



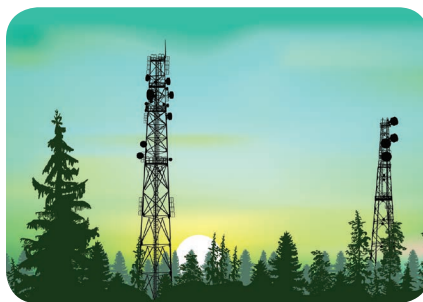
Women in Microwaves

Exploring the Wilderness: Amateur Radio Adventures in Royal Belum, Perak and Kuala Keniam, Pahang

■ **Nurul Huda Abd Rahman** 

I am currently an associate professor at Universiti Teknologi MARA (UiTM) in Malaysia (Figure 1). I earned an M.Eng. degree in electronics from the University of Surrey, Guildford, U.K. in 2008, followed by a Ph.D. in electrical, electronic, and systems engineering from Universiti Kebangsaan Malaysia in 2014. Prior to my academic role, I was a spacecraft engineer at Astronautic Technology (M) Sdn Bhd in 2008, where I contributed to various small-class satellite development and R&D projects. Currently, I lead the Antenna Research Center (ARC-UiTM), a prominent research lab at UiTM focused on pioneering research in antennas, electromagnetic analysis, and communication subsystems.

I am currently serving as a member of the Executive Committee of the IEEE Malaysia Antennas and Propagation/Microwave Theory and Technology/Electromagnetic Com-



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patibility Joint Chapter (IEEE Malaysia AP/MTT/EMC Joint Chapter) since 2021. This role provides a valuable platform for networking and knowledge-sharing within my field. Beyond my academic and organizational commitments, I contribute to the community through organizing technical conferences and workshops under the IEEE umbrella, as well as undertaking engineering and educational projects that have a direct positive impact on local and research communities.

Teamwork and Diversity

In engineering and technical fields, historically dominated by men, I am committed to promoting diversity and inclusion. My aim is to mentor and inspire individuals regardless of gender, background, or age. Through

my experiences, I have witnessed the transformative power of teamwork across diverse backgrounds in fostering innovation and creativity.

I have a passion for outdoor activities that bring together individuals of different age groups and backgrounds. At the ARC-UiTM, we leverage our technical expertise to engage in meaningful outdoor community projects. Our involvement goes beyond skill development; it is about making a positive impact on communities and inspiring others, irrespective of their backgrounds. Our team's diversity, including men and women from various backgrounds and age groups, underscores the profound impact of collaborative innovation.



Figure 1. Nurul Huda Abd Rahman.

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Figure 2. Antenna tuning process.

In this article, I will share experiences from projects that have significantly influenced me as a woman engineer and educator. These include projects involving equipment installation and field tests in diverse environments, like forests and remote rural areas.

Kuala Keniam, Where It all Began

Our journey began at Kuala Keniam, where we embarked on a communication enhancement project at the UiTM-PERHILITAN Research Station in Kuala Keniam, Pahang. This station, a collaboration between UiTM and the Department of Wildlife and National Parks (PERHILITAN) in Malaysia, is

dedicated to research and conservation efforts focused on the wildlife and ecosystems within the Pahang National Park, one of Malaysia's oldest and largest national parks [1]. The station supports research activities spanning biodiversity, ecology, conservation biology, and environmental management, providing a vital base for fieldwork, data collection, and conservation initiatives.

With the support of the UiTM Sustainable Development Goals grant and in partnership with the Malaysian Amateur Radio Transmitters' Society (MARTS), we initiated a project to enhance radio communication by installing high-frequency and very high-frequency amateur radio anten-

nas (Figures 2 and 3). This infrastructure significantly improves research efficiency and safety by facilitating better coordination and emergency response, particularly in remote and challenging environments like Kuala Keniam, with a communication coverage area extending approximately a few kilometers from the research center. Our team of researchers, comprised of UiTM lecturers and students (Figure 4), conducted numerous field trips for site surveys, equipment installation, and RF propagation tests.

Coming from backgrounds in antenna-related research, projects like this challenged our critical thinking, problem-solving skills, and physical endurance. We encountered moments where we had to pause, strategize, and adapt to complete our objectives in a resource-limited environment. Nonetheless, working with a team of diverse personalities was a rewarding experience that enriched our project outcomes.

Royal Belum Adventure

Our journey continued to Malaysia's Royal Belum State Park, a breathtaking rainforest boasting the world's oldest trees and richest biodiversity [2], [3]. Similar to our work in Royal Belum, the ARC-UiTM team embarked on a mission to install radio stations



Figure 3. On-site Yagi antenna installation.



Figure 4. At the entrance of the UiTM-PERHILITAN research station.

aimed at bolstering communication in these remote regions. This initiative promised improved connectivity for local communities, researchers, and emergency responders. The pilot project showcased the efficacy of our approach in enhancing regional radio communication, benefiting a broad spectrum of users. It was especially pivotal for improving search and rescue operations in these isolated areas. Additionally, the project fostered knowledge exchange among researchers, students, and the community.

The project featured a diverse team comprised of three undergraduate and two female postgraduate students, alongside seven experienced researchers, including four female members of the IEEE Malaysia AP/MTT/EMC Joint Chapter (Figures 5 and 6). Supported by the MARTS and IEEE Malaysia AP/MTT/EMC Joint Chapter, the project was conducted in two phases: Phase 1 involved initial testing and installation, while phase 2 focused on final testing and completion (Figure 7).

However, our adventure wasn't solely about work. In addition to technical tasks, team members enjoyed their stay aboard a houseboat, seizing the opportunity to bond outside of work, share stories and laughter, and engage in outdoor activities. After completing radio communication testing, we explored Temenggong Lake within the Belum-Temenggong Rainforest Complex (Figure 8). Activities included rafting, hiking Batu Putih Hill (Figure 9), visiting salt lick areas, and trekking to Kooi Waterfall (Figure 10). Salt licks, natural mineral-rich spots, attract wildlife, such as deer and elephants, providing essential nutrients for their well-being, underscoring the importance of conserving natural habitats and biodiversity.

During our visit, we also had the privilege of visiting and engaging with an indigenous village (Figure 11). In the Royal Belum forest, various indigenous tribes, known as *Orang Asli*, reside. *Orang Asli* women play

integral roles within their families and communities, with studies highlighting their contributions to gender equality (Figure 12) [4]. We were

warmly welcomed at an *Orang Asli* village, where we distributed food and snacks to children and villagers (Figure 13) and discussed with them



Figure 5. The dedicated team behind phase 1 of the Royal Belum expedition, bringing diverse talents together for a shared mission.



Figure 6. From installation to completion, the team shows what teamwork is all about.

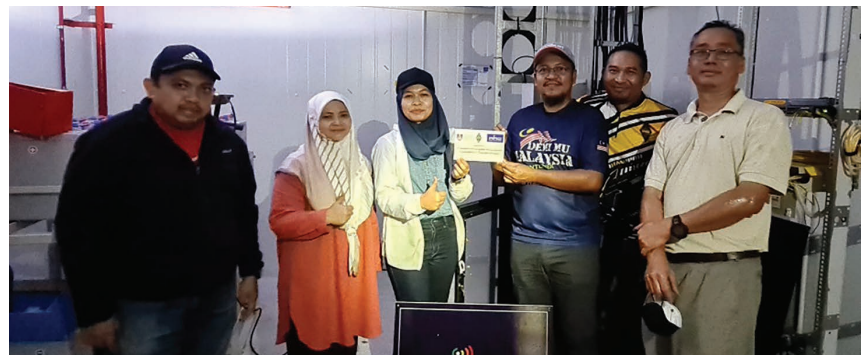


Figure 7. Group photo of UiTM researchers and MARTS members after a successful equipment demonstration.



Figure 8. Enjoyable boat ride to the test site, navigating through scenic waters en route to our destination.



Figure 9. (a) Stunning view of Temenggor Lake from the peak of Batu Putih Hill and (b) at the peak of Batu Putih Hill.

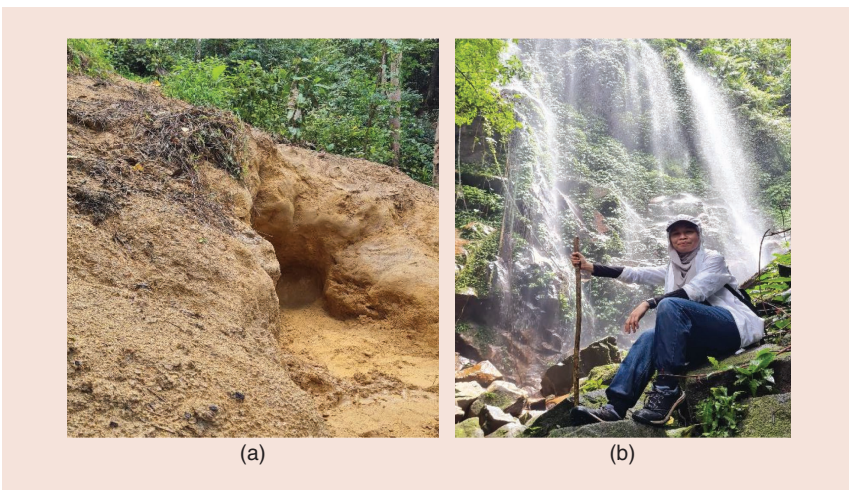


Figure 10. Exploring the wonders of Royal Belum: (a) Salt-lick sites in Temenggor and (b) Kooi Waterfall.

potential improvements for their community. Despite basic living conditions, the government's provision of broadband Internet via satellite (Figure 14) illustrates progress amid tradition, offering connectivity to the outside world despite challenges faced by the villagers.

This multifaceted experience emphasized the importance of collaborative initiatives that bridge technical advancements with community engagement, enriching both the project outcomes and our collective understanding of the region's unique challenges and opportunities.

The Team

- Nurul Huda Abd Rahman (Universiti Teknologi MARA, Malaysia)
- Suhaila Subahir (Universiti Teknologi MARA, Malaysia)
- Noor Hafizah Abdul Aziz (Universiti Teknologi MARA, Malaysia)
- Robi'atun Adayiah Awang (Universiti Teknologi MARA, Malaysia)
- Hamizan Yon (Universiti Teknologi MARA, Malaysia)
- Mohd Aziz Aris (Universiti Teknologi MARA, Malaysia)
- Ahmad Azlan Ab Aziz (Universiti Teknologi Brunei)
- Zanirul Akhmal Zanirun (Malaysian Amateur Radio Transmitters' Society)
- Fatimah Nur Mohd Redzwan (Universiti Teknologi MARA, Malaysia)
- Nurfarahin Miswadi (Universiti Teknologi MARA, Malaysia)
- Nurul Husna Mohamad Fadhil (Universiti Teknologi MARA, Malaysia)
- Muhammad Shakir bin Amin Nordin (Universiti Teknologi MARA, Malaysia)
- Tajmalludin Yaakob (Universiti Teknologi MARA, Malaysia)
- Bazilah Baharom (Universiti Teknologi MARA, Malaysia)
- Abdul Fiqri Bin Azhar (Universiti Teknologi MARA, Malaysia)
- Yusrilah Yusri (Universiti Teknologi MARA, Malaysia).



Figure 11. *Orang Asli (indigenous) village.*



Figure 12. *Capturing moments at an Orang Asli house, immersing in their culture and warmth.*



Figure 13. *Sharing food and snacks with local children fosters a sense of community.*

Conclusion

Reflecting on our experiences, we realized the critical importance of diversity in STEM fields. Through embracing outdoor activities and championing equality, we seek to inspire others

to broaden their horizons and drive positive change. Our adventures highlight that the most significant breakthroughs often arise when we step outside our comfort zones and collaborate toward shared goals.

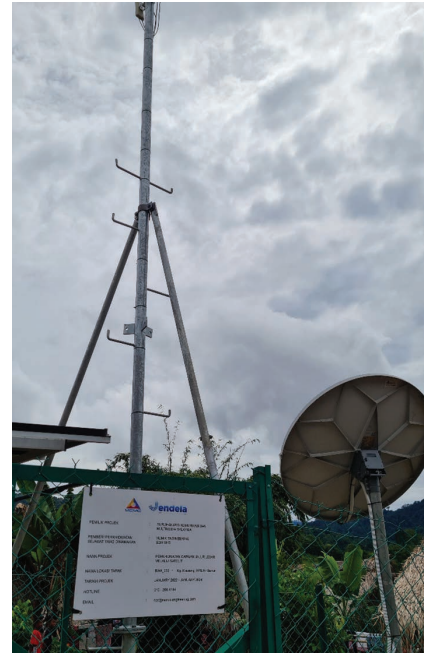


Figure 14. *Broadband Internet brings connectivity to remote villages, bridging the digital divide.*

Moreover, our efforts have indirectly encouraged increased participation from female members of the IEEE Malaysia AP/MTT/EMC Joint Chapter in humanitarian and community-driven initiatives. We take pride in representing women in physically demanding activities and commend our students for pushing their boundaries through these out-of-classroom experiences. We believe that the skills and resilience they cultivate will prove invaluable in their future endeavors.

Acknowledgment

I thank the Universiti Teknologi MARA and IEEE Malaysia Antennas and Propagation/Microwave Theory and Technology/Electromagnetic Compatibility Joint Chapter for their generous financial support for these projects. I also want to acknowledge the late Prof. Mohd Tarmizi Ali for his invaluable contributions, as he initiated the project and provided the initial ideas and groundwork. Sincere appreciation goes to all members of the Antenna Research Center and our collaborative partner, the Malaysian

Amateur Radio Transmitters' Society, for their unwavering support throughout the duration of these projects.

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Education News *(continued from page 94)*

computer engineering from Rutgers University, New Brunswick, NJ, USA, in 2020, where he is currently pursuing his Ph.D. degree and is expected to graduate in the fall of 2025. His current research interests include metamaterial antennas, RF/mm-wave circuits, and wireless radar sensors.

Project Description

As wireless health monitoring technology advances, the need for monitoring the health of multiple individuals becomes increasingly significant, particularly in overcrowded and resource-limited clinic situations. However, the leverage of the mechanical rotors or the phase shifters increases the hardware complexity and cost of a radar system. Meanwhile, the utilization of metamaterial leaky-wave antennas occupies a significant portion of the frequency spectrum, contributing to spectrum congestion in the 5G communication environment. In response to these challenges, we introduce the space-time-coding transmitting array for direct antenna modulation to detect the vital signs of multitargets within a significantly narrow frequency range. By leveraging the steering harmonics of the time-modulated transmitting array, we can achieve concurrent health monitoring of multiple targets while satisfying the spectrum coexistence in the era of continued 5G evolution.



Folk Narongrit

School: Purdue University, USA.

Advisor: Prof. Joseph Rispoli.

Project topic: Development and integration of a general-purpose automatic tuning and matching circuit for stretchable coils.

Folk Narongrit received his M.S. degree in electrical engineering from the University of Southern California, Los Angeles, USA, in 2021. He is currently pursuing his Ph.D. degree in electrical and computer engineering at Purdue University, West Lafayette,

IN, USA, where he is also concurrently pursuing his M.S. degree in biomedical engineering. His expected graduation date is July 2025. Since 2021, he has been a research assistant at the Magnetic Resonance Biomedical Engineering Laboratory under the supervision of Prof. Joseph Rispoli. His research interests include the development of magnetic resonance imaging (MRI) hardware for clinical and research use.

Project Description

Recent research in RF hardware for MRI involves utilizing stretchable and flexible coils, which provide adaptability to various anatomical structures, potentially enhancing imaging quality and patient comfort. However, these coils suffer from frequency shifts from changing impedance during stretch, compression, and bending. Despite prior research exploring potential solutions to this issue, a stable, general-purpose automatic tuning and matching system for these coils remains elusive, limiting their clinical viability. This work aims to bridge this gap by innovating and evaluating an automatic tuning system to retune the resonance frequency across all stretchable coils. The work will shape research on conformable antennas and devices, extending its impact beyond MRI to various wearable devices.

Deadlines for the 2025 MTT-S Graduate Student Fellowship Awards

In 2025, the MTT-S will sponsor up to 12 graduate fellowships in the general category and two graduate fellowships in the medical applications area. Travel supplement funds will again be available for the awardees to attend next year's IMS.

The MTT-S strongly encourages students in microwave and RF engineering to apply for the fellowships. As noted previously, the next application deadline is 15 October 2024. Please consult the detailed instructions for the graduate fellowship program at <https://mtt.org/students/>.

