

Page: 11 of 19

#### 3. EX3DV4 - SN 7515



Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504 E-mail: cttl@chinattl.com Http://www.chinattl.cn



Auden Certificate No: Z21-60435 Client

CAL	IBRA1	MOL	CERT	IFIC A	TE
UAL	IDIVA	IOIA	CENI		

Object

EX3DV4 - SN: 7515

Calibration Procedure(s)

FF-Z11-004-02

Calibration Procedures for Dosimetric E-field Probes

Calibration date:

December 28, 2021

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID#	Cal Date(Calibrated by, Certificate No.	.) Scheduled Calibration
Power Meter NRP2	101919	15-Jun-21(CTTL, No.J21X04466)	Jun-22
Power sensor NRP-Z91	101547	15-Jun-21(CTTL, No.J21X04466)	Jun-22
Power sensor NRP-Z91	101548	15-Jun-21(CTTL, No.J21X04466)	Jun-22
Reference 10dBAttenuator	18N50W-10dB	10-Feb-20(CTTL, No.J20X00525)	Feb-22
Reference 20dBAttenuator	18N50W-20dB	10-Feb-20(CTTL, No.J20X00526)	Feb-22
Reference Probe EX3DV4	SN 3617	27-Jan-21(SPEAG, No.EX3-3617_Jan	n21) Jan-22
DAE4	SN 1555	20-Aug-21(SPEAG, No.DAE4-1555_A	Aug21/2) Aug-22
Secondary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGenerator MG3700A	6201052605	16-Jun-21(CTTL, No.J21X04467)	Jun-22
Network Analyzer E5071C	MY46110673	21-Jan-21(CTTL, No.J20X00515)	Jan-22
Na	me	Function	Signature
Calibrated by:	Zongying	SAR Test Engineer	And who

Reviewed by:

Approved by:

Lin Hao SAR Test Engineer

Qi Dianyuan SAR Project Leader

Issued: December 30, 2021 This calibration certificate shall not be reproduced except in full without written approval of the laboratory

Certificate No: Z21-60435

Page 1 of 9



Unless otherwise agreed in writing, this document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <a href="http://www.sgs.com/en/Terms-and-Conditions.aspx">http://www.sgs.com/en/Terms-and-Conditions.aspx</a> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <a href="http://www.sgs.com/en/Terms-and-Conditions-Enrms-e-Document.aspx">http://www.sgs.com/en/Terms-and-Conditions/Ferms-e-Document.aspx</a>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is claim advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest tent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

\*\*Attention:\*\*To check the authenticity of testing //inspection reports\*\*Certificate, please contact us at telephone: (86-755) 8307 1443, \*\*Tother the authenticity of testing //inspection reports\*\*Certificate, please contact us at telephone: (86-755) 8307 1443, \*\*Tother the authenticity of testing //inspection reports\*\*Certificate, please contact us at telephone: (86-755) 8307 1443, \*\*Tother the authenticity of testing //inspection reports\*\*Certificate, please contact us at telephone: (86-755) 8307 1443, \*\*Tother the authenticity of testing //inspection reports\*\*

\*\*Certificate //i

No.10, Weiye Road, Innovation Park, Kunshan, Jiangsu, China 215300 中国・江苏・昆山市留学生创业园伟业路10号 邮编 215300



Page:

12 of 19



Add: No.52 Hua YuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504 Http://www.chinattl.cn

Glossary:

TSL tissue simulating liquid
NORMx,y,z sensitivity in free space
ConvF sensitivity in TSL / NORMx,y,z
DCP diode compression point

CF crest factor (1/duty\_cycle) of the RF signal modulation dependent linearization parameters

Polarization Φ rotation around probe axis

Polarization θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i

 $\theta$ =0 is normal to probe axis

Connector Angle information used in DASY system to align probe sensor X to the robot coordinate system Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016

c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

#### Methods Applied and Interpretation of Parameters:

 NORMx,y,z: Assessed for E-field polarization θ=0 (f≤900MHz in TEM-cell; f>1800MHz: waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E²-field uncertainty inside TSL (see below ConvF).

NORM(f)x,y,z = NORMx,y,z\* frequency\_response (see Frequency Response Chart). This
linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the
frequency response is included in the stated uncertainty of ConvF.

 DCPx,y,z: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.

 PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics.

Ax,y,z; Bx,y,z; Cx,y,z;VRx,y,z:A,B,C are numerical linearization parameters assessed based on the
data of power sweep for specific modulation signal. The parameters do not depend on frequency nor
media. VR is the maximum calibration range expressed in RMS voltage across the diode.

• ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for f≤800MHz) and inside waveguide using analytical field distributions based on power measurements for f >800MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx,y,z\* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from±50MHz to±100MHz.

 Spherical isotropy (3D deviation from isotropy): in a field of low gradients realized using a flat phantom exposed by a patch antenna.

• Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

 Connector Angle: The angle is assessed using the information gained by determining the NORMx (no uncertainty required).

Certificate No:Z21-60435

Page 2 of 9



advised that information contained nereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

Attention: To check the authenticity of testing /inspection report & certificate, please contact us at telephone: (86-755) 8307 1443, or email: CN. Doccheck@sas.com

No.10, Weiye Road, Innovation Park, Kunshan, Jiangsu, China 215300 中国・江苏・昆山市留学生创业园伟业路10号 邮编 215300 t(86-512)57355888 f(86-512)57370818 www.sgsgroup.com.cn t(86-512)57355888 f(86-512)57370818 sgs.china@sgs.com

Member of the SGS Group (SGS SA)



Page:

13 of 19



Tel: +86-10-62304633-2512 E-mail: cttl@chinattl.com

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Fax: +86-10-62304633-2504 Http://www.chinattl.cn

#### DASY/EASY – Parameters of Probe: EX3DV4 – SN:7515

#### **Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
$Norm(\mu V/(V/m)^2)^A$	0.44	0.49	0.47	±10.0%
DCP(mV) <sup>B</sup>	98.0	98.8	100.2	

#### **Modulation Calibration Parameters**

UID	Communication		Α	В	С	D	VR	Unc <sup>E</sup>
	System Name		dB	dBõV		dB	mV	(k=2)
0	CW	Х	0.0	0.0	1.0	0.00	146.7	±4.8%
		Υ	0.0	0.0	1.0		161.1	(10)
	8 -	Z	0.0	0.0	1.0		154.1	

The reported 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%.

<sup>B</sup> Numerical linearization parameter: uncertainty not required.

Certificate No:Z21-60435

Page 3 of 9



advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only of the sample(s) the proof is certificate, pleases contact us at telephone: (86-755) 8307 1443, or small: CN Doccheck@sms.com; or cannot be contact us at telephone: (86-755) 8307 1443, or small: CN Doccheck@sms.com; or cannot be contact us at telephone: (86-755) 8307 1443, or small: CN Doccheck@sms.com; or cannot be contact us at telephone: (86-755) 8307 1443, or small: CN Doccheck@sms.com; or cannot be contact us at telephone: (86-755) 8307 1443, or small: CN Doccheck@sms.com; or cannot contact us at telephone: (86-755) 8307 1443, or cannot contact us at telephone: (86-755) 8307 1443, or cannot contact us at telephone: (86-755) 8307 1443, or cannot contact us at telephone: (86-755) 8307 1443, or cannot contact us at telephone: (86-755) 8307 1443, or cannot contact us at telephone: (86-755) 8307 1443, or cannot contact us at telephone: (86-755) 8307 1443, or cannot contact us at telephone: (86-755) 8307 1443, or cannot contact us at telephone: (86-755) 8307 1443, or cannot contact us at telephone: (86-755) 8307 1443, or cannot contact us at telephone: (86-755) 8307 1443, or cannot contact us at telephone: (86-755) 8307 1443, or cannot contact us at telephone: (86-755) 8307 1443, or cannot contact us at telephone: (86-755) 8307 1443, or cannot

No.10, Weiye Road, Innovation Park, Kunshan, Jiangsu, China 215300 中国・江苏・昆山市留学生创业园伟业路10号 邮编 215300

A The uncertainties of Norm X, Y, Z do not affect the E2-field uncertainty inside TSL (see Page 4).

EUncertainly is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.



Page:

14 of 19



Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2512 E-mail: cttl@chinattl.com

Fax: +86-10-62304633-2504 Http://www.chinattl.cn

#### DASY/EASY - Parameters of Probe: EX3DV4 - SN:7515

## Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz] <sup>C</sup>	Relative Permittivity F	Conductivity (S/m) F	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup>	Unct.
750	41.9	0.89	10.02	10.02	10.02	0.08	(mm) 1.72	( <i>k</i> =2) ±12.1%
835	41.5	0.90	9.65	9.65	9.65	0.16	1.25	±12.1%
900	41.5	0.97	9.61	9.61	9.61	0.20	1.18	±12.1%
1750	40.1	1.37	8.40	8.40	8.40	0.47	0.79	±12.1%
1900	40.0	1.40	8.16	8.16	8.16	0.30	0.75	±12.17
2000	40.0	1.40	8.23	8.23	8.23	0.19	1.29	±12.1%
2300	39.5	1.67	7.71	7.71	7.71	0.60	0.70	±12.1%
2450	39.2	1.80	7.44	7.44	7.44	0.54	0.78	±12.1%
2600	39.0	1.96	7.31	7.31	7.31	0.60	0.74	±12.1%
3300	38.2	2.71	7.10	7.10	7.10	0.43	0.92	±13.3%
3500	37.9	2.91	6.87	6.87	6.87	0.42	1.00	±13.3%
3700	37.7	3.12	6.55	6.55	6.55	0.43	1.00	±13.3%
3900	37.5	3.32	6.47	6.47	6.47	0.40	1.25	±13.3%
4100	37.2	3.53	6.53	6.53	6.53	0.40	1.15	±13.3%
4200	37.1	3.63	6.44	6.44	6.44	0.40	1.25	±13.3%
4400	36.9	3.84	6.34	6.34	6.34	0.40	1.25	±13.3%
4600	36.7	4.04	6.25	6.25	6.25	0.50	1.17	±13.3%
4800	36.4	4.25	6.22	6.22	6.22	0.45	1.20	±13.3%
4950	36.3	4.40	5.97	5.97	5.97	0.50	1.20	±13.3%
5250	35.9	4.71	5.46	5.46	5.46	0.45	1.25	±13.3%
5600	35.5	5.07	4.89	4.89	4.89	0.55	1.20	±13.3%
5750	35.4	5.22	4.96	4.96	4.96	0.55	1.25	±13.3%

<sup>&</sup>lt;sup>C</sup> Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to  $\pm$  110 MHz.

Certificate No:Z21-60435

Page 4 of 9



advised that information contained hereon reflects the Company's findings at the time of its intervention only and wit Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exoner transaction from exercising all their rights and obligations under the transaction document. This document cannot except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless other results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only. Attention: To check the authenticity of testing inspection report & certificate, please charact us at telephone: [86

No.10, Weiye Road, Innovation Park, Kunshan, Jiangsu, China 215300 中国・江苏・昆山市留学生创业园伟业路10号 邮编 215300

F At frequency below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to  $\pm 10\%$  if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.



Page:

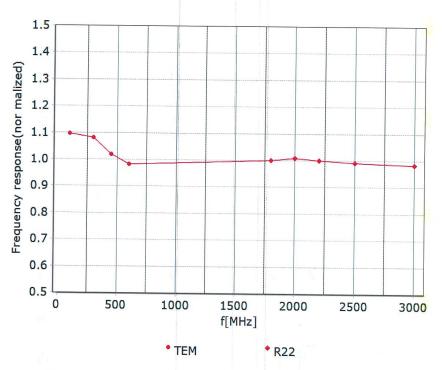
15 of 19



Tel: +86-10-62304633-2512 E-mail: cttl@chinattl.com

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Fax: +86-10-62304633-2504 Http://www.chinattl.cn

# Frequency Response of E-Field (TEM-Cell: ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: ±7.4% (k=2)

Certificate No:Z21-60435

Page 5 of 9



No.10, Weiye Road, Innovation Park, Kunshan, Jiangsu, China 215300 中国・江苏・昆山市留学生创业园伟业路10号 邮编 215300

 $t(86\text{-}512)57355888 \qquad f(86\text{-}512)57370818 \qquad \text{www.sgsgroup.com.cn}$  $t(86\text{-}512)57355888 \qquad f(86\text{-}512)57370818 \qquad sgs.china@sgs.com$ 



Page:

16 of 19

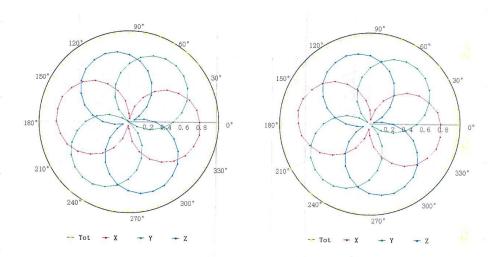


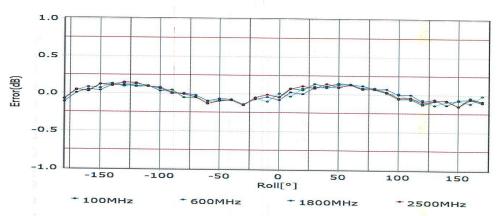
Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504 Http://www.chinattl.cn

# Receiving Pattern ( $\Phi$ ), $\theta$ =0°

## f=600 MHz, TEM

## f=1800 MHz, R22





Uncertainty of Axial Isotropy Assessment:  $\pm 1.2\%$  (k=2)

Certificate No:Z21-60435

Page 6 of 9



advised that information contained nereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only. Attention: To check the authenticity of testing /inspection report & certificate, please contact us at telephone: (86-755) 8307 1443,

No.10, Weiye Road, Innovation Park, Kunshan, Jiangsu, China 215300 中国・江苏・昆山市留学生创业园伟业路10号 邮编 215300

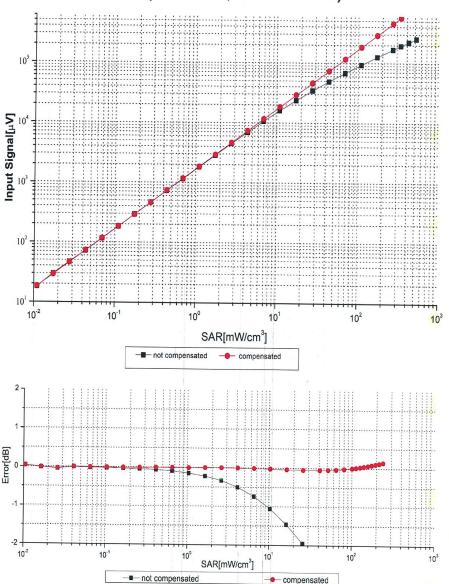


Page: 17 of 19



Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504 Http://www.chinattl.cn

# Dynamic Range f(SAR<sub>head</sub>) (TEM cell, f = 900 MHz)



Uncertainty of Linearity Assessment: ±0.9% (k=2)

Certificate No:Z21-60435

Page 7 of 9



No.10, Weiye Road, Innovation Park, Kunshan, Jiangsu, China 215300 中国・江苏・昆山市留学生创业园伟业路10号 邮编 215300



Page:

18 of 19



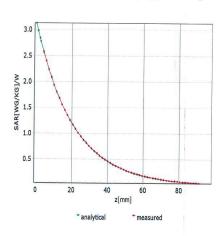
E-mail: cttl@chinattl.com

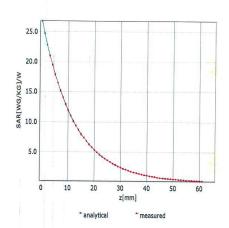
Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504 Http://www.chinattl.cn

# **Conversion Factor Assessment**

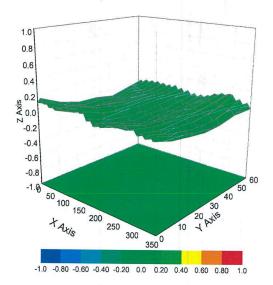
f=750 MHz,WGLS R9(H convF)

f=1750 MHz,WGLS R22(H\_convF)





# **Deviation from Isotropy in Liquid**



Uncertainty of Spherical Isotropy Assessment: ±3.2% (k=2)

Certificate No:Z21-60435

Page 8 of 9



No.10, Weiye Road, Innovation Park, Kunshan, Jiangsu, China 215300 中国・江苏・昆山市留学生创业园伟业路10号 邮编 215300

 $t(86\text{-}512)57355888 \qquad f(86\text{-}512)57370818 \qquad sgs.china@sgs.com$ 

t(86-512)57355888 f(86-512)57370818 www.sgsgroup.com.cn



Page:

19 of 19



Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504 Http://www.chinattl.cn

# DASY/EASY - Parameters of Probe: EX3DV4 - SN:7515

#### Other Probe Parameters

	10
Sensor Arrangement	Triangular
Connector Angle (°)	175.7
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	1.4mm

Certificate No:Z21-60435

Page 9 of 9



advised that information contained nereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content o appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only. Attention: To check the authenticity of testing (inspection report & certificate, please contact us at telephone: (86-755) 83071443

No.10, Weiye Road, Innovation Park, Kunshan, Jiangsu, China 215300 中国・江苏・昆山市留学生创业园伟业路10号 邮編 215300