

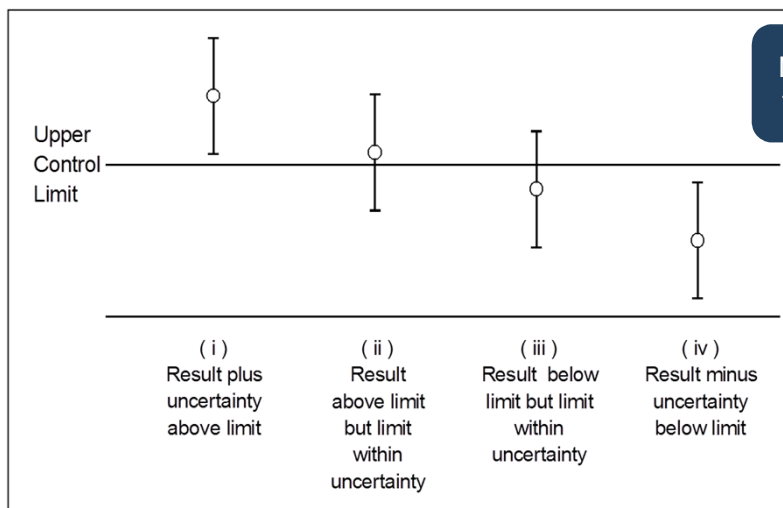
Principles of the Eurachem/CITAC Guide “Use of uncertainty for compliance assessment”

S Ellison, LGC, Teddington

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?

Basic guidance



Need additional information to deal with cases (ii) & (iii)



Consistent decisions need rules



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



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.”

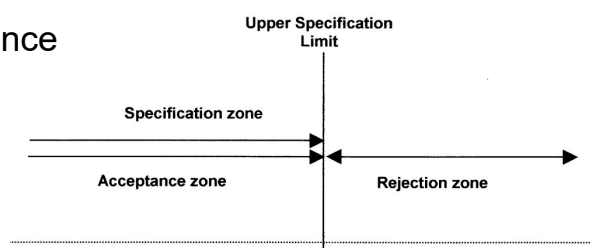


Example of a decision rule



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

“Simple acceptance”



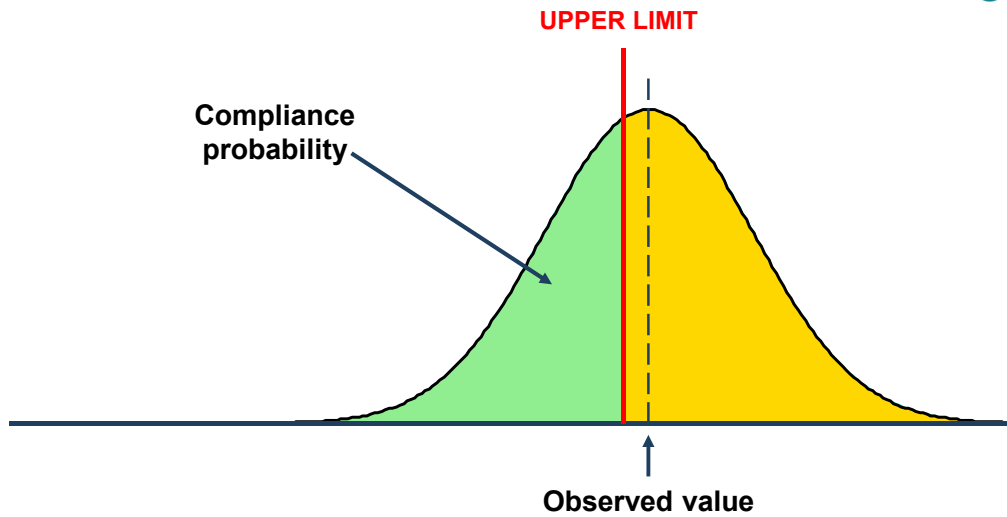
- IF uncertainty is below a specified value
– e.g. uncertainty is small compared with the limit
- THEN the risk of making a wrong decision is acceptable



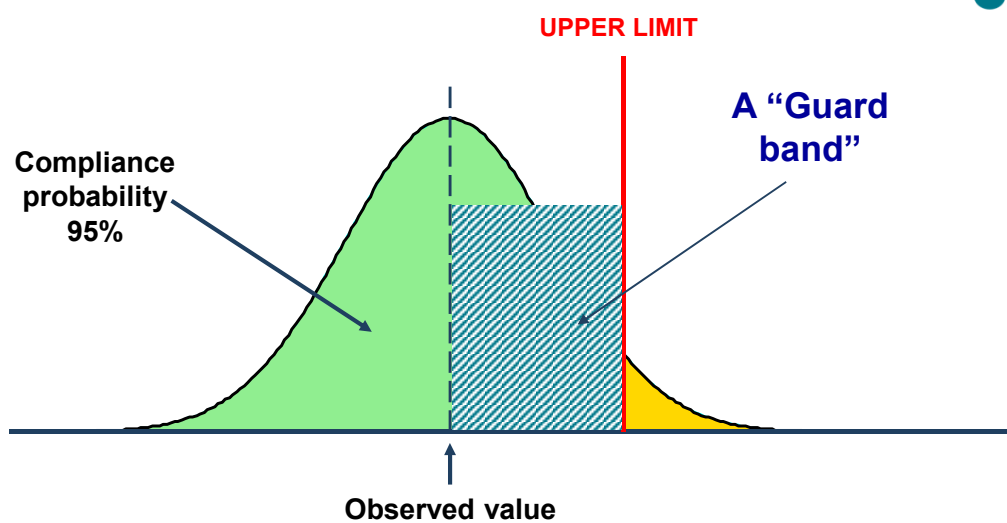
Decision rules can
control probabilities of
false decisions



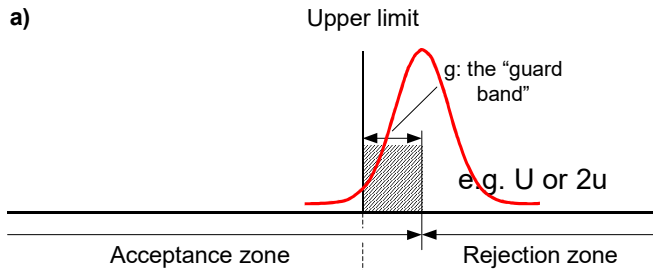
Probability of compliance



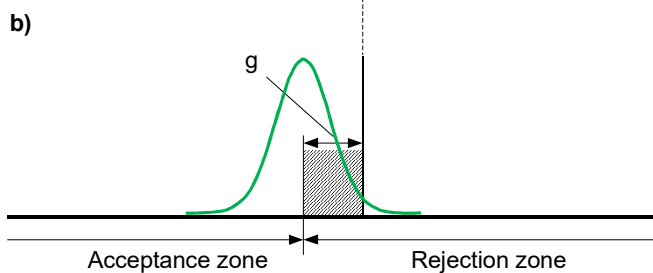
Probability of compliance



Decision rules & guard bands



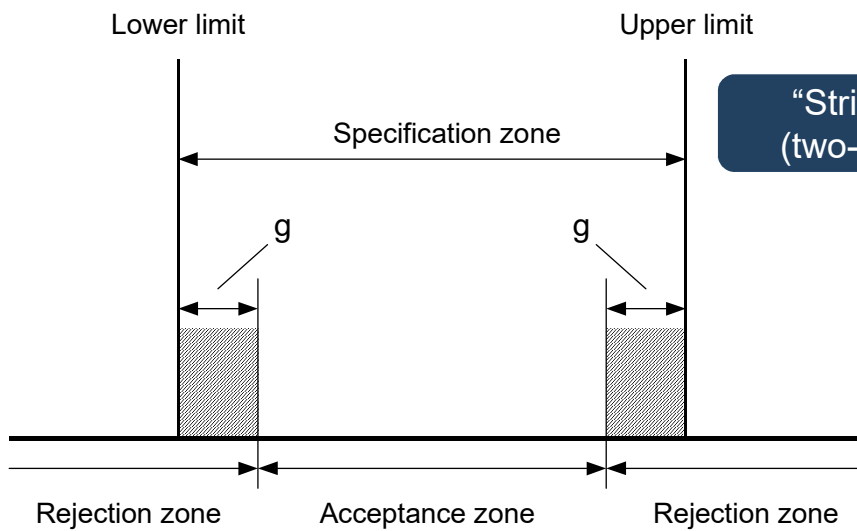
"Relaxed acceptance"
(test for *non-conformity*)



"Stringent acceptance"
(test for *conformity*)



Decision rules & guard bands



"Stringent acceptance"
(two-sided specification)



Decision rules & guard bands



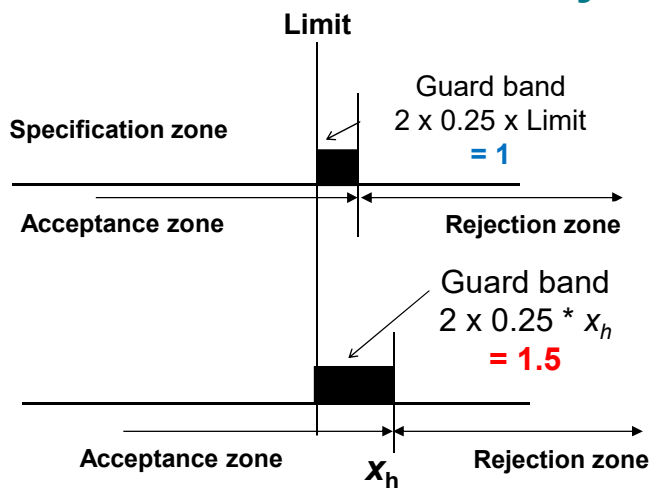
- Clear method of determining the location of acceptance and rejection zones
- Minimum acceptable level of the probability that the value of the measurand lies within the specification limits
- Procedure for dealing with repeated measurements and outliers



Additional technical problems



Constant relative uncertainty



Limit = 2
 $k_a = 2$
 $u_{rel} = 0.25$

$x_h = 3$

Which guard band is right?

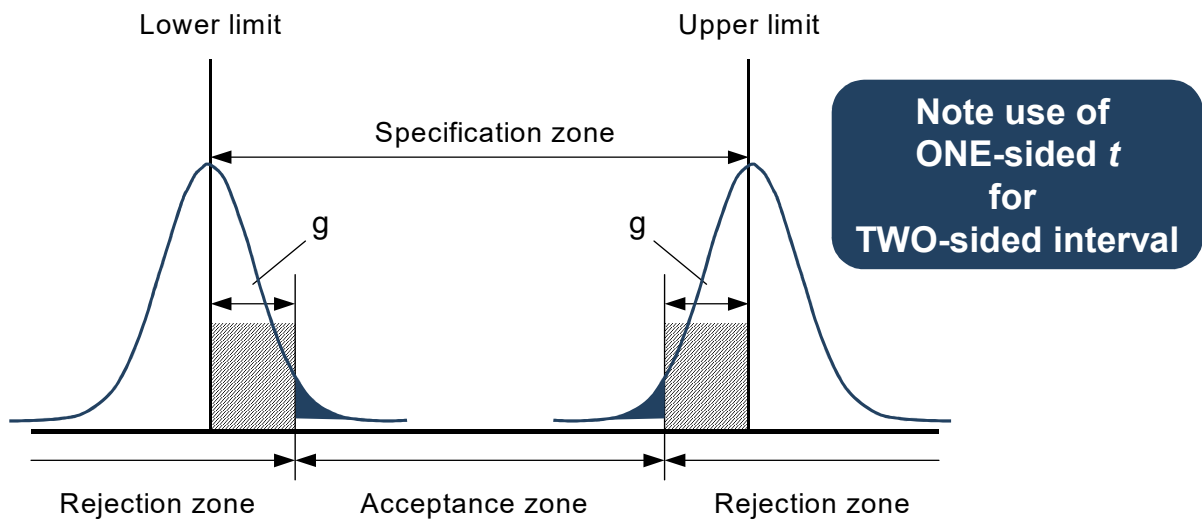


If uncertainty is proportional to true value:

Set the guard band based on the uncertainty at the Limit



Choosing k : k for 2-sided intervals



Inconclusive results



- Eurachem/CITAC Guide does not generate 'inconclusive' results for a given observation
BUT
- The decision rule may do so by requiring additional action on (non)compliance
 - e.g. "If a non-compliant result is within $2u$ of the limit, repeat the observation and reject if the second observation is above the limit"



Summary



Assessment of compliance requires:

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



Further reading



Use of uncertainty information in compliance assessment

Eurachem/CITAC Guide

www.eurachem.org

