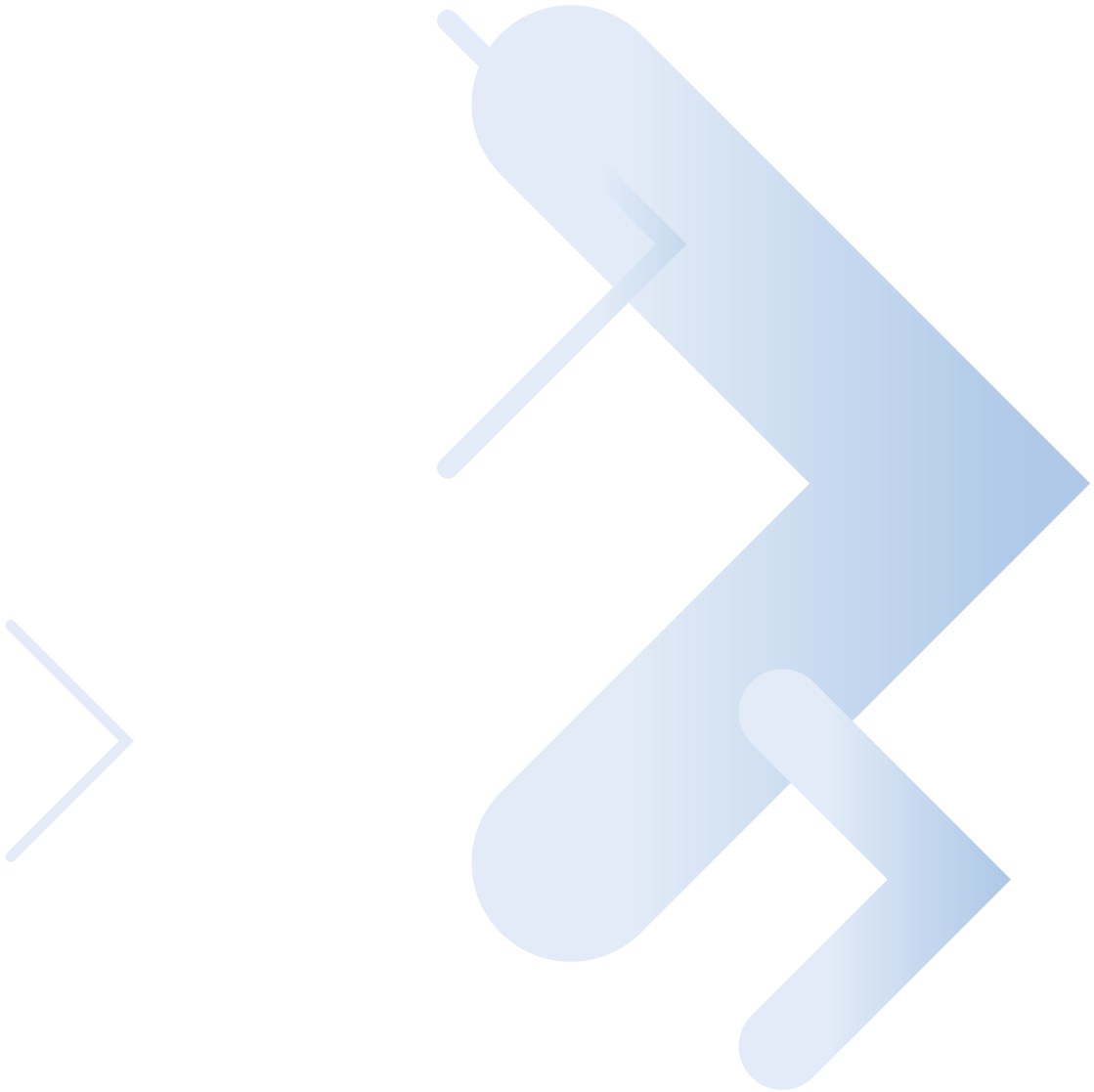
SOLUTION PAPER

Wi4 WiMAX Quality:
Solutions Designed for Maximum Reliability



A long history of commitment to quality

Since Motorola's founding more than 75 years ago, the company has maintained an unwavering reputation for quality. In 1986, Motorola introduced its trademarked quality and business improvement methodology, called Six Sigma, and revolutionized the way industry approaches quality. The United States Congress recognized this achievement in 1988, presenting Motorola with the first Malcolm Baldrige Quality Award.

Today, this intense focus on quality continues to take center stage as Motorola rolls out its WiMAX portfolio, leveraging best in class methodologies to provide the high level of quality that customers have come to expect for nearly eight decades.

Taking a leadership role on WiMAX standards

Over 400 companies have come together to help develop WiMAX standards and as one of the top five contributors of the WiMAX Forum, Motorola has taken a leadership role, helping blaze the trail toward WiMAX interoperability. Created to certify the conformance of WiMAX products, the Forum ensures that different vendor systems seamlessly interoperate in order to accelerate the introduction of cost-effective broadband wireless access services into the marketplace.

Motorola's WiMAX Forum members consist of experienced research and development engineers, systems engineers, marketing professionals, and other disciplines who collaborate regularly with other Forum participants to continue moving the WiMAX quality commitment forward.

WiMAX Forum-certified products are based upon 802.16e, the standard that facilitates global development of mobile broadband wireless access systems. Motorola maintains strict compliance to this standard and collaborates closely with WiMAX certification vendors Rhodes & Schwarz, Aeroflex, and Cetecom in preparation for Wave 1 and Wave 2 certification.

Certified and qualified—the importance of TL9000

Strict adherence to the TL9000 standard is another way Motorola deepens its quality commitment. TL9000 is a single, global quality standard and performance measurement system across the telecommunication industry. The standard drives accountability, a common language, and shared platform through consistent performance expectations across the industry. Compliance to the standard exhibits Motorola's commitment to delivering products to customers who expect on-time delivery, high quality and exceptional reliability. Motorola's product development process incorporates customer satisfaction and ongoing operational metrics, as well as process audits to drive continuous improvement and desired results.

Since 1998, the QuEST Forum has pursued a goal of global telecommunications quality and industry-wide performance excellence through its TL9000 standard. For service providers, requiring TL9000 certification helps assure consistent quality from suppliers across all products and services. It also helps drive supply chain efficiencies and improve supplier relationships. Service providers can rest assured that TL9000-certified suppliers have a sound Quality Management System that has been systematically audited by an independent TL9000 registrar.

The advanced measurement system analyzes and measures each vendor against industry benchmarks and provides a solid foundation for objective product or supplier evaluations to make fully informed purchase decisions.

Although WiMAX is a relatively new technology, Motorola's deep experience, expertise and certification in advanced technologies enabled the company to achieve early TL9000 certification.

Building quality into the design process

Motorola continues to evolve its quality program, most recently introducing Design for Six Sigma (DFSS), a methodology for driving breakthrough performance in new product development. DFSS is structured around a five-phase model that ensures quality, cost savings and faster time-to-market are built right into the product design. The model places special emphasis on collecting, understanding and quantifying service provider needs; translating those needs into precise product specifications; quantifying allowable variance; delivering innovative design solutions; and applying robust design techniques.

To ensure that quality is embedded throughout the organization, Motorola has also developed four levels of employee participation. The Yellow Badge program was created to educate and raise the awareness of each employee on the use of quality tools and practices through a series of focused classes. The second level of participation is the Green Belt program, which certifies project team members by teaching key Six Sigma concepts, including structured problem-solving methodologies, how to use higher level quality tools, and how to generate quantifiable results. The third level is Black Belt certification. Black Belts learn to effectively lead project teams with the skills and knowledge required for exceptional leadership of business improvement projects. And the fourth level is the elite Master Black Belt certification. Master Black Belts apply advanced knowledge and leadership to large process improvement projects that have quantifiable project savings and business impact and strategize with senior business leaders to integrate Six Sigma into Motorola's business objectives.

Motorola's WiMAX system architecture was developed by one of Motorola's most mature engineering teams consisting of senior architects with years of technical experience designing products for technologies such as GSM, iDEN, WLAN and CDMA. This team has been highly involved with the 802.16e and WiMAX standards forums and closely adheres to Motorola's DFSS quality methodologies. This level of solid experience and expertise is seamlessly transferable to the design and development of new WiMAX products and ensures traceability from customer requirements gathering and analysis all the way through the development cycle.

NeckarCom replaces DSL with WiMAX wireless broadband

NeckarCom Telekommunkation GmbH, a German utility and enterprise of the EnBW group, provides gas, power, and water to citizens of Baden-Wuerttemberg. In response to requests from the mayors of cities across its service area to offer communications services in addition to utilities, NeckarCom decided to leverage WiMAX to provide replace the region's inefficient DSL system with wireless broadband.

"We looked around and found that WiMAX was the only wireless technology that was available, market ready and standardized by the WiMAX Forum. Regarding our trial with Motorola, we found that WiMAX also offers a very high amount of interference resistance, especially when we use licensed systems with allocated 3.5 GHz spectrum by the German regulators. We very much appreciate the motivation of Motorola people, their technical experience and their willingness to solve the technical problems that are quite usual when you do a trial. In combination with the technical expertise of Motorola, I think we made the right decision.

—Jurgen Herrmann, Managing Director, NeckarCom Telekommunikation GmbH

Motorola's senior management team recognizes that quality is critical to the success of both Motorola and our service providers and holds the organization accountable for achieving or exceeding quality goals. Regular quality reviews are held to ensure that the WiMAX design and development teams are achieving these goals and actions are quickly put in place when an issue is identified.

Test processes that maintain laser-focus on WiMAX quality

Motorola's quality program is designed to not only develop and manufacture best in class products, but to also reduce the time to capture and resolve defects during the design phase. WiMAX product testing is done through a comprehensive set of highly sophisticated testing and verification processes, including calibrated RF facilities that prototype, measure and document capability.

Hardware Testing

WiMAX quality is closely governed by Motorola Networks Quality Standards and an established Quality Review Board comprised of experts across multiple technologies. Before any WiMAX product is shipped, a minimum of two ALTs (Accelerated Life Tests) are performed on every board and assembly. Emissions tests are performed to meet strict FCC requirements of -37dBm. Tower top electronics are tested with seven strikes of 10k amps to ensure zero resets or failures. Product metrics are tracked throughout the development project life cycle and regular quality reviews are held with development teams and senior management to review key quality metrics and address issues during the development cycle. Any changes to the WiMAX profile are closely monitored and incorporated through an established Change Control Board.

Software Testing

The WiMAX System Test Plan was developed and is executed by Motorola's certified Software Engineering Institute (SEI) Level 5 Test organization. Maturity Level 5 focuses on continually improving process performance through both incremental and innovative technological improvements.

When certified against the SEI Level 5 methodology, software costs are reduced, number of defects decrease, and quality is significantly and measurably improved. Motorola's WiMAX test plan entails first exercising functional system components against a standardized test plan and then performing a comprehensive system test to emulate end user activity, loading, performance, and other key criteria.

Third Party Testing

Another element of Motorola's WiMAX quality methodology is Interoperability Testing (IOT). IOT is especially critical in this stage of WiMAX development since the technology is still in its early stages and some of the standards are still in development. Motorola conducts IOT with multiple suppliers, including chipset vendors, to test that components are compatible with Motorola infrastructure. This level of testing takes place in Motorola's testing labs as well as throughout the alpha and field test phases. The process is one more stage of quality proofing to ensure complete interoperability with other vendor equipment. In addition, working closely with chipset vendors such as Intel, Beceem, and Sequans, Motorola is conducting interoperability testing both at the vendor sites and within Motorola labs to ensure alignment with all WiMAX features.

Motorola's Integrated Supply Chain has developed a comprehensive set of standards and requirements for third party vendors to ensure compliance and meet strict performance requirements for WiMAX products throughout the design process.

Alpha Test-Bed Systems

Testing processes are built around state of the art, dedicated test facilities with live Alpha test-bed systems used for drive testing between two of Motorola's primary development and engineering centers. The centers, located in the Schaumburg, IL corporate campus and the Arlington Heights, IL development engineering facility, are approximately ten miles apart and provide actual field data to the design team. Many Motorola employees, including some members of the WiMAX senior management team, conduct their own field tests by using WiMAX to access the Internet, sync their Outlook calendars, and run other critical applications.

WorldMAX meets growing demand for mobile communications

Based in the Netherlands, a country with the second highest broadband penetration rate in the world, WorldMAX owns the nationwide and exclusive 3.5 GHz license for the Dutch market. WorldMAX offers services based on Motorola's wi4 WiMAX (IEEE 802.16e) to offer fixed and mobile internet access, Voice over IP and multimedia applications.

"Currently we have a trial running in a part of Amsterdam. When we decided we wanted to do a trial, we listed all our requirements and asked a couple of vendors to see if their products matched our needs. Motorola's product line matched best. We looked at the roadmap and the plans they had and that was also very much in line with our thinking. The trial started in March 2007 and will take about three to four months to complete the testing before we can conclude the end results. But I am very impressed with the services and support Motorola is offering us and I am really confident that we will conclude a successful trial."

—Jeanine Van Der Vlist, CEO, WorldMAX

Field Testing

Motorola's testing approach continues in the field via actual customer usage trials. Customers participating in field trials have the opportunity to play a part in Motorola acceptance test plans as well as to run an independent test case. Through direct and sustained interaction with their own existing WiMAX systems, those service providers are able to demonstrate that the technology works as promised and identify any issues they might discover throughout the process, submitting them to the design and quality teams for resolution.

With more than 100 months of accumulated time in the field, Motorola is conducting extensive WiMAX field trials with over 25 customers, including some post-trials to measure execution as well as sustained product performance. Field data from these customer trials is used to not only identify and resolve issues but to also provide knowledge transfer and training to regional account teams and Motorola's service and support teams. Field trials play another useful role in helping to improve user documentation, customer communication and to plan future enhancements that will help service providers take even greater advantage of WiMAX technology.

Release Readiness Review

The Release Readiness Review is the final culmination of the design process before receiving ship acceptance. The Release Readiness Review is a checklist that ensures that every performance element of the design process has been met. It defines the number and result of alpha and field test cases run, reconciling the results to the original goals. The Review identifies if any defects still exist and whether they will impact the customer. In other words, the Release Readiness Review ensures that all transactions have gone through the multi-step, documented and measured design process to ensure that the WiMAX product has achieved Motorola's highest standard of quality.

Life Cycle quality from design and build to implementation and support.

Quality doesn't stop once the product is shipped. Motorola ensures that service providers continue to experience best in class quality throughout the lifecycle through a world class service organization that helps service providers deploy, optimize and support the network.

Motorola WiMAX comprehensive Support Services allow service providers to focus on their subscribers while Motorola takes care of the network. To further enhance service providers' seamless mobility experience for their subscribers, Motorola provides a robust suite of network efficiency solutions and revenue generating end-user applications with the opportunity to have such solutions fully managed. Keeping secured networks running at optimal efficiency requires the assistance of a vendor who understands the technical aspects of the network as well as the competitive business landscape.

Motorola offers a variety of lifecycle options tailored to the service provider's specific needs, including:

- **Support Practice:** security; network optimization; network management
- **Integration:** planning, design, installation, commissioning; turnkey services; program management
- **Applications:** mobile entertainment; mobile commerce; service delivery platform; hosting and business modeling
- Managed Services: out-tasking; out-sourcing; build, operate, manage/transfer; hosting services
- **Seamless Mobility:** conceptualize; realize; extend

Each lifecycle option was carefully designed to enable the service provider to choose specifically the service that fits its business model. Each service follows the same level of highly sophisticated delivery methodologies, quality process and quality measurements that are built into the design and manufacture stage to ensure a consistent customer experience throughout the WiMAX product lifecycle.

Global Distinction across end-to-end wi4 WiMAX Solution

wi4 WiMAX Distributed Network Architecture

- Best of WiMAX World Award USA 2006: Industry Innovation

Wi4 WiMAX CPEi 200/300 Series Desktop Unit

- Best of WiMAX World Award Europe 2007: Best Devices/Peripherals/Application Software
- RunnerpUp Best of WiMAX World Award Europe 2007: Industry Choice Award

Wi4 WiMAX Flexible Access Point and Product Portfolio

- Winner NXT comm Eos Awards 2007, Technology Innovation Group: Access Networking
- Winner Networks Middle East (NME) 2007: Best Telcom/Service Provider Offering

Wateen Telcom's Commercial Deployment of a wi4 MiMAX Network Solution

- Winner Networks Middle East (NME) 2007: Best WAN Implementation Award
- Runner-Up Best of WiMAX World Award Europe 2007: Commercial Deployment

Proven leadership

Motorola was the first WiMAX vendor to:

- 'Ping' with another vendor at the first WiMAX Plugfest (Malaga, Spain in 2006)
- Successfully deploy a WiMAX commercial installation (Wateen, Pakistan)
- Demonstrate 802.16e mobility to customers in-house and at industry event
- Transmit over-the-air from a rooftop via DAP (Diversity Access Point) base station

Trusting an industry leader

Motorola is one of few major vendors with assets in all of the critical product and service line areas—and the necessary global span and market presence—needed to deliver a practical, fully integrated WiMAX solution. Having long recognized the market need for high performing and cost-effective broadband wireless solutions, Motorola leverages over a decade of investment to deliver best of class WiMAX products. This strategy results in the ability for service providers to increase revenue, offer new services and ensure the highest level of quality to their subscribers.

In addition to 75+ years of experience in wireless systems deployment and subscriber devices design and manufacture, Motorola also has proven experience in wireless broadband. The highly successful Canopy® and Expedience® lines of fixed wireless broadband systems is currently in service in more than 100 countries around the world, providing low cost broadband communications through innovative software defined radios, integrated solution, and advanced radio techniques.

Recognized as a WiMAX industry leader for best in class products, Motorola is building a true end-to-end ecosystem for delivering fully integrated WiMAX solutions worldwide founded on global presence, technology heritage and industry-leading collaborations in mobile broadband. With a tight focus on interoperability, compliance to standards and Design for Six Sigma quality, Motorola can offer service providers an end-to-end solution, including devices for fixed and mobile convergence, base stations, mobility equipment, IP network, and all the applications that pull it all together for full utilization of the technology.

"Motorola has been out there since the beginning, evangelizing the technology," says Dan Coombes, senior vice president WiMAX and Advanced Network Technologies. "Within just a year's time, standards have been ratified, profiles defined, plug fests are taking place, trials are underway, and systems are now being deployed. We feel it's the future of a lot of things we're doing."

With industry-wide support, high performance and substantial cost advantages, Motorola WiMAX products are poised to play a key role in the transformation of wireless networks on a global scale.

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Motorola, Inc. www.motorola.com/wimax