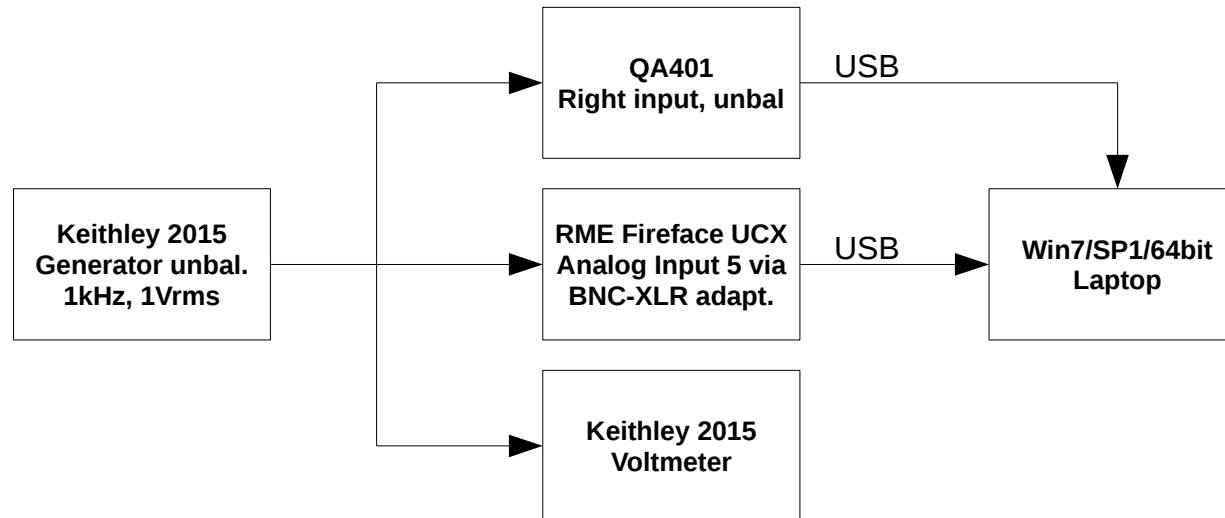


# Soundcard based Measurement and Analysis, Comparison of different Analysis-Software

## 1 Test Setup

The following hardware test setup was used to produce the results shown below. All cabling shielded, partially RG58, partially balanced Cordial.



The following software was used to calc the FFT and analyse the THD of the K2015 generator signal. In the following comparative analysis the results will be compared with the QA401 analysis results. For reference, the Keithley 2015 shows:  $V=0.9965V_{rms}$ , 0.001% THD, 0.175%THD+N in loopback.

- Virtins MI v3.7
- Wavespectra v1.51E
- HpW v3.7.0
- ARTA v1.9.1

## **2 QA401**

### **2.1 Summary**

**Config**

fs [kHz]	48
bit depth	24
sample duration [sec]	1,125
sample points	65536
averages	0
Anal. Bandwidth [kHz]	24
FFT Window	<b>Flat Top</b>

**Results**

Voltage reading [Vrms]	0,975
THD [%]	0,03096
THD+N [%]	0,03863

**Harmonics**

peak	frequency [Hz]	amplitude [dB]	amplitude [dBr]
f0	999,75	-0,2	
f1	3000	-73,5	-73,3
f2	5000	-76,1	-75,9
f3	7999	-81,6	-81,4
f4	15999	-82,5	-82,3

**Config**

fs [kHz]	48
bit depth	24
sample duration [sec]	1,125
sample points	65536
averages	0
Anal. Bandwidth [kHz]	24
FFT Window	<b>Hanning</b>

**Results**

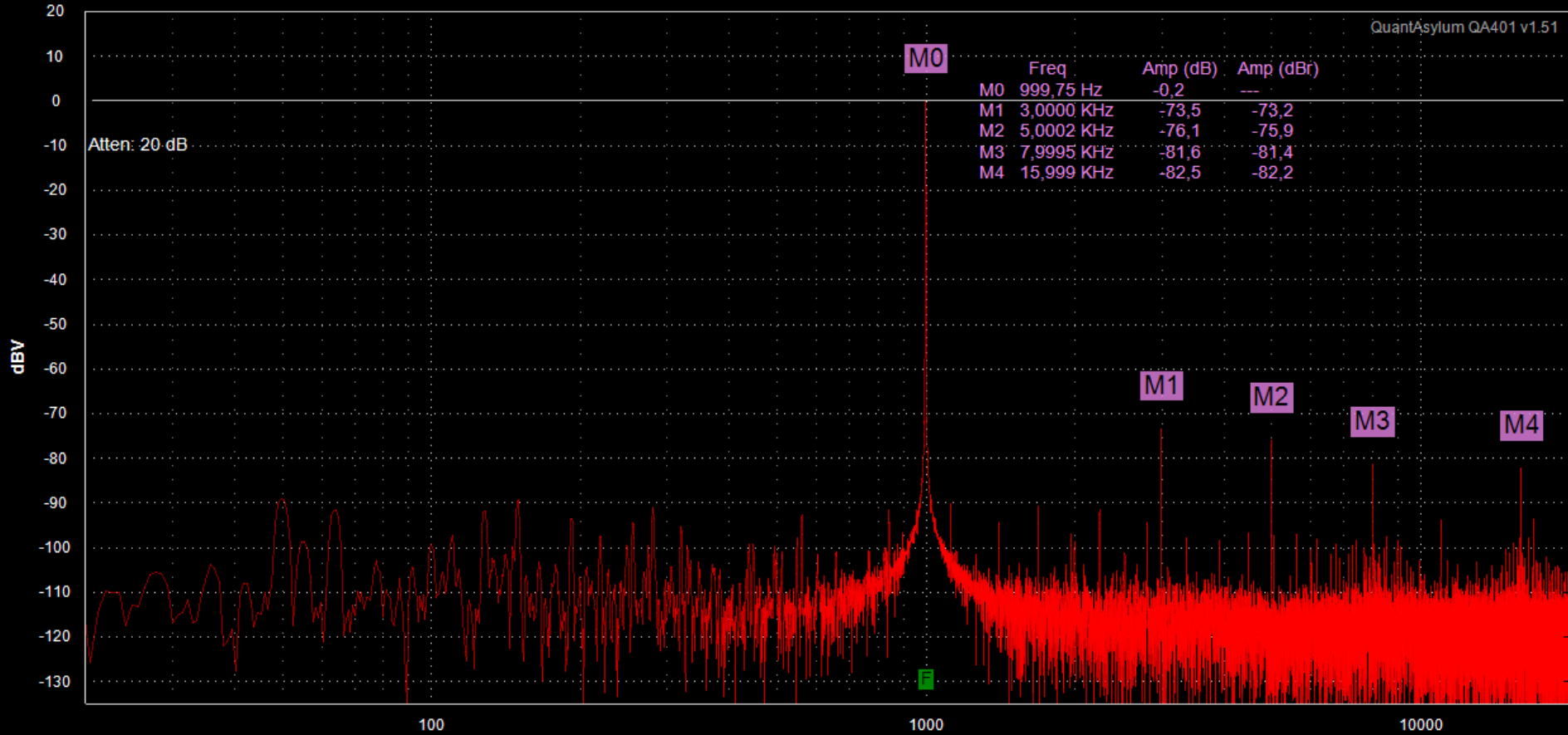
Voltage reading [Vrms]	0,973
THD [%]	0,02974
THD+N [%]	0,03578

**Harmonics**

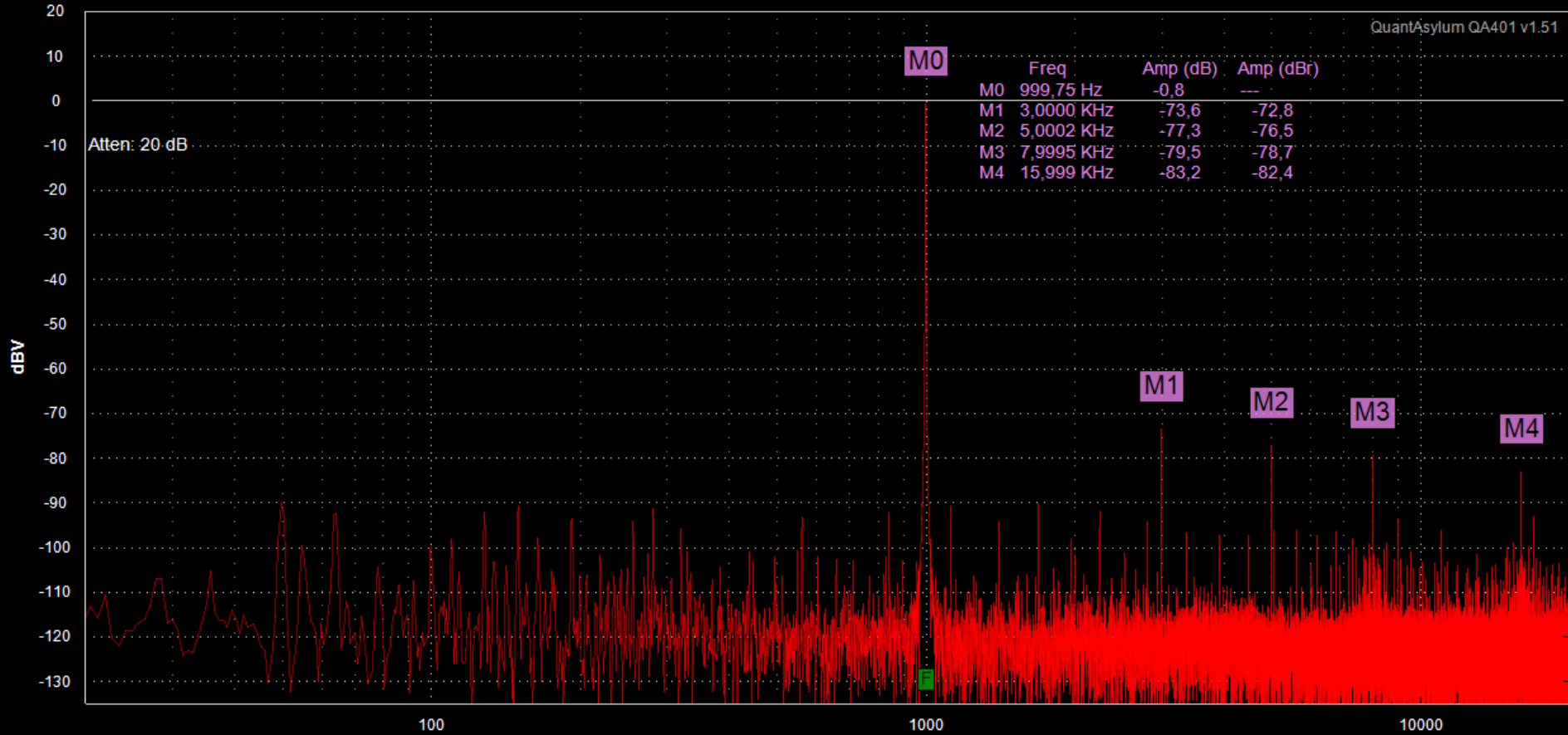
peak	frequency [Hz]	amplitude [dB]	amplitude [dBr]
f0	999,75	-0,8	
f1	3000	-73,6	-72,8
f2	5000	-77,3	-76,5
f3	7999	-79,5	-78,7
f4	15999	-83,2	-82,4

## 2.2 Plots

FFT: 65536 pts    Meas Start: 20,0 Hz    Gen 1: 999,7558 Hz @ -54,1 dBV  
 Avg: 0    Meas Stop: 24,0 KHz    Gen 2: 20,00024 KHz @ -14,1 dBV  
 Res: 732 mHz  
 Fs: 48,0 KHz    RMS R: -0,2 dBV    Peak R: 973 mVrms    SNR R: n. def. dB  
 Win: FlatTop    N+D R: -69,2 dBV    THD R: -70,5 dB/ 0,02974%    THD+N R: -68,9 dB/ 0,03578%  
 Filt: None



FFT: 65536 pts    Meas Start: 20,0 Hz    Gen 1: 999,7558 Hz @ -54,1 dBV  
 Avg: 0    Meas Stop: 24,0 KHz    Gen 2: 20,00024 KHz @ -14,1 dBV  
 Res: 732 mHz    Peak R: -0,78 dBV  
 Fs: 48,0 KHz    RMS R: -0,2 dBV    Peak R: 913 mVrms    SNR R: n. def. dB  
 Win: Hann    N+D R: -69,0 dBV    THD R: -70,2 dB/ 0,03096%    THD+N R: -68,3 dB/ 0,03863%  
 Filt: None



## **3 Virtins MI**

### **3.1 Summary**



### Config

fs [kHz]	48
bit depth	24
sample duration [sec]	1
sample points	65536
averages	0
Anal. Bandwidth [kHz]	24
FFT Window	<b>Flat Top</b>

### Results

Voltage reading [Vrms]	0,997
THD [%]	0,0266
THD+N [%]	0,0283

### Harmonics

peak	frequency [Hz]	amplitude [dB]	amplitude [dBr]
f0	1000	-0,03	
f1	3000	-73,68	-73,65
f2	5000	-76	-75,97
f3	2000	-91,29	-91,26
f4	17000	-94,26	-94,23

### Config

fs [kHz]	48
bit depth	24
sample duration [sec]	1
sample points	65536
averages	0
Anal. Bandwidth [kHz]	24
FFT Window	<b>Hanning</b>

### Results

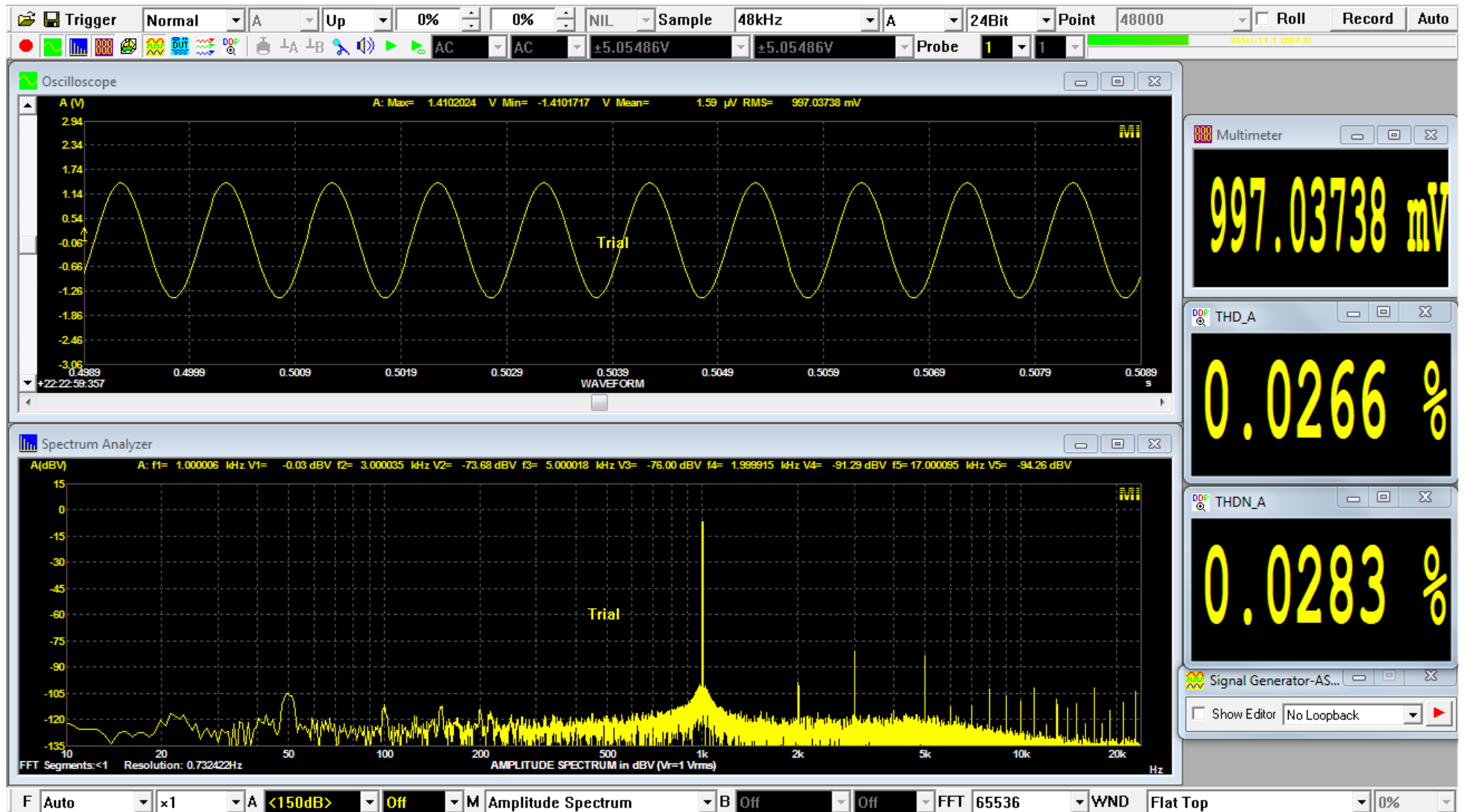
Voltage reading [Vrms]	0,997
THD [%]	0,0266
THD+N [%]	0,1778

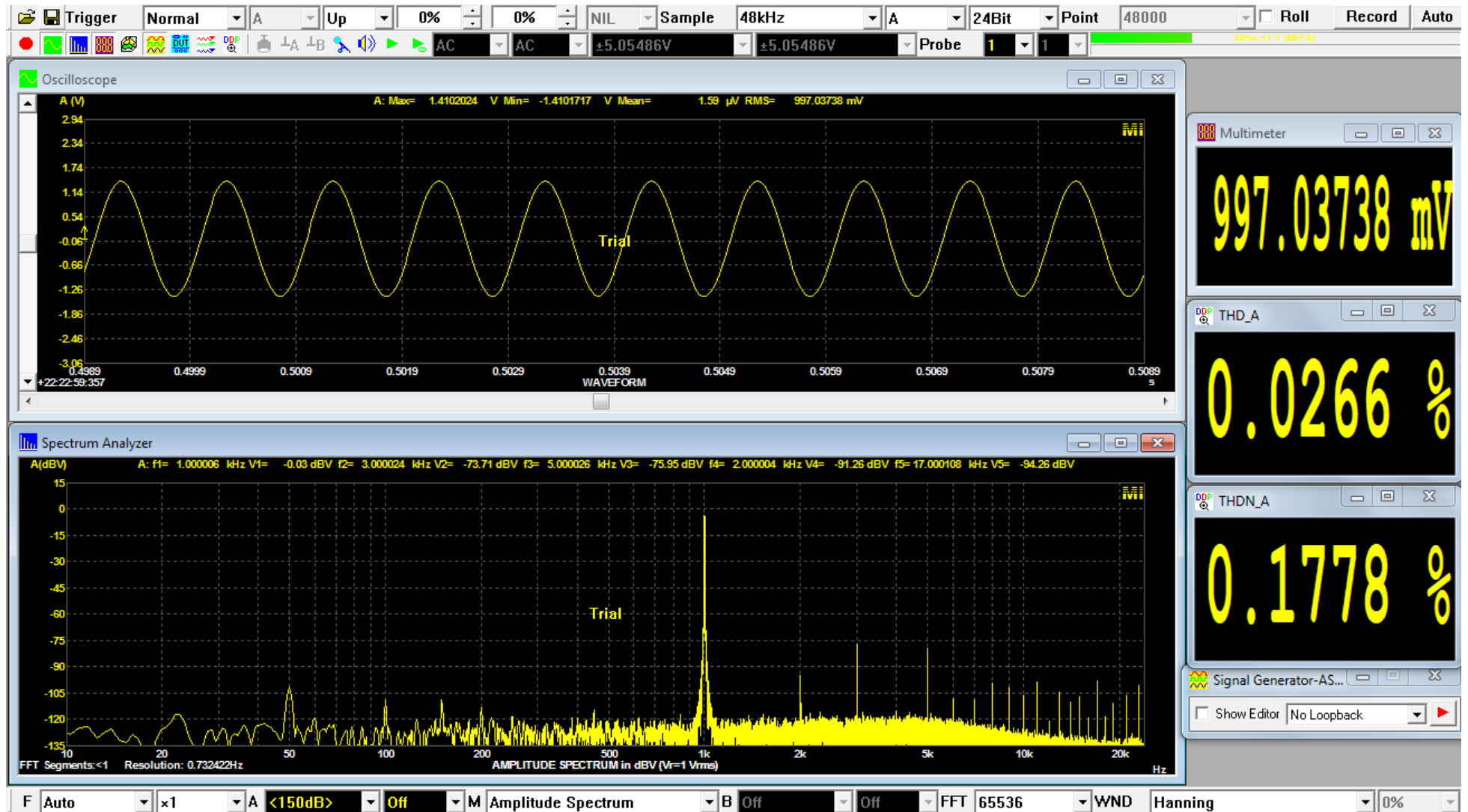
### Harmonics

peak	frequency [Hz]	amplitude [dB]	amplitude [dBr]
f0	1000	-0,03	
f1	3000	-73,71	-73,68
f2	5000	-75,95	-75,92
f3	2000	-91,26	-91,23
f4	17000	-94,26	-94,23

## 3.2 Plots







## 4 HpW

### 4.1 Summary

#### Config

fs [kHz]	48
bit depth	24
sample duration [sec]	1?
sample points	32768
averages	0
Anal. Bandwidth [kHz]	?
FFT Window	<b>Flat Top</b>

#### Results

Voltage reading [Vrms]	0,99665
THD [%]	0,006682
THD+N [%]	2,156

#### Harmonics

peak	frequency [Hz]	amplitude [dB]	amplitude [dBr]
f0	1000	-0,676	
f1	3000	-73,76	-73,084
f3	5000	-76,417	-75,741
f2	2000	-92,05	-91,374
f3	17000	-94,542	-93,866

#### Config

fs [kHz]	48
bit depth	24
sample duration [sec]	1?
sample points	32768
averages	0
Anal. Bandwidth [kHz]	?
FFT Window	<b>Hanning</b>

#### Results

Voltage reading [Vrms]	0,99665
THD [%]	0,006649
THD+N [%]	2,156

#### Harmonics

peak	frequency [Hz]	amplitude [dB]	amplitude [dBr]
f0	1000	-0,676	
f1	2000	-73,667	-72,991
f3	5000	-76,474	-75,798
f2	5000	-91,509	-90,833
f3	17000	-94,495	-93,819

### 4.2 Plots

### Amplitude Window

Setup Options Help

[Volt] Ch1: 996,827075 mV Ref.: Volt Gain [dB]: 0,000

Item	Value
Calculated at	20:59:05,871
Sample size	32768 (2 <sup>15</sup> )
Samplerate	48,0 kHz
Channels	1
Bit size	24
Calibration: Calibra...	
Level reading:	RMS
Reference level Ch1	1,001580 V
Reference SPL Ch1	20,0 mV/Pa
External gain	0,0 dB
Reference load	8,0 Ohms
Normalized gain Ch1	3,572
Level Ch1	996,827075 mV
dbu Ch1	2,191 dBu
dBFS Ch1	-11,08519 dBFS
Power Ch1	124,208027 mW
Crest factor Ch1	1,414
Mean Ch1	-51,874
StdDev Ch1	1655473,415
Variance Ch1	2740592228233,858
Range Ch1	4682256
Min sample value C...	-2341078
Max sample value C...	2341178
Min at Idx Ch1	14092
Max at Idx Ch1	10036

Calibration: Calibration Default PresetType

### HpW Works 32 : Evaluation < Expires in 10 days >

File Input Output Module Test Options Help

HpW Default PresetType

Sample idle... Ch(s): 1 Dump: Off DumpTree: Off

### FFT2D Win - 1

File FFT Screen Edit Options Help

FFT FFT ANA X/Y: (n/a)

Ch1

dBV

FFT Points = 32768 5-Jul-2017 20:59:05.871 HpW

f(Peak)

1 2 3 5 6 7

SNR = 22.239 dB THD = -83.502 dBFS (0.006682 %) THD+N = -33.324 dB (2.156770 %)

DC = -125.733 dBFS RMS = -0.028 dBV Fs = 48,0 kHz

1: Ch1 Flat-Top, 2 Term BW: None Filter: None Page 1 of 1 - Zoom 1:1

Amplitude Window

Setup Options Help

[Volt] Ch1: 996,763886 mV Ref.: Volt Gain [dB]: 0,000

Item	Value
Calculated at	20:57:08,817
Sample size	32768 (2 <sup>15</sup> )
Samplerate	48,0 kHz
Channels	1
Bit size	24
Calibration: Calibra...	
Level reading:	RMS
Reference level Ch1	1,001580 V
Reference SPL Ch1	20,0 mV/Pa
External gain	0,0 dB
Reference load	8,0 Ohms
Normalized gain Ch1	3,572
Level Ch1	996,763886 mV
dbu Ch1	2,190 dBu
dBFS Ch1	-11,08574 dBFS
Power Ch1	124,192281 mW
Crest factor Ch1	1,414
Mean Ch1	-433,465
StdDev Ch1	1655368,419
Variance Ch1	2740244601206,597
Range Ch1	4682093
Min sample value C...	-2340941
Max sample value C...	2341152
Min at Idx Ch1	9752
Max at Idx Ch1	10832

Calibration: Calibration Default PresetType

HpW Works 32 : Evaluation < Expires in 10 days >

File Input Output Module Test Options Help

HpW Default PresetType

Sample idle... Ch(s): 1 Dump: Off DumpTree: Off

FFT2D Win - 1

File FFT Screen Edit Options Help

FFT FFT ANA X/Y: (n/a)

Ch1

dBV

FFT Points = 32768 5-Jul-2017 20:57:08.817 HpW

f(Peak)

1 2 3 4 5

SNR = 22.238 dB THD = -83.545 dBFS (0.006649 %) THD+N = -33.324 dB (2.156767 %)

DC = -135.655 dBFS RMS = -0.028 dBV Fs = 48,0 kHz

1: Ch1 Hanning, 2 Term BW: None Filter: None Page 1 of 1 - Zoom 1:1

## 5 WaveSpectra

### 5.1 Summary

#### Config

fs [kHz]	48
bit depth	24
sample duration [sec]	0,5?
sample points	65536
averages	0
Anal. Bandwidth [kHz]	24
FFT Window	<b>Flat Top</b>

#### Results

Voltage reading [Vrms]	
THD [%]	0,02414
THD+N [%]	0,05278

#### Harmonics

peak	frequency [Hz]	amplitude [dB]	amplitude [dBr]
f0	1000	-11,07	
f1	3000	-84,8	-73,73
f2	5000	-86,94	-75,87
f3	2000	-102,81	-91,74
f4	17000	-105,22	-94,15

#### Config

fs [kHz]	48
bit depth	24
sample duration [sec]	0,5?
sample points	65536
averages	0
Anal. Bandwidth [kHz]	24
FFT Window	<b>Hanning</b>

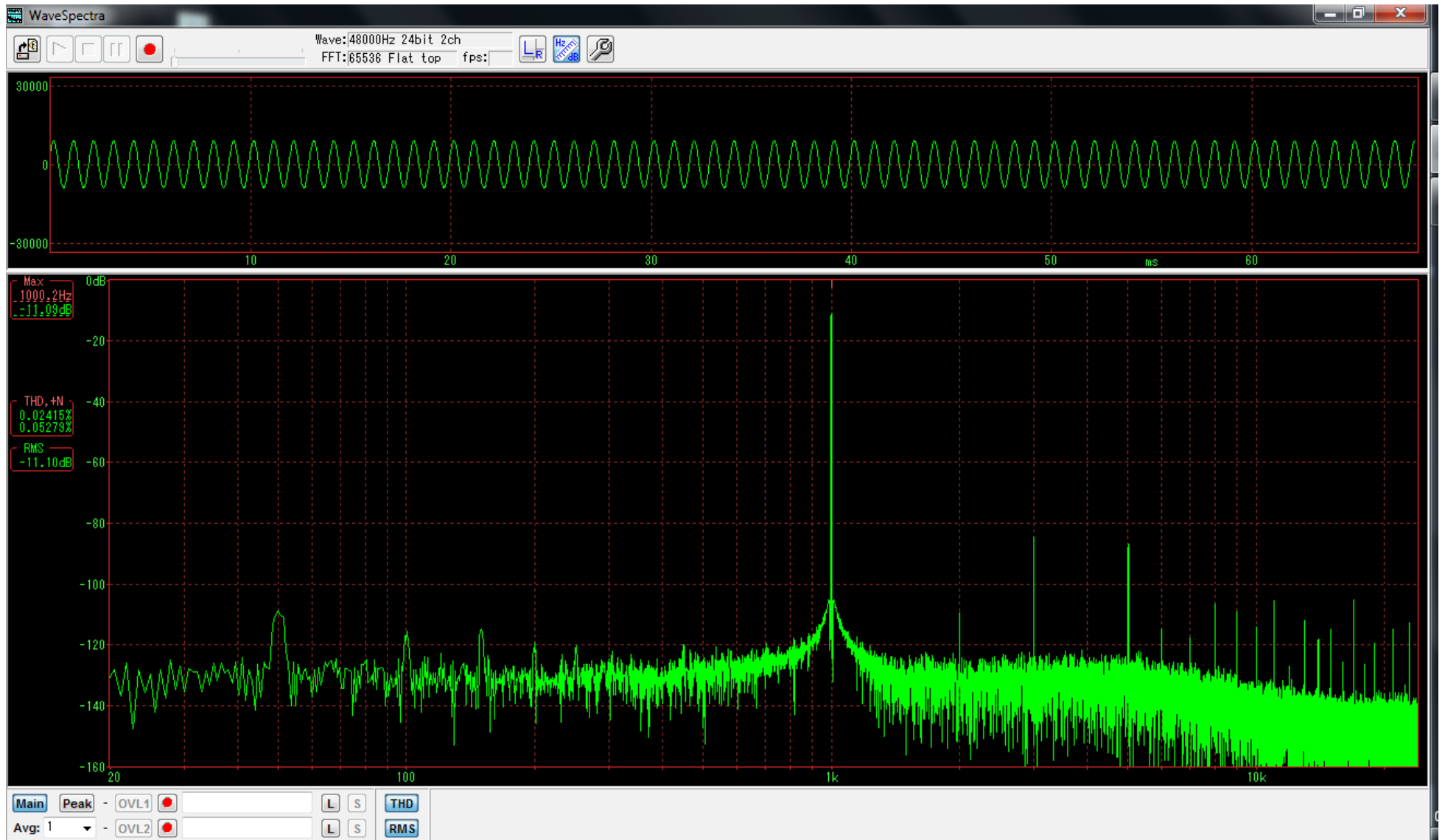
#### Results

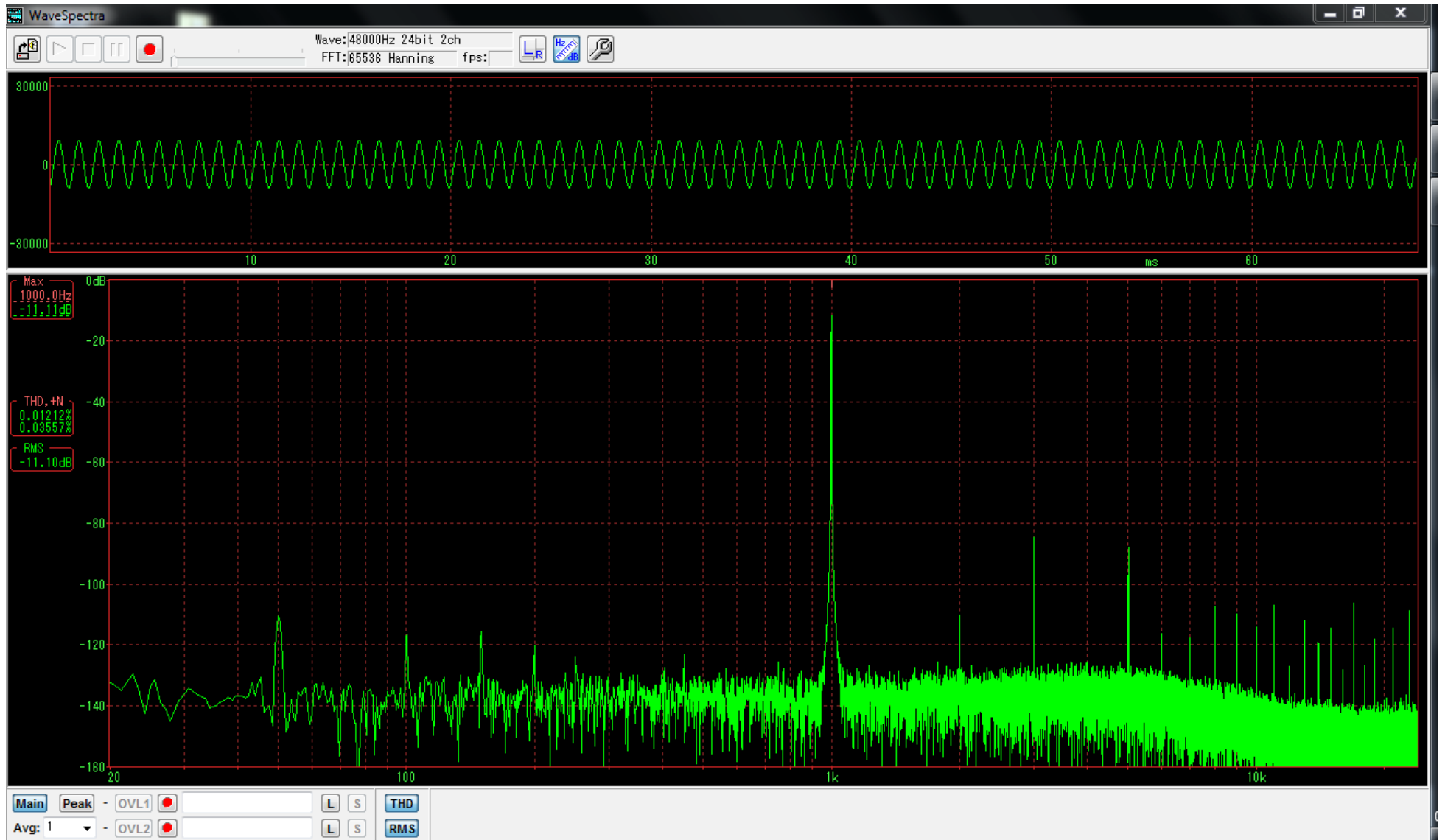
Voltage reading [Vrms]	
THD [%]	0,01215
THD+N [%]	0,03554

#### Harmonics

peak	frequency [Hz]	amplitude [dB]	amplitude [dBr]
f0	1000	-11,09	
f1	3000	-84,78	-73,69
f2	5000	-86,97	-75,88
f3	2000	-103,09	-92
f4	17000	-105,3	-94,21

### 5.2 Plots







## 6 ARTA

### 6.1 Summary

#### Config

fs [kHz]	48
bit depth	24
sample duration [sec]	??
sample points	65536
averages	0
Anal. Bandwidth [kHz]	24
FFT Window	<b>Flat Top</b>

#### Results

Voltage reading [Vrms]	
THD [%]	0,027
THD+N [%]	0,028

#### Harmonics

peak	frequency [Hz]	amplitude [dB]	amplitude [dBr]
f0	1000	0	
f1	3000	-73,62	-73,62
f2	5000	-75,8	-75,8
f3	2000	-92,07	-92,07
f4	17000	-94,02	-94,02

#### Config

fs [kHz]	48
bit depth	24
sample duration [sec]	??
sample points	65536
averages	0
Anal. Bandwidth [kHz]	24
FFT Window	<b>Hanning</b>

#### Results

Voltage reading [Vrms]	
THD [%]	0,027
THD+N [%]	0,027

#### Harmonics

peak	frequency [Hz]	amplitude [dB]	amplitude [dBr]
f0	1000	0	
f1	3000	-73,65	-73,65
f2	5000	-76,8	-76,8
f3	2000	-92,1	-92,1
f4	17000	-95,19	-95,19

### 6.2 Plots

