GCF
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Mobile Device TRENDS

An analysis of GCF device certifications in 2019

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.

Many 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.

March 2020

Executive SUMMARY

The Global Certification Forum (GCF) is the globally-recognised quality mark for the interoperability of cell phones and other devices that incorporate mobile connectivity with networks.

As of January 2020, over 130 device manufacturers are participating in GCF. The scheme is also recognised by operators with interests across global markets.

This annual review of mobile device trends is based on an analysis of device certifications published by the GCF during 2019. The analysis provides insights into the mobile technologies and functionalities being requested by operators and end-users across markets worldwide.

A total of 629 devices were certified by GCF in 2019. These came from 70 manufactures (a record) and included a record number of smartphones - 329. The following outlines the key findings:

5G:

- The integration of 5G into mobile devices and hotspots appears to be happening rapidly, with a greater share of devices certified in the technology's first year compared with 4G in its first year.
- The first certification of a 5G device took place in April and 2.5% of all 2019 certified devices integrated 5G, and these 16 devices came from six vendors. Additionally, GCF certified one device that was capable of using the mmWave spectrum - in both the 28 GHz and 39 GHz bands.
- This compares with just 1.9% of devices (9) able to access LTE spectrum in the 4G standard's first year of operation.
- Two companies currently dominate the market, contributing 69% (11) of these certifications.
- The complexity of 5G systems is high. The average (mean) 5G device supported 1.6 5G bands and 34.9 inter-band configurations (median 12).

LTE

- 2019 saw LTE become the most used wireless communications technology in devices certified by GCF.
- 88% of all devices (551) supported LTE. 100% of which supported FDD-LTE. 65% (357) supported TDD-LTE, 58% (319) supported carrier aggregation. These are all up on 2018 certifications.
- VoLTE support was certified in 70% of LTE devices (383 - 61% of all devices).

3G (UMTS/WCDMA)

- A drop in 3G device certifications was seen in 2019, with 83% of certified devices implementing the standard. This aligns with the operators' push to replace 3G data capacity with LTE.
- However, this is still higher than in 2017 (when 82% of devices implemented 3G).
- Additionally, five standalone 3G devices were developed and certified by GCF in 2019.
- The penetration of HSDPA dipped slightly vs 2017 and 2018 levels, with 80% of certifications including the standard (down five points on 2018), HSUPA penetration also dipped slightly to 79%, down five points on 2018.
- As per 2018, Dual-cell HSDPA was incorporated in 64% of all certified devices.

CDMA2000

- Just 8.1% of devices (51) incorporated CDMA2000. All the certified CDMA2000 devices also incorporated LTE.

GSM

- GSM saw a rise in its share of certifications for the first time since 2011.
- 79% of devices (494) incorporated the standard, 7.9% of which (39) were standalone GSM devices.
- EDGE penetration also increased from 67% in 2018 to 71% in 2019.

Cellular IoT

- 2019 saw a significant increase in the number of devices incorporating a cellular IoT standard vs both 2018 and 2019
- In particular, two technologies, NB-IoT featured and LTE CAT M1 (FDD), dominated these certifications, being seen in 45 and 37 devices respectively
- Conversely, LTE CAT M1 (TDD) was included in just six; and EC-GSM in just two

eSIM

- 2019 was the first full year that the certification of eSIM (eUICC) devices has been possible
- 14 devices were certified in 2019

NFC

- 162 smartphones (49% of all smartphones) were certified that supported UICC-based Secure NFC services according to GSMA NFC specifications

C-V2X communications

- GCF has established a testing criteria for vehicle to vehicle / vehicle to infrastructure equipment and expects to see the first devices certified during 2020

Complexity / multi-mode devices

- 91% of all devices certified in 2019 (574) incorporated more than one bearer technology
- 73% of devices (459) incorporated three or more technologies
- This reflects the need to support end-users served by operators whose network infrastructures include more than one generation of mobile technology

Number of bands in "average" (mean) GCF-certified device (across all devices)								
	2012	2013	2014	2015	2016	2017	2018	2019
GSM	3.5	3.5	3.5	3.2	3.1	3.1	3.2	3.7
3G	2.2	2.6	2.7	2.9	3.1	3.2	3.4	6.1
FDD-LTE	0.3	1.2	2.3	3.6	4.6	6.0	7.6	10.0
TDD-LTE	0.0	0.0	0.1	0.3	0.6	1.0	1.3	2.9
5G								1.6 / 34.9*

** = interband configurations*

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 older technologies start to decline.

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1. General device trends

1.1: Year on year growth

2019 saw the highest number of device manufacturers certificating with GCF.

Growth continued in 2019, with a 7.7% increase in the number of manufacturers certifying at least one device, (a record) and the second highest year for the number of devices certified.

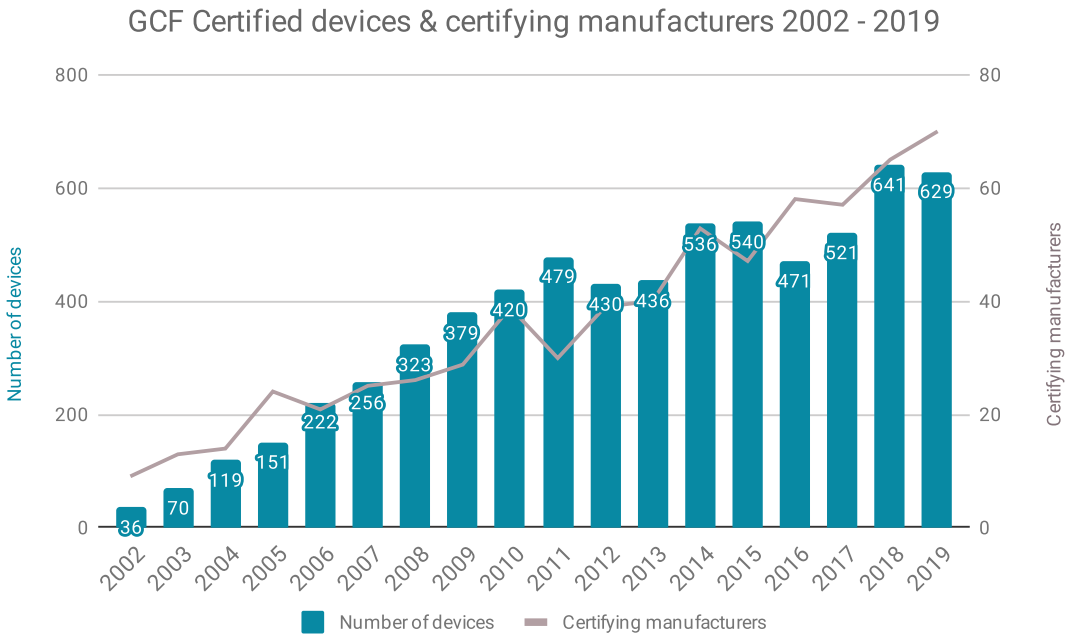


Fig 1 – GCF certified devices and certifying manufacturers 2002 - 2019

GCF works with device manufacturers of all sizes: five manufacturers certified 40 devices or more; 48 manufacturers certified three devices or fewer. And of the 65 manufacturers certifying devices in 2019, 13 were new members.

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 2).

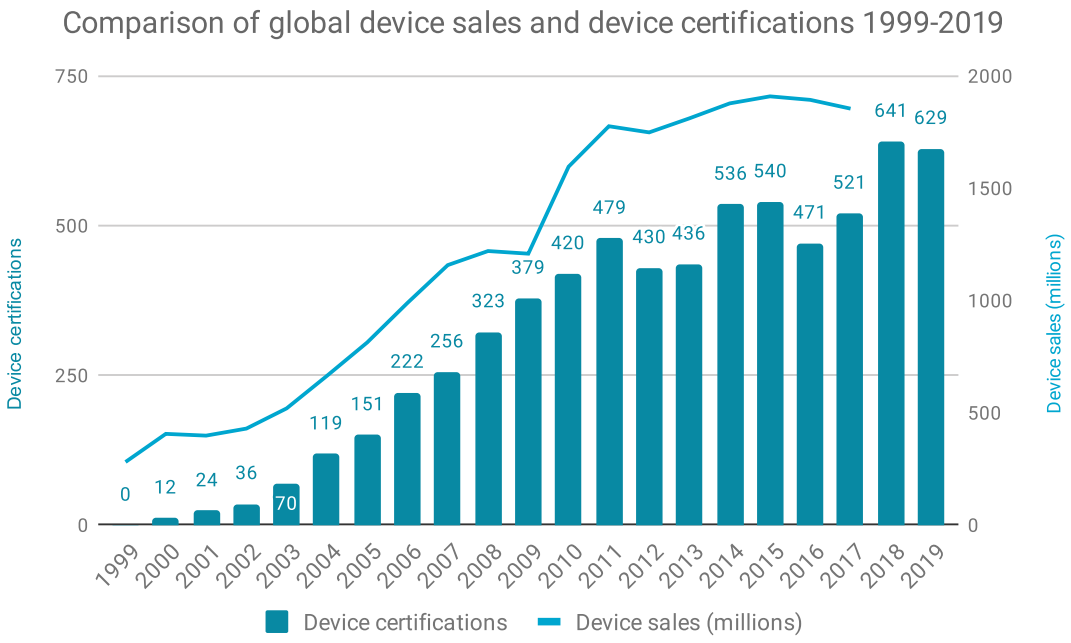
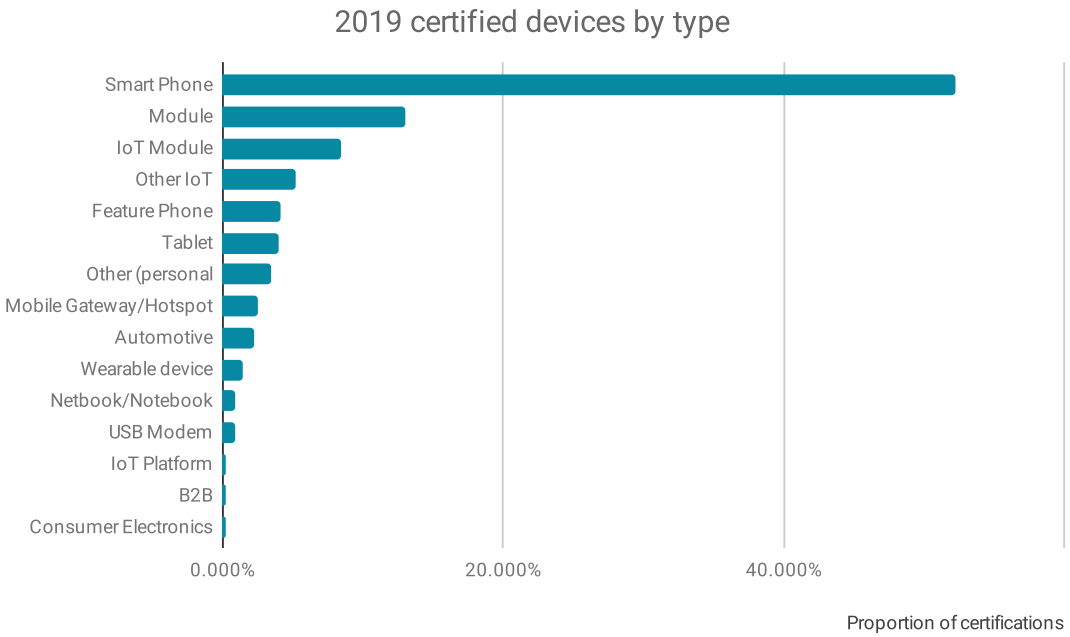


Fig 2: Device sales source: "Gartner Worldwide Manufacturer Sales to End Users of Mobile Terminal Devices", collated by GCF. No data is yet available for 2018/2019. Gartner attributed the pause in the growth of sales in 2008/2009 to the collapse in consumer confidence in the wake of the September 2008 international banking crisis.

1.2: 2019 certified devices by type

Smartphones still represent the largest type of devices certified. However, the growth in the number of modules has increased significantly, making up over a quarter of all devices certified (up from a sixth in 2017) (fig 3).



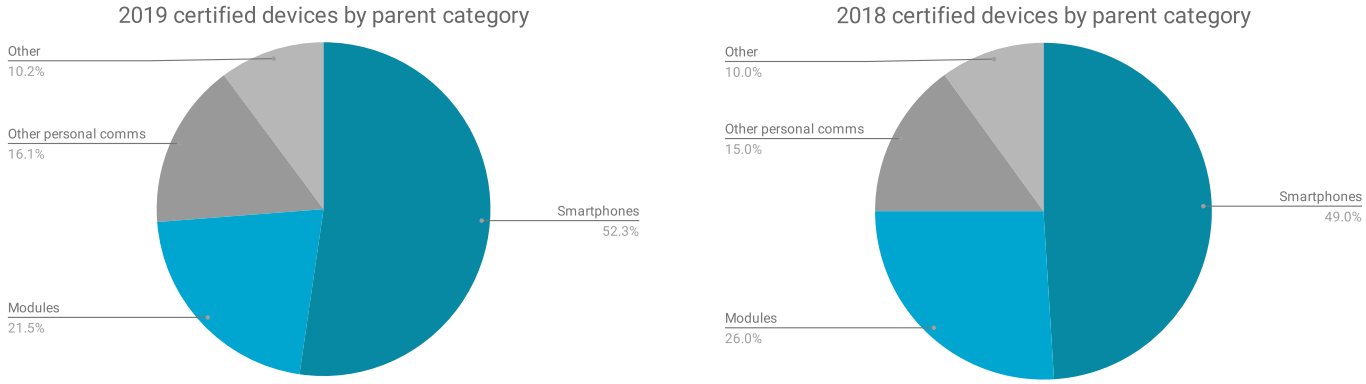


Fig 3

The number of smartphones certified increased to 329 in 2019, with the overall share increasing from 49% to 52% vs 2018.

The proportion of certifications for non-smartphone personal communication devices (feature phones, tablets, notebooks, mobile gateways/portable hotspots, USB modems) rose slightly from 15% to 16%.

Noteworthy among these are:

- The proportion of tablet certifications remained constant at just under 4% (albeit this is down two points on 2017).
- The proportion of feature phone certifications increased slightly (from less than 3.0% to 4.1%).
- The number of USB modems remains particularly low, with just six certified in 2019 (1.0%), albeit this is up on 2018 levels when just one USB modem was certified.

2018 saw a significant increase in the number of modules certified, while the class of device is still the second biggest category, the share dropped from 26% in 2018 to 21% in 2019. This is still five points higher than in 2017.

In addition to modules, many of which are for IoT devices, automotive systems accounted for 2.2% of certified devices, and other IoT devices accounted for 5.2%.

1.3: 2019 certified devices by mobile technology used

LTE has regained its crown as the most commonly integrated standard - see section 3.

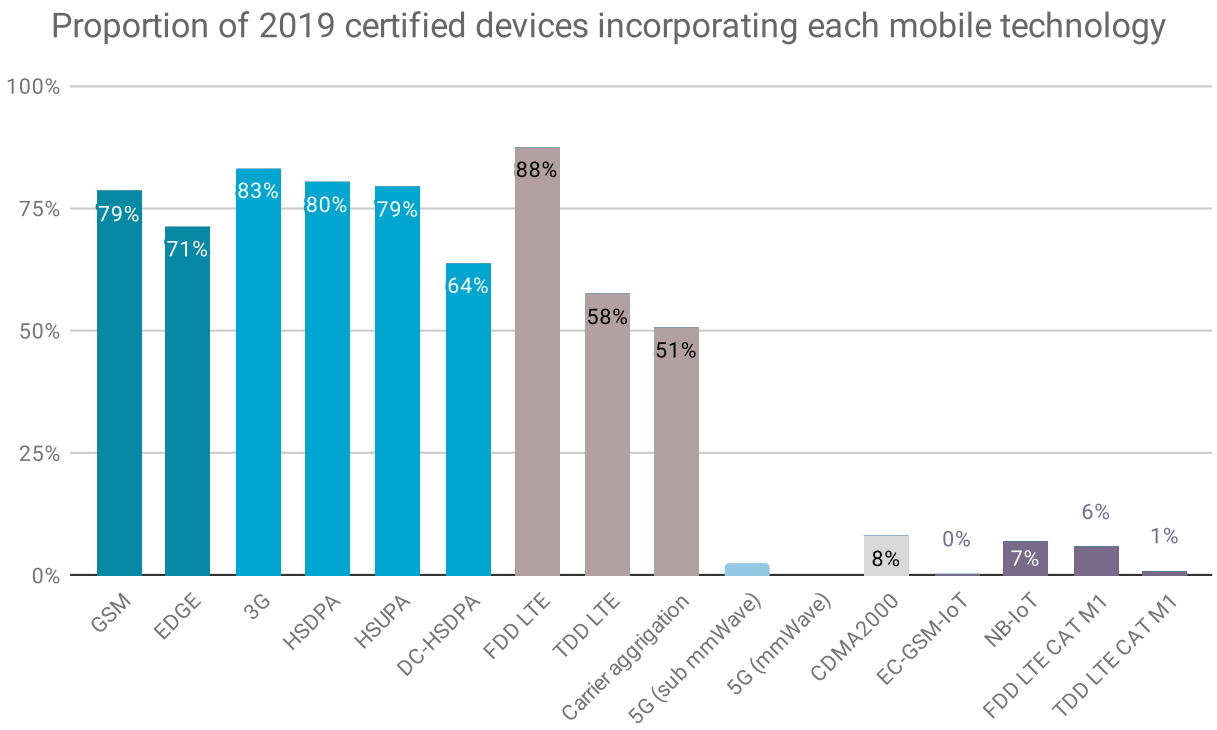


Fig 4 Proportion of 2019 certified devices incorporating each mobile technology

2. 5G

2.1: The rate of 5G adoption

Much has been written about the capabilities and demand for 5G services, with the technology set to revolutionise not just personal communication devices such as smartphones, but play a key role in delivering the ultra-low-latency communications required for autonomous vehicles and other applications.

2019 marked the first year of 5G devices and the number of certifications gives a snapshot on whether the technology can live up to the hype.

GCF offers certification for ENDC1-5, NRDC1, SANRFR1-2 and the many inter band configurations (see ETSI) related to these. The first GCF certification of a 5G device took place in April. Since then, 15 additional devices have been certified.

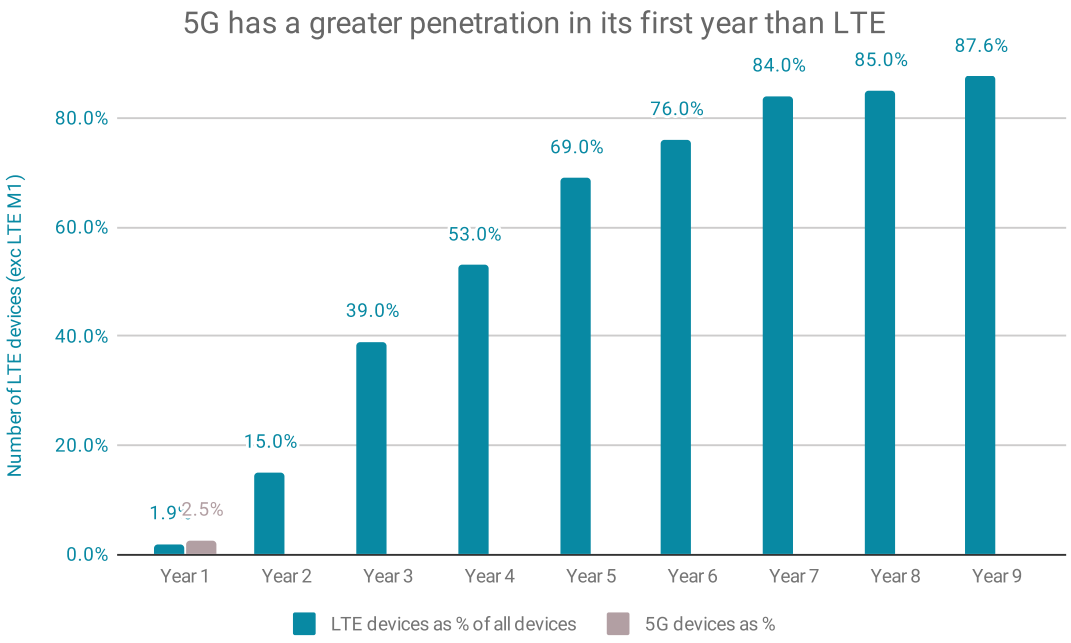


Fig 5 – 5G has greater penetration in its first year than LTE

2.2: How this compares with LTE

This is the first year in which 5G services have been available to the public. Whilst no direct year-on-year comparison can be made to understand its growth, the proportion of certifications have exceeded those of LTE devices.

2011 saw the first LTE devices certified by GCF, with nine certified that year, making up 1.8% of the total certifications. The 16 5G devices not only represents an absolute increase compared with the number of LTE devices in 2011, it represents a real-term increase, representing 2.5% of all 2019 devices

While numbers are low, and therefore susceptible to large skews, this increase suggests 5G is being rapidly adopted by the industry.

It will be interesting to see if this is a skew, or if 5G growth continues as strongly as LTE's.

2.3: 5G device manufacturers

Six device manufacturers have developed and certified 5G devices with GCF. Interestingly 69% (11) of these devices come from just two manufacturers (six and five devices respectively). All other manufacturers submitted one device only.

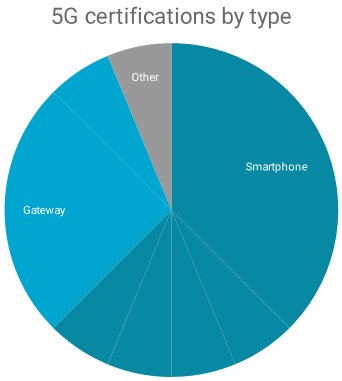


Fig 6 – 5G certification by type

2.4: Breakdown of 5G devices

Highlighting that the technology is in its infancy, just one manufacturer submitted two classes of device.

63% (10) of all 5G devices have been smartphones, with six of these smartphones coming from just one manufacturer. 31% (5) of 5G devices were mobile gateways / hotspots, four of these came from just one manufacturer. One additional 5G personal communication device has also been certified.

2.5: Breakdown of 5G bands

Five devices supported 5G NR dual connectivity (EN-DC).

The mean number of inter-band configurations supported was 34.9, however this is heavily skewed by two devices supported over 100 configurations and one additional device supporting 59. The median number of inter-band configurations was 12.

Interestingly, one device capable of using mmWave spectrum was certified by GCF. This used the Ka bands n260 (28 GHz) and n261 (39 GHz).

3. LTE

3.1: LTE year on year rise

The use of LTE in certified devices continued to rise in 2019, (fig 7) with the technology again replacing 3G to once again become the most commonly adopted standard.

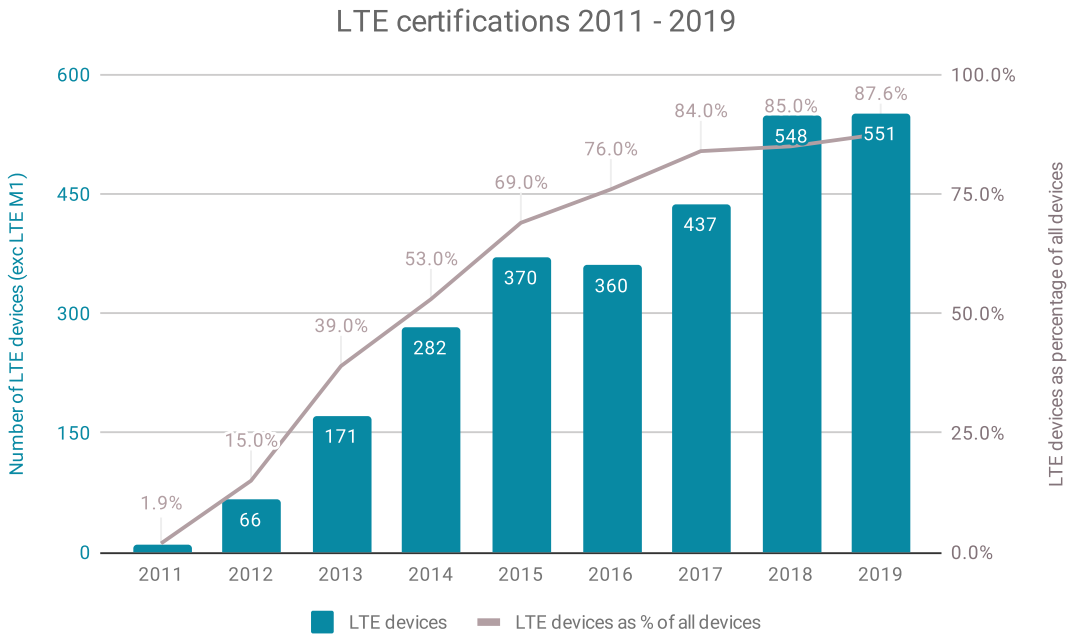


Fig 7 – LTE certifications 2011- 2019

In 2019, 551 certified devices (88%) supported LTE.

As in 2018, FDD-LTE was supported in all LTE devices. TDD-LTE was incorporated into 66% (362) of LTE devices, up from 62% in 2018.

As per 2017 and 2018, all TDD-LTE capable devices also incorporated FDD-LTE however, the proportion supporting simultaneous FDD/TDD operation dropped significantly from 75 to 52%.

Additionally, nine of the 551 LTE devices also incorporated the cellular IoT variant, LTE CAT M1.

There was also a significant rise in certifications supporting Gigabit LTE, with 50 Category 16 / Category 18 devices certified, up from 32 in 2018 and just six in 2017.

VoLTE operation was certified in 70% of LTE devices (383 devices), which is up from 51% in 2018.

This increase (coupled with the decrease in 3G certifications - see section 4) has led to LTE overtaking 3G (UMTS/ WCDMA/ HSDPA/ HSUPA) to once again becoming the most commonly certified mobile technology.

3.2: LTE bands used

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.

The GCF scheme enables the certification of devices designed to operate in 25 FDD-LTE and sub bands and eight TDD-LTE bands.

During 2019, all except two bands (E-UTRA FDD band 6 and TDD band 48) covered by the GCF scheme had devices certified (Fig 8). Bands of particular note include:

- Band 3 (1800 MHz) retained its position as the most commonly certified LTE band in 2018: it featured in 469 devices (85%% of LTE devices and 75% of all devices.)
- Band 7 (2600 MHz) remains the second most certified LTE band, incorporated in 466 devices (85% of LTE devices), followed by Band 1 (2100 MHz) in 446 devices.
- The US 850 MHz bands (Bands 5 and 26) and AWS bands (Bands 4 and 66) are also commonly implemented in GCF-certified devices, with all increasing significantly as a proportion of devices certified vs 2018.
- Band 8 (900 MHz) is widely implemented in LTE devices to facilitate the "re-farming" of spectrum that is still widely used around the world by GSM operators and has likewise increased its penetration.
- 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 50% of devices, a marked increase on 2018 (which saw 37% of devices able to utilise the band).

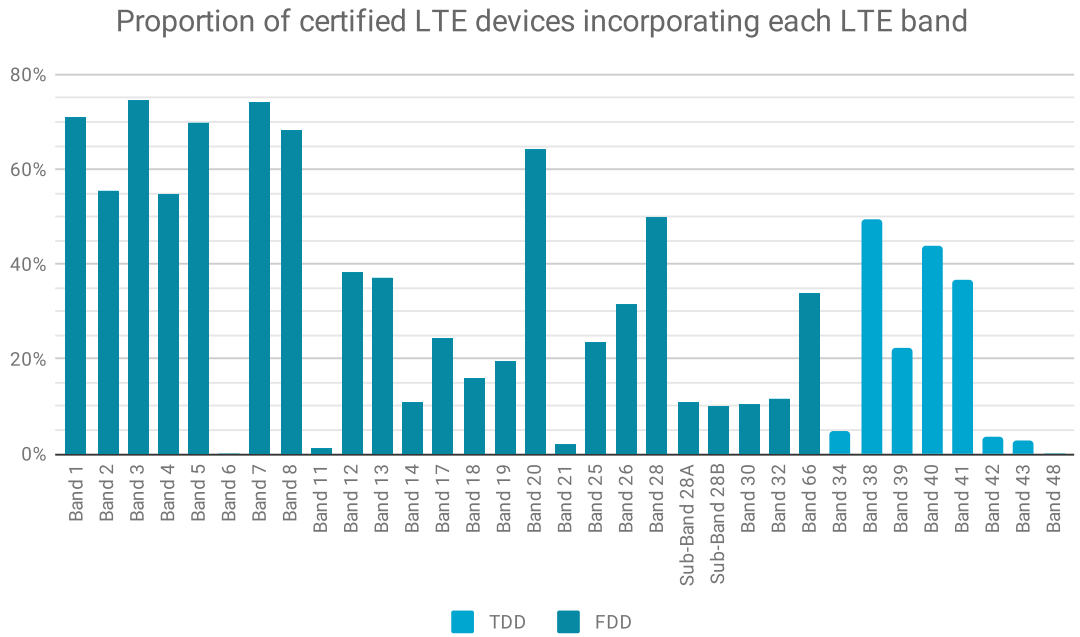


Fig 8 – Proportion of certified LTE devices incorporating each LTE band

3.3: LTE device complexity

It's particularly noteworthy that the number of certified bands in LTE devices continued to increase during 2019.

Of the 551 devices incorporating LTE, 537 (97% of LTE devices) incorporated three or more LTE bands, while 93% incorporated five or more bands, and over half of LTE devices incorporated nine or more. (Fig 9).

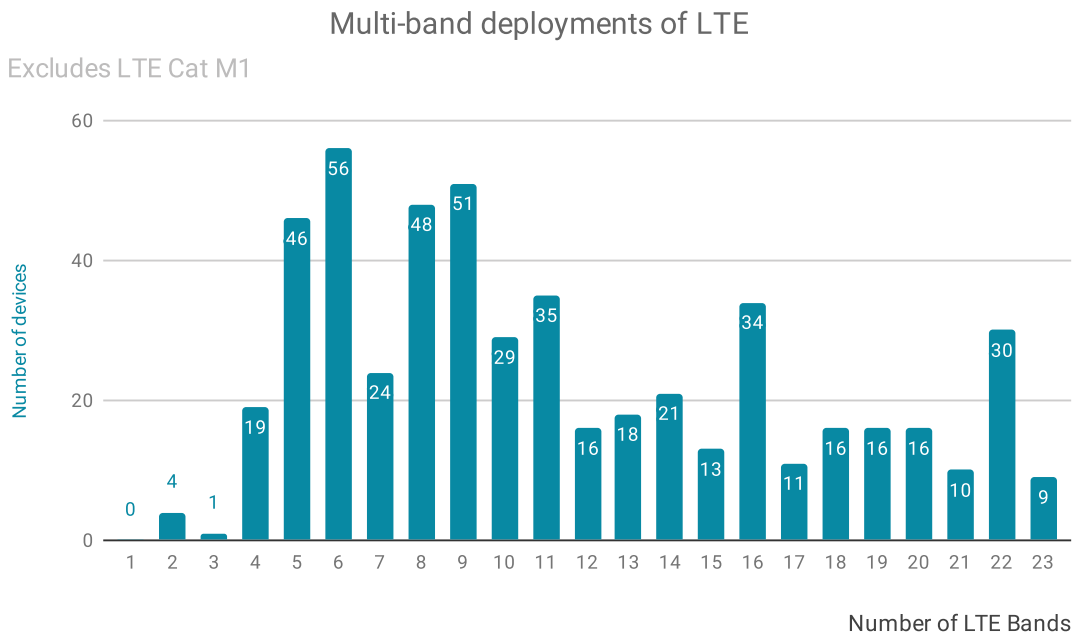


Fig 9 – multi-band deployments of FDD LTE

As in 2018 and 2017, the modal number of LTE (excluding LTE Cat M1) bands is six, however the average number is increasing. 236 (43% of LTE devices) incorporated 10 or more LTE bands; up from 204 (36%) in 2018 and 47 devices (13%) in 2017. 11 devices supported 15 or more LTE bands; up from 84 in 2018 and 28 in 2017.

In 2019, the average (mean) LTE device incorporated 10.0 LTE bands, up from 9.0 in 2018 and 7.1 in 2017.

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 that enables manufacturers to demonstrate their devices will work effectively in CA band combinations deployed by network operators.

Manufacturers are aligning with operators, with the use of carrier aggregation expanding. Indeed, the number of certified devices deploying carrier aggregation increased in the past year, with 319 devices certified (58% of LTE device certifications), an increase on 2018.

4. 3G

4.1: A 3G decline?

Manufacturers are still incorporating 3G, despite operator prioritisation of LTE for data delivery.

Even though operators and device manufacturers have continued to prioritise LTE for the delivery of data services, certifications for 3G (including HSDPA and HSUPA) have stayed high.

And whilst 3G is typically included as a backup in LTE devices, this isn't always the case: one standalone 3G device was also developed and submitted for certification in 2019 (see fig 11).

And while 2019 certifications dropped vs 2018 (2018 witnessed an unexpected surge in 3G enabled devices), it is still ahead of 2017 levels (which had 82% of devices). Certifications for 3G (UMTS/WCDMA) stood at 83% of all certified devices in 2018.

Certification of HSDPA dropped to 80% in 2019 vs 85% of all devices in 2018 and 82% in 2017. However, this still represents 97% of all 3G devices. HSUPA featured in 79% of certified devices, down from 84% in the prior year (this represents 95% of all 2019 3G enabled devices). In addition, the penetration of dual carrier HSPA remained static at 64% of all devices.

4.2: 3G bands used

The 2100 MHz band featured in 483 of the 559 certified devices (77% of all devices and 93% of 3G-capable devices). (Fig 10).

The 900 MHz band again remained the second most frequently certified 3G band – in 472 devices (75% of all devices and 91% of all 3G devices.).

The most commonly certified US 3G band remained 850 MHz, this is used in 71% of devices certified in 2019, up two points vs 2018.

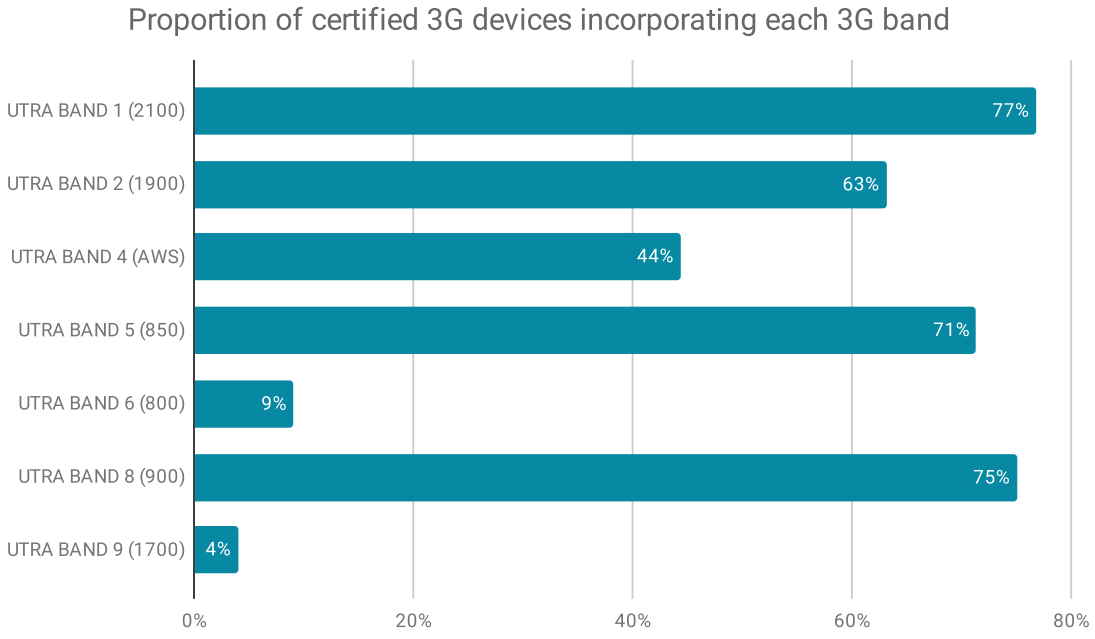


Fig 10 – Proportion of certified 3G devices incorporating each 3G band

4.3: 3G device complexity

Two or more 3G bands were certified in all except one device deploying 3G (Fig 11).

409 devices (97% of 3G devices) were certified in four or more 3G bands, with the modal number of bands increasing to from five in 2018 to seven in 2019.

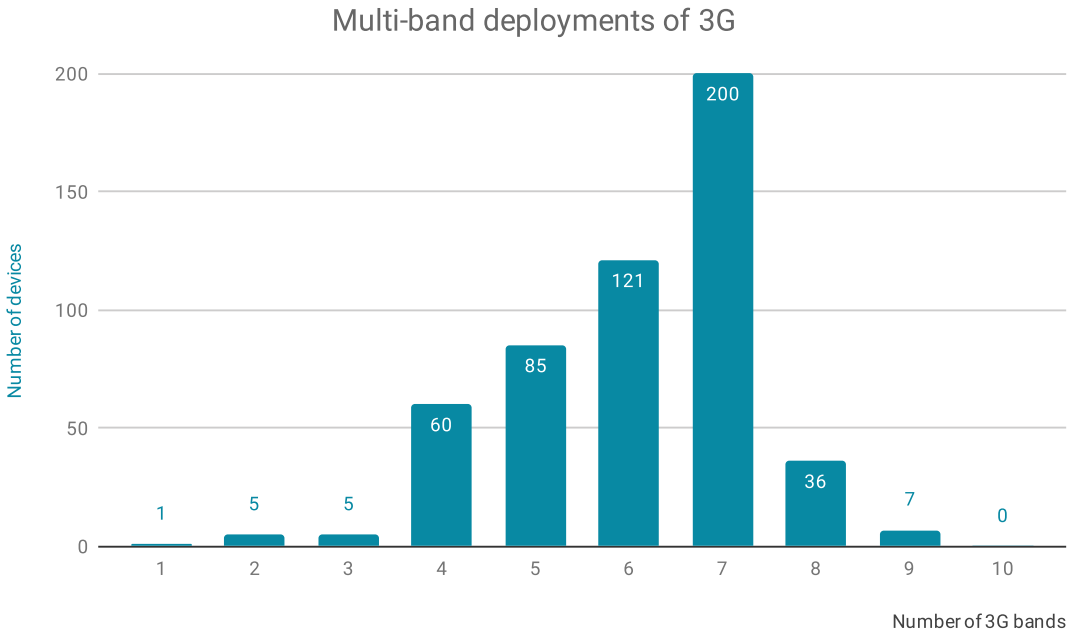


Fig 11 – Multi-band deployments of 3G

5. GSM

5.1: The penetration of GSM increased, the first time since 2011

The penetration of GSM has declined steadily since 2008/ 2009, when 100% of devices included the standard, to 2018, when just 75% of devices did. During this period, the penetration of GSM increased in only one year, 2011, and even then, by only one percentage point (from 98% to 99%).

2019 saw a reverse in this trend with a four point increase in penetration to 79% (Fig 12).

39 certified devices (6% of all certifications) were GSM-only, up from 20 in 2018.

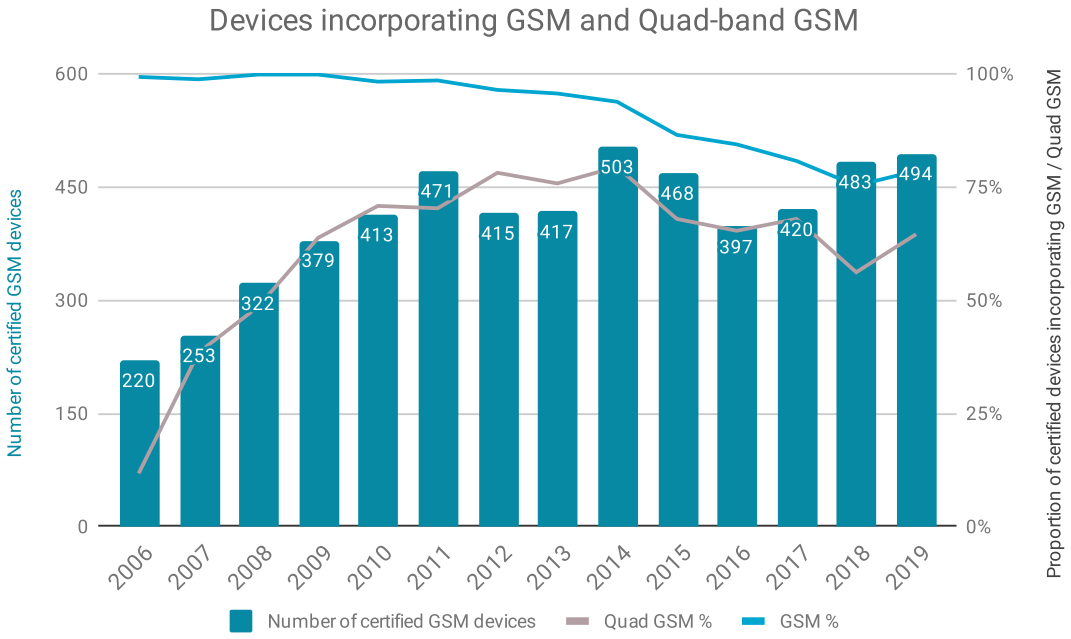


Fig 12 – Devices incorporating GSM and quad-band GSM

5.2: EDGE / Quad-band GSM

EDGE was certified in 449 devices (71% of all devices and 91% of all GSM-capable devices).

And certifications for Quad-band GSM devices also saw a reverse in decline, with a nine-point increase vs 2018 (from 56 to 65% of all devices).

6. Cellular IoT

6.1: The adoption of cellular IoT standards continues at a great pace

Cellular IoT has been widely adopted globally, and those based on 2, 3 and 4G technologies are set to be enhanced further with the arrival of 5G networks - not just in terms of speed, but in latency and reliability.

The number of devices connected by massive IoT and other emerging cellular technologies is forecast to reach 4.1 billion by 2024 and the growth in certified devices reflects this.

This is the third year that GCF has certified the cellular IoT standards LTE CAT M1 (FDD), LTE CAT M1 (TDD), NB-IoT and EC-GSM.

In this time the number of devices has increased significantly, with NB-IoT certifications increasing eight-fold, and LTE CAT M1 (FDD) increasing more than 11-fold:

- NB-IoT was featured in 45 devices certified this year (up from 19 in 2018 and five in 2017)
- LTE CAT M1 (FDD) featured in 37 (up from 22 in 2018 and three in 2017)

But, these standards dominate, with LTE CAT M1 (TDD) included in just six devices certified in 2019 (this is up from one in 2018); and EC-GSM in just two (down from three in 2018 and six in 2019).

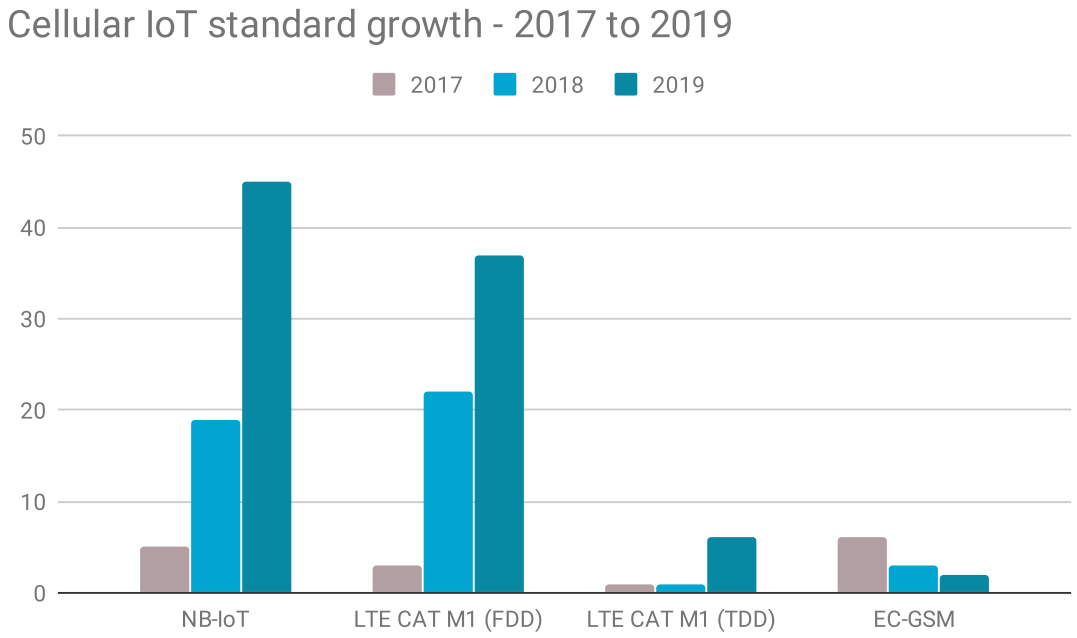


Fig 13 – Cellular IoT standard growth 2017 to 2019

7. Device complexity

7.1: A rise in overall complexity

Despite the rising proportion of single mode devices increasing, devices are becoming more complex.

2019 saw an increase in complexity, with the number of certifications for 3+ devices increasing from 65% in 2018 to 72%. This includes two devices that utilised five bearer technologies (vs 0 in 2018).

At the same time, the proportion of relatively simple devices increased by two points, from 8.8% to 11% of certifications (56 to 64 devices).

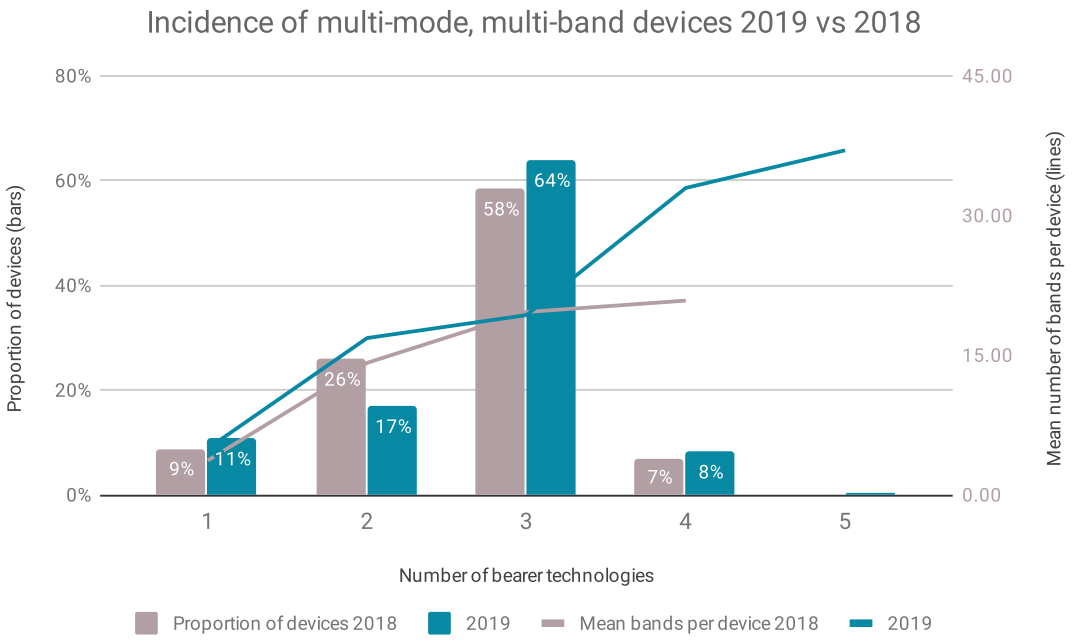


Fig 14 - Bearer technologies have been classified as 2G (GSM / EDGE), 3G (WCDMA / UTRA / HSDPA / HSUPA), 4G (LTE FDD, LTE TDD), CDMA2000, NB-IoT, LTE M1 (TDD, FDD), EC-GSM

7.2: Single-mode devices

The proportion of single mode devices increased slightly in 2019, up two points to 11% of devices. This is, however, still below 2017 figures, which saw single mode devices account for 16% of all certifications. The biggest rise came from GSM only devices (39, up from 20). LTE only devices also saw an increase (27 up from 16 in 2018). And there were, surprisingly, five standalone 3G devices.

There were no standalone cellular IoT devices (vs 20 in 2018). And no standalone 5G devices.

The complexity of single mode devices has also increased, with the mean number of bands increasing from 3.1 in 2017 and 3.7 in 2018 to 5.0 in 2019.

7.3: Multi-mode devices

The complexity of devices, in terms of the number of bearer technologies is once again rising.

As in 2018, the modal number of bearer technologies per device was three, however 72% of device certifications were for systems that employed three or more certifications (up seven points from 65% in 2018) and two devices employed five bearer technologies (vs 0 in 2018).

And while the number of devices with 4+ bearer technologies is still lower than 2017, when 35% of certifications were for devices with four bearer technologies, the number of implemented bands used in the average device is up considerably. Certified devices now have a mean of 17.6 frequency bands (including 5G inter-band configurations -16.8 when disregarding inter-band configurations). In 2018 this was 17.3.

Also highlighting this increase in complexity is the number of bands per device. Those with four bearer technologies had an average 33.0 (up from 20.9 in 2018). Those with three technologies had a mean of 19.0 bands per device, and those with four had a mean of 33.7.

The highest number of implemented bands in 2019 was 32 (218 including inter-band configurations).

8. Smartphones

8.1: Smartphone growth

Smartphones have consistently represented the largest category of devices certified by GCF. 2019 has been no exception to this rule, with the category representing over half (52%) of all certifications.

A total of 329 smartphones were certified in 2019, a record by absolute number, although not by proportion of devices.

These 329 devices came from 24 manufacturers. A third of the certified smartphones were developed by a single manufacturer. And more than 75% of smartphones certified were made by just six manufacturers.

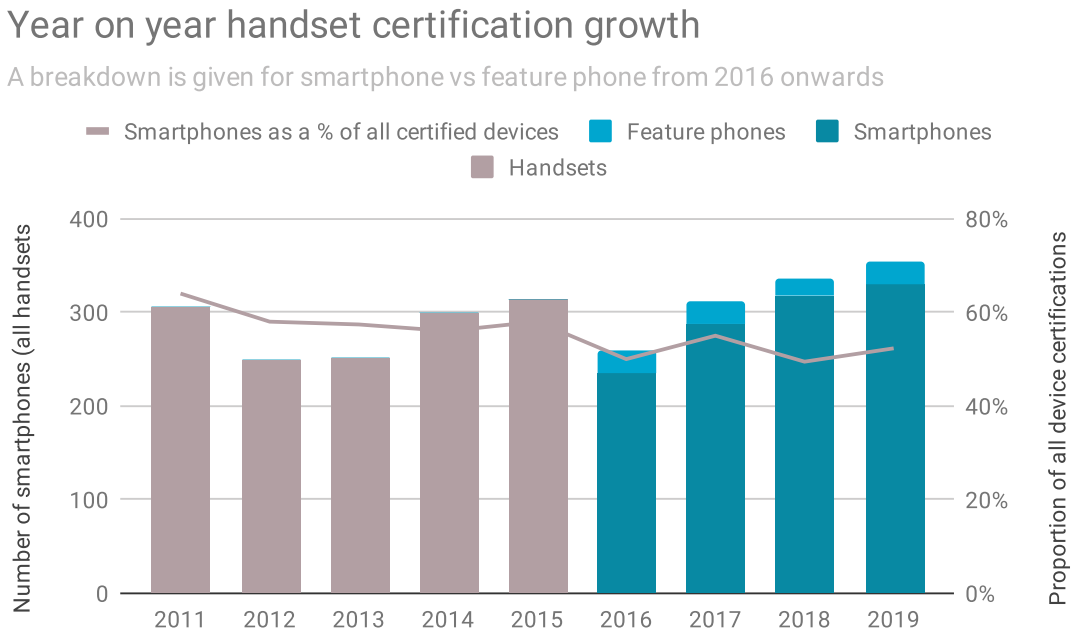


Fig 15 – Year on year handset certification gowth

8.2: Smartphone complexity

Smartphones are also significantly more complex than the average device, with 95% of smartphones integrating three or more bearer technologies, vs 72% for non-smartphone devices.

The number of bands per device was also higher, with a smartphone using three bearer technologies using spectrum across an average of 20.5 bands; those with four bearer technologies using 33.3 bands. This compares with 16.4 and 19.0 respectively for other classes of device.

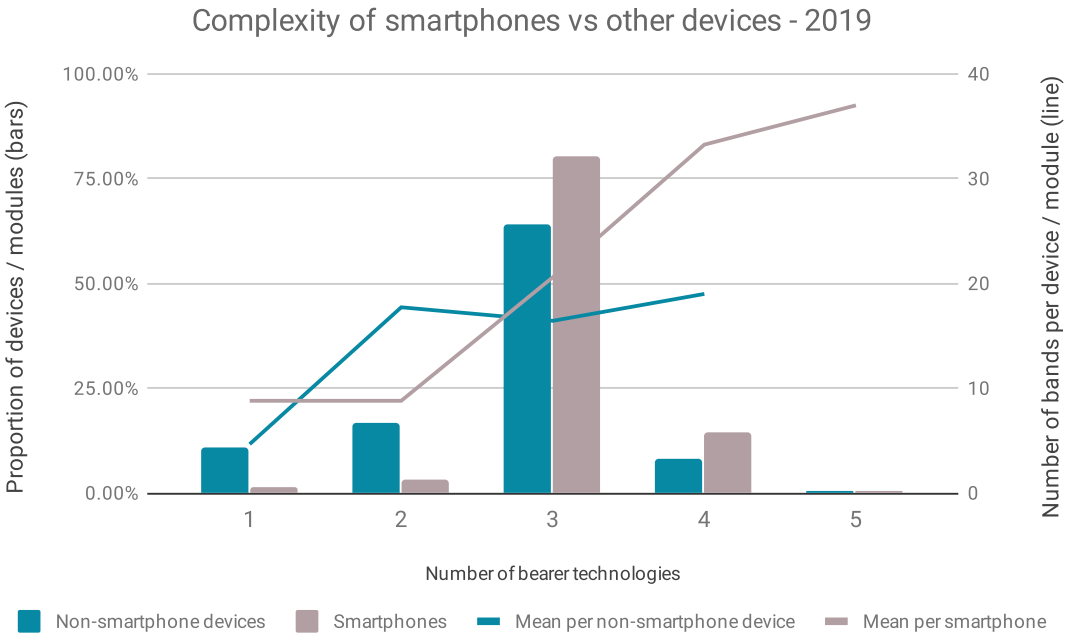


Fig 16 – Complexity of smartphones vs other devices 2019

8.3: Mobile technologies incorporated

The increased level of complexity of smartphones is also highlighted by examining the proportion of devices using each mobile technology and comparing it against non-smartphone devices.

FDD LTE is again the dominant mobile technology. With 10 smartphone designs supporting 5G, and one supporting mmWave 5G.

Just 50 designs supported the use of CDMA2000.

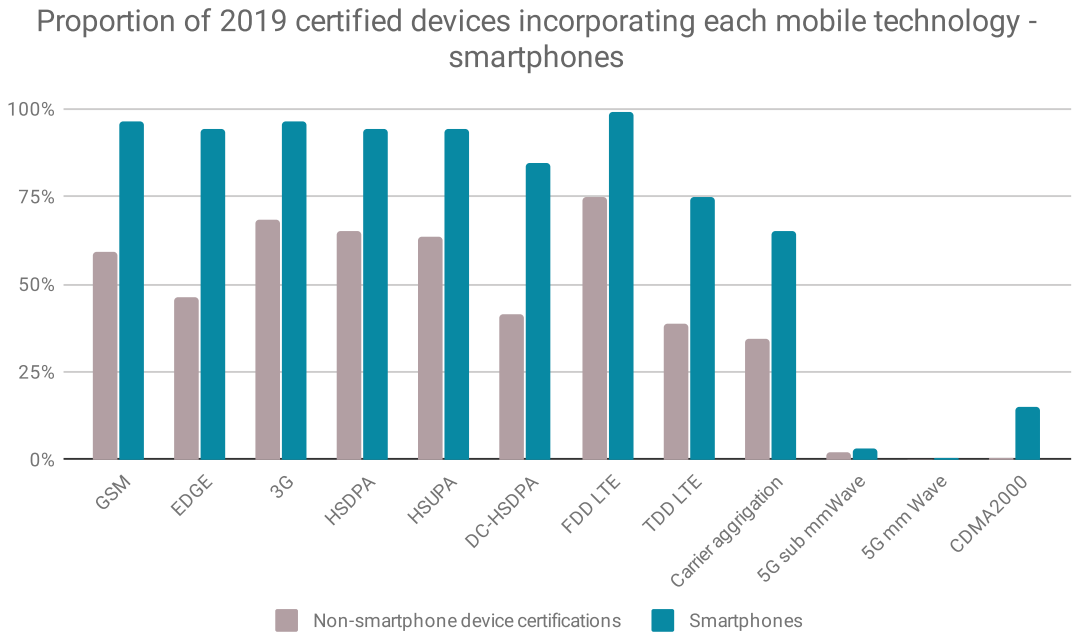


Fig 17 – proportion of 2019 certified devices incorporating each mobile technology - smartphones

9. Wireless modules

9.1: Wireless module growth

2019 saw a drop in the number and proportion of module certifications, with 135 modules certified (down from 169 in 2018); representing 21% of the total, this still represents the second highest year on record. (Fig 18).

As in 2018, growth came from just a handful of manufacturers (20) up from 19 in 2018.

70% of module certifications came from just four companies. Additionally, (as in 2018) two manufacturers that exclusively developed modules, and one for which modules represented over 90% of its devices certified were among GCF's top 10 manufacturers by number of certifications.

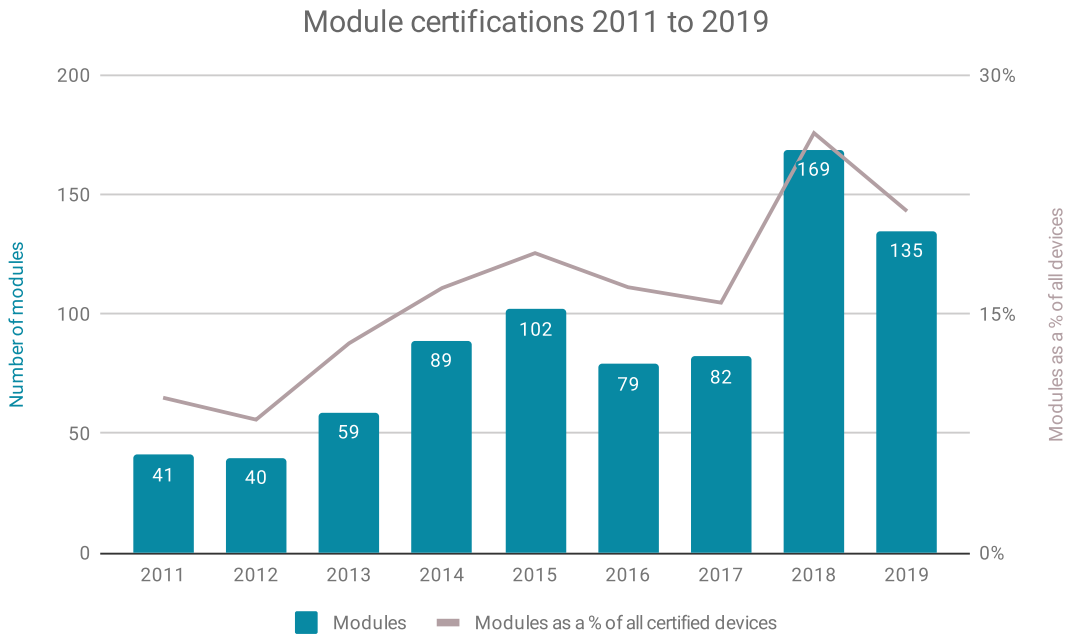


Fig 18 – Module certifications 2011 to 2019

9.2: Module complexity

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

Just 19% of the 64 certified modules (14 modules) being single-mode (Fig 19). This is down from 24% in 2018, 55% in 2017 and 24% in 2016.

The complexity of the modules has, however, increased, with the modal number of bearer technologies per module rising from two in 2018 (42% of all modules) to three in 2019 (48% of all modules).

This continues a trend, with 2017's modal number of bearer technologies being just 1 (45% of modules).

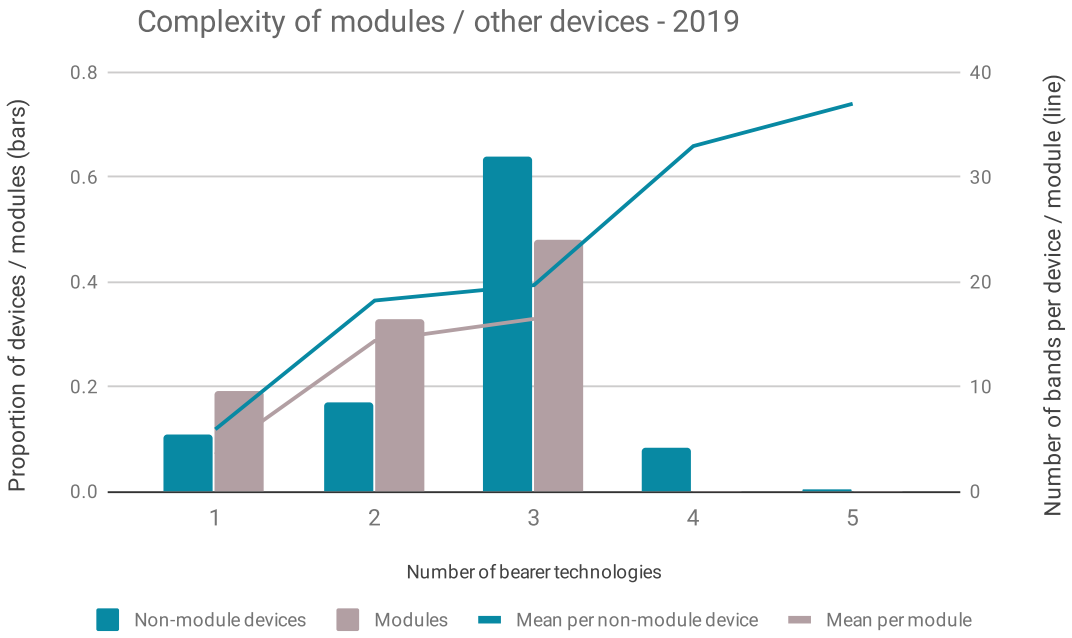


Fig 19 – Complexity of modules/non-module devices certified in 2019

The number of frequency bands per module certified has risen compared with 2018, now standing at 12.7 per module (vs 11.3 in 2018) and 15.5 per multi-mode module.

The maximum number of frequency bands for a module was 29.

9.3: Mobile technologies incorporated

Despite this, the average module is still significantly less complex than the average device, and this can also be observed in the proportion of devices supporting each mobile technology (Fig 20).

As per 2017 (but not 2018, when it was third), FDD LTE is the most commonly certified bearer technology in modules, with 85 modules incorporating it, versus 79 incorporating UTRA, and 77 incorporating GSM.

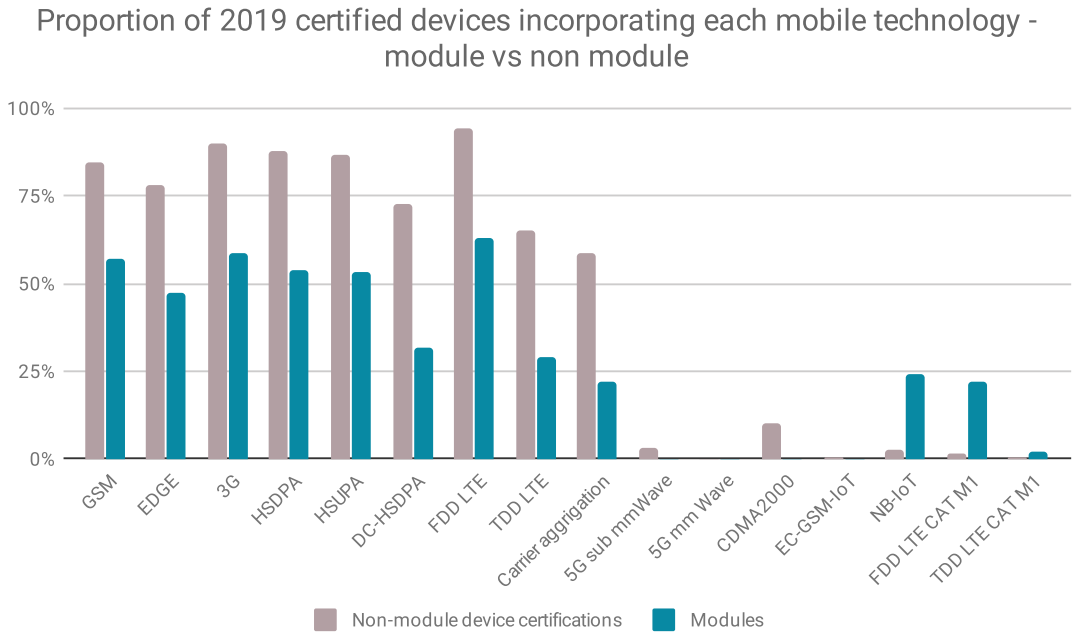


Fig 20 – Proportion of 2019 certified devices incorporating each mobile technology – module vs non module

10. Conclusion

In a global mobile ecosystem 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 2019, the average GCF certified device incorporated 2.6 bearer technologies and operated across 17.6 frequency bands.

Demonstrating the conformance and interoperability of today's sophisticated multi-mode, multi-band smartphones, modules devices and products to the satisfaction of the world's mobile operators and end users is therefore essential. And 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.

With 2020 set to see a significant rise in the number and penetration of 5G devices, coupled with its use in vehicle-to-vehicle and vehicle-to-infrastructure systems, the need to cost-effectively and reliably demonstrate this conformance and interoperability remains paramount.

11. How GCF ensures compliance and interoperability

11.1: About 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 live commercial networks.

11.2: Who GCF works with

As of January 2020, 335+ device manufacturers are participating in GCF. The scheme is also recognised by operators with interests in global markets (Fig 21).

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.

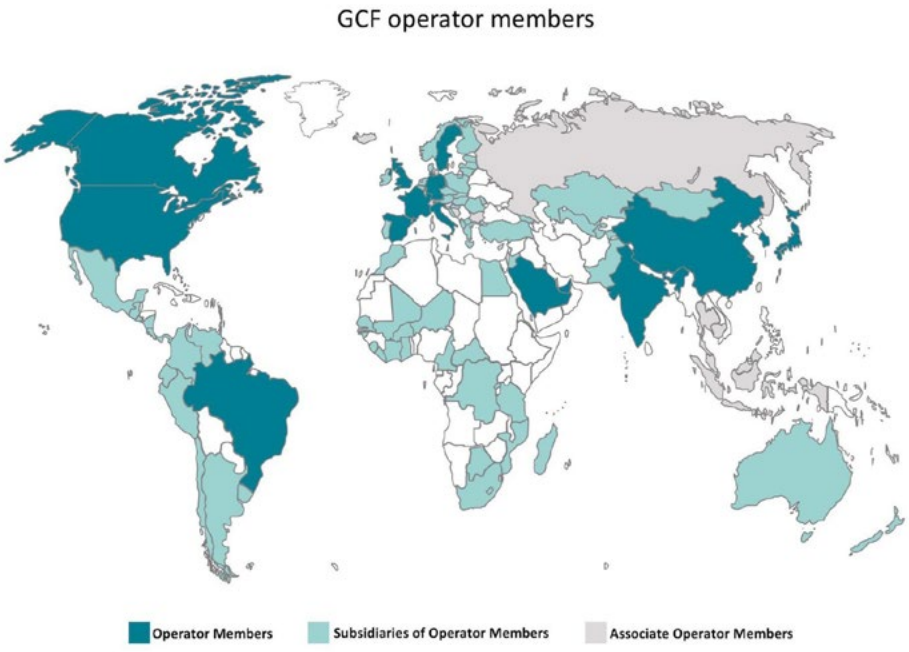


Fig 21

11.3: The GCF process

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 initiative provides a consistent, optimised, flexible, scalable framework for certifying any mobile device: from a simple single-mode low-cost handset to sophisticated multi-mode, multi-band smartphones, tablets, wireless routers, IoT modules and products.

11.4: The benefit of GCF certification

By adopting GCF certification into its quality management system, a manufacturer can be more appealing 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 broadened to cover newer technologies as they were adopted: GPRS, EDGE, 3G UMTS (WCDMA), HSPA, 4G LTE, LTE-Advanced, and LTE-Advanced Pro and more recently, e-Sim and 5G (sub-mmWave and Ka band).

For 2020 GCF is adding C-V2X compliance testing, and also MCX. GCF can also certify standards-based client applications such as RCS and NFC.

The effective use of frequency bands, and the handling of the growing number of band combinations available in devices to networks is assisted by the GCF initiative, which provides an effective method for verifying the correct operation of carrier aggregation currently up to 5CA.

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

12. Key GCF milestones:

Date	Event
July 2019	First 5G device capable of accessing mmWave bands certified
April 2019	First 5G device certified
September 2018	GCF and TTA announce global certification solution for oneM2M
August 2018	First RSP eSIM consumer device certified
May 2018	GCF introduces MVNO membership categories
February 2018	RSP eSIM certification for consumer devices introduced
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

Fig 22

13. 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

14. Index of figures

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