TTI-P-G166/98

Accredited Bluetooth™ Test Facility (BQTF)

Test report no.: 2_2648-02-02/01
FCC Part 15.231
LK 05 0515 50

CETECOM – ICT Services GmbH
Untertürkheimerstr. 6-10
66117 Saarbrücken, Germany

Telephone: + 49 (0) 681 / 598-0
Fax: + 49 (0) 681 / 9075

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. The 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.

1.2 Testing laboratory

CETECOM ICT Services GmbH
66117 Saarbrücken
Untertürkheimer Straße 6 - 10
Deutschland
Telefone : + 49 681 598 - 0
Telefax : + 49 681 598 - 9075
E-mail : info@ict.cetecom.de
Internet : www.cetecom.de

Accredited testing laboratory
DAR-registration number : TTI-P-G-166/98-30

1.3 Details of applicant

Name : Leopold KOSTAL GmbH & Co KG
Street : An der Bellmerei 10
City : D-58513 LÜDENSCHEID
Country : Germany
Telephone : +49 (0) 231 7588 586
Telefax : +49 (0) 231 7588 100
Contact : Mr. Michael Fromm, AEK8, (Werk Dortmund)
Telephone : +49 (0) 231 7588 586

1.4 Application details

Date of receipt of application : 16.01.2002
Date of receipt of test item : 16.01.2002
Date of test : 16.01.2002 – 04.02.2002

1.5 Test item

Type of equipment	:	Transceiver Module for car access
Type designation	:	**LK 05 0515 50**
Manufacturer	:	- applicant -
Street	:	
City	:	
Country	:	
Serial number	:	A211 820 98 26

Additional informations: :

Frequency	:	**315 MHz 60K0F1D**	Channel separation:	**>25 kHz**
Output Power	:	74.4 dBµV/m at 3m Average		
Number of channels	:	1		
Antenna	:	external antenna inside car		
Power supply	:	12 V DC by car battery		
Hardware	:	44/01		
Software	:	02/02		

1.6 Test standards

FCC Part 15.231 FCC and CANADA RSS-210

2 Technical test

2.1 Summary of test results

The radiated tests were performed in a 10m semi-anechoic chamber with a module that was build in a car. The highest produced frequency in the product is 315 MHz. So we round up to 4 GHz for harmonic measurements.
The antenna is fixed inside the car, here it is a wire antenna.

The measurements were performed vertical and horizontal over the whole frequency range. We start at 1 m high with vertical receiving antenna and rotate the turntable continuously. During rotation we use the antenna lift system to vary the high from 1 to 4 m. So we find maximum radiation output. At this points we do manual remeasurements. After this we do the same measurements in horizontal position of the receiving antenna. This (horizontal and vertical) is made for all the three planes of the test sample. We use the maximum received results.
The detector function and selection of bandwidth are according ANSI C63.2-1996 item 8.2.1 and ANSI C63.4-1992 Item 4.2.
Antennas are conform with ANSI C63.2-1996 item 15.
150 kHz - 30 MHz: Quasi Peak measurement, 9kHz Bandwidth, passive loop antenna.
30 MHz - 200 MHz: Peak and Quasi Peak measurement, 120KHz Bandwidth, biconical antenna. QP is measured with a CISPR system, Average power is calculated.
200MHz - 1GHz: Peak and Quasi Peak measurement, 120KHz Bandwidth, log periodic antenna. Average power may be calculated.
>1GHz: Peak and Average, RBW 1MHz, VBW 10 MHz, waveguide horns and standard gain horns.

All measurement settings are according to FCC 15.35, 15.205, 15.209, 15.231 .
The product fullfills also the requirements for CANADA RSS-210

No deviations from the technical specification(s) were ascertained in the course of the tests.

Final verdict : PASS

Technical responsibility for area of testing :

04.02.02	RSC 8414	Ames H.	
Date	**Section**	**Name**	**Signature**

Technical responsibility for area of testing :

04.02.02	RSC8412	Hausknecht D.	
Date	**Section**	**Name**	**Signature**

2.2 Testreport

TEST REPORT

FCC Part 15.231

Testreport no.: 2_2648-02-02/01

TEST REPORT REFERENCE

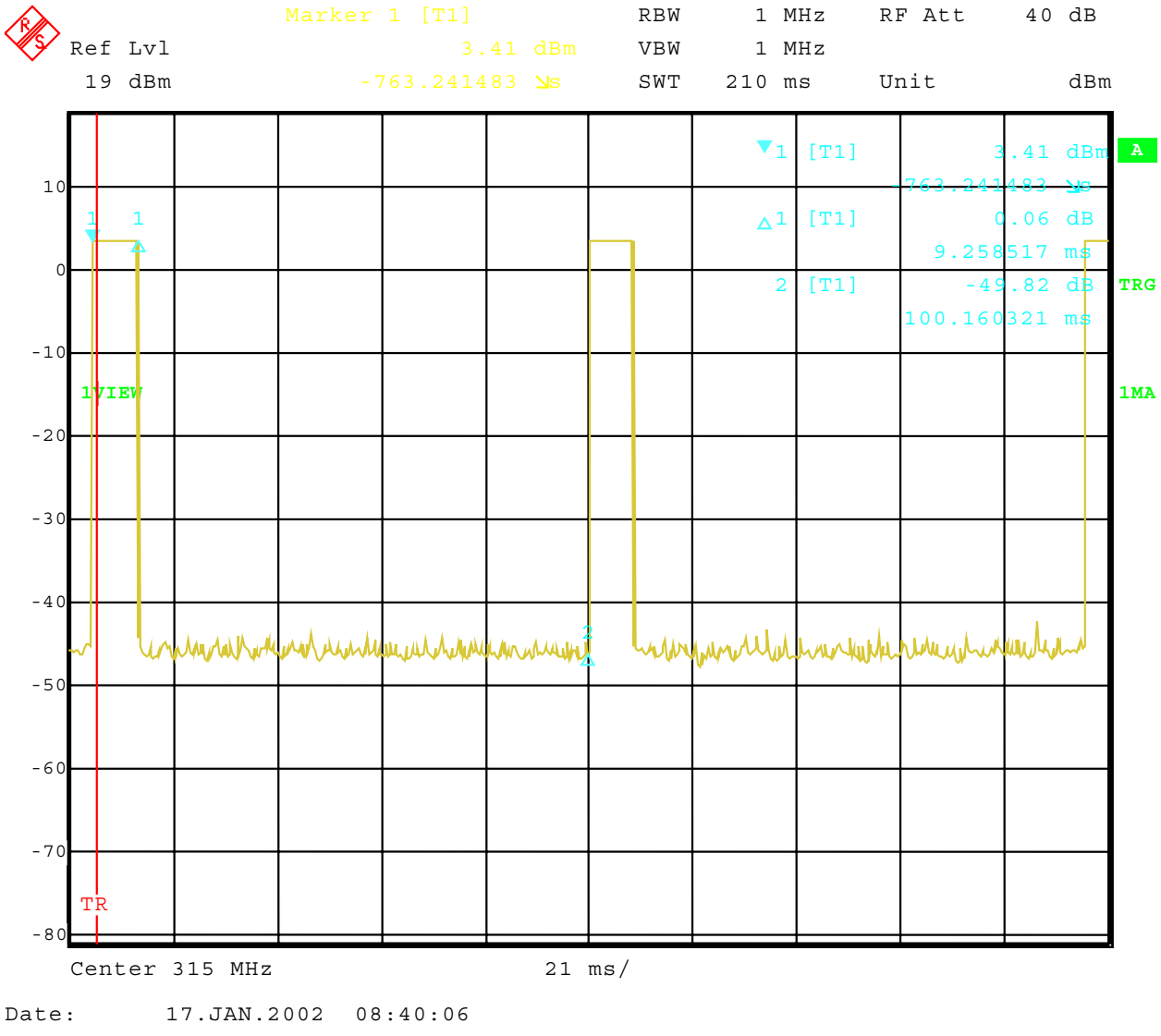
LIST OF MEASUREMENTS

The list of measurements called for in FCC Part 15.231 is given below.

TIME OF TRANSMITTING **SUBCLAUSE 15.231 (a)**

- The transmitter stops immediately after being released.

DUTY CYCLE/ ON-OFF-TIME **Subclause 15 231 (b)(2)**



TX on-time is 9.25 ms, TX off + TX on is 100 ms. So we have a ratio of <u>–10.34 dB</u> between Peak and Average (10*log(TX on/(Txon and off)))

FIELD STRENGTH OF RADIATED EMISSIONS SUBCLAUSE 15.231 (b)

In the measuring results below we base on a 10m distance.
For the FCC standard we have to correct the values with 10.5 dB for the distance of 3m.

Data File : / 16 Jan 1903 12:08:54

No	EMISSION FREQUENCY MHz	SPEC LIMIT dBuV	MEASUREMENTS ABS	dLIM dB	MODE	POL	SITE HGT cm	AZM deg	CORR FACTOR dB	COMMENTS
1	54.1	29.5	15.6	-13.9	PK	H	340	360	N/T	
2	109.5	33.0	20.1	-12.9	PK	V	102	0	N/T	rest. band
3	172.9	33.0	18.7	-14.3	PK	V	102	0	N/T	noise
4	314.968	35.5	74.2	38.7	PK	H	393	160		
5	629.963	35.5	43.3	7.8	PK	H	394	166		

The effective correction factor from 10m to 3m is 10.5 dB.

So we have at 54.1 MHz a value of 15.6 dBµV/m at 10m distance. With the correction factor from 10m to 3m we have 26.1 dBµV/m at 3m distance. (limit is 40 dBµV/m AV)
We have at 109.5 MHz a value of 20.1 dBµV/m at 10m distance. With the correction factor from 10m to 3m we have 30.6 dBµV/m at 3m distance. (limit is 43 dBµV/m AV)
We have at 630 MHz a value of 31.3 dBµV/m at 10m distance. With the correction factor from 10m to 3m we have 53.8 dBµV/m Peak at 3m distance. (limit is 46 dBµV/m Average)
We have to correct the value with –10.34 (see page above). The result is 43.46 dBµV/m AV.

The main carrier is peak 74.2 dBµV/m. So we have 84.7 dBµV/m Peak at 3m distance.
As we have a average correction factor of –10.34 dB (see page above), we have
74.36 dBµV/m AVERAGE at 3m distance. (Limit is 75.6 dBµV/m at 3m)

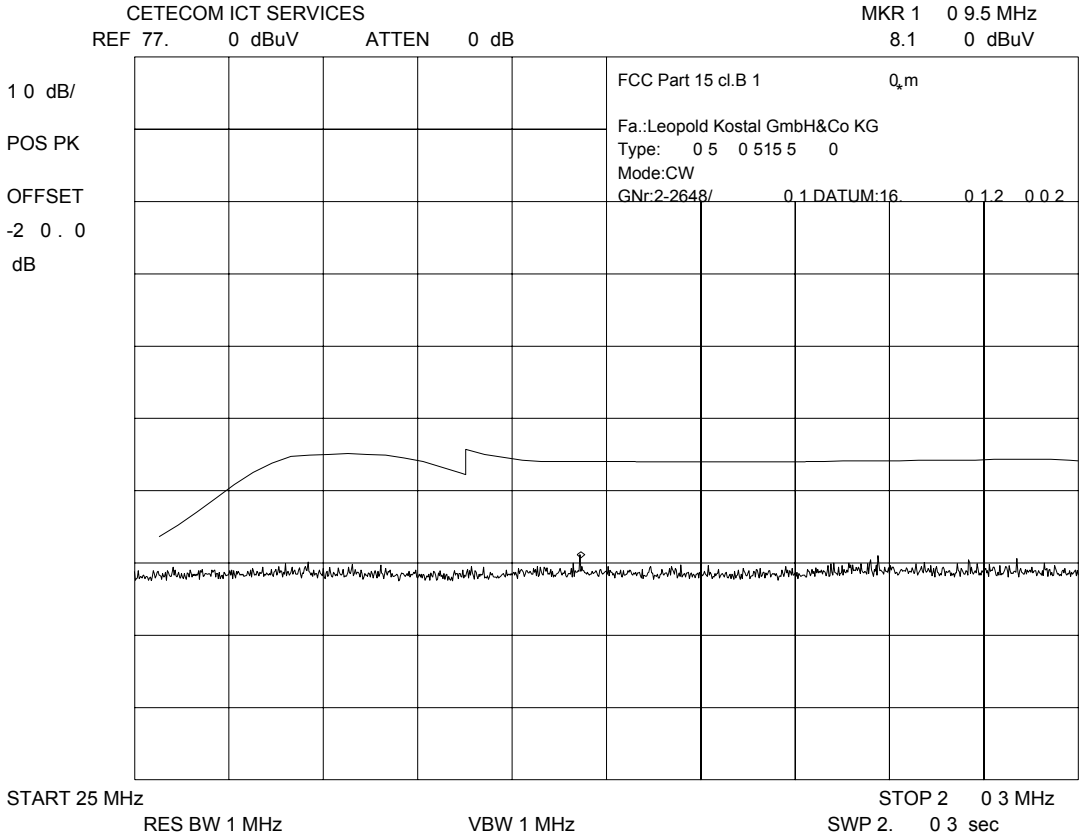
The manual measurement with a CISPR QP adapter at 120 kHz BW shows 75.2 dBµV/m.

All other frequencies are more than 6 dB below the limit of radiated emissions.

FIELD STRENGTH OF RADIATED EMISSIONS SUBCLAUSE 15.231 (b)

25 – 200 MHz vertical

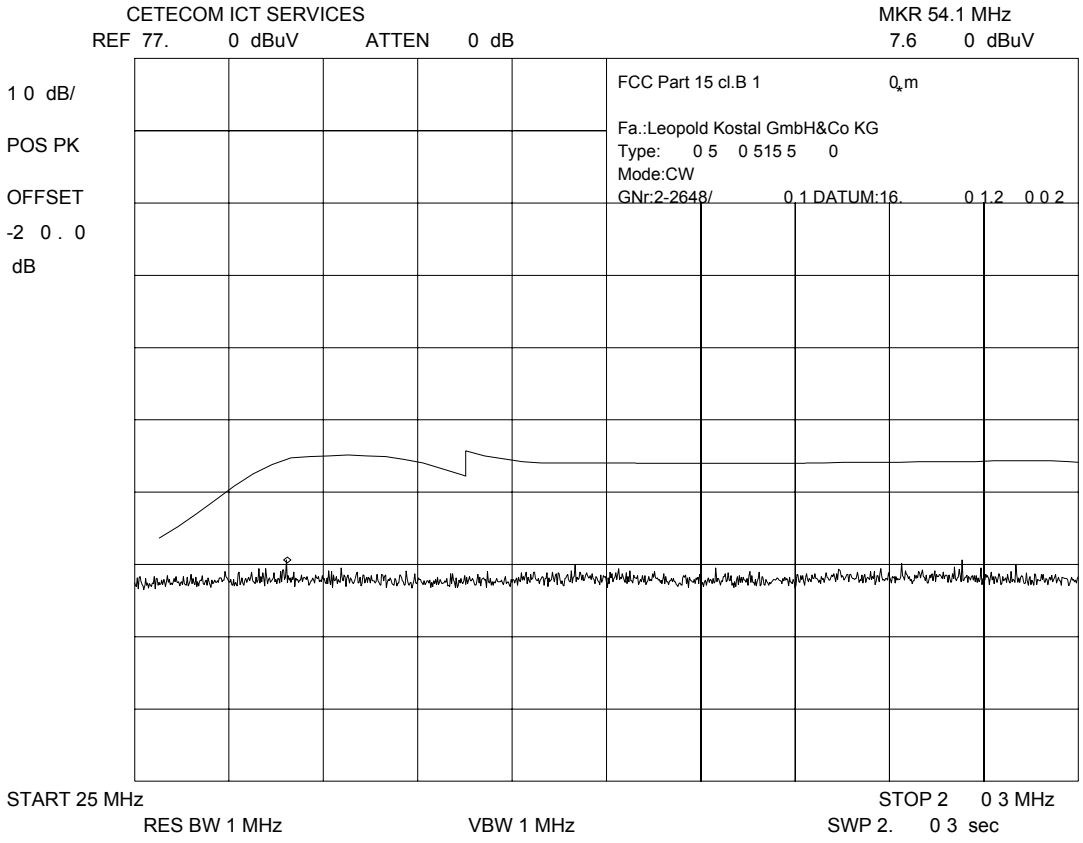
These measurements were performed in a 10m semi-anechoic chamber according to FCC rules. The correction factor from 10m to 3m is 10.5 dB.



This is a scan. Manual measurements were performed according to the procedure described at page 4.

FIELD STRENGTH OF RADIATED EMISSIONS SUBCLAUSE 15.231 (b)

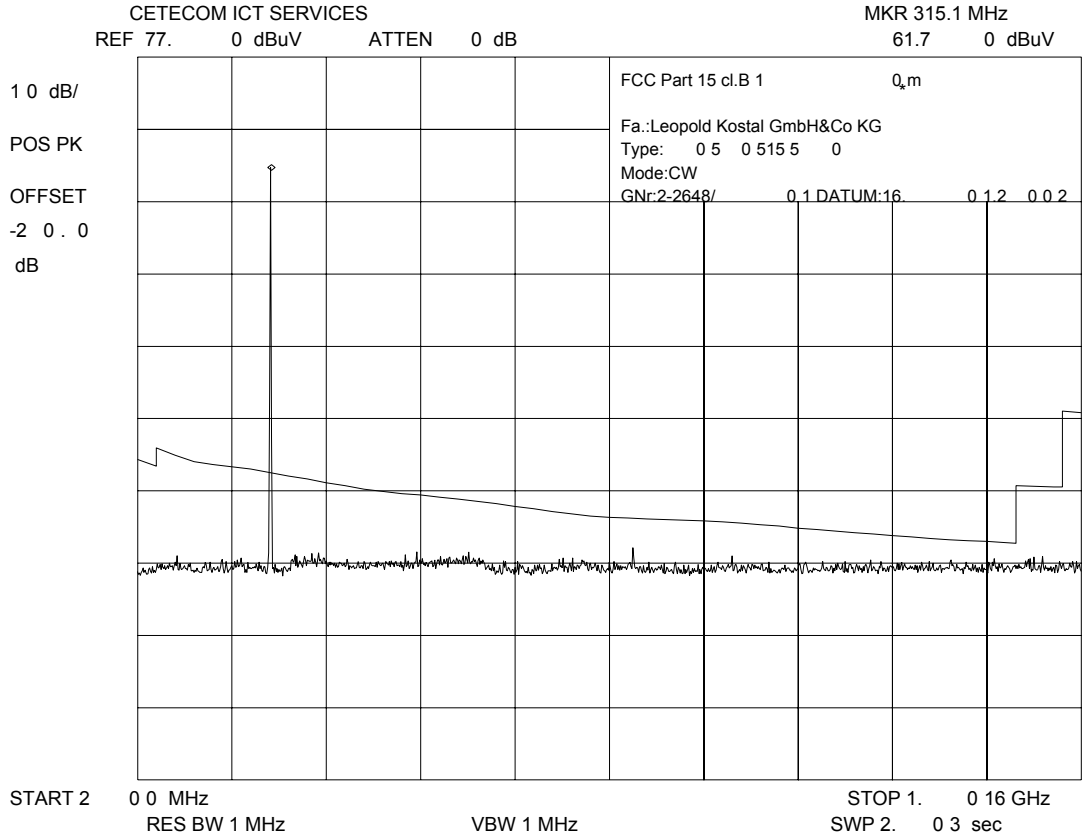
25 – 200 MHz horizontal



This is a scan. Manual measurements were performed according to the procedure described at page 4.

FIELD STRENGTH OF RADIATED EMISSIONS SUBCLAUSE 15.231 (b)

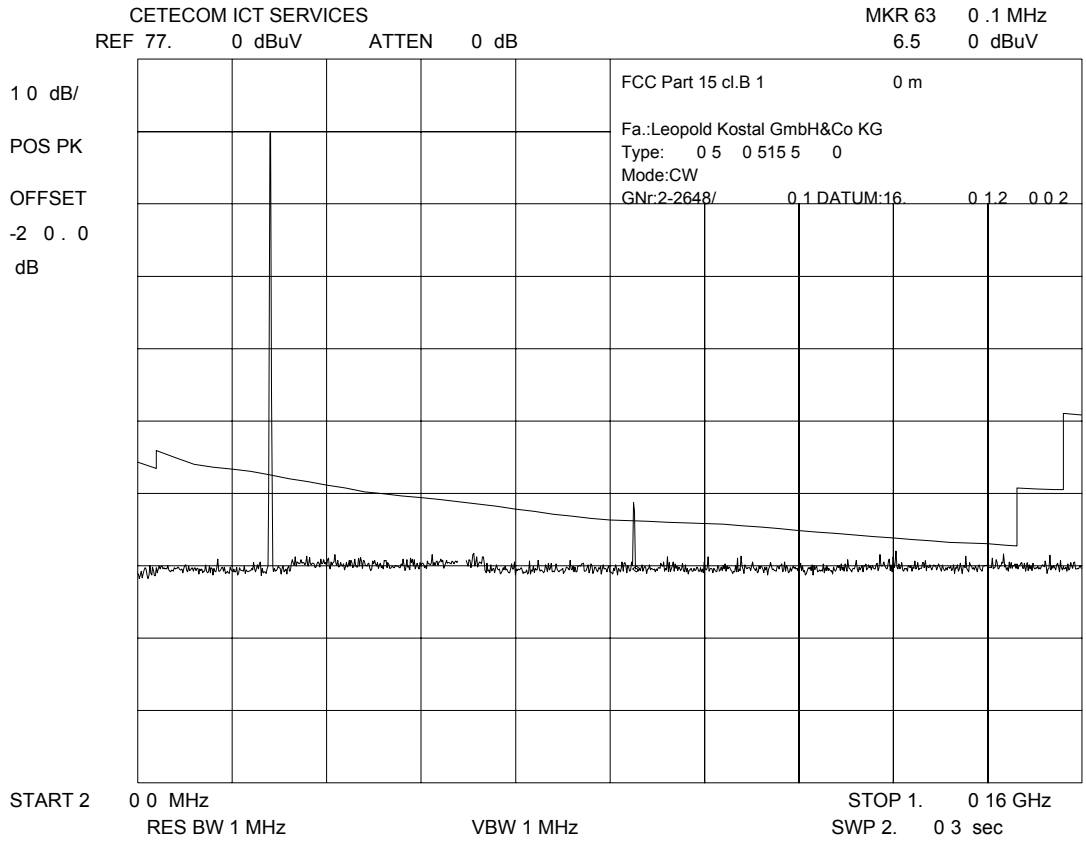
200 - 1000 MHz vertical



This is a scan. Manual measurements were performed according to the procedure described at page 4.

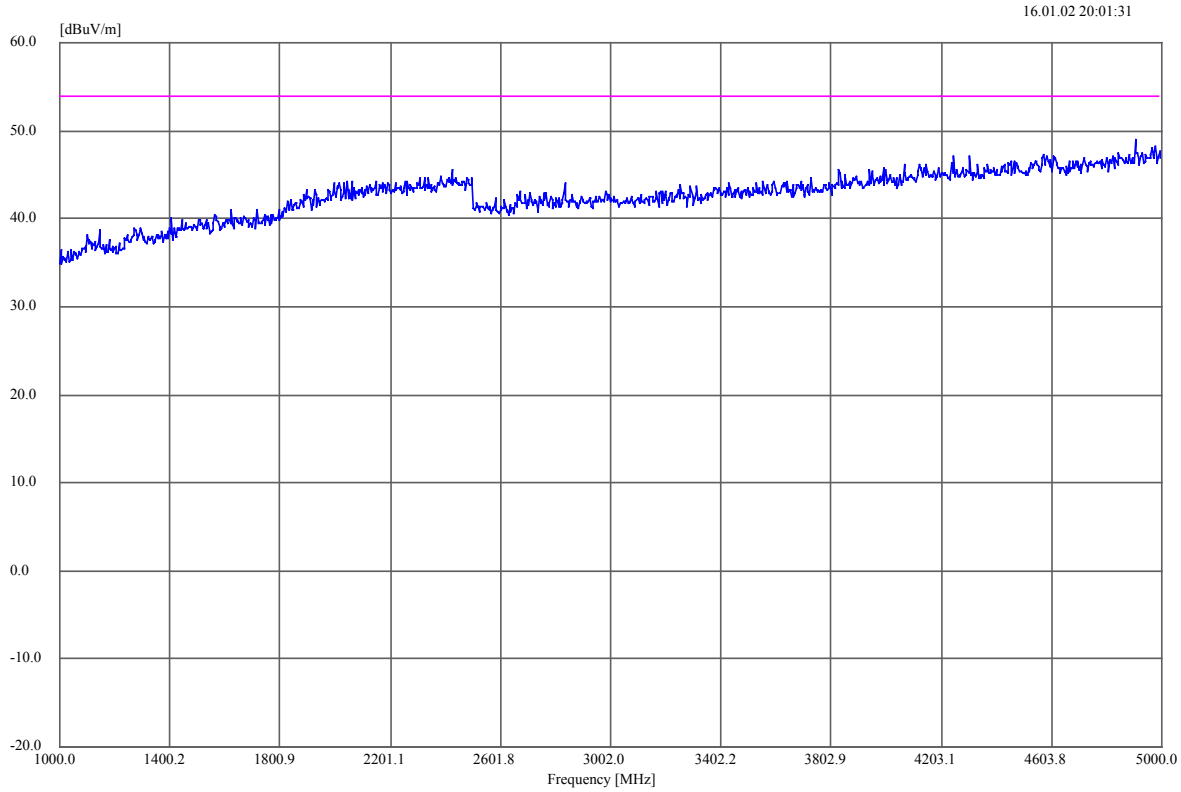
FIELD STRENGTH OF RADIATED EMISSIONS SUBCLAUSE 15.231 (b)

200 - 1000 MHz horizontal



This is a scan. Manual measurements were performed according to the procedure described at page 4.

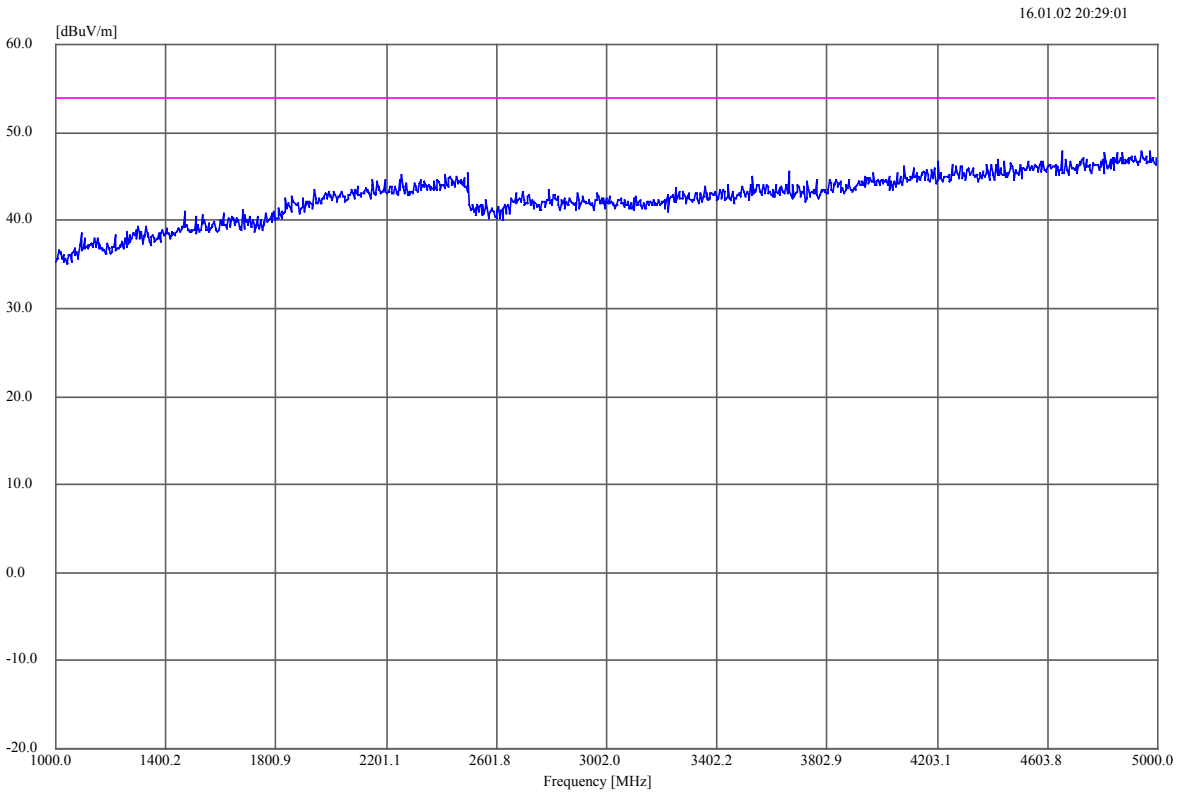
1000 – 5000 MHz vertical



RBW/VBW 1 MHz, red line is limit at 3m distance.

There were no peaks found.

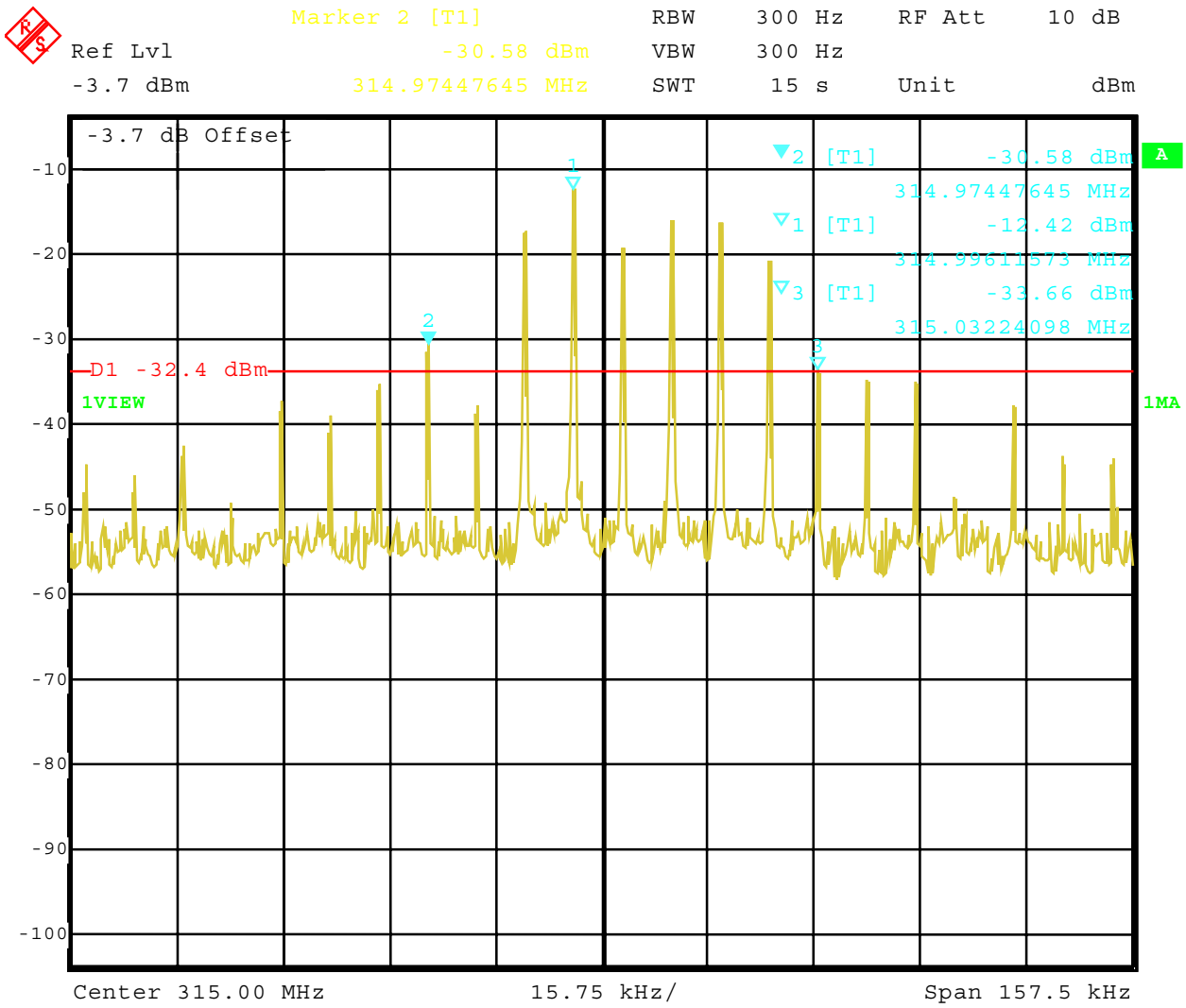
1000 – 5000 MHz horizontal



RBW/VBW 1 MHz, red line is limit at 3m distance.

There were no peaks found.

BANDWIDTH OF EMISSIONS **SUBCLAUSE 15.231 (c)**



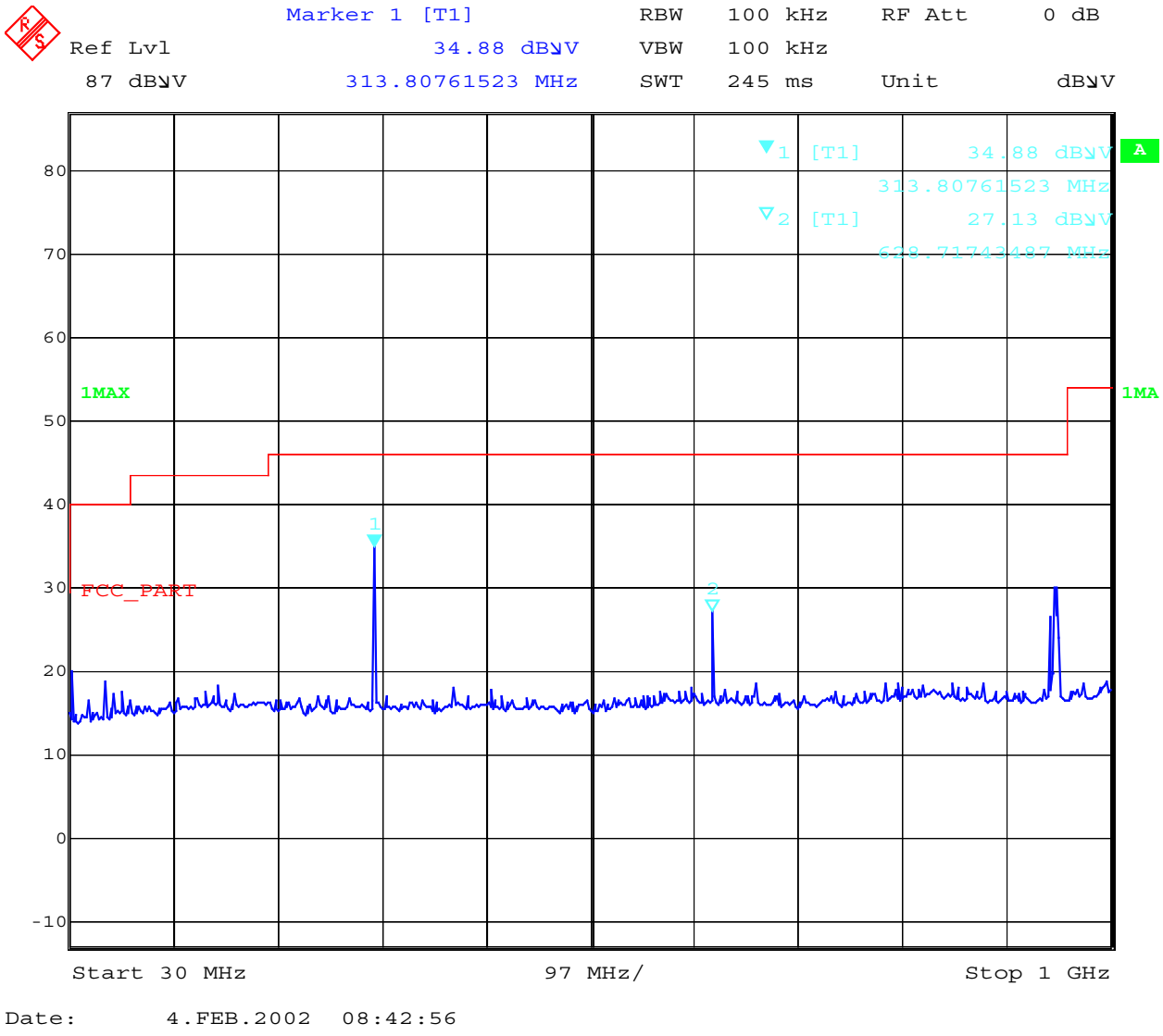
We used a small BW to determine the frequencies and a long sweep time to catch all signals. The red line is the –20 dB line (99.5 %) according to FCC standards.

So the occupied BW is 315.032 MHz – 314.974 MHz = <u>58kHz.</u>

The limit for 315 MHz is 780 kHz.

SPURIOUS EMISSIONS **SUBCLAUSE 15.209**
Receiver operating

30 - 1000 MHz



RBW/VBW 100 kHz. The measurements were made conducted at the antenna output.

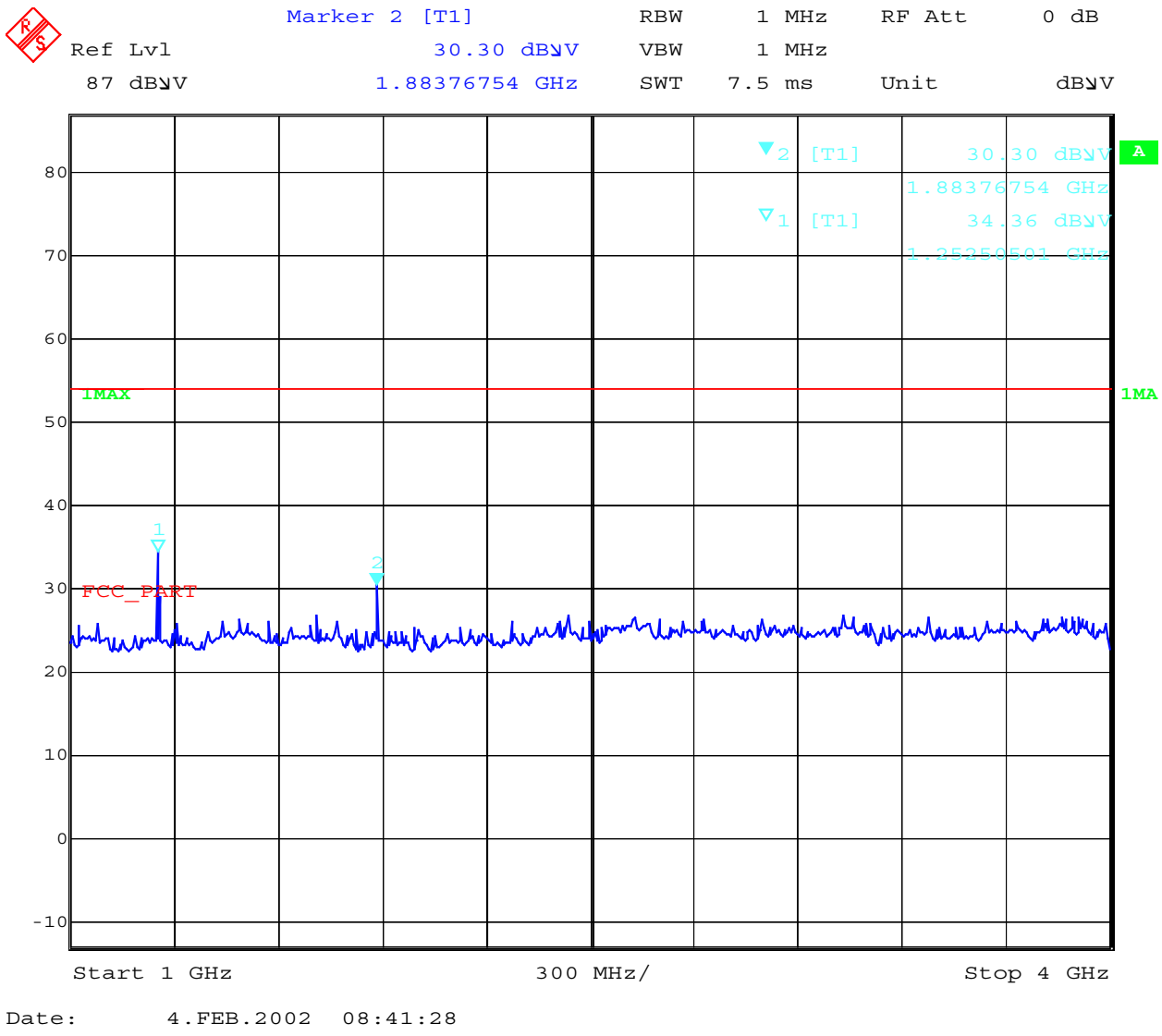
The peak at 940 MHz is caused by a GSM repeater nearby, not by the sample.

<u>All peaks are >10 dB below radiated limit for restricted bands.</u>

Radiated measurements showed no peaks.

SPURIOUS EMISSIONS **SUBCLAUSE 15.209**
Receiver operating

1000 - 4000 MHz Peak



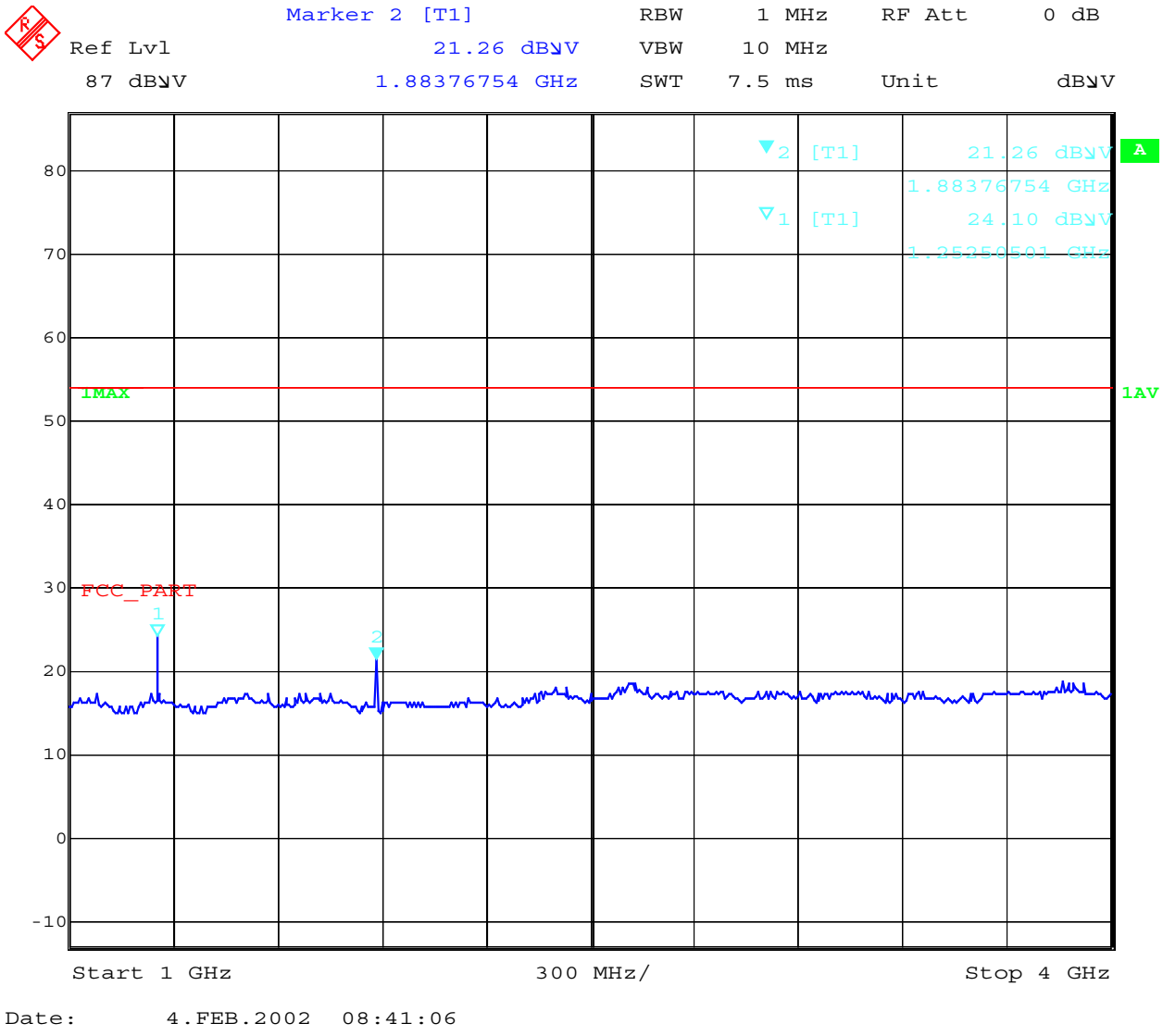
RBW/VBW 1000 kHz. The measurements were made conducted at the antenna output.

<u>All peaks are >10 dB below radiated limit for restricted bands.</u>

Radiated measurements showed no peaks.

SPURIOUS EMISSIONS **SUBCLAUSE 15.209**
Receiver operating

1000 - 4000 MHz Average



RBW/VBW 1000 kHz. The measurements were made conducted at the antenna output.

<u>All peaks are >10 dB below radiated limit for restricted bands.</u>

Radiated measurements showed no peaks.

TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

To simplify the identification on each page of the test equipment used, on each page of the test report, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory, below.

No	Instrument/Ancillary	Type	Manufacturer	Serial No.
01	Spectrum Analyzer	8566 A	Hewlett-Packard	1925A00257
02	Analyzer Display	8566 A	Hewlett-Packard	1925A00860
03	Oscilloscope	7633	Tektronix	230054
04	Radio Analyzer	CMTA 54	Rohde & Schwarz	894 043/010
05	System Power Supply	6038 A	Hewlett-Packard	2848A07027
06	Signal Generator	8111 A	Hewlett-Packard	2215G00867
07	Signal Generator	8662 A	Hewlett-Packard	2224A01012
08	Funktionsgenerator	AFGU	Rohde & Schwarz	862 480/032
09	Regeltrenntrafo	MPL	Erfi	91350
10	Netznachbildung	NNLA 8120	Schwarzbeck	8120331
11	Relais-Matrix	PSU	Rohde & Schwarz	893 285/020
12	Power-Meter	436 A	Hewlett-Packard	2101A12378
13	Power-Sensor	8484 A	Hewlett-Packard	2237A10156
14	Power-Sensor	8482 A	Hewlett-Packard	2237A00616
15	Modulationsmeter	9008	Racal-Dana	2647
16	Frequenzzähler	5340 A	Hewlett-Packard	1532A03899
17	Absorber Schirmkabine	---	MWB	87400/002
18	Spectrum Analyzer	85660 B	Hewlett-Packard	2747A05306
19	Analyzer Display	85662 A	Hewlett-Packard	2816A16541
20	Quasi Peak Adapter	85650 A	Hewlett-Packard	2811A01131
21	RF-Preselector	85685 A	Hewlett-Packard	2833A00768
22	Biconical Antenne	3104	Emco	3758
23	Log. Per. Antenne	3146	Emco	2130
24	Double Ridge Horn	3115	Emco	3088
25	EMI-Testreceiver	ESAI	Rohde & Schwarz	863 180/013
26	EMI-Analyzer-Display	ESAI-D	Rohde & Schwarz	862 771/008
27	Biconical Antenne	HK 116	Rohde & Schwarz	888 945/013
28	Log. Per. Antenne	HL 223	Rohde & Schwarz	825 584/002
29	Relais-Switch-Unit	RSU	Rohde & Schwarz	375 339/002
30	Highpass	HM985955	FSY Microwave	001
31	Amplifier	P42-GA29	Tron-Tech	B 23602
32	Absorber Schirmkabine		Frankonia	
33	Steuerrechner	PSM 7	Rohde & Schwarz	834 621/004
34	EMI Test Reciever	ESMI	Rohde & Schwarz	827 063/010
35	EMI Test Receiver	Display	Rohde & Schwarz	829 808/010

TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

To simplify the identification on each page of the test equipment used, on each page of the test report, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory, below.

No	Instrument/Ancillary	Type	Manufacturer	Serial No.
36	Controler	HD 100	Deisel	100/322/93
37	Relais Matrix	PSN	Rohde & Schwarz	829 065/003
38	Control Unit	GB 016 A2	Rohde & Schwarz	344 122/008
39	Relais Switch Unit	RSU	Rohde & Schwarz	316 790/001
40	Power Supply	6032A	Hewlett Packard	2846A04063
41	Spektrum Monitor	EZM	Rohde & Schwarz	883 720/006
42	Meßempfänger	ESH 3	Rohde & Schwarz	890 174/002
43	Meßempfänger	ESVP	Rohde & Schwarz	891 752/005
44	Biconi Ant. 20-300MHz	HK 116	Rohde & Schwarz	833 162/011
45	Logper Ant. 0.3-1 GHz	HL 223	Rohde & Schwarz	832 914/010
46	Amplifier 0.1-4 GHz	AFS4	Miteq Inc.	206461
47	Logper Ant. 1-18 GHz	HL 024 A2	Rohde & Schwarz	342 662/002
48	Polarisationsnetzwerk	HL 024 Z1	Rohde & Schwarz	341 570/002
49	Double Ridge G Horn Antenne 1-26.5 GHz	3115	EMCO	9107-3696
50	Microw. Sys. Amplifier 0.5- 26.5 GHz	8317A	Hewlett Packard	3123A00105
51	Spectrum Analyzer	FSIQ26	Rohde & Schwarz	1119.6001
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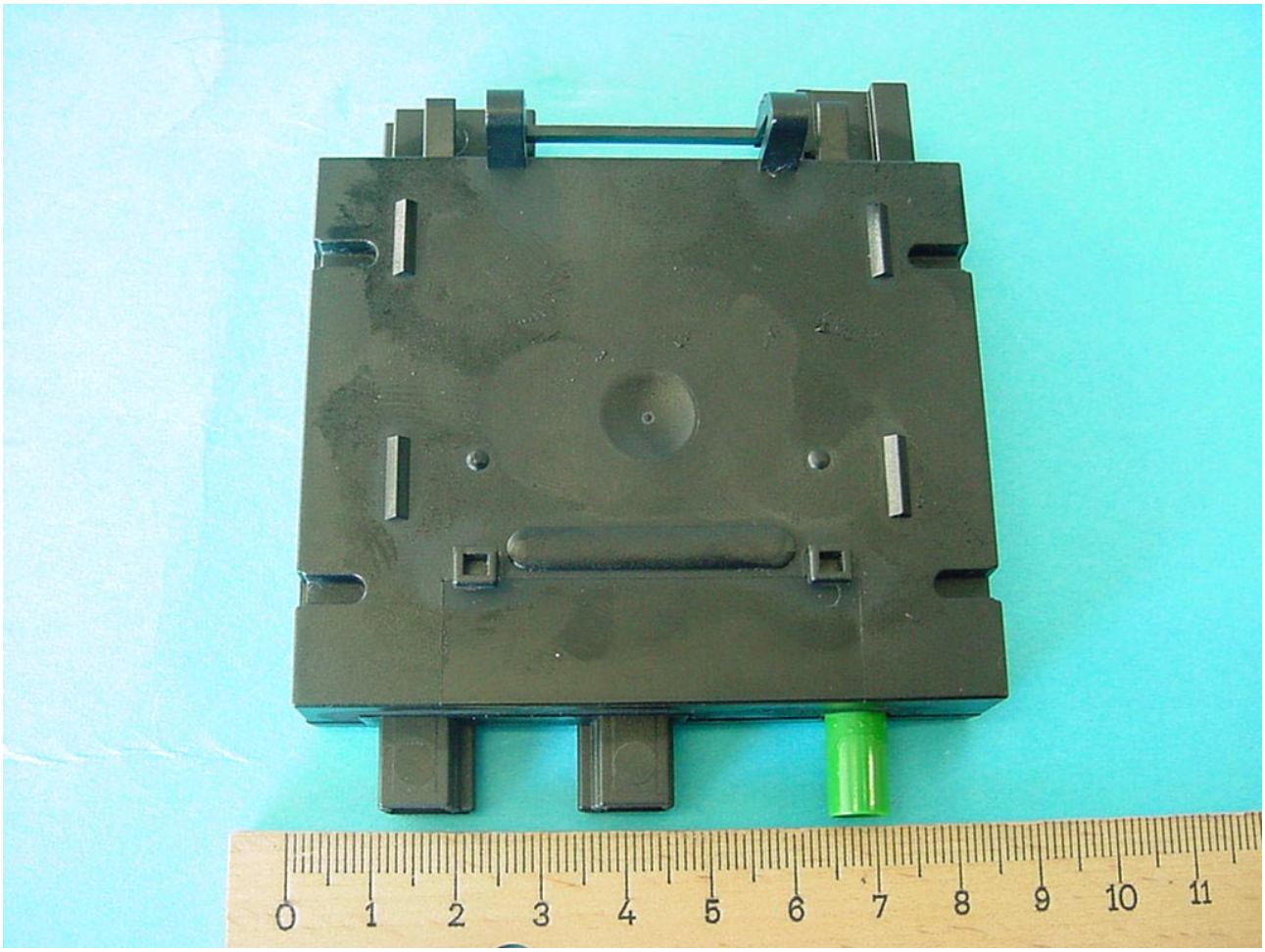
PHOTOGRAPHS OF THE EQUIPMENT

LK 05 0515 50
Photograph no.: 1

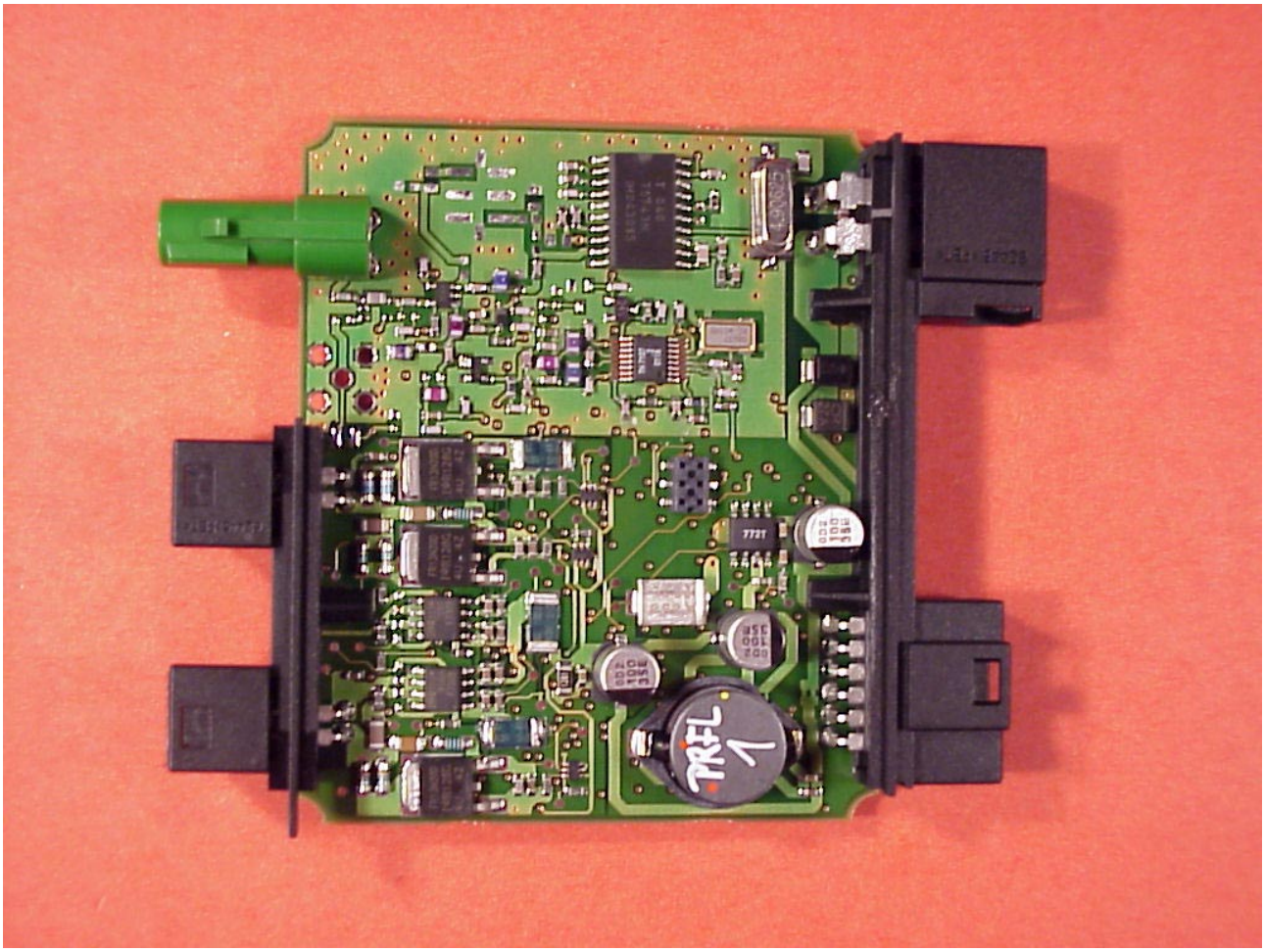
PHOTOGRAPHS OF THE EQUIPMENT

LK 05 0515 050
Photograph no.: 2



PHOTOGRAPHS OF THE EQUIPMENT

LK 05 0515 50
Photograph no.: 3



PHOTOGRAPHS OF THE EQUIPMENT

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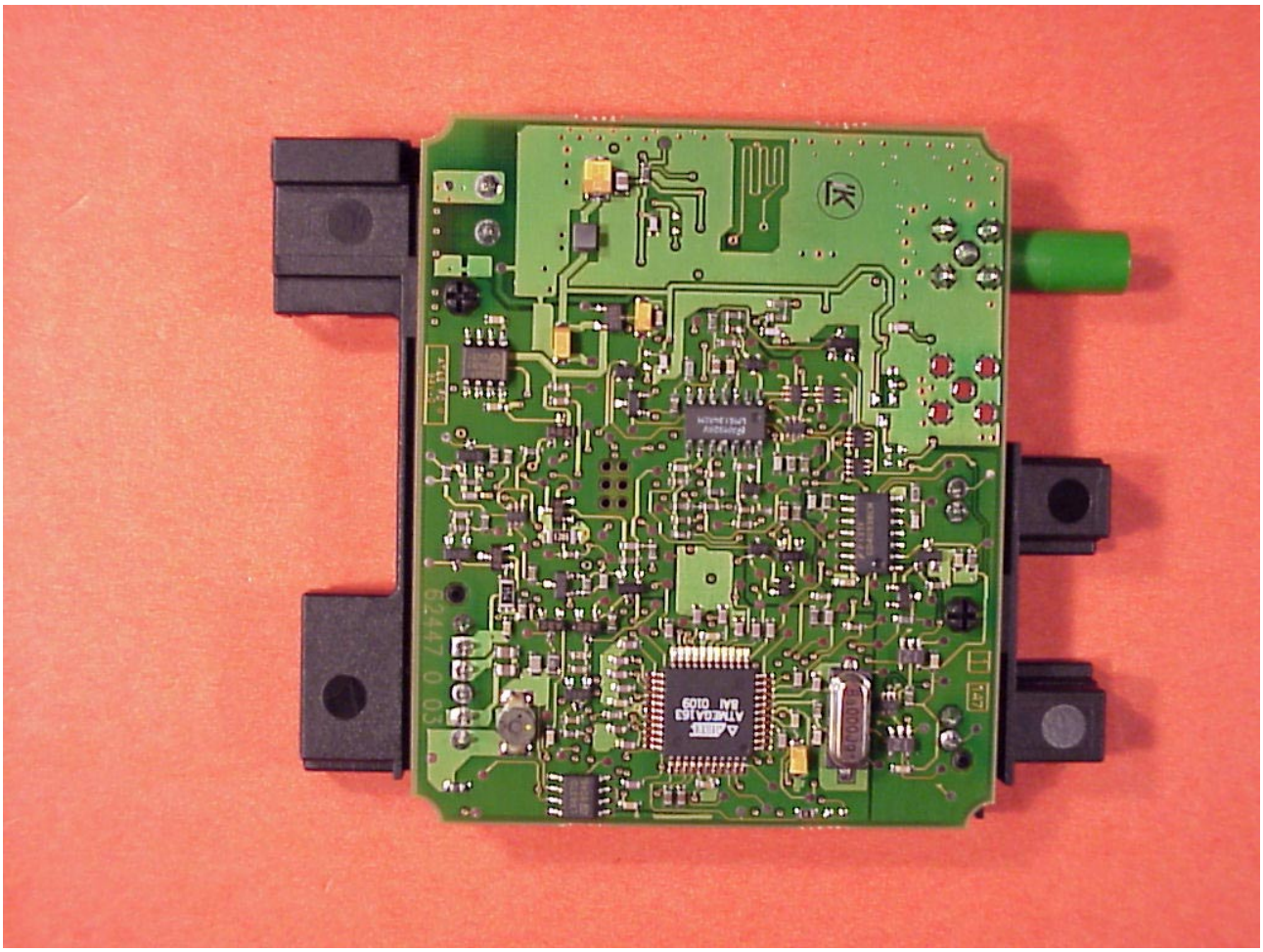
Photograph no.: 4



PHOTOGRAPHS OF THE TESTSITE

LK 05 0515 50
Photograph no.: 5