

Straubing, August 02, 2000

TEST-REPORT

No. 50511-00331

for

Micropilot S FMR 53X

Fluid Level Measuring Transmitter (with Rod and Horn Antennas)

Applicant:	Endress + Hauser GmbH & Co.
Purpose of testing:	To show compliance with
	FCC Code of Federal Regulations, CFR 47, Part 15, Subpart C, Sections 15.207 and 15.209

Note:

The test data of this report relate only to the individual item which has been tested. This report shall not be reproduced except in full extent without the written approval of the testing laboratory.

FCC-ID: LCGFMR53X



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1. Administrative Data

Equipment Under Test (EUT):	FMR 53X			
Type of equipment:	Fluid Level Measuring Transmitter			
Parts/accessories:	N.A.			
Version of EUT:	The following versions of the EUT have been tested: - FMR 530 with Horn Antenna - FMR 531 with PTFE Rod antenna - FMR 532 with Planar Antenna - FMR 533 with Parabolic Antenna			
FCC-ID:	LCGFMR53X			
Applicant:	Endress + Hauser GmbH + Co.			
(full address)	Hauptstrasse 1 D-79689 Maulburg			
Contract identification:	007/00300647			
Contact person:	Mr. Peter Klöfer			
Manufacturer:	Applicant			
Receipt of EUT:	June 06, 2000			
Date of test:	June 06, 2000			

Note: All tests were performed under normal installation conditions with the EUT installed in several tanks. Since it was not possible to transport the tanks used for testing to an open field test site, testing was performed at the mentioned factories:

- Plastic tank at Photo Print Electronic in D-79690 Schopfheim
- Concrete tank with open roof and windows at concrete factory Schweigert in D-79689 Maulburg
- Glass container and metallic tank at applicant's factory in D-79689 Maulburg

Responsible for testing:	Mr. Johann Roidt
Responsible for test report:	Mr. Johann Roidt



2. Summary of Test Results

The tested samples fully comply with the requirements for intentional radiators set forth in the

Code of Federal Regulations CFR 47 Part 15 Subpart C, Sections 15.207 and 15.209 of the Federal Communication Commission (FCC).

Johann Roidt Technical Manager



3. Operation Mode of EUT

The EUT was powered from a 18 V DC power source. During all measurements the EUT was set to normal measuring mode. During all measurements the EUT was placed vertically in non-metallic tanks.

The following applications were investigated in detail:

- EUT with Horn antenna
- EUT with Rod antenna.
- Applications in a plastic tank (fig. 1)
- Applications in a concrete tank with windows (fig. 2),
- Applications in a glass tank (fig.3)

4. Changes made to the EUT during this certification test

No changes have been made to the EUT during this certification test.

5. Configuration of EUT and Peripheral Devices

Configuration of cables to EUT

Unshielded two-wire power supply cable

Configuration of peripheral devices connected to EUT

Not applicable



6. Measuring Methods

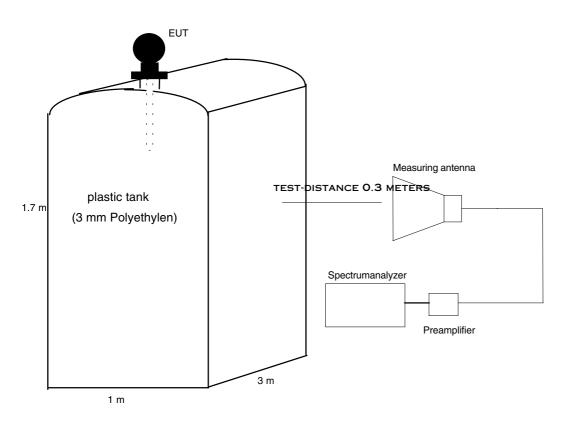
6.1. Radiated Emissions above 1 GHz

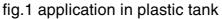
Radiated emissions were measured in the frequency range 5 GHz to 8 GHz in transmit mode of the EUT.

The resolution bandwidth and the video bandwidth of the spectrum analyzer were set to 1 MHz, the sweep-time to 20 ms.

Since the EUT is a pulsed system with a duty cycle < 1:100, a desensitization factor of > 40 dB had to be expected. Analyzer readings of emissons at the limit for peak emissions at 3 meter distance would be approximately – 4 dB μ V. The noise level of our very sensitive spectrum analyzer (ESMI, Rohde & Schwarz) plus a 40 dB preamplifier is approximately 5 dB μ V.

The only way to achieve sufficient dynamic range is to reduce test distance. For the measurement described in this report, the test distance was reduced to 0.3 meter.







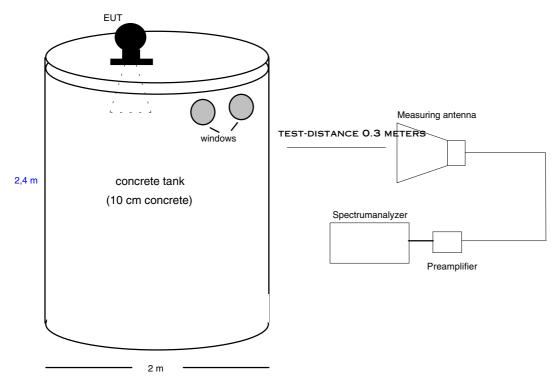
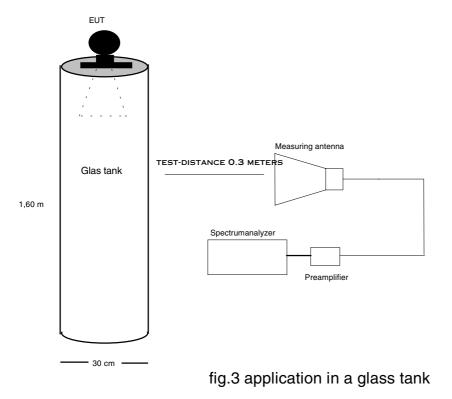


fig.2 application in a concrete tank





6.2. Procedure for Preliminary Radiated Emission Tests

The procedure for preliminary radiated emission tests was based on section 13.4.1 of ANSI C63.4-1992.

The EUT was mounted in its normal operation condition on the tanks.

Prescans are made in the frequency ranges:

4 GHz - 8 GHz

with the receiving antenna set to horizontal and vertical polarization.

The following step-by-step procedure was used:

- 1) Monitor the frequency range with the antenna at 30 cm distance to the EUT, all venting openings as well as other locations on which radiation might be detected.
- 2) Move the antenna while maintaining the test distance to detect maximum radiation.
- 3) Make a hardcopy of the spectrum.
- 4) Repeat steps 1 through 3 for orthogonal antenna polarisation



6.2.1. Method for comparing spectrum analyzer output to the limit

The following procedure will be used:

- 1) Maximize the emission according to 6.2.
- 2) Set the spectrum analyzer to Max Hold
- 3) Wait until the noise is fully maximized.
- 4) Put the **marker** on top of the investigated signal
- 5) Note frequency and level of the investigated signal

6.3. Spectrum analyzer settings for final test

Frequency range	Detector	Resolution Bandwidth	Video Bandwidth	Scan time	Trace Mode
30 - 1000 MHz	Quasi Peak	100 kHz	1 MHz		Max Hold
> 1000 MHz	Peak	1 MHz	1 MHz	20 ms	Max Hold



6.5 Desensitization for Pulsed Emissions

Since the EUT transmits pulsed energy the desensitization factor α has been calculated and included in the calculation for the final peak value.

In the HP Application Note 150-2 the analyser settings to measure a line spectrum are defined as follows:

- a) Bandwidth B < 0.3 x PRF
- b) Scan time $Ts > Fs / B^2$

With the pulse repetition frequency (PRF) of the EUT of 3.6 MHz and the selected measuring bandwith of B = 1 MHz the requirement a) was observed.

The scan width of Fs = 3 GHz and Bandwidth of B = 1 MHz leads to following values:

$$Fs/B^2 = 3 GHz / (1 GHz)^2 = 3x 10^{-9} s$$

The selected scan time of Ts= 20 ms meets requirement b). Hence, a line spectrum was measured, which could be seen, when the Pseudo-Noise-mode of the EUT was switched off (no influence on the measured amplitudes) and the frequency scale of the analyser zoomed.

The desensitization factor α_i was calculated according to HP Application note 150-2:

$$\alpha_1 = 20\log (\tau eff / T) = -47.35 \text{ dB}$$

The calculation based on the pulse width τ eff = 1.2 ns and the pulse period T= 280 ns, which have been supplied by the applicant.

To avoid overloading the spectrum analyzer the internal preselector has been activated during final testing. A linearity check by adding a 3 dB attenuator to the input was used to ensure integrity of the test data.



6.6 Sample Calculation of Field Strength values for pulsed systems:

- Duty cycle correction factor

Period of pulses = 280 ns Pulse width = 1.2 ns

Duty cycle correction factor (dB) = 20 log (Pulse width / Period of Pulses) = $20\log(1.2 / 280)$ = - **47.35 dB**

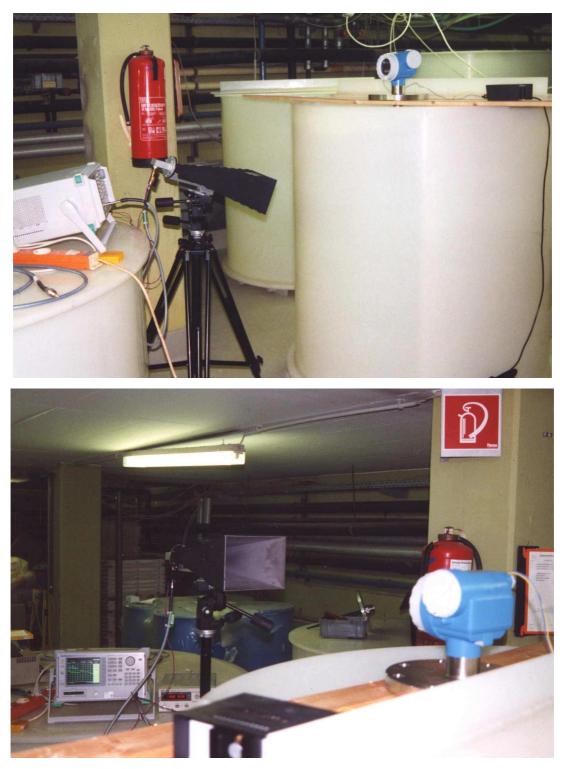
- Calculation of Field Strength values

- 1) Measure Peak value with analyzer RBW set to 1 MHz, VBW set to 1 MHz, Ts set to 20 ms
- 2) Calculate Field Strength by adding antenna correction factor
- 3) Calculate True Peak Field Strength by adding Desenstization Factor
- 4) Calculate Average value by subtracting Duty Cycle Correction Factor from True Peak Field Strength Value



7. Photographs Taken During Testing

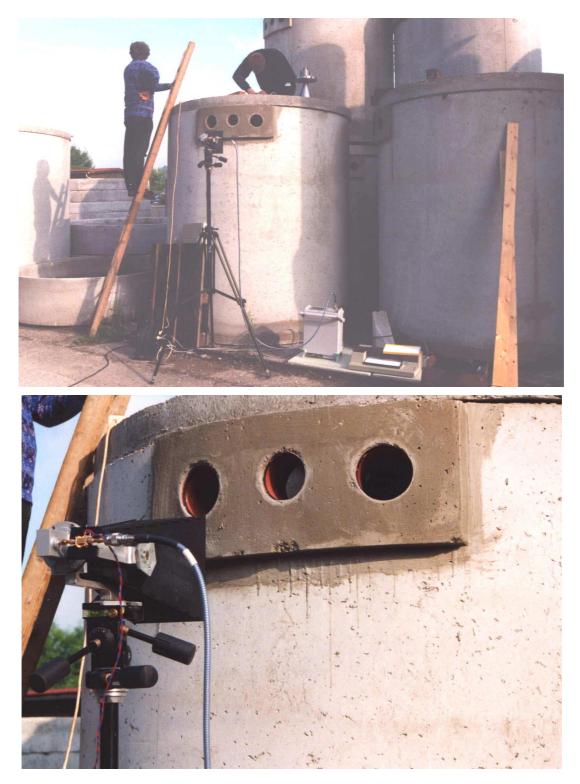
Test location plastic tank at PPE, Schopfheim



FCC-ID: LCGFMR53X



Test location concrete tank at Schweigert, Maulburg



FCC-ID: LCGFMR53X



Test location glass tank at Endress+Hauser, Maulburg





Test location metallic tank at Endress+Hauser, Maulburg





Test location splash tube at Endress+Hauser, Maulburg





8. List of Measurements

FCC Part 15 Subpart C						
Section(s):	Test	Page	Result			
	Transmit mode (TX):					
15.209	Field strength of emissions (fundamental)		passed			



9. Test Results



Model:	FMR 530
Туре:	with Horn Antenna
Serial No.:	
Application	Plastic tank
Applicant:	Endress + Hauser GmbH & Co.
Test Site:	Photo Print Electronic GmbH, Schopfheim
Distance:	0.3 meter
Date of Test	June 06, 2000
Test Operator:	J. Roidt

Charts 50 and 51

Frequency	Detector	Antenna Pol.	Analyzer Reading	Antenna correction	Field Strength	Limit	Margin
MHz		-	dBµV	dB/m	dBµV/m	dBµV/m	dB
6000.0	Peak	Horizontal	-12.1 (1)	25.1	59.15 (2)	74.0	14.85
6000.0	Average	Horizontal	-12.1 (1)	25.1	11.8 (3)	54.0	42.2

Sample calculation of Field Strength values:

Field Strength ($dB\mu V/m$) = Analyzer Reading ($dB\mu V$) + Antenna Correction (dB/m)

For duty cycle correction and desensitization factors see calculation overleaf

Note: Antenna correction includes cable losses as well.

- (1) Corrected by -56.6 dB due to 0.3 m test distance and preamplifier gain
- (2) Includes desensitization factor
- (3) Includes duty cycle correction factor



Model:	FMR 530
Туре:	with Horn Antenna
Serial No.:	
Application	concrete tank with windows
Applicant:	Endress + Hauser GmbH & Co.
Test Site:	Schweigert GmbH, Maulburg
Distance:	0.3 meter
Date of Test	June 06, 2000
Test Operator:	J. Roidt

Chart 35 and 36

Frequency	Detector	Antenna Pol.	Analyzer Reading	Antenna correction	Field Strength	Limit	Margin
MHz		-	dBµV	dB/m	dBµV/m	dBµV/m	dB
6000.0	Peak	Horizontal	-15.8 (1)	25.1	56.65 (2)	74.0	17.35
6000.0	Average	Horizontal	-15.8 (1)	25.1	9.3	54.0	44.7

Sample calculation of Field Strength values:

Field Strength ($dB\mu V/m$) = Analyzer Reading ($dB\mu V$) + Antenna Correction (dB/m)

For duty cycle correction and desensitization factors see calculation overleaf

Note: Antenna correction includes cable losses as well.

- (1) Corrected by -56.6 dB due to 0.3 m test distance and preamplifier gain
- (2) Includes desensitization factor
- (3) Includes duty cycle correction factor



Model:	FMR 530
Туре:	with Horn Antenna
Serial No.:	
Application	Glass tank
Applicant:	Endress + Hauser GmbH & Co.
Test Site:	Endress + Hauser GmbH & Co.
Distance:	0.3 meter
Date of Test	June 06, 2000
Test Operator:	J. Roidt

Chart 19 and 20

Frequency	Detector	Antenna Pol.	Analyzer Reading	Antenna correction	Field Strength	Limit	Margin
MHz		1 01.	dBµV	dB/m	dBµV/m	dBµV/m	dB
6554	Peak	Horizontal	-13.1	25.1	59.35	74.0	12.35
6554	Average	Horizontal	-11.37 (1)	25.1	12	54.0	42.0

Sample calculation of Field Strength values:

Field Strength ($dB\mu V/m$) = Analyzer Reading ($dB\mu V$) + Antenna Correction (dB/m)

For duty cycle correction and desensitization factors see calculation overleaf

Note: Antenna correction includes cable losses as well.

- (1) Corrected by -56.6 dB due to 0.3 m test distance and preamplifier gain
- (2) Includes desensitization factor
- (3) Includes duty cycle correction factor



Model:	FMR 530
Туре:	with Horn Antenna
Serial No.:	
Application	Metallic tank
Applicant:	Endress + Hauser GmbH & Co.
Test Site:	Endress + Hauser GmbH & Co.
Distance:	0.3 meter
Date of Test	June 06, 2000
Test Operator:	J. Roidt

Charts 29 and 30

Frequency	Detector	Antenna Pol.	Analyzer Reading	Antenna correction	Field Strength	Limit	Margin
MHz		-	dBµV	dB/m	dBµV/m	dBµV/m	dB
6304	Peak	Horizontal	-13.6 (1)	25.1	58.85	74.0	15.12
6304	Average	Horizontal	-13.6 (2)	25.1	11.5	54.0	21.5

Sample calculation of Field Strength values:

Field Strength ($dB\mu V/m$) = Analyzer Reading ($dB\mu V$) + Antenna Correction (dB/m)

For duty cycle correction and desensitization factors see calculation overleaf

Note: Antenna correction includes cable losses as well.

- (1) Corrected by -56.6 dB due to 0.3 m test distance and preamplifier gain
- (2) Includes desensitization factor
- (3) Includes duty cycle correction factor



Model:	FMR 531
Туре:	with Rod Antenna
Serial No.:	
Application	Plastic tank
Applicant:	Endress + Hauser GmbH & Co.
Test Site:	Photo Print Electronic GmbH, Schopfheim
Distance:	0.3 meter
Date of Test	June 06, 2000
Test Operator:	J. Roidt

Chart 49

Frequency	Detector	Antenna Pol.	Analyzer Reading	Antenna correction	Field Strength	Limit	Margin
MHz			dBµV	dB/m	dBµV/m	dBµV/m	dB
6288	Peak	Horizontal	-10.86 (1)	25.1	59.95 (2)	74.0	14.05
6288	Average	Horizontal	-10.86 (1)	25.1	12.6 (3)	54.0	41.4

Sample calculation of Field Strength values:

Field Strength ($dB\mu V/m$) = Analyzer Reading ($dB\mu V$) + Antenna Correction (dB/m)

For duty cycle correction and desensitization factors see calculation overleaf

Note: Antenna correction includes cable losses as well.

- (1) Corrected by -56.6 dB due to 0.3 m test distance and preamplifier gain
- (2) Includes desensitization factor
- (3) Includes duty cycle correction factor



Model:	FMR 531
Туре:	with Rod Antenna
Serial No.:	
Application:	Glass tank
Applicant:	Endress + Hauser GmbH & Co.
Test Site:	Endress + Hauser GmbH & Co.
Distance:	0.3 meter
Date of Test	June 06, 2000
Test Operator:	J. Roidt

Charts 17 and 18

Frequency	Detector	Antenna Pol.	Analyzer Reading	Antenna correction	Field Strength	Limit	Margin
MHz		1 011	dBµV	dB/m	dBµV/m	dBµV/m	dB
6472	Peak	Horizontal	-9.3 (1)	25.1	63.15 (2)	74.0	9.85
6472	Average	Horizontal	-9.3 (1)	25.1	15.8 (3)	54.0	38.2

Sample calculation of Field Strength values:

Field Strength ($dB\mu V/m$) = Analyzer Reading ($dB\mu V$) + Antenna Correction (dB/m)

For duty cycle correction and desensitization factors see calculation overleaf

Note: Antenna correction includes cable losses as well.

- (1) Corrected by -56.6 dB due to 0.3 m test distance and preamplifier gain
- (2) Includes desensitization factor
- (3) Includes duty cycle correction factor



Model:	FMR 533
Туре:	with Parabolic Antenna
Serial No.:	
Application	Plastictank
Applicant:	Endress + Hauser GmbH & Co.
Test Site:	Photo Print Electronic GmbH, Schopfheim
Distance:	0.3 meter
Date of Test	June 06, 2000
Test Operator:	J. Roidt

Charts 47 and 48

Frequency	Detector	Antenna Pol.	Analyzer Reading	Antenna correction	Field Strength	Limit	Margin
MHz			dBµV	dB/m	dBµV/m	dBµV/m	dB
6184	Peak	Horizontal	-9.4 (1)	25.1	63.05 (2)	74.0	11.95
6184	Average	Horizontal	-9.4 (1)	25.1	15.7 (3)	54.0	38.3

Sample calculation of Field Strength values:

Field Strength ($dB\mu V/m$) = Analyzer Reading ($dB\mu V$) + Antenna Correction (dB/m)

For duty cycle correction and desensitization factors see calculation overleaf

Note: Antenna correction includes cable losses as well.

- (1) Corrected by -56.6 dB due to 0.3 m test distance and preamplifier gain
- (2) Includes desensitization factor
- (3) Includes duty cycle correction factor



Model:	FMR 533
Туре:	with Parabolic Antenna
Serial No.:	
Application	Concrete tank with windows
Applicant:	Endress + Hauser GmbH & Co.
Test Site:	Schweigert GmbH, Maulburg
Distance:	0.3 meter
Date of Test	June 06, 2000
Test Operator:	J. Roidt

Charts 39 and 40

Frequency	Detector	Antenna Pol.	Analyzer Reading	Antenna correction	Field Strength	Limit	Margin
MHz		i on	dBµV	dB/m	dBµV/m	dBµV/m	dB
6000	Peak	Horizontal	-14.6 (1)	25.1	57.85 (2)	74.0	16.15
6000	Average	Horizontal	-14.6 (1)	25.1	10.5 (3)	54.0	43.5

Sample calculation of Field Strength values:

Field Strength ($dB\mu V/m$) = Analyzer Reading ($dB\mu V$) + Antenna Correction (dB/m)

For duty cycle correction and desensitization factors see calculation overleaf

Note: Antenna correction includes cable losses as well.

- (1) Corrected by -56.6 dB due to 0.3 m test distance and preamplifier gain
- (2) Includes desensitization factor
- (3) Includes duty cycle correction factor



Model:	FMR 532
Туре:	with Planar Antenna
Serial No.:	
Application	Splash Water Tube
Applicant:	Endress + Hauser GmbH & Co.
Test Site:	Endress + Hauser GmbH & Co.
Distance:	0.3 meter
Date of Test	June 06, 2000
Test Operator:	J. Roidt

Charts 25 and 26

Frequency	Detector	Antenna Pol.	Analyzer Reading	Antenna correction	Field Strength	Limit	Margin
MHz		1 01.	dBµV	dB/m	dBµV/m	dBµV/m	dB
6296	Peak	Horizontal	-10.3 (1)	25.1	62.15 (2)	74.0	11.85
6296	Average	Horizontal	-10.3 (1)	25.1	14.8 (3)	54.0	39.2

Sample calculation of Field Strength values:

Field Strength ($dB\mu V/m$) = Analyzer Reading ($dB\mu V$) + Antenna Correction (dB/m)

For duty cycle correction and desensitization factors see calculation overleaf

Note: Antenna correction includes cable losses as well.

- (1) Corrected by -56.6 dB due to 0.3 m test distance and preamplifier gain
- (2) Includes desensitization factor
- (3) Includes duty cycle correction factor



10. Equipment List

General Test Equipment and Ancillaries

No.	Instrument/Ancillary	Туре	Serial Number	Manufacturer
001	Open area test site	EG 1		Senton
002	Shielded room	No. 1	1451	Senton
003	Shielded room	No. 2	1452	Senton
004	Semi-anechoic room	No. 3	1453	Siemens
005	Shielded room	No. 4	3FD 100 544	Euroshield
006	Shielded room	No. 5	5468	Ray Proof Division
007	Temperature test chamber	HT4010	07065550	Heraeus
008	Cable	RG214	1309	Senton
009	Cable	200CM_001	1357	Rosenberger
010	Cable	150CM_001	1479	Rosenberger
011	Cable	150CM_002	1480	Rosenberger
012	Cable set EG1	RG214	1189 - 1191	Senton
013	Cable set cabin no. 1	RG214		Senton
014	Cable set cabin no. 2	RG214		Senton
015	Cable set cabin no. 3	RG214		Senton
016	Cable set cabin no. 4	RG214		Senton
017	DC power supply	NGSM 32/10	203	Rohde & Schwarz
018	DC power supply	NGB	2455	Rohde & Schwarz
019	DC power supply	NGA	386	Rohde & Schwarz
020	Isolating transformer	RT 5A	10387	Grundig
021	Isolating transformer	RT 5A	10416	Grundig
022	Digital multimeter	199	463386	Keithley
023	Multimeter	HP E2373A	2927J03345	Hewlett Packard



Test Equipment and Ancillaries used for Emission Tests

No.	Instrument/Ancillary	Туре	Serial Number	Manufacturer
101	EMI test receiver/ Spectrum Analyzer with Harmonic Mixer Set (26.5 - 40 GHz)	ESMI FS-Z-40	839379/013 839587/006 845881/005	Rohde & Schwarz
102	Spectrum analyzer	R 3271	05050023	Advantest
103	Test receiver	ESH 3	880112/032	Rohde & Schwarz
104	Test receiver	ESHS 10	860043/016	Rohde & Schwarz
105	Test receiver	ESV	881414/009	Rohde & Schwarz
106	Test receiver	ESVP	881120/024	Rohde & Schwarz
107	Audio analyzer	UPA	862954	Rohde & Schwarz
108	Radio communication service monitor	CMS 54	838384/030	Rohde & Schwarz
109	Power meter	NRVS	836856/015	Rohde & Schwarz
110	Power sensor	NRV-Z52	837901/030	Rohde & Schwarz
111	Power sensor	NRV-Z4	863828/015	Rohde & Schwarz
112	Preamplifier	ESV-Z3	860907/004	Rohde & Schwarz
113	Preamplifier	R14601		Advantest
114	Preamplifier	ACX/080-3030	32640	СТТ
115	Preamplifier	ACO/180-3530	32641	CTT
116	Signal generator	SMS	872166/039	Rohde & Schwarz
117	Signal generator	HP 8673 D	2930A00966	Hewlett Packard
118	Waveform generator	HP 33120 A	US34005375	Hewlett Packard
119	UHF attenuator set	DPU	300771/075	Rohde & Schwarz
120	UHF attenuator set	DPU	300788/006	Rohde & Schwarz
121	Attenuator	4776-10	9412	Narda
122	Attenuator	4776-20	9503	Narda
123	Pulse limiter	ESH 3-Z2	1144	Rohde & Schwarz
124	Pulse limiter	11947 A	3107A00566	Hewlett Packard
125	V-network	ESH 3-Z5	862770/018	Rohde & Schwarz
126	V-network	ESH 3-Z5	894785/005	Rohde & Schwarz
127	V-network	ESH 3-Z5	830952/025	Rohde & Schwarz
128	V-network	ESH 3-Z6	830722/010	Rohde & Schwarz
129	V-network	NSLK 8127	8127152	Schwarzbeck
130	Artificial mains network	ESH 2-Z5	842966/004	Rohde & Schwarz
131	T-network	ESH 3-Z4	890602/011	Rohde & Schwarz
132	T-network	ESH 3-Z4	890602/012	Rohde & Schwarz



Test Equipment and Ancillaries used for Emission Tests (continued)

No.	Instrument/Ancillary	Туре	Serial Number	Manufacturer
134	High impedance probe	TK 9416	01	Schwarzbeck
135	High impedance probe	TK 9416	02	Schwarzbeck
136	Current probe	ESH 2-Z1	863366/18	Rohde & Schwarz
137	Current probe	ESV-Z1	862553/3	Rohde & Schwarz
138	Absorbing clamp	MDS 21	80911	Lüthi
139	Absorbing clamp	MDS 21	79690	Lüthi
140	Loop antenna	HFH2-Z2	882964/1	Rohde & Schwarz
141	Biconical antenna	HK 116	836239/02	Rohde & Schwarz
142	Biconical antenna	HK 116	842204/001	Rohde & Schwarz
143	Log. periodic antenna	HL 223	834408/12	Rohde & Schwarz
144	Log. periodic antenna	HL 223	841516/023	Rohde & Schwarz
145	Horn antenna 1 - 18 GHz	3115	9508-4553	Emco
146	Horn antenna 1.7 - 2.6 GHz	3160-03	9112-1003	Emco
147	Horn antenna 2.6 - 3.95 GHz	3160-04	9112-1001	Emco
148	Horn antenna 3.95 - 5.85 GHz	3160-05	9112-1001	Emco
149	Horn antenna 5.85 - 8.2 GHz	3160-06	9112-1001	Emco
150	Horn antenna 8.2 - 12.4 GHz	3160-07	9112-1008	Emco
151	Horn antenna 12.4 - 18 GHz	3160-08	9112-1002	Emco
152	Horn antenna 18 - 26.5 GHz	3160-09	9403-1025	Emco
152	Horn Antenna 26.5 - 40 GHz	3160-10	9704-1047	Emco
153	Stub tuner	904N	04	Narda
154	Mains analyzer	DPA 503	496 - 02	EM Test
155	Controller	HIS 500	X71010	EM Test
156	AC Amplifier	ACS 500	HK51736	EM Test
157	Mains impedance	AIF 500	X71062	EM Test
158	Dual Directional Coupler	778D	0826A01562	Hewlett Packard
159	Data Analyzer	DA-10	J-0048	Wandel & Goltermann

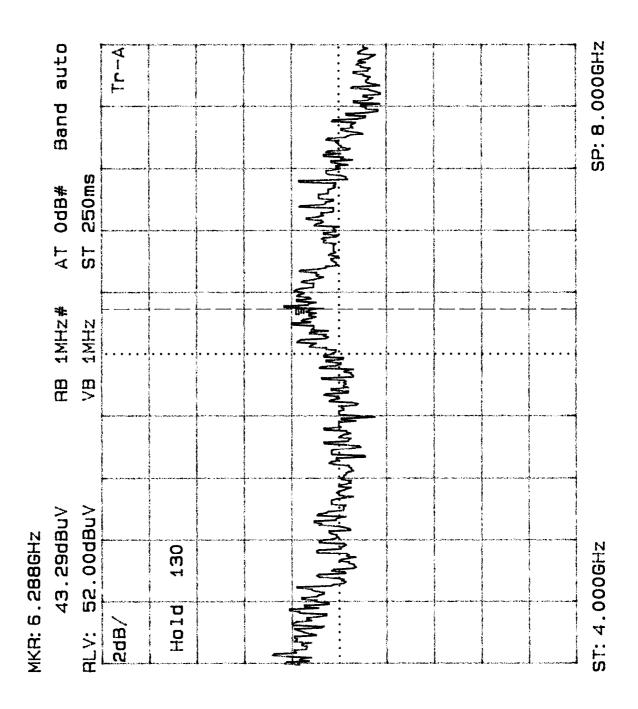


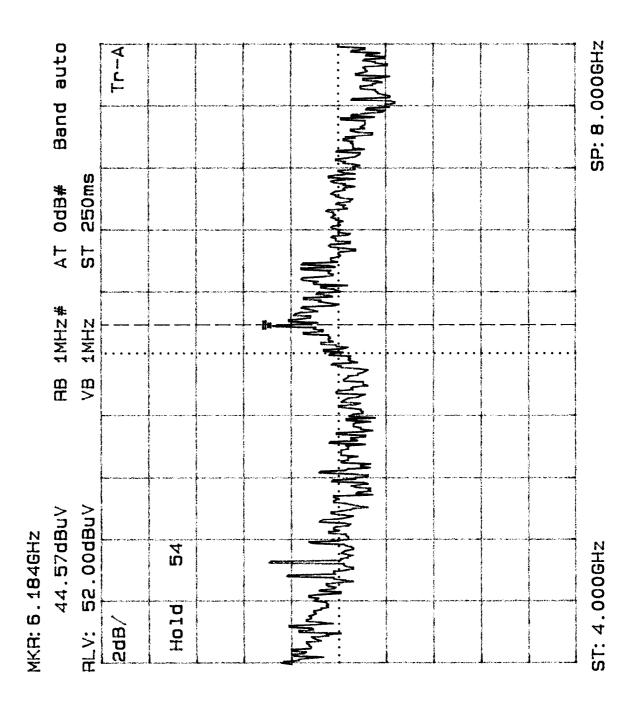
Test Equipment and Ancillaries used for Immunity Tests

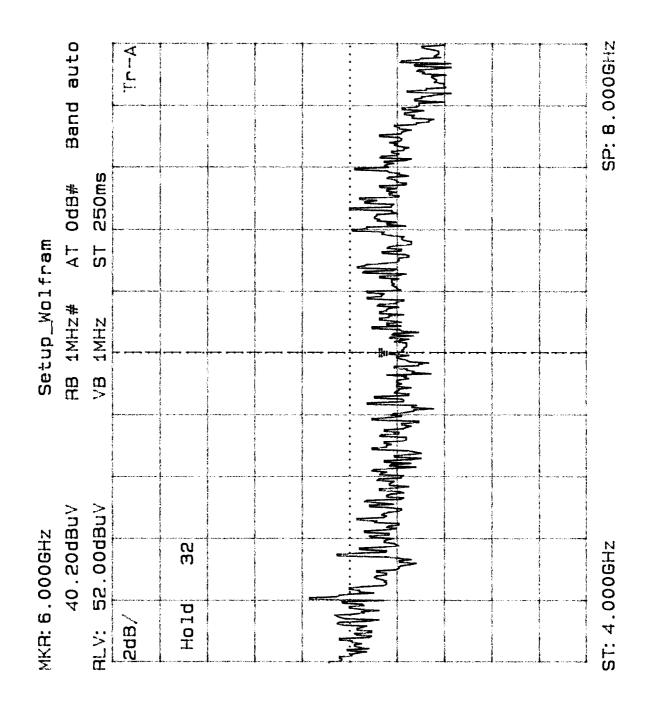
No.	Туре	Model	Serial Number	Manufacturer
201	ESD simulator	NSG 435	000290	Schaffner
202	EFT generator	NSG 1025	3020	Schaffner
203	Ultra compact simulator	UCS	1195-30	EM Test
204	Coupling clamp	CDN 8014	131	Schaffner
205	Coupling clamp	SL 400-071D	007	Schaffner
206	Coupling filter	FP 16	080554-14-84	Haefely
207	Oscilloscope	2225	203550	Tektronix
208	Signal generator	SMT 03	838129/029 837533/032	Rohde & Schwarz
209	Power amplifier	150 L	8835	Amplifier Research
210	Power amplifier	200 W 1000	12904	Amplifier Research
211	Power meter	NRVS	838624/016	Rohde & Schwarz
212	E-field generator	3107 B	2302	Emco
213	Biconical antenna	VHBA 9123	1018	Schwarzbeck
214	Log. periodic antenna	AT 1080	12834	Amplifier Research
215	Isotropic field probe	FP 2000	12847	Amplifier Research
216	Isotropic field monitor	FM 2004	12632	Amplifier Research
217	Ultra compact simulator	UCS	1195-30	EM Test
218	Surge generator	NSG 650	1679204	Schaffner
219	Coupling network	CDN 110	1649135	Schaffner
220	Coupling network	CDN 115	132	Schaffner
221	Dropping resistor	INA 110-40	121	Schaffner
222	Oscilloscope	HM 408	9005 F 3144	Hameg
223	Signal generator	SMX	883184/018	Rohde & Schwarz
224	Power amplifier	411 LA	299	ENI
225	Power amplifier	HVV 250	836956/004	Rohde & Schwarz
226	Power meter	NRV	863825/018	Rohde & Schwarz
227	Coupling network	FCC - 801- M3-25	117	FCC
228	Coupling network	FCC - 801- M4-25	17	FCC
229	Coupling network	FCC - 801- M5-25	16	FCC
230	Coupling network	FCC - 801- AF4	47	FCC
231	Coupling network	FCC - 801- AF4	48	FCC
232	Coupling network	FCC - 801-T4	68	FCC
233	Coupling network	FCC - 801- C1	64	FCC
234	Coupling network	CDN 801-M3		Senton
235	Coupling network	CDN 801-S37		Senton
236	Current clamp	FCC-120-9B	15	FCC
237	EM injection clamp	EM 101	35354	Lüthi
238	Ultra compact simulator	UCS 500	1195-30	EM Test
239	Transformer			Senton
240	Oscilloscope	54602B	US35060304	Hewlett Packard

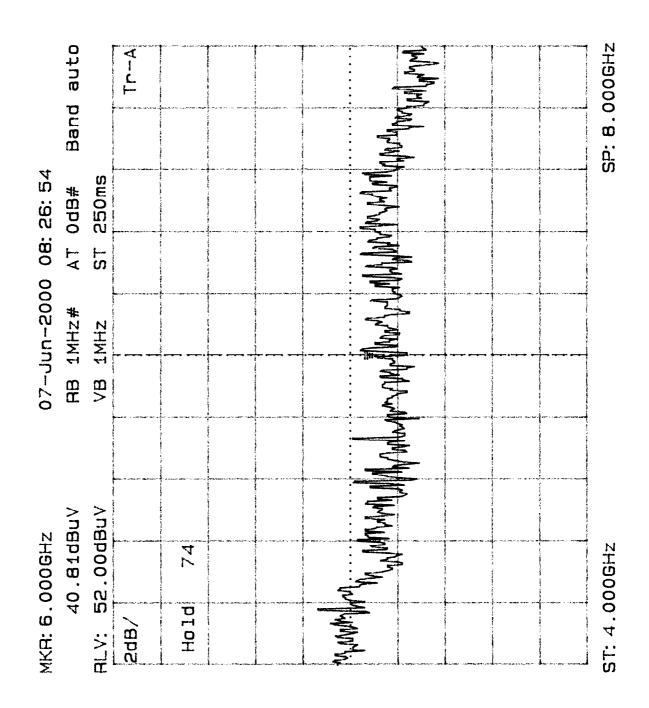


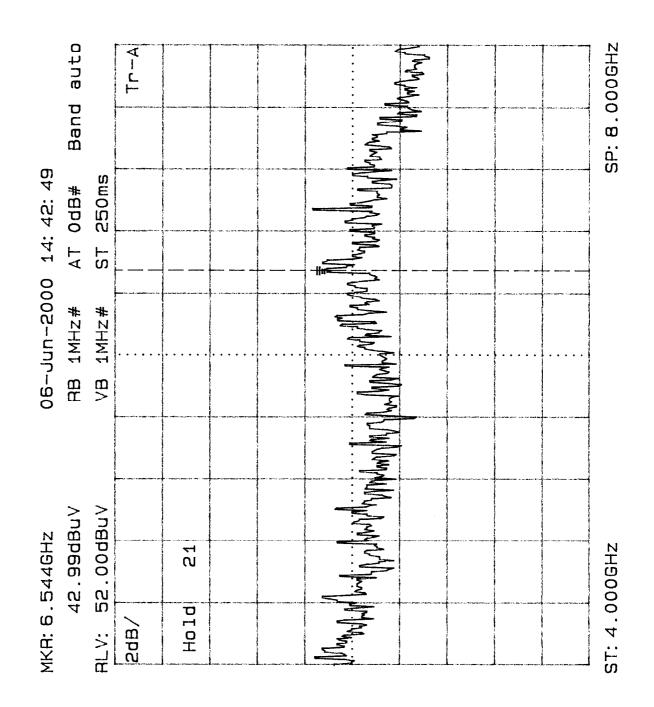
11. Charts Taken During Testing

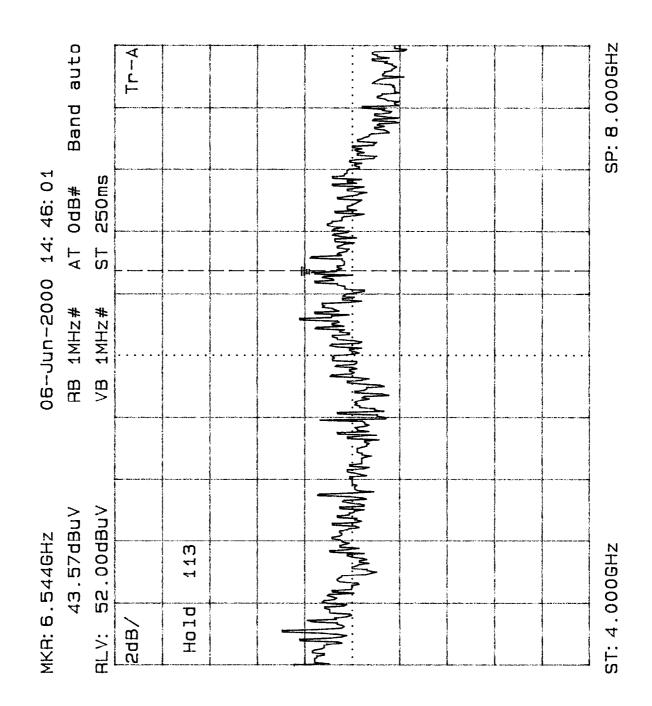


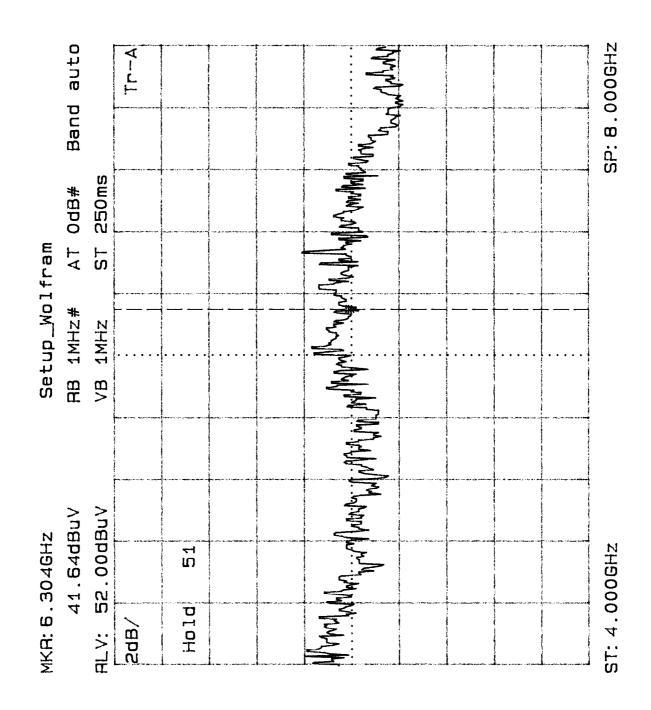


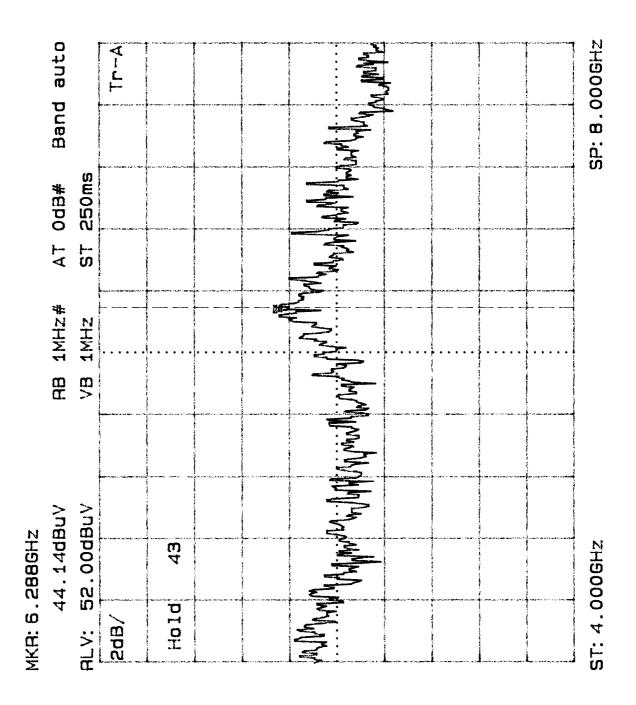


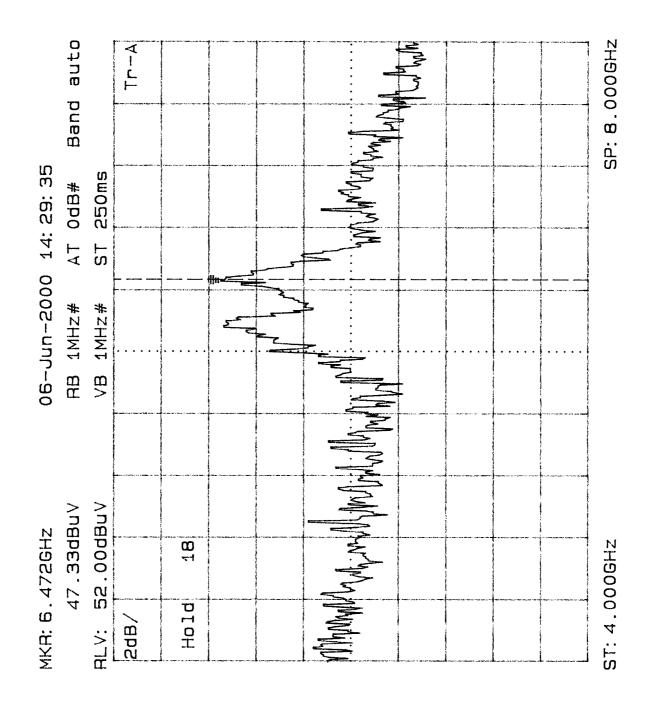


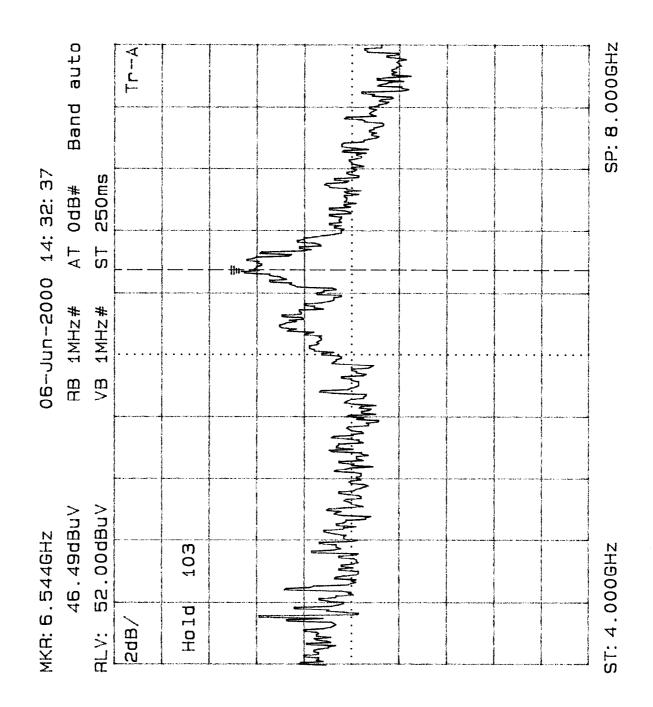


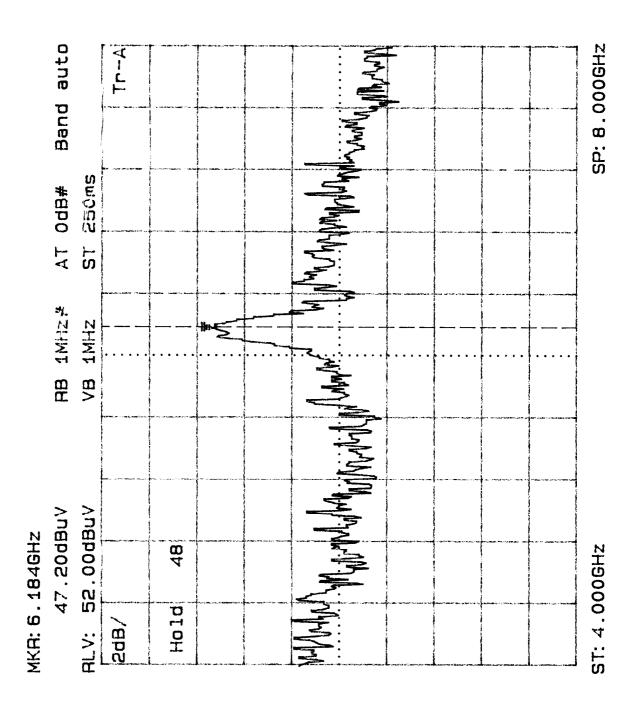


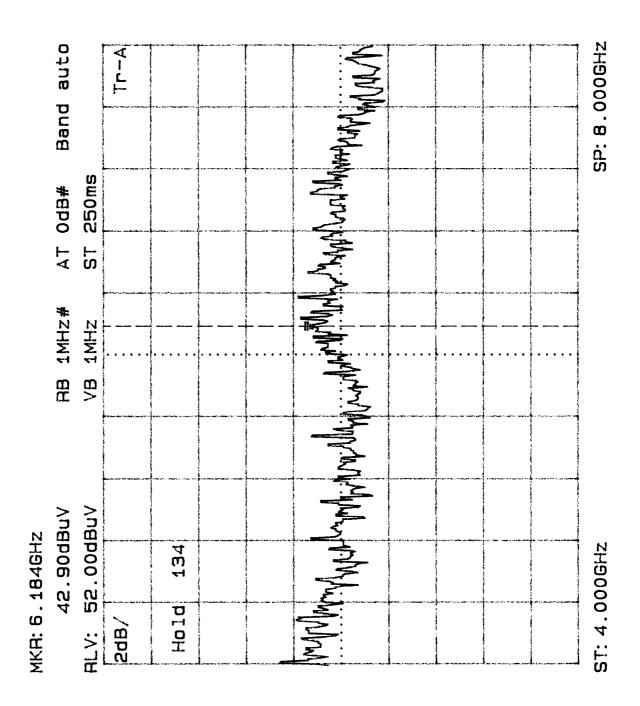


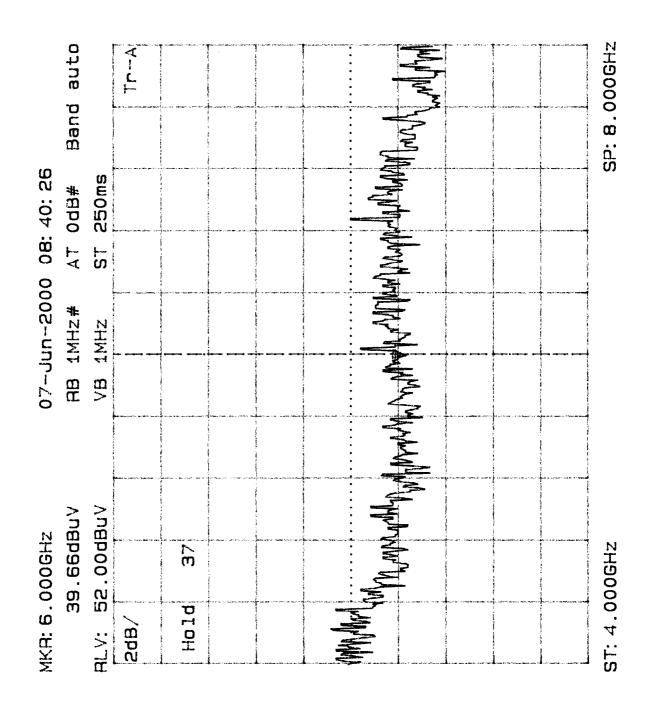


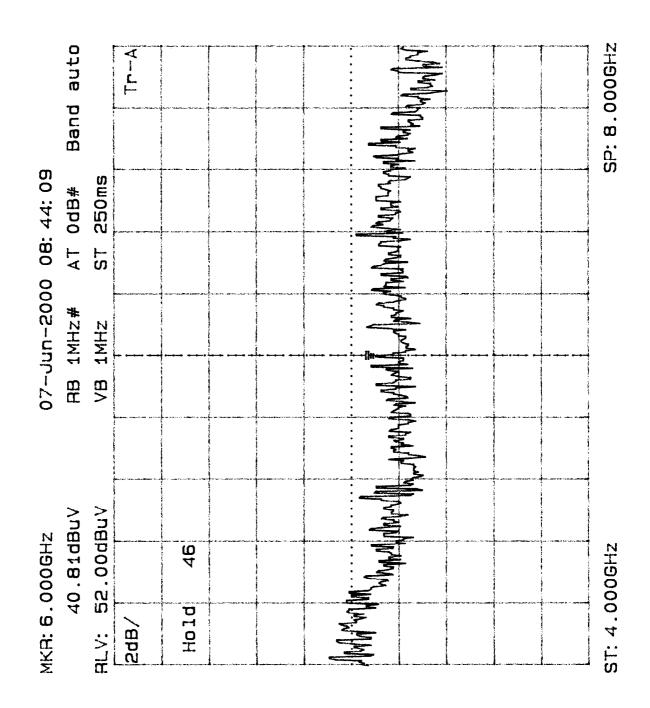


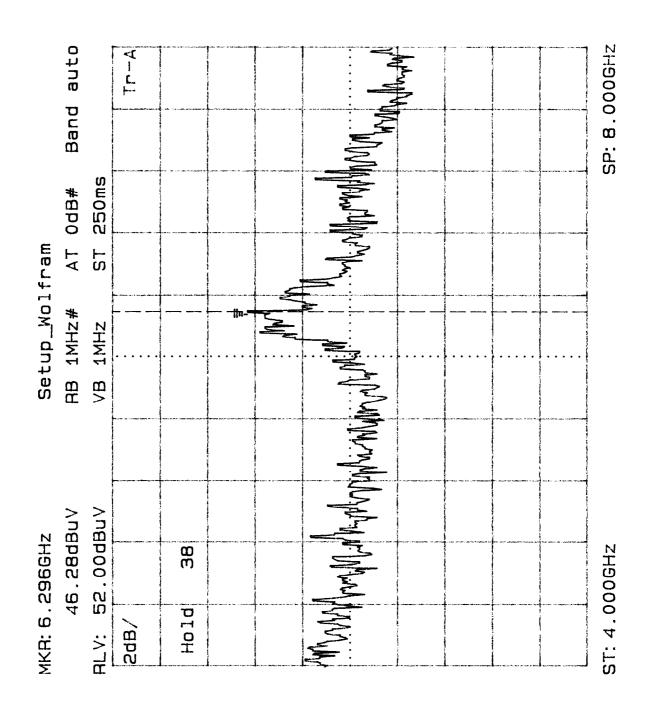


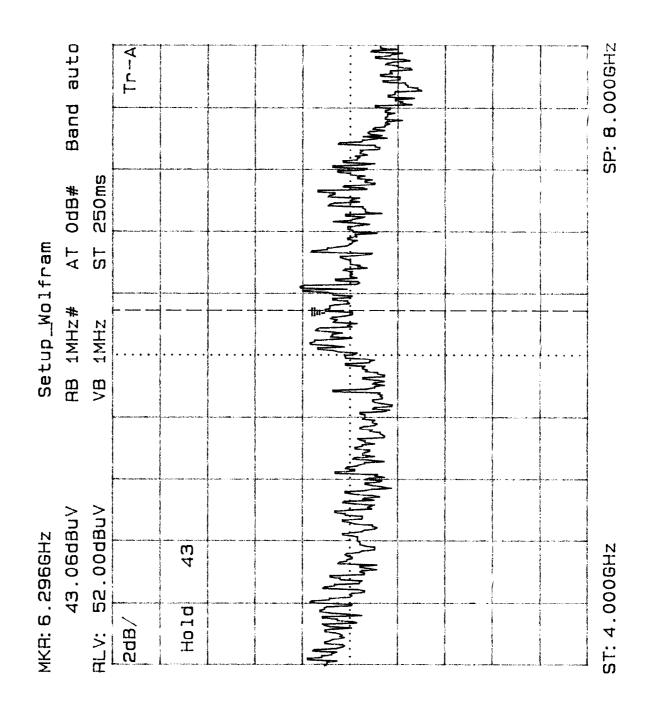












Radiated Emission Test	30 MHz - 300 MHz
according to FCC Pa	art 15 Subpart C

				3			
Model: Microp	ilot S				Mode: Normal operat	tion	
Serial no Prototy).:				Vertical position		
Applicar							
Test site					-		
Semi a	anechoic room	n, cabin no. 3					
Tested o							
	istance 3 mete ntal Polarizati						
Date of t 06/26/2		Oper J. R					
Test per	formed: atically	File n	ame:				
Detector	-				List of values:		
Peak					10 dB Margin	50 Sub	ranges
dBµV/m 60	ן 	ı — I			Limit1	: FCC Subpart C T	ransducer: HK 116
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							MHz
Result:					Project file:		· · · · · -
Presca	an				50511-00331	Pa	ge 49 of 68 Pages

Senton GmbH / EMI/EMC Laboratories / Aeussere Fruehlingsstrasse 45 / D-94315 Straubing / Tel. +49 9421 55220

Radiated Emission Test	300 MHz - 1 GHz
according to FCC Par	t 15 Subpart C

Model:			Mode:	
Microp			Normal operation	
Serial no Prototy	rpe		Vertical position	
Applican Endres	^{t:} ss + Hauser			
Test site Semi a	: Inechoic room, cabin no. (3		
Tested o				
	stance 3 meters ntal Polarization			
Date of to 06/26/2		rator: Roidt		
Test perf automa	formed: File	name:		
Detector			List of values:	
Peak			10 dB Margin	50 Subranges
dBµV/m 60	l		Limit1: FCC Subp	oart C Transducer: HL 223
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10		і і і і	· · ·	н н н н
	00			1000 MHz
Result:			Project file:	
Presca	in		50511-00331	Page 50 of 68 Pages

Model: Micropilot S					Mode: - Normal operation conditions						
Serial No.:					- Horizontal polarization						
Applicant: Endress + Hauser					- EMCO 3115						
Enuless	+ nausei										
Ref.Level 5 dB/Div.	45.5 dBµV			ATT	0 dB			Ref. Of	fset -35 dB		
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Start 1.000 RBW 1 MH				VBW	1 MHz	1		Stop	2.600 GHz SWP 20 ms		
	12				arker List				20113		
			No. 1	1.810667	GHz	3.69 dBµ\	/				
Tested by:					Project-No).:					
Johann F Date:	Koldt										
June 28,	2000						Page	51 of 68 P	ages		

Radiated Emissions M	leasurement according to FCC Rules
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Model:				Mode:						
Micropilot S				- Normal operation conditions						
Serial No.:	- Horizontal polarization									
Applicant: Endress + Haus	er			- EMCO 3115						
Ref.Level 50 dBµ 5 dB/Div.	IV		ATT	0 dB			Ref. Offs	et -30.5 d		
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	1	1		1 1				, ,		
Start 2.600 GHz RBW 1 MHz			VBW	1 MHz			Stop	3.950 GH SWP 20 m		
			Multi Ma	arker List						
		No. 1	2.600000	<u></u>	8.21 dBµ\					

Model: Micropilot S		Mode: - Normal operation conditions				
Serial No.:		- Horizontal polarization				
Applicant: Endress + Hauser		- EMCO	3115			
Ref.Level 50 dBµV 5 dB/Div.	ATT	0 dB			Ref. Offs	et -30.5 dB
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Start 3.950 GHz RBW 1 MHz	VBW 1	l MHz			Stop	5.850 GHz SWP 20 ms
	Multi Ma	rker List				
No. 1 3	.950000 (GHz	8.96 dBµ\	/		
Tested by:]	Project-No.				
Johann Roidt						
Date: June 28, 2000				Page	53 of 68 P	ages

Model: Micropilot S Serial No.: Applicant: Endress + Hauser						l operation ntal polariza 3160			
Deflevel								Def Offe	at 20 E dD
Ref.Level 5 5 dB/Div.	50 αΒμν			ATT	0 dB			Ref. Offs	et -30.5 dB
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Start 5.850) GHz			1				Stop	 8.200 GHz
RBW 1 MH	Hz			VBW	1 MHz			S	8.200 GHz SWP 20 ms
				Multi Ma	arker List				
		l	No. 1	7.027611	GHz	6.86 dBµ\	V		
Tested by: Johann F	Roidt				Project-No	.:			
Date: June 28,	2000						Page	e 54 of 68 P	ages

Model:					Mode:					
Micropilot	t S				- Normal	operation	conditions			
Serial No.:					- Horizontal polarization					
Applicant: Endress + Hauser					- EMCO	3160				
Ref.Level 4 5 dB/Div.	45.5 dBµV			ATT	0 dB			Ref. Of	fset -35 dB	
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			ı	1 1	ı ı					
Start 8.200 RBW 1 MH				VBW	1 MHz			Stop 1	2.400 GHz SWP 20 ms	
				Multi Ma	arker List					
		Ν	lo. 1	12.400000	GHz	4.62 dBµ	V			
Tested by:					Project-No.	.:]	
Johann R Date:	loidt									
June 28,	2000						Page	e 55 of 68 F	ages	

]		
Model: Micropilot S					Mode: - Normal operation conditions						
Serial No.:											
Applicant					- Horizontal polarization - EMCO 3160						
Endress	+ Hauser				- EMCO	3100					
Ref.Level - 5 dB/Div.	45.5 dBµV			ATT	0 dB			Ref. O	ffset -35 dB		
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Start 12.40					i	1		Stop 1			
RBW 1 M	Hz			VBW	1 MHz			Stop	8.000 GHz SWP 40 ms		
				Multi Ma	arker List						
		Ν	lo. 1	13.040889	GHz	7.52 dBµ	V				
Tested by:]	Project-No]		
Johann F	Roidt					·					
Date: June 28,	2000						Page	56 of 68 F	ages		

Modell: Micropilot S				Kommentar: Normal operation condition, EUT vertical					
Geräte-Nun	nmer:				RX antenna EMCO 3160-09				
Auftraggebe	Auftraggeber: Endress + Hauser				Test Distance 0.5 meter				
Linurcos					Horizont	al Polarisat	lion		
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Ref.Level : 5 dB/Div.	57 dBµV			ATT	0 dB				
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Start 18.00 RBW 1 MH				VBW	1 MHz			Stop 2	26.500 GHz SWP 40 ms
				Multi-Ma	rker-Liste				
		N	r. 1 2	26.396111	GHz	20.77 dBµ	ιV		
					01.12	20117 0.00			
Prüfer:					Projekt-Nr.:				
Johann F	Roldt				50511-00331				
Datum:	2000						Page F	57 of 68 Pa	des
June 28,	2000						i aye c	0, 00 i a	900

Modell: Micropilot S					Kommenta Normal d	r: operation c	ondition, El	JT vertical	
Geräte-Nummer:					RX Antenna EMCO 3160-10 + TEK WM782A Waveguide Mixer			ide Mixer	
Auftraggeber: Endress + Hau	Auftraggeber: Endress + Hauser					tance 0.5 m		0	
						al Polarisat			
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Ref.Level 57 dB 5 dB/Div.	μV			ATT	0 dB				
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Start 26.500 GHz RBW 1 MHz VBW			VBW	Stop 40.000 GHz 1 MHz SWP 60 ms					
				Multi-Mai	rker-Liste				
		Ν	r.1 4	0.000000	GHz	15.72 dBµ	١V		
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^{Prüfer:} Johann Roidt					Projekt-Nr. 50511-0				
Datum:									
June 28, 2000						Page 5	8 of 68 Pa	ges	

Radiated Emission Test	30 MHz - 300 MHz
according to FCC Pa	art 15 Subpart C

			J			-	
Model: Microp	ilot S			Mo	^{de:} ormal operation		
Serial no).:				ertical position		
Prototy Applican							
Endres	s + Hauser						
Test site Semi a	: Inechoic roon	n. cabin no. 3					
Tested c							
	stance 3 met Il Polarization						
Date of t 06/26/2		Operator J. Roid					
Test per automa		File name	9:				
Detector	-				t of values:		
Peak	-				dB Margin	50 Subranges	
dBµV/m 60) 				Limit1: FCC S	ubpart C Transducer: HK 11	6
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	80			1	00		300 /IHz
Result: Presca	in				ject file: 511-00331	Page 59 of 68 Pages	;

Senton GmbH / EMI/EMC Laboratories / Aeussere Fruehlingsstrasse 45 / D-94315 Straubing / Tel. +49 9421 55220

Radiated Emission Test	300 MHz - 1 GHz
according to FCC Par	t 15 Subpart C

Model:	ilet C		Mode:	
Microp Serial no			Normal operation	
Prototy	ире		Vertical position	
Applican Endres	^{it:} ss + Hauser			
Test site				
Tested o	anechoic room, cabin no. :	3		
Test di	istance 3 meters I Polarization			
Date of t		rator:		
06/26/2		Roidt		
Test per automa		name:		
Detector	· · · · · · · · · · · · · · · · · · ·		List of values:	
Peak			10 dB Margin	50 Subranges
dBµV/m 60) 	ı	Limit1: FCC Sub	part C Transducer: HL 223
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		1		MHz
Result: Presca	an		Project file: 50511-00331	Page 60 of 68 Pages
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Model: Micropilot	S				Mode: - Normal	operation	conditions		
Serial No.:					- Vertical polarization				
Applicant:	Applicant: Endress + Hauser			- EMCO	3115				
LIUICSS	Fildusei								
Ref.Level 4 5 dB/Div.	45.5 dBµV			ATT	0 dB			Ref. Of	fset -35 dB
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Start 1.000				· ·	· ·			Stop	2.600 GHz SWP 20 ms
RBW 1 MH	lz				1 MHz arker List				SWP 20 ms
			No. 1	1.810667		3.52 dBµ\	/		
Tested by: Johann R	oidt				Project-No	.:			
Date:							Page	61 of 68 P	ages
June 28,	2000						i aye		ayos

Serial No.: Applicant: Endress + Hauser			🛛 - Norma	l operation	conditions		
Applicant: Endress + Hauser	Serial No.:						
Applicant: Endress + Hauser			- Vertical polarization - EMCO 3115				
Ref.Level 50 dBµV 5 dB/Div.		ATT	0 dB			Ref. Offse	et -30.5 dB
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Start 2.600 GHz	1	1				Stop	3.950 GHz
RBW 1 MHz			1 MHz			S	3.950 GHz WP 20 ms
		Multi Ma	arker List				
	No. 1	2.600000	GHz	8.21 dBµ\	/		

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Date:

^{Model:} Micropilot S		Mode - Nc	e: ormal operation co	onditions	
Serial No.:		- Ve	rtical polarization		
Applicant: Endress + Hauser		EN	<i>I</i> CO 3115		
Ref.Level 50 dBµV 5 dB/Div.		ATT 0 dB		Ref. Offset -30.5 d	IE
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June may Minuden of Miller	mphyllimnymul	White When multiple	Www.Whenwww.when	March mark March M	M
					-
Start 3.950 GHz RBW 1 MHz		VBW 1 MHz	· · ·	Stop 5.850 GF SWP 20 m	าร
		Multi Marker L	ist		
	No. 1	3.950000 GHz	8.96 dBµV		

Tested by:	Project-No.:
Johann Roidt	
Date:	
June 28, 2000	Page 63 of 68 Pages

Radiated Emissions M	leasurement according to FCC Rules
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Model: Micropilot S					Mode: - Normal operation conditions					
Serial No.:					- Vertical polarization					
Applicant: Endress ·	+ Hauser				- EMCO	3160				
								D / O //		
Ref.Level 5 5 dB/Div.	50 αΒμν			ATT	0 dB			Ref. Offs	et -30.5 dB	
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Start 5.850 RBW 1 MF				VBW	1 MHz Stop 8.200 GHz SWP 20 ms					
				Multi Ma	arker List					
		1	No. 1	7.027611	GHz	6.79 dBµ\	V			
Tested by:					Project-No).:]	
Johann R Date:	Johann Roidt									
Date: June 28, 2000							Page	64 of 68 P	ages	

Model: Micropilo Serial No.: Applicant: Endress	t S + Hauser				Mode: - Normal operation conditions - Vertical polarization - EMCO 3160					
Ref.Level	45.5 dBµV			ATT	0 dB			Ref. Of	fset -35 dB	
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Start 8.200								Stop 1	2.400 GHz	
RBW 1 M	Ηz			VBW	1 MHz				SWP 20 ms	
				Multi Ma	arker List					
No. 1 12.400000 GHz 5.08 dBµV										
Tested by:						Project-No.:				
Johann F	Roidt									
Date: June 28, 2000					Page 65 of 68 Pages					

Model: Micropilot S	Mode: - Normal operation conditions						
Serial No.:	- Vertical polarization						
Applicant: Endress + Hauser	- EMCO 3160						
Ref.Level 45.5 dBµV ATT 5 dB/Div.	0 dB Ref. Offset -35 dB						
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a Aurick Andrewski Auricki Auri							
Start 12.400 GHz RBW 1 MHz VBW	Stop 18.000 GHz 1 MHz SWP 40 ms						
Multi Ma	arker List						
No. 1 13.040889	GHz 6.53 dBµV						
Tested by: Johann Roidt	Project-No.:						
Date: June 28, 2000	Page 66 of 68 Pages						

Modell:					Kommonto						
Micropilot S						Kommentar: Normal operation condition, EUT vertical					
Geräte-Nummer:						RX antenna EMCO 3160-09					
Auftraggeber:				Test Distance 0.5 meter							
Endress + Ha	user										
					Vertical Polarisation						
Ref.Level 57 d 5 dB/Div.	lΒμV			ATT	0 dB						
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Start 18.000 GI RBW 1 MHz	Hz			VBW	1 MHz Stop 26.500 GHz SWP 40 ms						
				Multi-Ma	rker-Liste						
		N	r. 1 2	26.396111	GHz	19.57 dBµ	١V				
Prüfer:					Projekt-Nr.:						
Johann Roidt					50511-00331						
Datum: June 28, 2000							Page 6	67 of 68 Pa	ges		
30110 20, 2000	Julie 20, 2000										

Modell: Micropilot Geräte-Num Auftraggebe Endress -	nmer: er: + Hauser				Kommentar: Normal operation condition, EUT vertical RX Antenna EMCO 3160-10 + TEK WM782A Waveguide Mixer Test Distance 0.5 meter Vertical Polarisation					
Ref.Level & 5 dB/Div.	57 dBµV			ATT	0 dB					
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Start 26.50	0 GHz	1	I			1	1	Stop 4	0.000 GHz	
RBW 1 MH				VBW [·]	1 MHz SWP 60 ms					
				Multi-Mai	rker-Liste					
		Ν	r. 1 4	10.000000	GHz	15.72 dBµ	١V			
Prüfer:					Projekt-Nr.:					
Johann Roidt					50511-00331					
Datum: June 28, 2000					Page 68 of 68 Pages					

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