Measurement of RF Emissions from a LED Decorative Fixture with RF Communication
Model No. 4700 Transmitter

For	HeathCo LLC 2445 Nashville Rd Bowling Green, KY 42102
P.O. Number	M001849
Date Tested	July 23 and 24, 2018
Test Personnel	Richard King
Test Specification	FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.249 for Digital Modulation Intentional Radiators Operating within the bands 902-928MHz Industry Canada RSS-GEN Industry Canada RSS-210

Test Report By: Richard E. King

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TABLE OF CONTENTS

TABLE OF CONTENTS

REVISION HISTORY

Revision	Date	Description
—	10 AUG 2018	Initial release

Measurement of RF Emissions from a LED Decorative Fixture with RF Communication, Model No. 4700 Transmitter

1. INTRODUCTION

1.1. Scope of Tests

This report represents the results of the series of radio interference measurements performed on a HeathCo LLC LED Decorative Fixture with RF Communication, Model No. 4700 transmitter (hereinafter referred to as the EUT). The EUT is a digital modulation transmitter. The transmitter was designed to transmit in the 902-928 MHz band using an internal antenna. The EUT was manufactured and submitted for testing by HeathCo LLC located in Bowling Green, KY.

1.2. Purpose

The test series was performed to determine if the EUT meets the conducted and radiated RF emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 15.207 and 15.249 for Intentional Radiators. The test series was also performed to determine if the EUT meets the conducted RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen, Section 7.2.4 and the radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-210, Annex 8 for transmitters. Testing was performed in accordance with ANSI C63.4-2014.

1.3. Deviations, Additions and Exclusions

There were no deviations, additions to, or exclusions from the test specification during this test series.

1.4. EMC Laboratory Identification

This series of tests was performed by Elite Electronic Engineering Incorporated of Downers Grove, Illinois. The laboratory is accredited by The American Association for Laboratory Accreditation (A2LA). A2LA Certificate Number: 1786.01.

1.5. Laboratory Conditions

The temperature at the time of the test was 23.5^{o}C and the relative humidity was 35%.

2. APPLICABLE DOCUMENTS

The following documents of the exact issue designated form part of this document to the extent specified herein:

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 15, Subpart C
- ANSI C63.4-2014, "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"
- Federal Communications Commission Office of Engineering and Technology Laboratory Division Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under Section 15.247, October 4, 2012
- Industry Canada Radio Standards Specification, RSS-Gen, “General Requirements for Compliance of Radio Apparatus”, Issue 5, April 2018
- Industry Canada Radio Standards Specification, RSS-210, “License-Exempt Radio Apparatus: Category I Equipment”, Issue 9, November 2017

3. EUT Setup and Operation

3.1. General Description

The EUT is a HeathCo LLC LED Decorative Fixture with RF Communication, Model No. 4700. A block diagram of the EUT setup is shown as Figure 1. A photograph of the EUT is shown as Figure 2.

3.1.1. Power Input

The EUT obtained 115V 60Hz power via a 2-wire, 2m, unshielded power cord.

3.1.2. Grounding

The EUT was ungrounded during the tests.

3.2. Operational Mode

For all tests, the EUT was placed on an 80cm high non-conductive stand. The EUT was energized. The unit was programmed to operate in one of the following modes:

- Transmit at 915MHz

Normal Operation – The EUT is powered on and set to transmit at 915MHz. The lightbulb on the unit was not powered.

3.3. EUT Modifications

No modifications were required for compliance to the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 15.207 and 15.249.

4. Test Facility and Test Instrumentation

4.1. Shielded Enclosure

All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. With the exception of the floor, the reflective surfaces of the shielded chamber are lined with ferrite tiles on the walls and ceiling. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2014 for site attenuation.

4.2. Test Instrumentation

The test instrumentation and auxiliary equipment used during the tests are listed in Table 9-1.

Conducted and radiated emission measurements were performed with a spectrum analyzer. This receiver allows measurements with the bandwidths and detector functions specified by the FCC.

4.3. Calibration Traceability

Test equipment is maintained and calibrated on a regular basis with a calibration interval not greater than two years. All calibrations are traceable to the National Institute of Standards and Technology (NIST).

4.4. Measurement Uncertainty

All measurements are an estimate of their true value. The measurement uncertainty characterizes, with a specified confidence level, the spread of values which may be possible for a given measurement system.

Values of Expanded Measurement Uncertainty (95% Confidence) are presented below:

Measurement Type	Expanded Measurement Uncertainty
Conducted disturbance (mains port) (150 kHz – 30 MHz)	2.7
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 6 GHz)	3.1
Radiated disturbance (electric field strength on an open area test site or alternative test site) (6 GHz – 18 GHz)	3.2

5. TEST PROCEDURES

5.1. Powerline Conducted Emissions

5.1.1. Requirements

Per the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Per 15.207(a) and Industry Canada RSS-Gen section 7.2.4, all radio frequency voltages on the power lines of a transmitter shall be below the values shown below when using a quasi-peak or average detector:

Frequency MHz	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 – 0.5	66 decreasing with logarithm of frequency to 56	56 decreasing with logarithm of frequency to 46
0.5 – 5	56	46
5 – 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.
Note 2: If the levels measured using the QP detector meet both the QP and the Average limits, the EUT is considered to have met both requirements and measurements do not need to be performed using the Average detector.

5.1.2. Procedures

The interference on each power lead of the EUT was measured by connecting the measuring equipment to the appropriate meter terminal of the Line Impedance Stabilization Network (LISN). The meter terminal of the LISN not under test was terminated with 50 ohms.

1) The EUT was operated in the Normal Operation mode.
2) Measurements were first made on the 120VAC high line.
3) The frequency range from 150 kHz to 30 MHz was broken up into smaller frequency sub-bands.
4) Conducted emissions measurements were taken on the first frequency sub-band using a peak detector.
5) The data thus obtained was then searched by the computer for the highest levels. Any emissions levels that were within 10dB of the average limit were then measured again using both a quasi-peak detector and an average detector. (If no peak readings were within 10dB of the average limit, quasi-peak and average readings were taken on the highest emissions levels measured during the peak detector scan.)

6) Steps (4) and (5) were repeated for the remainder of the frequency sub-bands until the entire frequency range from 150kHz to 30MHz was investigated. The peak trace was automatically plotted. The plot also shows quasi-peak and average readings that were taken on discrete frequencies. A table showing the quasi-peak and average readings was also generated. This tabular data compares the quasi-peak and average conducted emissions to the applicable conducted emissions limits.
7) Steps (3) through (6) were repeated on the 120VAC neutral line.

5.1.3. Results

The plots and tabular data of the peak, quasi-peak, and average conducted voltage levels acquired from each input power line with the EUT operated in the Normal Operation mode are shown on pages 18 through 21. All power line conducted emissions measured from the EUT were within the specification limits.

Photographs of the test configuration which yielded the highest or worst case, conducted emission levels are shown in Figure 3.

5.2. 99% Bandwidth

5.2.1. Requirement

The 99% bandwidth for devices operating above 900MHz shall be within the 902-928MHz band.

5.2.2. Procedures

The EUT was setup inside the chamber. The EUT was allowed to transmit continuously. The transmit channel was set separately to low, middle, and high channels. The resolution bandwidth (RBW) was set to 100kHz and the span was set to greater than the RBW.

The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined. The analyzer's display was plotted using a 'screen dump' utility.

5.2.3. Results

The plot on page 22 shows that the 99% bandwidth was measured to be 397.6kHz, which is within the 902-928MHz band.

5.3. Duty Cycle Factor Measurements

5.3.1. Requirements

Unless otherwise specified, when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

5.3.2. Procedures

1) The EUT was placed on the non-conductive stand and set to transmit continuously.
2) A double ridged waveguide antenna was positioned at a 3 meter distance from the EUT. The output of the antenna was connected to the input of a spectrum analyzer.
3) The center frequency of the spectrum analyzer was set to the transmit frequency of the EUT.
4) The frequency span of the spectrum analyzer was set to 0Hz so that the time domain trace of the transmitted pulse of the EUT was displayed on the spectrum analyzer.
5) The sweep time of the spectrum analyzer was adjusted so that the beginning and end of a single

pulse could be seen on the display of the spectrum analyzer.

6) The single sweep function of the spectrum analyzer was used multiple times to determine the maximum pulse width of the EUT.
7) The maximum pulse width display of the spectrum analyzer was recorded and then plotted using a 'screen dump' utility.
8) The sweep time of the spectrum analyzer was then adjusted to 100msec.
9) The single sweep function of the spectrum analyzer was used multiple times to determine the maximum number of transmitted pulses that occurred in a 100msec time period.
10) The maximum number of pulses transmitted in a 100msec time period was recorded and then plotted using a 'screen dump' utility.
11) The duty cycle correction was calculated using the following equation:

Duty Cycle Correction Factor (dB) = D.C. (dB)
D.C. (dB) = 20 x log [((pulse width (msec)) x (#pulses in a 100msecperiod)) / 100msec]

5.3.3. Results

Duty cycle plots are shown on pages 23 and 24. The EUT transmits a 7.2mS pulse followed by a 2.9mS pulse every 16mS (word). Since the word is less than 100msec long, the duty cycle factor was computed over the word interval. This results in a duty cycle correction factor of -4.0dB.

5.4. Radiated Emissions Measurements

5.4.1. Requirements

Per section 15.249(a), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Frequency MHz	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	250

5.4.2. Procedures

All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. The walls and ceiling of the shielded chamber are lined with ferrite tiles. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2014 for site attenuation.

The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All powerlines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals from entering the enclosure on these leads.

Preliminary radiated emissions tests were performed to determine the emission characteristics of the EUT. For the preliminary test, a broadband measuring antenna was positioned at a 3 meter distance from the EUT. The entire frequency range from 30MHz to 10.0GHz was investigated using a peak detector function.

The final emission tests were then manually performed over the frequency range of 30MHz to 10.0GHz.

1) For all emissions, the following procedure was used:
   a) The field strengths of all emissions below 1 GHz were measured using a bi-log antenna. The bi-log antenna was positioned at a 3 meter distance from the EUT. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.
   b) The field strengths of all emissions above 1 GHz were measured using a double-ridged waveguide

antenna. The waveguide antenna was positioned at a 3 meter distance from the EUT. A peak detector with a resolution bandwidth of 1 MHz was used on the spectrum analyzer.

c) To ensure that maximum or worst case emission levels were measured, the following steps were taken when taking all measurements:
   i) The EUT was rotated so that all of its sides were exposed to the receiving antenna.
   ii) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
   iii) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.
   iv) In instances where it was necessary to use a shortened cable between the measuring antenna and the spectrum analyzer, the measuring antenna was not raised or lowered to ensure maximized readings. Instead the EUT was rotated through all axes to ensure the maximum readings were recorded for the EUT.
d) For all radiated emissions measurements below 1 GHz, if the peak reading is below the limits listed in 15.249(a), no further measurements are required. If however, the peak readings exceed the limits listed in 15.249(a), then the emissions are remeasured using a quasi-peak detector.
e) For all radiated emissions measurements above 1 GHz, the peak readings must comply with the 15.35(b) limits. 15.35(b) states that when average radiated emissions measurements are specified, there also is a limit on the peak level of the radiated emissions. The limit on the peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. Therefore, all peak readings above 1 GHz must be no greater than 20 dB above the limits specified in 15.249(a).
f) Next, for all radiated emissions measurements above 1GHz, the resolution bandwidth was set to 1MHz. Since the emission is pulsed, the reading were adjusted by the “duty cycle correction factor” derived from 20*log(on time/100msec). These readings must be no greater than the limits specified in 15.249(a).

5.4.3. Results

Preliminary radiated emissions plots with the EUT transmitting at 915MHz are shown on pages 25 through 30. Final radiated emissions data are presented on data pages 31 and 32. As can be seen from the data, all emissions measured from the EUT were within the specification limits.

Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown in Figures 4 and 5.

5.5. Band Edge Compliance

5.5.1. Requirement

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

5.5.2. Procedures

5.5.2.1 Full Band Edge

1) The EUT was setup inside the test chamber on a non-conductive stand.
2) A broadband measuring antenna was placed at a test distance of 3 meters from the EUT.
3) The EUT was set to transmit continuously.
4) The EUT was maximized for worst case emissions at the measuring antenna. The maximum peak meter reading was recorded.
5) To determine the band edge compliance, the peak total in dBuV/m was compared to the QP total limit is dBuV/m.
6) A plot of the emission as compared to the operational band is show with the following settings:
   a) Center frequency = transmitter frequency.
   b) Span = Wide enough to capture the peak level of the emission operating on the

channel closest to the band-edges, as well as any modulation products which fall outside of the authorized band of operation.

c) The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
d) The marker was set on the peak of the in-band emissions. A display line was placed 20dB down from the peak of the in-band emissions. The display line is only shown for reference. All emissions which fall outside of the authorized band of operation must be 50dB down or to the general limit.
e) The analyzer's display was plotted using a 'screen dump' utility.

5.5.3. Results

Pages 33 and 34 show the radiated band-edge compliance results. As can be seen from data, the emissions at the low end band-edge and the high end band-edge are within the general limits.

6. Other Test Conditions

6.1. Test Personnel and Witnesses

All tests were performed by qualified personnel from Elite Electronic Engineering Incorporated. The test series was witnessed by HeathCo LLC personnel.

6.2. Disposition of the EUT

The EUT and all associated equipment were returned to HeathCo LLC upon completion of the tests.

7. Conclusions

It was determined that the HeathCo LLC LED Decorative Fixture with RF Communication, Model No. 4700 digital modulation transmitter did fully meet the conducted and radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 15.207 and 15.249 for Intentional Radiators Operating within the 902-928 MHz band, when tested per ANSI C63.4-2014.

It was also determined that the HeathCo LLC LED Decorative Fixture with RF Communication, Model No. 4700 digital modulation transmitter did fully meet the conducted and radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen Section 7.2.4 and RSS-210 Annex 8, for transmitters, when tested per ANSI C63.4-2014.

8. Certification

Elite Electronic Engineering Incorporated certifies that the information contained in this report was obtained under conditions which meet or exceed those specified in the test specifications.

The data presented in this test report pertains to the EUT at the test date as operated by HeathCo LLC personnel. Any electrical or mechanical modification made to the EUT subsequent to the specified test date will serve to invalidate the data and void this certification.

This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the Federal Government.

9. EQUIPMENT LIST

Table 9-1 Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
APW10	PREAMPLIFIER	PMI	PE2-35-120-5R0-10-12-SFF	PL9609/1139	1GHZ-20GHZ	4/5/2018	4/5/2019
NTA3	BILOG ANTENNA	TESEQ	6112D	32853	25-1000MHz	9/11/2017	9/11/2018
NWQ0	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3117	66657	1GHZ-18GHZ	5/31/2018	5/31/2020
PLF2	CISPR16 50UH LISN	ELITE	CISPR16/70A	002	.15-30MHz	5/7/2018	5/7/2019
PLF4	CISPR16 50UH LISN	ELITE	CISPR16/70A	003	.15-30MHz	5/7/2018	5/7/2019
RBG2	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101591	2HZ-44GHZ	2/23/2018	2/23/2019
RBJ2	EMI RECEIVER	ROHDE & SCHWARZ	ESW8	100987	2HZ-8GHZ	1/18/2018	1/18/2019
T1E1	10DB 25W ATTENUATOR	WEINSCHEL	46-10-43	AU1883	DC-18GHZ	6/28/2018	6/28/2020
XPQ2	HIGH PASS FILTER	K&L MICROWAVE	4IH30-1804/T10000-0	3	1.8-10GHZ	9/12/2017	9/12/2019

I/O: Initial Only
N/A: Not Applicable
Note 1: For the purpose of this test, the equipment was calibrated over the specified frequency range, pulse rate, or modulation prior to the test or monitored by a calibrated instrument.

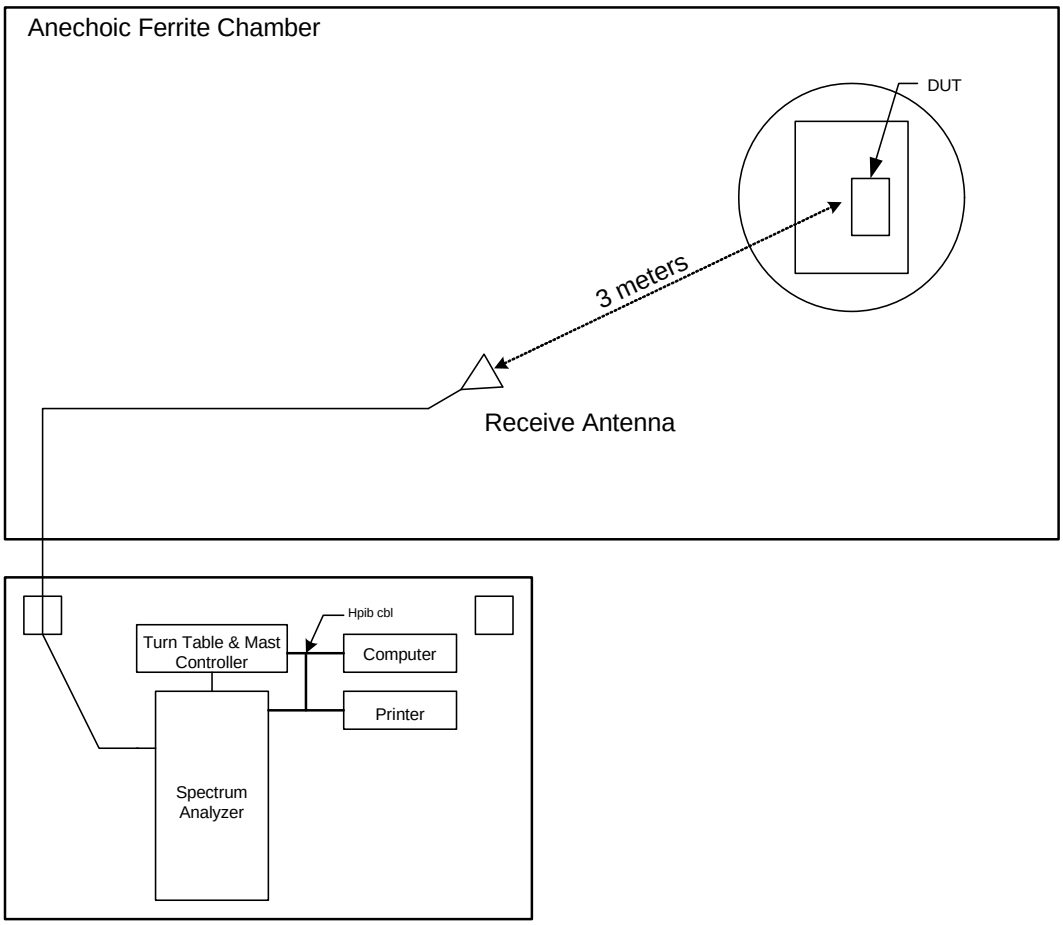
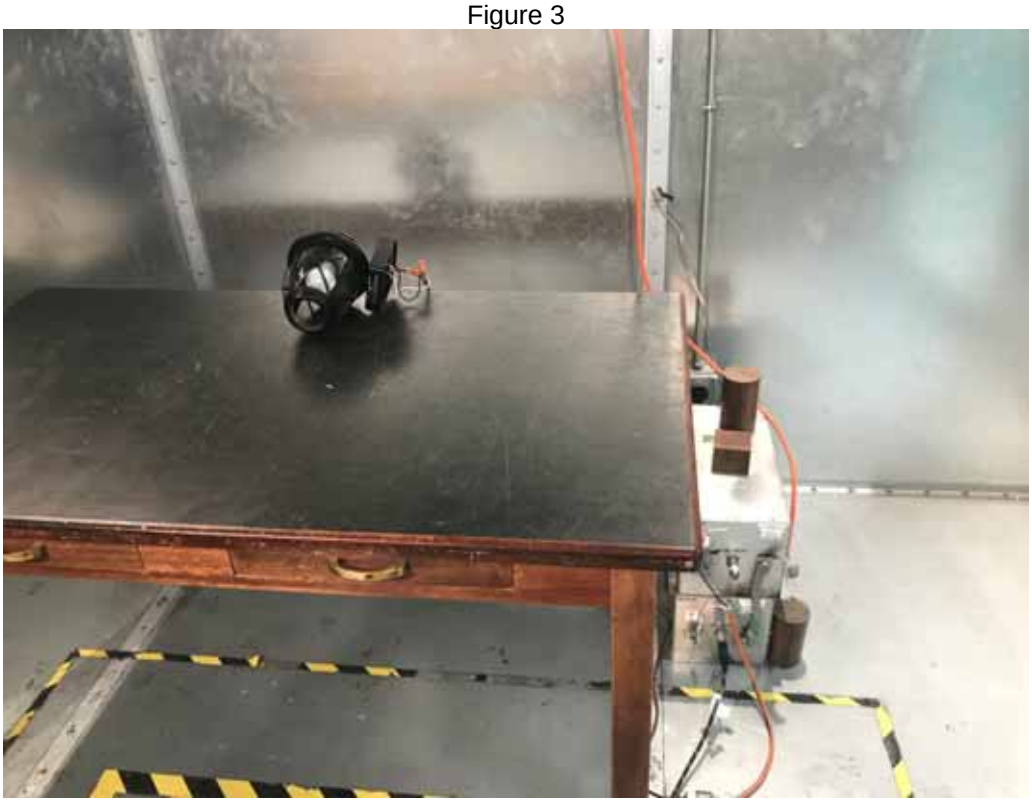


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

Figure 2

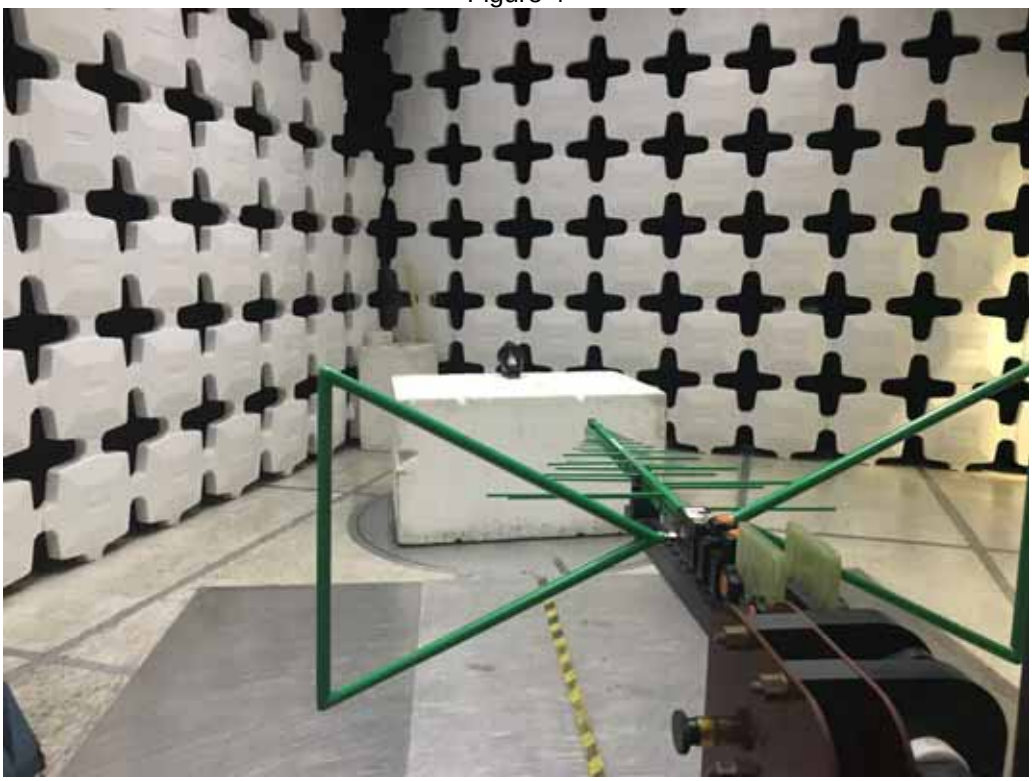
Photograph of EUT

Figure 3



Test Setup for Conducted Emissions

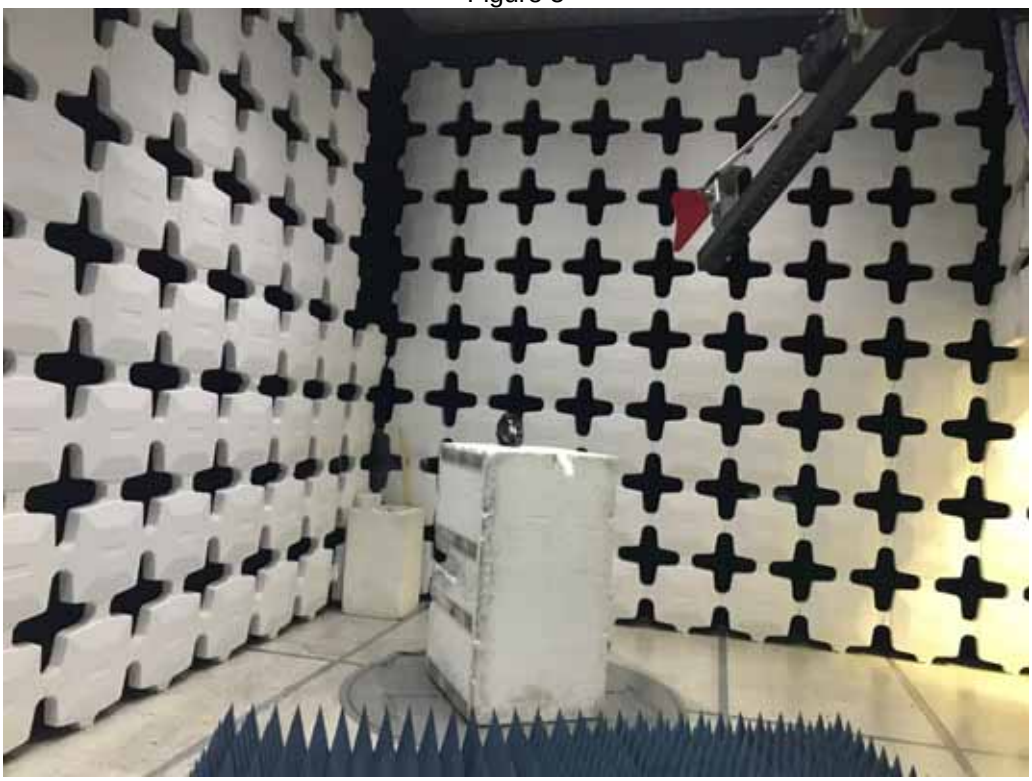
Figure 4



Test Setup for Radiated Emissions, 30MHz to 1GHz – Horizontal Polarization

Test Setup for Radiated Emissions, 30MHz to 1GHz – Vertical Polarization

Figure 5



Test Setup for Radiated Emissions, 1 to 10GHz – Horizontal Polarization

Test Setup for Radiated Emissions, 1 to 10GHz – Vertical Polarization

FCC Part 15 Subpart B Conducted Emissions Test

Significant Emissions Data

VBR8 04/23/2015

Manufacturer	:	HeathCo
Model	:	4700
Serial Number	:	#8
DUT Mode	:	Tx @ 915MHz
Line Tested	:	L1
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-1
Notes	:	FULL
Test Engineer	:	R. King
Limit	:	Class B
Test Date	:	Jul 23, 2018 10:49:53 AM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 1 dB margin below limit

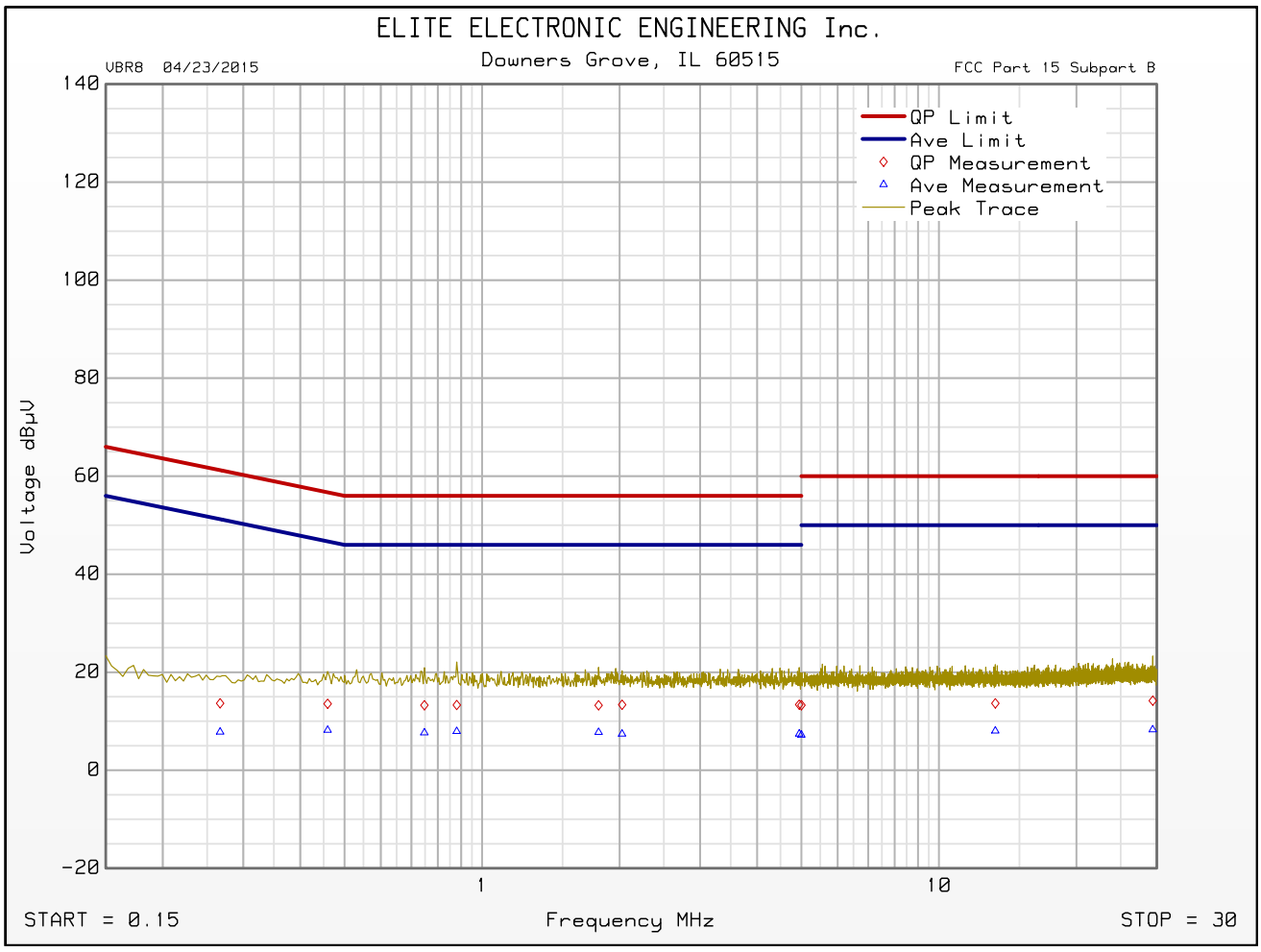
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.267	13.7	61.2		7.8	51.2	
0.459	13.6	56.7		8.2	46.7	
0.748	13.3	56.0		7.7	46.0	
0.880	13.3	56.0		8.0	46.0	
1.799	13.3	56.0		7.8	46.0	
2.025	13.4	56.0		7.4	46.0	
4.945	13.4	56.0		7.4	46.0	
5.000	13.3	56.0		7.2	46.0	
13.289	13.7	60.0		8.0	50.0	
29.381	14.2	60.0		8.3	50.0	

FCC Part 15 Subpart B Conducted Emissions Test

Cumulative Data

VBR8 04/23/2015

Manufacturer	:	HeathCo
Model	:	4700
Serial Number	:	#8
DUT Mode	:	Tx @ 915MHz
Line Tested	:	L1
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-1
Notes	:	FULL
Test Engineer	:	R. King
Limit	:	Class B
Test Date	:	Jul 23, 2018 10:49:53 AM



Emissions Meet QP Limit
Emissions Meet Ave Limit

FCC Part 15 Subpart B Conducted Emissions Test

Significant Emissions Data

VBR8 04/23/2015

Manufacturer	:	HeathCo
Model	:	4700
Serial Number	:	#8
DUT Mode	:	Tx @ 915MHz
Line Tested	:	L2
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-1
Notes	:	FULL
Test Engineer	:	R. King
Limit	:	Class B
Test Date	:	Jul 23, 2018 10:43:25 AM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 1 dB margin below limit

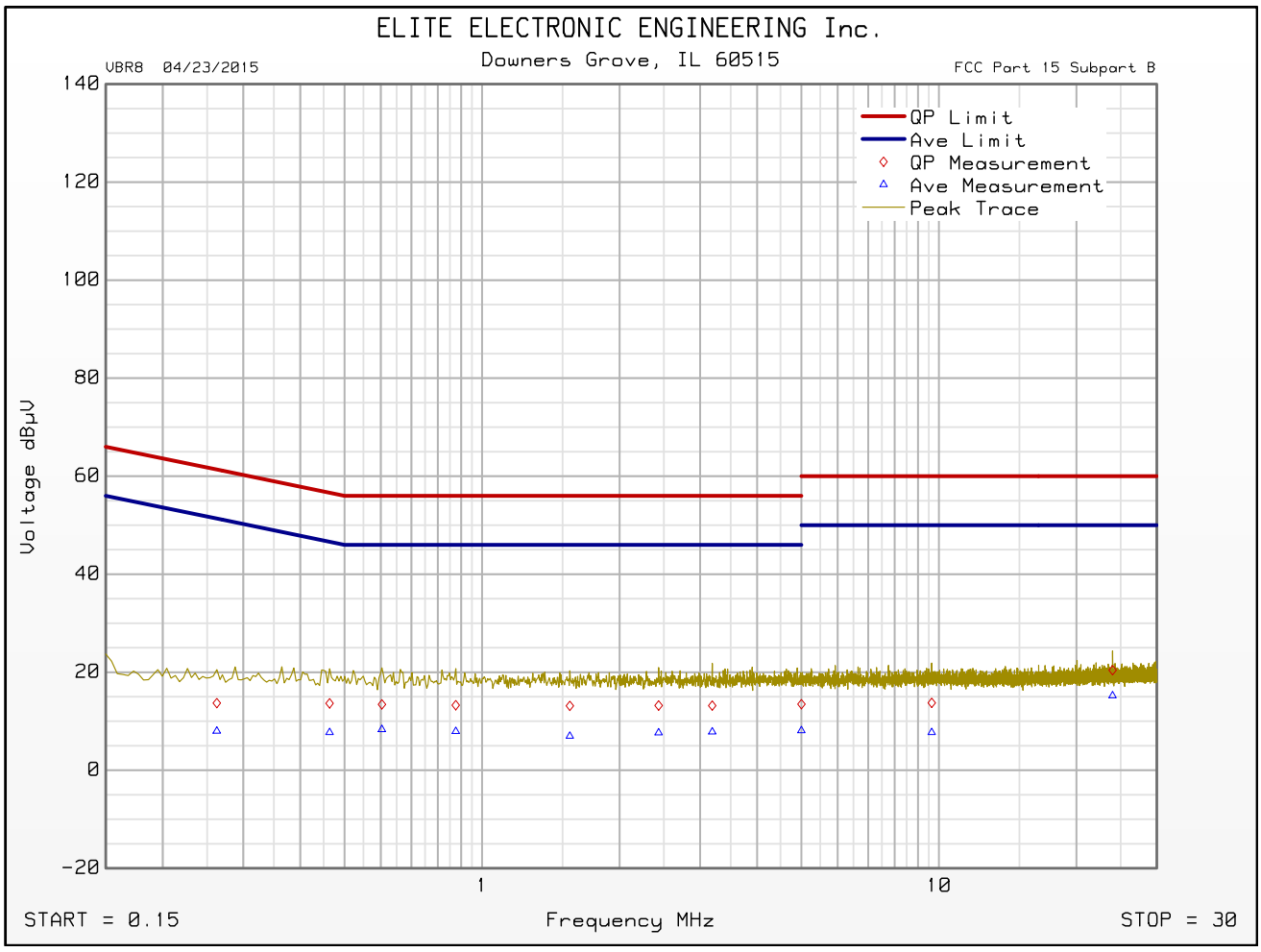
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.263	13.7	61.4		8.0	51.4	
0.464	13.7	56.6		7.7	46.6	
0.604	13.4	56.0		8.3	46.0	
0.876	13.3	56.0		7.9	46.0	
1.556	13.1	56.0		7.0	46.0	
2.435	13.2	56.0		7.7	46.0	
5.000	13.5	56.0		8.1	46.0	
9.644	13.8	60.0		7.7	50.0	
23.999	20.4	60.0		15.2	50.0	

FCC Part 15 Subpart B Conducted Emissions Test

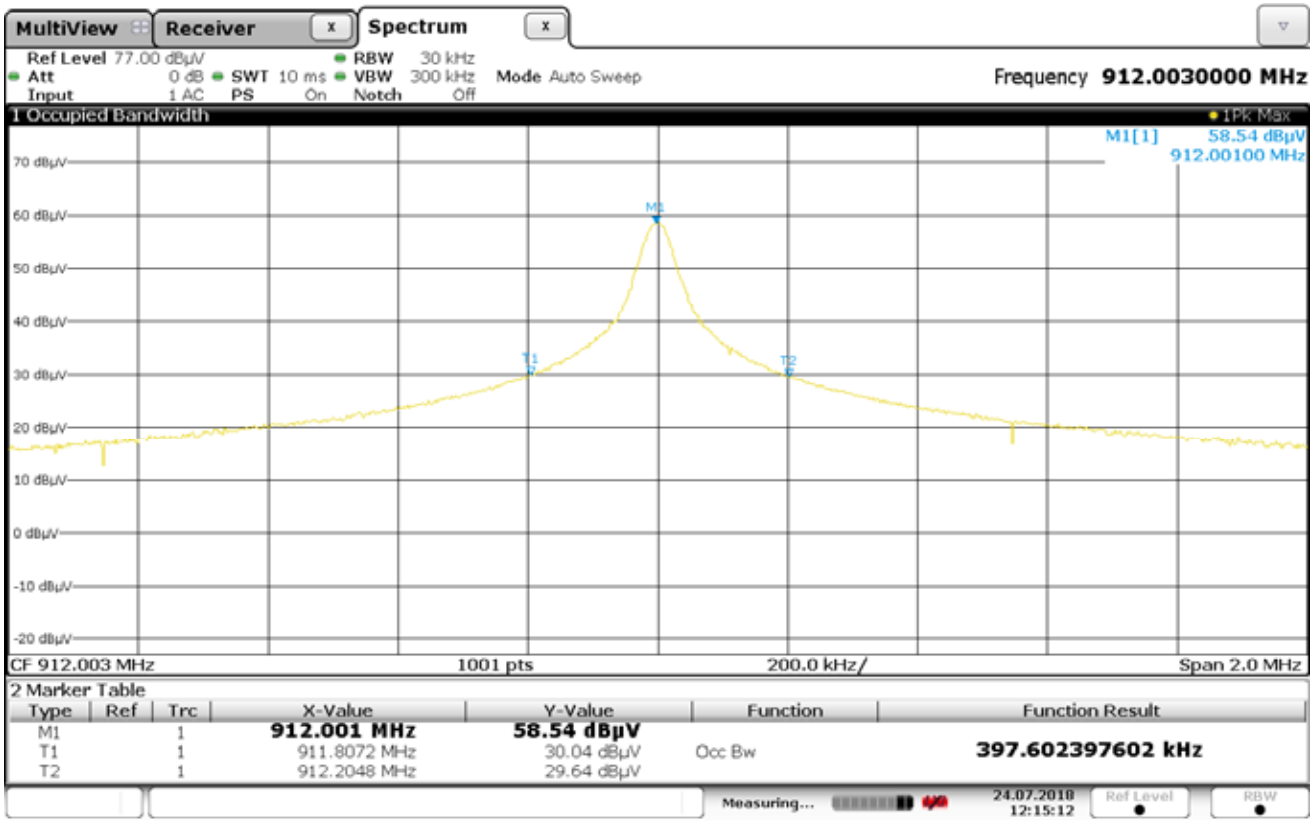
Cumulative Data

VBR8 04/23/2015

Manufacturer	:	HeathCo
Model	:	4700
Serial Number	:	#8
DUT Mode	:	Tx @ 915MHz
Line Tested	:	L2
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-1
Notes	:	FULL
Test Engineer	:	R. King
Limit	:	Class B
Test Date	:	Jul 23, 2018 10:43:25 AM



Emissions Meet QP Limit
Emissions Meet Ave Limit



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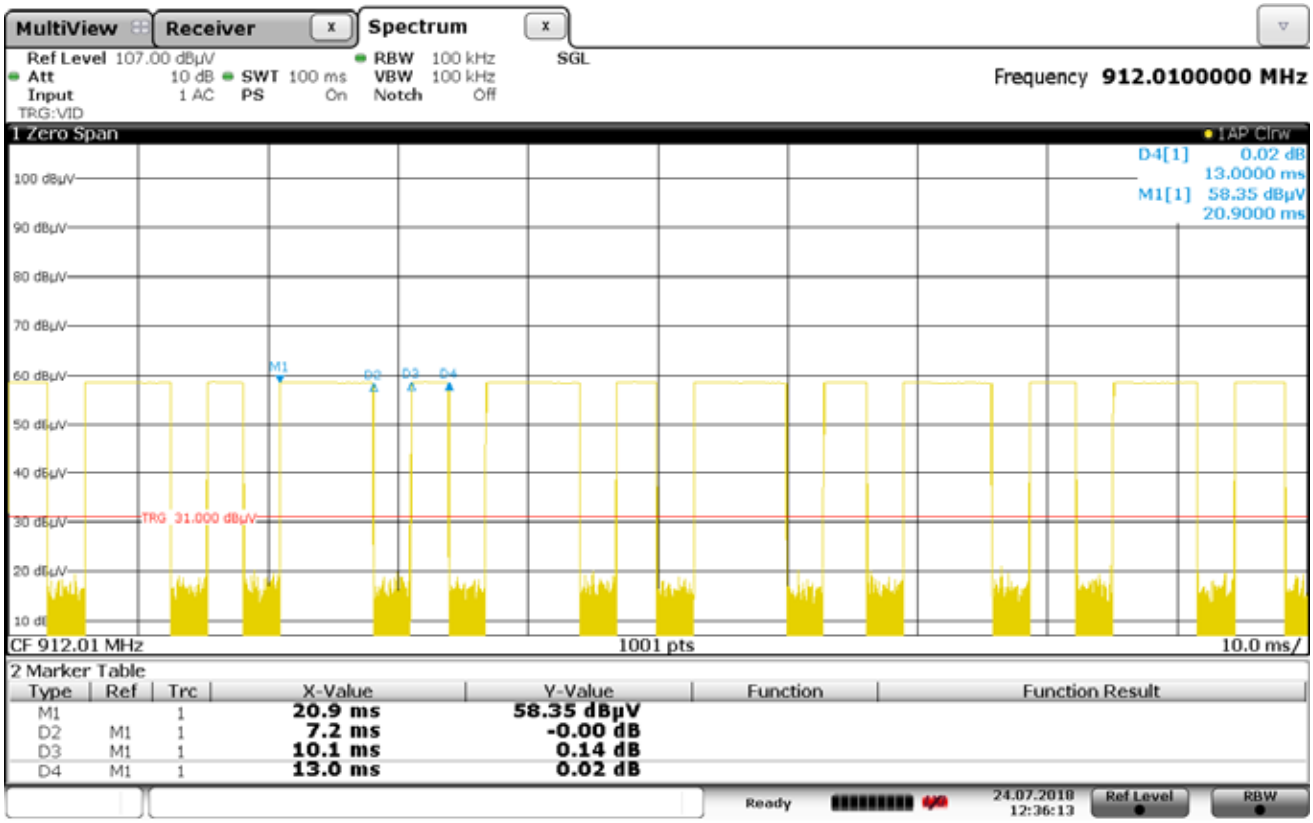
OCCUPIED BANDWIDTH – 99% BANDWIDTH

MANUFACTURER : HeathCo LLC
TEST ITEM : LED Decorative Fixture with RF Communication
MODEL NUMBER : 4700
TEST MODE : Normal Operation – 915MHz
: 99% BW = 397.6kHz

NOTES



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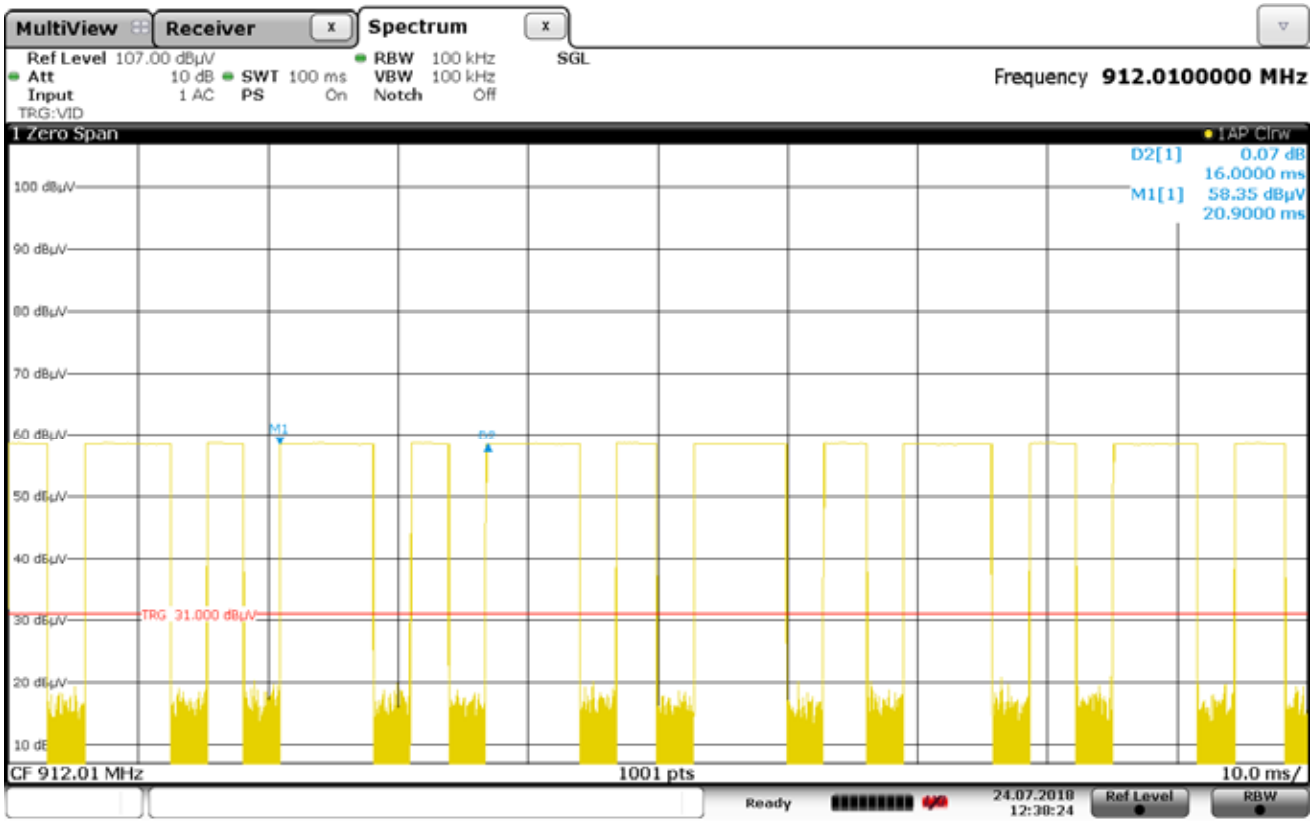
DUTY CYCLE

MANUFACTURER : HeathCo LLC
TEST ITEM : LED Decorative Fixture with RF Communication
MODEL NUMBER : 4700
TEST MODE : Normal Operation – 915MHz
: ON Time = 7.2mS+(13.0-10.1)= 10.1mS
: Word = 16mS
: Duty Cycle = 20*log((7.2mS+2.9mS)/16mS) = -3.99 dB

NOTES

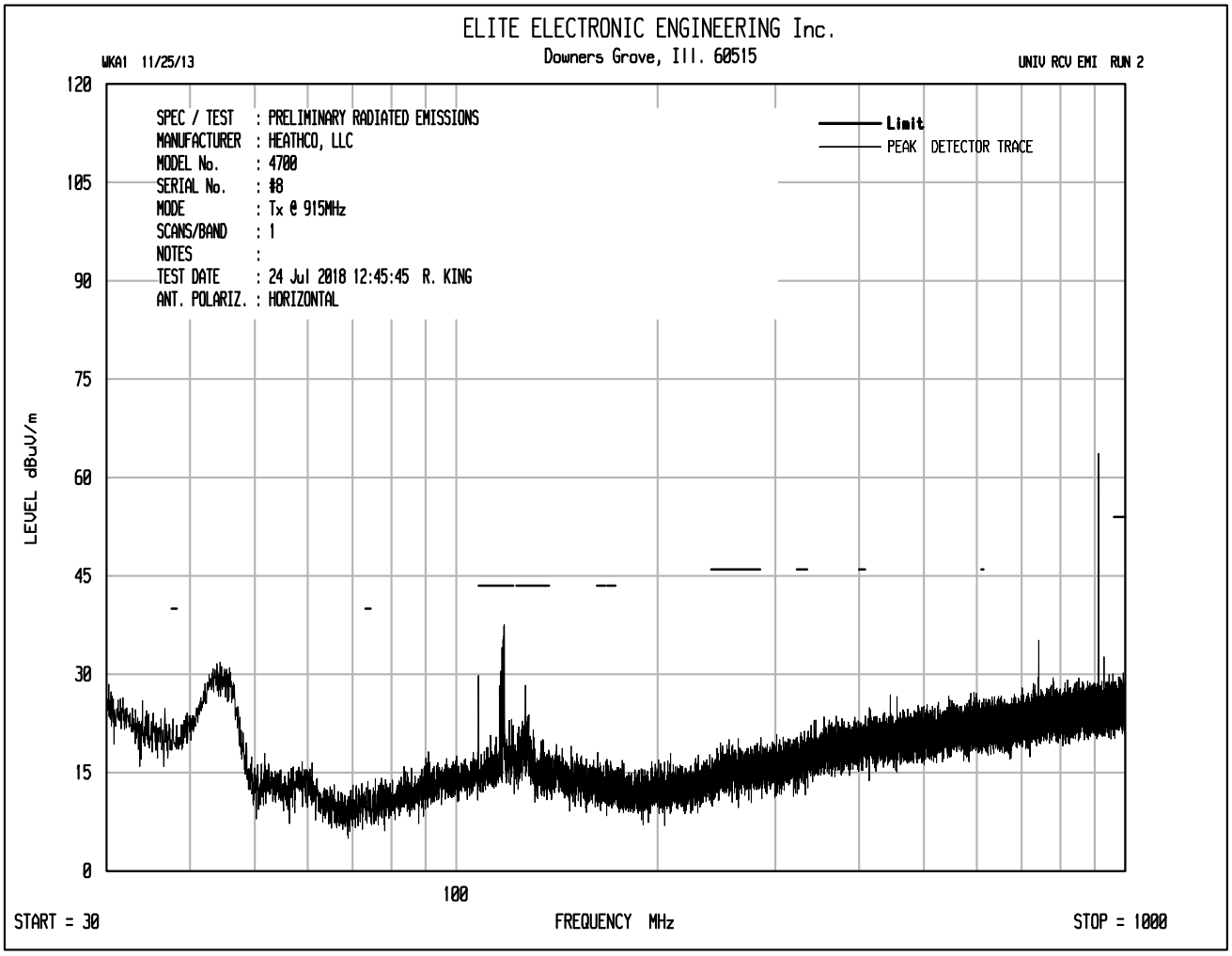


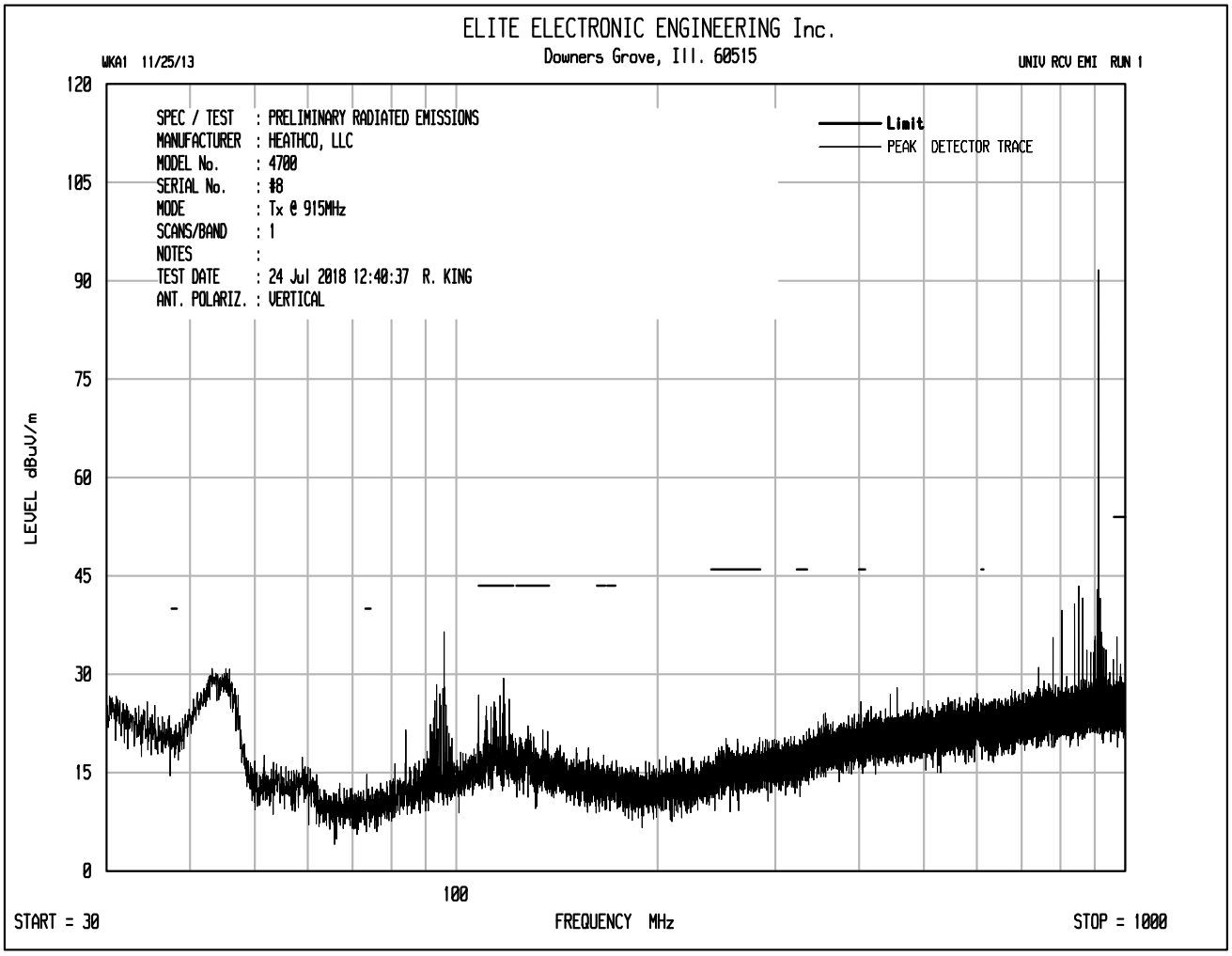
Date: 24.JUL.2018 12:38:25

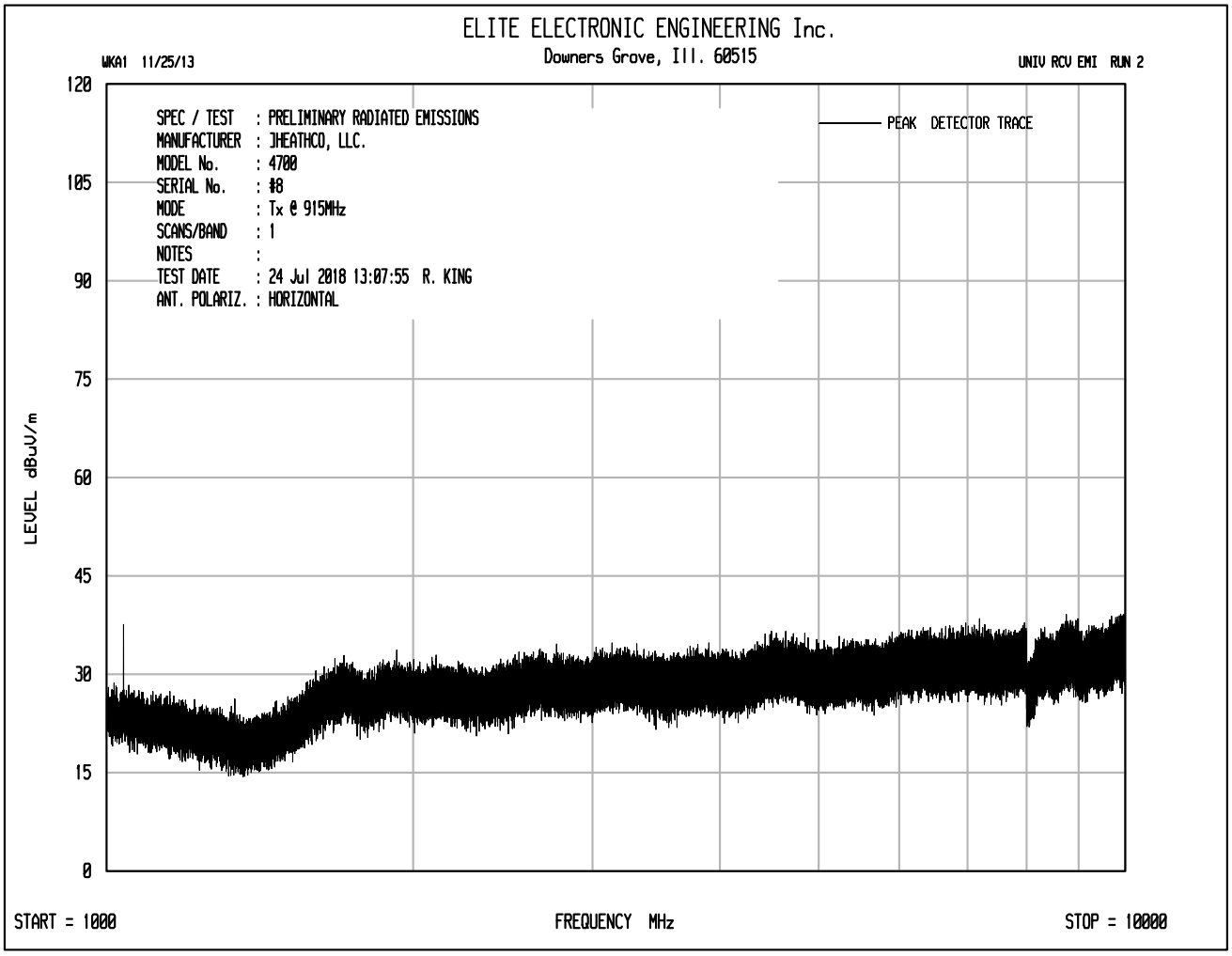
DUTY CYCLE

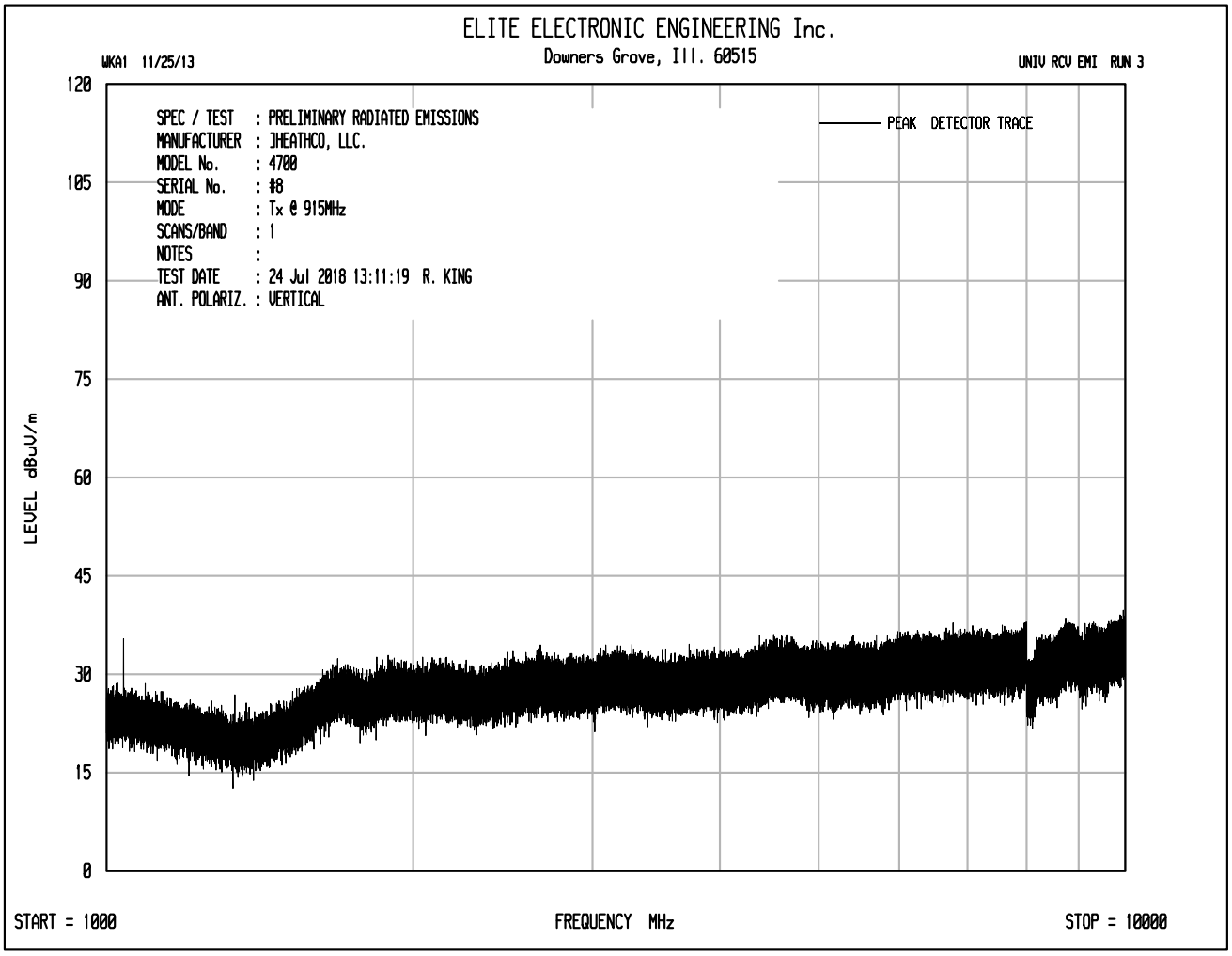
MANUFACTURER : HeathCo LLC
TEST ITEM : LED Decorative Fixture with RF Communication
MODEL NUMBER : 4700
TEST MODE : Normal Operation – 915MHz
: ON Time = 7.2mS+(13.0-10.1)= 10.1mS
: Word = 16mS
: Duty Cycle = 20*log((7.2mS+2.9mS)/16mS) = -3.99 dB

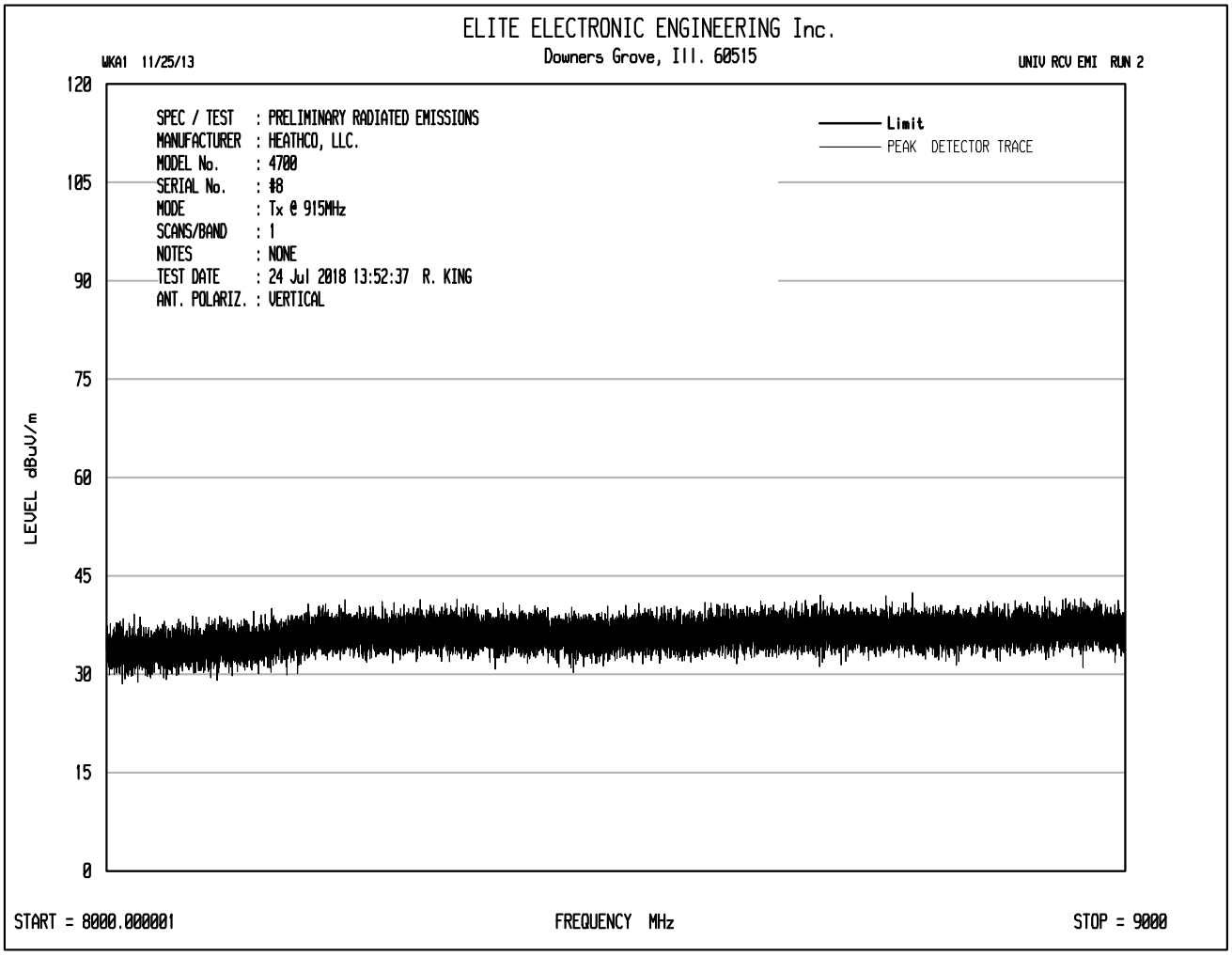
NOTES

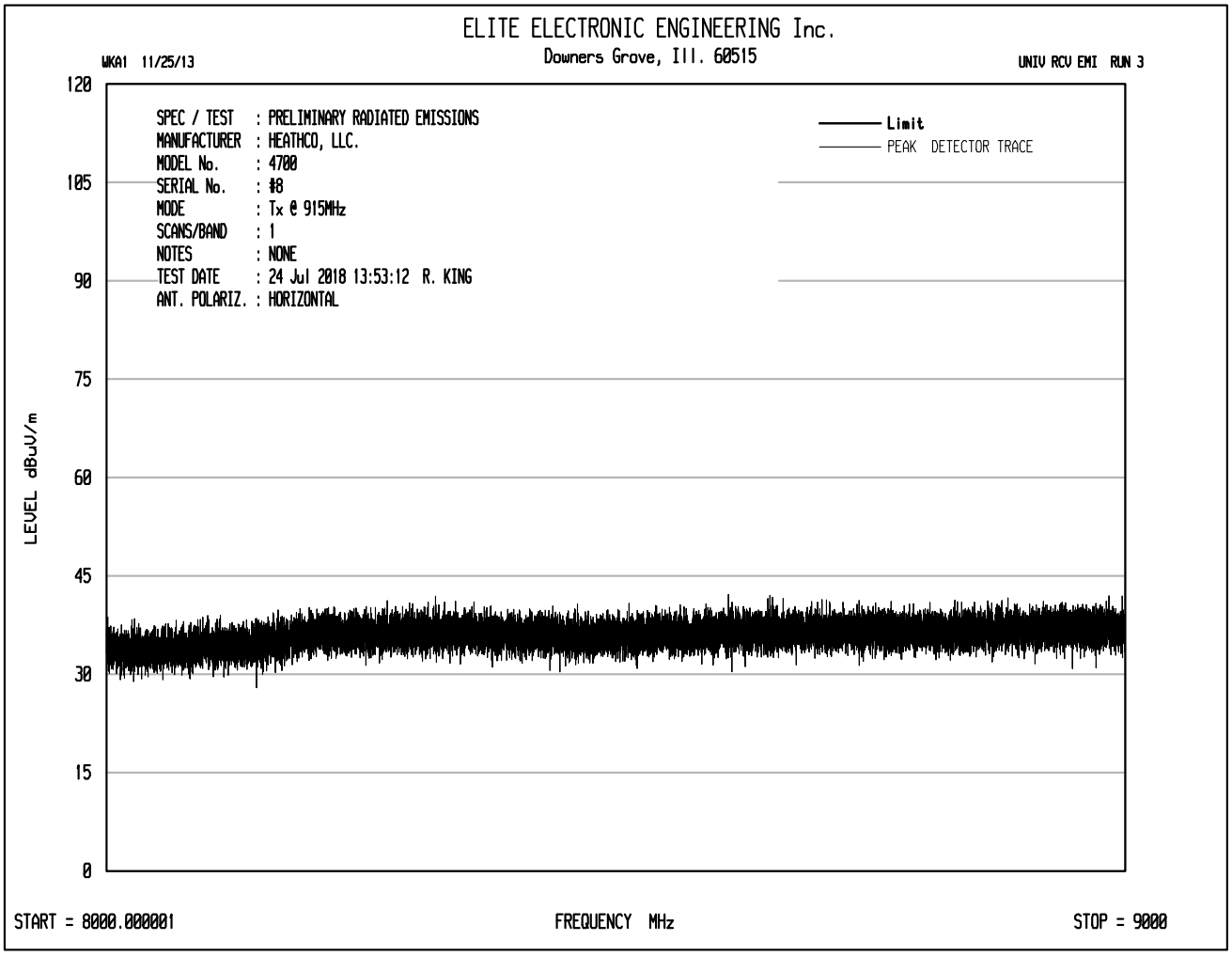

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HEATHCO, LLC
MODEL No. : 4700
SERIAL No. : #8
MODE : Tx @ 915MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 24 Jul 2018 12:45:45 R. KING
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 1
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HEATHCO, LLC
MODEL No. : 4700
SERIAL No. : #8
MODE : Tx @ 915MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 24 Jul 2018 12:40:37 R. KING
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HEATHCO, LLC.
MODEL No. : 4700
SERIAL No. : #8
MODE : Tx @ 915MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 24 Jul 2018 13:07:55 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HEATHCO, LLC.
MODEL No. : 4700
SERIAL No. : #8
MODE : Tx @ 915MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 24 Jul 2018 13:11:19 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HEATHCO, LLC.
MODEL No. : 4700
SERIAL No. : #8
MODE : Tx @ 915MHz
SCANS/BAND : 1
NOTES : NONE
TEST DATE : 24 Jul 2018 13:52:37 R. KING
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 8000.000001
FREQUENCY MHz
STOP = 9000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HEATHCO, LLC.
MODEL No. : 4700
SERIAL No. : #8
MODE : Tx @ 915MHz
SCANS/BAND : 1
NOTES : NONE
TEST DATE : 24 Jul 2018 13:53:12 R. KING
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 8000.000001
FREQUENCY MHz
STOP = 9000

DATA PAGE

Manufacturer : HeathCo LLC
Test Item : LED Decorative Fixture with RF Communication
Model No. : 4700
Mode : Normal Operation – Transmit at 915MHz
Test Specification : FCC-15.249, RSS-210 Radiated Spurious Emissions - Harmonics
Date : July 23, 2018

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	QP/Peak Total dBuV/m at 3m	QP/Peak Total uV/m at 3 m	QP/Peak Limit uV/m at 3 m	Margin (dB)
915.000	H	58.6		1.6	27.0	0.0	87.2	22922.1	50000.0	-6.8
915.000	V	64.0		1.6	27.0	0.0	92.6	42486.9	50000.0	-1.4
1830.000	H	49.5	*	2.2	31.1	-41.1	41.8	122.8	5000.0	-32.2
1830.000	V	49.5	*	2.2	31.1	-41.1	41.8	123.0	5000.0	-32.2
2745.000	H	51.7	*	2.8	33.7	-40.9	47.4	233.8	5000.0	-26.6
2745.000	V	53.9	*	2.8	33.7	-40.9	49.6	300.5	5000.0	-24.4
3660.000	H	49.4	*	3.3	34.6	-40.3	46.9	220.6	5000.0	-27.1
3660.000	V	50.0	*	3.3	34.6	-40.3	47.6	238.6	5000.0	-26.4
4575.000	H	54.2		3.6	36.2	-40.6	53.5	471.3	5000.0	-20.5
4575.000	V	51.0	*	3.6	36.2	-40.6	50.2	325.3	5000.0	-23.7
5490.000	H	49.6	*	3.9	36.8	-40.1	50.2	325.0	5000.0	-23.7
5490.000	V	48.8	*	3.9	36.8	-40.1	49.4	296.4	5000.0	-24.5
6405.000	H	49.1	*	4.3	38.0	-40.2	51.2	363.7	5000.0	-22.8
6405.000	V	49.1	*	4.3	38.0	-40.2	51.2	362.0	5000.0	-22.8
7320.000	H	50.6	*	4.7	38.1	-40.3	53.0	448.9	5000.0	-20.9
7320.000	V	48.7	*	4.7	38.1	-40.3	51.2	362.7	5000.0	-22.8
8235.000	H	48.4	*	4.9	38.6	-40.4	51.5	377.6	5000.0	-22.4
8235.000	V	48.2	*	4.9	38.6	-40.4	51.3	367.3	5000.0	-22.7
9150.000	H	47.7	*	5.0	38.9	-40.3	51.3	365.8	5000.0	-22.7
9150.000	V	47.5	*	5.0	38.9	-40.3	51.0	355.4	5000.0	-23.0
1039.500	H	54.2		1.7	29.0	-42.3	42.7	135.9	5000.0	-31.3
1039.500	V	61.2		1.7	29.0	-42.3	49.6	303.1	5000.0	-24.3

Checked BY Richard E. King :

Richard E. King

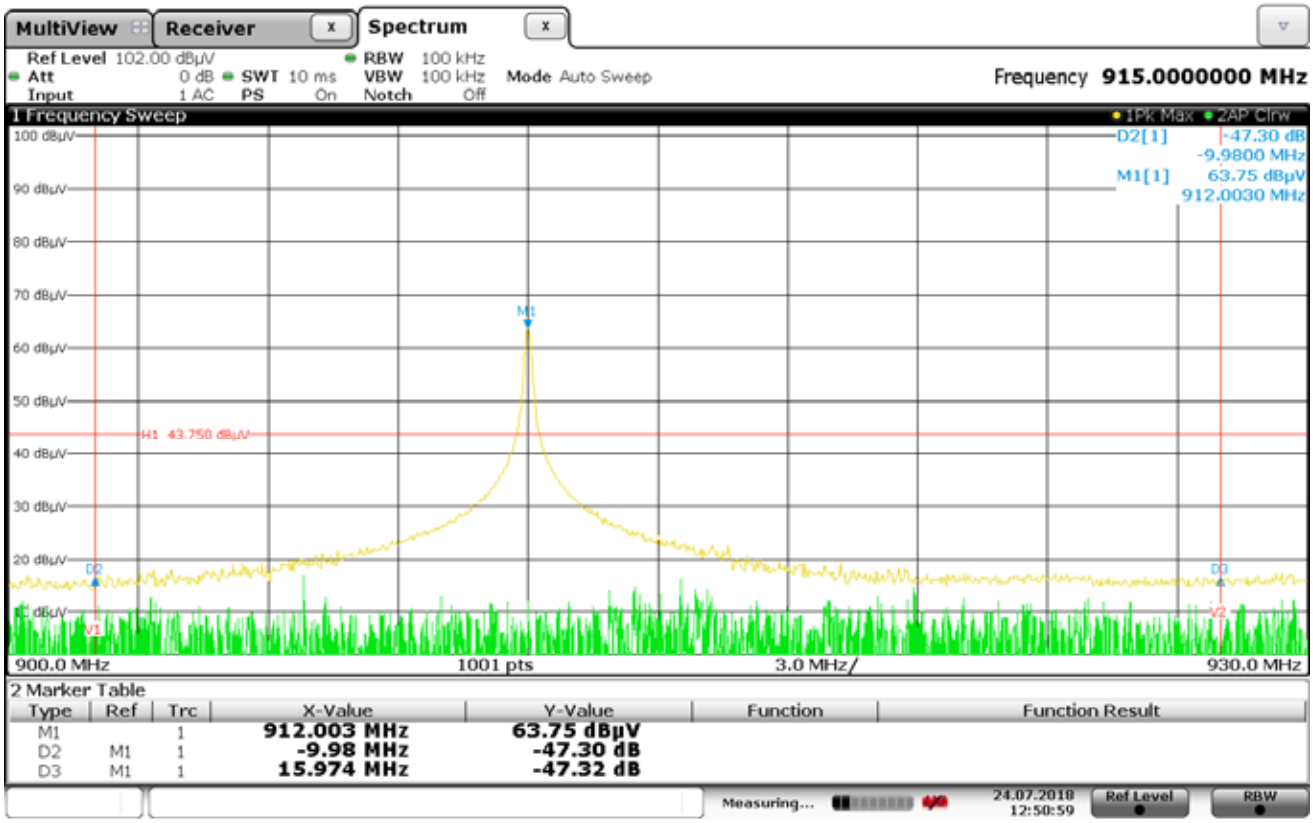
DATA PAGE

Manufacturer : HeathCo LLC
Test Item : LED Decorative Fixture with RF Communication
Model No. : 4700
Mode : Normal Operation – Transmit at 915MHz
Test Specification : FCC-15.249, RSS-210 Radiated Spurious Emissions – Averages
Date : May 17, 2018

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
1830.00	H	49.5	*	2.2	31.1	-41.1	-4.0	37.8	77.5	500.0	-16.2
1830.00	V	49.5	*	2.2	31.1	-41.1	-4.0	37.8	77.7	500.0	-16.2
2745.00	H	51.7	*	2.8	33.7	-40.9	-4.0	43.4	147.7	500.0	-10.6
2745.00	V	53.88	*	2.8	33.7	-40.9	-4.0	45.6	189.8	500.0	-8.4
3660.00	H	49.35	*	3.3	34.6	-40.3	-4.0	42.9	139.4	500.0	-11.1
3660.00	V	50.03	*	3.3	34.6	-40.3	-4.0	43.6	150.7	500.0	-10.4
4575.00	H	54.24		3.6	36.2	-40.6	-4.0	49.5	297.7	500.0	-4.5
4575.00	V	51.02	*	3.6	36.2	-40.6	-4.0	46.3	205.5	500.0	-7.7
5490.00	H	49.58	*	3.9	36.8	-40.1	-4.0	46.2	205.3	500.0	-7.7
5490.00	V	48.78	*	3.9	36.8	-40.1	-4.0	45.4	187.2	500.0	-8.5
6405.00	H	49.13	*	4.3	38.0	-40.2	-4.0	47.2	229.7	500.0	-6.8
6405.00	V	49.09	*	4.3	38.0	-40.2	-4.0	47.2	228.7	500.0	-6.8
7320.00	H	50.55	*	4.7	38.1	-40.3	-4.0	49.1	283.5	500.0	-4.9
7320.00	V	48.7	*	4.7	38.1	-40.3	-4.0	47.2	229.1	500.0	-6.8
8235.00	H	48.42	*	4.9	38.6	-40.4	-4.0	47.5	238.5	500.0	-6.4
8235.00	V	48.18	*	4.9	38.6	-40.4	-4.0	47.3	232.0	500.0	-6.7
9150.00	H	47.72	*	5.0	38.9	-40.3	-4.0	47.3	231.1	500.0	-6.7
9150.00	V	47.47	*	5.0	38.9	-40.3	-4.0	47.0	224.5	500.0	-7.0
1039.50	H	54.21		1.7	29.0	-42.3	-4.0	38.7	85.8	500.0	-15.3
1039.50	V	61.18		1.7	29.0	-42.3	-4.0	45.6	191.5	500.0	-8.3

Checked BY Richard E. King :

Richard E. King



Date: 24.JUL.2018 12:50:59

BAND EDGE

MANUFACTURER : HeathCo LLC
TEST ITEM : LED Decorative Fixture with RF Communication
MODEL NUMBER : 4700
TEST MODE : Normal Operation – 915MHz
:

NOTES

DATA PAGE

Manufacturer : HeathCo LLC
Test Item : LED Decorative Fixture with RF Communication
Model No. : 4700
Mode : Normal Operation – Transmit at 915MHz
Test Specification : FCC-15.249, RSS-210 Band-edge Compliance
Date : May 17, 2018
: Peak reading met the quasi-peak limit

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	QP/Peak Total dBuV/m at 3m	QP/Peak Total uV/m at 3 m	QP/Peak Limit uV/m at 3 m	Margin (dB)
902.000	V	16.5	*	1.5	26.8	0.0	44.8	173.7	200.0	-1.2
930.000	V	16.4	*	1.6	27.3	0.0	45.3	183.4	200.0	-0.8

Checked BY Richard E. King :

Richard E. King