

RC-032-C42-07-103891-1-A-BPe-AH

## E.M.C. TESTS REPORT

According to the standard(s):  
FCC Part 15 : 2007



Equipment under test:  
MILLI-Q Integral with Q-POD and E-POD

Company:  
MILLIPORE

Distribution: Mme OHLMANN FOUGEROUSSE

(Company: MILLIPORE)

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*NAME OF THE EQUIPMENT UNDER TEST (E.U.T.)* : MILLI-Q Integral with Q-POD and E-POD

*Type* : ZRXQ003T0 (Milli-Q Integral)  
ZMQSPOD01 (Q-Pod)

*Serial number* : F SAMPLE A (MILLI-Q Integral)  
F7HN 384650 and F7HN 384655 (Q-POD)

*Part number* : Not communicated

*Software Version* : Not communicated

*MANUFACTURER'S NAME* : MILLIPORE

APPLICANT'S ADDRESS:

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*Responsible* : Mrs OHLMANN FOUGEROUSSE

*DATES OF TESTS* : 20/08/2007  
21/08/2007  
22/08/2007  
03/09/2007

*TESTS LOCATIONS* : EMITECH Laboratory at Montigny-Le-Bretonneux and open area test site at AUNAINVILLE

*TESTS OPERATORS* : B. PELLERIN, C. FOURCADE



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*ANNEX 1: CUSTOMER'S QUESTIONNAIRE*



## 1. INTRODUCTION

This document submits the results of Electromagnetic Compatibility tests performed on the equipment «**MILLI-Q Integral with Q-POD and E-POD**» (denominated hereafter E.U.T.: equipment under test) according to document listed below.

## 2. REFERENCE DOCUMENT

### *FCC Part 15: 2007*

Code of federal regulations

Title 47- Telecommunication Chapter 1- Federal Communication Commission

Part 15- Radio frequency devices Subpart B- Unintentional Radiators

Limits and methods of measurement of radio disturbance

Characteristic of information technology equipment.

## 3. EQUIPMENT UNDER TEST CONFIGURATION

### Equipment under test (E.U.T.) description:

Water purification system.

### Cycle and operating mode during emission tests:

Normal mode

### Modification of the equipment during the test :

Addition of a 47 pF capacitor on 16 MHz oscillator on SMPS and main card (see photo)

Modification of the ferrite on RO pump. The new ferrite reference is WURTH ELEKTRONIK model 742 7111 (see photo) with one turn.



## Photographs of the equipment under test (EUT)



## Modification



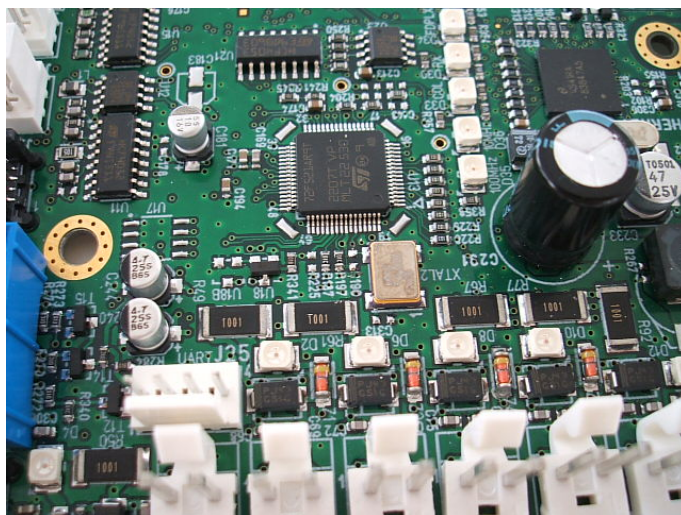




Modification



Modification





#### 4. SUMMARY OF TEST RESULTS

The following table summarizes test results of the EUT.

Designation of test	Test results				Comments
	Pass	Fail	N.A.	N.P.	
Intentional radiated emissions in the band 13.553 – 13.567 MHz	x				Section 15.225(a)
Unintentional radiated emissions in the band 9 kHz - 30 MHz	x				Section 15.209
Unintentional radiated emissions in the band 30 MHz – 1 GHz	x				Section 15.209 with modification
Conducted emissions on AC mains ports	x				Section 15.207
Frequency drift	x				Section 15.225 (e)

N.A.: Not Applicable

N.P.: Not Performed

The tested sample "*MILLI-Q Integral with Q-POD and E-POD*" complies with the requirements of the standard:

➤ FCC PART 15 Edition 2007

according to the limits specified in the present report with modifications.

**5. INTENTIONAL RADIATED EMISSIONS IN THE BAND 13.553 MHz – 13.567 MHz**

Standard: FCC PART 15 Edition 2007

Section: 15.225 (a)

Equipment under test arrangement

Category of equipment: Table-top equipment

The equipment under test (EUT) is placed on a non-conductive test table at 0.8 m above the horizontal reference ground plane.

Antenna height is 1 m above the ground plane.

For each frequency corresponding to an emission, EUT carried out a rotation through 360° with the aid of the turntable, with the aim to find the maximum of signal.

The test antenna is oriented in all orientations. Only the highest level is recorded.

Test configuration photographs:



Frequency range: 13.553 MHz – 13.567 MHz

Detection mode: Quasi-peak.





Resolution bandwidth: 200 Hz

Measurement distance: 30 meters.

Limit:

Frequency range (MHz)	Frequency field strength		Frequency measurement distance (meters)
	$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$	
13.593 – 13.567	15848	84.0	30

Operating mode during the test:

EUT is in permanent transmission.

Instrumentation test list:

Meter	N° Emitech	Category	Mark	Type
181	02/010	Receiver	Rohde & Schwarz	ESH3
187	16/004	Open site	Emitech	Aunainville
315	24/049	Loop antenna	Rohde et Schwarz	HFH2-Z2
2341	19/018	Antenna mast	HD GmbH	MA 240
2342	19/019	Mast controller	HD GmbH	HD 100
2451	35/071	Cable	Cables & Connectiques	HF 2m
2452	35/072	Cable	Cables & Connectiques	HF 13m
2863	35/240	Cable	Câbles & Connectiques	N-7m
4359	35/588	Cable		N-2m

Results:

FREQUENCY (MHz)	ANTENNA ORIENTATION	AZIMUTH (degrees)	MEASUREMENT ( $\text{dB}\mu\text{V/m}$ )	LIMIT ( $\text{dB}\mu\text{V/m}$ )	MARGIN (dB)
13.5602	Parallel	170	37.9	84.0	46.1

Observation during the test:

The equipment complies with the requirements of the standard FCC PART 15.225 Edition 2007.



## 6. UNINTENTIONAL RADIATED EMISSIONS IN THE BAND 9 KHZ – 30 MHZ

Standard: FCC PART 15 Edition 2007

Section: 15.209

### Equipment under test arrangement

Category of equipment: Table-top equipment

The equipment under test (EUT) is placed on a non-conductive test table at 0.8 m above the horizontal reference ground plane.

Antenna height is 1 m above the ground plane.

For each frequency corresponding to an emission, EUT carried out a rotation through 360° with the aid of the turntable, with the aim to find the maximum of signal.

The test antenna is oriented in all orientations. Only the highest level is recorded.

### Test configuration photographs:



Frequency range: 9 kHz - 30 MHz.

Detection mode: Quasi-peak except frequency bands 9-90 kHz and 110-490 kHz (average).

Resolution bandwidth: 200 Hz from 9 kHz to 150 kHz.  
9 kHz from 150 kHz to 30 MHz



Measurement distance: 30 meters.

Limit:

Frequency range (MHz)	Frequency field strength ( $\mu\text{V/m}$ )	Frequency measurement distance (meters)
0.009-0.490	2400/F (kHz)	300
0.490-1.705	24000/F (kHz)	30
1.705-30.0	30	30

Limits in dB $\mu\text{V/m}$  can be extrapolated to 10 m using 40 dB / decade.

Operating mode during the test:

EUT is in permanent transmission.

Instrumentation test list:

Meter	N° Emitech	Category	Mark	Type
181	02/010	Receiver	Rohde & Schwarz	ESH3
187	16/004	Open site	Emitech	Aunainville
315	24/049	Loop antenna	Rohde et Schwarz	HFH2-Z2
2341	19/018	Antenna mast	HD GmbH	MA 240
2342	19/019	Mast controller	HD GmbH	HD 100
2451	35/071	Cable	Cables & Connectiques	HF 2m
2452	35/072	Cable	Cables & Connectiques	HF 13m
2863	35/240	Cable	Câbles & Connectiques	N-7m
4359	35/588	Cable		N-2m

Results:

No frequency has been measured above the ambient noise.

Observation during the test:

The equipment complies with the requirements of the standard FCC PART 15.209 Edition 2007.



## 7. UNINTENTIONAL RADIATED EMISSIONS IN THE BAND 30 MHZ – 1 GHZ

Standard: FCC PART 15 Edition 2007

Section: 15.209

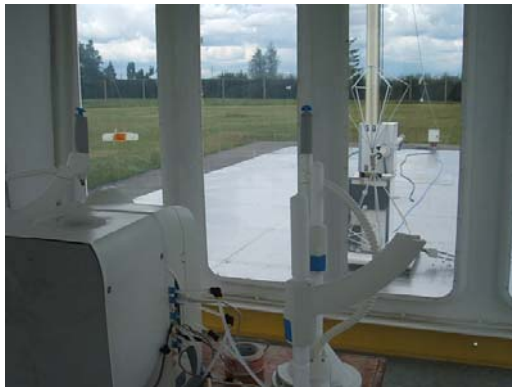
Equipment under test arrangement:

Category of equipment: Table-top equipment

The equipment under test (EUT) is placed on a non-conductive test table at 0.8 m above the horizontal reference ground plane.

For maximum meter reading at each frequency, the antenna height is adjusted between 1 m and 4 m above the ground plane. A 360 degrees rotation of the EUT is performed in vertical and horizontal polarization. The frequency azimuth and antenna height are presented in the tables on the next pages.

Test configuration photographs:





Frequency range: 30 MHz - 1 GHz

Detection mode: Quasi-peak

Resolution bandwidth: 120 kHz

Measurement distance: 3 meters

Limit: The EUT must satisfy requirements of the section 15.209 as shown in table below.

Frequency range (MHz)	Limit (dBμV/m)
30 to 88	40.0
88 to 216	43.5
216 to 960	46.0
960 to 1000	54.0

Operating mode during the test: EUT is in permanent transmission.

Instrumentation test list:

Meter	Nr Emitech	Category	Mark	Type
187	16/004	OATS	Emitech	Site champ libre
1057	02/045	Receiver	Rohde & Schwarz	ESVP
1144	24/195	Biconical antenna	Schwarzbeck	VHBA 9123
2341	19/018	Antenna mast	HD GmbH	MA 240
2342	19/019	Mast controller	HD GmbH	HD 100
2450	35/070	Cable	Cables & Connectiques	HF 12m
2451	35/071	Cable	Cables&Connectiques	HF 2m
2452	35/072	Cable	Cables & Connectiques	HF 13m
3106	24/571	Antenna	Schwarzbeck	UHALP 9108



Results:

Table reference	Comments
Table 1	Measurement in vertical polarization
Table 2	Measurement in horizontal polarization

Observation during the test:

The equipment complies with the requirements of the standard FCC PART 15.209 Edition 2007 with modification.



Test site: Open area test site

TABLE 1

Radiated emission: Electric field

Standard: FCC Part 15.209 Edition 2007

Test distance: 3 m

Polarization: Vertical

Model: MILLI-Q Integral with Q-POD and E-POD

FREQUENCY (MHz)	ANTENNA HEIGHT (cm)	AZIMUTH (degrees)	MEASUREMENT (dB $\mu$ V/m)	LIMIT (dB $\mu$ V/m)	MARGIN (dB)
38,28	150	0	39,8	40	0,2
80,000	109	140	37,5	40,0	2,5
112,002	105	110	43,4	43,5	0,1
128,002	105	110	39,0	43,5	4,5
144,002	105	120	38,7	43,5	4,8
192,002	105	180	34,6	43,5	8,9
224,000	190	330	35,1	46	10,9
240,000	180	0	31,0	46	15,0
256,000	164	0	38,0	46	8,0
272,000	160	10	37,2	46	8,8
336,006	105	180	39,1	46	6,9
368,000	105	240	39,2	46	6,8
400,000	105	200	37,6	46	8,4
512,000	105	330	32,5	46	13,5



TABLE 2

Test site: Open area test site

Radiated emission: Electric field

Standard: FCC Part 15.209 Edition 2007

Test distance: 3 m

Polarization: Horizontal

Model: MILLI-Q Integral with Q-POD and E-POD

FREQUENCY (MHz)	ANTENNA HEIGHT (cm)	AZIMUTH (degrees)	MEASUREMENT (dB $\mu$ V/m)	LIMIT (dB $\mu$ V/m)	MARGIN (dB)
48,250	275	100	37,1	40	2,9
64,588	260	50	37,9	40	2,1
80,003	270	160	34,6	40	5,4
111,990	200	180	40,7	43,5	2,8
176,004	220	175	36,9	43,5	6,6
192,000	105	200	40,0	43,5	3,5
230,530	248	0	33,8	46,0	12,2
256,009	105	0	36,8	46,0	9,2
257,650	105	60	39,9	46,0	6,1
271,210	130	320	35,6	46,0	10,4
284,770	165	40	37,2	46,0	8,8
311,890	180	10	38,4	46,0	7,6
320,009	200	210	32,9	46,0	13,1
339,020	150	0	35,2	46,0	10,8
352,009	210	200	36,7	46,0	9,3
379,690	105	130	32,8	46,0	13,2
752,007	205	230	36,5	46,0	9,5
759,407	120	150	38,9	46,0	7,1



## 8. MEASUREMENT OF CONDUCTED EMISSION

Standard: FCC Part 15 : 2007

Test method: FCC Part 15 : 2007

Test configuration:

Tested cable(s)	Measure with	E.U.T. height
115V-60Hz POWER SUPPLY	LISN	80cm





Frequency band	Tested cable(s)	Resolution bandwidth	Video bandwidth	Detection mode
150kHz 1MHz	115V-60Hz POWER SUPPLY	10kHz	30kHz	Peak
1MHz 10MHz	115V-60Hz POWER SUPPLY	10kHz	30kHz	Peak
10MHz 30MHz	115V-60Hz POWER SUPPLY	10kHz	30kHz	Peak
150kHz 1MHz	115V-60Hz POWER SUPPLY	9kHz	Auto	Average
1MHz 10MHz	115V-60Hz POWER SUPPLY	9kHz	Auto	Average
10MHz 30MHz	115V-60Hz POWER SUPPLY	9kHz	Auto	Average
150kHz 1MHz	115V-60Hz POWER SUPPLY	9kHz	Auto	Quasi peak
1MHz 10MHz	115V-60Hz POWER SUPPLY	9kHz	Auto	Quasi peak
10MHz 30MHz	115V-60Hz POWER SUPPLY	9kHz	Auto	Quasi peak

Test method deviation: None

Test equipment list:

CATEGORY	BRAND	TYPE	N° EMITECH
Software	Nexio	BAT EMC	0000
Enceinte d'essais	Emitech	JD	1804
AC power source	SCHAFFNER	NSG 1007-5-400	4637
Cable	-	N-2m	2814
Cable	-	-	2808
Limiter	HP	11947A	3258
Receiver	Agilent Technologies	E7405A	2205
LISN	PMM	L3-25	0813
Cable	-	N-2m	2814
Cable	-	-	2808
Receiver	Rohde & Schwarz	ESH3	0181

Results:

See curves hereafter. Limits on the curves are average limit (green) and quasi-peak limit (blue).

The peak frequency at 13.56 MHz is the transmission frequency.



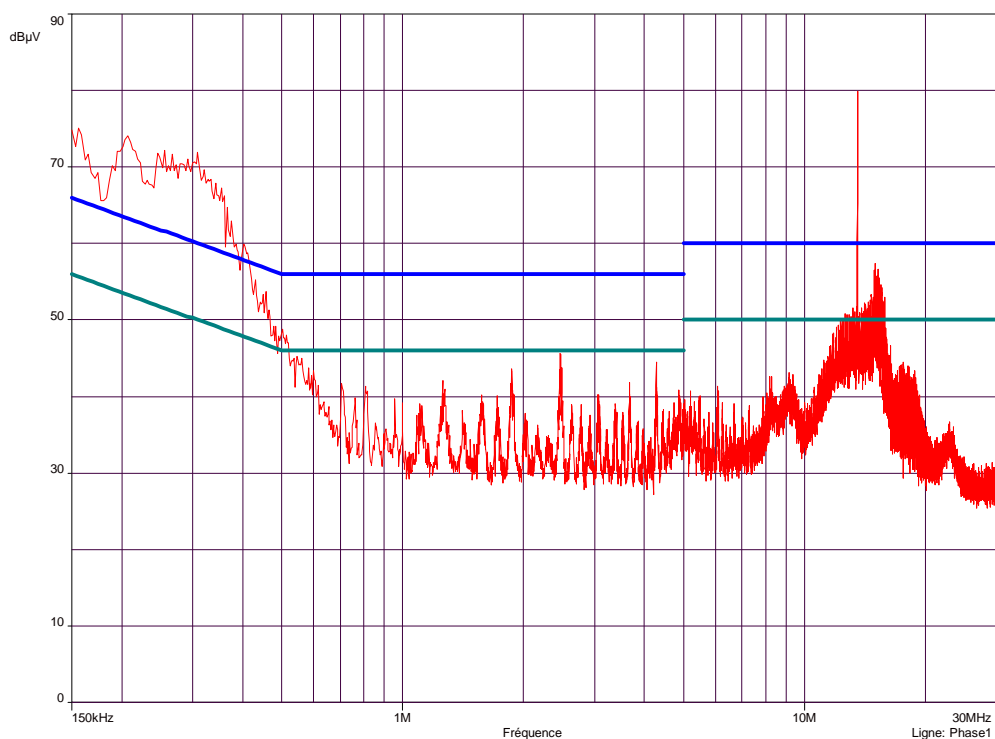
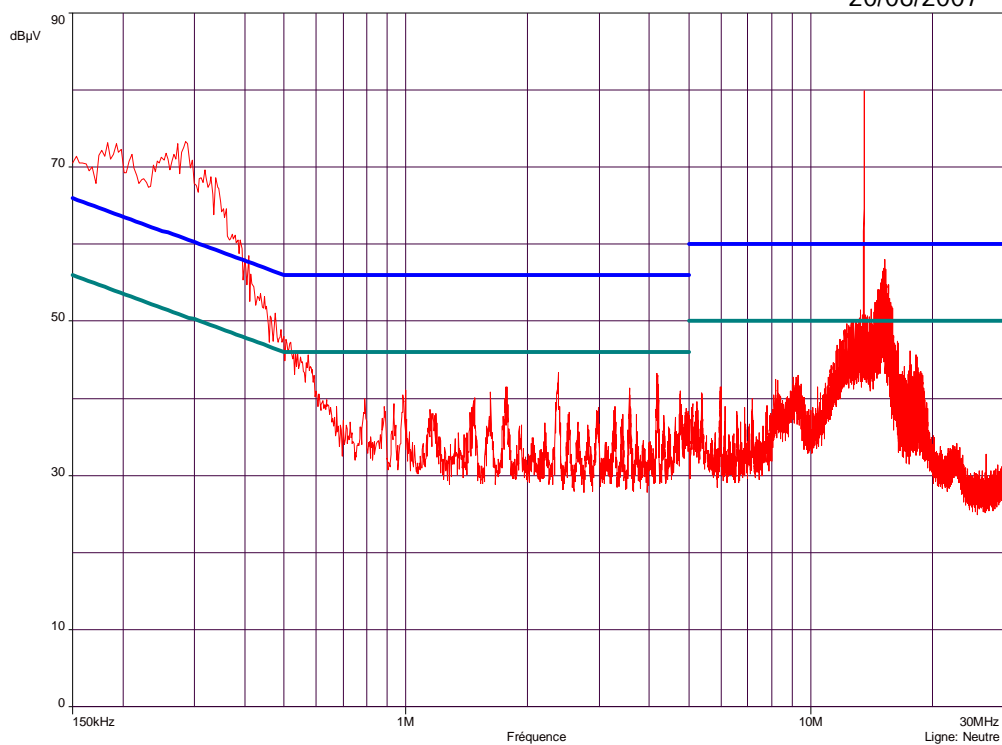


Curves 1 and 2

## MILLI-Q Integral with Q-POD and E-POD

Conducted voltage emission (measurement): 115V-60Hz POWER SUPPLY in Peak detection.

20/08/2007



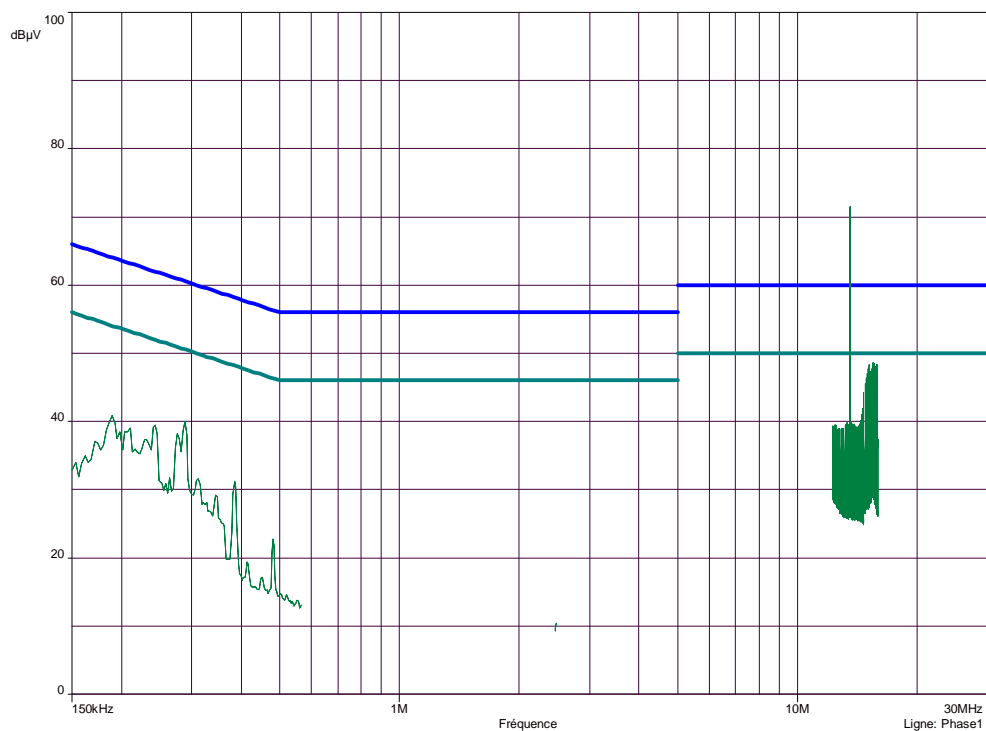
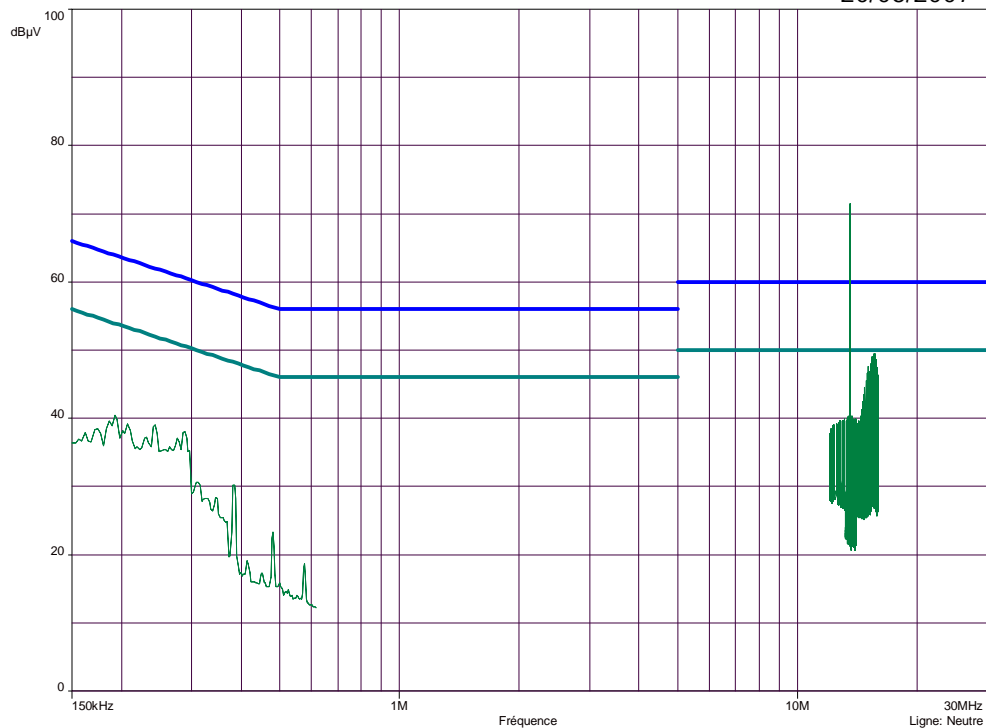
Class: B of the standard



## MILLI-Q Integral with Q-POD and E-POD

Conducted voltage emission (measurement): 115V-60Hz POWER SUPPLY in Average detection.

20/08/2007



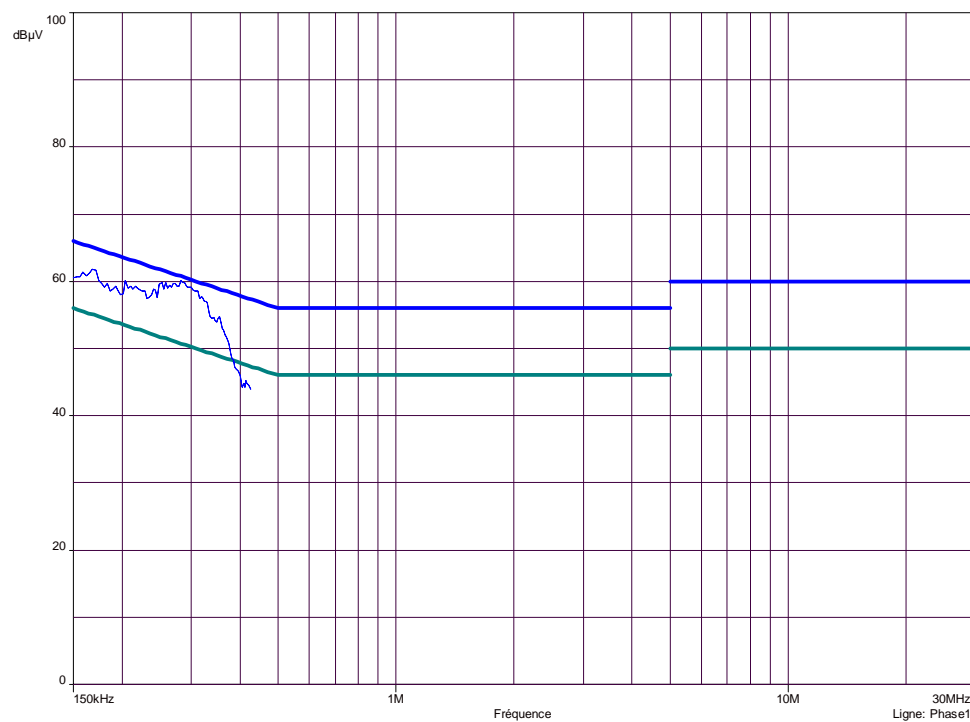
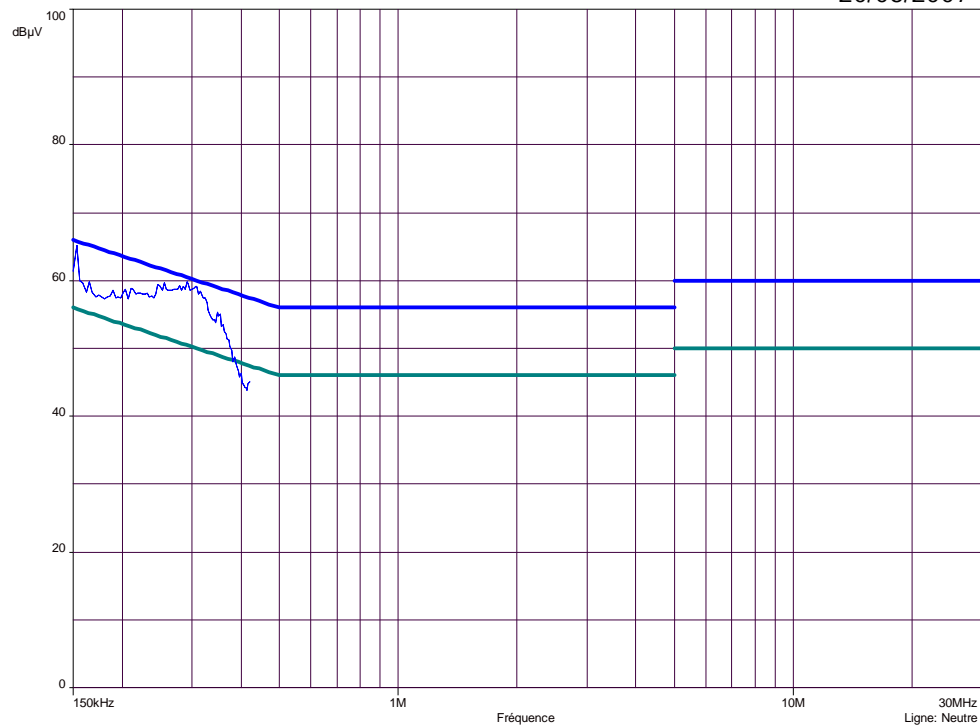
Class: B of the standard



## MILLI-Q Integral with Q-POD and E-POD

Conducted voltage emission (measurement): 115V-60Hz POWER SUPPLY in Quasi Peak detection.

20/08/2007



Class: B of the standard

**9. FREQUENCY DRIFT**

**Standard:** FCC Part 15 Edition 2007

**Section:** 15.225 (e)

**Test equipment used:**

Meter	NrEmitech	Category	Mark	type
2694	07/111	Climatic enclosure	Flonic Schlumberger	200P
4196	02/107	Spectrum analyzer	Rohde & Schwarz	FSEA

**Measurement conditions:**

Resolution bandwidth: 9 kHz

Video bandwidth: 30 kHz

**Test operating conditions of the equipment:**

The transmitter is in transmission with modulation.



### Results:

			F (MHz)	Deviation (kHz)	Curve	Limit (1)
Normal test conditions	Nominal power source (110 V)	Temperature (+20°C) Humidity (50%)	13.56140	0	7	+ 1.356 kHz
	Minimal power source (93.5 V)		13.56140	0	8	
	Maximal power source (126.6 V)		13.56140	0	9	
Extreme test conditions	Minimal temperature (5°C)	Nominal power source (110 V)	13.56140	0.09	10	
	Maximal temperature (+50°C)		13.56140	0	11	

(1) + 0.01 % of the operating frequency.

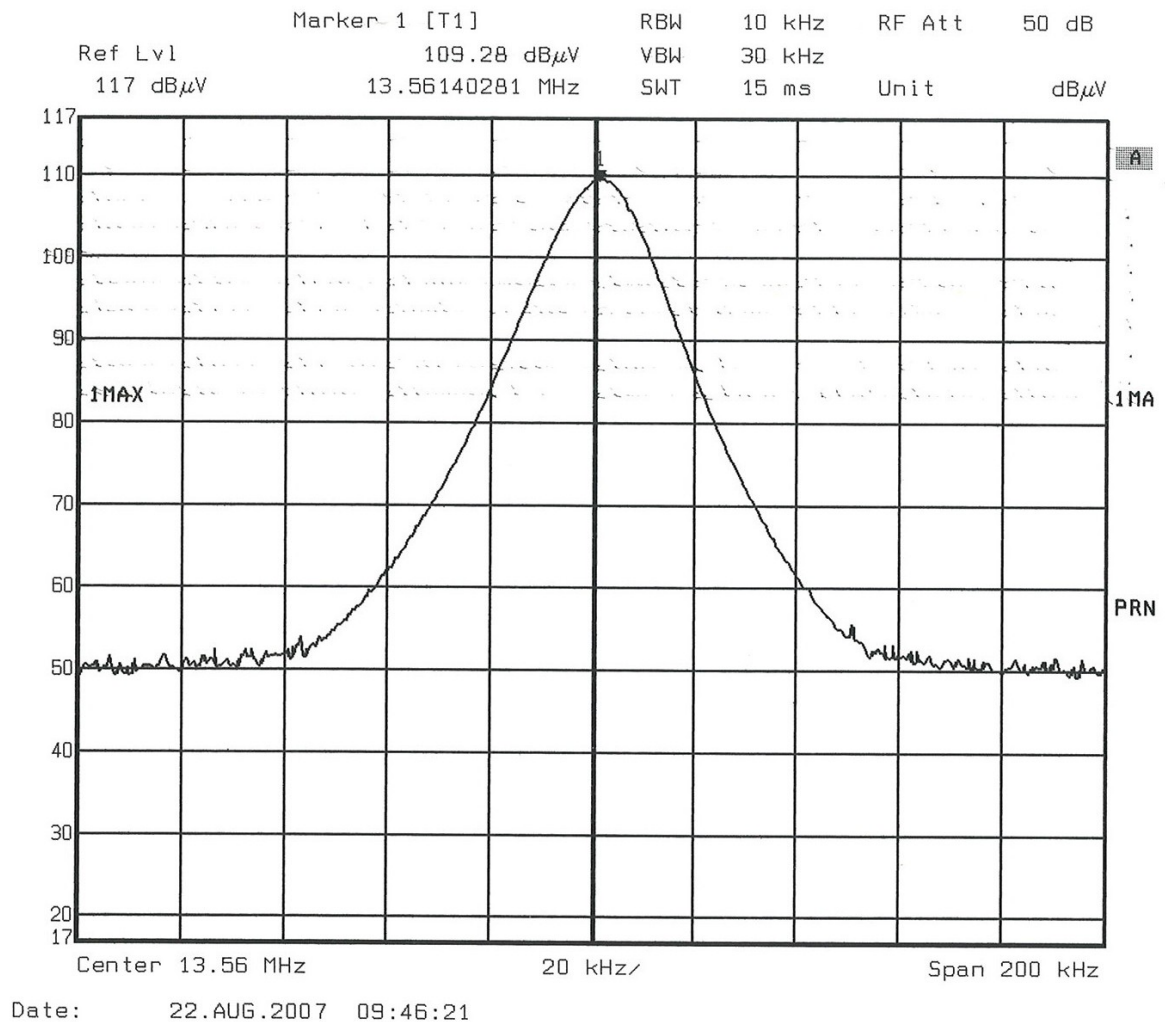
Measurement uncertainty:  $\pm 1 \times 10^{-7}$

Test conclusion: Standard respected



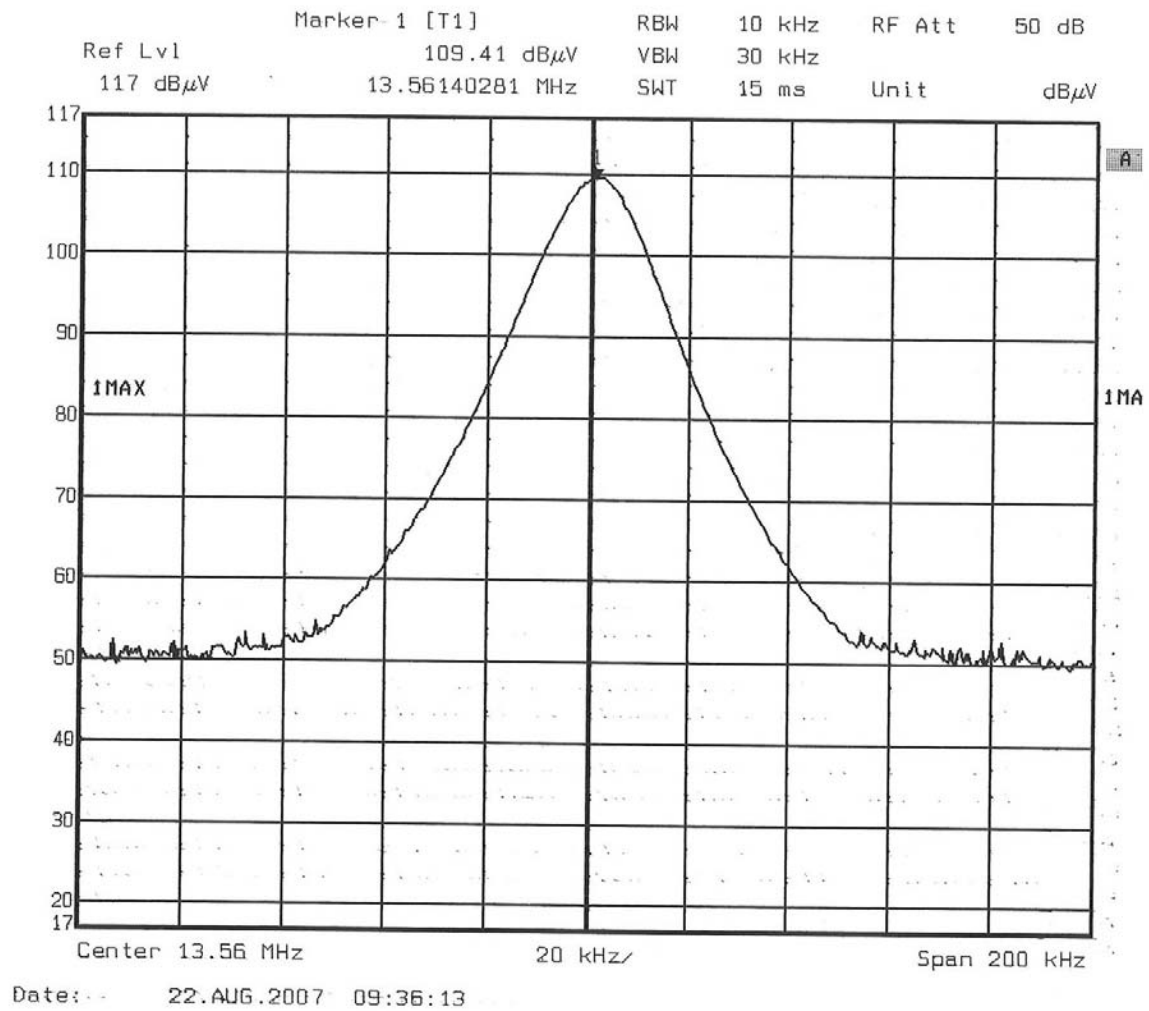


Curve 7



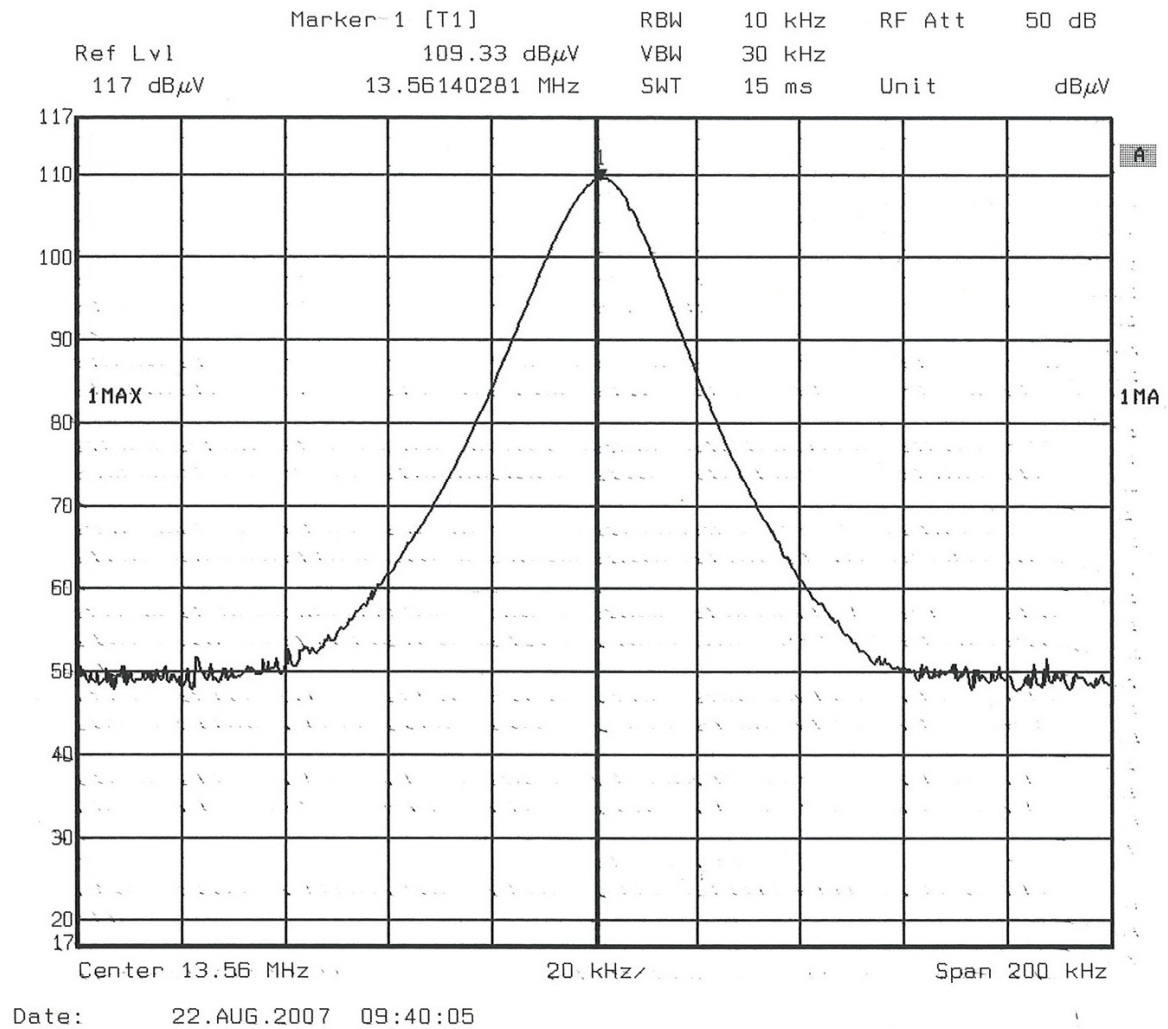


Curve 8



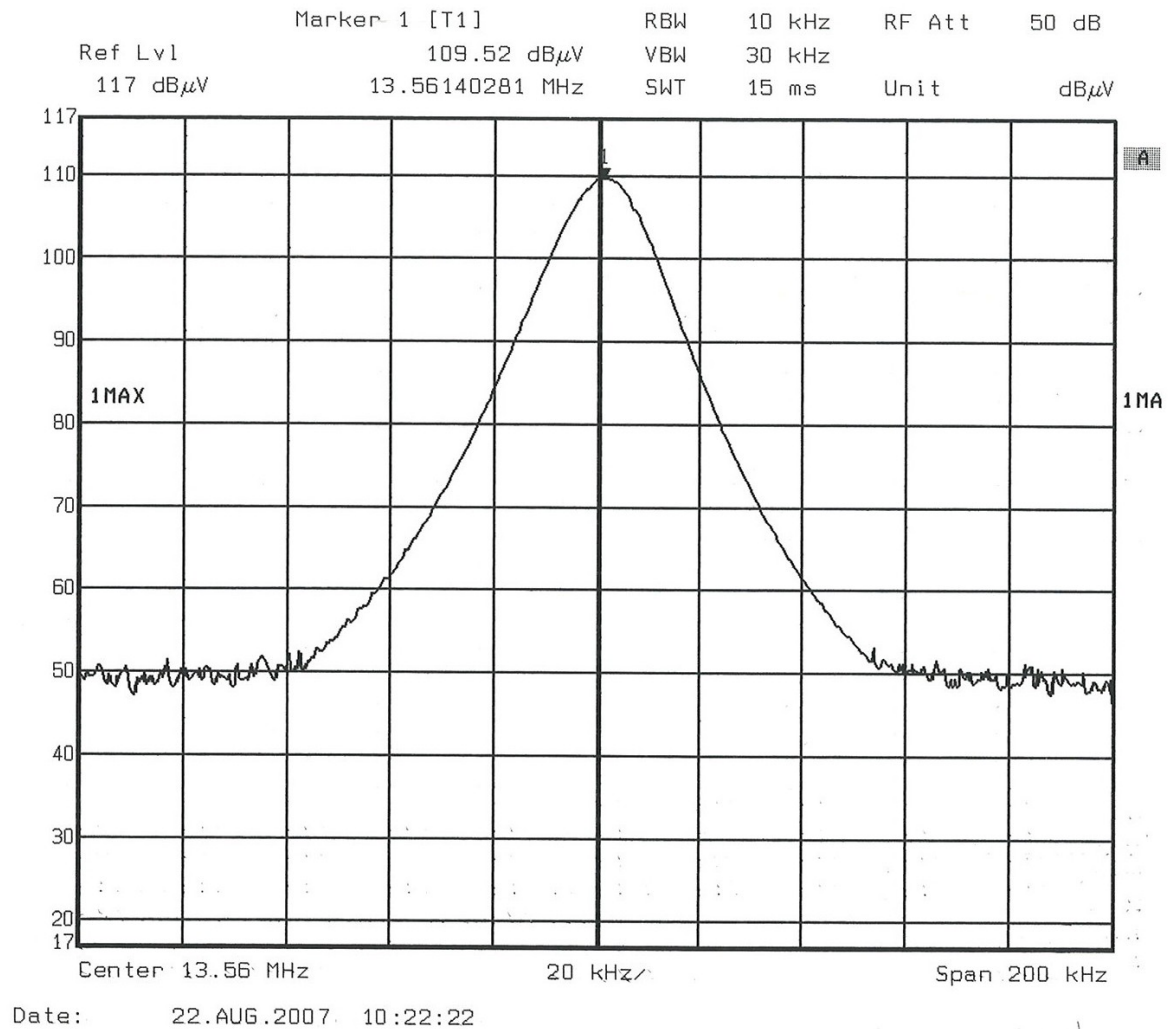


Curve 9



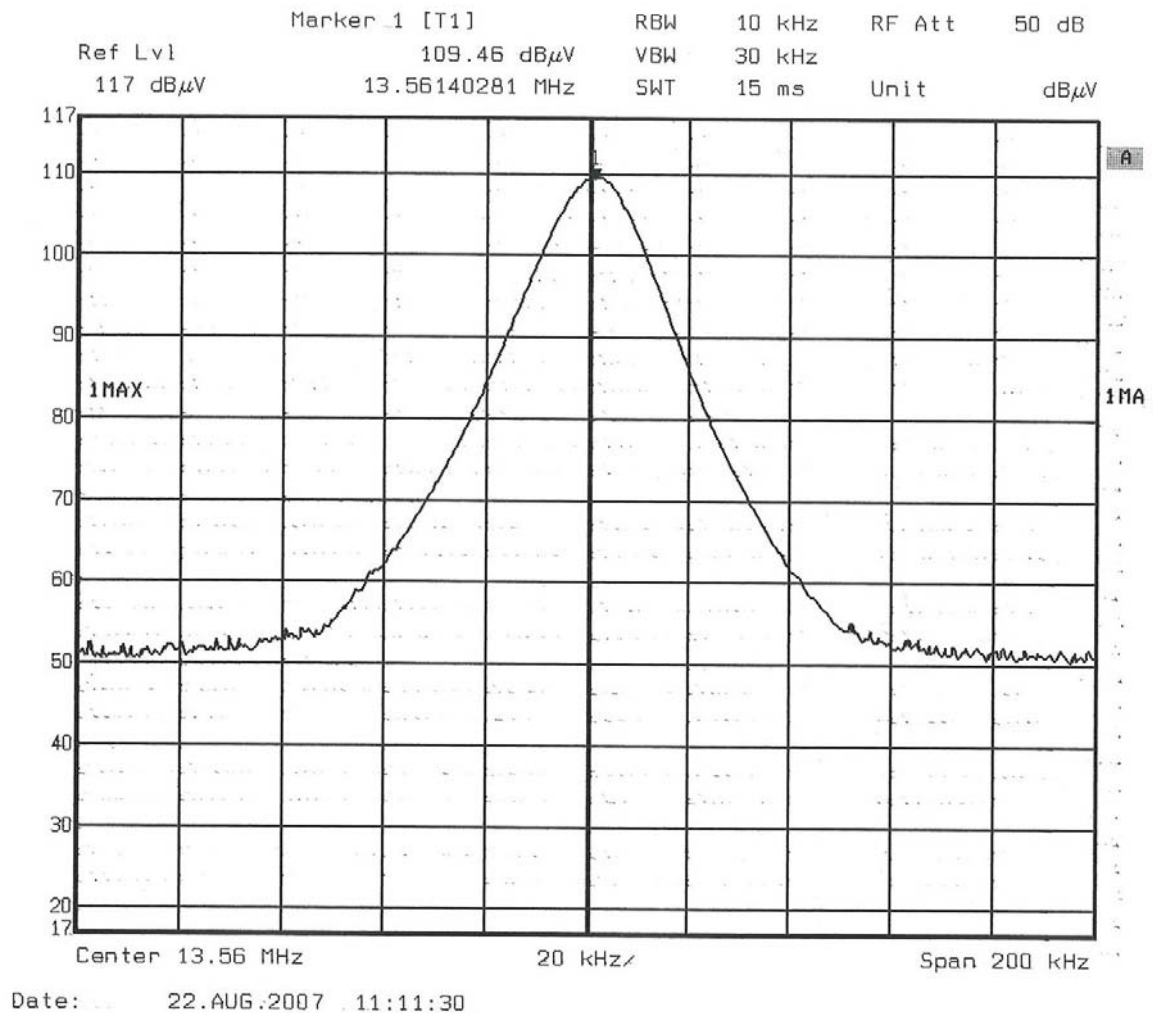


Curve 10





Curve 11



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