

## Key comparison CCEM.RF-K9.1

TRAVELLING STANDARD : Waveguide gas discharge noise generator

MEASURAND : Excess noise ratio

NOMINAL VALUE : 18 dB

$x_{ENR i}$  : Excess noise ratio measured by laboratory  $i$

$u_{ENR i}$  : standard uncertainty of  $x_{ENR i}$

Lab $i$	$x_{ENR i}$ / dB	$u_{ENR i}$ / dB	$x_{ENR i}$ / dB	$u_{ENR i}$ / dB	$x_{ENR i}$ / dB	$u_{ENR i}$ / dB	$x_{ENR i}$ / dB	$u_{ENR i}$ / dB	Date of measurement
	Frequency 12.4 GHz		Frequency 13.5 GHz		Frequency 15 GHz		Frequency 17.5 GHz		
PTB	17.904	0.025	17.931	0.029	17.929	0.032	17.905	0.036	Dec 03
VNIIFTRI	17.948	0.032	17.952	0.038	17.906	0.035	17.950	0.046	Feb - Apr 07

MEASURAND : Noise temperature

$x_{Ti}$  : Noise temperature measured by laboratory  $i$

$u_{Ti}$  : standard uncertainty of  $x_{Ti}$

Lab $i$	$x_{Ti}$ / K	$u_{Ti}$ / K	$x_{Ti}$ / K	$u_{Ti}$ / K	$x_{Ti}$ / K	$u_{Ti}$ / K	$x_{Ti}$ / K	$u_{Ti}$ / K	Date of measurement
	Frequency 12.4 GHz		Frequency 13.5 GHz		Frequency 15 GHz		Frequency 17.5 GHz		
PTB	18187	105	18298	122	18290	135	18192	147	Dec 03
VNIIFTRI	18370	134	18387	158	18196	145	18378	190	Feb - Apr 07

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NOMINAL VALUE : 18 dB

At each frequency, the key comparison reference value,  $x_{ENR R}$ , is calculated as the unweighted mean of the participants results. Its standard uncertainty  $u_{ENR R}$  is calculated as the experimental standard deviation of the mean.

Frequency 12.4 GHz		Frequency 13.5 GHz		Frequency 15 GHz		Frequency 17.5 GHz	
$x_{ENR R}$ / dB	$u_{ENR R}$ / dB	$x_{ENR R}$ / dB	$u_{ENR R}$ / dB	$x_{ENR R}$ / dB	$u_{ENR R}$ / dB	$x_{ENR R}$ / dB	$u_{ENR R}$ / dB
17.926	0.022	17.9415	0.0105	17.9175	0.0115	17.9275	0.0225

The degree of equivalence of laboratory  $i$  with respect to the key comparison reference value is given by a pair of terms, both expressed in dB:  $D_i = (x_{ENR i} - x_{ENR R})$  and its expanded uncertainty  $U_i$  ( $k = 2$ ).

No pair-wise degrees of equivalence are computed for this comparison.

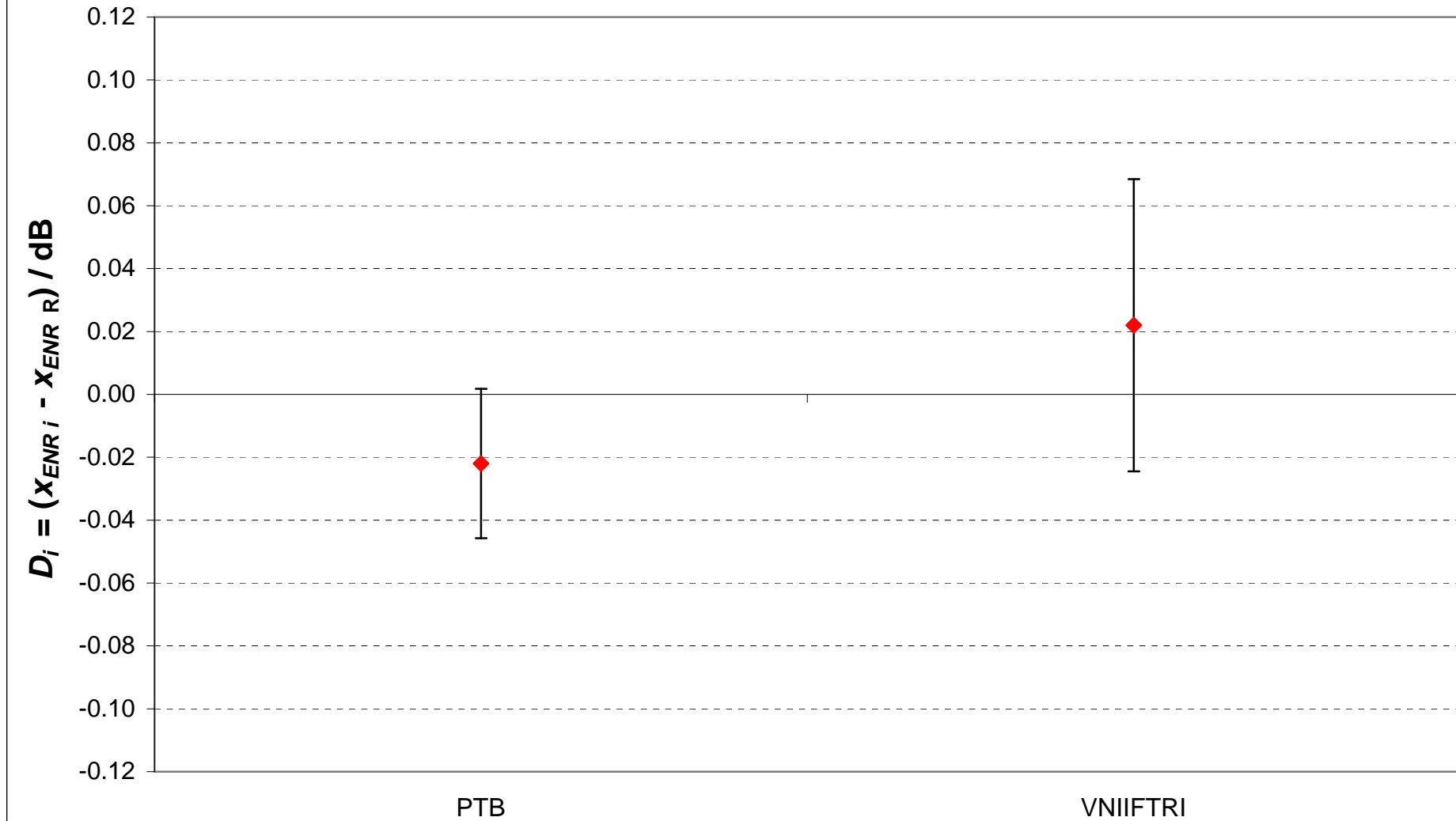
Degrees of equivalence relative to the key comparison reference value

Lab $i$	Frequency 12.4 GHz		Frequency 13.5 GHz		Frequency 15 GHz		Frequency 17.5 GHz	
	$D_i$ / dB	$U_i$ / dB	$D_i$ / dB	$U_i$ / dB	$D_i$ / dB	$U_i$ / dB	$D_i$ / dB	$U_i$ / dB
PTB	-0.022	0.024	-0.0105	0.0541	0.0115	0.0597	-0.0225	0.0562
VNIIFTRI	0.022	0.046	0.0105	0.0730	-0.0115	0.0661	0.0225	0.0802

# CCEM.RF-K9.1

# Excess noise ratio, 12.4 GHz

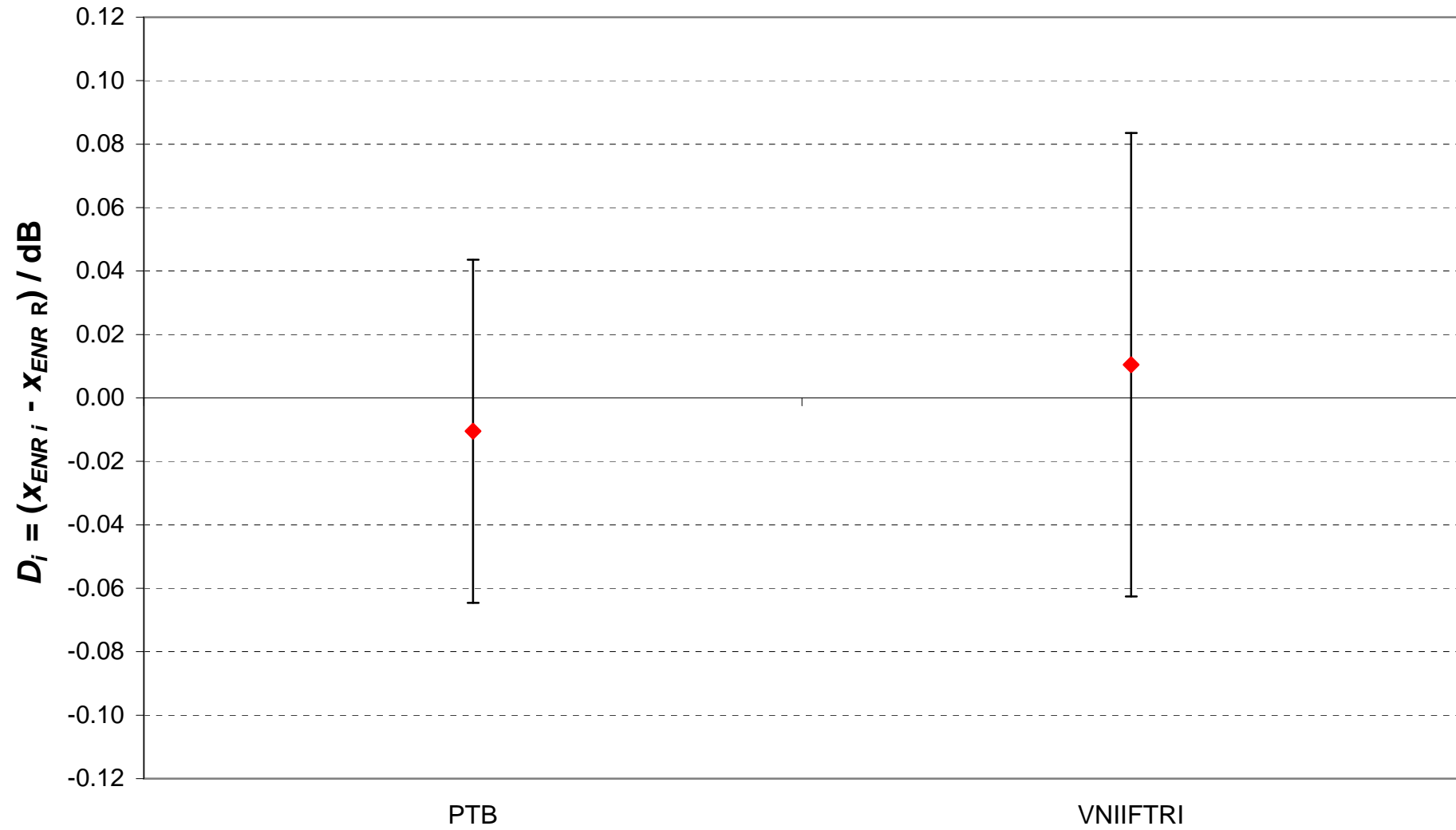
Degrees of equivalence,  $D_i$  and expanded uncertainty  $U_i$  ( $k = 2$ )



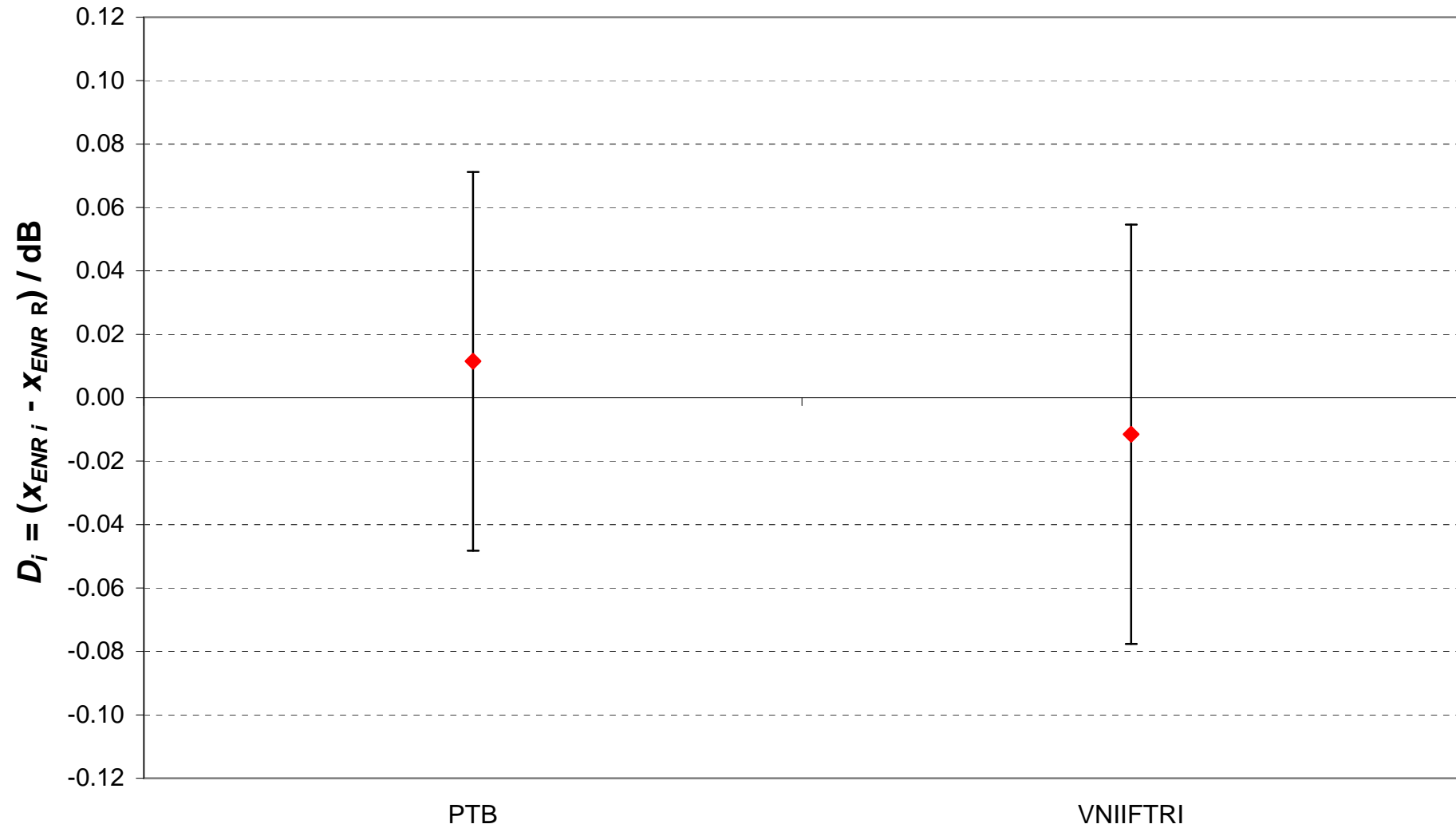
# CCEM.RF-K9.1

# Excess noise ratio, 13.5 GHz

Degrees of equivalence,  $D_i$  and expanded uncertainty  $U_i$  ( $k = 2$ )



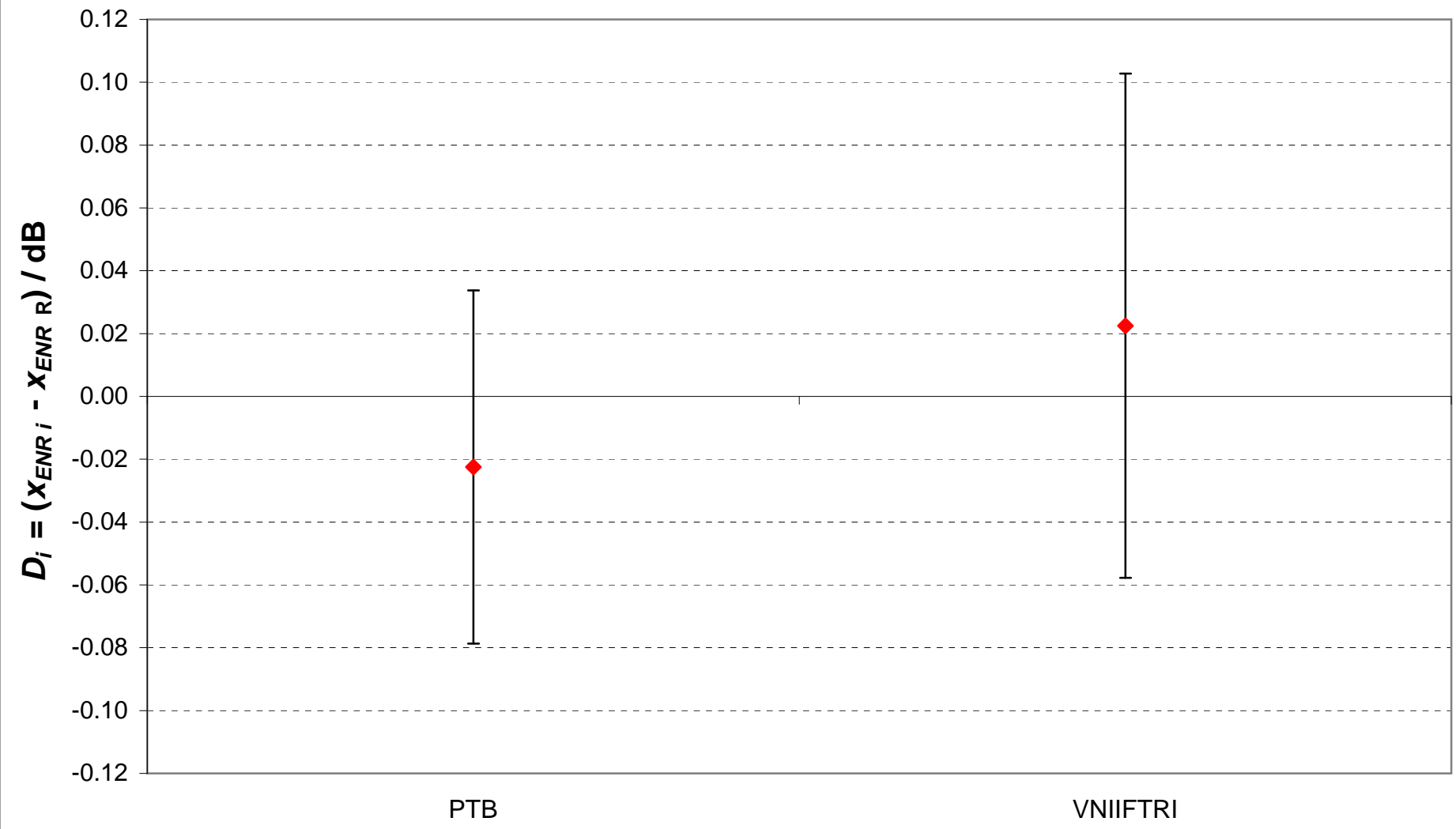
**CCEM.RF-K9.1**      **Excess noise ratio, 15 GHz**  
Degrees of equivalence,  $D_i$  and expanded uncertainty  $U_i$  ( $k = 2$ )



**CCEM.RF-K9.1**

**Excess noise ratio, 17.5 GHz**

Degrees of equivalence,  $D_i$  and expanded uncertainty  $U_i$  ( $k = 2$ )



## Key comparison CCEM.RF-K9.1

MEASURAND : Noise temperature

TRAVELLING STANDARD : Waveguide gas discharge noise generator

At each frequency, the key comparison reference value,  $x_{TR}$ , is calculated as the unweighted mean of the participants results. Its standard uncertainty  $u_{TR}$  is calculated as the experimental standard deviation of the mean.

Frequency 12.4 GHz		Frequency 13.5 GHz		Frequency 15 GHz		Frequency 17.5 GHz	
$x_{TR}$ /K	$u_{TR}$ /K	$x_{TR}$ /K	$u_{TR}$ /K	$x_{TR}$ /K	$u_{TR}$ /K	$x_{TR}$ /K	$u_{TR}$ /K
18278.5	91.5	18342.5	44.5	18243	47	18285	93

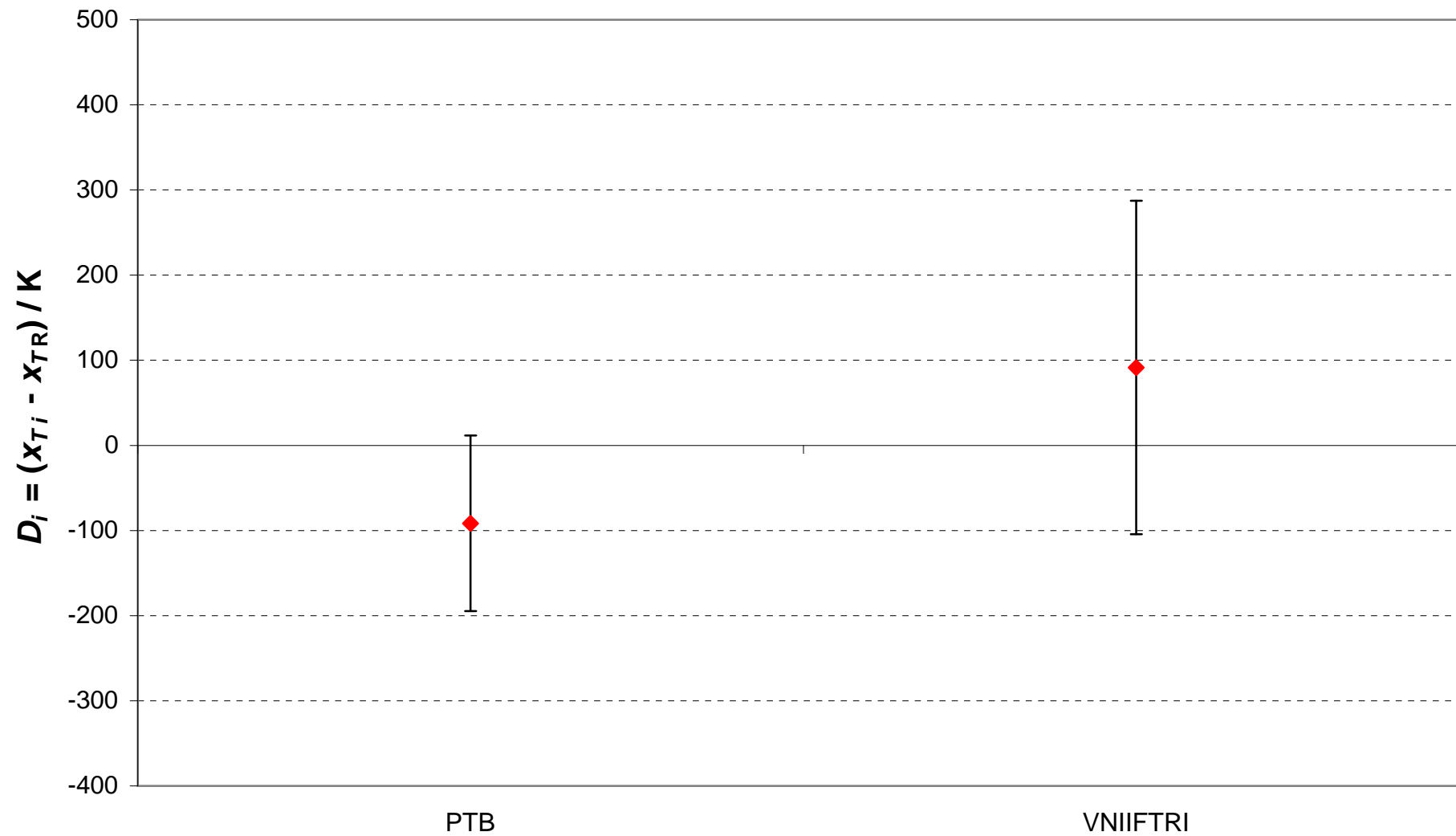
The degree of equivalence of laboratory  $i$  with respect to the key comparison reference value is given by a pair of terms, both expressed in K:  $D_i = (x_{Ti} - x_{TR})$  and its expanded uncertainty  $U_i$  ( $k = 2$ ).

No pair-wise degrees of equivalence are computed for this comparison.

Degrees of equivalence relative to the key comparison reference value

Lab $i$ ↓	Frequency 12.4 GHz		Frequency 13.5 GHz		Frequency 15 GHz		Frequency 17.5 GHz	
	$D_i$ /K	$U_i$ /K	$D_i$ /K	$U_i$ /K	$D_i$ /K	$U_i$ /K	$D_i$ /K	$U_i$ /K
PTB	-91.5	103.0	-44.5	227.2	47	253	-93	228
VNIIFTRI	91.5	195.8	44.5	303.2	-47	274	93	331

**CCEM.RF-K9.1**      **Noise temperature, 12.4 GHz**  
Degrees of equivalence,  $D_i$  and expanded uncertainty  $U_i$  ( $k = 2$ )

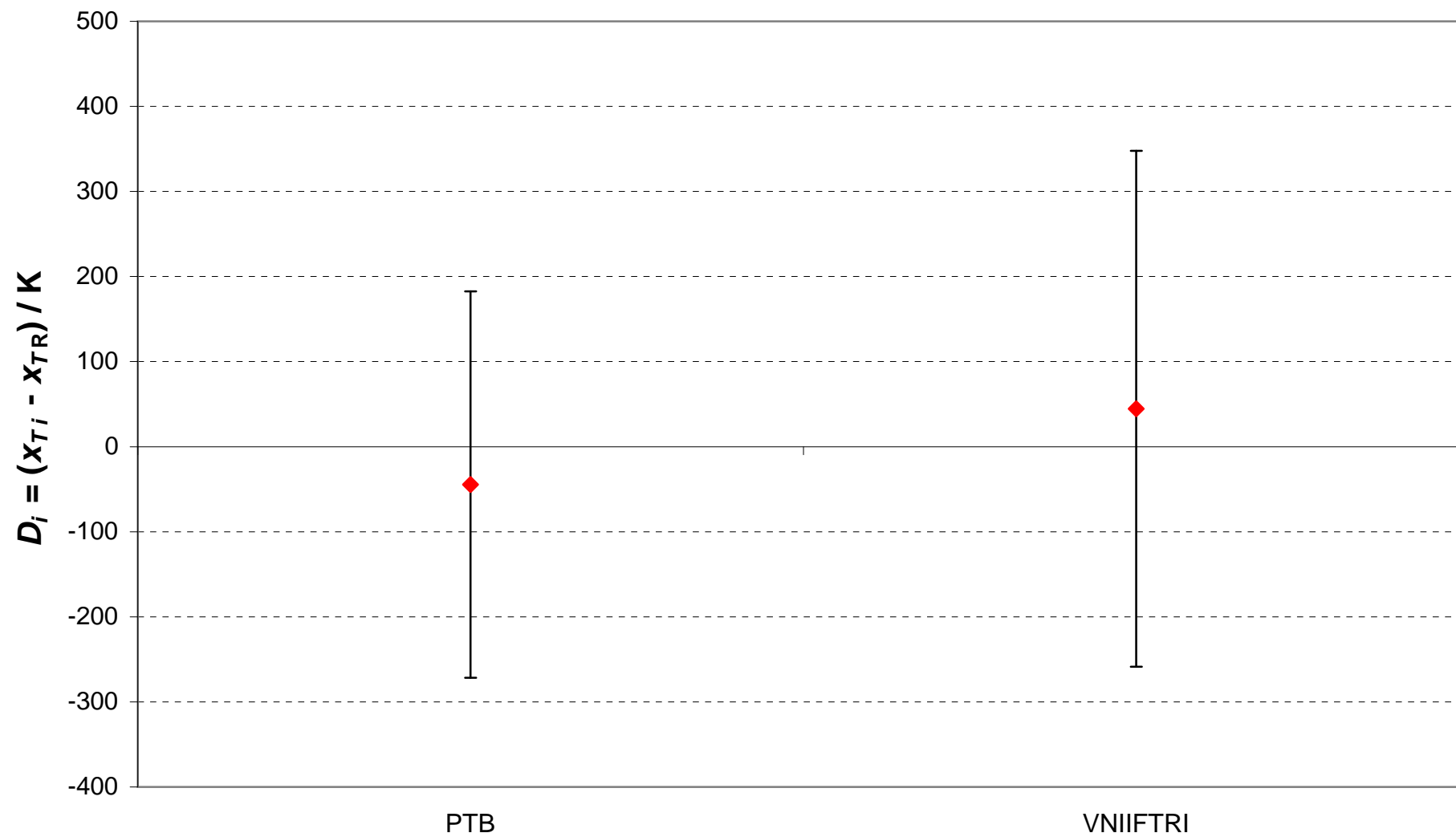




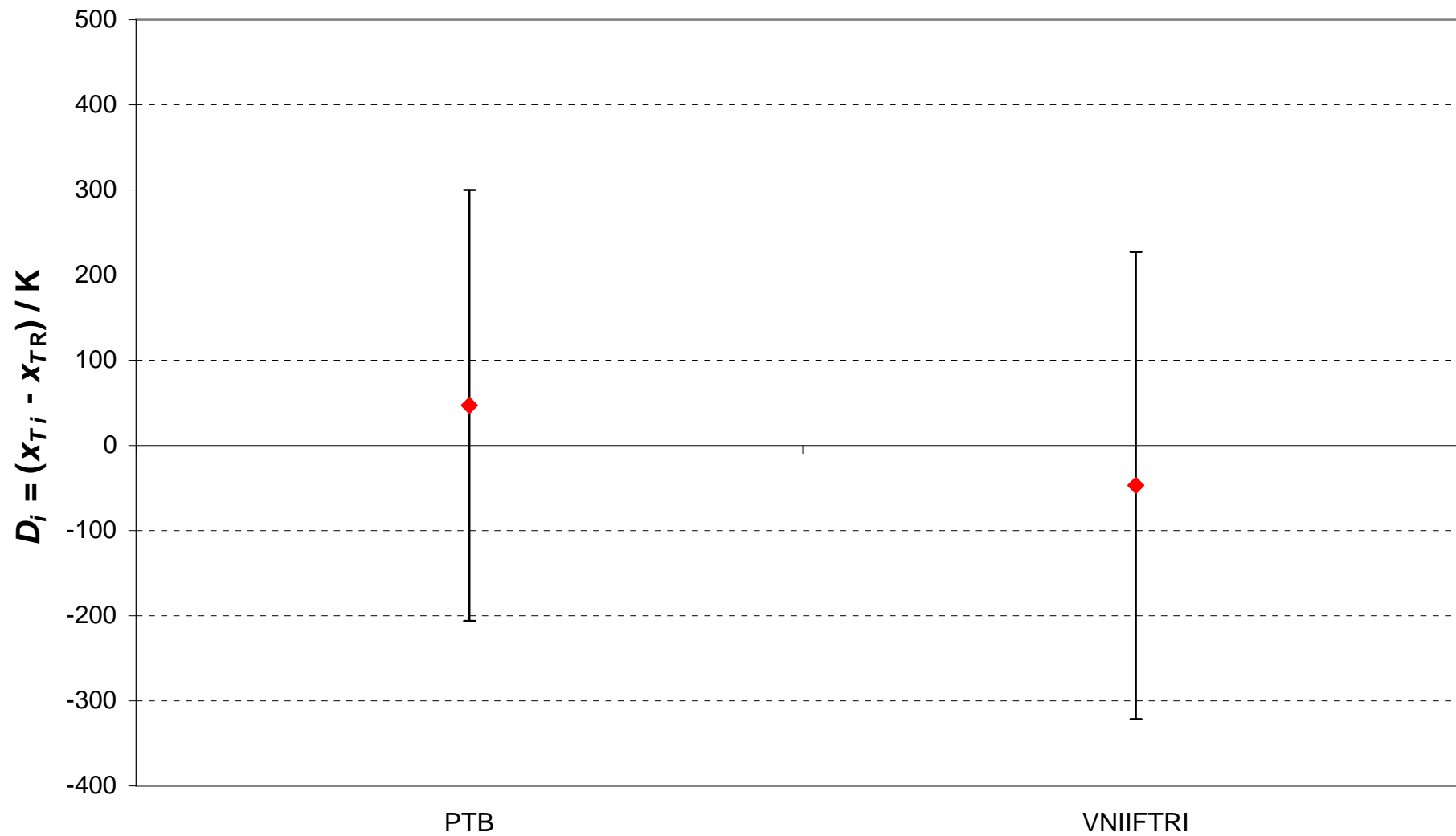
# CCEM.RF-K9.1

# Noise temperature, 13.5 GHz

Degrees of equivalence,  $D_i$  and expanded uncertainty  $U_i$  ( $k = 2$ )



**CCEM.RF-K9.1**      **Noise temperature, 15 GHz**  
Degrees of equivalence,  $D_i$  and expanded uncertainty  $U_i$  ( $k = 2$ )



**CCEM.RF-K9.1**      **Noise temperature, 17.5 GHz**  
Degrees of equivalence,  $D_i$  and expanded uncertainty  $U_i$  ( $k = 2$ )

