

COMOHAC H-Field probe Calibration Report



Ref: CR-280-19-08-SATB-A

Page: 1/10

Issue: A

Date: 2012/10/06

COMOHAC H-FIELD PROBE CALIBRATION REPORT

Prepared By: LUC Jérôme, SATIMO
Project Description: HAC TEST BENCH
Prepared For (End User): Shenzhen Morlab Communication Technology

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COMOHAC H-Field probe Calibration Report



Ref: CR-280-19-08-SATB-A

Page: 2/10

Issue: A

Date: 2012/10/06

COMOHAC H-FIELD PROBE CALIBRATION REPORT

DATE: 14/11/2008

REFERENCE: SN 41/08 HPH18

OBJECT: COMOHAC H-FIELD PROBE

MANUFACTURER: SATIMO

SERIAL NUMBER: SN 41/08 HPH18

CUSTOMER: Shenzhen Morlab Communication Technology

CONTRACT: PF2130108b_SAR_Morlab

DATE OF CALIBRATION: 06/10/2012

WARRANTY:

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Date

06. 06. 2012

SAR TEAM MANAGER

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COMOHAC H-Field probe Calibration Report



Ref: CR-280-19-08-SATB-A

Page: 3/10

Issue: A

Date: 2012/10/06

PRODUCT DESCRIPTION



Frequency Range	100 MHz - 30 GHz
Probe length	330 mm
Dimension of one loop	3.3 mm
Maximum external diameter	8 mm
Probe extremity diameter	6 mm
Distance between dipoles/probe extremity	3 mm
Resistance of the three dipole (at the connector)	Dipole 1: $R1=2.1650\text{ M}\Omega$ Dipole 2: $R2=2.2176\text{ M}\Omega$ Dipole 3: $R3=2.4084\text{ M}\Omega$
Connector (HIROSE series SR30)	6 wire male (Hirose SR30series)

The probe could be checked by measuring the resistance of the three ways.

CALIBRATION TEST EQUIPMENT

TYPE	IDENTIFICATION
Calibration bench	SATIMO AIR CALIBRATION SOFTWARE
Multimeter	Keithley 2000

MEASUREMENT PROCEDURE

Probe calibration is realized by using the waveguide method. The probe was inserted in a waveguide loading by a 50 load. By controlling the input power in the waveguide, we are able to create a know H-Field value in the waveguide.

Keithley configuration:

Rate = Medium; Filter =ON; RDGS=10; FILTER TYPE =MOVING AVERAGE; RANGE AUTO

COMOHAC H-Field probe Calibration Report



Ref: CR-280-19-08-SATB-A

Page: 4/10

Issue: A

Date: 2012/10/06

PROBE UNCERTAINTIES

Calibration report of dosimetric SATIMO probe

Uncertainty on calibration system

ERROR SOURCES	Uncertainty value (%)	Probability Distribution	Divisor	ci	Standard Uncertainty (%)
Incident or forward power	3,00%	Rectangular	$\sqrt{3}$	1	1,732%
Reflected power	3,00%	Rectangular	$\sqrt{3}$	1	1,732%
Field homogeneity	3,00%	Rectangular	$\sqrt{3}$	1	1,732%
Field probe positioning	5,00%	Rectangular	$\sqrt{3}$	1	2,887%
Field probe linearity	3,00%	Rectangular	$\sqrt{3}$	1	1,732%
Combined standard uncertainty					4,509%
Expanded uncertainty (confidence interval of 95%)					8,838%

COMOHAC H-Field probe Calibration Report



Ref: CR-280-19-08-SATB-A

Page: 5/10

Issue: A

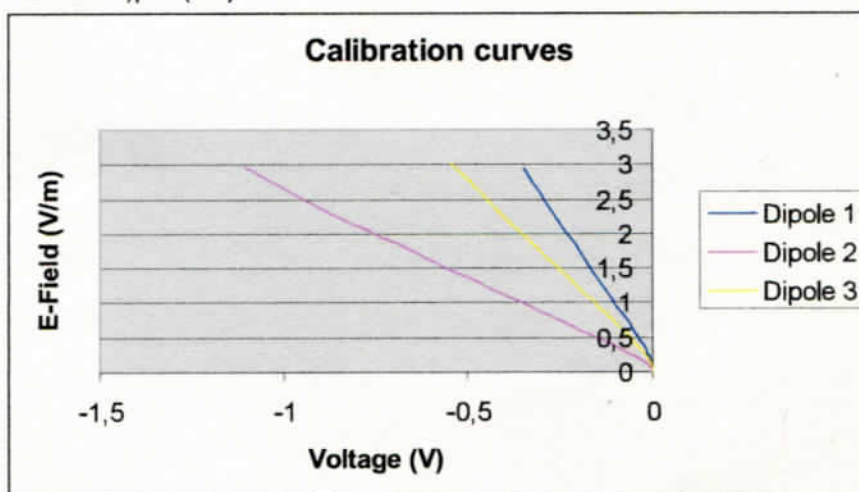
Date: 2012/10/06

A. Calibration parameters 800-1000 MHz.

Temperature	21°C
Cable loss	0.00 dB
Coupler loss	20.30 dB
Low limit detection	0.009 A/m

Calibration curves $h_i=f(V)$ ($i=1,2,3$) allow to obtain H-field value using the formula:

$$H=(h_1 \cdot h_1 + h_2 \cdot h_2 + h_3 \cdot h_3) \text{pow}(1/2)$$



The following tables represent the calibration curves linearization by curve segment in CW signal.

COMOHAC H-Field probe Calibration Report



Ref: CR-280-19-08-SATB-A

Page: 6/10

Issue: A

Date: 2012/10/06

Calibration coefficients for the three loops in CW:

v1	h1	v2	h2	v3	h3
-0,386758	3,3612	-1,228248	3,3868	-0,613324	3,4576
-0,346668	2,9412	-1,106784	2,9704	-0,547987	3,0332
-0,307706	2,6008	-0,989555	2,6228	-0,485971	2,6816
-0,271061	2,308	-0,879874	2,32	-0,428227	2,3712
-0,238197	2,0344	-0,779503	2,0608	-0,37642	2,1012
-0,210244	1,8296	-0,694408	1,8528	-0,332852	1,888
-0,183745	1,6224	-0,612353	1,6424	-0,291397	1,6792
-0,160391	1,4424	-0,539657	1,462	-0,254668	1,4936
-0,139165	1,28	-0,4729	1,2952	-0,221251	1,3212
-0,120617	1,1308	-0,414229	1,1484	-0,191893	1,1696
-0,105005	1,0092	-0,364351	1,0264	-0,16732	1,0456
-0,090243	0,8988	-0,317641	0,9156	-0,144273	0,9288
-0,077376	0,7988	-0,276292	0,808	-0,123869	0,8256
-0,065792	0,7084	-0,238578	0,7168	-0,105684	0,7328
-0,05574	0,6296	-0,206008	0,6372	-0,09006	0,652
-0,047389	0,5628	-0,178282	0,5688	-0,076968	0,582
-0,039605	0,5	-0,152755	0,5048	-0,06484	0,5168
-0,032977	0,4436	-0,130295	0,4492	-0,054283	0,4588
-0,02731	0,394	-0,111077	0,3996	-0,04533	0,4064
-0,022509	0,3488	-0,093768	0,3528	-0,03763	0,3608
-0,018582	0,3124	-0,079883	0,3164	-0,031347	0,3224
-0,015099	0,2768	-0,067357	0,28	-0,025836	0,2864
-0,012254	0,246	-0,056258	0,2484	-0,021186	0,254
-0,009897	0,2188	-0,047082	0,2208	-0,017231	0,2252
-0,008	0,194	-0,039175	0,1964	-0,01409	0,2008
-0,006488	0,1736	-0,032658	0,1756	-0,011516	0,1796
-0,005242	0,154	-0,026875	0,156	-0,009289	0,1588
-0,004171	0,1372	-0,022034	0,1392	-0,007485	0,1416
-0,003341	0,122	-0,018019	0,1236	-0,006002	0,126
-0,00266	0,1088	-0,014574	0,1104	-0,004807	0,112
-0,002155	0,0972	-0,011952	0,0988	-0,003875	0,1004
-0,001711	0,0868	-0,009672	0,0884	-0,003113	0,0896
-0,001367	0,0772	-0,007728	0,0784	-0,002485	0,08
-0,00109	0,0688	-0,006228	0,0696	-0,001996	0,0712
-0,000872	0,0612	-0,004988	0,0624	-0,001589	0,0636
-0,000711	0,0552	-0,004076	0,0564	-0,001288	0,0572
-0,000565	0,0492	-0,003269	0,0504	-0,001035	0,0508
-0,000456	0,044	-0,002632	0,0448	-0,000829	0,0456
-0,000368	0,0396	-0,00209	0,04	-0,000664	0,0408
-0,000304	0,0352	-0,00168	0,0356	-0,000531	0,0364
-0,000249	0,032	-0,001365	0,0324	-0,000436	0,0328
-0,000206	0,0288	-0,001097	0,0292	-0,000355	0,0296
-0,000164	0,0256	-0,00088	0,0264	-0,000292	0,0264

COMOHAC H-Field probe Calibration Report



Ref: CR-280-19-08-SATB-A

Page: 7/10

Issue: A

Date: 2012/10/06

-0,000137	0,0232	-0,000704	0,0236	-0,000238	0,024
-0,000113	0,0208	-0,00057	0,0212	-0,000195	0,0216
-0,0001	0,0192	-0,000462	0,0192	-0,000167	0,0196
-8,10E-05	0,0172	-0,000369	0,0176	-0,00013	0,018
-7,30E-05	0,016	-0,000307	0,016	-0,000116	0,0164
-6,00E-05	0,0148	-0,000262	0,0148	-9,92E-05	0,0148
-5,60E-05	0,0136	-0,000214	0,0136	-7,74E-05	0,014
-5,10E-05	0,0128	-0,000175	0,0128	-7,30E-05	0,0128
-4,40E-05	0,012	-0,000143	0,012	-6,87E-05	0,012
-4,10E-05	0,0112	-0,000128	0,0112	-6,00E-05	0,0112
-4,00E-05	0,0108	-0,000107	0,0108	-5,56E-05	0,0108
-3,70E-05	0,0104	-9,16E-05	0,01	-4,58E-05	0,0104
-3,50E-05	0,0057	-7,10E-05	0,0075	-4,25E-05	0,0078

B. Isotropy.

- Axial isotropy: 0.13 dB

C. Linearity.

- Linearity: 0.18 dB

COMOHAC H-Field probe Calibration Report



Ref: CR-280-19-08-SATB-A

Page: 8/10

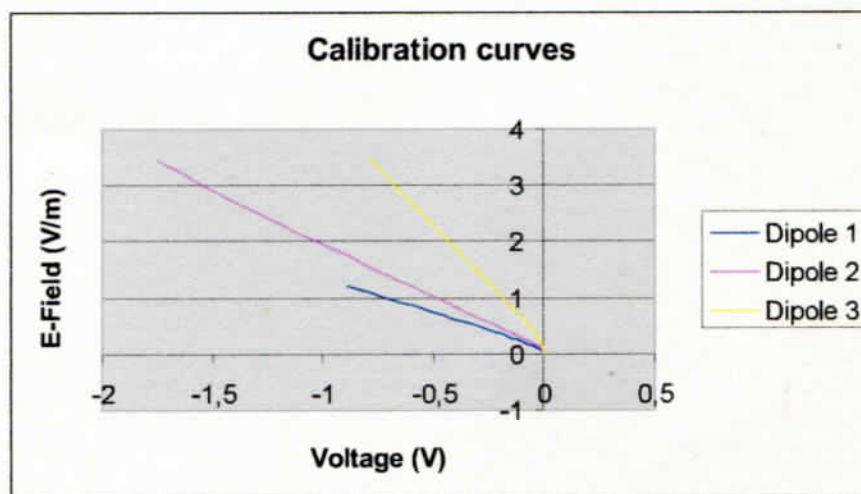
Issue: A

Date: 2012/10/06

B. Calibration parameters 1700-2450 MHz.

Temperature	21°C
Cable loss	0.00 dB
Coupler loss	20.13 dB
Low limit detection	0.009 A/m

Calibration curves $h_i=f(V)$ ($i=1,2,3$) allow to obtain H-field value using the formula:
 $H=(h_1*h_1+h_2*h_2+h_3*h_3)\text{pow}(1/2)$



The following tables represent the calibration curves linearization by curve segment in CW signal.

COMOHAC H-Field probe Calibration Report



Ref: CR-280-19-08-SATB-A

Page: 9/10

Issue: A

Date: 2012/10/06

Calibration coefficients for the three loops in CW:

v1	h1	v2	h2	v3	h3
-1,131875	1,504554	-2,060658	4,186241	-0,964406	4,221819
-1,013515	1,371071	-1,906931	3,813079	-0,87963	3,84986
-0,888133	1,223411	-1,741665	3,436171	-0,790934	3,468004
-0,780539	1,090062	-1,56563	3,061404	-0,699998	3,090561
-0,683995	0,972229	-1,408949	2,74027	-0,621273	2,76809
-0,597311	0,868305	-1,264068	2,454714	-0,55027	2,476649
-0,520824	0,774413	-1,126654	2,18601	-0,484112	2,216505
-0,452151	0,691487	-1,003941	1,958234	-0,426244	1,986856
-0,390527	0,614448	-0,886669	1,771653	-0,372738	1,75694
-0,337092	0,546503	-0,787257	1,547889	-0,325991	1,57183
-0,290249	0,487653	-0,697923	1,37602	-0,284607	1,402904
-0,25017	0,434821	-0,615305	1,231169	-0,247496	1,252034
-0,215021	0,387875	-0,542138	1,102501	-0,214269	1,114539
-0,184254	0,345878	-0,476444	0,979184	-0,185149	0,988948
-0,155968	0,306555	-0,417871	0,870178	-0,15949	0,884623
-0,13277	0,273251	-0,364806	0,774948	-0,136471	0,787921
-0,11278	0,243024	-0,31822	0,69015	-0,116196	0,707671
-0,095335	0,216541	-0,276273	0,615384	-0,098207	0,641331
-0,080528	0,193403	-0,238395	0,548509	-0,082726	0,550649
-0,067289	0,171735	-0,205371	0,48899	-0,068957	0,496747
-0,056091	0,152609	-0,176379	0,437764	-0,057209	0,44298
-0,046691	0,136425	-0,150324	0,388143	-0,047276	0,395098
-0,038711	0,121846	-0,128043	0,347349	-0,038918	0,35203
-0,031799	0,108605	-0,106981	0,307491	-0,03146	0,311771
-0,025858	0,096568	-0,089765	0,273786	-0,025527	0,277932
-0,02106	0,086135	-0,074605	0,24396	-0,020649	0,247437
-0,017158	0,076906	-0,06174	0,217745	-0,016654	0,220554
-0,013874	0,068748	-0,051053	0,194205	-0,013494	0,197148
-0,0112	0,061391	-0,041447	0,172003	-0,010773	0,175079
-0,009019	0,054971	-0,033714	0,153813	-0,008588	0,155551
-0,007271	0,049086	-0,027282	0,13803	-0,006874	0,1391
-0,005814	0,044004	-0,022099	0,123184	-0,005556	0,124254
-0,004673	0,039322	-0,017782	0,109675	-0,004435	0,110611
-0,003741	0,03531	-0,014204	0,09737	-0,003511	0,098574
-0,002901	0,031164	-0,011396	0,086938	-0,00282	0,08774
-0,002318	0,028088	-0,00913	0,077575	-0,002263	0,078244
-0,001857	0,025279	-0,007313	0,069282	-0,001813	0,069818
-0,001491	0,022738	-0,005842	0,06206	-0,001459	0,062461
-0,001192	0,020597	-0,004687	0,055372	-0,001184	0,055774
-0,000945	0,018725	-0,003747	0,049755	-0,000948	0,050022
-0,000758	0,016986	-0,002985	0,044138	-0,000771	0,044539
-0,000611	0,015515	-0,002409	0,03959	-0,000617	0,040125
-0,000492	0,014311	-0,001934	0,035711	-0,000524	0,035979

COMOHAC H-Field probe Calibration Report



Ref: CR-280-19-08-SATB-A

Page: 10/10

Issue: A

Date: 2012/10/06

-0,000396	0,013241	-0,001535	0,031565	-0,000437	0,031565
-0,000331	0,012305	-0,001216	0,028221	-0,00034	0,028355
-0,00027	0,011503	-0,00099	0,025546	-0,000295	0,025546
-0,000223	0,010834	-0,000796	0,022871	-0,000234	0,023139
-0,000179	0,010299	-0,000673	0,020865	-0,000203	0,020865
-0,000152	0,009898	-0,000528	0,018859	-0,000167	0,018992
-0,000131	0,009496	-0,000447	0,01712	-0,000108	0,013375
-0,00011	0,006095	-0,000357	0,015649	-7,60E-05	0,005229
0	0	-0,000293	0,014311	0	0
0	0	-0,00026	0,013241	0	0
0	0	-0,000222	0,012439	0	0
0	0	-0,00019	0,011636	0	0
0	0	-0,000175	0,010968	0	0
0	0	-0,00015	0,010432	0	0
0	0	-0,000139	0,009898	0	0
0	0	-0,000116	0,005095	0	0
0	0	0	0	0	0

B. Isotropy.

- Axial isotropy: 0.17 dB

C. Linearity.

- Linearity: 0.20 dB