Episode 224 – Can 5G NTN Really Connect the Next 50 Billion Devices?

Speaker: Omar Qaise, Founder and CEO, OQ Technology – 18 minutes

John Gilroy:

Welcome to Constellations, the podcast from Kratos. My name is John Gilroy, and I'll be your moderator. Today, we talk about satellite IoT, the challenges of integrating with telcos, and just how far we've come from the satellite phones of the past. Joining us is Omar Qaise, founder and CEO of OQ Technology, a global satellite IoT firm that aims to connect the next unconnected 50 billion IoT devices and machines. OQ Technology had a recent breakthrough in satellite IoT, demonstrating that a widely adopted cellular IOT module can operate seamlessly over a 5G NTN satellite network. Omar, it sounds like a big breakthrough, huh?

Omar Qaise:

Hi. Hi, John. Yes, indeed.

John Gilroy:

Good, good, good. Well, let's kick it off here. So how would you describe the current state of the satellite IoT and NTN industry, and what major shifts are you seeing right now?

Omar Qaise:

Thanks a lot, John. So in fact, we live in a very exciting time right now in the satellite industry. The satellite IoT is really moving from specialized propriety devices to standard-based connectivity, which looks and feels more like cellular. The biggest shift in the NTN industry really right now is no longer just about space problems. It's actually a network integration problem. How can we blend terrestrial together with satellite coverage and still have applications that work with this blend?

So we see, mainly there is two directions where there is a clear split in the industry. You have the traditional satellite IoT where you have ultra low power devices using propriety messages, propriety technology and chip sets and protocols, but you have now what's the 3GPP NTN path, the non-terrestrial network path, where leveraging terrestrial LTM, NB-IoT on 5G into satellites as a standard in order to scale the ecosystem, reduce device friction, and integrate into the mobile core network.

So really, the industry is shifting from satellite as a last resort, but really having satellite as native part of the network.

John Gilroy:

Wow, that's a big change, especially with standard base that we're seeing here in the last few years. So Omar, what are the biggest engineering challenges in making satellite and cellular systems work seamlessly together? You touched on it.

Omar Qaise:

Yeah. In fact, the biggest three challenges with cellular over satellite is that the problems that arise when you're trying to connect a moving, fast-moving cell tower with a cellular device. On Earth, you have the cell tower stationary, maybe moving on a fast train, but all this is not comparable to a seven kilometer per second satellite in low Earth orbit. It's like a cell tower moving with the speed of a bullet.

John Gilroy:

Oh.

Omar Qaise:

Yeah. That introduces problems like first, the link dynamics. So such a moving satellite will cause doppler shifts into the waveforms and you will have some intermittent visibility windows, and that changes quickly the link budget, so it's not like a fixed point to point or a geosatellite with a terminal on the ground. Then you have the timing synchronization issues because cellular protocols have certain timings that time out. These timers time out when the signal is propagated over a long distance to a satellite, so you need to deal with that. And finally, the network integration, like with roaming, authentication, routing and all these issues of a normal roaming network integration with a fast moving satellite. So really, it's not just one network. It's really a service across multiple networks, if we want to put it this way.

John Gilroy:

Yeah. Network of networks or something like that. So Omar, earlier this year, you demonstrated successful narrowband IOT data transmission directly from a mass market module to a LEO satellite. So what does this milestone signal for the broader IoT ecosystem?

Omar Qaise:

Indeed. We managed to certify and connect our standard base cell tower satellites to a Nordic module, NBIT module in the market, and we are on our way on certifying more modules like that. What does that mean is that you don't need any more bespoke satellite device to get satellite reach. If you could use a mass market cellular module, you immediately tap into a huge supply chain, proven security models, familiar sim provisioning and an existing IoT ecosystem. And that's completely different from the past where you need to have your own specialized module, your own technology in order to scale your ecosystem, which is like as if building an ecosystem from scratch. Here, we're tapping into an existing ecosystem. It allows lower device cost, fast time to market, easier certification and integration, and having truly global coverage with both satellite and terrestrial. So it's really, the breakthrough is not just about the link. It's really the scalability of the ecosystem behind the link.

John Gilroy:

So Omar, what does it mean when you talk about a hybrid IoT solution, and how does it work?

Omar Qaise:

So a hybrid IoT solution is like a device and a service that's designed to use terrestrial networks by default, but it falls back to satellite when terrestrial coverage is absent or unreliable or compromised. And in practice, it works on multiple layers, on the connectivity layer, like choosing terrestrial or

satellite, on the core and network layer by identifying which network and authenticating it, and also on the application layer like with which endpoints there to be used and what type of message formats and so on. So the goal is really to have one device, one service, and one integration across the globe, and then the network decides the best path for the data to go through. So that's what we mean by what is a hybrid connectivity or hybrid network. It's really not two products, but it's one experience, combining both terrestrial and satellite together.

John Gilroy:

Well, it's good theory. I'm sure that listeners are wondering, "Well, give you an example of something like this." So can you walk us through a real world example of how this hybrid approach solved a problem that neither satellite nor terrestrial networks could solve alone?

Omar Qaise:

Yeah. So for example, if you look at the energy sector, let's say you have a pipeline and you'd like to monitor the flow on the pipeline of oil or water, and of course, if you want to have sensors all along the pipeline, you'll have areas where you could have satellite coverage. If you have terrestrial coverage, definitely it's not going to be covering the whole of the pipeline, while having, let's say, a combined coverage of both satellite and terrestrial across the whole pipeline with the same hardware, the same device, can give you this blend of hybrid connectivity.

The same as with moving assets. Let's say you have a car that's connected to the cellular network, it's sending telematics and suddenly it goes out of coverage of terrestrial network because it's driving on a remote road or whatsoever, then you will be handed over seamlessly to satellite and you could still have that continuous coverage of IoT data from the car or location, status, health, or even if needed for emergency and so on.

John Gilroy:

I think security has to be part of this discussion. So how will secure 5G NTN messaging and emergency alerts shape the future of public safety and digital sovereignty?

Omar Qaise:

Yeah. Indeed, this is a very interesting question and very important one. So secure NTN messaging can become a national resilience layer, especially for emergency alerts and critical communication when terrestrial infrastructure is compromised or degraded. The key ideas here is that trust and integrity should involve messages that could be authenticated end to end and avoid spoofing, and also prioritizing the traffic. For example, emergency traffic during disaster catastrophe of cyber attacks over satellites gets priority over any other traffic. And finally, also the sovereign control aspect of it. So countries want to assure that the identity, the keys, the routing policies, and even the infrastructure is sovereign and that infrastructure is fully end-to-end owned by that country, or for example, Europe by the European Union, for example. And this is very important in a time where a disaster could hit, cyber attacks, and also having the information end to end within the same national network. So this is really important in terms of the 5G security concepts and how that could extend into NTN. So it's really not just about the coverage. It's the continuity of the coverage and the governance and trust of that.

John Gilroy:

Spectrum is becoming increasingly crowded, especially as more LEO constellations come online. What are the biggest spectrum management challenges you foresee for satellite IoT operators, and how should regulators and industry collaborate to avoid bottlenecks?

Omar Qaise:

Yeah. So at OQ Technology, one of the things we did early on is really to target filing for the MSS S-Band spectrum that became now the standard for NTN for both IoT and direct to device, both the L-band, MSS, and the S-Band. So filing early, having some priority on that is something very important, which allows easier scalability and market access. But with more operators coming into the 3GPB, NTN-IoT and D2D market, it's very important to address the challenges are the coordination across constellations in order interference for interference management and coexistence of the different constellations. The cross-border harmonization, how satellite footprints are bigger than national borders and how to address that. Also, protecting the incumbents that already have services or in the same bands or adjacent bands, especially if the service is being used and the spectrum is not warehoused. And also how we can implement dynamic use of traffic and beams and spectrum over different geographical areas at different times to address that.

And regulators, of course, need a better collaboration on shared coordination frameworks and also sharing interference data-driven models, and also having realistic enforcement mechanisms. At the same time, encouraging innovation and new startups with their services so that both incumbents and the new entrants could benefit from the spectrum.

John Gilroy:

So Omar, what is one mission or satellite deployment that taught you a lesson about resilience, engineering trade-offs, or the realities of operating in space?

Omar Qaise:

So a consistent lesson in space, really, everything is a trade-off and everything will be stressed to the end. You design something with an idea in mind, and then in orbit with all the temperature swings and radiation effects and unexpected behaviors and constraints come into the point. But the important thing is that we should never assume everything is perfect. We should always plan for the worst case, and we should always think how we can utilize what's available to get the best out of it, and how to use the best engineering ways of operations in orbit in order to address the challenges and still operate with the resources that you have. And that of course builds into the experience so your next generation satellites and payloads could be better and better, and that's what I learned over the years.

And I think this is something a lot of operators don't get is that we've tested narrowband IoT waveforms in LEO for the first time in the world in 2019 with our first satellites. Still, we had to learn a lot over the years, even until today to bring that NTN service into orbit. Now, when the standard came in 2022, a lot of operators are jumping into it now, investing into the next satellite that will do that, but I would really doubt that the first satellites launched for all these constellations are going to be functional as planned. There is a long learning curve, and OQ is a pioneer on that. We learned over the years, and this is why we're looking for our next satellite launches that will be even better, bigger, and more reliable.

John Gilroy:

Deploying global satellite IoT services means navigating a patchwork of national regulations, so what strategies have you found effective in scaling across borders?

Omar Qaise:

Yeah, I think two important things here. First is standards alignment. If you are aligned with the standard and building on it like the 3GBP cellular standard, then this will ease the policy conversion. It will ease the market access because you're using existing hardware that's compliant, you're introducing a new service, but it's part of the cellular. That's one thing. The other thing is local partnerships like working with local MNOs in these countries, integrators or stakeholders is an important key in order to bring such satellite NTN IoT service into that country, and they could help you a lot in that. And whether you are in the driving seat or they're in the driving seat, it does not matter in the end. You would like to bring that innovative service and coverage to that country where there is no coverage today in remote or rural areas.

And of course, on top of that, looking into, as we mentioned, spectrum is very important, trying to be aware of the regulations, working with ITU and the local administrations to make sure there's no interference, to make sure that you can utilize the spectrum in the most efficient way is also very important.

John Gilroy:

So as more players enter the satellite IoT and D2D space, what misconceptions do you see emerging?

Omar Qaise:

Yeah, I think there are a few misconceptions that emerge with more players entering this arena. First one is coverage is equal to service. Well, this is a misconception. Coverage is necessary, but the quality of service of that coverage, the guarantees of reliability, the latency expectations are all different, and that's why this needs to be carefully engineered in order to address that. For example, at OQ Technology, we have a lot of vertical integration over the stack software, the payload, so that we can control the quality of the traffic, and we just don't rely on third parties always, especially for the critical elements of the network.

The other thing is that D2D works the same way as terrestrial. Well, it doesn't. Link budget timing and service windows change, and design assumptions have to take that into account. Obviously, a cell tower will always have an edge in terms of broadband services over satellite, but for SMS, emergency communication, voice, IoT, in remote rural areas, satellites could be very crucial and could deliver good quality.

And of course, finally, not one constellation fits all. There are different use cases that need different trade-offs and message sizes, power, latency cost, and the revisit time is different also for different use cases. So space connectivity is real, but it's not magic. It's engineering.

John Gilroy:

Omar, I think you've given our listeners a pretty good idea of some of the challenges of trying to connect 50 billion IoT devices and machines in the next few years. I'd like to thank our guest, Omar Qaise, founder and CEO of OQ Technology.

Omar Qaise:

Thank you very much, John. Thanks a lot.