

## EMC EMISSIONS - TEST REPORT (Full)

Test Report No. **3159446DEN-005** Issue Date: **Thursday 28/Aug/2008**

Model / Serial No. **MN: GPCC /SN: 29012/29011**

Product Type **Active RFID tag**

Client **SYMX Systems Inc.**

Manufacturer **SYMX Systems Inc.**

License holder **SYMX Systems Inc.**

Address **4909 Pearl East Cr. Suite 104**

**Boulder, CO 80301**

Test Criteria Applied  
Test Result

**FCC 47 CFR Part 15.231**

**PASS**

**3159446**

**26**

Title 47 CFR 15: RADIO FREQUENCY  
DEVICES  
Subpart C – Intentional Radiators

Test Project Number  
References  
Total Pages  
Including  
Appendices:

*Michael Spataro*

Tested By : Michael Spataro

*Ty Orosco*

Reviewed By : Ty Orosco

REVISION SUMMARY - The following changes have been made to this Report:

Rev.	Revision Statement	Author	Revision Date
	Initial Release of Document	See above	See above

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Lab Code:200264-0

The entity logos above are for reference only and may not apply to this test report.

# DIRECTORY

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## STATEMENT OF MEASUREMENT UNCERTAINTY

The data and results referenced in this document are true and accurate. The measurement uncertainty for Conducted Emissions in the frequency range of 150kHz – 30MHz is calculated to be  $\pm 2.30\text{dB}$  and for Radiated Emissions is calculated to be  $\pm 3.60\text{dB}$  in the frequency range of 30MHz – 200MHz and  $\pm 3.38\text{dB}$  in the frequency range of 200MHz – 1000MHz.

EUT Received Date: 19-August-2008

Testing Start Date: 19-August-2008

Testing End Date: 22-August-2008

The tests were performed according to following regulations:

1. FCC CFR47 Part 15 subpart C

**Emission Test Results:**

**Conducted Emissions 15.207 - NA**

**Test Result**

Minimum limit margin NA dB at NA MHz

Remarks: EUT is battery powered

**Radiated Unintentional and Spurious Emissions 15.109 /15.205/209 - PASS**

**Test Result**

Minimum limit margin -18.6 dB at 5000.00 MHz

Remarks:

**Automatic Shutoff 15.231(a)(2) - PASS**

**Test Result**

Remarks:

**Bandwidth 15.231(c) - PASS**

**Test Result**

Remarks: The 20dB bandwidth is less than .25% of the fundamental frequency.

**Field Strength of the Fundamental 15.231(e) - PASS**

**Test Result**

Minimum limit margin -4.0 dB at 433.93 MHz

Remarks: Unit complies with the limits for 15.231(b). Lowest delta from Axis 1.

**Field Strength of Harmonics 15.231(b)(3)/15.209- PASS**

**Test Result**

Minimum limit margin -0.3 dB at 3037.54 MHz

Remarks: The higher field strength of 15.209 was used to show compliance. Lowest delta from Axis 2.

**GENERAL REMARKS:**

The following remarks are to be considered as “where applicable” and are taken into account while completing any FCC/IC/ETSI radio tests at Intertek.

Testing was performed in 3 different orthogonal axis to determine the worst case emissions from the device. The worst case emissions measurements are shown in this report.

**FCC CFR47 Part 15.31: Measurement Standards:** In any case where the device is powered off a battery, a fresh battery was used during test. In cases where the device is powered off an AC supply, voltage was varied per Part 15.31 to find worst case emissions.

**FCC CFR47 Part 15.35: Measurement Detector Functions and Bandwidths:** FCC Part 15.35 was utilized when performing the measurements within this report.

EUT is battery powered.

Sample:

☒ Production    ☐ Prototype    ☐ See RFQ

Modifications required to pass: None

Test Specification Deviations: Additions to or Exclusions from: None

Test-setup photo(s):  
Radiated Intentional Emissions: Axis 1



Test-setup photo(s):  
Radiated Intentional Emissions: Axis 2





Test-setup photo(s):  
Radiated Intentional Emissions: Axis 3



Test-setup photo(s):  
Radiated Unintentional Emissions:





## **Appendix A**

### **Test Data Sheets and Test Equipment Used**

**Spurious Emissions  
And  
Unintentional Emissions  
15.109 and 15.205/209**

# Radiated Electromagnetic Emissions

Test Report #:	<b>3159446 Run 02</b>	Test Area:	Pinewood Site 1 (3m)	Temperature:	20.1	°C
Test Method:	FCC Part 15.209	Test Date:	19-Aug-2008	Relative Humidity:	51.8	%
EUT Model #:	GPCC	EUT Power:	3VDC	Air Pressure:	101	kPa
EUT Serial #:	29011					
Manufacturer:	SYMX Systems					
EUT Description:	Active RFID tag					
Notes:						

Level Key	
Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB) (dBm) (dB)	(dBuV)	(m) (DEG)	15.209 <1GHz	15.209 >1GHz
No emissions found: 4-5 GHz						
Noise floor.						
4500.00	34.8 Av	6.6 / 32.3 / 40.7	33.0	V / 1.0 / 0.0	N/A	-21.0
5000.00	34.2 Av	7.8 / 33.4 / 40.1	35.4	V / 1.0 / 0.0	N/A	-18.6
No emissions found: 1-4 GHz.						
Noise floor.						
1000.00	35.1 Av	3.7 / 24.1 / 38.2	24.7	H / 1.0 / 0.0	N/A	-29.3
2500.00	36.1 Av	4.0 / 28.8 / 38.5	30.4	H / 1.0 / 0.0	N/A	-23.6
3500.00	34.8 Av	4.8 / 31.5 / 38.2	32.9	H / 1.0 / 0.0	N/A	-21.1
No emissions found: 30-200 MHz.						
Noise floor.						
30.00	31.9 Qp	0.5 / 12.8 / 28.2	17.0	V / 1.0 / 0.0	-23.0	N/A
85.00	31.9 Qp	0.9 / 6.9 / 28.0	11.7	V / 1.0 / 0.0	-28.3	N/A
195.00	29.5 Qp	1.5 / 13.1 / 27.4	16.6	V / 1.0 / 0.0	-26.9	N/A
No emissions found: 200-1000 MHz.						
Noise floor.						
200.00	29.4 Qp	1.5 / 11.2 / 27.3	14.8	H / 1.0 / 0.0	-28.7	N/A
500.00	23.8 Qp	2.6 / 18.1 / 28.2	16.3	H / 1.0 / 0.0	-29.7	N/A
995.00	21.2 Qp	3.7 / 23.8 / 27.2	21.5	H / 1.0 / 0.0	-32.5	N/A

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB) (dB\m) (dB)	(dBuV)	(m) (DEG)	15.209 <1GHz	15.209 >1GHz
<b>***** Measurement Summary *****</b>						
5000.00	34.2 Av	7.8 / 33.4 / 40.1	35.4	V / 1.0 / 0.0	N/A	-18.6
4500.00	34.8 Av	6.6 / 32.3 / 40.7	33.0	V / 1.0 / 0.0	N/A	-21.0
3500.00	34.8 Av	4.8 / 31.5 / 38.2	32.9	H / 1.0 / 0.0	N/A	-21.1
30.00	31.9 Qp	0.5 / 12.8 / 28.2	17.0	V / 1.0 / 0.0	-23.0	N/A
2500.00	36.1 Av	4.0 / 28.8 / 38.5	30.4	H / 1.0 / 0.0	N/A	-23.6
195.00	29.5 Qp	1.5 / 13.1 / 27.4	16.6	V / 1.0 / 0.0	-26.9	N/A
85.00	31.9 Qp	0.9 / 6.9 / 28.0	11.7	V / 1.0 / 0.0	-28.3	N/A
200.00	29.4 Qp	1.5 / 11.2 / 27.3	14.8	H / 1.0 / 0.0	-28.7	N/A
1000.00	35.1 Av	3.7 / 24.1 / 38.2	24.7	H / 1.0 / 0.0	N/A	-29.3
500.00	23.8 Qp	2.6 / 18.1 / 28.2	16.3	H / 1.0 / 0.0	-29.7	N/A
995.00	21.2 Qp	3.7 / 23.8 / 27.2	21.5	H / 1.0 / 0.0	-32.5	N/A

**Fundamental field strength  
And  
Harmonics of the Fundamental  
15.231(e)/15.209**



# Field Strength Measurements Fundamental and Spurious of the Transmitter

Test Report #: <b>3159446</b>	Test Area: Pinewood Site 1 (3m)	Temperature: 23.7 °C
Test Method: FCC Part 15.231	Test Date: 19-Aug-2008	Relative Humidity: 19.9 %
EUT Model #: GPCC	EUT Power: 3VDC	Air Pressure: 101 kPa
EUT Serial #: 29012		
Manufacturer: SYMX Systems		
EUT Description: Active RFID tag		
Notes:		

Nb – Narrow Band  
 Qp – QuasiPeak      Bb – Broad Band  
 Av - Average

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	Duty Cycle Correction	Final Corrected	Limit	DELTA
(MHz)	(dBuV)	(dB) (dBm) (dB)	(dBuV)	(m) (DEG)	(dB)	(dBuV/m)	(dBuV/m)	(dB)

The following duty cycle was used for compliance.

~24mS

**Averaging method for pulsed signals and calculation in accordance to FCC CFR47 Part 15.35 utilized to calculate field strength emissions.**

The testing performed in accordance to FCC CFR47 Part 15.205 (restricted bands of operation) and 15.231 emissions and delta limits were calculated as follows:

Final Corrected Peak Measurement – Duty Cycle Correction Factor\* = Final Calculated Emission

The Final Calculated Emission was then compared to the Limits in CFR47 Part 15.209 and 15.231 and the emission/limit delta was calculated.

the DTCF is calculated as follows  $20 \cdot \log_{10}(\text{duty cycle in 100mS})$  "not to exceed 20dB"

Axis 1 EUT is flat on the table.

433.93	54.0 Pk	2.4 / 16.1 / 0.0	72.5	V / 2.3 / 185.0	-12	60.5	72	-11.5
433.93	61.5 Pk	2.4 / 16.1 / 0.0	80	H / 1.0 / 92.5	-12	68	72	-4
867.86	38.4 Pk	3.5 / 22.4 / 0.0	64.3	H / 1.0 / 55.0	-12	52.3	54	-1.7
867.88	31.4 Pk	3.5 / 22.4 / 0.0	57.3	V / 1.4 / 157.0	-12	45.3	54	-8.7
1301.8	53.9 Pk	2.6 / 24.7 / 37.8	43.3	V / 1.5 / 0.0	-12	31.3	54	-22.7
1301.8	56.1 Pk	2.6 / 24.7 / 37.8	45.6	H / 1.2 / 295.0	-12	33.6	54	-20.4
1735.73	67.9 Pk	2.9 / 26.0 / 37.8	59.1	V / 1.1 / 335.0	-12	47.1	54	-6.9
1735.74	67.7 Pk	2.9 / 26.0 / 37.8	58.8	H / 1.0 / 310.0	-12	46.8	54	-7.2
2169.66	64.7 Pk	3.3 / 27.7 / 38.2	57.5	H / 1.4 / 0.0	-12	45.5	54	-8.5
2169.67	61.7 Pk	3.3 / 27.7 / 38.2	54.5	V / 1.5 / 5.0	-12	42.5	54	-11.5
2603.6	59.8 Pk	3.9 / 29.2 / 38.2	54.8	V / 1.4 / 208.0	-12	42.8	54	-11.2
2603.62	57.8 Pk	3.9 / 29.2 / 38.2	52.8	H / 1.5 / 10.0	-12	40.8	54	-13.2
3037.53	65.9 Pk	3.7 / 30.9 / 38.2	62.3	H / 1.7 / 10.0	-12	50.3	54	-3.7
3037.54	63.3 Pk	3.7 / 30.9 / 38.2	59.7	V / 1.5 / 208.0	-12	47.7	54	-6.3
3471.47	48.4 Pk	4.7 / 31.5 / 38.1	46.5	V / 1.1 / 150.0	-12	34.5	54	-19.5
3471.48	50.6 Pk	4.7 / 31.5 / 38.1	48.8	H / 1.9 / 156.0	-12	36.8	54	-17.2
3905.41	40.3 Pk	5.5 / 32.2 / 37.5	40.5	H / 1.0 / 280.0	-12	28.5	54	-25.5
3905.44	42.0 Pk	5.5 / 32.2 / 37.5	42.2	V / 1.1 / 0.0	-12	30.2	54	-23.8
4339.35	48.9 Pk	6.3 / 32.3 / 40.7	46.8	V / 1.9 / 20.0	-12	34.8	54	-19.2
4339.36	49.5 Pk	6.3 / 32.3 / 40.7	47.4	H / 1.1 / 20.0	-12	35.4	54	-18.6

Axis 2 EUT is vertical on the table.

433.93	59.9 Pk	2.4 / 16.1 / 0.0	78.4	V / 1.0 / 20.0	-12	66.4	72	-5.6
433.94	53.0 Pk	2.4 / 16.1 / 0.0	71.5	H / 1.0 / 17.7	-12	59.5	72	-12.5
867.86	34.6 Pk	3.5 / 22.4 / 0.0	60.5	V / 1.0 / 109.0	-12	48.5	54	-5.5
867.87	31.9 Pk	3.5 / 22.4 / 0.0	57.8	H / 1.0 / 243.0	-12	45.8	54	-8.2
1301.8	50.2 Pk	2.6 / 24.7 / 37.8	39.7	H / 1.0 / 348.0	-12	27.7	54	-26.3
1301.8	58.0 Pk	2.6 / 24.7 / 37.8	47.4	V / 1.3 / 80.0	-12	35.4	54	-18.6
1735.74	64.0 Pk	2.9 / 26.0 / 37.8	55.2	H / 1.9 / 10.0	-12	43.2	54	-10.8

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	Duty Cycle Correction	Final Corrected	Limit	DELTA
(MHz)	(dBuV)	(dB) (dBm) (dB)	(dBuV)	(m) (DEG)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
1735.74	72.2 Pk	2.9 / 26.0 / 37.8	63.4	V / 1.0 / 216.0	-12	51.4	54	-2.6
2169.66	70.2 Pk	3.3 / 27.7 / 38.2	63	V / 1.6 / 5.0	-12	51	54	-3
2169.67	66.3 Pk	3.3 / 27.7 / 38.2	59.1	H / 1.4 / 173.0	-12	47.1	54	-6.9
2603.6	58.8 Pk	3.9 / 29.2 / 38.2	53.7	V / 1.4 / 5.0	-12	41.7	54	-12.3
2603.61	57.0 Pk	3.9 / 29.2 / 38.2	52	H / 1.9 / 135.0	-12	40	54	-14
3037.54	66.5 Pk	3.7 / 30.9 / 38.2	62.9	H / 1.6 / 140.0	-12	50.9	54	-3.1
3037.54	69.2 Pk	3.7 / 30.9 / 38.2	65.7	V / 1.5 / 350.0	-12	53.7	54	-0.3
3471.46	54.3 Pk	4.7 / 31.5 / 38.1	52.4	H / 1.5 / 148.0	-12	40.4	54	-13.6
3471.49	51.8 Pk	4.7 / 31.5 / 38.1	49.9	V / 1.7 / 10.0	-12	37.9	54	-16.1
3905.4	47.1 Pk	5.5 / 32.2 / 37.5	47.3	V / 1.5 / 31.0	-12	35.3	54	-18.7
3905.44	43.7 Pk	5.5 / 32.2 / 37.5	43.9	H / 1.5 / 146.0	-12	31.9	54	-22.1
4339.36	57.0 Pk	6.3 / 32.3 / 40.7	54.9	V / 1.6 / 115.0	-12	42.9	54	-11.1
4339.36	51.1 Pk	6.3 / 32.3 / 40.7	49	H / 1.6 / 100.0	-12	37	54	-17
Axis 3 EUT is Vertical, rotated 90 degrees.								
433.93	54.5 Pk	2.4 / 16.1 / 0.0	73	V / 1.3 / 103.0	-12	61	72	-11
433.93	60.4 Pk	2.4 / 16.1 / 0.0	78.9	H / 1.0 / 159.0	-12	66.9	72	-5.1
867.87	36.2 Pk	3.5 / 22.4 / 0.0	62.1	H / 1.0 / 351.0	-12	50.1	54	-3.9
867.89	34.6 Pk	3.5 / 22.4 / 0.0	60.5	V / 1.4 / 294.0	-12	48.5	54	-5.5
1301.8	56.3 Pk	2.6 / 24.7 / 37.8	45.7	V / 1.3 / 83.0	-12	33.7	54	-20.3
1301.81	53.7 Pk	2.6 / 24.7 / 37.8	43.1	H / 1.2 / 5.0	-12	31.1	54	-22.9
1735.72	65.8 Pk	2.9 / 26.0 / 37.8	57	H / 1.1 / 156.0	-12	45	54	-9
1735.74	72.3 Pk	2.9 / 26.0 / 37.8	63.5	V / 1.1 / 276.0	-12	51.5	54	-2.5
2169.66	66.9 Pk	3.3 / 27.7 / 38.2	59.7	H / 1.5 / 5.0	-12	47.7	54	-6.3
2169.66	67.1 Pk	3.3 / 27.7 / 38.2	59.9	V / 1.3 / 0.0	-12	47.9	54	-6.1
2603.6	57.9 Pk	3.9 / 29.2 / 38.2	52.9	V / 1.1 / 5.0	-12	40.9	54	-13.1
2603.61	59.0 Pk	3.9 / 29.2 / 38.2	53.9	H / 1.5 / 150.0	-12	41.9	54	-12.1
3037.53	66.9 Pk	3.7 / 30.9 / 38.2	63.3	H / 1.5 / 140.0	-12	51.3	54	-2.7
3037.54	59.5 Pk	3.7 / 30.9 / 38.2	55.9	V / 2.5 / 125.0	-12	43.9	54	-10.1
3471.47	50.2 Pk	4.7 / 31.5 / 38.1	48.3	V / 1.8 / 45.0	-12	36.3	54	-17.7
3471.49	51.6 Pk	4.7 / 31.5 / 38.1	49.8	H / 1.0 / 140.0	-12	37.8	54	-16.2
3905.42	46.5 Pk	5.5 / 32.2 / 37.5	46.6	H / 1.2 / 209.0	-12	34.6	54	-19.4
3905.44	41.4 Pk	5.5 / 32.2 / 37.5	41.5	V / 2.0 / 42.0	-12	29.5	54	-24.5
4339.34	52.2 Pk	6.3 / 32.3 / 40.7	50.1	V / 1.2 / 238.0	-12	38.1	54	-15.9
4339.34	55.9 Pk	6.3 / 32.3 / 40.7	53.8	H / 1.6 / 222.0	-12	41.8	54	-12.2

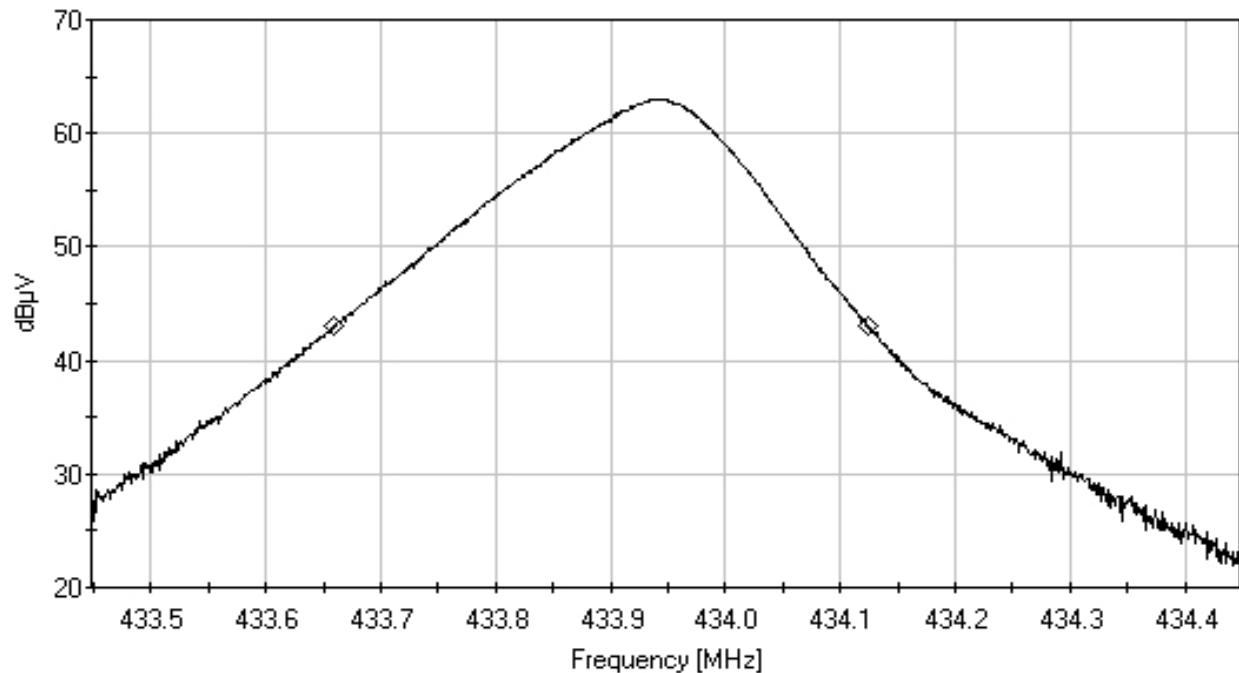
# Bandwidth

Test Report #:	3159446	Test Area:	Pinewood Site 1 (3m)
Test Method:	FCC Part 15.231	Test Date:	19-Aug-2008
EUT Model #:	GPCC	EUT Power:	3VDC
EUT Serial #:	29011		
Manufacturer:	SYMx Systems		
EUT Description:	Active RFID tag		
Notes:	Bandwidth to be less than 1MHz		

Temperature:	23.7	°C
Relative Humidity:	19.9	%
Air Pressure:	101	kPa

	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	

Bandwidth 15.231(c)  
Ref Level 70 dBµV ATTN 0 dB  
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec  
Marker 1: 433.66MHz 42.95 dBµV Marker 2: 434.125MHz 42.95 dBµV Delta: 465.0kHz



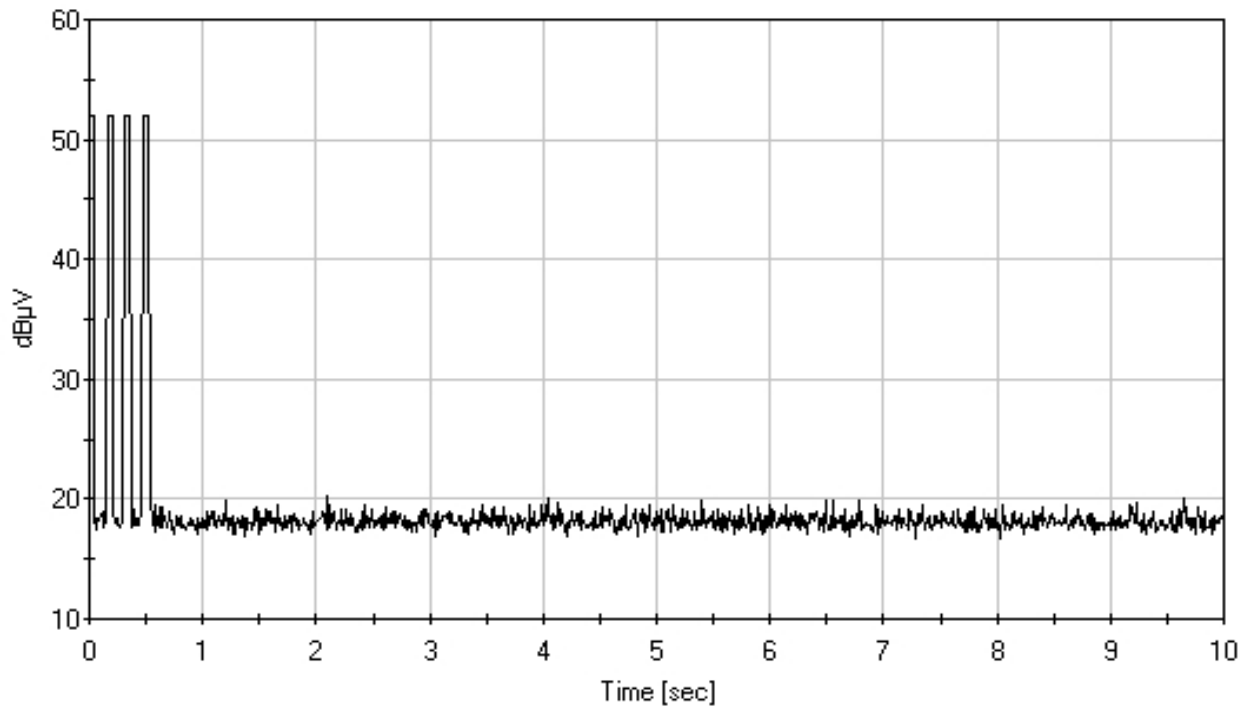
# Automatic Shutoff

Test Report #:	3159446	Test Area:	Pinewood Site 1 (3m)
Test Method:	FCC Part 15.231	Test Date:	19-Aug-2008
EUT Model #:	GPCC	EUT Power:	3VDC
EUT Serial #:	29012		
Manufacturer:	SYMX Systems		
EUT Description:	Active RFID tag		
Notes:	Automatic shutoff after 5 seconds.		

Temperature:	23.7	°C
Relative Humidity:	19.9	%
Air Pressure:	101	kPa

	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	

Automatic Shutoff 15.231(a)(2)  
Ref Level 65.5 dBμV ATTN 0 dB  
RES BW: 100.0kHz VID BW: 300.0kHz Center Freq: 433.948MHz

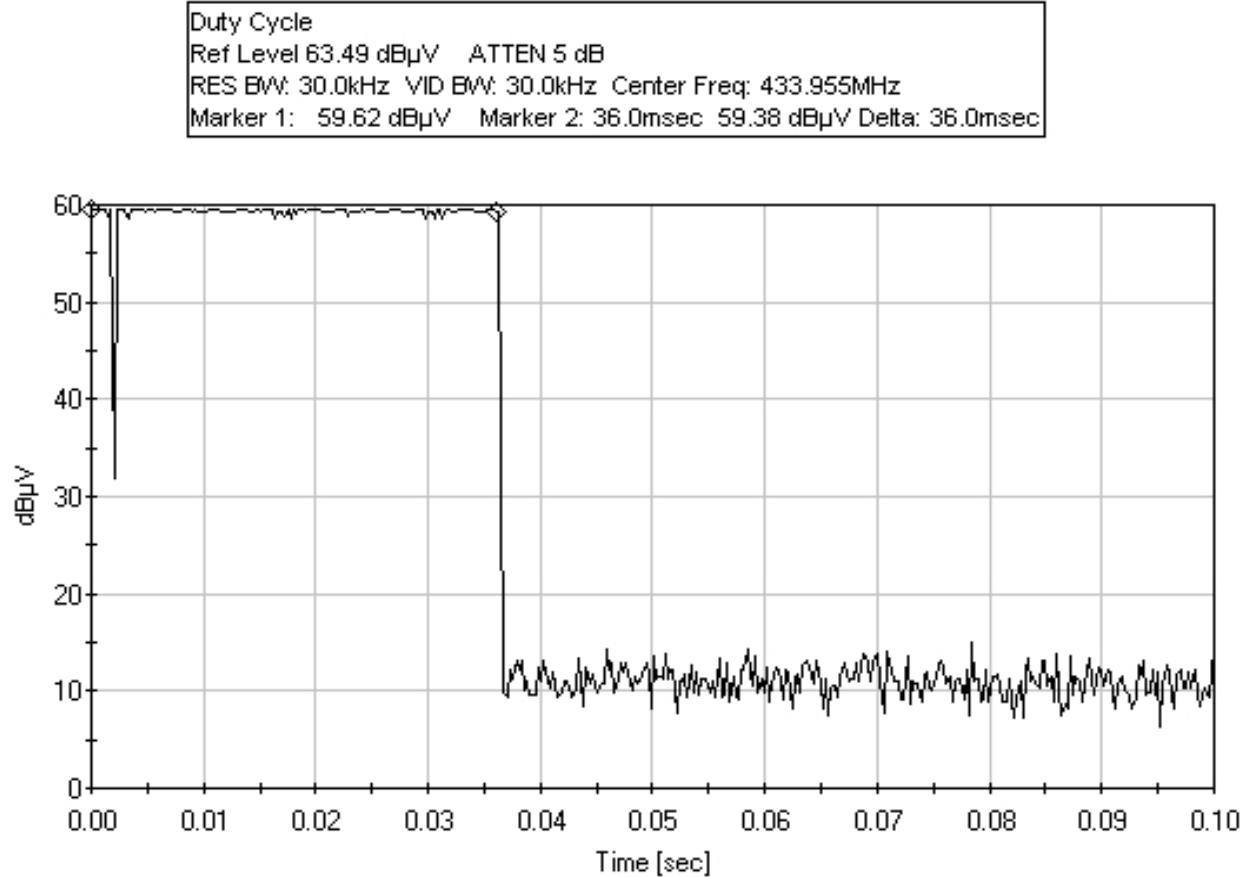


# Duty cycle

Test Report #:	3159446	Test Area:	Pinewood Site 1 (3m)
Test Method:	FCC Part 15.231	Test Date:	19-Aug-2008
EUT Model #:	GPCC	EUT Power:	3VDC
EUT Serial #:	29012		
Manufacturer:	SYMx Systems		
EUT Description:	Active RFID tag		
Notes:	See Operation Description for on time within the 36mS.		

Temperature:	23.7	°C
Relative Humidity:	19.9	%
Air Pressure:	101	kPa

	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	





## **List of Equipment Utilized for Final Test**

# Project Report

**Begin Date:** 8/19/2008 **End Date:** 8/22/2008

**Technician** Mike Spataro

**Project** 3159446

Capital Asset ID	Manufacturer	Model #	Serial #	Description	Test Performed	Service Type	Service Date	Service Due
18808	EMCO	3146	9203-3376	Log Periodic Antenna	R Radiated Emissions	For Cal	10/12/2007	10/12/2008
18880	Hewlett-Packard	85650A	2811A01300	Q.P Adapter	R Radiated Emissions	For Cal	11/15/2007	11/15/2008
18882	Hewlett-Packard	8566B	2410A00154	Spectrum Analyzer (dc-22 GHz)	R Radiated Emissions	For Cal	11/13/2007	11/13/2008
18887	EMCO	3115	9205-3886	Horn Antenna 1-18GHz	R Radiated Emissions	For Cal	3/6/2008	3/6/2009
18889	EMC TEST SYSTEMS	3109	3142	Biconical Antenna 30-300MHz	R Radiated Emissions	For Cal	10/11/2007	10/11/2008
18900	Avantek	AFT97-8434-10F	1007	RF Pre-Amplifier (4-8 GHz)	R Radiated Emissions	For Ver	5/2/2008	5/2/2009
18901	Avantek	AWT-18037	1002	RF Pre-Amplifier (8-18 GHz)	R Radiated Emissions	For Ver	5/2/2008	5/2/2009
18906	Mini-Circuits Lab	ZHL-42	N052792-2	Amplifier	R Radiated Emissions	For Ver	5/2/2008	5/2/2009
18912	Hewlett-Packard	8447F	3113A05545	9 kHz- 1.3GHz Pre Amp	R Radiated Emissions	For Ver	5/2/2008	5/2/2009

## **Appendix B**

Test Plan

and

Constructional Data Form

(To be supplied by the customer)

## **Appendix C**

Measurement Protocol

And

Test Procedures

## MEASUREMENT PROTOCOL

### GENERAL INFORMATION

#### Test Methodology

Conducted and radiated emission testing is performed according to the procedures in ANSI C63.4 & CNS13438.

#### Justification

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral into its characteristic impedance or left unterminated. When appropriate, the cables are manually manipulated with respect to each other to obtain maximum emissions from the unit.

#### CONDUCTED EMISSIONS

The final level, expressed in dB $\mu$ V, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the applicable limit.

To convert between dB $\mu$ V and  $\mu$ V, the following conversions apply:

- $\text{dB}\mu\text{V} = 20(\log \mu\text{V})$
- $\mu\text{V} = \text{Inverse log}(\text{dB}\mu\text{V}/20)$

#### RADIATED EMISSIONS

The final level, expressed in dB $\mu$ V/m, is arrived at by taking the reading from the spectrum analyzer (Level dB $\mu$ V) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has the applicable limit subtracted from it to provide the Delta which gives the tabular data as shown in the data sheets in Attachment B. The amplifier gain is automatically accounted for by using an analyzer offset.

*Example: At a Test Frequency of 30 MHz, with a peak reading on the spectrum analyzer or measuring receiver of 14 dB $\mu$ V:*

Measured Level	+	Transducer & Cable Loss factor	=	Corrected Reading	Specification Limit	-	Corrected Reading	=	Delta Specification
(dB $\mu$ V)		(dB)		(dB $\mu$ V/m)	(dB $\mu$ V/m)		(dB $\mu$ V/m)		
14.0		14.9		28.9	40.0		28.9		-11.1



## DETAILS OF TEST PROCEDURES

### *General Standard Information*

The test methods used comply with ANSI C63.4-2003 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

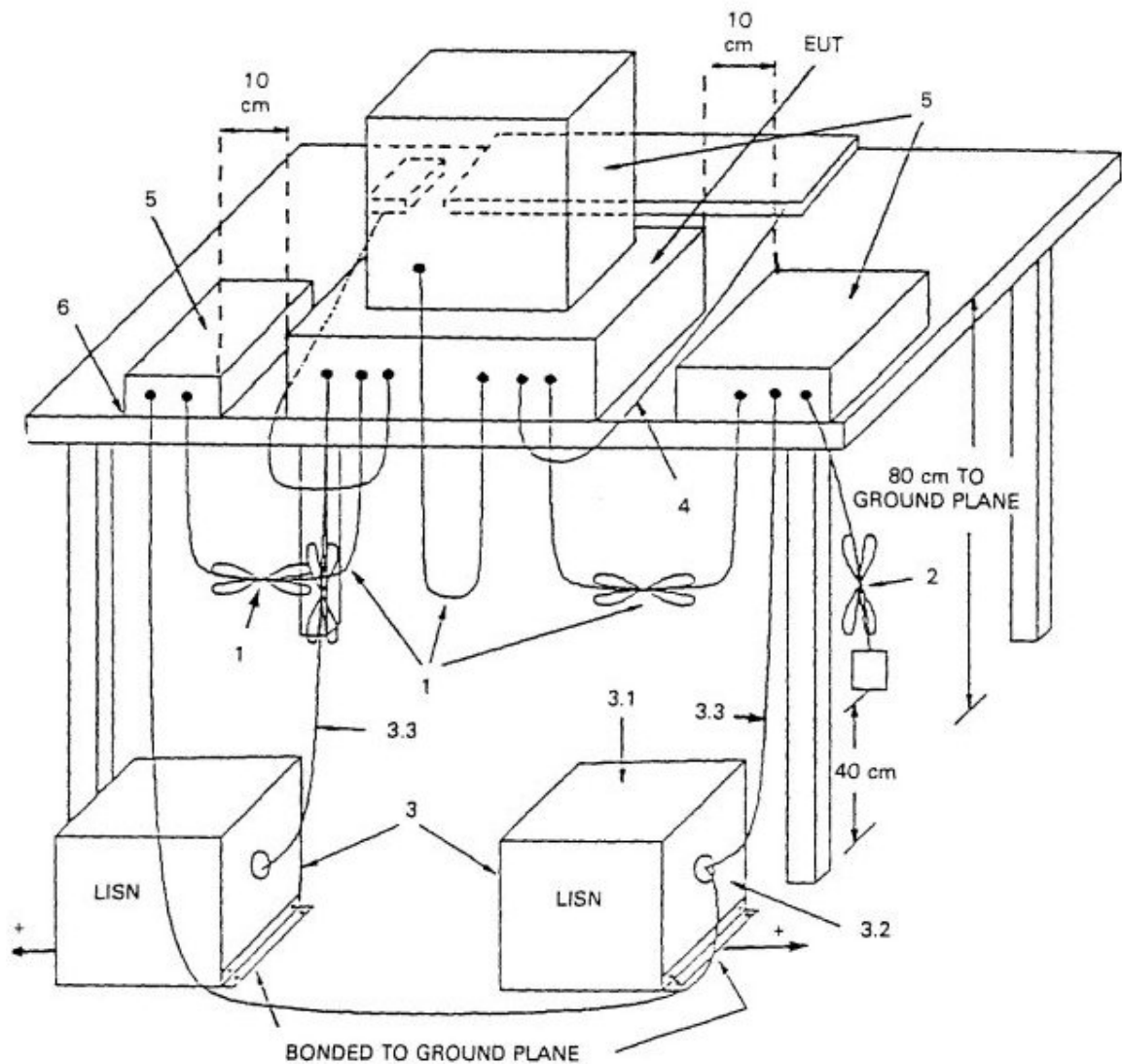
### **Conducted Emissions**

Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EUT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection, and a Line Impedance Stabilization Network (LISN), with 50  $\Omega$ /50  $\mu$ H (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimeters above the floor and is positioned 40 centimeters from the vertical ground plane (wall) of the screen room. In some cases, a pre-scan using a spectrum analyzer is initially performed on the units comprising the system under test to locate the highest emissions. If the minimum passing margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver or spectrum analyzer with quasi-peak and average detection and recorded on the data sheets.

### **Radiated Emissions**

Radiated emissions from the EUT are measured in the frequency range of 30 to 22GHz using a spectrum analyzer and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection and measurements above 1000 MHz are made with a 1 MHz/6 dB bandwidth and peak detection. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimeters above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. Interface cables that are closer than 40 centimeters to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimeters from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna is positioned 3, 10 or 30 meters horizontally from the EUT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarizations and the EUT are rotated 360 degrees.

## Conducted Emissions Diagram:



## Radiated Emissions Diagram:

