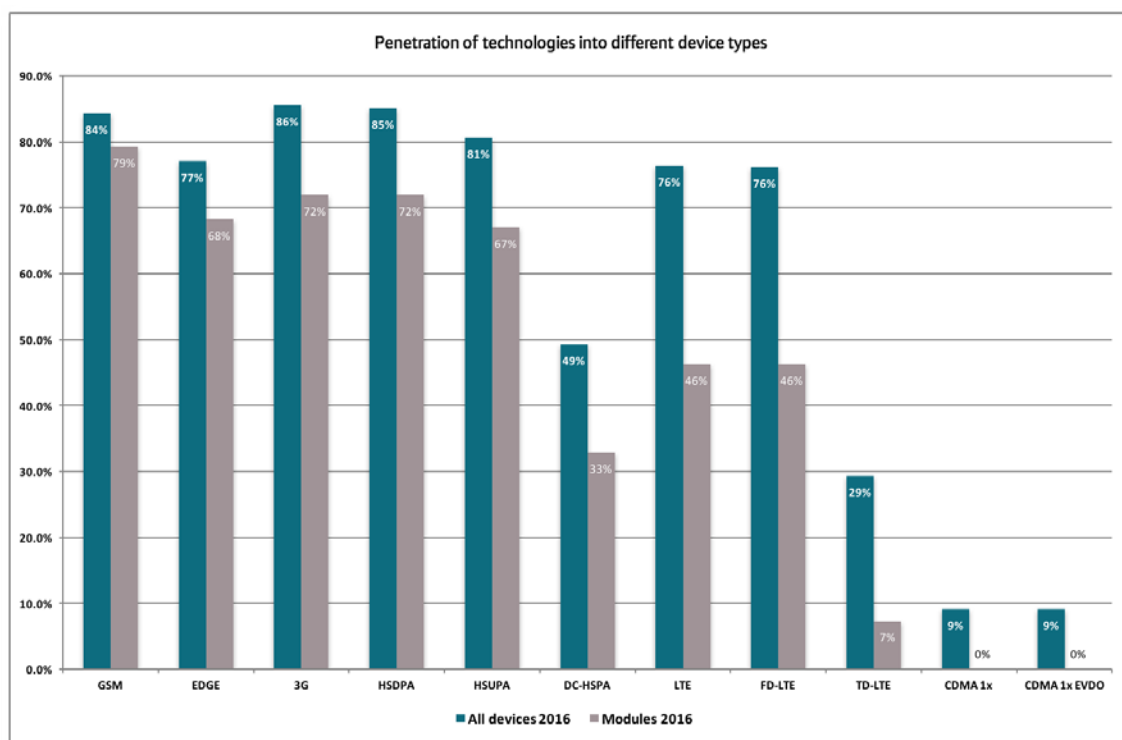


Fig 15

3G UMTS (WCDMA) and HSPDA was certified in 72 per cent of modules while the penetration of LTE is now over 46 per cent, up from 33 per cent in 2015.

The volume of module certifications is expected to increase in 2017 when the scope of GCF is expanded to include the 3GPP LPWA IoT technologies CAT-M1 and NB-IoT.

## Conclusion

In a global mobile eco-system that embraces five main bearer technologies deployed across more than 25 frequency bands, GCF Certification provides a practical and widely recognised means of ensuring devices will interoperate correctly with networks and meet the performance expectations of end-users.

In 2016, the average GCF-Certified device incorporated 2.8 bearer technologies and operated across 12 frequency bands.

Pre-launch testing of today's sophisticated multi-mode, multi-band smartphones would be infinitely more difficult, time-consuming and expensive without a scheme such as GCF Certification. However, the 2016 GCF Device Analysis shows that the scheme remains relevant to the pre-launch testing of relatively simpler single-mode and even single-band devices.

The scheme can play an important role in realising the benefits of the coming Internet of Things - LTE CAT-M1 and NB-IoT device certification will become an integral part of GCF certification during 2017.



## MORE INFORMATION

For more information on GCF and the benefits of certification, please visit <http://www.globalcertificationforum.org/>

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