Measurement of RF Emissions from a Sennco Solutions Bubble Maker

For	Sennco Solutions 14404 Coil Plus Drive, Unit A Plainfield, IL 60644
P.O. Number	004629
Date Tested	August 12, 2015 through August 26, 2015
Test Personnel	Mark Longinotti
Test Specification	FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 15.207 and 15.209 for Intentional Radiators FCC "Code of Federal Regulations" Title 47, Part15, Subpart 15B, Section 15.107 and 15.109 for Receivers Industry Canada RSS-Gen

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REVISION HISTORY

Revision	Date	Description
—	14 Sept 2015	Initial release

Measurement of RF Emissions from a Sennco Solutions Bubble Maker

1. INTRODUCTION

1.1. Scope of Tests

This report presents the results of the RF emissions measurements performed on a Sennco Solutions Bubble Maker, hereinafter referred to as the Equipment Under Test (EUT). No Serial Number was assigned to the EUT. The EUT was designed to transmit at approximately 134.2kHz using an internal fixed air coil antenna. The EUT was also designed to receive in the 907MHz to 920.4MHz range using an internal PCB mounted fixed ceramic chip antenna. The EUT was manufactured and submitted for testing by Sennco Solutions located in Plainfield, IL.

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 B, Sections 15.107 and 15.109, for receivers and Subpart C, Sections 207 and 209 for Intentional Radiators. Testing was performed in accordance with ANSI C63.4-2014.

The test series was also performed to determine if the EUT meets the conducted and radiated RF emission requirements of the Industry Canada Radio Standards Specification RSS-Gen Sections 8.8 and 7.1.2 for receivers and Sections 8.8 and 8.9 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^{o}C and the relative humidity was 45%.

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, dated 1 October 2014
- 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"
- Industry Canada Radio Standards Specification, RSS-Gen, “Spectrum Management and Telecommunications Radio Standards Specification, General Requirements for Compliance of Radio Apparatus”, Issue 4, November 2014
- ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices”

3. EUT SETUP AND OPERATION

3.1. General Description

The EUT is a Sennco Solutions Bubble Maker. 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 5VDC through 2 each, 1.85 meter long power leads of a CUI Power Supply, Part No. ETSA 24027OUDC-P5RP-SZ, Model No. ETSA 24027OUD. The CUI Power Supply was powered with 115V, 60Hz via 2 each, 1.8 meter long power leads.

3.1.2. Peripheral Equipment

No peripheral equipment was submitted with the EUT.

3.1.3. Signal Input/Output Leads

No interconnect cables were submitted with the EUT.

3.1.4. Grounding

The EUT was not grounded during the tests.

3.1.5. Frequency of EUT

The EUT was equipped with a 134.2kHz transmitter. Per 15.33(a)(1), for an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in this paragraph:

(1) If the intentional radiator operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

The EUT was also equipped with a receiver that tuned in the 907MHz to 920.4MHz range. Per 15.33(b)(3), a receiver employing superheterodyne techniques shall be investigated from 30 MHz up to at least the second harmonic of the highest local oscillator frequency generated in the device.

3.2. Software

For all tests the EUT had Firmware Version V2.0.02 loaded onto the device to provide correct load characteristics.

3.3. Operational Mode

For all tests the EUT was placed on an 80cm high non-conductive stand. The EUT and all peripheral equipment were energized. For power line conducted emissions tests, the EUT was operated in the Normal Operation mode. In this mode, the EUT continuously cycled through the following modes: transmit at 134.2kHz, receive at 907MHz, and receive at 916.8MHz.

All radiated emissions tests were run separately with the EUT programmed to operate in the following modes:

- Receive at 907MHz
- Receive at 913.8MHz
- Receive at 920.8MHz
- Transmit at 134.2kHz

3.4. EUT Modifications

No modifications to the EUT were required for compliance.

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. All equipment was calibrated per the instruction manuals supplied by the manufacturer.

Conducted and radiated emissions tests were performed with an EMI receiver with internal peak, quasi-peak, and average detectors. All measurements were performed using the bandwidths specified by the FCC.

4.3. Calibration Traceability

Test equipment is maintained and calibrated on a regular basis. 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.

The measurement uncertainty for these tests is presented below:

Conducted Emissions Measurements		
Combined Standard Uncertainty	1.06	-1.06
Expanded Uncertainty (95% confidence)	2.12	-2.12

Radiated Emissions Measurements		
Combined Standard Uncertainty	2.09	-2.09
Expanded Uncertainty (95% confidence)	4.19	-4.19

5. TEST PROCEDURES

5.1. Receiver

5.1.1. Powerline Conducted Emissions

5.1.1.1 Requirements

Per the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, 15.107(a) and Industry Canada RSS-Gen section 8.8, all radio frequency voltages on the power lines of a receiver shall be below the values shown below when using a quasi-peak or average detector:

CONDUCTED LIMITS FOR RECEIVER

Frequency MHz	RFI Voltage dBuV(QP)	RFI Voltage dBuV(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.

5.1.1.2 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.

a) The EUT was operated in the Normal Operation mode.

b) Measurements were first made on the 115V, 60Hz high line of the CUI Power Supply, Part No. ETSA 24027OUDC-P5RP-SZ, Model No. ETSA 24027OUD.

c) The frequency range from 150 kHz to 30 MHz was broken up into smaller frequency sub-bands.

d) Conducted emissions measurements were taken on the first frequency sub-band using a peak detector.

e) 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.)

f) Steps (d) and (e) 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. The resultant voltage level (VL) is a summation in decibels (dB) of the receiver meter reading (MTR) and the cable loss factor (CF).

Formula 1: VL (dBuV) = MTR (dBuV) + CF (dB)

g) Steps (c) through (f) were repeated on the 115V, 60Hz return line of the CUI Power Supply, Part No. ETSA 24027OUDC-P5RP-SZ, Model No. ETSA 24027OUD.

5.1.1.3 Results

The plots 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 23 and 25. The tabular quasi-peak and average results from each input power line with the EUT operated in the Normal Operation mode are shown on pages 22 and 24. All power line conducted emissions measured from the EUT were within the specification limits. The emissions level closest to the limit (worst case) occurred at 191kHz. The emissions level at this frequency was 23.5dB within the limit. Photographs of the test configuration which yielded the highest or worst case, conducted emission levels are shown on Figure 3.

5.1.2.Radiated Measurements

5.1.2.1 Requirements

Per the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Section 15.109(a) and Industry Canada RSS-Gen, Section 7.1.2, all radio frequency emissions from a receiver shall be below the limits shown on the following table:

RADIATION LIMITS FOR A RECEIVER

Frequency MHz	Distance between EUT And Antenna in Meters	Field Strength uV/m	Field Strength dBuV/m
30-88	3	100	40
88-216	3	150	43.5
216-960	3	200	46
Above 960	3	500	54

Note: The tighter limit shall apply at the edge between the two frequency bands.

5.1.2.2 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.

Since a quasi-peak detector and an average detector require long integration times, it is not practical to automatically sweep through the quasi-peak and average levels. Therefore, radiated emissions from the EUT were first scanned using a peak detector and automatically plotted. The frequencies where significant emission levels were noted were then remeasured using the quasi-peak detector or average detector.

The broadband measuring antenna was positioned at a 3 meter distance from the EUT. The frequency range from 30MHz to 1GHz was investigated using a peak detector function with the bilog antenna at several heights, horizontal and vertical polarization, and with several different orientations of the EUT with respect to the antenna. The frequency range from 1GHz to 2GHz was investigated using a peak detector function with the double ridged waveguide antenna at several heights, horizontal and vertical polarization, and with several different orientations of the EUT with respect to the antenna. The maximum levels for each antenna polarization were plotted. The resultant field strength (FS) is a summation in decibels (dB) of the receiver meter reading (MTR), the antenna correction factor (AF), and the cable loss factor (CF). If an external pre-amplifier is used, the total is reduced by its gain (-PA). If a distance correction (DC) is required, it is added to the total.

Formula 1: FS (dBuV/m) = MTR (dBuV) + AF (dB/m) + CF (dB) + (- PA (dB)) + DC (dB)

To convert the Field Strength dBuV/m term to uV/m, the dBuV/m is first divided by 20. The Base 10 AntiLog is taken of this quotient. The result is the Field Strength value in uV/m terms.

Formula 2: FS (uV/m) = AntiLog [(FS (dBuV/m))/20]

Final radiated emissions were performed on all significant broadband and narrowband emissions found in the preliminary sweeps using the following methods:

1) Measurements from 30MHz to 1GHz were made using a quasi-peak detector and a broadband bilog antenna. Measurements above 1GHz were made using an average detector and a broadband double ridged waveguide antenna.

2) To ensure that maximum or worst case, emission levels were measured, the following steps were taken:

   a) The EUT was rotated so that all of its sides were exposed to the receiving antenna.

   b) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.

   c) The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.

   d) For hand-held or body-worn devices, the EUT was rotated through three orthogonal axes to determine which orientation produces the highest emission relative to the limit.

5.1.2.3 Results

The preliminary plots with the EUT operating in the Receive at 907MHz and Receive at 916.8MHz mode are presented on pages 26 through 29. The plots are presented for a reference only, and are not used to determine compliance. The final radiated levels are presented on pages 30 and 31. As can be seen from the data, all emissions measured from the EUT were within the specification limits. The emissions level closet to the limit (worst case) occurred at 185.56MHz. The emissions level at this frequency was 5.5dB within the limit. See data pages 30 and 31 for details. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figure 5 and Figure 6.

The preliminary plots with the EUT operating in the Receive at 911MHz and Receive at 920.8MHz mode are presented on pages 32 through 35. The plots are presented for a reference only, and are not used to determine compliance. The final radiated levels are presented on pages 36 and 37. As can be seen from the data, all emissions measured from the EUT were within the specification limits. The emissions level closet to the limit (worst case) occurred at 186.25MHz. The emissions level at this frequency was 5.3dB within the limit. See data pages 36 and 37 for details. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figure 5 and Figure 6.

5.2. Transmitter

5.2.1. Powerline Conducted Emissions

5.2.1.1 Requirements

Per the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Per 15.207(a) and Industry Canada RSS-Gen section 8.8, 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.

5.2.1.2 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.

e) The EUT was operated in the Normal Operation mode.

f) Measurements were first made on the 115V, 60Hz high line of the CUI Power Supply, Part No. ETSA 24027OUDC-P5RP-SZ, Model No. ETSA 24027OUD.

g) The frequency range from 150 kHz to 30 MHz was broken up into smaller frequency sub-bands.

h) Conducted emissions measurements were taken on the first frequency sub-band using a peak detector.

i) 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.)

j) Steps (d) and (e) 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. The resultant voltage level (VL) is a summation in decibels (dB) of the receiver meter reading (MTR) and the cable loss factor (CF).

Formula 1: VL (dBuV) = MTR (dBuV) + CF (dB)

k) Steps (c) through (f) were repeated on the 115V, 60Hz return line of the CUI Power Supply, Part No. ETSA 24027OUDC-P5RP-SZ, Model No. ETSA 24027OUD.

5.2.1.3 Results

The plots 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 23 and 25. The tabular quasi-peak and average results from each input power line with the EUT operated in the Normal Operation mode are shown on pages 22 and 24. All power line conducted emissions measured from the EUT were within the specification limits. The emissions level closest to the limit (worst case) occurred at 191kHz. The emissions level at this frequency was 23.5dB within the limit. Photographs of the test configuration which yielded the highest or worst case, conducted emission levels are shown on Figure 3.

5.2.2. Duty Cycle Factor Measurements

5.2.2.1 Requirements

Per the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart A, Section 15.35(c) and Industry Canada RSS-Gen section 6.10, 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.

5.2.2.2 Procedures

With the transmitter set up to transmit, the time domain trace is displayed on the spectrum analyzer. This trace is obtained by tuning center frequency to the transmitter frequency and then setting a frequency span of zero. Multiple sweeps were made with various sweep times to capture the widths of individual pulses.

5.2.2.3 Results

Sample plots of the pulsed data are shown on pages 38 through 44. Per Sennco Solutions personnel, the EUT employs “On-Off” keying (OOK).

A word consists of the following bits:

Preamble bit 1 : 5 msec
Preamble bit 2 : 2 msec
16 data bits : OOK
End bit : 0.794msec

Off time

16 data bits : OOK
End bit : 0.794usec

The first 16 OOK data bits are fixed with 7 each “On” bits that are 0.550usec each and 9 each “Off” bits that are 0.275usec each. The second 16 OOK data bits can vary. Therefore the worst case “On Time” must be taken into consideration for duty cycle correction factor. The worst case would be all “Ons” for the second 16 OOK data bits.

Therefore the worst case “On Time” would be:

Preamble bit 1 : 5 msec
Preamble bit 2 : 2 msec
16 data bits : 7 x (0.550msec) + 9 x (0.275msec) = 3.85 msec + 2.475msec = 6.325 msec
End bit : 1msec

Off time

16 data bits : 16 x (0.550msec) = 8.8msec
End bit : 0.794usec

Worst case “On Time” = 5msec + 2msec + 6.325msec + 1msec + 8.8msec + 0.794msec = 23.919msec

No more than 1 transmission can occur in any 100msec period. Therefore the duty cycle correction factor can be determined by:

Duty Cycle Correction Factor = 20 x log ((on-time in 100msec)/100msec)
Duty Cycle Correction Factor = 20 x log (23.919msec/100msec)
Duty Cycle Correction Factor = -12.43 dB

5.2.3.Radiated Measurements

5.2.3.1 Requirements

Per the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.209(a) and Industry Canada RSS-Gen, Section 8.9, all radio frequency emissions from an intentional radiator shall be below the limits shown on the following table:

Frequency MHz	Field Strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	3
30.0-88.0	100	3
88.0-216.0	150	3
216.0-960.0	200	3
Above 960	500	3

Note 1: The lower limit shall apply at the transition frequencies.

In addition, per the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.209(d) and Industry Canada RSS-Gen, Section 8.9, the emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

5.2.4. 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.

A preliminary radiated emissions test was performed to determine the emission characteristics of the EUT. For the preliminary test, an active loop measuring antenna was positioned at a 3 meter distance from the EUT. The entire frequency range from 10kHz to 30MHz was investigated using a peak detector function.

The final open field emission tests were then manually performed over the frequency range of 10kHz to 30MHz using an active loop antenna. All significant broadband and narrowband signals were measured and recorded. A 200Hz bandwidth was used for all measurements below 150kHz. A quasi-peak detector with a 9kHz bandwidth was used for all measurements above 150kHz. Since an average detector is required for emissions between 110kHz and 490kHz and since pulsed operation is employed, peak readings were taken in this band and a duty cycle correction factor was added to the peak readings to convert the peak readings to average readings.

To ensure that maximum or worst case, emission levels were measured, the following steps were taken:

1) The EUT was rotated so that all of its sides were exposed to the receiving antenna.
2) The active loop antenna was placed at a height of 1 meter.
3) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
4) With the loop antenna in the vertical polarization, the loop antenna was rotated through 360 degrees.

The resultant field strength (FS) is a summation in decibels (dB) of the receiver meter reading (MTR), the antenna correction factor (AF), and the cable loss factor (CF). If peak reading are taken, and the standard calls out an average limit, the peak readings are converted to average readings by adding a duty cycle correction factor (DC). If an external pre-amplifier is used, the total is reduced by its gain (-PA). If a distance correction (DC) is required, it is added to the total. (Per 15.231(f)(2), at frequencies below 30MHz, measurements may be made at a distance closer than that specified. When performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by using the square of an inverse linear distance extrapolation factor (40 dB/decade).)

Formula 1: FS (dBuV/m) = MTR (dBuV) + AF (dB/m) + CF (dB) + DC (dB) + (- PA (dB)) + DC (dB)

To convert the Field Strength dBuV/m term to uV/m, the dBuV/m is first divided by 20. The Base 10 AntiLog is taken of this quotient. The result is the Field Strength value in uV/m terms.

Formula 2: FS (uV/m) = AntiLog [(FS (dBuV/m))/20]

5.2.5.Results

The preliminary plots, with the EUT transmitting at 134.2kHz, are presented on data pages 45 and 46. The plots are presented for a reference only, and are not used to determine compliance.

The final open area radiated levels, with the EUT transmitting at 134.2kHz, are presented on data page 47. As can be seen from the data, all emissions measured from the EUT were within the specification limits. The emissions level closet to the limit (worst case) occurred at 134.2kHz. The emissions level at this frequency was 5.6dB within the limit. Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown on Figure 4.

6. OTHER TEST CONDITIONS

6.1. Test Personnel and Witnesses

All tests were performed by qualified personnel from Elite Electronic Engineering Incorporated.

6.2. Disposition of the EUT

The EUT and all associated equipment were returned to Sennco Solutions upon completion of the tests.

7. CONCLUSIONS

It was determined that, the Sennco Solutions Bubble Maker did fully meet the conducted and radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Sections 15.107 and 15.109 for receivers and Subpart C, Sections 15.207 and 15.209 for Intentional Radiators when tested per ANSI C63.4-2014.

It was also determined that, the Sennco Solutions Bubble Maker did fully meet the conducted and radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen, Sections 8.8 and 7.1.2 for receivers and Sections 8.8 and 8.9 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. 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
CDW8	DESKTOP COMPUTER	ELITE ELECTRONIC ENG	PENTIUM 4	009	3.8GHZ	N/A	
CDX8	COMPUTER	ELITE	WORKSTATION			N/A	
CDY0	WORKSTATION	ELITE	WORKSTATION		WINDOWS 7	N/A	
CMA1	Controllers	EMCO	2090	9701-1213	---	N/A	
NLS0	24" ACTIVE LOOP ANTENNA	EMCO	6502	89979	10KHZ-30MHZ	7/7/2014	7/7/2016
NTA2	BILOG ANTENNA	TESEQ	6112D	28040	25-1000MHz	10/10/2014	10/10/2015
NWQ1	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS-LINDGREN	3117	66655	1GHZ-18GHZ	3/11/2014	3/11/2016
PLF5	CISPR16 50UH LISN	ELITE	CISPR16/15A	006	.15-30MHz	5/20/2015	5/20/2016
PLF7	CISPR16 50UH LISN	ELITE	CISPR16/15A	008	.15-30MHz	5/20/2015	5/20/2016
RAKG	RF SECTION	HEWLETT PACKARD	85462A	3549A00284	0.009-6500MHZ	2/27/2015	2/27/2016
RAKH	RF FILTER SECTION	HEWLETT PACKARD	85460A	3448A00324	---	2/27/2015	2/27/2016
RAKI	RF SECTION	HEWLETT PACKARD	85462A	3411A00181	0.009-6500MHZ	3/12/2015	3/12/2016
RAKJ	RF FILTER SECTION	HEWLETT PACKARD	85460A	3330A00154	---	3/12/2015	3/12/2016
RBB0	EMI TEST RECEIVER 20HZ TO 40 GHZ.	ROHDE & SCHWARZ	ESIB40	100250	20 HZ TO 40GHZ	2/13/2015	2/13/2016
RBD1	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESU40	100009	20Hz-40GHz	11/18/2014	11/18/2015
VBR8	CISPR EN FCC CE VOLTAGE.exe						
WKA1	SOFTWARE, UNIVERSAL RCV EMI	ELITE	UNIV_RCV_EMI	1	---	I/O	
WQB0	RE_8546A						
WQC0	HF_8546A						

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.

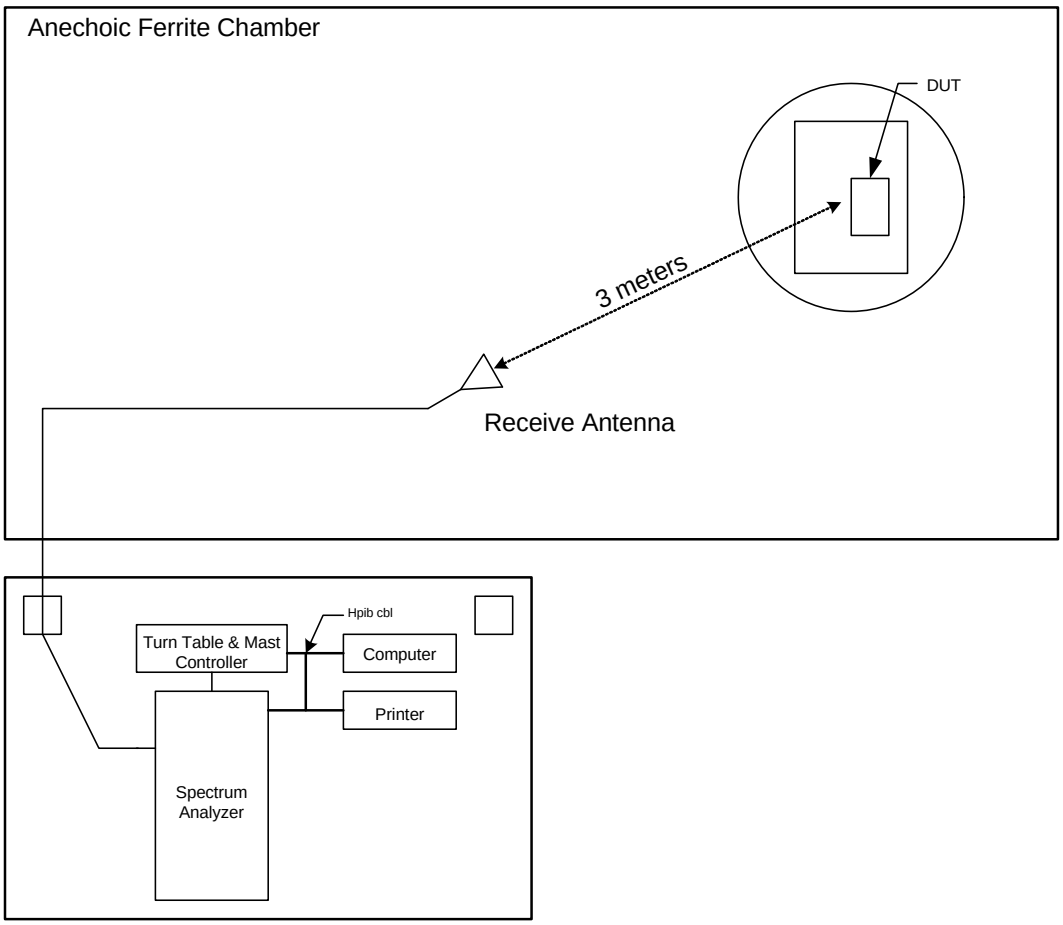


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

Figure 2

Photograph of EUT

Figure 3

Test Setup for Conducted Emissions

Figure 4

Test Setup for Radiated Emissions, 10kHz to 30MHz – Horizontal Polarization

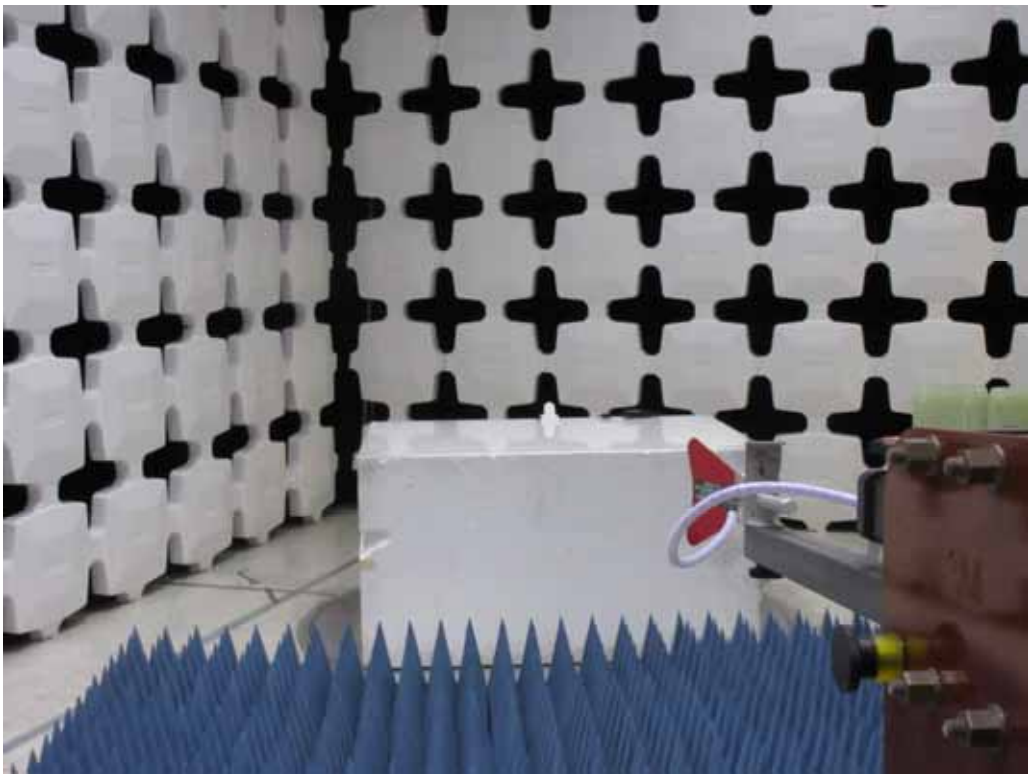
Test Setup for Radiated Emissions, 10kHz to 30MHz – Vertical Polarization

Figure 5

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

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

Figure 6



Test Setup for Radiated Emissions, 1GHz to 2GHz – Horizontal Polarization

Test Setup for Radiated Emissions, 1GHz to 2GHz – Vertical Polarization

FCC Part 15 Subpart B Conducted Emissions Test

Significant Emissions Data

VBR8 03/04/2015

Manufacturer	:	SENNCO SOLUTIONS
Model	:	BUBBLE MAKER
DUT Revision	:	
Serial Number	:	NONE ASSIGNED
DUT Mode	:	NORMAL OPERATION (Tx @ 134.2kHz, Rx @ 907MHz, Rx @ 916.8MHz)
Line Tested	:	115V, 60Hz HIGH
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	TESTED WITH CUI PS P/N: ETSA 24027OUDC-P5RP-SZ
Test Engineer	:	M. Longinotti
Limit	:	Class B
Test Date	:	Aug 12, 2015 01:13:22 PM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

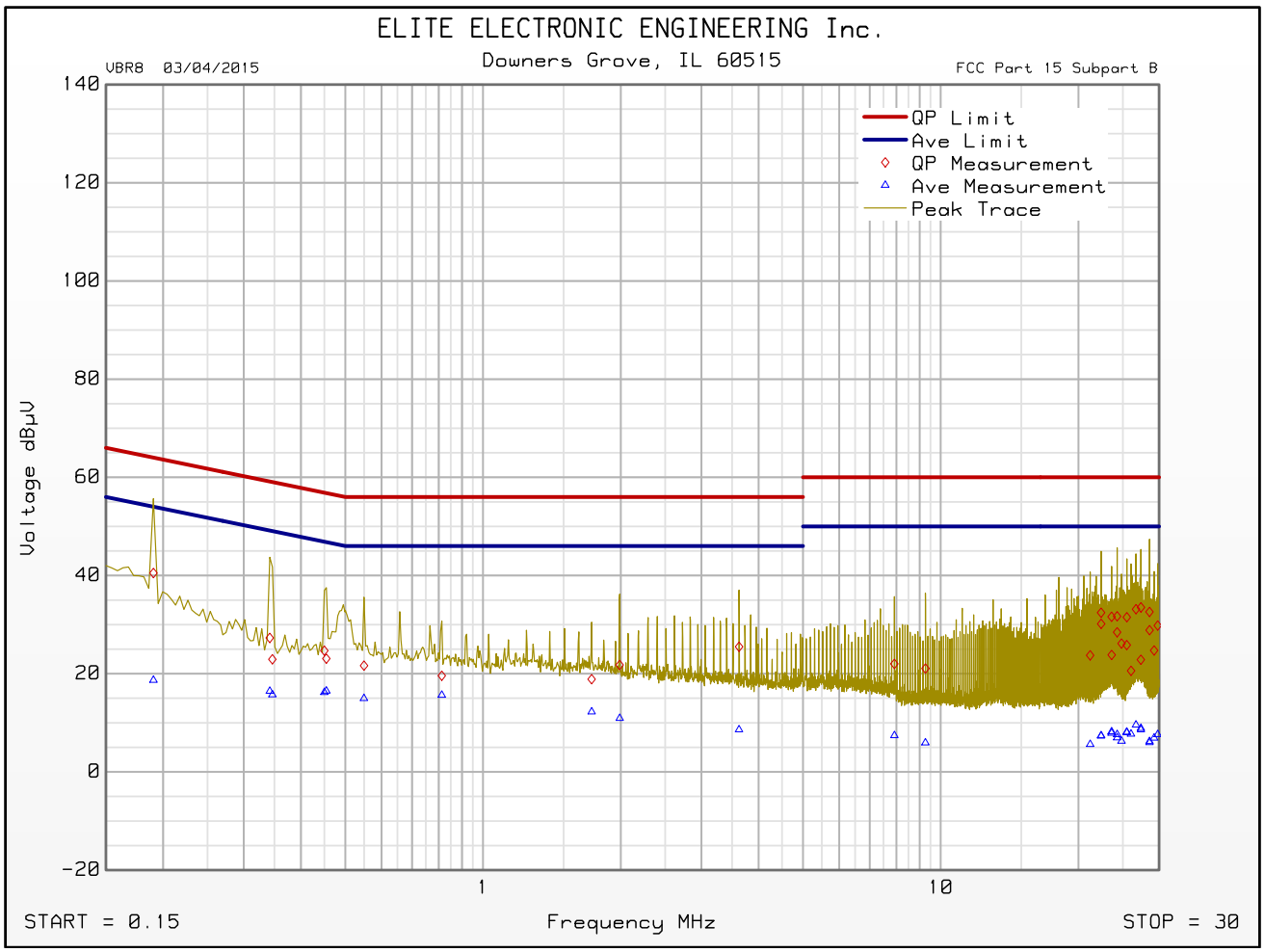
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.191	40.5	64.0		18.7	54.0	
0.342	27.3	59.2		16.4	49.2	
0.550	21.7	56.0		15.0	46.0	
0.813	19.6	56.0		15.6	46.0	
1.727	18.9	56.0		12.2	46.0	
1.989	21.8	56.0		10.9	46.0	
3.626	25.5	56.0		8.6	46.0	
7.921	22.0	60.0		7.4	50.0	
9.261	21.1	60.0		6.0	50.0	
27.383	33.5	60.0		8.6	50.0	

FCC Part 15 Subpart B Conducted Emissions Test

Cumulative Data

VBR8 03/04/2015

Manufacturer	:	SENNCO SOLUTIONS
Model	:	BUBBLE MAKER
DUT Revision	:	
Serial Number	:	NONE ASSIGNED
DUT Mode	:	NORMAL OPERATION (Tx @ 134.2kHz, Rx @ 907MHz, Rx @ 916.8MHz)
Line Tested	:	115V, 60Hz HIGH
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	TESTED WITH CUI PS P/N: ETSA 24027OUDC-P5RP-SZ
Test Engineer	:	M. Longinotti
Limit	:	Class B
Test Date	:	Aug 12, 2015 01:13:22 PM



Emissions Meet QP Limit
Emissions Meet Ave Limit

FCC Part 15 Subpart B Conducted Emissions Test

Significant Emissions Data

VBR8 03/04/2015

Manufacturer	:	SENNCO SOLUTIONS
Model	:	BUBBLE MAKER
DUT Revision	:	
Serial Number	:	NONE ASSIGNED
DUT Mode	:	NORMAL OPERATION (Tx @ 134.2kHz, Rx @ 907MHz, Rx @ 916.8MHz)
Line Tested	:	115V, 60Hz RETURN
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	TESTED WITH CUI PS P/N: ETSA 24027OUDC-P5RP-SZ
Test Engineer	:	M. Longinotti
Limit	:	Class B
Test Date	:	Aug 12, 2015 01:03:29 PM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

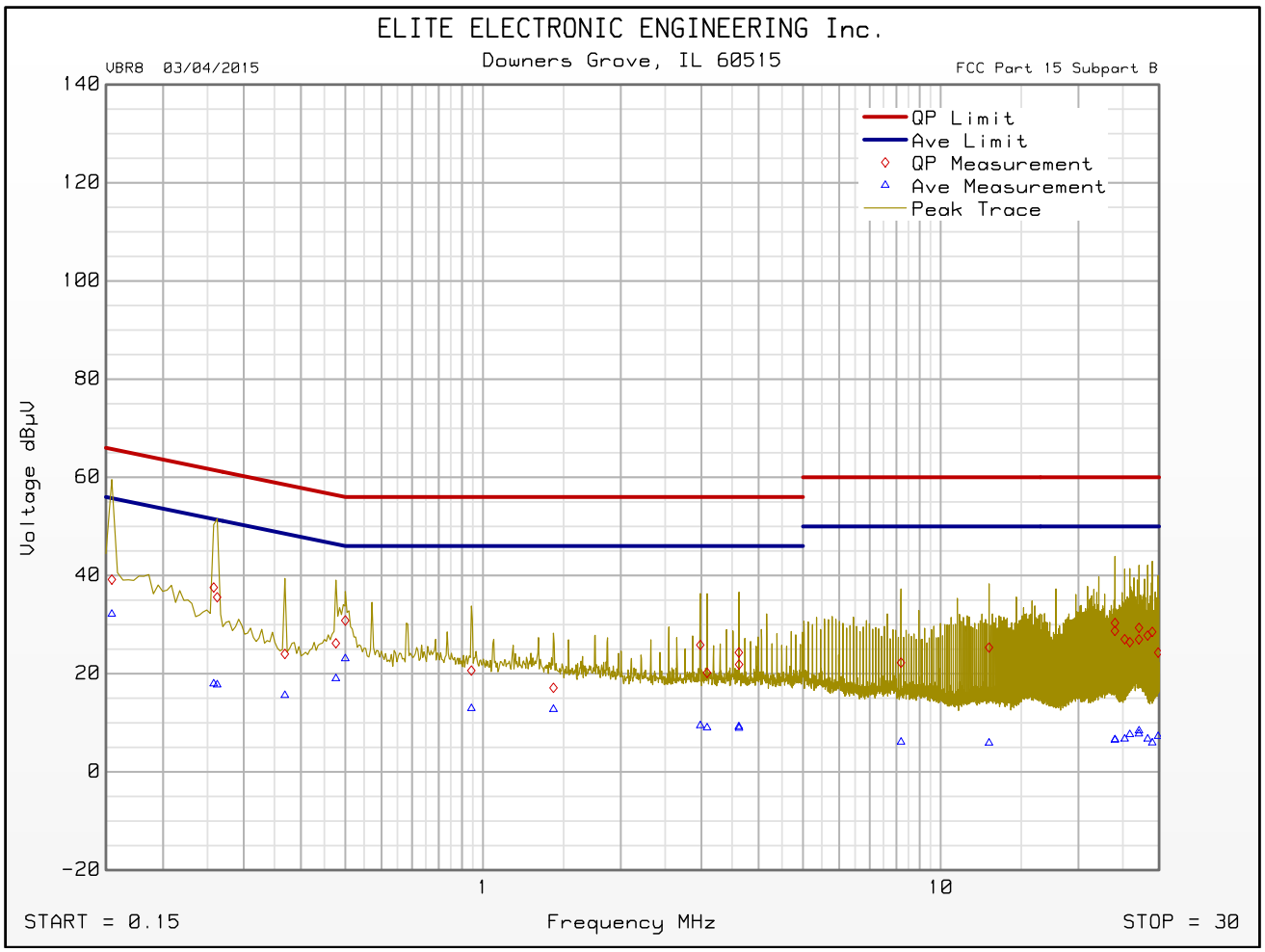
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.258	37.6	61.5		18.0	51.5	
0.500	30.8	56.0		23.1	46.0	
0.943	20.6	56.0		12.9	46.0	
1.426	17.1	56.0		12.8	46.0	
2.984	25.9	56.0		9.5	46.0	
3.622	24.3	56.0		9.2	46.0	
8.191	22.2	60.0		6.1	50.0	
12.753	25.3	60.0		5.9	50.0	
24.031	30.4	60.0		6.6	50.0	

FCC Part 15 Subpart B Conducted Emissions Test

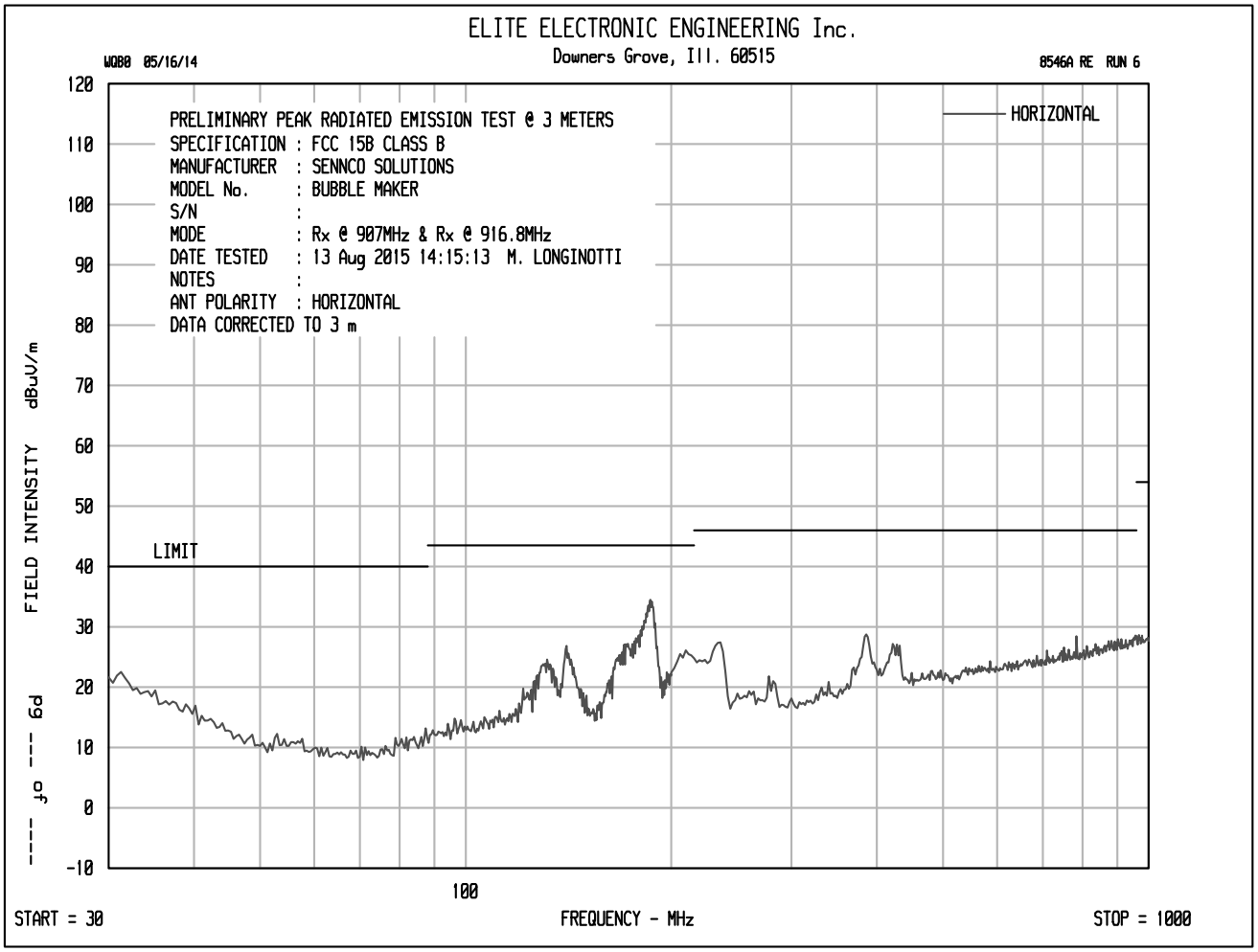
Cumulative Data

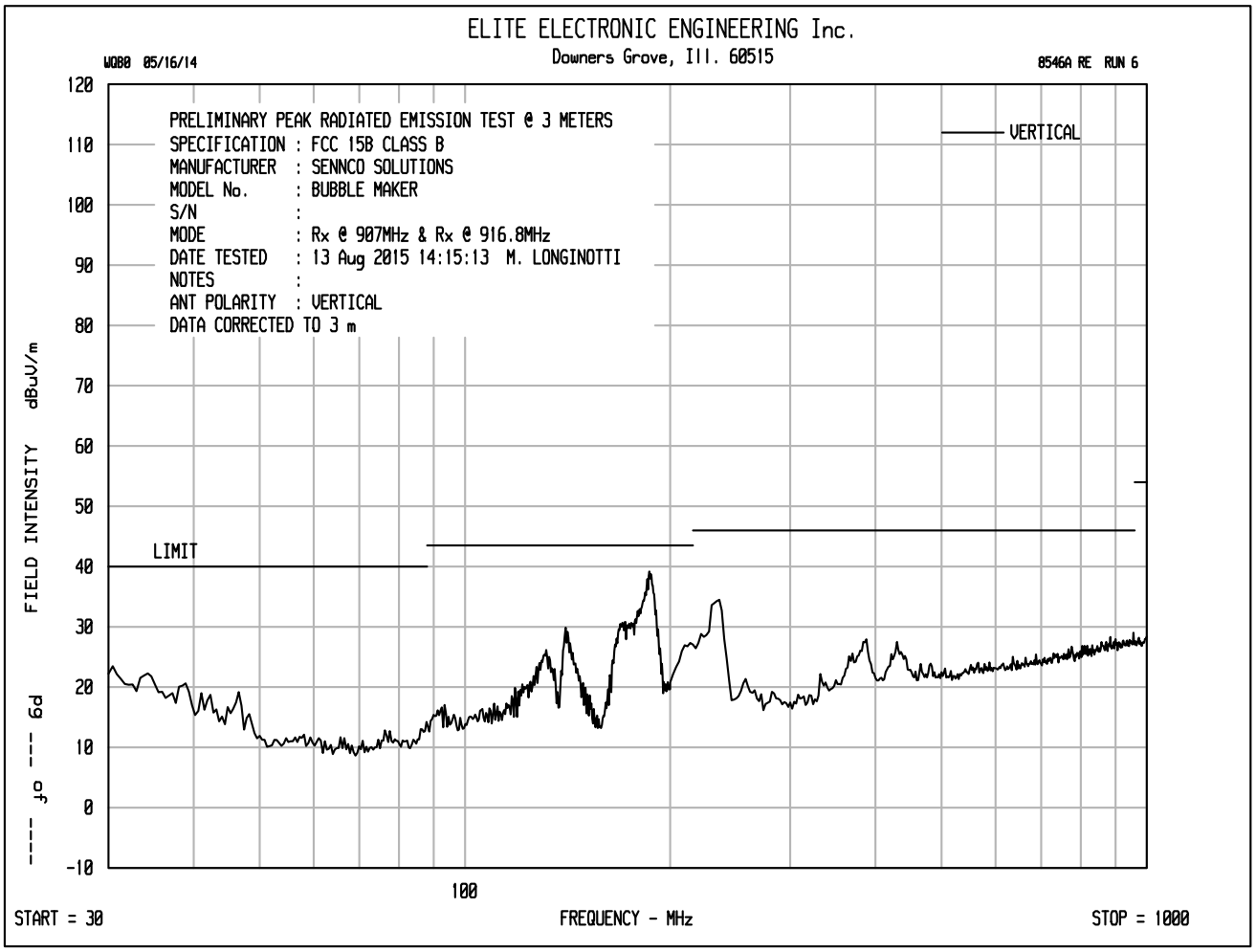
VBR8 03/04/2015

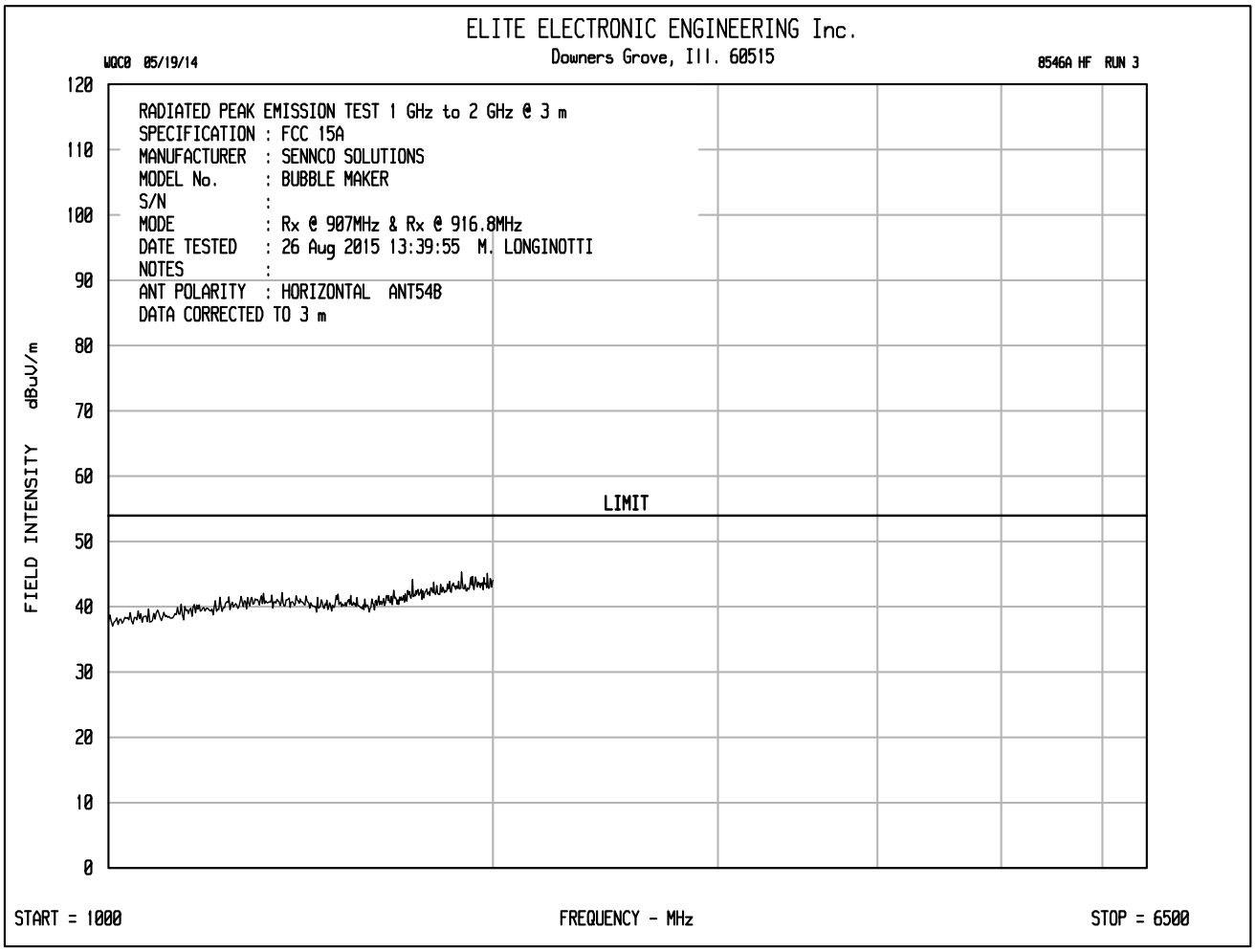
Manufacturer	:	SENNCO SOLUTIONS
Model	:	BUBBLE MAKER
DUT Revision	:	
Serial Number	:	NONE ASSIGNED
DUT Mode	:	NORMAL OPERATION (Tx @ 134.2kHz, Rx @ 907MHz, Rx @ 916.8MHz)
Line Tested	:	115V, 60Hz RETURN
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	TESTED WITH CUI PS P/N: ETSA 24027OUDC-P5RP-SZ
Test Engineer	:	M. Longinotti
Limit	:	Class B
Test Date	:	Aug 12, 2015 01:03:29 PM

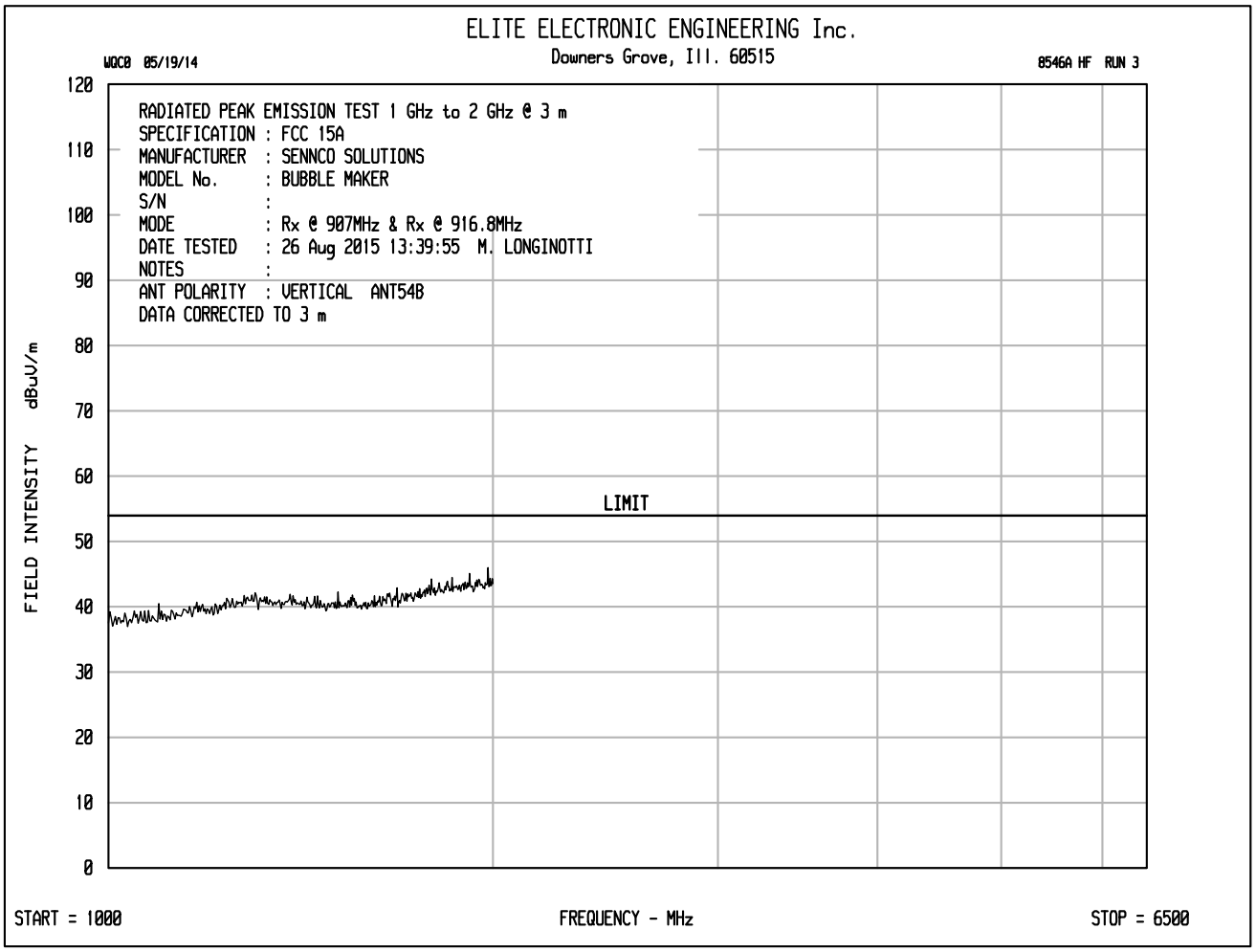


Emissions Meet QP Limit
Emissions Meet Ave Limit


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
W080 05/16/14
8546A RE RUN 6
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : BUBBLE MAKER
S/N :
MODE : Rx @ 907MHz & Rx @ 916.8MHz
DATE TESTED : 13 Aug 2015 14:15:13 M. LONGINOTTI
NOTES :
ANT POLARITY : HORIZONTAL
DATA CORRECTED TO 3 m
HORIZONTAL
LIMIT
FIELD INTENSITY dBuV/m
---- uo --- 6d
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
100
START = 30
FREQUENCY - MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
W080 05/16/14
8546A RE RUN 6
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : BUBBLE MAKER
S/N :
MODE : Rx @ 907MHz & Rx @ 916.8MHz
DATE TESTED : 13 Aug 2015 14:15:13 M. LONGINOTTI
NOTES :
ANT POLARITY : VERTICAL
DATA CORRECTED TO 3 m
VERTICAL
LIMIT
FIELD INTENSITY dBuV/m
---- fo --- 6d
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
100
START = 30
FREQUENCY - MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WQC8 05/19/14
8546A HF RUN 3
RADIATED PEAK EMISSION TEST 1 GHz to 2 GHz @ 3 m
SPECIFICATION : FCC 15A
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : BUBBLE MAKER
S/N :
MODE : Rx @ 907MHz & Rx @ 916.8MHz
DATE TESTED : 26 Aug 2015 13:39:55 M. LONGINOTTI
NOTES :
ANT POLARITY : HORIZONTAL ANT54B
DATA CORRECTED TO 3 m
LIMIT
FIELD INTENSITY dBuV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 6500


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WQC8 05/19/14
8546A HF RUN 3
RADIATED PEAK EMISSION TEST 1 GHz to 2 GHz @ 3 m
SPECIFICATION : FCC 15A
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : BUBBLE MAKER
S/N :
MODE : Rx @ 907MHz & Rx @ 916.8MHz
DATE TESTED : 26 Aug 2015 13:39:55 M. LONGINOTTI
NOTES :
ANT POLARITY : VERTICAL ANT54B
DATA CORRECTED TO 3 m
LIMIT
FIELD INTENSITY dBuV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 6500

ETR No. 8546A
DATA SHEET TEST NO. 6

RADIATED QP EMISSION MEASUREMENTS in a 3 m SEMI-ANECHOIC ROOM
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : SENNCO SOLUTIONS
MODEL NO. : BUBBLE MAKER
SERIAL NO. :
TEST MODE : Rx @ 907MHz & Rx @ 916.8MHz
NOTES :
TEST DATE : 13 Aug 2015 14:15:13
TEST DISTANCE : 3 m

FREQUENCY MHz	QP READING dBuV	ANT FAC dB	CBL FAC dB	EXT ATTN dB	DIST FAC dB	TOTAL dBuV/m	QP LIMIT dBuV/m	AZ deg	ANT HT cm	ANT POL
53.81	-6.0	7.6	.5	0.0	0.0	2.2	40.0	45	200	H
89.17	-3.4	9.8	.5	0.0	0.0	6.9	43.5	269	120	V
120.22	3.1	12.8	.6	0.0	0.0	16.5	43.5	225	120	V
139.82	16.4	11.9	.7	0.0	0.0	29.0	43.5	225	120	V
168.57	18.9	10.3	.9	0.0	0.0	30.1	43.5	225	120	V
185.56	26.7	10.4	.9	0.0	0.0	38.0	43.5	225	120	V
188.18	23.7	10.4	1.0	0.0	0.0	35.1	43.5	225	120	V
365.89	5.0	15.5	1.3	0.0	0.0	21.9	46.0	135	200	V
384.13	9.1	16.1	1.4	0.0	0.0	26.7	46.0	0	340	H
563.84	-6.9	18.9	1.5	0.0	0.0	13.5	46.0	90	340	V
687.47	-6.6	19.8	1.7	0.0	0.0	14.9	46.0	225	120	V
783.44	-6.6	20.7	2.0	0.0	0.0	16.0	46.0	90	340	H
887.77	-5.8	21.7	2.0	0.0	0.0	17.9	46.0	45	120	V
957.66	-5.9	22.3	2.0	0.0	0.0	18.3	46.0	135	120	V

tested by: MARK E. LONGINOTTI
M. LONGINOTTI

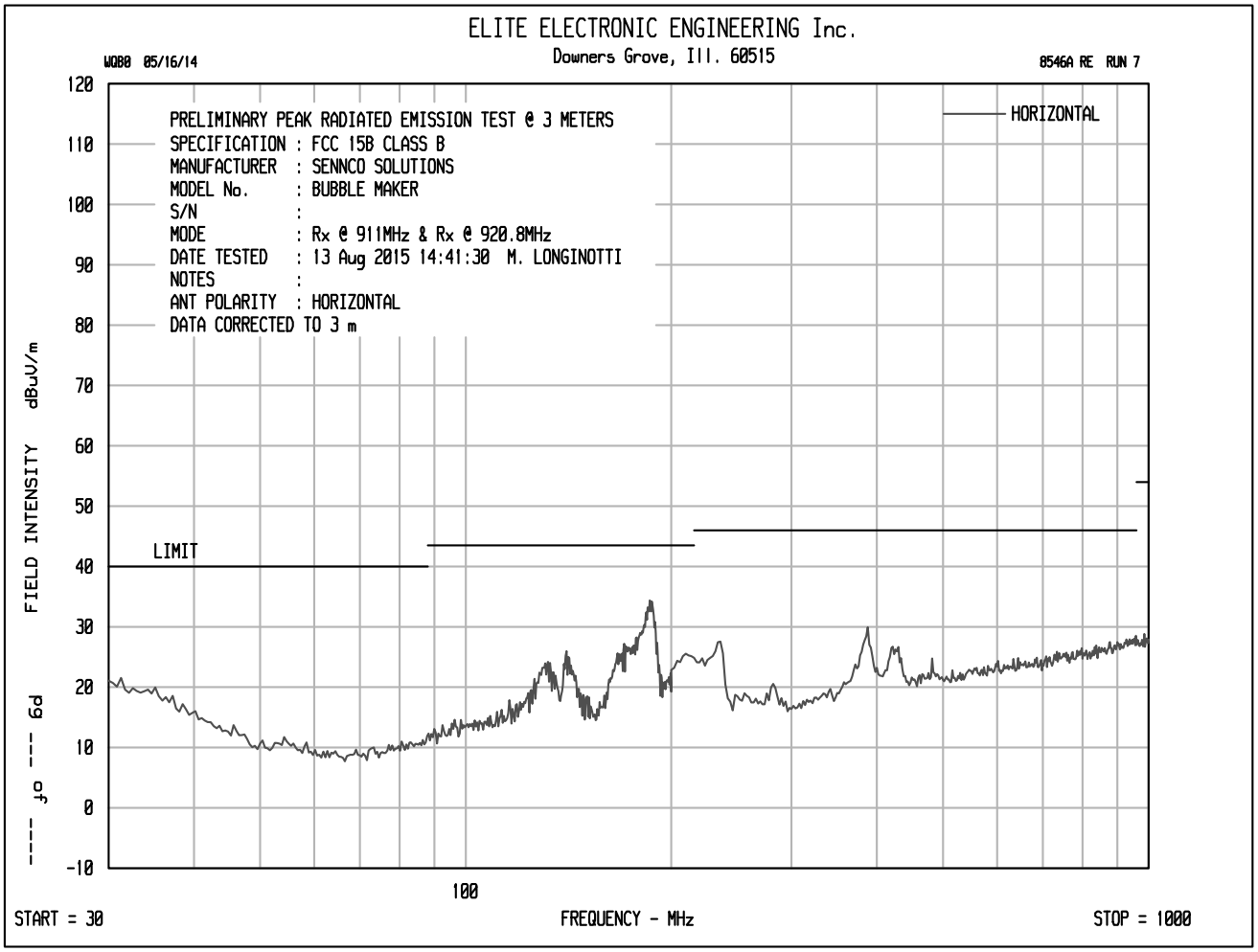
DATA SHEET HF TEST NO. 3

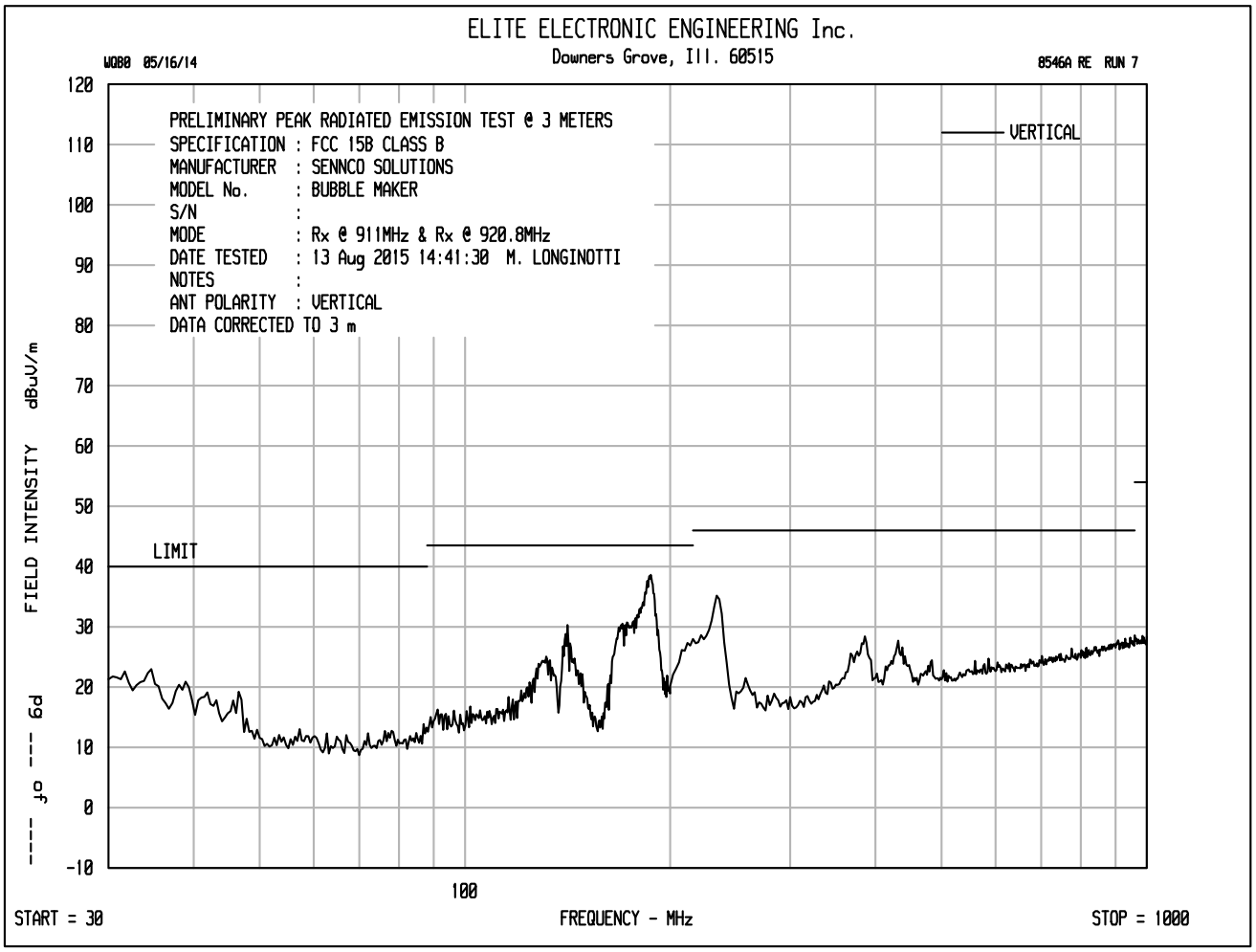
RADIATED AVG EMISSION MEASUREMENTS >=1000 MHz in a 3 m ANECHOIC ROOM

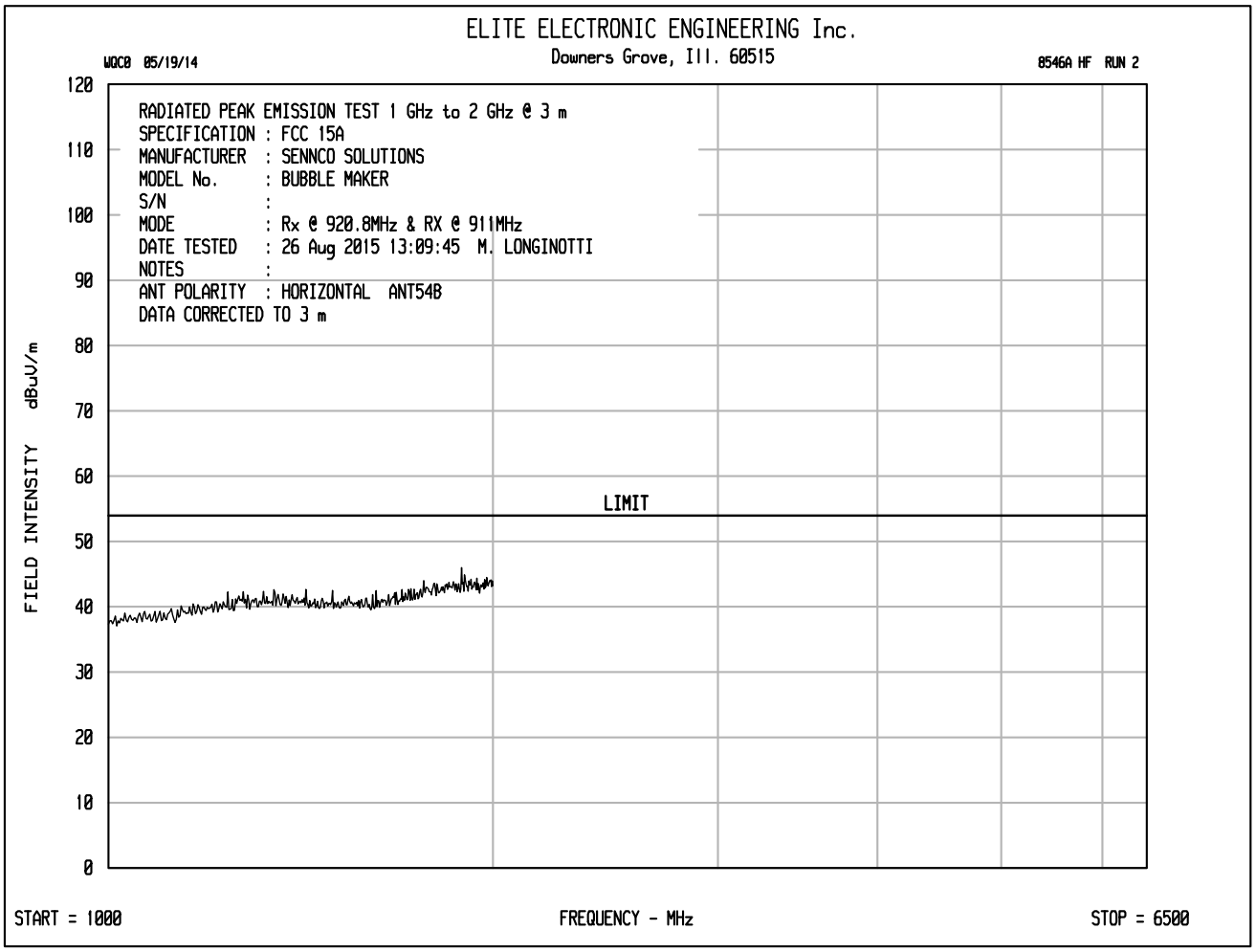
SPECIFICATION : FCC 15A
MANUFACTURER : SENNCO SOLUTIONS
MODEL NO. : BUBBLE MAKER
SERIAL NO. :
TEST MODE : Rx @ 907MHz & Rx @ 916.8MHz
NOTES :
TEST DATE : 26 Aug 2015 13:39:55
TEST DISTANCE : 3 m
ANTENNA : ANT54B

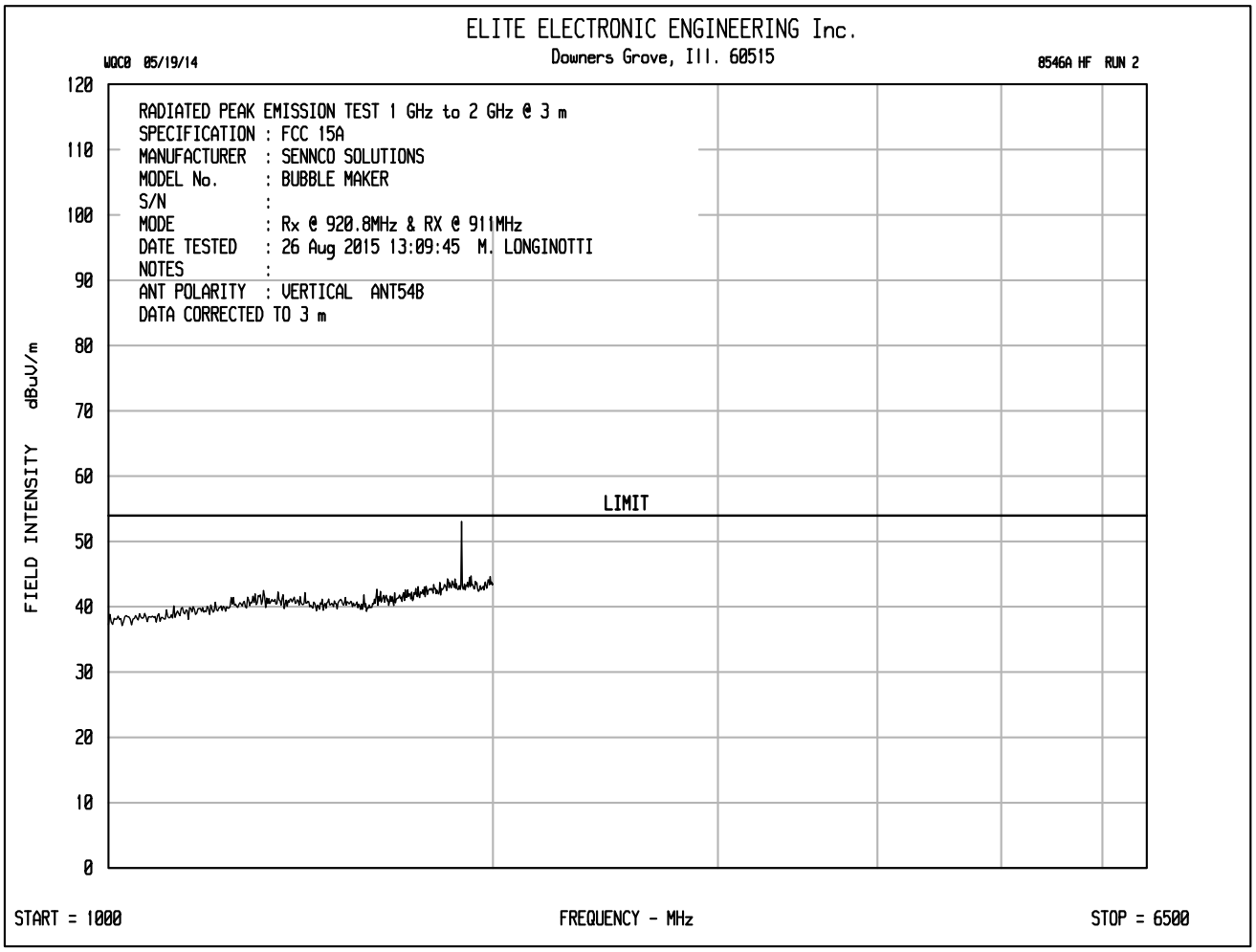
FREQUENCY MHz	AVG READING dBuV	ANT FAC dB	CBL FAC dB	DIST FAC dB	TOTAL dBuV/m	AVG LIMIT dBuV/m	PASS/ FAIL	AZ deg	ANT HT cm	POLAR
1090.31	-3.5	27.1	1.6	0.0	25.2	54.0		0	340	V
1209.31	-3.4	28.4	1.7	0.0	26.8	54.0		225	120	H
1373.51	-2.6	29.0	1.9	0.0	28.3	54.0		45	340	H
1534.67	-2.6	28.4	2.0	0.0	27.7	54.0		45	200	V
1648.27	-3.2	28.9	2.1	0.0	27.8	54.0		315	340	V
1796.70	-2.8	30.6	2.2	0.0	29.9	54.0		180	340	V
1862.15	-2.9	31.2	2.2	0.0	30.5	54.0		180	120	H
1985.67	-3.6	31.7	2.3	0.0	30.4	54.0		315	340	V

tested by: MARK E. LONGINOTTI
M. LONGINOTTI


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
W080 05/16/14
8546A RE RUN 7
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : BUBBLE MAKER
S/N :
MODE : Rx @ 911MHz & Rx @ 920.8MHz
DATE TESTED : 13 Aug 2015 14:41:30 M. LONGINOTTI
NOTES :
ANT POLARITY : HORIZONTAL
DATA CORRECTED TO 3 m
HORIZONTAL
LIMIT
FIELD INTENSITY dBuV/m
---- uo --- 6d
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
100
START = 30
FREQUENCY - MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
W080 05/16/14
8546A RE RUN 7
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : BUBBLE MAKER
S/N :
MODE : Rx @ 911MHz & Rx @ 920.8MHz
DATE TESTED : 13 Aug 2015 14:41:30 M. LONGINOTTI
NOTES :
ANT POLARITY : VERTICAL
DATA CORRECTED TO 3 m
VERTICAL
LIMIT
FIELD INTENSITY dBuV/m
---- fo --- 6d
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
100
START = 30
FREQUENCY - MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WQC8 05/19/14
8546A HF RUN 2
RADIATED PEAK EMISSION TEST 1 GHz to 2 GHz @ 3 m
SPECIFICATION : FCC 15A
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : BUBBLE MAKER
S/N :
MODE : Rx @ 920.8MHz & RX @ 911MHz
DATE TESTED : 26 Aug 2015 13:09:45 M. LONGINOTTI
NOTES :
ANT POLARITY : HORIZONTAL ANT54B
DATA CORRECTED TO 3 m
LIMIT
FIELD INTENSITY dBuV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 6500


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WQC8 05/19/14
8546A HF RUN 2
RADIATED PEAK EMISSION TEST 1 GHz to 2 GHz @ 3 m
SPECIFICATION : FCC 15A
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : BUBBLE MAKER
S/N :
MODE : Rx @ 920.8MHz & RX @ 911MHz
DATE TESTED : 26 Aug 2015 13:09:45 M. LONGINOTTI
NOTES :
ANT POLARITY : VERTICAL ANT54B
DATA CORRECTED TO 3 m
LIMIT
FIELD INTENSITY dBuV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 6500

ETR No. 8546A
DATA SHEET TEST NO. 7

RADIATED QP EMISSION MEASUREMENTS in a 3 m SEMI-ANECHOIC ROOM
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : SENNCO SOLUTIONS
MODEL NO. : BUBBLE MAKER
SERIAL NO. :
TEST MODE : Rx @ 911MHz & Rx @ 920.8MHz
NOTES :
TEST DATE : 13 Aug 2015 14:41:30
TEST DISTANCE : 3 m

FREQUENCY MHz	QP READING dBuV	ANT FAC dB	CBL FAC dB	EXT ATTN dB	DIST FAC dB	TOTAL dBuV/m	QP LIMIT dBuV/m	AZ deg	ANT HT cm	ANT POL
33.98	-2.8	17.1	.5	0.0	0.0	14.8	40.0	90	200	V
58.73	-3.8	6.8	.5	0.0	0.0	3.4	40.0	135	200	V
86.60	-4.8	9.4	.5	0.0	0.0	5.1	40.0	270	200	V
122.86	4.9	12.9	.6	0.0	0.0	18.5	43.5	225	120	V
139.84	16.3	11.9	.7	0.0	0.0	28.9	43.5	225	120	V
168.61	18.9	10.3	.9	0.0	0.0	30.1	43.5	270	120	V
186.25	26.9	10.4	.9	0.0	0.0	38.2	43.5	315	120	V
233.98	20.6	11.7	1.0	0.0	0.0	33.3	46.0	135	120	V
363.96	3.5	15.5	1.3	0.0	0.0	20.4	46.0	135	200	V
385.58	8.3	16.1	1.4	0.0	0.0	25.9	46.0	-0	340	H
478.90	-6.0	17.9	1.5	0.0	0.0	13.4	46.0	315	120	H
689.99	-6.7	19.8	1.7	0.0	0.0	14.8	46.0	135	340	H
798.86	-6.7	20.8	2.0	0.0	0.0	16.1	46.0	225	120	H
900.95	-5.9	21.8	2.0	0.0	0.0	18.0	46.0	135	340	V
966.56	-6.0	22.3	2.0	0.0	0.0	18.4	54.0	315	340	V

tested by: MARK E. LONGINOTTI
M. LONGINOTTI

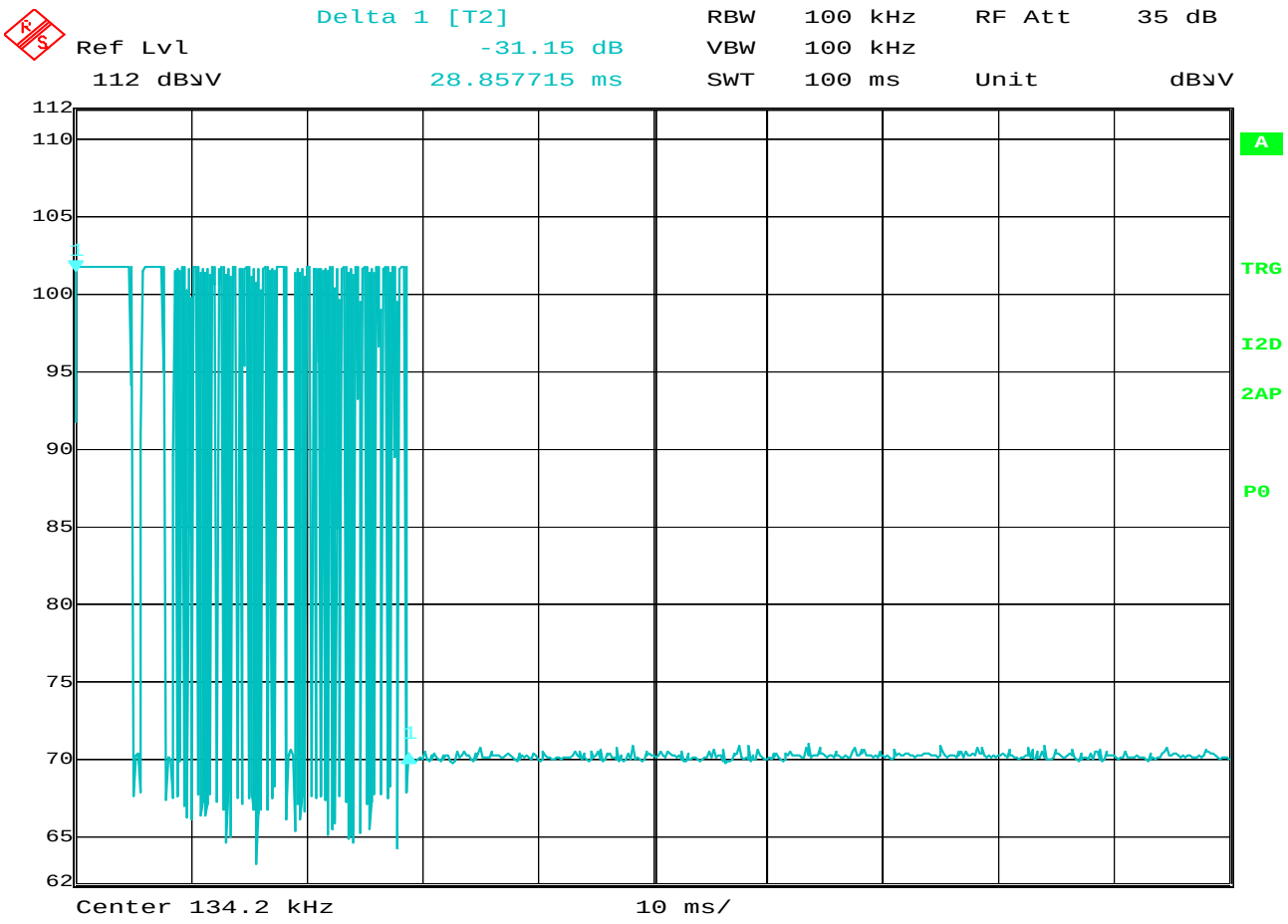
DATA SHEET HF TEST NO. 2

RADIATED AVG EMISSION MEASUREMENTS >=1000 MHz in a 3 m ANECHOIC ROOM

SPECIFICATION : FCC 15A
MANUFACTURER : SENNCO SOLUTIONS
MODEL NO. : BUBBLE MAKER
SERIAL NO. :
TEST MODE : Rx @ 920.8MHz & RX @ 911MHz
NOTES :
TEST DATE : 26 Aug 2015 13:09:45
TEST DISTANCE : 3 m
ANTENNA : ANT54B

FREQUENCY MHz	AVG READING dBuV	ANT FAC dB	CBL FAC dB	DIST FAC dB	TOTAL dBuV/m	AVG LIMIT dBuV/m	PASS/ FAIL	AZ deg	ANT HT cm	POLAR
1135.43	-2.9	27.6	1.7	0.0	26.3	54.0		-0	200	V
1221.44	-2.9	28.5	1.7	0.0	27.4	54.0		90	120	H
1353.89	-2.6	29.1	1.9	0.0	28.4	54.0		180	200	H
1448.14	-2.5	28.6	1.9	0.0	28.1	54.0		135	120	H
1619.14	-3.5	28.6	2.0	0.0	27.2	54.0		90	120	V
1740.59	-2.6	29.9	2.1	0.0	29.3	54.0		90	340	H
1894.43	-3.1	31.5	2.2	0.0	30.6	54.0		315	120	V
2011.13	-3.5	31.8	2.3	0.0	30.6	54.0		-0	200	V

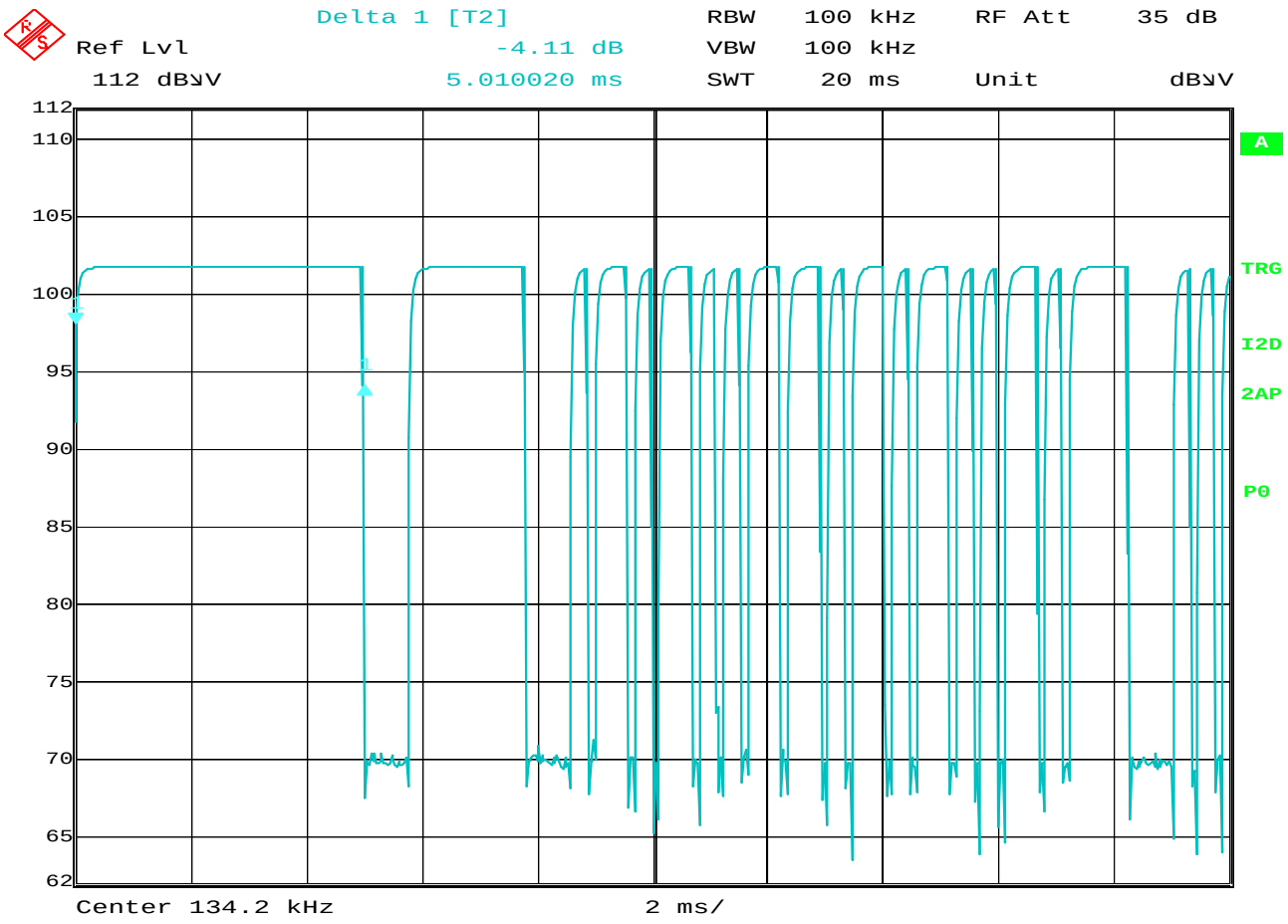
tested by: MARK E. LONGINOTTI
M. LONGINOTTI



FCC 15.209 Duty Cycle Correction Factor

MANUFACTURER	:	Sennco Solutions
MODEL NUMBER	:	Bubble Maker
SERIAL NUMBER	:	
TEST MODE	:	Transmit at 134.2kHz
TEST PARAMETERS	:	Duty Cycle Correction Factor
NOTES	:	
EQUIPMENT USED	:	RBB0, NLS0

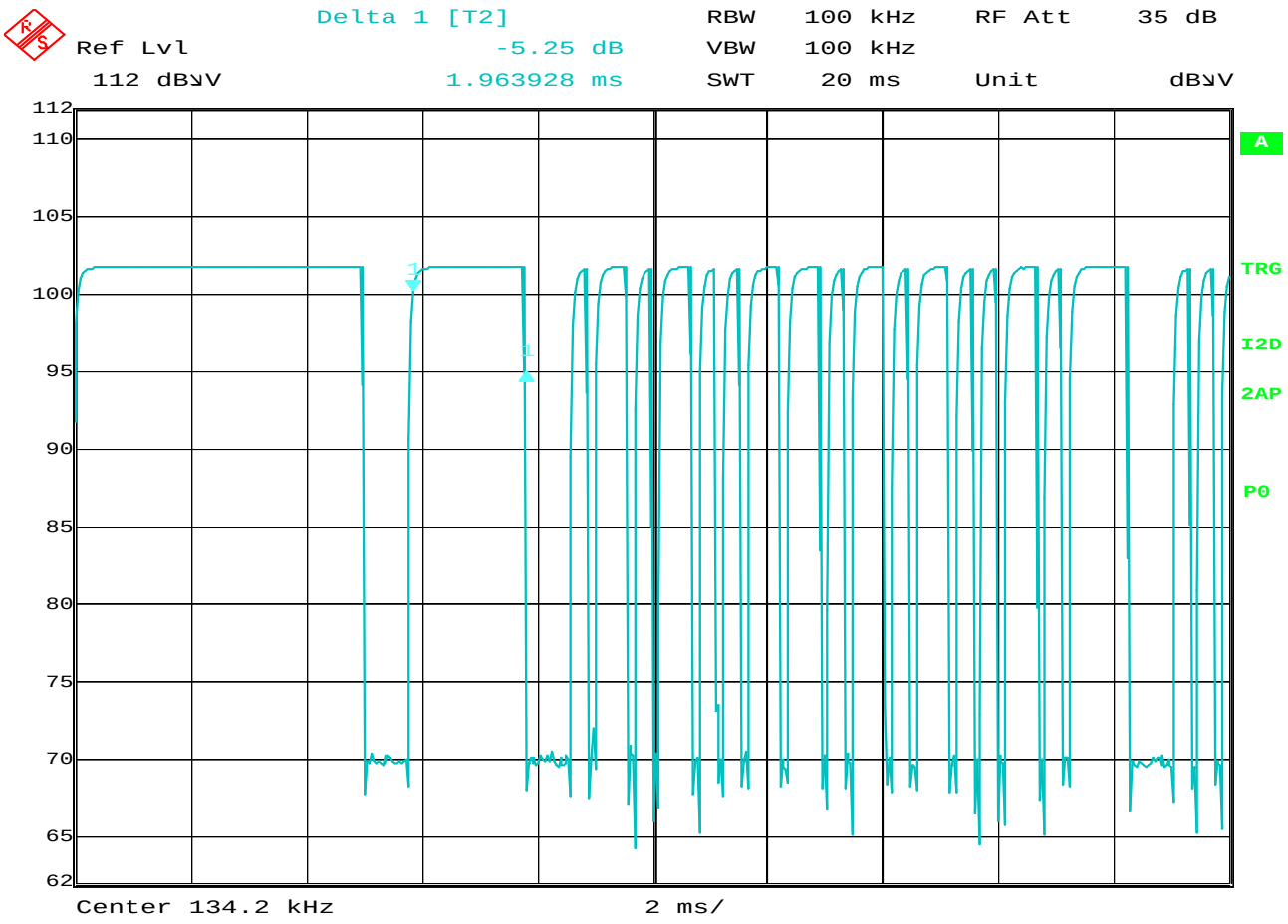
NOTES



FCC 15.209 Duty Cycle Correction Factor

MANUFACTURER	:	Sennco Solutions
MODEL NUMBER	:	Bubble Maker
SERIAL NUMBER	:	
TEST MODE	:	Transmit at 134.2kHz
TEST PARAMETERS	:	Duty Cycle Correction Factor
NOTES	:	1bit is 5msec
EQUIPMENT USED	:	RBB0, NLS0

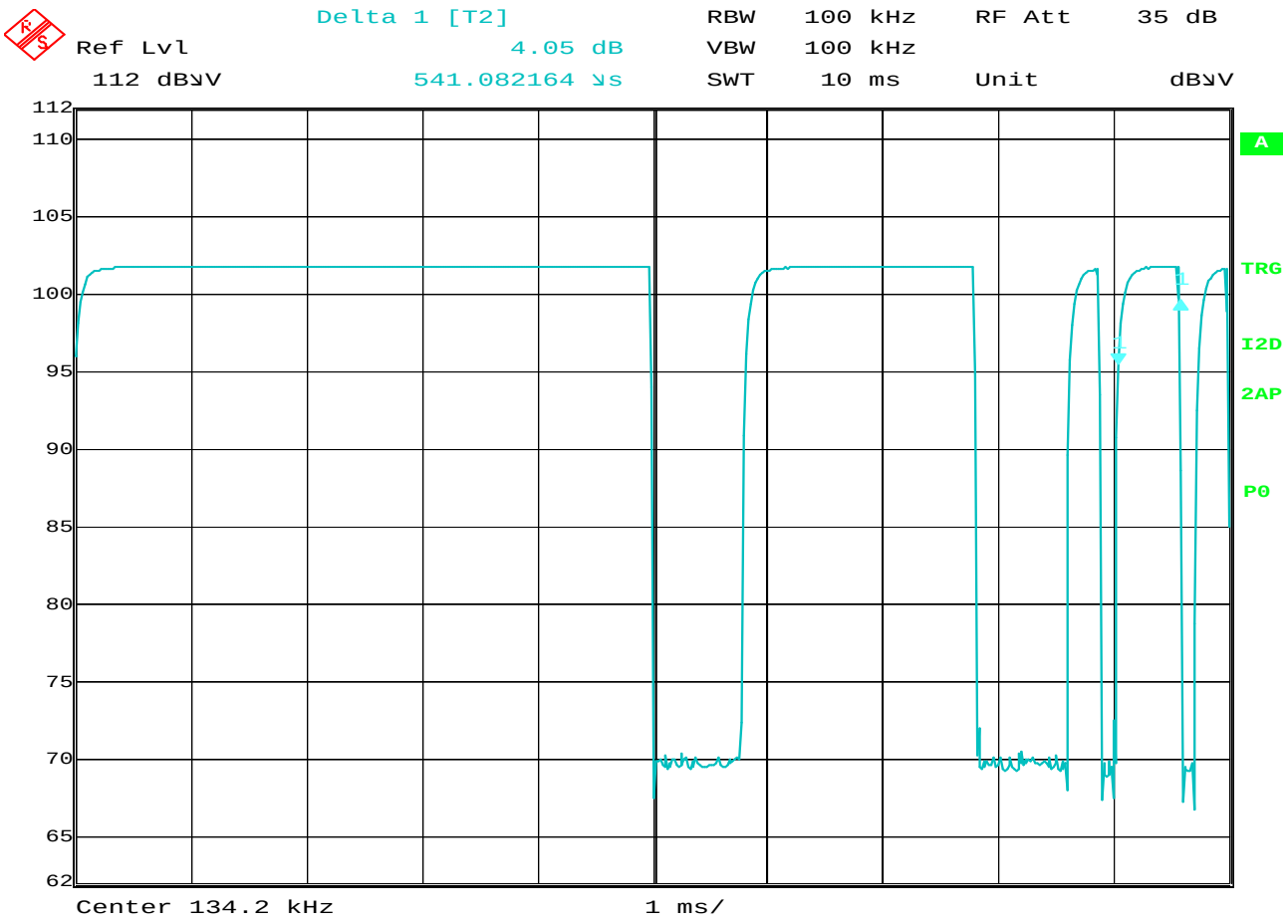
NOTES



FCC 15.209 Duty Cycle Correction Factor

MANUFACTURER	:	Sennco Solutions
MODEL NUMBER	:	Bubble Maker
SERIAL NUMBER	:	
TEST MODE	:	Transmit at 134.2kHz
TEST PARAMETERS	:	Duty Cycle Correction Factor
NOTES	:	2nd bit is 2msec
EQUIPMENT USED	:	RBB0, NLS0

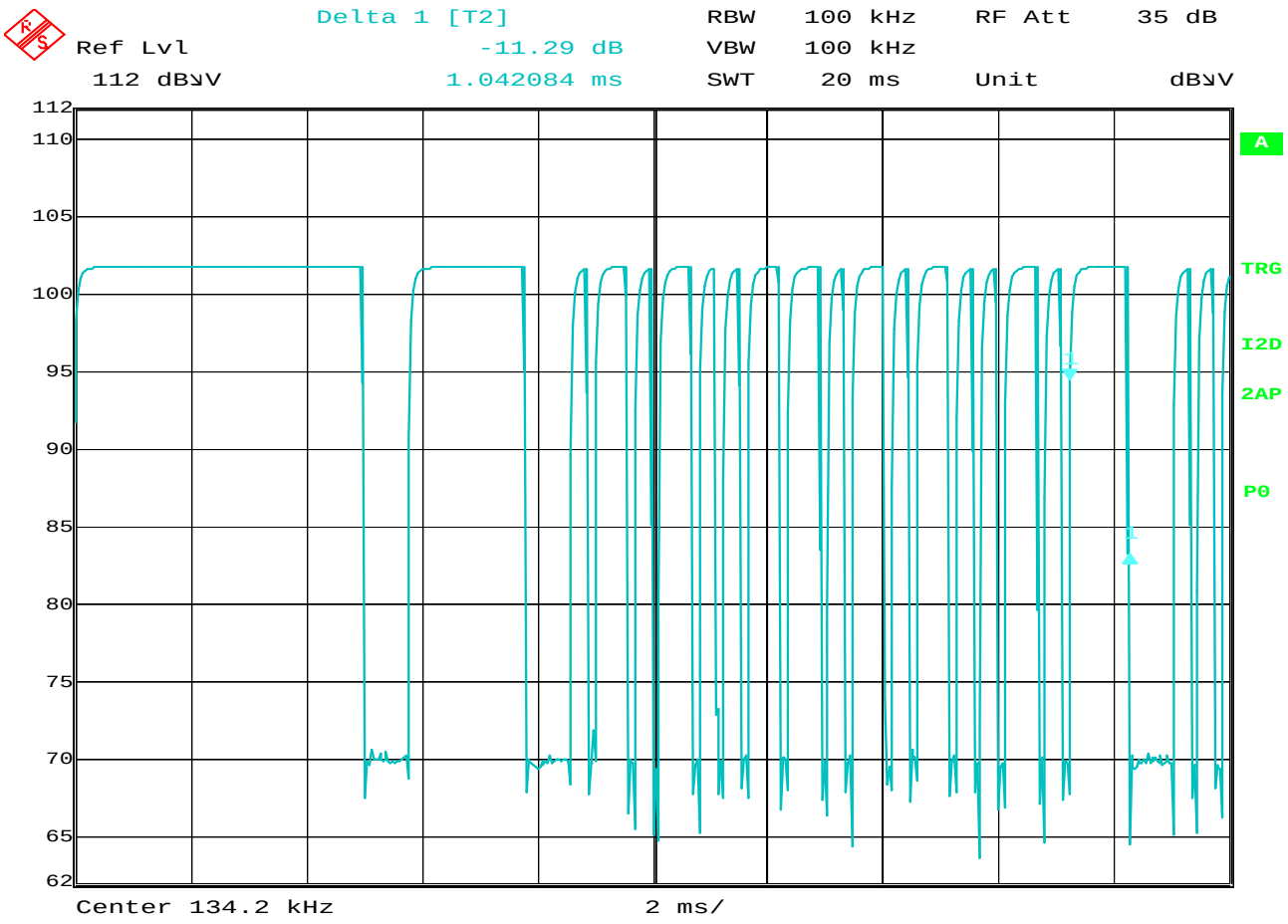
NOTES



FCC 15.209 Duty Cycle Correction Factor

MANUFACTURER	:	Sennco Solutions
MODEL NUMBER	:	Bubble Maker
SERIAL NUMBER	:	
TEST MODE	:	Transmit at 134.2kHz
TEST PARAMETERS	:	Duty Cycle Correction Factor
NOTES	:	worst case “1” bit is 550usec
EQUIPMENT USED	:	RBB0, NLS0

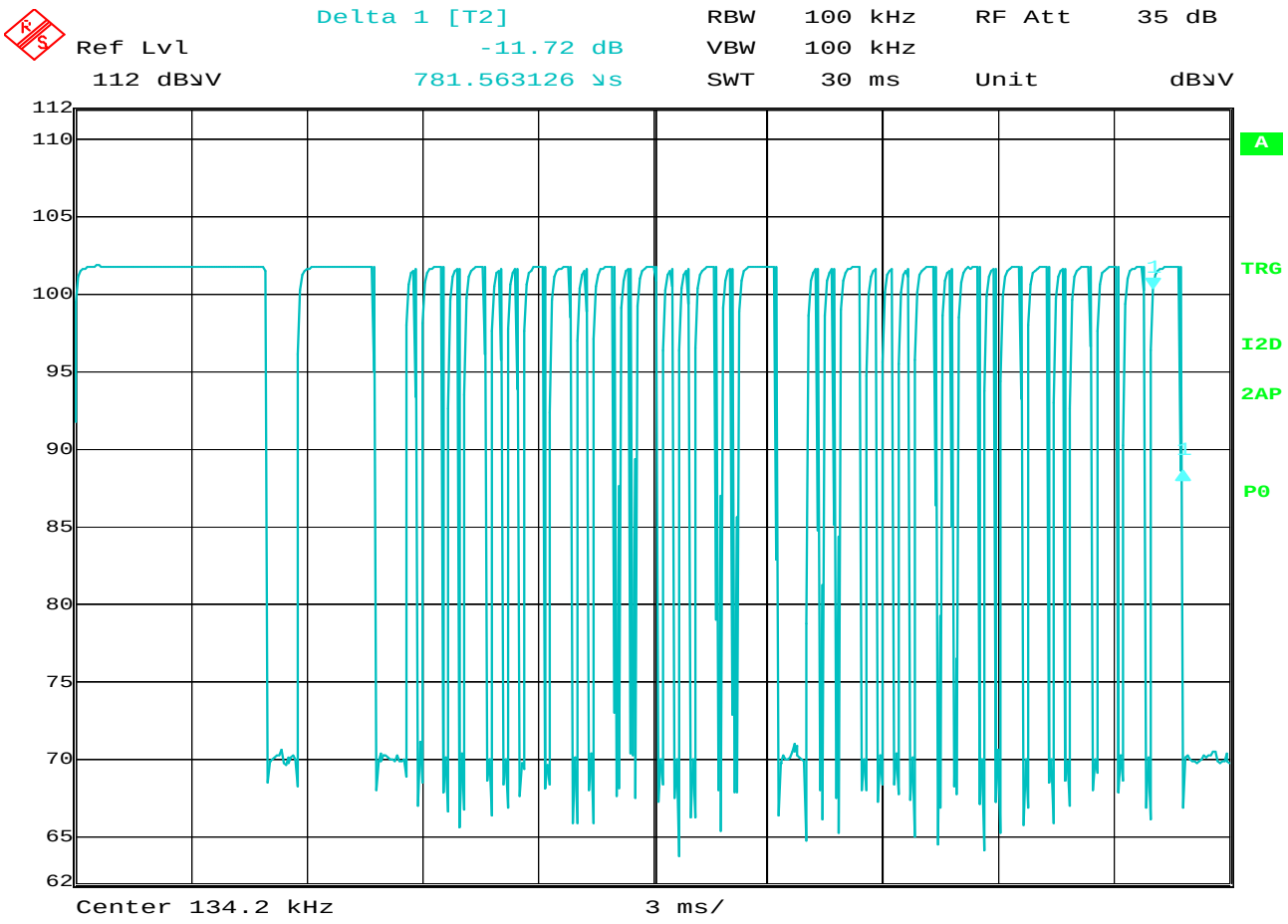
NOTES



FCC 15.209 Duty Cycle Correction Factor

MANUFACTURER	:	Sennco Solutions
MODEL NUMBER	:	Bubble Maker
SERIAL NUMBER	:	
TEST MODE	:	Transmit at 134.2kHz
TEST PARAMETERS	:	Duty Cycle Correction Factor
NOTES	:	17th bit is 1msec
EQUIPMENT USED	:	RBB0, NLS0

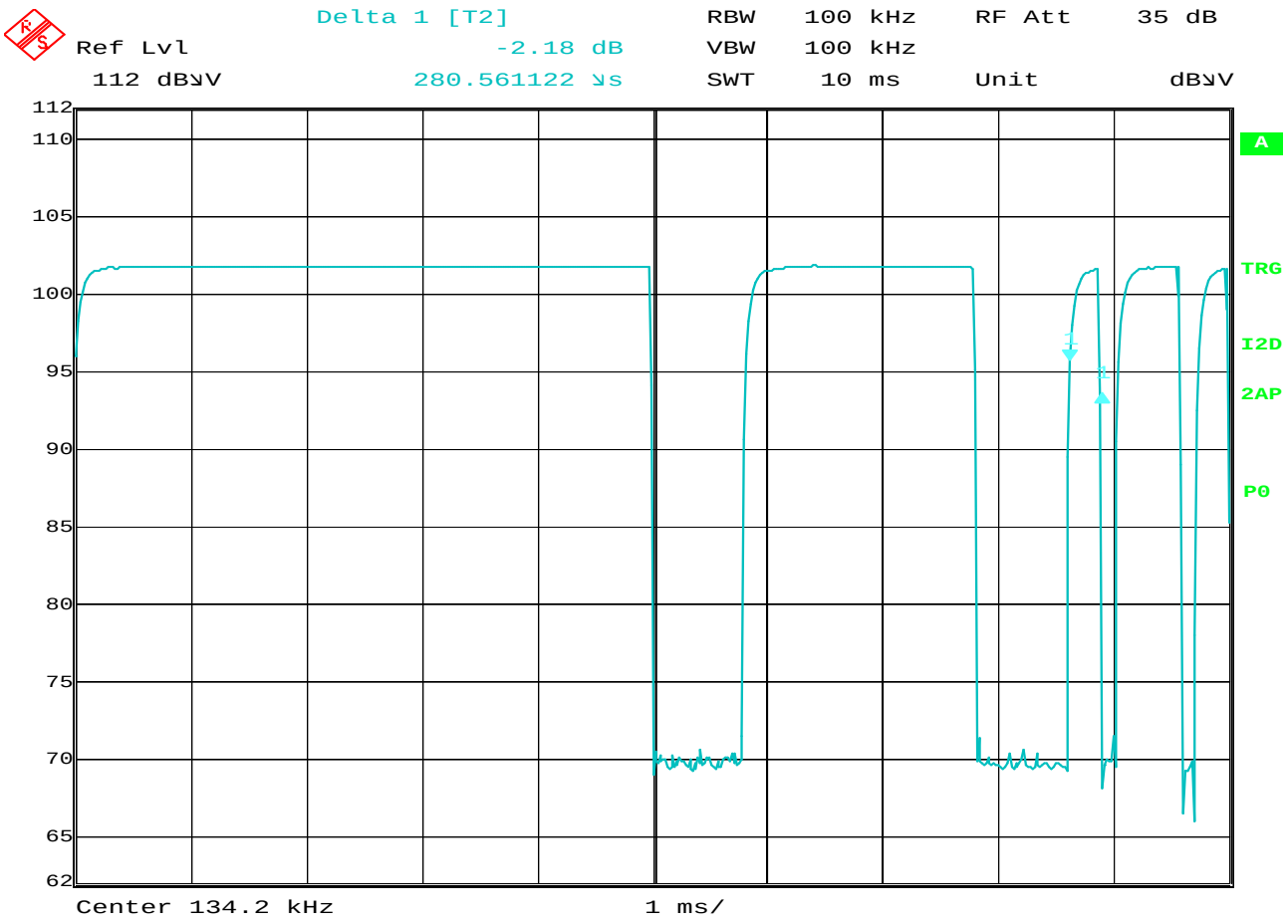
NOTES



FCC 15.209 Duty Cycle Correction Factor

MANUFACTURER	:	Sennco Solutions
MODEL NUMBER	:	Bubble Maker
SERIAL NUMBER	:	
TEST MODE	:	Transmit at 134.2kHz
TEST PARAMETERS	:	Duty Cycle Correction Factor
NOTES	:	last bit is 794usec
EQUIPMENT USED	:	RBB0, NLS0

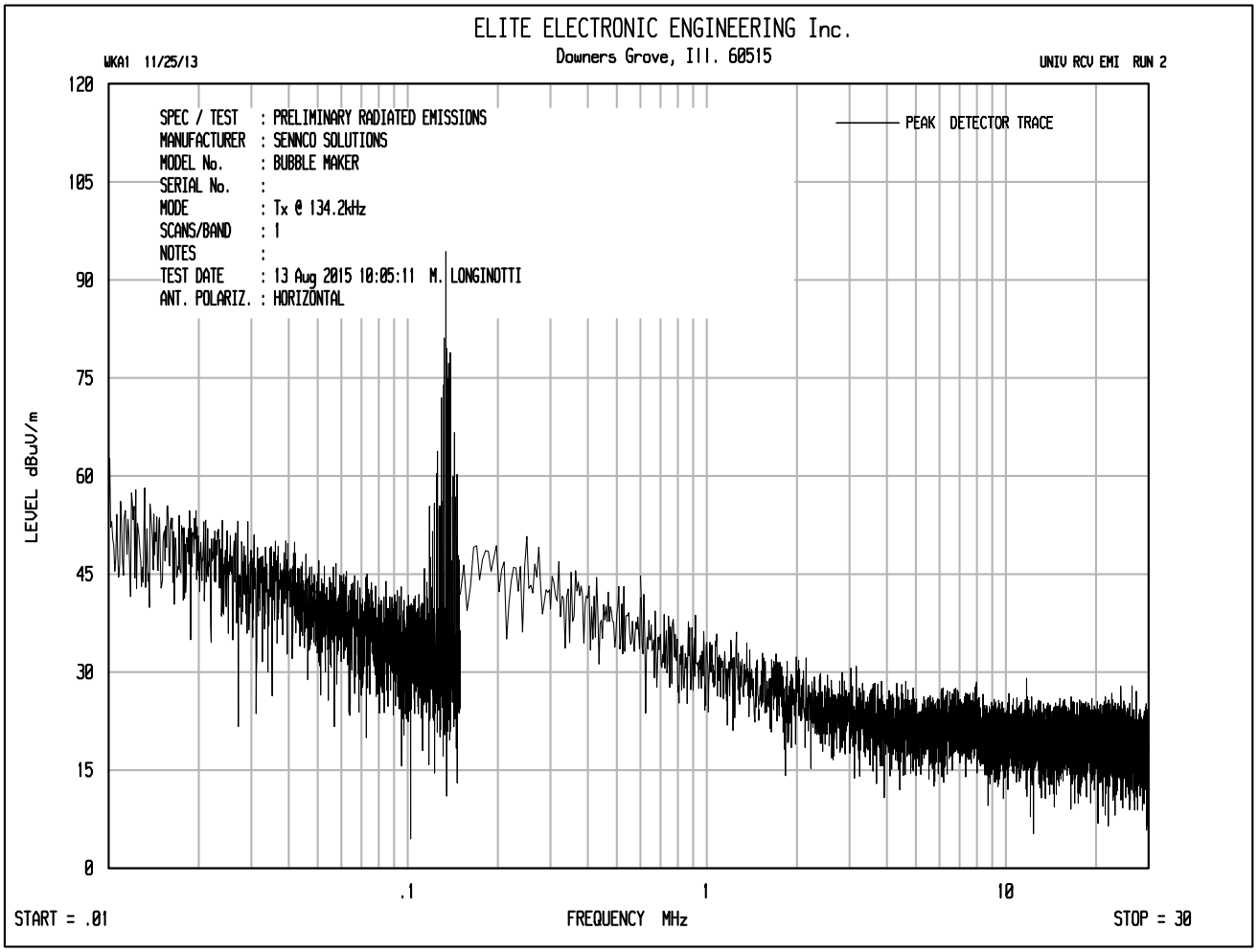
NOTES

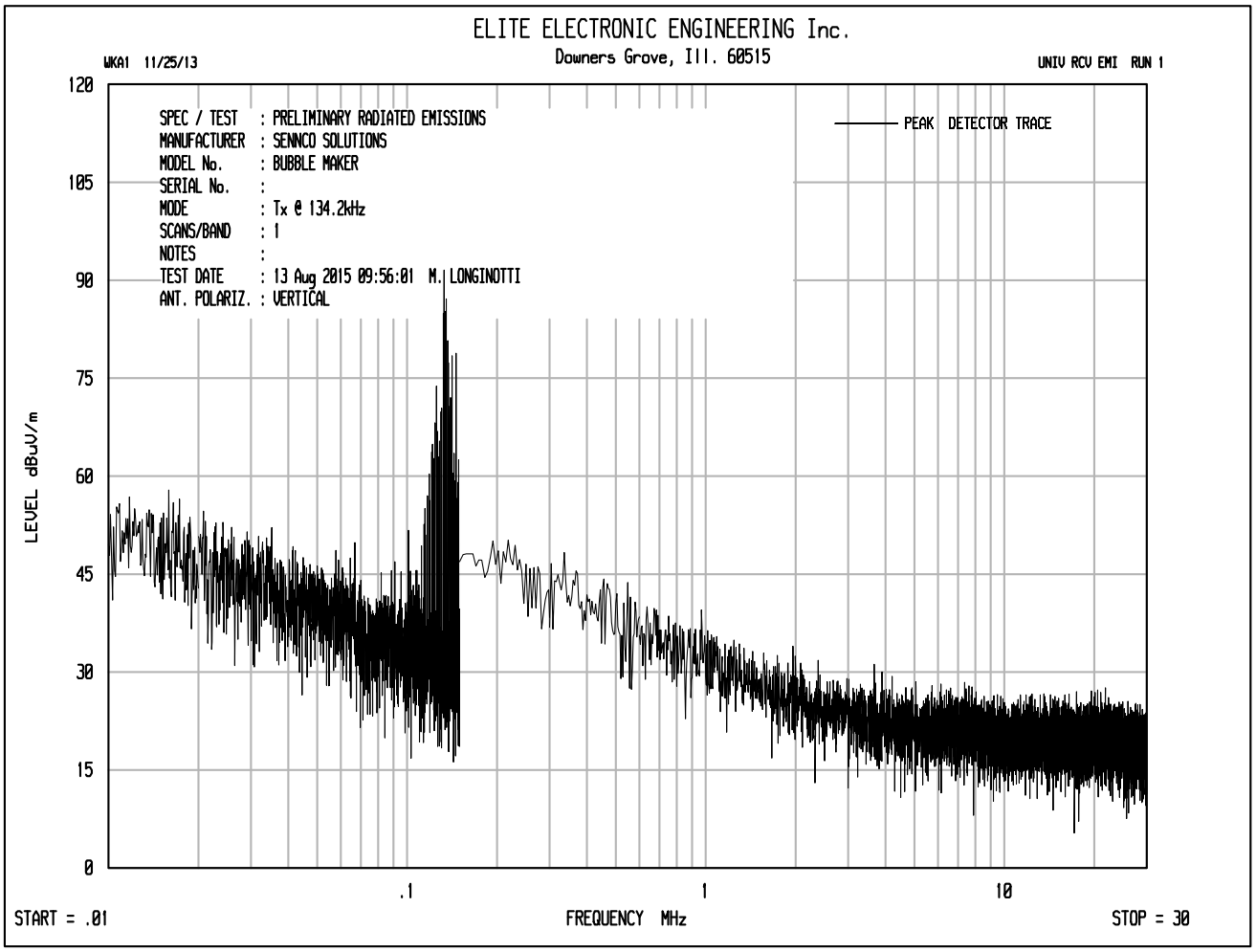


FCC 15.209 Duty Cycle Correction Factor

MANUFACTURER	:	Sennco Solutions
MODEL NUMBER	:	Bubble Maker
SERIAL NUMBER	:	
TEST MODE	:	Transmit at 134.2kHz
TEST PARAMETERS	:	Duty Cycle Correction Factor
NOTES	:	0 bit is 275usec
EQUIPMENT USED	:	RBB0, NLS0

NOTES


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : BUBBLE MAKER
SERIAL No. :
MODE : Tx @ 134.2kHz
SCANS/BAND : 1
NOTES :
TEST DATE : 13 Aug 2015 10:05:11 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
.1
1
10
START = .01
FREQUENCY MHz
STOP = 30


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 1
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : BUBBLE MAKER
SERIAL No. :
MODE : Tx @ 134.2kHz
SCANS/BAND : 1
NOTES :
TEST DATE : 13 Aug 2015 09:56:01 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
.1
1
10
START = .01
FREQUENCY MHz
STOP = 30

MANUFACTURER : Sennco Solutions
MODEL NUMBER : Bubble Maker
SERIAL NUMBER :
TEST MODE : Transmit at 134.2kHz
TEST PERFORMED : FCC15C, section 15.209 Radiated Emissions
TEST DATE : August 13, 2015
TEST DISTANCE : 3 meters
NOTES : Readings below 150kHz: Peak reading with 200Hz bandwidth
: Readings above 150kHz: Quasi-peak readings with 9kHz bandwidth

Freq. (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Duty Cycle Corr. (dB)	Pre Amp (dB)	Dist. Corr. (dB)	Total (dBuV/m)	Total (uV/m)	Limit (uV/m)	Specified Test Distance (meters)	Margin (dB)
0.134	H	90.4		0.0	11.1	-12.4	0.0	-80.0	9.1	2.83712	17.9	300.0	-16.0
0.134	V	100.8		0.0	11.1	-12.4	0.0	-80.0	19.5	9.39460	17.9	300.0	-5.6

Freq. (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Dist. Corr. (dB)	Total (dBuV/m)	Total (uV/m)	Limit (uV/m)	Specified Test Distance (meters)	Margin (dB)
0.2684	H	44.0	Ambient	0.0	10.9	0.0	-80.0	-25.1	0.05577	8.9	300.0	-44.1
0.2684	V	49.2	Ambient	0.0	10.9	0.0	-80.0	-19.9	0.10148	8.9	300.0	-38.9
0.4026	H	47.0		0.0	10.8	0.0	-80.0	-22.2	0.07768	6.0	300.0	-37.7
0.4026	V	57.3		0.0	10.8	0.0	-80.0	-11.9	0.25427	6.0	300.0	-27.4
0.5368	H	37.1	Ambient	0.0	11.0	0.0	-40.0	8.1	2.54097	44.7	30.0	-24.9
0.5368	V	38.8	Ambient	0.0	11.0	0.0	-40.0	9.8	3.09030	44.7	30.0	-23.2
0.6710	H	39.6	Ambient	0.0	11.0	0.0	-40.0	10.6	3.38844	35.8	30.0	-20.5
0.6710	V	47.9		0.0	11.0	0.0	-40.0	18.9	8.81049	35.8	30.0	-12.2
0.8052	H	33.5	Ambient	0.0	11.0	0.0	-40.0	4.5	1.67987	29.8	30.0	-25.0
0.8052	V	33.7	Ambient	0.0	11.0	0.0	-40.0	4.7	1.71900	29.8	30.0	-24.8
0.9394	H	34.0	Ambient	0.0	11.1	0.0	-40.0	5.1	1.80731	25.5	30.0	-23.0
0.9394	V	42.0		0.0	11.1	0.0	-40.0	13.1	4.53976	25.5	30.0	-15.0
1.0736	H	31.0	Ambient	0.0	11.2	0.0	-40.0	2.2	1.29078	22.4	30.0	-24.8
1.0736	V	30.0	Ambient	0.0	11.2	0.0	-40.0	1.2	1.15041	22.4	30.0	-25.8
1.2078	H	30.0	Ambient	0.0	11.2	0.0	-40.0	1.2	1.15415	19.9	30.0	-24.7
1.2078	V	37.7		0.0	11.2	0.0	-40.0	8.9	2.80068	19.9	30.0	-17.0
1.3420	H	28.4	Ambient	0.0	11.2	0.0	-40.0	-0.3	0.96278	17.9	30.0	-25.4
1.3420	V	28.2	Ambient	0.0	11.2	0.0	-40.0	-0.5	0.94086	17.9	30.0	-25.6