TEST REPORT

Report Number: 101277992MIN-011D
Project Number: G101277992

Testing performed on the
Model 4200, Programmer Charger

FCC ID:
Industry Canada ID:

to
47 CFR Part 15.249:2013
RSS- 210, Issue 8, 2010
RSS-Gen, Issue 3, 2010
47 CFR, Part 15:2013, §15.107 and §15.109, Class B / ICES-003, Issue 5:2012

For
Minnetronix

Test Performed by:
Intertek Testing Services NA, Inc.
7250 Hudson Blvd., Suite 100
Oakdale, MN 55128 USA

Test Authorized by:
Minnetronix
1635 Energy Park Drive
St. Paul, MN 55108 USA

Prepared by: _____ Date: October 30, 2013
Uri Spector

Reviewed by: _____ Date: October 30, 2013
Simon Khazon

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1.0 GENERAL DESCRIPTION

Model:	4200
Type of EUT:	Programmer Charger, Wakeup Radio
Serial Number:	DBR 1471
FCC ID:	
Industry Canada ID:	
Related Submittal(s) Grants:	N/A
Company:	Minnetronix
Customer:	Sue Sibilski
Address:	1635 Energy Park Drive St. Paul, MN 55108
Phone:	(651) 917-4060
Fax:	(651) 917-4066
e-mail:	ssibilski@minnetronix.com
Test Standards:	☒ 47 CFR, Part 15:2013, §15.249 ☒ RSS–210, Issue 8, 2010 ☒ RSS-Gen, Issue 3, 2010 ☒ 47 CFR, Part 15:2013, §15.107 and §15.109, Class B ☒ ICES-003, Issue 5:2012 ☐ Other
Type of radio:	☒ Stand -alone ☐ Module ☐ Hybrid
Date Sample Submitted:	August 16, 2013
Test Work Started:	August 19, 2013
Test Work Completed:	September 26, 2013
Test Sample Conditions:	☐ Damaged ☐Poor (Usable) ☒ Good

1.1 Product Description; Test Facility

Product Description:	Programmer Charger
Operating Frequency	2.45GHz
Power Level Setting	6
Modulation:	OOK
Emission Designator:	3MX1D
Antenna(s) Info:	-2dBi Chip antenna
Antenna Installation:	☐ User ☐ Professional ☒ Factory
Transmitter Power Configuration:	☐ Internal battery ☒ External power source ☒ 100-240VAC ☐ 400VAC ☐ DC ☐ Other: ☒ 50-60Hz
Special Test Arrangement:	As a hand-held device the EUT was rotated through three orthogonal axes to determine and tested with the maximum emissions
Test Facility Accreditation:	A2LA (Certificate No. 1427.01)
Test Methodology:	Measurements performed according to the procedures in ANSI C63.10-2009

1.2 EUT Configuration

The equipment under test was operated during the measurement under the following conditions:

☒ - Standby
☒ - Continuous
☒ - Continuous un-modulated
☒ - Continuous modulated
☐ - Test program (customer specific)
☒ - Below

Operating modes of the EUT:

No.	Description
1	The EUT was powered 120VAC and was activated to transmit continuously at 2.45GHz.

Cables:

No.	Type	Length	Designation	Note
1	Not shielded USB Power cable	2m	Power Cable	
2	Model 4230 not shielded cable	1m	Charging Paddle	

Support equipment/Services:

No.	Item	Description
1	None	

1.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

☒ **Normal**

Temperature: 15-35 ° C

Humidity: 30-60 %

Atmospheric pressure: 86-106 kPa

1.4 Measurement uncertainty

The expanded uncertainty (k = 2) for radiated emissions from 30 to 1000 MHz has been determined to be: ±4 dB at 10m and ±5.4 dB at 3m

The expanded uncertainty (k = 2) for conducted emissions from 150 kHz to 30 MHz has been determined to be:
±2.6 dB

1.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured emissions reading on the EMI Receiver.
The basic equation with a sample calculation is as follows:
FS = RA + AF + CF - AG

Where: FS = Field Strength in dB(µV/m)
RA = Receiver Amplitude in dB(µV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB(m^{-1})
AG = Amplifier Gain in dB

Assume a receiver reading of 48.1 dB(µV) is obtained. The antenna factor of 7.4 dB(m^{-1}) and cable factor of 1.6 dB is added and amplifier gain of 16.0 dB is subtracted giving field strength of 41.1 dB(µV/m).

RA = 48.1 dB(µV)
AF = 7.4 dB(m^{-1})
CF = 1.6 dB
AG = 16.0 dB
FS = RA + AF + CF - AG
FS = 48.1 + 7.4 + 1.6 – 16.0
FS = 41.1 dB(µV/m)

General notes:

2.0 TEST SUMMARY

Referring to the performance criteria and the operating mode during the tests specified in this report, the equipment complies with the requirements according to the following standards.

TEST SPECIFICATION	TEST PARAMETERS	RESULT
15.249(a) / RSS-210 A2.9(a)	Field strength of fundamental	Pass
15.249(a) / RSS-210 A2.9(a)	Field strength of harmonics	Pass
15.249(d) / RSS-210 A2.9(b)	Field strength of spurious emissions	Pass
15.215(c) / RSS- Gen 4.6.1	Bandwidth of the emission	Pass
15.207/RSS-Gen 7.2.2	Transmitter Power Line conducted emissions	Pass
15.109/ICES-003	Receiver/digital device radiated emissions	Pass
15.107/ ICES-003	Digital device conducted emissions	Pass

3.0 TEST CONDITIONS AND RESULTS

3.1 Field strength of fundamental

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test distance: ☐ 10 meters ☒ 3 meters

Frequency range of measurements: 2.45GHz

Test result: **Pass**

Max. Emissions margin at fundamental: 0.3dB below the limits

Notes: None

Date:	September 25, 2013	**Result:** **Pass**
Standard:	FCC 15.249(a) / RSS-210 A2.9	
Tested by:	Uri Spector	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Emission at fundamental	

Table 3.1.1

Frequency MHz	Antenna Polarity	Antenna Hts(cm)	Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Reading dBµV	AVG CF dB	Total @ 3m dBµV/m	Limit dBµV/m	Margin dB	Comments
Peak Limits											
2450.00	V	100	28.4	2.9	0.0	76.6	0.0	107.9	114.0	-6.1	
2450.00	H	213	28.4	2.9	0.0	78.7	0.0	110.0	114.0	-4.0	
Average Limits											
2450.00	V	100	28.4	2.9	0.0	76.6	16.3	91.7	94.0	-2.3	
2450.00	H	213	28.4	2.9	0.0	78.7	16.3	93.7	94.0	-0.3	

3.2 Field strength of harmonics and spurious emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test distance: ☐ 10 meters ☒ 3 meters

Frequency range of measurements: 30MHz-26000MHz

Test result: **Pass**

Max. margin of harmonics and spurious emissions: 2.2dB below the limits

Notes: The radiated harmonics and spurious emissions test was performed in the Anechoic chamber at 3m measurement distance (see Tables 3.2.1, 3.2.2, 3.2.3 and Graphs 3.2.1. 3.2.2, 3.2.3, 3.2.4, 3.2.5).

Date:	September 25-26, 2013	**Result:**	**Pass**
Standard:	FCC 15.249(a) / RSS-210 A2.9		
Tested by:	Uri Spector		
Test Point:	Enclosure with antenna		
Operation mode:	See Page 5		
Note:	Harmonics and spurious emissions 30MHz-1GHz		

Table 3.2.1

Frequency	Ant. Polarity	Peak Reading dBµV	Total C.F. dB1/m	Total at 3m dBµV/m	Limit dBµV/m	Margin dB
46.624 MHz	V	23.6	11.2	34.7	40.0	-5.3
79.481 MHz	V	22.0	8.6	30.6	40.0	-9.4
87.167 MHz	V	22.1	9.8	31.9	40.0	-8.1
93.285 MHz	V	23.7	11.2	34.9	43.5	-8.6
197.28 MHz	V	16.7	12.0	28.7	43.5	-14.8
202.26 MHz	V	18.1	12.3	30.4	43.5	-13.2
314.55 MHz	V	17.5	16.4	33.9	46.0	-12.1
740.76 MHz	V	14.6	23.5	38.1	46.0	-7.9
766.93 MHz	V	12.7	23.7	36.4	46.0	-9.6
93.36 MHz	H	22.5	11.2	33.7	43.5	-9.8
197.12 MHz	H	17.8	11.9	29.7	43.5	-13.8
202.74 MHz	H	19.1	12.3	31.4	43.5	-12.1
206.12 MHz	H	19.2	12.3	31.5	43.5	-12.1
209.34 MHz	H	18.9	12.1	31.0	43.5	-12.5
290.03 MHz	H	14.7	15.5	30.2	46.0	-15.8
328.4 MHz	H	18.4	16.7	35.1	46.0	-10.9
336.36 MHz	H	18.0	16.9	34.9	46.0	-11.2
533.08 MHz	H	13.3	20.9	34.2	46.0	-11.9
740.76 MHz	H	14.5	23.5	38.0	46.0	-8.0
766.93 MHz	H	14.1	23.7	37.8	46.0	-8.2

Date:	August 30-September 26, 2013	**Result:** **Pass**
Standard:	FCC 15.249(a) / RSS-210 A2.9	
Tested by:	Uri Spector	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Harmonics and spurious emissions 1GHz-26GHz. Emission at fundamental frequency was excluded from the table.	

Table 3.2.2

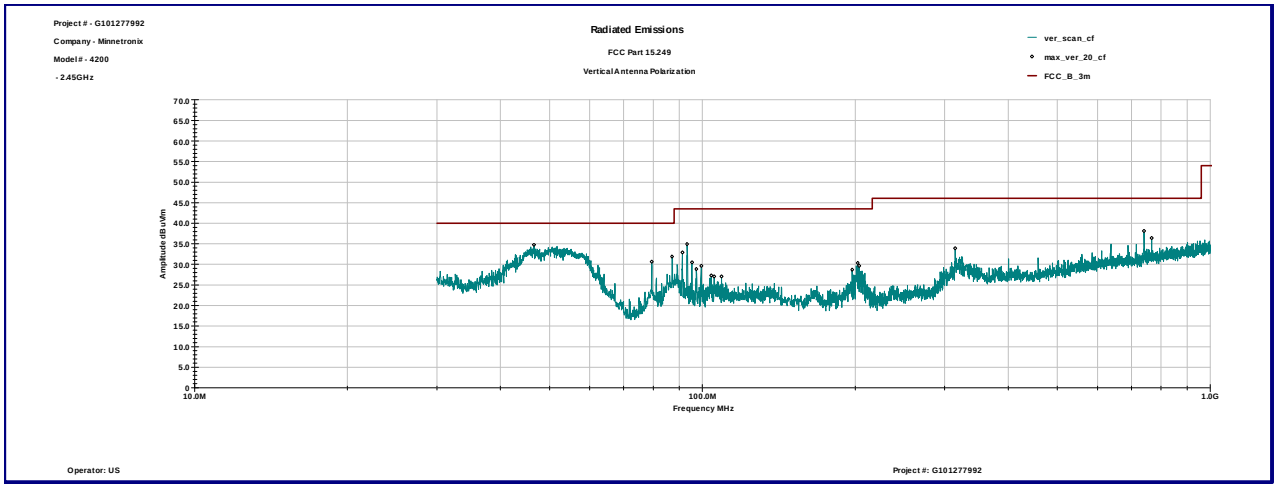
Frequency	Antenna		Ant. CF	Cable loss	Pre-amp	Reading	AVG CF	Total @ 3m	Limit	Margin	Comments
MHz	Polarity	Hts(cm)	dB1/m	dB	Gain (dB)	dBµV	dB	dBµV/m	dBµV/m	dB	
2485.00	V	252	28.5	3.0	0.0	29.1	0.0	60.6	74.0	-13.4	Peak
2485.00	V	252	28.5	3.0	0.0	29.1	16.3	44.3	54.0	-9.7	AVG
2485.00	H	215	28.5	3.0	0.0	36.6	0.0	68.1	74.0	-5.9	Peak
2485.00	H	215	28.5	3.0	0.0	36.6	16.3	51.8	54.0	-2.2	AVG

Table 3.2.3

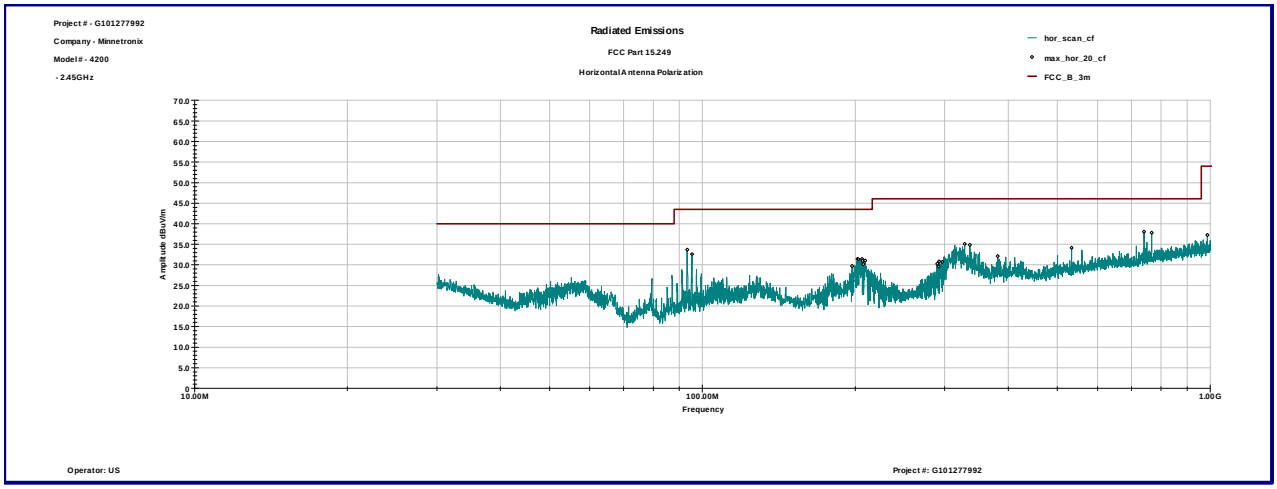
Frequency	Antenna		Ant. CF	Cable loss	Pre-amp	Reading	AVG CF	Total @ 3m	Limit	Margin	Comments
MHz	Polarity	Hts(cm)	dB1/m	dB	Gain (dB)	dBµV	dB	dBµV/m	dBµV/m	dB	
Bandedge Compliance											
2400.00	V	100	28.3	2.9	0.0	33.5	0.0	64.7	74.0	-9.3	Peak
2400.00	V	100	28.3	2.9	0.0	33.5	16.3	48.4	54.0	-5.6	AVG
2400.00	H	194	28.3	2.9	0.0	35.6	0.0	66.8	74.0	-7.2	Peak
2400.00	H	194	28.3	2.9	0.0	35.6	16.3	50.5	54.0	-3.5	AVG
2483.50	V	126	28.5	3.0	0.0	36.0	0.0	67.5	74.0	-6.5	Peak
2483.50	V	126	28.5	3.0	0.0	36.0	16.3	51.2	54.0	-2.8	AVG
2483.50	H	178	28.5	3.0	0.0	36.6	0.0	68.1	74.0	-5.9	Peak
2483.50	H	178	28.5	3.0	0.0	36.6	16.3	51.8	54.0	-2.2	AVG

Graph 3.2.1

Vertical antenna polarization

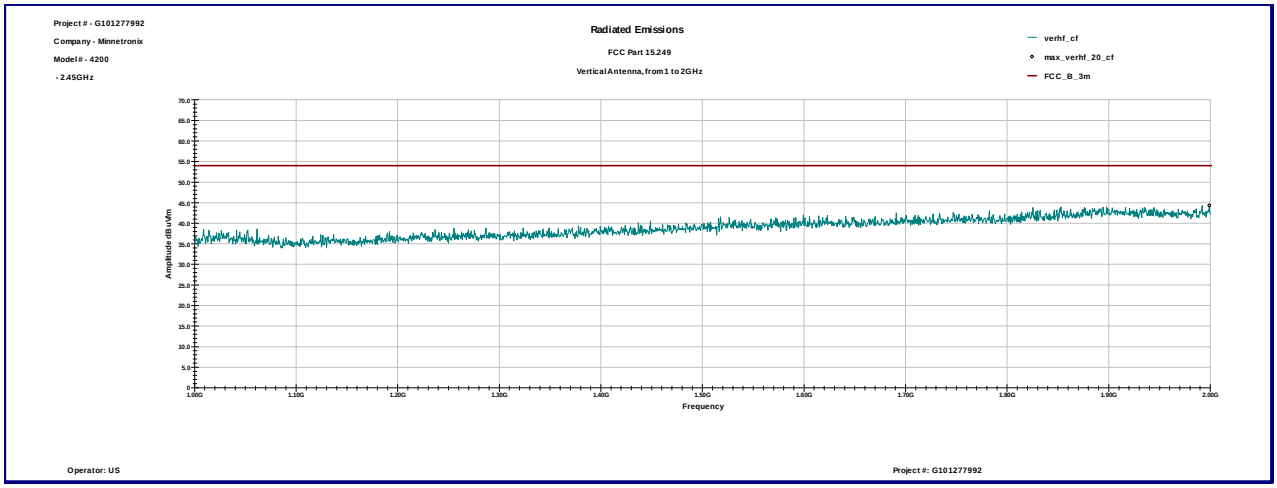


Horizontal antenna polarization

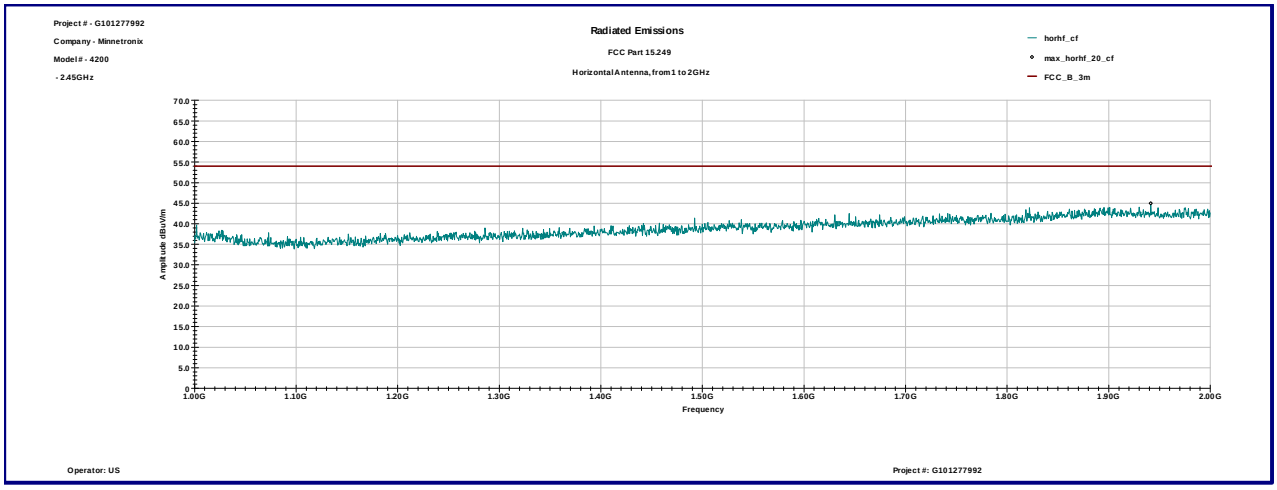


Graph 3.2.2

Vertical antenna polarization

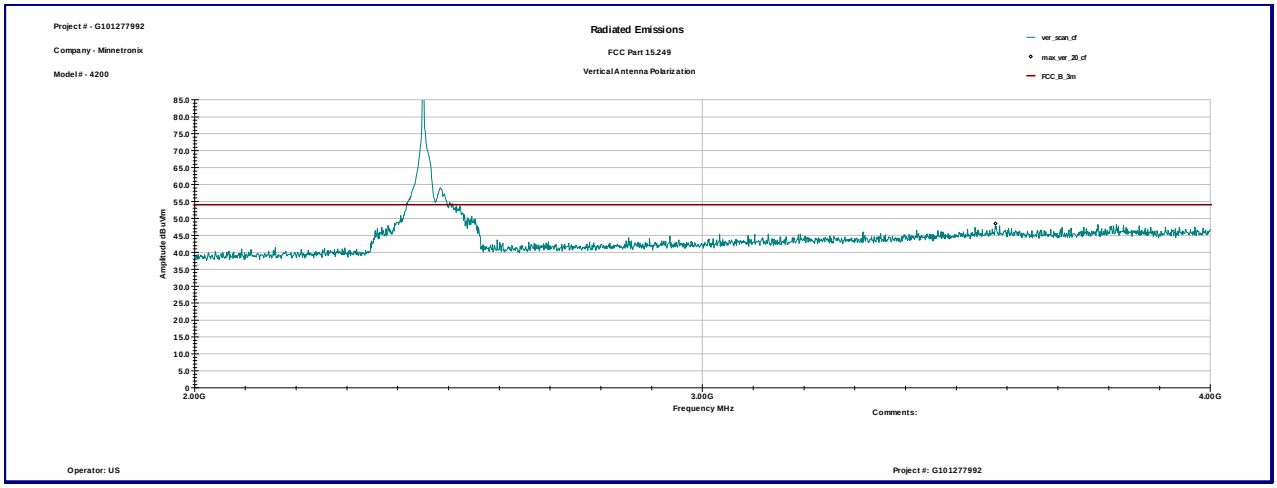


Horizontal antenna polarization

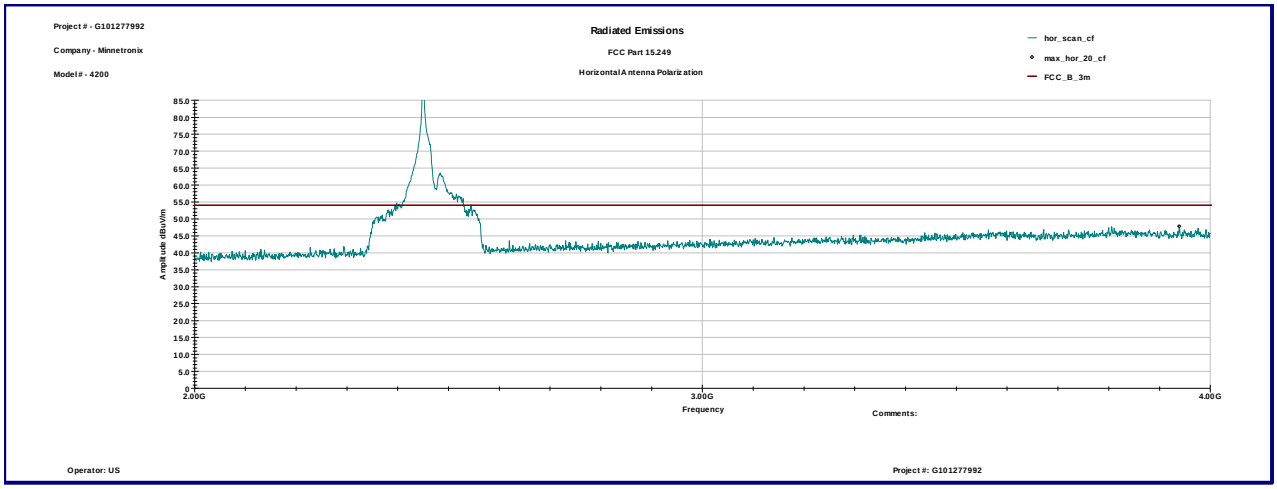


Graph 3.2.3

Vertical antenna polarization

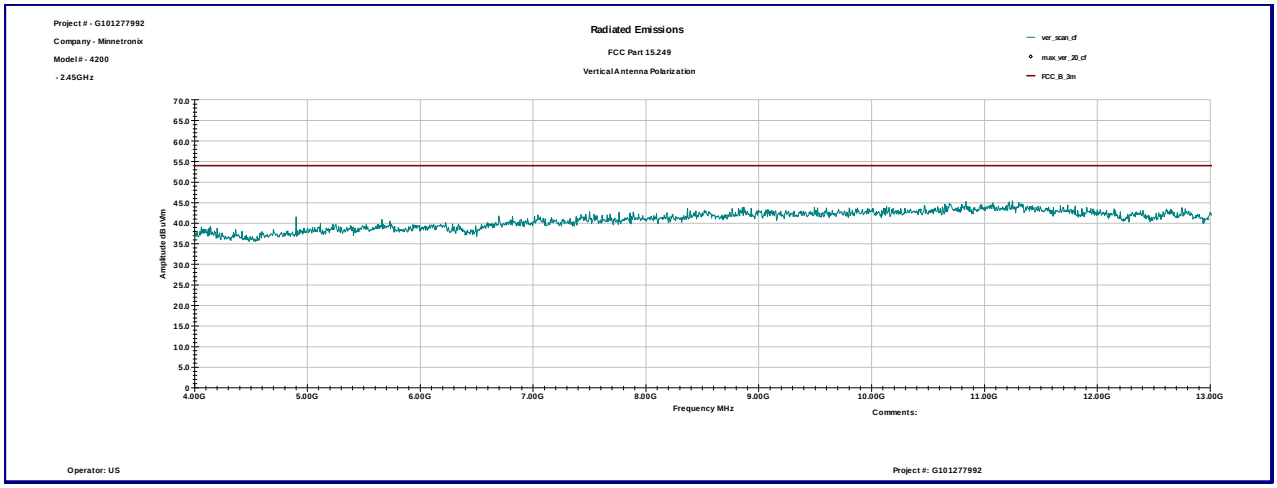


Horizontal antenna polarization

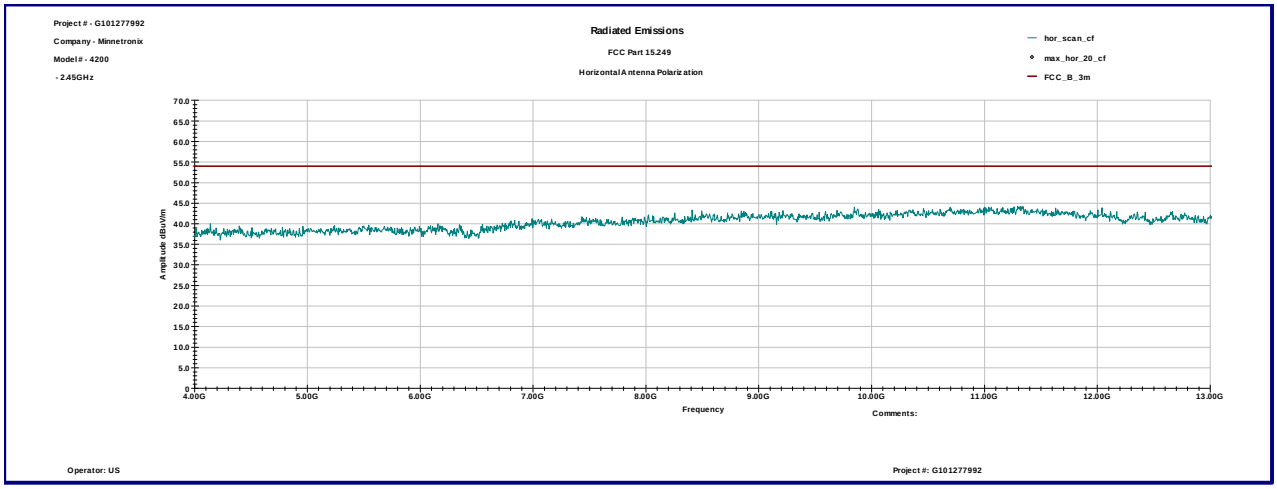


Graph 3.2.4

Vertical antenna polarization

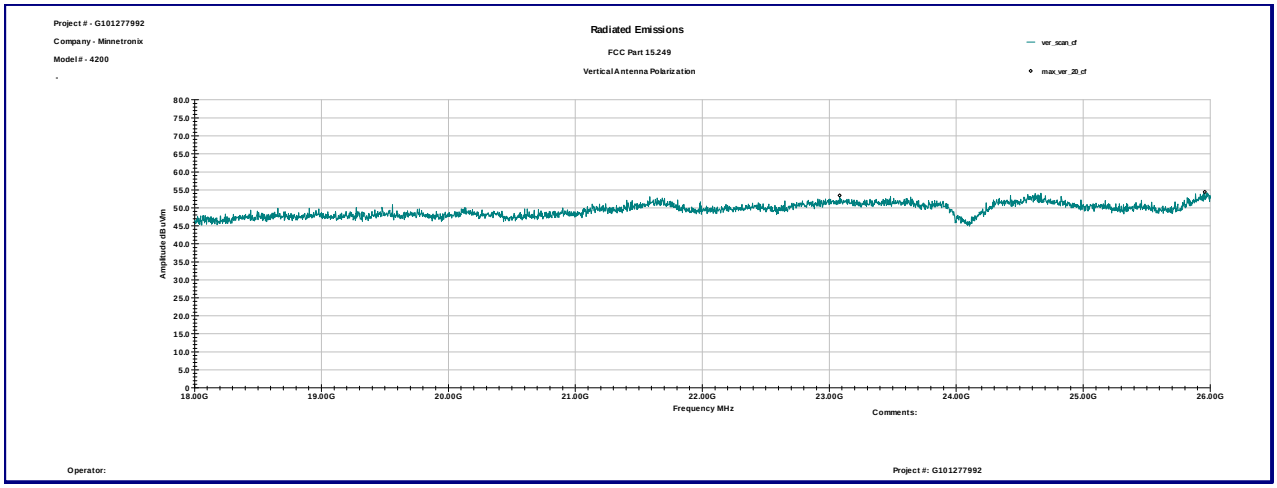


Horizontal antenna polarization

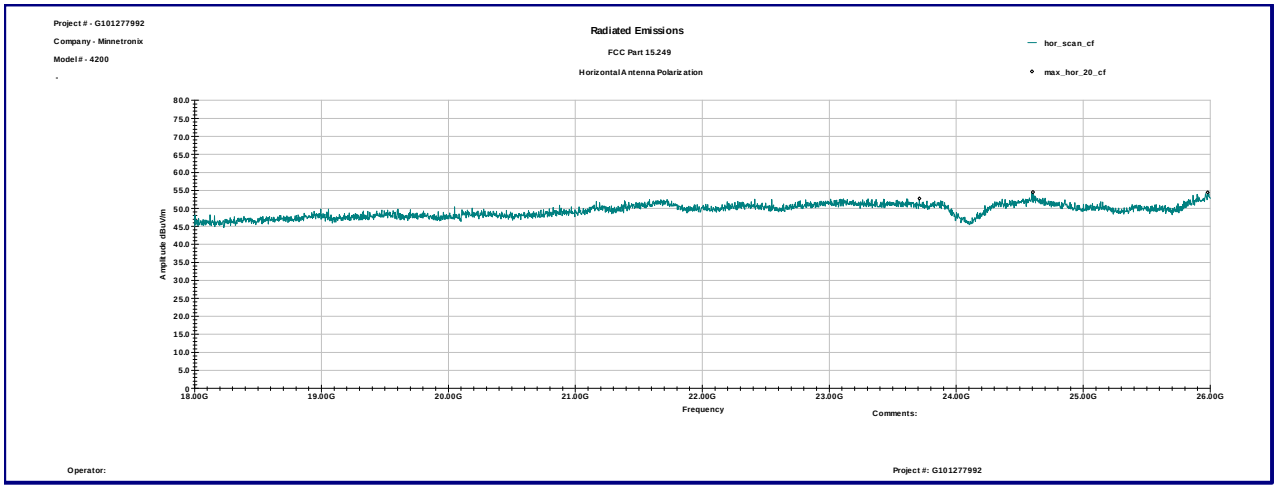


Graph 3.2.5

Vertical antenna polarization



Horizontal antenna polarization



3.2.1 Average correction factor calculation

An Average correction factor is calculated by averaging one complete pulse train.

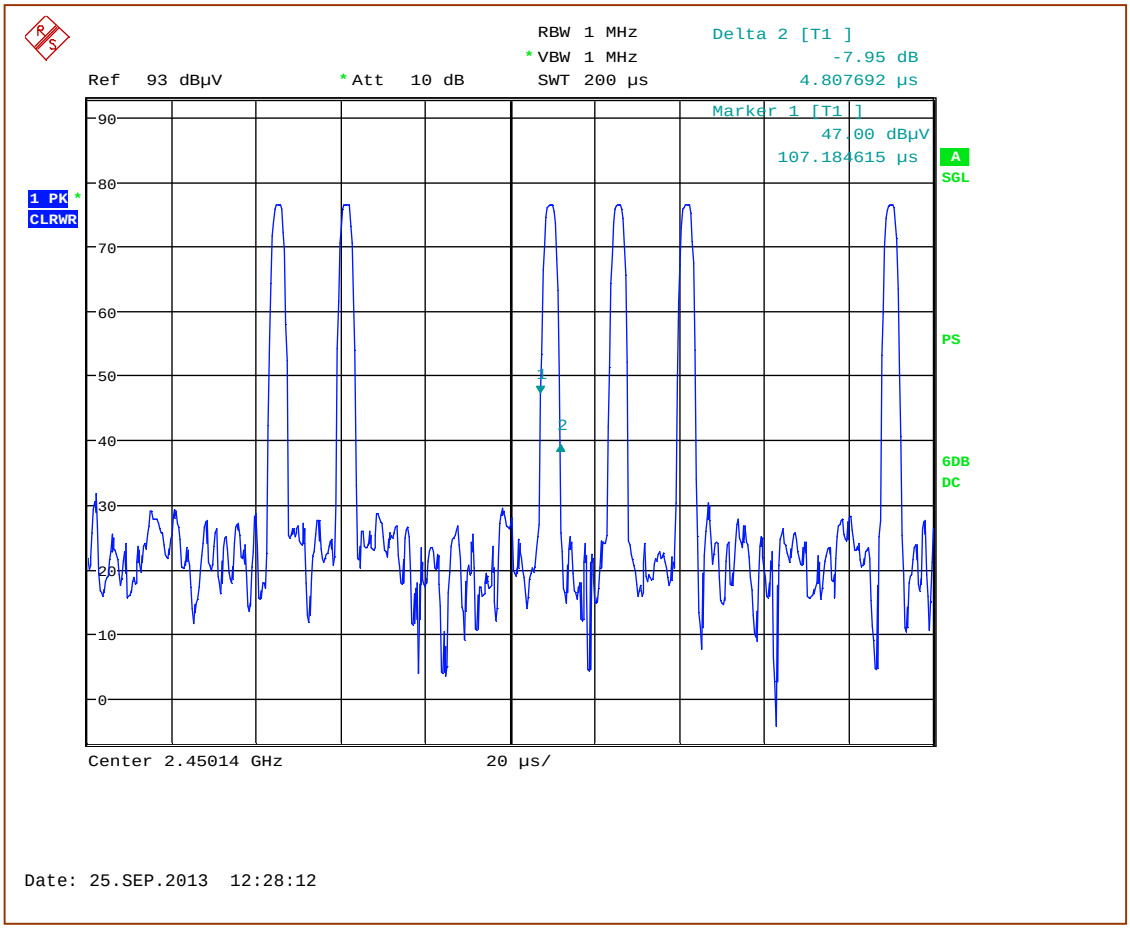
Time of one pulse is 4.807µsec (see Graph 3.2.6). There are 32 pulses over 1msec period (see Graph 3.2.7) or 3200 pulses over 100msec period.

Time with field strength is in its maximum value (length of pulses) = 3200* 4.8µsec = 15.38ms

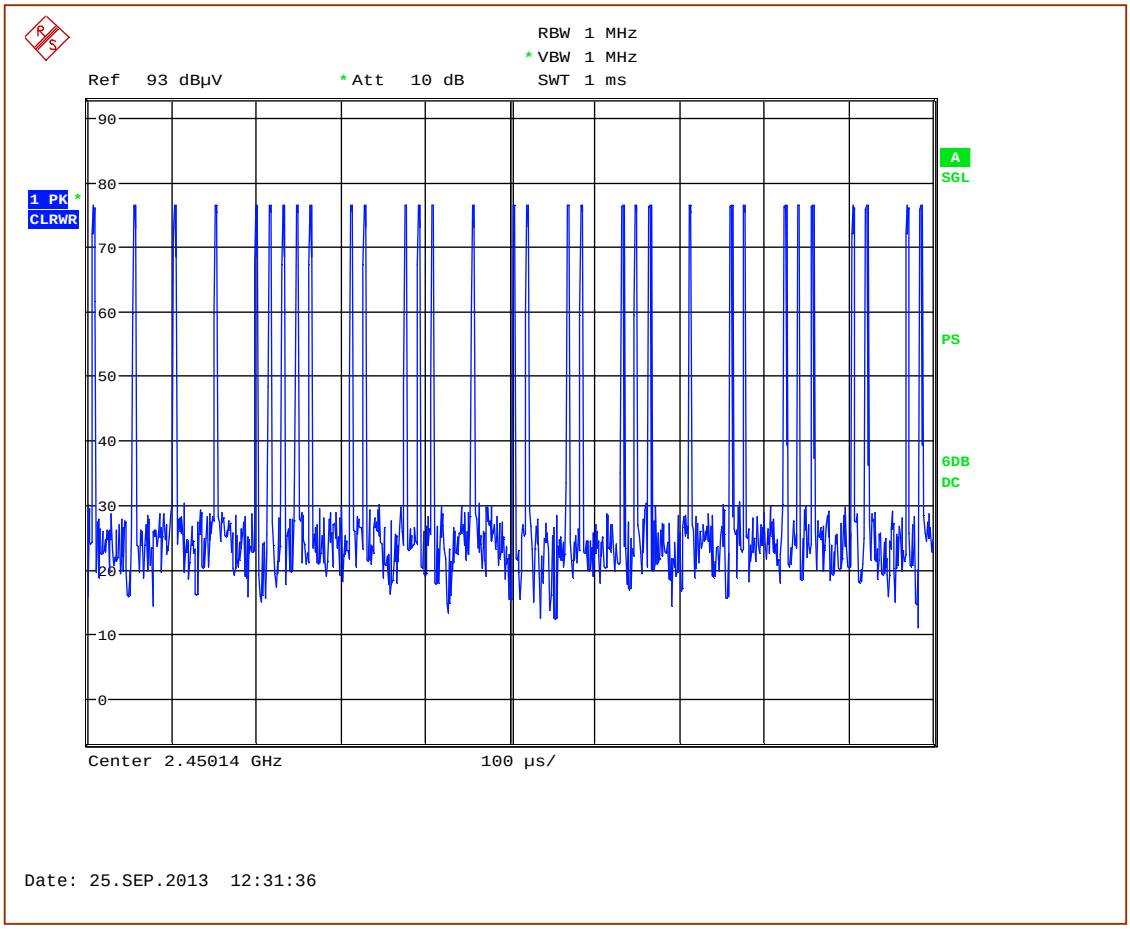
Average Correction Factor = 20Log(15.38ms/100ms) = -16.3dB

Graphs 3-2-6 to 3-2-7 show pulse train timing.

Graph 3.2.6


RBW 1 MHz
*VBW 1 MHz
SWT 200 µs
Delta 2 [T1]
-7.95 dB
4.807692 µs
Marker 1 [T1]
47.00 dBµV
107.184615 µs
Ref 93 dBµV
*Att 10 dB
1 PK
CLRWR
A
SGL
PS
6DB
DC
90
80
70
60
50
40
30
20
10
0
Center 2.45014 GHz
20 µs/
Date: 25.SEP.2013 12:28:12

Graph 3.2.7


RBW 1 MHz
*VBW 1 MHz
Ref 93 dBµV
*Att 10 dB
SWT 1 ms
90
80
70
60
50
40
30
20
10
0
1 PK *
CLRWR
A
SGL
PS
6DB
DC
Center 2.45014 GHz
100 µs/
Date: 25.SEP.2013 12:31:36

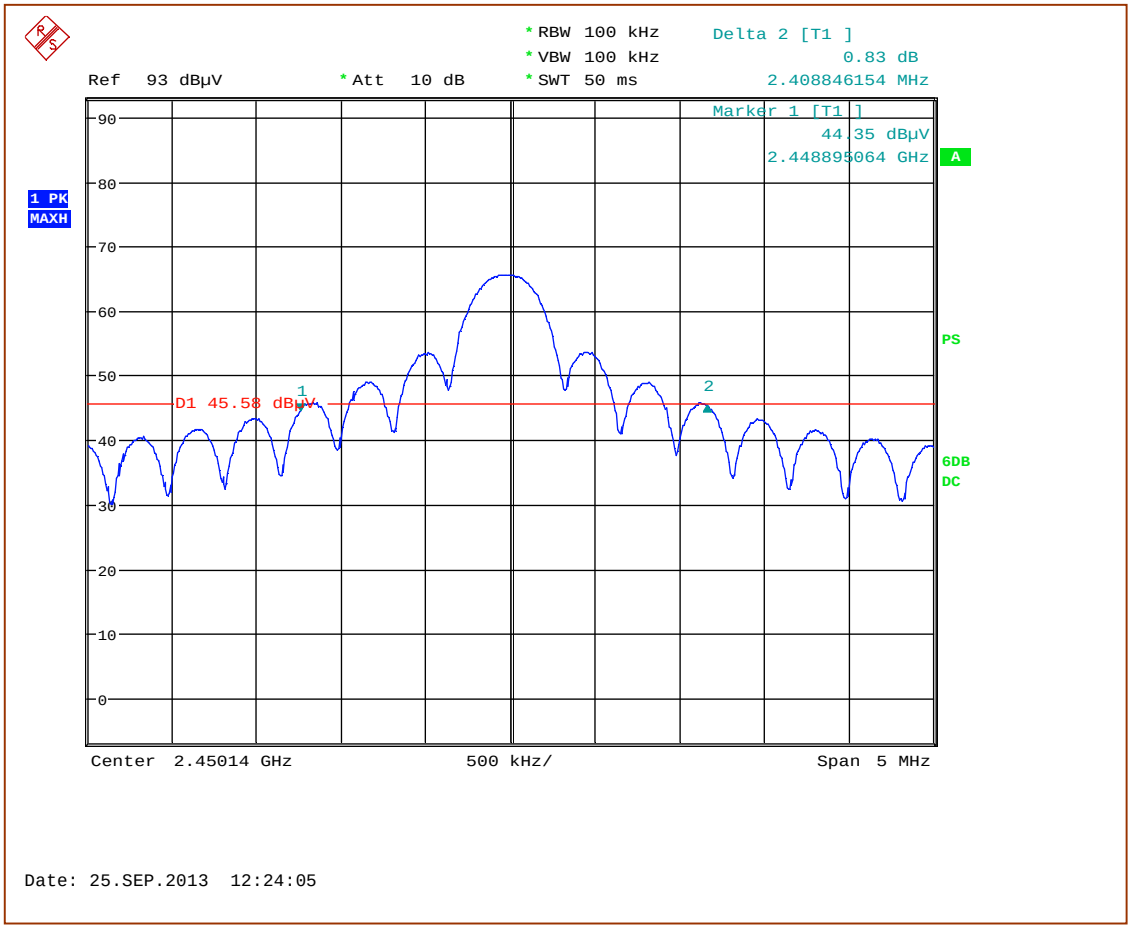
3.3 Bandwidth of Emissions

Center Frequency of operation MHz	Measured 20dB bandwidth MHz	Measured 99% bandwidth MHz
2450	2.41	3.03

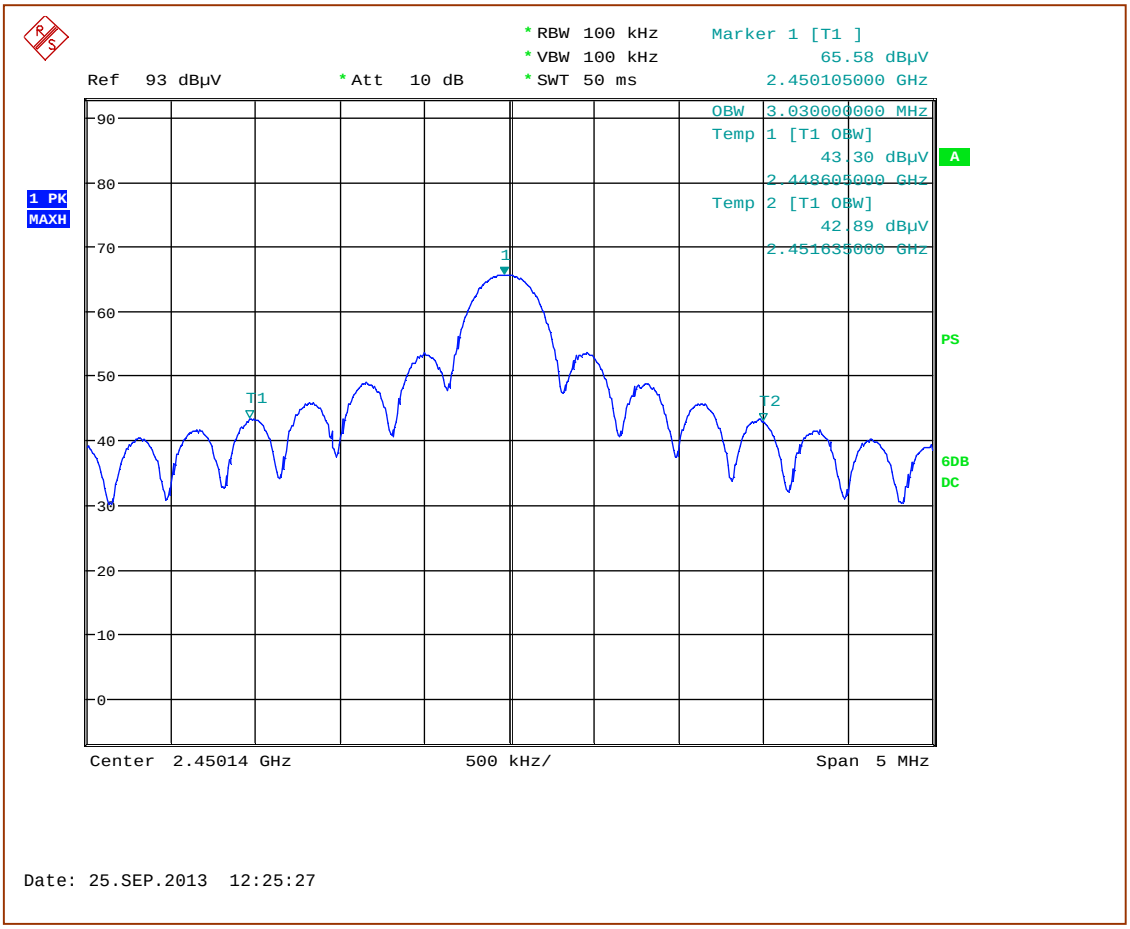
Graphs 3-3-1 and 3-3-2 are show bandwidth of emissions

Notes: The bandwidth of emissions is contained within the frequency band of operation

Graph 3.3.1


*RBW 100 kHz
*VBW 100 kHz
*SWT 50 ms
Delta 2 [T1]
0.83 dB
2.408846154 MHz
Ref 93 dBµV
*Att 10 dB
Marker 1 [T1]
44.35 dBµV
2.448895064 GHz
A
1 PK
MAXH
PS
6DB
DC
D1 45.58 dBµV
1
2
90
80
70
60
50
40
30
20
10
0
Center 2.45014 GHz
500 kHz/
Span 5 MHz
Date: 25.SEP.2013 12:24:05

Graph 3.3.2


*RBW 100 kHz
*VBW 100 kHz
*SWT 50 ms
Marker 1 [T1]
65.58 dBµV
2.450105000 GHz
Ref 93 dBµV
*Att 10 dB
OBW 3.030000000 MHz
Temp 1 [T1 OBW]
43.30 dBµV
2.448605000 GHz
Temp 2 [T1 OBW]
42.89 dBµV
2.451635000 GHz
1 PK
MAXH
A
PS
GDB
DC
T1
T2
Center 2.45014 GHz
500 kHz/
Span 5 MHz
Date: 25.SEP.2013 12:25:27

3.4 Transmitter power line conducted emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: 0.8dB below the limits

Notes: None

Date:	September 24, 2013	**Result:** **Pass**
Standard:	FCC 15.207	
Tested by:	Uri Spector	
Test Point:	Power Line	
Operation mode:	See Page 5	
Note:	None	

Table 3.4.1

Line 1

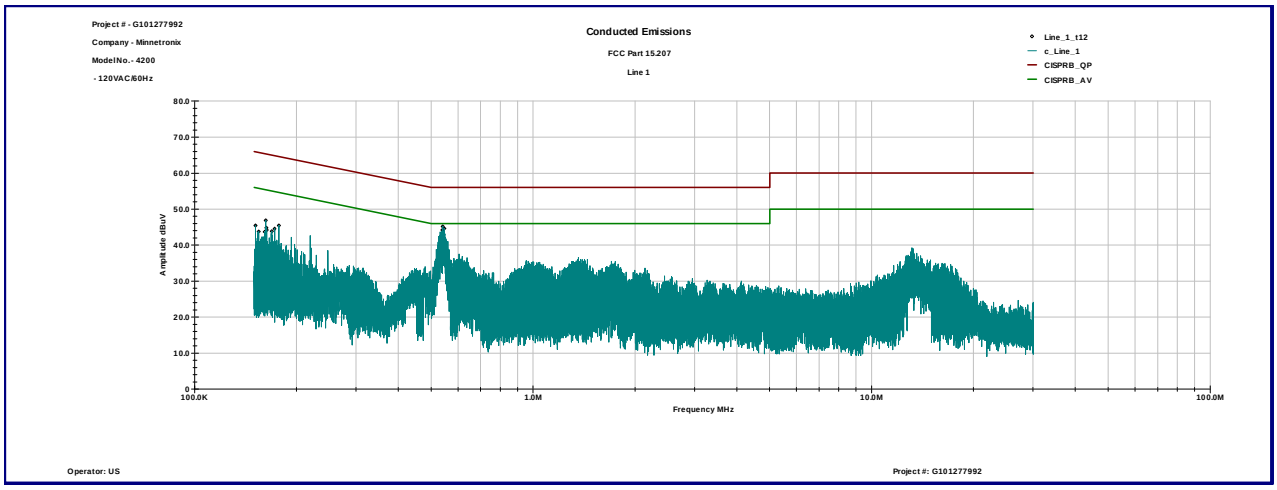
Frequency	Peak dBµV	QP Limit dBµV	AVG Limit dBµV	QP Margin dB	AVG Margin dB
151.44 KHz	45.4	65.9	55.9	-20.5	-10.5
162.43 KHz	46.8	65.3	55.3	-18.5	-8.5
177.58 KHz	45.4	64.6	54.6	-19.2	-9.2
539.44 KHz	44.2	56.0	46.0	-11.8	-1.8
540.42 KHz	45.2	56.0	46.0	-10.8	-0.8
546.93 KHz	44.6	56.0	46.0	-11.4	-1.4

Line 2

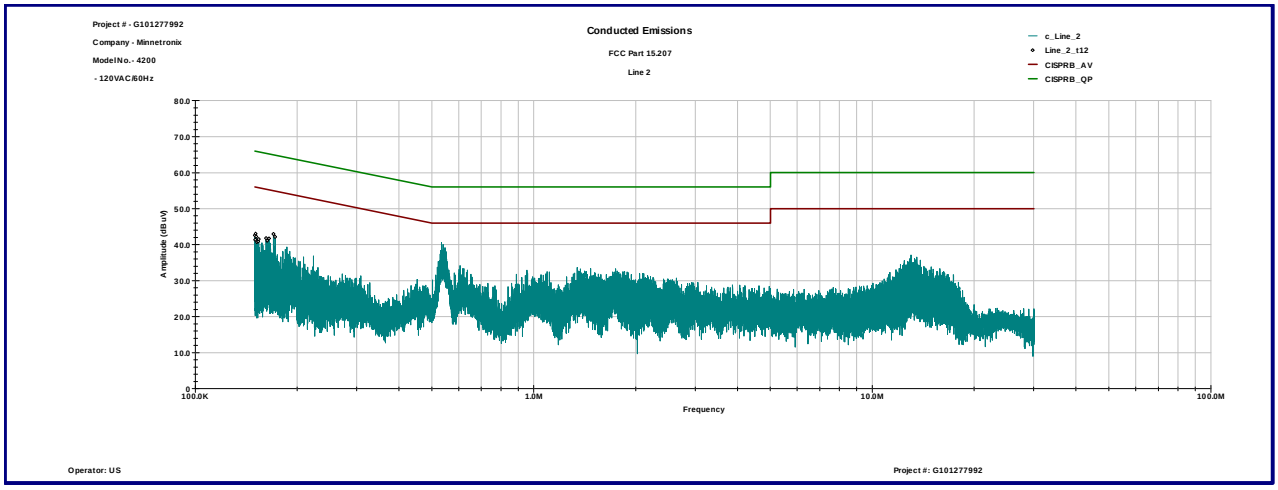
Frequency	Peak dBµV	QP Limit dBmV	AVG Limit dBmV	QP Margin dB	AVG Margin dB
150.93 KHz	43.0	66.0	56.0	-22.9	-12.9
154.08 KHz	41.6	65.8	55.8	-24.2	-14.2
162.04 KHz	41.8	65.4	55.4	-23.6	-13.6
165.19 KHz	41.7	65.2	55.2	-23.5	-13.5
170.39 KHz	42.9	64.9	54.9	-22.0	-12.0
172.22 KHz	42.1	64.9	54.9	-22.7	-12.7

Graph 3.4.1

Line 1



Line 2



3.5 Receiver/digital device radiated emissions

Test location: ☐ OATS ☒ Anechoic Chamber

Test distance: ☐ 10 meters ☒ 3 meters

Test result: **Pass**

Frequency range: 30MHz-13000MHz

Max. Emissions margin: 7.1dB below the limits

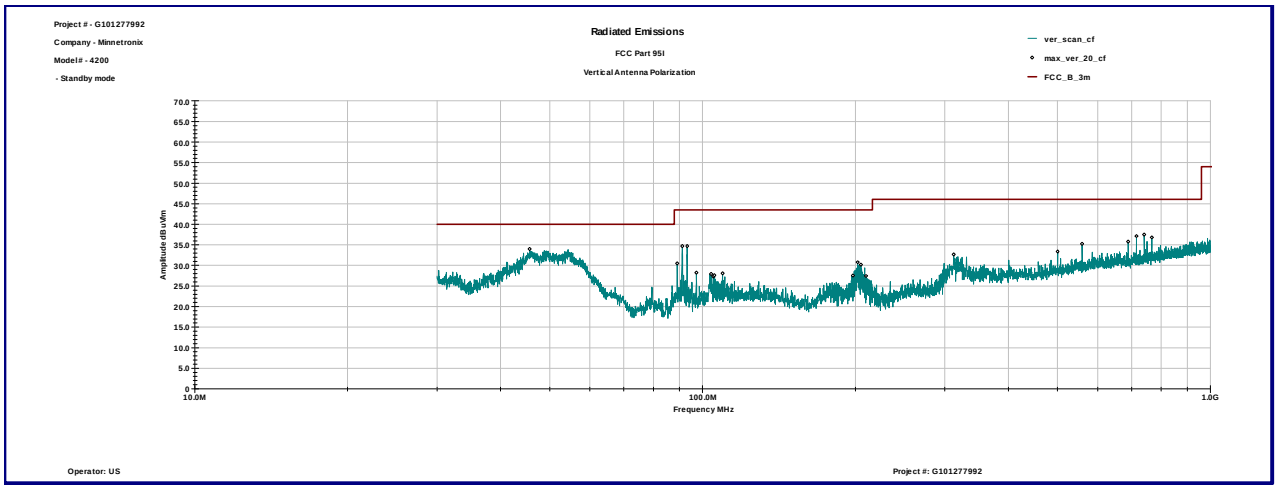
Notes: The Radiated Emissions test was performed in the Anechoic chamber at 3m measurement distance (see Table 3.5.1 and Graphs 3.5.1 to 3.5.2).

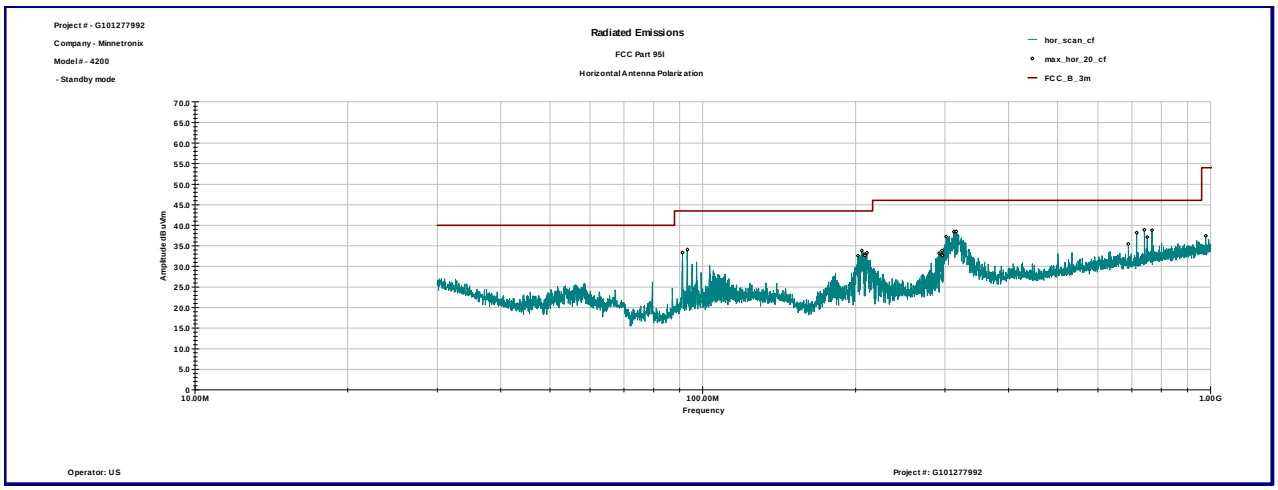
Date:	September 20, 2013	**Result:**	**Pass**
Standard:	FCC Part 15.109, Class B		
Tested by:	Uri Spector		
Test Point:	Enclosure		
Operation mode:	Standby/Receiving mode		
Note:	No radiated spurious emissions were detected above 1GHz (see Graph 3.5.2).		

Table 3.5.1

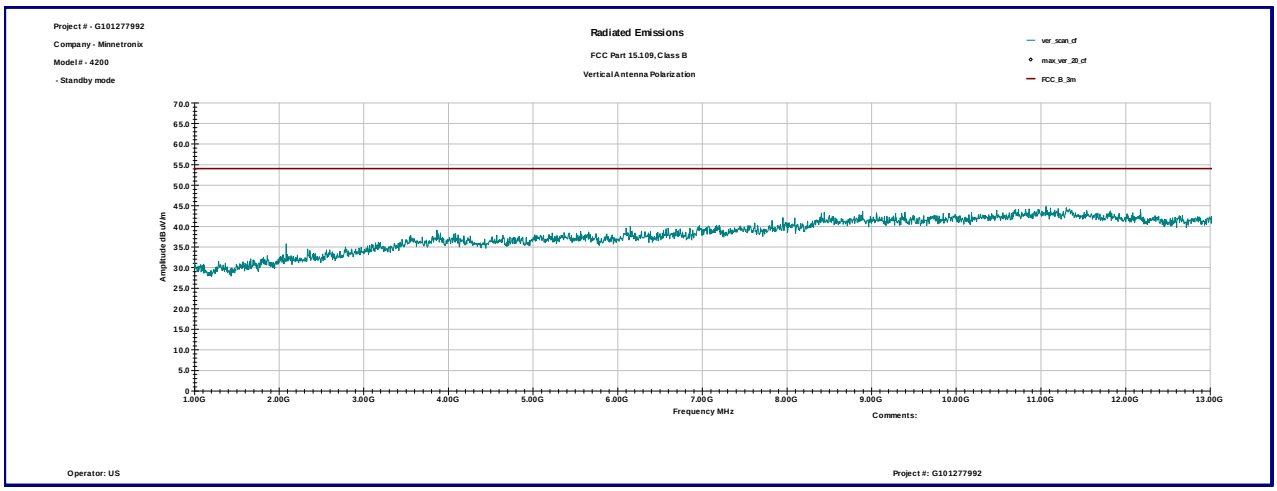
Frequency	Ant. Polarity	Peak Reading dBµV	Total C.F. dB1/m	Total at 3m dBµV/m	Limit dBµV/m	Margin dB
45.654 MHz	V	22.4	11.6	34.0	40.0	-6.0
91.27 MHz	V	24.0	10.7	34.7	43.5	-8.8
93.285 MHz	V	23.5	11.2	34.7	43.5	-8.8
109.48 MHz	V	14.6	13.5	28.1	43.5	-15.4
201.94 MHz	V	18.5	12.3	30.8	43.5	-12.8
559.06 MHz	V	13.6	21.7	35.2	46.0	-10.8
688.77 MHz	V	12.9	22.9	35.8	46.0	-10.2
714.94 MHz	V	14.2	23.0	37.1	46.0	-8.9
740.76 MHz	V	14.0	23.5	37.5	46.0	-8.5
766.93 MHz	V	13.1	23.7	36.8	46.0	-9.2
93.285 MHz	H	22.9	11.2	34.1	43.5	-9.5
205.8 MHz	H	21.5	12.3	33.8	43.5	-9.7
210.46 MHz	H	21.2	12.0	33.3	43.5	-10.3
301.39 MHz	H	21.3	16.0	37.3	46.0	-8.8
315.58 MHz	H	22.1	16.4	38.5	46.0	-7.5
714.94 MHz	H	15.3	23.0	38.2	46.0	-7.8
740.76 MHz	H	15.4	23.5	38.9	46.0	-7.1
749.96 MHz	H	13.6	23.6	37.1	46.0	-8.9
766.93 MHz	H	15.1	23.7	38.8	46.0	-7.2

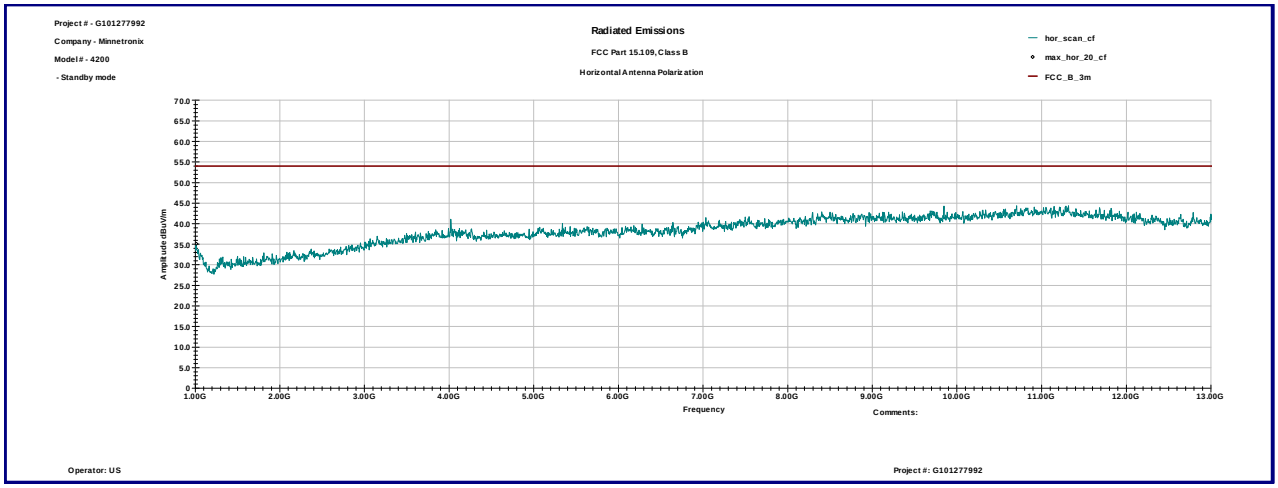
Graph 3.5.1


Project # - G101277992
Company - Minnetronix
Model # - 4200
- Standby mode
Radiated Emissions
FCC Part 95I
Vertical Antenna Polarization
ver_scan_cf
max_ver_20_cf
FCC_B_3m
Amplitude dB uVm
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0
10.0M
100.0M
1.0G
Frequency MHz
Operator: US
Project #: G101277992


Project # - G101277992
Company - Minnetronix
Model # - 4200
- Standby mode
Radiated Emissions
FCC Part 95I
Horizontal Antenna Polarization
hor_scan_cf
max_hor_20_cf
FCC_B_3m
Amplitude dB uVm
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0
10.00M
100.00M
1.00G
Frequency
Operator: US
Project #: G101277992

Graph 3.5.2


Project # - G101277992
Company - Minnetronix
Model # - 4200
- Standby mode
Radiated Emissions
FCC Part 15.109, Class B
Vertical Antenna Polarization
ver_scan_cf
max_ver_20_cf
FCC_B_3m
Amplitude dBuV/m
Frequency MHz
Comments:
Operator: US
Project #: G101277992


Project # - G101277992
Company - Minnetronix
Model # - 4200
- Standby mode
Radiated Emissions
FCC Part 15.109, Class B
Horizontal Antenna Polarization
hor_scan_cf
max_hor_20_cf
FCC_B_3m
Amplitude dBuV/m
Frequency
Comments:
Operator: US
Project #: G101277992

3.6 Digital device conducted emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: 13.4dB below the limits

Notes: None

Date:	September 24, 2013	**Result:**	**Pass**
Standard:	FCC 15.107, Class B		
Tested by:	Uri Spector		
Test Point:	Power Line		
Operation mode:	Receiving mode		
Note:	None		

Table 3.6.1

Line 1

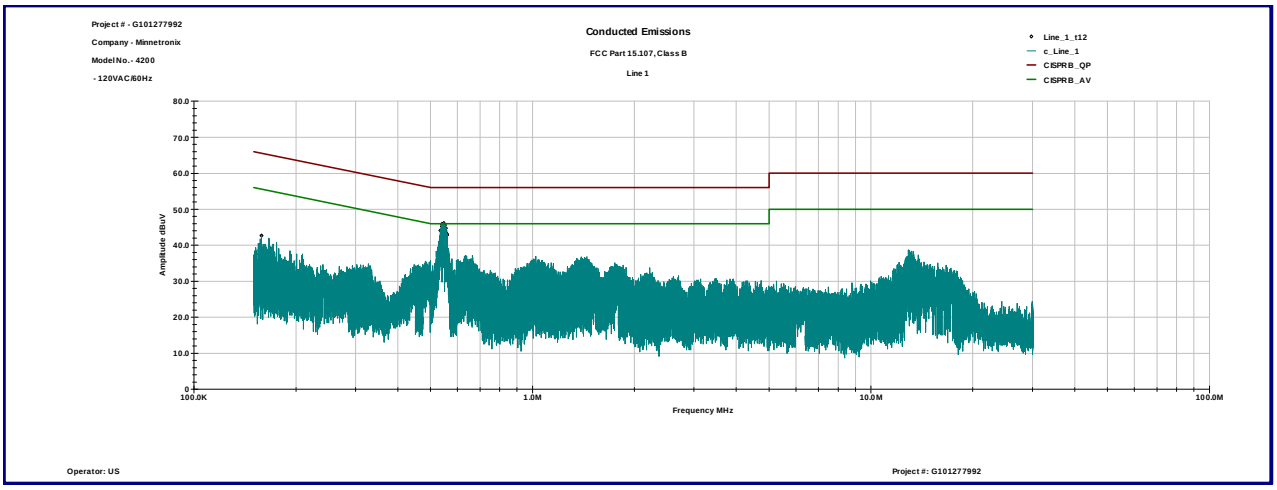
Frequency MHz	QP dBµV	AVG dBµV	Cable Loss dB	QP Lim dBµV	AVG Lim dBµV	QP Margin dB	AVG Margin dB
0.150	33.3	17.2	0.1	66.0	56.0	-32.6	-38.7
0.310	30.6	18.5	0.1	60.0	50.0	-29.2	-31.3
0.547	42.4	31.0	0.2	56.0	46.0	-13.4	-14.8
1.022	32.1	22.1	0.2	56.0	46.0	-23.7	-23.7
1.422	32.3	21.9	0.3	56.0	46.0	-23.4	-23.8
13.160	31.9	20.8	0.9	60.0	50.0	-27.2	-28.3

Line 2

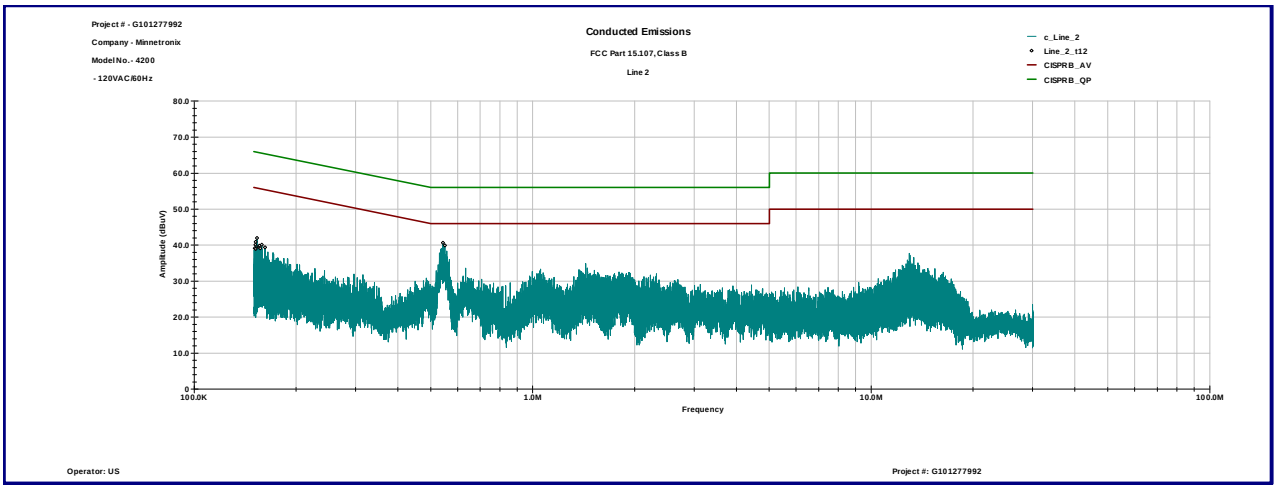
Frequency MHz	QP dBµV	AVG dBµV	Cable Loss dB	QP Lim dBµV	AVG Lim dBµV	QP Margin dB	AVG Margin dB
0.150	33.9	17.5	0.1	66.0	56.0	-32.0	-38.4
0.550	17.1	10.3	0.2	56.0	46.0	-38.7	-35.5
1.049	25.0	17.3	0.2	56.0	46.0	-30.8	-28.5
1.433	26.7	19.4	0.3	56.0	46.0	-29.0	-26.3
2.323	25.3	15.4	0.4	56.0	46.0	-30.3	-30.2
12.945	29.6	17.6	0.9	60.0	50.0	-29.5	-31.5

Graph 3.6.1

Line 1



Line 2



4.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	INTERTEK ID	CAL DUE	USED
Spectrum Analyzer	R & S	ESU	100398	25283	12/19/2013	☒
Spectrum Analyzer	R & S	FSP 40	100024	12559	11/29/2013	☒
Bicono-Log Antenna	Schaffner-Teseq	CBL6112B	2468	9734	11/30/2013	☒
Horn Antenna	EMCO	3115	6579	15580	07/18/2014	☒
LISN	Fischer Custom Communications	FCC-LISN-50-25-2	2014	9665	04/23/2014	☒
System	Quantum Change	TILE! Instrument Control	Ver. 3.4.K.29	15259	VBU	☒
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1122951	13475	11/01/2013	☒