EUROPEAN SPALLATION SOURCE

PIN diode
Critical Design Review

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ESS LLRF Critical Design Review, Lund

Agenda

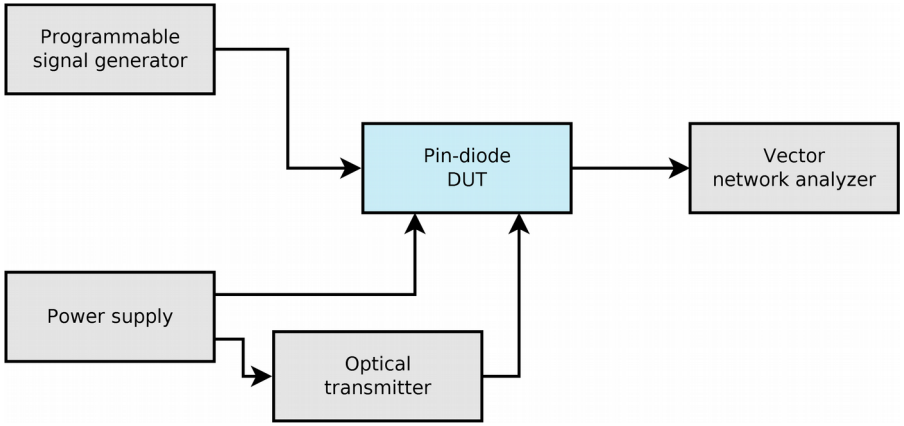
- Tests of the prototype
- Problems during optical inspection
- Device manufacturability
- Procurement, production, delivery
- Planned tests and measurements

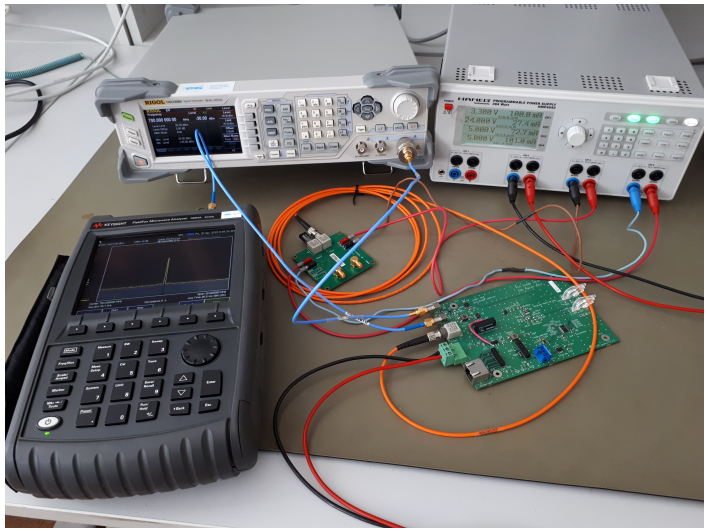
Tests of the prototype

The testing procedure consisted of analysis of the RF signal transmission through the device:

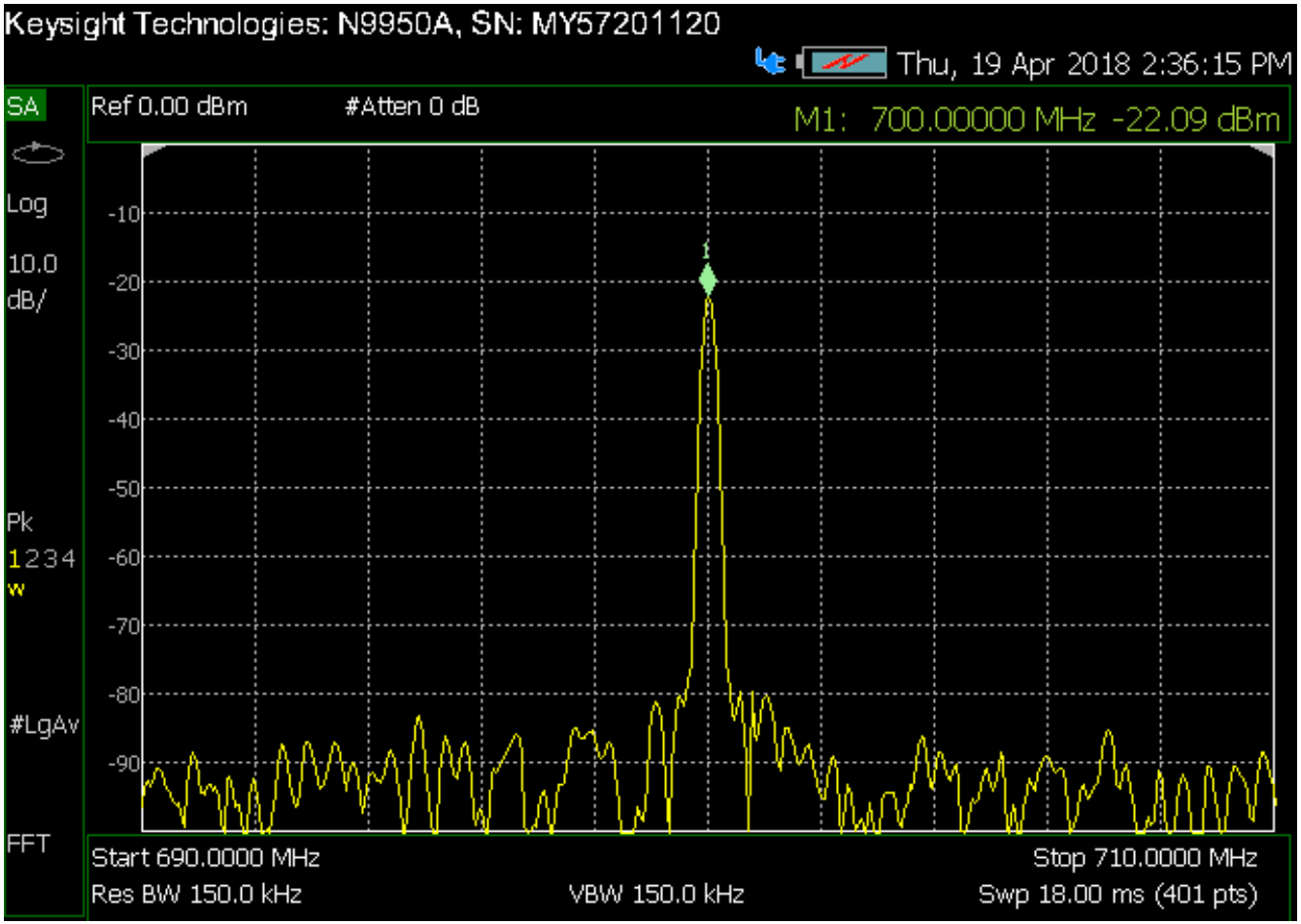
- the input sinus waveform of 700MHz and amplitude level of -20dBm
- the optical signal was delivered from evaluation board.
- output level signal was measured utilizing vector network analyzer

In principle, the device is working correctly.



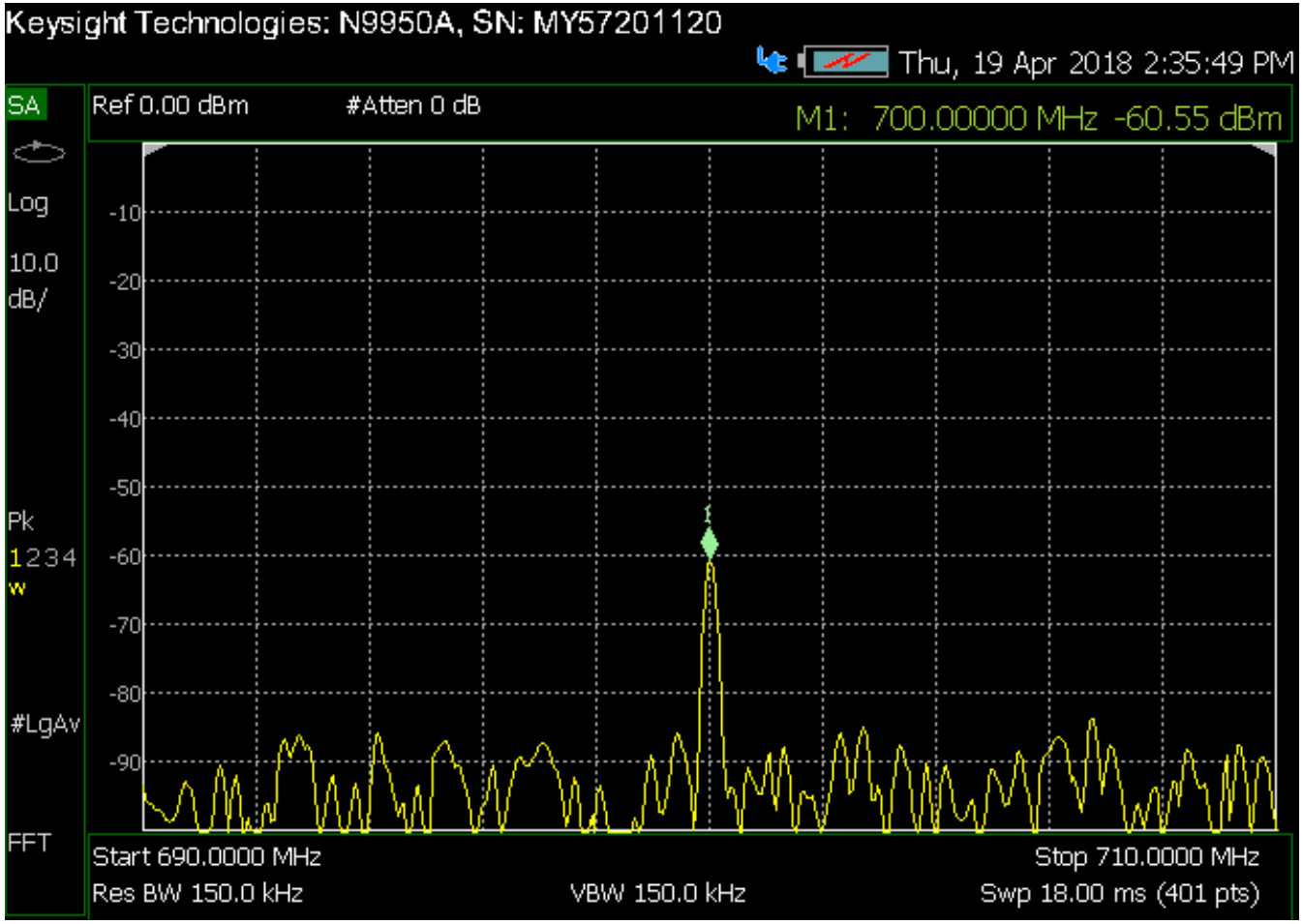


Tests of the prototype - results



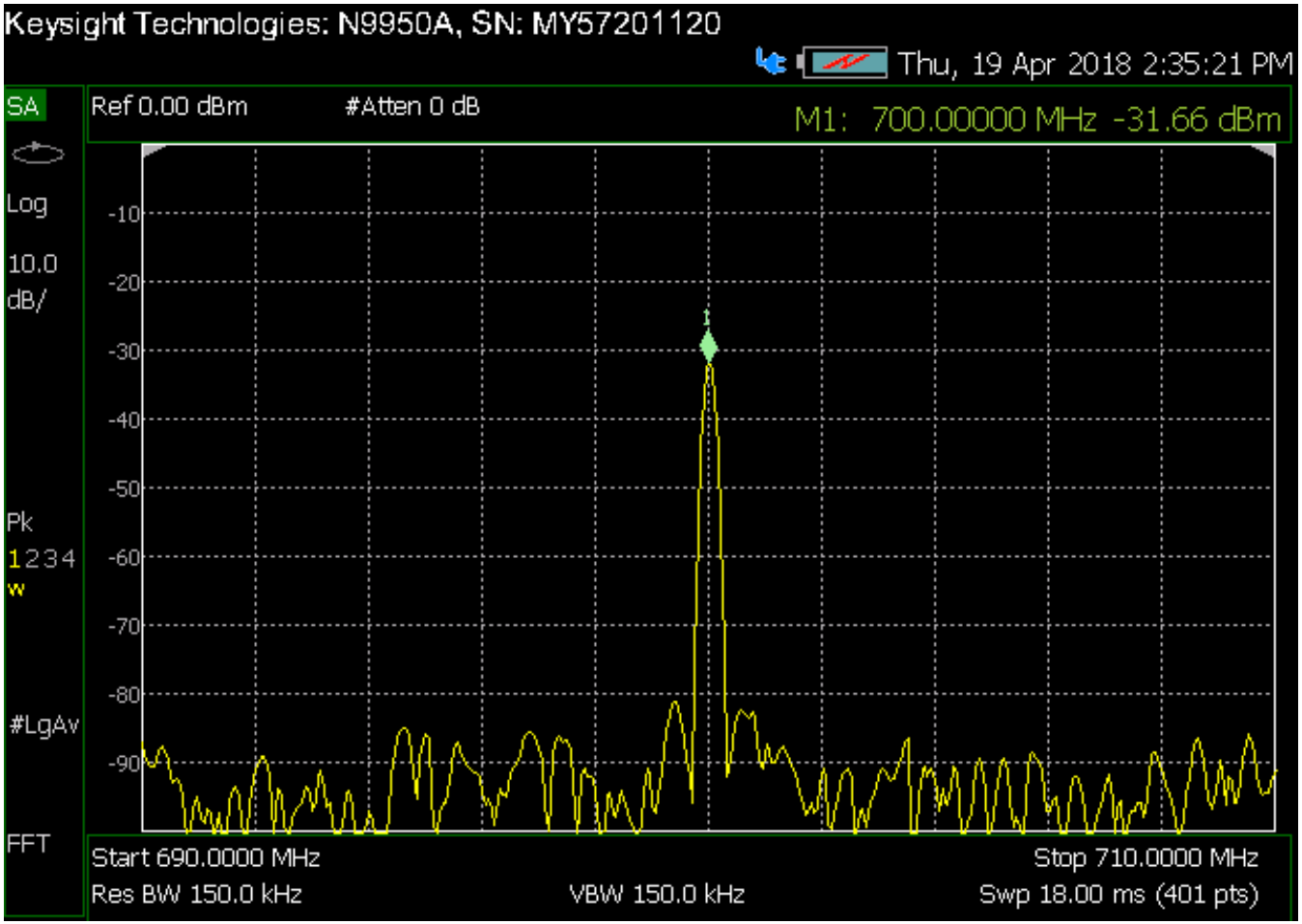
when device is powered on and interlock is off

Tests of the prototype - results



when device is powered on and interlock is on

Tests of the prototype - results



when device is powered off, while it was in non-interlock state

Problems during optical inspection

- capacitors C5, C6 - two components soldered instead of each of them;
- connection between Ethernet connector and XT-Pico: additional components soldered, some signal lines cut;
- additional wiring after production added between U6 and C4;
- we strongly suggest to use gold-plating pads, due to used QFN package components (PCB metallization in prototype device was HAL).

Next improved PCB design revision should be considered. Otherwise, the quality of the devices mass production cannot be guaranteed. If changes of the device layout will not be done, some additional manual PCB rework has to be applied. This can cause increase of the device assembling time because of higher failure probability and lower production yield.

Device manufacturability

Manufacturability of the device was checked:

- all components that are utilized in the design were available
- no long lead times
- reasonable MOQ (minimum order quantity)
- PCB is manufacturable in Euro Circuit company, that is able to produce printed circuit board with provided stackup
- mechanical enclosure drawings were not provided, that's why its availability was not validated

Procurement, production, delivery

- analysis of the changes made to the device schematics and PCB layout (if any) **[0.5 month]**
- verification of the production files, including GERBER production files of the PCB, pick and place file for automatic components placement, bill of materials and assembly drawings of the PCB **[0.5 month]**
- call for tender for PCB production and assembly **[1 month]**
- call for tender for mechanical enclosure manufacturing and delivery **[1 month]**
- production of elements in external companies **[2 months]**
- visual inspection of delivered elements of the device **[0.25 month]**
- DC electrical measurements of delivered PCBs **[0.25 month]**
- assembly of the devices **[2 month]**
- functional tests of devices **[2 month]**
- delivery to ESS partner **[1 month]**

Planned tests and measurements

Following tests and measurements are forseen to be performed by PEG:

- on components delivered from external manufacturers:
  - visual inspection of delivered elements of the device:
    - PCB manufacturing defects;
    - components placement on PCB;
    - soldering quality check;
    - mechanical enclosure manufacturing defects.
  - DC electrical measurements of delivered PCBs:
    - PCB connection to power supply;
    - measurements of low voltages generated on device, when powered on;
- on assembled devices:
  - visual inspection of assembled devices.
- automated functional tests of devices connected to test setup:
  - Ethernet communication with XT-Pico;
  - complete tests of functions embedded in XT-Pico firmware;
  - output spectra analysis:
    - with interlock off;
    - with interlock on.

Results of all completed tests and measurements will be contained in final manufacturing report.

The End

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Thank You for Your Attention !