



### Technical Talk: From Concept to Application: The Role of RFID Antennas in Modern Engineering

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On 15<sup>th</sup> February 2025, the IEM Electronic Engineering Technical Division (eETD) successfully organised a physical technical talk titled From Concept to Application: The Role of RFID Antennas in Modern Engineering. Dr. Bong Fwee Leong from Wavelin STCC delivered the presentation physically at IEM Penang to an audience of 11 registered participants. The session commenced at 9:30 AM with a brief introduction of the speaker by the moderator, Ir. Ts. Lee Choo Mou, who warmly welcomed all the attendees.


The speaker started by giving example of installation TNG RFID tag onto car's windscreen or headlamp. The speaker then further explained to install RFID tag on non-metallic areas like car's windscreen and headlamp can indeed help prevent metal contact from interfering with the RFID signal and ensures the tag functions properly.



**Figure 1: Install TNG RFID Tag onto car's windscreen or headlamp.**

The speaker also shared barcode system versus RFID that despite its applications, comparison and advantages. The speaker elaborated why RFID is needed despite the similar applications for both barcode systems and RFID in various fields such as retail, warehouses, factories, and IT departments for inventory management, product identification, and asset tracking. The speaker further explained the benefits of


RFID included enhances efficiency, reduces costs through automation, improves asset management, and drives the Internet of Things.



## Barcode Systems vs RFID

### Applications, Comparison, and Advantages

➤ Why do we need RFID?




Barcode

RFID

Figure 2: The speaker sharing on barcode systems vs RFID.

Next, the speaker shared about the general comparison of the RFID market share according to the different RFID frequency band which are low frequency (LF), high frequency (HF) and ultra-high frequency (UHF) and its applications. The speaker further explained different RFID frequency band has different reading distance and also its pros and cons.



## General comparison of the market share

Here's a general comparison of the market share and key applications of LF, HF, and UHF RFID technologies:

RFID Frequency	Market Share (%)	Common Applications
Low Frequency (LF) (30 kHz ~ 300 kHz)	~5-10%* (Smallest)	Animal tracking, access control, industrial automation
High Frequency (HF) (13.56 MHz)	~40-50%*	Contactless payment, library management, ticketing, secure access
Ultra-High Frequency (UHF) (300 MHz ~ 3 GHz)	~50-60%* (Largest)	Inventory management, logistics, retail, pharmaceuticals

**Notes:**

- The market share figures are approximate and vary by source.
- UHF RFID dominates due to its long read range and high data transfer rates.
- HF RFID holds a strong position in payment and secure applications.
- LF RFID has a niche presence but remains important for specific industries.

Here's a table summarizing the market share of UHF RFID by key applications:

Application	Market Share (%)	Use Cases
Retail	~69-70%	Inventory tracking, supply chain management, anti-theft
Logistics & Warehousing	~10-15%	Asset tracking, shipment monitoring, automation
Healthcare & Pharmaceuticals	~5-8%	Medication tracking, patient identification
Aviation & Automotive	~5-7%	Baggage tracking, vehicle identification
Manufacturing & Industry	~5-10%	Process automation, tool tracking

**Notes:**

- The retail sector dominates UHF RFID usage, primarily due to large-scale adoption in inventory management.
- Logistics and healthcare are also significant adopters.
- Market share percentages are approximate and may vary by source.

Figure 3: The speaker shared the general comparison of the RFID market share.

After then, the speaker shared contemporary RFID tag antennas available in the market and handed out real RFID samples to the audience, enabling them to closely examine the different tag designs and understand the tag's role in various industries.

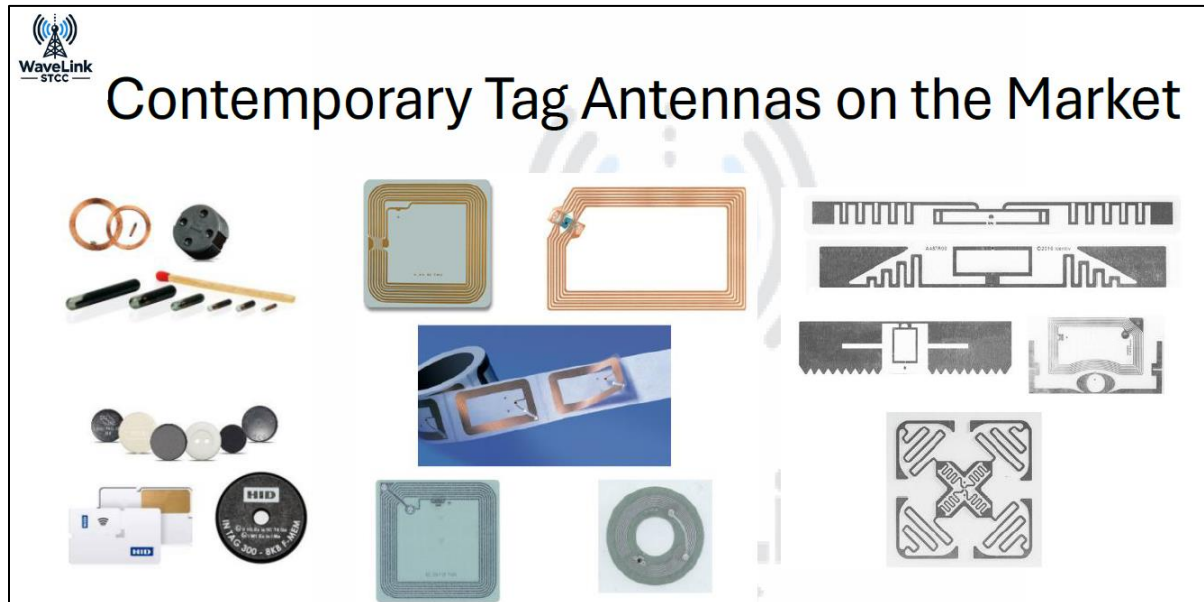


Figure 4: The speaker shared contemporary tag antennas on the market.

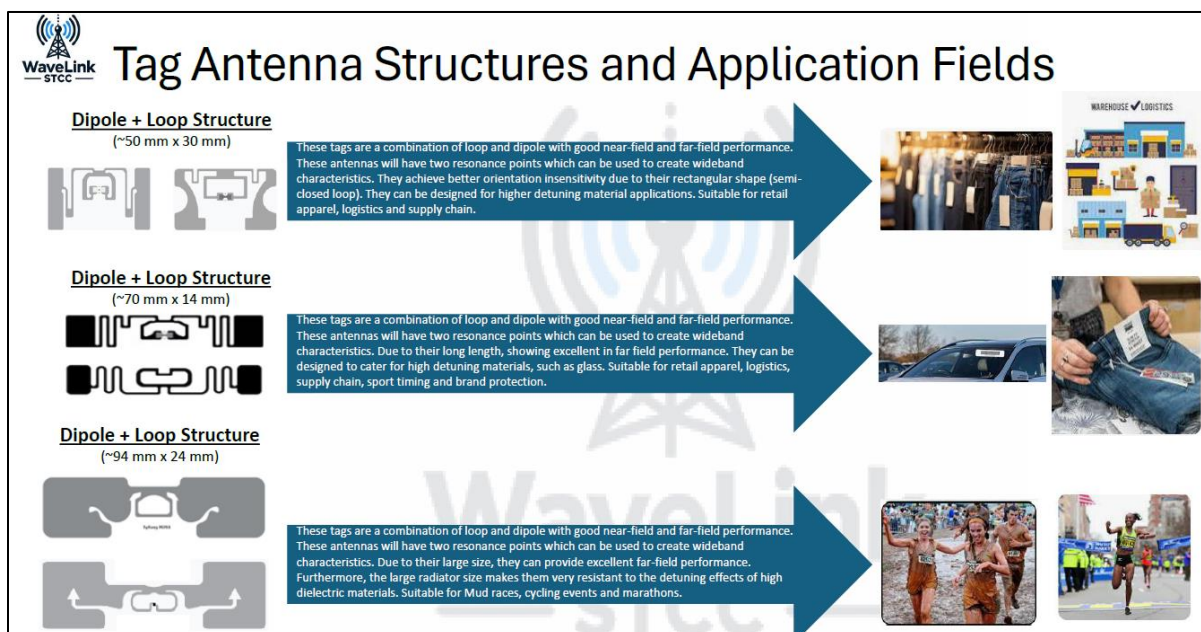


Figure 5: The speaker shared tag antenna structures and application fields.



Finally, the speaker shared insights on the emerging trend in RFID miniaturisation with RFID tags are becoming smaller and versatile. Emerging trend RFID in energy harvesting by reducing dependency on batteries and artificial intelligence (AI) integration.



## Emerging Trends in RFID Miniaturization

- RFID tags are becoming smaller and more versatile.
- Applications in wearables, healthcare devices, and high-density tracking.
- Benefits:
  - Enables tagging of smaller items and advanced use cases.

Figure 6: The speaker shared emerging trends in RFID miniaturisation.

The event concluded with a group photo at 12:00 PM and reached the end of a highly engaging and informative session. It has been a valuable learning experience for all IEM members involved.



Figure 7: Group photo of the speaker, moderator and the participants.