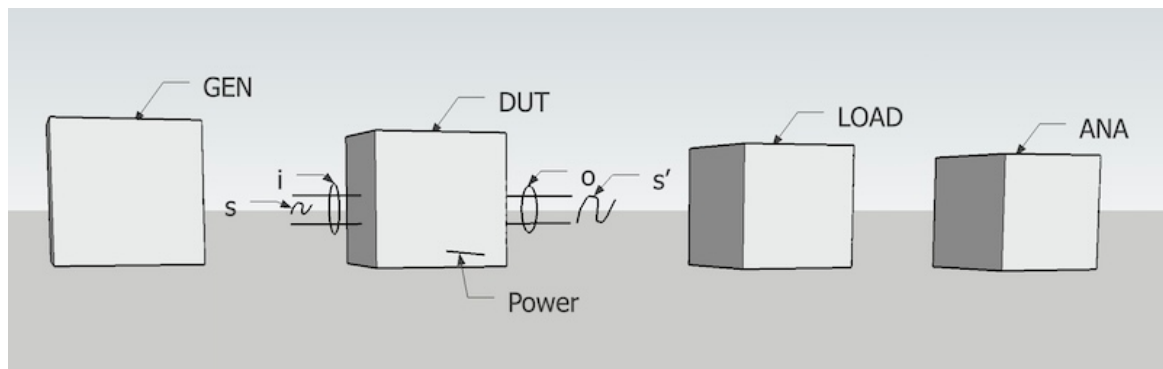


diyaudio AFOM contribution...



by diyaudio.com member TNT

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Rev A

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Below is a suggestion for the structure of a specification for evaluation of Amplifier performance. Italics are descriptions and should not be present in released document, but remain during writing.

The term “tbd” is used if data is missing or being guesstimated by the author of this draft.

AMPLIFIER AVALUATION

Date, Revision (*letter A...Z*)

1. FOREWORD (Background etc)

Ipsum lorem

2. PURPOSE

To serve as a definition of a complete set of measurements to characterise an Amplifiers performance along with a one figure score (D) that describe the amplifiers total merits. This performance score can be used to compare amplifiers and where an amplifier with a higher score will represent one that will amplify a signal with less error.

3. PREREQUISITIES

To accept the strategies in this document one has to agree to:

- the idea is to make an evaluation standard for amplifiers of electric signals.
- the idea is to make a ranking system for amplifiers.
- the ranking shall be based on a “sum” of several different performance aspects.
- the evaluation shall be independent of amplifier technology. If it isn't, it becomes a design guide for different class amplifiers which is not the goal.
- the end goal is to reduce error in electrical signal amplification in general.
- it must be accepted that exchanging an amp in a sound system with one that has less amplification “errors” may result in subjectivity less attractive sound quality for some users.
- that good engineering involves using a safety factor for dimensioning.
- that a human can never listen to an amplifier as the human don't expose an compatible electrical interface.
- tbd

4. DEFINITIONS

4.1. Amplifier

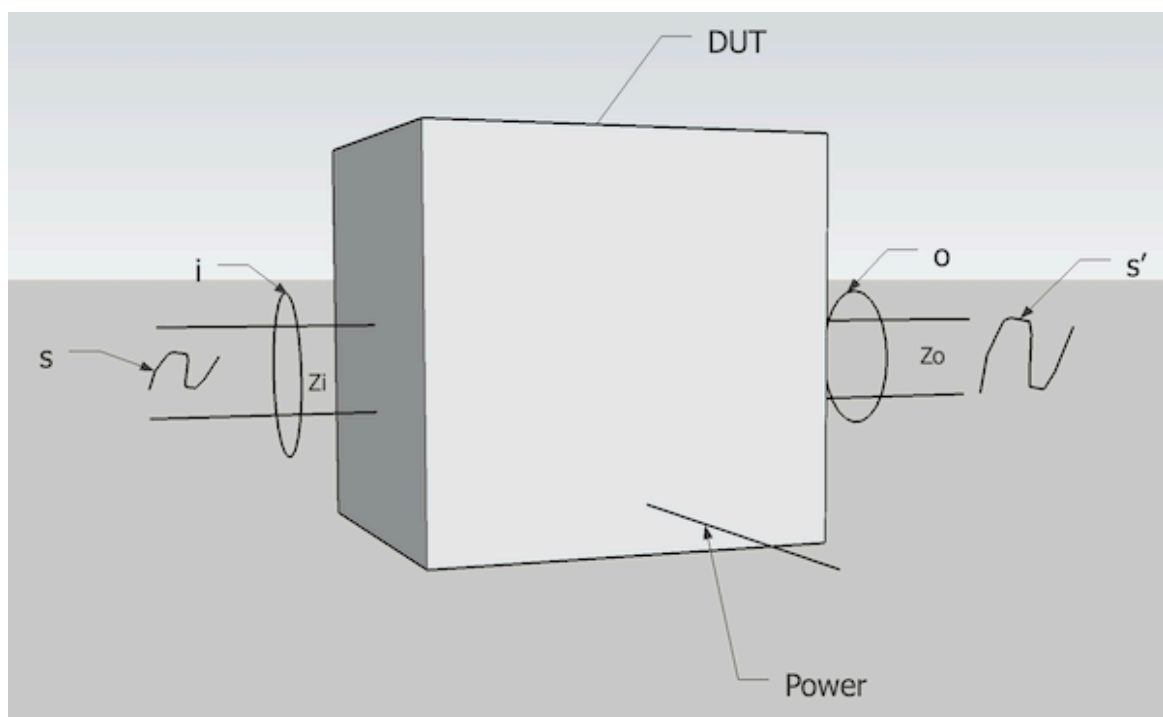
In this context: An electrical appliance that performs a multiplication (aka amplification) with a factor G on the input signal (s) to produce an output signal (s') and, an impedance input (i) to output (o) transformation Z_i - Z_o . The output signal (s') will deviate from a pure multiplication (G) of its input (s) due to errors (E) in the amplifier. The Amplifier is powered via its Power inlet.

4.2. Device function

The amplifier that performs the function $F()$ is the Device Under Test, DUT.
The below model is used to describe the DUT as a 2 pole input, 2 pole output entity fed with power.

(This could be extended to include from DUT radiated magnetic and electrical fields as well as reception of the like.)

The output of an amplifier is a function of it's input, gain and errors.



4.3. Stimuli signal (s , s') spectrum properties

The following list contains the complete aspects that characterise the signal spectrum payload:

- Frequency spectrum (variation)
- Spectrum Level (magnitude)
- Spectrum Phase (time, not relevant at single sinus stimuli)

Spectrum: a stimuli consisting of; DC, single sinus, multi sinus (i.e. multi tone, square wave, saw tooth etc). Also cadences of spectrum groups varying in level may constitute a stimuli.

4.4. User bandwidth

For the purpose of defining a test range of a DUT, the User bandwidth U_{bw} is defined here to 20Hz-20kHz.

4.5. User dynamic

For the purpose of defining a test range of a DUT, the User bandwidth U_{dy} is defined here to 120dB.

4.6. Evaluated bandwidth

For the purpose of limiting the test range of a DUT, the Evaluated bandwidth E_{bw} is defined here to be 2x U_{bw} : 0Hz-40kHz.

4.7. Evaluated dynamic

For the purpose of defining a test range of a DUT, the Evaluated bandwidth E_{dy} is defined here to $U_{dy}+6\text{dB}$: 126dB.

5. ERRORS

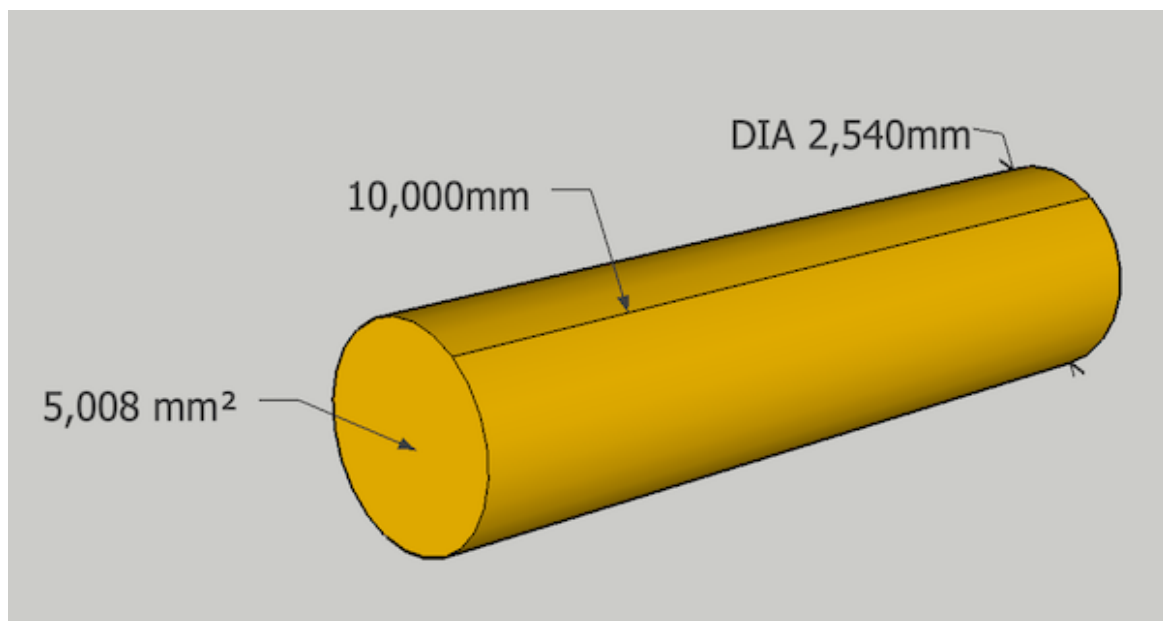
5.1. General

5.2. Reference

As a real world reference (RWR) is suggested: a 0,1 meter (10cm) of a 5mm² / 2,54mm diameter of single core of 99,999 pure copper, elevated 1cm over ground in air @20C - it exposes:

- dc R: 0.0000331 Ω , Resistivity (ρ): $1.678 \times 10^{-8} \Omega \cdot m$ (<https://www.chemandy.com/calculators/round-wire-resistance-calculator.htm>)
- self L: 4.26 nH (<https://www.eeweb.com/tools/wire-self-inductance-calculator/>)
- C: 27.14 pF (<https://www.emissoftware.com/calculator/wire-over-ground-plane-capacitance/>)

What is named in this document as “error” is a DUT deviating in comparison to the RWR.



This represents a “straight wire with gain”. It’s gain is equal to 1.

5.3. Gain error

A deviation from the gain at 1kHz.

Characterised wrt: (meaning that these aspect shall be varied to understand the variations impact on DUTs gain error level)

- frequency (aka frequency response)
- level (compression/expansion)
- load
- power
- environment.

5.4. Spectrum error

The spectrum difference between s' and s when the factor of G has been deducted, aka distortion.

Characterised wrt: (meaning that these aspect shall be varied to understand the variations impact on DUTs spectrum error level)

- frequency
- level
- phase
- load
- power
- environment

5.5. Phase error

The s' spectrum delay in time compared to s .

Characterised wrt: (meaning that these aspect shall be varied to understand the variations impact on DUTs phase error level)

- frequency (aka phase response)

- level
- load
- power
- environment

5.6. Impedance error

A deviation from the nominal specified input and output impedance Z_i and Z_o .

Characterised wrt: (meaning that these aspect shall be varied to understand the variations impact on DUTs impedance error level)

- frequency (aka frequency response)
- level (compression/expansion)
- load
- environment

5.7. EMI susceptibility

tbd

5.8. EMI radiation

tbd

5.9. Power contamination

tbd

6. Power efficiency error

(not in combined score, but presented)

The DUTs deviation from zero use of energy (as per the performance reference RWR) to perform its function calculated as: $100 / (\text{Power consumed} / \text{power transferred})$ to load. (For the RWR it will be $0 / \text{something}$ $\Rightarrow 1/0 \Rightarrow \text{undefined/infinite}$). Always ≤ 1 but if not, lets switch business.

7. Stimuli

7.1. Generator requirements

Generator performance must exceed the DUT performance by 3 times. This means it needs to have 3 times (tbd) less noise, 3 times (tbd) less distortion etc (tbd).

A generator shall expose an output impedance of 1/10 of the driven entity's input impedance.

7.2. Single frequency spectrum

Single sinus stimuli.

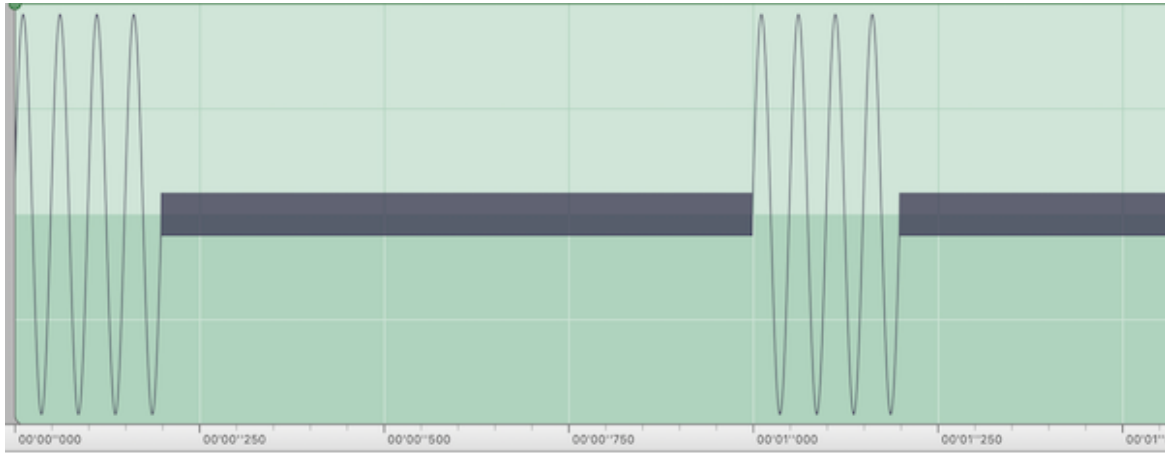
Steeped sweep.

7.3. Multi frequency spectrum

2 tone 18/19kHz standard measurement

20 tone standard measurement.

Cadence of: 200ms 20Hz 95% - 800ms 1kHz 10% - 200ms 20Hz.... tbd...



7.4. Level

Expressed as Watt or dBx where x is: a, u, ... (tbd)

7.5. Phase

Multi tone stimuli may choose to inject some tones at varying phase.

8. LOAD

8.1. General

The load is defined with a cube of R,L an C.

Its must be able to receive the DUTs output power while maintaining its RLC parameters within 5%.

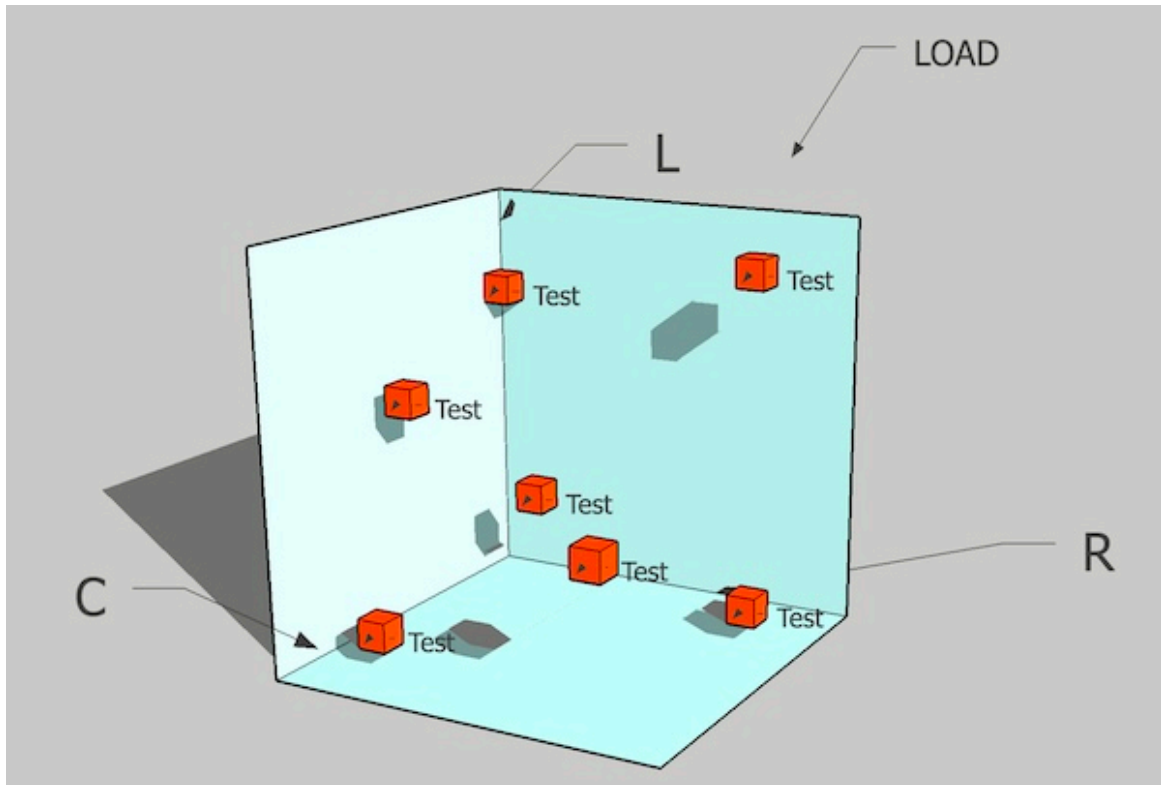
8.2. Resistive load

The “resistive” load to be used shall have less reactive components than:

C: tbd

L: tbd

and be of 2, 4, 8 and 16 ohm at dc.



8.3. Complex load

The complex load shall look like:

tbd.

9. ANALYSER

Requirements: (tbd)

BW: +/- 0,1 dB with Ebw

N: 3 dB better than DUT

Distortion (intrinsic): 3 dB better than DUT

Phase dev: +/- 1 deg within Ebw

min R, max C, max L exposed to DUT and/or LOAD

10. POWER

10.1. General

10.2. Power Level

The power fed to DUT shall be within 5% (tbd) of the nominal specified voltage for the DUT. Current capacity shall exceed the by DUT maximal drawn current at any situation except failure conditions.

10.3. Power THD

The power fed to the DUT shall have less than 3% (tbd) THD spectrum level compared to the mains level when performing DUT evaluation. Special tests for how DUT handles extra dirt mains may be performed.

10.4. Power Noise

Noise on mains line shall be below -30dBc (tbd)

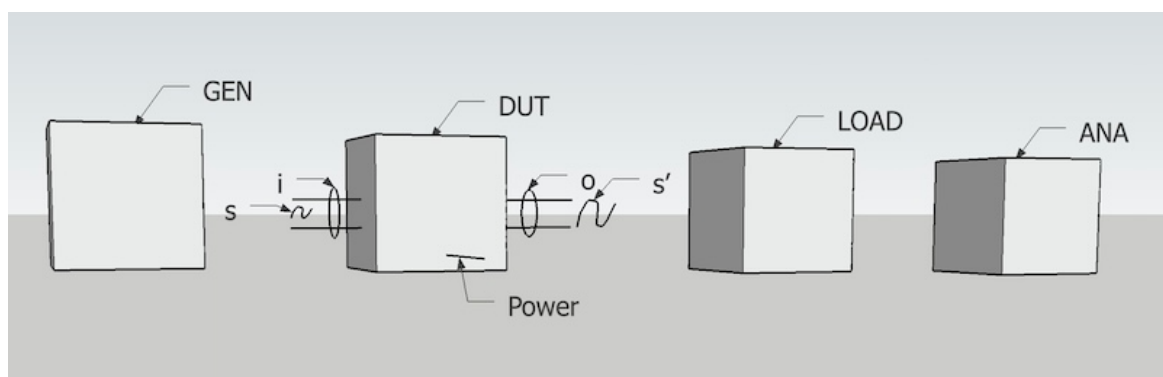
11. ENVIRONMENT

11.1. Temperature

11.2. Humidity

11.3. EMI

12. EVALUATION CONFIGURATION



About test setup - tbd.

13. ERROR QUANTISATION AND SCALE

For each test, define the scale and calculation of ranking score.
tbd.

14. SUMMED SCORE

Describe how to “sum” scores for a single figure off merit.
tbd.

15. RECCOMENDATIONS

16.ABBREVIATIONS

RWR: Real World Reference

17. REFERENCES

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