85. US Speaker and Mic Characteristics **Draft 1.1**

UFO Doctor, Dec. 19h, 2014

1. Material and Method

Speaker: UST-40T, 2.4nF, max. 20V_{RMS}, Diameter 16mm

Receiver: Kobiton 255-400SR10P, 1.8nF,max 0.2W, Diameter 10mm

Method: US-Transmission to an anechoic chamber

2.Test Setup 1

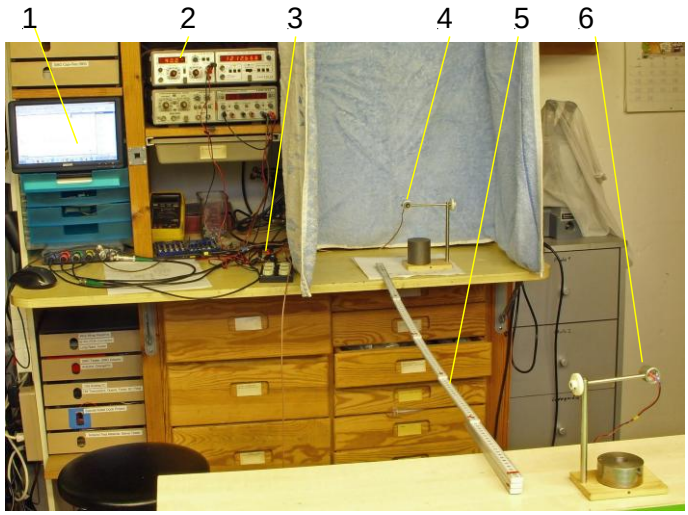
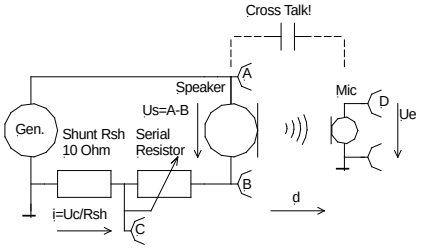


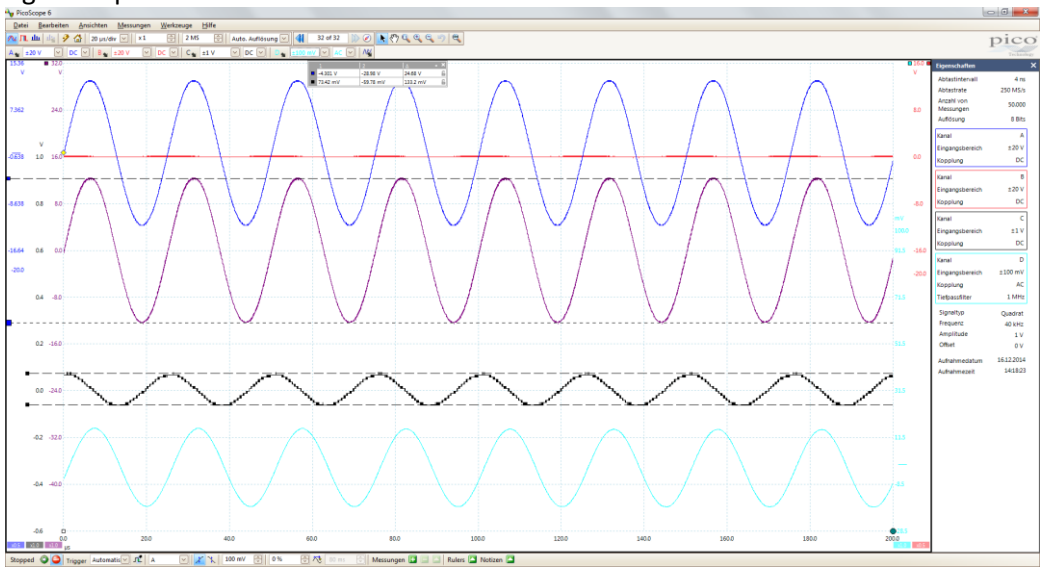
Fig.1: Test Setup 1
1. Scope
2. Sinus generator
   40kHz max. 10V
3. Serial Resistor and Shunt
4. Mic Kobinton
5. Distance d=1m
6. Speaker UST-40T



3. Experimental Results with Test Setup 1

3.1. Screen Shot PicoScope, full US-Power with 8.4Veff at speaker

Fig.2: Scope data with Serial Resistor=0 Ohm



Signals from top to bottom: A, B, A-B (Voltage at Speaker), C (Current into Speaker) and D (Received)

Comments: The Speaker Voltage A-B is not perfectly in phase with the current C, making real power consumption calculation difficult. The impedance of the speaker depends on many factors such as frequency, voltage, current and also on environment conditions (e.g. reflections)!

3.2. Evaluated Data for variable Input Voltage at distance d=1m

Rs kOhm	Is eff mA	Ueff	P mVA	Umic mV
0	4.48	8.5	38.2	23.85
1	3.70	7.1	26.1	19.24
10	0.76	1.9	1.4	4.07
100	0.09	0.9	0.1	3.38

Fig. 3a:
Variable Serial Resistor
0 to 100 kOhm

Generator 4
0kHz: 8.4Veff

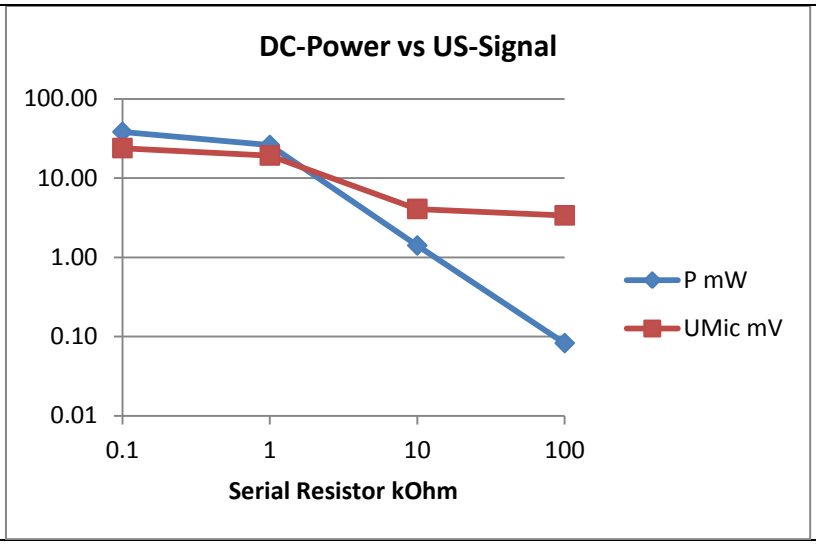


Fig. 3b:
DC-Power into Speaker and received US-Signal

Note: Due to capacitive cross talk between Speaker and Mic the Mic reception data are more or less correct for Serial Resistor 0 to 10 kOhm only!

3.3. Data with UST-40 and Kobinton Speaker to Kobitone Mic

Receiver: Kobiton R with 37dB Amplifier, Distance 1m

1: UST-40 Speaker directed to Receiver

2: Kobiton Speaker directed to Receiver

3: Kobiton Omnidirectional Speaker

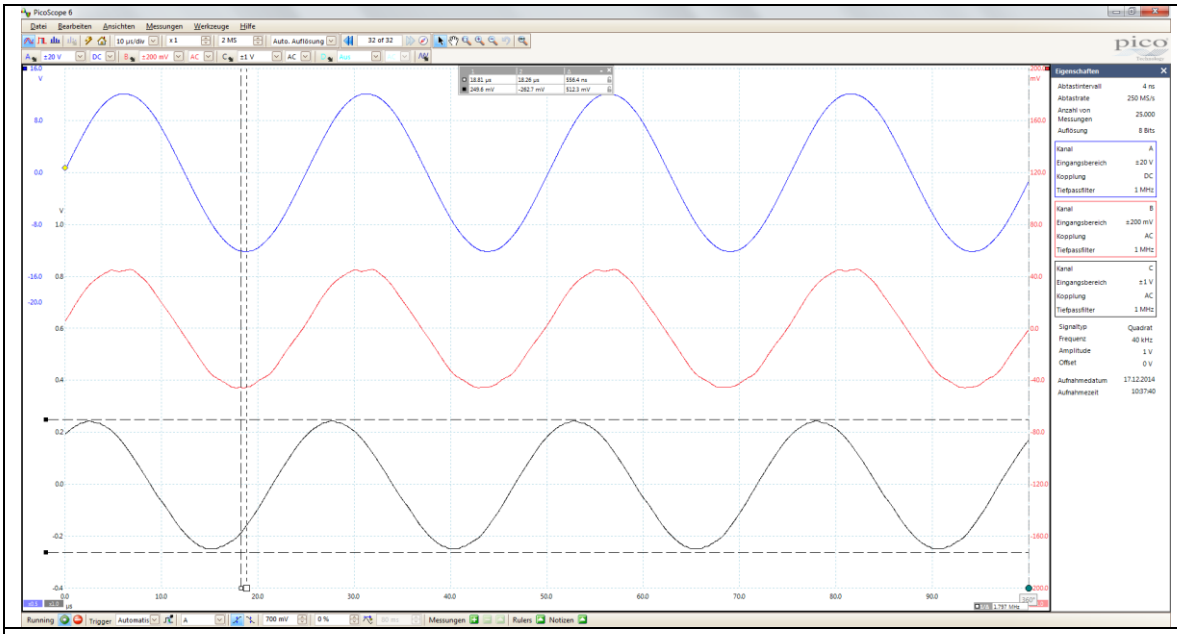


Fig. 5: Scope data at 40 kHz, Series 3 with omnidirectional Speaker
Top A:Voltage at Speaker; Middle B: Voltage at 10 Ohm Shunt, Below C: Received Voltage
Note: Since the speaker is primarily a capacitor, the input current appears about 0.5 to 5 usec before the supply voltage! The maximum phase angle, depending on frequency, was 84 degree, meaning a Cos phi is 0.1.This leads to high current, high apparent but low effective power.

3.4. Evaluated Data, with complex apparent (VA) and effective power (W)

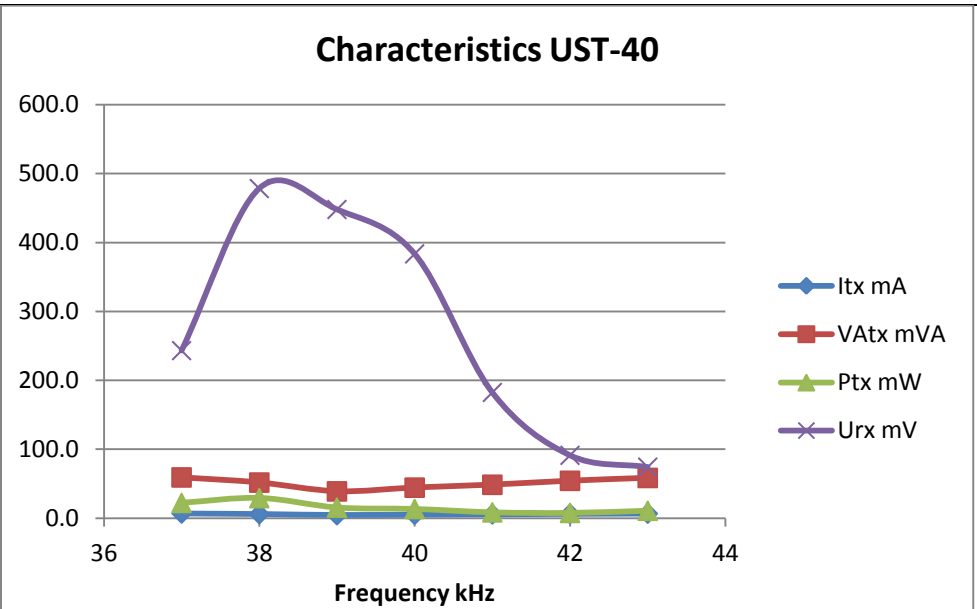


Fig. 6a:
40kHz:
13mW@
24.5Vpp
= 8.6Vrms

Received:
380mV

Very efficient!

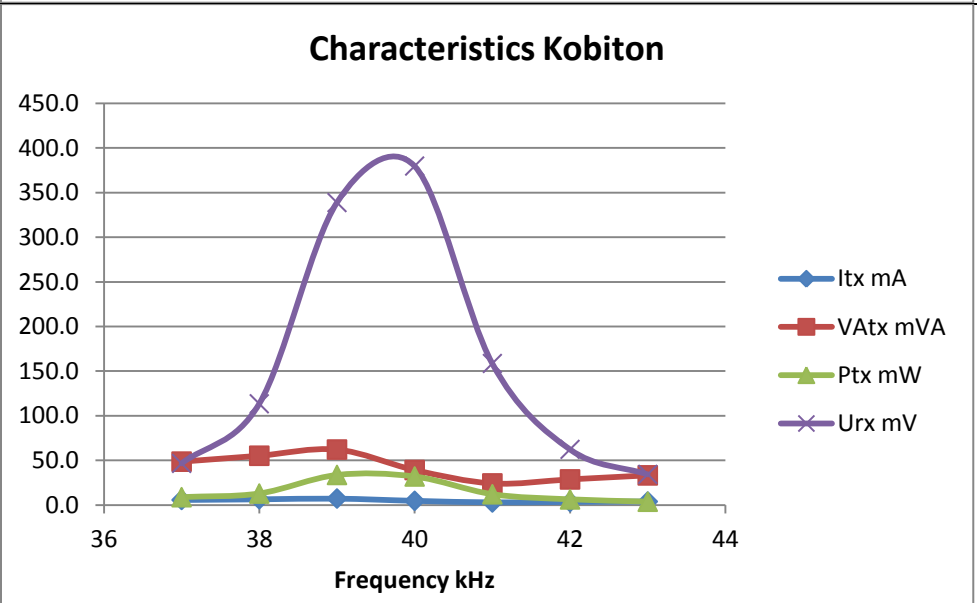


Fig. 6b:
40kHz:
32mW@
24.6Vpp
= 8.6Vrms

Received:
380mV

Less efficient

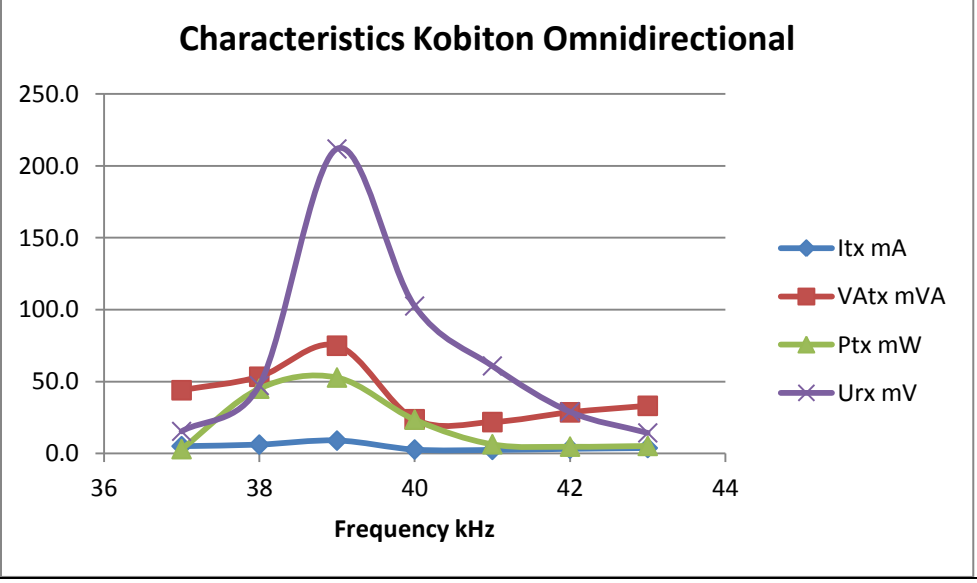


Fig. 6c:
40kHz:
24mW@
24.3Vpp
= 8.5Vrms

Received:
100mV

Quite good for omidirectional speaker!
Note the resonance shift from 40kHz to 39kHz!

3. Experimental Results with Test Setup 2

- Mama Duck omnidirectional Kobiton Speaker, with voltage Doubler
- Baby Duck with Kobiton Mic, First BP Stage 37dB, Bandwidth ca. 20 to 100 kHz
- Transmitting Distance 1m
- US-Low power: Serial resistor 10kOhm in Speaker line
- US-High power: No resistor in Series in Speaker line
- Speaker data measured with HP Multimeter 974A, received signal measured by PicoScope

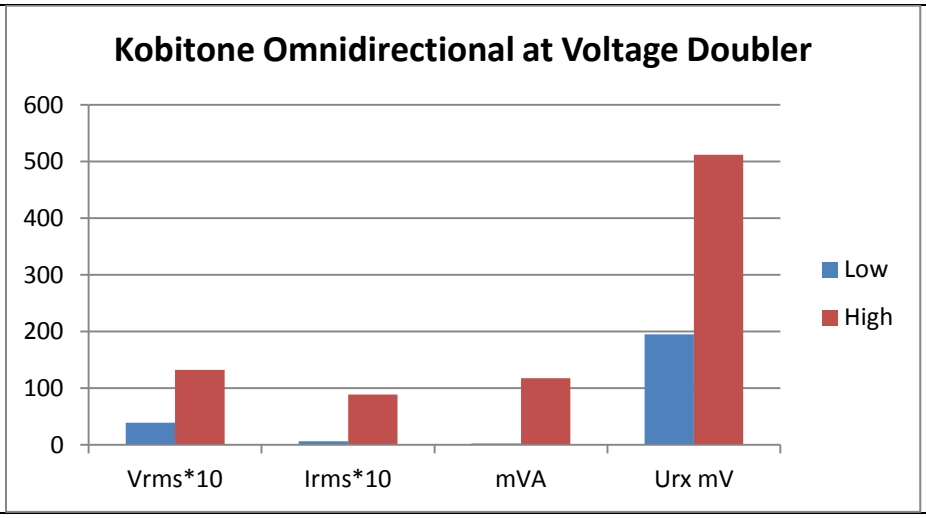


Fig. 7a:

The received Voltage is about proportional to the applied speaker voltage:

Receive Voltage factor 2.63
Supply voltage factor 3.39

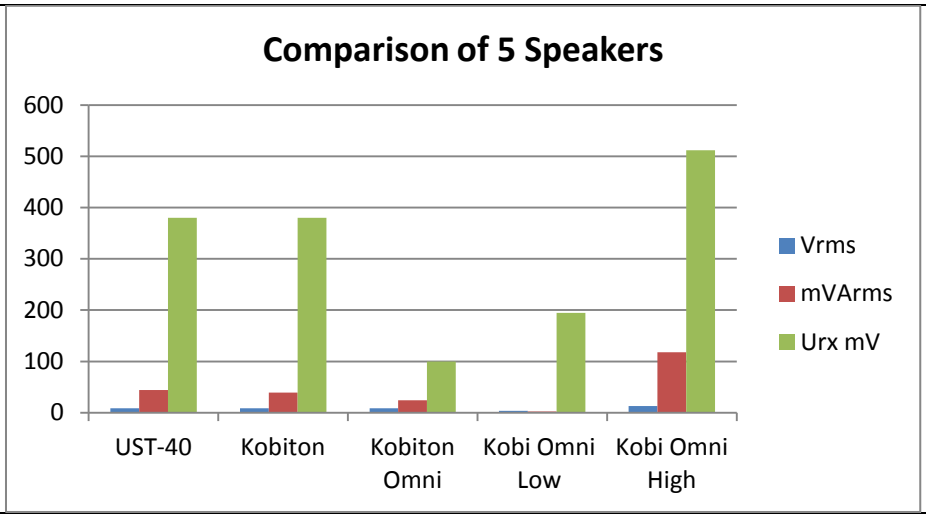


Fig. 7b:

The received signal from the Kobinton Omnidirectional at 13.2Vrms is comparable with the signal from the unidirectional UST-40 at 8.5V

4. Outdoor experimental data

Material:

- Kobiton TX omnidirectional speaker at 15.6V voltage doubler supply
- 2 x Kobiton RX, lateral distance 12.7mm
- Lock-in Distance >30 m
- Good Direction Detection > 20m
- Detection Angle: about +/-15 Degree

This looks good now, except the narrow reception angle!