Annex B: Probe and dipole description and calibration certificates

B.1 Probe, measurement chain description, specification and calibration certificate

SlackB	erry	Annex B to Hearing Aid Con Report for the BlackBerry®			Page 2(14)
Author Data	Dates of Test		Report No	FCC ID	
Daoud Attayi	March 1	8-24, May 20-June 02, 2014	RTS-6057-1405-07	L6A	RGY180LW

DASY Dosimetric Assessment System by Schmid & Partner Engineering AG

DASY Schmid & Partner Engineering AG News Sales Contact		A CONTRACT OF A
Applications	ER3DV6 ISOTRO	PIC E-FIELD PROBE FOR GENERAL NEAR-FIELD
Support & Downloads Products DASY4 Packages		<u>t Flyer</u> (PDF, 192kB)
EASY4 Probes ET3DV6 - Isotropic Dos-Probe ES3DV3 - Isotropic Dos-Probe	Construction	One dipole parallel, two dipoles normal to probe axis Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., glycolether)
EX3DV4 - Isotropic Dos-Probe ET1DV3 - D-Probe	Calibration	In air from 100 MHz to 3.0 GHz (absolute accuracy ±6.0%, k=2)
EUV3 - Universal Vector E-Probe H3DV6 - Isotropic H-Probe	Frequency	100 MHz to > 6 GHz; Linearity: \pm 0.2 dB (100 MHz to 3 GHz)
HUV4 - Universal Vector H-Probe T1V3 - Temp-Probe DP1 - Dummy-Probe	Directivity	± 0.2 dB in air (rotation around probe axis) ± 0.4 dB in air (rotation normal to probe axis)
Data Acquisition System	Dynamic Range	2 V/m to > 1000 V/m; Linearity: ± 0.2 dB
Software Phantoms Robots	Dimensions	Overall length: 330 mm (Tip: 16 mm) Tip diameter: 8 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.5 mm
Validation Kits & Calibration Dipoles Hearing Aid Compatibility (HAC) Ext Tissue Simulating Liquids SPEAG Home	Application	General near-field measurements up to 6 GHz Field component measurements Fast automatic scanning in phantoms

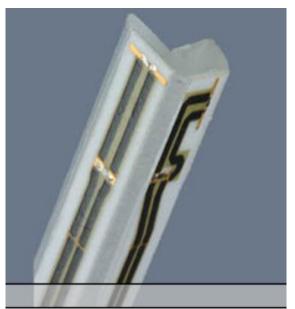
http://www.dasy4.com/er3.htm

SlackB	erry	-	npatibility RF Emissions Test Smartphone model RGY181L\		Page 3(14)
Author Data	Dates of Test		Report No	FCC ID	
Daoud Attayi	March 1	8-24, May 20-June 02, 2014	RTS-6057-1405-07	L6AF	RGY180LW

All measurements were performed to the nearest element point as per the C63.19 standard. Offset distances were entered in the DASY5 software so that the measurement was to the nearest element.

Figures 1, provided by the manufacturer, illustrate detail of the probe tip and its dimensions.

ER3DV6 E-Field probe: The distances from the probe tip to the closest points on the dipole sensors are 1.45mm for X and Y and 1.25mm for Z. From the probe tip to the center of the sensors is 2.5mm.



E-Field Probe (ER3DV6)

SlackB	erry		npatibility RF Emissions Test Smartphone model RGY181LV	
Author Data	Dates of Test		Report No	FCC ID
Daoud Attayi	March 1	8-24, May 20-June 02, 2014	RTS-6057-1405-07	L6ARGY180LW

The following information is from the system manufacturer user manual describing the process chain:

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$
(20.1)

with	V_i	= compensated signal of channel i	(i = x, y, z)
	U_i	= input signal of channel i	(i = x, y, z)
	cf	= crest factor of exciting field	(DASY parameter)
	dcp_i	= diode compression point	(DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

	$\mathbf{E}-\mathbf{field probes}$:	$E_i = \sqrt{\frac{V_i}{Norm_i \cdot C}}$	ConvF
	$\mathbf{H}-\mathbf{fieldprobes}$:	$H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1}}{j}$	$\frac{f + a_{i2}f^2}{f}$
with	= compensated signal of α = sensor sensitivity of cha $\mu V/(V/m)^2$ for E-field = sensitivity enhancement = sensor sensitivity factor = carrier frequency [GHz] = electric field strength of = magnetic field strength	unnel i 1 Probes t in solution rs for H-field probes f channel i in V/m	$\begin{array}{l} (i=x,y,z) \\ (i=x,y,z) \end{array}$

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$
(20.2)

The measurement / integration time per point is > 500 ms, as per the system manufacturer:

The time response of the field probes has been assessed by exposing the probe to a well-controlled field producing signals larger than HAC E- and H-fields of class M4. The signal response time is evaluated as the time required by the system to reach 90% of the expected final value after an on/off switch of the power source with an integration time of 500 ms and a probe response time of <5 ms. In the current implementation, DASY4 waits longer than 100 ms after having reached the grid point before starting a measurement, i.e., the response time uncertainty is negligible.

If the device under test does not emit a CW signal, the integration time applied to measure the electric field at a specific point may introduce additional uncertainties due to the discretization. The tolerances for the different systems had the worst-case of 2.6%.

Dates Dates of Test Proof No RTS-6057-1405-07 PCID Calibration Laboratory of Schmid & Partner Engracenty of Additional Schwarzenant Exercited in the Sc	οιαυλο		nex B to Hearing Aid Cor port for the BlackBerry®		
			, May 20-June 02, 2014		FCC ID L6ARGY180LV
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RF generator HP 8648C US3642U01700 4-Aug-99 (in house check Apr-13) In house check: Apr-16 Network Analyzer HP 8753E US37390585 18-Oct-01 (in house check Oct-13) In house check: Oct-14 Calibrated by: Claudio Leubler Laboratory Technician Signature Approved by: Katja Pokovic Technical Manager January 17, 2014	This calibration certific The measurements at All calibrations have b Calibration Equipmen Primary Standards Power meter E4419E Power sensor E4412 Reference 3 dB Atter Reference 20 dB Atte Reference 20 dB Atte Reference 20 dB Atter	cate documents the tracea and the uncertainties with o been conducted in the close t used (M&TE critical for or been conducted in the close t used (M&TE critical for or B GB4129387- A MY4149087 auator SN: S5054 (anuator SN: S5129 (SN: S5129 (SDV6 SN: 2328	bility to national standards, which realize the phy onfidence probability are given on the following p ed laboratory facility: environment temperature (alibration) Cal Date (Certificate No.) O4-Apr-13 (No. 217-01733) Color Apr-13 (No. 217-01733) O4-Apr-13 (No. 217-01735) O4-Apr-13 (No. 217-01735) Ob) O4-Apr-13 (No. 217-01738) 10-Oct-13 (No. ER3-2328_C	22 ± 3)°C and humidity < 70%. 22 ± 3)°C and humidity < 70%. Scheduled Calibration Apr-14 Apr-14 Apr-14 Apr-14 Apr-14 Apr-14 Apr-14 Apr-14 Apr-14 Apr-14	
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Name Function Signature Calibrated by: Claudio Leubler Laboratory Technician Approved by: Katja Pokovic Technical Manager Jssued: January 17, 2014 Jssued: January 17, 2014	This calibration certific The measurements at All calibrations have b Calibration Equipmen Primary Standards Power meter E4419E Power sensor E442 Reference 3 dB Atter Reference 3 of B Atter Reference 3 of B Atter Reference 9 of B Atter Reference 9 of B Atter Reference Probe ER DAE4 Secondary Standards	cate documents the tracea and the uncertainties with o been conducted in the close trust (M&TE critical for or ID 3 GB4129387- A MY4149808; nuator SN: S5054 (; anuator SN: S5129 (; anuator SN: S5129 (; anuator SN: 2328 SN: 789 a ID	bility to national standards, which realize the phy onfidence probability are given on the following p ed laboratory facility: environment temperature (alibration) Cal Date (Certificate No.) Cal Date (Certificate No.) Check Date (in house)	Sequences and are part of the certificate. 22 ± 3)°C and humidity < 70%.	
Calibrated by: Claudio Leubler Laboratory Technician Approved by: Katja Pokovic Technical Manager Issued: January 17, 2014	This calibration certific The measurements and All calibrations have b Calibration Equipmen Primary Standards Power meter E44198 Power meter E44198 Power sensor E4419 Power sensor E4419 Reference 30 dB Atte Reference 30 dB Atte Reference Probe ER DAE4 Secondary Standards RF generator HP 864	cate documents the tracea and the uncertainties with o been conducted in the close trusted (M&TE critical for or ID 3 GB4129387- A MY41498087 auator SN: S5054 (anuator SN: S5054 (anuator SN: S5129 (anuator	bility to national standards, which realize the phy onfidence probability are given on the following p ed laboratory facility: environment temperature (alibration) Cal Date (Certificate No.) Cal Date (Certificate No.) Color Color Cal Color Color Check Date (in house) Color Cal Color Cal Color Cal Color Color Cal Date (in house check A	Scheduled Calibration Apr-14 Apr-14	
Approved by: Kalja Pokovic Technical Manager Issued: January 17, 2014	This calibration certific The measurements and All calibrations have b Calibration Equipmen Primary Standards Power meter E44198 Power meter E44198 Power sensor E4419 Power sensor E4419 Reference 30 dB Atte Reference 30 dB Atte Reference Probe ER DAE4 Secondary Standards RF generator HP 864	cate documents the tracea and the uncertainties with o been conducted in the close trusted (M&TE critical for or ID 3 GB4129387- A MY41498087 auator SN: S5054 (anuator SN: S5054 (anuator SN: S5129 (anuator	bility to national standards, which realize the phy onfidence probability are given on the following p ed laboratory facility: environment temperature (alibration) Cal Date (Certificate No.) Cal Date (Certificate No.) Color Color Cal Color Color Check Date (in house) Color Cal Color Cal Color Cal Color Color Cal Date (in house check A	Scheduled Calibration Apr-14 Apr-14	
Issued: January 17, 2014	This calibration certific The measurements and All calibrations have b Calibration Equipmen Primary Standards Power meter E44198 Power meter E44198 Power sensor E4419 Power sensor E4419 Reference 30 dB Atte Reference 30 dB Atte Reference Probe ER DAE4 Secondary Standards RF generator HP 864	cate documents the tracea and the uncertainties with o seen conducted in the close t used (M&TE critical for o ID 3 GB4129387- A MY41498087 Inator SN: S5054 (enuator SN: S5129 (30V6 SN: S5129 (30V6 SN: S129 (30V6 SN: S89 SN: 789 S ID I8C US3642U01 8753E US37390585	bility to national standards, which realize the phy onfidence probability are given on the following p ed laboratory facility: environment temperature (alibration) Cal Date (Certificate No.) Gal Date (Certific	See and are part of the certificate. 22 ± 3)°C and humidity < 70%.	
	This calibration certific The measurements at All calibrations have b Calibration Equipmen Primary Standards Power meter E4419E Power sensor E4412 Reference 30 dB Atter Reference 30 dB Atter Reference 30 dB Atter Reference 90 dB Atter Reference 90 dB Atter DAE4 Secondary Standards RF generator HP 864 Network Analyzer HP	cate documents the tracea and the uncertainties with o been conducted in the close trust (M&TE critical for or ID 3 GB4129387- A MY41498083 nuator SN: S5054 (anuator SN: S5277 (anuator SN: S5277 (anuator SN: S5277 (anuator SN: S5277 (anuator SN: S5278 (anuator SN: S528 (anua	bility to national standards, which realize the phy onfidence probability are given on the following p ed laboratory facility: environment temperature (alibration) Cal Date (Certificate No.) Cal Date (Certificate No.) Check Date (in house) Color Cal Certificate No. DAE4-789 Check Date (in house check Certificate No.) Function	See and are part of the certificate. 22 ± 3)°C and humidity < 70%.	
	This calibration certific The measurements at All calibrations have b Calibration Equipmen Primary Standards Power meter E4419E Power sensor E4412 Reference 30 dB Atter Reference 30 dB Atter Reference 30 dB Atter Reference 9 robe ER DAE4 Secondary Standards RF generator HP 864 Network Analyzer HP Calibrated by:	cate documents the tracea and the uncertainties with o been conducted in the close t used (M&TE critical for of ID 3 GB41293874 A MY41496081 Juator SN: S5054 (anuator SN: S5054 (anuator SN: S5129 (SDV6 SN: S129 (SDV6 SN: 2328 SN: 789 S ID IBC US3642U011 8753E US37390585 Name Ctaudio Le	bility to national standards, which realize the phy onfidence probability are given on the following (ed laboratory facility: environment temperature (alibration) Cal Date (Certificate No.) 04-Apr-13 (No. 217-01733) 7 04-Apr-13 (No. 217-01737) 7 04-Apr-13 (No. 217-01737) 30b) 04-Apr-13 (No. 217-01737) 30b) 04-Apr-13 (No. 217-01738) 10-Oct-13 (No. ER-2328 _C 15-May-13 (No. DAE4-789_ Check Date (in house) 700 4-Aug-89 (in house check A i 18-Oct-01 (in house check A i 18-Oct-01 (in house check A i 18-Oct-01 (in house check A	See and are part of the certificate. 22 ± 3)°C and humidity < 70%.	

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#BlackB	erry	patibility RF Emissions Test Smartphone model RGY181LV	v	Page 6(14)
Author Data	Dates of Test	Report No	FCC ID	

Daoud Attavi

March 18-24, May 20-June 02, 2014

RTS-6057-1405-07

s

С

S

FCC ID

Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland

Schweizerischer Kallbrierdienst Service suisse d'étalonnage Servizio svizzero di taratura Swiss Calibration Service

Accreditation No.: SCS 108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service Is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

NORMx,y,z	sensitivity in free space
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization &	9 rotation around an axis that is in the plane normal to probe axis (at measurement center).
	i.e., $\vartheta = 0$ 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:

 IEEE Std 1309-2005, "IEEE Standard for calibration of electromagnetic field sensors and probes, excluding antennas, from 9 kHz to 40 GHz", December 2005

b) CTIA Test Plan for Hearing Aid Compatibility, April 2010.

Methods Applied and Interpretation of Parameters:

- NORMx,y,z: Assessed for E-field polarization θ = 0 for XY sensors and θ = 90 for Z sensor (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide).
- NORM(f)x,y,z = NORMx,y,z * frequency_response (see Frequency Response Chart).
- DCPx,y,z: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (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; Dx,y,z; VRx,y,z: A, B, C, D 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.
- Spherical isotropy (3D deviation from isotropy): in a locally homogeneous field realized using an open waveguide setup.
- 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).

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SlackB	erry		npatibility RF Emissions Test Smartphone model RGY181LV	v	Page 7(14)
Author Data	Dates of Test		Report No	FCC ID	
Daoud Attayi	March 1	8-24, May 20-June 02, 2014	RTS-6057-1405-07	L6A	RGY180LW

ER3DV6 - SN:2286

January 17, 2014

Probe ER3DV6

SN:2286

Manufactured: Calibrated: September 18, 2002 January 17, 2014

Calibrated for DASY/EASY Systems (Note: non-compatible with DASY2 system!)

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SlackB	erry		npatibility RF Emissions Test Smartphone model RGY181LV	V Page 8(14)	
Author Data	Dates of Test		Report No	FCC ID	
Daoud Attayi	March 1	8-24, May 20-June 02, 2014	RTS-6057-1405-07	L6ARGY180	LW

ER3DV6-SN:2286

January 17, 2014

DASY/EASY - Parameters of Probe: ER3DV6 - SN:2286

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (μV/(V/m) ²)	2.24	1.46	1.50	± 10.1 %
DCP (mV) ^B	98.6	100.7	100.5	

Modulation Calibration Parameters

UID	Communication System Name		A	В	С	D	VR	Unc
			dB	dBõV		dB	mV	(k=2)
0	CW	Х	0.0	0.0	1.0	0.00	181.8	±3.5 %
		Y	0.0	0.0	1.0		196.2	
		Z	0.0	0.0	1.0		175.8	

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%.

⁸ Numerical linearization parameter: uncertainty not required. ^e Uncertainty is determined using the max, deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

Certificate No: ER3-2286_Jan14

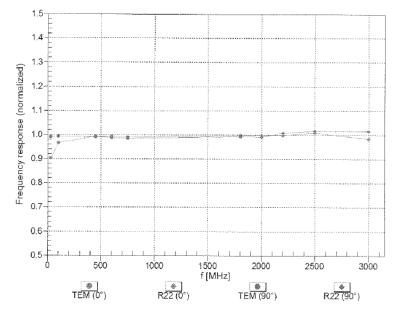
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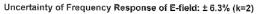
SlackB	BlackBerry® Smartphone model RGY181LW				Page 9(14)
Author Data Daoud Attayi	Dates of Test March 1	8-24, May 20-June 02, 2014	Report No RTS-6057-1405-07	FCC ID	RGY180LW

ER3DV6- SN:2286

January 17, 2014

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





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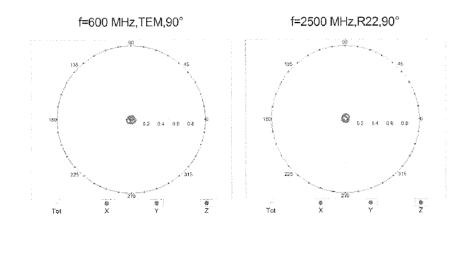
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SlackB	BlackBerry® Smartphone model RGY181LW				Page 10(14)
Author Data Daoud Attayi	Dates of Test March 1	8-24, May 20-June 02, 2014	Report No RTS-6057-1405-07	FCC ID	RGY180LW

ER3DV6-- SN:2286

January 17, 2014

$Peceritar Pattern (\phi), \theta = 0^{\circ}$ $F=00 \text{ MHz, TEM, 0^{\circ}}$ $F=250 \text{ MHz, R22, 0^{\circ}}$ $f=00 \text{ MHz, R22, 0^{\circ}}$



Certificate No: ER3-2286_Jan14

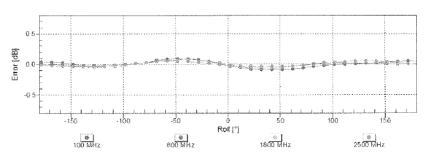
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SlackB	BlackBerry® Smartphone model RGY181LW			
Author Data Daoud Attayi	Dates of Test March 1	8-24, May 20-June 02, 2014	Report No RTS-6057-1405-07	FCC ID L6ARGY180LW

ER3DV6- SN:2286

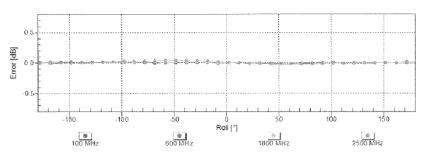
January 17, 2014

Receiving Pattern (ϕ), $\vartheta = 0^{\circ}$





Receiving Pattern (ϕ), $\vartheta = 90^{\circ}$



Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Certificate No: ER3-2286_Jan14

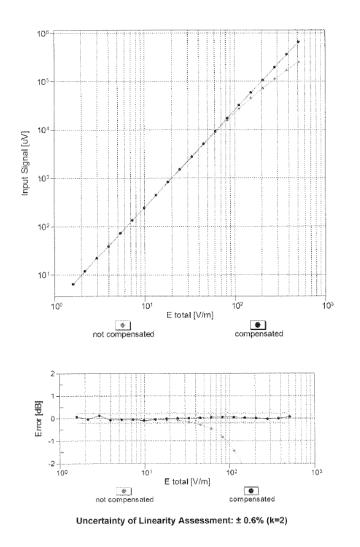
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SlackB	BlackBerry® Smartphone model RGY181LW				Page 12(14)
Author Data Daoud Attayi	Dates of Test March 1	8-24, May 20-June 02, 2014	Report No RTS-6057-1405-07	FCC ID	RGY180LW

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Dynamic Range f(E-field) (TEM cell , f = 900 MHz)



Certificate No: ER3-2286_Jan14

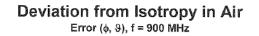
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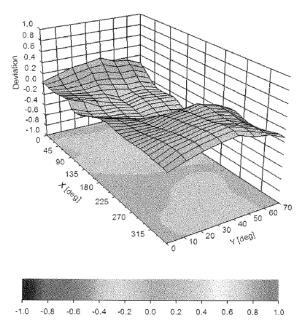
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BlackBerry					Page 13(14)
Author Data Daoud Attayi	Dates of Test March 1	8-24, May 20-June 02, 2014	Report No RTS-6057-1405-07	FCC ID	RGY180LW

ER3DV6- SN:2286

January 17, 2014





Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

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PlackPort		Annex B to Hearing Aid Compatibility RF Emissions Test Report for the BlackBerry® Smartphone model RGY181LW		Page 14(14)
Author Data Dates of Test		Report No	FCC ID	
Daoud Attayi March 18-24, May 20-June 02, 2014		RTS-6057-1405-07	L6AI	RGY180LW

ER3DV6-- SN:2286

January 17, 2014

DASY/EASY - Parameters of Probe: ER3DV6 - SN:2286

Other Probe Parameters

Rectangular
-8.1
enabled
disabled
337 mm
10 mm
10 mm
8 mm
2.5 mm
2.5 mm
2.5 mm

Certificate No: ER3-2286_Jan14

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