Measurement of RF Interference from a Sennco Solutions Head Transceiver

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REVISION HISTORY

Revision	Date	Description
—	14 September 2015	Initial release

Measurement of RF Emissions from a Sennco Solutions Head Transceiver

1. INTRODUCTION

1.1 Scope of Tests

This document represents the results of the series of radio interference measurements performed on a Sennco Solutions Head transceiver (hereinafter referred to as the EUT). No Serial Number was assigned to the EUT. The EUT is a Digital Transmission System (DTS) transceiver. The transceiver was designed to transmit and receive in the 902-928 MHz band 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 15.207 and 15.247 for Intentional Radiators Operating within the 902-928 MHz band. 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, Section 8.8 and Section 7.1 for receivers and the Industry Canada Radio Standards Specification RSS-Gen Section 8.8 and RSS-247 Section 5, 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 National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP). NVLAP Lab Code: 100278-0.

1.5 Laboratory Conditions

The temperature at the time of the test was 23C 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, Subparts B and 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".
- Federal Communications Commission Office of Engineering Technology Laboratory Division Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating under § 15.247, June 9, 2015.
- Industry Canada RSS-247, Issue 1, May 2015, “Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices”.
- Industry Canada RSS-GEN, Issue 4, November 2014, “Spectrum Management and Telecommunications Radio Standards Specification, General Requirements and Information for the Certification of radio communication equipment”.
- 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 Head. 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

A cradle unit, upon which the EUT is placed, obtained 5VDC through two (2) each, 1 meter long power leads of a CUI Power Supply, Part No. ETSA 050360UDC-P5P-SZ, Model No. ETSA 050360UD. The CUI Power Supply was powered with 115V, 60Hz via 2 each, 1.8 meter long power leads. When the EUT is placed in the cradle unit, it receives 5VDC from the cradle.

3.1.2 Peripheral Equipment

The following peripheral equipment was submitted with the EUT:

Item	Description
Cradle Unit	Powered with 5VDC from the CUI power supply. When the EUT is placed on the cradle, the cradle provides 5VDC to the EUT
Apple iPhone	Connected to the EUT via a Sennco 0003 cable. The iPhone was used to provide proper loading to the EUT. The iPhone was placed in "Airplane mode" for all tests.

3.1.3 Interconnect Cables

The following interconnect cables were submitted with the EUT:

Item	Description
Sennco 0003 cable	Used to connect the iPhone to 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 transmitter that transmits in the frequency range 907MHz to 920.8MHz. 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 920.8MHz 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 and all peripheral equipment were placed on an 80cm high non-conductive stand. The EUT and all peripheral equipment were energized.

Power line conducted emissions tests were run separately with the EUT programmed to operate in the receive at 913.8MHz and transmit at 913.8MHz.

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 907MHz
- Transmit at 913.8MHz
- Transmit at 920.8MHz

3.4 EUT Modifications

No modifications 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 A 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 Receive at 913.8MHz mode.

b) Measurements were first made on the 115V, 60Hz high line of the CUI Power Supply, Part No. ETSA 050360UDC-P5P-SZ, Model No. ETSA 050360UD.

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, CUI Power Supply, Part No. ETSA 050360UDC-P5P-SZ, Model No. ETSA 050360UD.

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 Receive at 913.8MHz mode are shown on pages 26 and 28. The tabular quasi-peak and average results from each input power line with the EUT operated in the Receive at 913.8MHz mode are shown on pages 25 and 27. 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 491kHz. The emissions level at this frequency was 11.6dB 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.

    a) 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 mode are presented on pages 29 through 32. The plots are presented for a reference only, and are not used to determine compliance. The final radiated levels are presented on pages 33 and 34. 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 1871.39MHz. The emissions level at this frequency was 23.1dB within the limit. See data pages 33 and 34 for details. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figure 4 and Figure 5.

The preliminary plots with the EUT operating in the Receive at 913.8MHz mode are presented on pages 35 through 38. The plots are presented for a reference only, and are not used to determine compliance. The final radiated levels are presented on pages 39 and 40. 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 1880.22MHz. The emissions level at this frequency was 23.1dB within the limit. See data pages 39 and 40 for details. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figure 4 and Figure 5.

The preliminary plots with the EUT operating in the Receive at 920.8MHz mode are presented on pages 41 through 44. The plots are presented for a reference only, and are not used to determine compliance. The final radiated levels are presented on pages 45 and 46. 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 1881.72MHz. The emissions level at this frequency was 23dB within the limit. See data pages 45 and 46 for details. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figure 4 and Figure 5.

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.

a) The EUT was operated in the Transmit at 913.8MHz mode.

b) Measurements were first made on the 115V, 60Hz high line of the CUI Power Supply, Part No. ETSA 050360UDC-P5P-SZ, Model No. ETSA 050360UD.

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, CUI Power Supply, Part No. ETSA 050360UDC-P5P-SZ, Model No. ETSA 050360UD

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 transmit at 913.8MHz mode are shown on pages 48 and 50. The tabular quasi-peak and average results from each input power line with the EUT operated in the transmit at 913.8MHz mode are shown on pages 47 and 49. 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 495kHz. The emissions level at this frequency was 11.6dB 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 6dB Bandwidth

5.2.2.1 Requirements

Per 15.247(a)(2),the minimum 6dB bandwidth shall be at least 500kHz for all systems using digital modulation techniques.

5.2.2.2 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.

5.2.2.3 Results

The plots on pages 51 through 53 show that the minimum 6 dB bandwidth was 521.04kHz which is greater than minimum allowable 6dB bandwidth requirement of 500kHz for systems using digital modulation techniques. The 99% bandwidth was measured to be 1.06MHz.

5.2.3 Peak Output Power

5.2.3.1 Requirements

Per section 15.247(b)(3), for systems using digital modulation the maximum peak output conducted power shall not be greater than 1.0W (30dBm). Per section 15.247(b)(4), this limit is based on the use of antennas with directional gains that do not exceed 6dBi. Since the limit allows for a 6dBi antenna gain, the maximum EIRP can be increased by 6dB to 4 Watt (36dBm).

5.2.3.2 Procedures

The EUT was placed on the non-conductive stand and set to transmit. A bilog antenna was placed at a test distance of 3 meters from the EUT. The resolution bandwidth (RBW) of the spectrum analyzer was set to greater than the 6dB bandwidth. The EUT was maximized for worst case emissions (or maximum output power) at the measuring antenna. The maximum meter reading was recorded. The peak power output was measured for the low, middle and high channels.

The equivalent power was determined from the field intensity levels measured at 3 meters using the substitution method. To determine the emission power, a dipole antenna was then set in place of the EUT and connected to a calibrated signal generator. The output of the signal generator was adjusted to match the received level at the spectrum analyzer. The signal level was recorded. The reading was then corrected to compensate for cable loss as required. The peak power output was calculated for low, middle, and high hopping frequencies.

5.2.3.3 Results

The results are presented on pages 54 through 56. The maximum EIRP measured from the transmitter was 1.5dBm (1.4mW) which is below the 36dBm (4 Watt) limit.

5.2.4 Duty Cycle Factor Measurements

5.2.4.1 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.

5.2.4.2 Procedures

With the transmitter set up to transmit for maximum pulse density, 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 zero span width with 100usec/div. The amplitude settings are adjusted so that the on/off transitions clear the 4th division from the bottom of the display. The markers are set at the beginning and end of the “on-time”. The trace is recorded.

Next the spectrum analyzer center frequency is set to the transmitter frequency with a zero span width and 10msec/div. 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. The maximum number of pulses transmitted in a 100msec time period was recorded and then plotted using a ‘screen dump’ utility. 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]

5.2.4.3 Results

The plots of the duty cycle are shown on data pages 57 and 58. The EUT transmits 10 each 907.82usec pulses every 100msec. The duty cycle was calculated to be -20.84dB (-20.84dB = 20*log((0.90782msec per pulse x 10 pulses)/100msec)).

5.2.5 Radiated Spurious Emissions Measurements

5.2.5.1 Requirements

Per section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated emissions measurement. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a).

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a).

Paragraph 15.209(a) has the following radiated emission limits:

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

5.2.5.2 Procedures

Radiated measurements were performed in a 32ft. x 20ft. x 14ft. high shielded enclosure. 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 open field emission tests were then manually performed over the frequency range of 30MHz to 10.0GHz.

1) For all harmonics not in the restricted bands, the following procedure was used:
   a) The field strength of the fundamental was measured using a bilog antenna. The bilog 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 of the harmonics not in the restricted band were then 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 100 kHz was used on the spectrum analyzer.
   c) To ensure that maximum or worst case emission levels at the fundamental and harmonics were measured, the following steps were taken when measuring the fundamental emissions and the spurious emissions:
      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.
   d) All harmonics not in the restricted bands must be at least 20 dB below levels measured at the fundamental. However, attenuation below the general limits specified in §15.209(a) is not required.
2) For all emissions in the restricted bands, the following procedure was used:
   a) The field strengths of all emissions below 1 GHz were measured using a bilog antenna. The bilog 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.

d) For all radiated emissions measurements below 1 GHz, if the peak reading is below the limits listed in 15.209(a), no further measurements are required. If however, the peak readings exceed the limits listed in 15.209(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 15.209(a).

f) Next, for all radiated emissions measurements above 1GHz, if the emission is pulsed, the reading can be adjusted by a “duty cycle correction factor” derived from 20*log(on time/word length). These readings must be no greater than the limits specified in 15.209(a).

5.2.5.3 Results

Preliminary radiated emissions plots with the EUT transmitting at 907MHz, 913.8MHz, and 920.8MHz are shown on pages 59 through 70. Final radiated emissions data are presented on data pages 71 through 79. 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 7310.4MHz. The emissions level at this frequency was 21.0dB within the limit. Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown on Figure 4 and Figure 6.

5.2.6 Band Edge Compliance

5.2.6.1 Requirements

Per section 15.247(d), the emissions at the band-edges must be at least 20dB below the highest level measured within the band but attenuation below the general limits listed in 15.209(a) is not required.

5.2.6.2 Procedures

5.2.6.2.1 Low 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 at the channel closest to the low band-edge.
4) The EUT was maximized for worst case emissions at the measuring antenna. The maximum meter reading was recorded.
5) To determine the band edge compliance, the following spectrum analyzer settings were used:
    a. Center frequency = low band-edge frequency.
    b. Span = Wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation.
    c. Resolution bandwidth (RBW) ≥ 1% of the span.
    d. The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
    e. 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. All emissions which fall outside of the authorized band of operation must be below the 20dB down display line. (All emissions to the left of the center frequency (band-edge) must be below the display line.)
    f. The analyzer's display was plotted using a 'screen dump' utility.

5.2.6.2.2 High 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 at the channel closest to the high band-edge (hopping function disabled).
4) The EUT was maximized for worst case emissions at the measuring antenna.

5) To determine the band edge compliance, the following spectrum analyzer settings were used:

   a. Center frequency = high band-edge frequency.
   b. Span = Wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation.
   c. Resolution bandwidth (RBW) ≥ 1% of the span.
   d. The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
   e. 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. All emissions which fall outside of the authorized band of operation must be below the 20dB down display line. (All emissions to the right of the center frequency (band-edge) must be below the display line.)
   f. The analyzer's display was plotted using a 'screen dump' utility.

5.2.6.3 Results

Pages 80 and 81show the radiated band-edge compliance results. As can be seen from these plots, the emissions at the low end band edge and the high end band edge are within the 20 dB down limits.

5.2.7 Power Spectral Density

5.2.7.1 Requirement

Per section 15.247(d), the peak power spectral density from the intentional radiator shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

5.2.7.2 Procedures

1) The EUT was placed on the non-conductive stand and set to transmit at 907MHz.
2) A broadband measuring antenna was placed near the EUT.
3) To determine the power spectral density, the following spectrum analyzer settings were used:
   a. Center frequency = transmit frequency
   b. Span = 1MHz or wider
   c. Resolution bandwidth (RBW) greater than the 6dB bandwidth.
   d. Sweep time = auto
   e. The peak detector and 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
4) This reading corresponds to the EIRP measured at 907MHz.
5) Turn on the display line and place it at the corresponding +8dBm level. (e.g. if the peak output power is +18dBm then the +8dBm level will be 10dB down from the radiated level and if the peak output power is +6dBm then the +8dBm level will be 2dB above the radiated level.)
6) To determine the power spectral density, the following spectrum analyzer settings were used:
   a. Center frequency = transmit frequency
   b. Span = 1MHz or wider
   c. Resolution bandwidth (RBW) = 100kHz
   d. Sweep time = auto
   e. The peak detector and 'Max-Hold' function was engaged.
   f. The display line represents the 8 dBm limit
   g. The analyzer's display was plotted using a 'screen dump' utility.
7) Steps 2) through 6) were repeated with the EUT set to transmit at 913.8MHz.
8) Steps 2) through 6) were repeated with the EUT set to transmit at 920.8MHz.

5.2.7.3 Results

Pages 82 through 84 show the power spectral density results. As can be seen from these plots, the peak power density is less than 8dBm in a 3kHz band during any time interval of continuous transmission.

6. CONCLUSIONS

It was determined that the Sennco Solutions Head, digital modulation transceiver, 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 15.247 for Intentional Radiators Operating within the 902-928 MHz, band, when tested per ANSI C63.4-2014.

It was also determined that the Sennco Solutions Head, digital modulation transceiver, did fully meet the conducted and radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen, Section 8.8 and Section 7.1 for receivers and the Industry Canada Radio Standards Specification RSS-Gen Section 8.8 and RSS-247 Section 5 for Transmitters, when tested per ANSI C63.4-2014.

7. 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.

8. ENDORSEMENT DISCLAIMER

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
APW3	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-35-120-5R0-10-12	PL2924	1GHZ-20GHZ	11/3/2014	11/3/2015
CDX8	COMPUTER	ELITE	WORKSTATION			N/A	
GRE0	SIGNAL GENERATOR	AGILENT TECHNOLOGIES	E4438C	MY42083127	250KHZ-6GHZ	3/18/2015	3/18/2016
NDQ1	TUNED DIPOLE ANTENNA	EMCO	3121C-DB4	313	400-1000MHZ	4/17/2014	4/17/2016
NTA3	BILOG ANTENNA	TESEQ	6112D	32853	25-1000MHz	3/27/2015	3/27/2016
NWQ1	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS-LINDGREN	3117	66655	1GHZ-18GHZ	3/11/2014	3/11/2016
PLF1	CISPR16 50UH LISN	ELITE	CISPR16/70A	001	.15-30MHz	5/20/2015	5/20/2016
PLF3	CISPR16 50UH LISN	ELITE	CISPER16/70A	003	.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
RBA0	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB26	100145	20HZ-26.5GHZ	3/3/2015	3/3/2016
T1E4	10DB 25W ATTENUATOR	WEINSCHEL	46-10-43	AV5805	DC-18GHZ	11/17/2014	11/17/2015
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						
XPQ3	HIGH PASS FILTER	K&L MICROWAVE	4IH30-1804/T10000-0	4	1.8GHZ-10GHZ	10/24/2014	10/24/2015

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.

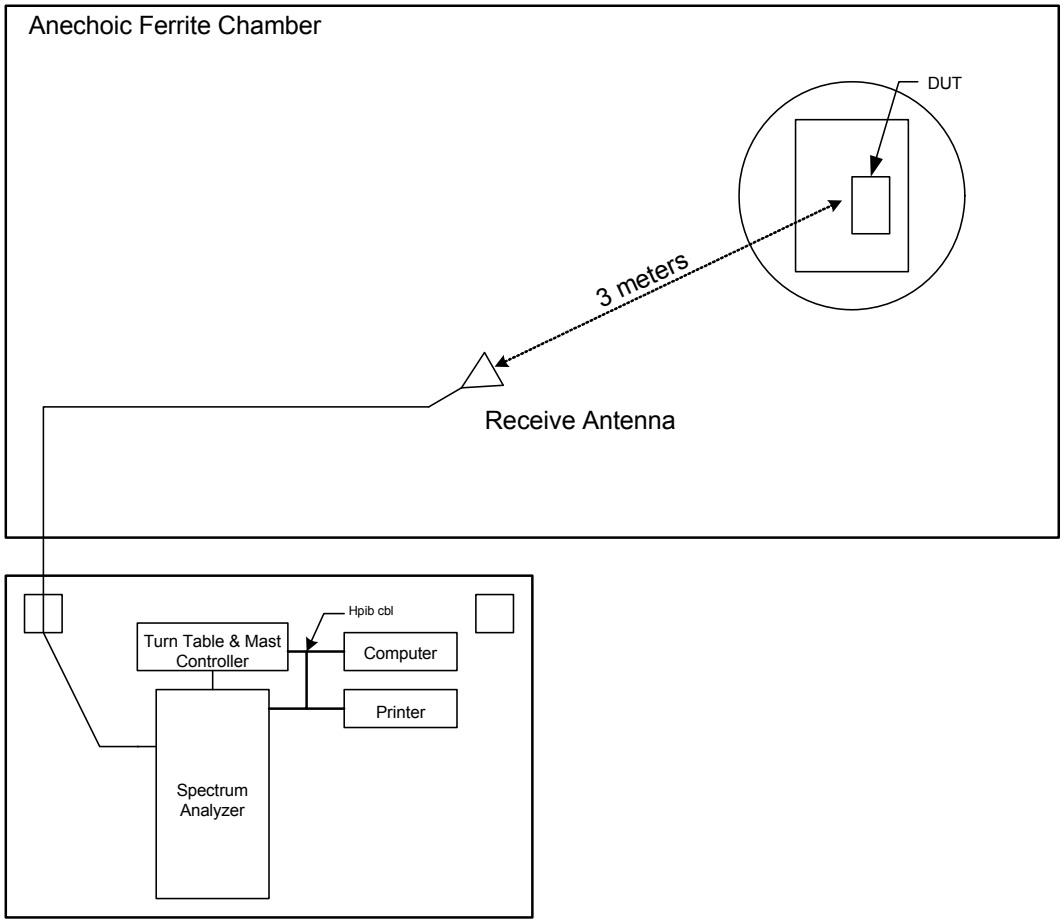
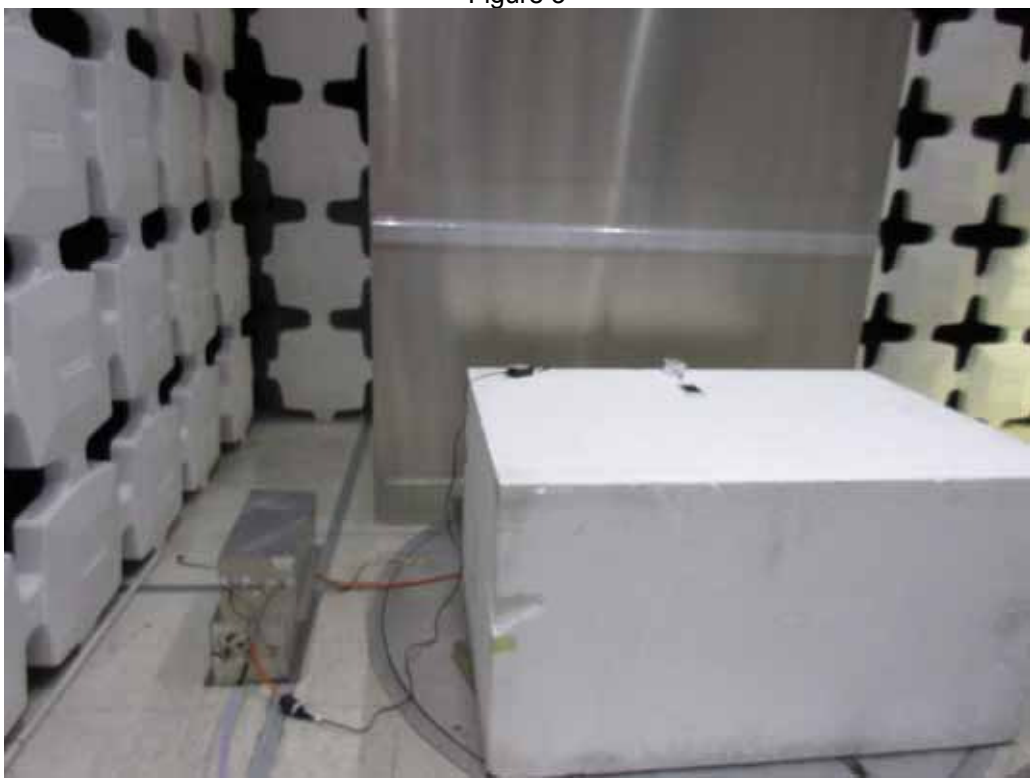


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

Figure 2

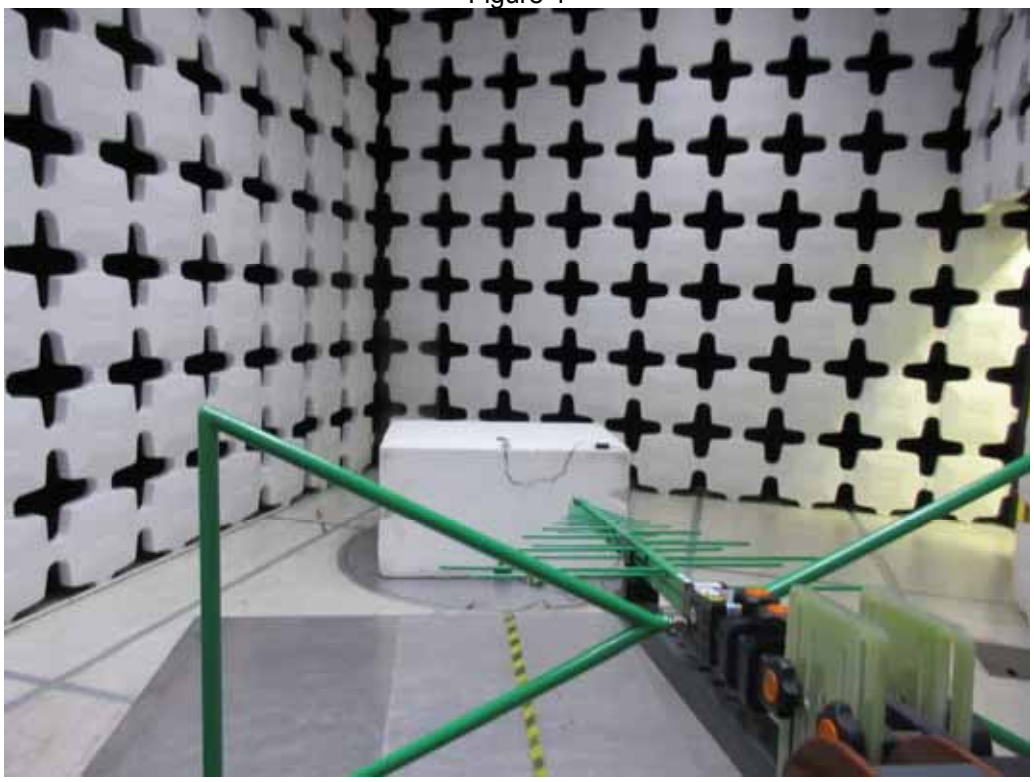
Photograph of EUT

Figure 3



Test Setup for Conducted Emissions

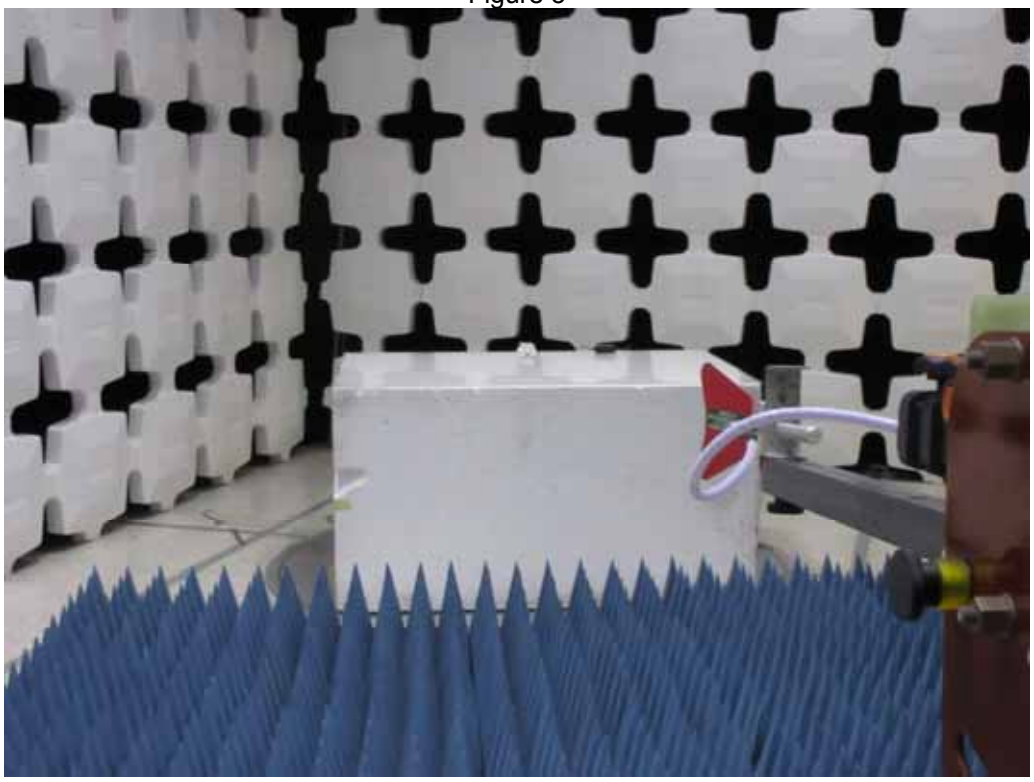
Figure 4



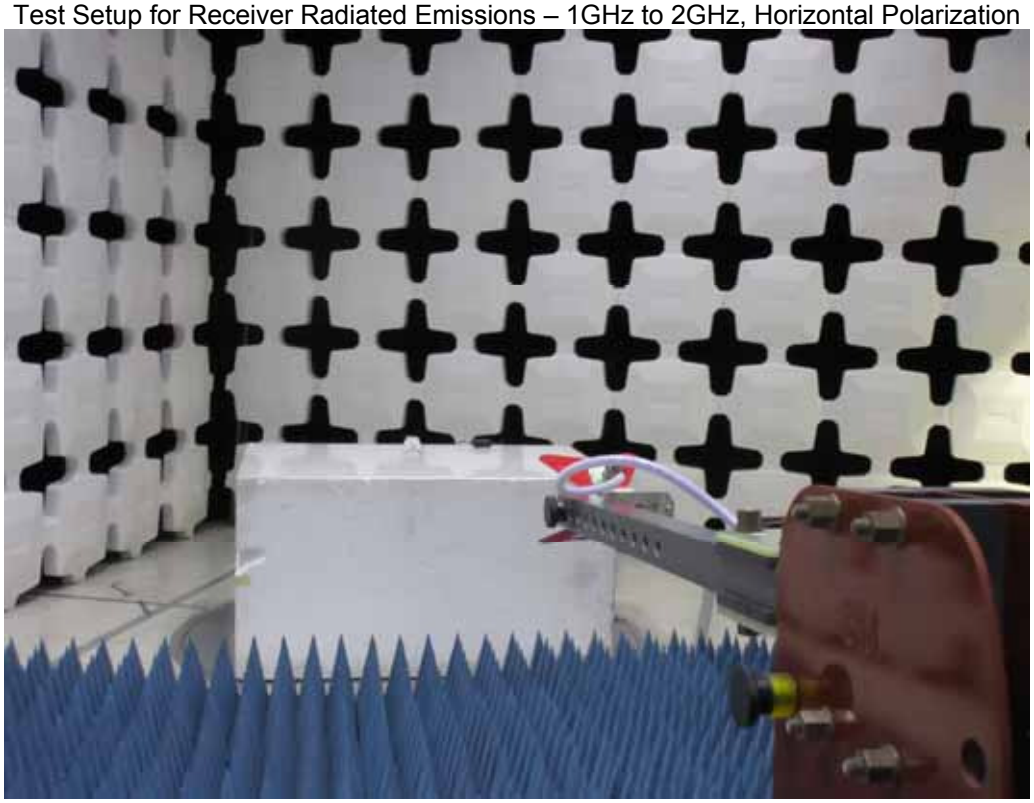
Test Setup for Radiated Emissions – 30MHz to 1GHz, Horizontal Polarization

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

Figure 5



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



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

Figure 6

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

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

FCC Part 15 Subpart B Conducted Emissions Test

Significant Emissions Data

VBR8 03/04/2015

Manufacturer	:	SENNCO SOLUTIONS
Model	:	HEAD
DUT Revision	:	
Serial Number	:	
DUT Mode	:	Rx @ 913.8MHz
Line Tested	:	115V, 60Hz HIGH
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-1
Notes	:	WITH iPHONE, WITH CUI ETSA050360UD POWER SUPPLY
Test Engineer	:	M. Longinotti
Limit	:	Class B
Test Date	:	Aug 28, 2015 08:41:54 AM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 1 dB margin below limit

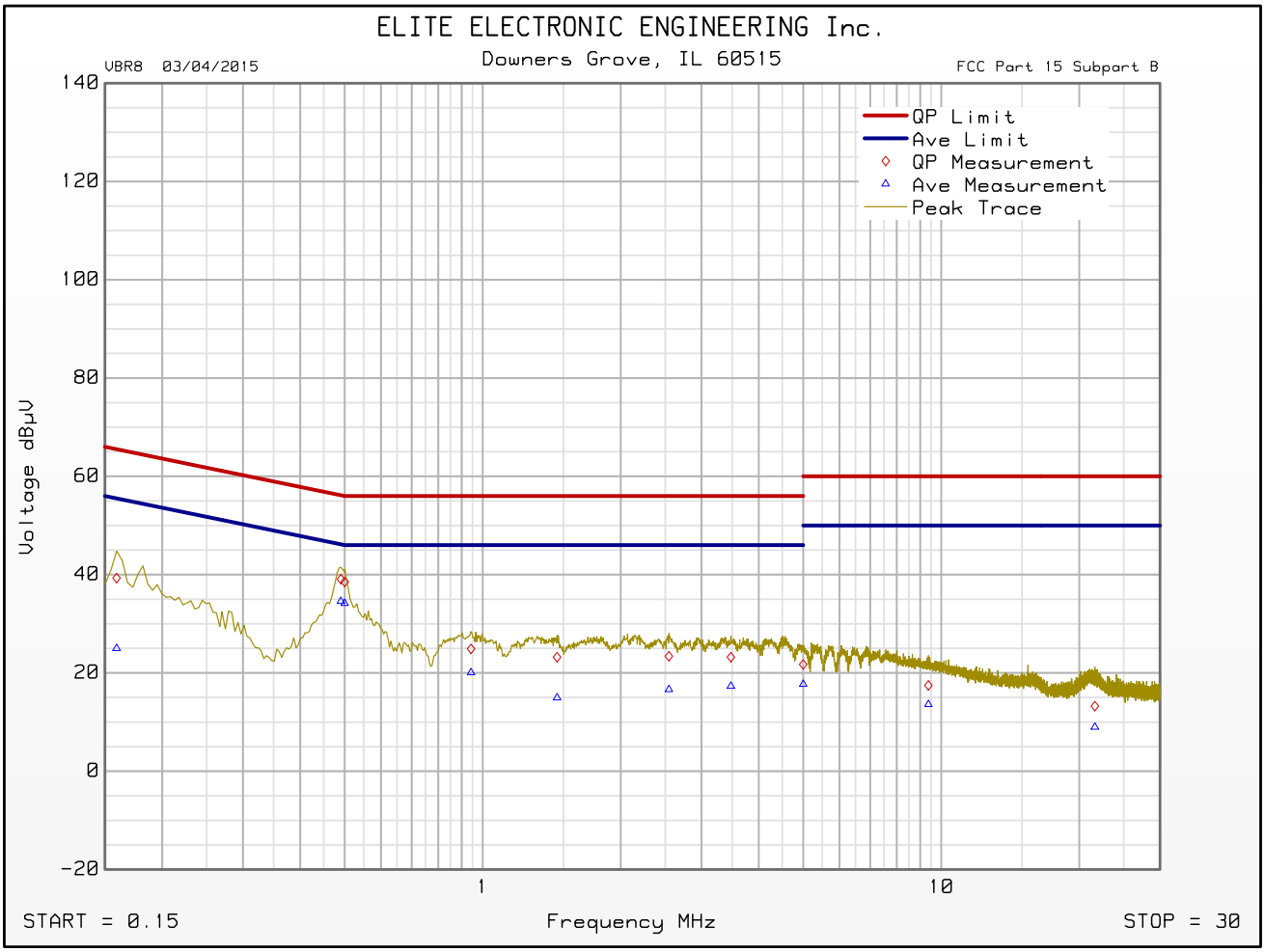
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.159	39.3	65.5		25.0	55.5	
0.491	39.1	56.2		34.6	46.2	
0.500	38.5	56.0		34.2	46.0	
0.943	24.9	56.0		20.1	46.0	
1.453	23.2	56.0		15.0	46.0	
2.547	23.4	56.0		16.6	46.0	
3.478	23.2	56.0		17.3	46.0	
5.000	21.7	56.0		17.7	46.0	
9.378	17.5	60.0		13.6	50.0	
21.641	13.2	60.0		9.0	50.0	

FCC Part 15 Subpart B Conducted Emissions Test

Cumulative Data

VBR8 03/04/2015

Manufacturer	:	SENNCO SOLUTIONS
Model	:	HEAD
DUT Revision	:	
Serial Number	:	
DUT Mode	:	Rx @ 913.8MHz
Line Tested	:	115V, 60Hz HIGH
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-1
Notes	:	WITH iPHONE, WITH CUI ETSA050360UD POWER SUPPLY
Test Engineer	:	M. Longinotti
Limit	:	Class B
Test Date	:	Aug 28, 2015 08:41:54 AM



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	:	HEAD
DUT Revision	:	
Serial Number	:	
DUT Mode	:	Rx @ 913.8MHz
Line Tested	:	115V, 60Hz RETURN
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-1
Notes	:	WITH iPHONE, WITH CUI ETSA050360UD POWER SUPPLY
Test Engineer	:	M. Longinotti
Limit	:	Class B
Test Date	:	Aug 28, 2015 09:00:07 AM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 1 dB margin below limit

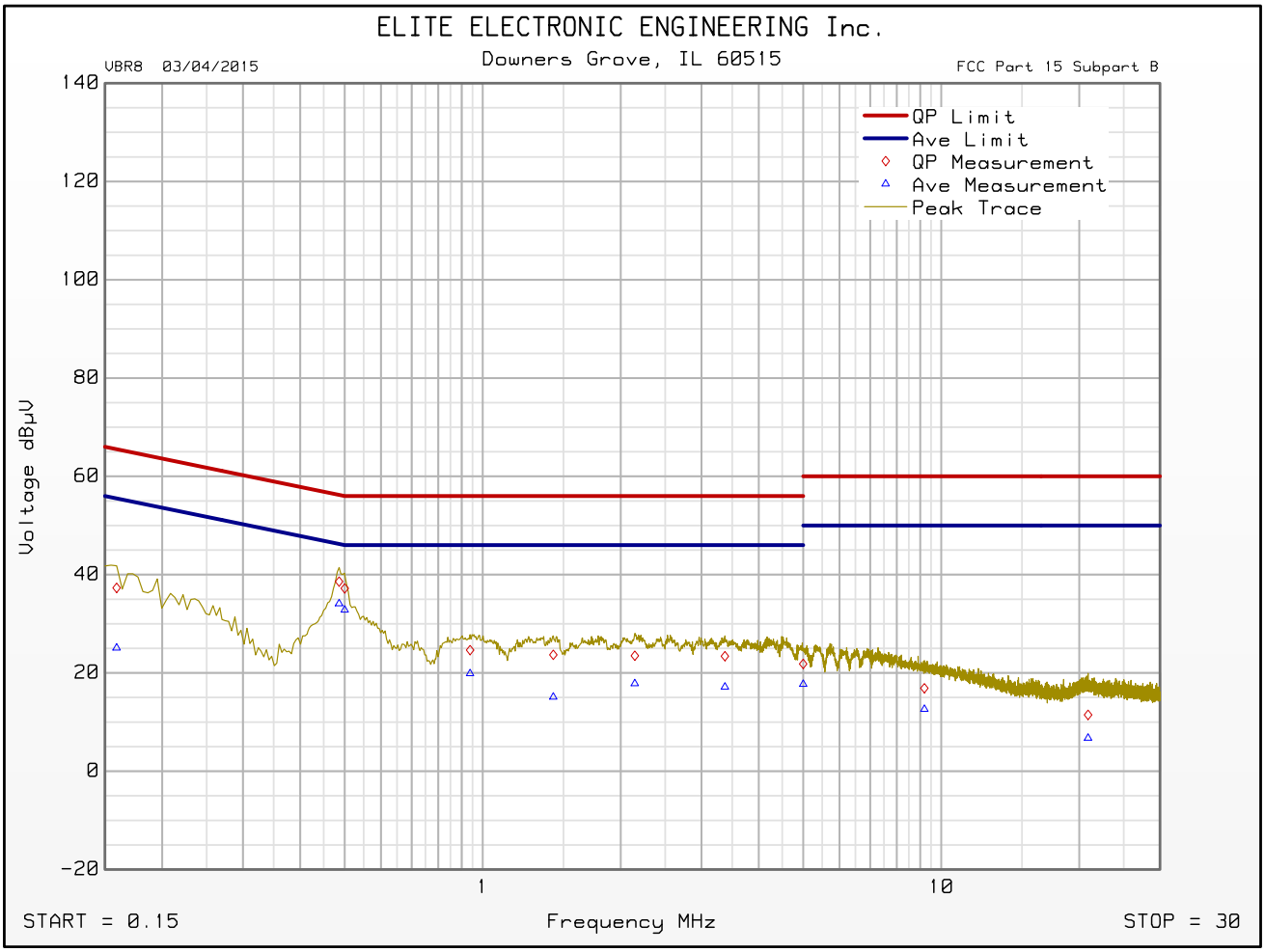
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.159	37.3	65.5		25.1	55.5	
0.486	38.6	56.2		34.1	46.2	
0.500	37.2	56.0		32.8	46.0	
0.939	24.6	56.0		19.9	46.0	
1.426	23.7	56.0		15.1	46.0	
2.147	23.5	56.0		17.8	46.0	
3.374	23.4	56.0		17.1	46.0	
5.000	21.8	56.0		17.7	46.0	
9.189	16.9	60.0		12.6	50.0	
20.908	11.5	60.0		6.8	50.0	

FCC Part 15 Subpart B Conducted Emissions Test

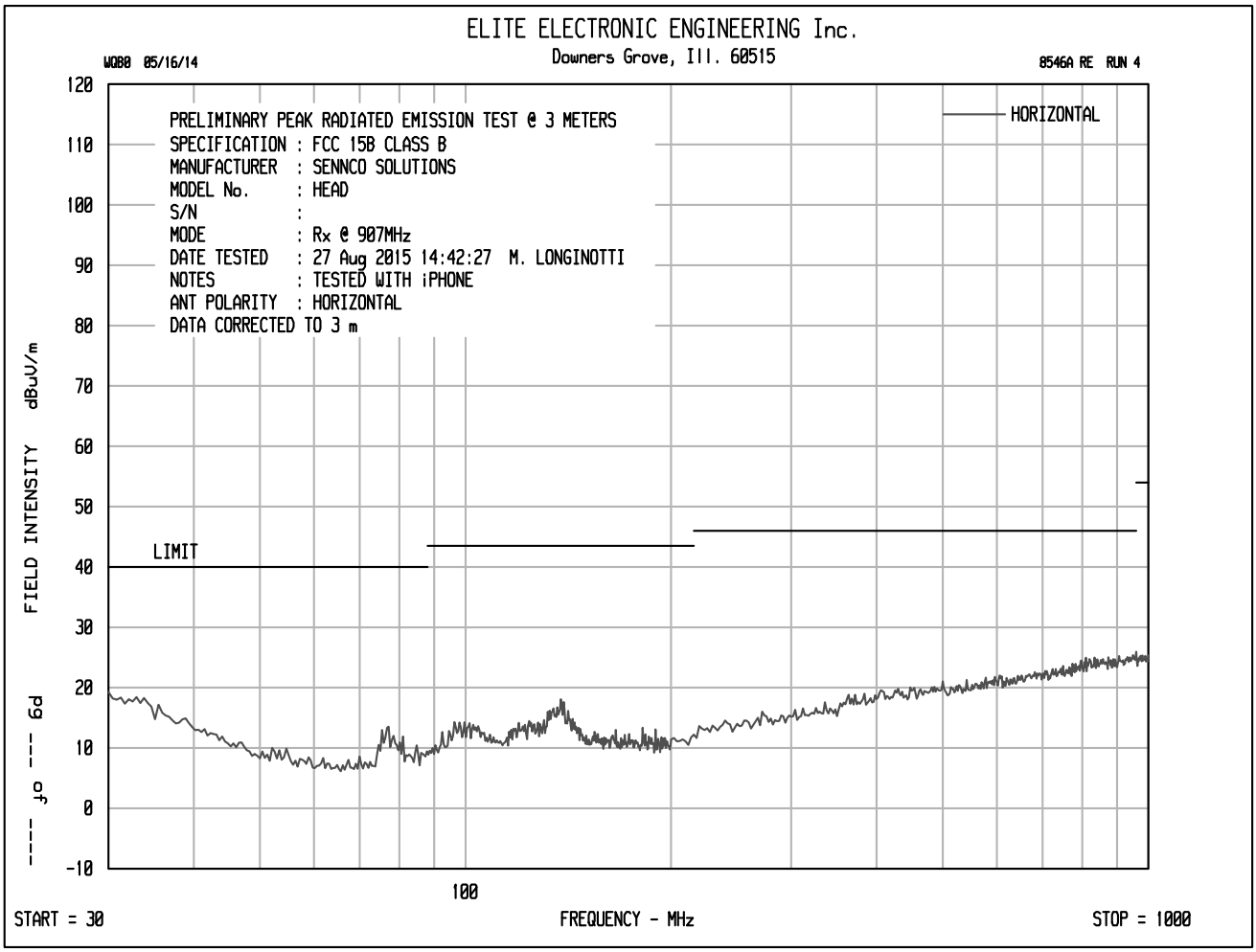
Cumulative Data

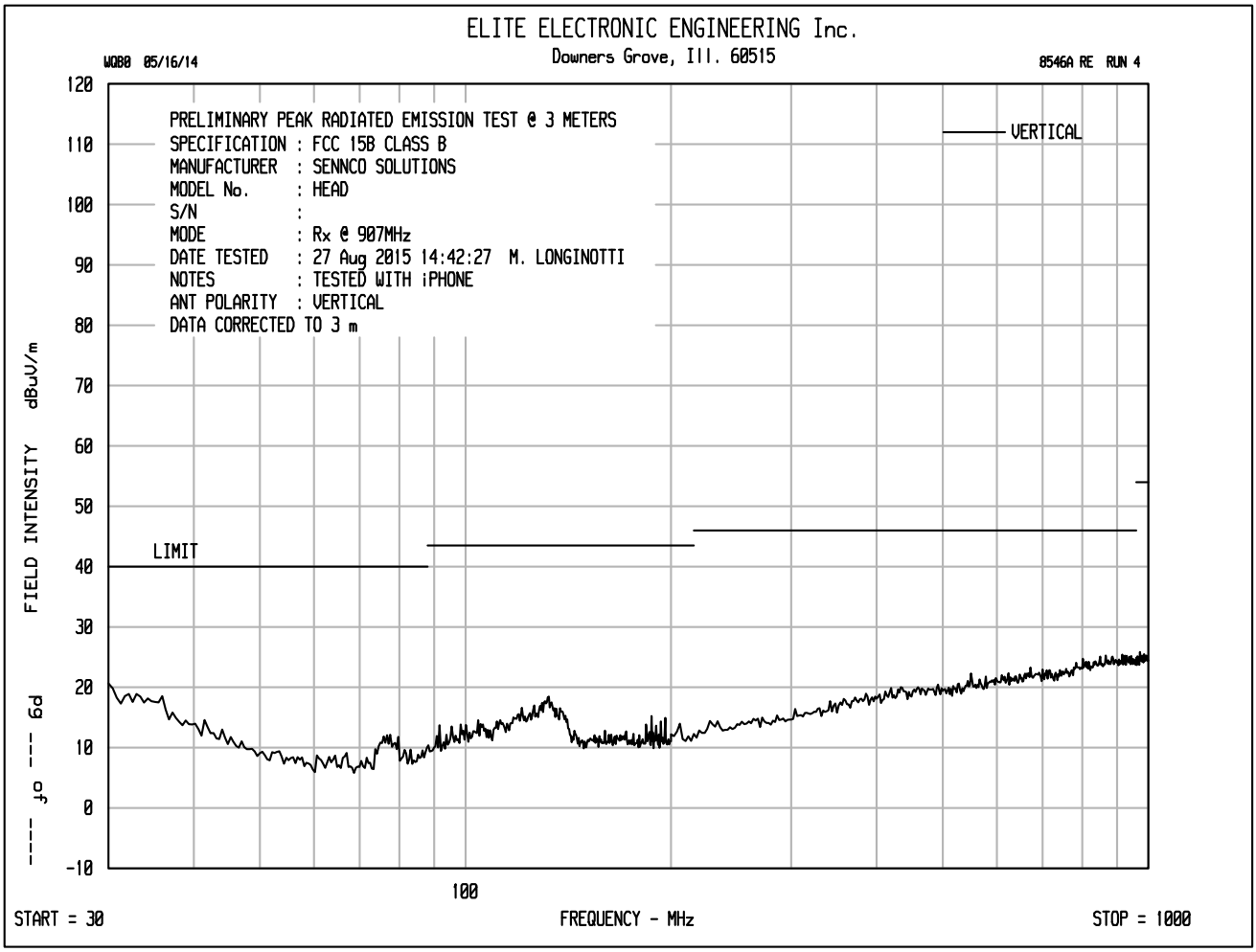
VBR8 03/04/2015

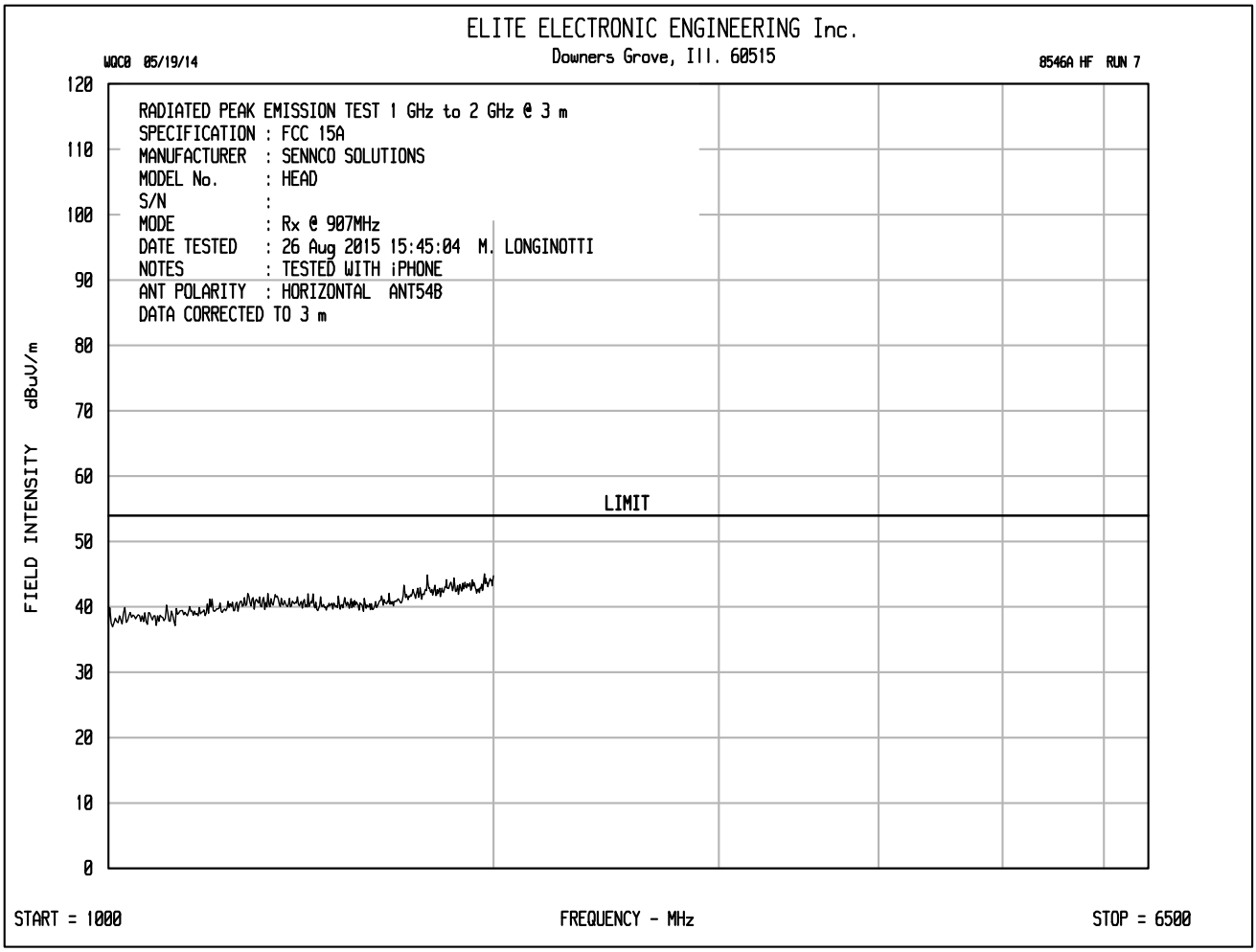
Manufacturer	:	SENNCO SOLUTIONS
Model	:	HEAD
DUT Revision	:	
Serial Number	:	
DUT Mode	:	Rx @ 913.8MHz
Line Tested	:	115V, 60Hz RETURN
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-1
Notes	:	WITH iPHONE, WITH CUI ETSA050360UD POWER SUPPLY
Test Engineer	:	M. Longinotti
Limit	:	Class B
Test Date	:	Aug 28, 2015 09:00:07 AM

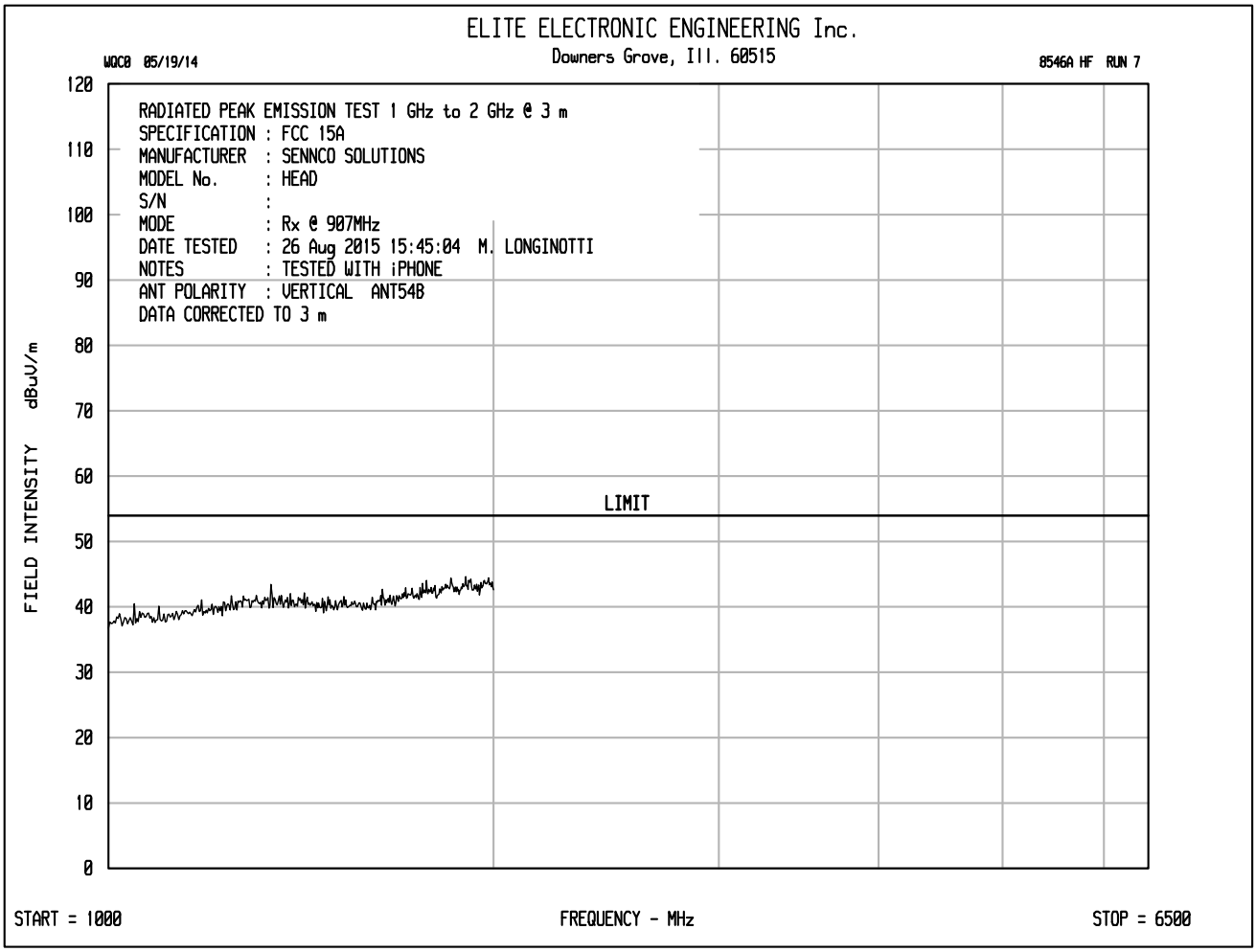


Emissions Meet QP Limit
Emissions Meet Ave Limit


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WQB0 05/16/14
8546A RE RUN 4
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
S/N :
MODE : Rx @ 907MHz
DATE TESTED : 27 Aug 2015 14:42:27 M. LONGINOTTI
NOTES : TESTED WITH iPHONE
ANT POLARITY : HORIZONTAL
DATA CORRECTED TO 3 m
HORIZONTAL
LIMIT
FIELD INTENSITY dBuV/m
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
WQB0 05/16/14
8546A RE RUN 4
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
S/N :
MODE : Rx @ 907MHz
DATE TESTED : 27 Aug 2015 14:42:27 M. LONGINOTTI
NOTES : TESTED WITH iPHONE
ANT POLARITY : VERTICAL
DATA CORRECTED TO 3 m
VERTICAL
LIMIT
FIELD INTENSITY dBuV/m
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
WQC0 05/19/14
8546A HF RUN 7
RADIATED PEAK EMISSION TEST 1 GHz to 2 GHz @ 3 m
SPECIFICATION : FCC 15A
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
S/N :
MODE : Rx @ 907MHz
DATE TESTED : 26 Aug 2015 15:45:04 M. LONGINOTTI
NOTES : TESTED WITH iPHONE
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
WQC0 05/19/14
8546A HF RUN 7
RADIATED PEAK EMISSION TEST 1 GHz to 2 GHz @ 3 m
SPECIFICATION : FCC 15A
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
S/N :
MODE : Rx @ 907MHz
DATE TESTED : 26 Aug 2015 15:45:04 M. LONGINOTTI
NOTES : TESTED WITH iPHONE
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. 4

RADIATED QP EMISSION MEASUREMENTS in a 3 m SEMI-ANECHOIC ROOM
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : SENNCO SOLUTIONS
MODEL NO. : HEAD
SERIAL NO. :
TEST MODE : Rx @ 907MHz
NOTES : TESTED WITH iPHONE
TEST DATE : 27 Aug 2015 14:42:27
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
30.00	-3.7	18.3	.4	0.0	0.0	15.0	40.0	135	120	V
74.91	-4.0	6.7	.4	0.0	0.0	3.1	40.0	315	120	V
78.75	-5.5	6.9	.4	0.0	0.0	1.8	40.0	-0	200	H
120.68	-2.4	10.6	.5	0.0	0.0	8.7	43.5	45	120	V
131.40	-1.6	10.4	.5	0.0	0.0	9.3	43.5	-0	120	V
142.05	-4.6	10.2	.6	0.0	0.0	6.2	43.5	225	200	H
186.03	.8	9.6	.7	0.0	0.0	11.1	43.5	225	120	V
196.46	-4.8	9.4	.8	0.0	0.0	5.4	43.5	-0	120	V
367.83	-6.7	14.6	1.0	0.0	0.0	9.0	46.0	90	200	H
447.98	-4.9	16.2	1.1	0.0	0.0	12.4	46.0	270	340	H
555.15	-8.1	18.0	1.1	0.0	0.0	11.0	46.0	45	340	V
671.90	-6.4	18.5	1.3	0.0	0.0	13.4	46.0	45	340	V
793.41	-6.6	19.8	1.5	0.0	0.0	14.7	46.0	180	120	H
868.15	-6.4	20.5	1.5	0.0	0.0	15.6	46.0	45	200	V
958.23	-6.7	21.2	1.5	0.0	0.0	16.0	46.0	180	120	H

tested by: MARK E. LONGINOTTI
M. LONGINOTTI

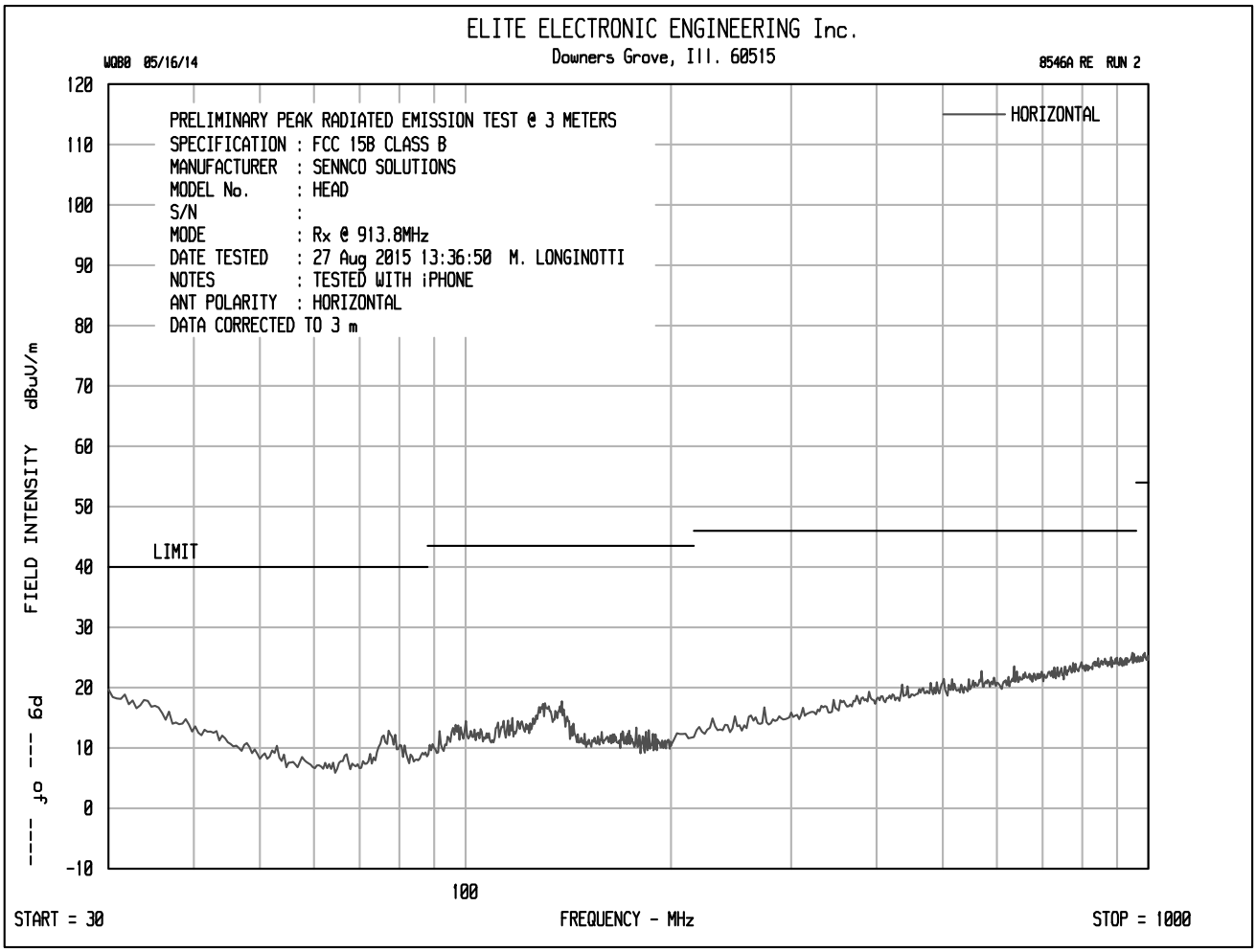
DATA SHEET HF TEST NO. 7

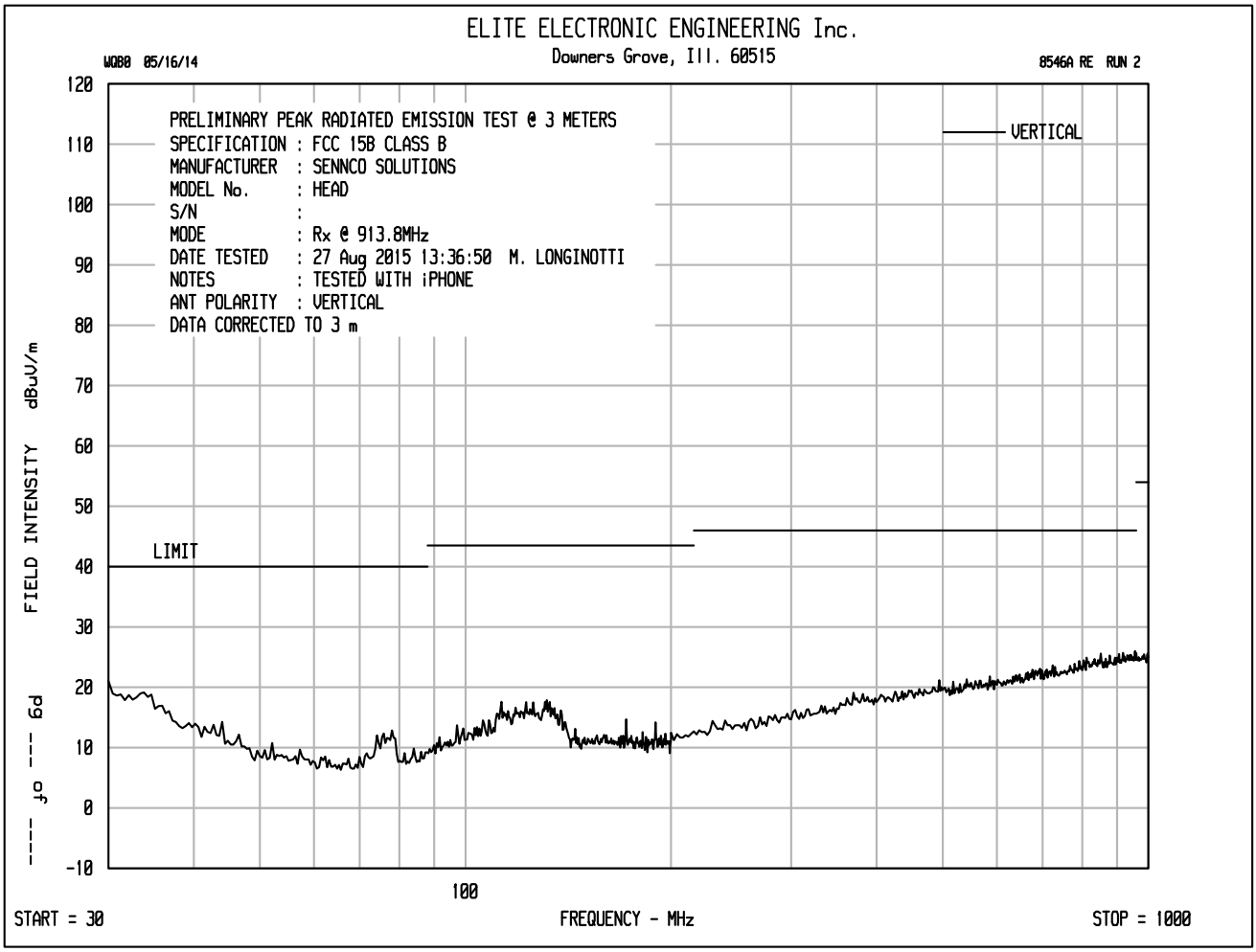
RADIATED AVG EMISSION MEASUREMENTS >=1000 MHz in a 3 m ANECHOIC ROOM

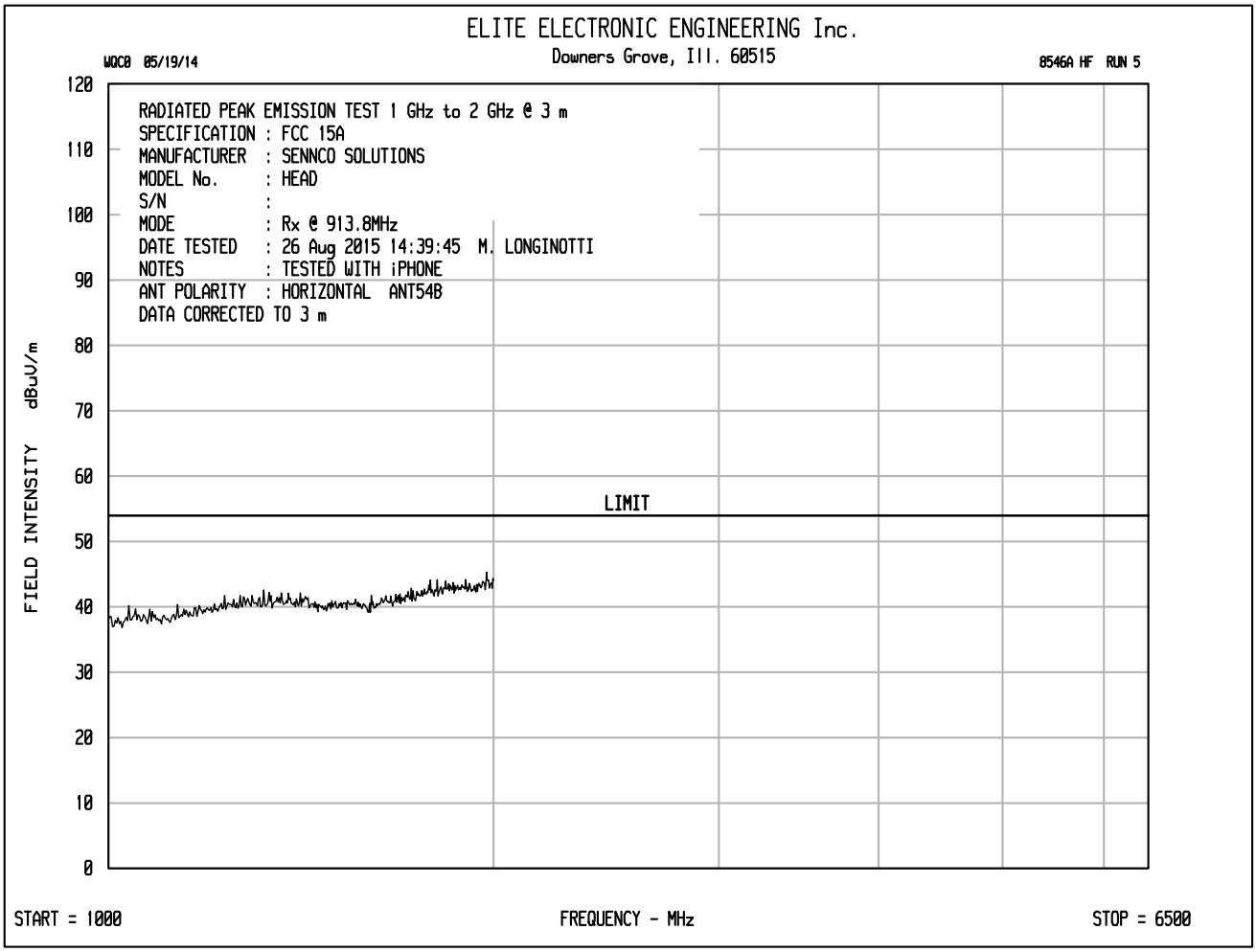
SPECIFICATION : FCC 15A
MANUFACTURER : SENNCO SOLUTIONS
MODEL NO. : HEAD
SERIAL NO. :
TEST MODE : Rx @ 907MHz
NOTES : TESTED WITH iPHONE
TEST DATE : 26 Aug 2015 15:45:04
TEST DISTANCE : 3 m
ANTENNA : ANT54B

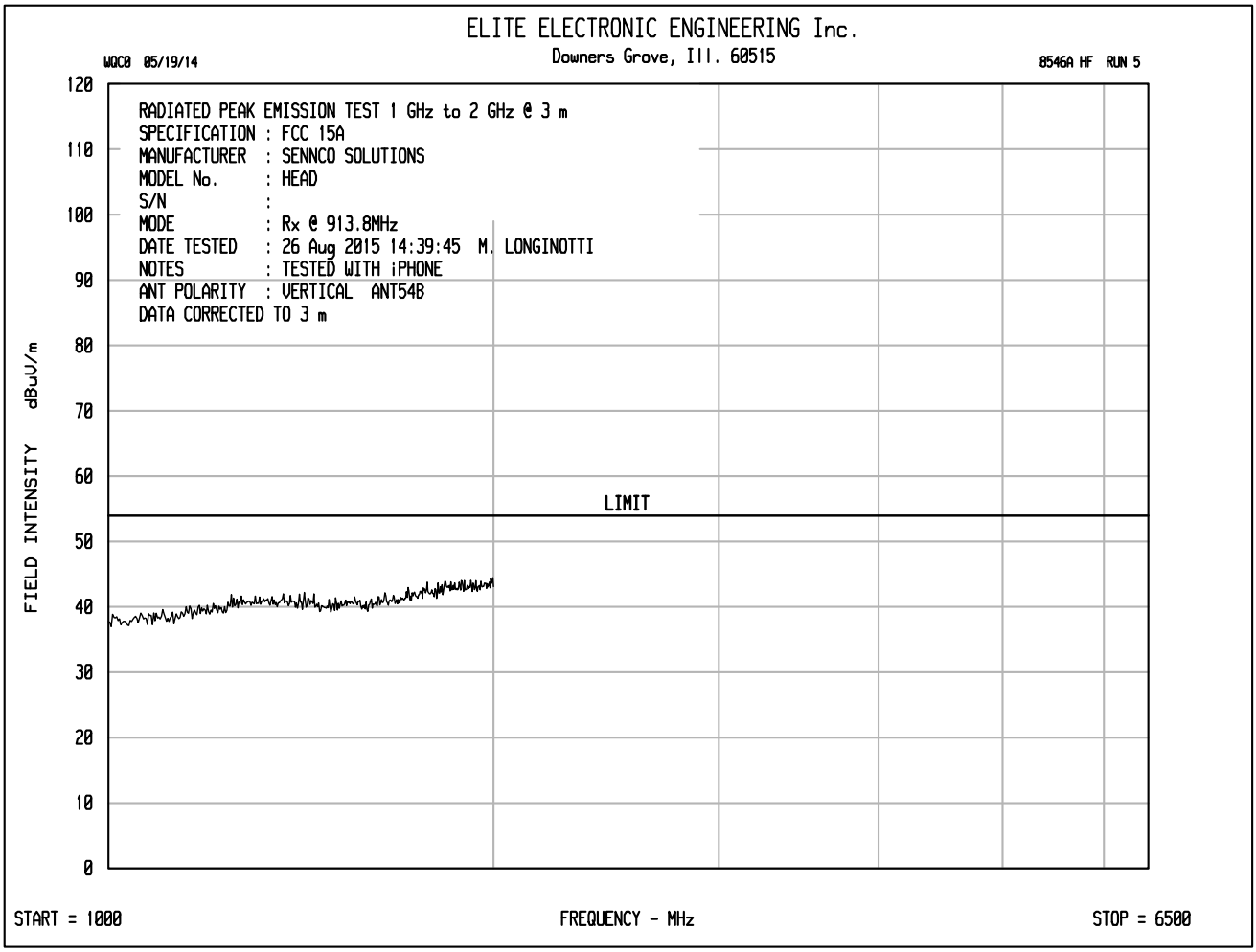
FREQUENCY MHz	AVG READING dBuV	ANT FAC dB	CBL FAC dB	DIST FAC dB	TOTAL dBuV/m	AVG LIMIT dBuV/m	PASS/ FAIL	AZ deg	ANT HT cm	POLAR
1057.35	-3.0	27.1	1.6	0.0	25.6	54.0		270	340	V
1255.21	-3.8	28.9	1.8	0.0	26.8	54.0		90	340	V
1361.68	-2.9	29.1	1.9	0.0	28.0	54.0		225	120	V
1413.57	-3.1	28.9	1.9	0.0	27.6	54.0		315	120	V
1632.59	-3.4	28.8	2.1	0.0	27.4	54.0		135	120	V
1760.05	-3.1	30.1	2.1	0.0	29.1	54.0		315	120	H
1871.39	-2.7	31.3	2.2	0.0	30.9	54.0		0	340	V
1968.67	-3.8	31.7	2.3	0.0	30.1	54.0		270	120	H

tested by: MARK E. LONGINOTTI
M. LONGINOTTI


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WQB0 05/16/14
8546A RE RUN 2
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
S/N :
MODE : Rx @ 913.8MHz
DATE TESTED : 27 Aug 2015 13:36:50 M. LONGINOTTI
NOTES : TESTED WITH iPHONE
ANT POLARITY : HORIZONTAL
DATA CORRECTED TO 3 m
HORIZONTAL
LIMIT
FIELD INTENSITY dBuV/m
---- pg --- of ----
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
WQB0 05/16/14
8546A RE RUN 2
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
S/N :
MODE : Rx @ 913.8MHz
DATE TESTED : 27 Aug 2015 13:36:50 M. LONGINOTTI
NOTES : TESTED WITH iPHONE
ANT POLARITY : VERTICAL
DATA CORRECTED TO 3 m
VERTICAL
LIMIT
FIELD INTENSITY dBuV/m
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
WQC0 05/19/14
8546A HF RUN 5
RADIATED PEAK EMISSION TEST 1 GHz to 2 GHz @ 3 m
SPECIFICATION : FCC 15A
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
S/N :
MODE : Rx @ 913.8MHz
DATE TESTED : 26 Aug 2015 14:39:45 M. LONGINOTTI
NOTES : TESTED WITH iPHONE
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
WQC0 05/19/14
8546A HF RUN 5
RADIATED PEAK EMISSION TEST 1 GHz to 2 GHz @ 3 m
SPECIFICATION : FCC 15A
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
S/N :
MODE : Rx @ 913.8MHz
DATE TESTED : 26 Aug 2015 14:39:45 M. LONGINOTTI
NOTES : TESTED WITH iPHONE
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. 2

RADIATED QP EMISSION MEASUREMENTS in a 3 m SEMI-ANECHOIC ROOM
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : SENNCO SOLUTIONS
MODEL NO. : HEAD
SERIAL NO. :
TEST MODE : Rx @ 913.8MHz
NOTES : TESTED WITH iPHONE
TEST DATE : 27 Aug 2015 13:36:50
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
73.38	-7.0	6.6	.4	0.0	0.0	-0.0	40.0	-0	200	V
80.27	-5.5	7.1	.4	0.0	0.0	2.0	40.0	315	340	H
113.84	-5.8	10.8	.5	0.0	0.0	5.5	43.5	90	120	V
131.82	-3.4	10.4	.5	0.0	0.0	7.5	43.5	45	120	V
145.97	-8.3	10.2	.6	0.0	0.0	2.5	43.5	225	200	V
170.94	-3.9	9.8	.7	0.0	0.0	6.6	43.5	180	200	V
247.54	-7.5	11.3	.8	0.0	0.0	4.6	46.0	225	340	H
362.14	-6.7	14.6	1.0	0.0	0.0	8.9	46.0	135	340	V
435.13	-7.5	16.0	1.1	0.0	0.0	9.7	46.0	135	340	H
563.81	-8.2	18.1	1.1	0.0	0.0	11.1	46.0	225	200	H
638.71	-7.4	18.6	1.2	0.0	0.0	12.3	46.0	180	200	H
791.04	-6.5	19.8	1.5	0.0	0.0	14.8	46.0	135	200	V
845.04	-6.5	20.3	1.5	0.0	0.0	15.3	46.0	180	340	V
955.77	-6.6	21.2	1.5	0.0	0.0	16.1	46.0	180	340	V

tested by: MARK E. LONGINOTTI
M. LONGINOTTI

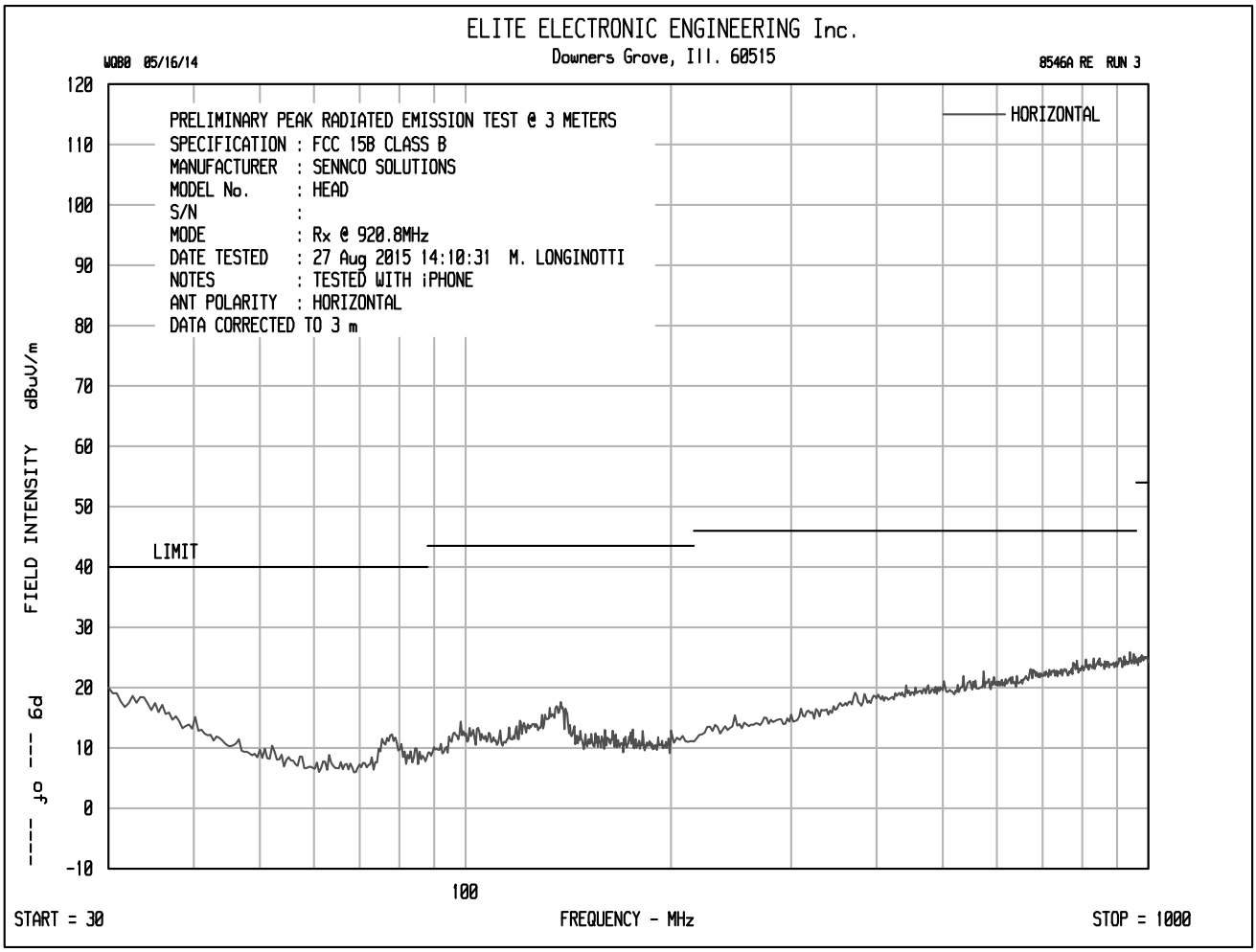
DATA SHEET HF TEST NO. 5

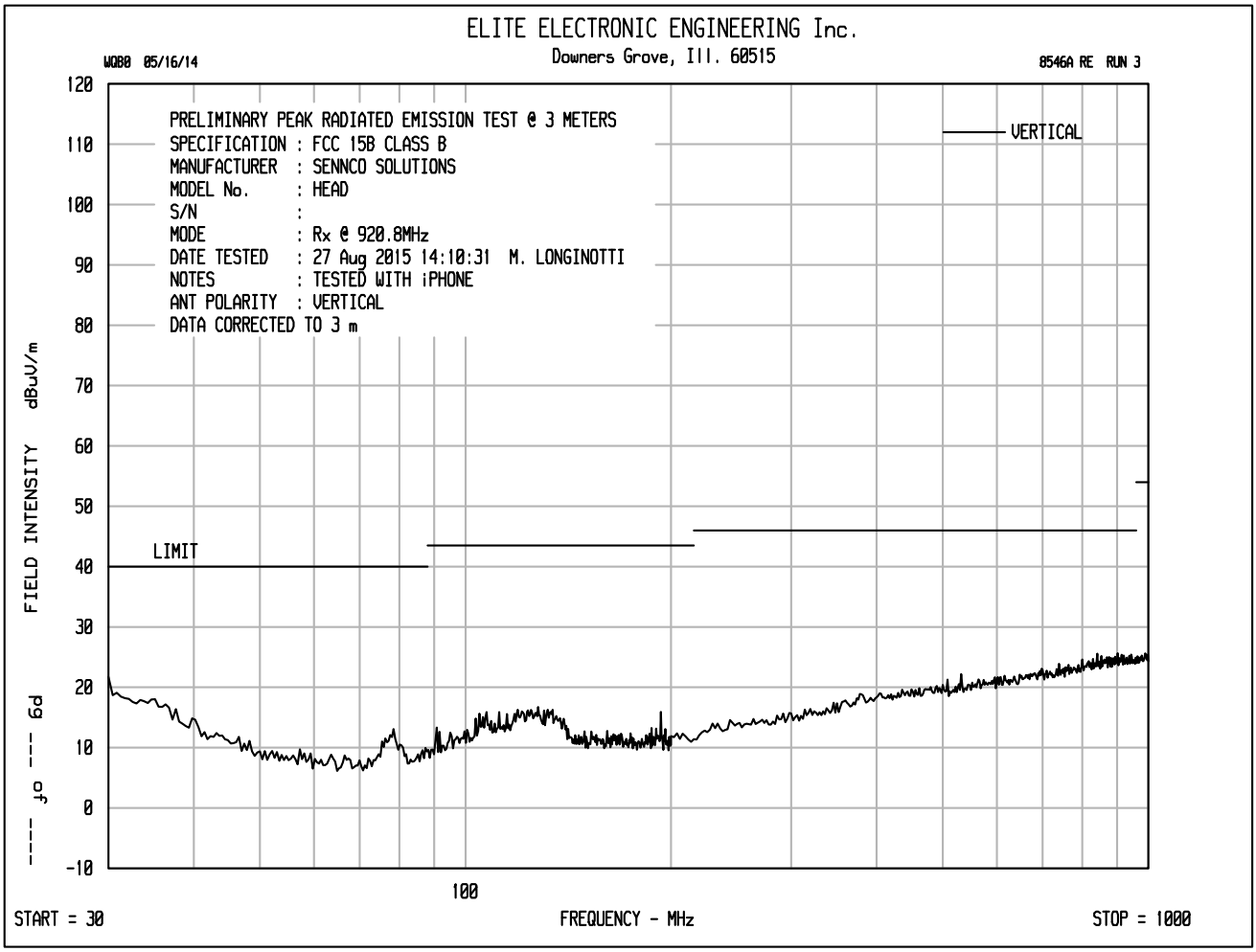
RADIATED AVG EMISSION MEASUREMENTS >=1000 MHz in a 3 m ANECHOIC ROOM

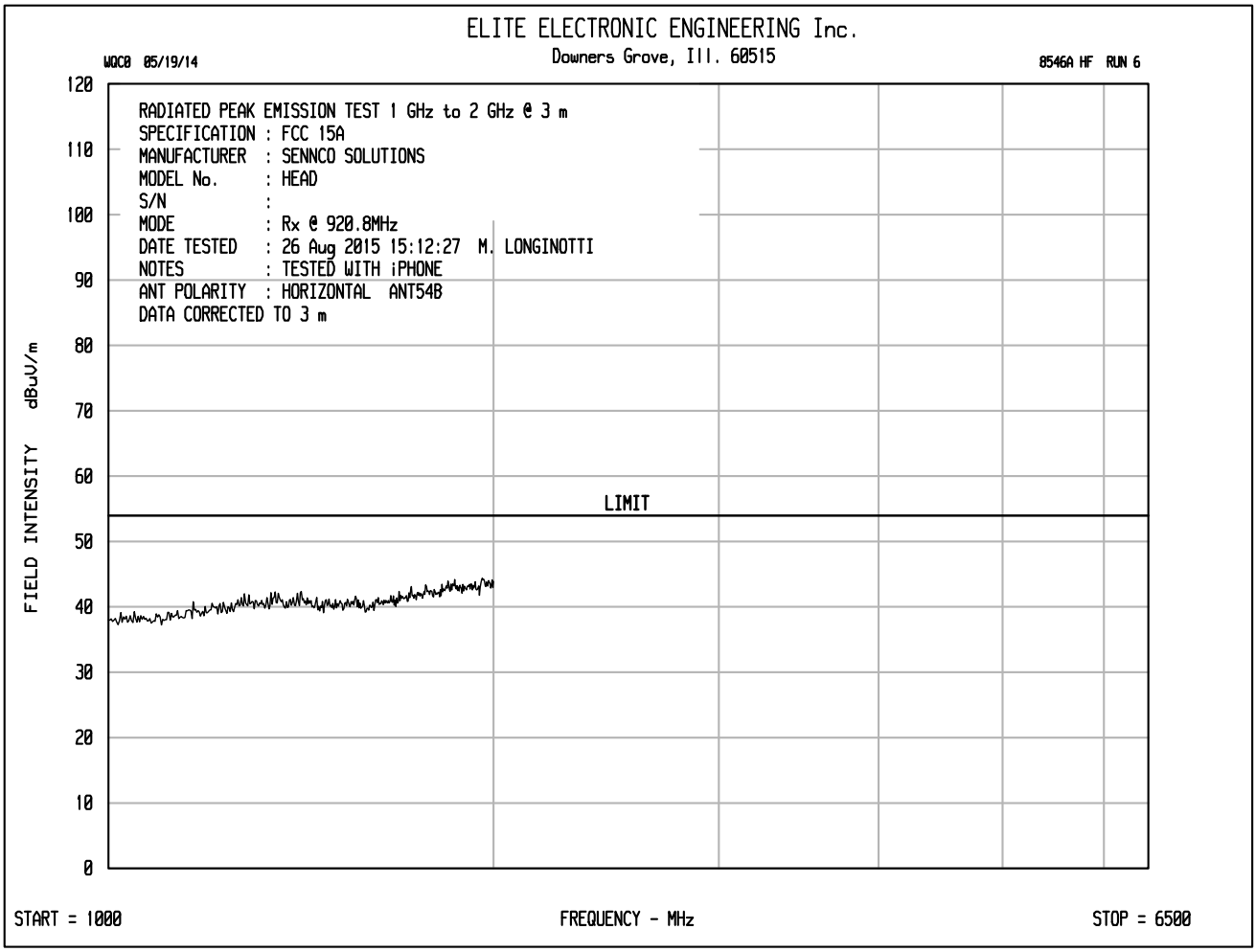
SPECIFICATION : FCC 15A
MANUFACTURER : SENNCO SOLUTIONS
MODEL NO. : HEAD
SERIAL NO. :
TEST MODE : Rx @ 913.8MHz
NOTES : TESTED WITH iPHONE
TEST DATE : 26 Aug 2015 14:39:45
TEST DISTANCE : 3 m
ANTENNA : ANT54B

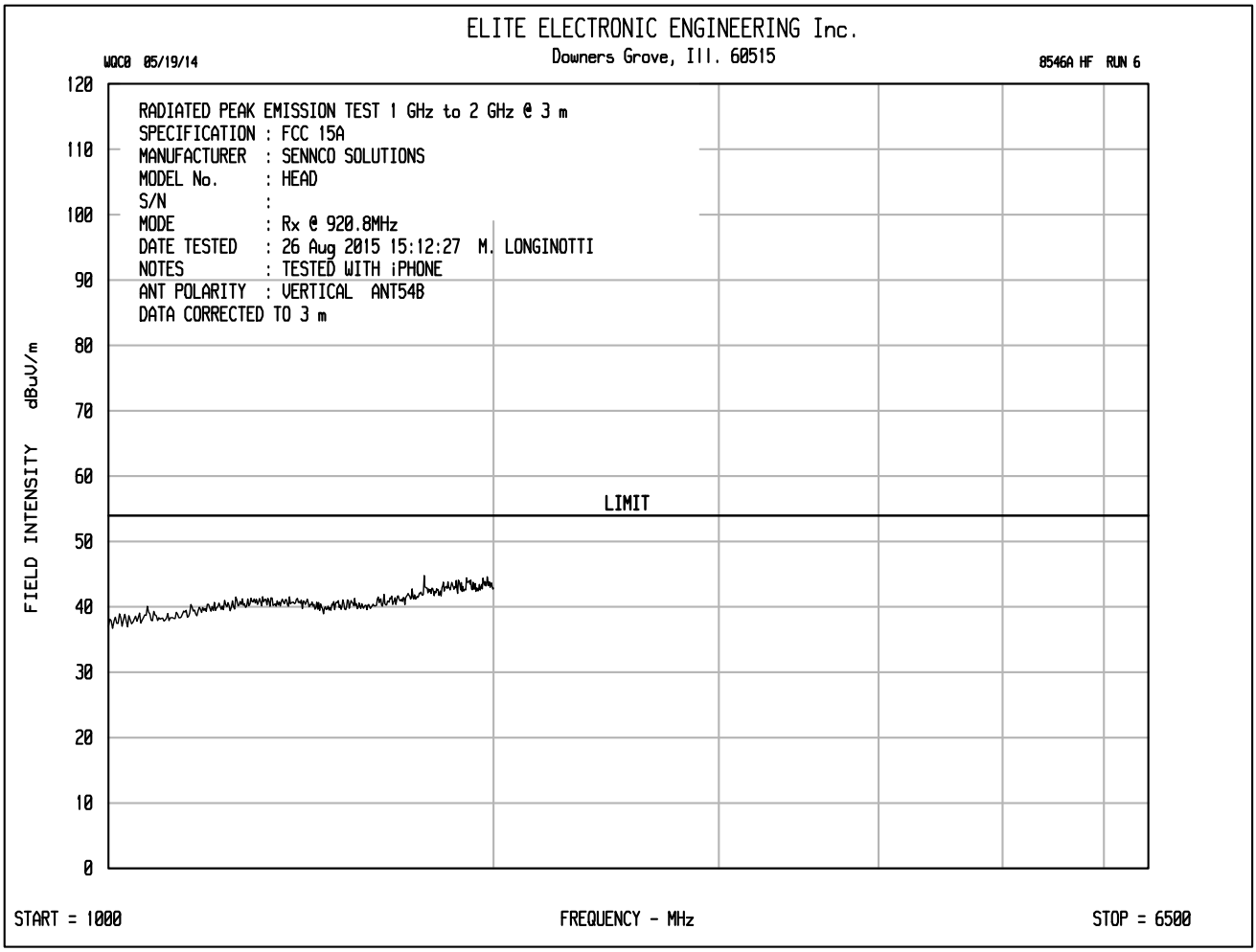
FREQUENCY MHz	AVG READING dBuV	ANT FAC dB	CBL FAC dB	DIST FAC dB	TOTAL dBuV/m	AVG LIMIT dBuV/m	PASS/ FAIL	AZ deg	ANT HT cm	POLAR
1052.48	-3.8	27.1	1.6	0.0	24.8	54.0		90	120	H
1261.19	-3.5	28.9	1.8	0.0	27.1	54.0		270	340	V
1345.86	-3.0	29.1	1.8	0.0	28.0	54.0		225	120	H
1399.52	-3.1	29.0	1.9	0.0	27.7	54.0		0	340	V
1636.55	-3.4	28.8	2.1	0.0	27.5	54.0		0	340	V
1770.97	-3.4	30.2	2.1	0.0	29.0	54.0		180	340	H
1880.22	-2.7	31.4	2.2	0.0	30.9	54.0		270	340	H

tested by: MARK E. LONGINOTTI
M. LONGINOTTI


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WQB0 05/16/14
8546A RE RUN 3
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
S/N :
MODE : Rx @ 920.8MHz
DATE TESTED : 27 Aug 2015 14:10:31 M. LONGINOTTI
NOTES : TESTED WITH iPHONE
ANT POLARITY : HORIZONTAL
DATA CORRECTED TO 3 m
HORIZONTAL
LIMIT
FIELD INTENSITY dBuV/m
---- pg --- of ----
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
WQB0 05/16/14
8546A RE RUN 3
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
S/N :
MODE : Rx @ 920.8MHz
DATE TESTED : 27 Aug 2015 14:10:31 M. LONGINOTTI
NOTES : TESTED WITH iPHONE
ANT POLARITY : VERTICAL
DATA CORRECTED TO 3 m
VERTICAL
LIMIT
FIELD INTENSITY dBuV/m
---- µo --- 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
WQC0 05/19/14
8546A HF RUN 6
RADIATED PEAK EMISSION TEST 1 GHz to 2 GHz @ 3 m
SPECIFICATION : FCC 15A
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
S/N :
MODE : Rx @ 920.8MHz
DATE TESTED : 26 Aug 2015 15:12:27 M. LONGINOTTI
NOTES : TESTED WITH iPHONE
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
WQC0 05/19/14
8546A HF RUN 6
RADIATED PEAK EMISSION TEST 1 GHz to 2 GHz @ 3 m
SPECIFICATION : FCC 15A
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
S/N :
MODE : Rx @ 920.8MHz
DATE TESTED : 26 Aug 2015 15:12:27 M. LONGINOTTI
NOTES : TESTED WITH iPHONE
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. 3

RADIATED QP EMISSION MEASUREMENTS in a 3 m SEMI-ANECHOIC ROOM
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : SENNCO SOLUTIONS
MODEL NO. : HEAD
SERIAL NO. :
TEST MODE : Rx @ 920.8MHz
NOTES : TESTED WITH iPHONE
TEST DATE : 27 Aug 2015 14:10:31
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
76.33	-4.7	6.8	.4	0.0	0.0	2.5	40.0	180	200	H
77.28	-2.2	6.8	.4	0.0	0.0	5.0	40.0	270	120	V
118.15	-2.0	10.7	.5	0.0	0.0	9.1	43.5	45	120	V
139.53	-2.0	10.3	.6	0.0	0.0	8.9	43.5	225	200	H
145.48	-6.6	10.2	.6	0.0	0.0	4.2	43.5	225	200	H
188.96	-.3	9.5	.7	0.0	0.0	10.0	43.5	225	200	V
191.97	1.9	9.5	.7	0.0	0.0	12.1	43.5	225	200	V
356.17	-6.7	14.4	1.0	0.0	0.0	8.7	46.0	90	120	V
448.89	-7.6	16.3	1.1	0.0	0.0	9.8	46.0	315	200	H
569.46	-8.0	18.2	1.1	0.0	0.0	11.3	46.0	90	200	H
666.14	-6.5	18.5	1.3	0.0	0.0	13.3	46.0	180	340	H
781.86	-6.4	19.7	1.5	0.0	0.0	14.8	46.0	225	120	H
905.76	-6.7	20.8	1.5	0.0	0.0	15.7	46.0	180	340	V
945.38	-6.5	21.1	1.5	0.0	0.0	16.2	46.0	135	120	H

tested by: MARK E. LONGINOTTI
M. LONGINOTTI

DATA SHEET HF TEST NO. 6

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

SPECIFICATION : FCC 15A
MANUFACTURER : SENNCO SOLUTIONS
MODEL NO. : HEAD
SERIAL NO. :
TEST MODE : Rx @ 920.8MHz
NOTES : TESTED WITH iPHONE
TEST DATE : 26 Aug 2015 15:12:27
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
1076.94	-2.7	27.1	1.6	0.0	25.9	54.0		135	120	V
1261.09	-3.4	28.9	1.8	0.0	27.3	54.0		270	200	V
1354.66	-2.6	29.1	1.9	0.0	28.4	54.0		90	200	H
1420.42	-2.6	28.8	1.9	0.0	28.1	54.0		0	200	H
1641.13	-3.2	28.8	2.1	0.0	27.6	54.0		315	120	V
1779.21	-3.3	30.3	2.2	0.0	29.2	54.0		45	200	V
1881.72	-2.6	31.4	2.2	0.0	31.0	54.0		135	340	V
1946.49	-3.3	31.7	2.3	0.0	30.6	54.0		270	340	V

tested by: MARK E. LONGINOTTI
M. LONGINOTTI

FCC Part 15 Subpart B Conducted Emissions Test

Significant Emissions Data

VBR8 03/04/2015

Manufacturer	:	SENNCO SOLUTIONS
Model	:	HEAD
DUT Revision	:	
Serial Number	:	
DUT Mode	:	Tx @ 913.8MHz
Line Tested	:	115V, 60Hz HIGH
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-1
Notes	:	WITH iPHONE, WITH CUI ETSA050360UD POWER SUPPLY
Test Engineer	:	M. Longinotti
Limit	:	Class B
Test Date	:	Aug 28, 2015 08:47:49 AM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 1 dB margin below limit

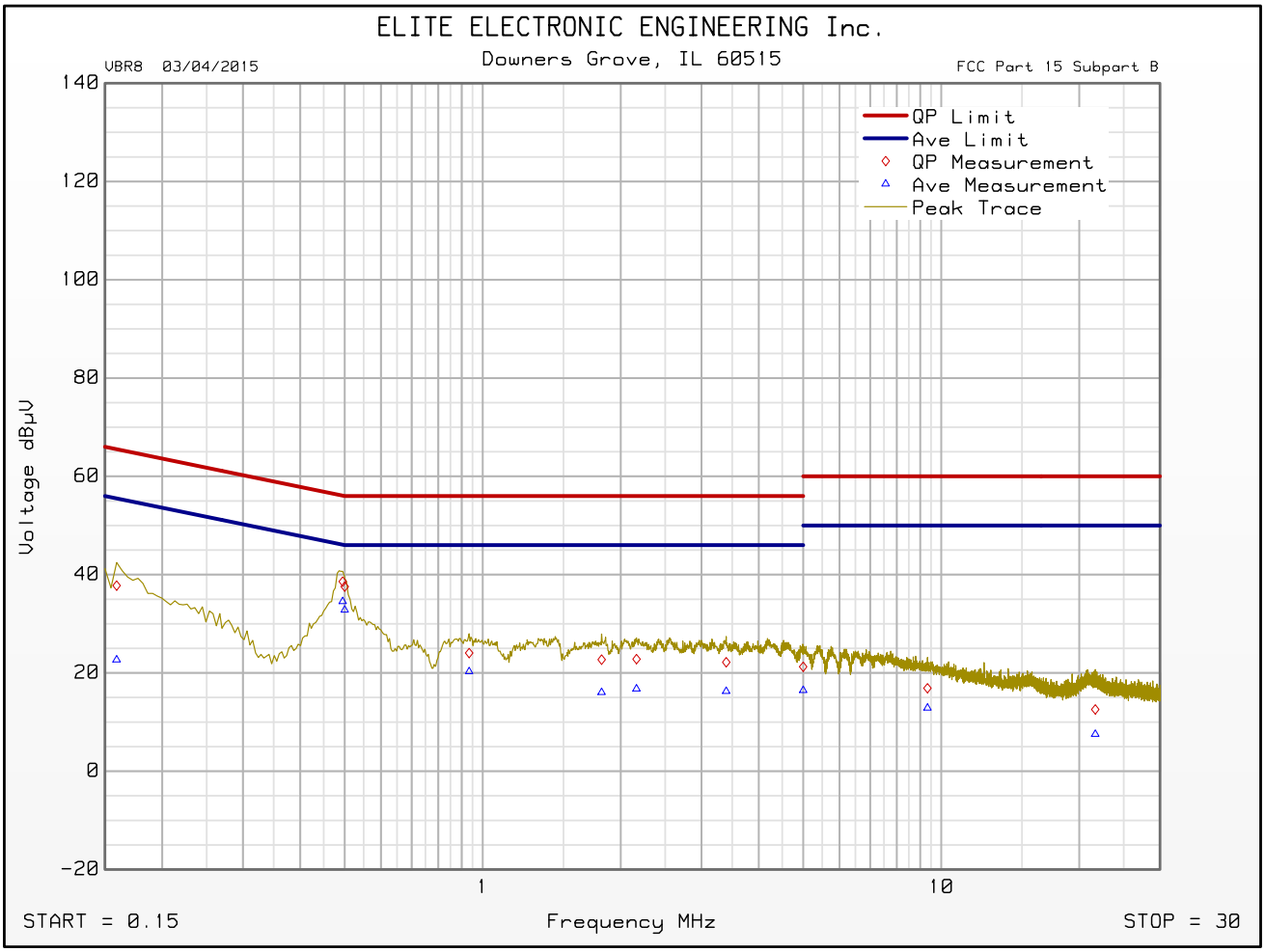
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.159	37.8	65.5		22.7	55.5	
0.495	38.6	56.1		34.5	46.1	
0.500	37.6	56.0		32.8	46.0	
0.934	24.0	56.0		20.3	46.0	
1.817	22.7	56.0		16.1	46.0	
2.165	22.8	56.0		16.8	46.0	
3.397	22.2	56.0		16.3	46.0	
5.000	21.2	56.0		16.5	46.0	
9.333	16.9	60.0		12.9	50.0	
21.677	12.6	60.0		7.5	50.0	

FCC Part 15 Subpart B Conducted Emissions Test

Cumulative Data

VBR8 03/04/2015

Manufacturer	:	SENNCO SOLUTIONS
Model	:	HEAD
DUT Revision	:	
Serial Number	:	
DUT Mode	:	Tx @ 913.8MHz
Line Tested	:	115V, 60Hz HIGH
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-1
Notes	:	WITH iPHONE, WITH CUI ETSA050360UD POWER SUPPLY
Test Engineer	:	M. Longinotti
Limit	:	Class B
Test Date	:	Aug 28, 2015 08:47:49 AM



Emissions Meet QP Limit
Emissions Meet Ave Limit

FCC Part 15 Subpart B Conducted Emissions Test

Significant Emissions Data

VBR8 03/04/2015

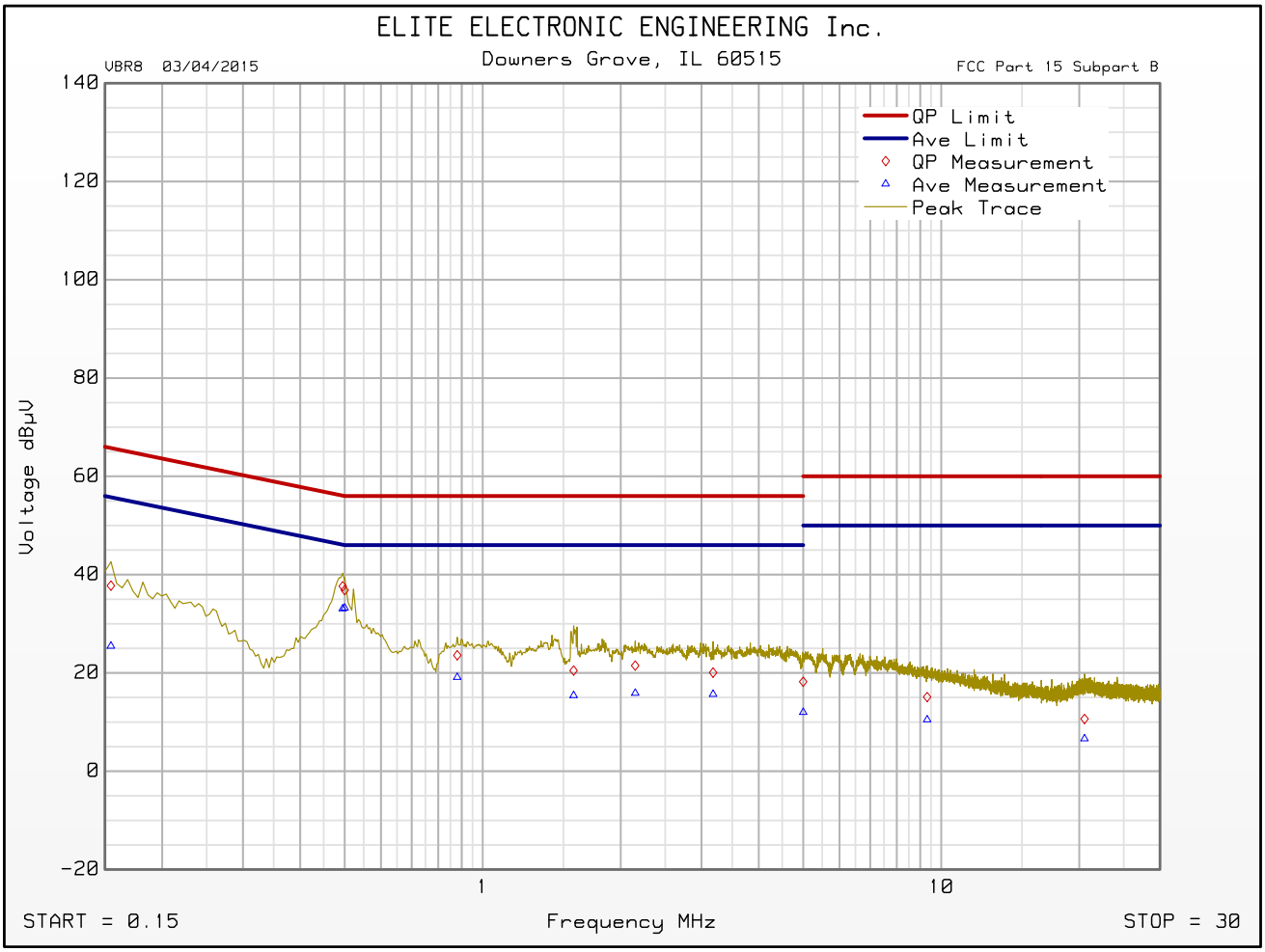
Manufacturer	:	SENNCO SOLUTIONS
Model	:	HEAD
DUT Revision	:	
Serial Number	:	
DUT Mode	:	Tx @ 913.8MHz
Line Tested	:	115V, 60Hz RETURN
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-1
Notes	:	WITH iPHONE, WITH CUI ETSA050360UD POWER SUPPLY
Test Engineer	:	M. Longinotti
Limit	:	Class B
Test Date	:	Aug 28, 2015 08:54:14 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
0.155	37.8	65.8		25.5	55.8	
0.495	37.6	56.1		33.1	46.1	
0.500	36.9	56.0		33.2	46.0	
0.880	23.6	56.0		19.1	46.0	
1.579	20.5	56.0		15.4	46.0	
2.151	21.5	56.0		15.9	46.0	
3.181	20.1	56.0		15.7	46.0	
5.000	18.2	56.0		12.0	46.0	
9.320	15.1	60.0		10.5	50.0	
20.543	10.6	60.0		6.6	50.0	

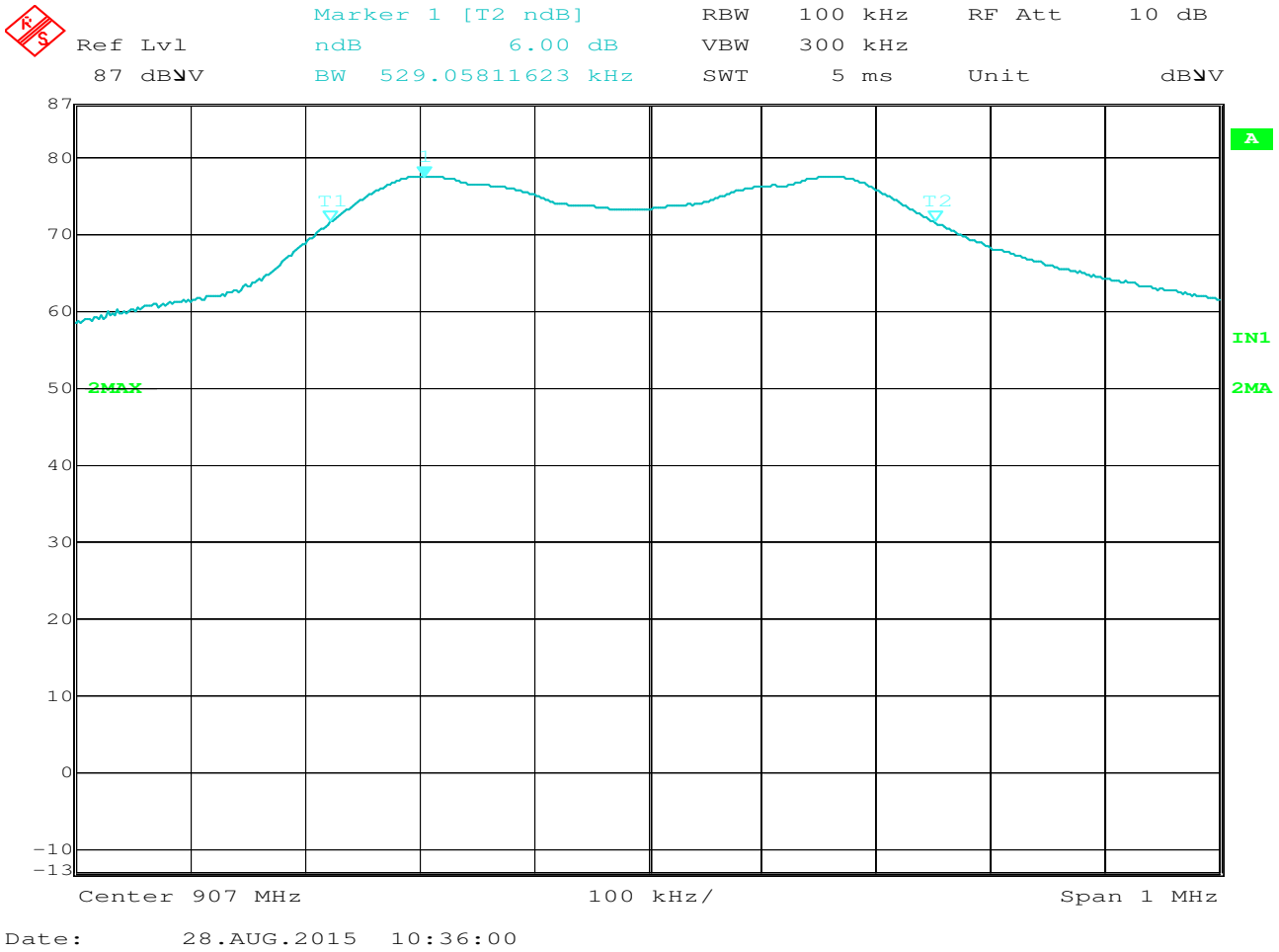
FCC Part 15 Subpart B Conducted Emissions Test
Cumulative Data

VBR8 03/04/2015

Manufacturer	:	SENNCO SOLUTIONS
Model	:	HEAD
DUT Revision	:	
Serial Number	:	
DUT Mode	:	Tx @ 913.8MHz
Line Tested	:	115V, 60Hz RETURN
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-1
Notes	:	WITH iPHONE, WITH CUI ETSA050360UD POWER SUPPLY
Test Engineer	:	M. Longinotti
Limit	:	Class B
Test Date	:	Aug 28, 2015 08:54:14 AM



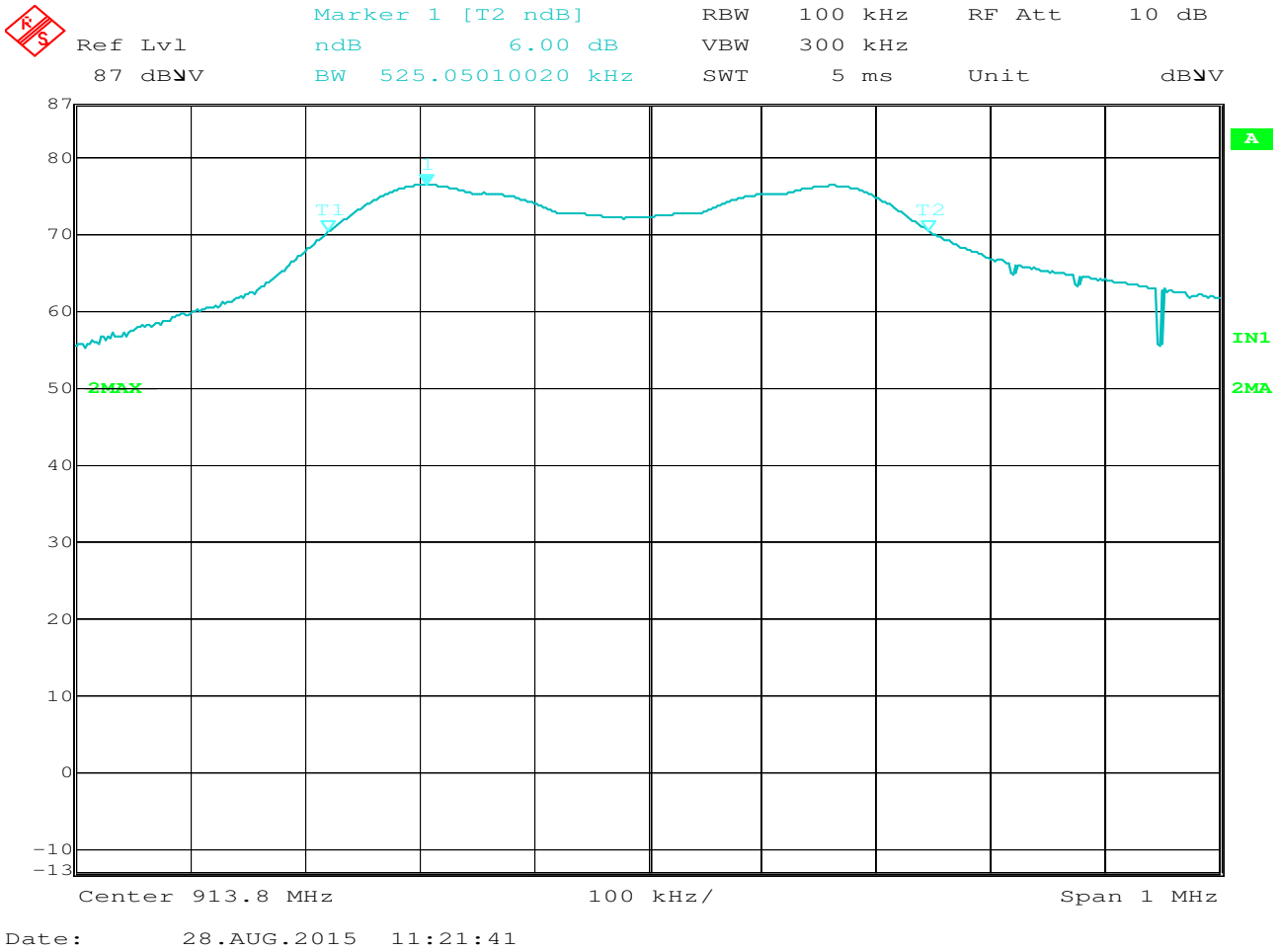
Emissions Meet QP Limit
Emissions Meet Ave Limit



FCC 15.247 6dB Band width

MANUFACTURER	:	Sennco Solutions
MODEL NUMBER	:	Head
SERIAL NUMBER	:	
TEST MODE	:	Transmit at 907MHz
TEST PARAMETERS	:	6dB Bandwidth
NOTES	:	6dB bandwidth = 529.06kHz
EQUIPMENT USED	:	RBA0, NTA3

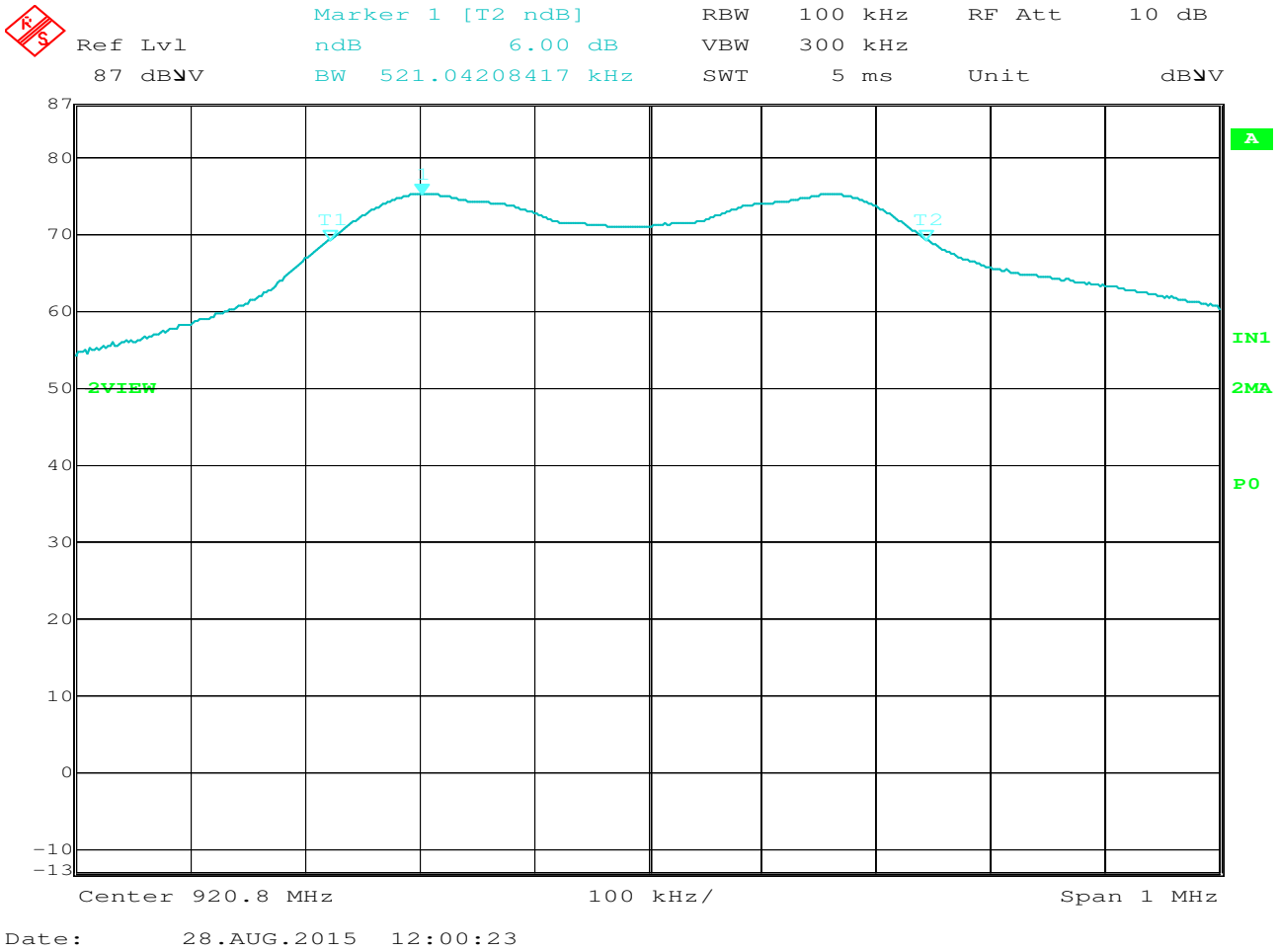
NOTES



FCC 15.247 6dB Band width

MANUFACTURER	:	Sennco Solutions
MODEL NUMBER	:	Head
SERIAL NUMBER	:	
TEST MODE	:	Transmit at 913.8MHz
TEST PARAMETERS	:	6dB Bandwidth
NOTES	:	6dB bandwidth = 525.05kHz
EQUIPMENT USED	:	RBA0, NTA3

NOTES



FCC 15.247 6dB Band width

MANUFACTURER	:	Sennco Solutions
MODEL NUMBER	:	Head
SERIAL NUMBER	:	
TEST MODE	:	Transmit at 920.8MHz
TEST PARAMETERS	:	6dB Bandwidth
NOTES	:	6dB bandwidth = 521.04kHz
EQUIPMENT USED	:	RBA0, NTA3

NOTES

MANUFACTURER : Sennco Solutions
MODEL NUMBER : Head
SERIAL NUMBER :
TEST PERFORMED : EIPR
TEST DATE : August 27, 2015 and August 28, 2015
TEST MODE : Transmit at 907MHz
TEST PARAMETERS : EIRP
NOTES :
EQUIPMENT USED : RBA0, NTA3, NDQ1, GRE0
TEST DISTANCE : 3 meters

Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
907.00	H	77.4	1.4	2.2	2.0	1.5	36.0	-34.5
907.00	V	70.7	-4.2	2.2	2.0	-4.1	36.0	-40.1

EIRP(dBm) = Sig. Gen. Reading (dBm) + Equivalent Antenna Gain (dB) – Cable Loss (dB)

MANUFACTURER : Sennco Solutions
MODEL NUMBER : Head
SERIAL NUMBER :
TEST PERFORMED : EIPR
TEST DATE : August 27, 2015 and August 28, 2015
TEST MODE : Transmit at 913.8MHz
TEST PARAMETERS : EIRP
NOTES :
EQUIPMENT USED : RBA0, NTA3, NDQ1, GRE0
TEST DISTANCE : 3 meters

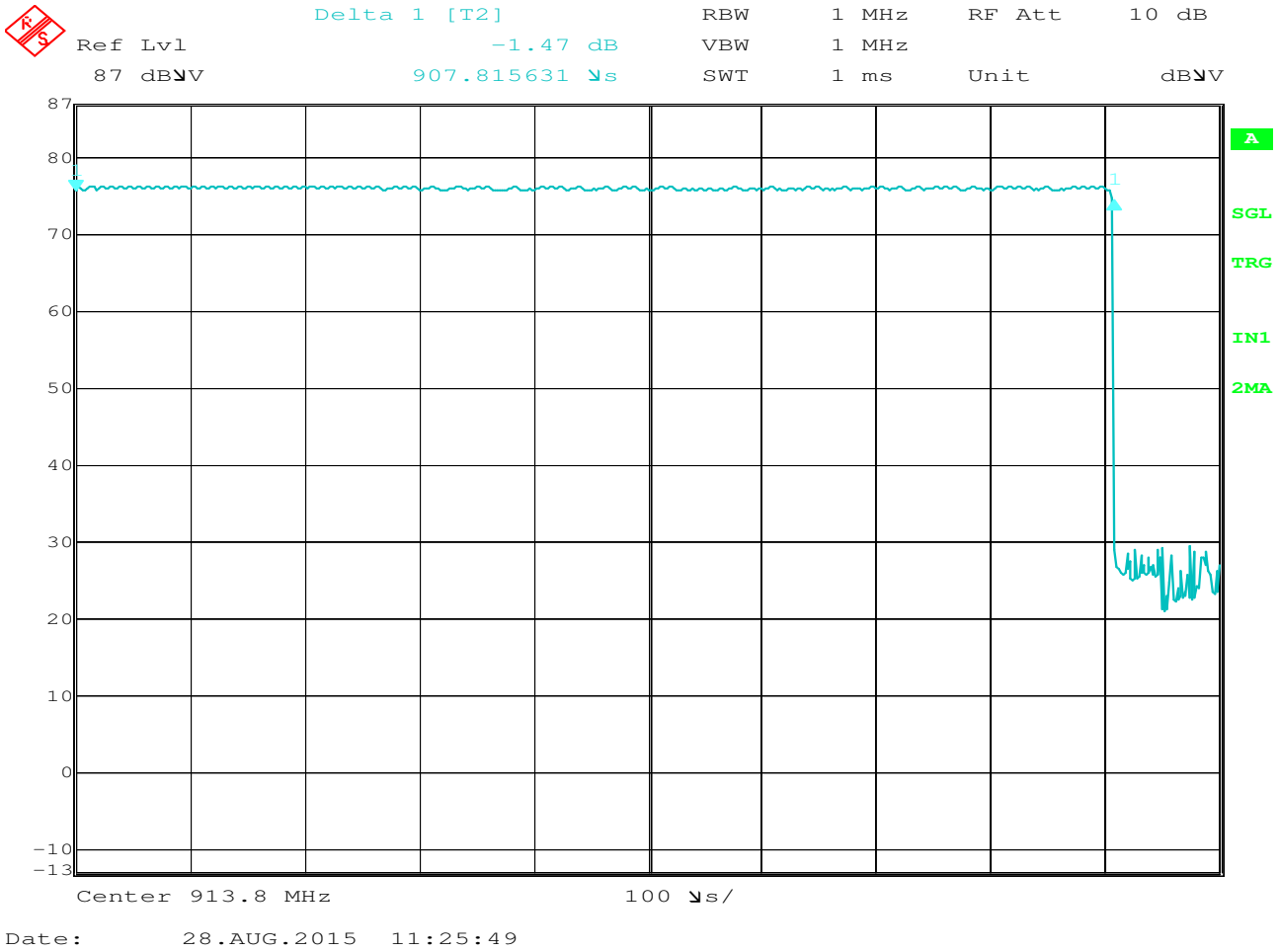
Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
913.80	H	76.2	0.2	2.2	2.1	0.3	36.0	-35.7
913.80	V	69.3	-4.4	2.2	2.1	-4.3	36.0	-40.3

EIRP(dBm) = Sig. Gen. Reading (dBm) + Equivalent Antenna Gain (dB) – Cable Loss (dB)

MANUFACTURER : Sennco Solutions
MODEL NUMBER : Head
SERIAL NUMBER :
TEST PERFORMED : EIPR
TEST DATE : August 27, 2015 and August 28, 2015
TEST MODE : Transmit at 920.8MHz
TEST PARAMETERS : EIRP
NOTES :
EQUIPMENT USED : RBA0, NTA3, NDQ1, GRE0
TEST DISTANCE : 3 meters

Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
920.80	H	75.2	-1.2	2.2	2.1	-1.1	36.0	-37.1
920.80	V	67.8	-7.0	2.2	2.1	-6.9	36.0	-42.9

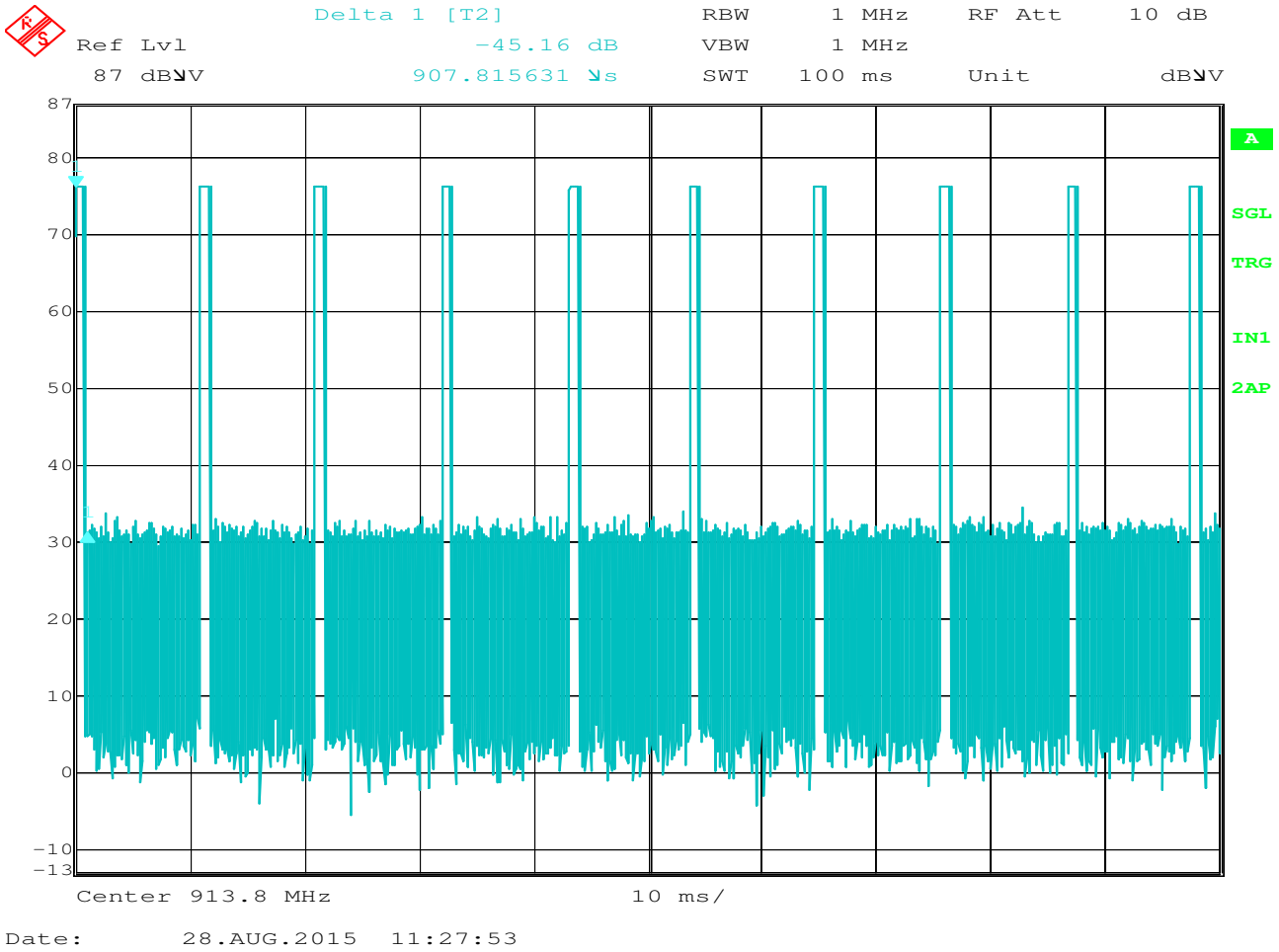
EIRP(dBm) = Sig. Gen. Reading (dBm) + Equivalent Antenna Gain (dB) – Cable Loss (dB)



FCC 15.247 Duty Cycle Correction Factor

MANUFACTURER	:	Sennco Solutions
MODEL NUMBER	:	Head
SERIAL NUMBER	:	
TEST MODE	:	Transmit at 913.8MHz
TEST PARAMETERS	:	Pulse Width
NOTES	:	Pulse Width is 907.82usec
EQUIPMENT USED	:	RBA0, NTA3

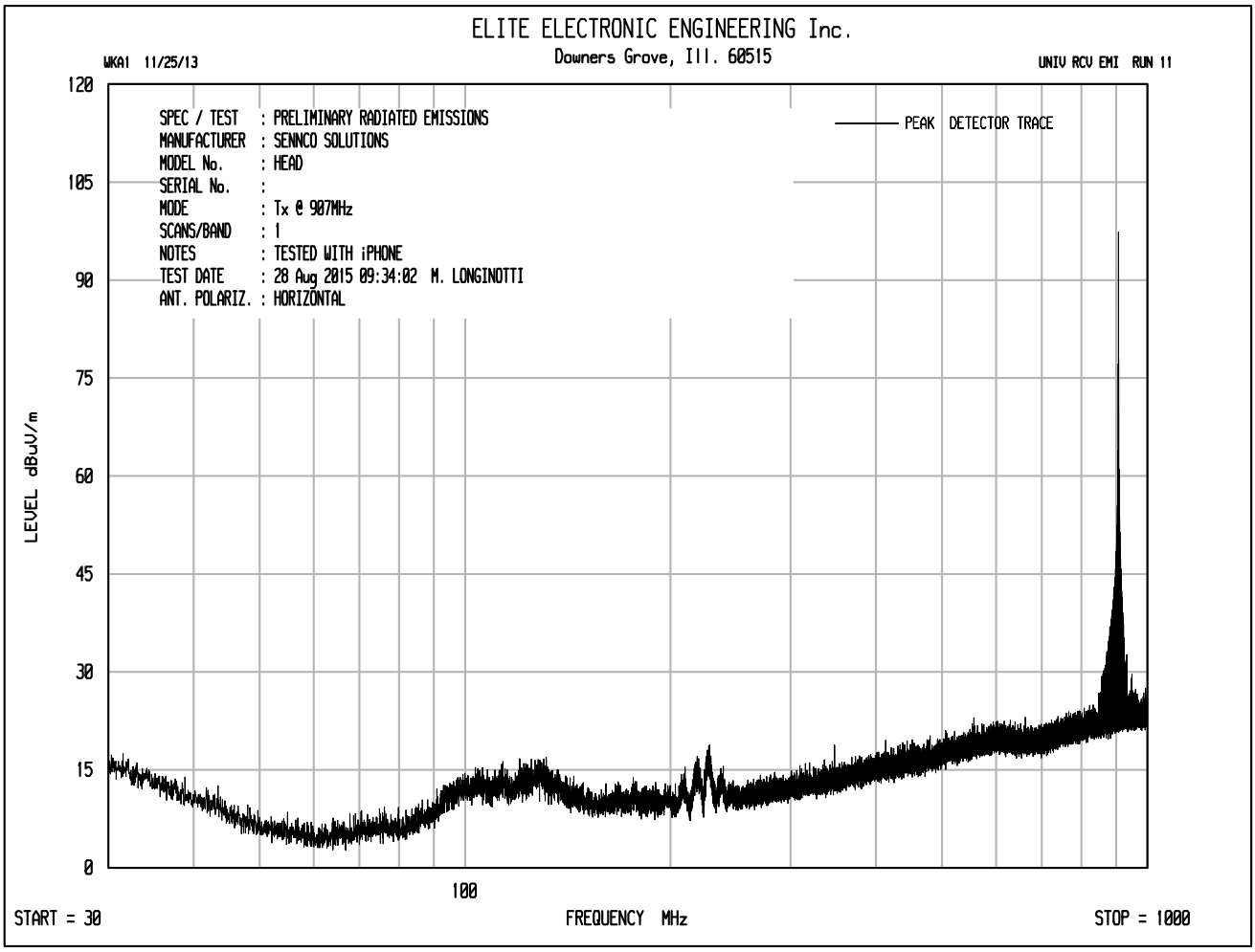
NOTES

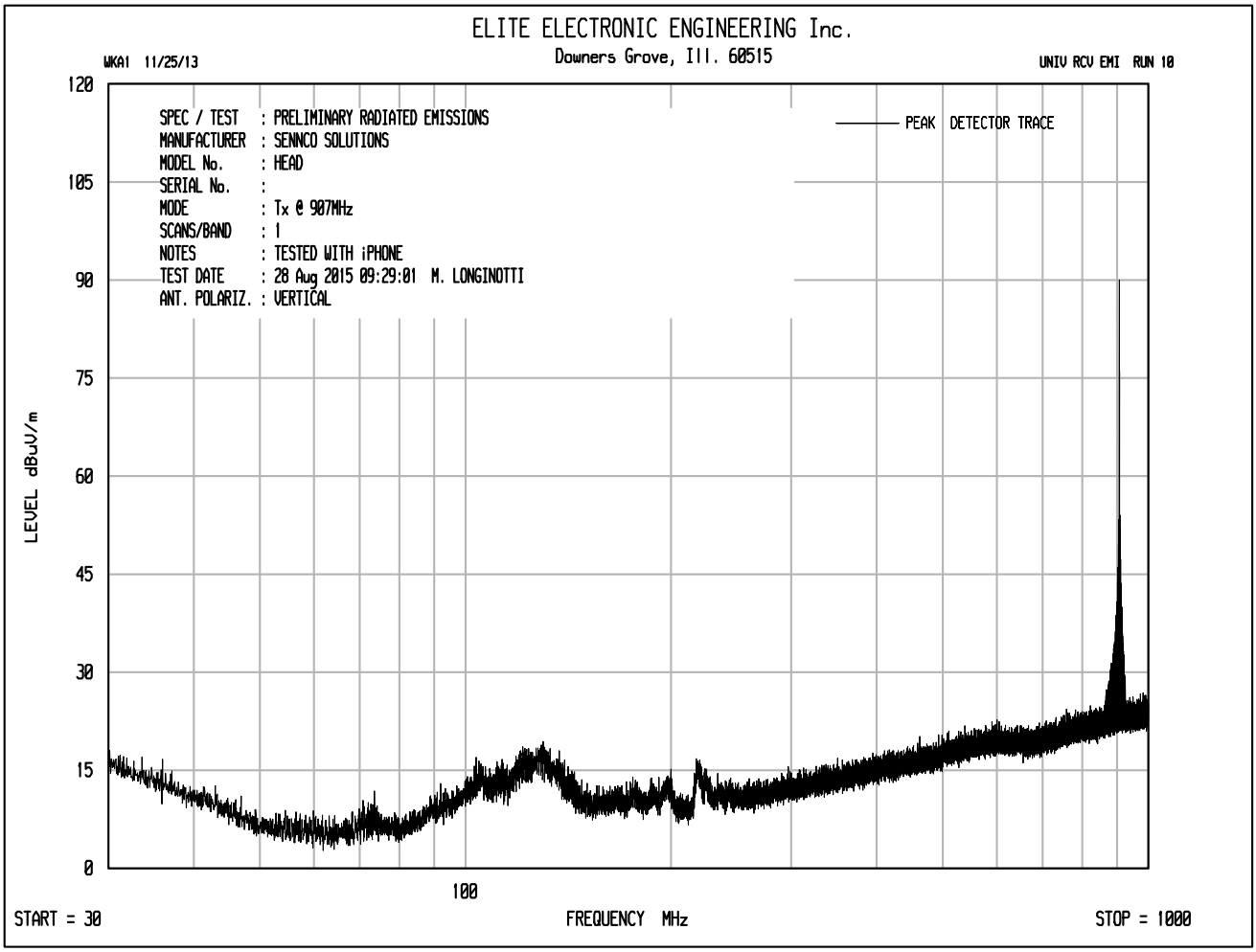


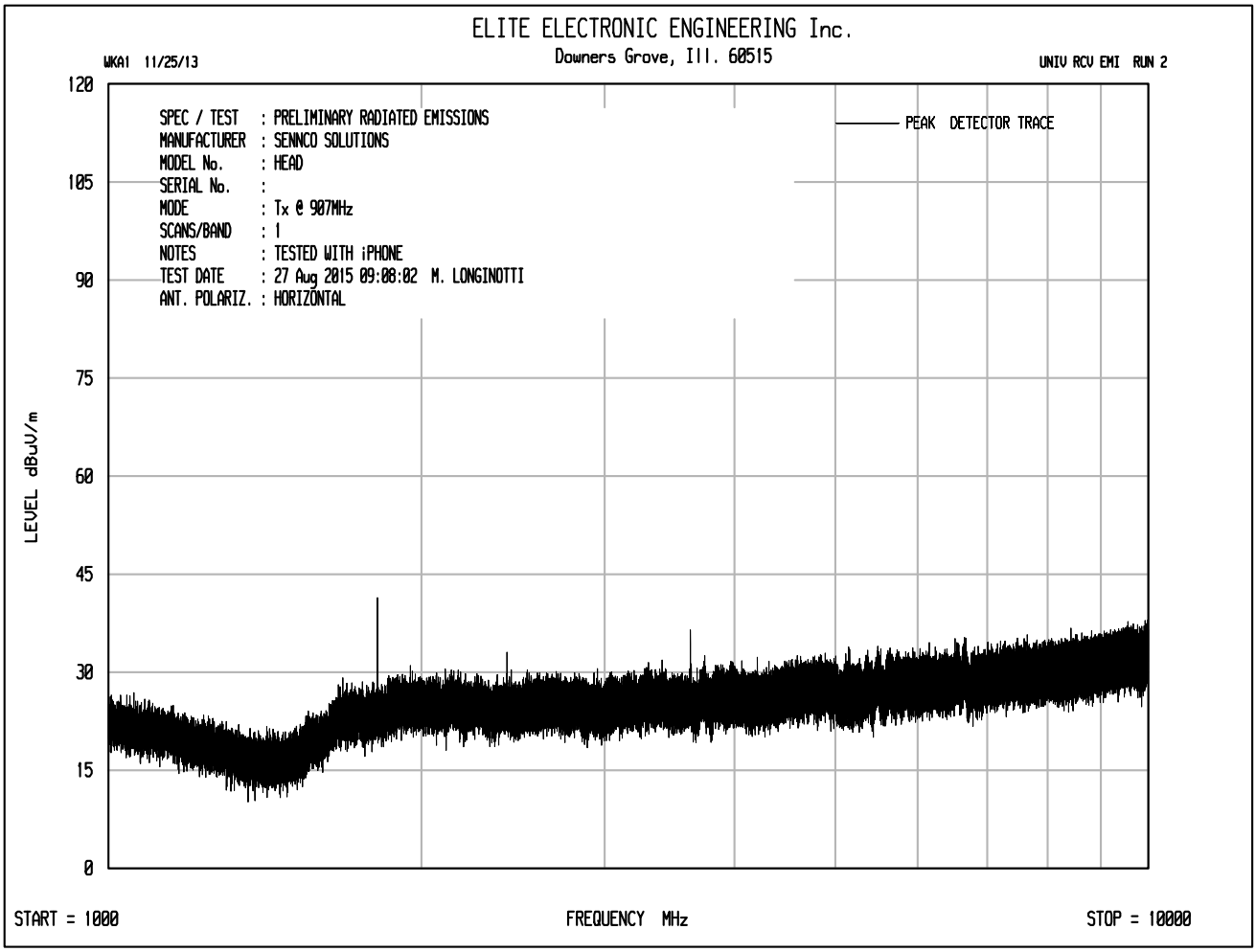
FCC 15.247 Duty Cycle Correction Factor

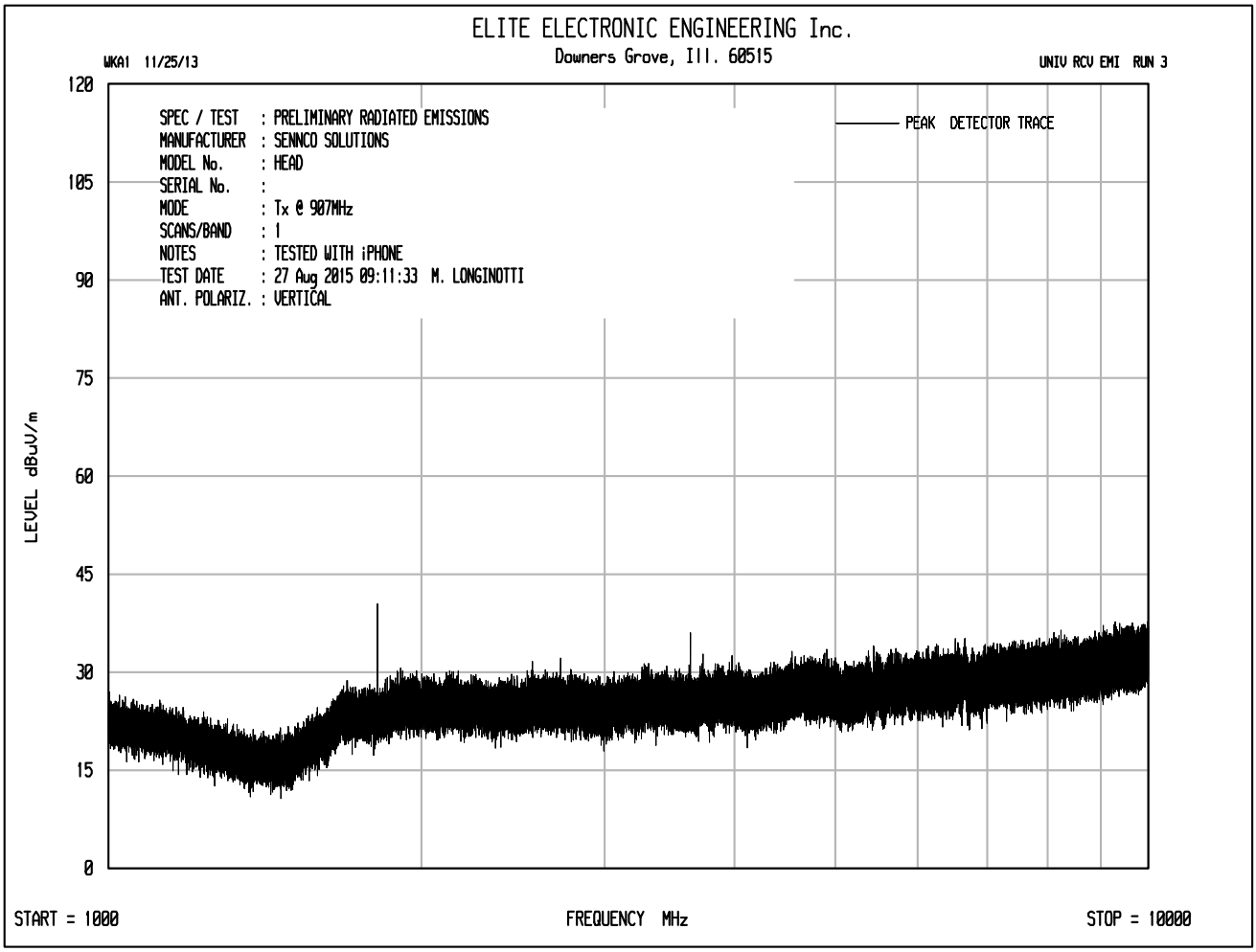
MANUFACTURER	:	Sennco Solutions
MODEL NUMBER	:	Head
SERIAL NUMBER	:	
TEST MODE	:	Transmit at 913.8MHz
TEST PARAMETERS	:	Duty Cycle Correction Factor
NOTES	:	Duty Cycle Correction Factor = 20 x log (((Pulse Width) x (#pulses in 100msec))/100msec)
	:	Duty Cycle Correction Factor = 20 x log (((907.82usec) x (10))/(100msec))
	:	Duty Cycle Correction Factor = -20.84dB
EQUIPMENT USED	:	RBA0, NTA3

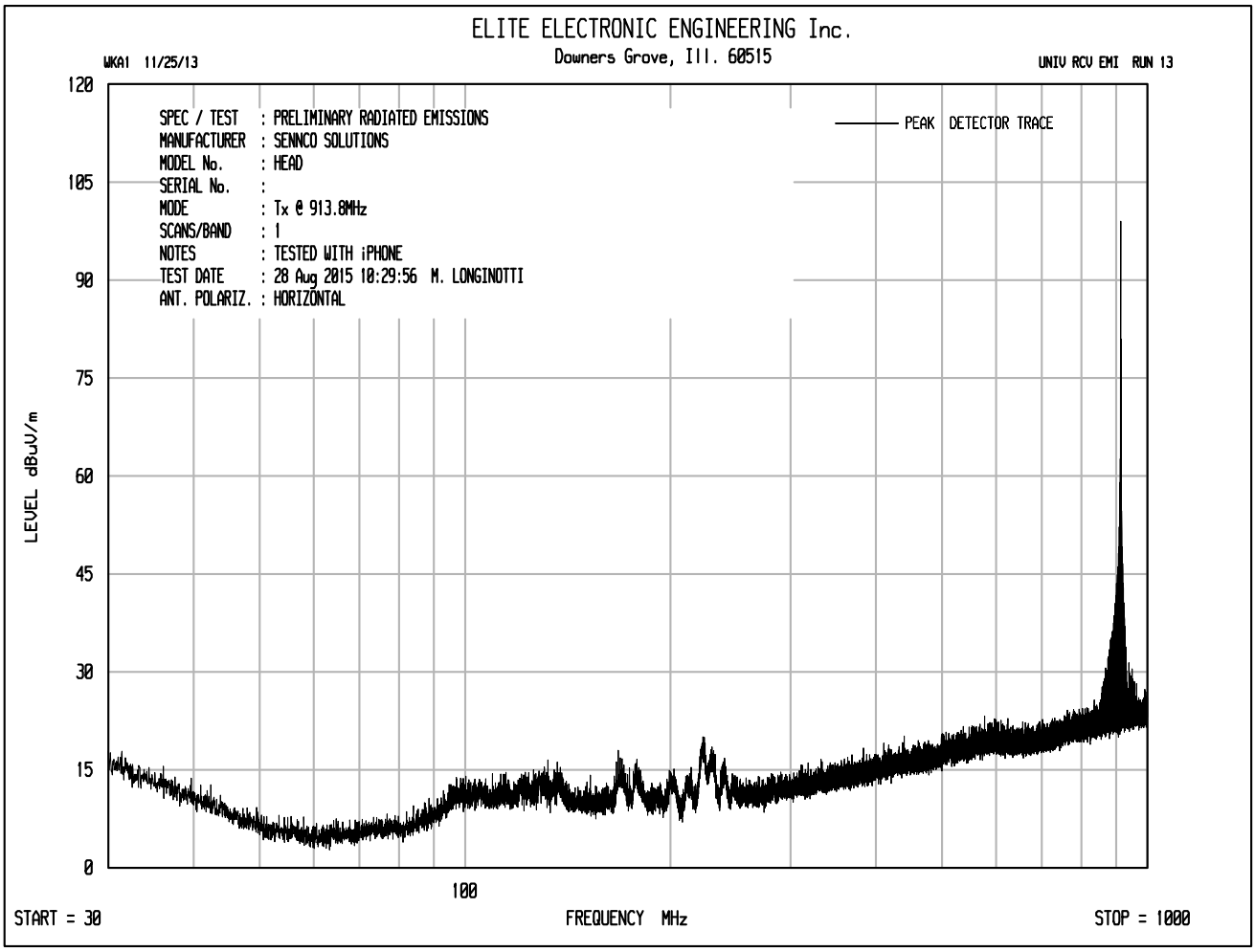
NOTES

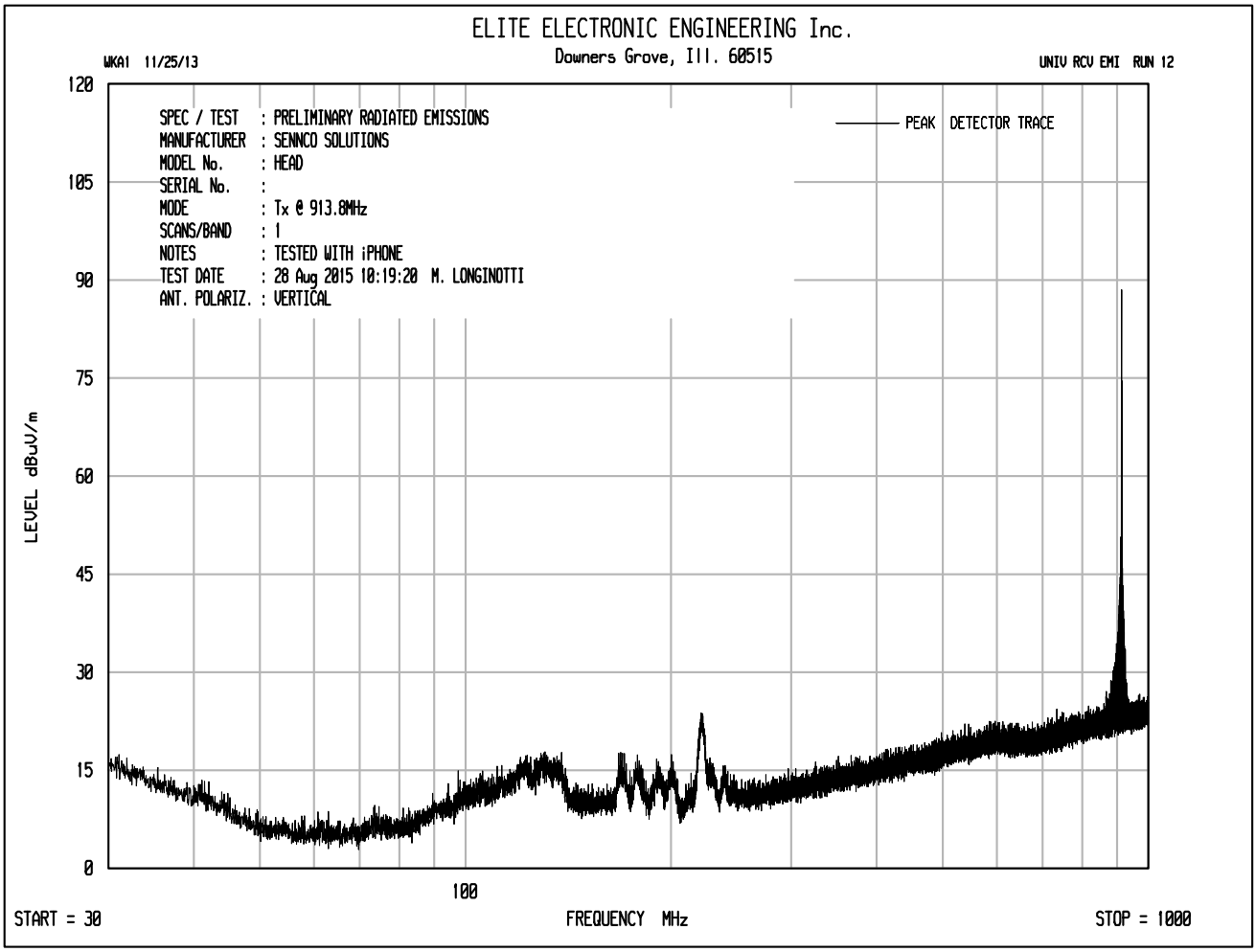

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 11
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
SERIAL No. :
MODE : Tx @ 907MHz
SCANS/BAND : 1
NOTES : TESTED WITH iPHONE
TEST DATE : 28 Aug 2015 09:34:02 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

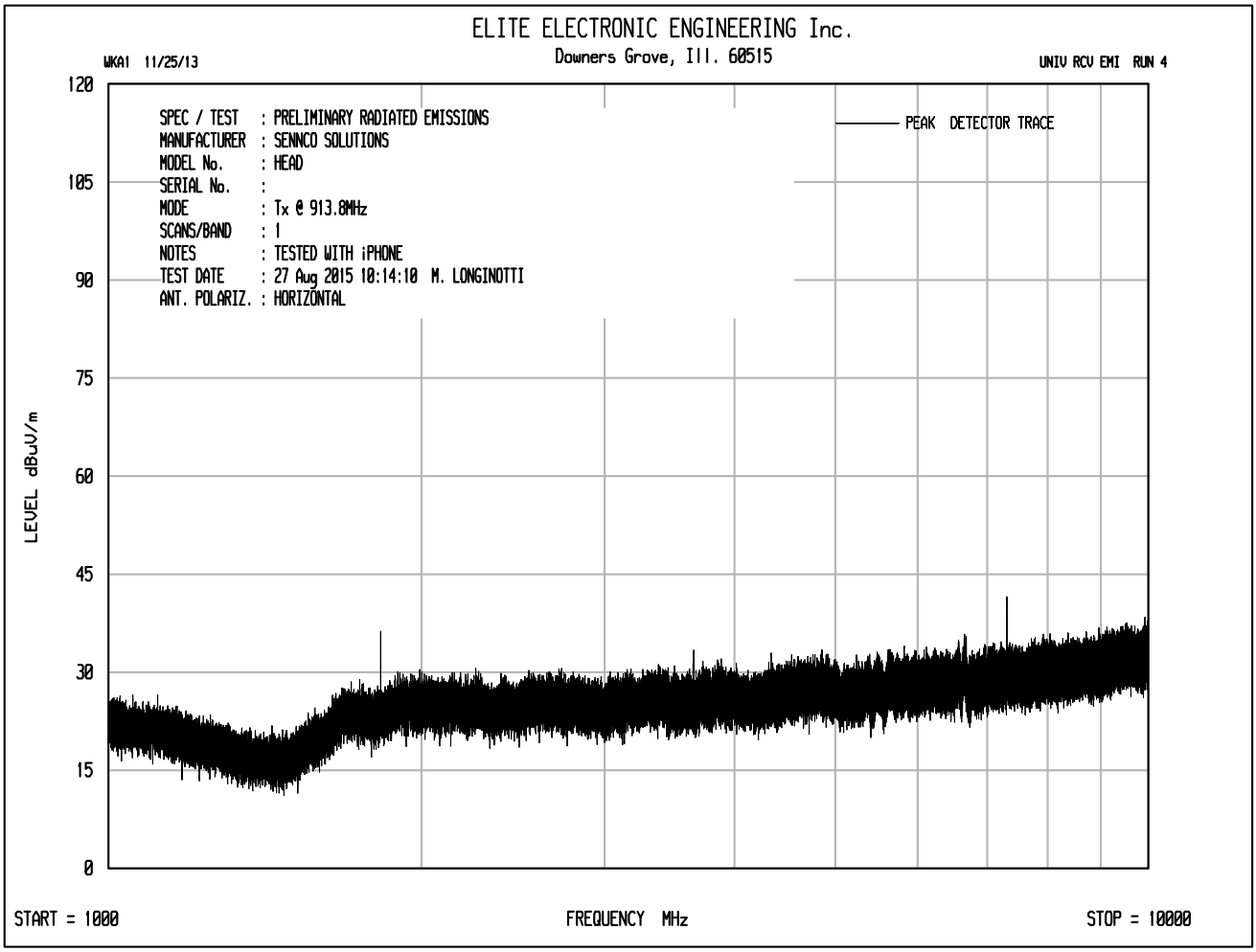

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
SERIAL No. :
MODE : Tx @ 907MHz
SCANS/BAND : 1
NOTES : TESTED WITH iPHONE
TEST DATE : 28 Aug 2015 09:29:01 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

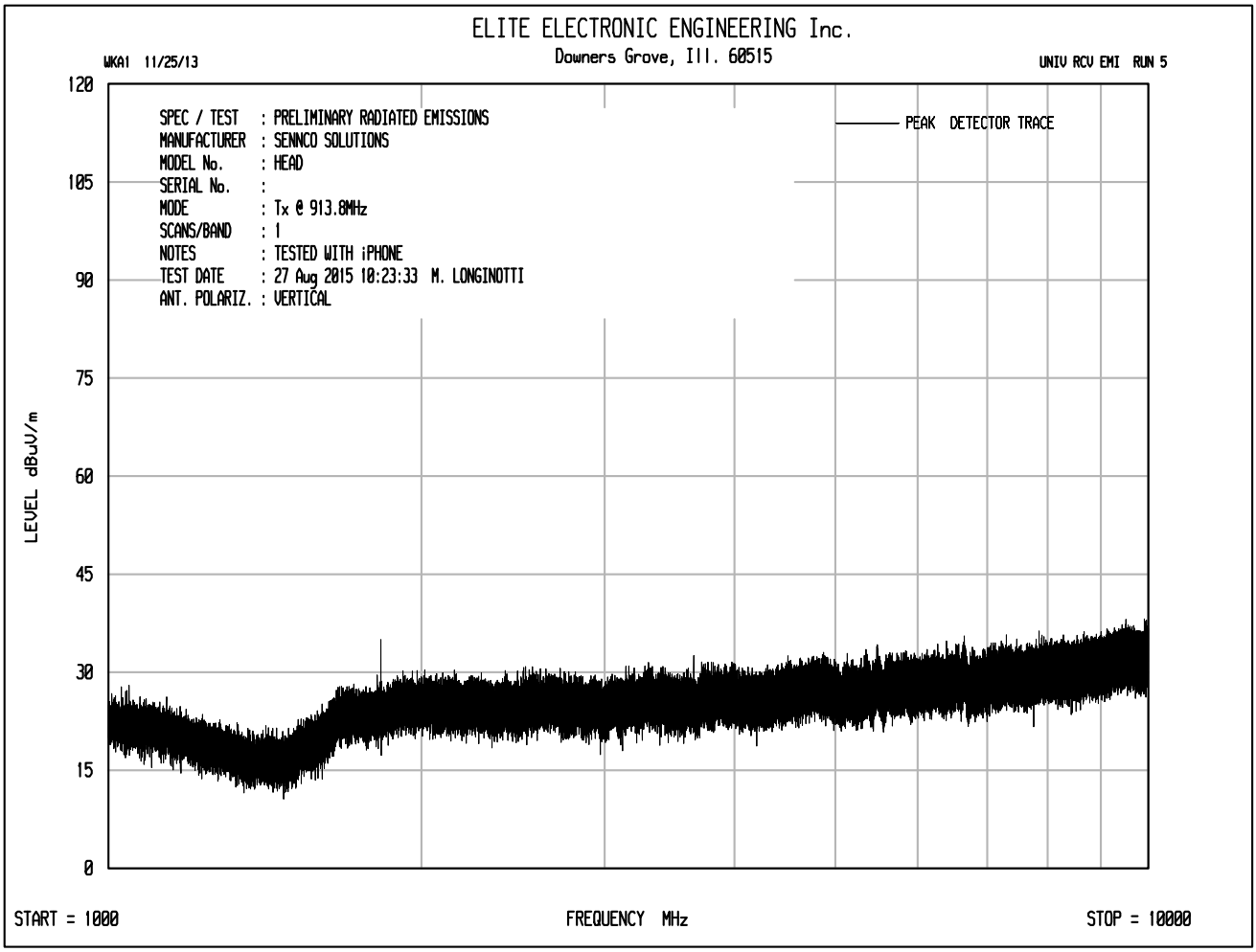

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
SERIAL No. :
MODE : Tx @ 907MHz
SCANS/BAND : 1
NOTES : TESTED WITH iPHONE
TEST DATE : 27 Aug 2015 09:08:02 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

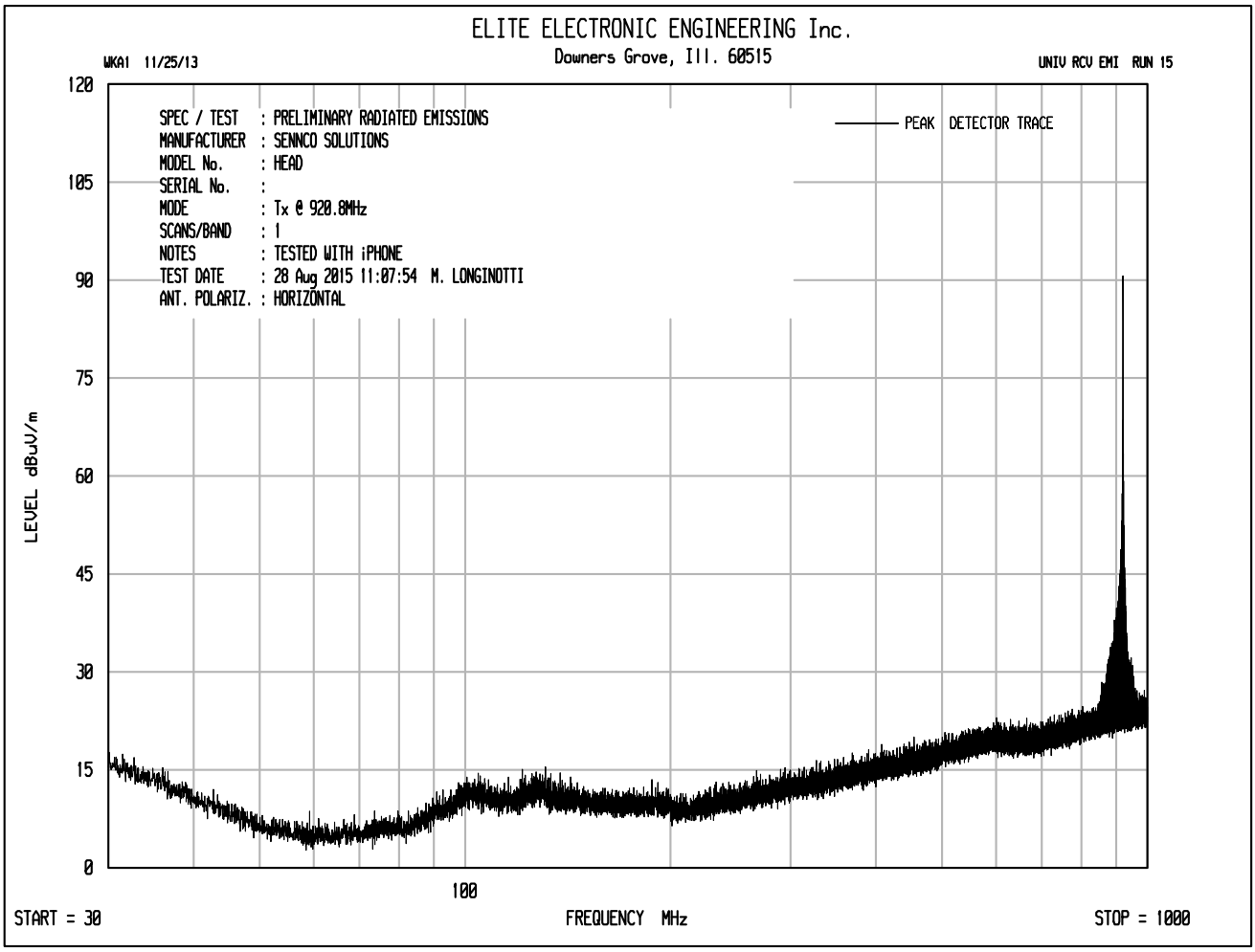

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
SERIAL No. :
MODE : Tx @ 907MHz
SCANS/BAND : 1
NOTES : TESTED WITH iPHONE
TEST DATE : 27 Aug 2015 09:11:33 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

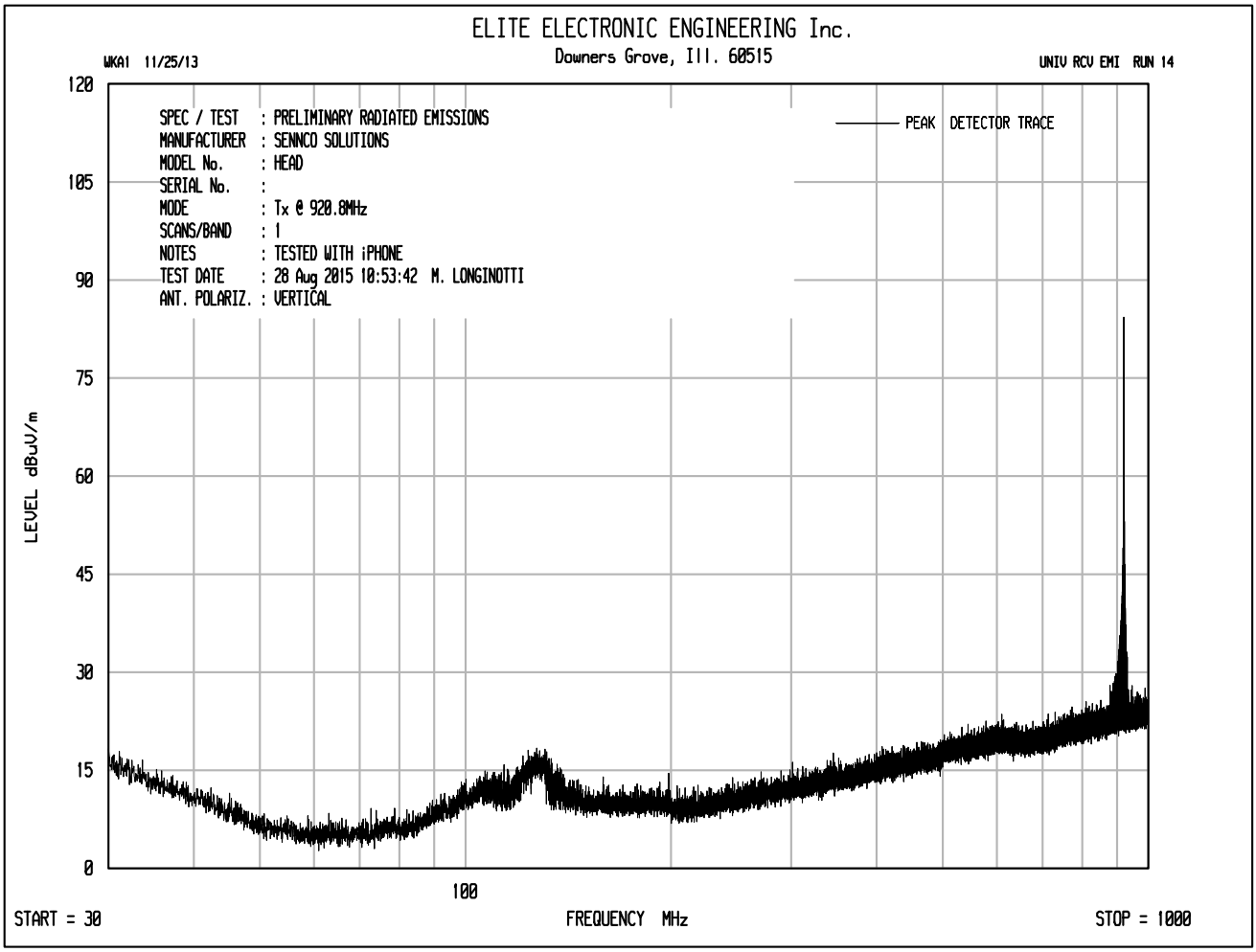

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
SERIAL No. :
MODE : Tx @ 913.8MHz
SCANS/BAND : 1
NOTES : TESTED WITH iPHONE
TEST DATE : 28 Aug 2015 10:29:56 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

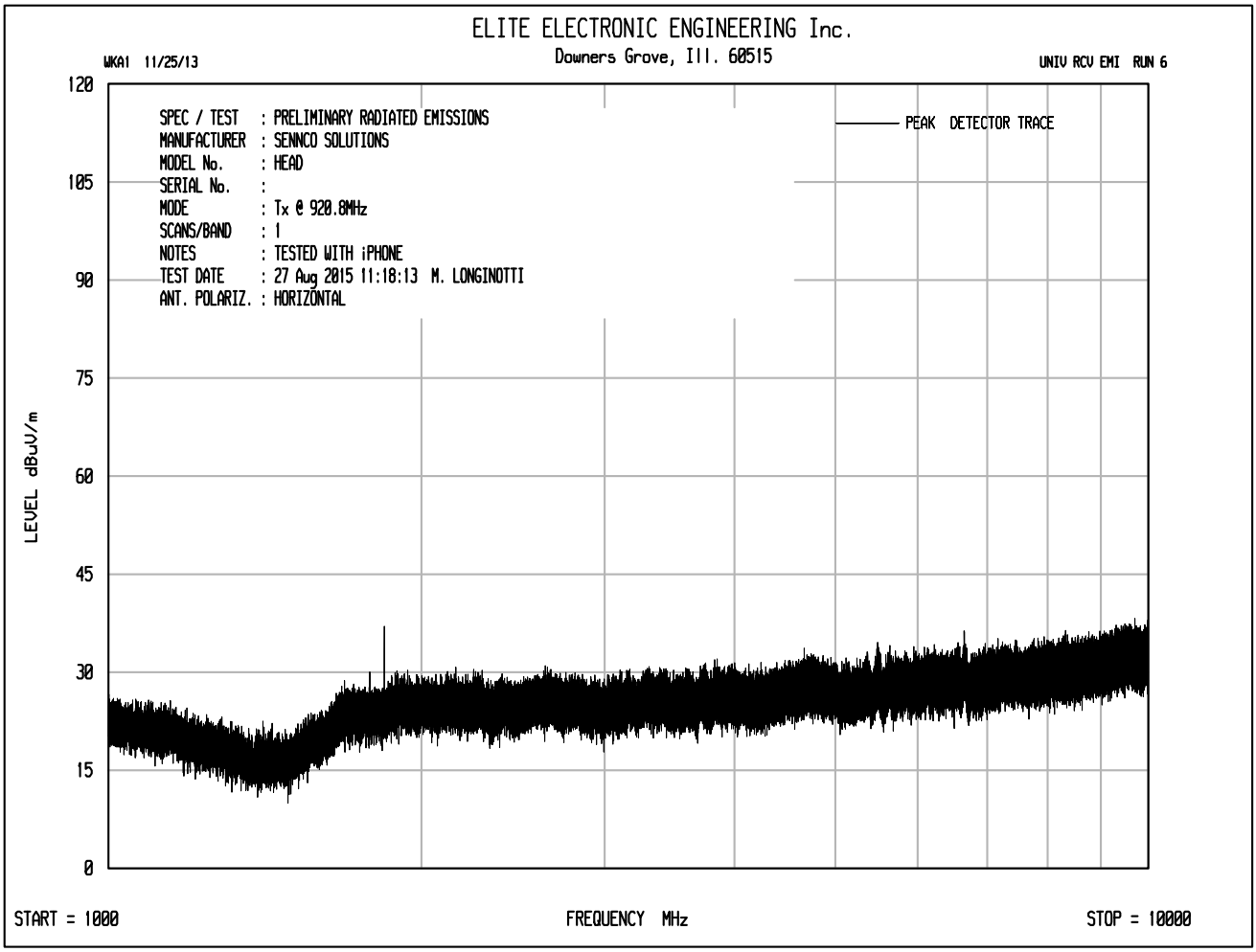

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 12
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
SERIAL No. :
MODE : Tx @ 913.8MHz
SCANS/BAND : 1
NOTES : TESTED WITH iPHONE
TEST DATE : 28 Aug 2015 10:19:20 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

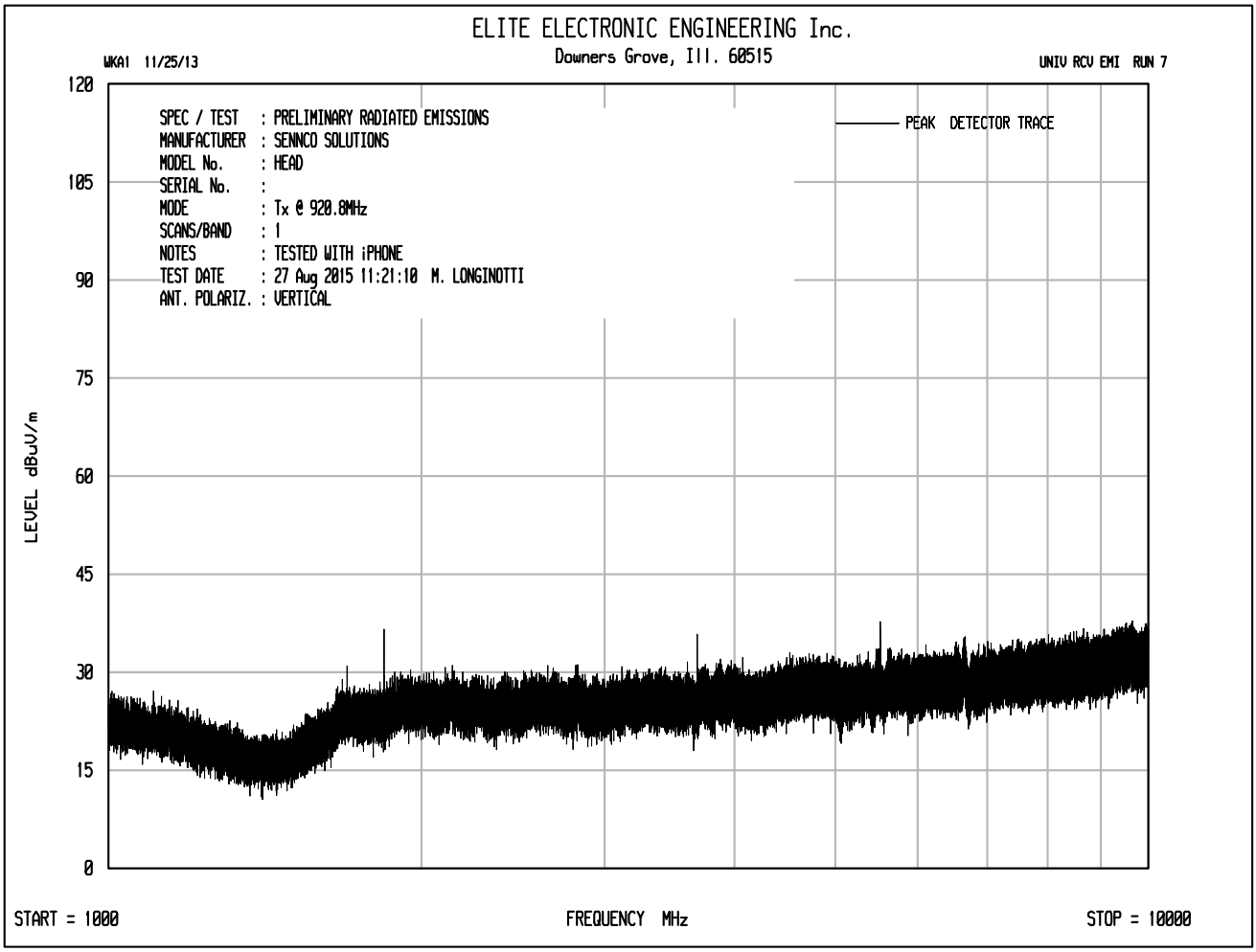

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 4
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
SERIAL No. :
MODE : Tx @ 913.8MHz
SCANS/BAND : 1
NOTES : TESTED WITH iPHONE
TEST DATE : 27 Aug 2015 10:14:10 M. LONGINOTTI
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 5
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
SERIAL No. :
MODE : Tx @ 913.8MHz
SCANS/BAND : 1
NOTES : TESTED WITH iPHONE
TEST DATE : 27 Aug 2015 10:23:33 M. LONGINOTTI
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 15
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
SERIAL No. :
MODE : Tx @ 920.8MHz
SCANS/BAND : 1
NOTES : TESTED WITH iPHONE
TEST DATE : 28 Aug 2015 11:07:54 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
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 14
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
SERIAL No. :
MODE : Tx @ 920.8MHz
SCANS/BAND : 1
NOTES : TESTED WITH iPHONE
TEST DATE : 28 Aug 2015 10:53:42 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
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 6
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
SERIAL No. :
MODE : Tx @ 920.8MHz
SCANS/BAND : 1
NOTES : TESTED WITH iPHONE
TEST DATE : 27 Aug 2015 11:18:13 M. LONGINOTTI
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 7
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : SENNCO SOLUTIONS
MODEL No. : HEAD
SERIAL No. :
MODE : Tx @ 920.8MHz
SCANS/BAND : 1
NOTES : TESTED WITH iPHONE
TEST DATE : 27 Aug 2015 11:21:10 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

MANUFACTURER : Sennco Solutions
MODEL NUMBER : Head
SERIAL NUMBER :
TEST PERFORMED : Peak Radiated Emissions NOT in a restricted band
TEST DATE : August 27, 2015 and August 28, 2015
TEST MODE : Transmit at 907MHz
EQUIPMENT USED : RBA0, NTA3, CDX8, NWQ1, APW3, XPQ3
TEST DISTANCE : 3 meters
NOTES : Peak Readings with a 100kHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
907.00	H	77.4		1.6	20.9	0.0	99.8	97839.6		
907.00	V	70.5		1.6	20.9	0.0	92.9	44209.4		
1814.00	H	57.9		2.2	30.6	-40.9	49.8	310.8	9784.0	-30.0
1814.00	V	59.1		2.2	30.6	-40.9	51.0	356.8	9784.0	-28.8
6349.00	H	36.7	Ambient	4.3	35.7	-40.1	36.6	67.3	9784.0	-43.2
6349.00	V	41.3		4.3	35.7	-40.1	41.2	114.3	9784.0	-38.6

FS (dBuV/m) = MTR (dBuV) + CF + AF (dB/m) + (- PA (dB))

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

MANUFACTURER : Sennco Solutions
MODEL NUMBER : Head
SERIAL NUMBER :
TEST PERFORMED : Peak Radiated Emissions in a restricted band
TEST DATE : August 27, 2015 and August 28, 2015
TEST MODE : Transmit at 907MHz
EQUIPMENT USED : RBA0, NTA3, CDX8, NWQ1, APW3, XPQ3
TEST DISTANCE : 3 meters
NOTES : Peak Readings with a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2721.00	H	48.2	Ambient	2.8	32.8	-40.4	43.4	147.7	5000.0	-30.6
2721.00	V	48.5	Ambient	2.8	32.8	-40.4	43.7	152.9	5000.0	-30.3
3628.00	H	50.3		3.2	33.3	-40.3	46.5	211.6	5000.0	-27.5
3628.00	V	54.1		3.2	33.3	-40.3	50.3	327.8	5000.0	-23.7
4535.00	H	49.3	Ambient	3.6	34.3	-40.1	47.0	224.5	5000.0	-27.0
4535.00	V	49.2	Ambient	3.6	34.3	-40.1	46.9	222.0	5000.0	-27.1
5442.00	H	53.2		3.9	35.0	-40.2	51.9	392.9	5000.0	-22.1
5442.00	V	53.8		3.9	35.0	-40.2	52.5	421.0	5000.0	-21.5
7256.00	H	50.0		4.7	35.6	-40.1	50.2	323.4	5000.0	-23.8
7256.00	V	52.2		4.7	35.6	-40.1	52.4	416.7	5000.0	-21.6
8163.00	H	46.4	Ambient	4.9	35.8	-40.0	47.2	228.6	5000.0	-26.8
8163.00	V	46.1	Ambient	4.9	35.8	-40.0	46.9	220.9	5000.0	-27.1
9070.00	H	46.9	Ambient	5.0	36.2	-39.7	48.3	260.9	5000.0	-25.7
9070.00	V	48.7	Ambient	5.0	36.2	-39.7	50.1	320.9	5000.0	-23.9

FS (dBuV/m) = MTR (dBuV) + CF + AF (dB/m) + (- PA (dB))

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

MANUFACTURER : Sennco Solutions
MODEL NUMBER : Head
SERIAL NUMBER :
TEST PERFORMED : Average Radiated Emissions in a restricted band
TEST DATE : August 27, 2015 and August 28, 2015
TEST MODE : Transmit at 907MHz
EQUIPMENT USED : RBA0, NTA3, CDX8, NWQ1, APW3, XPQ3
TEST DISTANCE : 3 meters
NOTES : Peak Readings with a 1MHz RBW converted to average readings using Duty Cycle Correction Factor

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)
2721.00	H	48.20	Ambient	2.8	32.8	-40.4	-20.8	22.5	13.4	500.0	-31.4
2721.00	V	48.5	Ambient	2.8	32.8	-40.4	-20.8	22.8	13.9	500.0	-31.1
3628.00	H	50.3		3.2	33.3	-40.3	-20.8	25.7	19.2	500.0	-28.3
3628.00	V	54.1		3.2	33.3	-40.3	-20.8	29.5	29.8	500.0	-24.5
4535.00	H	49.3	Ambient	3.6	34.3	-40.1	-20.8	26.2	20.4	500.0	-27.8
4535.00	V	49.2	Ambient	3.6	34.3	-40.1	-20.8	26.1	20.1	500.0	-27.9
5442.00	H	53.2		3.9	35.0	-40.2	-20.8	31.0	35.7	500.0	-22.9
5442.00	V	53.8		3.9	35.0	-40.2	-20.8	31.6	38.2	500.0	-22.3
7256.00	H	50.0		4.7	35.6	-40.1	-20.8	29.4	29.4	500.0	-24.6
7256.00	V	52.2		4.7	35.6	-40.1	-20.8	31.6	37.8	500.0	-22.4
8163.00	H	46.4	Ambient	4.9	35.8	-40.0	-20.8	26.3	20.8	500.0	-27.6
8163.00	V	46.1	Ambient	4.9	35.8	-40.0	-20.8	26.0	20.1	500.0	-27.9
9070.00	H	46.9	Ambient	5.0	36.2	-39.7	-20.8	27.5	23.7	500.0	-26.5
9070.00	V	48.7	Ambient	5.0	36.2	-39.7	-20.8	29.3	29.1	500.0	-24.7

FS (dBuV/m) = MTR (dBuV) + CF + AF (dB/m) + (- PA (dB)) + D.C. (dB)

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

MANUFACTURER : Sennco Solutions
MODEL NUMBER : Head
SERIAL NUMBER :
TEST PERFORMED : Peak Radiated Emissions NOT in a restricted band
TEST DATE : August 27, 2015 and August 28, 2015
TEST MODE : Transmit at 913.8MHz
EQUIPMENT USED : RBA0, NTA3, CDX8, NWQ1, APW3, XPQ3
TEST DISTANCE : 3 meters
NOTES : Peak Readings with a 100kHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
913.80	H	76.2		1.6	20.9	0.0	98.7	85809.1		
913.80	V	69.3		1.6	20.9	0.0	91.8	38773.3		
1827.60	H	56.5		2.2	30.6	-40.9	48.5	264.8	8580.9	-30.2
1827.60	V	58.9		2.2	30.6	-40.9	50.9	349.1	8580.9	-27.8
5482.80	H	52.8		3.9	35.0	-40.2	51.5	377.1	8580.9	-27.1
5482.80	V	55.1		3.9	35.0	-40.2	53.8	491.4	8580.9	-24.8
6396.60	H	36.2	Ambient	4.3	35.8	-40.1	36.1	64.2	8580.9	-42.5
6396.60	V	39.8		4.3	35.8	-40.1	39.7	97.1	8580.9	-38.9

FS (dBuV/m) = MTR (dBuV) + CF + AF (dB/m) + (- PA (dB))

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

MANUFACTURER : Sennco Solutions
MODEL NUMBER : Head
SERIAL NUMBER :
TEST PERFORMED : Peak Radiated Emissions in a restricted band
TEST DATE : August 27, 2015 and August 28, 2015
TEST MODE : Transmit at 913.8MHz
EQUIPMENT USED : RBA0, NTA3, CDX8, NWQ1, APW3, XPQ3
TEST DISTANCE : 3 meters
NOTES : Peak Readings with a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2741.40	H	48.0	Ambient	2.8	32.8	-40.4	43.2	144.3	5000.0	-30.8
2741.40	V	48.6	Ambient	2.8	32.8	-40.4	43.8	154.6	5000.0	-30.2
3655.20	H	51.1		3.3	33.3	-40.3	47.4	234.2	5000.0	-26.6
3655.20	V	54.4		3.3	33.3	-40.3	50.7	342.4	5000.0	-23.3
4569.00	H	47.6	Ambient	3.6	34.3	-40.1	45.4	185.9	5000.0	-28.6
4569.00	V	49.6	Ambient	3.6	34.3	-40.1	47.4	234.1	5000.0	-26.6
7310.40	H	52.8		4.7	35.6	-40.1	53.0	446.7	5000.0	-21.0
7310.40	V	50.4		4.7	35.6	-40.1	50.6	338.8	5000.0	-23.4
8224.20	H	46.6	Ambient	4.9	35.8	-39.9	47.5	235.8	5000.0	-26.5
8224.20	V	46.7	Ambient	4.9	35.8	-39.9	47.6	238.5	5000.0	-26.4
9138.00	H	47.6	Ambient	5.0	36.2	-39.7	49.1	284.6	5000.0	-24.9
9138.00	V	47.8	Ambient	5.0	36.2	-39.7	49.3	291.3	5000.0	-24.7

FS (dBuV/m) = MTR (dBuV) + CF + AF (dB/m) + (- PA (dB))

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

MANUFACTURER : Sennco Solutions
MODEL NUMBER : Head
SERIAL NUMBER :
TEST PERFORMED : Average Radiated Emissions in a restricted band
TEST DATE : August 27, 2015 and August 28, 2015
TEST MODE : Transmit at 913.8MHz
EQUIPMENT USED : RBA0, NTA3, CDX8, NWQ1, APW3, XPQ3
TEST DISTANCE : 3 meters
NOTES : Peak Readings with a 1MHz RBW converted to average readings using Duty Cycle Correction Factor

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)
2741.40	H	48.00	Ambient	2.8	32.8	-40.4	-20.8	22.3	13.1	500.0	-31.6
2741.40	V	48.6	Ambient	2.8	32.8	-40.4	-20.8	22.9	14.0	500.0	-31.0
3655.20	H	51.1		3.3	33.3	-40.3	-20.8	26.6	21.3	500.0	-27.4
3655.20	V	54.4		3.3	33.3	-40.3	-20.8	29.9	31.1	500.0	-24.1
4569.00	H	47.6	Ambient	3.6	34.3	-40.1	-20.8	24.5	16.9	500.0	-29.4
4569.00	V	49.6	Ambient	3.6	34.3	-40.1	-20.8	26.5	21.3	500.0	-27.4
7310.40	H	52.8		4.7	35.6	-40.1	-20.8	32.2	40.5	500.0	-21.8
7310.40	V	50.4		4.7	35.6	-40.1	-20.8	29.8	30.8	500.0	-24.2
8224.20	H	46.6	Ambient	4.9	35.8	-39.9	-20.8	26.6	21.4	500.0	-27.4
8224.20	V	46.7	Ambient	4.9	35.8	-39.9	-20.8	26.7	21.7	500.0	-27.3
9138.00	H	47.6	Ambient	5.0	36.2	-39.7	-20.8	28.2	25.8	500.0	-25.7
9138.00	V	47.8	Ambient	5.0	36.2	-39.7	-20.8	28.4	26.4	500.0	-25.5

FS (dBuV/m) = MTR (dBuV) + CF + AF (dB/m) + (- PA (dB)) + D.C. (dB)

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

MANUFACTURER : Sennco Solutions
MODEL NUMBER : Head
SERIAL NUMBER :
TEST PERFORMED : Peak Radiated Emissions NOT in a restricted band
TEST DATE : August 27, 2015 and August 28, 2015
TEST MODE : Transmit at 920.8MHz
EQUIPMENT USED : RBA0, NTA3, CDX8, NWQ1, APW3, XPQ3
TEST DISTANCE : 3 meters
NOTES : Peak Readings with a 100kHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
920.80	H	75.2		1.6	21.0	0.0	97.7	77022.4		
920.80	V	67.7		1.6	21.0	0.0	90.2	32480.1		
1841.60	H	57.5		2.2	30.6	-40.8	49.5	297.5	7702.2	-28.3
1841.60	V	56.8		2.2	30.6	-40.8	48.8	274.4	7702.2	-29.0
5524.80	H	47.9		4.0	35.1	-40.2	46.7	215.6	7702.2	-31.1
5524.80	V	55.5		4.0	35.1	-40.2	54.3	517.3	7702.2	-23.5
6445.60	H	37.8	Ambient	4.3	35.9	-40.1	37.8	78.0	7702.2	-39.9
6445.60	V	40.9		4.3	35.9	-40.1	40.9	111.5	7702.2	-36.8
9208.00	H	40.2	Ambient	5.0	36.2	-39.7	41.7	122.0	7702.2	-36.0
9208.00	V	41.3		5.0	36.2	-39.7	42.8	138.5	7702.2	-34.9

FS (dBuV/m) = MTR (dBuV) + CF + AF (dB/m) + (- PA (dB))

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

MANUFACTURER : Sennco Solutions
MODEL NUMBER : Head
SERIAL NUMBER :
TEST PERFORMED : Peak Radiated Emissions in a restricted band
TEST DATE : August 27, 2015 and August 28, 2015
TEST MODE : Transmit at 920.8MHz
EQUIPMENT USED : RBA0, NTA3, CDX8, NWQ1, APW3, XPQ3
TEST DISTANCE : 3 meters
NOTES : Peak Readings with a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2762.40	H	48.1	Ambient	2.8	32.7	-40.4	43.3	145.9	5000.0	-30.7
2762.40	V	48.0	Ambient	2.8	32.7	-40.4	43.2	144.2	5000.0	-30.8
3683.20	H	50.2		3.3	33.3	-40.2	46.6	212.6	5000.0	-27.4
3683.20	V	54.9		3.3	33.3	-40.2	51.3	365.2	5000.0	-22.7
4604.00	H	48.0	Ambient	3.6	34.4	-40.1	45.9	196.7	5000.0	-28.1
4604.00	V	49.9	Ambient	3.6	34.4	-40.1	47.8	244.8	5000.0	-26.2
7366.40	H	50.1		4.7	35.6	-40.1	50.3	329.0	5000.0	-23.6
7366.40	V	50.9		4.7	35.6	-40.1	51.1	360.7	5000.0	-22.8
8287.20	H	46.3	Ambient	4.9	35.9	-39.9	47.2	228.8	5000.0	-26.8
8287.20	V	47.2	Ambient	4.9	35.9	-39.9	48.1	253.7	5000.0	-25.9

FS (dBuV/m) = MTR (dBuV) + CF + AF (dB/m) + (- PA (dB))

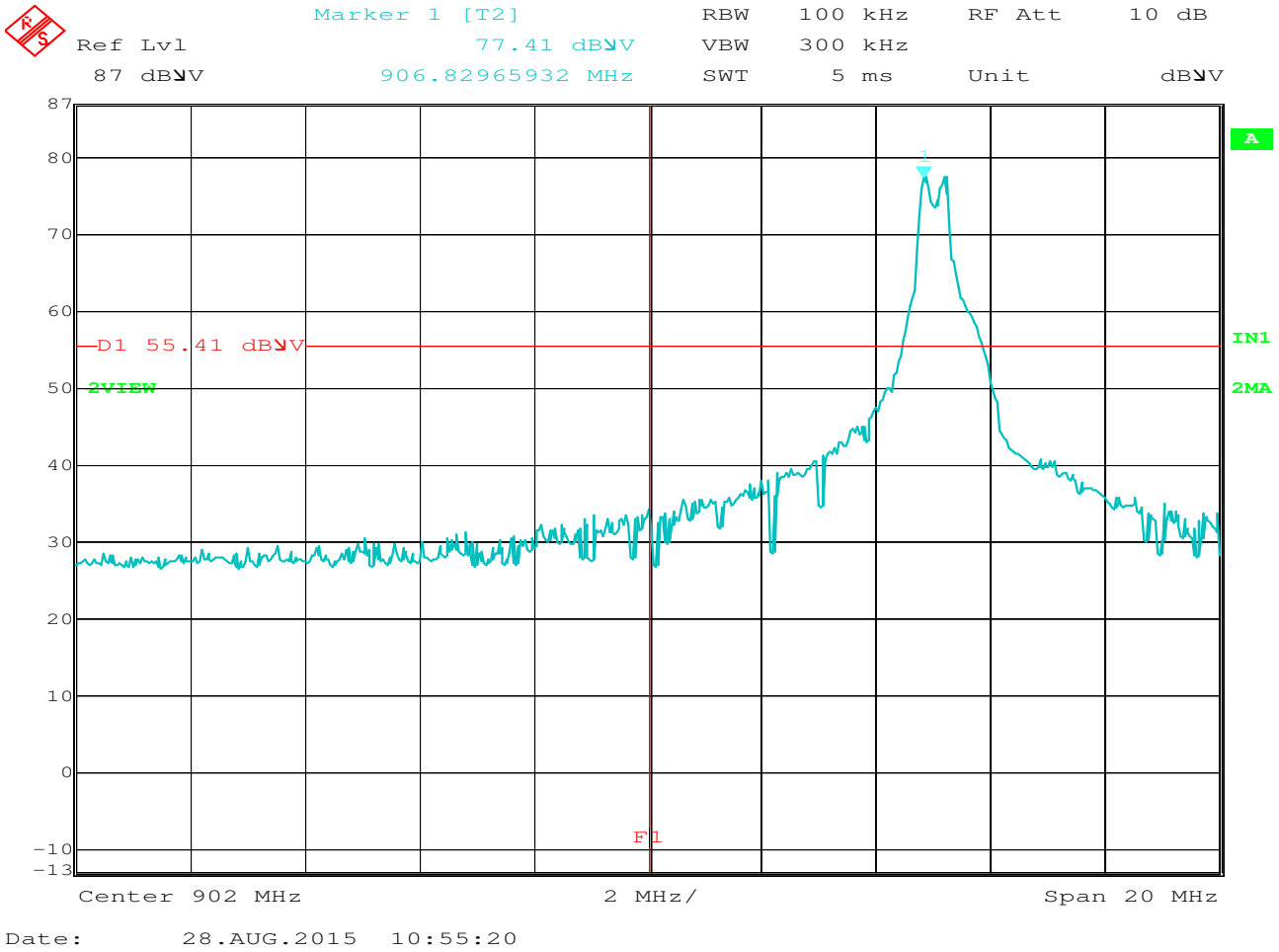
FS (uV/m) = AntiLog [(FS (dBuV/m))/20]

MANUFACTURER : Sennco Solutions
MODEL NUMBER : Head
SERIAL NUMBER :
TEST PERFORMED : Average Radiated Emissions in a restricted band
TEST DATE : August 27, 2015 and August 28, 2015
TEST MODE : Transmit at 920.8MHz
EQUIPMENT USED : RBA0, NTA3, CDX8, NWQ1, APW3, XPQ3
TEST DISTANCE : 3 meters
NOTES : Peak Readings with a 1MHz RBW converted to average readings using Duty Cycle Correction Factor

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)
2762.40	H	48.10	Ambient	2.8	32.7	-40.4	-20.8	22.5	13.3	500.0	-31.5
2762.40	V	48.0	Ambient	2.8	32.7	-40.4	-20.8	22.4	13.2	500.0	-31.6
3683.20	H	50.2		3.3	33.3	-40.2	-20.8	25.8	19.4	500.0	-28.2
3683.20	V	54.9		3.3	33.3	-40.2	-20.8	30.5	33.3	500.0	-23.5
4604.00	H	48.0	Ambient	3.6	34.4	-40.1	-20.8	25.1	17.9	500.0	-28.9
4604.00	V	49.9	Ambient	3.6	34.4	-40.1	-20.8	27.0	22.3	500.0	-27.0
7366.40	H	50.1		4.7	35.6	-40.1	-20.8	29.5	30.0	500.0	-24.4
7366.40	V	50.9		4.7	35.6	-40.1	-20.8	30.3	32.9	500.0	-23.6
8287.20	H	46.3	Ambient	4.9	35.9	-39.9	-20.8	26.4	20.9	500.0	-27.6
8287.20	V	47.2	Ambient	4.9	35.9	-39.9	-20.8	27.3	23.1	500.0	-26.7

FS (dBuV/m) = MTR (dBuV) + CF + AF (dB/m) + (- PA (dB)) + D.C. (dB)

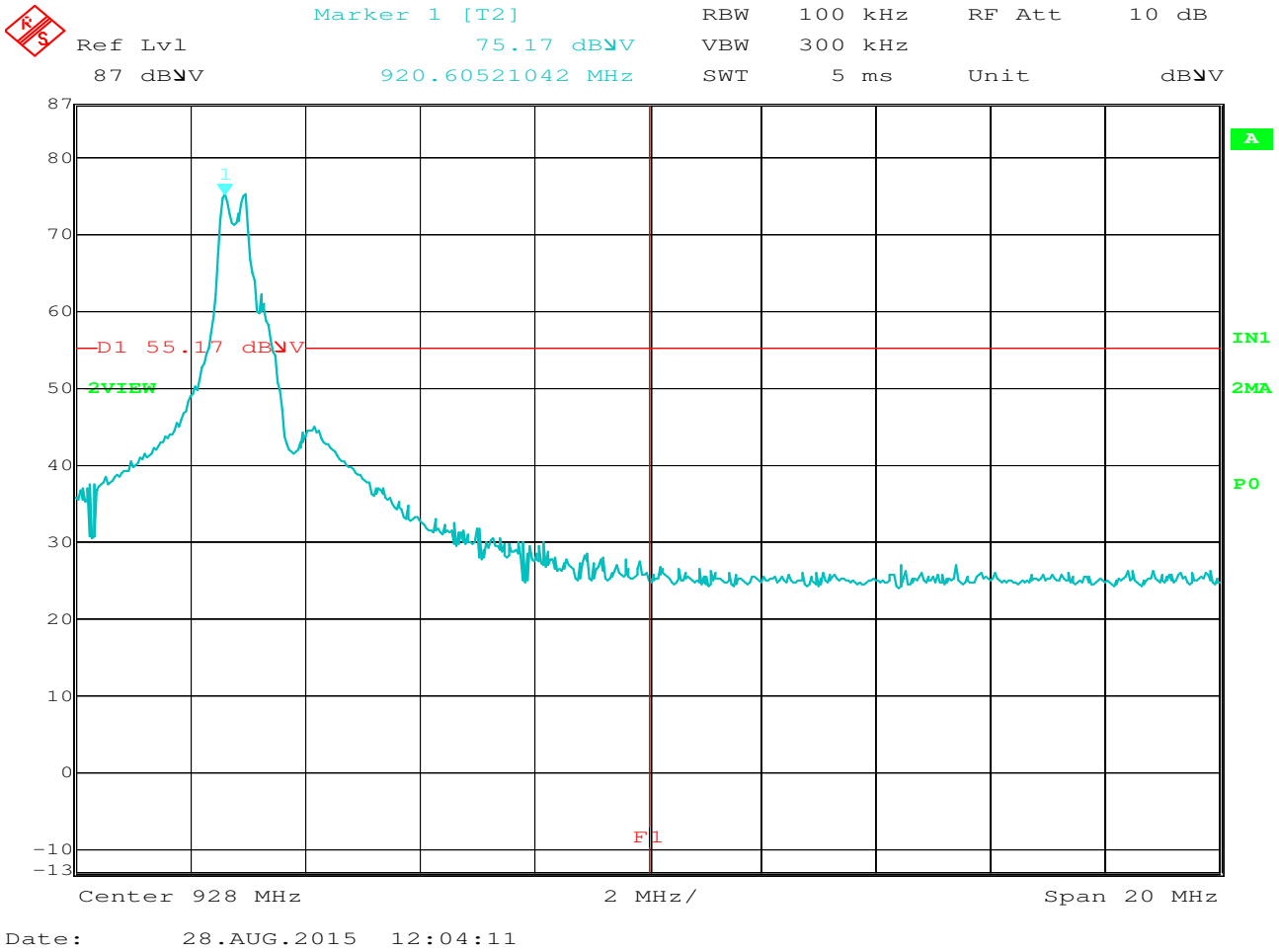
FS (uV/m) = AntiLog [(FS (dBuV/m))/20]



FCC 15.247 band-edge

MANUFACTURER	:	Sennco Solutions
MODEL NUMBER	:	Head
SERIAL NUMBER	:	
TEST MODE	:	Transmit at 907MHz
TEST PARAMETERS	:	Band-edge
NOTES	:	Display Line (F1) represents the low band edge. Display Line (D1) represents the 20dB down point from the maximum in-band peak power level.
EQUIPMENT USED	:	RBA0, NTA3

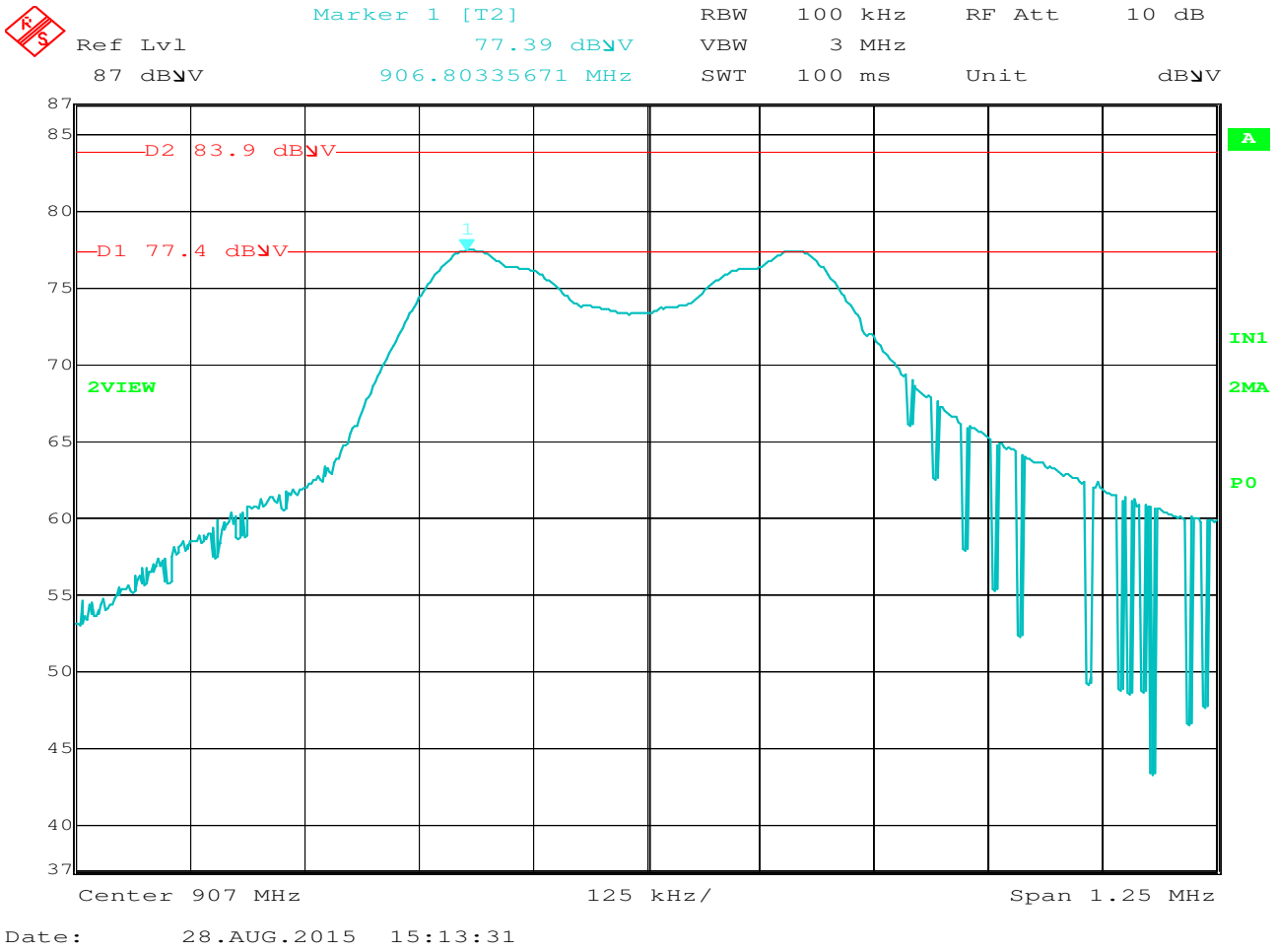
NOTES



FCC 15.247 band-edge

MANUFACTURER	:	Sennco Solutions
MODEL NUMBER	:	Head
SERIAL NUMBER	:	
TEST MODE	:	Transmit at 920.8MHz
TEST PARAMETERS	:	Band-edge
NOTES	:	Display Line (F1) represents the high band edge. Display Line (D1) represents the 20dB down point from the maximum in-band peak power level.
EQUIPMENT USED	:	RBA0, NTA3

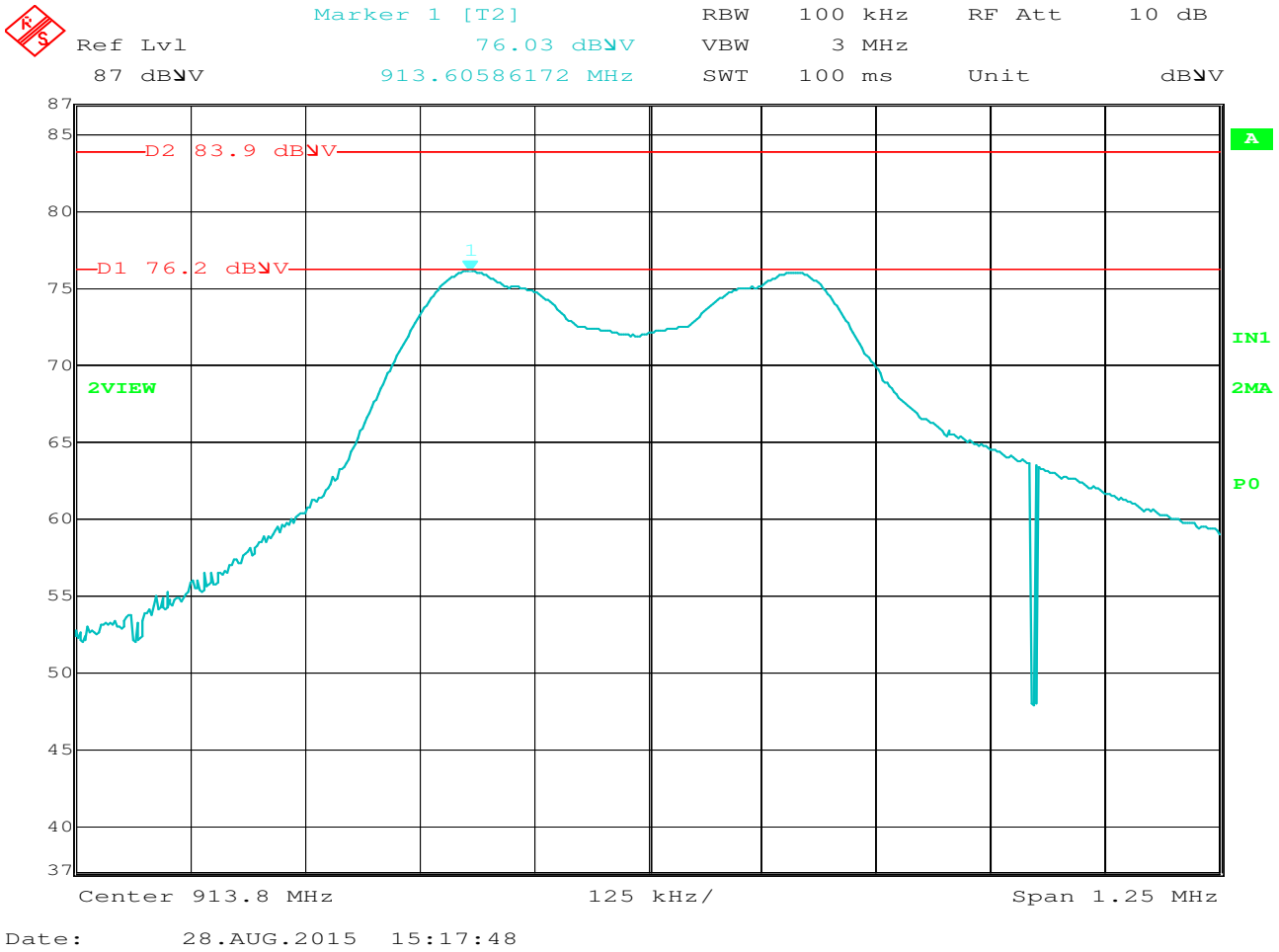
NOTES



FCC 15.247 Power Spectral Density

MANUFACTURER	:	Sennco Solutions
MODEL NUMBER	:	Head
SERIAL NUMBER	:	
TEST MODE	:	Transmit at 907MHz
TEST PARAMETERS	:	Power Spectral Density
	:	Display Line (D1 = 77.4dBm) corresponds to the EIRP reading of 1.5dBm in a 1MHz RBW.
	:	Display Line (D2 = 83.9dBm) corresponds to the Power Spectral Density limit of +8.0dBm. Trace 2 represents the Power Spectral Density in a 100kHz RBW
EQUIPMENT USED	:	RBA0, NTA3

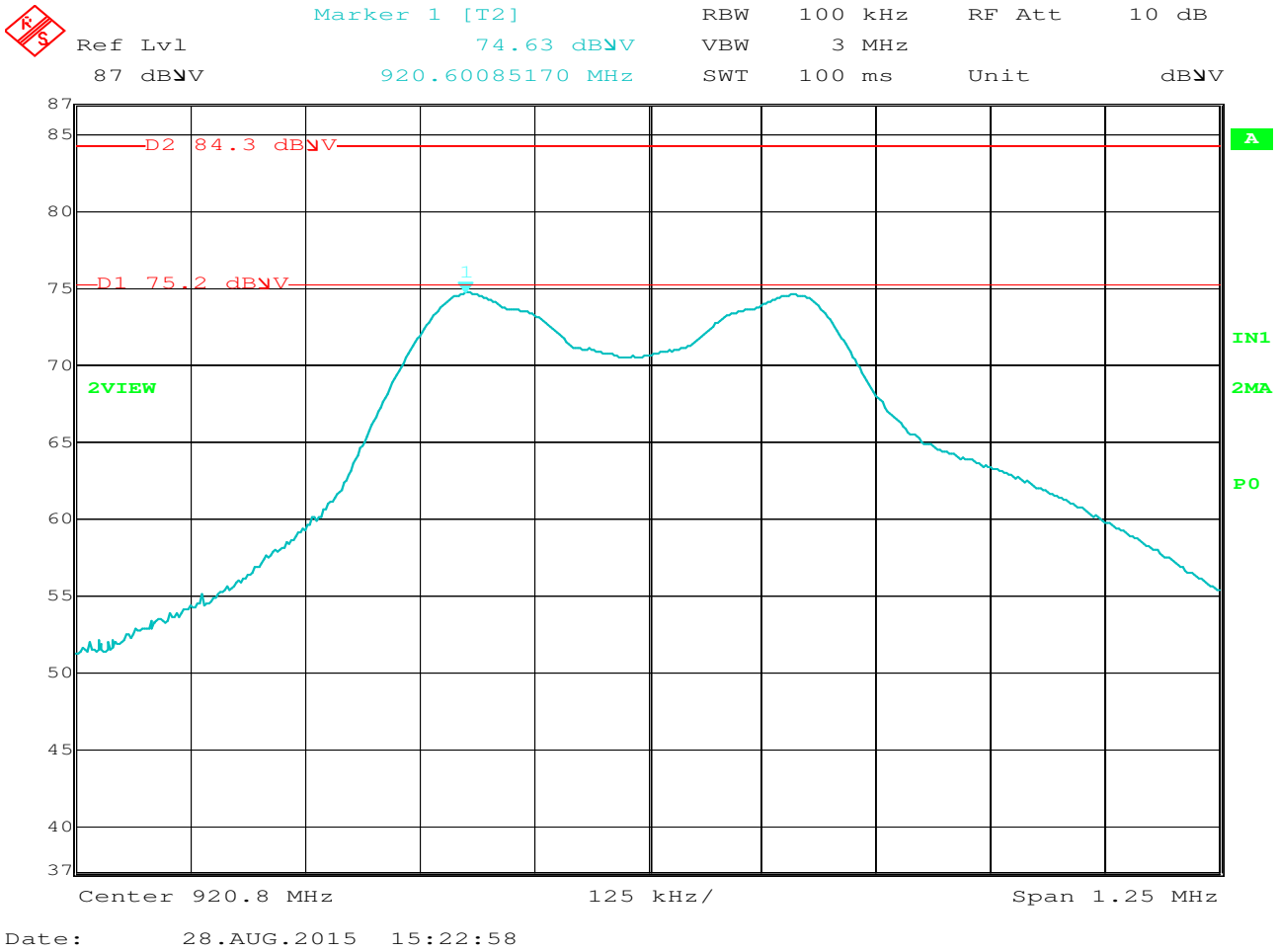
NOTES



FCC 15.247 Power Spectral Density

MANUFACTURER	:	Sennco Solutions
MODEL NUMBER	:	Head
SERIAL NUMBER	:	
TEST MODE	:	Transmit at 913.8MHz
TEST PARAMETERS	:	Power Spectral Density
	:	Display Line (D1 = 76.2dBm) corresponds to the EIRP reading of 0.3dBm in a 1MHz RBW.
	:	Display Line (D2 = 83.9dBm) corresponds to the Power Spectral Density limit of +8.0dBm. Trace 2 represents the Power Spectral Density in a 100kHz RBW
EQUIPMENT USED	:	RBA0, NTA3

NOTES



FCC 15.247 Power Spectral Density

MANUFACTURER	:	Sennco Solutions
MODEL NUMBER	:	Head
SERIAL NUMBER	:	
TEST MODE	:	Transmit at 920.8MHz
TEST PARAMETERS	:	Power Spectral Density
	:	Display Line (D1 = 75.2dBm) corresponds to the EIRP reading of -1.1dBm in a 1MHz RBW.
	:	Display Line (D2 = 84.3dBm) corresponds to the Power Spectral Density limit of +8.0dBm. Trace 2 represents the Power Spectral Density in a 100kHz RBW
EQUIPMENT USED	:	RBA0, NTA3

NOTES