



Operator: Good afternoon, ladies and gentlemen, and welcome to the ADI Uncovered series. At this time, all participants have been placed on a listen-only mode. It is now my pleasure to turn the floor over to your host, Toshiya Hari. Sir, the floor is yours.

Toshiya Hari: Thank you, Kate, and good morning, everyone. I am Toshiya Hari, and I cover the semiconductor and semicap equipment space at Goldman Sachs. We're very excited to be hosting the latest edition of the ADI Uncovered series, with a focus on instrumentation and test. I'm very honored to be joined by Dr. Karim Hamed, general manager of the instrumentation business unit, and also Michael Lucarelli from investor relations.

This call is scheduled for roughly an hour. Karim will kick us off with a brief overview of the business, after which I'll follow up with a list of questions. For investors on the call that would like to ask a question, please either send them in through the webcast or feel free to e-mail me directly at Toshiya.Hari@GS.com.

With that, I would like to hand it over to Mike for some comments. Mike?

Mike Lucarelli: Thanks, Toshiya. I'll add my welcome. Thanks everyone for joining us this morning. This is our sixth installment of the ADI Uncovered series, something we've done during Covid when we are all working from home. Today I am pleased to introduce Karim. Karim comes to us from Hittite, about five or six years ago. He is an RF guru. He started his career at TriQuint, and when he joined ADI, he was in the RF group. About one or two years ago, he moved into instrumentation, and today we are going to spend our time on the instrumentation market, which is really the hidden gem, in my opinion, in the industrial market for ADI.

And with that, I'll pass it to Karim. Thanks so much and hope you guys enjoy.

Dr. Karim Hamed: Thank you, Mike, thank you Toshiya, and good morning, everyone, and thank you for joining us this morning.

I am here today to talk about our industrial instrumentation business and devices, to give you guys some color on our position in this market and the future growth drivers that make us excited about the business. I have a few slides today that I will go ahead and talk through. So let me start with this one.

In 2020, our instrumentation business generated approximately \$860 million in revenue. This is a diverse and growing business across customers, geographies, applications, and technology, comprised of three segments, roughly all about equal in size.

First is our automatic test equipment, or ATE, which mostly covers high-volume manufacturing test solutions for semiconductors and portable devices. The second is our electronic test and measurements, which cover field and lab test solutions for markets like communications infrastructure, automotive, and aerospace and defense. Our third is scientific instruments, which service customers providing measurement solutions for life-sciences, environmental and process monitoring, and geological exploration.

ADI is the market leader in providing semiconductor solutions, enabling the advances in the test and

measurement market. Diversity of applications within the market really benefits from the full breadth of ADI technologies. Furthermore, our acquisitions of Hittite and Linear Technologies have strengthened our position and provided unique capabilities which enabled us to work more closely with our customers to provide complete and innovative signal chains leveraging the full portfolio, from precision to high-speed converters to RF and microwave and high-performance power.

Looking ahead, the instrumentation business is well positioned for continued growth, building upon our strong growth over the last five years and fueled by multiple drivers. First, we have exposure to all secular growth trends that will drive demand for new test applications throughout the lifecycle of these trends. Also, the complexity of these emerging technologies drives demand for increased testing, hence more ADI content.

Finally, the ongoing semiconductor re-shoring that's taking place globally would provide a strong tailwind for our business. For example, over the last few months, top semiconductor manufacturers such as TSMC, Samsung, Intel, SK Hynix, and others announced plans to expand capacity and build new fabs over the next five years, with an expected investment well into the hundreds of billions of dollars. A portion of this spend will go towards test equipment used for wafer and module testing, and ADI is well-positioned to capitalize on this growth.

Moving to the next slide, all the key secular growth markets, from electrification to connectivity to artificial intelligence all require reliable and efficient testing for the various phases from development, R&D, to deployment, and manufacturing. ADI technology is instrumental in enabling these emerging test applications during these various phases.

In addition, the increased technology complexity associated with these mega-drivers – whether it's the move towards finer node geometries and advanced packaging for semiconductor products or the increased technology content in a mobile device or in a base station or in an electric vehicle – all drive the demands for more tests and more testers, which drives the demand for ADI technology.

I'll give you an example. The move toward finer geometries enables engineers to integrate more transistors on a single chip, which translates to more functionality. These functionalities will need to be tested, and the test time will increase, and hence the volume of testers will increase, and hence ADI content.

Another example: A mobile device five years ago would have 3G, 4G, and Wi-Fi 4 for connectivity. Fast forward five years: current handsets will have 3G, 4G, 5G low band, 5G high band, Wi-Fi 4, 5, and 6, and ultra wideband. All these added functionalities need to be tested, hence driving test time up and hence more testers. There are many more applicable examples across data centers, EVs, and other next-generation technologies. As a result of these growing secular trends and the increased test complexity, we expect our SAM to grow in the high single digits over the next five years to slightly above 5 billion by 2025.

Turning to slide five now. Okay. So what's inside a tester? And again, given the diversity of applications, what's inside the tester can vary, but this very simple diagram of communications testers is generic enough to give you an idea.

Up top on the left-hand side we have the comms tester, which in most cases has an FPGA or an ASIC

that does all the computing and processing within the instrument. Beyond that, the rest of signal chain is a solution delivered by ADI.

We talked about how our acquisitions have strengthened our position in this market, and this block diagram is a good illustration where you can see how Linear and Hittite add a significant bill of material content for ADI.

We are building complete signal chains to ensure seamless interface between the various devices, most importantly optimizing the performance of each of the individual blocks, enabling us to achieve the optimum system performance, what we call instrument-grade performance, which is extremely valuable to our customers because it allows them to reduce the development cycle and get to market faster.

To give an example, working with one of our lead 5G test customers, this customer was able to reduce the development cycle by 25 percent working with ADI. In addition, while leveraging our domain expertise, we are moving into the front end. This is creating a greater content opportunity, as we deploy our additional algorithm capabilities, which ultimately expands our SAM opportunity.

Now Slide 6. So moving on to examples on how secular trends impact the instrumentation business, I've selected two applications to highlight today. First is around communication test and how the insatiable demand for data and the push towards ubiquitous connectivity and growth in cloud computing present a strong opportunity for our test and measurement business.

We can divide the communication test space into two main buckets. The first is around production test solutions, which cover areas like memory, processors, modems, and other front-end power semiconductors test. It also covers portable devices and handsets and OLED screen test. The second cluster is around lab and field tests, this covers test applications for channel emulators, base stations, protocol analyzers and data centers, conformance tests for wireless, and many other applications.

As you can see, we have – even within comms – we have a diverse set of test applications that we are able to serve within this market, and ADI is an established leader working very closely with our customers to develop innovative solutions.

Over the years, we have evolved our offering from discrete components to full system solutions, whether it's through integration or leveraging our systems level expertise to put together instrument grade signal chains, as I highlighted, or enabling our customers to get to market faster. Within the communication test market, we believe 5G and data centers will present a strong growth opportunity for us over the long term.

Turning to slide seven, I also want to highlight the battery test. Although this market is in early stages of development, we see it as a significant growth opportunity for our business as the automotive industry continues to evolve and transition toward electric and autonomous vehicles.

Like communications, we can divide the test application in the auto space into two categories. First is our production test, which covers semiconductors and battery formation. With the growing semiconductor content in vehicles, especially in power and high performance and compute, we see great upside in our semi test business to support automotive. Similarly, we anticipate the expected surge in the battery manufacturing capacity to support EV will be a strong tailwind to our battery

manufacturing test solutions.

Similarly, in the field and lab test category, with the electrification and autonomous transportation presenting a unique and new test application for ADAS, including radar, 77ghz, and lidar, vehicle-to-vehicle communications, inverter tests for EVs, and many others.

Leveraging our strong power and precision portfolio, ADI offers unique and anchoring application-specific products tailored for the automotive test market. In addition, our strong position in the automotive market, particularly within battery management systems, enables us to establish strong partnerships within the ecosystem, between test equipment suppliers, battery manufacturing, and OEMs. So again, as electric vehicles and autonomous transportation becomes mainstream, this generates a new demand for ADI instrumentation.

In closing, I am very excited about the opportunities ahead in instrumentation. Everything needs to be tested, from transistors to data centers, from portable devices to EVs, and ADI is enabling this. I hope you took away three key points today. Instrumentation is a well-diversified business that is reaching an inflection point aligned with all secular growth trends. ADI differentiates itself with high-performance solutions leveraging a complete product portfolio that's well suited for this market. Applications are getting increasingly complex, requiring much higher volume, so overall growing test content. This presents a unique growth opportunity for ADI, and we are well-positioned to capture.

With that, I'll turn it over to Toshiya for Q&A.

Toshiya Hari: Wonderful. Karim, thank you so much for that overview. I wanted to start off with a fairly basic question. I guess in this business of instrumentation and test, who are your key customers, and what's the typical sales motion like in the business? And specifically, on the latter point, how long is the design-in process, and how sticky our sockets or designs once you establish yourself as an incumbent supplier for a specific application?

Dr. Karim Hamed: Great. Instrumentation is a very broad, horizontal market business. We service thousands of customers, from small to big, with business models that are different. We service customers who build testers with their customers and OEMs who build their own test solutions. So it's really diverse, and we have a very good position across the industry.

It's an industrial business, so it has the longevity and the stickiness. So I would say typical 10 year lifecycle for test.

Mike Lucarelli: Question to ask about design cycles, like if you talk to a customer today about a new opportunity, how long does it take from discussion to revenue?

Dr. Karim Hamed: This is a good question, and it really varies, but we see the clock speed is going up in this market. So before, it used to be maybe a year to a year and a half. Now we are talking about development cycle in the months. So definitely the clock speed is going up in the institution market.

Toshiya Hari: Okay, and as a quick follow-up to that, I guess, and sort of asked differently, the question that Mike asked, but in semiconductor tests, for example, if you're working with, you know, a Teradyne on a future solution, how much in advance would you kind of know or have insight into what

the product roadmap looks like for a specific customer?

Dr. Karim Hamed: Across the board, we work very closely with our customers. I mean, this is, we have a symbiotic relationship because we develop solutions for their testers. We then use their testers to test our high-volume manufacturing. In general, I think we have a very symbiotic relationship. We develop long-term roadmaps together that encompass three, four years, five years out, right.

It is really a strong technical engagement, and as I said, ADI has been partnered with these customers for many, many years.

Mike Lucarelli: One thing I learned doing this project with Karim is while we are shipping stuff for 5G today, the conversations are about 6G on the test side. So, as you said, there's four or five years in the future where we are working on those testers for the next gen – the next next gen of the technology.

Dr. Karim Hamed: Yes.

Toshiya Hari: Got it. That's helpful. And then from a product perspective, Karim, in instrumentation, are you mostly selling ASSPs, or is this more of a catalog business? And to the extent you've got data in front of you, how has that mix evolved over the past five years, and how do you see that going or evolving going forward, over the next 3 to 5 years?

Dr. Karim Hamed: That's a good question. Most of the instrumentation business is standard products. It leverages our really unrivaled portfolio of precision, power, RF, and microwave.

We definitely deploy ASSPs when it makes sense, when we are solving a problem. At the end of the day, it's all about getting the performance – as I said, what we call the instrument-grade performance – because testers, by definition, have to be higher performance than the device under test. So that's the front and center of our customers, right? It's performance. So if we can optimize the performance with our discrete signal chain, we do that. If it requires integration, we do that.

But I would say ASSPs, roughly less than 20 percent of the overall, and I don't see that changing over the next five years – maybe up or down a couple of points, but not significant change.

Toshiya Hari: Got it. And then from a growth perspective, in your prepared remarks, you talked about a compound annual growth rates in the high single digits for the overall instrumentation business, and you also described a number of key drivers, but if you had to rank order drivers based on potential contribution to growth, what would that look like?

Dr. Karim Hamed: So, for comms, we are well-positioned there. We are well-positioned within comms tests, whether it's in wireless or wired, and I think it's still in the early innings, so as the 5G and data centers grow, I expect that this comms test business will grow nicely.

In automotive, we don't have that big of a share yet, but still, the market is still emerging, and we see a tremendous opportunity to gain share and offer customers high performance. To give you an example, for our latest battery formation solution, to integrate all the measurements and control and diagnostics and eliminate the use of DSP, this improves the cost, cuts the cost of the system by half. So we see this as a tremendous opportunity, and we're going to continue to push for that.

As I said, over the past five years, we grew this business in the double digits, and we expect the next five years, we are going to continue this growth level. The growth might come from different areas, but we can expect to continue the double-digit growth over the next five years.

Mike Lucarelli: Karim, could you elaborate a little bit on, you talked about the ATE market, ETM with automotive and comms. Could you talk about the scientific instrument market also, how it's changing, how it's evolved over the past year?

Dr. Karim Hamed: That's a great comment, Mike. So as I said in my prepared remarks, we have three segments within instrumentation. Each of them has its uniqueness and its growth driver. We talked about ATE, and we talked about the increasing semiconductor demand, that re-shoring is driving. We talked about ETM, 5G, 6G, the data centers, the EV. Scientific is also a very unique business, and we see this changing with cloud connected instruments to provide real-time detection and real-time pathogen detection, with a focus in ESG initiatives - environmental monitoring and air quality. We are going to grow this piece of the business at a higher rate than what we've seen historically.

Toshiya Hari: Got it. And then on 5G, obviously it's a big driver for not only you guys but for your customers and your customers' customers. I'm assuming the proliferation of 5G has implication both for ATE business as well as your electronic test and measurement business, but what are you seeing in the market today as it relates to 5G demand?

Dr. Karim Hamed: It is growing very nicely for us. At a high level, as I said, 5G test, it really covers all the phases, from R&D to deployment to manufacture. So, I can see that we definitely see an uptick in the manufacturing side and semi test support infrastructure rollout.

As Mike highlighted earlier, for instrument development for 6G, we are having these conversations now. So overall, I think, wireless will continue to drive decent growth for instrumentation.

Toshiya Hari: Okay. And as a quick follow-up to that, given your breadth from a test perspective, I think when it comes to deployment schedules, it can be quite lumpy and your comms business at ADI for example can ebb and flow depending on the quarter. But for instrumentation specifically, is it fair to say that your business, as it relates to 5G, is a lot more stable because you do have exposure to R&D manufacturing and so on and so forth?

Dr. Karim Hamed: Exactly. It's the diversity within instrumentation. So I would say, different applications will drive the business up and down – of course, they all add, it all adds up. But we have a really well diversified business, with multiple pockets of growth.

Mike Lucarelli: Like we were saying, because there's testing done at each facet of 5G, it helps smooth out that curve, where on the comm side, you're right, hands down, our comms business is lumpy. That's because it's based on deployments and there's only one area. Once you build it, you deploy it, whereas on the test side, you have to test it from manufacturing to deployment to the field.

Toshiya Hari: That makes sense. Thank you. And then shifting over to automotive as one of your key growth drivers, you know, the electrification of the car is a clear secular trend that many companies are

focused on. What are some of the challenges facing your customers today in the area of automotive from a test perspective, and how would you describe your growth opportunity here, relative to the overall instrumentation business?

Dr. Karim Hamed: So definitely I think first and foremost is increasing battery manufacturing capacity and reducing cost. I think that's one of the biggest challenges for mass deployment of EVs. So the battery capacity – you know, all the leading signs, like, it's going to exponentially grow. So how can you enable this? How can you streamline this battery formation and reduce the developments, the formation cycle of batteries? That's a key. That's one area.

In autonomous, for example, testing radar and lidar systems and vehicle to vehicle communications is also an interesting area and an interesting challenge. For EV inverter testing, now, it's like, when you talk about EV, it's a whole slew of test applications from the traditional internal combustion engine, and how you emulate and simulate all of these components and together, that is a very challenging test problem that we are working very closely with our customers to help resolve.

In terms of growth, as I said, we see the automotive market right now as going at an inflection point. I think automotive will grow at a faster pace. I think it will drive a lot of growth in instrumentation the next five years. And we are starting from a lower share as well, so that will help us. So overall, I'd say, in the last five years, ATE and ETM led the charge in terms of growth, followed by scientific. Looking five years ahead, I think growth will mainly come from ETM, which is driven by a lot of the automotive and comms. ATE and scientific will grow at a fast pace too.

Toshiya Hari: Okay, so as a quick follow, is it fair to say that your business tied to automotive accelerates going forward, relative to what you had seen of the past five years?

Dr. Karim Hamed: That's correct.

Toshiya Hari: Okay.

Mike Lucarelli: I think as the market shifts – I mean, your typical car five years ago in test, you didn't need as high-performance testers or as many testers. The move to more fully autonomous and fully electric vehicles is a paradigm shift in the market, and that's an opportunity for our business, because we have the know-how from the automotive side to create these testers. And that increases our SAM and also will increase our share of the next five years.

Toshiya Hari: Got it. Karim, in your prepared remarks, you talked about the on-shoring of semiconductor production as well, and obviously, to your point, we have heard from the likes of TSM and Intel about their plans to expand capacity specifically in the US but also in Europe and other parts of the world as well. I mean, what does this mean for ADI, and to the extent you see this as a tailwind, how impactful could this be to your future growth profile?

Dr. Karim Hamed: As I said in the prepared remarks, this is going to be providing a strong tailwind for us, because, as you see large investment going to foundry, this will be beneficial. So you can think of the business as a semi-capex-plus style of business. If the semi-caps grow in the mid-single digits, our instrumentation business will grow in the mid-single digits plus.

Furthermore, our automation business will also benefit from the re-shoring. But again, I am not the one directly responsible for this business unit, but it is a cyclical driver in instrumentation, so any pickup in this vein would be definitely a win for ADI.

Toshiya Hari: Okay. Got it. You talked about some of your customers actually designing and manufacturing their own testers, as opposed to going to merchant tester suppliers. But recently we hear from merchant tester suppliers how the increase in device complexity could drive some of their customers to use more of their solutions. Is this something that you are seeing, and to the extent you are, is this beneficial for ADI's instrumentation business as well?

Dr. Karim Hamed: I would say the net sum is a zero for us. We supply to customers who build testers. We supplied to OEMs who build their own testers because they have certain specific applications. I'd say the pie size is the same. The net sum for us is neutral.

The addition of OEMs building their own testers, it just adds more diversity to the business and more, I would say, customization of solutions, which I think is a positive thing. It's a good thing. But as I said, overall, it's net neutral whether we supply directly to OEMs building their own testers – and again, there are few of them because that requires significant resources, as you can tell, or supplied to a customers specialized in building those testers.

Mike Lucarelli: I want to add, as you create more specialized, customized tests for more specific OEMs, we do capture more value when we go direct, just because you're customizing it specially for them.

Toshiya Hari: Yeah. That makes sense. Thank you. Shifting gears a little bit, I wanted to ask about the competitive landscape. Karim, who are your key competitors in the instrumentation and test business? And more importantly, what are some of the things that differentiate your solutions from the peer group? And I guess as you answer the question, it would be helpful if you could describe how classic ADI has been able to leverage the Hittites and Linear acquisitions?

Dr. Karim Hamed: So instrumentation is a high-performance accuracy market. So it really is performance driven, and this is well-suited for ADI because it's in our DNA to solve these most difficult problems and bring to market high performance solutions.

In addition to having the high-performance, we also have really an unrivaled portfolio that really differentiates us from all of our competition. If you look at the portfolio from ADI from RF to high-speed precision, power, micro modules, software and algorithms and digital capabilities, I think I would say we are really in a very good position. Our diversified model creates organizational synergies. For example, we are leaders in 5G and in BMS. We can leverage our expertise to provide optimal test solutions for customers in this space.

In terms of how the acquisitions of Hittite and Linear helped, we looked at this – and again, in my prepared slides, we show approximately 50 percent increase in our SAM content, which is significant.

Toshiya Hari: Great. As a quick follow-up, Karim, your key competitors in this field, is it the usual suspects like TI and Maxim and so forth, or is it a slightly different lineup?

Dr. Karim Hamed: Most of the semiconductor suppliers supply to this market, but I would say we have

the strongest position definitely in this market.

Mike Lucarelli: Yeah, I think where we are unique, I learned of the last month doing this, is the portfolio, because no one else has the high-performance RF, high-performance precision signal chain, and high-performance power in the markets. And having all that, too – what does the customer want? Well, they want the most optimized solutions. The only way to do that is to have all of that in one place. So instead of piecing different performances from different companies, if they were to go to ADI, they'll get a fully optimized system solution that increases their throughput for their tester.

Toshiya Hari: Got it. And then it's really difficult for us to gauge how high your market share is in this field. You know, you gave a fiscal 20 revenue number. You gave a 2025 SAM, but where is your market share today? And I guess based on your commentary, it's probably fair to assume you've been gaining share, but how has that been going, and how do you see market share going forward?

Dr. Karim Hamed: I would say, again, depending on the applications you look at, so in certain areas we definitely have a very strong market share, I would say above 50, 60 percent. In other areas we are lower than that.

I would say overall blended market share, we are about 30 percent, so that's – you know, when you look at overall blended – which is a very strong position. My goal is to grow that share and as I highlighted earlier, the growth strategy is two-pronged. One, how we grow the pipeline. One, we have to defend and extend our core. Where we are, we have the share, we have to extend that and even expand to even more customers and spaces, which we are very strong. And then second is look at the areas that is emerging that we don't have a bigger share, like in automotive and scientific, and put our focus, bring our solutions together to grow our share in this space.

Mike Lucarelli: Looking forward to five years from now, what applications would you call share gainers?

Dr. Karim Hamed: I think that's actually automotive and scientific. And we have a very good position already in comms that we are definitely going to work very hard to maintain.

Toshiya Hari: Karim, in this business, do customers typically single source solutions, or do they try to engage with two or three or four suppliers? For example, if, again, I want to bring up the – Teradyne example, but if they're looking for a solution specifically for the analog test platform, are they specifically working with you guys, or is it you and someone else? How does that typically work?

Dr. Karim Hamed: You know, it's mostly single source. Again, the volume in instrumentation – and that's the bit about things in this business. It's just very broad, very diverse. The volume is not, I would say, high enough to drive multisource. So again, there is a lot of work, and maybe there was a very clear, but there's a lot of work that goes into optimizing the signal chain and getting really the instrument grade performance out of the instrument. And, as I said, once this is locked, it's locked for like 10 years.

Toshiya Hari: Got it. Okay. That's helpful. And then just given the current geopolitical backdrop, there is a lot of focus on China exposure and sort of how and with whom you compete in China. What is your exposure to that region today, and if you can talk a little bit about the competitive landscape in China vis-à-vis the rest of the world, that would be helpful, if there any differences there.

Dr. Karim Hamed: Yeah. So, China, again, important region, but I would say it's one of the smallest regions within the instrumentation business. I would say overall less than 20 percent. So that's that.

Definitely there is a competitive landscape in China, like, you know, they're pushing very hard. But I would say, as I keep saying, instrumentation is really a performance driven market, and it takes time, and it takes certain capabilities to get to this performance. And again, this is a market that "good enough" will not work, so it's not an option.

So definitely we see some local competition, and that's going to continue, but I believe it's all about upping our game and innovation and how we stay ahead in this market, whether in China or any other region.

Toshiya Hari: Okay. And Karim, any specific local competitors that we should monitor or that we should be worried about, as you think about your business over the next three, four, five years?

Dr. Karim Hamed: I can't think of a specific name, Toshiya, but again, there is a lot of competition in China, a lot of local – and that's not something new. Maybe it's a little bit accelerated, but I can't think of a specific name.

Mike Lucarelli: Yeah. I mean, from a standpoint of, where would China go, I feel like instrumentation would probably be the last market they would target from kind of a go to market strategy. It's not super high-volume, and it's super high performance, and those two things are very – they want volume, and they want lower performance.

I would say if there is a business at ADI that's well insulated, it would definitely be the instrumentation market, because it is the highest performance portfolio we have.

Toshiya Hari: Got it. I've gotten a couple of questions from investors through the webcast regarding the opportunity as it relates to Maxim. I know it's a sensitive topic, but any sort of opportunities specific to instrumentation that you can speak to, Karim or Mike?

Mike Lucarelli: Yeah, I'll grab that one. Unfortunately, can't talk much about Maxim. We're still two separate companies. But once we close the deal, which is targeted for the summer, we'll look forward to talking more about how Maxim adds to the portfolio on the instrumentation side as well as the rest of our markets. ADI is the market leader here, and I think there is a technology portfolio that Maxim adds that we can bring to customers and end solutions.

Toshiya Hari: Got it. Thanks for that. Shifting gears, a little bit, wanted to dive a little bit into the financials of the business. But before I go into specific questions, Karim, a question on kind of KPIs that the senior management team focuses on. As the general manager of the business units, what are you kind of evaluated on when you are having conversations with Vince and Prashanth? Are they asking you about revenue growth or market share or margins, free cash flow, all of the above? What's the focus?

Dr. Karim Hamed: I would say first and foremost, it's continued innovation, right? It's so definitely, you have – again, this is a performance driven market, and performance is the key, and to continue our innovation in this market. That's how we got there. That's how we are going to continue to drive growth.

But definitely, topline revenue growth is front and center for us, and as I highlighted earlier, we have a very solid strategy, leveraging our very unique position in this market. We have areas that we are doing very well that I think will drive growth longer-term. We have areas that are emerging that we are growing our share.

I would say first and foremost definitely innovation, and then topline growth is front and center.

Toshiya Hari: Got it. And then in terms of the margin profile of instrumentation, ADI clearly generates some of the best gross margins in the industry. But with instrumentation specifically, how are you positioned vis-à-vis either the industrial business or overall ADI? And to the extent that there is a delta between instrumentation and the rest of your business, what's driving the difference there?

Dr. Karim Hamed: I would say it's fairly in line with industrial average. So I wouldn't expect any material change to industrial gross margin one way or the other. Mike?

Mike Lucarelli: Yeah. I mean, for those on the call, our targeted gross margins are 70 percent plus. The delta is above that average, and I think as we were just talking through it, our average gross margins in this business are actually above 70 percent. And the good news is, as we grow this business, we're not sacrificing margins. We are adding more solutions, more content, and the margin profiles will stay similar.

Toshiya Hari: Got it. And then we have gotten a couple of questions on, for the near-term demand profile of the business as well. I think on your January quarter earnings call, Vince and Prashanth pointed to an acceleration in demand in the overall industrial segments, across automation and instrumentation, obviously, and I think energy. They also spoke to their expectations for continued growth or strength in the April quarter. What have you seen from a demand perspective, Karim, in instrumentation specifically recently, and what are your high-level expectations for the fiscal second half?

Dr. Karim Hamed: Instrumentation is becoming more broad and diverse, aided by all the secular trends that we discussed, like 5G and 6G now starting, EVs, autonomous transportation. So there's a multiple secular trends layering on top and we're working to create more sustainable and less volatile business. That's a general statement.

Demand remains very strong, so we anticipate another solid second quarter, and with the global economic recovery and our position in instrumentation, we continue to see strength in our bookings and improvement in overall supply and capacity. You know, the second half we think is going to be even better than the first half.

Mike Lucarelli: Yeah, I'll add, I mean, you're right. It's been a strong business even last year, in the downturn of 2020, our instrumentation business did quite well. As there was a move to more cloud compute and data centers being built, all that needed to be tested.

And as you turn the page to this year, all that demand has continued and probably accelerated some, I would say, and gotten broader, outside of just that. We are seeing demand on the memory of the business now as well as EV and automotive. It's a good market, and I think it's got legs to continue to grow through this year and into next year.

Toshiya Hari: Got it. That's great. Thank you. And then just on the supply constraints, Karim, it's something that we hear about, read about pretty much on a daily basis. In instrumentation specifically, how are you managing the current supply shortage, and have you picked up any change in customer order patterns that would potentially indicate double ordering.

Dr. Karim Hamed: No, we haven't picked that up. So, yes, as you said, this year supply is very constrained across the semiconductor industry. We work very closely with our customers to manage during this crunch. You know, as I said earlier, with most of these customers, we have symbiotic relationships, so we kind of need these testers to expand our capacity, and they need our technology to build these testers. We worked very closely together on this, and, you know, even with the supply crunch, we are able to grow. As Mike said, we're able to grow our revenue second half – second quarter and through second half.

So, yeah, we are managing through the crunch and working very closely with our customers to make sure that we don't have any supply issues or line-downs.

Toshiya Hari: Got it. Wanted to go to a question from an investor through the webcast – I guess two questions. What's the opportunity for ADI to replace customers ASICs with ASSPs? What's the size and duration of the opportunity related to millimeter-wave and then 6G, and with 6G specifically, when do you expect the cycle to start benefiting your business?

Dr. Karim Hamed: They're all great questions. Let me start by 6G first. So as I said, 6G is, I would say, 10 years out, right? But the instrument development and the R&D phase starts now, right? So the standardization, and that's – like, again, as I said, we develop solutions across the lifecycle, right? So 6G R&D is starting now, frequency ranges, performance, stuff like that, and there's no tech standards, but that's where we work very closely with our customers. But I would say it is starting now. We're starting some product development – again, prototypes, but nothing, I would say, significant. But that's normal, within the nature of instrumentation.

In terms of millimeter-wave, and terms of 5G and radar, definitely we see that up-and-coming, and I would say all indications within the next two or three years, we will see a significant uptick in millimeter-wave tests, fueled by radars and fueled by millimeter-wave 5G global deployment.

Mike Lucarelli: The ASIC versus ASSP.

Dr. Karim Hamed: The ASIC versus ASSP – so this is, again, it happens all the time, and at the end of the day, what we really look at is, can we bring value, right? If can we integrate our technology, our solutions and solve a problem. And that's our decision-making criteria, rather than, can I take a customer ASIC and do it internally. If it's just a replacement, there is no value there.

But if there is a value by doing this, by integrating this with our front end and our capabilities, then yes, absolutely. We are always open to that, and we do a lot of this currently in development.

Mike Lucarelli: I think another phrase – when we ship to a customer, we don't necessarily lose business to an ASIC they develop.

Dr. Karim Hamed: No.

Mike Lucarelli: We are complementary to that ASIC they develop.

Dr. Karim Hamed: Exactly. We sometimes have said, like, we integrate IPs from customers in our solutions and stuff like that.

Toshiya Hari: Got it. Another question from an investor: I guess when you think about your current portfolio, your technology portfolio, you've got the legacy ADI components, you've got Linear, you've got Hittite. Is there anything missing in the portfolio, as you think about addressing future customer problems?

Dr. Karim Hamed: So to be honest – again, and I highlight it so many times – this is the strength of why we are doing very well in this market is, it's really the strength of our portfolio. We really have an unrivaled portfolio. If you look across semiconductors, you will see that ADI is very unique, in terms of all of these core franchises, which is again, great technology franchises. You know, that has put us in a very unique spot, complete product portfolio, and again, all high-performance, in a market that customers are willing to pay for the performance, absolutely.

So I don't see any gaps in our portfolio, but of course, innovation is first and foremost. We are going to keep innovating. We just can't be, as Vincent says, a sleeping pill. No, we have to keep innovating. We have to work with our customers and make sure that we continue the leading edge of technology.

Toshiya Hari: Okay. Got it. And that I guess somewhat of a related question to that: You know, when you think about content growth going forward to across classic ADI, Linear, and Hittites, I guess things like high-speed mixed signal for ADI, power for Linear, and RF for Hittite, where do you see the most opportunity from a content growth perspective? Or do you not kind of think about your business that way?

Dr. Karim Hamed: No, we don't think about it. Definitely we see it to – you know, we think about it by product line, by technology and by core franchise and how each one is doing. I would say RF has a strong position. Mixed signal has a very good growth position.

And again, when you say about content growth, as I highlighted in the prepared remarks, we are also trying to get more into digital processing within our high-speed converters and adding more algorithms and capabilities, when it makes sense, to grow our SAM and share content.

But I would say, the beauty about this business is the diversity, and it's broad, right? So you can't just single out one technology. It's really all of the above. And I can say that precision has a big play in automotive and battery tests, big play in the growth, and really, RF is more toward comms. Precision also has a big play in scientific growth.

So it's really all of the above, and I can say, like, it's really the complete portfolio that really differentiates us from the competition.

Toshiya Hari: Got it. And Karim, a couple of questions that I've gotten as it relates to the competitive landscape vis-à-vis TI. Specifically, how are you different from TI? How are you unique, as you address customer problems?

Dr. Karim Hamed: So I can tell you this – like for example, again, the obvious example is RF, right? So RF, microwave, millimeter-wave, I think ADI is the market leader, and this is a critical technology in instrumentation. That's an example.

Again, across the board, it's really the performance driven and our innovation and high-speed precision that really put us in a very strong position versus, compared to like, for example, TI. But I went to the good and clear example is for RF, which is, this is something that's unique to ADI.

Toshiya Hari: Got it. Sorry, I'm jumping around a little bit here, but another question from an investor. Can you talk about your software and algo capabilities and how you leverage them in your instrumentation and test business?

Dr. Karim Hamed: Yeah. We definitely are growing our capabilities there. We are integrating some of this in our high-speed converters, and especially in our current platform and next-generation platform. If you look at it from a converter and even for our 5G, we have really grown in comms. We have really grown our capabilities there.

We are leveraging this. As I said, this is the organizational synergies that we can bring from, our position in comms, for example, that we are leveraging this know-how, and we are deploying it when it makes sense for our instrumentation business.

Toshiya Hari: Got it. And then, I guess the last question from investors, just on the potential share growth going forward. Can you elaborate on sort of the key enablers, as you think about potentially gaining share, is it proprietary products, quality of products, the breadth of your portfolio, scale, all of the above? If you elaborate on that, that would be great.

Dr. Karim Hamed: I think, Toshiya, it's more all of the above. I truly believe that in each of the technology franchises, in each of the applications, we have – as I highlighted in the call, we have unique applications. I can see, for example, areas like automotive will drive significant power and precision technology. I can see comms driving high-speed mixed signal and RF.

So again, with the growth in comms and data centers and EV, I think that all of the above have really good opportunities for growth.

Mike Lucarelli: I think the one thing I'll add to what Karim said is, looking at the market – like automotive, it's new technologies. There is a paradigm shift in the EVs, and we have a good market share there on the automotive side. Then you flip it to the scientific and instruments, it's new customers. It's adding new customers in that market, finding kind of how you get closer to those customers and sell your portfolio to those customers.

So there's share gains of content within each application, and also finding new customers in different markets.

Dr. Karim Hamed: And to your point, Mike, we have been growing our customer base over the last few years, so our customer base as well is growing. It's a really unique business that's very diverse, that's, you know, thousands – as I said, literally thousands of customers we're servicing within instrumentation.

Toshiya Hari: Got it. Okay. We've gone through a lot. I've exhausted the list of questions from investors. Karim and Mike, anything else that we should be asking you guys or focused on as it relates to instrumentation? Anything that we haven't covered yet that you think is very important going forward?

Dr. Karim Hamed: No, I think, Toshiya, you covered it all. But what I want to leave you with, as I said, instrumentation is really at the forefront of innovation, right? It's driven by megatrends. The instruments need to be high performance, for the device under test – the instruments need to be high performance and enabling this from DC to 100 gigahertz is really where ADI shines.

Our portfolio is complete. We have incredible portfolio, and as the market continues to evolve with increased complexity a much higher volume, I think that's a great opportunity for us to grow.

Mike Lucarelli: I want to thank you for joining us. We will post the slides on the ADI investor events page either later today or tomorrow.

Toshiya Hari: Great. Karim and Mike, thank you very much for taking time today. It was great to learn more about the instrumentation and test business, and I hope it gets the focus and attention it deserves going forward. It sounds like a great business. Thank you.

Dr. Karim Hamed: Thank you, Toshiya. I really appreciate it. Thank you everyone on the call. It was a great discussion, and we are happy to have this call. Thank you.

Toshiya Hari: Thanks so much.

Operator: Thank you, ladies and gentlemen. This does conclude today's event. You may disconnect your lines at this time and have a wonderful day. Thank you for your participation.

[End]