Explore the next sense

Getting Started Guide A111 Lens Evaluation Kit LH112/122/132

July 2022

Getting Started Guide

The Lenses are delivered as kits with two different lenses, a cover and a holder. The holder comes in three versions LH112 used for XR112 and XM112, LH122 used for XM122 and finally LH132 used for XE132, XE123 and XE124. This getting started guide will show you how to setup the lens evaluation kit.

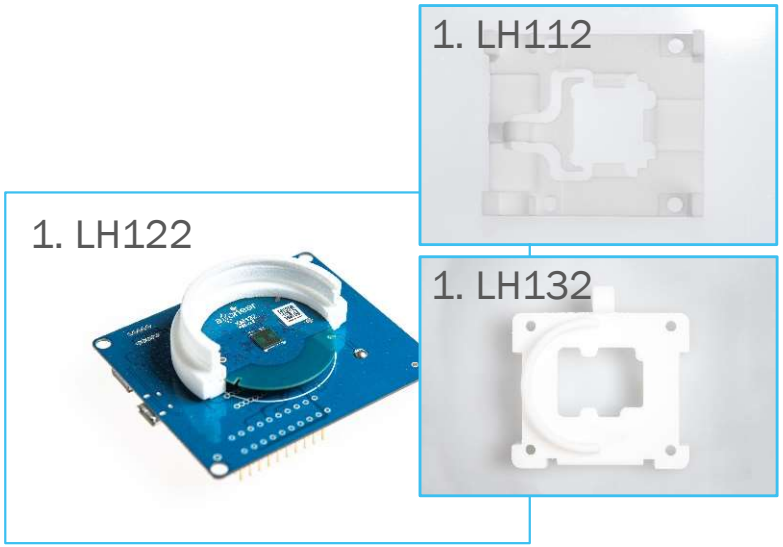
We assume that you already have a sensor evaluation kit (EVK) XC/XR112, or a module EVK XB/XM112, XB/XM122, XE132, XE123 or XE124 and that you are familiar with how to use it.

Acconeer reference lenses are made of Polyamide PA12. They are solid.

Kit content

The Lens Kit from Acconeer is delivered including 4 parts.

1. Lens and PCB holder
2. HBL Lens (Hyperbolic Lens)
3. FZP Lens (Fresnel Zone Plate)
4. Flat cover



Acconeer apologize for our choice of White on White.

How to Assemble LH112

XR112 in the holder

First thing you need to do is to fit the PCB into the holder, which can be used with both XR112 (to the left) and Acconeer's XB/XM112 (to the right). If using XB/XM112 we recommend to also screw the PCB to the holder. The exact sensor position in relation to the lens will be important for optimal performance.

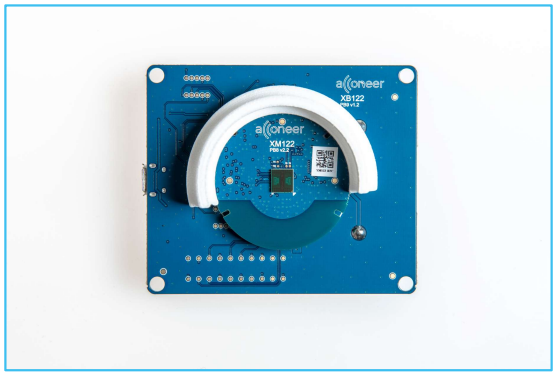
Link to Screw and Bolt:
https://www.digikey.com/product-detail/en/b-f-fastener-supply/NY-PMS-632-0050-PH/H560-ND/46293

https://www.digikey.com/products/en?keywords=HN-6-32-01

XM112 in the holder

How to Assemble LH122

XM122 in the holder



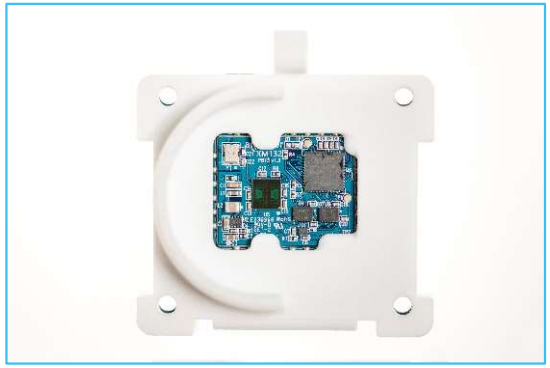
First thing you need to do is to fit the PCB into the holder. After XM122 is securely fitted you can easily connect it to your XB122 breakout board if needed. *Be careful to not try to fit the holder to XM122 when it is connected to the XB card. The connector is sensitive and can break.*
The exact sensor position in relation to the lens will be important for optimal performance.

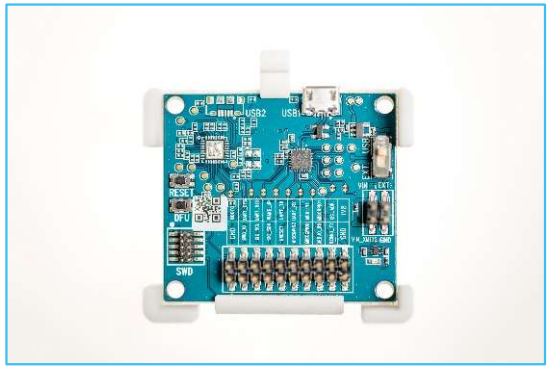
To the right is an example how to NOT place the sensor. Ensure that the BT antenna always is placed in the gap of the holder to ensure best performance.

XM122 suboptimal placement

How to Assemble LH132

XE132 in the holder





First thing you need to do is to fit the PCB into the holder. (To the left.)
We recommend to screw the PCB to the holder. The exact sensor position in relation to the lens will be important for optimal performance.
The PCB only fits one way into the holder without obstructing the USB.

Distance from PCB to Lens for LH112 /122 /132

D2

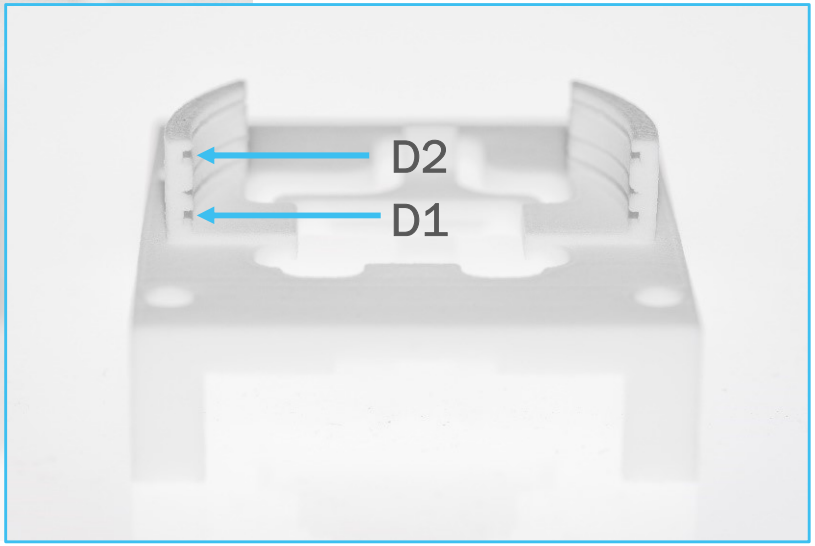
D1

	LH112						LH122			LH132		
	XR112			XM112			XM122			XE132/XE123/XE124		
	FZP	HBL	Cover	FZP	HBL	Cover	FZP	HBL	Cover	FZP	HBL	Cover
D1[mm]	3.1	3.1	4.5	3.4	3.1	4.5	3	3	5	3	3	5
D2[mm]	8.2	8.3	N/A	8.6	8.3	N/A	8.2	8.2	N/A	8.2	8.2	N/A

Both lenses can be fitted in the holder in two different positions: D1 or D2. The positioning numbering is identical for all three lens kits.

The cover (see page 3) is only used in D1.

The two positions will give you slightly different performance. See next 3 pages



Performance Tables

On the following pages, the expected performance of the lenses, cover and holders are summarized. The performance is defined by the following parameters:

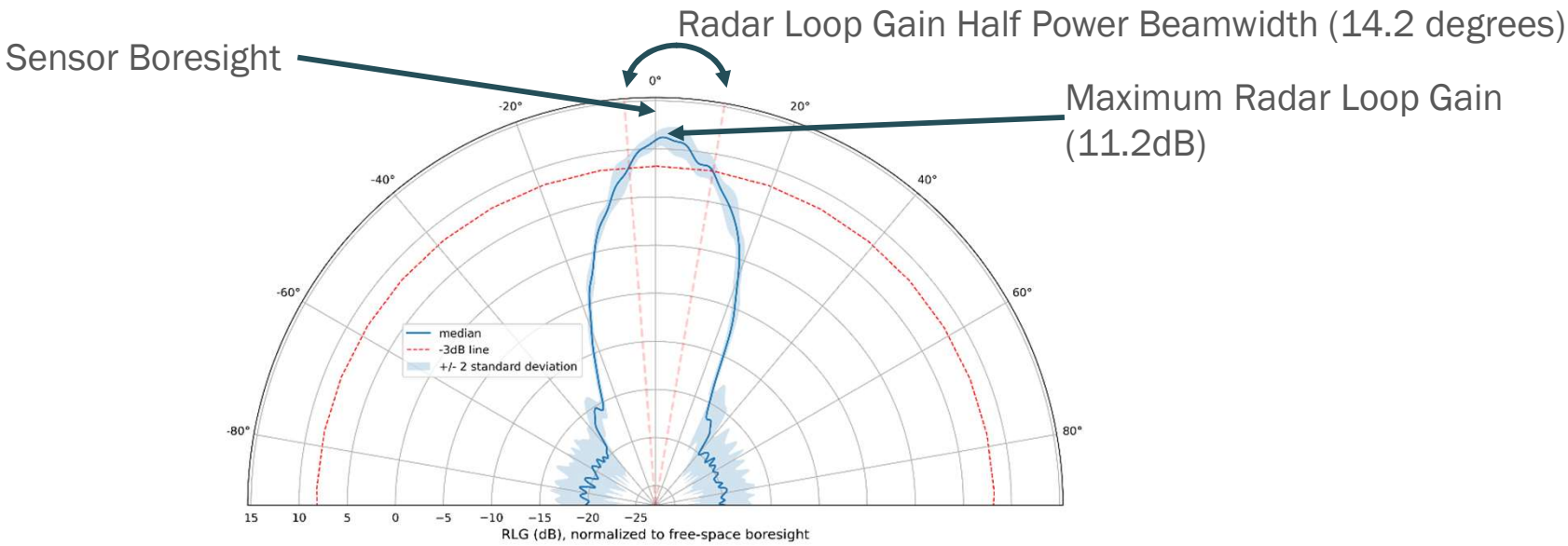
- Maximum Radar Loop Gain (Max RLG)
- Radar Loop Gain Half Power Beamwidth (RLGHPBW)

Definitions:
The Max RLG is the maximum value of the received power measured by the radar itself, meaning that it is the sum of the gain in the radar TX and RX path. The Max RLG is normalized to the Radar Loop Gain of Free Space Sensor Boresight.

The RLGHPBW includes the attenuation in both the TX and RX radar path and is defined as the angular separation between the two points at which the gain has decreased by 3dB relative to the maximum main lobe value, when the radar itself is used to measure the reflected power. The Radar Loop Gain Radiation Pattern is normalized to Free Space Sensor Boresight. For details regarding the measurement setup, refer to HW and Physical integration guideline, chapter 1.2.

Performance Tables

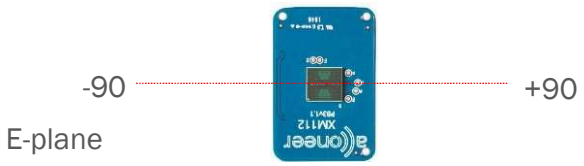
Below is an example of the measured parameters (XM132 Radar Loop Gain Radiation Pattern in H-plane with LH132 and Hyperbolic lens placed at distance D1):

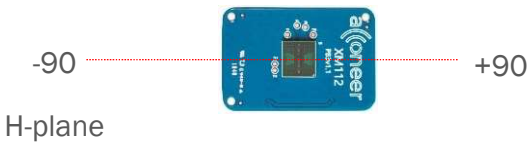


Performance Table LH112+XM112

Acconeer has verified both lenses on both EVK variants. The expected performance can be viewed in the table to the right.

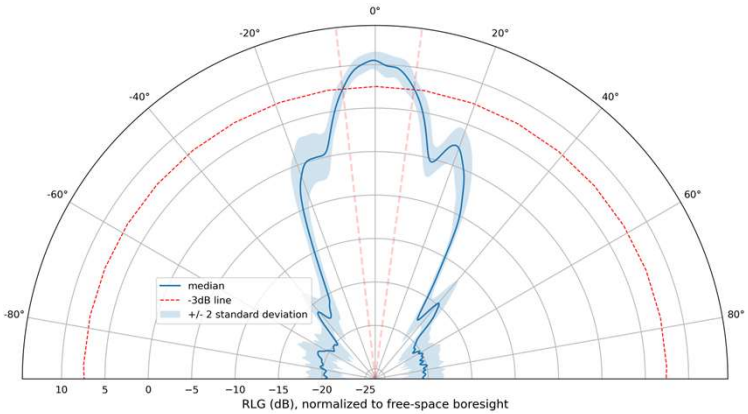
XM112 with LH112 holder	Max RLG (dB)		RLGHPBW-E (degree)		RLGHPBW-H (degree)	
	D1	D2	D1	D2	D1	D2
HBL	10.5+/-1.1	15.46+/-1.4	13.6+/-1.3	10.7+/-1.7	12.1+/-1.2	10.4+/-1.5
FZP	10.1+/-1.0	14.0+/-1.4	11.5+/-1.0	9.3+/-1.2	12.3+/-1.5	7.3+/-1.2

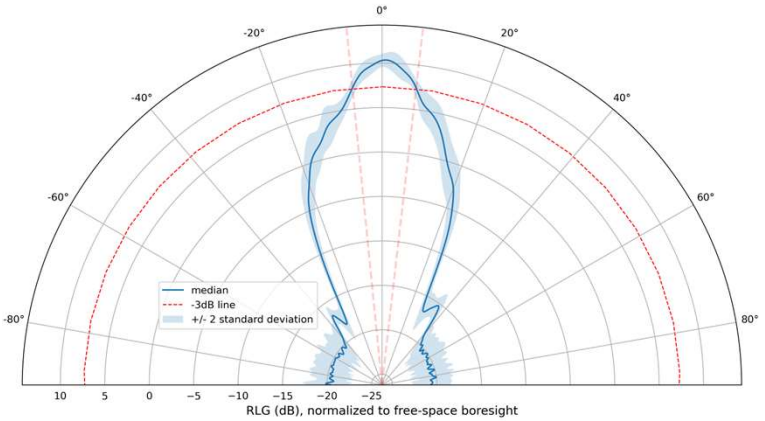


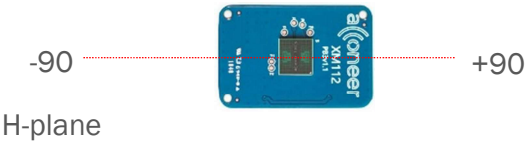


Max RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

LH112 + XM112 – Hyperbolic lens, D1

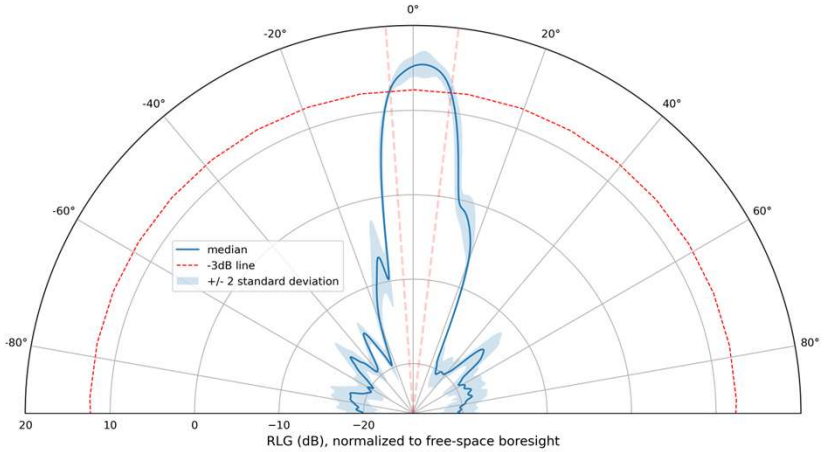


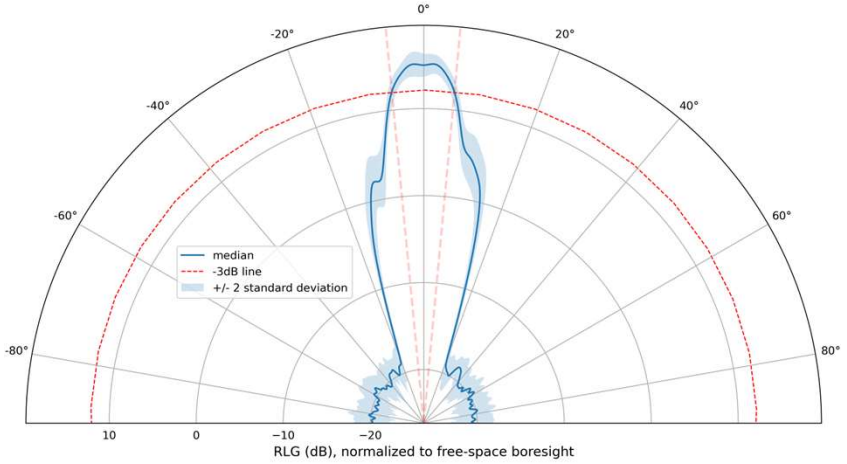


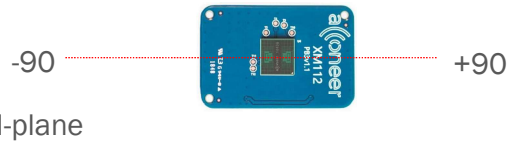


Max RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

LH112+XM112 – Hyperbolic lens, D2

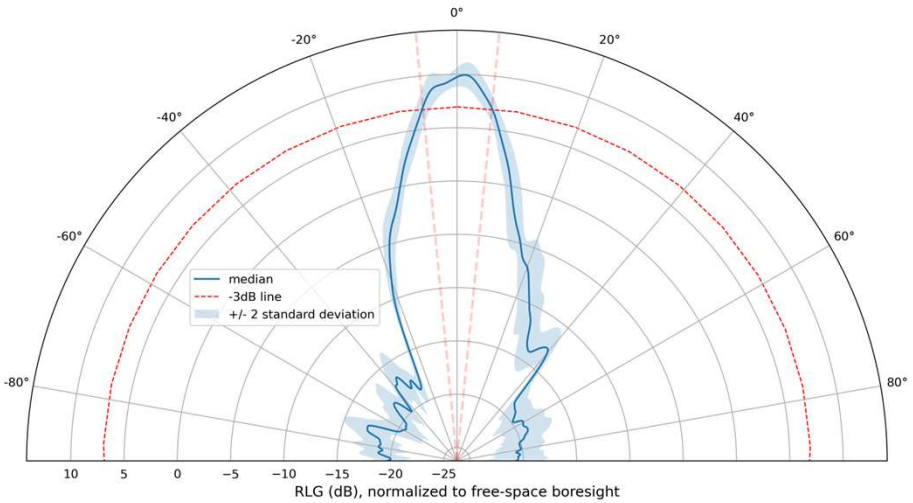


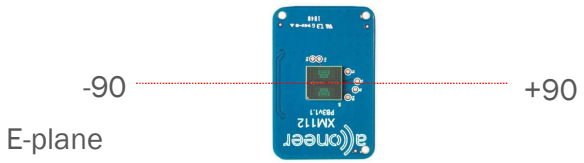


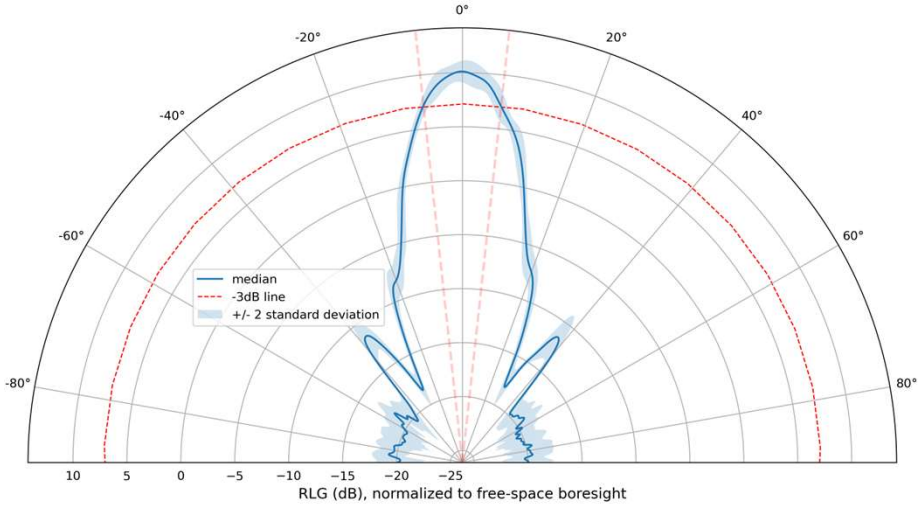


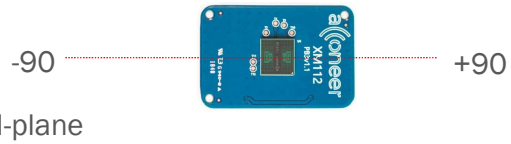
Max RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

LH112+XM112 – FZP lens, D1



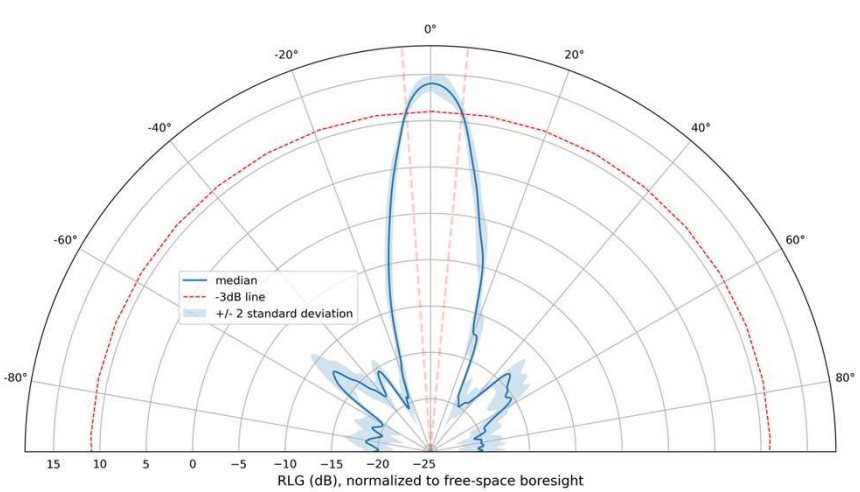


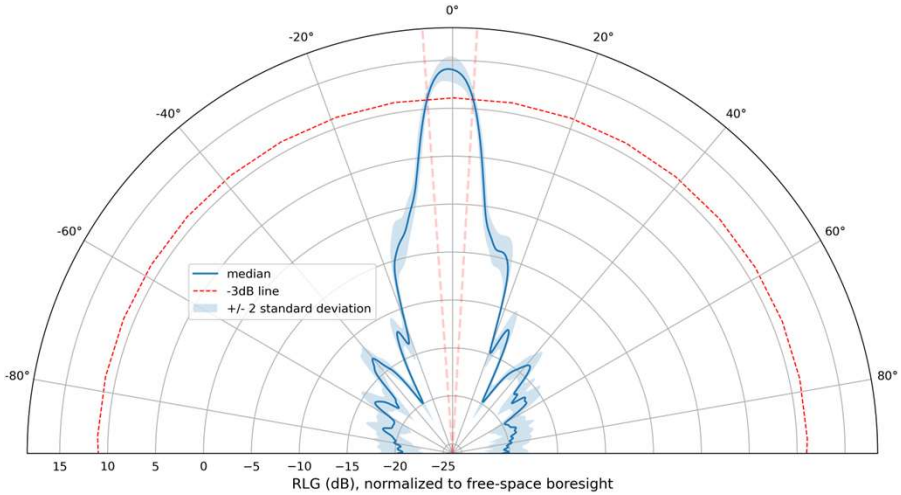


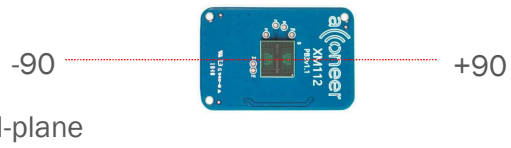


Max RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

LH112+XM112 – FZP lens, D2







Max RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

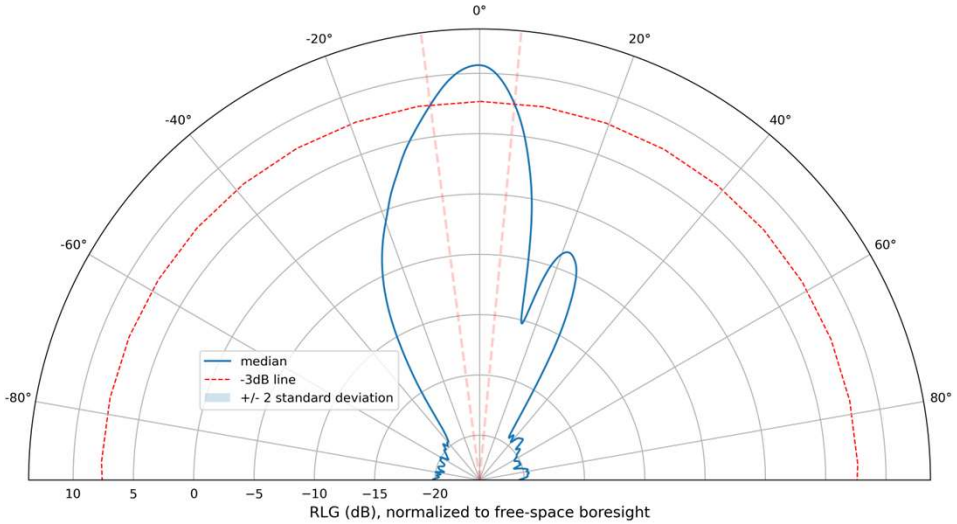
Performance Table LH112+XR112

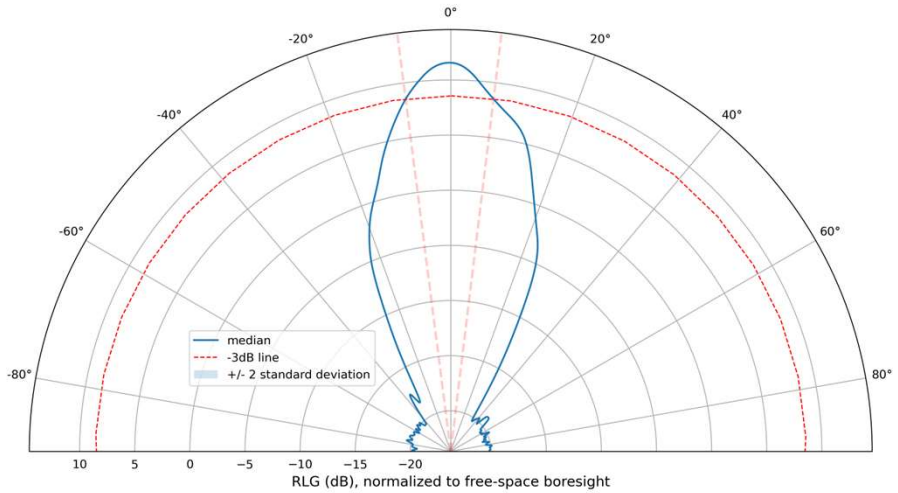
Acconeer has verified both lenses on both EVK variants. The expected performance can be viewed in the table to the right.

XR112 with LH112 holder	Max RLG (dB)		RLGHPBW-E (degree)		RLGHPBW-H (degree)	
	D1	D2	D1	D2	D1	D2
HBL	11.5	16.8	12.8	10.5	14.2	11.7
FZP	12.7	15.89	10.5	9.2	12.1	8.3

Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW measurement setup tolerance=+/- 2 degrees

LH112+XR112 – Hyperbolic lens, D1





-90 +90

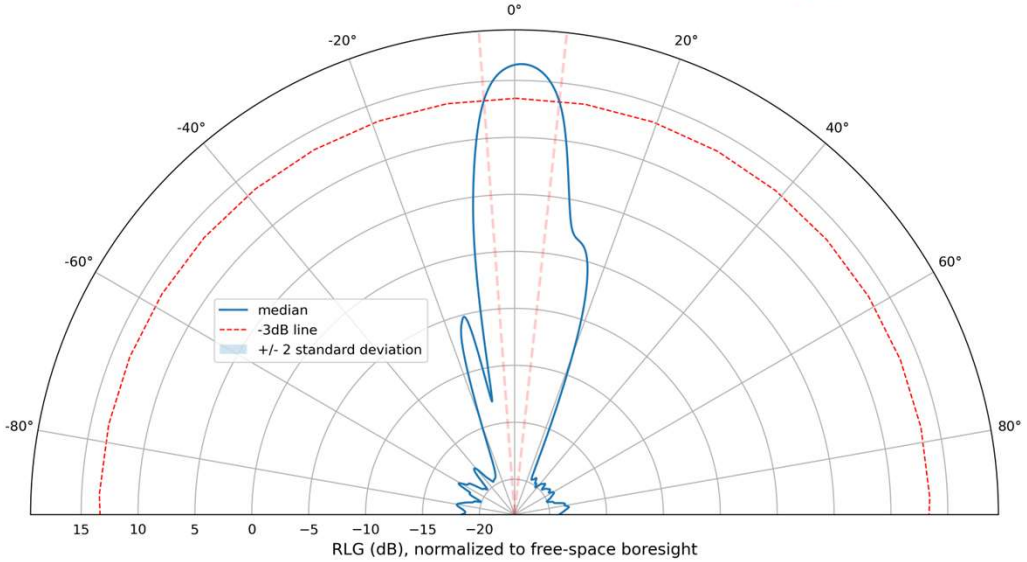
E-plane

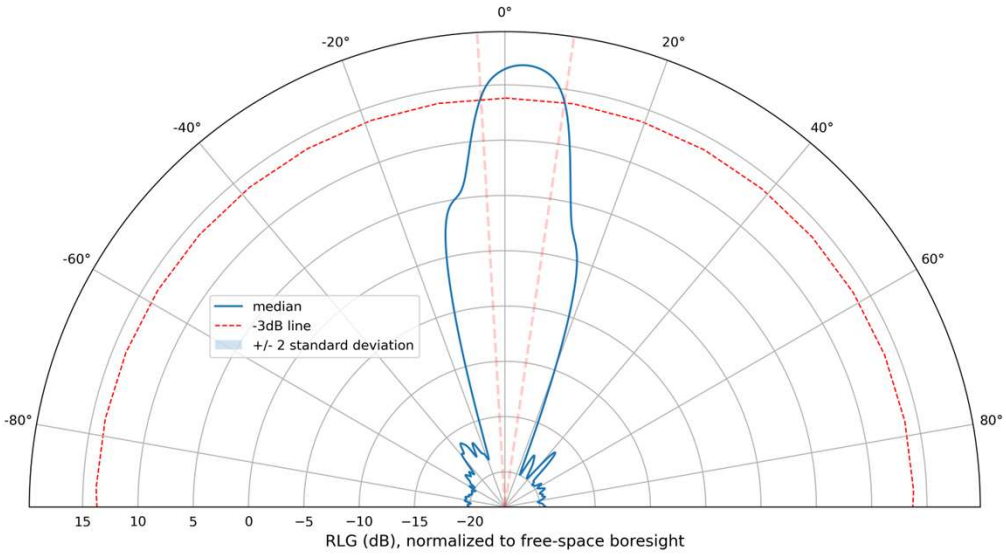
-90 +90

H-plane

Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW measurement setup tolerance=+/- 2 degrees

LH112+XR112 – Hyperbolic lens, D2





-90 +90

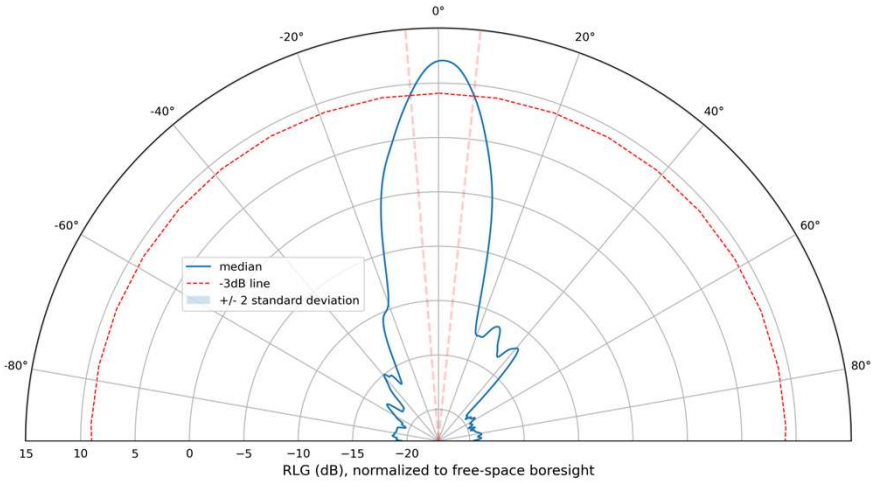
E-plane

-90 +90

H-plane

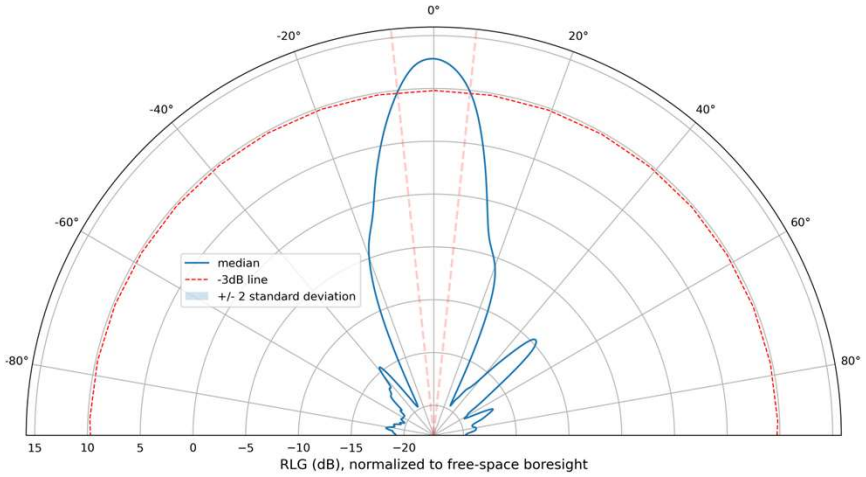
Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW measurement setup tolerance=+/- 2 degrees

LH112+XR112 – FZP lens, D1



-90 +90

E-plane

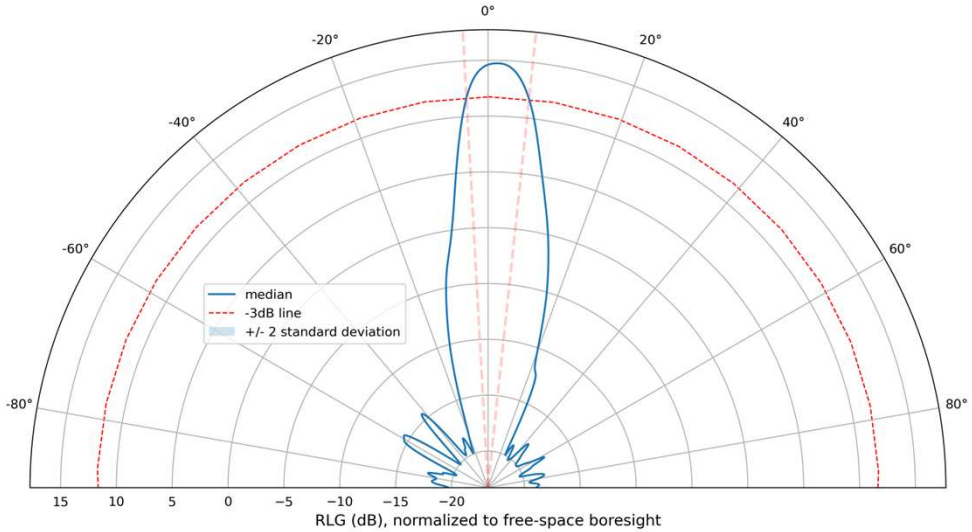


-90 +90

H-plane

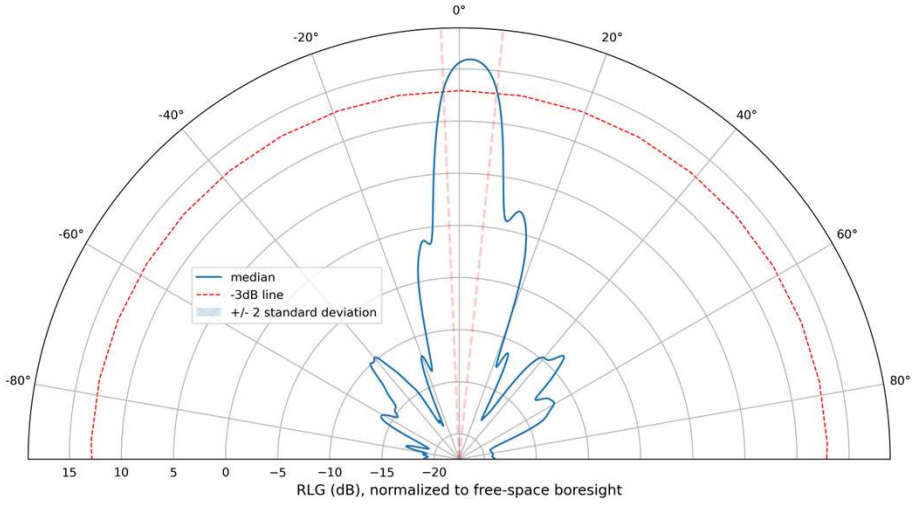
Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW measurement setup tolerance=+/- 2 degrees

LH112+XR112 – FZP lens, D2



-90 +90

E-plane



-90 +90

H-plane

Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW measurement setup tolerance=+/- 2 degrees

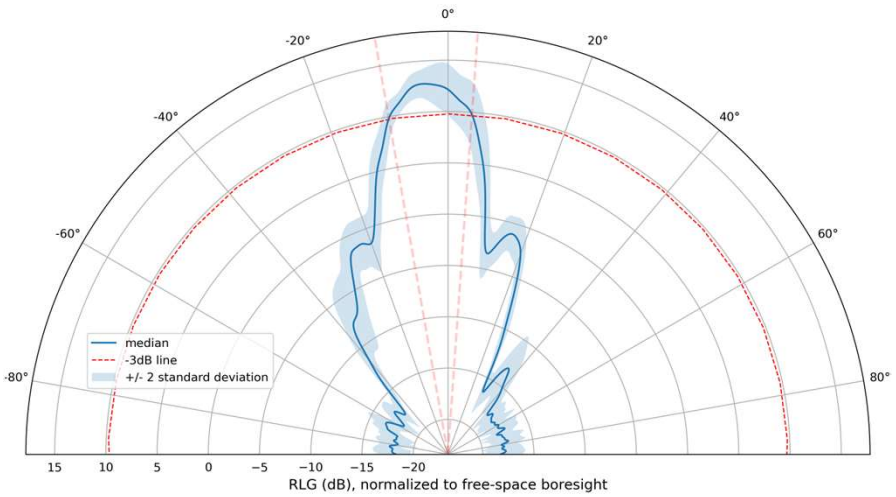
Performance Table LH122

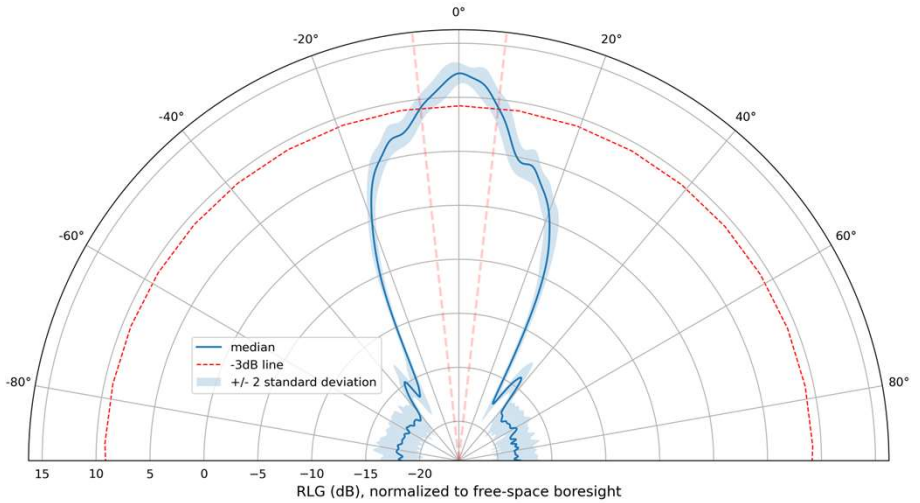
Acconeer has verified both lenses. The expected performance can be viewed in the table to the right.

XM122 with LH122 holder	Max RLG (dB)		RLGHPBW-E (degree)		RLGHPBW-H (degree)	
	D1	D2	D1	D2	D1	D2
HBL	12.9+/-1.5	17.2+/-1.5	13.7+/-1.8	11.2+/-1.2	12.5+/-1.8	10.2+/-1.7
FZP	13.2+/-1.0	15.9+/-1.2	11.9+/-1.3	9.4+/-1.1	9.5+/-0.9	7.6+/-0.9

Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

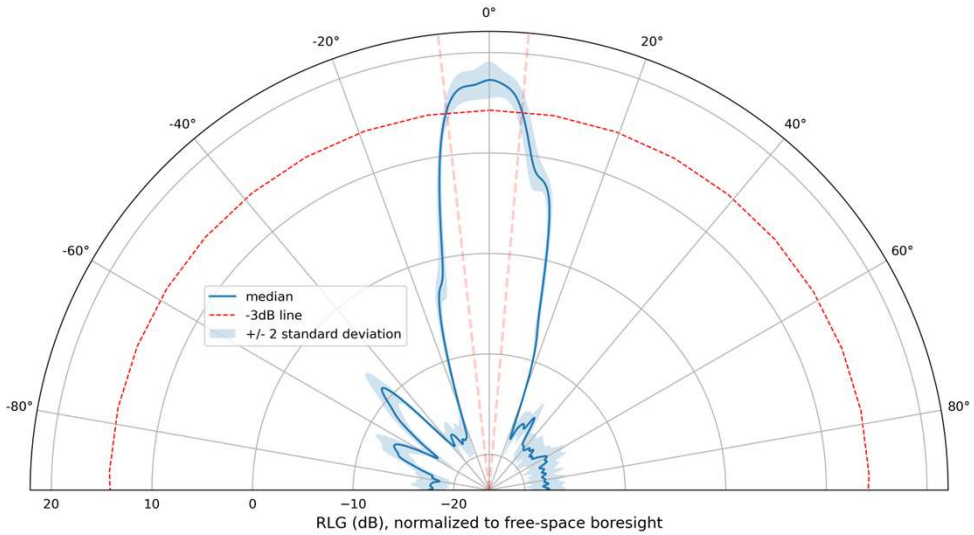
LH122 – Hyperbolic lens, D1

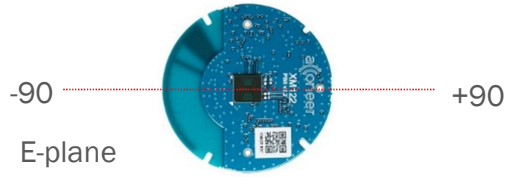


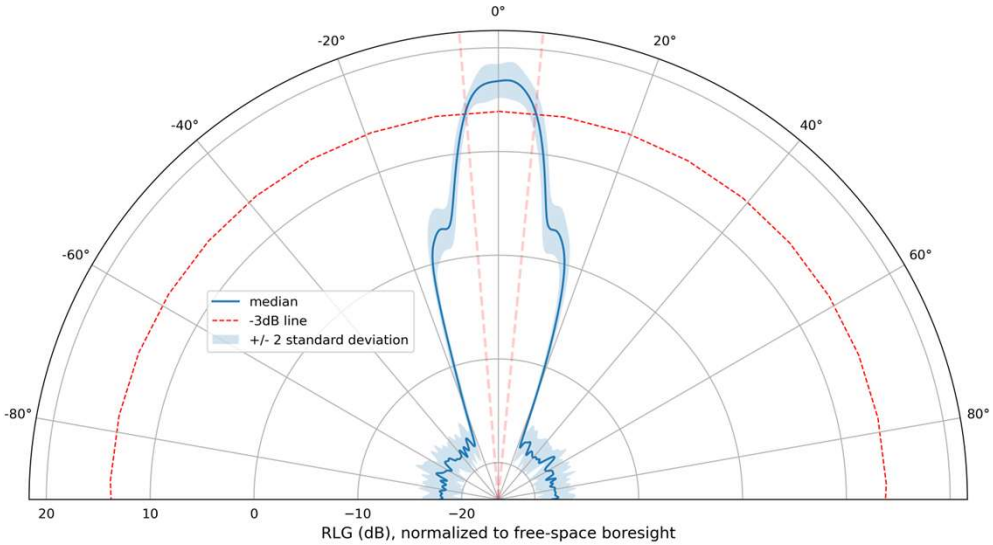


Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

LH122 – Hyperbolic lens, D2

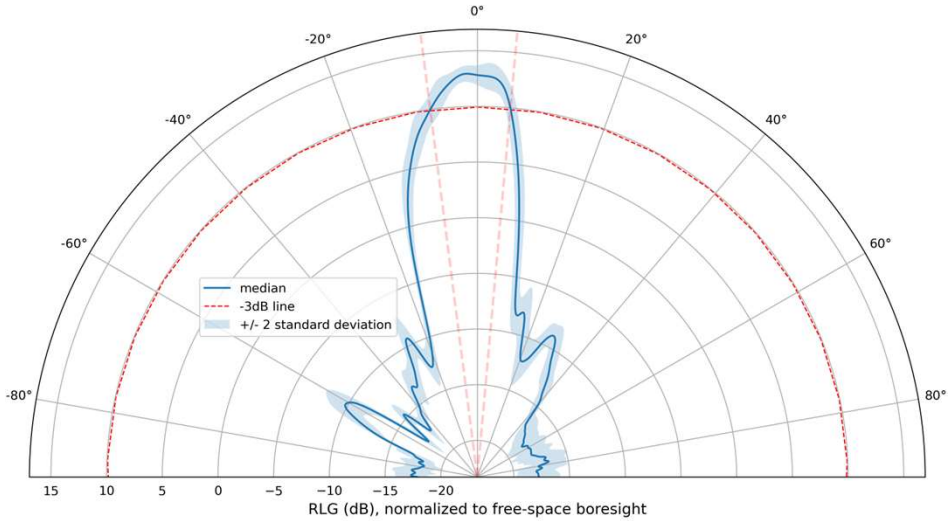


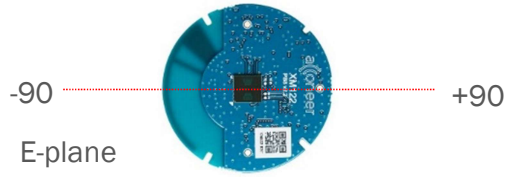


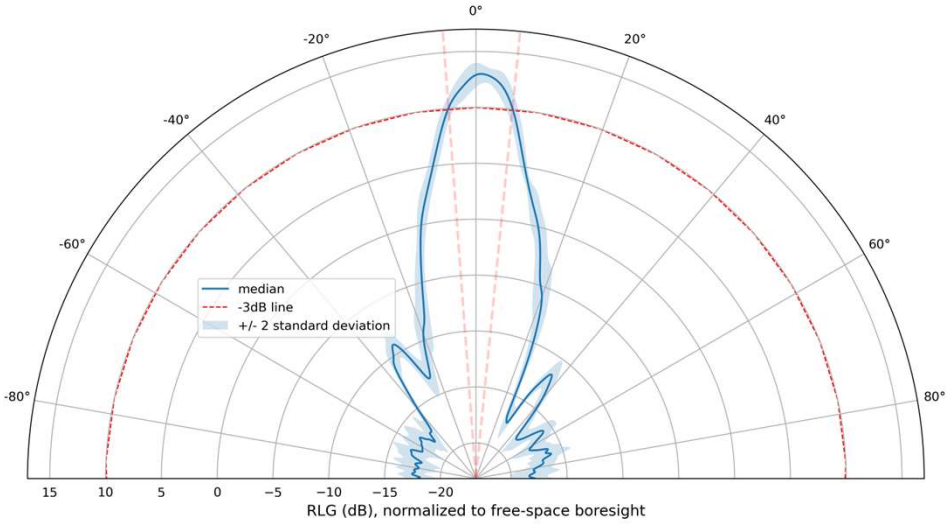


Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

LH122 – FZP lens, D1

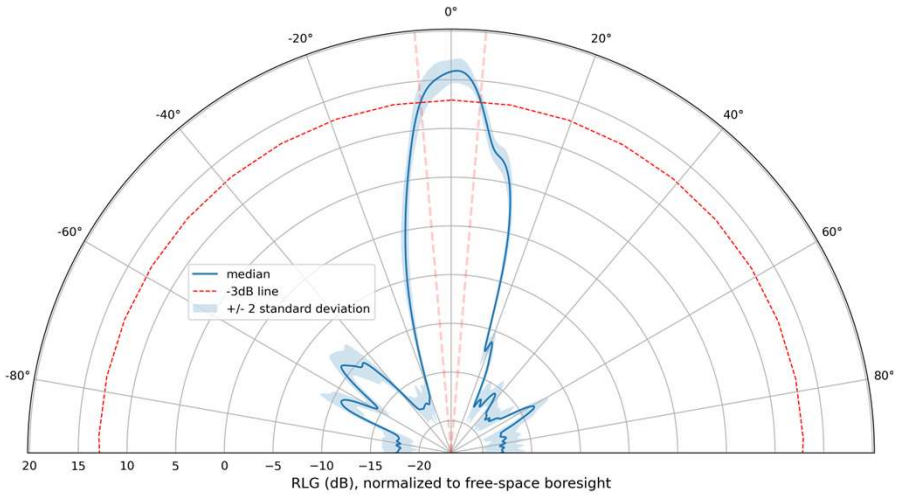


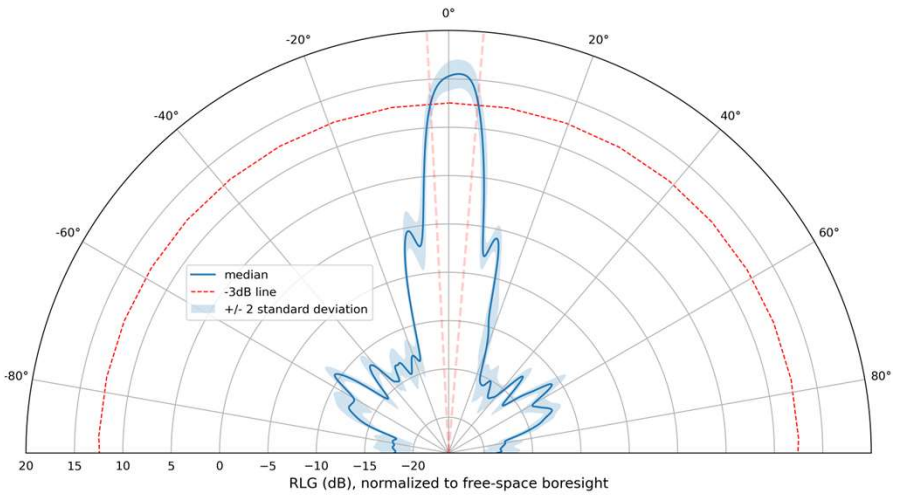


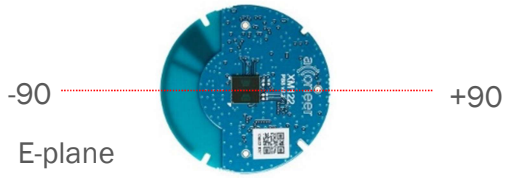


Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

LH122 – FZP lens, D2





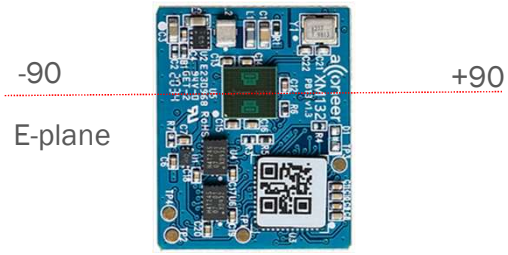


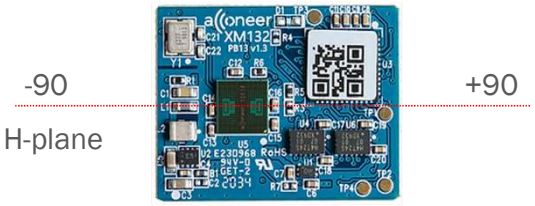
Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

Performance Table LH132+XE132

Acconeer has verified both lenses. The expected performance can be viewed in the table to the right.

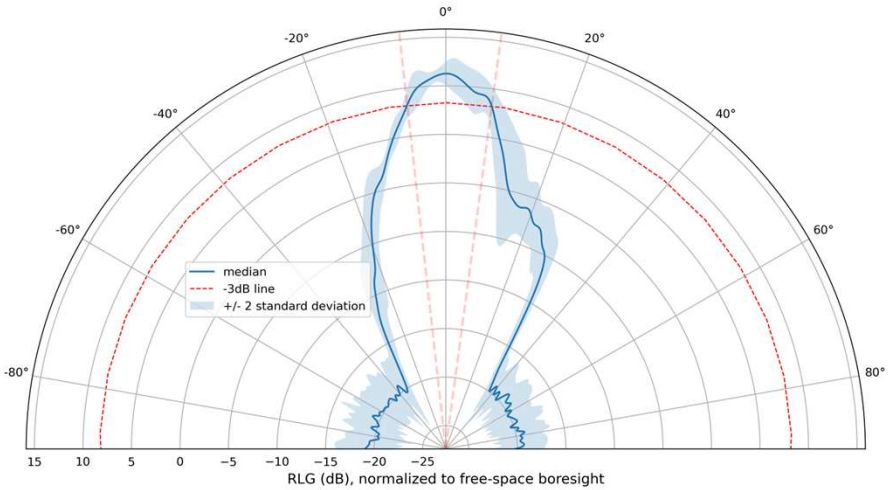
XE132 with LH132 holder	Max RLG (dB)		RLGHPBW-E (degree)		RLGHPBW-H (degree)	
	D1	D2	D1	D2	D1	D2
HBL	11.2+/-1.0	16.4+/-2.1	14.2+/-1.5	11.9+/-2.0	13.5+/-2.6	12.1+/- 1.2
FZP	11.9+/-1.2	14.6+/-2.2	13.0+/-3.0	9.4+/-2.7	11.0+/-1.7	8.3+/-1.0

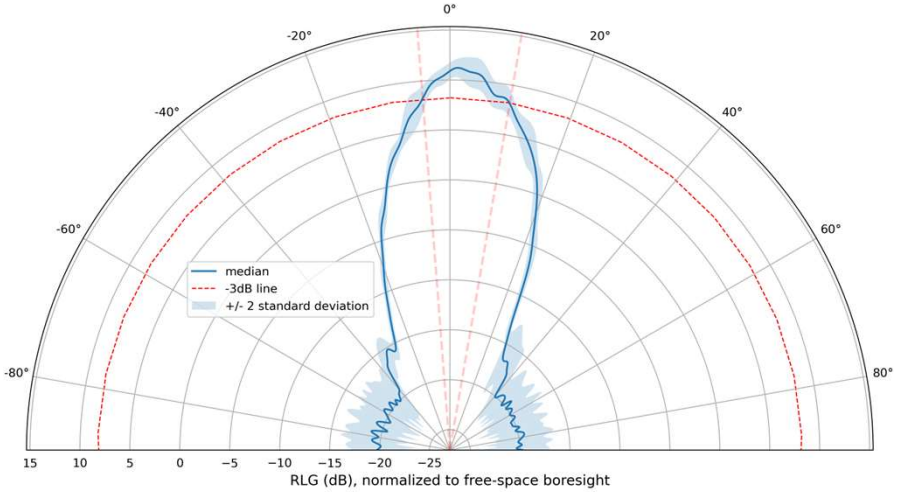




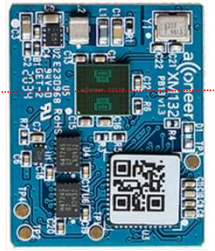
Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

LH132+XE132 – Hyperbolic lens, D1

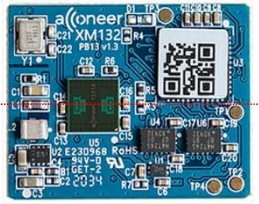




-90 E-plane +90

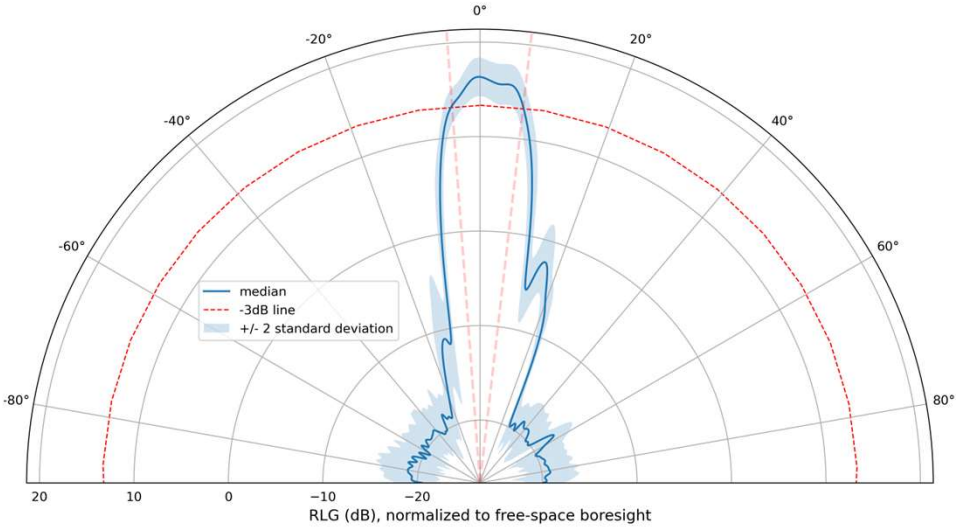


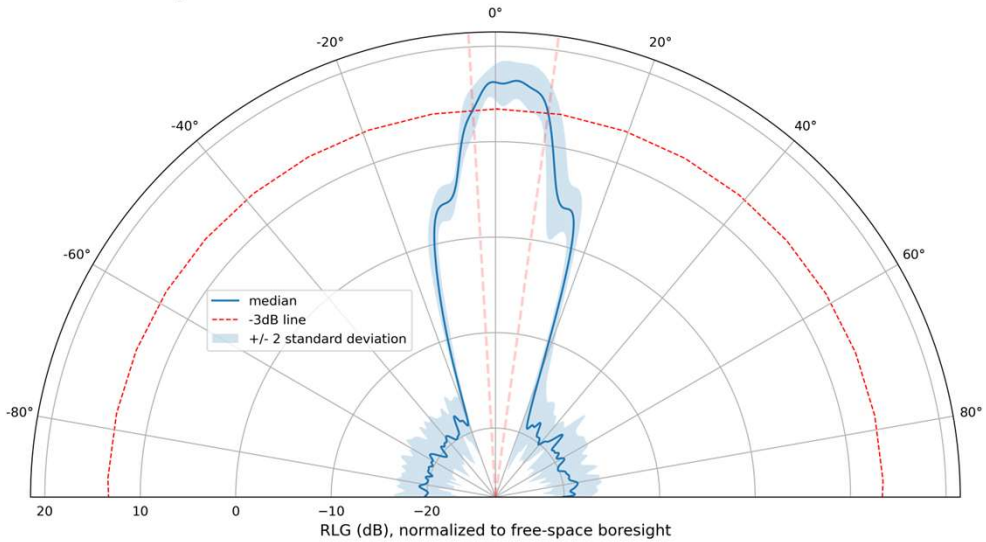
-90 H-plane +90

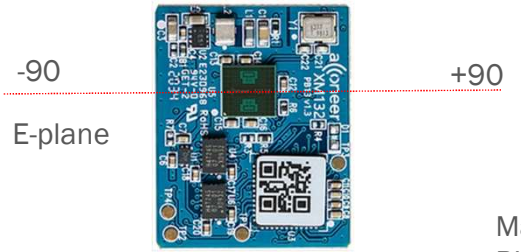


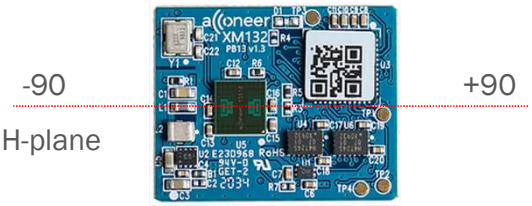
Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

LH132+XE132 – Hyperbolic lens, D2



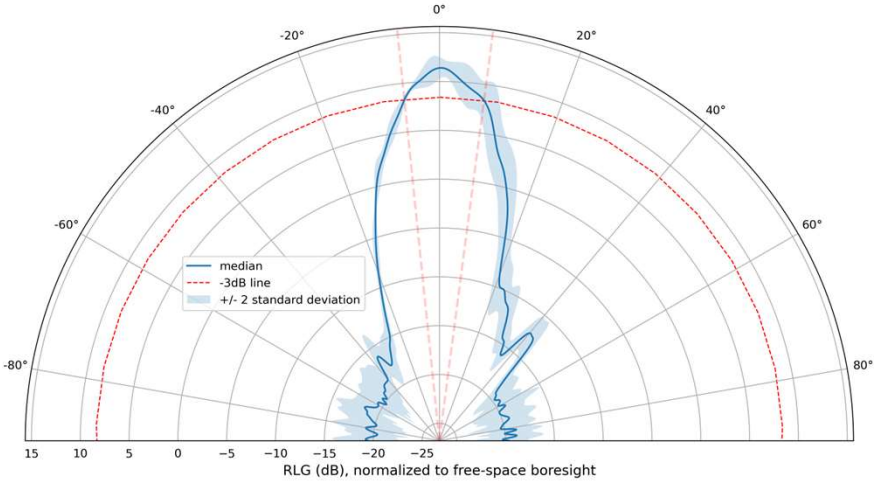


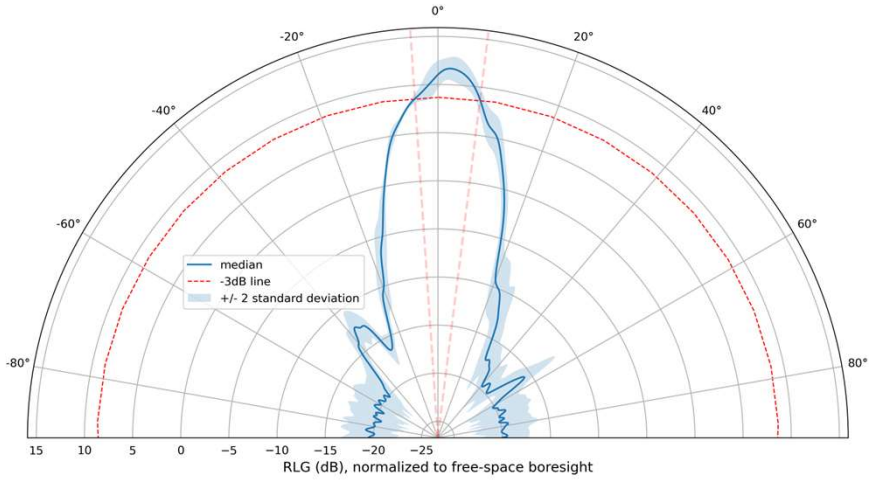




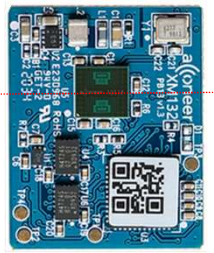
Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

LH132+XE132 – FZP lens, D1

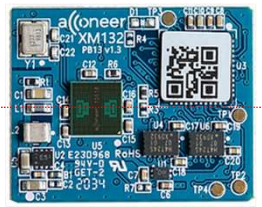




-90 E-plane +90

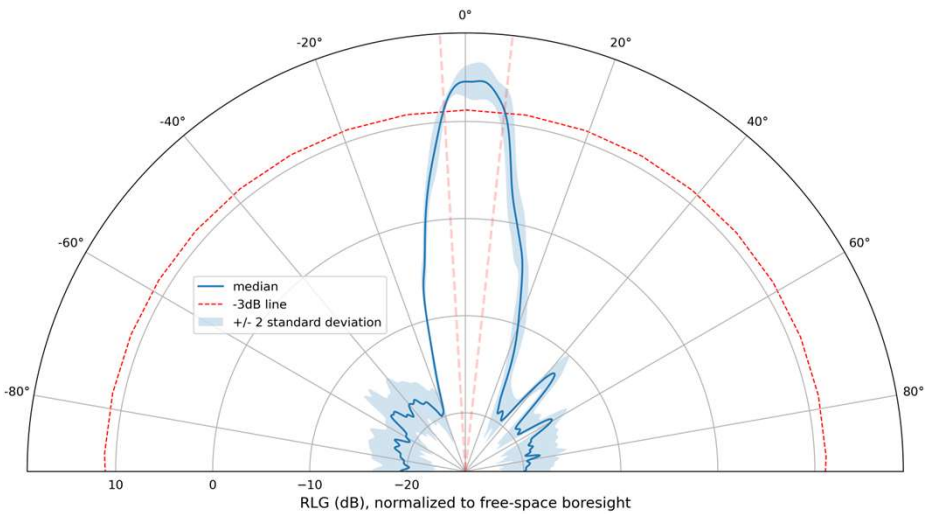


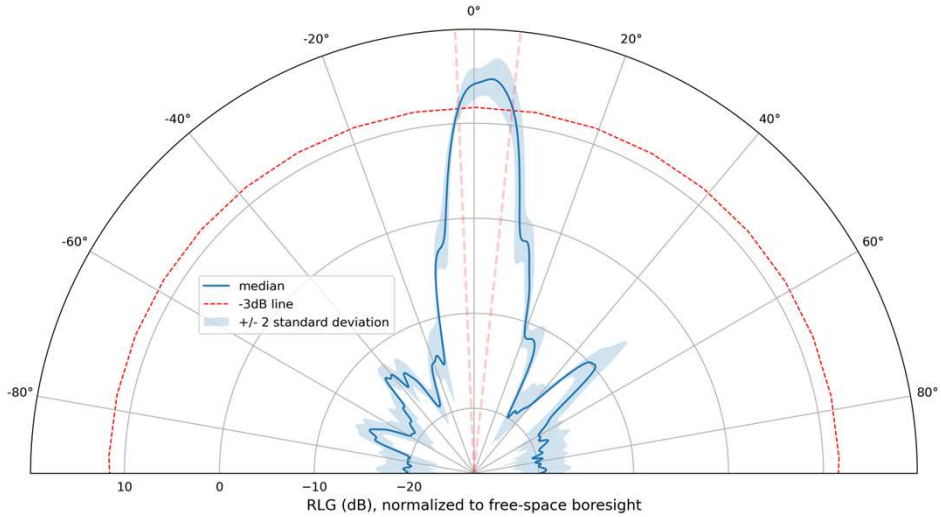
-90 H-plane +90



Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

LH132+XE132 – FZP lens, D2



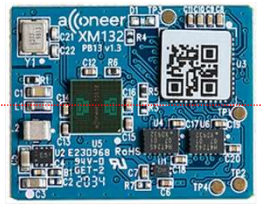


-90 +90

E-plane

-90 +90

H-plane

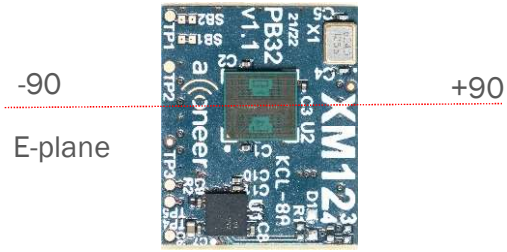


Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

Performance Table LH132+XE123/124

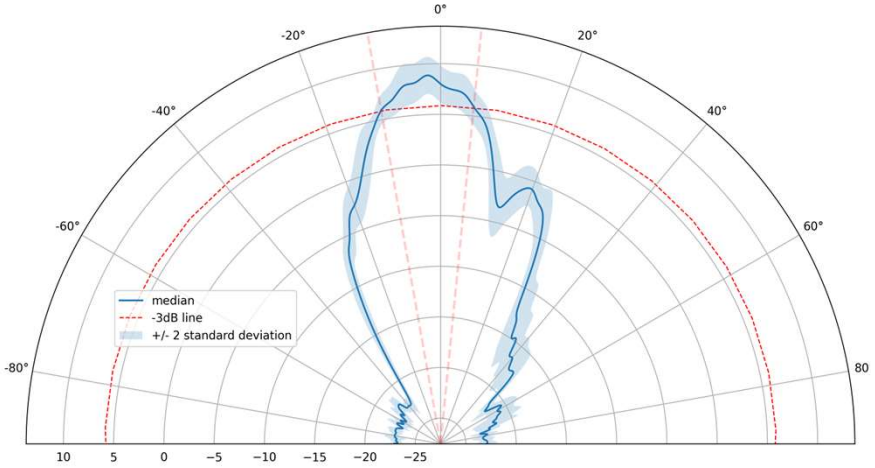
Acconeer has verified both lenses. The expected performance can be viewed in the table to the right.

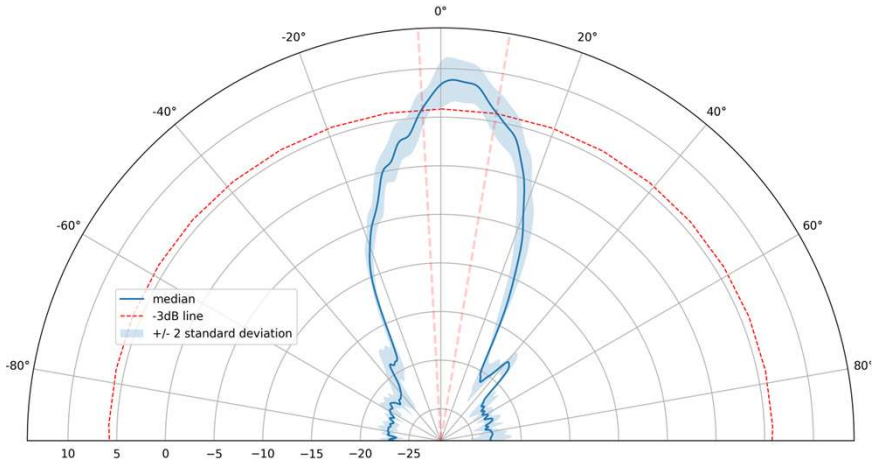
XE123/124 with LH132 holder	Max RLG (dB)		RLGHPBW-E (degree)		RLGHPBW-H (degree)	
	D1	D2	D1	D2	D1	D2
HBL	8.97+/-1.84	17.37+/-1.88	16.76+/-4.16	7.39+/-1.22	12.61+/-1.21	7.57+/-0.67
FZP	9.41+/-1.03	15.50+/-1.86	10.81+/-1.73	6.67+/-0.64	9.37/-1.18	5.77+/-0.58



Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

LH132+XE123/124 – Hyperbolic lens, D1

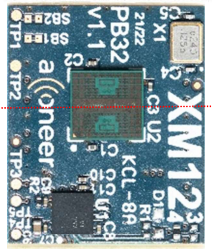




RLG (dB), normalized to free-space boresight

-90 +90

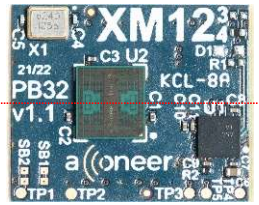
E-plane



RLG (dB), normalized to free-space boresight

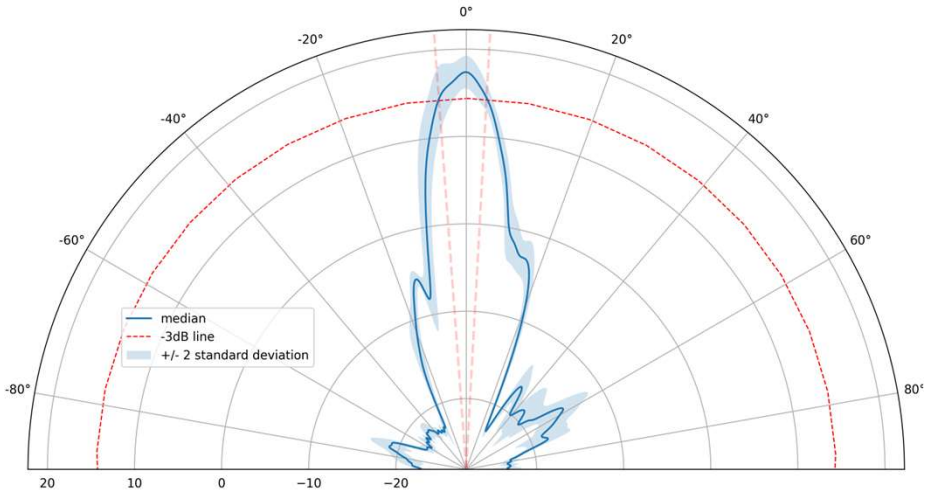
-90 +90

H-plane

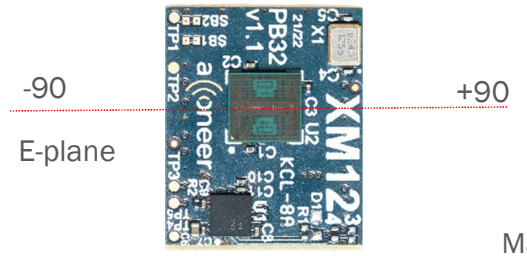


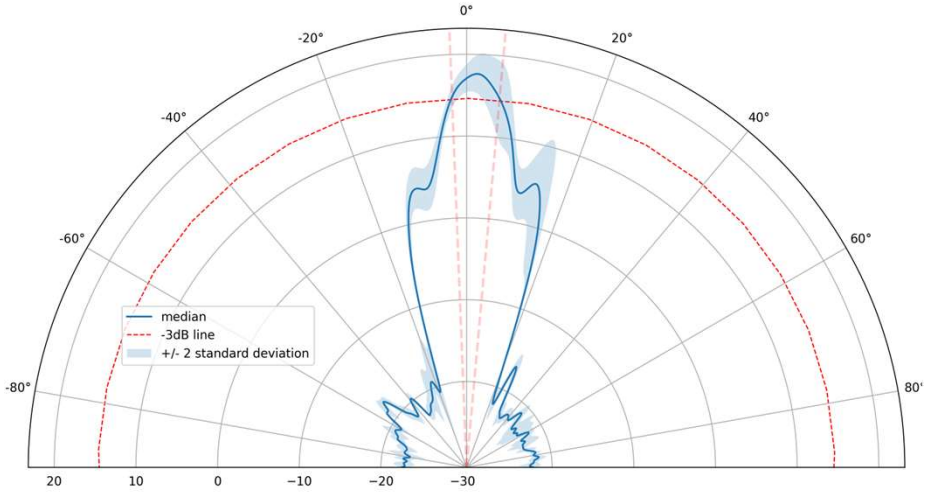
Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

LH132+XE123/124 - Hyperbolic lens, D2

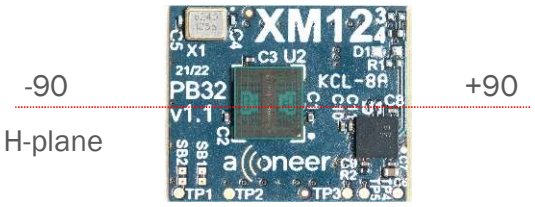


RLG (dB), normalized to free-space boresight



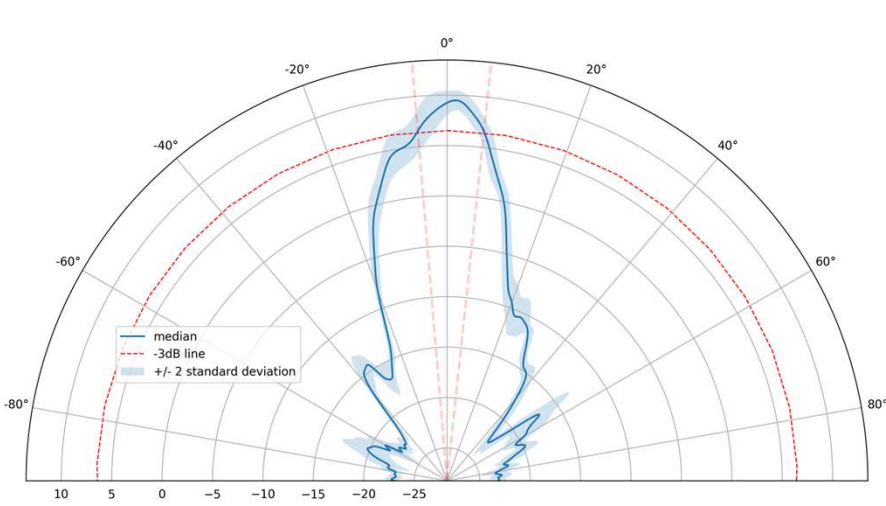


RLG (dB), normalized to free-space boresight



Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

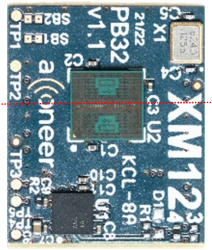
LH132+XE123/124 – FZP lens, D1

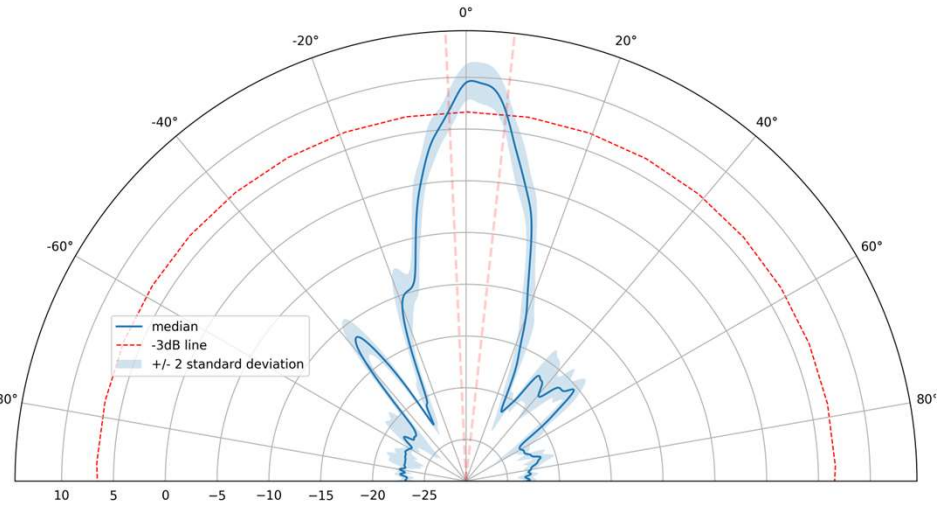


-90

E-plane

+90





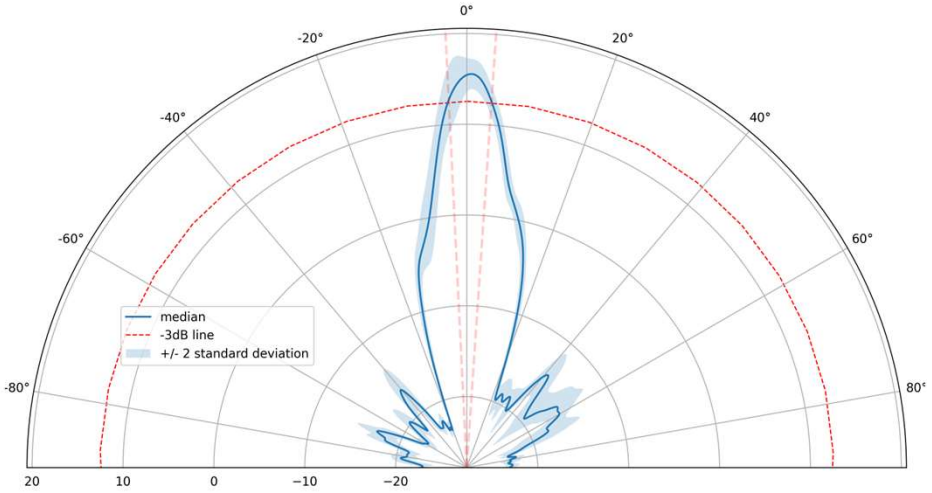
-90

H-plane

+90

Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

LH132+XE123/124 – FZP lens, D2

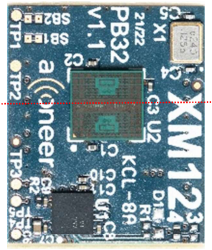


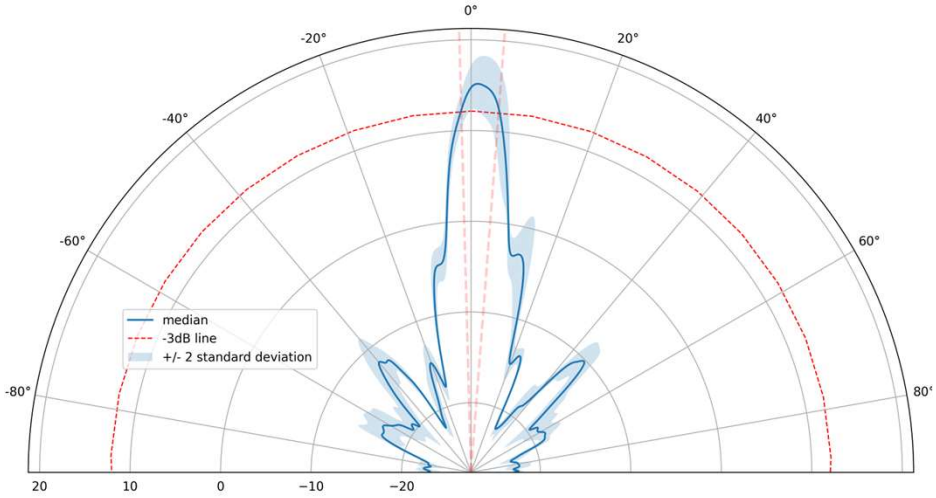
RLG (dB), normalized to free-space boresight

-90

+90

E-plane





RLG (dB), normalized to free-space boresight

-90

+90

H-plane

Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

Performance Table – flat cover

LH112 holder	Max RLG (dB)		RLGHPBW-E (degree)		RLGHPBW-H (degree)	
	XM112	XR112	XM112	XR112	XM112	XR112
FS	0	0	26.5+/-4.8	28.1+/-1.5	36.7+/-3.2	48.6+/-7.7
Cover [placed at D1]	0.9 +/-1.0	3.1	40+/-12.9	24.5	29.5+/-3.3	43.4

LH122 holder	Max RLG (dB)	RLGHPBW-E (degree)	RLGHPBW-H (degree)
	XM122	XM122	XM122
FS	0	19.8+/-3.1	43.2+/-4.8
Cover [placed at D1]	0.38+/-1.1	30.7+/- 27.7	70+/-7.5

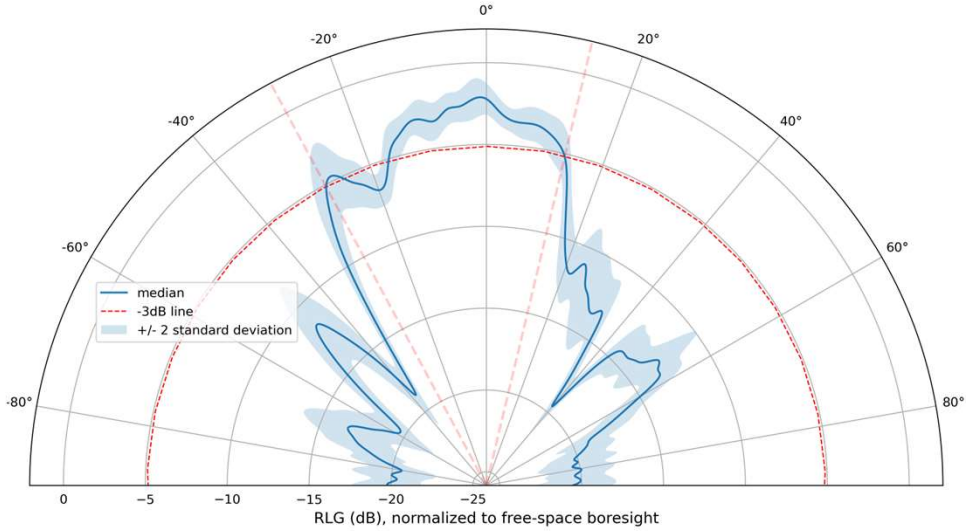
Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

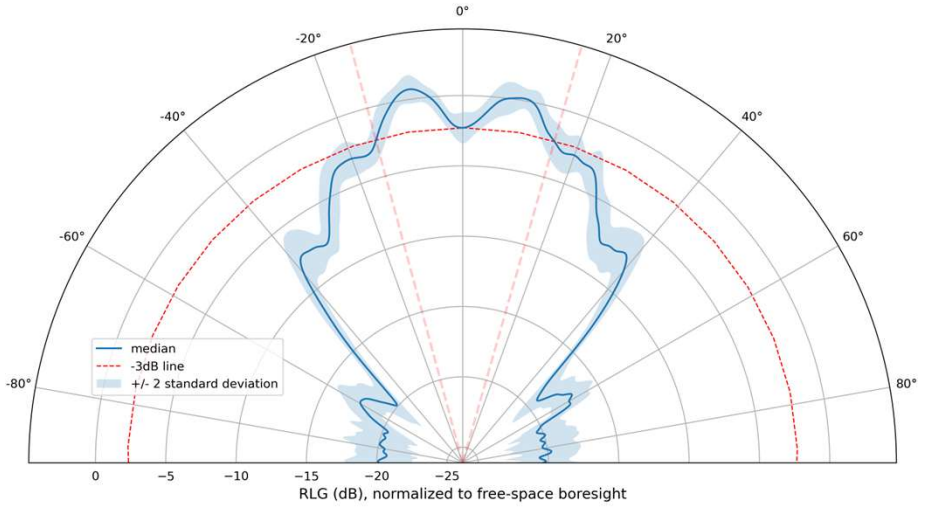
Performance Table – flat cover

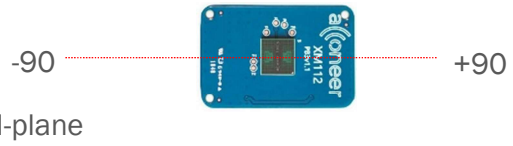
LH132 holder	Max RLG (dB)		RLGHPBW-E (degree)		RLGHPBW-H (degree)	
	XE132	XE123/XE124	XE132	XE123/124	XE132	XE123/124
FS	0	0	35.1+/-10.0	15.50+/-1.99	40+/-3.1	43.60+/-2.92
Cover [placed at D1]	1.56+/-0.9	-1.36+/-2.25	27.2+/-5.7	21.80+/-5.43	34.4+/-15.3	23.24+/-35.88

Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

LH112+XM112 – flat cover, D1

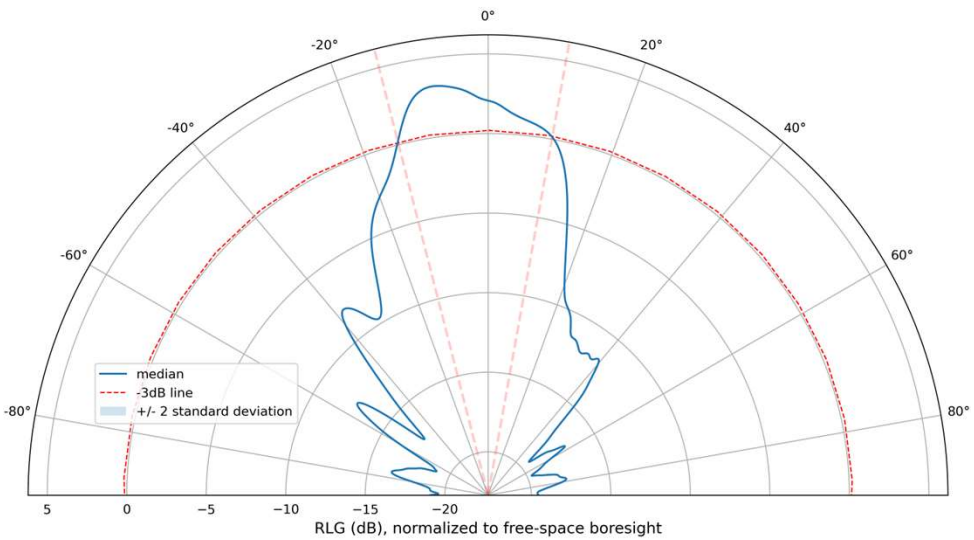






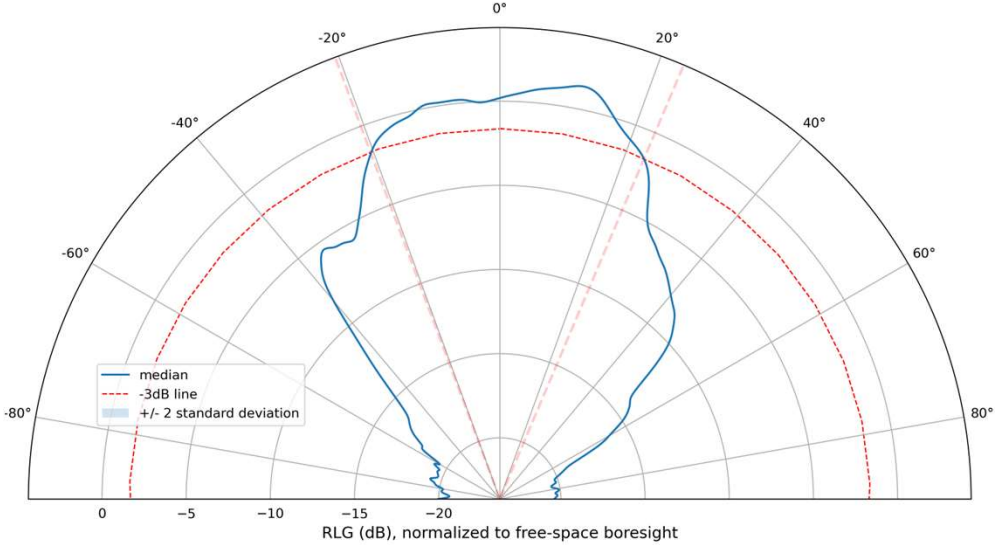
Max RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

LH112+XR112 – flat cover, D1



-90 +90

E-plane

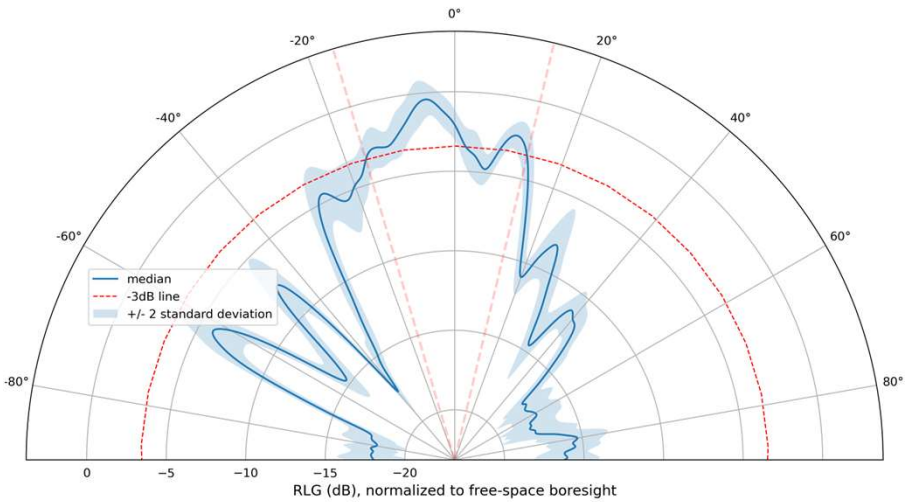


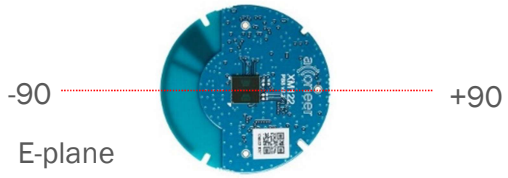
-90 +90

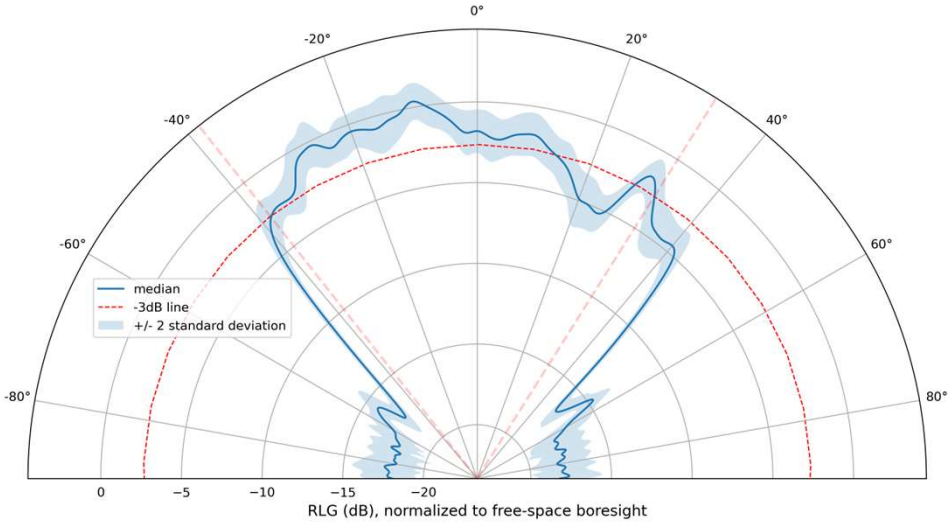
H-plane

Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW measurement setup tolerance=+/- 2 degrees

LH122 – flat cover, D1

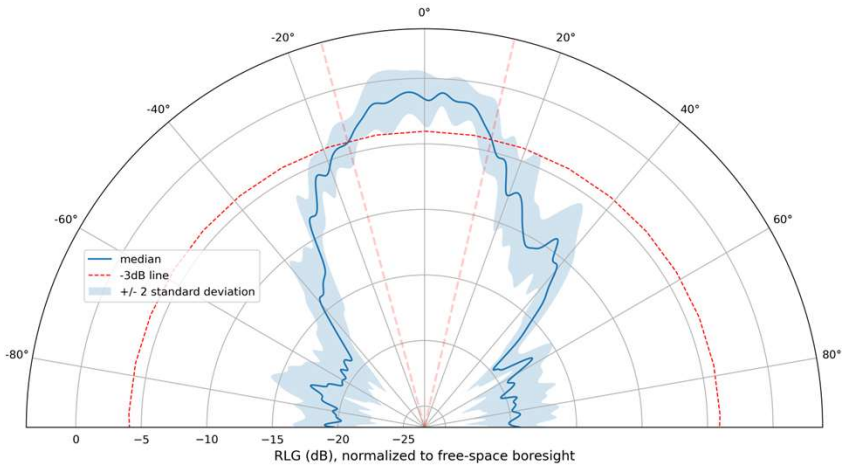


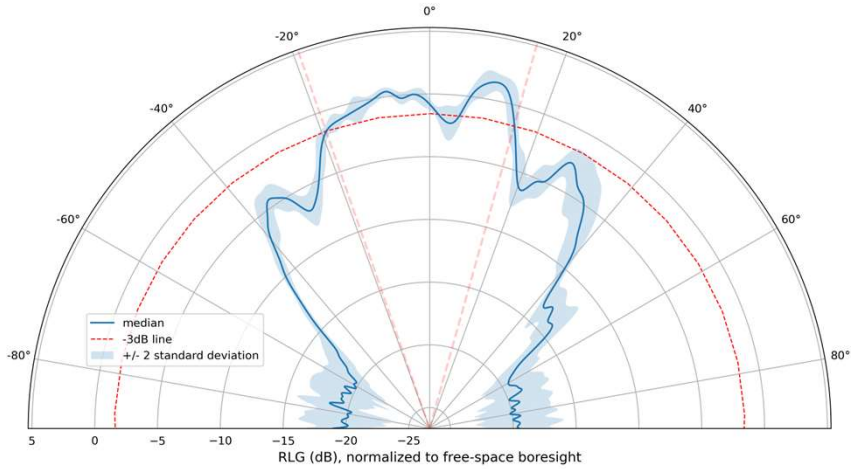




Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

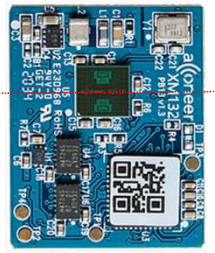
LH132+XE132 – flat cover, D1





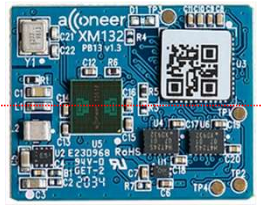
-90 +90

E-plane



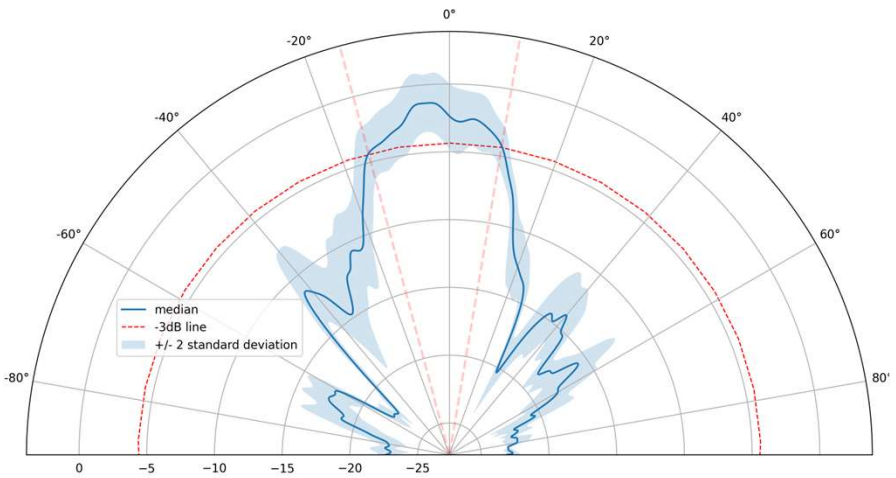
-90 +90

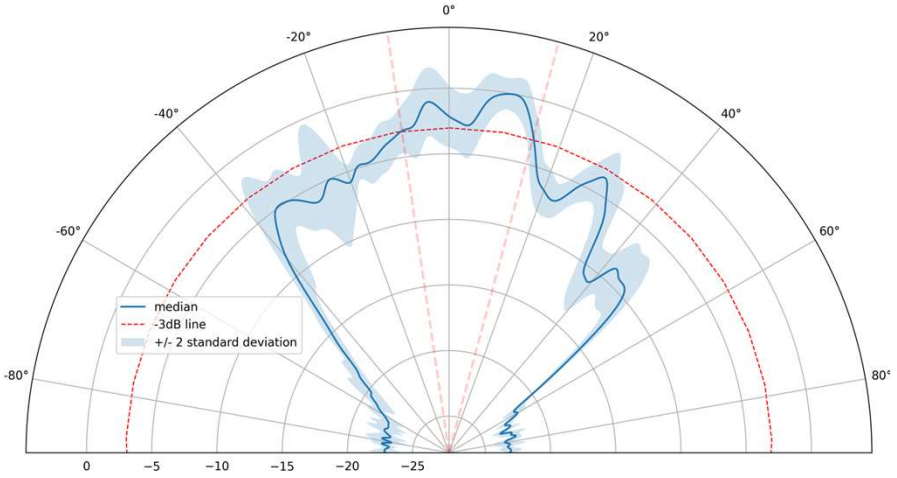
H-plane



Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

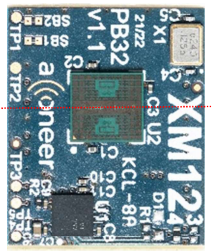
LH132+XE123/124 – flat cover, D1





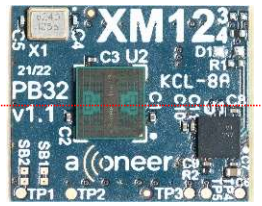
-90 +90

E-plane



-90 +90

H-plane



Maximum RLG is relative to the free-space boresight scenario.
RLGHPBW= median +/- 2 standard deviation over measured devices
RLGHPBW measurement setup tolerance=+/- 2 degrees

End Result LH112

HBL Lens in D1

XR112 used

The correctly assembled lens EVK should look like one of the examples in the pictures depending on chosen position.

FZP Lens in D1

XM/XB112 used

HBL Lens in D2

XR112 used

Cover, only in D1

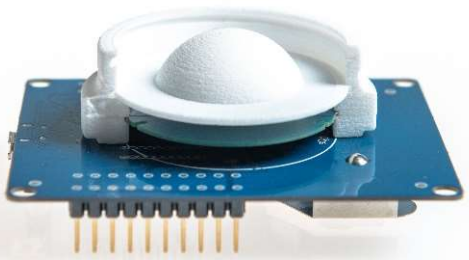
XM/XB112 used

FZP Lens in D2

XM/XB112 used

End Result LH122

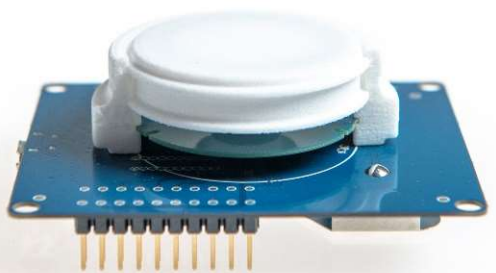
HBL Lens in D1



XM122 used

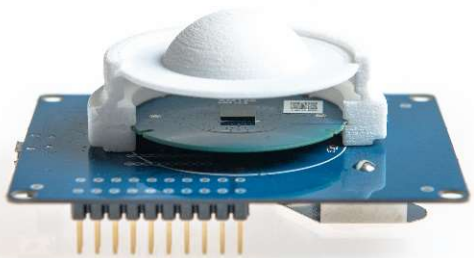
The correctly assembled lens EVK should look like one of the examples in the pictures depending on chosen position.

FZP Lens in D1



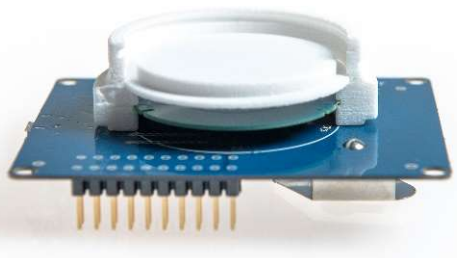
XM122 used

HBL Lens in D2



XM122 used

Cover, only in D1



XM122 used

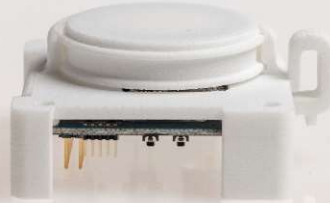
End Result LH132

HBL Lens in D1

XE132 used

The correctly assembled lens EVK should look like one of the examples in the pictures depending on chosen position.

FZP Lens in D1

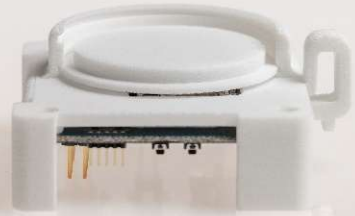


XE132 used

HBL Lens in D2

XE132 used

Cover, only in D1



XE132 used

FZP Lens in D2

XE132 used


aoneer