REPORT

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SWEDAC ACKREDITERING 1002

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Handläggare, enhet/*Handled by, department*	Datum/*Date*	Beteckning/*Reference*	Sida/*Page*
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Equipment Authorization measurements on Mobitex Base Radio station 900 MHz

(7 enclosures)

Test objects

BRU3902-D, product number HRB 104 43/C7, R-state R1A, s/n A400041YC4.
BRU3902-T, product number HRB 104 43/C8, R-state R1A, s/n A400041YEJ.

Summary

Standard	Compliant	Enclosure	Remarks
FCC CFR 47			
2.1046/90.205 RF Power output	Yes	2	
2.1049/90.209/90.210 Occupied bandwidth	Yes	3	
2.1051/90.669 Spurious emission at antenna	Yes	4	
2.1053/90.669 Field strength of spurious radiation	Yes	5	
2.1055/90.213 Frequency stability	Yes	6	

SP Swedish National Testing and Research Institute
Electronics - EMC

Jan Carlsson
Deputy Technical Manager

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SP 511

Description - Equipment Under Test (EUT)

Equipment:	Mobitex Base station transceiver 900 MHz	
Tx Frequency range:	935-941 MHz	
Tested Channels:	Ch. 3601	935.012 5 MHz.
	Ch. 3800	937.500 0 MHz
	Ch. 4000	940.000 0 MHz

BRU3902-D, product number HRB 104 43/C7, R-state R1A, s/n A400041YC4.
BRU3902-T, product number HRB 104 43/C8, R-state R1A, s/n A400041YEJ.

EUT configuration:
The transmitter was modulated (GMSK) with 8 kbs pseudorandom data (V.52, BT=0.3) during the measurements.

Manufacturer's representative: Reinhold Reul, Ericsson AB

Purpose of test

The purpose of the tests is to verify compliance with the performance characteristics specified in FCC CFR47.

Reservation

The test results in this report apply only to the particular Equipment Under Test (EUT) as declared in the report.

Delivery of test object

The test object was delivered: 2003-01-13

Test engineers

Peter Grahn
Fredrik Isaksson

Test witnesses

Reinhold Reul, Ericsson AB (partly present)
Mikael Hazard, Ericsson AB (partly present)
Carl-Gunnar Sjöberg, Ericsson AB (partly present)

RF Power output measurements according to 47CFR 2.1046/90.205

Date	Temperature	Humidity
2003-01-14	22 °C ± 3 °C	31 % ± 5 %

Test set-up and Procedure

The measurements were made per ANSI/TIA/EIA-603-1992. Measurements were made at output connector TX ANT. The output was connected to a Peak power analyser via a 50 ohm attenuator. The RF power was measured with variation in supply voltage at the highest power level.

Measurement equipment	Calibration Due	SP number
Boonton RF Peak power meter/analyser	2004-01	503 144
Boonton Power sensor 56518-S/4	2003-02	503 146
Multimeter Fluke 87	2003-09	502 190
Testo 610, Temperature and humidity meter	2004-12	502 658

Results

Test object: **BRU3902-D**

Mode: **CW**
Nominal voltage 120 V AC
Rated output power level at output connector TX ANT: 6 W (37.8 dBm)

BRU3902-D Test conditions		Transmitter power (dBm) Peak/Average		
		Channel 3601	Channel 3800	Channel 4000
T_{nom} 22°C	V_{nom} 120 V AC	37.6/37.1	38.6/37.6	38.1/37.7
T_{nom} 22°C	V_{min} 102 V AC	37.6/37.1	38.1/37.6	38.1/37.7
	V_{max} 138 V AC	37.6/37.1	38.1/37.6	38.1/37.7
Measurement uncertainty		0.5 dB		

Mode: **GMSK**
Nominal voltage 120 V AC
Rated output power level at output connector TX ANT: 6 W (37.8 dBm)

BRU3902-D Test conditions		Transmitter power (dBm) Peak/Average		
		Channel 3601	Channel 3800	Channel 4000
T_{nom} 22°C	V_{nom} 120 V AC	37.6/37.1	38.1/37.6	38.1/37.7
T_{nom} 22°C	V_{min} 102 V AC	37.6/37.1	38.1/37.6	38.1/37.7
	V_{max} 138 V AC	37.6/37.1	38.1/37.6	38.1/37.7
Measurement uncertainty		0.5 dB		

Test object: **BRU3902-T**

Mode: **CW**
Nominal voltage 120 V AC
Rated output power level at output connector TX ANT: 6 W (37.8 dBm)

BRU3902-T Test conditions		Transmitter power (dBm) Peak/Average		
		Channel 3601	Channel 3800	Channel 4000
T_{nom} 22°C	V_{nom} 120 V AC	37.9/37.5	38.1/37.7	38.3/37.8
T_{nom} 22°C	V_{min} 102 V AC	37.9/37.5	38.2/37.7	38.3/37.9
	V_{max} 138 V AC	37.9/37.5	38.2/37.7	38.3/37.9
Measurement uncertainty		0.5 dB		

Mode: **GMSK**
Nominal voltage 120 V AC
Rated output power level at output connector TX ANT: 6 W (37.8 dBm)

BRU3902-T Test conditions		Transmitter power (dBm) Peak/Average		
		Channel 3601	Channel 3800	Channel 4000
T_{nom} 22°C	V_{nom} 120 V AC	37.9/37.5	38.2/37.7	38.3/37.9
T_{nom} 22°C	V_{min} 102 V AC	37.9/37.5	38.2/37.7	38.3/37.9
	V_{max} 138 V AC	38.0/37.5	38.2/37.7	38.3/37.9
Measurement uncertainty		0.5 dB		

Limits (according to Industry Canada RSS-119 Issue 6, 2000-03-25)

The output power shall be within ±1 dB of the manufacturer's rated power.

Complies?	Yes

Occupied bandwidth measurements according to 47CFR 2.1049/90.209/90.210

Date	Temperature	Humidity
2003-01-14	22 °C ± 3 °C	31 % ± 5 %

Test set-up and Procedure

The measurement test set-up was made per ANSI/TIA/EIA-603-1992. Measurements were made at output connector TX ANT. The output was connected to a spectrum analyser. The transmitter was modulated (GMSK) with 8 kbs pseudorandom data (V.52, BT=0.3) during the measurements.

Measurement equipment	Calibration Due	SP number
R&S ESI40	2003-08	503 125
Testo 610, Temperature and humidity meter	2004-12	502 658

Measurement uncertainty: 3.7 dB

Results

Test object: **BRU3902-D**

Nominal voltage 120 V AC
Output power level at output connector TX ANT: 38.1 dBm

Diagram 1 Channel 3800 (937.500 MHz), 0.5 % of the total mean power (-23 dB points)
Diagram 2 Channel 3800 (937.500 MHz), mask J

Test object: **BRU3902-T**

Nominal voltage 120 V AC
Output power level at output connector TX ANT: 38.2 dBm

Diagram 3 Channel 3800 (937.500 MHz), 0.5 % of the total mean power (-23 dB points)
Diagram 4 Channel 3800 (937.500 MHz), mask J

Limits

90.209: Authorized bandwidth < 13.6 kHz
90.210: Mask J

Complies?	Yes

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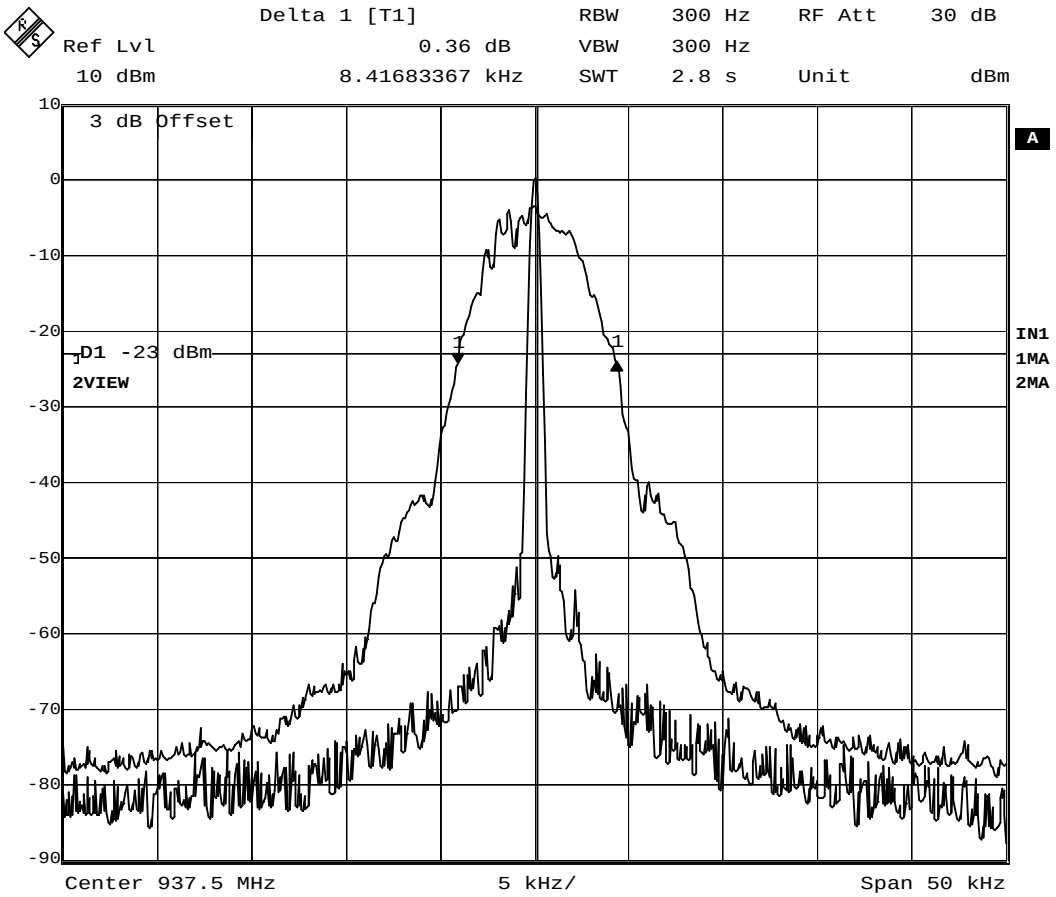

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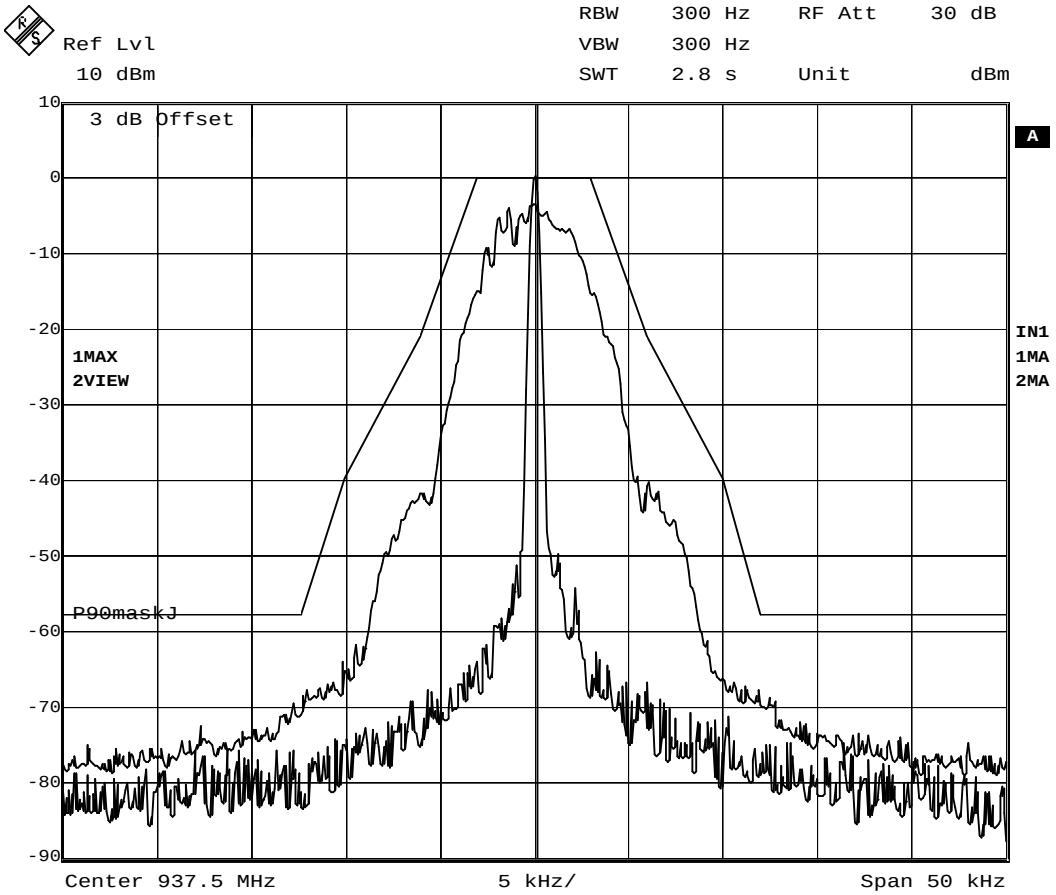

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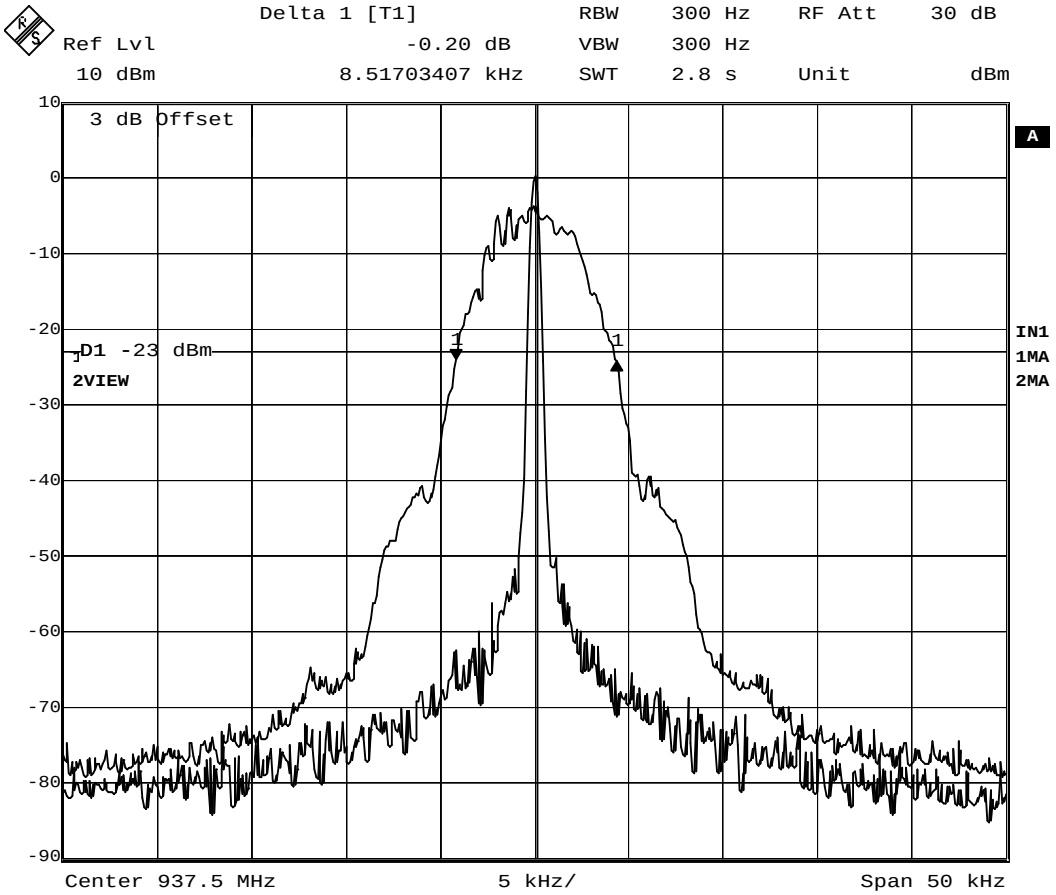

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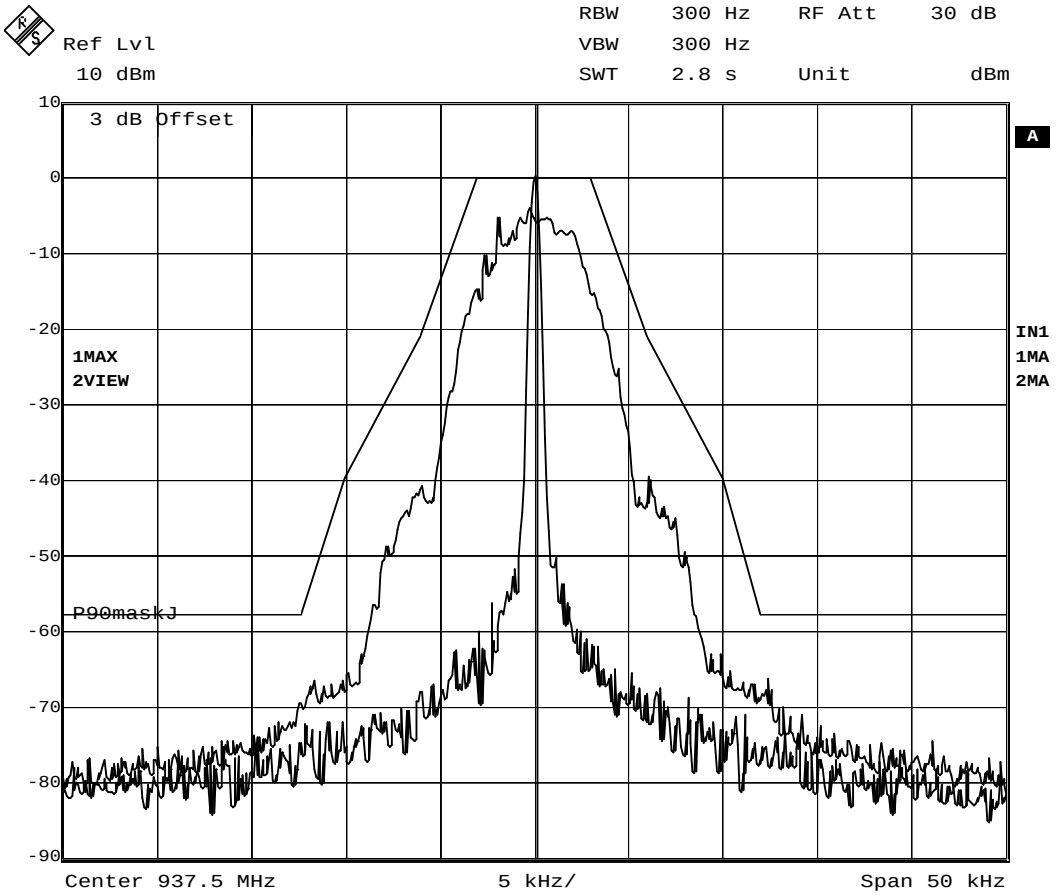

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Conducted spurious emission measurements according to 47CFR 2.1051/90.669

Date	Temperature	Humidity
2003-01-14	22 °C ± 3 °C	31 % ± 5 %

Test set-up and Procedure

The measurement test set-up was made per ANSI/TIA/EIA-603-1992. Measurements were made at output connector TX ANT. The output was connected to a spectrum analyser. The transmitter was modulated (GMSK) with 8 kbs pseudorandom data (V.52, BT=0.3) during the measurements.

Measurement equipment	Calibration Due	SP number
R&S ESI40	2003-08	503 125
Testo 610, Temperature and humidity meter	2004-12	502 658

Measurement uncertainty: 3.7 dB

Results

Test object: **BRU3902-D**

Nominal Voltage 120 V AC

Diagram 1: Channel 3601 (935.012 5 MHz), 37.6 dBm, 9 kHz-1000 MHz
Diagram 2: Channel 3601 (935.012 5 MHz), 37.6 dBm, 1-10 GHz
Diagram 3: Channel 4000 (940.000 MHz), 38.1 dBm, 9 kHz-1000 MHz
Diagram 4: Channel 4000 (940.000 MHz), 38.1 dBm, 1-10 GHz

Test object: **BRU3902-T**

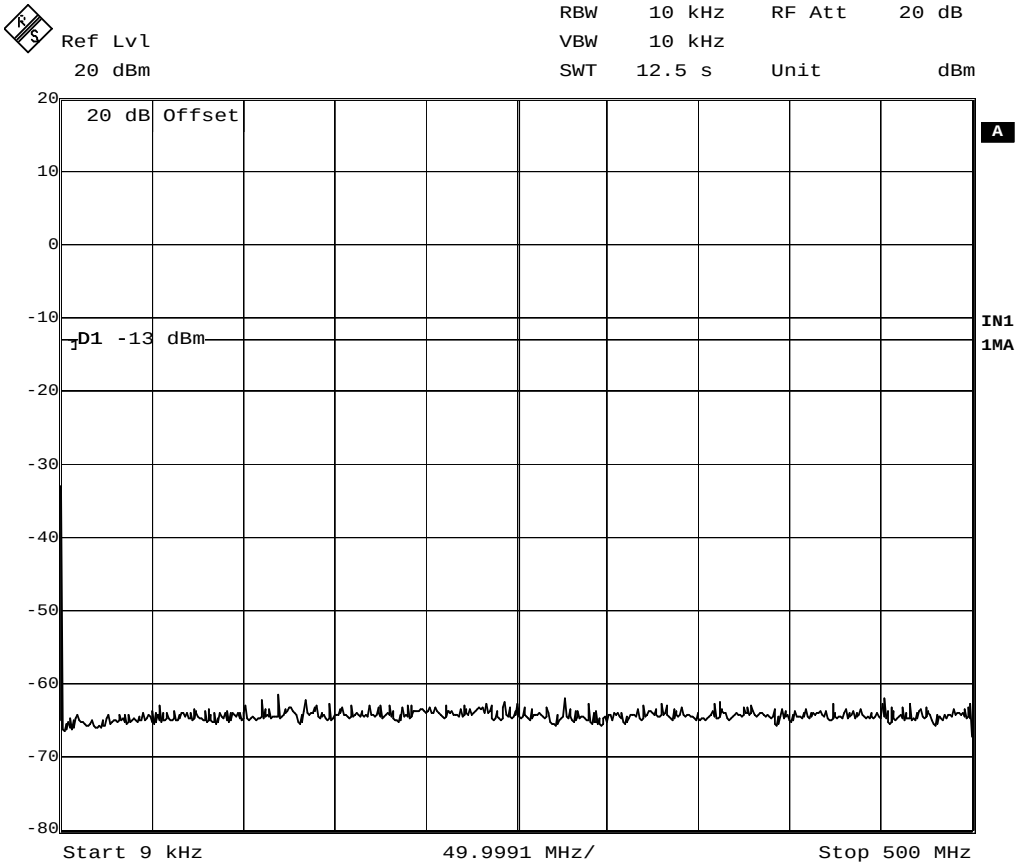
Nominal voltage 120 V AC

Diagram 5: Channel 3601 (935.012 5 MHz), 37.9 dBm, 9 kHz-1000 MHz
Diagram 6: Channel 3601 (935.012 5 MHz), 37.9 dBm, 1-10 GHz
Diagram 7: Channel 4000 (940.000 MHz), 38.3 dBm, 9 kHz-1000 MHz
Diagram 8: Channel 4000 (940.000 MHz), 38.3 dBm, 1-10 GHz

Limits

The power of any emission outside the frequency band shall be attenuated below the transmitter power (P) by at least 43 + 10 log P dB.

Complies?	Yes



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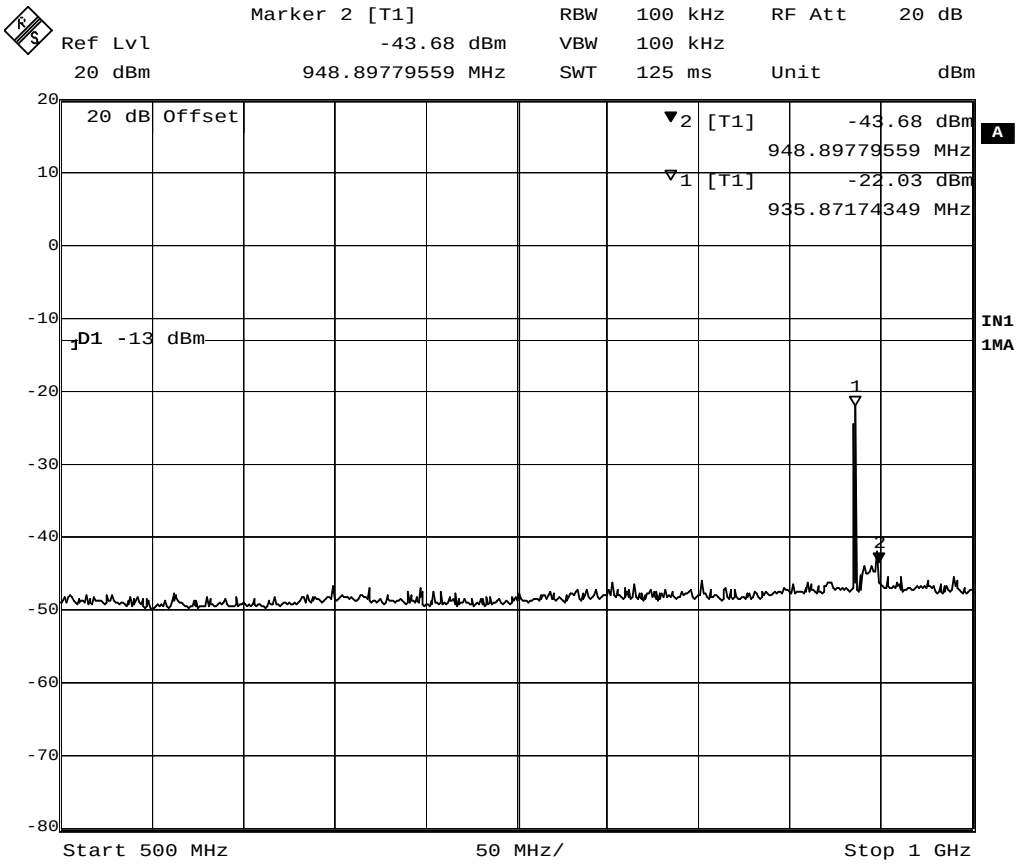

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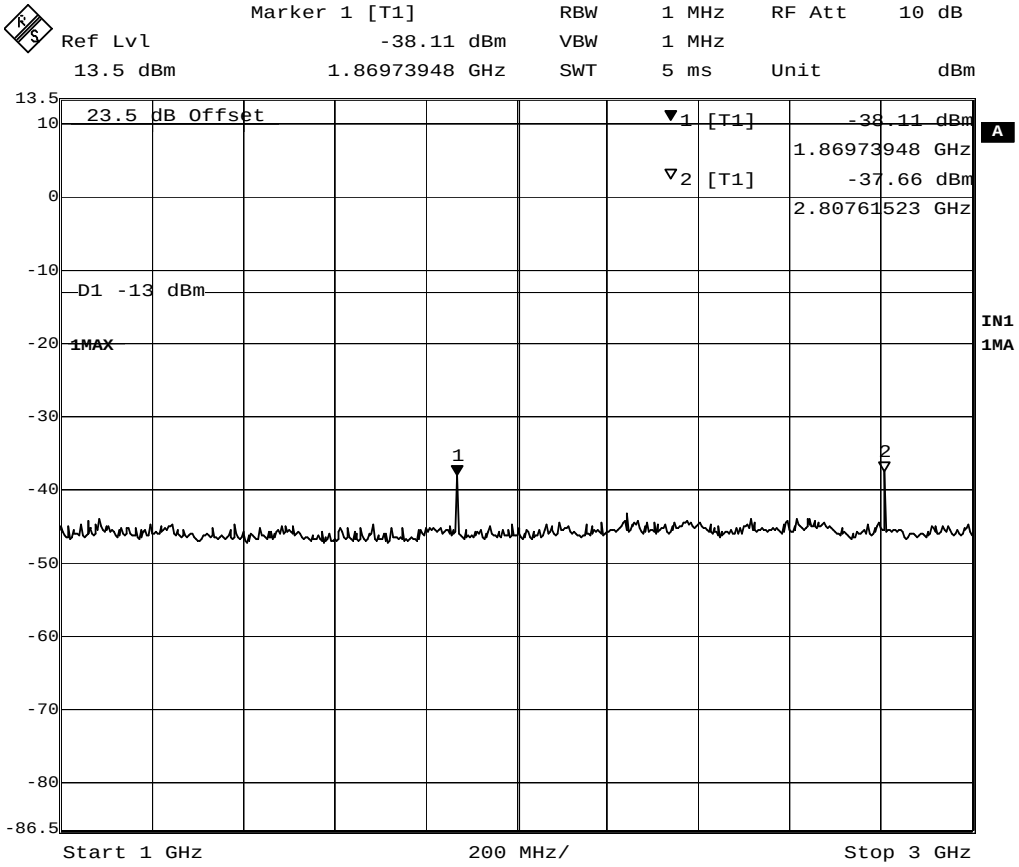

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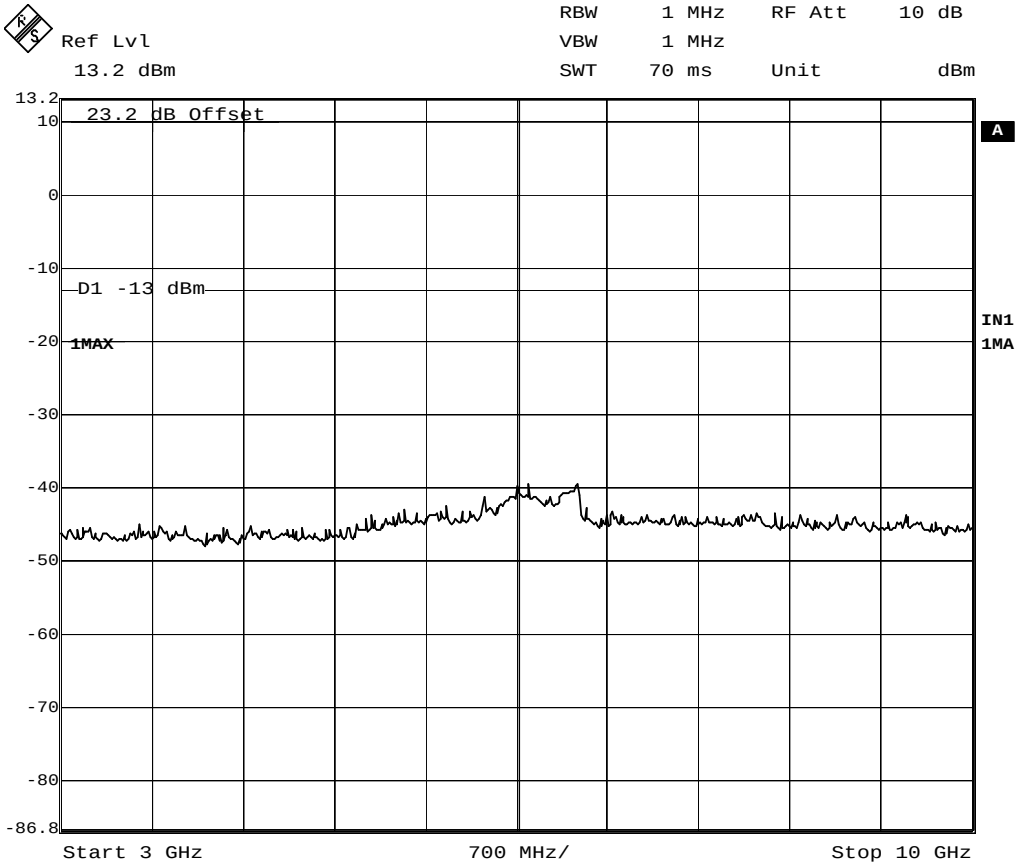

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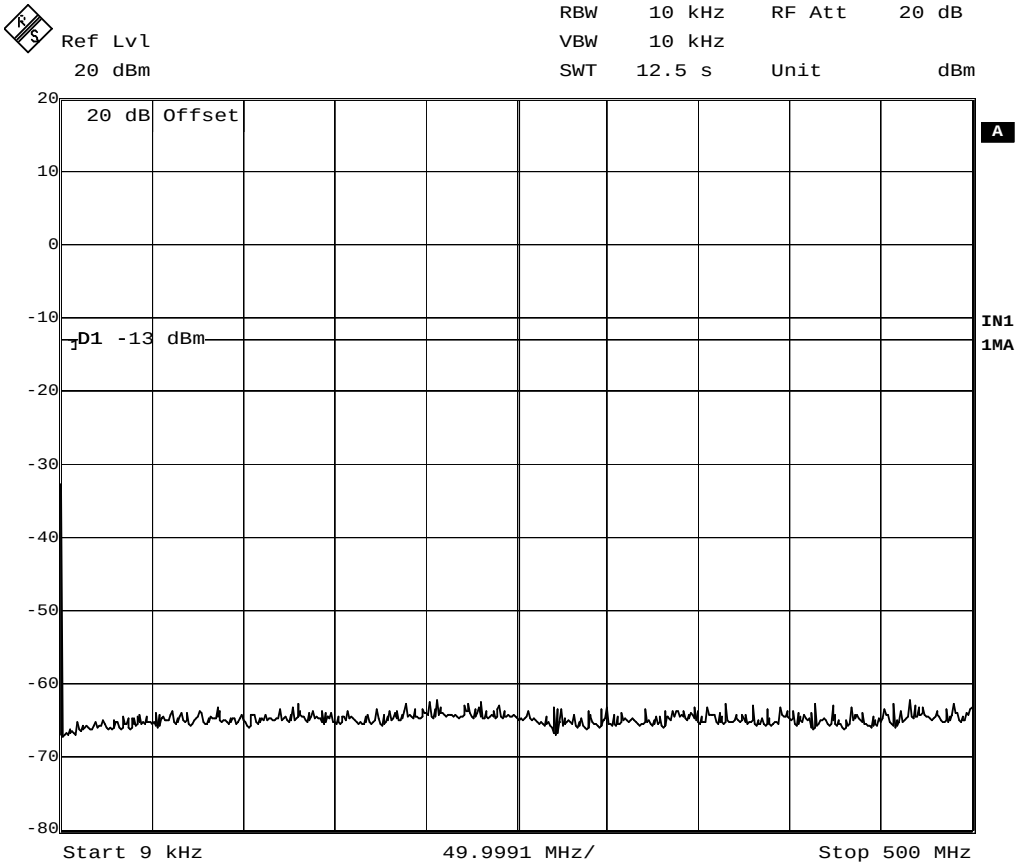

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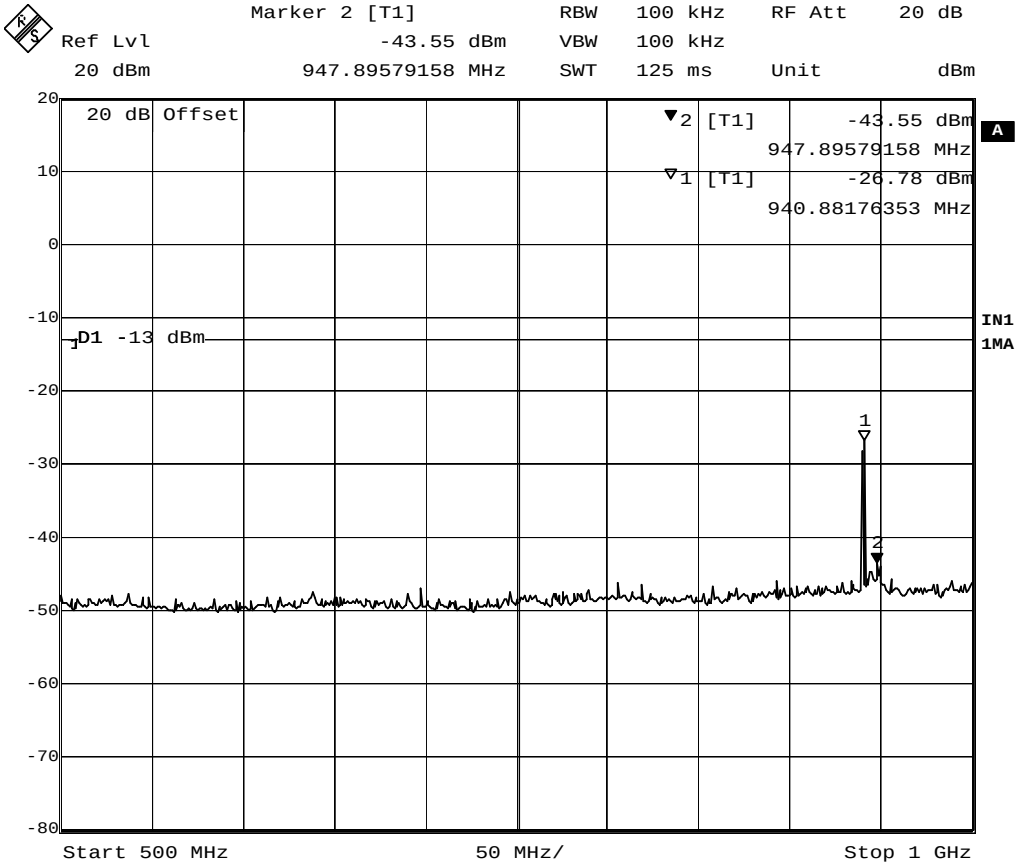

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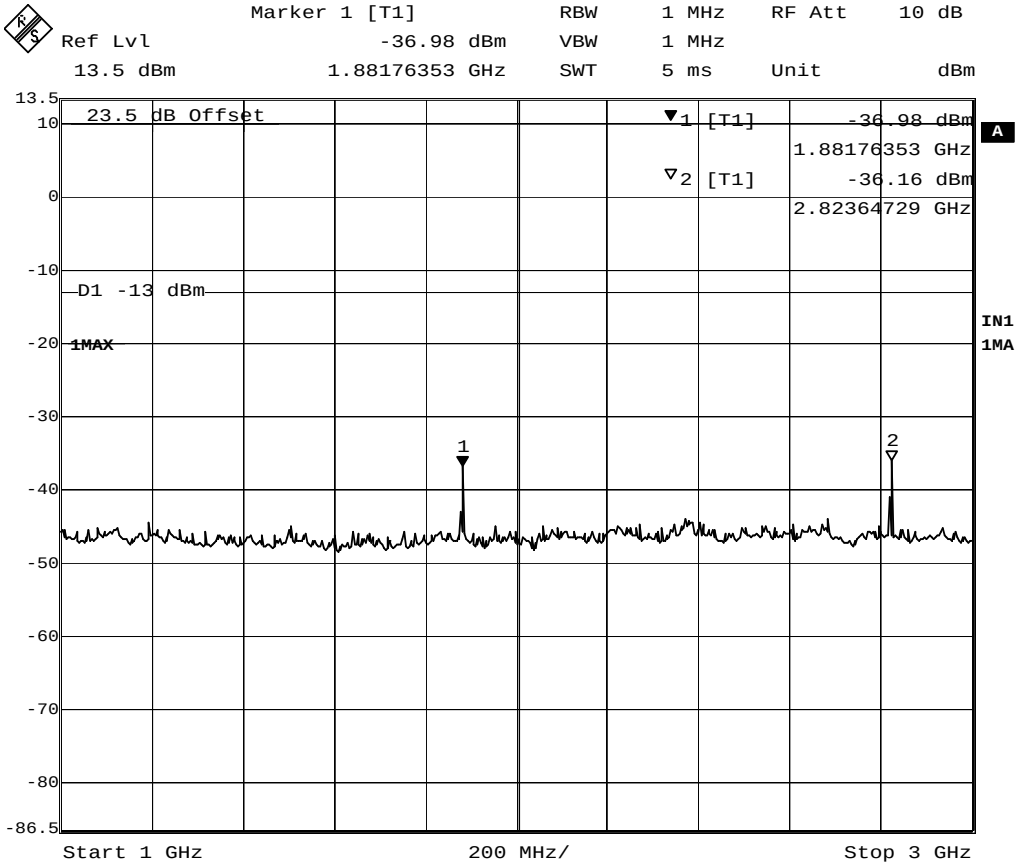

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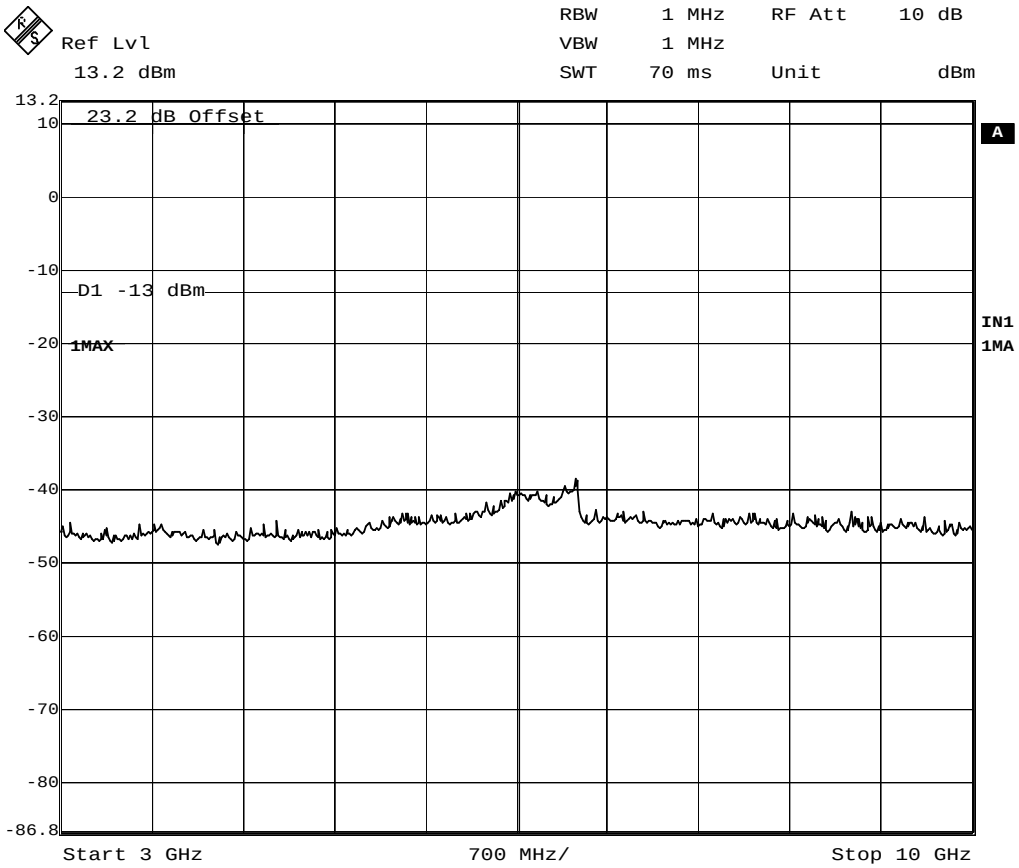

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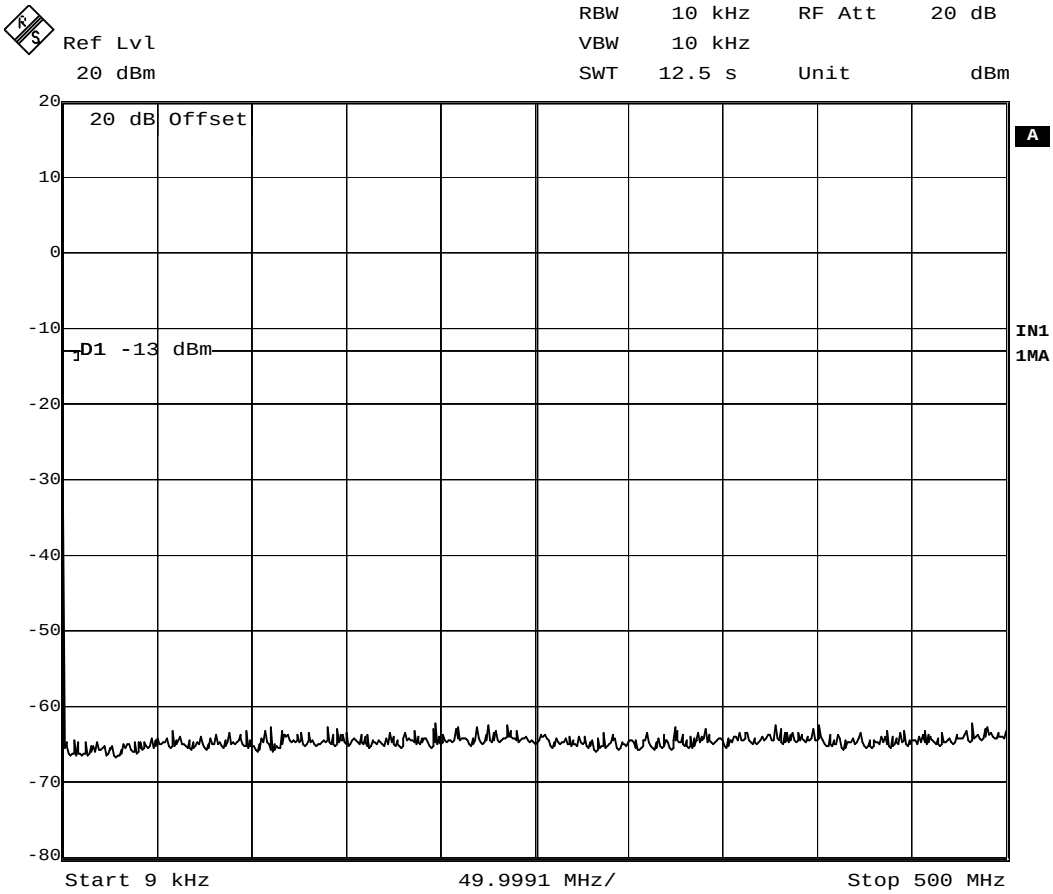

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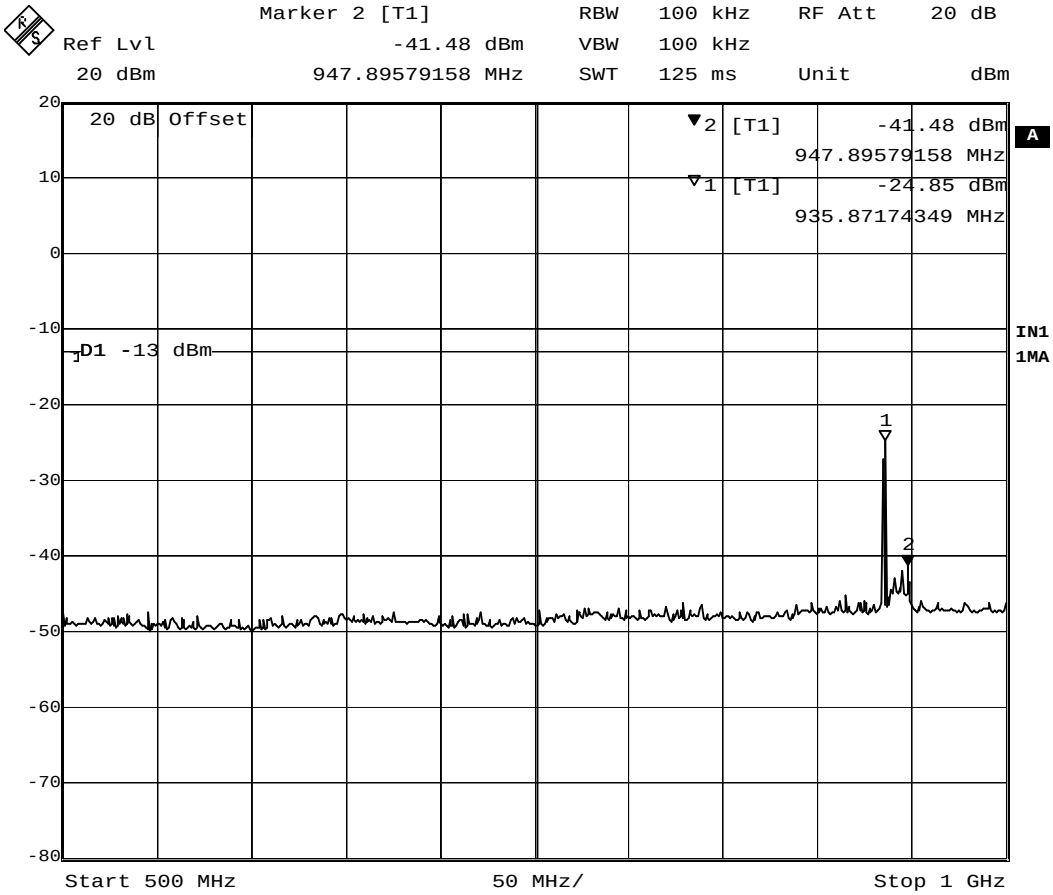

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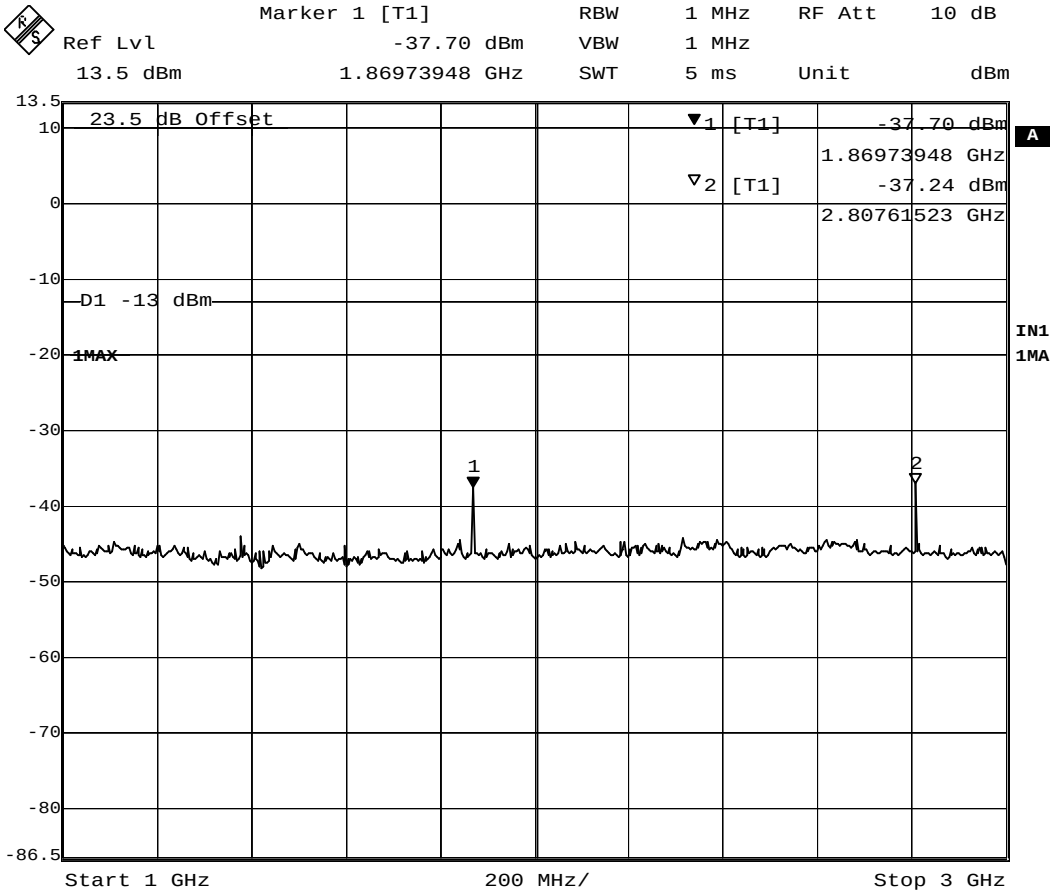

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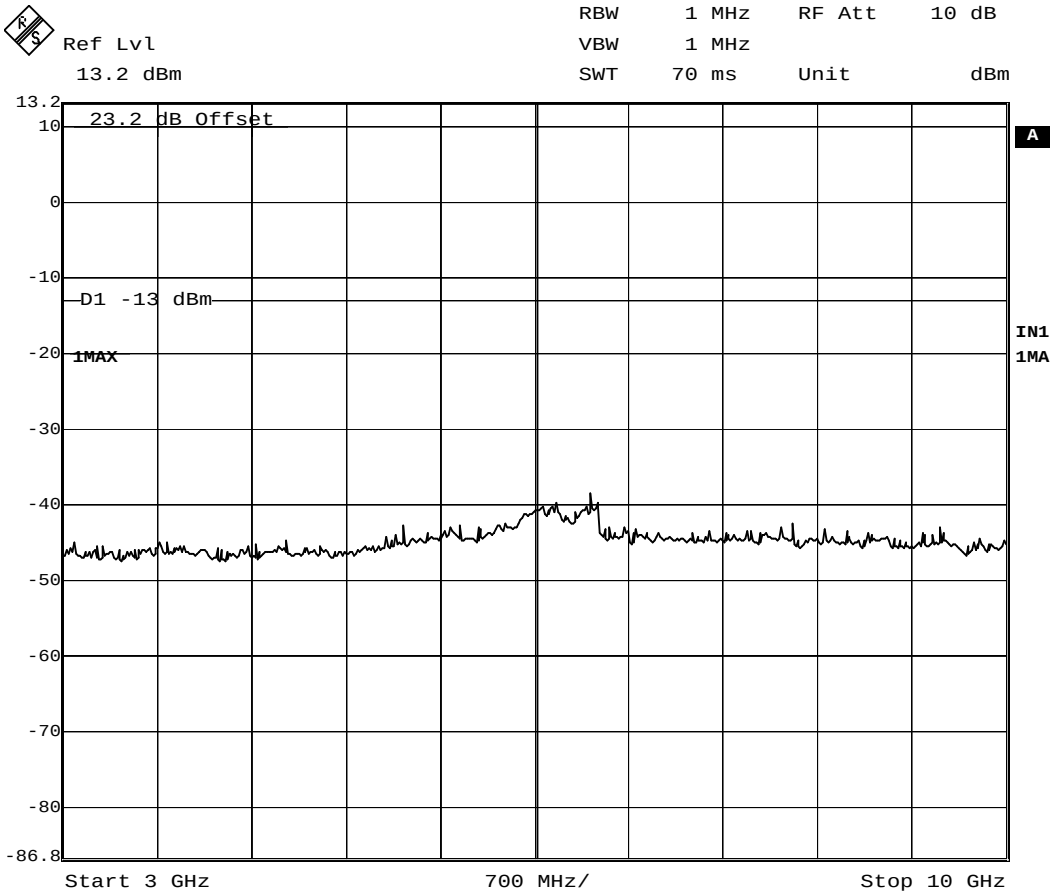

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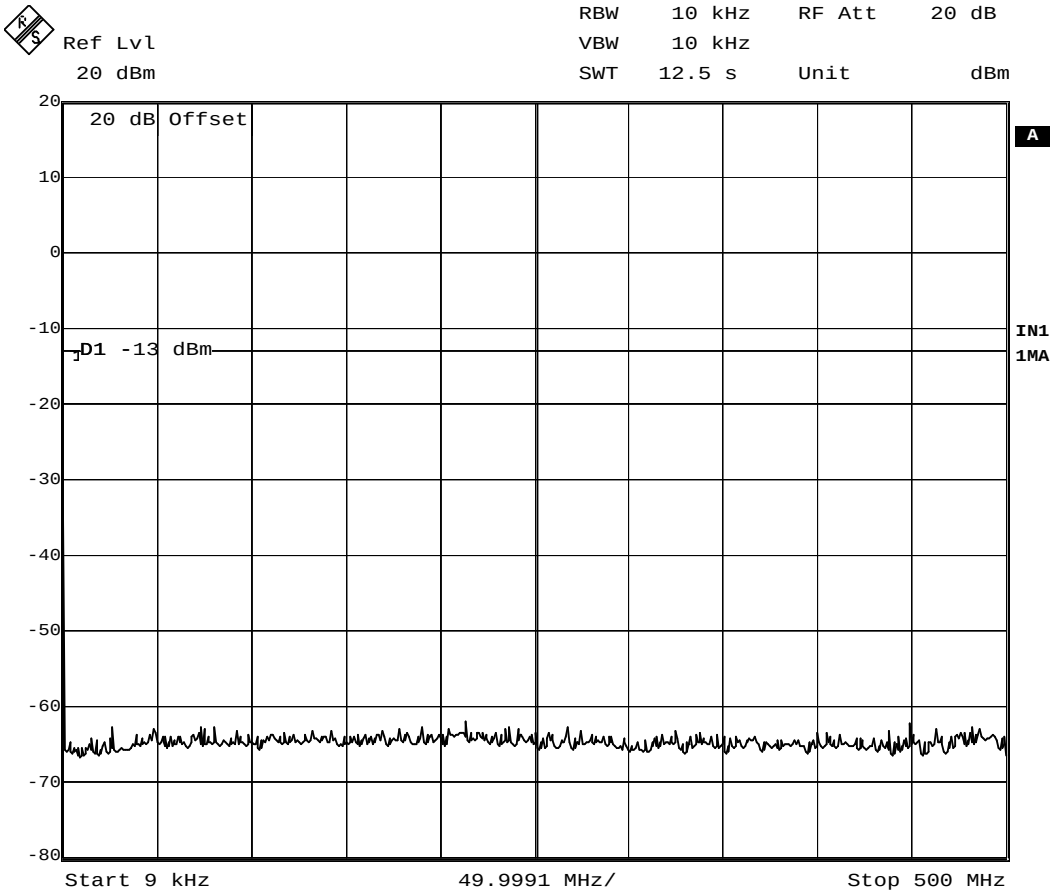

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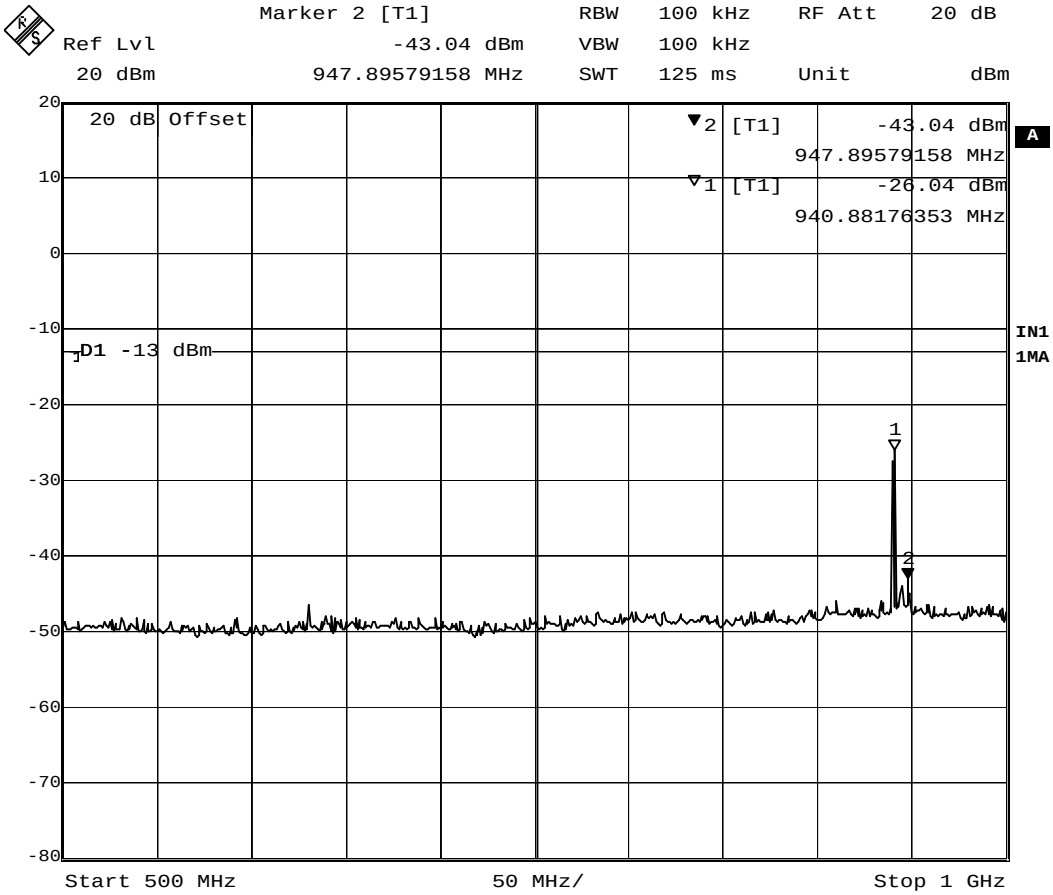

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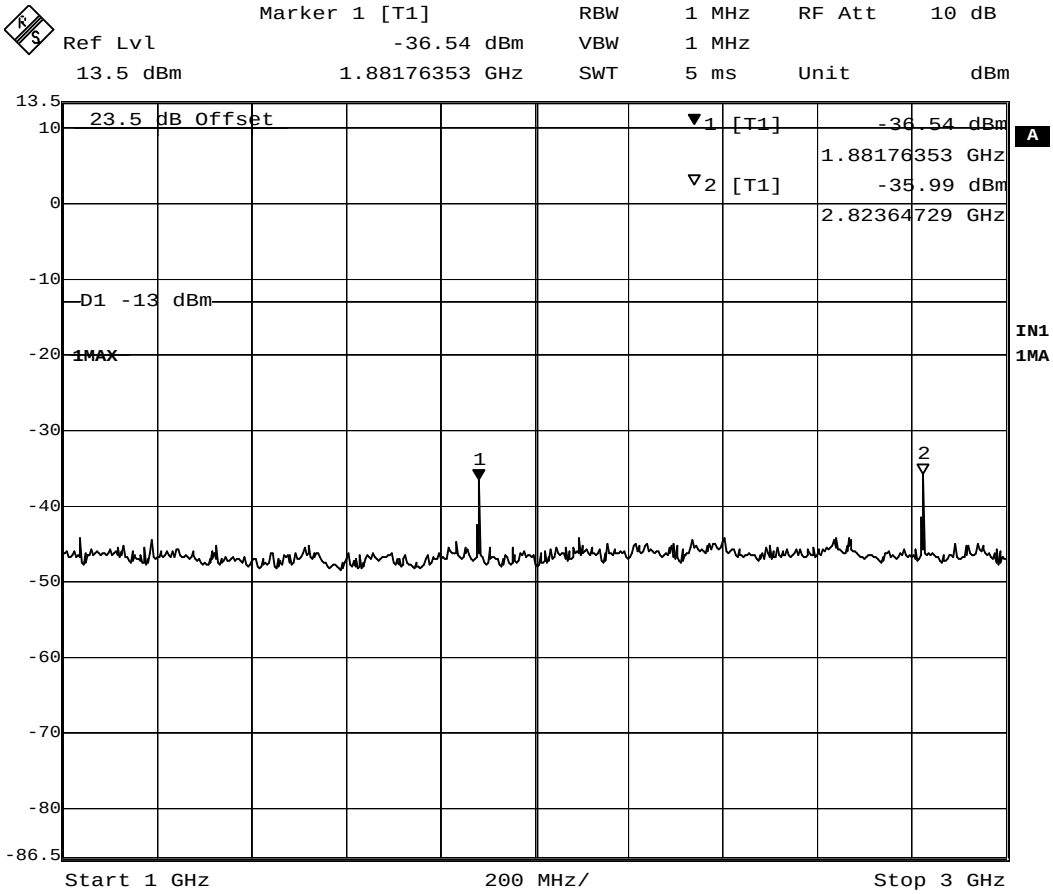

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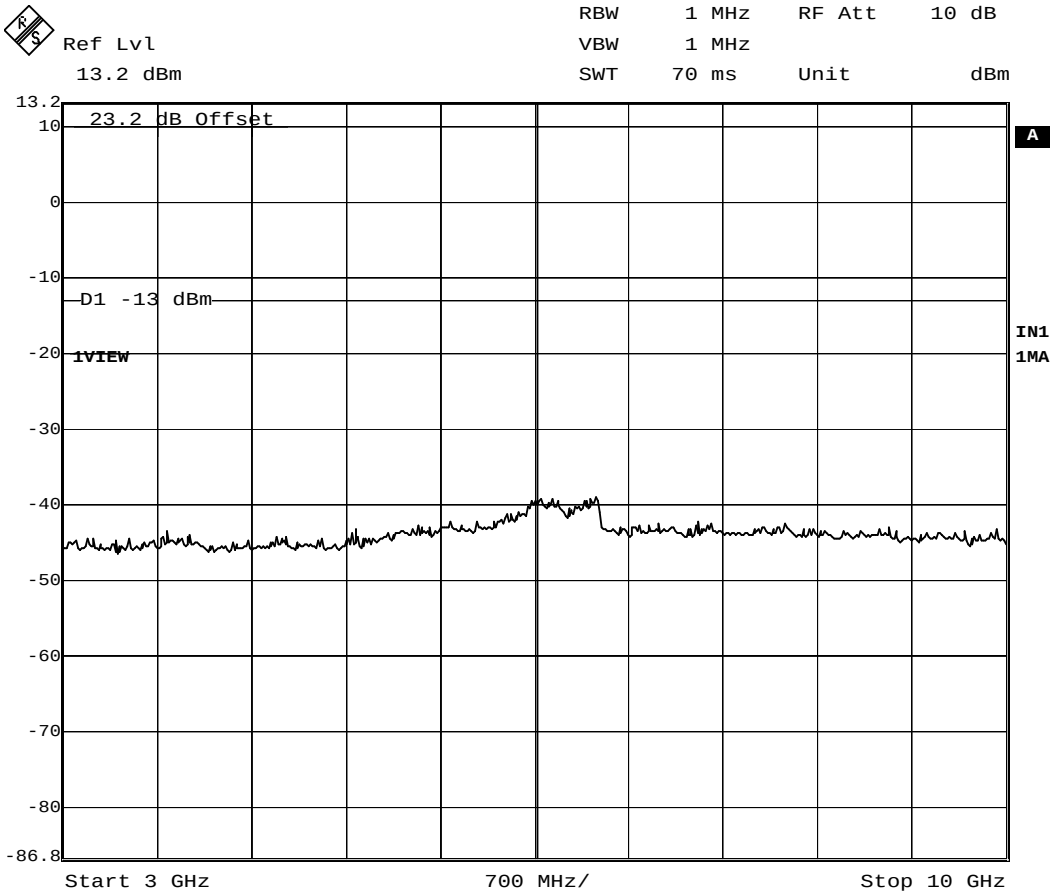

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Field strength of spurious radiation measurements according to 47CFR 2.1053/90.669

Date	Temperature	Humidity
2003-01-13	21 °C ± 3 °C	29 % ± 5 %

Test set-up and Procedure

The measurement test set-up was made per ANSI/TIA/EIA-603-1992.
The transmitter was modulated (GMSK) with 8 kbs pseudorandom data (V.52, BT=0.3) during the measurements.
The test of radiated emission was performed in a fully anechoic chamber.
The antenna distance was 3 m.

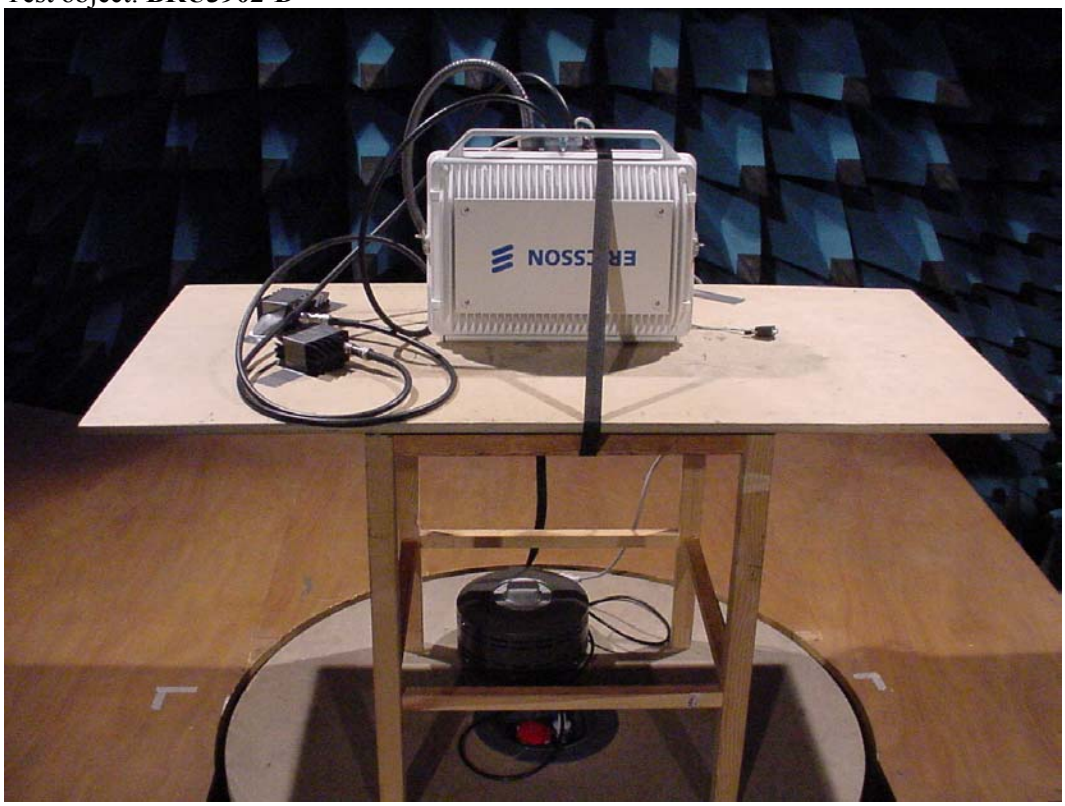
A pre-measurement was first performed:
9 kHz- 30 MHz:
The measurement was performed in field strength. The limit in power, –13 dBm, was recalculated to field strength in free space, 82 dBµV/m. The EUT was measured in one direction. The measurements were performed with both perpendicular and longitudinal polarisation of the antenna. The antenna height was 1.20 m.
30 MHz-10 GHz:
The measurement was performed in power. A pre-substitution measurement in the fully anechoic chamber in the frequency 30 MHz-10 GHz was used as a correction factor during the pre-measurement. The EUT was rotating 360 degrees and was measured during the all 360 degrees. The measurements were performed with both horizontal and vertical polarisation of the antenna. The antenna height was 1.55 m.

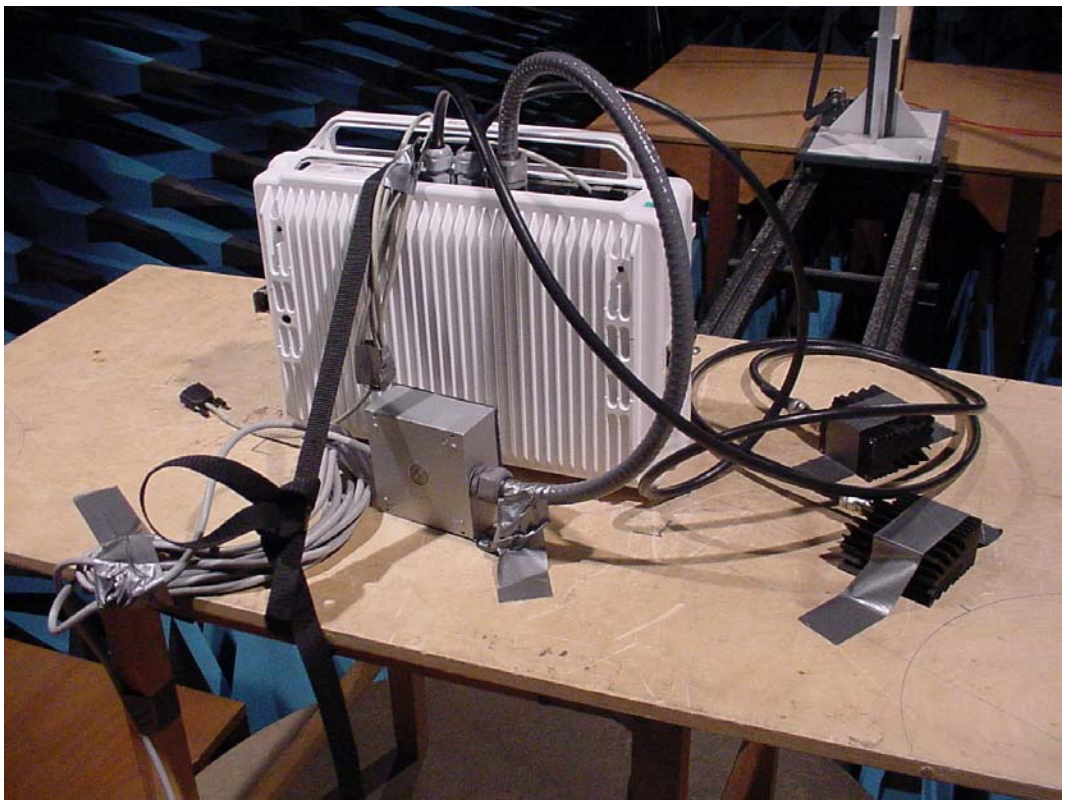
The measurement procedure was as the following:
1. The pre-measurement was first performed with peak detector.
2. Spurious radiation on frequencies closer than 20 dB in the frequency range 9 kHz-30 MHz to the limit and spurious radiation on frequencies closer than 6 dB in the frequency range 30 MHz-10 GHz, was measured with the substitution method according to the standard.

Measurement equipment	Calibration Due	SP number
Anechoic chamber, Hertz	-	15:116
R&S ESI 26	2003-05	503 292
Control computer	-	503 479
Software: R&S ES-K1, ver. 1.60	-	-
Chase Bilog antenna CBL 6111A	2003-12	503 182
EMCO loop antenna 6502	2004-07	502 916
EMCO Horn Antenna 3115	2004-11	502 175
MITEQ Low Noise Amplifier	2003-12	503 285
Testo 615, Temperature and humidity meter	2003-08	503 505

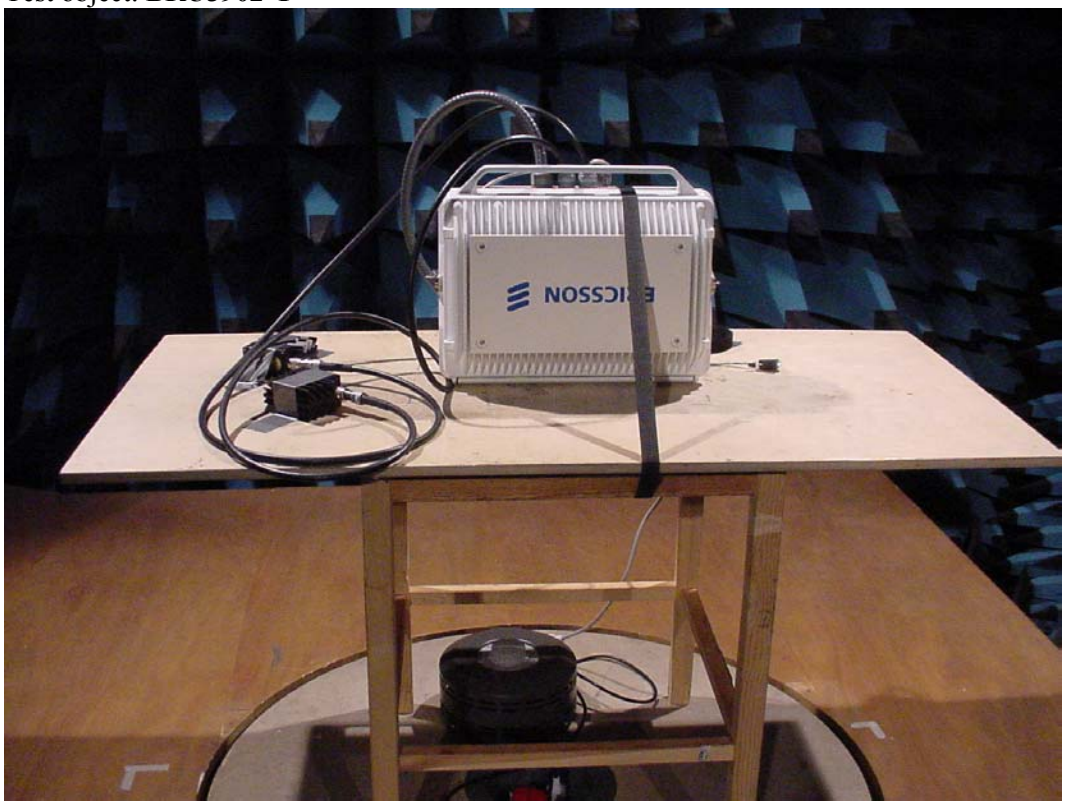
The test set-up during the spurious radiation measurements can be seen in the pictures below.

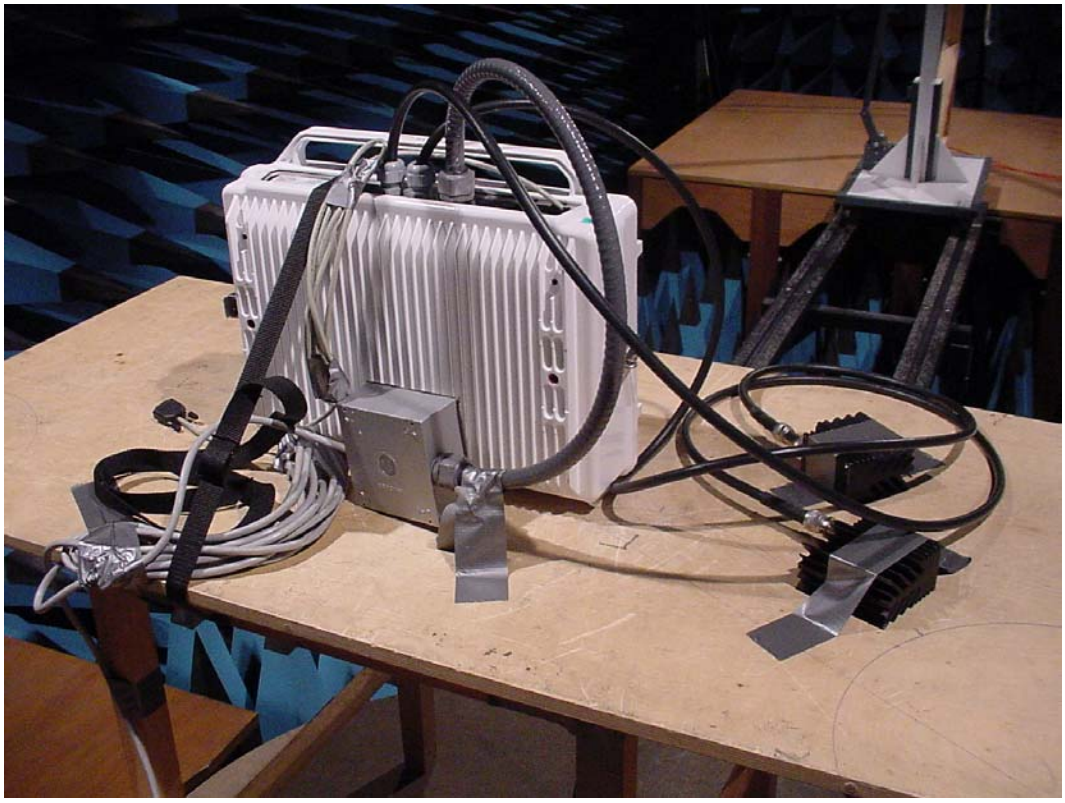
Test object: **BRU3902-D**





Test object: **BRU3902-T**





Results

The spurious radiation measured with the substitution method for both the EUT, **BRU3902-D** and **BRU3902-T** can be found in the table below:

		Spurious emission level (dBm)	
Frequency (MHz)	RBW	Vertical (9k-30MHz: Longitudinal)	Horizontal (9k-30MHz: Perpendicular)
0.009-0.15	200 Hz	All emission > 20 dB below limit	All emission > 20 dB below limit
0.15-30	9 kHz	All emission > 20 dB below limit	All emission > 20 dB below limit
30-1000	100 kHz	All emission > 20 dB below limit	All emission > 20 dB below limit
1000-10 000	1 MHz	All emission > 20 dB below limit	All emission > 20 dB below limit
Measurement uncertainty		4.7 dB	

The pre-test emission spectra can be found in encl. 5.1:

Test object: **BRU3902-D**
Voltage 110 V AC

Diagram 1: Channel 3601 (935.012 5 MHz), 37.6 dBm, 9 kHz-30 MHz
Diagram 3: Channel 3601 (935.012 5 MHz), 37.6 dBm, 30-1000 MHz
Diagram 3: Channel 3601 (935.012 5 MHz), 37.6 dBm, 1-10 GHz,
Diagram 4: Channel 4000 (940.000 MHz), 38.1 dBm, 9 kHz-30 MHz
Diagram 5: Channel 4000 (940.000 MHz), 38.1 dBm, 30-1000 MHz
Diagram 6: Channel 4000 (940.000 MHz), 38.1 dBm, 1-10 GHz

Test object: **BRU3902-T**
Voltage 110 V AC

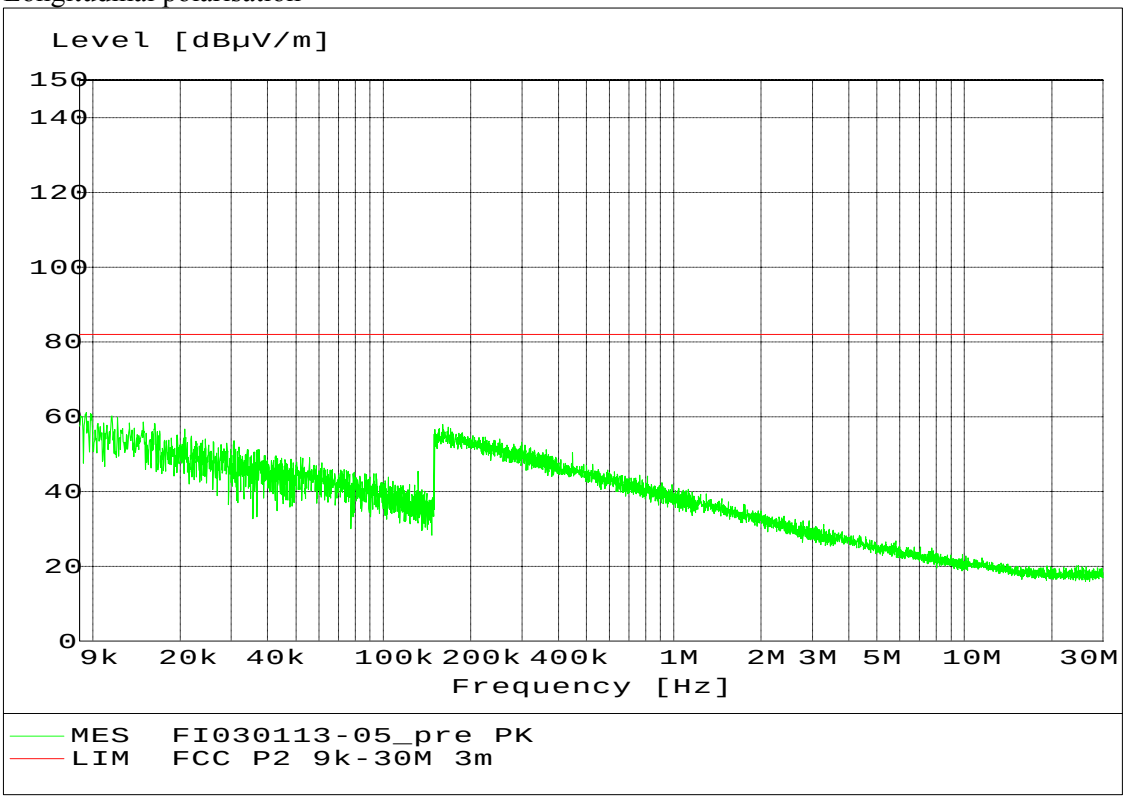
Diagram 7: Channel 3601 (935.012 5 MHz), 37.9 dBm, 9 kHz-30 MHz
Diagram 8: Channel 3601 (935.012 5 MHz), 37.9 dBm, 30-1000 MHz
Diagram 9: Channel 3601 (935.012 5 MHz), 37.9 dBm, 1-10 GHz,
Diagram 10: Channel 4000 (940.000 MHz), 38.3 dBm, 9 kHz-30 MHz
Diagram 11: Channel 4000 (940.000 MHz), 38.3 dBm, 30-1000 MHz
Diagram 12: Channel 4000 (940.000 MHz), 38.3 dBm, 1-10 GHz

Limits

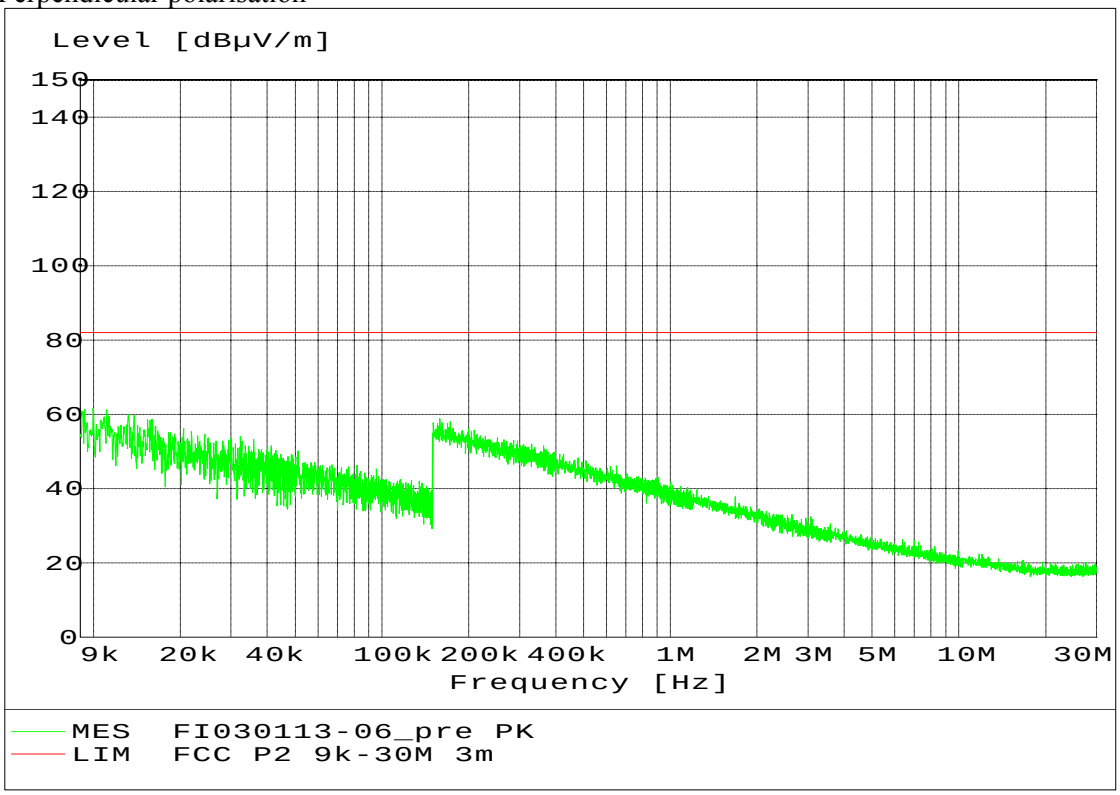
The power of any emission outside the frequency band shall be attenuated below the transmitter power (P) by at least 43 + 10 log P dB.

Complies?	Yes

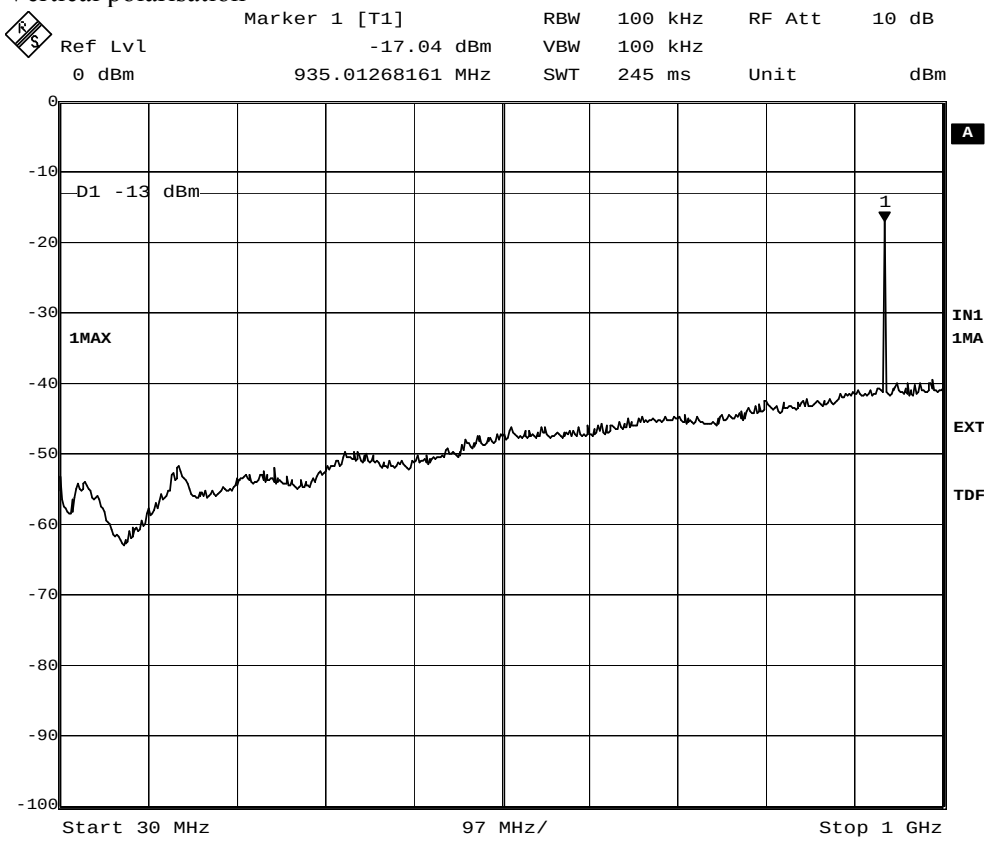
Longitudinal polarisation



Perpendicular polarisation



Vertical polarisation



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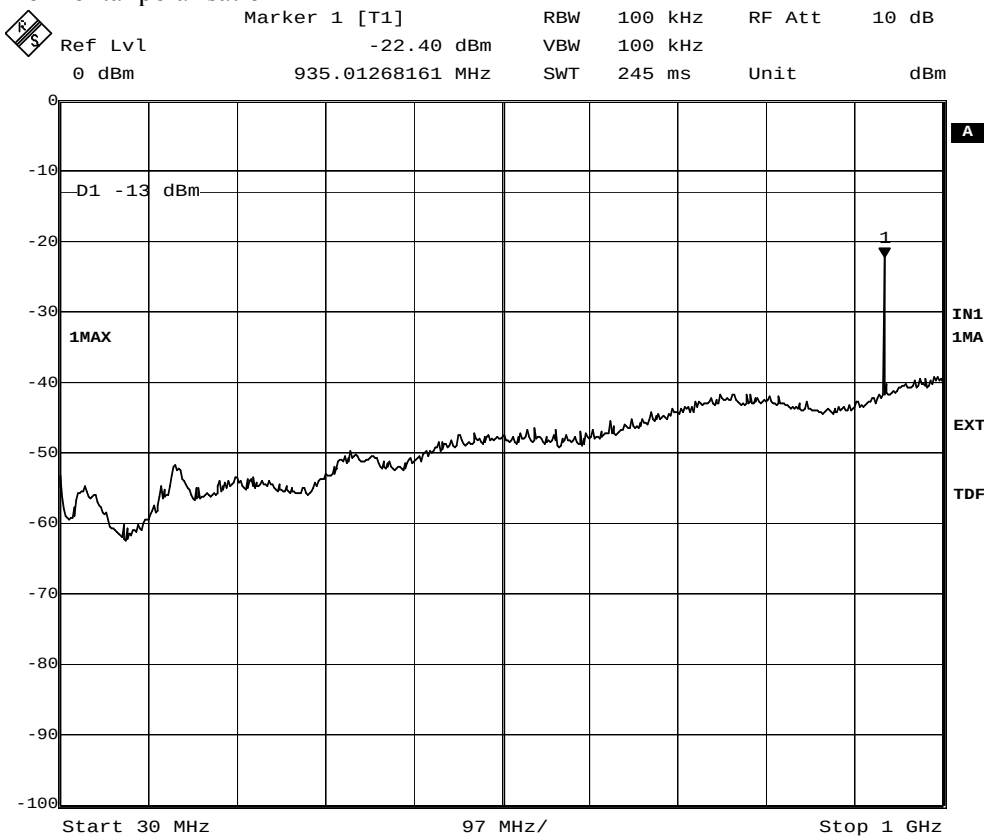

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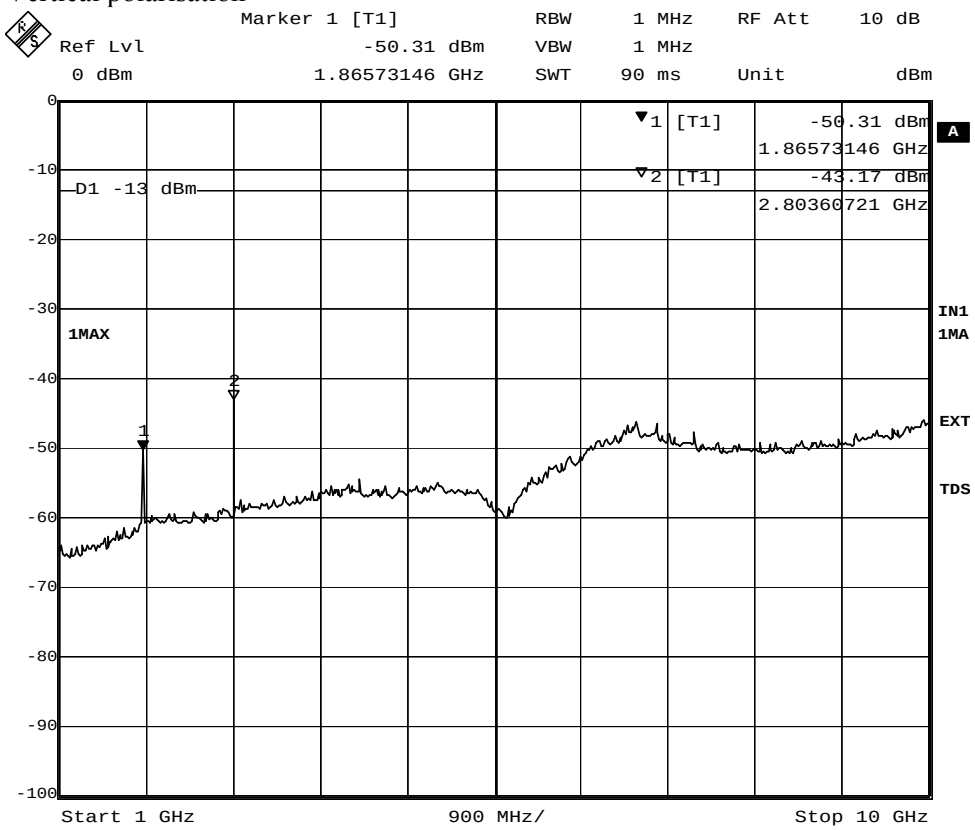
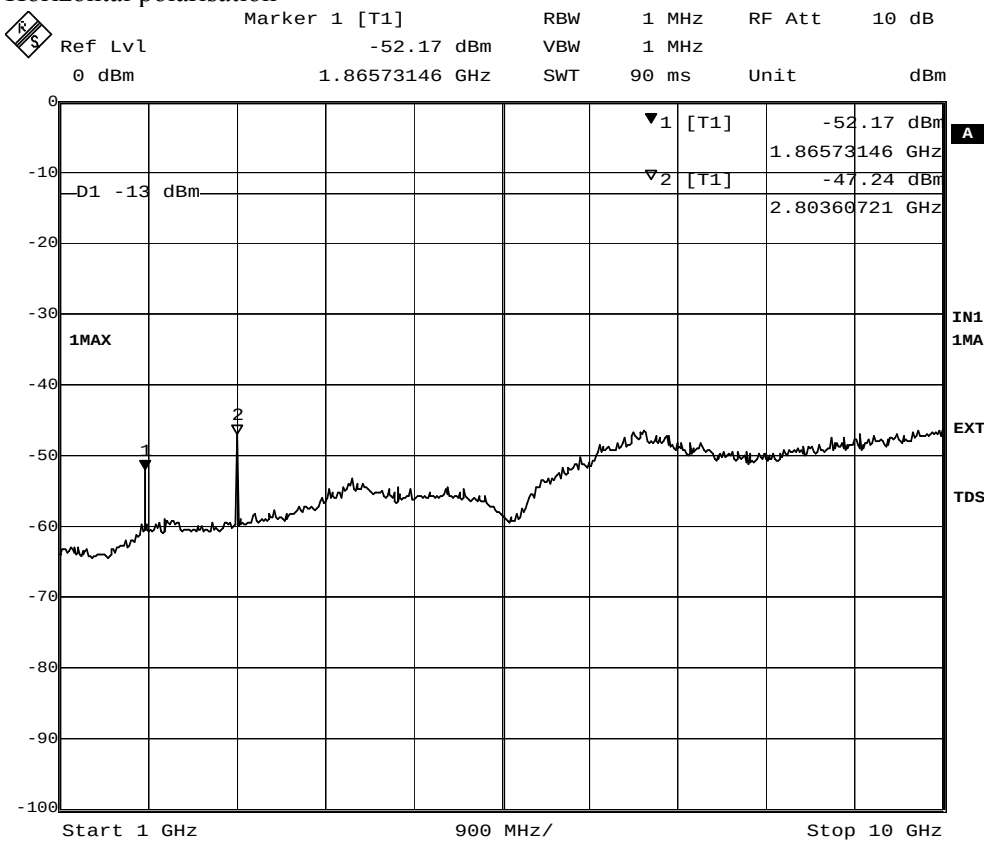


Date: 13.JAN.2003 12:52:15

Horizontal polarisation



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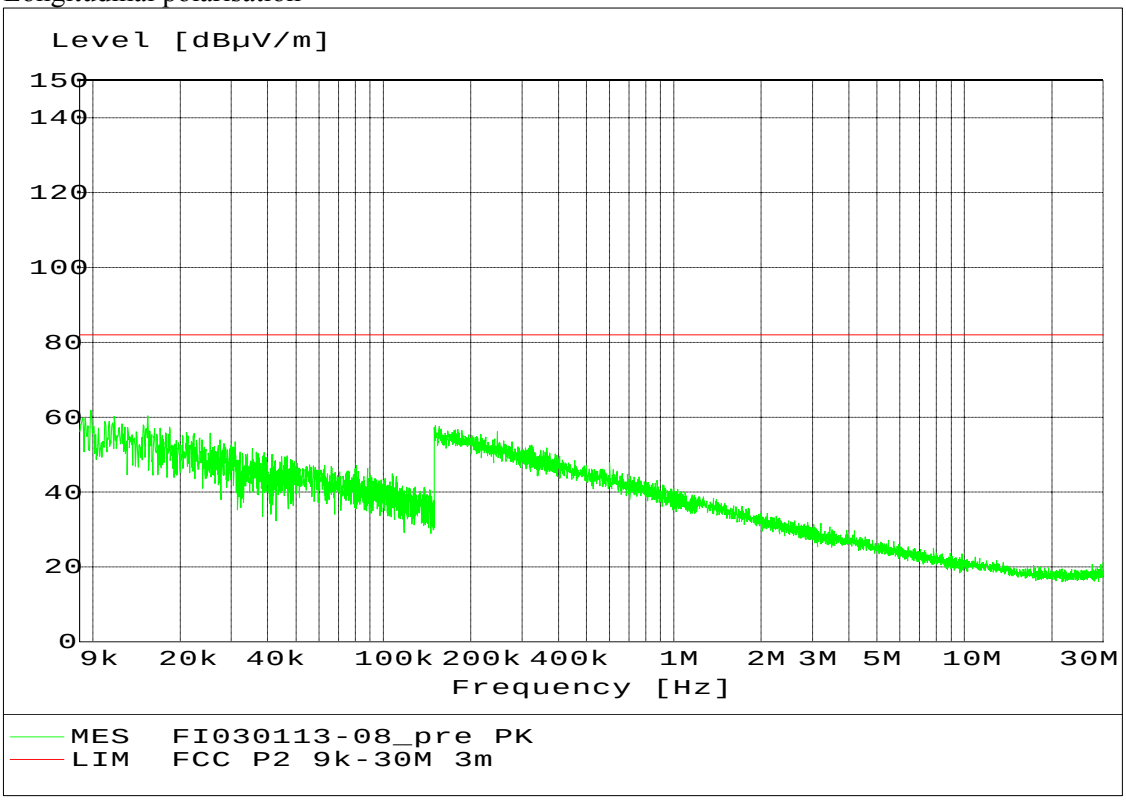
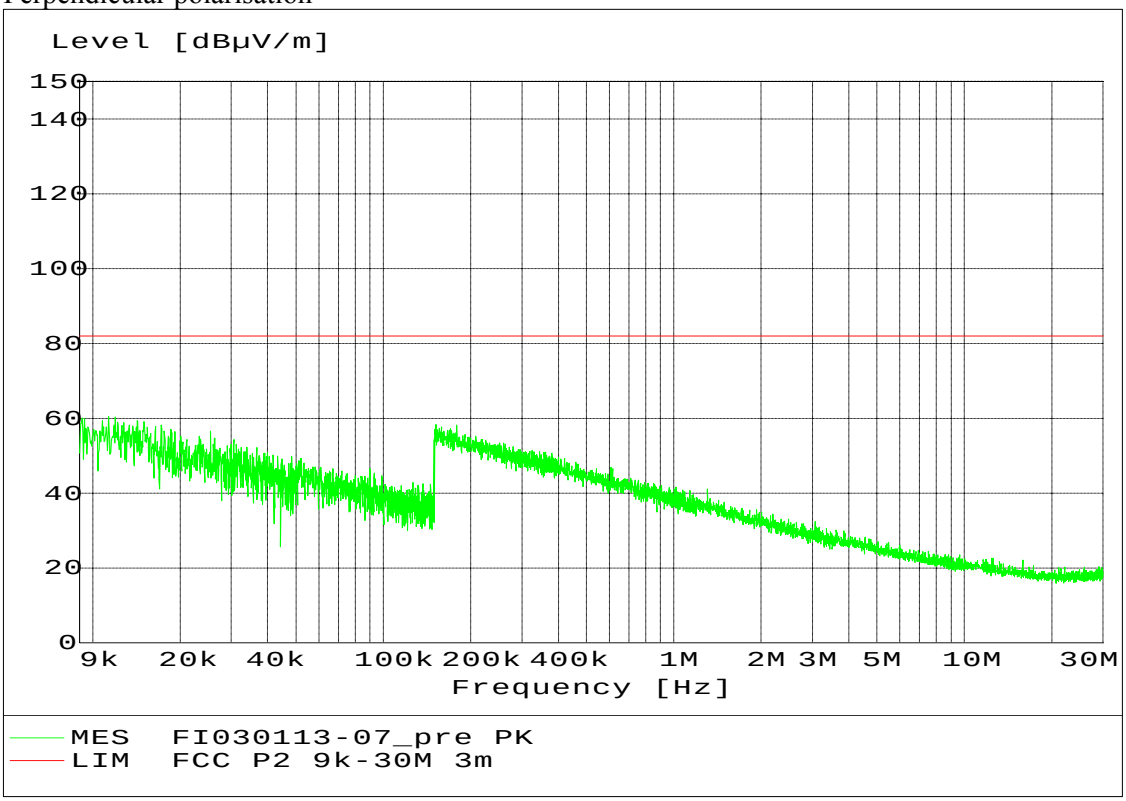
Sign:…..

Longitudinal polarisation

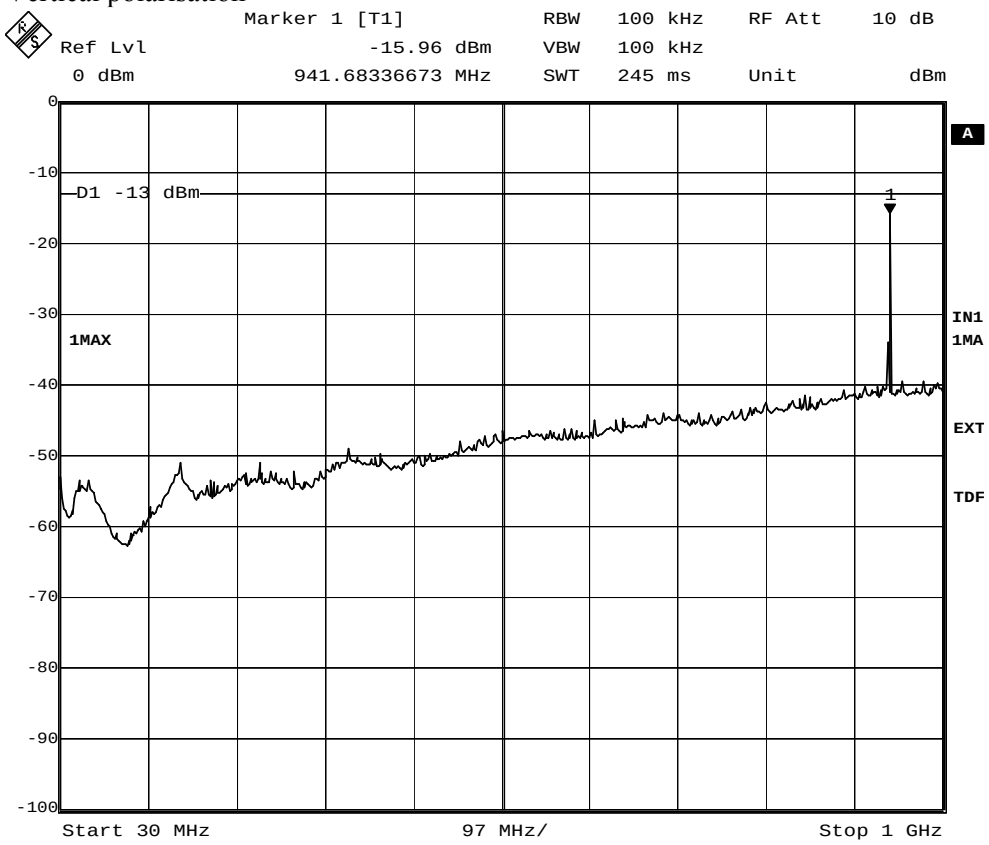


Perpendicular polarisation



Sign:…..

Vertical polarisation



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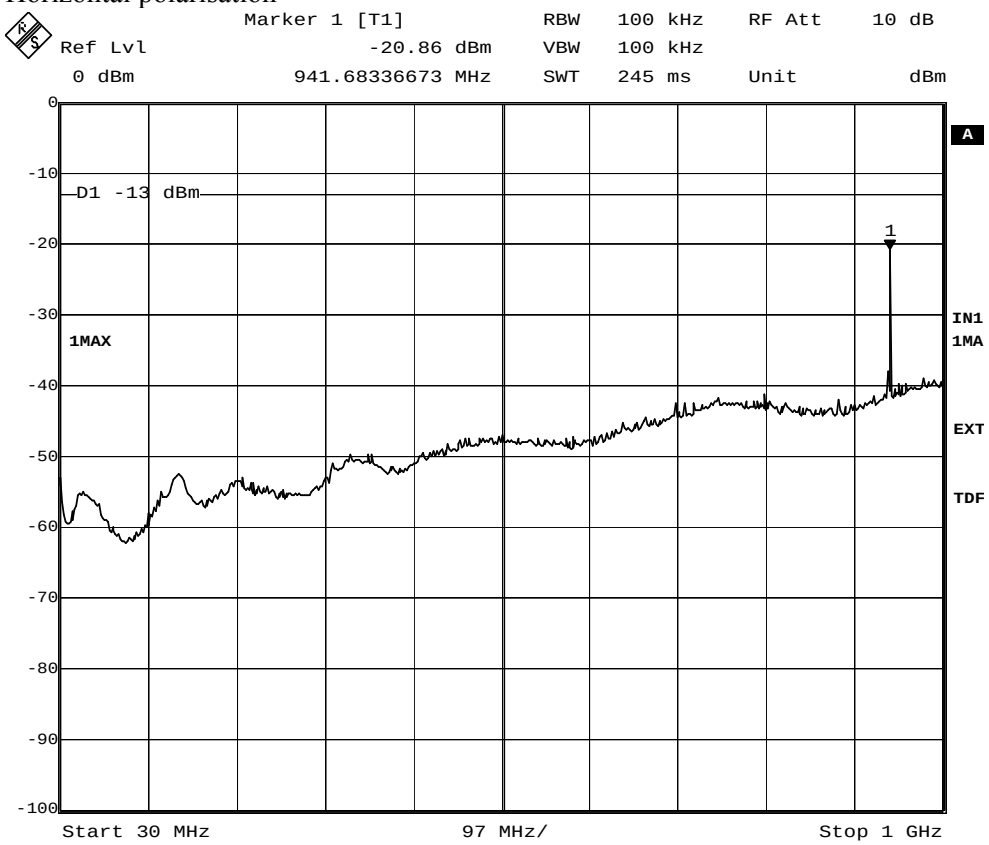

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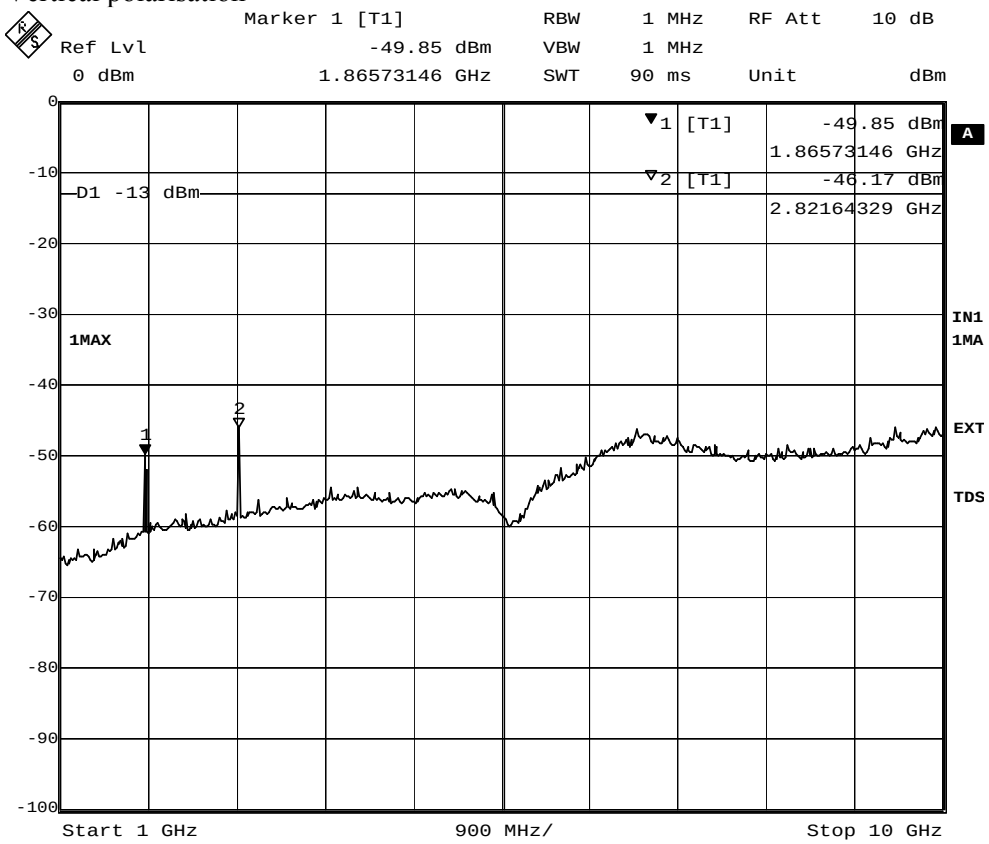

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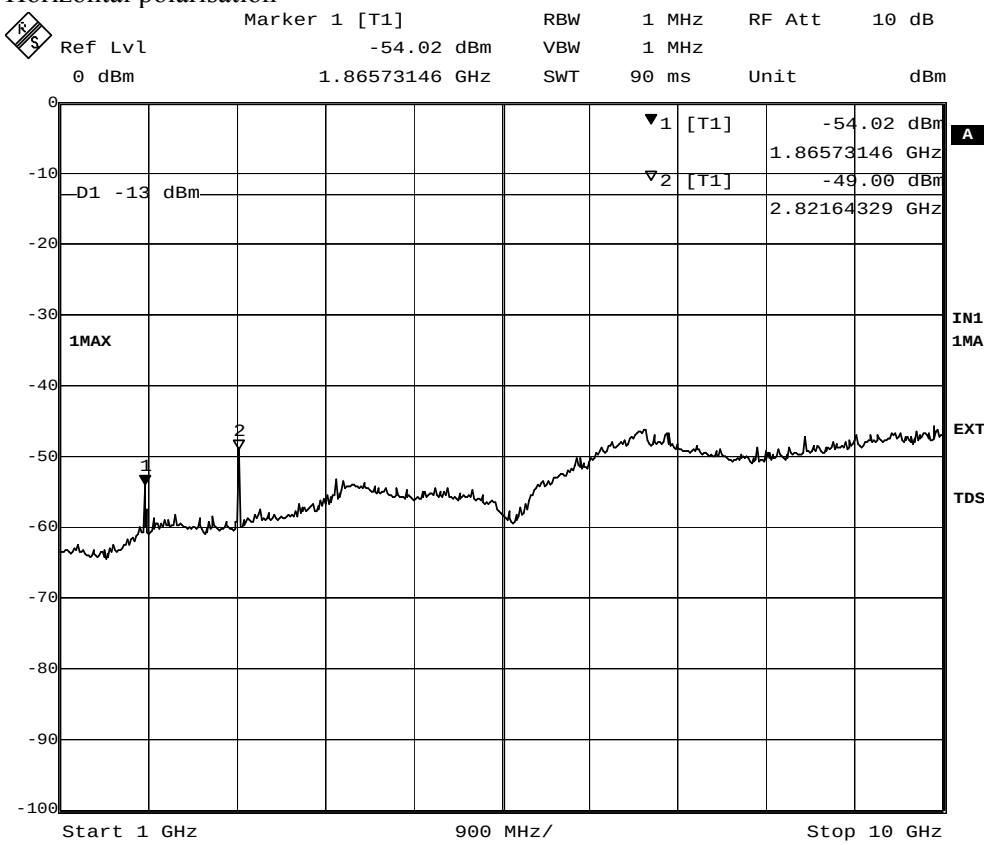

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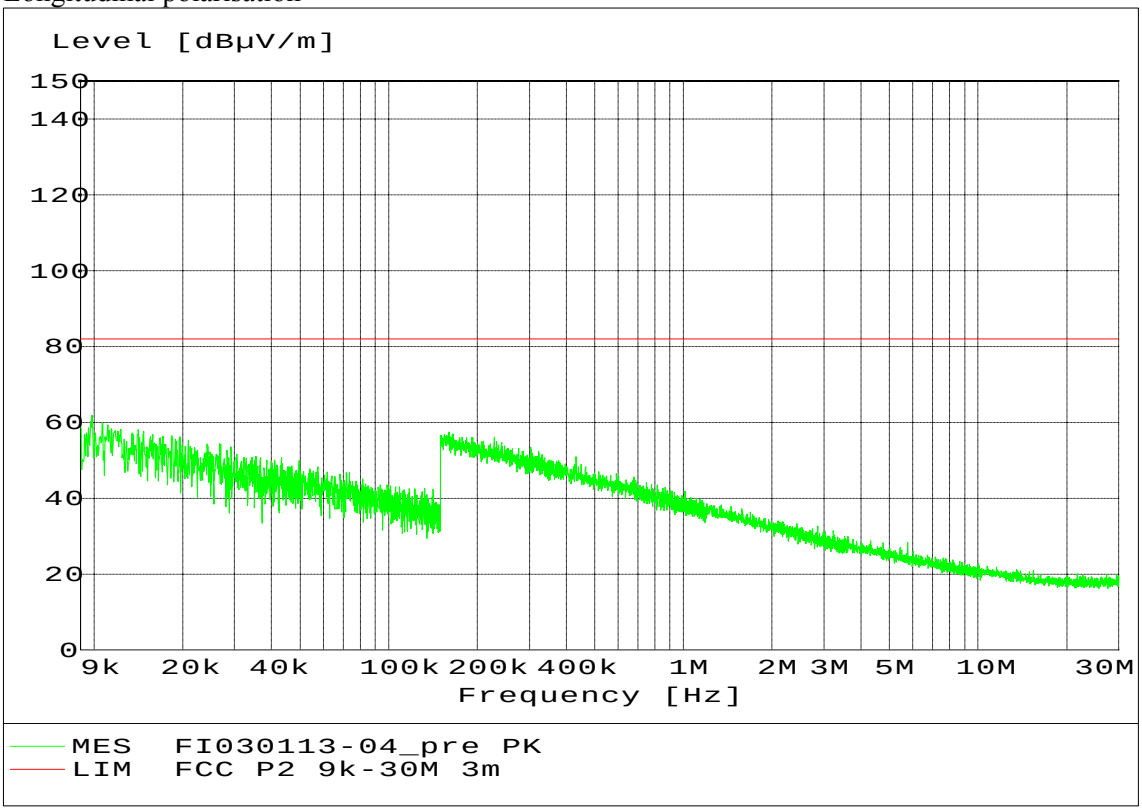
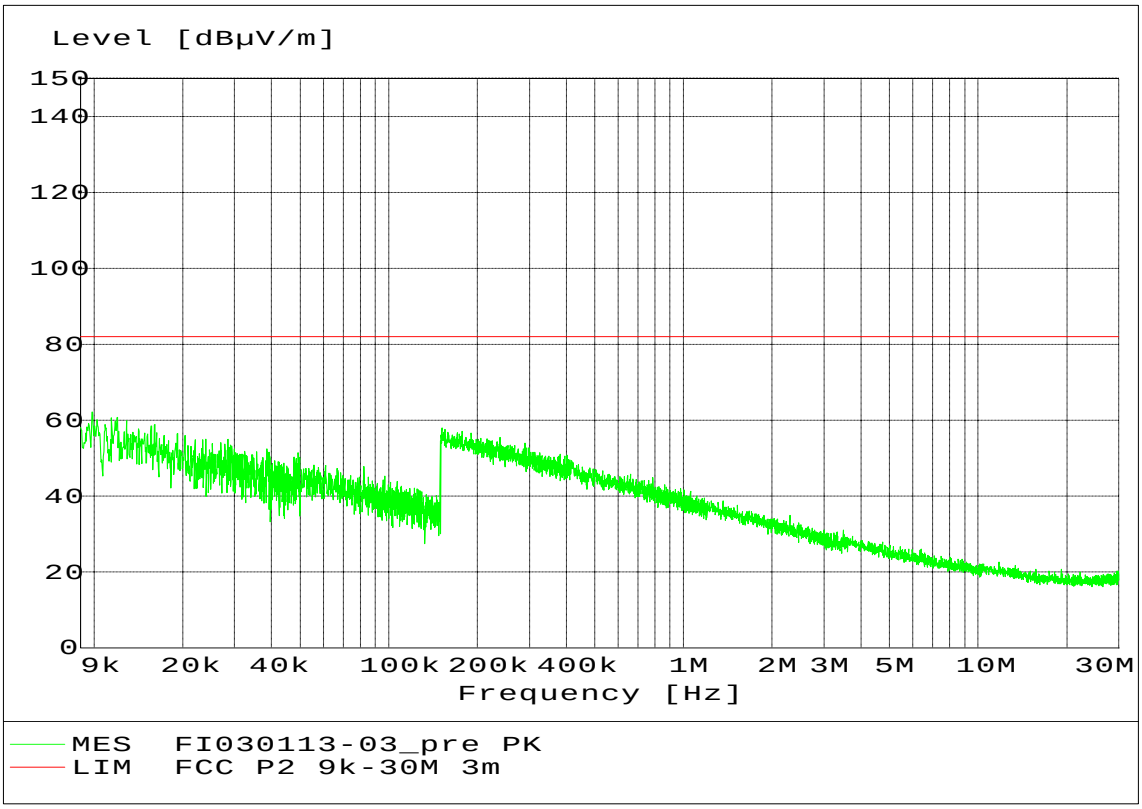
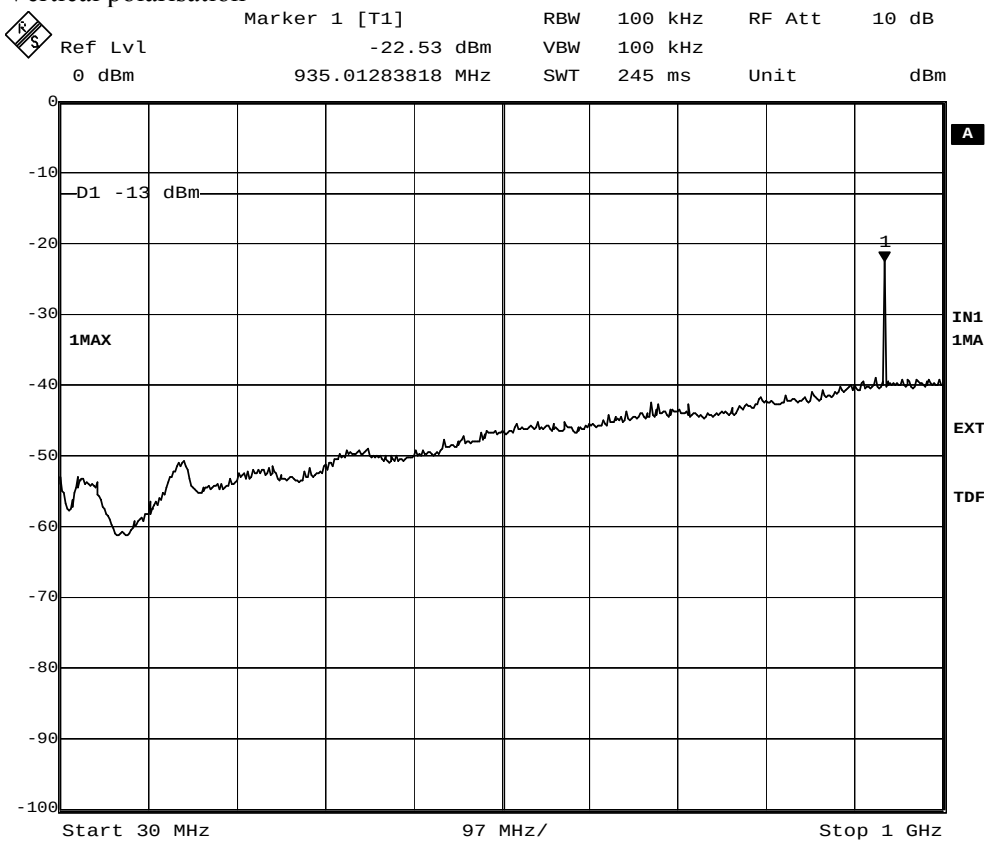
Longitudinal polarisation



Perpendicular polarisation



Vertical polarisation



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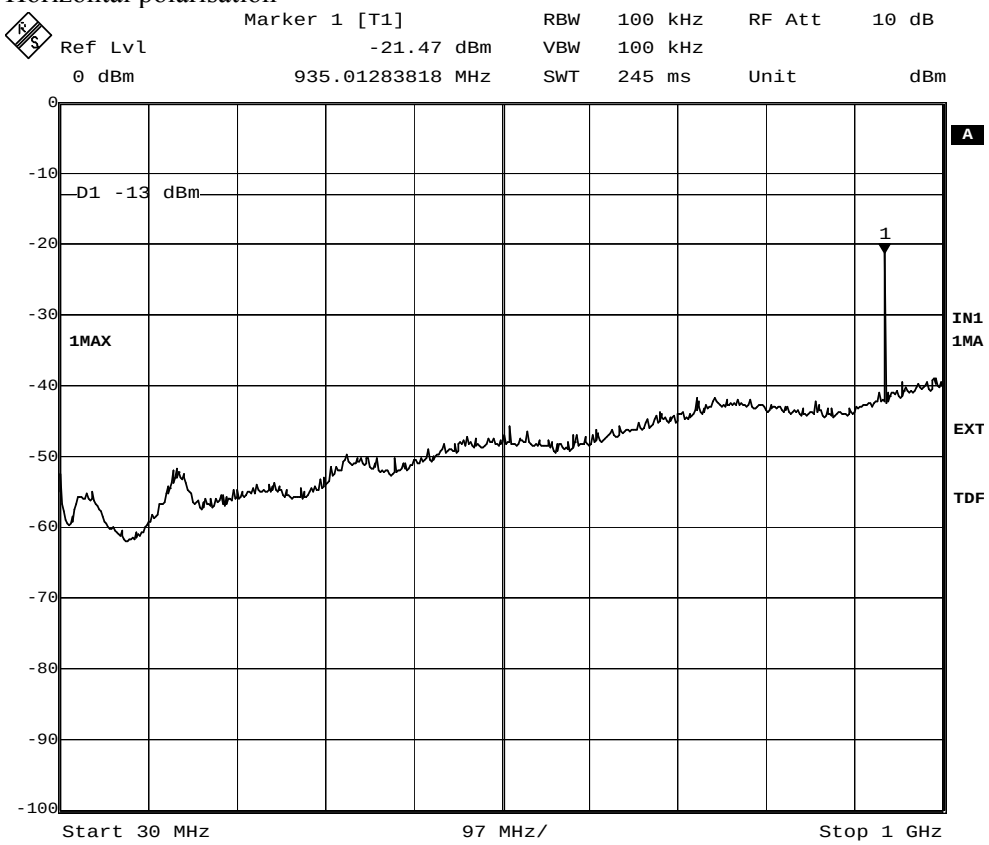
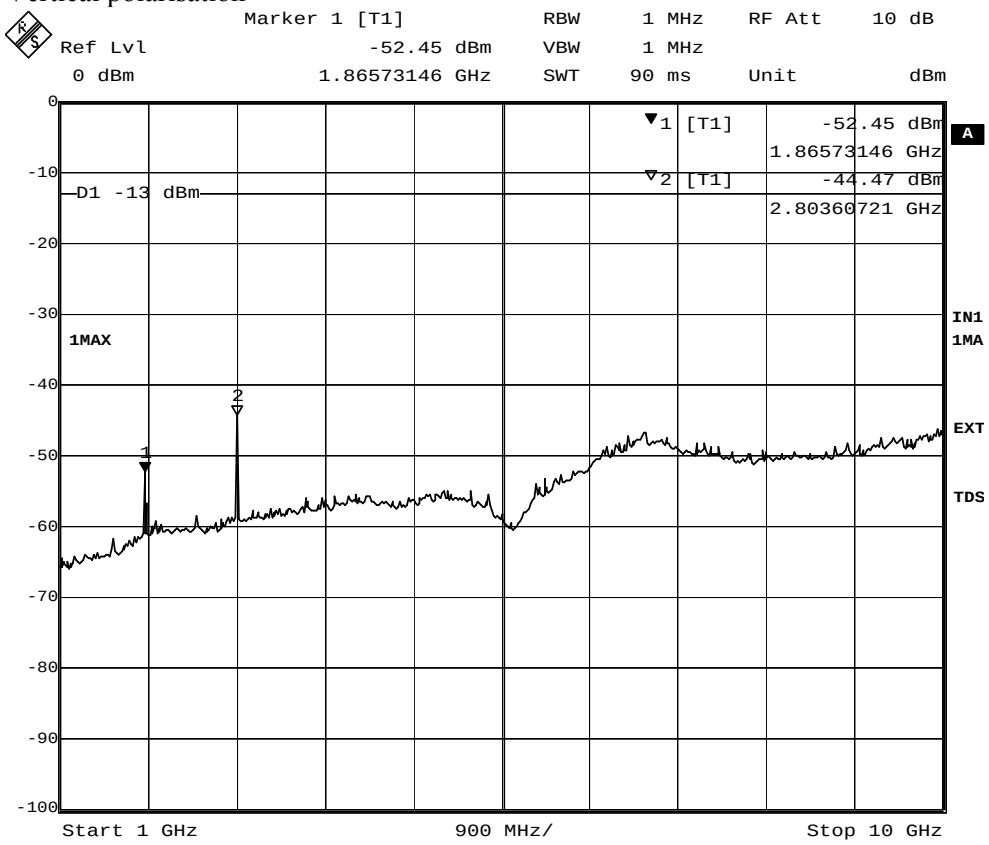


Date: 13.JAN.2003 10:04:51

Vertical polarisation



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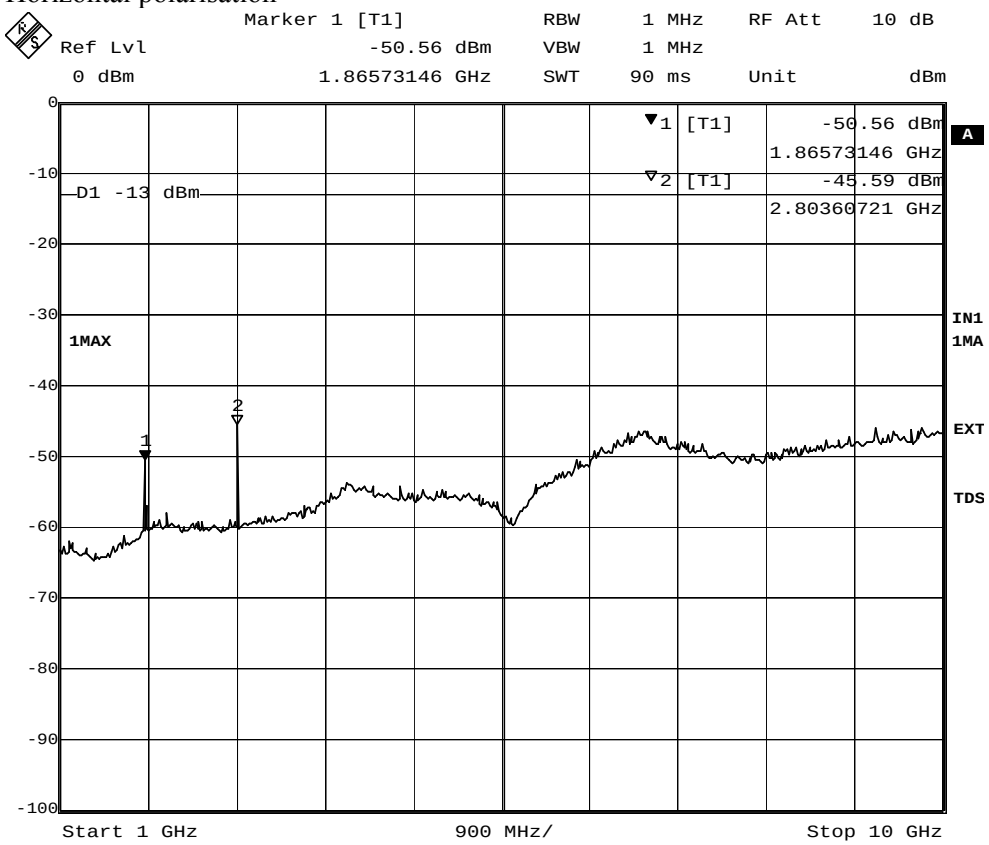
Horizontal polarisation



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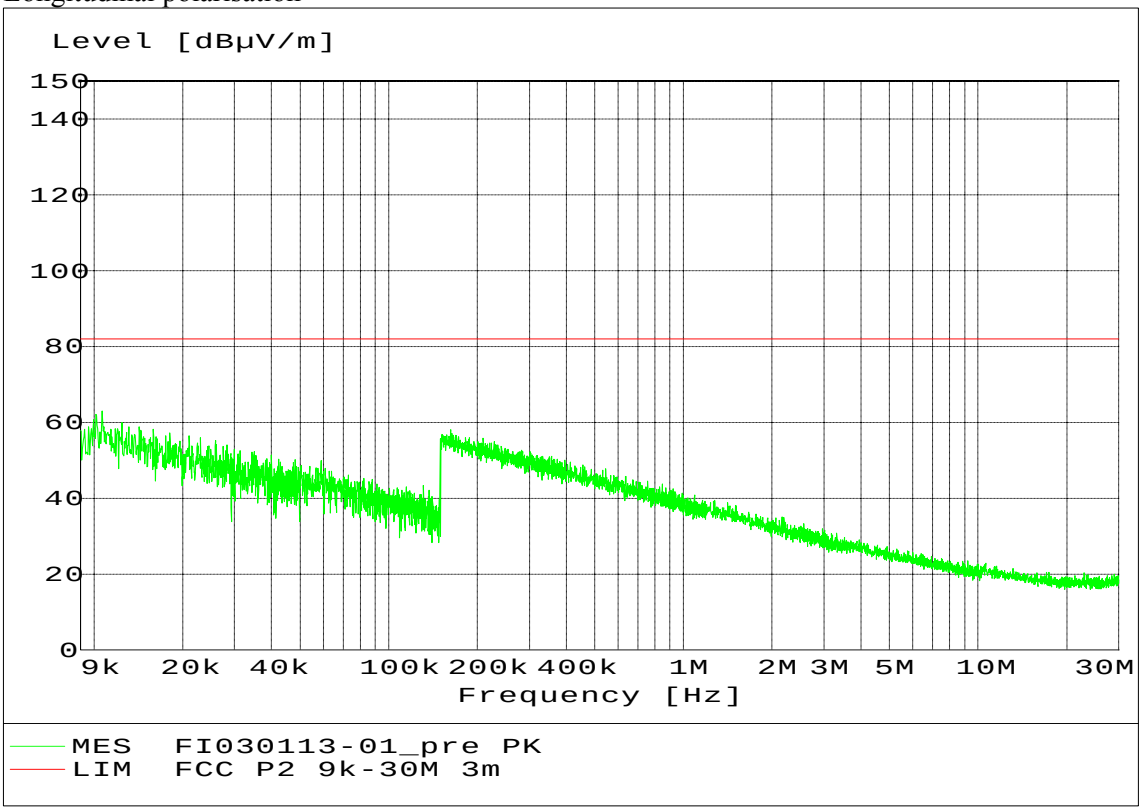
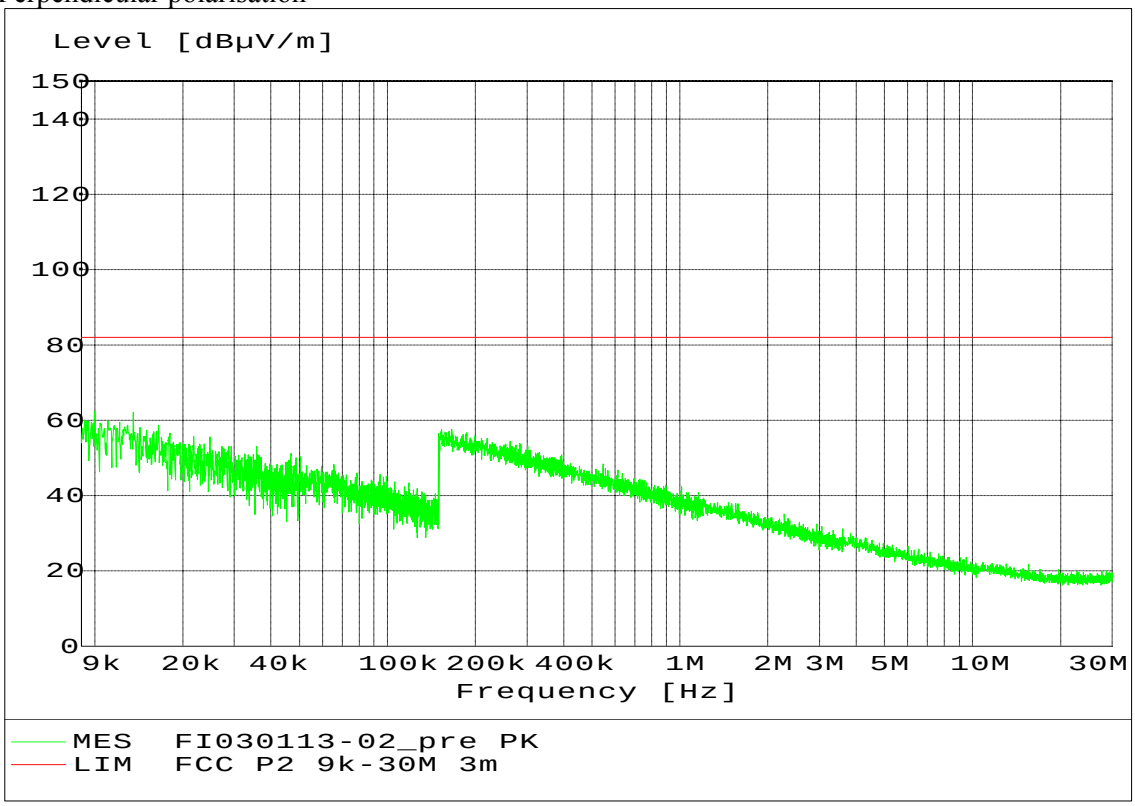
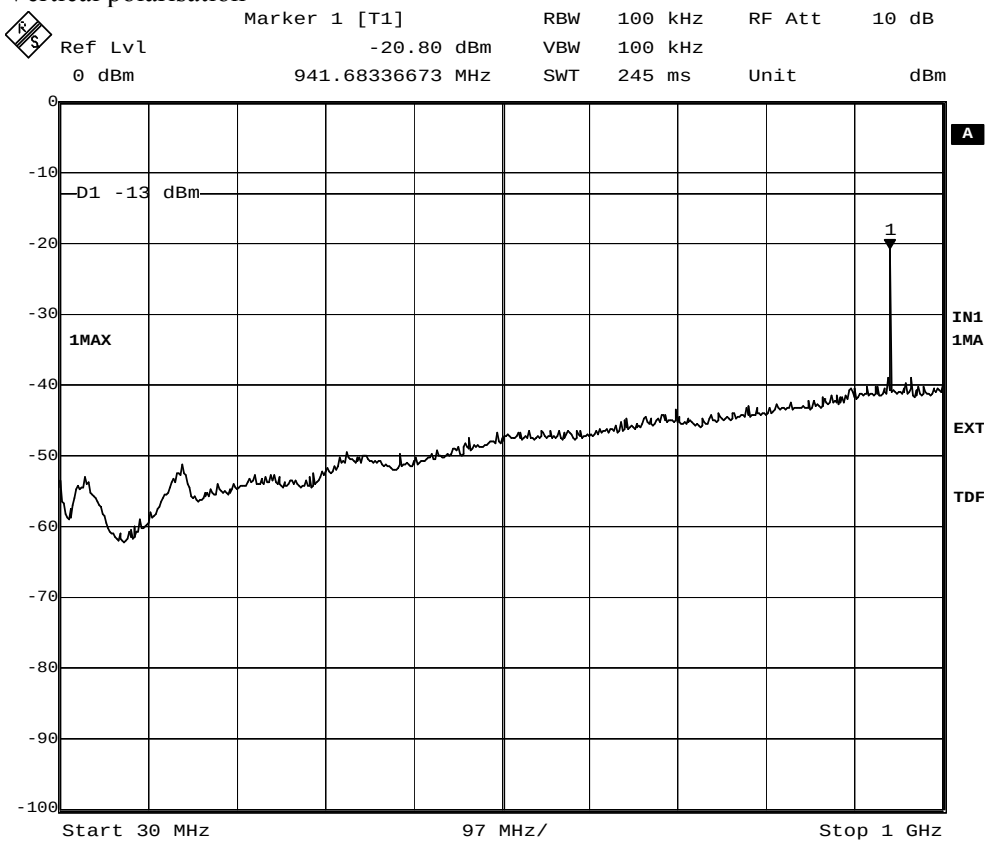
Longitudinal polarisation



Perpendicular polarisation



Vertical polarisation



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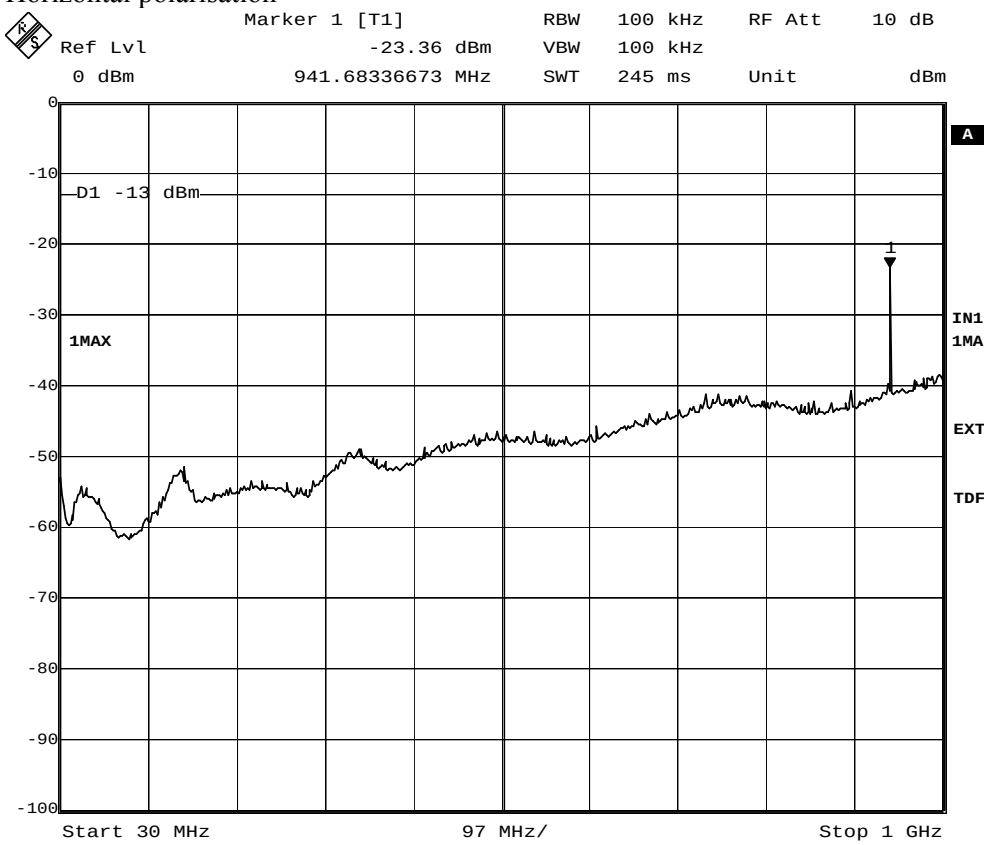
Horizontal polarisation



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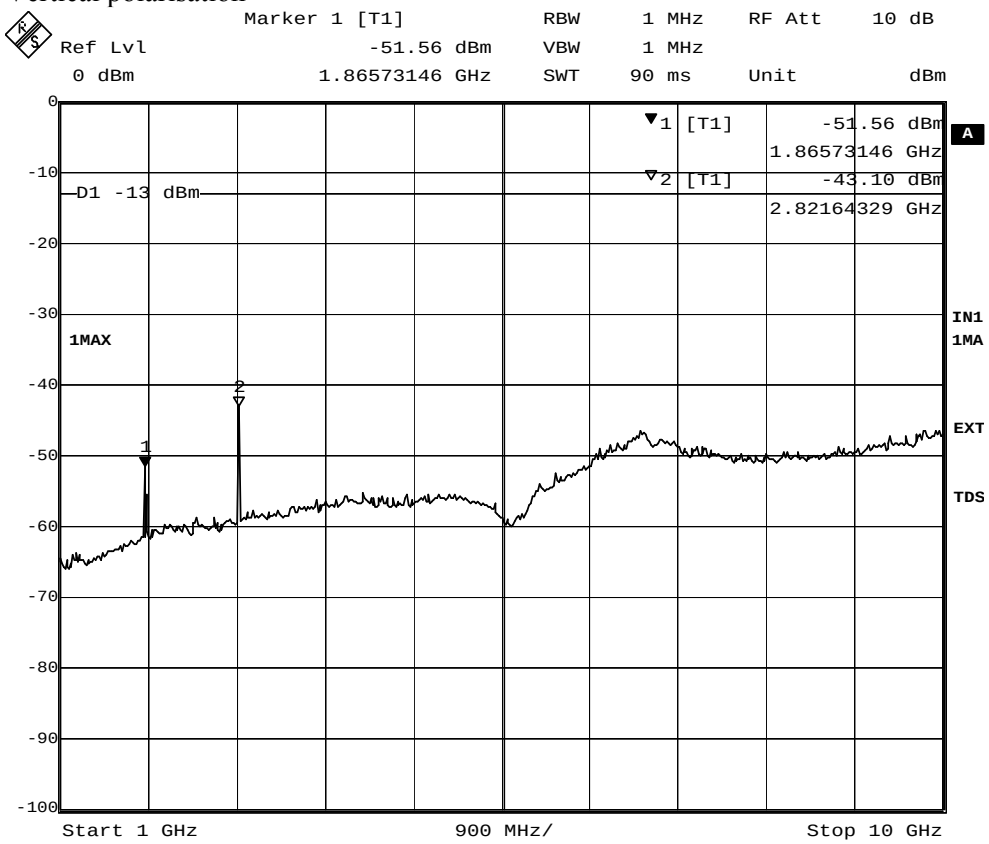
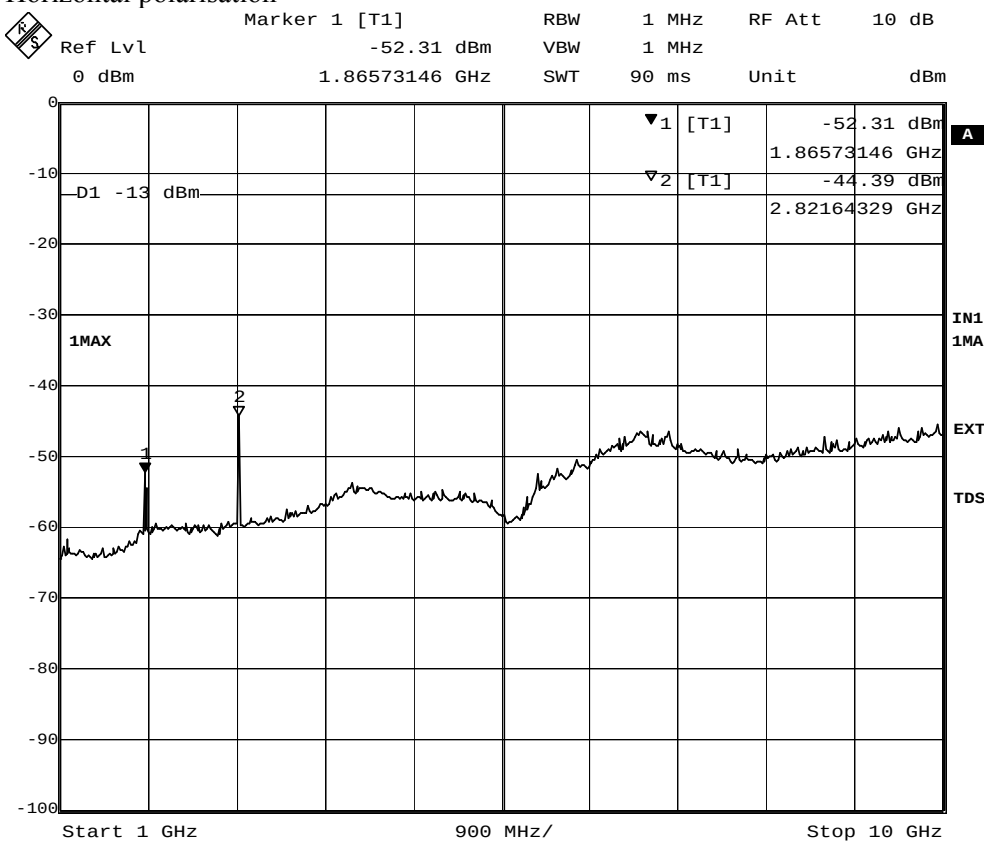
Vertical polarisation



Date: 13.JAN.2003 13:14:55

Horizontal polarisation



Date: 13.JAN.2003 13:08:18

Sign:…..

Frequency stability measurements according to 47CFR 2.1055/90.213

Date	Temperature (test equipment)	Humidity (test equipment)
2003-01-21	20 °C ± 3 °C	34 % ± 5 %
2003-01-22	21 °C ± 3 °C	38 % ± 5 %
2003-01-23	21 °C ± 3 °C	39 % ± 5 %

Test set-up and Procedure

The measurement test set-up was made per ANSI/TIA/EIA-603-1992. Measurements were made at output connector TX ANT. The output was connected to a spectrum analyser. The spectrum analyser was connected to an external 10 MHz reference standard during measurement. The test was performed without modulation.
During the measurements in extreme temperatures the battery-backup was switched off during the test.

Measurement equipment	Calibration Due	SP number
Climate chamber	2003-11	501 031
R&S ESI40	2003-08	503 125
Multimeter Fluke 87	2003-09	502 190
Testo 610, Temperature and humidity meter	2004-12	502 658

Results

Test object: **BRU3902-D**
Nominal Voltage 120 V AC
Channel 3800 (937.500 MHz)
Output power level at output connector TX ANT: 38.6 dBm

Test conditions		Frequency error (Hz)
Supply voltage AC (V)	T (°C)	Output TX ANT
120	+20	+7
102	+20	+7
138	+20	+7
120	+30	+7
120	+40	+4
120	+50	+8
120	+10	+9
120	0	+8
120	-10	+9
120	-20	+3
120	-30	+1
Maximum freq. error (Hz)		+9
Measurement uncertainty		$< \pm 1 \times 10^{-7}$

Sign:…..

Remark

At test at extreme temperature the measurement was performed 15 minutes after the EUT had been switched on in the transmit condition.
According to the client the EUT is specified to fulfil the frequency error after 30 minutes in the transmit condition.

Limits

The frequency Error shall be within ± 0.1 PPM (93.75 Hz).

Complies?	Yes

Photos

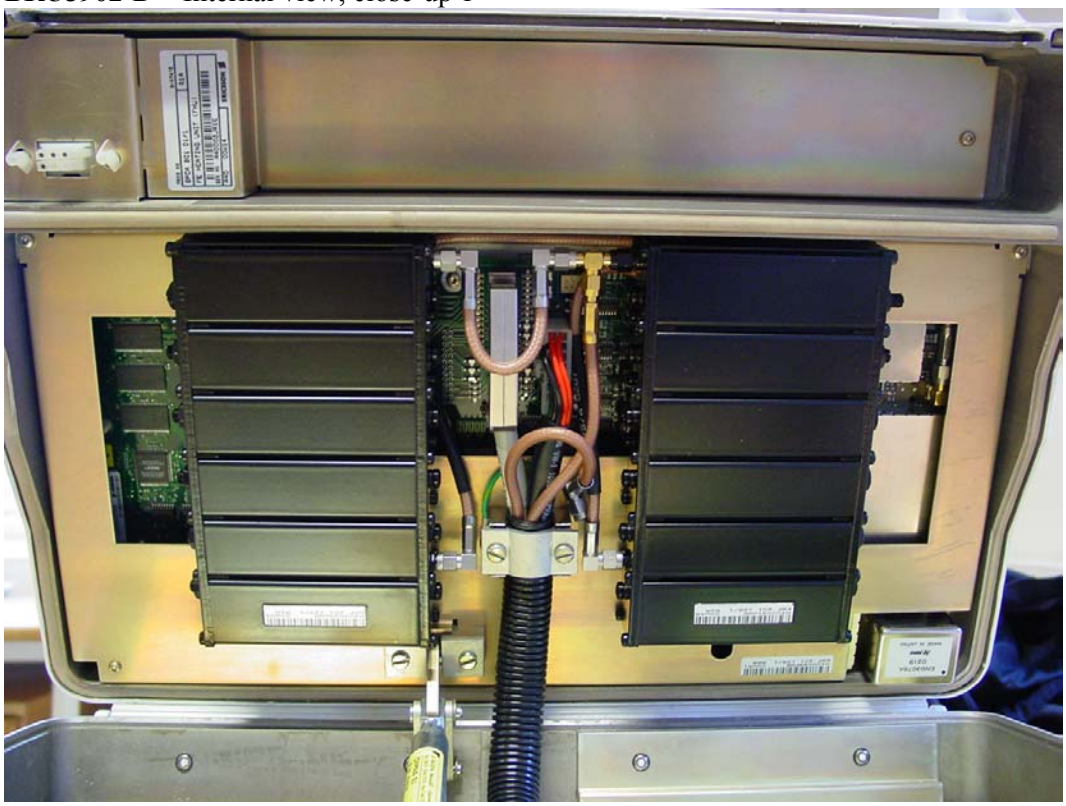
BRU3902-D - Front side

BRU3902-D - Rear side

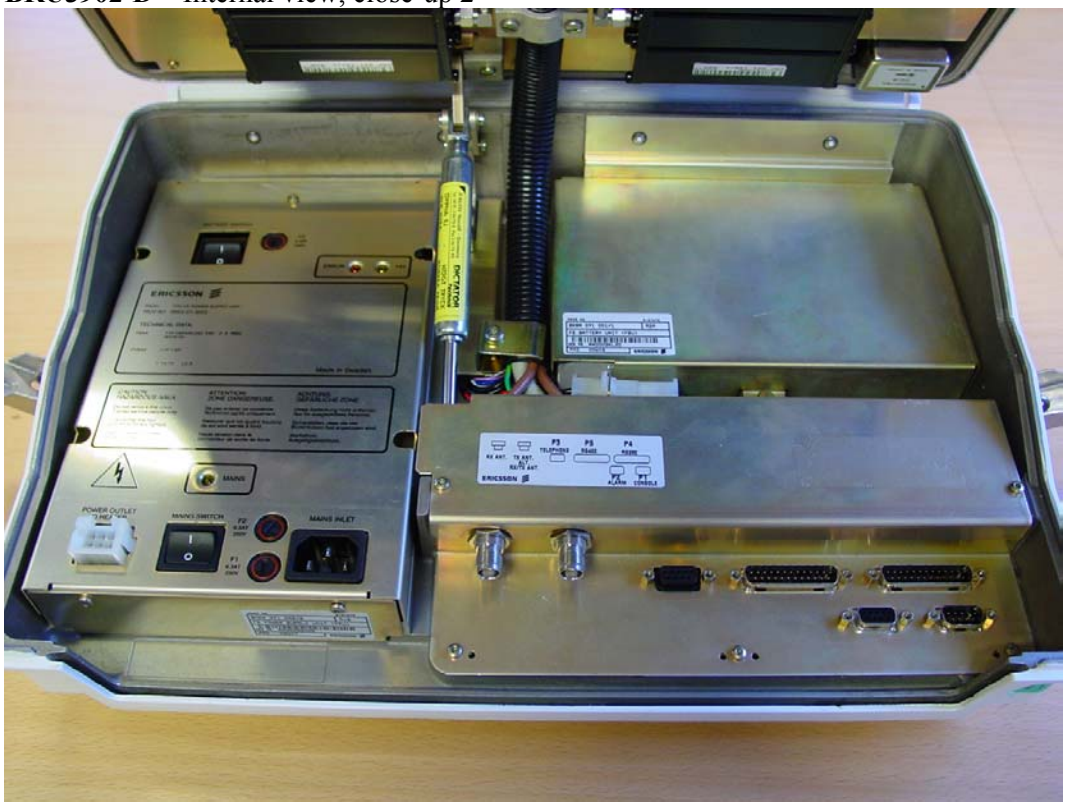
BRU3902-D - Identity

BRU3902-D – Internal view, overview

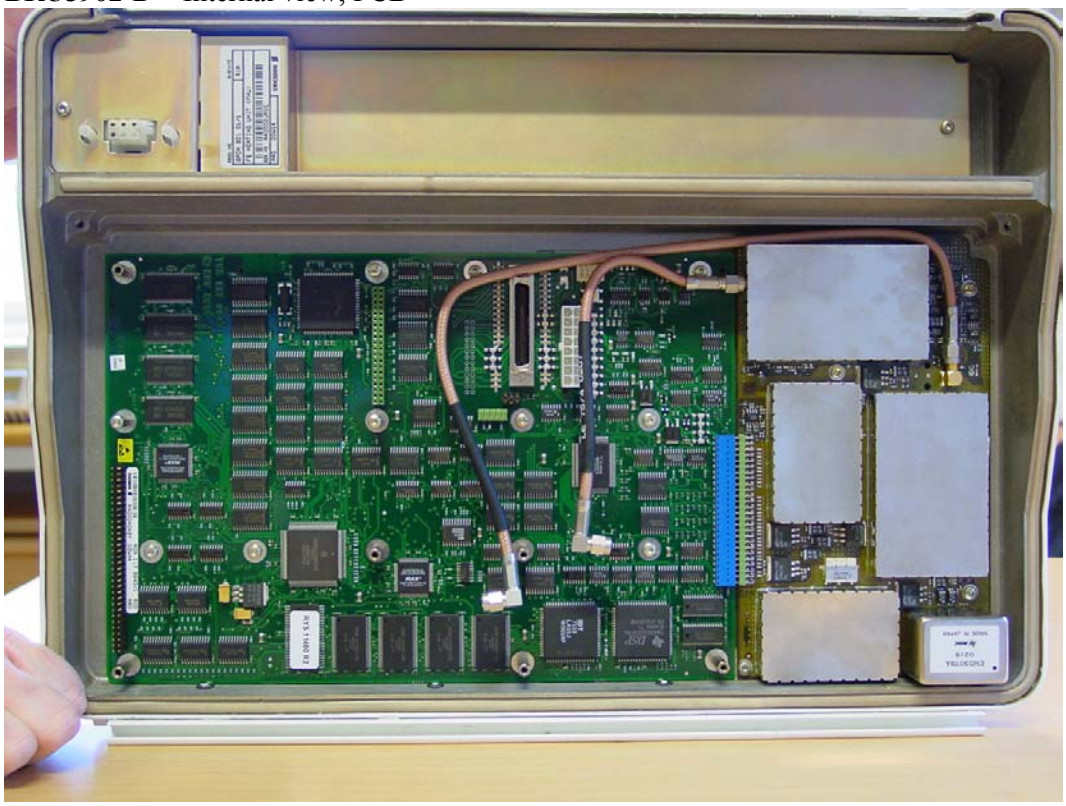
BRU3902-D – Internal view, close-up 1



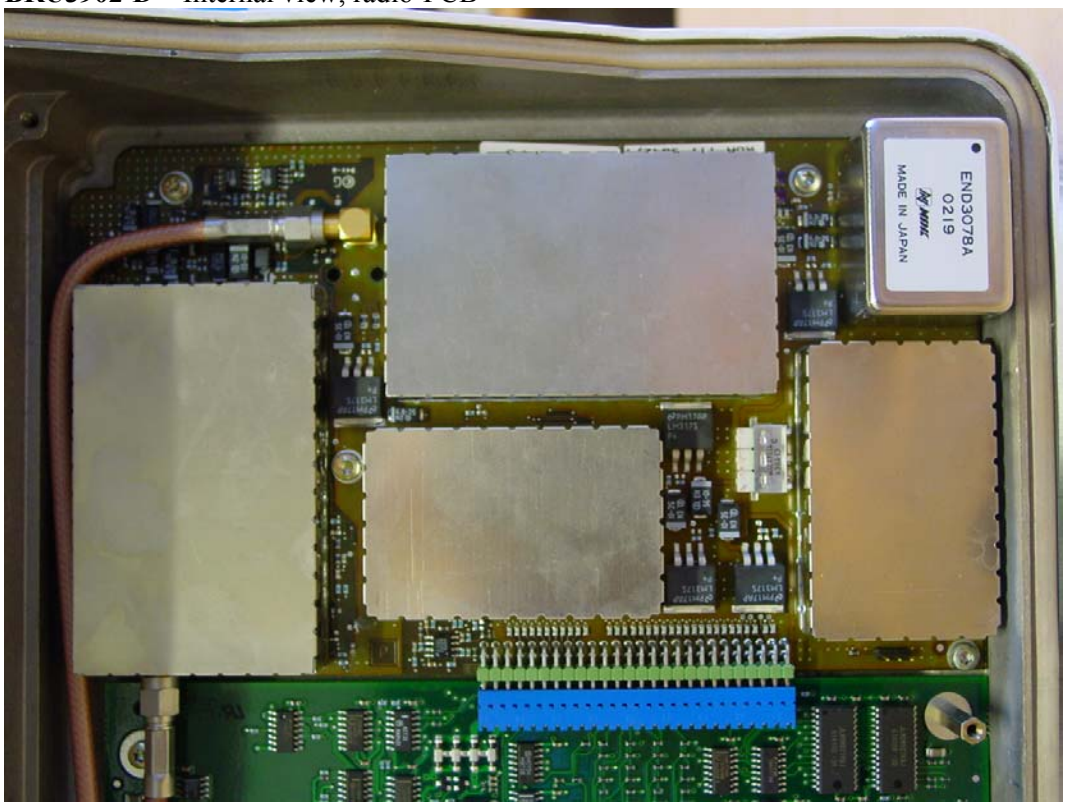
BRU3902-D – Internal view, close-up 2



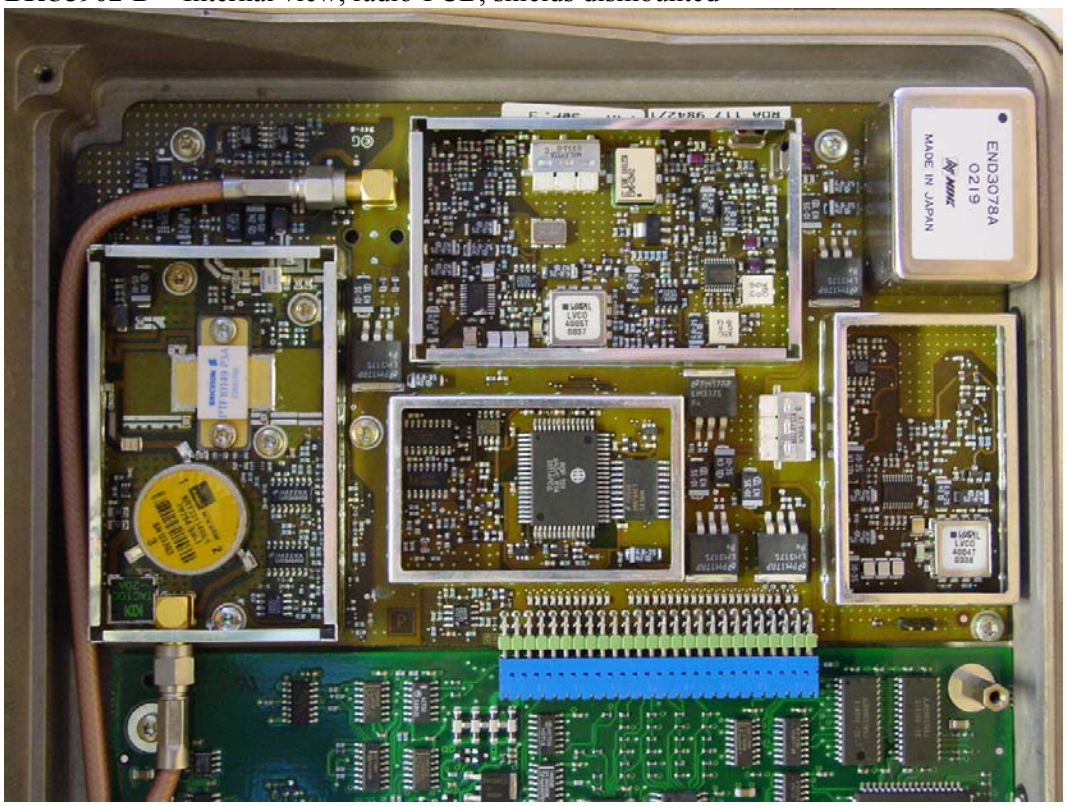
BRU3902-D – Internal view, PCB



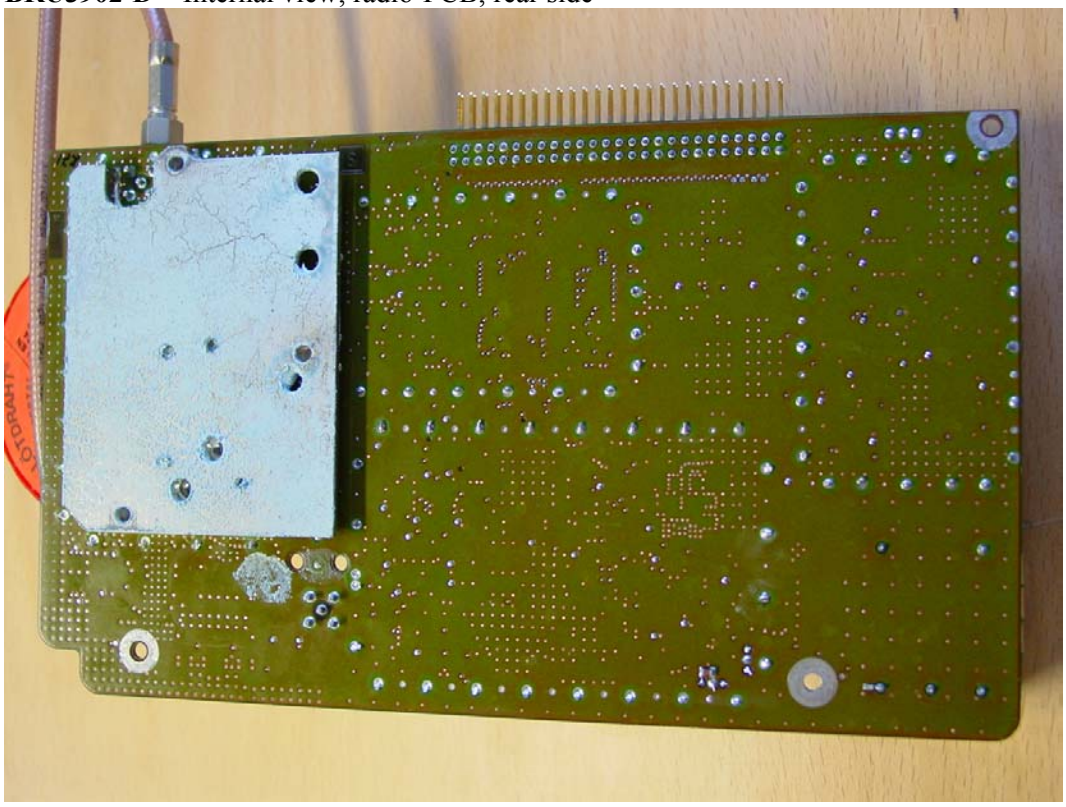
BRU3902-D – Internal view, radio-PCB



BRU3902-D – Internal view, radio-PCB, shields dismounted



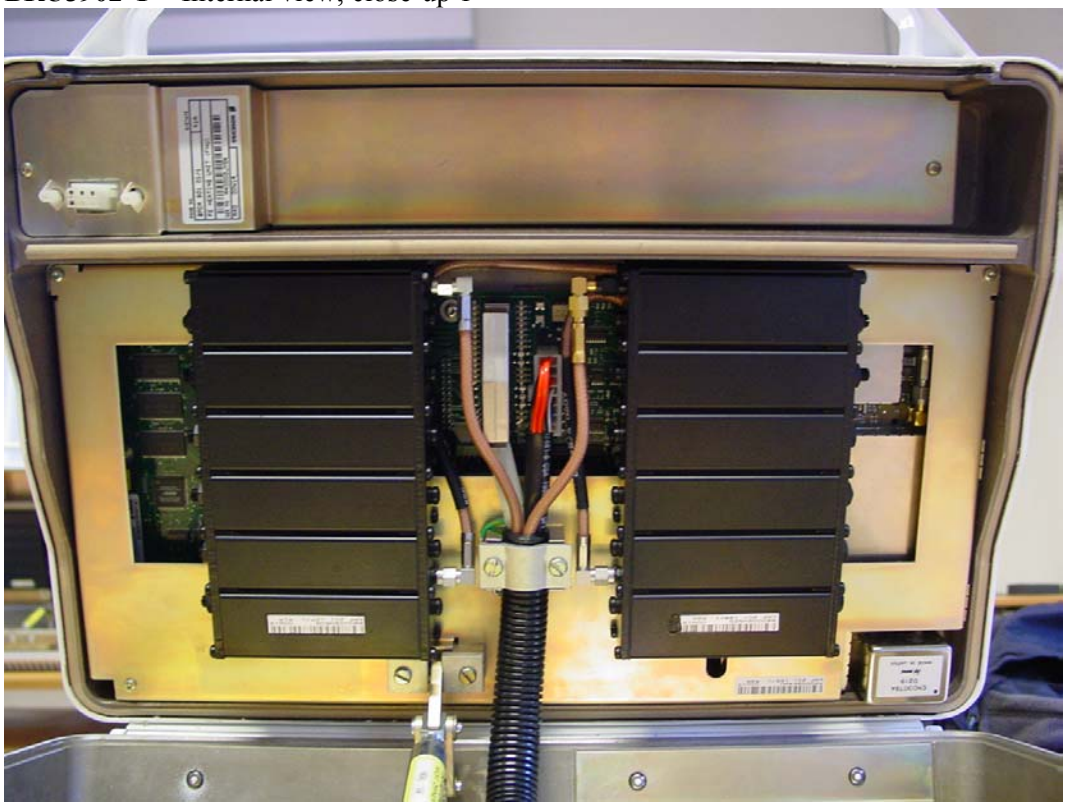
BRU3902-D – Internal view, radio-PCB, rear side



BRU3902-T - Identity

BRU3902-T – Internal view, overview

BRU3902-T – Internal view, close-up 1



BRU3902-T – Internal view, close-up 2