AUT report for SDR operation of Kamstrup pit antenna

As per "35-Part-15-Antenna-Updates-TCB_Oct_2022.pdf"

Tested by	kamstrup a/s
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Device under test	
Antenna type	Monopole
Reference	6697916, 6697914 and 9967915
Use	The antenna is used with Kamstrup meters KWM2220 and KWM3220 both approved under FCC id OUY-KWMX220.
Test results	
Test conditions	
Temperature	20 oC - 22 oC / 68 oF - 72 oF
Date	2023.07.12
Test by	Kamstrup
Report	
Date	2024.02.20
Report by	Kamstrup

Frequency	902 MHz	915 MHz	928 MHz
Peak Gain	-2 dBi	-3 dBi	-5 dBi
Total efficiency	-6 dB	-7 dB	-8 dB
Directivity	4 dBi	4 dBi	3 dBi

Contents

1 Equipment under test

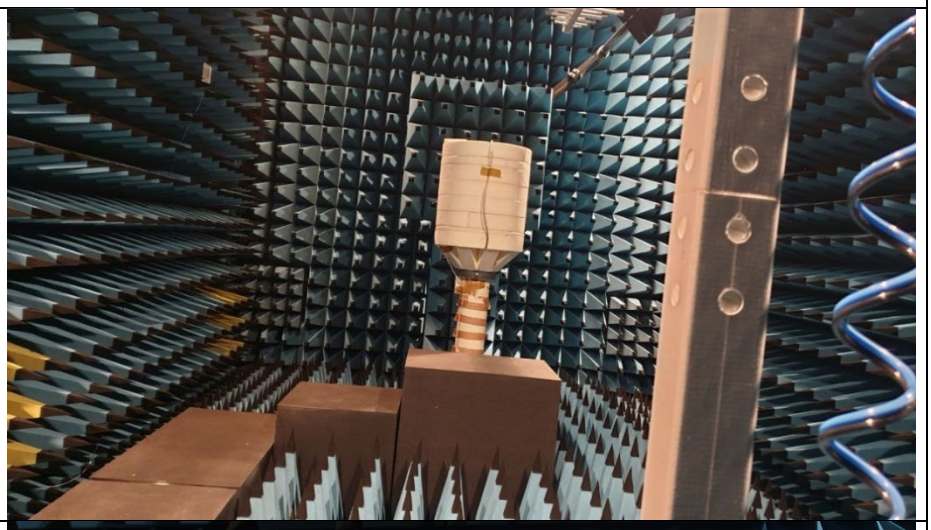
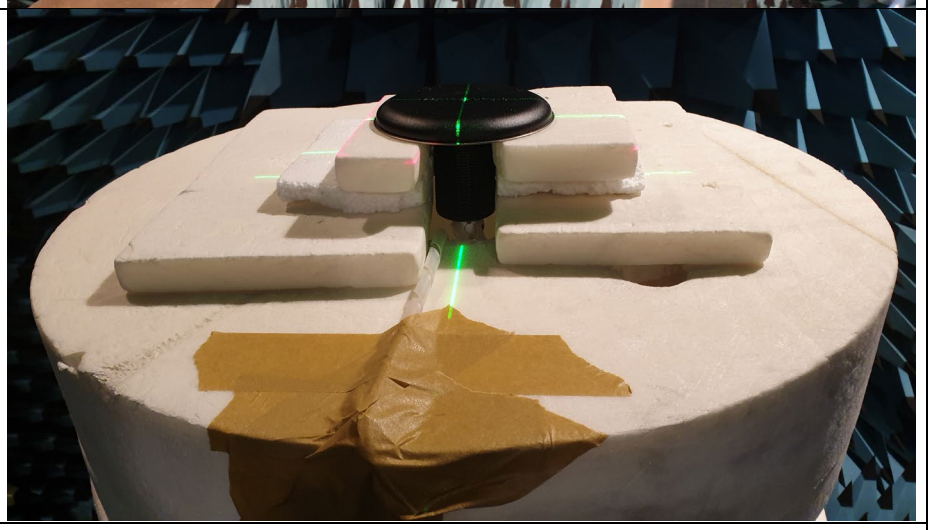
Description	Proprietary antenna for use if the meter is placed in a pit. It is designed specifically for Kamstrup KWM series water meters. The antenna comes with either 0.6- 2- or 7.5-meter cable. Hence three references numbers 6697916, 6697914 and 9967915 refer to this antenna. The highest values of gain are achieved by the pit antenna with the shortest cable. Hence, the measured data refers to the pit antenna with the shortest cable.
Electric specification	
Frequency range:	902 - 928 MHz
Impedance:	50 Ohm
VSWR:	3:1
Gain:	3.5 dBi
Radiation	Omnidirectional
Polarization	Linear
Mechanical specification	
Connector	Proprietary
Material	
Radiator	Metal
Dielectric	Polycarbonate + Urethane
Temperature	
Operational	-20 ºC - 55 ºC / 32 ºF - 131ºF
Storage	-20 ºC - 55 ºC / 68ºF - 131ºF
Design	
Antenna information used for conformity with limits	Spurious emission measurements were performed with the antenna mounted on the DUT in reports G0M-2311-2314-TFC090PMR and G0M-2311-2314-TFC247DT. The maximal in-band gain is used for calculations of exposure in reports G0M-2311-2314-TFC091MP and G0M-2311-2314-TIC091MP

2 Support Equipment

NA	

3 Test setup

Method	Full 3D antenna measurements in the anechoic chamber
Chamber certification	Shielding Efficiency: EN 50147-1

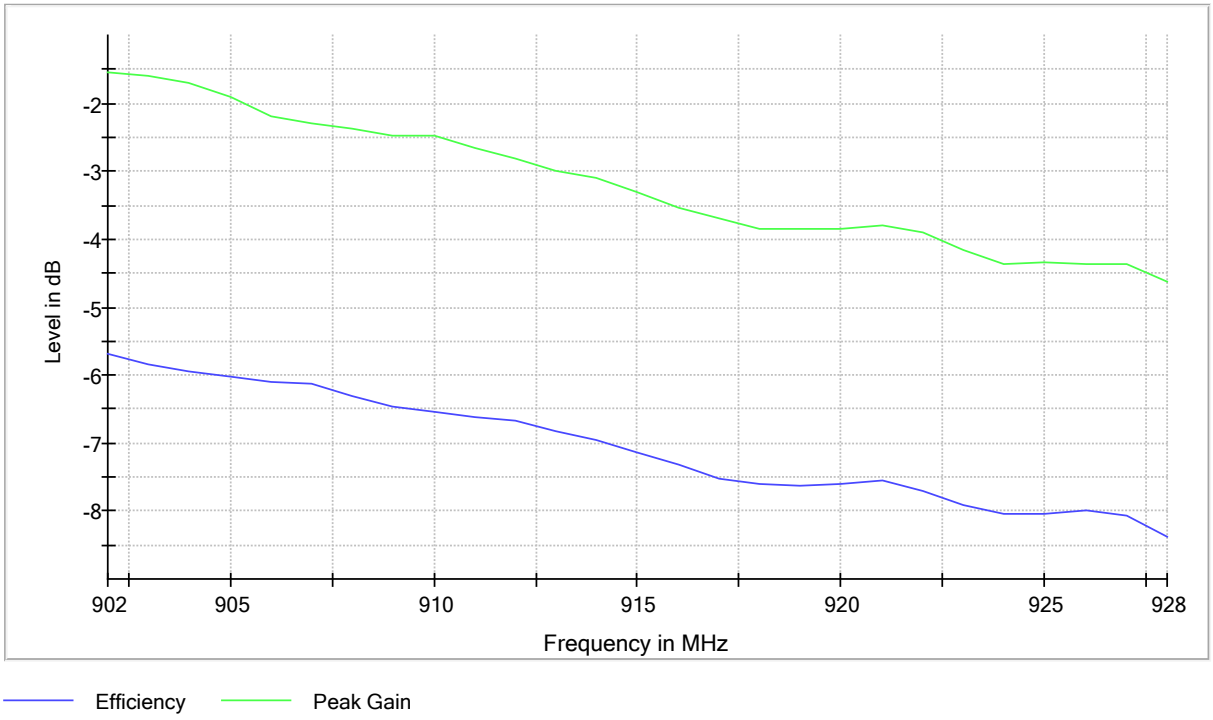
Site/equipment information:	
Test Chamber	Antenna Chamber AC and Pre-Compliance EMC Chamber M-CDC, AlbatrossProjects 003-008-017/14E
Test Equipment	
Network analyzer	Rohde & Schwarz, ZVL6
Antenna	The Howland Company, QR-3A
Theta Axis Boom	Maturo
Phi Axis Turntable	Maturo
Antenna/equipment calibration status:	
ZVL6:	Calibrated 2023-01-27, by Rohde & Schwarz Certificate number 0001-300683390
Antenna	Verified on 2023-02-13 by Kamstrup technical personnel
Boom	Verified on 2023-02-13 by Kamstrup technical personnel
Turntable	Verified on 2023-02-13 by Kamstrup technical personnel
Full system	Verified on 2023-02-13 by Kamstrup technical personnel
Test software	AMS32 antenna test suit from Rohde & Schwarz
Test setup	
Anechoic chamber	
Antenna Placement	
Additional equipment	NA
Signal feed	The signal was fed through an SMA adaptor

4 Results

4.1 Source of antenna gain information

The antenna efficiency and peak gain was measured across the supported frequency band, while gain was characterized with 3D measurements performed with the system and methods described in section above.

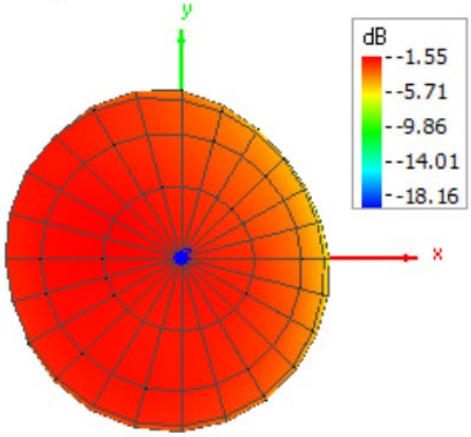
4.2 Peak gain and efficiency across the tested band



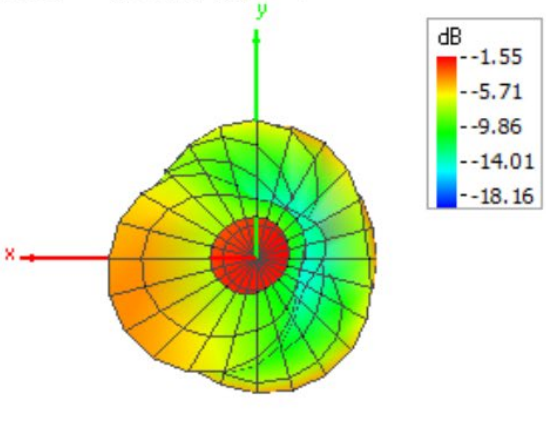
4.3 Max gain, polarization, θ, ϕ and radiation plots for max gain plane

4.3.1 Radiation plots at 902 MHz

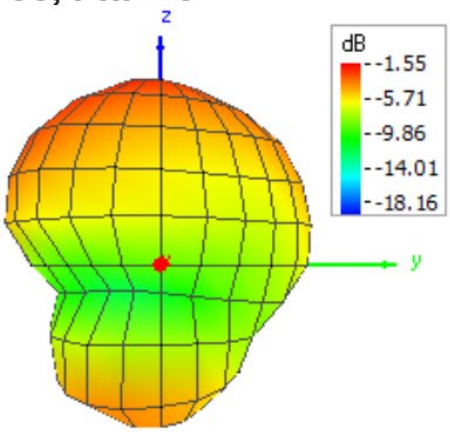
Theta = 0, Phi = 0



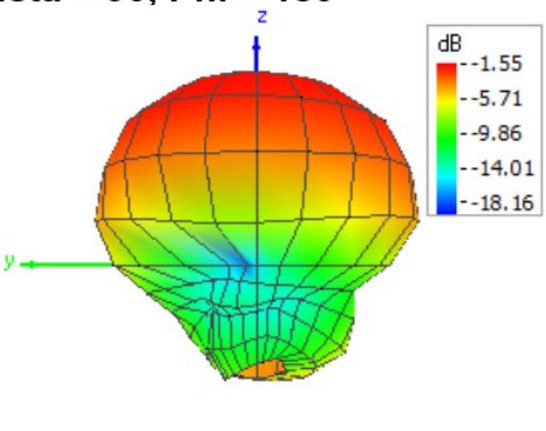
Theta = 180, Phi = 0



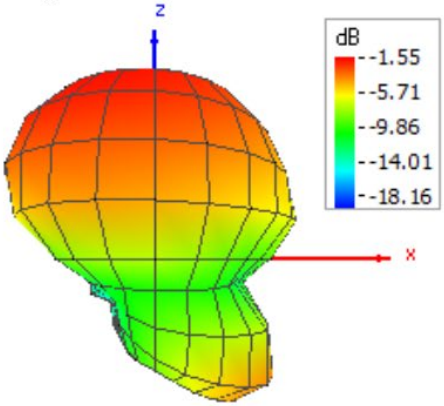
Theta = 90, Phi = 0



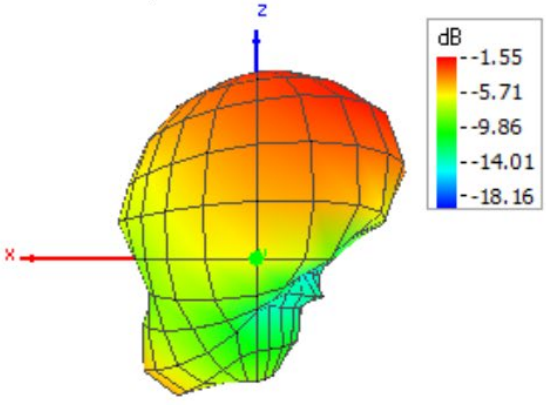
Theta = 90, Phi = 180



Theta = 90, Phi = 270

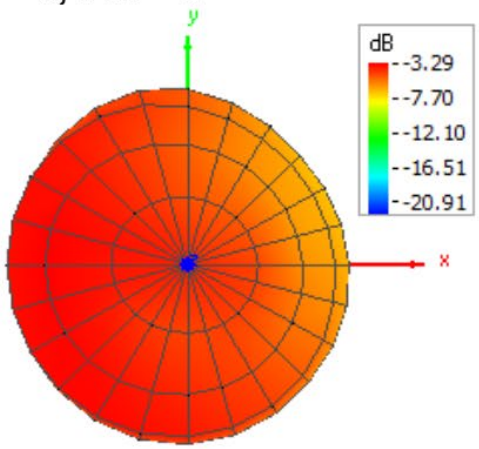


Theta = 90, Phi = 90

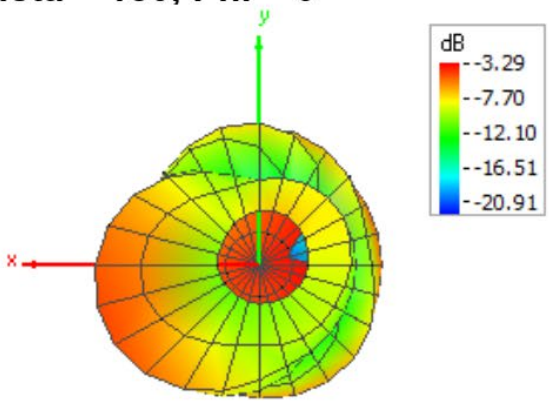


4.3.2 Radiation plots at 915 MHz

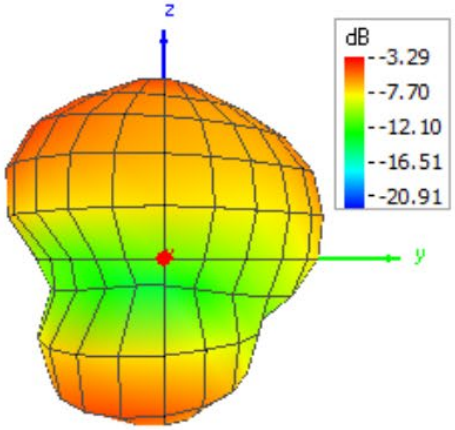
Theta = 0, Phi = 0



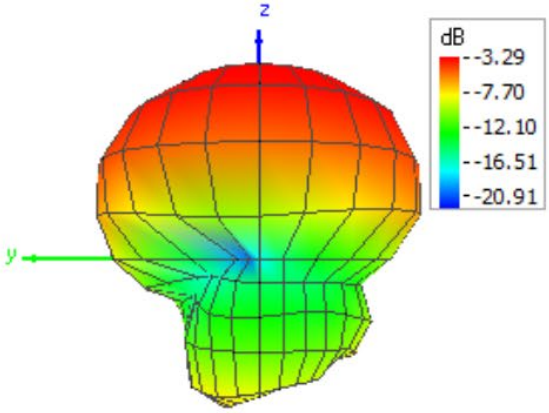
Theta = 180, Phi = 0



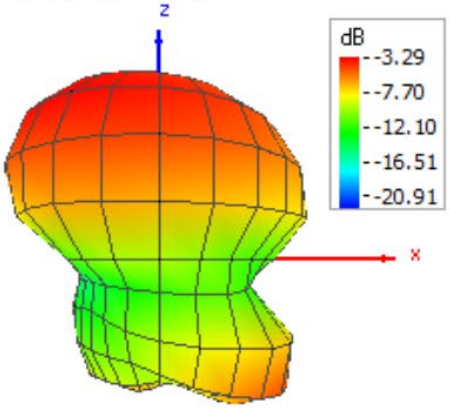
Theta = 90, Phi = 0



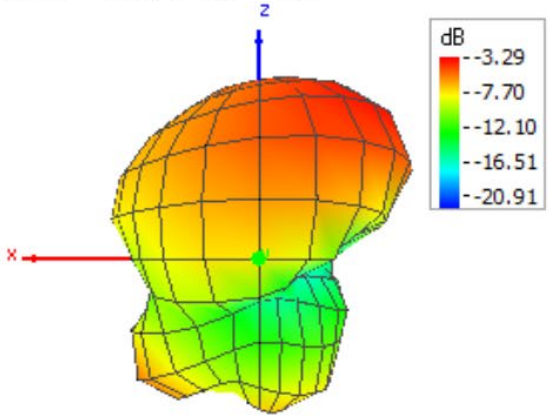
Theta = 90, Phi = 180



Theta = 90, Phi = 270

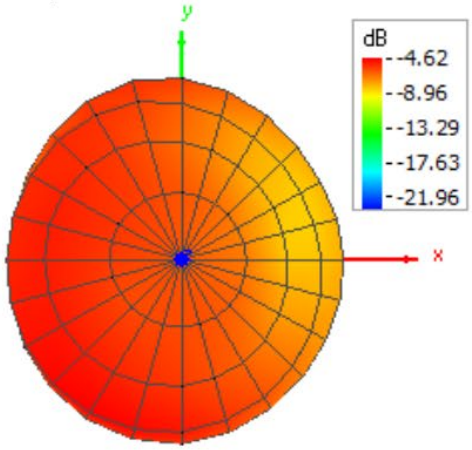


Theta = 90, Phi = 90

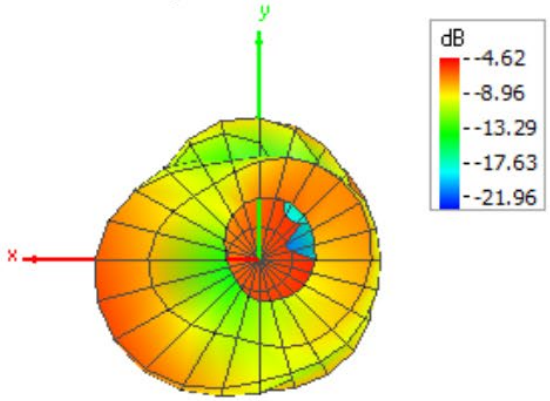


4.3.3 Radiation plots at 928 MHz

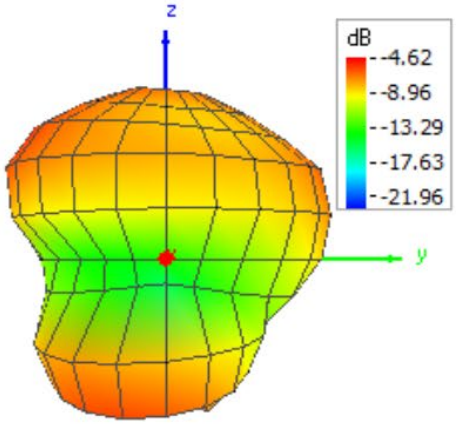
Theta = 0, Phi = 0



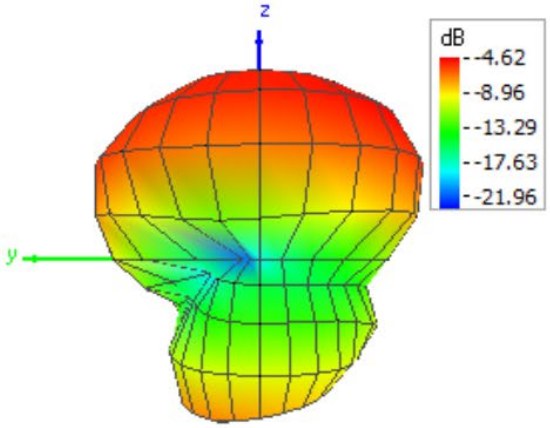
Theta = 180, Phi = 0



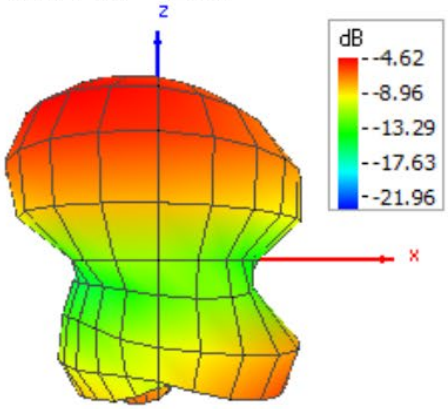
Theta = 90, Phi = 0



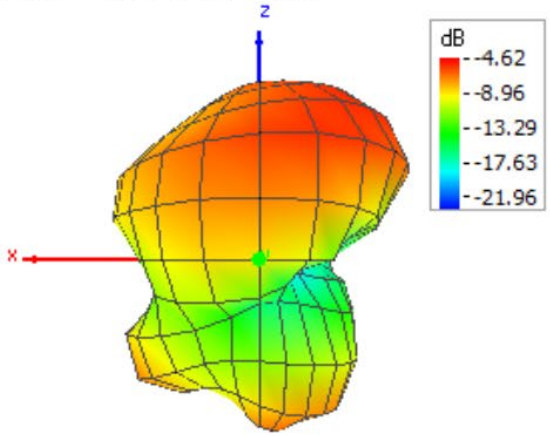
Theta = 90, Phi = 180



Theta = 90, Phi = 270



Theta = 90, Phi = 90



5 Signature

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