

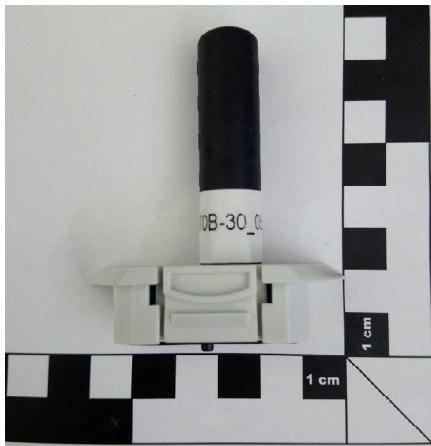
AUT report for SDR operation of Kamstrup helix antenna
As per "35-Part-15-Antenna-Updates-TCB_Oct_2022.pdf"

Tested by	kamstrup a/s				
Address	Industrivej 28, Stilling dk-8660 Skanderborg				
Contact	TEL: +45 89 93 10 00 FAX: +45 89 93 10 01 E-MAIL: kamstrup@kamstrup.dk WEB: www.kamstrup.com				
Test specification	EN/IEC 61000-4-3 (M-CDC)				
Device under test					
Antenna type	Helix				
Reference	30261216				
Use	The antenna is used with Kamstrup meters KWM2220 and KWM3220 both approved under FCC id OUY-KWMX220.				
Test results		Frequency	902 MHz	915 MHz	928 MHz
		Peak Gain	-2 dBi	-2 dBi	-3 dBi
		Total efficiency	-4 dB	-5 dB	-5 dB
		Directivity	2 dBi	2 dBi	2 dBi
Test conditions					
Temperature	20 oC - 22 oC / 68 oF - 72 oF				
Date	2022.06.30				
Test by	Kamstrup				
Report					
Date	2023.07.12				
Report by	Kamstrup				

Contents

1	EQUIPMENT UNDER TEST	3
2	SUPPORT EQUIPMENT	3
3	TEST SETUP	3
4	RESULTS	5
4.1	SOURCE OF ANTENNA GAIN INFORMATION	5
4.2	MAX GAIN, POLARIZATION, Θ, ϕ AND RADIATION PLOTS FOR MAX GAIN PLANE	6
4.2.1	RADIATION PLOTS AT 902 MHz	6
4.2.2	RADIATION PLOTS AT 915 MHz	7
4.2.3	RADIATION PLOTS AT 928 MHz	8

1 Equipment under test

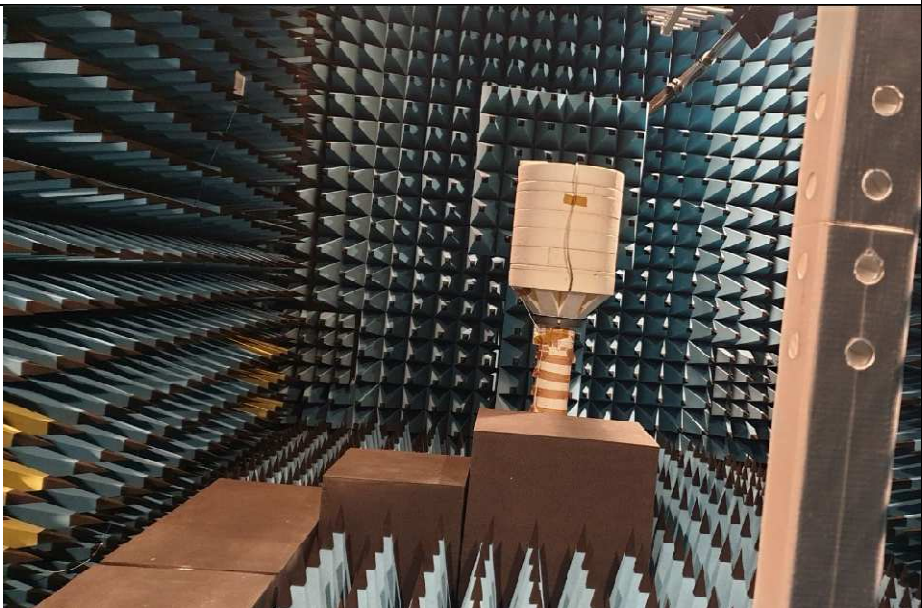
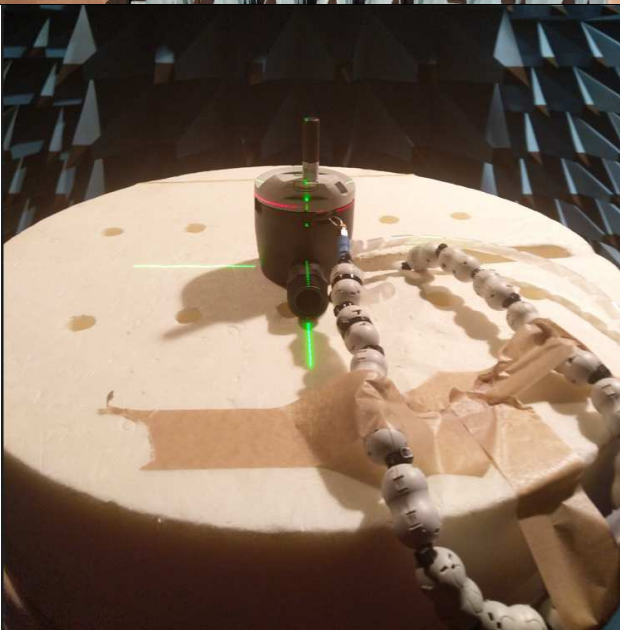
Description	Proprietary helix antenna designed specifically for Kamstrup KWM series water meters
Electric specification	
Frequency range:	902 - 928 MHz
Impedance:	50 Ohm
VSWR:	3:1
Gain:	0 dBi
Radiation	Omnidirectional
Polarization	Linear
Mechanical specification	
Connector	Proprietary
Material	
Helix	Metal
Dielectric	Poly Carbonate
Temperature	
Operational	-20 °C - 55 °C / 32 °F - 131°F
Storage	-20 °C - 55 °C / 68°F - 131°F
Design	
Antenna information used for conformity with limits	Spurious emission measurements were performed with the antenna mounted on the DUT in reports G0M-2211-1783-EF0115B and G0M-2211-1783-TFC247DT. The maximal in-band gain is used for calculations of exposure in report G0M-2211-1783-TFC91MP.

2 Support Equipment

Housing	KWM 2220 meter shell
----------------	----------------------

3 Test setup

Method	Full 3D antenna measurements in the anechoic chamber
Chamber certification	Shielding Efficiency: EN 50147-1 (M-CDC, AR and AC) Field Uniformity: EN 61000-4-3 (M-CDC) FS-NSA and VSWR: CISPR 16-1-4 (M-CDC)
Site/equipment information:	

Test Chamber	Antenna Chamber AC and Pre-Compliance EMC Chamber M-CDC, AlbatrossProjects 003-008-017/14E
Test Equipment	
Network analyzer	Rohde & Schwarz, ZVL6
Antenna	The Howland Company, QR-3A
Theta Axis Boom	Maturo
Phi Axis Turntable	Maturo
Antenna/equipment calibration status:	
ZVL6:	Calibrated 2021-08-26, by Rohde & Schwarz Certificate number 1700-00950-039
Antenna	Verified on 2021-08-24 by Kamstrup technical personnel
Boom	Verified on 2021-08-24 by Kamstrup technical personnel
Turntable	Verified on 2021-08-24 by Kamstrup technical personnel
Full system	Verified on 2021-08-24 by Kamstrup technical personnel
Test software	AMS32 antenna test suit from Rohde & Schwarz
Test setup	
Anechoic chamber	
Antenna Placement	

Additional equipment	The antenna was mounted on a KWM meter, where the signal to the antenna was fed through a coaxial cable.
----------------------	--

4 Results

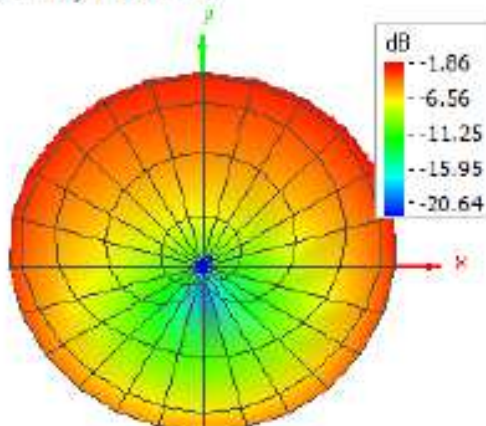
4.1 Source of antenna gain information

The antenna gain was characterized with 3D measurements performed with the system and methods described in section above.

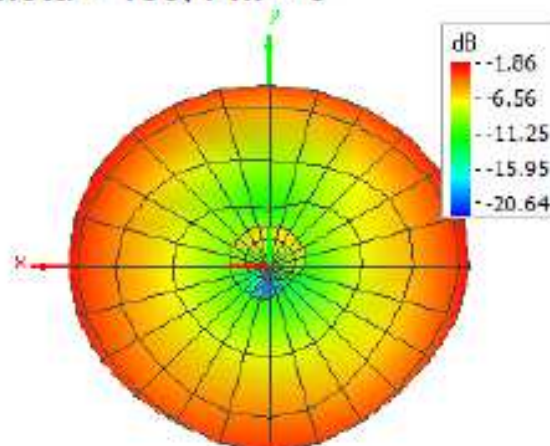
4.2 Max gain, polarization, θ , ϕ and radiation plots for max gain plane

4.2.1 Radiation plots at 902 MHz

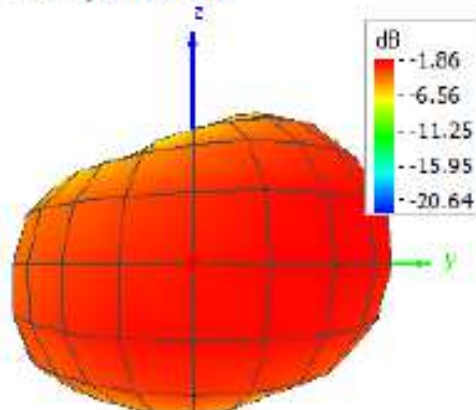
Theta = 0, Phi = 0



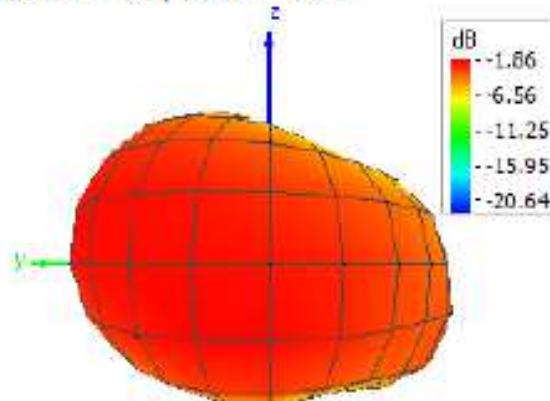
Theta = 180, Phi = 0



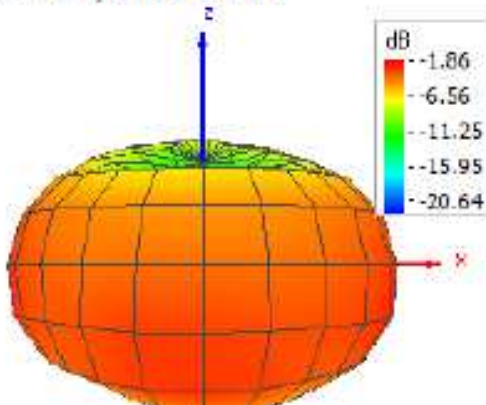
Theta = 90, Phi = 0



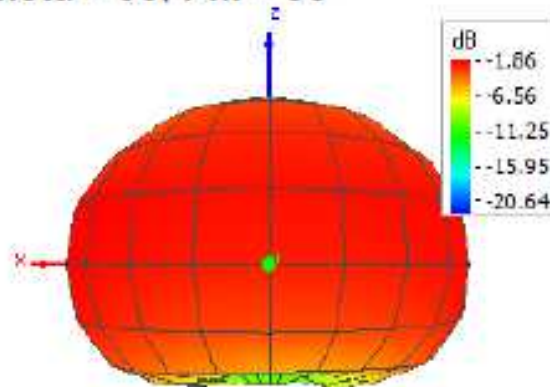
Theta = 90, Phi = 180



Theta = 90, Phi = 270

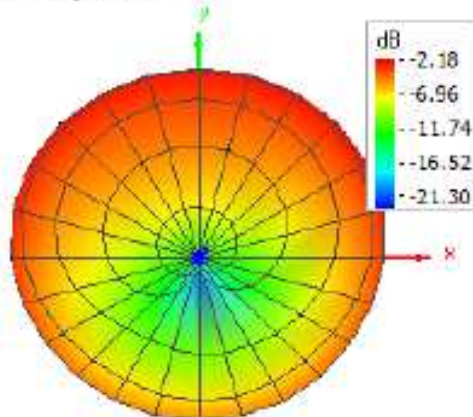


Theta = 90, Phi = 90

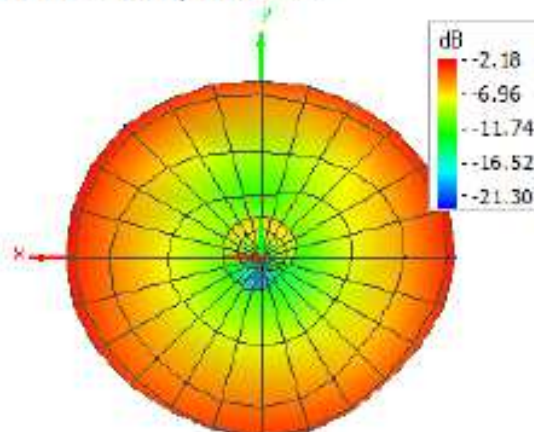


4.2.2 Radiation plots at 915 MHz

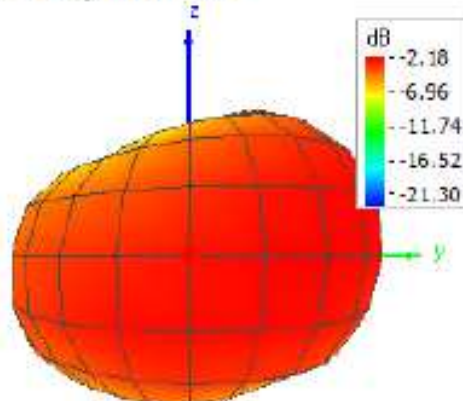
Theta = 0, Phi = 0



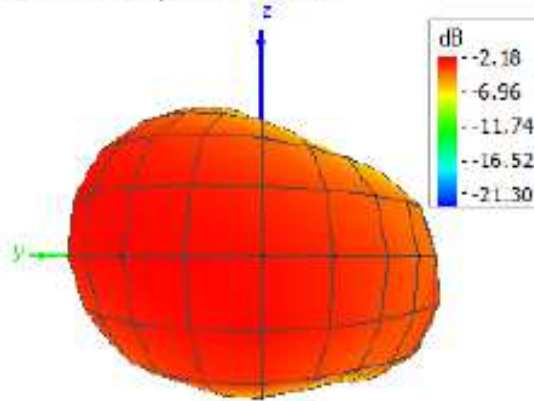
Theta = 180, Phi = 0



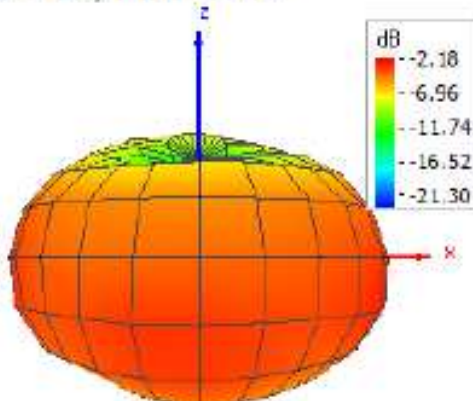
Theta = 90, Phi = 0



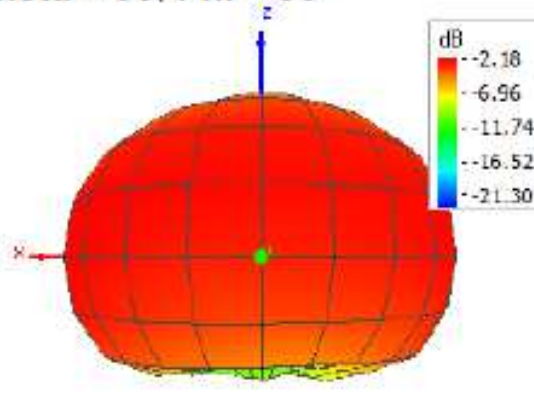
Theta = 90, Phi = 180



Theta = 90, Phi = 270

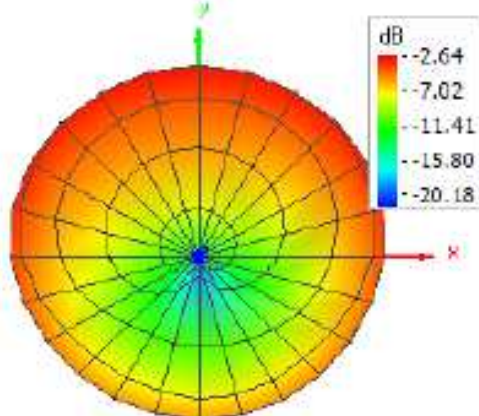


Theta = 90, Phi = 90

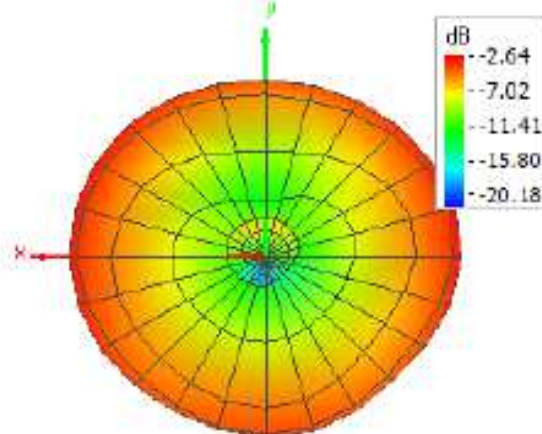


4.2.3 Radiation plots at 928 MHz

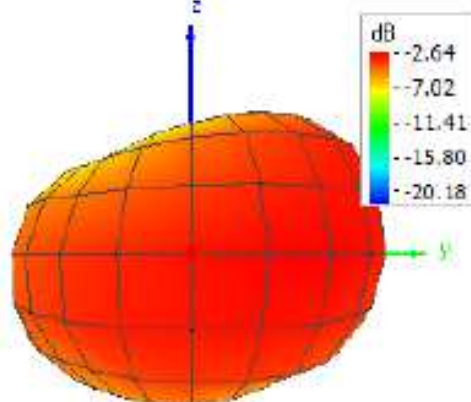
Theta = 0, Phi = 0



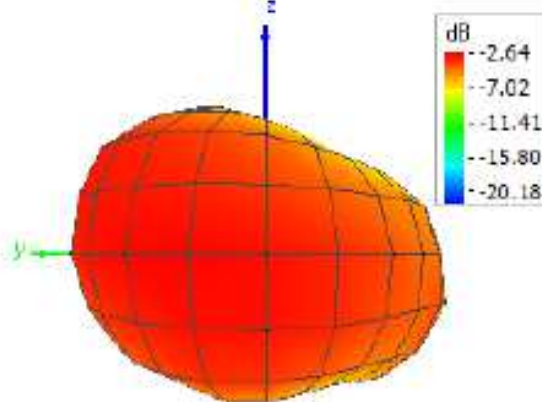
Theta = 180, Phi = 0



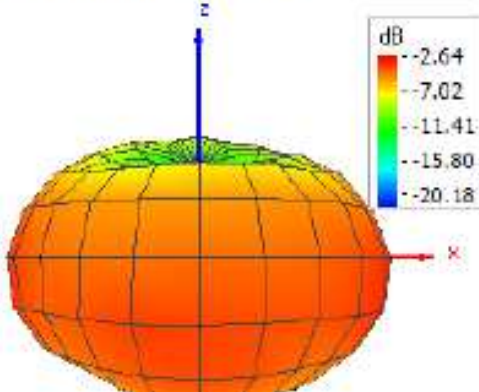
Theta = 90, Phi = 0



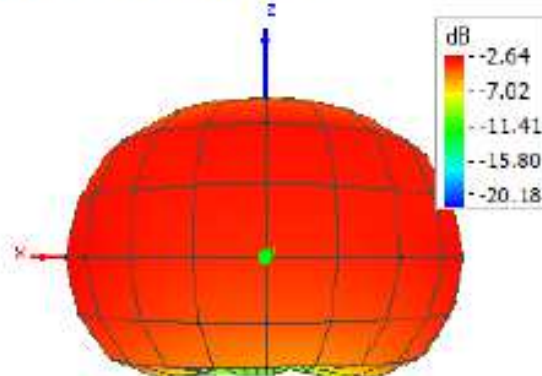
Theta = 90, Phi = 180



Theta = 90, Phi = 270



Theta = 90, Phi = 90



5 Signature

A handwritten signature in black ink, appearing to read 'Frederik S.' with a stylized flourish at the end.

Frederik Grandt Søndergaard
Product Manager
Water Division
Direct phone: +45 89 93 10 00
E-mail: fgrs@kamstrup.com