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QUALCOMM, Inc. (QCOM)

Investor Day

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MANAGEMENT DISCUSSION SECTION

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Please welcome, Vice President-Investor Relations, Mauricio Lopez-Hodoyan.

Mauricio Lopez-Hodoyan

Vice President, Investor Relations, QUALCOMM, Inc.

Good morning, everyone, and welcome to Qualcomm's 2021 Investor Day. It's great to be back in New York and to see everyone in person. Before we start, I'd like to thank the multiple teams that worked on today's program and our executives for their commitment to investor communications.

And now, for some housekeeping. We'll make forward-looking statements in today's program regarding our business and financial expectations and other future events. I would like to refer you to our SEC filings for a description of our businesses and associated risks and other important factors, which could cause actual results to differ materially from those in the forward-looking statements.

Today's agenda includes presentations by Cristiano Amon; Jim Thompson; and Akash Palkhiwala. And then, we'll have Alex Rogers join the question-and-answer session.

And with that, please join me in welcoming Qualcomm's President and Chief Executive Officer, Cristiano Amon.

Cristiano R. Amon

President, Chief Executive Officer & Director, QUALCOMM, Inc.

Good morning, everyone. Thank you very much for being here. Actually, we're super excited you all came in person; full house. So, this make the day even more special.

Before we start, I just want to say big thank you to team Qualcomm that made this happen. This has been a big team effort because we have a lot to tell you. This is the time of Qualcomm right now, and we are going to have a lot of information to give you. We promised to make it all make sense. But the key message you're going to see is we're truly diversifying. There's so many new end markets for the company right now, and the market is really moving towards our technology.

Before I start, I want to highlight a few things. Here's what you're going to see today. Number one, demand for technologies continue to accelerate. We are now diversified across many large addressable markets. The time for Qualcomm is now. We have one technology road map that we're very proud of, and that extends across every single growth opportunity we have, which we can leverage. We will have focused execution, as you have seen for the past few quarters, and financial discipline. And that is going to drive our company with strong operating cash flow and consistent capital return to our shareholders. Today, we cover our vision, our strategy, our incredible technology position, and our financials.

So, with that, I would like to start the presentation and I want to show you that we'll always be the company defining the pace of innovation in mobile. You know us from mobile. But we're no longer defined by a single end-market and a single customer relationship. While we'll always going to be the company focused in driving

innovation in mobile, there's more to Qualcomm. It is really an opportunity to connect everything that is supported by the [ph] cloud company (00:03:42) in what we call the connected intelligent edge. It's about billions of devices they are becoming smarter, they're becoming connected, they have efficient processing, and they're enabling the [ph] cloud company (00:03:55).

And that is no different than the vision we had for 5G. While this is not enabled by 5G alone, it is clearly how we design 5G to make sure it's the technology that connects everything to the cloud 100% of the time. We are the company that will power the connected intelligent edge. And this is what we would like to demonstrate that to you and help you understand what are the opportunities we have ahead.

So, it's company is really focused on this vision, enabling a world when everyone and everything is intelligent connected. And that's actually supported by data. Just want to highlight, there are a number of industry predictions out there. 64% of the data will be created outside the traditional data center, and more data at the edge will require local intelligent processing. And this is what we can do.

So, before we get to the presentation today, I know it's a busy slide, but I promise there's nothing in here that I believe you're going to disagree with me. When we look of the situation today, we see an incredible number of changes in the industry that are driving the need for technology. So, those industry trends, I'm not going to be able to cover them all, but is really been putting Qualcomm at the intersection in creating demand for technology virtually across every industry.

Accelerated digital transformation, that is happening at every enterprise. It got accelerated by the pandemic, but is not pandemic related. It's about increasing the percentage of digital in the economy. Every single company is going to the process of becoming digital, accelerating digital transformation.

Working from anywhere. Working from anywhere is changing computing. It's accelerating the connection between physical and digital spaces. It's changing home broadband. It's changing IoT at the home and at the enterprise.

Convergence of mobile and PC is real. This is an area of incredible excitement for Qualcomm. And at the end of the day, connectivity, advanced, efficient processing in AI is really gaining scale at the edge. The metaverse and different versions of what is going to be the connection between digital and physical is going to enable the next computing platform. In the automotive industry, it's going through an incredible pace of change where the car companies are becoming tech companies. And we are well-positioned at the intersection of all these trends.

So, when [ph] one look of that (00:07:01), it create opportunities for Qualcomm across many end markets. Automotive, which we will talk more about it, and I would like to point that some of you may have not seen, please look at the press release we issued this morning. It's very meaningful. Qualcomm has just been awarded the ADAS by BMW, and we're going to talk about that during the presentation. Huge opportunity in automotive and opportunity in the consumer, the industrial, enterprise, in edge networking within IoT. That's what we're going to spend most of the time during the day today identifying how big those opportunities are for Qualcomm and our strategy to make that a reality.

And what is unique about our model is that we have one technology road map that is scaled to address all growth vectors. And the reason is because mobile is winning. Our mobile heritage and DNA put us in incredible position to provide high-performance, low-power computing on device, intelligent, everything wireless, and the leadership across not only AI processing connectivity by camera, graphics, and sensors, we'll scale to support every single device at the edge from [ph] earbuds (00:08:38) all the way to connected intelligent vehicles. And that has been true as we look of the performance of the business as the diversification starts to gain scale. It's accretive to

margins. It's changing the operating margin profile of our semiconductor business. But we're just at the beginning of this incredible opportunity.

And the next slide is actually the most important slide. If there is one thing I would like you to take away from today's presentation and our vision for the future is we have an incredible opportunity to grow. I wanted to look at this, and I'll give you a notion of the past, the present, and the future. You're familiar looking at our business about MSMs. We don't have the metric anymore. MSMs, MDMs or what some would call the thin modem, and licensing, and we have done well within that addressable market.

Today, our technology is driving premium and high-tier Android. We have an incredible opportunity for growth as a result of a changing OEM landscape. RF front-end, it's one of the biggest success stories of a new entrant in RF front-end space. Automotive and the broad IoT, that creates $100 billion addressable market opportunity for Qualcomm. And as we look at every single end market that we are powering, and we're just at the beginning of that transition, with the full dimension of [ph] the (00:10:28) connected intelligent edge, we see the opportunity to address a $700 billion addressable market in the next decade. That's one of the single expansion and create really secular growth opportunities. That's why this company can no longer be defined by a single market and a single end customer. And that's the most exciting part of where Qualcomm is going and how we think about the future of this company.

I also wanted to highlight one other thing. And hopefully, this will come clear to you in this presentation. There is belief in the market today in the cloud growth. I think it's undisputed. You just look at the valuation of some of the hyperscalers cloud providers, and there's this belief that the cloud will continue to grow exponentially. Just if you look at the CapEx projections, 35% year-over-year growth. If you believe in the growth of the cloud, you believe in the Qualcomm growth plan because for the cloud to generate all of these data, you need billions of devices to be connected, to be intelligent, to have contextual information, and AI will get scale at the edge. We're very aligned, and you're going to see that through this presentation where the pace of digital transformation and cloud economy.

And with that, I would like to summarize it. We're truly at the beginning of one of the largest opportunities in our history. The industry trends are creating new vectors of growth for Qualcomm. And we're seeing demand for technology virtually across every industry. We have one technology road map that is highly leveraged, is designed to scale, and is driving earnings expansion for our business. And we're focused on customers and end markets to drive stable, long-term revenues. This is an example of expanding our TAM and diversification while increasing margins and shareholder returns. And at the end of the day, in an intelligent connected edge, virtually all roads virtually was put in for legal purposes. Virtually all roads leads to Qualcomm. So, we're very excited about our future, and we have a lot to share with today. I want to promise, this is all going to make sense.

So, now what I would like to do is to invite on stage it's our CTO, but he's my friend. I have been working side by side with Jim for almost two decades. And Jim is responsible for what's the best part of Qualcomm, which is our technology road map, and he's going to tell you about it.

So, please welcome to the stage, Dr. Jim Thompson, our CTO.

James H. Thompson

Chief Technology Officer, QUALCOMM, Inc.

So thank you. So, I'd been at Qualcomm for 30 years. I started when I was a youngster, and I started out on the CDMA project – I'm sure a lot of you are aware of what that is – ended up in QCT over 20 years ago and have been the Head of Engineering for that for the better part of that 20 years. And so, I've seen a lot of basically all of

the technology development within Qualcomm. So, my career path kind of follows almost everything that we're talking about today. So, I've been really lucky in that respect.

I think that our technology road map is really pretty spectacular, and it's been developed over a couple of decades really from mobile. And just going back, you look at Qualcomm, when I started we were a mobile company. And starting with CDMA, that was about voice, but then we went to something called EV-DO, which was about mobile internet.

And so, we're very – our vision was really about the mobile internet. And at the time, this is going back 20 years, in developing these various technologies, we were looking at or I should say when we were trying to drive the mobile internet, we're looking at, well, what is going to generate use cases that are interesting. So, we're trying to imagine what the smartphone was going to be. And so, and at the time digital cameras were kind of new, so we started working on digital cameras. And at the time, it was simple enough that you could have two people assigned to it and you could do a digital camera. Same thing with graphics, Game Boys, things like that. Video, so we started doing video, audio, MP3 players, things like that.

So, we started getting involved in all of these different things that we thought would drive data and would drive the wireless Internet. Our intention really was or our thoughts were really about modems, but we started doing all these technologies about 20 years ago. And so, we've had this long history of developing them and you end up with a – they're quite complex now. So, we have hundreds and even thousands of people working on some of these technologies at this point.

So, I'm very proud of our technology portfolio, and we do competitive analysis quite often. And, at least in my opinion, there's lots of different ways you can look at these technologies, but I think we have the best portfolio in the world. And I think there's only a handful of companies that can compete with us.

So now, you're looking at our future going forward, and it's about extending that technology road map. Came out of mobile but extending that into the intelligent edge. And I'll give you just some examples of when Cristiano talks about one technology road map, what we really mean by that, and I'll start with automotive.

So, with automotive, there are cameras. There was just the BMW announcement about us winning ADAS, and that involves cameras. So, if you look at a smartphone camera, it's about kind of making, for example, a face look good, a person look good, their hair look good. I mean, that's basically what it's about, and the sky looks very blue and nice. But a car doesn't really care about that so much. I mean, you want to have some good colors, so you can show things on the display. But what you care about is computer vision, and computers don't care about what they look like. It's about identifying a pedestrian very quickly, so that you can make some decisions based on that. So, computer vision for a camera is very different than what you would do for a smartphone.

Other things for auto, supporting multiple OS's. We don't do that in smartphone, but all of our hardware, all of our IP needs, to be able to run multiple operating systems in auto and other areas as well. Maybe talk a little bit about XR, and their graphics plays a very, very big role. And, for example, in – whether it be VR or AR, when you render something with graphics, so you've got this very high-resolution display that you want because you want everything to look super real, so they're lots and lots of pixels, but then you don't want to render every pixel in the resolution that exists on the display. What you want to do is only render those pixels that you're looking at.

So, if you can track using a camera, you can track your eye, what you're looking at, then you only render what's relevant and everything else is in low resolution, and you can just imagine that. But you're looking at me and I'm in high resolution. And then if I pulled my hand out there, your peripheral vision can't really hit – the resolution of my

hand is probably not as high. It depends on where you're sitting in the room. But that's an example of things that we do in XR. So, we're extending the technology. In that case, it's graphics. We're extending it into capabilities that are relevant to XR.

And then finally, PC. The thing I want to say about PC is that it's actually moving towards the smartphone architecture. So, instead of us extending to it, it's kind of coming towards us. If you look at like operating systems like Windows, for example, now they have the capability of using accelerators. And what I mean by that is that in a smartphone, we put all these accelerators, like video, audio, for example, cameras, that that the operating system understands how to use and you can operate. And it works much more efficiently. Like doing a video codec, for example, in the CPU or the GPU is much less efficient than doing it in hardware. And the modern operating systems are starting to understand that. They're really moving. That's really what smartphones are all about, the smartphone operating systems. And then on top of that, what we've done from – when you think of extending our road map. So, we believe the future of the PC SoCs are going to be a fully integrated SoC. So, I think that that's something really important to understand.

And so, that means you're integrating CPU, GPU, all of these accelerators, connectivity and so forth, that's all being integrated into one thing, one compute platform. And so, for us, what that means is that we need to have a best-in-class CPU. And so, I'm sure you're aware of us acquiring NUVIA. And so, they're designing the next-generation Qualcomm CPU.

And then, of course, graphics. We have the ability to extend our graphics all the way up to kind of gaming class, desktop gaming class graphics. Right now, you've only seen it in the smartphone, but you will see that in the PC as well.

So, I can't talk about all of the technology. We don't have enough time, all the technology we're doing. But I'm going to cover a handful of areas here. But I think one of the key messages throughout this whole presentation is that we have this one technology road map. So, we've taken that mobile road map and we've extended it. And that gives us a lot of advantage when it comes to things like time-to-market or just the cost of doing this IP is very expensive. And the fact that we have this base already gives us a fairly big advantage.

So, I'm going to start with AI, where we are with AI. Okay. So, I'm going to claim, make a claim that the gravity of AI processing is moving towards the edge. So, obviously, cloud is super important for that. But I think it's moving towards the edge now. And maybe, I'll just explain that.

If you look at like how you experience AI today, for the most part, the way you experience it is through your experiences on Google and Amazon and so forth. And really it's – AI is used. They collect data on you and then they essentially market to you whether it's a product or a website or whatever. But that's really the way you experience it today. But as we go through this digital transformation where there are sensors that are basically measuring everything about the world, whether it be a city, a business, your house, whatever, making things more efficient, that's generating an incredible amount of data. And you look at like, for example, the most prolific sensor would be video. That's obvious one that easy to understand. And so, you're generating all these data and you just cannot send the amount of data that is being generated all back to the cloud. So, that's number one. Just can't do it.

And so, some of that has to be processed on the edge. And then on top of that, there are other reasons like, for example, privacy, reliability, all these things that you probably think about when you think of AI that – so, there's many, many reasons why you want to keep that data. Whoever is generating that data will want to keep that and process it on the edge of the network versus going into the cloud.

And I want to give you an example of that. So, this is just an example. I think it's very intuitive example and it kind of goes with our ADAS announcement this morning. So, we have a number of different, not just BMW, but other ADAS customers. And if you look at the kind of data that is generated in the car, it's about – between our customers' range from about 5 gigabits per second to 15 gigabits per second. That is a lot of data generated, okay? You can't possibly send all that back. Imagine, every single car in the road sending that data back, not possible.

Okay. So, there's other reasons, too. You don't want to wait, the time that it would take to send all the data back to the cloud. The cloud might be 100 milliseconds away and then it has to come back and you end up – you could have moved 20, 30 feet in that kind of timeframe, and you can't afford that kind of lag and reliability. So, that just gives you an idea of why that processing has to be done on the edge.

And one of the things I want to make clear though is that I'm not saying that there's no more cloud computing or whatever or AI in the cloud. That's not the case at all. It's just what I mean by that is that in a system design, there's going to be a lot of it that should be processed on the edge. And there's going to be also a lot that needs to be processed in the cloud. But the point here is that there are certain things that must be done on the edge of the network, and that's what we're focused on.

Okay. So, we've been working on AI for about 10 years, more than 10 years. Initially, it was a research topic for us, and then it started to move into all of our technology. So, if you think a lot of our technologies are signal processing-based and this signal processing-based technologies can be enhanced by AI. I mean, cameras are a great example of that. And so, it's really pervasive. It's affected almost everything that we do. We're also developing – and this is pretty, I would say, a big spend for us right now or a big increase in spend for us right now – is on the platform itself. And so, when I say platform, it's what our customers use to develop AI in our products.

Well, why don't I start – this slide talks a little bit about the base of that platform and how good the hardware is. So, what you see, the chart on the left, is performance versus power, so performance on the vertical, so high is good. And it shows us this is for smartphones compared to our next best competitor. And so, you can see that from – this – again, this is a public benchmark that's run. So, we're about twice the performance and about half the power. And so, that's really our focus. It's about making our accelerators for AI energy-efficient.

So, we feel really good about the hardware we have. On top of that, we have a pretty good research effort. And I would say that research effort, we write a lot of papers, but our objective really is to capture the results of those papers and tools that our customers can use, and its focus is really energy efficiency. And I won't go through all these examples, just the top example there where by going from floating point computation to integer computation, you can reduce the power consumption dramatically, so over a order of magnitude improvements that you can make. And I want to bring this up because we have a lot of activity here because we think that that is really how you get power efficiency.

So, going to the next node, process node helps, Moore's law helps. But really, where you're going to get orders of magnitude kind of improvement comes from algorithmic improvements and us capturing that in software that we can provide our customers.

So, speaking of software, software actually is the single most or area of highest growth, I would say, from a technology perspective. So, a lot of spend going into software. And on the edge, it's a pretty complex ecosystem, a lot of different customers, a lot of different requirements, a lot of different models that they use, a lot of different

what are called operators, the low-level operations of the hardware that are required. But at the core of it is something we call Snapdragon neural processor SDKs, software developer (sic) [development] (00:27:59) kit. So, that's really the core of it.

And then what we do for our customers is then we provide the ability to plug in, for example, the framework that they like to use like PyTorch or TensorFlow or something like that. So, we have I consider it to be the best hardware, the most scalable hardware going from low to high in terms of performance. And then we have this software developer (sic) [development] (00:28:25) kit that is quite – that basically that's what everyone uses, and it's – spending a lot of money on it and improving it every day.

So, I'm going to move on to camera. So, camera is one that is super easy for everyone to understand. My opinion is we're the best in the world at digital imaging. And there's a lot of ways that you can look at it, measure it. And there are benchmarks like, for example, DXOMARK is a benchmark that is used for measuring camera performance. And basically, kind of the pattern here that you're seeing here is that every year we come out with our premium-tier product, Snapdragon, in mobile. And then every year we have a customer. I mean, it looks like Xiaomi is typical, Xiaomi, OPPO. But we work with a particular customer and we come out with the best camera in the world. So, we have that capability.

And then really it comes down to, from a customer perspective, do they choose to – how much effort are they willing to put into it, and we work with them very closely at getting the best results from the camera. And by the way, this isn't just image quality that's part of it, but it's also video quality. There's a lot of different features, aspects to this benchmark.

So, I want to go to now a video, and if we could run that video, that would be good. There we go. Okay. So this is an example of a video that was taken with Snapdragon. It's an 8K 30-frame-per-second video. We're the only ones in the industry that support that right now. It uses H.265. That's a number. We also – that – it's a standard, but it's – HEVC is another term that's used in the industry, and it gives you about 200 – this is about 240 times compression from the actual data and it is visually lossless.

And then going forward, we have other capabilities like, for example, we'll announce this shortly in two weeks, I believe, but high dynamic range. And so we – what that means is we just essentially support more bits in the pipeline which allows us to get blacker blacks and lighter lights. And so we can make things like this, you look, very realistic looking and you can do even better. So it just continues to improve.

Not only that, but just even from a compression point of view, we're leading the standard, a standard called the H.266. And it's called VVC and that'll reduce – it'll increase the compression by about a factor of 2. So this is just an evolving technology and it keeps moving.

What – let's – oh, there we go. Okay. So, just talking about cameras and how AI intersects with cameras, so the – I pulled out this one example. It's very simple example, and the kind of the point I want to make is that it's not all going to be AI but AI can make your camera much better. So, there's a lot of conventional signal processing that you do. But look at the picture up top, and what we can do is you take that picture and then the phone or your device can look at that picture and determine what's what.

For example, what is the sky and then what is the face, what is the hair? And, for example, with the sky, you like it to be blue, right? So we can make that blue or make it bluer than it is. You like the little definition in the clouds, you like the skin to be smooth but you like, for example, the buildings in the background to be sharp. And those – that's all very different processing that you do, but it allows us, by doing what's called semantic segmentation, we

can we can determine what is what and we could process everything differently in that picture to make it look the best.

So, that – that's an example of an AI feature that you're – that it – will become very prevalent in smartphones. On the left there, I guess that was running before, I didn't watch it, but this is just a night shot. So, with the night shot video, this – I guess this was a video. Did it – was it running before? I don't know if you had a chance to see it, but anyways, so you can see on the left is the improved and on the right is the original. And so on the left, what we do is we take multiple frames and we can blend them together to get better signal to noise.

And then on top of that, we run – we have an AI algorithm that we run that you can eliminate things that are artifacts because you – just like you know when something doesn't look right, AI can know when something doesn't look right. Also, like just colors, like with green, for example, you know that the tree should be green. So, AI knows that, too, and so you can make changes to the video on the fly and just make it look a lot better. So that's just examples of how we use AI.

So this is about extending our road map, so with camera. You look on the left, and this is about computer vision, so the computer vision portion of our camera. For auto, for ADAS, we needed to do something that – what's called dense optical flow. And that – that's kind of confusing, but what it means is that you track the motion of every pixel. So on a pixel by pixel basis, you track that motion.

So you've got these motion vectors associated with every single pixel, and that – for – why you want that in automotive is so that you can very quickly see a pedestrian, for example, and you can identify it. So you're not tracking an object, you're tracking pixels so you can identify things superfast. And then that, in turn, then can go back into our other – for other like, for example, for XR or – so that feature is not just for automotive. It flows back into our road map for everything else.

Other obvious one is in automotive, the camera can be looking straight into the sun but you still have to see that pedestrian on the side, so you can't have it just wash out your camera. So supporting very high dynamic range is another example, and again, it's just an extension of our existing road map. If you look on the left – or the right, sorry, for XR, I mentioned foveated rendering and eye tracking. If you can see, that only the things that we're looking at are in high resolution and when we move out of high resolution, you can't see it so well. So – and then that just allows us to reduce the processing that we need to do in the graphics.

And then on the far right, that's just an example of a camera understanding what the room is. So mapping the room, and then also understanding what's a surface, what's a wall. And in this case, it's being used for a game, but that general concept is used over and over and over again in – for our products.

Okay. So, moving on to graphics, okay. So we've been shipping graphics for about 10 years. And if you look at our mobile graphics, we're the best in terms of power performance. So we'll have – and I think that's really a key thing, especially as we move into this – the PC era where we scale our graphics up. Being power efficient and doing an integrated SoC, that's super important.

But let me go to the – this chart, and this chart just shows the sustained performance of our graphics. And that's really what's important because, for example, graphics is most heavily used with – for gaming. And so in gaming, you don't play for one minute, you play for – I guess I don't play, but kid – probably not many people in this room play, but kids definitely play and it's 10 minutes, 20 minutes or more, and so it's really about sustained performance.

And so when you get a benchmark like our – this is our nearest mobile competitor, you'll get a benchmark that's really high. But that benchmark doesn't mean anything. The benchmark only means something if you run it over and over and over again, and that's what this chart is. And so – and our graphics also scales. So it scales from supporting milliwatt kind of range, a watch, a smartwatch, so tiny little display. And then it will scale, like I said, to automotive which has some compute requirements that use the – our GPU, but then also to PCs. So I just want to make it clear that our graphics will scale up to desktop-class gaming capabilities. So that architecture allows us to do that.

Okay. I'll move on to processing. And really, I just got one slide here and this is about the purchase of NUVIA. And what – they're working on our next-generation ARM CPU. And you think about that as – that – they – and they're pretty far along at this point and we'll sample a product at – I – let's say nine months from now or something like that. I can't remember the exact date. But anyways, so we're pretty far along with the – with that development, and our objective is to have the highest performing low-power CPU in the industry.

And if you think about our overall product road map or our, I'm sorry, technology road map, that was the one weakness that I felt that we had for quite a while, and then by acquiring NUVIA, we filled in that weakness. I'll go on to the next. So, connectivity, so start with just all of the connectivity technologies that we have. I consider us to be leaders in all of them. We're leaders not just in products but also in standards.

So – and I wish I had more time, but I see I'm running a little bit long, so I'm going to go right into 5G. Okay. So the basis for 5G today is Release 15, and Release 15 was designed to be very flexible. Think of it as being forward compatible, so – because the whole point of 5G was to be able to have this, call it, platform that allows us to build all sorts of capabilities on top of it. So, the next Release that's coming out is Release 16. So Release 16, our – the first device that will come out will be in December, so it's maybe a month away.

And so most of the devices, pretty much all the devices that are coming from Qualcomm that are using Qualcomm chips will be Release 16 next year. And then Release 17, the standards are almost done, so it's pretty much baked. And that will be about two years from now. So, that'll be in 2023 – end of 2023, you'll see Release 17 come out.

And if you look at what's in Release 16 and 17, there's a lot of features associated with smartphone. So, a lot of coverage enhancements; mobility enhancements; capacity enhancements; band aggregation to provide, for example, aggregating millimeter wave and sub-6 bands together to improve the, call it, the coverage of millimeter wave, for example. So, there's lots and lots of features associated with smartphone in Release 16 and 17. And so if you are a competitor to Qualcomm, you better keep up with that road map. So, very, very kind of complicated, dense road map.

There's also a lot of new device types that are coming that are being supported in Release 16 and 17. So just quick examples of that would be like C-V2Xs, so I should say cellular vehicle-to-vehicle, vehicle-to-pedestrian, vehicle-to-infrastructure, and so supporting that industry. There's also like, for example, I would call – wireless Ethernet is another example, so very high-throughput, low-latency, high-reliability kind of communications.

So, those are just some quick examples. And then finally, Release 18 and beyond, that's what we call 5G advanced. And that's where you're going to see like, for example, a bunch of features come out for extended reality, augmented reality. So, it's a little different requirements than what you would use in a phone. And then a lot of AI capability is going to be introduced at that point.

There's a lot of talk about the industry where 6G is AI. Well, in reality, 5G is, too, and it was built that way, to be flexible. And so you're going to see capabilities that come in like the – we'll be introducing – that we'll, for example, improve the capacity by 60% by just using some AI capability in determining the channel, of what I'll call the channel conditions to the various users in a sector.

So, lots of interesting stuff coming. And maybe just to talk a little bit about our capability, so we are a company that supports the entire world, and I think that makes us unusual. When I say the entire world, the world is not all – 5G is not the same everywhere, 4G is not the same everywhere. There are all these different band combinations that you have to support, they're different everywhere in the world.

So, like, for example, there are about 10,000 different band combinations that we have to design for. So very – so it's pretty complicated if you're doing that. And then there's also 180, I believe that's how many we've – that have launched 5G at this point. But everybody's got little bit different bands, they've got different infrastructure providers, their feature sets are different. So there's a lot of idiosyncrasies associated with the bands or the global nature of mobile, and it's something that we do very well.

And then I think it shouldn't be underestimated that we're in our – the value of being in our fourth generation of our 5G baseband. And it's just a lot of complexity. Every single generation that we come out with improves from a throughput point of view, from a feature point of view, and from a power point of view. And, in fact, they're pretty dramatic improvements that you see that we're achieving now and you'll see in the future.

Okay. So we – now, the way we think of modem is not just baseband or baseband and transceiver, but we think of baseband all the way to the antenna. And to start, you need to have best-in-class components, okay. So, like for example, with RF front-end that's the latest, we've been working a lot on that and we're actually super happy with how things are going in RF front-end, but I – it – and the set of components that we have, it's is like PAs, LNAs, switches, filters, pretty complex to kind of go, who is the best? But I would say we are – you compare us across all the different players and we're extremely competitive is the way I would describe it.

But then the advantage that we have is that because we control the whole system from baseband all the way to the antenna, we can optimize, and there are features that we can provide that nobody else can provide. And then those features end up giving us a better performance at the system level, so better thermal performance, better – actually better throughput, better power, all sorts of advantages that we get out of designing it as a system.

And the first thing that I – it's – I want to help you understand or make you believe that we actually, from a component level, we are the best. And so the one area that's really easy to look at, so you can kind of look at our chart and see, is filters. So, we have the most comprehensive filter portfolio, and we released – this was over a year ago, we – and we released something we call ultraSAW, SAW, surface acoustic wave filter.

And it's – pretty much every single one of our customers that – I should say our Android customers use ultraSAW at this point. And it is clearly the winner in terms of performance. You can see the chart. Our next best competitor is below us. So, ultraSAW, very, very successful this past year.

And then we're going to – for frequencies above 3 gigahertz, we're going to a technology called ultraBAW. And that is on the right side. And so BAW is bulk acoustic wave filter. And you can see there on the chart that – that's comparing us to our next best competitor. So, really we – what – that's the area that I'm actually really happy about at this point, that we've closed the gap with that very strong competitor. And it's – you look at the launches, virtually every one of our customers, again, if you look at this coming year, they're going to be launching with ultraBAW. So, very – it's been very successful from a component point of view.

But I'll talk a little bit about system here. But before I do, this is an example with a power amplifier. So, if you look at – one of the things that we've done over the last number of years is we've developed our own transistor. So we have our own epitaxial stack up for that transistor, and that's got us to the point where we're very – one of the best, if not the best, in PA. And again, it's complex, how you measure it, and so – but what we can do is not just have a very competitive PA, but we can have a much better PA because we can tie it in with the system.

One of the things we do is what we call DPD, digital pre-distortion. So we have digital pre-distortion in the baseband with the knowledge of the PA, so we can do a much better job. And then on top of that, we use something called envelope tracking. Because we know exactly the signal that's going out, we can always bias the PA to be at its most efficient point.

And so the – this chart shows 30% advantage, but that advantage can be even higher depending on the modulation rate. So, it's really something that's an advantage that we have that's pretty hard to compete with. So, if you look at smartphone – or, I'm sorry, modem, there's – I mean, obviously, it starts with the smartphone, but there's a lot of other areas, just to give you an idea like, for example, in fixed wireless, fixed wireless is something that is really taking off for us.

And, for example, we support eight antennas, so eight different digital streams. We also support higher power modes. All that's things that were – came out of the standards, and standards that support other types of device types. And so that's a fairly easy extension from our existing design that we have, so it's not super difficult for us to do that. And then on top of it, there's other things I mentioned, wireless Ethernet for – think of the factory of the future where you're getting rid of a lot of the cables.

So, those are examples of things that we do in – for modem. So I hope that I gave you a good feel for all these technologies and why we – how we've taken the investments that we've made over the last few decades, and we've extended that with understanding of all the end markets we're going into and extended all these technologies to support different – the – these different end markets. And we have this one technology road map to do that, and I think that's a big advantage that we have. And that applies perfectly to all these different end markets that we have that Cristiano is going to talk about.

And I'll say one more thing, and that is we have a very healthy patent portfolio. Obviously, our focus there, lots and lots of work in 5G. All the subsequent releases that I talked about, there's lots of patents that are being generated associated with that. And then also, just our very broad technology portfolio, it's the same thing. We've developed a lot of, I think, very important patents associated with that. So we protect ourselves and also our licensing business. So – and that, I'd like to thank you, and I guess we're going back to Cristiano.

Cristiano R. Amon

President, Chief Executive Officer & Director, QUALCOMM, Inc.

Thank you very much, Jim. Hopefully, what you could see is we have a very unique technology road map. Pretty difficult to compete with Qualcomm in connectivity because we continue to drive the road map forward. We have everything wireless. Think about our camera, audio. You can see, you can listen, we can sense with RF, and we have the most efficiency in processing whether it's CPU, GPU and AI. And that's the combination that is really driving the scale of Qualcomm and the growth across a number of end markets.

So, what I'm going to do in this part of the presentation, I'm going to walk you through our strategy and then provide you an ability to understand how we're executing on those new opportunities. So, I'm – divided the presentation in four key pillars of the strategy.

So in Handsets, we're very focused on the opportunity available to us in the market right now. Android is one of the fastest growing revenue and margin expansion opportunity for us in Handsets. The second one is our RF technology across everything. Number three is the opportunity that we have in Automotive to be the preferred partner of the auto industry. And the broadest opportunity of them all is our IoT's revenue stream where it's about all of those technologies that Jim outlined to you, connectivity and smart processing, enabling the cloud connected edge.

So with that, let's just start focusing with Handsets. So our strategy can be summarized in one single statement. Snapdragon is the platform of choice for premium and high-tier Android smartphones. And let's talk about Snapdragon a little bit. The phone market is changing. I think people need to get out more, and there is incredible opportunity within the Android space.

There's a change in the OEM landscape. There is an opportunity for Android to move forward to be – to become a more premium, and Snapdragon has been the undisputed leader, setting the industry benchmark for premium experiences in mobile, period, number one, in a number of different categories and doing that with all-day battery life.

One thing that is probably going to be new to you is the incredible effort that we have put in a – such a short period of time in Snapdragon marketing. So the reason I said that people need to get out more, 80% awareness in China and India about Snapdragon processor, it is now the number one preferred smartphone mobile processor brand. And there's one thing I would like you to look in this slide.

When our customers are launching their premium flagship devices [ph] and (00:54:45) how they communicate that to their customer base, there's one thing in common. And Snapdragon is, from its display, front and center about the experience the consumers will see out of their premium smartphone. That's an incredibly valuable assets in – for Qualcomm and it is incredible power in the industry today of the Snapdragon brand.

I'm also going to use this opportunity in Handset to make a new disclosure. We have now two-year customer commitments for premium and high-tier handsets across all of our main customers. So, Xiaomi, HONOR, Vivo, OPPO, we have two-year contracts with them, Akash is going to provide a little bit more detail on the financials, that provide incredible predictability for our Handset revenues.

And when we think about Samsung, this is a relationship that we have been expanding their upswing trajectory when we think about share. We have design wins across all of 2022. For the new flagships and new form factors, they're getting traction in the market. Qualcomm has the worldwide volume in the Fold Series and the Flip Series and a very stable position within the Galaxy S Series.

So, it's really – this slide is the validation that the strategy is working. It's the focus on premium and high-tier, we're highly differentiated with Snapdragon, it's consumer preference and of – that is providing incredible stability of our revenue in the handset space.

And with that, I'm going to talk about how we feel about the RF front-end market. As we entered the space, we've been redefining connectivity, as Jim Thompson outlined, modem plus RF. And it's not only an opportunity to generate one of the fastest growth in QCT in the mobile space, but also to take that across every industry.

This is a summary of where we are. We're well-positioned to be the global leader in revenue. We're the number one in the mobile industry. We exceeded our 2019 Analyst Day target one year ahead of schedule, and we've

been design across every single OEM. So there was a lot of skepticism about Qualcomm entering this space as the fifth player, and we're very proud of the execution of our team and the fact that we're winning with technology.

So this is an incredible position to be in and we have opportunity to grow. And it – I want to give you an ability to understand our scale. We now have performance leadership across every component. Jim outlined the filter. With our ultraSAW, with ultraBAW, we're now defining the benchmark for performance. And besides leading in performance, we have now incredible scale. We shipped 8 billion RF front-end units in fiscal 2021. The smallest units is in excess of 300 million. So this, it's a very good position to be in.

We had executed well in Handset, and going forward, we have an incredible opportunity to grow. And there are going to be three drivers of growth in addition of tracking or expansion in Handset. Global millimeter wave adoption. Millimeter wave is deployed in the United States, it is deployed in Japan, it's going to be deployed in Korea, and we remain optimistic with all the activity in China with the China Unicom millimeter wave for the Winter Olympics.

But as a casual outline of our assumptions, we don't have any assumptions in our long-term model other than the millimeter wave markets that are commercial today. But the reality is if millimeter wave gets traction, and we'll get traction and we'll expand it, that's an incredible upside opportunity for RF Front-End business. We're also going to extend the RF front-end modem plus RF into the Wi-Fi, and we're going to attach RF front-end to automotive and IoT. So, we're very proud RF Front-End is a success story by every metric and it's going to be – continue to be part of the growth of Qualcomm.

So, with that, I want to move away from Handsets and Front-End and talk about Automotive and the IoT. Starting with the Automotive. What is unique about Qualcomm is the ability to have capabilities across every single domain. In a single strategy statement, is we are the preferred partner for the digital chassis. We have eligibility. We're the number one in telematics and automotive connectivity, also the number one in premium infotainment.

We're now working with 25 global OEMs. The last time you heard from us was 23. We're working with 25 global OEMs. They have select Qualcomm platforms. And with the acquisition of Arriver, we're very well-positioned for ADAS. And what we have been building is a solution that really meets the demand for technology as the car is being transformed. You should think about the car with a completely new digital cockpit experience. The demand for that is very easy to see, and it also points to why Qualcomm has been extremely successful in building a digital cockpit. User driving looking at their phone and, at the end of the day, there's opportunities to bring a much more immersive experience what's relevant to you within the cockpit of the car.

The car is going to be connected to the cloud 100% of the time. With 5G, the car is connected to the cloud. When that happens, the car becomes a center of distribution of media, gaming, personalized experience, a lot of data analytics, and artificial intelligence. New OEMs create a completely new business model with services and upgrades over the life cycle of the vehicle, and ADAS become table stakes.

We built a platform for this. That's what we call the Snapdragon Digital Chassis which is a platform for the future of automotive. And our success in a very short period of time is not only because we have the relevant technologies that are required for this transformation, but the ability to have capabilities across every single domain and do what Qualcomm does best. We build a system.

The Digital Chassis comprises of the Snapdragon Cockpit Platform, the Snapdragon cloud connectivity, Snapdragon Ride for ADAS and autonomy, and Snapdragon Car-to-Cloud services. What that does, it provides an opportunity for us to increase our silicon contents within new vehicles by 10x. And we're not doing this alone.

We're doing this in partnership of our customers. If you look at the valuation of the auto companies right now and you look at valuation of a company like Tesla, it's very clear to everyone of the OEMs that they're becoming a technology company. And Qualcomm become the preferred partner to help build this technology future. And that's why we build this open, flexible platform, which is our digital chassis in partnership with our customers.

One of those great strategic customers, a great example of bringing together digital chassis is our partnership with General Motors. So that – the ability of creating a platform that enable not only new services and technology, but makes the car an innovation – a platform as a service center. We're very proud of the partnership with GM and we're working with them across every single domain for connectivity cockpit to the service platform of our car to cloud service platform, as well as the Super Cruise.

And I think that's just the beginning of what's happening in our partnerships with the automotive sector. When you think about having all of those technologies, this also has an impact outside the car when we think about the future of transportation. I like to provide this example because it's easy to understand. Let's just talk about navigation today and navigation tomorrow. And I think that's an example, they'll tell you the difference about being a component provider versus a system provider. And all of those technologies work together.

So navigation today, you're driving your car, you're behind the wheel. You look at the map in your infotainment. You have the streets. You have with position location, your position in that street. You have the direction of traffic. And looking information that comes for example from Google, you'll have the ability to see green, yellow, red based on number of cars and roads congestion.

Think about the future of navigation even with the driver behind the wheel. With technology such as 5G C-V2X, the car is connected to every other car in the road, is connected to every pedestrian to every bicycle. It's connected to the traffic lights, so you start to get information on how much you should adjust your speed to get a green.

You have information about what's happening at the intersection. Is there a car coming and is supposed to be stopping and based on the rate of speed, you need to get an alert. The front-facing camera looking at you from the dashboard powered by the digital cockpit, you will understand if you pay attention or not based on recent events.

A pedestrian moving straight in – parallel to you in the sidewalk, you were 45 miles, 65 miles per hour, that's a safe environment. If the direction of speed of the pedestrian is towards the street, that's not a safe environment. So, ability to predict, use artificial intelligence and processing in the car and make sure that all those systems are integrated together [ph] is (01:06:24) the ADAS system working with the digital cockpit, with the cloud connectivity.

So, that is what makes very – the Qualcomm position very unique, and in addition of building a lot of technology into car, building the future of transportation. And we're very happy in how we can make this come to life through the enhancement of our platform, provided by the acquisition of Arriver.

Qualcomm Technologies plus Arriver allow us to have a scalable, open, proven platform for ADAS and autonomy. And I'll give you a glimpse of how that's going to look like.

So, the Snapdragon Ride platform front and surround vision provided by Qualcomm and Arriver, driver policy provided by Qualcomm, many years of research, as some of you have seen our cars driving around this San

Diego, plus Arriver, plus the OEM stack, open platform and with a broad set of partnerships for parking and driver monitoring, and then multiple software platforms.

And the reason we're getting a lot of traction already and the market is really paying attention to what we can do in ADAS and autonomy, is because in addition of having the most comprehensive platform, it is open and allow the OEMs to also innovate. It's the Qualcomm horizontal business model that has proven to be very successful across all the business and what we have done in mobile.

And with that, I'd like to show a quote from a great partner of Qualcomm, which is BMW. It's part of the announcement we made this morning. We've been awarded the next-generation ADAS in autonomy from BMW. It's going to be – we're going to be helping BMW building next-generation ADAS and autonomous driving platform. And we're very excited to continue our expansion in automotive with a great strategic partner such as BMW.

And I think that's just the beginning. This no different than what happened to us in telematics, in digital cockpit. We have an incredible opportunity to scale very fast and that which is reflected in our automotive contractive pipeline right now.

So with that, I'm going to go from automotive to IoT. So, I wanted to remind you back to the many trends we discussed earlier, and I'll pick a few. Conversions of mobile and PC. How do you build new computing devices at the edge? Mixed reality, XR, virtual reality, augmented reality, is the next computing platform. Connection of physical and digital spaces. This can be as big as mobile and will enable the Metaverse.

5G is driving next generation infrastructure. And fundamentally, reshaping how we think about edge networking. And the broad the digital transformation of enterprises back to the message. Growth of the cloud is directly associated with the growth of the edge, that is driving demand for our technology. And that creates opportunity for us to do connectivity and smart processing across the entire cloud connected edge, across consumer, edge networking and industrial IoT.

So as you [ph] reflect upon (01:10:30) those trends and I just highlighted few of the trends I showed this morning, there's one company that shares our vision across all of those areas. And that company is Microsoft. And here's from a few words to you from Satya.

Satya Nadella

Chairman & Chief Executive Officer, Microsoft Corp.

Hello. Thank you so much for having me here at your Investor Day to talk about our deep and longstanding strategic partnership with Qualcomm. Looking back, there is no question that in the past 20 months have been a catalyst for an unprecedented wave of digital transformation that's creating important new opportunities for our customers.

Fundamentally, we are moving from a mobile and cloud era to an era of ubiquitous computing and ambient intelligence. To put this in perspective, by 2030, there'll be 50 billion connected devices, more than double the number today. This means the places we go to, the things we interact with will increasingly be digitized, creating new opportunities and new breakthroughs, from precision medicine to precision agriculture, from personalized e-commerce to personalized education, from connected manufacturing floors to connected homes. That's why our partnership with Qualcomm is so important to us.

Qualcomm is a leader at the intelligent edge, driving advances in efficient computing, wireless connectivity and on-device AI. And your vision for a future of technology where everyone and everything is intelligently connected is aligned with our own.

Together, we are helping our customers apply the power of our entire technology stack to meet the real-world needs of today and tomorrow. There are so many examples from how we have collaborated to bring ARM to Windows ecosystem, to how we have designed silicon and systems for category creating devices like Surface Pro X or Surface Duo and HoloLens 2, to how we have advanced new IoT platforms that bring AI to the edge.

And we are also working together in many areas that will be increasingly critical to our customers going forward, including building the next-gen 5G infrastructure and private networks.

This is all just the beginning and I greatly look forward to what we will accomplish together in the years ahead. Thank you so much.

Cristiano R. Amon

President, Chief Executive Officer & Director, QUALCOMM, Inc.

We're incredibly proud of the partnership with Microsoft. Few companies are as strategically aligned with Qualcomm as Microsoft. This is a very long-term relationship for Qualcomm. We're really committed to this success and what is interesting [ph] is actually (01:13:22) expand across each and every one of the opportunities we have into connected intelligent edge.

So as we think about each of those opportunities and I know one of the questions is, how should we think about the Qualcomm IoT revenue stream? So, I'm going to provide a summary to you as I go through each one of those opportunities.

IoT is changing. And the way to think about IoT, we think about IoT next generation. It's moving away from traditional microcontrollers with embedded software and connectivity. It's really about, always connected. If it's not connected, it's not useful. It's about high performance computing that can run a full operational system with very complex computational requirements and doing this with very low power.

And it's about scaling AI at the edge with on-device intelligence. Our IoT revenue stream and growth opportunity is divided in three categories, consumer, edge networking, and industrial. You're going to see a lot of opportunities. And they look very different. But there's one thing in common. So I would like to use this time in the presentation to connect it to you where is this coming from because it's really about building on those industry trends. They're moving the demand towards the Qualcomm roadmap.

On consumer, it's about the convergence of mobile with PC and the upcoming opportunity with the Metaverse. Wearables is about extension of what you do with your smartphone and the devices that are around your smartphone. And then consumer electronics is about going from the IoT of the past into the IoT of the future, leveraging the technology roadmap that comes from mobile. Networking, it builds on Qualcomm connectivity at DNA.

We're not ashamed to say that we're the number one cellular and Wi-Fi company in the world. We really understand connectivity. We really understand connectivity and RF. And we can take that to the other side of the link. We can leverage our technology to build networking as networking has been transformed, and industrial was just this very broad digital transformation which has started and is going to grow significantly within the next few years. So that's how we think about this IoT revenue stream.

So now, I'm going to take you to each one of those, and I'll tell you what's really important at the end of my presentation. The first one within the consumer space is to focus on delivering next-generation consumer experiences. And you can easily understand what this opportunity is looking at this slide. On the left, you see the opportunity to expand the Snapdragon platform with attach devices. So for the investment community, the easy way to think of this, there's an incredible opportunity in a very large, very large [ph] SAM (01:17:15) created by Apple for watches and AirPods. We're the company providing those devices for everybody else.

So that's the opportunity within attach, wearable devices to the Snapdragon platform. The other one is really focused on category leading devices for the new consumer electronics that are representatives of the capabilities of the edge. Example of this is the Peloton Plus Bike (sic) [Peloton Bike Plus] (01:17:50), the thread is the Amazon Astro robot. Here is a quote from David Limp from Amazon, highlighting the role of Qualcomm.

Qualcomm Technologies help us realize this vision, delivering world-class solution (sic) [solutions] (01:18:09) that make it a reality across multiple products. This, it's just the beginning of a great opportunity within this segment. This is a very important partnerships expanding. We're working with Amazon with a number of devices on the home from the [ph] eero device to Ring (01:18:26), all the way to the Astro robot. And we're excited about we can accomplish together. That's a great example of what's happening with Qualcomm in the IoT consumer segment.

Now, I would like to talk about the conversions on mobile and PC. This is one opportunity that we are very bullish on, and we are super excited about the recent developments in the industry that is moving the architecture to a mobile architecture. Qualcomm is using our Snapdragon platform to enable next-generation laptops. And you can connect to all of those trends, we talk about it, the work from anywhere, the enterprise transformation of the home and what's happening with the industry. I'll point to key things that defines the next-generation laptop: always connected, enterprise anywhere that drives on-demand computing. 5G on demand computing allow, if you have a workstation, you have a on-demand computing that you run workloads from the cloud on your laptop and you can move whether it's in the work premise or from the home.

Collaboration experiences, camera, audio, super important in PC. I bet each and every one of you, number one use case on your PC right now is a collaboration tool, whether Teams or Zooms. It took a pandemic to create a killer application of video telephony. We've been trying to do that since 3G, and now, in every single one of the PCs, the number one application is communications is even changing phone form factors as many folks are holding their phones like this to do a Zoom call.

Gaming is moving to the cloud. It's a no-brainer to a gaming developer to be able to develop a game host it in the cloud, have a compatibility with – instead of multiple consoles and the desktop gaming PC, have a compatibility with every single screen out there whether it's a television, it's a computer device or it's a phone do online gaming. As that happens, the most important thing is, do you actually have a gaming PC that allow you to have an all-day battery life, it has the right connectivity for you to play games, instead of thinking a separate dedicated gaming desktop? So while gaming desktop will continue to be a market opportunity, laptops can now provide that experience as companies like Netflix and Microsoft started to bring gaming to the cloud.

On device AI accelerated experience, you didn't see a lot of AI processing in PCs, very CPU-centric architecture. You see some of the announcements we've made with Microsoft in the Qualcomm platform, that's unique to the Qualcomm platform, the ability [ph] to you (01:21:39) on device AI. Great example of that is, your eyes are always looking at the camera when you're doing a Teams call. And the ability to continue to have efficiency processing with the leading performance per watt. This is an incredible opportunity for Qualcomm, and you should think about

where we are. We have the winning team. We are very well positioned to be the preferred platform for PCs for the inevitable transition to ARM.

When we think of our next generation CPU, it's about creating the benchmark in performance for Windows PCs. We're going to scale our GPU to desktop like or discrete graphics performance capabilities. And we're going to have the most power efficient AI engine in addition of what we do in multimedia connectivity. So, that's another great opportunity that we have within the IoT consumer. And here is a quote from my dear friend Panos from Microsoft, about the very board partnership we have with Microsoft for the transition of Windows to ARM in the ability to build on this incredible opportunity for the future of personal computing.

By the way, great job from Panos and Microsoft on Windows 11. It further validates the opportunity that we see right in front of us.

So, now I'm going to go to the last category of IoT consumer, which is the next computing platform with mixed reality. One thing that you're going to see in every single one of those discussions about the Metaverse. Absolutely, the majority of the devices that you see right now in virtual reality and augmented reality is powered by Snapdragon.

We also recently announced the Snapdragon Spaces, which is the – Snapdragon Spaces is the XR development platform. We're getting a lot of traction and we couldn't be more happy with what we have done partnering with Meta on the Oculus Quest 2.

Snapdragon XR2 also named Times Magazine 2021 a best invention for augmented reality. So, that has the potential to be the next computing platform, and it could be as big as mobiles if we're thinking about carrying AR glasses with us in addition to a smartphone. And here's what I would like you to take away. If you were going to spend time in the Metaverse, Snapdragon is going to be your ticket to the Metaverse. The technologies that Jim outlined is very difficult to do, how do you connect the human into a virtual reality and augmented reality world, and that's what we have been investing early on.

I remember talking about XR before it was popular a few years ago, and we're very excited about our position right now. And I'll point you out that this is already starting. Oculus Quest 2 was 10 million units, and the success of Oculus Quest 2 had an impact on the company that it's providing. So high-performance, super low-power hardware and perception algorithms and software platforms are required to make this a reality. And that's a role that we can play and with that, create an incredible growth opportunity.

And here's a quote from Mark Zuckerberg. The partnership that we have is very, very strong, it's multi-generation, and we're super excited with the work that we have been doing with Meta and the Oculus team. And I honestly believe that's just the beginning.

So I summarized those three opportunities. Now, I'm going to talk about architecting the modern network. IoT edge networking. We divide that in a couple of new opportunities that are available to us. For the first time in wireless, we now have a technology that [ph] we (01:26:30) can truly compete with fiber. 3G, 4G for home broadband wasn't an ideal technology. 5G is now the fastest growing last mile broadband technology and is really gaining scale. Just to put in perspective, there's now 68 5G fixed wireless access providers across 32 countries. And we predict that by 2026, 25% of global mobile traffic – data traffic is going to be provided by 5G. So this is a growth opportunity that leverages our technology. It's not the same as mobile. It's about creating a very reliable, long range, high performance. And that is reflected in the design pipeline.

Virtually everyone that is building on this opportunity is designing with Qualcomm. That's an incredible opportunity for growth, highly leveraged and we see this happening at both developing economies as well as developed economies. And here is example for you of a quote from T-Mobile about our partnership. T-Mobile has launched 5G fixed wireless access, providing now home broadband in addition to mobile. And it is a very strong partnership with Qualcomm. And I think we're just at the beginning of this transition, especially as more countries are deploying 5G. Bigger is going to be the addressable market for 5G wireless fiber.

There's also a lot of excitement on Wi-Fi access point. What we saw happening, first, there was a very high demand from the enterprise transformation of the home. Now that demand that continues to be very high as the workplace is preparing for the future of work that includes collaboration and video. We see Wi-Fi anywhere as not only we're connecting computers and phones in the home but every other device out there. The mesh continue to evolve and be deployed everywhere. The Wi-Fi access point is becoming a hub for IoT in the home. It is not a coincidence. You saw the success of the Amazon acquisition of Eero, the evolution of the access point with more technology and more value.

You have the opportunity to create the modern network, connecting the access point directly to the cloud. And you see a very vibrant technology roadmap with Wi-Fi 6E and Wi-Fi 7 with carrier upside expansion as Wi-Fi access point become connected to 5G wireless fiber. We have 30-plus immersive home designs with Wi-Fi and 300-plus customers for enterprise-grade designs with our Wi-Fi access point platforms.

And here is a testimonial for one of our great customers, NETGEAR, has been first with the majority of our technologies, a very innovation-focused company that is helping us commercialize next-generation Wi-Fi access point as well as access point with 5G.

And then I'm going to go to the last part of the IoT edge networking. We don't talk much about this because we have a lot of things that we're talking about, but the cellular infrastructure is changing, is changing fundamentally because the RAN is getting virtualized. Many of you have heard about vRAN. You may have not pay attention, but Qualcomm has been leveraging our one roadmap to build with the world's best solution for the future of vRAN.

Not only we have solutions for the small cells, but we have solutions for the large capacity radio units, and we have an inline accelerator card that plugs directly into a data center. What the feedback we have been receiving from the market compared to every single alternative they have is 50% lower total cost of ownership and 50% more energy efficiency, which is particularly important as many of the operators now have aggressive sustainability targets.

This is becoming a reality. And I'll just want to show and we're very proud of showing that we had made an announcement with NEC. Here's a testimonial from NTT DOCOMO, Japan is one – and this operator, in particular, is one of the most advanced, most difficult to get in operators in the world in terms of the quality requirements and the feature requirements they require for 5G. And we're partnering with them and NEC for next generation vRAN architecture using the Qualcomm platform for both the radio unit as well as the digital unit for vRAN and open RAN. So that's yet another growth opportunity.

And before I summarize it to you, I want to spend some time on the broader IoT industrial. The transformation of industry is really tying Qualcomm to the cloud. We become – and you saw that clearly from Satya video, as the cloud company and Microsoft as the enterprise cloud company continues to grow with the cloud economy across a number of enterprises, we become the partner of choice at the edge. And it's not only unique to the cloud; it's about changing all the companies with the technologies we have at the edge.

So, I want to start listing some of the different areas. I won't have time today to cover each and every one. I'm going to pick one example. But hopefully, this example will give you an idea of what's driving a lot of the fast growth for Qualcomm, already significant revenues in this space, an incredible opportunity as IoT matures.

There are a number of different verticals. I'll spend time today providing you examples of smart cities and retail. But even the verticals that we're showing you today are not all the verticals we're focused on. And we're excited because at the end of the day, the market is moving towards our one technology roadmap.

So, we're making an announcement of the Smart Times Square Experiences. If I believe, the announcement is going out today. We're really partner with Times Square to create a whole new experience for smart cities. 134 million global visitors per years in the Times Square and we're going to help it become the epicenter of a brand new smart entertainment hub and a premium platform for some of the world most innovative tenants. State-of-the-art connectivity infrastructure with indoor and outdoor 5G and Wi-Fi 6, transforming visitor experiences. This is a great showcase of smart cities. There's a lot more happening in smart cities, but we couldn't miss to show this example, especially as we're here in New York.

And then I'm going to go to retail. Retail is one sector that is an incredible transformation happening, especially as we think about e-commerce. You have to really reimagine the store at the edge. The retail store today has the ability to apply technology at the edge to fundamentally change the experience.

Operations become way more efficient, data available to retailers. There is a number of technologies from making shelf labels digital with electronic shelf labels, all the way to computer vision for inventory tracking or touchless point of sale.

One of the great partnerships we have is with Walmart, and here is a testimony provided by Doug. They are actively pursuing the digital transformation of retail, and they really see a company like Qualcomm with capability across all domains as the key partner they look for Walmart as they become a very advanced technology company for retail. We're very proud. Thank you, Doug, for the incredible partnership and that's just an example of the many opportunities we have in industrial IoT.

So, I know I spend a lot of time telling you about a lot of opportunities. As a recap, we talk about what we're doing in Handsets in front end. We have Automotive. We have IoT consumer. We have IoT networking, and we have IoT industrial.

While it looks a lot, we're incredibly focused because it leverages our one technology roadmap. But from everything you've heard today, there are a number of opportunities that I would like you to take away. Those are some of the most significant opportunities for us in IoT. If I could go back to slide, I accidentally clicked forward.

All right. If we can't go back, I'll just talk to it. Number one is the convergence of mobile and PC. That's very significant. The number two opportunity is enabling the Metaverse. The number three is wireless fiber, and then what is happening at the edge base off Industry 4.0.

This will create an incredible opportunity for growth beyond what we've seen today into the next decade. And at the end of the day, we're uniquely positioned to grow across multiple industries, multiple end markets. And at the end of my presentation, we're truly going to enable world when everyone and everything will be intelligent (sic) [intelligently] (01:37:57) connected.

Hopefully, this was helpful. I know we had a lot of information. But I want you to really take away that we're having a 7x expansion of the addressable market, and we never had so many end market opportunities for Qualcomm as we see today. We're super excited about that and we're going to provide it to you a view and what that means financially from our CFO after the lunch break.

Thank you very much for listening to our presentation today, and we look forward to continue the conversation with you after lunch. Thank you.

Unverified Participant

At this time, we'd like to invite everybody to please enjoy your lunch. We'll give the room an update on when we'll begin the next session in just a few minutes. Enjoy your lunch.

[Break] (01:38:48)

Unverified Participant

Please welcome Qualcomm's Chief Financial Officer, Akash Palkhiwala.

Akash Palkhiwala

Chief Financial Officer, QUALCOMM, Inc.

All right. Hope all of you had a great lunch or should I call it brunch. We started a little early. This is great. Thanks for attending the show. We are so glad to be doing this in-person to meet all of you after a long time. And also people who are online, shout out to you as well. Thank you for joining. I know there are a lot of people who are online and unfortunately, everyone could not be here in-person, but we're super excited to be doing this.

So last time we did this was two years ago. I had been CFO of Qualcomm for two weeks. So that was a little rushed. So I'm just very happy that I get a redo today. And so, hopefully, I'll do a better job today than I did then.

Very, very exciting time for Qualcomm. Last couple years, you've all been tracking us. We've done great and really we – all of us believe that the best is yet to come. Cristiano and Jim talked to our technology portfolio. They talked through the businesses we have, our overall vision. And what I'm going to try to do next is put a financial framework around all of that. So, let's get to it. Let's do this.

All right. So through my presentation, I'll talk about these four key priorities. They're the same ones that I talked about two years ago, and we're still very focused on all of them. Revenue growth, diversification, operating discipline and capital allocation, these are all extremely important to us. And as we execute going forward, these are going to be front and center for us.

There are tremendous opportunities in front of us. We have the intersection of all these trends that Cristiano talked through and really looking forward to take advantage of all of them. But before that, before we go there, what I'd like to do is give a scorecard against our 2019 Analyst Day performance, the targets we set at that point, and then quickly talk through record results in fiscal 2021.

Well, it's great to see a lot of familiar faces in the audience. It's great. I've been seeing all of you on Zoom calls and Teams meetings, so this is awesome.

All right. So this is the picture of the slide that I presented two years ago, and what I'm very happy to report that we have significantly exceeded these targets. And what's more, we did it one year in advance of when we said we'd do it. So it's been fantastic. And this was across all objectives: growth, diversification, fiscal discipline.

Also, during this time, we did not sacrifice investments in technology. We've continued to make investments where appropriate in select areas, and a lot of what Jim and Cristiano laid out is a result of the investments we made.

Today, I lay out targets for the next three years at the end of my presentation and through it. And the key message we want to convey is we're positioned to drive diversified growth, while significantly reducing reliance on any specific customer or product. That's a key objective we have, and you'll see that in the numbers I'll show.

All right. So the next three or four slides, I'll quickly go through our fiscal 2021 results. I think they're important because they set the tone for what I'm going to say after that.

At fiscal 2021, a record year for us. Revenues, up 55% to $34 billion, and we also guided $10 billion for our December quarter. That's a big quarter for any chip company, any fabless chip company that you've seen. Really excited about the scale we bring to solving big problems. Operating margin, nearly doubled, and we more than doubled EPS.

So if you think about a company at our scale growing this fast, it's not every day that you see that happen. And we're excited about where we are, but more excited about where we're going.

On this slide, I want to quickly talk through RF front-end, Auto and IoT. In these three areas, these were very small businesses for us some time ago. In these three areas, we had record revenues in each one of them in fiscal 2021. We grew by more than 50% in each one in the fiscal year.

RF front-end, as Cristiano said, we're the largest player in Handsets today, and we're positioned to keep growing beyond that. In Auto, we have revenues up approximately $1 billion in fiscal 2021 and we think of this as a 10-year revenue growth run rate. We're in tremendous position based on the announcements and the technology we have, and I'm going to translate that into what we think it'll happen for us financially. The last one is IoT, $5.1 billion in fiscal 2021. If you look at our peers and the scale of IoT companies, that's a very large number. And what's attractive is all these markets use the technology, the one technology platform that we've created is used across all of these.

So our diversification strategy, it's working. If you look at what has happened over the last two years to our revenues across RF front-end, Auto, IoT, it's more than doubled. So we went from $4.8 billion to $10.2 billion over the last two years, and the growth rate was 1.5 times faster than Handsets, which, by itself, was growing very strongly.

If you look at how much of QCT revenues is contributed by these businesses, it's 38%. And it used to be a lot less before and it's grown over to 38%. So we're going in the right direction. We're achieving the objectives we wanted to achieve. Also, this diversification is margin-accretive. As we talked about earlier, we are reusing the R&D that we have in mobile in all these areas, and that makes it financially attractive to grow in these areas.

Okay, operating margin. Definitely my favorite chart. In the last two years, we've shown very strong operating margin leverage. I think when we were here the last time, the most number of questions I got was on this topic. And so, it feels gratifying that we executed based on the targets, much better than the targets we've set up.

So, OpEx as a percent of revenue over the last two years has declined from 34% to 23%. That's 11-point decline, extremely, extremely strong. And again, we were able to leverage our technology. At the same time, QCT margins expanded by 14 points from 15% to 29%, greatly surpassing the target we've set two years ago of greater than 20% operating margins. And of course, the gap between the 11% decline in OpEx and 14% increase in EBT margins, this was driven by improvement in our gross margin structure as well. So, pretty powerful margin story, operating leverage story across the board.

As I mentioned earlier, while we did this, we continued to invest in the key technologies that were needed for us to have a very strong path going forward. In addition, and this is an important point that we haven't talked about before, is we've continued to invest in go-to-market channels for Auto and IoT. As we get into all these markets, that's something that we needed to build. And so we got some of those talent from other companies and we've built the team so that we have a go-to market channel in those areas.

Similarly, we've built the organization within Qualcomm, focused on each of these areas so that we can have a dedicated team that's focused on executing in each one of them. And also these metrics, of course, show the benefit of the one technology roadmap that Jim and Cristiano discussed.

Over the last couple years, we've significantly expanded our commitment to ESG as well. So we announced a goal for net-zero global emissions for Scope 1, 2, and 3 to be zero by 2040, which is defined by Science Based Targets.

Qualcomm's heritage is all about low power, right? The entire business is actually built on, and Jim talked about this in some detail, built on technology that consumes the least amount of power. That's our competitive advantage, very aligned with our ESG objectives.

In addition, if you look at 5G, 5G is going to drive growth across industries. That really helps from an energy efficiency perspective as well. So our business is naturally inclined toward some of these initiatives.

All right. So, that was the past. Now, we're going to talk about the future and how we see each of our businesses play out. We have a strong platform for growth. I'll talk through the QCT revenue streams, each one of them that Cristiano addressed. I'll talk to stability in QTL. And as Cristiano said, there's a tremendous expansion of our addressable market, and I'll cover that in our three-year financial forecast.

Let me start with the 5G unit forecast. All right. So this is going to be a very long-term driver for us. I think there's a conversation about 5G being a very short-term driver and that's very a handset-centric view. I think if you step back and look at the various opportunities that Jim and Cristiano outlined, this is a very long-term driver for us. And let me break it into two parts.

Let me first talk about handsets and non-handsets. Before we look at the forecast, the key premise to remember is we are the leader in 5G. We invested early. We accelerated 5G deployment, working with our partners by one year. There's a very dense roadmap. We're going to keep investing, and we're going to lead in 5G solutions. It's a key priority for us going forward.

If you look at handsets, it is playing out exactly as we had laid out two years ago. So if we look at our forecast back then, if you look at our forecast now, it's playing out exactly in line. And we gave that forecast even before the initial 5G networks were deployed.

As you can see, we're only 525 million out of 1.3 billion or 1.4 billion of handset market and there is a long way to go within handsets. So within handsets, we see this as a three- to four-year curve and we have a forecast that you can see there.

In non-handsets, 5G is not the same as 4G. 5G was designed for low latency, high data rates, high security. These are qualities that are required in lot of the applications that will require 5G, and that is why we believe that 5G is going to have a very strong long-term growth outside handsets. And you should think of this as a 10-year curve with the scale eventually being similar to handsets.

Okay. So the next three slides, I'm going to talk about the Handsets business, then go to RF front-end, Auto, and IoT.

So, in the Handsets business, I'll start with what happened over the last year. The SAM over the last year expanded from $19 billion to $33 billion. And there were three key drivers for this. First is 4G going to 5G. When 4G goes to 5G, a lot more content is needed and we expand the revenue we get per device.

Second is increased capability of Snapdragon chipsets. As Jim outlined, between camera, video, audio, GPU, CPU, every single vector is being pushed to the limit in terms of device performance, and that benefits our ASP.

The third driver, which is the most important one for this year, is we saw SAM expansion from the change in the OEM landscape. This means there was a share shift in China where our customers – OPPO, Vivo, Xiaomi, Honor – they all picked up share and they became bigger. And a lot of their share that they picked up was in premium and high tiers, which is where Qualcomm is very strong. So it was a very attractive expansion of our SAM.

The key takeaway for this page is that the SAM expansion that we saw because of this is significantly larger than the modem-only opportunity, than the Apple opportunity. So, it puts us in a very fortunate position as we go forward.

As we've said in the short term, as our supply improves, it – the benefit of the improvement is reflected in our first quarter guidance and we expect that to benefit the rest of fiscal year as well.

Okay. So I think Cristiano made this point briefly. I wanted to reiterate it and talk about the scale of Android. If you look at the scale of Android, Android accounts for 85% of the total worldwide phones sold. It's a very large number, 15%, of course, is Apple. 85% is Android.

When you take that number and you convert it into addressable market for us, 87% of our addressable market is Android. So that is why, as Cristiano said, our primary strategy in handsets is to be the platform of choice for premium and high-tier Android devices, and that's where the market is as well.

As the SAM continues to grow, the ecosystem innovations in Android will continue as well, and that will expand our SAM even when the total unit curve matures.

And then I'll finish with just a data point that we gave at our earnings as well. In fiscal 2021, our Android revenues was 40% larger than our largest competitor.

With that, I'm transitioning now to the forecast for handsets. So over the next three years, we expect a SAM CAGR of 12% in handsets. This is between 2021 and 2024. The drivers for this are the same as the ones you've seen before, which is you have 4G to 5G and you have increased Snapdragon content.

Our forecast for revenue is that it will grow at least in line with total SAM. And the assumption we use for this forecast is that for Apple 2023 launch, our share is down to 20%. This is a planning assumption for the forecast purposes.

Just to be clear, there is no new data point that makes us do this forecast versus our discussions in the past. We just wanted to set a base for this forecast. And so, we've used that as a planning assumption.

Let me step back and make sure you understand our leadership in 5G as we talk about this assumption. We started early investing in 5G. We are clearly the leader. If you want to launch a global phone, we're going to have the best modem. And we're going to be significantly ahead as we go from Release 16, 17, 18 that Jim talked about.

So we're going to offer that product to all of our customers. So you could have higher share, but the forecast that I'm giving you today is based on a 20% share of iPhone 2023. Anything better than that would be upside. If you look at just Android revenue, we expect that to grow significantly faster than SAM.

And then finally, the last point that Cristiano talked about, we have commitments from our Android OEMs. All right. So OPPO, Vivo, Xiaomi, Honor, Samsung, we have commitments from them that Cristiano outlined and so that gives us the confidence in the forecast we are providing to them.

So with that, I'll transition over to RF front-end. RF front-end success has been tremendous for us over the last several years. As you know, we are at $4.2 billion now for RF front-end revenue and we are the largest player in handsets.

But we are not done. We're poised for growth going forward. And the reason for that is we have the broadest product portfolio and the modem-to-antenna development that we're going to do is going to be a competitive advantage. People who only have the modem are not able to do that. People who only have RF front-end are not able to do that. So we're going to have the best individual components and a system advantage in bringing the two together.

Within Handsets, and I'll talk through growth opportunity in each of these areas. Within Handsets, there are three key drivers for growth for RF front-end. First one, 4G to 5G transition. As I mentioned earlier, we are only partway through the transition. There's a long way to go. As that transition continues, the RF front-end opportunity for us continues as well.

Second is OEM landscape shift. As that shift happen, a larger portion of the market became available to us for RF front-end solutions.

And then, finally, millimeter wave. As millimeter wave gets broadly deployed, we'll have an opportunity to expand our revenues as well. So three very strong drivers for growth within Handsets.

Then we'll take our RF front-end products and apply it to Auto and IoT. So we'll have an opportunity to grow in both of those areas. In Auto, as everyone knows well, all cars are getting connected. 5G is going to be in all cars. As that happens, as 5G gets attached to all cars, we will be able to add RF front end to our solution.

The total amount of content available per car in certain cases could be as high as $30. So it's a very large number, and we're happy to provide a new disclosure today that our design win pipeline for RF front-end in Auto is already greater than $600 million.

Going over to IoT, there are two inflection points for the RF front-end business in IoT. First is the adoption of 5G. Cristiano talked about various places where 5G would be used in IoT. As 5G gets used, you should assume our RF front-end gets used with it.

Second is Wi-Fi 7. That'll be the second inflection point. When Wi-Fi 7 gets deployed late 2022, early 2023, we're going to make sure that our RF front-end solution is available for Wi-Fi 7. That – just like 5G was the entry point for our RF front-end, Wi-Fi 7 will be the entry point for RF front-end in Wi-Fi.

So now looking at the forward growth forecast, very similar approach to Handsets, we see the SAM growth rate consistent with Handsets at 12%. It's a combination of two things, 4G to 5G and then Auto and IoT coming in.

As I said earlier, modem-to-antenna, we expect to have a technology advantage as we go into these markets and going forward. We're forecasting, similar to Handsets, total revenues to grow at least in line with SAM and non-Apple revenues to grow much faster than SAM.

Similar to the customer commitments we have on the chipset, we also have customer commitments on our RF front end. Cristiano did not cover this, so just an update to what he said, and that is reflected in our forecast, that's what gives us confidence that we'll be able to achieve this plan.

All right. So now, I'll transition over to Auto. This is the same slide that Cristiano showed. There is a tremendous opportunity for us to sell a system rather than individual components. This is an advantage we have in mobile, selling a system. This is an advantage we're going to have in Auto, selling a system. And that's a tremendous benefit when you go to a customer.

Arriver acquisition, Veoneer and the software stack part of Veoneer that we're going to keep is Arriver. That is a key part of our strategy going forward. With that, we're going to have an integrated software plus hardware solution for ADAS, and that's consistent with the win we announce today with BMW.

So here's our forecast for Auto. We expect the SAM to expand from $3 billion to $15 billion over the next few years. The drivers are pretty simple. It's digital cockpit and telematics, both expanding. And now we've added ADAS as an incremental opportunity for us. If you think about ADAS, ADAS is moving towards Level 2+, Level 3. As more and more vehicles go there, the opportunity in ADAS will continue to expand. And we're very excited to have just a tremendous product line that goes from the lowest end car to the highest end car addresses the entire spectrum. So as we look at our design win pipeline, last time we gave you an update was three months ago, we had $10 billion. Now, we're at $13 billion. So design win pipeline has expanded to $13 billion. This does not include the RF front end that I mentioned on the other page, $13 billion design win pipeline. And from a revenue forecast perspective, we expect to go from $1 billion in fiscal 2021 to $3.5 billion in five years and then 10-year of $8 billion. And the reason why we have confidence in this forecast is, of course, our product roadmap customer relationships. But over the next five years, 70% of our revenue forecast is covered in existing design wins. This is cumulative revenue over the next five years. 70% of that is covered in existing design wins. Also, we expect

several OEMs to make decisions on what platforms they pick over the next 24 months. And we are in a great spot with the product portfolio that we have to be able to win a significant portion of it. So as we look forward, we're in a position to expand our design win pipeline.

Okay. So next, I'm going to transition over to IoT. Cristiano talked to you through all of our IoT categories, so I'm not going to talk through it again. But the key points I want to make on this page is we have a diversified product portfolio and revenue base. Total revenue of $5.1 billion in fiscal 2021, that's spread over nearly 14,000 customers. The top 10 customers is 42% of our revenues. It's a very long tail. And as we get into all the areas Cristiano outlined, the tail will get longer. So this is a business that will continue to be diversified as we move forward. Similar to the discussion earlier, we still have one technology portfolio, right? One technology road map that we're going to be using across all these opportunities. So financially, that's obviously very attractive to us.

The last point on this slide is just revenue split across these three. You should think of each one contributing a very significant portion of the revenue, that adds up to the $5.1 billion. And when we talk about growth rates on the next page, all three of them are growing at strong rates as well. So this is not a scenario where we are concentrated in one area. It really is diversified across the three buckets with strong growth rates for each one of them.

So, from a forecast perspective, we see the SAM in IoT expanding at a CAGR of 17%, very strong growth over the next three years. This obviously is driven by a digital transformation, cloud computing, creating a demand for our technologies, connectivity, low power compute, and edge AI. Everything that Cristiano went through applies to this page, and that's what's driving the demand for our solutions.

The strong momentum that we have in IoT exiting fiscal 2021, we expect that to continue and revenues to grow up to $9 billion by fiscal 2024. This is growth faster than SAM. And really, this is a question of how quickly can we grow and take advantage of the opportunities in front of us. As I said earlier, IoT is more of a 10-year opportunity for us, not just a three-year strong growth rate.

All right. So going over to QTL now. QTL, our forecast is we're going to maintain the current revenue scale and margin profile. QTL is the most successful licensing business in our industry. And over the last few years through litigation, regulatory challenges, and FTC decision, that has validated our business model. So, that is a position of strength as we look forward. Within handsets, greater than 90% of our QTL revenues come from handset. And all the major OEMs are licensed for a long period of time. The one key thing to note here is all OEMs are obligated to pay royalties, independent of a chip relationship. So, you should think of those as [ph] distinctive (02:06:30). Going to non-handsets, we have an established program in Auto and IoT. As more and more cars get connected, especially as 4G goes to 5G, it's a tremendous opportunity for growth for us. In IoT, the way we approach that market is through a module licensing program. So, if you're making a module, we're licensing the module and that's how we get paid. And again, IoT is a significant growth opportunity in the very long-term for us.

All right. So, if you go beyond the three-year forecast, I want to step back and talk through the slide that I didn't skip – Cristiano ended up skipping over and provide some financial insights on it. We have opportunities for transformative growth because of the 7x TAM expansion over the next decade. And this goes beyond kind of the three-year forecast that we are discussing. There are several of these opportunities that I want to highlight for today. First is PCs. As you all know well, this is a very large unit and revenue pool market that exists today, over $35 billion in revenue available. As this market transitions to ARM and we have the next-gen CPU developed by the NUVIA team, we combine that with the Snapdragon technologies, all the technologies that Jim talked about and make it available in an integrated SoC, we have an opportunity to be a significant player in this market. So, we're excited about what it means for us in the long term.

Second is XR. As Cristiano said, there are more than 50 devices that have already been launched with our chipset in it. We have approximately 90% share of chipset design wins. So if you're convinced this is the next computing platform and the market could be very large over a period of time, it's a tremendous opportunity for us. There's obviously a lot of variability on how this market happens, how quickly. But regardless of what your view is on the scale or the pace of that change, as the market grows, we're going to benefit from it.

Third is Industry 4.0. Because of the connectivity to the cloud, as everything in various industries gets connected, this is going to play out over the next 10 years, and there is tremendous opportunity for us to leverage mobile technology and sell into these markets.

And then finally, ADAS, I've already laid out the financial forecast for the total auto business, so I won't repeat that. But this is a market that is expanding very quickly with a lot of demand for technology, and we like the cards we have, especially with the Arriver transaction. And so, we are positioned to benefit from it. Overall, we're kind of at this intersection of several trends with the right technology roadmap, which will help us drive long-term growth beyond three years.

All right. So, on the M&A side, our historical model has been very simple. We buy companies and make them number one. So, if you look at the history and I'll pick TDK EPCOS as an example. We bought the RF front end asset from them. They were the number four, number five player. And now we are the leader in handsets. We've done that for several of these technologies. As you know NUVIA, we just closed and we are in the process of acquiring Arriver. And we see that fitting into the same model. And then finally, if you look at going forward, our strategy remains unchanged. We'll acquire small teams or technologies. We'll acquire businesses that accelerate our internal growth strategy, and large acquisitions, we'll be opportunistic. We'll look at them but we don't see it as an integral part, required part of our strategy.

Okay. Capital return, as all of you know very well, very strong capital return program. Over the last five years, we have returned $47 billion while still keeping a very strong balance sheet. Over the last two years, we have returned 90% of our free cash flow. Our forward strategy is very consistent with what we have done over the last two years. We're going to grow dividends. We're going to do anti-dilutive buybacks and opportunistically consider incremental buybacks. We're committed to a strong balance sheet and our current debt ratings.

So, before I conclude, I wanted to summarize all the financial guidance we gave on different pages. When you put it all together, we have an opportunity to be a company with revenue greater than $46 billion. Just looking at QCT, the guidance we gave implies mid-teens revenue CAGR over the last three years with the planning assumption that our share of iPhone 2023 is down at 20%. With this assumption, Apple revenue as a percent of QCT will be low single digits exiting fiscal 2024. Regarding QCT operating margins, up 30% plus. I already talked through QTL, very similar to what I said earlier. OpEx, as a percent of revenue, were currently at 23%. We're guiding 21% to 23% as the range going forward.

So that's the summary of all of our guidance points. I mean, needless to say, it's a tremendous growth for any company, especially someone our scale. We're in a very good position even with reducing reliance on a specific customer. So, as I conclude, I want to quickly highlight some key takeaways. Cloud adoption is accelerating demand for intelligent connected edge. That's who we are. We're positioned to drive diversified revenue growth going forward. One technology roadmap across all growth opportunities, prioritize disciplined and focused execution. And then finally, drive strong free cash flow and capital returns.

This concludes my presentation. We will now go to Q&A. Thank you.

Unverified Participant

Please welcome to the stage Cristiano, Jim, Akash, and Alex Rogers, President-QTL and Global Affairs.

Unverified Participant

All right.

QUESTION AND ANSWER SECTION

Timothy Arcuri
Analyst, UBS Securities LLC

Q

Hi. It's Tim Arcuri at UBS. Thanks. Jim, you showed a slide, you showed a 10x incremental opportunity per car in Autos. And I was wondering – I had two questions, one, can you put numbers around that like what's the baseline today and can you give us some numbers on that?

And secondly, what's the sort of front-end versus back-end monetization opportunity? Is there a significant back-end monetization? One of your peers is talking about getting half of the back-end monetization for over-the-air downloads. And I'm wondering if that's contemplated in that number as well. Thanks.

Cristiano R. Amon
President, Chief Executive Officer & Director, QUALCOMM, Inc.

A

Do you want to take that?

Akash Palkhiwala
Chief Financial Officer, QUALCOMM, Inc.

A

Sure. Well, if you really look at cars, it's like phones. The variance of price bands or total silicon opportunity across a low-tier car versus a premium tier car, there's a very large gap across. But thinking of $100 as an average opportunity today and some multiple of that tomorrow, depending on which tier you're in, is a reasonable framework to think about it.

Front-end versus back-end, I think that's just a business model question. You can monetize it multiple different ways. And to me, that's not really what portion of the value do you get. It's just how do you price it. And so, I think you'll see a variance across various players in the industry for that.

Kevin Cassidy
Analyst, Rosenblatt Securities, Inc.

Q

Hi. Thanks for the presentations. It's Kevin Cassidy from Rosenblatt Securities. I wonder if you could give us a little more detail about the NUVIA designers. Are they going to be focused just on the ARM portion of the Snapdragon, or do they go to the GPU and the AI portions also?

Cristiano R. Amon
President, Chief Executive Officer & Director, QUALCOMM, Inc.

A

Yeah. Maybe I'll start that. So, we have in that asset – that team is developing our next-generation CPU and there's incredible scalability. So, our very first commercial deployment of the CPU is for our next-generation PC computing part. Then, that's going to be taken to automotive. It's going to scale to the Snapdragon premium Android flagship. And we're looking at the data center opportunistically. We're very focused on the edge. We have an asset that can go to the data center, but that's more opportunistic. We're really focused on bringing that for PCs, for automotive and for the Snapdragon premium to your device.

Srini Pajjuri Q
Analyst, SMBC Nikko Securities America, Inc.

Thank you, Srini Pajjuri from SMBC Nikko Securities. A couple of questions. Great presentations, by the way. First on the margins, Akash. You said your target is to maintain greater than 30%. Just wondering, how do you think about growth versus margins, especially given your scale? Is there an upper limit that we should think about when it comes to your gross margins and operating margins?

And then, I'm going to ask the second question as well.

Akash Palkhiwala A
Chief Financial Officer, QUALCOMM, Inc.

Sure.

Srini Pajjuri Q
Analyst, SMBC Nikko Securities America, Inc.

QTL. One of the, I guess, struggles for us is how to think about the terminal value of QTL. Obviously, the duration of these contracts and duration of this IP portfolio is not public. So if you could give us some framework about how we should think about the potential terminal value. I know you said it's going to be stable in handsets, but is it sustainable longer term? Like, I guess that's the question that most investors want to understand. Thank you.

Akash Palkhiwala A
Chief Financial Officer, QUALCOMM, Inc.

So maybe I can take the first one. You want to take the second one...

Alexander H. Rogers A
President, Qualcomm Technology Licensing & Global Affairs, QUALCOMM, Inc.

Yeah.

Akash Palkhiwala A
Chief Financial Officer, QUALCOMM, Inc.

Sustainability. So on operating margins, as you can see, we made tremendous progress over the last two years, right? We've gone from 15% to 29%, we'd set a target of 20% plus two years ago, and we beat it by a wide margin. So super happy with that. We think a prudent target to set going forward is 30% plus. This is I think a reasonable way to operate the company going forward, and we might have opportunities to go higher than that. The real question is what we're trying to contemplate in our guidance is a normalized supply chain environment as well. So we think at this point, this is a reasonable guidance point.

Alexander H. Rogers A
President, Qualcomm Technology Licensing & Global Affairs, QUALCOMM, Inc.

And then on the QTL side, first, starting with the commercial side of the question, if you look at our contracts now, we're in a cadence of about 5 to 10 years. For your typical SEP agreement, standard essential patent license agreement. And they typically cover all versions of cellular standards, 3G, 4G, and now 5G. And for QTL looking forward, as I said, we have every major handset OEMs signed up to long-term agreements in that range that I just discussed. The first renewal is not until fiscal year 2024. So we have a good position on the commercial side.

In terms of the IP portfolio, if you looked at the slide that Jim presented and you look at the progression of 5G from the first release, and all the kind of foundational innovation in Release 15, and then you look at Release 16 and then on to 17 and 18, the portfolio is really foundational to everything you're seeing on that slide that was articulated. Qualcomm's timeline leading up to those releases in 5G is a timeline that starts 10 years earlier. And so Qualcomm is really positioned, I think, better than any company in the industry because we've continued to innovate through every successive generation. And we're always focused on what's going to move the industry forward in the most effective way, from a technology perspective. And the standards actually benefit from the key innovations that Qualcomm has driven into the standards. And because we're able to scale that technology worldwide, I think as Cristiano or Jim mentioned, we're actually able to bring that technology into the market in a way that's successful. And so that adds value to the intellectual property that's associated with all of that innovation.

Now, it's a very large portfolio, and the portfolio has migrated over time to being primarily focused on cellular standard essential patents. So it's very heavily weighted for what's driving the QTL revenue, and that's the way we're planning on managing the portfolio of the business going forward.

Matthew D. Ramsay
Analyst, Cowen Inc.

Q

Thanks, guys. It's Matt Ramsay from Cowen. One quick clarification. Akash, I think I've asked you on the last, I don't know, five or six earnings calls about operating margin and QCT and the progress has been remarkable. You guys talked about 30% going forward as a baseline. Would that hold even if the Apple revenue goes to single-digits of QCT as you've laid out?

Akash Palkhiwala
Chief Financial Officer, QUALCOMM, Inc.

A

Yeah. The margin guidance contemplates all the other assumptions, so yes.

Matthew D. Ramsay
Analyst, Cowen Inc.

Q

Okay. Perfect. My second question, Cristiano, we've been over the last 10 years down this path of Windows and ARM in the notebook market. I think it's crazy that every tablet I buy and put a keyboard on, I can get on the internet through 4G or 5G, and none of the notebooks do. So what's different this time, and could you calibrate for us a bit the size of the – or the ambition that Qualcomm has in the notebook market in terms of market share or dollars or whatever metrics you want to give? Thank you.

Cristiano R. Amon
President, Chief Executive Officer & Director, QUALCOMM, Inc.

A

Look, it's a great question. Thank you, Matt. Well, it's different – it's not different than what we'd expect to happen, but it's different this time because the architecture is changing. If you look at some of the fastest PCs out there right now, it's provided based on an ARM architecture, very – bringing an SoC to the PC market is very disruptive. If you look what Apple has done with the M Series, on the upper hand, it even has the performance of an RTX

3080 discrete graphics. So, the transition to that architecture is happening. As Apple switch to ARM, we're seeing also the developer [ph] of system (02:24:04) switching. You look at some of the companies like Adobe and part of their software development is this ARM first. So that is different.

There's another thing that is different, the change in productivity, work from anywhere, if you describe it that way, it did change some of the attributes of what is the computing device that is required and accelerated what we call the mobile convergence with PC. So, those two things are really creating an accelerated transition to a new architecture. And I would argue, we're probably the best positioned company to do this on the Windows side.

Now, the second part of the answer is, we knew it will be [ph] a road (02:24:53) to get there. So that's why we started earlier with Windows on Snapdragon. I think there was not only work for us, work for Microsoft. Now with Windows 11, Microsoft has the full 32- and 64-bit capability on ARM. And connected with the fact that we're now going to have the technologies, that scale on both on the CPU and the GPU side, we're actively working to build, as we've said, the benchmark of performance for this new architecture [indiscernible] (02:25:25) Windows. And then the answer to your question if you look at 250 million devices right now on the PC, you can model – I don't want to make share projections, but you can model even if we get a smaller share is a significant opportunity for Qualcomm. As you think about the use case changing with streaming of gaming and on-demand computing, I want to explain on-demand computing, I think sometimes this is not easily understood. We demonstrated right at the beginning of 2020, an 8K video editing on Adobe, on a Lenovo laptop connected with 5G completely [indiscernible] (02:26:09). So, if you have a full workstation for computer-aided design, [ph] view editing (02:26:13), you are not going to take the workstation with you when you have mobility. And that is going to also pull 5G to the PC. So, it's an incredible opportunity for Qualcomm.

Samik Chatterjee
Analyst, JPMorgan Securities LLC

Q

H, Samik from JPMorgan. Thanks for taking my question. Just one on the RF front end opportunity that we've talked about. So, I'm a little bit surprised to see that you're guiding to grow in line with the SAM just given the track record that you have of share gains. So, if you can just dig into that a bit deeper as to what are the offset there and why shouldn't we think that's a conservative number. And just in relation to RF but the non-smartphone market, what are you seeing in terms of the competition or competitive landscape there related with the smartphones?

Akash Palkhiwala
Chief Financial Officer, QUALCOMM, Inc.

A

Yeah. So on the first one, as we said, a non-Apple, we expect to grow significantly faster than markets, so what you said is accurate. The offset is just the assumption that we're making on what share of Apple we're going to have. As you know, we participate on the millimeter wave side at Apple. So that's the driver. Remind me of your second question again.

Samik Chatterjee
Analyst, JPMorgan Securities LLC

Q

[indiscernible] (02:27:27)

Akash Palkhiwala
Chief Financial Officer, QUALCOMM, Inc.

A

Yeah. Yeah. So if you think about IoT, 5G in auto or IoT, right, it's the same people we compete within phones. And you should think of it as just the same way we succeeded in phones, we'll succeed in those places. So, that's

just extension of the 5G market from phones going into those areas and very similar landscape. Wi-Fi today, we don't compete in it and it's mostly driven by the same competitors. And as we develop Wi-Fi end-to-end similar to 5G, that's going to create an advantage for us.

Joseph Moore
Analyst, Morgan Stanley & Co. LLC

Q

Hi. It's Joe Moore from Morgan Stanley. I wanted to ask about the growth in Android SoC, to the extent that you're talking about more than 12% CAGR for three years. The 200 million incremental 5G units are below the premium tier, I would think. You're coming out of a shortage, so there might be a little bit more competition and some of the Huawei benefit already played out. Like what gives you the confidence to project that kind of growth that far forward?

Akash Palkhiwala
Chief Financial Officer, QUALCOMM, Inc.

A

Yes. So, Joe, as we mentioned in our presentation Cristiano outlined, we have two things. One is design win pipeline, we have insight into what's going to happen through all of 2022. Second is, as we mentioned, we have commitments from customers that gives us confidence as well. So, it's really a combination of those factors. And of course, the roadmap's great. There's all the reason, especially in China with Snapdragon branding, all the reason for OEMs to use us and supply has been the constraint that we think that opens up.

Gary Mobley
Analyst, Wells Fargo Securities LLC

Q

Hi. Over here. Gary Mobley, Wells Fargo Securities. Thanks for hosting this event. I wanted to ask a question about your RFFE's success. You've been a clear winner in your baseband to antenna strategy, however, I'm curious to know if you've done any analysis on your design win traction or the revenue generated outside of your baseband market share footprint. And then, I guess related to that, and I guess you already addressed it a bit, Apple is presumably going to move to some different variety or combination of somebody else's RF, that's part of your assumption, correct? Just a clarification there. Thank you.

Cristiano R. Amon
President, Chief Executive Officer & Director, QUALCOMM, Inc.

A

No. Thanks for your question. Let me address that. The first one is, we are winning design not only on the modem-to-antenna but also winning on the discrete side. For example, some of our largest customers that choose to have both Snapdragon in their devices, as well as their own silicon, [ph] we're now winning (02:30:14) RF front-end constant across the entire lineup of devices. One of the fastest growth areas we had had over the few quarter has been the expansion of the modem-to-antenna into the screen. Having said that, the modem-to-antenna, the system level, because it saves R&D, because it's validated, and it has performance benefits, is going to continue to be the key driver of growth.

As far as Apple, look, I said many times before, as we continue to invest in leading RF front-end technology, there's opportunity to supply to Apple. But as relayed to Apple, we don't make any assumptions other than the assumptions we have in the plan and what we're doing with them on the millimeter wave. So, everything on Apple, you should think about upside.

Ivan Feinseth
Analyst, Tigress Financial Partners LLC

Q

Ivan Feinseth, Tigress Financial Partners. Very great event. And thank you for taking my question.

Cristiano R. Amon
President, Chief Executive Officer & Director, QUALCOMM, Inc.
A

Thank you.

A

Thank you.

Ivan Feinseth
Analyst, Tigress Financial Partners LLC
Q

Can you give me the range of functionality that you contribute to an automobile? Like what would be the minimum functionality and the maximum functionality, and then the cost range, and then how you integrate with like software updatability?

Cristiano R. Amon
President, Chief Executive Officer & Director, QUALCOMM, Inc.
A

For automobiles?

Ivan Feinseth
Analyst, Tigress Financial Partners LLC
Q

For the Snapdragon Ride for ADAS systems.

Cristiano R. Amon
President, Chief Executive Officer & Director, QUALCOMM, Inc.
A

Yeah. Happy to take that. One of the I think differentiations of Qualcomm Snapdragon Ride platform that we're getting very positive feedback of OEMs is the ability to provide scalability. We have this view that you should be thinking of ADAS, it should be as pervasive as ABS and airbags. So, why not bring it to every car? And we had took the same approach that we took to mobile, which is creating a multitier platform. We're doing that with ADAS as well with multiple [ph] SKUs (02:32:13). We even – I wanted to emphasize when we talk about the whole platform having not only the Snapdragon Ride, but the connectivity, the service platform, one of the services as part of the service platform was the Car-to-Cloud, is the Soft SKU we're getting traction, which will allow OEMs to also upgrade from the minimum functionality to higher-level functionality, selling directly to the consumer. And that's going to be commercialized within the coming quarters with one of our customers. So, the idea is to look at a multitier and create a business model that could actually upsell functionality at the lower levels, or would continue to do the full functionality for premium and high automobiles.

Ivan Feinseth
Analyst, Tigress Financial Partners LLC
Q

And then what would be the range in revenue to you from the minimum that, let's say, an OEM would adopt to the maximum?

Cristiano R. Amon
President, Chief Executive Officer & Director, QUALCOMM, Inc.
A

The range of...

Ivan Feinseth
Analyst, Tigress Financial Partners LLC

Q

In revenue of per car.

Cristiano R. Amon
President, Chief Executive Officer & Director, QUALCOMM, Inc.

A

We did say the – around a 10x revenue opportunity overall for the whole Digital Chassis. We kind of – we thought about putting a dollar amount, but you can think about – it's – you can start in the multiple hundreds of dollars. And you have a significant upside opportunity. At the end of the day, we have a lot of silicon opportunity in the car across all of those different domains.

Akash Palkhiwala
Chief Financial Officer, QUALCOMM, Inc.

A

And also I'd suggest that you just look at our overall revenue forecast because I think being able to do math across tiers on ASPs is a little more difficult. So, that's not a direct answer to your question, but that's contemplated in the guidance we gave you.

Ivan Feinseth
Analyst, Tigress Financial Partners LLC

Q

Then like Mary Barra speak – spoke about the ongoing subscription service to updates in connectivity. Would you participate, or do you provide a software upgrade kit to the OEM? And then the ongoing subscription to the end user, that piece either is included in the service or as an [ph] angular (02:34:21) point of time subscription upgrade?

Cristiano R. Amon
President, Chief Executive Officer & Director, QUALCOMM, Inc.

A

Yes. Some of those capabilities for our technology is enabled by our Car-to-Cloud service platform.

Ivan Feinseth
Analyst, Tigress Financial Partners LLC

Q

Thank you.

Blayne Curtis
Analyst, Barclays Capital, Inc.

Q

Thanks for taking the question. Blayne Curtis with Barclays. I just want to ask on the Auto side. You did extend the TAM out to [ph] 2026 (02:34:38) to capture ADAS. So, just kind of curious how to think about more in line with the other segments in a three-year TAM. I'm just trying to figure out how material you see ADAS. I think the old TAM was growing at 12%. You've been doing much better than that. How are you seeing Auto for a shorter duration?

Cristiano R. Amon
President, Chief Executive Officer & Director, QUALCOMM, Inc.

A

Yeah. So, the typical timeline on a design win and when a car launches is three to four years. So, the way you should think about ADAS is really a lot of the design wins today don't necessarily hit much in the three-year forecast. It's really a tailwind beyond that for us or for anyone else.

Brett Simpson
Analyst, Arete Research Services LLP

Q

Thanks. It's Brett Simpson at Arete. I just had a multipart question on Autos. The BMW deal, can you maybe just talk about the – does that flow through the whole fleet of BMW? Is it parts of the portfolio? Can you just give us a sense for the scale of that agreement and when it might start to kick in? The second question on Auto is really about – I think in your slide deck, you talked about 70% of car reconnected by 2024. What portion would be 5G and what type of market share do you think Qualcomm can attain within that space? And I have a follow-up for QTL.

Cristiano R. Amon
President, Chief Executive Officer & Director, QUALCOMM, Inc.

A

Maybe I'll take that.

Akash Palkhiwala
Chief Financial Officer, QUALCOMM, Inc.

A

Do you want to take the first one?

Cristiano R. Amon
President, Chief Executive Officer & Director, QUALCOMM, Inc.

A

Yes. It's really a technology platform. That's why I keep referring to additional chassis that can be applied across a number of cars within the BMW family. It's part of – it's really a technology design win. And I think to your question on – if I understand, it's of 5G market share in Automotive. Yeah. Our market share in automotive telematics is very, very high right now. And it is – and that could be a good proxy how we think about 5G. One thing that we like about opportunities beyond Handsets, Jim Thompson in his presentation talked about [indiscernible] 02:36:45), one of the few companies that really enabled the globe. And when you're building some of those noncellular devices, sometimes you don't really do regional SKUs, you just have one platform. And you wanted future-proof that design as well because you're going to have new frequency bands, or you're going to have new versions of the standard while – by the time you launch the car into production. That speaks to our strength in connectivity. As a result, it's a good proxy that we're going to have high share when we think about 5G in automobile.

Brett Simpson
Analyst, Arete Research Services LLP

Q

So, essentially, it's a software upgrade over the life of the car. The modem keeps improving, and you get paid a follow-on for upgrading the modems.

Cristiano R. Amon
President, Chief Executive Officer & Director, QUALCOMM, Inc.

A

That's one of the concepts. It's a common concept that you started to see and why we build a Car-to-Cloud service platform. It's not only about connectivity. It's also about features in the digital cockpit or even different tiers of ADAS. And that's the reason I think this is actually good not only for Qualcomm but also for OEM partners as well.

Brett Simpson
Analyst, Arete Research Services LLP

Q

And maybe just finally on QTL, you talked about the new program for Autos and the IoT for licensing. I guess, historically, you've always been part of patent pools like the Avanci patent pool, and there's not a lot of revenue from those types of agreements is my understanding. Can you maybe just talk a little bit about the licensing opportunity in the car? Would it be similar levels to a smartphone? Do you think that the value you're adding is a lot higher? Just help us maybe with sizing the opportunity. Thanks.

Alexander H. Rogers
President, Qualcomm Technology Licensing & Global Affairs, QUALCOMM, Inc.

A

So, I'll just put Avanci aside for a second. So, Qualcomm has been licensing independently in the Automotive space for a long time. I think when GM had OnStar generations [ph] of cellular (02:38:43) ago. And so, we have literally hundreds of millions of licensed connected automobiles, connected units on the road. And what we've done with 5G is we went ahead and transitioned from a percentage-based royalty to a dollar-based royalty. So, we're licensing at $5 per connected unit or connected vehicle. And we went to market with that. We went public with that number, but we went to market with that some years ago to make sure that we were bringing our licensing program to the market for 5G in a way that was useful for the auto OEMs so that they can plan their adoption of the technology in the units. It's been very successful. We have dozens of 5G agreements already signed up. And so, we think that that program will be successful going forward.

On the IoT side, we've been licensing at the module level for quite some time. And as Akash mentioned, the IoT curve is a longer curve. He talked about a 10-year curve. So, we have 3G, 4G license units out there. We have major – all the major module manufacturers' license. And we hope to see a pickup on the IoT side from the QTL business is that 5G gets adopted across that curve. Now, in the Handsets space, obviously the 5G adoption has happened much more quickly. But we're looking at the IoT space optimistically as well.

Q

Hey, guys. First of all, thank you for an extremely informative Analyst Day and congratulations on the last 12 months; some pretty incredible results. I had two questions. A lot of your growth going forward is [ph] hindered (02:40:26) on Android. You talked about a two-year sort of understanding deal contract, whatever you want to call it, with the Chinese guys. And I think – was Samsung a part of that as well? Or maybe I'm mistaken. And then could you talk – give us some color on what that means? Is it inked? Is it an understanding? Is it a partnership? And then I have a follow-up.

Cristiano R. Amon
President, Chief Executive Officer & Director, QUALCOMM, Inc.

A

Yes. So, with the Chinese OEMs, it's an agreement that we have in place and which gives us a high level of confidence. I'll just stay at that level in terms of disclosure. For Samsung, as we said, we have high confidence in 2022 based on the design wins and conversations with them as well. So, that gives us confidence for the next year for Samsung.

Q

And then a follow-up, quick question on the edge opportunity. Could you help us think about a framework for competition? We typically see microcontrollers as something on the edge compute, but we don't see a lot of companies targeting it with sort of SoCs that you have. Is that a fair statement at this point in time? And if you do see somebody, who is [indiscernible] (02:41:39)?

Cristiano R. Amon
President, Chief Executive Officer & Director, QUALCOMM, Inc.
A

I'll take the question. It is a fair statement. What is really creating demand for Qualcomm Technology, it's really what is happening in IoT as part of a much broader digital transformation that is driving a lot of growth to the cloud. And it's also – we have been very focused on the opportunities that require the value of high-performance computing and on device of the Vision Intelligence. What makes Qualcomm unique is we actually have every single technology in-house. We control the road map. And we have the ability to quickly scale, as Jim said, from a watch and an earbud, all the way to a high-performance computing on the trunk of a car.

And what is also unique about Qualcomm versus other company is we have a direct relationship with the large cloud providers, the hyperscalers, and the large enterprises. So, think about Qualcomm had been a company that is not dealing with the traditional [ph] where (02:42:51) you think about the space with distributors and like a catalog-type business, is really about transformative edge solutions. And that's why what you see different of Qualcomm compared with some other companies is the direct relationship as hopefully I brought some a few examples with some testimonies and quotes with some of the large enterprises. And I think that what makes it very unique.

Christopher Rolland
Analyst, Susquehanna Financial Group LLLP
Q

Chris Rolland, Susquehanna. Thanks so much for hosting this day. My first question's for Akash. And, Cristiano, maybe you can chime in here, too. So, I just want to make sure that I understood the guidance correctly. So, that's better than 12% for Handset, and that includes the wind-down of Apple in that number?

Akash Palkhiwala
Chief Financial Officer, QUALCOMM, Inc.
A

That's right.

Christopher Rolland
Analyst, Susquehanna Financial Group LLLP
Q

And that's – okay. So, the...

Cristiano R. Amon
President, Chief Executive Officer & Director, QUALCOMM, Inc.
A

The 12% includes the assumption on Apple.

Christopher Rolland
Analyst, Susquehanna Financial Group LLLP
Q

Great. So, I think that takes us to high teens then on that rate ex-Apple for you guys. And during this time, 5G is maturing, pricing is maturing. So, I'm wondering if you can bridge us to that high-teens percent. Is it all RFFE? Is it that move from 4G to 5G pricing? What accelerates that, bridges that pretty big gap?

Akash Palkhiwala
Chief Financial Officer, QUALCOMM, Inc.
A

Sure. So, overall, as I said on the QCT level, we are seeing mid-teens is kind of the consolidated guidance, as I mentioned on my conclusion page. There are two key drivers within Handsets. First is 4G going to 5G. And as we've said in the past, we've – typically, when that happens, we see a 1.5x increase for a like-to-like device. So,

you take a high-tier 4G phone, high-tier 5G phone, a 1.5x increase in our revenue opportunity. A portion of it is RFFE, but the rest is chipset. So, that's driving an increase.

Second is there is just – we're continuing to see tremendous demand from the OEMs to increase the capabilities on cameras, CPU, GPU, video, audio, all these features. And that increases the Snapdragon content that's available as well. And then, of course, Moore's law plays into it as we go to advanced nodes. So, it's a combination of these factors that increases our monetization for a device.

Cristiano R. Amon
President, Chief Executive Officer & Director, QUALCOMM, Inc.
A

Yeah. Look, I like to chime in on that question because it's actually important, and I want to use this opportunity to make a clarification. I think we're also making a lot of clarifications during this day how we think about growth in mobile. When you look what is driving ASP, we – of course, I think we're highly differentiated in 5G where millimeter wave is a key differentiation of Qualcomm. But even as you think of 5G, it gets more mature, and we continue to see the 5G plus RF front-end, we've been talking in the past about the 1.5 multiplier that stays in place.

But what's really driving ASP is the demand for much higher artificial intelligence computing, much bigger GPU, much faster CPU, and that's why we're bringing the next-generation CPU designed by the NUVIA team all the way to the mobile Snapdragon. And some of the new use cases we're seeing happening with 5G. So, it's very well-balanced.

The other thing is the consolidation of Snapdragon brand as a must-have for premium Android and especially as with the changing in the OEM landscape that had occur, some of our traditional customers like Xiaomi, OPPO and Vivo, they're climbing up to the premium tier, and the Snapdragon brand is helping them to achieve that also globally. I remind everyone that Xiaomi is now number one in Europe, and I think all of those things are really great contributors to the QCT gross margin and growth.

Operator: We have time for one more question.

Rod Hall
Analyst, Goldman Sachs & Co. LLC
Q

Yeah. Thanks for fitting me in. It's Rod Hall with Goldman Sachs. I just wanted to ask two questions. One, back to the Apple exposure, Akash. Thanks, by the way, for the conservative estimate on 2023. Just we're getting a lot of questions. We continue to get a lot of questions about what the current exposure is, and everybody's done their calculations. We would calculate about 16% QCT revenue exposure, so QCT only, not the royalty part, being 16% of revenues. And probably – and this is the tougher part – around 12% of EBT. So, that's the calculation we do. I just wanted to check with you and see if those kinds of numbers are in the ballpark.

Akash Palkhiwala
Chief Financial Officer, QUALCOMM, Inc.
A

Yes. So, I mean, as you know, we haven't provided a specific disclosure on what percent of our business is them today. But if you're looking at their overall scale, and you're using kind of ASP numbers that aligns with our 1.5x and how 4G played out, that would be a reasonable way of thinking about it.

Rod Hall
Analyst, Goldman Sachs & Co. LLC
Q

Okay. Okay. Thanks for that. And then the second thing I wanted to ask is in your – I think I'm right to say that in your IoT SAM, you're including the compute opportunity, the ARM-based NUVIA compute opportunity. Can you say when in a trajectory you might expect first revenue from those products, or give us any kind of an indication of how that fits into that SAM, maybe what the proportion of the SAM is if you don't want to say what the timing is?

Akash Palkhiwala

Chief Financial Officer, QUALCOMM, Inc.

A

Yeah. So, within kind of next three years, we are including some benefit from the compute opportunity, but there is no heroic assumption in the forecast we outlined. And then I think on NUVIA, as we said, we'd be sampling the parts late in 2022 and commercial launches in 2023.

A

[indiscernible] (02:48:49).

Akash Palkhiwala

Chief Financial Officer, QUALCOMM, Inc.

A

Yeah. But just the other thing to note is just we already have chips that still serve that market, right? So, that is just when the CPU intersection happens, but we'll have products much before that.

Cristiano R. Amon

President, Chief Executive Officer & Director, QUALCOMM, Inc.

I understand we've run out of time. I just want to say a big thank you to all of you that came in person. Really appreciate. Thank you for listening to us. Also, the folks that followed the stream online, thank you so much. And we're super-excited about the future of this company. I think we have a great opportunity ahead, and we'll continue to be focused in delivering return to our shareholders. Thank you so much.