

Electromagnetic Compatibility Test Report

Prepared in accordance with

FCC Part 15C, ANSI C63.10:2009

On

RFID Module with Passive Tag

HS1RN4

JADAK LLC

7279 William Barry Blvd.

North Syracuse, NY 13212

Prepared by:

TUV Rheinland of North America, Inc.

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Manufacturer's statement - attestation

The manufacturer; JADAK LLC, 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.

Mark Macko

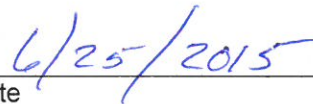
Printed name of official



Signature of official

**7279 William Barry Blvd.
North Syracuse, New York 13212**

Address



Date

315-218-1304

Telephone number

mmacko@jadaktech.com

Email address of official

Client:	JADAK LLC 7279 William Barry Blvd. North Syracuse, NY 13212	Contact: Mark Macko Tel: 315-218-1304 Fax: 315-701-0679 e-mail mmacko@jadaktech.com		
Identification:	RFID Module with Passive Tag	Serial No.:	TS-1	
Test item:	Model HS1RN4	Date Test Completed:		6/23/2015
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, FCC Part 15.225(b), 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		
23 September 2015 Date Name Signature 		23 September 2015 Date Name Signature 		
Other Aspects:	None			
Abbreviations: OK, Pass, Compliant, Complies = passed Fail, Not Compliant, Does Not Comply = failed N/A = not applicable				
 US5253	 	Industry Canada	VCCI	BSMI
	Testing Cert.# 3331.08	482B-1	A-0203	SL2-IN-E-050R

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1 General Information

1.1 Scope

This report is intended to document the status of conformance with the requirements of the FCC Part 15C, ANSI C63.10:2009 based on the results of testing performed on 6/23/2015 on the RFID Module with Passive Tag, Model Number. HS1RN4, manufactured by JADAK LLC. 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.

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1.3 Summary of Test Results

Applicant	JADAK LLC 7279 William Barry Blvd. North Syracuse, NY 13212	Tel	315-218-1304	Contact	Mark Macko
		Fax	315-701-0679	e-mail	mmacko@jadaktech.com
Description	RFID Module with Passive Tag	Model Number	HS1RN4		
Serial Number	TS-1	Test Voltage/Freq.	Powered Via USB		
Test Date Completed:	6/23/2015	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
FCC Part 15.225	Operation in the band 13.110 - 14.010 MHz	See Basic Standards Below		See Below	Complies
FCC Part 15.209	Radiated Emissions	Class B, 9kHz - 1000 MHz		Limit	Complies
FCC Part 15.225(b)	Field Strength of Fundamental and Spurious Emissions	15.225 Limit is 83.9 dBuV at 13.565 MHz at 30m		Limit	Complies
FCC Part 15.207	Conducted Emissions	Transmitter, 150 kHz - 30 MHz		Limit	Not Applicable
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

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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.

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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 (dB μ V/m)

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

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.

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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	

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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.

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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	6/18/2015	
Standard	FCC Part 15.209							
Product Model	HS1RN4				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	Powered Via USB	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

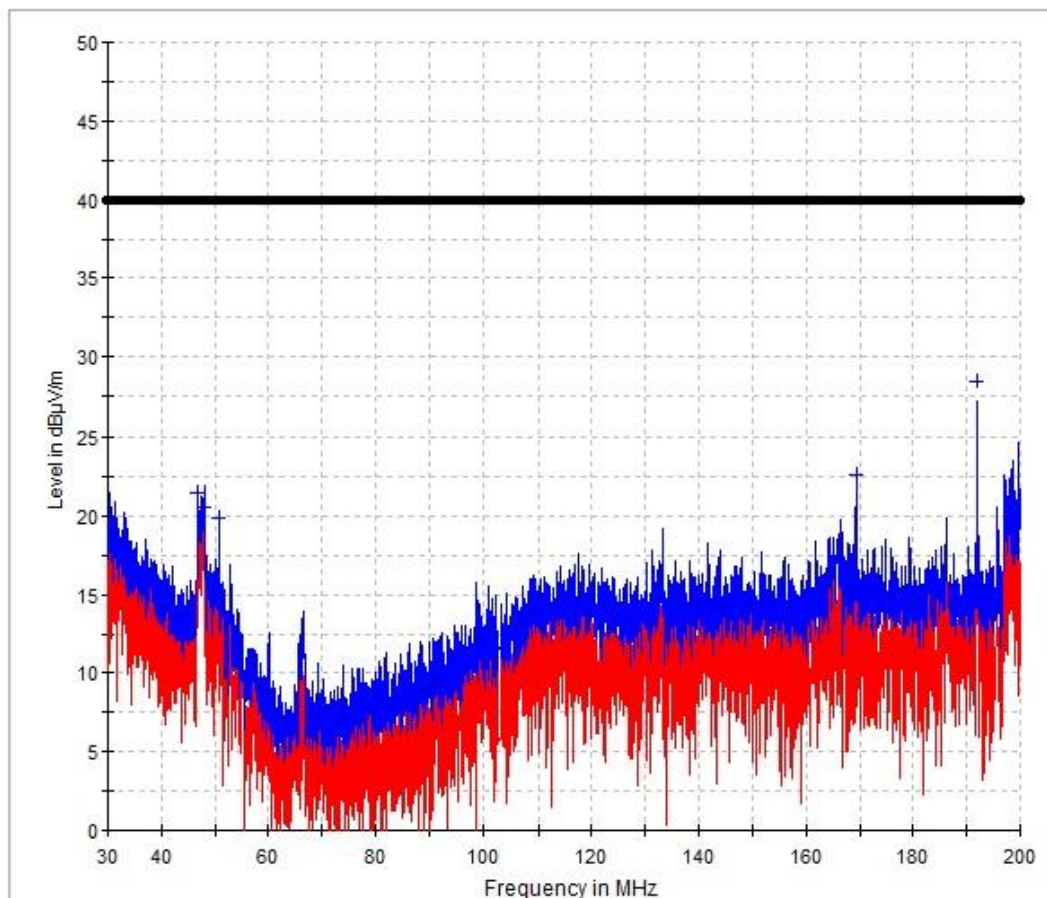
There were no deviations from the test methodology listed in the test plan for the radiated emission test.

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4.1.1 Final Graphs

NOTES:

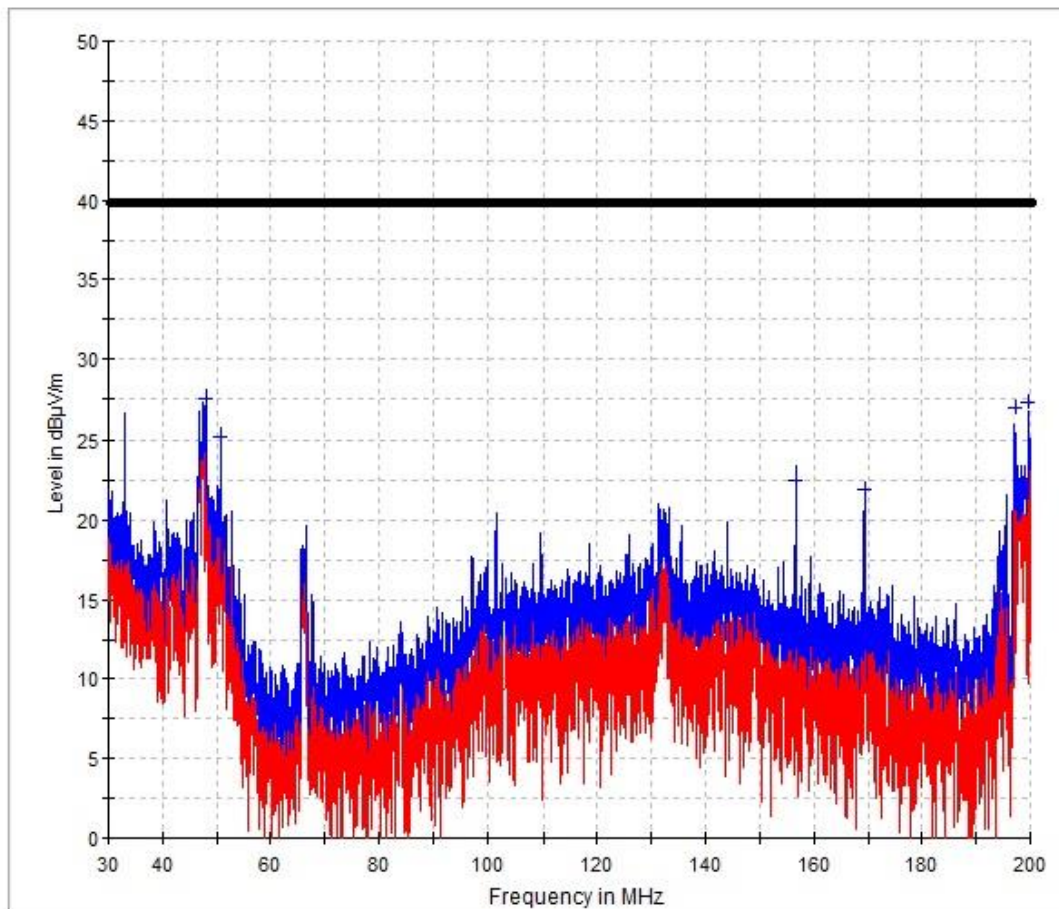
Radiated Emissions Prescan Horizontal



Frequency MHz	QuasiPeak dBµV/m	Meas. Time ms	Bandwidth kHz	Height cm	Polarization	Azimuth deg	Corr. dB	Comment
---	---	---	---	---	---	---	---	---
46.720000	21.4	150.0	120.000	100.0	H	349.0	-7.8	
48.040000	20.6	150.0	120.000	100.0	H	349.0	-8.5	
50.760000	19.8	150.0	120.000	100.0	H	349.0	-9.7	
169.320000	22.6	150.0	120.000	100.0	H	349.0	-5.5	
192.000000	28.4	150.0	120.000	100.0	H	349.0	-5.9	

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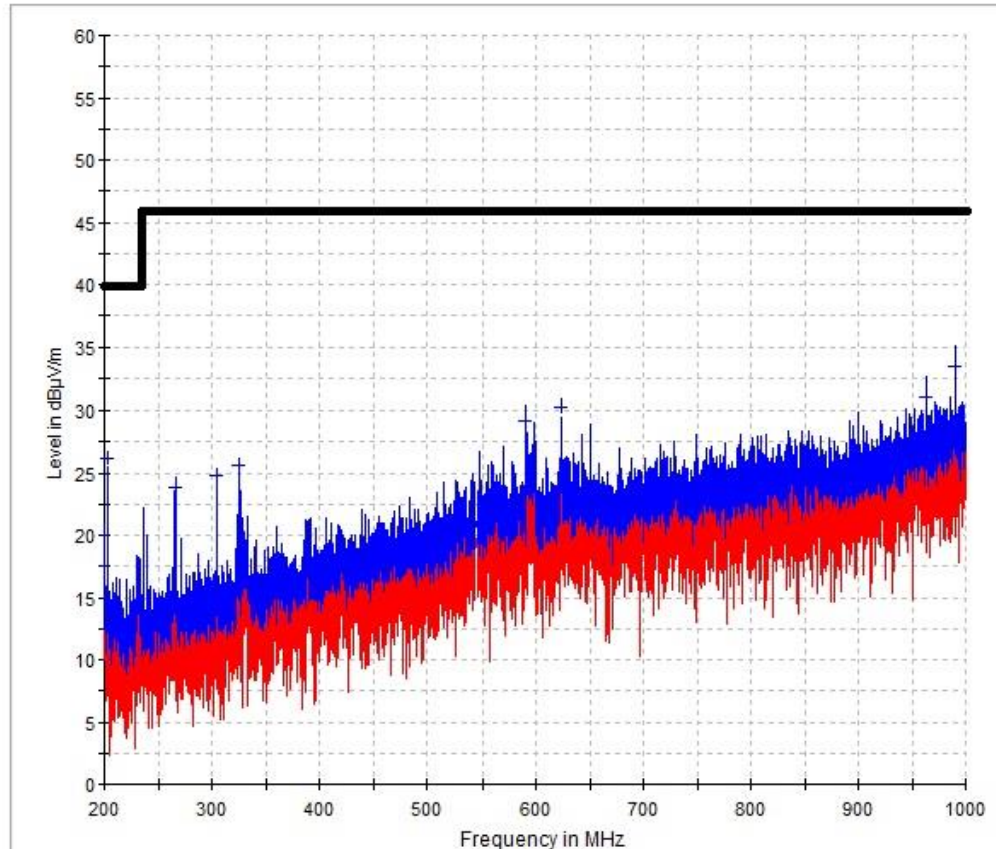
NOTES:

Radiated Emissions Prescan
Vertical


Frequency MHz	QuasiPeak dBµV/m	Meas. Time ms	Bandwidth kHz	Height cm	Polarization	Azimuth deg	Corr. dB	Comment
32.880000	19.1	150.0	120.000	100.0	V	349.0	-0.9	
48.000000	27.5	150.0	120.000	100.0	V	349.0	-8.5	
50.760000	25.2	150.0	120.000	100.0	V	349.0	-9.7	
156.720000	22.5	150.0	120.000	100.0	V	349.0	-5.1	
169.320000	22.0	150.0	120.000	100.0	V	349.0	-5.5	
197.160000	27.0	150.0	120.000	100.0	V	349.0	-5.5	
199.800000	27.3	150.0	120.000	100.0	V	349.0	-5.4	

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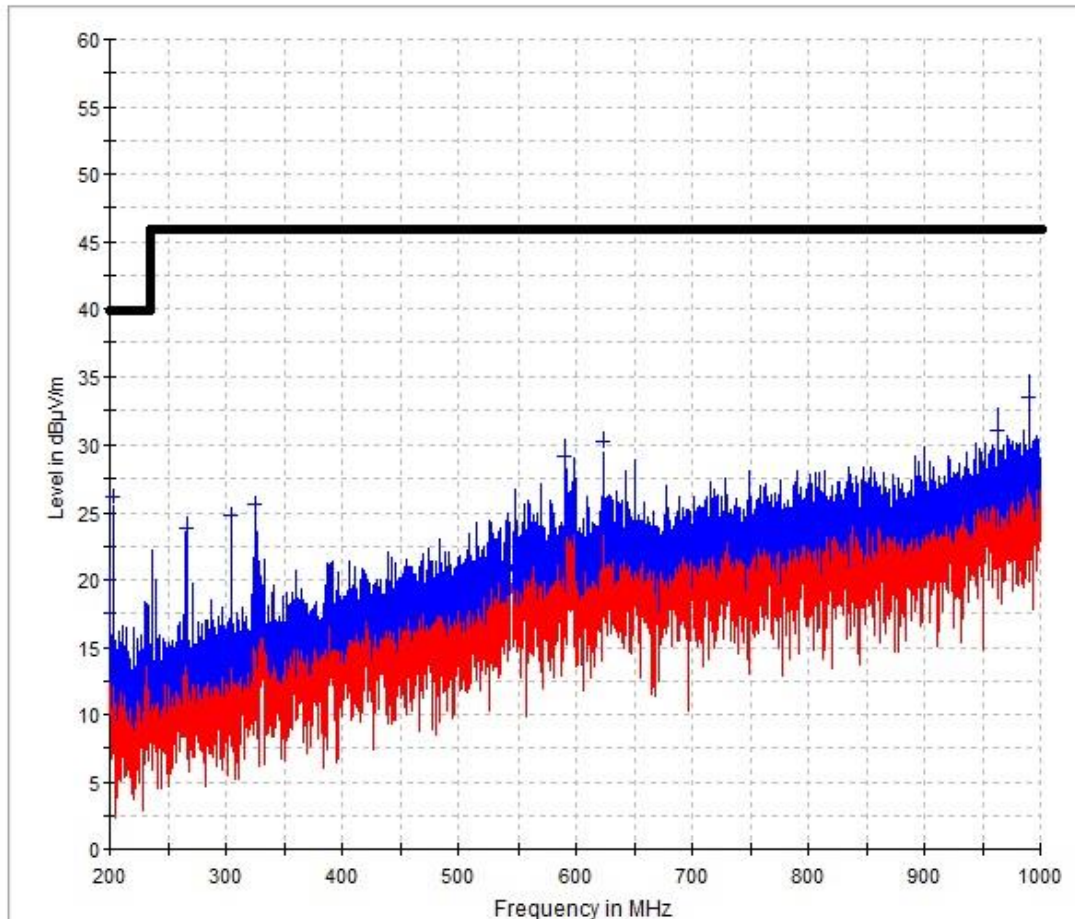
NOTES:

Radiated Emissions Prescan
Horizontal


Frequency MHz	QuasiPeak dBµV/m	Meas. Time ms	Bandwidth kHz	Height cm	Polarization	Azimuth deg	Corr. dB	Comment
203.200000	26.2	100.0	120.000	150.0	H	349.0	-5.2	
266.240000	23.9	100.0	120.000	150.0	H	349.0	-1.3	
304.800000	24.8	100.0	120.000	150.0	H	349.0	0.0	
326.080000	25.7	100.0	120.000	150.0	H	349.0	0.8	
591.120000	29.2	100.0	120.000	150.0	H	349.0	7.9	
623.840000	30.2	100.0	120.000	150.0	H	349.0	8.8	
962.960000	30.9	100.0	120.000	150.0	H	349.0	17.0	
990.080000	33.4	100.0	120.000	150.0	H	349.0	18.1	

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NOTES:

Radiated Emissions Prescan
Vertical


Frequency MHz	QuasiPeak dBμV/m	Meas. Time ms	Bandwidth kHz	Height cm	Polarization	Azimuth deg	Corr. dB	Comment
203.200000	26.2	100.0	120.000	150.0	V		349.0	-5.2
266.240000	23.9	100.0	120.000	150.0	V		349.0	-1.3
304.800000	24.8	100.0	120.000	150.0	V		349.0	0.0
326.080000	25.7	100.0	120.000	150.0	V		349.0	0.8
591.120000	29.2	100.0	120.000	150.0	V		349.0	7.9
623.840000	30.2	100.0	120.000	150.0	V		349.0	8.8
962.960000	30.9	100.0	120.000	150.0	V		349.0	17.0
990.080000	33.4	100.0	120.000	150.0	V		349.0	18.1

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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)							
Product Model	HS1RN4				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	Powered Via USB	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

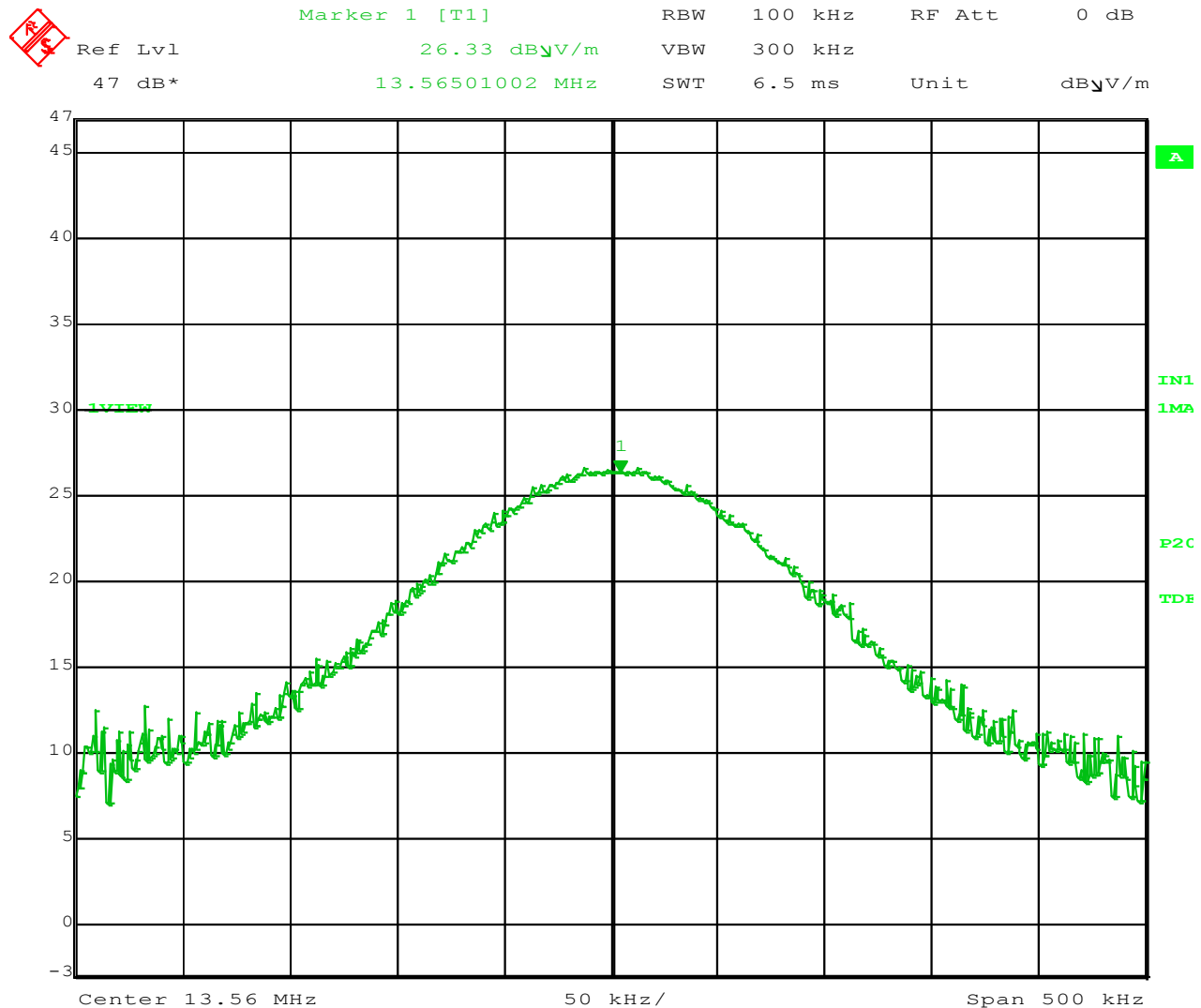
There were no deviations from the test methodology listed in the test plan for the harmonic current emissions test.

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4.2.4 Final Test

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

4.2.5 Final Data



Date: 18.JUN.2015 10:47:09

Figure 1 – Peak Field Strength Parallel Polarity is 26.33 dBuV at 1m

NOTE: The limit for 15.225 (b) 13.553 – 13.567 MHz band is 90.4 dBuV at 3m

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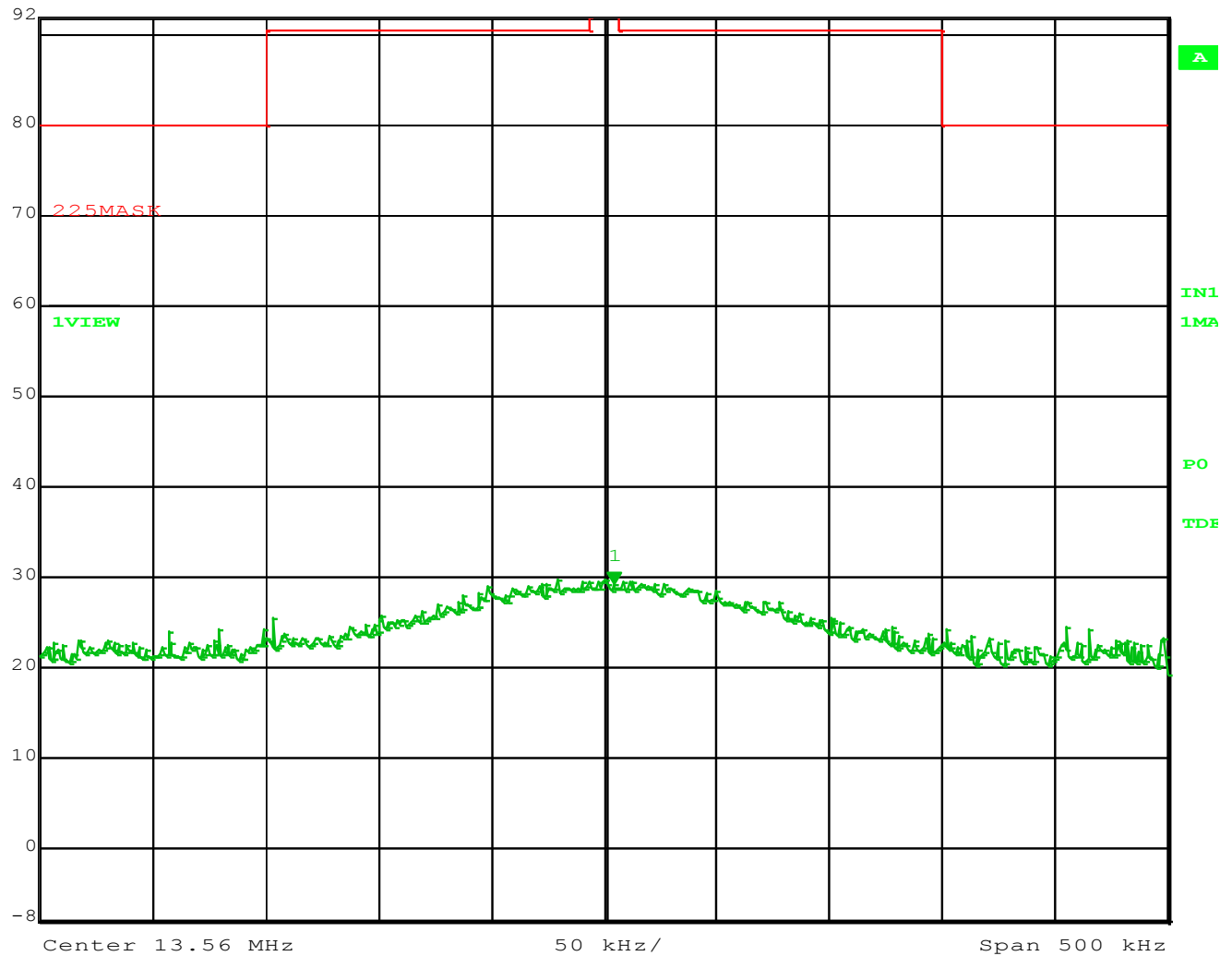
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Ref Lvl	Marker 1 [T1]	RBW	100 kHz	RF Att	0 dB
92 dB*	29.20 dBV/m	VBW	300 kHz		
	13.56501002 MHz	SWT	6.5 ms	Unit	dBV/m



Date: 18.JUN.2015 10:52:39

Figure 2 – Mask measured at 1m distance

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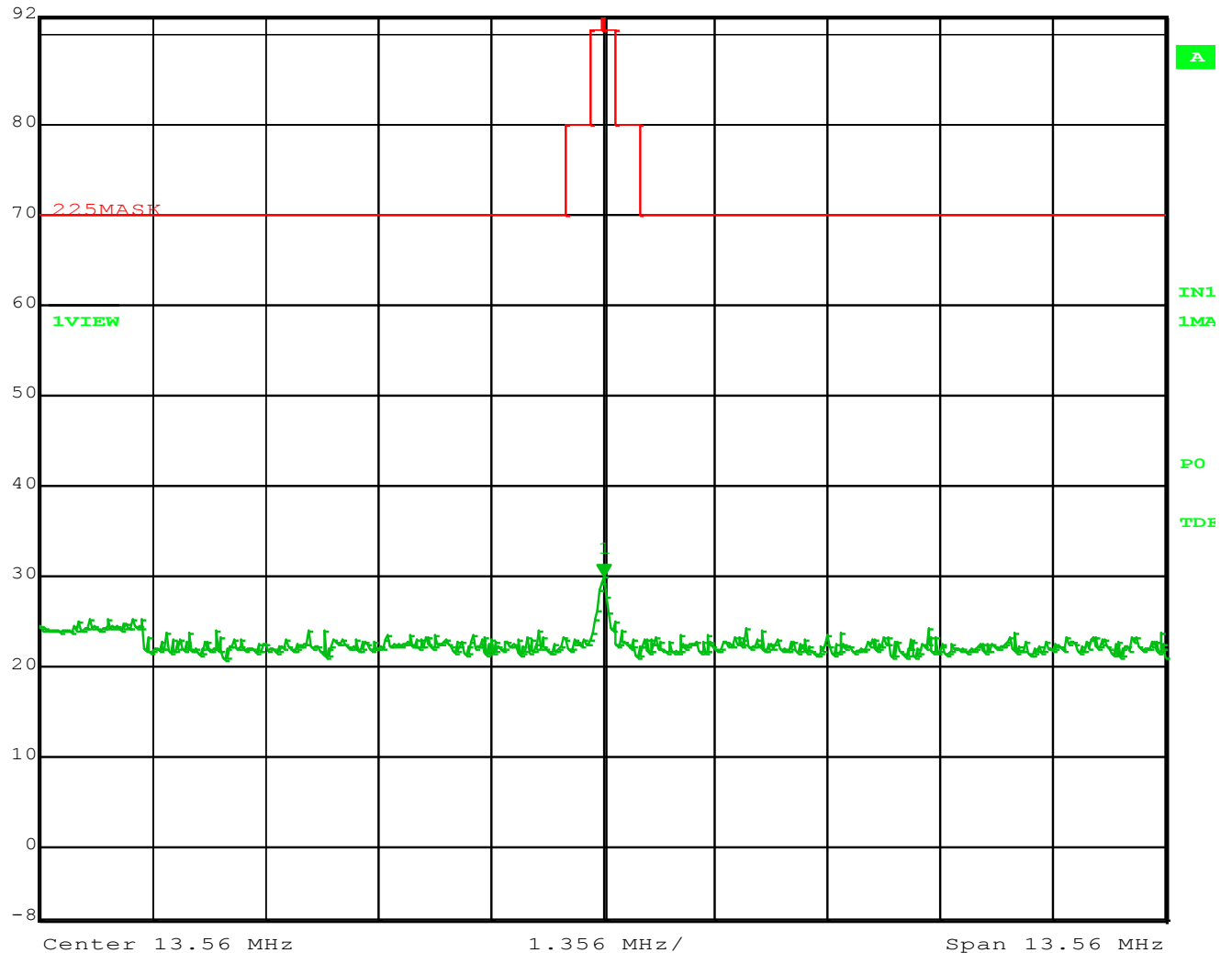
Report No.:

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Marker 1 [T1]	RBW	100 kHz	RF Att	0 dB
Ref Lvl	29.88 dBμV/m	VBW	300 kHz	
92 dB*	13.56501002 MHz	SWT	145 ms	Unit dBμV/m



Date: 18.JUN.2015 10:54:04

Figure 3 – Mask measured at 1m distance

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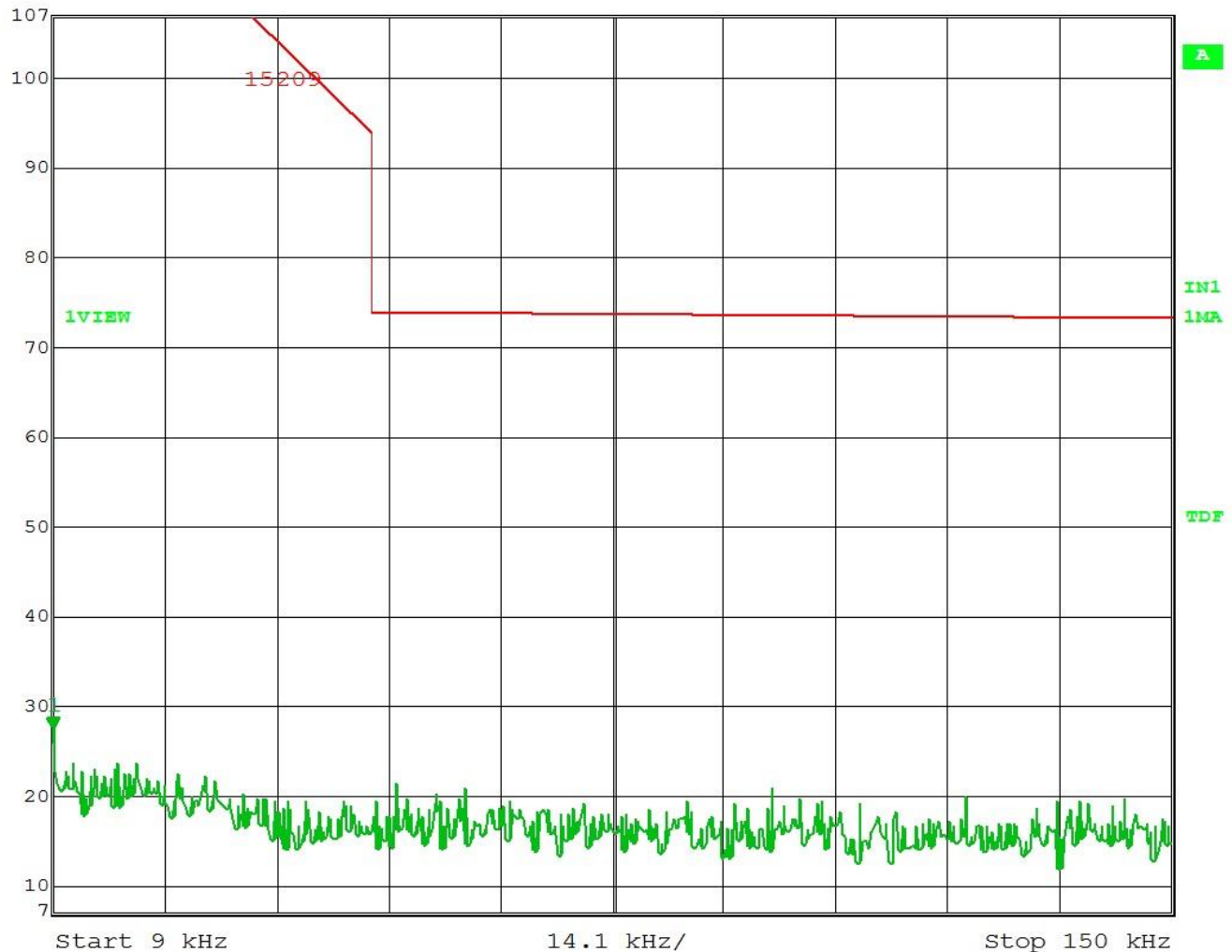
Report No.:

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Marker 1 [T1] RBW 200 Hz RF Att 10 dB
Ref Lvl 27.49 dBV VBW 200 Hz
107 dBV 9.00000000 kHz SWT 18 s Unit dBV



Date: 18. June. 2015 23:17:53

Figure 4 – Spurious Emissions (Parallel) 9 kHz to 150 kHz Measured at 1m distance

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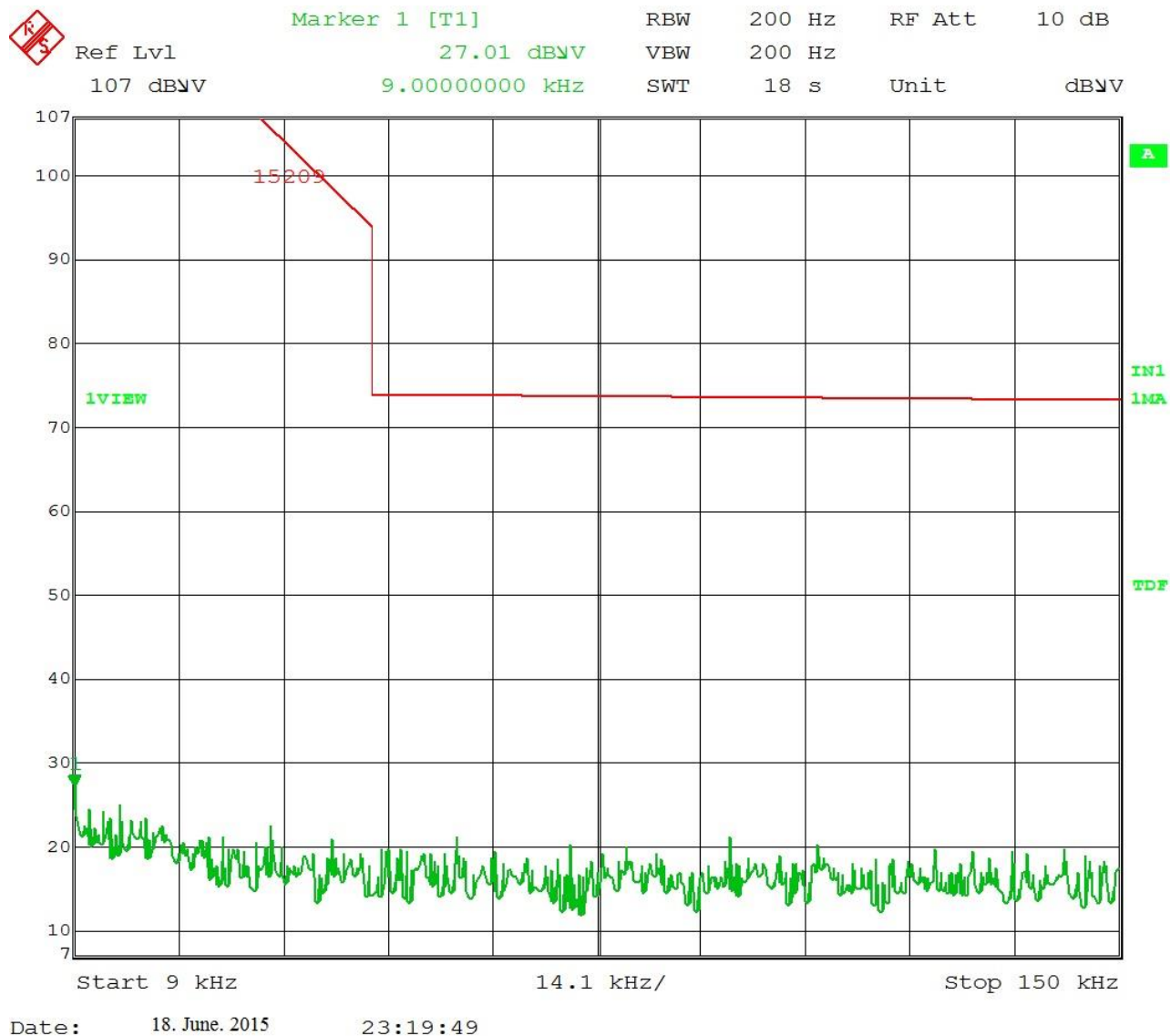


Figure 5 – Spurious Emissions (Perpendicular) 9 kHz to 150 kHz Measured at 1m distance

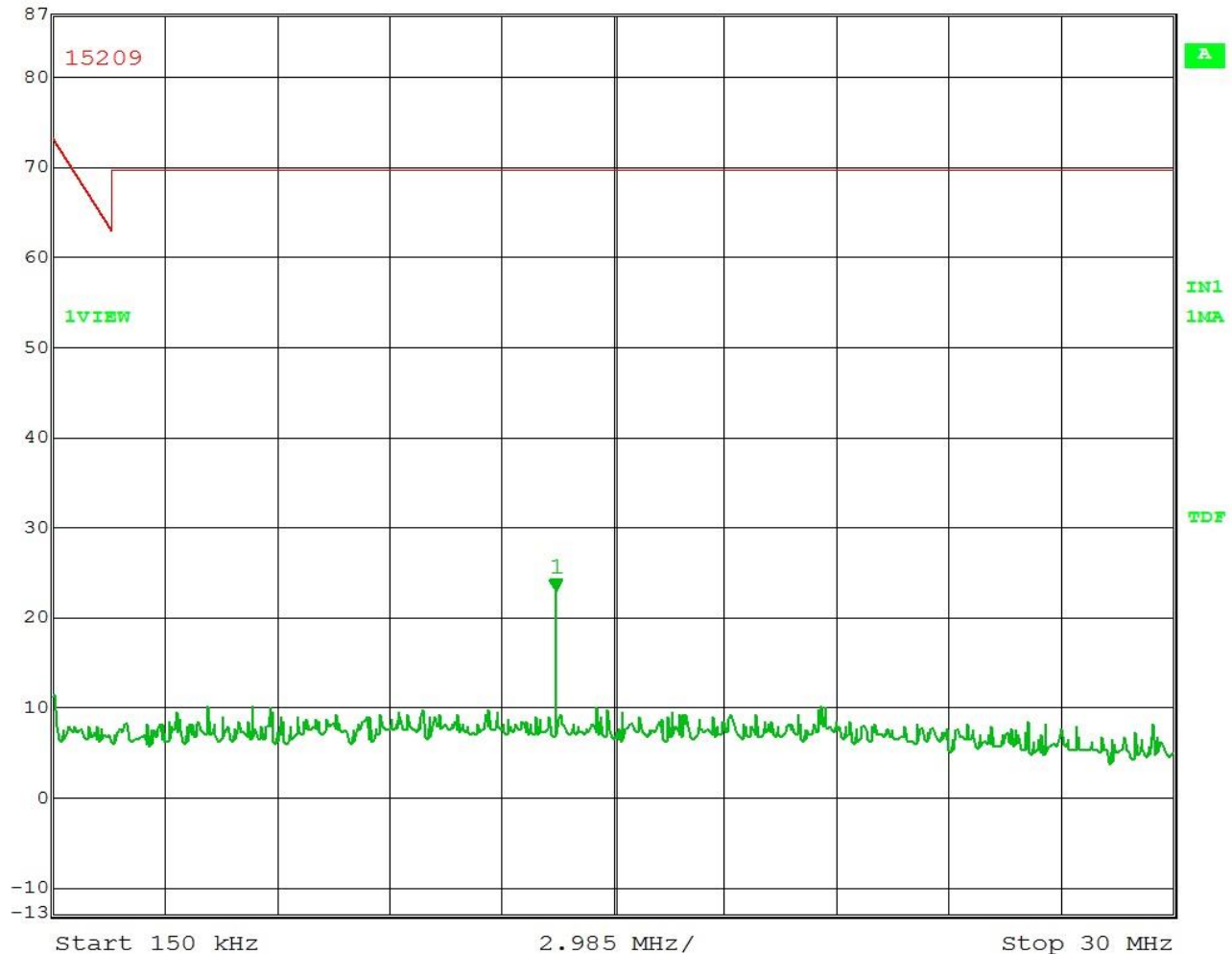
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Marker 1 [T1] RBW 10 kHz RF Att 0 dB
 Ref Lvl 22.80 dBμV VBW 10 kHz
 87 dBμV 13.5600000 MHz SWT 760 ms Unit dBμV



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Figure 6 – Spurious Emissions (Parallel) 150 kHz to 30 MHz Measured at 1m distance

Frequency (MHz)	Peak	QP	Result
13.560	22.80	FUNDAMENTAL	Complies

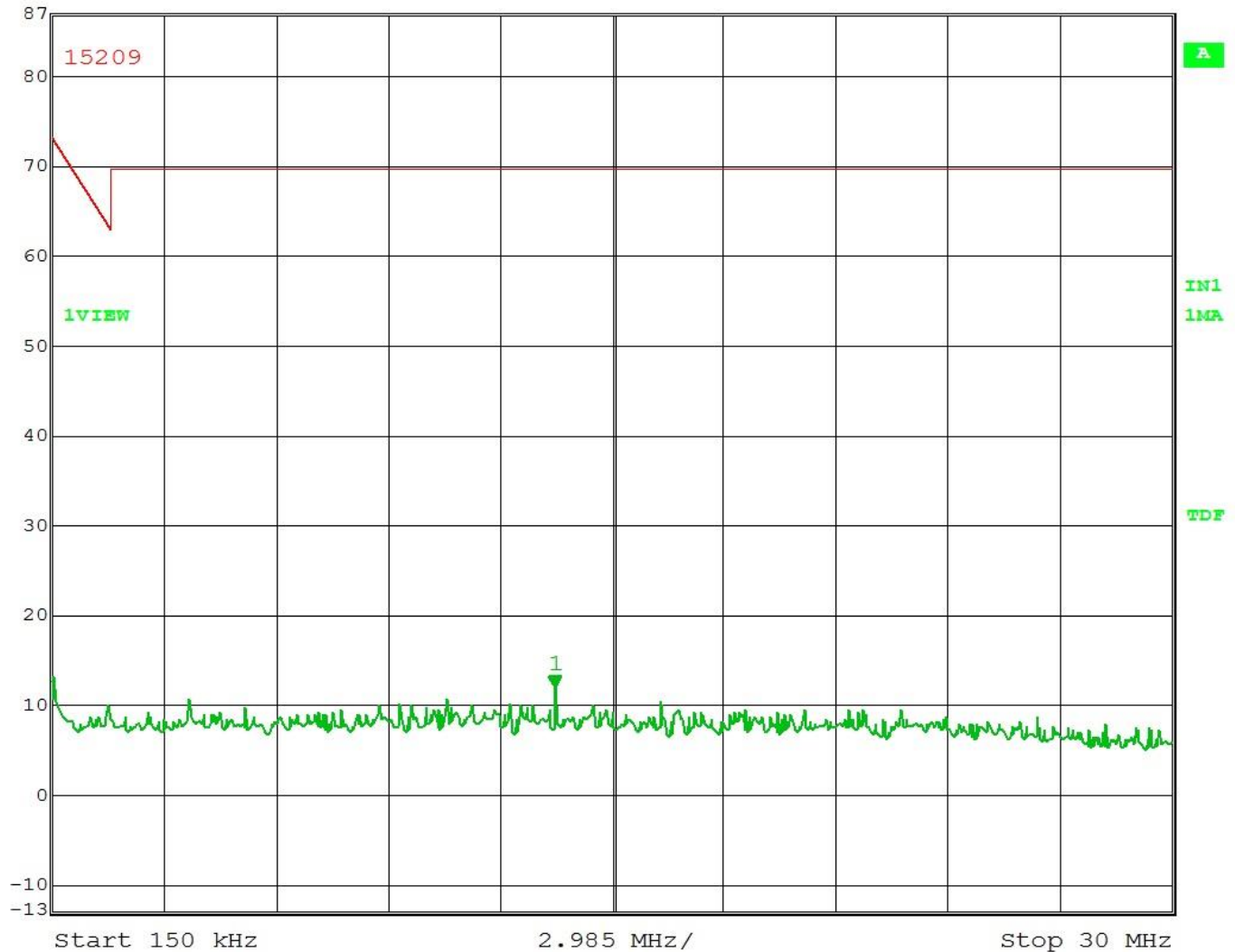
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Marker 1 [T1] RBW 10 kHz RF Att 0 dB
Ref Lvl 11.75 dBμV VBW 10 kHz
87 dBμV 13.56000000 MHz SWT 760 ms Unit dBμV



Date: 18. June. 2015 23:21:50

Figure 7 – Spurious Emissions (Perpendicular) 150 kHz to 30 MHz Measured at 1m distance

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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	6/18/2015	
Standard	FCC Part 15.225(c)							
Product Model	HS1RN4				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	Powered Via USB	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.

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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	13.5668722	Complies
Nom 22° C	13.56501002	Complies
+55° C	13.56002512	Complies

Voltage Variation	Frequency (MHz)	Result
85% - 102VAC	13.56998725	Complies
Nom 120VAC	13.56501002	Complies
115% - 138VAC	13.56003012	Complies

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5 RF Exposure - FCC

5.1 Exposure Requirements – FCC KDB # 447498 DO1

FCC KDB # 447498 DO1 V05r02 - Mobile and Portable Device RF Exposure and Procedures and Equipment, Appendix A shows that the SAR Text Exclusion Threshold for a device with a separation distance of 5 mm at 2450 MHz is 10 mW

5.1.1 Test Procedure

If the antenna is located $> 20\text{cm}$ from the user, then an MPE calculation is acceptable.

If the antenna is located $< 20\text{cm}$ (portable / mobile / hand-held device) from the user, then SAR evaluation is required.

5.1.2 Evaluation

The EUT will be used as a portable device where the antenna will be located less than 20cm from the user, therefore SAR evaluation is required.

5.1.2.1 Evaluation for FCC

FCC 447498 DO1 Mobile Portable RF Exposure V05r02, Appendix C shows that the SAR Text Exclusion Threshold for a device with a worst-case separation distance of $< 50\text{ mm}$ and $< 50\text{ MHz}$ is 308 mW.

The minimum power that requires SAR testing with a separation distance of 50 mm at $< 50\text{ MHz}$ is 308 mW.

The maximum EiRP peak power output of the EUT is: $< 0.1\text{ mW}$

The 0.1 mW EiRP of the EUT is well below the 308 mW power level that requires SAR Testing.

5.1.3 Conclusion

SAR data is not required for FCC

Note: The $< 0.1\text{ mW}$ power level includes the 100% Duty Cycle factor.
This is considered to be the absolute worst case.

5.1.4 Calculated EiRP Level

Notes: The EUT does not have a means to make direct measurements.

This EiRP calculation was made using the maximum Peak Field value of 26.33 dB μ V/m at 3m.

The Duty Cycle was at 100%

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5.1.5 Antenna Gain:

The antenna used in the EUT is a Loop antenna which is etched onto a flexible PCB.

According to the manufacturer, the antenna has a theoretical gain of 0 dBi or numeric gain of 1 (unity gain).

The stated Maximum EIRP power of the EUT is < 0.1 mW (100% Duty Cycle)

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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	JADAK LLC
Address 1	27279 William Barry Blvd.
Address 2	North Syracuse, NY 13212
Contact Person	Mark Macko
Telephone	315-218-1304
Fax	315-701-0679
e-mail	mmacko@jadaktech.com

6.2 Model(s) Name

HS1RN4

6.3 Type of Product

RFID Module with Passive Tag

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6.4 Equipment Under Test (EUT) Description

The Model number HS1RN4 is a RFID Module with Passive Tag that operates at 13.56 MHz

6.5 Modifications

No modifications were necessary to meet the requirements.

6.6 Product Environment

☒	Residential	☐	Hospital
☒	Light Industrial	☐	Small Clinic
☐	Industrial	☐	Doctor's office
☐	Other		

*Check all that apply

6.7 Countries

☒	USA
☐	Canada

*Check all that apply

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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

☐	AC	☒	DC	☐	Batteries	☐	Host -
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6.9.2 Electrical Power Information

Name	Type	Voltage		Frequency	Current	Notes
		min	max			
USB	DC	5	5	DC	0.5A	
Notes						

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