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FACTSHEET

DSO and NTU Partner to Advance Local Research Capabilities in Electromagnetic Effects on Electronic Systems

The Electromagnetic Effects Research Laboratory (EMERL) is an initiative spearheaded by DSO National Laboratories (DSO) in partnership with the Nanyang Technological University (NTU) in 2004.

Jointly funded by the Defence Science & Technology Agency and the Agency for Science, Technology and Research, EMERL is the first national-level test facility that caters to both military and commercial electromagnetic effects research and testing.

Its state-of-the-art facilities will be pivotal in strengthening and springboarding local research capabilities in Electromagnetic Interference (EMI) and Electromagnetic Compatibility (EMC).

EMERL will also support in qualifying Singapore's homegrown electronic systems to meet international standards in EMC. This is due to government regulatory bodies such as the Federal Communications Commission in the United States and European Council in the European Union imposing these mandatory requirements on almost all electronic devices to prevent the emission of excessive EM transmissions, as well as the effect on these devices by other EM field sources.

With a complete suite of capabilities housed under one roof, EMERL will be able to break new grounds in EMI and EMC research in areas such as EM susceptibility testing methods for advanced electronic systems, research into cost-effective EMC design, and minimising Radio Frequency (RF) interference and cross-talk.

Facilities in EMERL

The facilities in EMERL comprise a Semi-Anechoic Chamber (SAC) and a Reverberation Chamber.

The SAC was designed to study the interference of EM radiation from the environment or surrounding electronics on test subjects. With an area of more than 200 square metres, the SAC contains a 4-metre diameter turntable that is capable of holding weights of up to 30 tonnes. This makes it versatile enough to test objects ranging from small electronic components such as a PDA, to large vehicles like a military tank. The SAC is capable of testing EM radiation ranging from 30 hertz to 40 gigahertz.

About 120 square metres large, the Reverberation Chamber can be similarly used to carry out radiated emission and susceptibility testing on test objects ranging from 80 megahertz to 18 gigahertz.

Military and commercial applications

As the Third Generation Singapore Armed Forces relies primarily on technology as a force multiplier to secure a decisive victory on the battlefield, it extensively exploits increasingly compact, sensitive and sophisticated electronic systems. These systems have to be electromagnetically compatible to ensure their robustness against EMI.

EMI and EMC also affect our daily lives. With our heavy reliance on electronics and wireless communications, EM fields can cause interference to electronic systems. These include malfunction of medical electronics such as hospital bedside monitors and instrumentation in a surgical suite, interference to aircraft navigation systems and automotive electronics such as engine control and transmission systems.

EMERL R&D Highlights

EMC Systems for the Stealth Frigates

An example of a successful operationalised EMC capability for military systems is the Republic of Singapore Navy's Stealth Frigates. DSO leveraged EMERL's facilities to conduct EMI and EMC tests on the frigate's systems to ensure its compliance to military EMC standards before they were installed onto the ship.

DSO performed Radio Frequency Interference (RFI) prediction, analysis and validation between all transmitters and receivers on board, while taking into consideration the needs for stealth and combat effectiveness in various operational scenarios.

Studies on EM hazard to personnel and ordnance, combat system placement and installation, radiation hazard measurement, lightning protection, EM shielding and filtering, as well as EMC integration of naval helicopters to the ship, were also conducted.

Lightweight, High Performance EM Shielding Material for Buildings

EMERL and Temasek Laboratories at Nanyang Technological University have also successfully collaborated to develop a lightweight metallic material that can reduce the effects of EM interference by up to 99 per cent.

The research sought to explore the use of porous aluminum – an ultra lightweight material about one-tenth the weight of solid aluminum with reasonable ruggedness for architectural EM shielding. With its light weight, the material is portable, easily assembled and can be mass produced at a reduced cost.

The technology can be deployed for both military and commercial applications. These include protection for military personnel working in areas close to high-powered broadcast transmitters, buildings that require tight security to prevent sabotage from high-powered EM fields and mobile shelters.

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