

DARE!!

DARE!! Calibrations Calibration services

Vijzelmolenlaan 7
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The Netherlands

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www.dare.nl
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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: H-field probe
manufacturer Narda / Wandel & Goltermann
type HF-0191 + NBM-550
serial number A-0303 + B-0872
identification E2-010189 + E2-020090
asset number. 140000122

Calibration method: 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.

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.

The H-Field is calculated by dividing the E-Field with 377 ohm.

$$\text{Correction Factor} = \frac{\text{Applied field strength}}{\text{Measuring field strength}}$$

The probe position has been determined as follows:
The point of view is from the antenna to the probe.

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

Certificate number 201600475.00

This certificate is issued provided that DARE!! Calibrations does not assume any liability.

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Reproduction of the complete certificate is allowed. Parts of the certificate may only be reproduced with written approval of the calibration laboratory.



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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.

See page 9 and 10 for a detailed drawing of the probe positioning.

Ambient conditions: The calibration was carried out in a screened room, at an ambient temperature of $(23 \pm 2)^\circ\text{C}$ and a relative humidity of $(50 \pm 10)\%$.

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

Due date: 2017 February, 9

Results: The results are listed on page 4 to 7.
No adjustments have been made to the instrument.
The measured values were calculated from a single sample.

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.

<u>Description</u>	<u>Identification</u>	<u>Certificate number</u>	<u>Last calibration date</u>
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	-
Radcentre, Siemens	ID 7407	-/No cal required	-

<u>Description</u>	<u>Identification</u>	<u>Certificate number</u>	<u>Last calibration date</u>
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

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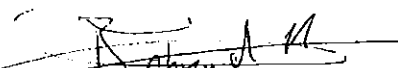
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RF Amplifier	ID 1163	D.A.R.E!! Calibrations/201405073.00	December 2014
RF Amplifier	ID 1164	-/No cal required	-
RF Amplifier	ID 1347	D.A.R.E!! Calibrations/201403073.00	June 2014
Power head	ID 7406	RvA K063/201500912.00	May 2015
Attenuator 30dB	ID 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	-
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	-

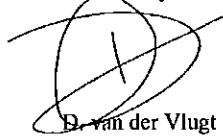
Date

Calibrated by

Checked by

2016 February, 9


B. Ahyud
Calibration Engineer


D. van der Vlugt
Director

Certificate number 201600475.00

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H-field Probe linearity (Position 1)

Frequency: 100 MHz, Septum height: 0,45 m
Range: range less

APPLIED FIELD [A/m]	MEASURED FIELD [A/m]	LINEARITY ± UNCERTAINTY [dB]	CORRECTION FACTOR
0,0213	0,0220	(-0,308 ± 0,027) dB	0,97
0,0426	0,0426	0 dB (Reference)	1,00
0,0850	0,0850	(0,003 ± 0,026) dB	1,00
0,1706	0,1701	(0,02 ± 0,05) dB	1,00
0,2664	0,2666	(-0,01 ± 0,06) dB	1,00

H-field Probe linearity (Position 2)

Frequency: 100 MHz, Septum height: 0,45 m
Range: range less

APPLIED FIELD [A/m]	MEASURED FIELD [A/m]	LINEARITY ± UNCERTAINTY [dB]	CORRECTION FACTOR
0,0213	0,0202	(0,343 ± 0,027) dB	1,06
0,0426	0,0420	0 dB (Reference)	1,02
0,0851	0,0846	(-0,074 ± 0,026) dB	1,01
0,1709	0,1700	(-0,09 ± 0,05) dB	1,01
0,2667	0,2660	(-0,11 ± 0,06) dB	1,00

H-field Probe linearity (Position 3)

Frequency: 100 MHz, Septum height: 0,45 m
Range: range less

APPLIED FIELD [A/m]	MEASURED FIELD [A/m]	LINEARITY ± UNCERTAINTY [dB]	CORRECTION FACTOR
0,0212	0,0218	(-0,198 ± 0,027) dB	0,98
0,0426	0,0427	0 dB (Reference)	1,00
0,0850	0,0846	(0,061 ± 0,026) dB	1,00
0,1707	0,1697	(0,07 ± 0,05) dB	1,01
0,2665	0,2655	(0,05 ± 0,06) dB	1,00

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H-field Probe frequency response
Frequency range: 30 MHz – 150 MHz
Septum height: 0,45 m
Range: range less

FREQUENCY [MHz]	APPLIED FIELD [A/m]			MEASURED FIELD [A/m]			CF ± UNCERTAINTY		
	Pos 1	Pos 2	Pos 3	Pos 1	Pos 2	Pos 3	Pos 1	Pos 2	Pos 3
30	0,053	0,053	0,053	0,048	0,048	0,049	1,10 ± 0,22	1,10 ± 0,22	1,09 ± 0,22
40	0,053	0,053	0,053	0,056	0,055	0,056	0,95 ± 0,19	0,95 ± 0,19	0,95 ± 0,19
50	0,053	0,053	0,053	0,058	0,058	0,058	0,92 ± 0,18	0,91 ± 0,18	0,92 ± 0,18
60	0,053	0,053	0,053	0,057	0,057	0,058	0,94 ± 0,18	0,93 ± 0,18	0,92 ± 0,18
70	0,053	0,053	0,053	0,056	0,055	0,056	0,94 ± 0,19	0,96 ± 0,19	0,95 ± 0,19
80	0,053	0,053	0,053	0,055	0,054	0,054	0,97 ± 0,19	0,97 ± 0,19	0,97 ± 0,19
90	0,053	0,053	0,053	0,053	0,053	0,054	0,99 ± 0,20	1,00 ± 0,20	0,98 ± 0,19
100	0,053	0,053	0,053	0,052	0,053	0,052	1,01 ± 0,20	1,00 ± 0,20	1,02 ± 0,20
150	0,053	0,053	0,053	0,048	0,048	0,048	1,11 ± 0,22	1,10 ± 0,22	1,10 ± 0,22

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H-field Probe frequency response

Frequency range: 200 MHz – 1000 MHz

Antenna distance: 2,0 m

Range: range less

FREQUENCY [MHz]	APPLIED FIELD [A/m]			MEASURED FIELD [A/m]			CF ± UNCERTAINTY		
	Pos 1	Pos 2	Pos 3	Pos 1	Pos 2	Pos 3	Pos 1	Pos 2	Pos 3
200	0,053	0,053	0,053	0,040	0,043	0,043	1,33 ± 0,20	1,23 ± 0,18	1,23 ± 0,18
250	0,053	0,053	0,053	0,063	0,065	0,065	0,84 ± 0,12	0,81 ± 0,12	0,81 ± 0,12
300	0,054	0,054	0,054	0,047	0,047	0,048	1,14 ± 0,17	1,15 ± 0,17	1,13 ± 0,17
350	0,053	0,053	0,053	0,047	0,046	0,048	1,13 ± 0,17	1,17 ± 0,17	1,10 ± 0,16
400	0,053	0,053	0,053	0,049	0,049	0,051	1,07 ± 0,16	1,09 ± 0,16	1,04 ± 0,15
450	0,053	0,052	0,053	0,046	0,049	0,048	1,15 ± 0,17	1,08 ± 0,16	1,10 ± 0,16
500	0,052	0,052	0,052	0,055	0,056	0,055	0,94 ± 0,14	0,92 ± 0,14	0,93 ± 0,14
550	0,053	0,053	0,053	0,049	0,050	0,050	1,08 ± 0,16	1,06 ± 0,16	1,06 ± 0,16
600	0,053	0,053	0,052	0,053	0,054	0,054	0,99 ± 0,15	0,98 ± 0,15	0,97 ± 0,14
650	0,054	0,053	0,054	0,051	0,053	0,054	1,05 ± 0,16	1,01 ± 0,15	0,99 ± 0,15
700	0,053	0,054	0,054	0,051	0,053	0,053	1,05 ± 0,16	1,01 ± 0,15	1,01 ± 0,15
750	0,052	0,052	0,052	0,051	0,051	0,053	1,02 ± 0,15	1,02 ± 0,15	1,00 ± 0,15
800	0,053	0,053	0,053	0,052	0,051	0,053	1,02 ± 0,15	1,04 ± 0,15	0,99 ± 0,15
850	0,054	0,054	0,054	0,053	0,052	0,055	1,01 ± 0,15	1,03 ± 0,15	0,98 ± 0,14
900	0,054	0,054	0,054	0,054	0,055	0,058	0,99 ± 0,15	0,98 ± 0,15	0,92 ± 0,14
950	0,054	0,055	0,054	0,053	0,052	0,054	1,03 ± 0,15	1,06 ± 0,16	0,99 ± 0,15
1000	0,052	0,053	0,053	0,049	0,046	0,049	1,07 ± 0,16	1,13 ± 0,17	1,08 ± 0,16

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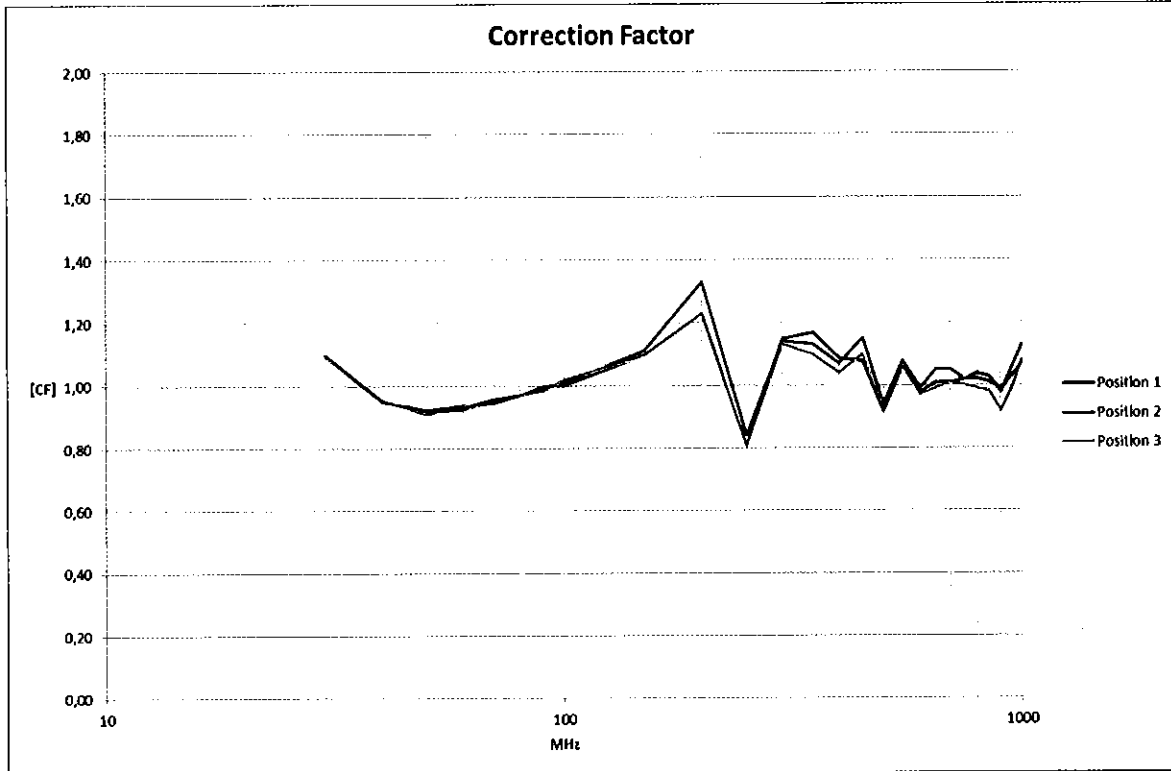
H-field Probe isotropy				
Applied field: 0,0531 A/m				
FREQUENCY	MEASURED FIELD	MEASURED FIELD	MEASURED FIELD	ANISOTROPY ± UNCERTAINTY
[MHz]	Position 1 [A/m]	Position 2 [A/m]	Position 3 [A/m]	[dB]
30	0,0482 A/m	0,0482 A/m	0,0487 A/m	(0,0 ± 1,4) dB
100	0,0525 A/m	0,0531 A/m	0,0520 A/m	(0,1 ± 1,2) dB
1000	0,0496 A/m	0,0469 A/m	0,0491 A/m	(0,2 ± 1,7) dB

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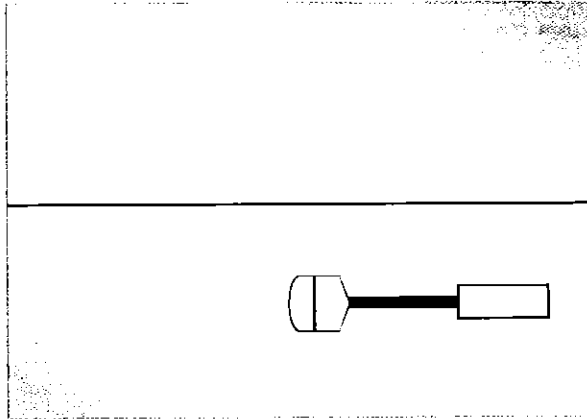
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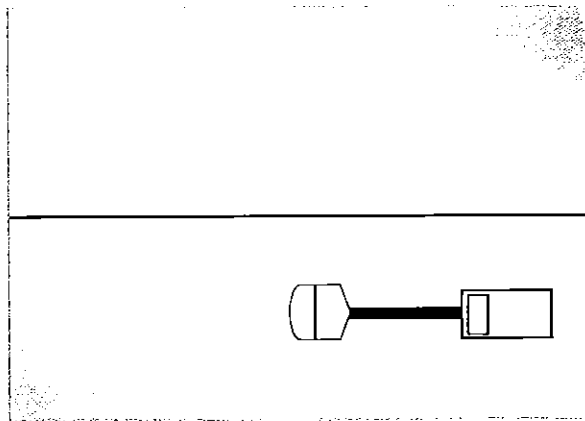
Probe orientation in Tem Cell 10 kHz – 150 MHz (Input side view)

Position 1



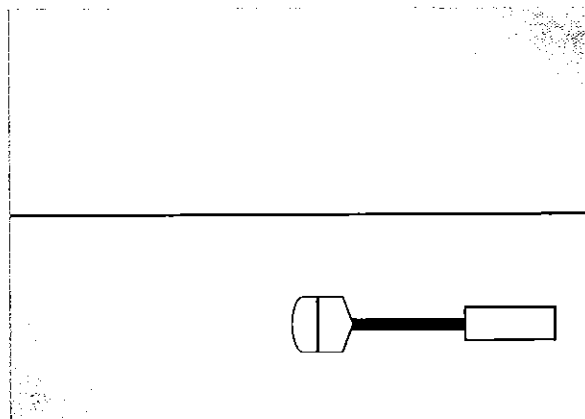
Septum

Position 2



Septum

Position 3



Septum

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

