

# Use of uncertainty for compliance assessment

## Principles of the Eurachem/CITAC Guide

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## Introduction

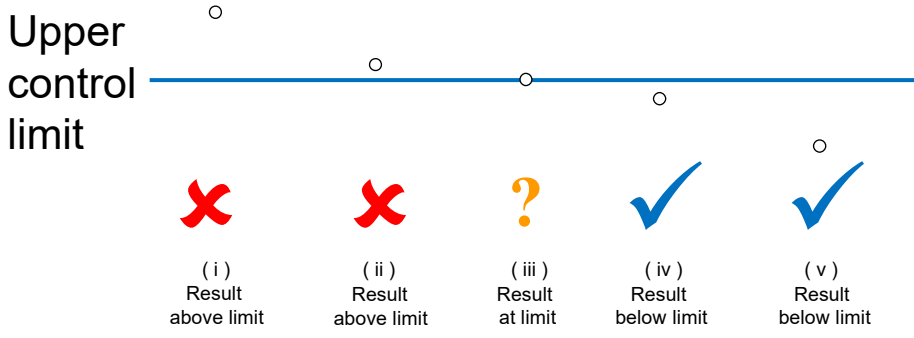
- Many analyses carried out to check compliance with a specification or regulation
- Necessary to take into account the measurement uncertainty when assessing compliance
- How can this be done?
- How does it help to control risk?

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## Basic use of limits



Need additional information to deal with case (iii)

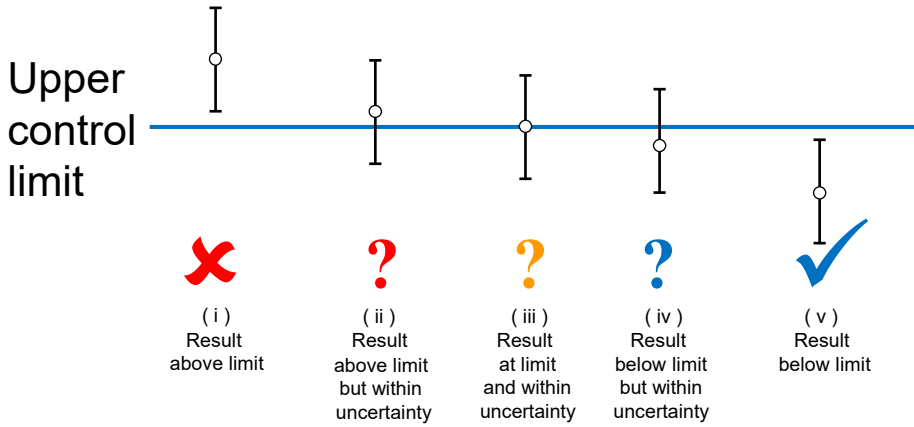


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## Basic guidance



Need additional information to deal with cases (ii) - (iv)



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# Consistent decisions need rules



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## Required information



ASME B89.7.3.1-2001 and similar guidance

- A specification giving upper and/or lower permitted limits
- A decision rule that describes how the uncertainty will be taken into account
- The limit(s) of the acceptance or rejection zone (i.e. the range of results), derived from the measurement result and a stated uncertainty



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## ISO/IEC 17025:2017



- Decision rule:  
“rule that describes how measurement uncertainty is accounted for when stating conformity with a specified requirement”
- §7.1.3: “When the customer requests a statement of conformity...the decision rule shall be clearly defined.”



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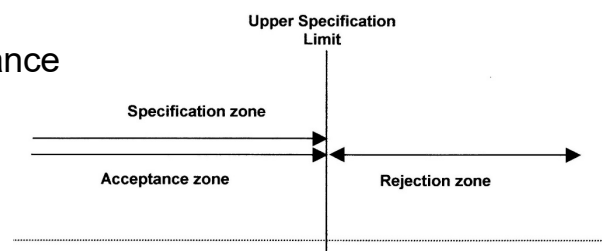
## Example of a decision rule



- A result equal to or above the upper limit implies non-compliance  
– result below the limit implies compliance

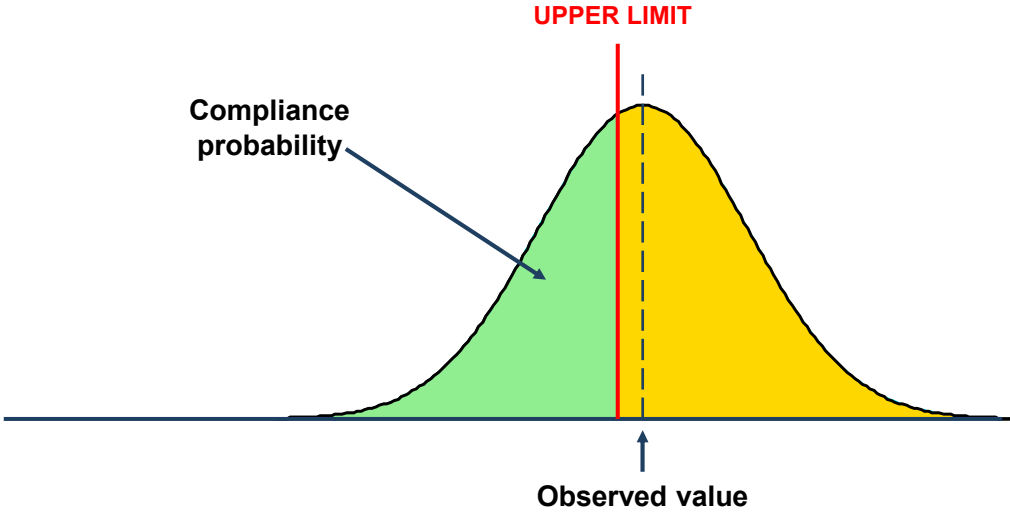
“Simple acceptance”

Also called  
“shared risk”



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# Probability of compliance



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## Small uncertainty

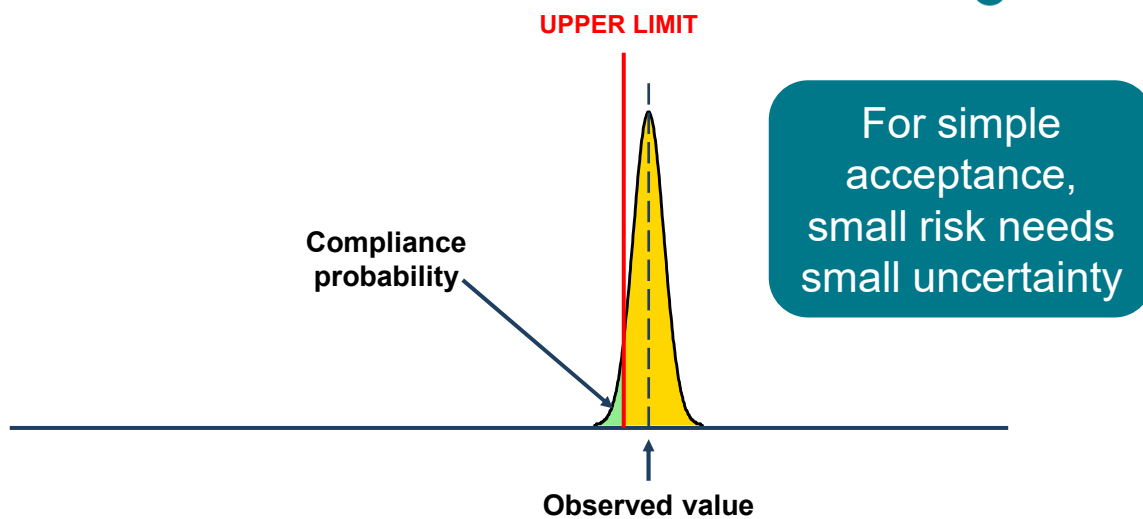


## Small risk



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## Probability of compliance



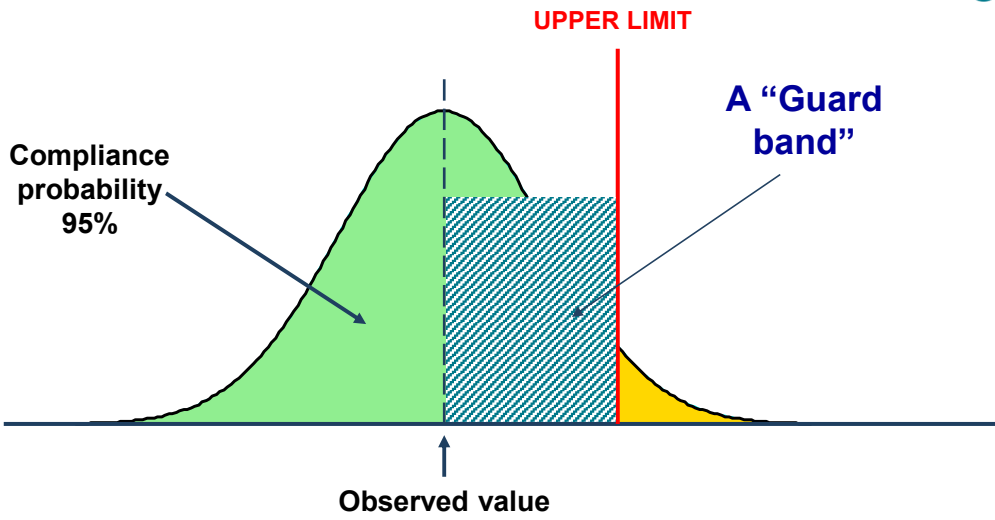
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Decision rules can control probabilities of false decisions



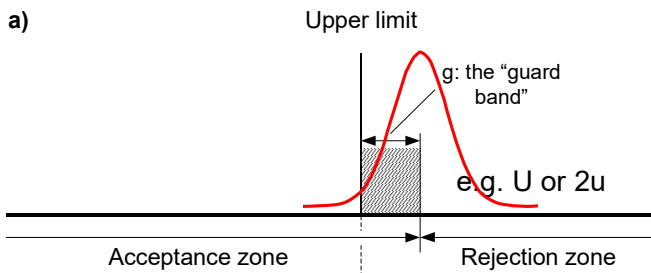
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# Probability of compliance

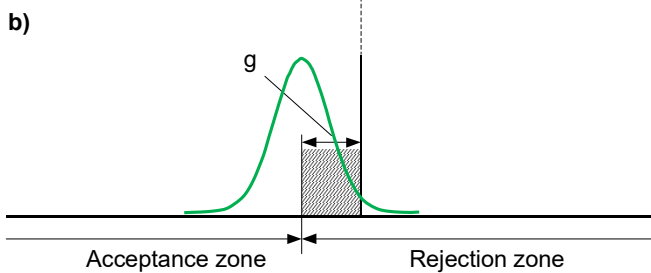


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# Decision rules & guard bands



"Relaxed acceptance"  
(test for *non-conformity*)



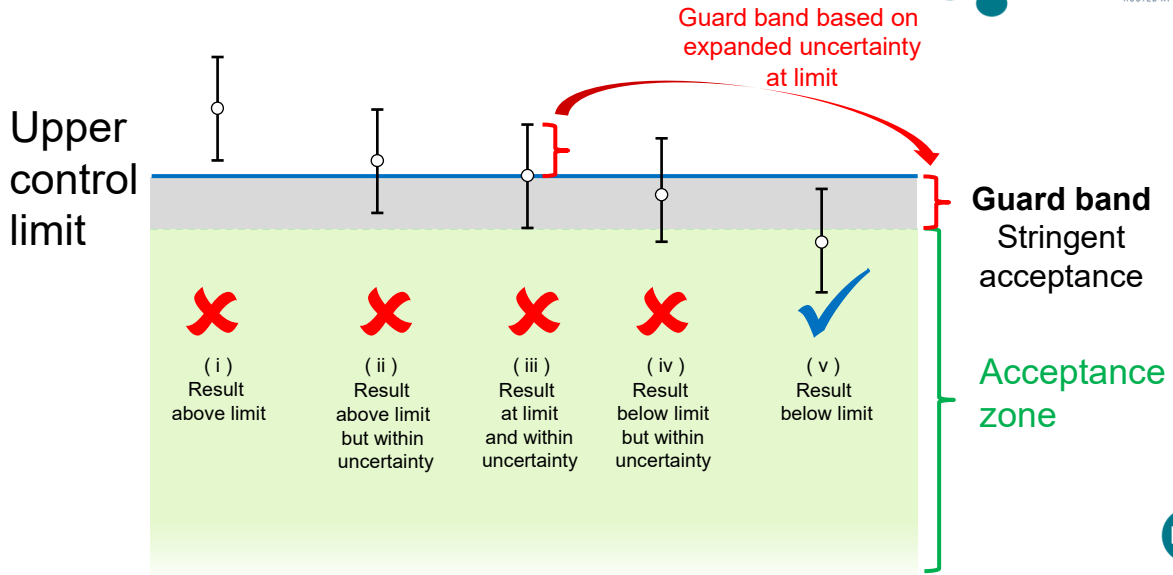
"Stringent acceptance"  
(test for *conformity*)

ILAC G-8 default



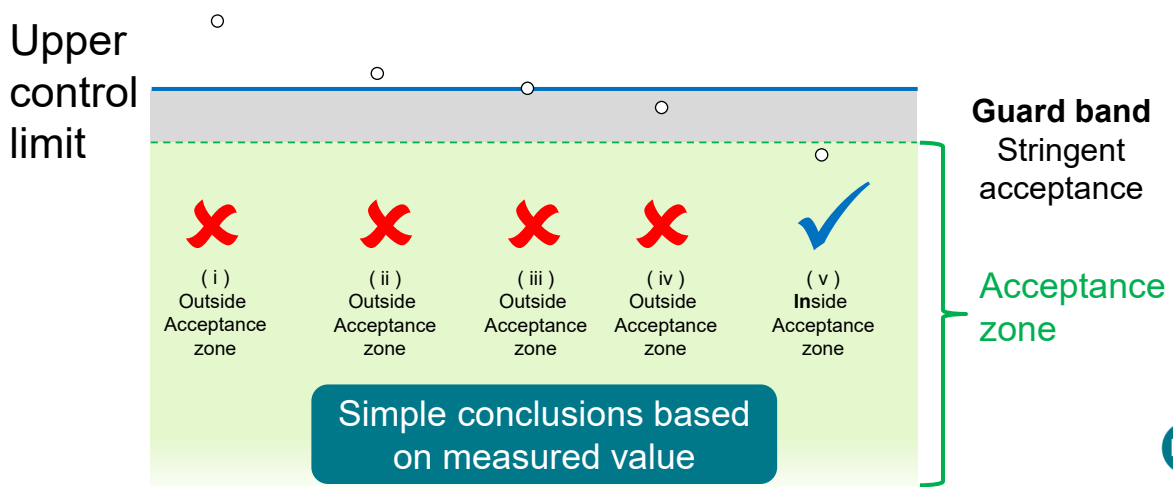
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## How does a Guard Band simplify interpretation?



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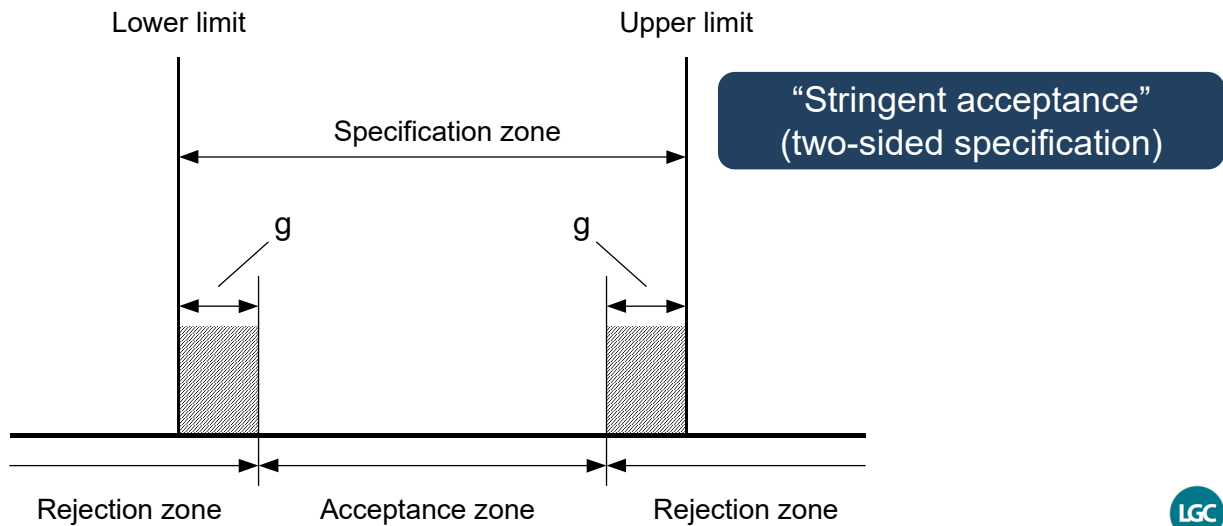
## How does a Guard Band simplify interpretation?



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## Decision rules & guard bands



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## Decision rules & guard bands



- Clear method of determining the location of acceptance and rejection zones
- Minimum acceptable level of the probability that the value of the measurand lies within the specification limits
- Procedure for dealing with repeated measurements and outliers



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# Additional technical problems



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## Other technical issues

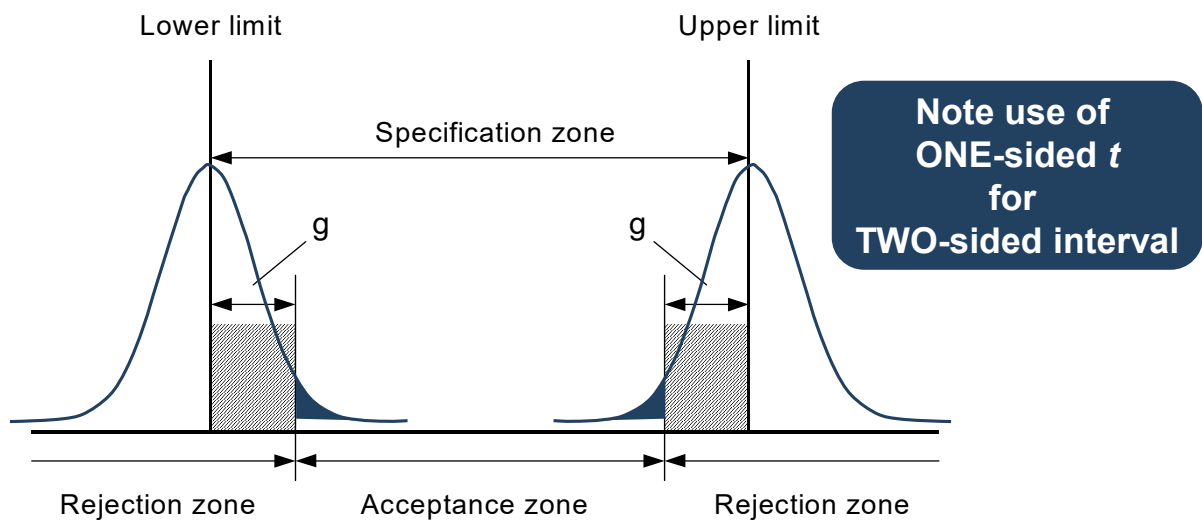


- **Relative uncertainty (uncertainty as % of value)**
  - Affects guard band – set for limit, not for measurement result
- **Asymmetry**
  - May require special consideration
- **Inconclusive results**
  - Can be accommodated in the decision rule
- **Setting coverage factor  $k$**



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## Choosing $k$ : $k$ for 2-sided intervals



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## Summary



### Assessment of compliance requires:

- a measurement result and a stated uncertainty
- a specification giving the upper and/or lower permitted limits of the characteristics (measurands) being controlled
- a decision rule that describes how the measurement uncertainty will be taken into account
- a reference to the decision rules used when reporting on compliance



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## Further reading



### Use of uncertainty information in compliance assessment

### Eurachem/CITAC Guide

[www.eurachem.org](http://www.eurachem.org)

