

Member of RWTÜV Group

Recognized by the
Federal Communications Commission and Industry Canada
Anechoic chamber registration No.: 90462 (FCC)
Anechoic chamber registration No.: 3463 (IC)
TCB ID: DE0001



Accredited by the
German Accreditation Council
DAR–Registration Number
TTI–P–G 081/94-D0



Independent ETSI
compliance test house



Test report No. 2-3470-01-01/03

Applicant: Fujitsu Ten Limited

Type: FTL 313

Test standard : FCC Part 15

FCC ID: BAB271000-313

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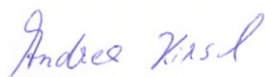
1 General information

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 .

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Tester :

Date	Name	Signature
2004-08-02	Andrea Kirsch	

Technical responsibility for area of testing:

Date	Name	Signature
2004-08-02	Harro Ames	



1.2 Testing laboratory

CETECOM ICT Services GmbH
Untertürkheimerstraße 6–10
D-66117 Saarbrücken
Germany

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e-mail : info@ict.cetecom.de
Internet : <http://www.cetecom.de>

Accredited testing laboratory

Accredited by : Regulierungsbehörde für Telekommunikation und Post (RegTP)
Listed by : Federal Communications Commission (FCC)
Industry Canada (IC)

Authority	Identification/Registration No.
RegTP	TTI-P-G 081/94-D0
FCC	90462
IC	3463

Testing location, if different from CETECOM ICT Services GmbH: (Not applicable)

1.3 Details of applicant

Name : Fujitsu Ten Limited
Street : 2-28, Goshō-dori 1-chome
Town : Hyogo-ku, Kobe 652-8510
Country : Japan
Phone : +81 78 682 2159
Fax : +81 78 671 7160

Contact person

Name : Mr. Keijiro Kumagai (UL Apex Co., Ltd.)
Phone : +81 596 24 8116
Fax : +81 596 24 8124
E-Mail : Keijiro.Kumagai@jp.ul.com

1.4 Application details

Date of receipt of application : 2004-07-21
Date of receipt of test item : 2004-07-21
Date of test : 2004-07-23 to 2004-07-29
Person(s) who have been present during the test : -/-

1.5 Test item (EUT)

Description	:	Field disturbance Sensor
Type designation	:	FTL313
Manufacturer		
Name	:	Fujitsu Ten Limited
Street	:	2-28, Gosho-dori 1-chome
Town	:	Hyogo-ku, Kobe 652-8510
Country	:	Japan

1.6 Technical data

Frequency range	:	24.075 GHz ... 24.175 GHz
Operational frequency	:	24.15 GHz
Field strength PEP	:	211.349 mV/m (CW), 180.302 mV/m (Pulse)
Type of modulation	:	10H0N0N (CW), 82M0P0N (Pulse)
Pulse duration	:	65µs
Pulse periode	:	500µs
Microwave modules	:	TX / RX – Module with integral antenna (patch antenna on the PC board)
Normal power supply (U nom)	:	12.0 V DC
Extreme DC power supply	:	8 V to 16V

1.6.1 Operation conditions

Operation:	:	As soon as the equipment is powered up, TX and RX start operating
Purpose of operation	:	Motion Sensor / Intrusion detection for vehicle

1.6.2 Equipment under test

FTL313

1.7 Test standards

Code of Federal Regulations (CFR 47)
Federal Communications Commission (FCC)

FCC Part 15 Radio Frequency Devices (08/2003)

SECTION 15.245
Operation within the band 24.075 GHz to 24.175 GHz

SECTION 15.205
Restricted bands of operation.

SECTION 15.209
Radiation emission limits, general requirements

2 Technical test

2.1 Summary of test results

- ☒ 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.

This test report :

- ☒ describes the first test
- ☐ describes an additional test
- ☐ is a verification of documents
- ☐ is only valid with the test report no.

2.2 Test environment

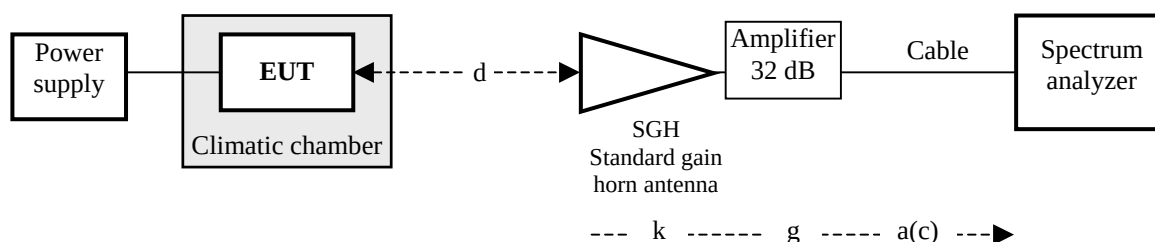
The environmental conditions are documented especially for each test.

2.3 Measurement and test set-up

The measurement and test set-up is defined in the technical specification .

2.4 Test equipment utilized and test set-up

2.4.1 Field strength measurement of fundamental and spurious radiation in the frequency range 0.9 GHz to 33 GHz



Frequency f [GHz]	Distance d [m]	Antenna factor k [dB(1/m)]	Amp.gain g [dB]	Cable loss a(c) [dB]
0.9 to 2.0	3.0	23.45	32.0	0.5 ... 0.7
2.0 to 4.0	3.0	23.68	32.0	0.7 ... 0.8
4.0 to 6.0	3.0	27.31	32.0	0.8 ... 1.2
6.0 to 8.0	3.0	30.06	32.0	1.2 ... 1.6
8.0 to 12.0	3.0	33.70	32.0	1.6 ... 2.0
12.0 to 18.0	3.0	33.97	32.0	2.0 ... 2.7
18.0 to 26.5	3.0	36.73	32.0	2.7 ... 3.0
26.5 to 33.0	3.0	40.29	32.0 to 28.0	3.0 ... 3.2

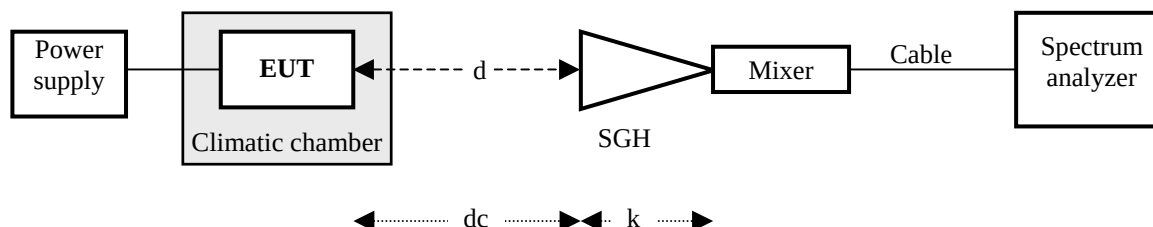
Calculation : Field strength = analyser reading + cable loss - amplifier gain + antenna factor
 $e \text{ [dB(}\mu\text{V/m)]} = u \text{ [dB(}\mu\text{V)]} + a \text{ [dB]} - g \text{ [dB]} + k \text{ [dB(1/m)]}$

Test equipment	Manufacturer	Type	CETECOM reference
Spectrum Analyser	HP	HP 8565E	300000916
SGH 1.0 to 2.0 GHz	flann	0624-10	300000225
SGH 2.0 to 4.0 GHz	narda	644	300000769
SGH 4.0 to 6.0 GHz	narda	643	300002447
SGH 6.0 to 8.0 GHz	narda	642	300000767
SGH 8.0 to 12.5 GHz	narda	640	300000784
SGH 12.0 to 18.0 GHz	narda	639	300000787
SGH 18.0 to 26.5 GHz	flann	2024-20	300001968
SHG 26.5 to 40.0 GHz	flann	2224-20	300001973
Amplifier 0.1 to 26.5 GHz	HP	HP 83017A	300002267
Climatic chamber	Vötsch	VUK 04/500	300000297
DC Power supply	HP	HP 6038A	300001174
RF-cable	Insulated Wire Inc.	KPS-1533-590	300002290

Measurement uncertainties

Test parameter	Measurement uncertainty
DC Power supply	±0.5 V
Temperature	±0.2 °C
Frequency	±0.01 ppm
eirp	±1.5 dB

2.4.3 Field strength and spurious radiation in the frequency range 33 GHz to 110 GHz



Frequency range [GHz]	Distance d [m]	Distance correction dc (3 m/Xm) [dB]	Antenna factor k [dB 1/m]
33.0 50.0	0.250	-21.60	39.00
50.0 75.0	0.125	-27.60	40.70
75.0 ... 110.0	0.125	-27.60	45.10

Calculation : Field strength = analyser reading + antenna factor - distance correction
 $e \text{ [dB}(\mu\text{V/m)}] = u \text{ [dB}(\mu\text{V)}] + k \text{ [dB(1/m)}] - d \text{ [dB]}$

Remark: Cable loss is automatically taken into account if the S.A. is operating with external mixers

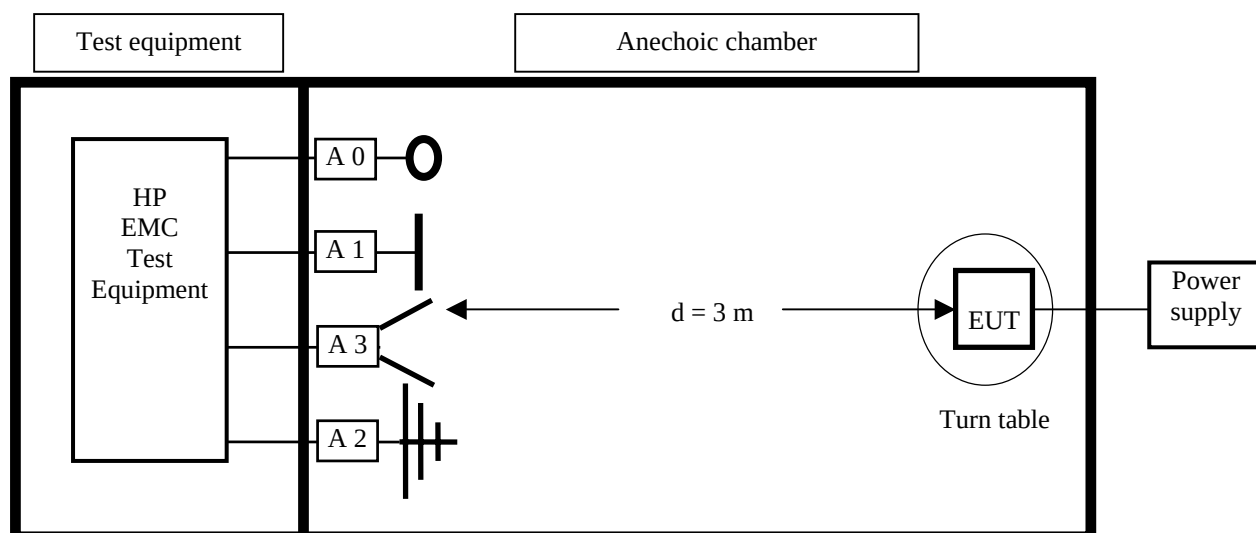
Test equipment	Manufacturer	Type	CETECOM reference
Spectrum Analyser	HP	HP 8565E	300000916
Power supply	HP	HP 6038A	300001174
SGH 33 ... 50 GHz	Thomson	COR 33_50	300000812
Mixer 33 ... 50 GHz	HP	11970Q	300000781j
SGH 50 ... 75 GHz	Thomson	COR 50_75	300000789k
Mixer 50 ... 75 GHz	HP	11970V	300000871o
SGH 75 ... 110 GHz	Thomson	COR 75_110	300000789m
Mixer 75 ... 110 GHz	HP	11970W	300000871v

Measurement uncertainty

Test parameter	Measurement uncertainty
Power supply	±0.1 VDC
Temperature	±0.2 °C
Frequency	±0.01 ppm
Field strength <50 GHz	±1.0 dB
Field strength >50 GHz	±3.0 dB

2.4.2 Field strength and spurious radiation in the frequency range 9 kHz to 12 GHz

Set-up for radiated measurements



Test equipment	Manufacturer	Type	Serial No.
Spectrum analyser	HP	HP 85660B	2478A05306
Analyser display	HP	HP 85662A	2816A16541
Quasi peak adapter	HP	HP 85650A	2811A01131
RF-preselector	HP	HP 85685A	2833A00768
Loop Antenna A 0	R&S	HFH 2-Z2	881 058/42
Biconical antenna A 1	Emco	3104	3758
Log.-per.-antenna A 2	Emco	3146	2304
Double ridge horn ant. A 3	Emco	3115	3007
Relay switch	R&S	RSU	375 339/002
High pass filter	FSY Microwave	HM 985955	001
Amplifier	Tron-Tech	P42-GA29	B2302
DC Power supply	HP	HP 6038A	300001174
RF-cable	HP	5061-5359	P36303

Measurement uncertainties

Performance	Measurement uncertainty
Input power (DC)	±0.5 V
Temperature	±0.2 °C
Frequency	±0.01 ppm
RF-power	±1.5 dB

2.5 Test results

2.5.1 Test results overview

This test was performed :

☐ in addition to the test report no.

Verification of EUT :

☒ EUT is in accordance with the technical description

☐ EUT is not in accordance with the technical description

☒ The equipment is compliant to FCC requirement

2.5.2 Remarks on methods of measurements

The EUT is positioned in a non-conductive test fixture and can be rotated and tilted in all angles and in all planes.

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 110 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas conform with specifications ANSI C63.2-1987 clause 15 and ANSI C63.4-1992 clause 4.1.5. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test set-ups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received.

The wanted and unwanted emissions are received by spectrum analysers where the detector modes and resolution bandwidths (RBW) over various frequency ranges are set according to requirement ANSI C63-4-1992 clause 4.2.

1. Measurements of ERP/EIRP at fundamental and spurious frequencies

Spurious frequencies are produced by transmitter and receiver when the EUT is active. According to FCC requirements 15.209, spurious emissions have to be investigated as maximum field strength values in the frequency range from 9 kHz to 960 MHz. Where possible, the measurement distance shall be 3 m. If other distances are used, the distance correction is added to the test result.

In the low frequency range (9 kHz to 30 MHz), the receiving antenna is an active loop antenna which is positioned at 3 m distance in a shielded, anechoic chamber (see page 8). In case of required measuring distances > 3 m, a distance correction factor is used to calculate the received field strength.

Spurious EIRP measurements in the frequency range 960 MHz to 4 GHz are carried out in a shielded semi-anechoic test chamber. The measurement distance is 3.0 m.

In the frequency range 4 GHz to 40 GHz, spurious EIRP measurements are performed in a shielded fully anechoic chamber with rectangular SGH's. The measurement distances are indicated underneath each plot, and a calculation for field strength is added, where all relevant factors like cable losses, antenna factors, etc are taken into account.

2.5.3 Test results in details

Equipment under test (EUT) : see page 5
 Ambient temperature : 23 °C
 Relative humidity : 55 %

TRANSMITTER PARAMETERS

SECTION 15.245

Fundamental frequency

Microwave module : FTL313 operating in N0N and P0N

Test condition t = 23.0 ° C	TRANSMITTER FIELD STRENGTH			
EUT operating: TX on and RX on DC power supply	Frequency f [GHz]	S.A. e [dBμV/m] @ 3 m	Field strength e [dBμV/m] @ 3 m	See plot no.:
U DC = 12.0 V (CW)	24.14	106.34	106.34	1 / 3
(Pulse)	24.14	105.12	105.12	2

REFERENCE OF TEST EQUIPMENT USED : see test set-up on page 8 / 9

LIMITS:

SECTION 15.245

Frequency range (MHz)	Measurement distance [m]	Field strength e [dBμV/m] @ 3 m	Field strength E [μV/m]
24,075 to 24,175	3	128.0	2 500 mV/m
Harmonics	3	54.0	25 mV/m

Verdict : Field strength limits are kept

Equipment under test (EUT) : see page 5
 Ambient temperature : 23 °C
 Relative humidity : 55 %

TRANSMITTER PARAMETERS Spurious Frequencies

SECTION 15.245
 SECTION 15.205 / 15.209

Microwave module : FTL313 operating in NON

Test condition t = 23.0 ° C	TRANSMITTER SPURIOUS FIELD STRENGTH			
Frequency range [GHz]	Spurious frequencies [GHz]	S A u [dBμV/m]	E [μV/m]	See plot no.:
0.009 to 30.0 MHz (h + v) horizontal and vertical plane	noise	n.a.	< Limit	4
0.030 to 4.0 (h + v)	0.04022 0.08013 0.09416 0.10034 0.12030 0.14058 0.18038 0.22149	24.5 33.4 26.3 28.9 26.2 30.9 26.3 27.2	< Limit	5
4.0 to 12.0 (h + v)	noise	n.a.	< Limit	6
12.0 to 17.8 (h + v)	noise	< 48.8	< Limit	7
17.8 to 26.5 (h + v)	noise + carrier	< 50.8	< Limit	8 - 9
26.5 to 33.0 (h + v)	noise	< 52.6	< Limit	10
33.0 to 50.0 (h + v)	noise + 48.2717 (2 nd Harmonic)	59.08	< Limit	11 - 12
50.0 to 75.0 (h + v)	noise + 72.416 (3 rd Harmonic)	54.66	< Limit	13 - 14
75.0 to 110.0 (h + v)	noise	< 48.0	< Limit	15

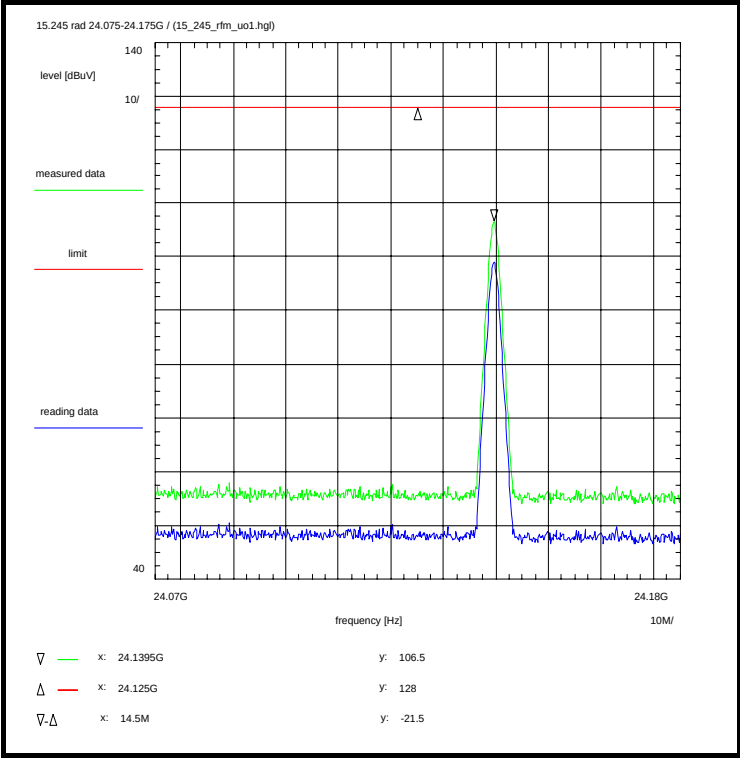
LIMITS:

SECTION 15.205 / 15.209 / 15.245

Frequency range (MHz)	Measurement distance [m]	Field strength e [dBμV/m] @ 3 m	Field strength E [μV/m]
0.009 – 0.490	300	88.5 ... 53.8	2400/F(kHz)
0.490 – 1.705	30	53.8 ... 43.0	24000/F(kHz)
1.705 – 30.0	30	49.5	30
30.0 – 88.0	3	40.0	100
88.0 – 216.0	3	43.5	150
216.0 – 960.0	3	46.0	200
> 960.0	3	54.0 (AV)	500
> 960.0	3	74.0 (PK)	5,000
Harmonics	3	68.0	2,500
Harmonics >17,700	3	77.5	7,500

Verdict : Field strength limits are kept if EUT is operating inside metal tanks

3 Plots, graphs and data sheets: Measurement result no. 1 (17)



Information on the measurement:

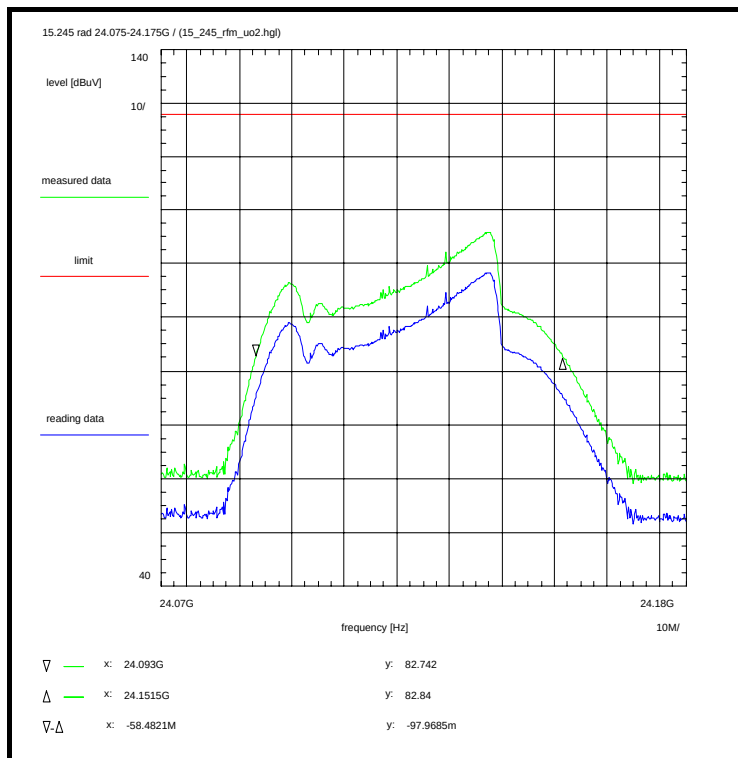
<u>Environment condition:</u>	
Date & Time:	Tue 27/Jul/2004 13:57:49
Location:	CETECOM ICT Services GmbH, Laboratory RSC-Sat
Temperature:	23 °C
Humidity:	55 %
Voltage:	232 Vac
<u>Setup of measurement equipment:</u>	
Start frequency:	24.075 GHz
Stop frequency:	24.175 GHz
Center frequency:	24.125 GHz
Frequency span:	100 MHz
Input attenuation:	10 dB
Resolution-BW:	1 MHz
Video-BW:	1 MHz
Video-Average:	1 sweep(s) (>1)
Detector-Mode:	0 Normal (Clear-Write)
<u>Correction (average):</u>	
Directional coupler	+ 0.0 dB
Coaxial cable (C217)	+ 2.8 dB
DUT-Antenna	+ 0.0 dBi
Test antenna (antenna factor)	+ 36.7 dB
BW correction factor	+ 0.0 dB
Atten. between HPA and feedhorn	- 0.0 dB
amplifier Gain	- 32.0 dB
TOTAL CORRECTION:	+ 7.5 dB
<u>Limit:</u>	
no limits defined	
This test serves to verify the general function of the EUT and for orientation regarding to the spurious emissions which are expected within the band, furthermore for comparison of the actual power with the rated value at cw-carrier adjusted in the middle of the band (EIRP).	

Remarks:
Test of general function of the EUT and measurement for orientation

Field strength = analyser reading + cable loss - amplifier gain + antenna factor
e [dB(μV/m)] = u [dB(μV)] + a [dB] - g [dB] + k [dB(1/m)]

<u>Subclause:</u> 15.245)	Field strength of fundamental frequency rf-carrier Radiation measurement within the band
<u>Test results:</u> see plot (an explicit table was not generated)	
<u>Operating condition of DUT:</u> operating condition 1	
<u>Test setup:</u> see page 8	
<u>Test equipment:</u> see page 8	
<u>Data of correction:</u> see page 8	
<u>Remark:</u>	
<u>Test result:</u>	Test of general function of the EUT

Measurement result no. 2 (17)



Information on the measurement:

Environment condition:

Date & Time: Tue 27/Jul/2004 14:37:51
 Location: CETECOM ICT Services GmbH, Laboratory RSC-Sat
 Temperature: 23 °C
 Humidity: 55 %
 Voltage: 232 Vac

Setup of measurement equipment:

Start frequency: 24.075 GHz
 Stop frequency: 24.175 GHz
 Center frequency: 24.125 GHz
 Frequency span: 100 MHz
 Input attenuation: 10 dB
 Resolution-BW: 2 MHz
 Video-BW: 3 MHz
 Video-Average: 1 sweep(s) (>1)
 Detector-Mode: 0 Normal (Clear-Write)

Correction (average):

Directional coupler + 0.0 dB
 Coaxial cable (C217) + 2.8 dB
 DUT-Antenna + 0.0 dBi
 Test antenna (antenna factor) + 36.7 dB
 BW correction factor - 0.0 dB
 Atten. between HPA and feedhorn - 0.0 dB
 amplifier Gain - 32.0 dB
 TOTAL CORRECTION: + 7.5 dB

Limit:

no limits defined

This test serves to verify the general function of the EUT and for orientation regarding to the spurious emissions which are expected within the band, furthermore for comparison of the actual power with the rated value at cw-carrier adjusted in the middle of the band (EIRP).

Remarks:

Test of general function of the EUT and measurement for orientation

Field strength = analyser reading + cable loss - amplifier gain + antenna factor
 $e [dB(\mu V/m)] = u [dB(\mu V)] + a [dB] - g [dB] + k [dB(1/m)]$

Subclause: 15.245) Field strength of fundamental frequency
 rf-carrier
 Radiation measurement within the band

Test results:
 see plot (an explicit table was not generated)

Operating condition of DUT:
 operating condition 1

Test setup:
 see page 8

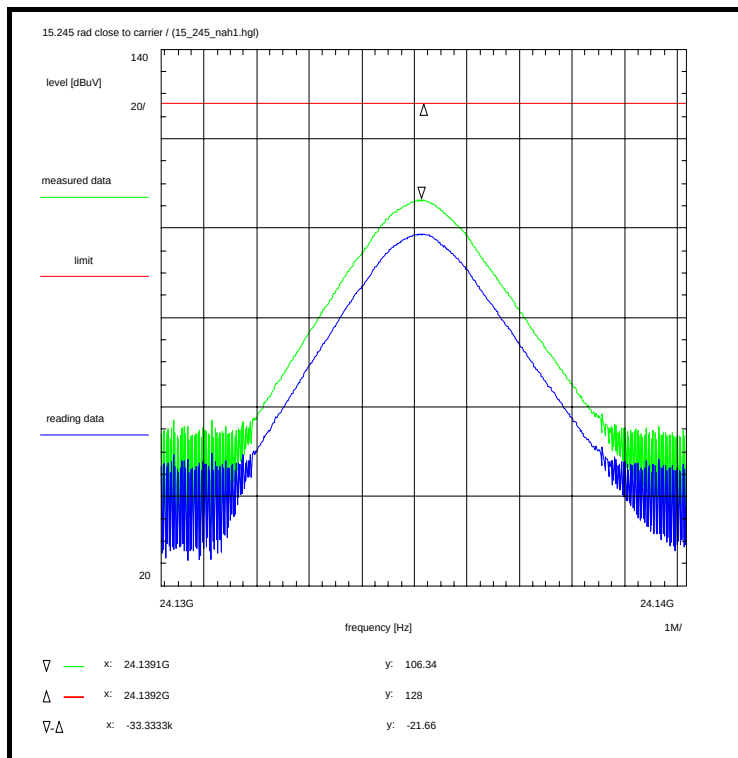
Test equipment:
 see page 8

Data of correction:
 see page 8

Remark:

Test result: measurement of the -23 dB bandwidth

Measurement result no. 3 (17)



Information on the measurement:

Environment condition:

Date & Time: Tue 27/Jul/2004 14:02:34
 Location: CETECOM ICT Services GmbH, Laboratory RSC-Sat
 Temperature: 23 °C
 Humidity: 55 %
 Voltage: 232 Vac

Setup of measurement equipment:

Start frequency: 24.134167 GHz
 Stop frequency: 24.144167 GHz
 Center frequency: 24.139167 GHz
 Frequency span: 10 MHz
 Input attenuation: 10 dB
 Resolution-BW: 1 MHz
 Video-BW: 1 MHz
 Video-Average: 1 sweep(s) (>1)
 Detector-Mode: 0 Normal (Clear-Write)

Correction (average):

Directional coupler + 0.0 dB
 Coaxial cable (C217) + 2.8 dB
 DUT-Antenna + 0.0 dBi
 Test antenna (antenna factor) + 36.7 dB
 BW correction factor + 0.0 dB
 Atten. between HPA and feedhorn - 0.0 dB
 amplifier Gain - 32.0 dB
 TOTAL CORRECTION: + 7.5 dB

Limit:

no limits defined
 This test serves to verify the general function of the EUT and for orientation regarding to the spurious emissions which are expected close to the carrier and for comparison of the actual rf-power with the rated value at cw-carrier adjusted in the middle of the band (EIRP!)

Remarks:

Function test and measurement for orientation

Field strength = analyser reading + cable loss - amplifier gain + antenna factor
 $e \text{ [dB(}\mu\text{V/m)]} = u \text{ [dB(}\mu\text{V)]} + a \text{ [dB]} - g \text{ [dB]} + k \text{ [dB(1/m)]}$

Subclause: 15.245) Field strength of fundamental frequency
 rf-carrier
 Radiation measurement within the band

Test results:
 see plot (an explicit table was not generated)

Operating condition of DUT:
 operating condition 1

Test setup:
 see page 8

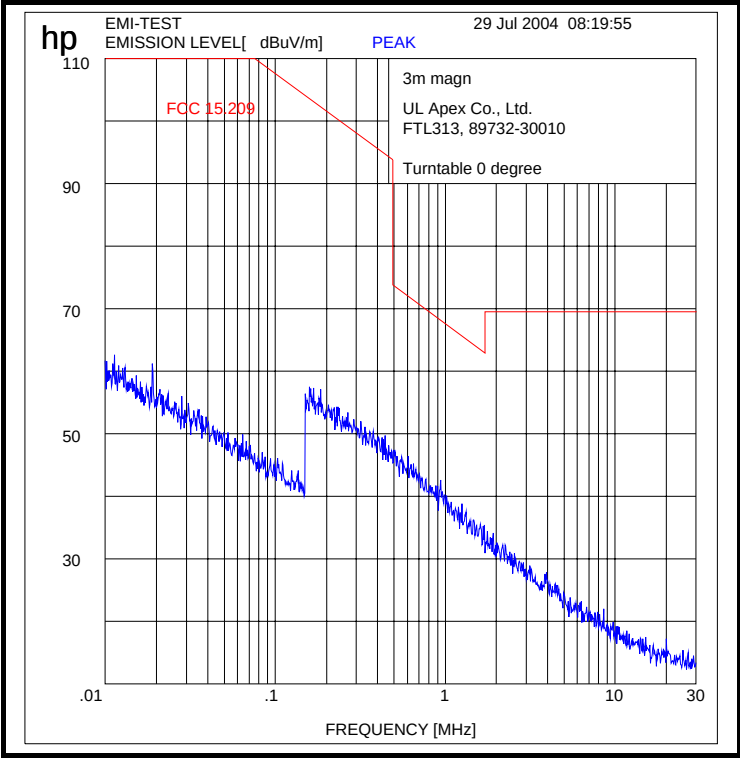
Test equipment:
 see page 8

Data of correction:
 see page 8

Remark:

Test result: Test of general function of the EUT

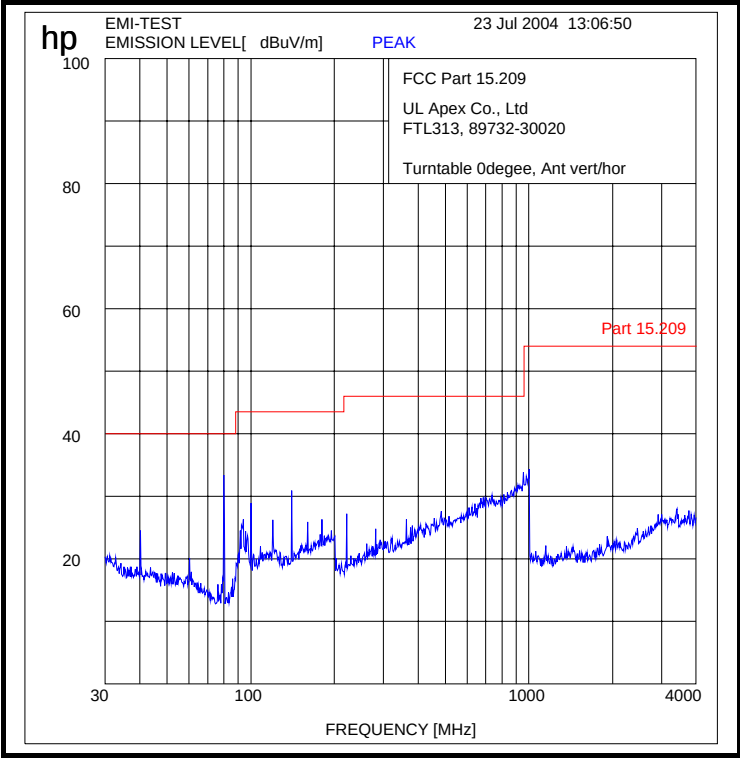
Measurement result no. 4 (17)



Information on the measurement:

-/-

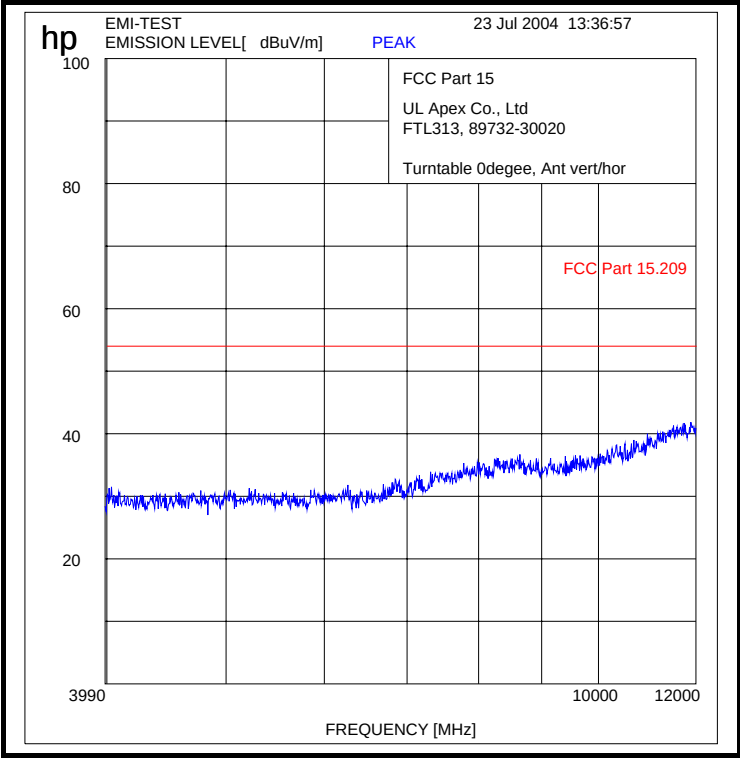
Measurement result no. 5 (17)



Information on the measurement:

-/-

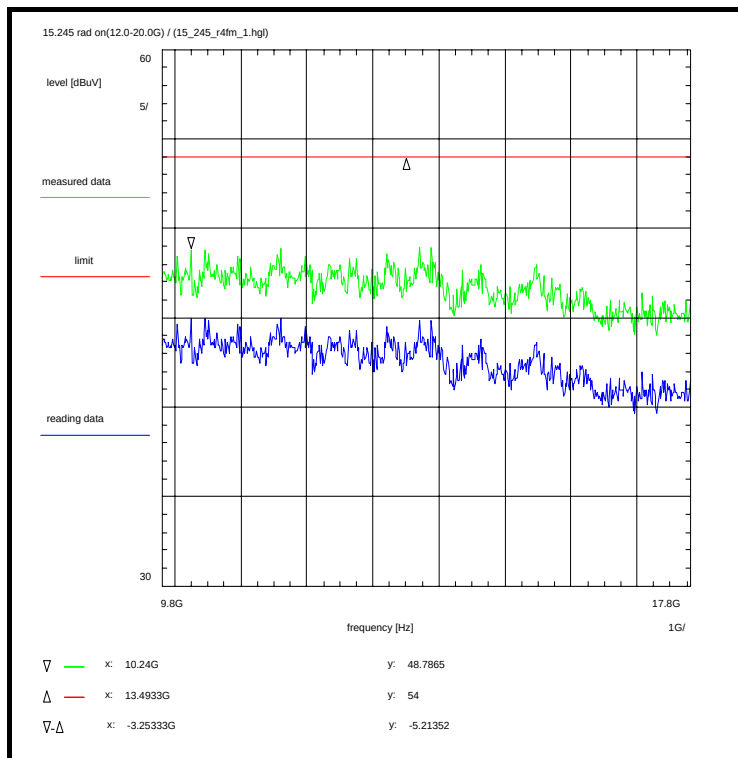
Measurement result no. 6 (17)



Information on the measurement:

-/-

Measurement result no. 7 (17)



Information on the measurement:

Environment condition:

Date & Time: Tue 27/Jul/2004 15:19:58
 Location: CETECOM ICT Services GmbH, Laboratory RSC-Sat
 Temperature: 23 °C
 Humidity: 55 %
 Voltage: 232 Vac

Setup of measurement equipment:

Start frequency: 9.8 GHz
 Stop frequency: 17.8 GHz
 Center frequency: 13.8 GHz
 Frequency span: 8 GHz
 Input attenuation: 0 dB
 Resolution-BW: 1 MHz
 Video-BW: 1 MHz
 Video-Average: 1 sweep(s) (>1)
 Detector-Mode: 2 Pos Peak (Maximum-Hold)

Correction (average):

Directional coupler + 0.0 dB
 Coaxial cable (C217) + 2.1 dB
 DUT-Antenna + 0.0 dBi
 Test antenna (antenna factor) + 34.0 dB
 BW correction factor + 0.0 dB
 Atten. between HPA and feedhorn - 0.0 dB
 amplifier Gain - 32.0 dB
 TOTAL CORRECTION: + 4.1 dB

Limit:

Limit acc. to 15.209): 500 uV/m or 54.0 dBuV/m (at 3m)
 this corresponds to 46.5 dBpW (at 3m)
 calculation: $p = e - 17 + 20 \cdot \log(d)$ with:
 d = Distance (m)
 e = Field Strength level (dBuV/m)
 p = Radiated Power level (dBpW)

Subclause: 15.245) Emission limitations
 Modulated rf-carrier in the middle of the band (fm)
 Radiation coming out of DUT-cabinet(s): 12.0 GHz - 17.8 GHz

Test results:
 see plot (an explicit table was not generated)

Operating condition of DUT:
 operating condition 1

Test setup:
 see page 8

Test equipment:
 see page 8

Data of correction:
 see page 8

Remark:

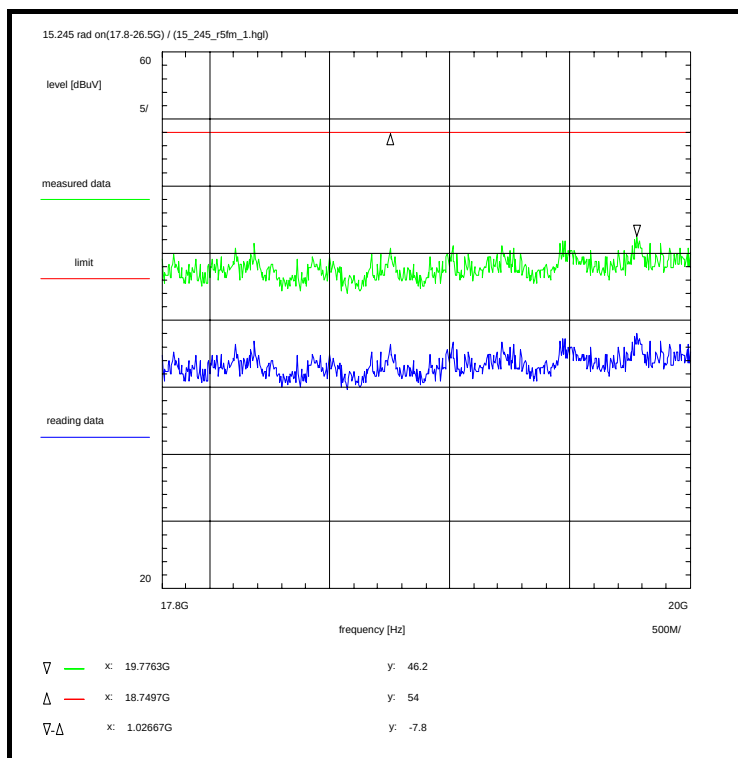
Test result: Test passed

Remarks:

Carrier-on state / Carrier in the middle of the band (fm)
 Measurement for orientation with a measuring antenna
 close to the DUT-cabinets (about 0.5m distance).
 If any critical spurious radiations are detected a measurement
 in an exactly defined distance will be carried out.

Field strength = analyser reading + cable loss - amplifier gain + antenna factor
 $e \text{ [dB(}\mu\text{V/m)}] = u \text{ [dB(}\mu\text{V)}] + a \text{ [dB]} - g \text{ [dB]} + k \text{ [dB(1/m)]}$

Annex 0: Measurement result no. 8 (17)



Information on the measurement:

Environment condition:

Date & Time: Tue 27/Jul/2004 15:24:00
 Location: CETECOM ICT Services GmbH, Laboratory RSC-Sat
 Temperature: 23 °C
 Humidity: 55 %
 Voltage: 232 Vac

Setup of measurement equipment:

Start frequency: 17.8 GHz
 Stop frequency: 20 GHz
 Center frequency: 18.9 GHz
 Frequency span: 2.2 GHz
 Input attenuation: 0 dB
 Resolution-BW: 1 MHz
 Video-BW: 1 MHz
 Video-Average: 1 sweep(s) (>1)
 Detector-Mode: 2 Pos Peak (Maximum-Hold)

Correction (average):

Directional coupler + 0.0 dB
 Coaxial cable (C217) + 2.5 dB
 DUT-Antenna + 0.0 dBi
 Test antenna (antenna factor) + 36.7 dB
 BW correction factor + 0.0 dB
 Atten. between HPA and feedhorn - 0.0 dB
 amplifier Gain - 32.0 dB
 TOTAL CORRECTION: + 7.2 dB

Limit:

Limit acc. to 15.209): 500 uV/m or 54.0 dBuV/m (at 3m)
 this corresponds to 46.5 dBpW (at 3m)
 calculation: $p = e - 17 + 20 \cdot \log(d)$ with:
 d = Distance (m)
 e = Field Strength level (dBuV/m)
 p = Radiated Power level (dBpW)
 harmonics acc. to 15.245): 25 mV/m or 87.96 dBuV/m (at 3m)
 this corresponds to 80.5 dBpW (at 3m)

Remarks:

Carrier-on state / Carrier in the middle of the band (fm)
 Measurement for orientation with a measuring antenna close to the DUT-cabinets (about 1.0m distance).
 If any critical spurious radiations are detected a measurement in an exactly defined distance will be carried out.

Field strength = analyser reading + cable loss - amplifier gain + antenna factor
 $e \text{ [dB(}\mu\text{V/m)}] = u \text{ [dB(}\mu\text{V)}] + a \text{ [dB]} - g \text{ [dB]} + k \text{ [dB(1/m)]}$

Subclause: 15.245) Emission limitations
 Modulated rf-carrier in the middle of the band (fm)
 Radiation coming out of DUT-cabinet(s): 17.8 GHz - 26.5 GHz

Test results:
 see plot (an explicit table was not generated)

Operating condition of DUT:
 operating condition 1

Test setup:
 see page 8

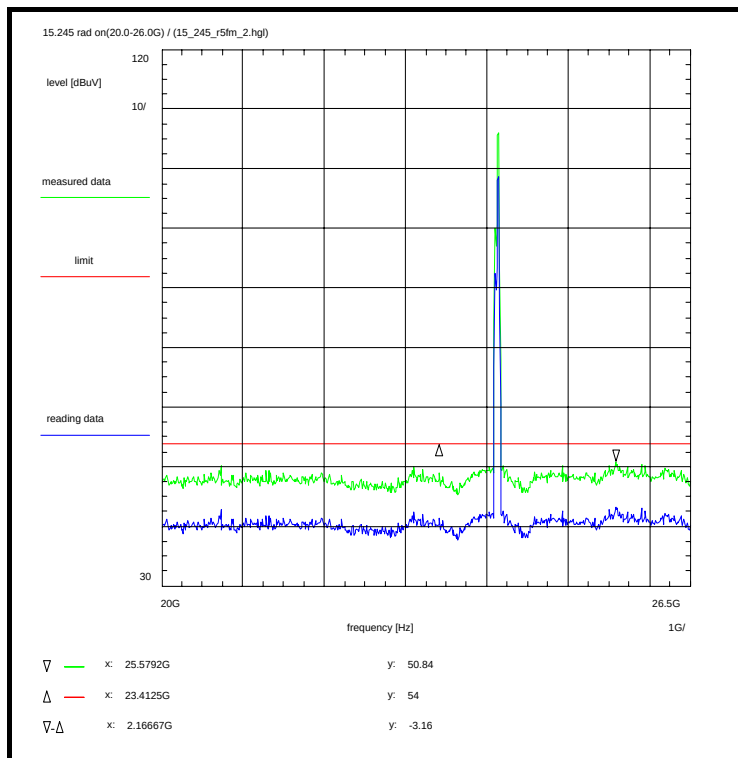
Test equipment:
 see page 8

Data of correction:
 see page 8

Remark:

Test result: Test passed

Measurement result no. 9 (17)



Information on the measurement:

Environment condition:

Date & Time: Tue 27/Jul/2004 15:26:09
Location: CETECOM ICT Services GmbH, Laboratory RSC-Sat
Temperature: 23 °C
Humidity: 55 %
Voltage: 232 Vac

Setup of measurement equipment:

Start frequency: 20 GHz
Stop frequency: 26.5 GHz
Center frequency: 23.25 GHz
Frequency span: 6.5 GHz
Input attenuation: 0 dB
Resolution-BW: 1 MHz
Video-BW: 1 MHz
Video-Average: 1 sweep(s) (>1)
Detector-Mode: 2 Pos Peak (Maximum-Hold)

Correction (average):

Directional coupler + 0.0 dB
Coaxial cable (C217) + 2.8 dB
DUT-Antenna + 0.0 dBi
Test antenna (antenna factor) + 36.7 dB
BW correction factor + 0.0 dB
Atten. between HPA and feedhorn - 0.0 dB
amplifier Gain - 32.0 dB
TOTAL CORRECTION: + 7.5 dB

Limit:

Limit acc. to 15.209): 500 uV/m or 54.0 dBuV/m (at 3m)
this corresponds to 46.5 dBpW (at 3m)
calculation: $p = e - 17 + 20 \cdot \log(d)$ with:
d = Distance (m)
e = Field Strength level (dBuV/m)
p = Radiated Power level (dBpW)
harmonics acc. to 15.245): 25 mV/m or 87.96 dBuV/m (at 3m)
this corresponds to 80.5 dBpW (at 3m)

Remarks:

Carrier-on state / Carrier in the middle of the band (fm)
Measurement for orientation with a measuring antenna close to the DUT-cabinets (about 1.0m distance).
If any critical spurious radiations are detected a measurement in an exactly defined distance will be carried out.

Field strength = analyser reading + cable loss - amplifier gain + antenna factor
 $e [\text{dB}(\mu\text{V}/\text{m})] = u [\text{dB}(\mu\text{V})] + a [\text{dB}] - g [\text{dB}] + k [\text{dB}(1/\text{m})]$

Subclause: 15.245) Emission limitations
Modulated rf-carrier in the middle of the band (fm)
Radiation coming out of DUT-cabinet(s): 20.0 GHz - 26.0 GHz

Test results:
see plot (an explicit table was not generated)

Operating condition of DUT:
operating condition 1

Test setup:
see page 8

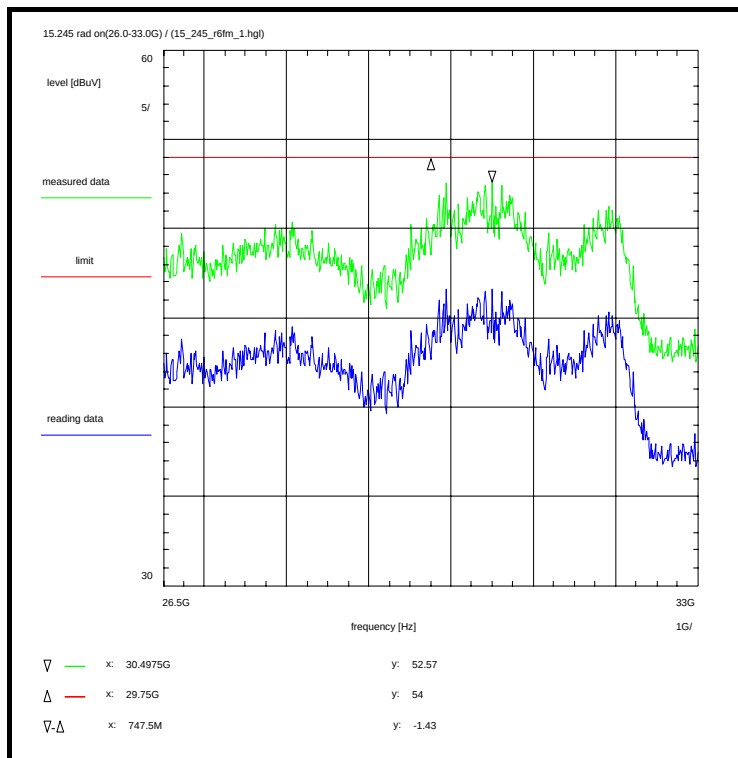
Test equipment:
see page 8

Data of correction:
see page 8

Remark:

Test result: Test passed

Measurement result no. 10 (17)



Information on the measurement:

Environment condition:

Date & Time: Wed 28/Jul/2004 11:20:24
 Location: CETECOM ICT Services GmbH, Laboratory RSC-Sat
 Temperature: 24 °C
 Humidity: 50 %
 Voltage: 232 Vac

Setup of measurement equipment:

Start frequency: 26.5 GHz
 Stop frequency: 33 GHz
 Center frequency: 29.75 GHz
 Frequency span: 6.5 GHz
 Input attenuation: 0 dB
 Resolution-BW: 1 MHz
 Video-BW: 1 MHz
 Video-Average: 1 sweep(s) (>1)
 Detector-Mode: 2 Pos Peak (Maximum-Hold)

Correction (average):

Directional coupler + 0.0 dB
 Coaxial cable (C217) + 3.1 dB
 DUT-Antenna + 0.0 dBi
 Test antenna (antenna factor) + 40.3 dB
 BW correction factor + 0.0 dB
 distance correction - 9.5 dB
 amplifier Gain - 28.0 dB
 TOTAL CORRECTION: + 5.9 dB

Limit:

Limit acc. to 15.209): 54.0 dBuV/m (at 3m)
 this corresponds to 46.5 dBpW (at 3m)
 calculation: $p = e - 17 + 20 \cdot \log(d)$ with:
 d = Distance (m)
 e = Field Strength level (dBuV/m)
 p = Radiated Power level (dBpW)

Subclause: 15.245) Emission limitations
 Modulated rf-carrier in the middle of the band (fm)
 Radiation coming out of DUT-cabinet(s): 26.0 GHz - 33.0 GHz

Test results:
 see plot (an explicit table was not generated)

Operating condition of DUT:
 operating condition 1

Test setup:
 see page 8

Test equipment:
 see page 8

Data of correction:
 see page 8

Remark:

Test result: measurement distance 1.0m

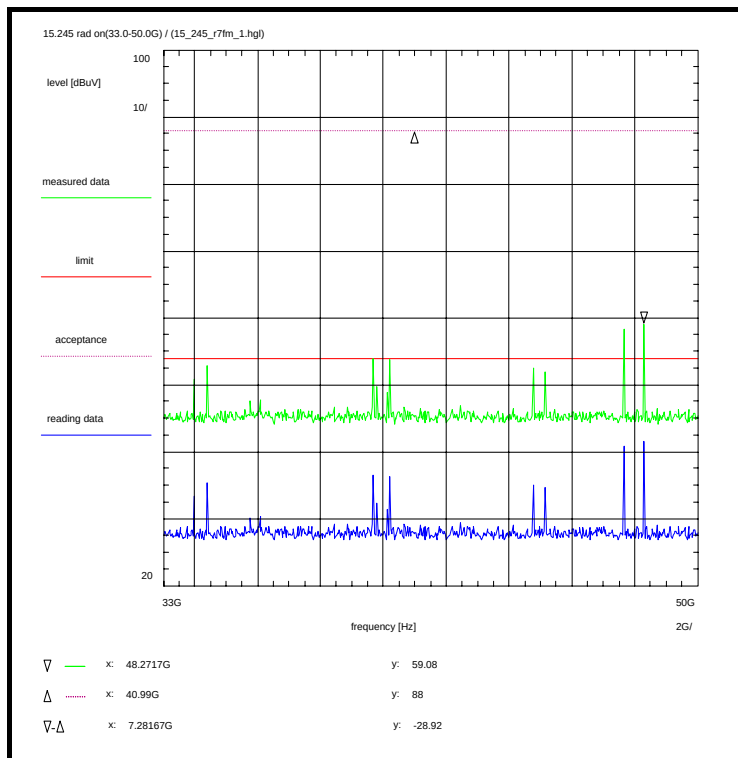
Remarks:

Carrier-on state / Carrier in the middle of the band (fm)
 Measurement for orientation with a measuring antenna
 close to the DUT-cabinets (about 1m distance).
 If any critical spurious radiations are detected a measurement
 in an exactly defined distance will be carried out.

measurement distance correction 3m --> 1m = -9.5 dB

Field strength = analyser reading + cable loss - amplifier gain + antenna factor -
 distance correction
 $e \text{ [dB}(\mu\text{V/m)}] = u \text{ [dB}(\mu\text{V)}] + a \text{ [dB]} - g \text{ [dB]} + k \text{ [dB(1/m)]} - d \text{ [dB]}$

Measurement result no. 11 (17)



Subclause: 15.245) Emission limitations
Modulated rf-carrier in the middle of the band (fm)
Radiation coming out of DUT-cabinet(s): 33.0 GHz - 50.0 GHz

Test results:
see plot (an explicit table was not generated)

Operating condition of DUT:
operating condition 1

Test setup:
see page 9

Test equipment:
see page 9

Data of correction:
see page 9

Remark:

Test result: Test passed

Information on the measurement:

Environment condition:

Date & Time: Wed 28/Jul/2004 14:03:06
Location: CETECOM ICT Services GmbH, Laboratory RSC-Sat
Temperature: 24 °C
Humidity: 52 %
Voltage: 232 Vac

Setup of measurement equipment:

Start frequency: 33 GHz
Stop frequency: 50 GHz
Center frequency: 41.5 GHz
Frequency span: 17 GHz
Input attenuation: 0 dB
Resolution-BW: 1 MHz
Video-BW: 100 kHz
Video-Average: 1 sweep(s) (>1)
Detector-Mode: 2 Pos Peak (Maximum-Hold)

Correction (average):

Directional coupler + 0.0 dB
Coaxial cable + 0.0 dB
DUT-Antenna + 0.0 dBi
Test antenna (antenna factor) + 39.0 dB
BW correction factor + 0.0 dB
distance correction - 21.6 dB
Freefield attenuation + 0.0 dB
TOTAL CORRECTION: + 17.4 dB

Limit:

Limit acc. to 15.209): 500 uV/m or 54.0 dBuV/m (at 3m)
this corresponds to 46.5 dBpW (at 3m)
calculation: $p = e - 17 + 20 \cdot \log(d)$ with:
d = Distance (m)
e = Field Strength level (dBuV/m)
p = Radiated Power level (dBpW)
harmonics acc. to 15.245): 25 mV/m or 87.96 dBuV/m (at 3m)
this corresponds to 80.5 dBpW (at 3m)

Remarks:

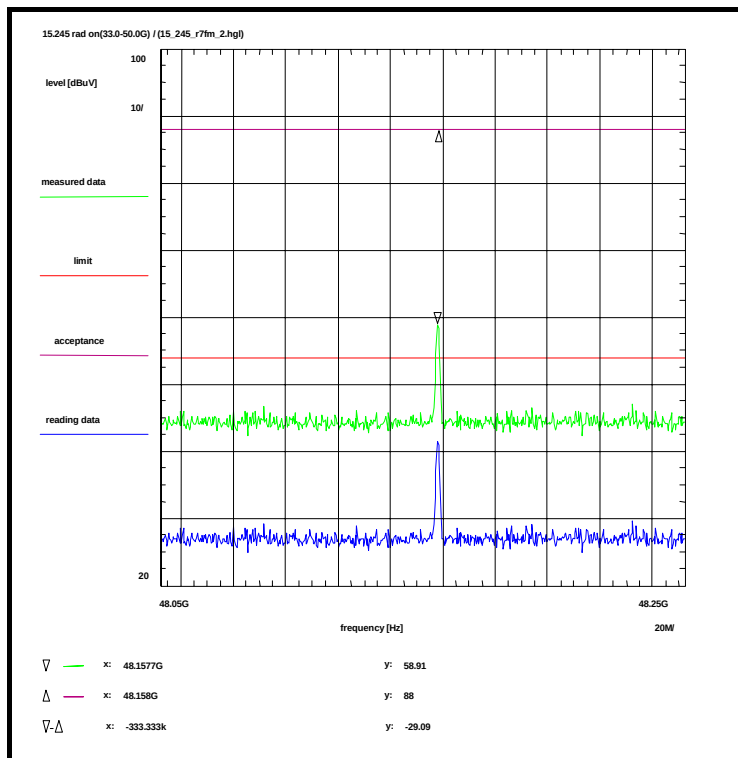
Carrier-on state / Carrier in the middle of the band (fm)
Measurement for orientation with a measuring antenna
close to the DUT-cabinets (about 0.25m distance).
If any critical spurious radiations are detected a measurement
in an exactly defined distance will be carried out.

Limit for 2nd and 3th harmonics 88dBuV/m (at 3m)
Spurious frequencies e.g. 33.96 GHz, 34.39 GHz, 39.66 GHz, 40.2 GHz, 44.76 GHz, 45.13 GHz and 47.65 GHz are produced by the external mixer. They are image frequency responses and can be identified by calling up signal identifier program.

measurement distance correction 3m --> 0.25m = -21.6 dB

Field strength = analyser reading + antenna factor - distance correction
 $e \text{ [dB(}\mu\text{V/m)}] = u \text{ [dB(}\mu\text{V)}] + k \text{ [dB(1/m)}] - d \text{ [dB]}$

Measurement result no. 12 (17)



Subclause: 15.245) Emission limitations
Modulated rf-carrier in the middle of the band (fm)
Radiation coming out of DUT-cabinet(s): 33.0 GHz - 50.0 GHz

Test results:
see plot (an explicit table was not generated)

Operating condition of DUT:
operating condition 1

Test setup:
see page 9

Test equipment:
see page 9

Data of correction:
see page 9

Remark:

Test result: Test passed

Information on the measurement:

Environment condition:

Date & Time: Wed 28/Jul/2004 13:56:03
Location: CETECOM ICT Services GmbH, Laboratory RSC-Sat
Temperature: 24 °C
Humidity: 52 %
Voltage: 232 Vac

Setup of measurement equipment:

Start frequency: 48.052 GHz
Stop frequency: 48.252 GHz
Center frequency: 48.152 GHz
Frequency span: 200 MHz
Input attenuation: 0 dB
Resolution-BW: 1 MHz
Video-BW: 100 kHz
Video-Average: 1 sweep(s) (>1)
Detector-Mode: 2 Pos Peak (Maximum-Hold)

Correction (average):

Directional coupler + 0.0 dB
Coaxial cable + 0.0 dB
DUT-Antenna + 0.0 dBi
Test antenna (antenna factor) + 39.0 dB
BW correction factor + 0.0 dB
distance correction - 21.6 dB
Freefield attenuation + 0.0 dB
TOTAL CORRECTION: + 17.4 dB

Limit:

Limit acc. to 15.209): 500 uV/m or 54.0 dBuV/m (at 3m)
this corresponds to 46.5 dBpW (at 3m)
calculation: $p = e - 17 + 20 \cdot \log(d)$ with:
d = Distance (m)
e = Field Strength level (dBuV/m)
p = Radiated Power level (dBpW)
harmonics acc. to 15.245): 25 mV/m or 87.96 dBuV/m (at 3m)
this corresponds to 80.5 dBpW (at 3m)

Remarks:

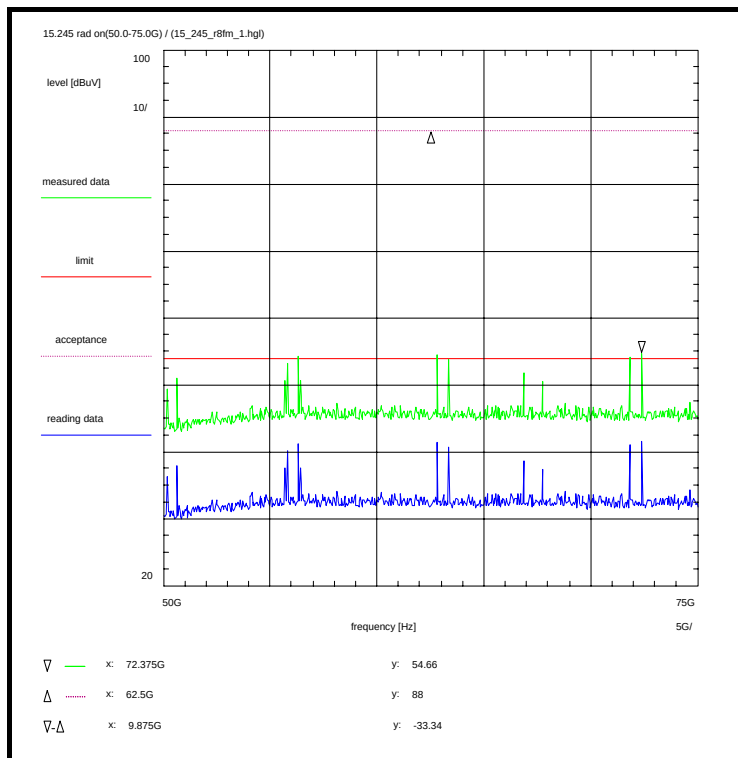
Carrier-on state / Carrier in the middle of the band (fm)
Measurement for orientation with a measuring antenna
close to the DUT-cabinets (about 0.25m distance).
If any critical spurious radiations are detected a measurement
in an exactly defined distance will be carried out.

Limit for 2nd and 3th harmonics 88dBuV/m (at 3m)

measurement distance correction 3m --> 0.25m = -21.6 dB

Field strength = analyser reading + antenna factor - distance correction
 $e \text{ [dB(}\mu\text{V/m)]} = u \text{ [dB(}\mu\text{V)]} + k \text{ [dB(1/m)]} - d \text{ [dB]}$

Measurement result no. 13 (17)



Information on the measurement:

Environment condition:

Date & Time: Wed 28/Jul/2004 14:45:46
 Location: CETECOM ICT Services GmbH, Laboratory RSC-Sat
 Temperature: 24 °C
 Humidity: 52 %
 Voltage: 232 Vac

Setup of measurement equipment:

Start frequency: 50 GHz
 Stop frequency: 75 GHz
 Center frequency: 62.5 GHz
 Frequency span: 25 GHz
 Input attenuation: 0 dB
 Resolution-BW: 1 MHz
 Video-BW: 100 kHz
 Video-Average: 1 sweep(s) (>1)
 Detector-Mode: 2 Pos Peak (Maximum-Hold)

Correction (average):

Directional coupler + 0.0 dB
 Coaxial cable + 0.0 dB
 DUT-Antenna + 0.0 dBi
 Test antenna (antenna factor) + 40.7 dB
 BW correction factor + 0.0 dB
 distance correction - 27.6 dB
 Freefield attenuation + 0.0 dB
 TOTAL CORRECTION: + 13.1 dB

Limit:

Limit acc. to 15.209: 54.0 dBuV/m (at 3m)
 this corresponds to 46.5 dBpW (at 3m)
 calculation: $p = e - 17 + 20 \cdot \log(d)$ with:
 d = Distance (m)
 e = Field Strength level (dBuV/m)
 p = Radiated Power level (dBpW)

Subclause: 15.245) Emission limitations
 Modulated rf-carrier in the middle of the band (fm)
 Radiation coming out of DUT-cabinet(s): 50.0 GHz - 75.0 GHz

Test results:
 see plot (an explicit table was not generated)

Operating condition of DUT:
 operating condition 1

Test setup:
 see page 9

Test equipment:
 see page 9

Data of correction:
 see page 9

Remark:

Test result: Test passed

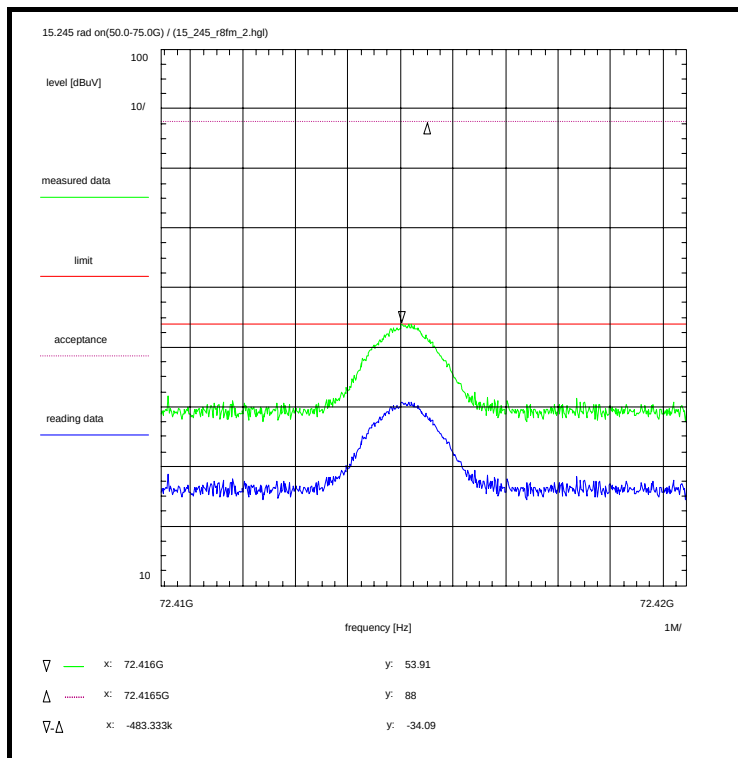
Remarks:

Carrier-on state / Carrier in the middle of the band (fm)
 Measurement for orientation with a measuring antenna
 close to the DUT-cabinets (about 0.125m distance).
 If any critical spurious radiations are detected a measurement
 in an exactly defined distance will be carried out.

Limit for 2nd and 3th harmonics 88dBuV/m (at 3m)
 Spurious frequencies e.g. 50.17 GHz, 50.65 GHz, 55.79 GHz, 56.29 GHz, 62.79 GHz, 63.33 GHz, 66.83 GHz, 67.71 GHz and 71.79 GHz are produced by the external mixer. They are image frequency responses and can be identified by calling up signal identifier program.

measurement distance correction 3m --> 0.125m = -27.6 dB

Field strength = analyser reading + antenna factor - distance correction
 $e \text{ [dB(}\mu\text{V/m)}] = u \text{ [dB(}\mu\text{V)}] + k \text{ [dB(1/m)}] - d \text{ [dB]}$

Measurement result no. 14 (17)

Subclause: 15.245) Emission limitations
Modulated rf-carrier in the middle of the band (fm)
Radiation coming out of DUT-cabinet(s): 50.0 GHz - 75.0 GHz

Test results:
see plot (an explicit table was not generated)

Operating condition of DUT:
operating condition 1

Test setup:
see page 9

Test equipment:
see page 9

Data of correction:
see page 9

Remark:

Test result: Test passed

Information on the measurement:**Environment condition:**

Date & Time: Wed 28/Jul/2004 14:52:55
Location: CETECOM ICT Services GmbH, Laboratory RSC-Sat
Temperature: 24 °C
Humidity: 52 %
Voltage: 232 Vac

Setup of measurement equipment:

Start frequency: 72.411433333 GHz
Stop frequency: 72.421433 GHz
Center frequency: 72.416433 GHz
Frequency span: 10 MHz
Input attenuation: 0 dB
Resolution-BW: 1 MHz
Video-BW: 100 kHz
Video-Average: 1 sweep(s) (>1)
Detector-Mode: 2 Pos Peak (Maximum-Hold)

Correction (average):

Directional coupler + 0.0 dB
Coaxial cable + 0.0 dB
DUT-Antenna + 0.0 dBi
Test antenna (antenna factor) + 40.7 dB
BW correction factor + 0.0 dB
distance correction - 27.6 dB
Freefield attenuation + 0.0 dB
TOTAL CORRECTION: + 13.1 dB

Limit:

Limit acc. to 15.209): 54.0 dBuV/m (at 3m)
this corresponds to 46.5 dBpW (at 3m)
calculation: $p = e - 17 + 20 \cdot \log(d)$ with:
d = Distance (m)
e = Field Strength level (dBuV/m)
p = Radiated Power level (dBpW)

Remarks:

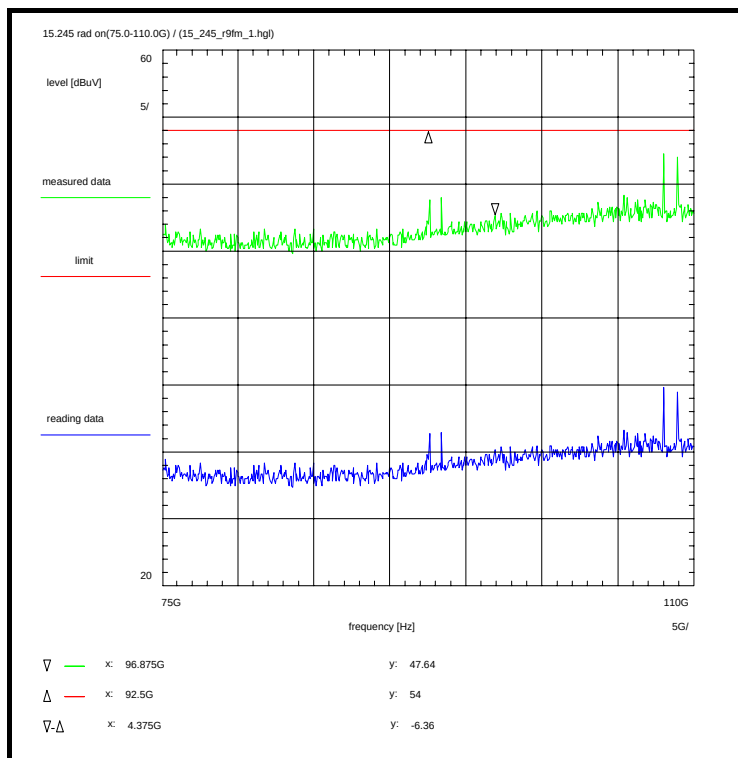
Carrier-on state / Carrier in the middle of the band (fm)
Measurement for orientation with a measuring antenna
close to the DUT-cabinets (about 0.125m distance).
If any critical spurious radiations are detected a measurement
in an exactly defined distance will be carried out.

Limit for 2nd and 3th harmonics 88dBuV/m (at 3m)

measurement distance correction 3m --> 0.125m = -27.6 dB

Field strength = analyser reading + antenna factor - distance correction
 $e \text{ [dB(}\mu\text{V/m)]} = u \text{ [dB(}\mu\text{V)]} + k \text{ [dB(1/m)]} - d \text{ [dB]}$

Measurement result no. 15 (17)



Information on the measurement:

Environment condition:

Date & Time: Wed 28/Jul/2004 15:29:55
 Location: CETECOM ICT Services GmbH, Laboratory RSC-Sat
 Temperature: 24 °C
 Humidity: 52 %
 Voltage: 232 Vac

Setup of measurement equipment:

Start frequency: 75 GHz
 Stop frequency: 110 GHz
 Center frequency: 92.5 GHz
 Frequency span: 35 GHz
 Input attenuation: 0 dB
 Resolution-BW: 1 MHz
 Video-BW: 100 kHz
 Video-Average: 1 sweep(s) (>1)
 Detector-Mode: 2 Pos Peak (Maximum-Hold)

Correction (average):

Directional coupler + 0.0 dB
 Coaxial cable + 0.0 dB
 DUT-Antenna + 0.0 dBi
 Test antenna (antenna factor) + 45.1 dB
 BW correction factor + 0.0 dB
 distance correction - 27.6 dB
 Freefield attenuation + 0.0 dB
 TOTAL CORRECTION: + 17.5 dB

Limit:

Limit acc. to 15.209): 54.0 dBuV/m (at 3m)
 this corresponds to 46.5 dBpW (at 3m)
 calculation: $p = e - 17 + 20 \cdot \log(d)$ with:
 d = Distance (m)
 e = Field Strength level (dBuV/m)
 p = Radiated Power level (dBpW)

Subclause: 15.245) Emission limitations
 Modulated rf-carrier in the middle of the band (fm)
 Radiation coming out of DUT-cabinet(s): 75.0 GHz - 100.0 GHz

Test results:
 see plot (an explicit table was not generated)

Operating condition of DUT:
 operating condition 1

Test setup:
 see page 9

Test equipment:
 see page 9

Data of correction:
 see page 9

Test result: Test passed

Remarks:

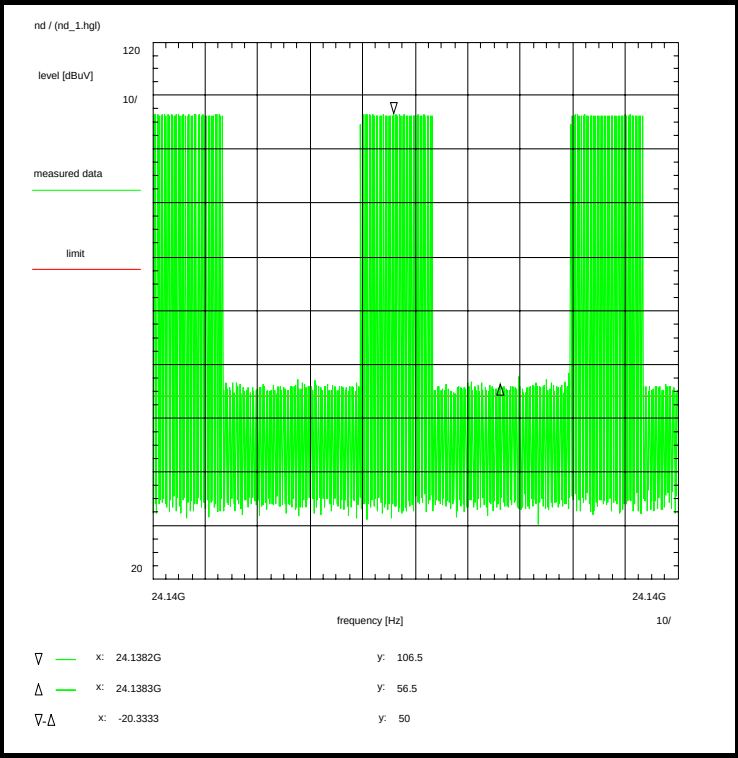
Carrier-on state / Carrier in the middle of the band (fm)
 Measurement for orientation with a measuring antenna
 close to the DUT-cabinets (about 0.1m distance).
 If any critical spurious radiations are detected a measurement
 in an exactly defined distance will be carried out.

Spurious frequencies e.g. 92.56 GHz, 93.38 GHz, 108.02 GHz and 108.25 GHz are
 produced by the external mixer. They are image frequency responses and can be
 identified by calling up signal identifier program

measurement distance correction 3m --> 0.125m = -27.6 dB

Field strength = analyser reading + antenna factor - distance correction
 $e \text{ [dB(}\mu\text{V/m)}] = u \text{ [dB(}\mu\text{V)}] + k \text{ [dB(1/m)}] - d \text{ [dB]}$

Measurement result no. 16 (17)



Information on the measurement:

Environment condition:
Date & Time: Wed 28/Jul/2004 10:38:57
Location: CETECOM ICT Services GmbH, Laboratory RSC-Sat
Temperature: 24 °C
Humidity: 50 %
Voltage: 232 Vac

Setup of measurement equipment:
Start frequency: 24.13825 GHz
Stop frequency: 24.13825 GHz
Center frequency: 24.13825 GHz
Frequency span: 0 Hz
Input attenuation: 10 dB
Resolution-BW: 1 MHz
Video-BW: 1 MHz
Video-Average: 1 sweep(s) (>1)
Detector-Mode: 0 Normal (Clear-Write)

Correction (average):
Directional coupler + 0.0 dB
Coaxial cable (C217) + 2.8 dB
DUT-Antenna + 0.0 dBi
Test antenna (antenna factor) + 36.7 dB
BW correction factor + 0.0 dB
Atten. between HPA and feedhorn - 0.0 dB
amplifier Gain - 32.0 dB
TOTAL CORRECTION: + 7.5 dB

Limit:
no limits defined

Subclause: -/- Additional test

Test results:
see plot (an explicit table was not generated)

Operating condition of DUT:
operating condition 1

Test setup:
see page 8

Test equipment:
see page 8

Data of correction:
see page 8

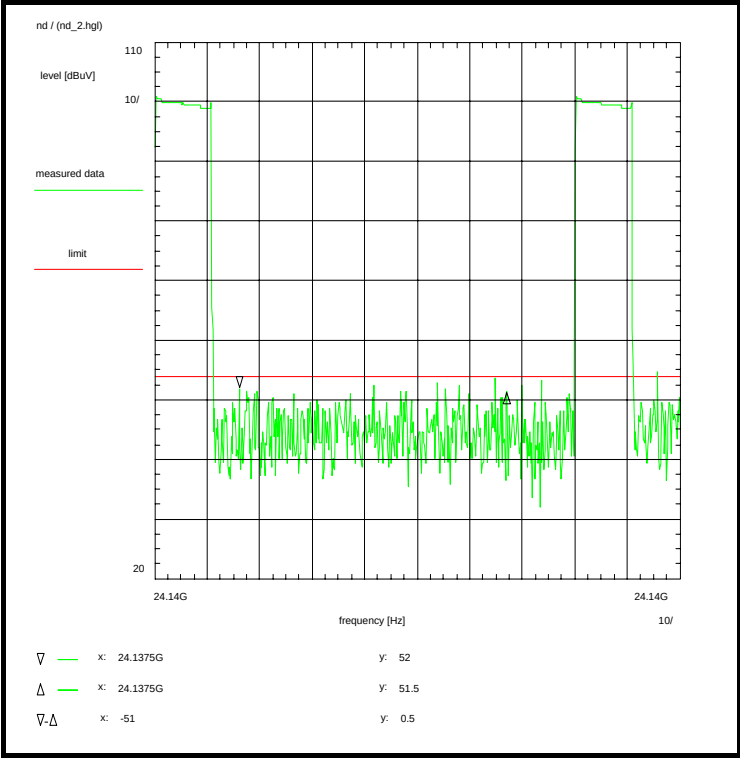
Remark:

Test result: measurements of the time domaine

Remarks:

Pulse packet duration = 110 ms
Pulse periode = 320 ms

Measurement result no. 17 (17)



Information on the measurement:

Environment condition:
Date & Time: Wed 28/Jul/2004 10:46:47
Location: CETECOM ICT Services GmbH, Laboratory RSC-Sat
Temperature: 24 °C
Humidity: 50 %
Voltage: 232 Vac

Setup of measurement equipment:
Start frequency: 24.1375 GHz
Stop frequency: 24.1375 GHz
Center frequency: 24.1375 GHz
Frequency span: 0 Hz
Input attenuation: 10 dB
Resolution-BW: 2 MHz
Video-BW: 3 MHz
Video-Average: 1 sweep(s) (>1)
Detector-Mode: 0 Normal (Clear-Write)

Correction (average):
Directional coupler + 0.0 dB
Coaxial cable (C217) + 2.8 dB
DUT-Antenna + 0.0 dBi
Test antenna (antenna factor) + 36.7 dB
BW correction factor (2M -> 1M) - 3.0 dB
Atten. between HPA and feedhorn - 0.0 dB
amplifier Gain - 32.0 dB
TOTAL CORRECTION: + 4.5 dB

Limit:
no limits defined

Subclause: -/- Additional test

Test results:
see plot (an explicit table was not generated)

Operating condition of DUT:
operating condition 1

Test setup:
see page 8

Test equipment:
see page 8

Data of correction:
see page 8

Remark:

Test result: measurements of the time domaine

Remarks:

Pulse duration = 65 us
Pulse periode = app. 500 us

4 Photographs

Photo no.: 1

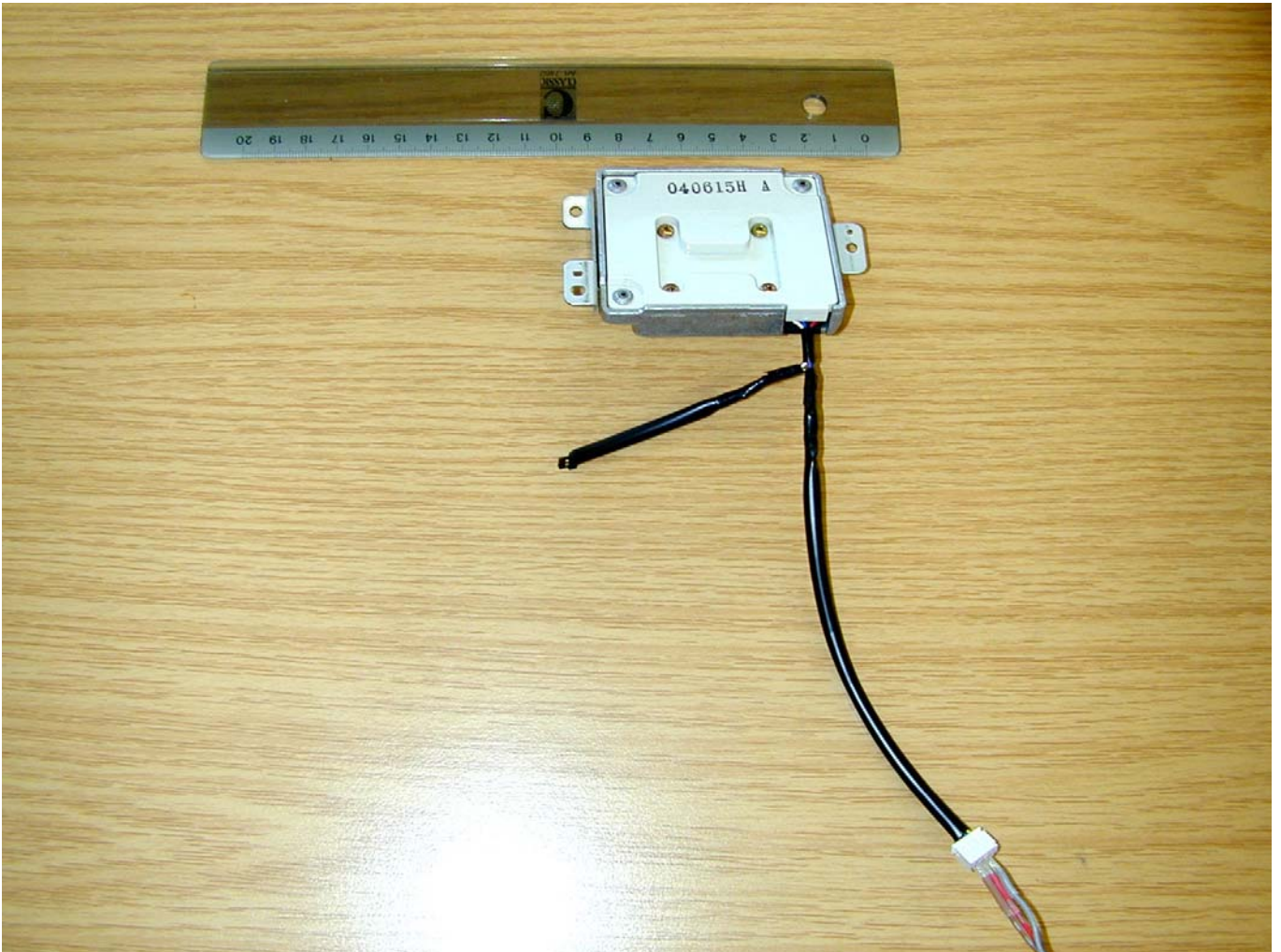


Photo no.: 2

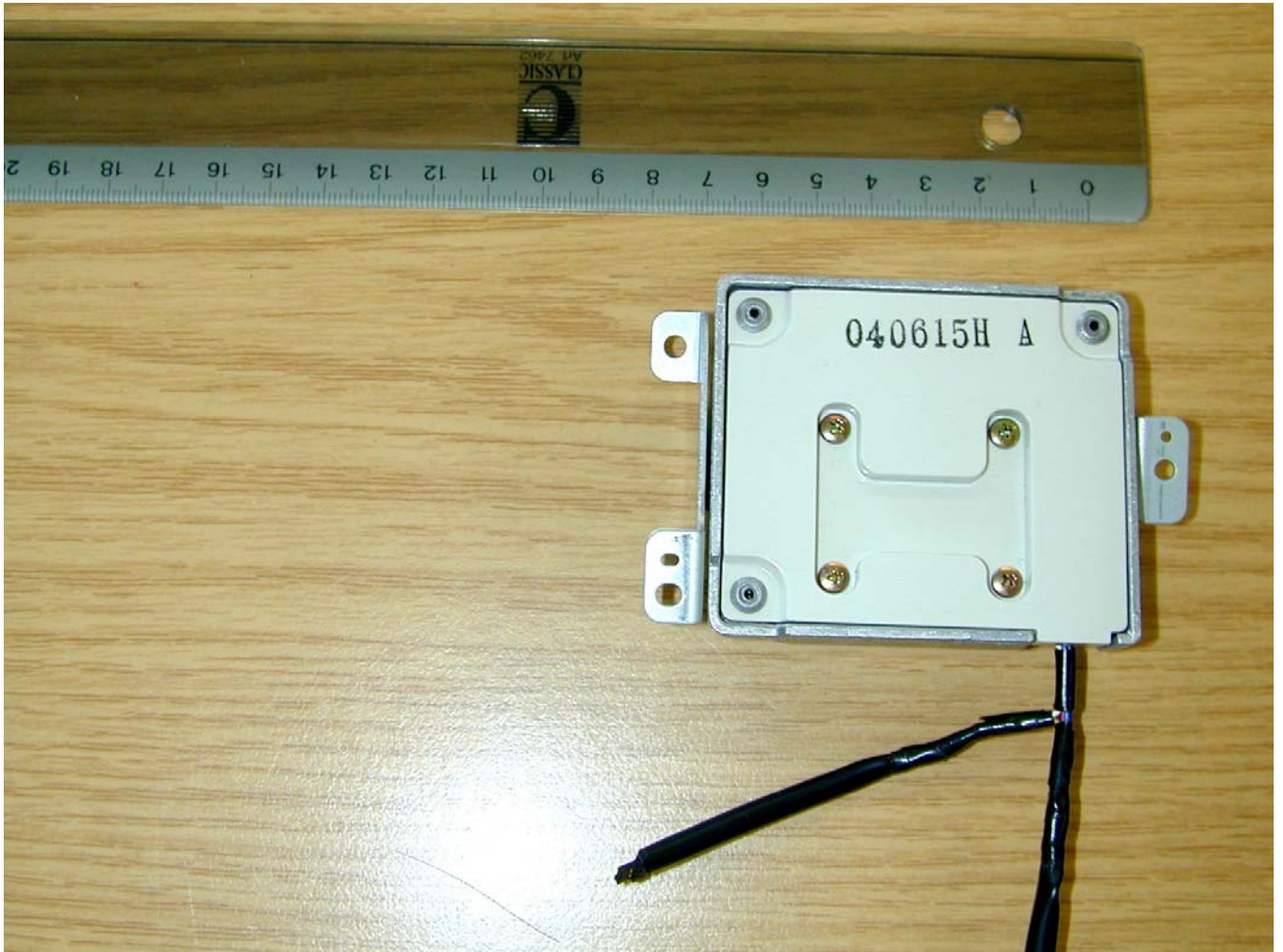


Photo no.: 3

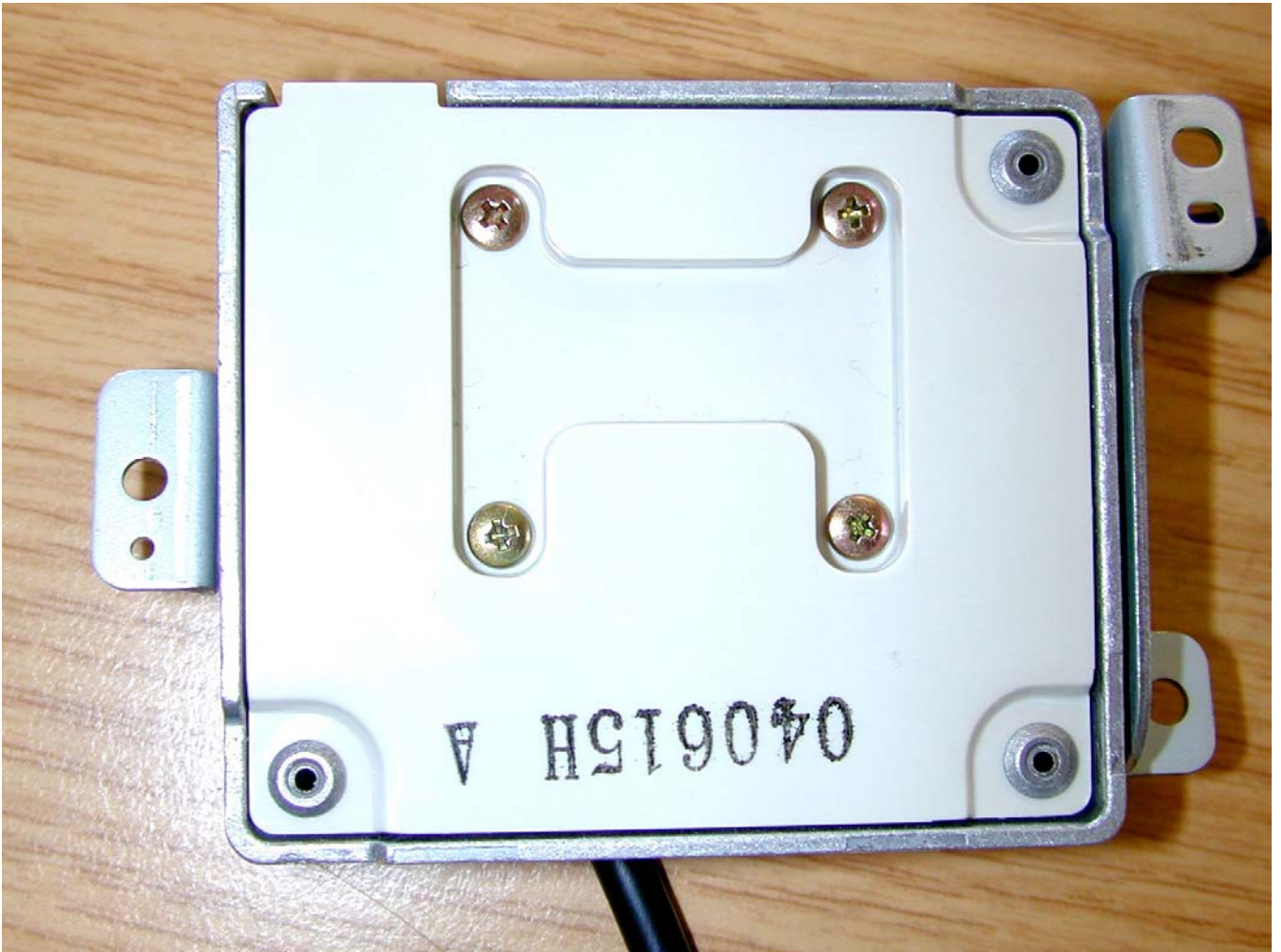


Photo no.: 4

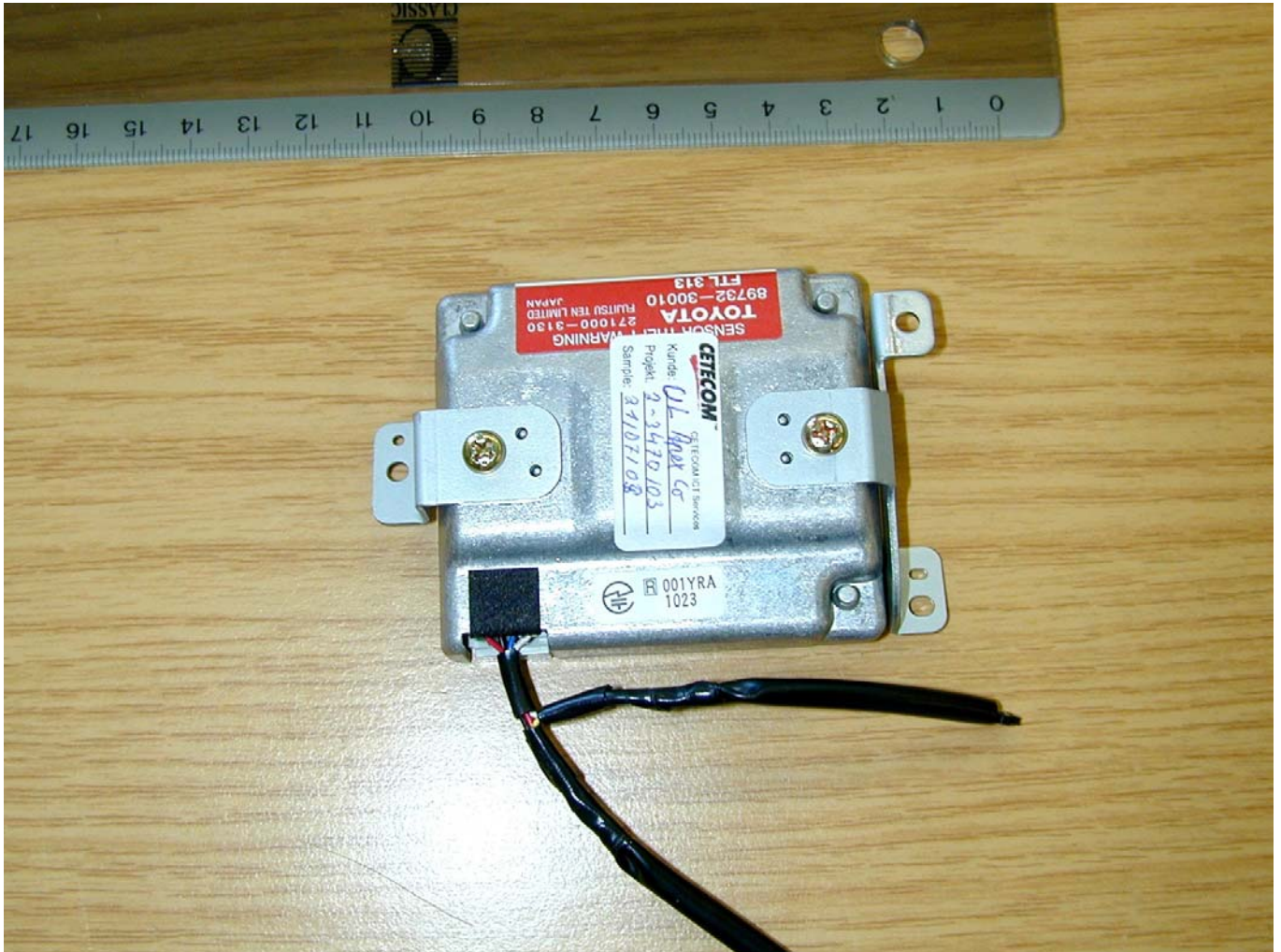


Photo no.: 5

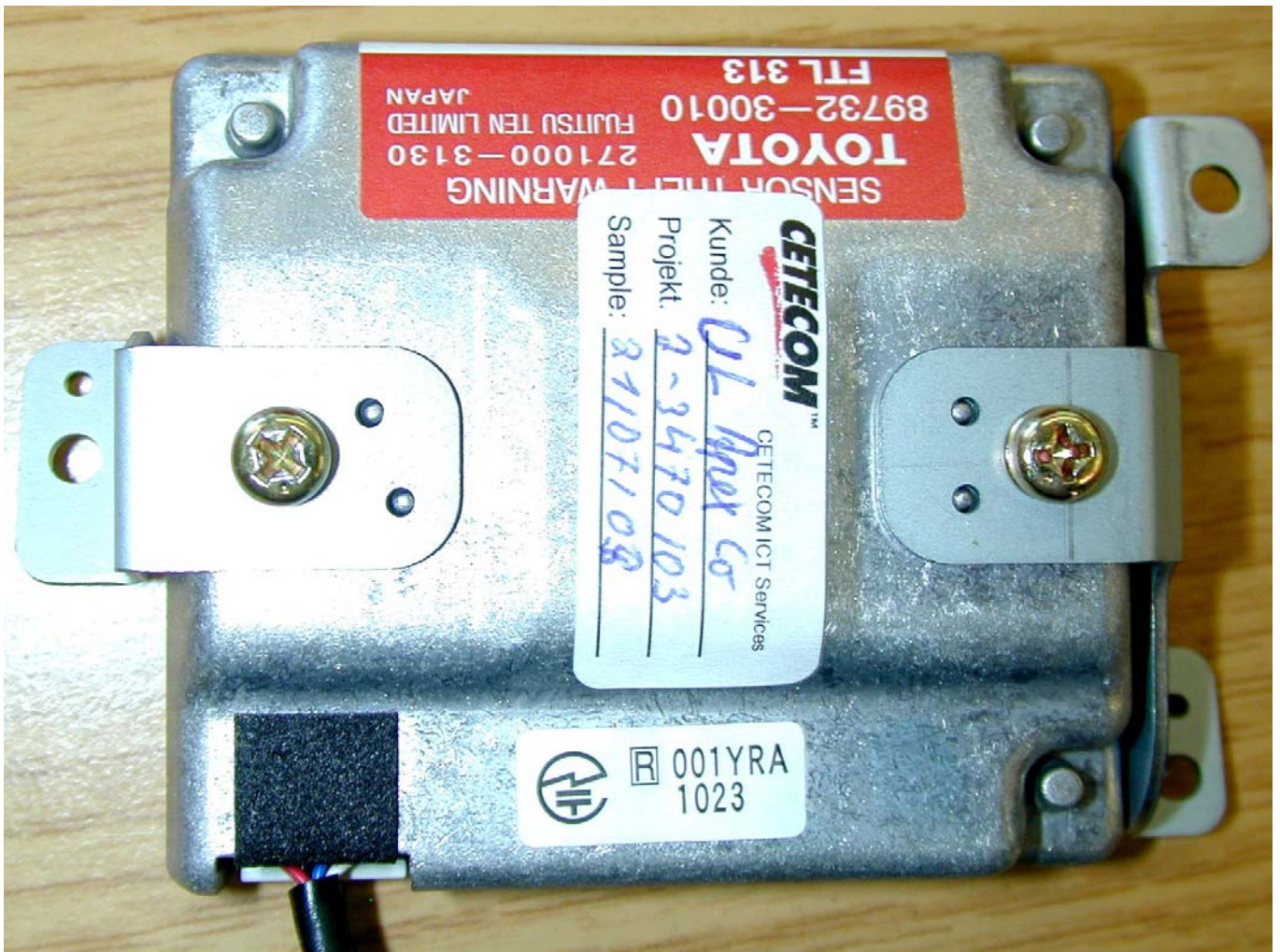


Photo no.: 6



Photo no.: 7



Photo no.: 8

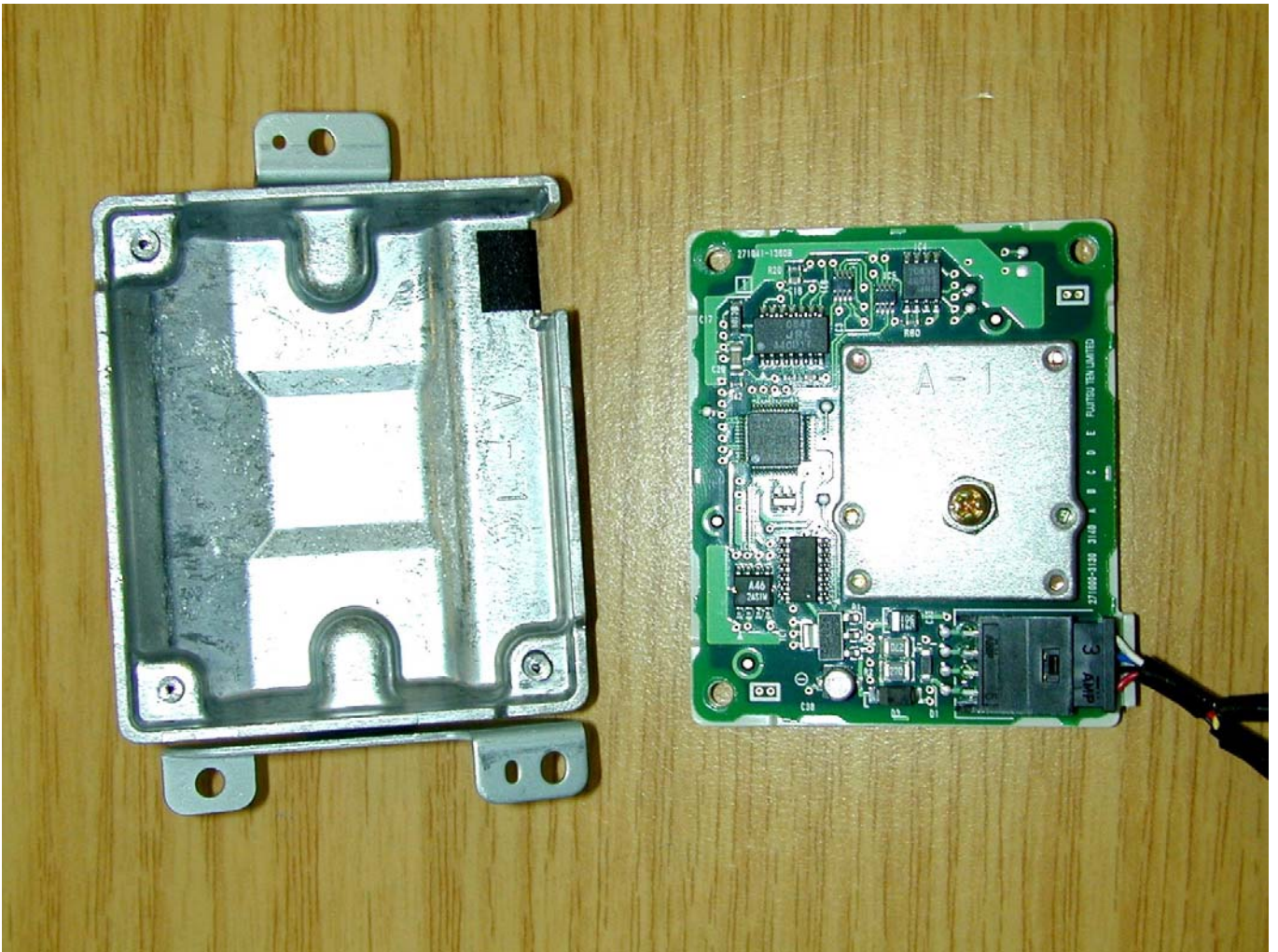


Photo no.: 9

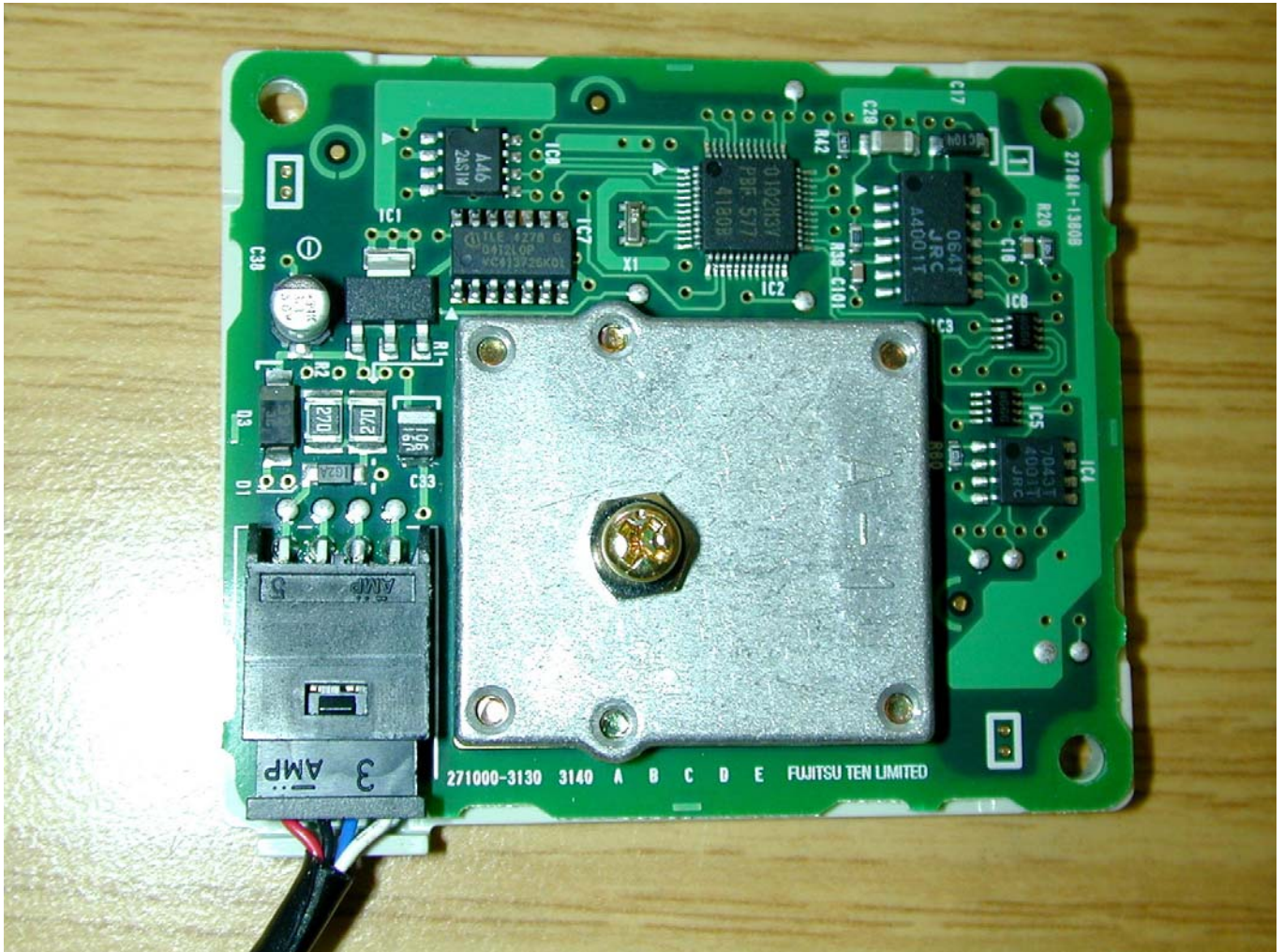


Photo no.: 10

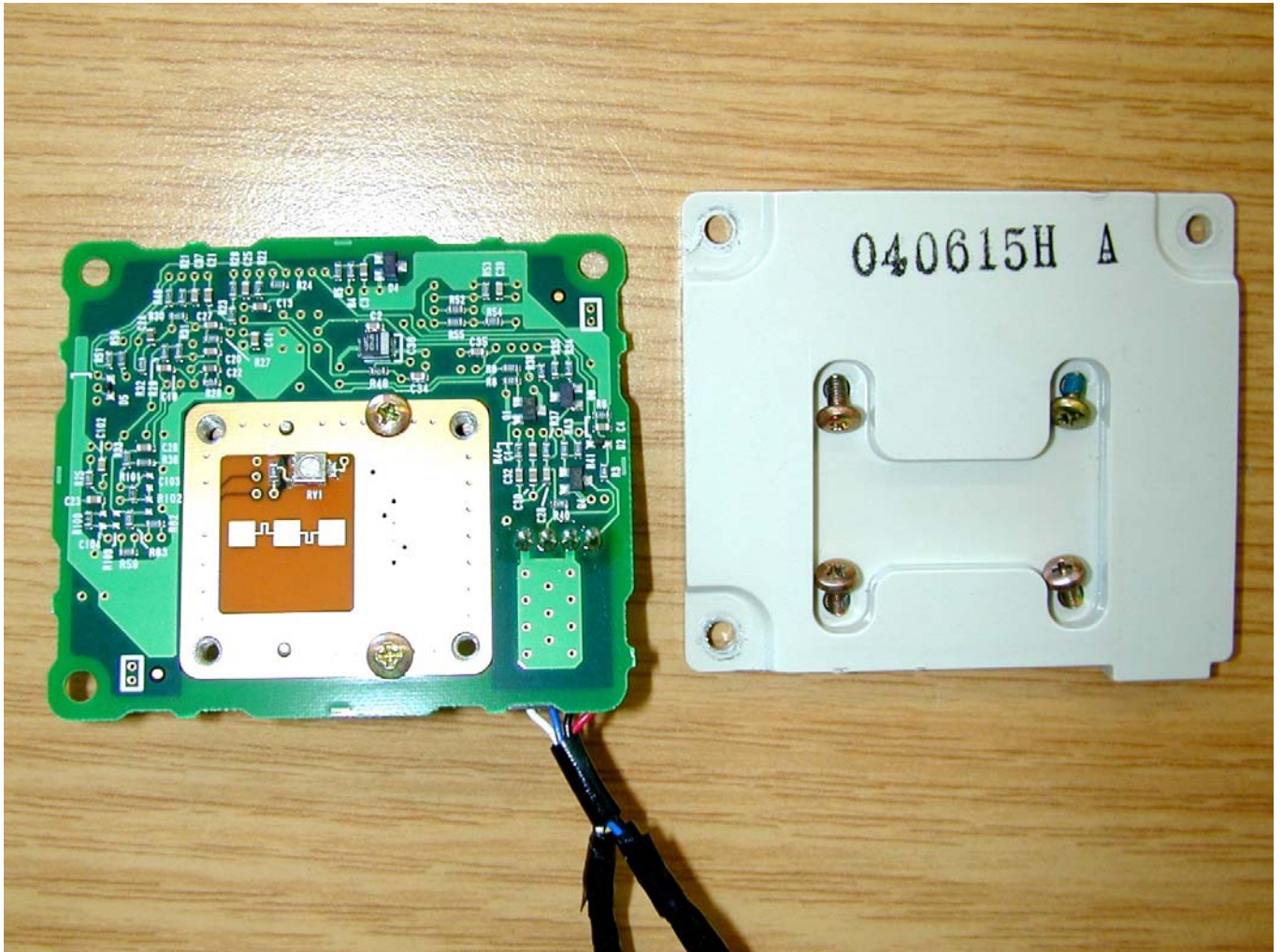


Photo no.: 11

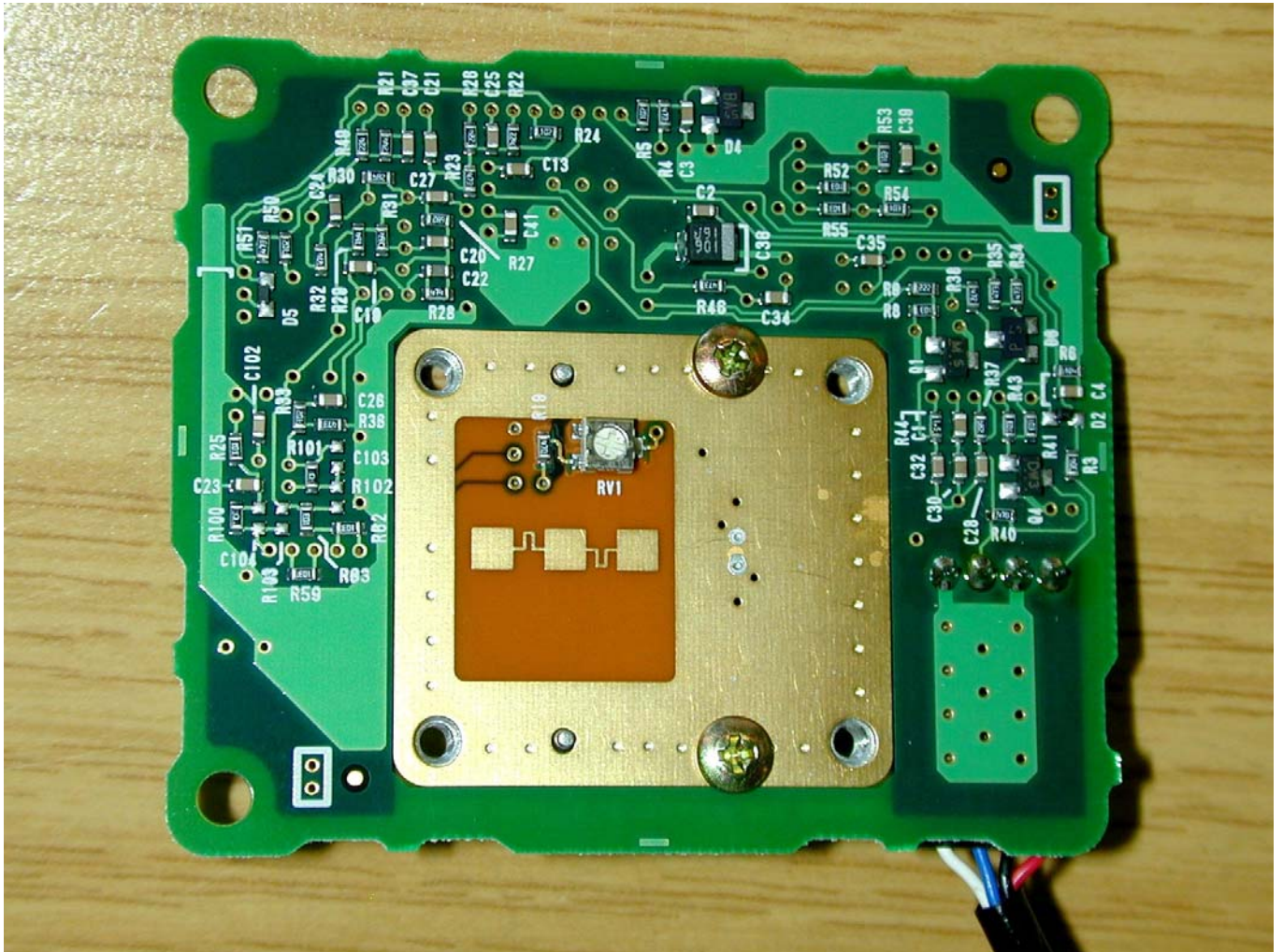


Photo no.: 12

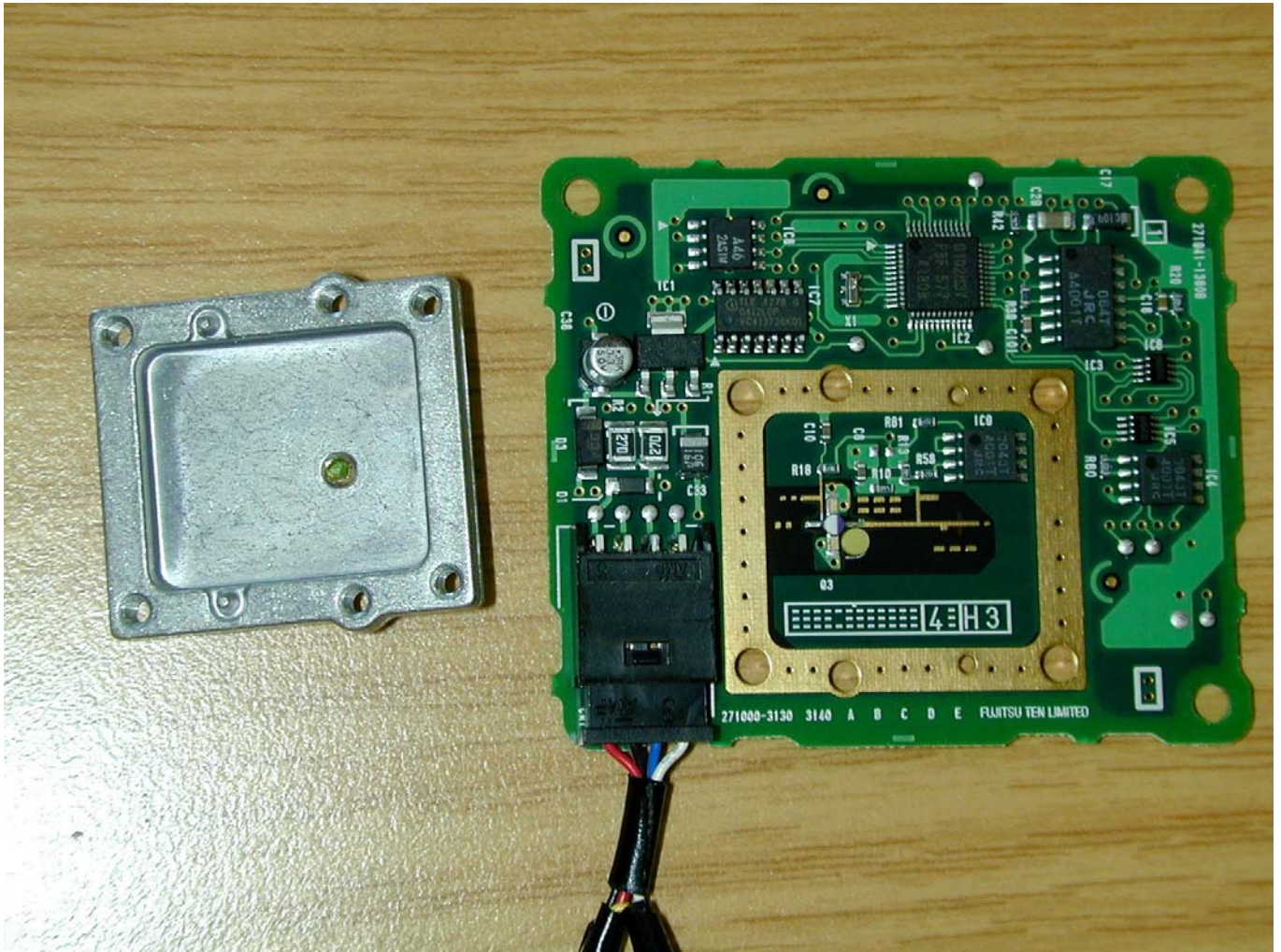


Photo no.: 13

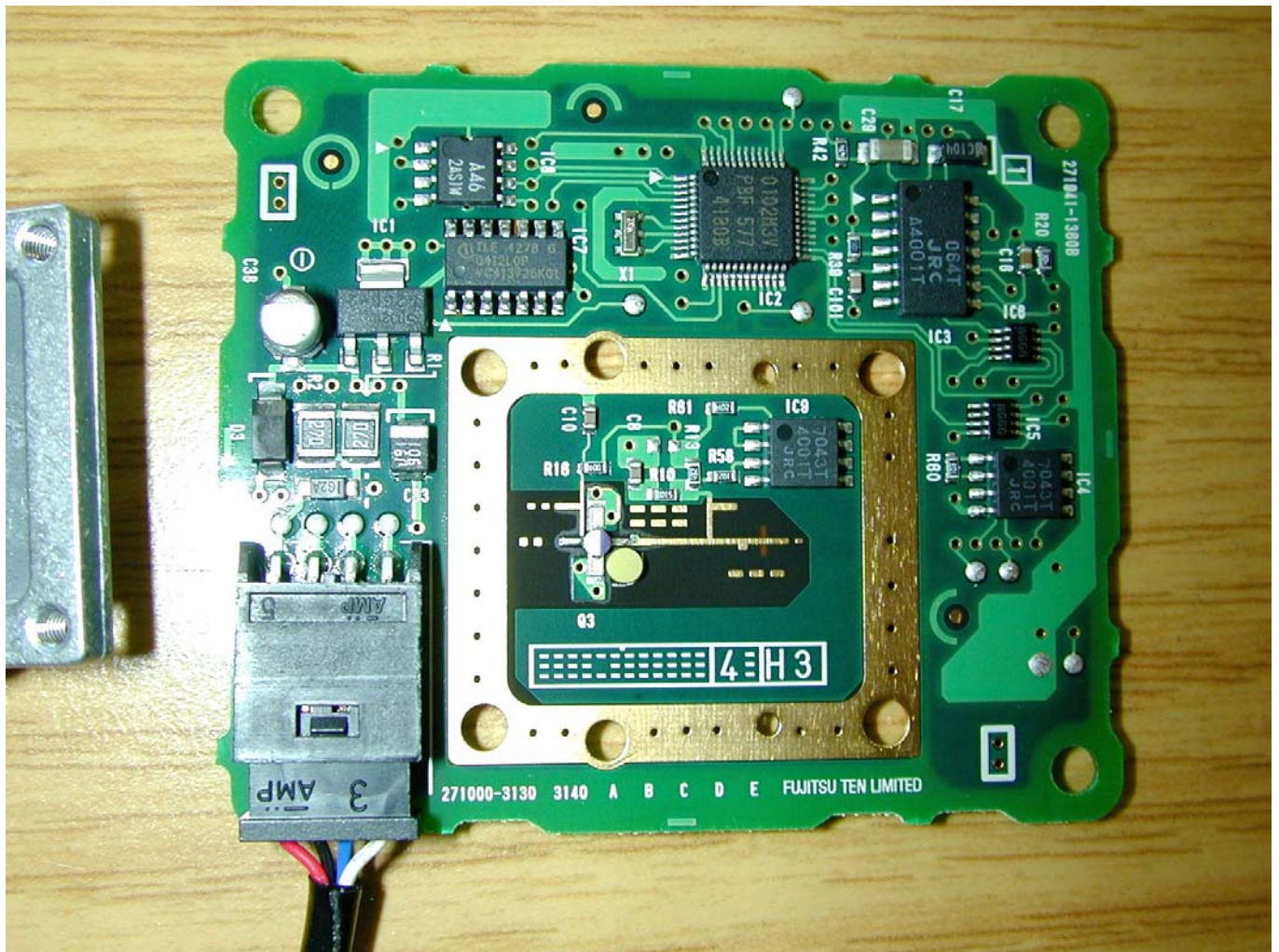


Photo no.: 14

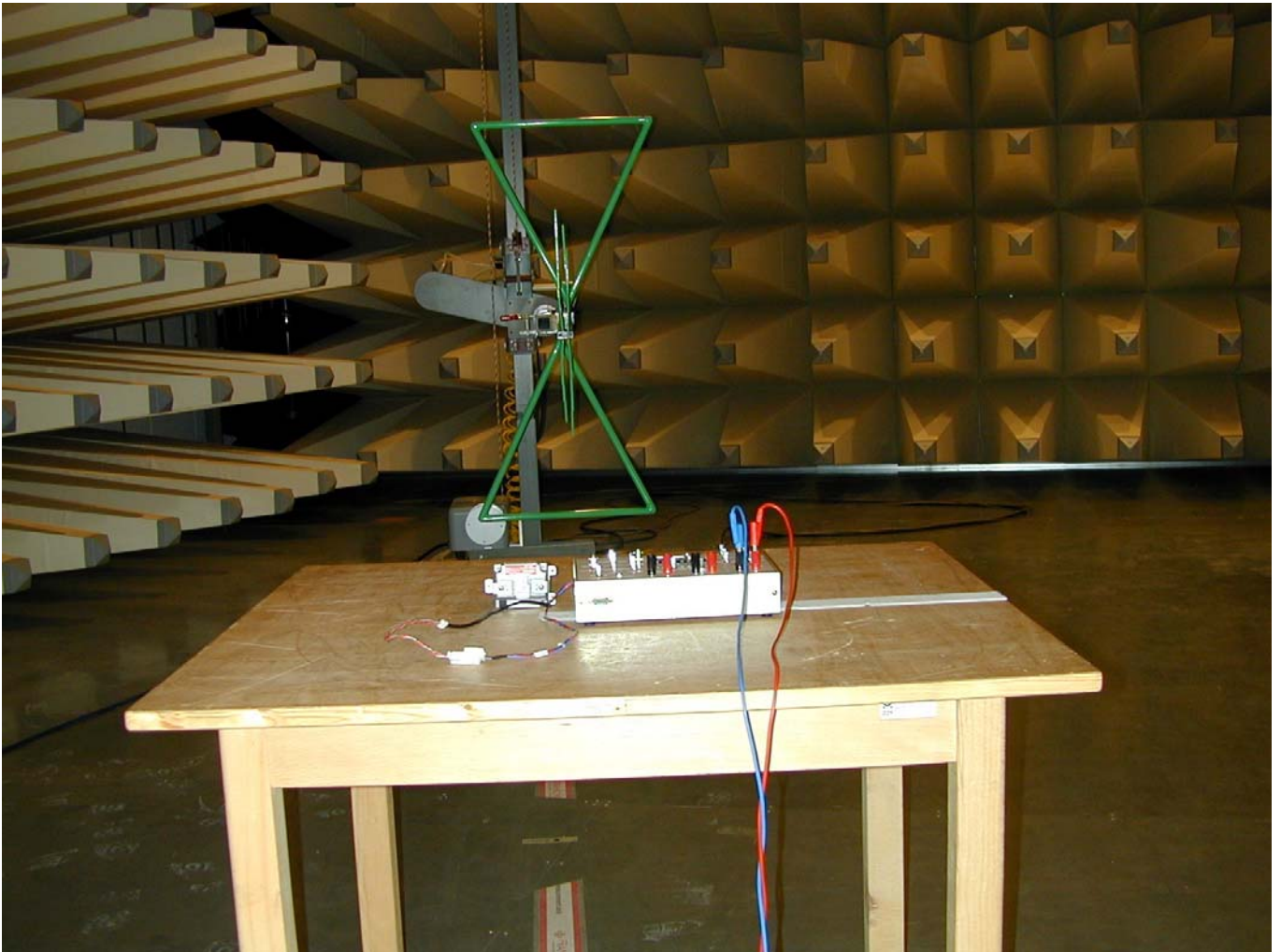


Photo no.: 15

