

Electromagnetic Compatibility Test Report

Prepared in accordance with

FCC Part 15C, RSS-210 Issue 8 and ANSI C63.10

C63.10:2009 and C63.10:2013 Versions were both used

On

Pumped Ink Supply

11930

ARRAY TECHNOLOGIES INC.

21 Sequin Dr

Glastonbury CT, 06033

Prepared by:

TUV Rheinland of North America, Inc.

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

Manufacturer's statement - attestation

The manufacturer; Array Technologies Inc, as the responsible party for the equipment tested, hereby affirms:

- a) That he has reviewed and concurs that the test shown in this report are reflective of the operational characteristics of the device for which certification is sought;
- b) That the device in this test report will be representative of production units;
- c) That all changes (in hardware and software/firmware) to the subject device will be reviewed.
- d) That any changes impacting the attributes, functionality or operational characteristics documented in this report will be communicated to the body responsible for approving (certifying) the subject equipment.

David Pirie

Printed name of official

Signature of official

**21 Sequin Dr
Glastonbury CT 06033**

Address

Date

(860) 657-8086

Telephone number



dpirie@arrayonline.com

Email address of official

Report No.:

31560224.005 Ink Pump.doc

Page 3 of 35

Client:	ARRAY TECHNOLOGIES INC. 21 Sequin Dr Glastonbury CT, 06033		Contact: David Pirie Tel: 860-657-8086 Fax: e-mail dpirie@arrayonline.com	
Identification:	Pumped Ink Supply		Serial No.:	TS-1
Test item:	Model 11930		Date Test Completed:	3/23/2015
Testing location:	TUV Rheinland of North America 710 Resende Road Webster, NY 14580 U.S.A.		Tel: (585) 645-0125	
Test specification:	Emissions: FCC Part 15.225 Radiated Emissions Std FCC Part 15.209 and RSS - 210 Issue 8, FCC Part 15.225(b) and RSS - 210 Issue 8, FCC Part 15.203			
Test Result:	The above product was found to be Compliant to the above test standard(s)			
tested by: Randall Masline			reviewed by: Cecil Gittens	
<u>1 May 2015</u> <i>Date</i>			<u>1 May 2015</u> <i>Date</i>	
<i>Name</i>			<i>Name</i>	
<i>Signature</i>			<i>Signature</i>	
Other Aspects:	None			
Abbreviations: OK, Pass, Compliant, Complies = passed Fail, Not Compliant, Does Not Comply = failed N/A = not applicable				
			Industry Canada	VCCI
US5253	Testing Cert.# 3331.08		482B-1	A-0203
				BSMI
				SL2-IN-E-050R

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

TABLE OF CONTENTS

1	GENERAL INFORMATION	5
1.1	SCOPE	5
1.2	PURPOSE	5
1.3	SUMMARY OF TEST RESULTS	6
2	LABORATORY INFORMATION	7
2.1	ACCREDITATIONS & ENDORSEMENTS	7
2.2	MEASUREMENT UNCERTAINTY EMISSIONS	8
2.3	CALIBRATION TRACEABILITY	8
2.4	MEASUREMENT EQUIPMENT USED	9
3	PRODUCT INFORMATION	10
3.1	EQUIPMENT MODIFICATIONS	10
3.2	TEST PLAN	10
4	EMISSIONS.....	11
4.1	RADIATED EMISSIONS	11
4.2	FUNDAMENTAL FIELD STRENGTH AND HARMONIC EMISSIONS	14
4.3	CONDUCTED EMISSIONS.....	22
4.1	FREQUENCY TOLERANCE	28
4.1	BANDWIDTH	30
5	MPE EVALUATION.....	32
	APPENDIX A	33
6	TEST PLAN.....	33
6.1	GENERAL INFORMATION	33
6.2	MODEL(S) NAME	33
6.3	TYPE OF PRODUCT	33
6.4	EQUIPMENT UNDER TEST (EUT) DESCRIPTION	34
6.5	MODIFICATIONS	34
6.6	PRODUCT ENVIRONMENT	34
6.7	COUNTRIES	34
6.8	GENERAL PRODUCT INFORMATION	35
6.9	EUT ELECTRICAL POWERED INFORMATION	35

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

1 General Information

1.1 Scope

This report is intended to document the status of conformance with the requirements of the FCC Part 15C, RSS-210 Issue 8 and ANSI C63.10 based on the results of testing performed on 3/23/2015 on the Pumped Ink Supply, Model Number. 11930, manufactured by ARRAY TECHNOLOGIES INC.. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the performance of the EUT (Equipment Under Test) in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

The 13.56 MHz Tag is passive. TI part # RI-I16-112A-03

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

1.3 Summary of Test Results

Applicant	ARRAY TECHNOLOGIES INC. 21 Sequin Dr Glastonbury CT, 06033	Tel	860-657-8086	Contact	David Pirie
		Fax		e-mail	dpirie@arrayonline.com
Description	Pumped Ink Supply	Model Number	11930		
Serial Number	TS-1	Test Voltage/Freq.	24 VDC		
Test Date Completed:	3/23/2015	Test Engineer	Randall Masline		
Standards	Description	Severity Level or Limit		Measured	Test Result
FCC Part 15 subpart C Standard	Radio Frequency Devices - Subpart C: Intentional Radiators	See called out parts below		See Below	Complies
RSS-210 Issue 8 Standard	Licence-exempt Radio Apparatus (All Frequency Bands): Category 1 Equipment	See called out parts below		See Below	Complies
FCC Part 15.225	Operation in the band 13.110 - 14.010 MHz	See Basic Standards Below		See Below	Complies
FCC Part 15.209 and RSS - 210 Issue 8	Radiated Emissions	Class B, 9kHz - 1000 MHz		Limit	Complies
FCC Part 15.225(b) and RSS - 210 Issue 8	Field Strength of Fundamental and Spurious Emissions	15.225 Limit is 90.4 dBuV at 13.57 MHz			Complies
FCC Part 15.207	Conducted Emissions	Class A, 150 kHz - 30 MHz		Limit	Complies
FCC Part 15.225(c)	Frequency Tolerance test.	Frequency contained with +/- 0.01% of operating Frequency -20° to +50° C Voltage Variations from 85% to 115%			Complies
FCC Part 15.203	Antenna Requirement	The Antenna is placed inside a housing that will not allow substitution.			Complies
RSS - 210 Issue 8	Bandwidth	RSS – 210 99% BW			Complies

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America located at, 710 Resende Road, Webster, NY 14580 is accredited by the commission for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (Registration No 90575). The laboratory scope of accreditation includes: Title 47 CFR Part 15, and 18. The accreditation is updated every 3 years.

2.1.2 A2LA

This is a program which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Standard 17025:2005 (Lab code: 3331.08). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 VCCI

VCCI Accredited test lab. Registration numbers A-0203

2.1.4 Industry Canada

(Registration No.: 482B-1) The 10m Semi-Anechoic Chamber has been accepted by Industry Canada to perform testing to 3 and to 10m, based on the test procedures described in ANSI C63.4-2013.

2.1.5 BSMI

Registration No.: SL2-IN-E-050R. The BSMI accreditation was obtained by NIST MRA with the BSMI.

2.1.6 Korea

Recognized by Radio Research Agency as an accredited Conformity Assessment Body (CAB) under the terms of Phase I of the APEC TEL.

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

2.1.7 Sample Calculation – radiated & conducted emissions

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

$$\text{Field Strength (dB}\mu\text{V/m)} = \text{RAW} - \text{AMP} + \text{CBL} + \text{ACF}$$

Where: RAW = Measured level before correction (dB μ V)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu\text{V/m} = 10^{\frac{\text{dB}\mu\text{V/m}}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

$$25 \text{ dBuV/m} + 17.5 \text{ dB} - 20 \text{ dB} + 1.0 \text{ dB} = 23.5 \text{ dBuV/m}$$

2.2 Measurement Uncertainty Emissions

	U_{lab}	U_{cispr}
Radiated Disturbance @ 10m		
30 MHz – 1,000 MHz	4.57 dB	5.2 dB
Conducted Disturbance @ Mains Terminals		
150 kHz – 30 MHz	2.62 dB	3.6 dB
Disturbance Power		
30 MHz – 300 MHz	3.88 dB	4.5 dB

2.3 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Standard 17025:2005. Equipment calibration records are kept on file at the test facility.

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

2.4 Measurement Equipment Used

Equipment	Manufacturer	Model #	Ref.	Serial #	Last Cal dd/mm/yy	Next Cal dd/mm/yy	Test
Radiated Emissions							
Analyzer w RF Filter Section 85460A	HP	8546A		3325A00134	12-Aug-14	12-Aug-15	RE
Multimeter	Fluke	83	C437	48162892	12-Aug-14	12-Aug-15	RE
BiLog	Chase	CBL6111	C017	1169	22 Aug 13	22 Aug 15	RE
Receiver (20Hz-40GHz)	Rohde & Schwarz	ESI(B) 40		100274	15-Aug-14	15-Aug-15	RE
Loop Antenna	EMCO	6502		8901-2302	10-Mar-15	10-Mar-17	RE
General Laboratory Equipment							
Multimeter	Fluke	87	C405	49050672	12-Aug-14	12-Aug-15	
Multimeter	Fluke	8062A	C452	4715199	12-Aug-14	12-Aug-15	
Pressure/Temperature/RH	Extech	SD700	C480	Q668876	12-Aug-14	12-Aug-15	

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

3 Product Information

3.1 Equipment Modifications

No modifications were needed to bring product into compliance.

3.2 Test Plan

The EUT product information, test configuration, mode of operation, test types, test procedures, test levels, pass/failure criteria, in this report were carried out per the product test plan located in appendix A of this report.

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

4 Emissions

4.1 Radiated Emissions

This test measures the electromagnetic levels of spurious signals generated by the EUT that radiated from the EUT and may affect the performance of other nearby electronic equipment.

4.1.1 Over View of Test

Results	Complies (as tested per this report)					Date	3/23/2015	
Standard	FCC Part 15.209 and RSS - 210 Issue 8							
Product Model	11930				Serial#	TS-1		
Configuration	Tested in 10m Semi-Anechoic Chamber							
Test Set-up	Tested in 10m Semi-Anechoic Chamber, placed on turn-table at 3 meters, see test plans for details							
EUT Powered By	24 VDC	Temp	24°C	Humidity	52%	Pressure	1013mbar	
Frequency Range	9kHz - 1000 MHz @ 3m							
Perf. Criteria	Class B. (Below Limit)			Perf. Verification		Readings Under Limit		
Mod. to EUT	None			Test Performed By		Randall Masline		

4.1.2 Test Procedure

Radiated FCC emissions tests were performed using the procedures of ANSI C63.10:2013 including methods for signal maximizations and EUT configuration. The photos included with the report show the EUT in its maximized configuration. Further radiated emission tests were performed per the procedures stated in the other emissions standards listed in this report.

The frequency range from 9kHz - 1000 MHz was investigated for radiated emissions.

Radiated emission testing was first performed at a distance of 3 meters in the semi-anechoic chamber in order to identify the specific frequencies for which these measurements will be made on the 10 m OATS, at a distance of 3 meters.

4.1.3 Deviations

There were no deviations from the test methodology listed in the test plan for the radiated emission test.

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

Report No.:

31560224.005 Ink Pump.doc

Page 12 of 35

4.1.1 Final Graphs

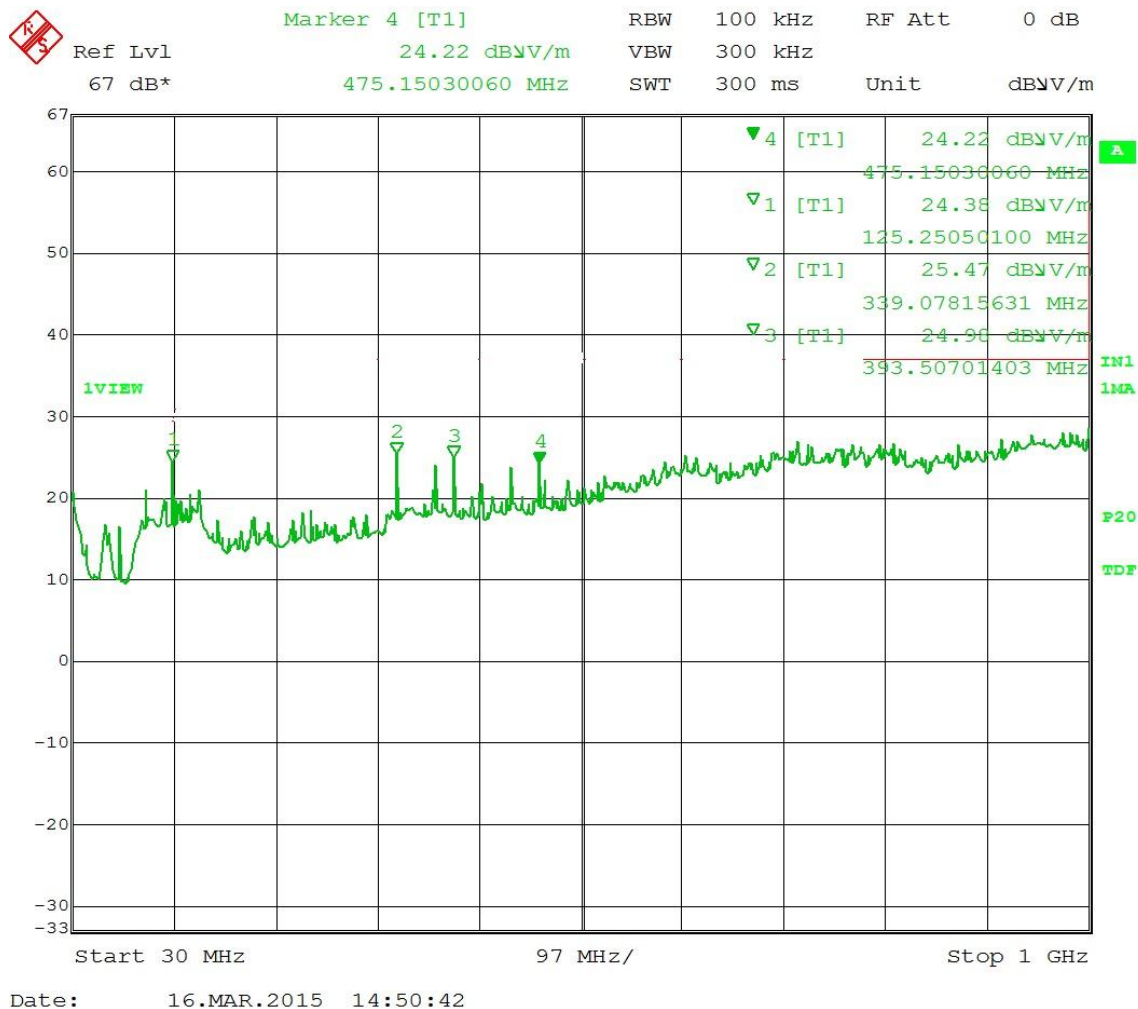


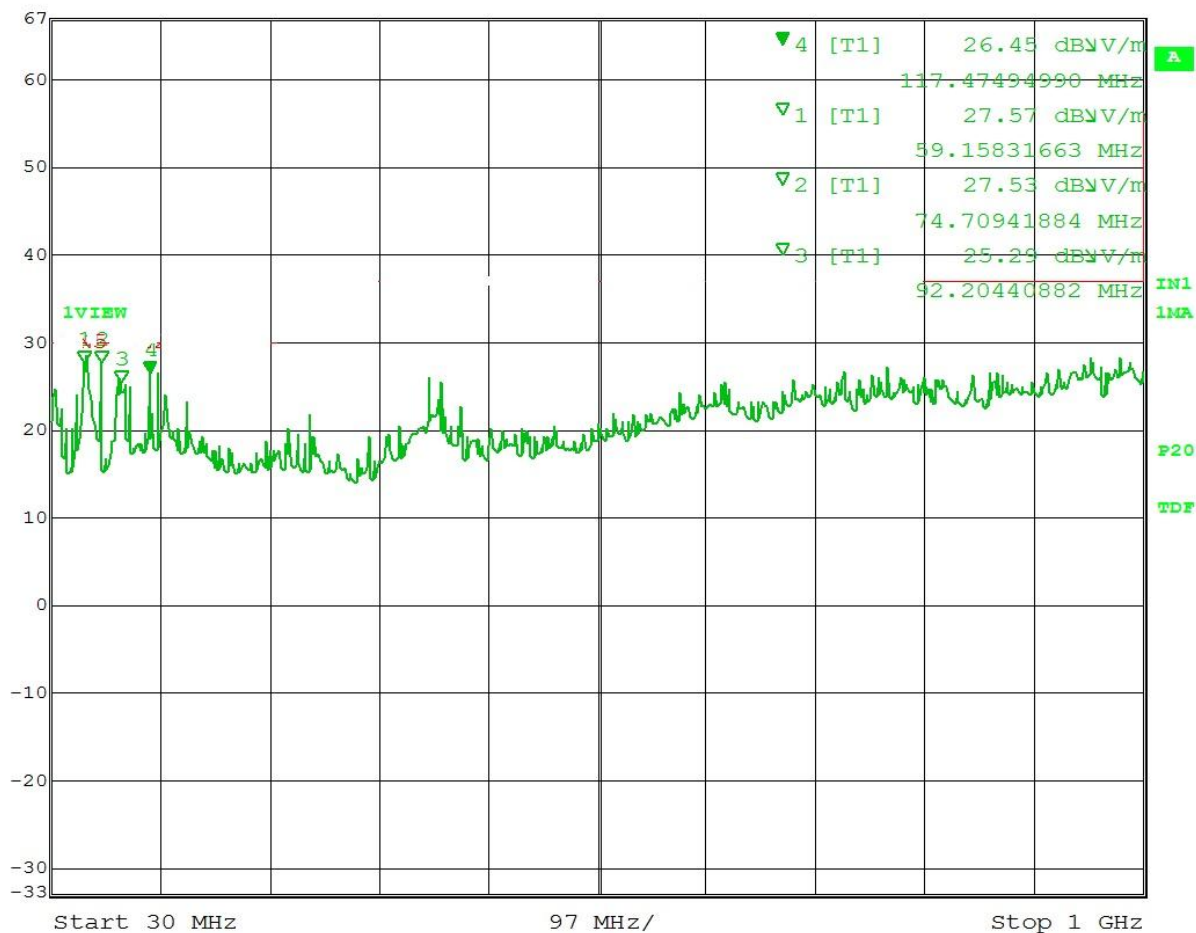
Figure 1 – Horizontal 30 – 1000 MHz

Frequency (MHz)	Peak	QP	Limit	Delta	Result
475.15	24.22	21.25	46	-24.75	Complies
125.25	24.35	21.14	43.5	-22.36	Complies
339.078	25.47	22.2	46	-23.8	Complies
393.507	24.90	21.4	46	-24.6	Complies

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.



Ref Lvl 67 dB*
 Marker 4 [T1] 26.45 dBµV/m
 117.47494990 MHz
 RBW 100 kHz RF Att 0 dB
 VBW 300 kHz
 SWT 300 ms Unit dBµV/m



Date: 16.MAR.2015 14:51:40

Figure 2 – Vertical 30 – 1000 MHz

Frequency (MHz)	Peak	QP	Limit	Delta	Result
117.47	26.45	22.3	43.5	-21.2	Complies
59.158	27.57	22.8	40	-17.2	Complies
74.709	27.53	22.8	40	-17.2	Complies
92.204	25.29	21.4	43.5	-22.1	Complies

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

4.2 Fundamental Field Strength and Harmonic Emissions

This test evaluates the field strength of the fundamental and field strength of the spurious emissions.

4.2.1 Test Over View

Results	Complies (as tested per this report)					Date	3/20/2015	
Standard	FCC Part 15.225(b) and RSS - 210 Issue 8							
Product Model	11930				Serial#	TS-1		
Configuration	Tested in 10m Semi-Anechoic Chamber							
Test Set-up	Tested in 10m Semi-Anechoic chamber EUT placed on table Tested in 10m Semi-Anechoic Chamber							
EUT Powered By	24 VDC	Temp	21° C	Humidity	48%	Pressure	1021mbar	
Perf. Criteria	15.225 (Below Limit)			Perf. Verification		Readings under Limit		
Mod to EUT	None			Test Performed By		Randall Masline		

4.2.2 Test Procedure

The EUT was placed on a table 3 meters from the antenna and all 3 orthogonal positions were investigated for highest field strength and highest spurious emissions. The fundamental frequency of the EUT is 433 MHz, therefore in addition to the requirements of 15.205 the EUT was tested to meet the following requirements in 15.231(b)

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66- 40.70.....	2,250.....	225
70-130.....	1,250.....	125
130-174.....	\1\ 1,250 to 3,750	\1\ 125 to 375
174-260.....	3,750.....	375
260-470.....	\1\ 3,750 to 12,500.	\1\ 375 to 1,250
Above 470.....	12,500.....	1,250

4.2.3 Deviations

There were no deviations from the test methodology listed in the test plan for the harmonic current emissions test.

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

Report No.:

31560224.005 Ink Pump.doc

Page 15 of 35

4.2.4 Final Test

All final measurements were below (in compliance) the limits.

4.2.5 Final Data

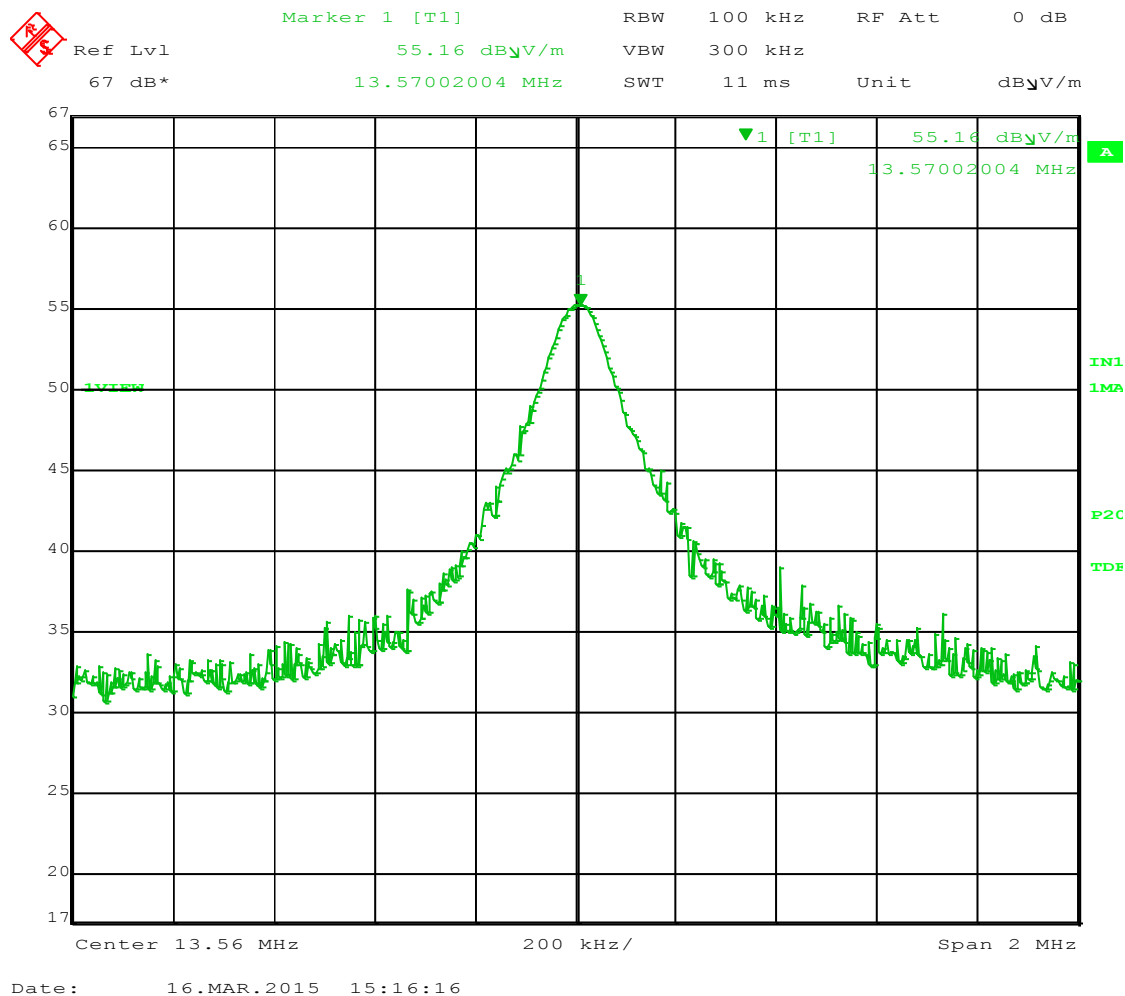


Figure 3 – Peak Field Strength Perpendicular Polarity is 55.16 dBuV

NOTE: The limit for 15.225 (b) 13.567 – 13.710 MHz band is 90.4 dBuV at 3m

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

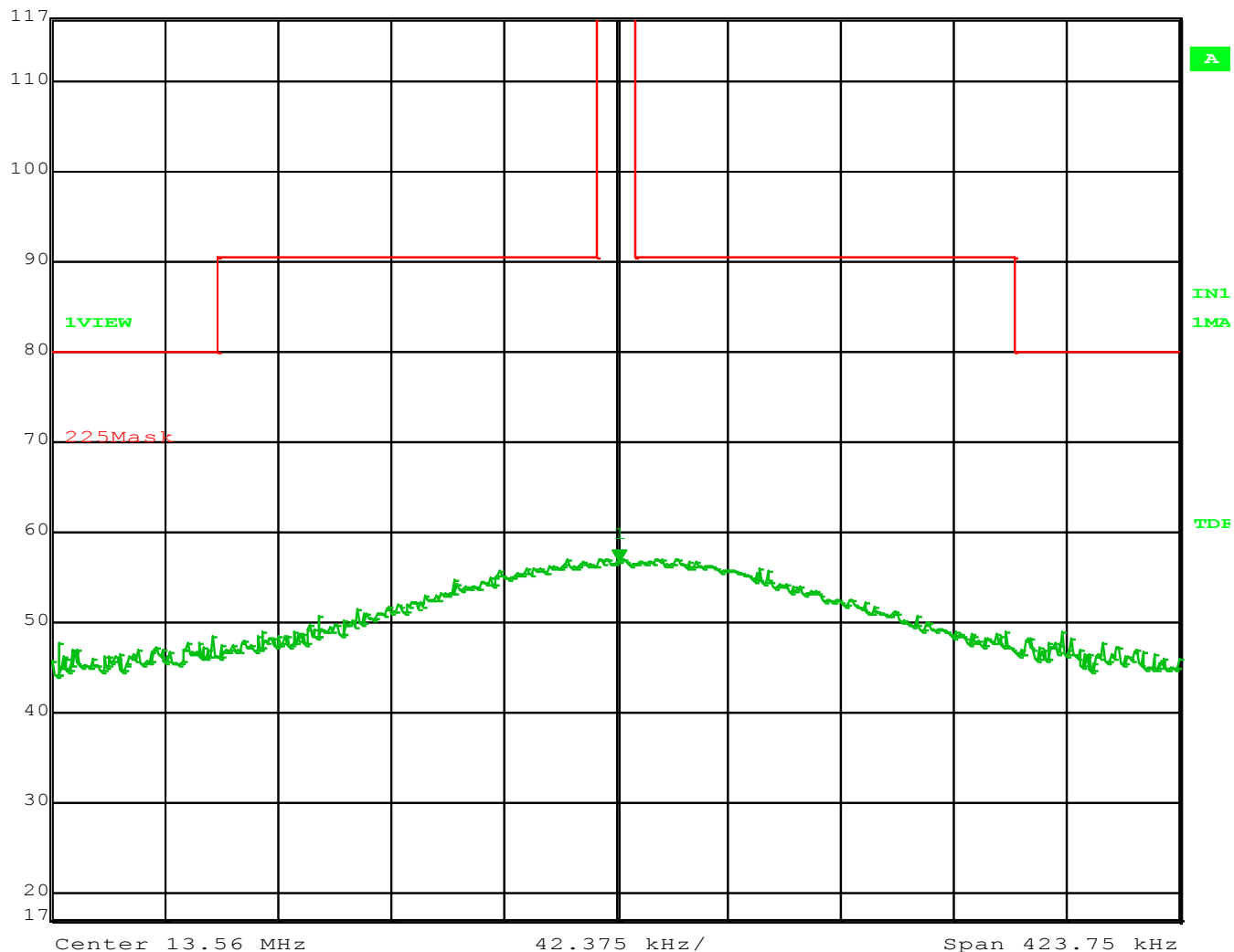
Report No.:

31560224.005 Ink Pump.doc

Page 16 of 35



Marker 1 [T1]	RBW	100 kHz	RF Att	20 dB
Ref Lvl	56.63 dBμV/m	VBW	300 kHz	
117 dB*	13.56156563 MHz	SWT	5 ms	Unit dBμV/m



Date: 21.APR.2015 12:54:10

Figure 4 – Mask

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

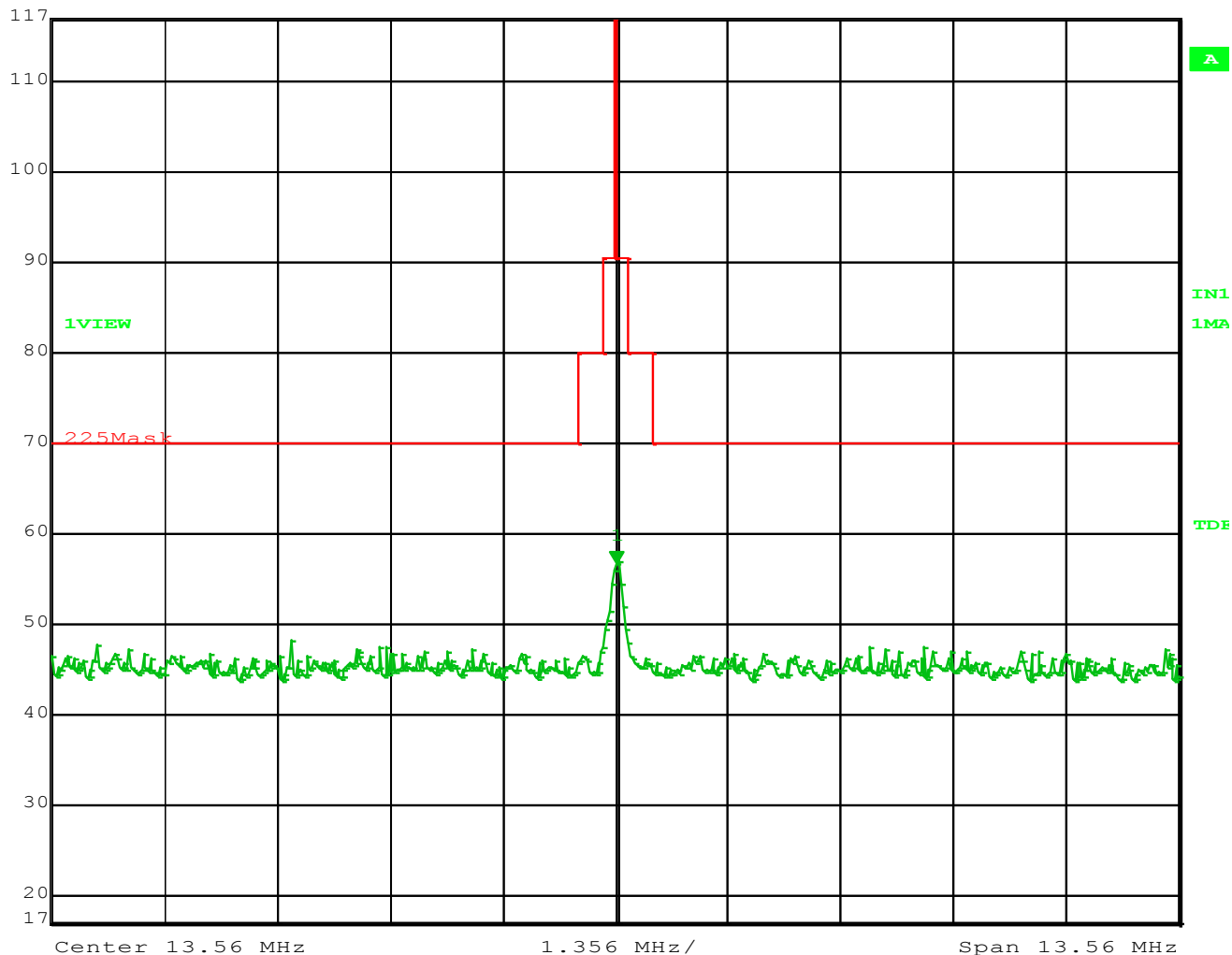
Report No.:

31560224.005 Ink Pump.doc

Page 17 of 35



Marker 1 [T1]	RBW	100 kHz	RF Att	20 dB
56.54 dB μ V/m	VBW	300 kHz		
117 dB*	SWT	5 ms	Unit	dB μ V/m
13.56156563 MHz				



Date: 21.APR.2015 12:52:48

Figure 5 – Mask

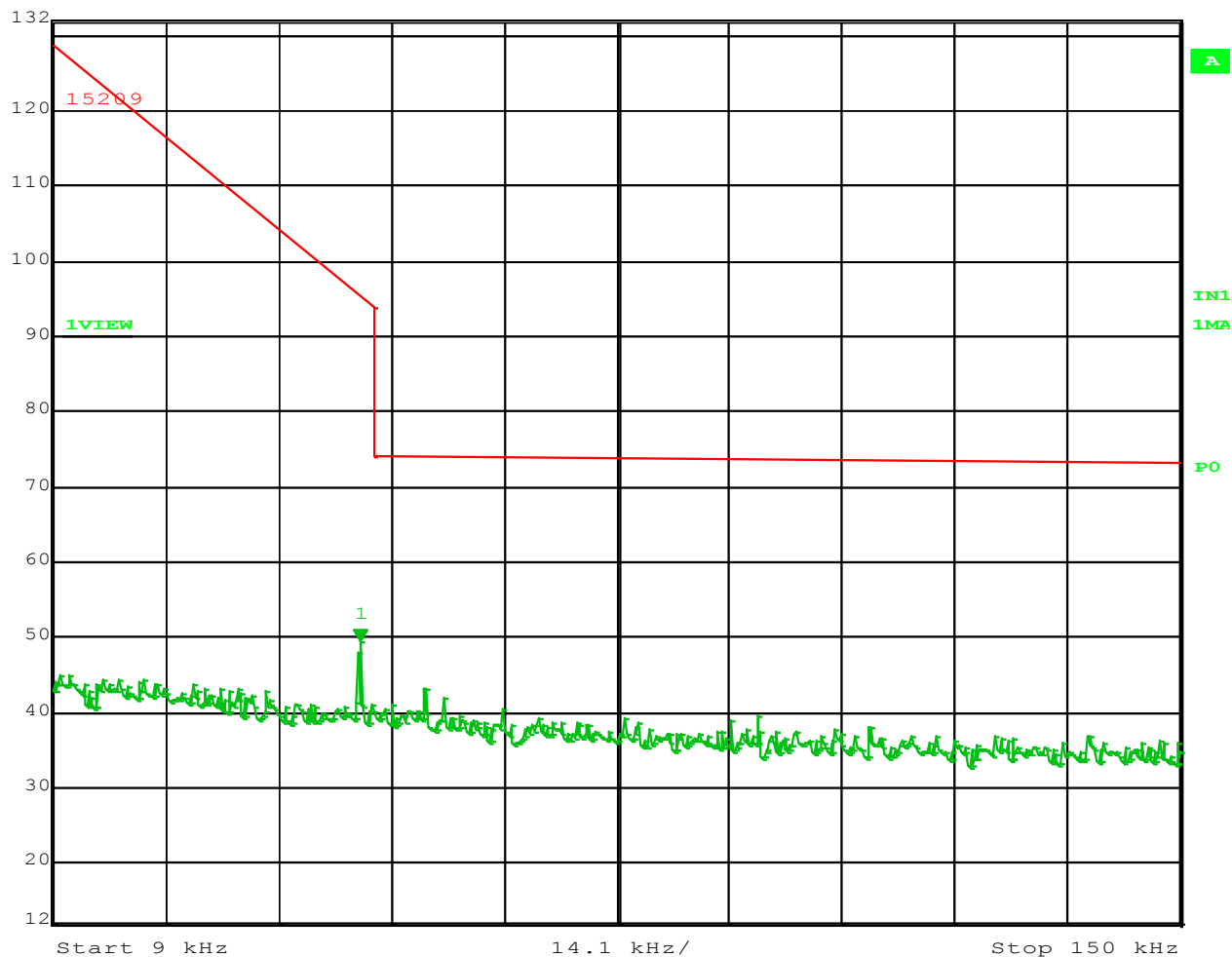
The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

Report No.:**31560224.005 Ink Pump.doc**

Page 18 of 35



Marker 1 [T1] RBW 200 Hz RF Att 40 dB
 Ref Lvl 49.28 dBV VBW 200 Hz
 132 dBV 47.42885772 kHz SWT 18 s Unit dBV



Date: 20.MAR.2015 13:16:49

Figure 6 – Spurious Emissions (Parallel) 9 kHz to 150 kHz

Frequency (kHz)	Peak	QP	Result
47.428	49.28	45.36	Complies

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

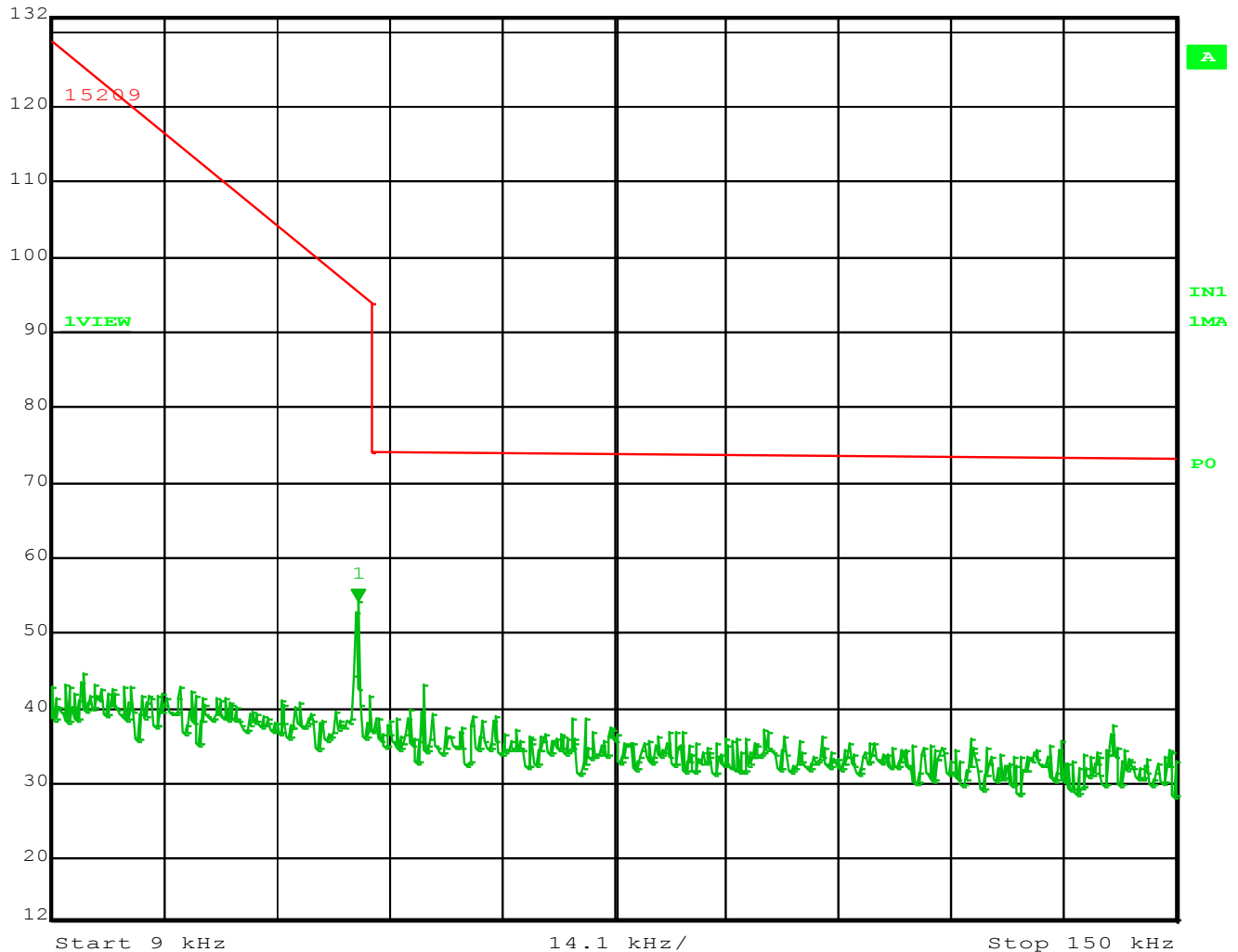
Report No.:

31560224.005 Ink Pump.doc

Page 19 of 35



Marker 1 [T1] RBW 200 Hz RF Att 40 dB
 Ref Lvl 54.14 dB μ V VBW 200 Hz
 132 dB μ V 47.4285772 kHz SWT 18 s Unit dB μ V



Date: 20.MAR.2015 13:13:42

Figure 7 – Spurious Emissions (Perpendicular) 9 kHz to 150 kHz

Frequency (kHz)	Peak	QP	Result
47.428	54.14	51.2	Complies

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

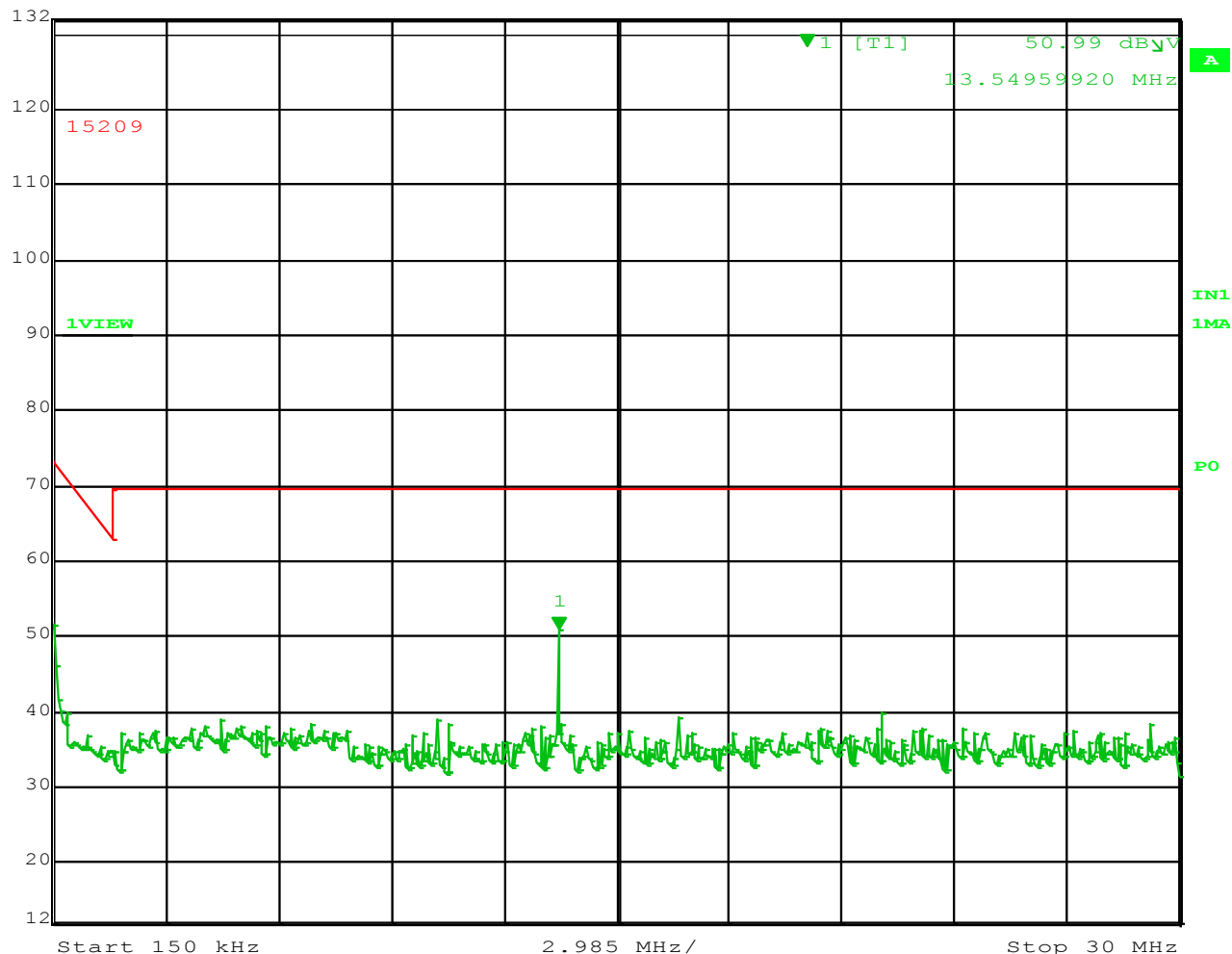
Report No.:

31560224.005 Ink Pump.doc

Page 20 of 35



Marker 1 [T1] RBW 10 kHz RF Att 40 dB
 Ref Lvl 50.99 dBμV VBW 10 kHz
 132 dBμV 13.54959920 MHz SWT 1.15 s Unit dBμV



Date: 20.MAR.2015 13:19:56

Figure 8 – Spurious Emissions (Parallel) 150 kHz to 30 MHz

Frequency (MHz)	Peak	QP	Result
13.549	50.99	FUNDAMENTAL	Complies

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

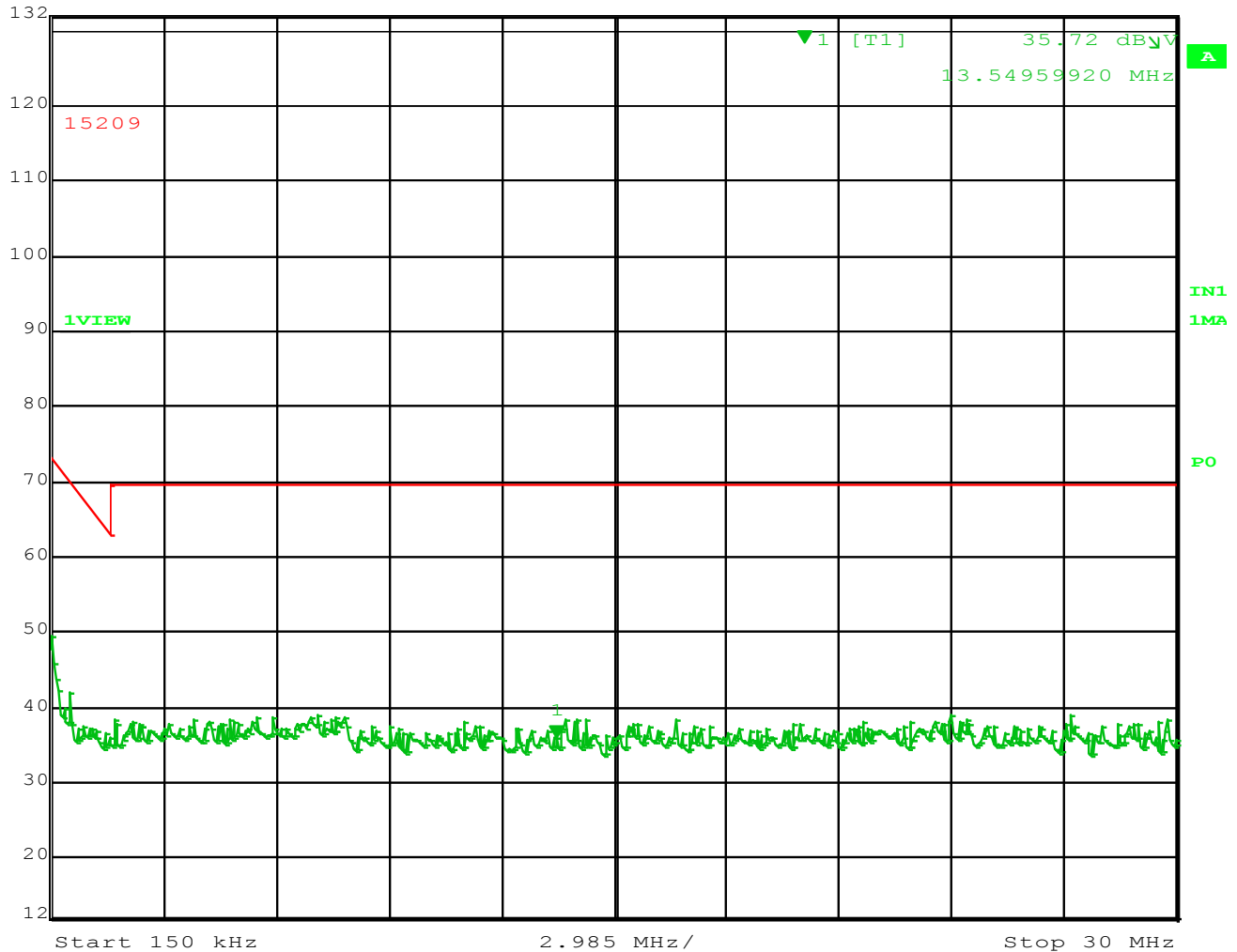
Report No.:

31560224.005 Ink Pump.doc

Page 21 of 35



Marker 1 [T1] RBW 10 kHz RF Att 40 dB
Ref Lvl 35.72 dBV VBW 10 kHz
132 dBV 13.54959920 MHz SWT 1.15 s Unit dBV



Date: 20.MAR.2015 13:20:46

Figure 9 – Spurious Emissions (Perpendicular) 150 kHz to 30 MHz

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

4.3 Conducted Emissions

This test measures the electromagnet levels of spurious signals generated by the EUT on the AC power line that may affect the performance of other near by electronic equipment.

4.3.1 Over View of Test

Results	Complies (as tested per this report)					Date	3/18/2015	
Standard	FCC Part 15.207							
Product Model	11930				Serial#	TS-1		
Configuration	See test plan for details							
Test Set-up	Tested in open area		EUT placed on table			see test plans for details		
EUT Powered By	24 VDC	Temp	22° C	Humidity	22%	Pressure	1008mbar	
Frequency Range	150 kHz - 30 MHz							
Perf. Criteria	Class A (Below Limit)		Perf. Verification		Readings Under Limit for L1 & Neutral			
Mod. to EUT	None		Test Performed By		Randall Masline			

4.3.2 Test Procedure

Conducted and FCC emissions tests were performed using the procedures of ANSI C63.10:2009 & ANSI C63.4 including methods for signal maximizations and EUT configuration. The photos included with the report show the EUT in its maximized configuration. Further conducted emission tests were performed per the procedures stated in the other emissions standards listed in this report.

The frequency range from 150 kHz - 30 MHz was investigated for conducted emissions.

Conducted Emissions measurements were performed in the shielded room using procedures specified in the test plan and standard.

4.3.3 Deviations

There were no deviations from the test methodology listed in the test plan for the conducted emission test.

4.3.4 Final Test

All final conducted emissions measurements were below (in compliance) the limits.

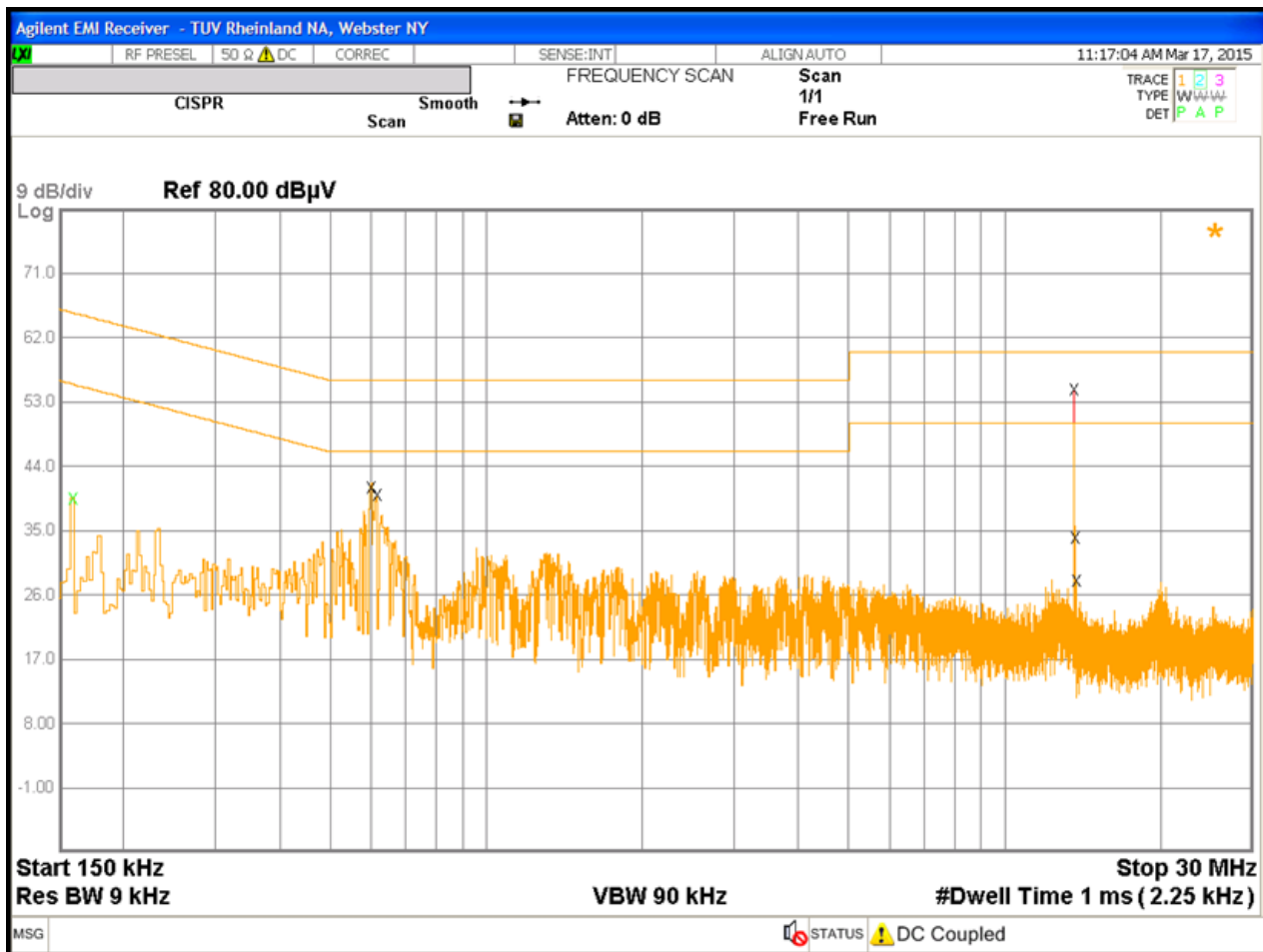
NOTE: The EUT is normally powered by 24 VDC, for test purposes the client sent an AC source to provide the 24 VDC, therefore; conducted emissions were performed.

The EUT Initially failed at 13.56 MHz, so the antenna was removed and a load was put in its place.

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

4.3.5 Final Graphs

Line 1



Sig	Trc	Freq	PEAK Amptd	QPD Amptd	EAVG Amptd	PEAK vs LL1	QPD vs LL1	EAVG vs LL2	RBW	RBW Type	Time Stamp
1	1	159.00 kHz	46.223 dBuV	41.105 dBuV	30.824 dBuV	-19.293 dB	-24.411 dB	-24.692 dB	9.00 kHz	CISPR	2015/03/17 11:11:24
2	1	597.81 kHz	44.893 dBuV	42.325 dBuV	34.181 dBuV	-11.107 dB	-13.675 dB	-11.819 dB	9.00 kHz	CISPR	2015/03/17 11:06:16
3	1	615.81	42.763	40.238	31.977	-13.237	-15.762	-14.023	9.00	CISPR	2015/03/17

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

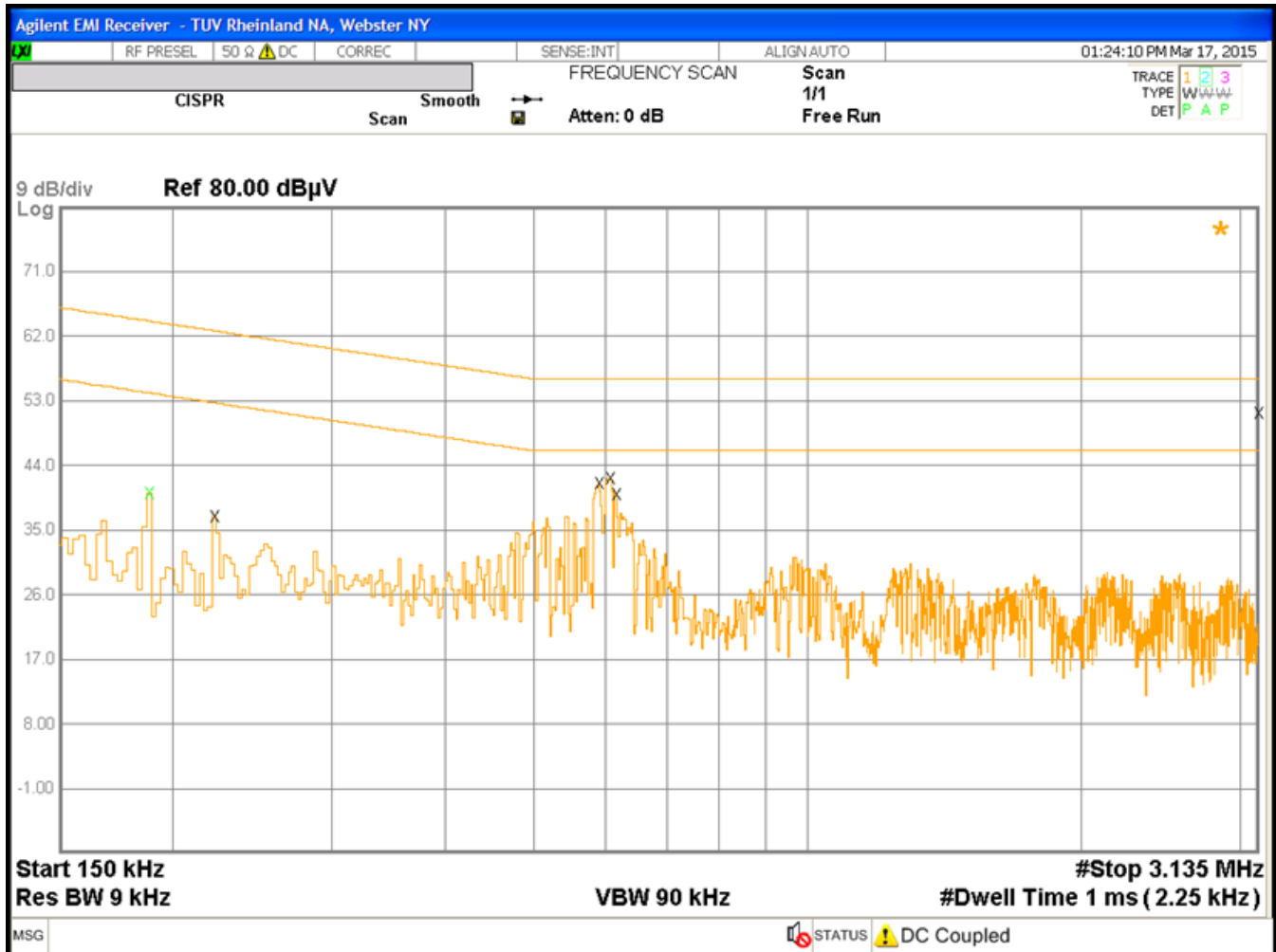
Report No.:**31560224.005 Ink Pump.doc**

Page 24 of 35

		kHz	dBuV	dBuV	dBuV	dB	dB	dB	kHz		11:07:34
4	1	13.560 MHz	54.755 dBuV	54.487 dBuV	54.136 dBuV	-5.245 dB	-5.513 dB	4.136 dB	9.00 kHz	CISPR	2015/03/17 11:02:53
5	1	13.598 MHz	37.215 dBuV	32.591 dBuV	21.232 dBuV	-22.785 dB	-27.409 dB	-28.768 dB	9.00 kHz	CISPR	2015/03/17 11:04:34
6	1	13.718 MHz	32.196 dBuV	27.109 dBuV	19.894 dBuV	-27.804 dB	-32.891 dB	-30.106 dB	9.00 kHz	CISPR	2015/03/17 11:05:00

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

Neutral



Sig	Trc	Freq	PEAK Amptd	QPD Amptd	EAVG Amptd	PEAK vs LL1	QPD vs LL1	EAVG vs LL2	RBW	RBW Type	Time Stamp	Co
1	1	188.25 kHz	45.146 dBuV	37.058 dBuV	29.595 dBuV	-18.967 dB	-27.055 dB	-24.518 dB	9.00 kHz	CISPR	2015/03/17 13:21:34	
2	1	222.01 kHz	41.868 dBuV	37.487 dBuV	29.746 dBuV	-20.876 dB	-25.257 dB	-22.997 dB	9.00 kHz	CISPR	2015/03/17 13:21:04	
3	1	588.81	44.024	41.695	33.442	-11.976	-14.305	-12.558	9.00	CISPR	2015/03/17	

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

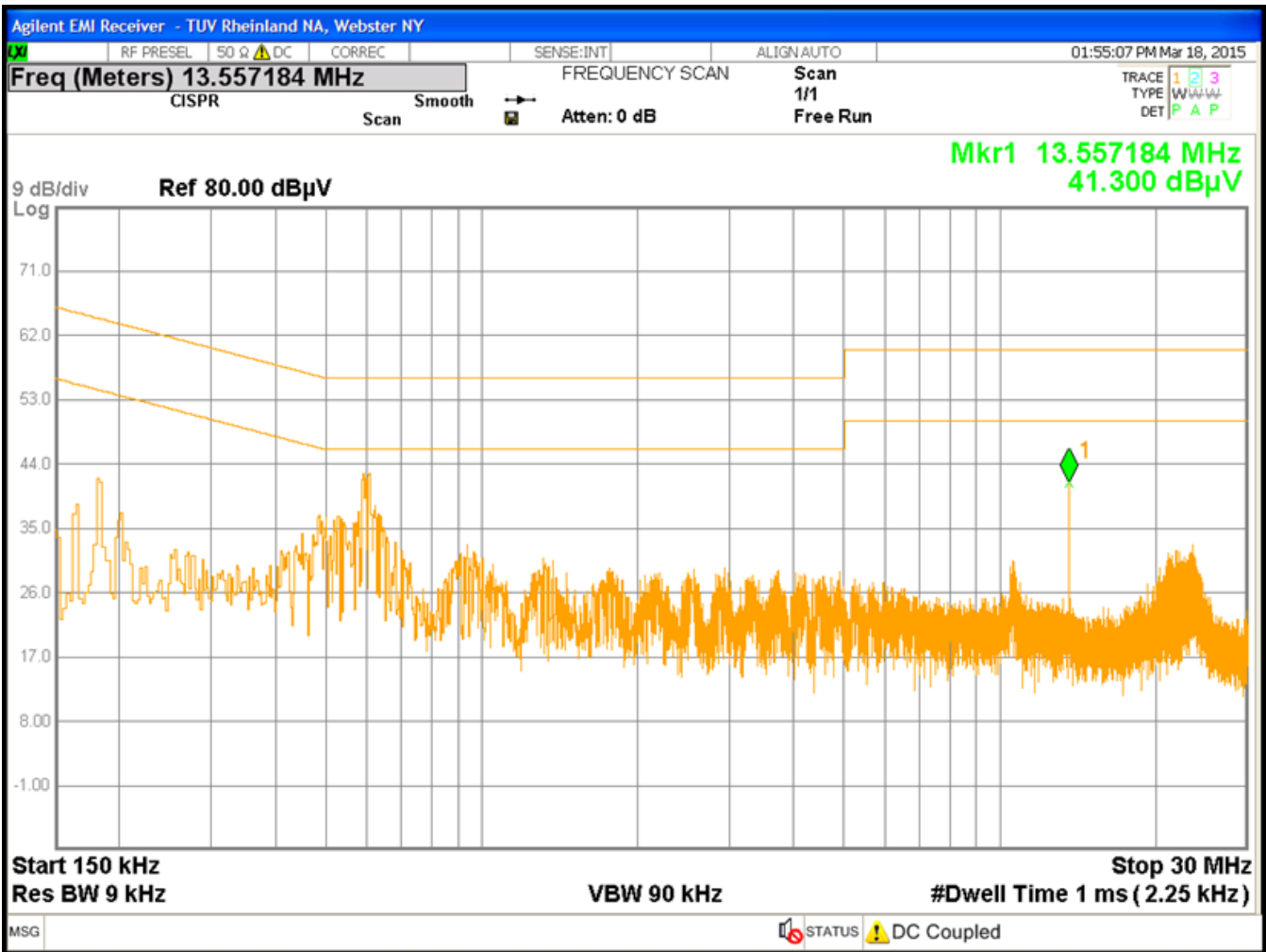
Report No.:**31560224.005 Ink Pump.doc**

Page 26 of 35

		kHz	dBuV	dBuV	dBuV	dB	dB	dB	kHz		13:19:33
4	1	606.81 kHz	45.045 dBuV	42.420 dBuV	36.065 dBuV	-10.955 dB	-13.580 dB	-9.935 dB	9.00 kHz	CISPR	2015/03/17 13:18:47
5	1	615.81 kHz	42.503 dBuV	39.701 dBuV	31.565 dBuV	-13.497 dB	-16.299 dB	-14.435 dB	9.00 kHz	CISPR	2015/03/17 13:19:55
6	1	13.564 MHz	50.677 dBuV	50.294 dBuV	49.815 dBuV	-9.323 dB	-9.706 dB	-0.185 dB	9.00 kHz	CISPR	2015/03/17 13:16:49

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

Line 1 retested with Antenna load



Freq	Peak	QP
13.56 MHz	43.5 dBuV	43.5 dBuV

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

4.1 Frequency Tolerance

This test is to evaluate the performance of the EUT when subjected to Variations in voltage and temperature.

4.1.1 Over View of Test

Results	Complies (as tested per this report)					Date	3/18/2015		
Standard	FCC Part 15.225(c)								
Product Model	11930				Serial#	TS-1			
Configuration	See test plan for details								
Test Set-up	Tested in open area on ground plane . See test plans for details								
EUT Powered By	24 VDC	Temp	22° C	Humidity	22%	Pressure	1008mbar		
Mod to EUT	None		Test Performed By		Randall Masline				

4.1.2 Test Procedure

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

4.1.3 Acceptable Climatic Conditions

Unless otherwise specified by the committee responsible for the generic or product standard, the climatic conditions in the laboratory shall be within any limits specified for the operation of the EUT and the test equipment by their respective manufacturers.

Tests shall not be performed if the relative humidity is so high as to cause condensation on the EUT or the test equipment.

4.1.4 Deviations

There were no deviations from the test methodology listed in the test plan for the Frequency Tolerance test.

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

Tolerance of carrier signal at +/- 0.01% in the 15.225(b) band for 13.567 - 13.710 MHz =
13.565643 MHz to 13.711371 MHz

Temperature	Frequency (MHz)	Result
-20° C	13.5698722	Complies
Nom 22° C	13.57002004	Complies
+55° C	13.57002512	Complies

Voltage Variation	Frequency (MHz)	Result
85% - 102VAC	13.56998725	Complies
Nom 120VAC	13.57002004	Complies
115% - 138VAC	13.57003012	Complies

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

4.1 Bandwidth

This test measures the Bandwidth of the fundamental emission.

4.1.1 Test Over View

Results	Complies (as tested per this report)					Date	4/21/2015	
Standard	FCC Part 15.203							
Product Model	11930				Serial#	TS-1		
Configuration	Tested in 10m Semi-Anechoic Chamber							
Test Set-up	Tested in an 10m Semi-anechoic chamber EUT placed on table							
EUT Powered By	24 VDC	Temp	21° C	Humidity	48%	Pressure	1021mbar	
Perf. Criteria	(Below Limit)			Perf. Verification		Readings under Limit		
Mod to EUT	None			Test Performed By		Randall Masline		

4.1.2 Test Procedure

Bandwidth measurements were made according to ANSI C63.10:2013 For Industry Canada the bandwidth measurements were made in accordance with RSS – 210 Issue 8

4.1.3 Deviations

There were no deviations from the test methodology.

4.1.4 Final Test

All final measurements were within (in compliance) the limits.

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

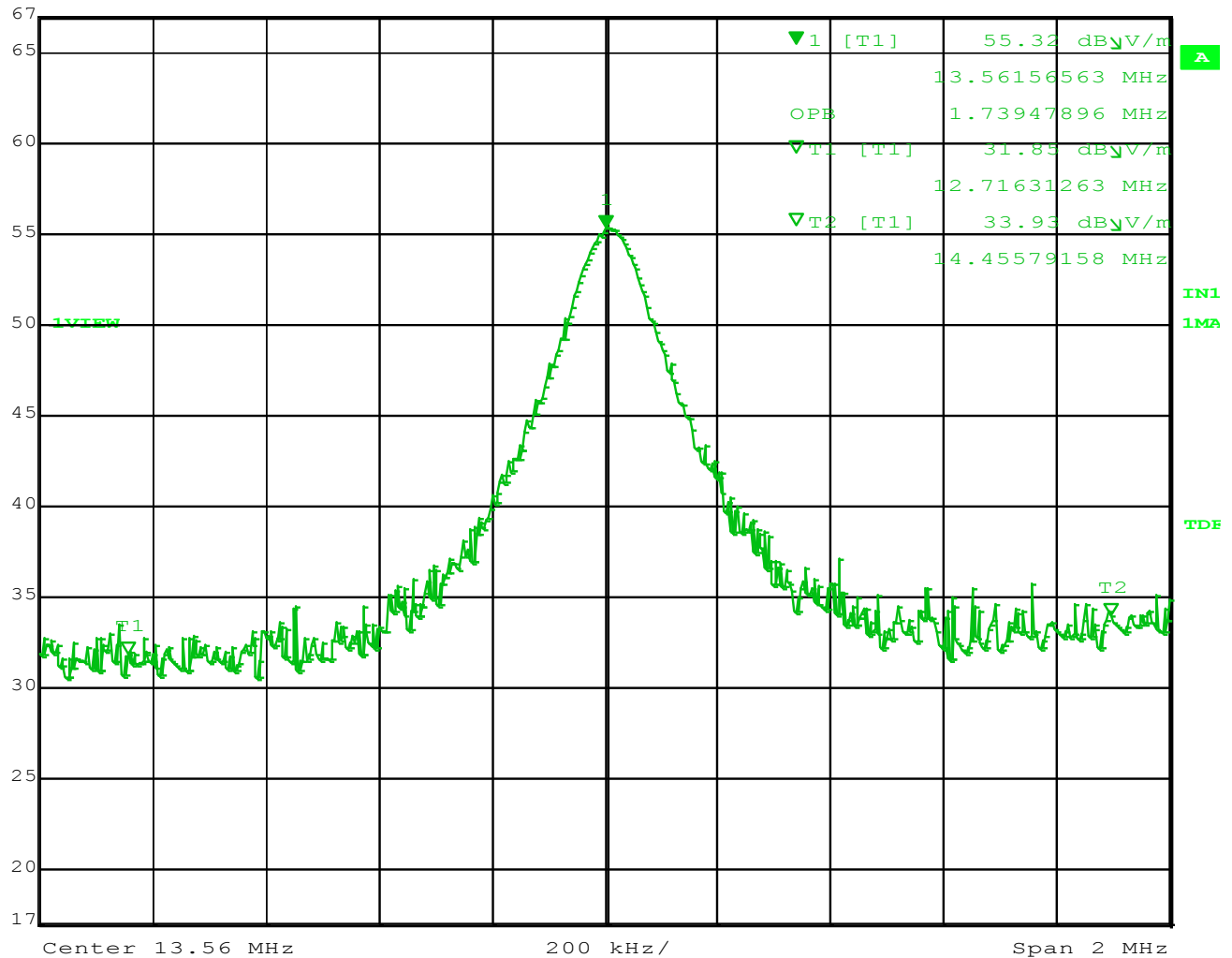
Report No.:

31560224.005 Ink Pump.doc

Page 31 of 35



Marker 1 [T1] RBW 100 kHz RF Att 0 dB
 Ref Lvl 55.32 dBV/m VBW 300 kHz
 67 dB* 13.56156563 MHz SWT 5 ms Unit dBV/m



Date: 21.APR.2015 12:57:19

Figure 10 – 99% Bandwidth

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

5 MPE Evaluation

FCC:

Controlled Exposures - Limit =	4.894666771	mW/cm ²
Uncontrolled Exposures - Limit =	0.978933354	mW/cm ²
Pd =	0.0000001	mW/cm ²
Controlled Margin to Limit =	4.8947	mW/cm ²
Uncontrolled Margin to Limit =	0.9789	mW/cm ²

Limit for 1.34-30 MHz: $900 / f^2$ mW/cm²Limit for 1.34-30 MHz: $180 / f^2$ mW/cm² $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2)$

IC:

Controlled Exposures to Limit =	10	W/m ²
Uncontrolled Exposures Limit =	2	W/m ²
Pd =	0.000001	W/m ²
Controlled Margin to Limit =	10.0000	W/m ²
Uncontrolled Margin to Limit =	2.0000	W/m ²

Limit for 10-20 MHz: 10 W/m²Limit for 10-20 MHz: 2 W/m² $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2)$

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

Appendix A

6 Test Plan

This test report is intended to follow this test plan outlined here in unless other wise stated in this here report. The following test plan will give details on product information, standards to be used, test set ups and refer to TUV test procedures. The test procedures will give the steps to be taken when performing the stated test. The product information below came via client, product manual, product itself and or the internet.

6.1 General Information

Client	ARRAY TECHNOLOGIES INC.
Address 1	221 Sequin Dr
Address 2	Glastonbury CT, 06033
Contact Person	David Pirie
Telephone	860-657-8086
Fax	
e-mail	dpirie@arrayonline.com

6.2 Model(s) Name

11930

6.3 Type of Product

Pumped Ink Supply

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

6.4 Equipment Under Test (EUT) Description

The Model number 11930 is a Pumped Ink Supply that operates at 13.56 MHz

6.5 Modifications

No modifications were necessary to meet the requirements.

6.6 Product Environment

<input checked="" type="checkbox"/>	Residential	<input type="checkbox"/>	Hospital
<input checked="" type="checkbox"/>	Light Industrial	<input type="checkbox"/>	Small Clinic
<input type="checkbox"/>	Industrial	<input type="checkbox"/>	Doctor's office
<input type="checkbox"/>	Other		

*Check all that apply

6.7 Countries

<input checked="" type="checkbox"/>	USA
<input type="checkbox"/>	Canada

*Check all that apply

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.

6.8 General Product Information

Size	H	35.5cm	W	8cm	L	10cm
Weight	<1kg		Fork-Lift Needed		No	
Notes						

6.9 EUT Electrical Powered Information

6.9.1 Electrical Power Type

<input type="checkbox"/>	AC	<input checked="" type="checkbox"/>	DC	<input type="checkbox"/>	Batteries	<input type="checkbox"/>	Host -
--------------------------	----	-------------------------------------	----	--------------------------	-----------	--------------------------	--------

6.9.2 Electrical Power Information

Name	Type	Voltage		Frequency	Current	Notes
		min	max			
24VDC Mains	DC	20	26	DC		
Notes						

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the Federal Government.