



**Akoustis Technologies Inc.**

**First Quarter 2020 Investor Update Call**

**November 8, 2019**

## C O R P O R A T E P A R T I C I P A N T S

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**Jeff Shealy**, *Chief Executive Officer*

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## C O N F E R E N C E C A L L P A R T I C I P A N T S

**Suji DeSilva**, *ROTH Capital Partners*

**Cody Acree**, *Loop Capital Markets*

**Anthony Stoss**, *Craig Hallum Capital Group*

**Patrick Walsh**, *Oppenheimer & Co.*

**Harsh Kumar**, *Piper Jaffray*

## P R E S E N T A T I O N

### **Operator:**

Good day, ladies and gentlemen, and welcome to the Akoustis Technologies Business Update Conference Call. As a reminder, this conference call is being recorded. At the conclusion of the Company's presentation, Akoustis' Management will take questions. To ask a question, please press star, one on your keypad to be placed into queue. A replay of the call will be available on the Investor Relations section of the Akoustis website.

I would now hand the call over to Tom Sepenzis, Vice President of Corporate Development and Investor Relations. Please go ahead, sir.

### **Tom Sepenzis:**

Thank you, Operator, and good morning to everyone on the call. Welcome to Akoustis first quarter fiscal 2020 business update conference call. We are joined today by Founder and CEO, Jeff Shealy; Interim CFO, Ken Boller; and VP of Business Development, Dave Aichele.

Before we begin, please note that today's presentation includes forward-looking statements about our business outlook. All statements other than statements of historical facts included during this conference

call, including statements regarding our strategies, operations, costs, plans, and objectives, including the timing and prospects of product development and customer orders, the possibility of entering into collaborative or partnering relationship and guidance regarding expected revenue for the current fiscal quarter, are forward-looking statements. Such forward-looking statements are predictions based on the Company's expectations as of today and are subject to numerous risks and uncertainties. The Company and our Management team assume no obligations to update any forward-looking statements, made on today's call. Our SEC filings mention important factors that could cause actual results to differ materially. Please refer to our latest Form 10-K filed with the SEC to get a better understanding of those risks and uncertainties.

I would now like to turn the call over to Jeff Shealy, Founder and CEO of Akoustis.

**Jeff Shealy:**

Thank you, Tom, and welcome, everyone, to our first quarter fiscal 2020 business update call. In the September quarter, we delivered several important milestones as we continue our transition from an R&D-focused Company to a commercial manufacturing Company. With the recent design lock of our 5.6 gigahertz WiFi filter that we announced in July, we were able to begin shipping pre-production 5.2 gigahertz and 5.6 gigahertz WiFi coexistence filter solutions to multiple customers during the September quarter. These filters are the world's first tandem 5 gigahertz WiFi BAW microfilter solution, which we expect will pave a path into high volume filter markets, with the goal of delivering significant revenue growth over the next 12 months and beyond.

This September quarter also brought a second tier-1 customer in the 5G network infrastructure segment. The number of opportunities we're seeing in 5G network infrastructure are expanding as we expect many carriers will begin deploying sub-6 gigahertz networks throughout calendar 2020. We believe that our current 5G infrastructure customers will deliver significant revenue growth over the next 12 months, and may even outpace WiFi filter revenue in the first half of calendar 2020.

We also took a significant step towards penetrating the mobile handset market as we push beyond our first 5G development order that we received in the June quarter from a tier-1 customer. The mobile handset market is our largest potential BAW filter market opportunity by both volume and revenue. Given the performance of our first 5G mobile filter, our tier-1 customer responded earlier in the September quarter with a new order to develop two additional filters in the ultrahigh band frequency spectrum. For clarification, all three filters target the performance and form factor necessary for 5G handsets.

With respect to the call today, I have organized our comments into three sections. First, a recap of our September quarter accomplishments by market. Second, Ken will provide an update on our financial results; and finally, I will highlight our expectations and milestones beyond the September quarter.

The September quarter continued to build on the momentum from the first half of calendar 2019. Akoustis was founded in 2014 on the premise that by utilizing advanced single crystal piezoelectric materials, we could create a unique manufacturing process to produce a new class of high performance BAW RF filters that would exhibit differentiated and superior performance in the ultrahigh band frequency spectrum. Today Akoustis produces some of the most advanced piezoelectric materials and resonators to address high performance RF filter applications.

What differentiates Akoustis is a unique and patented materials and process technology, which we have branded and trademarked XBAW. Our products currently target applications operating in the 1 to 7 gigahertz frequency spectrum in the growing WiFi, wireless network infrastructure, mobile handset and defense markets, each application requiring characteristics that could include high frequency, high power handling, wide bandwidth, reduced form factor and/or any combination thereof.

I would now like to outline our progress in calendar 2019 in each of the four major markets we are targeting, namely defense, high band WiFi, 5G and other network infrastructure, and finally, mobile handsets.

The transition to high volume packaging in our defense products in early calendar 2019 led to the successful ramp of our 3.8 gigahertz filter for the defense market during the June quarter. We filled three open orders in the June quarter for our 3.8 gigahertz filters with positive feedback from our customer. Since the successful delivery of our 3.8 gigahertz XBAW filter, a customer awarded Akoustis with an order to develop five additional S-Band filters for new phased array radar systems. Each of these five new filters will operate within the 2 to 4 gigahertz spectrum.

Our team has made significant progress on the development of these new filters during the September quarter, and we remain on track to deliver our first samples by the end of the current quarter. We still expect to enter production with our customer with these new S-Band filters in calendar 2020.

In the first half of calendar 2019, we introduced the world's first 5.2 gigahertz BAW WiFi coexistence filter operating in the U-NII 1 plus 2A band. This XBAW microfilter for the WiFi CPE market has garnered significant attention in the WiFi industry. By the end of the first half of calendar 2019, we had sampled our 5.2 gigahertz filter to over 15 potential customers, including SoC makers, RF frontend makers, OEMs, ODMs and distributors.

On July 30 of this year, we introduced the world's first 5.6 gigahertz WiFi coexistence filter with wide bandwidth covering the entire 345 megahertz U-NII 2C+3 band. This 5.6 gigahertz filter specification is extremely challenging to meet as it simultaneously requires high frequency operation, wide bandwidth and high rejection performance. Our ability to meet this difficult specification is a testament to our XBAW technology.

From a supply chain standpoint, our 5.6 gigahertz filter leverages the high volume packaging that we developed for our 5.2 gigahertz filter which has cut down on time to market considerably. We now offer the world's first 5.2 gigahertz and 5.6 gigahertz tandem WiFi microfilter solution. We are currently shipping preproduction filters to multiple SoC, RFFE, OEM, ODM and distribution companies. We expect design wins over the coming months and remain on track to commence production for WiFi customers in the first half of calendar 2020.

In the September quarter, we separately announced shipment of pre-production 5.6 gigahertz filters to a tier-1 WiFi OEM as well as a win with a leading SoC vendor that took pre-production parts of our tandem 5.2 and 5.6 gigahertz filter solutions. This morning we also announced that we shipped over 60,000, 5.6 gigahertz filters to a leading RF customer during the September quarter. The high power handling capability of our XBAW process and high purity piezoelectric materials attracted our first 5G network infrastructure customer late last year. In the first half of calendar 2019 we continued to develop samples for this customer.

The same high power handling capability and performance characteristics of our filters led to a second customer engagement in the September quarter, which I will discuss in great detail in a moment. With respect to 5G network infrastructure filters, we believe that XBAW has several advantages over competing solutions, including our first to market presence above 3 gigahertz where 5G cellular is being deployed worldwide.

The United States market is focused on Citizen's Broadband Radio Service, or CBRS, in the sub-6 gigahertz spectrum, while the rest of the world is moving rapidly towards multiple bands within the sub-6 gigahertz spectrum. Both play right into Akoustis' sweet spot.

In the September quarter, we delivered advanced samples of our 5G filters to our first network infrastructure customer. These filters are being developed for massive MIMO base stations, with an expected production ramp beginning by mid calendar 2020. Our customer continues to evolve its platform, and we believe we are now more closely aligned with performance characteristics that can work within its 5G architecture. We expect to enter production with this customer in calendar year 2020.

In September, we announced the second global tier-1 5G network infrastructure customer. This customer has asked us to develop an ultrahigh band filter in the sub-6 gigahertz spectrum for small cell base station applications. Specifically, the filter is expected to operate within the n79 bands, one of the initial global 5G bands in the sub-6 gigahertz spectrum. Our filters are particularly well suited for 5G network infrastructure due to high power handling and small form factor. We expect to deploy BAW filters for 5G ultrahigh band network infrastructure in calendar year 2020. This filter is aimed at the rapidly growing 5G network infrastructure market in China, but is expected to be the first of several ultrahigh band filters we plan to develop for 5G networks over the next several quarters.

One highlight in the first half of the current calendar year was our first 5G mobile customer engagement. This multibillion dollar tier-1 telecommunications customer contracted us to develop an XBAW filter in the sub-6 gigahertz frequency band for 5G mobile handsets. As I've stated many times, during previous Investor conferences and conference calls, Akoustis does not intend to enter the tier-1 handset market without a partner, at least in the foreseeable future.

It is worth noting that our XBAW filters have already been evaluated by several select top tier mobile OEMs. The mobile handset engagement with the current customer started in the June quarter with the development of one XBAW filter which we were able to deliver within two months. The feedback on that initial filter was extremely positive, which led to one of our most significant announcements in the September quarter, that this customer ordered the development of two additional filters for 5G handset applications.

Mobile remains the largest potential market by volume and revenue for Akoustis with approximately 1.5 billion handsets sold last year according to a February 2019 Gartner report. The order of two additional filters by our initial customer represents strong validation.

I would now like to turn the call over to Ken to go through select financial highlights.

**Ken Boller:**

Thank you, Jeff. For the September quarter, we reported revenue of \$543,000, in line with prior guidance. As anticipated, total revenue was flat sequentially, despite rapid filter revenue growth as we experienced the expected fall off in non-core MEMS-related revenue. Importantly, XBAW filter-related revenue grew sequentially 39%. Currently, we have concluded nearly all non-core MEMS foundry related business to allow our future capacity to be dedicated to our XBAW filter product line at our fab in Canandaigua, New York.

On a GAAP basis operating loss was \$9 million for the September quarter, mainly driven by labor costs of \$5.3 million, depreciation of \$0.7 million and other one-time GAAP expenses and operational costs totaling \$2.2 million. As a result, our GAAP loss per share was \$0.30.

On a non-GAAP basis, operating loss was \$5.8 million and non-GAAP loss per share was \$0.19. Our cap ex spend for Q1 was \$1.6 million compared to \$0.3 million in the prior quarter, primarily related to our five times capacity expansion in our New York fab. Cash use and operating activities and cap ex in Q1 was \$7.4 million. We exited the quarter with \$22.7 million of cash on the balance sheet.

To provide Investors with additional color on operating cash burn, the September quarter carries higher expenses, including the annual bonus payout and year-end related professional fees. We remain in a strong financial position with sufficient cash on hand, which provides adequate operating capital through our fiscal year 2020.

Now I will provide guidance for the December quarter. We believe revenue will remain relatively flat on a sequential basis with continued growth of our XBAW filter-related revenue, offsetting expected declines in our non-core MEMS foundry revenue. Foundry revenue is expected to decline to less than \$25,000 per quarter on a go-forward basis.

I will now turn the call back over to Jeff to discuss our forward outlook.

**Jeff Shealy:**

Thank you, Ken. The Company had a successful quarter with respect to our reported milestones. In September we delivered fully qualifiable 5.6 gigahertz WiFi filters, shipped to 5.6 gigahertz WiFi filters against two open orders received in the June quarter. We delivered 5G network infrastructure filters samples to our first tier-1 infrastructure customer for massive MIMO architectures.

Our second half calendar 2019 target milestones included receiving two additional orders for the development of sub-6 gigahertz RF filters for 5G handsets, as well as shipping samples of a new XBAW filter for 5G small cell infrastructure, both of which we have already achieved as discussed earlier. What we have left on the milestone list includes the demonstration of our wafer level packaging for handsets, and the introduction of a new application for our filters, both of which are on track to deliver by the end of the current calendar year.

I will now discuss what Investors should expect in each of our major markets. We are currently targeting the delivery of five new S-Band filters for our defense customer in the December quarter. These five filters are expected to sample by the end of the calendar year with potential acceptance and commercial sales expected to begin in the first half of calendar 2020. We believe we are on track to deliver the samples by the end of December and continue to work with our customer to achieve qualifiable parts that meet very stringent specifications. Historically, this market is driven by radar and communication applications, with attractive ASPs and long product life cycles driven by repeat orders. We choose customers in this segment which we believe can materialize into a multimillion dollar per year revenue with attractive margins.

We have announced the shipment of our new tandem WiFi filter solution covering both the 5.2 gigahertz and 5.6 gigahertz frequency bands to several potential customers including SoC, OEM and distribution partners. We have sampled multiple customers and have identified new WiFi 6 platforms interested in our performance, utilizing our smaller form factor for these higher MIMO architectures.

We are currently tracking four active product developments considering our filter solution which expect to launch in calendar year 2020. As customers complete their product development, we expect to receive confirmation of one or more design wins and schedules for the accompanying production ramps.

Next, I will move on to network infrastructure. First, I will discuss our activity related to small cell infrastructure. We recently shipped initial samples to our second 5G network infrastructure customer, and we expect to hear feedback and receive our first pre-production order by the end of the year. Additionally, this customer has provided specifications for the development of new XBAW filters to support additional 5G frequencies. Given our current visibility, we believe that we are well positioned to ship the second design by March with the possibility of both designs ramping to commercial volumes by mid-year.



Next, I will discuss our activity related to massive MIMO infrastructure. We continue to develop a unique solution for higher power BAW devices targeting network infrastructure. During the September quarter, we shipped our most recent sub-6 gigahertz product samples to our tier-1 customer. We expect to meet with this customer this quarter to review performance of the latest prototypes and we expect to receive a new purchase order for engineering development. Overall, we plan to achieve a design win in the first half of calendar 2020, and we are discussing strategic opportunities to work closer together to support their production ramp in the second half of calendar 2020.

Next, I will move on to the mobile market, our pathway into the mobile market includes selling ultrahigh band discrete into the tier-2 market or developing a partnership with a supplier in the tier-1 market. We are focused on shipping two filters to our current customer for evaluation in their 5G solutions. We remain confident that we will achieve our shipment goals for this customer in the December quarter.

In conclusion, we are working diligently to achieve each of our stated objectives. We will update you on our execution against these objectives each quarter going forward. As we discussed in our previous conference call, in order to support our current engagements and emerging sales opportunities, we continue investing to increase manufacturing capacity by up to five fold over the next 12 months to produce hundreds of millions of XBAW filters per year. Beyond our current expansion, the Company will be positioned to scale our current New York wafer fab to produce up to 5 billion XBAW filters per year when fully equipped, if the right partnership opportunity presents itself.

I would like to thank those who have joined us today on this call. We continue to build the Company on four solid pillars; including, strong Management and technical staff; strong intellectual property, which includes 26 issued patents, and 52 patents pending; large and growing markets with limited historical competition, and the high band and ultrahigh band spectrum; and our qualified wafer manufacturing operation, which is expanding to address high growth opportunities in our target end markets.

We are now favorably positioned to penetrate the WiFi market with the world's first tandem 5.2 and 5.6 gigahertz ultrahigh band BAW filter solutions. Additionally, we continue to progress on our 5G engagements with global market leaders in both network infrastructure and mobile handsets, providing our Company with strong growth opportunities in high performance coexistence BAW RF filters.

Before ending my remarks, I would like to congratulate and thank our employees for their hard work and commitment to our mission and our Shareholders who continue to support the Company, and with that, I would like to open up the call for questions from the investment community. Operator, please go ahead with the first question.

**Operator:**

At this time, we will be conducting a question-and-answer session. If you'd like to ask a question, please press star, one on your telephone keypad. A confirmation tone will indicate your line is in the question queue. You may press star, two if you'd like to remove your question from the queue. For participants using speaker equipment, it may be necessary to pick up your handset before pressing the star key. One moment, please, while we poll for questions.

Your first question comes from line of Suji DeSilva with ROTH Capital Markets. Please proceed with your question.

**Suji DeSilva:**

Good morning, Jeff, Dave and Tom. Congratulations on a very busy 2019. The activity really is a good validation of your technology, so hat's off to you. Jeff, this could be a tough question, but I'll ask it anyway. Calendar year '20, you have a lot of end market opportunities. Would you be able to rank order among WiFi, wireless infrastructure and military, smartphone, which has the potential to be the largest revenue contributors in 2020? More importantly, (inaudible)-wise, which are the most likely to be revenue contributors in 2020? Any color there would be helpful. I know it's a hard question.

**Jeff Shealy:**

Good morning, Suji, and thank you for the comments. In terms of markets that contribute to our 2020 plan, we're—let me provide them in a couple of different ways. I think we outlined some of the dynamics of those in the prepared comments.

But first, we are deepening the sales funnel with WiFi. That represents a significant opportunity for us. When you factor in the ASPs for that market, they're lower than they are in the infrastructure. We noted in the prepared comments that we've got—we added a new tier-1 customer in the small cell infrastructure.

We also had indicated that we felt by mid-year, with the rapid deployment of small cells and massive MIMOs into the 5G markets, that infrastructure could certainly overtake the WiFi business, perhaps as early as middle of the year. We've got significant activity going on there with actually multiple customers, and there's significant filtering requirements required for those networks that have been deployed.

To just give you some feel for some of the—what's motivating some of the numbers, we see approximately—you're going from approximately 100,000 5G base stations in the China market to close to a million by the end of 2020. There're significant growth opportunities there and we're pushing that product line heavily. It's not competing with our WiFi, because we're already out in the market with that, so if you look at where the engineering resources are going...

Let me add to that, as hopefully you caught from my prepared comments, so we are extremely enthusiastic about what we got going on in the mobile market, with development of two filters. We have—and we're on track to deliver those filters to that customer. Those are development filters. Those are new 5G ultrahigh band frequency devices. We're effectively focused on educating for the customer today and we'll see where that engagement takes us after delivery this quarter of those parts.

**Suji DeSilva:**

Okay, that's helpful. Then a quick question on the smartphone market. Is the demonstration of the wafer level packaging a critical component of having a joint development effort or joint venture type of investment, is that a critical factor in being able to do that?

**Jeff Shealy:**

No, it's not. Let me clarify that. One of the things the mobile customer brings is their own wafer level packaging. Effectively, they buy filters from us and they can integrate those seamlessly in their module schemes. As we have stated, we have our own WLP that we've been working. But when you're working with it, for someone who's got a release platform, we focused on deploying the filters for that customer in their module technology.

That takes some of the pressure off of us on WLP and we can focus on hitting the filter chip performance for them.

**Suji DeSilva:**



Okay, that's very helpful color there, and then two questions on wireless infrastructure. On the tier-2—the new tier-1 customer and the original tier-1 customer, can you talk about what geography the companies are headquartered in, whether it's Asia or Europe, and what geographies the companies are targeting? Just if you could clarify for both customers, that'd be helpful.

**Dave Aichele:**

Hi, Suji. It is Dave Aichele. I would say that what we can comment in is the region that they're targeting. It is the Asian market, primarily China, and the exposure there, as Jeff highlighted in the prepared comments, is that we've got one band that we're focusing on, which is the band 79. But that there are additional designs that we're starting to work on that would expand into the other frequency bands down at 3.5 and also at 2.6.

That's really focused on the China market. But part of what we're doing is creating a platform that we can sell these types of components into other tier-1 and tier-2 infrastructure customers, because they recognize obviously the tier-1, once they adopt it, that this is a platform that they want to—or a technology that they want to incorporate as well. That would allow us to go into South Korea, and then also into Europe as well.

Then, thirdly, is the CBRS also fits in line with our development of 3.5 gigahertz. We've got activities with the North American market as well.

**Operator:**

Your next question comes from the line of Cody Acree with Loop Capital Markets. Please proceed with your question.

**Cody Acree:**

Yes. Good morning, guys. Excuse me. Good morning, guys, and thanks for taking my questions. Can you help us with the pricing differential that you're seeing between pre-production and once you expect to go to production, how much of a step function or a gap is there between those two definitions?

**Jeff Shealy:**

Hey, good morning, Cody. Jeff here. I am going to hand that one off to Dave to discuss the pricing.

**Dave Aichele:**

Yes, hi Cody. The pre-production volumes are, from a volume standpoint, depending on the market. We really look at the WiFi and the infrastructure. WiFi, we're shifting hundreds to tens of thousands right now. As you go from that hundreds to tens of thousands, you start seeing a decline, obviously on the ASP. Then where we see it stabilizing is the millions, as far as becoming more flat. Obviously the ASPs, again, in multiples go down. I think we've highlighted what high volume, manufacturing price is going to be in the WiFi side. It's the same model with the infrastructure, but it's multiple times higher from an ASP. The good thing is we're utilizing our XBAW technology to support both the WiFi market and also the infrastructure. Then the volumes there, you're, again, talking hundreds of thousands for pre-production and then ultimately going to hundreds of thousands and even low millions for that market.

**Cody Acree:**

Great, thank you for that. I guess the timing, when we're thinking about—and I know that there's probably no typical, but give us a range between what you've been seeing as post pre-production shipments, and then the time it takes to get to volume production.

**Dave Aichele:**

Yes, I'll take that one, Cody. It's Dave again. The main thing is that, in the prepared comments, we really started shipping these pre-production volumes in the September quarter. Then we've continued to ship that through this quarter as well. The beauty of it is that we now get two designs, at least for the WiFi market, the 5.2 gigahertz and the 5.6 gigahertz that are meeting all of the specifications, and customers are excited to see that.

Really, what we're doing is focusing on the two markets for retail side and the enterprise side. We've got a funnel of over 20 engagements. We have identified and we're tracking four active projects right now. These are all WiFi 6, 802.11AX, and they are higher MIMO counts. You're looking at typically four by four. The retail market is usually a six to nine months design cycle and the enterprise is usually nine to 12 months design cycle. We expect to be able to announce design wins in the coming months. Then we will be able to give you a little bit better clarity and visibility to the production ramp once we get obviously everything shored up.

**Cody Acree:**

Sure. Okay, and lastly then, you alluded to this or you gave us some parameters that, just any further color on your expectations for op ex and cap ex through the year?

**Jeff Shealy:**

I will hand the mic to Ken.

**Ken Boller:**

Yes. Good morning, Cody. Our op ex expectations are to remain consistent with what our average has been throughout the previous year, including this quarter, which is in the \$4.5 million to \$5 million per quarter. That is taking in to account certain annual expenses that occur at certain points during the year and extraordinary items. I expect the op ex remains in that range going forward until we see a revenue ramp, at which point that operating cash burn will decrease.

As far as the cap ex side goes, we have stated about a year ago that we were on a journey to increase our capacity five times. That would take about two years and cost approximately \$20 million. So far, we spent about \$6 million in that process. I anticipate spending about \$12 million to \$15 million in the next 12 months, which is additional cap ex capacity expansion to five times, getting us to the hundreds of millions of filters range.

**Cody Acree:**

Great, thank you, guys.

**Jeff Shealy:**

Thanks, Cody.

**Operator:**

Your next question comes from the line of Anthony Stoss with Craig Hallum. Please proceed with your question.

**Anthony Stoss:**

Good morning, guys. Nice to see the continued progress. Jeff, maybe if you could elaborate, is it fair to say that you've sampled to all the major WiFi players, and if so, how many you are—or how many different customers do you think you'll have by the end of 2020 shipping commercial volume to?

Then on the handset side, similar question, how many different handset customers have you sampled to? Also getting back to the primary one with three filters, do you think you'll be in commercial volume with them by the end of calendar 2020?

**Jeff Shealy:**

Okay. Let's start with your first question was on WiFi front. The answer to your question is yes. We have sampled to all the major players that we plan to sample to. I think we—as we said in prepared comments and Dave commented on earlier, we're tracking four—we've identified four platforms that we are currently tracking that have design wins. In terms of how many that could be in production, I think a little color on—not all these cycles occur at once. The product refresh can vary. I would probably estimate that we could have perhaps double that type of engagement by the end of 2020.

In terms of handset, we continue—we've been creating these filters for the infrastructure market. The bands that are used in infrastructure communicating with handsets so you can see that there's synergies between the spectrum, between what we're making in infrastructure. We've been sampling over into that market.

Dave, you want to comment how many samples?

**Dave Aichele:**

Yes. I will add a little bit of color there. One of the things we've also done is we've added additional heads in—on the sales side in Greater China, covering basically China and Taiwan, and also in South Korea. The purpose of that is we've got products now that we're releasing and expecting to go into production volume with the WiFi and the infrastructure. Then also, we've got these demonstrators that we're engaging with the mobile market. The sales team is focused on penetrating the WiFi accounts and securities design wins and supporting the ramp.

Then on the mobile side, get more exposure to those markets, particularly with the 5G opportunities on the mobile side. We've sampled to the tier-1 OEM from the mobile side, and then there's a handful of tier-2 customers that have an architecture that utilizes some discrete components. They're looking for higher performance premium filters for that ultrahigh band at 5G to work also with the WiFi codes. This is a very good opportunity for us to engage with tier-2 market segment in the mobile side that's not as demanding from a volume standpoint, but still it's very, very attractive.

**Jeff Shealy:**

Then your final question regarding current customer with that filter developments that we've had ongoing, I think I'd like to just make a couple comments there that we can state which is, first and foremost, just to reiterate, we're planning on shipping the second two filters this quarter. We're on track on that. We also have gone through an exercise of capacity. We've been gearing our capacity of our factory for the

infrastructure markets. What that would entail contemplating something in mobile would be a significant increase in capacity and would represent an acceleration in capacity. I guess what I would perhaps share with you, just a horizon of what something like that would look like would be a significant increase over what we're already planning.

It will take us about 12 months. I don't see us—we would not be in a position to shift manufacturing before the fourth quarter of next calendar year. That's really with any customer in mobile that has significant—certainly would fit the tier-1 profile. I probably should leave my comments at that point given certain sensitivities with the customer.

In terms of what they are planning on that we're—we certainly see significant opportunities in the ultrahigh band. We're one of very, very few players that can make some of these extremely difficult high frequency filters. We're currently playing with these developments in an ultrahigh band, and these are higher frequency than what you are seeing in LTE. We're extremely confident that we're going to ship it to the customer, the second two filters this quarter.

We're very confident in our capabilities. The most important thing we can do right now is focus on executing and delivering. Then we've done the planning exercise for capacity expansion as we see—as the business warrants.

**Anthony Stoss:**

Thanks, Jeff. As a quick follow up, also getting back to the 5G infrastructure side, the increasing interest, is that predominantly on the power handling side or form factor? I'm curious if there's any call for millimeter wave frequencies yet from either of the two additional customers.

**Jeff Shealy:**

When we say—so let me just clarify. We break the network infrastructure parts into really two segments, the small scale segment, which is in the—would be in the power handling of 1 watts to 3 watts. That's not trivial to achieve with micro filter technology. We are very comfortable with achieving that performance with the product, for example the n79 filter. We are very comfortable with its performance, and we believe the customer's comfortable with its power handling performance. That would be on a low power side.

The massive MIMO side has a requirement of 3 watts and higher, and we have been working on that design with our customer. As we said in the prepared comments, we've got a meeting later this quarter with the customer to review the latest specs. Quite frankly, what we've also said is that they've been ramping their base station design around the performance of our filter, at least the transmit side, to accommodate performance of our filter. It is for power handling, but it's also—it's a combination of power handling as well as high frequency performance which, with these micro filter technologies, turns out to be a significant trade space you have to engineer around.

**Anthony Stoss:**

Thanks, Jeff. Best of luck.

**Jeff Shealy:**

Okay, thanks, Tony.

**Operator:**

Your next question comes from the line of Rick Schafer with Oppenheimer. Please proceed with your question.

**Patrick Walsh:**

Hi, guys, this is Patrick Walsh. I'm on for Rick Schafer. A lot of great ones have already been asked. But I guess as a follow up, can you talk a little bit about splitting the network infrastructure market into small cell versus massive MIMO? Just in terms of the revenue ramp, can you kind of weight which market is maybe more likely to ramp first and the relative size of each market?

**Jeff Shealy:**

Yes. Good morning, Patrick. I will ask Dave to touch on that for you.

**Dave Aichele:**

Hi, Patrick. The market that will ramp the soonest is the small cell market, and the relative volume on these type of systems is attractive. But you're only talking potentially two to four filters per system. The volume that you'll see in these systems depending on which OEM you're dealing with is in the hundreds of thousands per year with this 5G deployment.

We're looking at volumes of filters in the millions. Again, you're looking at different frequency bands. The ASPs are attractive too. It's a relatively attractive market for us. The massive MIMO, that has a larger market opportunity for us, and what you see happening there is the network providers are shifting from utilizing RU, which are traditional macro base stations to these massive MIMO systems. Then you're talking arrays in each of the systems that are 32 or 64 for the number of filters and also ASP is higher than what we're going to see in a small cell because of what Jeff highlighted earlier, the power handling and the complexities are a little bit more difficult. That market's going to be a little bit slower in roll out because it is more of a system architecture change.

But we expect that, as we've highlighted, ramping second half of next year, and that market will overtake the small cell side in 2021, and it's—both are very attractive to us.

**Patrick Walsh:**

Great, thanks. That was very helpful. I guess, as a follow-up question, it seems like you guys have a ton going on in terms of design activity and developing new filters. I just want to make sure on the op ex guidance for next year, the \$4.5 million to \$5.5 million, you guys expect to be able to stay within that range through 2020, or was that a through 2019 statement? Thanks.

**Dave Aichele:**

I expect to be within that range, \$4.5 million to \$5 million throughout the next several quarters. Then as the revenue ramp increases, that operating cash burn amount will actually come down.

**Jeff Shealy:**

Patrick, (inaudible) by the way.

**Patrick Walsh:**

Great. Thanks, and then just as a follow-up to the last question, I noticed from the Annual General Meeting on Monday, on 8-K, it looks like you guys voted to increase the capital from 45 million to 100 million. I was just wondering, what the thought process was and what exactly that implied for the business. I mean, this has to do with the strategic partnership or what exactly is going on there? Thank you.

**Jeff Shealy:**

Thank you, Patrick. The increase in authorized shares from 45 million to 100 million would be, we consider that corporate governance, positioning us for growth in the future. We've, for example, depending on how rapidly we need to continue expansion in a facility, we need to be positioned for that. Getting the Shareholder approval ahead of time would be pretty important along those lines. We're looking at different growth trajectories in the Company, and want to be positioned to be able to finance the growth as we see fit. That's the summary around that increase in authorized shares.

**Patrick Walsh:**

Awesome. Thank you.

**Jeff Shealy:**

Thank you, Pat.

**Operator:**

As a reminder, if you would like to ask a question, please press star, one on your telephone keypad. As a reminder, if you would like to ask a question, press star, one on your telephone keypad. One moment, please, while we poll for questions.

Your next question comes from the line of Harsh Kumar with Piper Jaffray. Please proceed with your question.

**Harsh Kumar:**

Yes. Hey guys, congratulations, lot of good stuff going on. Question, Jeff, for you, could you frame the router market the way it stands for you as a revenue opportunity? Also with it, with the router market transitioning to AX or what's called as WiFi 6, how does that open up or broaden the market for you? I believe that's got to be good for you guys.

**Jeff Shealy:**

Good morning, Harsh, and let me let Dave touch on it, I mean, add some color.

**Dave Aichele:**

Yes. Hi Harsh. The WiFi 6 which is the 802.11AX does increase the market opportunity for us. You've seen missile systems that are being released by the OEMs. Obviously new platforms are in development right now that we've been able to identify. The increase in MIMO from 2x2 to 4x4 is what we're seeing. That requirement for more filters in that and being able to offer smaller form factor and ease of manufacturing versus the traditional DR is very attractive to OEMs and the ODMs.



There's also some architectures that we've seen that are pushing to an eight requirement. In addition to the adoption of the MESH platform that we're seeing, both from service providers and also from the retail market, smaller form factors and then the increased MIMO, it's all playing in our favor. Now having two designs that are shipping in pre-production, it's opening that funnel even more.

The move to the FCC releasing the spectrum in the 6 gigahertz is also playing very much into our favor. We see that being even larger market potential starting in 2021 and beyond. We're very well positioned right now, both for enterprise and retail, and also the service industry, for the cable providers and so forth with the gateway.

**Harsh Kumar:**

Thanks.

**Jeff Shealy:**

Harsh, let me add to that. Just for clarity, for framing the market for us, in a triband router there are three frequencies. We have what we call our bandwidth solution, which is both the high band solutions. One of the high bands is the 5.2 gigahertz, the other is a 5.6 gigahertz. The 5.6 gigahertz is a significantly wider band filter, which is extremely challenging. You have to engineer the material science in order to address that market. I think that wider band technology we've developed for the 5.6 gigahertz is exactly feeds into what Dave was talking about in the new spectrum at 6 gigahertz. That's also very wide band requirements. It's what we've developed for the 5.2 gigahertz and 5.6 gigahertz translates over very, very well to the new spectrum that will follow on the triband spectrum.

**Harsh Kumar:**

Thanks, Jeff, for the color. I have another one for you guys. We were talking to a bunch of carriers and the network guys, and there's a view that with 5G coming on, hopefully next year in earnest, it positions the carriers to be able to provide fixed wireless access. But they all mentioned that once you get to the house, it gets sort of dicey after that. You have to have a point inside the house that distributes the signal inside the house. I was curious, Jeff, your thoughts on perhaps—I mean, it may not be even an opportunity at this point. But I suspect it may be a pretty big opportunity down the line. You have any thoughts on that or any color you would care to provide?

**Jeff Shealy:**

Yes, I think I'd like to provide some and I will let Dave provide some, since this is an area that we've been looking at pretty carefully. If you go back all the way to the beginning of this calendar year, at CES, I believe we had certain router companies that were looking at doing fixed wireless into a router, and then their router would distribute the WiFi signal throughout the home. That could be—that's exactly what we're looking at in terms of the CBRS. Domestically, we've got a second generation part that is actually sampling in the market. It sampled with at least one of the big tier-1 infrastructure players that we've already mentioned. We're in certain discussions with them over opportunities for that CBRS product Dave mentioned, some of the U.S. opportunity there.

It's precisely what we had in mind in terms of developing the CBRS filter technology that we're now sampling into the market, and you have anything to add?

**Dave Aichele:**

Yes. I guess the color, a little bit more on that, Harsh. I think the spectrum that we're focusing on for 5G at 3.5 gigahertz, and your question on fixed wireless, we are seeing the OEMs starting to look at us offering both unlicensed and licensed solutions and sometimes having that in the same system. Being able to offer that last mile connection. The good thing is we're able to offer designs, optimized for certain frequencies for licensed and unlicensed. Then also work architecture of supporting unlicensed filters to basically reject licensed when they're trying to build that type of system.

We're seeing some activity picking up on architecture front what are the traditionally WiFi OEMs that are looking at the license spectrum, and we think this is a good opportunity for us that we're going to continue to capitalize on.

**Harsh Kumar:**

Very cool. Then I wanted to, maybe this will put you a little bit in a spot, if I had to say, when can we expect commercial revenues from any of the products? Seemed like WiFi will be the first. Would you say that first half looks like it's locked in, but if I had to pin you down towards the quarter, would you venture there, Jeff?

**Jeff Shealy:**

Well, I personally think commercial revenue, we've already been shipping qualified product into the Defense. But if you move over to these higher volume markets, as we've said earlier, we're tracking four developments, and we're going to start with design wins on those. We think those are most (inaudible), and that would be in the WiFi.

We are also extremely active in—I would characterize activity in the infrastructure as accelerating with the rollout in China and some of the spectrum requirements that we see there. I think we've been—in the prepared comments, we were pretty forthcoming that first half of the year, we're expecting design wins and we'll be announcing the production ramp timeframe at that time.

**Harsh Kumar:**

Great, guys. Congratulations. Thank you so much for your time.

**Jeff Shealy:**

Thank you, Harsh.

**Operator:**

Ladies and gentlemen, we have run out of time for the question-and-answer session. I would like to turn the call back to Jeff Shealy for closing remarks.

**Jeff Shealy:**

Okay. First, I will take the opportunity to thank you all for your time today. Never in the history of the Company have we been more convinced of the opportunity as we see today. We're progressing towards our objectives for the December quarter. We plan to update you on further progress as the quarter moves ahead. We look forward to speaking with you during our next update call to discuss our execution against the milestones that we published and look forward to talking to you in the future. Thank you.

**Operator:**

This concludes today's conference. You may disconnect your lines at the time. Thank you for your participation.