Demystifying EMC 2024 online conference

HOW TO QUALIFY DEVICES WITHOUT ACCESSIBLE ANTENNA PORTS ACCORDING TO RED AND FCC

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ROHDE&SCHWARZ

Make ideas real

FCC empower Wi-Fi technology in USA market Milestones for 6GHz band

FCC Opens 6GHz Band to Wi-Fi and Other Unlicensed Uses

April 2020

FCC empower Wi-Fi technology in USA market
Milestones for 6GHz band

The commission begins the process for authorizing 6GHz band automated frequency coordination systems

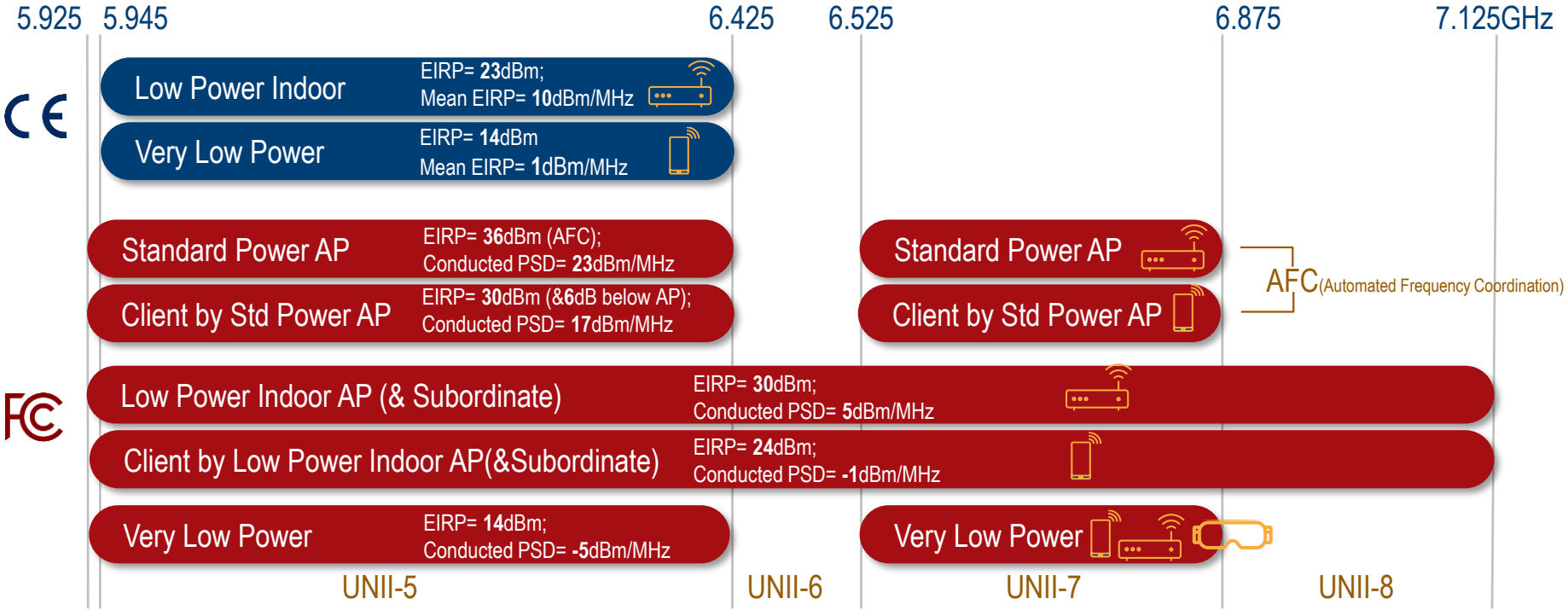
August 2021

FCC empower Wi-Fi technology in USA market Milestones for 6GHz band

FCC permits very low power device operations in 6GHz band

October 2023

Wi-Fi device spectrum allocations and power limits CE and FCC 6GHz bands

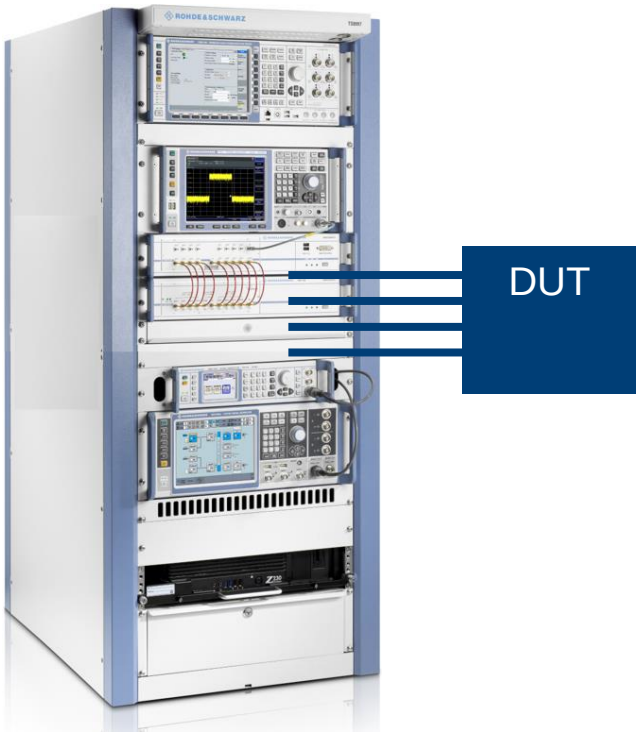


ETSI EN standards test cases for CE RED

	Test case	EN 300 328 2.4 GHz band	EN 301 893 5 GHz band	EN 303 687 6 GHz band
Transmitter	Carrier frequency accuracy		◆	◆
	RF output power	◆	◆	◆
	Transmit power control (TPC)		◆	
	Power spectral density	◆	◆	◆
	Occupied channel bandwidth	◆	◆	◆
	Transmitter unwanted emissions	*In out-of-band domain* *Spurious domain*	*within 5 GHz bands* *Outside 5 GHz bands*	*within 6 GHz bands* *Outside 6 GHz band*
Coexistence	Duty cycle, TX sequence, TX gap	◆		
	Dwell time, min. freq. occupation, hopping sequence (only for freq. hopping DUTs)	◆		
	Hopping frequency separation	◆		
	Medium utilization (MU) factor	◆		
	Adaptivity	◆	◆	◆
	Dynamic frequency selection (DFS)		◆	
Rec.	Receiver spurious emissions	◆	◆	◆
	Receiver blocking	◆	◆	◆
	Receiver adjacent channel selectivity		◆	◆

REGULATORY CHALLENGES DUE TO USE IN UNLICENSED BAND

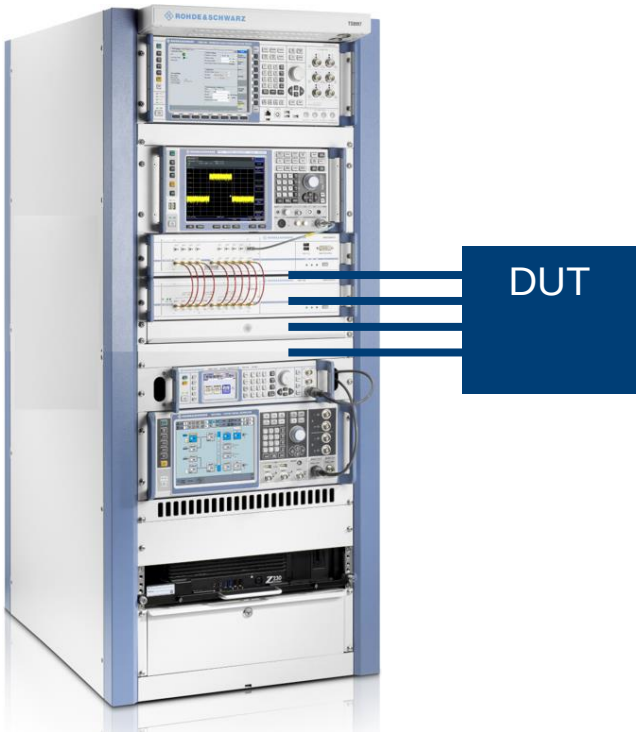
1. RF output power
2. Adaptivity
3. Receiver Blocking
4. Dynamic Frequency Selection (DFS)



REGULATORY CHALLENGES DUE TO USE IN UNLICENSED BAND

1. RF output power

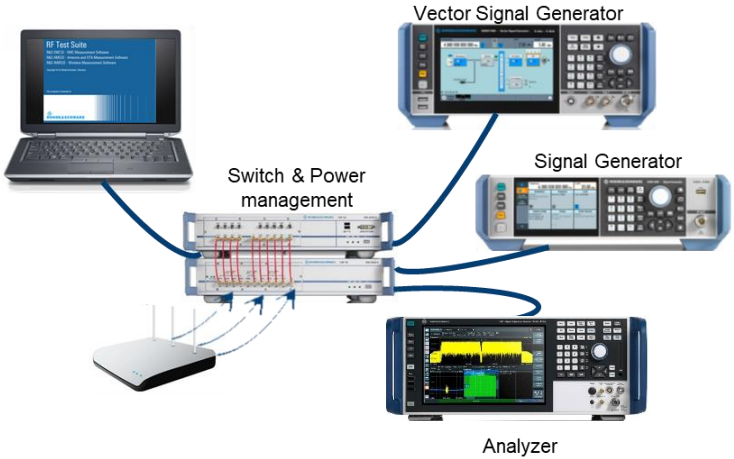
- Time-power-analysis with fast RMS detector
- Broadband measurement over the transmit spectrum
- Sampling >10 MS/s
- Synchronous measurement on all antenna ports
- Dedicated pulse and power analysis up to several seconds

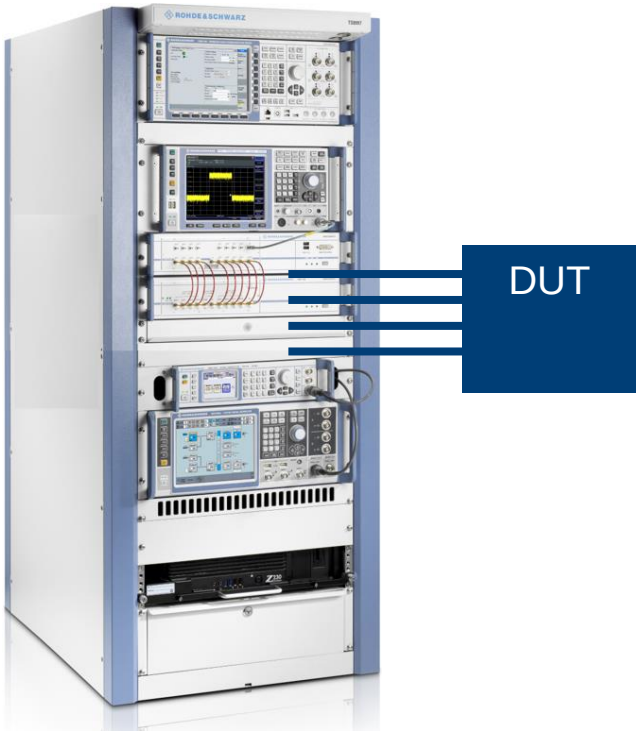


REGULATORY CHALLENGES DUE TO USE IN UNLICENSED BAND

1. RF output power
2. Adaptivity

- Check for coexistance of different services and devices
- It must adopt to allow other devices to communicate

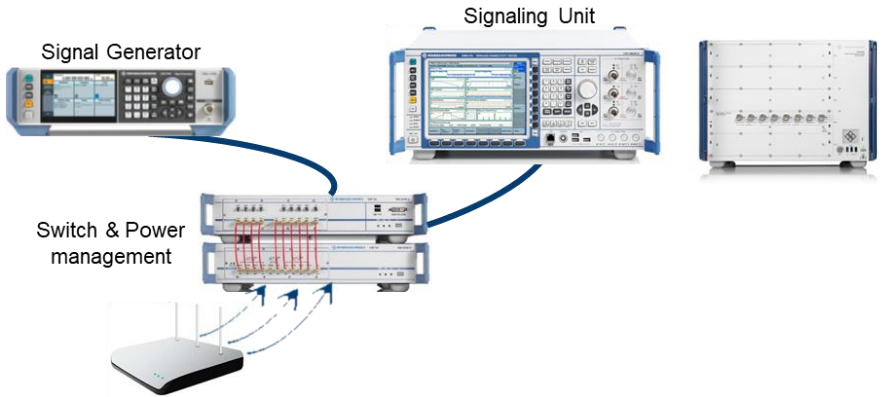


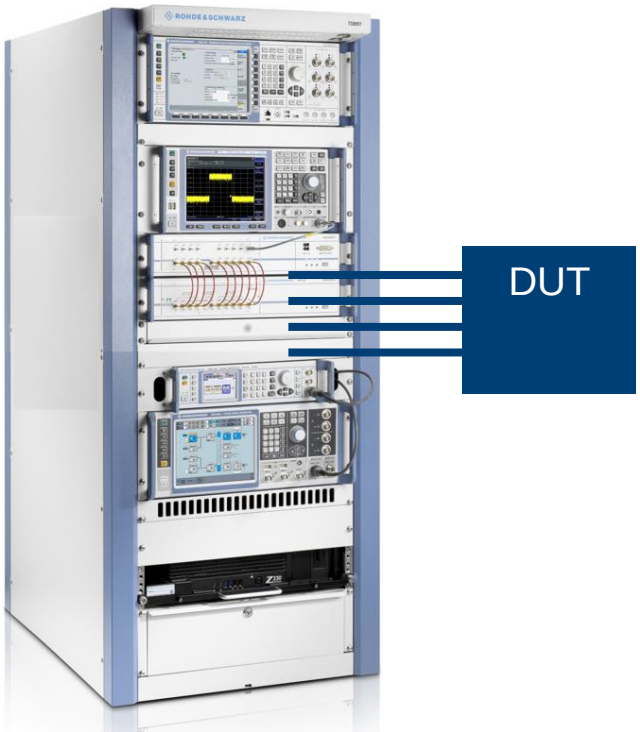


REGULATORY CHALLENGES DUE TO USE IN UNLICENSED BAND

1. RF output power
2. Adaptivity
3. Receiver Blocking

- Receiver sensitivity must not degrade in presence of interferer

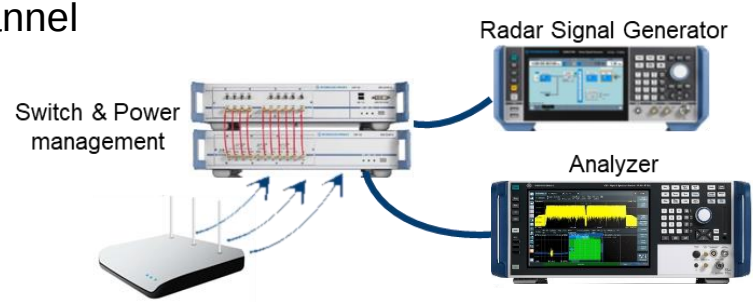


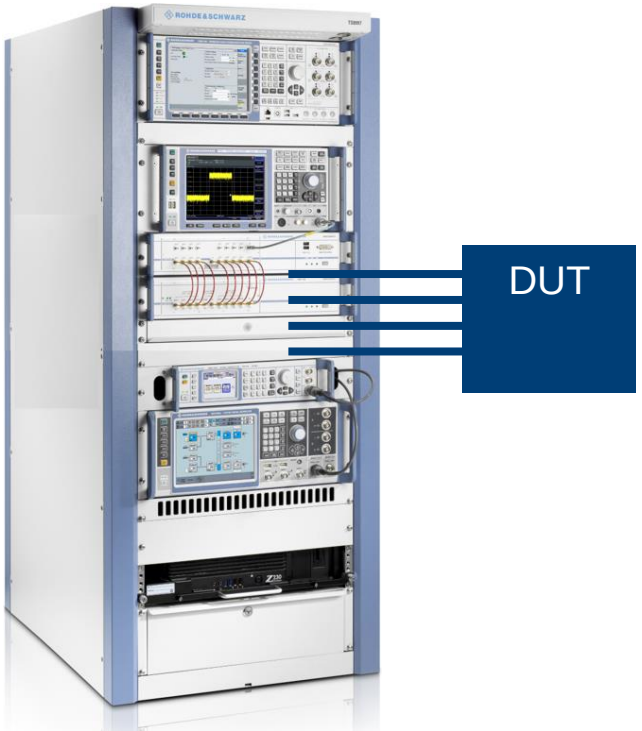


REGULATORY CHALLENGES DUE TO USE IN UNLICENSED BAND

1. RF output power
2. Adaptivity
3. Receiver Blocking
4. Dynamic Frequency Selection (DFS)

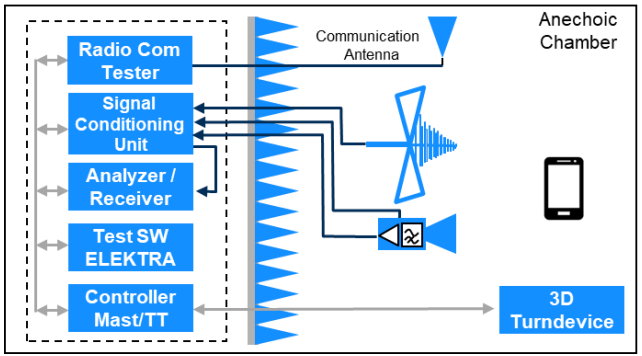
- Detection of dedicated radar signals
  -> Immediate channel change and periodic check on this channel

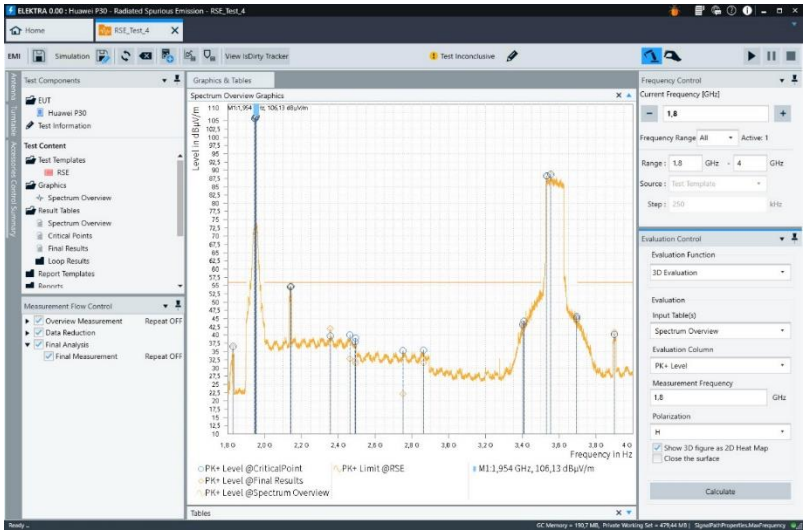




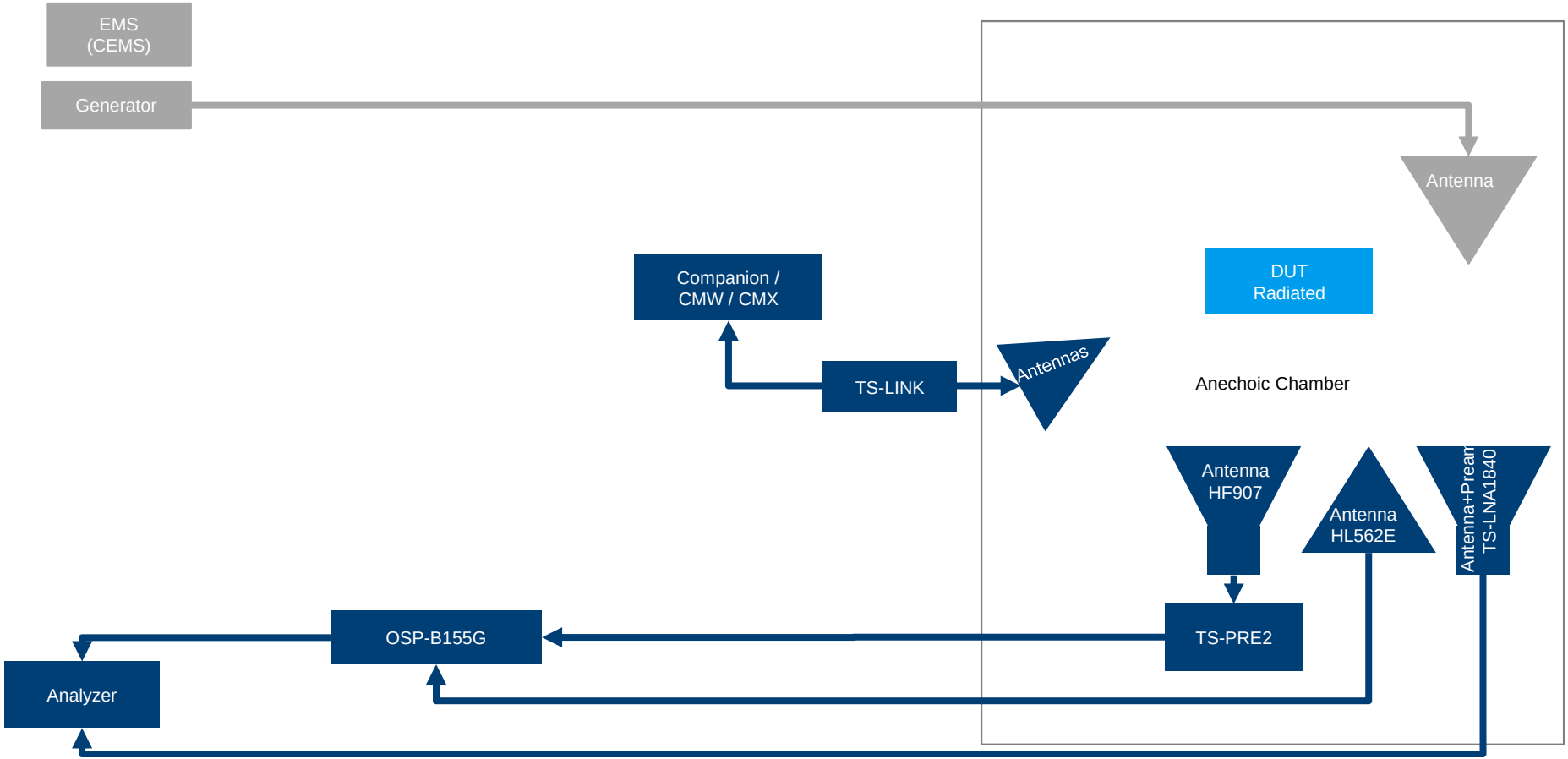
RADIATED SPURIOUS EMISSION (RSE) ALWAYS IN ANECHOIC CHAMBER

- ► Frequency range 30 MHz to 12.75 GHz / 26 GHz / 40 GHz
- ► RSE is part of regulatory testing
- ► Test setup similar EMC in 3m FAR
- ► 3m test distance, with floor absorbers, no height scan
- ► Signal conditioning for high sensitivity in presence of carrier
- ► Combination with EMC test system possible

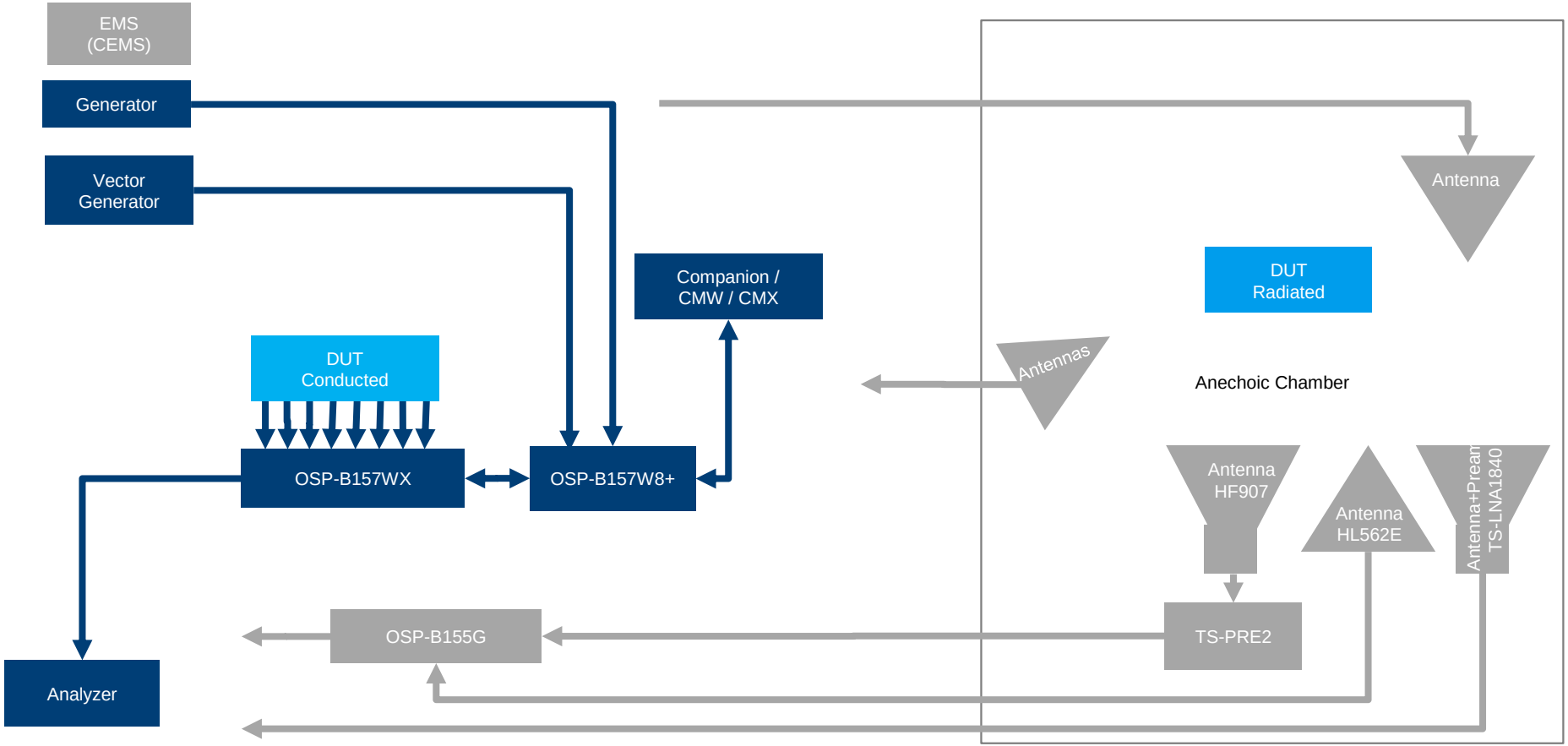




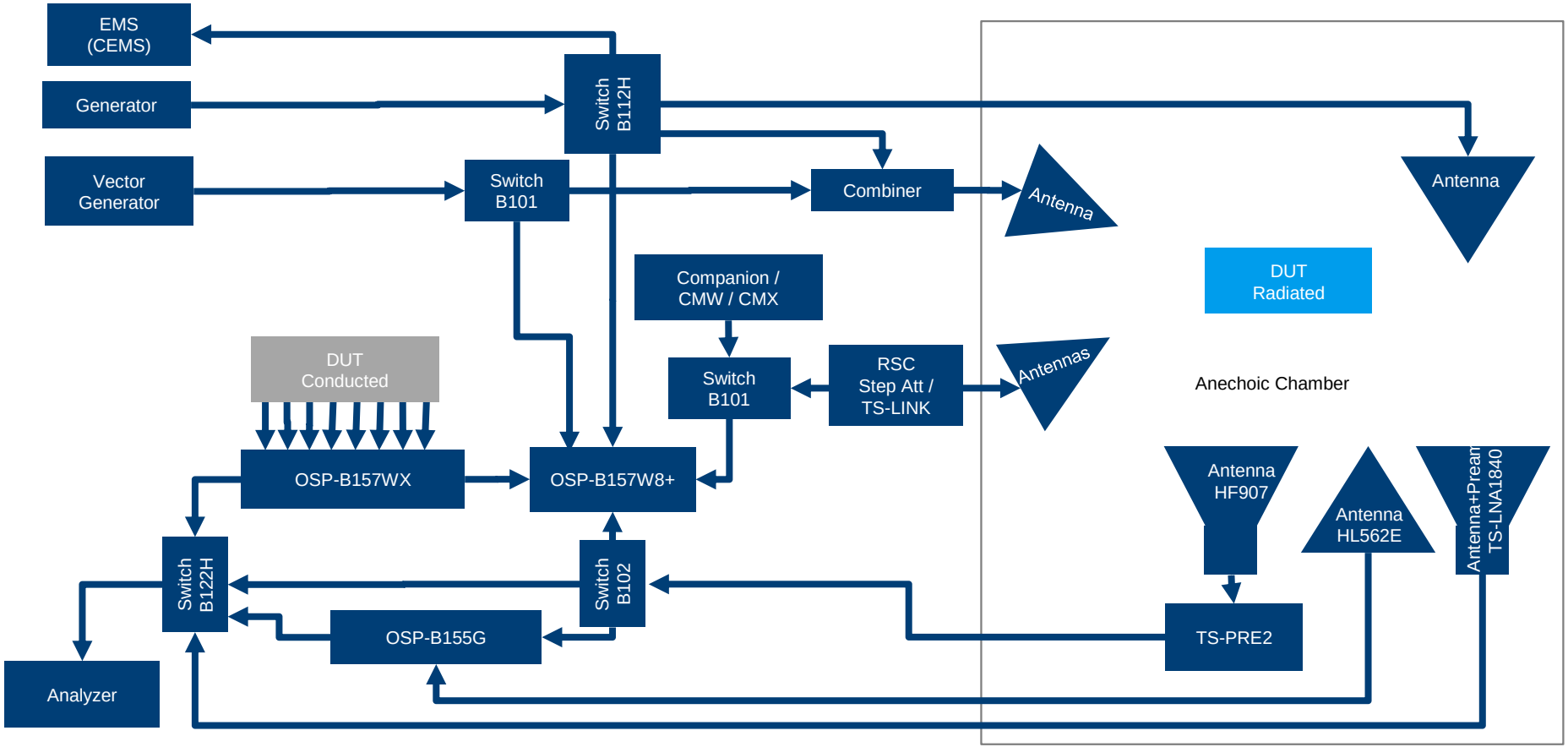
RADIATED SPURIOUS EMISSION (RSE)



… + REGULATORY CONDUCTED



… + ALL REGULATORY TESTS RADIATED



THE SOLUTION: NORMALIZED TEST

1. Determine the maximum EIRP of the DUT e.g. in a regular EMC chamber for the required channels and bandwidths.

2. Place the DUT in an RF-shielded box (R&S TS7124) and normalize the measured power levels by calculating a coupling loss via the previously measured maximum EIRP.

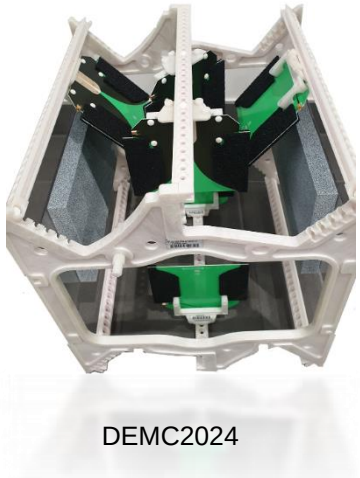
3. Perform automated regulatory tests (e.g. ETSI EN 301893, ETSI EN 303 687) using the determined coupling loss for the different probe antennas in use (assuming Tx and Tx reciprocity).

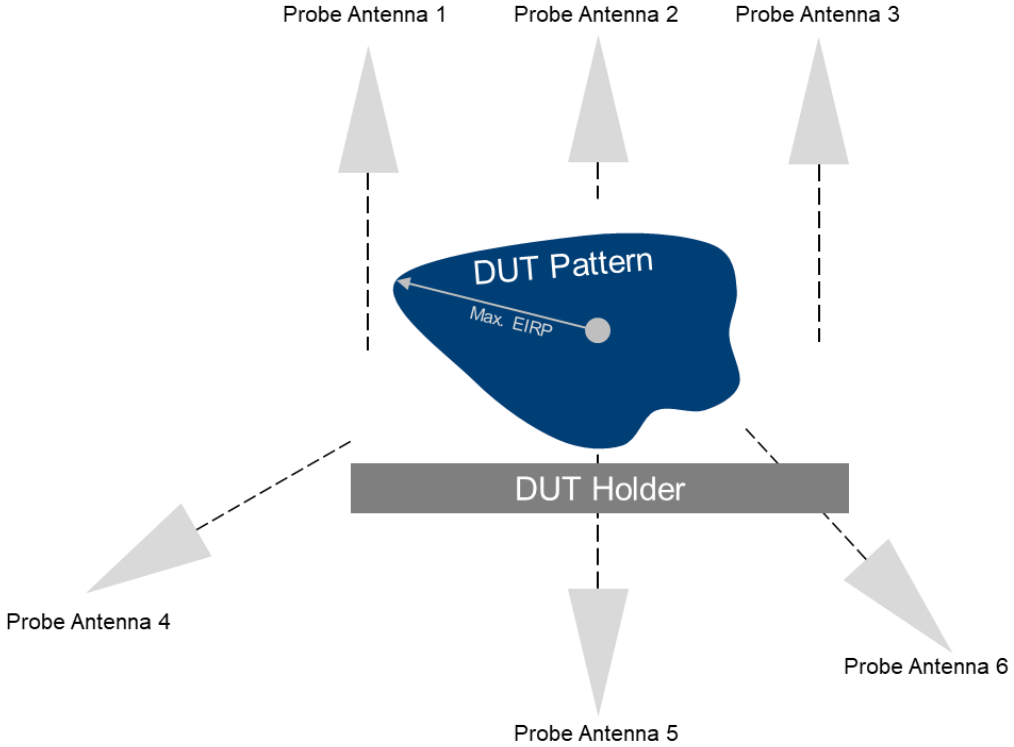
NORMALIZED MEASUREMENT IN RF-SHIELDED BOX WITH SEVERAL ANTENNAS

Challange of normalized measurement:

- DUT Antenna Pattern
- Probe Antenna Pattern
- Polarization Mismatch
- Near Field Path Loss

Solution: Use of 6 probe antennas





THE SOLUTION: NORMALIZED TEST

- The normalized measurements are intended for DUTs with a single integrated antenna (i.e. DUTs where accessing the antenna port is not feasible or not wanted).

- The normalized fixture approach is currently mentioned in the following ETSI standard drafts:
  - ETSI EN 301 893 (5 GHz Wi-Fi)
  - ETSI EN 303 687 (6 GHz Wi-Fi)

CONCLUSION

- Regulatory testing includes specific tests for e.g. coexistance
- Challenge:
  More and more devices with integrated antenna
  - Conducted regulatory test is then no more possible
  - RSE, EMC and free space EIRP are always measured radiated in anechoic chamber
  - Other tests as adaptivity, dynamic frequency selection (DFS) and receiver blocking get very complex in the anechoic chamber
- Solution:
  Compact setup by shielded box with several antennas
  - Path loss normalized to measured free space EIRP
  - Automated measurement with choosing optimum antennas
  - Compact, efficient and cost effective

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q&a

Thank you for listening.

For any questions please contact us via chat.

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