TEST REPORT

Report Number: 100202270LAX-001
Project Number: 100202270
January 17, 2011

Testing performed on the
WhiteStar Signature Battery Management System
Model Number: PID/BCC
FCC ID: VGESIGPM
IC ID: 7228A-SIGPM

to

FCC Part 15.209 and RSS-210 Issue 8

for

Abbott Medical Optics

Test Performed by:	Test Authorized by:
Intertek	AMO
25791 Commercentre Drive	1700 East Street Andrew Place
Lake Forest, CA 92630, USA	Santa Ana, CA 92799, USA

Prepared by: _____ **Date:** January 17, 2011
Martin Liu

Reviewed by: _____ **Date:** January 17, 2011
Krishna Vemuri

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1.0 Summary of Tests

TEST	REFERENCE FCC	REFERENCE RSS-210	RESULTS
Field Strength of Fundamental and Spurious Emissions	15.209	A2.6	Complies
Line Conducted Emissions	15.207	RSS-GEN	Complies
Antenna requirement	15.203		Complies. The antenna is permanently connected, internal to the PCB.
Occupied Bandwidth			Complies

2.0 General Description

2.1 Product Description

The Primary Inductive Drive (PID) p/n 0100-1013-L and Base Charge Controller (BCC) p/n 0100-1048-L, the equipment under test (EUT) is for charging application. It is inbeded and and designed for the Ophthalmic Surgery System Model WhiteStar Signature. The Primary Inductive Drive (PID) and Base Charge Controller (BCC) consists of 2 transmitters in charge mode.

Overview of the EUT

Applicant name & address	AMO 1700 East Street Andrew Place Santa Ana, CA 92799, USA
Contact info	Mr. Dung Ma, Dung.Ma@amo.abbott.com
Model No.	PID/BCC
FCC Identifier	VGE-SIGPM
IC Identifier	7228A-SIGPM
Operating Frequency	Single frequency, 25 kHz
Number of Channels	1
Operating Temperature	5^0C to +35^0C

A prototype version of the EUT was received on September 27, 2010 in good operating condition. As declared by the Applicant, it is identical to production units.

Description of EUT:

The Whitestar Signature Battery Management System is an integral part of the Whitestar Signature System. Its main functions are to store and deliver the energy to the Footpedal and Remote Control inductively. The Whitestar Signature Battery Management System consists of an SLA battery, Primary Inductive Drive (PID), and the Base Charge Controller (BCC) with SLA battery charger. The Primary Inductive Drive and the Base Charge Controller both contain a transformer primary assembly for coupling to the Remote Control and Footpedal transformer secondary, respectively. The transformer secondaries and the NiMH chargers reside in the Footpedal and the Remote. As such, the Battery Management System does not charge the Footpedal and Remote batteries directly, this is done by the charging circuits in those devices. The Battery Management System simply provides power to these circuits through inductive coupling. The SLA Battery is charged by the Battery Management System.

The system is designed to detect the presence of the Footpedal and the Remote when they are placed in the charging cradles. If power to the Whitestar Signature system is off, then the Battery Management System must be powered from the SLA Battery and the Footpedal and Remote must be charged from the SLA Battery when they are placed in the cradle. If power is on, the Battery Management System must be powered from the Whitestar Signature's 24V supply and the Footpedal and Remote must be charged from the Whitestar Signature's 24V power supply when they are placed in the cradle. Furthermore, the SLA Battery must be charged from the 24V power supply when power is on.

During a Remote, Foot Pedal, and SLA Battery charge cycle, the chargers shall progress through a battery preconditioning phase, a fast charge phase, and a trickle charge phase. A time limit shall be placed on the charging of the batteries to prevent battery deterioration from overheating. A preconditioning phase is required to determine battery open/short condition and to bring battery voltage up to a voltage suitable for enabling fast charging. Fast charging is required to minimize the time required to recharge the SLA/Remote/Foot Pedal batteries. The SLA fast charge current is nominally 3.5A. The Remote and Foot Pedal fast charge currents are determined by their respective chargers. Trickle charging is required to top off the batteries.

The general requirements for using Whitestar Signature system 24V power or SLA Battery power are listed below. Since the NiMH batteries and their chargers are the same for the Footpedal and the Remote, the requirements for charging of the Footpedal and Remote are identical. Charging requirements for the SLA Battery are similar to the Footpedal and Remote requirements:

- Power the Battery Management System from the SLA Battery when Whitestar Signature power is OFF.
- Power the Battery Management System from the Whitestar Signature 24V supply when Whitestar Signature power is ON.
- Detect placement of Footpedal/Remote in the cradle and deliver power to the Footpedal/Remote chargers.
- Detect removal of Footpedal/Remote from the cradle and turn off power to the Footpedal/Remote chargers.
- Charge the SLA Battery when Whitestar Signature Power is ON.
- Detect missing SLA Battery or open battery condition when charging the SLA and stop the charger.
- Detect internally shorted SLA Battery when charging SLA and stop the charger.
- Detect battery charging faults and turn OFF power to the SLA, Footpedal, or Remote chargers.
- Protect SLA Battery from deep discharges.

2.2 Related Submittal(s) Grants

This report is for use with an application for certification of a low power transmitter.

2.3 Test Methodology

Both AC mains line-conducted and radiated emissions measurements were performed according to the procedures in ANSI C63.4. Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the **"Data Sheet"** of this Application. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

2.4 Test Facility

The 3 meter anechoic chamber and conducted measurement facility used to collect the radiated data is chamber site. This test facility and site measurement data have been fully placed on file with the FCC and A2LA accredited.

3.0 System Test Configuration

3.1 Support Equipment and Description

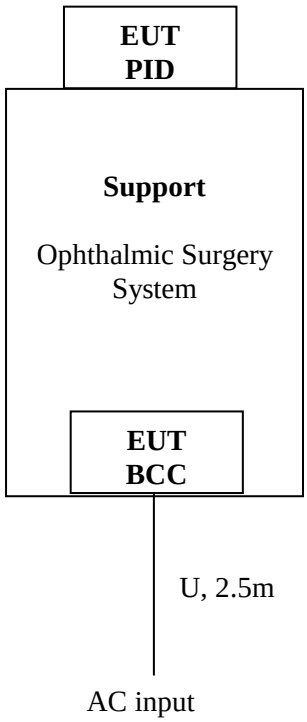
System Support Equipment

Item #	Description	Model No.	Serial No.
1	Ophthalmic Surgery System	WhiteStar Signature	200850010

Note: This unit provides power to the charging circuit.

3.2 Block Diagram of Test Setup

The diagram shown below details the interconnection of the EUT and support equipment. For specific layout, refer to the test configuration photograph in the relevant section of this report.



S = Shielded **U** = Unshielded	**F** = With Ferrite **m** = Length in Meters

3.3 Justification

For emission testing, the test procedures, as described in American National Standards Institute C63.4, were employed. The equipment Under Test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). During testing, all cables were manipulated to produce worst-case emissions.

Each of the Primary Inductive Drive (PID) and Base Charge Controller (BCC) consists of one charger. The circuit of each charger is identical. In normal operation, all transmitters are simultaneously ON when the load is placed on the charger. All tests were performed on the Primary Inductive Drive (PID) and Base Charge Controller (BCC) with all transmitters ON.

3.4 Software Exercise Program

None.

3.5 Mode of Operation During Test

Primary Inductive Drive (PID) and Base Charge Controller (BCC) were continuously transmitting during the tests. Both devices receiving the charges received the same amount of energy until the batteries were full.

3.6 Modifications Required for Compliance

No modifications were installed by Intertek during compliance testing in order to bring the product into compliance.

3.7 Additions, Deviations and Exclusions from Standards

No additions, deviations or exclusion have been made from standard.

4.0 Measurement Results

4.1 Transmitter Radiated Emissions
15.209

Requirements

The Field Strength of emissions at fundamental frequency and emissions radiated outside of the specified frequency band shall not exceed the general radiated emission limits in 15.209.

Procedure

Below 30 MHz
During the test the EUT is rotated and the measuring antenna angle are varied during the search for maximum signal level.

Radiated emissions are taken at 3 meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent 3 meters reading using inverse scaling with distance.

Above 30 MHz
During the test the EUT is rotated and the measuring antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at 3 meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent 3 meters reading using inverse scaling with distance.

Radiated emission measurements were performed from 9 kHz to 1 GHz.

Analyzer resolution is:
200 Hz or greater for frequencies 150 kHz and below.
9 kHz or greater for frequencies 30 MHz and below.
100 kHz or greater for frequencies 1000 MHz and below.

Data is included for the worst-case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation is as follows:

FS = RA + AF + CF – AG – DCF

Where FS = Field Strength in dB (μV/m)

RA = Receiver Amplitude (including preamplifier) in dB (μV)

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB (1/m)

AG = Amplifier Gain in dB

DCF = Distance Correction Factor

Test Result

The data below shows the significant emission frequencies, the limit and the margin of compliance.

Radiated Emissions at the fundamental frequency, up to 10th harmonic

Antenna (Axis: Parallel)

Frequency	Final Peak FS	Limit at 300 m	Margin	RA	CF	AG	AF	DCF
kHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB(1/m)	dB
24.65	-20.07	39.8	-59.87	45.9	0.03	0.0	14.0	-80.0
49.30	-31.36	48.7	-80.06	36.3*	0.04	0.0	12.3	-80.0
73.95	-34.46	32.5	-66.96	33.5	0.04	0.0	12.0	-80.0
98.60	-35.76	24.4	-60.16	32.3*	0.04	0.0	11.9	-80.0
123.25	-39.16	19.5	-58.66	28.9*	0.04	0.0	11.9	-80.0
147.70	-40.76	16.3	-57.06	27.3*	0.04	0.0	11.9	-80.0
172.05	-27.45	14.0	-41.45	40.6*	0.05	0.0	11.9	-80.0
196.70	-28.95	12.2	-41.15	39.1*	0.05	0.0	11.9	-80.0
221.35	-28.54	10.8	-39.34	39.5*	0.06	0.0	11.9	-80.0
246.00	-29.84	9.8	-39.64	38.5*	0.06	0.0	11.6	-80.0

*: Noise floor measurement.

Antenna (Axis: Perpendicular)

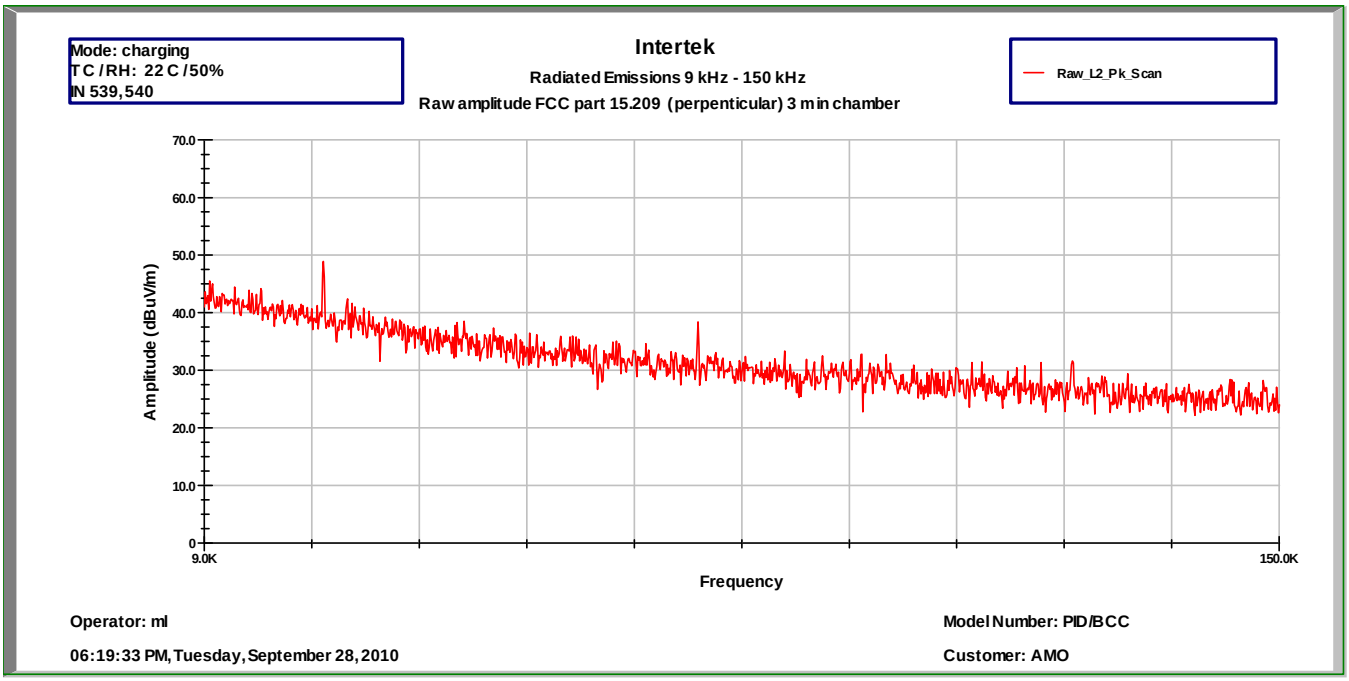
Frequency	Final Peak FS	Limit at 300 m	Margin	RA	CF	AG	AF	DCF
kHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB(1/m)	dB
24.65	-17.07	39.8	-56.87	48.9	0.03	0.0	14.0	-80.0
49.30	-31.36	48.7	-80.06	36.3*	0.04	0.0	12.3	-80.0
73.95	-29.56	32.5	-62.06	38.4	0.04	0.0	12.0	-80.0
98.60	-35.36	24.4	-59.76	32.7*	0.04	0.0	11.9	-80.0
123.25	-36.46	19.5	-55.96	31.6*	0.04	0.0	11.9	-80.0
147.70	-39.86	16.3	-56.16	28.2*	0.04	0.0	11.9	-80.0
172.05	-28.55	14.0	-42.55	39.5*	0.05	0.0	11.9	-80.0
196.70	-28.55	12.2	-40.75	39.5*	0.05	0.0	11.9	-80.0
221.35	-28.84	10.8	-39.64	39.2*	0.06	0.0	11.9	-80.0
246.00	-29.74	9.8	-39.54	38.6*	0.06	0.0	11.6	-80.0

*: Noise floor measurement.

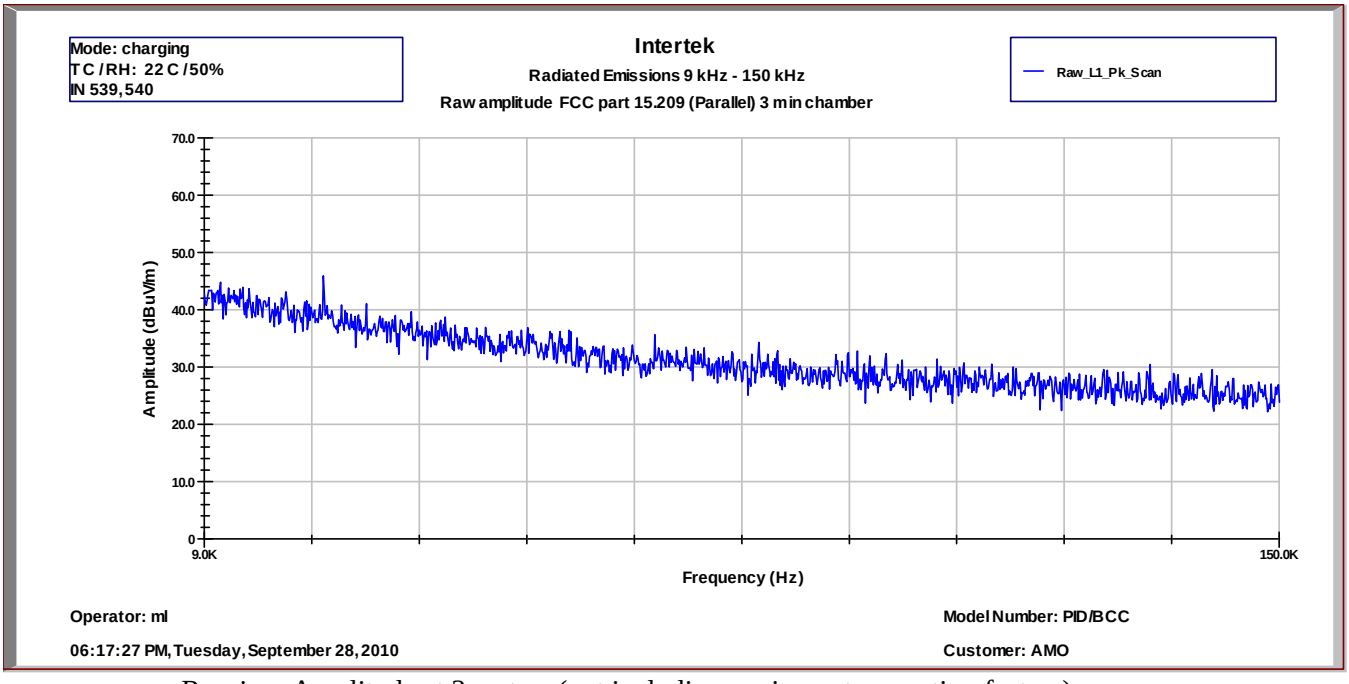
All measurements taken at 3m distance.

Limit in uV/m = 2400/F (kHz) at 300 Meters from 9 kHz to 490 kHz
Limit in uV/m = 24000/F (kHz) at 30 Meters from 490 kHz to 1705 kHz
Limit in uV/m = 30 at 30 Meters from 1705 kHz to 30 MHz
dBuV/m = 20 log (uV/m)

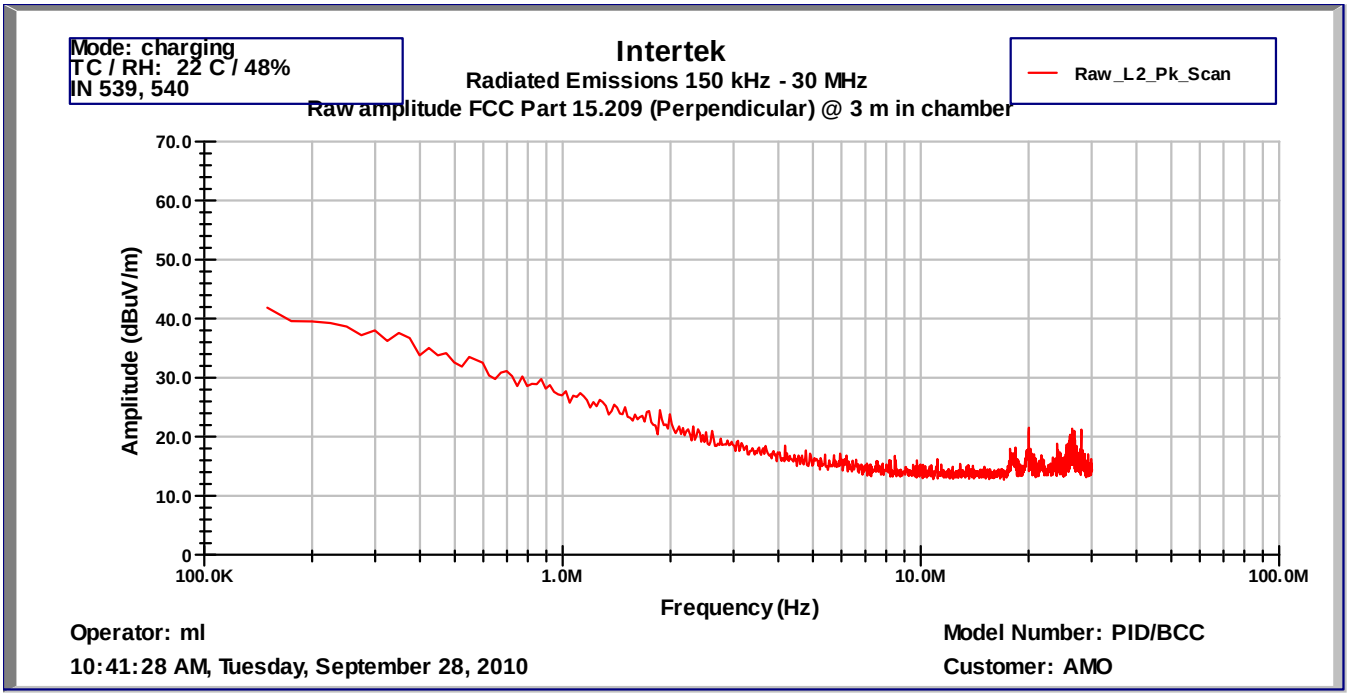
All other emissions not reported are at least 20 dB below the limit.



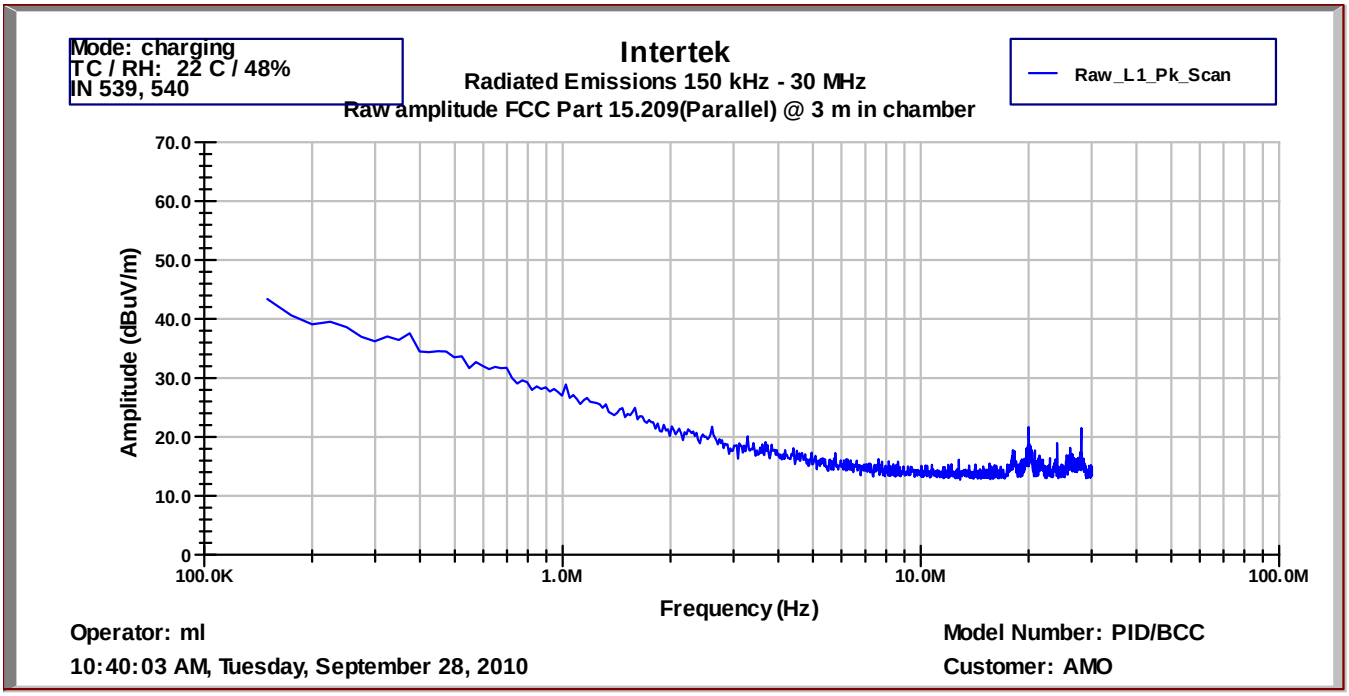
Receiver Amplitude at 3 meters (not including equipment correction factors)
9 kHz – 150 kHz, antenna perpendicular



Receiver Amplitude at 3 meters (not including equipment correction factors)
9 kHz – 150 kHz, antenna parallel

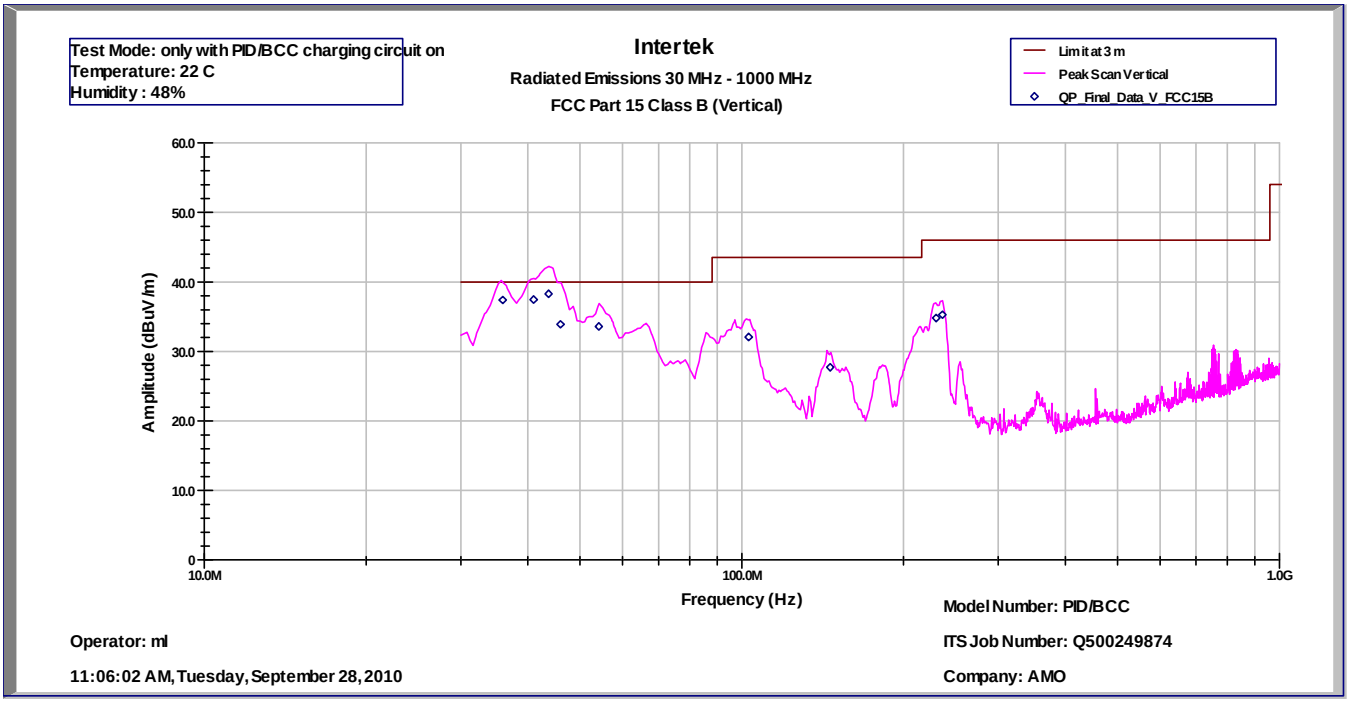


Receiver Amplitude at 3 meters (not including equipment correction factors)
150 kHz – 30 MHz, antenna perpendicular



Receiver Amplitude at 3 meters (not including equipment correction factors)
150 kHz – 30 MHz, antenna parallel

Spurious Radiated Emissions above 30 MHz



Intertek Testing Services
Radiated Emissions 30 MHz - 1000 MHz
FCC Part 15 Class B (QP-Vertical)

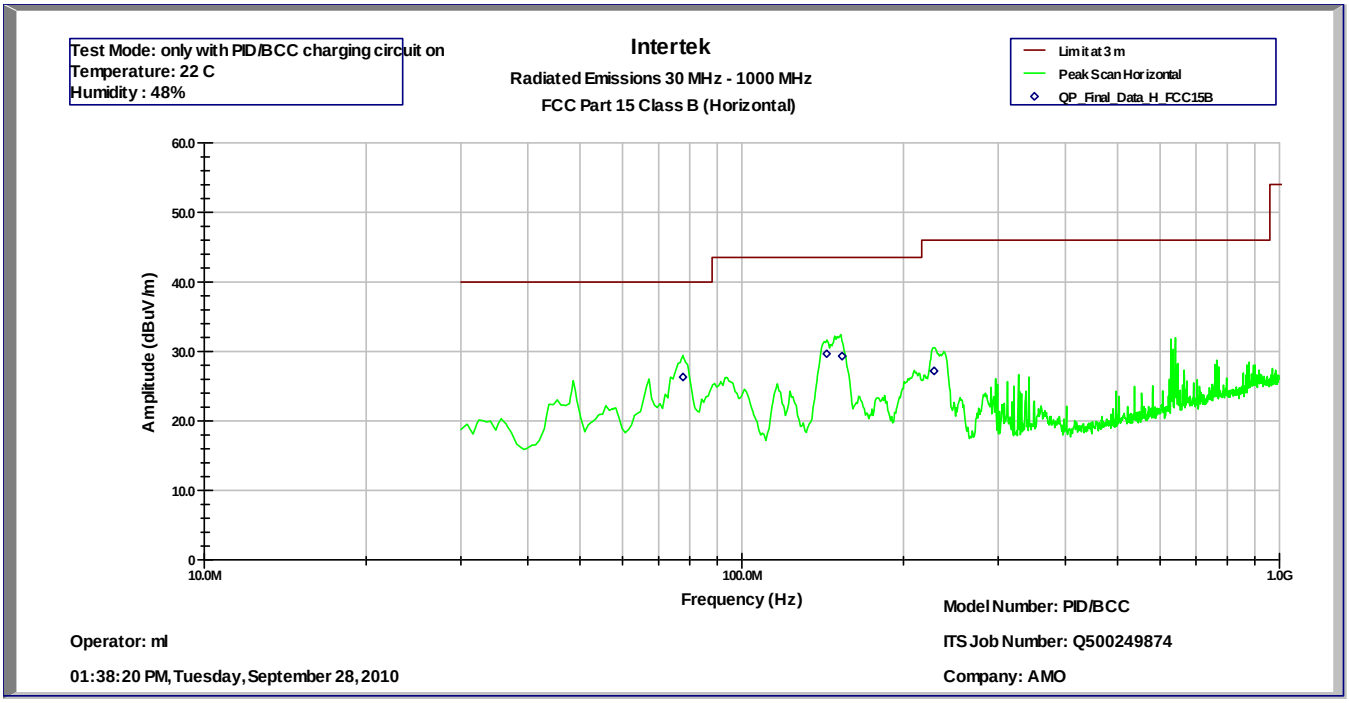
Operator: ml — Model Number: PID/BCC
11:06:02 AM, Tuesday, September 28, 2010 — Company: AMO

Frequency	Quasi Pk FS	Limit@3m	Margin	RA	AG	AF	CF
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB(1/m)	dB
35.9	37.4	40.0	-2.6	56.0	30.7	10.9	1.2
41.0	37.5	40.0	-2.5	57.4	30.7	9.5	1.3
43.7	38.3	40.0	-1.7	60.0	30.7	7.7	1.3
46.0	33.9	40.0	-6.1	56.1	30.7	7.2	1.3
54.2	33.6	40.0	-6.4	57.6	30.6	5.2	1.4
103.0	32.1	43.5	-11.4	54.1	31.0	7.1	1.9
146.0	27.7	43.5	-15.8	43.6	30.8	12.8	2.2
230.0	34.8	46.0	-11.2	52.1	30.5	11.0	2.2
236.1	35.3	46.0	-10.7	52.6	30.5	10.9	2.3

Note: all broadband noise

Test Mode: only with PID/BCC charging circuit on
Temperature: 22 C
Humidity : 48%

Spurious Radiated Emissions above 30 MHz



Intertek Testing Services
Radiated Emissions 30 MHz - 1000 MHz
FCC Part 15 Class B (QP-Horizontal

Operator: ml
12:33:49 PM, Tuesday, September 28, 2010

Model Number: PID/BCC
Company: AMO

Frequency	Quasi Pk FS	Limit@3m	Margin	RA	AG	AF	CF
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB(1/m)	dB
77.7	26.3	40.0	-13.7	48.3	30.8	7.1	1.7
143.9	29.7	43.5	-13.8	47.1	30.8	11.2	2.2
153.7	29.3	43.5	-14.2	48.1	30.8	9.8	2.2
227.9	27.2	46.0	-18.8	44.1	30.5	11.4	2.2

Test Mode: only with PID/BCC charging circuit on
Temperature: 22 C
Humidity : 48%

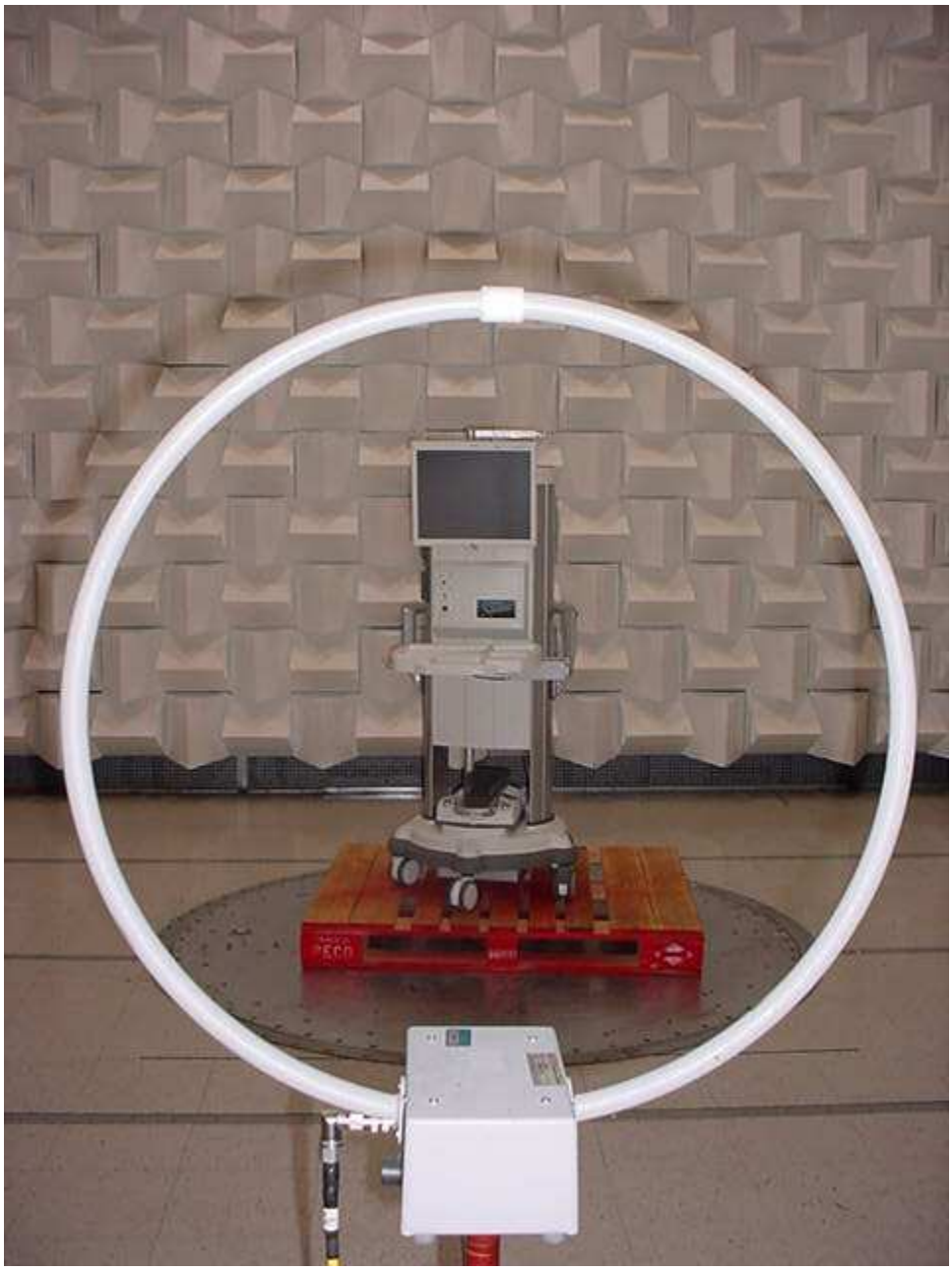
The EUT passed by 56.7 dB at fundamental frequency and by 1.7 dB at spurious emission frequencies.

Test configuration photographs:

Scan 30 MHz – 1000 MHz Spurious Radiated Emission

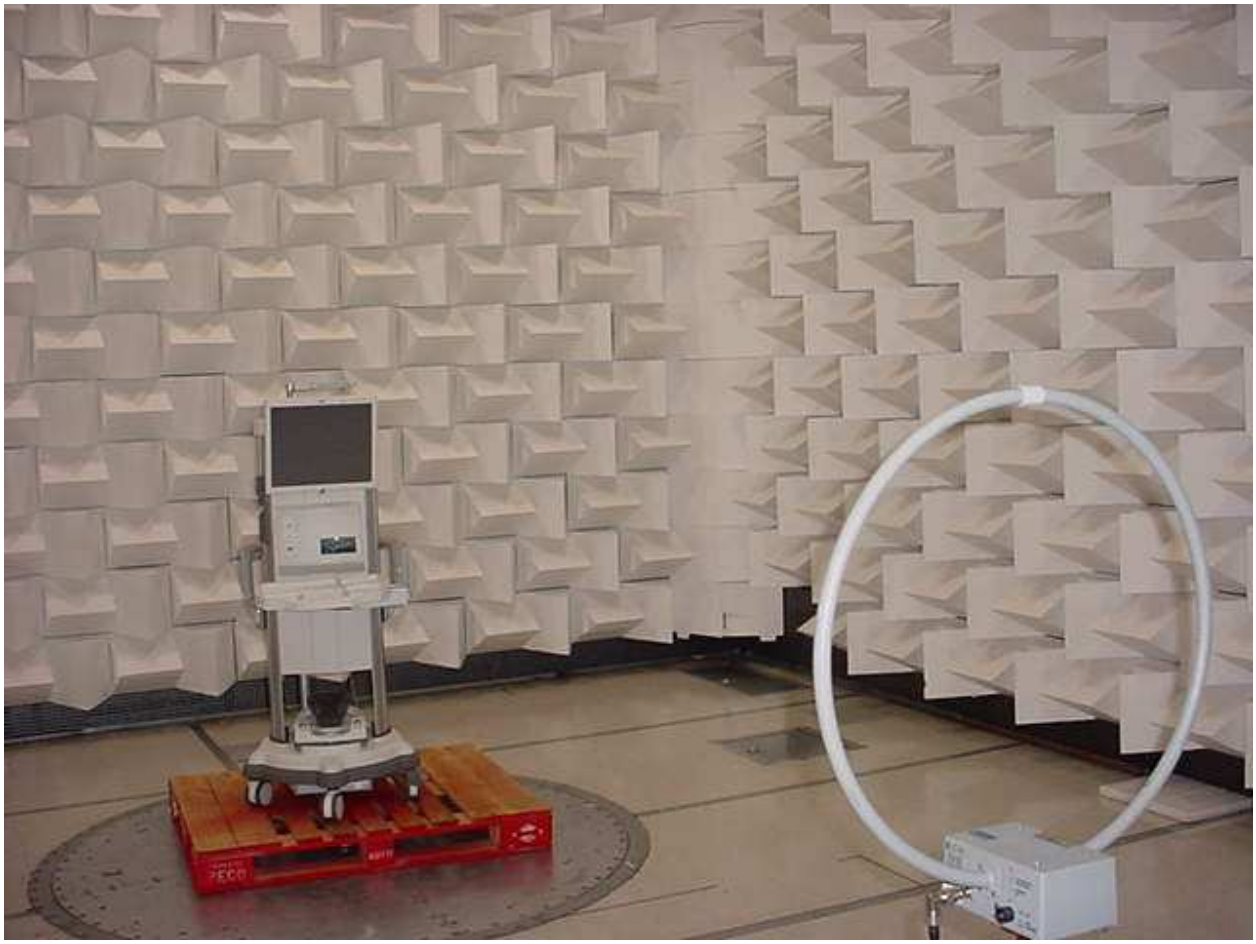
Scan 30 MHz – 1000 MHz Spurious Radiated Emission

Fundamental Measurement



Scan 9 kHz – 30 MHz Radiated Emission

Fundamental Measurement



Scan 9 kHz – 30 MHz Radiated Emission

Remote Control View 1

Remote Control View 2

Footpedal View 1

Footpedal View 2

4.2 AC Line Conducted Emission
FCC Rule 15.207

AC line conducted emission test was performed according the ANSI C63.4 standard. The EUT was connected to its charger, which was connected to the AC Line through the LISN.

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT is arranged and connected with cables terminated in accordance with the product specification. Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

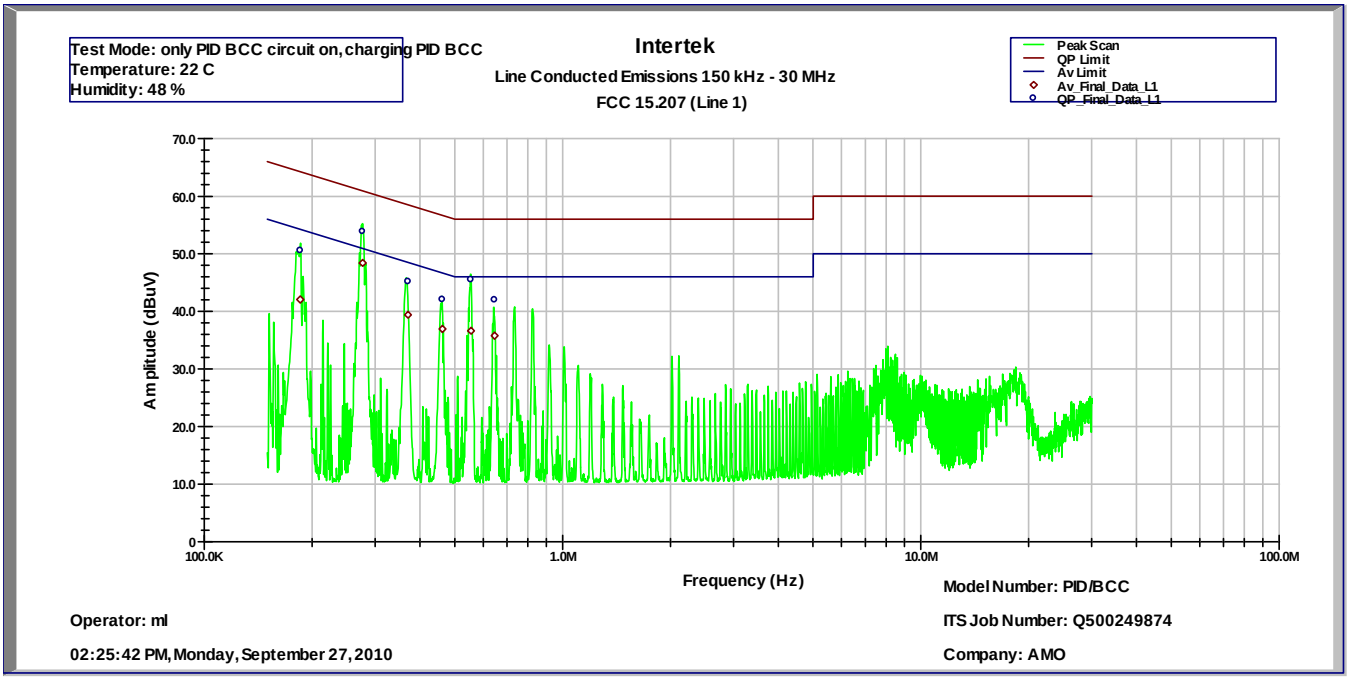
The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

Floor standing EUTs are placed on a horizontal metal ground plane and isolated from the ground plane by 3 to 12 mm of insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

Equipment setup for conducted disturbance tests followed the guidelines of ANSI C63.4.

Test Result

The data below shows the significant emission frequencies, the limit and the margin of compliance.



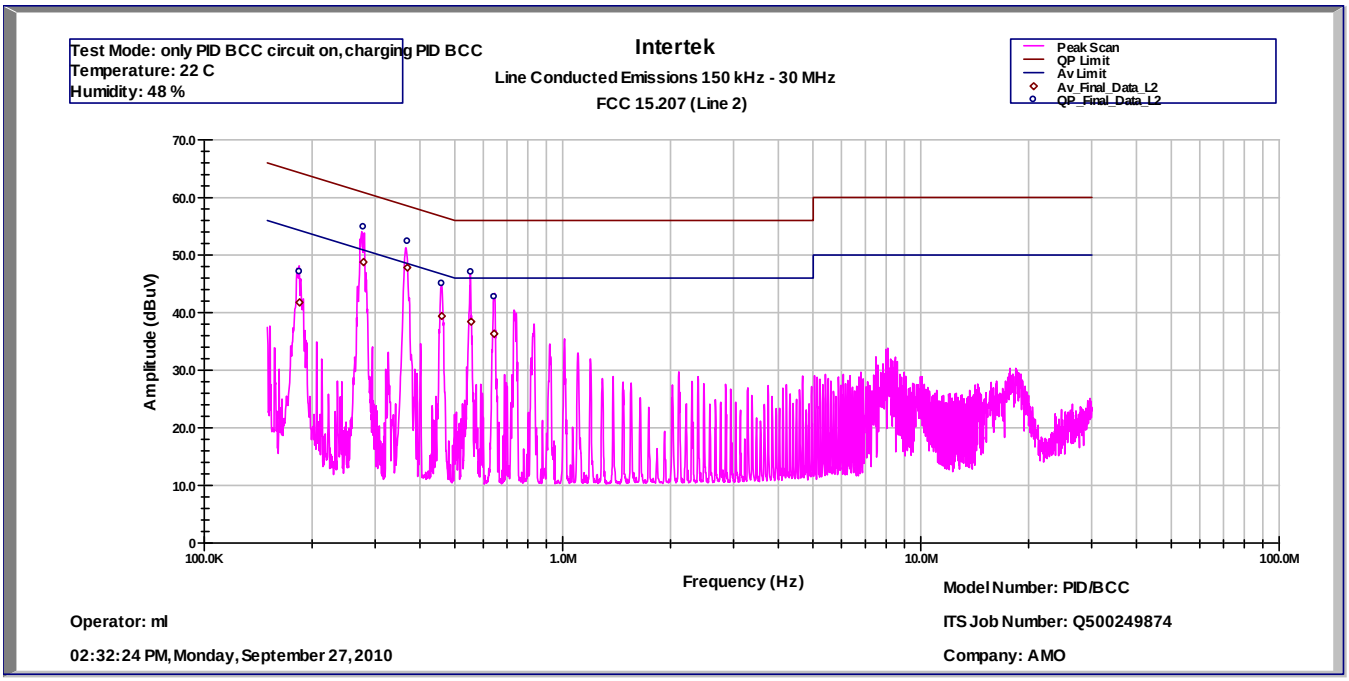
Intertek Testing Services
Line Conducted Emissions 150 kHz - 30 MHz
FCC 15.207 (Line 1)

Operator: ml Model Number: PID/BCC

02:37:20 PM, Monday, September 27, 2010
Company: AMO

Frequency	Av Level	QP Level	Av Limit	QP Limit	Av Margin	QP Margin
MHz	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)
0.185	42.0	50.5	55.0	65.0	-13.0	-14.4
0.277	48.4	53.8	52.4	62.4	-4.0	-8.5
0.370	39.4	45.1	49.7	59.7	-10.3	-14.6
0.462	36.9	42.0	47.1	57.1	-10.2	-15.1
0.555	36.6	45.5	46.0	56.0	-9.4	-10.5
0.646	35.8	42.0	46.0	56.0	-10.2	-14.0

Test Mode: only PID BCC circuit on, charging PID BCC
Temperature: 22 C
Humidity: 48 %



Intertek Testing Services
Line Conducted Emissions 150 kHz - 30 MHz
FCC 15.207 (Line 1)

Operator: ml
Model Number: PID/BCC

02:39:17 PM, Monday, September 27, 2010
Company: AMO

Frequency MHz	Av Level (dBuV)	QP Level (dBuV)	Av Limit (dBuV)	QP Limit (dBuV)	Av Margin (dB)	QP Margin (dB)
0.184	41.8	47.1	55.0	65.0	-13.2	-17.9
0.278	48.8	54.9	52.3	62.3	-3.6	-7.5
0.369	47.8	52.4	49.7	59.7	-1.9	-7.4
0.460	39.4	45.0	47.1	57.1	-7.7	-12.1
0.556	38.4	47.0	46.0	56.0	-7.6	-9.0
0.644	36.3	42.7	46.0	56.0	-9.7	-13.3

Test Mode: only PID BCC circuit on, charging PID BCC
Temperature: 22 C
Humidity: 48 %

Results:	Complies by 1.9 dB.

Test Configuration Photographs:

Test Setup View 1

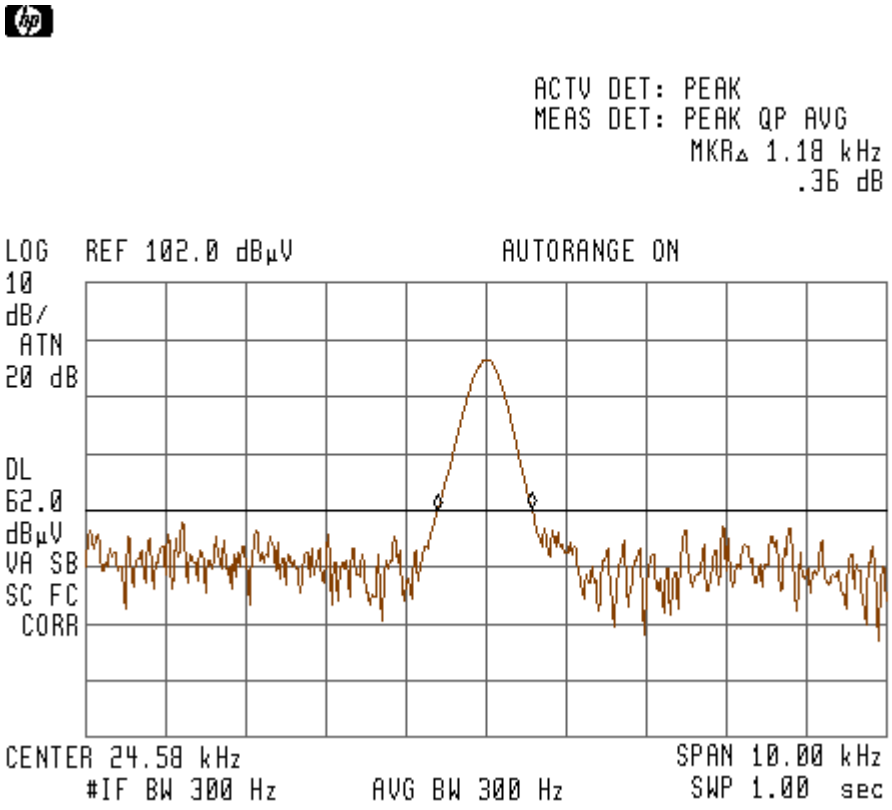
Test Setup View 2

4.3 Occupied Bandwidth

The EUT was setup to transmit in normal operating condition.

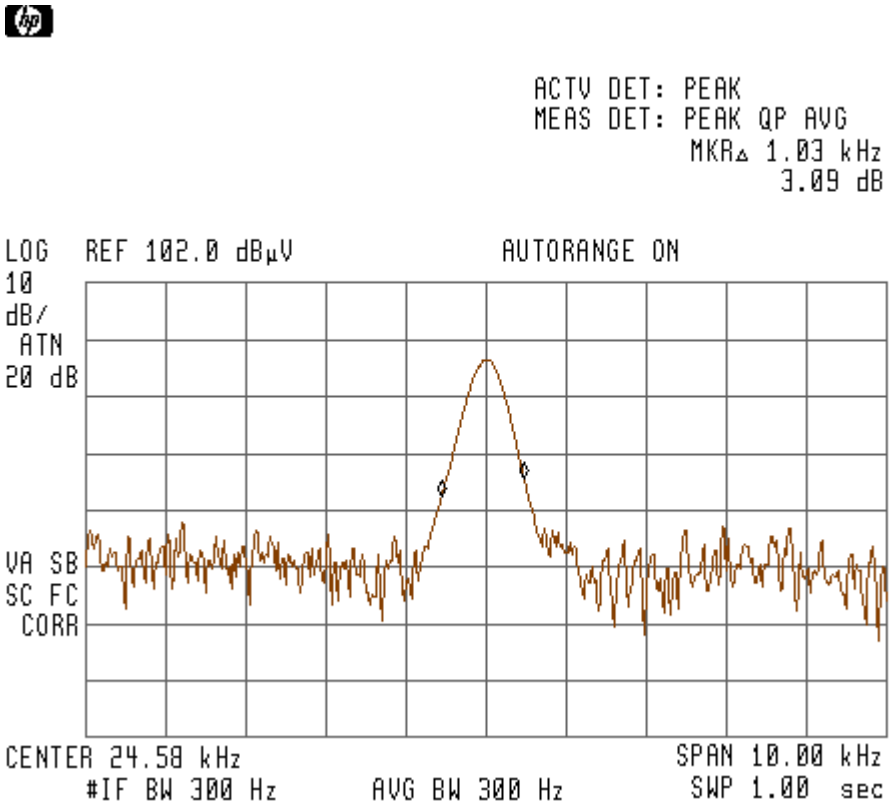
Measurements were made with the loop antenna at 10 cm distance using a Spectrum Analyzer. The spectrum analyzer reading was plotted.

Plot 1



Comment: 26 dB BW

Plot 2



Comment: 99% BW

5.0 List of Test Equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
RF Filter Section	Hewlett Packard	85460A	3549A00261	12	01/28/11
EMI Receiver	Hewlett Packard	8546A	3448A00265	12	01/28/11
BI-Log Antenna	EMCO	3143	1242	12	01/21/11
Pre-Amplifier	HP	8447D	2944A10141	12	05/21/11
Loop Antenna	EMCO	6502	9807-3213	12	03/16/11
LISN	EMCO	3825/2 25A	2527	12	10/18/11

6.0 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / 100202270LAX-001	ML	January 17, 2011	Original document