

**Qualcomm
Analyst Day
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Presenters

Mauricio Lopez-Hodoyan, Vice President of Investor Relations
Steve Mollenkopf, Chief Executive Officer
James Thompson, Executive Vice President of Engineering, and Chief Technology Officer
Alex Rogers, Executive Vice President and President, Qualcomm Technology Licensing
Cristiano Amon, President
Akash Palkhiwala, Executive Vice President and Chief Financial Officer

Q&A Participants

Don Rosenberg, Executive Vice President and General Counsel

Mike Walkley, Canaccord Genuity
Chris Caso, Raymond James
Rod Hall, Goldman Sachs
Matt Ramsey, Cowen
Ross Seymour, Deutsche Bank
Stacy Rasgon, Bernstein
Brett Simpson, Arete Research
CJ Muse, Evercore ISI
Ivan Feinseth, Tigress Financial Partners
Vijay Rakesh, Mizuho
Srini Pajjuri, SMBC Nikko Securities
Mitch Steves, RBC Capital Markets

Moderator

Ladies and gentlemen, please welcome Executive Vice President and Chief Financial Officer Akash Palkhiwala.

Akash Palkhiwala

Good afternoon, everyone, and thanks for coming to our Analyst Day. And thanks for coming back after lunch, I was little worried that after the really good presentations in the morning, no one was going to come back for the financial discussion. And so it's good to see you all back here and interested in the financial information, it gives me job security.

So, I'm very excited to be here in my new role, representing Qualcomm, and had an opportunity to meet several of you yesterday, and looking forward to meeting more as opportunities

present themselves. You know, we started working on 5G a long time ago, and it's great to now see networks being launched, devices being deployed, and what that brings to us in terms of growth. So you've heard a lot about that from the speakers before me, what I'm going to focus on is how do you put the financial framework around the data that were shared previously, and so that will be the focus of my presentation. Alright?

Okay, so, this is effectively the three sets of topics I'll cover. I'll go through the revenue forecast and growth opportunity, things we are doing on the margin expansion side, and then capital allocation, and then address capital return and M&A as a part of that discussion. With the investments that we've made over the last couple years, we have really strong growth factors in place with 5G, RF front end, and adjacent markets, and then QTL as well. And so I'll go through each one of those and I'll start with the growth discussion first.

Okay, so, think of our business in four parts, and the first, to effectively represent QCT as you know it. So you have the mobile handset platform and the adjacent platforms. And so what is included in the mobile handset platforms, is the core chipset, and I'll provide more details on that. That's the platform that will benefit from the transition to 5G, that's the RF front end, and fingerprint. And the total revenues for that segment is \$11.3 billion in fiscal '19.

Going over to adjacents, we'll talk through automotive, compute, and IoT. The total revenue for that segment in fiscal '19 was \$3.4 billion. You'll see that we have included RFFE connectivity, mobile connectivity, and fingerprint in the mobile handset platform. Because we just feel like, especially RF front end, the growth of that market is so closely tied to our mobile chipset business, that that's the right way of thinking about RF front end going forward. Long-term opportunities, I'll briefly touch on ADAS and cloud edge AI, I know the rest of the presenters have talked through it already, I'll give a quick financial lens on how we think about it. And then finally, I'll finish talking about licensing, just the overall status of the program, and then how to think about 5G impact.

As you know, QTL revenues in fiscal '19, \$4.6 billion. Okay, so, think for mobile handsets, of course a key driver for us, both for the QTL and the QTC chip business, is the market. So, the key assumptions as we look at the market, we are forecasting a market that's consistent with its current form, both in kind of the total scale of the handset market and the mix of OEMs across the board. And so, we're assuming that market carries forward, we don't have a market growth assumption built into our plan.

Within that, the way we talk about the 5G forecast, we mixed a combination of tops-down analysis and bottoms-up assumption. So tops-down, we looked at how the transition from 3G to 4G happened, and what could we learn from that. And we applied that to the transition from 4G to 5G. There are two key differences. The first difference is the availability of chipsets across tiers in 5G. When 4G was launched, we had a premium tier chip, and premium tier devices only in the first year. As 5G, you are well aware, we have chips across multiple tiers, all available in 2019, late in 2020.

The second difference is China. In 4G, China started two years after the rest of the market. In 5G, we're expecting China to really not just start at the same time, lead, in some cases, the 5G deployment. So you have that deployment curve pulled in. So when you take a combination of those factors, we are forecasting the market to grow from the 200 million midpoint that we gave for 2020, to greater than 750 million in 2022.

In order to kind of test these numbers, we also looked at the bottoms-up plans of our OEMs, which operators are deploying on what scale? Both Jim, and Steve, and Cristiano talked about the scale of the deployments, so we considered that, and the design pipeline for each of our OEMs. We have been working with them, and we have a pretty good idea of when they're going to launch their phones. So this is kind of the baseline assumption for our financial plan in terms of 5G devices. It's obvious, but just to clarify, we expect this kind of transition to continue so as you go beyond 2022, we'll see the additional remaining devices at our 4G transition over as well.

Okay, so talking about core chipsets. And when we say core chipset, what does that mean? It means our modem, application processor, transceiver PMIC, and connectivity chip. So it's the first set of chips that we've been selling for a significant period of time to our customers. That SAM, we expect to grow from 26 billion to 35 billion at a CAGR of 10%. If you think about the key driver for the CAGR, we have--you know, 5G is very complex. It's not just--as you heard, it's not just sub-6 and millimeter wave, there's DDD and FDD, there's NSA and SAA, there's carrier aggregation, there's DSS. And then you have to do all those things at the same time, and otherwise. So there's tremendous complexity, it plays to our strengths, and that's one of the key drivers of the growth in the market.

Also as you look at the bar for calendar '22, you'll see that about two-thirds of the bar is 5G. So while there is a certain curve for unit penetration, when you look at the dollar SAM, we expect a much quicker acceleration to 5G. And which, given our position in the technology, it allows us to participate in it in a good way. In terms of our traction, we've quoted this number before, we have over 230 design wins across all devices in 5G, which is a great starting point as we look at this ramp going forward and the transition happening, and our ability to participate in it.

The last point for this transition, as we have announced before, we have a multi-year deal with Apple. And so when those products get launched, we will have an incremental benefit, as well as revenue scales up. So, overall, when you think about this by this growth opportunity, it's in two parts; we grow with the SAM, and on top of that, we have growth driven by gaining share at Apple, when they launch phones with our chipsets.

So on this page, we'll talk through RF front-end. When you look at a similar metric for RF front-end, we see a growth from 13 billion to 18 billion, at a CAGR of 12%. And if you look at the technology or content mix, we expect the growth to be all driven by 5G. As devices move from 4G to 5G, we'll continue to have 4G content in those devices, but the growth is all driven by 5G

content. And as we have discussed earlier through the day, we have a very strong portfolio and strong position, especially in the 5G content, and so it will allow us to participate in that upside. In addition to that, we also, through dynamic spectrum sharing, expect 4G bands to be used in 5G mode as well. And as that happens, more content moves from 4G to 5G, and increases the 5G portion of the pie. And it sets us up in a really nice position to further expand our position in the share--in terms of share.

From a design win perspective, the same metric as we quoted on the handset side, we have over 230 design wins for 5G chipsets, and virtually all of them have our RFFE. So we already have a strong design win pipeline that we're going to benefit from. As you look at the SAM, our target for share in this is greater than 20%. And we feel like with the transition happening to 5G over the next year or so, it creates a chance for us to achieve that, and then become a much stronger player in the RF front end ecosystem.

So when you take those two things together, the RF front end growth and the chip set growth, and you look at that, we wanted to kind of bring it together and reiterate the metric we had given before, that as we go from 4G to 5G, we expect content per device to grow by 1.5x. And this, the 1.5x growth includes sub-6 and millimeter wave for RF front end, and for the core chipset.

The way to think about this metric is, if you take a 4G premium tier device, with our 800 tier chipset, to a 5G premium tier device with our 800 tier chipset, like-for-like device, we expect our revenue opportunity to grow by 1.5x. As 5G goes into lower tier devices, that carries over, so the same increase in opportunity would apply to the 700 and 600 tier as well.

Turning to adjacent platforms. So this slide shows a revenue breakdown of the three categories we are including in the adjacent platforms. We have auto, compute, and IoT. So I'll just quickly talk through each one of them. Auto--what SAM for auto means, telematics, connectivity, and infotainment. And then we'll talk about ADAS separately later in the deck, but this is an existing business that we have. I have a slide on auto, so I'll wait for that slide to give more details.

The second is compute. Cristiano talked about the very significant opportunity we have in the compute market. From a financial perspective, this is clearly a large profit pool that we are not participating in, and it's an area where we can reuse technology from mobile. So at very low incremental cost participate in a big profit pool, and so we'll look for the opportunity to do that. In terms of our financial assumptions, we are not assuming a big win in compute, and in the guidance we are giving. We're just excited about it as an upside opportunity.

For IoT, we've split the IoT market here, our revenues into non-cellular and cellular. And clearly, with 5G coming in, it's going to be a big advantage for us as we focus on the cellular IoT market in addition to the non-cellular. I have a slide later in the deck on that as well, so I'll talk about that a little more. The key part--the two key points for us as we look at these adjacent markets. First is, these markets are demanding technology from mobile, and so we can leverage our R&D

base with limited incremental cost, bring the technology to these markets, and grow our revenues. And then the second thing I would say is, these--because of that strategy, these markets are margin accretive to QTC. We're able to address these markets in a margin accretive fashion.

Okay. So transitioning to auto. Just to reiterate, for us, the SAM here is telematics and connectivity, and then infotainment. The way we think about telematics SAM, you know, we started with 3G and 4G chipsets in cars, now we're going to 5G. We can bring our RF front end now that we have that asset that can attach to cars as well. Jim talked about CV2X, cellular V2X, as that technology comes in we'll be able to address that on top of those.

So what happens is, what used to be a chipset sale, suddenly became a platform, a telematics platform where we can add more content on top of it. Connectivity includes Wi-Fi and Bluetooth, and we've been in that business for a while, and we got a portion of that business through DCSR acquisition. The light blue is infotainment, and I think Cristiano went through some significant detail on what the infotainment revenue includes. And so, we feel like there's a very big--this SAM that's available to us, and we have all the right technologies to go access it.

In the middle, we are showing the design win pipeline. You've seen this number before, 6.5 billion. But what we tried to do in this presentation is, take one step forward and help convert it to what it means for revenues. So in fiscal '19, we had over 600 million in revenues in auto, and we are forecasting that goes up to 1.5 billion in five years. Off that 1.5 billion, approximately 75% of the revenue is related to designs we have already won. So those are not--there's obviously high predictability in those revenue streams, and the remaining 25% is based on designs that will win.

Also, as you think about beyond '24, this is not the peak year for us in auto as we have this strong design win pipeline. We continue to have a steep growth profile beyond '24 as well. So, we really like the growth profile of that business because it complements the 5G growth profile in mobile, and adds more tailwinds to that growth.

From a financial perspective, the other thing that's very interesting about this opportunity is, and I think this was discussed earlier is, we are reusing technology and chips created for mobile, and we are planning them in such a way that they can be used in auto in later stages. So it just allows us to really leverage the R&D, and then there's some auto-specific software work, and other work done that allows us to bring it to the auto market. So from a margin perspective, as this business grows, it'll look very interesting to us.

So turning to IoT. Cristiano mentioned our total customer base here, we have over 11,000 customers, and the revenue is split across a lot of different segments, geographies, and different types of customers. So there's really good diversification within this pie, from a customer perspective. And then, as you breakdown the CAGR on the market, and you look at

cellular versus non-cellular, for the areas we are addressing, there is significantly higher growth in the cellular part of the market. And so, that is our opportunity to go and participate in that, use 5G as the lever to increase our presence and grow revenues. Overall, as we think about this market, we think we have an opportunity to grow with the market, and that's our financial planning assumption.

Okay, turning to long-term growth opportunities. Same premise as you've seen before, we're going after the ADAS market, and we are addressing the cloud edge AI market, and we are reusing all the technologies available from mobile, and chips available from mobile to go to that. So again, while this is a market--these are new markets for us, we are leveraging so much technology, and for ADAS we are leveraging our channel as well, so it puts us in a pretty good position to be able to access the market.

One interesting metric that I wanted to leave with you is, to address this total SAM of \$18 billion, we are investing an incremental \$200 million. So it's a very small incremental investment to address this SAM. And this 200 million is already in our spend run rate, so this is not something that's incremental to what we've guided before, it's within our spend run rate. And it's an example of how we can really leverage the R&D and mobile to address larger markets.

So turning to QTL. As Alex mentioned, we have signed over 75 licenses for 5G, and then we have some multi-year anchor agreements around which the program will evolve. So we're in a pretty good spot, and very good start on the 5G licensing program. From a guidance perspective, we have provided guidance for the December quarter, we've provided guidance for the March quarter. I think you have the actuals for September, so you should be able to use those numbers and the seasonality around those numbers to forecast QTL revenue for fiscal '20, and really use that as the baseline going forward.

There are two upside opportunities to that revenue base, first is Huawei. When that gets resolved, it'll get added on top of that forecast. And then, second is 5G benefit, we are not planning for any 5G benefit in QTL at this point. But there are two ways in which you could sort of see significant benefits could accrue to QTL.

First is replacement rates, so when we went from 3G to 4G, and I think Cristiano mentioned this as well, there was a significant increase in the replacement rates. And so if--we could see a very similar phenomenon with 5G, and that would increase the size of the market and benefit QTL. The second benefit is as devices at the mid-end low tier, those users upgrade their devices, and they buy more expensive devices to take advantage of what 5G offers, that will be another incremental benefit to QTL. So those two would be upside benefits to the program.

Okay, so moving over to operating expenses and leverage. This is obviously an area of key focus for us. We want to realize operating leverage, and realize increase in margins as we go forward. If you look at the cost reduction plan that we just concluded, of a billion dollars, the way we

approach the plan is, we cut things that were non-core to us, and then we focused on driving SG&A efficiencies. And we tried to do this in a way such that we can preserve the investments we needed for RF front end and 5G, and execute on those things. So we're pretty proud of how, over the last couple of years, we've been able to execute on RF front end 5G while reducing our cost structure.

Going forward, our focus will be continuing to look at SG&A efficiencies, focus on R&D productivities, and then really be selective about any new investments that we make. And any new investments we would make would be consistent with the philosophy we've outline, of being able to leverage the mobile R&D base into new markets.

So transitioning to capital structure, we're very happy, obviously, with how we have done with our capital return program. Over the last three years, we have returned \$36 billion to the shareholders, 10 billion in dividends, and 26 billion in buybacks. When we started our incremental buyback program about 15 months ago, since then we have bought 23 billion stock back at a price of \$65. And with that, we retired 22% of the shares outstanding. So that program has worked out extremely well for us, we're very happy about how that played out. Also during this time, these three years, we invested 17 billion in R&D, a lot of it was around the concepts Jim outlined. An early investment, kind of making 5G happen, taking a systems approach, and then driving chipsets and royalties licensing at the end.

Looking forward, we're focused on strong balance sheet, investment grade rating, obviously kind of keeping our balance sheet strong is extremely important to us. We will grow dividends over time. And then from a buyback perspective, our baseline will be antidilutive buybacks. And then opportunistically, we will consider buybacks on top of it. So that's kind of our overall capital structure policy going forward, and I'm very happy with how things have played out over the recent past.

From an acquisition perspective, we've done 21 acquisitions over the last five years. And as you can see, most of these acquisitions were much smaller. We've done two large acquisitions in the five years, the last one acquiring the EPCOS asset from TDK, which we recently completed the transaction. And then, one of the things we are proud about is how we were able to acquire that asset, and a couple other companies. And together, we were able to build a portfolio of RF front end technologies that complemented our internal R&D investment.

So we feel pretty good about the portfolio that we created, partially through M&A. Looking forward, we'll keep looking for attacking acquisitions, buying small technology teams, buying assets that fit with our existing strategy, and help us execute on it, so that'd be the primary focus. And then, opportunistically, we'll evaluate other M&A as well.

Okay, so going through our three-year financial targets. And what this slide really is, is a summary of what we've said on all the other pages, so that's how you should think about these numbers. One of the key things for us is as we grow going forward, a lot of the growth factors

are driven by QTC. And so, you will see a shift in the mix of businesses between QTC and QTL, where QTC will become a larger portion of our profits.

From a revenue growth perspective, when you take the SAM growth of our existing markets-- again, I'm excluding the longer term bets, our existing markets, it's around 10%. And so from a revenue perspective, we plan to grow with the SAM plus have Apple revenues on top of it, right? So that's how--if you think about the longer term modeling, it should be the SAM-related growth plus the Apple-related revenues.

From a QTL perspective, I think I already outlined the way to think about the business going forward is, the baseline profile, opportunity from Huawei resolution, and then opportunity from 5G on top of it. From an operating margin perspective, QTC, we think we have an opportunity to grow over 20%, and so we are very optimistic about where this takes us, our existing growth factors. And then as some of these large markets materialize, we would have an ability to grow beyond that target.

From a QTL perspective, we are guiding 70% operating margin, and you should think of a band around that number, where lower than 70% is effectively deflating of the run rate that we have provided to you. And then, as we resolve Huawei, we would be higher than the 70%. So just, maybe summarize the key takeaways from my presentation. We are assuming a mature handset market, and existing macro-economic conditions. We see an accelerated move, transition to 5G happening, where it says the transition to 4G. On the mobile handset platform side, we feel like we are in a very strong position with RF front-end and the 4G to 5G transition, the chipset opportunity for us.

And then, beyond mobile, we have growth factors in all the markets we are addressing including auto, IoT, compute, and then the longer term opportunities, ADAS, and AI. And then, finally, QTL, we have over 75 licenses completed for 5G, and that'll serve as a base for the expansion of the licensing program.

Overall, when you look at this, we feel like we are in a very strong position to grow earnings faster than revenue, and hit the targets that we've outlined. So that's concludes my presentation. Thanks for coming here today, and with that, I'll call the Qualcomm management team to come back on for Q&A.

Okay. Who is first?

Mike Walkley

Hi. Hello? Okay. Hi, it's Mike Walkley with Canaccord Genuity. I know there'll be a lot of questions about RF, but I might just switch gears here. Just on QTL, just how should we think about maybe the next steps, or the timing on the FCT case, the appeal case with the Ninth Circuit Court, and how might the business be contained given your 75 plus agreements and

licensing deals, your recent deals with Apple and Samsung? Are those deals set no matter what the Ninth Circuit rules, or just how do we frame about the risk of this case and the timing?

Don Rosenberg

I'll start, Mike, and then turn it over to Alex. So in terms of timing, so as you know, we have the stay-in-place unanimous panel from the Ninth Circuit ruled that we were entitled to a stay, which is obviously then extremely satisfying to us. The timing currently is that oral arguments on the merits should take place in February, perhaps March. All depends on the court scheduling and their dockets, but it won't be earlier than February, and it's possible that it'll move into March.

We'll do the argument then, and again, based on the court's history and schedule, it looks like it would take anywhere from, I don't know, seven months to a year and a half before they make their ruling. That sounds too specific than I want to be, but that's a range I've basically been given by several people. And as you know, Alex and his team have continued to--actually all through the FTC case, trial, they were continuing to, as he showed you on the timeline, negotiate license agreements. And I'll turn it over to him to fill in the rest of that answer.

Alex Rogers

Yeah. So I think two things, Mike. First, tremendous amount of confidence in our position on the appeal. The second thing is, I think you should just consider the fact that as we are entering into these agreements, including some of the key agreements that you mentioned, we have a very clear understanding of what the FTC issues were. And so the parties entered into these agreements with those in mind, both parties understood what these issues were. And I think that, kind of the best way to think about it is, we're smart enough to understand how to resolve and how to get to long-term deals, taking those issues into account.

Don Rosenberg

I think to be clear, picking up on Alex's point, we have and continue to view the FTC's complaint as without merit entirely. Nothing about it, we think, was meritorious, neither from a legal perspective or from a factual support for the legal perspective. And that will remain our position until we are successful here. But what Alex was essentially saying is, even if you look at some of the things they've accused us of, we're dealing with those effectively.

Chris Caso

Thank you. Hi, Chris Caso from Raymond James. I have two questions regarding millimeter wave. One, if you could address the incremental cost, and I think this is one of the concerns of putting millimeter wave solutions on, you know, what's the incremental cost of the phone, will that be prohibitive, make the phones too expensive? And then secondly, from a Qualcomm perspective, you know, it sounds like you've got very good penetration on that and the subjects in the next generation. What's the competitive moat that you have? Such as you have these designs, you'll hold onto them as you go onto the next generation.

Cristiano Amon

Yeah. I can address that question. Look, when you add millimeter wave to the phone, you increase the number of antennas. And it has, you know, been an increase of build materials, and we see an increase in the overall cost. However, having said that, we're bringing millimeter wave to all of our tiers, including, we have now our 700 tier design with millimeter wave. And when we look at some of the price points of the devices, especially as the technology is getting scale, we've been positively surprised by the fact that it's probably going to be viable. And we expect costs to go down as we go to next generation module.

So like any technology, you know, you have a technology premium, but it's--you have efficiency gains and ability to reduce the number of modules per device. And the metric will be our 700 tier device coming with millimeter wave within the 2020 in the first half. I think your second question was about a competitive landscape. If I understand, you want a competitive landscape in millimeter wave sub-6, or both?

Chris Caso

In both, in terms of the moat, how do you hang to the device that you have? What's the advantage of Qualcomm (inaudible)?

Cristiano Amon

On RF, modem, or both?

Chris Caso

On RF.

Cristiano Amon

RF. Alright, so, we have three vectors of differentiation. I think some, I will put them in the technology category, another one is in the scale category. So let me start with the technology category first. We've been very focused on 5G, and I think as Jim Thompson pointed out in his presentation, we work very hard to make sure we can win the performance comparison at the individual component level, whether it was a gas PA, a filter, a filter in the low band, a filter in the high band. And we feel we now--we have a very competitive solution at the individual component level.

As a matter of fact, we are winning some discretions, especially what we call agnostic, on the high silicon platform, or even on the excellence platform, because we perform at the component level. So that's how we could compete with existing players. But what we've actually done, and I'll say, that technology differentiation is really implement capabilities at the system level, and I'll walk you through a few examples. One is this technology that we call smart transmit that basically takes measurements at the millisecond level, and basically adjusts power. And we've seen delta of multiple DBs as the difference between have coverage or not having coverage, almost in the days of feature phones whether you have a good antenna or you don't have a good antenna, and you have significant performance at the edge of the cell.

The other capabilities that we have is how efficient we can make envelope tracker in 5G versus APT. The other driver of differentiation is what I call the scale model. So, in the 4G era, we were not yet ready to enter the RF space. So, we never get much credit for it, but our test platforms end up having an influence about market share in some of those players. When we develop a chip, a baseband chip. And that chip, we have samples that go to our customers. We build mobile task platforms and we build reference designs. And before we have commercial software on the baseband.

We take this into every geography, across every infrastructure vendor, every software version whether it's a Huawei base station, ZT, Dalton, Samsung, Erickson, Nokia, you name it. And across multiple operations implementation, and then we have a commercial software on the modem. We--in the 4G era, we will do this over test platforms, and we'll pick who goes into the board, whether it's Avago goes or Maratha goes, Skyworks goes, or Qorvo goes.

Now, our test platforms are only built on the Qualcomm front end. So when an OEM gets a commercial software or chipset, our frontend is tested and certified. He can do--build that with different solutions, but he has to test himself. So, I think the gain on scale and time to market is also big differentiation on Qualcomm as well, because now the name of the game's a little different, since we have our 5G front end solution across the entire chain.

Rod Hall

It's Rod Hall with Goldman Sachs. Thanks. Two questions; one would be regarding the millimeter wave unit volume. So, I don't think we question whether you have a competitive advantage in millimeter wave, it's more when do these units ramp? And I wonder if you could help us understand within the 200 million units next year, and the 450 the year after, and then maybe even the 750 if we're getting really greedy about data. You know, if you could help us understand how these units ramp through time, so that's question number one.

Question number two relates to 5G penetration in total. So, the penetration rates that we calculate based on not just your numbers but industry numbers, suggest that 5G by '21 would be well over 10%, 12, 13% penetration of the smartphone installed user base. That number is significantly higher than what we would've calculated the same year for 4G, and we know that conditions are different and so on.

And as you pointed out, Akash, the chip availability's different, but it's still a much different number. And even if we back out China, penetration's still a lot higher in the rest of the world than it would've been in 4G at the same time. So I'd just like to, you know, get a little bit more color on why that's the case.

Akash Palkhiwala

Sure. So I'll maybe start with your second question. As I said in my comments, the biggest driver in our minds--and there are two drivers, the biggest driver is China. And it's not just the China

market, the intensity comes from the China OEMs, and the OEMs wanting to take the 5G phones that they make in China and really export it in different markets. And they see it as an opportunity to be there first and gain share from other players. So the China phenomena is not just about the China market, it's about Chinese OEMs as well.

The second is, you have phones across multiple tiers, and maybe that also speaks to the question that Cristiano answered earlier, is we'll be able to go down the price premium curve much faster because you don't just have the 800 tier chips, you have 700 and 600 as well. And so it gives the OEM options to be able to hit aggressive price points with 5G, which will drive adoption rates. So those are the two factors I'd look at.

From a forecast breakdown perspective, we're not giving that insight at this point in terms of what's millimeter wave versus sub-6. But the way I would recommend you think about it is, think about the key markets. And Cristiano outlined which markets are going sub-6 and which markets are going millimeter wave. U.S., Japan, Korea, in 2020, those are the three key markets that will have millimeter wave deployed. And so, you would expect premium tier phones--and these are mostly premium tier markets, those phones do have millimeter wave capability. And so maybe that's a way to think about scale.

Matt Ramsey

Thank you. It's Matt Ramsey from Cowen. I'm not sure if this is for Akash or Cristiano, but you walked through the slides and you guys laid out a pretty compelling case of 50% content per device. I think it backed into some numbers in my head, I think there was a 20% growth rate in automotive, some pretty big numbers around edge computing and auto. And yet, SAM growth at 10% seems pretty conservative to me. So, are there things on the negative side that we should think about that are depressing that SAM growth rate? And then, maybe if my assumptions are correct, that things could be better than that, what keeps QTC op margins at 20, why can't they be higher? Thanks.

Akash Palkhiwala

So, maybe from a SAM growth perspective. That weighted average of 10% is a combination of 10% growth for the chipset market, the core chipset, we had 12% for RF front end, and then we had the adjacents growing in the 10% range as well. So, really that 10% was just math based on the growth rates we have in those three markets. The--we are not including--as I mentioned during my prepared remarks as well, we are not including the upside opportunity that we could have if we had a homerun win in compute, or we had a significant win in ADAS, which has a timeline to it, by the way, and then also in AI. So those are incremental things from a revenue and margin perspective.

Ross Seymour

Hi, over here, it's Ross Seymour from Deutsche Bank. Akash, another one for you, and kind of following up on Matt's question on the PBT side of things. Can you just talk to us a little bit about some of the moving parts to get to that 20% or higher? Is it mix, is it the adjacencies

coming in with higher margins, same thing with our RF? And then, on the other side of the equation but also sticking with PBT is on the QTL side, why is that only 70% when I think in-- historically you used to be in the mid to upper 80s for your operating margin in that segment?

Akash Palkhiwala

Sure. So on the QCT side, I'd say that maybe the three vectors that are most influential to getting to the 20% margin target is the 1.5x premium on a like-for-like basis that we talked about, which includes core chipset and RF front end premium for 5G. And then, the third factor would be Apple when that business comes in. And obviously it'll be incremental to our margin directly, because we've already done the investments, and the process of doing the investments required to scale them. So those would be the factors that improve the QCT margins, and that probably mattered the most in getting the margin targets.

On QTL, you have to recall that whereas a few years ago the scale of the business was a little different, so I think that impacts the operating margins a bit. And then, in terms of R&D, we've been investing on 5G and really making sure that we have a very strong portfolio, and so that impacts the margin some as well.

Stacy Rasgon

Thank you, Stacy Rasgon at Bernstein. I have two questions on chipsets. First, how much of that 10% SAM growth for the core chips, that's from '19 to '22, is simply because you weren't selling chips to Apple in 2019 and you presumably will be selling chips to Apple in 2022.

Akash Palkhiwala

That's like-to-like, so it includes Apple in both the '19 and the '22 SAMs. So the growth is not being driven by including Apple in that.

Stacy Rasgon

Is there Huawei in that SAM as well, or no?

Akash Palkhiwala

Yes.

Stacy Rasgon

There is. Okay. So I guess to follow-up on Matt's question, if your--like so much of the growth, I think the market was going from almost no 5G now to like two-thirds or 70% of it in 2022 with 5G. And your revenue opportunity is up 50% from 4G to 5G, I guess I'm still struggling with the 10% also. Why shouldn't it be a lot more than that? What else is going on to take it down?

Akash Palkhiwala

Yeah, so, just to confirm, the way to think about it is growth, because of the SAM growth, plus Apple business on top of it. So what we are guiding towards is not 10% inclusive of the Apple business, it's incremental.

Stacy Rasgon

Yeah, I understand that, but the 50% upside in the core business doesn't include Apple, that's going to be extra, presumably, because right now you're at zero.

Akash Palkhiwala

As we said earlier, our assumption is that the market structure remains the same, our share, the position remains the same as we go forward. And that, as a result, we would go with the market, at the same rate as the market, with Apple incremental on top of it.

Stacy Rasgon

So 10% without Apple, and then throw Apple on top?

Akash Palkhiwala

Correct.

Stacy Rasgon

Okay, thank you.

Akash Palkhiwala

And again, because of reasons like auto and RF front end, we could do a little bit better than 10, and then Apple on top.

Brett Simpson

Yeah, thanks, it's Brett Simpson at Arete Research. You talked a lot today about the adjacency opportunity in QCT. But my question really is about QTL, and how the non-smartphone opportunity plays out in the next couple years. And my understanding is that you've done a lot of deals with guys like Avanci where you've got patent pulls, you've got caps on things like IoT, autos. So could you maybe talk a bit about how you monetize the non-smartphone part of QTL? You know, what portion of the volume today might be non-smartphone, and what sort of growth do you expect, or what's the contribution from that going forward? Thanks.

Alex Rogers

So, let me address, kind of just generally, the non-smartphone part of the market. It currently is actually a very small percentage of our overall revenue. And so right now we're not guiding anything significant happening in the non-smartphone space. With respect to these deals that we entered into with platforms, for example, such as Avanci, we actually haven't done a lot. We've done a couple, and they're alternatives.

So, for example, with respect to the Avanci 3G/4G licensing opportunity for automotive, we actually have an automotive program currently in place, we've had a program in place for 10 years. A licensee can opt to stick with Qualcomm license directly, or opt out and take an Avanci license. And so, that actually, you know, the automotive licensing business remained largely

intact without a lot of difference from the Avanci platform. So there hasn't been a lot of experimentation in these other platforms. But I think the overall takeaway is, you know, right now--Akash can comment on this, we're not putting down any markers for a real shift in the revenue makeup for licensing.

CJ Muse

Yeah, thanks, CJ Muse with Evercore ISI. I guess Akash, back to you, a couple questions on the margin side. I guess first off, for PBT, exclusive of QCT/QTL, I think that's been running at about a 800-million-dollar loss. What are you projecting in fiscal '22? And then back to the PBT margins for QTC, it looks like it's an incremental PBT margin of 30, 35%. I would think that the chipset business was growing around 50% over the next kind of three-year type CAGR, that we would see more leverage there. So, are there investments that need to be made? Is there a time period beyond fiscal '22 where we see the real acceleration in terms of margins? Thank you.

Akash Palkhiwala

So on the first part, I think you're referring to the Corporate/Other column in our results. So there are two things to it; first is the net interest expense that we have, and we have guided during the Earnings call that on a quarterly basis that amount would be \$100 million. So you should expect that as kind of the run rate going forward, that's the net interest expect, so 400 million for the year.

And then for the OpEx, which is long-term investments that we are making, we expect that to be roughly flat going forward, so there's no specific plan to increase the scale of the investments, so you should be able to use that to model it. Can you repeat the second question again? Sorry.

CJ Muse

Sorry. I mean, if you had--you know, what you've given us in terms of adjacencies, etcetera, it looks like QTC revenues are going roughly 50% over that three-year timeframe. So, I would think that the incremental PBT margins would be above 30, 35% implied in the guide for PBT margins.

Akash Palkhiwala

So, as we think about our growth profile, we don't have a specific scaling on OpEx assumed, that the goal is to continue to invest judiciously, and really recognize the benefit of the operating leverage as the revenue grows. So, we feel like having a target of greater than 20% is the right place to go for now, and then as different markets kick in maybe there's an opportunity in the longer term.

Ivan Feinseth

Hi, Ivan Feinseth, Tigress Financial Partners. Thank you for taking my question. What were your original thoughts in the acquisition of NXP, and how do you feel like--what would've been

different if you were able to complete the acquisition, and what direction did you end up going without it? And also, do you feel that the government will continue to issue waivers to do business with Huawei, and what would happen if they don't?

Steve Mollenkopf

Sure, why don't I take that? And I'll do the second one first, then I'll do the first one. So the second one, I think one thing with Huawei you should remember, we have a pretty small product business with Huawei. And so, for us, we're actually somewhat insulated from all of the news cycle with Huawei, from the product side. Obviously on the licensing side, we're trying very hard to get them and their agreement done. But we tend to have less of the ups and downs based off of that. I don't think long-term you should think of the opportunity with Huawei on the product side to be very significant.

On the NXP question that you had, you should really think about the NXP acquisition in the context of when we started it, which was several years ago. At that point, our position in the market was very different than what it is today. If you look at what's happened particularly in our infotainment business, it's grown dramatically over that time period, in part because we came in with really differentiated technology, really from the roadmap that Jim Thompson described. And we were able to build that business really without some of the things that we wanted to have with the NXP acquisition.

So you go forward three, four years later, many of the channels or technology entry points that we were trying to get, we've been either able to do ourselves, or because we're so much closer to 5G, the need to get them has probably become lessened. So I think for us, we have the ability to leverage our existing roadmap.

Of course, we're looking at M&A and we're trying to get ourselves in a position where we can take advantage of that from a balance sheet perspective, as you've seen from Akash's presentation. But we've been happy with the markets that we've been able to drive in the meantime, since the time when we initiated that NXP acquisition.

Vijay Rakesh

Hi, this is Vijay (Rakesh) from Mizuho. Just on the 5G side, you talked about 175 to 225 million units for next year, and 450 million units the year after. Just wondering what's the attach rate you're resuming for RFFE and millimeter wave, that you built into your core chipset, etcetera? Thanks.

Akash Palkhiwala

So, just to confirm, the forecast we gave was for the total size of the market, rather than our units. I think millimeter wave--I answered Rod's question earlier, that's probably the right way to think about what the attach rate would be for millimeter wave overall for the market. And then, we would obviously expect and hope to win the millimeter wave attach for black forms.

And we feel like we're in a very strong position on millimeter wave from a competitive landscape perspective.

And then from an RF front end perspective, again, the forecast was the market, obviously all those devices will need RF front end capability for 5G. And so it really comes down to our ability to win the core chipset, and then offer an end-to-end advantage, and be able to kind of have a performance advantage that allows us to win the RF business as well.

Srini Pajjuri

Hi. Srini Pajjuri from SMBC Nikko, thanks for the presentations. Akash, I want to go back to the margin question again. You know, you said that--I guess for the March quarter you're guiding mid-teens margins, operating margins for QCT, and your longer term model is 20% plus. But at the same time, you're not spending much in terms of your OpEx. I'm still confused as to why it's only 20%--I know you said plus, but why not 25 or 30? Is it because your gross margins in 5G are somewhat below that of 4G, or is there anything else going on?

Akash Palkhiwala

No, I think it's really--we're trying to be careful with our margin target. We--there are a lot of variables in the 5G growth rate, when it happens, how it happens, in terms of which tiers. So there are several unknowns, so as this plays out, we feel like having a greater than 20% margin target is a reasonable place to be right now.

Srini Pajjuri

Thank you, and then I have a question for Alex. On 5G licensing--I mean, you talked about how strong your portfolio is. Can you put that into perspective as to compare that with your 3G portfolio and 4G portfolio? The reason I'm asking this is that I've read a few times that Huawei has at least more 5G patents than you guys have. So I'm just trying to understand that, what does that mean, you know? Is that a matter of number of patents, or how strong that patent portfolio is? And then, along the same lines, if you could talk about, you know, since the trade war has begun, have you seen any change in behavior in China in terms of compliance? Thank you.

Alex Rogers

So, taking the first one. So there has been a lot of discussion about quality versus quantity, and probably a lot more on the quantity side. And so one of the things I tried to do today is actually provide some insight into quality. And I don't want to get into kind of a battle on who has more patents where. I think I'll try to give some of the key foundational points, you know, early R&D, very strong foundation in 4G.

And I think the points that were made, not just in my presentation but primary in Jim's presentation, about driving some of the key fundamental features in 5G that enable the performance benefits, the benefits to operators and users, benefits to device manufacturers that we talked about, are really indicative of the heft and value of the portfolio we have going

into 5G. Again, it's just not really worthwhile to start getting into a debate about quantitative metrics, who has more here.

One of the things we came across recently, and it's not with respect to the company that you just identified, is somebody that said, look, I have a lot--in a discussion, I have a lot of patents so I'm 5G. And we started taking a look into them, and all of the priority dates are after the date of the finalization of the spec. So, there's a lot of noise out there, that I think we're trying to cut through a little bit, but it's kind of an endless debate that doesn't really go anywhere.

With respect to compliance, compliance is good, actually. We're not laying out the data on compliance, but it's actually been quite good. And we're not seeing any pushback on compliance, you know, relating to, kind of the overall geopolitical issue. We obviously have the Huawei issue, but we're not seeing any pushback in compliance.

Don Rosenberg

I'd just add one thing to Alex's first answer, with respect to your Huawei question. As Alex said, there's a difference between quality and quantity. And there have been studies, and it's quite clear that the quality of our patent portfolio, in addition to the quality of the contributions we make versus others make to the standard, in particular in 5G now, given all its complexity. It's a big difference, and so you can't look at numbers, because numbers can be very deceptive, deceiving, and we're confident that we have real strength in both the patents and the contributions to the standard.

Mauricio Lopez-Hodoyan

We have time for one more question.

Mitch Steves

Yeah, Mitch Steves from RBC. So I just had one, just kind of clarifying the 5G side. So it looks like a lot of the growth is predicated by a pretty substantial ramp there--so I guess I have two points. So the first is, what gives you guys clarity in kind of the unit growth rate there? Essentially, what are the chances that we see kind of inventory build in China, because it seems like that's kind of the big driver? And then secondly, kind of dovetailing off into a prior question, when you get to let's say, 450, or let's 700 million units, what's the margin trajectory look like, specifically to those phones?

Akash Palkhiwala

Yeah, so, I think from a forecast perspective, as I said, there's a lot of things in play right now with 5G. So the best we could do is look at how 4G played out, and what can we learn from that. And then, also, as I said, there are two key differences, where China is starting earlier, and then we have chipset across tiers. And then we've been talking to various customer as well, and we are aware of what their plans are of launching handsets. And so we're trying to make an educated estimate based on the data points we have on how the growth rate will materialize.

Cristiano Amon

You know, I just want to--we got a lot of questions about the 5G. Maybe, I just want to reiterate one thing we said during this call. Especially as we look at the projections we make of SAM growth, we had assumed in our projections that the market, as the market is. And we've been calling down the mobile market, we're assuming the market stays as is, and our current share situation stays as is.

So, any change--and you know, we're assuming that we're going to have competition, the competition's going to execute. Any change in replacement rates, any change in share, you know, will change that dynamic, and will be upside for QTC. I just wanted to, you know, probably reiterate what our assumptions on the market on the rollout, but we feel good, it is a very high confidence number.

Steve Mollenkopf

Okay. Well, thank you everyone for coming. I think this is going to be the year for 5G, we're excited about it, and we're very happy to be able to share with you the story. Thank you.