

Manufacturer	xDevs.com KX	Calibration date	17 July 2017
Model Number	VK5RC	Ambient Temperature	24.1 °C
Serial	02	Relative Humidity	41.85 %
ID Number	KX-LTZ	Pressure	1008.23
Notes	Calibration, 24 hour specs	Test type	Calibrate

Reference standard	Mfg	Model	Options	Serial Number	CEID	Calibration date	Due date
DMM	HP	3458A	001,X02	MY45040325	XD2	2017/01/05	2018/01/05
DMM	HP	3458A	001,X02	2823A13345	XD1	2016/09/25	2017/09/25
DMM	Keithley	2002	MEM2	0603805	XD4	2016/08/25	2017/08/25
DMM	Keithley	2002	X1801	1167961	XD3	2017/06/18	2018/06/18
STDV	xDevs.com	NVS-LTZ		± 0.8ppm	SD03	2017/02/15	2017/08/15
Scope	Tektronix	MDO4054C	EZ02	private	XG2	2016/12/09	2017/12/09
Amplifier	lymex/pipeline	10000:1	XA02	private		N/A	N/A
SMU	Keithley	2400	XS01	788393		2016/09/01	2018/09/01
SMU	Keithley	2510-AT	XS02	774537		2016/02/02	2018/02/02

As Received Conditions

The equipment was found to be partially outside of specifications. Consequently, only a partial set of tests, DCV check point and temperature coefficient could be performed. The observed measured values with their compliance, respectively non-compliance with specification are documented in the measurement report.

Action Taken

The equipment was modified to improve temperature coefficient performance.

Reference info	VK5RC KX 7.2V REF
Test date start	16 July 2017 23:52
Test specification interval	24 hour DUT spec
Line frequency	110V 60 Hz
Last calibration date	2017/07/17
Next calibration date	2018/07/17
DUT temperature to cal	0.1
Last calibration temperature	+24.0

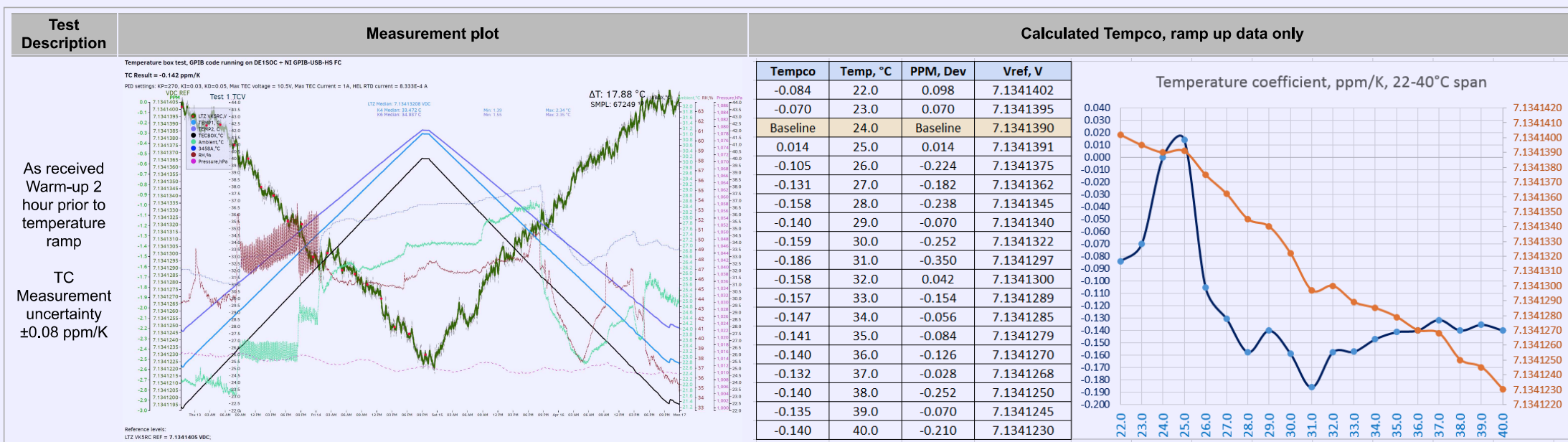
Service information

Last calibration temperature	+24.0
All CAL values	DNA
Reference	VK5RC DC Voltage reference, KX LTZ1000A as returned
DUT Condition	Enclosed
Reference Type	Linear LTZ1000ACH week 33 year 2016
Opamp configuration	Linear LTC2057 + LTC2057
Oven setpoint	+45 °C
Resistor type	Edwin PWW 70K+70K+12K+1K+120R
PCB Version	xDevs.com KX Rev.B01 modified for B03

As Received DC Voltage output performance test.
The following test for the output DC voltage specification using multiple meters as reference.
DCV verify value used median 1-hour measurement output after 24 hour warm-up time.

Test Description	Expected Value	Measured Value	Measurement Uncertainty	Lower Limit	Upper Limit	Units	Std.Dev.	Peak-peak	Test Status
7.2V DCV	As received	7.1341631	± 1.2 ppm	7.1341546	7.1341717	VDC	1.391 μV	10.58 μV	1000 samples

Main DC Voltage output temperature coefficient performance test.
The following test for the output DC voltage output versus ambient chamber temperature.
Temperature ramp speed is 0.42 °C/hour.



As Returned Conditions

The equipment adjusted and meet typical specifications. Full set of tests, DCV check point, output noise and temperature coefficient in limited span is performed. The observed measured values with their compliance, respectively non-compliance with specification are documented in the measurement report.

Action Taken

Reference module assembly mechanically decoupled from chassis

Zener package mounted to PCB without airgap

PCB modified from Rev.B01 to Rev.B03

DCV output calibrated.

As Returned DC Voltage output performance test.

The following test for the output DC voltage specification using multiple meters as reference.
DCV verify value used median 1-hour measurement output after 24 hour warm-up time.

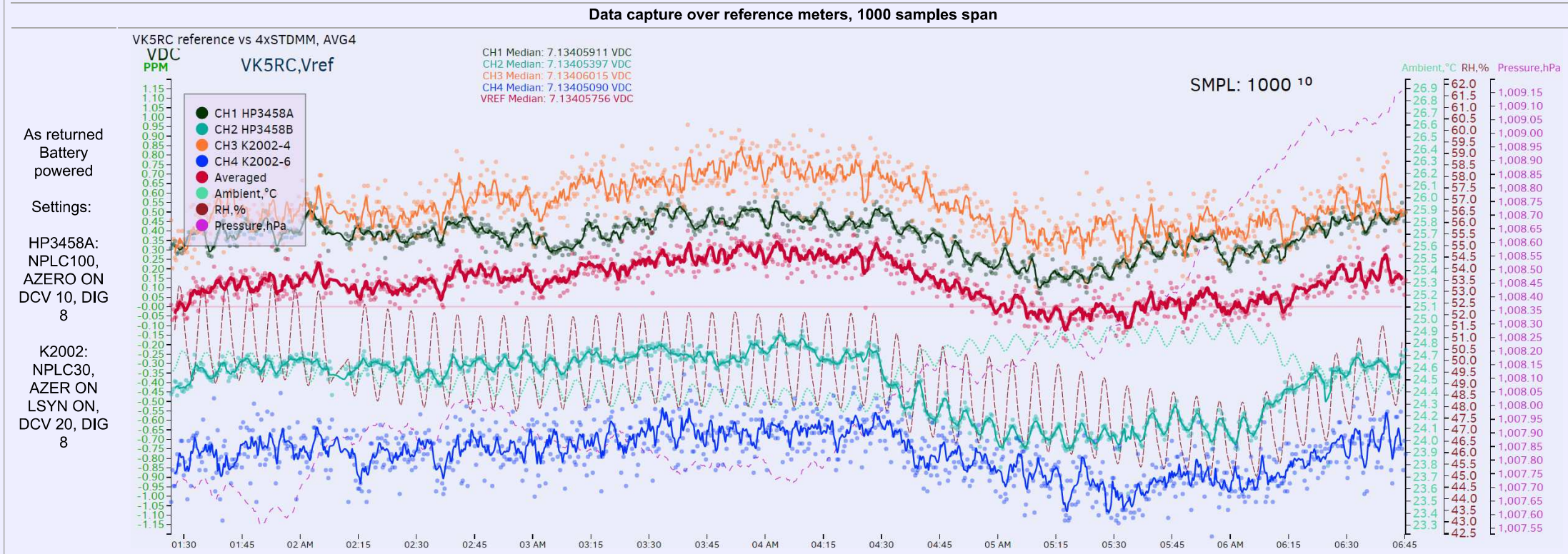
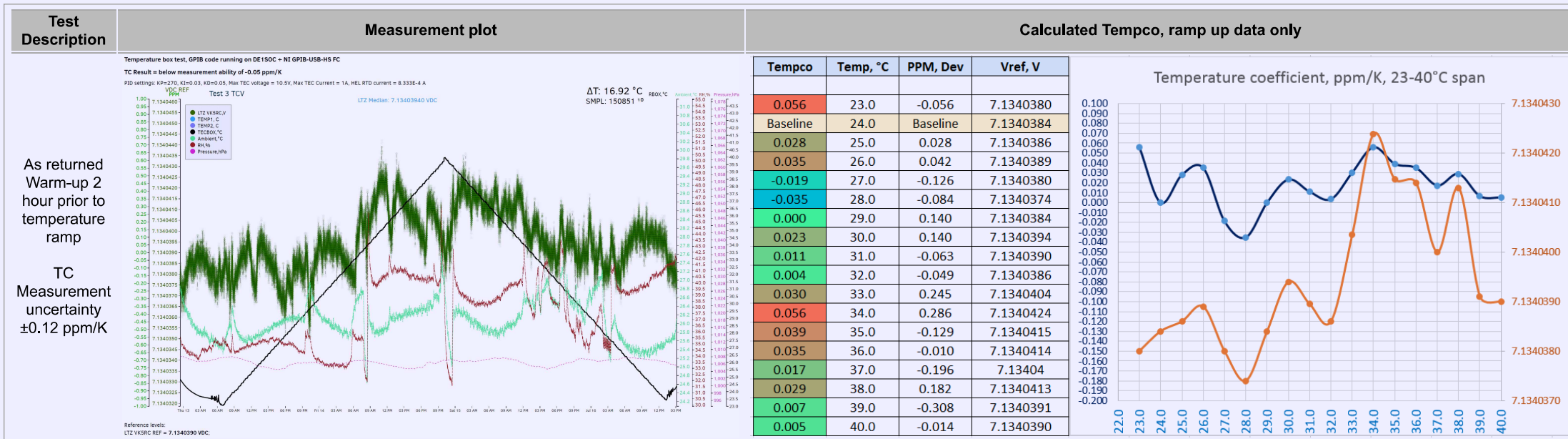
Test Description	Expected Value	Measured Value	Measurement Uncertainty	Lower Limit	Upper Limit	Units	Std.Dev.	Peak-peak	Test Status
7.2V DCV	As returned	7.1340566	± 1.2 ppm	7.1340480	7.1340651	VDC	0.622 μ V	5.08 μ V	1000 samples

Main DC Voltage output noise performance test.

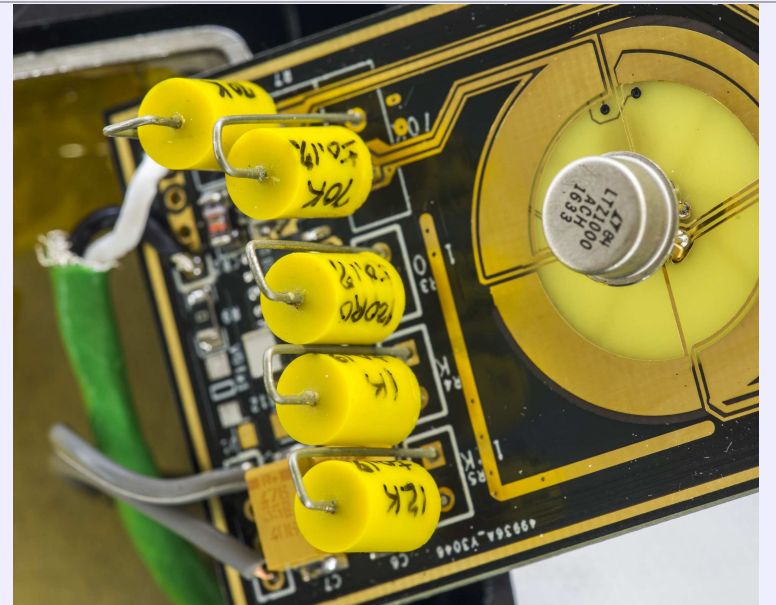
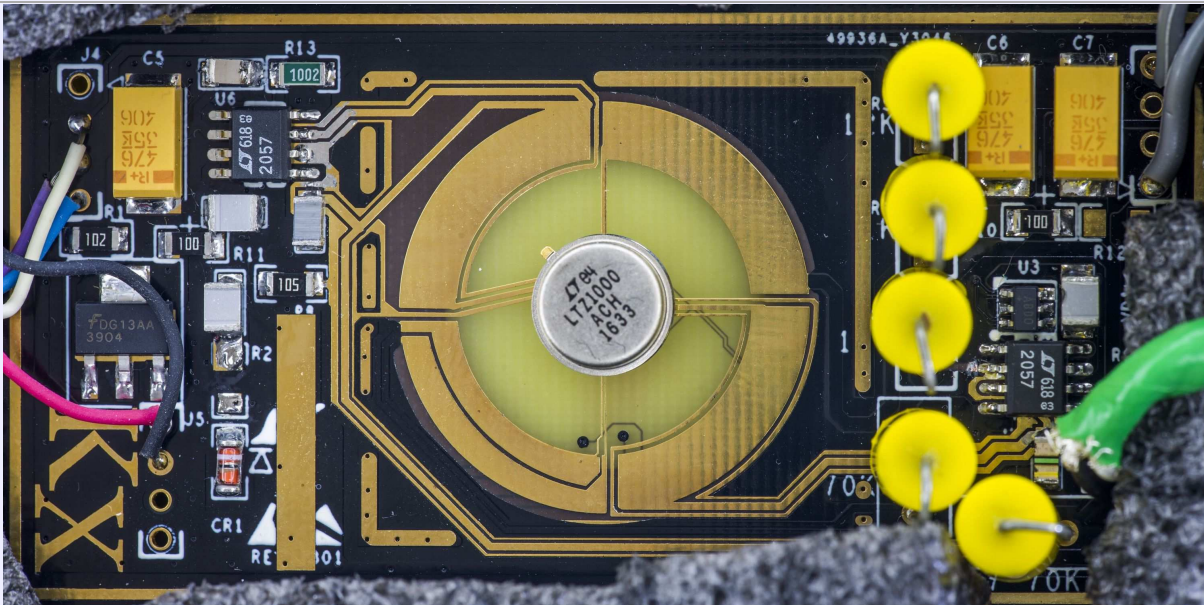
The following test for the output DC voltage specification using multiple meters as reference.
DCV verify value used median 1-hour measurement output after 24 hour warm-up time.

Test Description	Plot	Measured Value	Plot
<p>Noise measurement noise floor Reference not connected, warm-up 1 hour</p> <p>0.1Hz BW, <40nVpk-pk.</p>		<p>Noise measurement 0.1Hz BW Reference in series with 7.0000 KΩ BMF Settle time 30 min</p> <p>0.1Hz BW, <1.800 μVpk-pk.</p>	
<p>Noise measurement, 1 min span Reference in series with 7.0000 KΩ BMF</p> <p><1.80 μVpk-pk.</p>		<p>Noise measurement, 15 min span Reference in series with 7.0000 KΩ BMF</p> <p><2.00 μVpk-pk.</p>	
<p>Noise measurement, 1 hour span Reference in series with 7.0000 KΩ BMF</p> <p><3.00 μVpk-pk.</p>		<p>Noise measurement Reference in series with 7.0000 KΩ BMF</p> <p>0.1Hz BW, <1.800 μVpk-pk.</p>	

Main DC Voltage output temperature coefficient performance test.
 The following test for the output DC voltage output versus ambient chamber temperature.
 Temperature ramp speed is 0.42 °C/hour.



Reference photograph of the DUT



RAW data capture for further analysis and related links

URL

Temperature coefficient, as received	https://xdevs.com/vk5rc_ltz_tc/
Comparison of DUT Reference against NVS #2 Run	https://xdevs.com/nvs_ltz2/
Comparison of DUT Reference against NVS #3 Run	https://xdevs.com/nvs_ltz3/
Comparison of DUT Reference against NVS #4 Run	https://xdevs.com/nvs_ltz4/
Comparison of DUT Reference against NVS #5 Run	https://xdevs.com/nvs_ltz5/
Comparison of DUT Reference against NVS #6 Run	https://xdevs.com/nvs_ltz6/
Temperature coefficient, as returned, initial test	https://xdevs.com/vk5rc_ltz_tc2/
Temperature coefficient, as returned, final test	https://xdevs.com/vk5rc_ltz_tc3/
Final calibration data, as returned	https://xdevs.com/vk5rc_ltz_final/
Tale 1 : Little jumper, or sharks in voltage references world	https://xdevs.com/article/ltz_tale1/
xDevs.com KX Voltage reference design	https://xdevs.com/article/kx-ref/
Tale 3 : Testing VK5RC LTZ1000 reference module	https://xdevs.com/article/ltz_tale3/

Lab temperature maintained +24°C $\pm 2^\circ\text{C}$

Internal use only

Not validated