Narda Safety Test Solutions GmbH
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an ESCO Communications Company

Calibration Certificate

Narda Safety Test Solutions hereby certifies that the object referenced to this certificate has been calibrated by qualified personnel using Narda's approved procedures. The calibration was carried out in accordance with a certified quality management system which conformed to ISO 9001.

OBJECT	**Broadband Field Meter NBM-550**
MANUFACTURER	Narda Safety Test Solutions GmbH
PART NUMBER (P/N)	**2401/01B**
SERIAL NUMBER (S/N)	**E-0477**
CUSTOMER	
CALIBRATION DATE	2012-07-18
RESULT ASSESSMENT	within specifications
AMBIENT CONDITIONS	Temperature: (23 ± 3) °C Relative humidity: (20 to 60) %
CALIBRATION PROCEDURE	2401-8700-00A

ISSUE DATE: 2012-07-18

MANAGEMENT SYSTEM

Gillhart
CALIBRATED BY
Gillhart

i.A.
AUTHORIZED SIGNATORY

Certified by DQS according to ISO 9001:2008 (Reg.-No. 099379 QM08)

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Method of Measurement

The device under test (DUT) represents a three-channel voltage meter offering high accuracy and high resolution. The DUT is calibrated by applying a known DC voltage to each of the inputs.

Uncertainty of Measurement

The measurement uncertainty stated in this document is the expanded uncertainty with a coverage factor of 2 (corresponding, in the case of normal distribution, to a confidence probability of 95 %).

The uncertainty analysis for this calibration was done in accordance with the ISO/TAG-Guide (Guide to the expression of uncertainty in measurement). The measurement uncertainties are derived from contributions from the measurement of power, reflection, attenuation and frequency, mismatch, stability of instrumentation and repeatability of handling.

This statement of uncertainty applies to the measured values only and does not include effects like temperature response and long term stability of the calibrated device.

Traceability of Measuring Equipment

The calibration results are traceable to SI-units according to ISO/IEC 17025. Physical units, which are not included in the list of accredited measured quantities such as field strength or power density, are traced to the basic units via approved measurement and computational methods.

The equipment used for this calibration is traceable to the reference listed below and the traceability is guaranteed by ISO 9001 Narda internal procedure.

Reference- / Working- Standard	Manufacturer	Model	Serial Number	Certificate Number	Cal Due Date	Trace
Digital Multimeter	Agilent	34401A	US36121450	1-3055890662-1B	2013-02	UKAS

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Results

Voltage display uncertainty

Channel	Input voltage applied	Specified voltage display	Meas. Uncertainty	Meas. voltage display
X	2.400 V	(2.376+/-0.024) V	+/-0.007 V	2.371 V
Y	2.400 V	(2.376+/-0.024) V	+/-0.007 V	2.371 V
Z	2.400 V	(2.376+/-0.024) V	+/-0.007 V	2.371 V

Note: Because of an internal voltage divider the nominal indication is 2.376 V.

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OBJECT	Probe HF3061, H-Field
MANUFACTURER	Narda Safety Test Solutions GmbH
PART NUMBER (P/N)	2402/05
SERIAL NUMBER (S/N)	A-0333
CUSTOMER	
CALIBRATION DATE	2011-05-23
AMBIENT CONDITIONS	Temperature: (23 ± 3) °C Relative humidity: (20 to 60) %
CALIBRATION PROCEDURE	2402-8705-00A

ISSUE DATE: 2011-05-23

CALIBRATED BY
Martin

AUTHORIZED SIGNATORY

MANAGEMENT SYSTEM

Certified by DQS according to ISO 9001:2008
(Reg.-No. 099379 QM08)

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Method of Measurement

The calibration of RF field strength probes involves the generation of a calculable linearly polarized electromagnetic field - approximating to a plane wave - into which the device under test is placed. The probe is calibrated separately from the base meter.

The probe is located inside a TEM cell with the handle oriented perpendicular to both, the direction of propagation and the direction of the E-field vector. The sensor elements are nominally exposed to the same field level. The TEM cell is sufficiently small to avoid resonance at the frequencies of calibration.

A correction factor *K* is a numerical factor to compensate the systematic error due to frequency response.

$$K = H_{actual} / H_{mean}$$

The correction factor *K* is stored in the probe memory. When combined with the NBM-5xx Field Meter the frequency response correction may be enabled.

Field Generation

Set Up "D" (100 kHz ... 100 MHz):

Calibration using calculated field strength. A Crawford TEM cells are used to generate the known field strength *H*. The field strength is derived from TEM cell's septum height *b*, impedance Z_0 and from the output power of the cell. The power measurement includes the power meter's response $P_m F_{th}$ and a fixed attenuation *D*.

$$H = \frac{\sqrt{P_m \cdot F_{th} \cdot D \cdot Z_0}}{b \cdot \eta}$$

with η : intrinsic impedance of propagation medium in Ohms.

Reference: IEEE Std. 1309

Uncertainties

The measurement uncertainty stated in this document is the expanded uncertainty with a coverage factor of 1.96 (corresponding, in the case of normal distribution, to a confidence probability of 95 %).

The uncertainty analysis for this calibration was done in accordance with the ISO-Guide (Guide to the expression of Uncertainty in Measurement). The measurement uncertainties are derived from contributions from the measurement of power, impedance, attenuation, mismatch, length, frequency, stability of instrumentation, repeatability of handling and field uniformity in the field generators (TEM cell and anechoic chamber).

This statement of uncertainty applies to the measured values only and does not make any implementation or include any estimation as to the long-term stability of the calibrated device.

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Test Equipment and Traceability

The calibration results are traceable to SI-units according to ISO/IEC 17025. Physical units, which are not included in the list of accredited measured quantities such as field strength or power density, are traced to the basic units via approved measurement and computational methods.

The equipment used for this calibration is traceable to the reference listed below and the traceability is guaranteed by ISO 9001 Narda internal procedure.

Reference- / Working- Standard	Manufacturer	Model	Serial Number	Certificate Number	Cal Due Date	Trace
Digital Multimeter	agilent	34401A	US36121450	1-3055890662-1B	#	UKAS147
Set-Up "D" (100 kHz to 100 MHz)						
Calliper	Preisser	0-800mm	310121016	649724 DKD-K-12001 06-05	#	DKD
RF-Millivoltmeter	R&S	URV55	100627	0107 DKD-K-16101 2010-09	2012-09	DKD
Power Sensor	R&S	NRV-Z51	101777	0141 DKD-K-16101 2010-12	2012-12	DKD
Attenuator	Weinschel	49-30-33	KC115	3248 DKD-K-00501 2008-06	2011-06	DKD

Reference standard; not used for routine calibration

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Results

Frequency Response

The frequency response is measured with instrument setting: Apply Correction Frequency = OFF.

Frequency in MHz	H_{actual} in A/m	Meas. Uncertainty in dB	H_{mean} in A/m	Correction Factor K (*)
0.1	0.1246	0.6	0.0545	2.288
0.15	0.1247	0.6	0.0697	1.790
0.2	0.1250	0.6	0.0829	1.508
0.3	0.1250	0.6	0.0992	1.260
0.4	0.1249	0.6	0.1080	1.157
0.5	0.1250	0.6	0.1130	1.107
0.6	0.1248	0.6	0.1158	1.078
0.7	0.1247	0.6	0.1178	1.058
0.8	0.1249	0.6	0.1192	1.047
0.9	0.1249	0.6	0.1204	1.037
1	0.1250	0.6	0.1212	1.031
1.2	0.1250	0.6	0.1223	1.022
1.5	0.1248	0.6	0.1232	1.013
2	0.1249	0.6	0.1240	1.007
3	0.1250	0.6	0.1249	1.001
4	0.1250	0.6	0.1252	0.999
5	0.1248	0.6	0.1251	0.998
10	0.1249	0.6	0.1243	1.005
15	0.1251	0.6	0.1236	1.012
20	0.1249	0.6	0.1246	1.003
25	0.1249	0.6	0.1278	0.977
27.12	0.1251	0.6	0.1290	0.970
30	0.1250	0.6	0.1274	0.981

Flatness (1 - 30 MHz): +/-0.27 dB

(*) The frequency response correction data is stored in the probe memory. When the probe is connected to a NBM-5xx Field Meter the implemented frequency response correction may be enabled. This is done by selecting the desired frequency and the setting: Apply Correction Frequency = ON.

Adjustment (informative):

Gain multiplier = K_0 = 0.9979

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Frequency Response

Frequency response data with setting: Apply Correction Frequency = OFF.