

# Global EMC Inc. Labs

## EMC & RF Test Report

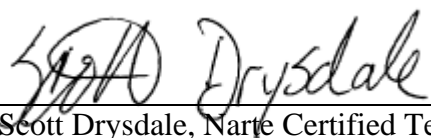
As per

**RSS 210 Issue 8:2010 &  
FCC Part 15 Subpart C:2010,  
15.209 & 15.231(e)**

**Unlicensed Intentional Radiators**

on the

**@Process RFID reader and exciter  
(PRX23)**



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Testing produced for




See Appendix A for full customer & EUT details.



Testing Laboratory  
Certificate #2555.01




R-2621  
C-2864

Client	<b>Lyngsoe Systems</b>	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

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Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Report Scope

This report addresses the EMC verification testing and test results of the Combi RFID Master ADM, herein referred to as EUT (Equipment Under Test) performed at Global EMC Labs.

The EUT was tested for compliance against the following standards:


RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010

Test procedures, results, justifications, and engineering considerations, if any, follow later in this report.

The results contained in this report relate only to the item(s) tested.

This report does not imply product endorsement by A2LA or any other accreditation agency, any government, or Global EMC Inc.


Opinions/interpretations expressed in this report, if any, are outside the scope of Global EMC Inc accreditation. Any opinions expressed do not necessarily reflect the opinions of Global EMC Inc, unless otherwise stated.

Client	<b>Lyngsoe Systems</b>	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Summary

The results contained in this report relate only to the item(s) tested.

EUT FCC Certification #, FCC ID:	PQG-PRX23
EUT Industry Canada Certification #, IC:	4113A-PRX23
EUT Passed all tests performed.	Yes (see test results summary)
Tests conducted by	Scott Drysdale

Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203	Antenna Requirement	Unique	Pass See Justification
FCC 15.205 RSS 210 (Table 1)	Restricted Bands for intentional operation	Not allowed	Pass
FCC 15.207	Power line conducted emissions	QuasiPeak Average	Pass
FCC 15.209 RSS-210 (Table 2)  FCC 15.231(e) RSS-210 (Table 5)	Intentional / Spurious Radiated emissions	QuasiPeak Average	Pass
FCC 15.231(e) RSS-210 A1.1.1(b)	Automatic transmission Transmission time	< 1 seconds	Pass
FCC 15.231 (e) RSS-210 A1.1.1(c)	Transmission off time	> 30 x TX interval > 10 seconds	Pass
FCC 15.231 (c) RSS-210 A1.1.3	20 dB or 99 %, Bandwidth	< 0.25% of carrier	Pass
<b>Overall Result</b>			<b>PASS</b>

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All tests were performed by Scott Drysdale.


If the product as tested or otherwise complies with the specification, the EUT is deemed to comply with the requirement and is deemed a 'PASS' grade. If not 'FAIL' grade will be issued. Note that 'PASS' / 'FAIL' grade is independent of any measurement uncertainties. A 'PASS' / 'FAIL' grade within measurement uncertainty is marked with a '\*'.

### ***Justifications, Descriptions, or Deviations***

The following justifications for tests not performed or deviations from the above listed specifications apply:

For the Antenna requirement specified in FCC 15.203 (RSS 210 section 5.5), for 125 kHz this device is designed with an integral antenna which meets the requirements of FCC 15.203. For the 433.92 MHz an integral antenna (PCB Trace) is used. Reverse polarity SMA type antennas as depicted are used for receive only on this device. Additionally, this device will typically be professionally installed in secure locations and is not accessible to the general public after installation.

For the Restricted Bands of operation as specified in FCC 15.205, the EUT is designed to only operate at 125 kHz and 433.92 MHz, neither is in a restricted band.

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## ***Applicable Standards, Specifications and Methods***

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
ANSI C63.4:2009	- Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
CFR 47 FCC 15	- Code of Federal Regulations – Radio Frequency Devices
CISPR 22:1997	- Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
ICES-003:2004	- Digital Apparatus - Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard
ISO 17025:2005	- General Requirements for the competence of testing and calibration laboratories
RSS 210:2010	- Issue 8: Spectrum Management and Telecommunications Policy. Radio Standards Specification Low Power Licence-Exempt Radiocommunication Devices

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### ***Sample calculation(s)***

Margin = limit – (received signal + antenna factor + cable loss – pre-amp gain)

Margin = 50.5dBuV/m – (50dBuV + 10dB + 2.5dB – 20dB)

Margin = 8.5 dB

### ***Document Revision Status***

Revision 1 - May 4, 2011

Revision 2 - May 25, 2011 –

Corrections:

Transmit antenna type for 433.92 MHz corrected.

20 dB (99 %) Bandwidth for 125 kHz added.

Re-test emissions with peripheral device(s) attached.

Calibration of LISN corrected


Clarification to statement for measurements above 1 GHz.

Revision 3 - May 26, 2011

Corrections

Clarified occupancy time with respect to 15.231(e) requirements.



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## Definitions and Acronyms

The following definitions and acronyms are applicable in this report.  
See also ANSI C63.14.

**AE** – Auxillary Equipment.

**BW** – Bandwidth. Unless otherwise stated, this refers to the 6 dB bandwidth.

**EMC** – Electro-Magnetic Compatibility

**EMI** – Electro-Magnetic Immunity

**EUT** – Equipment Under Test

**ITE** – Information Technology Equipment with a primary function(s) of entry, storage, display, retrieval, transmission, processing, switching, or control, of data.

**LISN** – Line impedance stabilization network

**NCR** – No Calibration Required

**RF** – Radio Frequency

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Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Testing Facility

Testing for EMC on the EUT was carried out at Global EMC labs in Toronto, Ontario, Canada. The testing lab consists of a 3m semi-anechoic chamber calibrated to be able to allow measurements on an EUT with a maximum width or length of up to 2m and height up to 3m. The chamber is equipped with a turn table that is capable of testing devices up to 3300lb in weight. This facility is capable of testing products that are rated for 120 Vac and 240Vac single phase, or 208 Vac 3 phase input. DC capability is also available. The chamber is equipped with an antenna mast that controls polarization and height from the control room adjoining the shielded chamber. Radiated emissions measurements are performed using a Bilog, and Horn antenna where applicable. Conducted emissions, unless otherwise stated, are performed using a LISN.

### ***Calibrations and Accreditations***


The measurement site used is registered with Federal Communications Commission (FCC) and Industry Canada (IC). This site is calibrated for Normalized Site Attenuation (NSA) using test procedures outlined in ANSI C63.4 “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz”. The semi-anechoic chamber is lined with ferrite tiles and absorption cones to minimize any undesired reflections. All measuring equipment is calibrated on an annual or bi-annual basis as listed for each respective test.

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## ***Testing Environmental Conditions and Dates***

Following were the environmental conditions in the facility during time of testing –

Date	Test	Init.	Temperature (°C)	Humidity (%)	Pressure (kPa)
April 4-15, 2011	All	SD	20-25°C	30-45%	100 -103kPa
May 20-24, 2011	Re-test	SD	20-25°C	30-45%	100 -103kPa

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## Detailed Test Results Section

Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## ***Power Line Conducted Emissions***

### **Purpose**

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT's power line does not exceed the limits listed below as defined in the applicable test standard, as measured from a LISN. This helps protect lower frequency radio services such as AM radio, shortwave radio, amateur radio operators, maritime radio, CB radio, and so on, from unwanted interference.

### **Limits & Method**

The limits are as defined in 47 CFR FCC Part 15 Section 15.207

Method is as defined in ANSI C63.4


Average Limits		QuasiPeak Limits	
150 kHz – 500 kHz	56 to 46 dBuV	150 kHz – 500 kHz	66 to 56 dBuV
500 kHz – 5 MHz	46 dBuV	500 kHz – 5 MHz	56 dBuV
5 MHz – 30 MHz	50 dBuV	500 kHz – 30 MHz	60 dBuV

The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

Note: If the Peak or Quasi Peak detector measurements do not exceed the Average limits, then the EUT is deemed to have passed the requirements.

Both limits are applicable, and each is specified as being measured with a 9 kHz measurement bandwidth .




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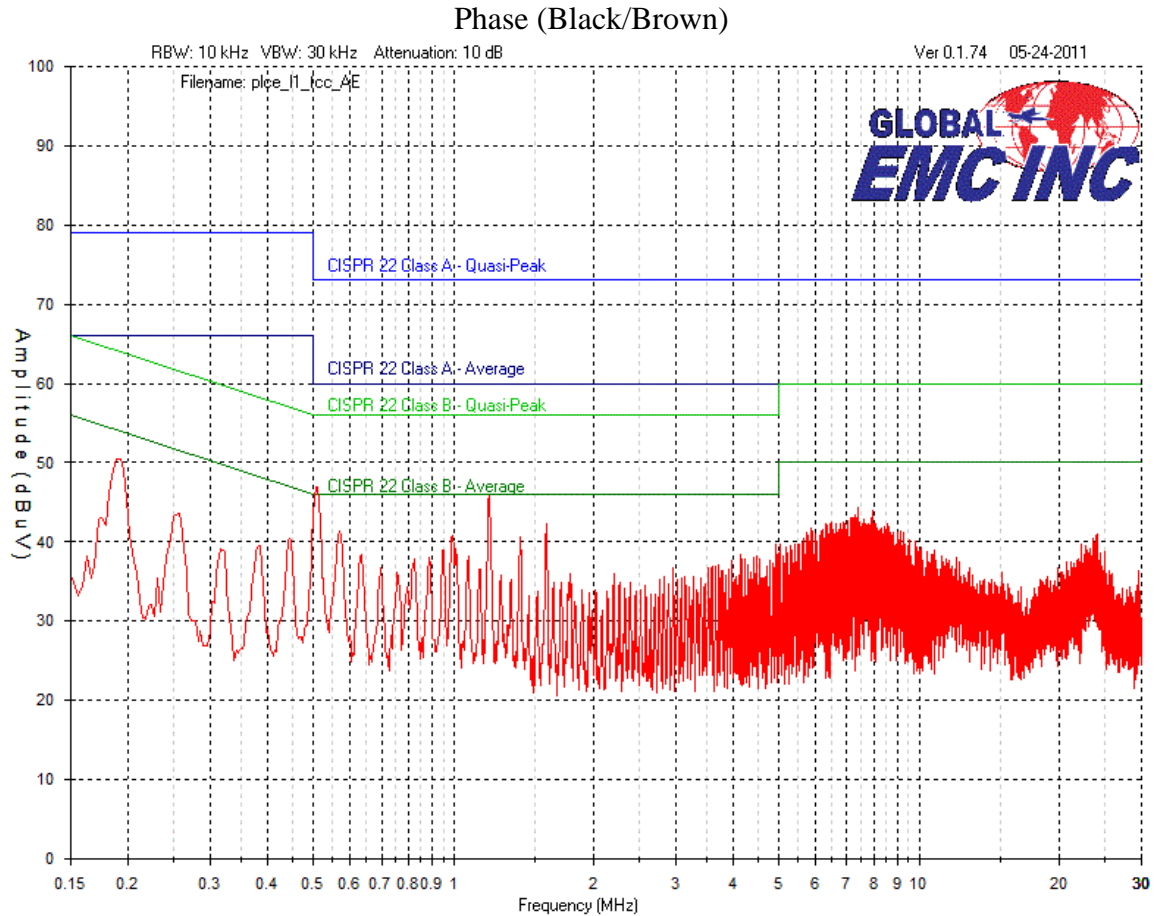
## Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is +/-3.6 dB with a 'k=2' coverage factor and a 95% confidence level.


## Preliminary Graphs

Note the graphs shown below are for graphical illustration only. For final measurements with the appropriate detector where applicable, please refer to the table. The graph shown below is a peak measurement graph, measured with a resolution bandwidth greater than or equal to the final required detector. These graphs are performed as a worst case measurement to enable the detection of frequencies of concern and for considerable time savings.

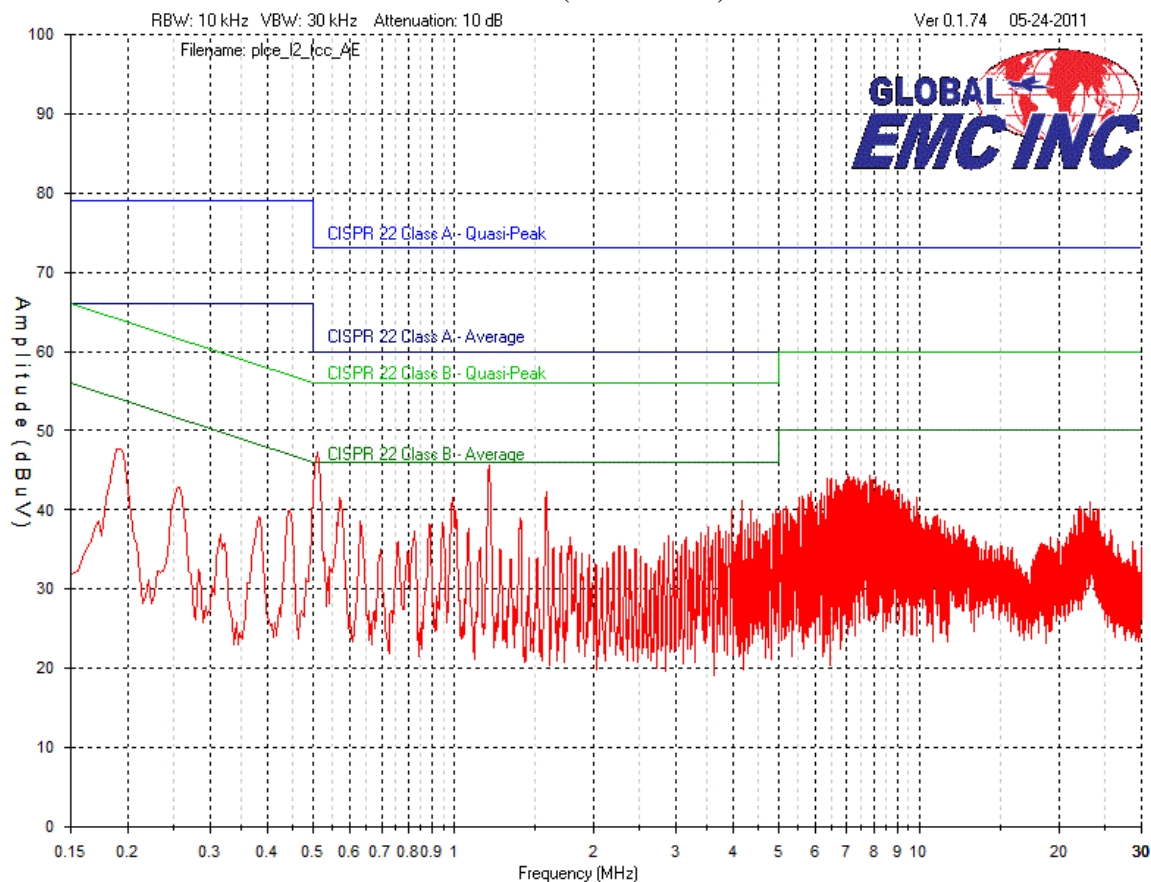
Client	Lyngsoe Systems	
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Client	Lyngsoe Systems	
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### Neutral (White/Blue)



Client	<b>Lyngsoe Systems</b>	
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Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Final Measurements

### Line 1 – Phase (Black/Brown)


Frequency (MHz)	Raw (dBuV)	Atten Factor (dB)	LISN Factor (dB)	Cable (dB)	Level (dBuV)	Limit (dB)	Margin (dB)	Pass/Fail
0.506	35	10	0.1	0.2	45.3	46	0.7	Pass
0.573	33.4	10	0.1	0.2	43.7	46	2.3	Pass
1.559	33.4	10	0.1	0.2	43.7	46	2.3	Pass
0.183	39	10	0.1	1.2	50.3	54.3	4	Pass
1.266	31.3	10	0.1	0.2	41.6	46	4.4	Pass
0.446	31.9	10	0.1	0.2	42.2	46.9	4.7	Pass

### Line 2 – Neutral (White/Blue)

Freq (MHz)	Raw (dBuV)	Atten Factor (dB)	LISN Factor (dB)	Cable (dB)	Level (dBuV)	Limit (dB)	Margin (dB)	Pass/Fail
1.162	34.6	10	0.1	0.2	44.9	46	1.1	Pass
1.012	34	10	0.1	0.2	44.3	46	1.7	Pass
0.49	34.7	10	0.1	0.2	45	46.2	1.2	Pass
1.096	34.4	10	0.1	0.2	44.7	46	1.3	Pass
1.152	34.4	10	0.1	0.2	44.7	46	1.3	Pass
0.47	34.7	10	0.1	0.2	45	46.5	1.5	Pass

No peak emissions exceeded the quasi-peak limits, therefore the unit was deemed to meet the quasi-peak requirements based on the peak emissions. The tables above represent the average emissions readings with respect to the average limit.


Note: See ‘Appendix B – EUT & Test Setup Photographs’ for photos showing the test set-up for the highest line conducted emission

Client	Lyngsoe Systems	
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Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
IFR Spectrum Analyzer	AN940	IFR	12/29/2009	12/29/2011	GEMC 6350
LISN	FCC-LISN-50/250-16-2-01	FCC	02/03/2011	02/03/2013	GEMC 65
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 28
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
Attenuator 10 dB	FP-50-10	Trilithic	NCR	NCR	GEMC 42

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B\_Rev1"

Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## ***Radiated Emissions***

### **Purpose**

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT does not exceed the limits listed below as defined in the applicable test standard, as measured from a receiving antenna. This helps protect broadcast radio services such as television, FM radio, pagers, cellular telephones, emergency services, and so on, from unwanted interference.

### **Limit(s) and Method**

The method is as defined in ANSI C63.4

The limits are as defined in FCC Part 15, Section 15.209 and 15.231 (e), whichever limit permits the higher field strength. The below table represents the 15.209 limits, which are presented as worst case.


0.009 MHz to 0.49 MHz,  $2400/F^3$  uV/m, at 300 meters  
0.49 to 1.7 MHz,  $24000/F^3$  uV/m, at 30 meters  
1.7 MHz to 30 MHz, 30 uV/m, at 30 meters  
30 MHz to 88 MHz, 100 uV/m (40.0 dBuV/m<sup>1</sup>) at 3 m  
88 MHz to 216 MHz, 150 uV/m (43.5 dBuV/m<sup>1</sup>) at 3 m  
216 MHz to 960 MHz, 200 uV/m (46.4 dBuV/m<sup>1</sup>) at 3 m  
Above 960 MHz, 500 uV/m (54.0 dBuV/m<sup>1</sup>) at 3 m  
Above 1000 MHz, 500 uV/m (54 dBuV/m<sup>2</sup>) at 3m

<sup>1</sup>30 MHz to 1 GHz is specified with 120 kHz resolution bandwidth and was measured using a peak detector. If the limit is exceeded the peak detector, it may be re-measured with the Quasi-Peak detector. If the quasi-peak exceeds the 15.209 limit it may be re-measured with an Average detector and compared against the limits specified in 15.231(e), if so applicable. If average emission measurements are employed, the provisions in 15.35 for averaging pulsed emissions and for limiting peak emissions apply.

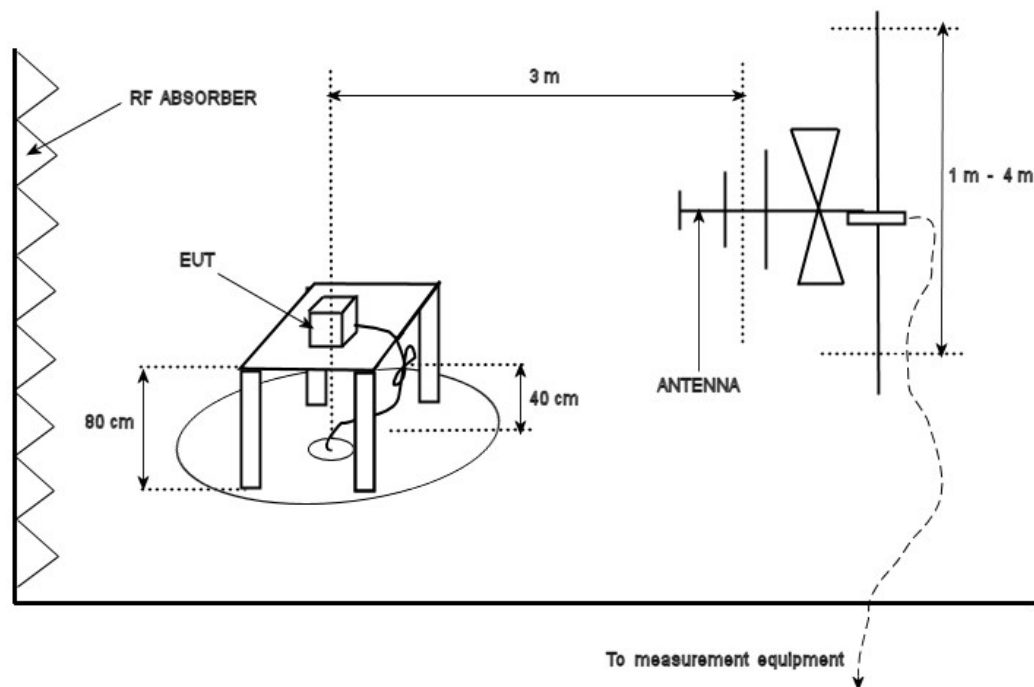
<sup>2</sup>Above 1 GHz is specified is with 1MHz resolution bandwidth and was measured using a peak detector. If the limit is exceeded with the peak detector, it is re-measured with the average detector. If average emission measurements are employed, the provisions in 15.35 for averaging pulsed emissions and for limiting peak emissions apply. This range is scanned in accordance with 15.33 to above the 5<sup>th</sup> harmonic.

<sup>3</sup>F is frequency in kHz.

The detector (and method) used shall be noted in the final measurement table in this report.

Client	Lyngsoe Systems	
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### Typical Radiated Emissions Setup




### Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is  $\pm 4.4$  dB with a 'k=2' coverage factor and a 95% confidence level.

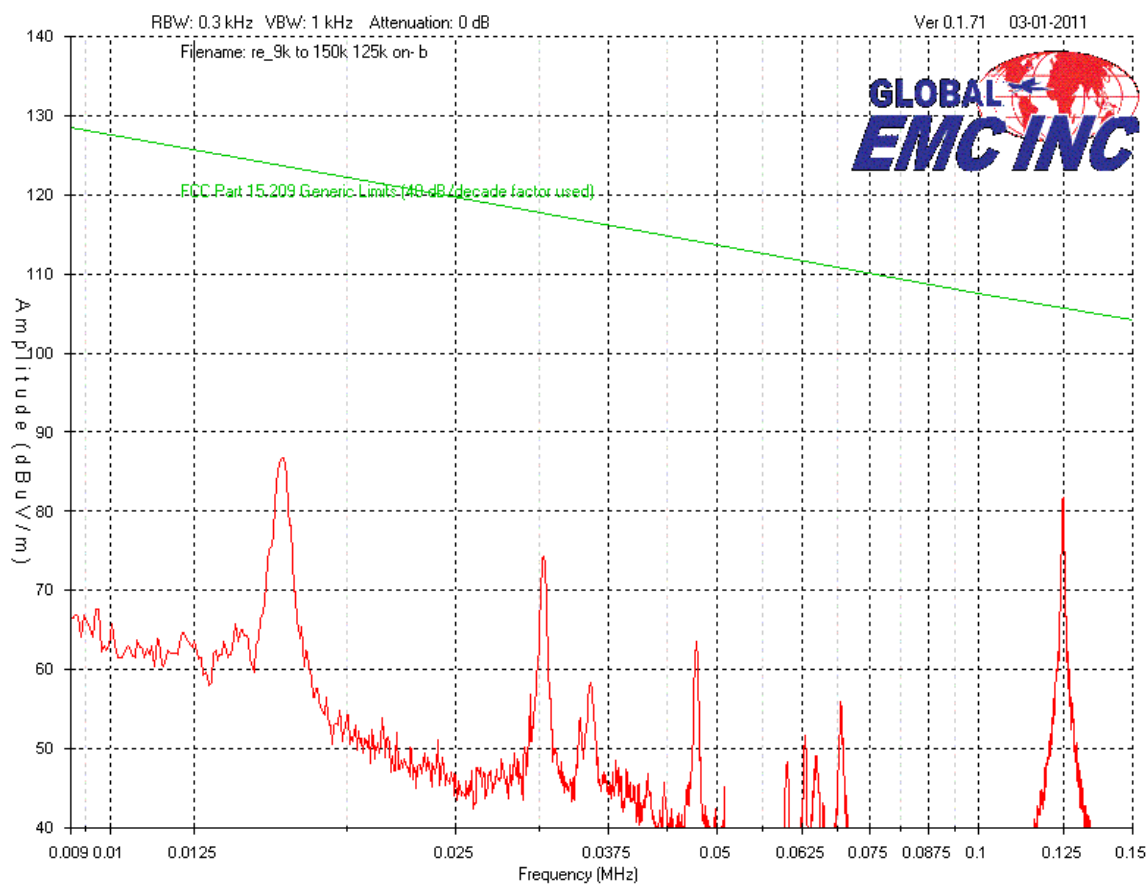
### Preliminary Graphs

Note the graphs shown below are for graphical illustration only. For final measurements with the appropriate detector, or with the appropriate factors taken into account please refer to the final measurement table where applicable. The graph shown below is a maximized peak measurement graph, measured with a resolution bandwidth greater than the final required detector and over a full 0-360 rotation of the EUT. This peaking process is done as a worst case measurement. This process enables the detection of frequencies of concern for final measurement, and provides considerable time savings.

In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to a minimum of a 5 GHz.


Client	Lyngsoe Systems	
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### 9 kHz to 150 kHz at 3 meters

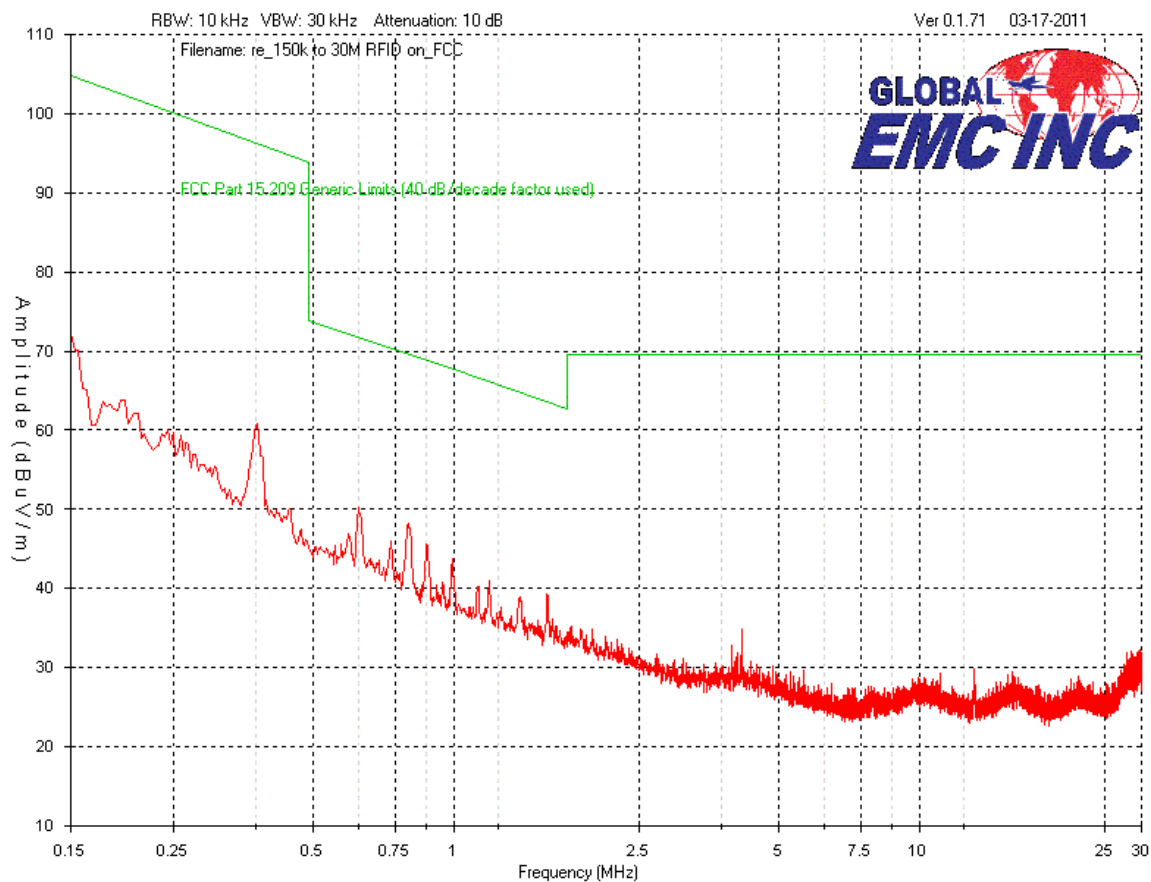


Note: The peak shown at 125 kHz was found to meet the requirement. Refer to tables.


No emissions were detected in receive mode in this frequency band.

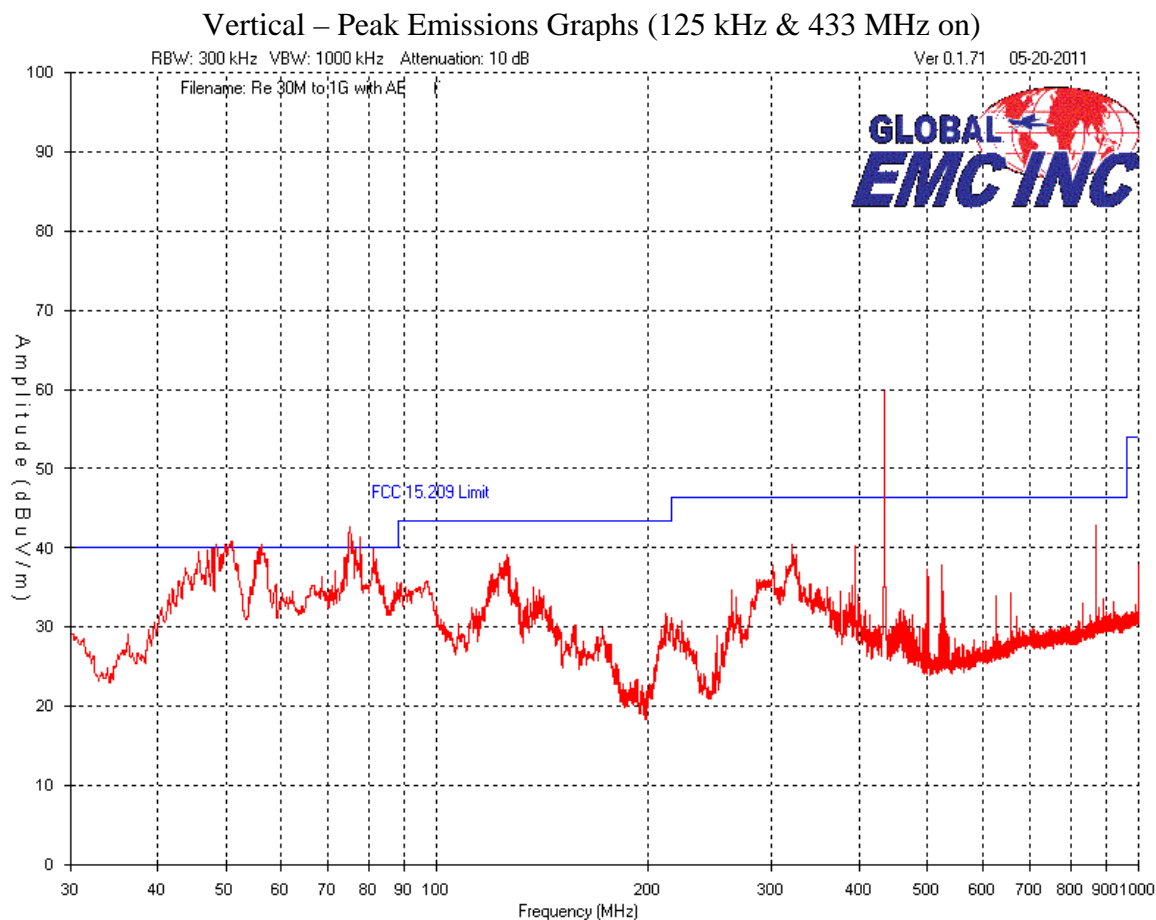
Client	Lyngsoe Systems	
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# 150 kHz to 30 MHz




No emissions were detected in receive mode in this frequency band.

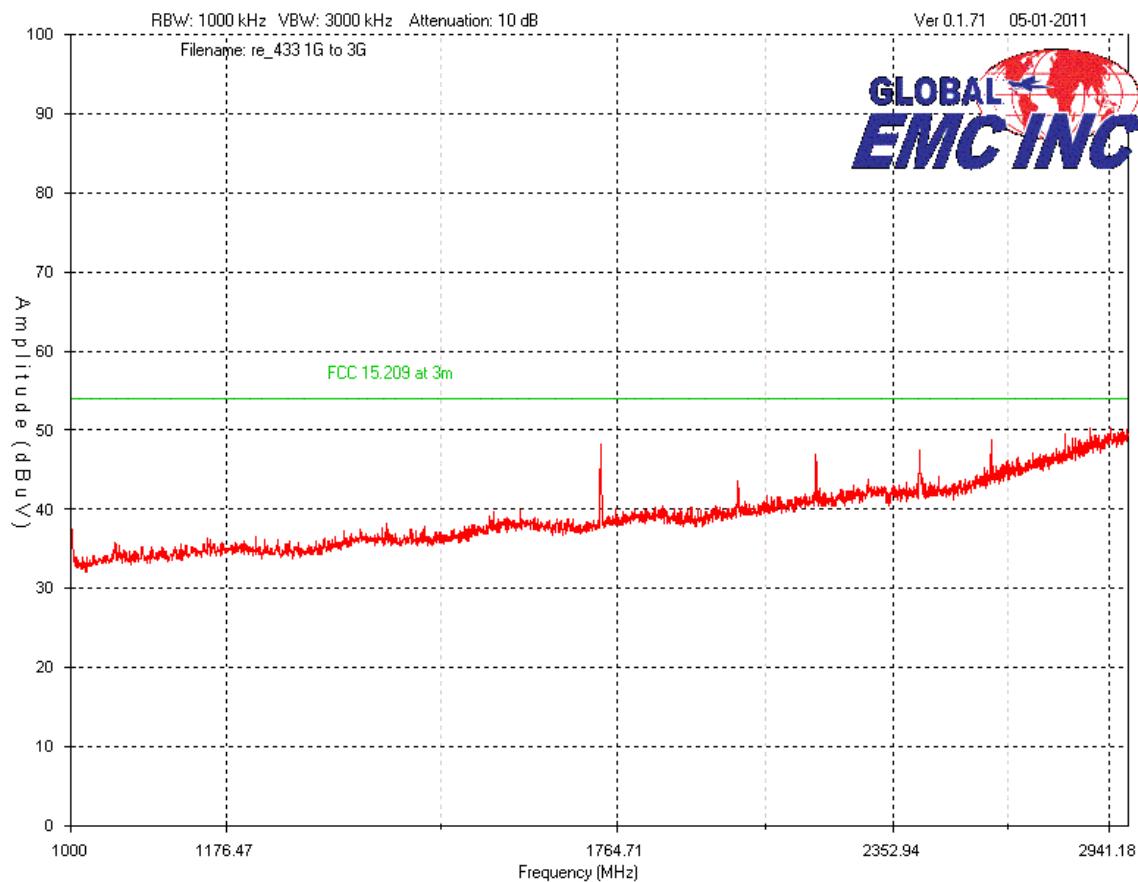
Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	




Emissions in receive mode in this frequency band, were the same as shown above, except the 433.92 MHz spike is not present.

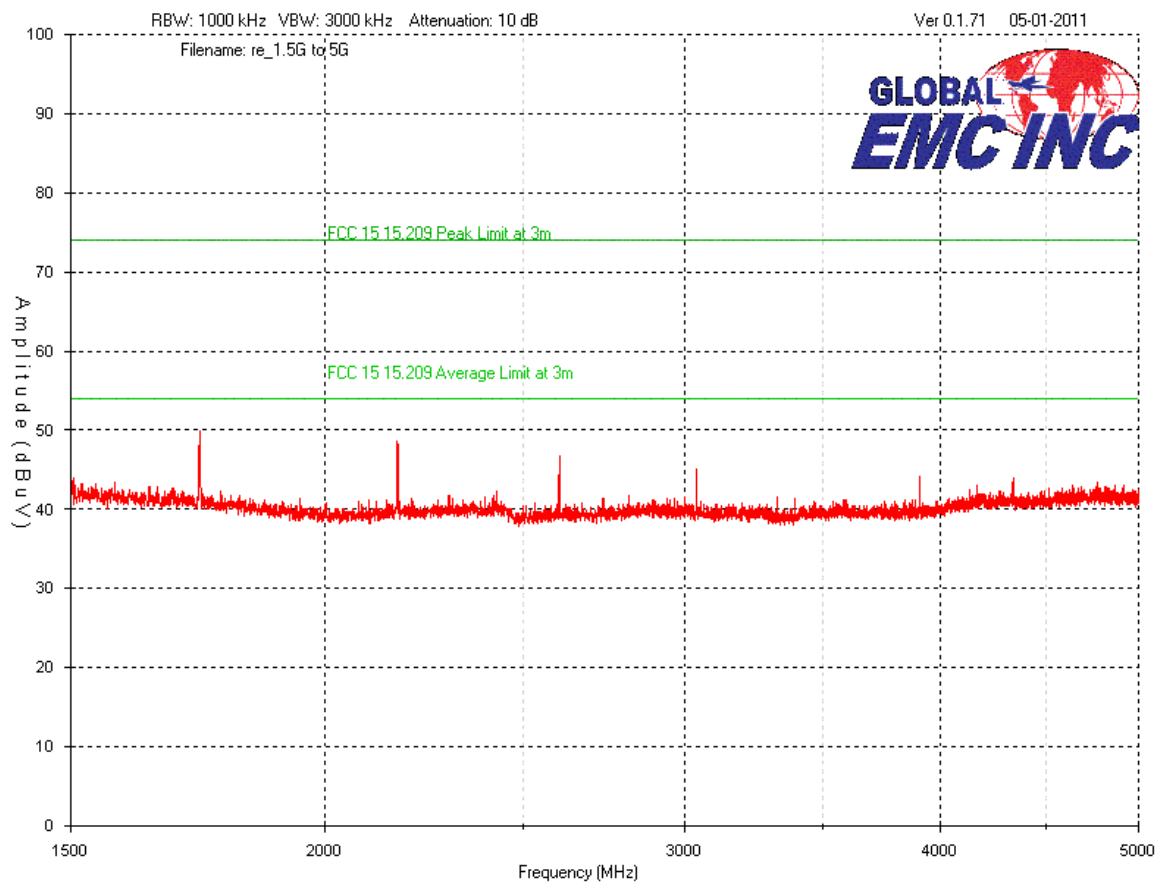


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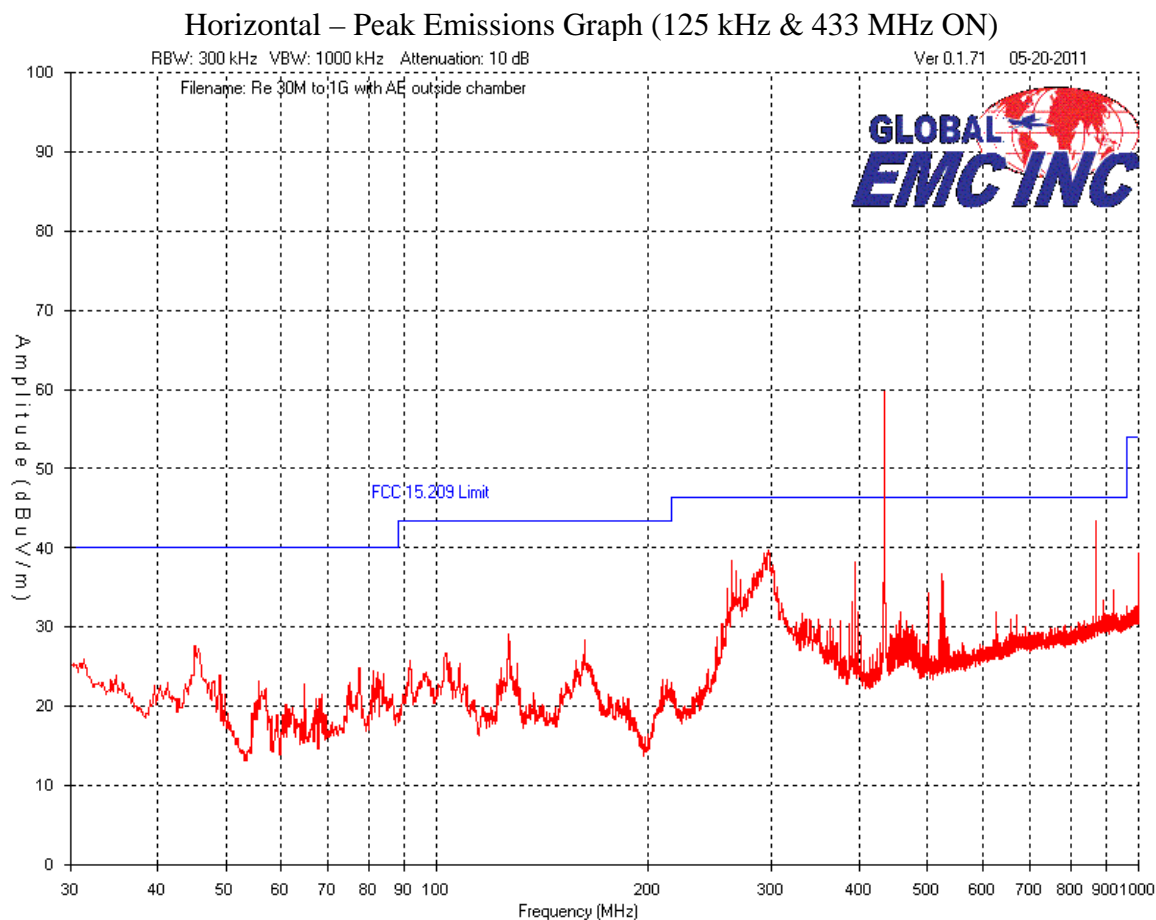
Emissions in receive mode in this frequency band, were the same as shown above

Client	Lyngsoe Systems	
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Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	




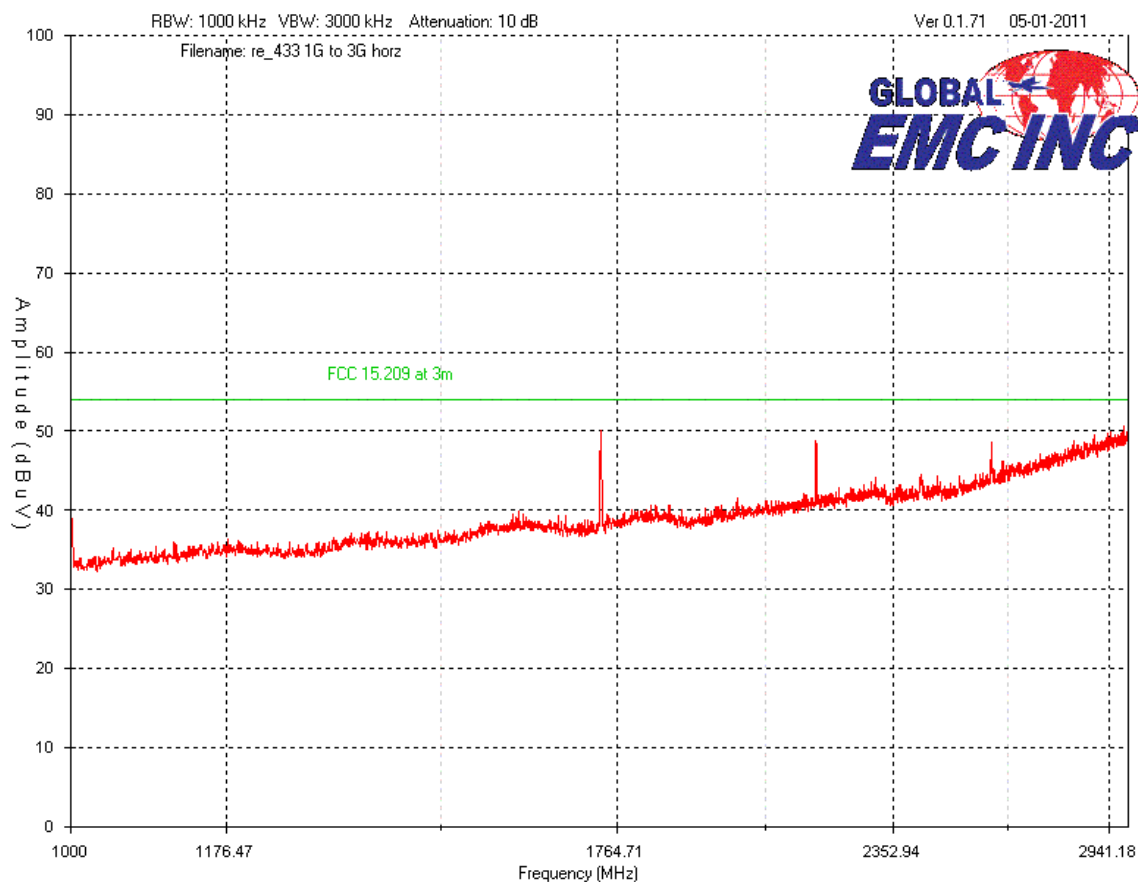
Emissions in receive mode in this frequency band, were the same as shown above

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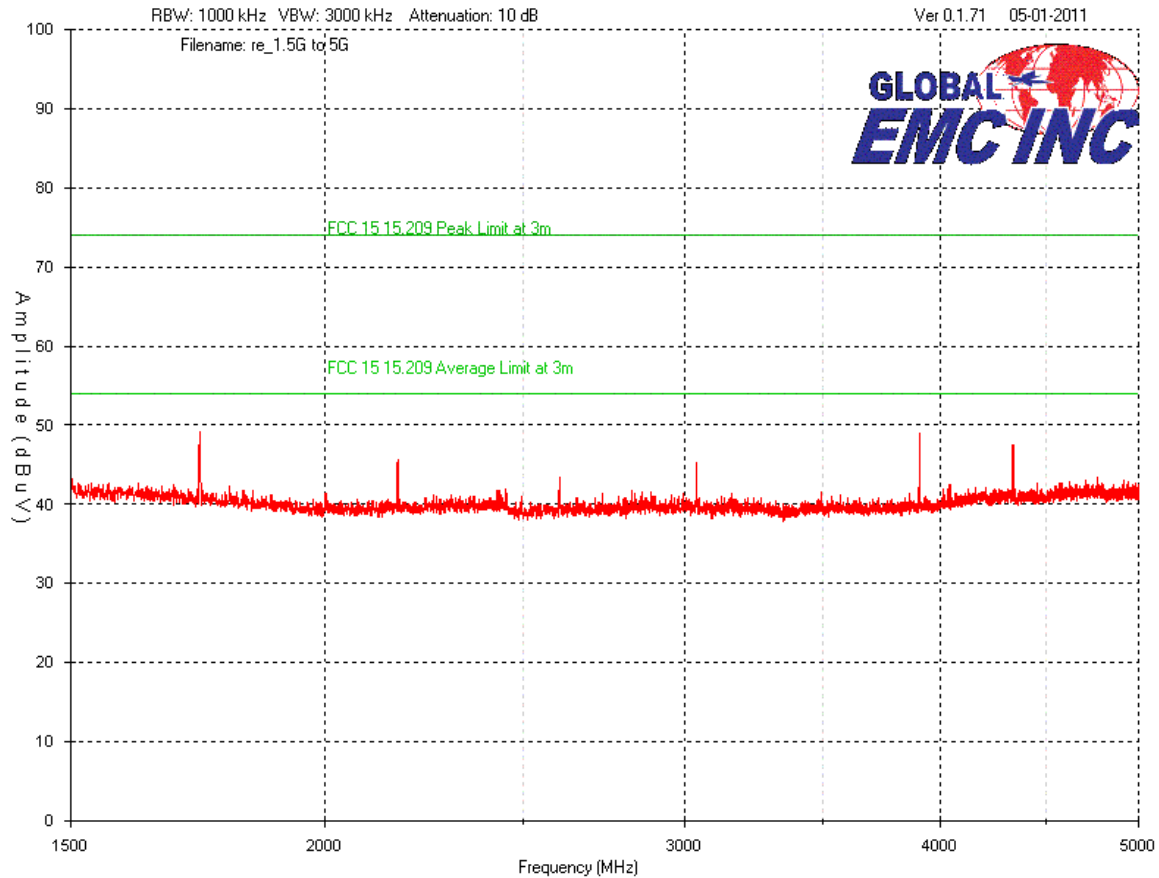
Emissions in receive mode in this frequency band, were the same as shown above, except the 433.92 MHz spike is not present.

Client	Lyngsoe Systems	
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Emissions in receive mode in this frequency band, were the same as shown above

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Emissions in receive mode in this frequency band, were the same as shown above


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## Final Measurements

9 kHz to 30 MHz

Frequency	Raw Reading dBuV	Ant Factor	Current to Voltage Factor	Preamp –(dB)	Level (dBuV/m)	Limits (40 dB/decade factor )	Margin (dB)	Comments
0.125	56.3	3.9	51.5	-30	81.7	105.7	24	Pass

Note: The above measurements show a peak detector compared against the average limit.

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#### Vertical – 30 MHz to 1 GHz

Frequency (MHz)	Reading (dBuV)	Ant – Factor (dB/m)	Cable (dB)	Preamp – Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail
433.92	71	16.4	0.7	-30.3	57.8			
867.84	50.3	22.1	1.2	-30	43.6	46.4	2.8	Pass
75.299	60.1	7.4	0.4	-30.2	37.7	40	2.3	Pass
50.952	58.1	8.6	0.4	-30.1	37	40	3	Pass
56.19	59.5	7.8	0.4	-30.1	37.6	40	2.4	Pass
500.741	50.8	17.5	0.7	-30.2	38.8	46.4	7.6	Pass
125.836	58.1	7.8	0.5	-30.2	36.2	43.5	7.3	Pass

#### Horizontal – 30 MHz to 1 GHz

Frequency (MHz)	Reading (dBuV)	Ant – Factor (dB/m)	Cable (dB)	Preamp – Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail
433.92	72	16.4	0.7	-30.3	58.8			
867.84	49.6	22.6	1.3	-30	43.5	46.4	2.9	Pass
262.897	55.8	12.5	0.6	-30.4	38.5	46.4	7.9	Pass
524.991	47.9	18.4	0.7	-30.2	36.8	46.4	9.6	Pass
500.741	46.4	17.5	0.7	-30.2	34.4	46.4	12	Pass
45.132	46.6	10.9	0.3	-30.1	27.7	40	12.3	Pass
390.355	46.8	16	0.6	-30.3	33.1	46.4	13.3	Pass

Note: Quasi-peak measurements applied above were made with a quasi-peak or peak detector with the device continuously transmitting data. These measurements do not apply a duty cycle correction factor to the peak data.


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Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
IFR Spectrum Analyzer	AN940	IFR	12/29/2009	12/29/2011	GEMC 6350
BiLog Antenna	3142-C	ETS	17-Jan-11	17-Jan-13	GEMC 137
Attenuator 3 dB	FP-50-3	Trilithic	NCR	NCR	GEMC 40
Chase Preamp 9kHz - 2 GHz	CPA9231A	Chase	8/25/2010	2012-08-2012	GEMC 6403
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 28
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 31
Q-Par 1.5-18 GHz Horn	6878/24	Q-par	8/25/2010	8/25/2012	GEMC 6365
Loop Antenna	EM 6871	Electro-Metrics	2011-01-31	2013-01-31	GEMC 70
Loop Antenna	EM 6872	Electro-Metrics	2011-01-31	2013-01-31	GEMC 71
HP Preamp	HP-8449B	HP	8/25/2010	8/25/2012	GEMC 6351

This report module is based on GEMC template "FCC - 15.209 - Radiated Emissions\_Rev1.doc"



Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## ***Duty Cycle of Periodically Operated Transmitters***

### **Purpose**

The purpose of this test is to measure the duty cycle of the transmitter. This calculation allows a true peak to average correction factor to be obtained. An average measurement may not be possible, as the device may be set to continually transmitting. Also, an average measurement may not be correct if the device transmits more frequently or less frequently than every 100 mS.


This calculation of duty cycle correction is then applied to the radiated emissions peak reading to obtain the calculated average

### **Limits**

No limit applies, however this calculation is applied to the peak reading to obtain the average reading which must be under the average limit.

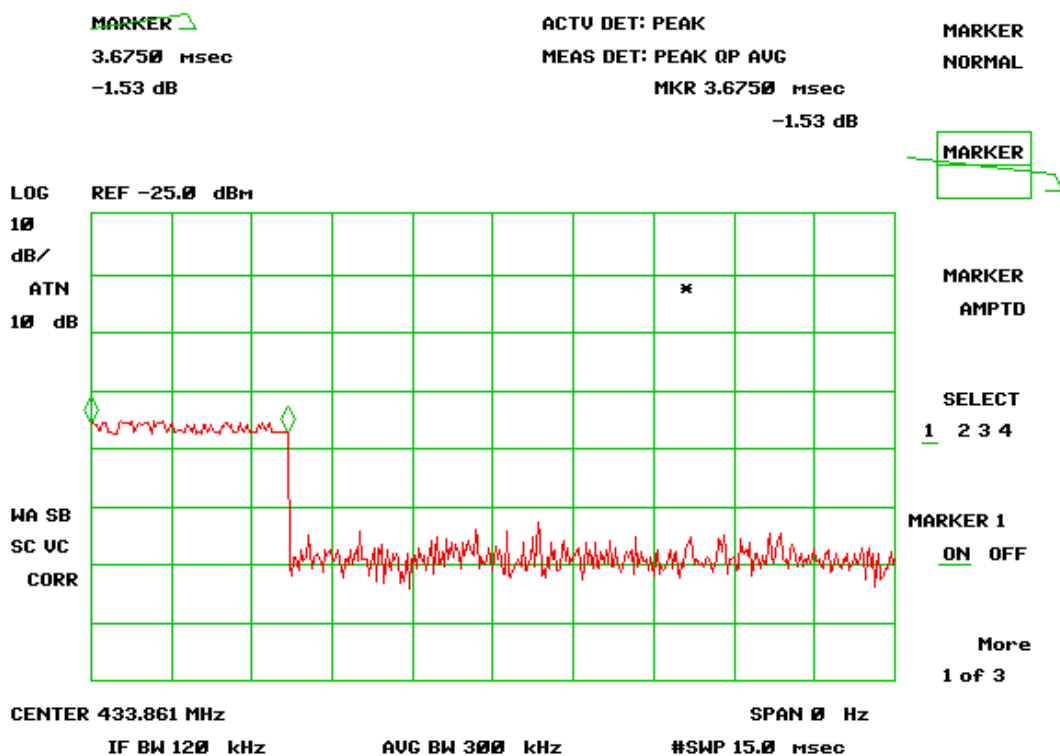
Additionally, for compliance to 15.231(e), the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.


A transmission burst of 8 bytes, less than 600 mSec, occurs once every hour, and is used to validate system integrity to ensure it can correctly receive signals from RFID tags.

Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

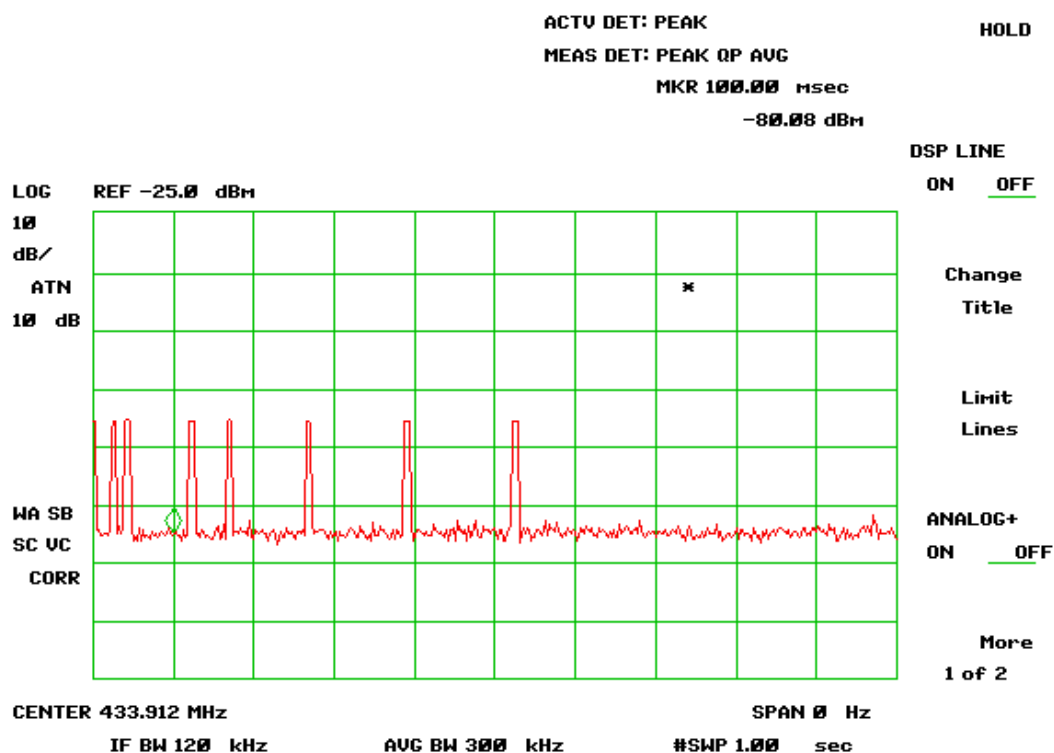
## Results

10:30:55 MAY 02, 2011




Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

11:01:37 MAY 02, 2011




Note: This represents a transmission burst of 8 bytes. This transmission burst of 8 bytes occurs once every hour, and is used to validate system integrity. The total duration of the burst is less than 600 mSec, and occurs once every hour. This complies with the requirements of 15.231(e).

Client	<b>Lyngsoe Systems</b>	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

Time on = 3.76 mSec x 3

Duty cycle = 20 Log (11.28 / 100)

Duty cycle = -18.9 dB

Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

### Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
IFR Spectrum Analyzer	AN940	IFR	Dec 29, 2009	Dec 29, 2011	GEMC 6350
BiLog Antenna	3142-C	ETS	Jan 17, 2011	Jan 17, 2013	GEMC 137
Attenuator 3 dB	FP-50-3	Trilithic	NCR	NCR	GEMC 40
Chase Preamp 9kHz - 2 GHz	CPA9231A	Chase	Aug 25, 2010	Aug 25, 2012	GEMC 6403
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 28
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 31
Q-Par 1.5-18 GHz Horn	6878/24	Q-par	8/25/2010	8/25/2012	GEMC 6365
Loop Antenna	EM 6871	Electro-Metrics	2011-01-31	2013-01-31	GEMC 70
Loop Antenna	EM 6872	Electro-Metrics	2011-01-31	2013-01-31	GEMC 71
HP Preamp	HP-8449B	HP	8/25/2010	8/25/2012	GEMC 6351

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B\_Rev1"

Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## ***Radiated Emissions of 433.92 MHz Fundamental***

### **Purpose**

The purpose of this test is to ensure that the RF energy intentionally emitted from the EUT does not exceed the limit listed below as defined in the applicable test standard, as measured from a receiving antenna. This helps protect other periodic operating devices, and licensed broadcasting devices, and so on, from unwanted interference.

### **Limit(s) and Method**


The method is as defined in ANSI C63.4

The limits are as defined in FCC Part 15, Section 15.231 (e), and is specific for the one frequency for the fundamental transmit frequency.

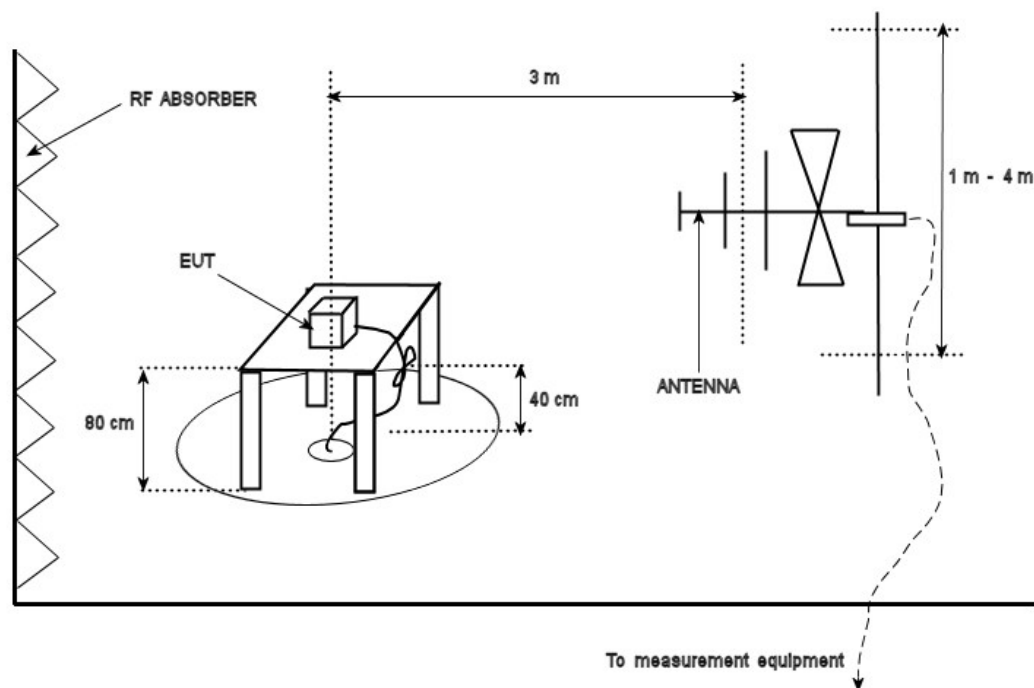
433.92 MHz – 72.5 dBuV/m<sup>1</sup> and 92.5 dBuV/m<sup>2</sup>

<sup>1</sup>Based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector.

<sup>2</sup>Based on the peak value of the measured emissions


Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

### Typical Radiated Emissions Setup



### Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is  $\pm 4.4$  dB with a 'k=2' coverage factor and a 95% confidence level.

Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Final Measurements


Peak readings vs. average limit.

Frequency (MHz)	Reading (dBuV)	Det.	Pol.	Ant – Factor (dB/m)	Preamplifier – Factor +Cable (dB)	Cor.	Level (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Pass / Fail
433.92	71	PK	V	16.4	-29.6	N/A	57.8	72.5	14.7	Pass
433.92	72	PK	H	16.4	-29.6	N/A	58.8	72.5	13.7	Pass

Note a duty cycle of -18.9 applies, as calculated in the duty cycle section of this report, however due to margin exhibited, was not applied.

The device complies with the requirement. A worst case measurement of 58.8 dBuV/m at 3 meters was obtained using a peak detector at a center frequency of 433.92 MHz in the horizontal polarity.




Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Test Equipment List

### Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
IFR Spectrum Analyzer	AN940	IFR	12/29/2009	12/29/2011	GEMC 6350
BiLog Antenna	3142-C	ETS	17-Jan-11	17-Jan-13	GEMC 137
Attenuator 3 dB	FP-50-3	Trilithic	NCR	NCR	GEMC 40
Chase Preamp 9kHz - 2 GHz	CPA9231A	Chase	8/25/2010	2012-08-2012	GEMC 6403
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 28
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 31

This report module is based on GEMC template "FCC - 15.209 - Radiated Emissions\_Rev1.doc"

Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## ***20 dB or 99 % Occupied Bandwidth***

### **Purpose**

The purpose of this test is to ensure that the bandwidth occupied does not exceed a stated minimum, or for frequency designator purposes. This helps ensure the utilization of the frequency allocation is sufficiently narrow and not occupying excessive spectrum. This also helps prevent accidentally interference of data by ensuring adequate data separation to distinguish the reception of the intended information by enabling the receiver to have a relatively narrow band response tuned to the transmitter's frequency.

### **Limits**


The Limit is as specified in FCC Part 15 and RSS 210.

For periodic transmitters below 900 MHz, this should not exceed 0.25 % of the fundamental frequency. The limit for 433.92 MHz is 108.5 kHz. This should be measured with a RBW equal to approximately %1 (or greater) of the 20 dB bandwidth of the signal and a VBW > then the RBW.

### **Results**

The EUT passed. The 20 dB bandwidth measured was 81.0 kHz and the requirement was that this be less than 108.5 kHz.

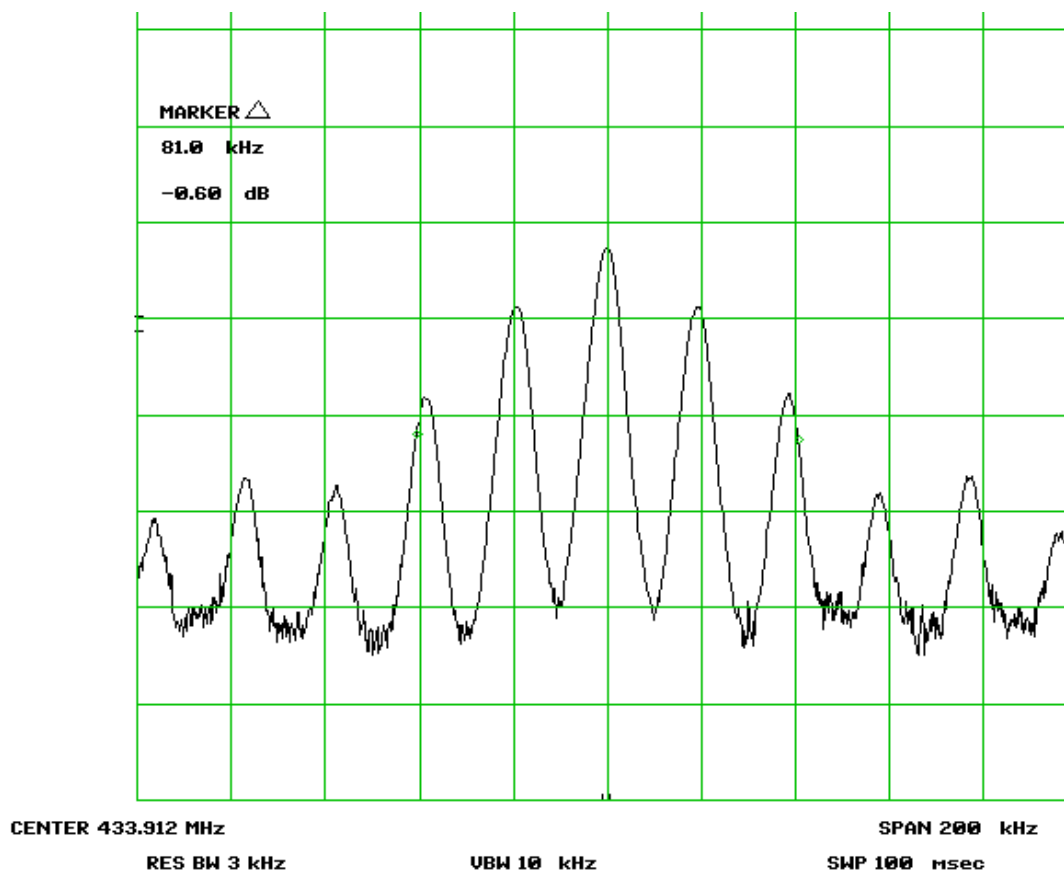
For information purposes, the 20 dB bandwidth of the 125 kHz signal was 3.28 kHz.


Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Graph(s)

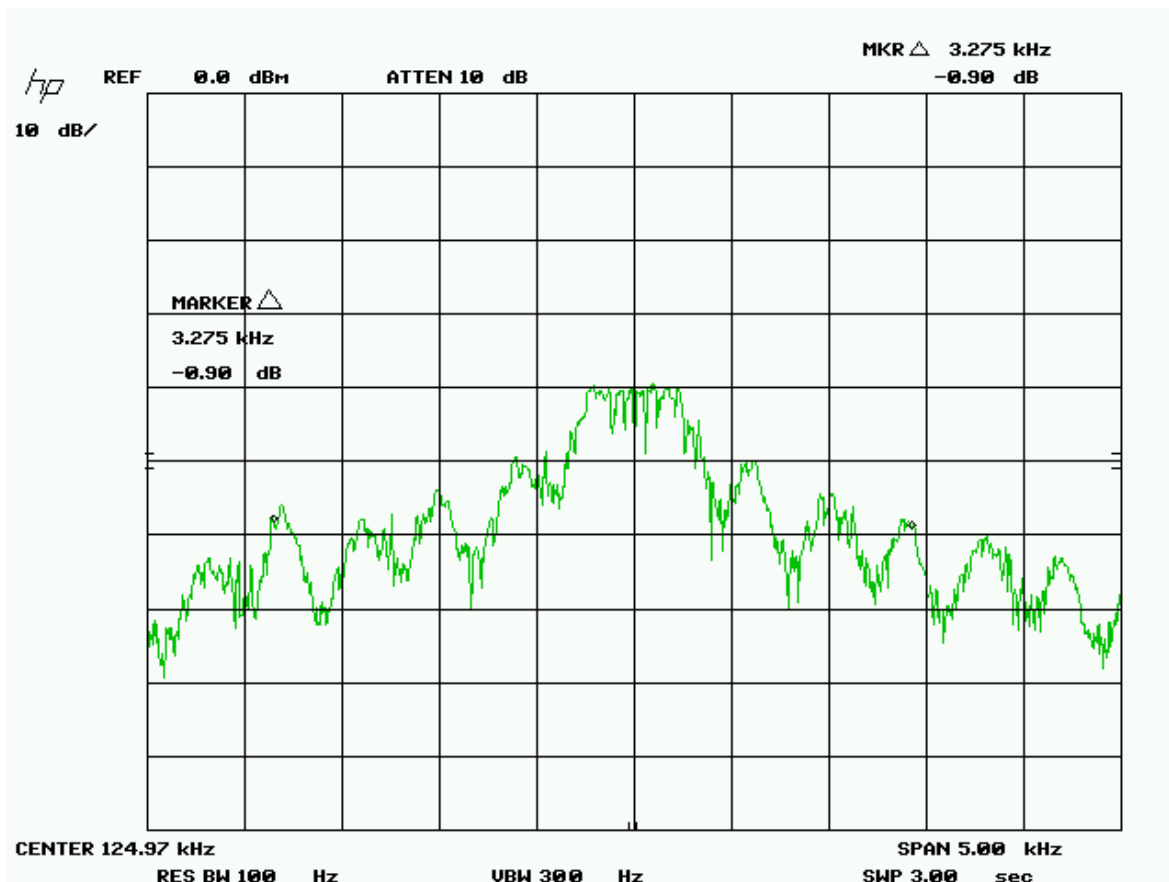
The graphs shown below shows the bandwidth during the operation of the device. This is measured by a max hold on the spectrum analyzer and the highest resolution bandwidth that is approximately 1 % of the 20 dB BW during operation of the EUT. This measurement is a peak measurement. Max hold is performed for a duration of not less then 1 minute.

Transmitter with predetermined data pattern (433.92 MHz)




Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

LF Transmitter (125 kHz)




Note: See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up.

Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	


## Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Attenuator 20 dB	FP-50-20	Trilithic	NCR	NCR	GEMC 43
IFR Spectrum Analyzer	AN940	IFR	12/29/2009	12/29/2011	GEMC 6350
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
Power Attenuator 20 dB	25-A-FFN-20	Bird / Hutton	NCR	NCR	GEMC 49

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B\_Rev1"

Client	<b>Lyngsoe Systems</b>	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Appendix A – EUT/Customer Summary


Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

For further details for filing purposes, refer to filing package.

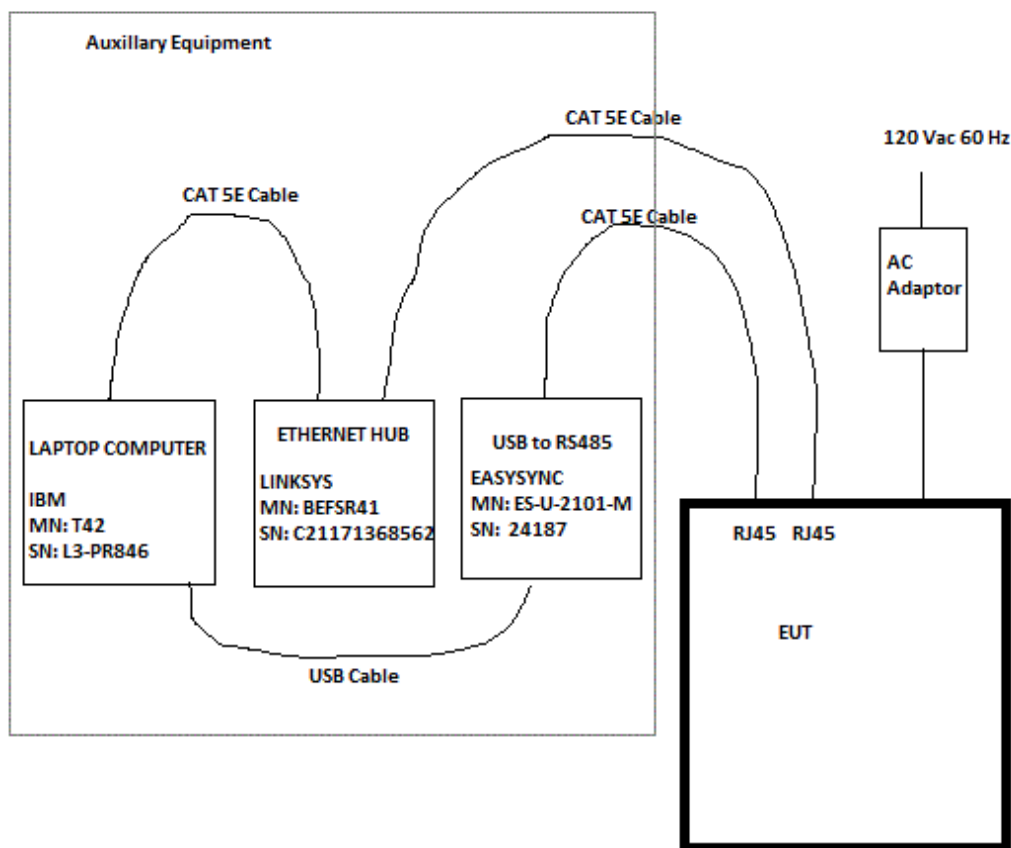
## General EUT Description

<b>Manufacturer</b>	Lyngsoe Systems
<b>EUT Name</b>	PRX23
<b>FCCID</b>	PQG-PRX23
<b>IC #</b>	4113A-PRX23
<b>Approximate Size (LxWxH)</b>	18cm x 12cm x 4cm
<b>Equipment Category (Commercial / Residential / Medical)</b>	Commercial
<b>Input Voltage and Frequency</b>	Battery powered
<b>Table Top / Wall mount / Floor standing (choose table top if unsure)</b>	Table top
<b>I/O Connectors available on EUT</b>	None – self contained
<b>Peripherals required for test</b>	Laptop to exercise Ethernet & RS485 USB to RS485 Adaptor Network Simulator (Ethernet Hub)  See block diagram for further details
<b>Minimum Separation distance from operator</b>	20 cm.
<b>Types and lengths of all I/O cables</b>	RS485 up to 100 meters Ethernet, up to 100 meters.


Note the EUT is considered to have been received the date of the commencement of the first test, unless otherwise stated. For a close-up picture of the EUT, see ‘Appendix B – EUT & Test Setup Photographs’.

Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	


## Setup Diagram





Client	<b>Lyngsoe Systems</b>	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	


## Appendix B – EUT and Test Setup Photographs

Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

Note: These photos are for information purposes only. Also refer to PDF files that are separate from this test report.


EUT



Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	


EUT reverse



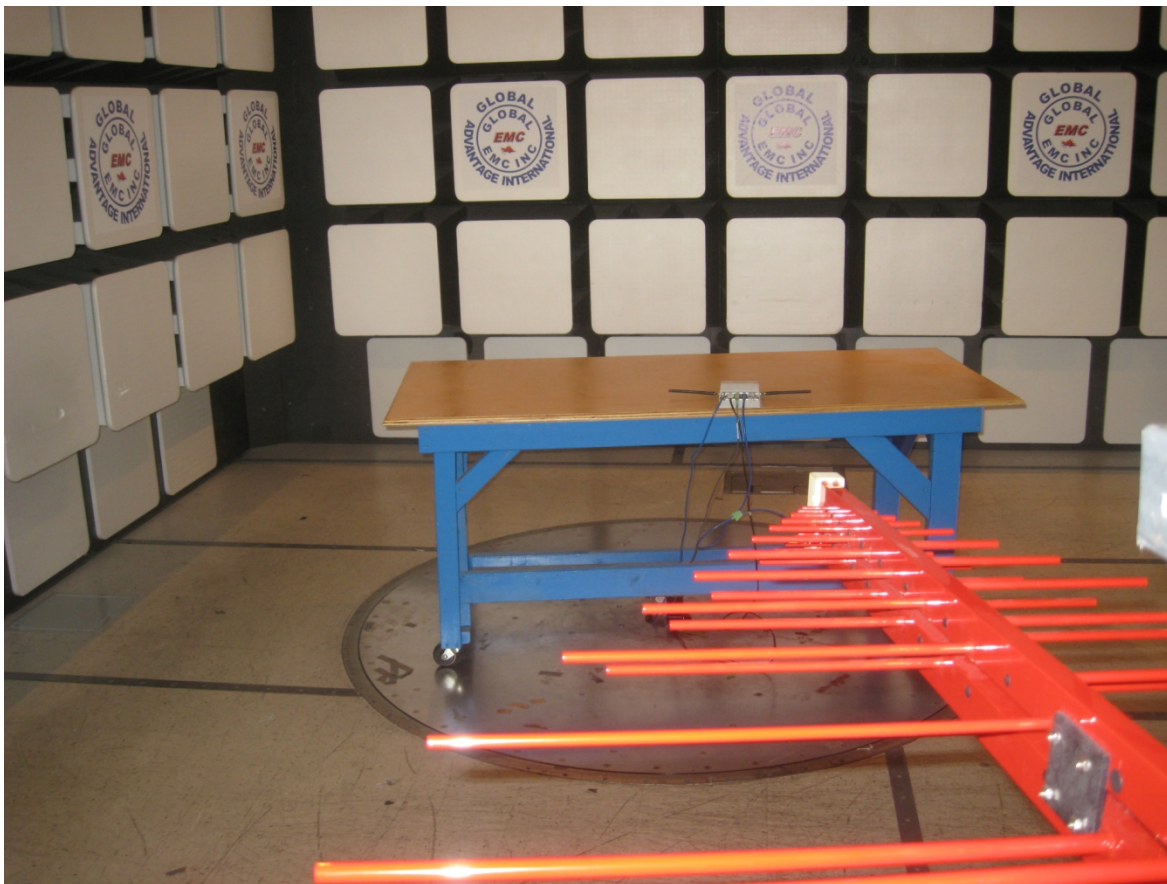
Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## EUT – Labels




Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

#### Radiated emissions – 30 MHz to 1 GHz

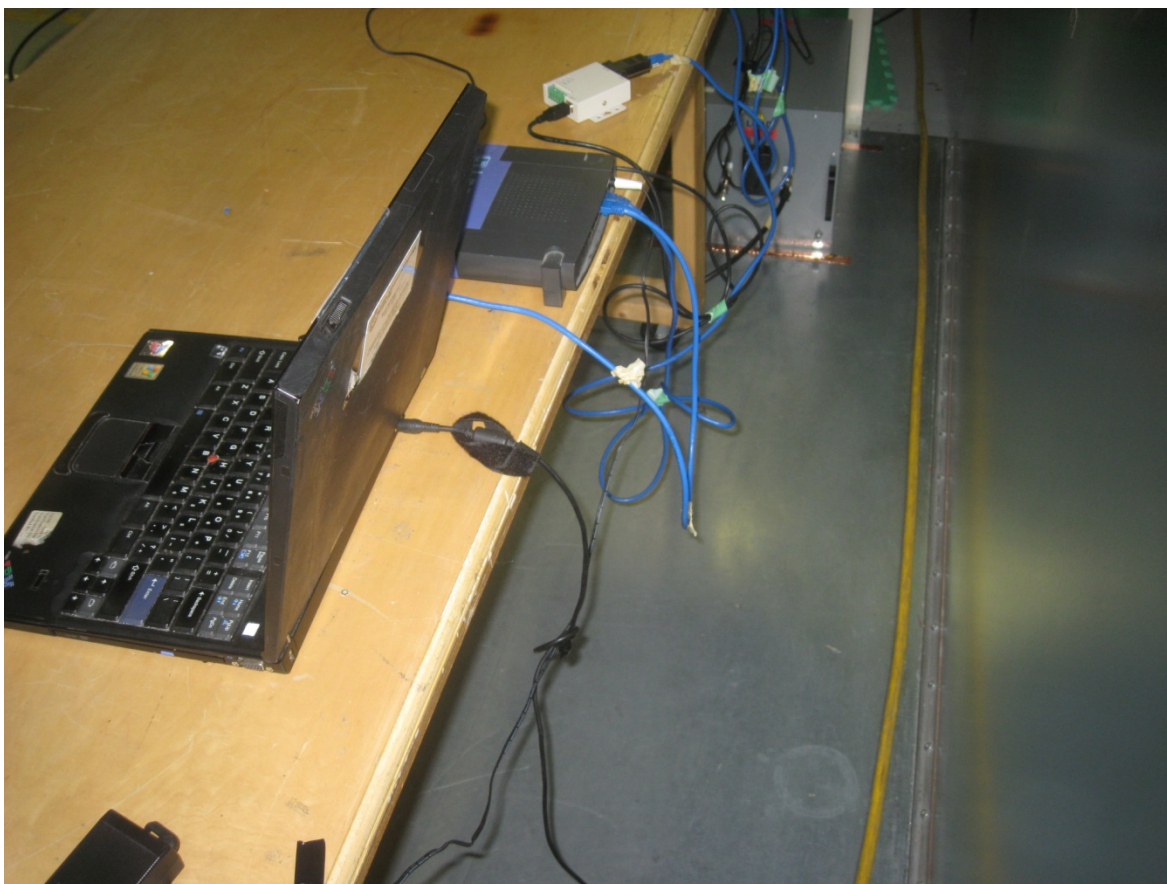



Note: In accordance with ANSI C63.4:2009 Section 6.2.2.1 and 6.2.2.2 the RS-485 and Ethernet auxiliary devices were remotely located from the test site.



Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Power Line Conducted Emissions Setup 1



Client	Lyngsoe Systems	
Product	@Process RFID reader and exciter (PRX23)	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Power Line Conducted Emissions 2

