

FCC Regulatory Compliance Process & Challenges for Wireless Devices

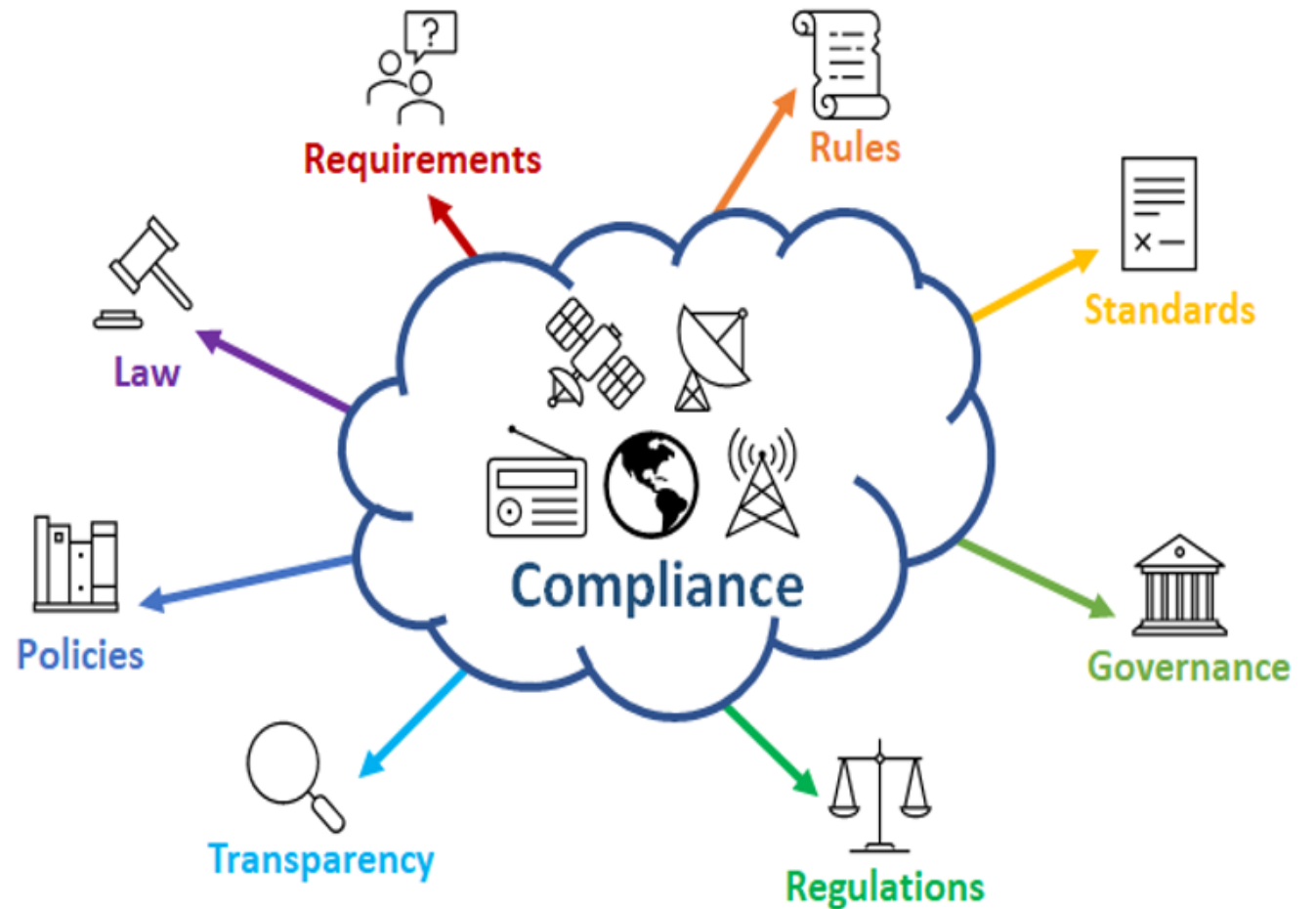
What are those symbols?



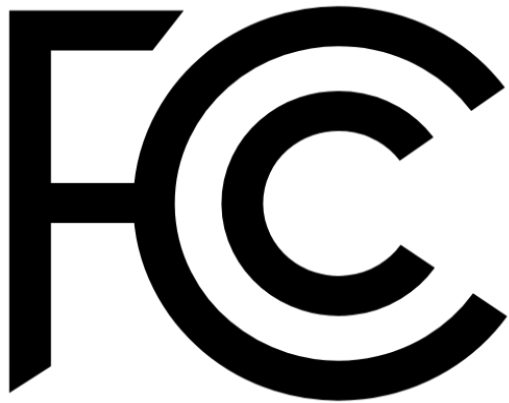
What Does Compliance Mark Mean?



- Various areas: Safety, EMC, RF, FDA, etc.
- Product sold in USA and other regions should bare corresponding compliance marks.



Example international compliance marks for RF devices



USA



Argentina Safety



Australia Safety Association



CE Listed, Safety and EMC



China Compulsory Certification



Canadian Safety Association



Electrical Testing Labs Canada



Electrical Testing Labs Safety



Electrical Testing Labs Sanitation



GOST-R Russia Safety, Sanitation, EMC



Brazil Safety

KSA

Kingdom of Saudi Arabia Safety Association



KETI South Korea Safety



NSF International



UL LISTED UL Listed



UL Classified Environment & Public Health

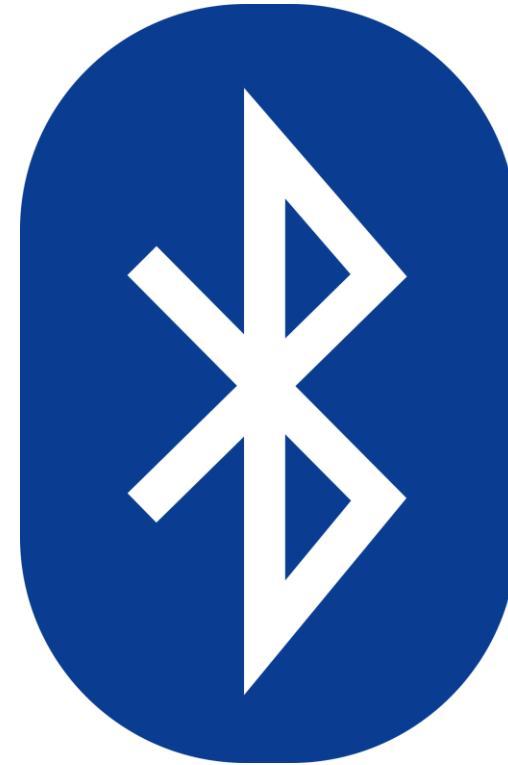
FCC Regulatory Certification Process

- **Step 1:** Select Radio Frequency and Design Equipment
- **Step 2:** Test Plan & Product Development (Pre-Compliance)
- **Step 3:** Register with FCC
- **Step 4:** Select an **authorized Test Lab**
- **Step 5:** Compliance Testing/ Reporting/ Documenting
 - EMC/RF
 - RF Exposure (SAR)
 - Other required test
- **Step 6:** Certification and Filing (TCB)

Equipment Under Test (EUT) Selection



Technology Selection



Unlicensed vs. Licensed Technologies

Unlicensed



Licensed

verizon^v



Sprint

T Mobile[®]

mintmobile

FCC Requirements

FCC



- Determine applicable FCC rule parts from Code of Federal Regulations (CFR) Title 47 for Radio Equipment
 - Common radio rule parts 0, 2, 15, 18, 22, 24, 27, 30, 90, 96, etc.
- Standards for test procedure guidance
 - Knowledge Data Base (KDB)
 - American National Standard Institute (ANSI)

Project Planning



- Manufacturer selects Authorized Test Lab
- Confirm project scope/test plan
- Pre-Compliance/Engineering Test
 - Can be performed in-house by OEM or at Authorized Test Lab

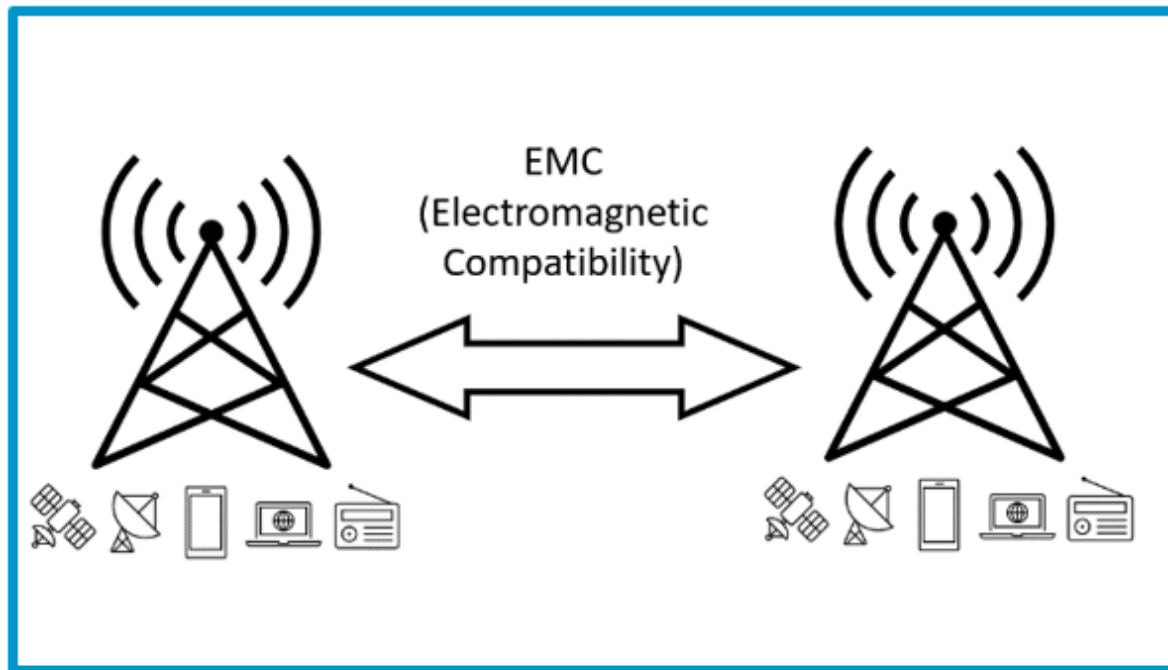
Pre- Compliance / Engineering

- Tests performed on prototype builds, could be months to couple years prior to product release
- Pros: early exposure to EUT, vet out all potential issues
- Cons: troubleshooting, volume, budget

EMC/RF & SAR

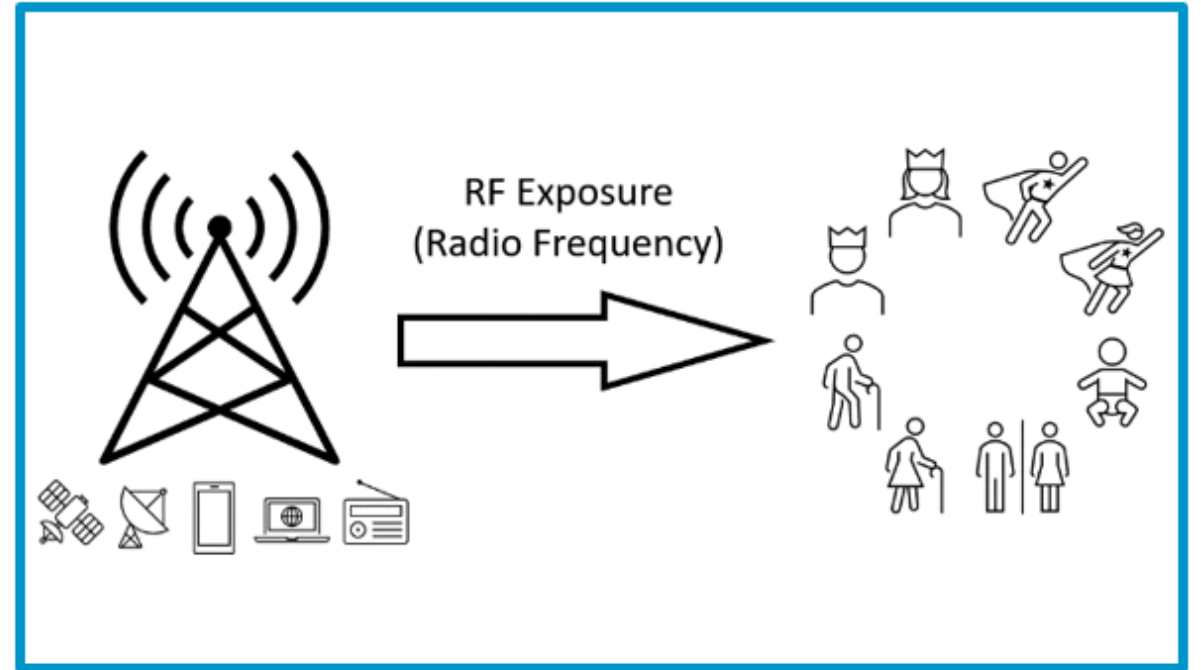
EMC

Electromagnetic Compatibility



RF Exposure (SAR)

Specific Absorption Rate



EMC: Electromagnetic compatibility

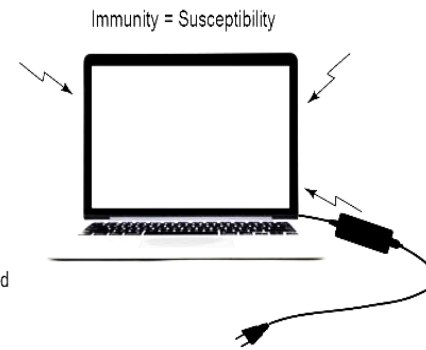
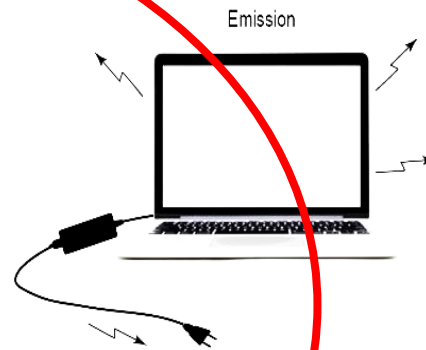
FCC

EMC
(Electromagnetic Compatibility)

EMI - Emissions
(Electromagnetic Interference)

RE
(Radiated Emissions)

CE
(Conducted Emissions)



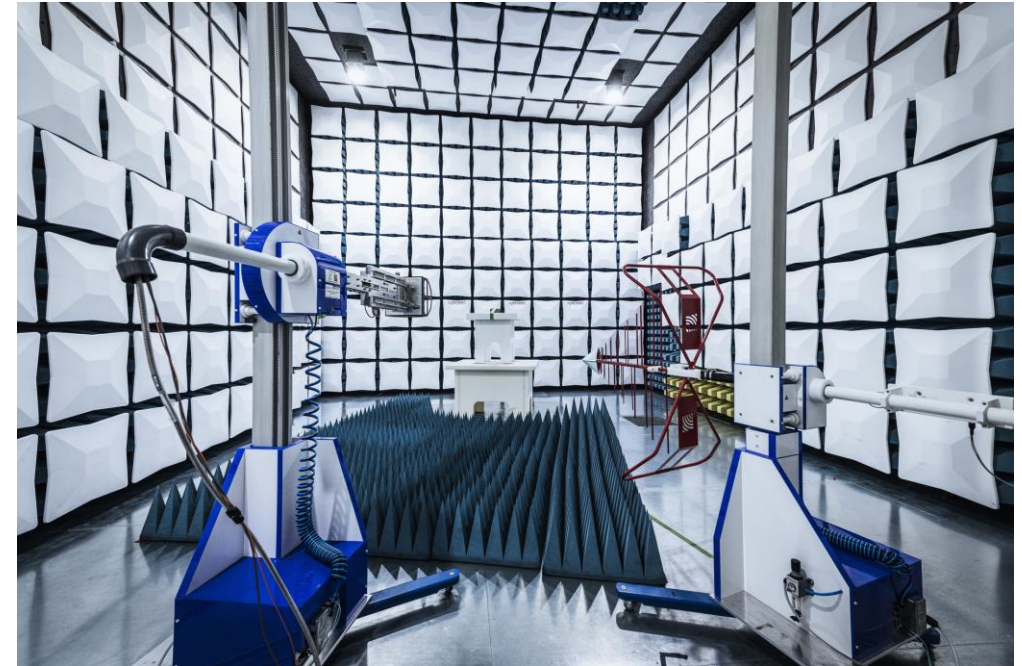
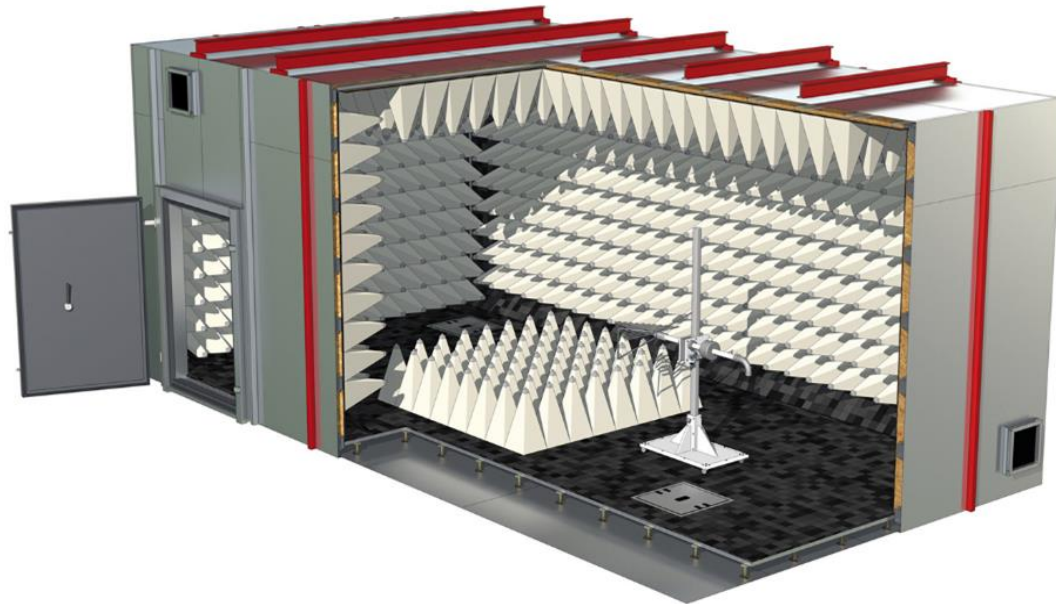
▶ Conducted
▶ Radiated

EMS - Susceptibility
(Electromagnetic Susceptibility)

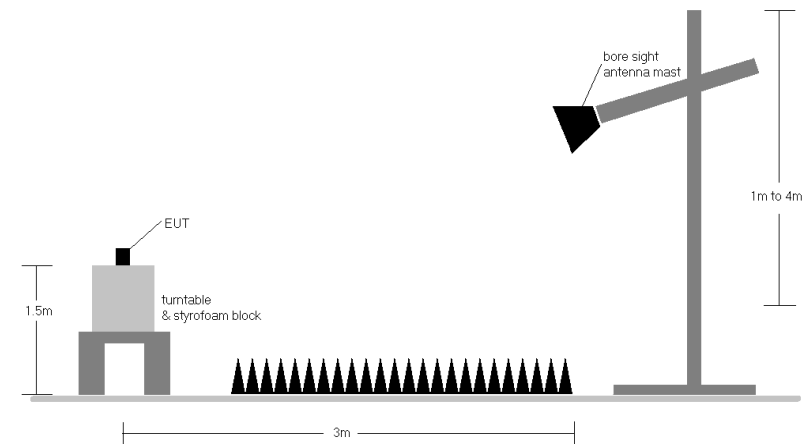
RI
(Radiated Immunity)

CI
(Conducted Immunity)

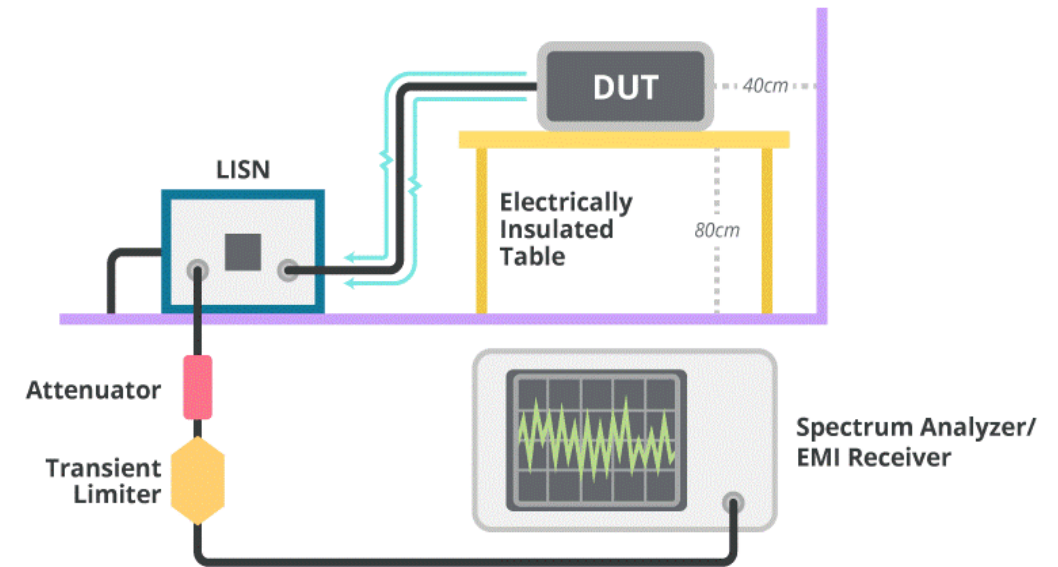
EMI Radiated Measurement



- Test setup is specified in applicable standards
- Typically, tests are performed inside some type of chamber/shielded room, and includes Equipment Under Test (EUT), ground plane, absorbers, Rx Antenna, Pre-amplifier, Spectrum Analyzer



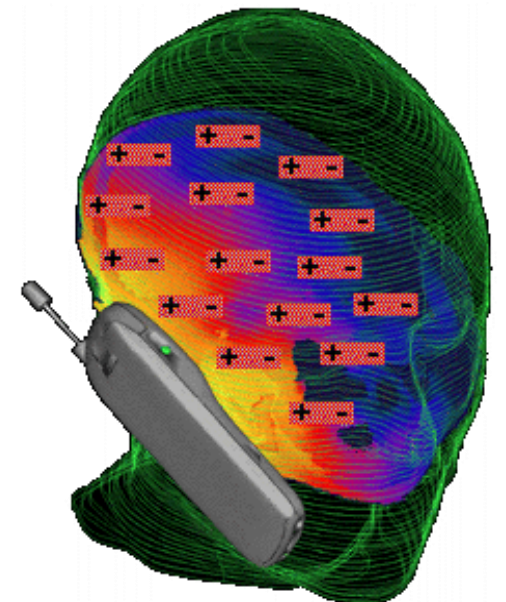
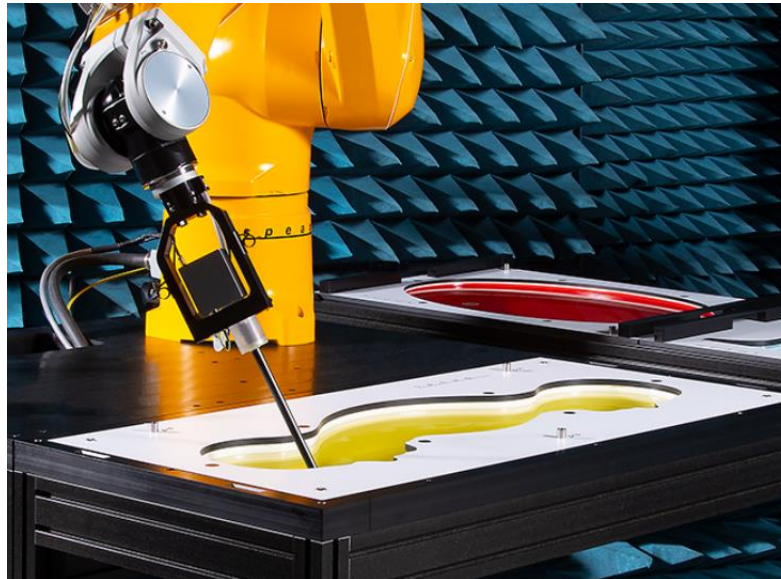
EMI Conducted Measurement



- Test setup is specified in applicable standards
- Typically, tests are performed at a test station/bench/table that are grounded

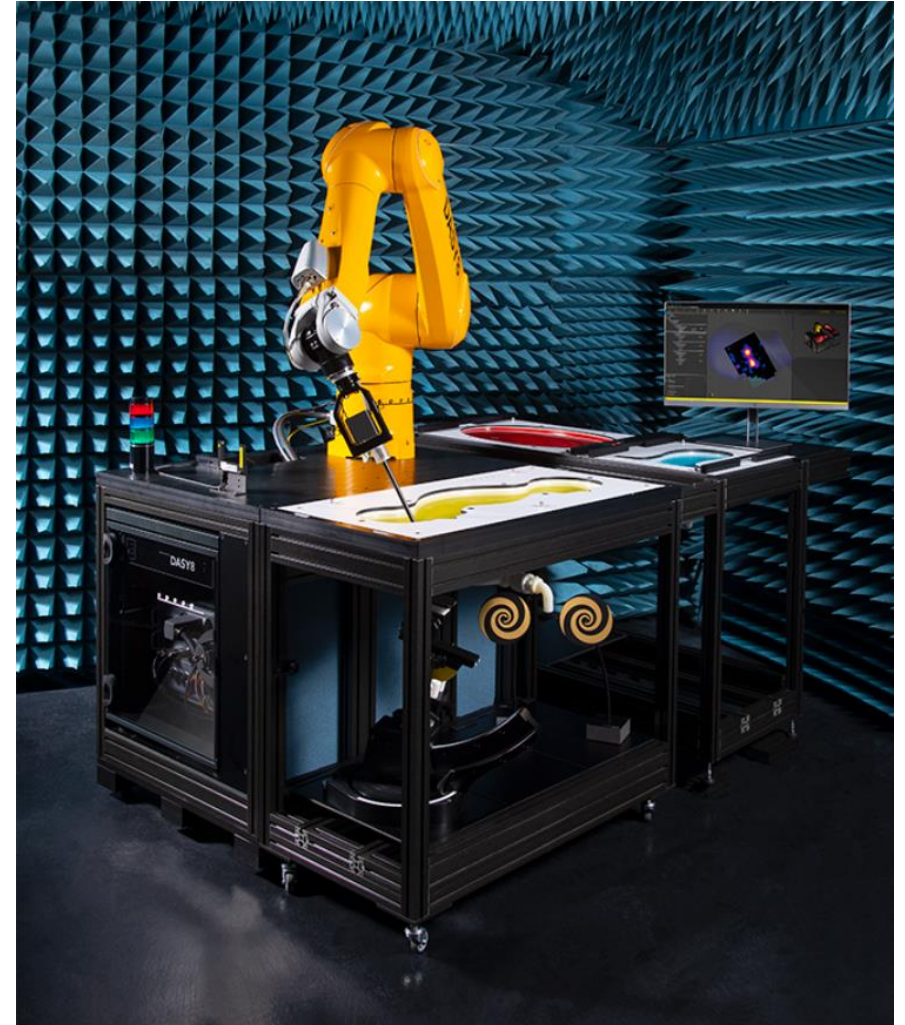
SAR: Specific Absorption Rate

- Rate at which radio Frequency (RF) energy is absorbed by human body
- Different types of SAR measurements include
 - Head SAR
 - Body SAR
 - Extremity SAR (limbs)



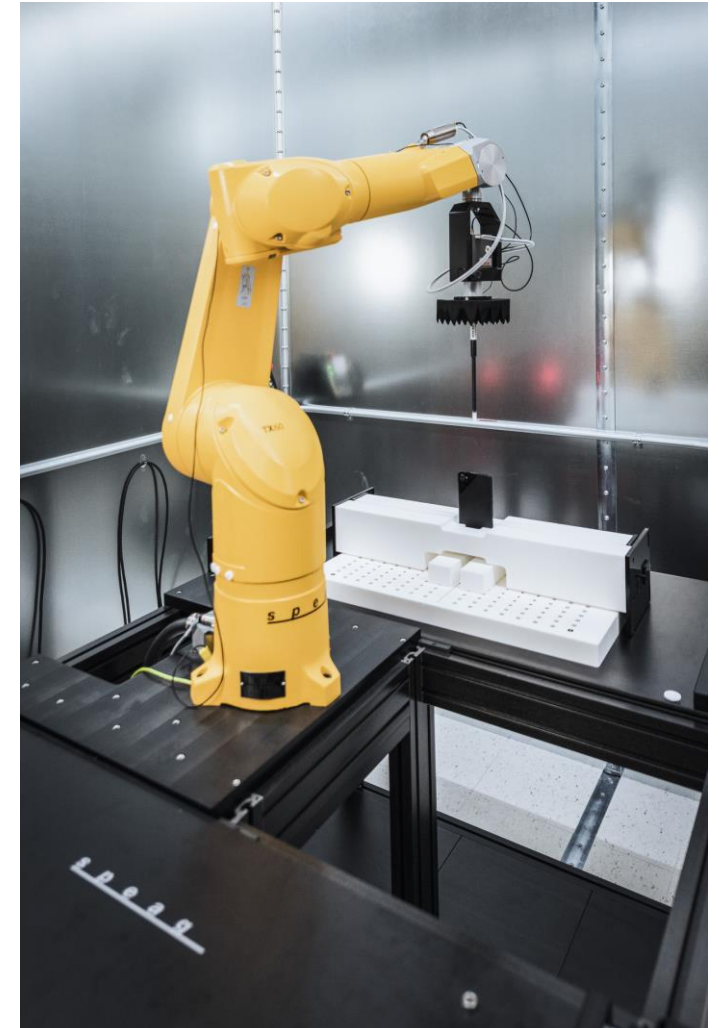
SAR Radiated Measurement

- SPEAG DASY (Dosimetric Assessment System)
- Dosimetric Probe
- DAE (Data Acquisition Electronics)
- Phantom: Head and Body
- Tissue Simulating Liquid
- Base Station Simulator (Callbox)



Power Density Measurement

- RF Exposure for frequency above 6 GHz occurs predominantly in the uppermost layers of superficial tissues.
- Free-space power density measurements at 6 GHz – 110 GHz evaluated as spatial-average over the averaging area.
- The electric field or magnetic field in the near-field of the DUT is evaluated.
- Perform measurement using SPEAG DASY System, mmWave phantom, DAE and mmWave probe (designed for precise near-field measurements in the mm-wave range)



Compliance Testing, Reporting, Certification



- Perform required tests per standards and guidance
 - Potential leverage from pre-cert testing
- Test Lab to compile Certification test reports
- Manufacturer to provide all necessary documents
 - Requirements certification reports and documents can be found in CFR Title 47 Part 2
- All Certification reports and documents will need to be submitted to a Telecommunication Certification Body (TCB)
- Product grant
- Market Surveillance

Recap

- **Step 1:** Select Radio Frequency and Design Equipment
- **Step 2:** Test Plan & Product Development (Pre-Compliance)
- **Step 3:** Register with FCC
- **Step 4:** Select an **authorized Test Lab**
- **Step 5:** Compliance Testing/ Reporting/ Documenting
 - EMC/RF
 - RF Exposure (SAR)
 - Other required test
- **Step 6:** Certification and Filing (TCB)

A large, stylized speech bubble graphic with a thick blue outline. The bubble is white and contains the text 'THANK YOU'. The bubble's tail points towards the bottom right, merging with the dark background.

**THANK
YOU**