

# TYCO / SENSORMATIC EMC TEST REPORT

Model:

AMS-1014

AMS-1003

FCC ID: BVCAMSUSUP

IC: 3506A-AMSUSUP

## Intentional Radiator

### FCC and IC

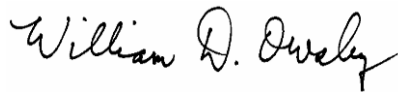
47 CFR, Part 15, Subpart B, and Subpart C

### Industry Canada

ICES-003e, RSS GENi3, RSS-210i8

Date:

October 11, 2011



EMC Engineer

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USA

Revision A	Oct. 11, 2011	Initial

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**1 SUMMARY OF RESULTS**

**1.1 47 CFR Part 15, Subpart B / Subpart C**

Part	PARAMETER TO BE MEASURED	Applies	Comments
<b>SubPart B, Unintentional Radiators (Class B)</b>			
15.107	Conducted Disturbance (Conducted Emissions, 0.15-30 MHz)	X	Complies
15.109	Radiated Disturbance (Radiated Emissions, 30-x000 MHz)	X	Complies
<b>SubPart C, Intentional Radiators (General Limit)</b>			
15.207	Conducted Disturbance (Conducted Emissions, 0.15-30 MHz)	X	Complies
15.209	Radiated Disturbance (Radiated Emissions, 0.009 plus x MHz)	X	Complies

**Compliance with 15.203:**

This product is professionally installed and setup, therefore the device is compliant with the requirement of this clause.

**Compliance with 15.204:**

The only antenna type used with this transmitter is a loop. The loop with the highest gain (area x turns x current) has been used for testing and the transmit circuit adjusted for highest output.

**1.2 IC RSS 210 (RSS GEN)**

Clause	PARAMETER TO BE MEASURED	Applies	comment
4.6.1	Emission Bandwidth - -20 dBc	X	Complies
4.6.2	6 dB Bandwidth		

**1.3 European Transmitter Tests, EN 300 330-2 / EN 300 330-1****(Product Class 1; Receiver Class 2)**

Clause	PARAMETER TO BE MEASURED	Applies	comment
<b>Transmitter Requirements</b>			
5.2.1 / 7.2.1	RADIATED H- FIELD	X	Complies
5.2.1 / 7.3	PERMITTED RANGE OF OPERATING FREQ	X	Complies
5.2.1 / 7.4	PERMITTED RANGE OF MODULATION BW	X	Complies
5.2.1 / 7.5.3	RADIATED EMISSIONS <30 MHZ	X	Complies
5.2.1 / 7.5.4	RADIATED EMISSIONS =>30 MHZ	X	Complies

**1.4 European EMC Tests, EN 301 489-1 as modified by EN 301 489-3**

Clause	PARAMETER TO BE MEASURED	Applies	comment
<b>Emissions parameters</b>			
8.4	CONDUCTED EMISSIONS ON AC MAINS (EN55022)	X	Complies
8.5	HARMONIC CURRENT (EN 61000-3-2, sec. 7 note 1)	X	< 75W, Complies
8.6	VOLTAGE FLUCTUATATIONS (EN 61000-3-3, sec 6.1)	X	Steady Current, Complies
<b>Immunity parameters</b>			
9.2	RF ELECTROMAGNETIC FIELD (.08-1 GHz , 1.4-2.7 GHz.)	X	Complies
9.3	ELECTROSTATIC DISCHARGE	X	Complies
9.4	FAST TRANSIENTS	X	Complies
9.5	CONDUCTED RADIO FREQUENCY DISTURBANCES	X	Complies
9.7	VOLTAGE DIPS AND INTERRUPTIONS	X	Complies
9.8	SURGES	X	Complies

**2 DESCRIPTION AND CHARACTERISTICS OF THE EUT**

**2.1 Description and Characteristics of Equipment Under Test (EUT).**

Unit Model: AMS-1014, and AMS-1003

**2.1.1 Additional EUT Setup / Configuration Details**

Configurator:

Boot Version:

**2.1.2 Type Designation**

The type designation may be either a single alphanumeric code or an alphanumeric/code divided into two parts.

TYPE DESIGNATION AS A SINGLE ALPHANUMERIC CODE: (See Note 1)

A	M	S	-	1	0	1	4												
A	M	S	-	1	0	0	3												

OR TYPE DESIGNATION IN TWO PARTS:

1. EQUIPMENT SERIES No. (See Note 2)

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

2. EQUIPMENT SPECIFIC No. (See Note 3)

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Note 1: This is the manufacturer’s numeric or alphanumeric code or name that is specific to a particular equipment. It may contain information in coded form on the characteristics of the equipment e.g. frequency, power. The manufacturer is free to choose the form of the type designation.

Note 2: This is the number, code or trade name used by the manufacturer to describe a series or “family” of equipment of substantially the same mechanical and electrical construction which will include a number of related equipments. This number is often referred to as the “model no.”

Note 3: This is the manufacturer’s identification number given to specific equipment in the series or “family” of equipments. It is often referred to as the “identification number”.

### 2.1.3 Construction Of Equipment Under Test (EUT)

Single unit

Multiple units

Describe each unit clearly:

2 pedestals; Control section in primary and capacitor section in secondary, interconnected by antenna cable.

### 2.1.4 Overview

The AMS-1014 is a controller capable of driving a pair of antennas to generate a magnetic field to excite EAS tags, receive the tag signal and alarm when an acceptable tag signal is detected and verified. This controller functions by transmitting a 58 kHz ringing burst for 1.6 mS at a maximum rate of 90 Hz. Then at the end of the burst, detects the resonant ringing of any tags in the field. A single main PCB in the Primary pedestal accommodates the Receiver, the Switching Amplifier, Transmitter, and the Power Supply. The Secondary pedestal has a capacitor board for tuning the loop to resonance.

The AMS-1003 uses the same controller board as the AMS-1014 above.

The pedestal holding the loop antennas is a little smaller as are the enclosed antennas.

This is a cost reduced version of the AMS-1014.

### 2.1.5 A limited modular approval

The two models, AMS-1014 / AMS-1003, using the same modular controller board, BVCAMSUSUP, will be assembled at the factory under the control of the manufacturer. Then each complete assembly is shipped to the customer. There is no mechanism for installing the module into any other end product outside of the manufacturer's control. Any future models will be fully tested to ensure continued compliance and are manufactured under the applicants control.

FCC note: may be granted for single or split modular transmitters that do not comply with all of the above requirements, e.g. , shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation, if the manufacturer can demonstrate by alternative means in the application for equipment authorization that the modular transmitter meets all the applicable part 15 requirements under the operating conditions in which the transmitter will be used. Limited modular approval also may be granted in those instances where compliance with RF exposure rules is demonstrated only for particular product configurations. The applicant for certification must state how control of the end product into which the module will be installed will be maintained such that full compliance of the end product is always ensured.

### 2.1.6 Installation

This system is professionally installed.

**2.1.7 Equipment Ratings**

Power Supply

Primary input .....100-120Vac or 200-240Vac @ 50–60Hz  
 Primary power fuse.....3.15A, 250V, slo-blow  
 Current draw (120V) .....<1.5Arms  
 Current draw (240V) .....<1Arms  
 Input power (120V) .....<130W  
 Input power (240V) .....<123W

Transmitter

Operating frequency .....58kHz (±20 %)  
 Transmit burst duration.....1.6ms  
 Transmit current maximum.....16A peak  
 Burst Repetition Rate:  
 Based on 50Hz ac.....75Hz or 37.5Hz  
 Based on 60Hz ac.....90Hz or 45Hz

Receiver

Center frequency .....58kHz

Ambient temperature .....0°C to 50°C, (32°F to 122°F)  
 Relative humidity .....0 to 90%, non-condensing

**2.1.8 Frequency Characteristics And Internal Clocks**

58 kHz +/- 20%  
 100 kHz  
 16 MHz  
 20 MHz  
 30 MHz  
 50 MHz  
 100 MHz

**2.1.9 Marketing And Installation Environment**

Either (FCC 15: Sub-part B, Class A or B) – Unintentional Radiator

- Emissions Class A is non-residential, not advertised or marketed to general public.
- or
- Emissions Class B is residential; advertised and marketed to general public
- And/or
- FCC 15, Sub-part C – Intentional Radiator

## 2.2 Test Site Registration

The Tyco Safety Products / Sensormatic Electronics, LLC OATS located at 6600 Congress Ave. Boca Raton, FL. 33487 is registered with the FCC, number – 889978 and 616407, and with Industry Canada, number – 3506A-1.

## 2.3 Test Procedures

Intentional and Unintentional Radiators are measured for compliance using the following procedure excluding sections 4.1.5.2, 5.7, 9 and 14: ANSI C63.4–2003.

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. (FCC 15.31)

## 2.4 Sample Calculation – Radiated & Conducted Emissions

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

$$\text{Field Strength (dB}\mu\text{V/m)} = \text{RAW} - \text{AMP} + \text{CBL} + \text{ACF}$$

Where:

RAW = Measured level before correction (dB $\mu$ V)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\text{dB}\mu\text{V/m} = 20 * \log * \mu\text{V/m}$$

Margin to Limit is calculated by subtracting corrected measurement from Limit. Positive margin indicates compliance. Negative margin indicates non-compliance

To convert dB $\mu$ V/m to dB $\mu$ A/m,

Reduce reading in dB $\mu$ V/m by 51.5 dB to convert to dB $\mu$ A/m.



**Per IC RSS-Gen, Ver. E, Section 4.8,**

The following formula may be used to convert field strength (FS) in volts/metre to transmitter output power (TP) in watts:

$$TP = (FS \times D) / (30 \times G)^2$$

Where D is the distance in meters between the two antennas and G is the antenna numerical gain referenced to isotropic gain.

(Note: In an open-area test measurement, the effect due to the metal ground plane should be subtracted from the maximum field strength value in order to reference it to free space, before calculating TP.)

**Effective Radiated Power is converted to Field Strength by the following:**

The Friis transmission equation governs the interaction between two antennas in the far field:

$$P_r = \frac{P_t G_t G_r \lambda^2}{(4\pi r)^2}, \quad (5)$$

where  $P_r$  is the power measured at the receive antenna output port;

$P_t$  is the power measured at the transmit antenna input port;

$G_t$  is the gain of the transmit antenna;

$G_r$  is the gain of the receive antenna;

$\lambda$  is the wavelength; and

$r$  is the separation between the two antennas (the range length).

The electric field generated at a point in the far field as a function of the transmitted power is given by

$$E = \frac{\sqrt{30 P_t G_t(\theta, \phi)}}{r}, \quad (12)$$

where  $E$  is the electric field generated at the distance  $r$  from the transmit antenna,

$P_t$  is the power measured at the transmit antenna input port,

$G_t(\theta, \phi)$  is the angle-dependent gain of the transmit antenna, and

$r$  is the distance from the transmit antenna to the test point (the range length)

Info: <http://www.ce-mag.com/archive/02/Spring/fogelle2.html>

**Note: power levels into a dipole results in an E-field at a distance according to**

$$\text{power: } (V^2) / R = P$$

$$\text{power flux density: } s = P / (4 * \pi * r^2), \text{ where } \pi = 3.14 \text{ and } r = \text{distance}$$

$$\text{field strength: } e = \sqrt{120 * \pi * s} = \sqrt{30 * P} / r$$

A half-wave dipole has a 1.64 gain in its equatorial plane, therefore:

$$e = \sqrt{1.64 * 30 * P} / r = 7 * \sqrt{P} / r$$

**Field strength (e)  $e = (7.02 * \sqrt{ERP}) / d$ , ERP in Watts, d in meters.**

Or Source Radiating (ERP) ->  $ERP = (e * d / 7.02)^2$  in Watts, Volts/meter, meters

Conversion to dBuV from [http://www.compeng.com.au/emc\\_conversion\\_tables\\_rf\\_calculator2.aspx](http://www.compeng.com.au/emc_conversion_tables_rf_calculator2.aspx)

## 2.5 Uncertainty of Measurements

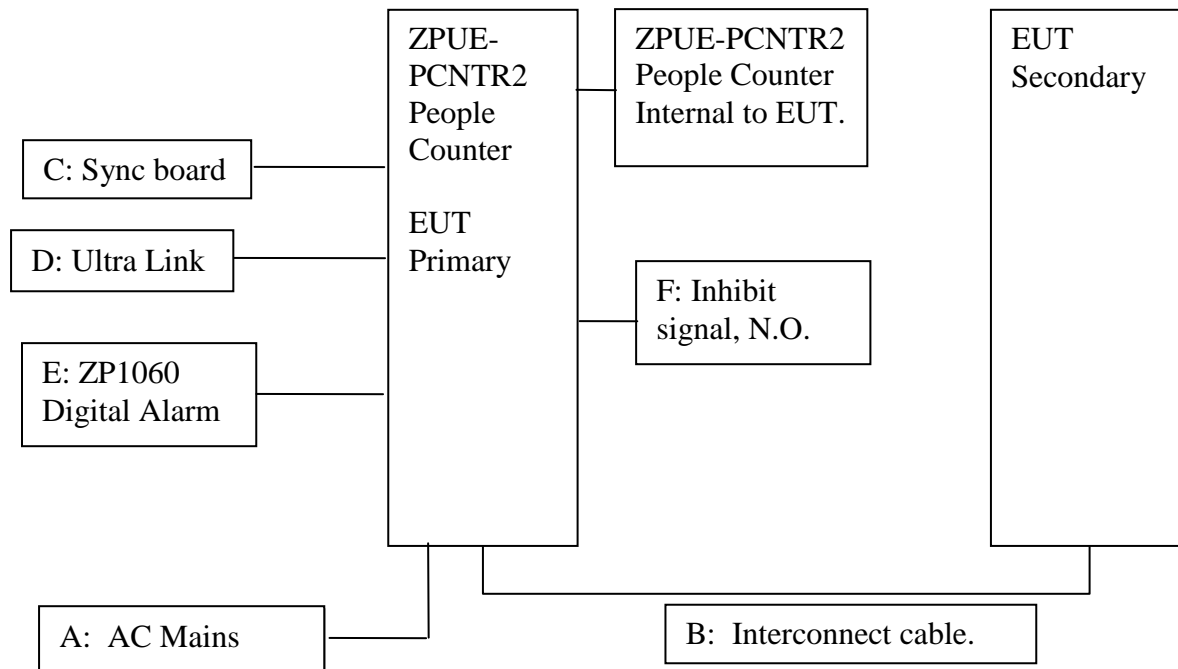
<b>Combined Standard Uncertainty and Expanded Uncertainty using an expansion factor of 2. (estimated)</b>		<b>CISPR 16-4-2 Uncertainty Limits</b>
Radiated Emissions = $\pm 1.56$ dB	Expanded Uncertainty = 3.12 dB	5.2 dB
Conducted Emissions = $\pm 1.12$ dB	Expanded Uncertainty = 2.24 dB	3.6 dB
Harmonic Current and Flicker = $\pm 2.6$ %	Expanded Uncertainty = 5.12 %	
Radiated Immunity = $\pm 2.15$ dB	Expanded Uncertainty = 4.3 dB	
ESD Immunity = 4.15 %	Expanded Uncertainty = 8.3 %	
EFT - Fast Transient Immunity = $\pm 2.82$ %	Expanded Uncertainty = 5.64 %	
Conducted Immunity = $\pm 1.83$ dB	Expanded Uncertainty = 2.24 dB	
Voltage Variation and Interruption = $\pm 1.7$ %	Expanded Uncertainty = 3.4 %	
Surge Immunity = $\pm 3.1$ %	Expanded Uncertainty = 6.2 %	

Uncertainty values were calculated based on methods in ETSI TR 100 028.

Per EN 300 330-1, Clause 9, the value of the measurement uncertainty for each measurement, shall be equal to or lower than the figures given below.

RF frequency  $\pm 1 \times 10^{-7}$ ;  
 RF power, conducted  $\pm 1$  dB;  
 RF power, radiated  $\pm 6$  dB;  
 Temperature  $\pm 1$  °C;  
 Humidity  $\pm 5$  %.

**3 TEST SET-UP BLOCK DIAGRAM**



List Of Ports

	Function	Classification	Max Cable Length	Test Length	Cable Type/Description
A	AC Mains	AC power	> 1 m but < 3 m	1.83m	3 conductor unshielded
B	Interconnect cables	Signal	< 3 m	2.5m	Shielded 2 Twisted Pairs w/drain
C	Multi-Unit sync	Signal	>3m		
D	Data	Signal	>3m		Unshielded Cat 5
E	Remote Alarm	Signal	>3m		
F	Inhibit sig	Signal	>3m		

\* Classify ports as ac power, dc power, or signal/control.

\*\* Classify maximum cable lengths as ≤ 1 m, > 1m but ≤ 3 m, or > 3m

**4 FCC TESTS**

**4.1.1 Conducted Emissions, FCC Part 15, Clause 15.107 And 15.207**

Limit : Class B, and general limits of 15.207  
 Equipment operation : Tag Detecting  
 Line Voltage / Freq : 120V / 60 Hz  
 Temp : 25.2° C  
 Humidity : 50.8% RH  
 Date : 06/06/2011

FCC Class B 15.107 and 15.207 limits

Frequency range	Quasi-peak (dBuV)	Average (dBuV)
0,15 - 0,50	66 - 56	56 - 46
0,50 - 5	56	46
5 - 30	60	50

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Freq (MHz)	Det	Reading		120 Volts 60 Hertz	Limit	Margin
		dBuV	Line	Corrected	Class B	
0.522	QP	49.94	L1	49.94	56.00	6.06
	Avg	34		34	46.00	12.00
7.3	QP	55.89	L1	55.89	60.00	4.11
	Avg	39.93		39.93	50.00	10.07
7.3	QP	57.15	L2	57.15	60.00	2.85
	Avg	41.48		41.48	50.00	8.52
8.55	Qp	55.48	L1	55.48	60.00	4.52
	Avg	33.94		33.94	50.00	16.06
8.55	Qp	55.76	L2	55.76	60.00	4.24
	Avg	33.88		33.88	50.00	16.12
23	Qp	52.95	L2	52.95	60.00	7.05
	Avg	27.86		27.86	50.00	22.14

AMS-1003

Screen captures indicate the same profile or slight reduction in conducted emissions.

Figure 1. Conducted Emissions on Line 1 (L1) (peak hold over time) AMS-1014

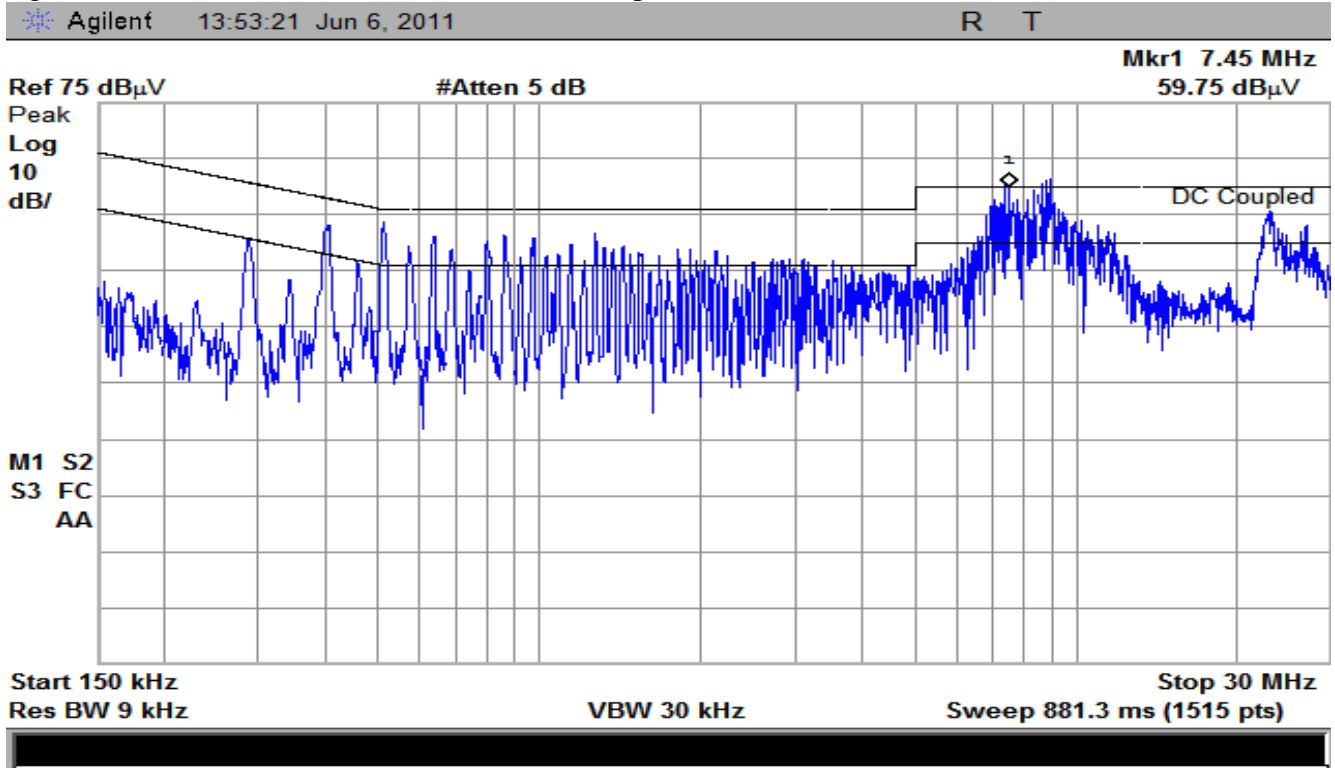


Figure 2. Conducted Emissions on Line 2 (L2) (peak hold over time) AMS-1014

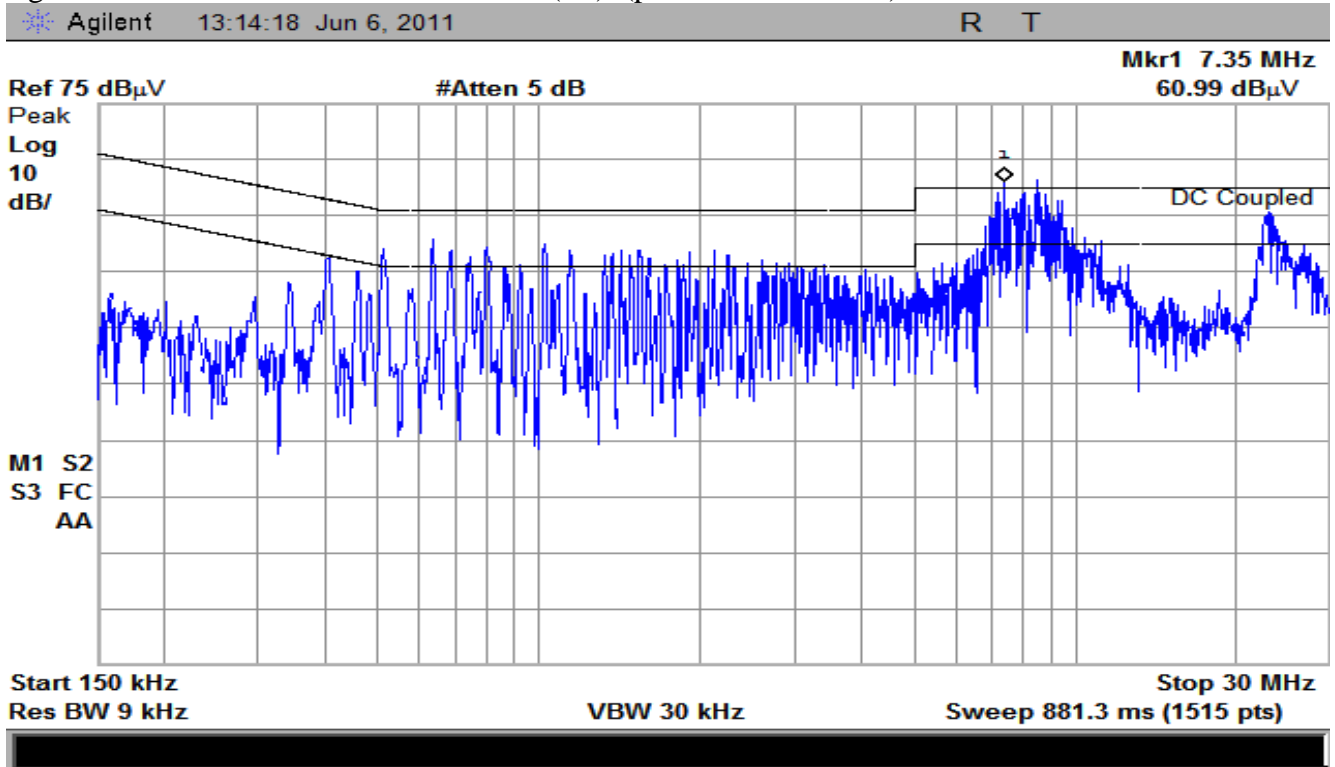


Figure 3. Conducted Emissions on Line 1 (L1) (peak hold over time) AMS-1003

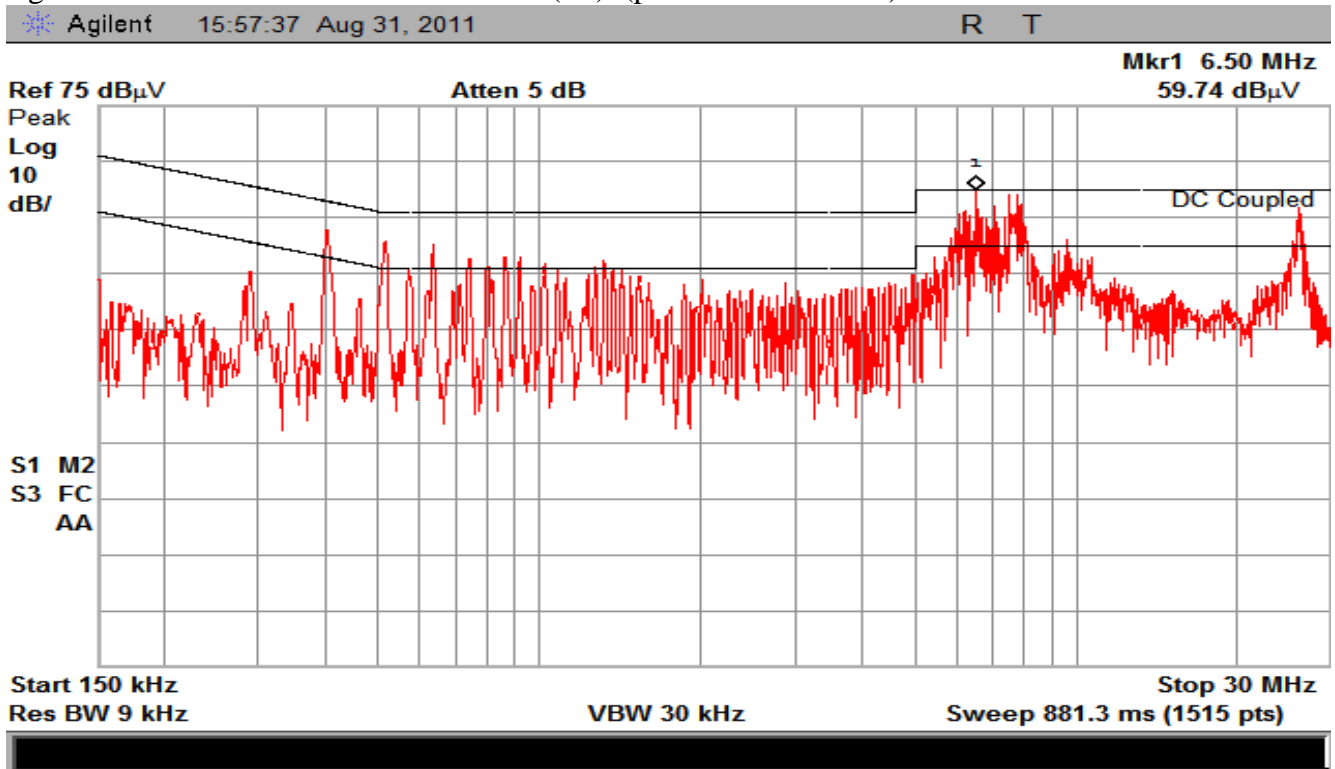
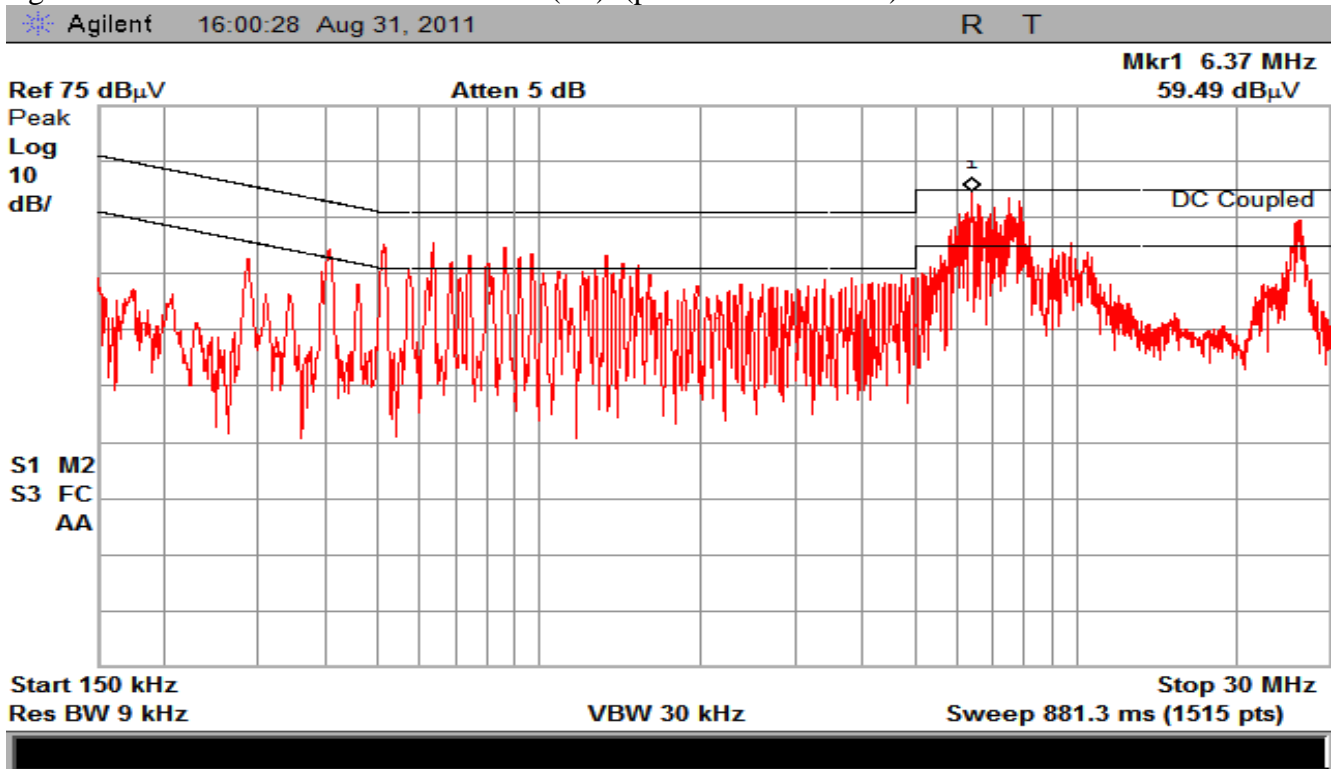


Figure 4. Conducted Emissions on Line 2 (L2) (peak hold over time) AMS-1003



**4.1.2 Radiated Emissions, FCC Part 15, Clause 15.109 and 15.209 (above 30 MHz)**

Limit : Class B  
 Equipment operation : Tag Detecting  
 Line Voltage / Freq : 120V / 60 Hz  
 Distance : 3 meters OATS  
 Temp : 36.8° C  
 Humidity : 42.9% RH  
 Date : 06/07/2011

LIMIT FCC Part 15, Subpart B.

Class B digital devices at 3 meters, Subpart B and General Limits, Subpart C

Frequency of emission (MHz)	Field strength (microvolts/meter)	Field strength (dBuV/m) at 3 meters
30–88	100	40
88–216	150	44
216–960	200	46
Above 960	500	54

Measurements: AMS-1014

Freq (MHz)	QP (dBuV)	Antenna	Polarization	ant fac	cable fac	Pre-amp	Corrected	Class B	Margin
32.39	21.84	Bi-con #1	Vert	12.676	0.85	0	35.36	40.00	4.64
150	24.4	Bi-con #1	Vert	12.143	2.20	0	38.74	43.50	4.76
150	21.3	Bi-con #1	Horz	12.632	2.20	0	36.13	43.50	7.37
300	22.76	LP #1	Horz	14.32	3.68	0	40.76	46.00	5.24
600	14.8	LP #1	Horz	18.747	6.44	0	39.98	46.00	6.02
600	19.26	LP #1	Vert	18.992	6.44	0	44.69	46.00	1.31

Note Sync signal provided by another PCB of the same construction with the transmitter disabled but the digital circuits functioning to provide signal. This contributed to emissions. Re-measured data follows: Sync signal source and other support equipment located remote as in typical setup.

Freq (MHz)	QP (dbUv)	Antenna	Polarization	ant fac	cable fac	Pre-amp	Corrected	Class B	Margin
32.42	23.26	Bi-con #1	Vert	12.676	0.85	0	36.78	40.00	3.22
150	20.03	Bi-con #1	Vert	12.143	2.20	0	34.37	43.50	9.13
150	9.92	Bi-con #1	Horz	12.632	2.20	0	24.75	43.50	18.75
300	9.9	LP #1	Horz	14.32	3.68	0	27.90	46.00	18.10
300	19.88	LP #1	Vert	14.754	3.68	0	38.32	46.00	7.68
600	13.8	LP #1	Horz	18.747	6.44	0	38.98	46.00	7.02
600	16.99	LP #1	Vert	18.992	6.44	0	42.42	46.00	3.58

The following are pre-compliance chamber frequency scans.  
Figure 1. Horizontal (peak hold over time) AMS-1014

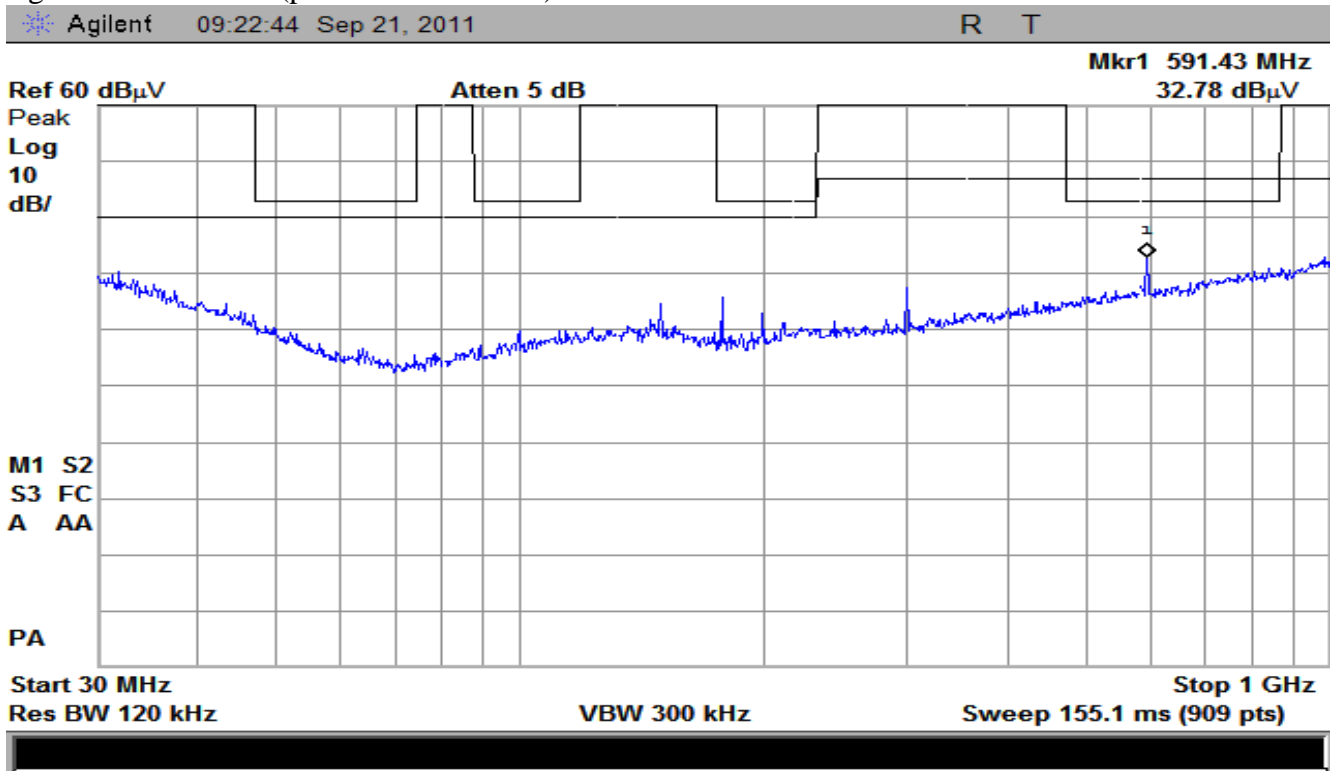


Figure 2. Vertical (peak hold over time) AMS-1014

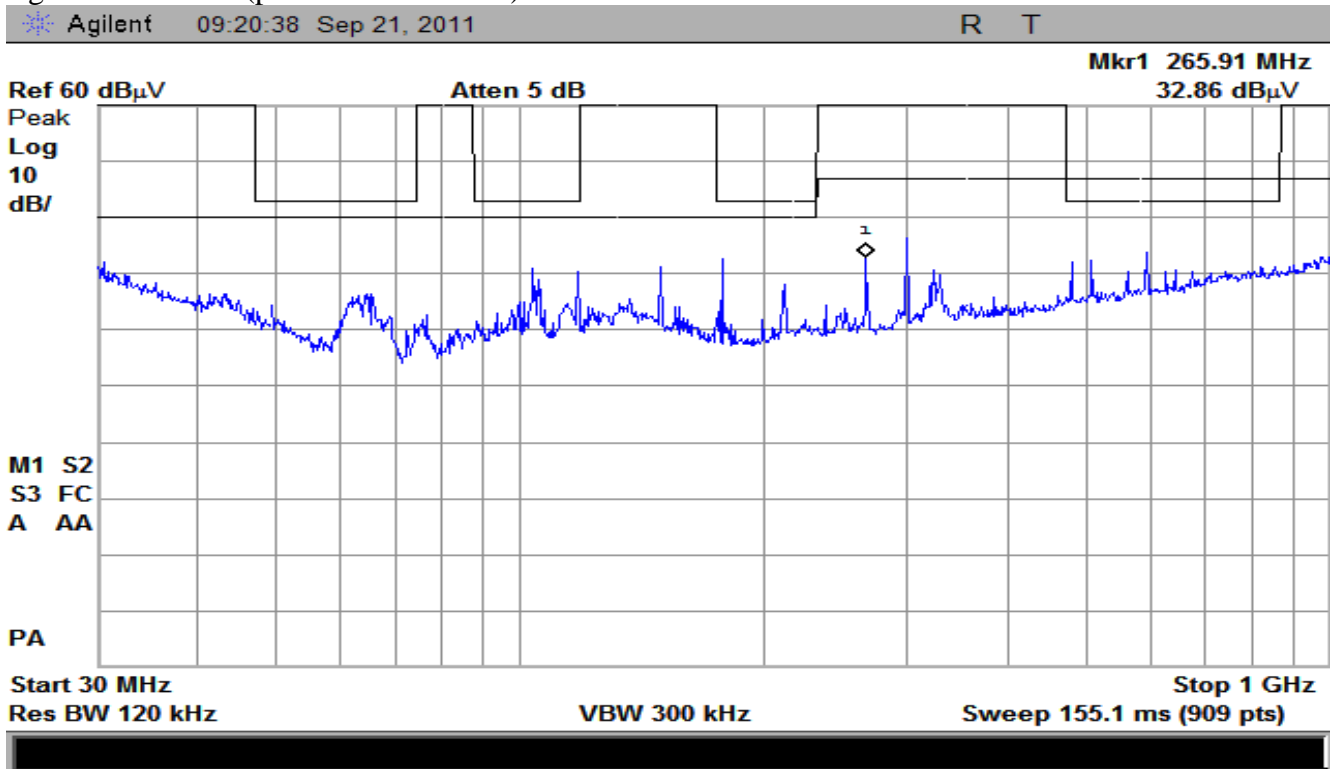




Figure 3. Horizontal (peak hold over time) AMS-1003

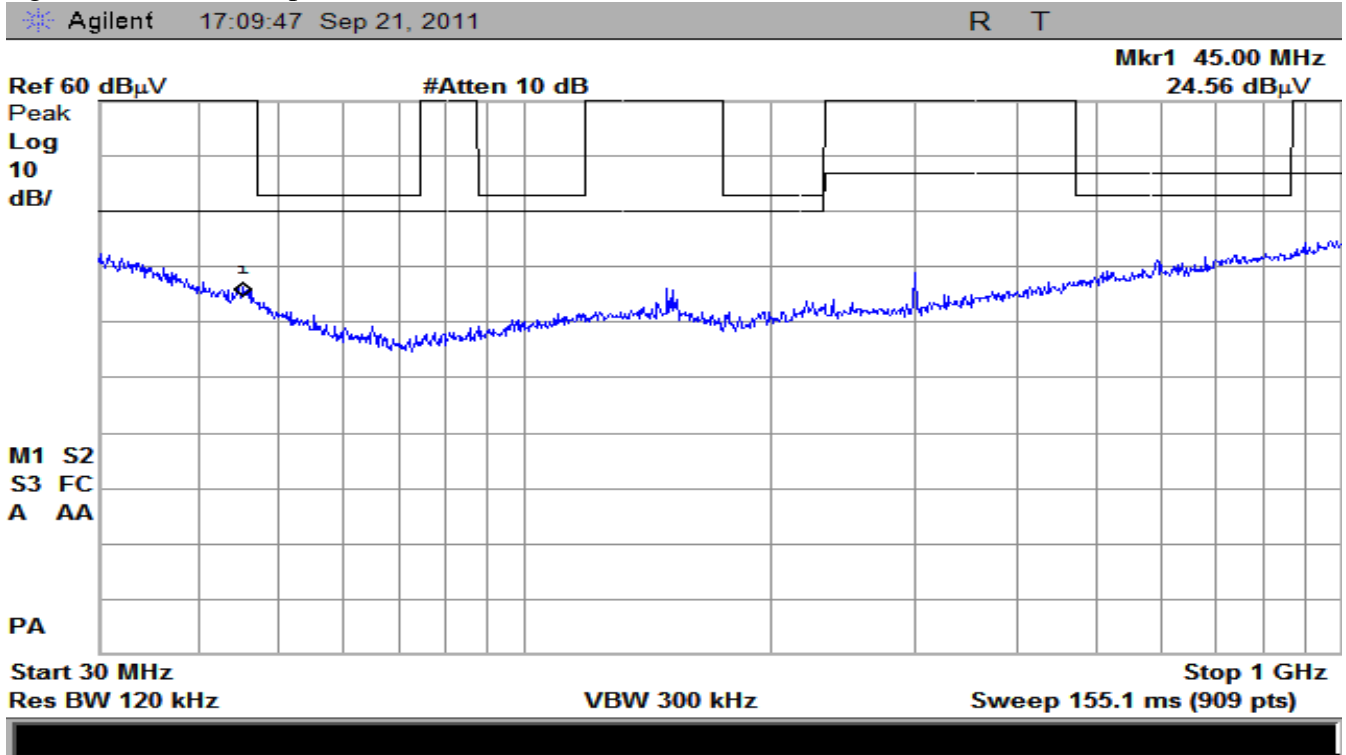
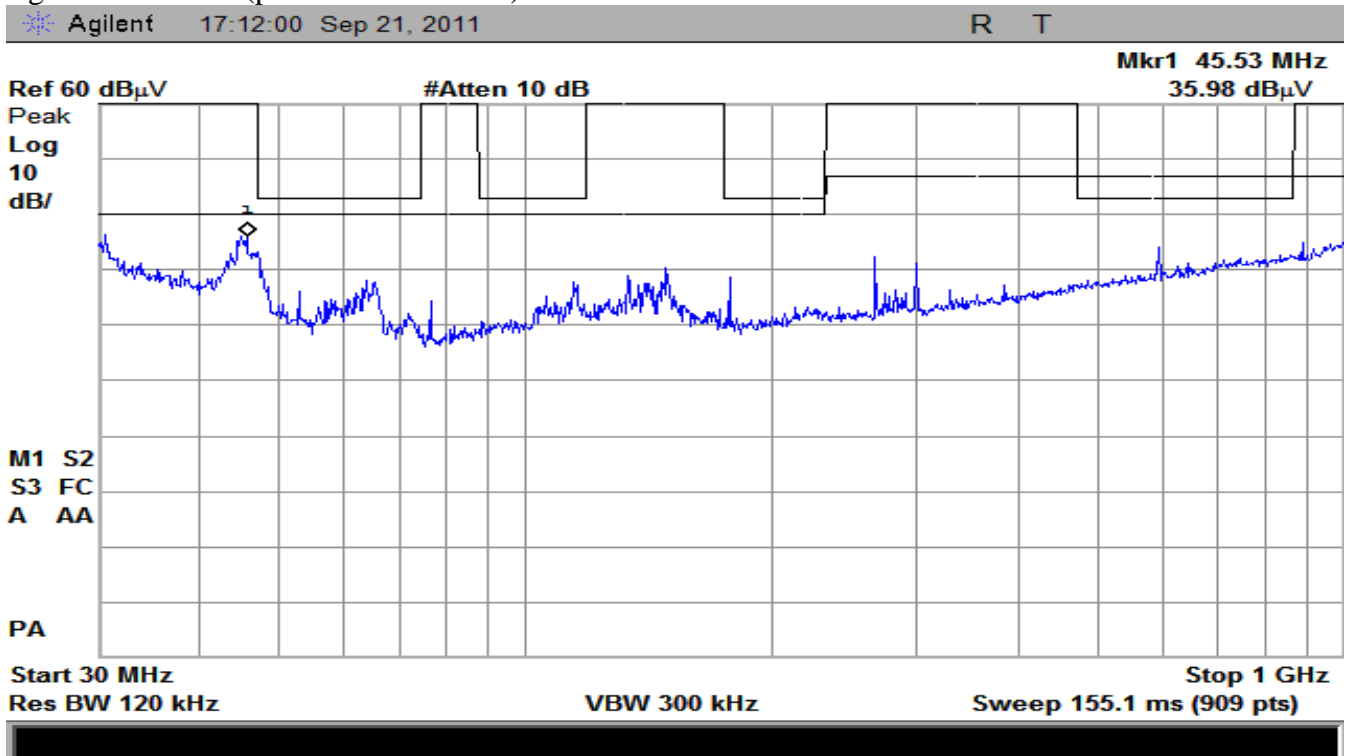


Figure 4. Vertical (peak hold over time) AMS-1003



**4.1.3 Radiated Emissions, FCC Part 15, Clause 15.209 (below 30 MHz)**

Limit : General Limits  
 Line Voltage / Freq : 120V / 60 Hz  
 Distance : 10 meters, H-field OATS  
 Temp : 33.2° C  
 Humidity : 52% RH  
 Date : 05/25/2011

All measurements made at appropriate RBW, 200 or 9000 Hz and with proper detector.  
 Average Det. up to 490 kHz and QP Det. above that.

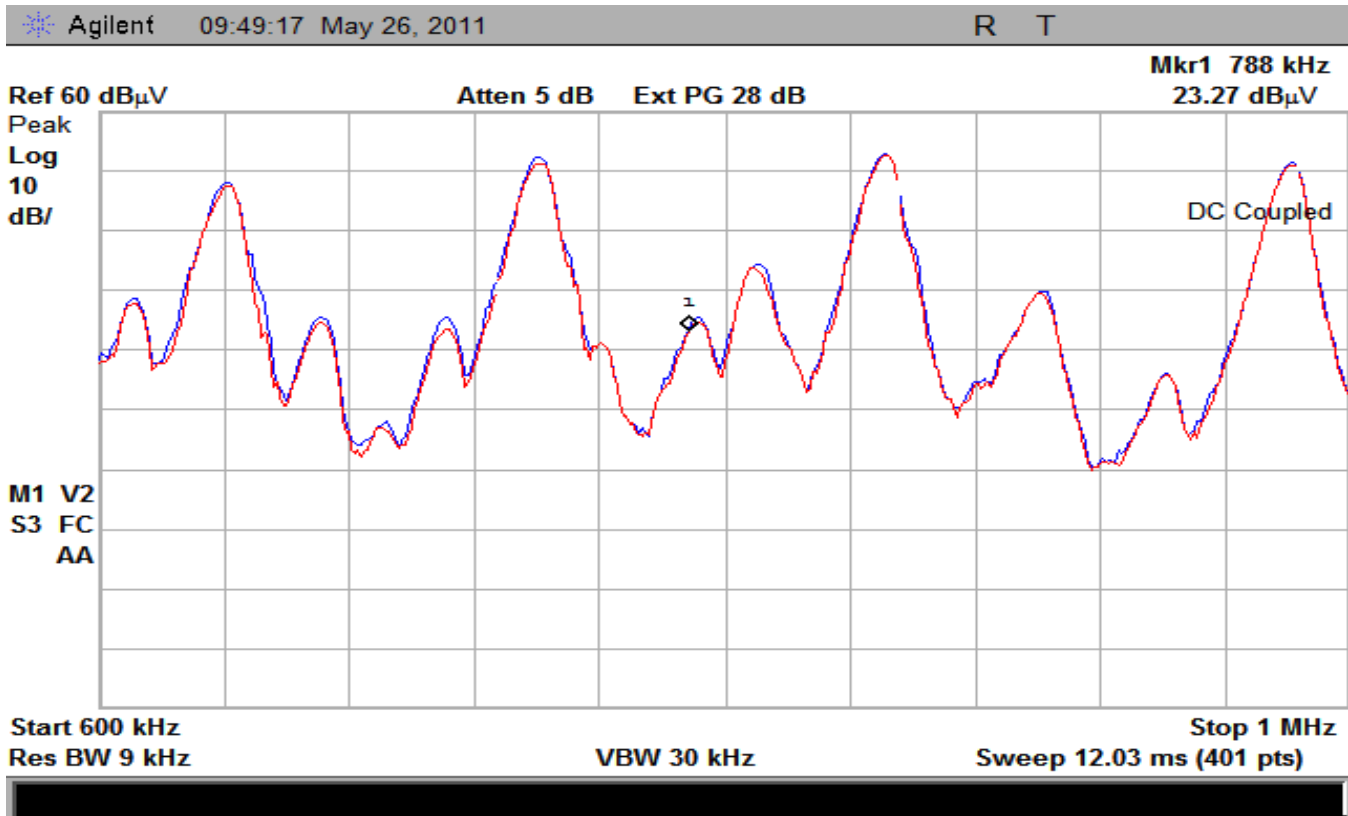
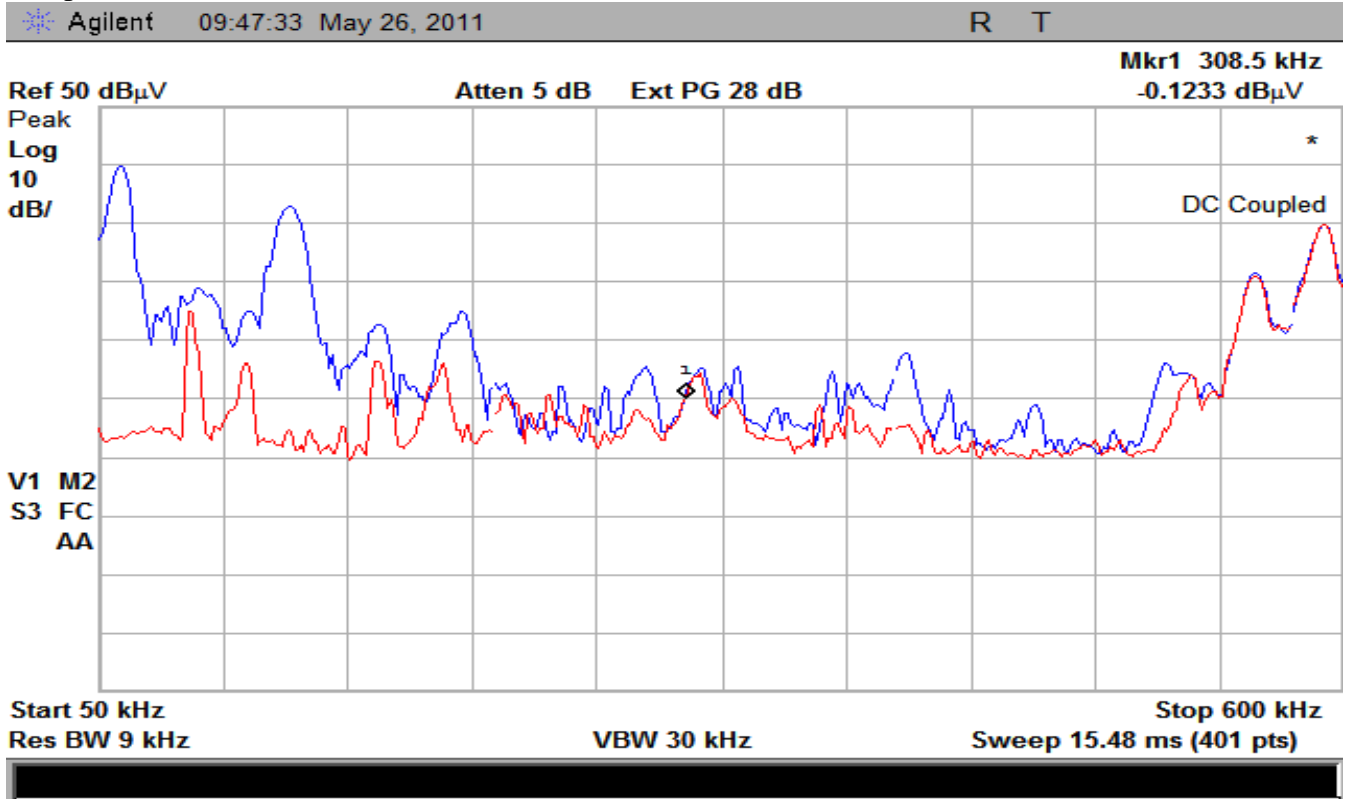
Freq kHz	SpecAn Level			Ambient Level			Ant Fact dB	F Fact dB	DCF dB	DCCF dB	QP Cor dBuV/m	Avg Cor dBuV/m	FCC Limit dBuV/m	Limit Distance	Margin dB
	pk	QP	av	pk	QP	av									
102vac	51.5	45.0	33.1				61.60	0	-88.8	-16.8	17.8	5.9	32.3	av@300m	26.4
138vac	54.8	47.9	35.9				61.60	0	-88.8	-16.8	20.7	8.7	32.3	av@300m	23.7
58	53.2	46.2	34.1				61.60	0	-88.8	-16.8	19.0	6.9	32.3	av@300m	25.5
116	-1.0	-8.6	-18.5	-25.0	-30.5	-33.2	55.75	1.3	-88.8	-16.8	-40.3	-50.2	26.3	av@300m	76.5
174	10.1	7.3	-14.0	-7.5	-10.9	-19.0	52.80	0.7	-88.8	-16.8	-28.0	-49.3	22.8	av@300m	72.1
232	-6.0	-10.7	-17.0	-7.1	-11.7	-17.0	50.60	0.4	-88.8	-16.8	-48.5	-54.8	20.3	av@300m	75.1
290	2.9	-2.2	-9.4	-1.7	-6.3	-9.9	48.80	0.3	-88.8	-16.8	-41.9	-49.1	18.4	av@300m	67.4
348	-3.4	-8.9	-17.5	-8.1	-12.6	-18.6	47.35	0.3	-88.8	-16.8	-50.0	-58.6	16.8	av@300m	75.4
406	6.5	0.3	-11.0	-5.2	-8.1	-12.6	46.15	0.2	-88.8	-16.8	-42.1	-53.4	15.4	av@300m	68.9
464	-6.4	-8.4	-18.0	-6.8	-13.5	-19.7	45.05	0.2	-88.8	-16.8	-51.9	-61.5	14.3	av@300m	75.8
522	2.2	-0.7	-13.2	-4.8	-9.2	-14.7	44.25	0.2	-28.7	-16.8	15.1	2.6	33.3	QP@30m	18.2
580	14.0	11.0	4.9	16.6	10.8	4.4	43.70	0.2	-28.7	-16.8	26.2	20.1	32.3	QP@30m	6.1

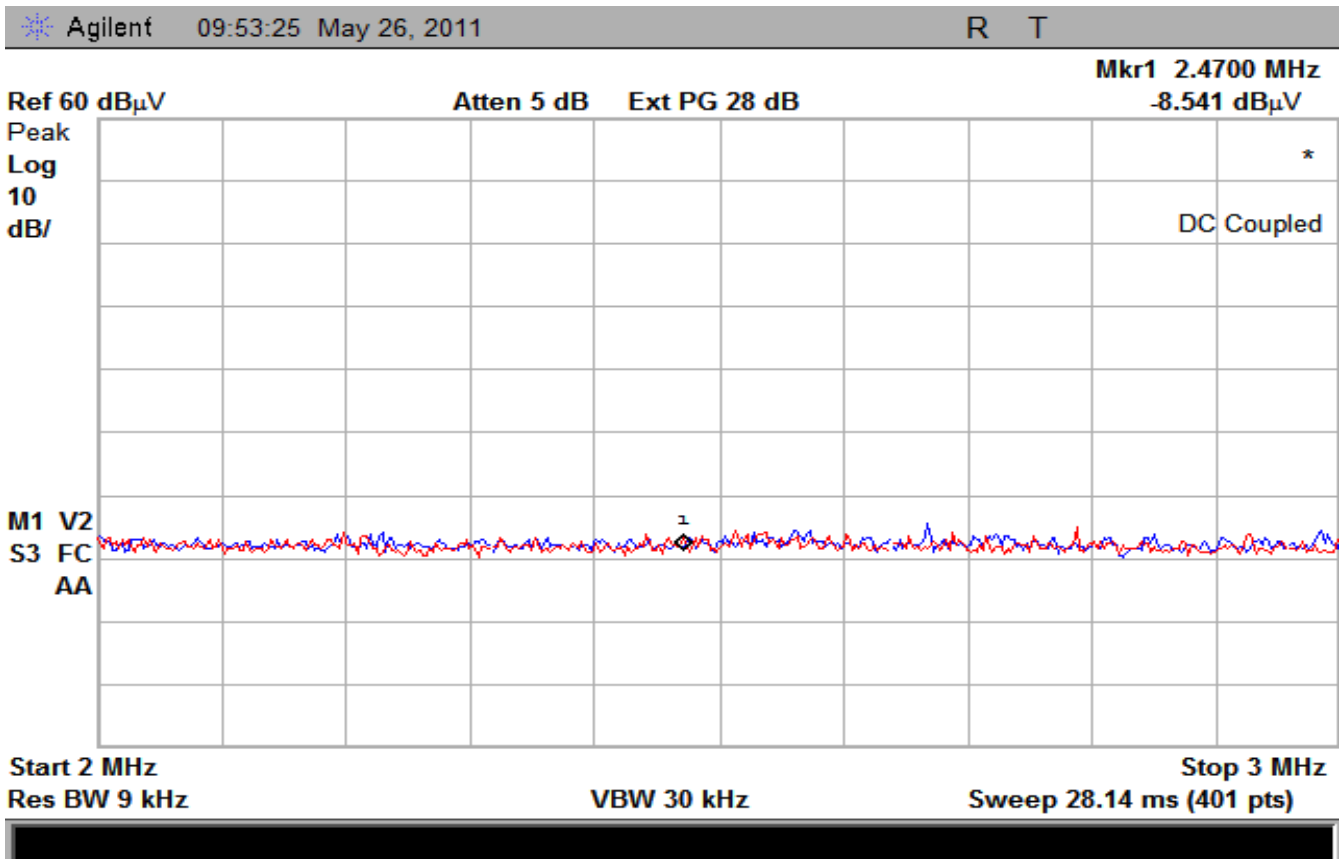
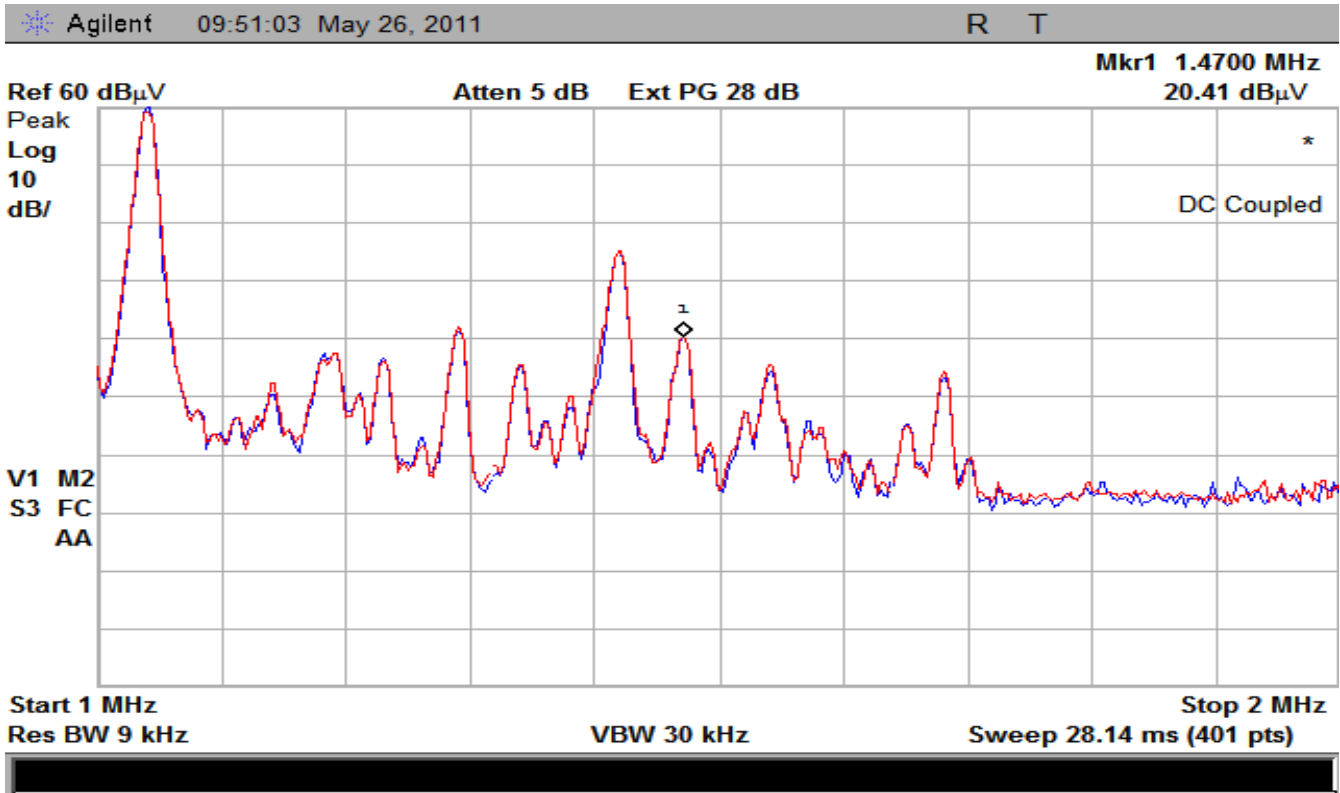
Note: No higher frequency emissions were detected up to 30 MHz.

Legend for Radiated Emissions below 30 MHz Table.

<b>Note: Limits and details change at 490 kHz, per 15.209(a)</b>
Detector bandwidths are specified in ANSI C63.4-2003, sec 4.2 which references ANSI C63.2-1996 and CISPR 16-1-1:2003-11
Video bandwidth is set to at least 3 times wider than the IF bandwidth.
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 per 15.209(d)
Average Detector measuring time is set to 100 mSec per 15.35(c)
QuasiPeak Detector measuring time is set to at least 1 second per CISPR 16
Peak Detector values may be used instead of QP if the value complies with the limit. 15.35(a)
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)
AF = Antenna Factor
FF = 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)
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.
Distance Correction Factor (DCF) = 20 log (Test Dist / 300)^P = 20 P log ( Test Dist / 300 ) to adjust measurement to 300 meters.
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)

Comparison of first 10 harmonics for the AMS-1014, Blue trace is EUT on. Red trace is ambient.





**4.1.4 Occupied Bandwidth For Industry Canada – IC.**

Port : Antenna  
 Line Input Voltage and Freq : 120V / 60 Hz  
 Ambient temperature : 22.6°C  
 Relative humidity : 51.2%  
 Date : 12/12/08

Figure 1.

20 dB Bandwidth from highest level. The indicated BW is 3.08 kHz.

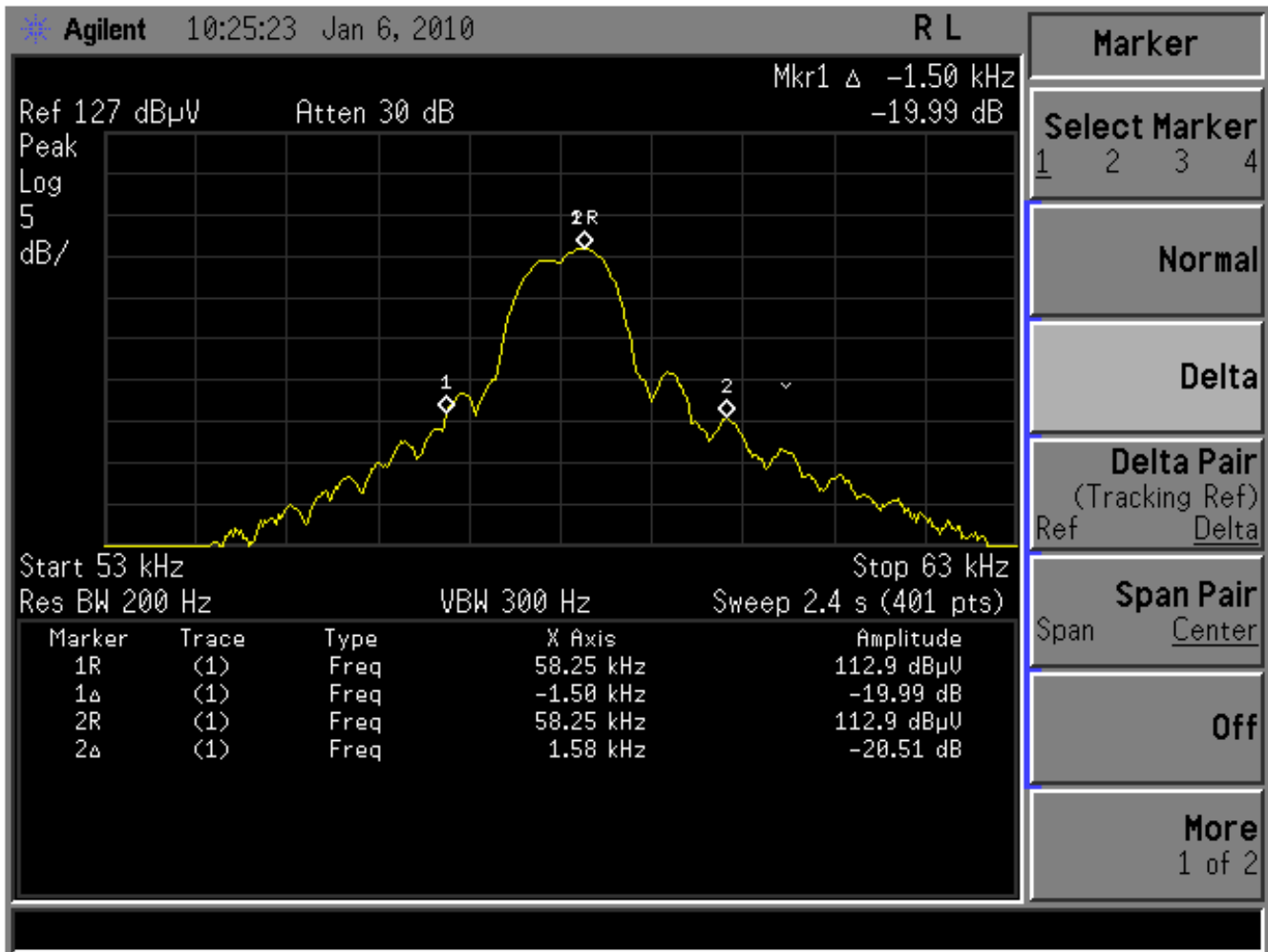
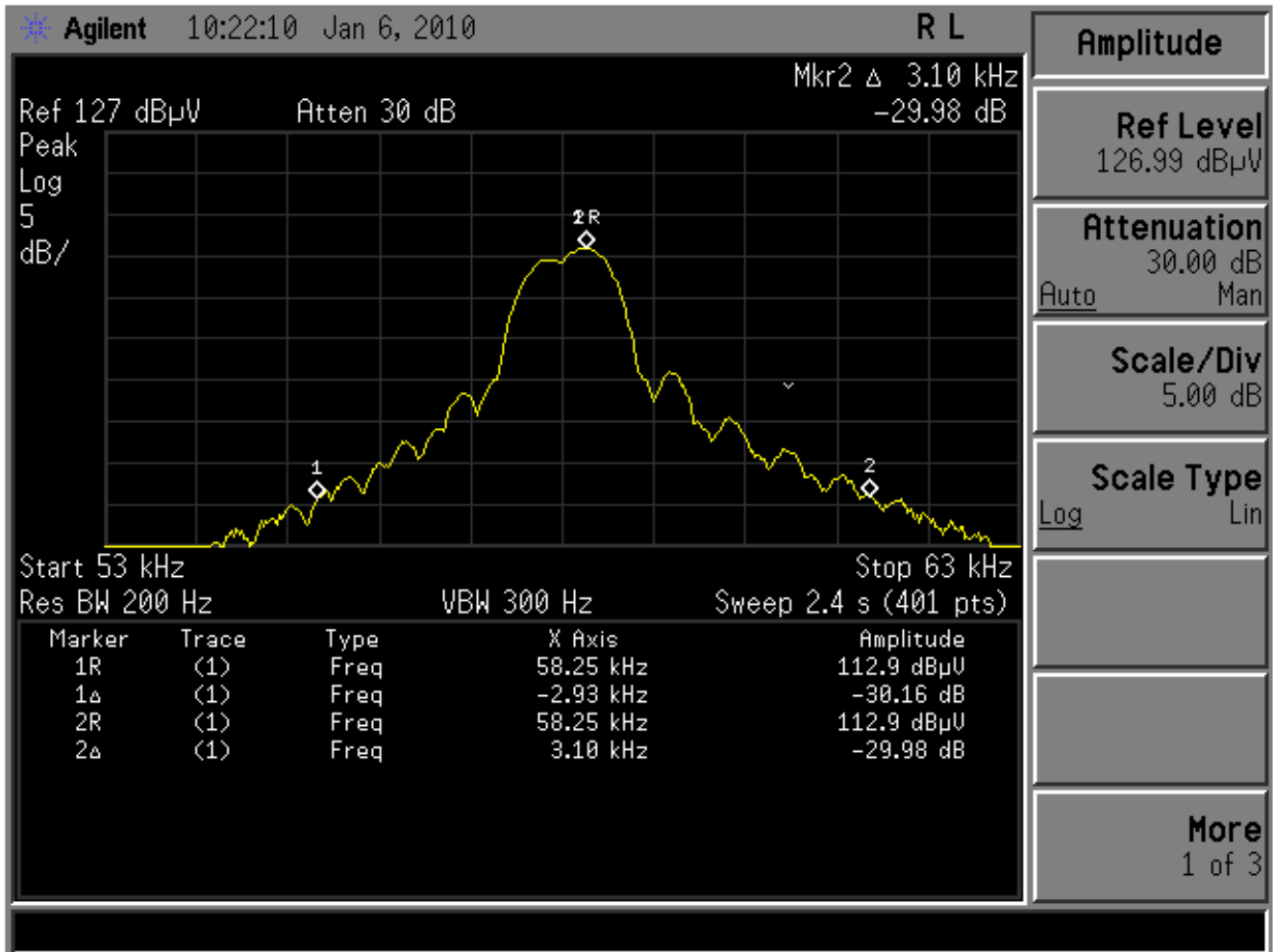


Figure 2.

30 dB Bandwidth from highest level. The indicated BW is 6.03 kHz



**5 EQUIPMENT LIST**

<b>Description</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial #</b>	<b>Due</b>	<b>Last</b>
Antenna Bicon	EMCO	3104C	4334	4/3/2011	4/3/2010
Antenna BiLog (Immunity)	Schaffner Chase	CBL6141	4112	Verify	Verify
Antenna Double-Ridge Horn	EMCO	3115	3006	4/2/2011	4/2/2010
Antenna Log Periodic	EMCO	3146	4731	5/4/2011	5/4/2010
Antenna Log Periodic	EMCO	3146	3576	4/3/2011	4/3/2010
Antenna Log Periodic	EMCO	3146	3909	5/4/2011	5/4/2010
Antenna Loop	Electro Metrics	ALP-70	163	5/4/2011	5/4/2010
Antenna Loop (Immunity)	Solar Elect	7334-1	73626	Verify	Verify
Capacitive Cable Clamp	Haefely Trench	PEFT Junior	083-078-31	Verify	Verify
CI 5kv VA AC Power Source	California Inst.	5001ix	54328	10/06/2011	10/06/2010
CI Electronic Output Switch	California Inst.	EOS-1	72377	10/06/2011	10/06/2010
CI Power Analyzer System	California Inst.	PACS-1	72376	10/06/2011	10/06/2010
Directional Coupler	Werlatone	C3910	6706	Verify	Verify
Directional Coupler	Werlatone	C5673	11481	Verify	Verify
DMM	Fluke	87IV	174	8/20/2011	8/20/2010
EFT Generator	Haefely Trench	PEFT Junior	083 180-16	7/10/2011	7/10/2010
ESD Simulator	Schaffner	NSG435	1197	7/15/2011	7/15/2010
Filter >58 kHz High Pass	Tyco EMC lab	unique	1	Verify	Verify
Humidity & Temperature Meter	Davis Inst	4465CF	10304858	8/20/2011	8/20/2010
Line Imp Stable Network	EMCO	3816/2NM	1018	Verify	Verify
Line Imp Stable Network	EMCO	3816/2NM	1064	Verify	Verify
Pre-Amp .009-1300MHz	HP	8447F	2805A03473	Verify	Verify
Pre-Amp .009-1300MHz	HP	8447F	3113A06072	Verify	Verify
High Freq Pre-Amp				Verify	Verify
High Pass Filter				Verify	Verify
RF Current Probe	FCC	F-33-1	304	Verify	Verify
RF Field Meter	Narda	EMR-200	AN-0055	5/5/2011	5/5/2010
RF Injection Clamp	FCC	F-203I	30	Verify	Verify
RF Power Meter	Boonton	4231-30	53701	6/5/2011	6/5/2010
RF Power Sensor	Boonton	51011-EMC	31932	6/5/2011	6/5/2010
Signal Generator	Marconi	2024	783031	2/6/2011	2/6/2010
Spectrum Analyzer	HP	E7405A			
Spectrum Analyzer	HP	E7405A			
Spectrum Analyzer	HP	E7401A	US39110103	2/26/2011	2/26/2010
Surge CDN Signal Line bal	Key Tek	CM-TELCD	9904206	Verify	Verify
Surge CDN Signal Line unbal	Key Tek	CM-I/OCD	9904213	Verify	Verify
Surge Coupler/Decoupler	Key Tek	CE50	9507535	Verify	Verify
Transient Limiter	Electro Metrics	EM 7600	187	Verify	Verify

**6 ANTENNA FACTORS.**

Date of Calibration = 4/May/2009  
 Date Printed: Monday, May 04, 2009 2:41 PM  
 Customer Name: Tyco Safety Products - Sensormatic  
 Antenna Manufacturer: Electro-Metrics  
**Antenna Model: ALP-70 Loop**  
 Antenna Serial No.: 163  
 Temperature (Deg C): 21.0  
 Humidity (%): 50.0  
 Measurement Distance in Meters = 1.0  
 NOTES: ACF valid to 10 meters per NIST methods.  
 CAL CERT #: 2009042912

Freq (MHz)	E-field ACF (dB)	H-field ACF (dB)
0.01	75.6	24.1
0.02	71.6	20.2
0.03	68.3	16.9
0.04	65.5	14.0
0.05	63.6	12.2
0.06	61.1	9.7
0.07	59.6	8.2
0.08	58.5	7.0
0.09	57.8	6.4
0.10	56.8	5.4
0.20	51.8	0.4
0.30	48.5	-3.0
0.40	46.3	-5.1
0.50	45.0	-6.5
0.60	43.6	-7.8
0.70	42.8	-8.6
0.80	41.6	-9.8
0.90	41.1	-10.3
1.00	40.5	-11.0
2.00	38.2	-13.3
3.00	37.2	-14.3
4.00	37.0	-14.4
5.00	36.7	-14.8
6.00	37.6	-13.8
7.00	37.7	-13.8
8.00	37.7	-13.7
9.00	37.6	-13.9
10.00	37.6	-13.8
15.00	37.4	-14.0
20.00	37.2	-14.2
25.00	36.2	-15.2
30.00	37.4	-14.1



Date of Calibration = April 3, 2009  
 Date Printed: Friday, April 03, 2009 1:51 PM  
 Customer Name: Tyco Safety Products - Sensormatic  
 Antenna Manufacturer: EMCO  
**Antenna Model: 3104C Biconical**  
 Antenna Serial No.: 9009-4334  
 Temperature (Deg C). 3  
 Humidity (%). 65  
 Measurement Distance in Meters = 3  
 Antenna Polarization = VERT / HORZ  
 CAL CERT #: 2009033120

Freq (MHz)	Ver ACF (dB)	Hor ACF (dB)
20.0	17.7	20.6
21.0	17.4	20.0
22.0	16.4	18.6
23.0	16.1	18.1
24.0	15.3	16.9
25.0	14.9	16.4
26.0	14.2	15.5
27.0	13.6	15.0
28.0	13.0	14.3
29.0	12.3	13.7
30.0	11.9	13.3
31.0	11.3	12.7
32.0	11.0	12.4
33.0	10.5	11.9
34.0	10.3	11.7
35.0	9.9	11.3
36.0	9.8	11.3
37.0	9.6	11.0
38.0	9.6	11.0
39.0	9.5	10.8
40.0	9.5	10.7
40.0	9.5	10.7
41.0	9.6	10.7
42.0	9.7	10.7
43.0	9.9	10.6
44.0	10.0	10.6
45.0	10.2	10.7
46.0	10.4	10.7
47.0	10.5	10.7
48.0	10.7	10.7
49.0	11.0	10.8
50.0	11.2	10.8
51.0	11.4	10.8
52.0	11.6	10.8
53.0	11.9	10.9
54.0	12.0	10.9
55.0	12.1	11.0
56.0	11.9	10.9

57.0	11.9	11.0
58.0	11.4	10.9
59.0	11.2	10.9
60.0	10.8	10.8
61.0	10.5	10.8
62.0	10.0	10.5
63.0	9.7	10.4
64.0	9.2	10.1
65.0	8.9	9.9
66.0	8.5	9.5
67.0	8.2	9.3
68.0	7.8	8.9
69.0	7.6	8.6
70.0	7.3	8.2
71.0	7.2	7.9
72.0	7.0	7.5
73.0	7.0	7.3
74.0	6.8	7.0
75.0	6.8	6.8
75.0	6.8	6.8
76.0	6.7	6.5
77.0	6.7	6.4
78.0	6.6	6.3
79.0	6.7	6.3
80.0	6.7	6.3
81.0	6.9	6.3
82.0	7.2	6.4
83.0	7.4	6.5
84.0	7.6	6.7
85.0	7.9	6.8
86.0	8.2	7.1
87.0	8.3	7.2
88.0	8.7	7.6
89.0	8.8	7.7
90.0	9.1	8.0
91.0	9.2	8.1
92.0	9.5	8.5
93.0	9.5	8.6
94.0	9.8	8.9
95.0	9.9	9.0
96.0	10.2	9.4

97.0	10.6	9.9
98.0	11.4	11.2
99.0	11.7	12.0
100.0	11.7	11.7
101.0	11.4	11.3
102.0	11.6	11.4
103.0	11.5	11.2
104.0	11.8	11.5
105.0	11.9	11.5
106.0	12.1	11.8
107.0	12.2	11.8
108.0	12.5	12.1
109.0	12.6	12.2
110.0	12.9	12.6
111.0	13.1	12.7
112.0	13.5	13.2
113.0	13.8	13.5
114.0	14.3	14.2
115.0	14.8	14.9
116.0	15.6	15.7
117.0	16.3	15.8
118.0	16.3	15.3
119.0	15.6	14.5
120.0	15.0	14.1
121.0	14.3	13.6
122.0	14.1	13.5
123.0	13.8	13.3
124.0	13.6	13.3
125.0	13.4	13.2
126.0	13.4	13.3
127.0	13.2	13.1
128.0	13.1	13.2
129.0	12.9	13.0
130.0	13.0	13.2
131.0	12.8	13.0
132.0	12.8	13.2
133.0	12.7	13.0
134.0	12.8	13.1
135.0	12.7	13.0
136.0	12.8	13.0
137.0	12.8	13.0

138.0	12.8	13.1
139.0	12.8	13.0
140.0	12.8	13.0
141.0	12.8	13.0
142.0	12.9	13.1
143.0	13.0	13.1
144.0	13.0	13.2
145.0	13.2	13.3
146.0	13.3	13.4
147.0	13.5	13.6
148.0	13.7	13.8
149.0	14.0	14.1
150.0	14.2	14.2
151.0	14.4	14.3
152.0	14.3	14.2
153.0	14.5	14.1
154.0	14.5	13.9
155.0	14.6	13.9
156.0	14.7	13.8
157.0	14.8	13.8
158.0	14.7	13.7
159.0	14.8	13.8
160.0	14.8	13.8
161.0	15.0	14.0
162.0	15.1	14.0
163.0	15.3	14.2
164.0	15.4	14.2
165.0	15.7	14.4
166.0	15.7	14.4
167.0	16.0	14.7
168.0	15.9	14.7
169.0	16.1	14.9
170.0	16.1	15.0
171.0	16.1	15.2
172.0	16.1	15.2
173.0	16.2	15.4
174.0	16.3	15.5
175.0	16.4	15.7
176.0	16.5	15.8
177.0	16.7	16.0
178.0	16.8	16.1

179.0	16.9	16.3
180.0	17.0	16.4
181.0	17.1	16.6
182.0	17.1	16.7
183.0	17.2	16.9
184.0	17.2	17.0
185.0	17.3	17.1
186.0	17.3	17.2
187.0	17.5	17.3
188.0	17.6	17.5
189.0	17.8	17.6
190.0	17.8	17.7
191.0	17.9	17.7
192.0	17.8	17.5
193.0	17.8	17.5
194.0	17.7	17.3
195.0	17.8	17.4
196.0	17.7	17.4
197.0	17.9	17.5
198.0	17.8	17.4
199.0	17.7	17.5
200.0	17.6	17.3
201.0	17.7	17.4
202.0	17.6	17.3
203.0	17.5	17.3
204.0	17.4	17.3
205.0	17.4	17.3
206.0	17.2	17.2
207.0	17.2	17.2
208.0	17.2	17.2
209.0	17.2	17.2

210.0	17.1	17.1
211.0	17.0	17.2
212.0	16.9	17.0
213.0	16.9	17.0
214.0	16.8	16.9
215.0	16.7	16.9
216.0	16.6	16.8
217.0	16.5	16.7
218.0	16.5	16.7
219.0	16.4	16.5
220.0	16.5	16.4
221.0	16.5	16.3
222.0	16.4	16.2
223.0	16.4	16.1
224.0	16.2	16.1
225.0	16.2	15.9
226.0	16.0	16.0
227.0	16.1	16.0
228.0	16.1	15.9
229.0	16.0	15.8
230.0	16.1	15.7
231.0	16.1	15.7
232.0	16.2	15.7
233.0	16.2	15.6
234.0	16.3	15.7
235.0	16.3	15.6
236.0	16.5	15.7
237.0	16.6	15.7
238.0	16.6	15.7
239.0	16.6	15.7
240.0	16.7	15.7

241.0	16.7	15.8
242.0	16.8	15.9
243.0	16.8	15.9
244.0	16.9	16.0
245.0	17.0	16.0
246.0	17.0	16.1
247.0	17.2	16.2
248.0	17.2	16.3
249.0	17.4	16.4
250.0	17.4	16.5
251.0	17.5	16.6
252.0	17.5	16.7
253.0	17.5	16.8
254.0	17.5	17.0
255.0	17.5	17.1
256.0	17.6	17.3
257.0	17.7	17.4
258.0	17.9	17.5
259.0	18.1	17.6
260.0	18.2	17.7
261.0	18.4	17.9
262.0	18.5	18.0
263.0	18.5	18.1
264.0	18.6	18.3
265.0	18.6	18.4
266.0	18.6	18.6
267.0	18.7	18.7
268.0	18.7	18.8
269.0	18.7	19.0
270.0	18.8	19.1
271.0	18.9	19.2

272.0	18.9	19.3
273.0	19.1	19.4
274.0	19.2	19.5
275.0	19.3	19.5
276.0	19.4	19.6
277.0	19.5	19.7
278.0	19.6	19.7
279.0	19.8	19.8
280.0	19.9	19.9
281.0	20.1	20.0
282.0	20.1	20.1
283.0	20.1	20.2
284.0	20.1	20.3
285.0	20.1	20.4
286.0	20.2	20.6
287.0	20.2	20.7
288.0	20.3	21.0
289.0	20.3	21.2
290.0	20.5	21.3
291.0	20.6	21.5
292.0	20.6	21.7
293.0	20.6	21.8
294.0	20.7	21.8
295.0	20.6	21.9
296.0	20.6	22.0
297.0	20.7	22.1
298.0	20.7	22.2
299.0	20.8	22.3
300.0	20.8	22.4

Date of Calibration = April 3, 2009  
 Date Printed: Friday, April 03, 2009 1:41 PM  
 Customer Name: Tyco Safety Products - Sensormatic  
 Antenna Manufacturer: EMCO  
**Antenna Model: 3146 – Log periodic**  
 Antenna Serial No.: 9303-3576  
 Temperature (Deg C). 3  
 Humidity (%). 65  
 Measurement Distance in Meters = 3  
 Antenna Polarization = VERT / HORZ  
 CAL CERT #: 2009033116

Freq (MHz)	Ver ACF (dB)	Hor ACF (dB)
200.0	11.7	12.1
205.0	11.6	12.1
210.0	11.7	11.9
215.0	11.6	11.7
220.0	11.5	11.5
225.0	11.2	11.4
230.0	11.1	11.4
235.0	11.5	11.6
240.0	11.8	11.9
245.0	12.2	12.1
250.0	12.6	12.4
255.0	12.6	12.6
260.0	12.8	13.0
265.0	12.9	13.2
270.0	13.0	13.5
275.0	13.3	13.6
280.0	13.6	13.7
285.0	13.9	13.8
290.0	14.1	14.0
295.0	14.1	14.1
300.0	14.2	14.3
305.0	14.5	14.8
310.0	14.8	15.2
315.0	14.8	15.1
320.0	14.7	14.8
325.0	14.7	14.6
330.0	14.6	14.6
335.0	14.3	14.7
340.0	14.1	14.9
345.0	14.2	14.9
350.0	14.5	14.9
355.0	14.8	14.8
360.0	15.0	14.9
365.0	15.3	15.0
370.0	15.2	15.1
375.0	15.1	15.2
380.0	15.0	15.3
385.0	15.4	15.5
390.0	15.7	15.8

395.0	15.5	15.9
400.0	15.4	16.1
405.0	15.5	16.0
410.0	15.7	15.9
415.0	16.0	16.1
420.0	16.0	16.2
425.0	15.9	16.4
430.0	15.8	16.5
435.0	15.9	16.5
440.0	16.1	16.4
445.0	16.4	16.5
450.0	16.7	16.7
455.0	16.9	16.9
460.0	16.9	17.2
465.0	16.9	17.3
470.0	16.9	17.3
475.0	17.1	17.4
480.0	17.2	17.4
485.0	17.5	17.5
490.0	17.7	17.6
495.0	17.9	17.9
500.0	17.9	17.9
505.0	18.0	18.2
510.0	18.3	18.6
515.0	18.5	19.0
520.0	18.3	18.8
525.0	18.0	18.6
530.0	17.7	18.5
535.0	17.6	18.6
540.0	17.6	18.4
545.0	17.9	18.3
550.0	18.2	18.3
555.0	18.3	18.6
560.0	18.2	18.7
565.0	18.1	18.8
570.0	18.0	18.9
575.0	18.2	18.7
580.0	18.4	18.6
585.0	18.7	18.8
590.0	18.8	19.1
595.0	18.7	19.2
600.0	18.7	19.2

605.0	18.7	19.1
610.0	18.8	19.3
615.0	19.0	19.5
620.0	19.2	19.4
625.0	19.4	19.4
630.0	19.2	19.4
635.0	19.2	19.4
640.0	19.5	19.7
645.0	19.7	19.9
650.0	19.9	20.0
655.0	20.1	20.1
660.0	20.3	20.3
665.0	20.4	20.4
670.0	20.5	20.6
675.0	20.5	20.7
680.0	20.5	20.9
685.0	20.4	20.9
690.0	20.4	21.1
695.0	20.4	21.0
700.0	20.5	21.0
705.0	20.6	21.0
710.0	20.5	21.0
715.0	20.5	21.0
720.0	20.5	21.2
725.0	20.7	21.3
730.0	20.7	21.2
735.0	20.7	21.2
740.0	20.6	21.1
745.0	20.6	21.2
750.0	20.6	21.4
755.0	20.6	21.4
760.0	20.7	21.3
765.0	20.7	21.4
770.0	20.7	21.4
775.0	20.7	21.4
780.0	20.7	21.4
785.0	20.7	21.4
790.0	20.8	21.5
795.0	20.9	21.6
800.0	21.1	21.6
805.0	21.0	21.7
810.0	21.1	21.7

815.0	21.1	21.8
820.0	21.3	22.0
825.0	21.4	22.1
830.0	21.5	22.1
835.0	21.6	22.2
840.0	21.7	22.3
845.0	21.7	22.4
850.0	21.8	22.4
855.0	21.9	22.5
860.0	22.2	22.7
865.0	22.4	22.9
870.0	22.5	23.0
875.0	22.6	23.1
880.0	22.6	23.1
885.0	22.5	23.2
890.0	22.6	23.1
895.0	22.6	23.1
900.0	22.7	23.3
905.0	22.7	23.3
910.0	22.8	23.3
915.0	22.8	23.2
920.0	22.6	23.3
925.0	22.6	23.4
930.0	22.6	23.4
935.0	22.7	23.4
940.0	22.7	23.5
945.0	22.7	23.6
950.0	22.6	23.5
955.0	22.7	23.6
960.0	22.9	23.7
965.0	22.9	23.9
970.0	23.1	23.8
975.0	23.1	23.8
980.0	23.1	23.9
985.0	23.2	23.9
990.0	23.3	24.1
995.0	23.5	24.4
1000.0	23.6	24.4

Date of Calibration = 2/Apr/2009  
 Date Printed: Thursday, April 02, 2009 3:33 PM  
 Customer Name: Tyco Safety Products - Sensormatic  
 Antenna Manufacturer: EMCO  
**Antenna Model: 3115 Horn**  
 Antenna Serial No.: 3006  
 Temperature (Deg C): 20.0  
 Humidity (%): 37.0  
 Measurement Distance in Meters = 3.0  
 Antenna Polarization = VERT / HORZ  
 NOTES: Observed Pin Depth: -0.0003" from typical.  
 CAL CERT #: 2009033119

Freq (MHz)	Vertical ACF (dB)	Horizontal ACF (dB)
1000.0	23.377	23.524
1500.0	25.067	25.087
2000.0	27.357	27.365
2500.0	29.000	29.024
3000.0	30.277	30.385
3500.0	31.557	31.512
4000.0	32.827	32.580
4500.0	32.593	32.499
5000.0	33.481	33.288
5500.0	34.467	34.421
6000.0	34.894	34.639
6500.0	34.730	34.612
7000.0	35.473	35.489
7500.0	36.832	36.780
8000.0	37.271	37.207
8500.0	37.649	37.600

9000.0	37.956	37.940
9500.0	37.858	37.743
10000.0	38.517	38.433
10500.0	38.992	39.004
11000.0	40.566	40.541
10030.0	39.704	39.684
12000.0	39.424	39.396
12500.0	38.797	38.822
13000.0	39.622	39.615
13500.0	40.408	40.394
14000.0	41.209	41.203
14500.0	41.665	41.584
15000.0	40.325	40.233
15500.0	38.024	38.049
16000.0	37.320	37.358
16500.0	38.400	38.340
17000.0	41.136	40.903
17500.0	42.866	42.522
18000.0	44.717	44.269



