F2 Labs
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CERTIFICATION TEST REPORT

Manufacturer:	**Aventusoft, LLC** **3651 FAU Boulevard, Suite 400** **Boca Raton, Florida 33431 USA**
Applicant:	**Same as Above**
Product Name:	**Aventusoft HemoTag™ System**
Product Description:	The HEMOTAG System, when used with HEMOTAG Device on the chest wall, is intended for use on adults 22 years of age and older in acquiring, analyzing and reporting ECG and heart sound data and to provide interpretation of the data in an integrated report for consideration by physicians. The HEMOTAG Recording may be obtained at any location specified by a physician including home, hospital or clinic.
Operating Voltage/Frequeny:	Battery-operated
Model:	**HT-17**
FCC ID:	**2AQS4-HT17999999**
Testing Commenced:	July 30, 2018
Testing Ended:	Aug. 14, 2018
Summary of Test Results:	**In Compliance** The EUT complies with the EMC requirements when manufactured identically as the unit tested in this report, including any required modifications and/or manufacturer's statement. Any changes to the design or build of this unit subsequent to this testing may deem it non-compliant.

Standards:

- **FCC Part 15 Subpart C, Section 15.249**
- **FCC Part 15 Subpart C, Section 15.215(c) – Additional provisions to the general radiated emission limitations**
- **FCC15.207 - Conducted Limits**
- **FCC Part 15 Subpart A, Section 15.31(e) – Measurement Standards**

Evaluation Conducted by:

Julius Chiller, EMC/Wireless Engineer

Michael Toth, Senior EMC Engineer

Report Reviewed by:

Ken Littell, Director of EMC & Wireless Operations

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TABLE OF CONTENTS

1 ADMINISTRATIVE INFORMATION

1.1 Measurement Location:

F2 Labs in Middlefield, Ohio. Site description and attenuation data are on file with the FCC's Sampling and Measurement Branch at the FCC Laboratory in Columbia, MD.

1.2 Measurement Procedure:

All measurements were performed according to the 2013 version of ANSI C63.10 and recommended FCC procedure of measurement of DTS operating under Section 15.249. A list of the measurement equipment can be found in Section 6.

1.3 Uncertainty Budget:

The uncertainty in EMC measurements arises from several factors which affect the results, some associated with environmental conditions in the measurement room, the test equipment being used, and the measurement techniques adopted.

The measurement uncertainty budgets detailed below are calculated from the test and calibration data and are expressed with a 95% confidence factor using a coverage factor of k=2. The Uncertainty for a laboratory are referred to as *U*lab. For Radiated and Conducted Emissions, the Expanded Uncertainty is compared to the *U*cispr values to determine if a specific margin is required to deem compliance.

*U*lab

Measurement Range	Combined Uncertainly	Expanded Uncertainty
Radiated Emissions <1 GHz @ 3m	2.54	5.07dB
Radiated Emissions <1 GHz @ 10m	2.55	5.09dB
Radiated Emissions 1 GHz to 2.7 GHz	1.81	3.62dB
Radiated Emissions 2.7 GHz to 18 GHz	1.55	3.10dB
AC Power Line Conducted Emissions, 150kHz to 30 MHz	1.38	2.76dB
AC Power Line Conducted Emissions, 9kHz to 150kHz	1.66	3.32dB

*U*cispr

Measurement Range	Expanded Uncertainty
Radiated Emissions <1 GHz @ 3m	5.2dB
Radiated Emissions <1 GHz @ 10m	5.2dB
Radiated Emissions 1 GHz to 2.7 GHz	Under Consideration
Radiated Emissions 2.7 GHz to 18 GHz	Under Consideration
AC Power Line Conducted Emissions, 150kHz to 30 MHz	3.6dB
AC Power Line Conducted Emissions, 9kHz to 150kHz	4.0dB

If *U*lab is less than or equal to *U*cispr, then:
- compliance is deemed to occur if no measured disturbance exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

If *U*lab is greater than *U*cispr in table 1, then:
- compliance is deemed to occur if no measured disturbance, increased by (*U*lab – *U*cispr), exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance, increased by (*U*lab – *U*cispr), exceeds the disturbance limit.

Note: Only measurements listed in the tables above that relate to tests included in this Test Report are applicable.

1.4 Document History:

Document Number	Description	Issue Date	Approved By
F2LQ9944B-01E	First Issue	Aug. 16, 2018	K. Littell

2 SUMMARY OF TEST RESULTS

Test Name	Standard(s)	Results
-20dB Occupied Bandwidth	CFR 47 Part 15.215(c)	Complies
Field Strength of Emissions	CFR 47 Part 15.249(a)(d)	Complies
Conducted Emissions	CFR 47 Part 15.207(a)	Complies
Variation of the Input Power	CFR 47 Part 15.31(e)	Complies*

Note: Product was operated using AAA batteries.
Requirements of 15.31 were met by using new batteries.

Modifications Made to the Equipment
None

3 TABLE OF MEASURED RESULTS

Test	Low Channel 2402 MHz	Mid Channel 2440 MHz	High Channel 2480 MHz
Average Field Strength of Fundamental	71.2 dBµV/m (3.6 mV/m)	74.5 dBµV/m (5.3 mV/m)	69.5 dBµV/m (2.98 mV/m)
Average Limit for Fundamental	50 millivolts/meter (93.97 dBµV/m)	50 millivolts/meter (93.97 dBµV/m)	50 millivolts/meter (93.97 dBµV/m)
Peak Field Strength of Fundamental	74.1 dBµV/m	75.0 dBµV/m	70.2 dBµV/m
Peak Limit for Fundamental	(113.97dBuV/m)	(113.97dBuV/m)	(113.97dBuV/m)
-20dB Occupied Bandwidth (MHz)	1.127	1.130	1.151

The -20dB bandwidth of the emission shall be contained within the frequency band designated in the rule section under which the equipment is operated.

4 ENGINEERING STATEMENT

This report has been prepared on behalf of Aventusoft, LLC to provide documentation for the testing described herein. This equipment has been tested and found to comply with part 15.249 of the FCC Rules using ANSI C63.10 2013 standard. The test results found in this test report relate only to the items tested.

5 EUT INFORMATION AND DATA

5.1 Equipment Under Test:

Product: Aventusoft HemoTag™ System
Model: HT-17
Serial No.: 0019
FCC ID: **2AQS4-HT17999999**

5.2 Trade Name:

Aventusoft, LLC

5.3 Power Supply:

Battery-operated

5.4 Applicable Rules:

CFR 47, Part 15.249

5.5 Equipment Category:

DXT

5.6 Antenna:

0dBi Gain Integral Antenna

5.7 Accessories:

N/A

5.8 Test Item Condition:

The equipment to be tested was received in good condition.

5.9 Testing Algorithm:

EUT was set up in a normal operating mode. Device was transmitting in three different channels (low, mid and high).

6 LIST OF MEASUREMENT INSTRUMENTATION

Equipment Type	Asset Number	Manufacturer	Model	Serial Number	Calibration Due Date
Shielded Chamber	CL166-E	Albatross Projects	B83117-DF435-T261	US140023	Jan. 9, 2019
Temp/Hum. Recorder	CL233	Extech	445814	02	Mar. 22, 2019
Temp./Hum. Recorder	CL119	Extech	RH520	H005869	Dec. 28, 2018
Receiver	CL151	Rohde & Schwarz	ESU40	100319	Nov. 17, 2018
Horn Antenna	CL098	Emco	3115	9809-5580	Dec. 28, 2018
Horn Antenna 18-26.5 GHz	CL114	A.H. Systems, Inc.	SAS-572	237	Nov. 17, 2018
Pre-Amplifier	CL153	Keysight Tech.	83006A	MY39500791	Sept. 20, 2018
Pre-Amplifier	CL136	Hewlett Packard	8447E	A937A01894	Mar. 26, 2019
Active 18” Loop Antenna	CL163-Loop	A.H. Systems, Inc.	EHA-52B	100	June 4, 2019
Antenna, JB3 Combination	CL175	Sunol Sciences	JB3	A030315	Oct.11, 2019
Spectrum Analyzer	CL147	Agilent	E7402A	MY45101241	Nov. 16, 2018
LISN	CL184	Com-Power	LI-125A	191213	June 18, 2021
LISN	CL185	Com-Power	LI-125A	191214	June 18, 2021
Software:	Tile Version 3.4.B.3		Software Verified: July 30-31, 2018; Aug. 14, 2018		
Software:	EMC 32, Version 5.20.2		Software Verified: July 30-31, 2018; Aug. 14, 2018		

7 FCC PART 15.215(e), OCCUPIED BANDWIDTH

7.1 Requirements:

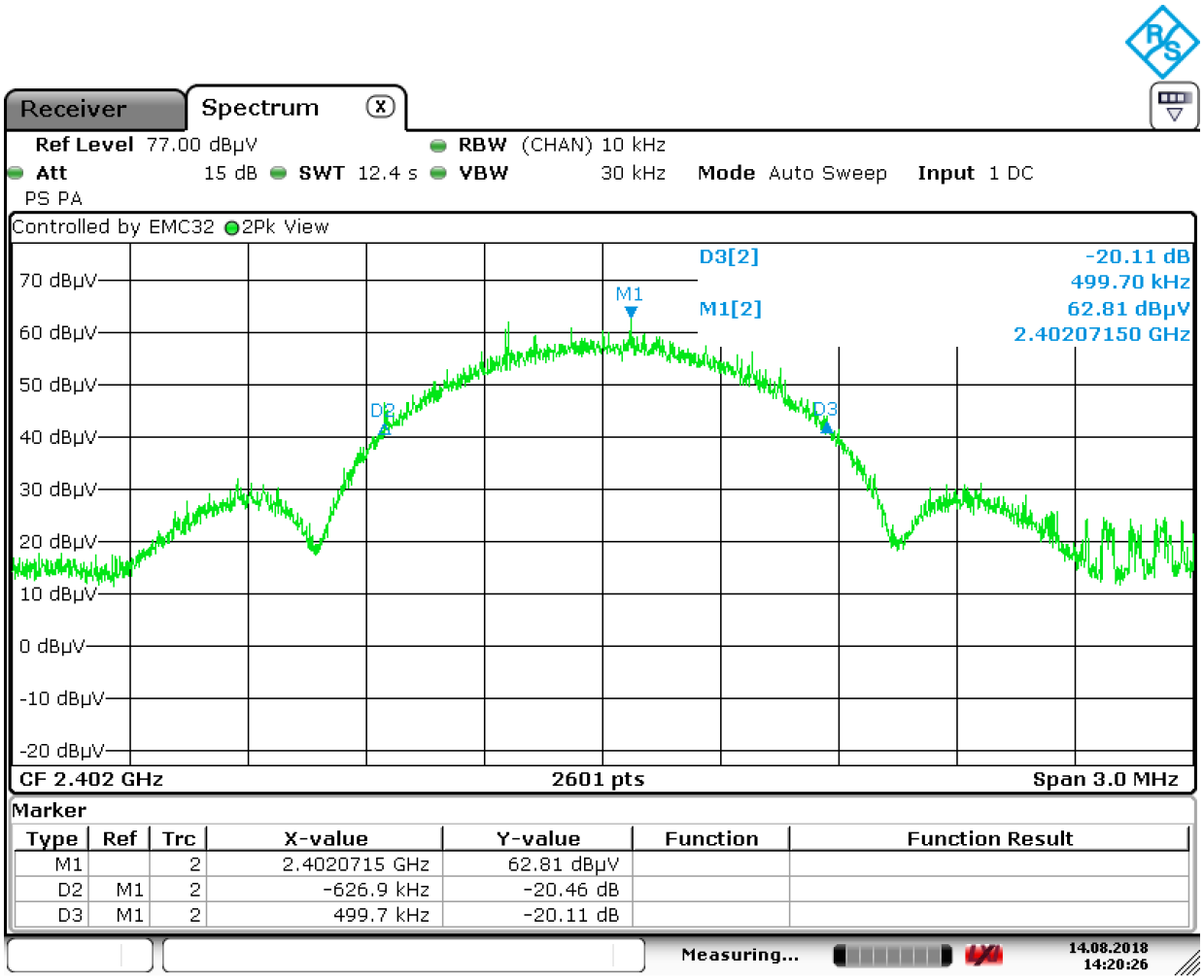
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the -20dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

Bandwidth measurements were made at the low (2.402 GHz), mid (2.440 GHz) and upper (2.480 GHz) frequencies. The bandwidth was measured using the analyzer's marker function.

7.2 Occupied Bandwidth Test Data

Test Date(s):	Aug. 14, 2018	Test Engineer(s):	J. Chiller
Standards:	CFR 47 Part 15.215(c)	Air Temperature:	22.4ºC
		Relative Humidity:	41%

Low Channel



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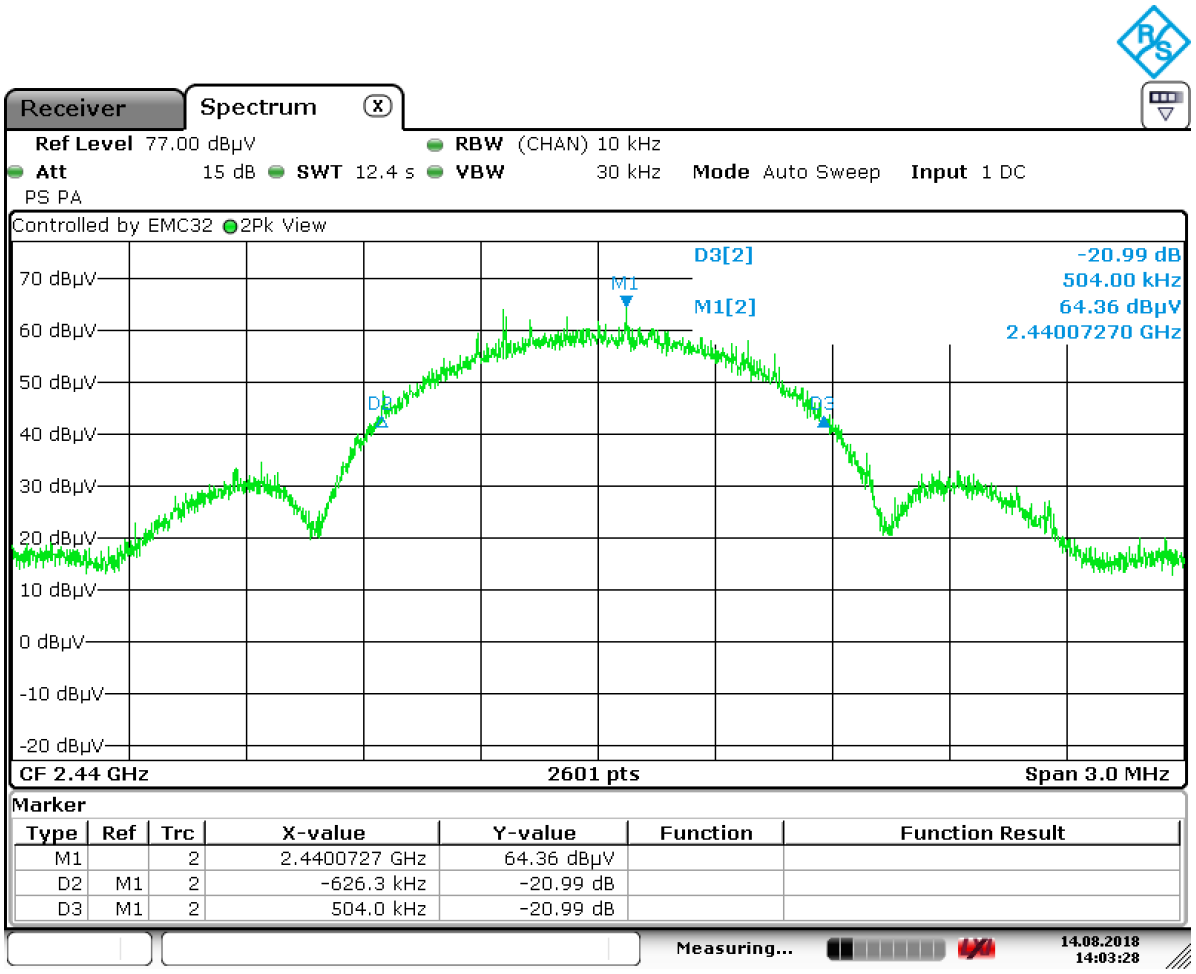
Mid Channel



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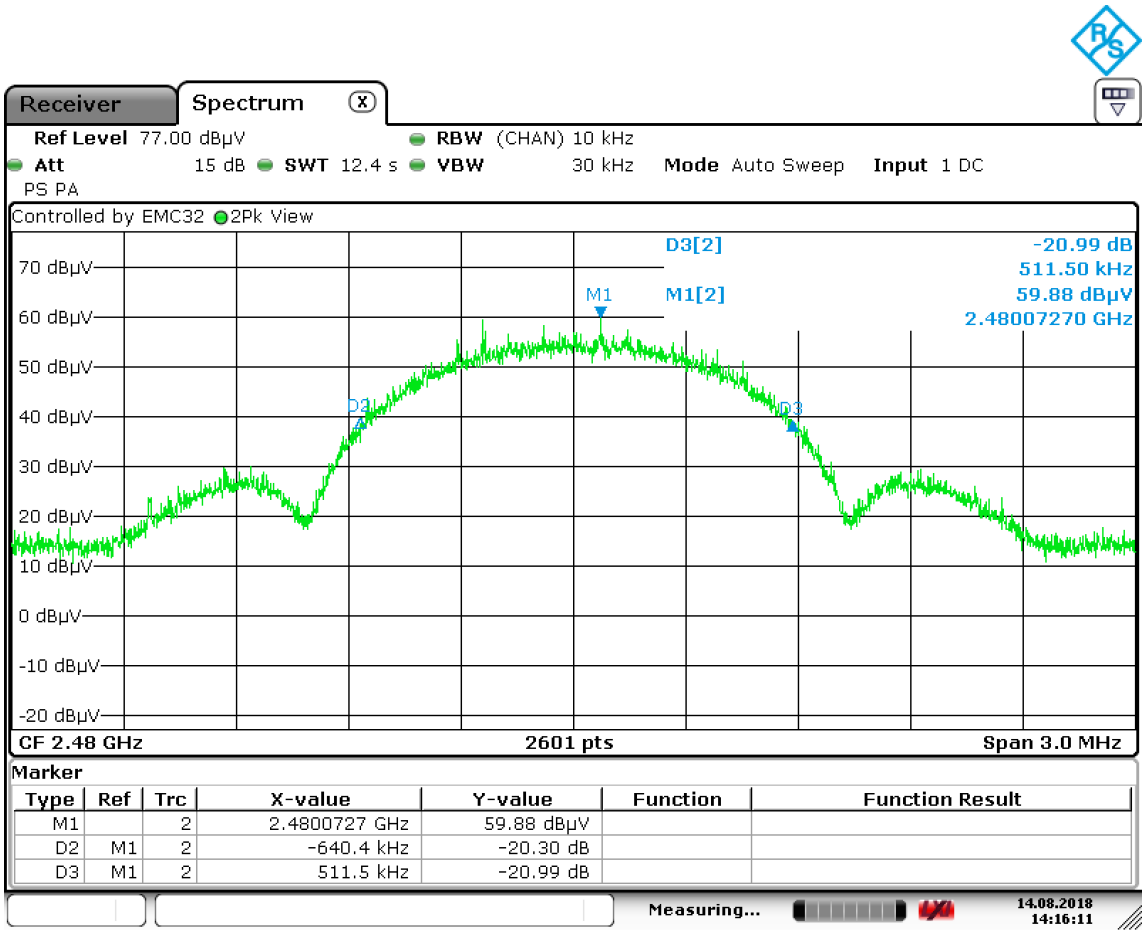
High Channel



Date: 14.AUG.2018 14:16:12

8 FCC PART 15.249(a)(d) – FIELD STRENGTH OF EMISSIONS FROM INTENTIONAL RADIATORS

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

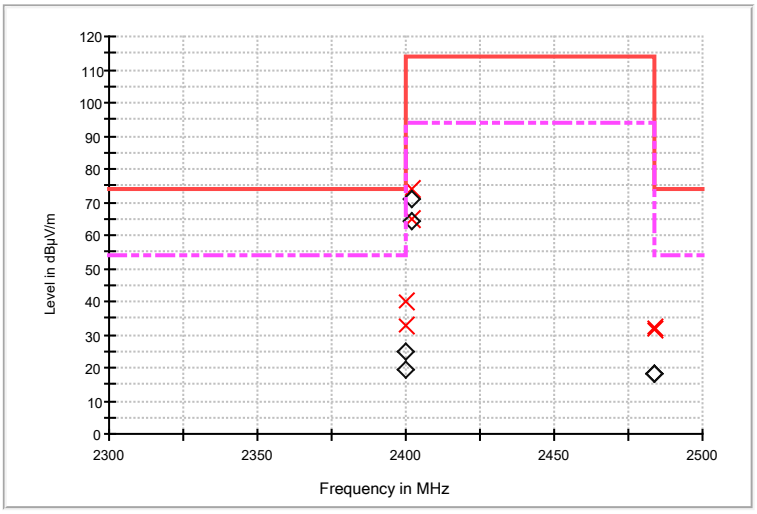
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

NOTE: During the pre-scan evaluation, the EUT was rotated in all possible directions to find the maximum emissions. The orthogonal position that showed the highest emissions was used. The antenna was raised between 1 and 4 meters and the EUT turntable was rotated 360 degrees to maximize the emissions.

8.1 Test Data - Field Strength of Emissions from Intentional Radiators

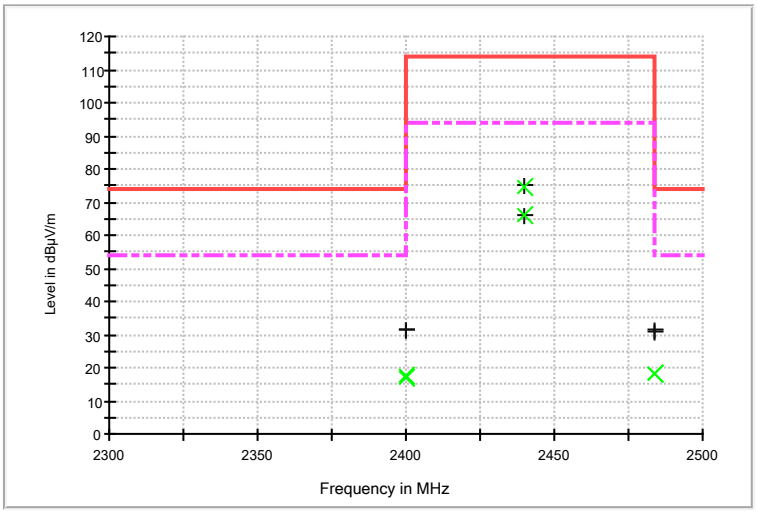
Test Date(s):	July 30, 2018	**Test Engineer(s):**	MT
Standards:	CFR 47 Part 15.249(a)	**Air Temperature:**	21.1ºC
		Relative Humidity:	44 %

Field Strength and Band edges, Low Channel



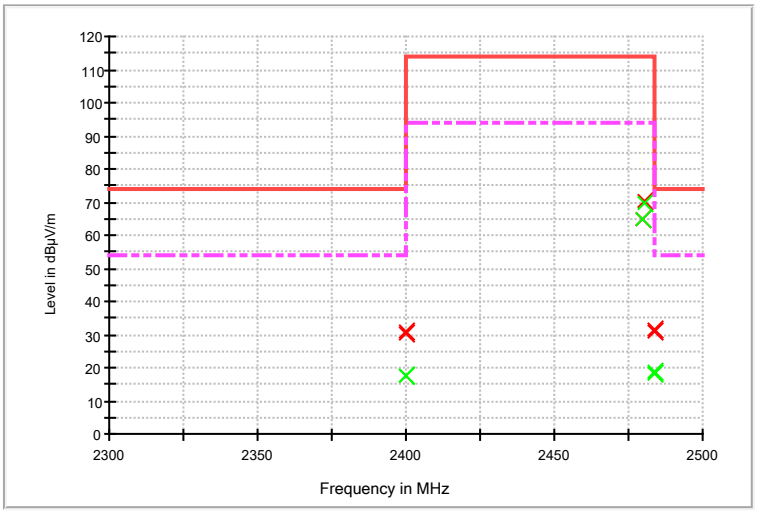
Frequency (MHz)	Polarity	Corr. (dB)	MaxPeak (dBµV/m)	MaxPeak (dBµV/m) Limit	MaxPeak Margin	Average (dBµV/m)	Average (dBµV/m) Limit	Average Margin	Bandwidth (kHz)
2400.000000	H	-4.7	32.9	74	-41.1	19.2	54	-34.8	1000.000
2400.000000	V	-4.7	39.9	74	-34.1	24.9	54	-29.1	1000.000
2402.320000	V	-4.7	74.1	114	-39.9	71.2	94	-22.8	1000.000
2402.320000	H	-4.7	65	114	-49.0	64	94	-30.0	1000.000
2483.520000	V	-4.2	31.4	74	-42.6	17.9	54	-36.1	1000.000
2483.520000	H	-4.2	31.9	74	-42.1	17.9	54	-36.1	1000.000

Field Strength and Band edges, Mid Channel



Frequency (MHz)	Polarity	Corr. (dB)	MaxPeak (dBµV/m)	MaxPeak (dBµV/m) Limit	MaxPeak Margin	Average (dBµV/m)	Average (dBµV/m) Limit	Average Margin	Bandwidth (kHz)
2400.000000	V	-4.70	31.3	74	-42.7	17.3	54	-36.7	1000.000
2400.000000	H	-4.70	31.8	74	-42.2	17.3	54	-36.7	1000.000
2440.000000	V	-4.30	75	114	-39.0	74.5	94	-19.5	1000.000
2440.000000	H	-4.30	66	114	-48.0	65.8	94	-28.2	1000.000
2483.520000	V	-4.20	31.7	74	-42.3	18	54	-36.0	1000.000
2483.520000	H	-4.20	31.1	74	-42.9	17.9	54	-36.1	1000.000

Field Strength and Band edges, High Channel



Frequency (MHz)	Polarity	Corr. (dB)	MaxPeak (dBµV/m)	MaxPeak (dBµV/m) Limit	MaxPeak Margin	Average (dBµV/m)	Average (dBµV/m) Limit	Average Margin	Bandwidth (kHz)
2400.000000	H	-4.70	30.7	74	-43.3	17.3	54	-36.7	1000.000
2400.000000	V	-4.70	30.5	74	-43.5	17.7	54	-36.3	1000.000
2480.000000	H	-4.30	64.8	114	-49.2	64.6	94	-29.4	1000.000
2480.440000	V	-4.30	70.2	114	-43.8	69.5	94	-24.5	1000.000
2483.520000	V	-4.20	31.5	74	-42.5	18.7	54	-35.3	1000.000
2483.520000	H	-4.20	31	74	-43.0	18.2	54	-35.8	1000.000

8.2 Test Data – Spurious Emissions

Notes: Plots are peak, max hold pre-scan data included only to determine what frequencies to investigate and measure. During the pre-scan evaluation, the EUT was rotated in all three orthogonal positions to find the maximum emissions. The orthogonal position that showed the highest emissions was used. At some frequencies, no emissions from the EUT were measurable over the ambient noise floor. The readings did not change with EUT on and EUT off.

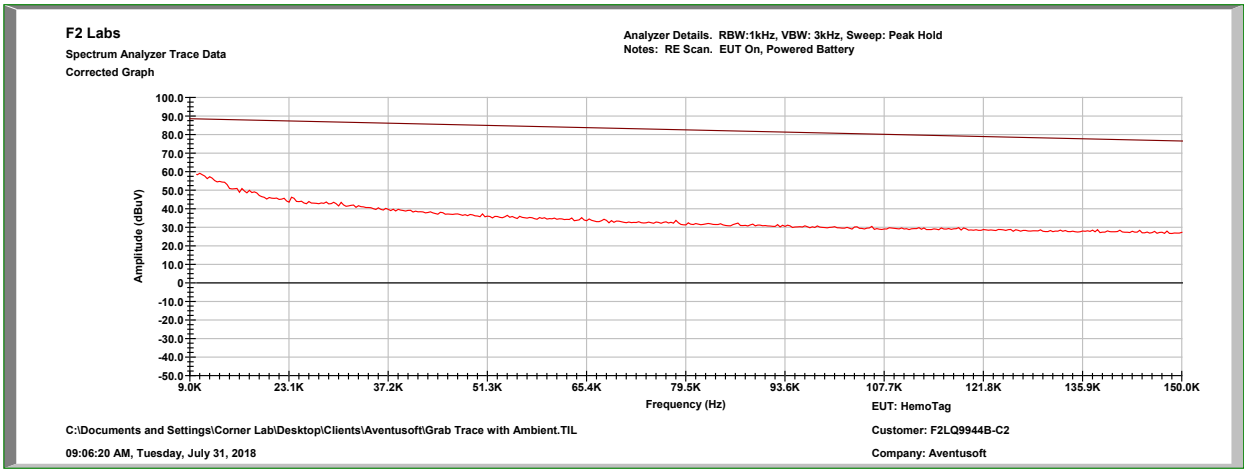
At least 6 of the highest frequencies within 20dB of the limit were measured per ANSI 63.4 in a 3-meter anechoic chamber. Frequencies below 1GHz were measured using a quasi-peak detector. The antenna was raised between 1 and 4 meters and the EUT turntable was rotated 360 degrees to maximize the emissions. Some of the frequencies did not change with the EUT on or off. At those frequencies, the test distance was shortened to 1 meter and still no emissions from the EUT were visible or over the ambient or limit. Frequencies were scanned from 9kHz to 26 GHz on the high, mid, and low channels and the highest emissions are listed below.

In the following plots, the black line indicates Quasi-Peak and the Green line indicates the Peak measurement. In the plots with the red emissions line, the red line is with the peak detector. Emissions to be found by the EUT are measured and listed in data tables.

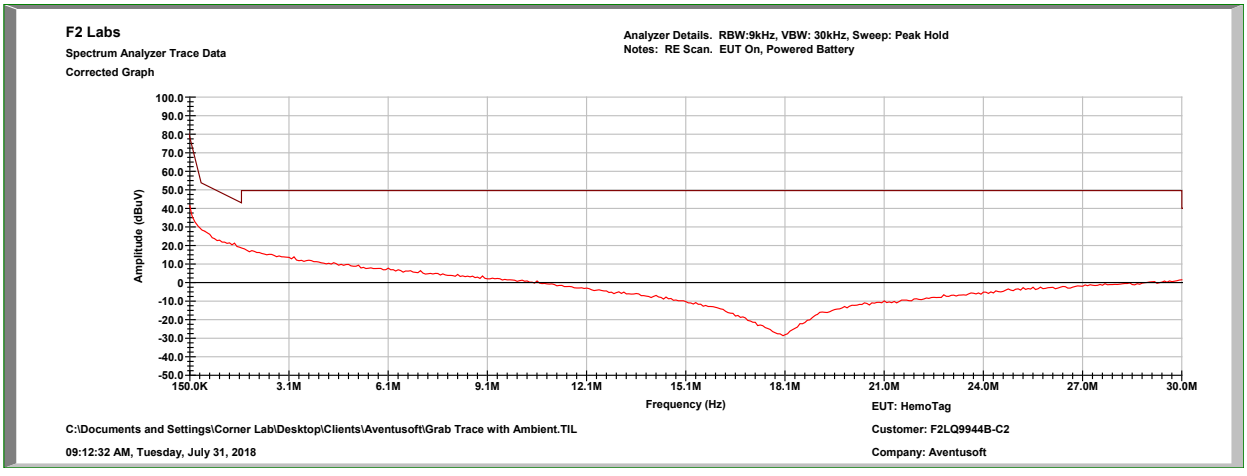
Test Date(s):	July 30, 2018	**Test Engineer(s):**	M. Toth
Standards:	CFR 47 Part 15.249(d) / Part 15.209	**Air Temperature:**	22.1ºC
		Relative Humidity:	40%

Note: No EUT emissions were within 20db of the limit.

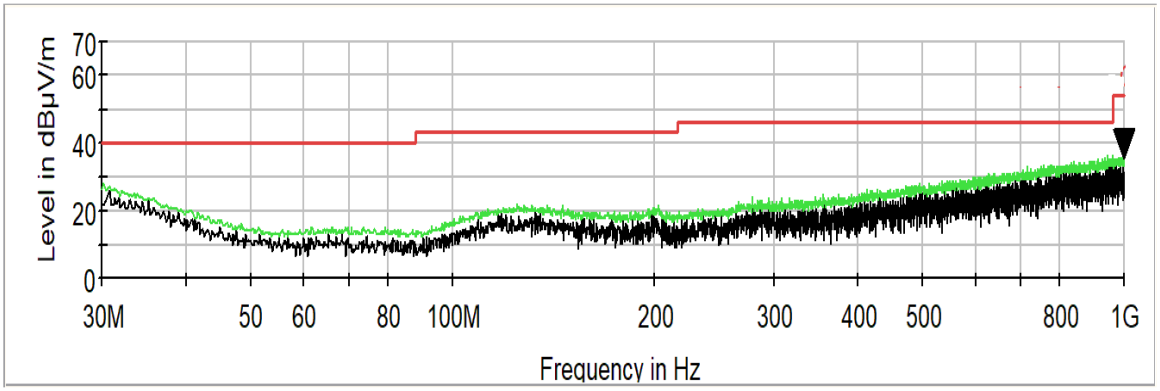
Characterization Scan, 0.009 MHz to 0.15 MHz



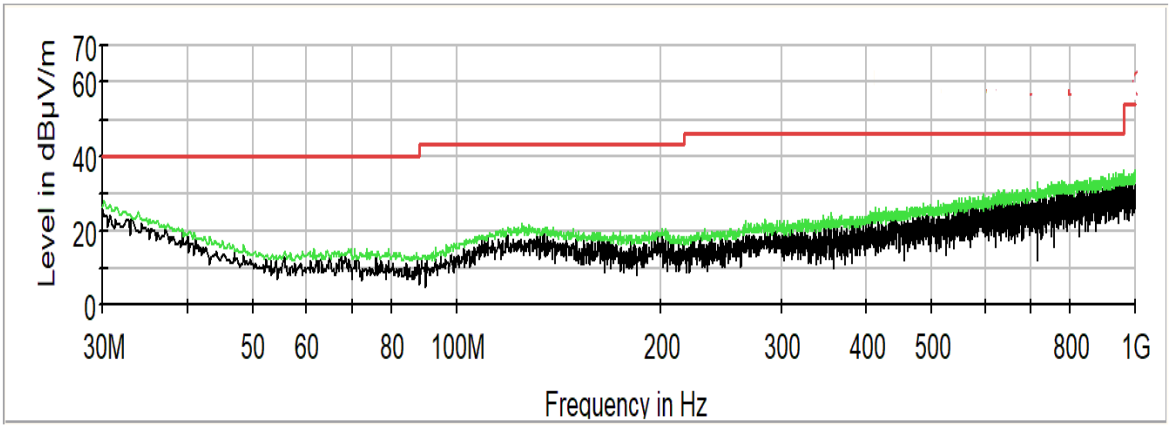
Characterization Scan, 0.15 MHz to 30 MHz

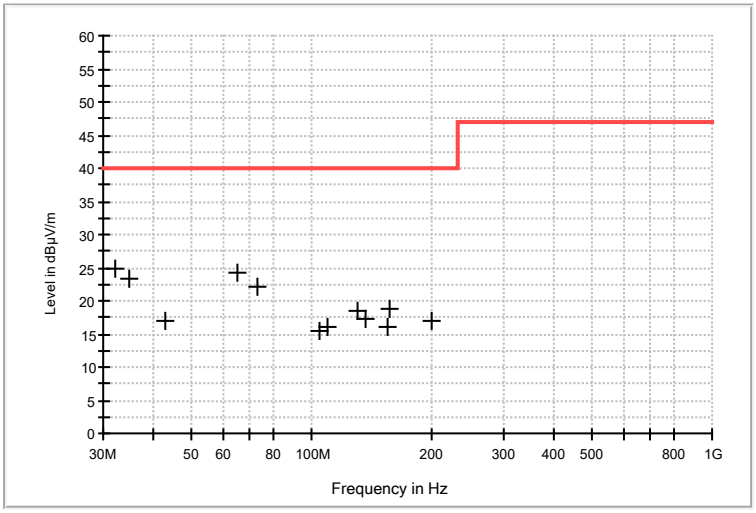


Characterization Scan, 30 MHz to 1000 MHz, Vertical



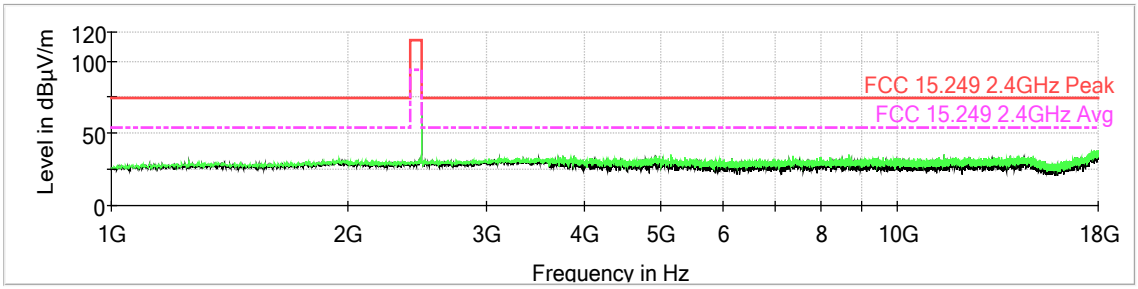
Characterization Scan, 30 MHz to 1000 MHz, Horizontal



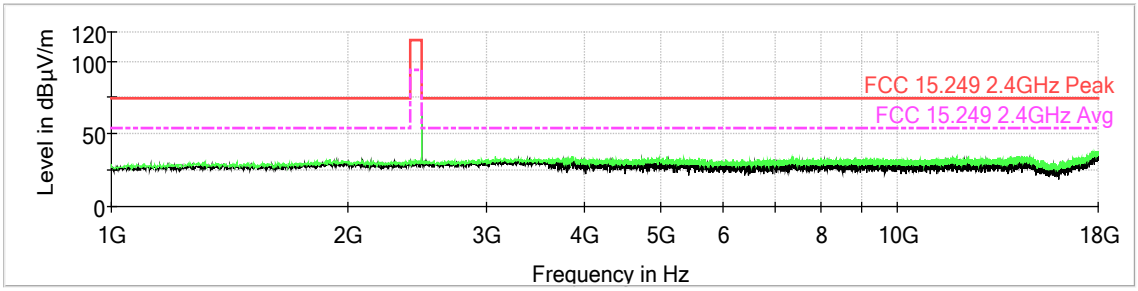


Frequency (MHz)	Antenna Polarization	Antenna Height (cm)	Azimuth (degrees)	Reading (dBµV)	Cable Loss & Antenna Factor (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
31.360000	H	100.00	340.00	19.70	5.1	24.80	40.0	-15.2
33.120000	V	100.00	0.00	20.00	3.3	23.30	40.0	-16.7
68.800000	V	100.00	0.00	19.70	-2.9	16.80	40.0	-23.2
80.640000	H	100.00	340.00	31.70	-7.3	24.40	40.0	-15.6
121.560000	V	100.00	0.00	29.10	-7.1	22.00	43.5	-21.5
137.880000	H	100.00	340.00	20.00	-4.4	15.60	43.5	-27.9
200.720000	V	100.00	0.00	19.60	-3.4	16.20	43.5	-27.3
201.880000	H	100.00	340.00	20.10	-1.7	18.40	43.5	-25.1
265.120000	V	100.00	0.00	19.20	-2.0	17.20	46.0	-28.8
375.520000	H	100.00	340.00	19.20	-3.0	16.20	46.0	-29.8
401.120000	V	100.00	0.00	21.80	-3.0	18.80	46.0	-27.2
713.280000	H	100.00	336.00	19.30	-2.5	16.80	46.0	-29.2

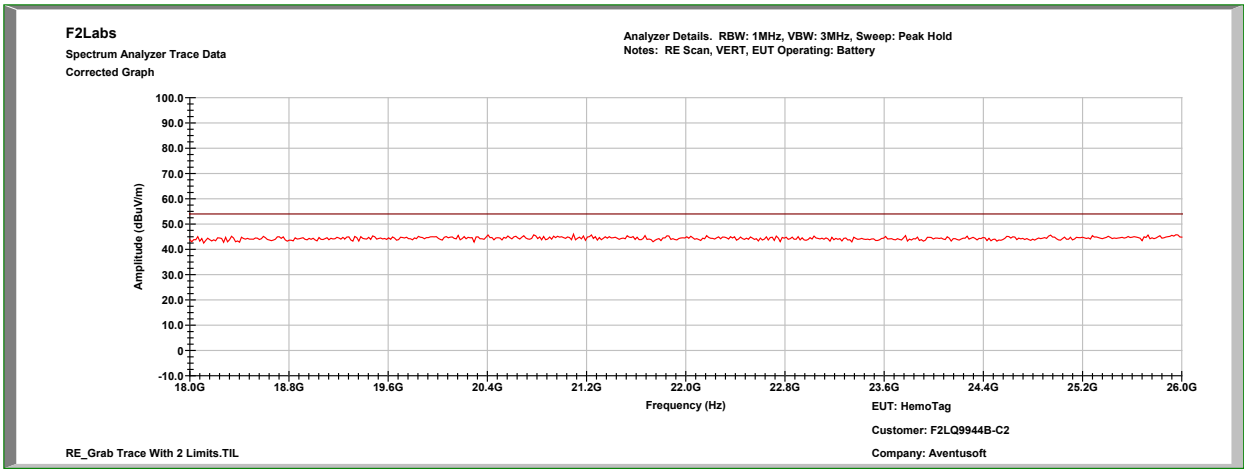
Characterization Scan, 1 GHz to 18 GHz, Vertical



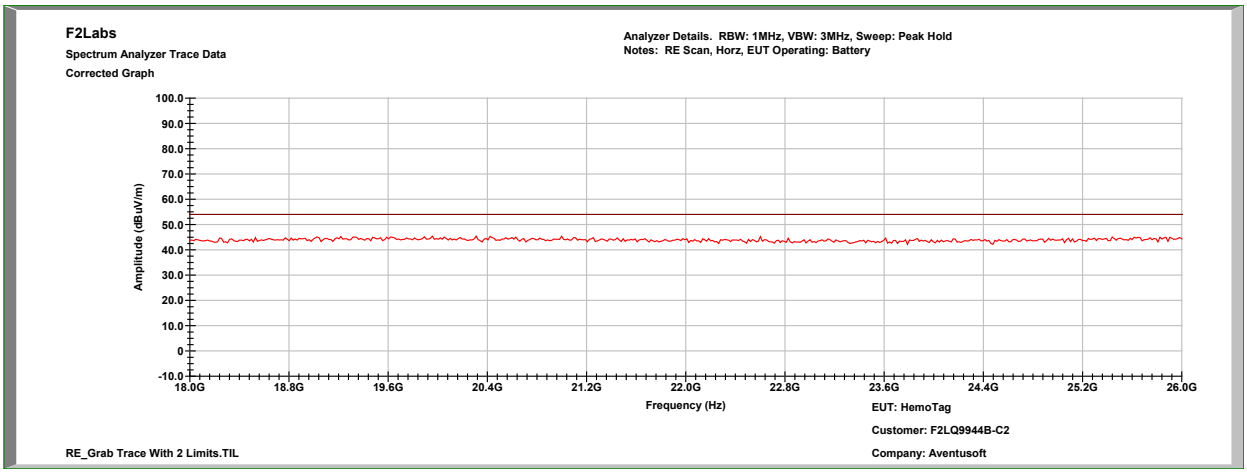
Characterization Scan, 1 GHz to 18 GHz, Horizontal



Characterization Scan, 18 GHz to 26 GHz, Vertical



Characterization Scan, 18 GHz to 26 GHz, Horizontal



9 CONDUCTED EMISSIONS

9.1 Requirements

In accordance with FCC CFR 47 Part 15.207(a), “Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

9.2 Procedure

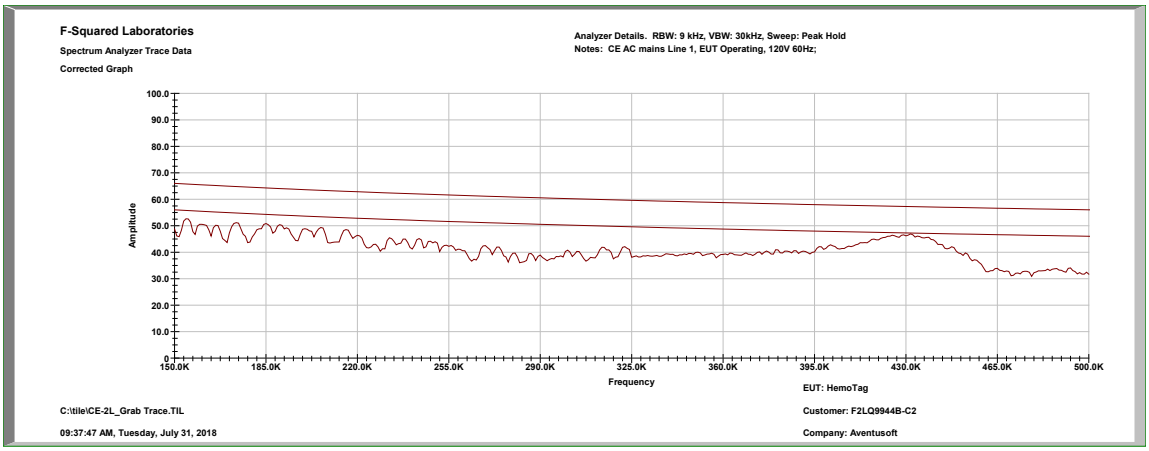
The EUT was placed on a 1.0 x 1.5 meter non-conductive table, 0.8 meter above a horizontal ground plane and 0.4 meter from a vertical ground plane. Power was provided to the EUT through a LISN bonded to a 3 x 2 meter ground plane. The LISN and peripherals were supplied power through a filtered AC power source. The output of the LISN was connected to the input of the receiver via a transient limiter, and emissions in the range 150 kHz to 30 MHz were measured. The measurements were recorded using the quasi-peak and average detectors as directed by the standard, and the resolution bandwidth during testing was 9 kHz. The raw measurements were corrected to allow for attenuation from the LISN, transient limiter and cables.

9.3 Conducted Emissions Test Data

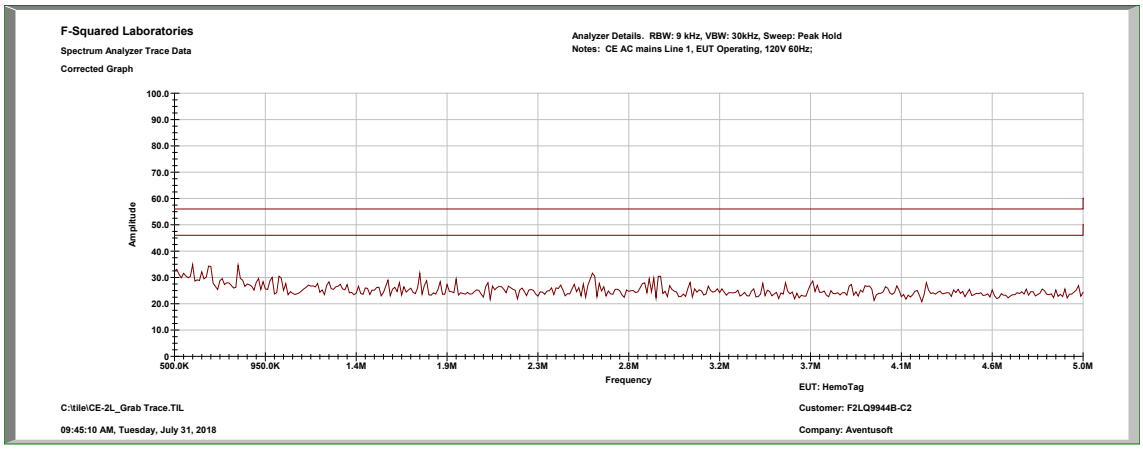
Test Date(s):	July 31, 2018	**Test Engineer:**	M. Toth
Rule:	15.207	**Air Temperature:**	21.1º C
Test Results:	Complies	**Relative Humidity:**	45%

Note: The data below represents worst case results of all three channels.

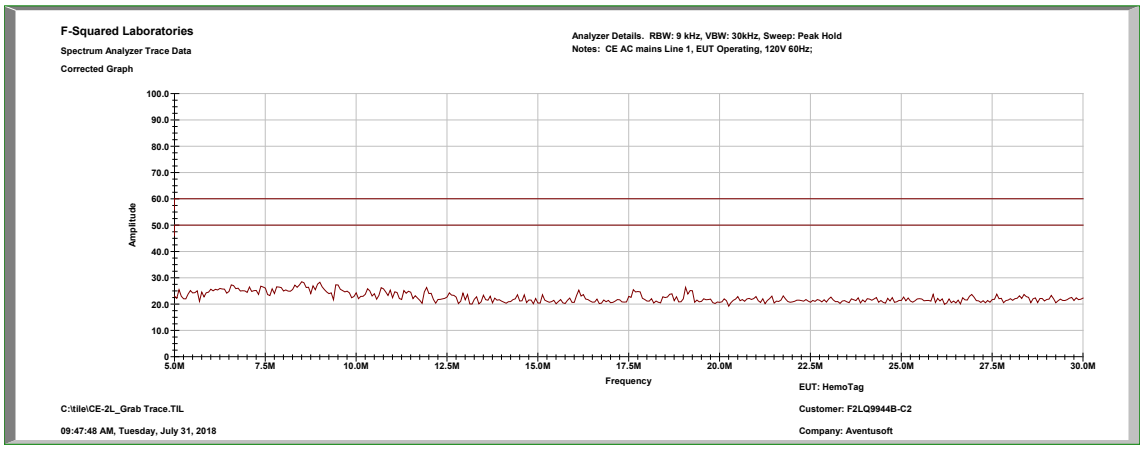
Conducted Test – Line 1: 0.15 MHz to 0.5 MHz



Conducted Test – Line 1: 0.5 MHz to 5.0 MHz

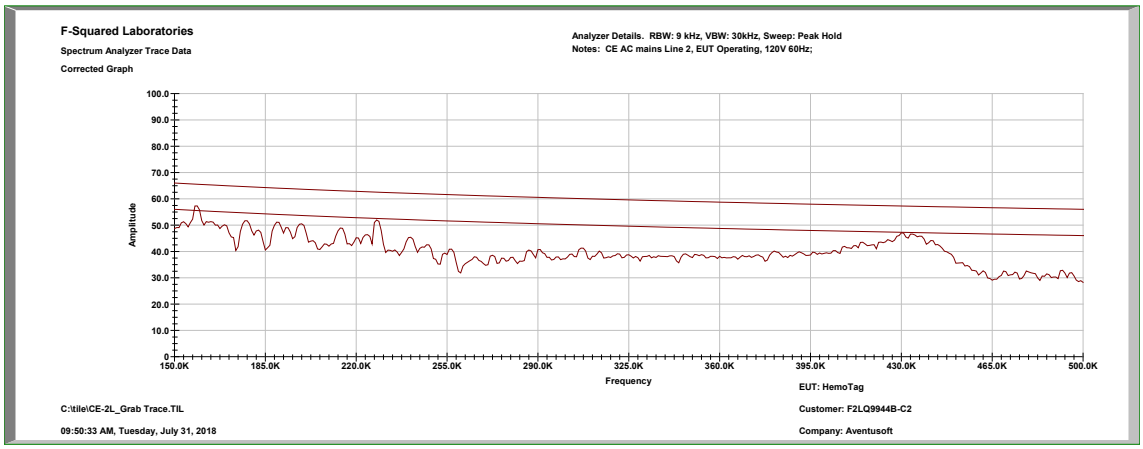


Conducted Test – Line 1: 5.0 MHz to 30.0 MHz

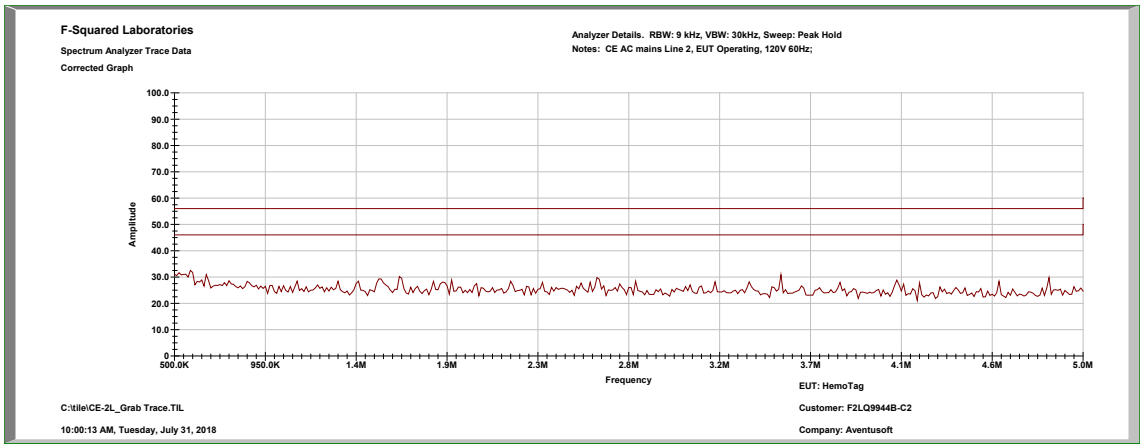


Top Discrete Measurements								
No.	Conductor	Frequency (MHz)	Detector	Level (dBµV)	Adjustment (dB)	Results (dBµV)	Limit (dBµV)	Margin (dB)
1	Line 1	0.15525	Quasi-Peak	32.37	11.51	43.88	65.72	-21.8
			Average	10.11	11.51	21.62	55.72	-34.1
2	Line 1	0.1745	Quasi-Peak	30.71	11.29	42.00	64.74	-22.7
			Average	11.30	11.29	22.59	54.74	-32.2
3	Line 1	0.19025	Quasi-Peak	31.00	11.16	42.16	64.03	-21.9
			Average	12.11	11.16	23.27	54.03	-30.8
4	Line 1	0.215625	Quasi-Peak	28.96	10.99	39.95	62.99	-23.0
			Average	11.31	10.99	22.30	52.99	-30.7
5	Line 1	0.430	Quasi-Peak	31.17	10.49	41.66	57.25	-15.6
			Average	16.41	10.49	26.90	47.25	-20.4
6	Line 1	0.815	Quasi-Peak	11.17	10.37	21.54	56.00	-34.5
			Average	3.53	10.37	13.90	46.00	-32.1

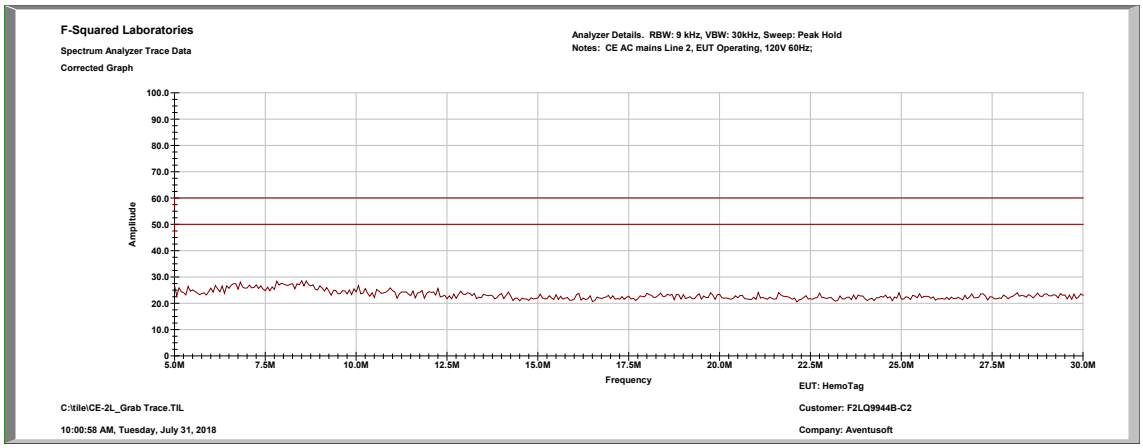
Conducted Test – Line 2: 0.15 MHz to 0.5 MHz



Conducted Test – Line 2: 0.5 MHz to 5.0 MHz



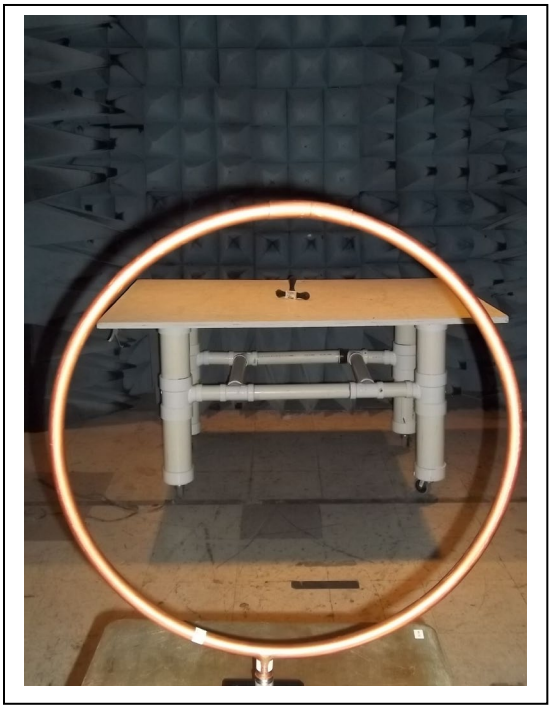
Conducted Test – Line 2: 5.0 MHz to 30.0 MHz



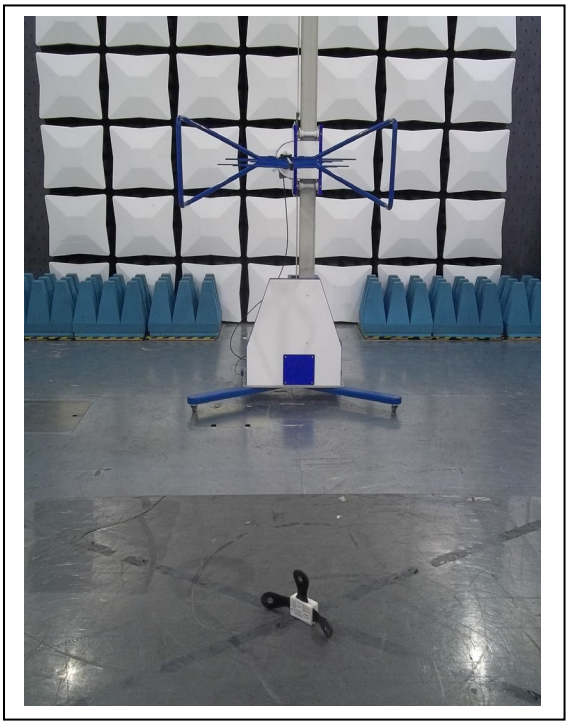
Top Discrete Measurements								
No.	Conductor	Frequency (MHz)	Detector	Level (dBµV)	Adjustment (dB)	Results (dBµV)	Limit (dBµV)	Margin (dB)
1	Line 2	0.15875	Quasi-Peak	30.86	11.53	42.39	65.71	-23.3
			Average	9.41	11.53	20.94	55.71	-34.8
2	Line 2	0.177125	Quasi-Peak	28.96	11.29	40.25	64.62	-24.4
			Average	10.03	11.29	21.32	54.62	-33.3
3	Line 2	0.190024	Quasi-Peak	27.29	11.17	38.46	64.04	-25.6
			Average	9.59	11.17	20.76	54.04	-33.3
4	Line 2	0.199	Quasi-Peak	27.56	11.11	38.67	63.62	-25.0
			Average	8.98	11.11	20.09	53.62	-33.5
5	Line 2	0.227875	Quasi-Peak	24.36	10.94	35.30	62.53	-27.2
			Average	7.57	10.94	18.51	52.53	-34.0
6	Line 2	0.43	Quasi-Peak	29.0	10.50	39.50	57.25	-17.8
			Average	11.84	10.50	22.34	47.25	-24.9

10 PHOTOGRAPHS/EXHIBITS – PRODUCT PHOTOS, TEST SETUPS

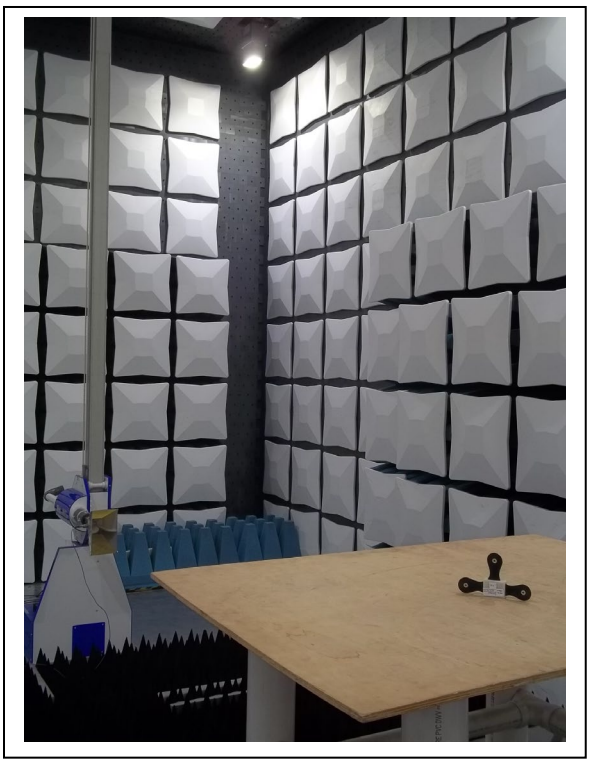
Radiated Spurious Emissions, Less than 30 MHz



Radiated Spurious Emissions, 30 MHz to 1000 MHz

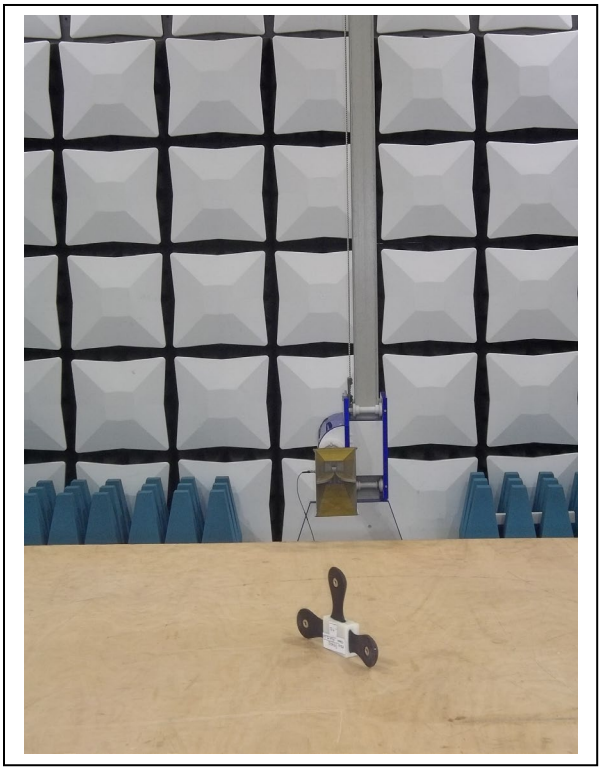


Radiated Spurious Emissions, 1 GHz to 18 GHz



Radiated Spurious Emissions, 18 GHz to 26 GHz

Field Strength of Emissions, Occupied Bandwidth



Conducted Emissions