SAR TEST REPORT

Test Report No. : 32AE0187-HO-A

Applicant	:	**TAIYO YUDEN Co., Ltd.**
Type of Equipment	:	**Wireless LAN Module**
Model No.	:	**WYSAAVDX7**
FCC ID	:	**RYYWYSAAVDX7**
Test regulation	:	**FCC47CFR 2.1093** **FCC OET Bulletin 65, Supplement C (Edition 01-01)**
Test Result	:	**Complied** **FCC15.247(2.4G) / Body : 1.11W/kg**

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Date of test: September 1, 2011

Representative test engineer:

Miyo Kishimoto
Engineer of WiSE Japan,
UL Verification Service

Approved by :

Mitsuru Fujimura
Leader of WiSE Japan
UL Verification Service

NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
*As for the range of Accreditation in NVLAP, you may refer to the WEB address,
http://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap

SECTION 1: Customer information

Company Name	:	TAIYO YUDEN Co., Ltd.
Address	:	8-1,Sakae-cho, Takasaki-shi,Gunma 370-8522, Japan
Telephone Number	:	+81-27-324-2313
Facsimile Number	:	+81-27-324-2314
Contact Person	:	Division Manager , Mitsuo Takagi

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment	:	Wireless LAN Module
Model No.	:	WYSAAVDX7
Serial No.	:	0026AB085F88
Power Supply	:	DC 5.00V
Operating Voltage Range	:	DC 3.50V Min. DC 5.50V Max.
Receipt Date of Sample	:	August 31, 2011
Country of Mass-production	:	Japan
Condition of EUT	:	Pre-Production (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab

2.2 Product description

Radio Specification

WLAN (IEEE802.11b/g/n-20)

Mode	**IEEE802.11b/g/n-20**	**IEEE802.11n-40**
Frequency of Operation	2412-2462MHz	2422-2452MHz
Type of Modulation	DSSS, OFDM	OFDM
Bandwidth & Channel spacing	20MHz & 5MHz	40MHz & 5MHz
Operating clock	38.4MHz	
Antenna Type	Monopole	
Antenna Gain	0.90 dBi	

SECTION 3 : Test standard information

3.1 Test Specification

Title : **Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01):**

Supplement C (Edition 01-01) - Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions
OET Bulletin 65 (Edition 97-01) - Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields

: **IEEE Std 1528-2003:**

IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques Supplement C

In additions;
KDB447498D01(v04): Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
KDB248227(rev.1.2): SAR Measurement Procedures for 802.11a//b/g Transmitters

Reference

[1]ANSI, ANSI/IEEE C95.1-1992: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, The Institute of Electrical and Electronics Engineers, Inc., New York, NY 10017, 1992.
[2]SPEAG uncertainty document (AN 15-7/AN19-17) for DASY 5 System from SPEAG (Shimid & Partner Engineering AG).

3.2 Procedure

The installed EUT into host device (Head Display Mount) performed SAR measurement.

Transmitter	**WLAN**
Test Procedure	FCC OET BULLETIN 65, SUPPLEMENT C
	SAR
Category	FCC47CFR 2.1093
Note: UL Japan, Inc. 's SAR Work Procedures 13-EM-W0429 and 13-EM-W0430	

3.3 Exposure limit

(A) Limits for Occupational/Controlled Exposure (W/kg)

Spatial Average (averaged over the whole body)	Spatial Peak (averaged over any 1g of tissue)	Spatial Peak (hands/wrists/feet/ankles averaged over 10g)
0.4	8.0	20.0

(B) Limits for General population/Uncontrolled Exposure (W/kg)

Spatial Average (averaged over the whole body	Spatial Peak (averaged over any 1g of tissue)	Spatial Peak (hands/wrists/feet/ankles averaged over 10g)
0.08	1.6	4.0

Occupational/Controlled Environments: are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure, (i.e. as a result of employment or occupation).

General Population/Uncontrolled Environments: are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

NOTE:GENERAL POPULATION/UNCONTROLLED EXPOSURE
SPATIAL PEAK(averaged over any 1g of tissue) LIMIT
1.6 W/kg

3.4 Test Location

*Shielded room for SAR testings
UL Japan, Inc. Head Office EMC Lab. *NVLAP Lab. code: 200572-0
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8116 Facsimile : +81 596 24 8124

SECTION 4 : Test result

4.1 Stand-alone SAR result

TEST Outline

This EUT is a limited module approval according to section 15.212(b). The procedure of SAR was measured according to the KDB447498 2).

Mode	1g SAR [W/kg]
WLAN	1.11

The 1-g SAR was <1.2W/kg for all configurations.
Therefore according to the KDB447498 D01, the EUT was approved for used in a single host platform.

SECTION 5 : Description of the operating mode

5.1 Output power operating modes

Mode	Duty cycle	Frequency Band	Test Frequency	Modulation
IEEE802.11b	100%	2412-2462MHz	2412MHz (1ch) 2437MHz(6ch) 2462MHz(11ch)	DSSS (DBPSK.DQPSK.CCK)
IEEE802.11g	100%	2412-2462MHz	2412MHz (1ch) 2437MHz(6ch) 2462MHz(11ch)	OFDM (BPSK.QPSK.16QAM,64QAM)
IEEE802.11n20 (2.4G)	100%	2412-2462MHz	2412MHz (1ch) 2437MHz(6ch) 2462MHz(11ch)	
IEEE802.11n40 (2.4G)	100%	2422-2452MHz	2422MHz (3ch) 2437MHz(6ch) 2452MHz(9ch)	
WLAN				
*Power of the EUT was set by the software as follows; Power setting: 11b 15dBm, 11g 12dBm,11n20 11dBm, 11n40 11dBm Software/version: MGG-8787-WIFI-SD-BT-WIN-X86-1.2.6.22.14.0.2.p155 *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.				

5.2 SAR testing operating modes

Decision of SAR test channel

The operating mode for SAR testing was decided by the output power
The average output power for 802.11a was measured on all channels in each frequency band.

Mode		GHz	Channel	Turbo Channel	"Default Test Channel"			
					FCC 15.247		UNII	
					802.11b	802.11g		
802.11 b/g		2.412	1		√	Δ		
		2.437	6	6	√	Δ		
		2.462	11		√	Δ		
802.11a	UNII	5.18	36				√	
		5.20	40	42(5.21 GHz)				*
		5.22	44					*
		5.24	48	50(5.25 GHz)			√	
		5.26	52				√	
		5.28	56	58(5.29 GHz)				*
		5.30	60					*
		5.32	64				√	
		5.50	100	Unknown				*
		5.52	104				√	
		5.54	108					*
		5.56	112					*
		5.58	116				√	
		5.60	120					*
		5.62	124				√	
		5.64	128					*
		5.66	132					*
		5.68	136				√	
		5.70	140					*
	UNII or FCC 15.247	5.745	149		√		√	
		5.765	153	152(5.76 GHz)		*		*
		5.785	157		√			*
		5.805	161	160(5.80GHz)		*	√	
	FCC 15.247	5.825	165		√			

√ = "default test channels"
* = Possible 802.11a channels with maximum average output > the "default test channels"
Δ = Possible 802.11g channels with maximum average output ¼ dB ≥ the "default test channels"

1) WLAN (11b/g/n(2.4G))
Test mode : 11b
Channel : 1ch
Crest factor : 1

Note:
1.The 11b mode was maximum average power. The 11g/n SAR is not required for other mode because the maximum average output power for other mode is less than 1/4dB higher than that measured 11b mode.

[IEEE802.11b] Rate Check

Rate	Freq.	P/M Reading [dBm]	Cable Loss	Atten.	Result [dBm]	Result [mW]
[Mbps]	[MHz]	AVG	[dB]	[dB]	AVG	AVG
1.0	2437	2.69	0.81	9.99	13.49	22.34
2.0	2437	2.61	0.81	9.99	13.41	21.93
5.5	2437	2.45	0.81	9.99	13.25	21.13
11.0	2437	2.54	0.81	9.99	13.34	21.58

:Worst data rate

IEEE802.11b 1Mbps

Ch	Frequency	P/M Reading [dBm]		Cable Loss	Atten.	Result [dBm]		Result [mW]	
	[MHz]	PK	AVG	[dB]	[dB]	PK	AVG	PK	AVG
1	2412	5.91	3.11	0.81	9.99	16.71	13.91	46.88	24.60
6	2437	5.34	2.69	0.81	9.99	16.14	13.49	41.11	22.34
11	2462	4.30	2.01	0.81	9.99	15.10	12.81	32.36	19.10

[IEEE802.11g] Rate Check

Rate	Frequency	P/M Reading [dBm]	Cable Loss	Atten.	Result [dBm]	Result [mW]
[Mbps]	[MHz]	AVG	[dB]	[dB]	AVG	AVG
6.0	2437	-0.12	0.81	9.99	10.68	11.69
9.0	2437	-0.21	0.81	9.99	10.59	11.46
12.0	2437	-0.27	0.81	9.99	10.53	11.30
18.0	2437	-0.14	0.81	9.99	10.66	11.64
24.0	2437	-0.25	0.81	9.99	10.55	11.35
36.0	2437	-0.33	0.81	9.99	10.47	11.14
48.0	2437	-0.27	0.81	9.99	10.53	11.30
54.0	2437	-0.22	0.81	9.99	10.58	11.43

IEEE802.11g 6Mbps

Ch	Frequency	P/M Reading [dBm]	Cable Loss	Atten.	Result [dBm]	Result [mW]
	[MHz]	AVG	[dB]	[dB]	AVG	AVG
1	2412	0.50	0.81	9.99	11.30	13.49
6	2437	-0.12	0.81	9.99	10.68	11.69
11	2462	-0.95	0.81	9.99	9.85	9.66

Sample Calculation:
Result = Reading + Cable Loss + Attenuator

[IEEE802.11n20] Rate Check

Rate	Frequency	P/M Reading [dBm]	Cable Loss	Atten.	Result [dBm]	Result [mW]
	[MHz]	AVG	[dB]	[dB]	AVG	AVG
MCS0	2437	-1.02	0.81	9.99	9.78	9.51
MCS1	2437	-1.11	0.81	9.99	9.69	9.31
MCS2	2437	-1.08	0.81	9.99	9.72	9.38
MCS3	2437	-1.09	0.81	9.99	9.71	9.35
MCS4	2437	-1.07	0.81	9.99	9.73	9.40
MCS5	2437	-1.09	0.81	9.99	9.71	9.35
MCS6	2437	-1.07	0.81	9.99	9.73	9.40
MCS7	2437	-1.04	0.81	9.99	9.76	9.46

IEEE802.11n20 MCS0

Ch	Frequency	P/M Reading [dBm]	Cable Loss	Atten.	Result [dBm]	Result [mW]
	[MHz]	AVG	[dB]	[dB]	AVG	AVG
1	2412	-0.03	0.81	9.99	10.77	11.94
6	2437	-1.02	0.81	9.99	9.78	9.51
11	2462	-1.84	0.81	9.99	8.96	7.87

[IEEE802.11n40] Rate Check

Rate	Frequency	P/M Reading [dBm]	Cable Loss	Atten.	Result [dBm]	Result [mW]
[Mbps]	[MHz]	AVG	[dB]	[dB]	AVG	AVG
MCS0	2437	-1.09	0.81	9.99	9.71	9.35
MCS1	2437	-1.00	0.81	9.99	9.80	9.55
MCS2	2437	-1.08	0.81	9.99	9.72	9.38
MCS3	2437	-1.09	0.81	9.99	9.71	9.35
MCS4	2437	-1.09	0.81	9.99	9.71	9.35
MCS5	2437	-1.15	0.81	9.99	9.65	9.23
MCS6	2437	-1.05	0.81	9.99	9.75	9.44
MCS7	2437	-1.08	0.81	9.99	9.72	9.38

IEEE802.11n40 MCS1

Ch	Frequency	P/M Reading [dBm]	Cable Loss	Atten.	Result [dBm]	Result [mW]
	[MHz]	AVG	[dB]	[dB]	AVG	AVG
3	2422	-0.99	0.81	9.99	9.81	9.57
6	2437	-1.00	0.81	9.99	9.80	9.55
9	2452	-1.78	0.81	9.99	9.02	7.98

5.3 Confirmation before SAR testing

Correlation of Output Power between EMC and SAR tests

It was checked that the antenna port power was correlated within 0~+5% (FCC requirements)

Mode	Max.power SAR sample		Max.power EMC sample		Deviation	Note
	Measured cnducted Peak		Measured cnducted Peak			
	[dBm]	[mW]	[dBm]	[mW]	[%]	
11b	16.71	46.88	16.69	46.67	0.5	*SAR testing mode

5.4 Confirmation after SAR testing

It was checked that the power drift [W] is within +/-5%.The verification of power drift during the SAR test is that DASY5 system calculates the power drift by measureing the e-filed at the same location at beginning and the end of the scan measurement for each test position.

DASY5 system calucation Power drift value[dB] =20log(Ea)/(Eb)
Before SAR testing : Eb[V/m]
After SAR testing : Ea[V/m]

Limit of power drift[W] =+/-5%
X[dB]=10log[P]=10log(1.05/1)=10log(1.05)-10log(1)=0.212dB

from E-filed relations with power.
p=E^2/η=E^2/
Therefore, The correlation of power and the E-filed
XdB=10log(P)=10log(E)^2=20log(E)

Therefore,
The calculated power drift of DASY5 System must be the less than +/-0.212dB.

SECTION6 : Description of the Body setup

6.1 Description of the Body setup

i)Procedure for SAR testing

-The test was performed according to the KDB447498D01(v04) (Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies)

ii)Test mode

WLAN 2.4G	**Data transmission mode (11b)**

(1) Front :
The measurement touched the front face of EUT and flat phantom.
(2) Rear :
T The measurement touched the rear face of EUT and flat phantom.
(3) Left edge :
The measurement touched the left edge of EUT and flat phantom.
(4) Right edge :
The measurement touched the right edge of EUT and flat phantom.
(5) Top edge :
The measurement touched the top edge of EUT and flat phantom.
(6) Bottom edge :
The measurement touched the bottom edge of EUT and flat phantom.
(7) Worst position (5mm) :
The measurement separated 5mm distance between the worst position of EUT and flat phantom.

<Antenna position>
The antennas use for WLAN is fixed position. The antennas are integral part of the device.

SECTION 7 : Test surrounding

7.1 Measurement uncertainty

The uncertainty budget has been determined for the DASY5 measurement system according to the SPEAG documents[2] and is given in the following Table.

Error Description	Uncertainty value ± %	Probability distribution	divisor	(ci) 1g	Standard Uncertainty (1g)	vi or veff
Measurement System						
Probe calibration	±6.55	Normal	1	1	±6.55	∞
Axial isotropy of the probe	±4.7	Rectangular	√3	0.7	±1.9	∞
Spherical isotropy of the probe	±9.6	Rectangular	√3	0.7	±3.9	∞
Boundary effects	±2.0	Rectangular	√3	1	±1.2	∞
Probe linearity	±4.7	Rectangular	√3	1	±2.7	∞
Detection limit	±1.0	Rectangular	√3	1	±0.6	∞
Readout electronics	±0.3	Normal	1	1	±0.3	∞
Response time	±0.8	Rectangular	√3	1	±0.5	∞
Integration time	±2.6	Rectangular	√3	1	±1.5	∞
RF ambient Noise	±3.0	Rectangular	√3	1	±1.7	∞
RF ambient Reflections	±3.0	Rectangular	√3	1	±1.7	∞
Probe Positioner	±0.8	Rectangular	√3	1	±0.5	∞
Probe positioning	±9.9	Rectangular	√3	1	±5.7	∞
Max.SAR Eval.	±4.0	Rectangular	√3	1	±2.3	∞
Test Sample Related						
Device positioning	±2.9	Normal	1	1	±2.9	8
Device holder uncertainty	±3.6	Normal	1	1	±3.6	6
Power drift	±5.0	Rectangular	√3	1	±2.9	∞
Phantom and Setup						
Phantom uncertainty	±4.0	Rectangular	√3	1	±2.3	∞
Liquid conductivity (target)	±5.0	Rectangular	√3	0.64	±1.8	∞
Liquid conductivity (meas.)	±5.0	Rectangular	1	0.64	±3.2	∞
Liquid permittivity (target)	±5.0	Rectangular	√3	0.6	±1.7	∞
Liquid permittivity (meas.)	±5.0	Rectangular	1	0.6	±3.0	∞
Combined Standard Uncertainty					**±13.356**	
Expanded Uncertainty (k=2)					**±26.7**	

SECTION 8 : Measurement results

8.1 WLAN Body SAR (2.4G)

(1)Method of measurement

Step1. The searching for the worst position
The test was performed in mode of the maximum average output power
Step2. The changing to the channels (Low, Mid, High)
The test was performed at the worst condition of Step1.
Step3. The changing to the separation
It was performed to confirm of the separation testing.
The device is moved away from the phantom in 5mm increments from the touching.
A single-point SAR is measured until the SAR is less than 50% of that measured at the touching position.

Note:
1)The BODY SAR is not required for 11g/n mode because the maximum average output power for 11g/n mode is less than 1/4dB higher than that measured 11b mode.

(2)Simulated Tissue Liquid Parameter confirmation

The dielectric parameters were checked prior to assessment using the HP85070D dielectric probe kit.
The dielectric parameters measurement is reported in each correspondent section.

DIELECTRIC PARAMETERS MEASUREMENT RESULTS										
Date	Ambient Temp. [deg.c]	Relative Humidity [%]	Liquid type	Liquid Temp. [deg.c]	Measured Frequency [MHz]	Parameters	Target Value*1	Measured	Deviation [%]	Limit [%]
1-Sep	23.5	64	MSL 2450	24.5	2450	εr	52.7	51.4	-2.5	+/-5
						σ [mho/m]	1.95	2.01	3.1	+/-5

εr: Relative Permittivity / σ : Coductivity
*1 The Target value is a parameter defined in FCC OET65.

3)Result of Body SAR

BODY SAR MEASUREMENT RESULTS							
Frequency		Modulation	Phantom Section	EUT Set-up Conditions			SAR(1g) [W/kg]
Channel	[MHz]			Antenna	Position	Separation [mm]	Maximum value of multi-peak
Step.1 Position searching							
1	2412	11b 1Mbps	Flat	Fixed	Front	0	**1.11**
1	2412	11b 1Mbps	Flat	Fixed	Rear	0	**0.072**
1	2412	11b 1Mbps	Flat	Fixed	Left edge	0	**0.048**
1	2412	11b 1Mbps	Flat	Fixed	Right edge	0	**0.397**
1	2412	11b 1Mbps	Flat	Fixed	Top edge	0	**0.109**
1	2412	11b 1Mbps	Flat	Fixed	Bottom	0	**0.027**
Step.2 Channel change (SAR level in Step.1 > 0.8 w/kg)							
6	2437	11b 1Mbps	Flat	Fixed	Front	0	**0.598**
11	2462	11b 1Mbps	Flat	Fixed	Front	0	**0.658**

A single- point SAR evaluation was evaluated by the peak SAR (Extrapolated).
As the result, a single-point SAR at 5mm separation position is checked that it was less than 50% from SAR at the touching position

BODY SAR MEASUREMENT RESULTS								
Frequency		Modulation	Phantom Section	EUT Set-up Conditions			Single-SAR [W/kg]	SAR(1g) [W/kg]
Channel	[MHz]			Antenna	Position	Separation [mm]		
Step.3 Separation distance change								
1	2412	11b 1Mbps	Flat	Fixed	Front	0	**2.758**	**1.11**
1	2412	11b 1Mbps	Flat	Fixed	Front	5	**0.507**	**0.24**

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SECTION 9 Test instruments

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MPM-12	Power Meter	Anritsu	ML2495A	0825002	Power Measurement	2011/08/09 * 12
MPSE-17	Power sensor	Anritsu	MA2411B	0738285	Power Measurement	2011/08/09 * 12
MAT-22	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	Power Measurement	2011/03/14 * 12
MCC-103	Microwave Cable	Hirose Electric	U.FL-2LP-066J1-A(200)	-	Power Measurement	2011/06/24 * 12
MPM-01	Power Meter	Agilent	E4417A	GB41290639	SAR	2011/02/01 * 12
MPSE-01	Power Sensor	Agilent	E9300B	US40010300	SAR	2011/01/28 * 12
MPSE-03	Power sensor	Agilent	E9327A	US40440576	SAR	2011/02/02 * 12
MAT-15	Attenuator(30dB)	Agilent	8498A	US40010300	SAR	2011/02/16 * 12
MSG-10	Signal Generator	Agilent	N5181A	MY47421098	SAR	2010/09/08 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	MY39500780	SAR	2011/03/10 * 12
MHDC-12	Dual Directional Coupler	Hewlett Packard	772D	2839A0016	SAR	Pre Check
EST-08	Network Analyzer	Agilent	8753ES	US39174808	SAR	2011/05/11 * 12
MDPK-01	Dielectric probe kit	Agilent	85070D	702	SAR	2010/10/25 * 36
EST-46	3.5mm Calibration Kit	Agilent	85052D	MY43252869	SAR	2011/06/13 * 12
MPB-03	Dosimetric E-Field Probe	Schmid&Partner Engineering AG	EX3DV3	3507	SAR	2011/03/16 * 12
MDAE-01	Data Acquisition Electronics	Schmid&Partner Engineering AG	DAE4	509	SAR	2011/07/20 * 12
COTS-MSAR-03	Dasy5	Schmid&Partner Engineering AG	DASY52.6.1.408	-	SAR	-
COTS-MSAR-02	S-Parameter Network Analyzer	Agilent	-	-	SAR	-
MDA-07	Dipole Antenna	Schmid&Partner Engineering AG	D2450V2	713	SAR	2010/09/06 * 36
MPF-02	2mmOval Flat Phantom ERI 4.0	Schmid&Partner Engineering AG	QD VA 001B (ERI4.0)	1045	SAR	2011/04/01 * 12
MDH-01	Device holder	Schmid&Partner Engineering AG	Mounting device for transmitter	-	SAR	Pre Check
MOS-26	Thermo-Hygrometer	CUSTOM	CTH-201	A08Q29	SAR	2011/05/26 * 12
MOS-10	Digtal thermometer	HANNA	Checktemp-2	MOS-10	SAR	2011/08/22 * 12
MBM-13	Barometer	Sunoh	SBR121	837	SAR	2011/03/14 * 36
MSL2450				Daily check Target value ± 5%		
SAR room				Daily check Ambient Noise<0.012W/kg		

The expiration date of the calibration is the end of the expired month.
As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.