

TYCO SAFETY PRODUCTS

SENSORMATIC

EMC

TEST REPORT

PRODUCT TESTED

AMS9040-68K

FCC ID: BVCAMS9040-68K

IC: 3506A-AMS904068K

FCC RULES

47 CFR, Part 15, Subparts B and C

IC SPECIFICATIONS

RSS-Gen:2007 / RSS-210e:2007 / ICES-003:2004

Test Report Number

AMS9040-68K

DATE

10/10/2007

1 Summary of Results

Test Reference	Test Name	Results
47 CER 15.107	CONDUCTED EMISSIONS	COMPLIES
47 CER 15.109	RADIATED EMISSIONS	COMPLIES
47 CFR 15.203	ANTENNA REQUIREMENTS	COMPLIES
47 CFR 15.207	CONDUCTED EMISSIONS	COMPLIES
47 CFR 15.209	RADIATED EMISSIONS	COMPLIES
RSS GEN: 4.6.1	OCCUPIED BANDWIDTH	PROVIDED

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1.1 General Information

1.1.1 Test Methodology

Conducted and Radiated Emissions testing were performed according to the procedures in ANSI C63.4-2003, and the requirements of 15.31, 15.33, 15.35, 15.207, and 15.209. Radiated emissions measurements below 30MHz were performed at a distance 15 meters and the results were extrapolated to the distance specified per 15.31 and 15.209 according the 2-point extrapolation method.

1.1.2 Test Facility

The shielded room conducted emissions measurement facility and the radiated emissions Open Area Test Site are located at Tyco / Sensormatic Electronics Corporation Headquarters at 6600 Congress Avenue, Boca Raton, Florida 33487. These sites have been found acceptable by and are on file with the FCC per FCC Registration Number 889978, and Industry Canada per file number IC 3506A-1.

1.1.3 Test System Description.

The AMS-9040-68K is a controller capable of driving a pair of antennas to generate a magnetic field to excite tags, receive the signal and alarm when an acceptable tag signal is detected and verified. A single main PCB accommodates the Receiver, the Switching Amplifier Transmitter and the Power Supply.

The AMS-9040-68K is intended to be paired with the following Sensormatic transmit antenna systems families:

- Digital Door-Max
- Digital Floor-Max
- Digital Pro-Max
- Digital Euro Pro-Max
- Ultra Loop

The worst-case radiated emissions data [below 30 MHz] was observed on the Ultra Loop Antenna. The worst case configuration was the vertical loop and the data reported is to that configuration.

The product tested was a pre-production unit built to production drawings.

LIST OF PORTS					
Id	Function	Class	Maximum Cable Length	Test Length	Cable Type
A	AC Mains*	ac power	> 1m but ≤ 3 m	6	18 AWG Cable
B	Transmit	signal/control	> 3 m	50	Shielded 2 Pairs [individual shields] + common drain [white] Belden-E E34372
C	Transmit	signal/control	> 3 m	50	Shielded 4 wire Cable [individual shield] + common drain [white] Belden-E E34372
D	External Receiver	signal/control	> 3 m	10	Shielded four wire cable [black] 22 AWG E116394
E	Remote Alarm	signal/control	> 3 m	11	Shielded 2 Pairs [individual shields] + 1 common drain [black] 22 AWG – E118871
F	Beacon Lamp	signal/control	> 3 m	26	Madison Cable 2 wire cable [shielded]
G	Relay Contact	signal/control	> 3 m	15	Madison Cable 2 wire cable [shielded] – same type as F
H	TX Inhibit	signal/control	> 3 m	14	Madison Cable 2 wire cable [shielded] – same type as F and G
I	RS232	signal/control	> 3 m		
J	RS485 Network	signal/control	> 3 m	20	Shielded 2 wire cable – Alpha AWG 24
K	Sync Link	signal/control	<3m	9	Ribbon Cable [unshielded]
L	Ultra Link	signal/control	> 3 m	15	Alpha wire – 2 wire - unshielded
M	Wired Sync	signal/control	> 3 m		
N	RS485 Cap Board	signal/control	> 3 m	50	2 Pairs [individual shields] + 1 common drain [black] 22 AWG – E118871

2 List of Measuring Equipment

<u>Model</u>	<u>Description</u>	<u>Vendor</u>	<u>Serial #</u>
ALP -70	Loop Antenna	Electro Metrics	163
3110B	Biconical Antenna	Electro Metrics	1017
3146	Log Periodic Antenna	EMCO	3909
3825/2	Line Imp Stable Network	EMCO	1562
3816/2NM	Line Imp Stable Network	EMCO	9703 1018
6060B	Frequency Generator	Giga-tronics	5850202
FM2000	Isotropic Field Monitor	Amplifier Research	15171
FP2000	Isotropic Field Probe	Amplifier Research	15214
888	Leveler	Amplifier Research	14998
75A220	Low Band Amplifier	Amplifier Research	15208
10W1000A	High Band Amplifier	Amplifier Research	15138
PEFT Junior	EFT Generator	Haefely Trench	083 180-16
PEFT Junior	Capacitive Cable Clamp	Haefely Trench	083-078-31
NSG435	ESD Simulator	Schaffner	1197
NSG431	ESD Simulator	Schaffner	1267
HP8591EM	EMC Analyzer	Hewlett - Packard	3520A00190
	Power Source	Pacific Instruments	
F-2031	EM Injection Clamp	Fischer Cust. Comm.	30
FCC-801-M3-16	Coupling Decoupling Nwk	Fischer Cust. Comm.	58
FCC-801-M3-16	Coupling Decoupling Nwk	Fischer Cust. Comm.	59
F-33-1	RF Current Probe	Fischer Cust. Comm.	304
EM 7600	Transient Limiter	Electro-Metrics	187
HP8594E	Spectrum Analyzer	Hewlett Packard	3246A00300
HP8447F Opt 64	Dual Preamplifier	Hewlett Packard	2805A03473

3 FCC 15.203 Antenna Requirement

The system is a professionally installed with an external antenna employing a terminal style connector; therefore the antenna is compliant with the requirements of this clause.

4 Conducted Emissions, FCC 15.107 and 15.207

Project Name	Conducted Emissions EN55022 B Limits	Filename	68kHz Loop_CondEMI-EUPEN_10-10-07.doc
EUT Name	68kHz Loop 9040 Controller with 2 Loops	Serial Number	
Engineer	Stanley Strzelec	Part Number	
Technician	Stephen Krizmanich	Phone Number	
Test Name	Conducted Emissions	Date of Test	10/10/07 4:51:32 PM

Comments	<p>Line Input: 120volts - 60Hz The AMS9040-68K Controller, 4 Amorphous Core Receivers, Digital Alarm and Beacon Lamp are in chamber. There are 2 Loops with associated Cap boxes (3'x7'x2' Loop - 15Amps Peak and 8'x10'x2' Loop - 12Amps Peak) are located outside chamber. The antenna cables for both loops are inserted through waveguide pipe entering chamber and are as short as possible inside chamber. The Line Cord is EUPEN. P/N 6003-0179-01 (See photos at end of report).</p>
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Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	Avg Amp (dBuV)	QP/Avg Limit	L1/L2	Margin to Limit	Comment
.204	54.6	53.3	31.1	63.4/53.4	L2	10.1 QP	Complies
.204	54.4	53.3	31.0	63.4/53.4	L1	10.1 QP	Complies
.340	51.3	49.9	29.0	58.9/48.9	L1	9.0 QP	Complies
.340	50.4	48.8	27.4	58.9/48.9	L2	10.1 QP	Complies
.477	31.2	28.5	10.8	56.3/46.3	L2	27.8 QP	Complies
.477	31.3	27.9	10.9	56.3/46.3	L1	28.4 QP	Complies
.610	28.9	25.6	8.8	56.0/46.0	L1	30.4 QP	Complies
.610	27.9	24.3	7.9	56.0/46.0	L2	31.7 QP	Complies

Figure 1.

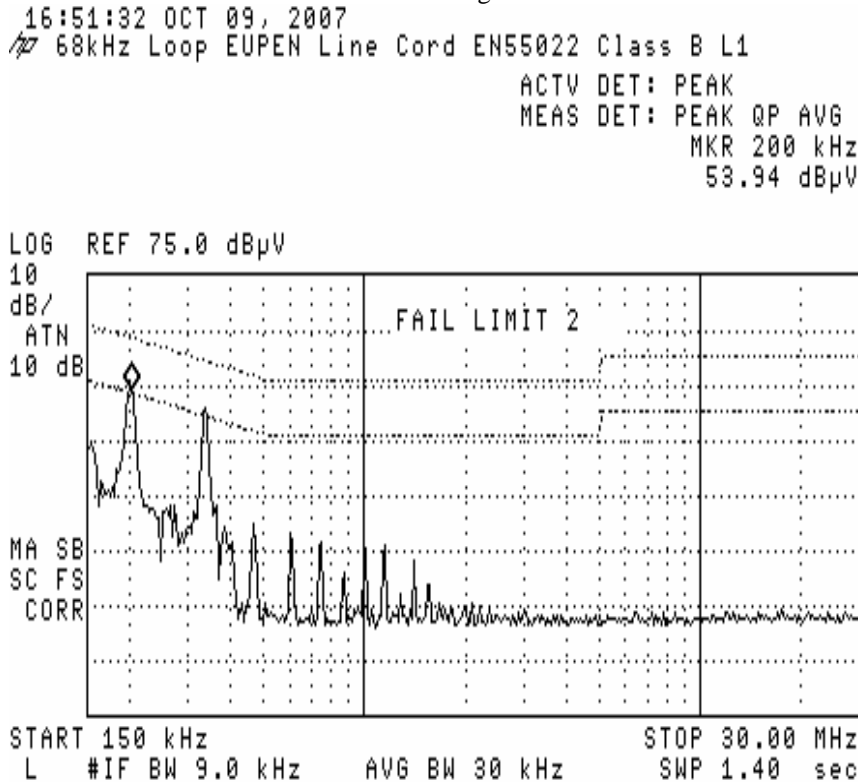


Figure 2.

16:54:38 OCT 09, 2007
68kHz Loop EUPEN Line Cord EN55022 Class B L2
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 200 kHz
54.10 dB μ V

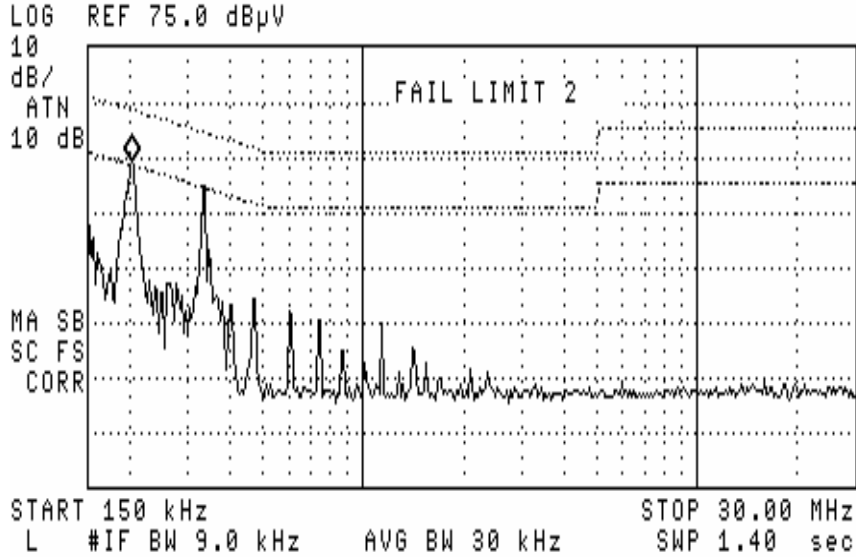


Figure 3.

08:40:25 OCT 10, 2007
68kHz Loop EUPEN Line Cord EN55022 Class B L1
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 205 kHz
53.59 dB μ V

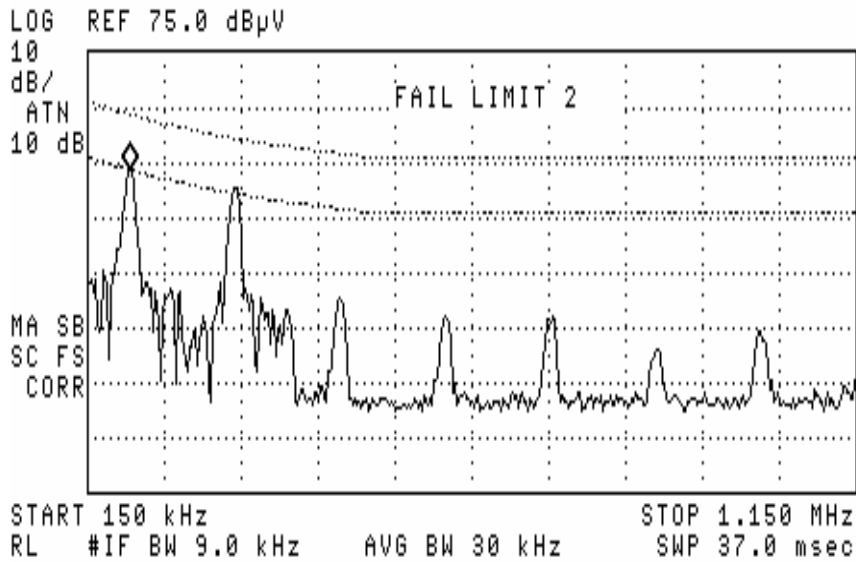


Figure 4.

08:43:00 OCT 10, 2007
68kHz Loop EUPEN Line Cord EN55022 Class B L2
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 205 kHz
53.55 dB μ V

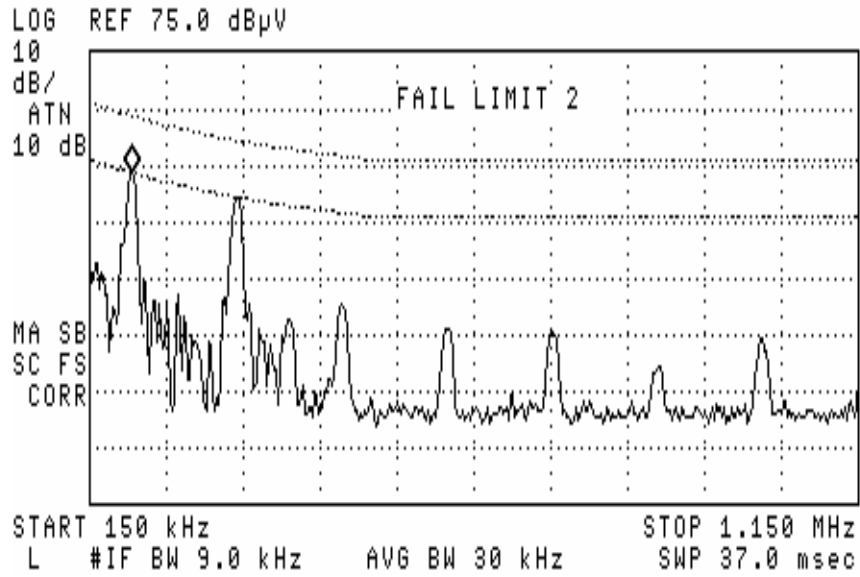
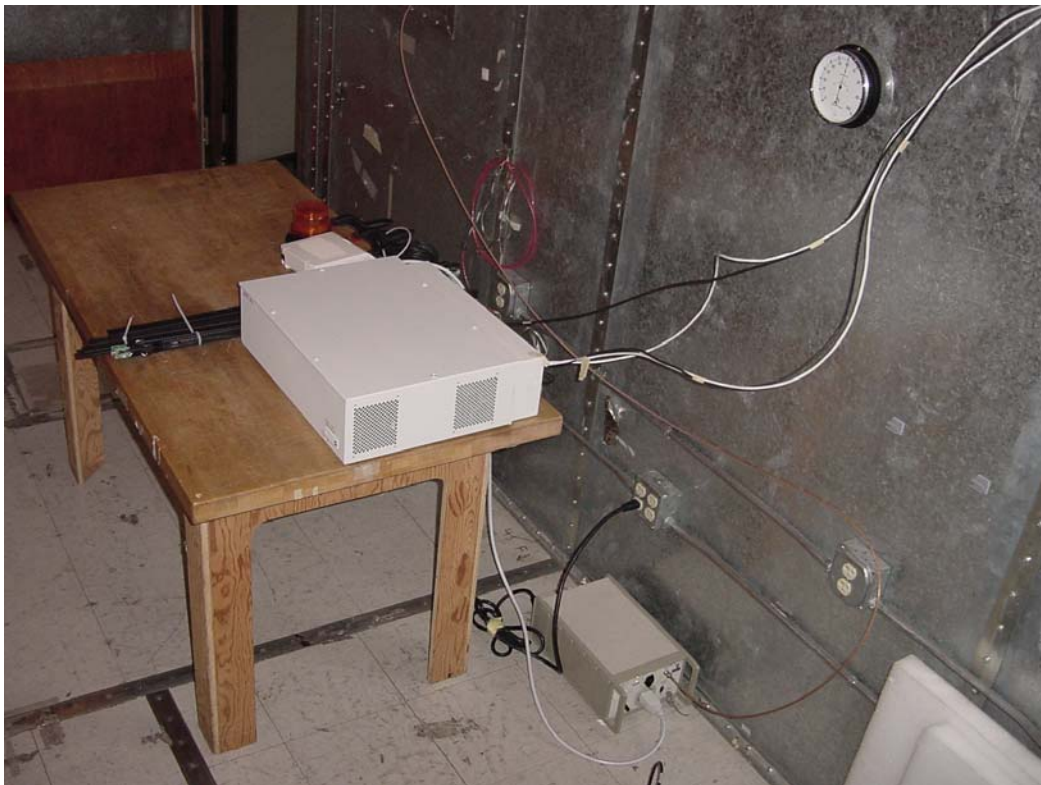


Figure 5.

Conducted Emissions setup



Antennas located outside the chamber



Shielded power cord required



5 Radiated Emissions

Radiated emissions data for this product are presented in two sections; one for above 30 MHz and one for below 30 MHz. The product demonstrated compliance with the requirements. Radiated emissions measurements below 30 MHz were performed at 15 meters. Propagation loss was determined by measuring emissions at 15 and 30 m. The results were compared to the limits by extrapolating the results to the specified measurement distance per 15.31(f)(2), using the 2-point extrapolation method. Tests were performed in accordance with method prescribed in ANSI C63.4.

Maximum radiation was determined by first assessing symmetry. The product exhibited semi-circular symmetry. Measurements were taken at radials of 22.5° throughout two quadrants; the measurement antenna was rotated for maximum pickup about the vertical axis of the measurement antenna at each radial. The maximum emission was determined to be with the measurement loop antenna in the vertical polarization, parallel to the radiating loop of the antenna structure.

The product was tested at input voltages to the power supply ranging from 102 – 138V, 60Hz. The emissions remained within the limits.

5.1 Radiated Emissions, FCC 15.209, 30-1000 MHz

Project Name	Radiated Emissions FCC Class B Limits	Filename	68kHz Loop_RadEMI_Chamber_10-4-07.doc
EUT Name	68kHz Loop 9040 Controller with 2 Loops	Serial Number	
Engineer	Stanley Strzelec	Part Number	
Technician	Stephen Krizmanich	Phone Number	
Test Name	Radiated Emissions	Date of Test	10/4/07 2:10:34 PM

Comments	Line Input: 120volts - 60Hz The 3040 Controller and 4 Ferrite Core Receivers are in chamber. The Digital Alarm, 2 Loops with associated Cap boxes (3'x7'x2' Loop - 15Amps Peak and 8'x10'x2' Loop - 12Amps Peak) are located outside chamber.
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Signal	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP Limits (dBuV)	Vert/Horz	Comments
1	43.1	34.1	27.2	40.0	Vert	Complies
2	100.0	36.7	35.4	43.5	Horz	Complies
3	150.0	33.5	33.3	43.5	Horz	Complies
4	300.0	31.3	27.2	46.0	Horz	Complies
5	180.0	40.5	34.1	43.5	Horz	Complies
6	240.0	34.5	24.0	46.0	Horz	Complies

Figure 1.

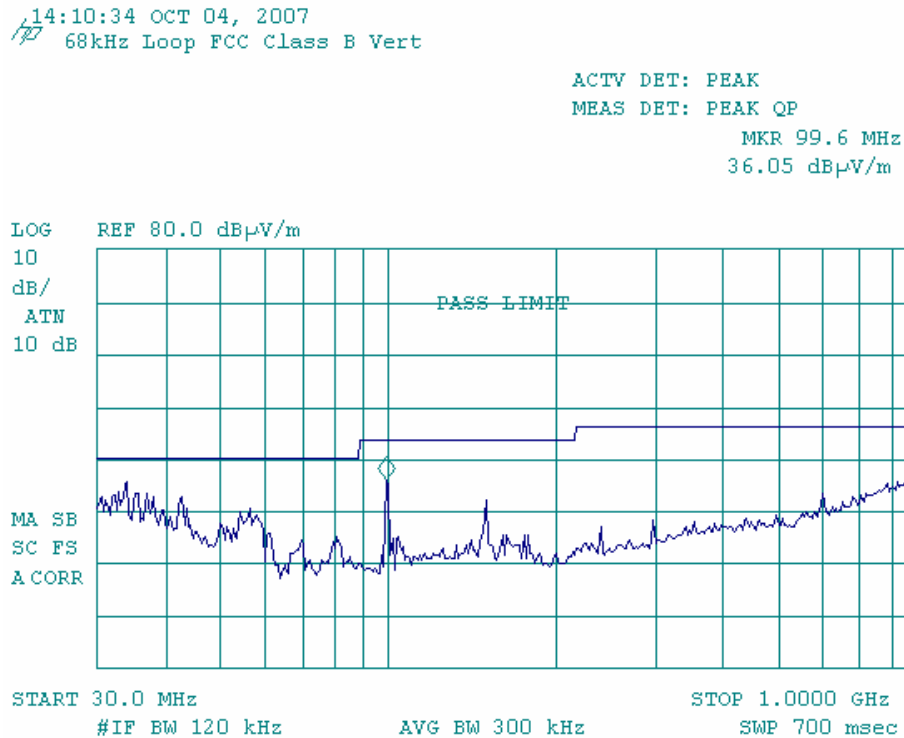


Figure 2.

14:15:07 OCT 04, 2007
68kHz Loop FCC Class B Horz

ACTV DET: PEAK
MEAS DET: PEAK QP
MKR 150.1 MHz
36.67 dB μ V/m

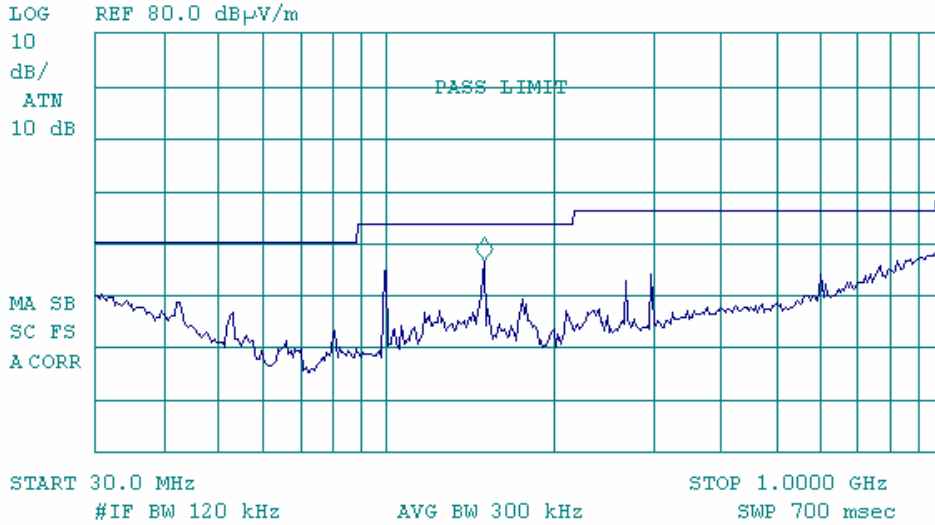


Figure 3.

14:17:43 OCT 04, 2007
68kHz Loop FCC Class B Vert

ACTV DET: PEAK
MEAS DET: PEAK QP
MKR 100.5 MHz
36.84 dB μ V/m

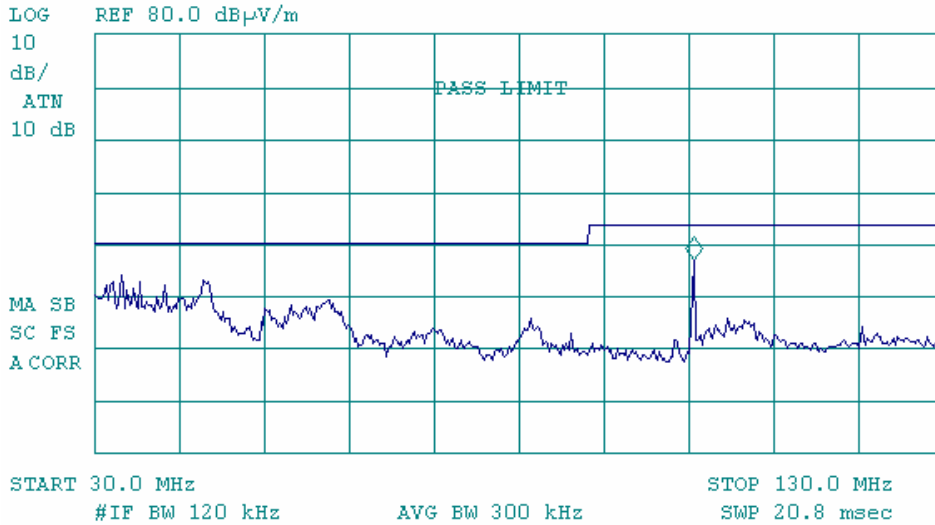


Figure 4.

14:20:51 OCT 04, 2007
68kHz Loop FCC Class B Vert

ACTV DET: PEAK
MEAS DET: PEAK QP
MKR 150.0 MHz
33.39 dB μ V/m

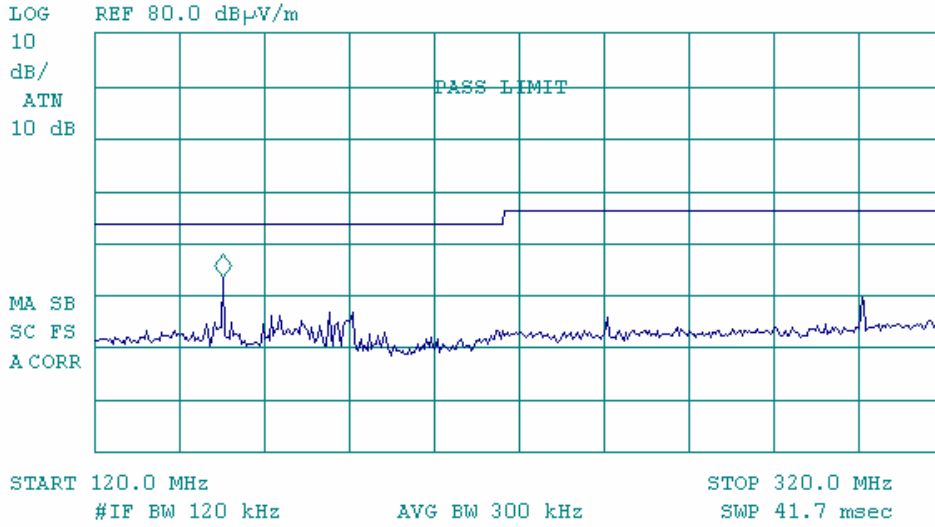


Figure 5.

14:39:27 OCT 04, 2007
68kHz Loop FCC Class B Horz

ACTV DET: PEAK
MEAS DET: PEAK QP
MKR 100.5 MHz
35.60 dB μ V/m

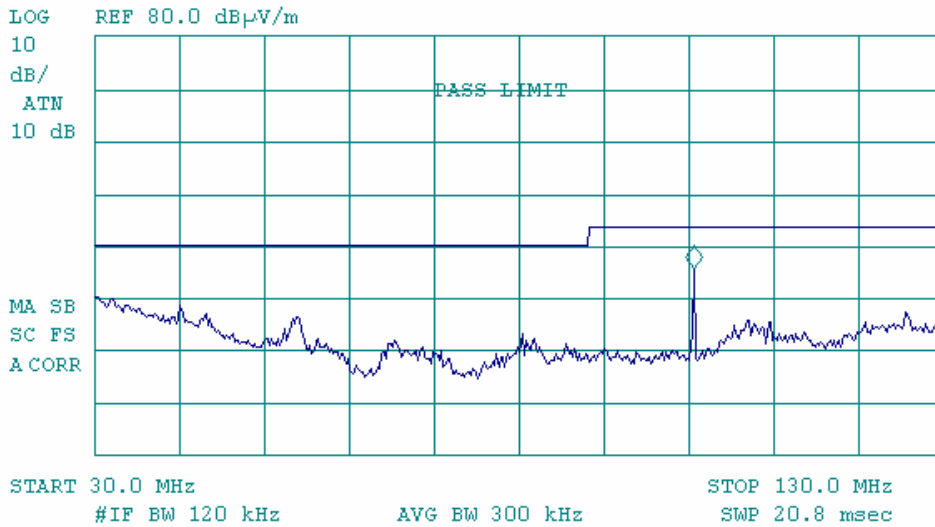


Figure 6.

14:41:30 OCT 04, 2007
68kHz Loop FCC Class B Horz

ACTV DET: PEAK
MEAS DET: PEAK QP
MKR 150.0 MHz
37.09 dB μ V/m

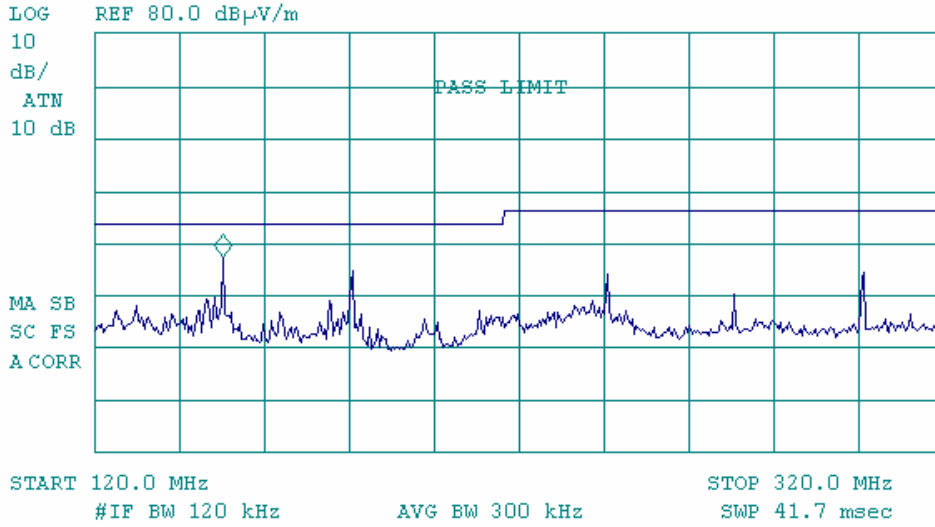


Figure 7.

14:27:58 OCT 04, 2007
68kHz Loop FCC Class B Vert

FREQ 43.11 MHz
PEAK 34.1 dB μ V/m
QP 27.2 dB μ V/m
AVG NOT SELECTED

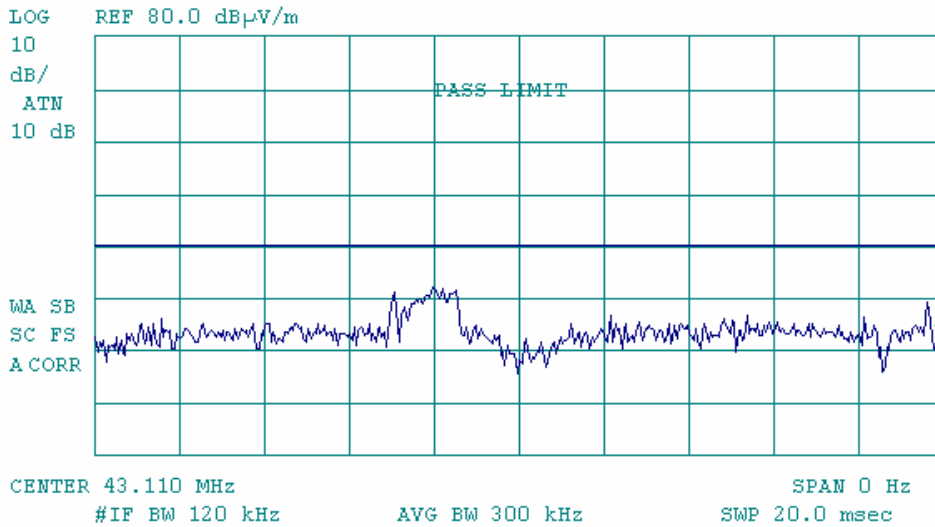


Figure 8.

14:32:07 OCT 04, 2007
68kHz Loop FCC Class B Vert

FREQ	100.00 MHz
PEAK	36.1 dB μ V/m
QP	34.8 dB μ V/m
AVG	NOT SELECTED

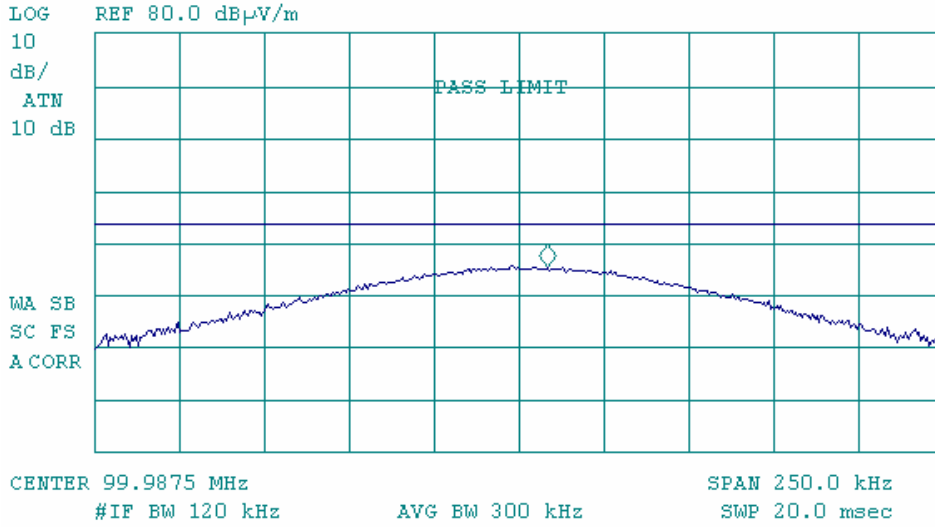


Figure 9.

14:36:54 OCT 04, 2007
68kHz Loop FCC Class B Vert

FREQ	150.0 MHz
PEAK	37.8 dB μ V/m
QP	32.0 dB μ V/m
AVG	NOT SELECTED

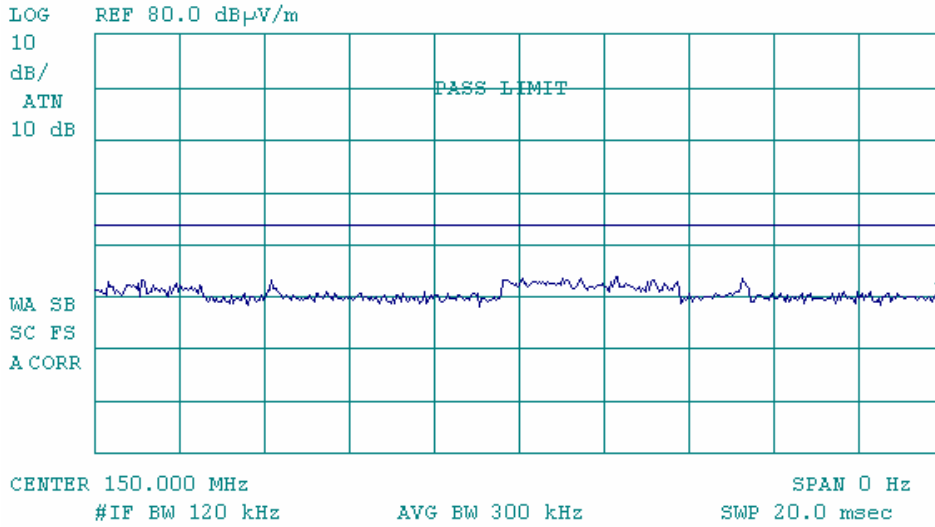


Figure 10.

14:45:19 OCT 04, 2007
68kHz Loop FCC Class B Horz

FREQ	99.99 MHz
PEAK	36.7 dB μ V/m
QP	35.4 dB μ V/m
AVG	NOT SELECTED

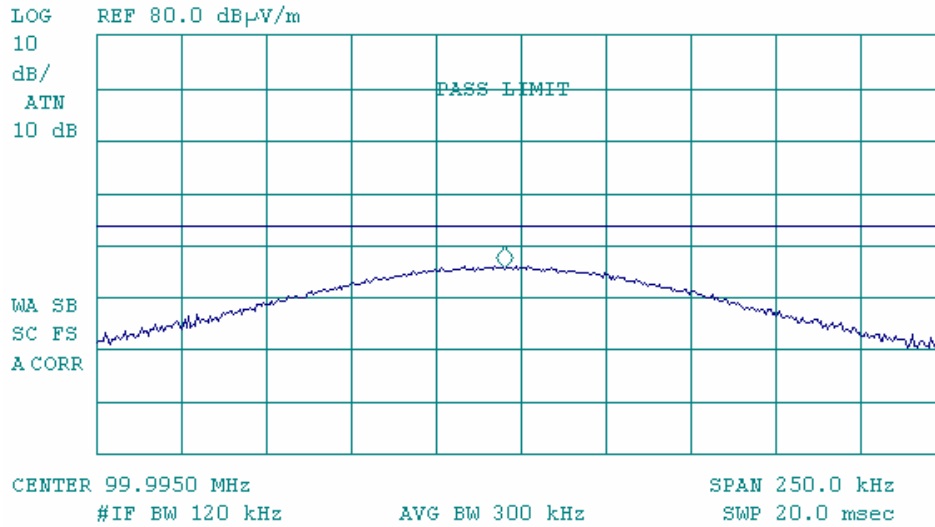


Figure 11.

14:52:54 OCT 04, 2007
68kHz Loop FCC Class B Horz

FREQ	150.0 MHz
PEAK	38.5 dB μ V/m
QP	33.8 dB μ V/m
AVG	NOT SELECTED

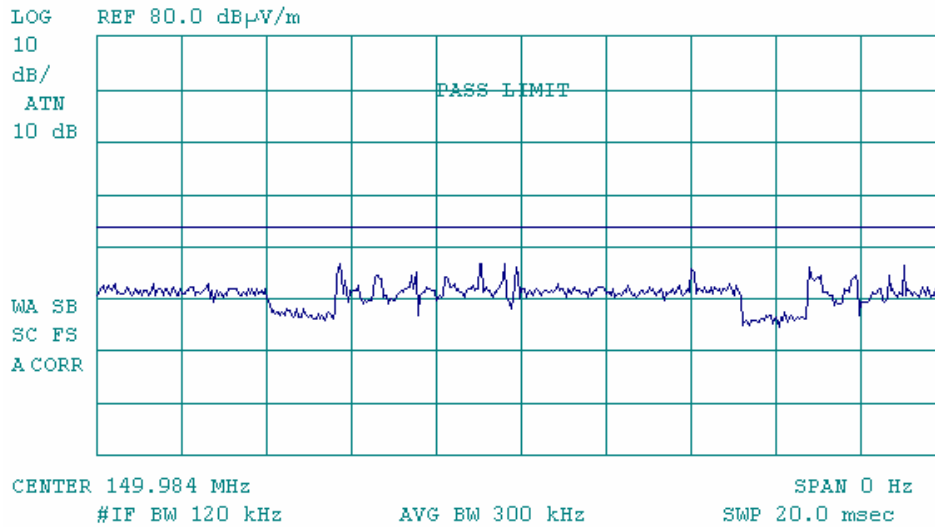


Figure 12.

14:58:00 OCT 04, 2007
68kHz Loop FCC Class B Horz

FREQ	300.0 MHz
PEAK	31.3 dB μ V/m
QP	27.2 dB μ V/m
AVG	NOT SELECTED

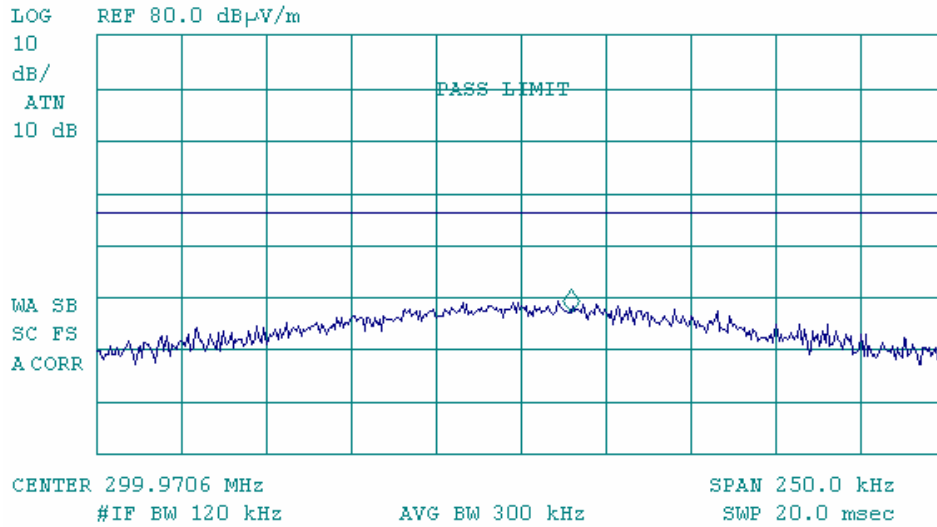
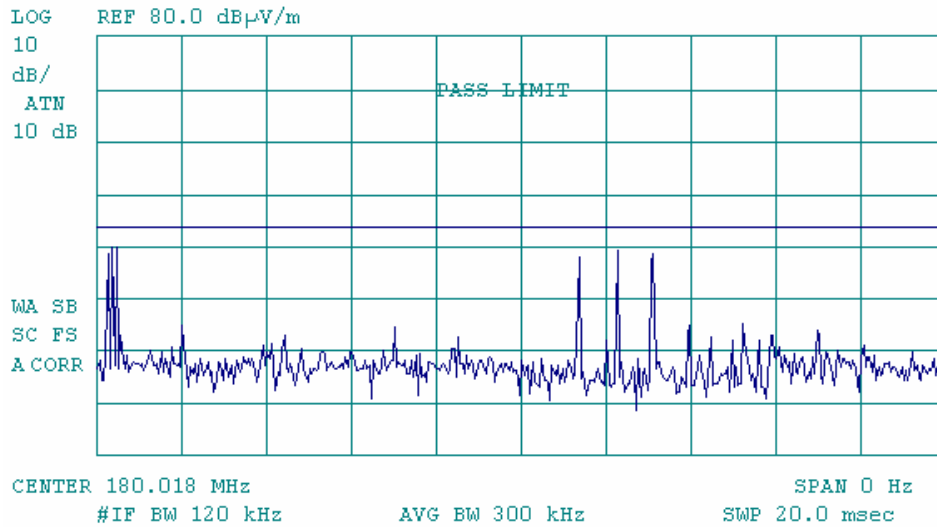


Figure 13.

15:04:27 OCT 04, 2007
68kHz Loop FCC Class B Horz

FREQ	180.0 MHz
PEAK	40.5 dB μ V/m
QP	34.1 dB μ V/m
AVG	NOT SELECTED

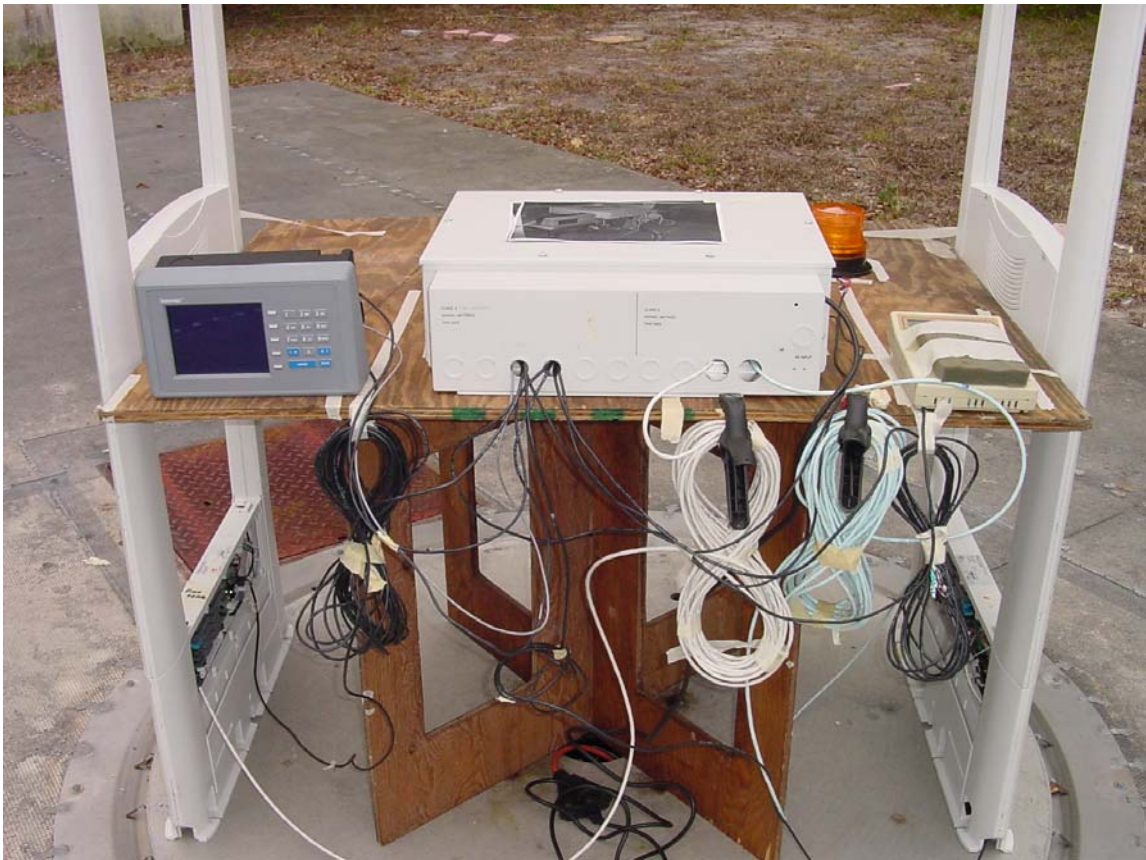


Radiated Emissions setup with amorphous core receive antennas



System antennas located outside of chamber

Typical OATS setup. Alternate antenna used for rotating system.



5.2 Radiated Emissions, FCC 15.209, below 30 MHz

Intentional Radiator	FCC part 15.209, 15.31, 15.33, 15.35	
Compliance Staff:	Krizmanich, Owsley	
Project Engineer:	Strzelec, Padula, Cooper, Catton, McLemore	
Test Date:	9/12/2007	
Test Site:	South Parking Lot, Congress Ave	
Product:	AMS-9040 68 kHz Loop System 8 ft x 10 ft X 2 ft	
Set-Up:	9040+Cap Brd+Ant Loop	
AC Line In:	120vac / 60hz	
:Transmit	45 Hz = 22.2 msec	
Cycle Freq	90 Hz = 11.1 msec	
Number of coil turns		4
Coil Area in meters		8.93 m ²
Coil current (amps)		8.3 A
Pulse TX on time:		1.6 mSec
TX total time:		11.1 mSec
Duty Cycle:		0.1441
DCCF:		-16.8 dB

Test Distance d1 (m)	15.0	m	
Test Distance d2 (m)	30.0	m	
20 x log(dist ratio)	6.0	6.0	6.0
	pk	QP	av
Fund Freq level@ d1	61.2	56.6	51.5
Fund Freq level@ d2	43.4	37.2	32.0
level@d1 - level@d2	17.8	19.4	19.5
Roll Off Factor - P	2.96	3.22	3.24
DCF d1 to 300m	-76.9	dB	
DCF d1 to 30m	-17.8	dB	

Note: Limits and details change at 490 kHz
Use Average detector for Freq bands 9-90 kHz and 110-490 kHz and above 1000 MHz per 15.209 (d).
Use QP detector for other Freq bands below 1000 MHz
Average Detector measuring time is set to 100 mSec per 15.35(c)
Peak Limit is 20 dB higher than QuasiPeak or Average Limit in Table of 15.209 per 15.35(b)
Measure Variation of Fundamental emission due to power supply variation +/-15% per 15.31(e)
F Fact: Filter Factor: Insertion loss of High Pass Filter, excluding fundamental.
DCCF (duty cycle correction factor) = 20 log (duty cycle) = 20 log (pulse duration/pulse repetition period) = 20 log (on time / repeat time)
Math Average of DCCF can be used instead of using Average Detector.
DCF: Use square law (40 dB).
If "Actual" is non-compliant, determine actual correction factor per formula below.
Dist_Corr_Factor = 20 log(Test Dist / 300)^P = 20 P log (Test Dist / 300)
Where P is the roll-off exponent. P is found as follows:
Roll off Factor P = (Level(@ Distance 1) - Level(@ Distance 2)) / 20 log (Distance 2 / Distance 1)

5.2.1 H- field data below 30 MHz, in particular 10 harmonics of the fundamental frequency.

Freq	S.A.	dBuV/m		Det	BW	Ant Fact	Filter Fact	DCF	DCCF	Pk Cor	QP Cor	MathAvg	AvgCor	FCC Limit	Limit	Margin	Peak Limit	Peak Margin
kHz	pk	QP	ave			dB	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dBuV/m	Distance	dB	dBuV/m	dB
102vac	57.4	53.4	46.0	pk / QP / av	200Hz	59.2	0	-76.9	-16.8	39.7	35.7	22.8	28.3	35.3	av@300m	7.0	55.3	15.6
138vac	60.0	55.6	50.3	pk / QP / av	200Hz	59.2	0	-76.9	-16.8	42.3	37.9	25.4	32.6	35.3	av@300m	2.7	55.3	13.0
68	61.2	56.6	51.5	pk / QP / av	200Hz	59.2	0	-76.9	-16.8	43.5	38.9	26.6	33.8	35.3	av@300m	1.5	55.3	11.8
136	3.3	-3.5	-11.4	pk / QP / av	200Hz	54.6	1.3	-76.9	-16.8	-17.7	-24.5	-34.6	-32.4	17.6	av@300m	50.1	37.6	55.4
204	39.7	39.1	18.8	pk / QP / av	9kHz	51.7	0.7	-76.9	-16.8	15.2	14.6	-1.7	-5.7	11.8	av@300m	17.5	31.8	16.6
272	24.4	16.6	-2.1	pk / QP / av	9kHz	49.3	0.4	-76.9	-16.8	-2.8	-10.6	-19.7	-29.3	8.8	av@300m	38.2	28.8	31.7
340	38.3	37.3	19.4	pk / QP / av	9kHz	47.4	0.3	-76.9	-16.8	9.1	8.1	-7.8	-9.8	7.1	av@300m	16.9	27.1	18.0
408	16.1	4.5	-7.3	pk / QP / av	9kHz	45.9	0.3	-76.9	-16.8	-14.6	-26.2	-31.5	-38.0	5.9	av@300m	43.9	25.9	40.5
476	22.8	21.8	4.1	pk / QP / av	9kHz	44.7	0.2	-76.9	-16.8	-9.2	-10.2	-26.1	-27.9	5.0	av@300m	33.0	25.0	34.3
544	10.5	3.6	-3.8	pk / QP / av	9kHz	44.0	0.2	-17.8	-16.8	36.9	30.0	20.1	22.6	44.1	QP@30m	14.1	64.1	27.2
612	17.0	7.4	18.4	pk / QP / av	9kHz	43.3	0.2	-17.8	-16.8	42.7	33.1	25.9	44.1	39.2	QP@30m	6.1	59.2	16.5
680	8.9	4.4	-9.1	pk / QP / av	9kHz	42.8	0.2	-17.8	-16.8	34.1	29.6	17.3	16.1	35.3	QP@30m	5.7	55.3	21.2

Open Area test site for H-field emissions



6 Occupied Bandwidth, RSS Gen 4.6.1

RSS 210e:2007. A bandwidth requirement was not specified for 68 kHz products, so the default 20dB bandwidth was measured. The HP 8591EM spectrum analyzer cannot measure a bandwidth over 1.8kHz in quasi-peak detection mode, so the bandwidth was measured in peak detection mode, providing a worst-case occupied bandwidth.

Project Name	Industry Canada BW Measurement	Filename	
EUT Name	AMS9040-68K	Serial Number	
Engineer	Stanley Strzelec	Phone Number	
Date of Test	3/17/08	Test Name	Industry Canada Bandwidth
Reg. Technician	Stephen Krizmanich		

Comments	Line Input:120vac 60hz
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Figure 1.

