



Company: Shuanghe Electron Instrument Co., Ltd.
Model Tested: KA GMT Digital Remote Thermometer
Report Number: 22183
Project Number: 8411

166 South Carter, Genoa City, WI 53128

Code of Federal Regulations 47 Part 15 – Radio Frequency Devices

Subpart C – Intentional Radiators

Section 15.231(e)

Periodic operation in the band 40.66 - 40.70 MHz
and above 70 MHz

THE FOLLOWING MEETS THE ABOVE TEST SPECIFICATION

FCC ID: 2ACVG128DSOB

Formal Name: KA GMT Digital Remote Thermometer
Kind of Equipment: Wireless Cooking Thermometer
Frequency Range: 433.92MHz transmitter Model KN128DSOB
Test Configuration: Tabletop - battery operated device tested in operational position
Model Number(s): KN128DSOB
Model(s) Tested: KN128DSOB
Serial Number(s): none (Test Sample)
Date of Tests: September 6, 2016 and September 7, 2016
Test Conducted For: Shuanghe Electron Instrument Co., Ltd.
Dayin Industrial Park, Yuanqu Rd. 11#
Yuyao, Zhejiang, China 315423

NOTICE: "This test report relates only to the items tested and must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government". Please see the "Description of Test Sample" page listed inside of this report.

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Company: Shuanghe Electron Instrument Co., Ltd.
Model Tested: KA GMT Digital Remote Thermometer
Report Number: 22183
Project Number: 8411

166 South Carter, Genoa City, WI 53128

SIGNATURE PAGE

Tested By:

A handwritten signature in black ink that reads "Paul Leo".

Paul Leo
Test Engineer

Reviewed By:

A handwritten signature in black ink that reads "William Stumpf".

William Stumpf
OATS Manager

Approved By:

A handwritten signature in black ink that reads "Brian J. Mattson".

Brian Mattson
General Manager



Company: Shuanghe Electron Instrument Co., Ltd.
Model Tested: KA GMT Digital Remote Thermometer
Report Number: 22183
Project Number: 8411

166 South Carter, Genoa City, WI 53128

Table of Contents

i.	Cover Page	1
ii.	Signature Page	2
iii.	Table of Contents	3
iv.	NVLAP Certificate of Accreditation	4
1.0	Summary of Test Report	5
2.0	Introduction	5
3.0	Test Facilities	5
4.0	Description of Test Sample	6
5.0	Test Equipment	7
6.0	Test Arrangements	7
7.0	Test Conditions	8
8.0	Modifications Made To EUT For Compliance	8
9.0	Additional Descriptions	8
10.0	Results	8
11.0	Conclusion	8
	Appendix A – Test Photos	9
	Appendix B – Measurement Data	11
1.0	Emission Bandwidth – 20 dB	11
2.0	Duration of each transmission	13
3.0	Silent period between transmissions	15
4.0	Field Strength of Emissions – Fundamental and Spurious	17
5.0	Duty Cycle Correction	19
	Appendix C – Measurement Uncertainty	22



Company: Shuanghe Electron Instrument Co., Ltd.
Model Tested: KA GMT Digital Remote Thermometer
Report Number: 22183
Project Number: 8411

166 South Carter, Genoa City, WI 53128

United States Department of Commerce
National Institute of Standards and Technology



Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 100276-0

D.L.S. Electronic Systems, Inc.
Wheeling, IL

*is accredited by the National Voluntary Laboratory Accreditation Program for specific services,
listed on the Scope of Accreditation, for:*

Electromagnetic Compatibility & Telecommunications

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality
management system (refer to joint ISO-ILAC-IAF Communiqué dated January 2009).*

2015-09-25 through 2016-09-30

Effective Dates



For the National Voluntary Laboratory Accreditation Program



Company: Shuanghe Electron Instrument Co., Ltd.
Model Tested: KA GMT Digital Remote Thermometer
Report Number: 22183
Project Number: 8411

166 South Carter, Genoa City, WI 53128

1.0 Summary of Test Report

It was determined that the KA GMT Digital Remote Thermometer transmitter, Model KN128DSOB complies with the requirements of CFR 47 Part 15 Subpart C Section 15.231(e).

Subpart C Section 15.231 Applicable Technical Requirements Tested:

Section	Description	Procedure	Note	Compliant?
15.231(c)	20 dB Emission Bandwidth	ANSI C63.4-2014 & ANSI C63.10-2013	1	Yes
15.231(e)	Duration of Each Transmission	ANSI C63.4-2014 & ANSI C63.10-2013	1	Yes
15.231(e)	Silent Period Between Transmissions	ANSI C63.4-2014 & ANSI C63.10-2013	1	Yes
15.231(e) 15.205	Field Strength of Emissions -Fundamental & Spurious	ANSI C63.4-2014 & ANSI C63.10-2013	1	Yes
15.35(c)	Duty Cycle Correction for Pulsed operation	ANSI C63.4-2014 & ANSI C63.10-2013	1	Yes

Note 1: Radiated emission measurement.

2.0 Introduction

On September 6th and September 7th, 2016 the KA GMT Digital Remote Thermometer transmitter, Model KN128DSOB, as provided from Shuanghe Electron Instrument Co., Ltd. was tested to the requirements of CFR 47 Part 15 Subpart C Section 15.231(e). To meet these requirements, the procedures contained within this report were performed by personnel of D.L.S Electronic Systems, Inc.

3.0 Test Facilities

D.L.S. Electronic Systems, Inc. is a full service EMC/Safety Testing Laboratory accredited to ISO 17025. NVLAP Certificate and Scope can be viewed at <http://www.dlsemc.com/certificate>. Our facilities are registered with the FCC, Industry Canada, and VCCI.

Wisconsin Test Facility:

D.L.S. Electronic Systems, Inc.
166 S. Carter Street
Genoa City, Wisconsin 53128

Wheeling Test Facility:

D.L.S. Electronic Systems, Inc.
1250 Peterson Drive
Wheeling, IL 60090



Company: Shuanghe Electron Instrument Co., Ltd.
Model Tested: KA GMT Digital Remote Thermometer
Report Number: 22183
Project Number: 8411

166 South Carter, Genoa City, WI 53128

4.0 Description of Test Sample

Description:

The Digital Remote Thermometer device measures through a meat probe the temperature of meat while it is cooking and sends that information to a remotely located receiver to monitor the cooking procedure. The device transmits the result of any attempted match to the building network system using a 433.92MHz momentary transmission.

Type of Equipment / Frequency Range:

Transmitter for periodic operation / 433.92 MHz

Physical Dimensions of Equipment Under Test:

Length: 128mm x Width: 70mm x Height: 37mm

Power Source:

3.0 V DC (two 1.5 volt, size AAA batteries.)

Internal Frequencies:

32.768khz

Transmit / Receive Frequencies Used For Test Purpose:

433.88 MHz

Type of Modulation(s) / Antenna Type:

AM/ Printed Stub antenna 17.2cm

Description of Circuit Board(s) / Part Number:

Transmitter PCB	KA-B-Rev.6
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Company: Shuanghe Electron Instrument Co., Ltd.
Model Tested: KA GMT Digital Remote Thermometer
Report Number: 22183
Project Number: 8411

166 South Carter, Genoa City, WI 53128

5.0 Test Equipment

A list of the equipment used can be found in the table below. All primary equipment was calibrated against known reference standards with a verified traceable path to NIST.

D.L.S. Wisconsin – OATS 3 30 – 1000 MHz

Description	Manufacturer	Model Number	Serial Number	Frequency Range	Cal Date	Cal Due Dates
Receiver	Rohde & Schwarz	ESI 40	8375808/005	20 Hz – 40 GHz	6-23-16	6-23-17
Filter-High Pass	Mini-Circuits	NHP-600	1-0521	30MHz-7GHz	6-3-16	6-3-17
Antenna	EMCO	3104C	9701-4785	20 MHz – 200 MHz	2-16-16	2-16-17
Antenna	EMCO	3146	9702-4895	200 MHz – 1 GHz	2-4-16	2-4-17
Test Software	Rohde & Schwarz	ESK-1	V1.7.1	N/A	N/A	N/A

Additional if 1-18 GHz

Description	Manufacturer	Model Number	Serial Number	Frequency Range	Cal Date	Cal Due Dates
Preamp	Miteq	AMF-7D-01001800-22-10P	1809602	1GHz-18GHz	6-6-16	6-6-17
Filter-High-Pass	Q-microwave	100460	1	1-18GHz	8-1-16	8-1-17
Horn Antenna	EMCO	3115	9903-5731	1-18GHz	9-24-15	9-24-17
Test Software	Rohde & Schwarz	ESK-1	V1.7.1	N/A	N/A	N/A

6.0 Test Arrangements

Radiated Emissions Measurement Arrangement:

All radiated emission measurements were performed at D.L.S. Electronic Systems, Inc. and set up according to ANSI C63.4-2014 and ANSI C63.10-2013, unless otherwise noted. Description of procedures and measurements can be found in Appendix B – Measurement Data. See Appendix A for additional photos of the test set up.

Unless otherwise noted, the bandwidth of the measuring receiver / analyzer used during testing is shown below.

Frequency Range	Bandwidth (-6 dB)
30 MHz to 1 GHz	120 kHz
Above 1 GHz	1 MHz



Company: Shuanghe Electron Instrument Co., Ltd.
Model Tested: KA GMT Digital Remote Thermometer
Report Number: 22183
Project Number: 8411

166 South Carter, Genoa City, WI 53128

7.0 Test Conditions

Temperature and Humidity:

71°F at 59% RH

Battery Voltage:

3.0 VDC

8.0 Modifications Made To EUT For Compliance

None noted at time of test.

9.0 Additional Descriptions

This device uses circuit board antennas that are not user serviceable.

The EUT's normal operation is mostly in sleep mode with very infrequent transmit bursts. Testing was done with test firmware which allowed for a continuous modulated transmit signal.

10.0 Results

Measurements were performed in accordance with CFR 47 Part 15 Subpart C Section 15.231 and ANSI C63.10-2013. Graphical and tabular data can be found in Appendix B at the end of this report.

11.0 Conclusion

The KA GMT Digital Remote Thermometer transmitter, Model KN128DSOB as provided from Shuanghe Electron Instrument Co., Ltd., tested on September 6th and September 7th, 2016 **meets** the requirements of CFR 47 Part 15 Subpart C Section 15.231(e).



Company: Shuanghe Electron Instrument Co., Ltd.
Model Tested: KA GMT Digital Remote Thermometer
Report Number: 22183
Project Number: 8411

166 South Carter, Genoa City, WI 53128

Appendix A – Test Photos

Photo Information and Test Setup:

Item: EUT – KA GMT Digital Remote Thermometer transmitter





Company: Shuanghe Electron Instrument Co., Ltd.
Model Tested: KA GMT Digital Remote Thermometer
Report Number: 22183
Project Number: 8411

166 South Carter, Genoa City, WI 53128

Appendix A

Radiated Emissions – Above 1 GHz





Company: Shuanghe Electron Instrument Co., Ltd.
Model Tested: KA GMT Digital Remote Thermometer
Report Number: 22183
Project Number: 8411

166 South Carter, Genoa City, WI 53128

Appendix B – Measurement Data

1.0 Emission Bandwidth – 20 dB

Rule Part:

Section 15.231 (c)

Test Procedure:

ANSI C63.4-2014 and ANSI C63.10-2013

Limit:

Section 15.231 (c):

$$433.88 \text{ MHz} \times 0.25\% = 1.085 \text{ MHz}$$

Results:

Compliant
20 dB bandwidth: **11.42 kHz**

Sample Equation(s):

None

Notes:

This was a radiated emissions measurement. The maximum field strength of the emission was determined and the bandwidth was measured from the points at 20 dB down from the modulated carrier.



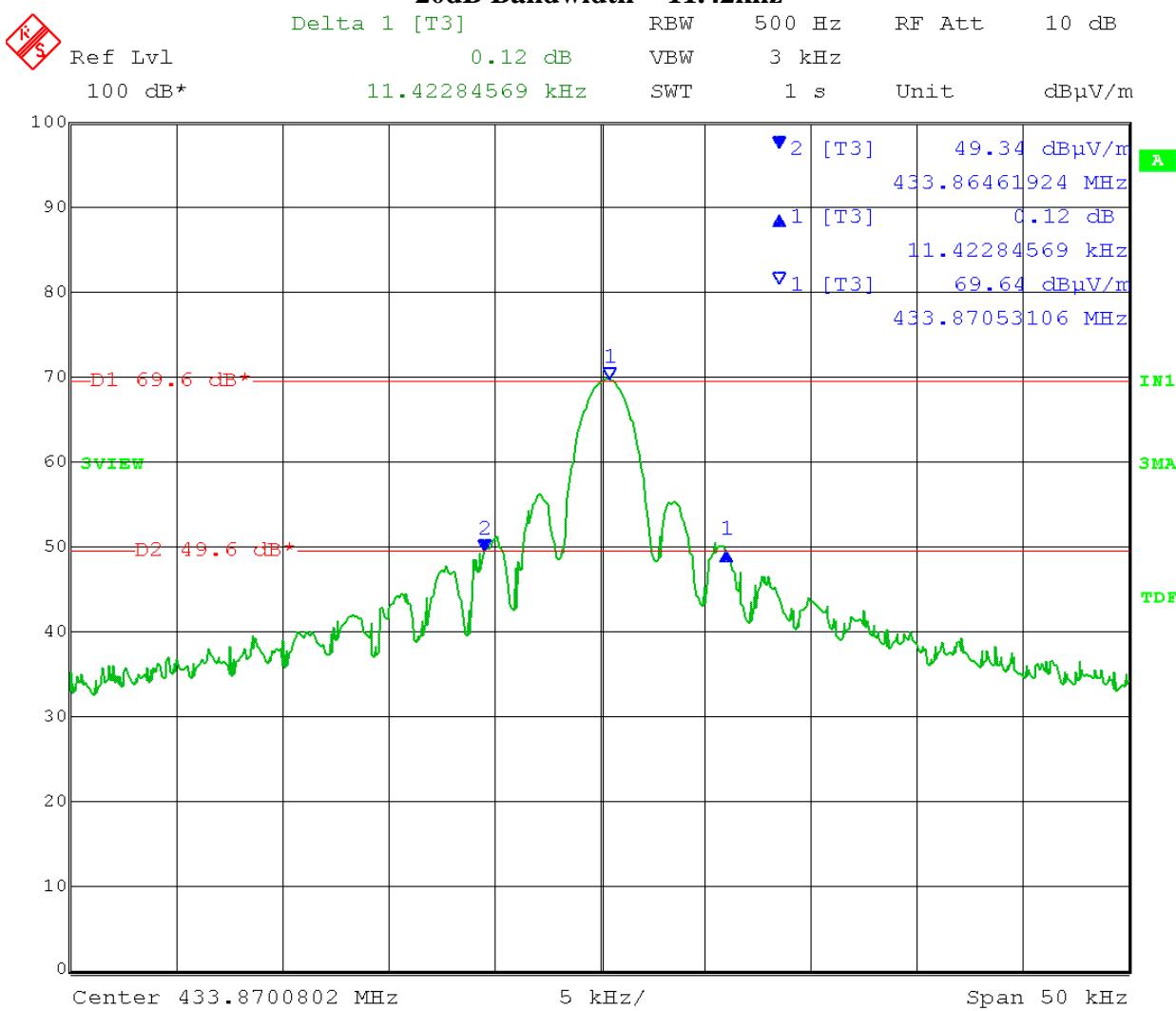
Company: Shuanghe Electron Instrument Co., Ltd.
Model Tested: KA GMT Digital Remote Thermometer
Report Number: 22183
Project Number: 8411

166 South Carter, Genoa City, WI 53128

Appendix B

Test Date: 09-06-2016
Company: Shuanghe Electron Instrument Co., Ltd.
EUT: KA GMT Digital Remote Thermometer transmitter
Test: 20db Bandwidth
Operator: Paul L
Rule Part: FCC Pt.15.231(c)
Comment: SPAN = 1.5 to 5 x OBW
RBW = 1% to 5% of OBW
VBW \geq 3 x RBW
Peak detector
Limit: 1.085 MHz

20dB Bandwidth = 11.42khz



Date: 6.SEP.2016 15:10:08



Company: Shuanghe Electron Instrument Co., Ltd.
Model Tested: KA GMT Digital Remote Thermometer
Report Number: 22183
Project Number: 8411

166 South Carter, Genoa City, WI 53128

Appendix B

2.0 Duration of each transmission

Rule Part:

15.231 (e)

Test Procedure:

ANSI C63.4-2014 and ANSI C63.10-2013

Limit:

The duration of each transmission shall not be greater than one second.

Results:

Compliant
Duration of each transmission = 741.48 ms.

Sample Equation(s):

None

Notes:

None



Company: Shuanghe Electron Instrument Co., Ltd.
Model Tested: KA GMT Digital Remote Thermometer
Report Number: 22183
Project Number: 8411

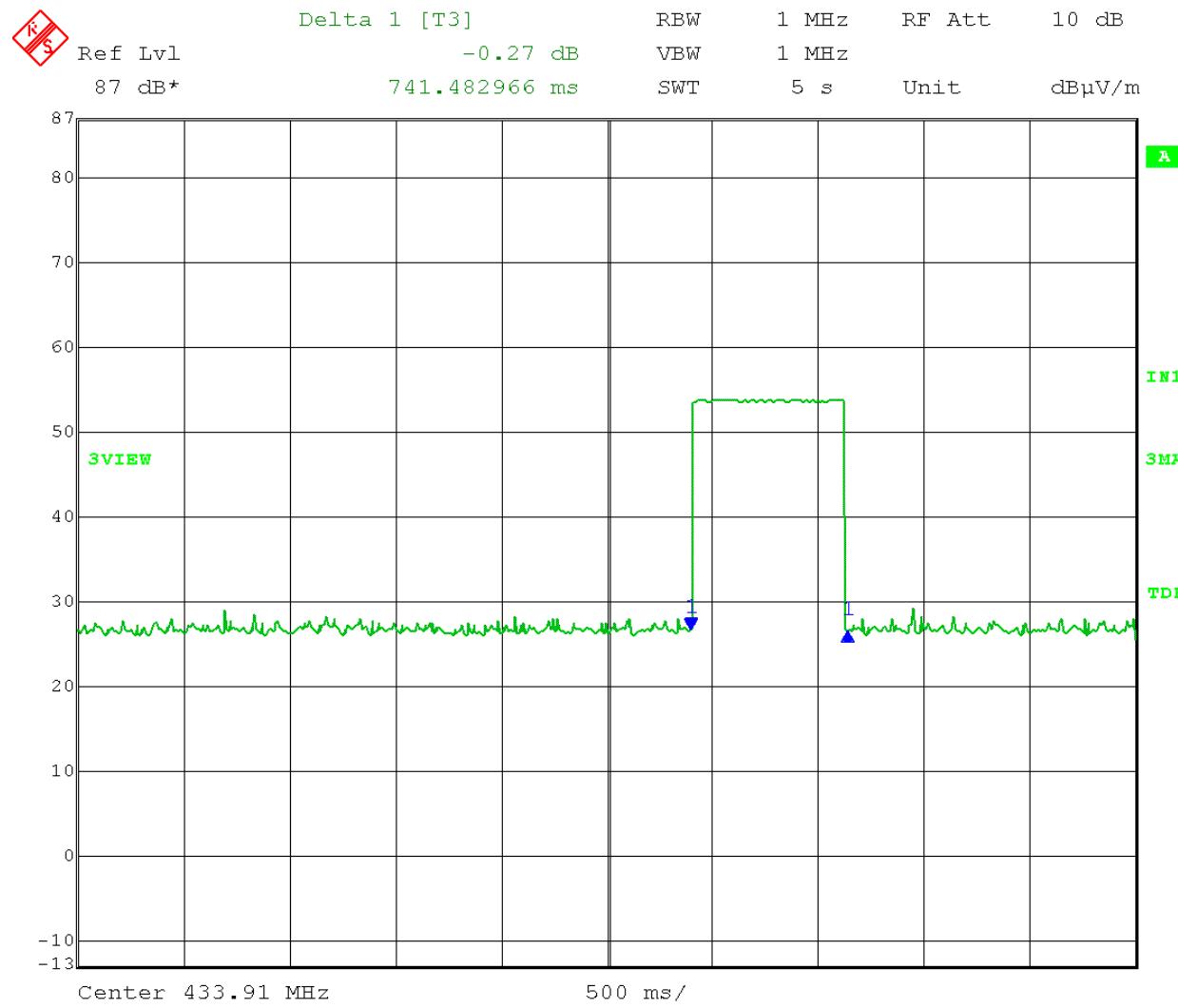
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Appendix B

Test Date: 09-06-2016
Company: Shuanghe Electron Instrument Co., Ltd.
EUT: KA GMT Digital Remote Thermometer transmitter
Test: Transmit Duration
Operator: Paul L
Rule Part: FCCPt.15.231e

Comment: Transmit duration shall be less than 1 second

Transmit duration = 741.48 ms



Date: 6.SEP.2016 12:14:55



Company: Shuanghe Electron Instrument Co., Ltd.
Model Tested: KA GMT Digital Remote Thermometer
Report Number: 22183
Project Number: 8411

166 South Carter, Genoa City, WI 53128

Appendix B

3.0 Silent period between transmissions

Rule Part:

15.231 (e)

Test Procedure:

ANSI C63.4-2014 and ANSI C63.10-2013

Limit:

The silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

Results:

Compliant
30 times the duration of the transmission = 22.23 seconds
Silent period between transmissions = 24.42 seconds.

Sample Equation(s):

$$30 \times 741 \text{ ms} = 22.23 \text{ seconds}$$

Notes:

None



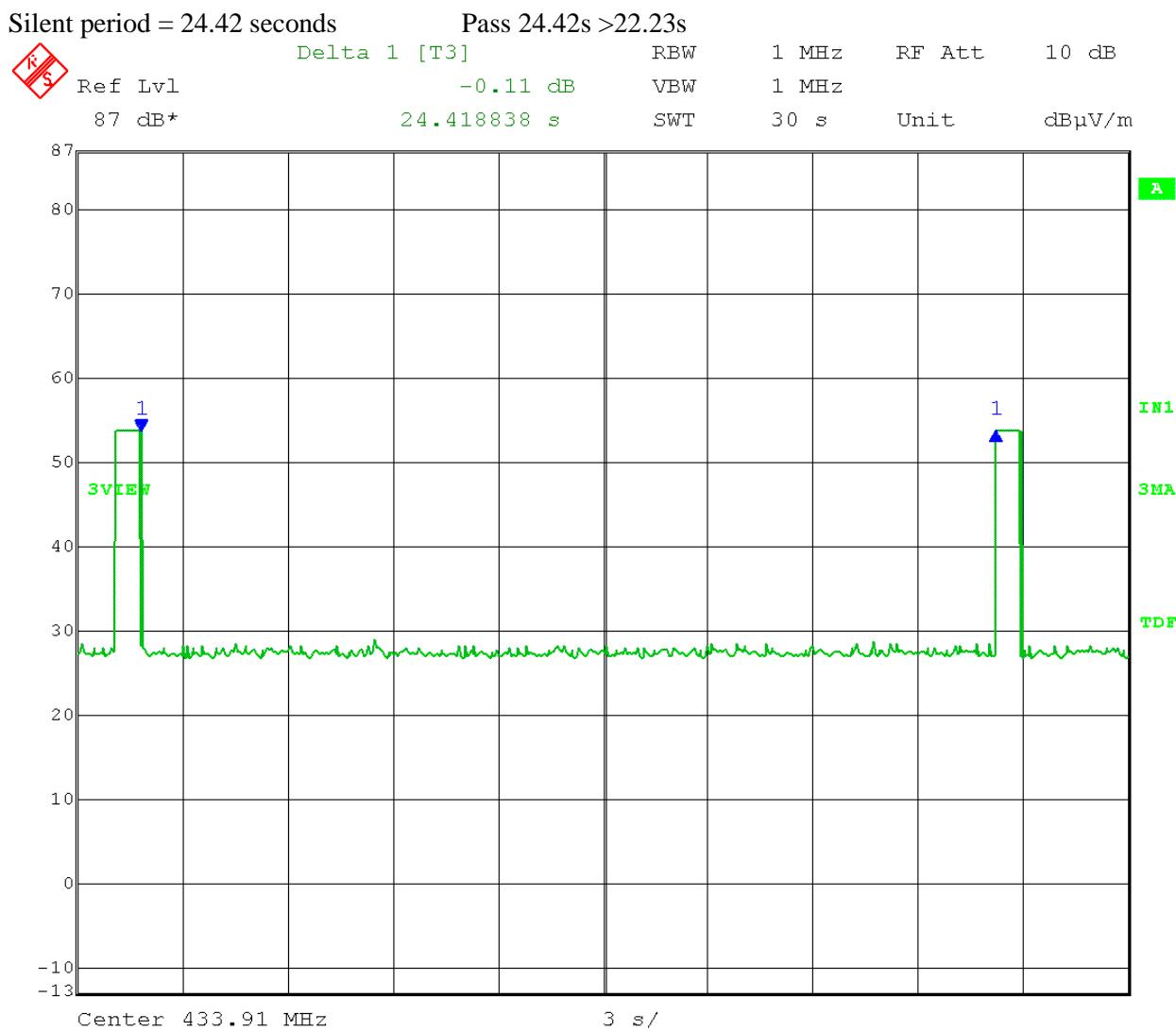
Company: Shuanghe Electron Instrument Co., Ltd.
Model Tested: KA GMT Digital Remote Thermometer
Report Number: 22183
Project Number: 8411

166 South Carter, Genoa City, WI 53128

Appendix B

Test Date: 09-06-2016
Company: Shuanghe Electron Instrument Co., Ltd.
EUT: KA GMT Digital Remote Thermometer transmitter
Test: Silent Period Between Transmissions
Operator: Paul L
Rule Part: FCCPt.15.231e, b3

Comment: Silent period between transmissions shall be at least 30 x transmit duration, but in no case less than 10 seconds. $30 \times 741 \text{ ms} = 22.23 \text{ seconds}$.



Date: 6.SEP.2016 12:28:25



Company: Shuanghe Electron Instrument Co., Ltd.
Model Tested: KA GMT Digital Remote Thermometer
Report Number: 22183
Project Number: 8411

166 South Carter, Genoa City, WI 53128

Appendix B

4.0 Field Strength of Emissions – Fundamental and Spurious

Rule Part:

15.231 (e) including 15.205

Test Procedure:

ANSI C63.4-2014 and ANSI C63.10-2013

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66-40.70	1,000	100
70-130	500	50
130-174	500 to 1,500 ¹	50 to 150 ¹
174-260	1,500	150
260-470	1,500 to 5,000 ¹	150 to 500 ¹
Above 470	5,000	500

¹ Linear interpolations.

Limit:

Fundamental (F) μ V/m at 3 meters: 4399.45 μ V/m at 3 meters at 433.88 MHz.

The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

Limit on Peak emissions is 20 dB above the average limits shown in the above table (from part 15.231(e)).

Results:

Compliant

Sample Equation(s):

$$20 * \log (4399.45) = 72.87 \text{ dB}\mu\text{V/m at 3 meters}$$

Final Corrected = Total Level - Duty Cycle Correction

Margin = Limit - Final Corrected

Level = Total Level - System Loss - Antenna Factor

Notes:

The emissions were measured of the fundamental and spurious at a distance of three meters between the EUT and the measuring antenna. Compliance is determined by comparing peak data, minus duty cycle correction, to the average limit.



Company: Shuanghe Electron Instrument Co., Ltd.
Model Tested: KA GMT Digital Remote Thermometer
Report Number: 22183
Project Number: 8411

166 South Carter, Genoa City, WI 53128

Radiated Fundamental and Spurious Emissions – 30 MHz to 4.5 GHz

Tested at a 3 Meter Distance

EUT: KA GMT Digital Remote Thermometer transmitter
Manufacturer: Shuanghe Electron Instrument Co., Ltd.
Operating Condition: 71 deg F; 59% R.H.
Test Site: Site 3
Operator: Paul L
Test Specification: FCC Pt. 15.231(e) FCC Pt.15.205
Comment: Transmit frequency: 433.88 MHz
Date: 09-06-2016
Notes: All other emissions at least 20 dB under the limit.

Frequency (MHz)	Measurement Type	Antenna Polarization	Level (dBuV)	Antenna Factor (dB/m)	System Loss (dB)	Duty Cycle Correction (dB)	Total Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	EUT Angle (deg)	Comment
433.88	Max Peak	Vert	57.30	16.60	4.1	0	78.0	92.87	14.9	1.50	180	Fundamental
433.88	Average	Vert	57.30	16.60	4.1	-16.55	61.5	72.87	11.4	1.50	180	Fundamental
433.88	Max Peak	Horz	65.60	16.60	4.1	0	86.3	92.87	6.6	1.00	135	Fundamental
433.88	Average	Horz	65.60	16.60	4.1	-16.55	69.8	72.87	3.1	1.00	135	Fundamental
867.76	Max Peak	Vert	23.54	22.86	6.5	0	52.9	74	21.1	1.00	170	Harmonic
867.76	Average	Vert	23.54	22.86	6.5	-16.55	36.4	54	17.7	1.00	170	Harmonic
867.76	Max Peak	Horz	24.24	22.86	6.5	0	53.6	74	20.4	1.00	0	Harmonic
867.76	Average	Horz	24.24	22.86	6.5	-16.55	37.1	54	17.0	1.00	0	Harmonic



Company: Shuanghe Electron Instrument Co., Ltd.
Model Tested: KA GMT Digital Remote Thermometer
Report Number: 22183
Project Number: 8411

166 South Carter, Genoa City, WI 53128

Appendix B

5.0 Duty Cycle Correction

Rule Part:

15.35 (c)

Test Procedure:

ANSI C63.4-2014 and ANSI C63.10-2013

Limit:

Informative

Results:

Duty Cycle correction = 16.55 dB

Sample Equation(s):

See data

Notes:

Compliance is determined by comparing peak data, minus duty cycle correction, to the average limit. Compliance with the provisions of section 15.205 is demonstrated using the measurement instrumentation specified in that section (Quasi-peak detector below 1 GHz, CISPR Average detector above 1 GHz).



Company: Shuanghe Electron Instrument Co., Ltd.
Model Tested: KA GMT Digital Remote Thermometer
Report Number: 22183
Project Number: 8411

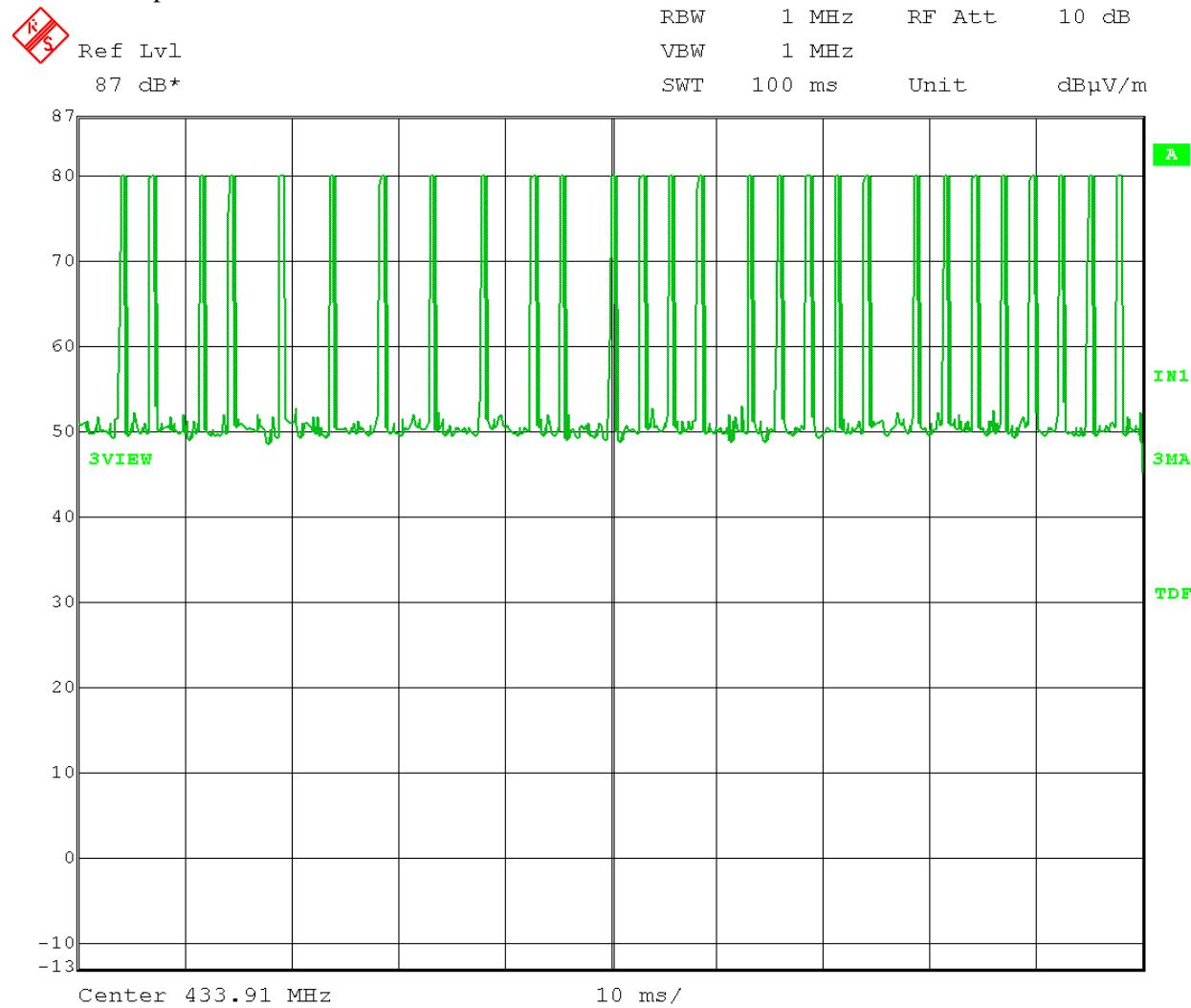
166 South Carter, Genoa City, WI 53128

Appendix B

Test Date: 09-06-2016
Company: Shuanghe Electron Instrument Co., Ltd.
EUT: KA GMT Digital Remote Thermometer transmitter
Test: Duty Cycle
Operator: Paul L

Comment: ON time of one pulse = 601.2 μ s
ON time during 100 mS = $28 \times 531.06 \mu$ s = 14.87 ms
Duty Cycle correction = $20 \log (14.87 / 100) = -16.55$ dB

100 ms sweep: 28 Pulses



Date: 6.SEP.2016 13:21:44



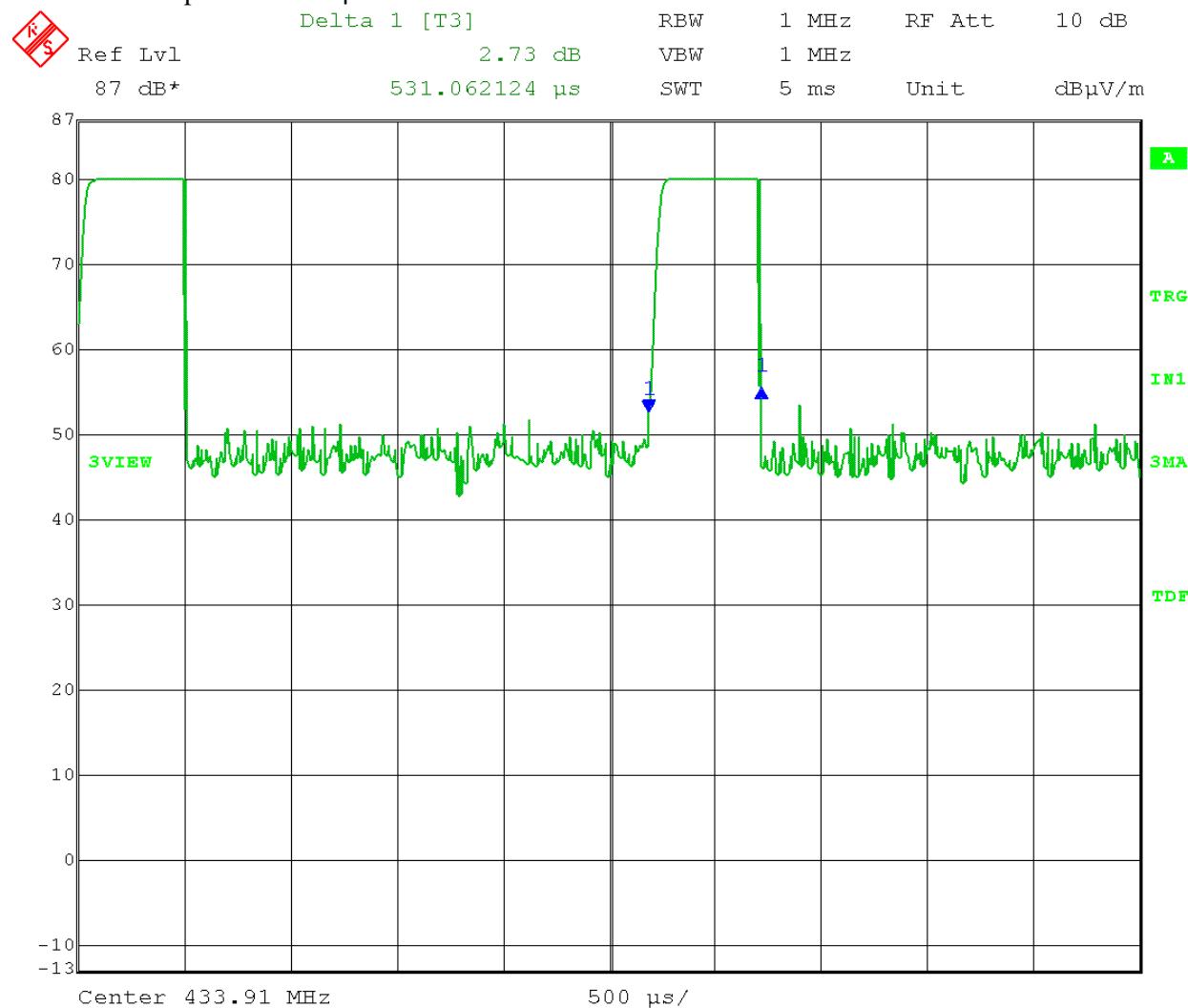
Company: Shuanghe Electron Instrument Co., Ltd.
Model Tested: KA GMT Digital Remote Thermometer
Report Number: 22183
Project Number: 8411

166 South Carter, Genoa City, WI 53128

Appendix B

Test Date: 09-06-2016
Company: Shuanghe Electron Instrument Co., Ltd.
EUT: KA GMT Digital Remote Thermometer transmitter
Test: Duty Cycle
Operator: Paul L
Comment: ON time of one pulse = 531.06 μ s
ON time during 100 mS = $26 \times 531.06 \mu$ s = 14.87 ms
Duty Cycle correction = $20 \log(14.87 / 100) = -16.55$ dB

On time of one pulse: 531.06 μ s



Date: 6.SEP.2016 13:24:01



Company: Shuanghe Electron Instrument Co., Ltd.
Model Tested: KA GMT Digital Remote Thermometer
Report Number: 22183
Project Number: 8411

166 South Carter, Genoa City, WI 53128

Appendix C – Measurement Uncertainty

Compliance with the limits in this standard are based on the results of the compliance measurement. Our calculated measurement uncertainty including the measurement instrumentation, associated connections between the various instruments in the measurement chain, and other contributions, are provided in this section of the test report.

Radiated Emissions from 30 MHz to 18 GHz

		Uncertainty (+ / - dB)								
		3M	3M	3M	3M	3M	3M	10M	10M	10M
Contribution	Probability Distribution	30-100MHz.	100-700MHz	700-1000MHz.	1- 4.5Ghz	4.5 - 7Ghz	7 - 18Ghz	30-100MHz.	100-700MHz.	700-1000MHz.
Combined Standard Uncertainty	Normal	1.70	1.62	1.66	2.13	2.48	2.85	1.64	1.58	1.66
Expanded Uncertainty	Normal (k=2)	3.40	3.23	3.33	4.26	4.95	5.69	3.29	3.16	3.31

Radiated Emission Substitution from 1 GHz to 18 GHz

		Uncertainty (+ / - dB)	Uncertainty (+ / - dB)	Uncertainty (+ / - dB)
		3M	3M	3M
Contribution	Probability Distribution	1- 4.5Ghz	4.5 - 7Ghz	7 - 18Ghz
Combined Standard Uncertainty	Normal	1.59	1.90	2.90
Expanded Uncertainty	Normal (k=2)	3.19	3.80	4.17



Company: Shuanghe Electron Instrument Co., Ltd.
Model Tested: KA GMT Digital Remote Thermometer
Report Number: 22183
Project Number: 8411

166 South Carter, Genoa City, WI 53128

END OF REPORT

Revision #	Date	Comments	By
1.0	9-9-2016	Preliminary Release	PL
1.1	9-10-2016	Minor typo and layout corrections	CB
1.2	9-10-2016	Added measurement uncertainty	CB