

7 Annex A: MPE calculation

7.1 Antenna configurations

The EUT can be used with different antenna configurations:

- Internal PCB-antenna
- External window-antenna
- External roof-antenna

The EUT is equipped with a switching MCX-connector to switch between internal and external antenna.

Maximum conducted output power configurations:

850 MHz:	GPRS multi-slot class 12	1.779 W
1900 MHz:	GPRS multi-slot class 12	0.832 W

Maximum antenna gain for internal PCB-antenna

850 MHz:	Gain -0.2 dBi
1900 MHz:	Gain 0.5 dBi

Maximum antenna Gain for external window-antenna (datasheet in chapter 7.3)

850 MHz:	Gain 2.15 dBi
1900 MHz:	Gain 2.15 dBi

Maximum antenna Gain for external roof-antenna (datasheets in chapter 7.3)

850 MHz:	Gain 11.0 dBi (antenna)
1900 MHz:	Gain 11.0 dBi (antenna)

This antenna will be delivered with 10 m antenna cable and an attenuator of 3 dB.

So the effective gain can be calculated as follows:

Gain = Gain(Antenna) – Attenuation(attenuator) – Attenuation(cable)

850 MHz: **Gain_(eff) = 11 dBi – 3 dBi – 10*0.45 dB/m = 3.5 dBi**

1900 MHz: **Gain_(eff) = 11 dBi – 3 dBi – 10*0.72 dB/m = 0.8 dBi**

7.2 MPE calculation

Maximum possible radiated output power configurations

850 MHz: 32.5 dBm + 3.5 dBi = 36.0 dBm = 4000 mW (EIRP) = 2432 mW (ERP) (with roof-antenna)

1900 MHz: 29.2 dBm + 2.15 dBi = 31.35 dBm = 1370 mW (EIRP) (with window-antenna)

Maximum permissive exposure (MPE)

850 MHz: Limit 0.57 mW/cm²

$$PD = P_{\text{rad}} * DF / (4 * \pi * r^2)$$

$$PD = 4000 \text{ mW} * 0.5 / (4 * \pi * 20^2 \text{ cm}^2)$$

$$PD = 0.398 \text{ mW/cm}^2$$

Result: The device complies with the rules for a distance of 20 cm.

1900 MHz: Limit 1.00 mW/cm²

$$PD = P_{\text{rad}} * DF / (4 * \pi * r^2)$$

$$PD = 1370 \text{ mW} * 0.5 / (4 * \pi * 20^2 \text{ cm}^2)$$

$$PD = 0.136 \text{ mW/cm}^2$$

Result: The device complies with the rules for a distance of 20 cm.

PD = Power Density

P_{rad} = Maximum radiated output power in mW

DF = Duty factor

r = Distance in cm

7.2.1 RF Technical Brief Cover Sheet acc. To RSS-102

All Fields must be completed with the requested information or the following codes: N/A for Not Applicable, N/P for Not Performed or N/V for Not Available. Where applicable, check appropriate box.

1. COMPANY NUMBER: **287X**
2. MODEL NUMBER: **MBR W30MBR W30**
3. MANUFACTURER: **Ericsson AB PDU RAN Transmission & Home Ericsson AB**
4. TYPE OF EVALUATION: **(c) RF Evaluation**

- Evaluated against exposure limits: General Public Use Controlled Use
- Duty cycle used in evaluation: 100 %
- Standard used for evaluation: RSS-102 Issue 2 (2005-11)
- Measurement distance: 0.20 m
- RF value: 3.98 V/m A/m W/m² (850 MHz)
- RF value: 1.36 V/m A/m W/m² (1900 MHz)

Measured Computed Calculated

Declaration of RF Exposure Compliance

ATTESTATION:

I attest that the information provided in this test report are correct; that a Technical Brief was prepared and the information it contains is correct; that the device evaluation was performed or supervised by me; that applicable measurement methods and evaluation methodologies have been followed and that the device meets the SAR and/or RF exposure limits of RSS-102.

Name: Stefan Boes
Title: Dipl.Ing.(FH)
Company: Cetecom ICT Services GmbH

7.3 Data sheets

7.3.1 Window antenna

UMTS Window Antenna

The UMTS window antenna is an optional accessory to Ericsson's Fixed Wireless Terminal W2x product series.

Ericsson part no: KRE 105 179

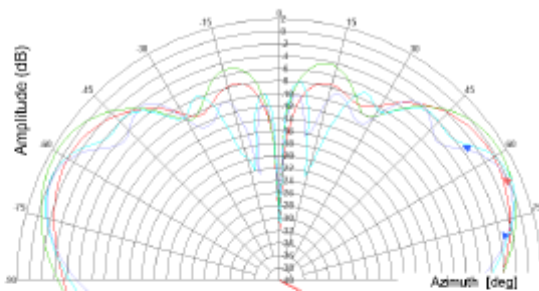
Specification:

Color: Black
 Operating frequency: 824-960, 1710-2170 MHz
 Polarization type: Linear, vertical
 Azimuth beam: Omni-directional
 Gain: 2.15 dBi
 Impedance: 50 Ohm nominal
 V.S.W.R: 2.0:1 Max
 Connector: SMA
 Antenna cable: 2.6 meter
 Dimensions: $\varnothing 27 \times 53$ mm
 Weight: 140 g (including ground plane)
 RoHS compliant: Yes
 Documentation: Printed installation guide included

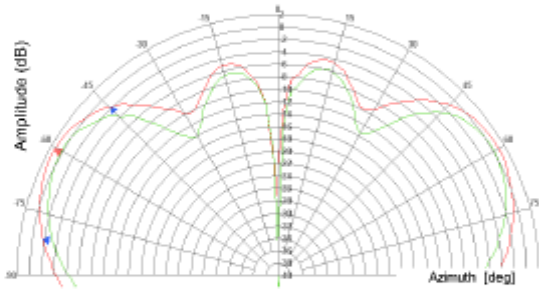
Mounting: Magnet on metal surfaces or suction cap on smooth vertical surfaces such as windows



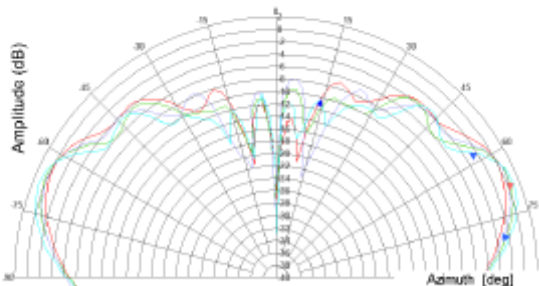
Radiation pattern
Elevation gain:



Red 824 MHz
 Green 894 MHz
 Purple 1850 MHz
 Cyan 1990 MHz



Red 890 MHz
 Green 960 MHz



Red 1710 MHz
 Green 1880 MHz
 Purple 1990 MHz
 Cyan 2170 MHz

7.3.2 Roof antenna



High Gain All-Band Cellular Antenna

824 - 1000 MHz and 1700 - 2170 MHz

Product code: LPDA-A0021



This high gain wideband directional antenna covers the GSM 900 and GSM1800 / UMTS bands. Its configuration is suitable for various cellular telephone systems.

Features:

- Broadband.
- Covers various international cellular bands.
- Robust and weatherproof

Application areas:

This antenna provides communications capabilities for the following:

Standard		Frequency (MHz)
TACS	Europe and Asia only	871 - 949
TDMA/CDMA/AMPS		824 - 894
SM "GSM 900"		870- 960
PDC Japan only		810 - 956
EGSM		806 - 869
GSM 1800 / PCS/ PCN		1710 - 1880
DECT		1880 - 1900
PHS	Japan, Taiwan and China only	1895 - 1918
GSM "GSM1900"	USA and Canada only	1850 - 1990
UMTS		1900 - 2170

Specifications:

Product Code:

LPDA-A0021	50 cm HDF195 with SMA(m) connector
LPDA-A0021-01	7 m HDF195 with SMA(m) connector

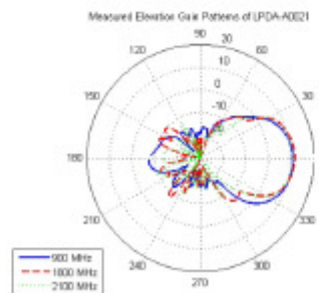
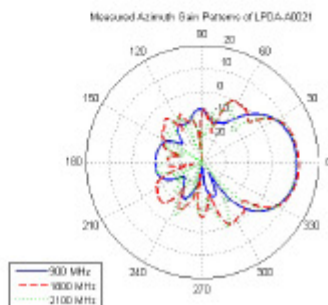
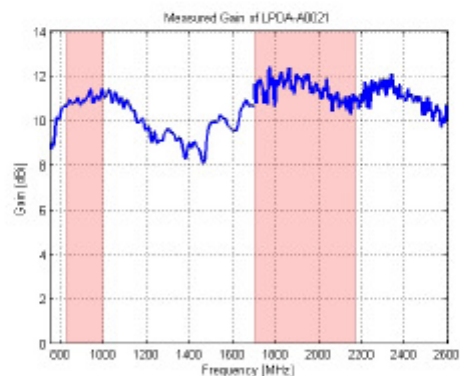
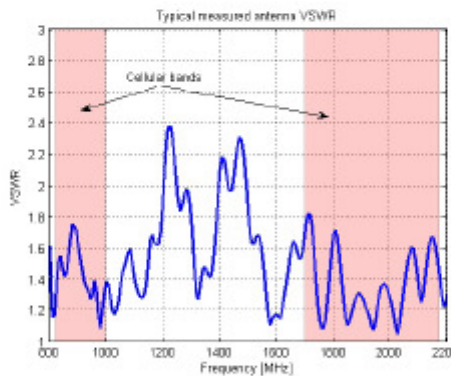
Electrical:

Gain (max)	11 dBi (± 0.5 dB)
Gain (min over band)	10.5 dBi (± 0.5 dB)
Frequency Band	824 - 1000 and 1700 - 2170 MHz
VSWR	< 2.5:1
Front to Back Ratio (F/B Ratio)	> 20 dB (nominal)
Feed power handling	10 W
Input impedance	50 Ohm (nominal)
Polarisation	Vertical

Mechanical:

Mounting	Pole or wall mount
Dimensions (l x w x h)	1010 mm x 200 mm x 50 mm
Weight	0.5 kg (including bracket)

Typical Antenna Measurements



LPDA-A0021_BROC Smarteq.odt

www.smarteq.com; info@smarteq.se

7.3.3 Attenuator

HUBER+SUHNER® DATA SHEET
RF ATTENUATORS: SERIES 66XX_SMA-50-1 (18 GHz)



Description

Standard Attenuator, Low Power

Type 66XX_SMA-50-1, for XX insert attenuation value in dB

For example for 3 dB attenuation insert "03" in the type code and write 6603_SMA-50-1



Product Configuration

Connectors (side 1 / side 2) SMA plug (male) / SMA jack (female)

Technical Data

Electrical Data

Nominal impedance	50 Ω
Attenuation values	from 1 up to 30 dB
Frequency range	DC to 18 GHz
Power rating	2 Watt average power to 25°C ambient temperature, linearly derated to 0.5 Watt at 125°C ambient temperature. 250 Watt peak power during max. 5 μs
Power Coefficient	0.001 dB/dB/W
Temp. Coefficient	0.0001 dB/dB/°C

Environmental Data

2002/95/EC (RoHS) compliant

Mechanical Data

Dimensions	9 / 8 / 21.8 (height / width / length coaxial in mm) until 20 dB 9 / 8 / 25.1 (height / width / length coaxial in mm) up to 21 dB
Weight	0.00419 kg

Material Data

Piece Part	Material	Surface Plating
Centre contacts	Copper-Beryllium Alloy	Gold Plating (Nickel underplated)
Outer contacts	Stainless steel	
Body	Stainless steel	
Insulator	PTFE	
Coupling Nut	Stainless steel	

Related Documents

Outline Drawing	DOU-00089028 until 20 dB DOU-00089053 up to 21 dB
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Ordering Information

Single Packing	66XX_SMA-50-1
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Additional Information

Remarks	
Interface dimensions acc. to	IEC 60169-15_MIL-STD-348/310_CECC 22110

HUBER+SUHNER® DATA SHEET
RF ATTENUATORS: SERIES 66XX_SMA-50-1 (18 GHz)



Type 66XX_SMA-50-1, for XX insert attenuation value in dB

For example for 3 dB attenuation insert "03" in the type code and write 6603_SMA-50-1

Nominal attenuation (dB)	Attenuation deviation max. over frequency (DC - 18 GHz) (dB)	VSWR max. *) over frequency (DC - 18 GHz)	Power	H+S type	Item number
1	+/-0.3	1.35	2 W	6601_SMA-50-1	84037360
2				6602_SMA-50-1	84030799
3				6603_SMA-50-1	84036313
4				6604_SMA-50-1	84034265
5				6605_SMA-50-1	84037413
6				6606_SMA-50-1	84037341
7	+/-0.5	1.35	2 W	6607_SMA-50-1	84037409
8				6608_SMA-50-1	84037387
9				6609_SMA-50-1	84037379
10				6610_SMA-50-1	84036459
15				6615_SMA-50-1	84037421
18				6618_SMA-50-1	84037417
20	6620_SMA-50-1	84037363			
30	+/-0.75	1.35	2 W	6630_SMA-50-1	84037371

The HUBER+SUHNER group is certified according to ISO 9001 and ISO 14001

WAIVER
 It is exclusively in written agreements that we provide our customers with warrants and representations as to the technical specifications and/or the fitness for any particular purpose. The facts and figures contained herein are carefully compiled to the best of our knowledge, but they are intended for general informational purposes only.

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7.3.4 Antenna cable

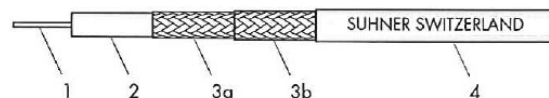


SUHNER® COAXIAL CABLE

TYPE: RG 223 /U

Item: 22510072

Cable design



1	Inner conductor	..... Silver-plated copper wire	.....	∅ 0.88 mm
2	Dielectric	..... Solid polyethylene (PE)	.....	∅ 2.95 mm
3	Outer conductor	a) Silver-plated copper braid	..... 96% coverage	∅ 3.60 mm
		b) Silver-plated copper braid	..... 94% coverage	∅ 4.20 mm
4	Jacket	..... Non-migratory PVC	..... bk (RAL 9005)	∅ 5.40 mm
	Print on jacket	..... SUHNER SWITZERLAND RG 223 /U 50 Ohm		

Electrical data

Typ. operating frequency	.....	(GHz)	≤ 5
Impedance	.....	(Ω)	50 ± 2
Capacitance	.....	(pF/m)	100.7
Relative signal propagation	.....	(%)	66.3
Signal delay	.....	(ns/m)	5.03
Phase stability	..... vs temperature	(°/GHz/m)	-
	..... vs bending	(°/GHz)	-
Insulation resistance	.....	(MΩm)	> 10 ⁸
Test voltage	..... 50 Hz / 1 min.	(kV _{rms})	5
Max. operating voltage	at sea level	(kV _{rms})	2.5
Typ. DC resistance	..... inner conductor	(Ω/km)	27.7
	..... outer conductor	(Ω/km)	6.7
Typ. screening effectiveness	..... 1 ... 300 MHz	(dB)	> 85

General data

Cable specification	..... cable design and materials in accordance with	.....	MIL-C-17/84
Temperature range	..... operating	(°C)	-40...+70
	..... installation	(°C)	-20...+60
Flame propagation	..... IEC 332-1	.....	n/a
Halogen content	..... IEC 754	.....	n/a
Typ. Weight	.....	(kg/100m)	5.5
Min. bending radius	..... for bending once	(mm)	30
	..... for repeated bendings	(mm)	55
	..... for flexible applications	(mm)	-

Suitable connectors

Cable group U9/U10
 For details refer to the "SUHNER[®] coaxial connector catalogue" or contact your nearest HUBER+SUHNER representative

Document No.:	01.03.0500	<i>Uncontrolled copy</i>	
Issue No.:	3	Issued/Checked/Released:	27.09.1997/486-thm
Supersedes:	0500/2	Last amended:	Modification of attenuation graph