Impact of adapters on LISN's input impedance calibration: How to improve accuracy and reliability of the measurements ?
Part 2

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Workshop – EMC Europe 2016

Le progrès, une passion à partager

Outline

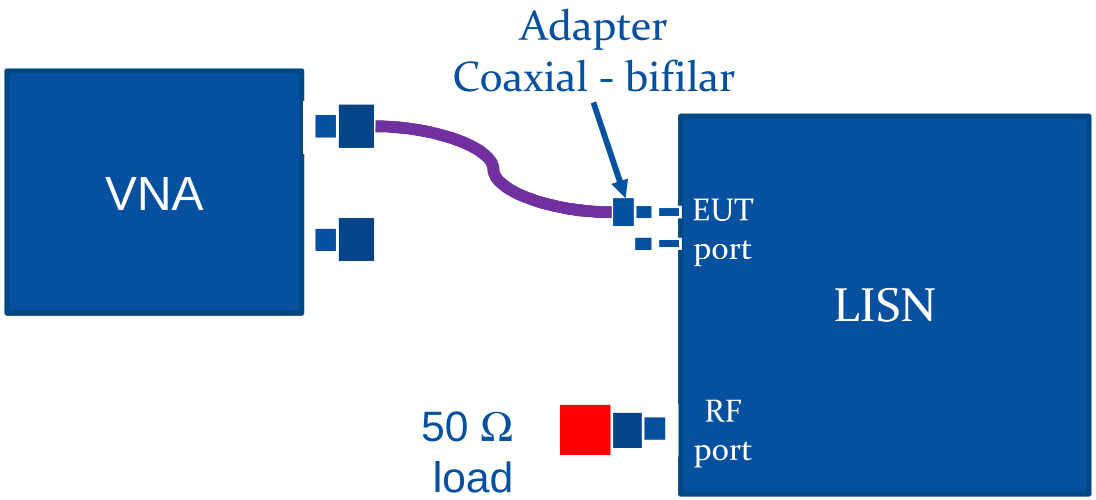
- Objective : measuring the “true” input impedance
- Setup and VNA calibration process
- Correction calculation
- Results
- Published Papers

Objective : measuring the "true" input impedance

- LISN : Measurement of input impedance Z_{LISN}
  - The input impedance has to be measured at EUT port:

Between each line and RF ground
Between neutral and RF ground

Measurement setup:

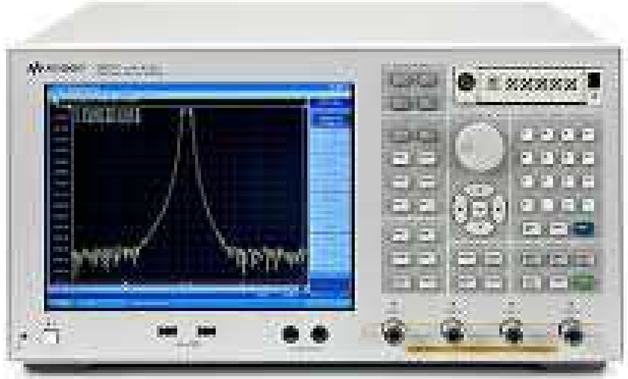


LISN: single phase

Setup and VNA calibration process

- 3 steps: calibration, reflection coefficient Γ_{in} measured and input impedance Z_{in} calculated

Open Short Load (OSL) calibration



[9 kHz – 30 MHz]

MATLAB & LABVIEW

Γ_{IN}

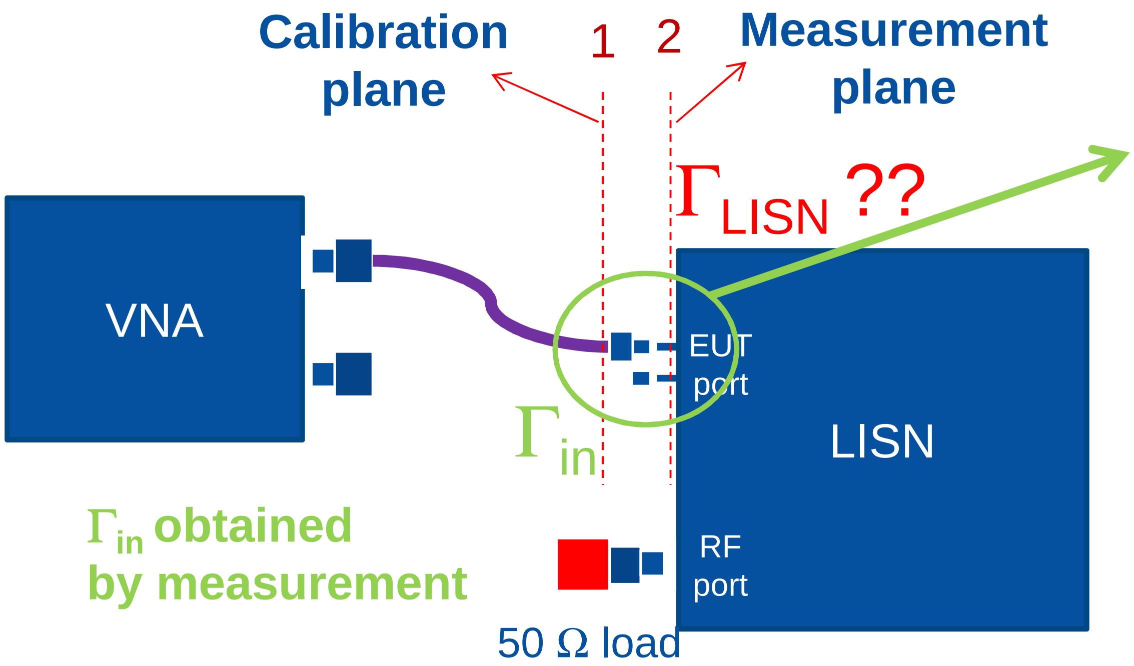
Rohde & Schwarz

Adapters for ESH3-Z5 And ESH2-Z5

LNE

Correction calculation

- Import data into Excel file



$$(S)=\begin{pmatrix} S_{11} & S_{12} \\ S_{21} & S_{22} \end{pmatrix}$$

(S) of the adapter Stored into a specific Excel File

$$\Gamma_{\mathrm{LISN}}=\frac{S_{11}-\Gamma_{in}}{S_{22}\left(S_{11}-\Gamma_{in}\right)-S_{12}S_{21}}$$

Correction calculation performed using a specific Excel file

Correction calculation

- Import data into Excel file

	A	B	C	D	E	F	G	H	I	J	K	L
1		MEASUREMENT 1		MEASUREMENT 2		MEASUREMENT 3		MEASUREMENT 4		MEASUREMENT 5		
2	FREQUENCY (Hz)	Re (Γ)	Im (Γ)	Re (Γ)	Im (Γ)	Re (Γ)	Im (Γ)	Re (Γ)	Im (Γ)	Re (Γ)	Im (Γ)	
3	9000	-0.80061	0.079804	-0.80089	0.079277	-0.80066	0.07912	-0.80038	0.07916	-0.80078	0.079516	
4	9107	-0.80026	0.079756	-0.8	0.079631	-0.7999	0.080094	-0.8001	0.080003	-0.8002	0.080163	
5	9214	-0.80091	0.079926	-0.80036	0.0802	-0.8008	0.079526	-0.80068	0.079762	-0.8007	0.079893	
6	9322	-0.80116	0.080624	-0.80061	0.080278	-0.80071	0.080741	-0.8012	0.080735	-0.80148	0.080743	
7	9429	-0.8014	0.081036	-0.80059	0.081096	-0.80108	0.08084	-0.80137	0.0809	-0.80113	0.080979	
8	9536	-0.8017	0.081119	-0.80151	0.081179	-0.8014	0.081717	-0.80149	0.081381	-0.80178	0.081397	
9	9643	-0.80171	0.081355	-0.80163	0.081372	-0.80136	0.081424	-0.80192	0.081249	-0.80165	0.081368	
10	9751	-0.80199	0.082095	-0.80161	0.081777	-0.80213	0.081946	-0.80164	0.081789	-0.80201	0.081883	
11	9858	-0.80206	0.082366	-0.80127	0.082458	-0.80144	0.082172	-0.80139	0.082657	-0.80121	0.081876	
12	9965	-0.80177	0.082667	-0.80153	0.082844	-0.80134	0.082431	-0.80156	0.082353	-0.80203	0.083133	
13	10072	-0.80177	0.083036	-0.80169	0.082621	-0.80182	0.083141	-0.80166	0.08296	-0.80202	0.082668	
14	10180	-0.80191	0.083864	-0.8016	0.083579	-0.80191	0.083972	-0.80191	0.08348	-0.80169	0.083664	
15	10287	-0.80245	0.084301	-0.80249	0.084075	-0.80212	0.084442	-0.80271	0.08424	-0.80247	0.084279	
16	10394	-0.80262	0.084561	-0.80191	0.084422	-0.80243	0.084373	-0.80226	0.084449	-0.8025	0.08446	
17	10501	-0.80277	0.085016	-0.80212	0.085255	-0.80237	0.085281	-0.80285	0.085404	-0.80192	0.085222	
18	10608	-0.80244	0.085986	-0.80211	0.085812	-0.80191	0.085778	-0.80254	0.085822	-0.80252	0.085693	
19	10716	-0.80232	0.085878	-0.80204	0.086026	-0.8015	0.086092	-0.80242	0.086395	-0.80214	0.086104	
20	10823	-0.80258	0.087108	-0.80285	0.087217	-0.80213	0.087188	-0.80286	0.087033	-0.80278	0.087153	
21	10930	-0.80289	0.087387	-0.80238	0.087726	-0.80255	0.087517	-0.80289	0.087594	-0.80274	0.087842	
22	11037	-0.80235	0.088417	-0.80263	0.088894	-0.8025	0.08818	-0.80259	0.08862	-0.80259	0.088395	
23	11145	-0.80255	0.088805	-0.80222	0.08842	-0.8024	0.088996	-0.80254	0.088787	-0.80332	0.088586	
24	11252	-0.8034	0.089952	-0.80246	0.089692	-0.80264	0.089748	-0.80296	0.08945	-0.80275	0.089396	
25	11359	-0.80277	0.090142	-0.80228	0.089918	-0.80234	0.089915	-0.80302	0.090014	-0.80262	0.090333	
26	11466	-0.80353	0.091064	-0.80286	0.090951	-0.80299	0.091093	-0.80333	0.091084	-0.8031	0.091293	
27	11573	-0.8027	0.091679	-0.8023	0.091809	-0.80233	0.091874	-0.80313	0.091986	-0.80239	0.091756	
28	11681	-0.80295	0.091784	-0.80282	0.091931	-0.80245	0.09195	-0.80245	0.09228	-0.80302	0.091987	
29	11788	-0.80255	0.093434	-0.80222	0.093412	-0.80227	0.093812	-0.80249	0.09357	-0.80234	0.093857	
30	11895	-0.8028	0.094101	-0.8026	0.09374	-0.80221	0.09426	-0.80283	0.093977	-0.80313	0.094102	
31	12002	-0.80287	0.094622	-0.80231	0.094382	-0.80236	0.095046	-0.80257	0.094836	-0.80284	0.094729	
32	12110	-0.80272	0.094715	-0.80189	0.094876	-0.80178	0.095094	-0.80232	0.095042	-0.80248	0.095017	
33	12217	-0.80253	0.096558	-0.8024	0.096512	-0.80243	0.096336	-0.80241	0.096243	-0.80214	0.096375	
34	12324	-0.80253	0.096741	-0.80253	0.096931	-0.80231	0.096923	-0.80232	0.09694	-0.80221	0.096734	
35	12450	-0.80266	0.097843	-0.80254	0.09791	-0.80193	0.097134	-0.80221	0.097978	-0.80243	0.097739	
36	12598	-0.80207	0.098927	-0.80173	0.098976	-0.80182	0.098966	-0.80156	0.099018	-0.80202	0.098971	

ESH3 RESULTS SUMMARY / ESH3 RESULTS / S MATRIX ESH3 / ESH3 MEAS / ESH2 RESULTS SUMMARY / ESH2 RESULTS / S MATRIX ESH2 / **ESH2 MEAS**

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Correction calculation

- S matrix of each adapter calculated at each frequency

1	S MATRIX OF THE ADAPTER CALCULATED WITH THE FREQUENCIES OF THE SHEET "ESH3 MEASUREMENTS"									UNCERTAINTY B OF INPUT IMPEDANCE CALCULATED WITH THE FREQUENCIES OF THE SHEET "ESH3 MEASUREMENTS"		
2	FREQUENCY (Hz)	Re (S_{11})	Im (S_{11})	Re (S_{12})	Im (S_{12})	Re (S_{21})	Im (S_{21})	Re (S_{22})	Im (S_{22})	FREQUENCY (Hz)	UB($\lvert Z_{IN} \rvert$)	UB($\phi(Z_{IN})$)
3	9000	-1.2131E-06	1.06869E-05	1	-1.82362E-05	1	-1.82427E-05	-1.62617E-06	1.07095E-05	9000	1.15E-03	4.75E-03
4	9107	-1.213E-06	1.08164E-05	1	-1.84551E-05	1	-1.84616E-05	-1.62605E-06	1.0839E-05	9107	1.15E-03	4.75E-03
5	9214	-1.2129E-06	1.09459E-05	1	-1.86741E-05	1	-1.86805E-05	-1.62593E-06	1.09685E-05	9214	1.15E-03	4.75E-03
6	9322	-1.2128E-06	1.10766E-05	1	-1.8895E-05	1	-1.89015E-05	-1.62581E-06	1.10993E-05	9322	1.15E-03	4.75E-03
7	9429	-1.2127E-06	1.12061E-05	1	-1.91139E-05	1	-1.91204E-05	-1.62569E-06	1.12288E-05	9429	1.16E-03	4.75E-03
8	9536	-1.2126E-06	1.13357E-05	1	-1.93328E-05	1	-1.93393E-05	-1.62556E-06	1.13583E-05	9536	1.16E-03	4.75E-03
9	9643	-1.2125E-06	1.14652E-05	1	-1.95517E-05	1	-1.95582E-05	-1.62544E-06	1.14878E-05	9643	1.16E-03	4.75E-03
10	9751	-1.2124E-06	1.15959E-05	1	-1.97727E-05	1	-1.97791E-05	-1.62532E-06	1.16185E-05	9751	1.16E-03	4.75E-03
11	9858	-1.2124E-06	1.17254E-05	1	-1.99916E-05	1	-1.99981E-05	-1.6252E-06	1.1748E-05	9858	1.16E-03	4.75E-03
12	9965	-1.2123E-06	1.18549E-05	1	-2.02105E-05	1	-2.0217E-05	-1.62508E-06	1.18775E-05	9965	1.16E-03	4.76E-03
13	10072	-1.2122E-06	1.19844E-05	1	-2.04294E-05	1	-2.04359E-05	-1.62495E-06	1.20071E-05	10072	1.16E-03	4.76E-03
14	10180	-1.2121E-06	1.21152E-05	1	-2.06504E-05	1	-2.06568E-05	-1.62483E-06	1.21378E-05	10180	1.16E-03	4.76E-03
15	10287	-1.212E-06	1.22447E-05	1	-2.08693E-05	1	-2.08757E-05	-1.62471E-06	1.22673E-05	10287	1.17E-03	4.76E-03
16	10394	-1.2119E-06						.62459E-06	1.23968E-05	10394		
17	10501	-1.2118E-06						.62447E-06	1.25263E-05	10501		
18	10608	-1.2117E-06						.62435E-06	1.26558E-05	10608		
19	10716	-1.2116E-06	1.27639E-05	1	-2.1747E-05	1	-2.17534E-05	-1.62422E-06	1.27866E-05	10716		
20	10823	-1.2115E-06	1.28934E-05	1	-2.19659E-05	1	-2.19723E-05	-1.6241E-06	1.29161E-05	10823		
21	10930	-1.2114E-06	1.3023E-05	1	-2.21848E-05	1	-2.21913E-05	-1.62398E-06	1.30456E-05	10930		
22	11037	-1.2113E-06	1.31525E-05	1	-2.24037E-05	1	-2.24102E-05	-1.62386E-06	1.31751E-05	11037	1.17E-03	4.77E-03
23	11145	-1.2112E-06	1.32832E-05	1	-2.26247E-05	1	-2.26311E-05	-1.62373E-06	1.33058E-05	11145	1.18E-03	4.77E-03
24	11252	-1.2111E-06	1.34127E-05	1	-2.28436E-05	1.00000001	-2.285E-05	-1.62361E-06	1.34353E-05	11252	1.18E-03	4.77E-03
25	11359	-1.211E-06	1.35422E-05	1	-2.30625E-05	1.00000001	-2.3069E-05	-1.62349E-06	1.35648E-05	11359	1.18E-03	4.77E-03
26	11466	-1.2109E-06	1.36717E-05	1	-2.32814E-05	1.00000001	-2.32879E-05	-1.62337E-06	1.36944E-05	11466	1.18E-03	4.77E-03
27	11573	-1.2108E-06	1.38012E-05	1	-2.35003E-05	1.00000001	-2.35068E-05	-1.62325E-06	1.38239E-05	11573	1.18E-03	4.77E-03
28	11681	-1.2107E-06	1.3932E-05	1	-2.37213E-05	1.00000001	-2.37277E-05	-1.62312E-06	1.39546E-05	11681	1.18E-03	4.77E-03
29	11788	-1.2106E-06	1.40615E-05	1	-2.39402E-05	1.00000001	-2.39466E-05	-1.623E-06	1.40841E-05	11788	1.18E-03	4.77E-03
30	11895	-1.2105E-06	1.4191E-05	1	-2.41591E-05	1.00000001	-2.41656E-05	-1.62288E-06	1.42136E-05	11895	1.18E-03	4.78E-03
31	12002	-1.2104E-06	1.43205E-05	1	-2.4378E-05	1.00000001	-2.43845E-05	-1.62276E-06	1.43431E-05	12002	1.19E-03	4.78E-03
32	12110	-1.2104E-06	1.44512E-05	1	-2.4599E-05	1.00000001	-2.46054E-05	-1.62264E-06	1.44739E-05	12110	1.19E-03	4.78E-03
33	12217	-1.2103E-06	1.45807E-05	1	-2.48179E-05	1.00000001	-2.48243E-05	-1.62251E-06	1.46034E-05	12217	1.19E-03	4.78E-03
34	12324	-1.2102E-06	1.47103E-05	1	-2.50368E-05	1.00000001	-2.50432E-05	-1.62239E-06	1.47329E-05	12324	1.19E-03	4.78E-03
35	12450	-1.21E-06	1.48628E-05	1	-2.52946E-05	1.00000001	-2.5301E-05	-1.62225E-06	1.48854E-05	12450	1.19E-03	4.78E-03
36	12598	-1.2099E-06	1.50419E-05	1	-2.55974E-05	1.00000001	-2.56038E-05	-1.62208E-06	1.50645E-05	12598	1.19E-03	4.78E-03

ESH3 RESULTS SUMMARY / ESH3 RESULTS / S MATRIX ESH3 / ESH3 MEAS / ESH2 RESULTS SUMMARY / ESH2 RESULTS / S MATRIX ESH2 / ESH2 MEAS

S matrix of the adapter

Type B uncertainty of Zin: Magnitude and phase

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Correction calculation

➢ Correction applied to Z_{in} at each frequency

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1		MEASUREMENT 1		MEASUREMENT 2		MEASUREMENT 3		MEASUREMENT 4		MEASUREMENT 5		MEAN OF MEASURMENTS		UA		UB		U (k=2)	
2	FREQUENCY (Hz)	$\|Z_{IN}\|$ (Ω)	$\phi(Z_{IN})$ (°)	$\|Z_{IN}\|$ (Ω)	$\phi(Z_{IN})$ (°)	$\|Z_{IN}\|$ (Ω)	$\phi(Z_{IN})$ (°)	$\|Z_{IN}\|$ (Ω)	$\phi(Z_{IN})$ (°)	$\|Z_{IN}\|$ (Ω)	$\phi(Z_{IN})$ (°)	$\|Z_{IN}\|$ (Ω)	$\phi(Z_{IN})$ (°)	$\|Z_{IN}\|$ (Ω)	$\phi(Z_{IN})$ (°)	$\|Z_{IN}\|$ (Ω)	$\phi(Z_{IN})$ (°)	$\|Z_{IN}\|$ (Ω)	$\phi(Z_{IN})$ (°)
3	9000	5.96	24.34	5.94	24.15	5.95	24.15	5.96	24.14	5.95	24.28	5.95	24.21	0.01	0.09	0.00	0.00	0.01	0.18
4	9107	5.97	24.29	5.97	24.35	5.98	24.35	5.97	24.35	5.97	24.40	5.97	24.35	0.00	0.04	0.00	0.00	0.01	0.08
5	9214	5.95	24.40	5.97	24.28	5.95	24.28	5.95	24.33	5.96	24.37	5.96	24.33	0.01	0.05	0.00	0.00	0.02	0.11
6	9322	5.95	24.62	5.96	24.61	5.96	24.61	5.95	24.66	5.94	24.69	5.95	24.64	0.01	0.03	0.00	0.00	0.02	0.07
7	9429	5.95	24.76	5.97	24.68	5.95	24.68	5.95	24.72	5.95	24.72	5.95	24.71	0.01	0.04	0.00	0.00	0.02	0.07
8	9536	5.94	24.81	5.95	24.95	5.95	24.95	5.95	24.87	5.94	24.90	5.95	24.90	0.01	0.06	0.00	0.00	0.01	0.12
9	9643	5.94	24.88	5.94	24.87	5.95	24.87	5.93	24.87	5.94	24.88	5.94	24.87	0.01	0.01	0.00	0.00	0.01	0.02
10	9751	5.94	25.12	5.95	25.09	5.94	25.09	5.95	25.00	5.94	25.06	5.94	25.07	0.01	0.05	0.00	0.00	0.01	0.09
11	9858	5.94	25.20	5.97	25.08	5.96	25.08	5.96	25.21	5.96	24.98	5.96	25.11	0.01	0.10	0.00	0.00	0.02	0.19
12	9965	5.95	25.25	5.96	25.14	5.96	25.14	5.96	25.14	5.95	25.41	5.96	25.22	0.01	0.12	0.00	0.00	0.01	0.23
13	10072	5.96	25.35	5.96	25.39	5.96	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.05	0.00	0.00	0.01	0.10
14	10180	5.96	25.60	5.97	25.63	5.96	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.06	0.00	0.00	0.01	0.13
15	10287	5.95	25.77	5.95	25.78	5.96	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.01	0.00	0.00	0.01	0.01
16	10394	5.95	25.86	5.97	25.79	5.95	25.79	5.96	25.80	5.95	25.82	5.96	25.81	0.01	0.03	0.00	0.00	0.02	0.06
17	10501	5.95	26.01	5.97	26.04	5.96	26.04	5.95	26.12	5.98	25.97	5.96	26.04	0.01	0.05	0.00	0.00	0.02	0.11
18	10608	5.97	26.24	5.98	26.13	5.98	26.13	5.96	26.20	5.96	26.17	5.97	26.17	0.01	0.05	0.00	0.00	0.02	0.10
19	10716	5.97	26.20	5.98	26.17	6.00	26.17	5.97	26.35	5.98	26.24	5.98	26.23	0.01	0.08	0.00	0.00	0.02	0.15
20	10823	5.98	26.56	5.97	26.54	5.99	26.54	5.97	26.57	5.97	26.60	5.98	26.56	0.01	0.02	0.00	0.00	0.02	0.05
21	10930	5.97	26.67	5.99	26.67	5.98	26.67	5.97	26.73	5.98	26.78	5.98	26.70	0.01	0.05	0.00	0.00	0.01	0.10
22	11037	6.00	26.90	6.00	26.85	5.99	26.85	5.99	26.98	5.99	26.92	5.99	26.90	0.00	0.05	0.00	0.00	0.01	0.11
23	11145	6.00	27.02	6.00	27.06	6.00	27.06	6.00	27.02	5.97	27.05	5.99	27.04	0.01	0.02	0.00	0.00	0.03	0.04
24	11252	5.99	27.43	6.01	27.29	6.01	27.29	5.99	27.24	6.00	27.21	6.00	27.29	0.01	0.08	0.00	0.00	0.02	0.17
25	11359	6.01	27.41	6.02	27.30	6.02	27.30	6.00	27.40	6.01	27.45	6.01	27.37	0.01	0.07	0.00	0.00	0.02	0.13
26	11466	6.00	27.74	6.01	27.69	6.01	27.69	6.00	27.73	6.01	27.76	6.01	27.72	0.01	0.03	0.00	0.00	0.02	0.06
27	11573	6.03	27.82	6.04	27.83	6.04	27.83	6.02	27.95	6.04	27.81	6.03	27.85	0.01	0.06	0.00	0.00	0.02	0.12
28	11681	6.02	27.88	6.03	27.87	6.04	27.87	6.04	27.96	6.02	27.94	6.03	27.90	0.01	0.04	0.00	0.00	0.02	0.09
29	11788	6.05	28.28	6.06	28.35	6.06	28.35	6.05	28.31	6.06	28.37	6.06	28.33	0.01	0.04	0.00	0.00	0.01	0.07
30	11895	6.05	28.48	6.05	28.46	6.07	28.46	6.05	28.45	6.04	28.52	6.05	28.48	0.01	0.03	0.00	0.00	0.02	0.06
31	12002	6.06	28.63	6.07	28.69	6.07	28.69	6.07	28.66	6.06	28.66	6.06	28.66	0.01	0.02	0.00	0.00	0.02	0.05
32	12110	6.06	28.64	6.09	28.64	6.09	28.64	6.08	28.68	6.07	28.69	6.08	28.66	0.01	0.03	0.00	0.00	0.02	0.06
33	12217	6.09	29.11	6.09	29.04	6.09	29.04	6.09	29.01	6.10	29.02	6.09	29.04	0.00	0.04	0.00	0.00	0.01	0.08
34	12324	6.09	29.16	6.09	29.18	6.10	29.18	6.10	29.19	6.10	29.12	6.10	29.17	0.00	0.03	0.00	0.00	0.01	0.06
35	12450	6.10	29.47	6.10	29.19	6.11	29.19	6.11	29.45	6.10	29.41	6.11	29.34	0.01	0.14	0.00	0.00	0.01	0.27
36	12598	6.13	29.68	6.14	29.67	6.14	29.67	6.14	29.65	6.13	29.69	6.14	29.67	0.01	0.02	0.00	0.00	0.01	0.03

ESH3 RESULTS SUMMARY / ESH3 RESULTS / S MATRIX ESH3 / ESH3 MEAS / ESH2 RESULTS SUMMARY / ESH2 RESULTS / S MATRIX ESH2 / ESH2 MEAS

Magnitude and phase corrected

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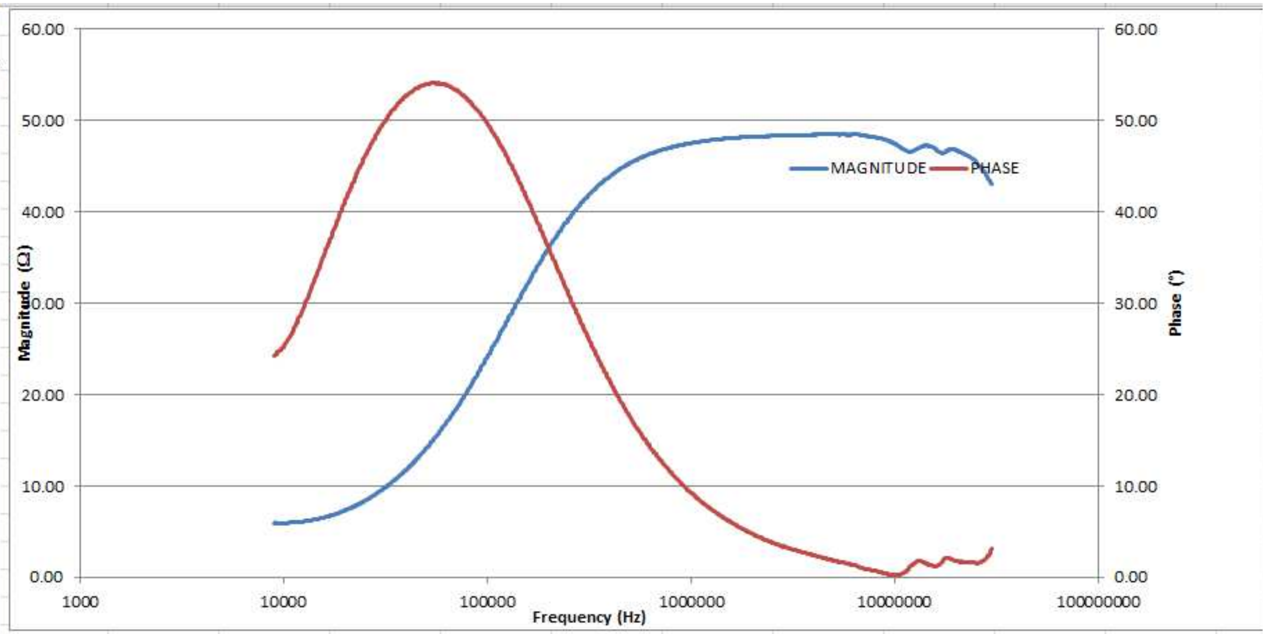
Correction calculation

- Summary of the results at each frequency

		MEAN		U (k=2)	
2	FREQUENCY (Hz)	$\lvert Z_{IN} \rvert$ (Ω)	$\phi(Z_{IN})$ (°)	$\lvert Z_{IN} \rvert$ (Ω)	$\phi(Z_{IN})$ (°)
3	9000	5.95	24.21	0.01	0.18
4	9107	5.97	24.35	0.01	0.08
5	9214	5.96	24.33	0.02	0.11
6	9322	5.95	24.64	0.02	0.07
7	9429	5.95	24.71	0.02	0.07
8	9536	5.95	24.90	0.01	0.12
9	9643	5.94	24.87	0.01	0.02
10	9751	5.94	25.07	0.01	0.09
11	9858	5.96	25.11	0.02	0.19
12	9965	5.96	25.22	0.01	0.23
13	10072	5.96	25.35	0.01	0.10
14	10180	5.96	25.57	0.01	0.13
15	10287	5.95	25.78	0.01	0.01
16	10394	5.96	25.81	0.02	0.06
17	10501	5.96	26.04	0.02	0.11
18	10608	5.97	26.17	0.02	0.10
19	10716	5.98	26.23	0.02	0.15
20	10823	5.98	26.56	0.02	0.05
21	10930	5.98	26.70	0.01	0.10
22	11037	5.99	26.90	0.01	0.11
23	11145	5.99	27.04	0.03	0.04
24	11252	6.00	27.29	0.02	0.17
25	11359	6.01	27.37	0.02	0.13
26	11466	6.01	27.72	0.02	0.06
27	11573	6.03	27.85	0.02	0.12
28	11681	6.03	27.90	0.02	0.09
29	11788	6.06	28.33	0.01	0.07
30	11895	6.05	28.48	0.02	0.06
31	12002	6.06	28.66	0.02	0.05
32	12110	6.08	28.66	0.02	0.06
33	12217	6.09	29.04	0.01	0.08
34	12324	6.10	29.17	0.01	0.06
35	12450	6.11	29.34	0.01	0.27
36	12598	6.14	29.67	0.01	0.03



ESH3 RESULTS SUMMARY / ESH3 RESULTS / S MATRIX ESH3 / ESH3 MEAS / ESH2 RESULTS SUMMARY / ESH2 RESULTS / S MATRIX ESH2 / ESH2 MEAS

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Results

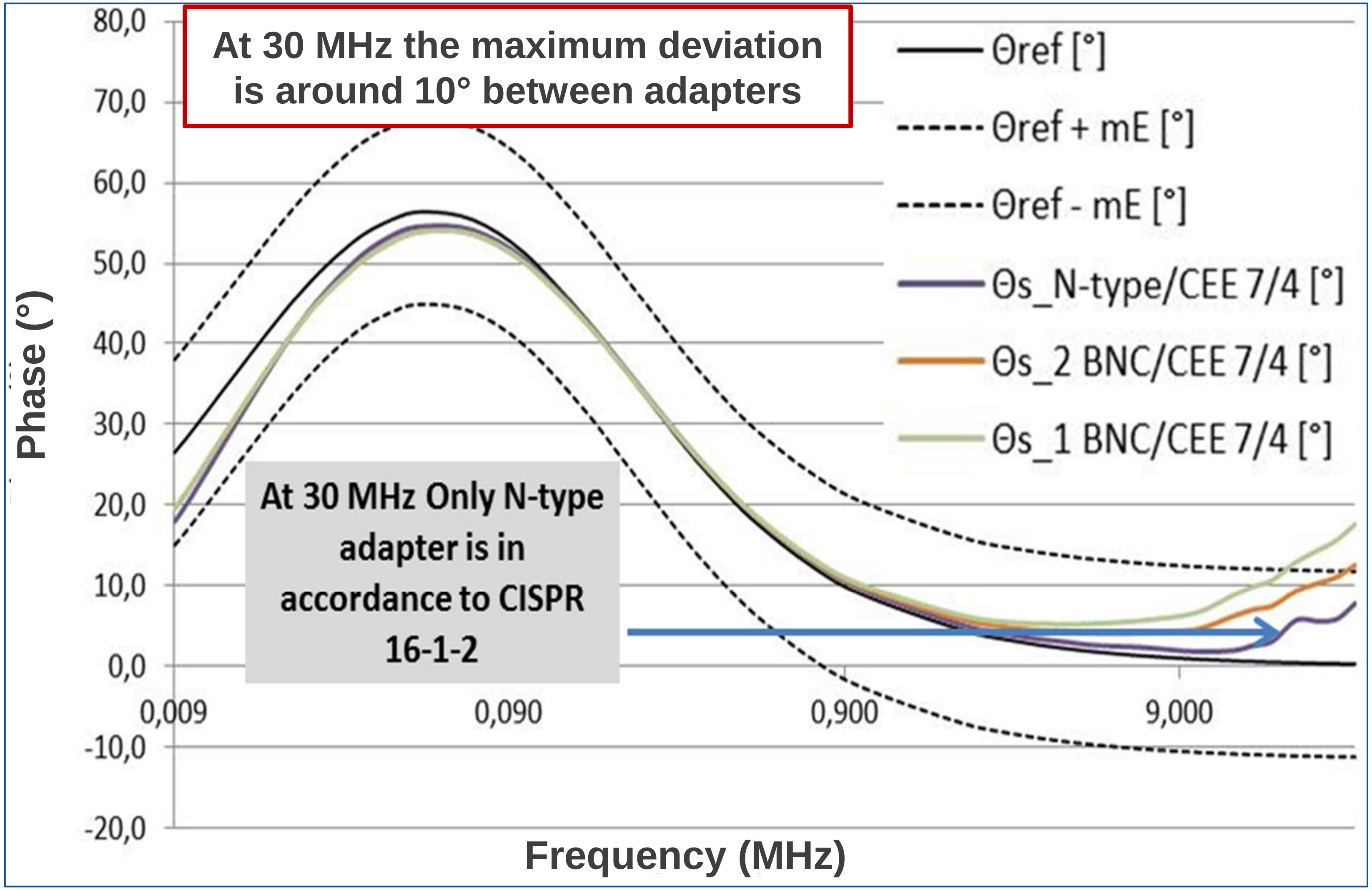
- Measurements with three different types of adapters

Adapter N-type

Adapter 2 BNC

Adapter 1 BNC

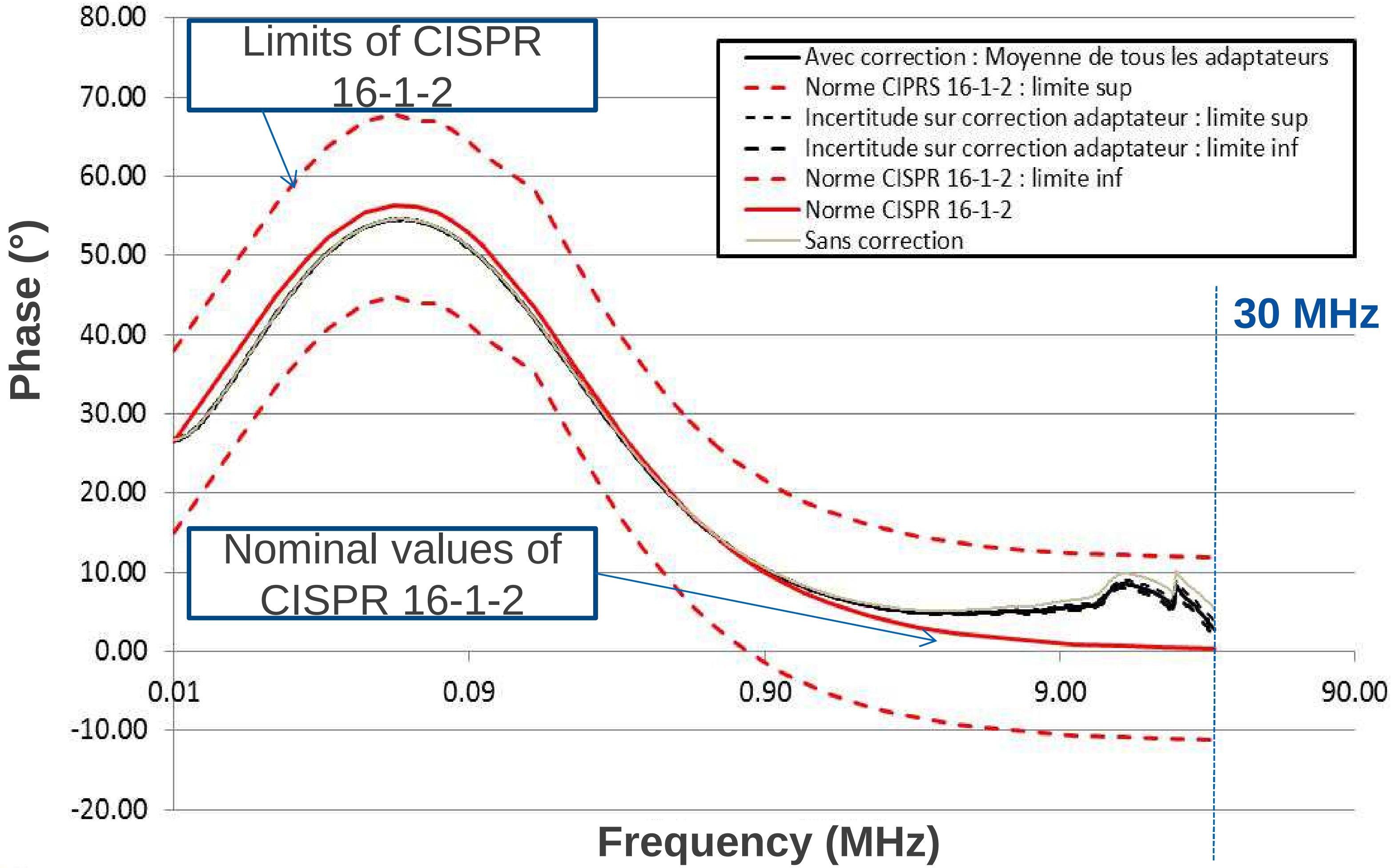
- Measurements with three different types of adapters



Results

➢ Measurements of ESH3 – Z5 (Rohde & Schwarz)

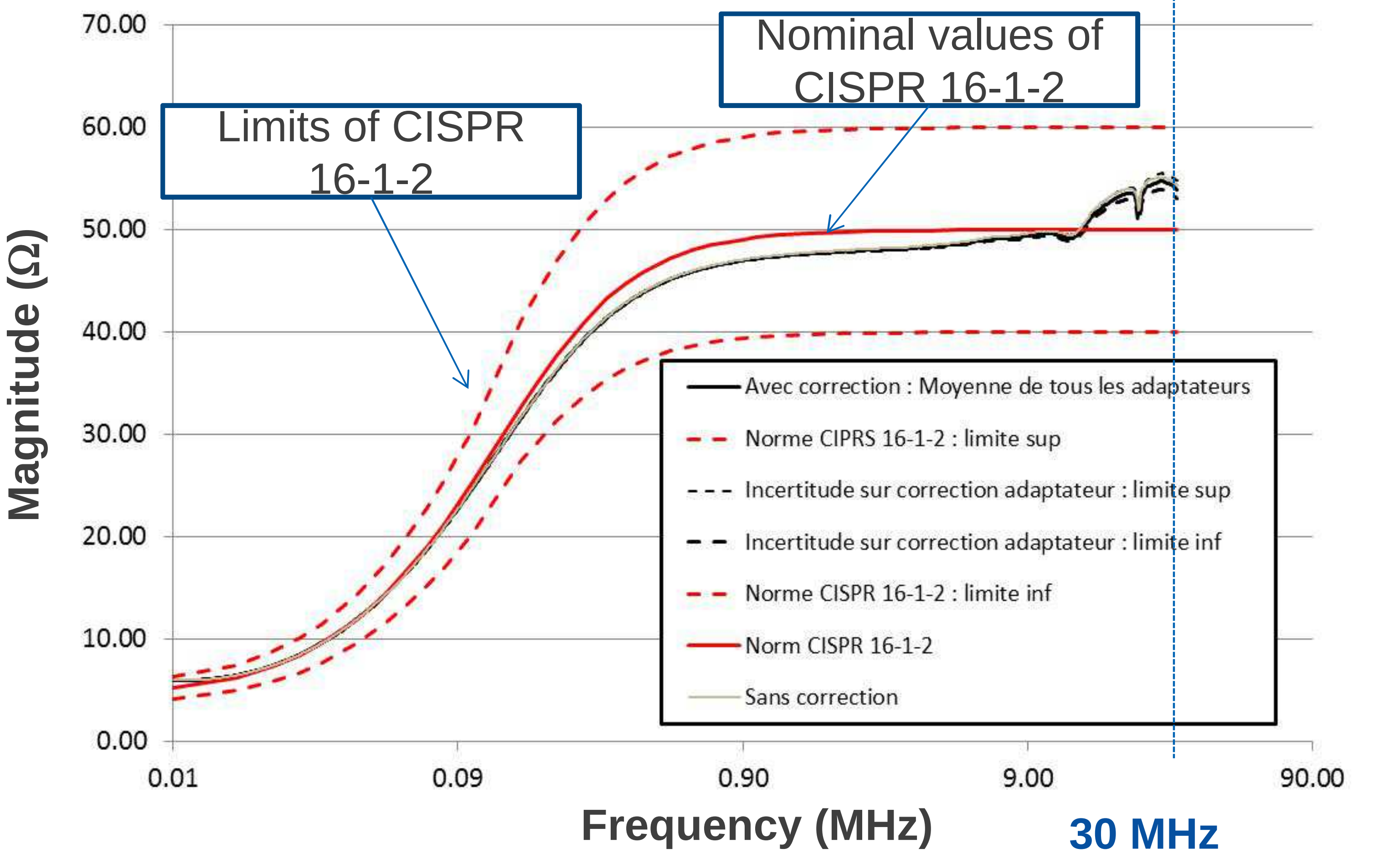
Result of input impedance phase



Results

➢ Measurements of ESH3 – Z5 (Rohde & Schwarz)

Result of input impedance magnitude



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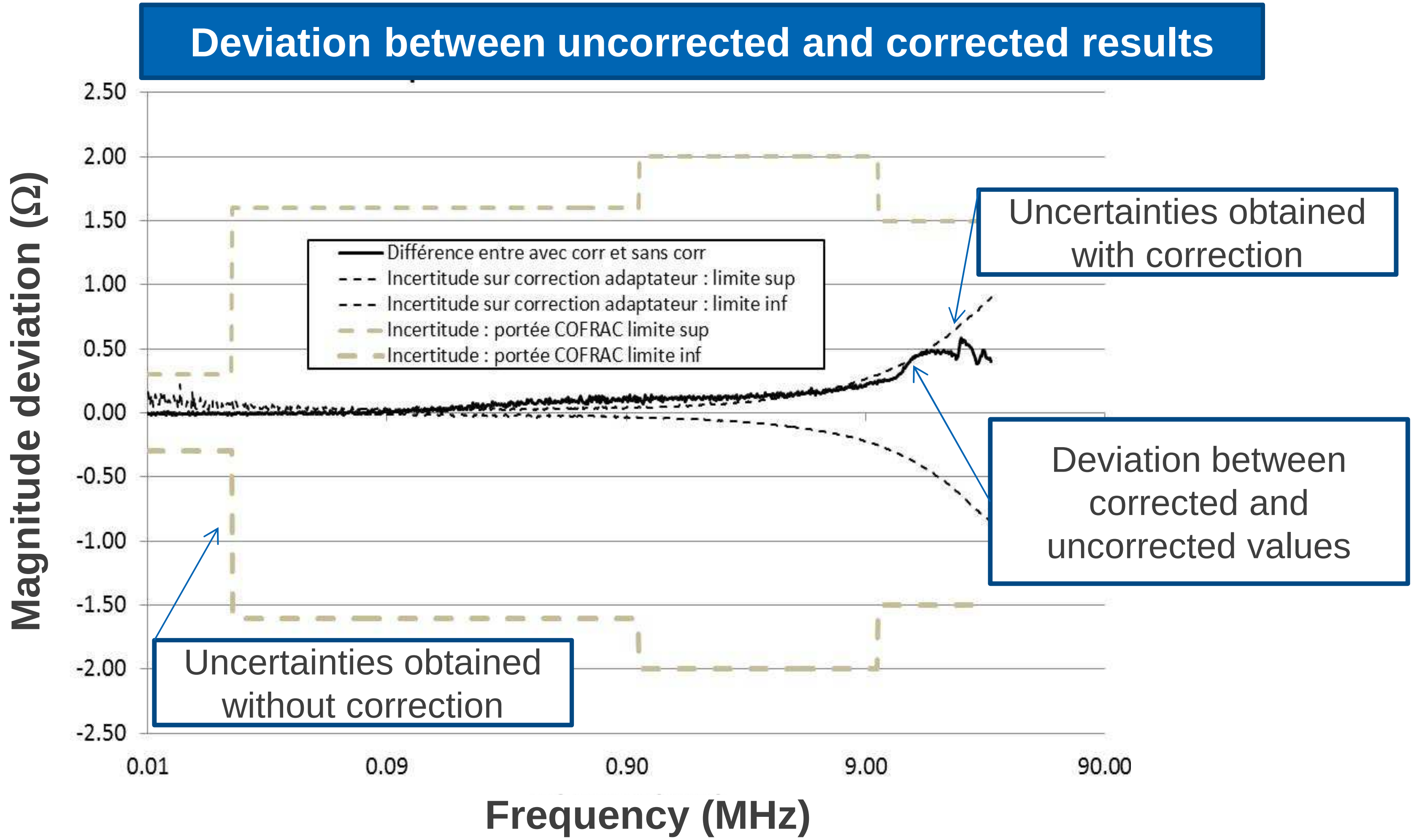
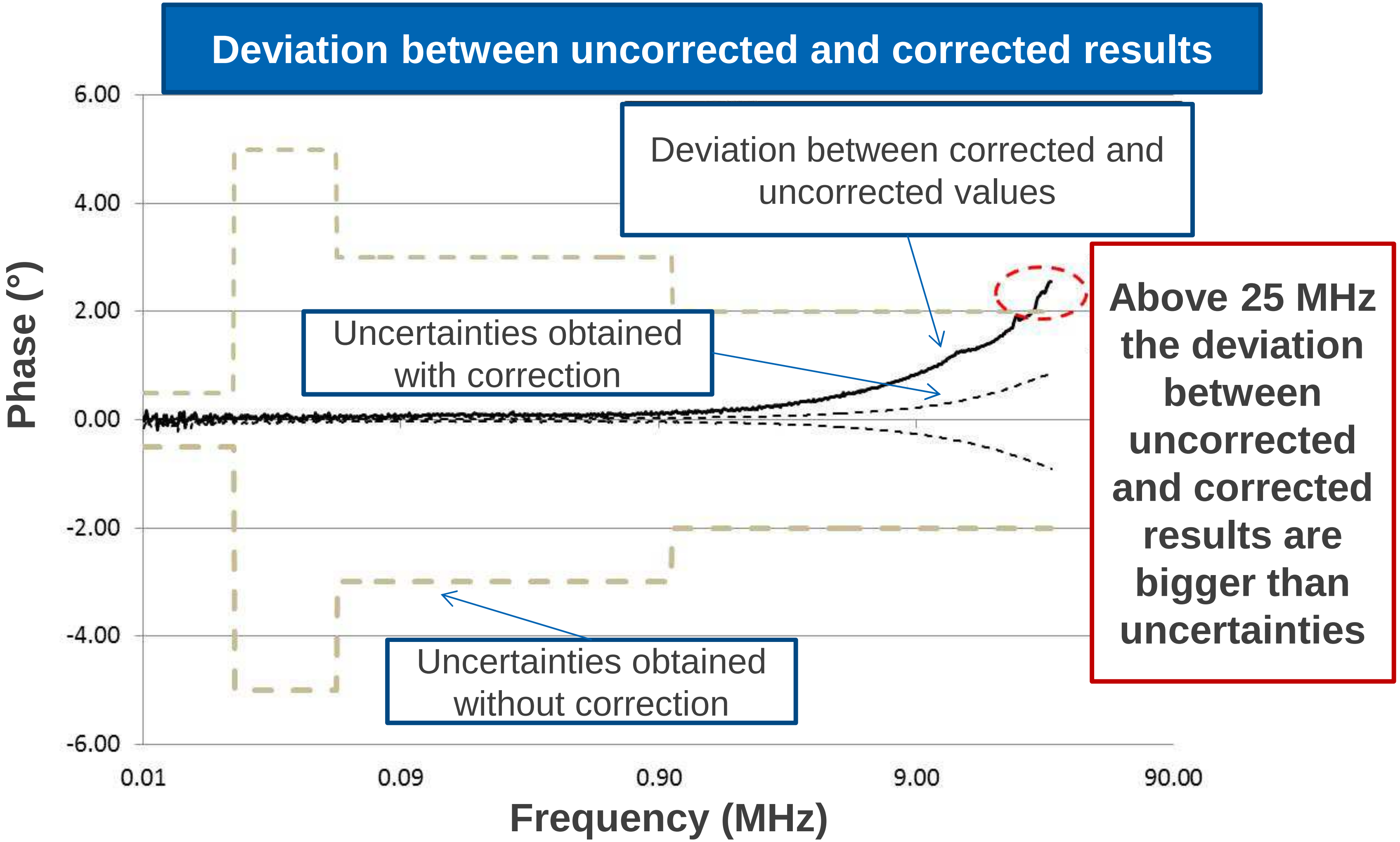
➢ Measurements of ESH3 – Z5 (Rohde & Schwarz)



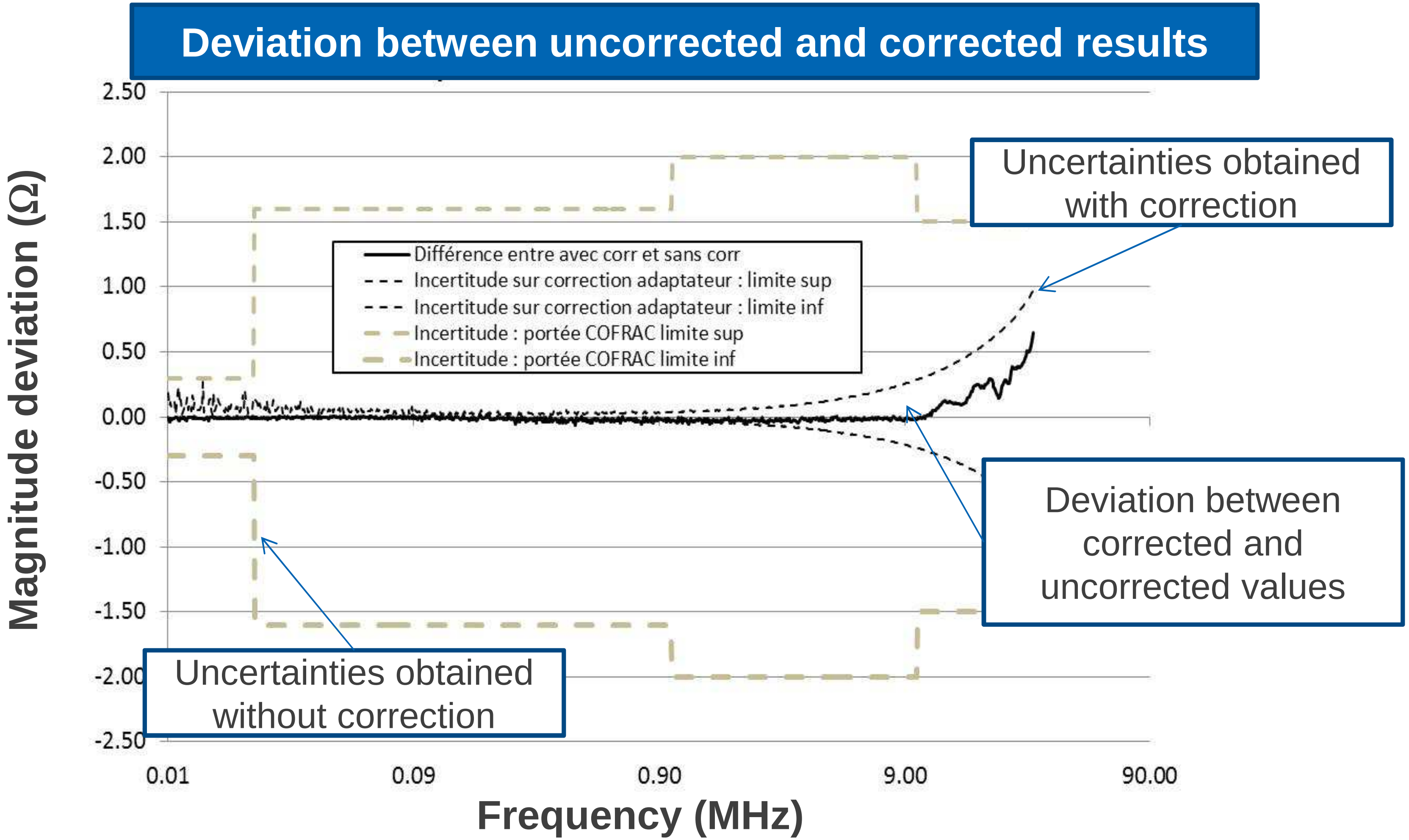
Results

➢ Measurements of ESH3 – Z5 (Rohde & Schwarz)



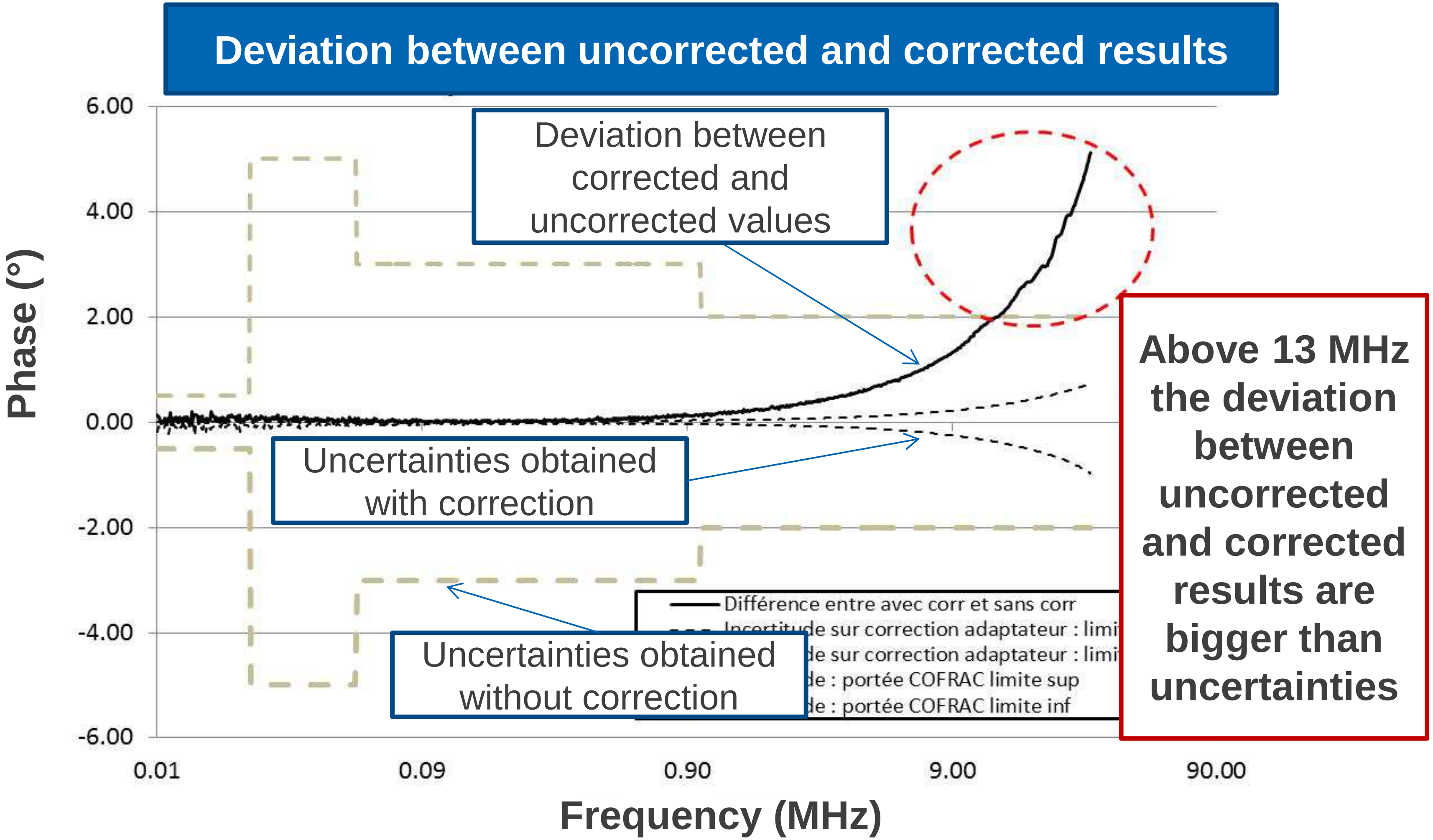
Results

➢ Measurements of ESH2 – Z5 (Rohde & Schwarz)



Results

➢ Measurements of ESH2 – Z5 (Rohde & Schwarz)

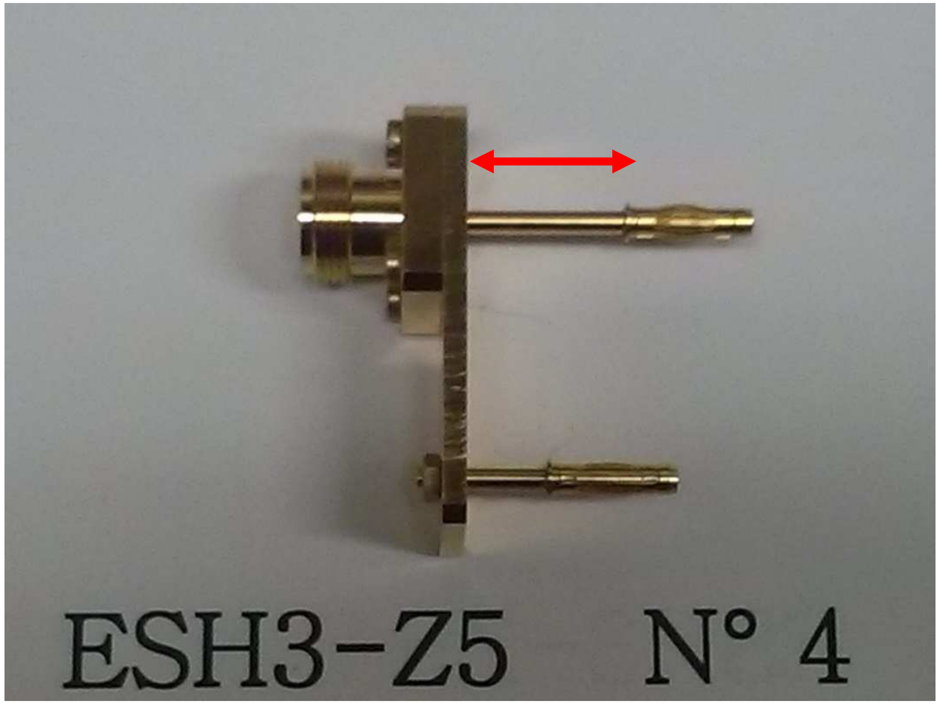


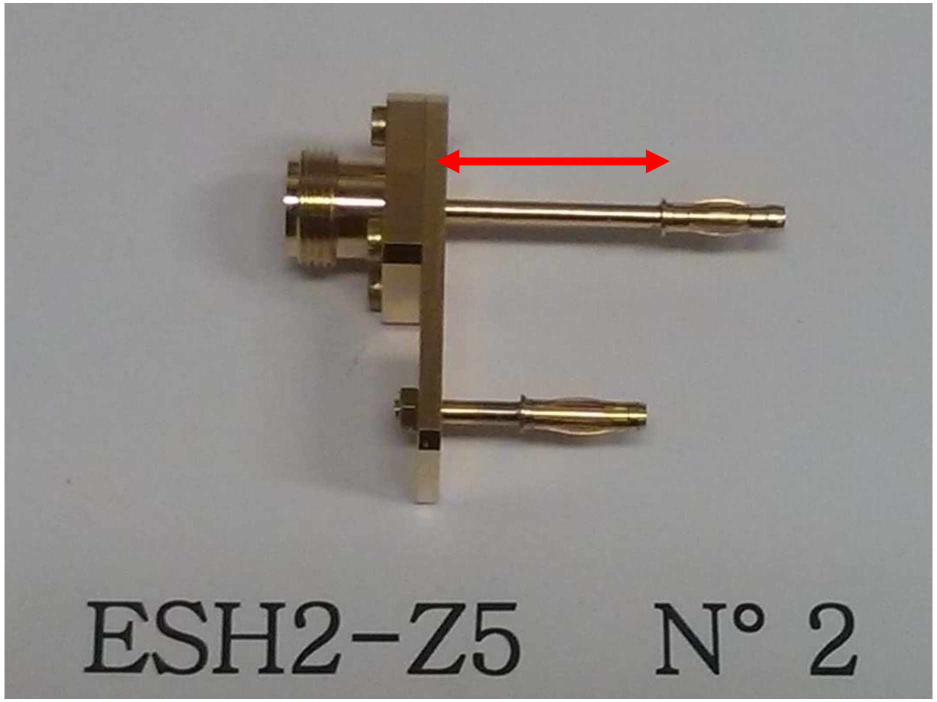
Results

- Difference between ESH2-Z5 and ESH3-Z5 measurement results

Deviation between uncorrected and corrected results = 2.4°

Deviation between uncorrected and corrected results = 5.5°





The length of ESH2-Z5 adapter is longer than ESH3-Z5 adapter

Published Papers

- EMC Europe 2015: “Adapter and method for improving the LISN input impedance measurement accuracy” (POSTER)

  - **F. ZIADÉ**, M. OUAMEUR, D. BÉLIÈRES, A. POLETAEFF, D. ALLAL, M. KOKALJ, B. PINTER, “Adapter and method for improving the LISN input impedance measurement accuracy”, 2015 IEEE International Symposium on Electromagnetic Compatibility (EMC), Dresden, Germany, 16-22 Aug. 2015, pp. 1254 – 1259.

- Paper accepted in IEEE Transactions on Instrumentation and Measurements (August 2015): “Improvement of LISN Measurement Accuracy Based on Calculable Adapters”

  - **F. ZIADÉ**, M. KOKALJ, M. OUAMEUR, B. PINTER, D. BÉLIÈRES, A. POLETAEFF, D. ALLAL, “Improvement of LISN Measurement Accuracy Based on Calculable Adapters”, IEEE Transactions on Instrumentation & Measurement, Vol. 65, pp. 365 - 377, Feb 2016.

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