SECTION A

Prepared (also subject responsible if other)		No.		
ERI/WP Roberto Crosta		1/102 65-UKL 601 04		
Doc respons/Approved	**Checked**	**Date**	**Rev**	**File**
ERI/W		2000-11-29	D	

Ericsson Type Acceptance Radio Transceiver
Test Report

Product description	31 GHz Hub and 31Ghz Subscriber Radio Transceiver
Product Number	UKL 601 04/xx
FCC ID	OOLUKL60104

Prepared (also subject responsible if other)		No.		
ERI/WP Roberto Crosta		1/102 65-UKL 601 04		
Doc respons/Approved	**Checked**	**Date**	**Rev**	**File**
ERI/W		2000-11-29	D	

Abstract
In the document are reported the results of some measurements performed on MINI-LINK BAS RAU.

Contents

1 ABBREVATIONS

EUT	Equipment Under Test
IF	Intermediate Frequency
NCU	Node Control UnitUnit
P_{out}	Output power
RAU	RAdio Unit
RF	Radio Frequency
T	Temperature
V	RAU Voltage Supply

2 REFERENCES

[1] Federal Communications Commission part. 2- Frequency allocations and radio treaty matters; general rules and regulations

[2] Federal Communications Commission part.101- Fixed microwave services

[3] 1/102 64-UKL 601 04, rev.B, Ericsson Type Acceptance Radio Transceiver test specification

3 INTRODUCTION

This test report is submitted to the FCC for the acceptance of the Ericsson Microwave AB radios operating in the LMDS band 31.0 to 31.3 GHz.

Ericsson radios are full compliant to the specification stated in the FCC part 2 and FCC part 101

The aim of the following tests is to give evidence of compliance to the relevant requirements of Federal Communications Commission ([1], [2].

1. Occupied bandwidth
2. Frequency stability vs temperature and supply voltage
3. Frequency tolerance
4. Output spectrum (spectrum mask)
5. Spurious emission at antenna terminal
6. Field strength of spurious radiation

The EUT are

radio terminal UKL 601 04/21 at 31.279 GHz

radio node UKL 601 04/11 at 31.021GHz (Output mask test)

radio terminal UKL 601 04/21 at 31.279 GHz (Output mask test)

The measurement set-up is sketched in fig.1

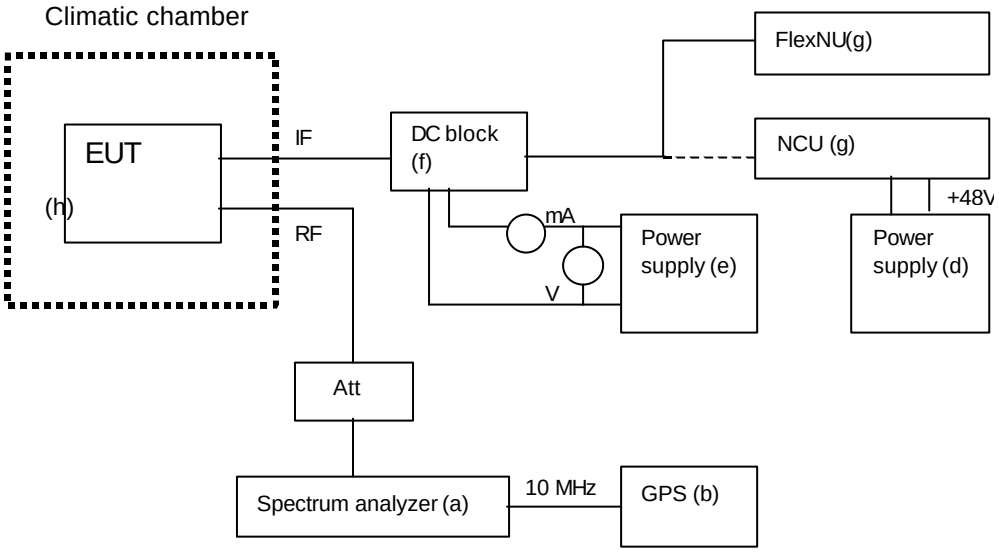


Figure 1 – Sketch of measurement set-up

4 LIST OF INSTRUMENTS

(a) Spectrum analyser HP8565E

(b) Exac Time 9390 Global Positioning System Time Code and Frequency Generator

(c) 2 X Multimeter HP 973A

(d) DC Power Supply Agilent 6038A

(e) DC Power Supply Agilent 6038A

(f) DC block Minicircuit 15542

(g) Node Control Unit ROJ 207 103/1 and/or Acces Terminal BFD 101 16/3

(h) Climatic Chamber Angelantoni Hygros 250

All the instruments are calibrated from a certified laboratory and the calibration information are filed in a dedicated binder

5 MEASUREMENTS

5.1 RF OUTPUT POWER

5.1.1 Conditions

T=20°C

V=44:60 V

$P_{out}=P_{max}$= xx dBm (7 dB attenuation outside RAU)

TX always ON

Modulation OFF

f_{TX}=31.279 GHz

Radio Control Loop OFF

5.1.2 Results

P/N	dBm @Fo
UKL 601 04/21	**22.7**

Table 1- Output power stability

Temperature (°C)	Output power (dBm)		
	V=44V	V=52V	V=60V
-30	15.4	15.4	15.4
-20	15.86	15.86	15.86
-10	16.2	16.2	16.2
0	16.14	16.14	16.14
10	16.04	16.04	16.04
20	15.74	15.74	15.74
25	15.7	15.7	15.7
30	15.7	15.7	15.7
40	15.6	15.6	15.6
50	15.6	15.6	15.6
60	15.3	15.3	15.3

5.2 OCCUPIED BANDWIDTH

5.2.1 Conditions

T=20°C

V=52V

TX always ON

Modulation ON

f_{TX}=31.015 GHz

$P_{out}=P_{max}$=22.7 dBm (10dB attenuation outside RAU)

Spectrum analyser settings:

SPAN=160MHz, RBW=100KHz, VBW=300Hz, f_c=31015000KHz

5.2.2 Results

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limit, the mean power radiated is equal to a certain percentage of the total mean radiated power. The percentage used in the measurement was 1%, so the occupied bandwidth refers to 99% of the total mean radiated power.

Occupied bandwidth (99%) = 28.3 MHz

See figg. 2 and 3

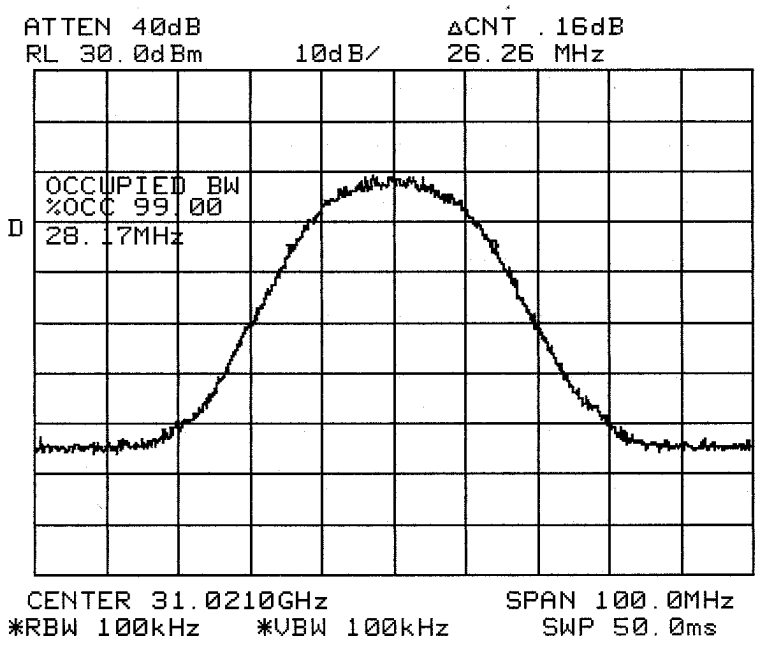


Figure 2- Occupied bandwidth measurement

Radio Node UKL 601 04/11

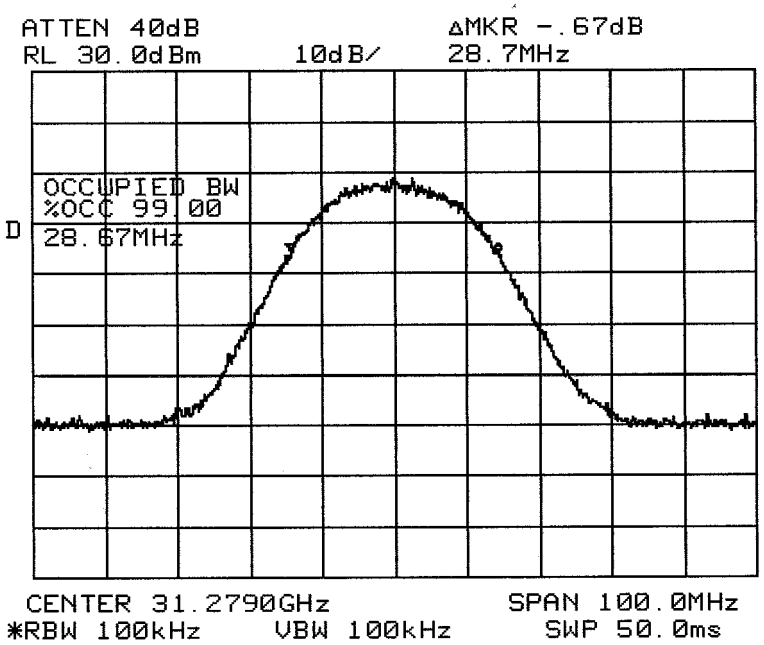


Figure 3- Occupied bandwidth measurement

Radio Terminal UKL 601 04/21

31.0 – 31.075GHz Lower block. Figures 4,5, show the 1st channel and 6, 7 the 2nd channel for band end compliance

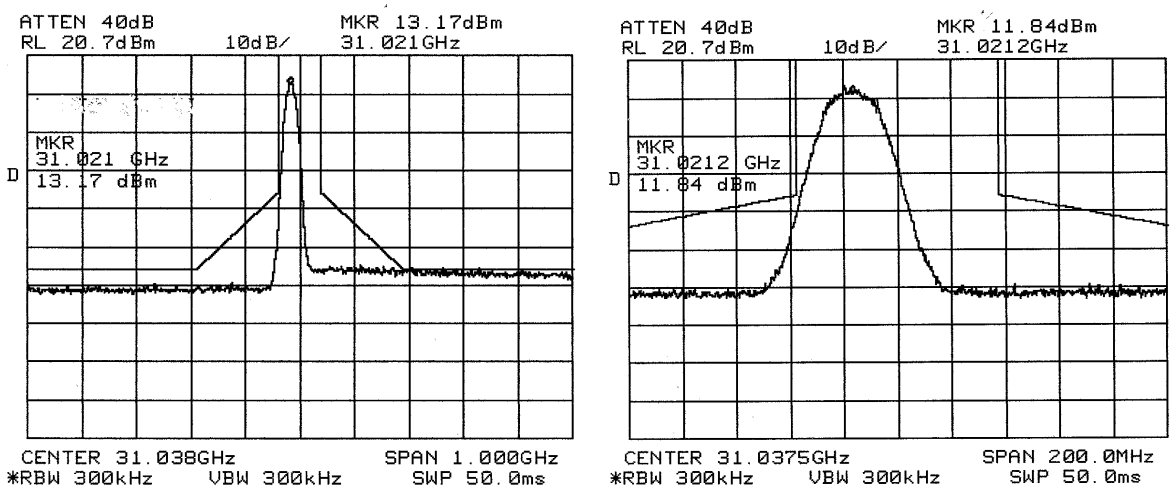


Figure 4-5. 31.021GHz - 1st channel lower band end measurement.

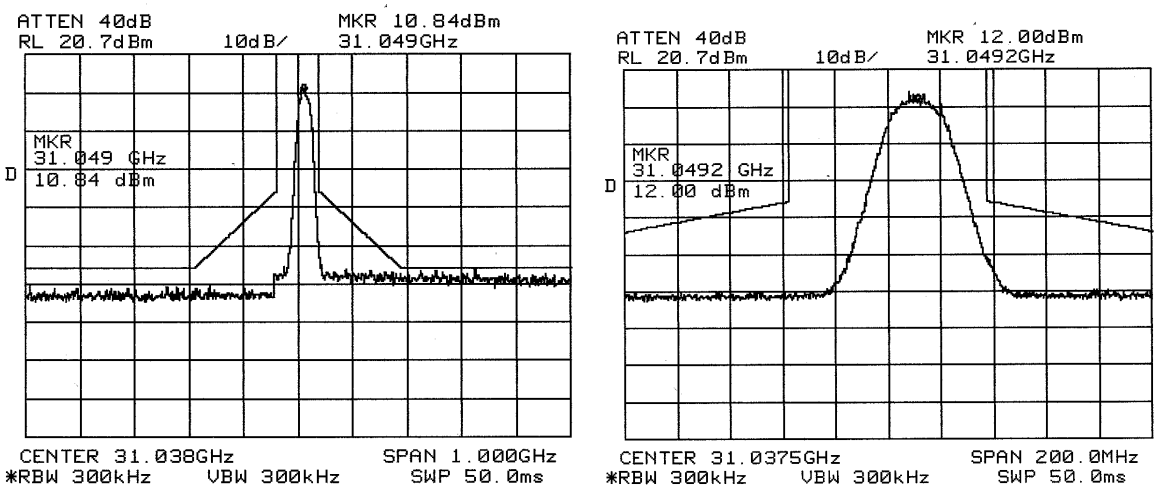


Figure 5-6. 31.049GHz - 2nd channel higher band end measurement.

31.225 – 31.3GHz Higher block. Figures 4,5,6 and 7 show the 1st and 2nd channel for band end compliance

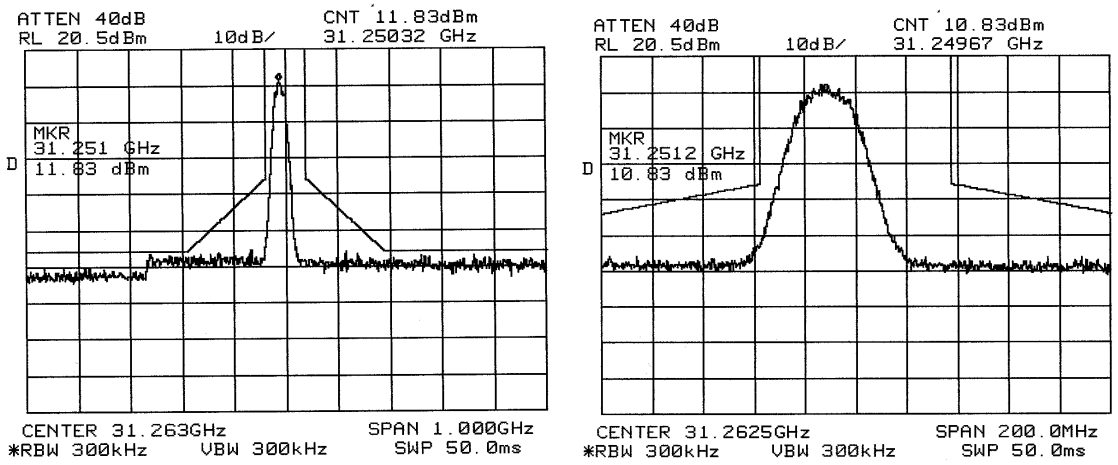


Figure 8-9. 31.251GHz - 1st channel lower band end measurement.

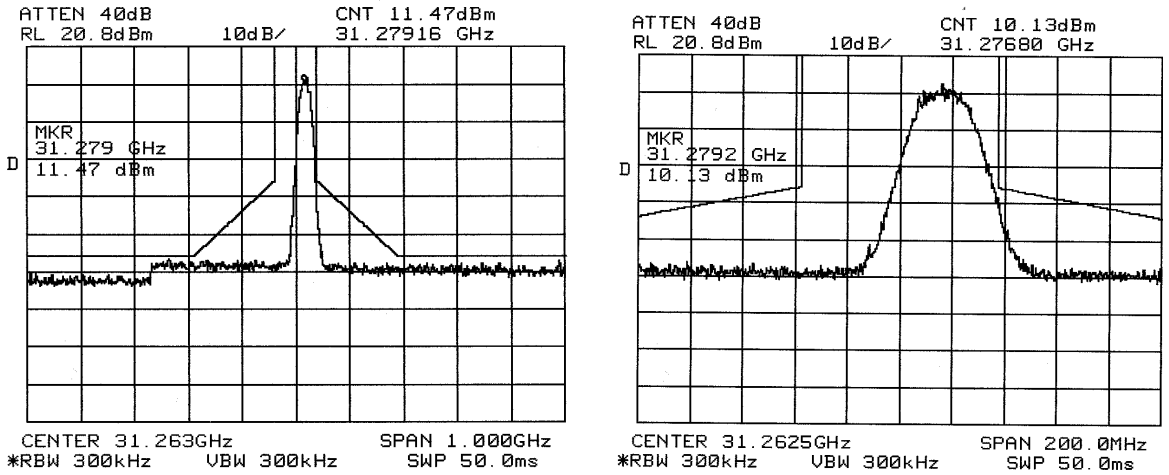


Figure 10-11 31.279GHz - 2nd channel higher band end measurement.

5.3 FREQUENCY STABILITY

5.3.1 Conditions

f_{TX}=31.279 GHz

$P_{out}=P_{max}$=22.7 dBm (20dB attenuation outside RAU)

TX always ON

Modulation OFF

5.3.2 Results

See table 3.

The frequency never changes when the supply voltages are modified from the minimum to the maximum value.

We have a maximum variation of 50 kHz going from –30°C to 60°C. That's a variation **< 2ppm**.

Table 3- Frequency stability

Temperature (°C)	Frequency (kHz)		
	V=44V	V=52V	V=60V
-30	31,278,975	31,278,975	31,278,975
-20	31,278,975	31,278,975	31,278,975
-10	31,278,980	31,278,980	31,278,980
0	31,278,980	31,278,980	31,278,980
10	31,278,988	31,278,988	31,278,988
20	31,279,000	31,279,000	31,279,000
25	31,279,000	31,279,000	31,279,000
30	31,278,997	31,278,997	31,278,997
40	31,278,990	31,278,990	31,278,990
50	31,278,970	31,278,970	31,278,970
60	31,278,950	31,278,950	31,278,950

5.4 FREQUENCY TOLERANCE

5.4.1 Conditions

f_{TX}=31,279 GHz

$P_{out}=P_{max}$=22.7 dBm (20dB attenuation outside RAU)

TX always ON

Modulation OFF

5.4.2 Results

See table 4

Table 4

Set frequency (KHz)	31.251.000	31.279.000
Measured frequency (KHz)	31.250.996	31.279.003
Delta (ppm)	0.1	0.1

5.5 SPECTRUM MASK

5.5.1 Conditions

T=20°C

V=52V

1st f_{TX}=31.021 GHz 2nd f_{TX}=31.279 GHz

$P_{out}=P_{max}$=22.7 dBm (20dB attenuation outside RAU)

TX always ON

Modulation ON

Spectrum analyser settings and plot:

See figures 1 to 6

5.5.2 Results

In Annex 1 are reported the attenuation values A(Δf) with respect to the fundamental level (as per [2] sec. 101.111 (a)(1)) at several frequency offset Δf according to [2] sec.101.111 par.(ii) (iii) and [3] sec.5.5.4. The Δf and the limits are evaluated considering B=850 MHz in par.(ii) sec.101.111 of FCC. In Figures are reported the measurements taken at the higher and lower side of the authorised bandwidth.

6 ANNEX 1 - SPECTRUM MASK

Testing of additional requirements

on

Frequency Spectrum at Antenna Terminal as specified in

FCC part 101.111

Table of contents

Tester and Technical responsibility for area of testing :

Date	*Name*	*Signature*
September 18, 2000	Manfred Paschwitz	

Date	*Name*	*Signature*
September 18, 2000	Arno Dejon	

1 General Information

1.1 Test laboratory

CETECOM ICT Services GmbH
Untertürkheimer Straße 6-10
D-66117 Saarbrücken
Germany

CETECOM ICT Services GmbH
P.O. Box 10 04 45
D-66004 Saarbrücken
Germany

Phone: +49 (0)681-598-8434
Fax: +49 (0)681-598-9075
E-Mail: info@ict.cetecom.de
Internet: http://www.cetecom.de

DAR Accredited Testing Laboratory
Registration Number TTI-P-G 166/98

1.2 Client information

Name	:	Ericsson Microwave Systems AB
Street	:	Flöjelbergsgatan 2
Town	:	SE - 43184 Mölndal
Country	:	Sweden
Telephone	:	+46-31-747-6037
Fax	:	+46-31-27 72 25

Contact person :

Name	:	Mr. Roberto Crosta
Company	:	Ericsson Lab Italy S.p.A.
Street	:	Via Cadorma, 73
Town	:	I-20090 Vimodrone - Milan

1.3 Application details

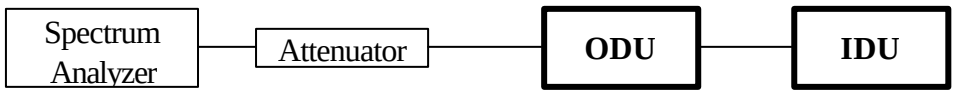
Date of receipt of application	:	Sept 07, 2000
Date of receipt of test item	:	Sept 11, 2000
Date of test	:	Sept 12/13, 2000

1.4 Device under test

Terminal Station:	Outdoor Unit :	MINI-LINK BAS 31GHz UKL 601 04/21	
	Serial numbers :	A23000 PN50 134106	(Radio) (Antenna)
	Indoor Unit :	BFD 101 16/3	
Base Station:	Outdoor Unit :	MINI-LINK BAS 31GHz UKL 601 04/11	
	Serial numbers :	A23000 PN50 134107	(Radio) (Antenna)
	Indoor Unit :	R-AAS	
	Serial number :	BFD 501 030/1	
	Indoor Unit :	NCU	
	Serial number :	ROJ 207 103/1	

1.5 Test Set-up Spectrum masks Measurement

f < 50 GHz:



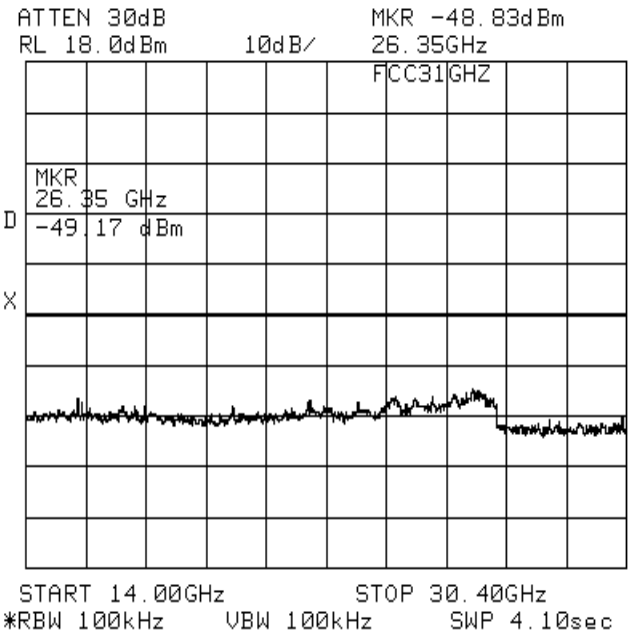
1.6 Used Test Equipment

No.	Equipment	Type	Manufacturer
1	Spectrum Analyzer	HP 8565E	Hewlett Packard
2	Spectrum Analyzer	TEK 2782	Tektronix
3	Harmonic Mixer	11970V	Hewlett Packard
4	Harmonic Mixer	11970W	Hewlett Packard
5	Harmonic Mixer	WM780F	Tektronix
6	Harmonic Mixer	WM780D	Tektronix
7	Tapered Transitions		Thomson-CSF
8	div. Cables		Suhner

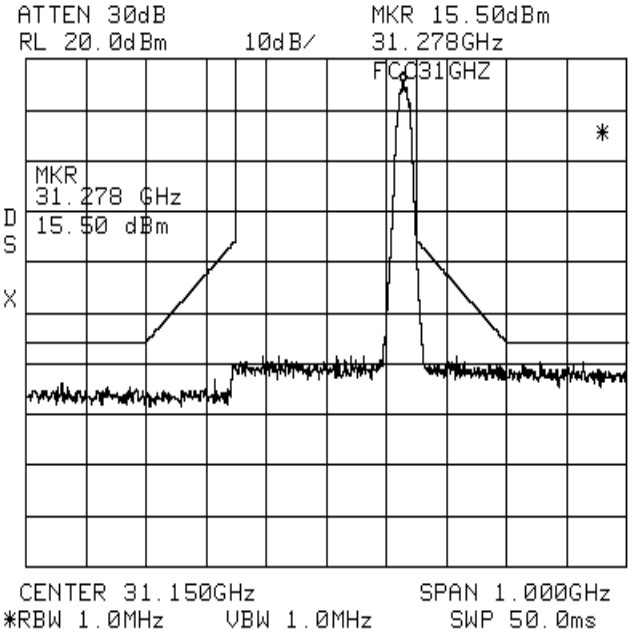
2 Test results

2.1 Frequency Spectrum of Terminal Station

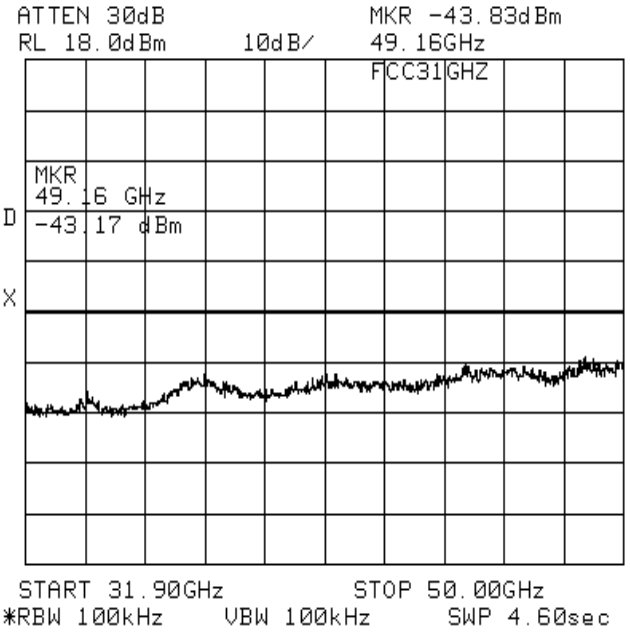
Plot 1 Spectrum mask (conducted)



Plot 2 spectrum mask (conducted)

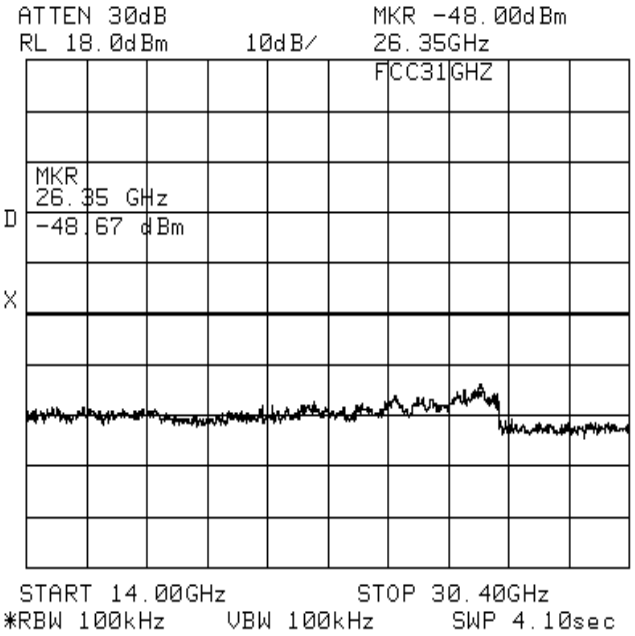


Plot 3 spectrum mask (conducted)

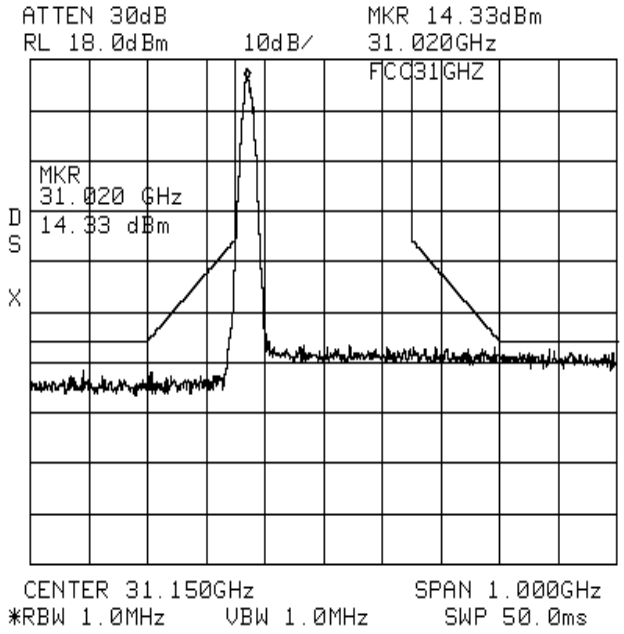


2.2 Frequency Spectrum of Base Station

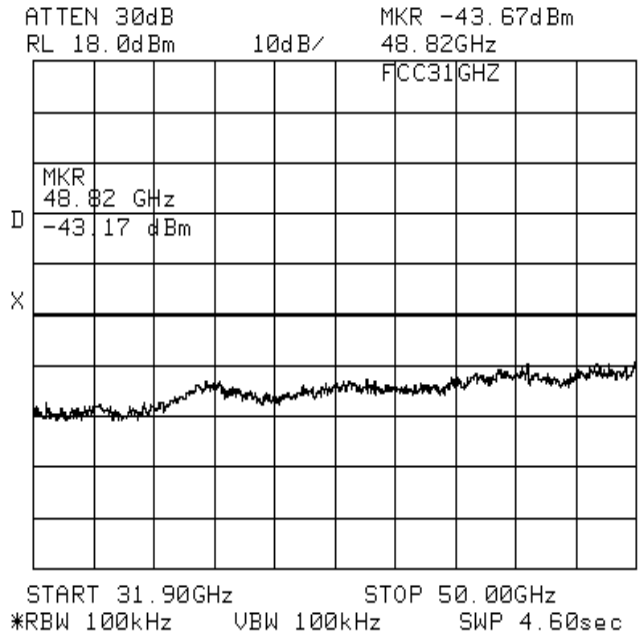
Plot 4 spectrum mask (conducted)



Plot 5 spectrum mask (conducted)



Plot 6 spectrum mask (conducted)



7 ANNEX 2 - SPURIOUS EMISSION AT ANTENNA TERMINAL

CONDUCTED SPURIOUS EMISSION W-BAS

Abstract

Spurious emission from 9KHz up to 170 GHz is measured at the antenna port of a W-Bas Node unit for FCC Type Approval Test Report

Contents

7.1 TEST FACILITIES DESCRIPTION

The test was performed into two different section due to instruments availability.

The first section was performed at Ericsson Lab Italy in Milan, Italy for the frequency range from 10KHz up to 14GHz.
The second was performed in an external lab. (see section 7.9)

The Ericsson Lab Italy facility is an open lab environment. The temperature is 20 - 25 ^{o}C and Rh 50-70 %.

7.2 EQUIPMENT UNDER TEST

Outdoor unit: UKL 60104/11 and UKL 601 04/21

Indoor Unit: NCU ROJ 207 103/1 S/N A23000L4BN
and BFD 101 16/3 S/N A23000RKXH

7.3 TEST MODE

All tests are done in continuos mode, modulation ON and a supply voltage of +50 V.

7.4 TEST EQUIPMENT

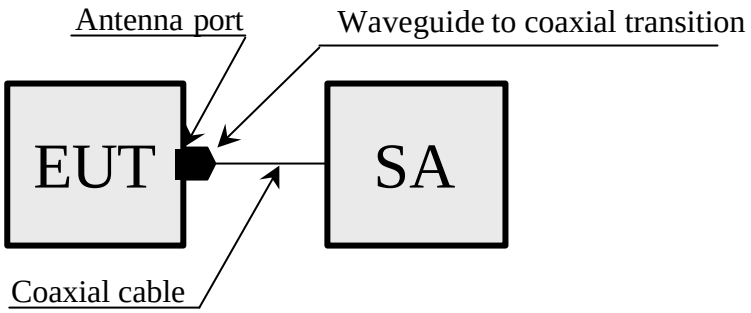
See Photo 1

Spectrum Analyser: HP 8564E S/N03120 Calibration. due to 01-2001

Coaxial cable: HP 11500F S/N 1555

Waveguide to coaxial transition: ICW-34-K 00-06-165 IMC

7.5 TEST METHODE



EUT = Equipment Under Test

SA = Spectrum Analyzer

Figure 1. Test set up # 1

In test set up #1 spurious emission between 9 kHz and 14 GHz is measured at the antenna port.

The test set up can be seen in Photo 1 .

The wanted signal is in diagram 1, in ON and OFF condition to show the instrument noise floor, and the test results are in diagram 2-5.

7.6 TEST RESULTS

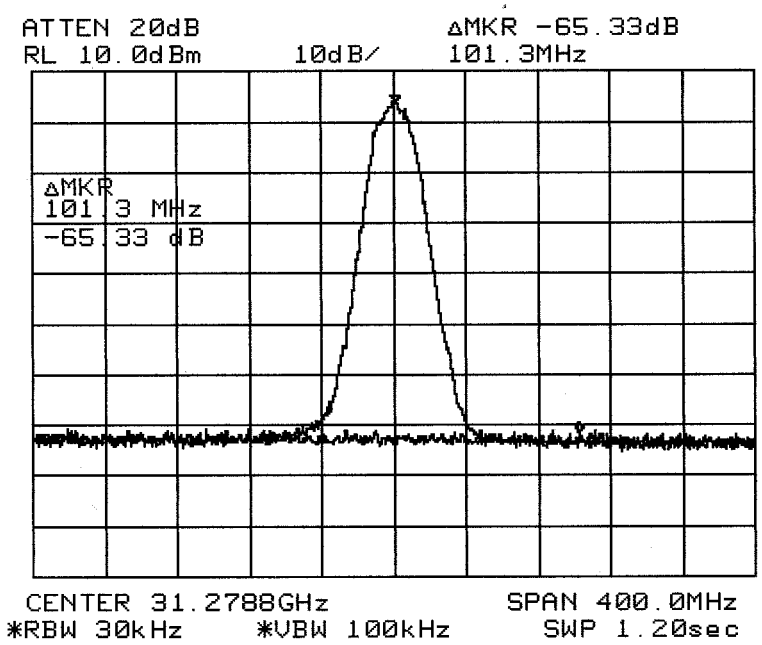


DIAGRAM 1

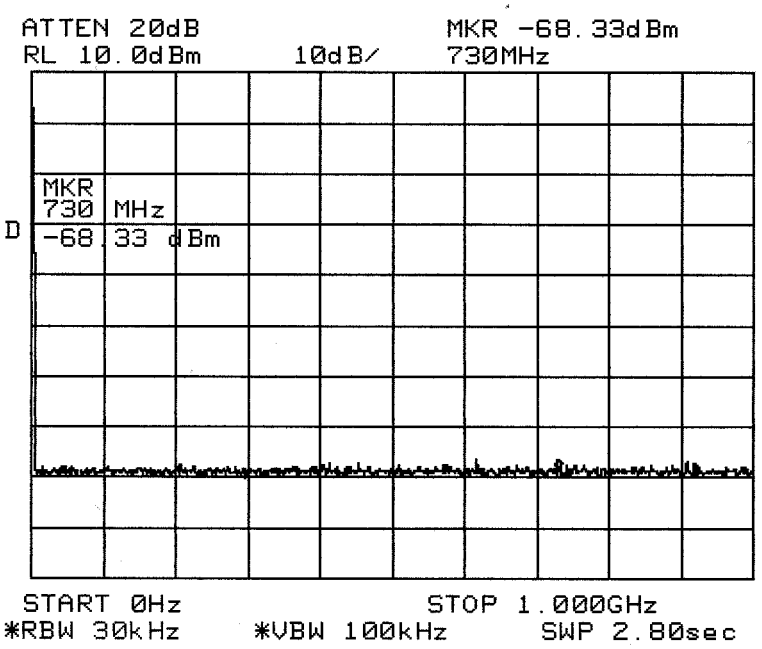


DIAGRAM 2

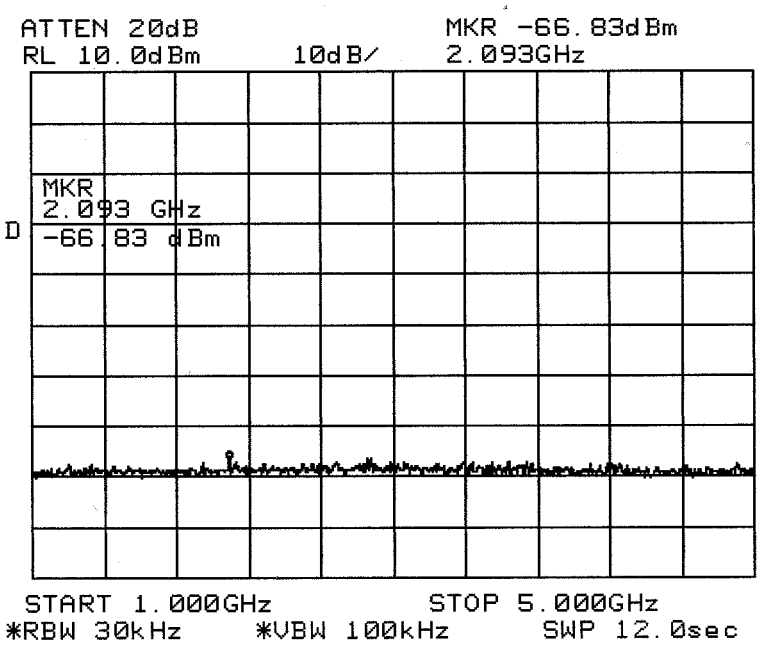


DIAGRAM 3

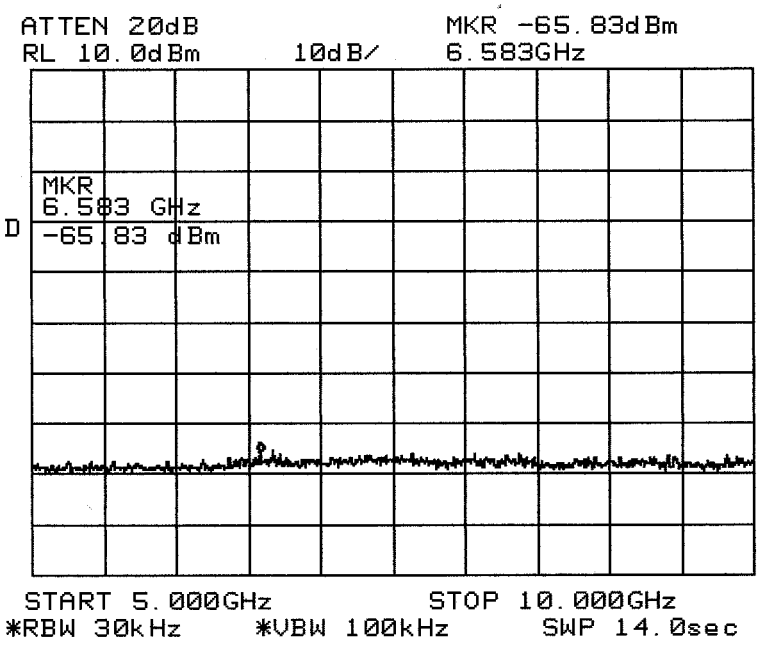


DIAGRAM 4

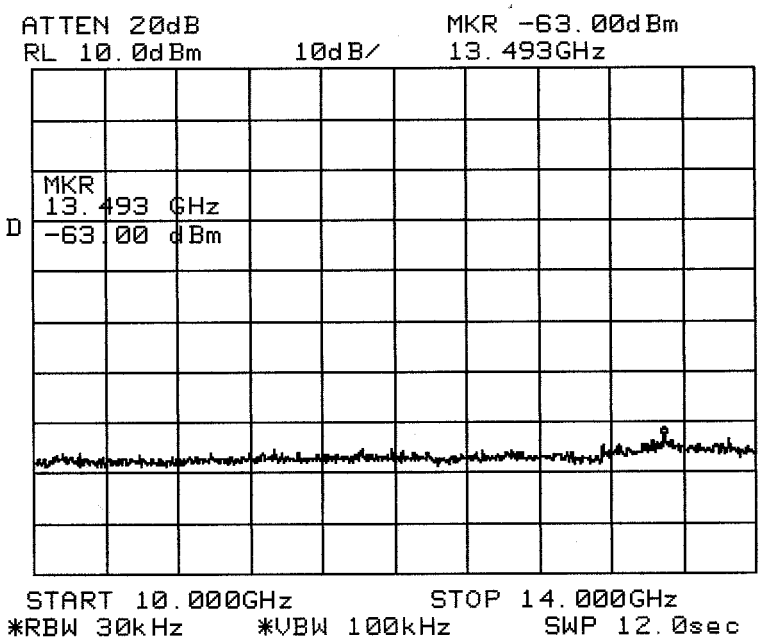
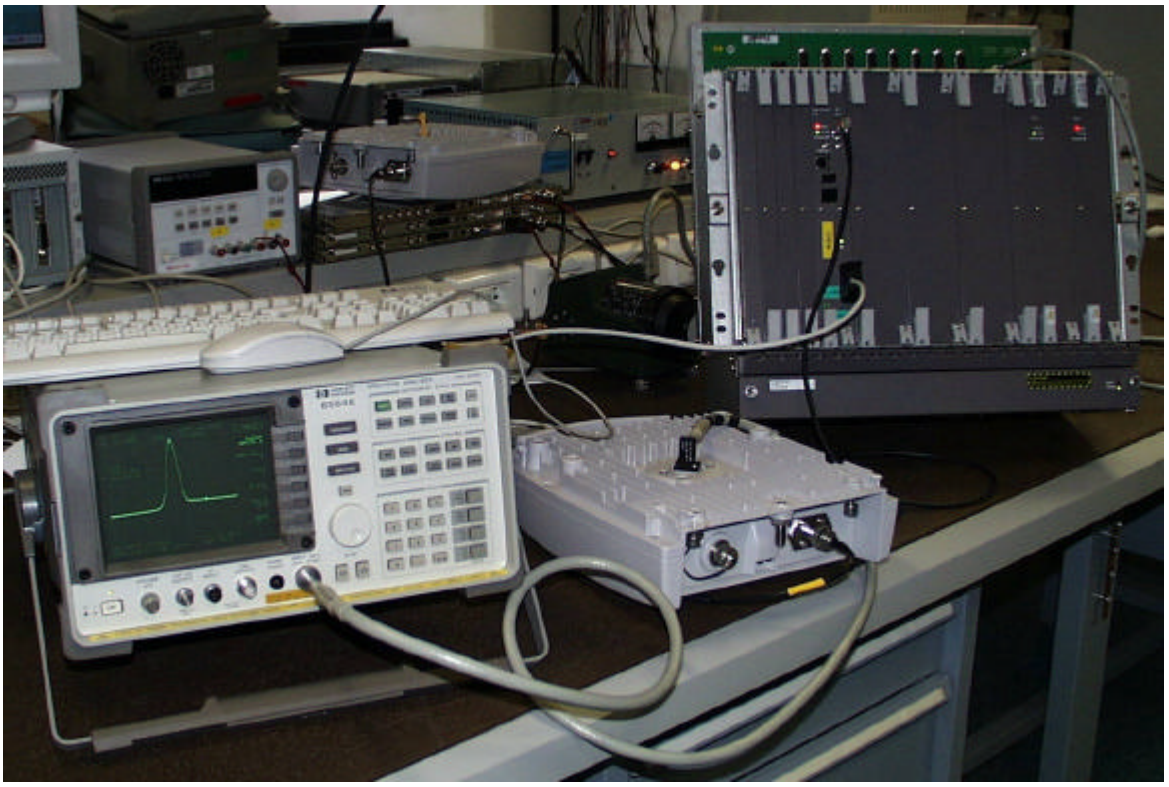


DIAGRAM 5

7.7 PHOTOS



7.8 ENCLOSED – CETECOM REPORT

This section covers the frequency range from 14GHz up to 170GHz and was perform in CETECOM.

SECTION B

Testing of additional requirements

on

Spurious Emission at Antenna Terminal

as specified in

FCC part 2.1051

FCC part 101.111

Table of contents

Tester and Technical responsibility for area of testing :

September 18, 2000	Manfred Paschwitz	
Date	*Name*	*Signature*

September 18, 2000	Arno Dejon	
Date	*Name*	*Signature*

1 General Information

1.1 Test laboratory

CETECOM ICT Services GmbH
Untertürkheimer Straße 6-10
D-66117 Saarbrücken
Germany

CETECOM ICT Services GmbH
P.O. Box 10 04 45
D-66004 Saarbrücken
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Phone: +49 (0)681-598-8434
Fax: +49 (0)681-598-9075
E-Mail: info@ict.cetecom.de
Internet: http://www.cetecom.de

DAR Accredited Testing Laboratory
Registration Number TTI-P-G 166/98

1.2 Client information

Name	:	Ericsson Microwave Systems AB
Street	:	Flöjelbergsgatan 2
Town	:	SE - 43184 Mölndal
Country	:	Sweden
Telephone	:	+46-31-747-6037
Fax	:	+46-31-27 72 25

Contact person :

Name	:	Mr. Roberto Crosta
Company	:	Ericsson Lab Italy S.p.A.
Street	:	Via Cadorma, 73
Town	:	I-20090 Vimodrone - Milan

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1.4 Device under test

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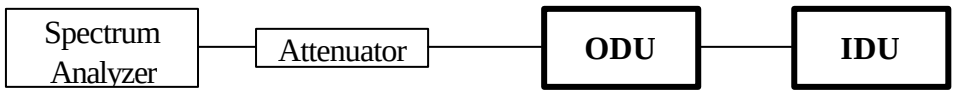
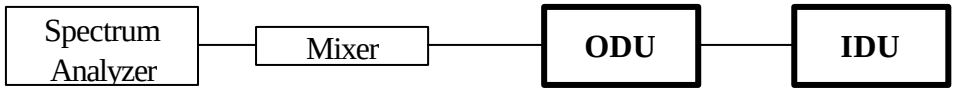
	Serial numbers :	A23000 PN50 134106	(Radio) (Antenna)
	Indoor Unit :	BFD 101 16/3	
Base Station:	Outdoor Unit :	MINI-LINK BAS 31GHz UKL 601 04/11	
	Serial numbers :	A23000 PN50 134107	(Radio) (Antenna)
	Indoor Unit :	R-AAS	
	Serial number :	BFD 501 030/1	
	Indoor Unit :	NCU	
	Serial number :	ROJ 207 103/1	

1.5 Test Set-up Conducted Emission

f < 50 GHz:



f > 50 GHz:



1.6 Used Test Equipment

No.	Equipment	Type	Manufacturer
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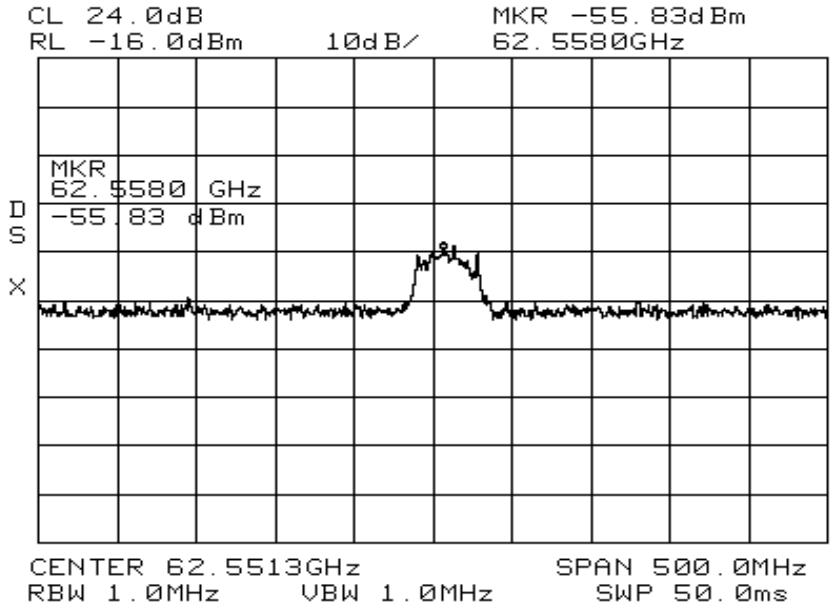
2	Spectrum Analyzer	TEK 2782	Tektronix
3	Harmonic Mixer	11970V	Hewlett Packard
4	Harmonic Mixer	11970W	Hewlett Packard
5	Harmonic Mixer	WM780F	Tektronix
6	Harmonic Mixer	WM780D	Tektronix
7	Tapered Transitions		Thomson-CSF
8	div. Cables		Suhner

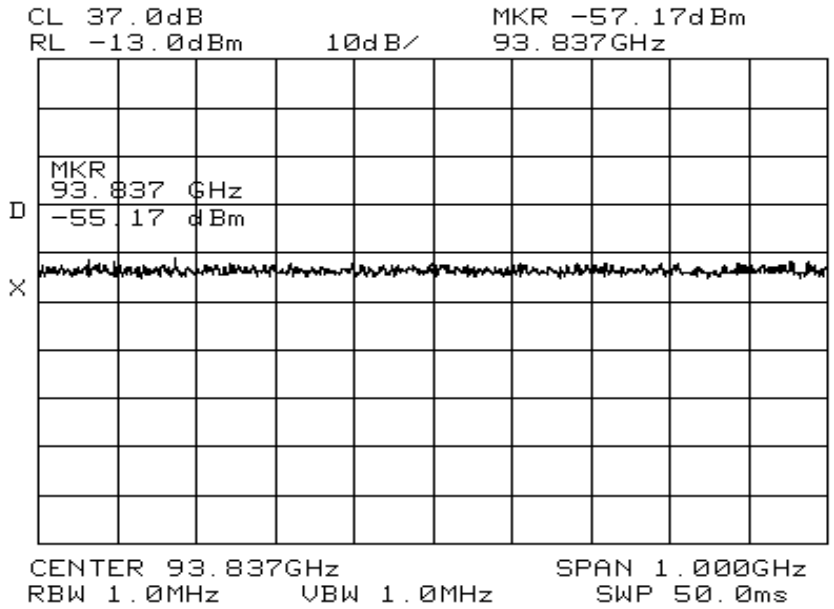
2 Testresults

2.1 Conducted Emission of Terminal Station

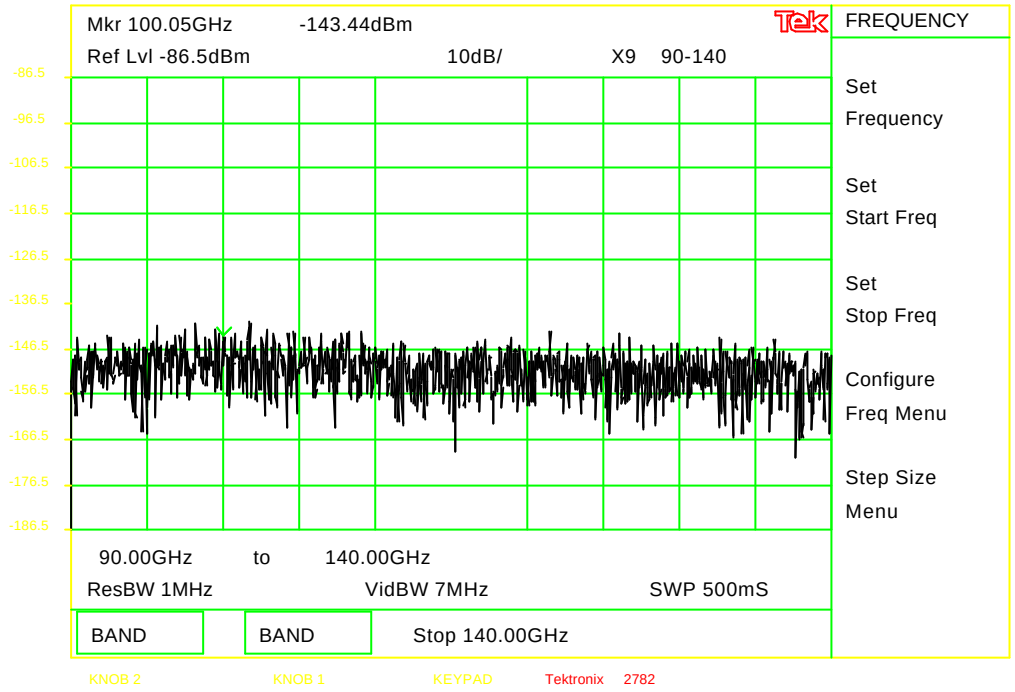
Plot 1 2nd Harmonics



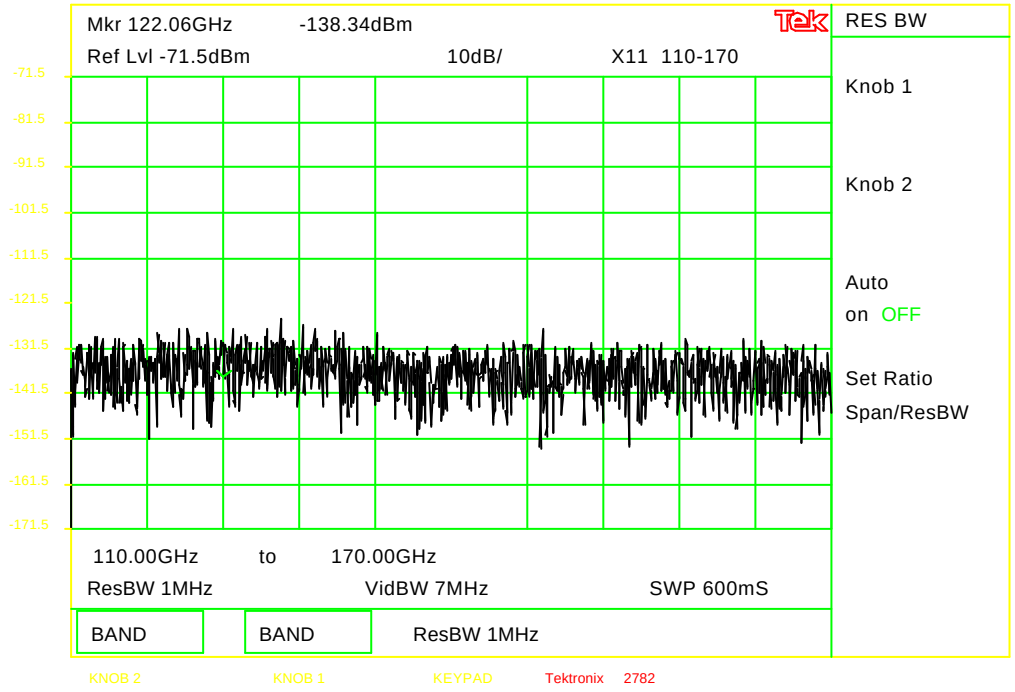
Plot 2 3rd Harmonics



Plot 3 4th Harmonics

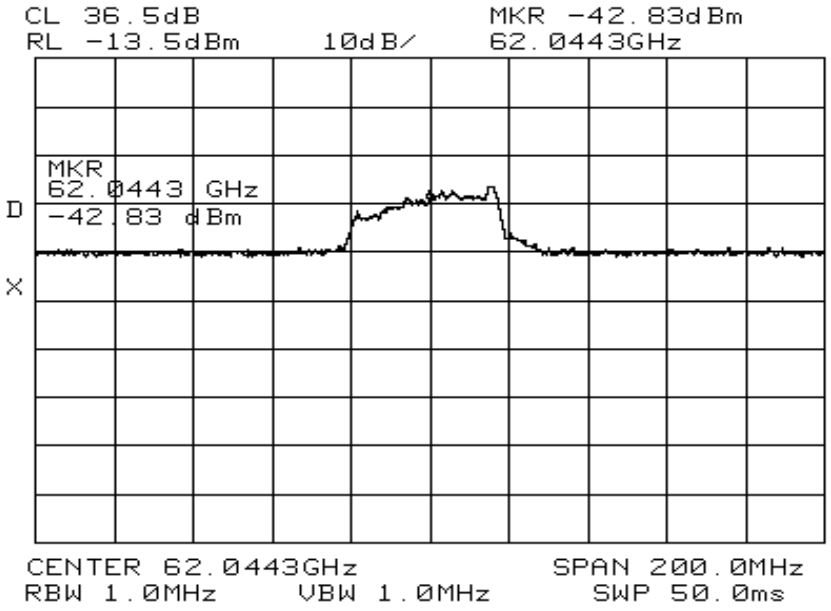


Plot 4 5th Harmonics

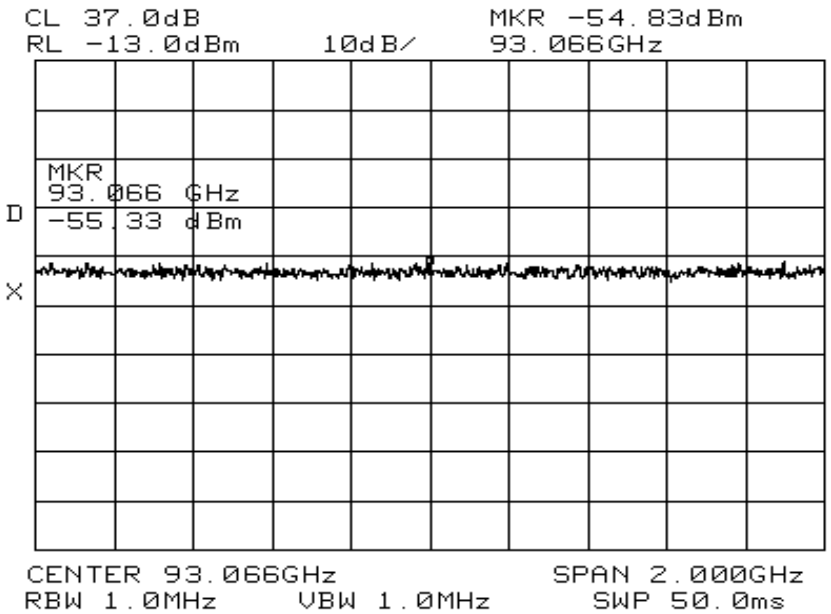


2.2 Conducted Emission of Base Station

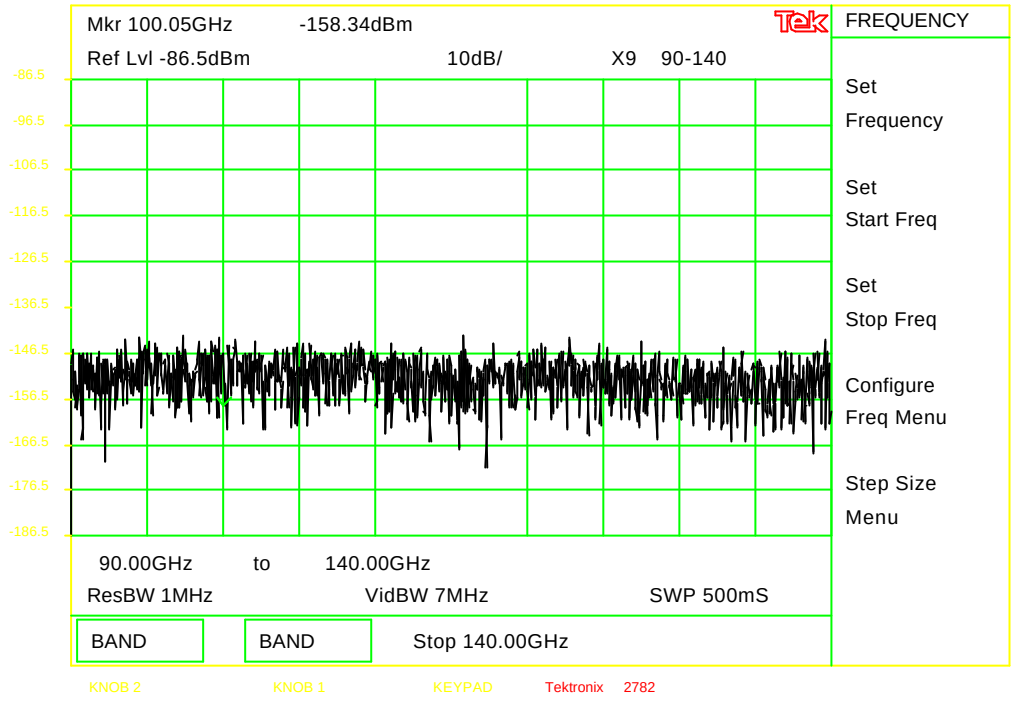
Plot 5 2nd Harmonics



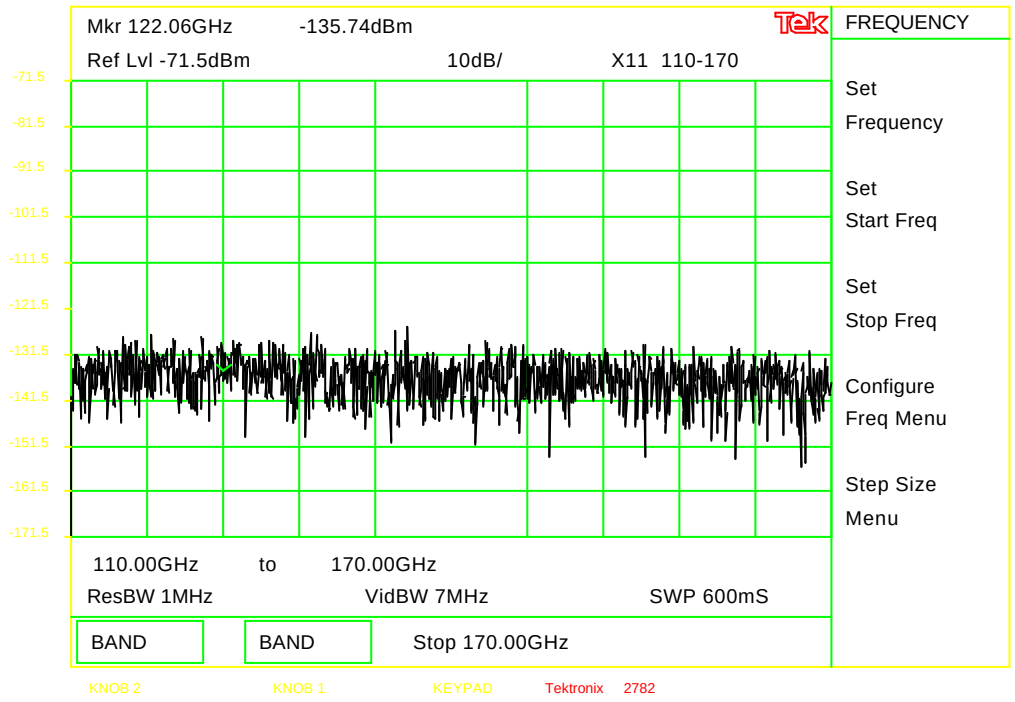
Plot 6 3rd Harmonics



Plot 7 4th Harmonics



Plot 8 5th Harmonics



SECTION C

8 ANNEX 3 - FIELD STRENGTH OF SPURIOUS RADIATION

Prepared (also subject responsible if other)		No.		
ERI/WP Roberto Crosta		1/102 65-UKL 601 04		
Doc respons/Approved	**Checked**	**Date**	**Rev**	**File**
ERI/W		2000-11-29	D	

RADIATED SPURIOUS EMISSION W-BAS

Abstract

Radiated spurious emission from 10KHz up to 170 GHz is measured on W-Bas units for FCC Type Approval Test Report

Contents

8.1 TEST FACILITIES DESCRIPTION

The Spurious emission tests from 10KHz up to 14 Ghz was performed at Ericsson Microwave System in Molndal, Sweden. The facilities at the FX/ME department is shielded room EMC2. The shielded room was lined with RF absorbing materials on the walls and in the ceiling. The shielded room has a conductive floor used as a ground plane.
The temperature is 20 - 25 ^{o}C and RH 40-70 %.

The range from 14GHz up to 170 GHz was tested in an external lab. (see chapter 8.9)

8.2 TEST DATE

The test was performed 2000-11-24 by Asa Algdal and Roberto Crosta.

8.3 EQUIPMENT UNDER TEST

Outdoor unit: UKL 601 04/11 and UKL 601 04/21 including antenna.

Indoor Unit: BFD 101 16/3 S/N A23000RKXH

8.4 TESTMODE

All tests are done in continuos mode, modulation ON and a supply voltage of +48 V.

The carrier frequency was 31.021 GHz for UKL 601 04/11 and 31.251GHz for UKL 601 04/21

8.5 TEST EQUIPMENT

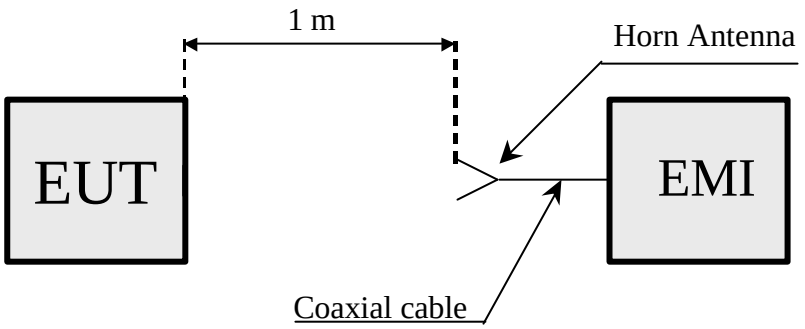
EMI receiver	R&S ESMI	s/n YY1903 Cal 2000:12
EMI receiver	R&S ESI	s/n AO7833 Cal 2001:08
RE/CE system	Ericsson	s/n XS2102 Cal 2001:07
Antenna Logbicon	Schwartz 99161	s/n YA3037 Cal 2002:09
Antenna	EMCO 3301B	s/n YA3037 Cal 2000:12
Horn Antenna	Ericsson 1-10GHz	s/n XS1975 Cal 2001:01
Horn Antenna	Ericsson 8-18Ghz	s/n XS1976 Cal 2001:05

8.6 TEST METHODE

The tests are done using different Horn Antennas for different frequency band. See Figure 1. The EUT is placed on a non-conductive platform in order not to disturb the electric field. The horn antennas are also supported to a mast of non-metallic material. See Photos.

The measurements are done on the four sides of the EUT towards the Horn Antennas and the plots represent the highest value for each frequency.

The Horn antennas are positioned in both horizontal and vertical polarisation mode during the measurements.



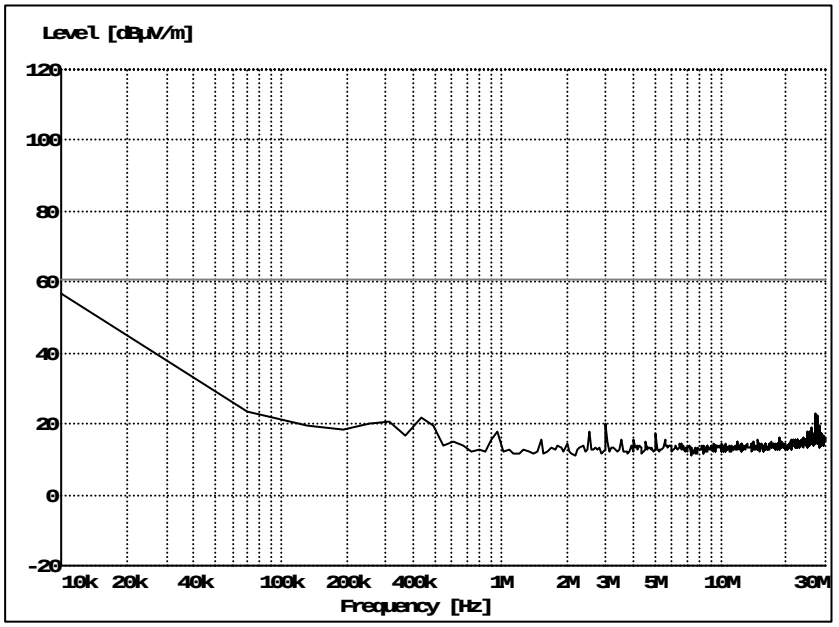
EUT = Equipment Under Test

EMI = Automatic test equipment

Figure 1. Test set up

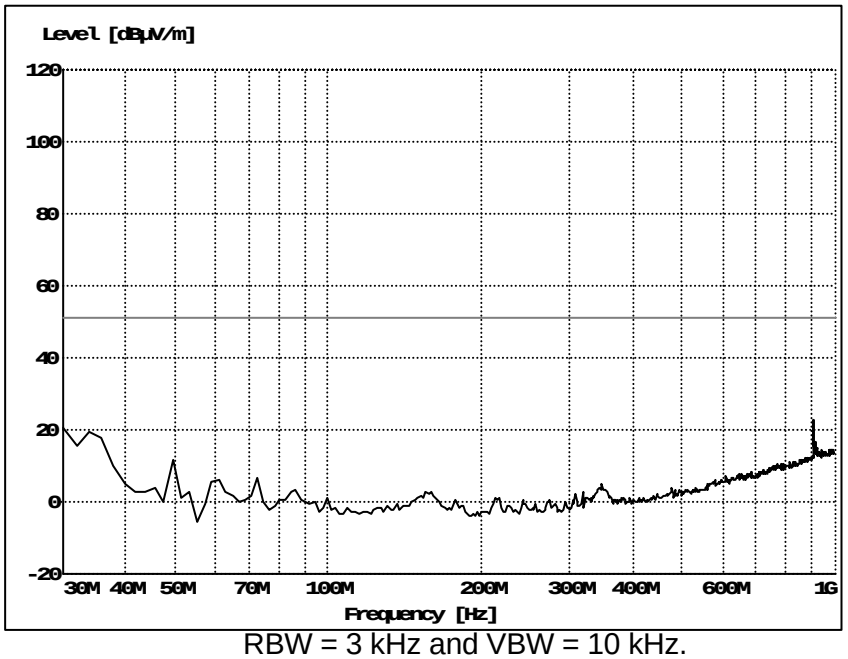
8.7 TEST RESULTS

Figure 1. Radiated emission 10 k– 30 MHz, unit UKL 601 04/11.



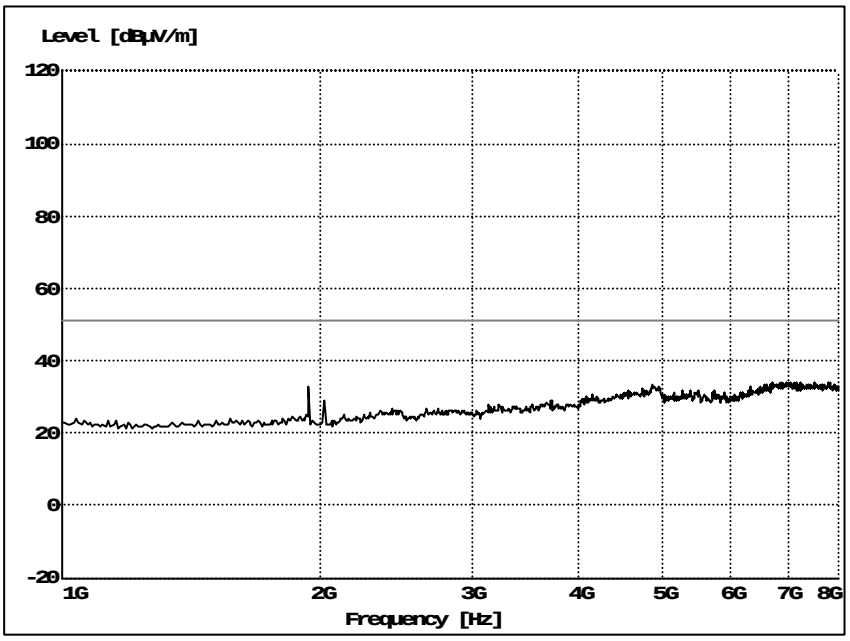
RBW = 3 kHz and VBW = 10 kHz.

Figure 2. Radiated emission 30 M – 1 GHz, unit UKL 601 04/11.



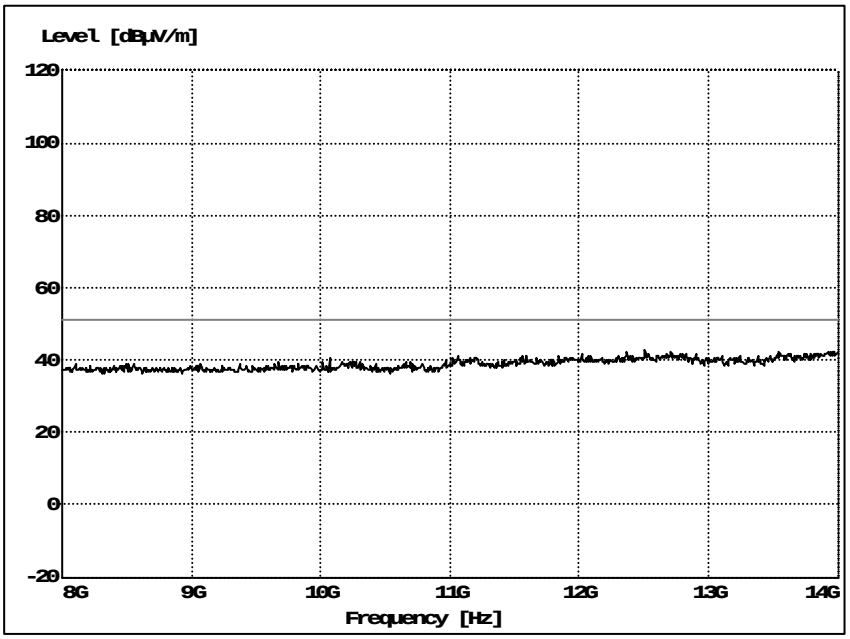
RBW = 3 kHz and VBW = 10 kHz.

Figure 3. Radiated emission 1 – 8 GHz, Unit UKL 601 04/11



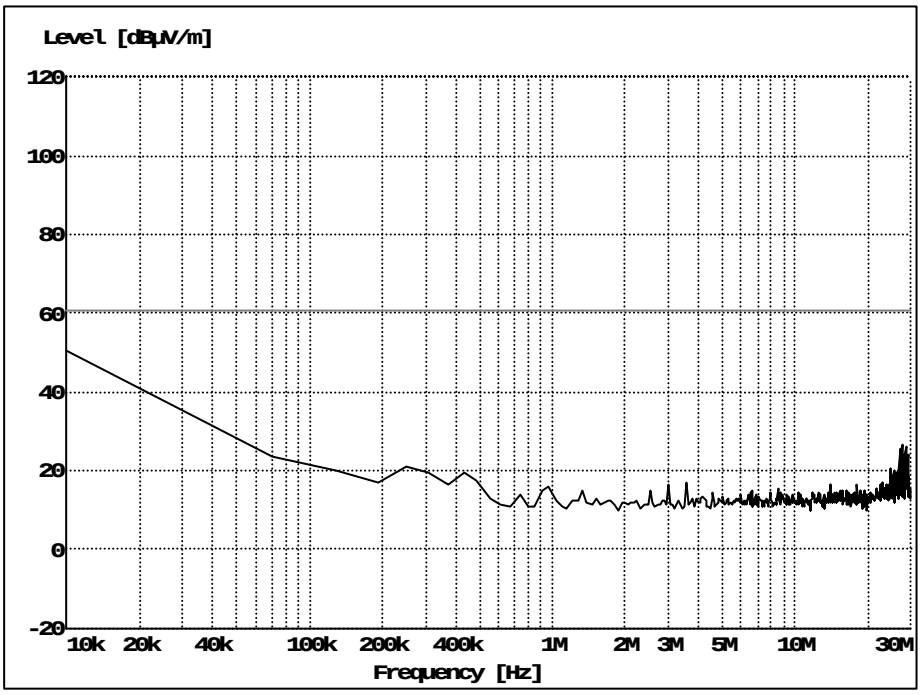
RBW = 100 kHz and VBW = 100 kHz.

Figure 4. Radiated emission 8 – 14 GHz, Unit UKL 601 04/11



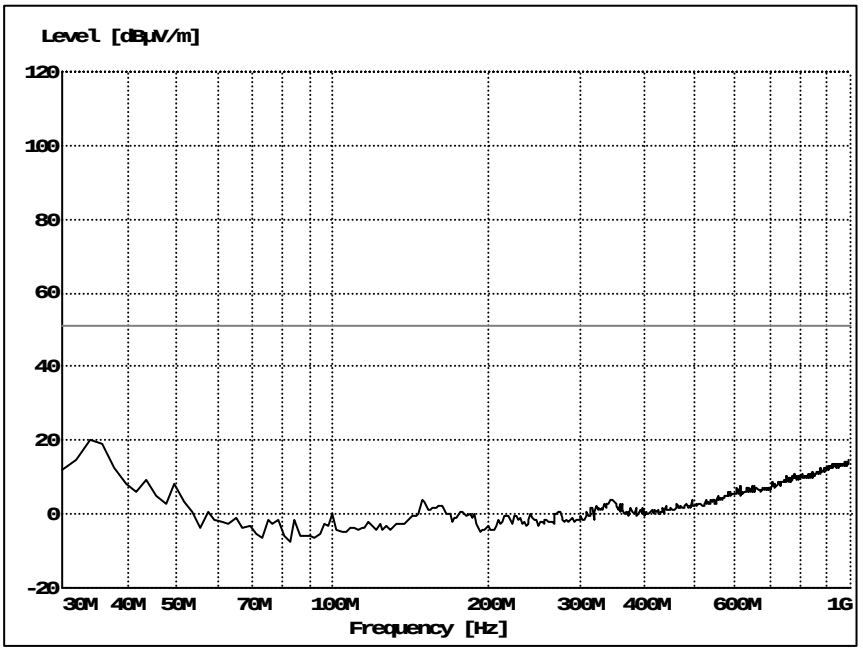
RBW = 100 kHz and VBW = 100 kHz.

Figure 5. Radiated emission 10 k– 30 MHz, unit UKL 601 04/21



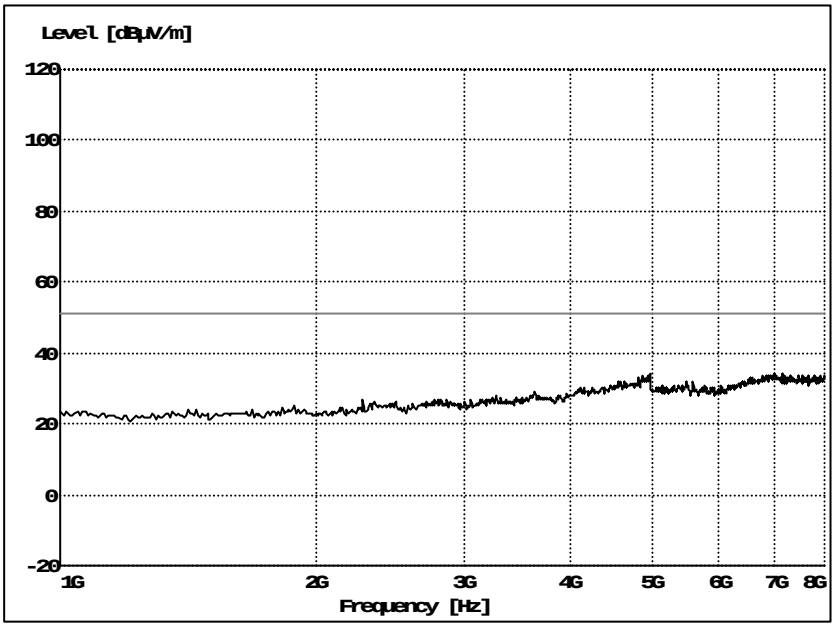
RBW = 3 kHz and VBW = 10 kHz.

Figure 6. Radiated emission 30 M – 1 GHz, unit UKL 601 04/21



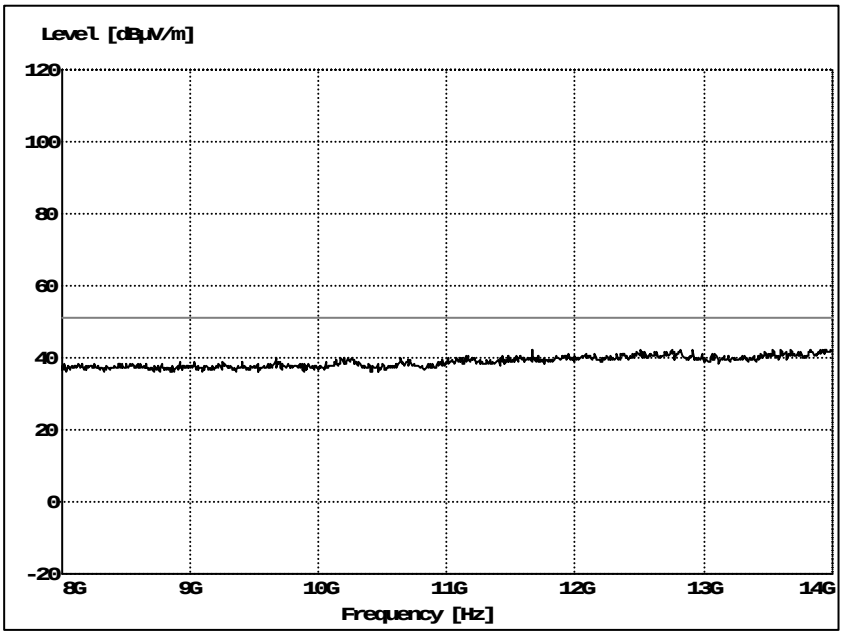
. RBW = 3 kHz and VBW = 10 kHz.

Figure 7. Radiated emission 1 – 8 GHz, Unit UKL 601 04/21



RBW = 100 kHz and VBW = 100 kHz.

Figure 8. Radiated emission 8 – 14 GHz, Unit UKL 601 04/21



RBW = 100 kHz and VBW = 100 kHz.

Noise floor references

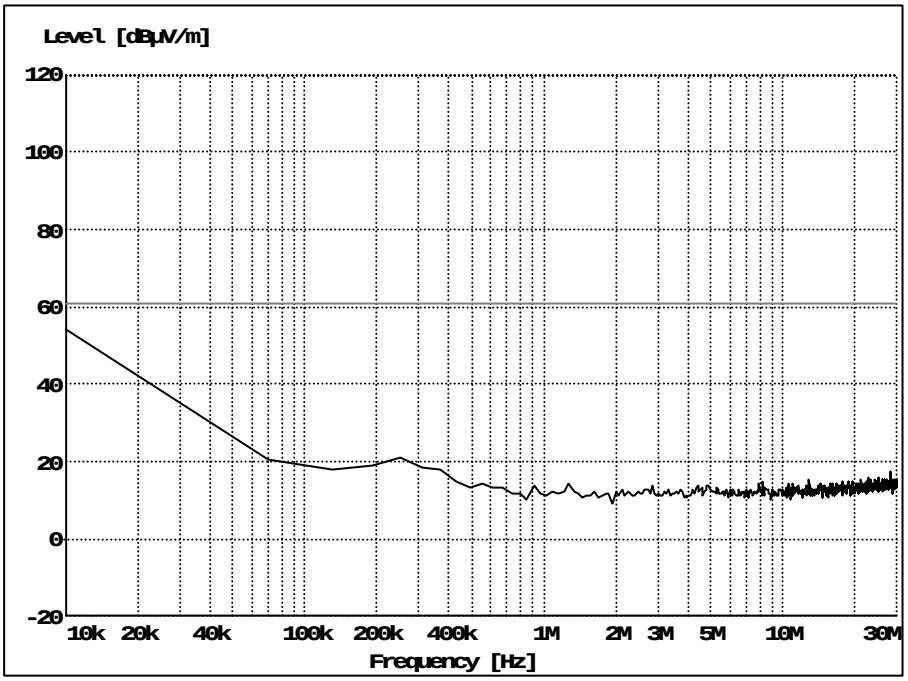


Figure 9. Radiated emission 10 k– 30 MHz, Background.
RBW = 3 kHz and VBW = 10 kHz.

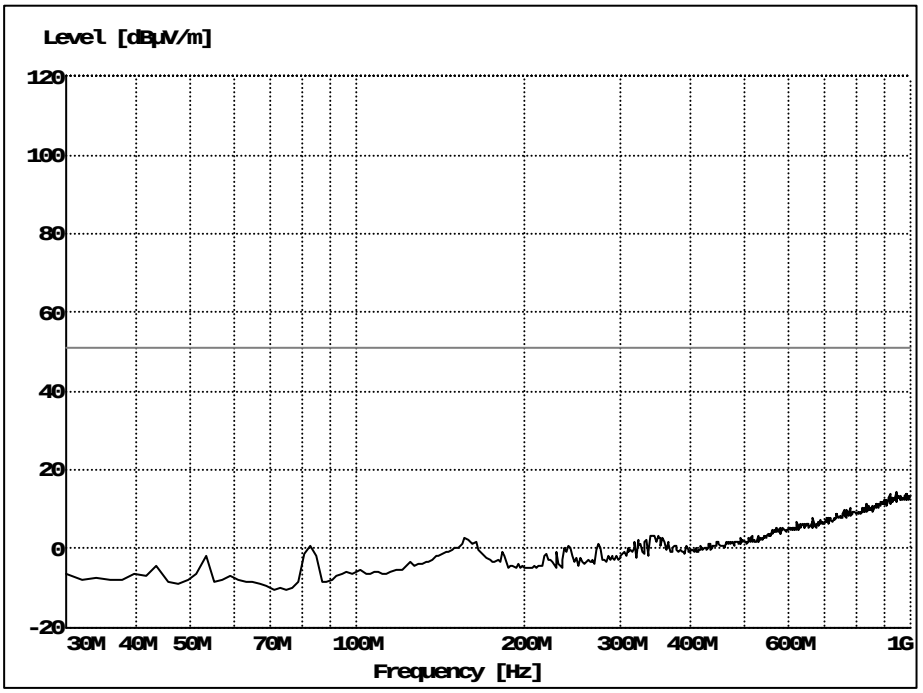


Figure 10. Radiated emission 30 M – 1 GHz, Background measurement.
RBW = 3 kHz and VBW = 10 kHz.

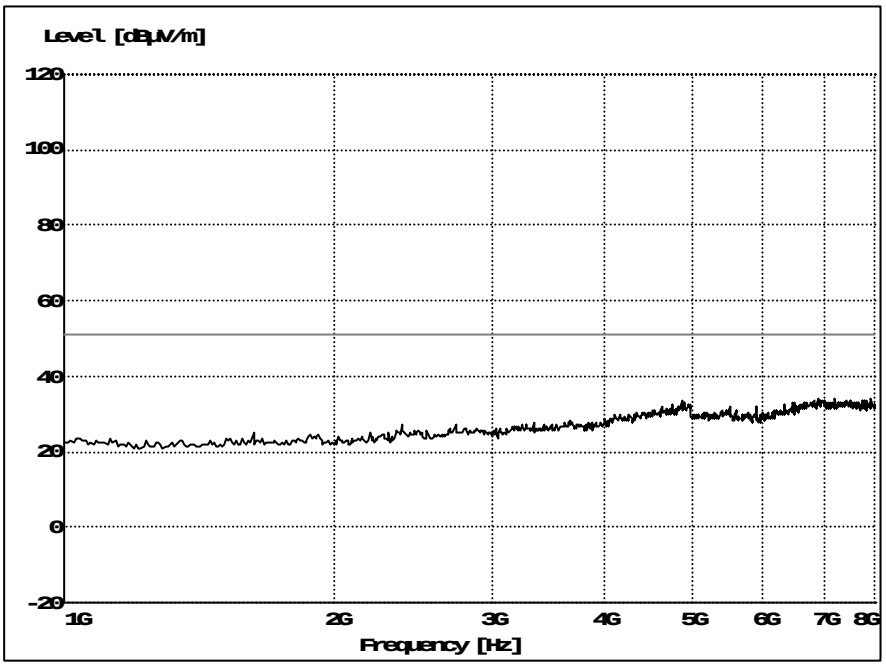


Figure 5. Radiated emission 1 – 8 GHz, Background.
RBW = 100 kHz and VBW = 100 kHz.

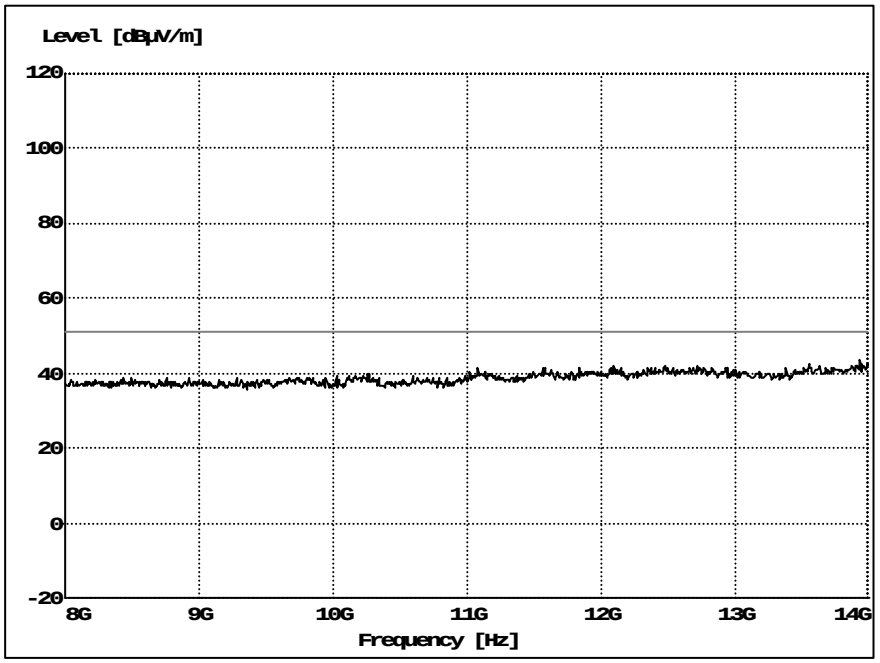


Figure 5. Radiated emission 8 – 14 GHz, Background.
RBW = 100 kHz and VBW = 100 kHz.

8.9 ENCLOSED – CETECOM REPORT

This section covers all the frequency range from 14GHz up to 170GHz

SECTION D

Testing of additional requirements

on

Field strength of Spurious Radiation

as specified in

FCC part 2.1053

FCC part 101.111

Table of contents

Tester and Technical responsibility for area of testing :

September 18, 2000	Manfred Paschwitz	
Date	*Name*	*Signature*

September 18, 2000	Arno Dejon	
Date	*Name*	*Signature*

1 General Information

1.1 Test laboratory

CETECOM ICT Services GmbH
Untertürkheimer Straße 6-10
D-66117 Saarbrücken
Germany

CETECOM ICT Services GmbH
P.O. Box 10 04 45
D-66004 Saarbrücken
Germany

Phone: +49 (0)681-598-8434
Fax: +49 (0)681-598-9075
E-Mail: info@ict.cetecom.de
Internet: http://www.cetecom.de

DAR Accredited Testing Laboratory
Registration Number TTI-P-G 166/98

1.2 Client information

Name	:	Ericsson Microwave Systems AB
Street	:	Flöjelbergsgatan 2
Town	:	SE - 43184 Mölndal
Country	:	Sweden
Telephone	:	+46-31-747-6037
Fax	:	+46-31-27 72 25

Contact person :

Name	:	Mr. Roberto Crosta
Company	:	Ericsson Lab Italy S.p.A.
Street	:	Via Cadorma, 73
Town	:	I-20090 Vimodrone - Milan

1.3 Application details

Date of receipt of application	:	Sept 07, 2000
Date of receipt of test item	:	Sept 11, 2000
Date of test	:	Sept 12/13, 2000

1.4 Device under test

Terminal Station:	Outdoor Unit :	MINI-LINK BAS 31GHz UKL 601 04/21	
	Serial numbers :	A23000 PN50 134106	(Radio) (Antenna)
	Indoor Unit :	BFD 101 16/3	
Base Station:	Outdoor Unit :	MINI-LINK BAS 31GHz UKL 601 04/11	
	Serial numbers :	A23000 PN50 134107	(Radio) (Antenna)
	Indoor Unit :	R-AAS	
	Serial number :	BFD 501 030/1	
	Indoor Unit :	NCU	
	Serial number :	ROJ 207 103/1	

1.5 Test Set-up Radiated Emission

f < 50 GHz:

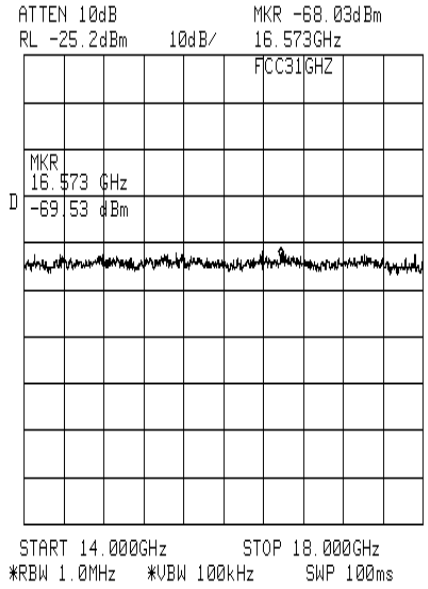
f > 50 GHz:

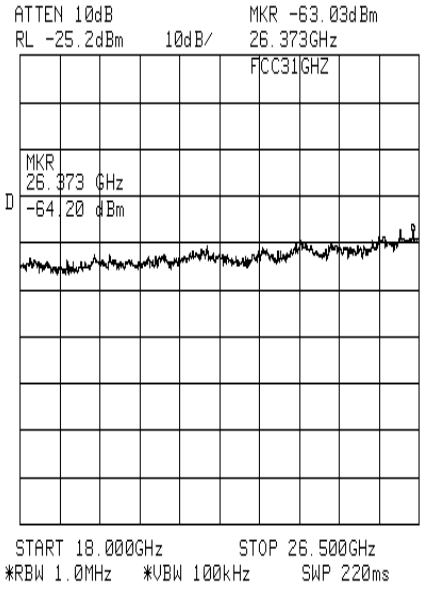
1.6 Used Test Equipment

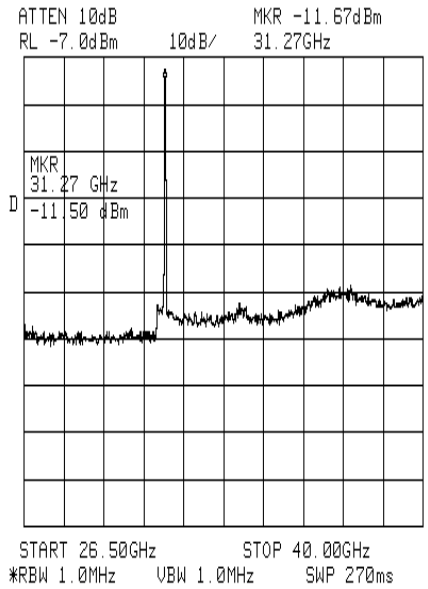
No.	Equipment	Type	Manufacturer
1	Spectrum Analyzer	HP 8565E	Hewlett Packard
2	Spectrum Analyzer	TEK 2782	Tektronix
3	Harmonic Mixer	11970V	Hewlett Packard
4	Harmonic Mixer	11970W	Hewlett Packard
5	Harmonic Mixer	WM780F	Tektronix
6	Harmonic Mixer	WM780D	Tektronix
7	Tapered Transitions		Thomson-CSF
8	Horn Antennas		Flann
9	Horn Antennas		Thomson-CSF

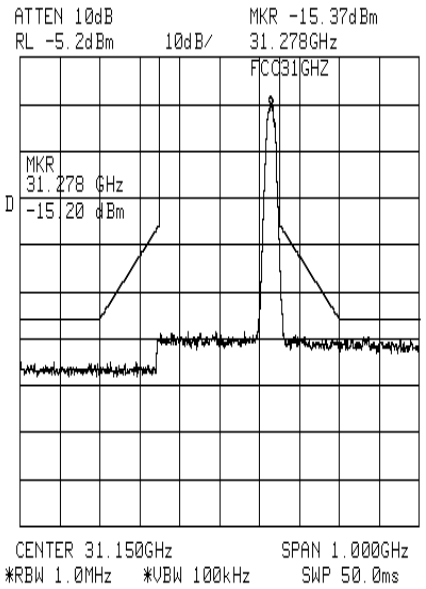
2 Test results

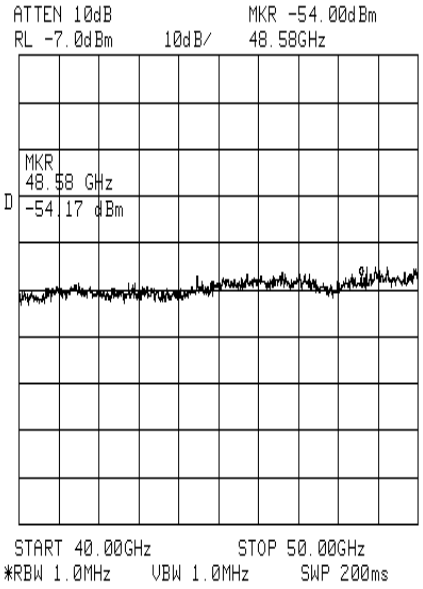
2.1 Radiated Emission of Terminal Station

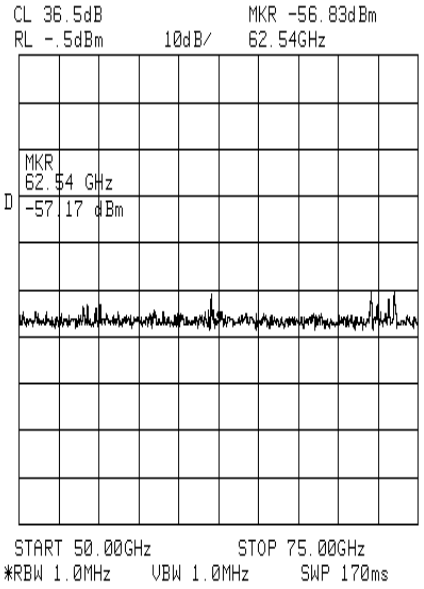


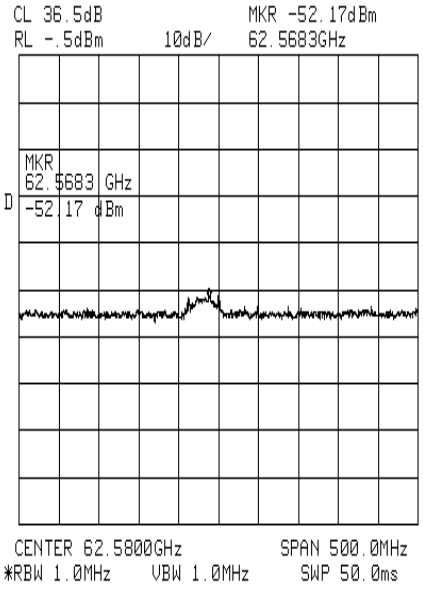


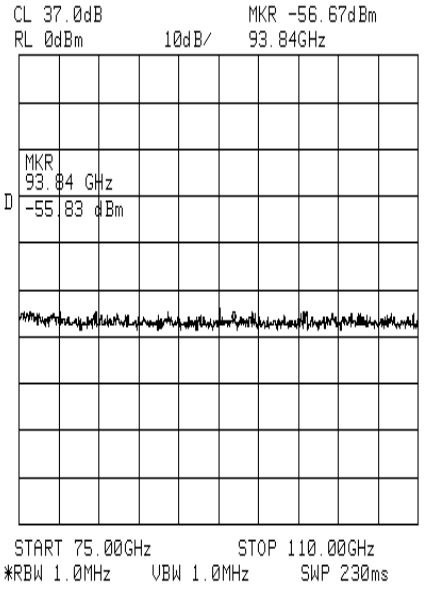






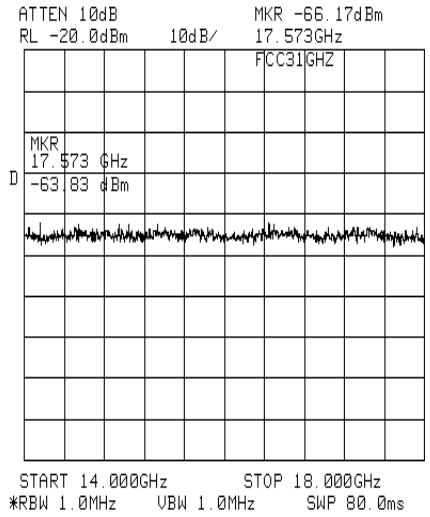


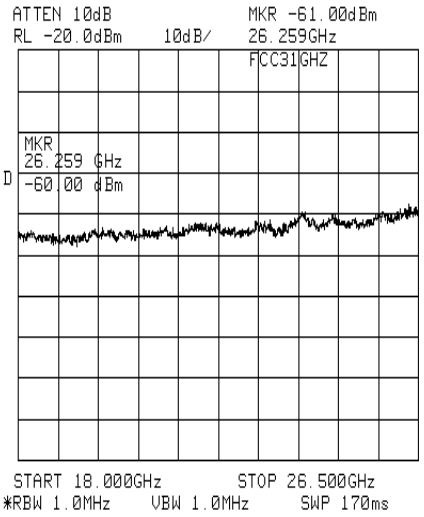


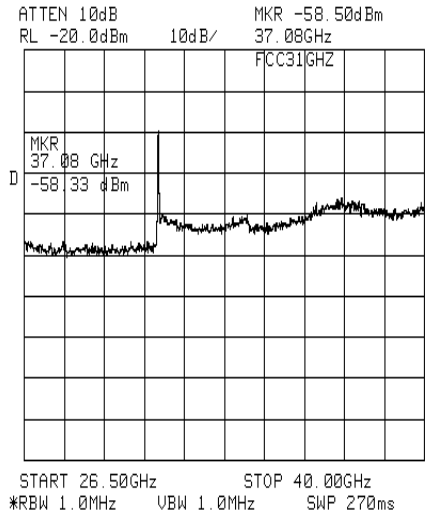


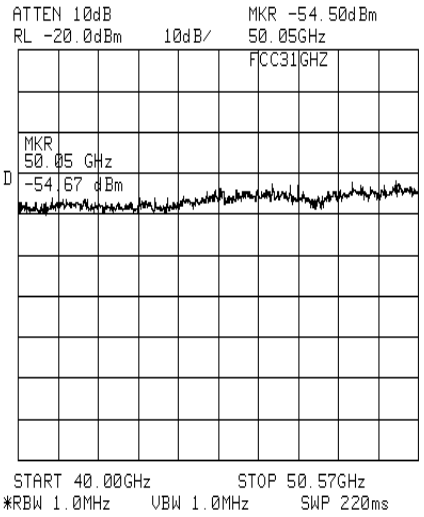
Note: Plots for the range 110-170GHz are not available, but the measurement was done. No spurious signal was detected.

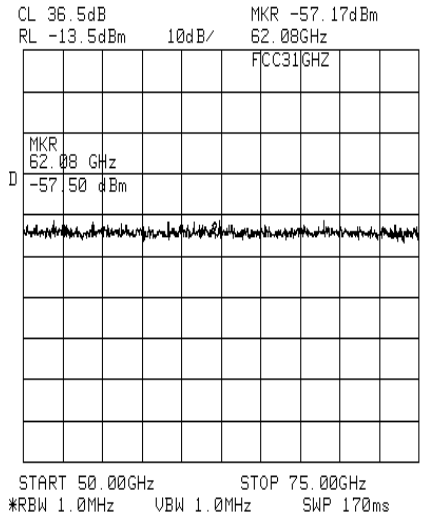
2.2 Radiated Emission of Base Station

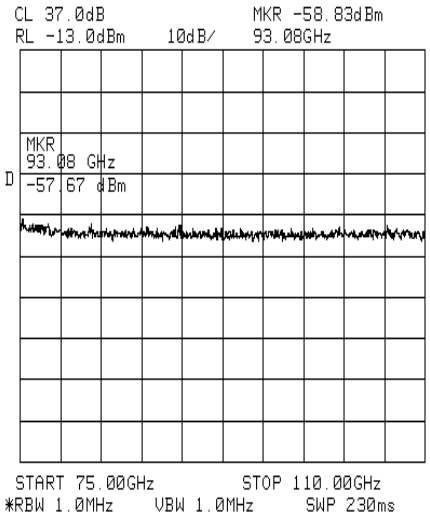












Note: Plots for the range 110-170GHz are not available, but the measurement was done. No spurious signal was detected.

ANTENNA PERFORMANCE SPECIFICATION

Prepared (also subject responsible if other)		No.		
EMWEMNW		1301-UKY 210 91+ Uen		
Approved	Checked	Date	Rev	Reference
TL/AC (S Johansson)		2000-04-18	B	

PRODUCT SPECIFICATION

RADIO NODE ANTENNA 30 GHz

Contents

1 INTRODUCTION

The Radio Node antenna is part of the MINI-LINK BAS family. The antenna is single polarized and separate antennas are used for vertical and horizontal polarization. It is designed for a square cell pattern and has a coverage of 90 degrees

The antenna module consists of an antenna and a mounting kit. It has a waveguide interface to the radio unit. The radio unit can easily be dismounted without affecting the alignment.

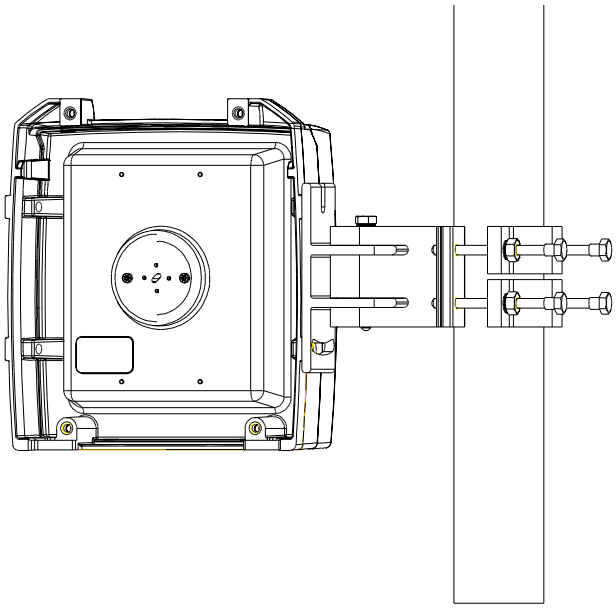


Figure 1.1 Radio node antenna.

The antenna module UKY 210 91 (vertical polarization) or UKY 210 92 (horizontal polarization) can be fitted directly to, or separate from the radio unit.

The antenna module mounting kit has a mechanism for alignment of azimuth and elevation.

2 ELECTRICAL DATA

2.1 FREQUENCY BAND

29.1 – 31.3 GHz

2.2 GAIN VERTICAL POLARIZATION

Guaranteed:	20.6 dBi
Nominal:	21.2 dBi
Gain tolerance:	±0.5 dB

2.3 GAIN HORIZONTAL POLARIZATION

Guaranteed:	20.8dBi
Nominal:	21.2 dBi
Gain tolerance:	±0.5 dB

2.4 HALF POWER BEAMWIDTH (HPBW) ELEVATION

The HPBW of the elevation for both horizontal and vertical polarization

Minimum:	4.1°
Maximum:	4.6°

2.5 RETURN LOSS AND VSWR

Minimum return loss:	14.0 dB
Maximum VSWR:	1.5 : 1

2.6 RADIATION PATTERN ENVELOPES (RPE)

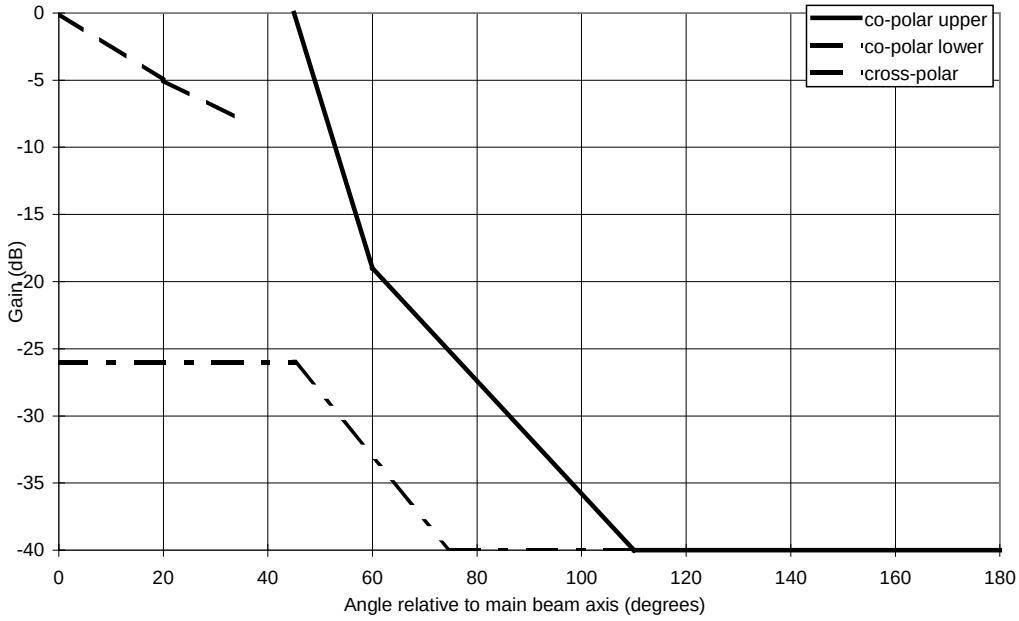


Figure 2.1 Guaranteed azimuth radiation pattern envelope (RPE), Radio node antenna 30 GHz.

Angle relative to main beam axis (degrees)	Guaranteed upper RPE co-polar (dB)	Guaranteed lower RPE co-polar (dB)	Guaranteed RPE cross-polar (dB)
0		0	-26
20		-5	
35		-8	
45	0		-26
60	-19		
75			-40
110	-40		
180	-40		-40

Table 2.1 Guaranteed azimuth radiation pattern envelope (RPE), Radio node antenna 30 GHz.

No peaks will exceed the RPE with more than 2.0 dB.

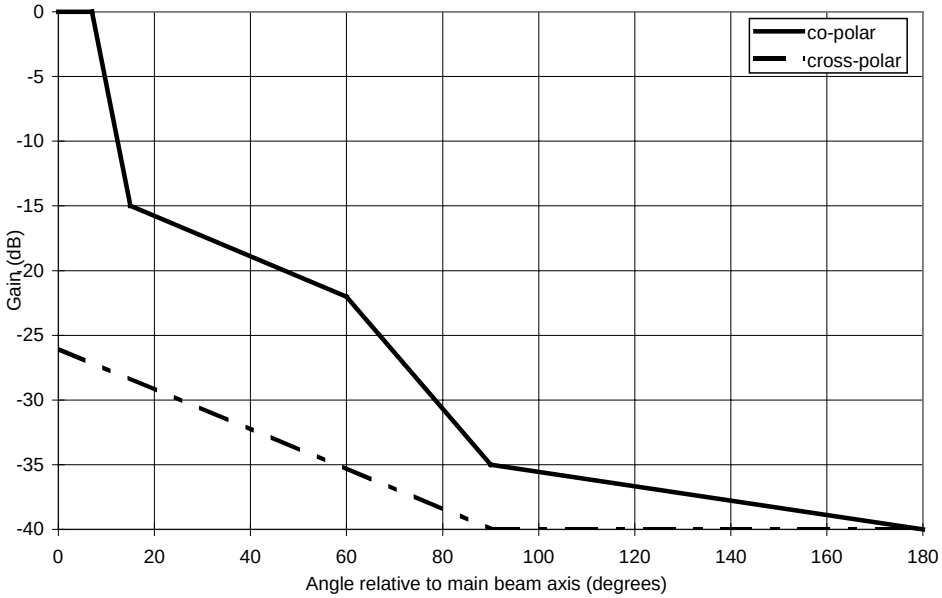


Figure 2.2 Guaranteed elevation radiation pattern envelope (RPE), Radio node antenna 30 GHz.

Angle relative to main beam axis (degrees)	Guaranteed upper RPE co-polar (dB)	Guaranteed RPE cross-polar (dB)
0	0	-26
7	0	
15	-15	
60	-22	
90	-35	-40
180	-40	-40

Table 2.2 Guaranteed azimuth radiation pattern envelope (RPE), Radio node antenna 30 GHz.

No peaks will exceed the RPE with more than 2.0 dB.

3 MECHANICAL DATA

3.1 SIZE

The dimensions in the following figures are nominal.

In Figure 3.1 a principle layout of the radio node antenna is shown.

In Figure 3.2 a principle layout of the radio node antenna fitted directly to the radio unit is shown.

In Figure 3.3 a principle layout of the radio node antenna and the dimensions when it is fixed to a tube with a diameter of 60 mm is shown.

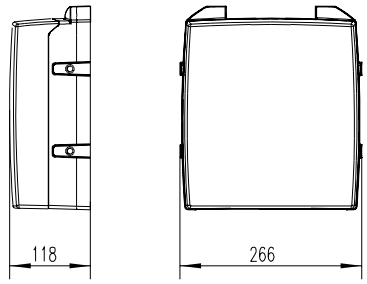


Figure 3.1 Principle layout of the antenna.

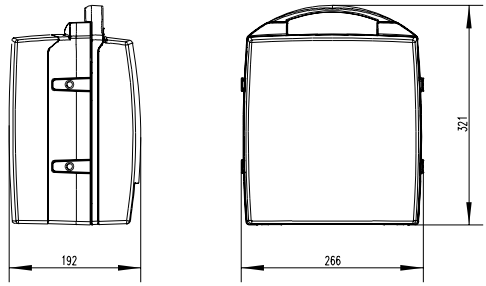


Figure 3.2 Principle layout of the antenna, fitted directly to the radio module.

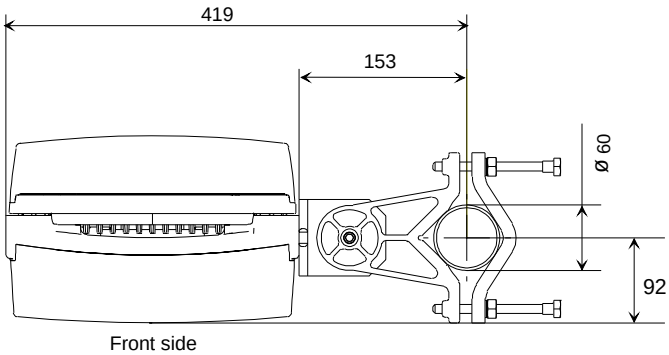


Figure 3.3 Principle layout of the antenna and the dimensions when it is fixed to a Ø60 mm tube (top view).

3.2 WEIGHT

Antenna: 3.8 kg
Mounting kit: 2.3 kg

3.3 RF INTERFACES

3.3.1 Integrated mounting

For integrated installation the antenna has a waveguide interface for MINI-LINK BAS 30 GHz radios.

3.3.2 Separated mounting

For separate installation the antenna has a 154 IEC - UBR 260 flange.

3.4 MATERIAL AND TREATMENT

The antenna is painted and has surface treatment to fulfil the environmental requirements, see section 4.

Antenna: Aluminum with nickel and gold coating.

Baffles: Aluminum with clear anodizing

Frame: sand-cast aluminum with yellow chromate coating and polyester powder paint, min 60 µm. Standard color is light gray, NCS S2502-R.

Radome: UV-resistant polycarbonate plastic. Standard color is light gray, NCS S2502-R. Flame retardancy, V-0.

Mounting kit: nature anodized aluminum profile.

Screws, nuts and washers: stainless steel A4.

4 ENVIRONMENTAL DATA

The antenna complies with the requirements for storage (class 1.2), transportation (class 2.3) and stationary use (class 4.1E, IEC class 4M5) as given in [1]-[3].

4.1 WIND VELOCITY

The equipment is designed for the following wind velocities at stationary use:

Operational:	50 m/s
Survival:	70 m/s

4.2 WIND LOAD AND TORQUE

At operational wind speed:

F = 170 N
M = 40 Nm

At survival wind speed:

F = 330 N
M = 80 Nm

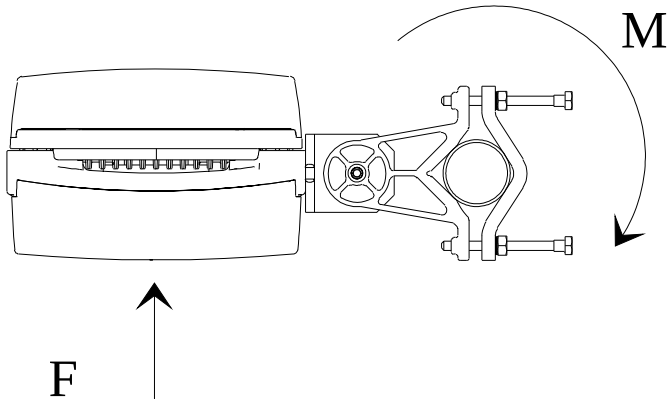


Figure 4.1 Wind load and torque.

4.3 ENDURANCE

The antenna is designed to withstand years of exposure to coastal and/or industrial atmosphere without noticeable performance degeneration or significant deterioration in finish, such as corrosion etc.

5 MOUNTING DATA

5.1 ALIGNMENT

Minimum alignment interval:

Elevation: ±13°
Azimuth: ±65°

5.2 MOUNTING KIT

The mounting kit can be fitted to tubes Ø 50-120 mm or on L-profiles 40x40 - 80x80 mm.

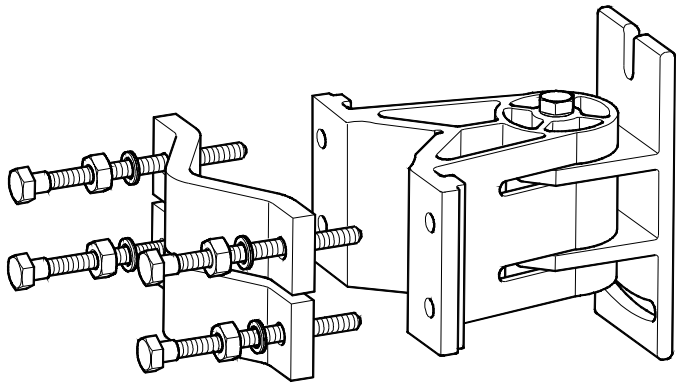


Figure 5.1 Mounting kit.

5.3 ACCESSORIES

- Tripod.
- Kit for separate installation.
- Universal installation kit.

For more details see MINI-LINK BAS product catalogues.

6 MARKING

6.1 ANTENNA MARKING

A label with product code, product number, revision state, serial number, frequency band and polarization is positioned as shown in Figure 6.1.

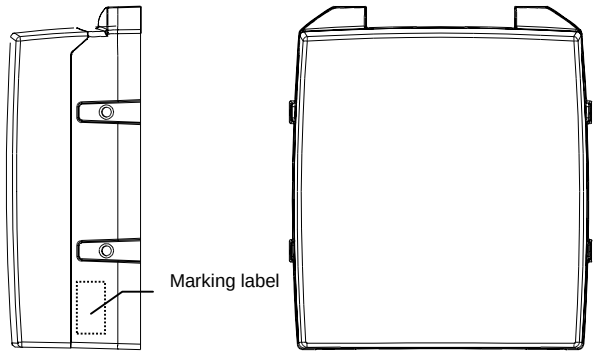


Figure 6.1 Marking label.

6.2 PACKAGING BOX MARKING

A label with product code and serial number is positioned in accordance with EMW instructions.

7 PACKAGING

Each antenna is delivered in its own packaging. The packaging with its fittings is reusable and possible to recycle. The waveguide port of the antenna is protected during transportation.

8 PRODUCT STRUCTURE

8.1 30 GHz VERTICAL RADIO NODE ANTENNA

UKY 210 91	Antenna module 30 GHz vertical polarization.

Consist of:

3/UKY 210 91	Antenna
SXK 111 582/1	Mounting kit

Prepared (also subject responsible if other)		No.		
EMWEMNW		1301-UKY 210 91+ Uen		
Approved	Checked	Date	Rev	Reference
TL/AC (S Johansson)		2000-04-18	B	

8.2 30 GHz HORIZONTAL RADIO NODE ANTENNA

UKY 210 92	Antenna module 30 GHz horizontal polarization.

Consist of:

3/UKY 210 92	Antenna
SXK 111 582/1	Mounting kit

9 DOCUMENT REVISION RECORDS

A	First issue
B	Minor corrections

10 REFERENCES

[1] ETS 300 019-2-1
Equipment Engineering (EE);
Environmental conditions and environmental tests for telecommunications equipment
Part 2-1: Specification of environmental tests
Storage

[2] ETS 300 019-2-2
Equipment Engineering (EE);
Environmental conditions and environmental tests for telecommunications equipment
Part 2-2: Specification of environmental tests
Transportation

[3] ETS 300 019-2-4
Equipment Engineering (EE);
Environmental conditions and environmental tests for telecommunications equipment
Part 2-4: Specification of environmental tests
Stationary use at non-weatherprotected locations

Prepared (also subject responsible if other)		No.		
EMWMATG		1/102 67-UKY 210 91+ Uen		
Approved	Checked	Date	Rev	Reference
TL/AC (Stefan Johansson)		2000-03-23	A	

VERIFICATION REPORT MINI-LINK BAS NODE ANTENNA 30 GHz PRESERIES (ELECTRICAL DESIGN)

Abstract

This verification report contains the results from the measurements of the MINI-LINK BAS Node Antenna preseries 30 GHz, UKY 210 91 and UKY 210 92 (vertical and horizontal polarization, respectively), to verify the electrical design.

Contents

1 INTRODUCTION

The measurements were carried out 2000-03-14 at the far-field range A-6 of the antenna department (UA). All measurements have been done using the equipment available at A-6, except for the return loss measurements that were measured using the network analyzer HP8510C 2000-03-23.

3 preseries antennas of horizontal polarization have been manufactured. Neither of them has been assigned to a serial number.

4 preseries antennas of vertical polarization have been manufactured, each of them having the following serial number:

A23000HUJ9, A23000HUJA, A23000HUJB, A23000HUJC

All requirements mentioned in this report are guaranteed requirements according to [1]. The measurements were carried out in accordance with the verification specification [2].

Prepared (also subject responsible if other)		No.		
EMWMATG		1/102 67-UKY 210 91+ Uen		
Approved	Checked	Date	Rev	Reference
TL/AC (Stefan Johansson)		2000-03-23	A	

2 MEASUREMENTS

2.1 FREQUENCY BAND

The antenna is designed for the frequency band 29.1-31.3 GHz.

2.2 GAIN

The gain is presented in Figure 1 and Figure 2.

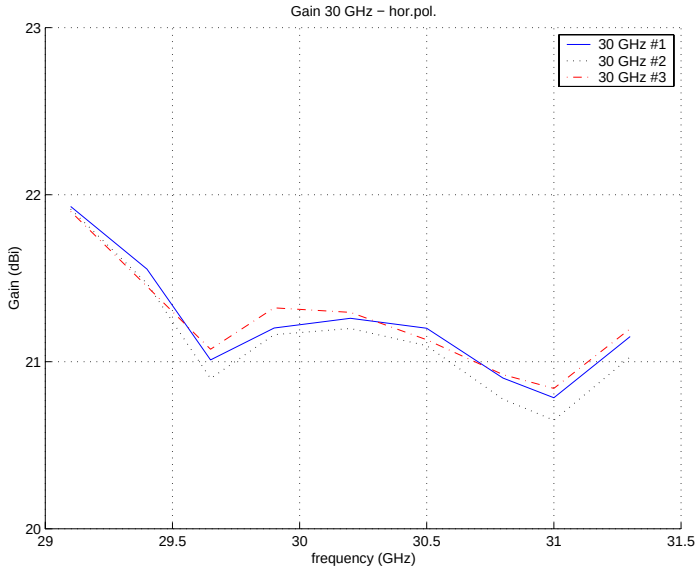


Figure 1 Gain measurements for some horizontally polarized antennas.

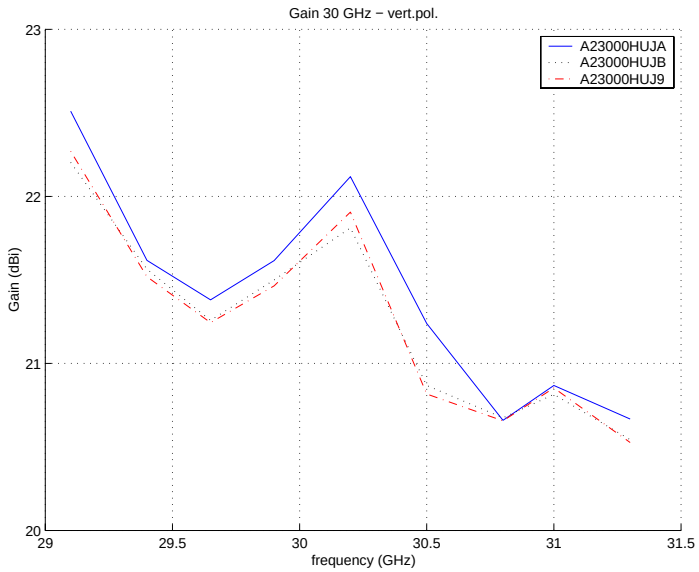


Figure 2 Gain measurements for some vertically polarized antennas.

2.3 HALF-POWER BEAMWIDTH

The half power beamwidth (3 dB) in elevation has been calculated (with linear interpolation) using the same radiation patterns as in section 2.5. The results are presented in Table 2-1 and Table 2-2.

Table 2-1 Measured and specified half power beamwidth (HPBW) in elevation for horizontal polarization.

	Horizontal polarization		
Freq. [GHz]	**Antenna #1 [°]**	**Antenna #2 [°]**	**Antenna #3 [°]**
29.1	4.5	4.5	4.6
30.2	4.3	4.3	4.3
31.3	4.1	4.1	4.2

Table 2-2 Measured and specified half power beamwidth (HPBW) in elevation for vertical polarization.

	Vertical polarization		
Freq. [GHz]	**A23000HUJA [°]**	**A23000HUJB [°]**	**A23000HUJ9 [°]**
29.1	4.6	4.6	4.6
30.2	4.3	4.4	4.5
31.3	4.3	4.4	4.5

2.4 RETURN LOSS

The reflection (S_{11}) was measured for the frequency band 29-32 GHz including frame and radome. The results are presented in Figure 3 and Figure 4. The minimum return loss ($|S_{11,dB}|$) within the frequency band 29.1-31.3 GHz is presented in Table 2-3 and Table 2-4.

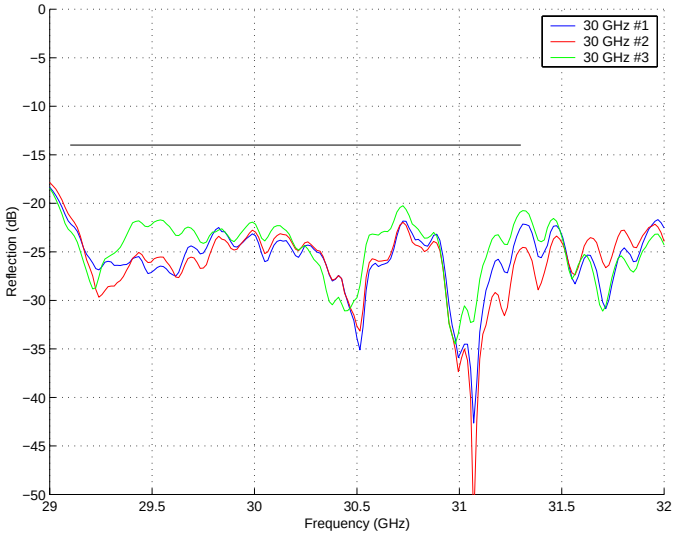


Figure 3 Measured reflection (S_{11}) for some horizontally polarized antennas.

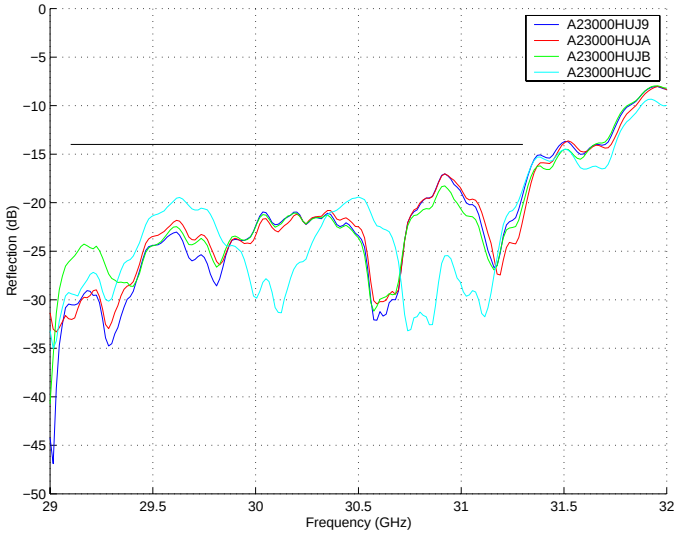


Figure 4 Measured reflection (S_{11}) for some vertically polarized antennas.

Table 2-3 Measured and specified minimum return loss (|S11,dB|) within the specified frequency band 29.1-31.3 GHz for horizontal polarization.

	Antenna #1	**Antenna #2**	**Antenna #3**		**Specified RL**
Return Loss [dB]	21.8	21.0	20.2		>14.0

Table 2-4 Measured and specified minimum return loss (|S11,dB|) within the specified frequency band 29.1-31.3 GHz for vertical polarization.

	A23000HUJ9	**A23000HUJA**	**A23000HUJB**	**A23000HUJC**	**Specified RL**
Return Loss [dB]	17.0	17.0	18.3	18.9	>14.0

2.5 RADIATION PATTERNS

In the measurements, an isolator has been used between the mixer and the AUT/SGH.

All radiation patterns are normalized to minimize the deviations from the specified masks according to [3].

The radiation patterns are shown in Figure 5-Figure 16.

2.5.1 Horizontal polarization

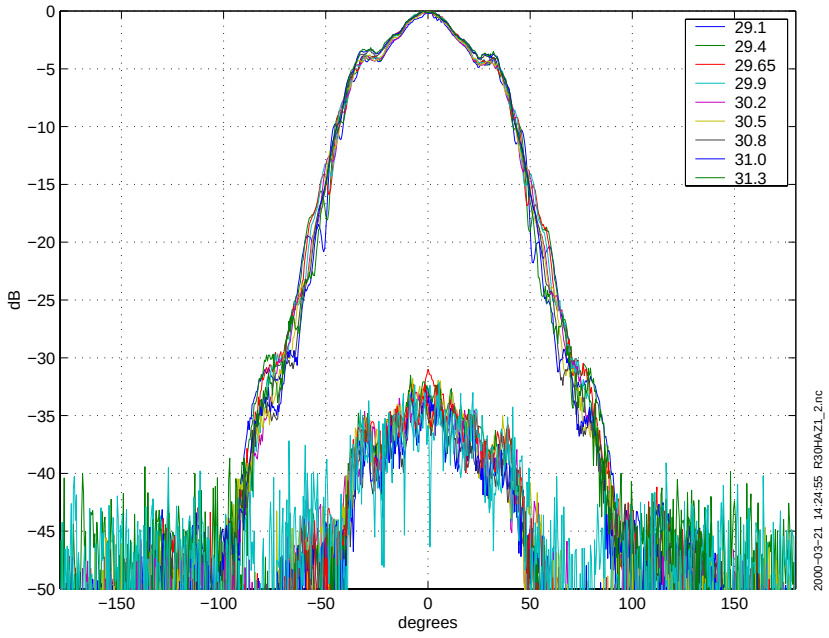


Figure 5 Radiation pattern in azimuth for antenna #1.

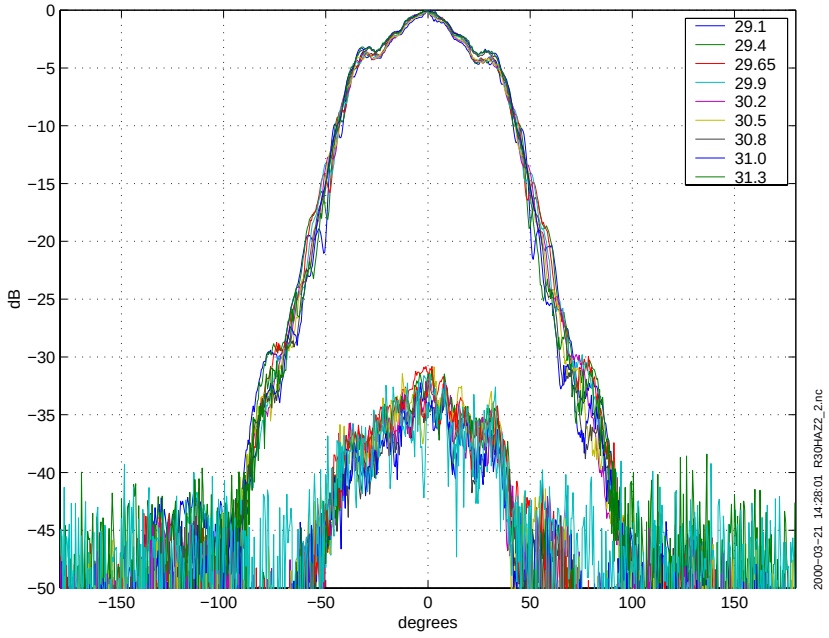


Figure 6 Radiation pattern in azimuth for antenna #2.

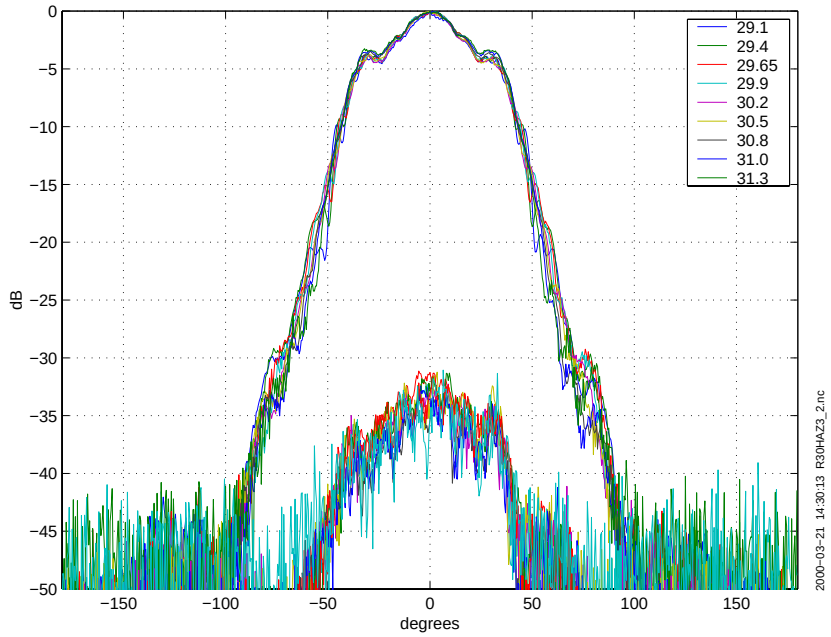


Figure 7 Radiation patterns in azimuth for antenna #3.

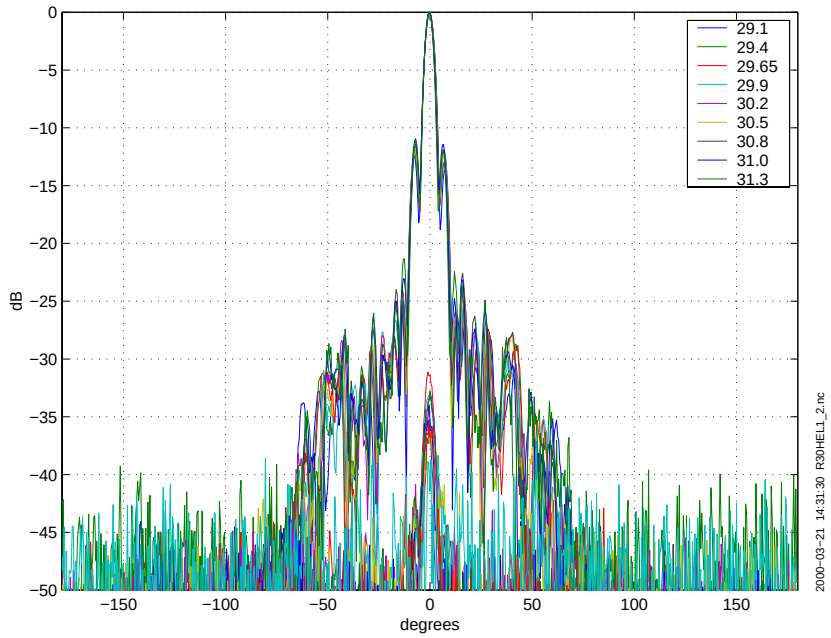


Figure 8 Radiation patterns in elevation for antenna #1.

Prepared (also subject responsible if other)		No.		
EMWMATG		1/102 67-UKY 210 91+ Uen		
Approved	Checked	Date	Rev	Reference
TL/AC (Stefan Johansson)		2000-03-23	A	

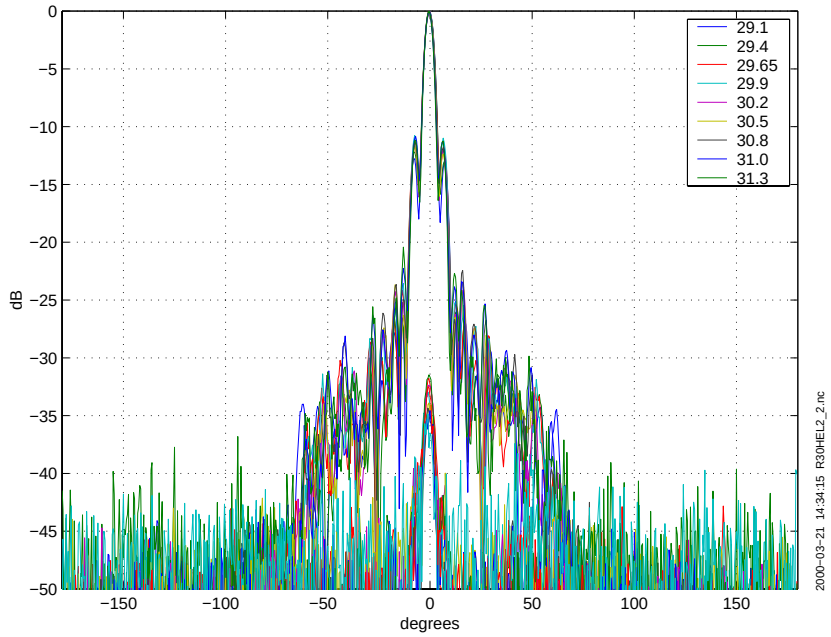


Figure 9 Radiation patterns in elevation for antenna #2.

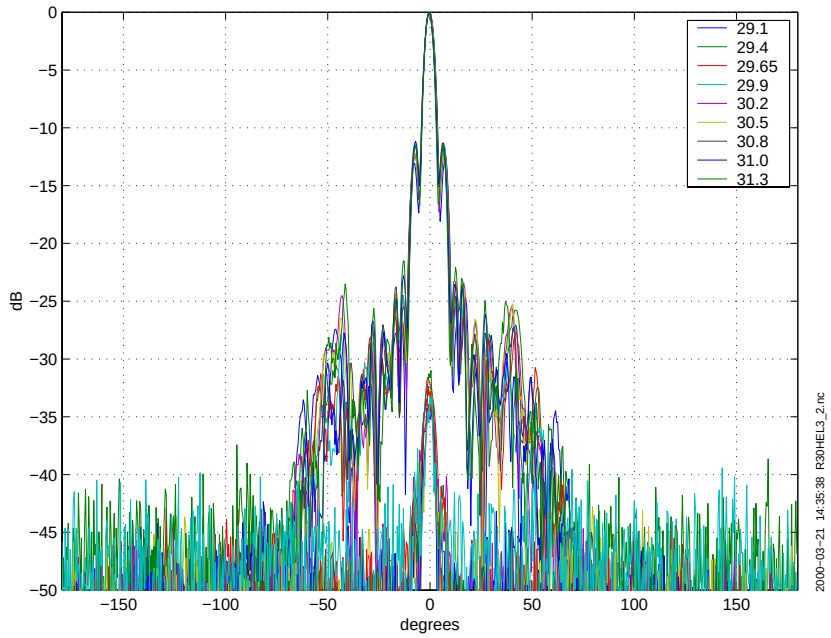


Figure 10 Radiation patterns in elevation for antenna #3.

2.5.2 Vertical polarization

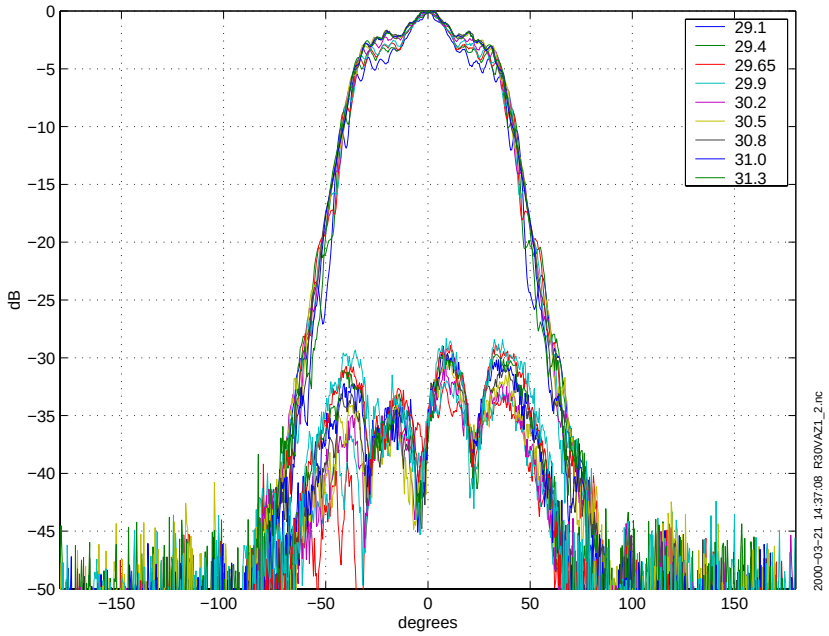


Figure 11 Radiation patterns in azimuth for A23000HUJA.

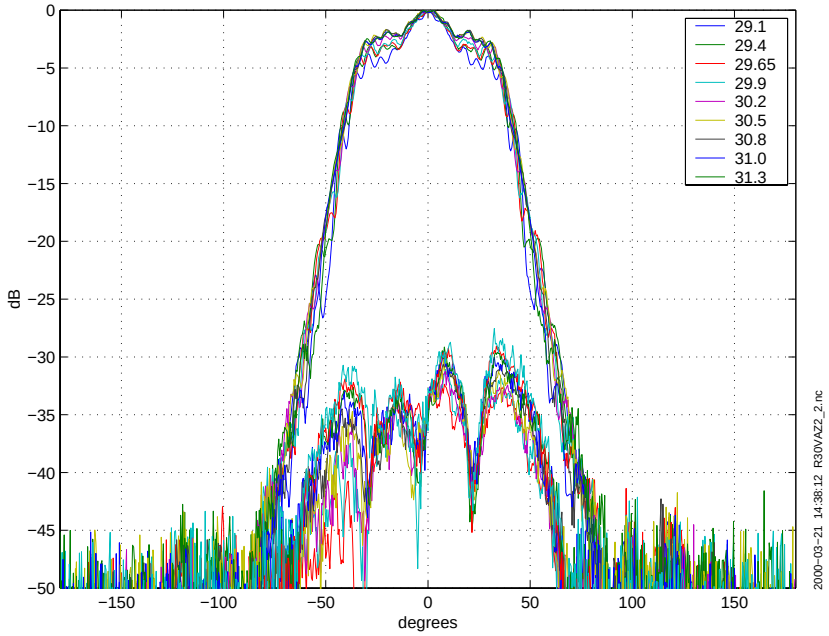


Figure 12 Radiation patterns in azimuth for A23000HUJB.

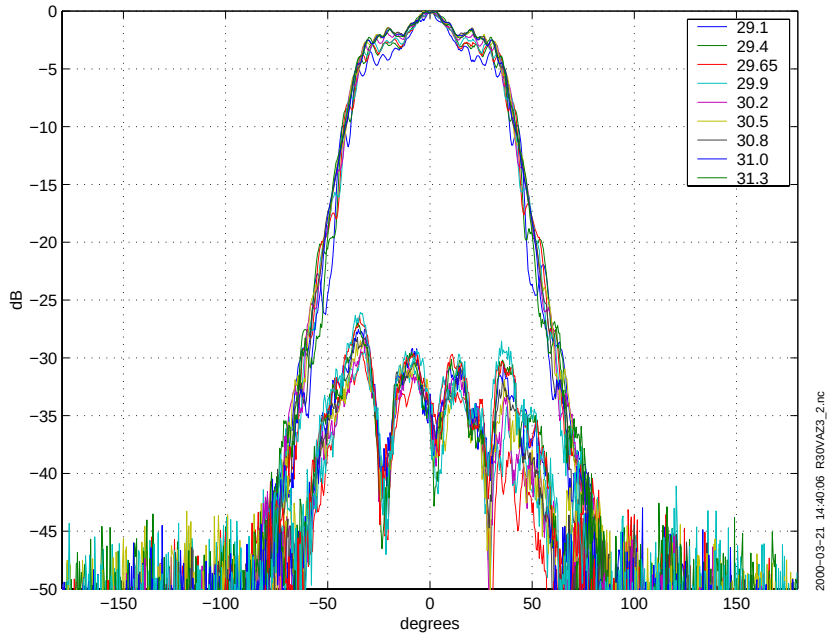


Figure 13 Radiation patterns in azimuth for A23000HUJ9.

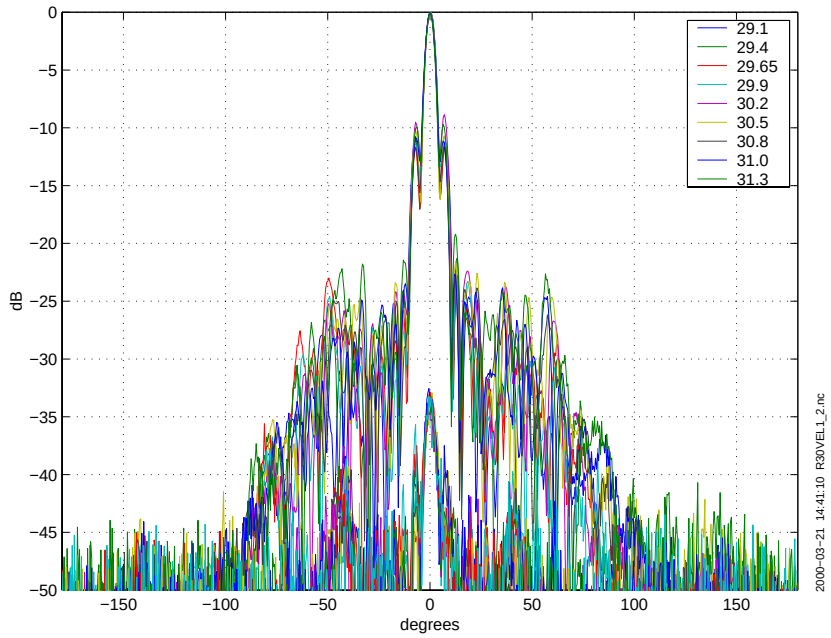


Figure 14 Radiation patterns in elevation for A23000HUJA.

Prepared (also subject responsible if other)		No.		
EMWMATG		1/102 67-UKY 210 91+ Uen		
Approved	Checked	Date	Rev	Reference
TL/AC (Stefan Johansson)		2000-03-23	A	

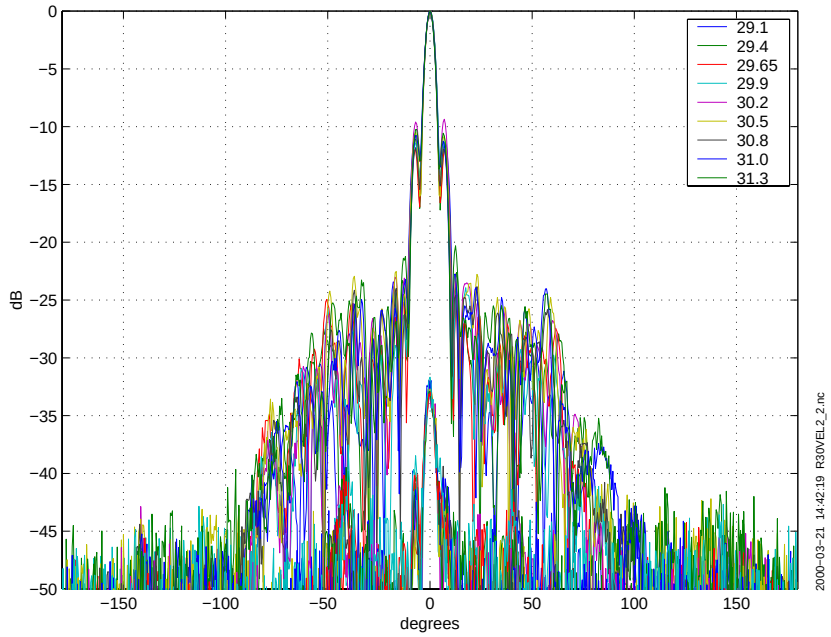


Figure 15 Radiation patterns in elevation for A23000HUJB.

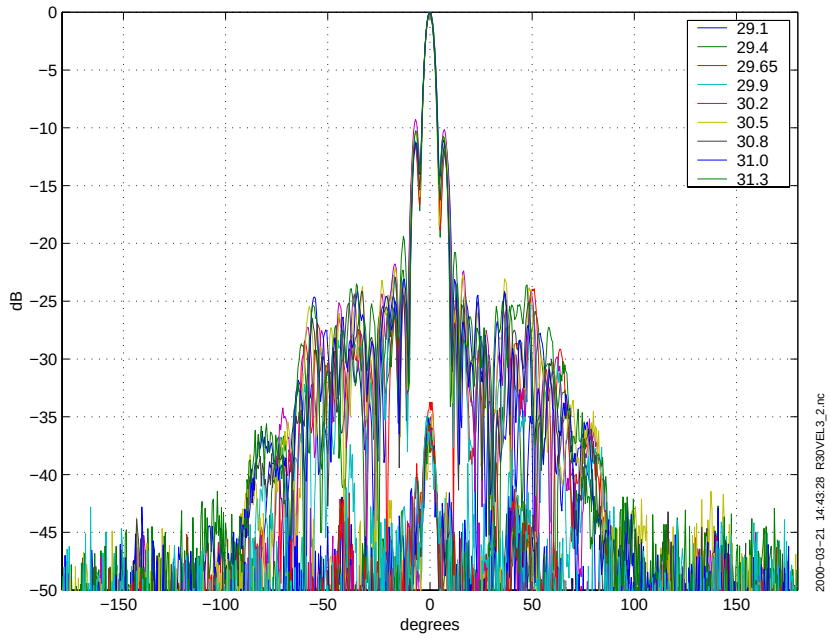


Figure 16 Radiation patterns in elevation for A23000HUJ9.

Prepared (also subject responsible if other)		No.		
EMWMATG		1/102 67-UKY 210 91+ Uen		
Approved	Checked	Date	Rev	Reference
TL/AC (Stefan Johansson)		2000-03-23	A	

3 CONCLUSIONS

- The half-power beamwidth (HPBW) is as expected within 4.1°-4.9° for both vertical and horizontal polarisation.
- The gain for both horizontal and vertical polarization is well above the expected value of 20 dBi.
- The return loss is better than 14.0 dB.

4 COMMENTS

In serial production it is expected that some antennas not will fulfil the specification of 14 dB return loss, due to manufacture failure. They will be sorted out in the production test [4] that all antennas will pass through. In this test the antennas with bad soldering will also be sorted out even if they fulfil the 14 dB return loss specification.

To improve the azimuth radiation pattern a new radome will be designed.

5 REFERENCES

[1] 1056- UKY 210 85 Uen, rev A
Requirement specification WBAS R1 node antenna

[2] 1/102 64-UKY 210 85+ Uen, rev B
Electrical design verification specification for WBAS node antenna

[3] EMW/UA/T-99:007, rev A
Suggested radiation pattern requirements for point-to-multipoint central station antenna.

[4] 152 41-UKY 210 85 Usv, rev PA1
Provningsspecification MINI-LINK BAS Nod Antenn

Prepared (also subject responsible if other)		No.		
EMWJF		1301-UKY 210 70/SC15 Uen		
Approved	Checked	Date	Rev	Reference
SML/XC (Jonny Dahlberg)		1999-11-11	B	30GHz 0.2m Comp HP mono

PRODUCT SPECIFICATION
0.2 m COMPACT ANTENNA 30 GHz, HIGH PERFORMANCE

Contents

1 INTRODUCTION

The antenna is part of the MINI-LINK family and can be installed with MINI-LINK BAS equipment.

The antenna module consists of a 0.2 m reflector, a feed, a radome and a mounting kit. It has an interface to the radio unit. The radio unit can easily be dismounted without affecting the alignment.

The antenna is single polarized. The feed is adjustable for vertical or horizontal polarization.

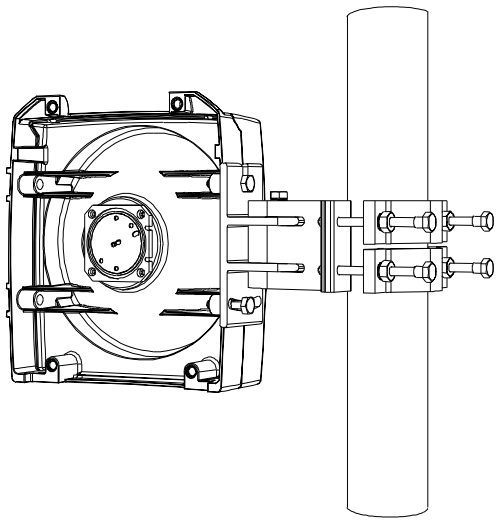


Figure 1.1 0.2 m compact antenna.

The antenna module UKY 210 70/SC15 can be fitted directly to, or separated from, the radio unit.

The antenna module mounting kit has a mechanism for alignment of azimuth and elevation.

2 ELECTRICAL DATA

2.1 FREQUENCY BAND

29.1 - 31.3 GHz

2.2 GAIN

Lower band edge:	34.6 dBi
Mid band:	34.6 dBi
Higher band edge:	35.5 dBi
Gain tolerance:	±1.0 dB

2.3 HALF POWER BEAMWIDTH (HPBW)

HPBW for horizontal and vertical polarization (E and H-plane):

Minimum:	2.6°
Maximum:	3.4°

2.4 CROSS-POLAR DISCRIMINATION (XPD)

XPD within the 1 dB co-polar contour:

Minimum:	27 dB
Typical:	30 dB

2.5 RETURN LOSS AND VSWR

Minimum return loss:	14.0 dB
Maximum VSWR:	1.50 : 1

2.6 FRONT TO BACK RATIO

Minimum: 55 dB

2.7 RADIATION PATTERN ENVELOPES (RPE)

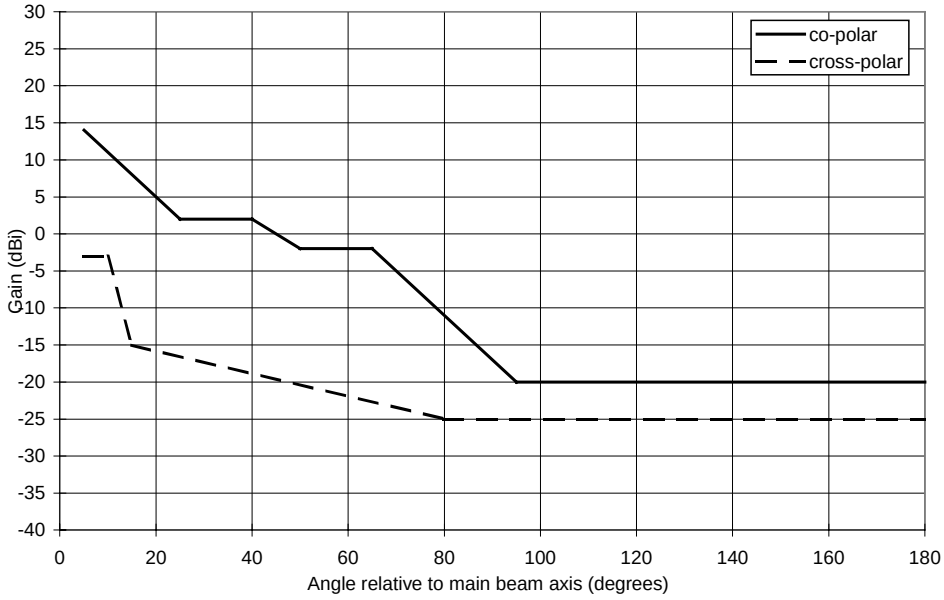


Figure 2.1 Guaranteed radiation pattern envelope (RPE), 0.2 m compact 30 GHz, high performance.

Table 2.1 Guaranteed radiation pattern envelope (RPE), 0.2 m compact 30 GHz, high performance.

Angle relative to main beam axis (degrees)	Guaranteed RPE co-polar (dBi)	Guaranteed RPE cross-polar (dBi)
5	14	-3
10		-3
15		-15
25	2	
40	2	
50	-2	
65	-2	
80		-25
95	-20	
180	-20	-25

No peaks will exceed the RPE with more than 2.0 dB.

3 MECHANICAL DATA

3.1 SIZE

The dimensions in the following figures are nominal.

In Figure 3.1 a principle layout of the high performance antenna is shown.

In Figure 3.2 a principle layout of the high performance antenna fitted directly to the radio unit is shown.

In Figure 3.3 a principle layout of the high performance antenna and the dimensions when it is fixed to a tube with a diameter of 60 mm is shown.

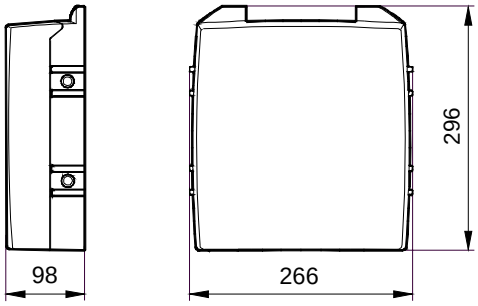


Figure 3.1 Principle layout of the antenna.

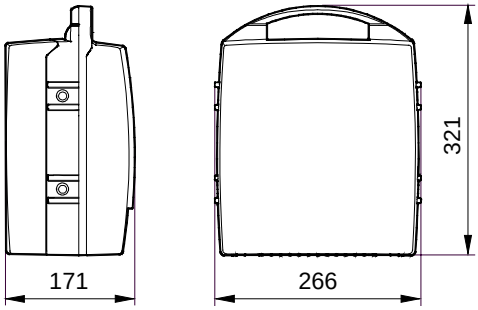


Figure 3.2 Principle layout of the antenna, fitted directly to the radio module.

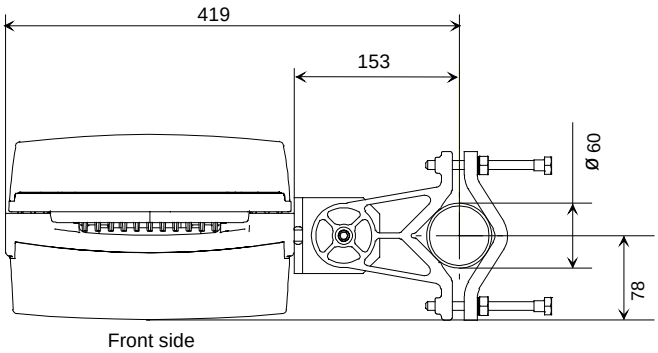


Figure 3.3 Principle layout of the antenna and the dimensions when it is fixed to a Ø60 mm tube (top view).

3.2 WEIGHT

Antenna: 2.5 kg
Mounting kit: 2.9 kg

3.3 RF INTERFACES

3.3.1 Integrated mounting

For integrated installation the antenna has a waveguide interface for MINI-LINK BAS 30 GHz radios, with polarization plate.

3.3.2 Separated mounting

For separate installation the antenna has a 154 IEC - UBR 260 flange.

3.4 MATERIAL AND TREATMENT

The antenna is painted and has surface treatment to fulfil the environmental requirements, see section 4.

Antenna: die-cast aluminum with yellow chromate coating and polyester powder paint, min 60 μm. Standard color is light gray, NCS S2502-R.

Radome: UV-resistant polycarbonate plastic. Standard color is light gray, NCS S2502-R. Flame retardancy, V-0.

Mounting kit: nature anodized aluminum profile.

Clamps: hot dip galvanizing to DIN 50976, min 65 μm zinc.

Feed: yellow chromate aluminum, EPDM rubber gasket and PTFE plug.

Screws, nuts and washers: stainless steel A4.

3.5 PRESSURIZATION

The maximum allowed antenna feed over pressure is 40 kPa (continuos operation).

4 ENVIRONMENTAL DATA

The antenna complies with the requirements for storage (class 1.2), transportation (class 2.3) and stationary use (class 4.1E, IEC class 4M5) as given in [1]-[3].

4.1 WIND VELOCITY

The equipment is designed for the following wind velocities at stationary use:

Operational: 50 m/s
Survival: 70 m/s

4.2 WIND LOAD AND TORQUE

At operational wind speed:

F = 170 N
M = 40 Nm

At survival wind speed:

F = 330 N
M = 80 Nm

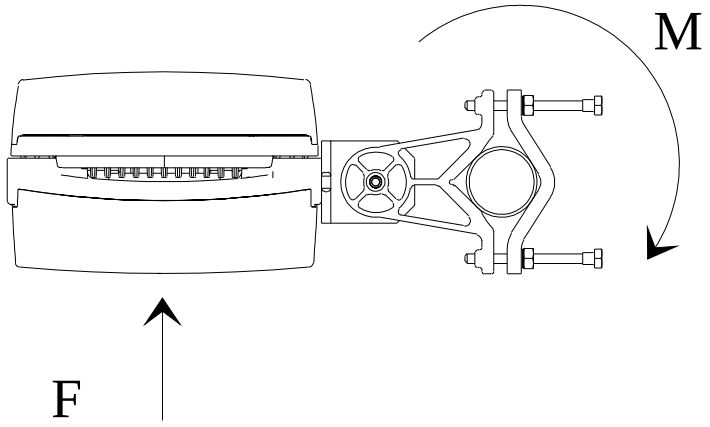


Figure 4.1 Wind load and torque.

4.3 ENDURANCE

The antenna is designed to withstand years of exposure to coastal and/or industrial atmosphere without noticeable performance degeneration or significant deterioration in finish, such as corrosion etc.

5 MOUNTING DATA

5.1 ALIGNMENT

Minimum alignment interval:

Elevation: ±13°
Azimuth: ±65°

5.2 MOUNTING KIT

The mounting kit can be fitted to tubes Ø 50-120 mm or on L-profiles 40x40 - 80x80 mm.

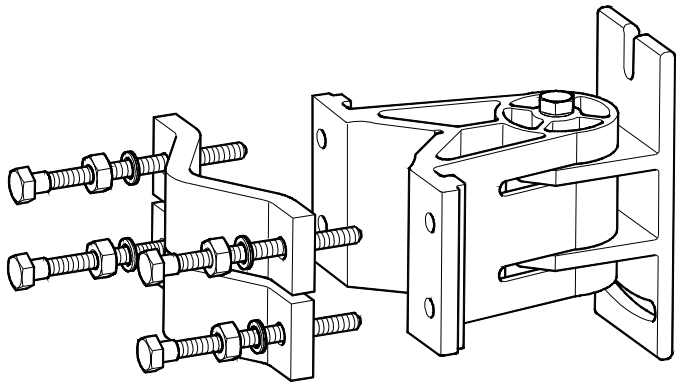


Figure 5.1 Mounting kit.

5.3 ACCESSORIES

- Tripod.
- Kit for separate installation.
- Universal installation kit.

For more details see MINI-LINK product catalogues.

6 MARKING

6.1 FEED MARKING

A label with product code, revision state and serial number in accordance with EMW instructions is positioned adjacent to the waveguide port of the feed.
The feed and the polarization plate are marked with the frequency band.

6.2 ANTENNA MARKING

A label with product code, product number, revision state, serial number, frequency band and nominal gain is positioned as shown in Figure 6.1.

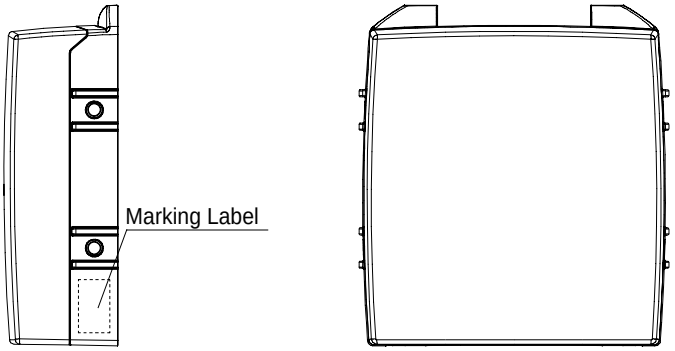


Figure 6.1 Marking label.

6.3 PACKAGING BOX MARKING

A label with product code and serial number is positioned in accordance with EMW instructions.

7 PACKAGING

Each antenna is delivered in its own packaging. The packaging with its fittings is reusable and possible to recycle. The waveguide port of the feed is protected during transportation.

The antenna is delivered with the feed installed for vertical polarization.

8 PRODUCT STRUCTURE

UKY 210 70/SC15	Antenna module (0.2 m compact, single polarized, high performance, gray)

Consist of:

3/UKY 210 70/SC15	Antenna
SXK 111 582/1	Mounting kit

Prepared (also subject responsible if other)		No.		
EMWJF		1301-UKY 210 70/SC15 Uen		
Approved	Checked	Date	Rev	Reference
SML/XC (Jonny Dahlberg)		1999-11-11	B	30GHz 0.2m Comp HP mono

9 DOCUMENT REVISION RECORDS

A First issue

B Minor corrections

10 REFERENCES

[1] ETS 300 019-2-1
Equipment Engineering (EE);
Environmental conditions and environmental tests for telecommunications equipment
Part 2-1: Specification of environmental tests
Storage

[2] ETS 300 019-2-2
Equipment Engineering (EE);
Environmental conditions and environmental tests for telecommunications equipment
Part 2-2: Specification of environmental tests
Transportation

[3] ETS 300 019-2-4
Equipment Engineering (EE);
Environmental conditions and environmental tests for telecommunications equipment
Part 2-4: Specification of environmental tests
Stationary use at non-weatherprotected locations