Ericsson Type Acceptance Radio Transceiver **Test Report**	
Product description	28 GHz Hub and 28Ghz Subscriber Radio Transceiver
Product Number	UKL 601 03/xx
FCC ID	OOLUKL60103

Abstract
In the document are reported the results of some measurements performed on MINI-LINK BAS RAU P1.

Contents

1. ABBREVATIONS

EUT	Equipment Under Test
IF	Intermediate Frequency
MMU	ModeM Unit
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 03, rev.PA1, Ericsson Type Acceptance Radio Transceiver

3. INTRODUCTION

This test report is submitted to the FCC for the acceptance of the Ericsson Microwave AB radios operating in the LMDS band 27.5 to 28.35 GHz band.

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], [3]

3.1. Occupied bandwidth

3.2. Output spectrum (spectrum mask)

3.3. Frequency stability vs temperature and supply voltage

3.4. Frequency tolerance

3.5. Spurious emission at antenna terminal

3.6. Field strength of spurious radiation

The EUTs are

radio node UKL 601 03/12 at 28.05 GHz

radio node UKL 601 03/11 at 27.519 GHz (Output mask test)

radio node UKL 601 03/22 at 28.331 GHz (Output mask test)

The measurement set-up is sketched in fig.1

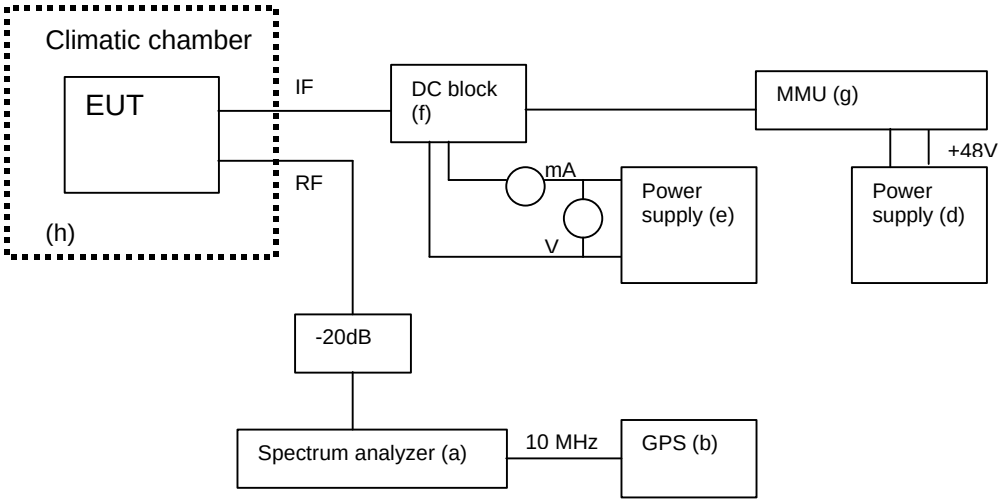


Figure 1 – Sketch of measurement set-up

4. LIST OF INSTRUMENTS

4.1. Spectrum analyser HP8565E

4.2. Exac Time 9390 Global Positioning System Time Code and Frequency Generator

4.3. 2 X Multimeter HP 973A

4.4. DC Power Supply HP E3631A

4.5. DC Power Supply Lareet Mod.AST60/6

4.6. DC block Minicircuit 15542

4.7. Modem Unit

4.8. 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

5.1.1.1. T=20°C

5.1.1.2. V=44:60 V

5.1.1.3. $P_{out}=P_{max}$=23.6 dBm (25 dB attenuation outside RAU)

5.1.1.4. TX always ON

5.1.1.5. Modulation OFF

5.1.1.6. f_{TX}=28.050 GHz

5.1.1.7. Radio Control Loop OFF

5.1.2. Results

P/N	dBm @Fo
UKL 601 03/12	23.6

Table 1- Output power stability

Temperature (°C)	Output power (dBm)		
	V=44V	V=52V	V=60V
-30	-3.1	-3.1	-3.1
-20	-3.3	-3.3	-3.3
-10	-3.8	-3.8	-3.8
0	-3.8	-3.8	-3.8
10	-4.0	-4.0	-4.0
20	-4.3	-4.3	-4.3
25	-4.8	-4.8	-4.8
30	-4.8	-4.8	-4.8
40	-5.0	-5.0	-5.0
50	-5.5	-5.5	-5.5
60	-5.8	-5.8	-5.8

5.2. OCCUPIED BANDWIDTH

5.2.1. Conditions

T=20°C

V=52V

TX always ON

Modulation ON

f_{TX}=28.050 GHz

$P_{out}=P_{max}$=23.6 dBm (20dB attenuation outside RAU)

Spectrum analyser settings:

SPAN=160MHz, RBW=100KHz, VBW=300Hz, f_c=28050000KHz

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%) = 28.8 MHz

See fig. 2

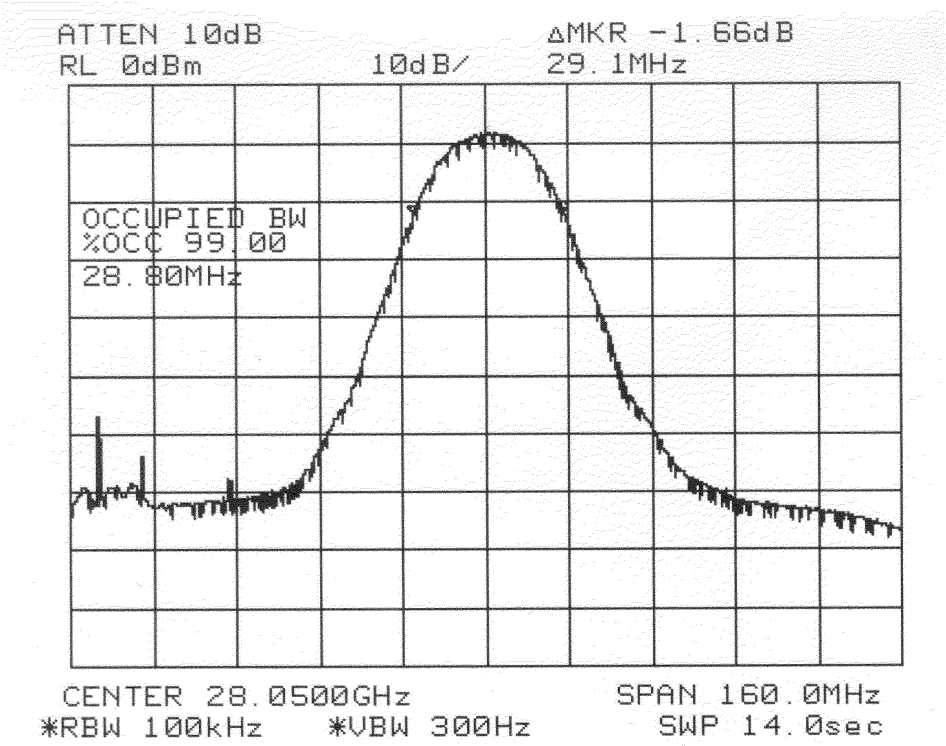


Figure 2- Occupied bandwidth measurement

5.3. SPECTRUM MASK

5.3.1. Conditions

T=20°C

V=52V

1st f_{TX}=27.519 GHz 2nd f_{TX}=28.331 GHz

$P_{out}=P_{max}$=23.6 dBm (20dB attenuation outside RAU)

TX always ON

Modulation ON

Spectrum analyser settings and plot:

See figures 1 to 12

5.3.2. Results

In tables 1 are reported the attenuation values A(Δf) with respect to the fundamental level (figure 1 and 3 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 in table 1 are evaluated considering B=850 MHz in par.(ii) sec.101.111 of FCC. The limits are then normalised according to measurement bandwidth.

In Figures 2 and 4 are reported the measurements taken at the lower and higher side of the authorised bandwidth.

Table 1 – FCC (B = 850) MHz Spectrum Mask

Frequency (Mhz)	Req. ΔBc (dB)	F_{TX}-1 ΔBc (dB)	F_{TX}-2 ΔBc (dB)
25,400	37	69,5	69,5
25,600	37	69,4	69,4
25,800	37/56	69,3	69,1
26,00	56	69,6	69,5
26,200	56	69,4	69,6
26,400	56	69,00	69,1
26,600	56	69,1	69,00
26,800	56	69,4	69,2
27,000	56	69,1	69,0
27,100	56	69,8	69,8
27,150	56	71,7	71,7
27,170	56	71,9	71,9
27,200	54.52	73,9	73,9
27,250	52.15	73,15	74,1
27,300	49.78	74,0	73,8
27,350	47.41	74,0	74.0
27,400	45.04	74.83	74.1
27,450	42.67	72.0	73.9
27,500	40.3/0	41,33	73.7
27,520	0	0.0	74.00
27,550	0	72.0	73.9
27,600	0	73.9	74.1
27,650	0	64.0	73.8
27,700	0	74.2	74.3
27,750	0	74.5	73.8
27,800	0	74.3	73.6
27,850	0	74.1	73.7
27,900	0	74.7	73.4

Frequency (Mhz)	Req.ΔBc (dB)	F_{TX}-1 ΔBc (dB)	F_{TX}-2 ΔBc (dB)
27,950	0	74.3	73.4
28,000	0	74.2	74.3
28,050	0	74.1	73.9
28,100	0	74.3	73.7
28,150	0	73.9	73.6
28,200	0	74.2	73.8
28,250	0	74.05	73.7
28,300	0	73.9	71.7
28,330	0	73.9	0
28,350	0/40.3	73.8	41,33
28,400	42.67	74.3	72.9
28,450	45.04	74.6	73.6
28,500	47.41	74.5	73.9
28,550	49.78	74.3	73.95
28,600	52.15	74.1	74.00
28,650	54.52	74.2	74.17
28,680	56	74.00	73.9
28,700	56	73.8	74.3
28.750	56	74.0	74.0
28,850	56	73.9	74.1
29,050	56	73.7	73.8
29,250	56	74.1	73,4
29,450	56	74.3	73.9
29,650	56	73.9	73.8
29,850	56	73.7	74.1
30,050	56/37	73.6	73.9
30,250	37	73.5	74.0
30,450	37	73.7	73.8

F1= 27,519 GHz- Lower frequency
F2= 28,331 GHz Higher frequency

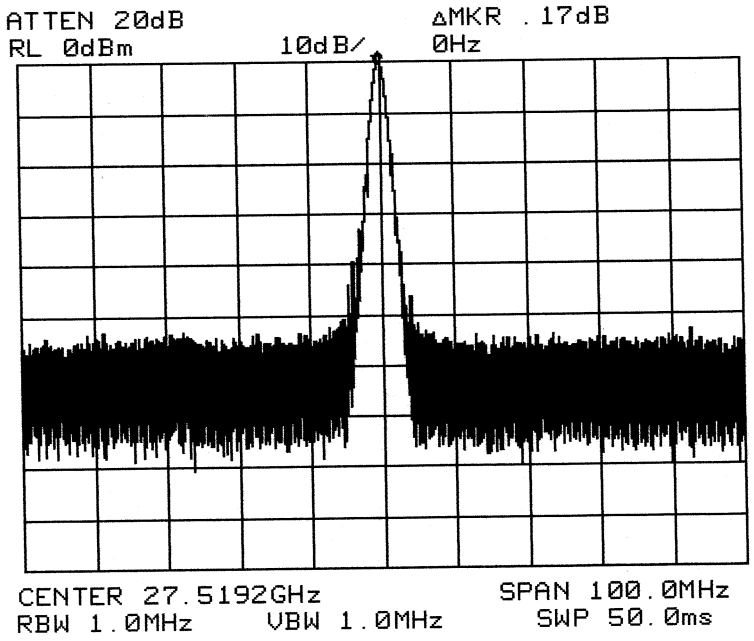


FIGURE 1 - Mean output power reference at 27.519 GHz

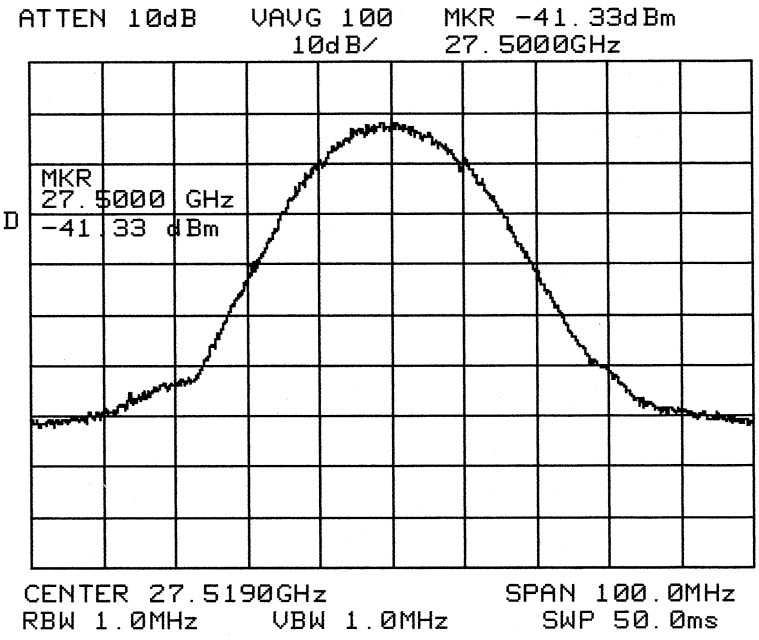


Figure 2 - Attenuation at 27.500 Ghz

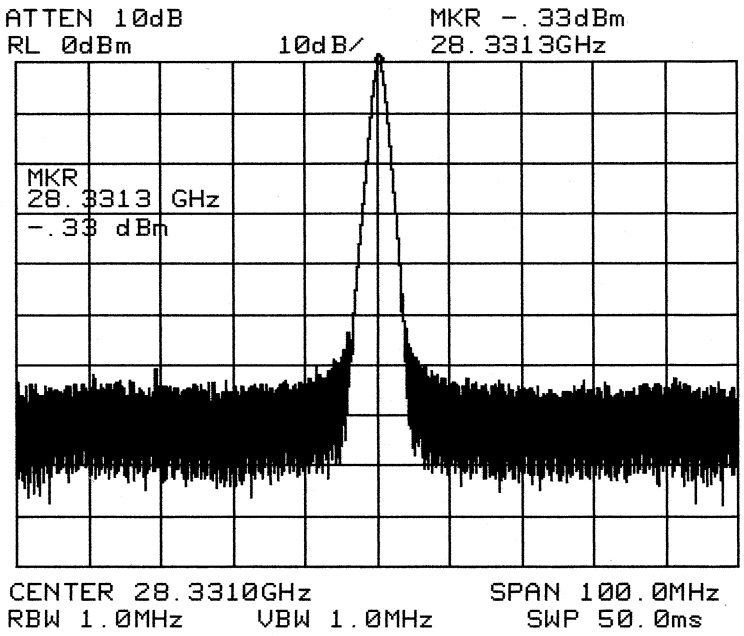


Figure 3 - Mean output power reference at 27.519 GHz

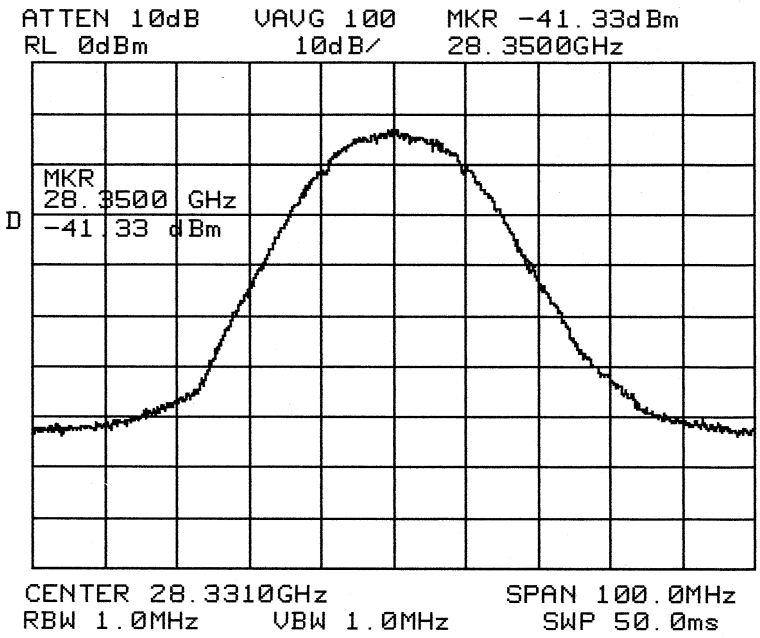


Figure 4 - Attenuation at 30.331 GHz

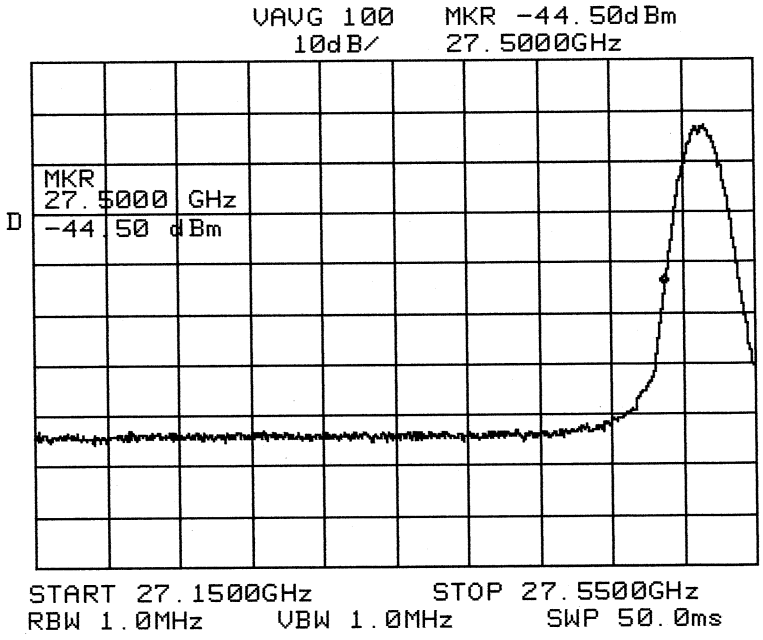


Figure 5 – Fo=27.519 GHz - Lower band

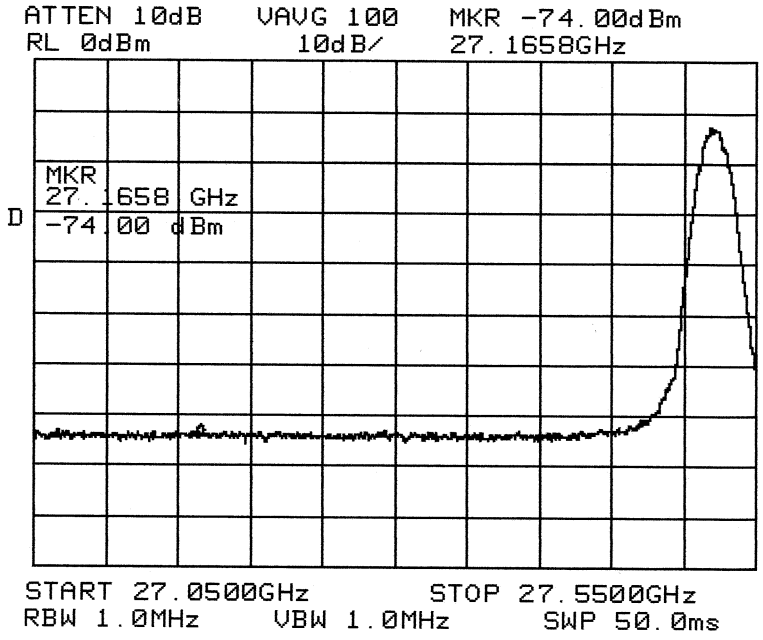


Figure 6 - Fo=27.519 GHZ - Lower extended band

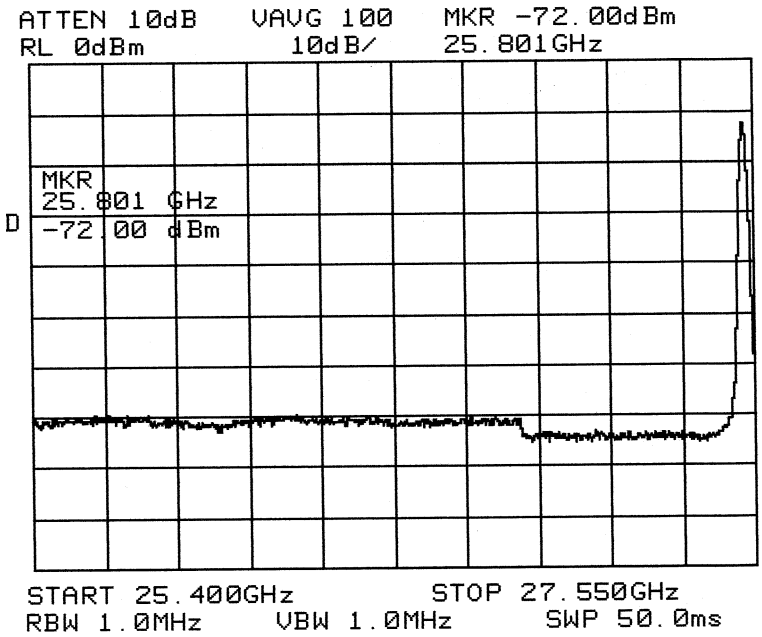


Figure 7 - Fo=27.519 GHZ - Lower extended band

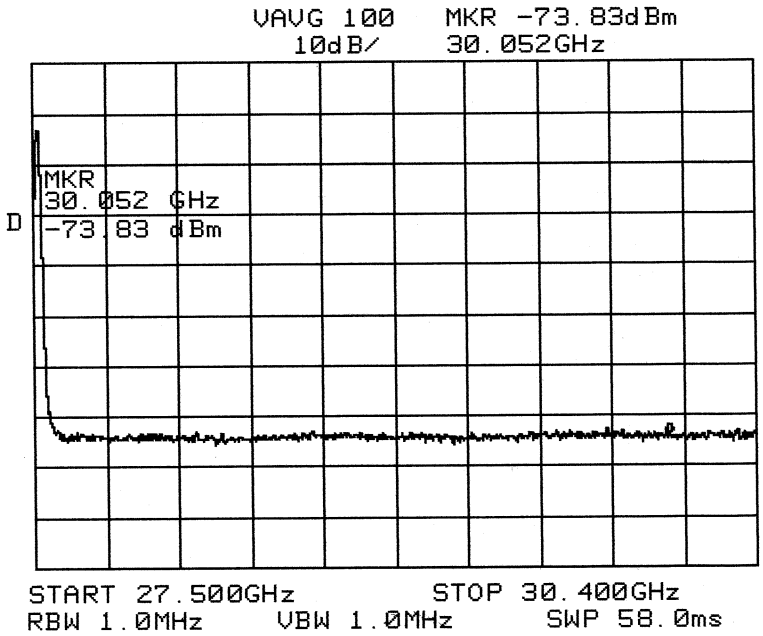


Figure 8 - Fo=27.519 GHz - Upper extended band

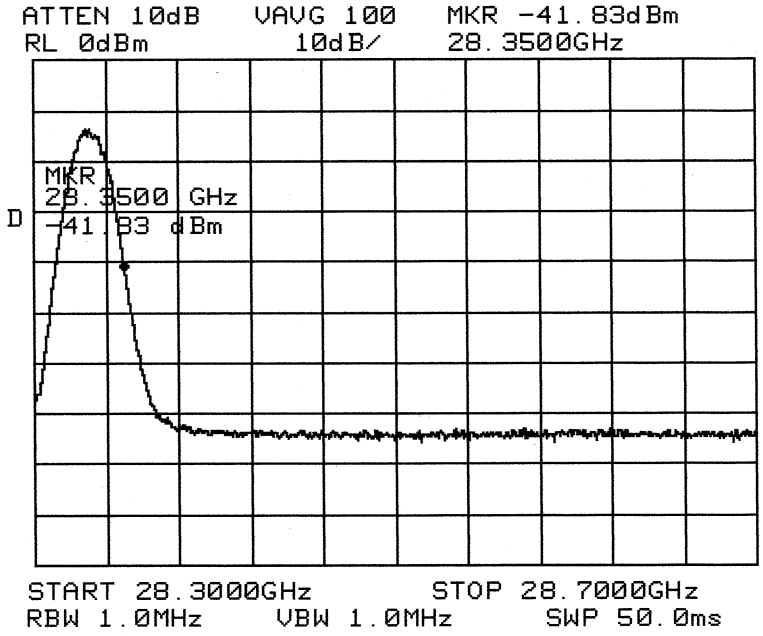


Figure 9 - Fo= 28.331 GHz - Higher band

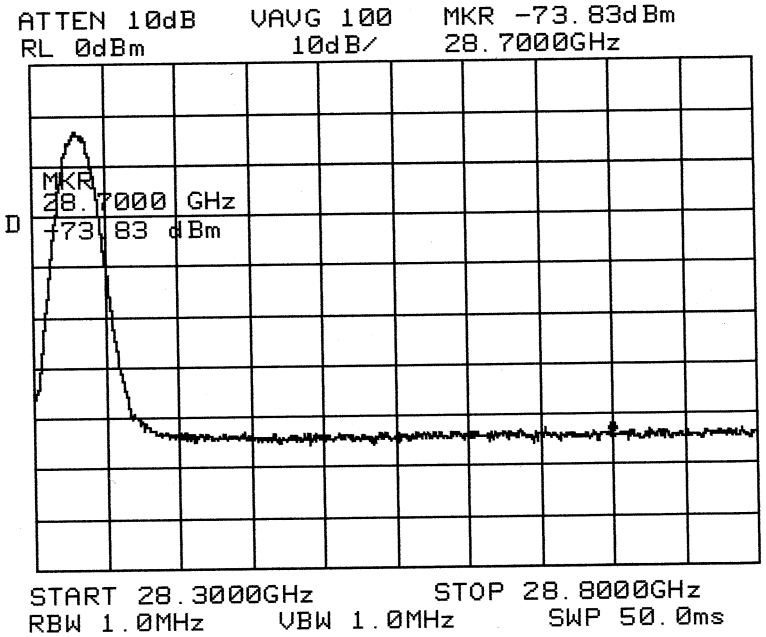


Figure 10 - Fo= 28.331 GHz - extended Higher band

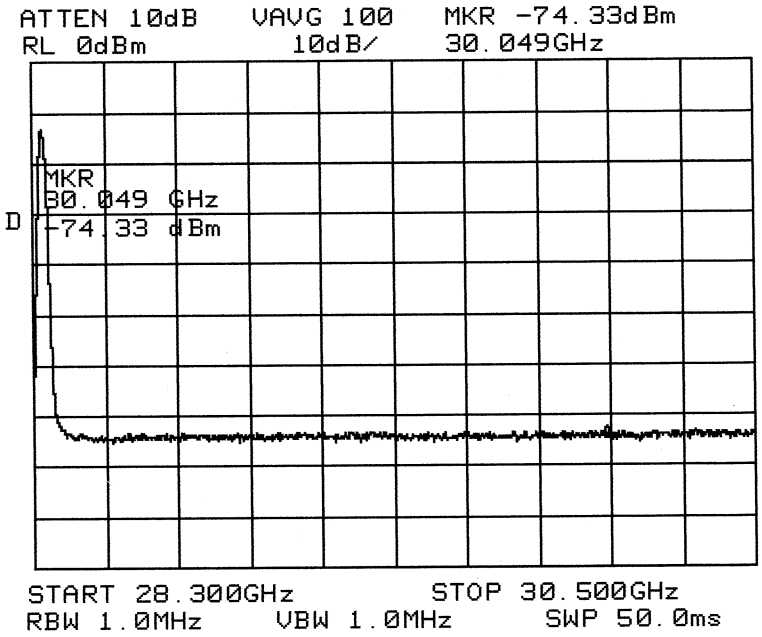


Figure 11- 28.331 higher extended band

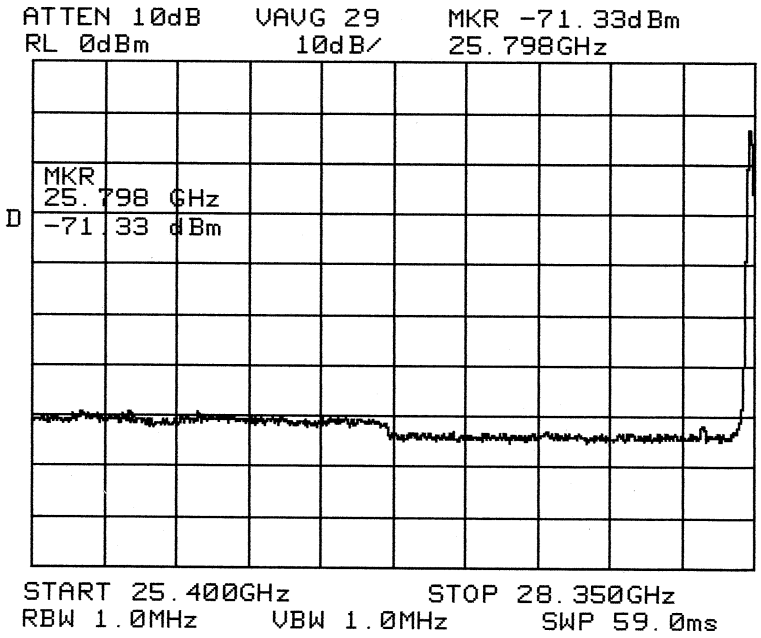


Figure 12 - 28.311 lower extended band

Figure 1 - Output mask results

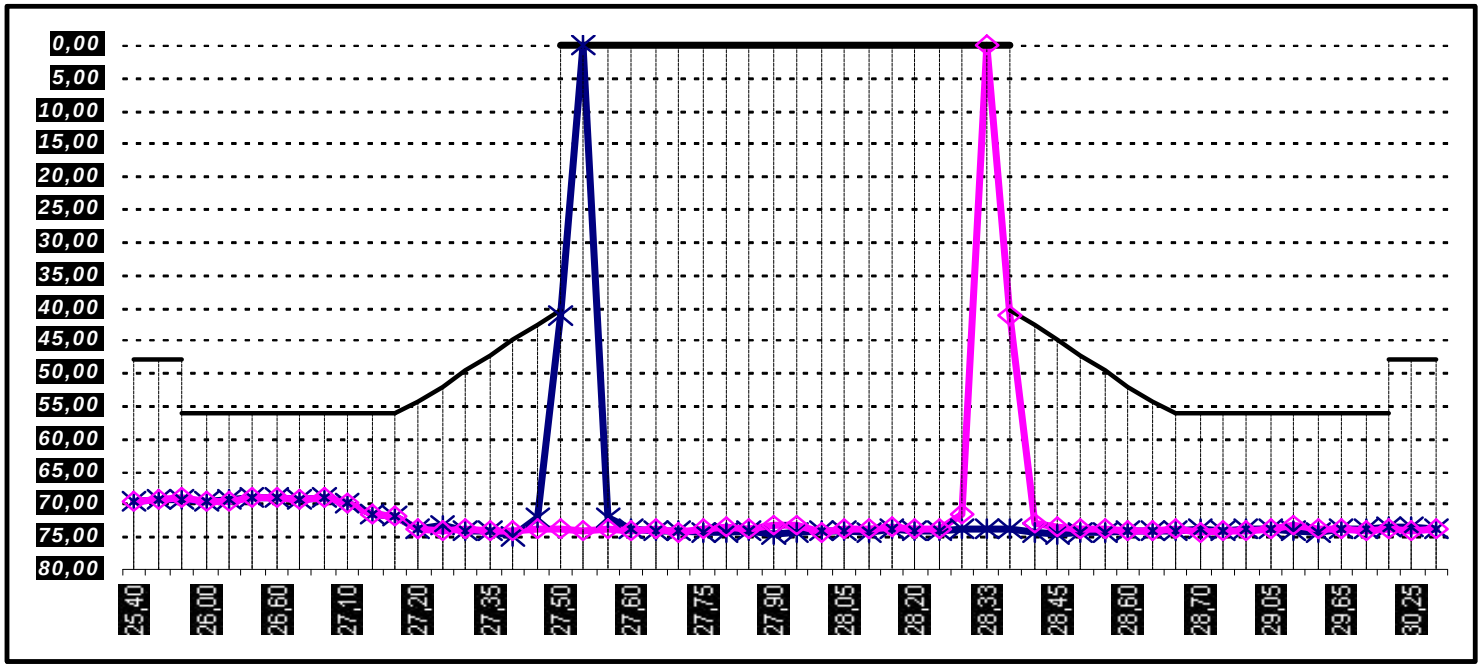
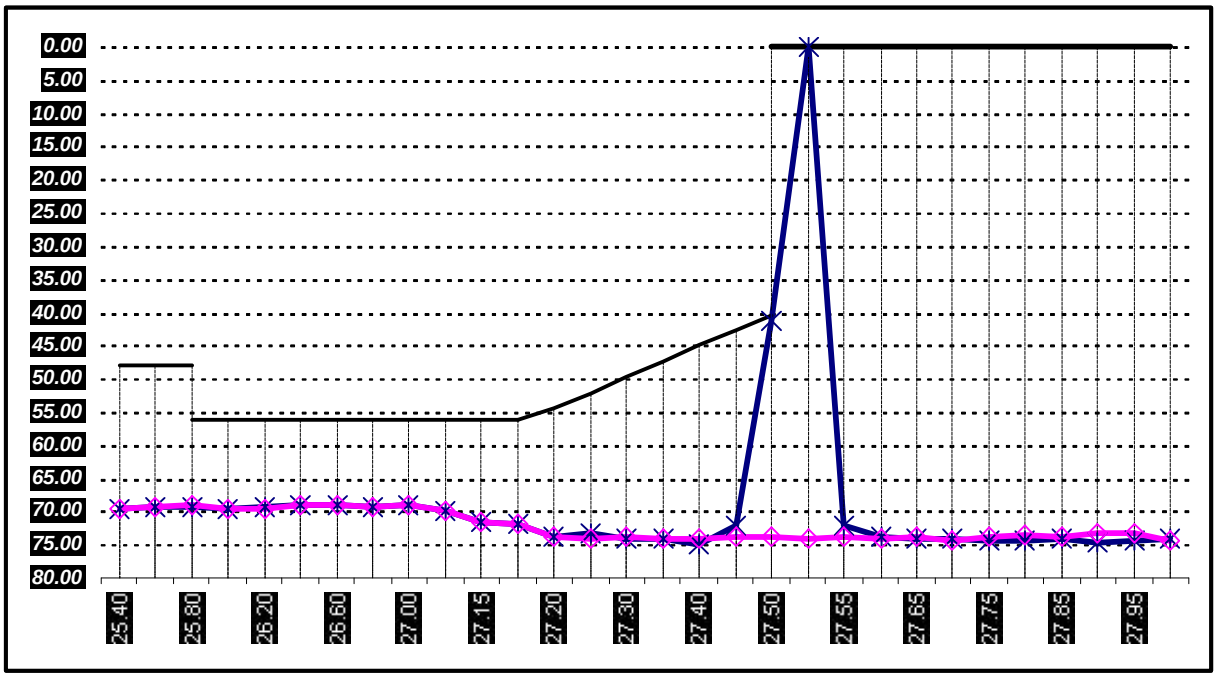
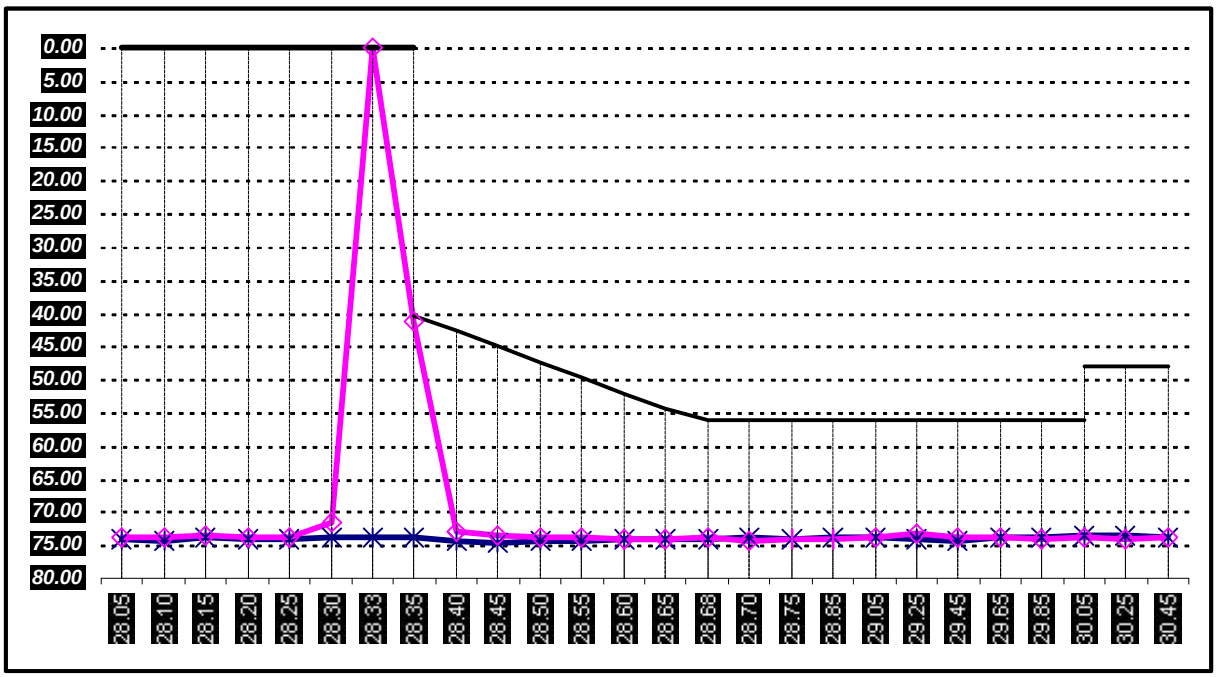


Figure 2 - Output mask results (enlarged and divided)





5.4. FREQUENCY STABILITY

5.4.1. Conditions

f_{TX}=28 GHz

P_{out}=P_{max}=23.6 dBm (20dB attenuation outside RAU)

TX always ON

Modulation OFF

Spectrum analyser settings:

SPAN=2MHz, RBW=30KHz, VBW=30Hz

5.4.2. Results

See table 3.

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

We have a variation of 56 kHz going from –30°C to 60°C. That's a variation of about 2ppm.

Table 3- Frequency stability

Temperature (°C)	Frequency (kHz)		
	V=44V	V=52V	V=60V
-30	27,999,970	27,999,970	27,999,970
-20	27,999,970	27,999,970	27,999,970
-10	27,999,976	27,999,976	27,999,976
0	27,999,983	27,999,983	27,999,983
10	27,999,986	27,999,986	27,999,986
20	27,999,994	27,999,994	27,999,994
25	28,000,000	28,000,000	28,000,000
30	28,000,004	28,000,004	28,000,004
40	28,000,010	28,000,010	28,000,010
50	28,000,017	28,000,017	28,000,017
60	28,000,027	28,000,027	28,000,027

5.5. FREQUENCY TOLERANCE

5.5.1. Conditions

f_{TX}=28 GHz

P_{out}=P_{max}=23.6 dBm (20dB attenuation outside RAU)

TX always ON

Modulation OFF

Spectrum analyser settings:

SPAN=200KHz, RBW=10KHz, VBW=3Hz

5.5.2. Results

See table 4

Table 4

Set frequency (KHz)	28,098,000	28,000,000	27,900,000
Measured frequency (KHz)	28,097,989.7	27,999,990.0	27,899,989.0
Delta (ppm)	0.3	0.4	0,3

6. ANNEX 1 - SPURIOUS EMISSION AT ANTENNA TERMINAL

CONDUCTED SPURIOUS EMISSION W-BAS

Abstract

Spurious emission up to 75 GHz is measured at the antenna port of a W-Bas Node unit for FCC Type Approval Test Report

Contents

6.1. TEST FACILITIES DESCRIPTION

The Spurious emission tests was performed at Ericsson Microwave System in Moelndal, Sweden. The facilities at the SML/TV department is an open lab environment. The temperature is 20 - 25 ^{o}C and RH 40-70 %.

6.2. TEST DATE

The test was performed 1999-09-06 by Johnny Selim.

6.3. EQUIPMENT UNDER TEST

Outdoor unit: UKL 60103/12

Indoor Unit: HRY 10201/3 MMU 34+2 Mb S/N 2005203

6.4. TESTMODE

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

6.5. TEST EQUIPMENT

Test set up # 1

See Photo 1 - 2.

Spectrum Analyser: HP 8565E YY 1926 Calib. due to 2000-04

Coaxial cable: Suhner Sucoflex 100 SN 626/2E DC - 40 GHz. Test certificate se diagram 1.

Waveguide to coaxial transition: Flann 21093-KF20 S/N 232

Test set up # 2

See Photo 3 - 4.

Spectrum Analyser: HP 8565E YY 1926 Calib. due to 2000-04

Waveguide transition: WG 21 - WG 22 Flann 21000-22 S/N 103

Directional coupler: Flann 22130-10 (10 dB) YD 5979

Waveguide termination: WG 22 Flann 22040 YV2642

Waveguide transition: WG 22 - WG 23 Flann 22000-23 YA 2954

Waveguide to coaxial transition: Wiltron 35WR22VF YA2948

Coaxials transitions: 2.4(f) - 2.4(f), 2.4(m) - APC 3.5(f), APC 3.5(m) - APC 3.5(m)

Test set up # 2

See Photo 5.

Spectrum Analyser: HP 8565E YY 1926 Calib. due to 2000-04

Waveguide transition: WG 21 - WG 22 Flann 21000-22 S/N 103

Directional coupler: Flann 22130-10 (10 dB) YD 5979

Waveguide termination: WG 22 Flann 22040 YV2642

Waveguide transition: WG 22 - WG 24 Flann 22000-24 S/N 63

Waveguide transition: WG 24 - WG 25 Flann 24000-25 S/N 79

Preselected mixer: HP 11974 V YX 2068 Calibr. 2000 -04

Preselector Power supply: HP11974-60028 Belongs to YX2068

Calibration instruments: HP83650L Swept CW Generator (0 - 50 GHz)

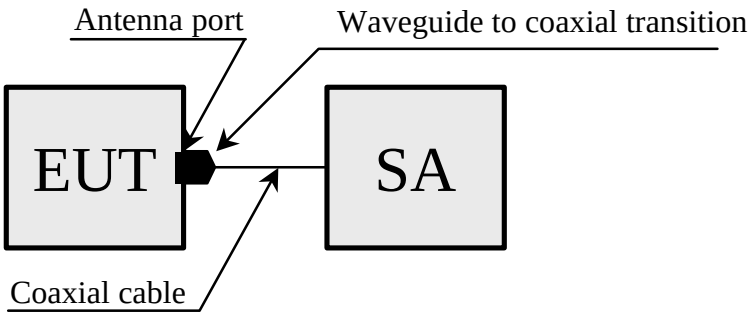
YO2559 Calibr. due to 1999-10.

Power Meter HP4418A YE2516 Calibr. due to 2000-08.

Power sensor HP 8487A YE 2509 Calibr. due to 1999-10.

6.6. TEST METHOD

The tests are done using three different test set up for different frequency band. See Figure 1 - 3.



EUT = Equipment Under Test

SA = Spectrum Analyzer

Figure 1. Test set up # 1

In test set up #1 spurious emission between 9 kHz and 33 GHz is measured at the antenna port.

The test set up can be seen in Photo 1 - 2.

The test certificate for the coaxial cable is submitted in diagram 1.

The wanted signal is in diagram 2, and the test results are submitted in diagram 3 - 10.

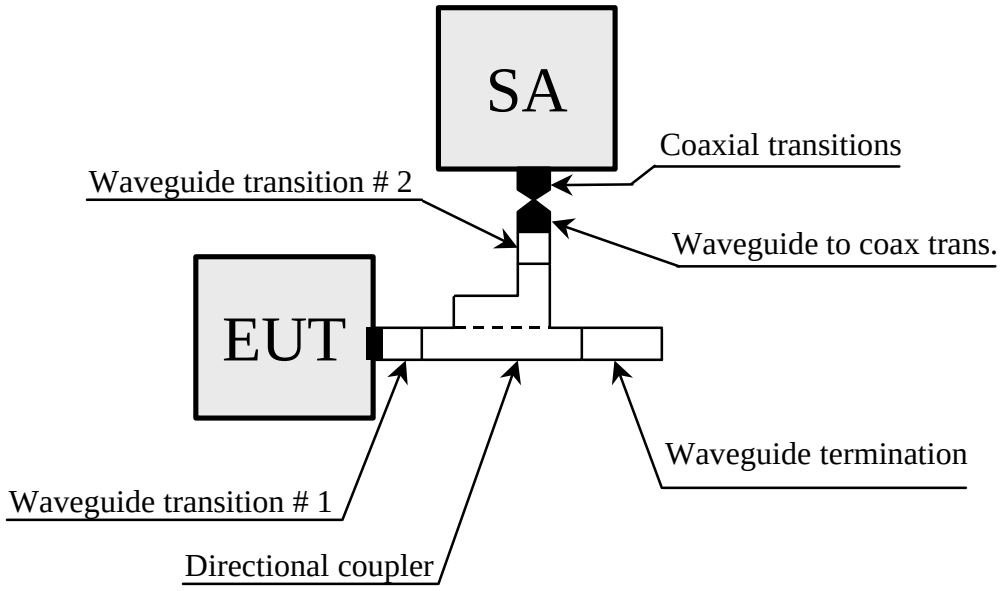


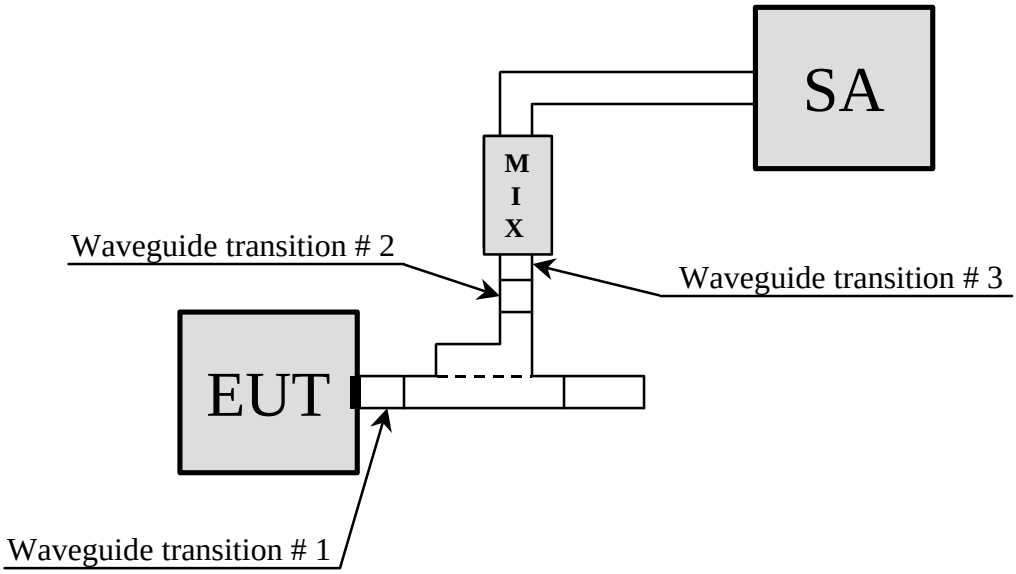
Figure 2. Test set up # 2

In test set up #2 spurious emission between 33 GHz and 50 GHz is measured at the antenna port, via a 10 dB directional coupler.

The directional coupler is used in order to terminate the wanted signal properly and avoid the output signal to be reflected back into the Equipment Under Test

The test set up can be seen in Photo 3 - 4.

The wanted signal is in diagram 11, and the test results are submitted in diagram 12- 15.



MIX= Preselected mixer

Figure 3. Test set up # 3

In test set up #3 spurious emission between 50 GHz and 75 GHz is measured at the antenna port, via a 10 dB directional coupler and a Preselected mixer

The test set up can be seen in Photo 5.

In order to calibrate the test set up an CW generator at 50 GHz was used. An input level of -10 dBm was injected at the point where the EUT antenna port is connected. The outpout signal was measured with the Spectrum analyzer and submitted in diagram 16. From diagram 16 we can see that the insertion loss between the antenna port and the Preselected mixer is 1.8 dB. This also include the confidencce interval of the coupling factor of the directional coupler.

The test results are submitted in diagram 17 - 20.

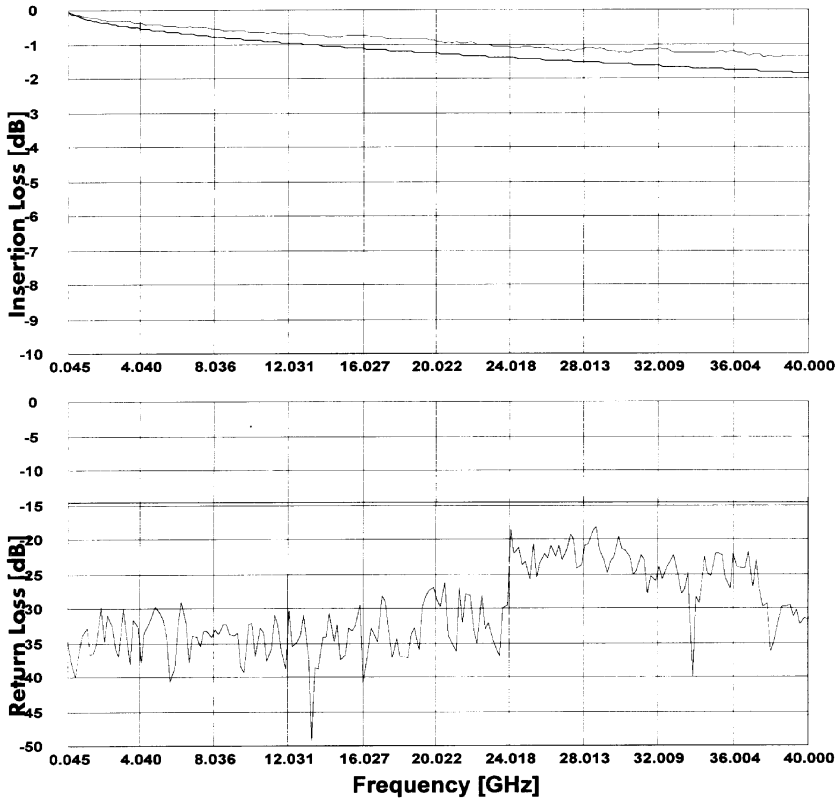
6.7. TEST RESULTS

Test Certificate

Microwave Cable Assembly

Frequency range [GHz]	Insertion Loss min [dB]	Return Loss max [dB]
0.0 - 4.0	-0.41	-29.89
4.0 - 8.0	-0.59	-29.25
8.0 - 12.0	-0.74	-30.37
12.0 - 16.0	-0.83	-29.63
16.0 - 20.0	-0.94	-26.99
20.0 - 24.0	-1.13	-18.66
24.0 - 28.0	-1.22	-19.53
28.0 - 32.0	-1.27	-18.34
32.0 - 36.0	-1.30	-22.19
36.0 - 40.0	-1.42	-21.97
M1: 0.00	0.00	0.00
M2: 0.00	0.00	0.00

Type:	**Sucoflex 102E**
Serial no.:	626/2E
Cable length:	500.00 mm
Connector 1:	11 K-252
Connector 2:	11 K-252
Type no.:	n/a
Drawing no.:	n/a
Commission no.:	503782
Meas. System:	Wiltron 562 + 6669B
Source Power:	5 dBm
Temperature:	23 ± 1 °C
Date:	2.9.97
Inspected by:	NT
Start Freq.:	0.05 GHz
Stop Freq.:	40.00 GHz



HUBER+SUHNER AG, RF Interconnection Division, CH-9100 Herisau, Switzerland
Phone: +41 (0)71 353 41 11; Fax: +41 (0)71 353 45 90; Telex: 882 729

DIAGRAM 1

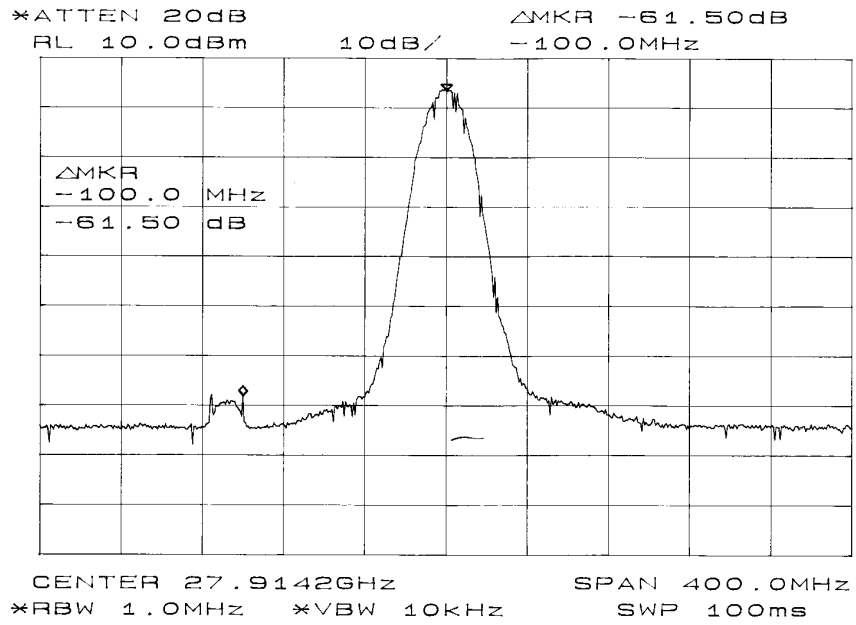


DIAGRAM 2

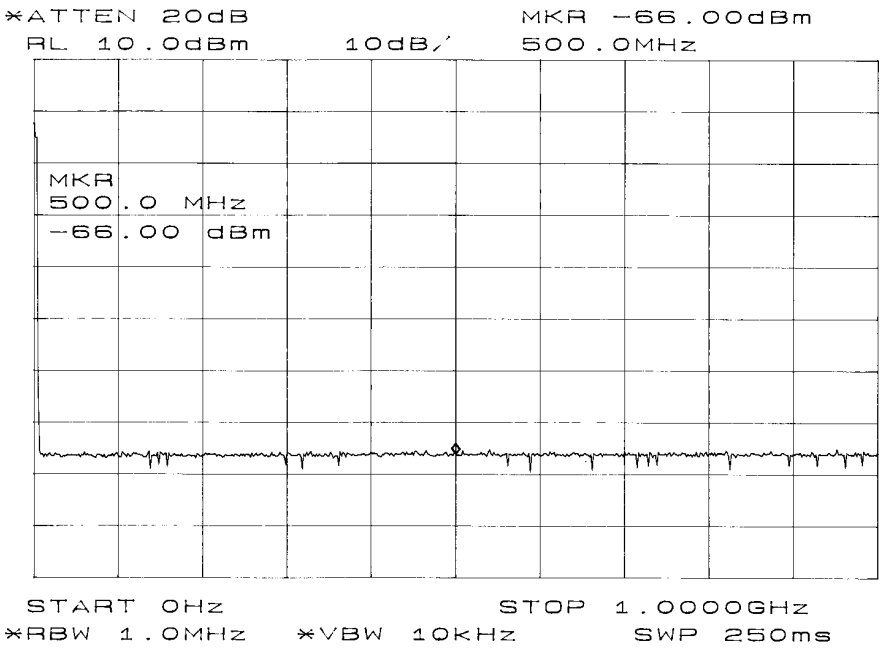


DIAGRAM 3

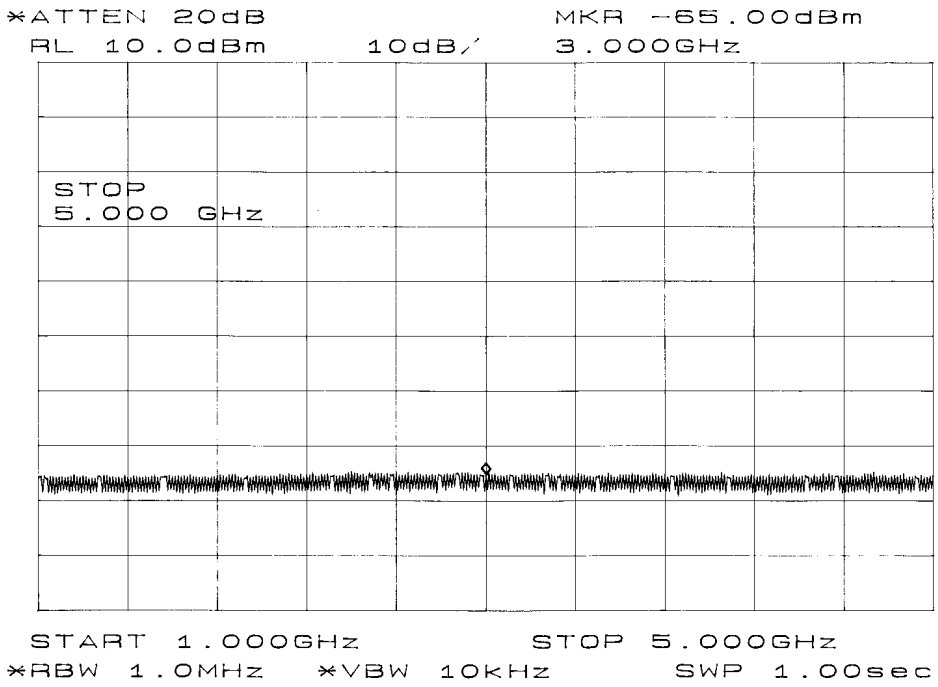
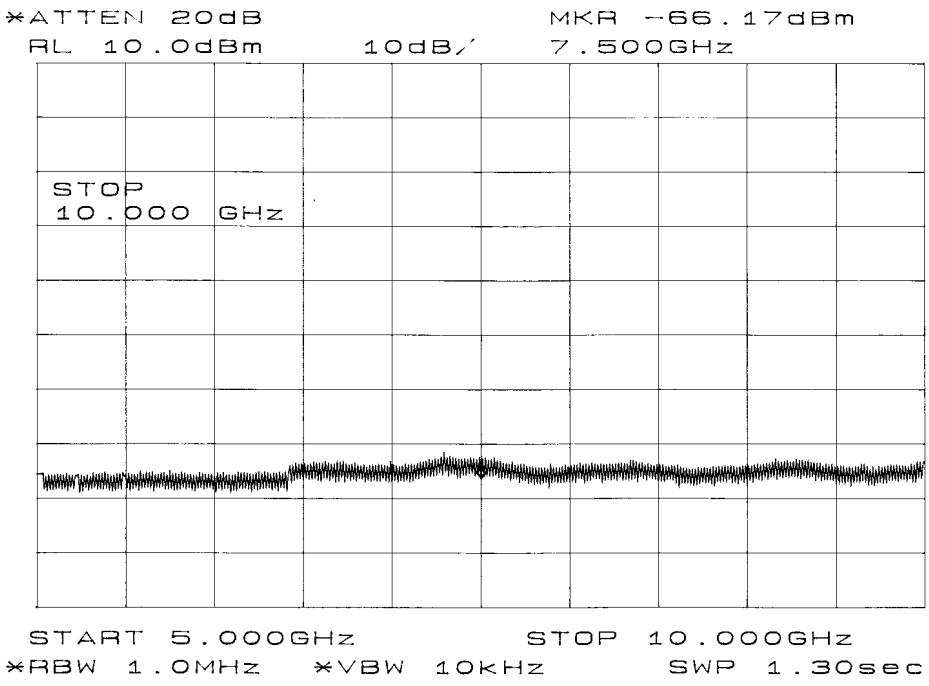


DIAGRAM 4



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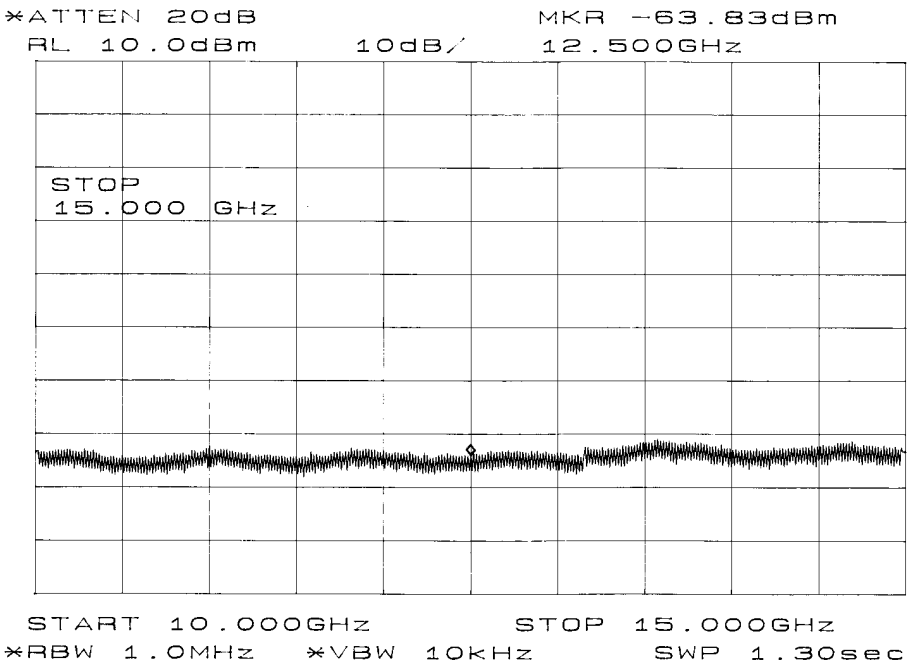

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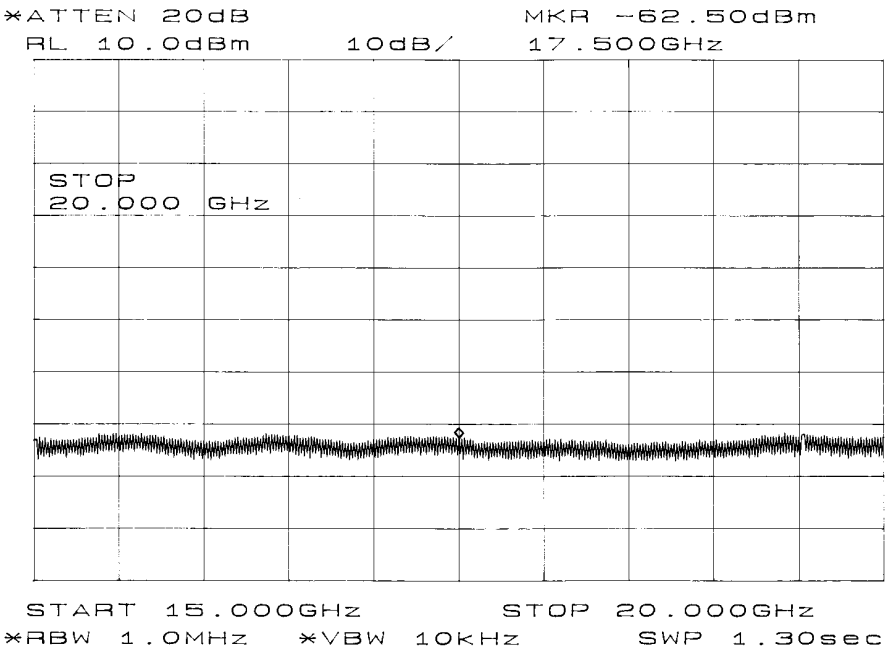


DIAGRAM 7

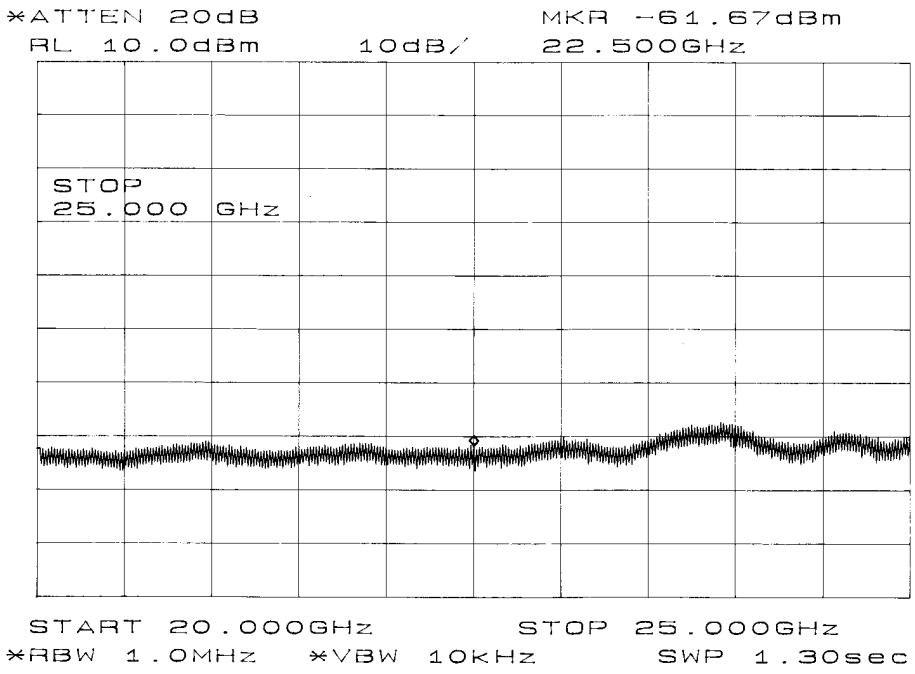


DIAGRAM 8

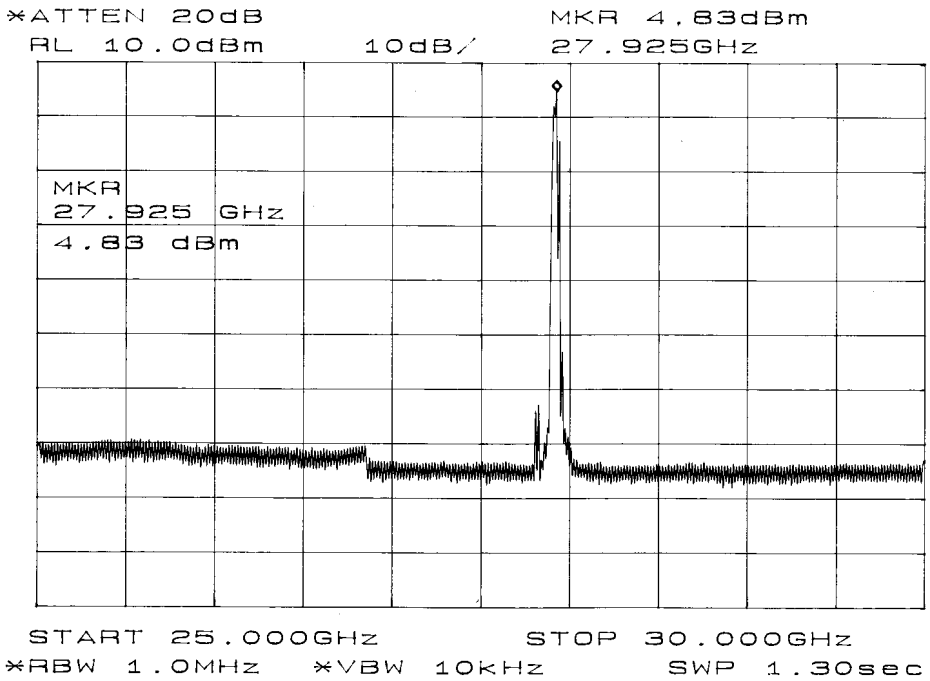


DIAGRAM 9

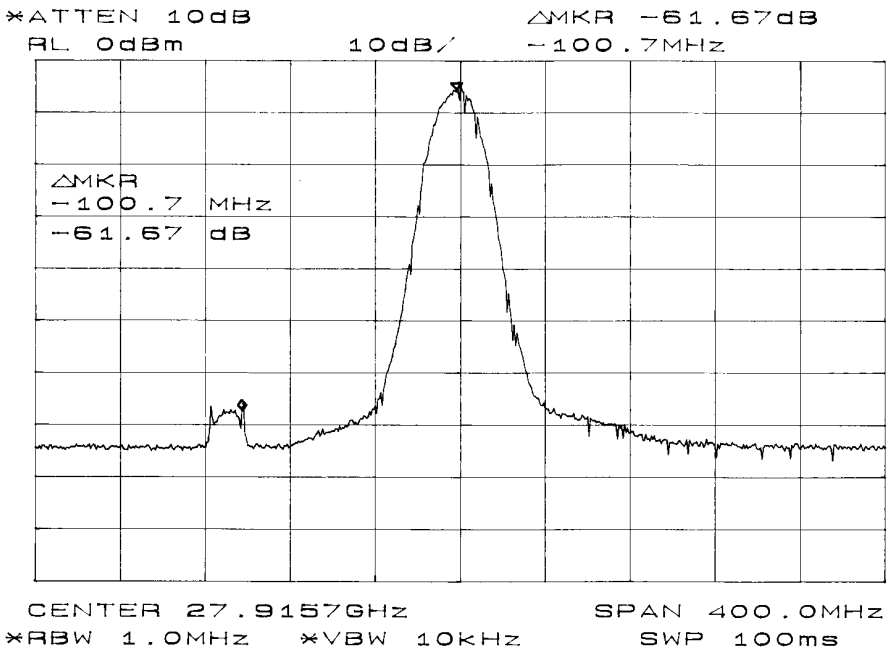
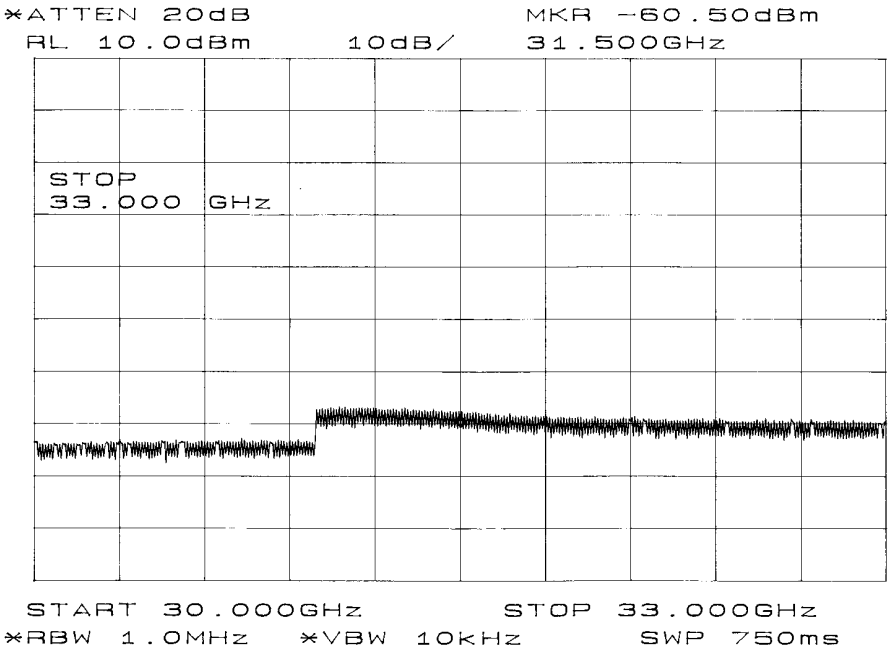


DIAGRAM 10



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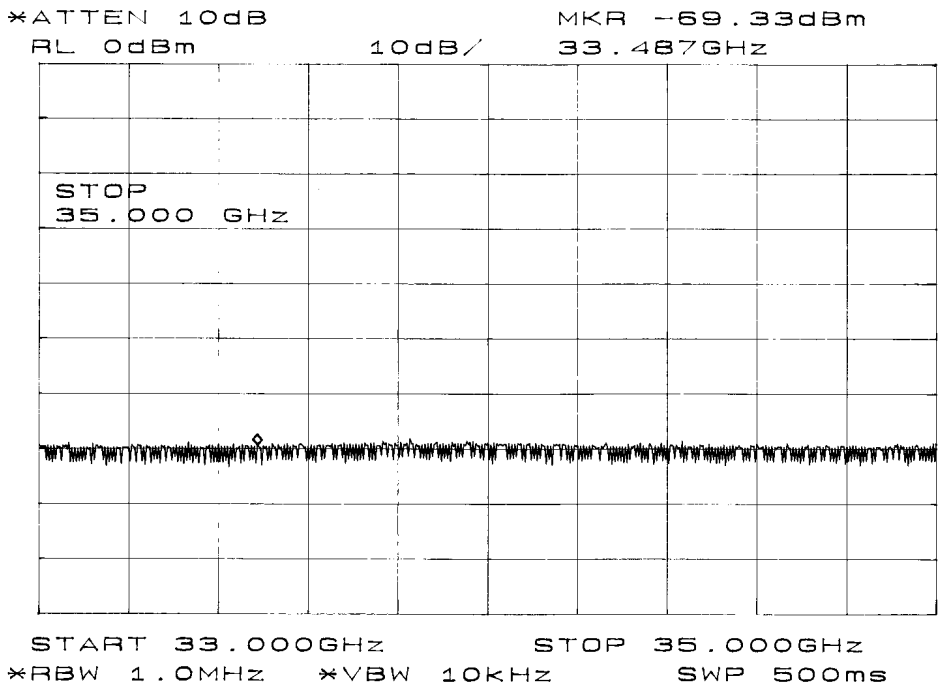

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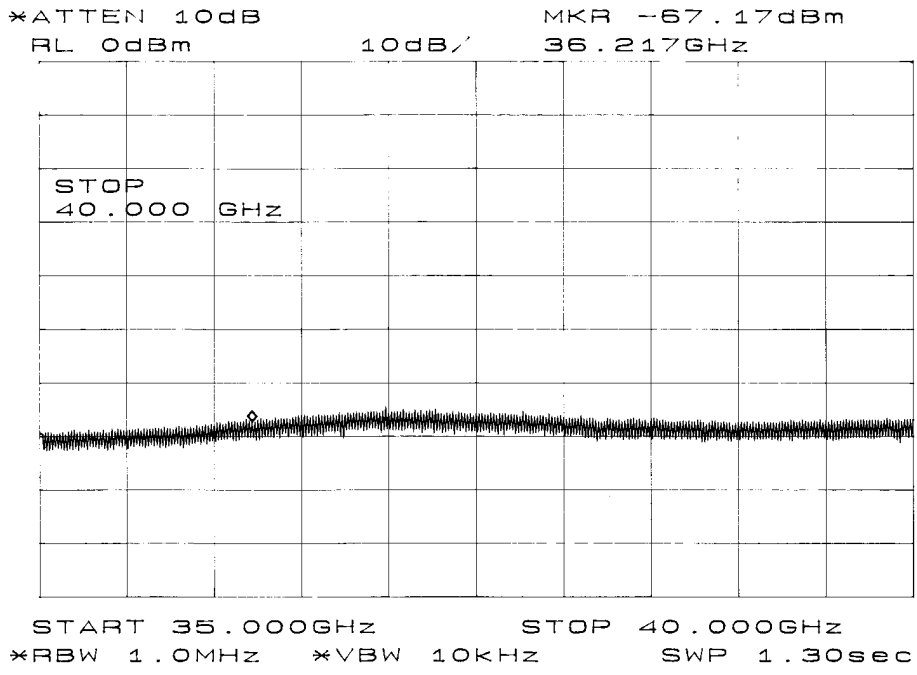
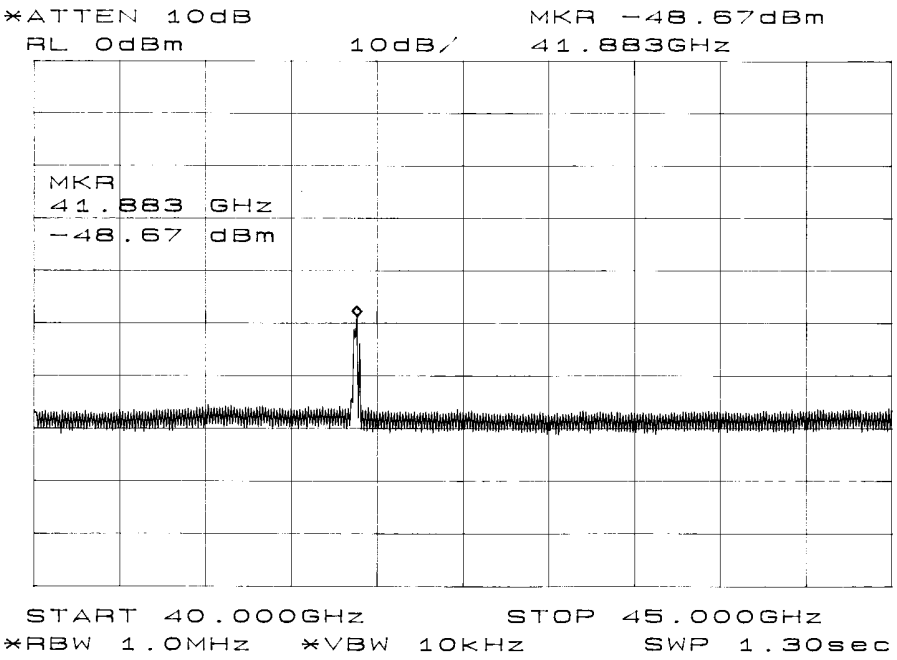


DIAGRAM 13



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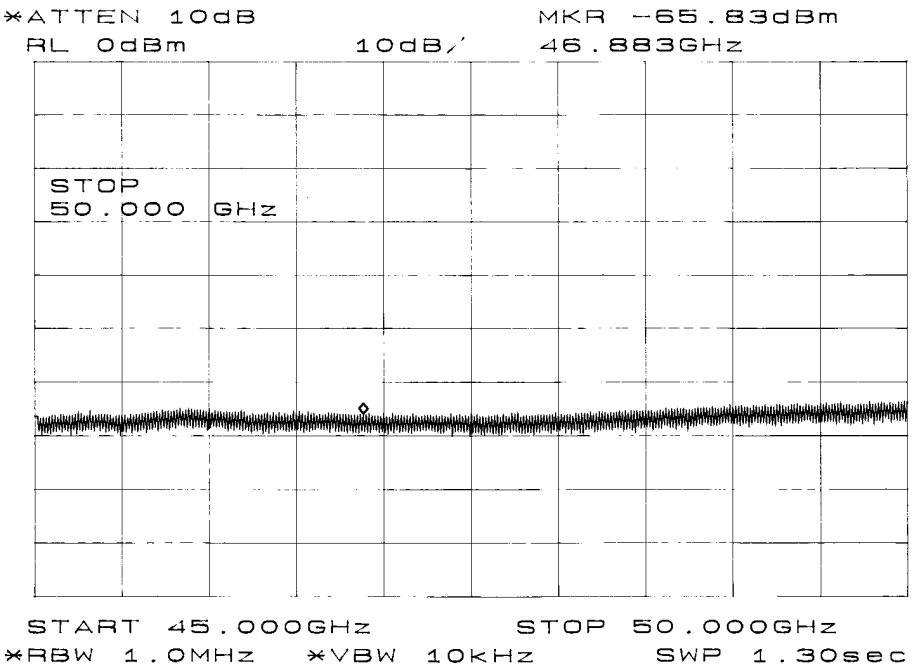

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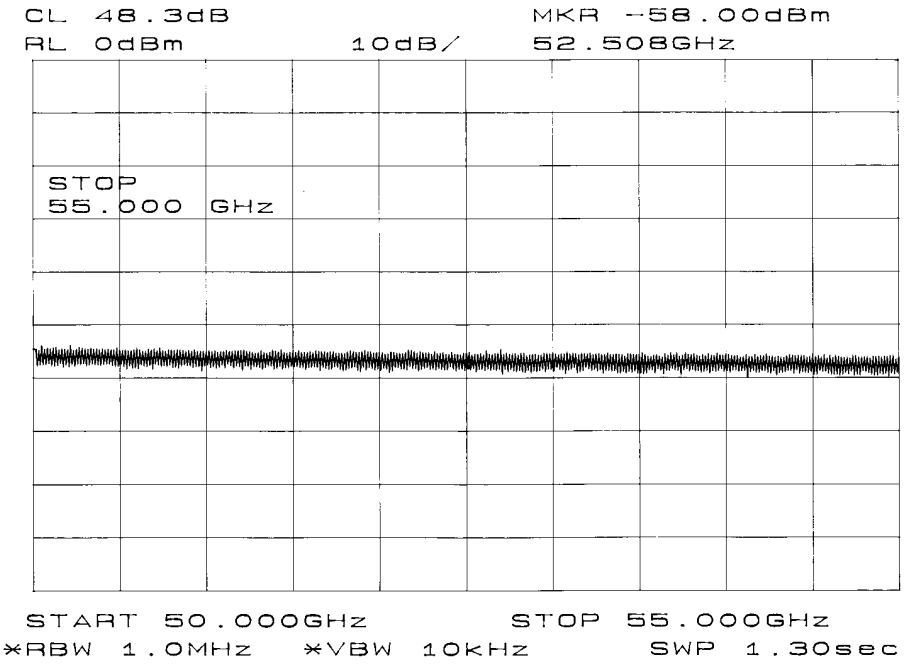

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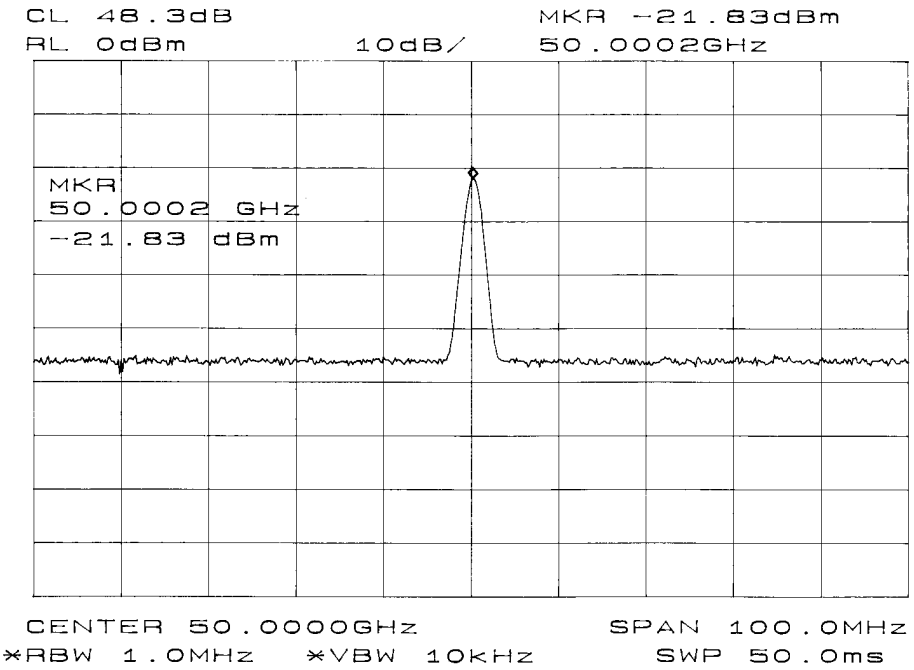

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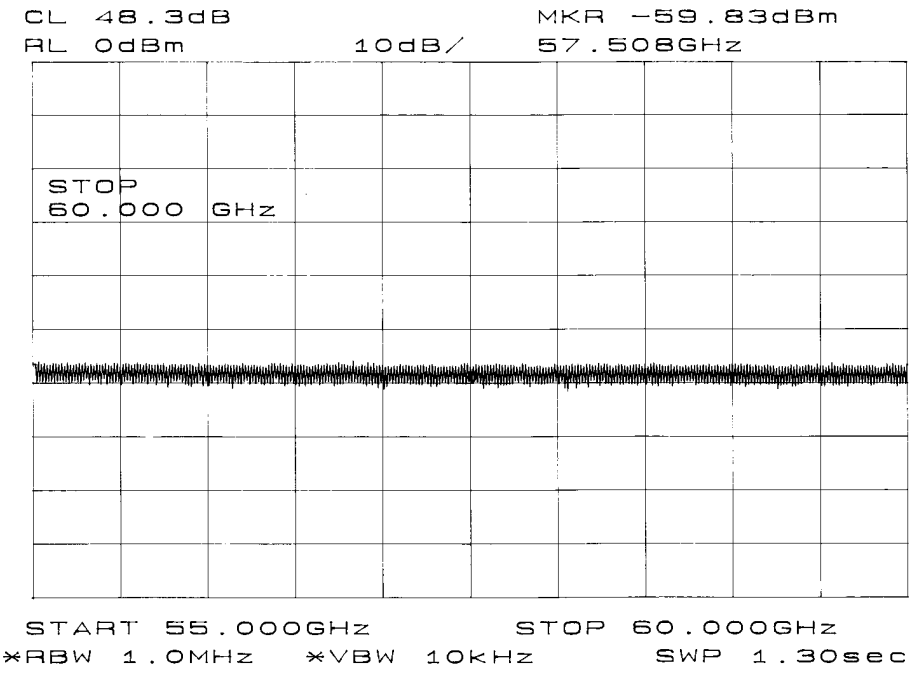

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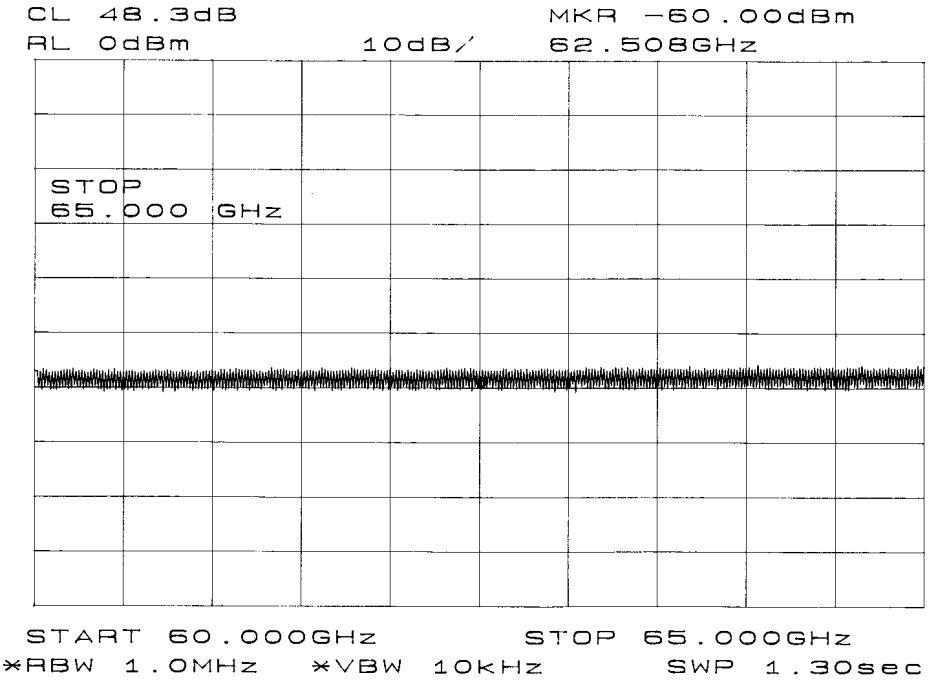

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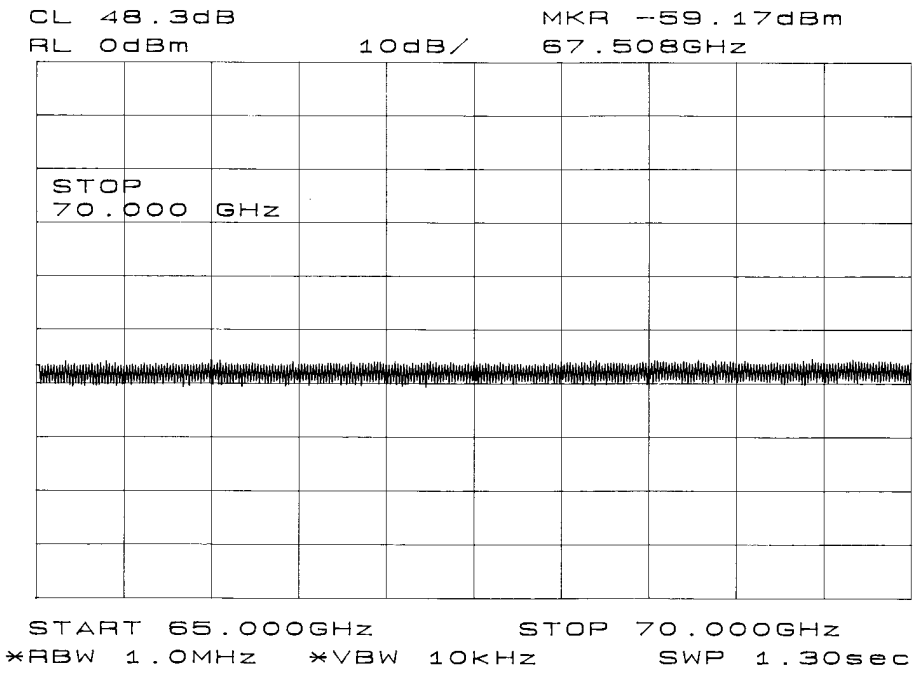
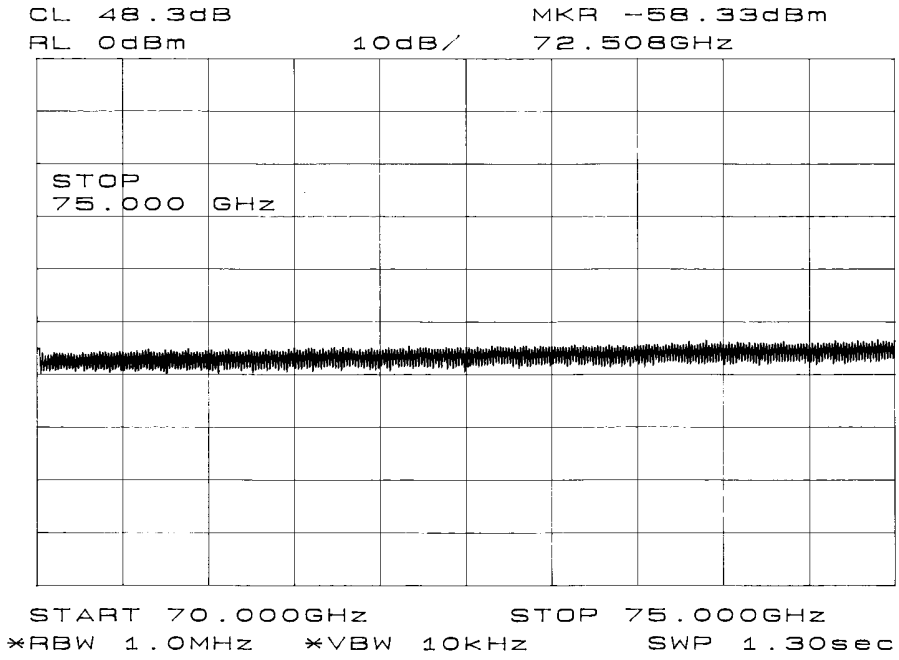


DIAGRAM 20



7. PHOTOS

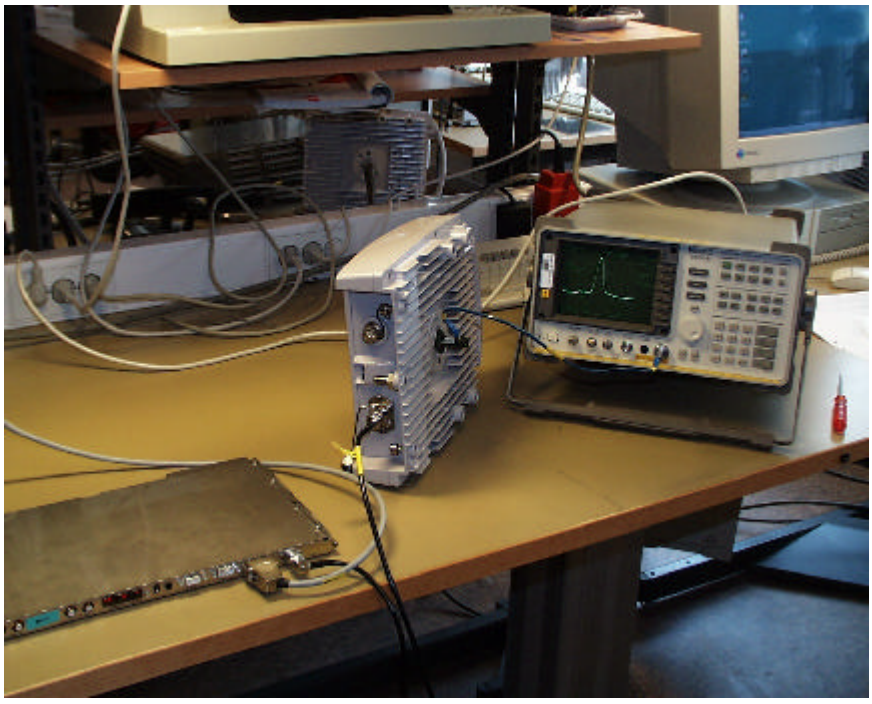


Photo 1

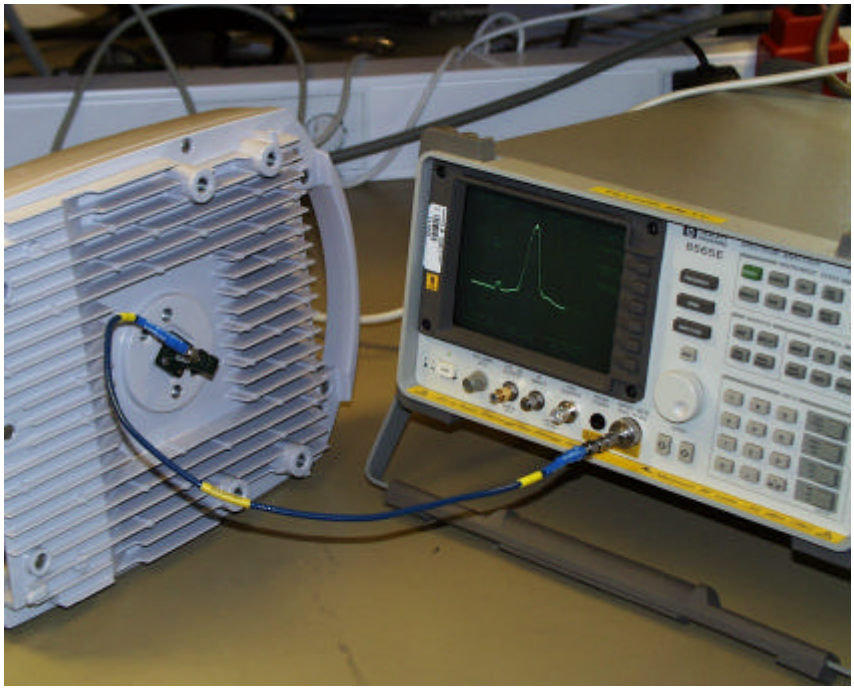


Photo 2

Photo 3

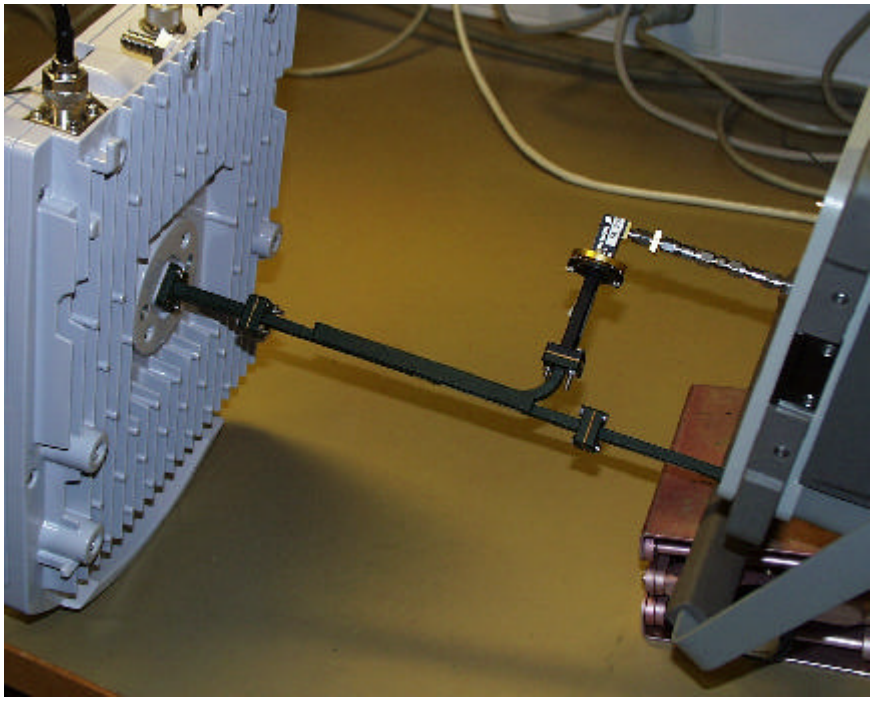


Photo 4

Photo 5

8. ANNEX 2 - FIELD STRENGTH OF SPURIOUS RADIATION

RADIATED SPURIOUS EMISSION W-BAS

Abstract

Radiated spurious emission from 1GHz up to 40 GHz is measured of a W-Bas Node unit for FCC Type Approval Test Report

Contents

8.1. TEST FACILITIES DESCRIPTION

The Spurious emission tests was performed at Ericsson Microwave System in Moelndal, Sweden. The facilities at the SML/TV department is an open lab environment. The temperature is 20 - 25 ^{o}C and RH 40-70 %.

8.2. TEST DATE

The test was performed 1999-09-09 by Johnny Selim.

8.3. EQUIPMENT UNDER TEST

Outdoor unit: UKL 60103/12 including antenna.

Indoor Unit: HRY 10201/3 MMU 34+2 Mb S/N 2005203

8.4. TESTMODE

All tests are done in continious mode, and a supply voltage of +48 V. The carrier frequency was 27.914 GHz

8.5. TEST EQUIPMENT

Horn Antenna AEL H-1479 , 1 - 12 GHz. Inventory number YA 2586 Calibrated due to 2001-01. Test certificate see calbration data.

Horn Antenna AEL H-1498 , 2 - 18 GHz. Inventory number YA 2587 Calibrated due to 2001-01

Horn Antenna EMCO 3116, 18 - 40 GHz. Inventory number YA 2765 Calibrated due to 2001-09. Test certificate see calbration data.

Spectrum Analyser: HP 8565E YY 1926 Calib. due to 2000-04

Coaxial cable: Suhner Sucoflex 104E SN 2071/4E DC - 18 GHz. Test certificate see calbration data.

Coaxial cable: Suhner Sucoflex 102E SN 514/2E DC - 40 GHz. Test certificate see calbration data.

8.6. CALIBRATION DATA

YA2586 1m

CORRECTION FACTORS OF HORN ANTENNA

Instrument, AEL H-1479
Inventory number, YA 2586
Standard: SAE ARP 958 (Free Space Calibration)

Senaste kalibrering: 990107

Frequency [MHz]	Antenna factor [dB/m]	Gain [dB]
1000	23.7	6.5
1500	25.3	8.4
2000	27.4	8.8
2500	28.7	9.5
3000	30.5	9.2
3500	31.6	9.5
4000	32.8	9.5
4500	32.3	11.0
5000	33.7	10.5
5500	34.5	10.5
6000	35.1	10.7
6500	35.7	10.8
7000	36.7	10.4
7500	37.5	10.2
8000	38.1	10.2
8500	38.2	10.6
9000	38.5	10.8
9500	38.8	10.9
10000	38.5	11.7
10500	38.4	12.3
11000	38.2	12.8
11500	39.0	12.5
12000	40.4	11.4

YA2587 1m

CORRECTION FACTORS OF HORN ANTENNA

Instrument, AEL H-1498
Inventory number, YA 2587
Standard: SAE ARP 958 (Free Space Calibration)

Senaste kalibrering: 990107

Frequency [MHz]	Antenna factor [dB/m]	Gain [dB]
2000	31.1	5.1
2500	31.1	7.1
3000	31.4	8.3
3500	33.9	7.2
4000	33.5	8.8
4500	34.0	9.3
5000	35.0	9.2
5500	34.9	10.1
6000	36.3	9.5
6500	37.5	9.0
7000	37.1	10.0
7500	38.0	9.7
8000	38.8	9.5
8500	38.0	10.8
9000	38.5	10.8
9500	38.7	11.0
10000	39.1	11.1
10500	40.2	10.5
11000	39.9	11.1
11500	40.3	11.2
12000	41.2	10.6
12500	41.0	11.2
13000	41.3	11.2
13500	42.0	10.9
14000	42.1	11.1
14500	43.6	9.9
15000	42.5	11.3
15500	43.3	10.8
16000	44.0	10.3
16500	43.6	10.9
17000	43.8	11.0
17500	43.8	11.3
18000	43.4	12.0

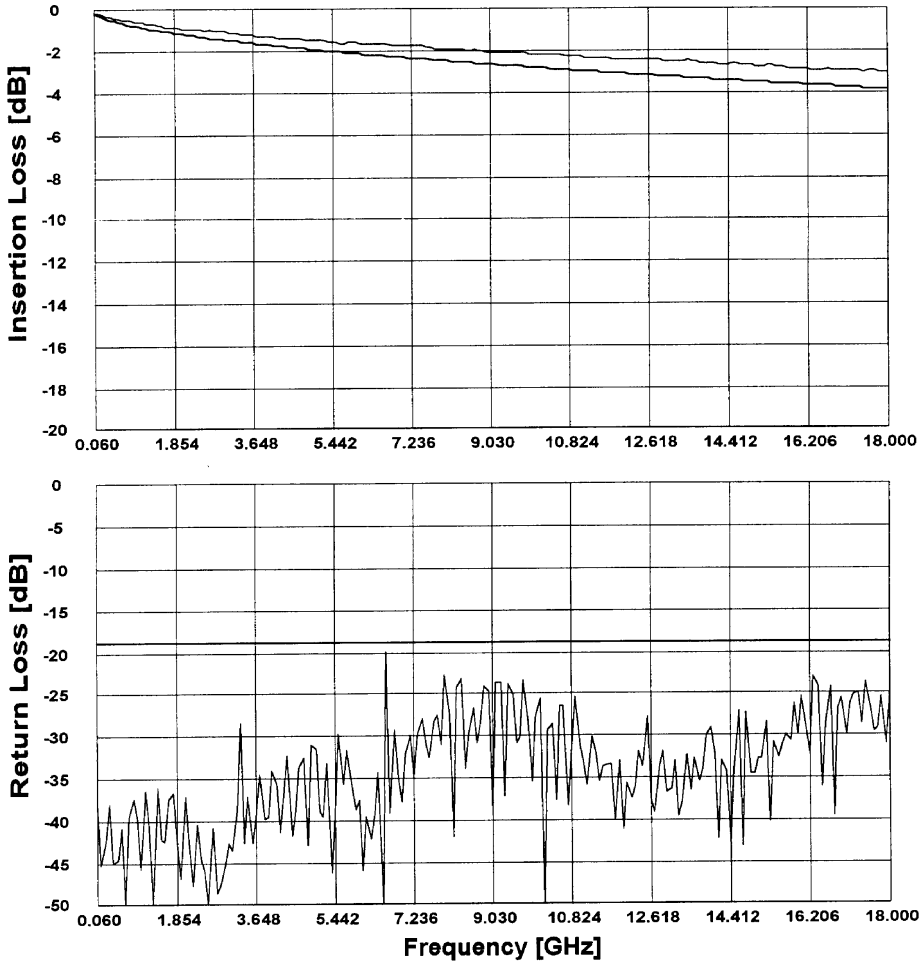
Test Certificate

Microwave Cable Assembly

Frequency range [GHz]	Insertion Loss min [dB]	Return Loss max [dB]
0.1 - 1.9	-0.92	-36.30
1.9 - 3.6	-1.31	-28.68
3.6 - 5.4	-1.63	-31.16
5.4 - 7.2	-1.84	-20.12
7.2 - 9.0	-2.14	-22.89
9.0 - 10.8	-2.32	-23.48
10.8 - 12.6	-2.52	-25.56
12.6 - 14.4	-2.74	-29.28
14.4 - 16.2	-2.95	-25.63
16.2 - 18.0	-3.12	-23.04
M1: 0.00	0.00	0.00
M2: 0.00	0.00	0.00

IL-Smoothing: 1%

Type:	SUCOFLEX 104E
Serial no.:	2071/4E
Cable length:	3000.00 mm
Connector 1:	11 SMA-451
Connector 2:	11 SMA-451
Type no.:	n/a
Drawing no.:	n/a
Commission no.:	466285
Meas. System:	HP 8720C
Source Power:	5 dBm
Temperature:	23 ± 1 °C
Date:	8.1.97
Inspected by:	DT
Start Freq.:	0.06 GHz
Stop Freq.:	18.00 GHz



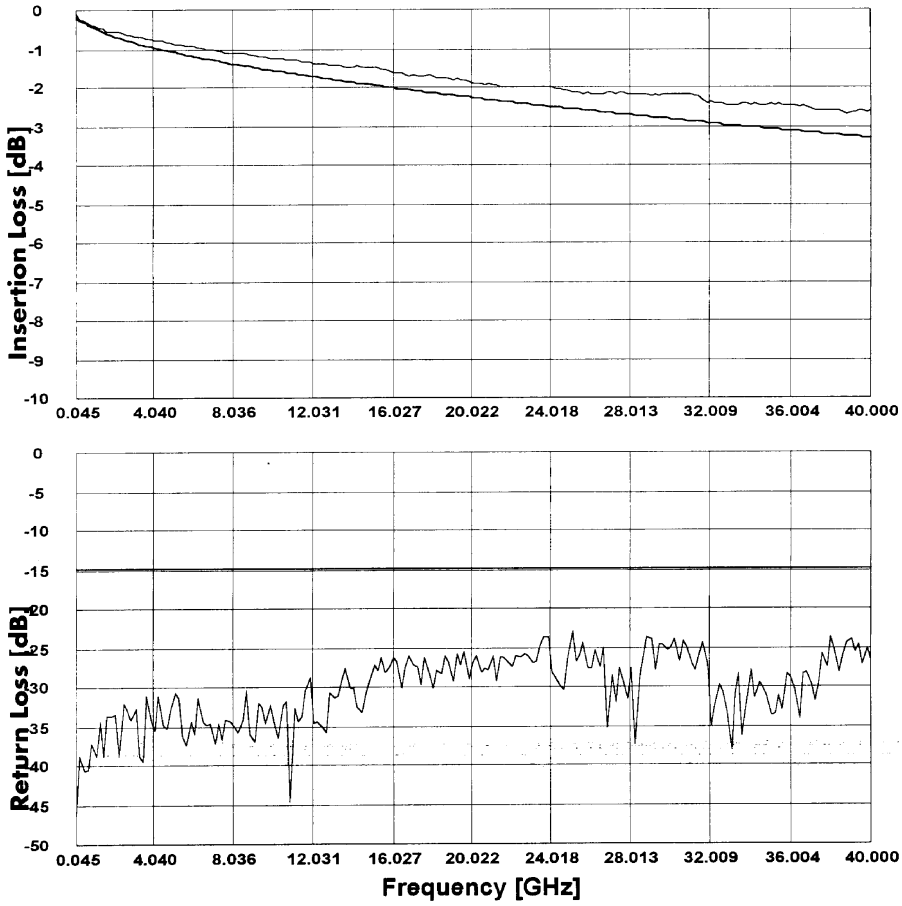
HUBER+SUHNER AG, RF Interconnection Division, CH-9100 Herisau, Switzerland
Phone: +41 (0)71 353 41 11; Fax: +41 (0)71 353 45 90; Telex: 882 729

Test Certificate

Microwave Cable Assembly

Frequency range [GHz]	Insertion Loss min [dB]	Return Loss max [dB]
0.0 - 4.0	-0.80	-31.39
4.0 - 8.0	-1.14	-30.86
8.0 - 12.0	-1.40	-29.05
12.0 - 16.0	-1.64	-26.34
16.0 - 20.0	-1.92	-25.77
20.0 - 24.0	-2.04	-23.74
24.0 - 28.0	-2.22	-23.13
28.0 - 32.0	-2.43	-23.77
32.0 - 36.0	-2.49	-28.02
36.0 - 40.0	-2.70	-23.81
M1: 0.00	0.00	0.00
M2: 0.00	0.00	0.00

Type:	SUCOFLEX 102E
Serial no.:	514/2E
Cable length:	1000.00 mm
Connector 1:	11 K-252
Connector 2:	11 K-252
Type no.:	n/a
Drawing no.:	n/a
Commission no.:	466287
Meas. System:	Wiltron 562 + 6669B
Source Power:	5 dBm
Temperature:	23 ± 1 °C
Date:	23.12.96
Inspected by:	DT
Start Freq.:	0.05 GHz
Stop Freq.:	40.00 GHz



HUBER+SUHNER AG, RF Interconnection Division, CH-9100 Herisau, Switzerland
Phone: +41 (0)71 353 41 11; Fax: +41 (0)71 353 45 90; Telex: 882 729

8.7. TEST METHOD

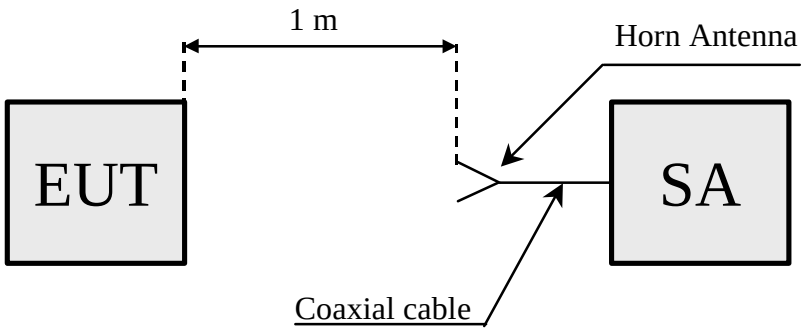
The tests are done using three different Horn Antennas for different frequency band. See Figure 1. The EUT is supported to a wooden mast in order not to disturb the electric field. The horn antennas are also supported to a mast of non-metallic material. See Photos.

The measurements are done with both the front and the rear of the EUT towards the Horn Antennas.

The Horn antennas are positioned in both horisontal and vertical polarization mode during the measurments.

All the tests are done in a open lab environmental, and in order to investigate if there are some spurious emission from other equipment , the tests are also done with no power to the EUT.

The only spurious from outside was at 1.83 GHz. This seems to be an GSM signal. SEE diagram 1.



EUT = Equipment Under Test

SA = Spectrum Analyzer

Figure 1. Test set up

8.8. TEST RESULTS

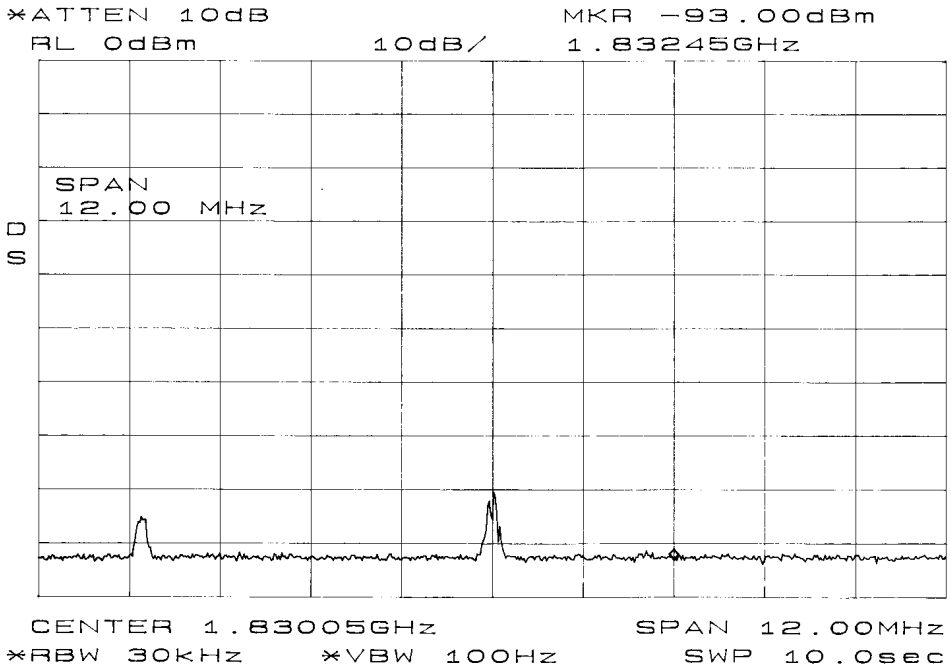


DIAGRAM 1 Outside spurious

8.9. Front of EUT towards the antennas

8.9.1. Vertical polarisation

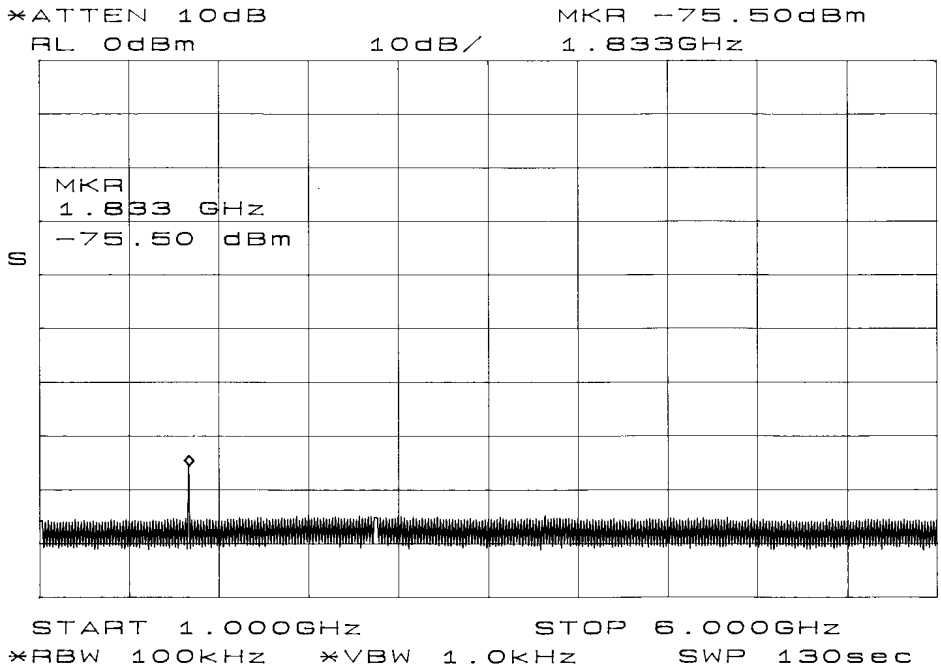


DIAGRAM 2

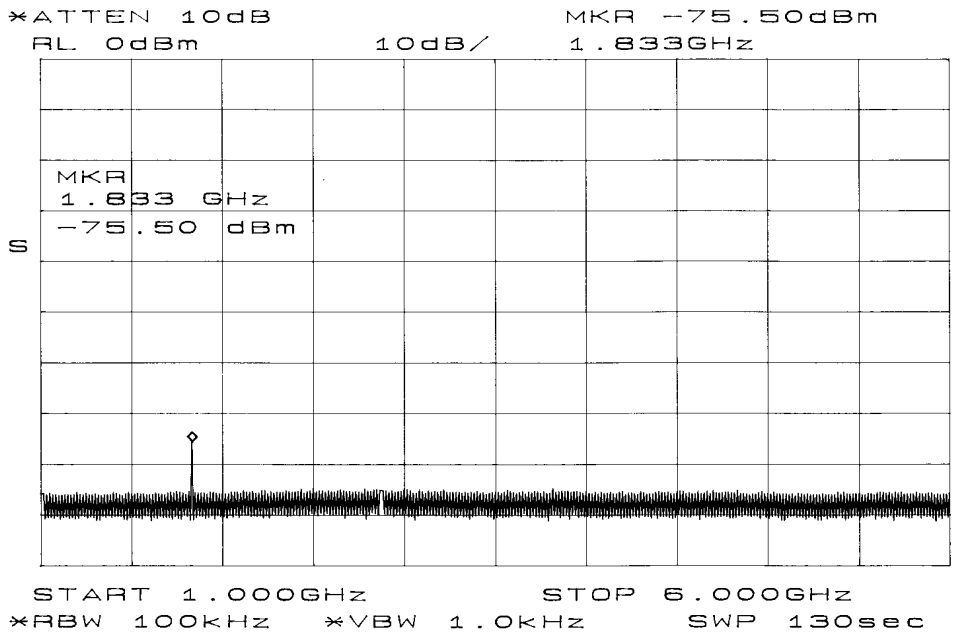


DIAGRAM 3

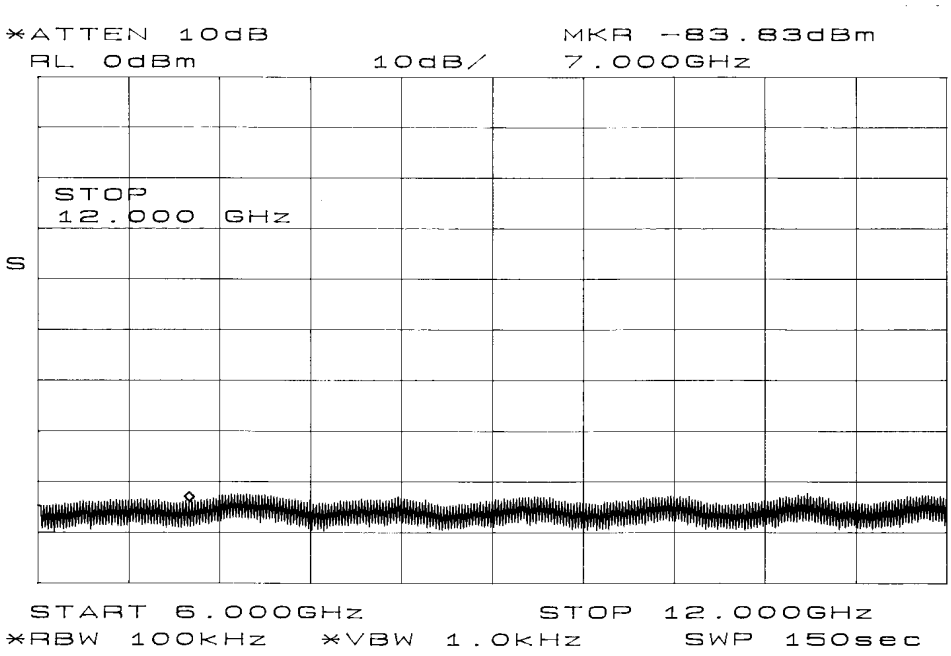


DIAGRAM 4

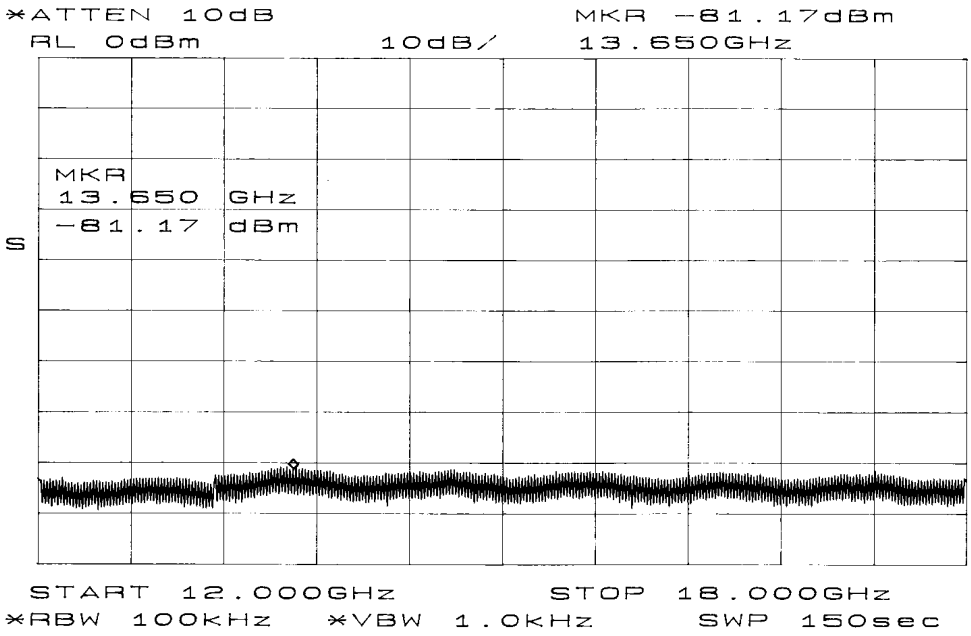


DIAGRAM 5

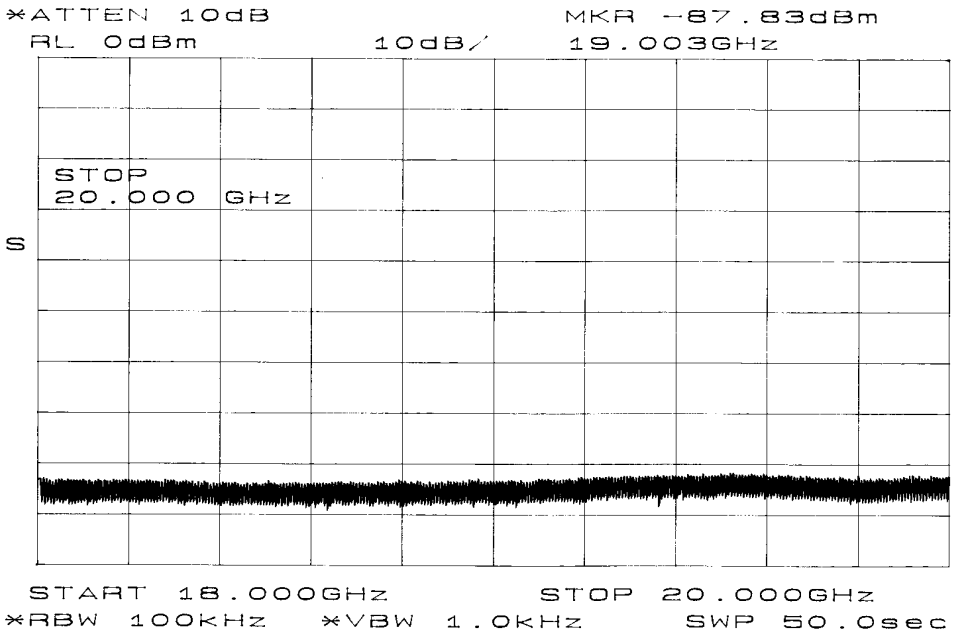


DIAGRAM 6

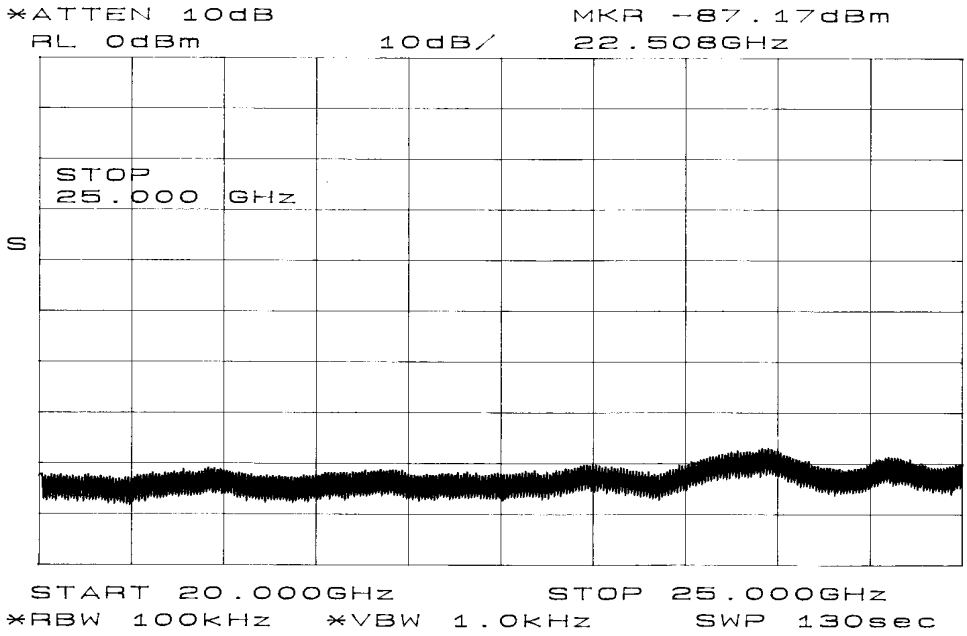


DIAGRAM 7

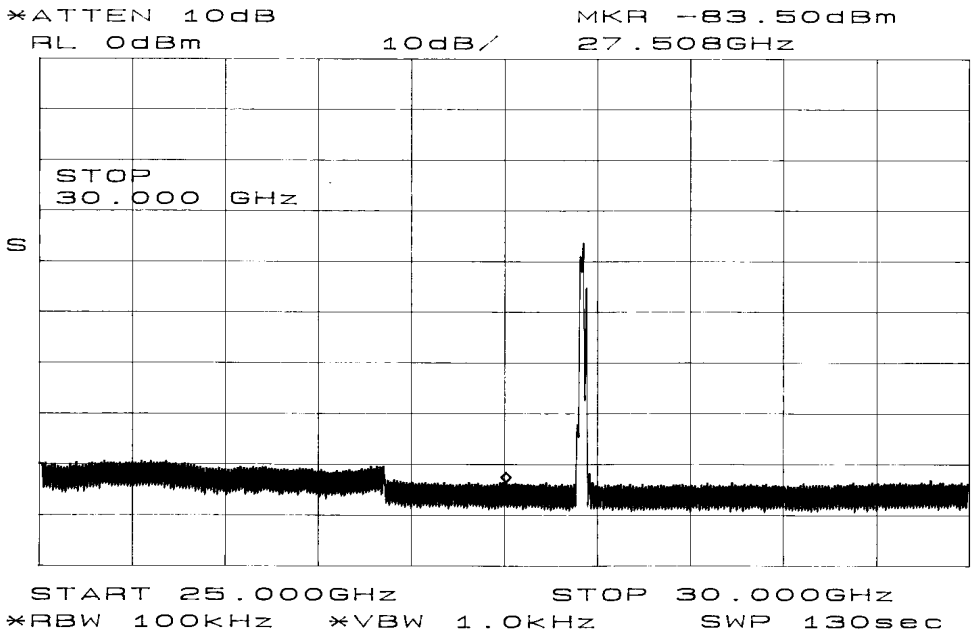


DIAGRAM 8

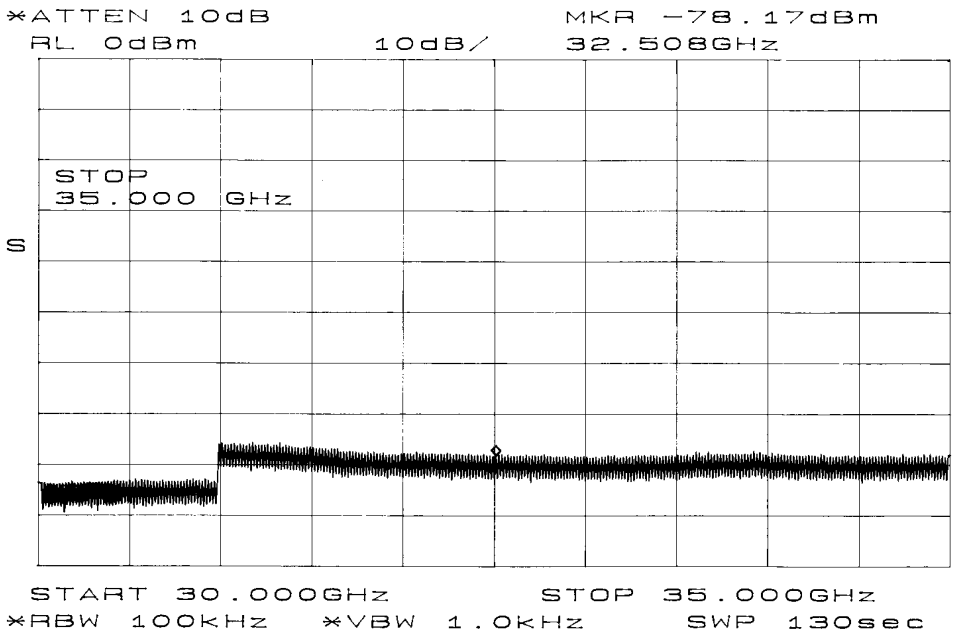


DIAGRAM 9

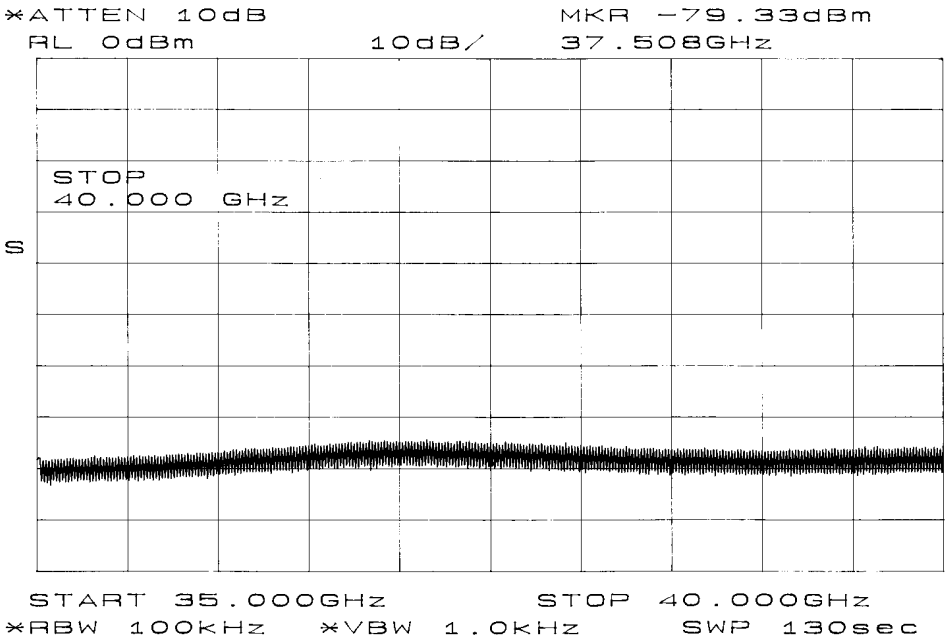
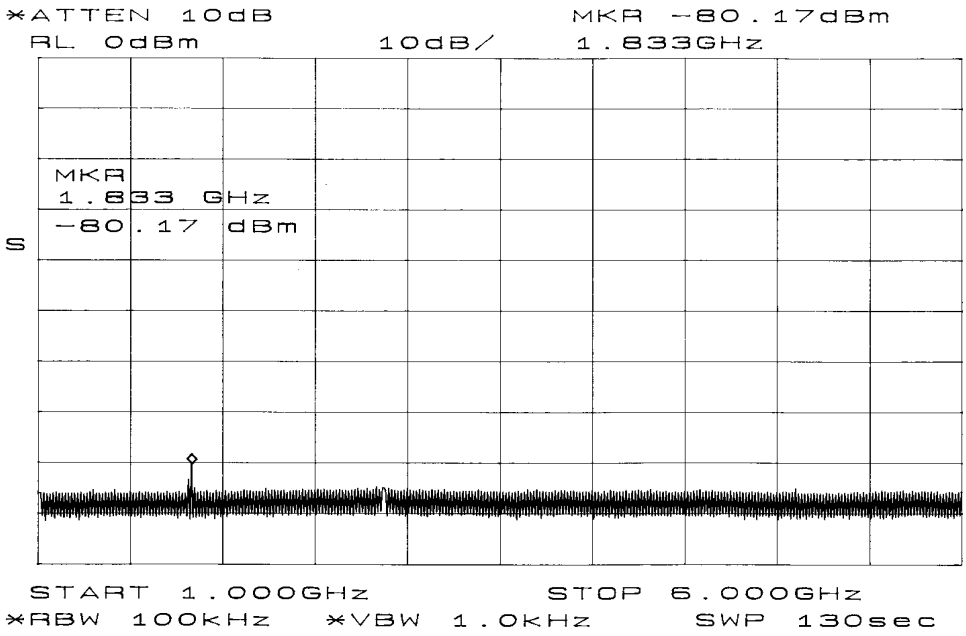


DIAGRAM 10

8.9.2. Horizontal polarisation



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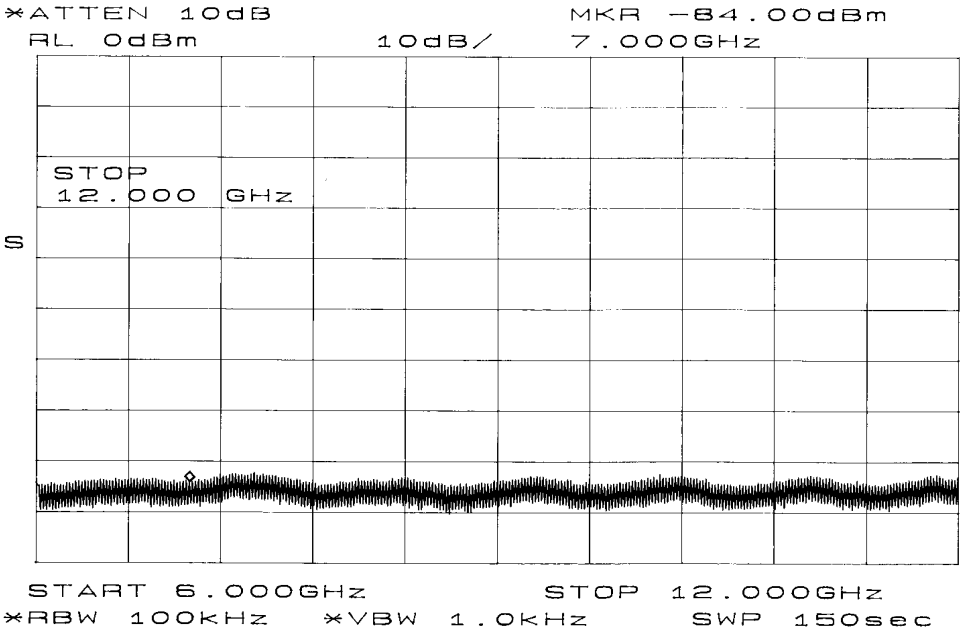


DIAGRAM 12

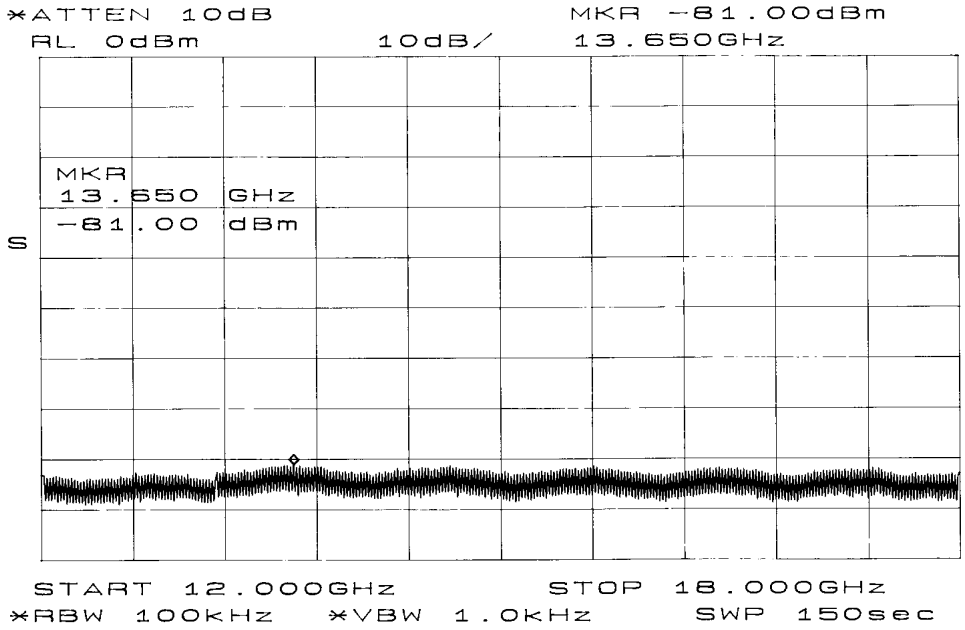


DIAGRAM 13

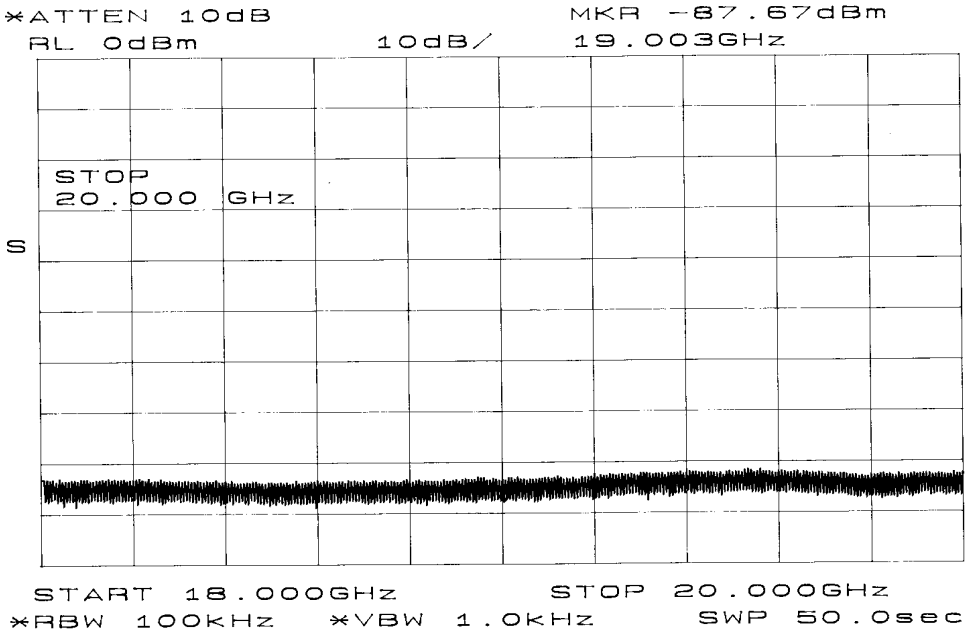


DIAGRAM 14

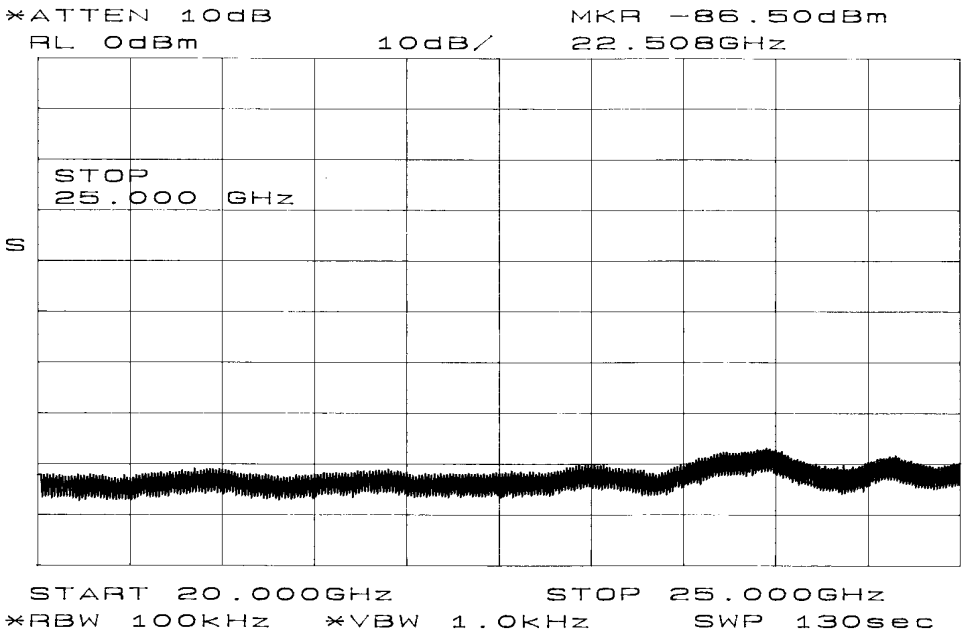


DIAGRAM 15

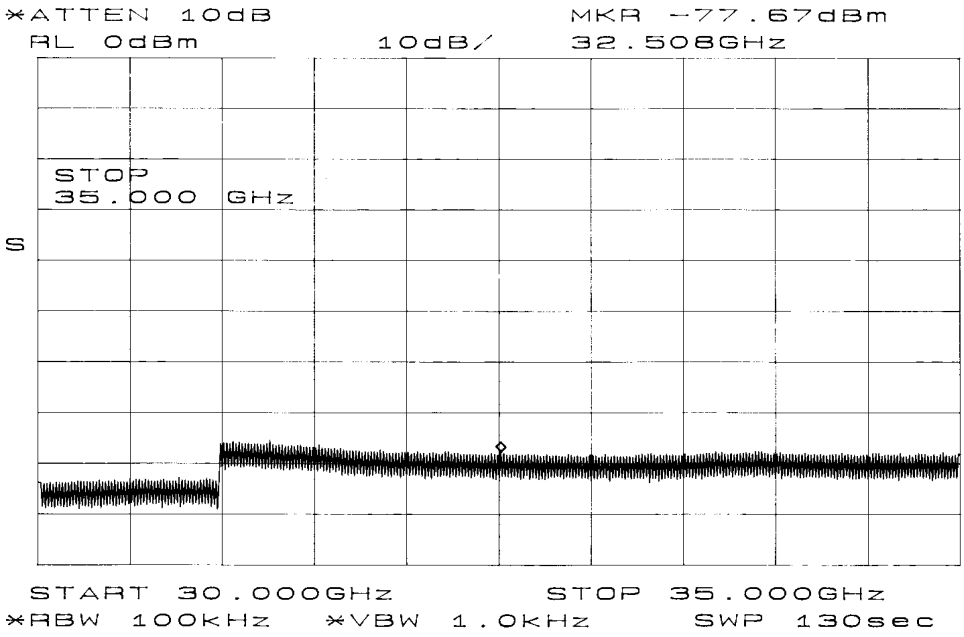


DIAGRAM 16

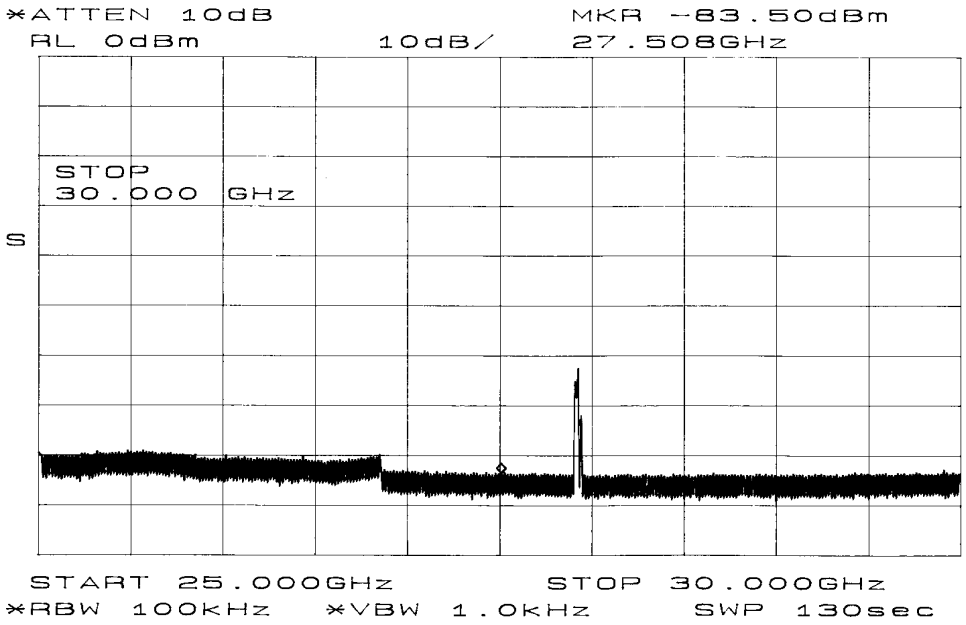


DIAGRAM 17

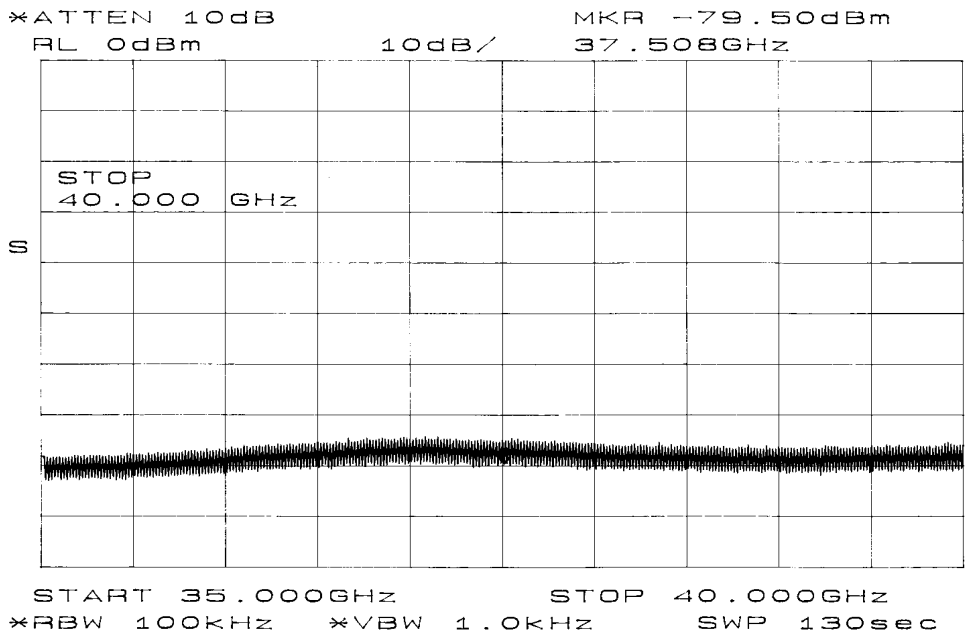


DIAGRAM 18

8.10. REAR OF EUT TOWARDS THE ANTENNAS

8.10.1. Vertical polarisation

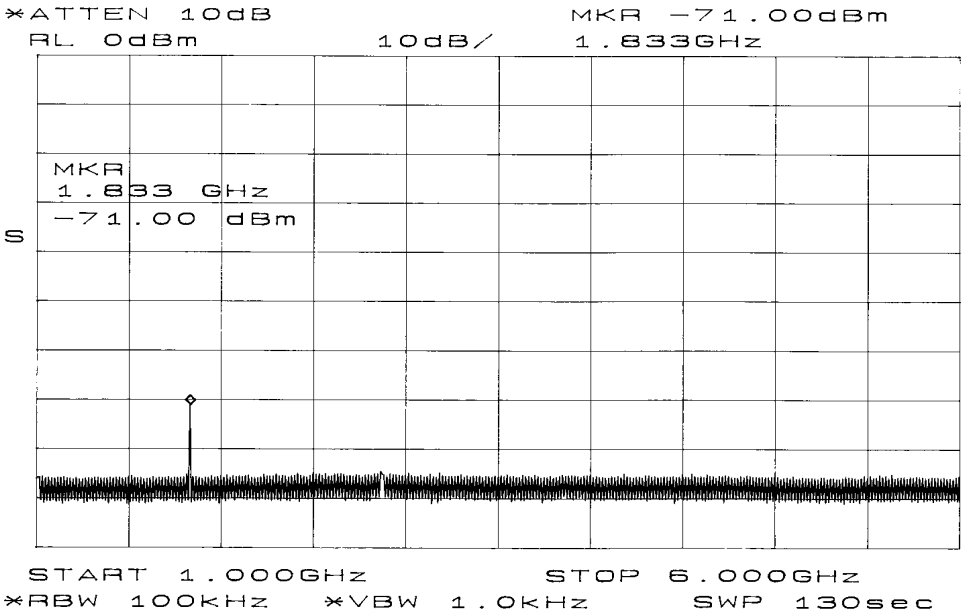


DIAGRAM 19

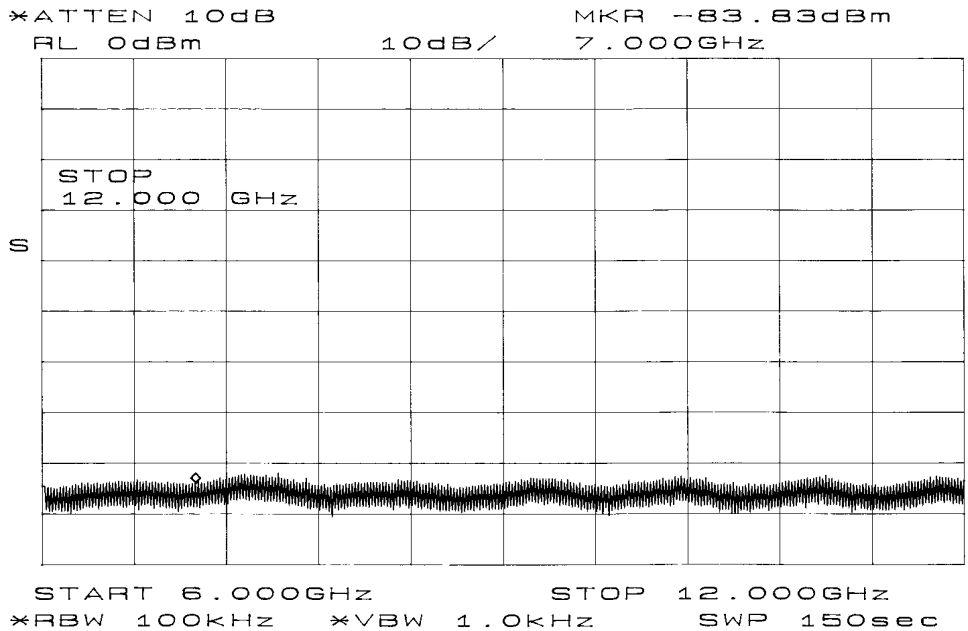


DIAGRAM 20

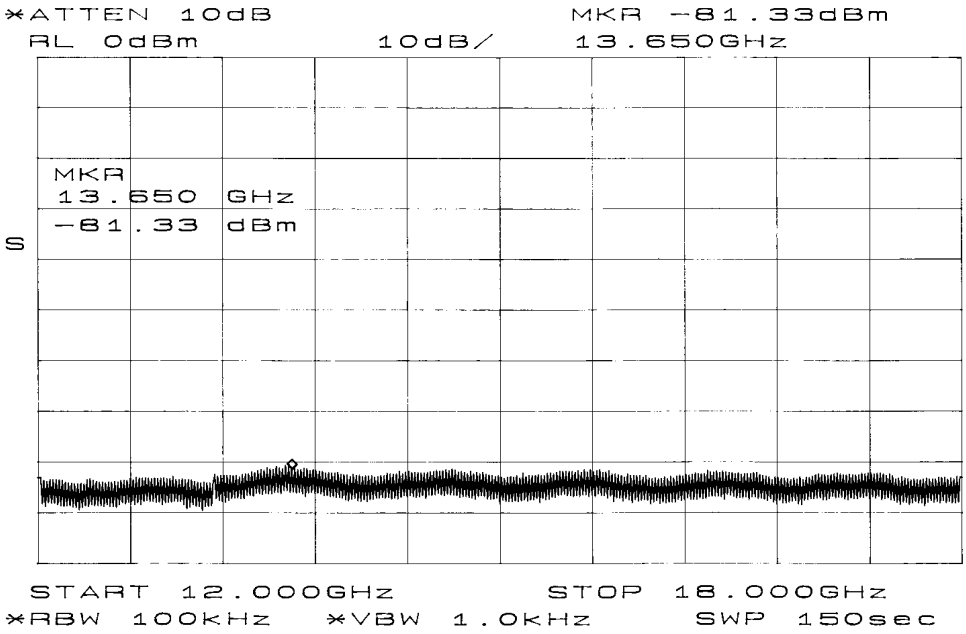


DIAGRAM 21

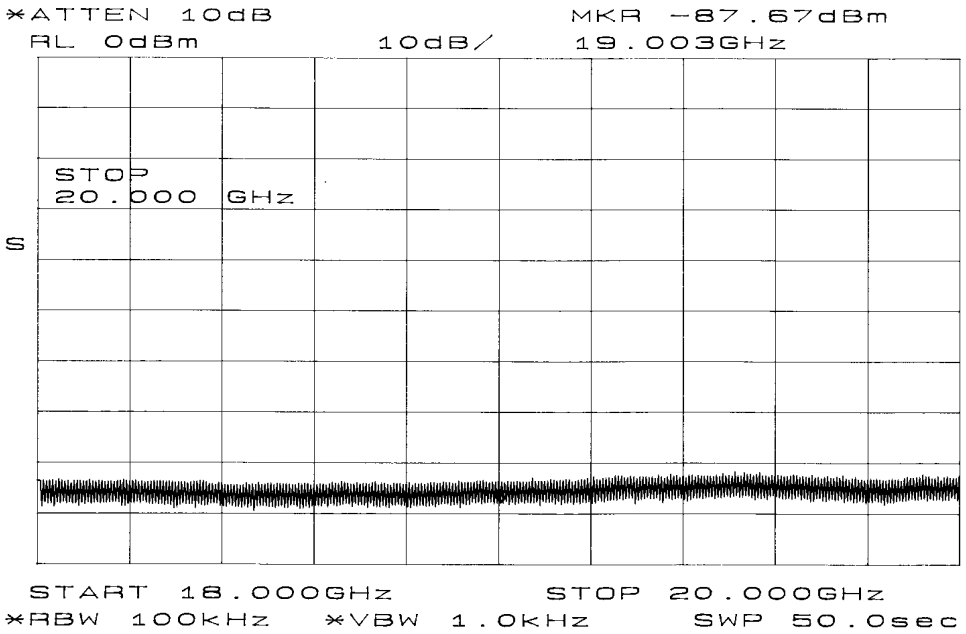


DIAGRAM 22

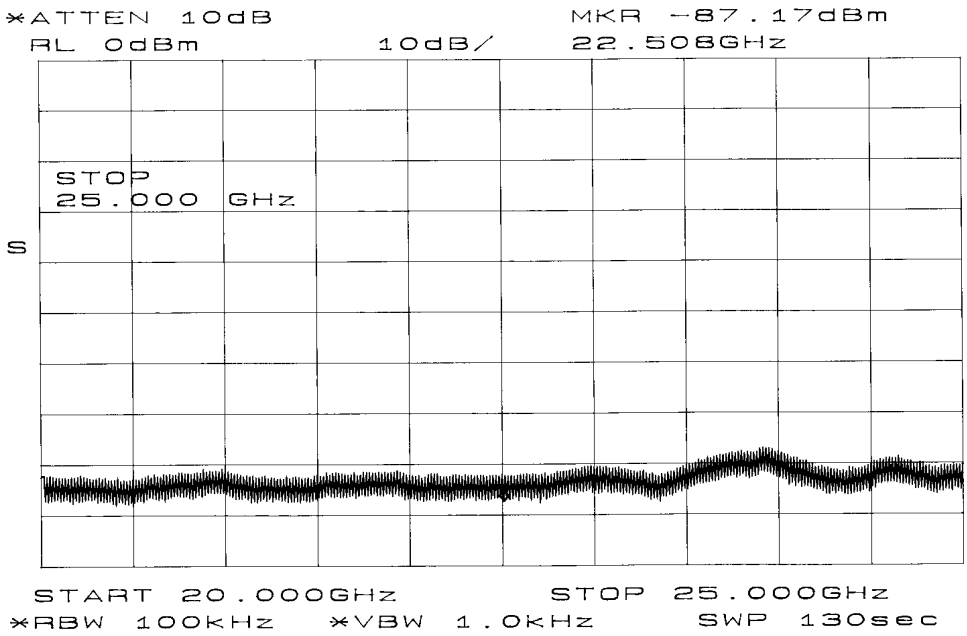


DIAGRAM 23

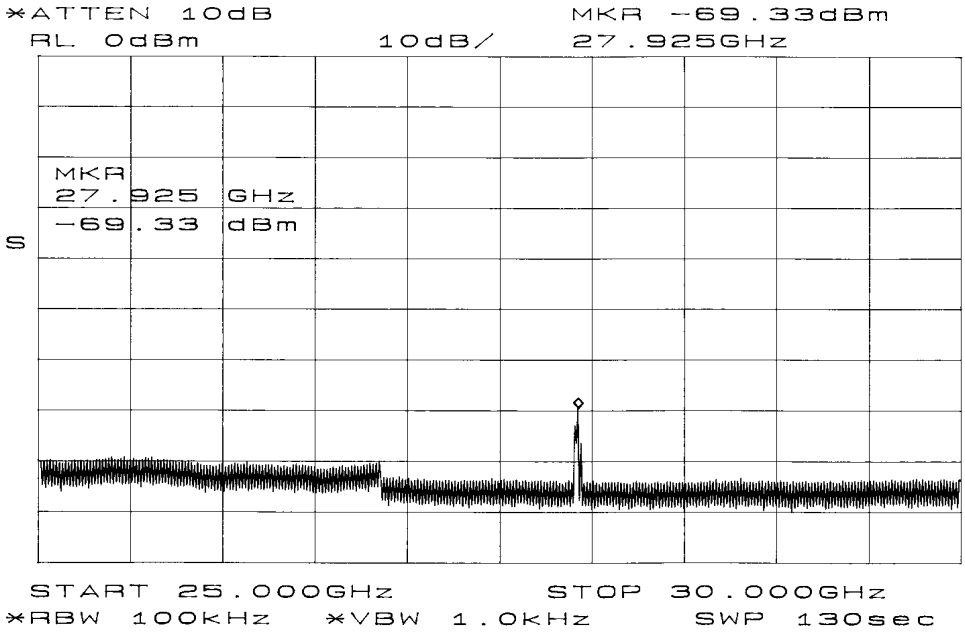


DIAGRAM 24

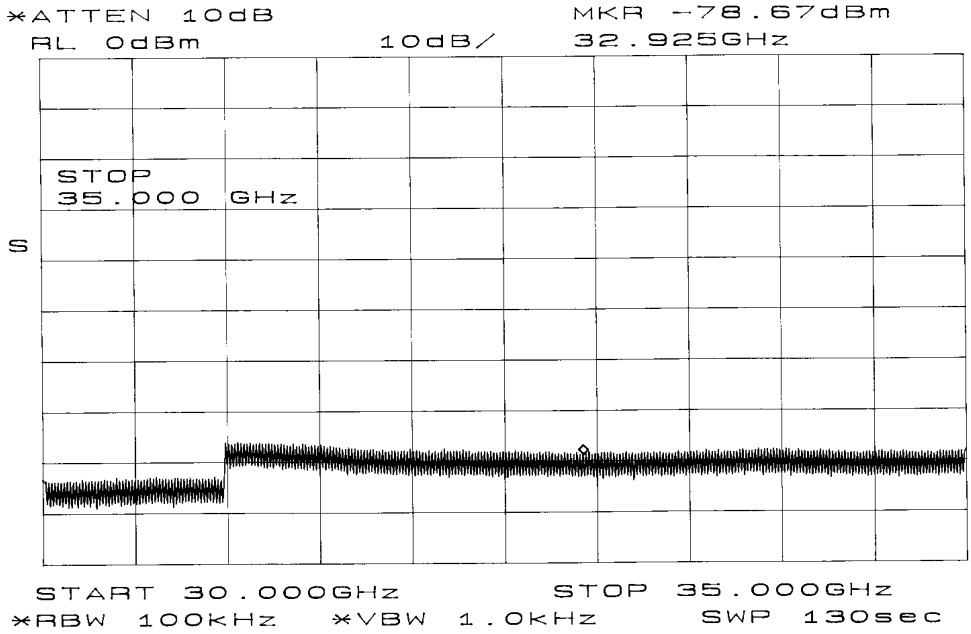


DIAGRAM 25

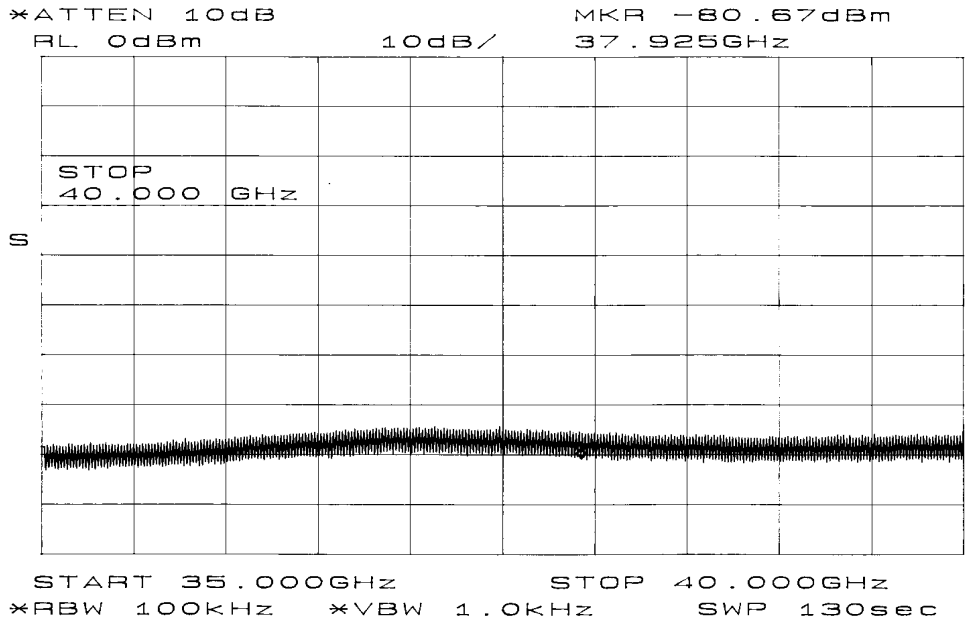


DIAGRAM 26

8.10.2. Horisontal polarization

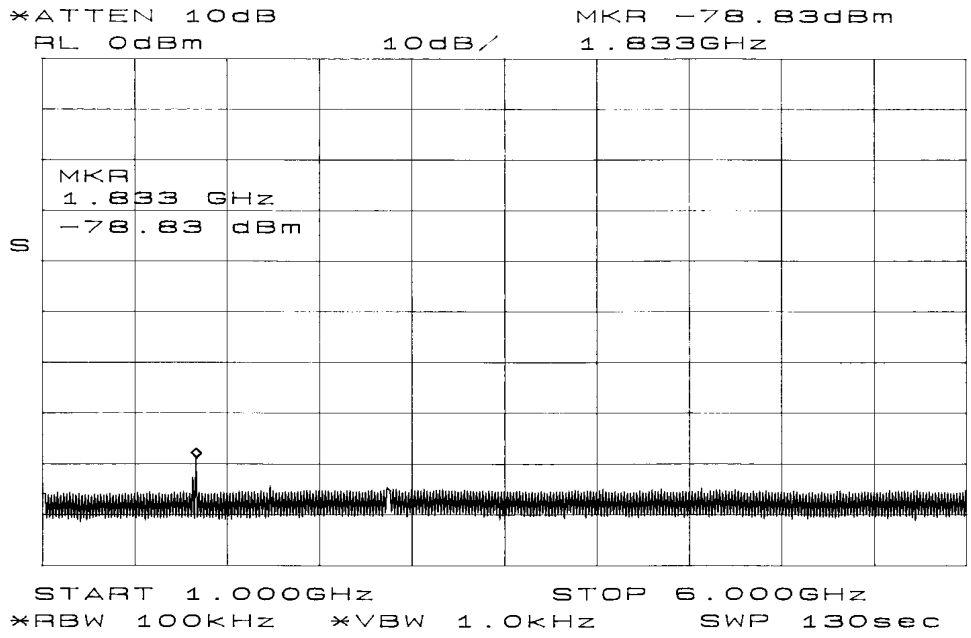


DIAGRAM 27

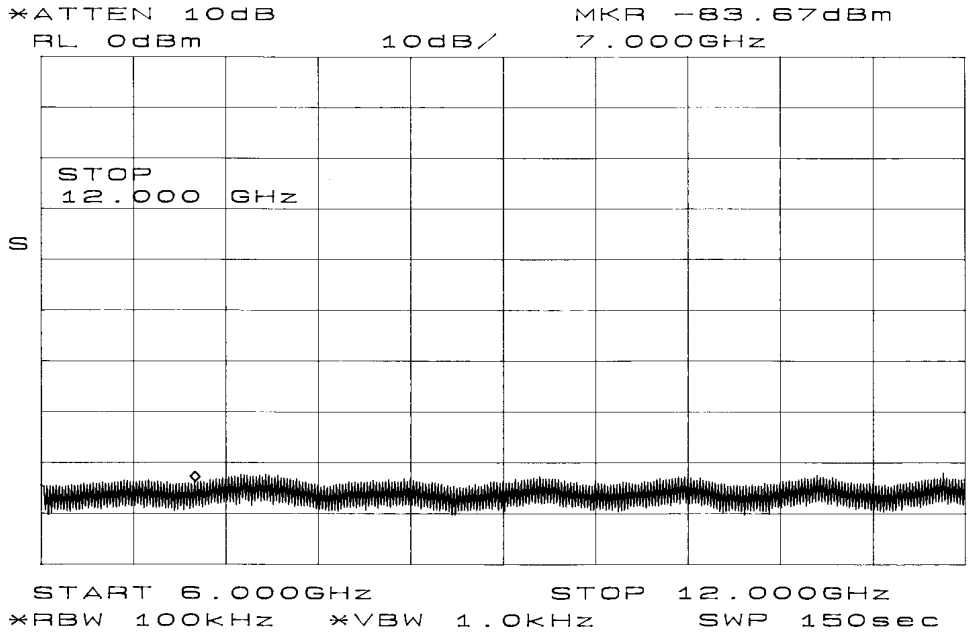


DIAGRAM 28

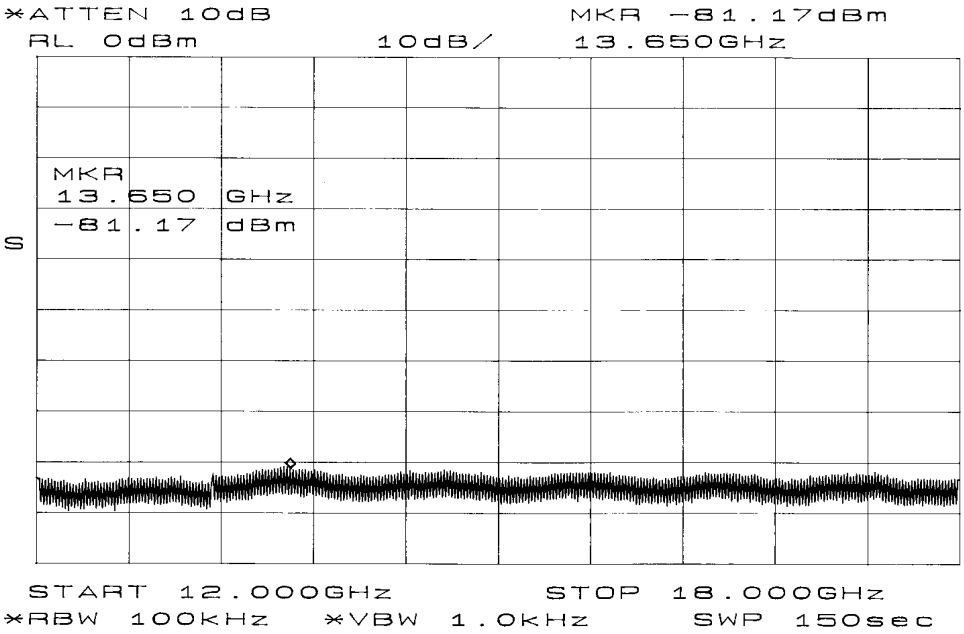


DIAGRAM 29

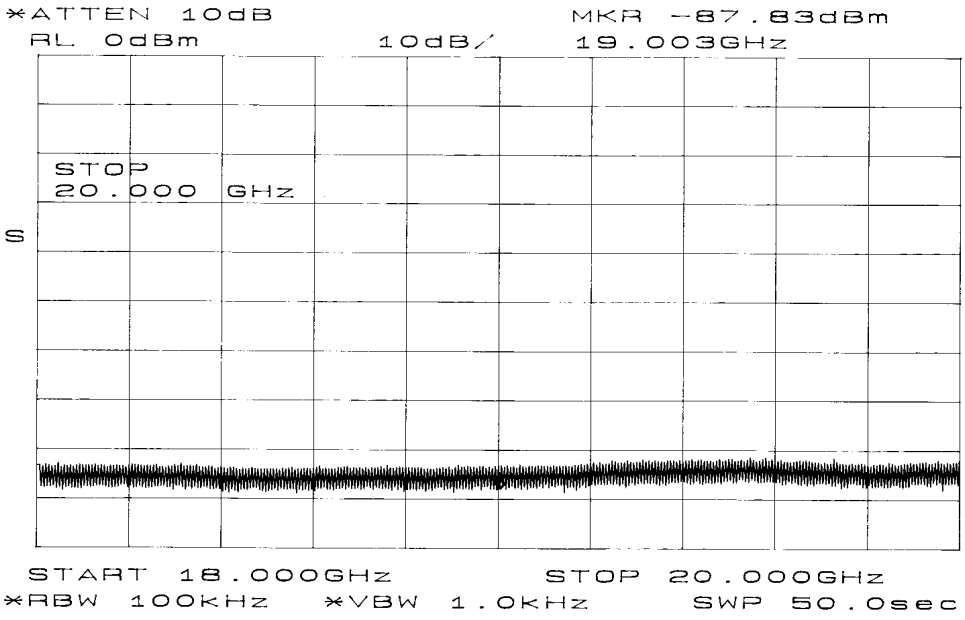


DIAGRAM 30

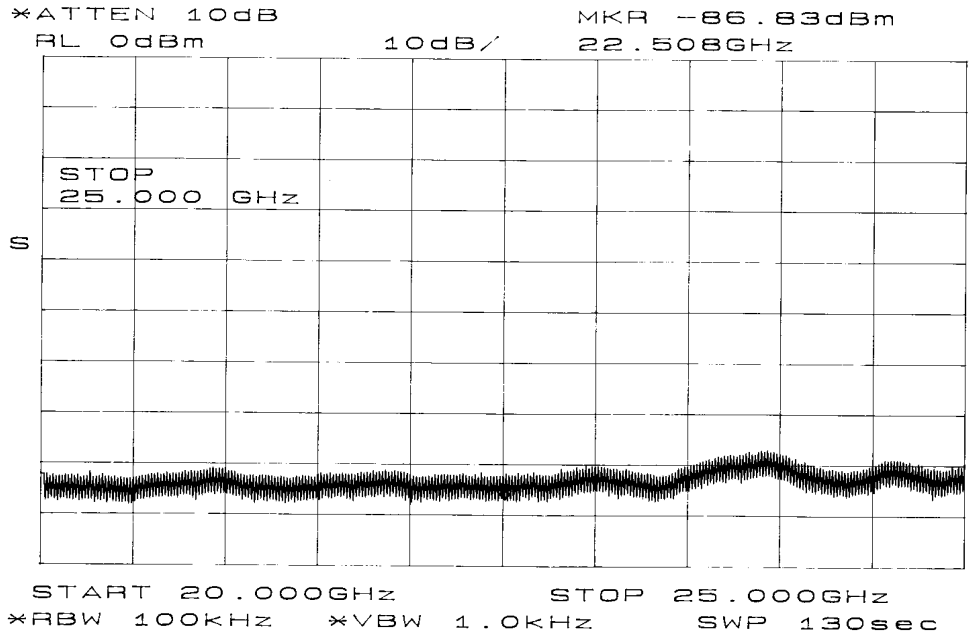


DIAGRAM 31

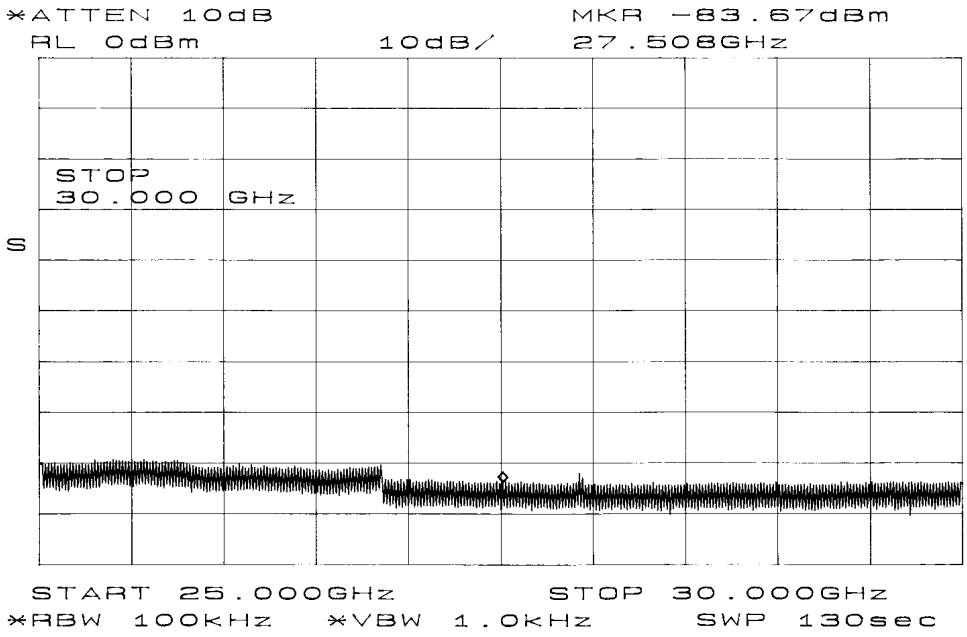


DIAGRAM 32

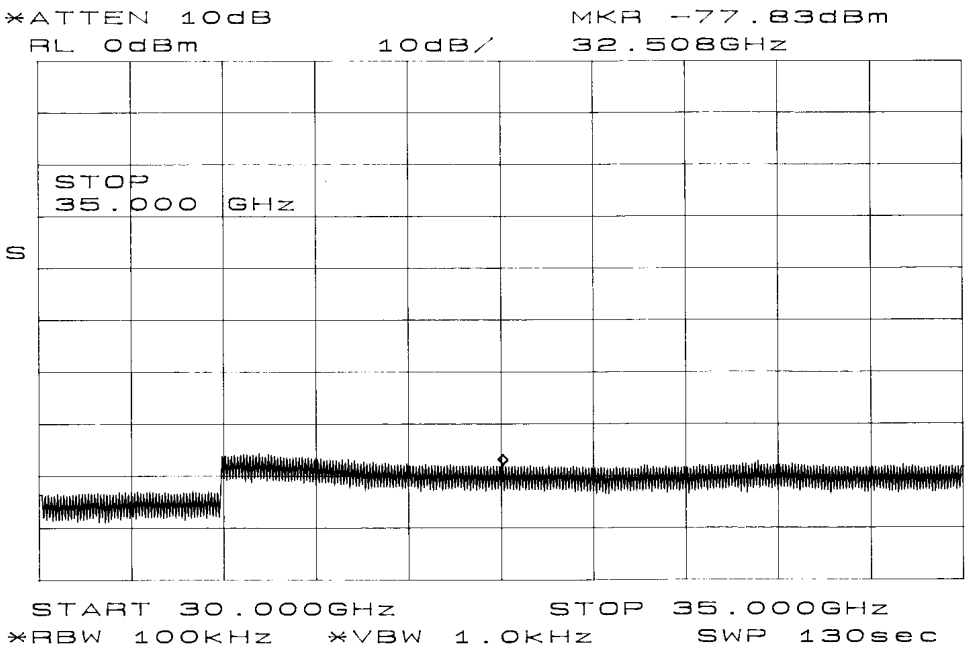


DIAGRAM 33

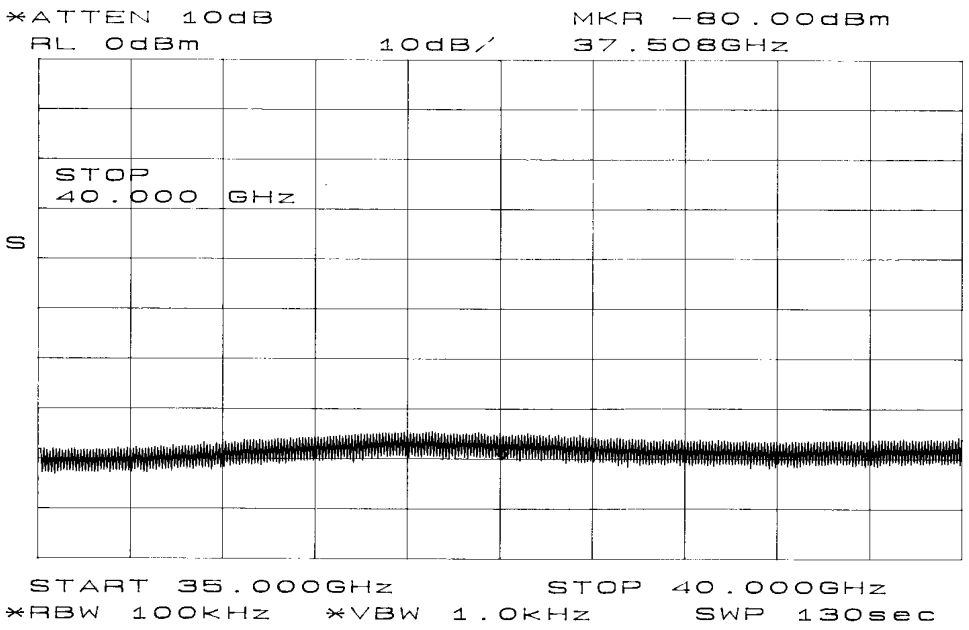
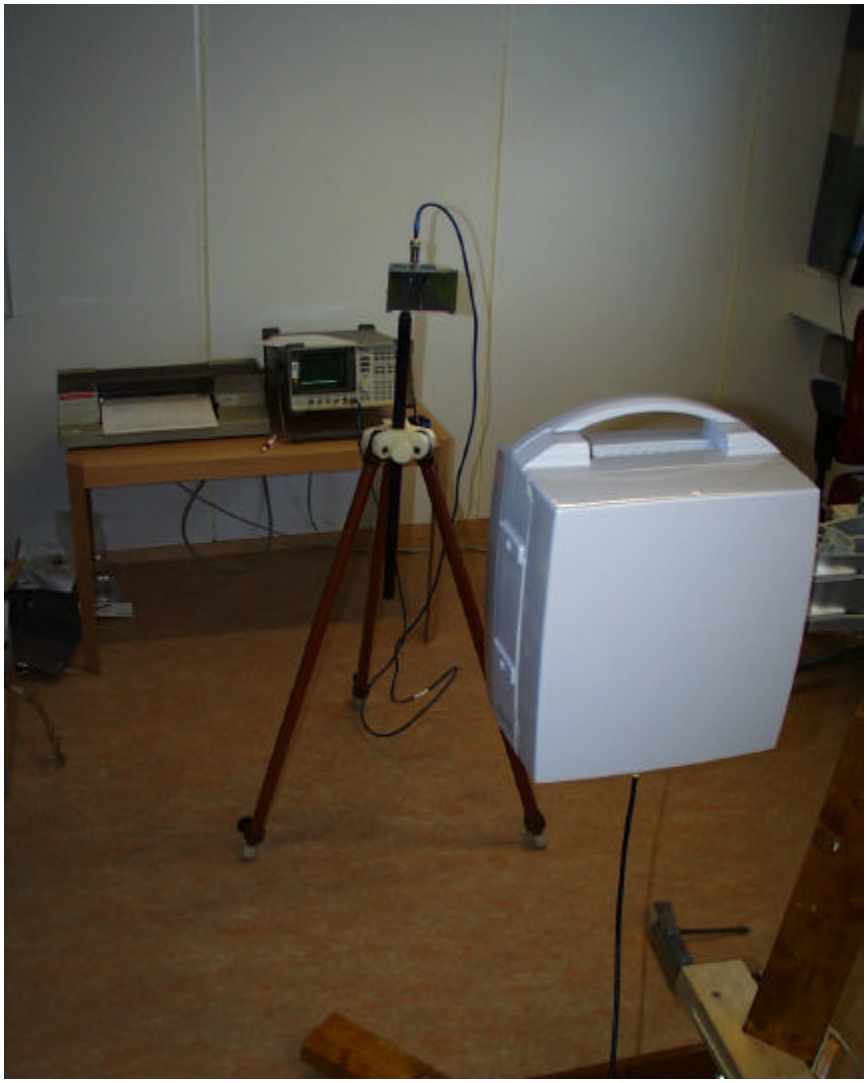


DIAGRAM 34

9. PHOTOS



10. ENCLOSED - CETECOM REPORT

CETECOM ICT Services GmbH

Untertürkheimer Straße 6-10 D-66177 Saarbrücken
Telefon: +49 (0)681 598-8431 Telefax: -9075
Laboratory for aeronautical radio, microwave radio and radar

Accredited testing laboratory

DAR registration number:
TTI-P-G 166/98-00 of 18.09.1998

Test report No.:

2-1686-A/99

MINI-LINK BAS

26 GHz PMP/28 GHz LMDS

Table of contents

1 General information

1.1 Notes

The test results of this test report relate exclusively to the test item specified in 1.5. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM ICT Services GmbH.

Tester :

Date	Name	Signature
06.10.1999	Detlev Gillmann	.....

Technical responsibility for area of testing :

Date	Name	Signature
06.10.1999	Klaus Kammerinke	.....

1.2 Testing laboratory

CETECOM ICT Services GmbH
Untertürkheimerstraße 6 - 10,
66117 Saarbrücken
Deutschland
Telefon : + 49 681 5 98 - 8431
Telefax : + 49 681 5 98 - 9075

Accredited testing laboratory
DAR-registration number: TTI-P-G 166/98-00 of 18.09.1998

Testing location, if different from CETECOM ICT Services GmbH:

Name	:
Street	:
Town	:
Country	:
Telephone	:
Fax	:

1.3 Details of applicant

Name	:	Ericsson GmbH
Street	:	Flöjelbergsgatan 2 A
Town	:	S-431 84 Mölndal
Country	:	Schweden
Telephone	:	+ 46 31 747 00 00
Fax	:	+ 46 31 2772 25

Contact person

Name	:	Mr. Fredrik Bramstang
Telephone	:	+ 46 31 747 60 37
Fax	:	+ 46 31 2772 25

1.4 Application details

Date of receipt of application	:06.10.1999
Date of receipt of test item	:06.10.1999
Date of test	:06.10.1999
Reference number	:048/99

1.5 Test item

Description of test item	:	Digital Radio Link as a point to multi-point system
Type identification	:	MINI-LINK BAS 26 GHz PMP/28 GHz LMDS
Manufacturer	:	Ericsson GmbH

1.5.1 Technical data according to the specification

1.5.2 Operating conditions :

Transmitter and receiver of the equipment were active

1.5.3 Equipment under test

ODU with sector antenna 3/UKY 21085
Type: UKL 60103/12
S/N: A230009GZ1

IDU
Type: Mini Link E, MMU 34 + 2 Mb
P/N : HRY 10201/3
S/N: 2005203

1.6 Test standards

- **EN 301 213 V.2.1 (issue 1998 - 02)**
- **RegTP 321 ZV 040 (issue**

Only spurious emissions (conducted and radiated) were measured

2 Technical test

2.1.2 Summary of test results according :

[X] **No deviations from the technical specification (s) were ascertained in the course of the performed tests.**

[ ] The deviations as specified in 2.5 were ascertained in the course of the performed tests

The test report :

[X] describes the first test
[X] describes a partial test:
[ ] is a verification of documents
[ ] is only valid with the test report no. :

The tests were witnessed by :

Individual test results are documented in 2.5

Representatives for manufacturer: Mr. Fredrik Bramstang

2.2 Test environment

The environmental conditions are documented specially for each test

2.3 Measurement and test set-up

The measurement and test set-up is in accordance to the specification .

2.4 Test equipment utilized

see appendix 2

2.5 Test results

2.5.1 Test results overview

☐ Additional to the test report no. :

Verification test item :

☒ in accordance with the technical description
see the test report : .....
☐ no accordance with the technical description

EN / RegTP Spurious emissions

Limits: **EN**

Frequency Range (GHz)	Limit (dBm)	Res. Bw (MHz)
0,000 009 – 0,000 150	- 50	0,001
0,000 150 – 0, 030	- 50	0,010
0,030 – 1,0	- 50	0,100
1,0 - 21,2	- 50	1,0
21,2 - 110	- 30	1,0
For channel spacing ≤ 7.0 MHz and in the range from 250 % of channel spacing to ± 56 MHz	- 30	0,1

Spurious emission frequency relative to channel assigned frequency	Specification limit	Controlling factor for requirement application
The average level of all spurious signals both discrete Continuous Wave and noise-like evaluated as total average signal level	≤ - 70 dBm	If spurious signal`s frequency falls within receiver half band

Limits: **RegTP (conducted emissions)**

Frequency Range (GHz)	Limit (dBm)
0.030 – 21.2	≤ - 60
> 21.2	≤ - 30

Limits: **RegTP (radiated emissions)**

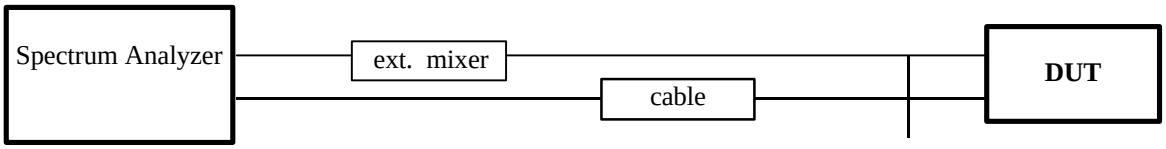
Frequency Range (GHz)	Limits
0.030 – 0.230	e = 30 dBµV/m
0.230 – 1.0	e = 37 dBµV/m
> 1.0	p = < - 33 dBm

1.10.3 RegTP

5.5.6 EN Spurious emissions (conducted)

Measurement conditions:				
	Frequency	f	=	27.914 250 GHz
	normal power supply	U	=	48,0 V DC
	extreme power supply	U	=	20.4 – 72.0 table
	channel spacing	CS	=	3.5 MHz
	Data rate	D	=	2x2 Mbit/s
	Temperature	t	=	23 ° C
	Measurement at C`,			

Test set up:



C'

Limits : see Page No.: 7

Test results:

Frequency/ frequency band (GHz)	Analyser reading (dBm)	remark	Cable loss integrated (dB)	**Spurious emission p (dBm)**	Res. BW (MHz)	Plot No.:
75.0 – 110.0	-58.7	noise	-	noise	0.3	1
80.0 – 85.0	-68.2	noise	-	noise	0.03	2

Remark: The fundamental frequency was suppressed by a stub - tuner

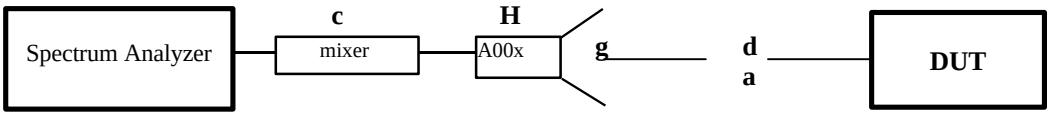
Test standards passed: Yes [X] **No** [ ]

1.10.3 RegTP

5.6 EN Spurious emissions (radiated) 40 GHz – 110 GHz

Measurement conditions:					
	Frequency	f	=	27.914 250	GHz
	Power supply	U	=	20.4 – 72.0	V DC
	Channel spacing	CS	=	3.5	MHz
	Data rate	D	=	2x2	Mbit/s
	Temperature	t	=	23	° C
	Modulation	M	=	on	

Test set up:



Explanation: Reference see Annex 2 (list of measuring equipment)

c = cable attenuation
g = Antenna gain
a = Free-space attenuation
H = Horn antenna
d = Measurement distance

Limits : see Page No.: 7

The measurements was carried out in an anechoic chamber at a distance of 1,0 m. According to the frequency band,different mixers and different standard gain horns (SGH) were used in horizontal and vertical polarization. A measurement system loss, consisting of: conversion loss of the mixers, free space attenuation and gain of SGH was integrated as reference level offset to the spectrum analyzer reading.

Test results:

Frequency/ frequency band (GHz)	Analyser reading (dBm)	remark	Res. BW (MHz)	**Spurious emissions p (dBm)**	Polari-zation hor./vert.	Plot No.
40.0 – 60.0	<- 64.0	noise	1.0	< - 64.0	hor.	3
48.95	- 53.2	n.t.	1.0	not true (n.t.)	hor.	3
57.46	- 47.7	n.t.	1.0	n.t.	hor.	3
40.0 – 60.0	< - 64.0	noise	1.0	< - 64.0	vert.	4
48.95	- 36.2	n.t.	1.0	n.t.	vert.	4
57.46	- 33.5	n.t.	1.0	n.t.	vert.	4
50.0 – 75.0	< - 59.5	noise	1.0	< - 59.5	h + v	5
75.0 – 110.0	< - 62.0	noise	1.0	< - 62.0	h + v	6

Test standards passed: **Yes** [X] **No** [ ]

CETECOM ICT Services GmbH

Prüfbericht Nr.: 2-1686-A/99 **Anlage 2**
Test report no.: 2-1686-A/99 Appendix 2

Anlage 2 zum Prüfbericht Nr. : 2-1686-A/99
Appendix 2 to test report no.: 2-1686-A/99

Eingesetzte Prüfmittel
Utilized test equipment

Diese Anlage besteht aus 8 Seiten inklusive Deckblatt.
This test report consists of 8 pages included cover page

CETECOM ICT Services GmbH

Prüfbericht Nr.: 2-1686-A/99 **Anlage 2**
Test report no.: 2-1686-A/99 Appendix 2

	Equipment:	Type:	Manufacturer:	Ser No.:	Ident No.:
1	Adapter	15050900	Tektronix		300000823
2	Anpassglied	RAM	R&S	890801/002	300000839
3	Anpassglied	RAZ	R&S	890801/003	300000840
4	Antennen Mast		Schwarzbeck		300000509
5	Attenuator / Switch driver	11713	HP Meßtechnik		300002339
6	Attenuator / Switch driver	11713	HP Meßtechnik		300002340
7	Attenuator / Switch Driver	11713	HP Meßtechnik		300001692
8	Attenuator / Switch Driver	11713A	HP Meßtechnik		300002407
9	Bandfilter	TTA300055EE	Telonic	20370-2	300001323
10	Bandfilter	TTF2250	Telonic	30014-1	300001798
11	Bias network	11590B	HP Meßtechnik		300000843
12	Bias network	11590B	HP Meßtechnik		300001664
13	Bitfehler Analyser	37717A	HP Meßtechnik	3545U01070	300002072
14	Cal.-Kit für 8510	85052B/85054B	HP Meßtechnik	2643A03725	300002404
15	Compakt-Kamera		Olympus		300002372
16	Dämpfungsglied	AP 18_27	Thomson CSF	276262	300002443
17	Dämpfungsglied 10 dB	772	Narda		300002369
18	Dämpfungsglied 10dB ,50W	R-417410	Microndе		300000496
19	Dämpfungsglied 20 dB	779	Narda	1866	300002367
20	Dämpfungsglied 20 dB	8491A	HP Meßtechnik	2708A43586, 2708A43570	300002347
21	Dämpfungsglied 20 W	768F-10	Narda		300002370
22	Dämpfungsglied 20dB ,20W	R-416420	Microndе	8508	300002393
23	Dämpfungsglied 20dB ,50W	R-417420	Microndе		300000495
24	Dämpfungsglied 30 dB	11708A	HP Meßtechnik	12596,5786,35686,35747	300002346
25	Dämpfungsglied 30 dB	8325	Bird	1529	300000780
26	Dämpfungsglied 30 dB	8498A	HP Meßtechnik	1801A01243	300000782
27	Dämpfungsglied 30 dB	8498A	HP Meßtechnik	2702A05798	300002472
28	Dämpfungsglied High Power	RBU BN33666/50	R&S	300802/6	300002374
29	Dämpfungsglied variabel	1611;1711	Flann	536;671	300002409
30	Dämpfungsglied variabel	2011;2211;2411;2311	Flann		300001622
31	Dämpfungsglied variabel	AE18-27	Thomson CSF	492632	300002376
32	Dämpfungsglied variabel	AE27-40	Thomson CSF	492729	300002377
33	Dämpfungsglied variabel	AE33-50	Thomson CSF	492156	300002378
34	Dämpfungsglied variabel	AE50-75	Thomson CSF	492315	300002379
35	Dämpfungsglied variabel	AE60-90	Thomson CSF	492687	300002384
36	Dämpfungsglied variabel 3dB		Weinschel Ass		300002068
37	Dämpfungsglieder Cal. Variable	749B	Narda	1003	300000417
38	Dämpfungsglieder Cal. Variable	750B	Narda	1018	300000437
39	Directional Coupler	1029CA	Narda	58	300000438
40	Directional Coupler	1079	Narda		300000774
41	Directional Coupler	1080	Narda		300000775
42	Directional Coupler	15132-03	Flann	120	300002142
43	Directional Coupler	15132-10	Flann	153	300002143
44	Directional Coupler	20132-03	Flann	187	300002161
45	Directional Coupler	20132-10	Flann	716	300002163
46	Directional Coupler	20132-20	Flann	224	300002165
47	Directional Coupler	CD18-27	Thomson CSF	492572	300000825
48	Directional Coupler	CD18-27	Thomson CSF	492688	300002395
49	Directional Coupler	CD27-40	Thomson CSF	492515	300002396
50	Directional Coupler	CD27-40	Thomson CSF	492086	300002397
51	Directional Coupler	CD33-50	Thomson CSF	492271	300002398
52	Directional Coupler	CD50-75	Thomson CSF	492164	300002399
53	Directional Coupler	CD60-90	Thomson CSF	492693	300002400

CETECOM ICT Services GmbH

Prüfbericht Nr.: 2-1686-A/99 **Anlage 2**
Test report no.: 2-1686-A/99 Appendix 2

	Equipment:	Type:	Manufacturer:	Ser No.:	Ident No.:
54	Directional Coupler	CD75-110	Thomson CSF	492093	300001401
55	Directional Coupler	CD90-140	Thomson CSF	492488	300002402
56	Directional Coupler	R752D 20dB	HP Meßtechnik	0049, 0052, 0074	300002348
57	Drucker	Laserjet II	HP I.V.	2837J80455	300002012
58	Drucker	Laserjet II	HP I.V.	2851J00182	300002109
59	Drucker	Quietjet	HP I.V.	2830S12963	300002013
60	Dummy Load 250 kW	Model 3208	Narda		300002371
61	Dummy Load diverse		Flann		300002049
62	Dummy Load diverse		Thomson CSF		300000805
63	Durchgangsleistungsmesser	Naus3	R&S	872343/028	300000766
64	Eichleitung	DPSP	R&S	871684/37	300000499
65	Eichleitung / Attenuatorset	11582	HP Meßtechnik	*	300000934
66	Empfänger	MFK 85	Kathrein	352	300000319
67	Ext. Mixer bis 140 GHz	11970 (U...) 4 Satz	HP Meßtechnik		300000781
68	Feldstärkemessgerät	8608	Narda	20105	300000800
69	Feldstärkemessgerät Close Field Probe	11945A	HP Meßtechnik	2654A02861	300000315
70	Filter Low Pass	R362A	HP Meßtechnik	1685	300000905
71	Filterschaltfeld HF	IEC 625	FZA		300002341
72	Frequenz Zähler	5351B	HP Meßtechnik	2719U00174	300000893
73	Frequenz Zähler	Model 548	EIP	352	300001113
74	Frequenzdoppler	11721A	HP Meßtechnik	1950A00410	300000519
75	Frequenzmesser	OD 27_40	Thomson CSF	277035	300000806
76	Frequenzmesser	OD 33_50	Thomson CSF	494005	300000807
77	Frequenzmesser	OD 50_75	Thomson CSF	276224	300000808
78	Frequenzmesser	OD 60_90	Thomson CSF	494017	300000809
79	Frequenzmesser	OD 75_110	Thomson CSF	492021	300000810
80	Frequenzmesser	OD 90_140	Thomson CSF	494047	300000811
81	Frequenzvergl. Empfänger	EA-155K	Schomandl		300002375
82	Hebebühnen		Boy		300002041
83	HF-Kabel		Alpen	A303550059	300002381
84	HF-Kabel	104Q	Sukoflex	2212-4Q	300002361
85	HF-Kabel	85106-60004	HP Meßtechnik	W19	300002336
86	HF-Kabel	85106-60005	HP Meßtechnik	W21	300002357
87	HF-Kabel	85106-60006	HP Meßtechnik	W24	300002358
88	HF-Kabel	KPS-143ATW-240-KPS	Insulated Wire		300002359
89	HF-Kabel	KPS-143ATW-600-KPS	Insulated Wire		300002360
90	HF-Kabel 0.5 m 50 *	104PA	Suhner	1166/4PA	300002031
91	HF-Kabel 0.5 m 50 *	104PA	Suhner	1276/4PA	300002033
92	HF-Kabel 0.5 m 50 *	104PA	Suhner	1168/4PA	300002032
93	HF-Kabel 0.5 m 50 *	104PA	Suhner	1284/4PA	300002034
94	HF-Kabel 0.5 m 50 *	104PA	Suhner	1290/4PA	300002035
95	HF-Kabel 0.5 m 50 *	104PA	Suhner	1153/4PA	300002030
96	HF-Kabel 0.5 m 50 *	50	Suhner		300002036
97	HF-Kabel 1.0 m				300002362
98	HF-Kabel 1.0 m 50 *	5061-5359 C.	HP Meßtechnik	P18591	300002385
99	HF-Kabel 1.0 m 50 *	5061-5359 C.	HP Meßtechnik	P18600	300002383
100	HF-Kabel 1.0 m 50 *	5061-5359 C.	HP Meßtechnik	P36303	300002382
101	HF-Kabel 1.0 m 50 *	5061-5359 C.	HP Meßtechnik	P39078	300002380
102	HF-Kabel 1.0 m 50 *	5061-5359 C.	HP Meßtechnik	P31529	300002386
103	HF-Kabel 1.0 m 50 *	SPSJ051	Insulated Wire	60492	300002355
104	HF-Kabel 1.0 m 75 *	RG 59B/U + RG60 B/U	Kabelmetall		300002365
105	HF-Kabel 1.5 m 50 *	104PA	Suhner	1306/4PA	300002029
106	HF-Kabel 1.5 m 50 *	104PA	Suhner	1297/4PA	300002028

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	Equipment:	Type:	Manufacturer:	Ser No.:	Ident No.:
107	HF-Kabel 1.5 m 50 *	104PA	Suhner	1298/4PA	300002026
108	HF-Kabel 1.5 m 50 *	104PA	Suhner	1186/4PA	300002027
109	HF-Kabel 1.5 m 50 *	104PA	Suhner	1312/4PA	300002024
110	HF-Kabel 1.5 m 50 *	104PA	Suhner	1316/4PA	300002025
111	HF-Kabel 1.5 m 50 *	RG 213	PKI		300002373
112	HF-Kabel 1.5 m 50 *	RG 223U	Kabelmetall		300002364
113	HF-Kabel 10.0 m 50 * I	SPS3881	Insulated Wire	60492	300002349
114	HF-Kabel 10.0 m 50 * II	SPS3881	Insulated Wire	40191	300002350
115	HF-Kabel 2.0 m 75 *	RG 59B/U	Kabelmetall		300002366
116	HF-Kabel 3.0 m 50 *	RG 223U	Kabelmetall		300002363
117	HF-Kabel 3.0 m 50 * I	SPS1180	Insulated Wire	40191	300002353
118	HF-Kabel 3.0 m 50 * II	SPS1180	Insulated Wire	40191	300002354
119	HF-Kabel 5.0 m 50 * I	SPS1969	Insulated Wire	40191	300002351
120	HF-Kabel 5.0 m 50 * II	SPS1969	Insulated Wire	40191	300002352
121	HF-Kabel 6.0 m 75 *	2YC	F&G		300002337
122	Hifi Verstärker & Boxen	UA140	Uher + canton	22648	300002040
123	Hohlleiter	UDR 58	Flann		300002046
124	Hohlleiter	UDR 58	Flann		300002045
125	Hohlleiter Adapter	06093-NF10	Flann	30, 31	300002140
126	Hohlleiter Adapter	08093-NF10	Flann	37, 38	300002172
127	Hohlleiter Adapter	10093-NF10	Flann	110, 115	300002174
128	Hohlleiter Adapter	11518A	HP Meßtechnik		300000776
129	Hohlleiter Adapter	11519A	HP Meßtechnik		300000777
130	Hohlleiter Adapter	11520A	HP Meßtechnik		300000778
131	Hohlleiter Adapter	17093-NF10	Flann	867.1406.869.868	300002006
132	Hohlleiter Adapter	18-140 GHz	Thomson CSF		300000801
133	Hohlleiter Adapter	4601 8.2-12.4 GHz	Narda		300000770
134	Hohlleiter Adapter	4609	Narda		300000789
135	Hohlleiter Adapter	601A	Narda		300000790
136	Hohlleiter Adapter	601B	Narda		300000788
137	Hohlleiter Adapter	609	Narda		300000762
138	Hohlleiter Adapter	HX292B	HP Meßtechnik		300000779
139	Hohlleiter Adapter	MP292B	HP Meßtechnik		300000516
140	Hohlleiter Adapter	MX292B	HP Meßtechnik		300000515
141	Hohlleiter Adapter	NP292A	HP Meßtechnik		300000518
142	Hohlleiter Adapter	NP292A	HP Meßtechnik		300000517
143	Hohlleiter Adapter + Mixer	11515A+11517A	HP Meßtechnik		300000514
144	Hohlleiter Adapter 23 GHz	20093-SF10	Flann	621	300001611
145	Hohlleiter Dämpf.+ Polarisationsfilter		Flann		300002050
146	Hohlleiter diverse		Flann		300002048
147	Hohlleiter Taper-transitions	verschiedene	Flann		300001615
148	Hohlleiter Winkel diverse		Flann		300002052
149	Horn Antenne 1-26.5GHz	3115	EMCO	8812-3089	300000307
150	IEEE Verteilschiene	VT 488	Meilhaus Electr.	*	300000931
151	Kasettengestell	"19"	R&S		300000793
152	Klimaschrank	VUK04/300	Heraeus Voetsch	32678	300000297
153	Koaxial Adapter	50645069	Narda		300000761
154	Koaxial Adapter	612A	Narda		300000771
155	Koaxial Adapter	614A	Narda		300000772
156	Leistungsmeßkopf	8481A	HP Meßtechnik	2702A65984	300001197
157	Leistungsmeßkopf	8481A	HP Meßtechnik	2702A56275	300000880
158	Leistungsmeßkopf	8481B	HP Meßtechnik	2702A05798	300001191
159	Leistungsmeßkopf	8482A	HP Meßtechnik	2652A16673	300001196

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	Equipment:	Type:	Manufacturer:	Ser No.:	Ident No.:
160	Leistungsmeßkopf	8482A	HP Meßtechnik	2642A16675	300001195
161	Leistungsmeßkopf	8483A	HP Meßtechnik	2405A03533	300000818
162	Leistungsmeßkopf	8484A	HP Meßtechnik	2645A30065	300001193
163	Leistungsmeßkopf	8484A	HP Meßtechnik	2645A30037	300001194
164	Leistungsmeßkopf	8484A	HP Meßtechnik	2237A10155	300000764
165	Leistungsmeßkopf	8485A	HP Meßtechnik	2238A00798	300000511
166	Leistungsmeßkopf	8485A	HP Meßtechnik	2238A00795	300001285
167	Leistungsmeßkopf	Q8486A	HP Meßtechnik	2503A00239	300000820
168	Leistungsmeßkopf	R8486A	HP Meßtechnik	2503A00340	300000819
169	Leistungsmeßkopf + Dämpfungsglied 30	8481A	HP Meßtechnik	2702A05796	300001192
170	Luminanz Meter	LS-110	Minolta	95221025	300000836
171	Meß Empfänger	ESVP	R&S	882401/010	300000856
172	Mess Transceiver	FD 1000	Schomandl	10004	300000506
173	Meßbrücke	ZRB2 75+50	R&S		300000293
174	Meßwandlerzange	MDS21	Schwarzbeck	881704	300000166
175	Meßwandlerzange	MDS21	Schwarzbeck	871522	300000164
176	Mixer bis 325 GHz	18 - 325 GHz	Tektronix		300000493
177	Mixer Satz 60-325 GHZ	WM780	Tektonics		300001685
178	Mixer Waveguide	18-26.5 GHz	Tektronix	B020630	300000298
179	Multimeter (Hand)	Multizet	Siemens		300000765
180	Multimeter (Hand)	UDL 33	R&S	890555/184	300000844
181	Multimeter (Hand)	Unigor 6E P	Goerz		300000508
182	Multimeter (Voltmeter)	URE	R&S	871910/010	300000503
183	Multimeter Dual Display	45	Fluke	4795229	300001532
184	Nachbarkanalleistungsmesser	NLM, KZ10	Schomandl		300000520
185	Network Analyzer	8510C	HP Meßtechnik	2728A03723	300000901
186	Netzgerät	2x30 VDC	Zentro	2009	300000500
187	Netzgerät	2X30V	Zentro	2008	300000501
188	Netzgerät	2X30V	Zentro	2010	300000505
189	Netzgerät	2X30V	Zentro	870008	300000830
190	Netzgerät	6032A	HP Meßtechnik	2920A04590	300001041
191	Netzgerät	M5P 40-15A	Systron		300000507
192	Netztgerät 0-20V	6632A	HP Meßtechnik		300000924
193	Netztgerät 0-50V	6633A	HP Meßtechnik		300001530
194	Noise Gain Analyzer	2075-2A	Eaton	0448-OS343	300000791
195	Oszilloskop	7603	Tektronix	703471	300000497
196	Oszilloskop	7633	Tektronix	703125	300000502
197	PC	PCD-5H	Siemens	wp266307	300002212
198	Plotter	7550A	HP I.V.	2848A04452	300002121
199	Plotter	7550A	HP I.V.	2725A95823	300001633
200	Plotter	7550AD	HP I.V.	2631A91602	300000910
201	Power Meter	438A	HP Meßtechnik	2649U00589	300001473
202	Power Meter	438A	HP Meßtechnik	2839I01315	300001186
203	Power Splitter	6dB 0.23W	FZA		300001795
204	Rack SAT-Intermod.	Spez.	HP Meßtechnik		300002014
205	Radiocom. Analyzer	CMTA 84	R&S	863086/012	300001796
206	Ramp Testset	T-11a – DME	Telonic		300000475
207	Rauschgenerator	7618E	Eaton	S-4114	300000792
208	Relais Matrix	2 x 4 ATSRM	R&S	316427-3	300000795
209	Rifu Coax Meßplatz		Insulated Wire		300002103
210	Rückleitungskabel	für HP85131F	HP Meßtechnik		300000923
211	S-Parameter Test Set	8515A	HP Meßtechnik	2723A01379	300002345
212	SAT Empfänger	spez.	Grundig	*	300002127

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	Equipment:	Type:	Manufacturer:	Ser No.:	Ident No.:
213	Schirmkabine	spez.	Frankonia	087400/04	300000939
214	Schraubensatz	spez.	Pro Nova	*	300002130
215	Screw Tuner	Flann 20160.17,6-26,7GHz	Pro Nova	90	300000927
216	Screw Tuner	Flann 22160,26,4- 40,1GHz	Pro Nova	149	300000911
217	Signal Generato Impuls	8112A	HP Meßtechnik	2522603955	300000816
218	Signal Generator	8341B	HP Meßtechnik	2819A02212	300002016
219	Signal Generator	8341B	HP Meßtechnik	2819A01911	300002111
220	Signal Generator	8642B	HP Meßtechnik	2529A00304	300000817
221	Signal Generator	SMDU	R&S	870766/366	300000109
222	Signal Generator	SMPD	R&S	882362/009	300000849
223	Signal Generator	SMS2	R&S	897112/90	300000794
224	Signal Generator (Funktions)	3314A	HP Meßtechnik	2141A03143	300000783
225	Signal Generator 0.01-26.5 GHz	8340B	HP Meßtechnik	2819A01275	300002015
226	Signal Generator 0.01-26.5 GHz	8340B	HP Meßtechnik	2730A00640	300000873
227	Signal Generator 0.05M-18.6 GHz	8673A	HP Meßtechnik	2228A00139	300000513
228	Signal Generator 0.05M-18.6 GHz	8673C	HP Meßtechnik	2708A00441	300000868
229	Spectrum Analyzer	2782	Tektronix	B020259	300001401
230	Spectrum Analyzer	8562A	HP Meßtechnik	2809A02682	300001164
231	Spectrum Analyzer	8565E	HP Meßtechnik	3738A00773	300001665
232	Static-Inverter	IA-700-1B	Avionic	205	300000481
233	Stativ	FR 3	EMCO	*	300002129
234	Std. Gain Horn Antenne	0624-10	Flann	36	300000228
235	Std. Gain Horn Antenne	0624-10	Flann	34	300001170
236	Std. Gain Horn Antenne	0624-10	Flann	29	300001188
237	Std. Gain Horn Antenne	0624-10	Flann	35	300000225
238	Std. Gain Horn Antenne	0824-10	Flann	45	300000230
239	Std. Gain Horn Antenne	0824-10	Flann	39	300002458
240	Std. Gain Horn Antenne	0824-10	Flann	46	300000234
241	Std. Gain Horn Antenne	0824-10	Flann	30	300002464
242	Std. Gain Horn Antenne	1024-15	Flann	52	300000238
243	Std. Gain Horn Antenne	1024-15	Flann	45	300002459
244	Std. Gain Horn Antenne	1024-15	Flann	41	300002465
245	Std. Gain Horn Antenne	1024-15	Flann	53	300002408
246	Std. Gain Horn Antenne	1224-15	Flann	32	300001941
247	Std. Gain Horn Antenne	1224-20	Flann	91	300002466
248	Std. Gain Horn Antenne	1224-20	Flann	98	300002460
249	Std. Gain Horn Antenne	1424-20	Flann	78	300002467
250	Std. Gain Horn Antenne	1424-20	Flann	111	300001948
251	Std. Gain Horn Antenne	1424-20	Flann	110	300001946
252	Std. Gain Horn Antenne	1424-20	Flann	96	300002461
253	Std. Gain Horn Antenne	1524-20	Flann	55	300002462
254	Std. Gain Horn Antenne	1524-20	Flann	49	300001951
255	Std. Gain Horn Antenne	1524-20	Flann	50	300002468
256	Std. Gain Horn Antenne	1724-20	Flann	95	300002469
257	Std. Gain Horn Antenne	1724-20	Flann	111	300002463
258	Std. Gain Horn Antenne	1824-20	Flann	226	300002470
259	Std. Gain Horn Antenne	1824-20	Flann	263	300002471
260	Std. Gain Horn Antenne	1924-20	Flann	42	300001967
261	Std. Gain Horn Antenne	1924-20	Flann	41	300001965
262	Std. Gain Horn Antenne	1924-20	Flann	32	300001958
263	Std. Gain Horn Antenne	2024-20	Flann	157	300001972
264	Std. Gain Horn Antenne	2224-20	Flann	235	300001976
265	Std. Gain Horn Antenne	2424-20	Flann	75	300001979

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	Equipment:	Type:	Manufacturer:	Ser No.:	Ident No.:
266	Std. Gain Horn Antenne	2424-20	Flann	76	300001981
267	Std. Gain Horn Antenne	2524-20	Flann	"	300001983
268	Std. Gain Horn Antenne	2524-20	Flann	"	300001986
269	Std. Gain Horn Antenne	2724-20	Flann	"	300001988
270	Std. Gain Horn Antenne	2724-20	Flann	"	300001991
271	Std. Gain Horn Antenne	2824-20	Flann	"	300001993
272	Std. Gain Horn Antenne	2824-20	Flann	"	300001995
273	Std. Gain Horn Antenne	2924-20	Flann	"	300001999
274	Std. Gain Horn Antenne	2924-20	Flann	"	300001997
275	Std. Gain Horn Antenne	3024-20	Flann	"	300002001
276	Std. Gain Horn Antenne	3024-20	Flann	"	300002000
277	Std. Gain Horn Antenne	3224-20	Flann	"	300002002
278	Std. Gain Horn Antenne	3224-20	Flann	"	300002003
279	Std. Gain Horn Antenne	637	Narda		300000510
280	Std. Gain Horn Antenne	638	Narda		300000486
281	Std. Gain Horn Antenne	638	Narda		300000487
282	Std. Gain Horn Antenne	638	Narda		300002440
283	Std. Gain Horn Antenne	638	Narda		300002442
284	Std. Gain Horn Antenne	639	Narda		300000786
285	Std. Gain Horn Antenne	639	Narda		300000787
286	Std. Gain Horn Antenne	640	Narda		300000785
287	Std. Gain Horn Antenne	640	Narda		300000784
288	Std. Gain Horn Antenne	642	Narda		300002445
289	Std. Gain Horn Antenne	642	Narda		300000767
290	Std. Gain Horn Antenne	643	Narda		300002447
291	Std. Gain Horn Antenne	643	Narda		300000768
292	Std. Gain Horn Antenne	644	Narda		300000769
293	Std. Gain Horn Antenne	644	Narda		300002449
294	Std. Gain Horn Antenne	ca 160 GHz	Flann		300002338
295	Std. Gain Horn Antenne	COR 27_40	Thomson CSF		300000797
296	Std. Gain Horn Antenne	COR 33_50	Thomson CSF		300000812
297	Std. Gain Horn Antenne	COR 50_75	Thomson CSF		300000813
298	Std. Gain Horn Antenne	COR 60_90	Thomson CSF		300000814
299	Std. Gain Horn Antenne	COR 75_110	Thomson CSF		300000798
300	Std. Gain Horn Antenne	COR 90_140	Thomson CSF		300000799
301	Std. Gain Horn Antenne	MC24/31B	MID-Century	1678/82	300000521
302	Std. Gain Horn Antenne	MC24/31B	MID-Century	1678/82	300002389
303	Steuerrechner	Vectra ES1/2	HP I.V.	2848F05118	300001071
304	Stub Tuner	904N	Narda		300000773
305	Switch / Control Unit	3488A	HP Meßtechnik		300000926
306	Switch / Control Unit	3488A	HP Meßtechnik		300000929
307	Switch / Control Unit	3488A	HP Meßtechnik		300001691
308	Tastkopf aktiv	P6201	Tektronix	B077335;B080178	300000824
309	Tastkopf passiv	P6063B	Tektronix		300000822
310	Tiefpassfilter	11870A	HP Meßtechnik	346	300000821
311	Transponder Test-Set	TEL T-23B-A	Telonic	266	300000477
312	Trenntrafo	MPL 91350	Erfi		300001606
313	Trenntrafo	MPL 91350	Erfi	13601-500	300002131
314	Trenntrafo	RT 5A	Grundig	12133	300000300
315	Trenntrafo	RT5A	Grundig	12780	300001166
316	Übergänge		Thomson CSF		300000804
317	Übergänge		Thomson CSF		300000802
318	Übergänge	60-110TRR	Telonic		300000815
319	Übergänge	TRR3375	Thomson CSF		300000803

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	Equipment:	Type:	Manufacturer:	Ser No.:	Ident No.:
320	Uni Ladestation	1530	FZA		300002128
321	Verstärker	11975A	HP Meßtechnik	2738A01298	300002405
322	Verstärker	11975A	HP Meßtechnik	2738A01262	300002406
323	Verstärker	11975A	HP Meßtechnik	2738A01625	300001669
324	Verstärker	8349B	HP Meßtechnik	2644A02323	300002112
325	Verstärker	8349B	HP Meßtechnik	2644A01483	300000921
326	Verstärker	8349B	HP Meßtechnik	2644A02362	300002137
327	Verstärker	8349B	HP Meßtechnik	2644A02560	300002135
328	Verstärker	8349B	HP Meßtechnik	2644A02397	300002133
329	Verstärker	8447A	HP Meßtechnik		300000878
330	Verstärker	8447A	HP Meßtechnik		300000875
331	Verstärker	8447D	HP Meßtechnik	2727A06107	300002110
332	Verstärker	8447F	HP Meßtechnik	2805A0332	300002011
333	Verstärker	ATS-2VS	R&S	299895204	300000796
334	Video Rausch-Generator	SUF2	R&S	879785/042	300000304
335	VSAT Antenne				300002070
336	Wave Source Modul	85100V	HP Meßtechnik	2735A00137	300002106
337	Wave Source Modul	85100W	HP Meßtechnik	2735A00147	300002107
338	Wave Source Modul (26.5-40 GHz)	83554A	HP Meßtechnik	2636A00383	300000914
339	Wave Source Modul (26.5-40 GHz)	83554A	HP Meßtechnik	2636A00596	300000912
340	Wave Source Modul (33-50 GHz)	83555A	HP Meßtechnik	2630A00204	300000918
341	Wave Source Modul (33-50 GHz)	83555A	HP Meßtechnik	2630A00271	300001695
342	Wave Source Modul (40-60 GHz)	83556A	HP Meßtechnik	2616A00215	300001693
343	Wave Source Modul (40-60 GHz)	83556A	HP Meßtechnik	2616A00280	300001694
344	Waveguide- Mixer	26.5-40 GHz	Tektronix	B021300	300002410
345	Workstation	9000/330C	HP I.V.	2801G06627	300002108

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Anlage 3 zum Prüfbericht Nr. 2-1686-A/99
Appendix 3 to test report no.: 2-1686-A/99

Meßschriebe und Plots
Test sheets, plots and graphs

Diese Anlage besteht aus 7 Seiten inklusive Deckblatt
This appendix consists of 7 pages included cover page

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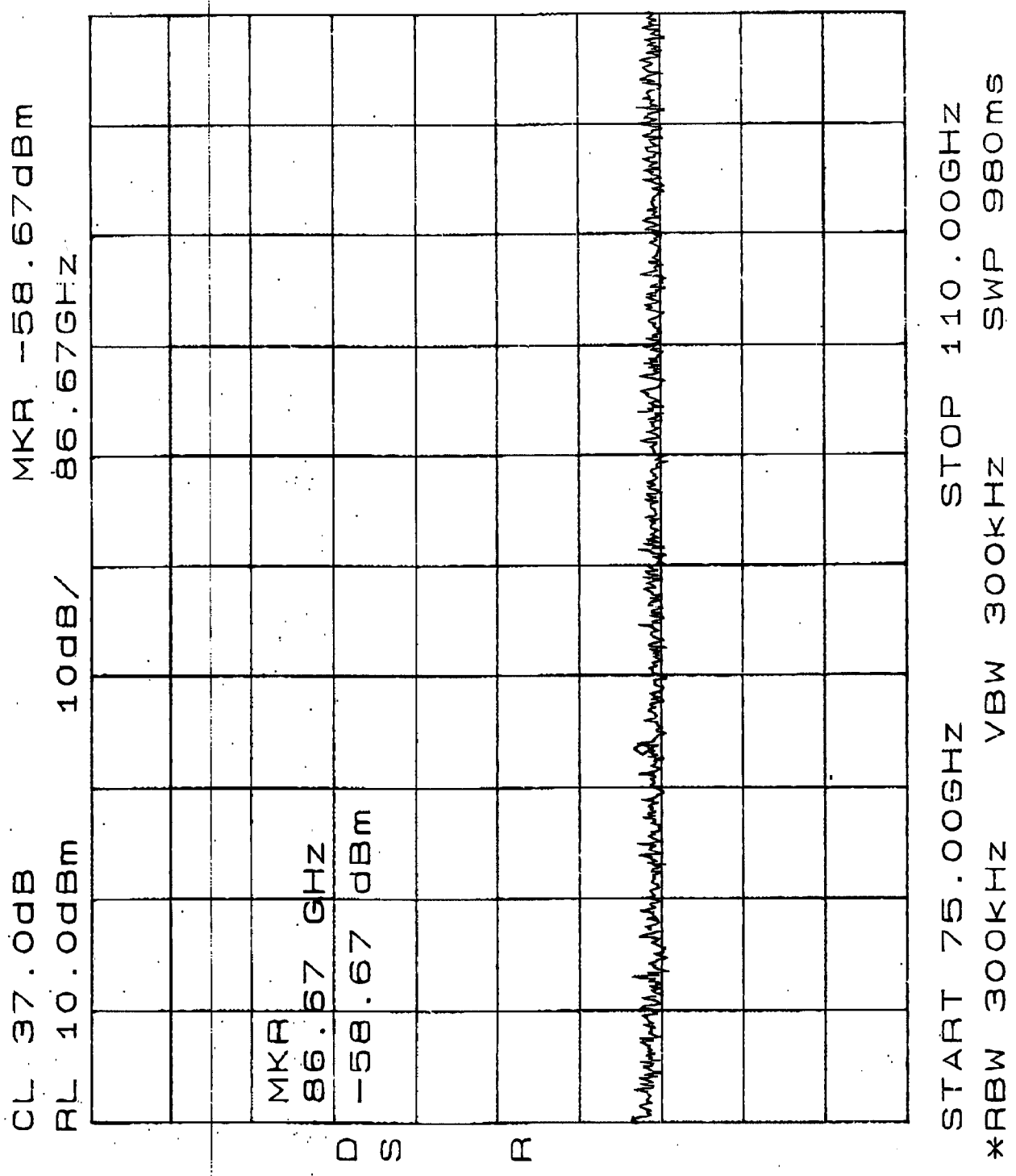
Prüfbericht Nr.: 2-1686-A/99 **Anlage 3**
Test report No.: 2-1686-A/99 Appendix 3

Plot No.: 1



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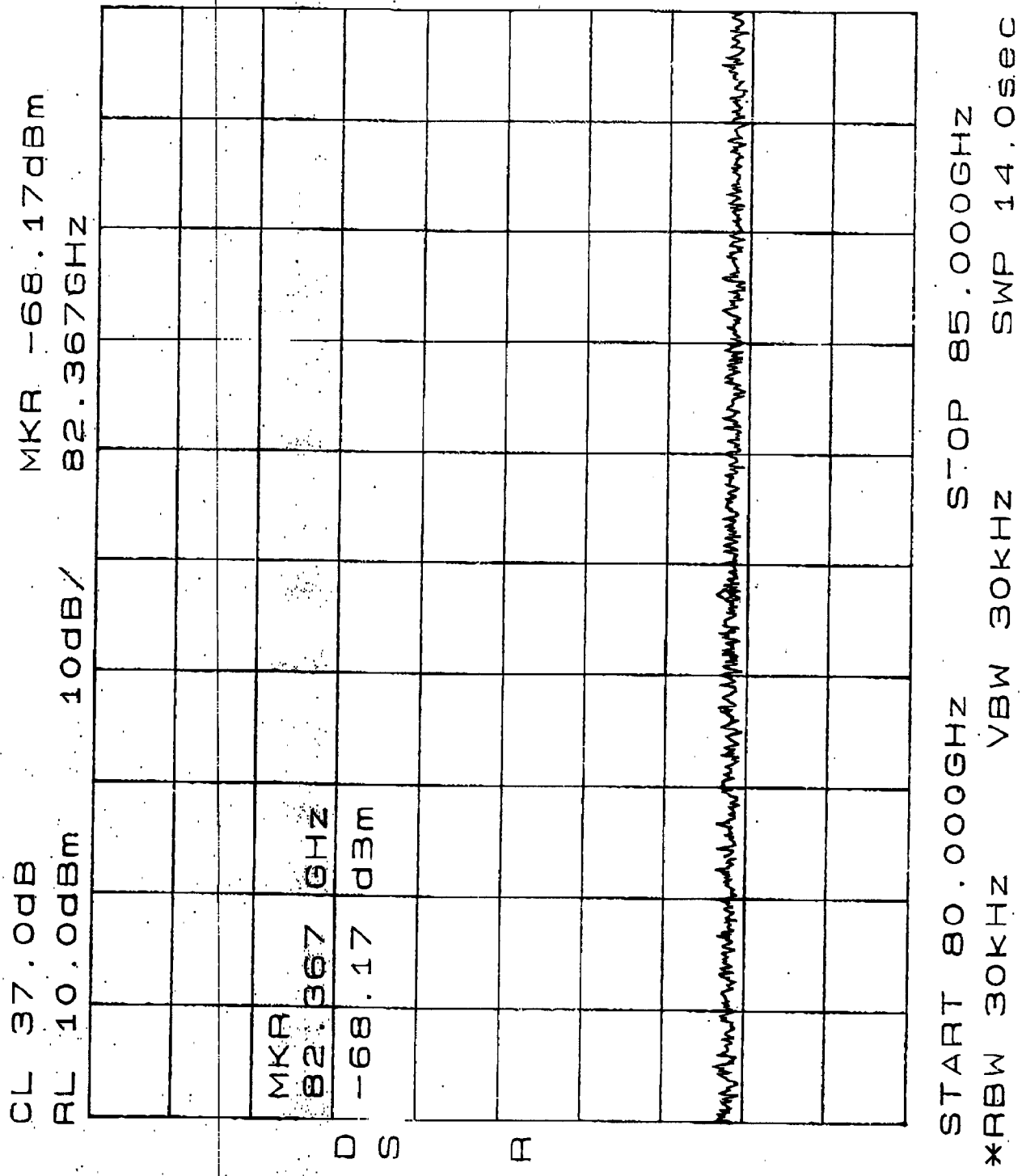
Plot No.: 2



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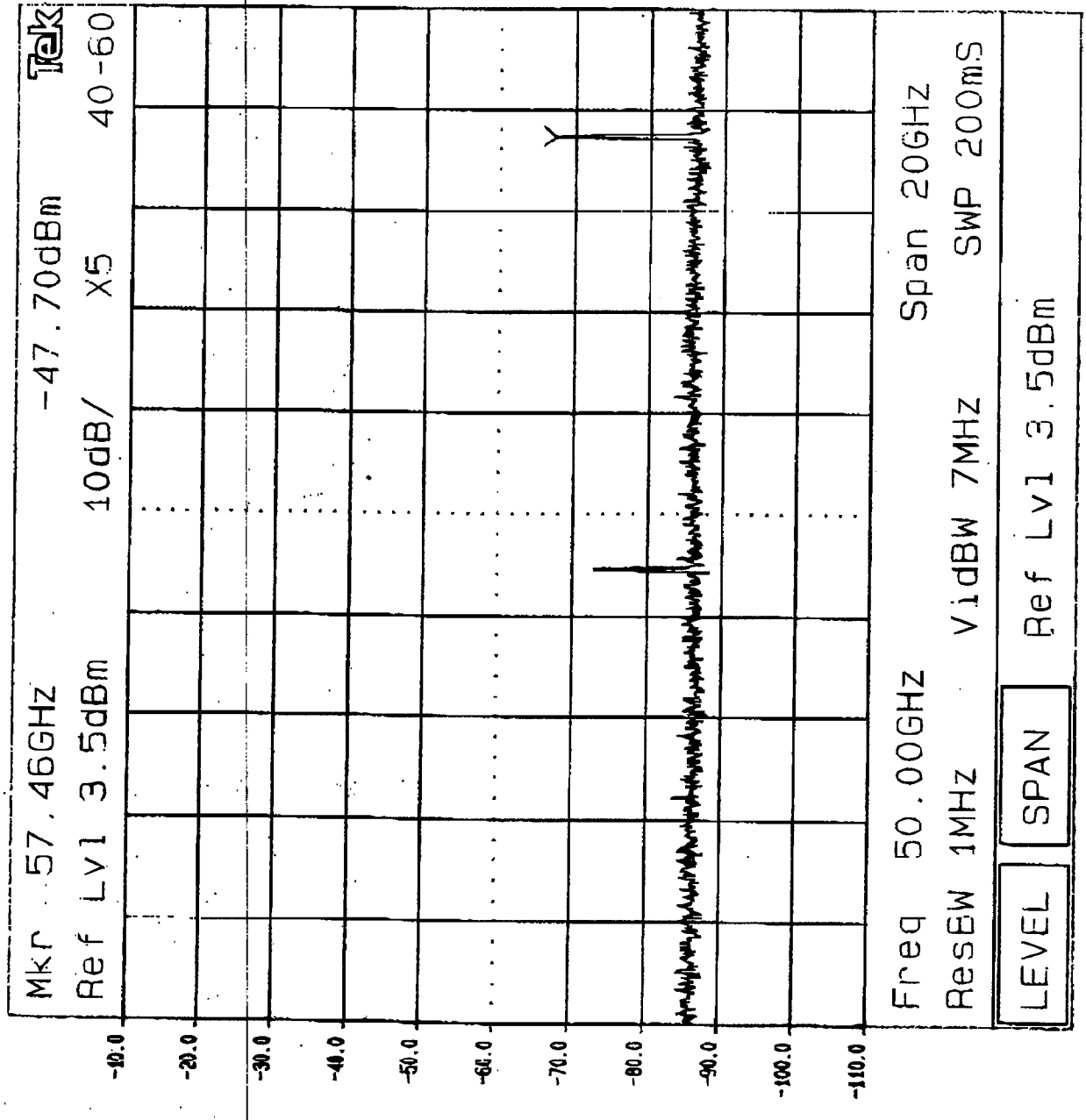
Test report No.: 2-1686-A/99 Appendix 3

Plot No.: 3



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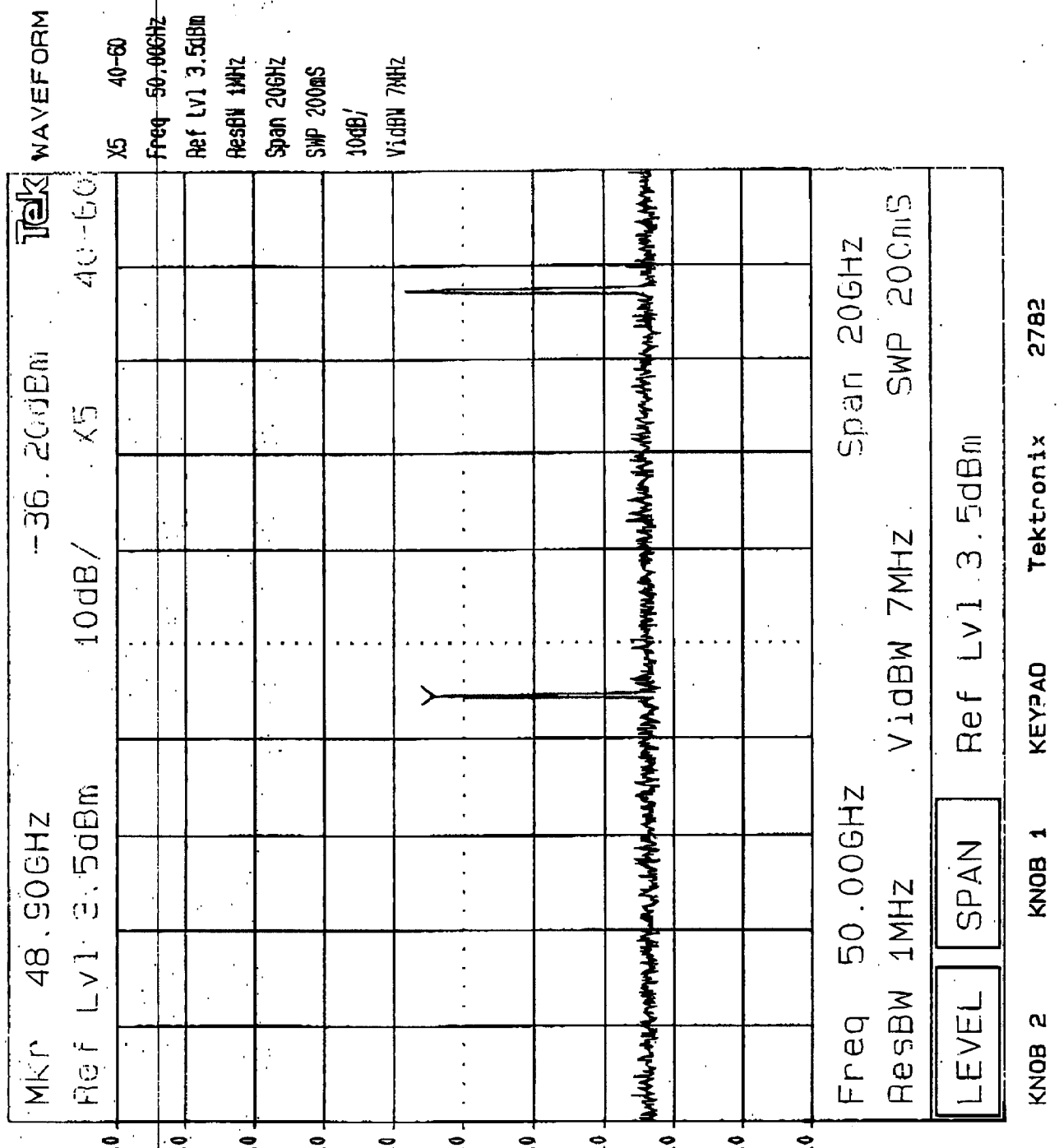
Test report No.: 2-1686-A/99 Appendix 3

Plot No.: 4



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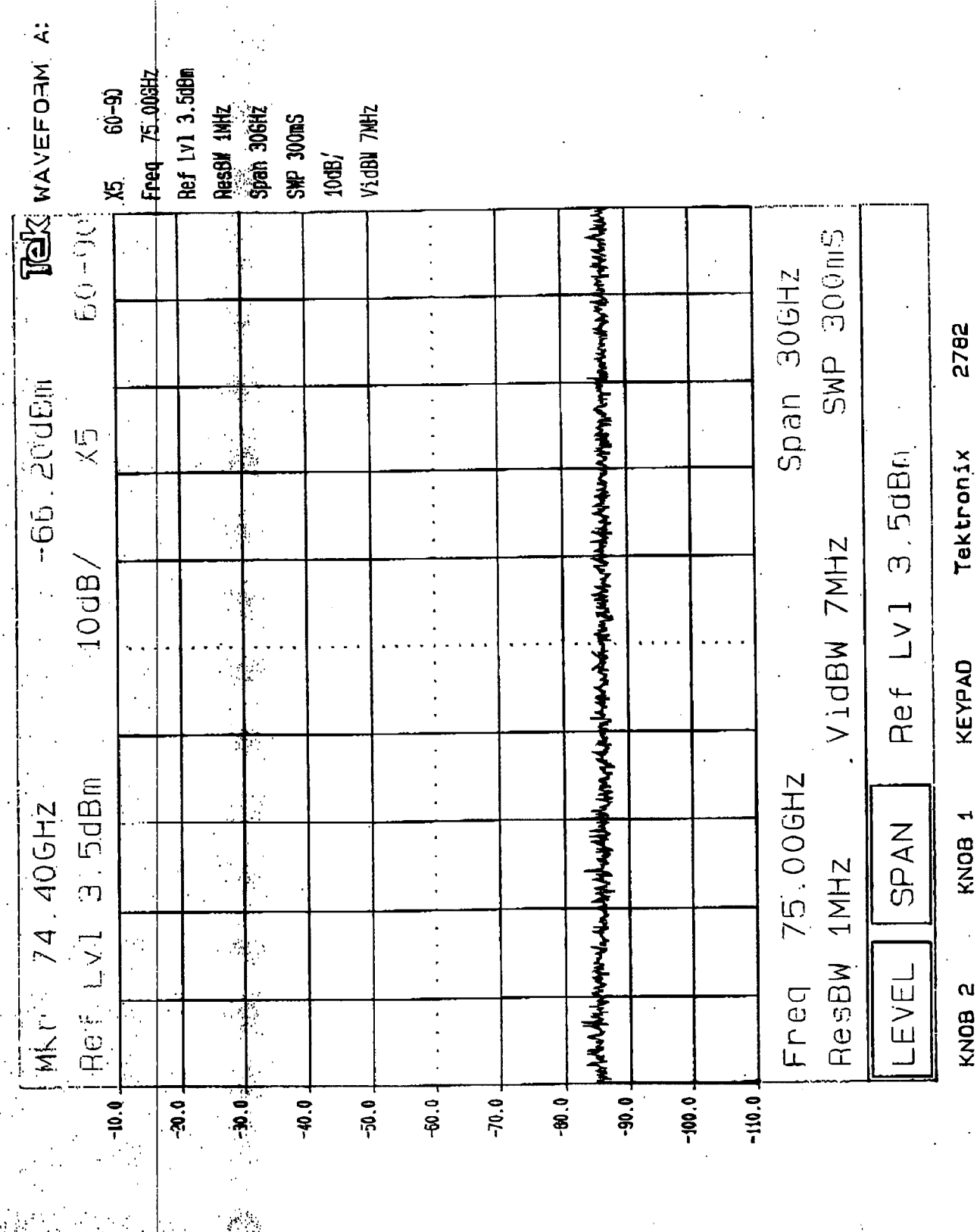
Test report No.: 2-1686-A/99 **Appendix 3**

Plot No.: 5



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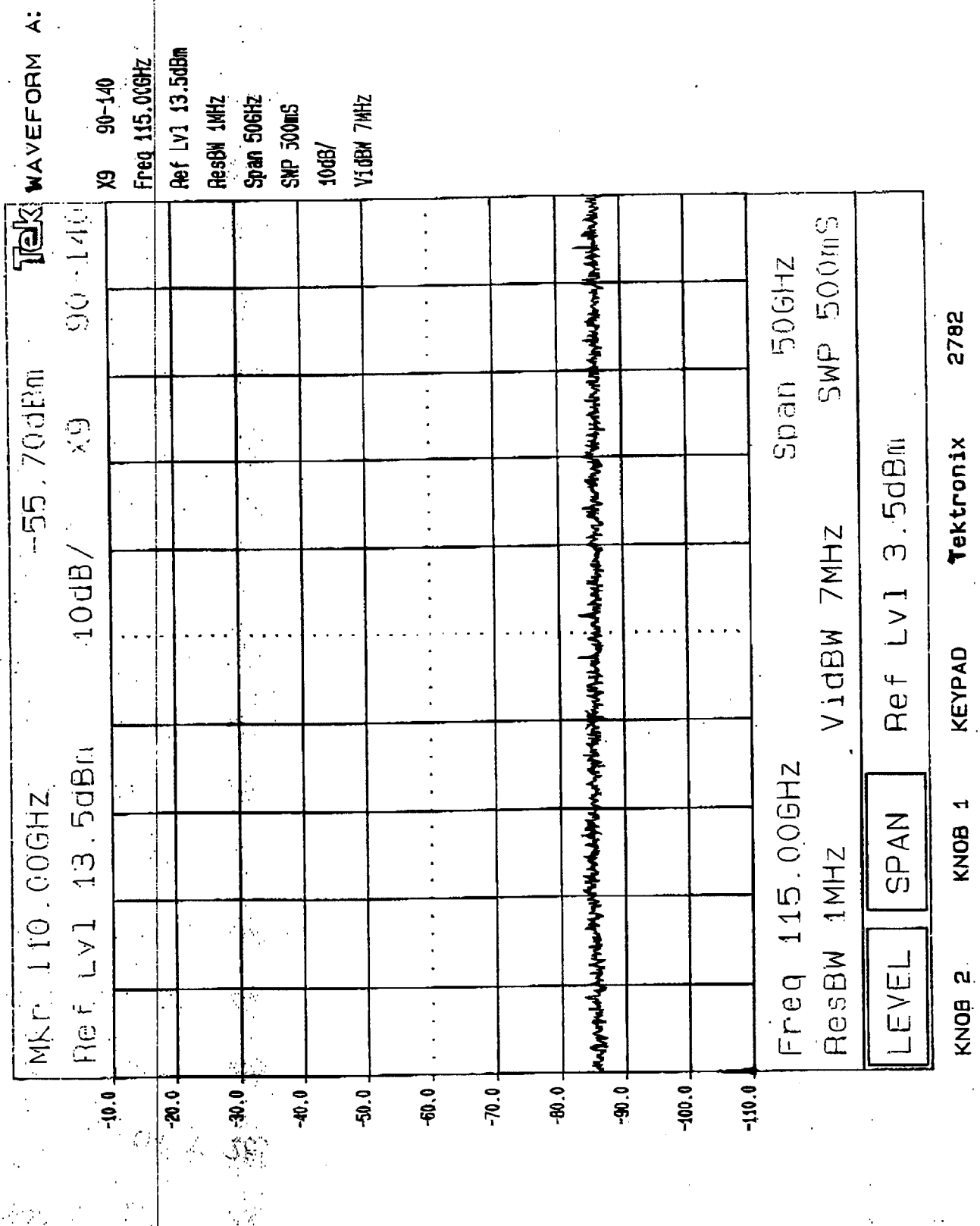
Test report No.:	2-1686-A/99	Appendix 3

Plot No.: 6



11. ENCLOSED – ANTENNA PERFORMANCE SPECIFICATION

Prepared (also subject responsible if other)		No.		
EMWJF		1301-UKY 210 69/SC15 Uen		
Approved	Checked	Date	Rev	Reference
SML/XC (Jonny Dahlberg)		1999-08-11	A	28GHz Comp HP mono

PRODUCT SPECIFICATION
COMPACT ANTENNA 28 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.

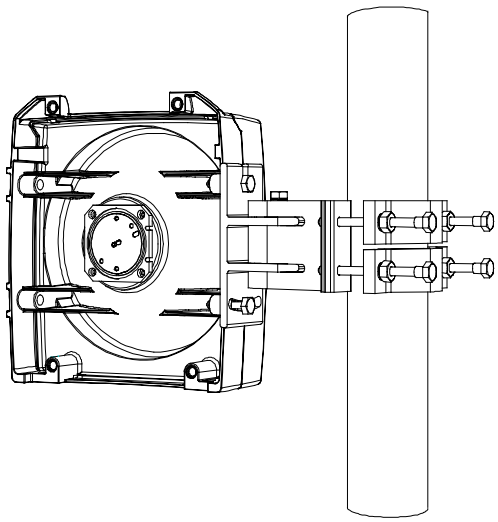


Figure 1.1 Compact antenna.

The antenna module UKY 210 69/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

27.35 - 29.50 GHz

2.2 GAIN

Lower band edge:	33.8 dBi
Mid band:	34.6 dBi
Higher band edge:	34.8 dBi
Gain tolerance:	±1.0 dB

2.3 HALF POWER BEAMWIDTH (HPBW)

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

Minimum:	2.9°
Maximum:	3.7°

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 RATION

Minimum:	55 dB

2.7 RADIATION PATTERN ENVELOPES (RPE)

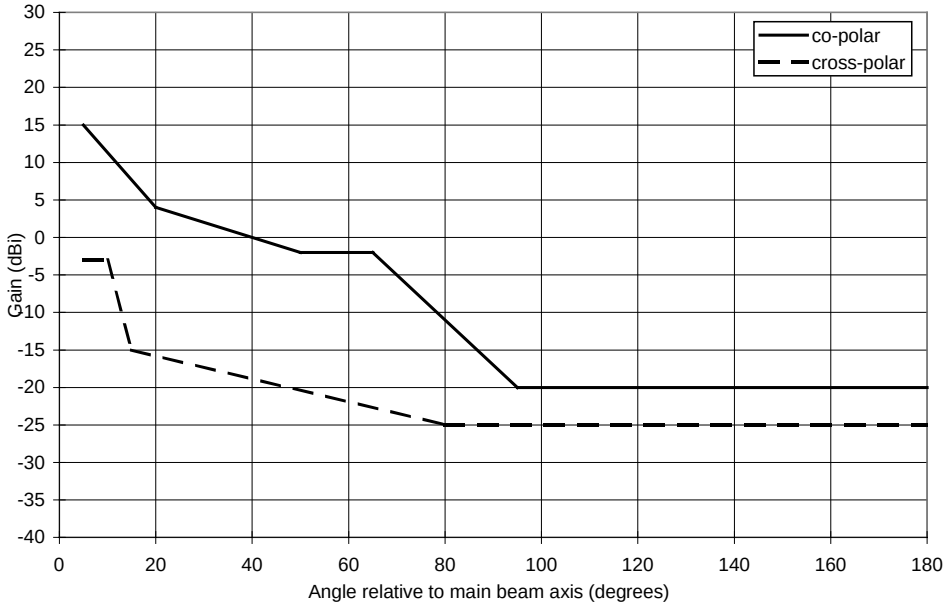


Figure 2.1 Guaranteed radiation pattern envelope (RPE), 28 GHz compact, high performance.

Table 2.1 Guaranteed radiation pattern envelope (RPE), 28 GHz compact, high performance.

Angle relative to main beam axis (degrees)	Guaranteed RPE co-polar (dBi)	Guaranteed RPE cross-polar (dBi)
5	15	-3
10		-3
15		-15
20	4	
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.

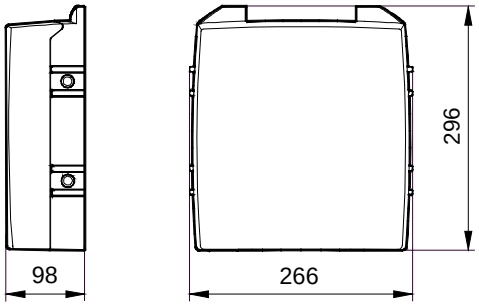


Figure 3.1 Principle layout of the antenna.

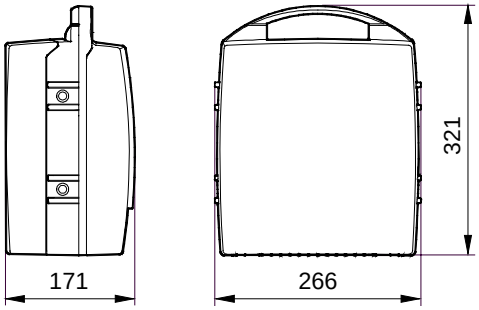


Figure 3.2 Principle layout of the antenna, fitted directly to the radio module.

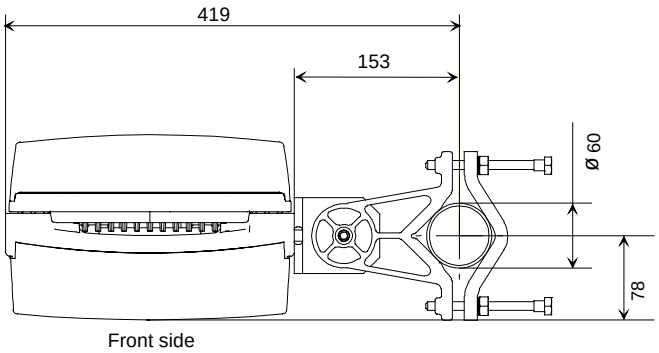


Figure 3.3 Principle layout of the antenna and the dimensions when it is fixed to a Ø60 mm tube (top view).

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 28 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

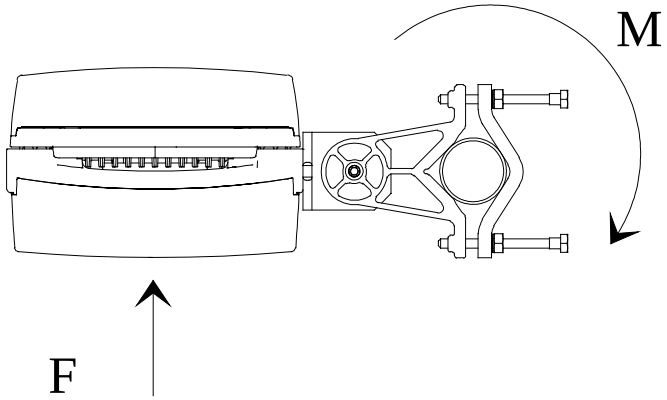


Figure 4.1 Wind load and torque.

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.

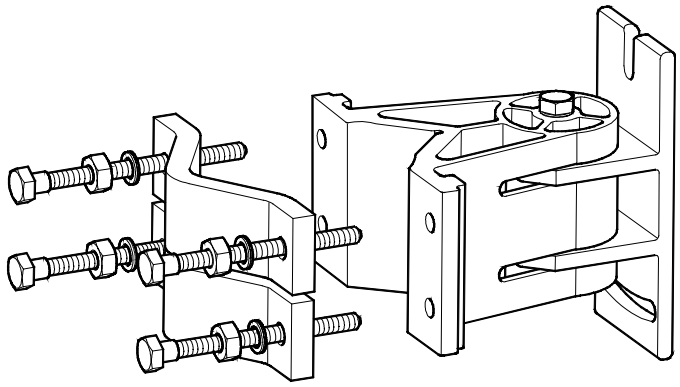


Figure 5.1 Mounting kit.

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 7.

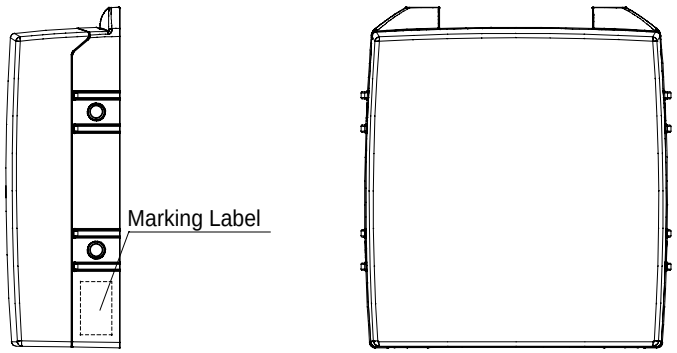


Figure 6.1 Marking label.

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 69/SC15	Antenna module (compact, single polarized, high performance, gray)

Consist of:

3/UKY 210 69/SC15	Antenna
SXK 111 582/1	Mounting kit

9 DOCUMENT REVISION RECORDS

A First issue

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

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EMWPRHO		1/102 67-UKY 210 85+ Uen		
Approved	Checked	Date	Rev	Reference
SL/AC (Stefan Johansson)		1999-10-19	A	

VERIFICATION REPORT MINI-LINK BAS NODE ANTENNA 28 GHz PRESERIES (ELECTRICAL DESIGN)

Abstract

This verification report contains the results from the measurements of the MINI-LINK BAS Node Antenna preseries 28 GHz, UKY 210 85 and UKY 210 86 (vertical and horizontal polarization, respectively), to verify the electrical design.

Contents

1 INTRODUCTION

The measurements were carried out at the far-field range A-6 of the antenna department (UA), the RPE measurements and the gain measurements in 1999-09-24. 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 1999-09-28.

16 preseries antennas of horizontal polarization have been manufactured, numbered 1-13 and screen 1-3. 13 preseries antennas of vertical polarization have been manufactured, numbered 1-11, disp 2 and screen 2. All requirements mentioned in this report are guaranteed requirements according to [1]. The measurements were carried out in accordance with the verification specification [2].

2 MEASUREMENTS

2.1 FREQUENCY BAND

The antenna is designed for the frequency band 26.5-29.25 GHz.

2.2 GAIN

The gain is presented in Figure 1 and Figure 2.

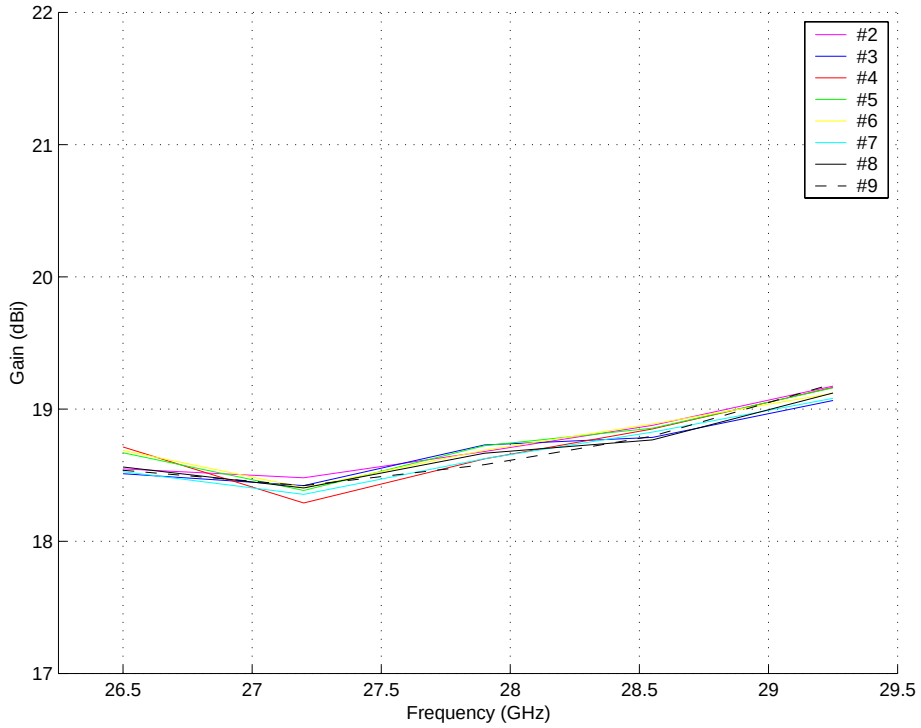

Figure 1 Gain measurements for some horizontally polarized antennas

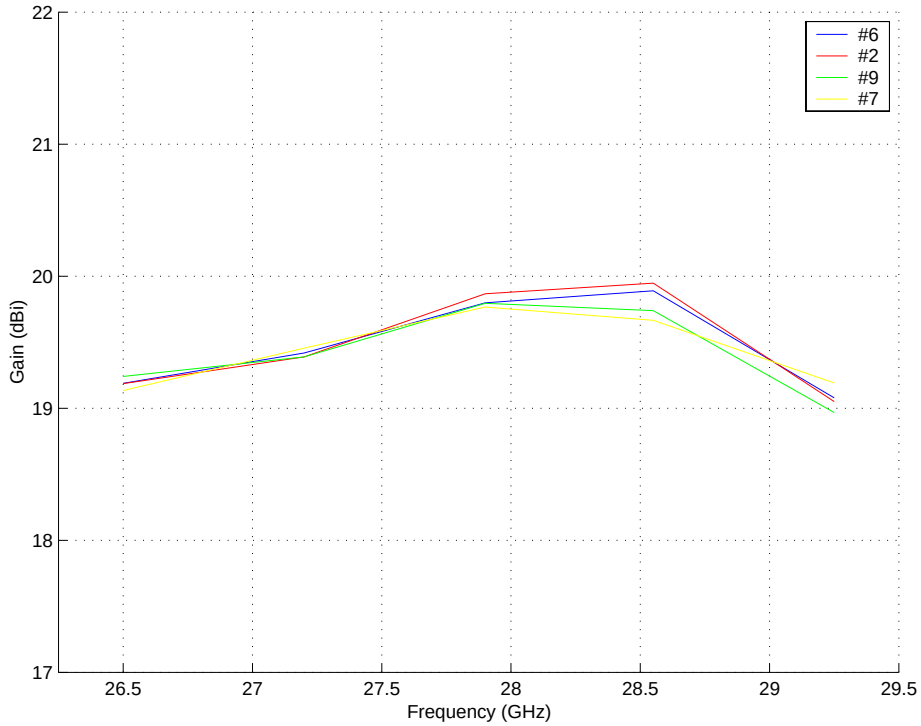

Figure 2 Gain measurements for some vertically polarized antennas**.**

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.

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

	Horizontal polarization.				
Freq. [GHz]	**Antenna 7 [°]**	**Antenna 8 [°]**	**Antenna 9 [°]**	**Antenna 10 [°]**	**Specified HPBW [°]**
26.5	6.4	6.4	6.3	6.3	6.2±1
27.9	5.8	5.9	5.9	5.8	6.2±1
29.25	5.6	5.8	5.9	5.7	6.2 ±1
	Vertical polarization				
Freq. [GHz]	**Antenna 6 [°]**	**Antenna 8 [°]**	**Antenna 9 [°]**	**Antenna 10 [°]**	**Specified HPBW [°]**
26.5	6.4	6.4	6.3	6.4	6.2±1
27.9	6.1	6.2	6.1	6.2	6.2±1
29.25	6.1	6.0	5.9	6.1	6.2±1

2.4 RETURN LOSS

The reflection (S_{11}) was measured for the frequency band 26-30 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 26.5-29.25 GHz is presented in Table 2-2 and Table 2.3. The antennas that would have been sorted out in the production test [4] (see section 4) are presented in Figure 5 and Figure 6.

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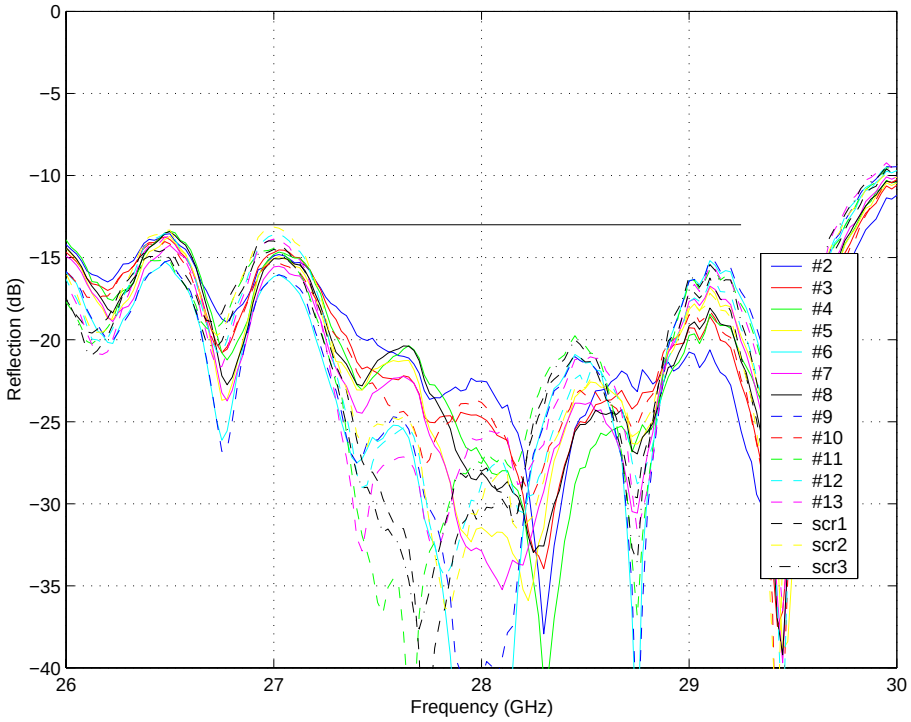

Figure 3 Measured reflection (S_{11}) for some horizontally polarized antennas.

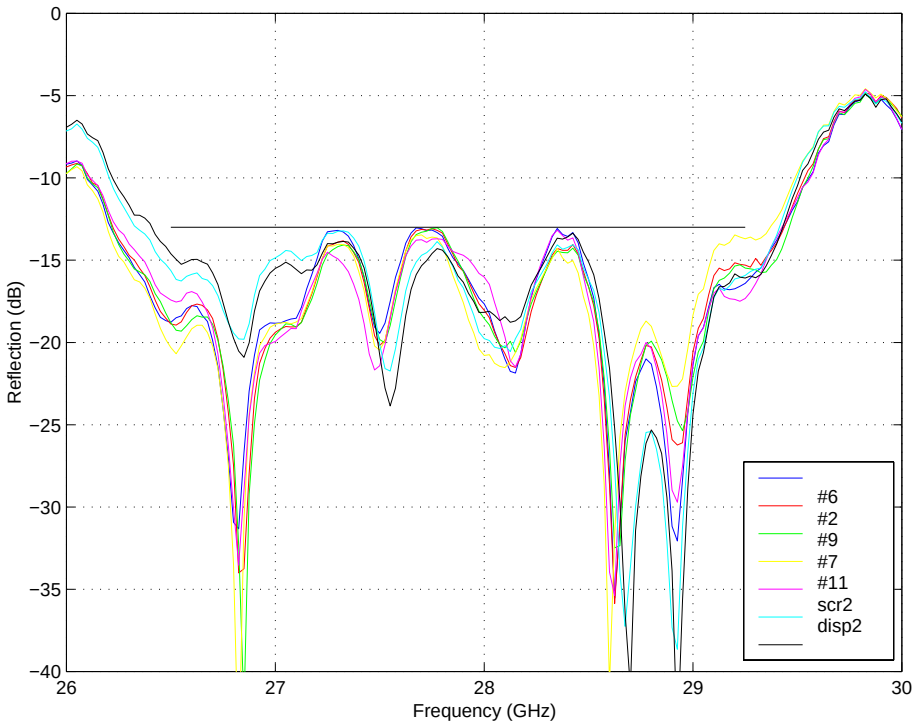

Figure 4 Measured reflection (S_{11}) for some vertically polarized antennas.

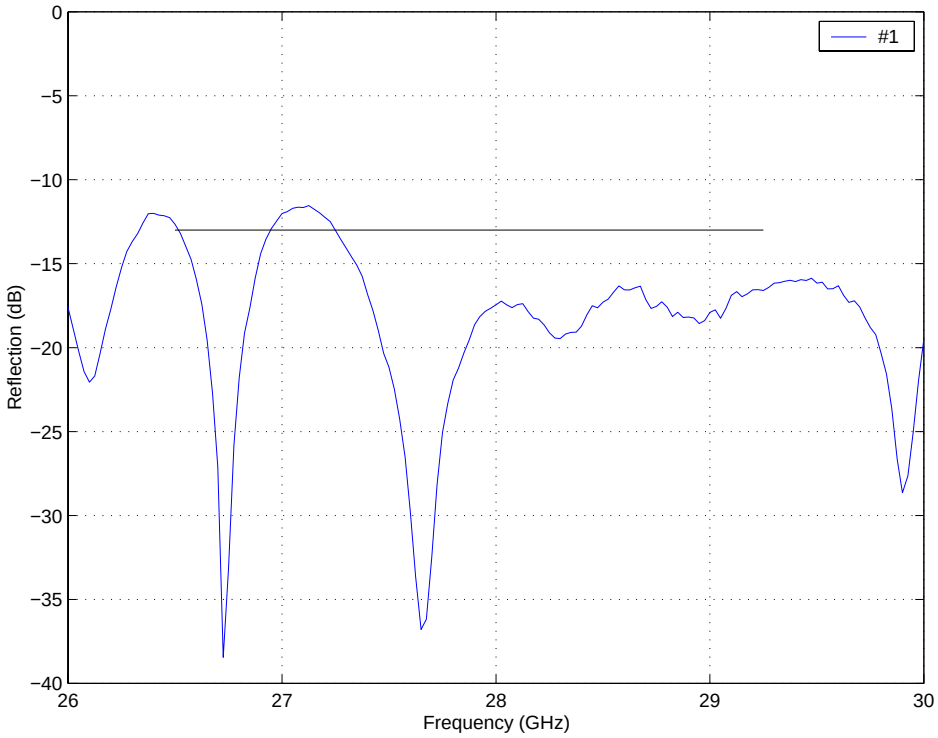

Figure 5 Measured reflection (S_{11}) for one horizontally polarized antenna that would have been sorted out in the production test.

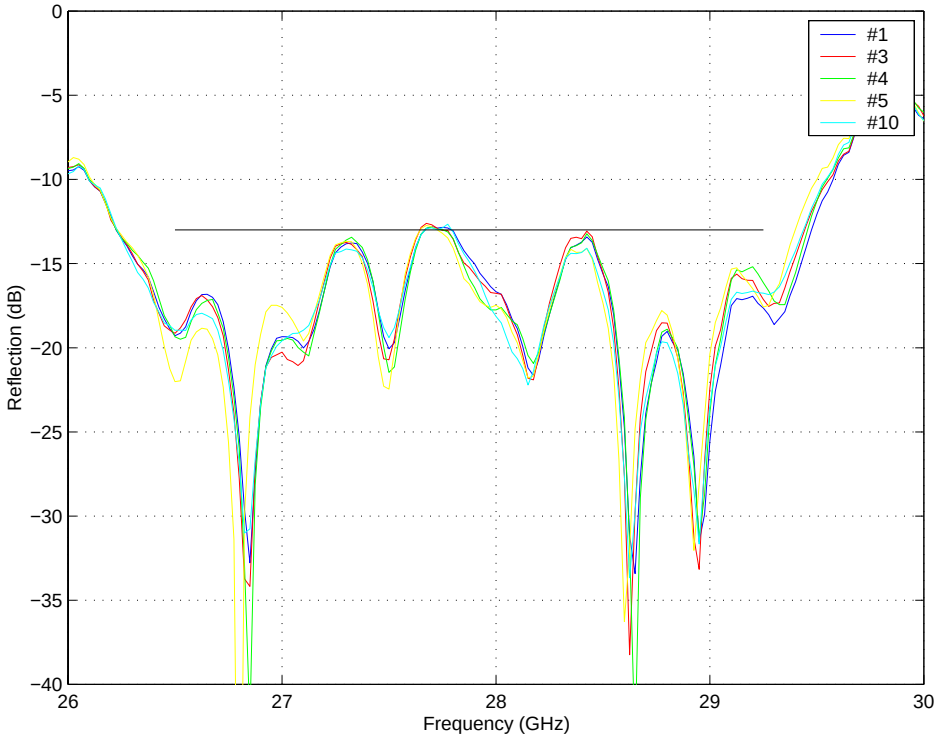

Figure 6 Measured reflection (S_{11}) for some vertically polarized antennas that would have been sorted out in the production test.

Table 2-2 Measured and specified minimum return loss (|S11,dB|) within the specified frequency band 26.5-29.25 GHz for the horizontally polarized antennas that meet the specification.

	Antenna 2	**Antenna 3**	**Antenna 4**	**Antenna 5**	**Specified RL**
Return Loss [dB]	13.5	13.9	13.4	13.7	>13.0
	Antenna 6	**Antenna 7**	**Antenna 8**	**Antenna 9**	
Return Loss [dB]	15.2	14.2	13.4	15.1	>13.0
	Antenna 10	**Antenna 11**	**Antenna 12**	**Antenna 13**	
Return Loss [dB]	14.0	14.4	13.5	13.8	>13.0
	Antenna screen1	**Antenna screen2**	**Antenna screen3**		
Return Loss [dB]	14.0	13.1	14.5		>13.0

Table 2.3 Measured and specified minimum return loss (|S11,dB|) within the specified frequency band 26.5-29.25 GHz for the vertically polarized antennas that meet the specification.

	Antenna 2	**Antenna 6**	**Antenna 7**	**Antenna 9**	**Specified RL**
Return Loss [dB]	13.5	13.1	13.5	13.0	>13.0
	Antenna 11	**Antenna disp2**	**Antenna screen2**		
Return Loss [dB]	13.2	13.4	13.2		>13.0

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 7-Figure 22.

2.5.1 Horizontal polarization

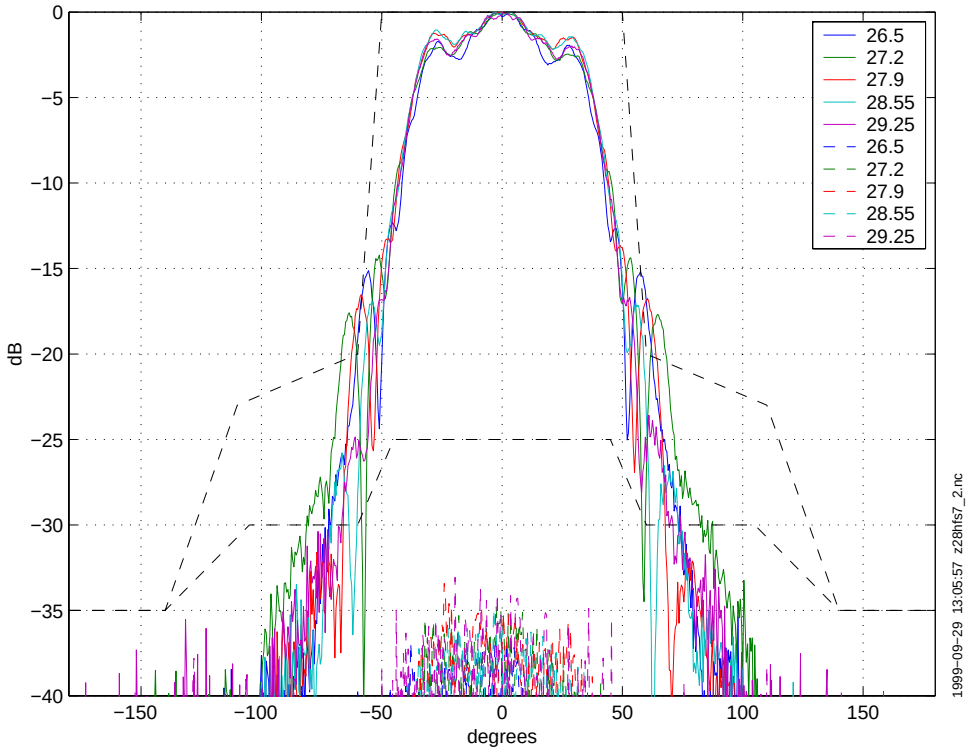

Figure 7 Co- and cross-polar radiation patters in azimuth for antenna 7.

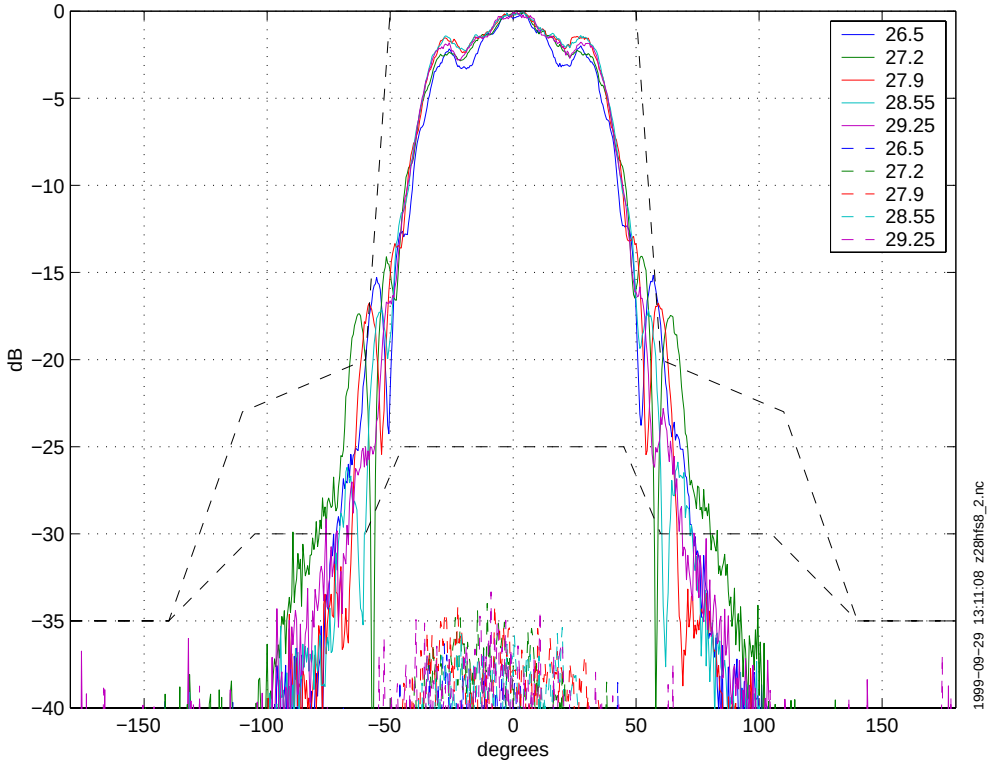

Figure 8 Co- and cross-polar radiation patters in azimuth for antenna 8.

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EMWPRHO		1/102 67-UKY 210 85+ Uen		
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SL/AC (Stefan Johansson)		1999-10-19	A	

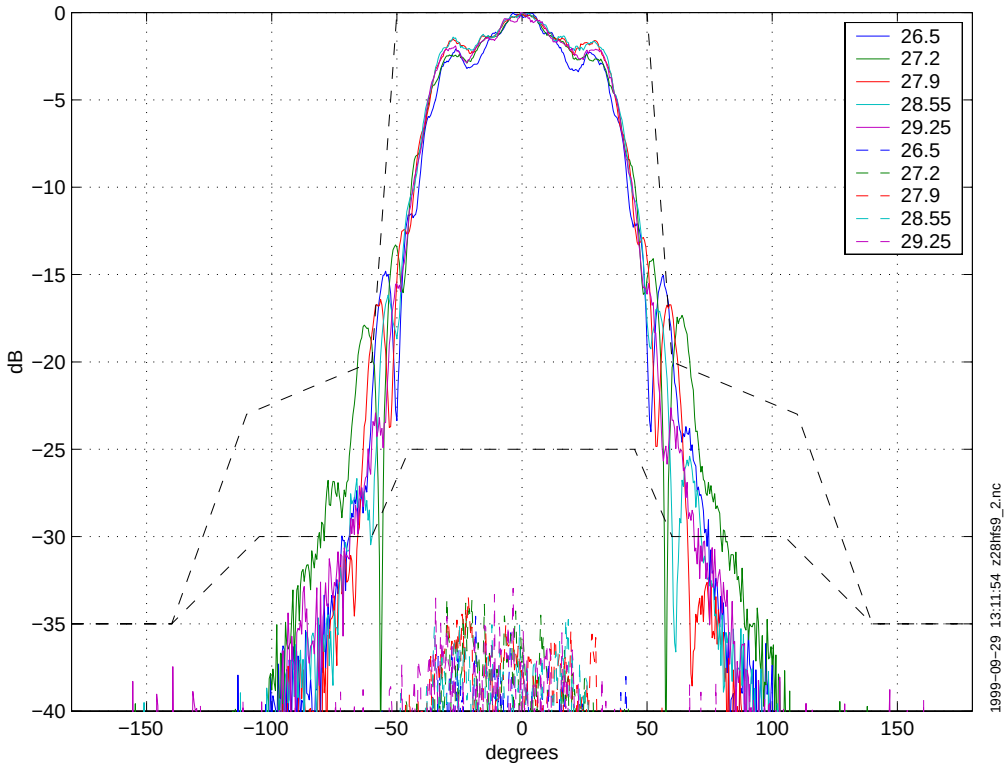

Figure 9 Co- and cross-polar radiation patters in azimuth for antenna 9.

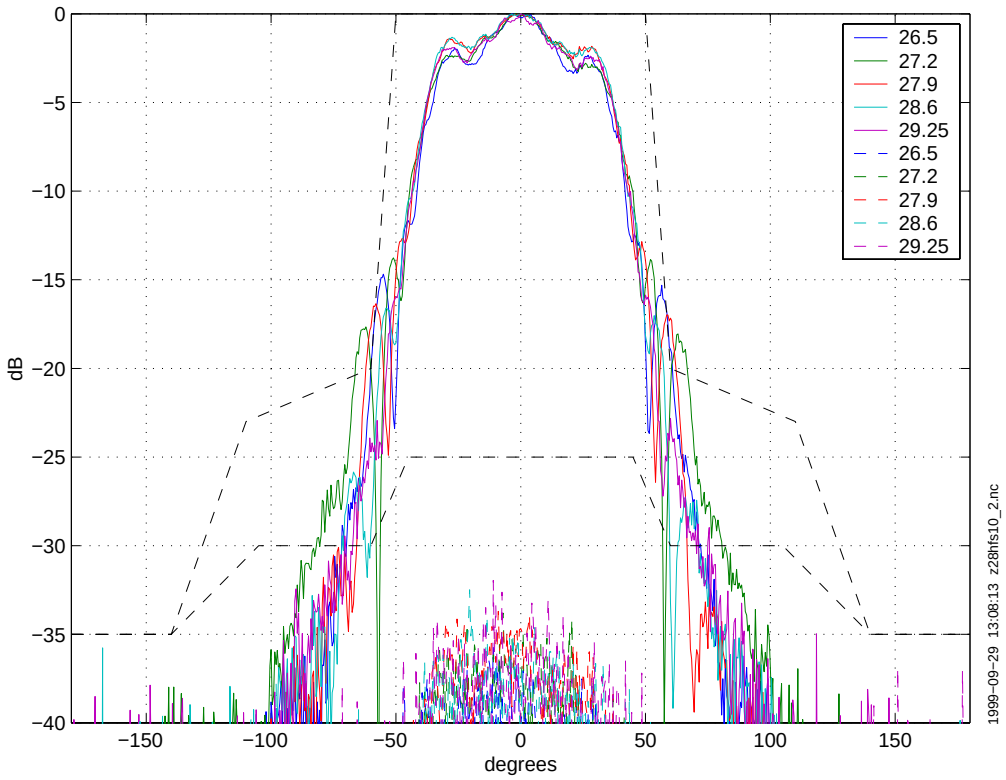

Figure 10 Co- and cross-polar radiation patters in azimuth for antenna 10.

Prepared (also subject responsible if other)		No.		
EMWPRHO		1/102 67-UKY 210 85+ Uen		
Approved	Checked	Date	Rev	Reference
SL/AC (Stefan Johansson)		1999-10-19	A	

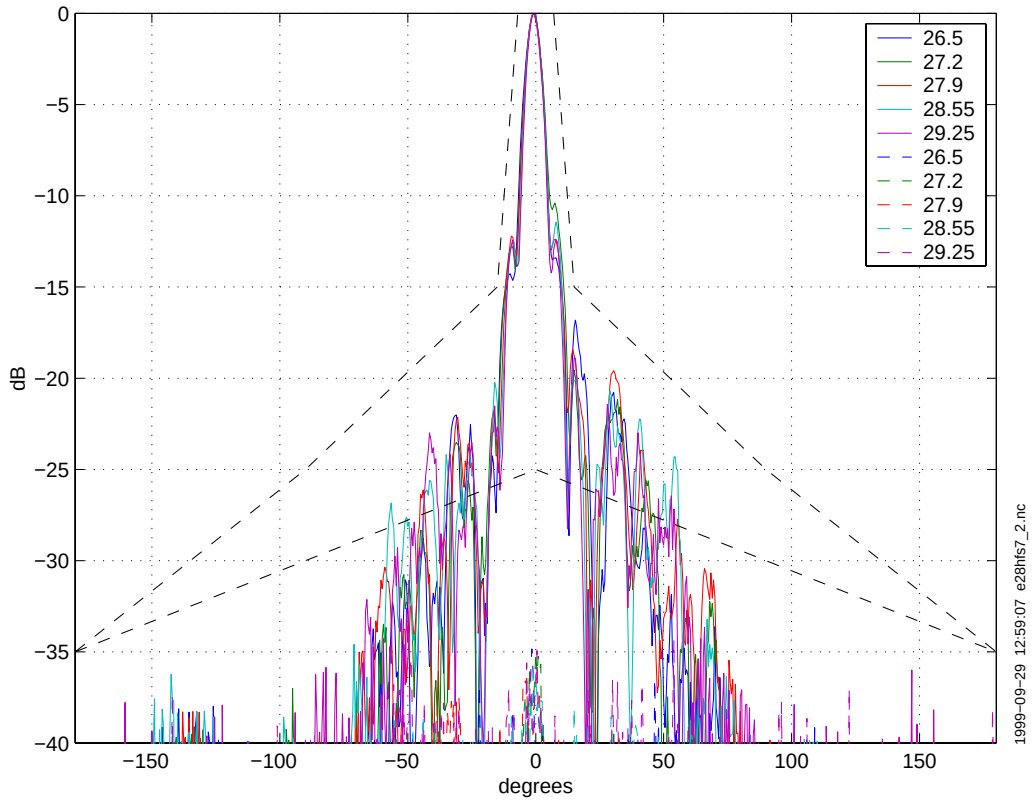

Figure 11 Co- and cross-polar radiation patters in elevation for antenna 7.

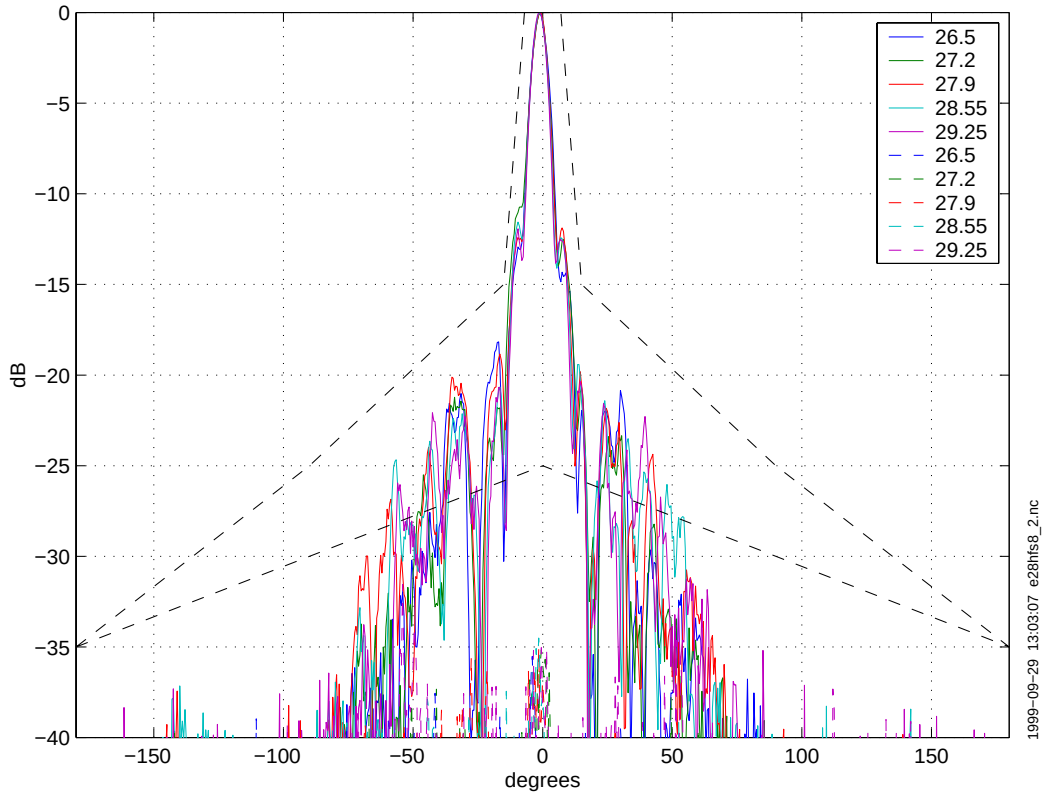

Figure 12 Co- and cross-polar radiation patters in elevation for antenna 8.

Prepared (also subject responsible if other)		No.		
EMWPRHO		1/102 67-UKY 210 85+ Uen		
Approved	Checked	Date	Rev	Reference
SL/AC (Stefan Johansson)		1999-10-19	A	

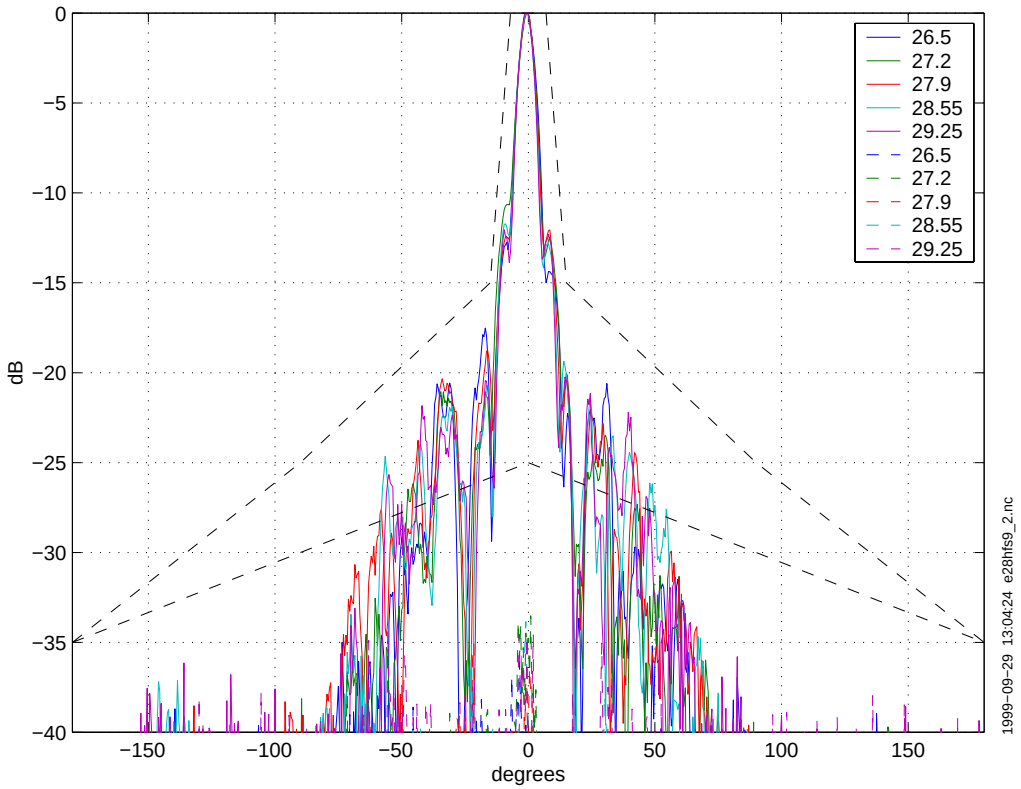

Figure 13 Co- and cross-polar radiation patters in elevation for antenna 9.

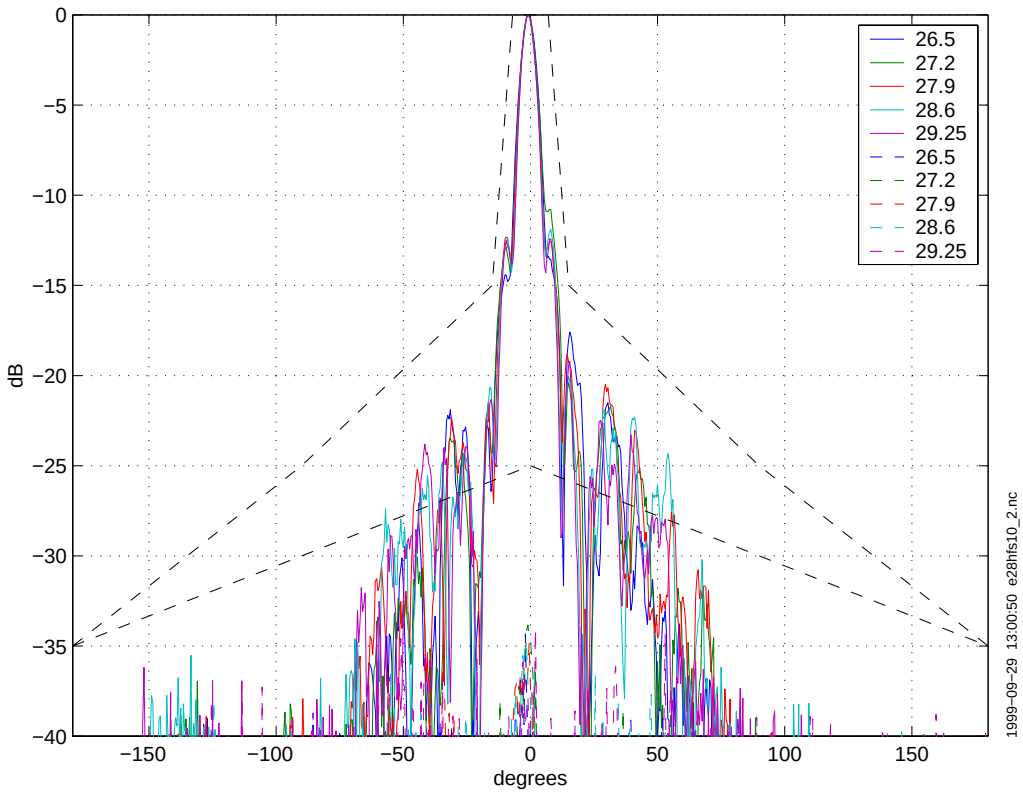

Figure 14 Co- and cross-polar radiation patters in elevation for antenna 10.

2.5.2 Vertical polarization

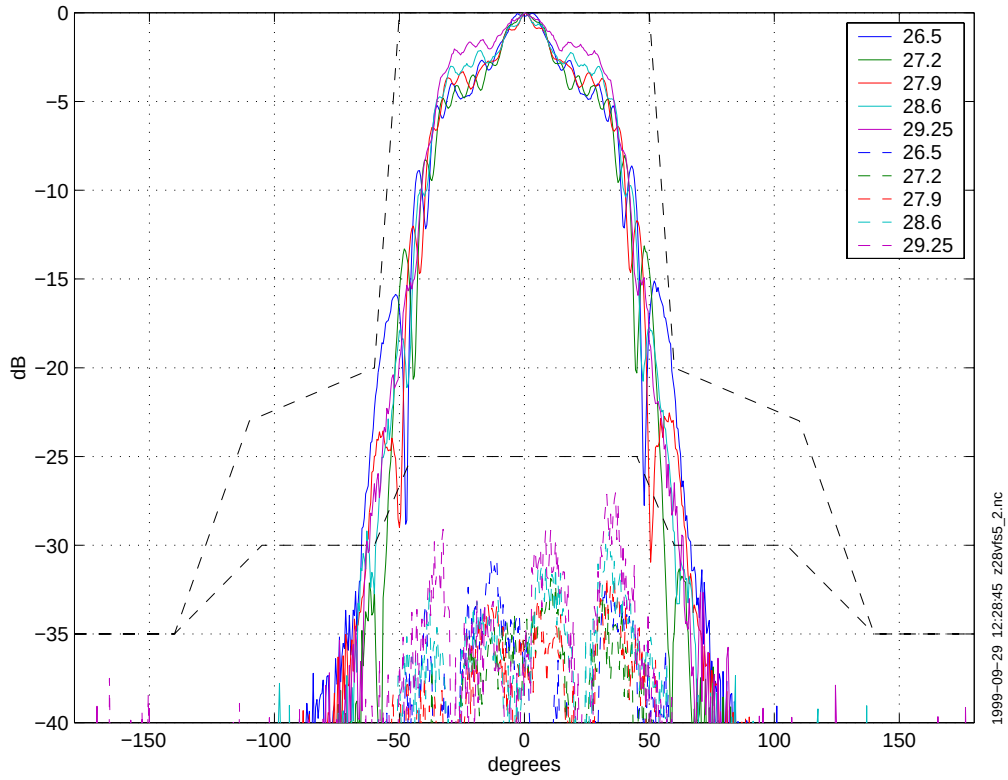

Figure 15 Co- and cross-polar radiation patters in azimuth for antenna 5.

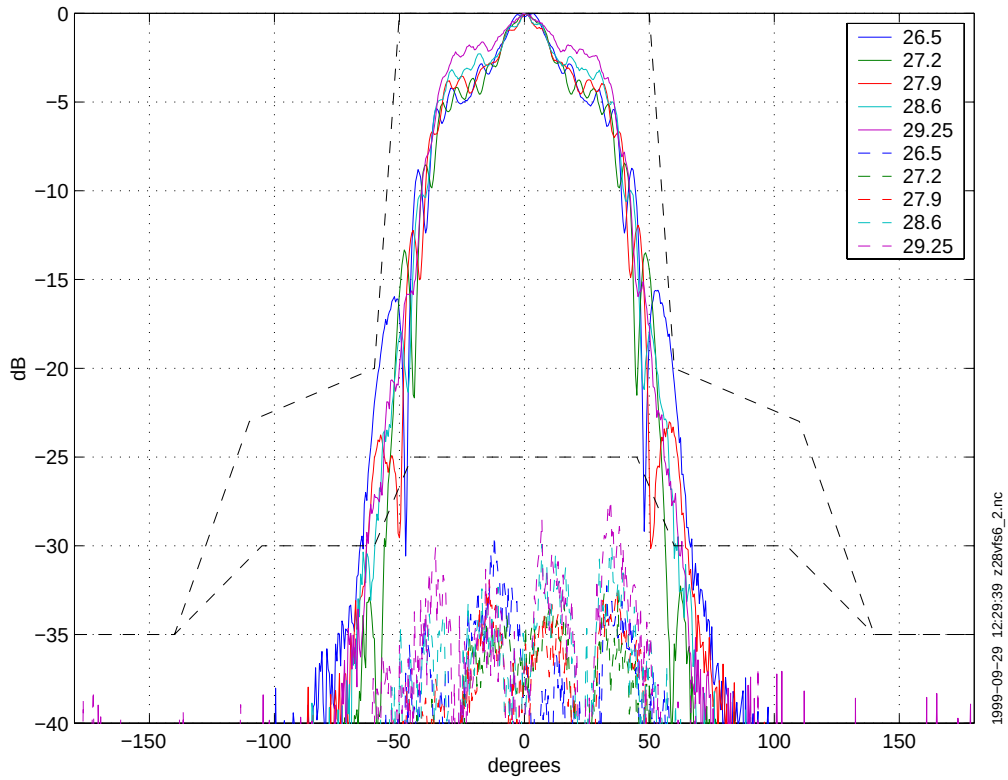

Figure 16 Co- and cross-polar radiation patters in azimuth for antenna 6.

Prepared (also subject responsible if other)		No.		
EMWPRHO		1/102 67-UKY 210 85+ Uen		
Approved	Checked	Date	Rev	Reference
SL/AC (Stefan Johansson)		1999-10-19	A	

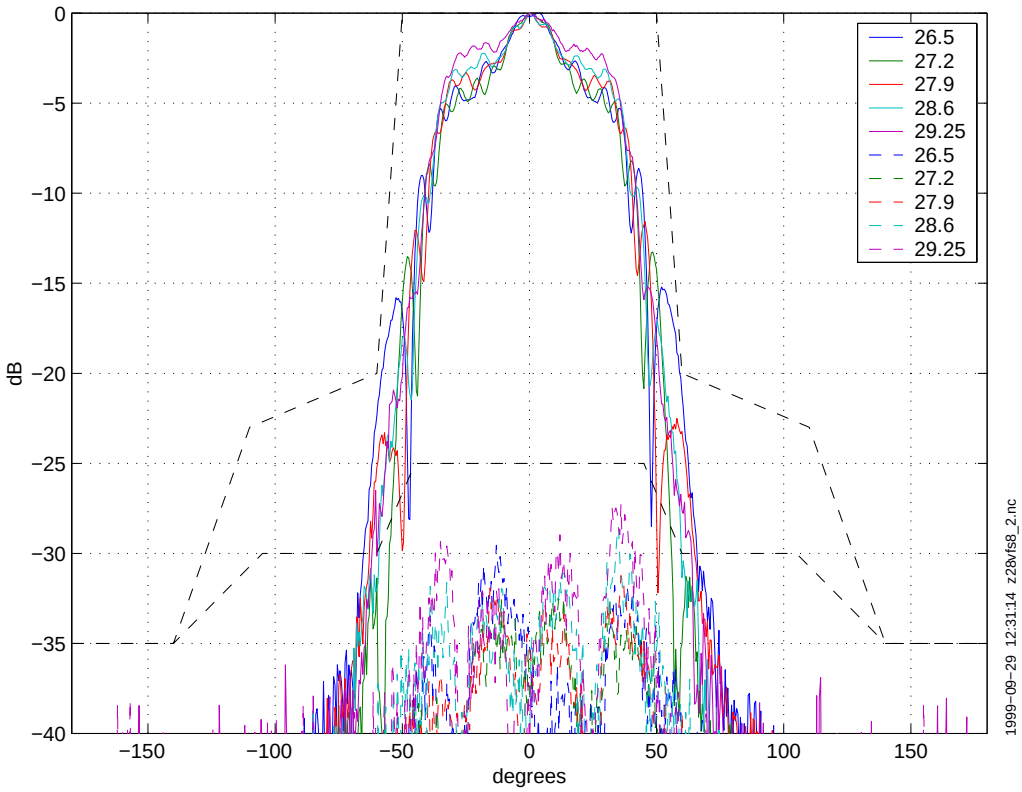

Figure 17 Co- and cross-polar radiation patters in azimuth for antenna 8.

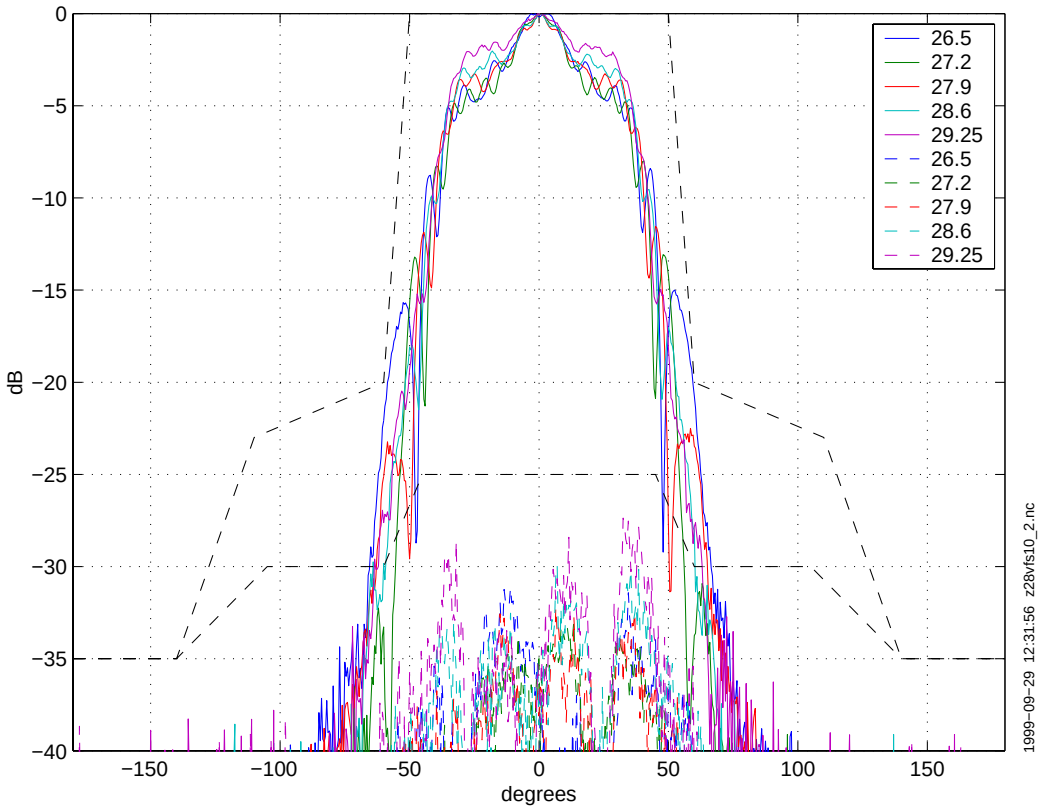

Figure 18 Co- and cross-polar radiation patters in azimuth for antenna 10.

Prepared (also subject responsible if other)		No.		
EMWPRHO		1/102 67-UKY 210 85+ Uen		
Approved	Checked	Date	Rev	Reference
SL/AC (Stefan Johansson)		1999-10-19	A	

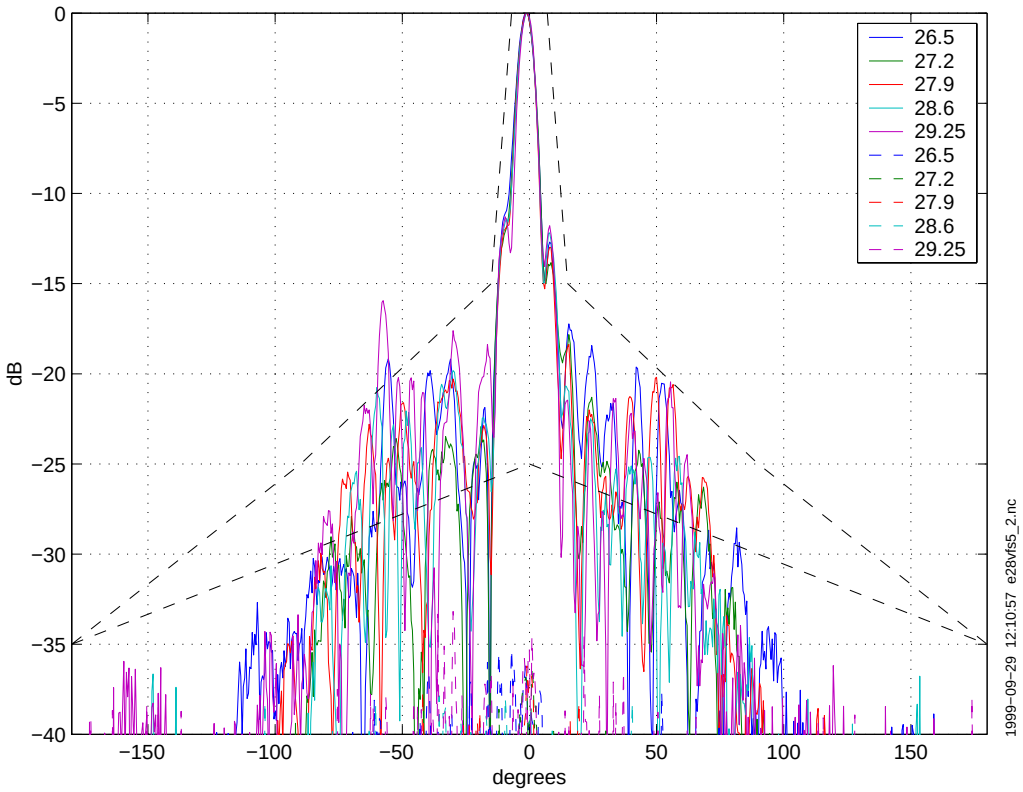

Figure 19 Co- and cross-polar radiation patters in elevation for antenna 5.

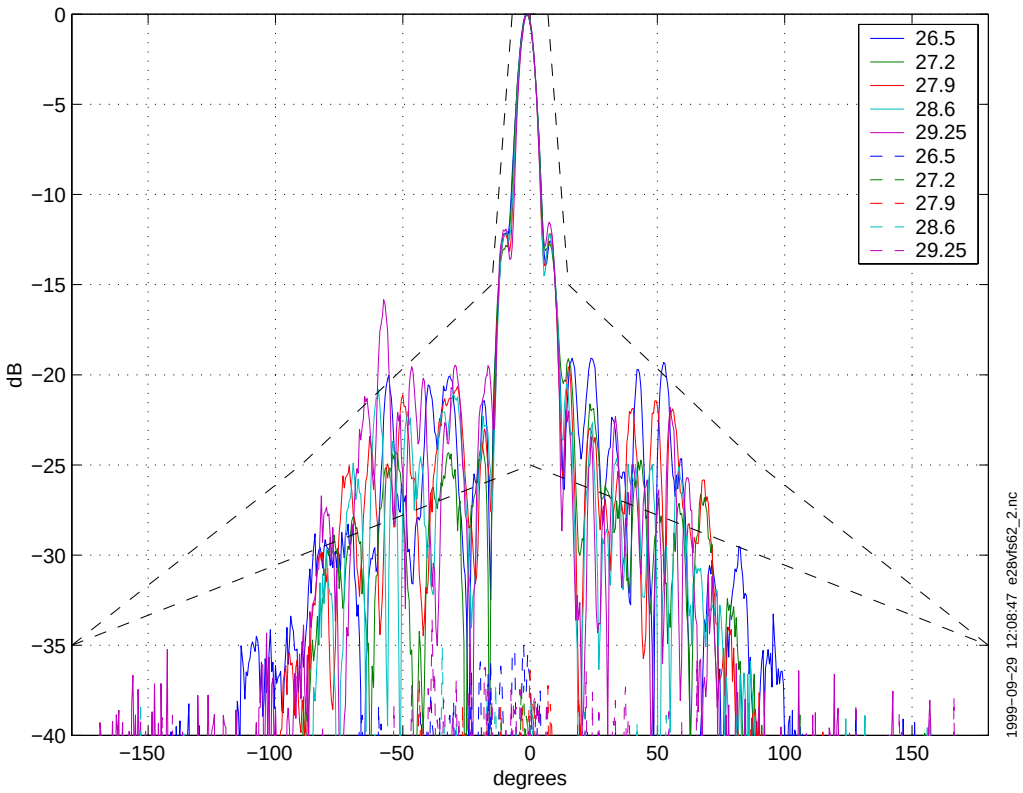

Figure 20 Co- and cross-polar radiation patters in elevation for antenna 6.

Prepared (also subject responsible if other)		No.		
EMWPRHO		1/102 67-UKY 210 85+ Uen		
Approved	Checked	Date	Rev	Reference
SL/AC (Stefan Johansson)		1999-10-19	A	

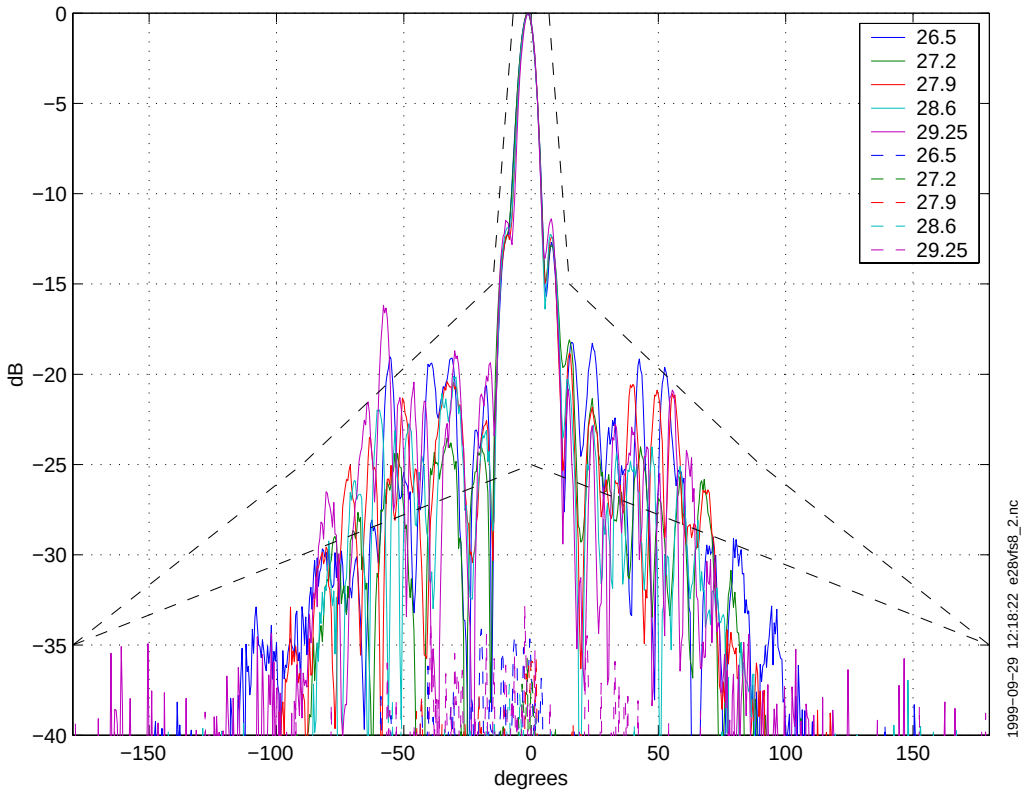

Figure 21 Co- and cross-polar radiation patters in elevation for antenna 8.

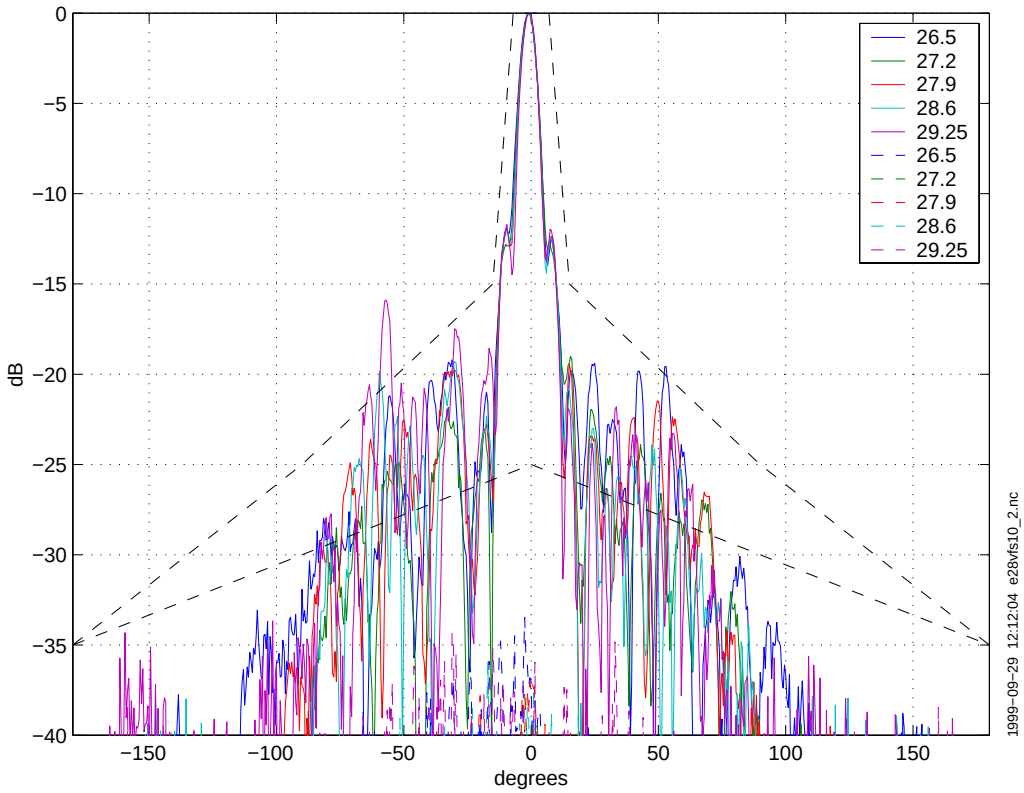

Figure 22 Co- and cross-polar radiation patters in elevation for antenna 10.

Prepared (also subject responsible if other)		No.		
EMWPRHO		1/102 67-UKY 210 85+ Uen		
Approved	Checked	Date	Rev	Reference
SL/AC (Stefan Johansson)		1999-10-19	A	

3 CONCLUSIONS

- For vertical and horizontal polarization the HPBW in azimuth is 5.6°-6.4°. Which is within the specified limit $6.2 \pm 1°$.
- The gain for both horizontal and vertical polarization is above the specified limit 18 ± 1 dBi.
- The return loss fulfils the specified requirements. It is better than 13.0 dB.
- The radiation patterns fulfil the specified radiation pattern envelopes (RPE) except for the azimuth pattern for the horizontal polarization and the elevation pattern for vertical polarization that does not fulfil the ETSI specification.

4 COMMENTS

Too many antennas don't fulfil the specification of 13 dB return loss. They will be sorted out in the production test [4] that all antennas will go through. In this test the antennas with bad soldering will also be sorted out even if they fulfil the 13 dB return loss specification. There were some production faults in the antennas which made that some of the antennas don't fulfil the return loss specification.

A likely cause why the elevation pattern for vertical polarization doesn't fulfil the specification is because of the production faults.

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 A
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