Mobile Device
TRENDS

An analysis of GCF device certifications in 2021

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.

Executive
SUMMARY

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

As of June 2022, over 150 device manufacturers across 25 countries were participating in GCF. The GCF suite of certification solutions is also recognised by operators with interests in global markets.

This annual review of Mobile Device Trends is based on an analysis of device certifications published by the Global Certification Forum during 2021. The analysis provides insights into the mobile technologies and functionalities being requested by operators and end-users across markets worldwide. It also takes into account the effect of Covid-19 on the sector and certifications.

A total of 609 devices from 89 manufacturers were certified by GCF in 2021. The following outlines the key findings:

5G:

- Now in its third year, the integration of 5G into devices has continued to grow, but its speed of adoption is starting to slow down. Compared with LTE, the speed of 5G adoption seems to be lower at the same stage.

- In the past, the number of devices supporting 5G standalone (SA) was relatively low – 34% of 5G devices in 2020. We are seeing this growing quickly, with 65% of 5G devices certified in 2021 supporting SA. As of June 2022, in our year-to-date figures we can see the percentage supporting SA has climbed again, to 88%.

- 189 devices (31%, up from 21% in 2020) of all 2021 certified devices integrated 5G. This came from 43 vendors, up from 28 in 2020.

- Looking specifically at smartphones, in 2020 a lot of smartphone models came in two variants (LTE and 5G), which were certified separately. However, in 2021, we typically see just one variant (5G) of smartphones, which has contributed to the reduction in the number of total certifications from 2020 to 2021.

Covid-19 and geo-political factors

- While 2020 was a record year for CGF certifications, these numbers dipped slightly in 2021. However, the number of certifications continued to grow at a relatively steady rate when examined month by month and quarter by quarter. We believe the pandemic did not have a strong effect on the number of certifications in

2021, although restrictions on travel would have had some impact, for example on access to field trials.

- We introduced processes to help our members complete certifications, for example providing more time to finish testing, and these changes have worked well. We have kept these processes in place in 2022, as multiple countries still have many Covid restrictions in place.

- Sanctions on US technology had some impact in 2021, restricting access to hardware and software. We did not see a big effect from this on the number of manufacturers certifying devices, or the number of products certified.

- The continued chip shortages have been a contributing factor to the reduced number of devices certified in 2021.

LTE

- As in 2020, LTE was the most used wireless communications standard in devices certified by GCF.

- In 2021, we did not see new features of LTE coming up for certification, which shows that it is a stable, mature technology.

- 88% of all devices (533) supported LTE.

- 100% of the LTE devices supported FDD-LTE. 78% (415) supported TDD-LTE, up from 70% in 2020.

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- VoLTE support was certified in 68% of LTE devices (363). This is very similar to 2020, where 69% supported VoLTE.
- An additional 61 devices incorporated the cellular IoT variant, LTE CAT M1.

3G (UMTS/ WCDMA)

- 3G certifications dropped slightly, with 79% of certified devices implementing the standard, compared to 83% in 2020. The standard's continued resilience is surprising given a long-term push by operators to replace 3G data capacity with LTE and 5G.
- There was just one standalone 3G device certified during 2021 (there were none in 2020).
- The penetration of HSDPA (78%) and HSUPA (74%) was slightly down on 2020 (which had 81% and 80%, respectively); dual-cell HSDPA (64%) remained approximately the same as 2020.

cdma2000

- There were no cdma2000 certifications in 2021, and GCF discontinued cdma2000 certifications at the end of 2021.

GSM

- 64% of 2021 GCF certified devices incorporated GSM, with only four standalone GSM devices.
- This continues the steady decline of GSM, down from 72% in 2020.
- EDGE penetration also dropped compared with 2020, from 67% of devices to 60%.

Cellular IoT

- 2021 saw a continued increase in the number of devices incorporating a cellular IoT standard.
- As in 2020, two standards dominated these certifications, NB-IoT and LTE CAT M1 (FDD). These were incorporated in 65 and 64 devices respectively.
- Conversely, LTE CAT M1 (TDD) and EC-GSM were not included in any certified devices in 2021.

eSIM

- This was the third full year that the certification of eSIM (RSP) devices has been possible.
- 83 devices were certified that supported RSP. This compares with 69 RSP devices that were certified in 2020.
- Additionally, 23 devices supported removable eUICC and 70 supported non-removable eUICC.

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Secure NFC

- Six smartphones (2% of all smartphones) were certified that supported SIM-based (UICC) Secure NFC services according to GSMA NFC specifications.
- Additionally, 30 smartphones (12% of all smartphones) were certified that supported embedded secure element NFC (eSE-NFC).

oneM2M

- In 2021, two products supporting oneM2M Release 1 were certified. Validation of Release 2 test cases has been delayed, which has reduced the number of oneM2M certifications.

Complexity / multi-mode devices

- 93% of all devices certified in 2021 incorporated more than one bearer technology.
- 71% of devices incorporated three or more technologies.
- This reflects the continued 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	2020	2021
GSM	3.5	3.5	3.5	3.2	3.1	3.1	3.2	3.7	3.4	3.7
3G	2.2	2.6	2.7	2.9	3.1	3.2	3.4	6.1	6.0	3.8
FDD-LTE	0.3	1.2	2.3	3.6	4.6	6.0	7.6	10.0	10.6	11.1
TDD-LTE	0.0	0.0	0.1	0.3	0.6	1.0	1.3	2.9	2.5	3.5
5G								0.1	1.7	10.7

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CONTENTS

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1. General device trends

1.1: Year on year growth

Despite the continuing impact of the pandemic, 2021 saw a record number of device manufacturers undergoing certification of at least one device with GCF (89), up 18.7% versus 2020.

The number of devices certified (609) was 14.8% down on 2020. This is partly due to the continued shift to 5G: in 2020 we had seen many smartphones certified as both 4G and 5G versions, while in 2021 there were more 5G-only smartphones. There was also an impact from the worldwide chip shortage, which has caused problems across many industries.

GCF certified devices & certifying manufacturers 2002 - 2021
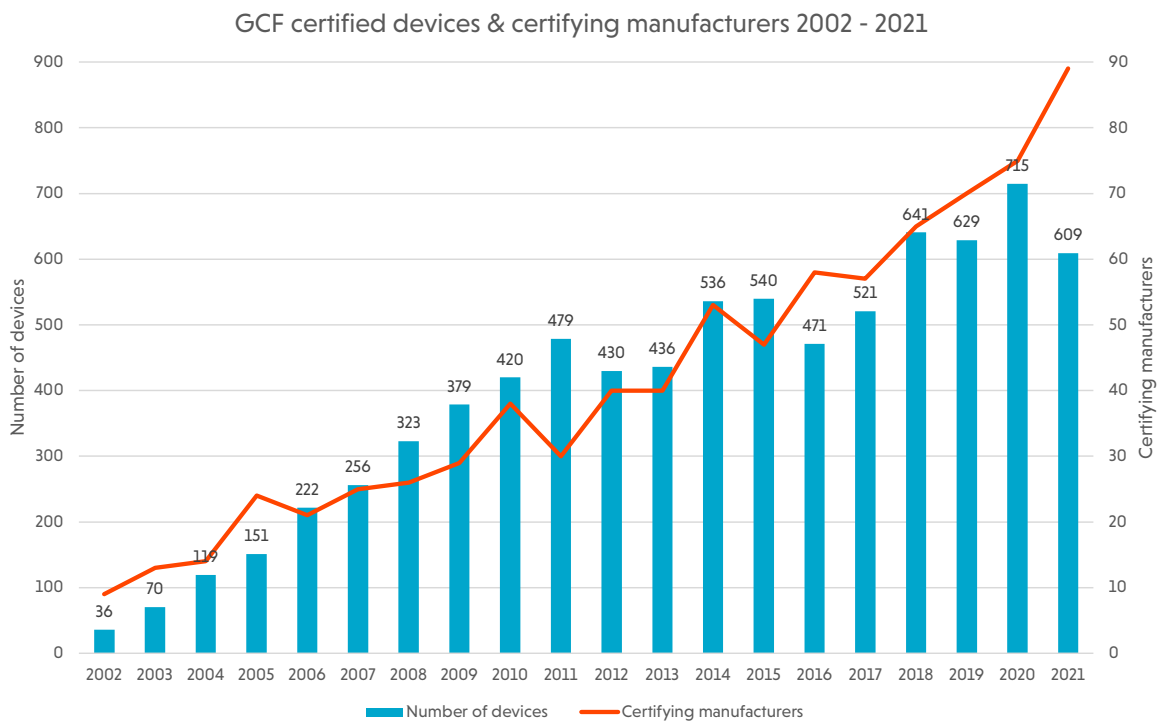
Fig 1

GCF works with device manufacturers of all sizes, and three manufacturers certified 40 devices or more. Conversely, 51 manufacturers certified three devices or fewer. And of the 89 manufacturers certifying devices in 2021, 23 were new members.

Comparing annual certifications against global device sales (source: Gartner) suggests there is a relationship between the choice of devices in the global market and overall market size. We have also tracked certifications against sales for the dominant class of device - smartphones (source: Gartner). All of the world's top-10 smartphone manufacturers are members of GCF and adhere to its principles.
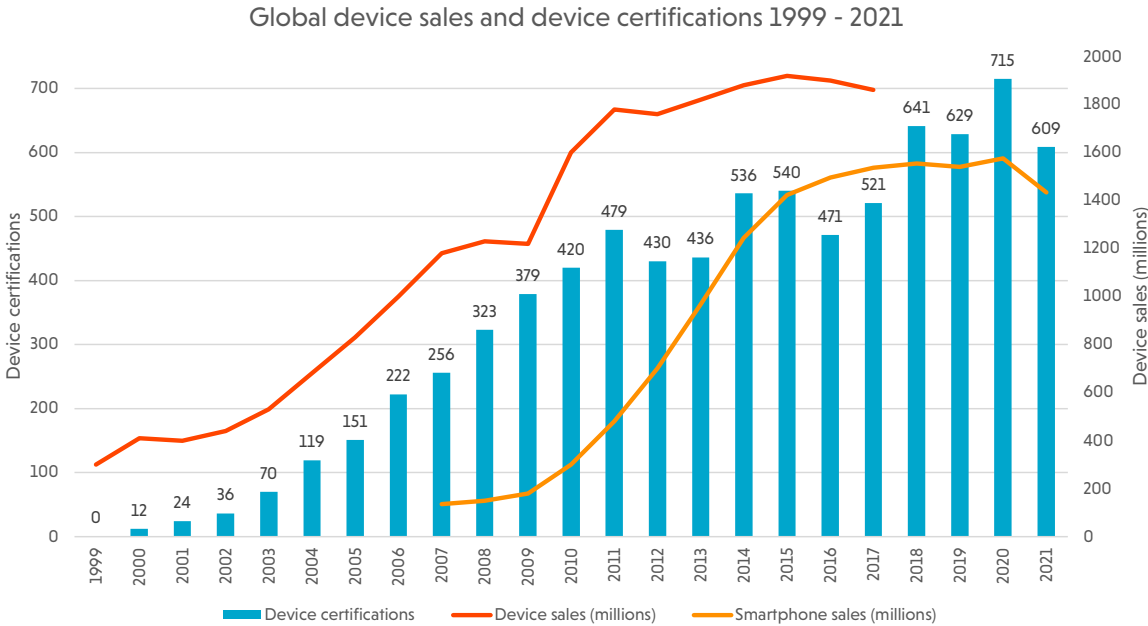
Global device sales and device certifications 1999 - 2021

1.2: 2021 certified devices by type

Smartphones continue to be the largest class of devices certified, and in 2021 they make up 43% of the devices certified, down five percentage points on 2020.

This decrease in smartphone share is partly due to continued growth in the number of modules certified, up more than three percentage points on 2020 to just under 30%. Nearly a third of the module total was made up of IoT modules.
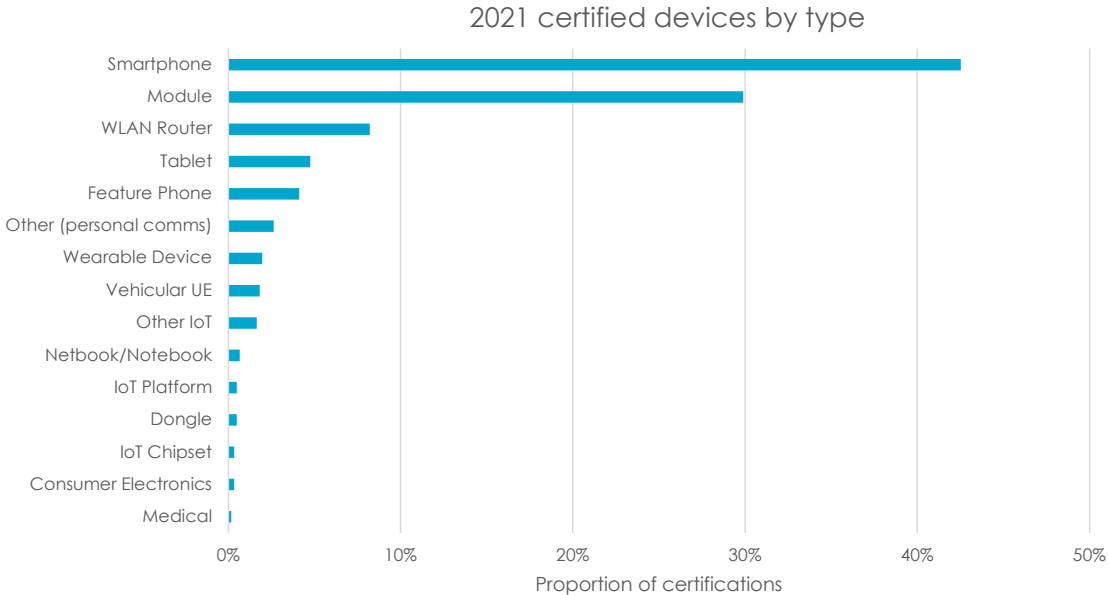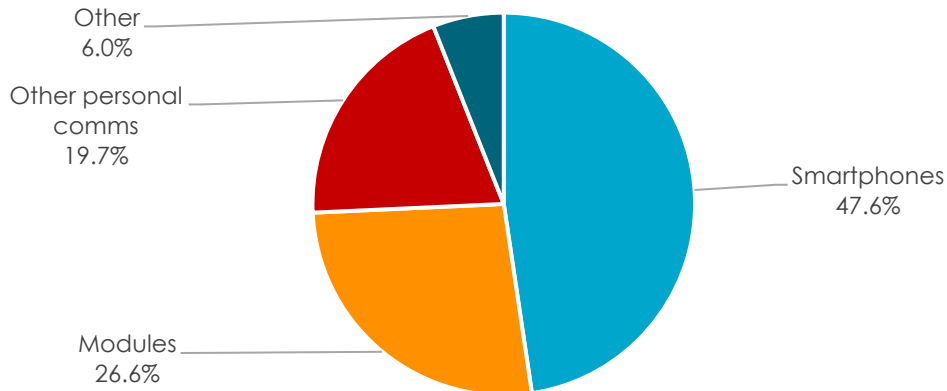
2021 certified devices by type

Fig 3a

2020 certified devices by parent category

Other
6.0%

Other personal
comms
19.7%

Smartphones
47.6%

Modules
26.6%

2021 certified devices by parent category

Other
2.5%

Other personal
comms
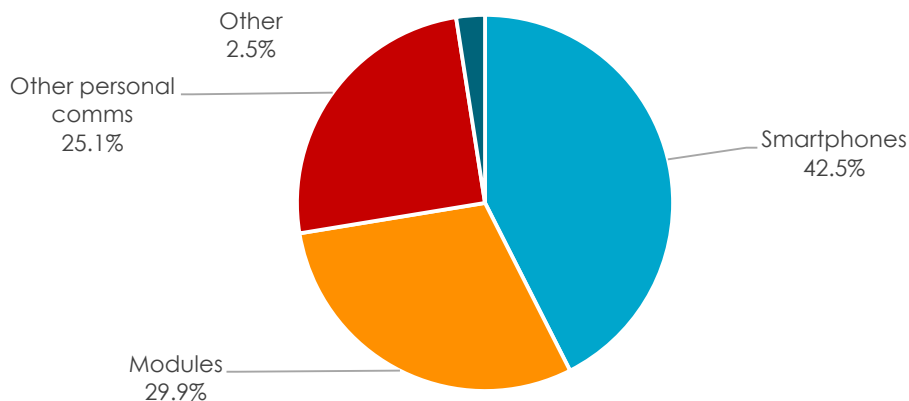25.1%

Smartphones
42.5%

Modules
29.9%

Fig 3b and c

The number of smartphones certified decreased from 340 in 2020 to 259 in 2021. As previously mentioned, this is at least partly due to more devices being 5G-only, rather than having 4G and 5G versions. Additionally, some global brands have stopped or limited their certifications of smartphones.

15% of certifications were feature phones, tablets, notebooks, mobile gateways/ portable hotspots, USB modems and other non-smartphone communication devices, down slightly on 20% in 2020.

This includes:

- Tablets, where the proportion of certifications rose slightly from 4.2% in 2020 to 4.8% in 2021 (although the number of devices certified fell very slightly from 30 to 29).
- Feature phones, where the proportion of certifications rose slightly from 3.1% in 2020 to 4.1% in 2020 (the number of devices certified rose from 22 to 25).

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1.3: 2021 certified devices by mobile technology used

As in 2020, LTE has again retained its crown as the most commonly integrated standard - see section 3.

Proportion of 2021 certified devices incorporating each mobile technology
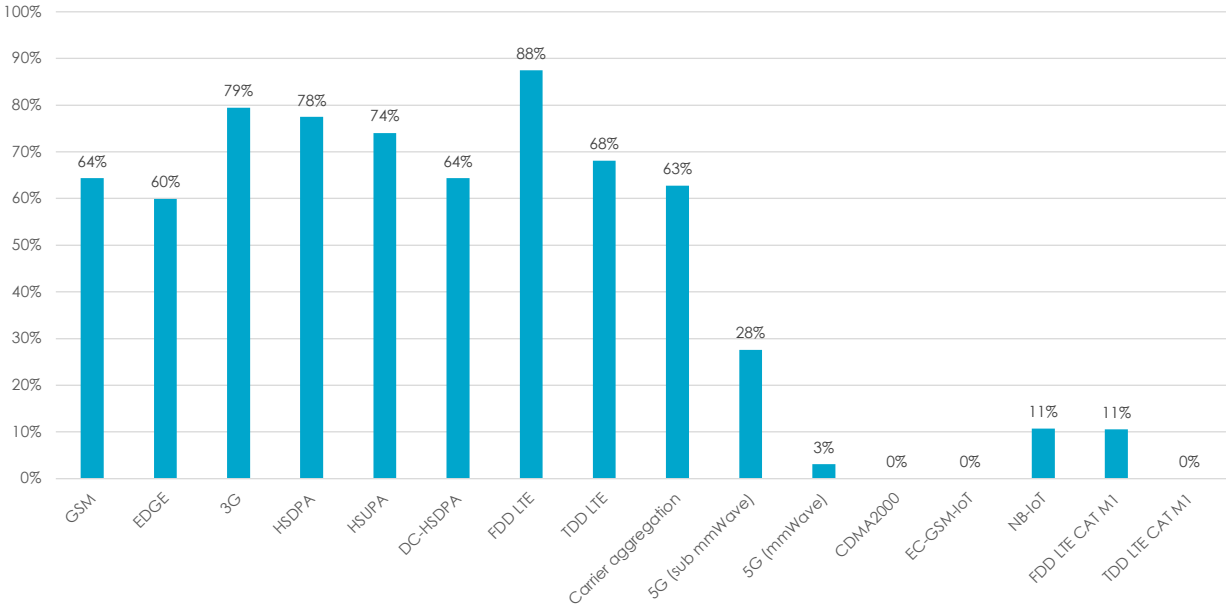

Technology	Value
GSM	64%
EDGE	60%
3G	79%
HSDPA	78%
HSUPA	74%
DC-HSDPA	64%
FDD LTE	88%
TDD LTE	68%
Carrier aggregation	63%
5G (sub mmWave)	28%
5G (mmWave)	3%
CDMA2000	0%
EC-GSM-IoT	0%
NB-IoT	11%
FDD LTE CAT M1	11%
TDD LTE CAT M1	0%

Fig 4

2. 5G

2.1: The rate of 5G incorporation

The rate of 5G incorporation has continued to increase, with the standard included in 31% of devices (189) certified, versus 21% in 2020, and just 2.5% in 2019.

Additionally, 65% (123) of 5G devices supported standalone 5G; and 10% (19) of 5G devices enabled access to FR2 5G frequencies, also referred to as high or FR2 bands.

GCF offers certification for standalone 5G as well as dual connectivity between 5G and LTE and the many inter-band configurations related to these.
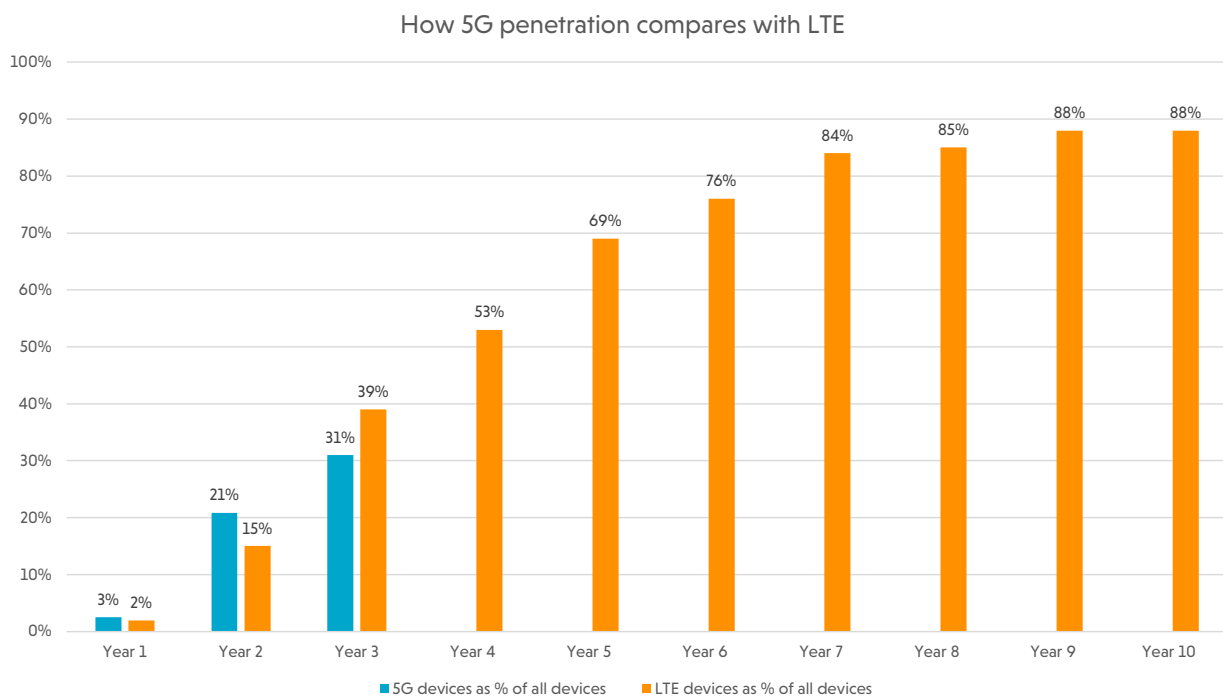
How 5G penetration compares with LTE

Fig 5a

2.2: How this compares with LTE

This is the third year in which 5G services have been available to the public.

LTE was launched at the end of 2009, with the first LTE device certifications completed by GCF in Q1 2011. Nine LTE certifications were made that year, representing 1.9% of the total. The following year this increased to 15%, with the technology becoming a dominant standard in 2017.

GCF announced its first 5G certification in Q2 2019, with 16 devices certified through the year (2.5% of all certifications). In 2020, we saw a big jump to 20.8% of certified devices supporting 5G, thus outpacing the rise of LTE.

While the adoption of 5G is still fast, it is now lagging behind LTE's progress in year three, with 189 5G devices certified in 2021, representing 31% of all devices certified.

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In the early stages of 5G deployment, there was a high proportion of devices classed as NSA (Non-Standalone), while more recently, in 2021, there has been a shift with more devices supporting 5G Standalone (SA). This reflects the rollout of more 5G SA networks by mobile operators, with launches in 2021 including networks in Germany, Finland, Australia, Spain, and the UK.

Figure 5b shows the increasing percentage of 5G devices certified by GCF which are SA, over the last two years. In 2021, 123 of the 189 5G devices certified were SA, which is 65% of the 5G devices.
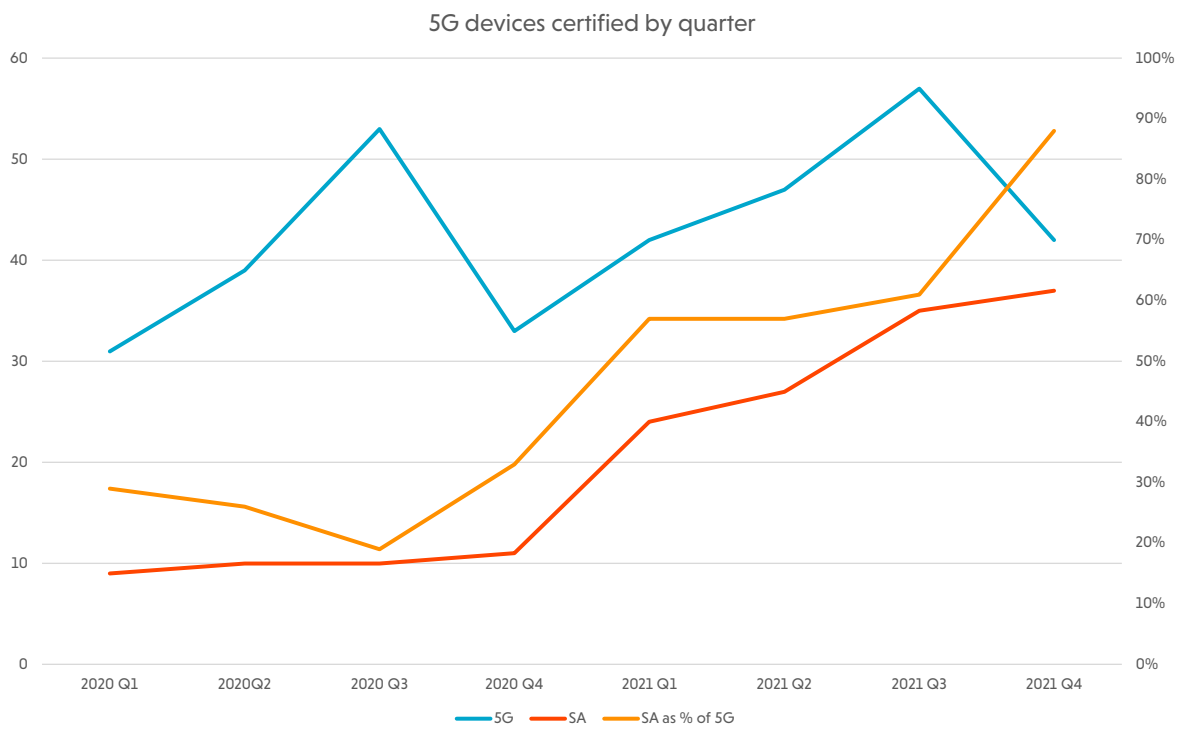

Fig 5b

2.3: Increasing numbers of 5G device manufacturers

In 2020, 28 device manufacturers developed and certified 5G devices with GCF, and over two thirds of these companies (21) submitted at least two. Nine manufacturers certified five or more.

In 2021, 43 device manufacturers certified 5G devices with GCF, and 27 submitted at least two. Fifteen manufacturers certified five or more.

2.4: Breakdown of 5G devices by classification

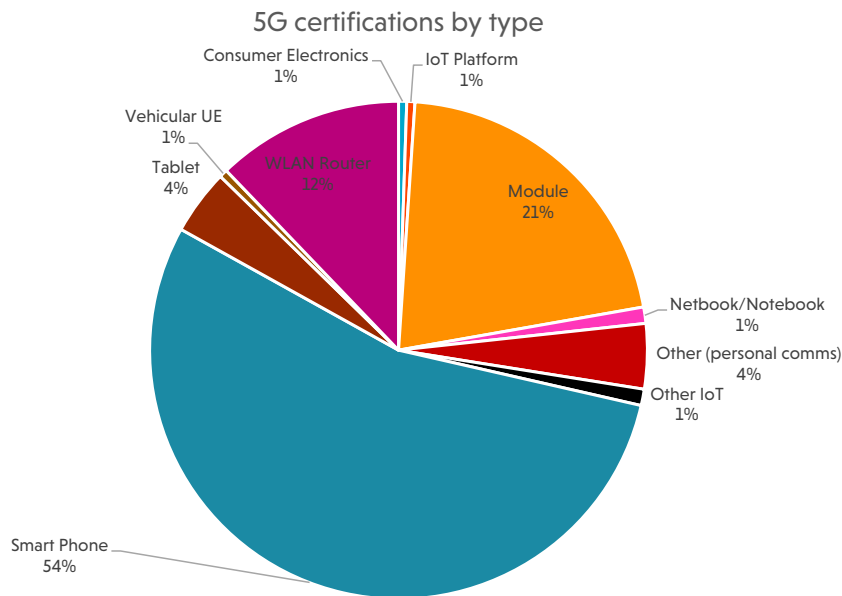

5G certifications by type

Fig 6

In 2019 94% of 5G certifications were predominantly for either smartphones (63%, 10 devices) or mobile gateways and hotspots (31%, five devices).

In 2020, most (84%) of 5G certifications were for smartphones (106 of the 149 certified 5G devices, 71%), and modules (twenty devices, 13%).

In 2021, the number of smartphones certified has stayed almost the same (103), but the growth in 5G certifications overall means this is now only 54% of the total. Modules have grown their share to 21% (40 devices), and WLAN routers make up 12% (23 devices, up from 4.7% in 2020).

2.5: 5G NR bands certified

Incorporating multiple bands expands the potential market for a given device and with certification actively underway for 14 of the 55 5G NR bands, GCF is being used to certify devices destined for use in all the leading mobile markets worldwide.

The GCF programme enables the certification of devices designed to operate in both FR1 (also referred to as low and high bands) and FR2 bands, as well as for standalone and non-standalone usage.

During 2021, devices using 26 of the FR1 and four of the FR2 bands were certified. Bands of particular note include:

- n78 (3500 MHz), which was in 153 devices (81%), was the most commonly incorporated band
- n5 (850 MHz) was the second most commonly incorporated band, featuring in 141 certified devices (75% of 5G devices).
- n1 (2100 MHz), n3 (1800 MHz) and n41 (2500 MHz) were the next most certified 5G bands, and each was incorporated in 132 5G devices (70%).
- In the FR2 spectrum, the Ka bands n260 (39 GHz) and n261 (28 GHz) were incorporated in all 19 of the 19 FR2 devices.
- Certified devices used 16 frequency division duplex (FDD) bands and nine FR1 time division duplex (TDD) bands. Additionally, (as stated) four FR2 bands were adopted in certified devices.
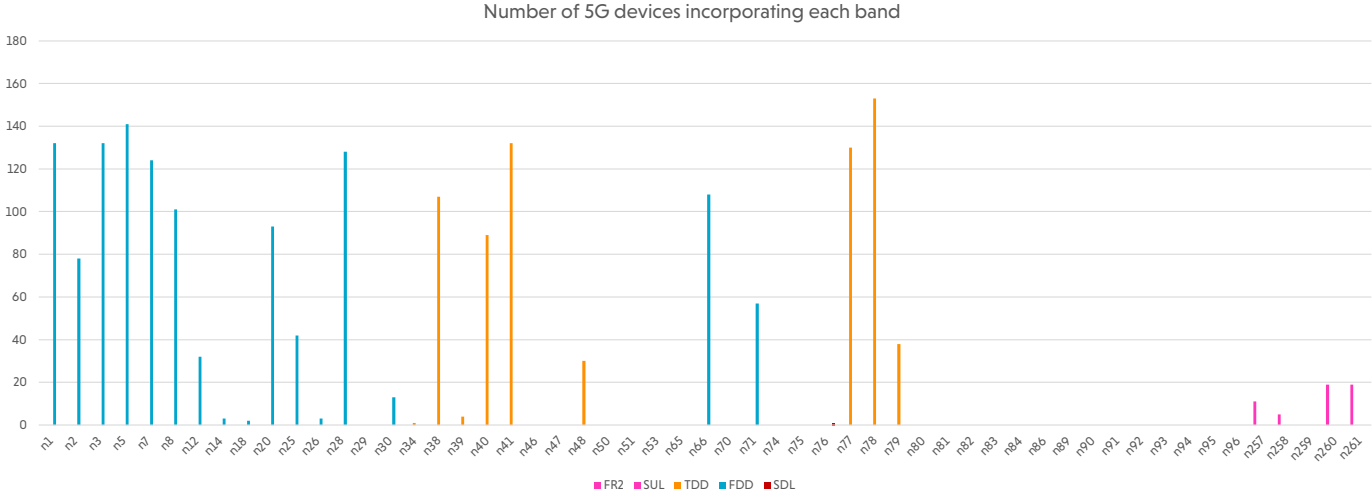
Number of 5G devices incorporating each band

Fig 7

2.6: 5G device complexity

Of the 189 certified 5G devices, 188 supported E-UTRA-NR dual connectivity (EN-DC).

Looking at 5G SA devices that were certified (and excluding several devices where the submitted data was incomplete), we can see that the mean number of 5G bands per 5G SA device was 10.9, up slightly on 10.2 in 2020, with 30 devices supporting 12 or more 5G bands.

19 devices were able to use the FR2 frequency bands and all 19 of these were able to access the n260 Ka band (all supporting use on both the 28 and 39 GHz bands).

The average complexity of FR2 capable devices increased, with these 19 devices allowing the use of 12.7 bands on average.
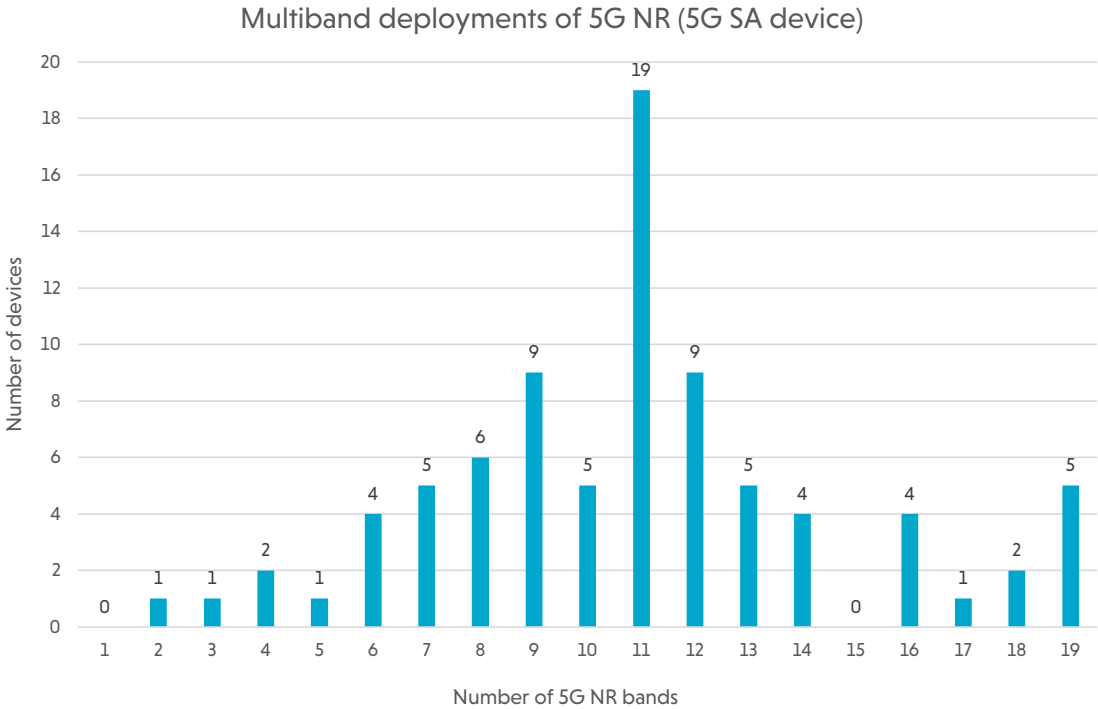
Multiband deployments of 5G NR (5G SA device)

Fig 8

3. LTE

3.1: LTE appears to have plateaued

The penetration of LTE in certified devices has continued to plateau in 2021, with the standard being integrated into 88% of all certified devices (as in 2019 and 2020), and LTE retaining its position as the most integrated standard.

While it is holding steady for now, it will be interesting to see if this share falls as 5G continues its growth and begins to replace LTE for data communications, or if it stays at this level for the short-to-midterm future.
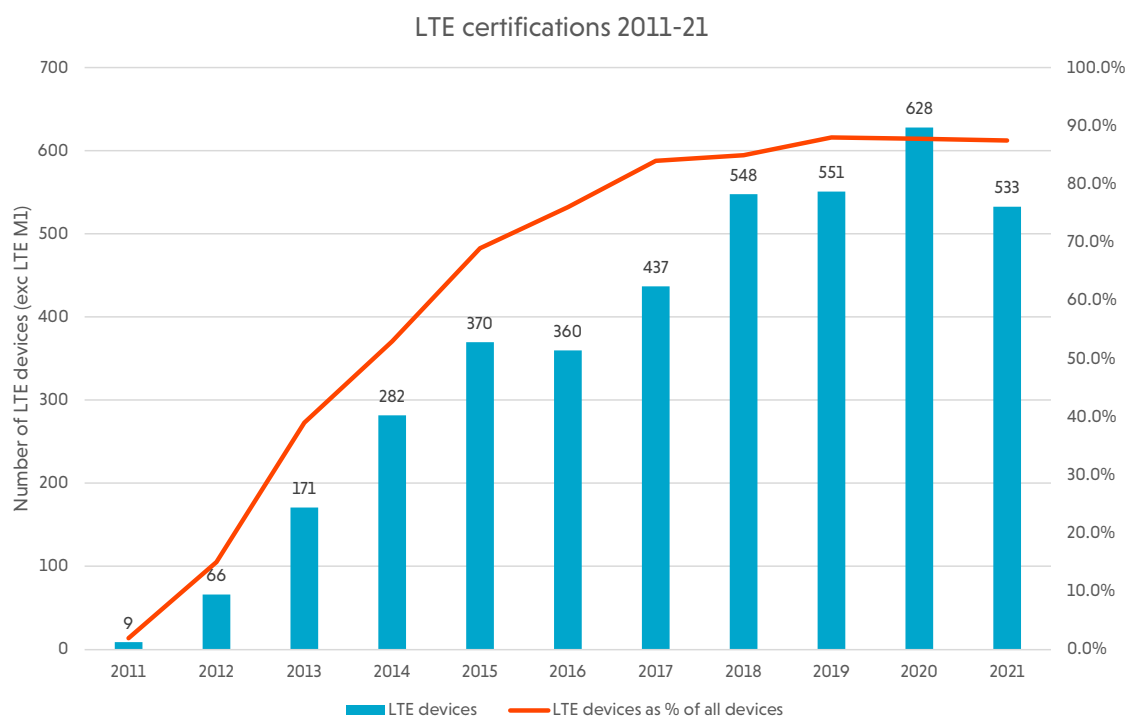
LTE certifications 2011-21

Fig 9

In 2021, 533 certified devices supported LTE. An additional 61 devices incorporated the cellular IoT variant, LTE CAT M1.

As in 2019 and 2020, FDD-LTE was supported in all of these devices. TDD-LTE was incorporated into 78% of them (415 devices), up from 70% in 2020, 66% in 2019 and 62% in 2018. And while all TDD-LTE capable devices also incorporated FDD-LTE, the proportion supporting simultaneous FDD/TDD operation is 55%. This is up from 49% in 2020.

There was also a decrease in certifications supporting Gigabit LTE, with 70 Category 16 / Category 18 devices certified, down from 125 in 2020, but still up from 50 in 2019 and just six in 2017.

VoLTE operation was certified in 68% of LTE devices (363), which is very similar to 2020 when 69% of devices supported it.

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3.2: LTE bands used

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

During 2021, all bands covered by the GCF scheme had devices certified. Bands of note include:

• Band 3 (1800 MHz) became the most certified LTE band. It features in 469 LTE devices (88% of LTE devices and 77% of all devices).

• Band 7 (2600 MHz) dropped down to become the second most certified LTE band, incorporated in 464 devices (87% of LTE devices and 76% of all devices).

• Band 1 (2100 MHz) became the third most incorporated band, regaining its lead over Band 5. Band 1 featured in 462 devices (87% of LTE devices).

• 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 378 devices (71% of LTE devices and 62% of all devices), up on 2020 (which saw 57% of devices able to utilise the band).

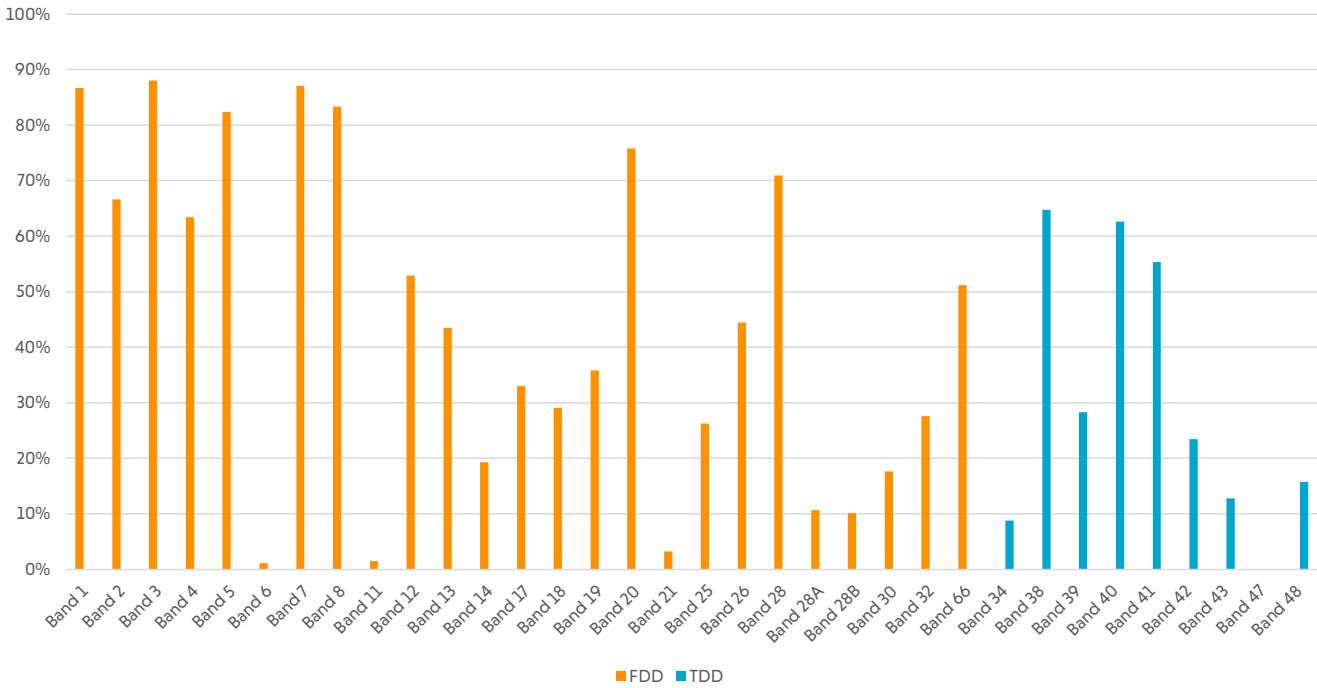Proportion of certified LTE devices incorporating each LTE band

Fig 10

3.3: LTE device complexity

In general, the number of certified bands in LTE devices continued to increase during 2021.

Of the 533 devices incorporating LTE, 530 (99% of LTE devices – the same percentage as in 2020) incorporated three or more LTE bands, while 98% incorporated five or more bands (same as 2020), and (over) half of LTE devices incorporated 13 or more bands (versus 11 bands in 2020 incorporated in half of the LTE devices).

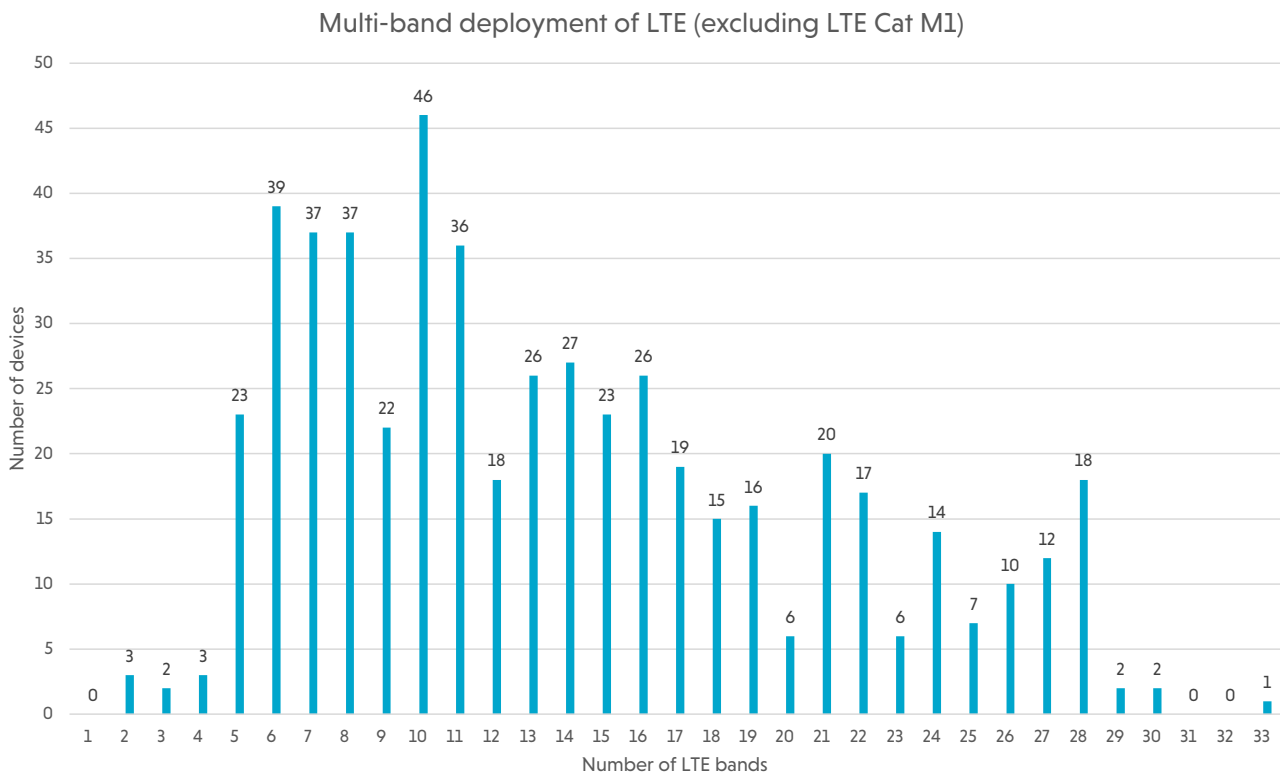Multi-band deployment of LTE (excluding LTE Cat M1)

Fig 11

The modal number of LTE (excluding LTE Cat M1) bands is ten (up from nine in 2020), and a slightly bimodal distribution is occurring, with 89 devices deploying 22+ bands (up slightly from 86 in 2020). 367 (69% of LTE devices) incorporated 10 or more FDD-LTE bands; up from 61% in 2020 and 51% in 2019. 214 devices supported 15 or more FDD-LTE bands; up from 201 in 2020 and 115 in 2019.

In 2021, the average (mean) LTE device incorporated 13.8 LTE bands, up from 12.7 in 2020.

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. The number of devices deploying Carrier Aggregation increased in the past year with 382 devices certified (62% of LTE device certifications), very similar to 2020, which had 61% (383 devices) deploying Carrier Aggregation.

4. 3G

4.1: Penetration of 3G

Manufacturers are still embracing 3G, despite operators prioritising LTE and 5G for data delivery. Certifications for 3G (UMTS/ WCDMA) stood at 79% (484 devices) in 2021, slightly down on 83% in 2020.

3G is typically included as a voice-call fallback for VoLTE devices when roaming, with just one standalone 3G device being certified during 2021 (there were none in 2020).

Certification of HSDPA and HSUPA were down slightly versus 2020, with 78% (472 devices) and 74% (451 devices) incorporating each respectively. This represents 98% and 93% of 3G devices. The penetration of dual-cell HSDPA remained about the same at 64% of all devices, within 1 percentage point of 2020.

4.2: 3G bands used

Bands of note include:

- Band 1 (2100 MHz) featured in 448 certified 3G devices (74% of all devices and 93% of 3G-capable devices), very slightly up on 2020.
- Band 8 (900 MHz) again remained the second most frequently certified 3G band – in 447 devices (73% of all devices and 92% of all 3G devices), very slightly up on 2020.
- Band 5 (850 MHz) was again the most commonly certified US 3G band, this is used in 420 (69% of devices certified in 2021), down four points vs 2020.
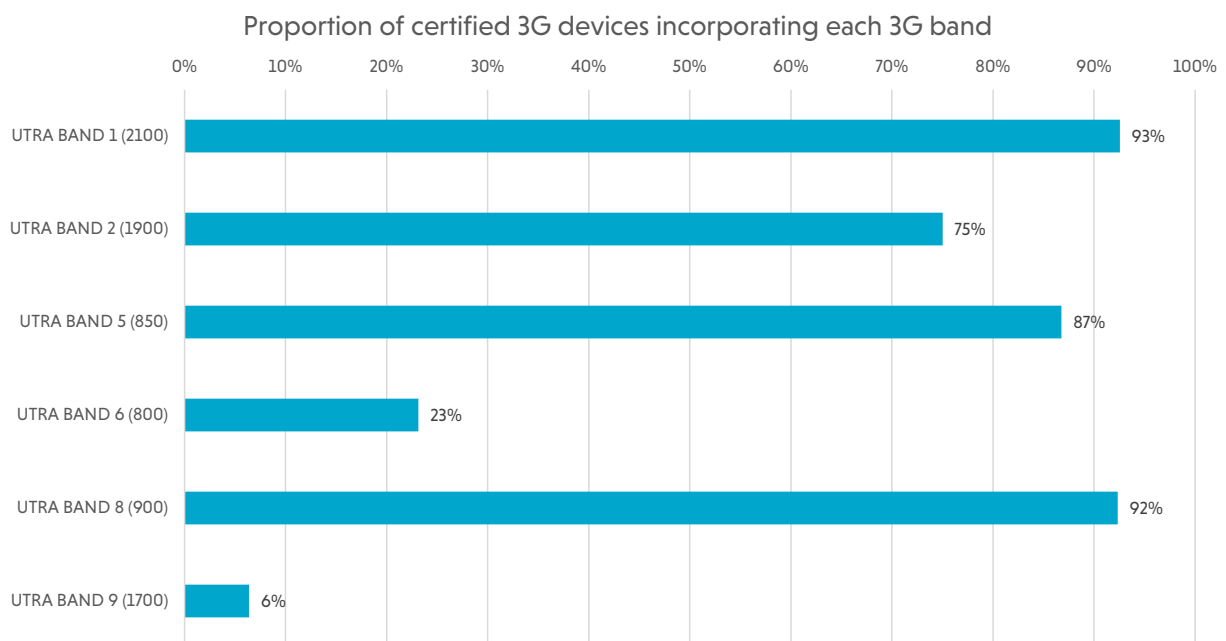

Proportion of certified 3G devices incorporating each 3G band

Fig 12

4.3: 3G device complexity

Two or more 3G bands were certified in all devices deploying 3G.

The number of bands considered for UTRA certification has been reduced by GCF, due to the sunsetting of technology. For 2021, in Figure 13, we are including bands FDDI, FDDII, FDDV, FDDVI, FDDVII, and FDDIX.

The modal number of bands is four in 2021, and 328 devices (68% of 3G devices) were certified with four or more 3G bands.
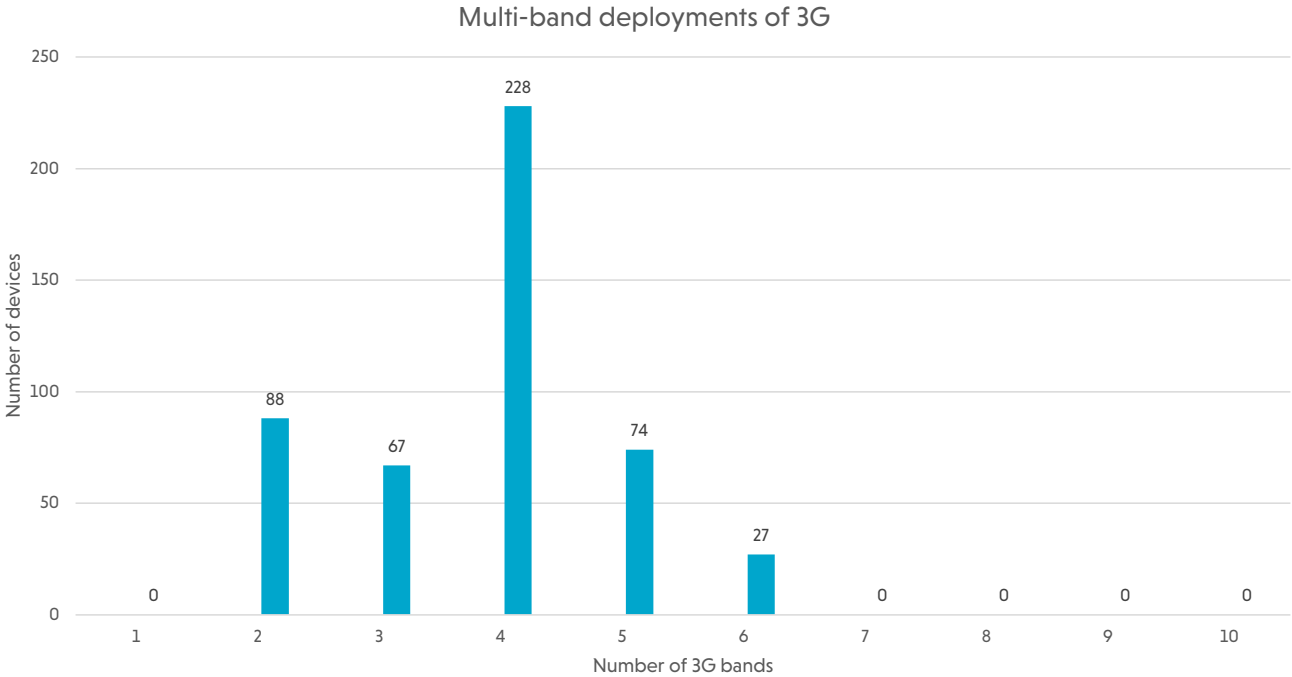
Multi-band deployments of 3G

Fig 13

5. GSM

5.1: GSM continued its decline

The penetration of GSM declined steadily from 2008/2009 (when 100% of devices included the standard) to 2020 (when just 72% of devices did).

2021 saw the decline continue, with 64% of devices including the standard, and only four GSM standalone devices certified.
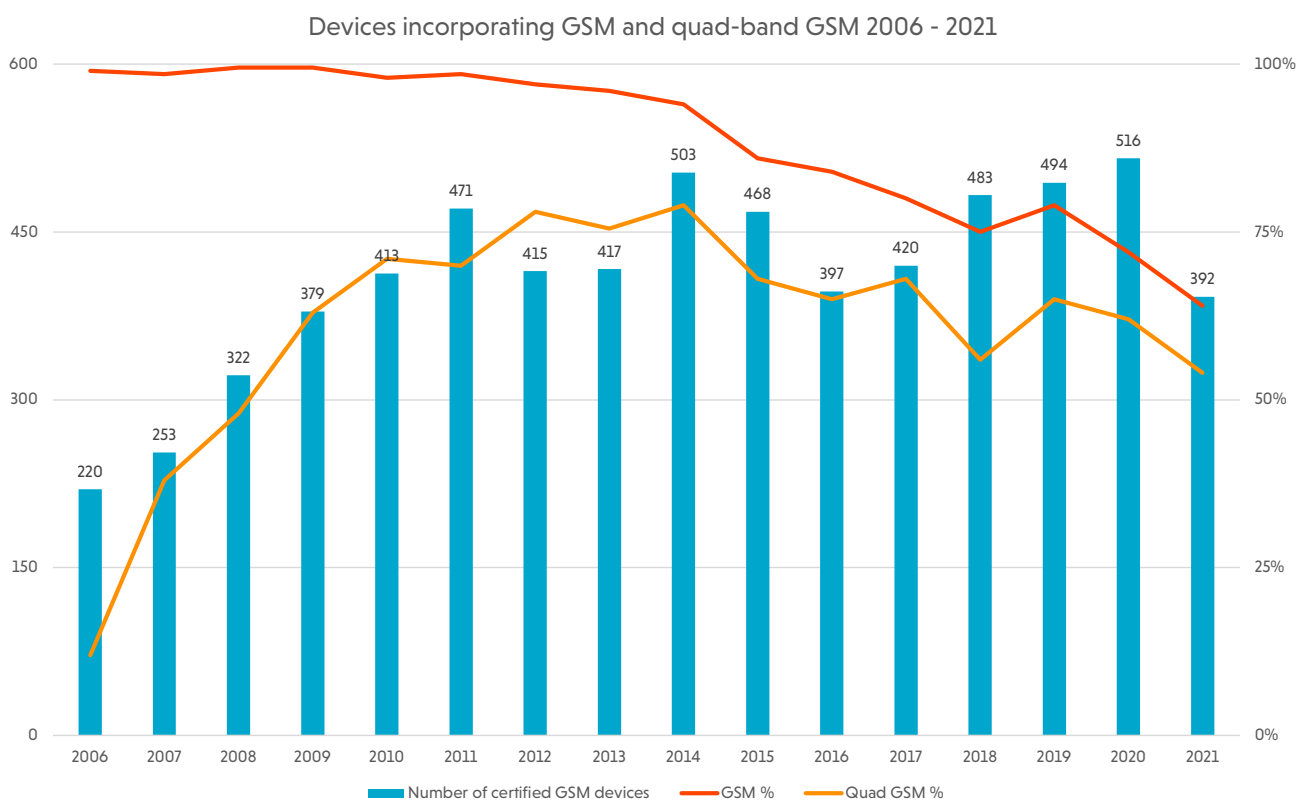

Devices incorporating GSM and quad-band GSM 2006 - 2021

Fig 14

5.2: EDGE/ Quad-band GSM

EDGE was certified in 365 devices (60% of all devices, down from 67% in 2020).

Certifications for Quad-band GSM devices saw a decrease, with 331 certifications (54% of all devices, versus 62% in 2020, 65% in 2019 and 56% in 2018).

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6. Cellular IoT

6.1: The adoption of cellular IoT standards continues to grow

Cellular IoT has been widely adopted globally, and those devices based on 2, 3 and 4G technologies are set to be enhanced further with the arrival of 5G networks: improving 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 - Source Ericsson.

This is the 5th 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 more than 10-fold, and LTE CAT M1 (FDD) increasing more than 20-fold:

•   NB-IoT was featured in 65 devices certified this year (up from 56 in 2020 and five in 2017)

•   LTE CAT M1 (FDD) featured in 64 (slightly down from 66 in 2020, but up from three in 2017)

But, these two standards dominate. LTE CAT M1 (TDD) was not included in any devices certified in 2021 (there was just one in 2020); and EC-GSM was also not in any devices (there were three in 2020).
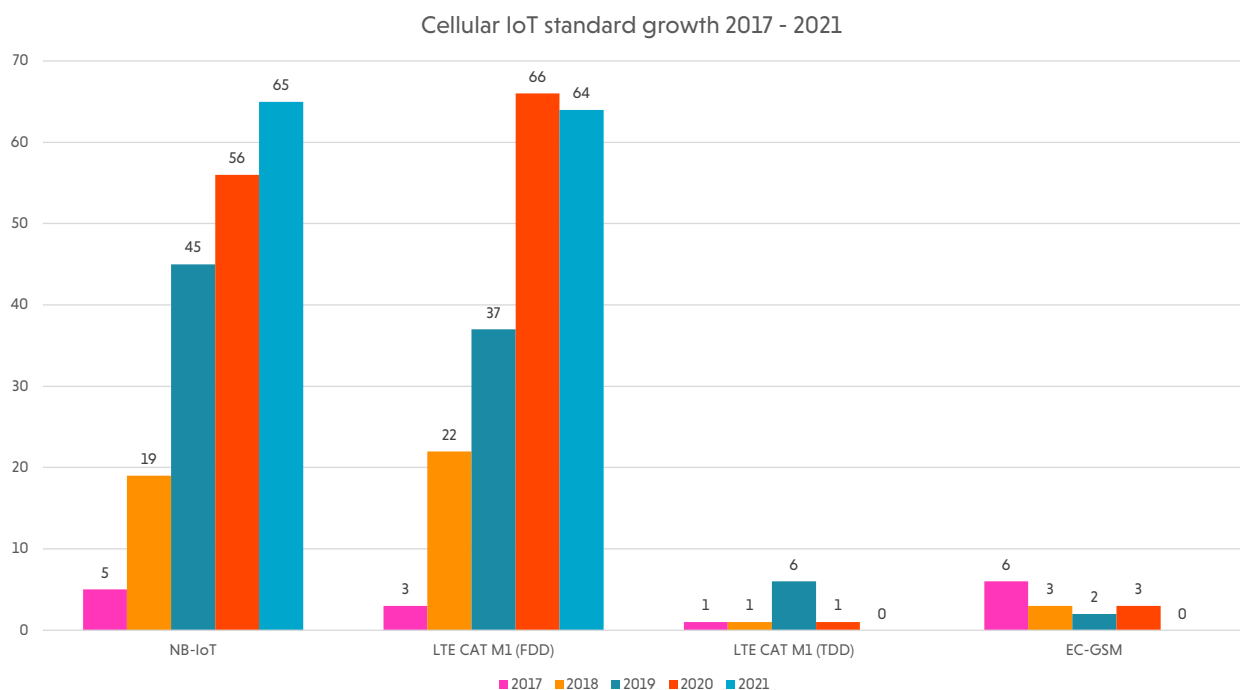

Fig 15

7. Device complexity

7.1: A further rise in overall complexity

> Devices on average have continued to increase in complexity for several years.

2021 continued this trend overall, although the proportion of certifications for devices supporting four or more bearer technologies dipped slightly to 18%, from 20% in 2020.
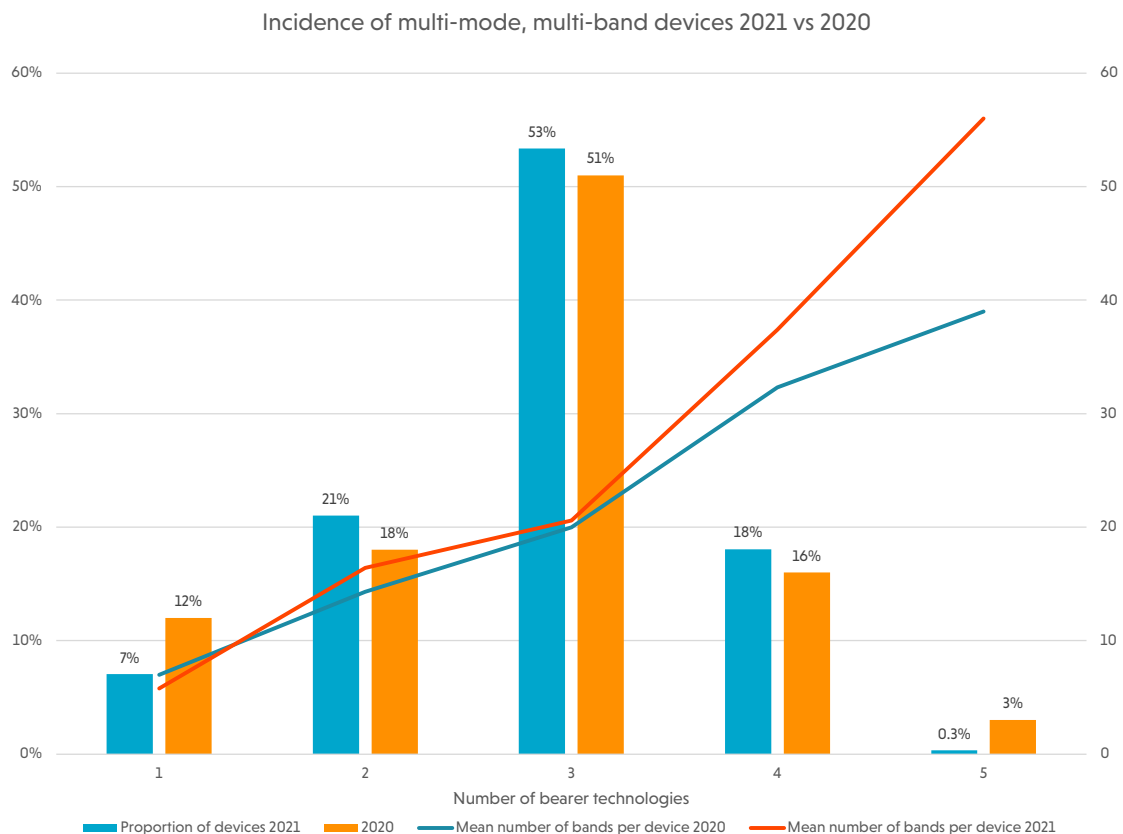
Incidence of multi-mode, multi-band devices 2021 vs 2020

Fig 16 - Bearer technologies have been classified as 2G (GSM/ EDGE), 3G (WCDMA/ UTRA/ HSDPA/ HSUPA), 4G (LTE FDD/ LTE TDD), 5G, CDMA2000, NB-IoT, LTE M1 (TDD/ FDD), EC-GSM

7.2: Single-mode devices

The proportion of single mode devices fell in 2021, down to 7% from 12% of devices in 2020. These single-mode devices are predominantly Cellular IoT (15 devices), and LTE systems (26 devices).

There was one standalone 3G device (that only supports 3G and no other modes), up from none in 2020. There were no 5G-only devices in 2021, the same as in 2020.

The complexity of single mode devices decreased slightly, with the mean number of bands in 2021 being 5.8, down from 6.5 in 2020, but still higher than 5.0 in 2019 and 3.7 in 2018.

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7.3: Multi-mode devices

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

As in 2020, 2019 and 2018, the modal number of bearer technologies per device was three, however the proportion of systems employing four or more bearer technologies has more than doubled in the last couple of years, from 8.5% in 2019 to 18% this year.

The number of implemented bands used in the average device is also up slightly. Certified devices now have a mean of 21.8 frequency bands, compared to 19.8 in 2020.

This figure increases to 37.7 bands for devices supporting four bearer technologies (up from 32.1 in 2020).

The highest number of implemented bands in 2021 was 68.

8. Smartphones

8.1: Smartphone growth

Smartphones have consistently represented the largest category of devices certified by GCF. 2021 continued this trend, with the category representing 42.5% of all certifications, although this was down on 2020's figure of 48%.

A total of 259 smartphones were certified in 2021, down from 340 in 2020.

These 259 devices came from 30 manufacturers. Almost half (45%) of the certified smartphones were developed by just two manufacturers. And 70% of smartphones certified were made by just five manufacturers.

Year on year handset certification growth

Legend: Handsets | Smartphones | Feature phones | Smartphones as a % of all certified devices
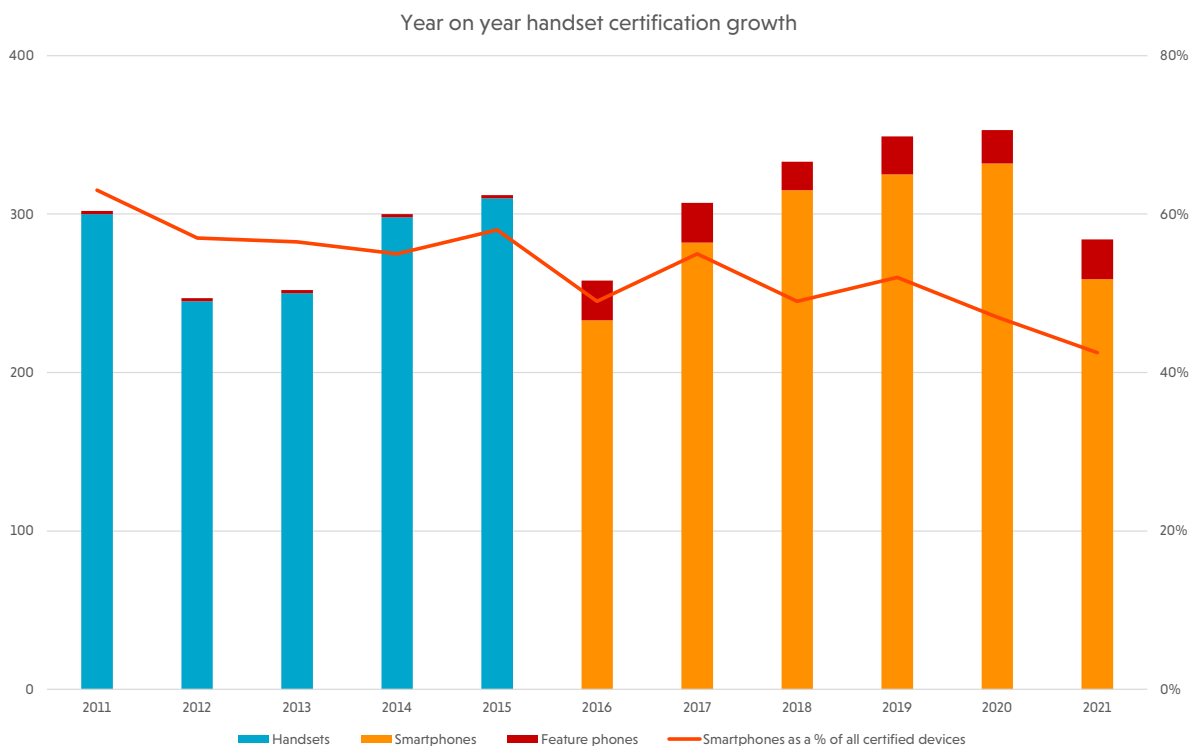
Fig 17

8.2: Smartphone complexity

Smartphones are also significantly more complex than the average device, with 97% of smartphones integrating three or more bearer technologies, versus 53% for non-smartphone devices.

However, the number of bands per device is now lower for smartphones, while in previous years it was higher than for non-smartphone devices. Smartphones with three bearer technologies used spectrum across an average of 19.7 bands; for non-smartphone devices this figure is 21.3. This appears to be due to the high number of modules being certified that support many bands.

Due to the very small number (11) of non-smartphone devices that support four or more bearer technologies, it is not possible to compare without being affected by skews.
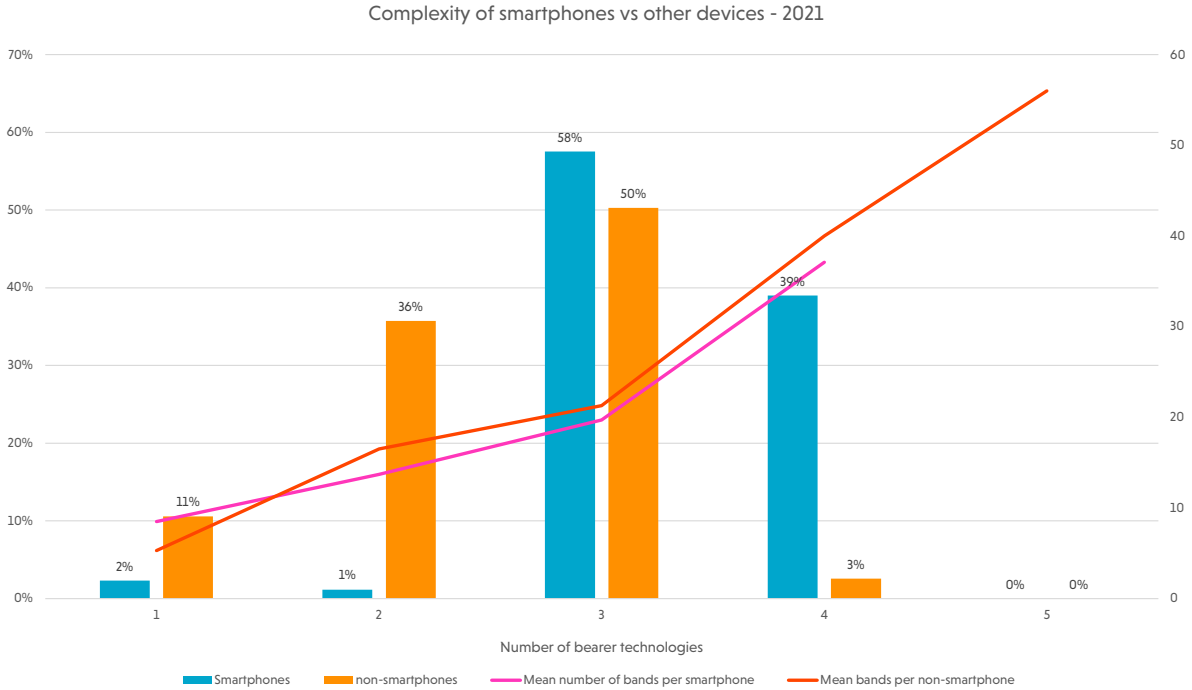
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Complexity of smartphones vs other devices - 2021

Fig 18

8.3: Mobile technologies incorporated

The increased level of complexity of smartphones can also be 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. Additionally, 96 smartphone designs support 5G.
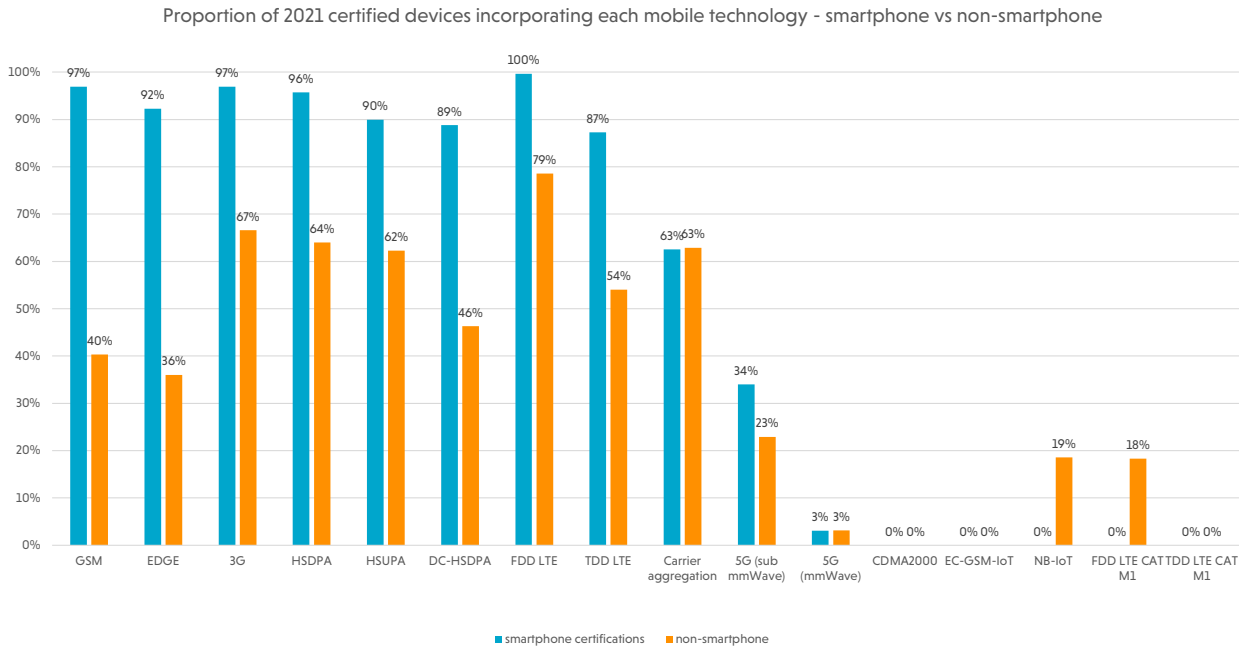
Proportion of 2021 certified devices incorporating each mobile technology - smartphone vs non-smartphone

Fig 19

9. Wireless modules

9.1: Wireless module growth

Since 2020, GCF has included IoT modules among the general module category.
In total, there were 182 modules certified in 2021; representing just under 30%
of the total, up from 27% in 2020.

In 2021, 71% of module certifications came from just four companies (down from 84% in 2020, but similar to 70% from the top four manufacturers in 2019). Additionally, the top four module manufacturers were among GCF's top 10 manufacturers by number of certifications.

Module certifications 2011 to 2021

Modules   Modules as a % of certified devices
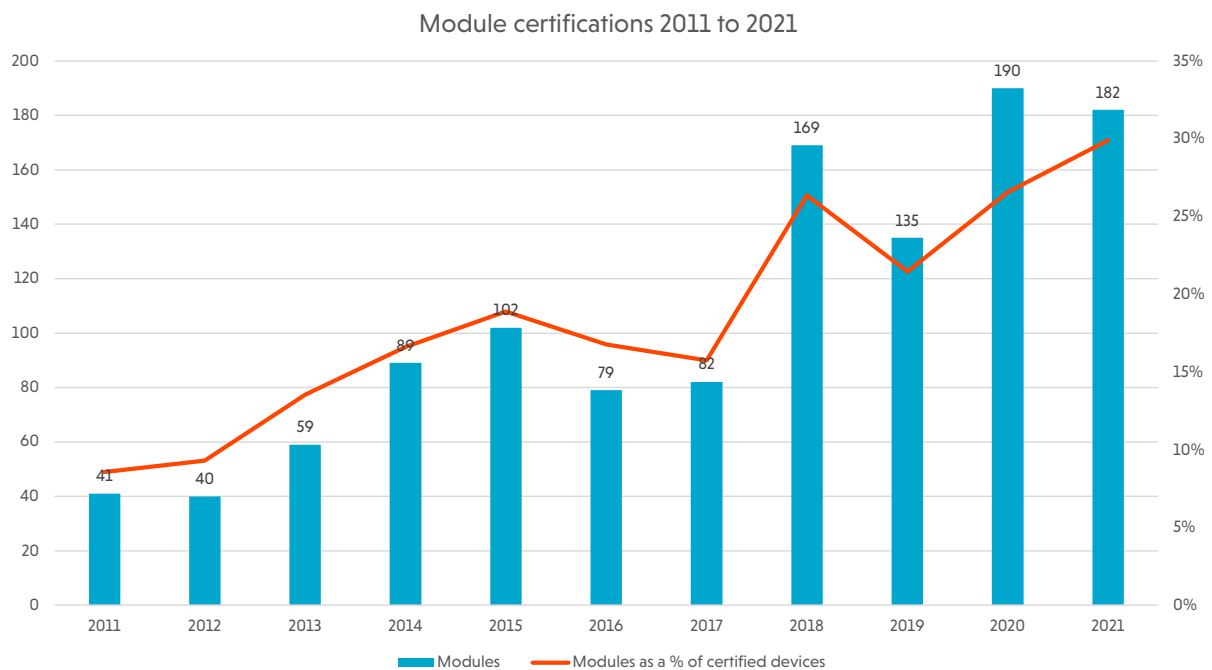
Fig 20

9.2: Module complexity

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

26 of the 182 certified modules (14%) were single-mode, down substantially on 32% in 2020. 32% in 2021 incorporated two bearer technologies (very similar to 31% in 2020) and 51% in 2021 included three (up substantially on 37% in 2020).
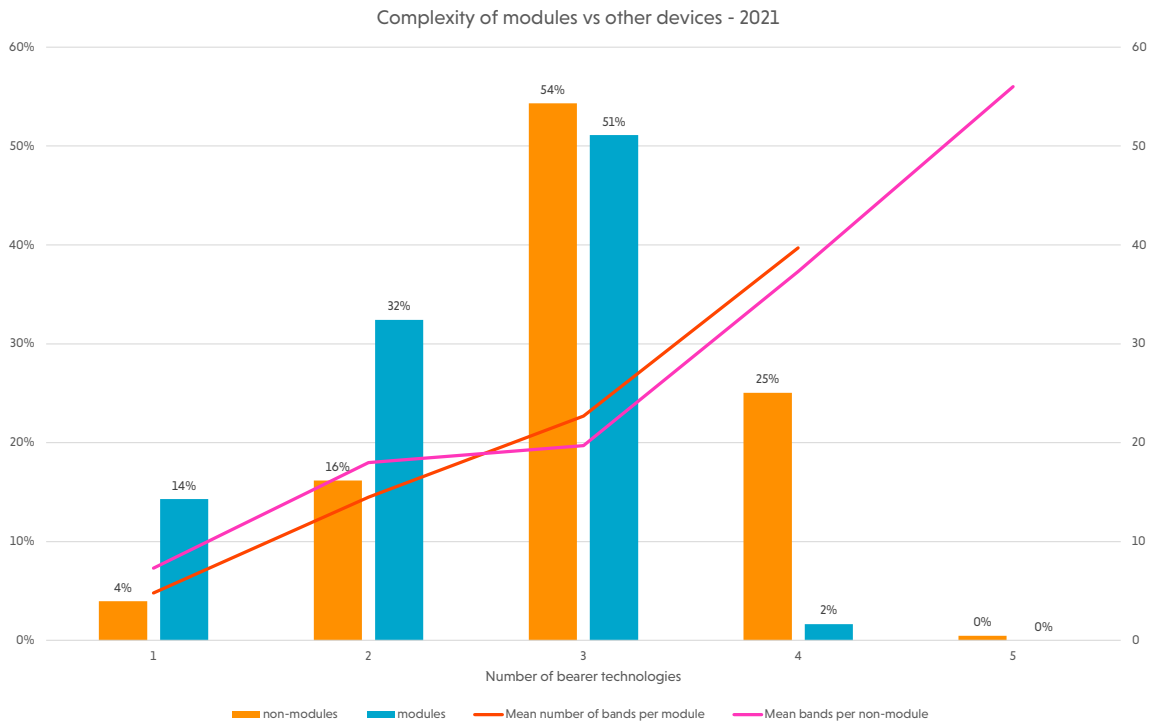
Complexity of modules vs other devices - 2021

Fig 21

The number of frequency bands per module certified has risen compared with recent years, now standing at 17.6 per module (up from 14.2 in 2020). The maximum number of frequency bands for a module was 51.

9.3: Mobile technologies incorporated

The average module is significantly less complex than the average device, and this can also be observed in the proportion of devices supporting each mobile technology.

As per 2020, FDD LTE is the most commonly certified bearer technology in modules, with 64% of modules incorporating it in 2021, compared to 63% in 2020. In 2021, 53% of modules incorporated 3G (UTRA) versus 57% in 2020, and in 2021, 38% incorporated GSM, versus 44% in 2020.

Proportion of 2021 certified devices incorporating each mobile technology - module vs non-module
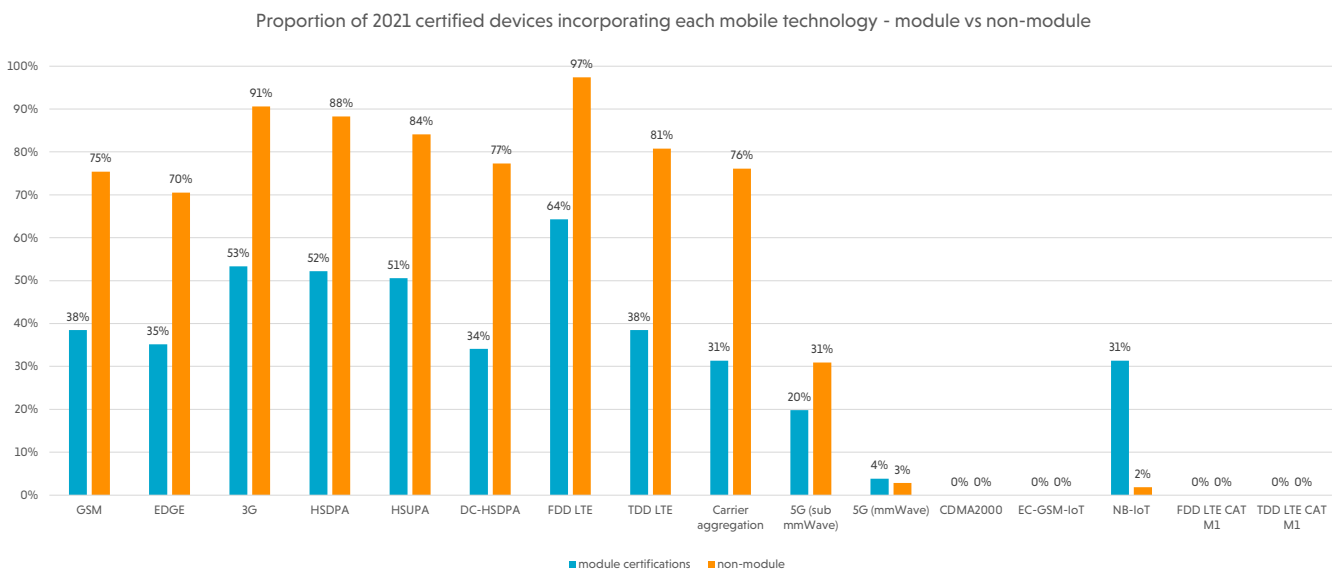
Fig 22

10. The effect of Covid-19 on device certifications

While 2020 was a record year for GCF certifications, these numbers dipped slightly in 2021. However, the number of certifications continued to grow at a relatively steady rate when examined month by month and quarter by quarter
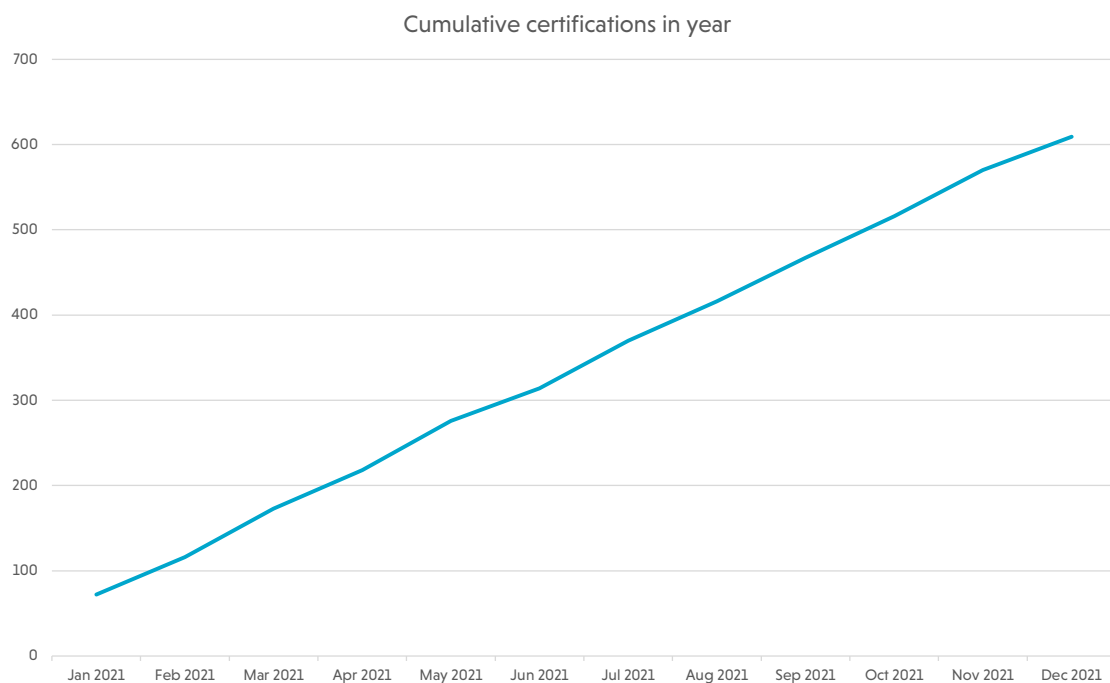
Cumulative certifications in year

Fig 23

We therefore do not think the outbreak had a significant effect on certifications.

It is not possible to say if any decrease in 2021 was caused by a transition to working from home (forcing manufacturers to prioritise the certification of 5G-devices), or if the dip was caused by an industry refocus towards 5G that would have occurred anyway.

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11. 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 2021, the average GCF-certified device incorporated 2.8 bearer technologies (the same as 2020) and operated across 21.8 frequency bands (up from 19.8 in 2020).

Demonstrating the conformance and interoperability of today's sophisticated multi-mode, multi-band smartphones, modules and vehicles to the satisfaction of the world's mobile operators and governments is therefore essential. And this GCF Device Analysis shows that its solutions remain relevant to the pre-launch testing of relatively simpler single-mode and even single-band devices.

With 2022 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 demonstrate this conformance and interoperability remains paramount.

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12. How GCF ensures compliance and interoperability

12.1: 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 lab-based conformance and interoperability testing complemented by field-trial testing on live commercial networks.

12.2: Who GCF works with

As of June 2022, over 150 device manufacturers are participating in GCF. The GCF suite of certification solutions is also recognised by operators with interests in global markets.

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.

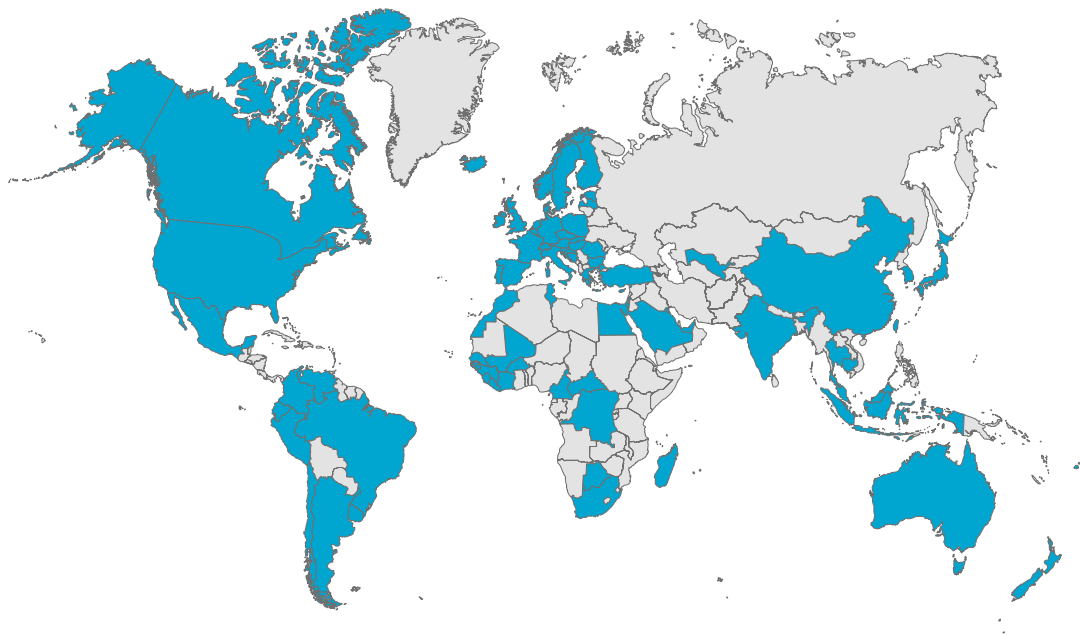GCF members are spread across the globe.

Fig 24

12.3: 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.

12.4: The benefit of GCF Certification

By adopting GCF Certification into its quality management system, a manufacturer 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 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 (FR1 and Ka band).

More recently, GCF has added vehicle-to-vehicle and vehicle-to-infrastructure compliance testing, and also MCPTT. 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.

13. Key GCF milestones:

Date	Event
June 2021	C-V2X Automotive programme launched
December 2020	Consumer IoT security programme launched
March 2020	First IoT chipset certified
July 2019	First 5G device capable of accessing FR2 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 25

14. GCF Device Certifications

Certified devices are listed on the GCF website at:
https://www.globalcertificationforum.org/services/3gpp-certifications/all-3gpp-certifications.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/services/3gpp-certifications/modules-and-iot-chipsets.html

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15. Table of figures

16 Appendix – summary of H1 2022 data

16.1: Introduction

Until now, GCF has published an annual report on mobile device trends. From 2022 onwards, we intend to also publish a shorter summary report after quarter 1 and 2 focusing on selected areas of interest.

This section covers H1 2022.

16.2: Device types

In H1 2022, 318 devices were certified by 51 manufacturer members. The breakdown of these devices by type is shown in Fig A1.

This shows that in H1 2022, the percentage of devices that are smartphones remained at 43%, the same as in 2021, while the proportion of modules went up from 30% in 2021 to 34% in H1 2022.
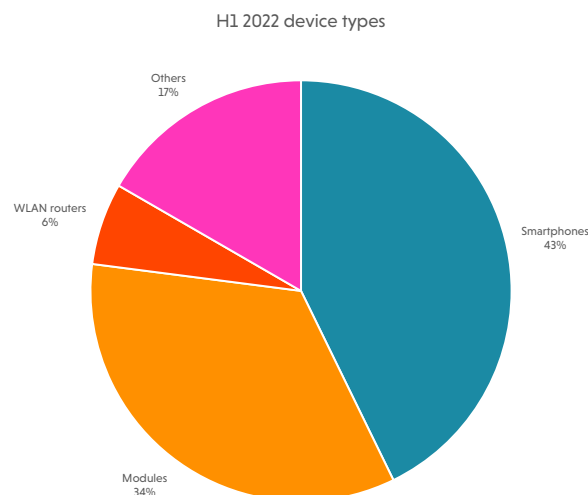
H1 2022 device types

Others
17%

WLAN routers
6%

Smartphones
43%

Modules
34%

Fig A1

16.3: 5G trends

The percentage of certified devices supporting 5G is growing and reached 40% in Q2 2022, compared with 26% in Q1 2022.

33% (105/318) supported 5G while 92% (291/318) supported LTE in H1 2022. One 5G product did not support LTE.

We were getting close to the milestone of 90% of all 5G devices supporting standalone (SA) in Q1 2022 with 87% supporting SA. The Milestone was met in Q2 2022– of the 59 5G devices certified in Q2 2022, 55 supported SA, which is 93% (see Fig A2).

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5G devices certified by quarter

Fig A2
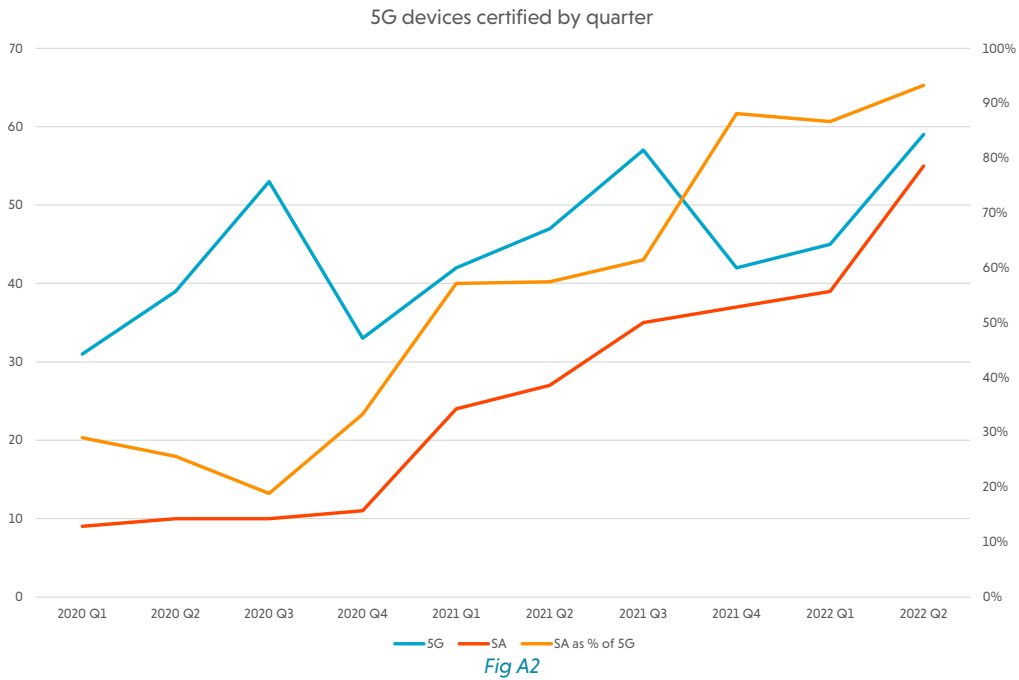
There were six 5G devices that support mmWave in Q1 2022, which is 9% of the 69 5G devices certified. As a percentage, this is about the same as the 10% of 5G devices that supported mmWave in 2021 (19 out of 189 5G devices), but the numbers of devices are too small to reliably draw any inferences about any trend here.

16.4: Update on other Activities

GCF started the introduction work items for support of connectivity option 4 5G NE-DC (NR – E-UTRA Dual Connectivity) in Q2 2022 with the target to activate certification in Q4 2022.

Working with TCCA and its members, GCF expects to launch certification of the 3GPP Mission Critical Services in late 2022.

During 2022, GCF is expected to retain the measures put in place to address the effects of the Covid-19 pandemic. However, it is expected that physical meetings of the forum will start again in Q4 2022. GCF will have a physical presence at industry events in the second half of 2022.

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