



Canova Tech

The Art of Silicon Sculpting

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IEEE802.3cg TF

EMC/EMI measurements on 10BASE-T1S evaluation boards

March 5th 2018

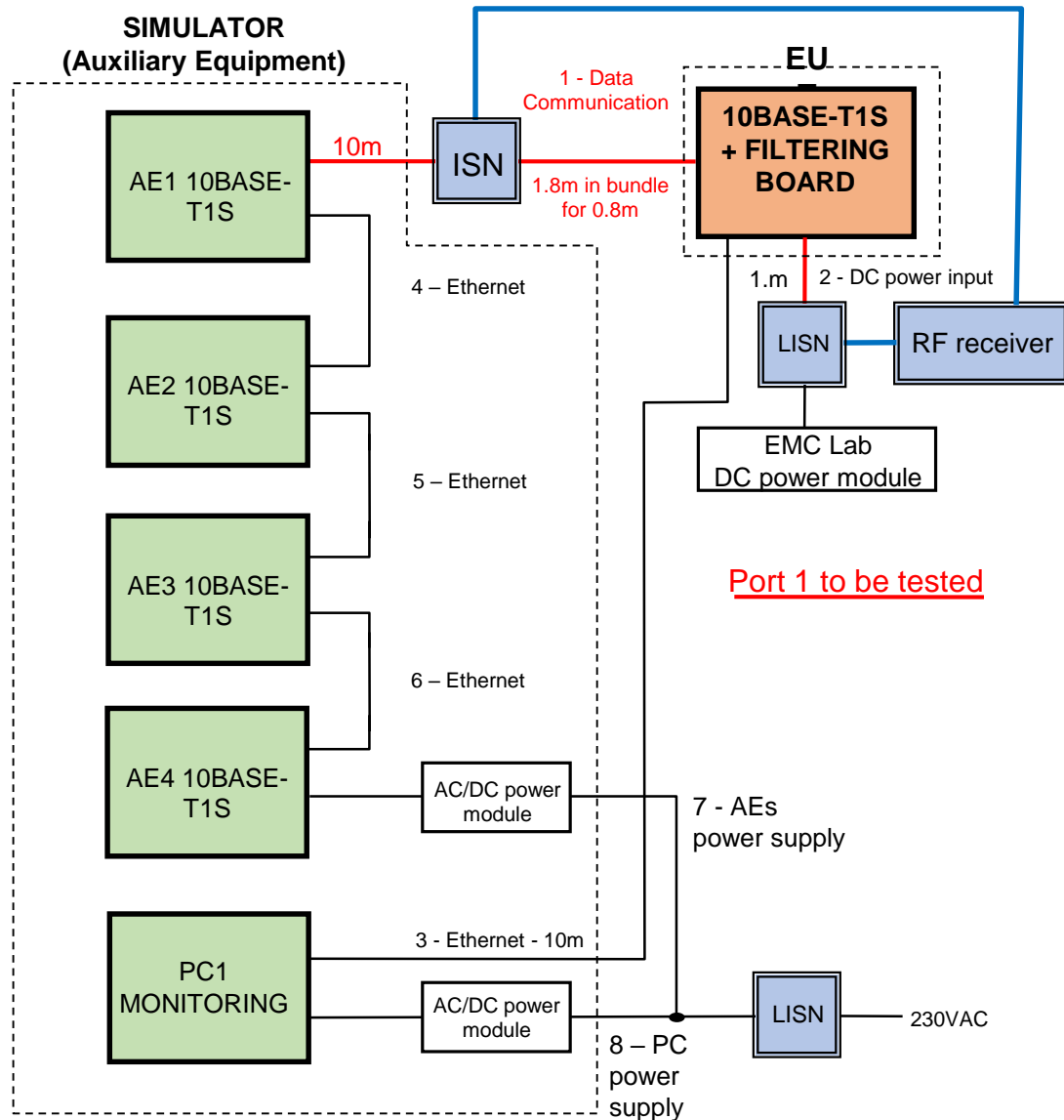
10BASE-T1S Evaluation Board

- 10BASE-T1S Prototype
 - Analog in discrete components
 - Digital in FPGA
 - Industrial / Automotive certified CPU with standard MAC
 - Multidrop support

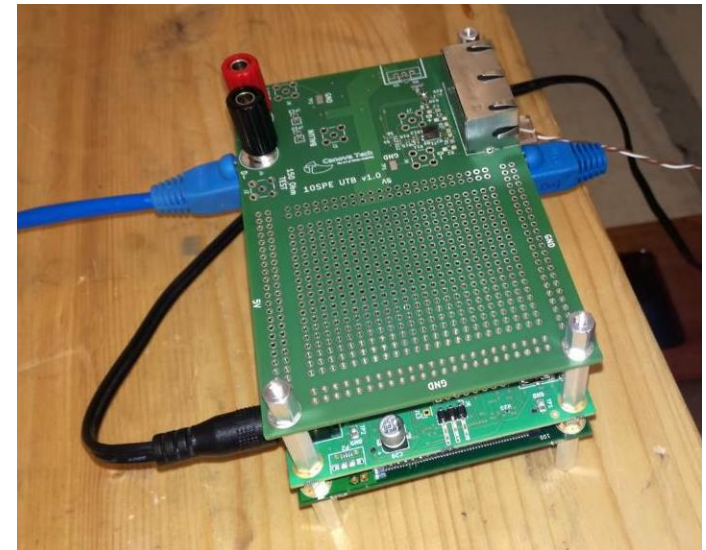


- Joint session Canova Tech - Kone
- EMC laboratory
 - IASELAB (Ferrara - Italy)
 - Conducted Emission (EN 55032)
 - Conducted Immunity (EN 61000-4-6, EN 55024)
 - Radiated Emission (EN 55025 - CISPR 25)
- NOTE: referenced normatives specify both test conditions and limits. For the sake of this presentation the limits are just informative.

Conducted Emission – Test Setup

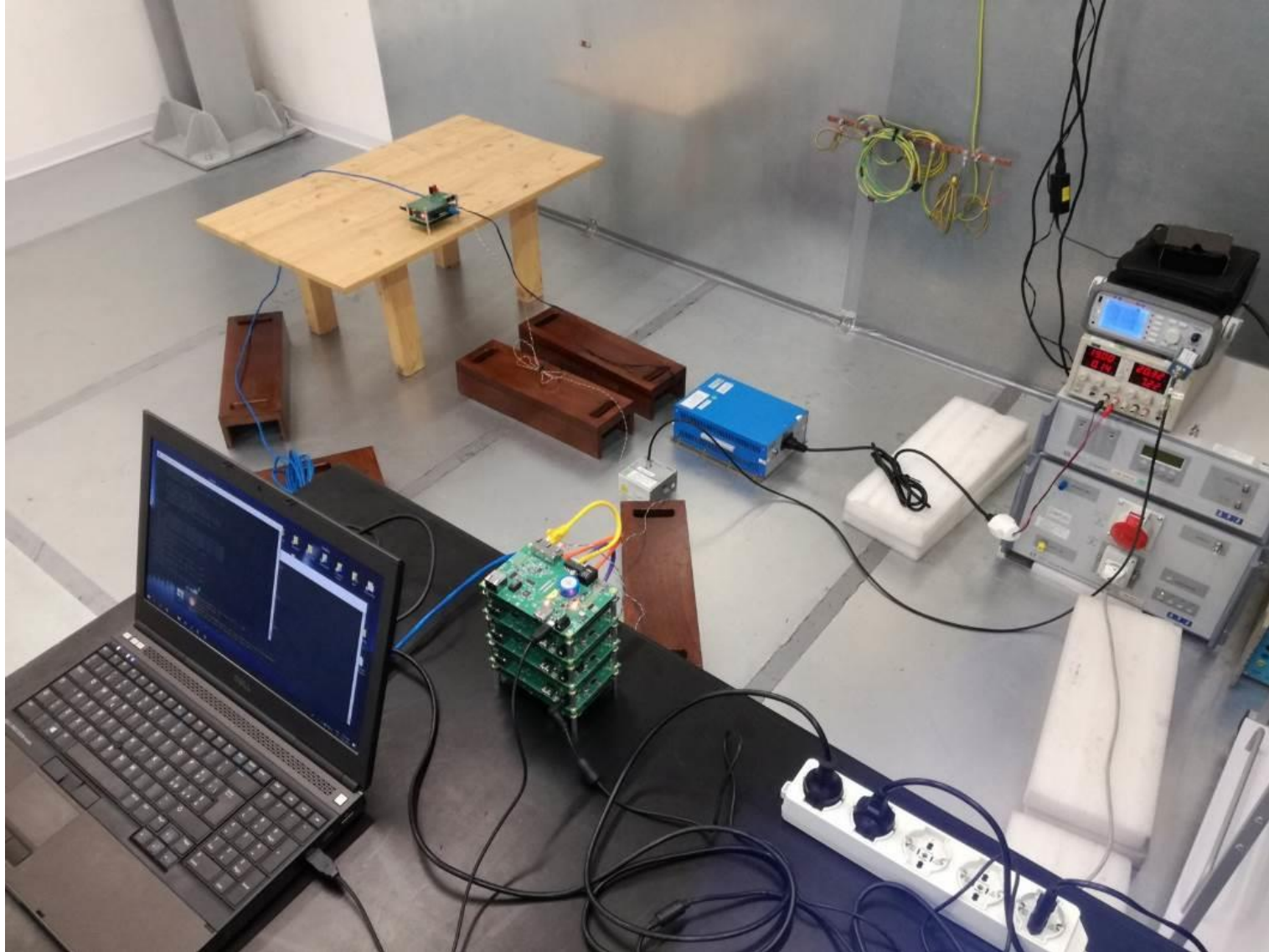


- CABLES
 - UTP CAT 5E
 - MC > 30db
- ISN
 - TESEQ ISN T8-Cat6



Optional Filter board (top)

Conducted Emission — Test Setup



PSD MASK



Measured PSD
MASK matches
simulations

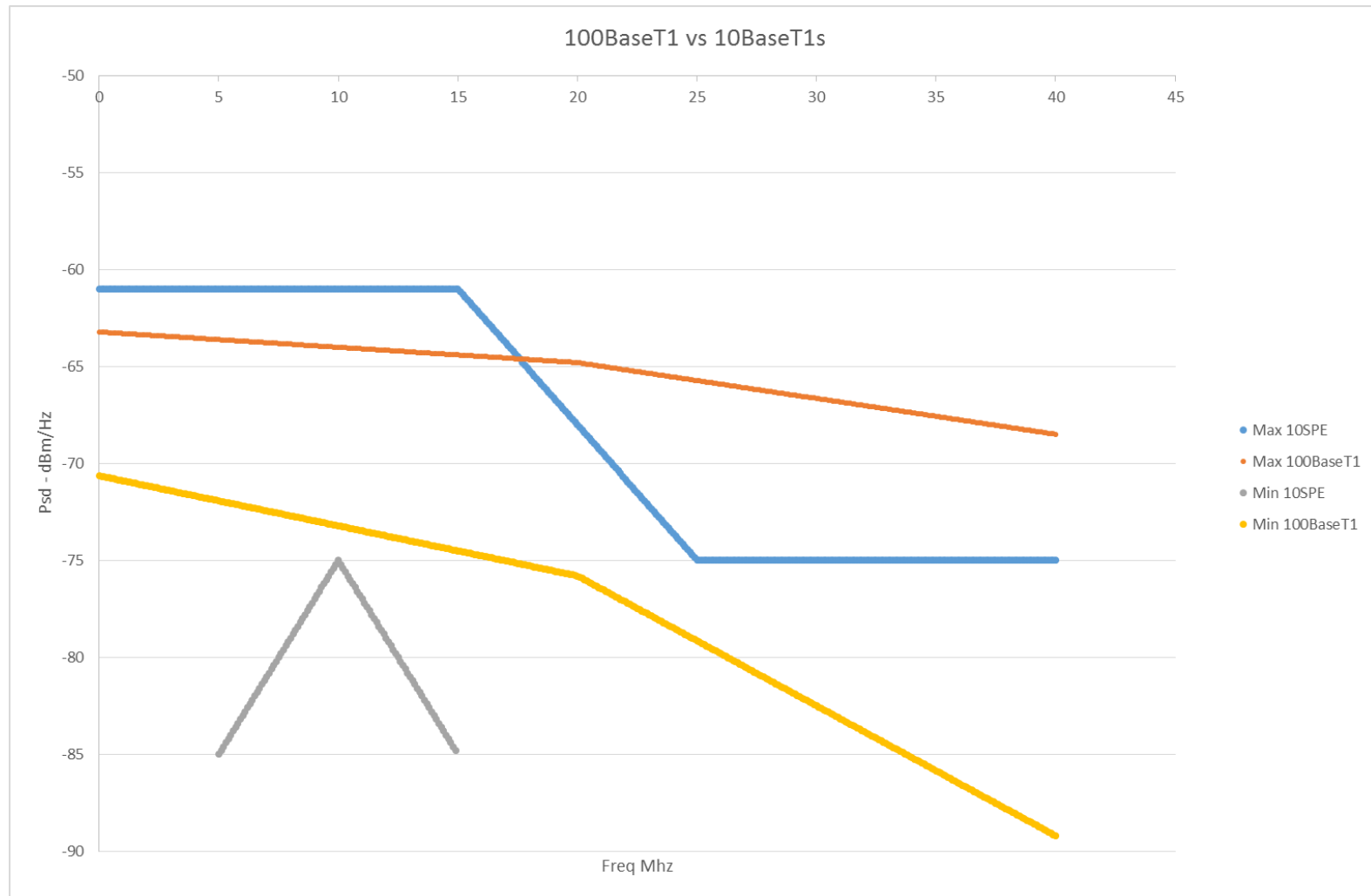
Slightly below
upper limit
currently defined
in 802.3cg

RBW=10 KHz

VBW=1 KHz

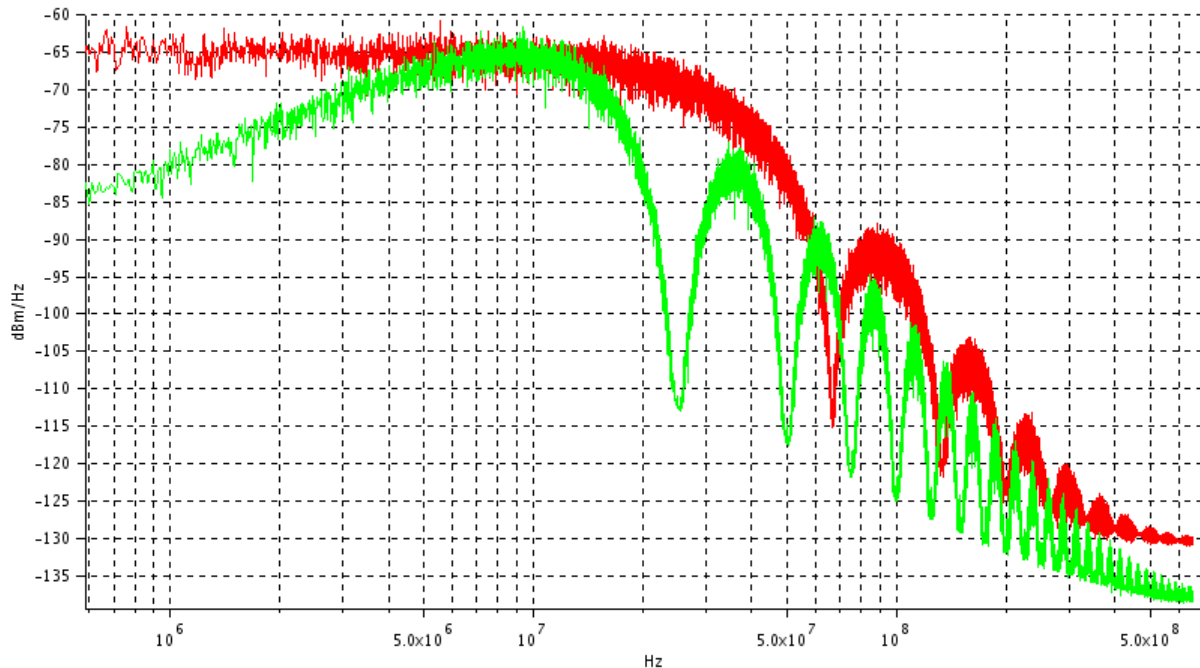
NOTE: Mask is in
dBm (not dBm/Hz)

100BASE-T1 vs 10BASE-T1S PSD



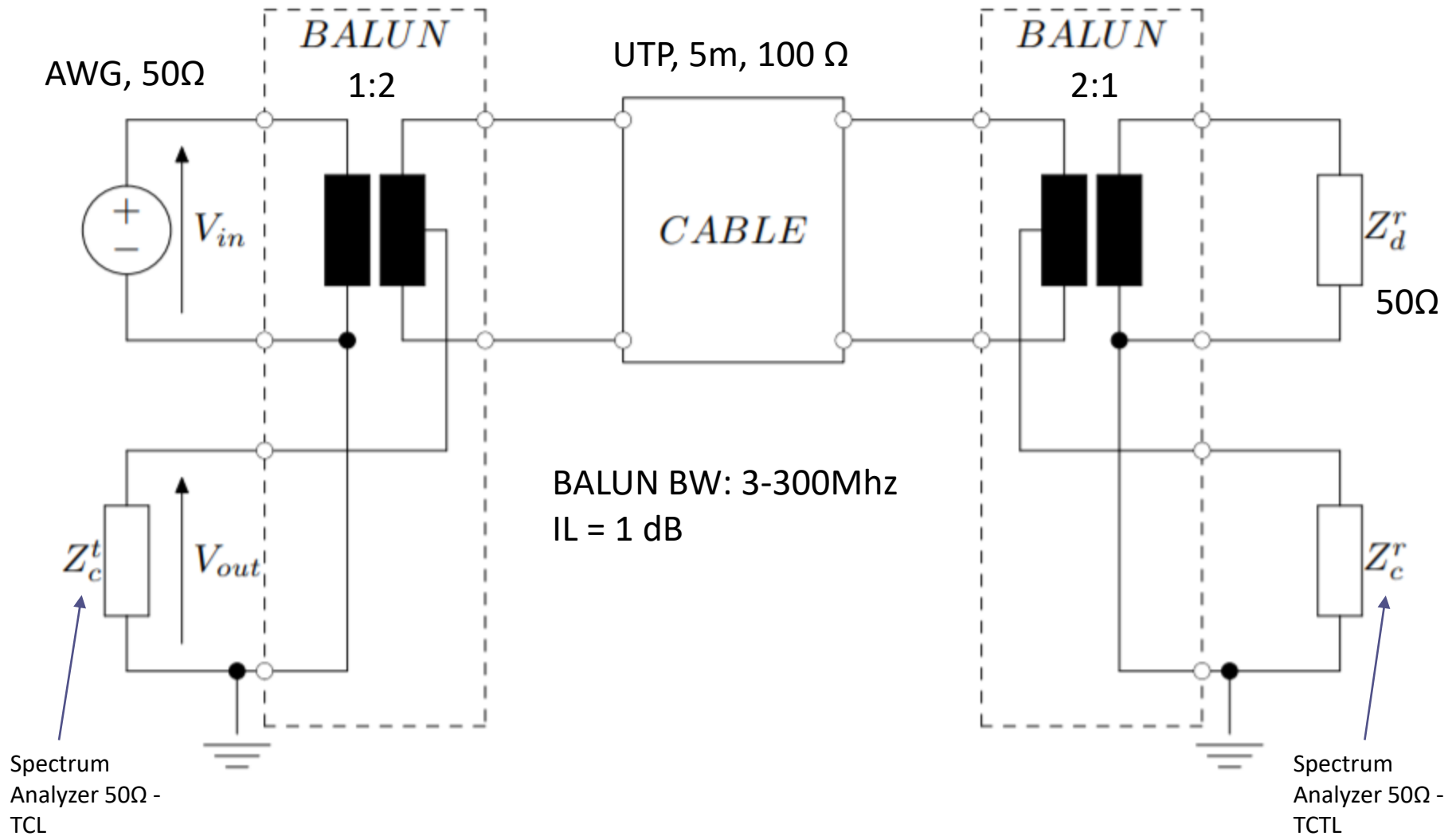
100BASE-T1 vs 10BASE-T1S PSD

Simulated PSD for 100BASE-T1 and 10BASE-T1S with typical TX amplitude

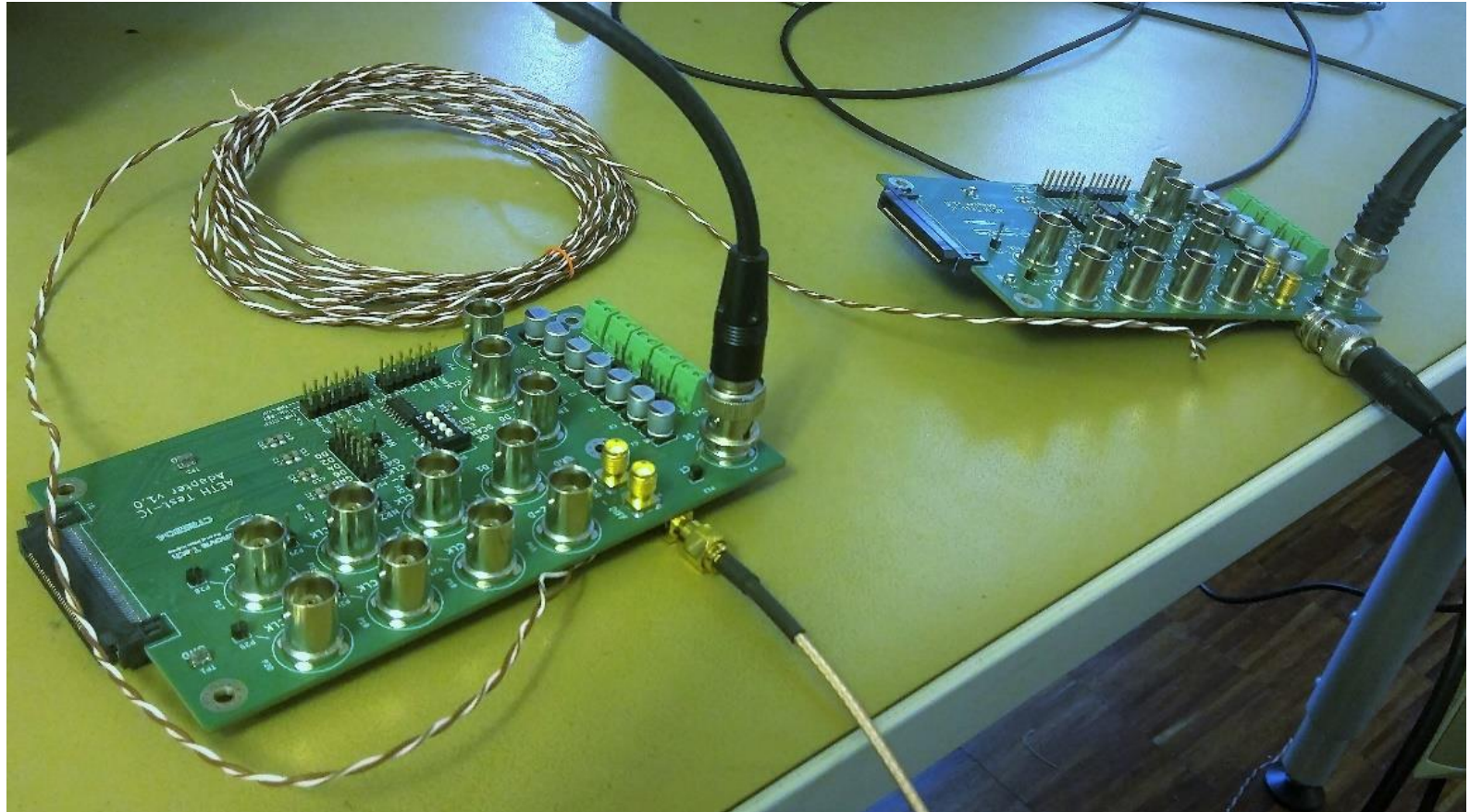


- Red
 - 100BASE-T1 PSD
 - RBW=10KHz
 - TX=2Vpp @ matched load
- Green
 - 10BASE-T1S PSD
 - RBW=10KHz
 - TX=1Vpp @ matched load

Cable MC measurement

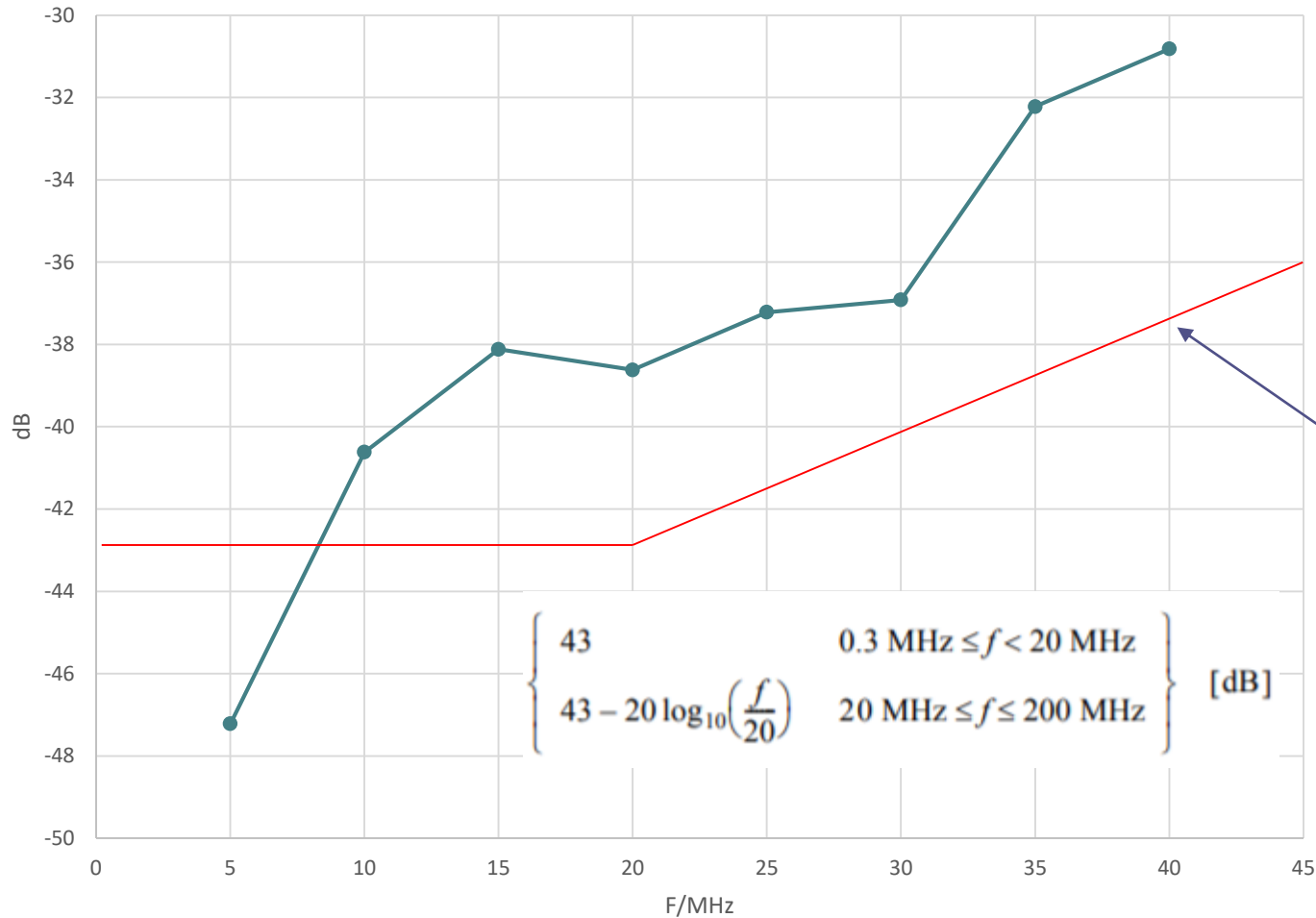


Cable MC measurement



Cable MC measurement

TCL



Conducted emission - results



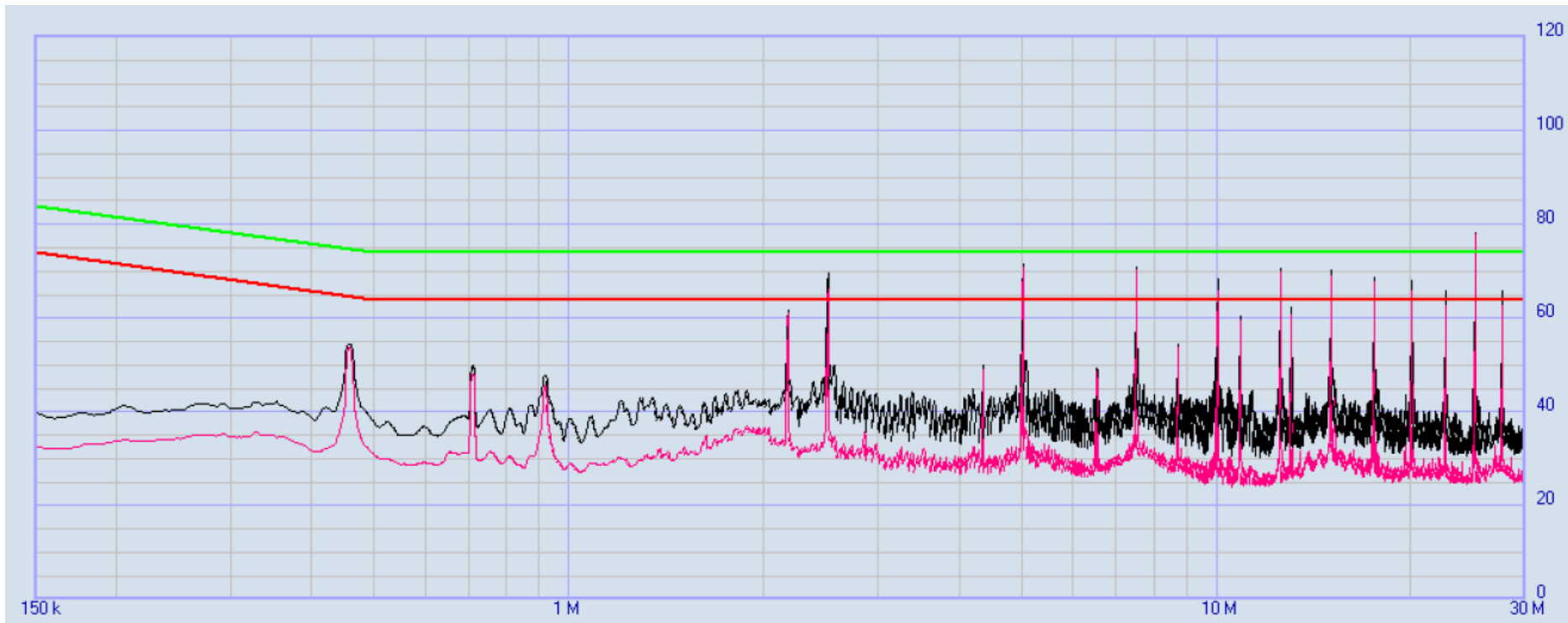
- **TRANSMITTER OFF**

- Contribution from powered-on board
- Peaks caused by onboard DC/DC supplies

BLACK = PEAK

PINK = AVG

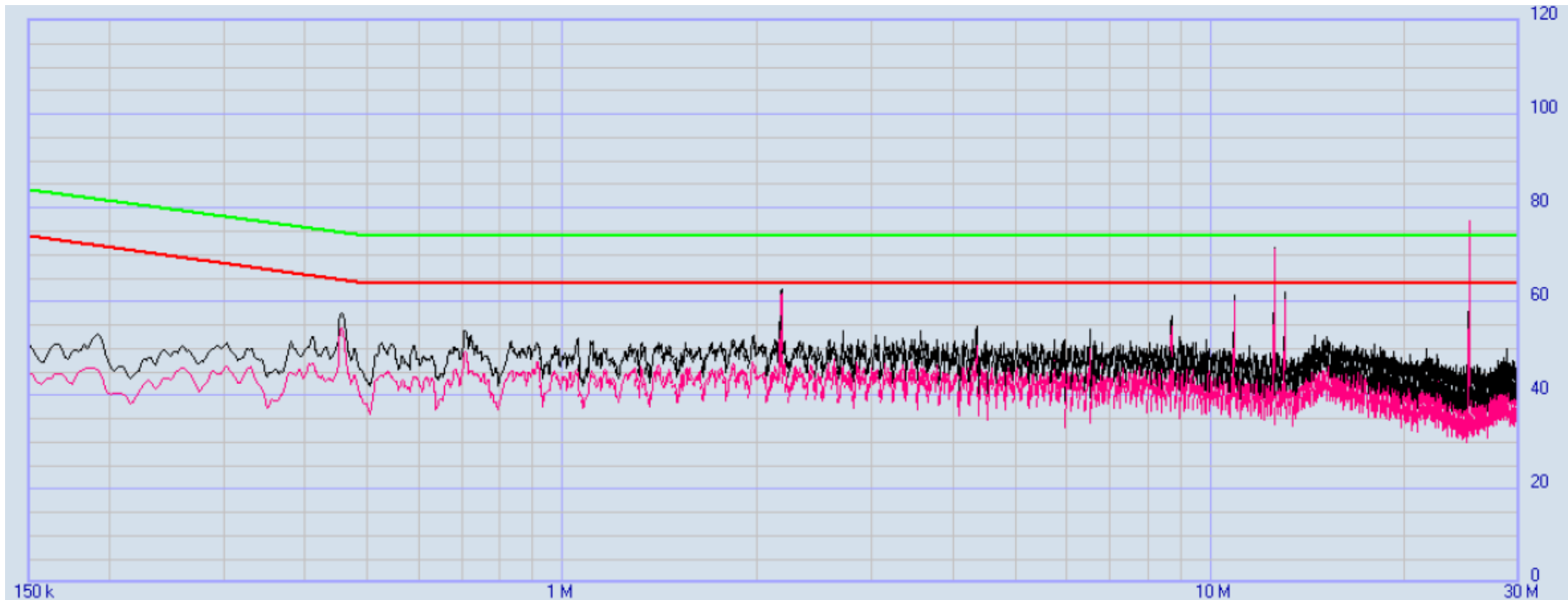
Conducted emission - results



- **TRANSMITTER - 2 Vp-p**
 - Sending repetitive payload (all 0x55) causes additional peaks to show up

BLACK = PEAK
PINK = AVG

Conducted emission - results

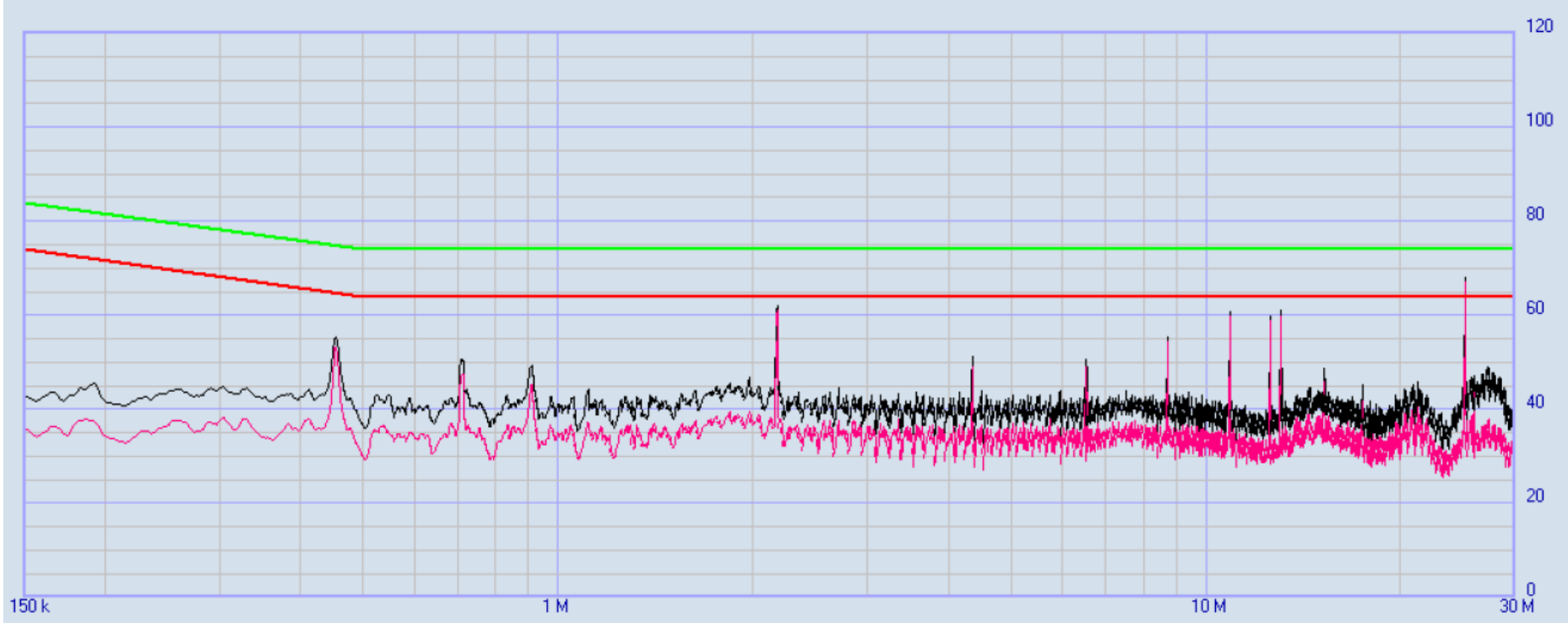


- **TRANSMITTER - 2 Vp-p with scrambler**
 - Peaks are redistributed over a wider spectrum
 - Peaks due to DC/DC converters remain
 - Additional peaks at 12.5 MHz and 25 MHz (unfiltered TX)

BLACK = PEAK

PINK = AVG

Conducted emission - results

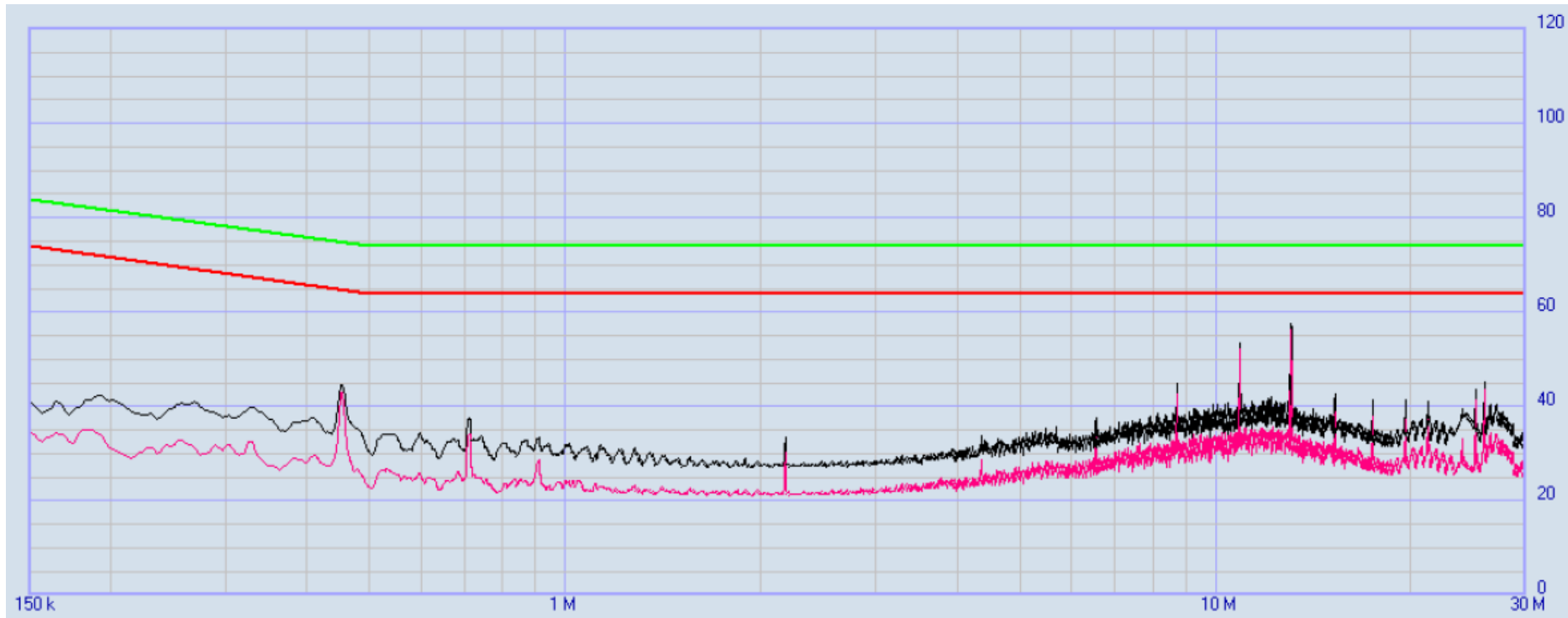


- TRANSMITTER - 1 Vp-p with scrambler
 - Lower than 2 Vp-p
 - Peaks due to DC/DC converters remain
 - Additional peaks at 12.5 MHz and 25 MHz (unfiltered TX) remain

BLACK = PEAK

PINK = AVG

Conducted emission - results

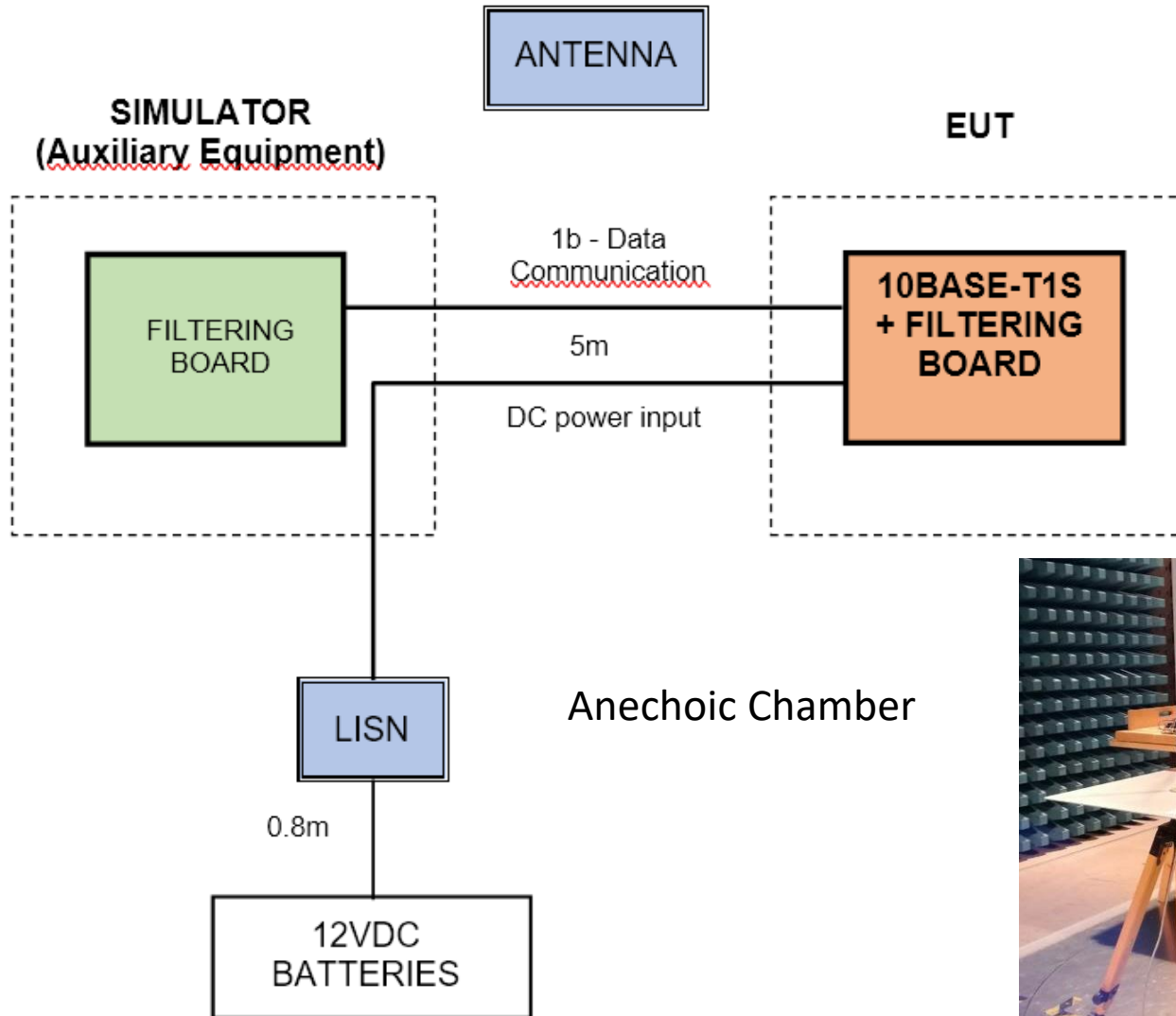


- **TRANSMITTER - 1 Vp-p with scrambler and CMC**
 - Best Result
 - Peaks due to DC/DC converters remain
 - Peaks at 12.5 MHz and 25 MHz are filtered out

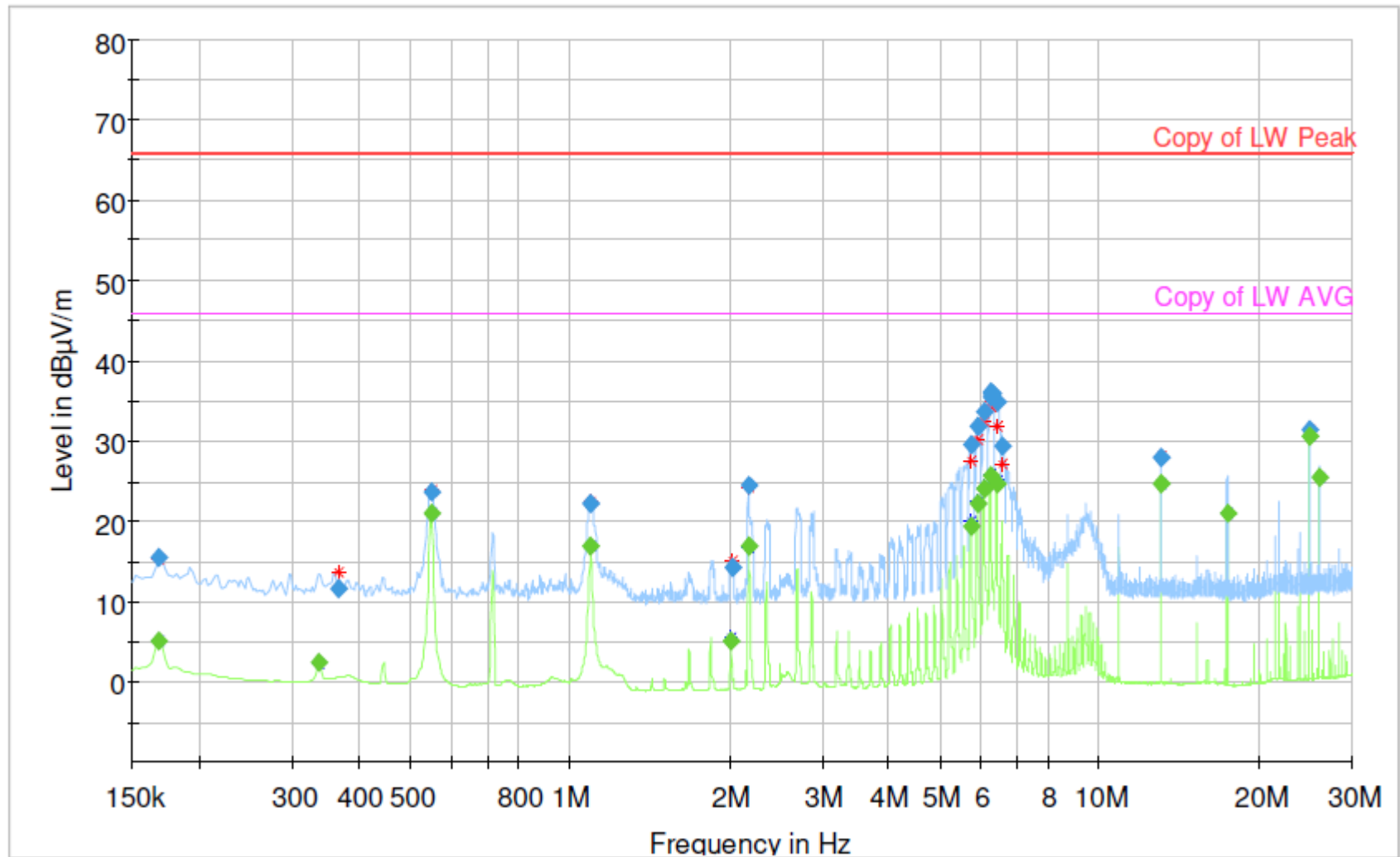
BLACK = PEAK

PINK = AVG

Radiated Emission – Test Setup

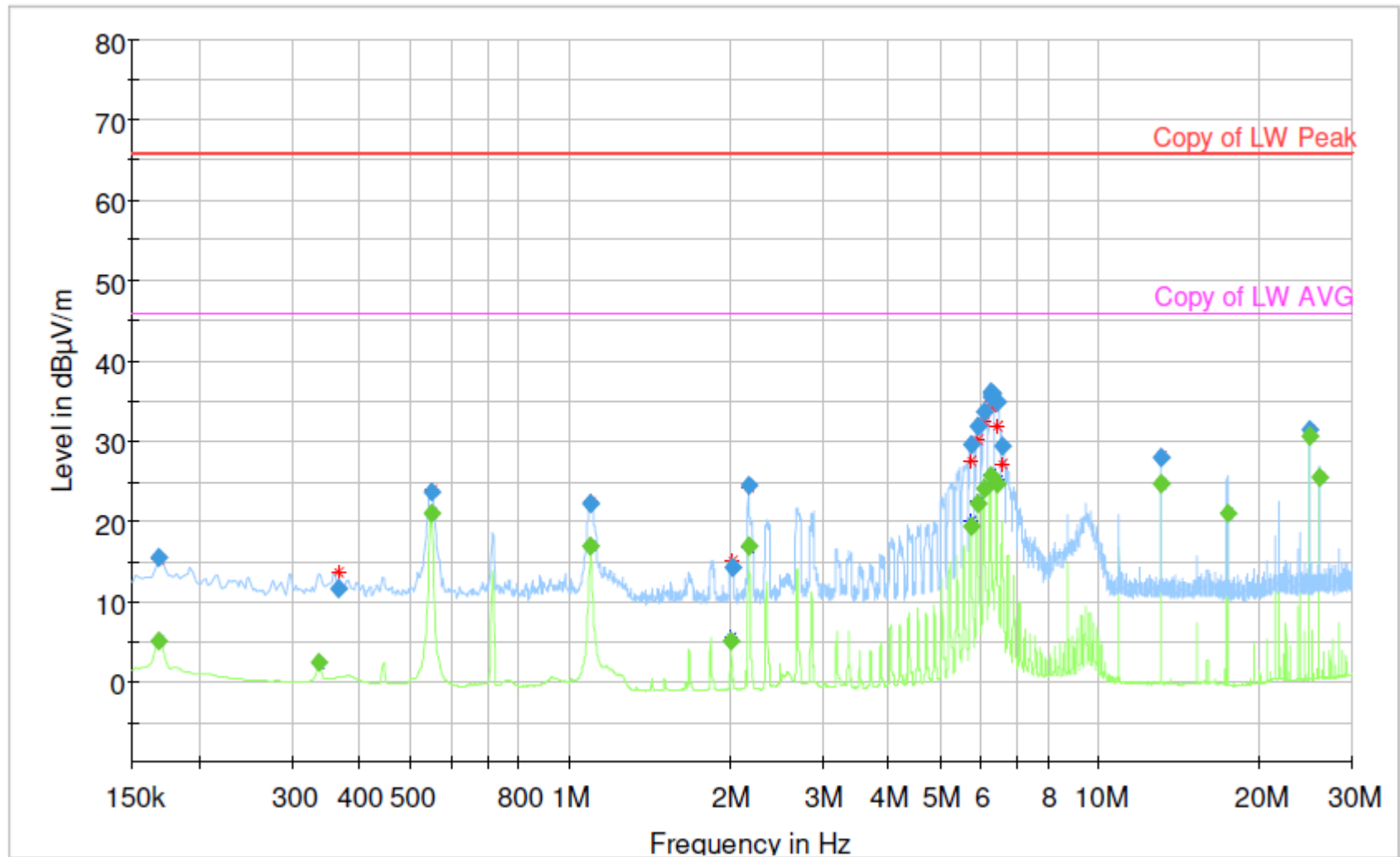


Radiated Emission — results



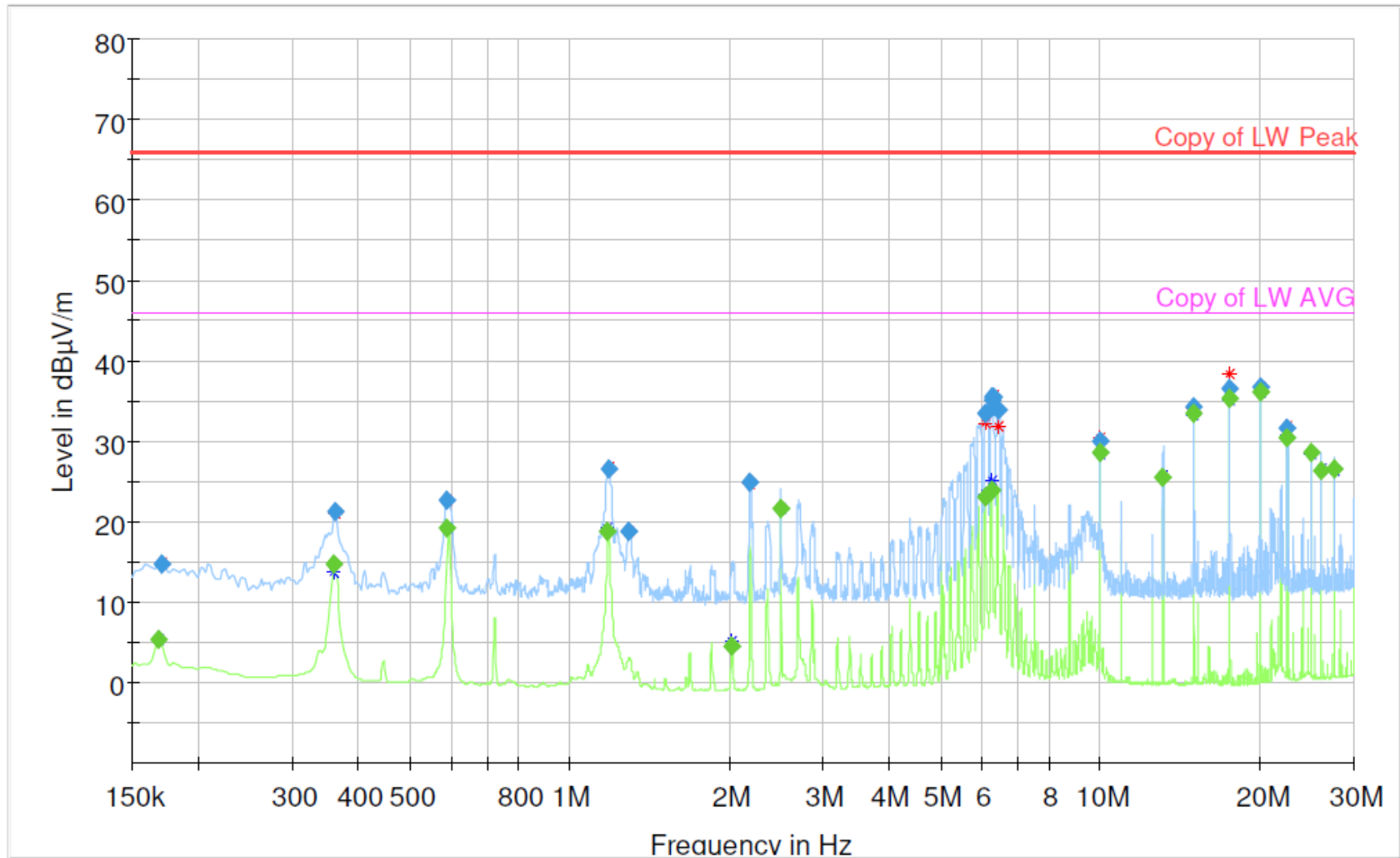
TRANSMITTER OFF (Board Contribution)

Radiated Emission — results



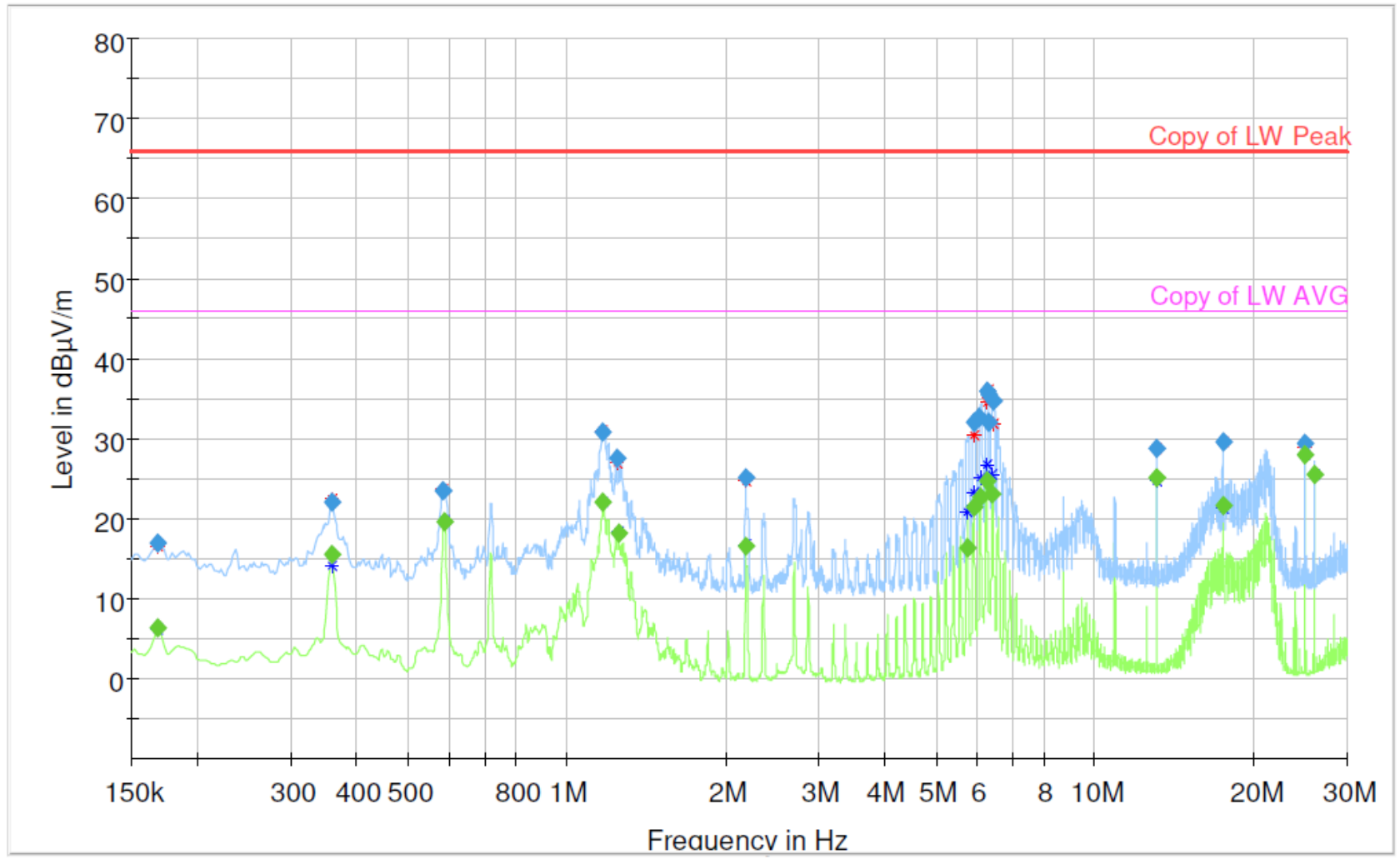
TRANSMITTER 2 Vp-p (without scrambler, with CMC)

Radiated Emission — results



TRANSMITTER 2 Vp-p (with scrambler, with CMC)

Radiated Emission — results



TRANSMITTER 1 Vp-p (with scrambler, with CMC)

- Emission tests results on evaluation boards shows that proposed PSD mask “Do not **preclude** meeting CISPR EMC requirements”, both for conducted and radiated tests
- Proposed PSD masks limits are close to the ones of 100BASE-T1
- Immunity test results post-processing in progress
- To achieve CISPR 25 class-5 limits Common mode chokes are required
- Scrambler significantly reduces the emission peaks in case of repetitive patterns

Thank You !