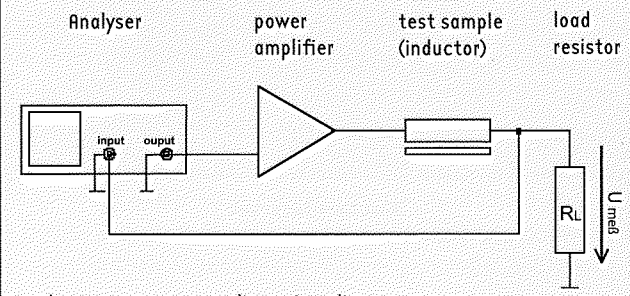
TEST SET-UP

2.1 Measurement to determine the saturation current:

Principal circuit diagram of the measuring system



Analyser: Audiomatica Clio
Amplifier: Solton
Load Resister: Wire Resistor (4 Ohm, 1000 Watt)

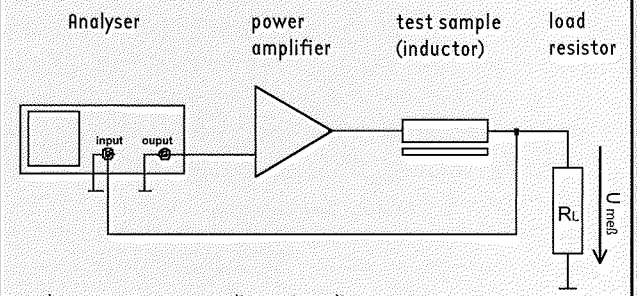
In the measuring setup the inductor operates as a longitudinal inductance in a 6 dB low-pass filter. The current through the load resistor leads to a voltage drop (Umeß), which is investigated in terms of distortion elements. To determine the saturation current Umeß is applied to the input of the analyser. On the one hand the voltage value is determined (out of which the current through the inductor is computed), on the other hand the distortion factor is measured. The level of the measuring signal that is displayed at the output and that supplies the power amplifier is steadily increased at a fixed frequency of 40 Hz whereby the current through the inductor mounts correspondingly. The saturation region is reached when the distortion factor rises strongly. 1% THD (aggregate distortion factor) has been specified as the threshold for the determination of the saturation current.

The results are found in chapter *3 Interpretation* and *3.1. Table Saturation Currents*

Notes:
The measurements were limited to the determination of the saturation current of ferrite core inductors. *(see explanation in 1.1.)*

2.2 Measurement for the comparative demonstration of the K3 harmonic fraction at different outputs

Principal circuit diagram of the measuring system



Analyser: Audiomatica Clio
Amplifier: Solton
Load Resister: Wire Resistor (4 Ohm, 1000 Watt)

In the measuring setup the inductor operates as a longitudinal inductance in a 6 dB low-pass filter. The current through the load resistor leads to a voltage drop (Umeß).
In the same way as in the measuring setup to determine the saturation current Umeß is applied to the input of the analyser. The output feeds the power amplifier with a slip sinus signal. The voltage Umeß is analysed for the K3 harmonic fraction. A measuring graph, where the distortion k3 (Y-axis) is plotted versus the frequency (x-axis), is obtained.
The point of the measurement was not to determine the absolute value of the K3 component, but the comparative illustration of the traits of different types of core inductors. On this account the measurement of the appropriate (distortion free) air core inductor is included as an additional graph for comparison and orientation. The measurements were conducted for three voltages (for the investigation of the behaviour at different modulations) at the input of the inductor.
Test series U2 with 2.0 V (corresponds to a power output of 1 Watt at 4 Ohm)
Test series U2 with 4.0 V (corresponds to a power output of 4 Watt at 4 Ohm)
Test series U2 with 9.0 V (corresponds to a power output of 20 Watt at 4 Ohm)
The results are found in chapter *3 Interpretation* and *3.2. K3 distortions of different core types and core materials.*

INTERPRETATION

FERRITE INDUCTORS SATURATION CURRENTS

Inductor type	L-Result/mH	0,68	1,00	1,50	2,20	3,30	4,70
HQR32/26	Isät / A >	6,91	5,69	4,65	3,49	3,13	2,15
	Performance an 4 Ohm / W	190,73	129,69	86,46	48,72	39,30	18,47
	Performance an 8 Ohm / W	381,45	259,39	172,92	97,44	78,60	36,94

Inductor type	L-Result/mH	0,68	1,00	1,50	2,20	3,30	4,70
HQP43/40	Isät / A >	12,46	10,28	8,39	6,30	5,66	3,88
	Performance an 4 Ohm / W	621,50	422,62	281,75	158,76	128,07	60,19
	Performance an 8 Ohm / W	1243,00	845,24	563,49	317,52	256,13	120,39

Inductor type	L-Result/mH	0,68	1,00	1,50	2,20	3,30	4,70
HQP56/35	Isät / A >	20,50	16,90	13,80	10,36	9,30	6,38
	Performance an 4 Ohm / W	1680,66	1142,85	761,90	429,32	346,32	162,78
	Performance an 8 Ohm / W	3361,31	2285,69	1523,79	858,64	692,63	325,55

Inductor type	L-Result/mH	0,68	1,00	1,50	2,20	3,30	4,70
HQ40/30	Isät / A >	16,42	13,54	11,06	8,30	7,45	5,11
	Performance an 4 Ohm / W	1078,74	733,54	489,03	275,56	222,29	104,48
	Performance an 8 Ohm / W	2157,47	1467,08	978,05	551,12	444,57	208,96

Inductor type	L-Result/mH	0,68	1,00	1,50	2,20	3,30	4,70
HQ43/45	Isät / A >	10,19	8,40	6,86	5,15	4,63	3,17
	Performance an 4 Ohm / W	415,31	282,41	188,27	106,09	85,58	40,22
	Performance an 8 Ohm / W	830,62	564,82	376,55	212,18	171,16	80,45

Inductor type	L-Result/mH	0,68	1,00	1,50	2,20	3,30	4,70
HQ58	Isät / A >	13,81	11,39	9,30	6,98	6,27	4,30
	Performance an 4 Ohm / W	762,90	518,77	345,85	194,88	157,20	73,89
	Performance an 8 Ohm / W	1525,81	1037,55	691,70	389,76	314,41	147,78

Inductor type	L-Result/mH	0,68	1,00	1,50	2,20	3,30	4,70
DR56/35	Isät / A >	23,78	19,61	16,01	12,02	10,80	7,40
	Performance an 4 Ohm / W	2262,39	1538,43	1025,62	577,92	466,19	219,12
	Performance an 8 Ohm / W	4524,79	3076,85	2051,24	1155,84	932,38	438,24

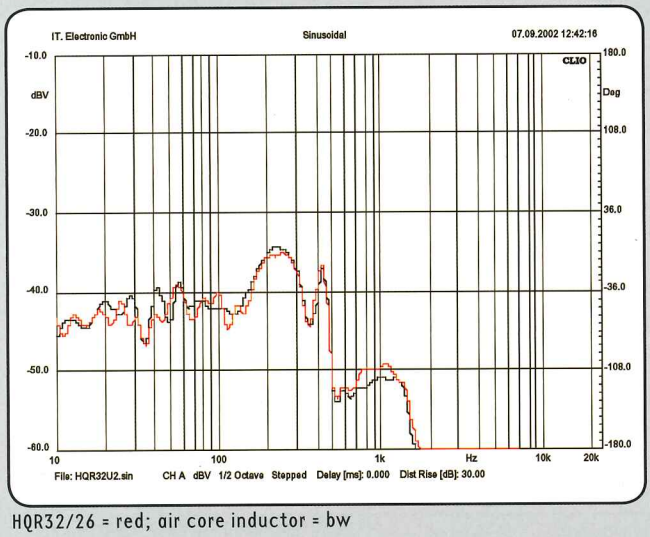
Inductor type	L-Result/mH	0,68	1,00	1,50	2,20	3,30	4,70
DR56/61	Isät / A >	26,57	21,91	17,89	13,43	12,06	8,27
	Performance an 4 Ohm / W	2824,30	1920,53	1280,35	721,46	581,98	273,54
	Performance an 8 Ohm / W	5648,60	3841,05	2560,70	1442,92	1163,95	547,08

Inductor type	L-Result/mH	0,68	1,00	1,50	2,20	3,30	4,70
HQG36	Isät / A >	5,28	4,36	3,56	2,67	2,40	1,64
	Performance an 4 Ohm / W	111,63	75,91	50,61	28,52	23,00	10,81
	Performance an 8 Ohm / W	223,26	151,82	101,21	57,03	46,01	21,62

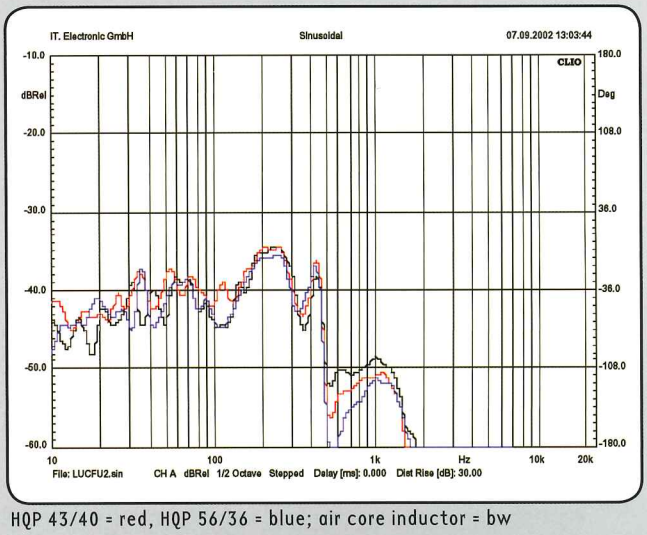
Inductor type	L-Result/mH	0,68	1,00	1,50	2,20	3,30	4,70
HQG52	Isät / A >	14,58	12,02	9,82	7,37	6,62	4,54
	Performance an 4 Ohm / W	850,54	578,37	385,58	217,27	175,26	82,38
	Performance an 8 Ohm / W	1701,08	1156,73	771,16	434,54	350,53	164,75

INTERPRETATION

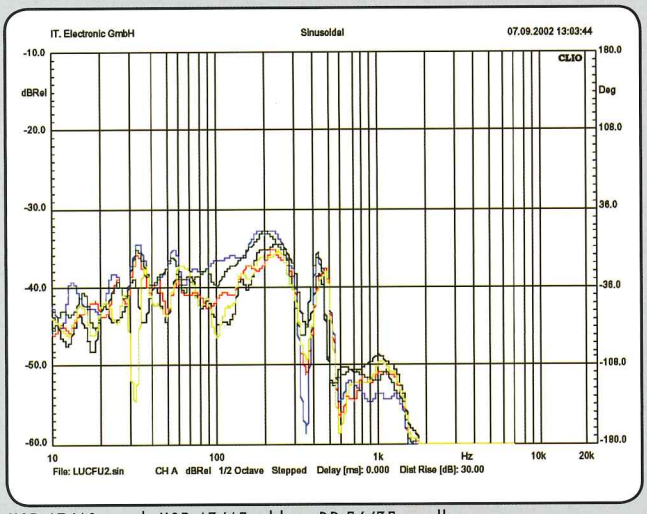
3.2 K3 distortions of different core types and core materials.
3.2.1 Measurement with Ue = 2V (L=2.2 mH)



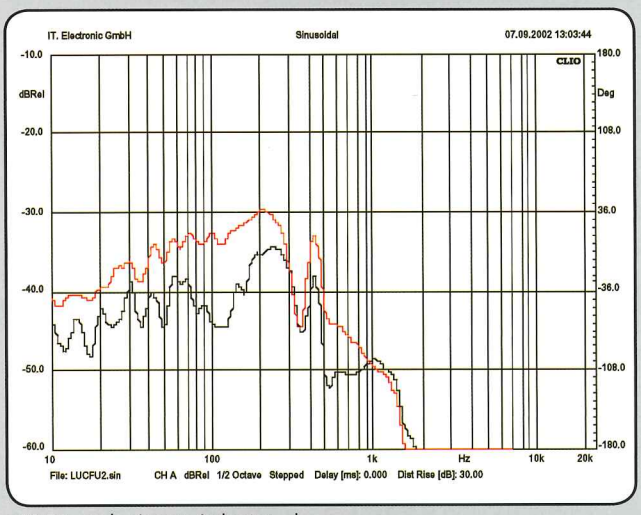
HQR32/26 = red; air core inductor = bw



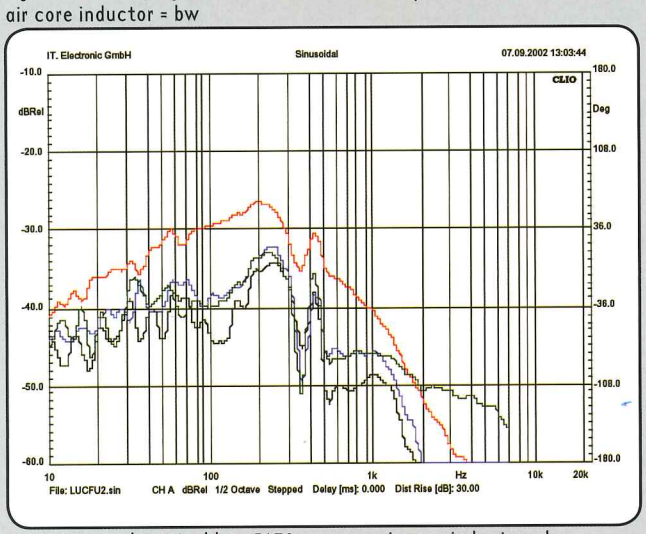
HQP 43/40 = red, HQP 56/36 = blue; air core inductor = bw



HQP 43/40 = red, HQP 43/45 = blue, DR 56/35 = yellow;
air core inductor = bw

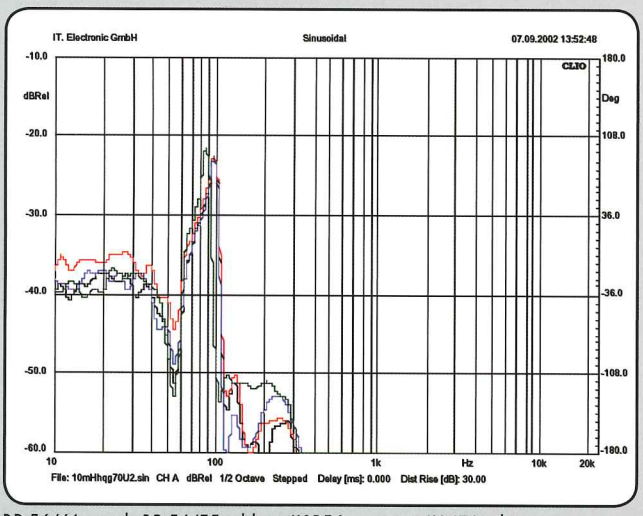


HQG 36 = red; air core inductor = bw

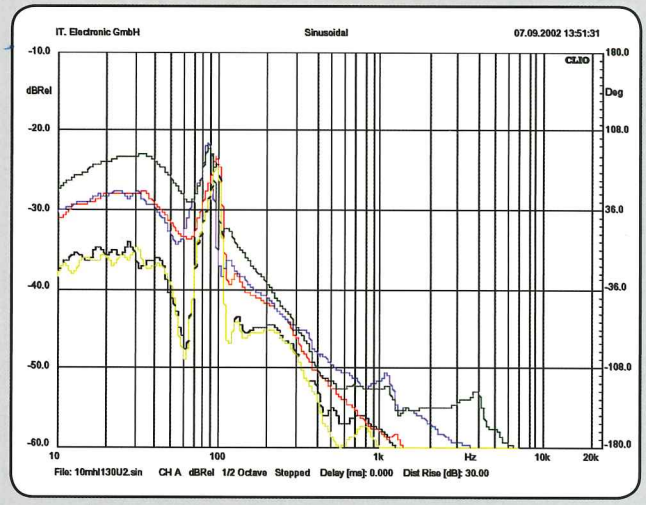


CO 62/41 = red; I 96 = blue; I130 = green; air core inductor = bw

INTERPRETATION

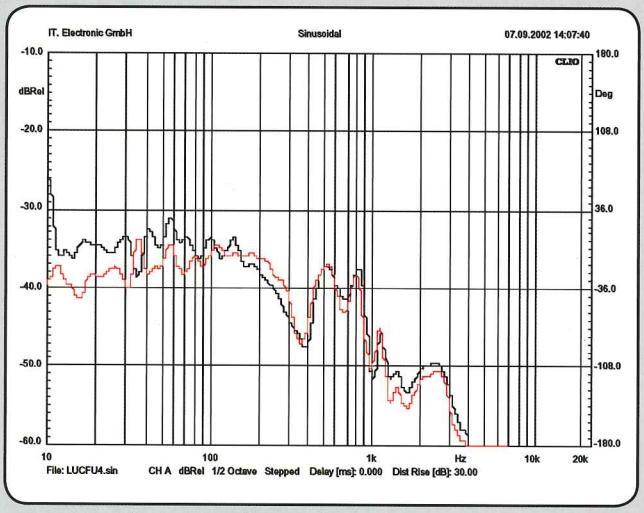


DR 56/61 = red; DR 56/35 = blue; HQP56 = green; HQ670 = bw

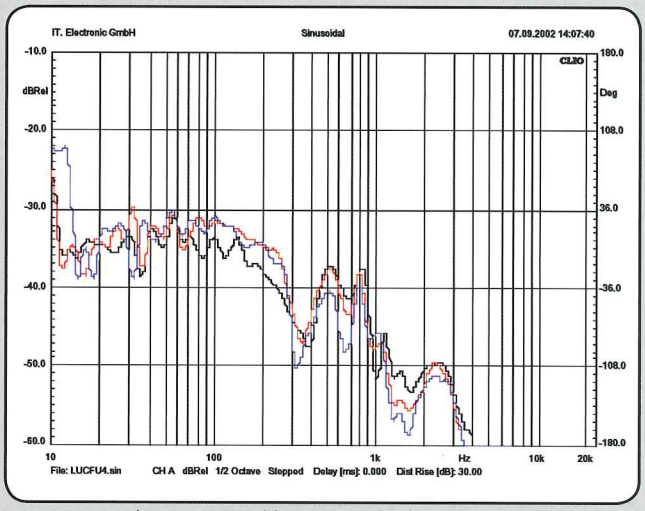


E 96 = red; E 130 = blue; T0 = green; I96 = yellow; I 130 = bw

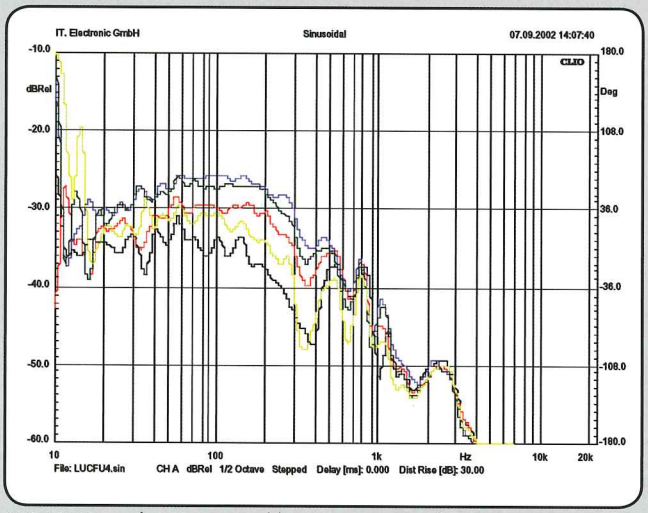
3.2.2. Measurement with Ue = 4V (L=2,2 mH)



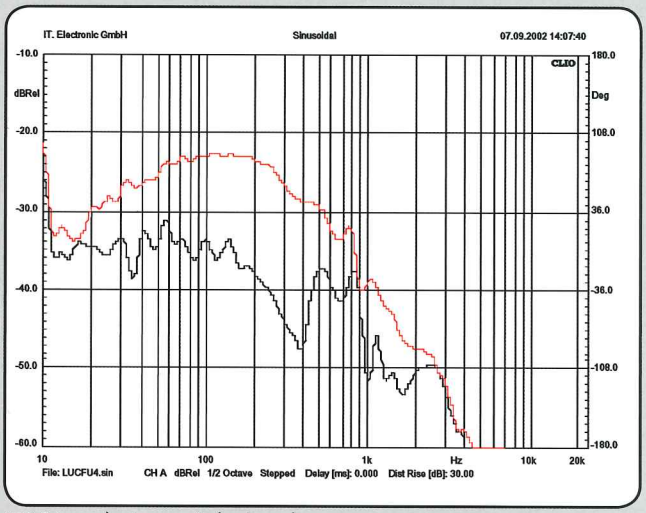
HQR32/26 = red; air core inductor = bw



HQP 43/40 = red, HQP 56/36 = blue; air core inductor = bw

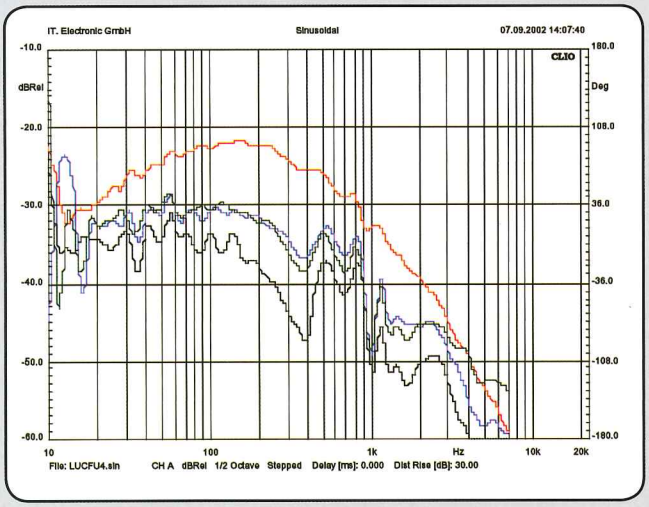


HQP 43/40 = red, HQP 43/45 = blue, DR 56/35 = yellow;
air core inductor = bw



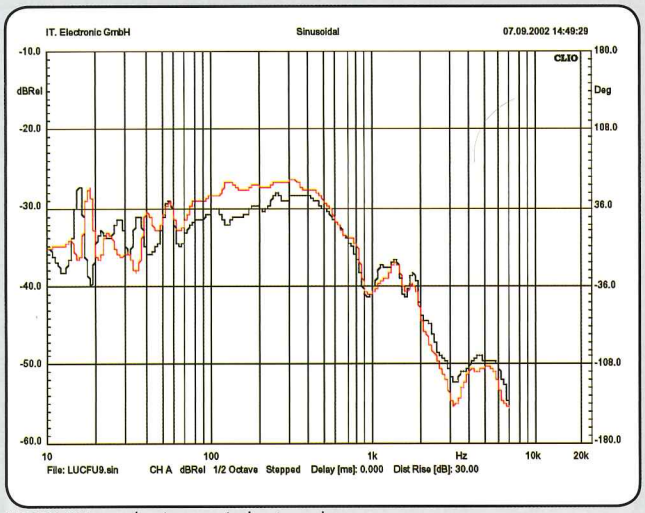
HQG 36 = red; air core inductor = bw

INTERPRETATION

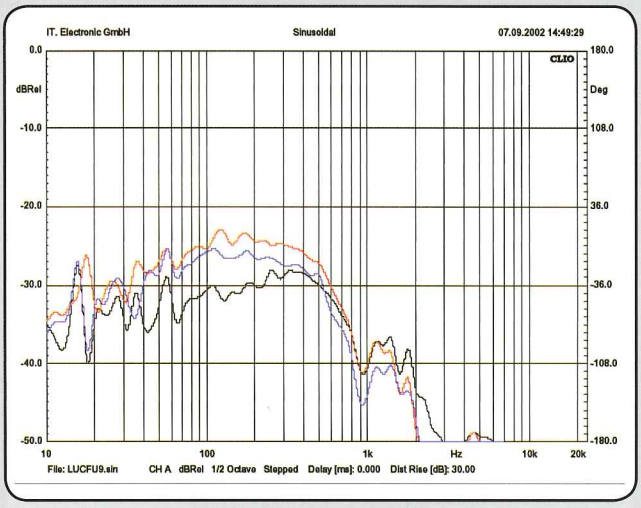


CO 62/41 = red; I 96 = blue; I130 = green; air core inductor = bw

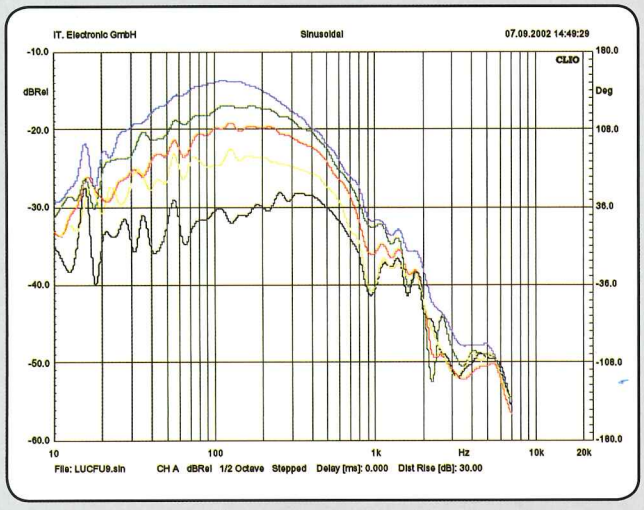
3.2.3. Measurement with Ue = 9V (L=2,2 mH)



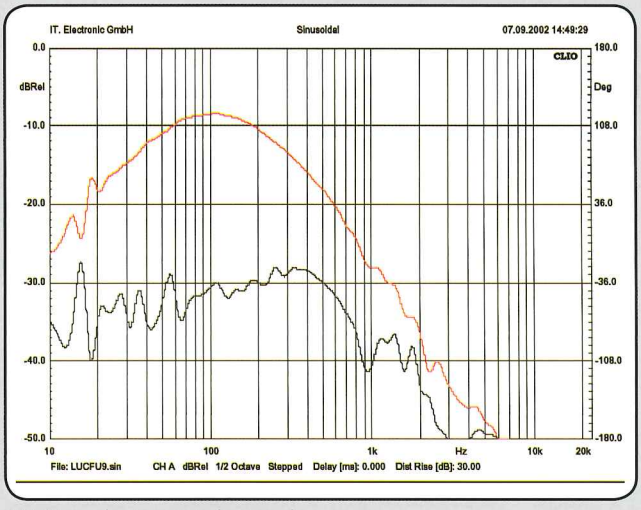
HQR32/26 = red; air core inductor = bw



HQP 43/40 = red, HQP 56/36 = blue; air core inductor = bw

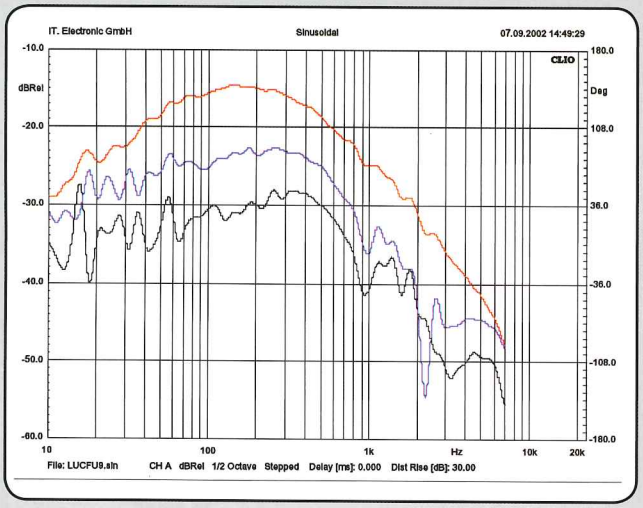


HQ40/30=rot; HQ43/45=blau; HQ58=grün; DR56/35=gelb; Luftspule=sw



HQG 36 = red; air core inductor = bw

INTERPRETATION



C0 62/41 = red; I 96 = blue; I130 = green; air core inductor = bw

3.3. Conclusions from the measurement results and application recommendations

Observation concerning saturation current:

When selecting an inductor on the basis of the table in 3.1. the operation of the inductor close to the saturation region is to be avoided at any rate.

Some reserves should be taken into account.

When an inductor with high inductance (lower sound region, low partition) is needed, a decision in favour of an iron core inductor should be considered at any rate. The basic distortion behaviour (with the exception of the types I96 and I 130) is not so good indeed, whereas the human ear is barely susceptible for distortions in the low frequency region.

Observation concerning the basic distortion behaviour:

From the graph it is apparent that the ferrite inductor types HQR (Pin Core), HQP (Mushroom Style Core), HQ (Bobbin Style Cores HQ 40 and DR56) as well as the iron core inductors I 96 and I 130 show a very low distor-tion level. The bobbin style core type HQ43 and the small bell core inductor HQG 36 do not show such good qualities among the ferrite inductors. Among the iron core inductors the sintered metal core inductors (C055; C062) and the E-core types E96 and E130 stand out through increased distortion values.