Hearing Aid Compatibility
（HAC）
T-Coil TEST REPORT

Report No: STS1506089H02

Issued for

NOITAVONNE INSTRUMENTS INC

11104 W.Airport Blvd.#225 Stafford,TX 77477,USA

Product Name:	WCDMA smart phone
Brand Name:	noitavonne
Model No.:	NOIT 21
Series Model:	N/A
FCC ID:	2AE4519NOIT21
Test Standard:	ANSI C63.19:2011
Test Result:	Pass

Shenzhen STS Test Services Co., Ltd.
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Test Report Certification

Applicant's name	:	NOITAVONNE INSTRUMENTS INC
Address	:	11104 W.Airport Blvd.#225 Stafford,TX 77477,USA
Manufacture's Name	:	Shenzhen Siecom Communication Technology Development Co., Ltd.
Address	:	Wanrong building A 6F,4th Industry road,Net valley, Shekou, Shenzhen, China

Product description

Product name	:	WCDMA smart phone
Trademark	:	noitavonne
Model and/or type reference	:	NOIT 21
Serial Model：		N/A
Standards	:	ANSI C63.19:2011

The device was tested by Shenzhen STS Test Services Co., Ltd. The test results in this report apply only to the tested sample of the stated device/equipment. Other similar device/equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Date of Test	:	
Date (s) of performance of tests	:	03 July. 2015
Date of Issue	:	06 July. 2015
Test Result	:	**Pass**

Testing Engineer **:** (Allen Chen)

Technical Manager **:** (John Zou)

Authorized Signatory **:** (Bovey Yang)

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1. General Information

1.1 EUT Description

Equipment	WCDMA smart phone
Brand Name	noitavonne
Model No.	NOIT 21
Serial Model	N/A
FCC ID	2AE4519NOIT21
Model Difference	N/A
Hardware Version	N/A
Software Version	N/A
Device Category:	N/A
Frequency Range	GSM 850: 824.2 ~ 848.8 MHz PCS1900: 1850.2 ~ 1909.8 MHz WCDMA II: 1852.4~1907.6 MHz WCDMA V: 826.4~846.6 MHz WLAN 802.11 b/g/n(HT20):2412-2462 MHz WLAN 802.11 n(HT40):2422-2452 MHz Bluetooth：2402~2480MHz
Transmit Power(MAX):	GSM 850: 32.36dBm GSM 1900: 27.38dBm WCDMA II: 23.12dBm WCDMA V: 21.49dBm
M category	T3
Test Result	Pass
Operating Mode:	GSM: GSM Voice, GPRS, Class 12; WCDMA: RMC, HSDPA, HSUPA Release 6; WLAN: 802.11 b/g/n; Bluetooth: V2.1+EDR (GFSK+ π /4DQPSK+8DPSK)
Antenna Specification:	GSM/WCDMA: PIFA Antenna BT/WIFA: PIFA Antenna
Hotspot Mode:	Support
DTM Mode:	Not Support

1.2 Test Environment

Ambient conditions in the SAR laboratory:

Items	Required	Actual
Temperature (℃)	15-30	21~23
Humidity (%RH)	30-70	55~65

1.3 Test Facility

Shenzhen STS Test Services Co., Ltd.
Add. : 1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road, Fuyong Street, Bao'an District, Shenzhen, Guangdong, China
CNAS Registration No.: L7649
FCC Registration No.: 842334; IC Registration No.: 12108A-1

1.4 Device Under Test

Mobile model:	A610
Normal operation:	Held to head
Accessory:	Standard cover

List of air interfaces/bands & operating modes for model A610

air interfaces	Bands (MHz)	Type	C63.19/ Tested	Simultaneous Transmissions Note:Not to be tested	OTT	Reduced power 20.19(c)(1)
GSM	850	VO	Yes	Bluetooth,WLAN	N/A	N/A
	1900		Yes			
	GPRS/ FDGE	DT	N/A	Bluetooth,WLAN	N/A	No
WCDMA	850	VO	No	Bluetooth,WLAN	N/A	N/A
	1900					
	HSPA	DT	N/A	Bluetooth,WLAN	N/A	N/A
WLAN	2412	DT	N/A	GSM,WCDMA	N/A	N/A
	2437			GSM,WCDMA	N/A	N/A
	2462			GSM,WCDMA	N/A	N/A
Bluetooth	2450	DT	N/A	GSM,WCDMA	N/A	N/A

VO: Voice CMRS/PTSN Service Only

V/D: Voice CMRS/PTSN and Data Service

DT: Digital Transport

2. System components

2.1 Test Conditions Description

Test frequency: GSM 850MHz PCS 1900MHz
Operation mode: Call established
Power Level: GSM 850 MHz Maximum output power(level 5)
PCS 1900 MHz Maximum output power(level 0)
During test, EUT is in Traffic Mode (Channel Allocated) at Normal Voltage Condition. A communication link is set up with a System Simulator (SS) by air link, and a call is established. The Absolute Radio Frequency Channel Number (ARFCN) is allocated to 128, 189 and 251 respectively in the case of GSM 850 MHz, or to 512, 661 and 810 respectively in the case of PCS 1900 MHz, The EUT is commanded to operate at maximum transmitting power.

2.2 Test Opertaion Description

On July 10.2003.the Federal Communications Commission (FCC) adopted new rules requiring wireless manufacturers and service providers to provide digital wireless phones that are compatible with hearing aids. The FCC has modified the exemption for wireless phones under the Hearing Aid Compatibility Act of 1998 (HAC Act) in WT Docket 01-309 RM-8658 to extend the benefits of wireless telecommunications to individuals with hearing disabilities. These benefits encompass business, social and emergency communications, which increase the value of the wireless network for everyone. An estimated more than 10% of the population in the United States show signs of hearing impairment and of that fraction, almost 80% use hearing aids. Approximately 500 million people worldwide suffer from hearing loss.

Compatibility Tests involved:

The standard calls for wireless communications devices to be measured for:
- RF Electric-field emissions.
- RF Magnetic- field emissions.
- T-coil mode, magnetic-signal strength in the audio band.
- T-coil mode, magnetic-signal frequency response through the audio band.
- T-coil mode, magnetic-signal and noise articulation index.

The hearing aid must be measured for:
- RF immunity in microphone mode
- RF immunity in T-coil mode In the following tests and results, this report includes the evaluation for a wireless communications device

2.3 ANSI/IEEE PC 63.19 Performance Categories

2.3.1. T-coil

The table below provides the signal quality requirement for the intended audio magnetic signal from a wireless device. Only the RF immunity of the hearing aid is measured in T-coil mode. It is assumed that a hearing aid can have no immunity to an interference signal in the audio band, which is the intended reception band for this mode. The only criterion that can be measured is the RF immunity in T-coil mode. This is measured using the same procedure as the audio coupling mode at the same levels. The signal quality of the axial and radial components of the magnetic field was used to determine the T-coil mode category.

Category	Telephone RF Parameter Wirless Device Signal Quality (Signal+Noise-to-noise ratio in dB)
T1	0-10 dB
T2	10-20 dB
T3	20-30 dB
T4	>30 dB
Magnetic Coupling Parameters	

FCC wireless hearing aid compatibility rules ensure that consumers with hearing loss are able to access wireless communications services through a wide selection of handsets without experiencing disabling radio frequency (RF) interference or other technical obstacles. To define and measure the hearing aid compatibility of handsets, in CFR47 part 20.19 ANSI C63.19 is referenced. A handset is considered hearing aid-compatible for acoustic coupling if it meets a rating of at least M3 under ANSI C63.19, and A handset is considered hearing aid compatible for inductive coupling if it meets a rating of at least T3.

For inductive coupling, the wireless communication devices should be measured as below.

1) Magnetic signal strength in the audio band
2) Magnetic signal frequency response through the audio band
3) Magnetic signal to noise

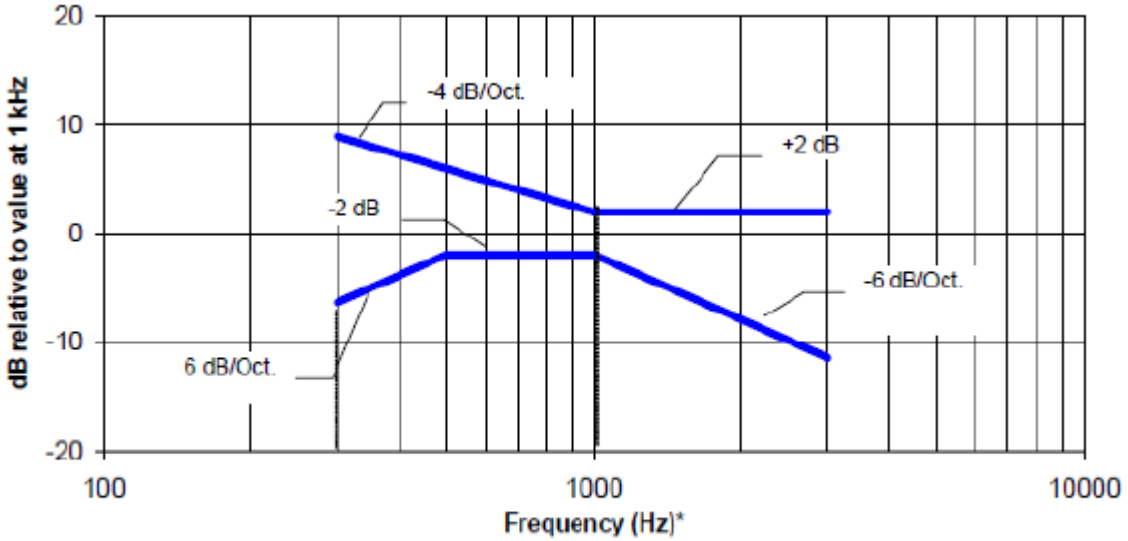
1. T-Coil Coupling Field Intensity

When measured as specified in this standard, the T-Coil signal shall be $\geqslant$ –18 dB (A/m) at 1 kHz, in a 1/3 octave band filter for all orientations.

2. T-Coil Frequency Response

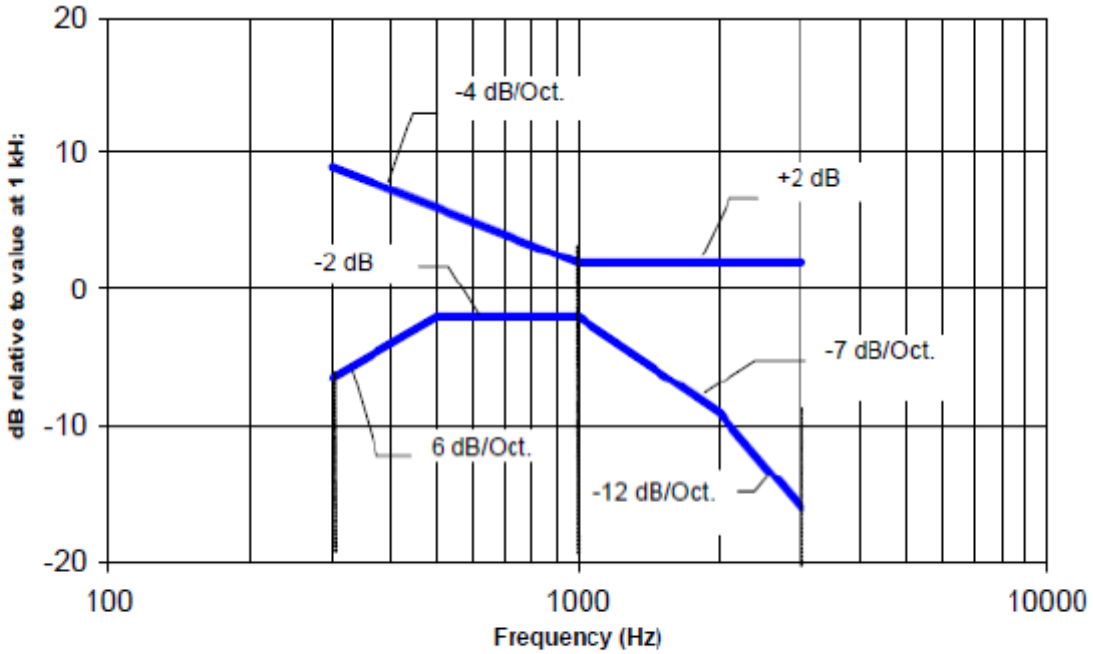
The frequency response of the perpendicular component of the magnetic field, measured in 1/3 octave bands, shall follow the response curve specified in this sub-clause, over the frequency range 300 Hz to 3000 Hz.

Figure 4.1 and Figure 4.2 provide the boundaries as a function of frequency. These response curves are for true field-strength measurements of the T-Coil signal. Thus, the 6 dB/octave probe response has been corrected from the raw readings.



NOTE—The frequency response is between 300 Hz and 3000 Hz.

Fig. 4.1 Magnetic field frequency response for WDs with field strength≤-15dB at 1 KHz



NOTE—The frequency response is between 300 Hz and 3000 Hz.

Fig. 4.2 Magnetic field frequency response for WDs with a field that exceeds –15 dB(A/m) at 1 kHz

2.4 Axis Articulated Robot

ALSAS-10U utilizes a six articulated robot, which is controlled using a Pentium based real-time movement controller. The movement kinematics engine utilizes proprietary (Thermo CRS) interpolation and extrapolation algorithms, which allow full freedom of movement for each of the six joints within the working envelop. Utilization of joint 6 allows for full probe rotation with a tolerance better than 0.05mm around the central axis.

Robot /Controller Manufacturer	KUKA
Number of Axis	Six independently controlled axis
Positioning Repeatability	＜±0.03mm
Controller Type	KR C4 compact
Robot Reach	901mm
Communication	RS232 and LAN compatible

2.5 Universal Device Positioner

The universal device positioner allows complete freedom of movement of the EUT. Developed to hold a EUT in a free-space scenario any additional loading attributable to the material used in the construction of the positioner has been eliminated. Repeatability has been enhanced through the linear scales which form the design used to indicate positioning for any given test scenario in all major axes.

2.6 T-Coil Probe

Coil Dimension	6.55 mm length * 2.29 mm diameter
DC resistance	860.6 Ω
Wire size	51AWG
Inductance at 1 kHz	132.1 mH at 1 kHz

2.6.1 System Hardware

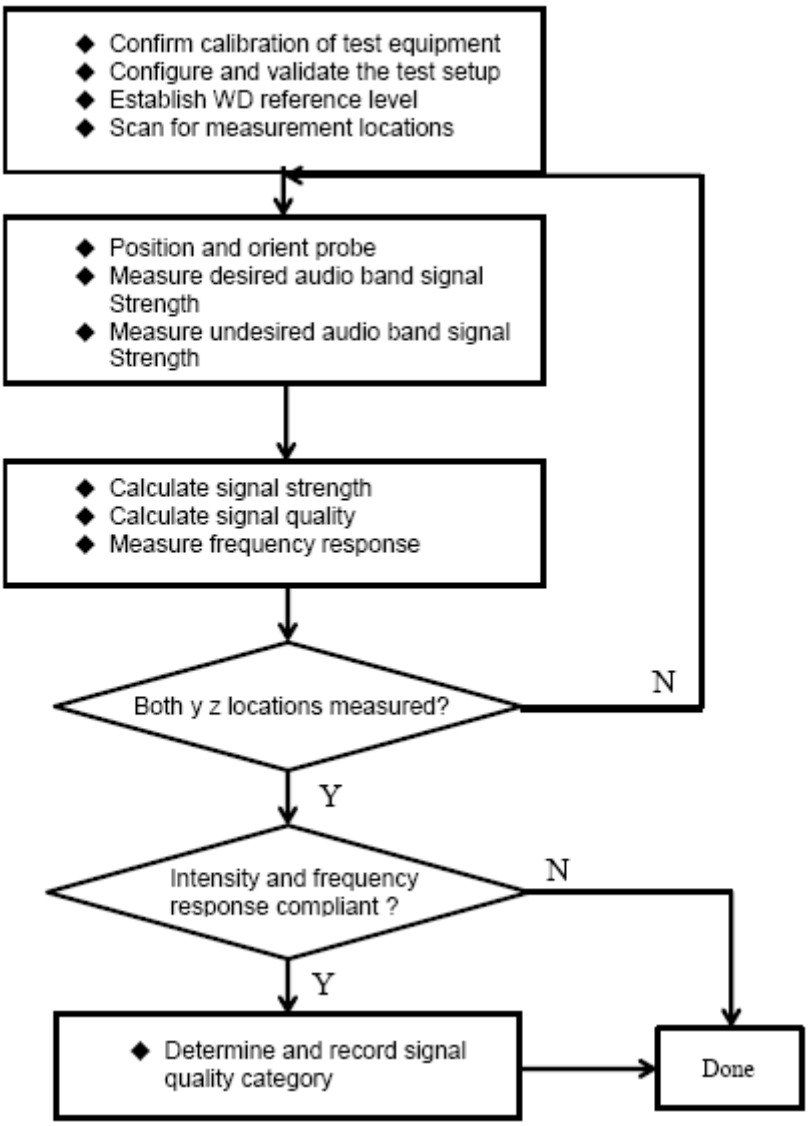
The HAC positioning ruler is used to position the phone properly with the regard to the position of the probe during a measurement. The positioning system is made of a dedicated frame that can be fixed on the table. The tip of the probe is positioned on a reference point located on the top of the positioning ruler. The distance between this reference point and the cross located on the ruler being known, the speaker of the phone is positioned on this cross in order to make sure both probe and phone are positioned properly.

During the measurement, the HAC ruler has to be removed so that it does not interfere with the measurement.

2.6.2 Test Procedure

2.7.2.1 T-coil Test Flow

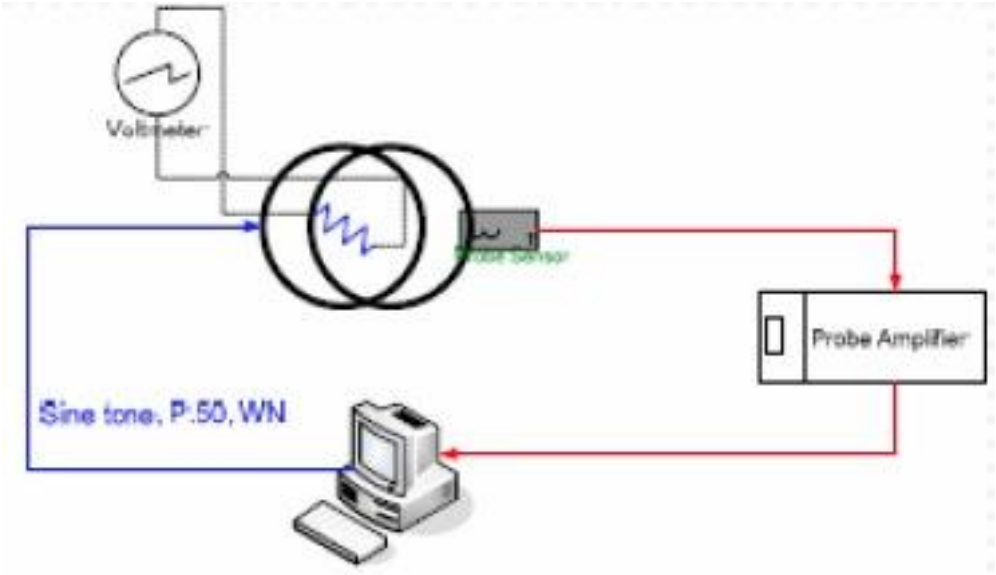
The flow diagram below was followed:



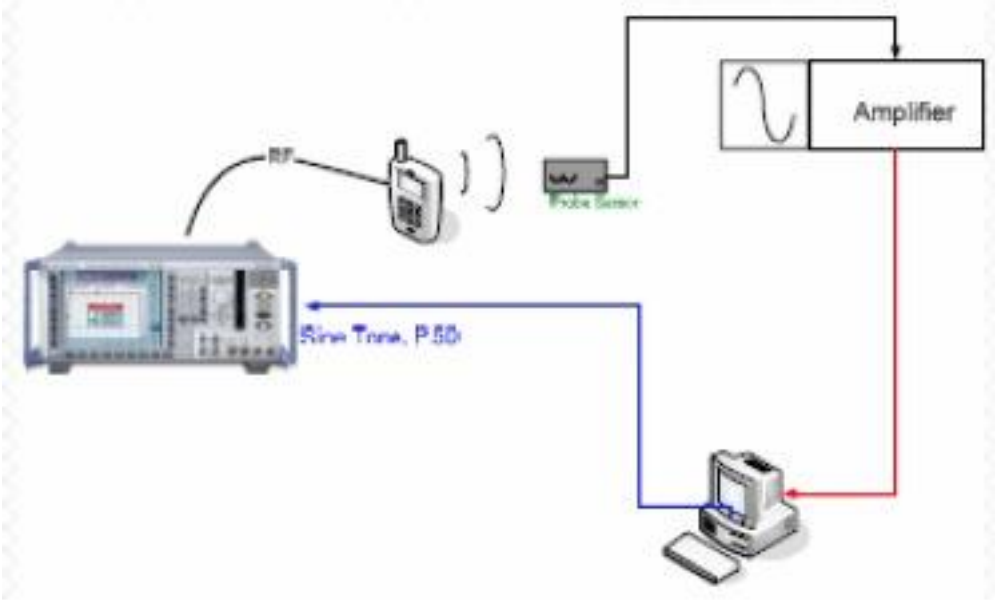
T-Coil Signal Test Process

2.6.2.2 Test Setup

The equipment was connected as shown in an acoustic/RF hemi-anechoic chamber:



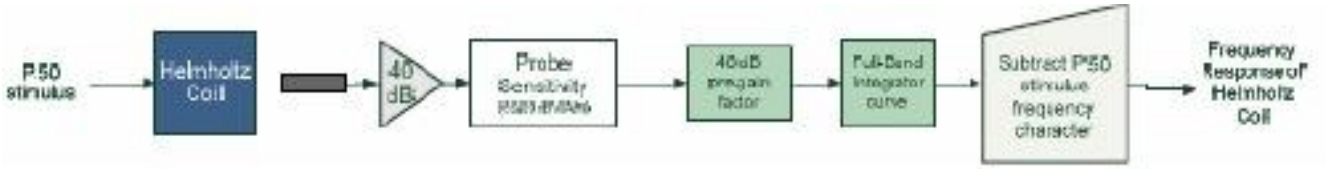
Validation Setup with Helmholtz Coil



T-Coil Test Setup

2.6.2.3 Test Procedure

Frequency Response Validation The frequency response through the Helmholtz Coil was verified to be within 0.5 dB relative to 1 kHz, between 300 – 3000 Hz using the ITU-P.50 artificial speech signal as shown below:



Measurement Validation WD noise measurements are filtered with A-weighting and Half-Band Integration over a frequency range of 100Hz – 10kHz to process ABM2 measurements. Below is the verification of the system processing A-weighting and Half-Band integration between system input to output within 0.5 dB of the theoretical result:

f(Hz)	HBI, A- Measured (dB re 1kHz)	HBI, A- Theoretical (dB re 1kHz)	dB Var.
100	-16.150	-16.170	0.012
125	-13.241	-13.250	0.008
160	-10.333	-10.340	0.007
200	-8.005	-8.010	0.006
250	-5.915	-5.920	0.005
315	-4.035	-4.040	0.005
400	-2.395	-2.400	0.004
500	-1.207	-1.210	0.003
630	-0.347	-0.350	0.003
800	0.068	0.070	0.002
1000	0.001	0.000	0.001
1250	-0.501	-0.500	-0.001
1600	-1.511	-1.510	-0.001
2000	-2.783	-2.780	-0.003
2500	-4.323	-4.320	-0.003
3150	-6.175	-6.170	-0.005
4000	-8.338	-8.330	-0.008
5000	-10.599	-10.590	-0.009
6300	-13.212	-13.200	-0.010
8000	-16.284	-16.270	-0.011
10000	-19.539	-19.520	-0.015

2.7 Test Equipment List

NO.	Instrument	Manufacturer	Model	S/N	Cal. Date	Cal. Due Date
1	T-coil Probe	SATIMO	STCOIL	SN 06/14 TCP30	2014.09.01	2015.08.31
2	Reference Validation Dipole 850MHz	SATIMO	SID835	SN 13/14 DHA55	2014.09.01	2015.08.31
3	Reference Validation Dipole 1900MHz	SATIMO	SIDB1900	SN 13/14 DHB59	2014.09.01	2015.08.31
4	Dielectric Probe Kit	SATIMO	SCLMP	SN 32/14 OCPG52	2014.09.01	2015.08.31
5	Device Holder	SATIMO	SCLMP	SN 32/14 TABH37	2014.09.01	2015.08.31
6	Waveguide	SATIMO	SWG5500	SN 13/14 WGA32	2014.09.01	2015.08.31
7	COMHAC Test Bench	SATIMO	Version 2	NA	Validated. No cal required	Validated. No cal required
8	HAC positioning ruler	SATIMO	TABH12 SN 42/09	NA	Validated. No cal required	Validated. No cal required
9	SAR TEST BENCH	SATIMO	3G MOBILE PHONE POSITIONNING SYSTEM	SN 32/14 MSH97	2014.09.01	2015.08.31
10	SAR TEST BENCH	SATIMO	LAPTOP POSITIONNING SYSTEM	SN 32/14 LSH29	2014.09.01	2015.08.31
11	Temperature/Humidity sensor	Mieo	HH660	STS-H025	2014.10.28	2015.10.27
12	Multi Meter	Keithley	Multi Meter 2000	4050073	2014.11.20	2015.11.19
13	Amplifier	Mini-Circuit	ZHL-42	22374	2014.11.20	2015.11.19
14	Signal Generator	R&S	SMF100A	104260	2014.10.27	2015.10.26
15	Power Meter	R&S	NRP	100510	2014.10.25	2015.10.24
16	Power Sensor	R&S	NRP-Z11	101919	2014.10.25	2015.10.24
17	Network Analyzer	R&S	5071C	EMY46103472	2014.12.12	2015.12.11
18	KUKA Robot	KUKA	10012265	501821	2014.09.01	2015.08.31

Note: All equipment upon which need to be calibrated are with calibration period of 1 year.

2.8 Measurement Uncertainty

UNCERTAINTY EVALUATION FOR RF HAC MEASUREMENT					
Uncertainty Component	Tol. (± dB)	Prob. Dist.	Div.	Uncertainty (dB)	Uncertainty (%)
Measurement System					
RF reflections	0.1	R	√3	0.06	
Field probe conv. Factor	0.4	R	√3	0.23	
Field probe anisotropy	0.25	R	√3	0.14	
Positioning accuracy	0.2	R	√3	0.12	
Probe cable placement	0.1	R	√3	0.06	
System repeatability	0.2	R	√3	0.12	
EUT repeatability	0.4	N	1	0.40	
Combined Standard Uncertainty		N	1	0.52	
Expanded Uncertainty (95% CONFIDENCE INTERVAL)		N	k=2	1.03	12.65
REPORTED Expanded uncertainty (confidence level of 95%, k = 2)		N	k=2	1.00	13.00

UNCERTAINTY EVALUATION FOR AUDIO HAC MEASUREMENT					
Uncertainty Component	Tol. (± dB)	Prob. Dist.	Div.	Uncertainty (dB)	Uncertainty (%)
Measurement System					
RF reflections	0.1	R	√3	0.06	
Acoustic noise	0.1	R	√3	0.06	
Probe coil sensitivity	0.49	R	√3	0.28	
Reference signal level	0.25	R	√3	0.14	
Positioning accuracy	0.4	R	√3	0.23	
Cable loss	0.1	N	2	0.05	
Frequency analyzer	0.15	R	√3	0.09	
System repeatability	0.2	N	1	0.20	
Repeatability of the WD	0.4	N	1	0.40	
Combined Standard Uncertainty		N	1	0.61	
Expanded uncertainty (confidence level of 95%, k – 2)		N	k=2	1.22	15.05
REPORTED Expanded uncertainty (confidence level of 95%, k = 2)		N	k=2	1.20	15.00

3 .OVERALL MEASUREMENT SUMMARY

3.1 Conducted Power(Unit:dBm)

Band	GSM850			GSM1900		
Channel	128	190	251	512	661	810
Frequency(MHz)	824.2	836.6	848.8	1850.2	1880.0	1909.8
RF Output power(dBm)	32.36	32.27	32.16	27.38	27.19	27.12

Band	WCDMA 850			WCDMA 1900		
Channel	4133	4175	4232	9263	9400	9537
Frequency(MHz)	826.6	8.35	846.4	1852.6	1880.0	1907.4
RF Output power(dBm)	21.15	21.49	21.13	22.48	22.84	23.12

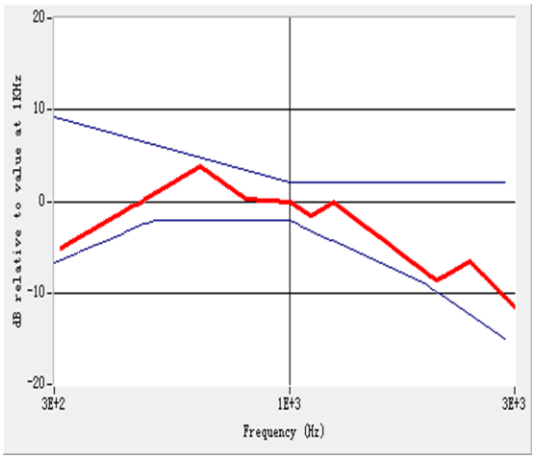
3.2 T-coil for GSM:

T-Coil Test Result

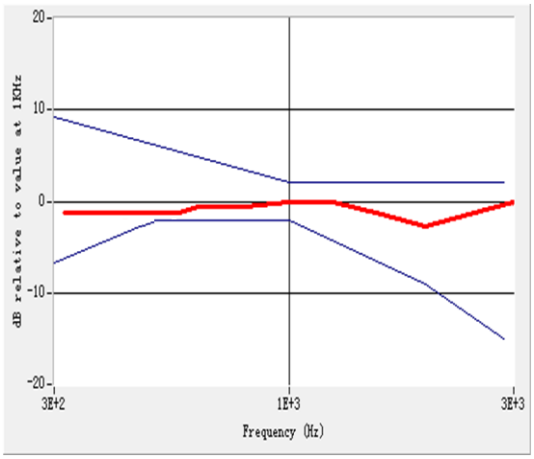
Plot No.	Mode	Channel	Probe Position	ABM1 (dB A/m)	ABM2 (dB A/m)	SNR (dB)	T Rating
1	GSM850	190	Axial(Z)	-3.29	-36.52	33.23	T4
			Transversal(Y)	-13.66	-45.61	31.95	T4
2	PCS1900	661	Axial(Z)	-2.68	-34.58	31.90	T4
			Transversal(Y)	-8.62	-33.82	25.20	T3
3	WCDMA850	4175	Axial(Z)	-6.81	-47.67	40.86	T4
			Transversal(Y)	-1.35	-36.54	35.19	T4
4	WCDMA1900	9400	Axial(Z)	-3.25	-32.87	29.62	T3
			Transversal(Y)	-12.51	-32.94	20.43	T3

Remark:
1. There is special HAC mode software on this EUT.
2. The volume was adjusted to maximum level and the backlight turned off during T-Coil testing

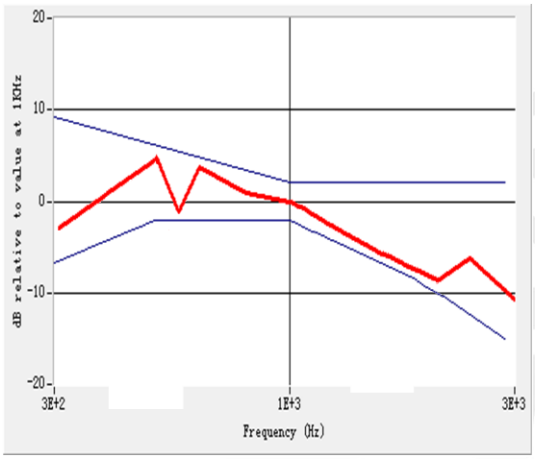
4. Frequency Response Plots



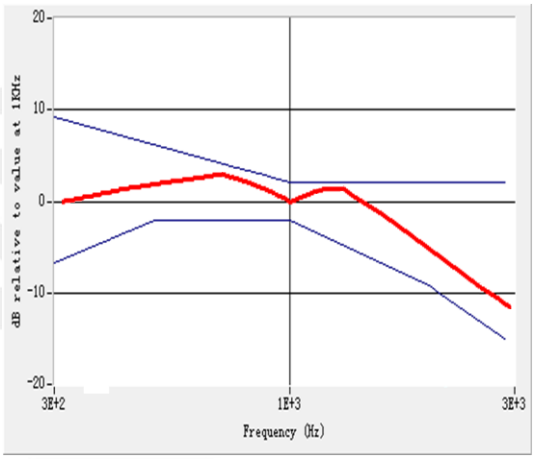
GSM 850



GSM 1900

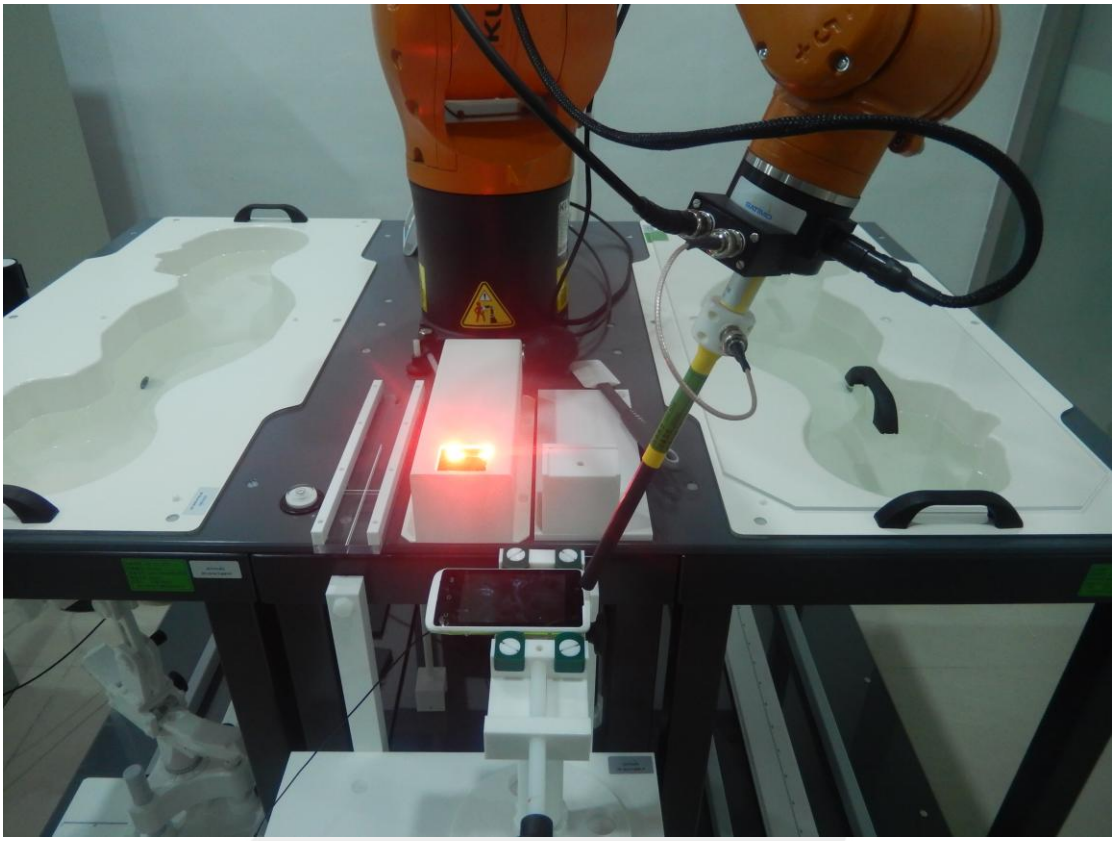


WCDMA 850



WCDMA 1900

5. T-coil Test Photo



6. Probe Calibration And Dipole Calibration Report

The following pages include the probe calibration used to evaluate HAC for the DUT.

SATIMO
The microwave vision company

COMOHAC T-coil Probe Calibration Report

Ref : ACR.262.16.14.SATU.A

SHENZHEN STS TEST SERVICES CO., LTD.
1/F, BUILDING 2, ZHUOKE SCIENCE PARK,No.190,
CHONGQING ROAD,FUYONG,
BAO' AN DISTRICT, SHENZHEN,GUANGDONG,CHINA
SATIMO COMOHAC T-COIL PROBE
SERIAL NO.: SN 06/14 TCP30

Calibrated at SATIMO US
2105 Barrett Park Dr. - Kennesaw, GA 30144

ilac-MRA ACCREDITED

09/01/2014

Summary:

This document presents the method and results from an accredited COMOHAC T-coil Probe calibration performed in SATIMO USA using the COMOHAC test bench, for use with a SATIMO COMOHAC system only. All calibration results are traceable to national metrology institutions.

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	9/19/2014	
Checked by :	Jérôme LUC	Product Manager	9/19/2014	
Approved by :	Kim RUTKOWSKI	Quality Manager	9/19/2014	

	Customer Name
Distribution :	Shenzhen STS Test Services Co., Ltd.

Issue	Date	Modifications
A	9/19/2014	Initial release

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1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOHAC T-COIL PROBE
Manufacturer	Satimo
Model	STCOIL
Serial Number	SN 06/14 TCP30
Product Condition (new / used)	New
Frequency Range of Probe	200-5000 Hz

A yearly calibration interval is recommended.

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

Satimo's COMOHAC T-coil Probes are built in accordance to the ANSI C63.19 and IEEE 1027 standards.

Figure 1 – *Satimo COMOHAC T-coil Probe*

Coil Dimension	6.55 mm length * 2.29 mm diameter
DC resistance	860.6 Ω
Wire size	51AWG
Inductance at 1 kHz	132.1 mH at 1 kHz

3 MEASUREMENT METHOD

All methods used to perform the measurements and calibrations comply with the ANSI C63.19 and IEEE 1027 standards. All measurements were performed using a Helmholtz coil built according to the specifications outlined in ANSI C63.19 and IEEE 1027.

3.1 SENSITIVITY

The T-coil was positioned within the Helmholtz coil in axial orientation. Using an audio generator connected to the input of the Helmholtz coil, a known field (1 A/m) was generated within the coil and the T-coil probe reading recorded over the frequency range of 100 Hz to 1000 Hz.

3.2 LINEARITY

The T-coil probe was positioned within the Helmholtz coil in axial orientation. The audio generator connected to the input of the Helmholtz coil was adjusted to obtain a field within the coil from 0 dB A/m to -50 dB A/m and the T-coil reading recorded at each power level (10 dB steps).

3.3 SIGNAL TO NOISE MEASUREMENT OF THE CALIBRATION SYSTEM

The T-coil probe was positioned within the Helmholtz coil in axial orientation. The audio generator connected to the input of the Helmholtz coil was adjusted to obtain a field of -50 dB A/m. The T-coil reading was recorded. The audio generator is then turned off and the T-coil reading recorded.

4 MEASUREMENT UNCERTAINTY

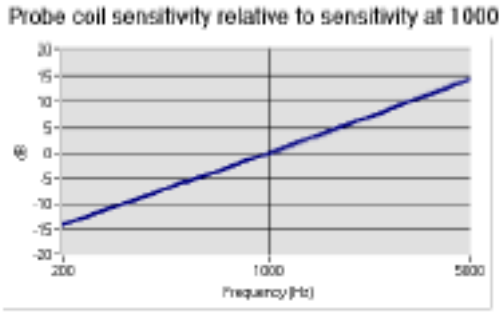
The guideline outlined in the IEEE ANSI C63.19 standard was followed to generate the measurement uncertainty for validation measurements. All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

Uncertainty analysis of the T-coil probe calibration					
Uncertainty Component	Tol. (± dB)	Prob. Dist.	Div.	Uncertainty (dB)	Uncertainty (%)
Current/Volage Accuracy	0.224	R	√3	0.13	
Acoustic/ Signal Source drift	0.008	R	√3	0.00	
Probe coil sensitivity	0.2	R	√3	0.12	
Positioning accuracy	0.4	R	√3	0.23	
Acoustic Signal Receive Accuracy	0.03	R	√3	0.02	
Acoustic Signal Receive Linearity	0.006	R	√3	0.00	
System repeatability	0.4	N	1	0.40	
Combined Standard Uncertainty		N	1	0.49	
Expanded uncertainty (confidence level of 95%, k = 2)		N	k=2	1.00	12.0

5 CALIBRATION MEASUREMENT RESULTS

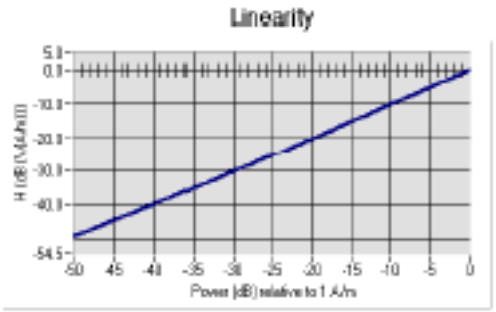
Calibration Parameters	
Lab Temperature	21°C
Lab Humidity	45%

5.1 SENSITIVITY



	Measured	Required
Sensitivity at 1 kHz	-60.25 dB (V/A/m)	–60.5 +/- 0.5 dB (V/A/m)
Max. deviation from Sensitivity	0.38 dB	+/- 0.5 dB

5.2 LINEARITY



	Measured	Required
Linearity Slope	0.21 dB	+/ 0.5 dB

5.3 SIGNAL TO NOISE MEASUREMENT OF THE CALIBRATION SYSTEM

	Measured	Required
Signal to Noise	-65.42 dB A/m	"Reading with -50 dB A/m in coil" – 'no signal applied' > 10 dB

6 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
COMOHAC Test Bench	Version 2	NA	Validated. No cal required.	Validated. No cal required.
Audio Generator	National Instruments	15222AE	01/2014	01/2017
Reference Probe	Satimo	TCP 18 SN 47/10	10/2013	10/2014
Multimeter	Keithley 2000	1188656	12/2013	12/2016
Helmholtz Coil	Satimo	HC07 SN47/10	Validated. No cal required.	Validated. No cal required.
Temperature / Humidity Sensor	Control Company	11-661-9	8/2012	8/2015

COMOHAC TMFS Calibration Report

Ref : ACR.262.19.14.SATU.A

SHENZHEN STS TEST SERVICES CO., LTD.

1/F, BUILDING 2, ZHUOKE SCIENCE PARK,No.190,
CHONGQING ROAD,FUYONG,
BAO' AN DISTRICT, SHENZHEN,GUANGDONG,CHINA

SATIMO COMOHAC MAGNETIC FIELD SIMULATOR

SERIAL NO.: SN 07/14 TMFS24

Calibrated at SATIMO US

2105 Barrett Park Dr. - Kennesaw, GA 30144

09/01/2014

Summary:

This document presents the method and results from an accredited COMOHAC TMFS calibration performed in SATIMO USA using the COMOHAC test bench, for use with a SATIMO COMOHAC system only. All calibration results are traceable to national metrology institutions.

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	9/19/2014	
Checked by :	Jérôme LUC	Product Manager	9/19/2014	
Approved by :	Kim RUTKOWSKI	Quality Manager	9/19/2014	

	Customer Name
Distribution :	Shenzhen STS Test Services Co., Ltd.

Issue	Date	Modifications
A	9/19/2014	Initial release

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3.1 Maximum Axial and Radial Magnetic Field Values 4
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5.1 Maximum Axial and Radial Magnetic Field Values 5
6 List of Equipment 7

Shenzhen STS Test Services Co., Ltd.
1/F., Building B, Zhuoke Science Park, No.190,Chongqing Road, Fuyong Street, Bao'an District, Shenzhen, Guangdong,China
Tel: 0755-36886288 Fax: 0755-36886277 Http://www.stsapp.com E-mail: sts@stsapp.com

1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOHAC Magnetic Field Simulator
Manufacturer	Satimo
Model	STMFS
Serial Number	SN 07/14 TMFS24
Product Condition (new / used)	New
Frequency Range	200-5000 Hz

A yearly calibration interval is recommended.

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

Satimo's COMOHAC T-coil Probes are built in accordance to the ANSI C63.19 and ANSI S3.22-2003 standards.

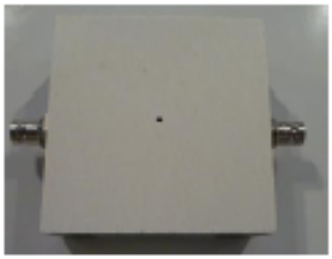


Figure 1 – *Satimo COMOHAC Magnetic Field Simulator*

3 MEASUREMENT METHOD

All methods used to perform the measurements and calibrations comply with the ANSI C63.19. All measurements were performed with the TMFS in the standard device test configuration, with the TMFS in free space, 10 mm below the coil center.

3.1 MAXIMUM AXIAL AND RADIAL MAGNETIC FIELD VALUES

An audio signal was fed into the TMFS and the magnetic field measured and recorded over an area scan with the T-coil probe in three orientations; axial and two radial. The maximum magnetic field is recorded for all three T-coil orientations.

4 MEASUREMENT UNCERTAINTY

The guideline outlined in the IEEE ANSI C63.19 standard was followed to generate the measurement uncertainty for validation measurements. All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

Uncertainty analysis of the probe calibration in Helmholtz Coil					
Uncertainty Component	Tol. (± dB)	Prob. Dist.	Div.	Uncertainty (dB)	Uncertainty (%)
Reflections	0.1	R	$\sqrt{3}$	0.06	
Acoustic noise	0.1	R	$\sqrt{3}$	0.06	
Probe coil sensitivity	0.49	R	$\sqrt{3}$	0.28	
Reference signal level	0.25	R	$\sqrt{3}$	0.14	
Positioning accuracy	0.2	R	$\sqrt{3}$	0.12	
Cable loss	0.1	N	1	0.05	
Frequency analyzer	0.15	R	$\sqrt{3}$	0.09	
System repeatability	0.2	N	1	0.20	
Repeatability of the WD	0.1	N	1	0.10	
Combined standard uncertainty		N	1	0.43	
Expanded uncertainty 95 % confidence level k = 2		N	2	0.85	10.3%

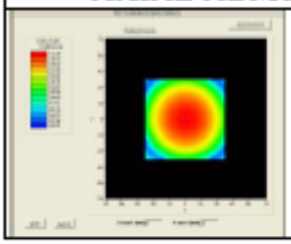
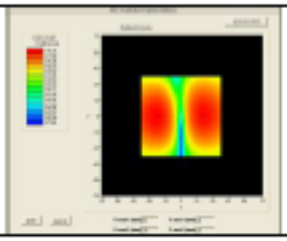
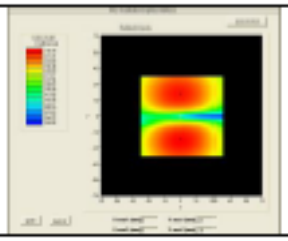
5 CALIBRATION MEASUREMENT RESULTS

Calibration Parameters	
Software	OpenHAC V2
HAC positioning ruler	SN 42/09 TABH12
T-Coil probe	SN 47/10 TCP18
Distance between TMFS and coil center	10 mm
Frequency	1025 Hz
Scan Size	X=70mm/Y=70mm
Scan Resolution	dx=5mm/dy=5mm
Output level	0.5 VAC
Lab Temperature	21°C
Lab Humidity	45%

5.1 MAXIMUM AXIAL AND RADIAL MAGNETIC FIELD VALUES

Test Description	Measured Magnetic Field	
	Location	Intensity (dB A/m)
Axial	Max	-12.06
Radial H	Right side	-19.27
	Left side	-19.03

Radial V	Upper side	-19.12
	Lower side	-18.56

AXIAL ABM1	RADIAL H ABM1	RADIAL V ABM1
		

6 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
COMOHAC Test Bench	Version 2	NA	Validated. No cal required.	Validated. No cal required.
HAC positioning ruler	Satimo	TABH12 SN 42/09	Validated. No cal required.	Validated. No cal required.
Audio Generator	National Instruments	15222AE	01/2014	01/2017
Reference Probe	Satimo	TCP 18 SN 47/10	10/2013	10/2014
Multimeter	Keithley 2000	1188656	12/2013	12/2016
Temperature / Humidity Sensor	Control Company	11-661-9	8/2012	8/2015

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