|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| SINTEF_hovedlogo_black | | MEMO | | | | |
|  | | MEMO CONCERNS | FOR YOUR ATTENTION | COMMENTS ARE INVITED | FOR YOUR INFORMATION | AS AGREED |
|  | | Price offer for spectral response equipment for solar cell characterization |
| **SINTEF Materials and Chemistry**  Address: NO-7465 Trondheim  NORWAY  Location: Høgskoleringen 5  Telephone: +47 4000 3730  Fax: +47 73 59 70 40  Enterprise No.: NO 948 007 029 MVA | |
| DISTRIBUTION |  |  |  |  |
| Turid Reenaas Worren |  |  |  |  |
| FILE CODE | CLASSIFICATION |
|  |  |
| ELECTRONIC FILE CODE | |
| spectral\_response.doc | |
| PROJECT NO. | DATE | PERSON RESPONSIBLE / AUTHOR | NUMBER OF PAGES | | | |
|  | 2009-12-01 | Cecile Ladam/ Øystein Dahl |  | | | |

# In the 3GPV project, a set of calibrated detectors have to be ordered to calibrate the light coming out from the spectral response equipment bought previously this year. The spectral range of the detectors has to cover 200-2500 nm with a maximal signal-to-noise ratio. In this process, four different companies have been contacted to ask for price quotation:

1. Lot Oriel (contact person in Germany):

Michael Foos, tel: +49 6151 880634, email: [foos@lot-oriel.de](mailto:foos@lot-oriel.de)

1. Thorlabs
2. Horiba Jobin Yvon (contact person in Sweden):

Distributor company for Horiba in Scadinavia: Gammadata Instrument AB, box 15120, 75015 Uppsala.

Contact person: Sven Södergren, tel: +46 18 480 5885, mobile: +46 70 565 80 30, email: [Sven.Sodergren@gammadata.se](mailto:Sven.Sodergren@gammadata.se)

1. Hamamastu Photonics Norden AB(contact person in Sweden):  
   Postal adress: Smidesvägen 12, se-171 41 Solna, Sweden

Contact person: Björn Ramsten, Tel: +46-8 50903126, Fax: +46-8 50903101, e-mail: [bjorn.ramsten@hamamatsu.se](mailto:bjorn.ramsten@hamamatsu.se)

# Lot Oriel

They do not provide any calibrated detector in the proposed range.

# Thorlabs

The detection limit of the proposed detector was not good enough.

# Horiba

We received 3 offers from Horiba: one including the Horiba calibration and two without calibration but with 2 different detector sizes.

They propose a set of three detectors to covering the spectral range (350-2500nm).

The advantage of this offer is that the detectors are directly mountable on the monochromator because a housing is provided with the alignment optics.

1. **Offer #1 (including Horiba calibration)**

One set of calibrated light detectors, range 350 – 2500 nm, calibrated with step 50 nm:

**Price of offer #1: 23100 Euros or 184 kNOK**

This price includes:

* a thermo-electrically cooled Si detectors and the required electronics,
* a thermo-electrically cooled InGaAs detectors and the required electronics,
* a thermo-electrically cooled PbS detectors and the required electronics (except from the lock-in amplifier),
* housing including alignment optics
* calibration (50 nm step) for each detector

The calibration cost about 3200 Euros or 25kNOK per detector (so total for calibration is 75kNOK)

1. **Offer #2 (including without calibration)**

One set of calibrated light detectors, range 200 – 2500 nm (no calibration) with a 2mm diameter detector size:

**Price: 12900 Euros or 103 kNOK**

This price includes:

* a thermo-electrically cooled Si detectors and the required electronics,
* a thermo-electrically cooled InGaAs detectors and the required electronics,
* a thermo-electrically cooled PbS detectors and the required electronics (except from the lock-in amplifier),
* housing including alignment optics

1. **Offer #3 (including without calibration)**

One set of calibrated light detectors, range 200 – 2500 nm (no calibration) with a 3mm diameter detector size:

**Price: 18600 Euros or 152 kNOK**

This price includes:

* a thermo-electrically cooled Si detectors and the required electronics,
* a thermo-electrically cooled InGaAs detectors and the required electronics,
* a thermo-electrically cooled extended InGaAs detectors and the required electronics,
* housing including alignment optics

1. **Calibration**

2 different companies can provide the detector calibration:

* Justervesenet (Norway): contact person: Jarle Gran ([jag@justervesenet.no](mailto:jag@justervesenet.no)). The price for the proposed calibration will be roughly **20 kNOK**.

NPL (UK): contact person: Subrena Harris ([subrena.harris@npl.co.uk](mailto:subrena.harris@npl.co.uk)). The price for the proposed calibration will be roughly **6000 pounds** or **55 kNOK**.

# Hamamastu

One set of calibrated light detectors, range 200 – 2500 nm, calibrated with step 10-20 nm:

**Price of offer #3: 70635 SEK or 62 kNOK**

This price includes:

* a thermo-electrically cooled Si detectors and the required electronics,
* a thermo-electrically cooled InGaAs detectors and the required electronics,
* calibration:

For Si detector: 200nm-400nm (10nm step), 400nm-1100nm (20nm step)   
For InGaAs detector: 1100nm-2600nm (10nm step) (might have variations in the 1100-1200 nm range.

No housing is included in this case

## Conclusion

In table 1, the prices are summarized for the different offers:

|  |  |  |
| --- | --- | --- |
| Offer | Price (in kNOK) | Comments |
| #1 (Horiba detectors and calibration) | 184 | All included |
| #2 (Horiba detectors and justerveneset calibration) | 123 | Need to arrange calibration |
| #2 (Horiba detectors and justerveneset calibration) | 172 | Need to arrange calibration |
| #3 (Hamamastu detectors and calibration) | 62 | Housing and optical alignment not included |