



Test report for

Bluetooth antenna for CIM module

This material is property of Grundfos Holding A/S
To be kept confidential

Summary	2G4 antenna for CIM form factor PCB
Author	Flemming Nørskov Larsen
Version	V01.00.00

1 CONTENTS

- 1 Contents..... 2
 - 1.1 Table of figures..... 3
 - 1.2 Table of tables 3
- 2 Test Report Overview..... 4
 - 2.1 Purpose of test 4
 - 2.2 Version history 4
 - 2.3 Terms & Abbreviations 4
 - 2.4 Conclusion..... 4
 - 2.5 Operator..... 4
 - 2.6 FAR site..... 4
 - 2.7 Measurements summary 5
 - 2.7.1 Antenna gain..... 5
 - 2.7.2 Radiated power 2402 MHz..... 6
 - 2.7.3 Radiated power 2426 MHz..... 7
 - 2.7.4 Radiated power 2480 MHz..... 8
 - 2.8 Antenna configuration..... 9
 - 2.9 Instrumentation..... 9
 - 2.10 FAR site..... 10
 - 2.11 Measurement setup..... 11

1.1 TABLE OF FIGURES

Figure 6:Polar plot 2402 MHz..... 6

Figure 7: Polar plot 2426 MHz..... 7

Figure 8: Polar plot 2480 MHz..... 8

Figure 9 Antenna circuit..... 9

1.2 TABLE OF TABLES

Table 1 Version history 4

Table 3 Terms & Abbreviations 4

2 TEST REPORT OVERVIEW

The test is performed in a 3 m anechoic room, the device under test is put on a turntable in a 3 m distance from a measuring antenna. The CIM550 is put into a CIU271 box to have a true indication of the performance. Cim 550 is measured in the planes X, Y, Z.

2.1 PURPOSE OF TEST

To verify first iteration of the Bluetooth antenna configuration, the antenna is a new configuration specially designed for the CIM550, the antenna form factor is changed due to space constraints.

The report is applicable for same configuration of different CIM modules, means e.g. CIM 280 MKII, CIM 290 LPWAN.

2.2 VERSION HISTORY

This table shows the version history of the document.

Date	Initials	Description	Version
2021-06-01	FNL	First draft	V00.00.01

Table 1 Version history

2.3 TERMS & ABBREVIATIONS

This table lists special terms and abbreviations, which are used throughout this document.

Term / Abbreviation	Explanation
PCB	Printed Circuit Board
HW	Hardware
dBm	Power referenced to 1 mW in 50 Ohms
EIRP	Equivalent Isotropic Radiated Power

Table 2 Terms & Abbreviations

2.4 CONCLUSION

The maximum gain is approximately in the range 1 dBi to 1,5 dBi, this is a decent value and will give a good user experience

2.5 OPERATOR

Flemming N. Larsen	Grundfos Holding A/S
--------------------	----------------------

Table 3 Operator

2.6 FAR SITE

Fully Anechoic Room 7.04m x 4.8m x 3.06 m (l x w x h)

Grundfos Holding A/S internal lab

2.7 MEASUREMENTS SUMMARY

Emitted power in dBm		Gain
X_2402 Measure ant. horisontal: Max	1,35	-1,15
X_2402 Measure ant. vertical: Max	-2,16	-4,66
X_2426 Measure ant. horisontal: Max	1,74	-0,76
X_2426 Measure ant. vertical: Max	-2,02	-4,52
X_2480 Measure ant. horisontal: Max	2,11	-0,39
X_2480 Measure ant. vertical: Max	-2,88	-5,38
Y_2402 Measure ant. horisontal: Max	0,51	-1,99
Y_2402 Measure ant. vertical: Max	4,03	1,53
Y_2426 Measure ant. horisontal: Max	0,69	-1,81
Y_2426 Measure ant. vertical: Max	3,84	1,34
Y_2480 Measure ant. horisontal: Max	0,48	-2,02
Y_2480 Measure ant. vertical: Max	3,59	1,09
Z_2402 Measure ant. horisontal: Max	1,84	-0,66
Z_2402 Measure ant. vertical: Max	0,32	-2,18
Z_2426 Measure ant. horisontal: Max	1,45	-1,05
Z_2426 Measure ant. vertical: Max	0,2	-2,3
Z_2480 Measure ant. horisontal: Max	0,65	-1,85
Z_2480 Measure ant. vertical: Max	0,14	-2,36

Table 4 Maximum EIRP

2.7.1 Antenna gain

The measurement data from the test site is EIRP, in order to have the antenna gain the TX feed power must be taken into account, the power fed into the antenna is 2,5 dB

2.7.2 Radiated power 2402 MHz

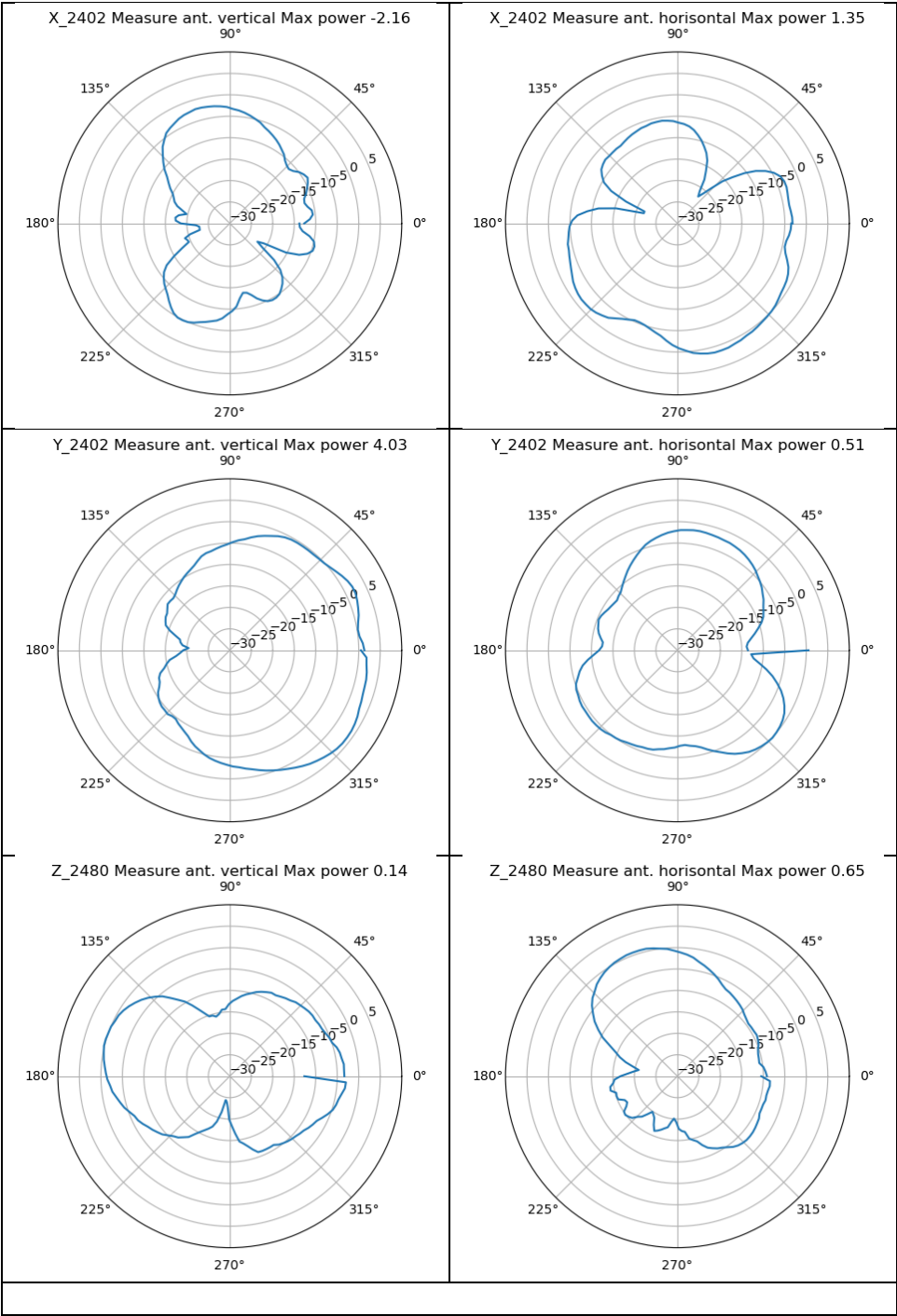


Figure 1:Polar plot 2402 MHz

2.7.3 Radiated power 2426 MHz

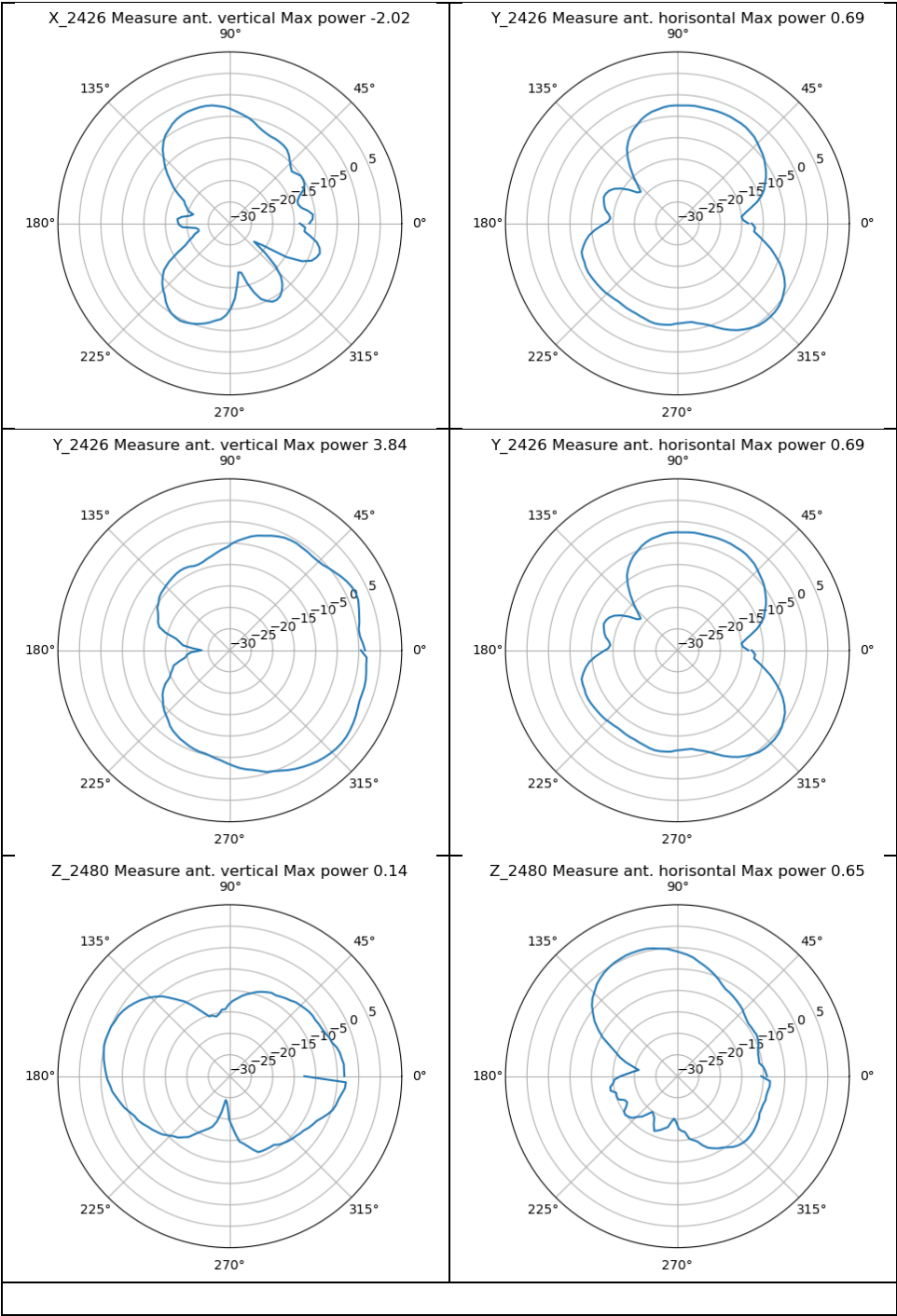


Figure 2: Polar plot 2426 MHz

2.7.4 Radiated power 2480 MHz

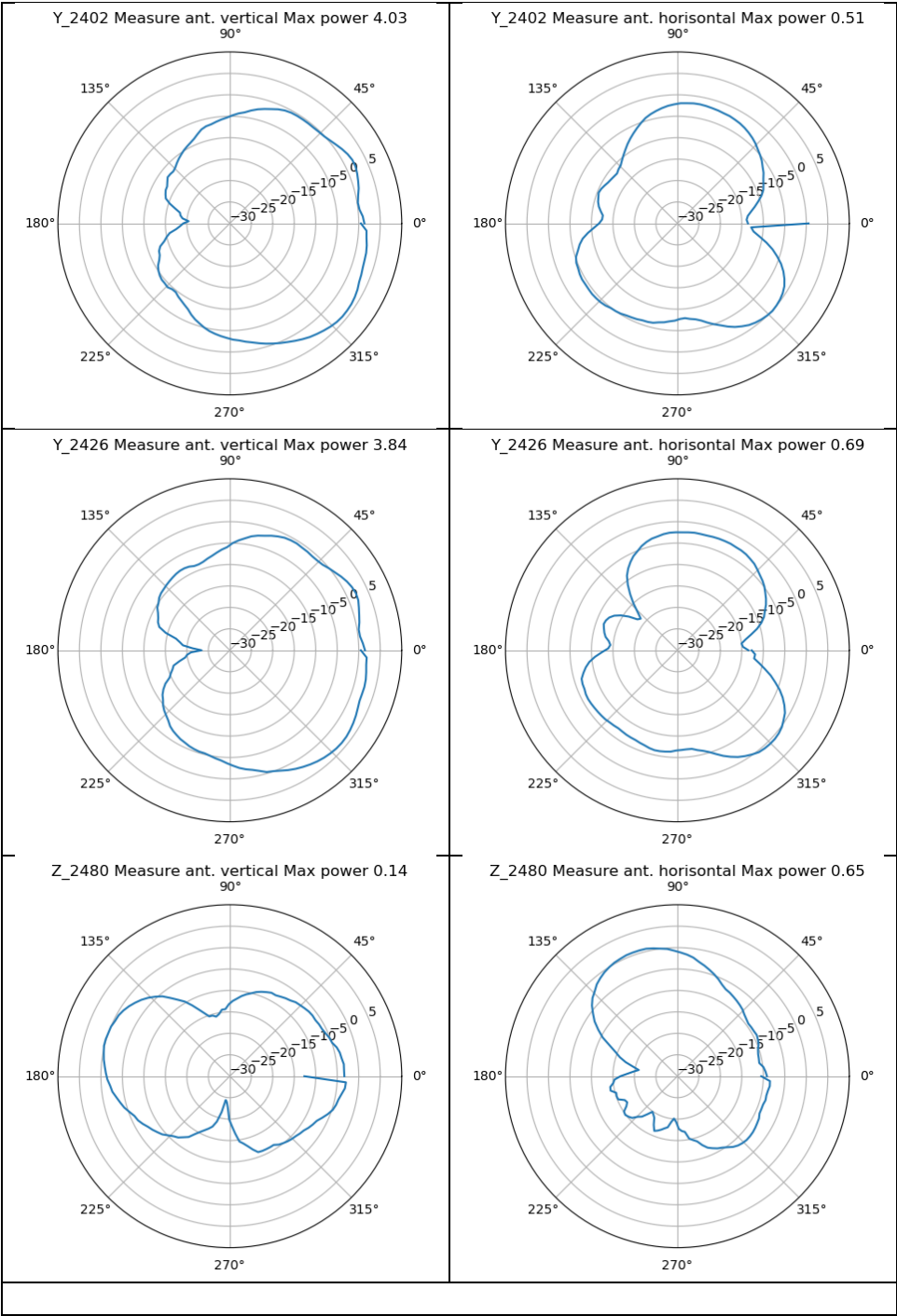


Figure 3: Polar plot 2480 MHz

2.8 ANTENNA CONFIGURATION

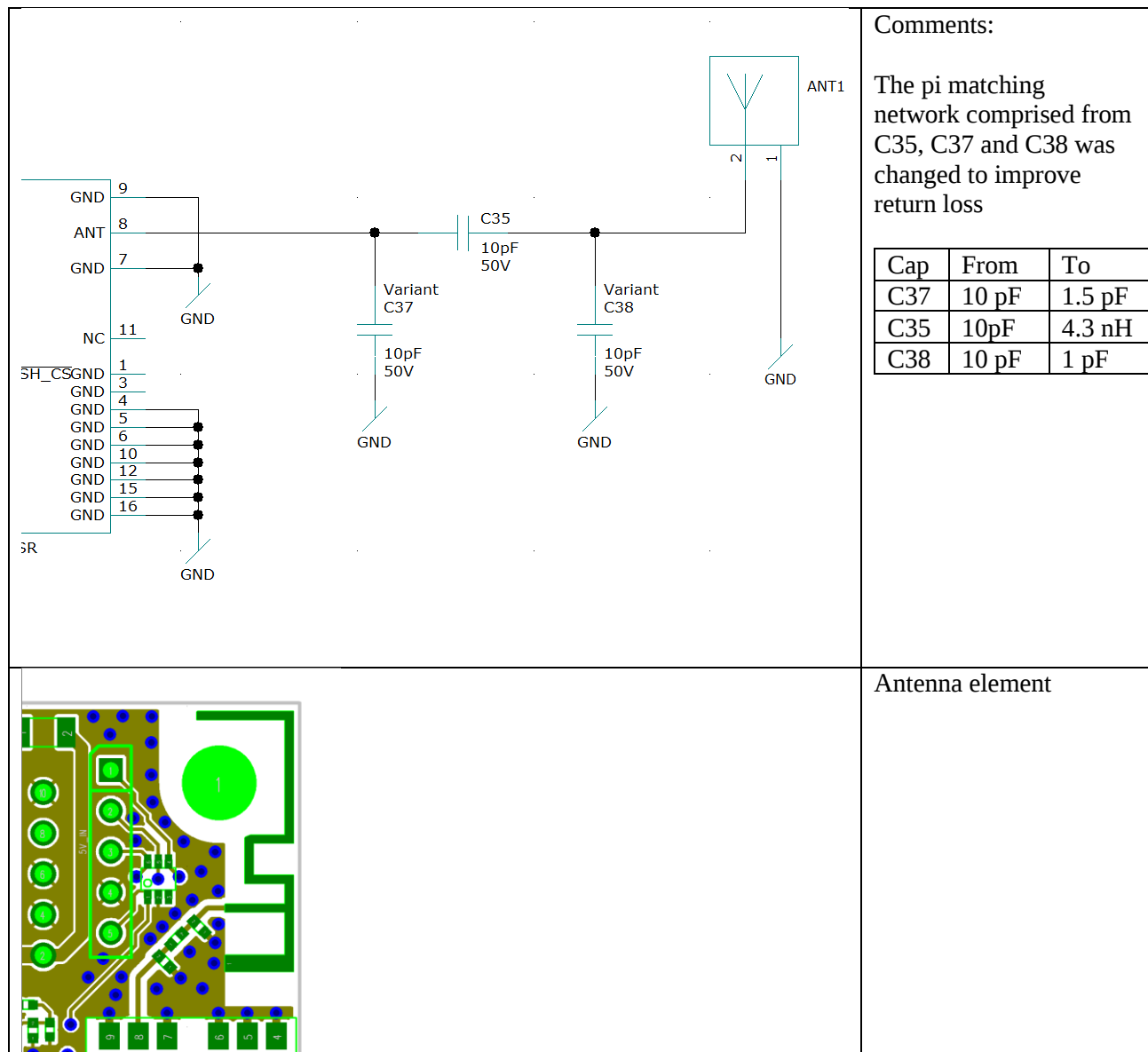


Figure 4 Antenna circuit

2.9 INSTRUMENTATION

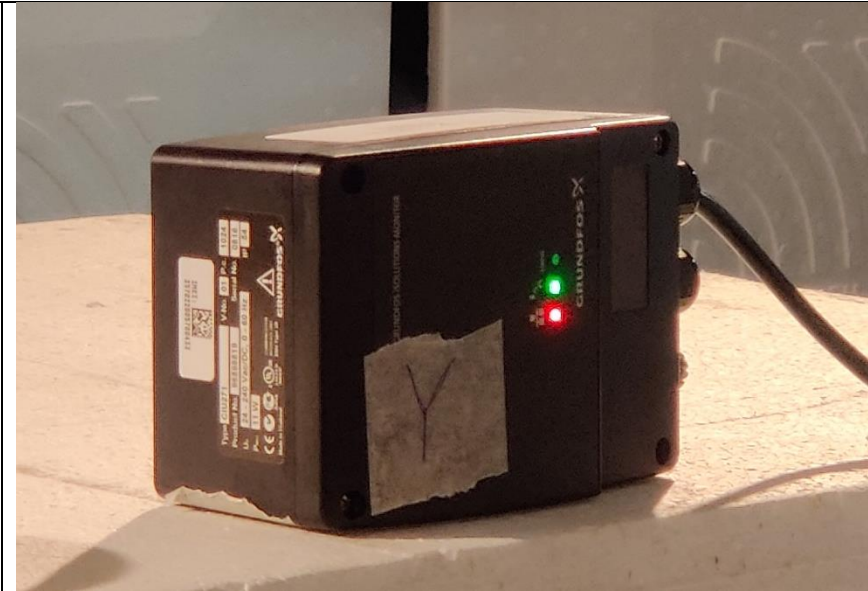
Device	Manufacturer	Asset no	Cal Expires
N9020 MXA Spectrum Analyzer	Keysight	529528	2022-24-11
Coax Cable SucoFlex 100	Huber-Suhner	S69	2022-11-11
Coax Cable SucoFlex 100	Huber-Suhner	S71	2022-11-11
Coax Cable SucoFlex 100	Huber-Suhner	S72	2022-11-11
EMCO 3115	ETS-Lindgreen	514231	2022-11-11
ANT_Test – meas. SW	Grundfos Holding		
FAR-3	Euroshield/ETS-Lindgren	271667	2022-16-11

Table 5 Terms & Abbreviations

2.10 FAR SITE

Fully Anechoic Room 7.04m x 4.8m x 3.06 m (l x w x h)

2.11 MEASUREMENT SETUP

 A black Grundfos pump unit is shown from a side-front perspective. A yellow label with 'For Field Test only' and 'GRUNDFOS' is attached. A white piece of paper with a handwritten 'X' is placed on the front. The unit is on a wooden surface.	 A black Grundfos pump unit is shown from a side-front perspective. A white piece of paper with a handwritten 'Y' is placed on the front. The unit is on a wooden surface.	 A black Grundfos pump unit is shown from a side-front perspective. A yellow label with 'For Field Test only' and 'GRUNDFOS' is attached. A white piece of paper with a handwritten 'Z' is placed on the front. The unit is on a wooden surface.
X plane measurements	Y plane measurements	Z plane measurements

