CETECOM ICT Services GmbH

Radio Satelite Communication
Untertürkheimer Straße 6-10 . D-66117 Saarbrücken Telefon: +49 (0)681 598-9100 Telefax: -9075

Accredited Testing Laboratory

DAR-Registration number:
TTI-P-G 166/98-00

Test report no.: 2_2274-B3/00
FCC Part 15.249
dwcs2.4DM

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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. 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 - 9100
Telefax : + 49 681 598 - 9075
E-mail : Michael.Berg@ict.cetecom.de
Internet : www.cetecom.de
Accredited testing laboratory
DAR-registration number : TTI-P-G 166/98

1.3 Details of applicant

Name : AVM-IRP audio Products GmbH
Street : Mülheimer Freiheit 132
City : D-51063 Köln
Country : Germany
Telephone : +49 (0)221 6 40-13 26
Telefax : +49 (0)221 6 40-21 84
Contact : Mr. Mathias Müller
Telephone : +49 (0)221 6 40-33 35

1.4 Application details

Date of receipt of application : 20.09.00
Date of receipt of test item : 05.10.00
Date of test : 05-06.10.00

1.5 Test item

Type of equipment	:	**Wireless digital conference system**
Type designation	:	**dwcs2.4DM**
Manufacturer	:	applicant
Street	:	
City	:	
Country	:	
Serial number	:	000001
Additional informations:	**:**	
Frequency	:	2436.2 – 2475.8 MHz
Type of modulation	:	1M60F1D
Number of channels	:	14
Antenna	:	integral antenna
Power supply	:	7.2V DC NiMH Accu
Output power	:	max. 0,158 mW
Type of equipment	:	Temperature range : -30°C - +50°C

1.6 Test standards: FCC Part 15 §15.247

2 Technical test

2.1 Summary of test results

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

Technical responsibility for area of testing :

Date	Section	Name	Signature
20.10.00	RSC 8411	Berg	

Technical responsibility for area of testing :

Date	Section	Name	Signature
20.10.00	RSC8414	Ames	

2.2 Testreport

TEST REPORT

Testreport no. : 2_2274-B3/00

TEST REPORT REFERENCE

LIST OF MEASUREMENTS

Paragraph	PARAMETER TO BE MEASURED	PAGE
	Transmitter parameters	
§ 15.249 (a)	Maximum field Strenght	7
§ 15.107	Conducted emissions	11
§15.249 (c)	Transmitter spurious	12
	Transmitter output spectrum	20
	Transmitter stability, Voltage variation	21
	Transmitter stability, Temperature variation	22
	Test equipment listing	23
	Photographs of the equipment	25

MAXIMUM FIELD STRENGTH (RADIATED) **SUBCLAUSE § 15.249 (a)**

TEST CONDITIONS			MAXIMUM FIELD STRENGTH (dBµV/m)		
Frequency (MHz)			2436.2	2453,3	2475.8
T_{nom}(23) °C	V_{nom}(110.0)V	Peak	89.50	87,24	86.90
		Average	82.48	80,22	79.88
Maximum deviation from output power under extreme test conditions (dBc)			-1.8	-1,9	-1.8
Measurement uncertainty			±3dB		

Tx on : 4.1ms
Tx off : 5.1ms
Duty cycle = Tx on/(Tx on + Tx off) = 4.1ms/(4.1 + 5.1)ms = 0.45 or –7.02 dB

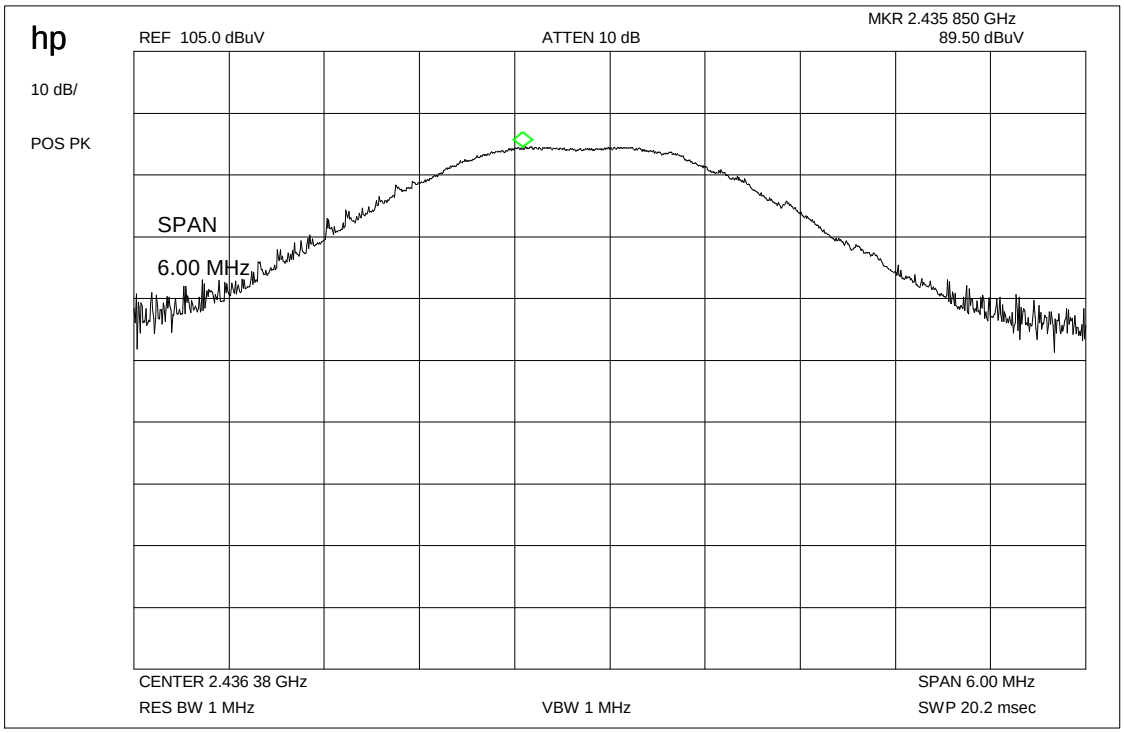
LIMIT **SUBCLAUSE § 15.249 (a)**

Frequency range	MAXIMUM FIELD STRENGTH
2400-2483.5	50mV/m or 94 dBµV/m

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
52 - 63

MAXIMUM FIELD STRENGTH (RADIATED) **SUBCLAUSE § 15.249 (a)**

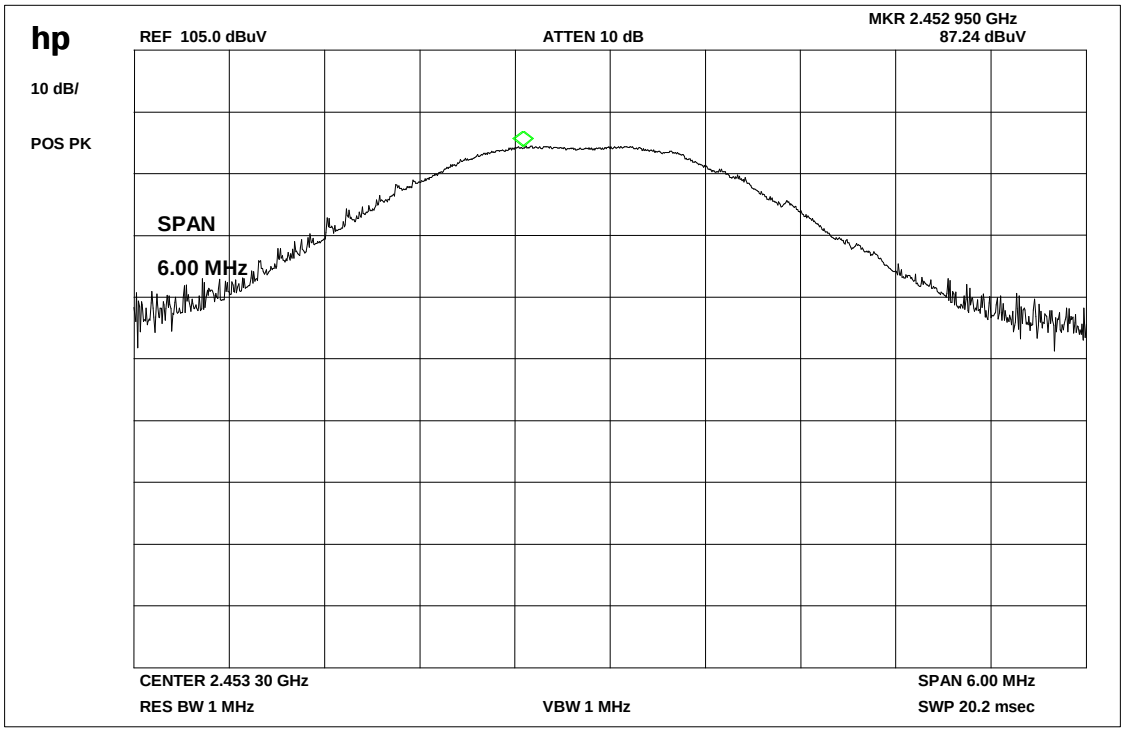
2436.2 MHz



REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
52 - 63

MAXIMUM FIELD STRENGTH (RADIATED) **SUBCLAUSE § 15.249 (a)**

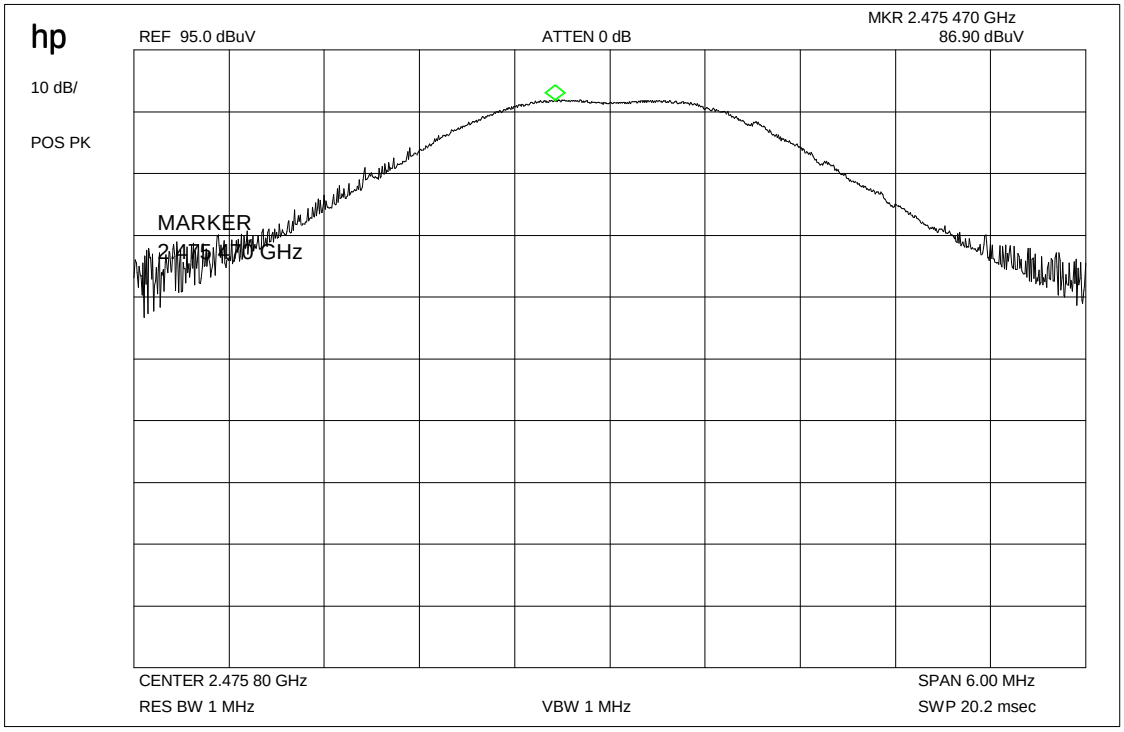
2453.3 MHz



REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
52 - 63

MAXIMUM FIELD STRENGTH (RADIATED) **SUBCLAUSE § 15.249 (a)**

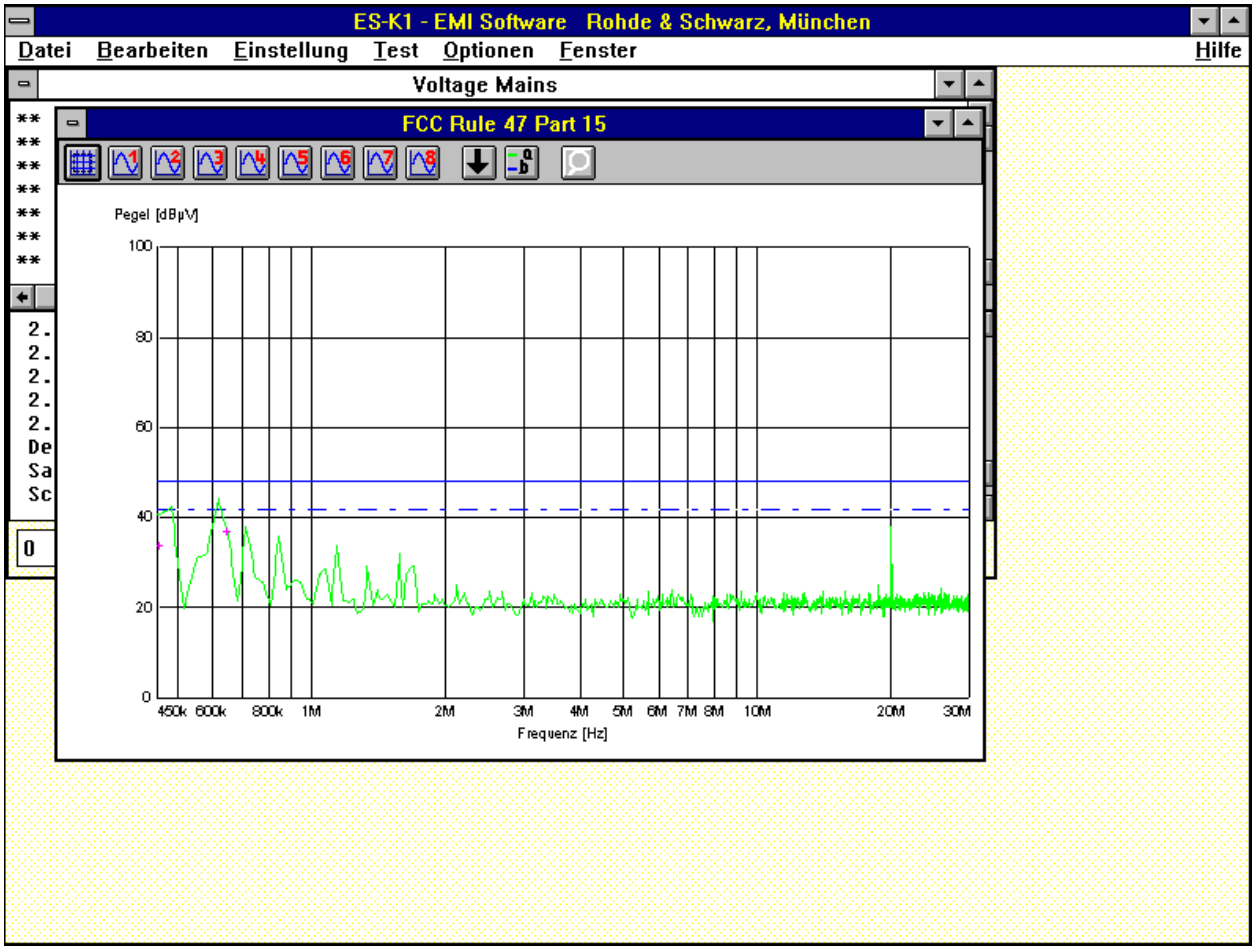
2475.8 MHz



REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
52 - 63

CONDUCTED EMISSIONS **FCC Rule 47 Part 15**

measured with battery charger



Technical specification : 15.207 (Revised as of October 1, 1991)
Limit

0.45 to 30 MHz	250 µV / 47.96 dBµV

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
52 - 63

TRANMITTER SPURIOUS RADIATION **§15.249 (c) / § 15.209**

Radiated

SPURIOUS EMISSIONS LEVEL (µV/m)								
2436.2 MHz			2453,3 MHz			2475.8 MHz		
f (MHz)	Detector	Level (µV/m)	f (MHz)	Detector	Level (µV/m)	f (MHz)	Detector	Level (µV/m)
all peaks <<limit see plots								
Measurement uncertainty			±3 dB					

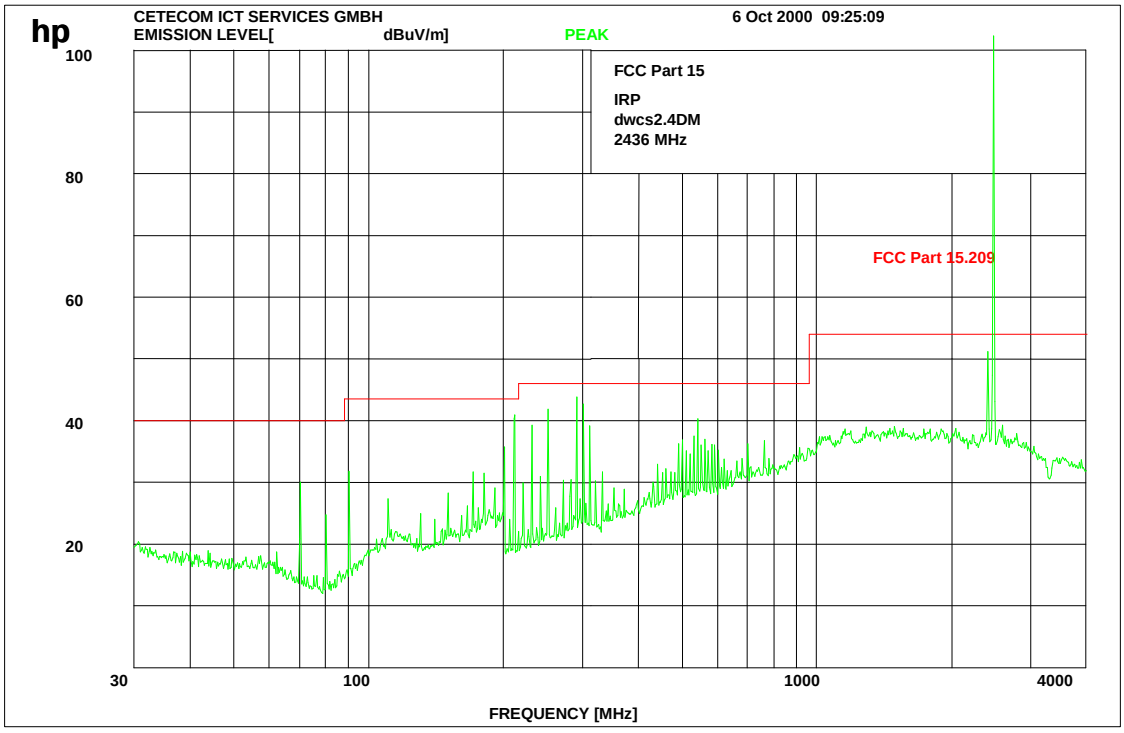
Measurement distance see table

Limits **SUBCLAUSE § 15.209**

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 - 24

TRANSMITTER SPURIOUS RADIATION § 15.209

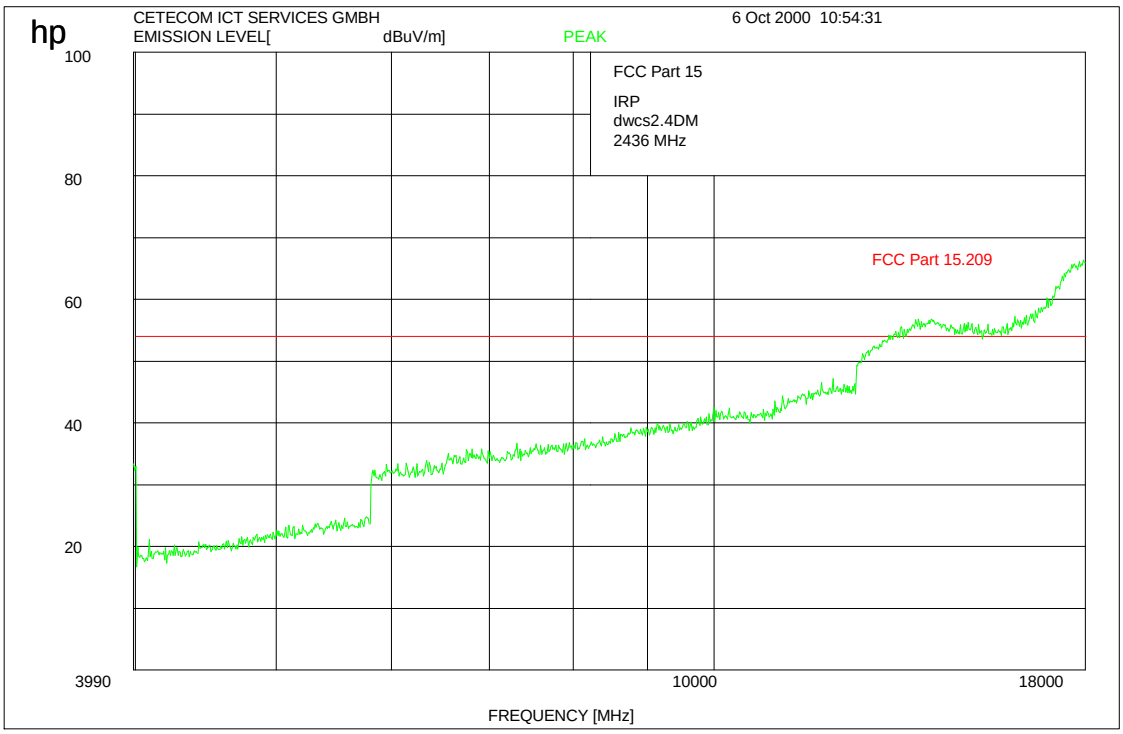


Limits SUBCLAUSE § 15.209

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 - 24

TRANSMIITER SPURIOUS RADIATION **§ 15.209**



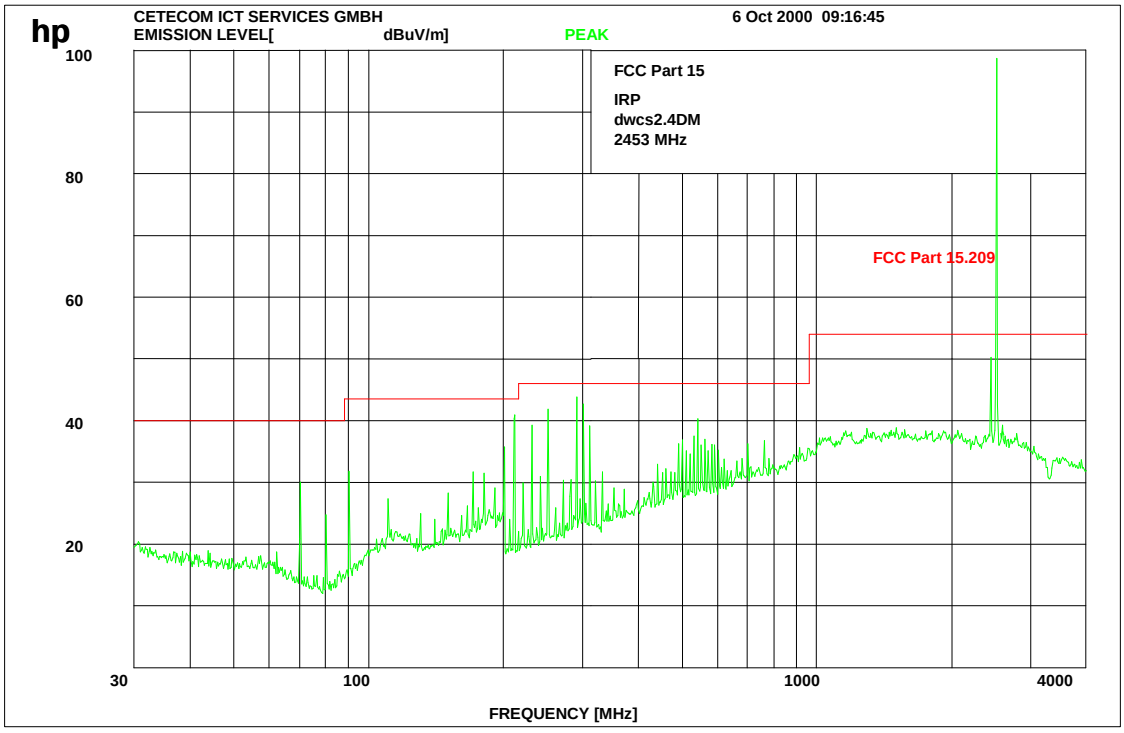
Measurements were made up to 25 GHz with a second Pre-amplifier to reduce noise.

Limits **SUBCLAUSE § 15.209**

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 - 24

TRANSMITTER SPURIOUS RADIATION § 15.209

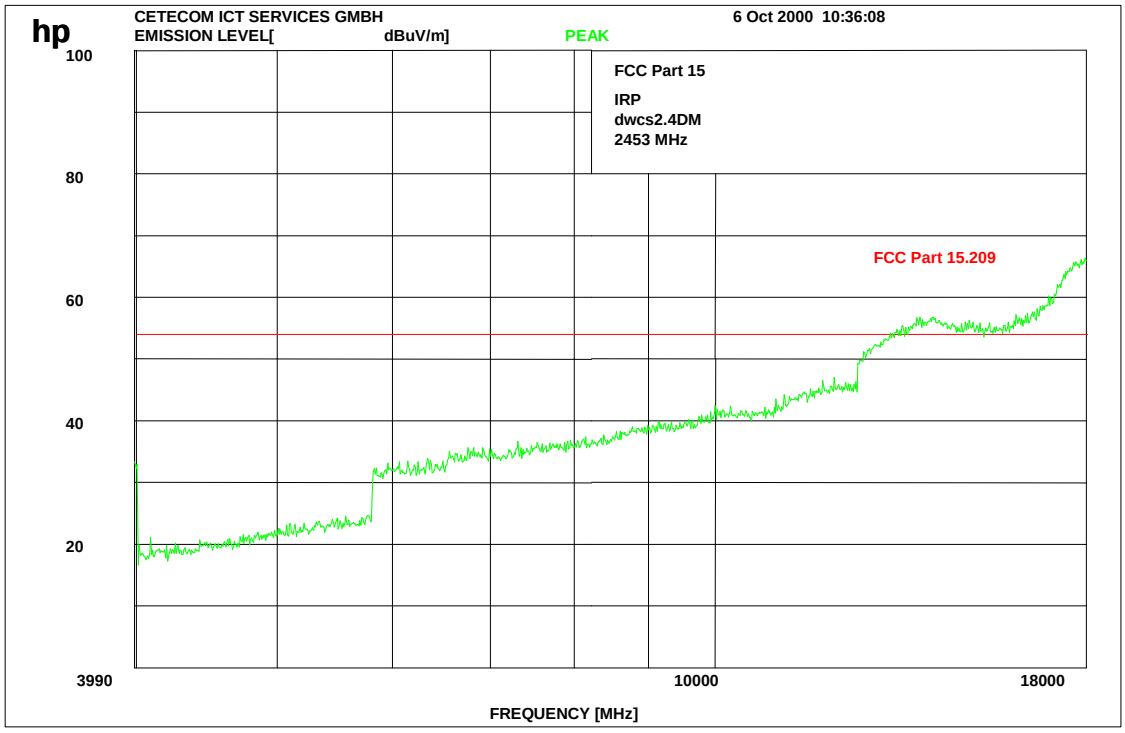


Limits SUBCLAUSE § 15.209

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 - 24

TRANSMIITER SPURIOUS RADIATION § 15.209



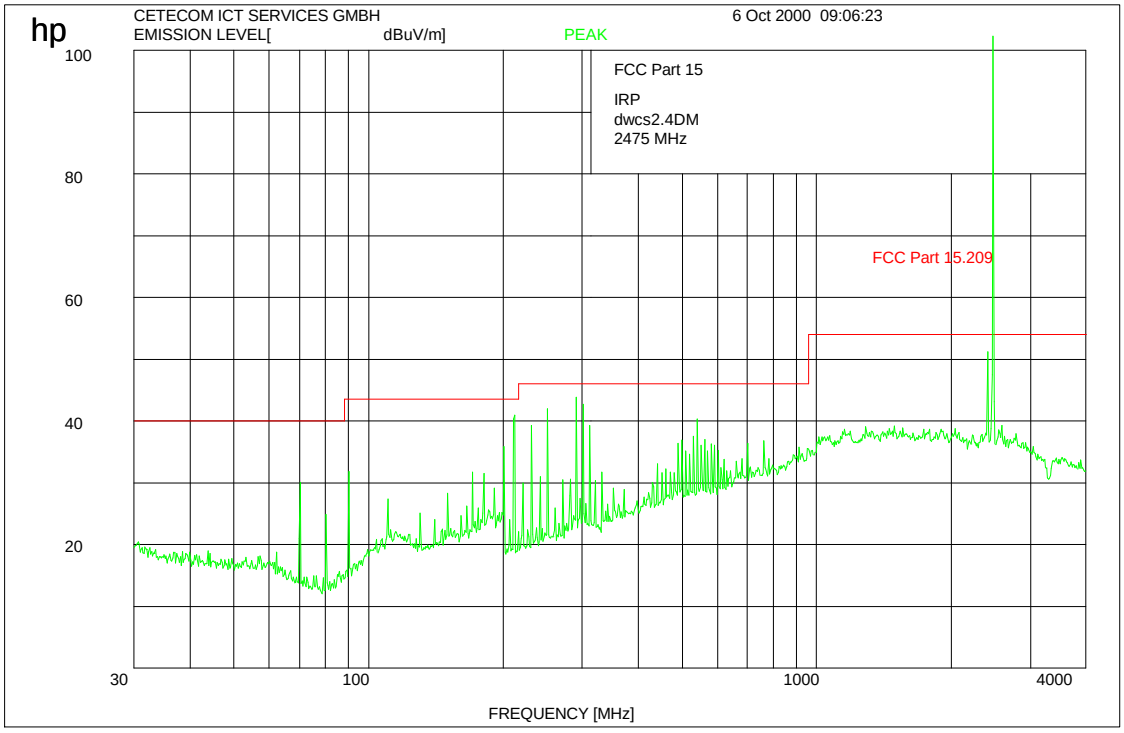
Measurements were made up to 25 GHz with a second Pre-amplifier to reduce noise.

Limits **SUBCLAUSE § 15.209**

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 - 24

TRANSMITTER SPURIOUS RADIATION § 15.209

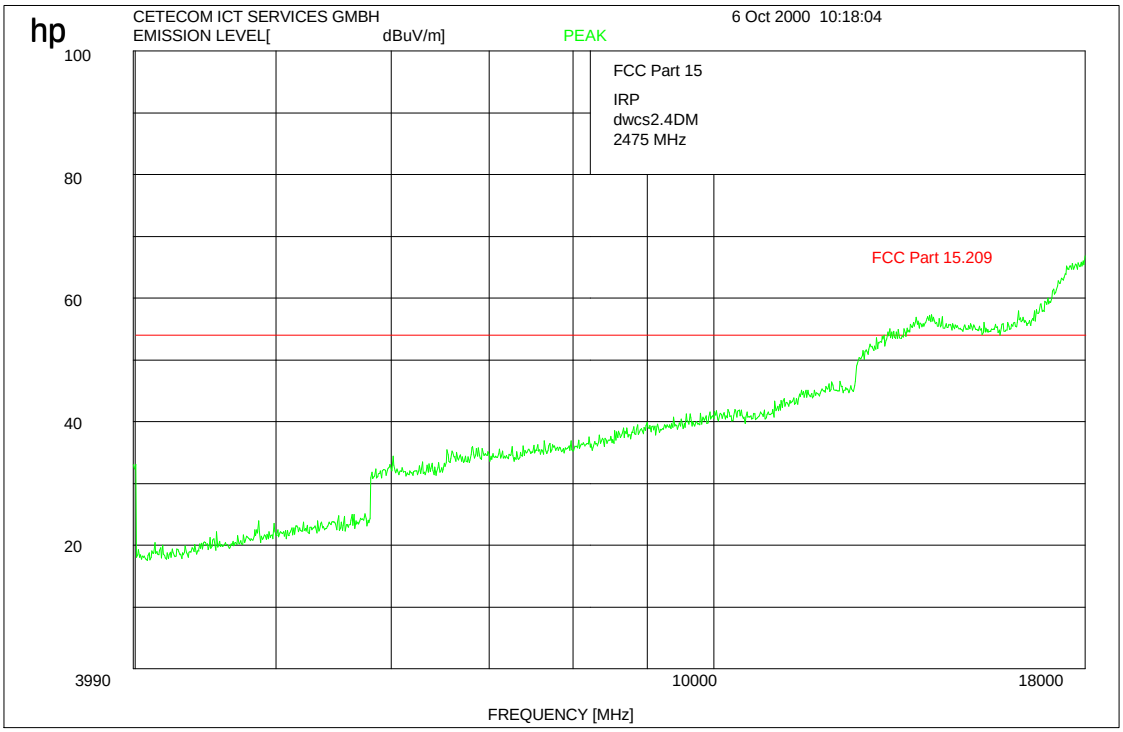


Limits SUBCLAUSE § 15.209

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 - 24

TRANSMIITER SPURIOUS RADIATION § 15.209



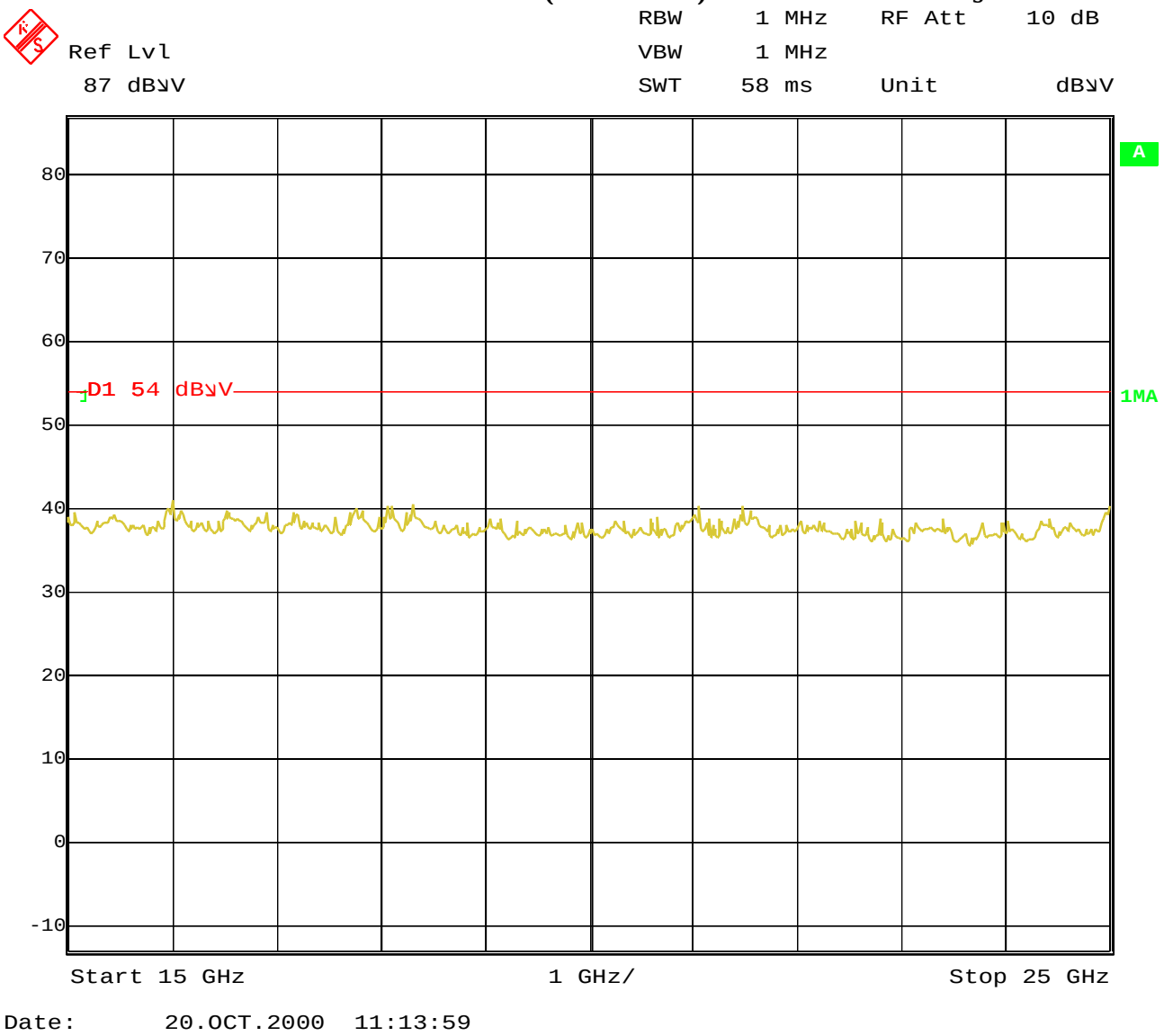
Measurements were made up to 25 GHz with a second Pre-amplifier to reduce noise.

Limits **SUBCLAUSE § 15.209**

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 - 24

TRANSMIITER SPURIOUS RADIATION (all channels) **§ 15.209**



Date: 20.OCT.2000 11:13:59

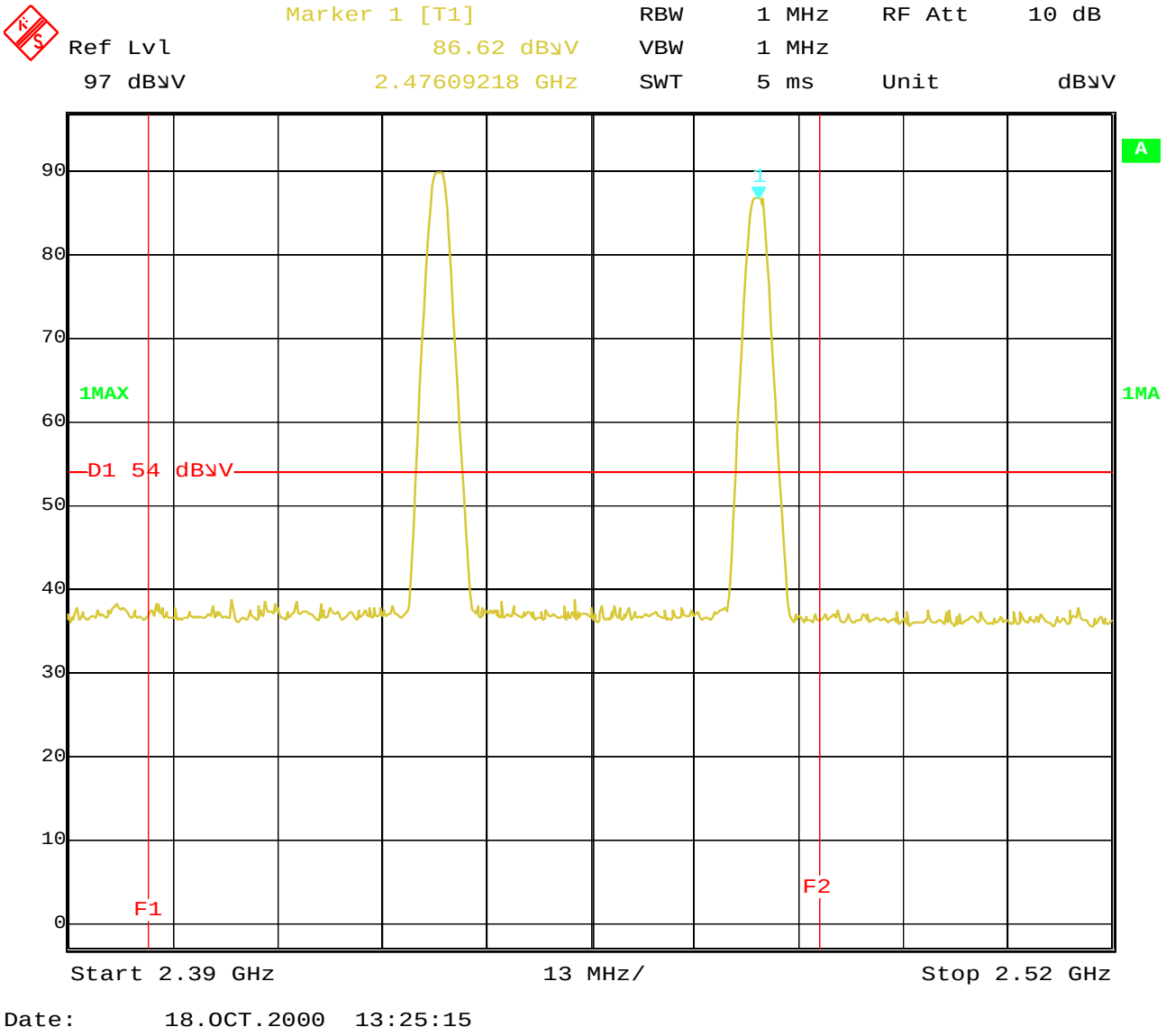
Measurements were made up to 25 GHz with a Pre-amplifier to reduce noise.

Limits **SUBCLAUSE § 15.209**

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
50 ; 64

TRANSMIITER OUTPUT SPECTRUM



F1 : 2400 MHz
F2 : 2483.5 MHz
D1 : Radiated emission limits; general requirements, 500µV/m or 54 dBµV/m

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64

TRANSMITTER STABILITY, VOLTAGE VARIATION

FREQUENCY STABILITY, VOLTAGE VARIATION			
	2436.2 MHz		
% OF TD	Frequency MHz	Variance, Hz	Variance,%
85 %	2436.152	-48 000	-0,00197
100 %	2436.105	-95 000	-0,00390
115 %	2436.197	-3 000	-0,00012
B.E.P.			

FREQUENCY STABILITY, VOLTAGE VARIATION			
	2453.3 MHz		
% OF TD	Frequency MHz	Variance, Hz	Variance,%
85 %	2453.263	+37 000	+0,00151
100 %	2453,276	+24 000	+0,00098
115 %	2453.285	+15 000	+0,00061
B.E.P.			

FREQUENCY STABILITY, VOLTAGE VARIATION			
	2475.8 MHz		
% OF TD	Frequency MHz	Variance, Hz	Variance,%
85 %	2475.824	+24 000	+0,00097
100 %	2475,836	+36 000	+0,00145
115 %	2475.834	+34 000	+0,00137
B.E.P.			

B.E.P. : BATTERY ENDPOINT

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
01, 02

TRANSMITTER STABILITY, VOLTAGE VARIATION

FREQUENCY STABILITY, TEMPERATURE VARIATION			
	2436.2 MHz		
TEMP.	Frequency MHz	Variance, Hz	Variance,%
-30°C	2436.082	-118 000	-0.00484
-20°C	2436.088	-112 000	-0.00460
-10°C	2436.092	-108 000	-0.00443
0°C	2436.090	-110 000	-0.00452
10°C	2436.091	-109 000	-0.00447
20°C	2436.105	-95 000	-0.00390
30°C	2436.119	-81 000	-0.00332
40°C	2436.126	-74 000	-0.00304
50°C	2436.145	-55 000	-0.00226

FREQUENCY STABILITY, TEMPERATURE VARIATION			
	2453,3 MHz		
TEMP.	Frequency MHz	Variance, Hz	Variance,%
-30°C	2475.261	-39 000	-0.00158
-20°C	2475.283	-17 000	-0.00069
-10°C	2475.290	-10 000	-0.00040
0°C	2475.324	+24 000	+0.00097
10°C	2475.339	+39 000	+0.00158
20°C	2475.354	+54 000	+0.00218
30°C	2475.369	+69 000	+0.00278
40°C	2475.383	+83 000	+0.00335
50°C	2475.402	+102 000	+0.00412

FREQUENCY STABILITY, TEMPERATURE VARIATION			
	2475.8 MHz		
TEMP.	Frequency MHz	Variance, Hz	Variance,%
-30°C	2475.765	-35 000	-0.00141
-20°C	2475.767	-33 000	-0.00133
-10°C	2475.769	-31 000	-0.00125
0°C	2475.781	-19 000	-0.00077
10°C	2475.811	+11 000	+0.00044
20°C	2475.836	+36 000	+0.00145
30°C	2475.838	+38 000	+0.00153
40°C	2475.847	+47 000	+0.00190
50°C	2475.852	+52 000	+0.00210

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
01, 02

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.

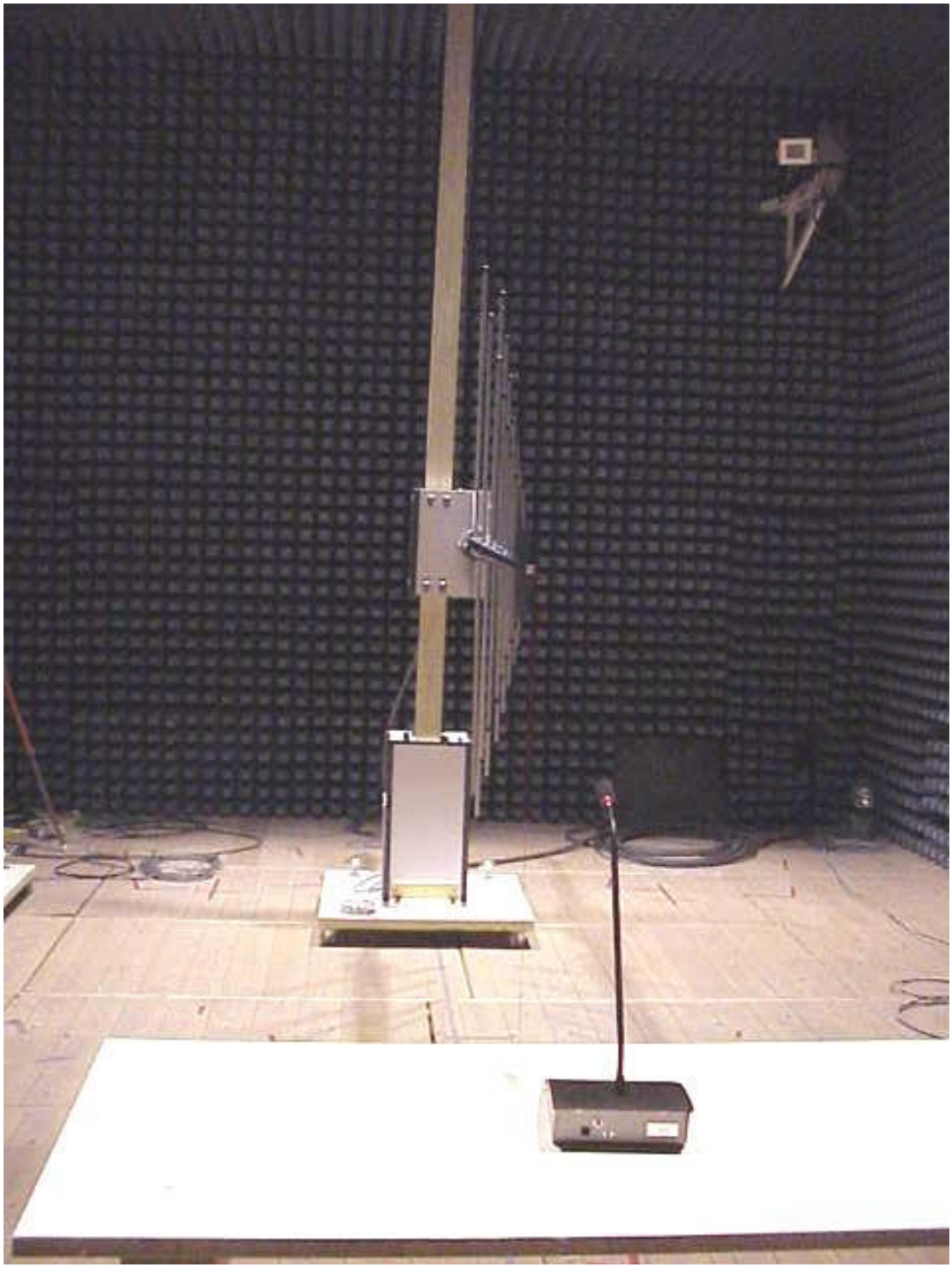
No	Instrument/Ancillary	Type	Manufacturer	Serial No.
01	Spectrum Analyzer	8566 A	Hewlett-Packard	1925A00257
02	Analyzer Display	8566 A	Hewlett-Packard	1925A00860
03	Oscilloscope	7633	Tektronix	230054
04	Radio Analyzer	CMTA 54	Rohde & Schwarz	894 043/010
05	System Power Supply	6038 A	Hewlett-Packard	2848A07027
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	Audio Analyzer	UPD	Rohde & Schwarz	1030.7500.04
52	Steuerrechner	PSM 7	Rohde & Schwarz	883 086/026
53	DC V-Netzwerk	ESH3-Z6	Rohde & Schwarz	861 406/005
54	DC V-Netzwerk	ESH3-Z6	Rohde & Schwarz	893 689/012
55	AC 2 Phasen V-Netzwerk	ESH3-Z5	Rohde & Schwarz	861 189/014
56	AC 2 Phasen V-Netzwerk	ESH3-Z5	Rohde & Schwarz	894 981/019
57	AC-3 Phasen V-Netzwerk	ESH2-Z5	Rohde & Schwarz	882 394/007
58	Stromversorgung	6032A	Rohde & Schwarz	2933A05441
59	HF-Test Empfänger	ESVP.52	Rohde & Schwarz	881 487/021
60	Spectrum Monitor	EZM	Rohde & Schwarz	883 086/026
61	HF-Test Empfänger	ESH3	Rohde & Schwarz	881 515/002
62	Relais Matrix	PSU	Rohde & Schwarz	882 943/029
63	Relais Matrix	PSU	Rohde & Schwarz	828 628/007
64	Spectrum Analyzer	FSIQ 26	Rohde & Schwarz	119.6001.27
67				
68				
69				
70				

Test site
RADIATED EMISSIONS



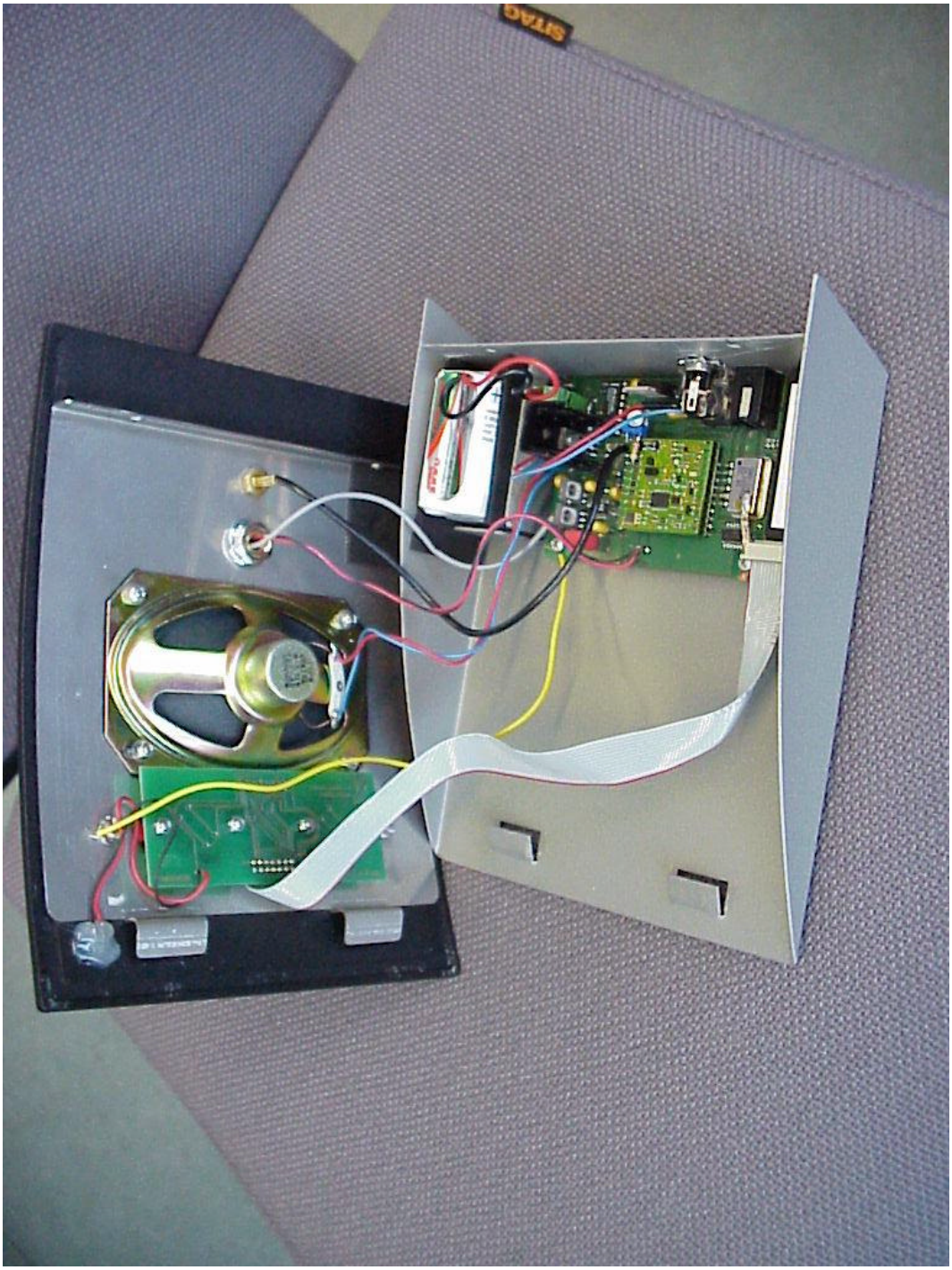
Test site
Conducted emissions

dwcs2.4DM
PHOTOGRAPHS OF THE EQUIPMENT
Photograph no.: 1

dwcs2.4DM
PHOTOGRAPHS OF THE EQUIPMENT
Photograph no.: 2

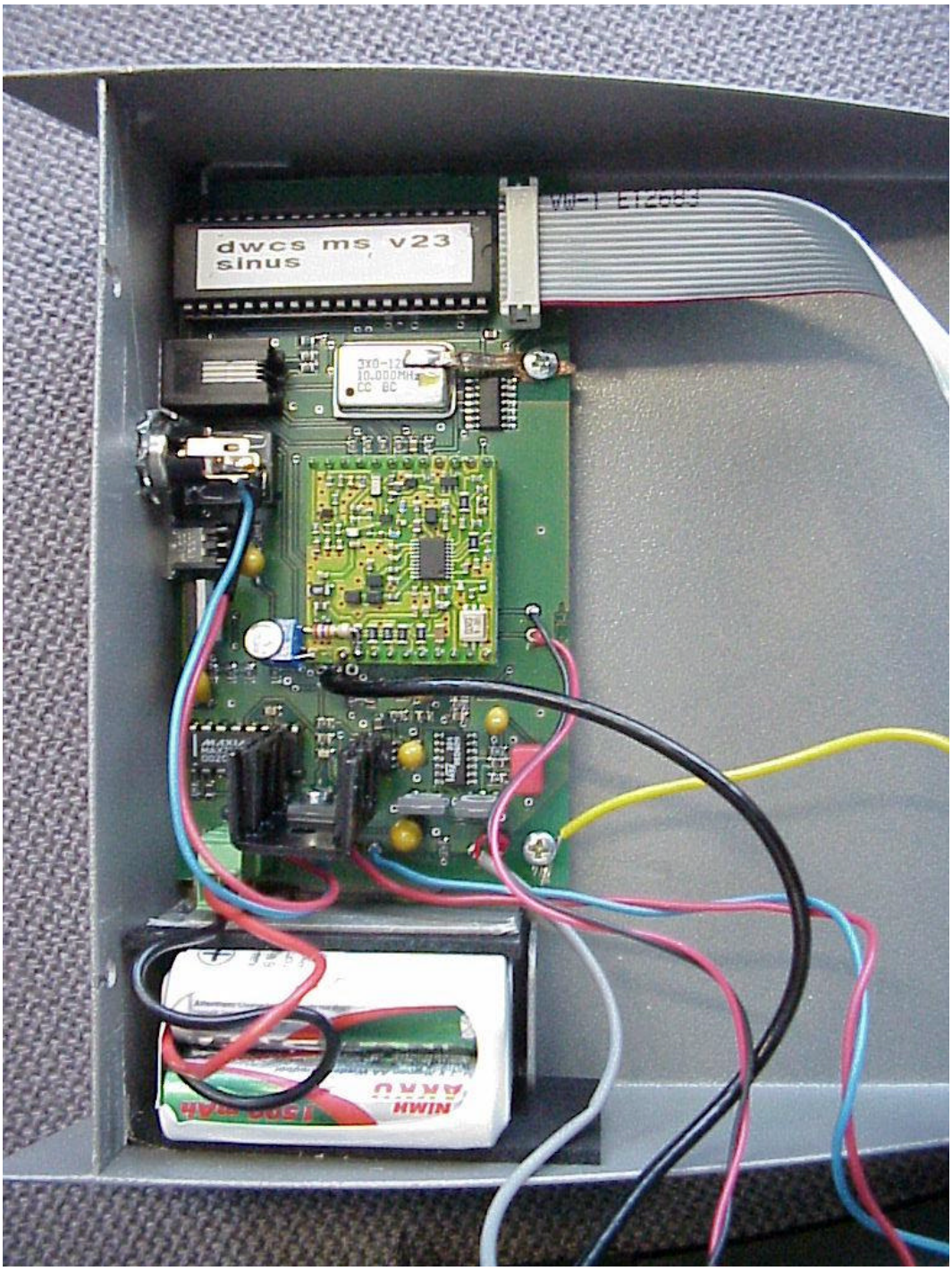
dwcs2.4DM
PHOTOGRAPHS OF THE EQUIPMENT

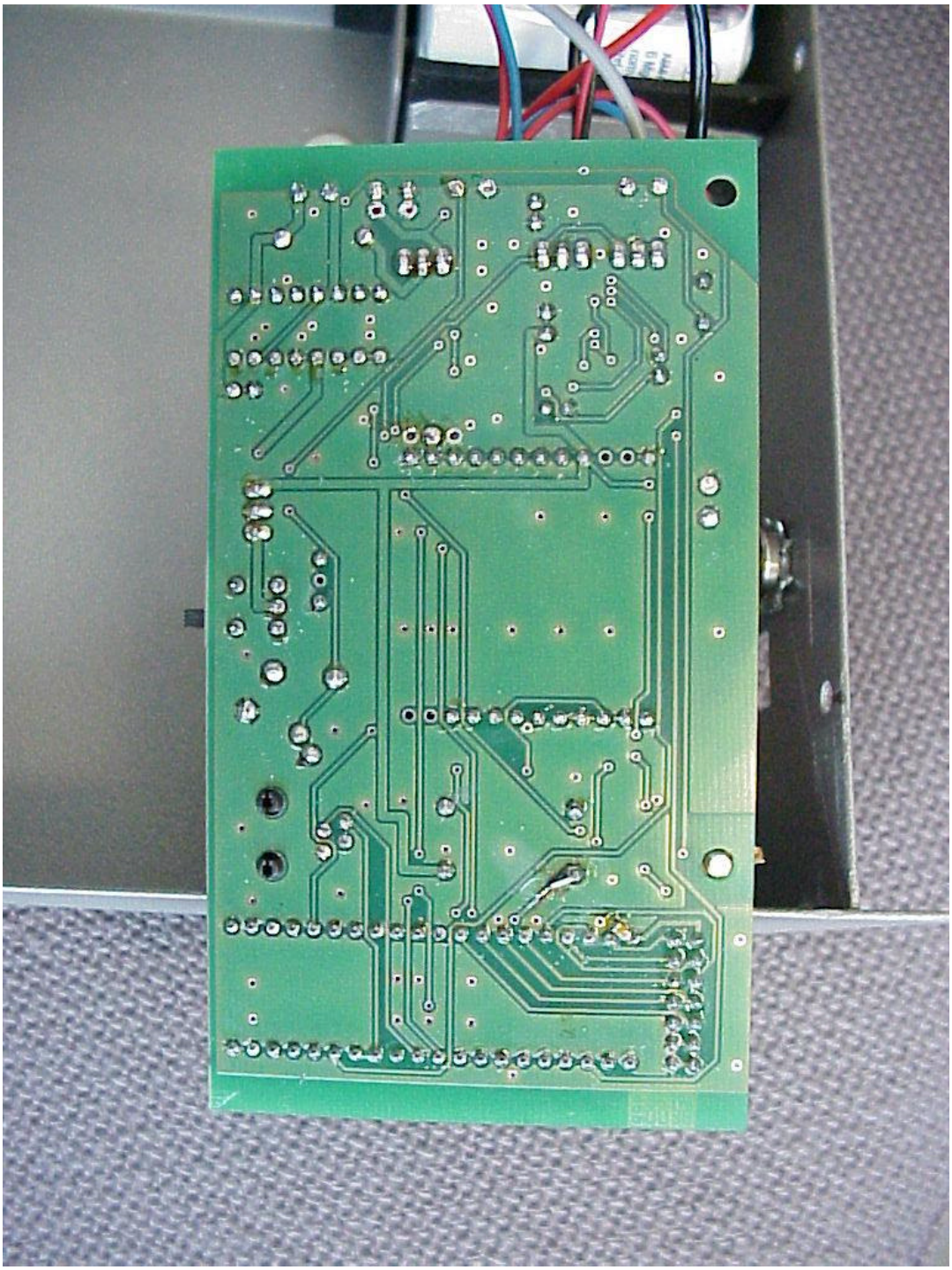
Photograph no.: 3



dwcs2.4DM
PHOTOGRAPHS OF THE EQUIPMENT

Photograph no.: 4



dwcs2.4DM
PHOTOGRAPHS OF THE EQUIPMENT

Photograph no.: 5