Individual Report

LTE-5G Qualcomm SnapdragonX55 5G modem

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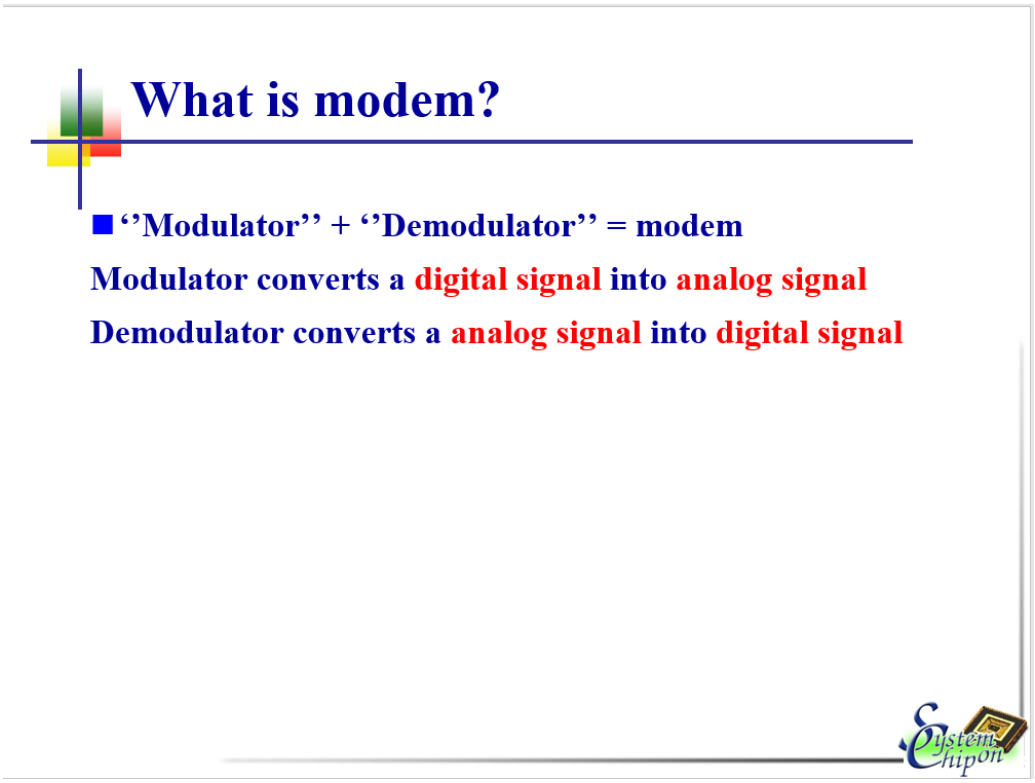
- Outline
  - Introduction
  - 5G Mode
  - Technology Analysis
  - Comparison
  - Conclusion
  - Reference

1. Introduction

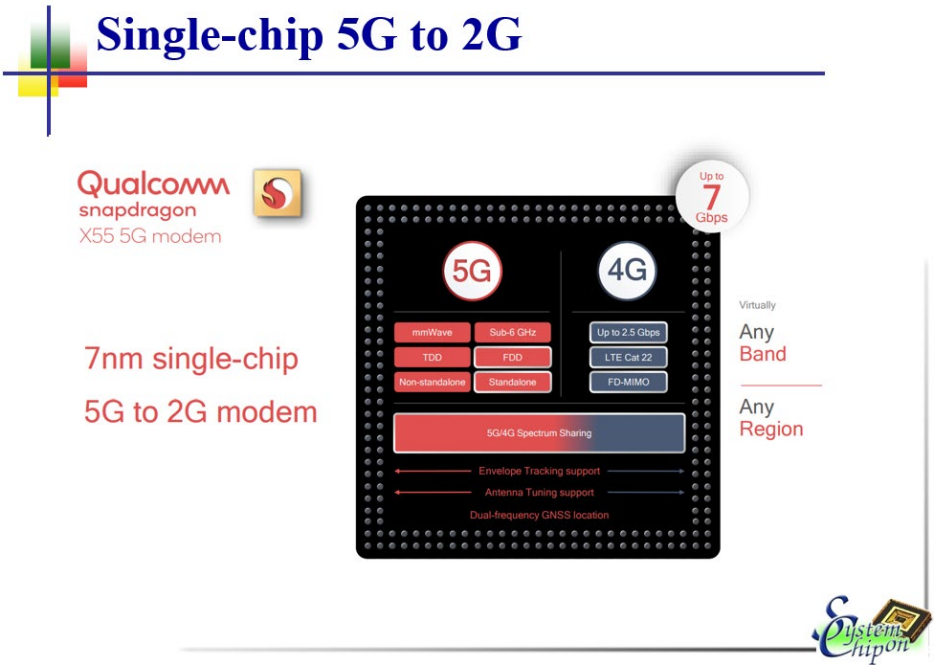


This part is a brief introduction of what is a modem so that everyone can have a better understanding of this chip. Modem is composed of Modulator and Demodulator, and Modulator is to convert the signal from digital to analog, and Demodulator is to restore the signal from analog to digital signal.

The Snapdragon X55 is one of Qualcomm's comprehensive 5G solutions, and the 5G solution includes a modem (baseband), RF IC, and RF front-end.

This solution provides a complete communication experience for people using 5G, and also provides an optimal option for the conversion point from 4G to 5G.

The reason is that Snapdragon X55 supports both mmWave and sub-6GHz spectrum, and also supports various communication modes of 5G.



According to the 5G comprehensive solution I mentioned earlier, this picture can explain why Snapdragon X55 can be part of the solution.

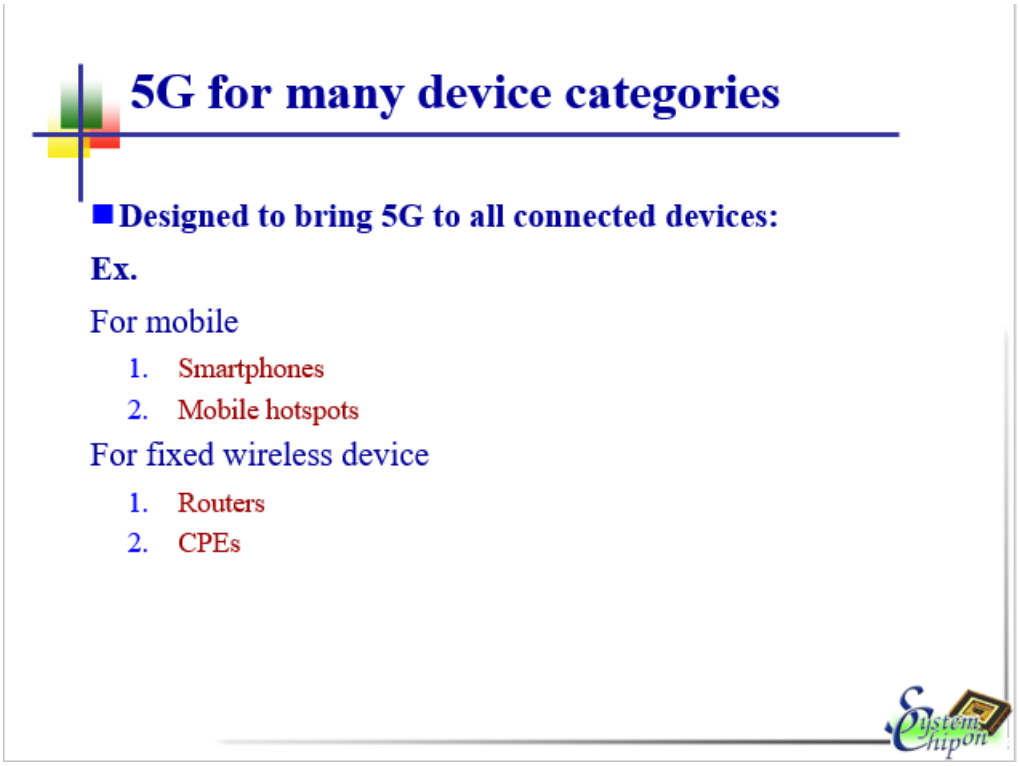
Snapdragon X55 supports various modes of 5G communication, the spectrum including sub-6GHz and mmWave, the multiplexing technology supports FDD and TDD, and 5G architecture supports the SA and NSA, this chip has already covered all types of the 5G communication.

For 4G communication, Snapdragon X55 supports the LTE Cat 22, FD-MIMO, and the download speed can reach to 2.5Gbps.

In order to increase the spectrum efficiency, this chip also supports 5G/4G spectrum sharing technology.

The snapdragon X55 can significantly improve network efficiency and

capacity, mainly due to FD-MIMO technology and 5G/4G spectrum sharing technology.

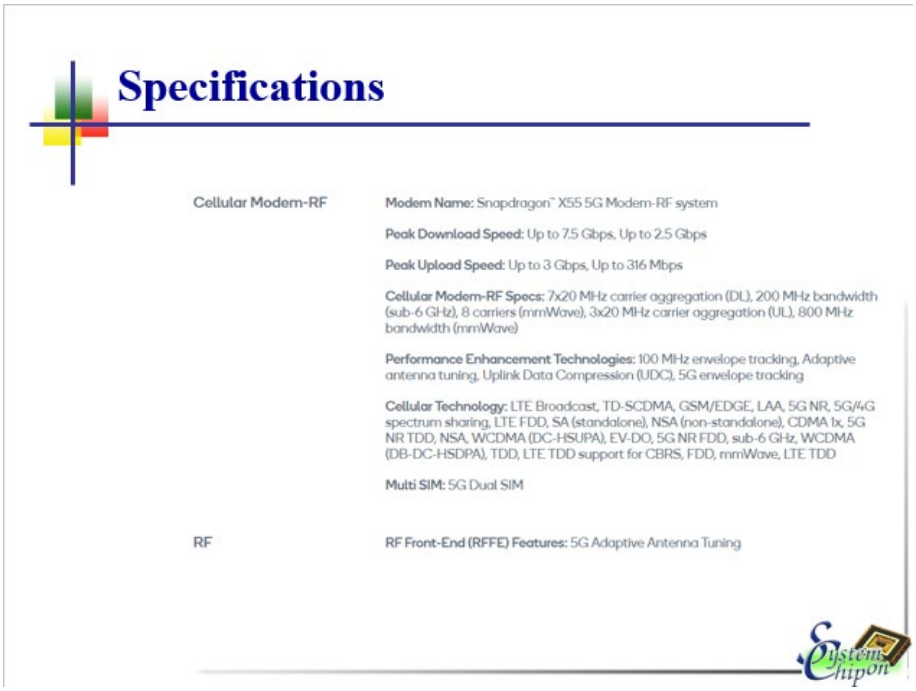


In addition to supporting multiple modes of 5G communication, this chip supports. It also suitable for a variety of devices.

For mobile, it can be used on the smartphones and mobile hotspots.

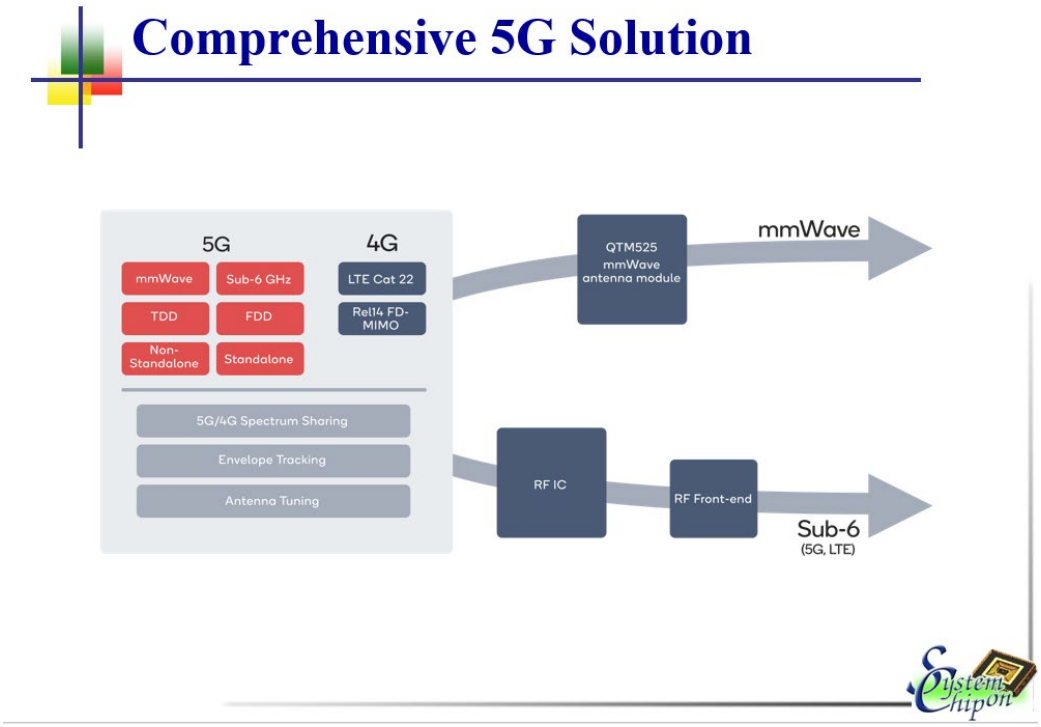
For fixed wireless device, it can be used on the routers and CPEs.

Because of this feature, the Snapdragon X55 can bring 5G communications to not just smartphones.



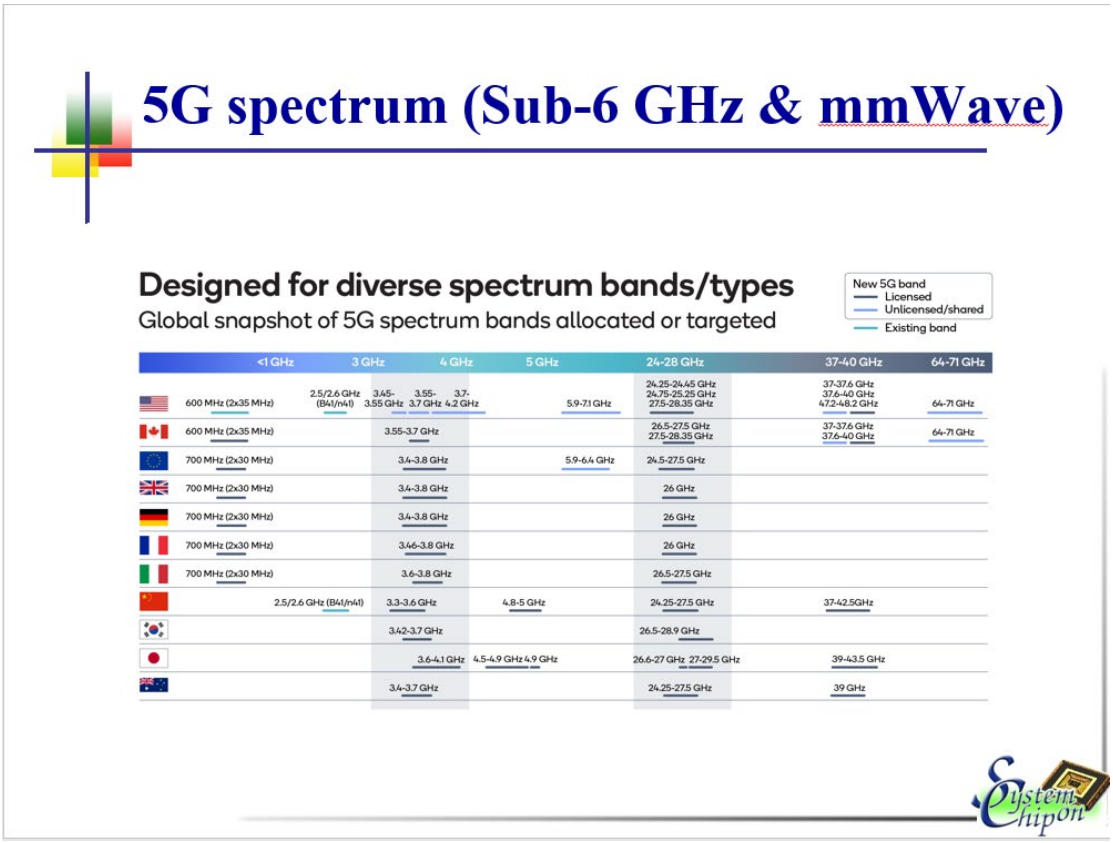
This is the specification of Snapdragon X55. We can find that its download speed can reach 7.5Gbps when using the 5G communication, and the download speed can reach 2.5Gbps when using 4G-LTE communication. The upload speed of 5G communication can also reach 3Gbps.

There are also some technical supports that deserve our attention. In cellular modem-RF specs, there is 7x20MHz carrier aggregation which enables users to use larger bandwidth transfers. In performance enhancement technologies, there are several important technologies, such as 100MHz envelope tracking and adaptive antenna tuning. As for cellular technology, there is what I mentioned earlier like TDD, FDD, SA, NSA….



This is the flow of the 5G comprehensive solution launched by Qualcomm. The process is divided into two parts: mmWave and sub-6GHz. In the mmWave, there is a QTM525 mmWave antenna module to assist. On the other hand, the reception and transmission in the sub-6Ghz band is assisted by RF IC and RF-front end.

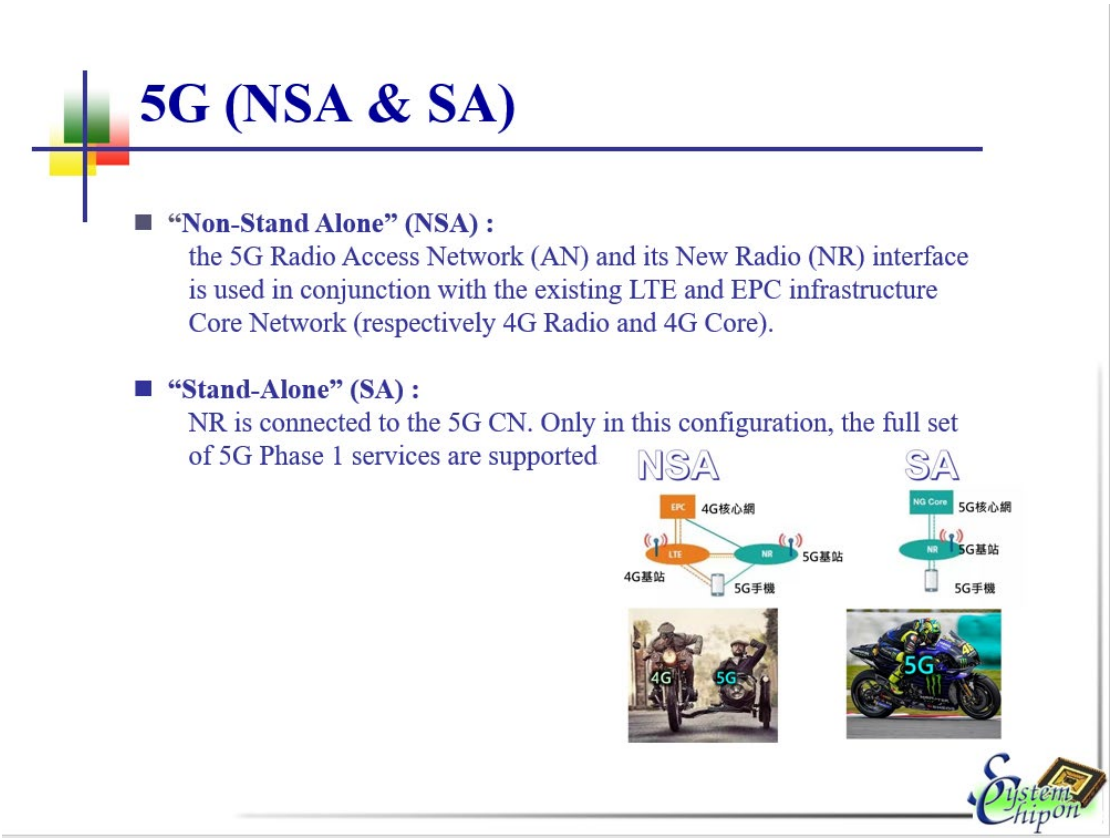
2. 5G mode



Next, I will introduce the 5G frequency bands and deployment modes supported by Snapdragon X55.

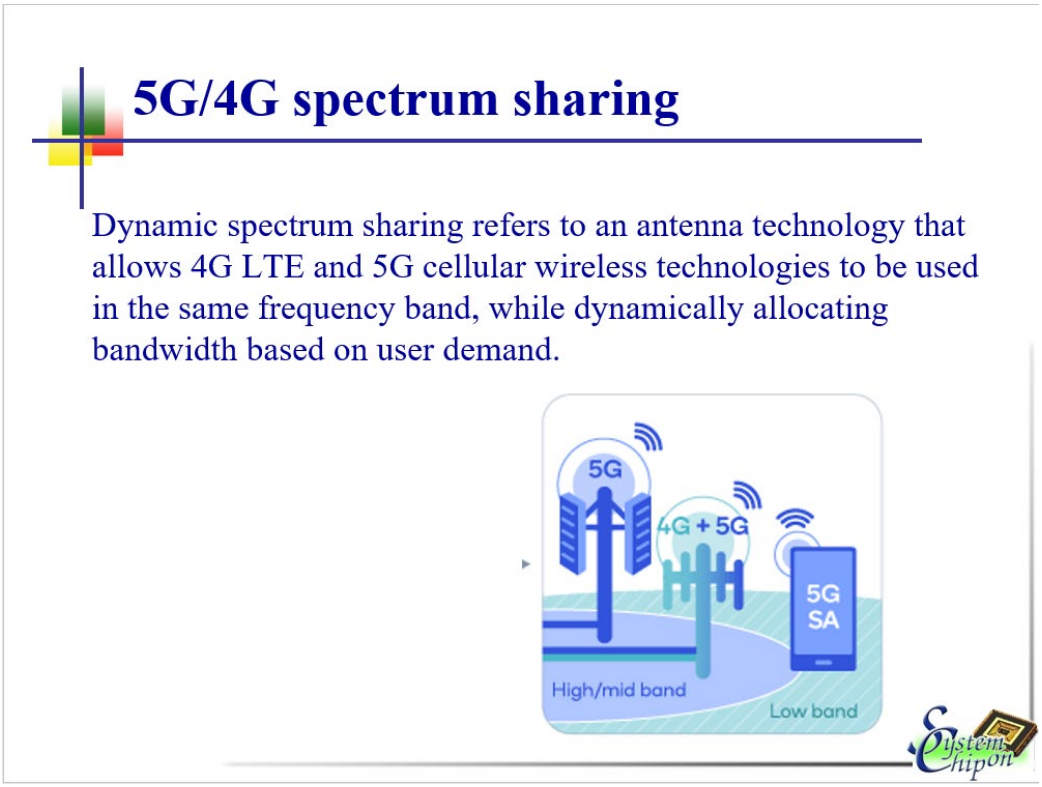
From the allocated 5G spectrum, the current global 5G deployment is divided into two camps: Sub-6G and mmWave. The camp represented by Chinese and European operators mainly adopts Sub-6GHz, the 3.5GHz industry chain is relatively mature, the development progress is relatively fast, the frequency is lower, more economical, the required base station density is lower, and the expenditure is relatively small. The current deployment plan of US operators is mainly focused on the

24GHz-28GHz millimeter wave end, and the large bandwidth in the millimeter wave band can support higher uplink and downlink rates, but the density of required base stations is larger, which puts certain pressure on expenditure.



There are two ways to deploy 5G, one is Non-Stand-Alone (NSA) and the other is Stand-Alone (SA). NSA refers to the deployment of 5G networks using existing 4G infrastructure. The 5G bearer based on the NSA architecture only carries user data, and the control signaling is still transmitted over the 4G network. SA refers to the new 5G network, including base stations, backhaul links and core networks. In other words, SA is building a 5G network from zero. It is conceivable that SA is more in line with the conceptual architecture of 5G networks, and NSA is a network built by using existing construction. And the reason for splitting into two different networks is money. Because 5G uses a new

networking architecture, and the infrastructure requirements of 5G are more than the previous generation of wireless communication networks, the NSA is available under the trade-off between money and 5G deployment.



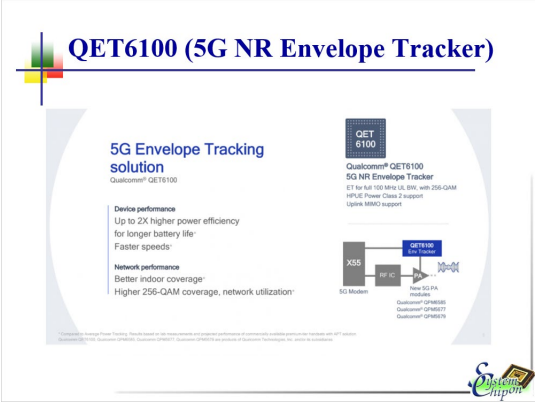
Dynamic spectrum sharing is an antenna technology method that allows 4G and 5G to use the same frequency band. Why 'Dynamic Spectrum Sharing' is attractive? For mobile telecom operators, when 5G users exceed the 5G coverage area, their 5G terminals can continue to run 5G services in the lower frequency band 4G environment through DSS technology, which is the advantage of enabling DSS technology. At the same time, this technology enables telecom companies to build 5G at a relatively low cost, accelerating the realization of 5G coverage across the country. In addition, the aforementioned approach also makes up for the lack of indoor coverage in the initial stage of 5G commercial use to a certain extent. Because Snapdragon X55 supports

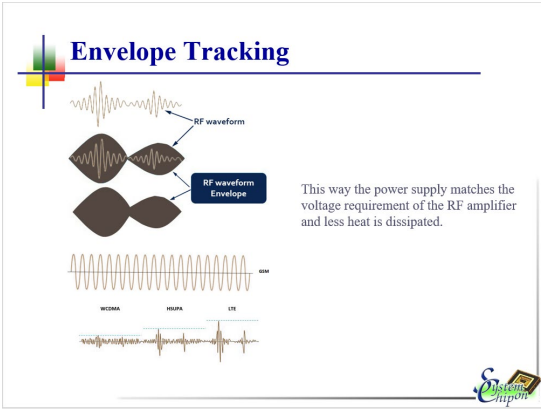
DSS technology, it can be said that the device using this chip can be said to be unfavorable in 5G communication, which makes up for the shortcoming that millimeter waves are easily shielded.

3. Technology analysis

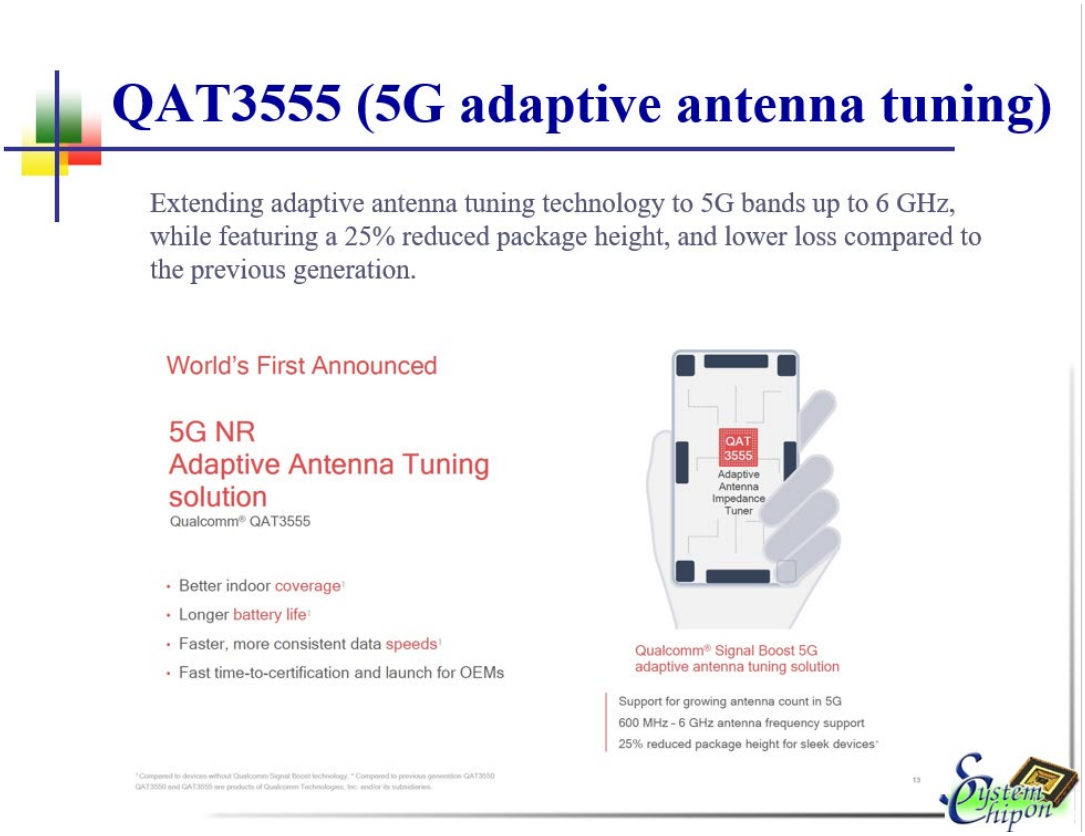
This part is to introduce the technology in the flow of the 5G solution. First of all, I want to introduce the QTM525 5G millimeter wave antenna module. This module is based on the innovation of Qualcomm Technologies' first mmWave antenna module. Considering the occlusion of the user's hand and the coverage of the millimeter wave, at least two millimeter wave arrays are required, so the millimeter wave antenna module must be reduced in size. For the purpose, QTM525 reduced the size in height, and Qualcomm claims this antenna module can fit into an 8mm-thick smartphone. Moreover, compared with the previous

generation of products, QTM525 first supports a wider range of millimeter wave frequency bands. On the basis of the original support for 28GHz and 39GHz, 26GHz support is added again.





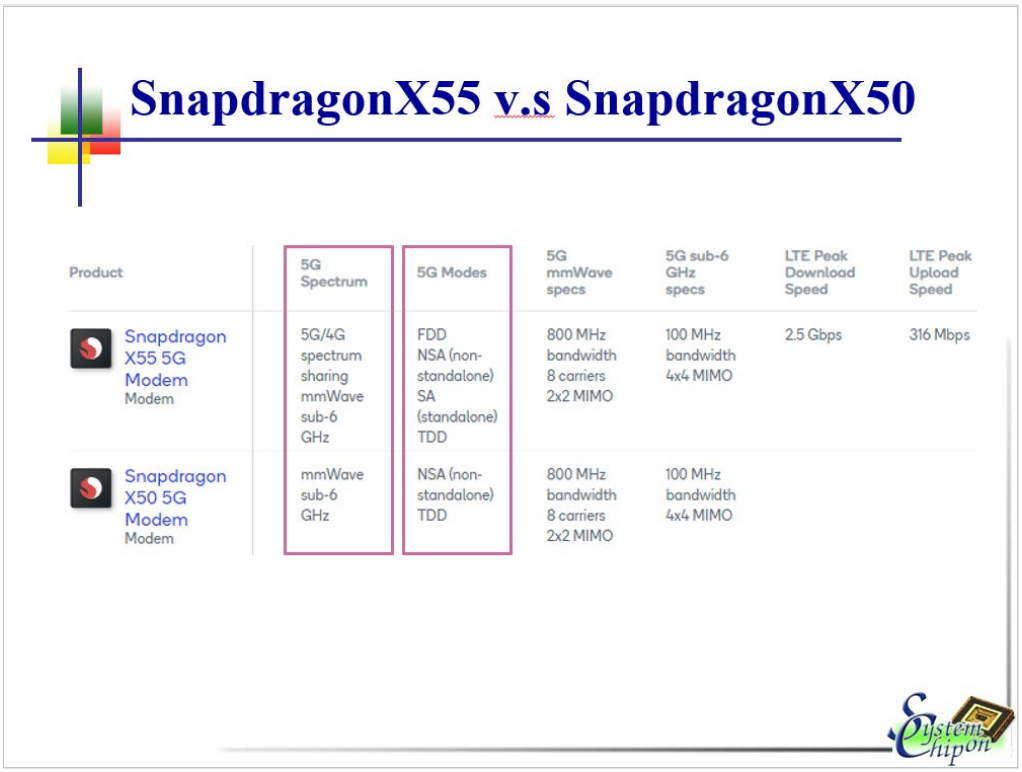
Next is the technology belonging to the RF front-end. The first thing to introduce is the QET6100-5G NR envelope tracker as well as a family of integrated 5G/4G power amplifier (PA) and diversity modules. The QET6100 extends envelope tracking technology to the wide 100 MHz uplink bandwidth and 256-QAM modulation needed for 5G NR. This technique can achieve up to 2X higher the power efficiency compared to the alternative average power tracking technology. Due to the improvement of power efficiency, the power consumption can also be effectively reduced, enabling faster devices with long battery life, as well as improvement the indoor coverage and capacity.



To help OEMs address the growing number of antennas and frequency range support required in mobile devices. Qualcomm launched the QAT3555 adaptive antenna tuning solution. The QAT3555 extends adaptive antenna tuning technology to 5G bands up to 6 GHz, while featuring a 25 percent reduced package height, and lower loss compared to the previous generation. The benefits it brings are also better indoor coverage, longer battery life, and faster data speeds.

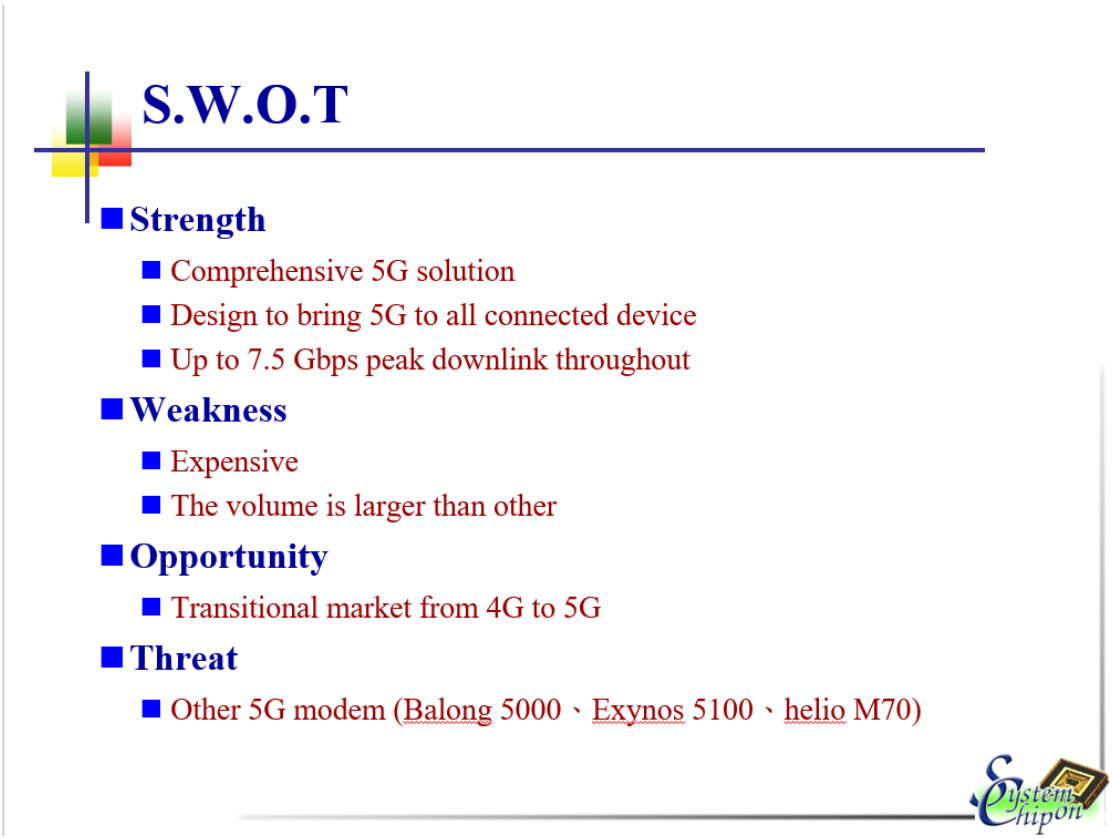
4. Comparison

Here is a comparison between Snapdragon X55 and Hisilicon Balong 5000. From the comparison chart, it can be seen that due to the use of TSMC's 7nm FinFET technology, comparing to the balong 5000 which only uses 10nm technology, the number of transistors in Snapdragon X55 can be 2.6 times greater than that of Balong 5000, and the chip size is also smaller than that of Balong 5000. From the perspective of the supported 5G spectrum, the Snapdragon X55 supports mmWave and sub-6GHz, while the Balong 5000 only supports sub-6GHz. From this part, it can be seen that the Snapdragon X55 was quite outstanding in terms of manufacturing process and support in the 5G chip at that time.



This part is to compare with the previous generation Snapdragon X50, here I mainly focus on 5G spectrum and 5G modes. From the 5G spectrum supported by the two chips, it can be found that the X55 has an additional mmWave frequency band compared to the previous generation. In addition, the X55 also supports 4G/5G spectrum sharing. This upgrade allows all devices using the X55 chip to have sufficient bandwidth for 5G communications. From the comparison of 5G modes, X55 has more FDD and SA modes than the previous generation. It can be seen that Qualcomm has launched many 5G communication modes in this upgrade, so that the increasing number of 5G users can communicate more smoothly.

5. Conclusion



Conclusion I did a S.W.O.T analysis. First of all, I think the strength of the snapdragon X55 lies in its combination with other technologies introduced by Qualcomm to form a comprehensive 5G solution to achieve the most complete 5G communication, and make other devices can also be applied to this communication chip. Moreover, the download speed can be as high as 7Gbps, which was considered outstanding among the 5G chips at the time.

As for Weakness, I think it is expensive and it needs to occupy a large area of the phone to use this chip. The reason is that this chip is not

integrated with the CPU into a SoC, so if you want to use this chip, you need to buy another CPU, and this design will take up more area than a SoC.

At opportunity I think this chip can have a place in the 4G transition to 5G market. Now that the 5G communication infrastructure is not enough, chips that can support both NSA and SA networking technologies are absolutely needed at present.

Finally, the threat I think is the 5G chips that were released in the same period, including Balong 5000, Samsung's Exynos 5100, and MediaTek's helio M70. Although Qualcomm is the best performer among them, this chip is relatively late. Therefore, the process used is also relatively good. Of these chips, only MediaTek and Qualcomm are 7nm FinFETs, and the others are all 10nm processes.

Finally, the threat I think is the 5G chips that were released in the same period, including Balong 5000, Samsung's Exynos 5100, and MediaTek's helio M70. Although Qualcomm is the best performer among them, X55 is relatively late. Therefore, the process used is relatively good. Of these chips, only MediaTek and Qualcomm are 7nm FinFETs, and the others are all 10nm. If you compare it with the helio M70, the performance of

the snapdragon is still relatively good, but the helio M70 is The modem and CPU are integrated together, so I think this packaging method will be a trend.

6. Reference

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