

# TMF8806 - OPTICAL DESIGN GUIDE (ODG)

Version 25. July 2024

*Optical simulation results are meant for relative comparison of competing design configurations.  
Design prototypes are required for optical performance verification.*

# TMF8806 Optical design guide

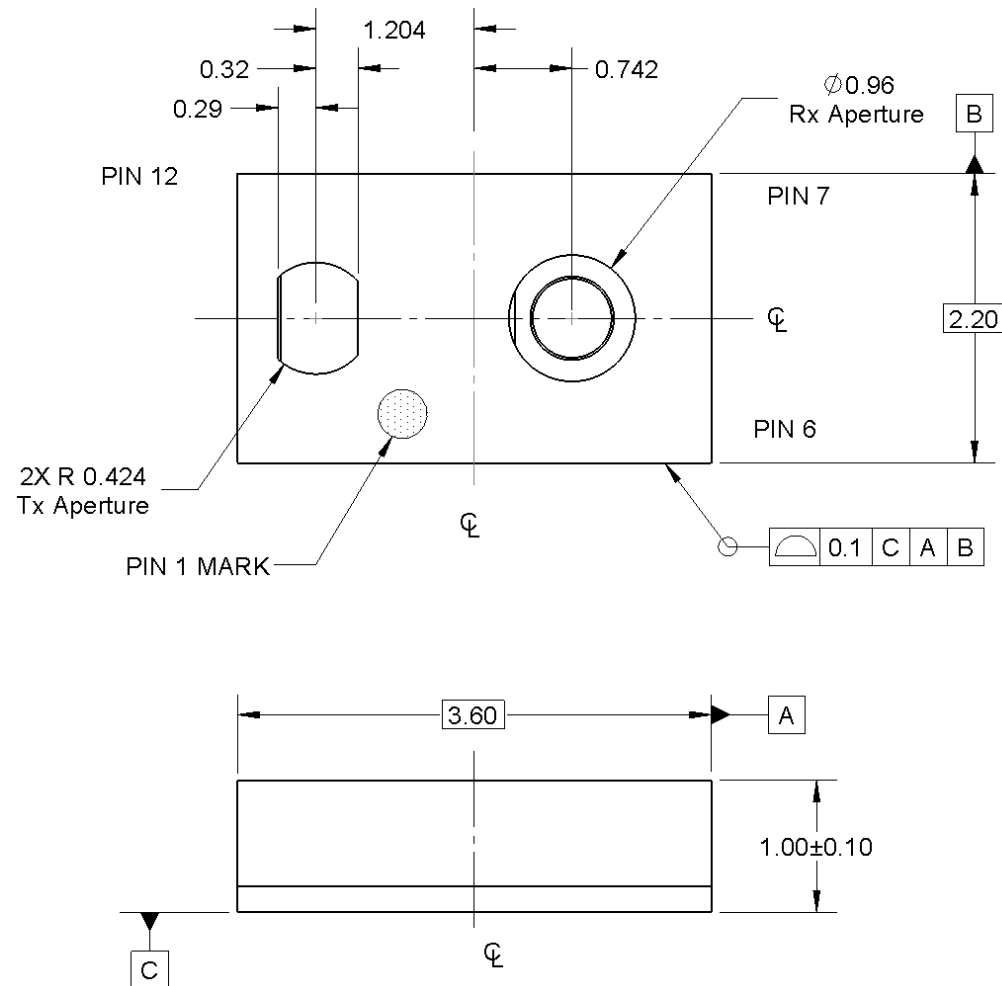
The design goal is to control system xtalk to stay with min and maximum levels. The main factors for controlling system xtalk are airgap, glass thickness, glass apertures, optical barrier, and ink/tint characteristics.

General system recommendations are for default mode with 2.5m maximum distance:

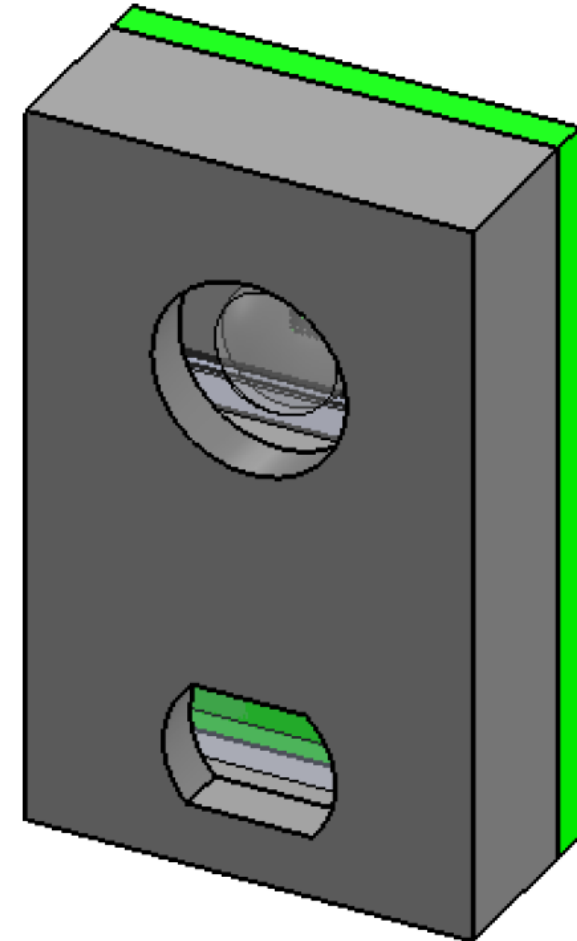
- Glass/TMF8806 airgap 0.4 - 0.8 mm range; IR ink required for calibration and operation
- Optical barrier design (e.g. rubber boot)
- Glass thickness 0.55mm
- Glass ink with 85% or better IR transmissivity
- Assembly XY tolerance between Glass apertures and TMF8806 is  $\pm 0.20$ mm maximum

The TMF8806 additionally has a large airgap and thick cover glass mode – see the section later describing the setup.

## DRAWING



TMF8806\_FOI\_FOV.7z

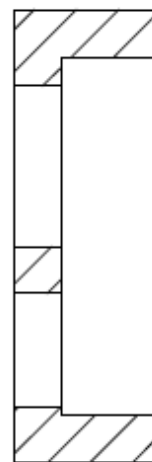
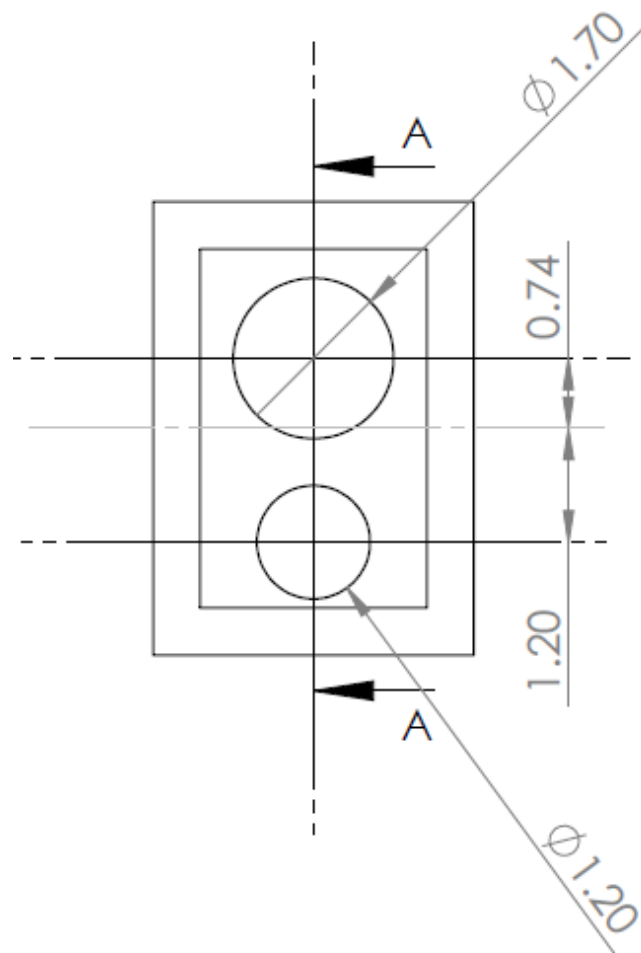


# TMF8806 - ODG

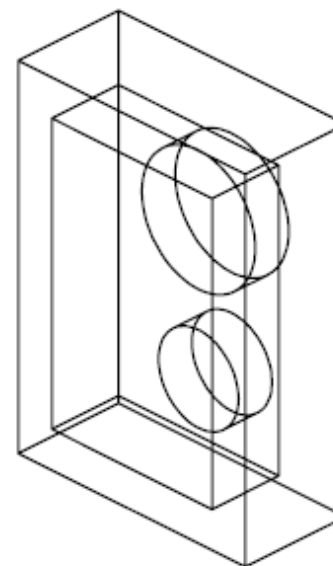
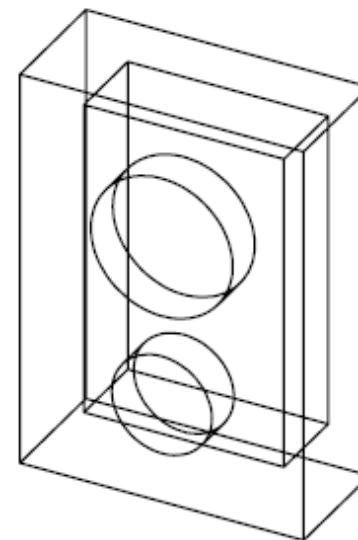
## TMF8806 OPTICAL BARRIER DESIGN



TMF8806\_EVM\_4.7z

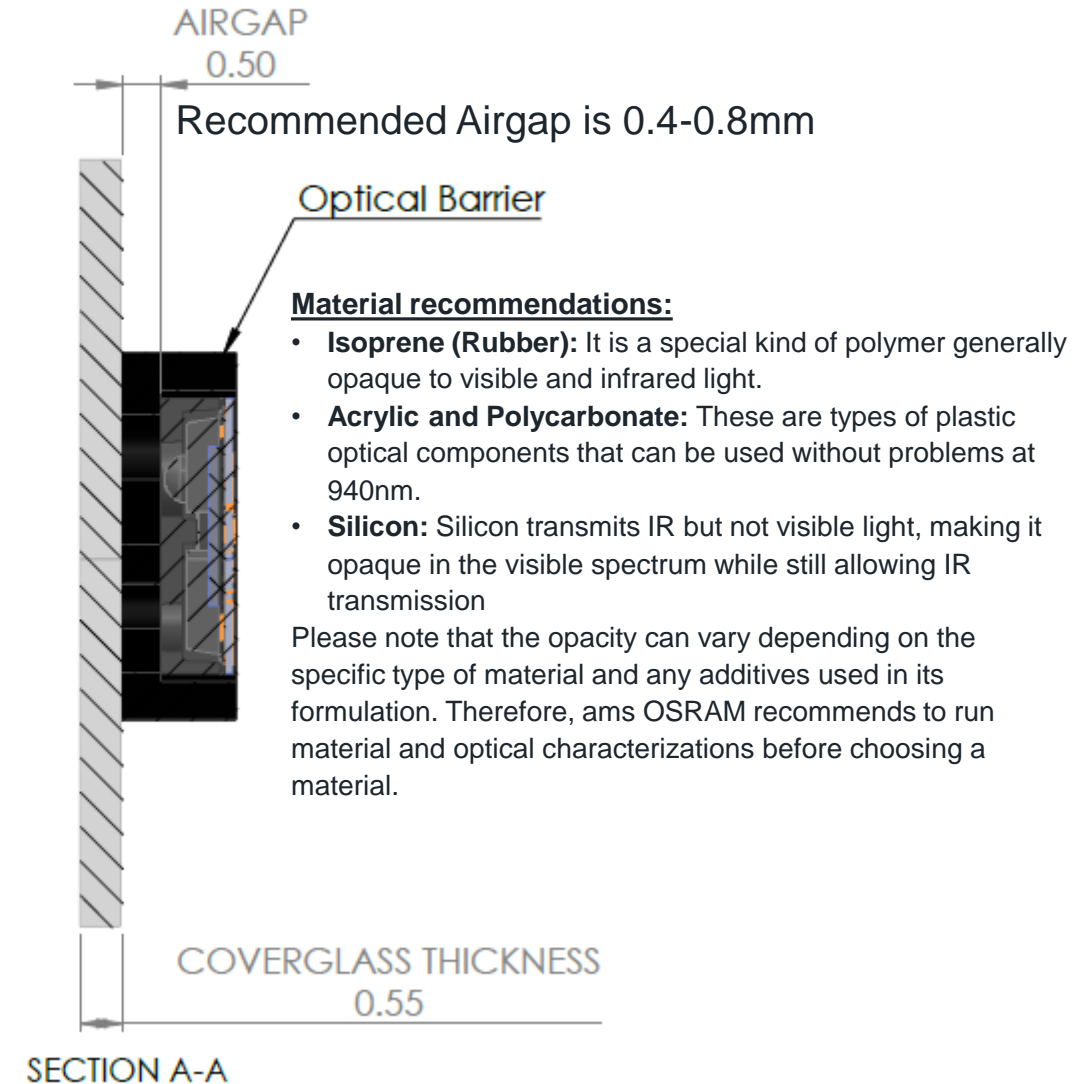
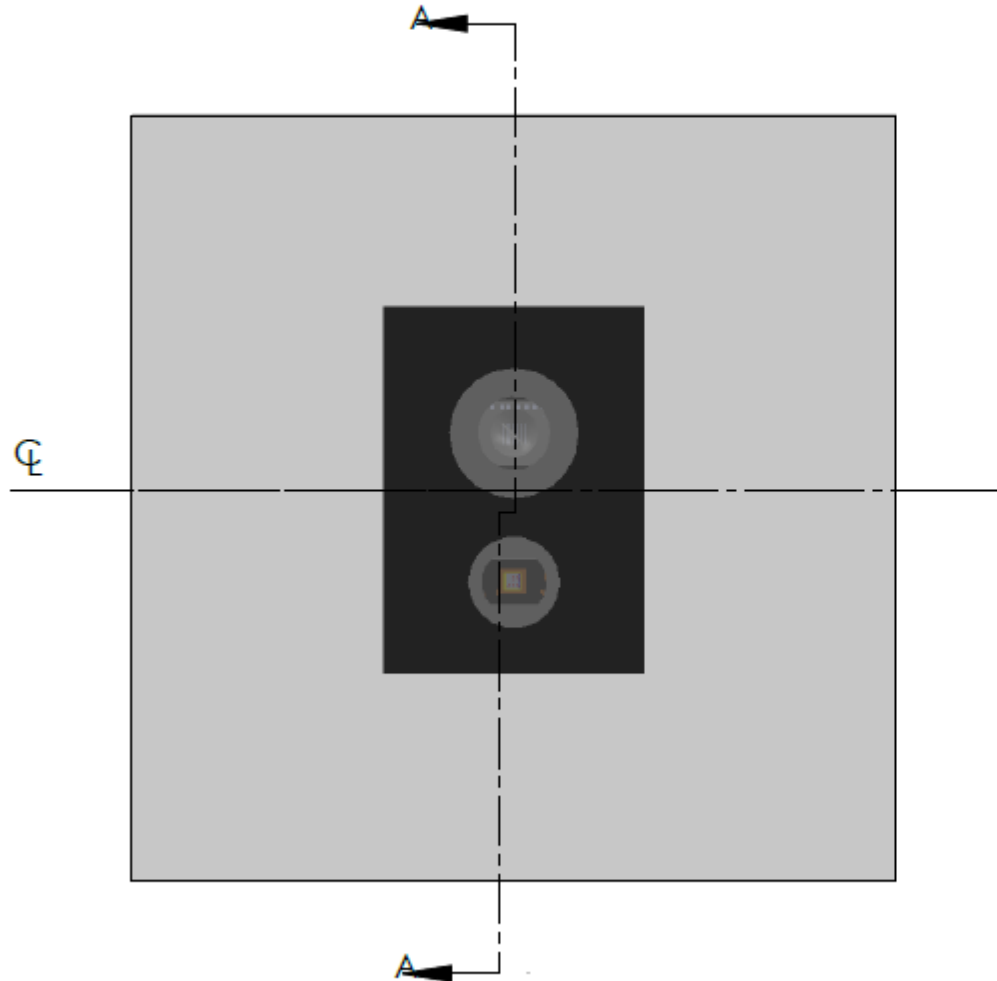


SECTION A-A



# TMF8806 - ODG

## TMF8806 OPTICAL ASSEMBLY RECOMMENDATION



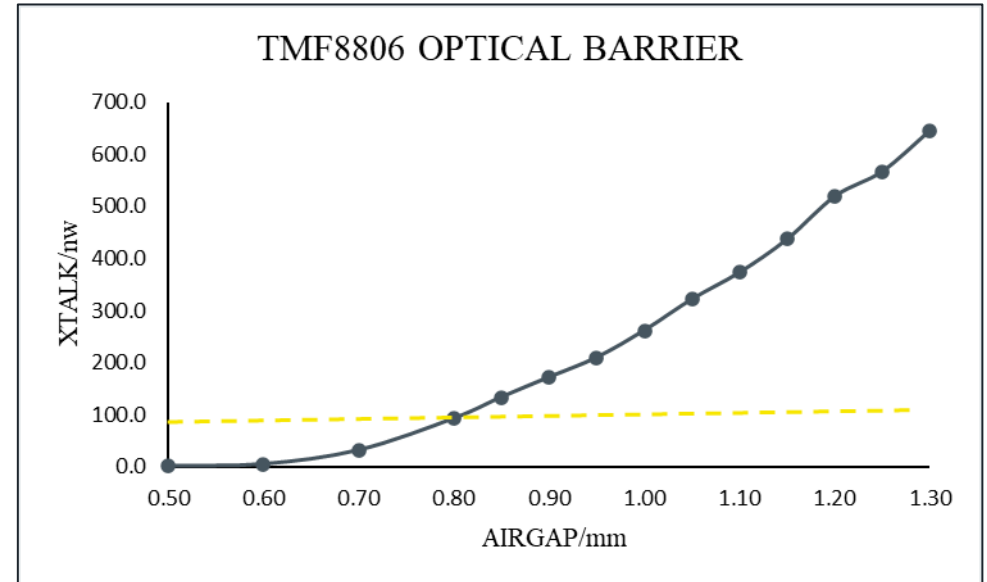
# TMF8806 - ODG

## CORRELATION BETWEEN MEASUREMENT (COUNTS) & SIMULATION (WATTS), 2.5m default mode

TMF8806 with Optical Barrier		
AIRGAP	XTALK (nW)	Counts
0.50	0.5	1295
0.60	4.1	3659
0.70	31.2	4982
0.80	92.4	6245
0.85	133.4	7807
0.90	171.6	9161
0.95	209.6	10328
1.00	261.6	10906
1.05	321.7	11597
1.10	373.0	12373
1.15	437.1	12368
1.20	519.3	12305
1.25	567.3	13065
1.30	645.9	13596

Allowed crosstalk range  
400 to 7000 counts

Crosstalk too high!  
>7000 counts



# TMF8806 - ODG

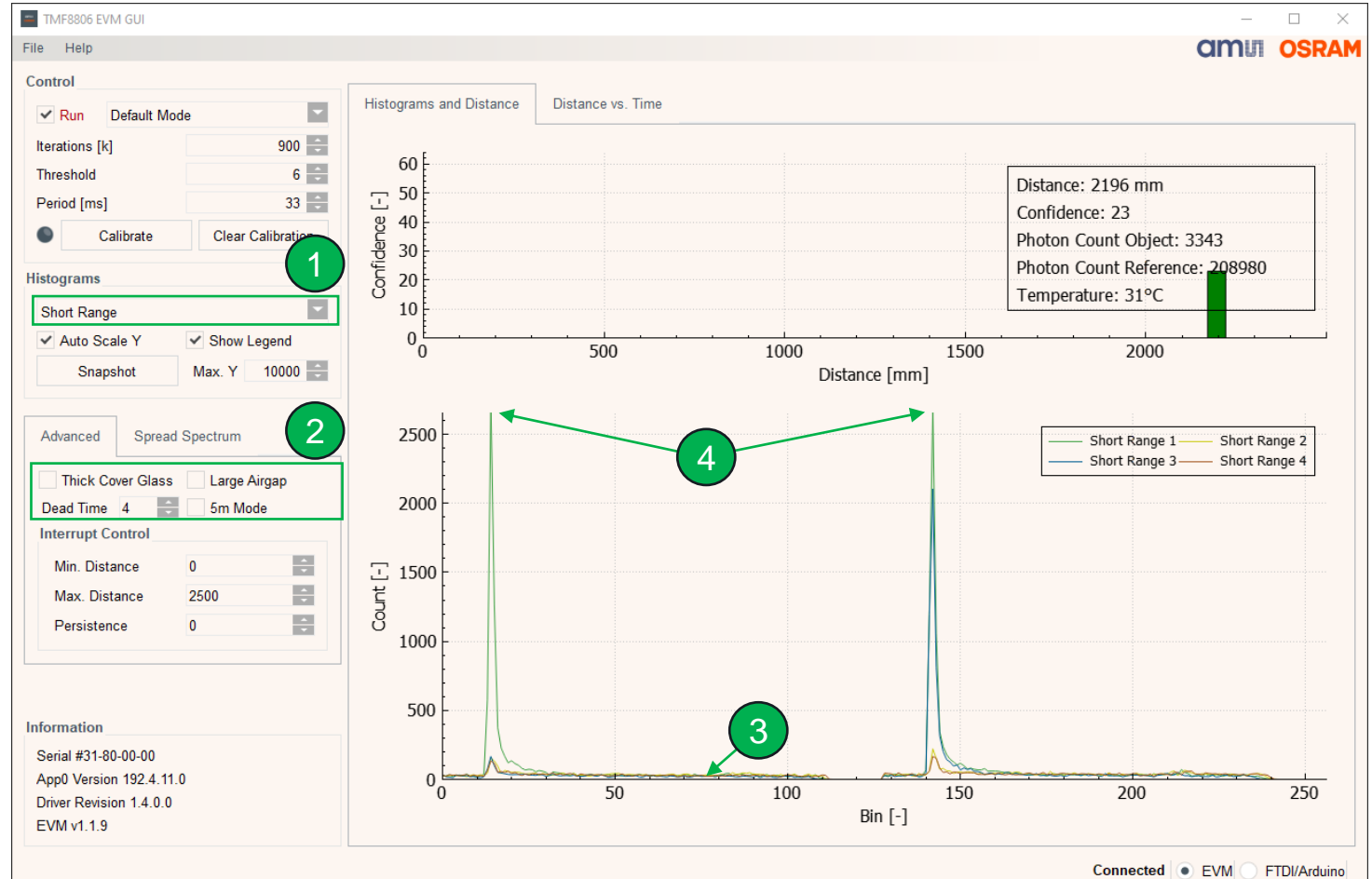
## TARGET XTALK VALUES

Operate the EVM with the full optical stack

No target in front below 40 cm, low ambient light

### Procedure

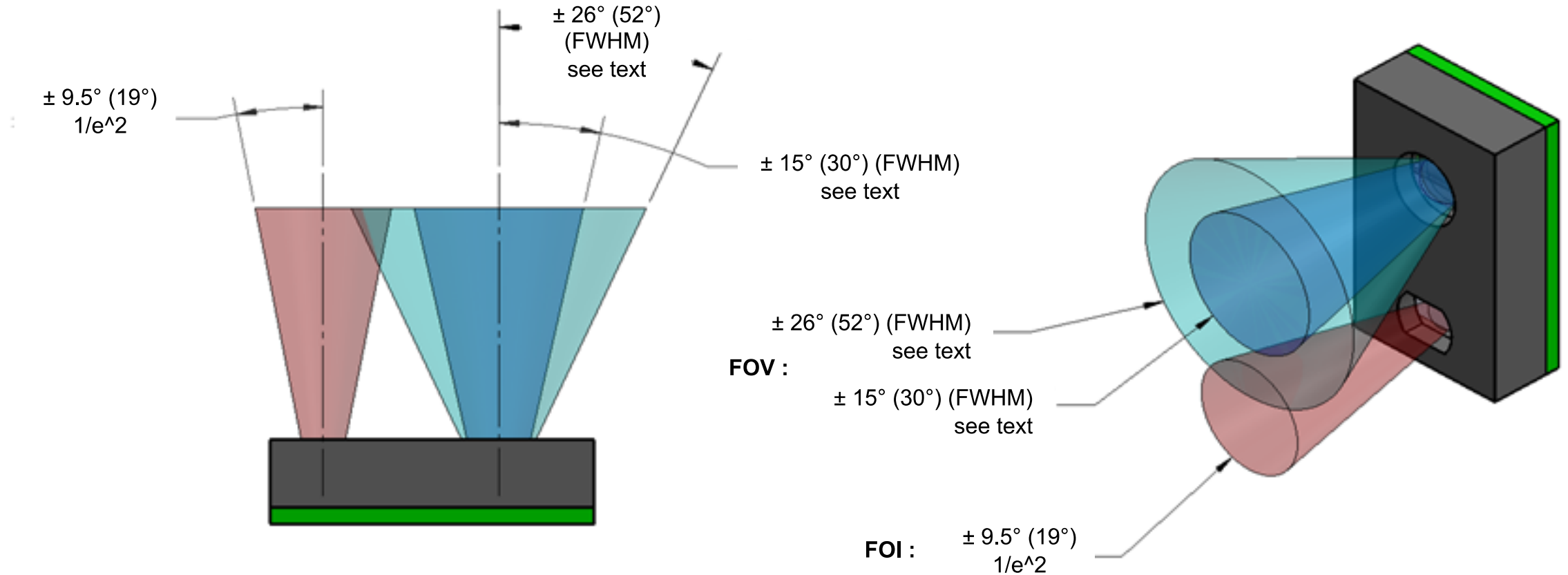
1. Select short range histogram only
2. Pick the **same operating mode** as in the final application (5m mode, large airgap, thick cover glass)
3. Minimal ambient light
4. The highest peak shall be within **400-7000 counts**



# TMF8806 - ODG

## FoI / FoV Cones

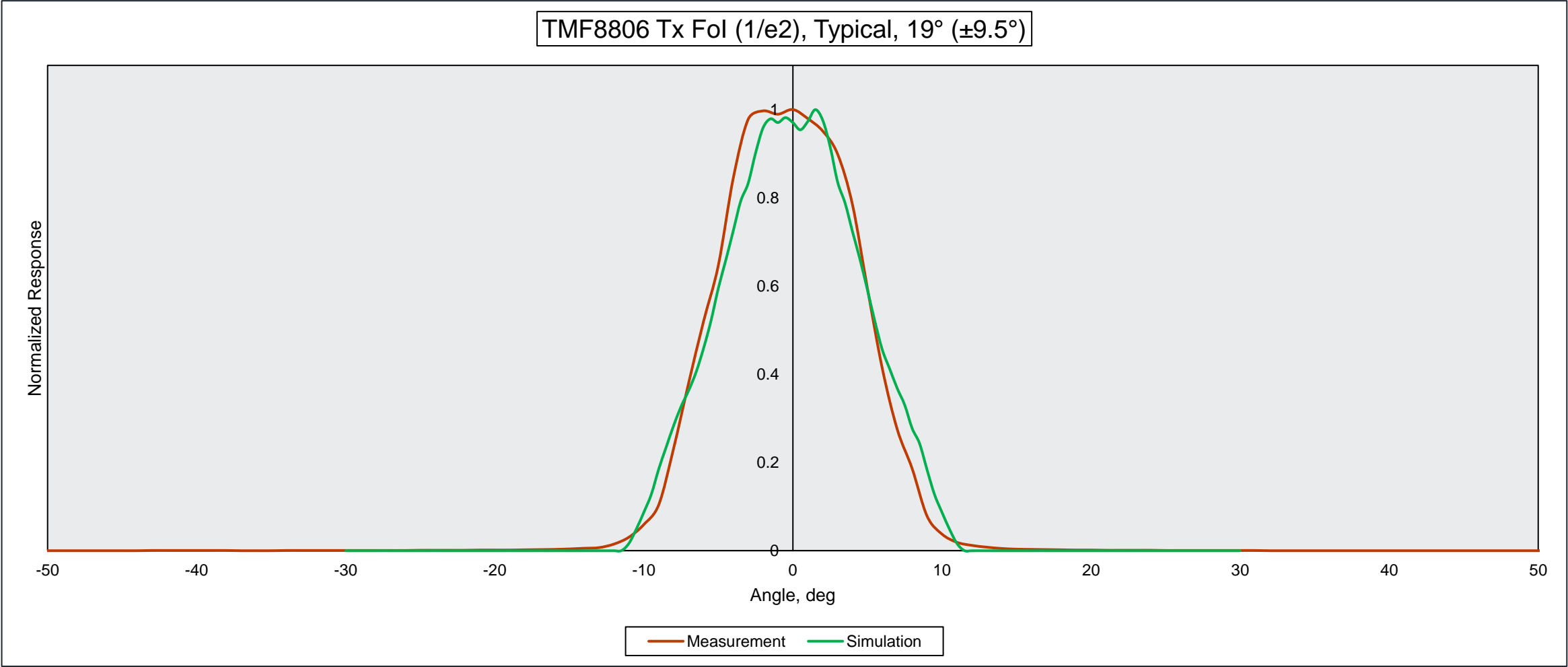
FOV:  $\pm 26^\circ$  only used for short range, default mode  
 $\pm 15^\circ$  used for all other modes





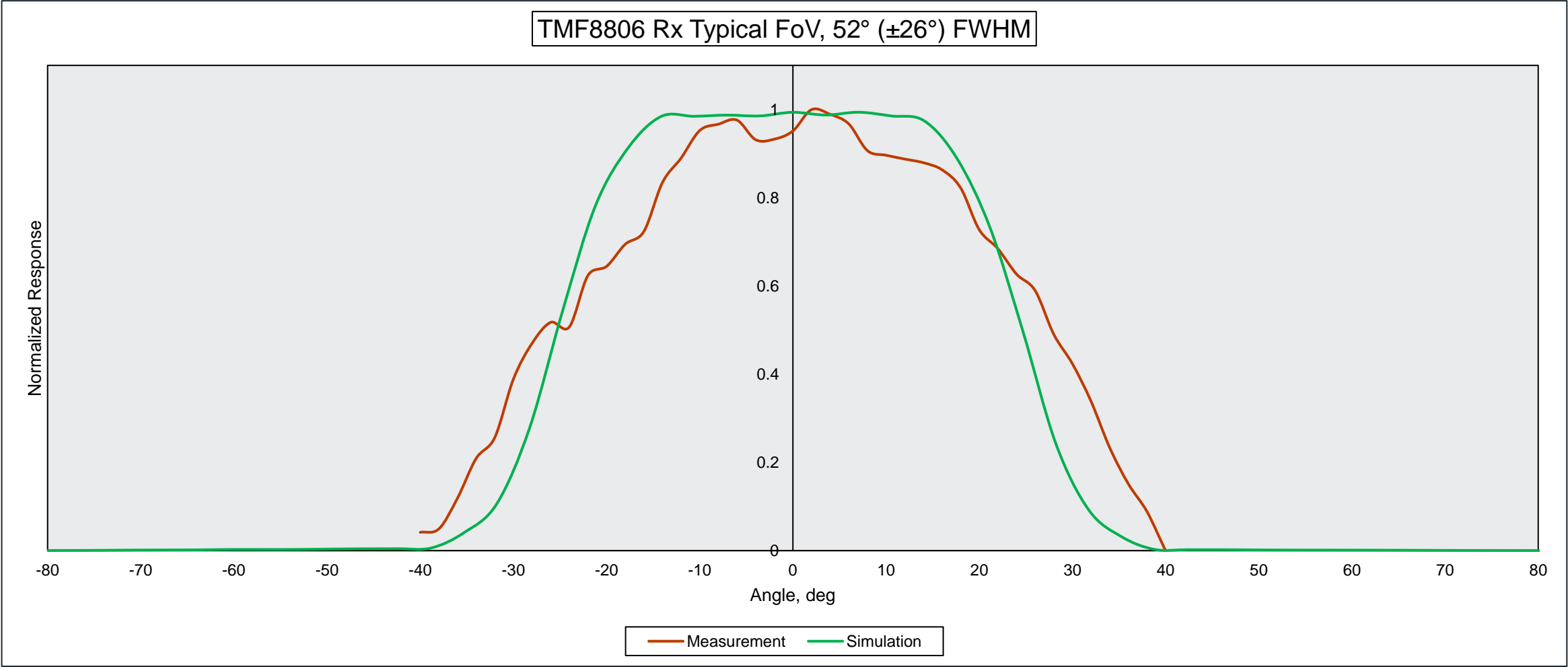
# TMF8806 - ODG

FoI, EMISSION,  $\pm 9.5^\circ$  ( $19^\circ$ )  $1/e^2$



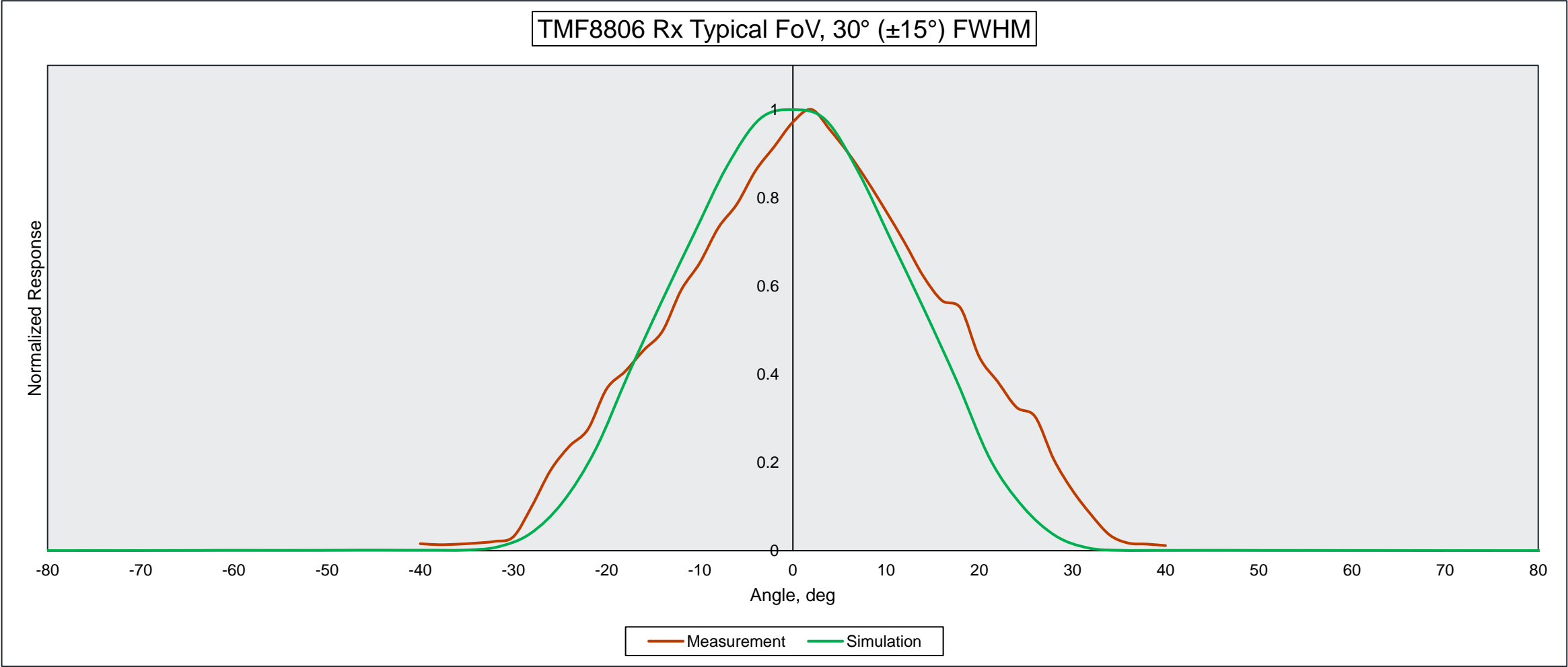
# TMF8806 - ODG

**SPAD FoV: 52° ±26° FWHM**      Short range default mode is based on the entire SPAD array.



# TMF8806 - ODG

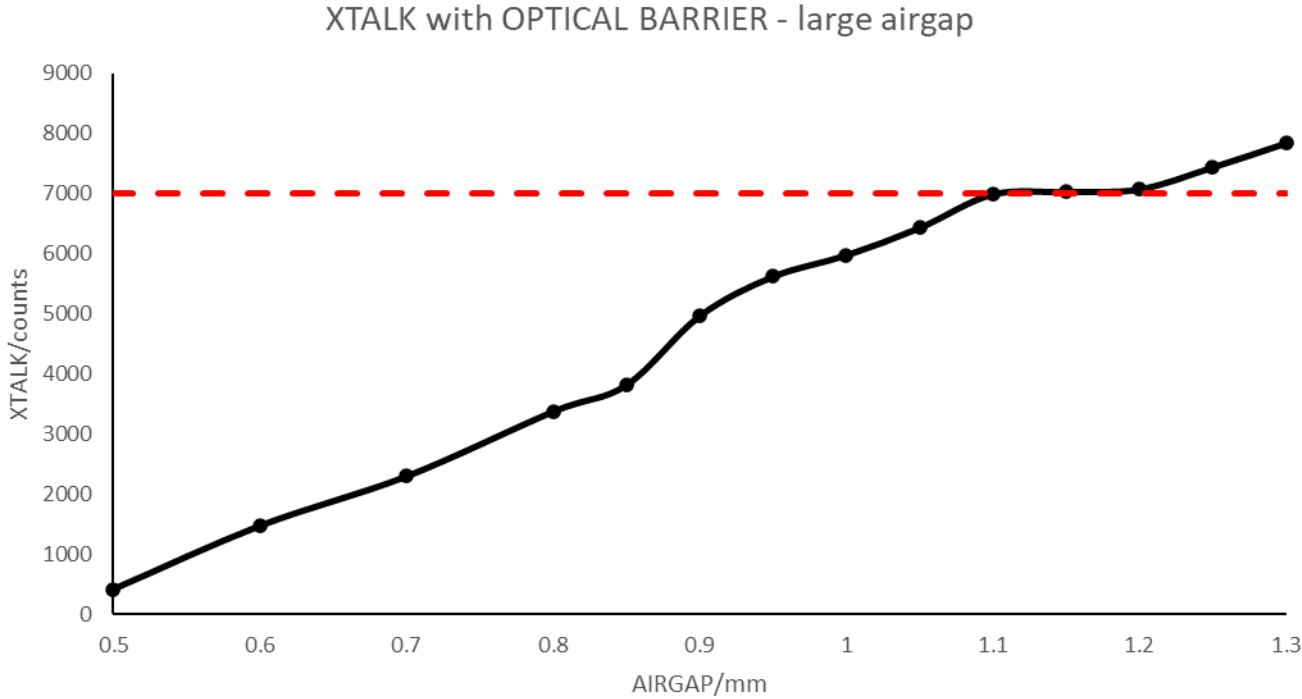
SPAD FoV: 30° (±15°) FWHM    All other modes expect short range, default mode is based on a part of the SPAD array.



# TMF8806 - ODG

Coverglass 0.55mm thick, large airgap mode

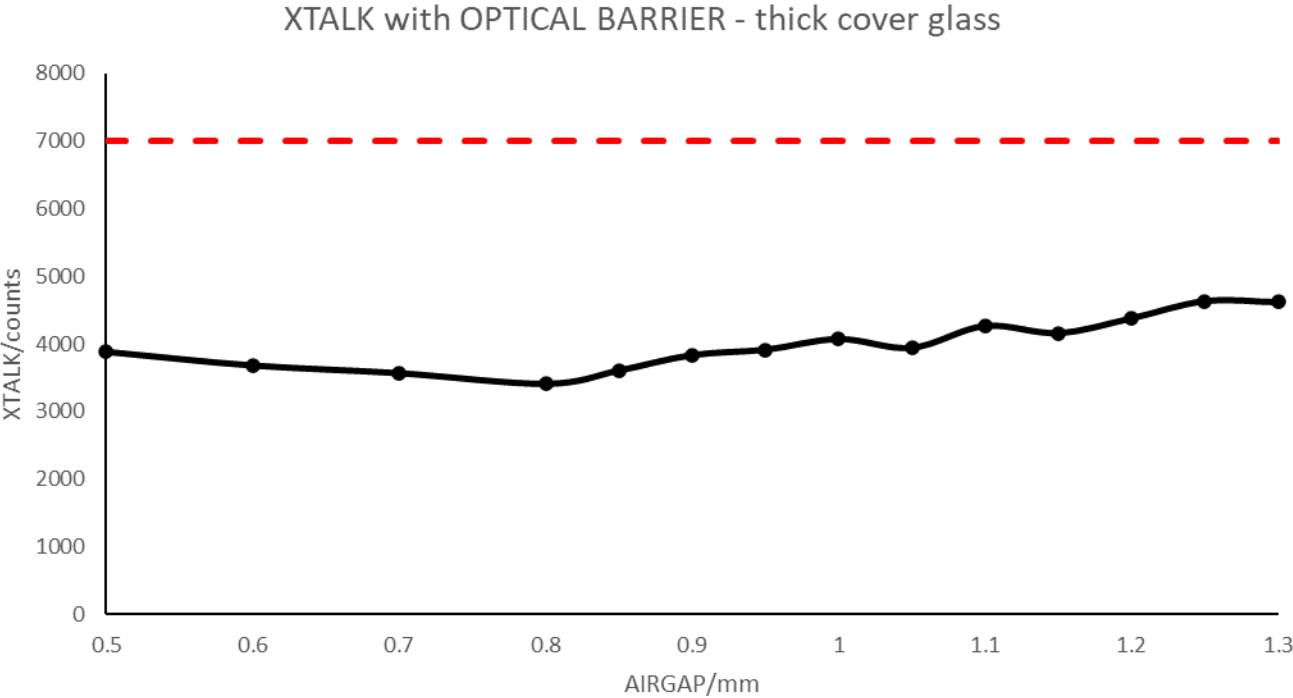
TMF8806 with Optical Barrier - large airgap	
AIRGAP	Counts
0.5	420
0.6	1476
0.7	2299
0.8	3376
0.85	3818
0.9	4969
0.95	5624
1	5981
1.05	6438
1.1	6997
1.15	7037
1.2	7081
1.25	7446
1.3	7847



# TMF8806 - ODG

Coverglass 3.2mm thick, thick cover-glass mode

TMF8806 with Optical Barrier - thick CG	
AIRGAP	Counts
0.5	3883
0.6	3680
0.7	3566
0.8	3408
0.85	3605
0.9	3835
0.95	3914
1	4073
1.05	3943
1.1	4267
1.15	4161
1.2	4380
1.25	4635
1.3	4619

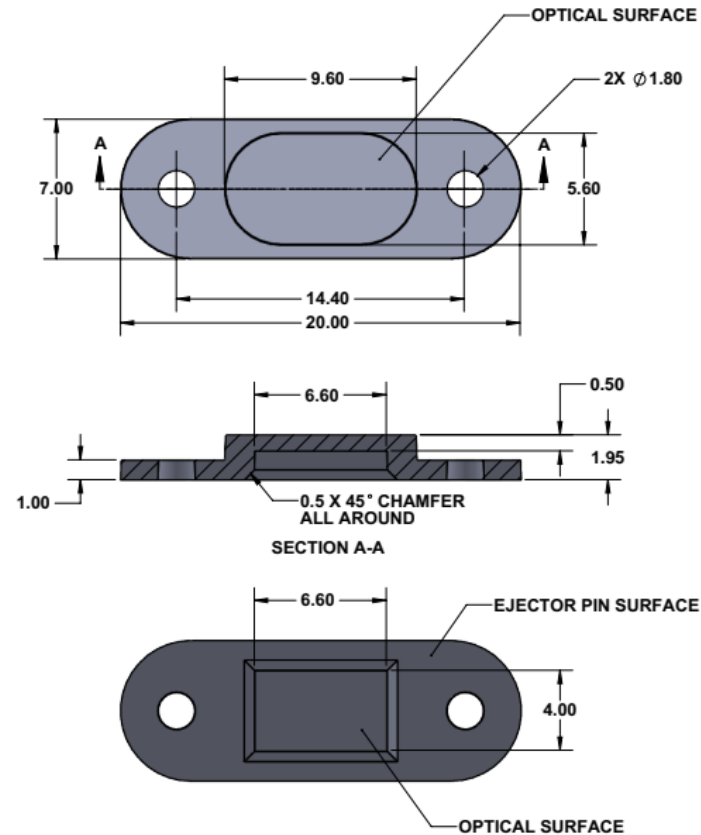


# TMF8806\_EVM\_EB\_SHIELD cover glass drawings

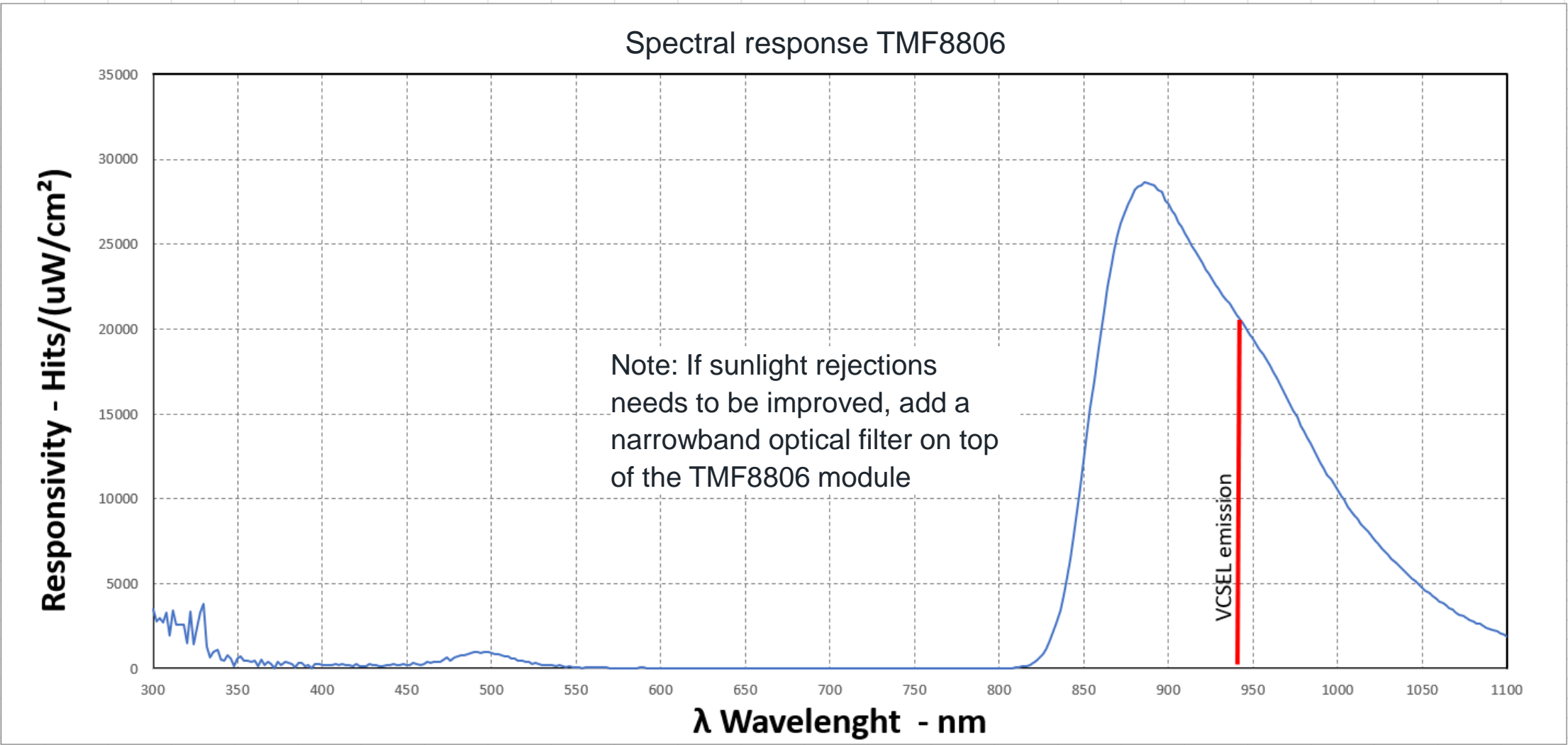
## Cover glass drawing for shield board

### NOTES:

1. REFER TO CAD FILE TMF8806\_CG.STEP FOR ANY MISSING DIMENSIONS.
2. 2° DRAFT SHOWN. DRAFT MAY BE ADJUSTED FOR MANUFACTURING PURPOSES WITH APPROVAL FROM amsAG.
3. SURFACES INDICATED AS OPTICAL SURFACES SHALL MEET THE FOLLOWING REQUIREMENTS:
  1. TOOL SURFACE FINISH 0.1µm Ra MAXIMUM ON SURFACES INDICATED. OTHER SURFACES SPI-B1 OR BETTER.
  2. NO BUBBLES OR VOIDS VISIBLE THROUGH OPTICAL SURFACE UNDER 30X MAGNIFICATION MINIMUM.

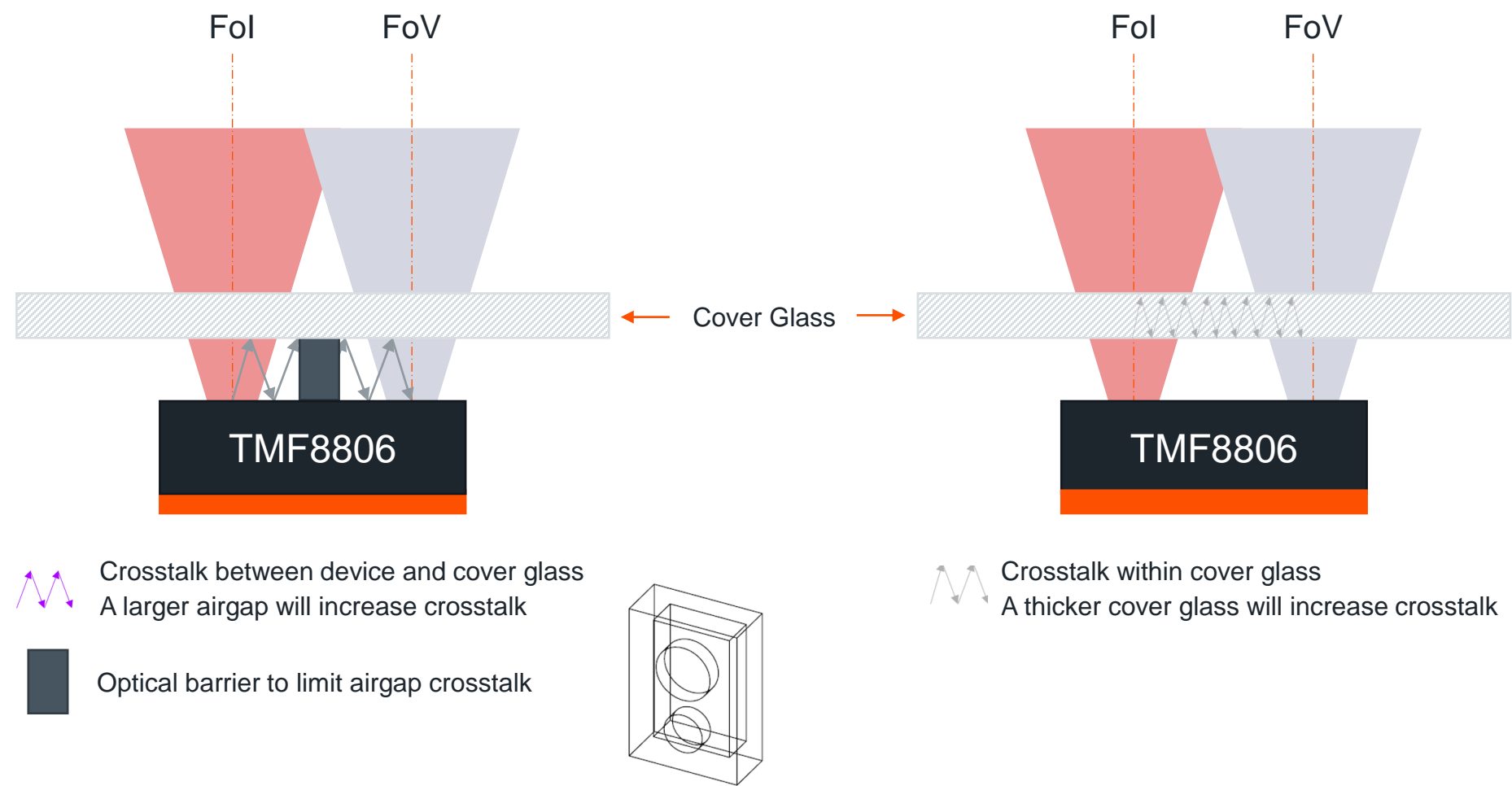


# TMF8806 Optical Filter + SPAD response



# Evaluation using TMF8806\_EVM\_EB\_SHIELD

## Controlling crosstalk



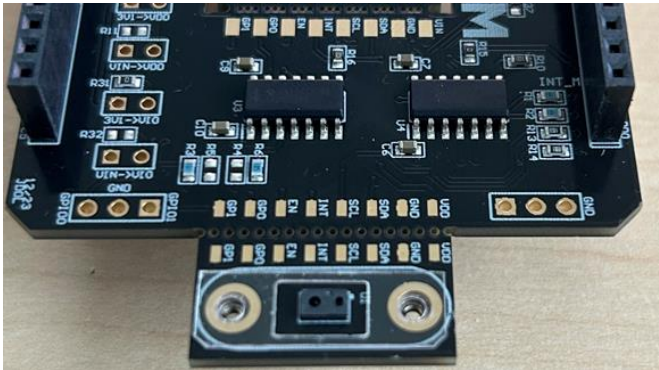


# Evaluation using TMF8806\_EVM\_EB\_SHIELD

## Optical Design Guide (ODG) crosstalk limits – default mode

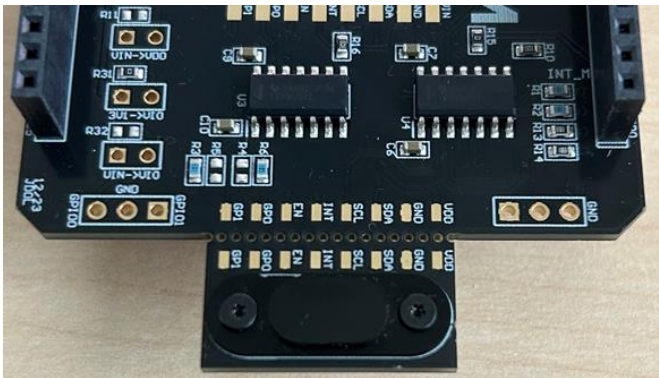
### Airgap Spacers

- 0.17mm
- 0.25mm
- 0.35mm
- 0.5mm



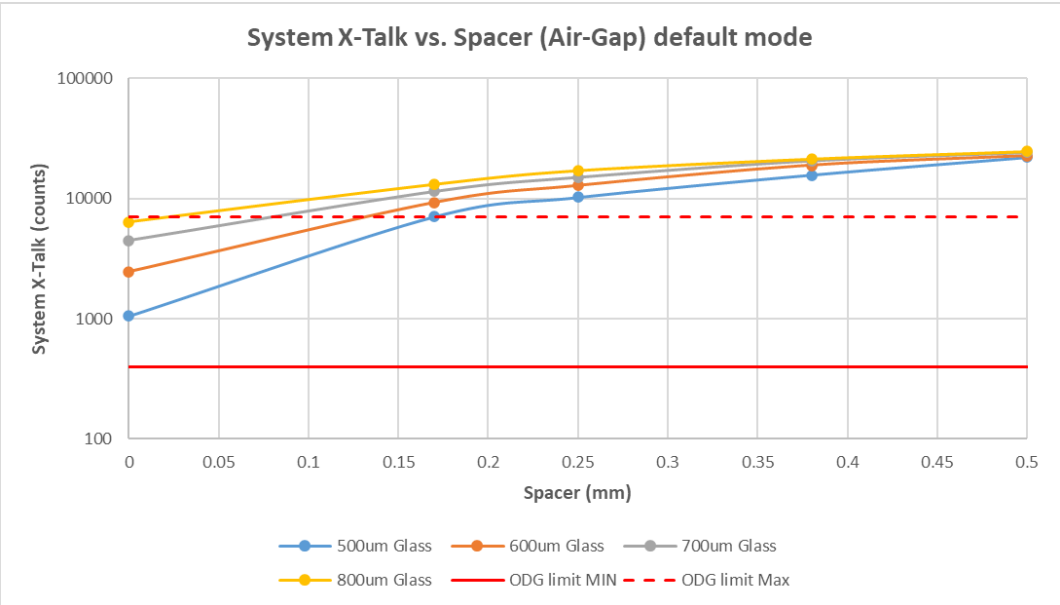
### Cover Glass

- 0.5mm
- 0.6mm
- 0.7mm
- 0.8mm



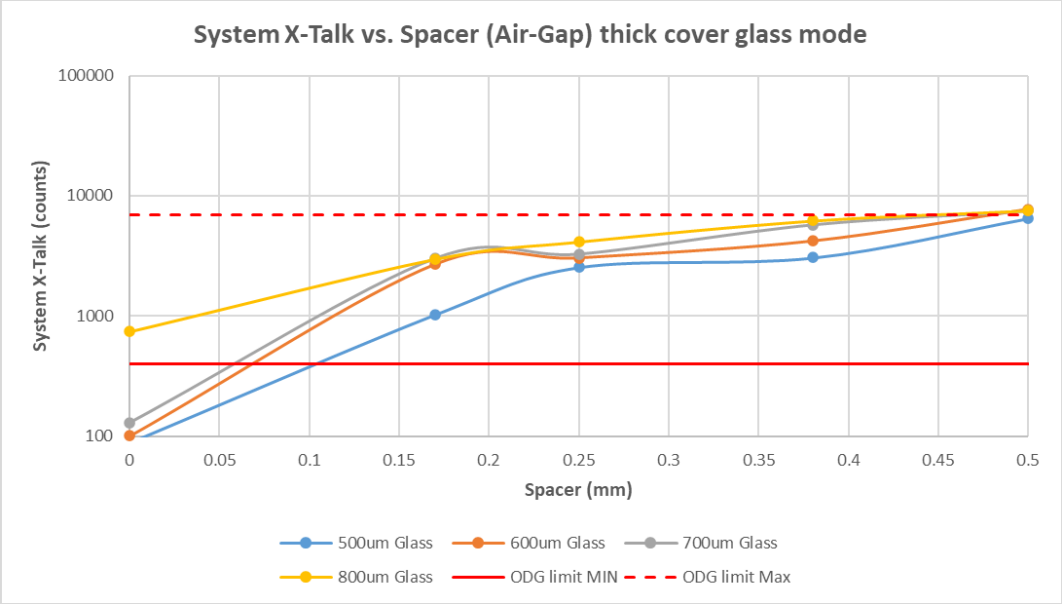
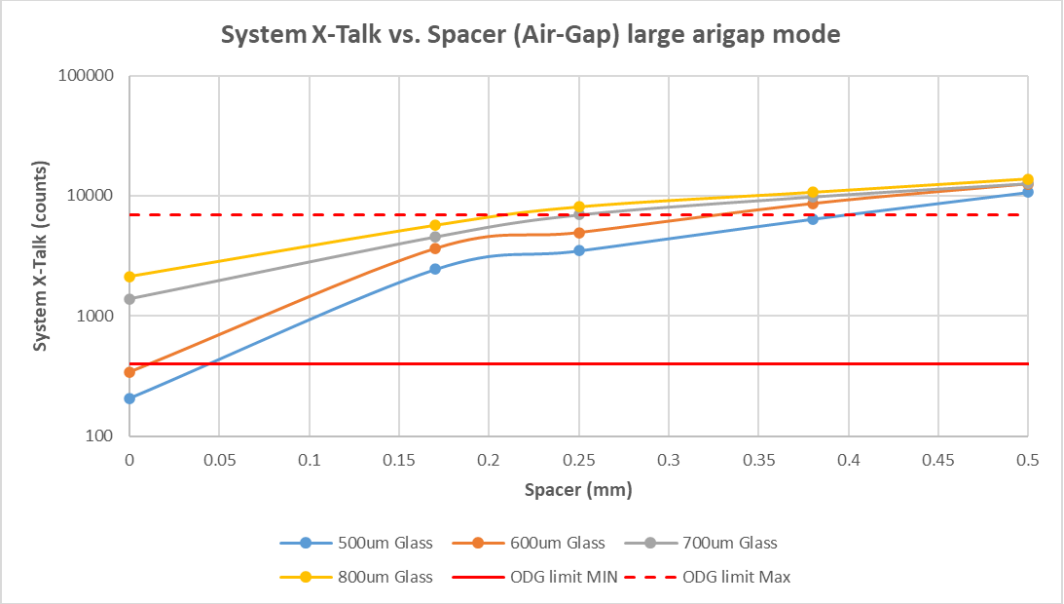
Optical Design Guide crosstalk limits

Mode	Min. crosstalk counts	Max. crosstalk counts
Default mode	400	7000
Larger airgap mode	400	7000
Thick cover glass mode	400	7000



# Evaluation using TMF8806\_EVM\_EB\_SHIELD

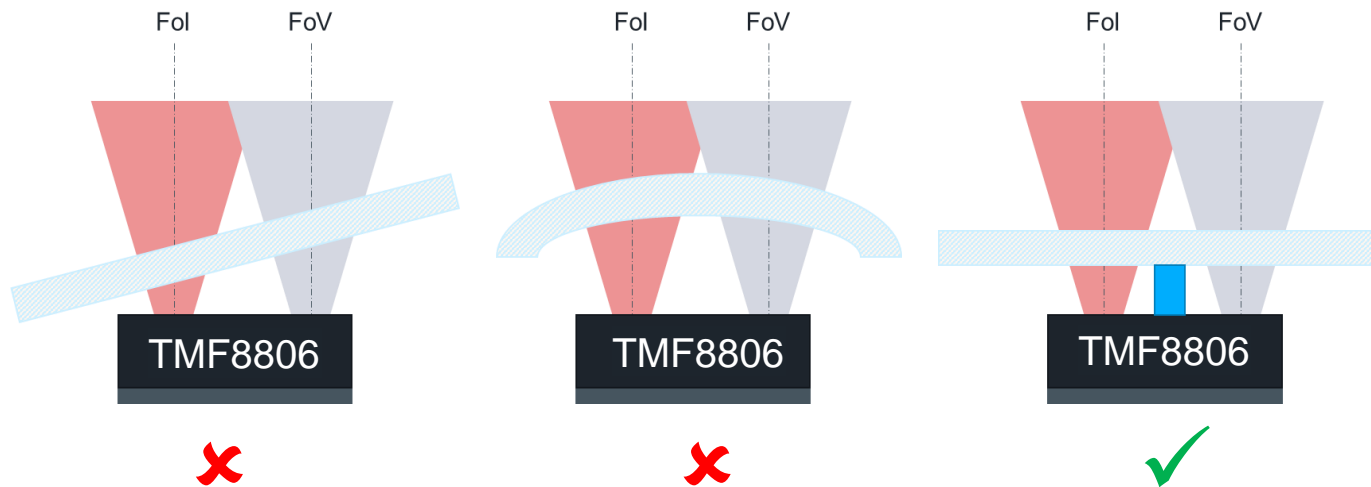
## Optical Design Guide (ODG) crosstalk limits – large airgap and thick cover glass mode



# Evaluation using TMF8806\_EVM\_EB\_SHIELD

## Optical design recommendations

- Keep airgap with limits defined by this document
- Use optical isolation barrier (rubber boot) to reduce crosstalk
- Use cover glass with  $> 90\%$  940nm transmissivity
- Ensure crosstalk is within Optical Design Guide min & max range
- Keep cover glass perpendicular to FoI / FoV & no curved, textured or patterned glass



# TMF8806 Crosstalk & factory calibration Python script

## Setup and run tool

### Setup

- Use EVM or shield board
- Download logging tools from [https://github.com/ams-OSRAM-Group/tmf8806\\_zmq\\_data\\_logger/releases](https://github.com/ams-OSRAM-Group/tmf8806_zmq_data_logger/releases)
- Setup of tools see [https://github.com/ams-OSRAM-Group/tmf8806\\_zmq\\_data\\_logger](https://github.com/ams-OSRAM-Group/tmf8806_zmq_data_logger)

Execute: Open shell tool and execute following commands:

```
PS C:\...\tmf8806_zmq_data_logger...> pip install zmq_client-1.1.9.tar.gz
...removed output...
PS C:\...\tmf8806_zmq_data_logger...> python.exe .\example_zmq_client_calibration.py
#CONF;2.5m mode;all SPADs
#XTALK;1740
#CONF;2.5m mode;40best SPADs
#XTALK;731
#CONF;2.5m mode;20best SPADs
#XTALK;411
#CONF;4m mode;all SPADs
#XTALK;1067
#CONF;4m mode;40best SPADs
#XTALK;1476
#CONF;4m mode;20best SPADs
#XTALK;894
```

The script outputs crosstalk in all modes and stores all results in `example_log_calibration.csv` – only these #XTALK readings are relevant , which are actually used in an application

All SPADs	= default mode
40 best SPADs	= large airgap mode
20 best SPADs	= thick cover glass mode

# TMF8806 Crosstalk & factory calibration Python script

## How-to interpret the results

Check Optical Design Guide to ensure crosstalk is within specified limits, adjust cover glass / air gap if outside limits

min = 400 counts, max = 7000 counts

- If crosstalk is too high, decrease airgap, reduce cover glass thickness or use optical barrier
- If crosstalk is too low, increase airgap or increase cover glass thickness

See individual driver documentation how-to integrate calibration data.

Note for using the tool for the TMF8806 Shield board:

- Run ZMQ server on PC: tmf8806\_zmq\_server\_ftdi\_arduino\_<latest version>.exe from <https://ams-osram.com/tmf8806>
- Edit example\_zmq\_client\_calibration.py script to change server to 127.0.0.1:

```
39 if __name__ == "__main__":  
40  
41     CMD_SERVER_ADDR = "tcp://127.0.0.1:5555"  
42     RESULT_SERVER_ADDR = "tcp://127.0.0.1:5556"  
43     LOG_FILE = Path(__file__).parent / "example_log_calibration.csv"
```

am



OSRAM