



CETECOM ICT Services consulting - testing - certification >>>

TEST REPORT



Deutsche

Akkreditierungsstelle D-PL-12076-01-01

Test report no.: 1-2177/16-01-02

Testing laboratory

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Accredited Testing Laboratory: The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS) The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-01

Applicant

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Manufacturer

Mettler-Toledo GmbH Im Langacher 44 8606 Greifensee / SWITZERLAND

Test standard/s

47 CFR Part 15

Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices

For further applied test standards please refer to section 3 of this test report.

	Test Item
Kind of test item:	RF-ID Reader 125 KHz
Model name:	Powder Dosing Controller Board
FCC ID:	THVQCB
Frequency:	125 kHz
Technology tested:	RFID
Antenna:	RFID coil antenna
Power supply:	10.8 V to 13.2 V DC by PHIHONG switching power supply
Temperature range:	0°C to +55°C

This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test report authorized:

Andreas Luckenbill Lab Manager Radio Communications & EMC

Test performed:

Benedikt Gerber Testing Manager Radio Communications & EMC



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2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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2.2 Application details

Date of receipt of order:	2016-07-07
Date of receipt of test item:	2016-07-26
Start of test:	2016-07-29
End of test:	2016-08-03
Person(s) present during the test:	-/-

3 Test standard/s and references

Test standard	Date	Description
47 CFR Part 15		Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices

Guidance	Version	Description
ANSI C63.4-2014 ANSI C63.10-2013	-/- -/-	American national standard for methods of measurement of radio- noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz American national standard of procedures for compliance testing of unlicensed wireless devices



4 Test environment

Temperature	:	T _{nom} T _{max} T _{min}	+22 °C during room temperature tests No tests under extreme conditions No tests under extreme conditions			
Relative humidity content	:		55 %			
Barometric pressure	:		not relevant for this kind of testing			
Power supply	•	V _{nom} V _{max} V _{min}	12 V DC by PHIHONG switching power supply No tests under extreme conditions No tests under extreme conditions			

5 Test item

5.1 General description

Kind of test item	:	RF-ID Reader 125 KHz
Type identification	:	Powder Dosing Controller Board
S/N serial number	:	see table below
HW hardware status	:	see table below
SW software status	:	see table below
Frequency band	:	125 kHz
Type of radio transmission Use of frequency spectrum		RFID
Type of modulation	:	ASK
Number of channels	:	1
Antenna	:	RFID coil antenna
Power supply	:	10.8 V to 13.2 V DC by PHIHONG switching power supply
Temperature range	:	0°C to +55°C

		Equipme	nt under test:			
Name	Part	BL TMS SW	TMS SW	BL LPC SW	LPC SW	Note
Back Bone	30006323 C	30006193 D	30095459 A	30006192 C	30006178 8	
					(V1.28)	
Powder Dosing Controller	30005413 F	30006193 D	30006190			DUT
Board			(V1.3)			
MULTI-RFID-SWITCH 5x	30008471 B	30006193 D	30095040			
			(V0.92)			
CAN/POWER CONN.	30034244 B					
BOARD						
Power mains	MT 11107909					
RS(m)-RS(f) cable	MT 11101051					
CAN cable L=65 mm	MT 30005904					
RFID-Tag	MT 11141451					
Gender Changer f/f	Distrelec					
5	671410					
Null Modem m/f	Distrelec					
	675596					



5.2 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup- and EUT-photos are included in test report:

1-2177/16-01-01_AnnexA 1-2177/16-01-01_AnnexB

6 Test laboratories sub-contracted

None



7 Description of the test setup

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

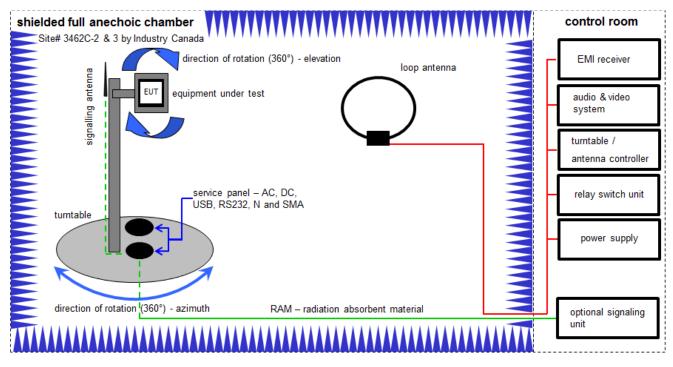
Agenda: Kind of Calibration

- k calibration / calibrated
- ne not required (k, ev, izw, zw not required)
- ev periodic self verification
- Ve long-term stability recognized
- vlkl! Attention: extended calibration interval
- NK! Attention: not calibrated

- EK limited calibration
- zw cyclical maintenance (external cyclical maintenance)
- izw internal cyclical maintenance
- g blocked for accredited testing
- *) next calibration ordered / currently in progress



7.1 Shielded fully anechoic chamber



Measurement distance: loop antenna 3 meter

FS = UR + CA + AF (FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

Example calculation:

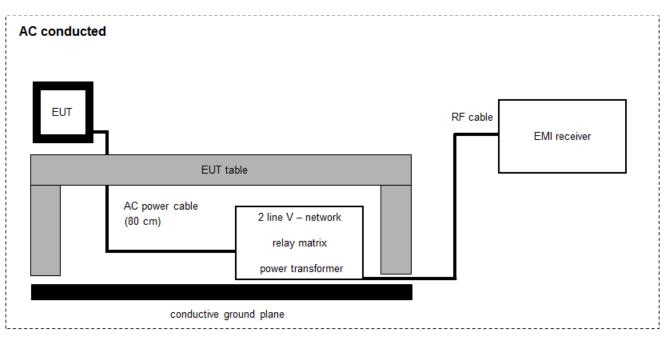
 $\overline{FS} [dB\mu V/m] = 40.0 [dB\mu V/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dB\mu V/m] (71.61 \mu V/m)$

Equipment table:

No.	Lab / Item	Equipment	Туре	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A,B	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
2	A,B	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
3	A,B	Active Loop Antenna 10 kHz to 30 MHz	6502	EMCO/2	8905-2342	300000256	k	24.06.2015	24.06.2017
4	A,B	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
5	A	EMI Test Receiver 9kHz-26,5GHz	ESR26	R&S	101376	300005063	k	04.09.2015	04.09.2016
6	В	PXA Spectrum Analyzer 3Hz to 50GHz	N9030A PXA Signal Analyzer	Agilent Technologies	US51350267	300004338	k	09.02.2016	09.02.2017



7.2 AC conducted



FS = UR + CF + VC

(FS-field strength; UR-voltage at the receiver; CR-loss of the cable and filter; VC-correction factor of the ISN)

 $\frac{Example \ calculation:}{FS \ [dB\muV/m] = 37.62 \ [dB\muV/m] + 9.90 \ [dB] + 0.23 \ [dB] = 47.75 \ [dB\muV/m] \ (244.06 \ \muV/m)}$

Equipment table:

No.	Lab / Item	Equipment	Туре	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Two-line V-Network (LISN) 9 kHz to 30 MHz	ESH3-Z5	R&S	893045/004	300000584	k	02.02.2016	02.02.2017
2	Α	RF-Filter-section	85420E	HP	3427A00162	300002214	k	27.11.2006	-/-
3	Α	EM-Injection Clamp	FCC-203i	emv	232	300000626	ev	18.05.2001	-/-
4	A	Magnetfeldantenne	MS 100	EM-Test		300002659	ev	24.04.2000	-/-
5	A	AC- Spannungsquelle variabel	MV2616-V	EM-Test	0397-12	300003259	k	11.12.2015	11.12.2017
6	A	Analyzer-Reference- System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	02.02.2016	02.02.2018
7	Α	Hochpass 150 kHz	EZ-25	R&S	100010	300003798	ev	08.04.2008	-/-
8	A	Power Supply	NGSM 32/10	R&S	3939	400000192	vIKI!	22.01.2015	22.01.2017
9	A	MXE EMI Receiver 20 Hz to 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	04.02.2016	04.02.2017



8 Sequence of testing

8.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1.5 m.
- At each turntable position the analyzer sweeps with positive-peak detector to find the maximum of all emissions.

Final measurement

- Identified emissions during the premeasurement are maximized by the software by rotating the turntable from 0° to 360°. In case of the 2-axis positioner is used the elevation axis is also rotated from 0° to 360°.
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.



9 Measurement uncertainty

Measurement uncertainty						
Test case	Uncertainty					
Occupied bandwidth	± used RBW					
Field strength of the fundamental	± 3 dB					
Field strength of the harmonics and spurious	± 3 dB					
Receiver spurious emissions and cabinet radiations	± 3 dB					
Conducted limits	± 2.6 dB					



10 Summary of measurement results

\boxtimes	No deviations from the technical specifications were ascertained
	There were deviations from the technical specifications ascertained
	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	CFR Part 15	See table!	2016-08-11	-/-

Test specification clause	Test case	Temperature conditions	Power source conditions	с	NC	NA	NP	Remark
for information only	Occupied bandwidth	Nominal	Nominal	X				-/-
§ 15.209	Field strength of the fundamental	Nominal	Nominal	\boxtimes				-/-
§ 15.209 RSS Gen Issue 4 (6.13)	Field strength of the harmonics and spurious	Nominal	Nominal	\boxtimes				-/-
§15.107 §15.207	Conducted limits	Nominal	Nominal	X				-/-

Note: NA = Not applicable; NP = Not performed; C = Compliant; NC = Not compliant

11 Additional comments

Reference documents:	None
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Special test descriptions: None

Configuration descriptions: None



12 Measurement results

12.1 Occupied bandwidth

Measurement:

The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal.

Measurement parameters				
Detector:	Positive Peak			
Resolution bandwidth:	1 % - 5 % of the occupied bandwidth			
Video bandwidth: ≥ 3x RBW				
Trace mode:	Max hold			
Analyzer function:	99 % power function			
Used test setup:	See sub clause 7.1 - B			
Measurement uncertainty:	See sub clause 9			

Limit:

IC
for information only

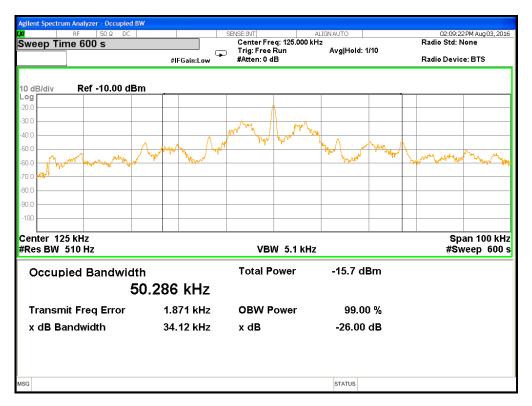
Result:

99% emission bandwidth			
50 kHz			



Plots:

Plot 1: occupied bandwidth, dosing unit





12.2 Field strength of the fundamental

Measurement:

The maximum detected field strength for the carrier signal.

Measurement parameters			
Detector:	Quasi peak		
Resolution bandwidth:	9 kHz		
Video bandwidth:	≥ 3x RBW		
Trace mode:	Max hold		
Used test setup	See sub clause 7.1 - A		
Measurement uncertainty:	See sub clause 9		

Limit:

FCC & IC				
Frequency (kHz)	Field strength (dBµV/m)	Measurement distance (m)		
125	25.7	300		
125	105.7*	3		

*see also remark on recalculation below

Recalculation:

According to ANSI C63.10, chapter 6.4 a correction factor of -80 dB is used.

Result:

Field strength of the fundamental				
Frequency 125 kHz				
Distance	@ 3 m	@ 300 m		
EIRP	65 dBµV/m	-15 dBµV/m		



12.3 Field strength of the harmonics and spurious

Measurement:

The maximum detected field strength for the harmonics and spurious.

Measurement parameters				
Detector:	Quasi peak / average or			
2000000	peak (worst case – pre-scan)			
Resolution bandwidth:	F < 150 kHz: 200 Hz			
Resolution bandwidth.	150 kHz < F < 30 MHz: 9 kHz			
Video bondwidth	F < 150 kHz: 1 kHz			
Video bandwidth:	150 kHz < F < 30 MHz: 100 kHz			
Trace mode:	Max hold			
Used test setup: 9 kHz to 30 MHz: see sub clause 7.1 - A				
Measurement uncertainty:	See sub clause 9			

Limit:

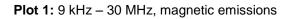
FCC & IC					
Frequency	Field strength	Measurement distance			
(MHz)	(dBµV/m)	(m)			
0.009 - 0.490	2400/F(kHz)	300			
0.490 – 1.705	24000/F(kHz)	30			
1.705 – 30	30 (29.5 dBµV/m)	30			
30 – 88	100 (40 dBµV/m)	3			
88 – 216	150 (43.5 dBµV/m)	3			
216 – 960	200 (46 dBµV/m)	3			

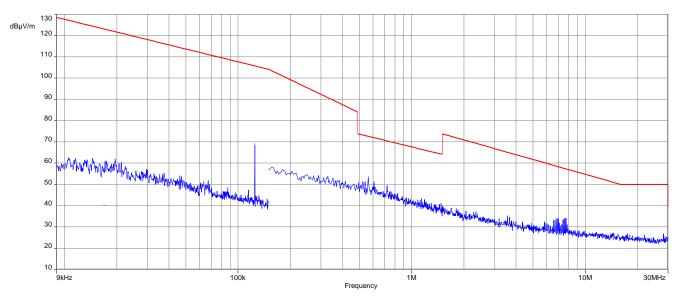
Result:

Detected emissions					
Frequency (MHz) Detector Resolution bandwidth (kHz) Detected value					
All detected emissions are more than 20 dB below the limit					



Plots:







12.4 Conducted limits

Measurement:

Measurement of the conducted spurious emissions for an intentional radiator that is designed to be connected to the public utility (AC) power line.

Measurement parameters				
Detector:	Quasi peak / average or			
Delector.	peak (worst case – pre-scan)			
Resolution bandwidth:	F < 150 kHz: 200 Hz			
	F > 150 kHz: 9 kHz			
Video bandwidth:	F < 150 kHz: 1 kHz			
	F > 150 kHz: 100 kHz			
Trace mode:	Max hold			
Used test setup	See sub clause 7.2 - A			
Measurement uncertainty:	See sub clause 9			

Limit:

FCC & IC			
Frequency	Quasi-peak	Average	
(MHz)	(dBµV/m)	(dBµV/m)	
0.15 – 0.5	66 to 56*	56 to 46*	
0.5 – 5	56	46	
5 – 30.0	60	50	

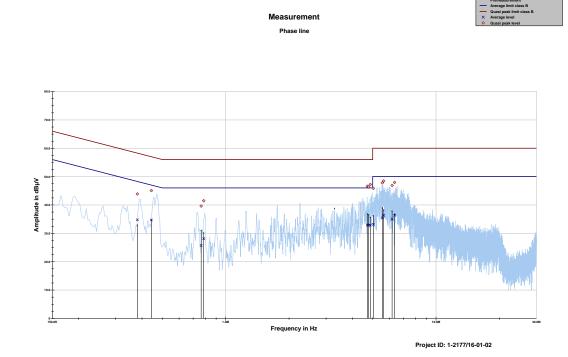
Result:

See plots 1 and 2.



Plots:

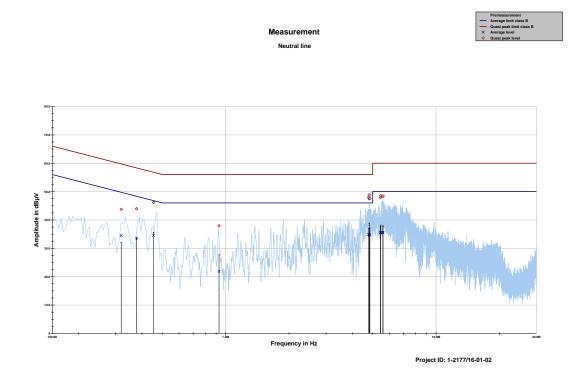
Plot 1: 150 kHz to 30 MHz, phase line



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.380101	43.87	14.41	58.277	34.74	14.69	49.426
0.443161	45.07	11.93	57.002	34.71	12.91	47.624
0.764547	39.61	16.39	56.000	25.71	20.29	46.000
0.786272	41.47	14.53	56.000	28.13	17.87	46.000
4.713507	46.61	9.39	56.000	32.92	13.08	46.000
4.781544	46.37	9.63	56.000	32.85	13.15	46.000
4.871356	47.21	8.79	56.000	32.85	13.15	46.000
5.035067	45.87	14.13	60.000	33.16	16.84	50.000
5.554745	47.78	12.22	60.000	35.39	14.61	50.000
5.633361	48.45	11.55	60.000	36.34	13.66	50.000
6.181803	46.87	13.13	60.000	35.02	14.98	50.000
6.359143	47.95	12.05	60.000	36.36	13.64	50.000



Plot 2: 150 kHz to 30 MHz, neutral line



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.318499	43.74	16.01	59.746	34.52	16.66	51.186
0.376678	43.95	14.41	58.352	33.67	15.85	49.523
0.454032	46.19	10.61	56.801	34.52	12.79	47.313
0.929686	37.94	18.06	56.000	21.88	24.12	46.000
4.787946	48.01	7.99	56.000	34.84	11.16	46.000
4.811254	48.82	7.18	56.000	34.86	11.14	46.000
4.816492	47.47	8.53	56.000	34.65	11.35	46.000
4.848083	47.62	8.38	56.000	34.80	11.20	46.000
5.442039	47.93	12.07	60.000	35.45	14.55	50.000
5.459751	48.56	11.44	60.000	35.62	14.38	50.000
5.591606	48.33	11.67	60.000	35.52	14.48	50.000
5.595397	48.46	11.54	60.000	35.66	14.34	50.000



13 Observations

No observations except those reported with the single test cases have been made.



Annex A Document history

Version	Applied changes	Date of release
	Initial release	2016-08-11

Annex B Further information

<u>Glossary</u>

AVG	-	Average
DUT	-	Device under test
EMC	-	Electromagnetic Compatibility
EN	-	European Standard
EUT	-	Equipment under test
ETSI	-	European Telecommunications Standard Institute
FCC	-	Federal Communication Commission
FCC ID	-	Company Identifier at FCC
HW	-	Hardware
IC	-	Industry Canada
Inv. No.	-	Inventory number
N/A	-	Not applicable
PP	-	Positive peak
QP	-	Quasi peak
S/N	-	Serial number
SW	-	Software
PMN	-	Product marketing name
HMN	-	Host marketing name
HVIN	-	Hardware version identification number
FVIN	-	Firmware version identification number



Annex C Accreditation Certificate

Front side of certificate	Back side of certificate			
Deutsche kkreditierungsstelle Deutsche Akkreditierungsstelle GmbH Biehene gemäß § absatz 1 AkkStelleG I.V.m. § 1 Absatz 1 AkkStelleGBV Unterzeichnerin der Mutbilateralen Abkommen von EA, ILAC und IAF zur gegenseitigen Anerkennung Akkreditierung	Deutsche Akkreditierungsstelle GmbH Standort Berlin Standort Frankfurt am Main Standort Braunschweig Spittelmarkt 10 Europa-Allee 52 Bundesallee 100 10117 Berlin 60327 Frankfurt am Main 38116 Braunschweig			
াই বিশেষ Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium CETECOM ICT Services GmbH Untertürkheimer Straße 6-10, 66117 Saarbrücken				
die Kompeterz nach DIN EN ISO/IEC 17025:2005 besitzt, Prüfungen in folgenden Bereichen durchzuführen: Funk Mobilium (GSM / DCS) + OTA Elektromagnetische Verträglichkeit (EMV) Produktsicherheit San / EMF Umweit Smart Card Technology Biseteoth* Umweit Automotive WI-FJ-Services Kanadische Anforderungen US-Anforderungen Akustik Near Field Communication (NFC)	Die auszugsweise Veroffentlichung der Akkreditierungsurkunde bedarf der vorherigen schriftlichen Zustimmung der Deutsche Akkreditierungstelle Gmöhl (DAKS). Ausgenommen davon ist die separate Weiterweibreitung des Deckblattes durch die umseitig genante Konformitätabewertungsstelle in unweränderter Form. Es darf nicht der Anschein erweckt werden, dass sich die Akkreditierung auch auf Bereiche erstreckt, die über den durch die DAKs bestätigten Akkreditierungsbereich hinausgehen. Die Akkreditierung erfolgte gemäß des Gesetzes über die Akkreditierungsstelle (AkkStelleG) vom 31. Juli 2009 (BGBI, 15. 2623) sowie der Verordnung (EG) Nr. 755/2008 des Europäischen Parlaments und des Rates vom 9. Juli 2008 über die Vorschnien für die Akkreditierung und Juli 2008, S. 30). Die DAKst Unterzeichnen in der Multitarterlan blommen zur gegenseitigen Anerkennung der European co-operation for Acceditation (DK), des International Accreditation Forum (AF) und der Interzeindenlichterzein (ILA). Die Unterzeichnen dieser Abkommen zur geleser kohommen			
Die Aktreditierungsummer O-FL2070-01 und ist glick john 70.52016 mit der Aktreditierungsummer O-FL2070-01 und ist glick john 70.12015. Gie besteht aus diesem Deckblatt, der Rückselte des Deckblatts und der folgenden Anlage mit insgesamt 63 Seiten. Registrierungsnummer der Urkunde: D-PL-12076-01-01 Frankfurt, 04.05.2016 Im Auftrag Diek, Jng. (PH) Raif Egner Abteilungsleht	erkennen ihre Akkreditierungen gegenseitig an. Der aktuelle Stand der Mitgliedschaft kann folgenden Webseiten entnommen werden: EA- www.europaan-accreditation.org ILAC: www.ilac.org IAF: www.iaf.nu			

Note:

The current certificate including annex can be received from CETECOM ICT Services GmbH on request.