GCF™
Global Certification Forum

Mobile Device Trends

An analysis of GCF device certifications in 2017

By combining conformance and interoperability tests undertaken in laboratories with field trials on multiple commercial networks, GCF Certification verifies the quality of the interoperability between mobile phones, wireless or IoT devices across different network elements and vendors' infrastructure.

Hundreds and hundreds of different devices are certified each year. The following is an analysis of GCF's certification listings which provides insight into current trends within the mobile device market.

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Introduction to GCF

Founded in 1999, the Global Certification Forum (GCF) is the globally-recognised quality mark for the interoperability of mobile phones and other devices that incorporate mobile connectivity.

GCF Certification is based on test cases defined by recognised standards organisations such as 3GPP, GSMA, OMA, NFC Forum, oneM2M and TCCA. GCF operator and manufacturer members identify and agree a selection of available test cases for each technology and functionality to be brought within the scope of the scheme to deliver a robust but pragmatic testing regime that meets market needs.

GCF Certification comprises of lab-based conformance and interoperability testing complemented by field trial testing on commercial networks.

As of January 2018, more than 100 device manufacturers are participating in GCF. The scheme is also recognised by operators with interests in global markets (Fig 1). Collectively, these operators invest tens of billions of dollars in marketing devices each year.

A number of GCF operator members have undertaken studies to evaluate device performance on their networks monitoring features such as RSCP, Ec/Io, dropped calls etc. These studies have shown that devices from GCF members perform significantly better than devices from non-member companies.

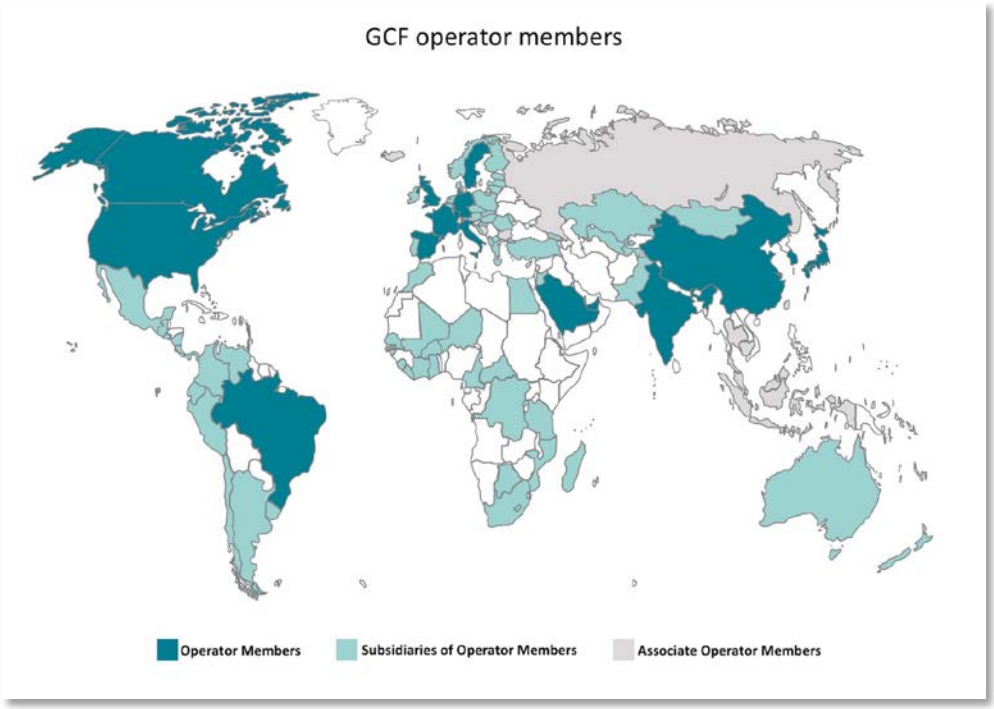

Fig 1

Common, rigorous and trusted certification criteria promote harmonisation of operator acceptance testing schemes. By minimising duplication, GCF Certification reduces acceptance testing costs and contributes to improved economies of scale for device manufacturers.

The scheme provides a consistent, optimised 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 can be marketed 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 GCF's 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 the number of possible band combinations growing exponentially, the scheme provides the most effective method for verifying the correct operation of Carrier Aggregation. In December 2014, GCF became the recognised certification scheme for CDMA2000 devices.

GCF can also certify standards-based client applications such as RCS and NFC applications.

The quality of interoperability assured by the scheme facilitates successful international and national roaming for end-users.

GCF introduced Platform Certification in February 2017 to help designers and manufacturers source 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 may be reduced.

The cellular Low Power Wide Area (LPWA) IoT communications technologies NB-IoT, LTE Cat M1 and EC-GSM were brought within the scope of GCF certification during 2017. At the end of the year, GCF formally started the development of 5G device certification.

Key GCF milestones:

Date	Event
December 2017	GCF starts development of 5G device certification
September 2017	First LTE CAT M1 device certified
March 2017	First NB-IoT device certified
February 2017	Platform Certification introduced
December 2016	Certification of first device supporting Carrier Aggregation
December 2014	First CDMA2000 devices certified.
October 2013	Certification for client applications introduced
October 2012	First dual-mode FDD/TDD LTE device certified
September 2011	First LTE TDD device certified
March 2011	First LTE FDD device certified
Aug 2008	First HSUPA device certified
Jun 2008	First HSDPA device certified
Feb 2006	First 3G device certified
May 2000	Certification of first device – GSM
1999	GCF Founded

GCF Device Certifications

Certified devices are listed on the GCF website at:
https://www.globalcertificationforum.org/products/all-certified-products.html

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

Executive Summary

This annual review of Mobile Device Trends is based on an analysis of device certifications published by the Global Certification Forum during 2017. The analysis provides insights into the mobile technologies and functionalities being requested by operators and end-users across markets worldwide.

A total of 521 devices were GCF-certified by 57 manufacturers in 2017. Certifications increased by 10.6 per cent compared with the 471 devices certified in 2016.

Cellular IoT

During 2017, the scope of GCF certification was extended to include the three Low Power Wide Area (LPWA) communications technologies standardised by 3GPP for IoT applications. All three of the new technologies were certified in devices during the year: NB-IoT featured in five devices; LTE CAT M1 (FDD) featured in three; LTE CAT M1 (TDD) in one; and EC-GSM in six.

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 84 per cent of all devices certified in 2017 incorporated more than one bearer technology. 70 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 deliver seamless operation to end-users 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 marketed 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 (across all devices)						
	2012	2013	2014	2015	2016	2017
GSM	3.5	3.5	3.5	3.2	3.1	3.1
3G	2.2	2.6	2.7	2.9	3.1	3.2
FDD-LTE	0.3	1.2	2.3	3.6	4.6	6.0
TDD-LTE	0.0	0.0	0.1	0.3	0.6	1.0

In 2017, 66 per cent of all certified devices incorporated GSM, 3G and LTE, up from 60 per cent in 2016.

Modules accounted for 16 per cent of all certifications.

LTE

By the end of 2017, GCF enabled the certification of LTE devices in 23 FDD-LTE bands and six TDD-LTE bands.

The proportion of GCF-certified devices incorporating FDD-LTE rose to 84 per cent, up from 76 percent in 2016. 437 devices incorporated FDD-LTE.

209 devices supported TDD LTE, 40 per cent of all certifications.

Carrier Aggregation was certified in 216 devices in 2017, 42 per cent of all certified devices, 49 per cent of LTE devices. The scheme can be used to certify devices capable of aggregating two, three or four downlink bands.

VoLTE support was certified in 260 devices, representing half of all devices and 59 per cent of LTE devices.

3G (UMTS/WCDMA)

The proportion of all devices incorporating 3G declined slightly from 85 per cent of all 2016 certifications to 82 per cent in 2017.

The penetration of HSDPA also declined from 85 per cent to 82 percent while HSUPA was a feature of 79 percent per cent of all devices compared with 81 percent in 2016.

Dual-Carrier HSDPA was incorporated in 57 per cent of certified devices, up from 49 per cent in 2016.

GSM

The penetration of GSM across all devices continues to decline gradually. GSM was still a feature of 81 per cent of all certified devices, down from 84 per cent in 2016. However, 33 GSM-only devices (or six per cent of all devices) were brought to market.

EDGE penetration also continues to decline, reflecting LTE's now dominant position as the principle bearer technology for data services. EDGE was incorporated in 71 per cent of all devices in 2017, down from 77 per cent in the prior year.

CDMA2000

43 devices, eight per cent of all certified devices, incorporated CDMA2000. All the certified CDMA2000 devices also incorporated LTE. 36 (84 per cent) of the CDMA2000 capable devices also incorporated 3G (UMTS/WCDMA) and 35 were quad-mode devices that also incorporated GSM.

PLATFORMS

GCF launched platform certification in 2017. A platform is any hardware or software subsystem that provides defined functionality within the scope of the GCF certification scheme. The scheme enables manufacturers to design new wireless products around previously certified functionality and reuse the test results and certification of the platform used. 20 platforms were certified during 2017.

5G

GCF has approved a Work Item that lays the foundation for the certification of 5G devices based on 3GPP Release 15. The Work Item will cover both the Non-Stand Alone (NSA) and Stand Alone (SA) 5G System modes of operation. Marking the start of its formal participation in 5G, this is an important milestone for GCF.

GCF Certifications by year

After a decline in 2016, the total number of device certifications increased by 10.6 per cent to 521 in 2017. The number of manufacturers certifying at least one device, 57, was only marginally lower than the record number of 58 certifying manufacturers in 2016.

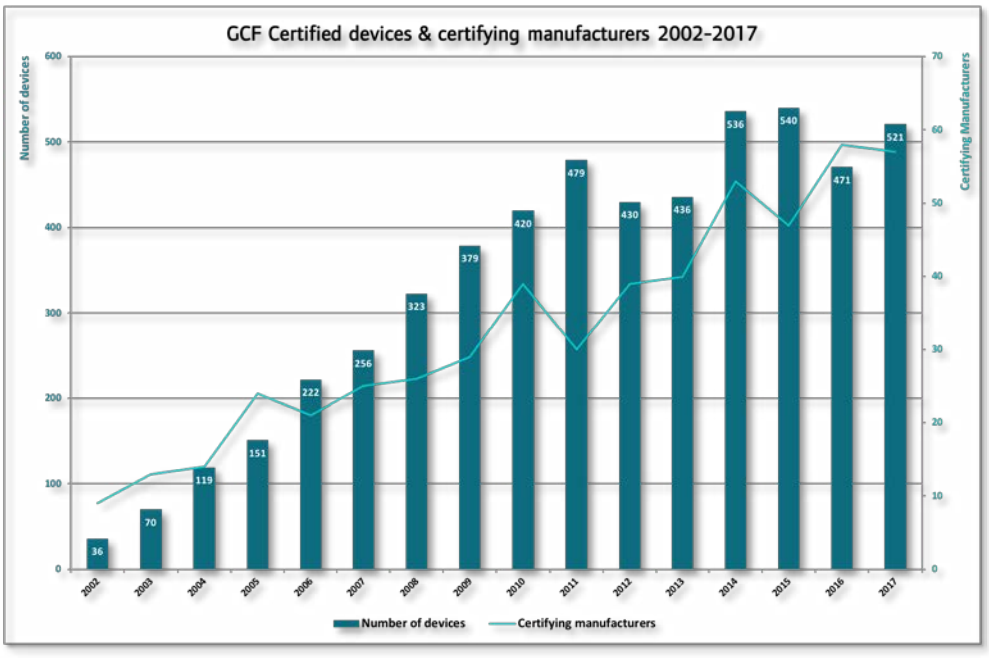

Fig 2

The data shows that certification benefits manufacturers of all sizes. Three manufacturers certified 50 devices or more; 34 manufacturers certified three devices or fewer. 13 companies who joined GCF during 2017 certified one or more devices during their first year of membership.

Comparing annual certifications against global device sales suggests there is a relationship between the choice of devices in the global market and overall market size (fig 3).

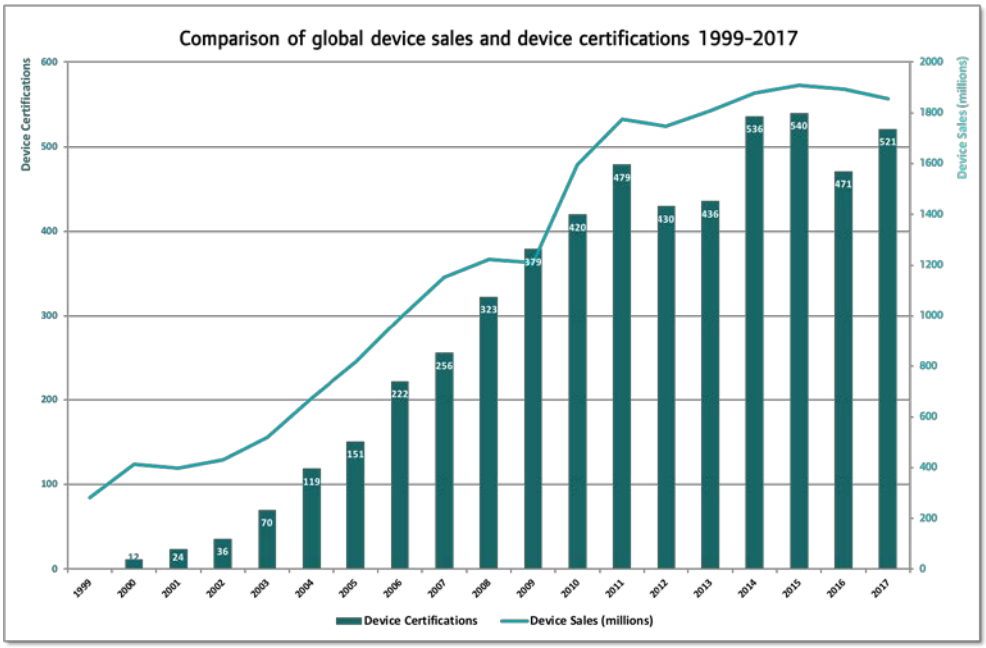

Fig 3

[†]Device sales source: "Gartner Worldwide Manufacturer Sales to End Users of Mobile Terminal Devices", collated by GCF. 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.

2017 certified devices by type

More than half (55 per cent) of all devices certified in 2017 were smartphones (fig 4).

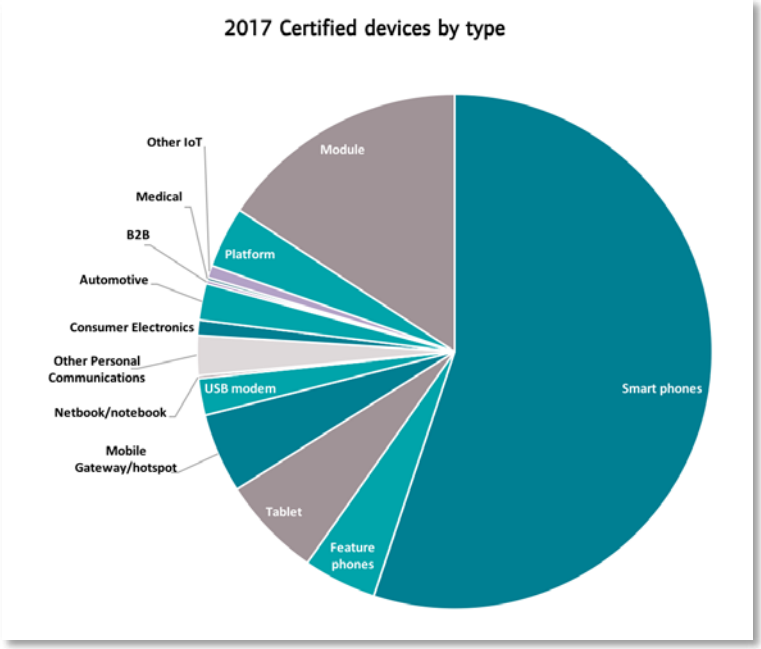

Fig 4

Wireless modules, designed to allow mobile connectivity to be added to other products, were the second largest category accounting for 16 per cent of certifications. Six per cent of certified devices were tablets while five per cent were feature phones.

The mobile gateway/portable hotspot category also accounted for five per cent of all certifications while USB modems contributed a further two percent of certifications.

Devices that enable personal communications – smartphones, feature phones, tablets, mobile gateways/portable hotspots, USB modems, etc. – made up 76 per cent of all certified devices.

M2M / IoT devices accounted for 3.5 per cent of certified devices, although the volume of IoT device certifications is likely to increase in the years ahead now that NB-IoT and LTE CAT M1 have been brought within the scope of the scheme. Many of the GCF certified modules are also likely to be incorporated into IoT devices.

LTE penetration continues to grow, becomes most certified technology

Penetration of LTE in certified devices continued its inexorable rise in 2017 (fig 5).

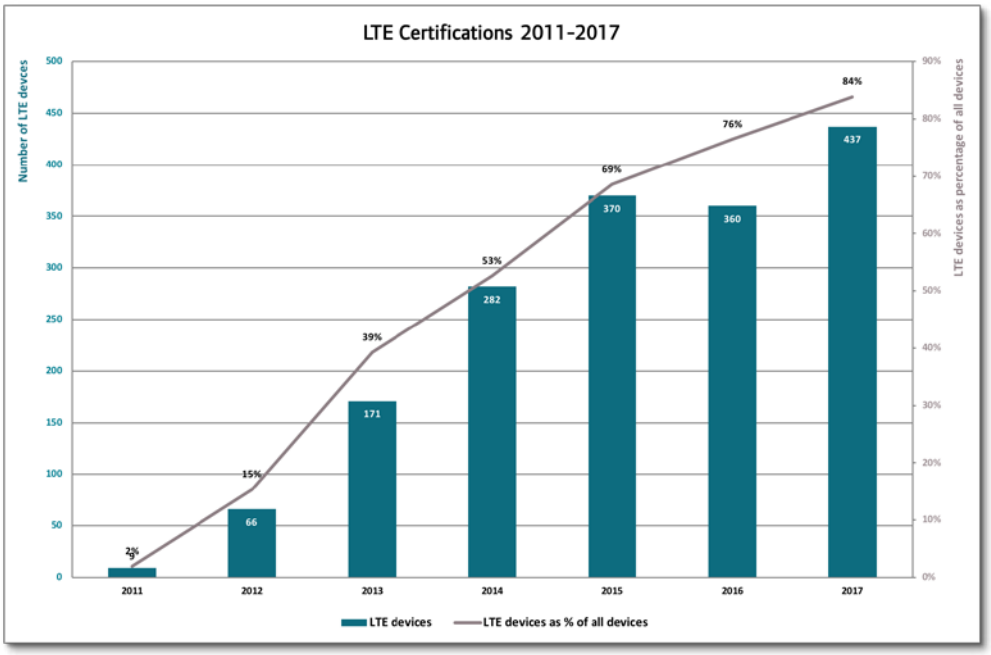

Fig 5

LTE has now overtaken 3G (UMTS/WCDMA) as the most commonly certified mobile technology. LTE was a feature of 84 per cent of all certified devices, up from 75 per cent in 2016, and ahead of 3G which was certified in 82 per cent of devices. GSM featured in 81 per cent of devices (Fig 6).

437 devices incorporated FDD-LTE while 209 (40 per cent of all devices) incorporated TDD-LTE. All TDD-LTE capable devices also incorporated FDD-LTE and 82 per cent of these were certified as supporting simultaneous FDD/TDD operation.

Six LTE devices were Category 16 – capable of supporting "Gigabit LTE" on suitably configured networks.

VoLTE operation was certified in 50 per cent of LTE devices (260 devices).

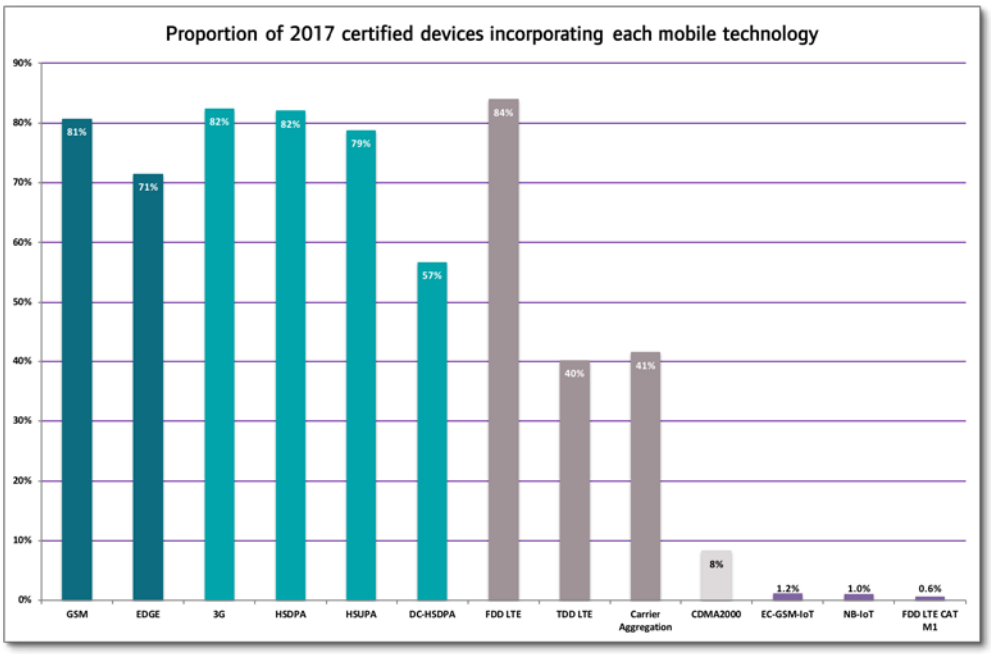

Fig 6

While the penetration of HSDPA and HSUPA declined slightly year-on-year, implementation of Dual-Carrier HSPA increased from 49 to 57 per cent of all certified devices.

Multi-band devices open door to global LTE market

The GCF scheme enables the certification of devices designed to operate in 23 FDD-LTE and six TDD-LTE bands. During 2017, devices were certified in 21 of the 23 LTE FDD bands and six out of the six LTE TDD bands currently covered by the GCF scheme (Fig 7).

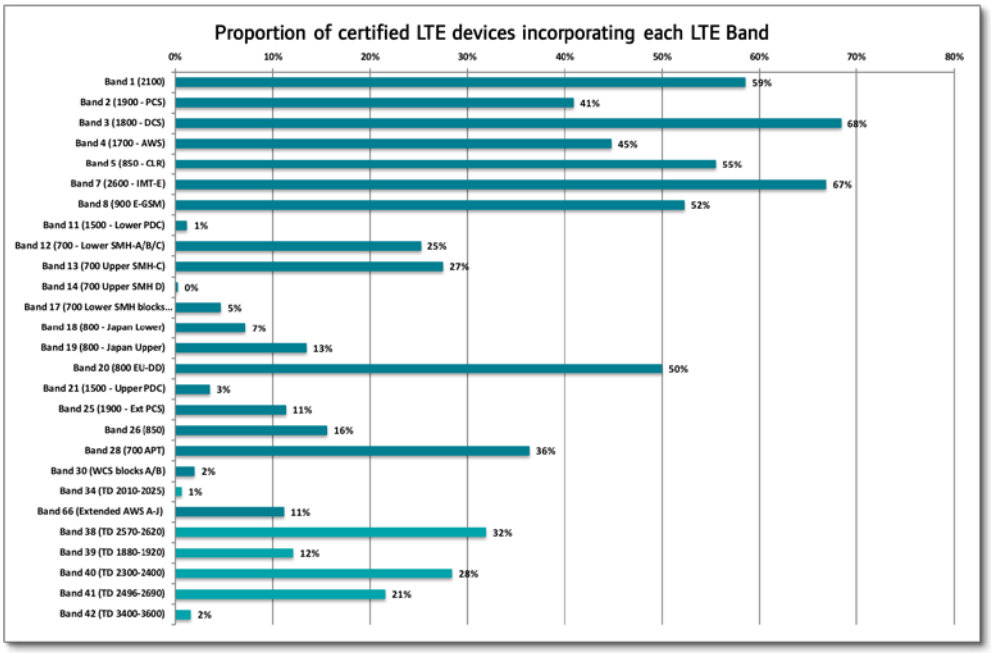

Fig 7

Incorporating multiple bands expands the potential market for a given device. With its extensive coverage of LTE bands, GCF is being used to certify devices destined for use in all the leading mobile markets worldwide.

Band 3 (1800 MHz) retained its position as the most commonly certified LTE band in 2017: it featured in 356 devices (84 per cent of LTE devices, 68 per cent of all devices.)

Band 7 (2600 MHz) remains the second most certified LTE band, incorporated in 348 devices (79 per cent of LTE devices), followed by Band 1 (2100 MHz) in 305.

The US 850 MHz bands (Bands 5 and 26) and AWS bands (Bands 4 and 66) are also commonly implemented in GCF-certified devices.

Band 8 (900 MHz) is widely implemented in LTE devices to facilitate "re-farming" of spectrum that is still widely used around the world by GSM operators.

Band 28, the APT 700 MHz band, which has been allocated in major markets in Latin America and Asia Pacific including Brazil, Argentina, Japan, Korea, India, the Philippines, Australia and New Zealand was certified in approaching 40 per cent of certified LTE devices.

The number of certified bands in LTE devices continued to increase during 2017. Of the 437 devices incorporating FDD-LTE, 408 (93 per cent of LTE devices) incorporated three or more LTE bands, while 80 per cent incorporated five or more bands. (Fig 8).

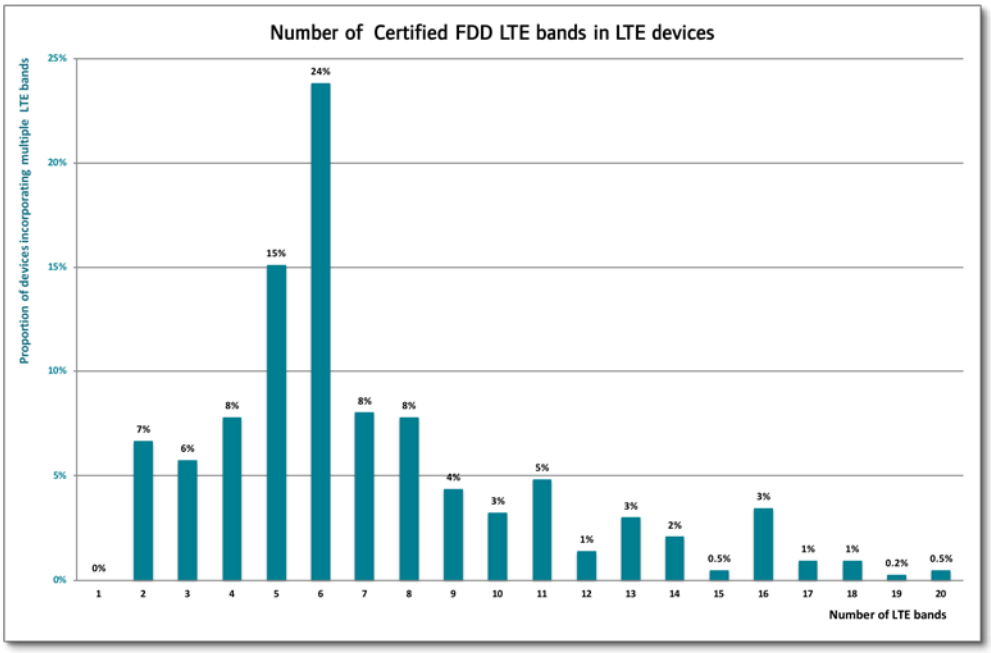

Fig 8

47 devices (13 per cent of LTE devices) incorporated 10 or more FDD-LTE bands. 28 devices supported 15 or more FDD-LTE bands.

In 2017, the "average" LTE device incorporated 7.1 FDD-LTE bands, up from 6.1 in 2016,

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 network operators. Carrier Aggregation became much more commonplace in the past year featuring in 216 devices, 49 per cent of LTE device certifications.

3G/HSPA support has started to decline

With operators and device manufacturers prioritising LTE for the delivery of data services, the penetration of HSDPA and HSUPA declined in 2016. 3G (UMTS/WCDMA) featured in 82 per cent of all certified devices in 2017, down from 86 per cent in 2016.

Certification of HSDPA declined from 85 per cent in 2016 to 82 per cent of all devices in 2017. HSUPA featured in 79 per cent of certified devices, down from 81 per cent in the prior year. In contrast, the penetration of Dual Carrier HSPA actually increased to 57 per cent of all devices, up from 49 per cent in 2016.

Two or more 3G bands were certified in all 3G devices (Fig 9). 304 devices (71 per cent of 3G devices) were certified in four or more 3G bands.

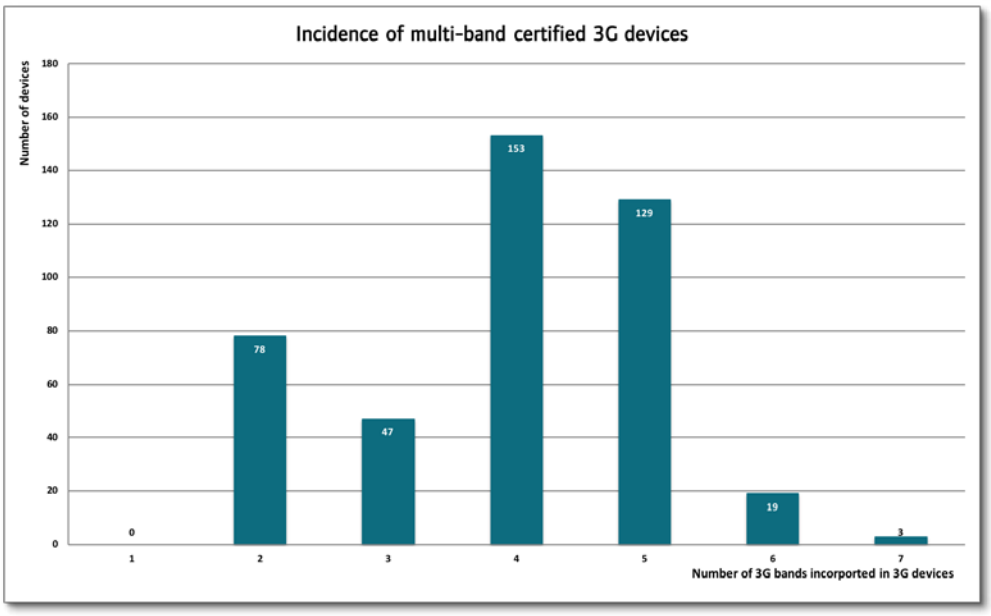

Fig 9

The 2100 MHz band featured in 419 of the 521 certified devices (80 per cent of all devices and 98 per cent of 3G-capable devices). (fig 10).

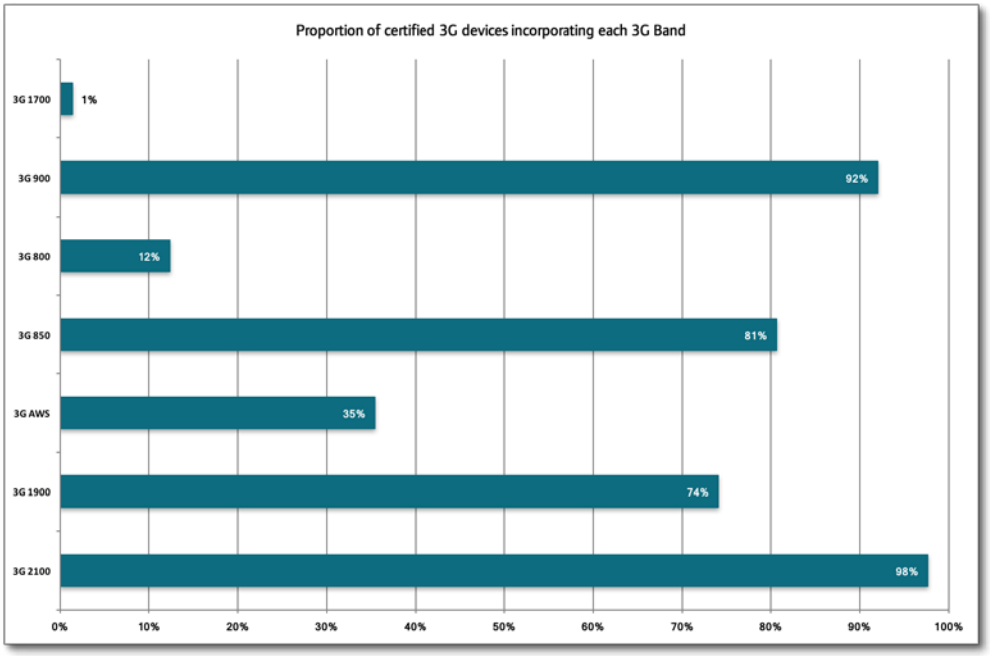

Fig 10

The 900 MHz band remained the second most frequently certified 3G band – in some 395 devices (76 per cent of all devices and 92 per cent of all 3G devices.).

The most commonly certified US 3G band was 850 MHz which featured in 346 devices (81 per cent of 3G devices).

149 devices (34 per cent of 3G) incorporated three US 3G bands.

Slow decline of GSM continues

The penetration of GSM declined from 84 per cent of certified devices in 2016 to 81 per cent in 2017. (Fig 11).

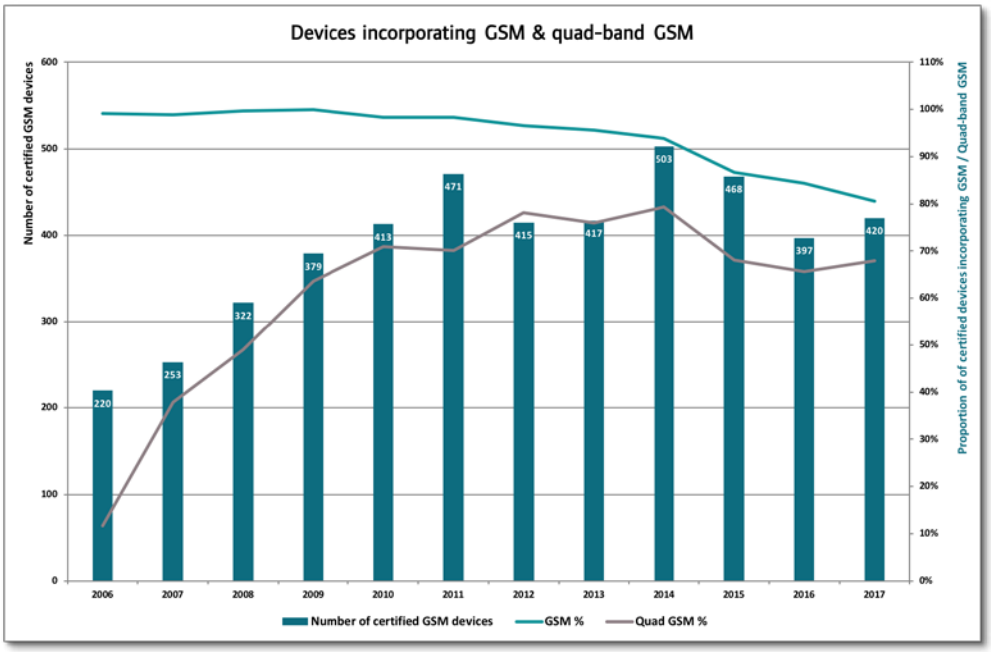

Fig 11

33 certified devices (6 per cent of all certifications) were GSM-only.

EDGE was certified in 372 devices (71 per cent of all devices and 89 per cent of all GSM-capable devices).

Growth in single-mode devices

The number of relatively simple, single mode devices targeted at specific applications increased from 51 in 2016 (11 per cent of all certifications) to 82 in 2017, representing 16 per cent of all devices. (Fig 12).

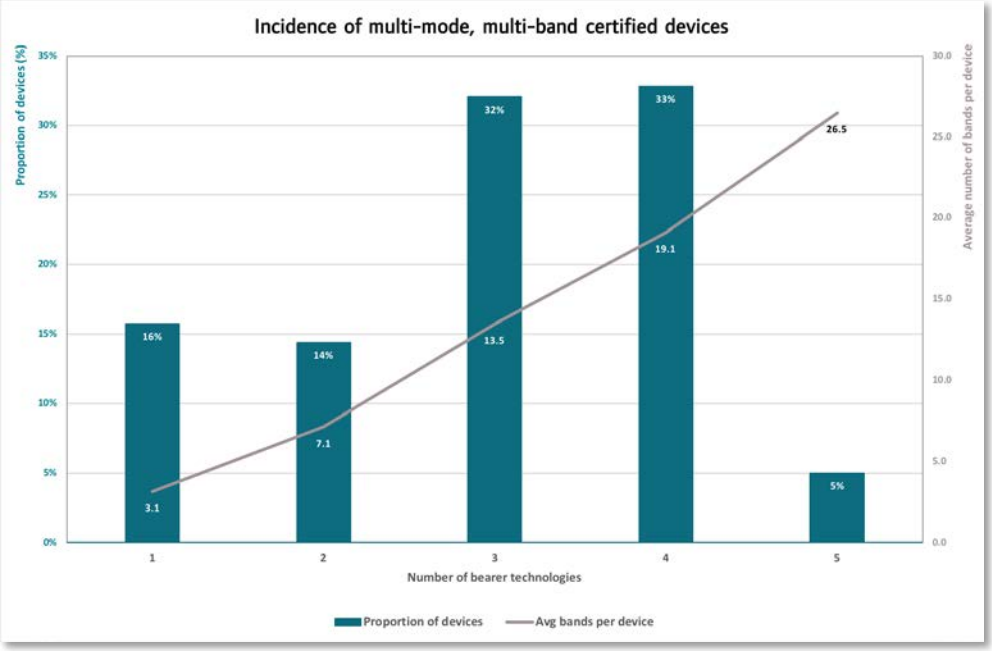

Fig 12

A big driver of this increase was the growth in single mode LTE devices: 40 FDD LTE were certified in 2017 compared with 25 in 2016. GSM still accounted for 33 single mode devices while the new LPWA categories of NB-IoT and LTE CAT M1 (FDD) contributed four and two respectively. Just three of the single mode devices supported 3G.

18 of the 40 certified single-mode LTE devices and 21 of the 33 single-mode GSM devices were modules.

Single-mode devices still tend to be multi-band: the "average" single-mode device incorporated 3.1 bands.

Three single-mode, single-band products shared the honour of being the simplest certified products in 2017. Two were NB-IoT modules, the third a LTE CAT M1(FDD) module.

However, multi-mode devices predominate: 70 per cent of certified devices incorporated three or more bearer technologies.

Five per cent of certifications (26 devices) incorporated five bearer technologies. Devices in this category supported an average of 29 bands.

Two five-technology devices incorporated 37 different bands – the highest number of implemented bands in 2017.

Across all certifications, the "average" certified device incorporated 3.0 bearer technologies and was capable of operating across 13.4 frequency bands.

Wireless modules

82 modules were certified in 2017, 16 per cent of all certifications. (Fig 13).

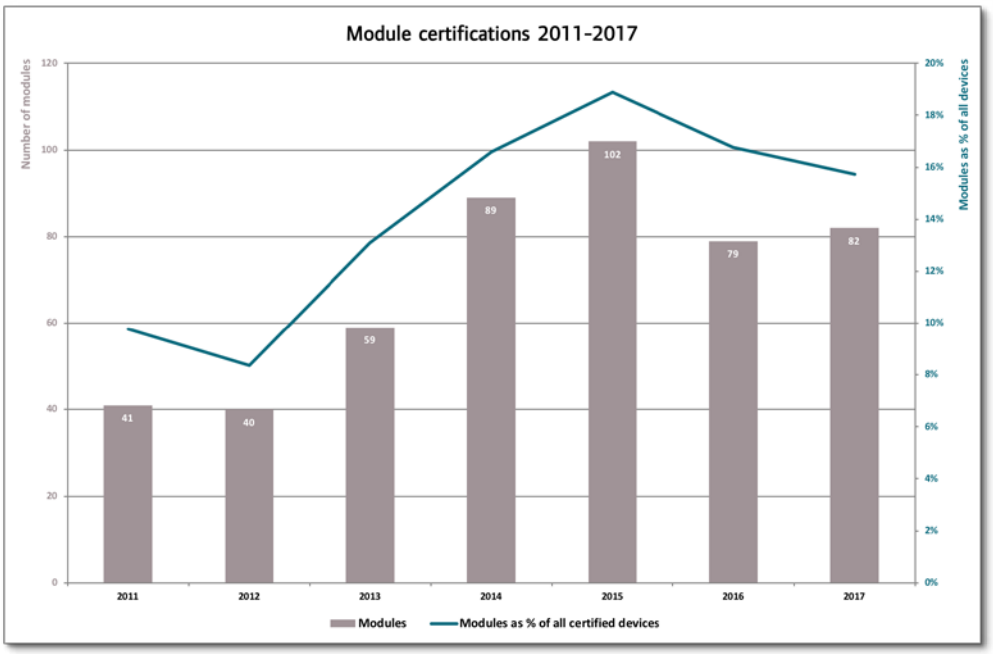

Fig 13

16 manufacturers certified modules during 2017: two specialist module manufacturers were among GCF's top 10 manufacturers by volume of device certifications.

As with certified devices generally, a variety of multi-mode, multi-band modules are currently being offered to the market. However, 2017 saw a marked increase in the proportion of single-mode devices in the modules category. 55 per cent (45 out of 92) modules certified in 2017 were single-mode compared with 24 per cent in the prior year. Generally, modules tend to incorporate fewer bearer technologies than all certified devices (Fig 14).

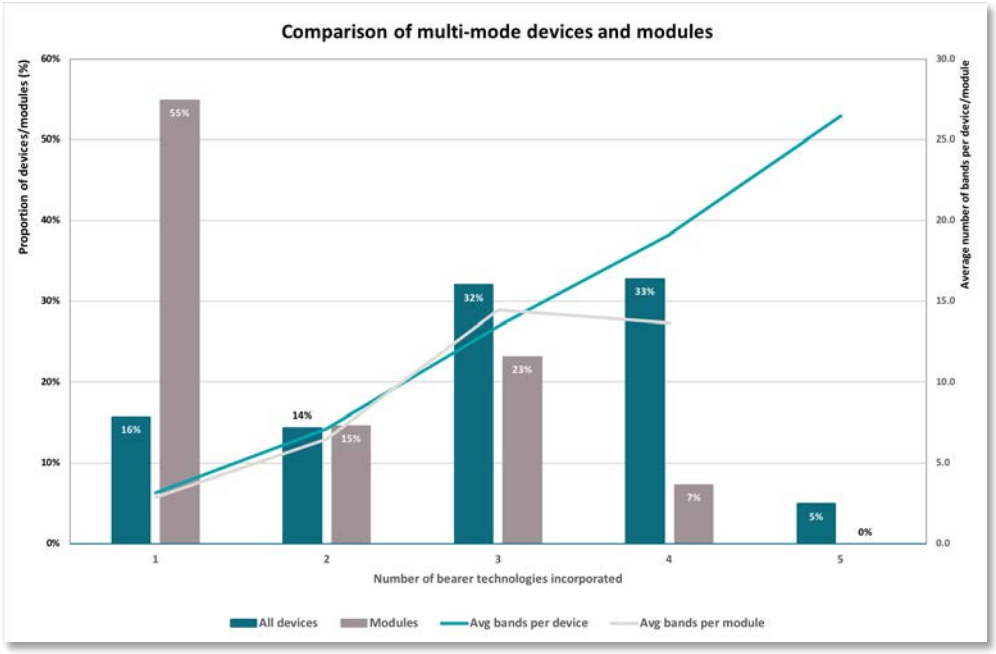

Fig 14

Only 6 of the 82 modules incorporated more than three certified technologies. These operated across an average of 13.7 bands per device. Across all certifications, four technology devices typically operated across an average of 19.1 bands.

As in 2016, no modules incorporated five technologies in 2017

FDD LTE overtook GSM as the most commonly certified bearer technology in modules in 2017: 50 modules incorporated FDD LTE compared with 46 incorporating GSM. (Fig 15)

GCF's extension into cellular LPWA technologies was marked with the certification of the first five NB-IoT and two LTE CAT M1 modules.

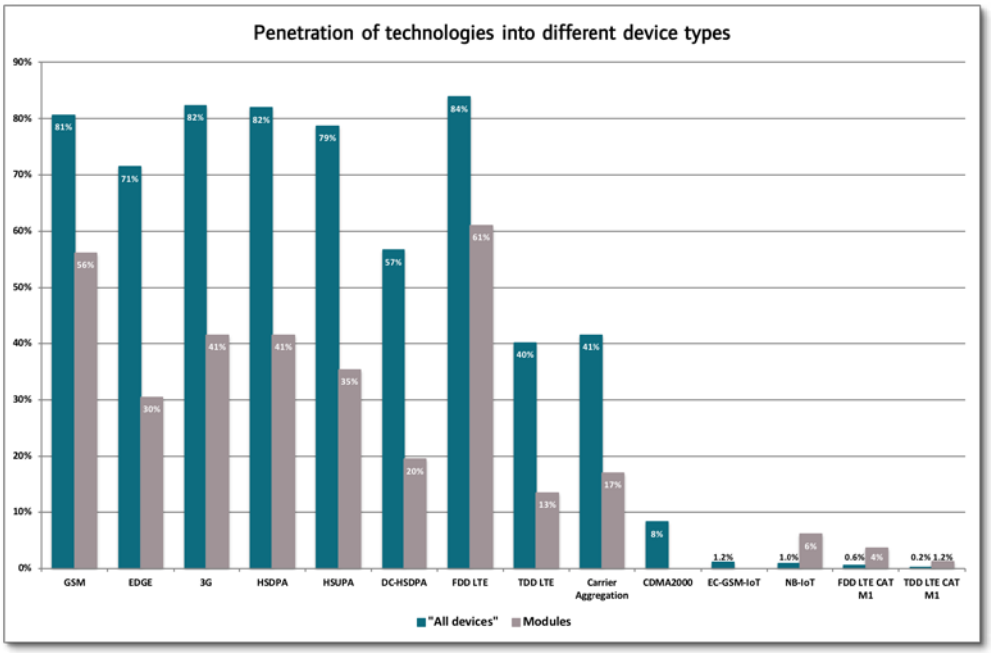

Fig 15

14 of the FDD LTE modules (17 per cent of all modules) supported Carrier Aggregation.

Conclusion

In a global mobile eco-system that now embraces multiple distinct bearer technologies deployed across numerous frequency bands, GCF Certification provides a practical and industry-recognised means of ensuring devices will interoperate correctly with networks and meet the performance expectations of end-users.

In 2017, the average GCF-Certified device incorporated 3.0 bearer technologies and operated across 13.4 frequency bands.

Demonstrating the conformance and interoperability of today's sophisticated multi-mode, multi-band smartphones to the satisfaction of the world's mobile operators would be more difficult, time-consuming and expensive without a scheme such as GCF Certification. However, this 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 will play an important role in realising the full benefits of the Internet of Things as certified LTE CAT-M1 and NB-IoT modules are incorporated in increasing volumes of IoT devices in the years ahead.

Some operators have already announced plans to launch initial 5G services based on the Non-Stand Alone variant of the stand by the end of 2018. GCF is working towards being able to certify devices based on the 3GPP Release 15 5G standards to support these early deployments. It will be interesting to see how many IoT and 5G devices will be included in the 2018 GCF Mobile Device Trends report.