CETECOM ICT Services GmbH

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Laboratory for aeronautical radio , microwave radio and radar

Accredited by the
German Accreditation
Council

Deutscher
Akkreditierungs
Rat

Accredited testing laboratory

DAR registration number:
TTI-P-G166/98-00
FCC registration number:
90462, date Oct. 06, 2000

Test Report No.:
2-2332-A/00
FSG 90
FSG 200

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FCC Part 87 Subpart D		**ETS 300 676**	
Section		**Clause**	
87.131	**Power and emissions**	**7.3**	**Carrier power**
87.133	**Frequency stability**	**7.2**	**Frequency error**
87.135	**Bandwidth of emission**	**7.4**	**Amplitude modulation characteristic**
87.137	**Types of emission**	**7.5**	**Adjacent channel power**
87.139	**Emission limitations**	**7.7**	**Conducted spurious emissions**
87.141	**Modulation requirements**	**7.5**	**Adjacent channel power**
87.147	**Authorisation of equipment**		

FCC Part 15 Subparts B & C		**ETS 300 676**	
Section		**Clause**	
15.209	**Radiated emission limits**	**7.7**	**Conducted spurious emissions (TX active)**
	C (intentional radiators)		
15.109	**Radiated emission limits**	**7.7**	**Conducted spurious emissions (RX active)**
	B (unintentional radiators)		

Remark: The tests are carried out on a test objekt FSG 90-H1 Ser.No.:5657 which is compliant to ETS standard. This EUT is identical in function and design with the following FSG 90 / FSG 200 variants. (see App.3**)**

[X] Appendix 1 Photographs 4 pages

[X] Appendix 2 Plots, data sheets 31 pages

[X] Appendix 3 Variants of FSG 90 / FSG 200 designed for the US market 1 page

1 General Information

1.1 Notes

The test results of this test report relate exclusively to the test item specified in clause1.5. 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
15.02.2001	Detlev Gillmann.	

Technical responsibility for area of testing :

Date	Name	Signature
15.02.2001	Klaus Kammerinke.	

1.2 Testing laboratory

CETECOM ICT Services GmbH
P.O. Box 100445, 66004 Saarbrücken
Untertürkheimer Str. 6 - 10, 66117 Saarbrücken
Germany
Telephone : + 49 681 5 98 - 84 32
Fax : + 49 681 5 98 - 90 75
e-mail : klaus.kammerinke@ict.cetecom.de

Accredited testing laboratory
DAR registration number: TTI-P-G166/98-00

Testing location , if different from CETECOM ICT Services GmbH:

Name :
Street :
Town :
Country :
Telephone :
Fax :

1.3 Details of applicant

Name : Walter Dittel GmbH Luftfahrt-Gerätebau
Street : Erpftinger Str. 36
Town : D-86899 Landsberg
Country : Germany
Telephone : +49 (0) 8191 3551-0
Fax : +49 (0) 8191 3551-49

Contact person
Name : Mr. Mössinger
Telephone : +49 (0) 81 91 33 51 51
Fax : +49 (0) 81 91 33 51 49

1.4 Application details

Date of receipt of application : 28.11.2000
Date of receipt of test item : 17.01.2001
Date of test : 17.01.2001
Laboratory number : 050/2000

1.5 Test item (EUT)

Description of test item	:	**VHF/ AM Transmitter / Receiver**
Type identification	:	**FSG 90 / 200**
Manufacturer	:	**Walter Dittel GmbH** **Erpftinger Str. 36** **D-86899 Landsberg**

Technical data of EUT

1. Frequency range	:	118.000 – 136.975 MHz (TX + RX)
Number of channels	:	760
Type of modulation	:	3K20A3E
Modulation depth	:	85 %
Carrier power	:	10.5 W
Channel spacing	:	25.0 kHz
Nominal power supply U DC	:	13.8 V
Extreme power supply U DC	:	10.8 V to 15.6 V
2. Frequency range	:	118.000 – 136.975 MHz (TX + RX)
Number of channels	:	2278
Type of modulation	:	3K00A3E
Modulation	:	85 %
Carrier power	:	10.5 W
Channel spacing	:	8.33 kHz
Nominal power supply U DC	:	13.8 V
Extreme power supply U DC	:	10.8 V to 15.6 V

Remark: The channel spacing 25 kHz / 8.33 kHz can be activated / deactivated by jumpers (manufacturer) or by a set - up routine

1.5.1 Operation conditions :

Simplex operation TX or RX.

1.5.2 Equipment under test (EUT)

FSG 90 (X) family with 6.0 W output power
FSG 90 (X)-H1 family with 10.0 W o. p.
FSG 200 (X) family with 6.0 W o.p.
FSG 200 (X) H1 family with 10.0 W o.p.

1.6 Standards

EN 300 676	**Electromagnetic compatibility and Radio spectrum Matters (ERM)**
FCC Part 87	**Aviation Services**
FCC Part 15	**Radio frequency devices**

2. Technical test

2.1 Summary of test results

[X] **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.

The test report :

[X] **describes the first test**

[X] **describes an additional test according to FCC Part 87**

[ ] is a verification of documents

[ ] is only valid with the test report no :

2.2 Test conditions

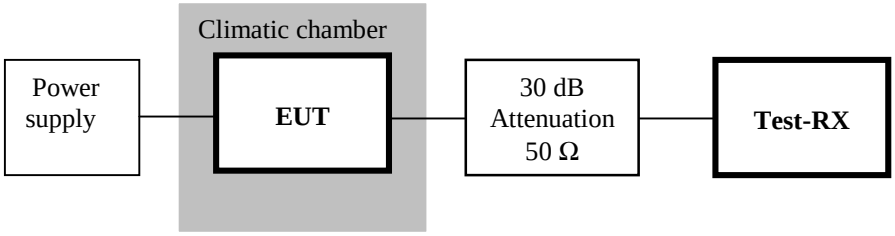
The environmental conditions are documented specially for each test

2.3 Measurement and test set-up

The measurement and test set-up is in accordance to the specification .

2.4 Test equipment and test set-up

2.4.1 Set-up 1 for conducted measurements



Test-RX for transmitter tests:

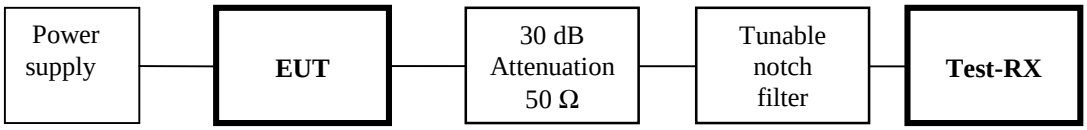
Test set-up	Test equipment	Manufacturer	Type	Serial No.	Calibration due
1.1	Spectrum analyser	HP	HP 8565E	3738A00773	05.05.2001
1.2	Power meter	HP	HP E4419B	G839510924	10.10.2002
1.2	Power sensor	HP	HP 8482A	2652A16675	10.05.2001
1.3	Frequency counter	EIP	Model 548 CNN	1602	01.07.2001
1.4	Test-TX/RX	R&S	CMTA 84	158391007	01.07.2001
	30 dB attenuation	HP	HP 8498A	1801A02445	01.05.2001
	Power supply	HP	HP 6032A	2848A07227	01.07.2001
	Climatic chamber	Vötsch	VUK 04/500	522/32678	01.05.2001
	RF-cable	HP	5061-5359	P36303	Every month

Measurement uncertainties

Performance	Uncertainty
Input power (DC)	±0.1 V
Temperature	±0.2 °C
Frequency	±0.01 ppm
RF-power	±0.4 dB

2.4 Test equipment and test set-up

2.4.2 Set-up 2 for conducted measurements



Test equipment for EUT transmitter tests:

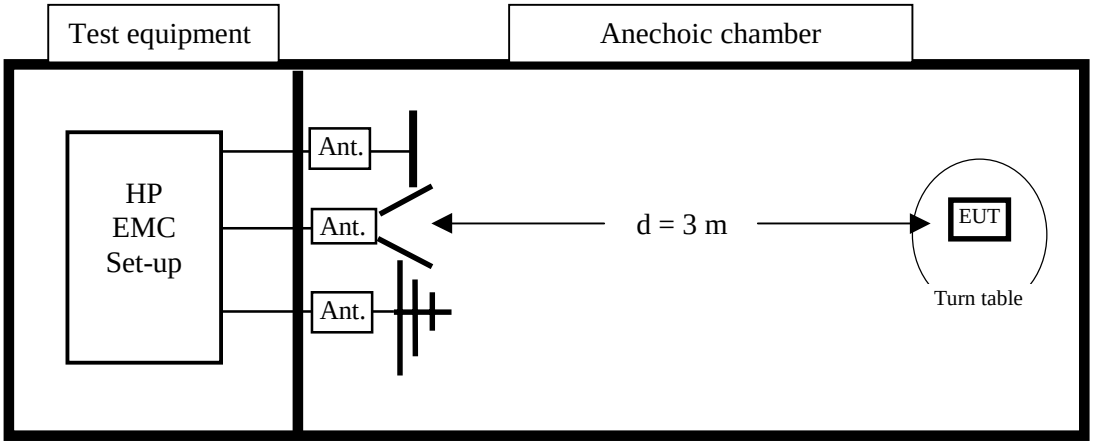
Test set-up	Test equipment	Manufacturer	Type	Serial No.	Calibration due
2.1	Spectrum analyser	HP	HP 8565E	3738A00773	05.05.2001
	30 dB attenuation	HP	HP 8498A	1801A02445	01.05.2001
	Power supply	HP	HP 6032A	2848A07227	01.07.2001
	Notch filter	Telonic	TTR 95	20372-4	01.05.2001
	Notch filter	Telonic	TTR 190	30036-4	01.05.2001
	RF-cable	HP	5061-5359	P36303	Every month

Measurement uncertainties

Performance	Uncertainty
Input power (DC)	±0.1 V
Temperature	±0.2 °C
Frequency	±0.01 ppm
RF-power	±0.4 dB

2.4 Test equipment and test set-up

2.4.3 Test set-up for the measurement of spurious radiation in the frequency range up to 4 GHz.



Test equipment	Manufacturer	Type	S/No.	Calibration due
Spectrum analyser	HP	HP 85660B	2478A05306	05.07.2001
Analyser display	HP	HP 85662A	2816A16541	05.07.2001
Quasi peak adapter	HP	HP 85650A	2811A01131	05.07.2001
RF-preselector	HP	HP 85685A	2833A00768	05.07.2001
Biconical antenna	Emco	3104	3758	01.07.2001
Log.-per.-antenna	Emco	3146	2304	01.07.2001
Double ridge horn	Emco	3115	3007	01.07.2001
Relay switch	R&S	RSU	375 339/002	01.07.2001
High pass filter	FSY Microwave	HM 985955	001	01.07.2001
Amplifier	Tron-Tech	P42-GA29	B2302	01.07.2001
Power supply	HP	HP 6038A	2848A07027	12.12.2001
RF-cable	HP	5061-5359	P36303	Every month

Measurement uncertainties

Test parameter	Uncertainty
Input power (DC)	±0.1 V
Temperature	±0.2 °C
Frequency	±0.01 ppm
RF-power	±1.5 dB

2.5 Test results

2.5.1 Test results overview

☐ in addition to the test report no :

Verification of the EUT:

☒ The EUT is in accordance with the technical description
☐ The EUT is not in accordance with the technical description
☐

Test results in details:

87.131	**Power and emissions** **Test standards passed:**
X	**Yes**
	No
	No measurement

87.133.a	**Frequency stability** **Test standards passed:**
X	**Yes**
	No
	No measurement

87.135.a	**Bandwidth of emission** **Test standards passed:**
X	**Yes**
	No
	No measurement

87.137.a	**Types of emission** **Test standards passed:**
X	**Yes**
	No
	Not applicable

87.139.c	**Emission limitations** **Test standards passed:**
X	**Yes**
	No
	No measurement

87.141	**Modulation requirements** **Test standards passed:**
X	**Yes**
	No
	No measurement

15.209	**General requirements for intentional radiators** **Test standards passed:**
X	**Yes**
	No
	No measurement

15.109	**General requirements for unintentional radiators** **Test standards passed:**
X	**Yes**
	No
	No measurement

EN 7 Transmitter tests
EN 7.1 Protection of the transmitter

Test conditions:	TX frequency	f 1	=	127.500	MHz
	Modulation frequency	f m	=	No modulation	
	Normal power supply	U DC	=	13.80	V
	Extreme power supply	U DC	=	10.80 – 15.60	V
	Normal temperature	t	=	23.0	°C
	Test set-up: 2.4.1				

Test performance at RF-output	Duration (sec)	Test results
Short circuit	60	No degradation
Open circuit	60	No degradation

Limits kept : **Yes** [X] **No** [ ]

EN 7.2 Frequency error
FCC 87.133 Frequency stability

Test conditions:	TX frequencies	f	=	118.000 / 127.500 / 136.975	MHz
	Normal power supply	U DC	=	13.80	V
	Extreme power supply	U DC	=	10.80 – 15.60	V
	Normal temperature	t n	=	23.0	°C
	Extreme temperature	t min	=	-20.0	°C
	Extreme temperature	t max	=	55.0	°C
	Test set-up: 2.4.1				

Limits

Equipment	Normal temperature	Extreme temperature
EN: 25 kHz Fixed/base	<±5.0 ppm	<±10.0 ppm
EN: 25 kHz Mobile/portable	<±10.0 ppm	<±15.0 ppm
FCC 25 kHz	<±20.0 ppm	<±20.0 ppm

Test results

TX-frequency (MHz)	t (°C)	U (V)	Measured frequency (MHz)	Frequency error (Hz)	Frequency error (ppm)
118.000 000	23.0	10.80	117.999 960	-40	-0.33
118.000 000		13.80	117.999 950	-50	-0.42
118.000 000		15.60	117.999 940	-60	-0.50
127.500 000		10.80	127.499 910	-90	-0.70
127.500 000		13.80	127.499 900	-100	-0.78
127.500 000		15.60	127.499 890	-110	-0.86
136.975 000		10.80	136.974 950	-50	-0.36
136.975 000		13.80	136.974 940	-60	-0.43
136.975 000		15.60	136.974 930	-70	-0.51
118.000 000	55.0	10.80	117.999 850	-150	-1.27
118.000 000		15.60	117.999 830	-170	-1.44
127.500 000		10.80	127.499 810	-190	-1.49
127.500 000		15.60	127.499 810	-190	-1.49
136.975 000		10.80	136.974 800	-200	-1.46
136.975 000		15.60	136.974 810	-190	-1.38
118.000 000	-20.0	10.80	118.000 100	100	0.84
118.000 000		15.60	118.000 080	80	0.67
127.500 000		10.80	127.500 150	150	1.17
127.500 000		15.60	127.500 130	130	1.07
136.975 000		10.80	136.975 140	140	1.02
136.975 000		15.60	136.975 100	100	0.73

Limits kept : **Yes** [X] **No** [ ]

EN 7.3 Carrier power
FCC 87.131 Power and emissions

Test conditions:	TX frequencies	f	=	118.000 / 127.500 / 136.975	MHz
	Modulation	m	=	Modulation off	
	Normal power supply	U DC	=	13.80	V
	Extreme power supply	U DC	=	10.80 – 15.60	V
	Normal temperature	t n	=	23.0	°C
	Extreme temperature	t min	=	-20.0	°C
	Extreme temperature	t max	=	55.0	°C
	Rated output power	**p**	**=**	**40.0**	**dBm**
	Test set-up: 2.4.1				

Tolerances; limits

Equipment	Normal temperature	Extreme temperature
EN: 8.33 kHz/25 kHz	Output power (x dBm)± 1.5 dB	x dBm +1.5 dB to –3.0 dB
FCC 25 kHz Mobile device	10.0 W	10.0 W
FCC 25 kHz Fixed device	50.0 W	50.0 W

Test results

TX-frequency (MHz)	t (°C)	U (V)	Output pwr. p (dBm)	Tolerance (dB)
118.000 000	23.0	10.80	39.5	-0.5
118.000 000		13.80	40.5	+0.5
118.000 000		15.60	40.5	+0.5
127.500 000		10.80	39.6	-0.4
127.500 000		13.80	40.5	+0.5
127.500 000		15.60	40.5	+0.5
136.975 000		10.80	39.4	-0.6
136.975 000		13.80	40.4	+0.4
136.975 000		15.60	40.4	+0.4
118.000 000	55.0	10.80	39.5	-0.5
118.000 000		15.60	40.6	+0.6
127.500 000		10.80	39.6	-0.4
127.500 000		15.60	40.8	+0.8
136.975 000		10.80	39.5	-0.5
136.975 000		15.60	40.5	+0.5
118.000 000	-20.0	10.80	39.5	-0.5
118.000 000		15.60	40.4	+0.4
127.500 000		10.80	39.5	-0.5
127.500 000		15.60	40.6	+0.6
136.975 000		10.80	39.6	-0.4
136.975 000		15.60	40.6	+0.6

Limits kept : **Yes** [X] **No** [ ]

EN 7.4 Amplitude modulation characteristic
EN 7.4.1 Modulation depth
FCC 87.141.a Modulation requirements

Test conditions:	TX frequencies	f	=	118.000 / 127.500 / 136.975	MHz
	Modulation frequency	f m	=	1000	Hz
	Modulation depth	m	=	85.0	%
	Normal power supply	U DC	=	13.80	V
	Extreme power supply	U DC	=	10.80 – 15.60	V
	Normal temperature	t n	=	23.0	°C
	Extreme temperature	t min	=	-20.0	°C
	Extreme temperature	t max	=	55.0	°C
	AF input voltage	**U eff**	**=**	**40.0 to 50.0**	**mV**
	Test set-up: 2.4.1				

Limits

Equipment		Normal temperature	Extreme temperature
EN:	8.33 kHz/25 kHz	m = 85.0 %	m = 80.75 % to 90.25 %
FCC	25 kHz	m = < 100 %	

Test results

TX-frequency (MHz)	t (°C)	U (V)	AF = 1000Hz U eff (mV)	m (%)
118.000 000	23.0	10.80	46.2	85.0
118.000 000		13.80	46.2	85.0
118.000 000		15.60	46.0	85.0
127.500 000		10.80	45.8	85.0
127.500 000		13.80	45.7	85.0
127.500 000		15.60	45.5	85.0
136.975 000		10.80	46.0	85.0
136.975 000		13.80	45.7	85.0
136.975 000		15.60	45.7	85.0
118.000 000	55.0	10.80	45.3	85.0
118.000 000		15.60	45.5	85.0
127.500 000		10.80	45.0	85.0
127.500 000		15.60	45.2	85.0
136.975 000		10.80	45.5	85.0
136.975 000		15.60	45.7	85.0
118.000 000	-20.0	10.80	44.8	85.0
118.000 000		15.60	44.0	85.0
127.500 000		10.80	44.2	85.0
127.500 000		15.60	43.5	85.0
136.975 000		10.80	44.5	85.0
136.975 000		15.60	44.0	85.0

Limits kept : **Yes** [X] **No** [ ]

FCC 87.135 Bandwidth of emission
EN 7.4.2 Modulation compression

Test conditions:	TX frequencies	f	=	118.000 / 127.500 / 136.975	MHz
	Modulation frequency	f m	=	100 to 3000	Hz
	Modulation depth	m	=	50 % to 86	%
	Normal power supply	U DC	=	13.80	V
	Normal temperature	t n	=	23.0	°C
	AF input voltage	**U eff**	**=**	**26.0 to 200.0**	**mV**
	Test set-up: 2.4.1				

Limits

AF level increase (dB)	Modulation change (%)
10.0 (± 2.0)	10 to 30
9.0 (± 2.0)	30 to 85
20.0 (± 2.0)	max 95

Test results See Plots 01 to 06

TX-frequency (MHz)	U eff (mV) 100 to 2500 Hz	m (%)	U eff (mV) +16 dB	m (%)	F min (MHz) -23 dBc	F max (MHz) -23 dBc
118.000 000	26.2	50.0	157.2	85.5	117.997	118.003
127.500 000	26.1	50.0	156.6	85.4	127.498	127.502
136.975 000	26.0	50.0	156.0	85.9	136.973	136.977

Test results See Plots 07to 09

TX-frequency (MHz)	U eff (mV) AF white noise	m (%)	F min (MHz) -23 dBc	F max (MHz) -23 dBc
118.000 000	160.0	>86.0	117.996 500	118.007 500
127.500 000	160.0	>86.0	127.492 580	127.507 420
136.975 000	160.0	>86.0	136.969 250	136.981 750

Limits kept : **Yes** [X] **No** [ ]

EN 7.4.3 Amplitude modulation distortion
FCC 87.141.a Modulation requirements

Test conditions:	TX frequencies	f	=	118.000 / 127.500 / 136.975	MHz
	Modulation frequency	f m	=	1000	Hz
	Modulation depth	m	=	85	%
	Normal power supply	U DC	=	13.80	V
	Normal temperature	t n	=	23.0	°C
	AF input voltage	**U eff**	**=**	**25.0 to 161.0**	**mV**
	Test set-up: 2.4.1				

Limits

Max. modulation (%)	Max. distortion (%)
EN 85.0 to 95.0	10.0
FCC <100.0	

Test results

TX-frequency (MHz)	AF U eff (mV)	m (%)	distortion d (%)	U eff (mV) +16 dB	m (%)	distortion d (%)
118.000 000	26.2	50.0	2.5	160.7	85.5	5.6
127.500 000	25.5	50.0	2.6	160.8	85.5	5.6
136.975 000	25.7	50.0	2.6	160.0	85.5	5.6

Limits kept : **Yes** [X] **No** [ ]

EN 7.4.4 Audio frequency response
FCC 87.137 Types of emission

Test conditions:	TX frequency	f	=	127.500	MHz
	Modulation frequencies	f m	=	300 Hz to 3400	Hz
	Modulation depth	m	=	60	%
	Normal power supply	U DC	=	13.80	V
	Normal temperature	t n	=	23.0	°C
	AF input voltage	**U eff**	**=**	**36.0**	**mV**
	Test set-up: 2.4.1				

Limits

Equipment	AF range (Hz)	Modulation (%)	Max. mod. ratio (dB)
25 kHz base/mobile	300 to 3400	60.0	+2.0 / -4.0
25 kHz portable	350 to 2500	60.0	+2.0 / -4.0

Audio frequency (kHz)	Const. AF input m (%)	Mod. ratio (dB)
0.100	-	>-30.0
0.200	23.0	-4.2
0.300	**39.7**	**-1.8**
0.350	**50.6**	**-0.8**
0.400	59.0	-0.5
0.600	61.5	+0.2
0.800	62.4	+0.4
1.000	**60.0**	**(ref) 0.0**
1.200	58.2	-0.3
1.400	57.4	-0.6
1.600	57.5	-0.6
1.800	58.0	-0.5
2.000	56.2	-0.4
2.500	**55.7**	**-0.3**
3.000	40.4	-1.7
3.200	36.0	-2.2
3.400	**30.0**	**-3.0**
3.500	20.5	-4.6
4.000	2.0	-14.7
4.500	1.0	-17.5
5.000	**<0.1**	**-27.8**
6.000	-	>-30.0
10.000	-	>-30.0

Limits kept : **Yes** [X] **No** [ ]

EN 7.5 Adjacent channel power (ACP)
FCC 87.135 Bandwidth of emission

Test conditions:	TX frequencies	f	=	118.000 / 127.500 / 136.975	MHz
	Modulation frequency	f m	=	EN 1000	Hz
	Modulation frequency	f m	=	FCC white noise 100 to 10,000	Hz
	Modulation depth	m	=	EN: 85	%
	Modulation depth	m	=	FCC: > 50	%
	Normal power supply	U DC	=	13.80	V
	Normal temperature	t n	=	23.0	°C
	AF input voltage	**U eff**	**=**	**46.0 to 260.0**	**mV**
	Test set-up: 2.4.1				

Limits

Specification	Modulation (%)	Carrier offset (kHz)	ACP (dBc)
EN 25 kHz	85.0	± 25.0	>-60.0
FCC	> 50.0	± 25.0	>-23.0

Test results EN

TX-frequency (MHz)	AF input 46.0 mV	TX -25 kHz	TX +25 kHz	See plot No.
	m (%)	ACP (dBc)	ACP (dBc)	
118.000 000	85.0	-63.3	-64.5	1 + 2
127.500 000	85.0	-75.2	-73.5	3 + 4
136.975 000	85.0	-84.3	-85.4	5 + 6

Test results FCC

TX-frequency (MHz)	AF input 260.0 mV	See plot No.
	m (%)	
118.000 000	86.0	7
127.500 000	86.0	8
136.975 000	86.0	9

Limits kept : **Yes** [X] **No** [ ]

EN 7.7 Conducted spurious emissions
FCC 87.139.c Emission limitations

Test conditions:	TX frequency	f	=	118.000	MHz
	Modulation frequency	f m	=	2500	Hz
	Modulation depth	m	=	85	%
	Normal power supply	U DC	=	13.80	V
	Normal temperature	t n	=	23.0	°C
	Test set-up: 2.4.2				

EN Limits

Frequency range (MHz)	TX stand by Spurious (dBm)	TX active Harmonics (dBm)	TX active Spurious (dBm)	Resolution BW (kHz)
0.009 – 0.150	-57.0	not applicable	-46.0	1.0
0.150 – 30.000	-57.0	not applicable	-46.0	10.0
30.000 – 1 000	-57.0	-36.0	-46.0	10.0
1 000 – 4 000	-47.0	-30.0	-40.0	10.0

FCC Limits

Wanted frequency (MHz)	Spurious frequency ranges (MHz)	Attenuation (dBc)
118.000	177.000 to 295.000	-30.0
	295.000 to 413.000	-38.0
	413.000 to 980.000	-53.0

Test results:

Frequency range (MHz)	Spurious (MHz)	Res BW (kHz)	Atten. (dBc)	Level (dBm)	Remarks	See plot No. :
0.009 – 0.150	0.0643	1.000	<-106.0	-66.0	Noise	10
0.150 – 30.000	3.994	10.000	<-101.0	-61.0	Noise	11
0.000 – 200.000	118.000 *1)	10.000		-5.5	TX + notch	12
200.000 – 400.000	236.000	3.000	-105.7	-65.7	2 nd harmonic	13
	354.000	3.000	-106.6	-66.6	3 rd harmonic	13
400 MHz – 1.000 GHz	638.000	10.000	<-102.0	-63.0	Noise	14
1.000 GHz – 2.000 GHz	1442	1000	-79.0	-39.0	12 th harmonic	15
2.310 GHz – 2.390 GHz	n.f. *2)	10.000	<-105.2	<-65.2	Noise	16

1) Tx suppressed by a notch filter
2) n.f. = nothing found

Limits kept : **Yes** [X] **No** [ ]

EN 7.7 Conducted spurious emissions
FCC 87.139.c Emission limitations

Test conditions:	TX frequency	f	=	120.000	MHz
	Modulation frequency	f m	=	No modulation	
	Normal power supply	U DC	=	13.80	V
	Normal temperature	t n	=	23.0	°C
	Test set-up: 2.4.2				

EN Limits

Frequency range (MHz)	TX stand by Spurious (dBm)	TX active Harmonics (dBm)	TX active Spurious (dBm)	Resolution BW (kHz)
0.009 – 0.150	-57.0	not applicable	-46.0	1.0
0.150 – 30.000	-57.0	not applicable	-46.0	10.0
30.000 – 1 000	-57.0	-36.0	-46.0	10.0
1 000 – 4 000	-47.0	-30.0	-40.0	10.0

FCC Limits

Wanted frequency (MHz)	Spurious frequency ranges (MHz)	Attenuation (dBc)
120.000	180.000 to 300.000	-30.0
	300.000 to 420.000	-38.0
	420.000 to 980.000	-53.0

Test results:

Frequency range (MHz)	Spurious (MHz)	Res BW (kHz)	Atten. (dBc)	Level (dBm)	Remarks	See plot No. :
0.009 – 0.150	n.f. *2)	1.000	<-110.0	<-70.0	Noise	-
0.150 – 30.000	n.f.	10.000	<-108.0	<-68.0	Noise	-
0.000 – 200.000	120.000 *1)	10.000		-3.8	TX + notch	17
	178.344	10.000	-102.8	-62.8		17
200.000 – 400.000	240.000	3.000	-103.8	-63.8	2 nd harmonic	18
400 MHz – 1.000 GHz	542.000	10.000	-102.0	-62.0		19
1.435 GHz – 1.535 GHz	1440.240	1000	-79.5	-39.5	12 th harmonic	20

1) Tx suppressed by a notch filter
2) n.f. = nothing found

Limits kept : **Yes** [X] **No** [ ]

EN 7.7 Conducted spurious emissions
FCC 87.139.c Emission limitations

Test conditions:	TX frequency	f	=	136.975	MHz
	Modulation frequency	f m	=	No modulation	
	Normal power supply	U DC	=	13.80	V
	Normal temperature	t n	=	23.0	°C
	Test set-up: 2.4.2				

EN Limits

Frequency range (MHz)	TX stand by Spurious (dBm)	TX active Harmonics (dBm)	TX active Spurious (dBm)	Resolution BW (kHz)
0.009 – 0.150	-57.0	not applicable	-46.0	1.0
0.150 – 30.000	-57.0	not applicable	-46.0	10.0
30.000 – 1 000	-57.0	-36.0	-46.0	10.0
1 000 – 4 000	-47.0	-30.0	-40.0	10.0

FCC Limits

Wanted frequency (MHz)	Spurious frequency ranges (MHz)	Attenuation (dBc)
136.975	205.463 to 342.438	-30.0
	342.438 to 479.413	-38.0
	479.413 to 980.000	-53.0

Test results:

Frequency range (MHz)	Spurious (MHz)	Res BW (kHz)	Atten. (dBc)	Level (dBm)	Remarks	See plot No. :
0.009 – 0.150	n.f.	1.000	<-106.0	<-66.0	Noise	-
0.150 – 30.000	n.f.	10.000	<-101.0	<-61.0	Noise	-
0.000 – 200.000	136.975 *1)	10.000		-4.8	TX + notch	21
	196.000	10.000	-104.7	-64.7		21
200.000 – 400.000	273.950	10.000	-101.5	-61.5	2 nd harmonic	22
400.000 – 1.000 GHz	821.850	10.000	-98.2	-58.2	6 th harmonic	23
1.000 – 4.000 GHz	n.f.	10.000	<-105.0	<-63.0	Noise	-

1) Tx suppressed by a notch filter

Limits kept : **Yes** [X] **No** [ ]

FCC 15.209. General requirements for intentional radiators

Test conditions:	TX frequency	f 1	=	118.000	MHz
	TX frequency	f 2	=	127.500	MHz
	TX frequency	f 3	=	136.975	MHz
	Modulation frequency	f m	=	No modulation	
	Normal power supply	U DC	=	13.80	V
	Normal temperature	t n	=	23.0	°C
	Test set-up: 2.4.3				

Limits

Frequency (MHz)	Field strength e (dBµV/m) @ 3.0 m	Field strength E (µV/m)	Measurement distance (m)
0.009 – 0.490	88.5 ... 53.8	2400/F(kHz)	300
0.490 – 1.705	53.8 ... 43.0	24000/F(kHz)	30
1.705 – 30.0	49.5	30	30
30 - 88	40.0	100	3
88 – 216	43.5	150	3
216 - 960	46.0	200	3
above 960	54.0	500	3

Measurements at 3.0 m distance

Frequency band	**Spurious No.**	**Measured spurii (MHz)**	**e (dBµV/m)**	**E (µV/m)**	Plot No
0.009 ... 30.000 MHz	-	n.f.	<30.0	<31.62	28
30 MHz – 4.000 GHz	1	118.000		Wanted frq.	24
	2	1180.500	45.0	177.828	24
	3	1298.830	52.0	398.107	24
	4	1416.990	51.0	354.813	24
30 MHz – 4.000 GHz	1	127.500		Wanted frq.	25
	2	1402.500	51.5	375.837	25
30 MHz – 4.000 GHz	1	136.975		Wanted frq.	26
	3	1369.800	42.5	133.352	26
	4	1506.800	48.7	272.270	26
4.000 – 12.000 GHz	-	n.f.	Noise		27

Test standards passed: **Yes** [X] **No** [ ]

FCC 15.109. General requirements for unintentional radiators

Test conditions:	RX frequency	f 1	=	127.500	MHz
	Normal power supply	U DC	=	13.80	V
	Normal temperature	t n	=	23.0	°C
	Test set-up: 2.4.3				

Limits

Frequency (MHz)	Field strength e (dBµV/m) @ 3.0 m	Field strength E (µV/m)	Measurement distance (m)
30 - 88	40.0	100	3
88 – 216	43.5	150	3
216 - 960	46.0	200	3
above 960	54.0	500	3

Measurements at 3.0 m distance

Frequency band	**Measured spurii (MHz)**	**e (dBµV/m)**	**E (µV/m)**	Plot No
0.009 ... 30.000 MHz	n.f.	<30.0	<31.62	29
30 MHz – 1.000 GHz	n.f.			30

Test standards passed: **Yes** [X] **No** [ ]

Anlage 1 zum Prüfbericht
Appendix 1 to test report

Fotos der Prüflinge
Photographs of EUT

Diese Anlage besteht aus 4 Seiten inklusive Deckblatt.
This appendix consists of 4 pages included cover page.

Foto: **1**

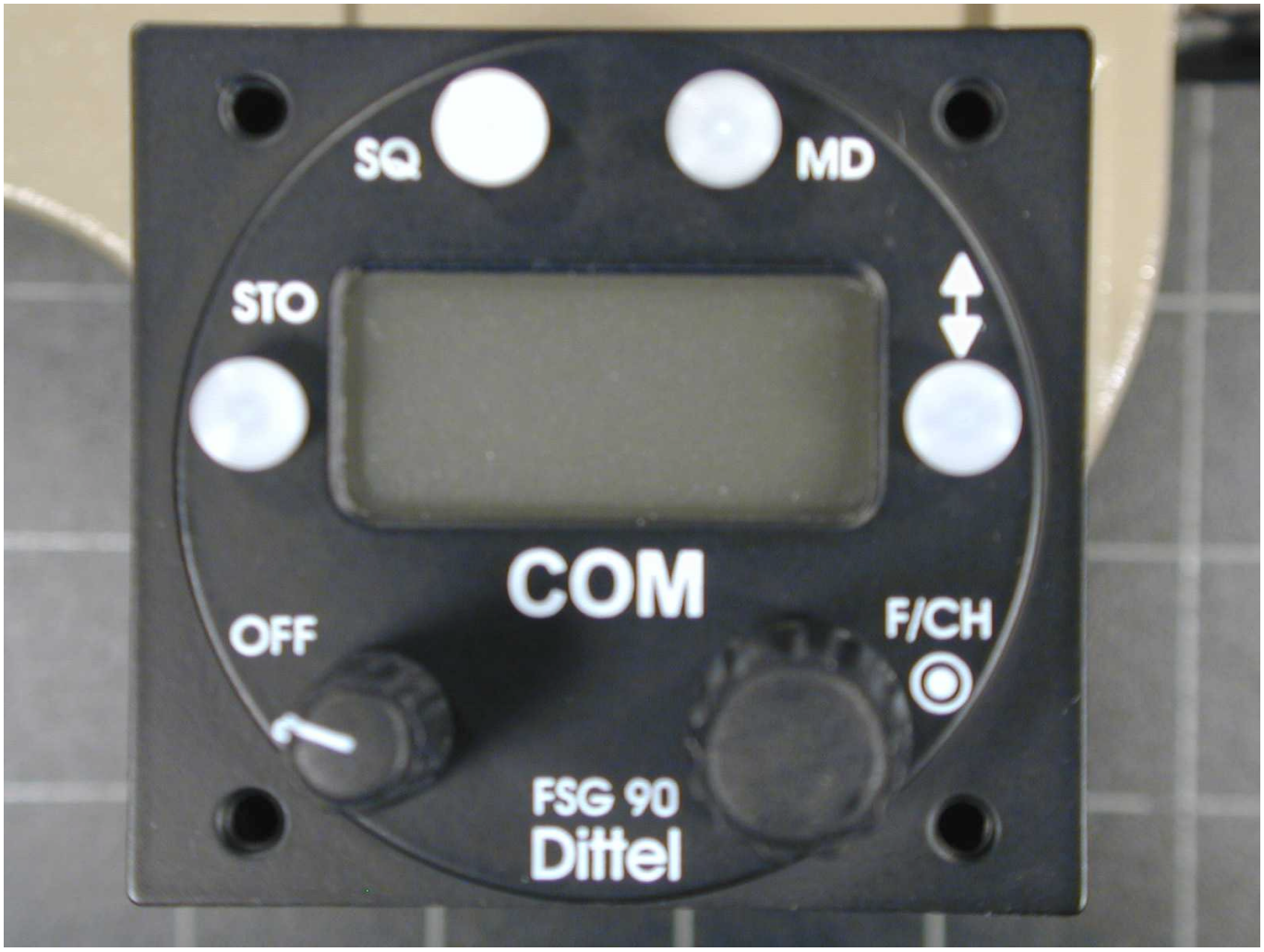


Foto: **2**

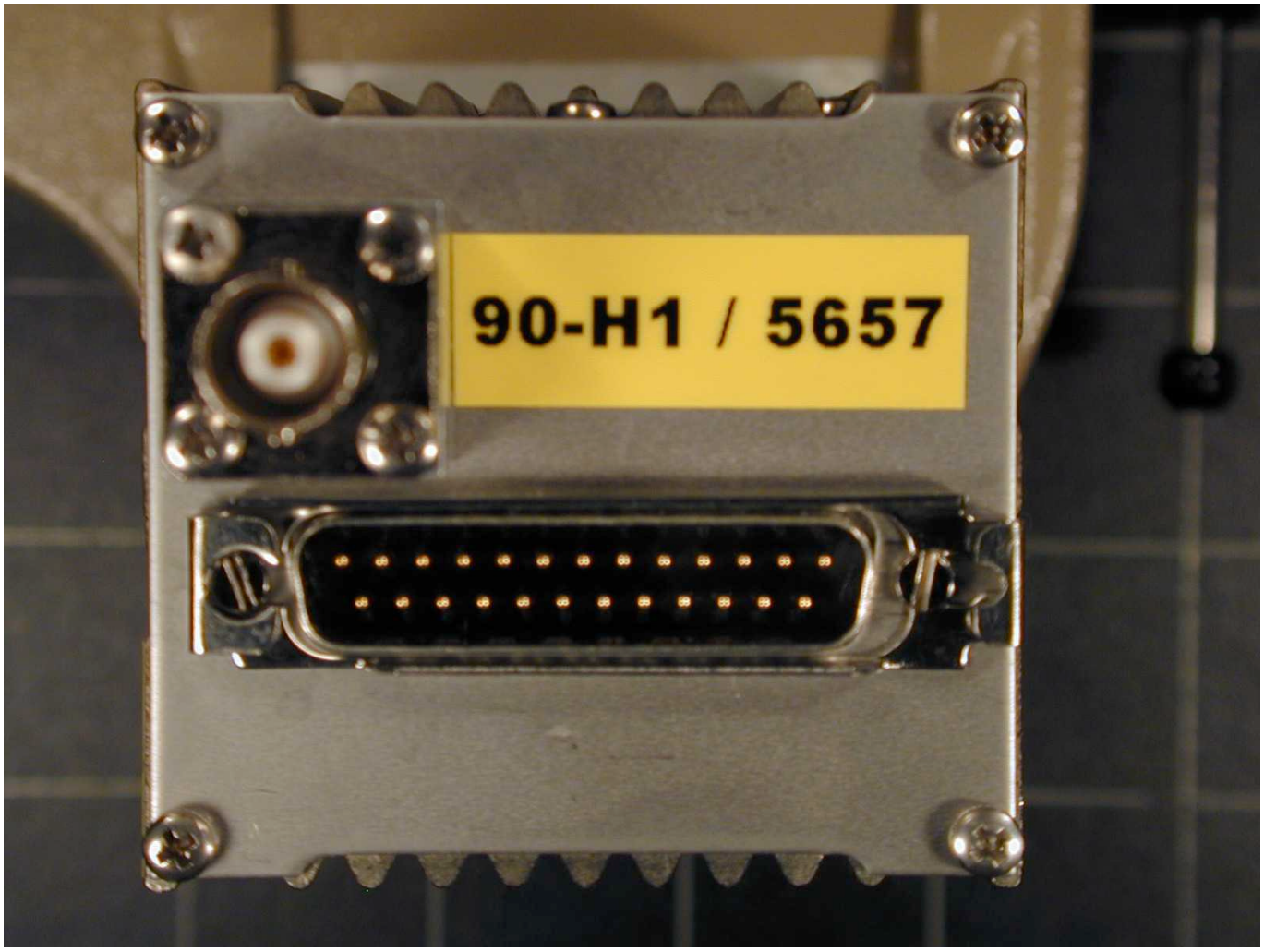
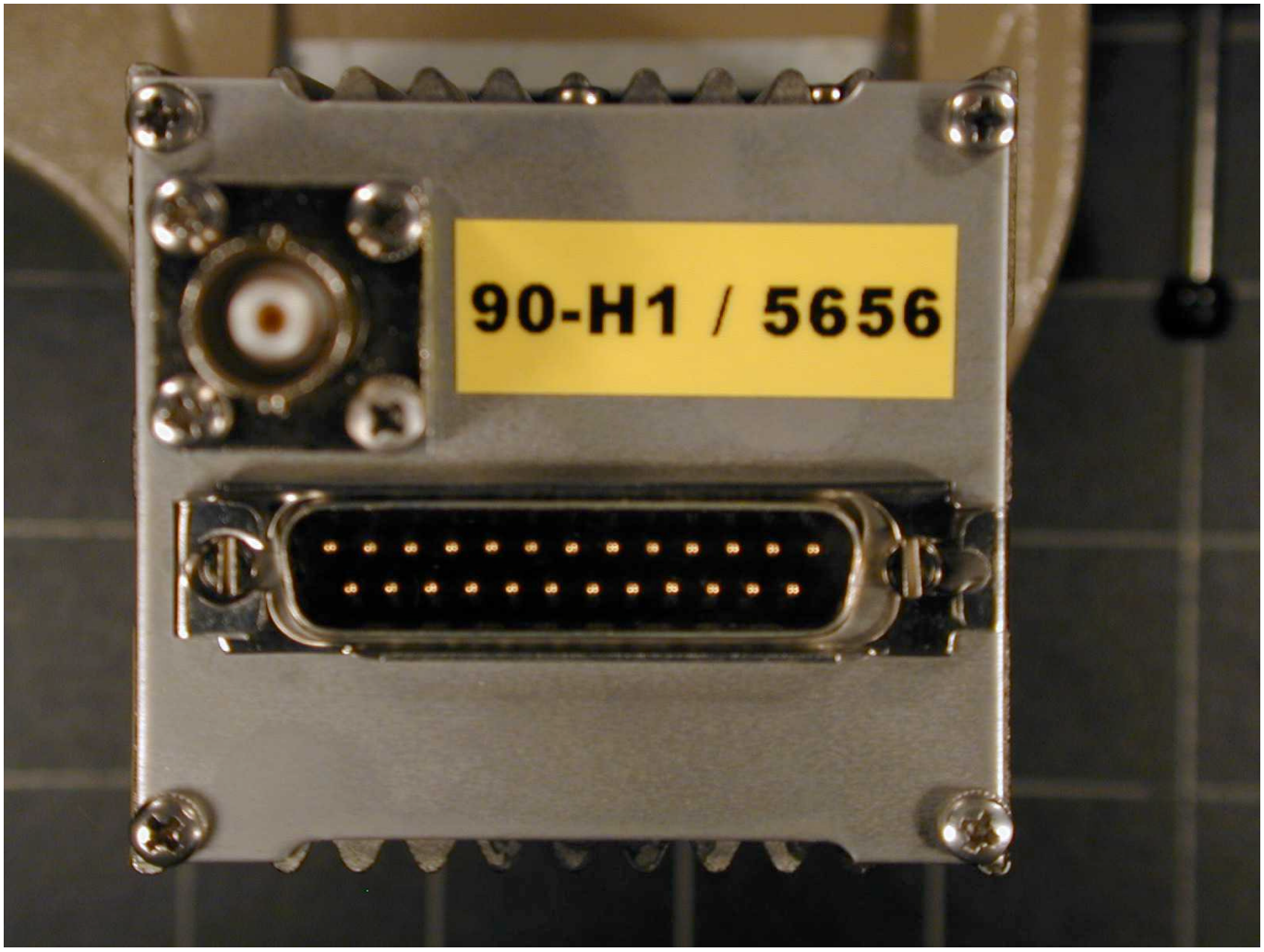


Foto: **3**

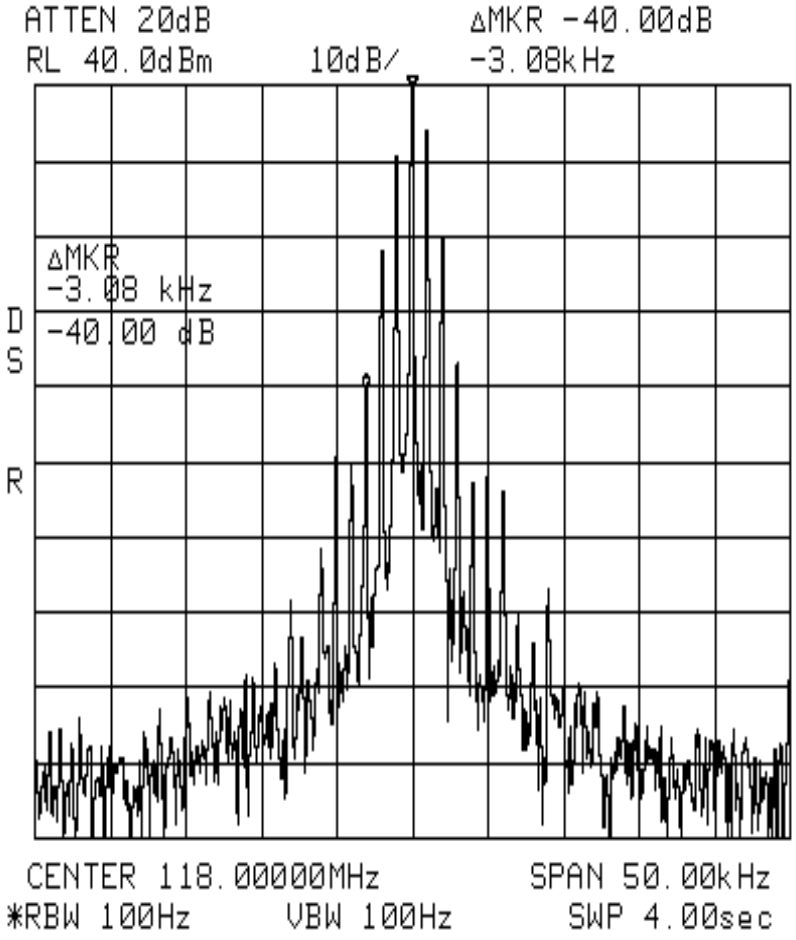


Appendix 2 to test report
Anlage 2 zum Prübericht

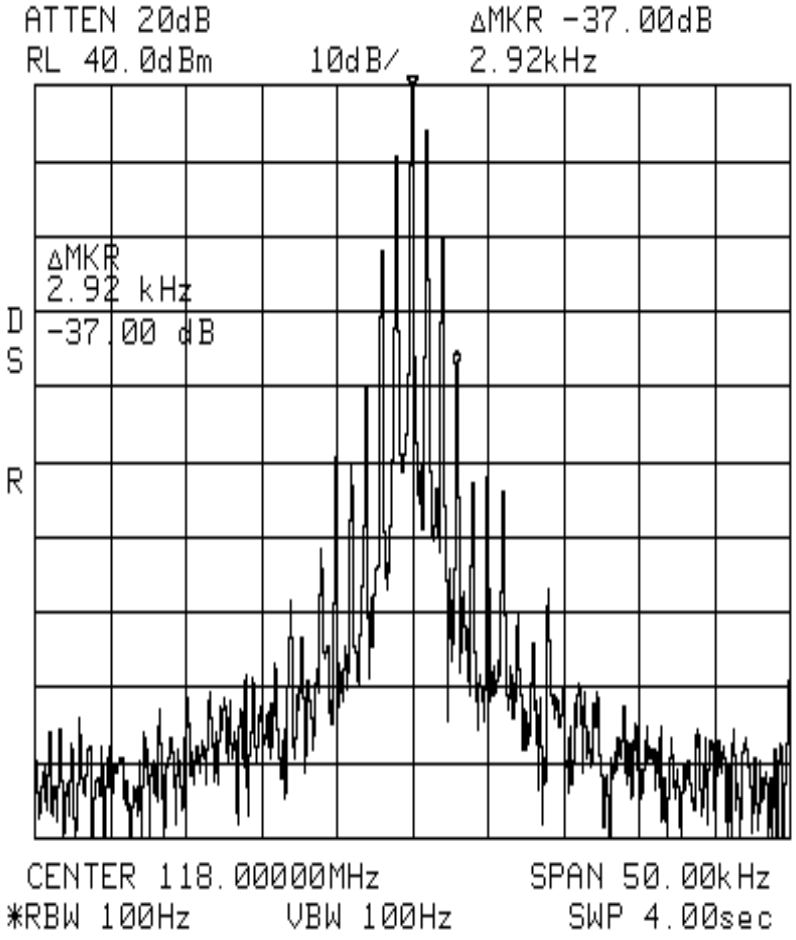
Test sheets and plots
Messschriebe und Plots

This appendix consists of 31 pages included cover page
Diese Anlage besteht aus 31 Seiten inklusive Deckblatt

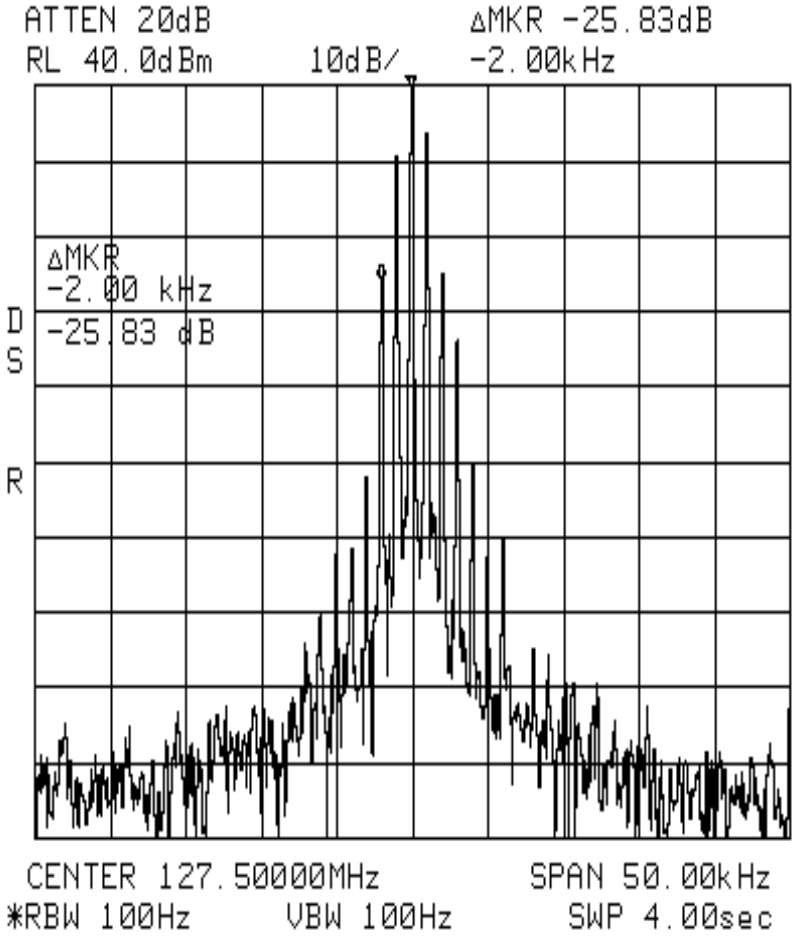
Plot No.: 1


ATTEN 20dB
RL 40.0dBm
10dB/
ΔMKR -40.00dB
-3.08kHz
ΔMKR
-3.08 kHz
-40.00 dB
D
S
R
CENTER 118.00000MHz
SPAN 50.00kHz
*RBW 100Hz
VBW 100Hz
SWP 4.00sec

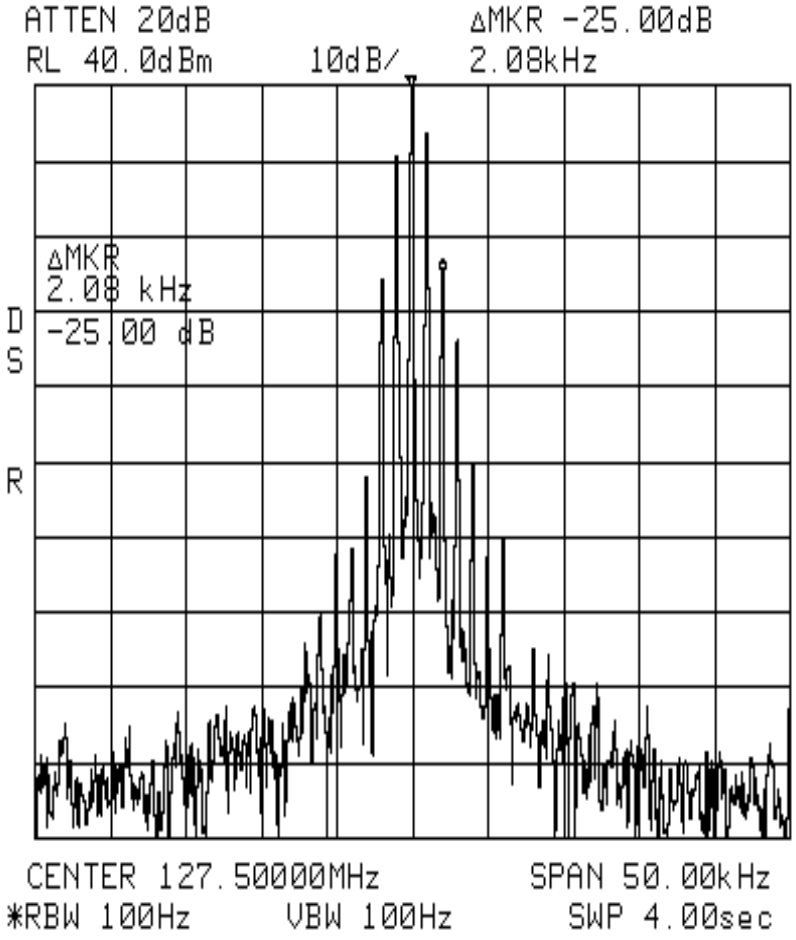
Plot No.: 2


ATTEN 20dB
RL 40.0dBm
10dB/
ΔMKR -37.00dB
2.92kHz
ΔMKR
2.92 kHz
-37.00 dB
D
S
R
CENTER 118.00000MHz
SPAN 50.00kHz
*RBW 100Hz
VBW 100Hz
SWP 4.00sec

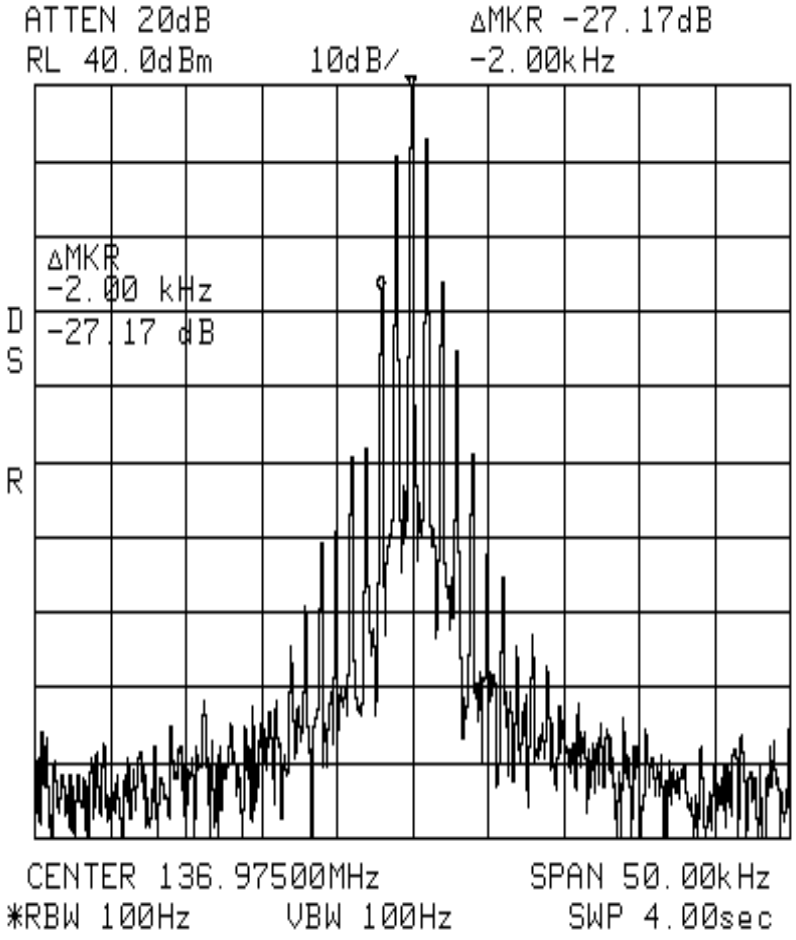
Plot No.: **3**


ATTEN 20dB
RL 40.0dBm
10dB/
ΔMKR -25.83dB
-2.00kHz
ΔMKR
-2.00 kHz
-25.83 dB
D
S
R
CENTER 127.50000MHz
SPAN 50.00kHz
*RBW 100Hz
VBW 100Hz
SWP 4.00sec

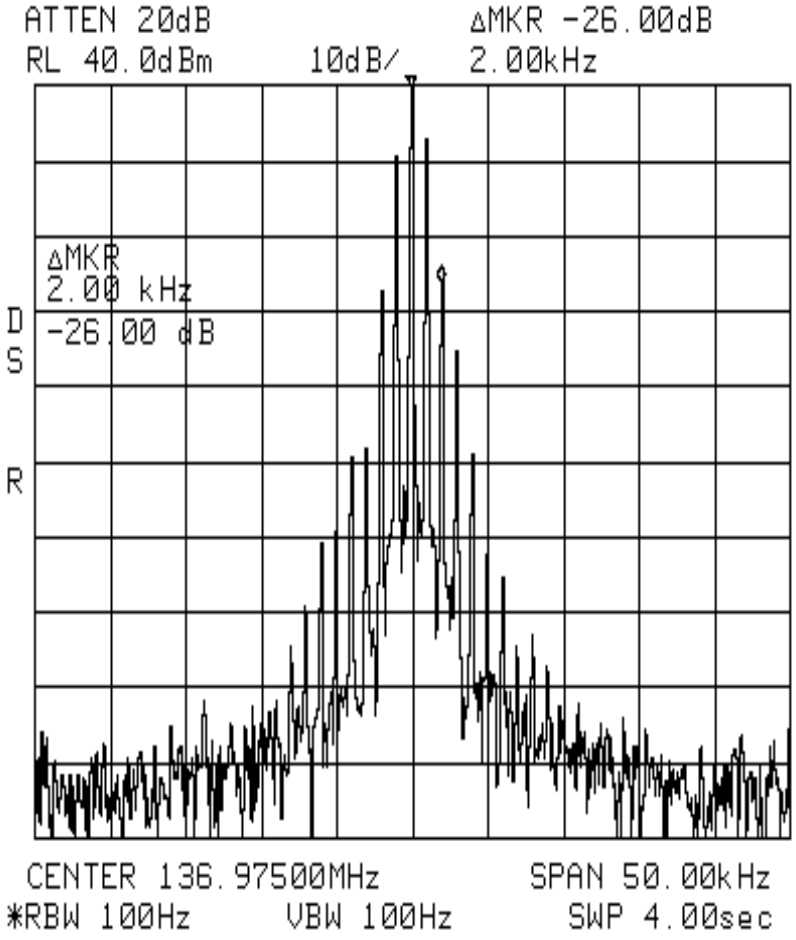
Plot No.: 4


ATTEN 20dB
RL 40.0dBm
10dB/
ΔMKR -25.00dB
2.08kHz
ΔMKR
2.08 kHz
-25.00 dB
D
S
R
CENTER 127.50000MHz
SPAN 50.00kHz
*RBW 100Hz
VBW 100Hz
SWP 4.00sec

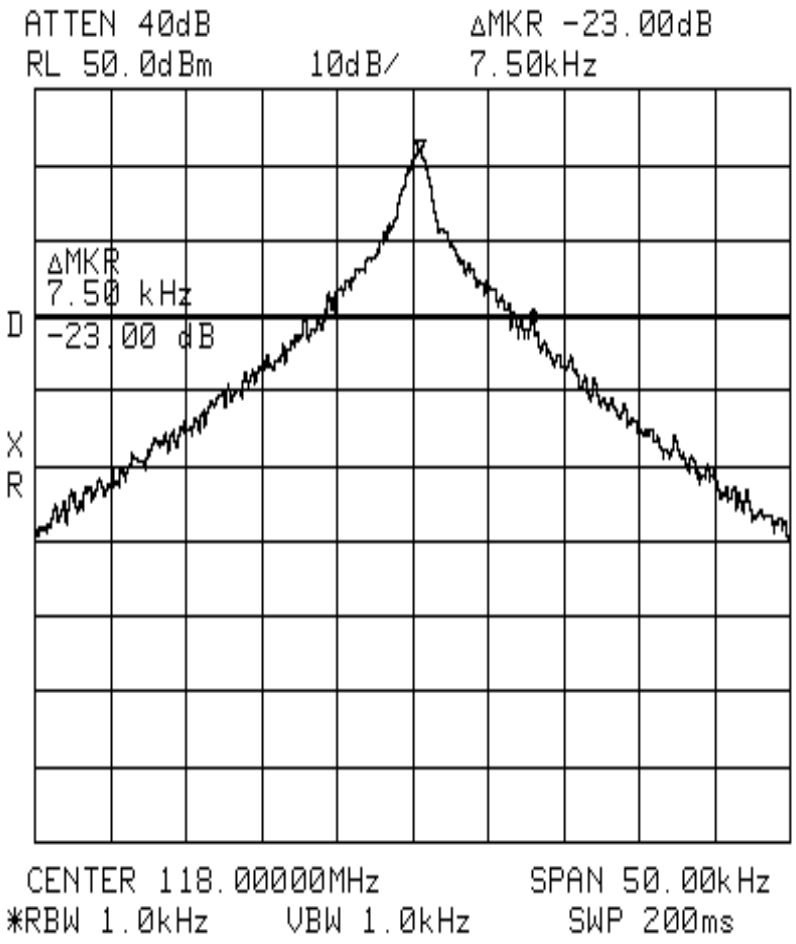
Plot No.: **5**


ATTEN 20dB
RL 40.0dBm
10dB/
ΔMKR -27.17dB
-2.00kHz
ΔMKR
-2.00 kHz
-27.17 dB
D
S
R
CENTER 136.97500MHz
SPAN 50.00kHz
*RBW 100Hz
VBW 100Hz
SWP 4.00sec

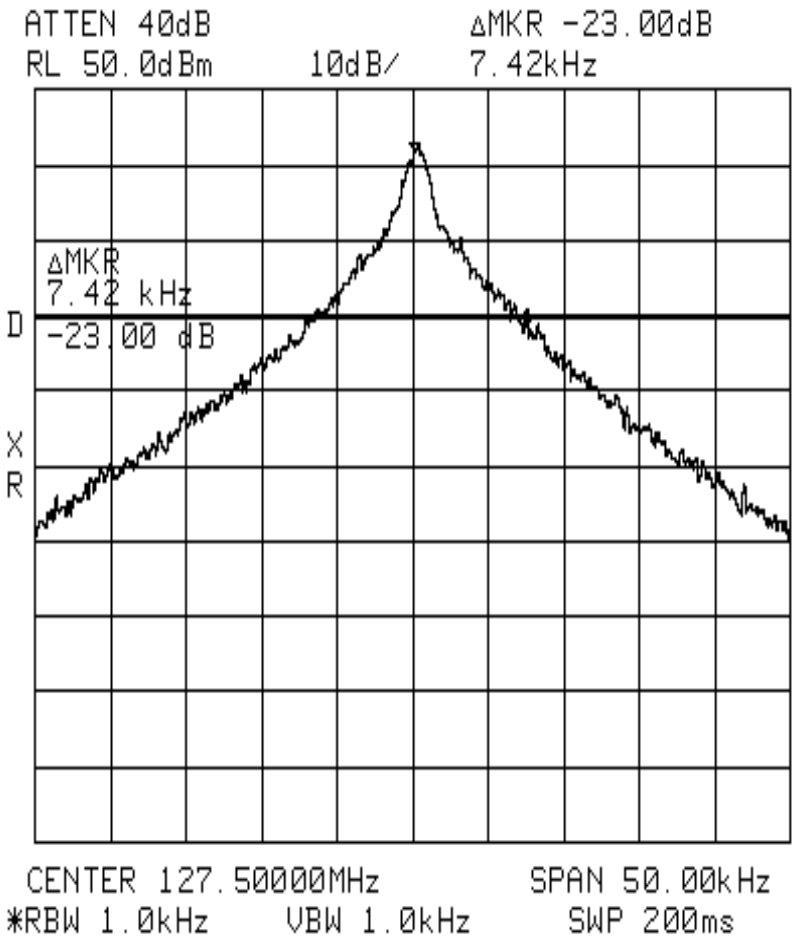
Plot No.: 6


ATTEN 20dB
RL 40.0dBm
10dB/
ΔMKR -26.00dB
2.00kHz
ΔMKR
2.00 kHz
-26.00 dB
D
S
R
CENTER 136.97500MHz
SPAN 50.00kHz
*RBW 100Hz
VBW 100Hz
SWP 4.00sec

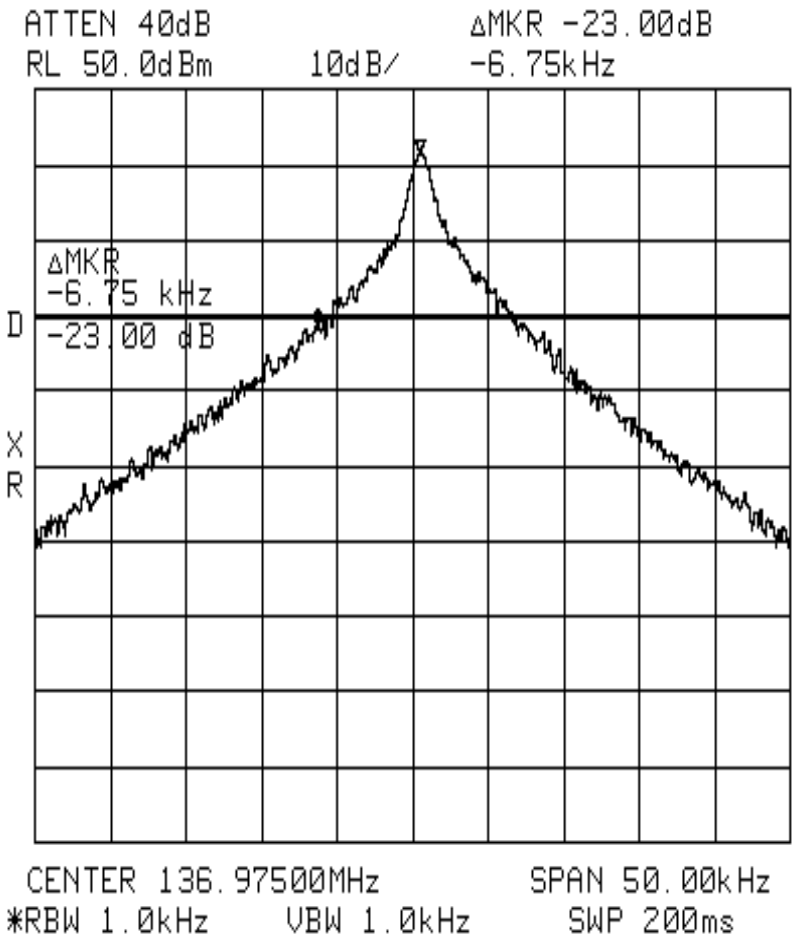
Plot No.: **7**


ATTEN 40dB
RL 50.0dBm
10dB/
ΔMKR -23.00dB
7.50kHz
ΔMKR
7.50 kHz
-23.00 dB
D
X
R
CENTER 118.00000MHz
SPAN 50.00kHz
*RBW 1.0kHz
VBW 1.0kHz
SWP 200ms

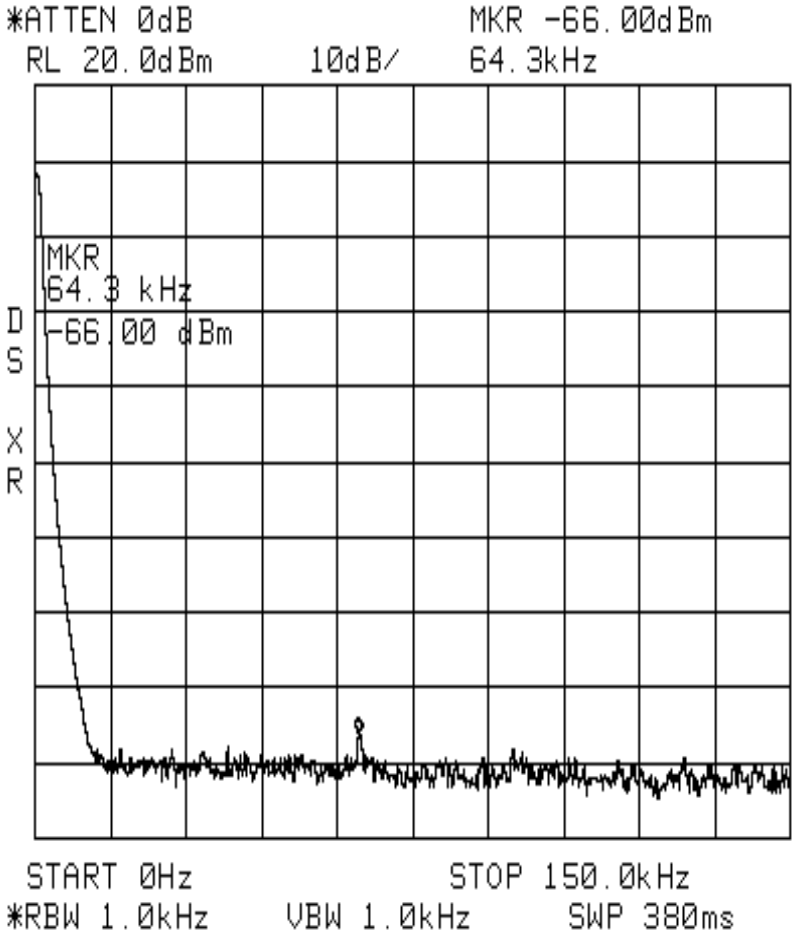
Plot No.: 8


ATTEN 40dB
RL 50.0dBm
10dB/
ΔMKR -23.00dB
7.42kHz
ΔMKR
7.42 kHz
-23.00 dB
D
X
R
CENTER 127.50000MHz
SPAN 50.00kHz
*RBW 1.0kHz
VBW 1.0kHz
SWP 200ms

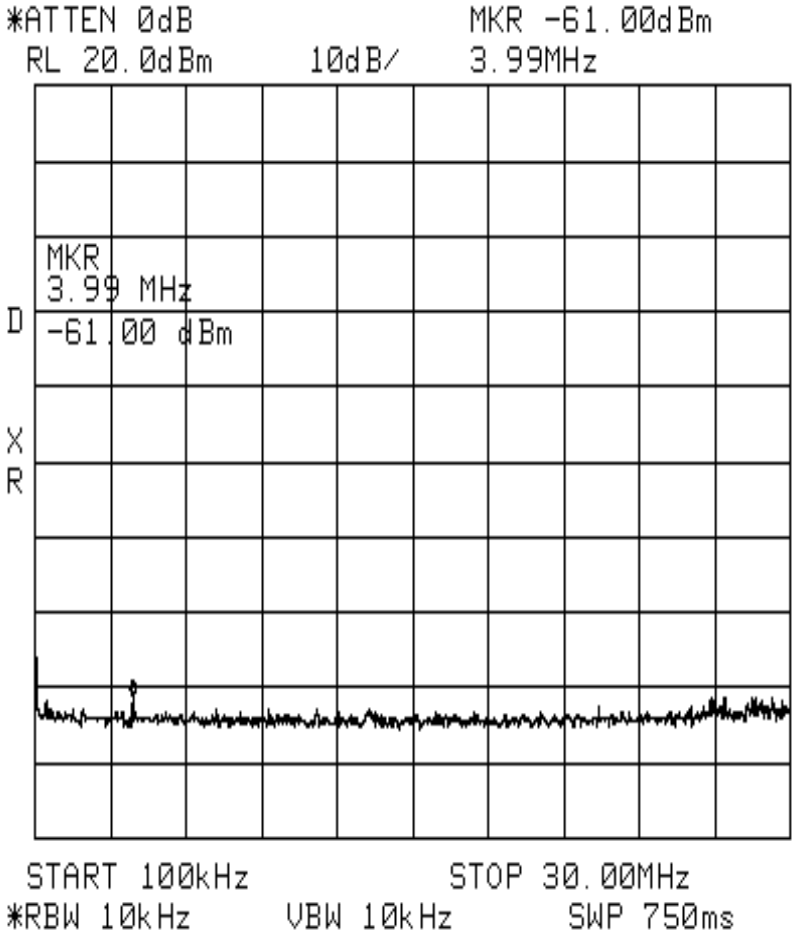
Plot No.: 9


ATTEN 40dB
RL 50.0dBm
10dB/
ΔMKR -23.00dB
-6.75kHz
ΔMKR
-6.75 kHz
-23.00 dB
D
X
R
CENTER 136.97500MHz
SPAN 50.00kHz
*RBW 1.0kHz
VBW 1.0kHz
SWP 200ms

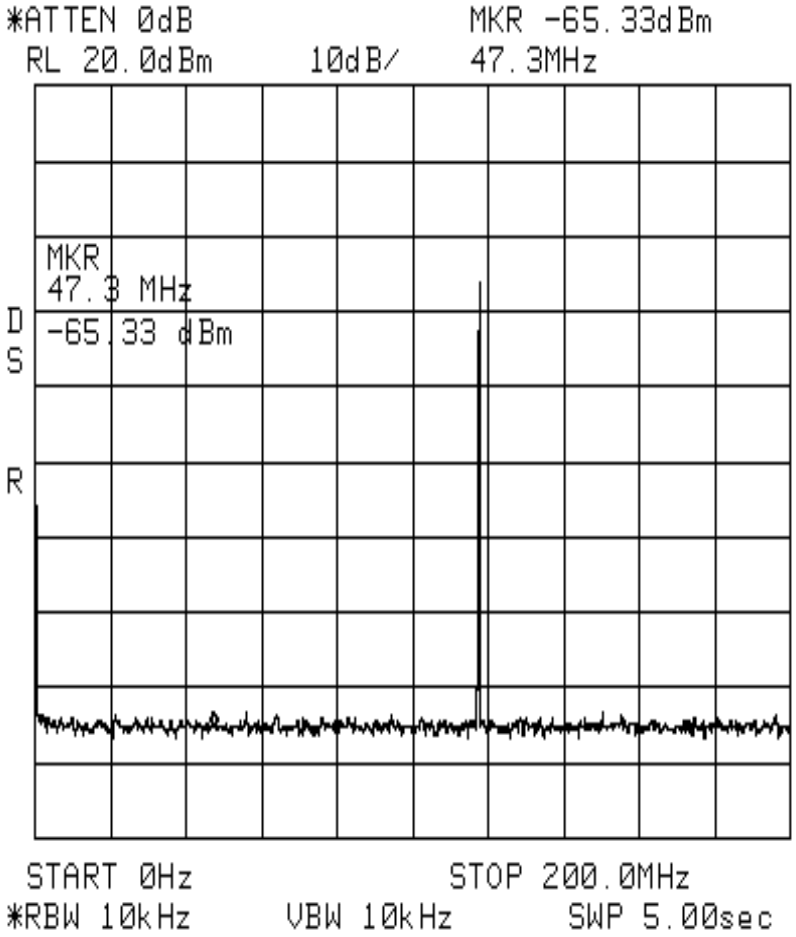
Plot No.: 10


*ATTEN 0dB
MKR -66.00dBm
RL 20.0dBm
10dB/
64.3kHz
MKR
64.3 kHz
-66.00 dBm
D
S
X
R
START 0Hz
STOP 150.0kHz
*RBW 1.0kHz
VBW 1.0kHz
SWP 380ms

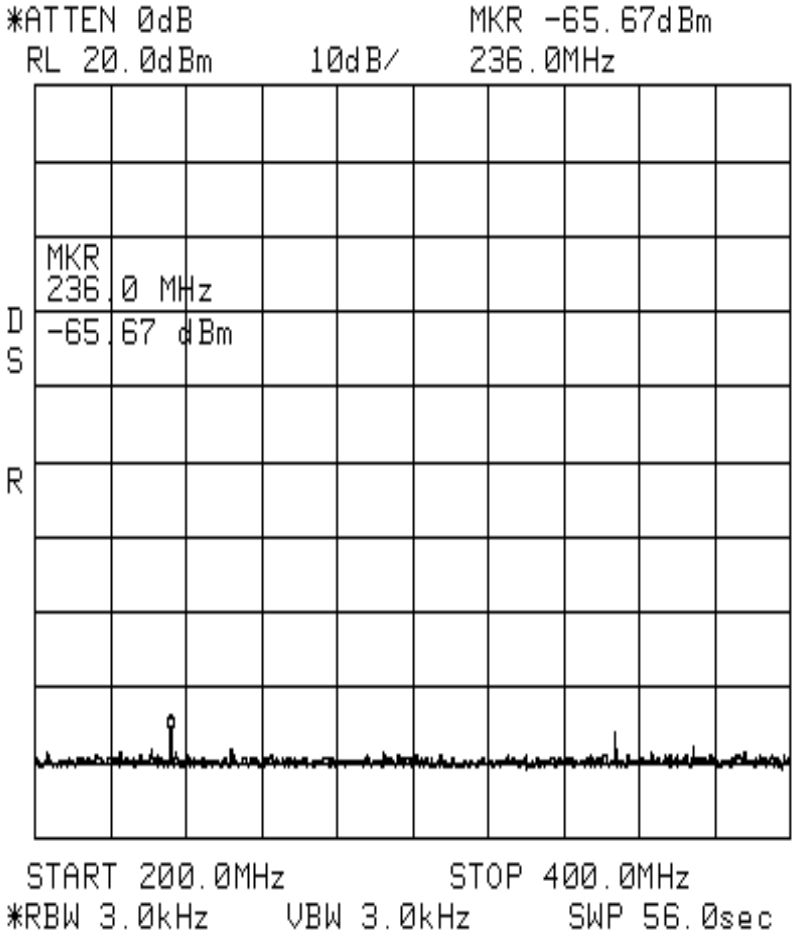
Plot No.: 11


*ATTEN 0dB
MKR -61.00dBm
RL 20.0dBm
10dB/
3.99MHz
MKR
3.99 MHz
-61.00 dBm
D
X
R
START 100kHz
STOP 30.00MHz
*RBW 10kHz
VBW 10kHz
SWP 750ms

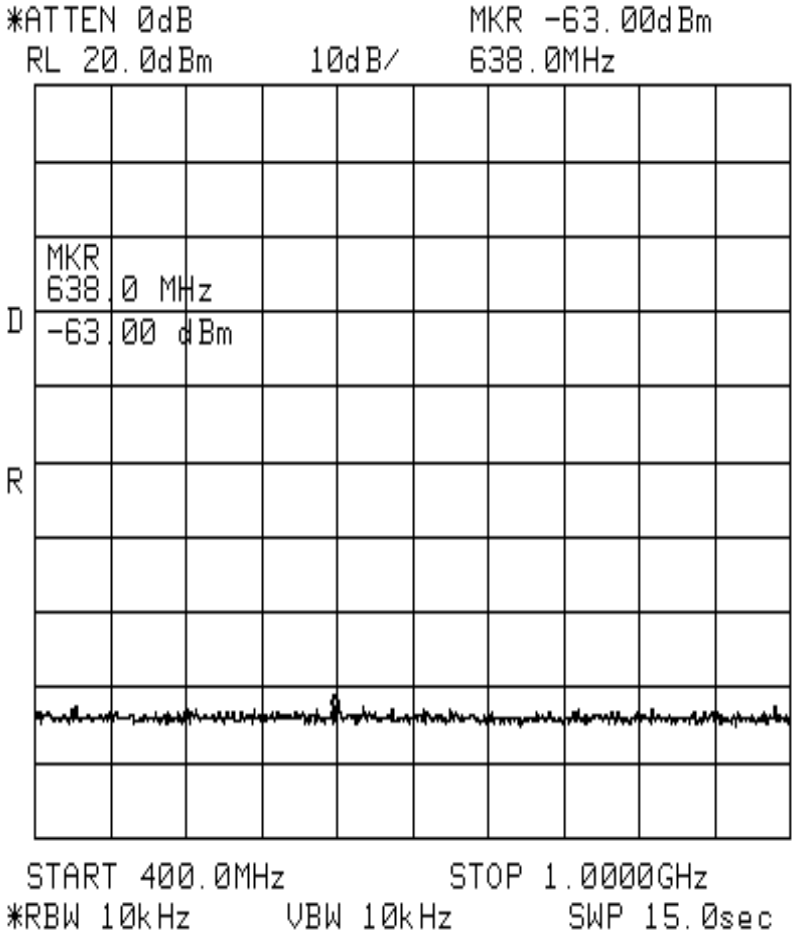
Plot No.: 12


*ATTEN 0dB
MKR -65.33dBm
RL 20.0dBm
10dB/
47.3MHz
MKR
47.3 MHz
-65.33 dBm
D
S
R
START 0Hz
STOP 200.0MHz
*RBW 10kHz
VBW 10kHz
SWP 5.00sec

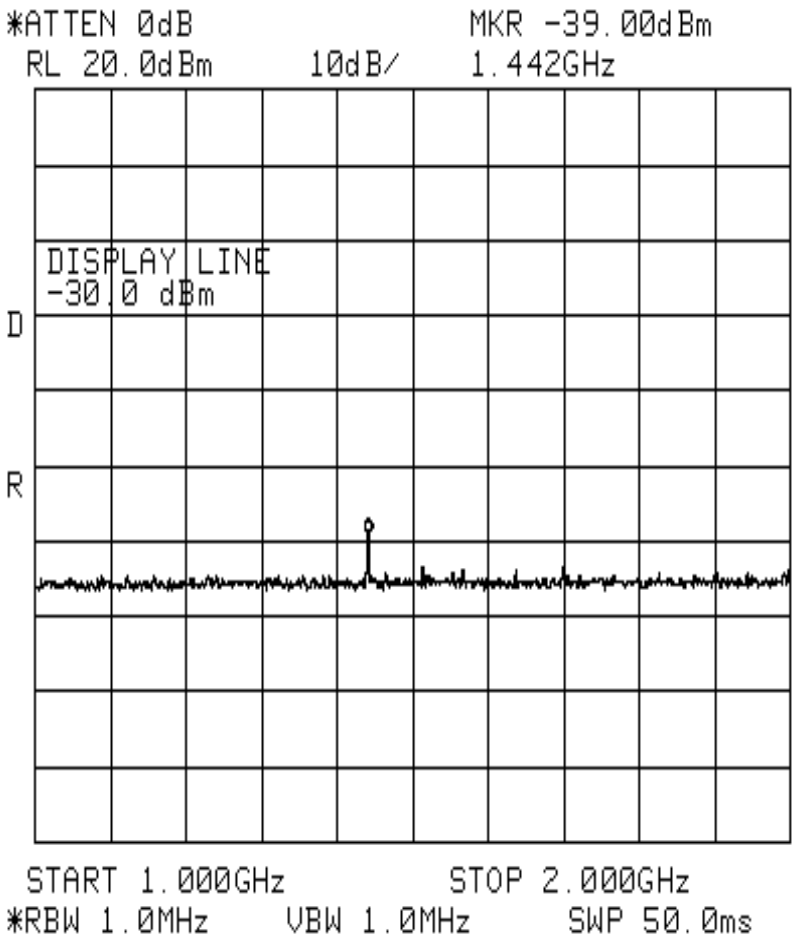
Plot No.: 13


*ATTEN 0dB
MKR -65.67dBm
RL 20.0dBm
10dB/
236.0MHz
MKR
236.0 MHz
-65.67 dBm
D
S
R
START 200.0MHz
STOP 400.0MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 56.0sec

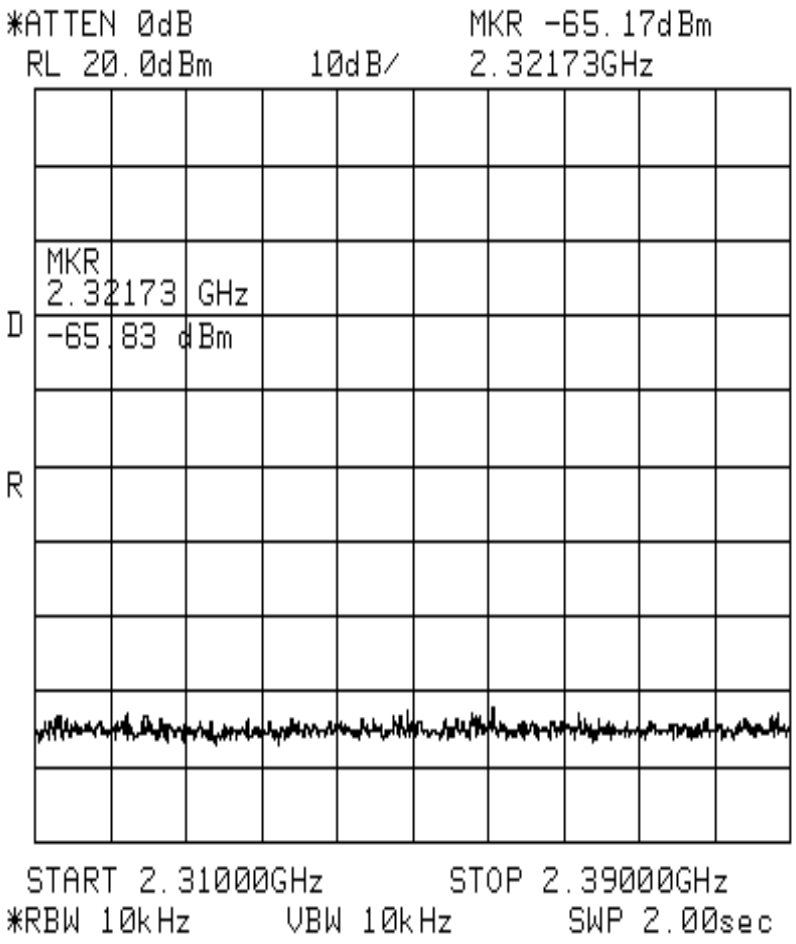
Plot No.: 14


*ATTEN 0dB
MKR -63.00dBm
RL 20.0dBm
10dB/
638.0MHz
MKR
638.0 MHz
D
-63.00 dBm
R
START 400.0MHz
STOP 1.0000GHz
*RBW 10kHz
VBW 10kHz
SWP 15.0sec

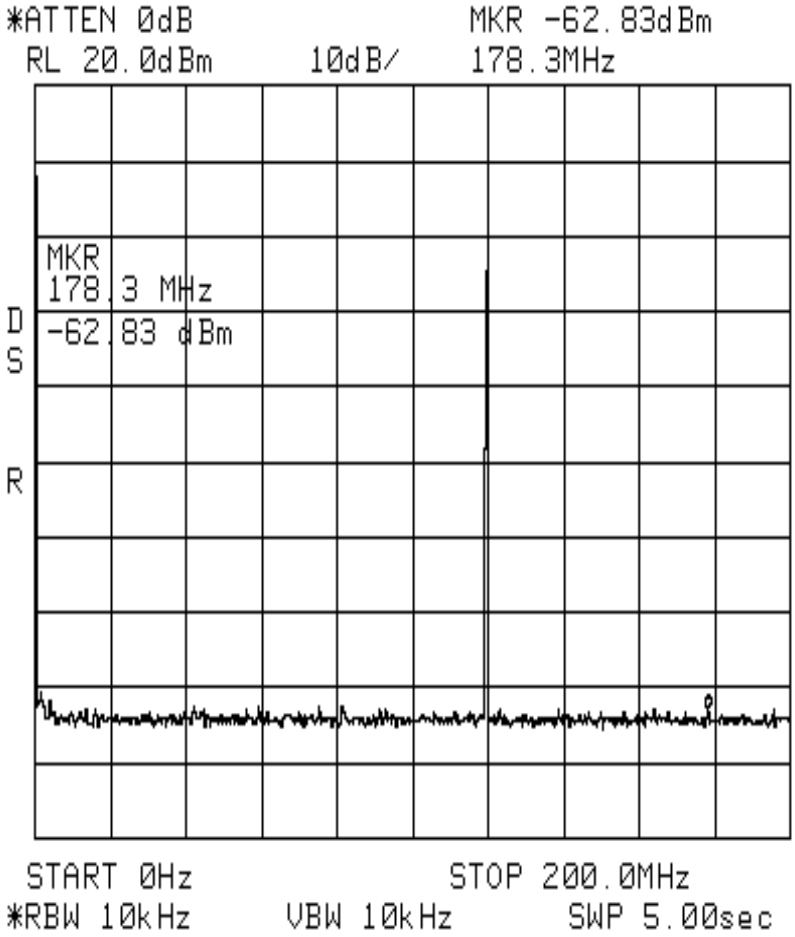
Plot No.: 15


*ATTEN 0dB
MKR -39.00dBm
RL 20.0dBm
10dB/
1.442GHz
DISPLAY LINE
-30.0 dBm
D
R
START 1.000GHz
STOP 2.000GHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 50.0ms

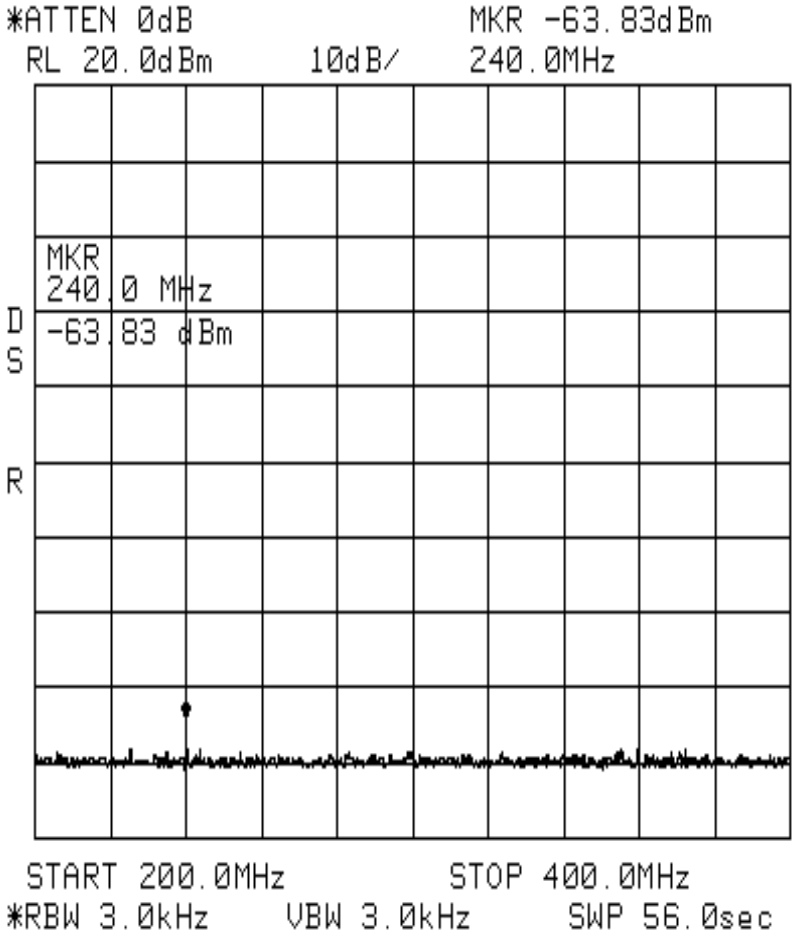
Plot No.: 16


*ATTEN 0dB
MKR -65.17dBm
RL 20.0dBm
10dB/
2.32173GHz
MKR
2.32173 GHz
D
-65.83 dBm
R
START 2.31000GHz
STOP 2.39000GHz
*RBW 10kHz
VBW 10kHz
SWP 2.00sec

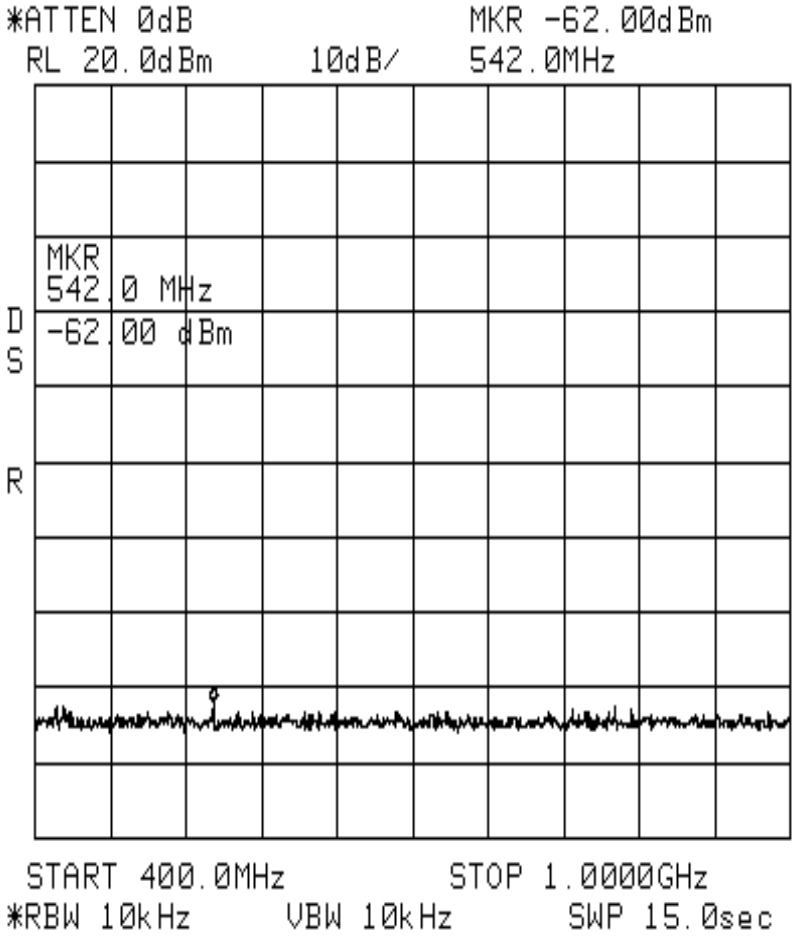
Plot No.: 17


*ATTEN 0dB
MKR -62.83dBm
RL 20.0dBm
10dB/
178.3MHz
MKR
178.3 MHz
-62.83 dBm
D
S
R
START 0Hz
STOP 200.0MHz
*RBW 10kHz
VBW 10kHz
SWP 5.00sec

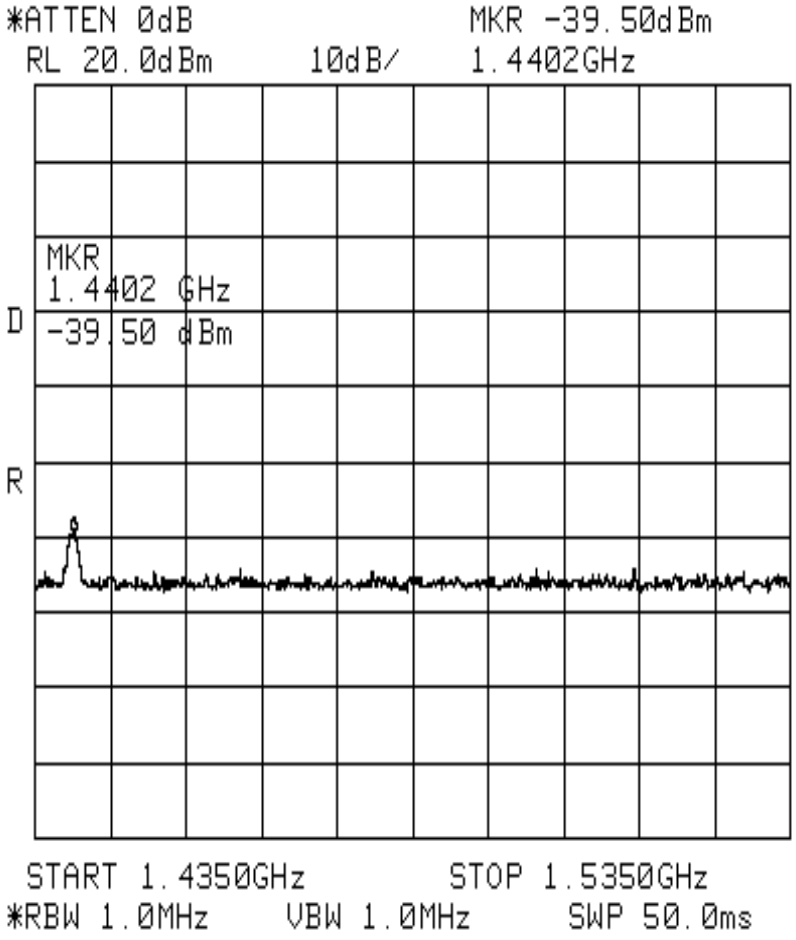
Plot No.: 18


*ATTEN 0dB
MKR -63.83dBm
RL 20.0dBm
10dB/
240.0MHz
MKR
240.0 MHz
-63.83 dBm
D
S
R
START 200.0MHz
STOP 400.0MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 56.0sec

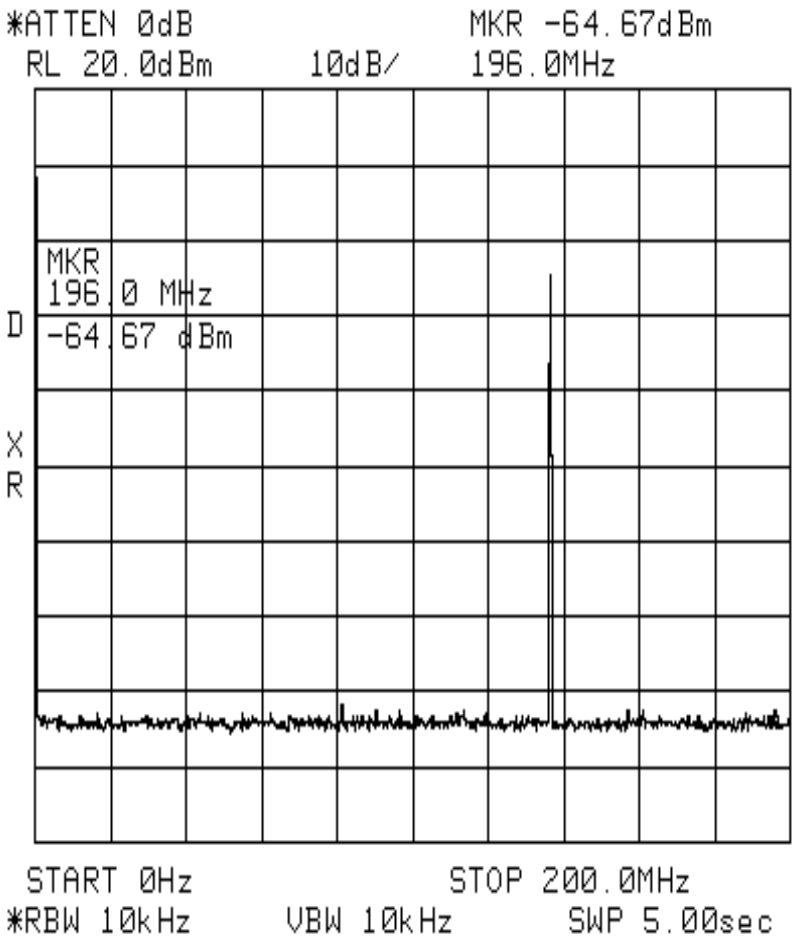
Plot No.: 19


*ATTEN 0dB
MKR -62.00dBm
RL 20.0dBm
10dB/
542.0MHz
MKR
542.0 MHz
-62.00 dBm
D
S
R
START 400.0MHz
STOP 1.0000GHz
*RBW 10kHz
VBW 10kHz
SWP 15.0sec

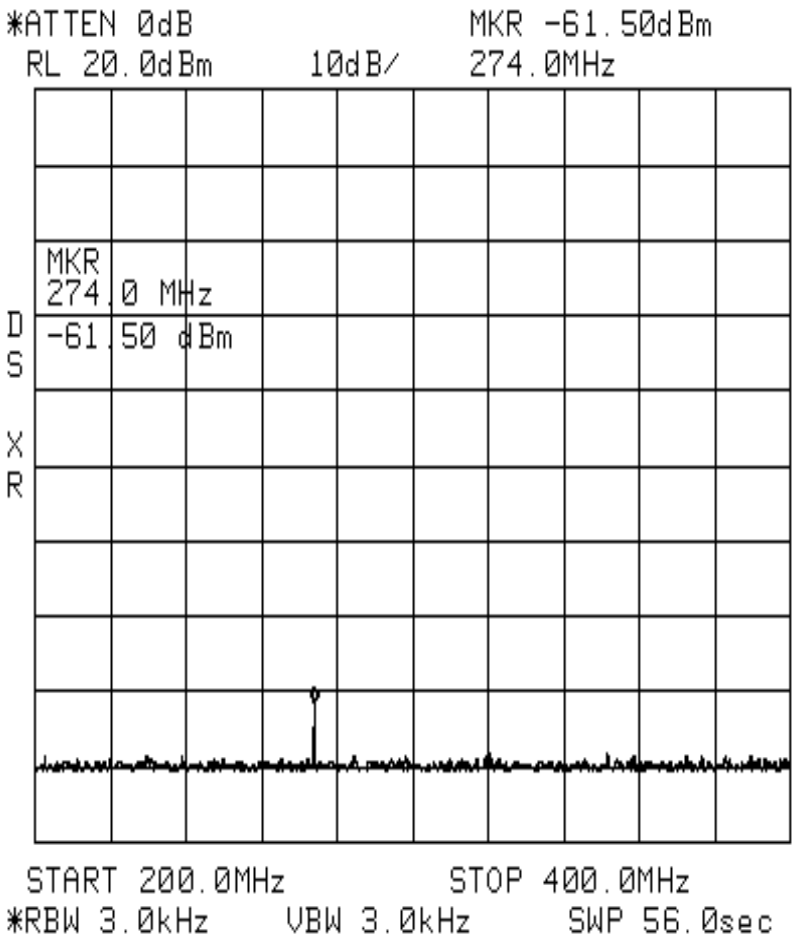
Plot No.: 20


*ATTEN 0dB
MKR -39.50dBm
RL 20.0dBm
10dB/
1.4402GHz
MKR
1.4402 GHz
D
-39.50 dBm
R
START 1.4350GHz
STOP 1.5350GHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 50.0ms

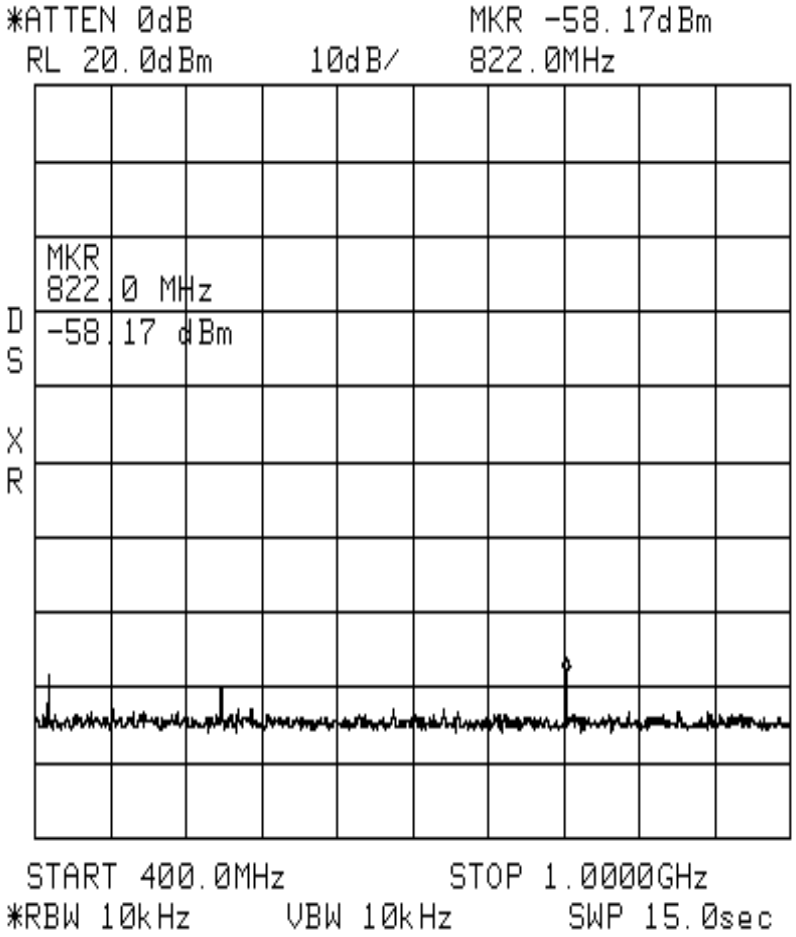
Plot No.: 21


*ATTEN 0dB
MKR -64.67dBm
RL 20.0dBm
10dB/
196.0MHz
MKR
196.0 MHz
-64.67 dBm
D
X
R
START 0Hz
STOP 200.0MHz
*RBW 10kHz
VBW 10kHz
SWP 5.00sec

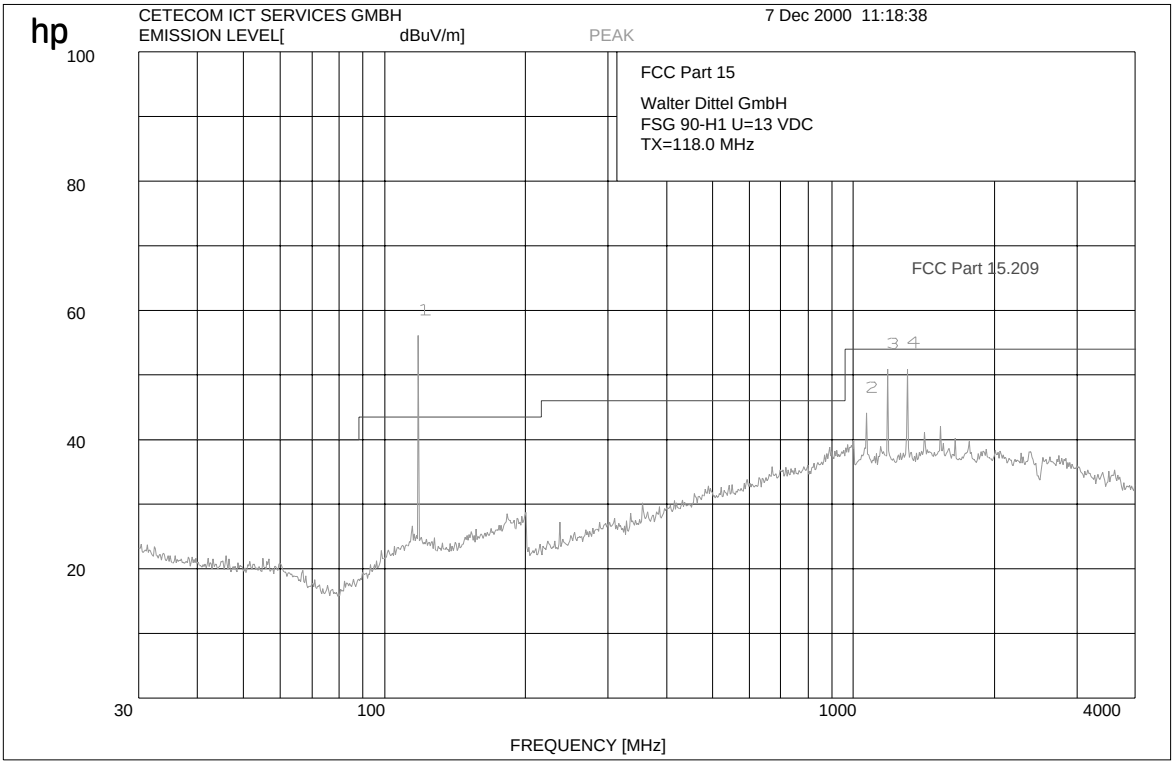
Plot No.: 22


*ATTEN 0dB
MKR -61.50dBm
RL 20.0dBm
10dB/
274.0MHz
MKR
274.0 MHz
-61.50 dBm
D
S
X
R
START 200.0MHz
STOP 400.0MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 56.0sec

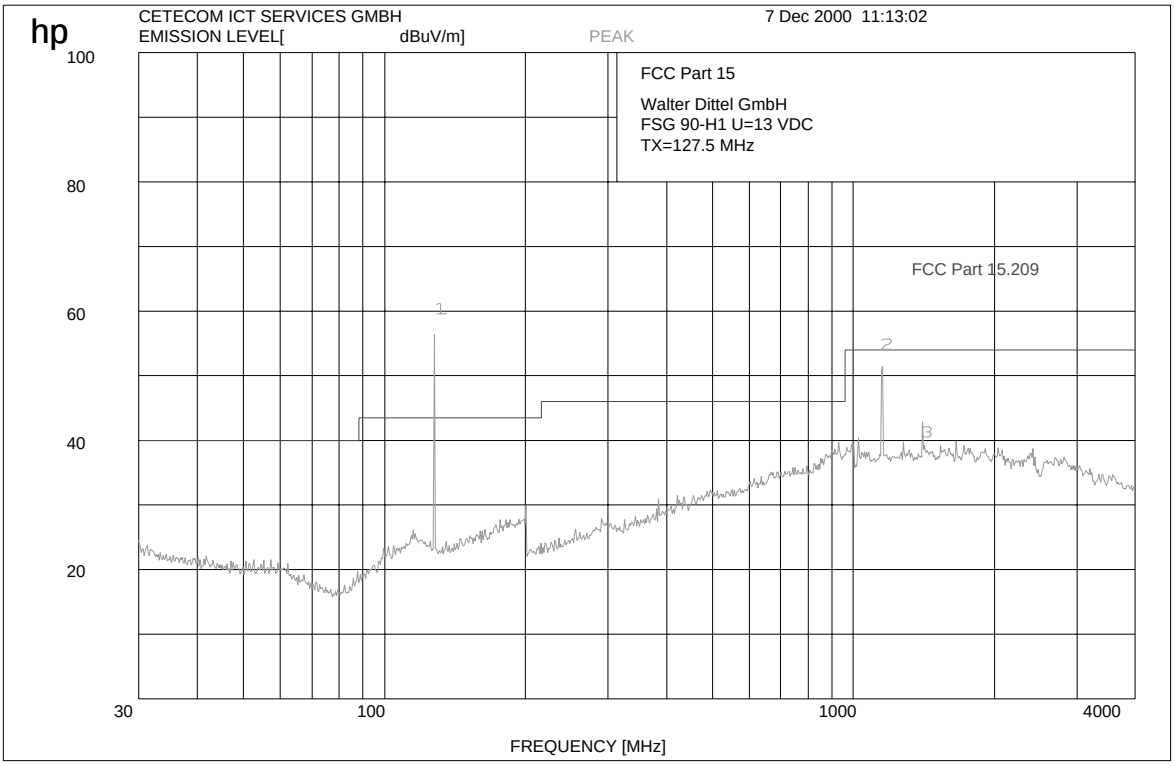
Plot No.: 23


*ATTEN 0dB
MKR -58.17dBm
RL 20.0dBm
10dB/
822.0MHz
MKR
822.0 MHz
-58.17 dBm
D
S
X
R
START 400.0MHz
STOP 1.0000GHz
*RBW 10kHz
VBW 10kHz
SWP 15.0sec

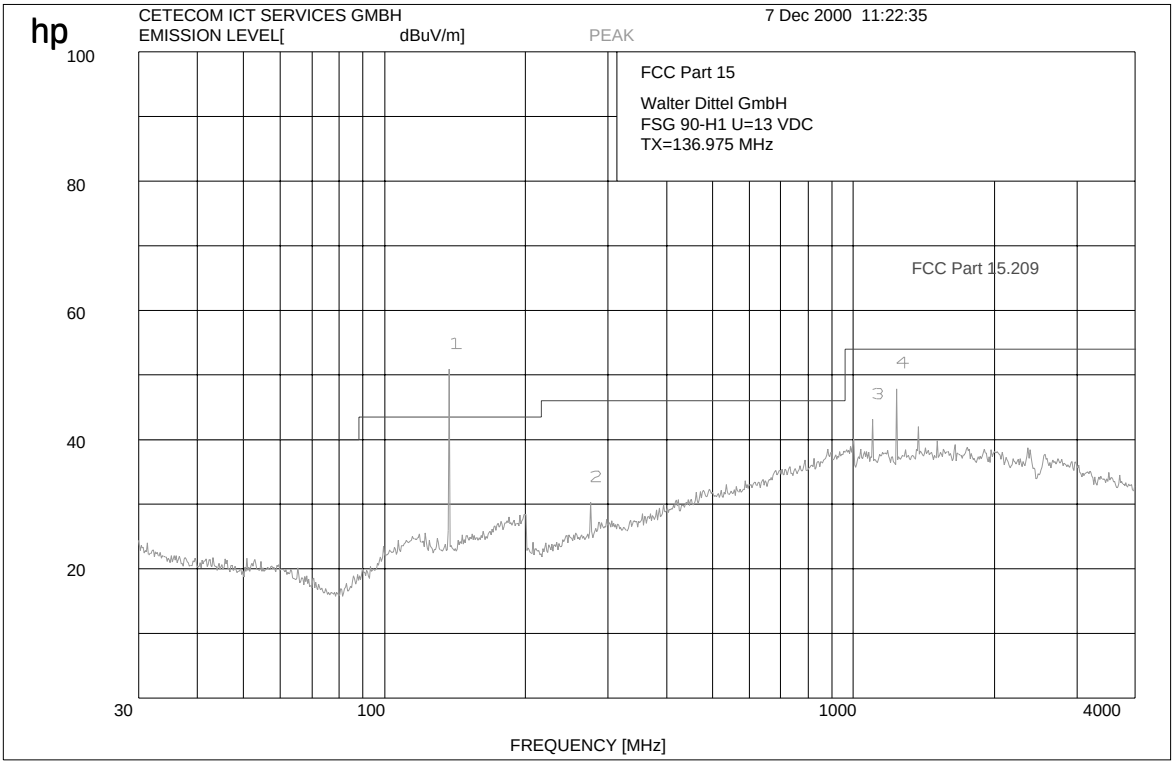
Plot No.: 24


hp
CETECOM ICT SERVICES GMBH
EMISSION LEVEL[dBuV/m]
PEAK
7 Dec 2000 11:18:38
FCC Part 15
Walter Dittel GmbH
FSG 90-H1 U=13 VDC
TX=118.0 MHz
FCC Part 15.209
1
2
3 4
100
80
60
40
20
30
100
1000
4000
FREQUENCY [MHz]

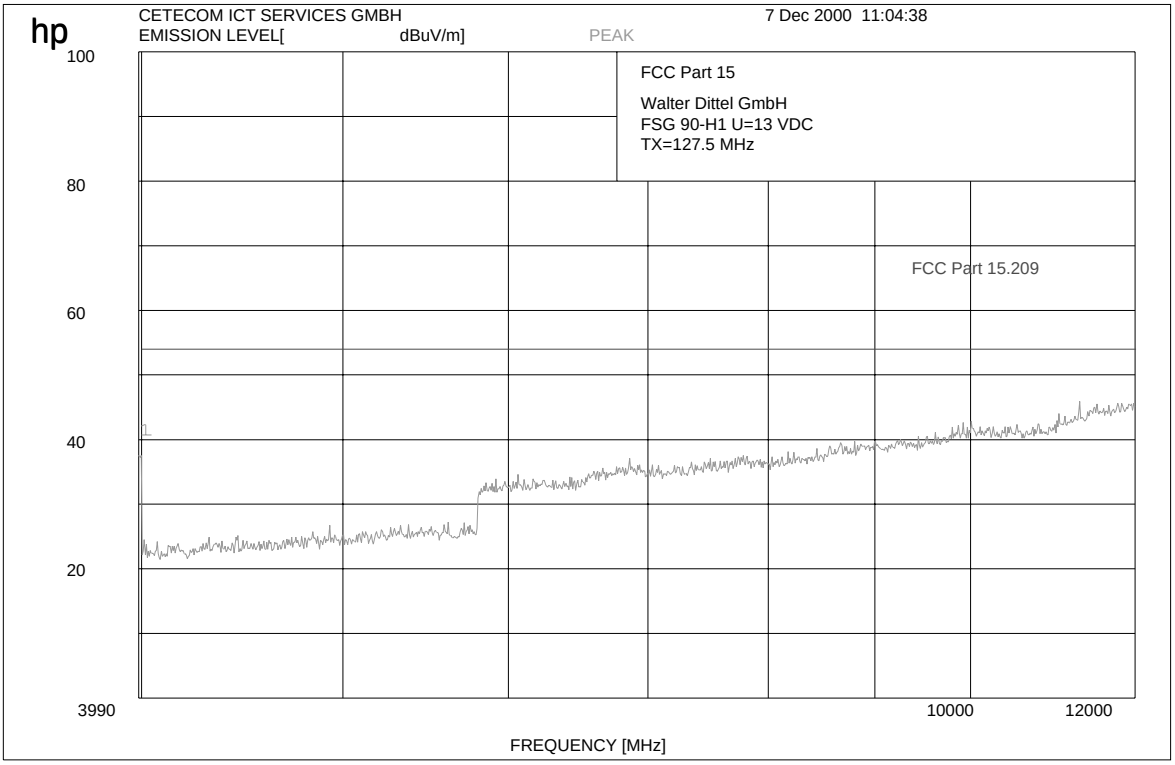
Plot No.: 25


hp
CETECOM ICT SERVICES GMBH
7 Dec 2000 11:13:02
EMISSION LEVEL[dBuV/m]
PEAK
FCC Part 15
Walter Dittel GmbH
FSG 90-H1 U=13 VDC
TX=127.5 MHz
FCC Part 15.209
1
2
3
100
80
60
40
20
30
100
1000
4000
FREQUENCY [MHz]

Plot No.: 26


hp
CETECOM ICT SERVICES GMBH
EMISSION LEVEL[dBuV/m]
PEAK
7 Dec 2000 11:22:35
FCC Part 15
Walter Dittel GmbH
FSG 90-H1 U=13 VDC
TX=136.975 MHz
FCC Part 15.209
1
2
3
4
100
80
60
40
20
30
100
1000
4000
FREQUENCY [MHz]

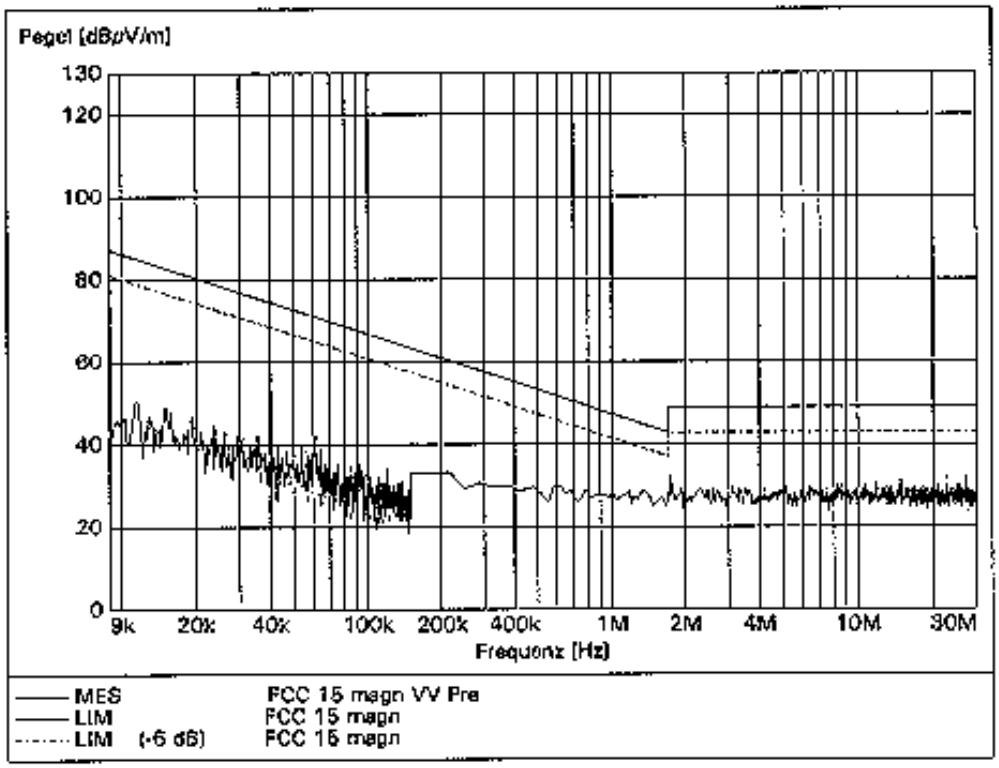
Plot No.: 27


hp
CETECOM ICT SERVICES GMBH
7 Dec 2000 11:04:38
EMISSION LEVEL[dBuV/m]
PEAK
FCC Part 15
Walter Dittel GmbH
FSG 90-H1 U=13 VDC
TX=127.5 MHz
FCC Part 15.209
100
80
60
40
20
3990
10000
12000
FREQUENCY [MHz]

Plot No.: 28

FCC 15

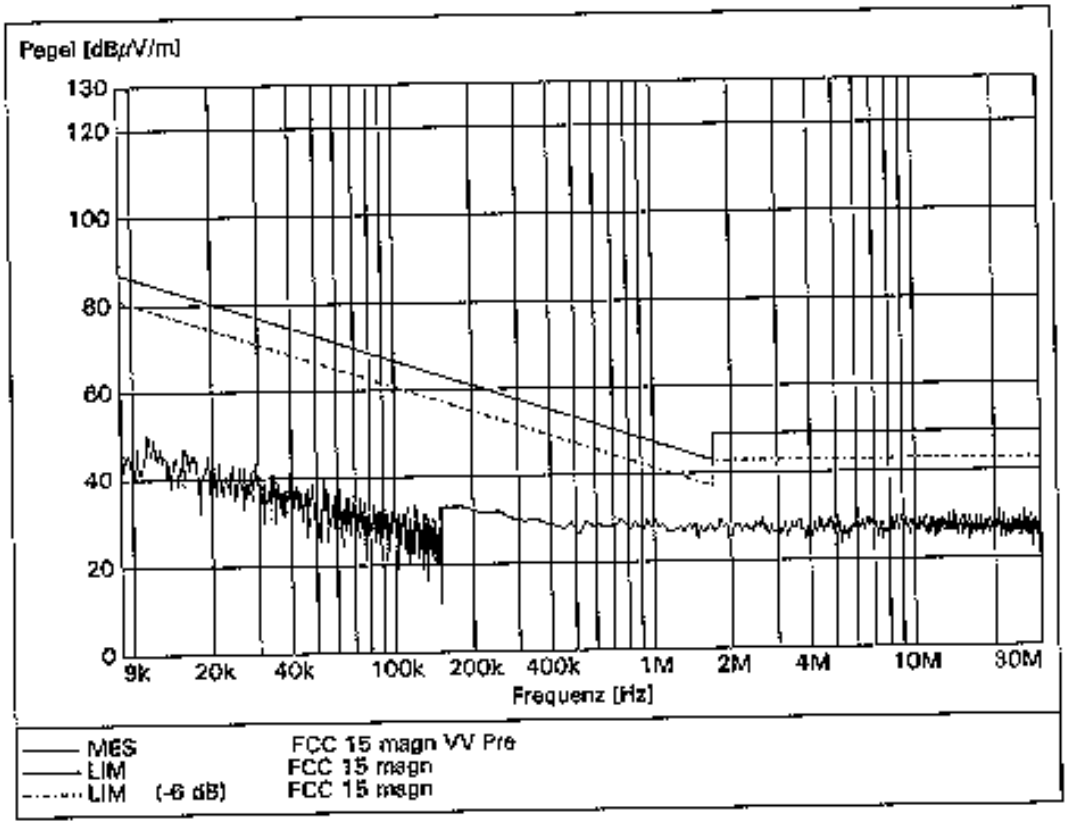
Prüfobjekt: FSG 90 - H1
Auftraggeber: Walter Dittel GmbH
Testbedingungen: Abstand 3,0 m ; TX mode
Testumgebung: EMC-Testcenter
Prüfer: Kammerinke
Vorgangsnummer: 2-2332/00
Seriennummer:
Bemerkung:



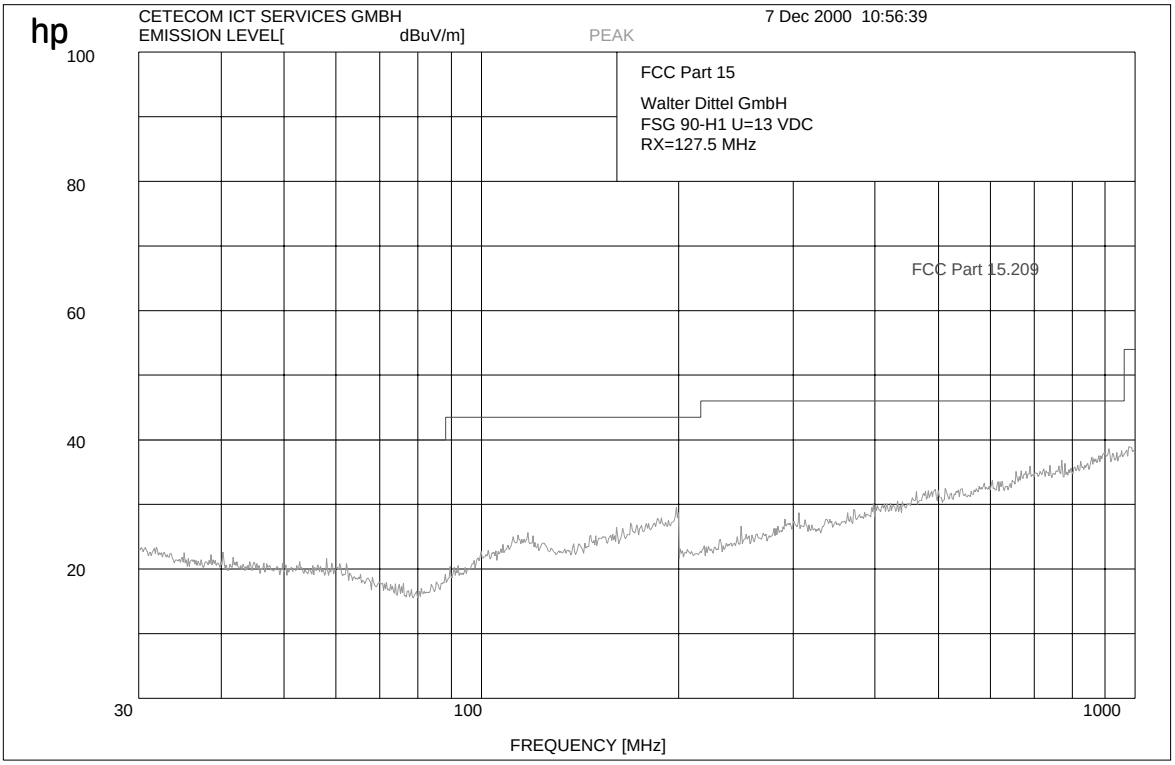
Plot No.: 29

FCC 15

Prüfobjekt: FSG 90 - #1
Auftraggeber: Walter Hittel GmbH
Testbedingungen: Abstand 3,0 m ; RX mode
Testumgebung: EMC-Testcenter
Prüfer: Kammerinke
Vorgangsnummer: 2-2332/00
Seriennummer:
Bemerkung:



Plot No.: 30


hp
CETECOM ICT SERVICES GMBH
EMISSION LEVEL[dBuV/m]
PEAK
7 Dec 2000 10:56:39
FCC Part 15
Walter Dittel GmbH
FSG 90-H1 U=13 VDC
RX=127.5 MHz
FCC Part 15.209
100
80
60
40
20
30
100
1000
FREQUENCY [MHz]

Appendix 3 to test report
Anlage 3 zum Prübericht

Variants of FSG 90 / FSG 200 designed for the US market

	Type	Part – Number	FCC - Identifier
*	FSG 90	F 10185	BVYFSG90
*	FSG 90-H1	F 10302	BVYFSG90H1
*	FSG 90	F 10191	BVYFSG90
*	FSG 90-H1	F 10303	BVYFSG90H1
*	FSG 90-F	F 10194	BVYFSG90F
*	FSG 90-F-H1	F 10306	BVYFSG90FH1
*	FSG 90-F	F 10195	BVYFSG90F
*	FSG 90-F-H1	F 10307	BVYFSG90FH1
*	FSG 90-L	F 10208	BVYFSG90L
*	FSG 90-L-H1	F 10310	BVYFSG90LH1
*	FSG 90-F-L	F 10210	BVYFSG90FL
*	FSG 90-F-L-H1	F 10312	BVYFSG90FLH1
*	FSG 200	F 10321	BVYFSG200
*	FSG 200-H1	F 10333	BVYFSG200H1
*	FSG 200	F 10322	BVYFSG200
*	FSG 200-H1	F 10334	BVYFSG200H1
*	FSG 200-F	F 10325	BVYFSG200F
*	FSG 200-F-H1	F 10337	BVYFSG200FH1
*	FSG 200-F	F 10326	BVYFSG200F
*	FSG 200-F-H1	F 10338	BVYFSG200FH1
*	FSG 200-L	F 10329	BVYFSG200L
*	FSG 200-L-H1	F 10341	BVYFSG200LH1
*	FSG 200-F-L	F 10331	BVYFSG200FL
*	FSG 200-F-L-H1	F 10343	BVYFSG200FLH1