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CERTIFICATE OF CALIBRATION

Applicant: Bureau Veritas Consumer Products Service (H.K.) Ltd.
Taoyuan Branch

Order by: EMC Instruments corporation
1F, No.8, Lane38 WenSan 3rd street
Kwei-Shan Hsiang Taoyuan Hsien

Instrument: Read out unit + E-field probe (100 MHz-6 GHz)

manufacturer	Narda / Wandel & Goltermann
type	NBM-550 + EF6091
serial number	B-0872 + 01124
identification	E2-020090 + E2-020088
asset number.	140000123

Calibration method: The calibration is carried out according to IEC 61000-4-3 (2006-02) + A1 (2007-11) + A2 (2010-03).

The instrument was allowed to acclimatize for at least 2 hours before any measurements were made.

During calibration, all axis of the field probe are switched on as in the normal isotropic mode of operation of the probe.

Up to 150 MHz, the calibration is performed in a TEM cell. The calculated field method is used for the calibration.

The calibration of frequencies from 200 MHz is carried out in a full anechoic room. Over the frequency range of 200 MHz to 1000 MHz, the standard transfer method is used. For frequencies from 1200 MHz, the calculated field method is used.

The polarization of the E-field is vertical. For each frequency and field strength setting, the field probe is rotated so that each position is aligned with the E-field. The position under test is always perpendicular to the direction of propagation and parallel to the E-field.

Page 11 describes the orientation of the DUT during calibration.

$$\textit{Correction Factor} = \frac{\textit{Applied field strength}}{\textit{Measured field strength}}$$

Position 1: probe horizontal, perpendicular to the field, display horizontal (up). Probe head aligned with center of the antenna, probe box to the right.

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Position 2: probe horizontal, perpendicular to the field, display aligned vertical, to the front facing the antenna. Probe head aligned with center of the antenna, probe box to the right.

Position 3: probe horizontal, perpendicular to the field, display horizontal (down). Probe head aligned with center of the antenna, probe box to the right.

.The linearity is compared to the limits given by the IEC 61000-4-3 standard as mentioned at page 12.

Ambient conditions: The calibration was carried out in a screened room, at an ambient temperature of (23 ± 2)°C and a relative humidity of (50 ± 10)%.

Period of calibration: 2016 February, 8 to 2016 February, 9.

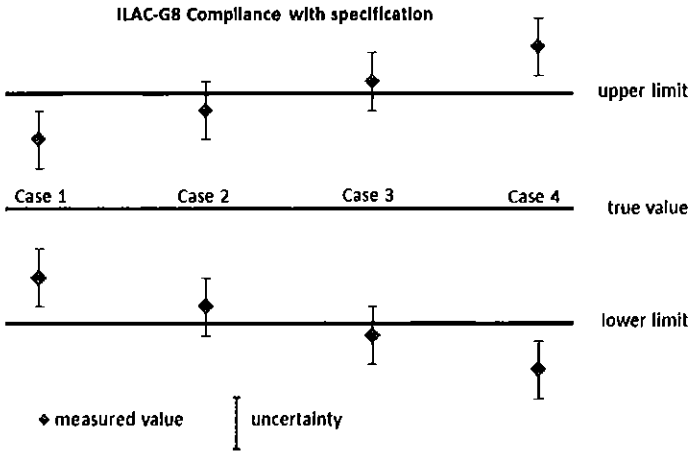
Due date: 2017 February, 9

Results: Final result: PASS. This pass or fail statement excludes the measurement uncertainty.
The results are listed on page 5 to 10.
The results of comparisons with specifications are shown in the column 'Remarks'.
Reported statements comply with ILAC-G8 (2009-03): 'Guidelines on the Reporting of Compliance with Specification'. The following remarks can be reported:

(a) Case 1 - 'Pass' or no remark if:
The measurement result is within (or below) the specification limit when the measurement uncertainty is taken into account.

(b) Case 4 - 'Out of specs.' if:
The measurement result is outside (or above) the specification limit when the measurement uncertainty is taken into account

(c) Case 2 & 3 - 'Border value' if:
It is not possible to state compliance using a 95% coverage probability for the expanded uncertainty.



No adjustments have been made to the instrument.
The measured values were calculated from a single sample.

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Uncertainty: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.The standard uncertainty of measurement has been determined in accordance with EA publication EA-4/02.

The uncertainties refer to the measured values only with no account being taken of the ability of the instruments under test to maintain their calibration.

Traceability: The measurements have been executed using standards for which the traceability to (inter)national standards has been demonstrated towards the RvA.

Description	Identification	Certificate number	Last calibration date
Signal Generator	ID 1265	RvA K063/201501248.00	October 2015
Power meter	ID 1247	RvA K063/201404632.01	November 2014
Power head	ID 1248	RvA K063/201404632.01	November 2014
RF Amplifier	ID 7387	D.A.R.E!! Calibrations/201501265.00	October 2015
Coupler	ID 7432	RvA K063/201500583.00	April 2015
TEM cell	ID 1073	-/No cal required	-
Attenuator 30dB	ID 1313	RvA K063/201600022.00	January 2016
Termination 50 ohms, N-type	ID 1545	/No cal required	-
Radicentre, Siemens	ID 7407	/-/No cal required	-

Description	Identification	Certificate number	Last calibration date
Signal Generator	ID 3049	RvA K063/201500914.00	April 2015
Signal Generator	ID 7340	RvA K063/201500915.00	April 2015
RF Amplifier	ID 1003	D.A.R.E!! Calibrations/201405072.00	January 2015
RF Amplifier	ID 1163	D.A.R.E!! Calibrations/201405073.00	December 2014
RF Amplifier	ID 1164	-/No cal required	-
RF Amplifier	ID 1347	D.A.R.E!! Calibrations/201403073.00	June 2014
Power head	ID 7406	RvA K063/201500912.00	May 2015
Attenuator 30dB	ID 7193	RvA K063/201600013.00	January 2016
Attenuator 20dB	ID 7196	RvA K063/201600016.00	January 2016
Coupler	ID 1005	RvA K063/201501244.00	September 2015
Coupler	ID 7422	RvA K063/201503883.00	October 2015
Antenna Horn	ID 1218	RvA K063/201401760.00	-
Antenna Horn	ID 1169	RvA K063/201404331.00	November 2014
Antenna Horn	ID 7395	/-/No cal required	-
Antenna Horn	ID 1156	RvA K063/201404330.00	November 2014
Antenna Horn	ID 7316	-/No cal required	-
Antenna Horn	ID 7317	-/No cal required	-
Antenna Horn	ID 7447	-/No cal required	-
Antenna Horn	ID 7448	-/No cal required	-
Antenna Horn	ID 7449	-/No cal required	-

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Description	Identification	Certificate number	Last calibration date
Antenna Horn	ID 7450	-/No cal required	-
Antenna Horn	ID 7293	-/No cal required	-
Antenna Horn	ID 7294	-/No cal required	-
Field sensor	ID 7457	NPL/2015080200-1	September 2015
Field sensor	ID 7273	NPL/2014090127-1	September 2014
Anechoic Room	ID 7092	-/No cal required	-

Date	Calibrated by	Checked by
2016 February, 9	B. Ahyud Calibration Engineer	D. van der Vlugt Director

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E-field Probe linearity (Position 1)
Frequency: 150 MHz
Range: range less

APPLIED FIELD [V/m]	MEASURED FIELD [V/m]	LINEARITY ± UNCERTAINTY	REMARKS DUE TO SPECIFICATIONS	CORRECTION FACTOR
10,04	8,64	(0,3 ± 0,6) dB	Border value	1,16
11,28	9,74	(0,2 ± 0,6) dB	Border value	1,16
12,67	10,96	(0,2 ± 0,6) dB	Border value	1,16
14,22	12,37	(0,2 ± 0,5) dB	Border value	1,15
16,0	14,0	(0,1 ± 0,5) dB	Border value	1,15
17,9	15,7	(0,1 ± 0,5) dB	Border value	1,14
20,1	17,8	0 dB (Reference)		1,13
22,5	20,1	(-0,07 ± 0,37) dB		1,12
25,3	22,9	(-0,17 ± 0,35) dB	Border value	1,11
28,4	26,0	(-0,29 ± 0,34) dB	Border value	1,09
31,6	29,4	(-0,41 ± 0,33) dB	Border value	1,08
35,5	33,5	(-0,56 ± 0,32) dB	Border value	1,06
39,9	38,5	(-0,75 ± 0,31) dB	Border value	1,04

E-field Probe linearity (Position 2)
Frequency: 150 MHz
Range: range less

APPLIED FIELD [V/m]	MEASURED FIELD [V/m]	LINEARITY ± UNCERTAINTY	REMARKS DUE TO SPECIFICATIONS	CORRECTION FACTOR
10,04	8,51	(0,2 ± 0,7) dB	Border value	1,18
11,29	9,59	(0,2 ± 0,6) dB	Border value	1,18
12,67	10,80	(0,2 ± 0,6) dB	Border value	1,17
14,22	12,18	(0,2 ± 0,5) dB	Border value	1,17
16,0	13,8	(0,1 ± 0,5) dB	Border value	1,16
17,9	15,5	(0,1 ± 0,5) dB		1,15
20,1	17,5	0 dB (Reference)		1,15
22,5	19,8	(-0,08 ± 0,38) dB		1,14
25,3	22,5	(-0,18 ± 0,36) dB	Border value	1,12
28,4	25,6	(-0,29 ± 0,34) dB	Border value	1,11
31,6	28,9	(-0,40 ± 0,33) dB	Border value	1,10
35,4	32,9	(-0,55 ± 0,32) dB	Border value	1,08
39,8	37,8	(-0,74 ± 0,31) dB	Border value	1,05

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E-field Probe linearity (Position 3)
Frequency: 150 MHz
Range: range less

APPLIED FIELD [V/m]	MEASURED FIELD [V/m]	LINEARITY ± UNCERTAINTY	REMARKS DUE TO SPECIFICATIONS	CORRECTION FACTOR
10,04	8,73	(0,2 ± 0,6) dB	Border value	1,15
11,27	9,84	(0,2 ± 0,6) dB	Border value	1,15
12,66	11,07	(0,2 ± 0,5) dB	Border value	1,14
14,21	12,48	(0,2 ± 0,5) dB	Border value	1,14
16,0	14,1	(0,1 ± 0,5) dB	Border value	1,13
17,8	15,8	(0,1 ± 0,4) dB		1,13
20,1	18,0	0 dB (Reference)		1,12
22,5	20,4	(-0,09 ± 0,37) dB		1,11
25,3	23,1	(-0,18 ± 0,35) dB	Border value	1,09
28,4	26,3	(-0,30 ± 0,33) dB	Border value	1,08
31,6	29,7	(-0,44 ± 0,32) dB	Border value	1,06
35,4	33,9	(-0,59 ± 0,31) dB	Border value	1,04
39,8	38,9	(-0,77 ± 0,31) dB	Border value	1,02

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E-field Probe frequency response

Frequency range: 100 MHz – 150 MHz

Probe orientation: monopole in the same plane as E-field

Septum height: 0,45 m

Range: range less

FREQUENCY [MHz]	APPLIED FIELD [V/m]			MEASURED FIELD [V/m]			CF ± UNCERTAINTY		
	Pos 1	Pos 2	Pos 3	Pos 1	Pos 2	Pos 3	Pos 1	Pos 2	Pos 3
100	19,9	19,9	19,9	16,4	15,9	16,1	1,21 ± 0,24	1,25 ± 0,25	1,23 ± 0,24
150	20	20	20	17,7	17,5	18,0	1,13 ± 0,23	1,14 ± 0,23	1,11 ± 0,22

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E-field Probe frequency response

Frequency range: 200 MHz – 1000 MHz

Probe orientation: monopole in the same plane as E-field

Antenna distance: 2,0 m

Range: rangeless

FREQUENCY [MHz]	APPLIED FIELD [V/m]			MEASURED FIELD [V/m]			CF ± UNCERTAINTY		
	Pos 1	Pos 2	Pos 3	Pos 1	Pos 2	Pos 3	Pos 1	Pos 2	Pos 3
200	20,1	19,9	20,0	19,8	17,6	19,6	1,01 ± 0,15	1,13 ± 0,17	1,02 ± 0,15
250	19,9	19,8	20,0	20,6	18,5	19,5	0,96 ± 0,14	1,07 ± 0,16	1,03 ± 0,15
300	20,4	20,3	20,4	22,0	20,8	21,3	0,93 ± 0,14	0,97 ± 0,14	0,96 ± 0,14
350	20,0	19,9	20,1	21,7	19,4	20,5	0,92 ± 0,14	1,03 ± 0,15	0,98 ± 0,15
400	19,9	19,9	19,8	22,0	19,9	21,6	0,90 ± 0,13	1,00 ± 0,15	0,92 ± 0,14
450	19,7	19,8	19,9	21,6	20,2	22,7	0,91 ± 0,14	0,98 ± 0,15	0,88 ± 0,13
500	19,5	19,6	19,6	21,2	20,2	23,3	0,92 ± 0,14	0,97 ± 0,14	0,84 ± 0,12
550	19,8	19,8	19,9	21,1	19,4	22,2	0,94 ± 0,14	1,02 ± 0,15	0,89 ± 0,13
600	19,8	19,7	19,9	21,9	20,1	23,1	0,90 ± 0,13	0,98 ± 0,15	0,86 ± 0,13
650	20,3	20,3	20,2	22,4	21,2	22,8	0,91 ± 0,13	0,95 ± 0,14	0,89 ± 0,13
700	20,3	20,3	20,3	22,4	22,0	22,9	0,91 ± 0,13	0,92 ± 0,14	0,88 ± 0,13
750	19,6	19,8	19,7	22,1	22,7	22,0	0,89 ± 0,13	0,87 ± 0,13	0,89 ± 0,13
800	20,0	19,9	19,9	23,3	23,1	22,8	0,86 ± 0,13	0,86 ± 0,13	0,87 ± 0,13
850	20,2	20,2	20,2	25,0	23,0	23,2	0,81 ± 0,12	0,88 ± 0,13	0,87 ± 0,13
900	20,2	20,2	20,2	25,1	22,0	23,6	0,81 ± 0,12	0,92 ± 0,14	0,86 ± 0,13
950	20,5	20,5	20,4	23,3	21,0	21,9	0,88 ± 0,13	0,98 ± 0,14	0,93 ± 0,14
1000	19,8	19,8	19,9	21,7	20,1	20,9	0,91 ± 0,14	0,99 ± 0,15	0,95 ± 0,14

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E-field Probe frequency response

Frequency range: 1200 MHz – 6000 MHz

Probe orientation: monopole in the same plane as E-field

Antenna distance: 1,0 m

Range: rangeless

FREQUENCY [MHz]	APPLIED FIELD [V/m]			MEASURED FIELD [V/m]			CF ± UNCERTAINTY		
	Pos 1	Pos 2	Pos 3	Pos 1	Pos 2	Pos 3	Pos 1	Pos 2	Pos 3
1200	20,0	19,9	19,9	21,7	19,4	22,1	0,92 ± 0,14	1,03 ± 0,15	0,91 ± 0,14
1400	20,0	20,0	20,0	21,8	20,9	21,9	0,92 ± 0,12	0,96 ± 0,13	0,92 ± 0,12
1600	20,1	20,1	20,1	24,1	22,2	23,6	0,83 ± 0,11	0,91 ± 0,12	0,85 ± 0,11
1800	20,1	19,9	19,9	23,0	21,4	23,4	0,87 ± 0,14	0,93 ± 0,15	0,86 ± 0,14
2000	20,0	19,9	19,9	21,8	18,9	21,4	0,92 ± 0,15	1,06 ± 0,17	0,94 ± 0,15
2200	20,0	19,9	19,9	21,0	16,7	20,8	0,95 ± 0,16	1,19 ± 0,20	0,96 ± 0,16
2400	20,0	20,1	20,1	21,9	20,3	22,0	0,92 ± 0,15	0,99 ± 0,16	0,91 ± 0,15
2600	20,0	20,1	20,1	21,8	20,3	21,5	0,92 ± 0,15	0,99 ± 0,16	0,93 ± 0,15
2800	20,0	20,0	20,0	22,4	18,9	23,3	0,89 ± 0,14	1,06 ± 0,17	0,87 ± 0,14
3000	20,0	20,0	20,0	20,5	18,1	20,7	0,97 ± 0,16	1,10 ± 0,18	0,97 ± 0,16
3200	20,0	20,0	20,0	20,5	17,0	20,2	0,97 ± 0,16	1,18 ± 0,19	0,99 ± 0,16
3400	19,9	19,9	19,9	19,9	17,5	18,9	1,00 ± 0,16	1,14 ± 0,19	1,06 ± 0,17
3600	20,0	20,2	20,2	21,6	19,7	21,6	0,93 ± 0,15	1,02 ± 0,17	0,93 ± 0,15
3800	19,9	19,9	19,9	20,0	17,8	20,4	0,99 ± 0,16	1,12 ± 0,18	0,99 ± 0,16
4000	20,0	20,0	20,0	20,5	16,3	20,8	0,97 ± 0,16	1,23 ± 0,20	0,96 ± 0,16
4200	20,2	20,1	20,1	18,9	15,8	19,1	1,07 ± 0,16	1,28 ± 0,19	1,05 ± 0,16
4400	20,0	20,2	20,2	19,7	17,2	19,5	1,01 ± 0,16	1,17 ± 0,18	1,03 ± 0,16
4600	20,1	20,0	20,0	19,5	17,4	18,5	1,03 ± 0,16	1,15 ± 0,18	1,08 ± 0,16
4800	20,0	20,0	20,0	20,6	17,0	19,4	0,98 ± 0,15	1,17 ± 0,18	1,03 ± 0,16
5000	20,1	20,0	20,0	20,4	16,5	20,0	0,98 ± 0,15	1,22 ± 0,19	1,01 ± 0,15
5200	20,0	19,9	19,9	19,4	15,6	19,9	1,03 ± 0,16	1,28 ± 0,20	1,00 ± 0,15
5400	20,1	19,9	19,9	19,5	17,0	19,4	1,03 ± 0,16	1,17 ± 0,18	1,04 ± 0,16
5600	20,0	20,0	20,0	19,3	16,9	19,4	1,04 ± 0,16	1,18 ± 0,18	1,03 ± 0,16
5800	19,9	20,1	20,1	18,7	16,3	18,6	1,07 ± 0,16	1,23 ± 0,19	1,08 ± 0,16
6000	20,0	20,1	20,1	19,4	15,3	18,6	1,03 ± 0,16	1,31 ± 0,20	1,07 ± 0,16

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E-field Probe isotropy
Applied field: 20 V/m

FREQUENCY [MHz]	MEASURED FIELD Position 1 [V/m]	MEASURED FIELD Position 2 [V/m]	MEASURED FIELD Position 3 [V/m]	ANISOTROPY ± UNCERTAINTY [dB]
100	16,5 V/m	16,1 V/m	16,3 V/m	(0,1 ± 2,2) dB
1000	22,0 V/m	20,2 V/m	21,1 V/m	(0,4 ± 1,70 dB

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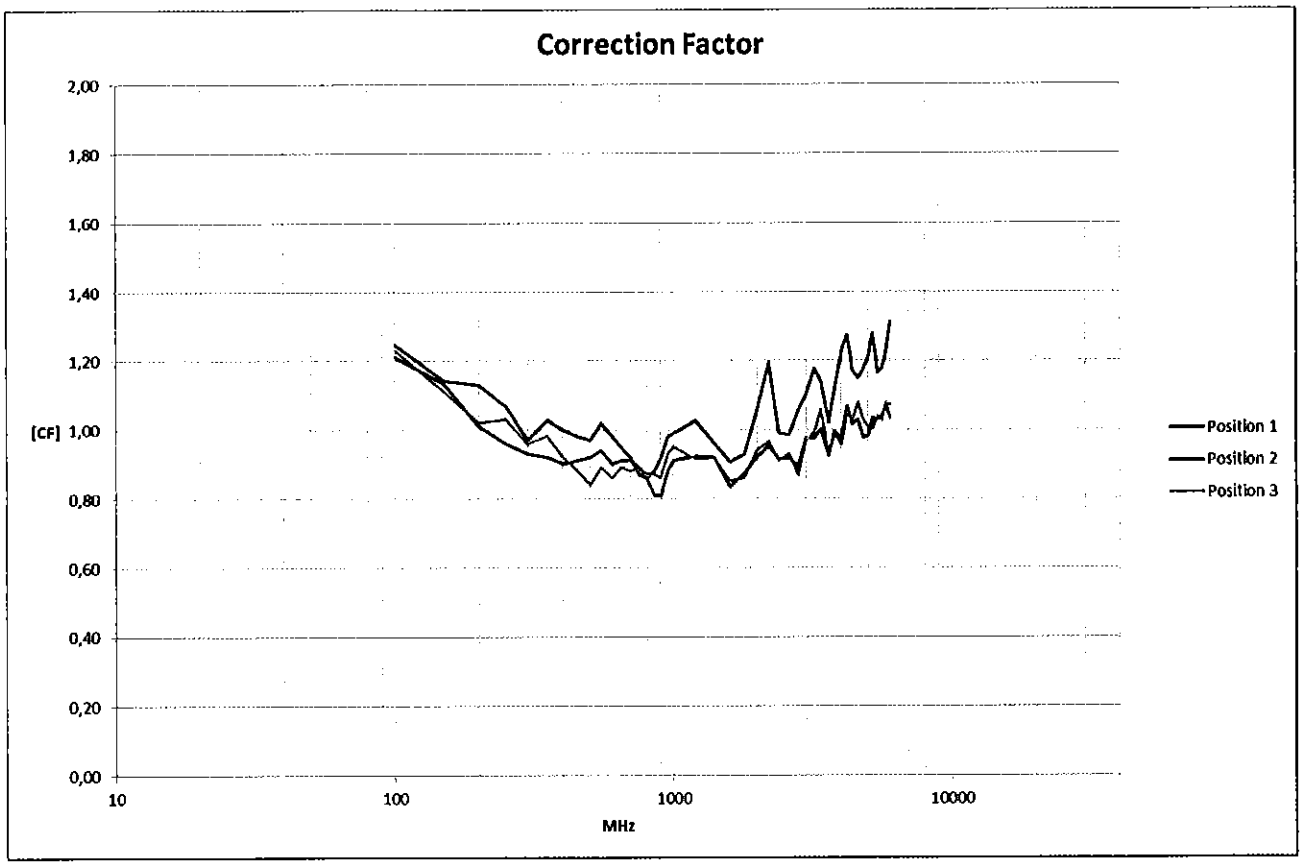

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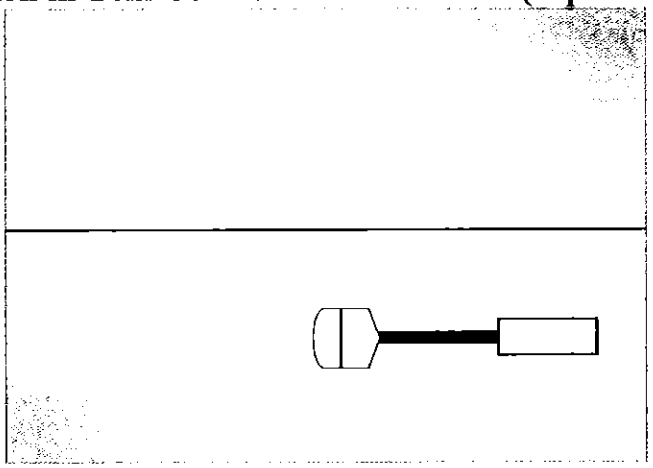
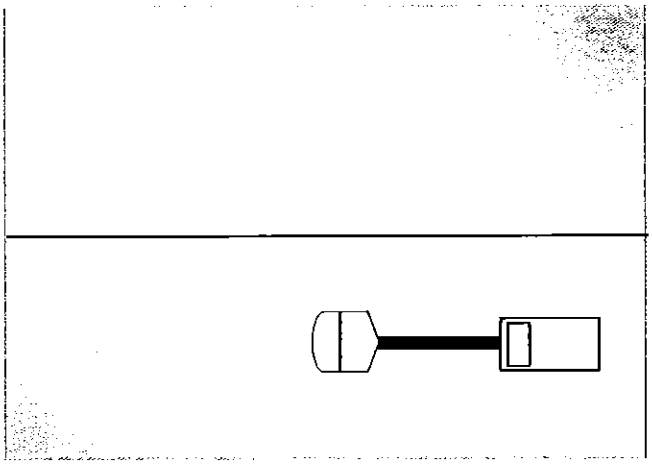
Probe orientation in Tem Cell 10 kHz – 150 MHz (Input side view)

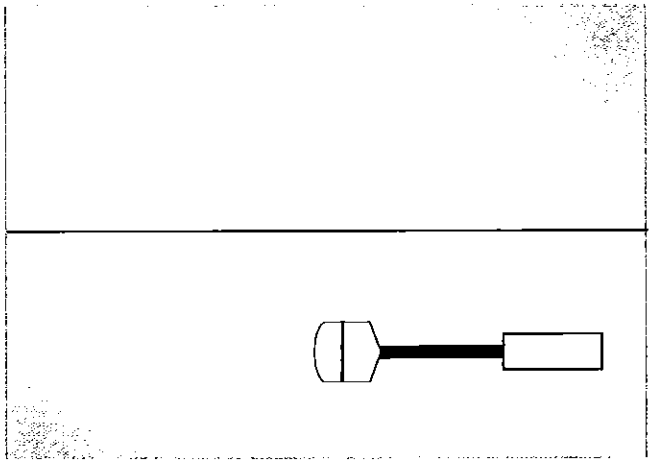
Position 1



Position 2



Position 3



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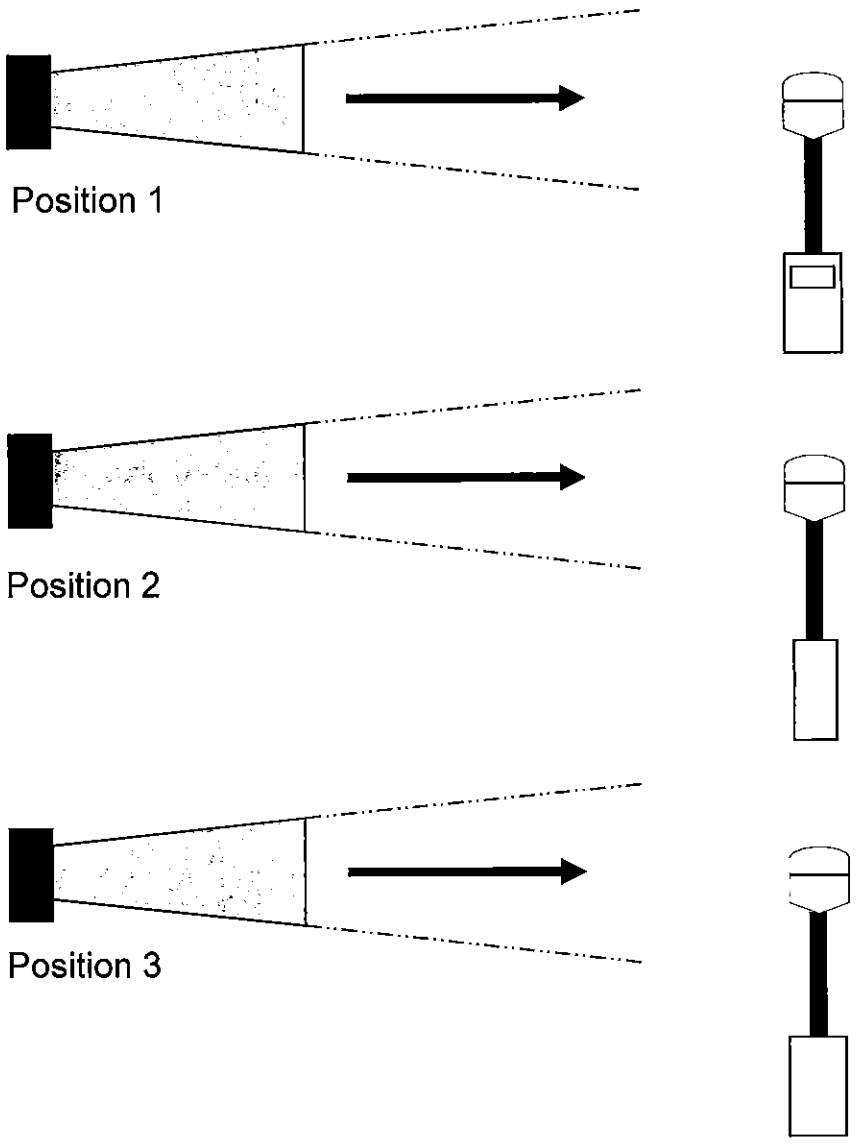
Probe orientation in anechoic room 200 MHz – 40 GHz (Top view)



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IEC 61000-4-3 (2006-02) + A1 (2007-11) + A2 (2010-03) specifications

Linearity check	± 0,5 dB

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