



# TEST REPORT

Report Number: 102938966MIN-001  
Project Number: G102938966

Testing performed on the  
738Zplus  
FCC ID: CCKPC0137R2  
IC: 5251A-PC0137R2

to  
47 CFR, Part 15. 249:2017  
RSS- 210, Issue 9, 2016  
RSS-Gen, Issue 4, 2014  
47 CFR, Part 15:2017, §15.107 and §15.109, Class B / ICES-003, Issue 6:2016

For  
Digital Monitoring Products

Test Performed by:  
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Date of issue: March 6, 2017

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## 1.0 GENERAL DESCRIPTION

<b>Model:</b>	738Zplus
<b>Type of EUT:</b>	Z-Wave interface module
<b>Intertek Sample ID:</b>	MN1702241314-007
<b>FCC ID:</b>	CCKPC0137R2
<b>IC:</b>	5251A-PC0137R2
<b>Related Submittal(s) Grants:</b>	None
<b>Company:</b>	Digital Monitoring Products
<b>Customer:</b>	James Wilson
<b>Address:</b>	2500 N Partnership Blvd. Springfield, MO 65803-8877 USA
<b>Phone:</b>	(800) 641-4282
<b>E-mail:</b>	<a href="mailto:jwilson@dmp.com">jwilson@dmp.com</a>
<b>Test Standards:</b>	<input checked="" type="checkbox"/> 47 CFR, Part 15:2017, §15.249 <input checked="" type="checkbox"/> RSS-210, Issue 9, 2016 <input checked="" type="checkbox"/> RSS-Gen, Issue 4, 2014 <input checked="" type="checkbox"/> 47 CFR, Part 15:2017, §15.107 and §15.109, Class B, test method: ANSI C63.4-2014 <input checked="" type="checkbox"/> ICES-003, Issue 6:2016 <input type="checkbox"/> Other
<b>Type of radio:</b>	<input checked="" type="checkbox"/> Stand -alone <input type="checkbox"/> Module <input type="checkbox"/> Hybrid
<b>Date Sample Submitted:</b>	February 24, 2017
<b>Test Work Started:</b>	March 1, 2017
<b>Test Work Completed:</b>	March 3, 2017
<b>Test Sample Conditions:</b>	<input type="checkbox"/> Damaged <input type="checkbox"/> Poor (Usable) <input checked="" type="checkbox"/> Good

1.1 Product Description; Test Facility

<b>Product Description:</b>	Z-Wave Radio
<b>Operating Frequency</b>	908.46 MHz
<b>Modulation:</b>	FSK
<b>Emission Designator:</b>	276KF1D
<b>Antenna(s) Info:</b>	Antenna Type: Integral trace
<b>Antenna Installation:</b>	<input type="checkbox"/> User <input checked="" type="checkbox"/> Professional <input type="checkbox"/> Factory
<b>Transmitter Power Configuration:</b>	<input type="checkbox"/> Internal battery <input checked="" type="checkbox"/> External power source (AC Adapter) <input checked="" type="checkbox"/> 100-240VAC <input type="checkbox"/> 230VAC <input type="checkbox"/> 400VAC <input type="checkbox"/> █ VDC <input type="checkbox"/> Other: █ 0.2 Amp. <input checked="" type="checkbox"/> 50Hz <input checked="" type="checkbox"/> 60Hz
<b>Special Test Arrangement:</b>	None
<b>Test Facility Accreditation:</b>	A2LA (Certificate No. 1427.01)
<b>Test Methodology:</b>	Measurements performed according to the procedures in ANSI C63.10-2013

## 1.2 EUT Configuration

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

- Standby
- Continuous modulated
- Continuous un-modulated
- Test program (customer specific)
- See below

### Operating modes of the EUT:

No.	Description
1	Samples wired to provide continuous transmitting mode or receiving/standby mode.

### Cables:

No.	Type	Length	Designation	Note
1	2-wire DC power cable	6ft.	DC side connecting the board and AC adapter	

### Support equipment/Services:

No.	Item	Description
1	R & S SMT 03	Signal Generator used to activate receiver

## 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:  $\pm 4$  dB at 10m and  $\pm 5.4$  dB at 3m

The expanded uncertainty ( $k = 2$ ) for radiated emissions above 1GHz has been determined to be:  $\pm 6.4$  dB at 3m

The expanded uncertainty ( $k = 2$ ) for conducted emissions from 150 kHz to 30 MHz has been determined to be:  $\pm 2.6$  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( $\mu$ V/m)

RA = Receiver Amplitude in dB( $\mu$ V)

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( $\mu$ V) 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( $\mu$ V/m).

$$RA = 48.1 \text{ dB}(\mu\text{V})$$

$$AF = 7.4 \text{ dB}(m^{-1})$$

$$CF = 1.6 \text{ dB}$$

$$AG = 16.0 \text{ dB}$$

$$FS = RA + AF + CF - AG$$

$$FS = 48.1 + 7.4 + 1.6 - 16.0$$

$$FS = 41.1 \text{ dB}(\mu\text{V}/\text{m})$$

### 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

**Test result:** **Pass**

**Max. Emissions margin at fundamental:** 5.8dB below the limits

**Notes:** The EUT was tested for worst case emissions in Z axis configuration.

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<b>Date:</b>	March 1, 2017	<b>Result: Pass</b>
<b>Tested by:</b>	Uri Spector	
<b>Standard:</b>	FCC 15.249(a) / RSS-210 A2.9	
<b>Test Point:</b>	Enclosure with antenna	
<b>Operation mode:</b>	See page 5	
<b>Environmental Conditions:</b>	22.5°C; 43%(RH); 96kPa	
<b>Equipment Verification:</b>	<input checked="" type="checkbox"/>	
<b>Note:</b>	None	

**Table 3.1.1**

Frequency MHz	Antenna		Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Reading dB $\mu$ V	AVG Value C.F. (dB)	Total @ 3m dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Comments
	Polarity	Hts(cm)									
908.46	V	127	22.0	2.6	0.0	71.0	0.0	95.6	114.0	-18.4	Pk
908.46	H	129	22.0	2.6	0.0	74.3	0.0	98.9	114.0	-15.1	Pk
908.46	V	127	22.0	2.6	0.0	71.0	10.7	84.9	94.0	-9.1	Avg
908.46	H	129	22.0	2.6	0.0	74.3	10.7	88.2	94.0	-5.8	Avg



### 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-10GHz

**Test result:** **Pass**

**Max. margin of harmonics and spurious emissions:** 5.7dB below the limits

**Max. margin of bandedge compliance:** 8.3dB below the limits

**Notes:**

1. The EUT was tested for worst case emissions in Z axis configuration.
2. Fundamental transmitting frequency was excluded from the table.

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<b>Date:</b>	March 1, 2017 and March 2, 2017	<b>Result: Pass</b>
<b>Tested by:</b>	Uri Spector	
<b>Standard:</b>	FCC 15.249(a) and (d) / RSS-210 A2.9	
<b>Test Point:</b>	Enclosure with antenna	
<b>Operation mode:</b>	See page 5	
<b>Environmental Conditions:</b>	22.5°C; 43%(RH); 96.0kPa 23°C; 39%(RH); 96.7kPa	
<b>Equipment Verification:</b>	<input checked="" type="checkbox"/>	
<b>Note:</b>	30MHz-1GHz	

**Table 3.2.1**

Frequency MHz	Antenna Polarity	Peak Reading dB $\mu$ V	Total C.F. dB1/m	Total at 3m dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB
30.654 MHz	V	13.0	20.0	33.0	40.0	-7.0
115.84 MHz	V	12.8	13.5	26.3	43.5	-17.2
31.614 MHz	H	13.5	19.4	33.0	40.0	-7.1
126.84 MHz	H	13.0	13.6	26.6	43.5	-16.9

**Table 3.2.2**

Frequency MHz	Antenna		Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Reading dB $\mu$ V	Total @ 3m dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Comments
	Polarity	Hts(cm)								
<b>Bandedge Compliance</b>										
902.00	V	100	22.0	2.6	0.0	12.1	36.7	46.0	-9.3	Pk
902.00	H	100	22.0	2.6	0.0	11.5	36.1	46.0	-9.9	Pk
928.00	V	100	22.0	2.6	0.0	12.4	37.0	46.0	-9.0	Pk
928.00	H	100	22.0	2.6	0.0	13.1	37.7	46.0	-8.3	Pk

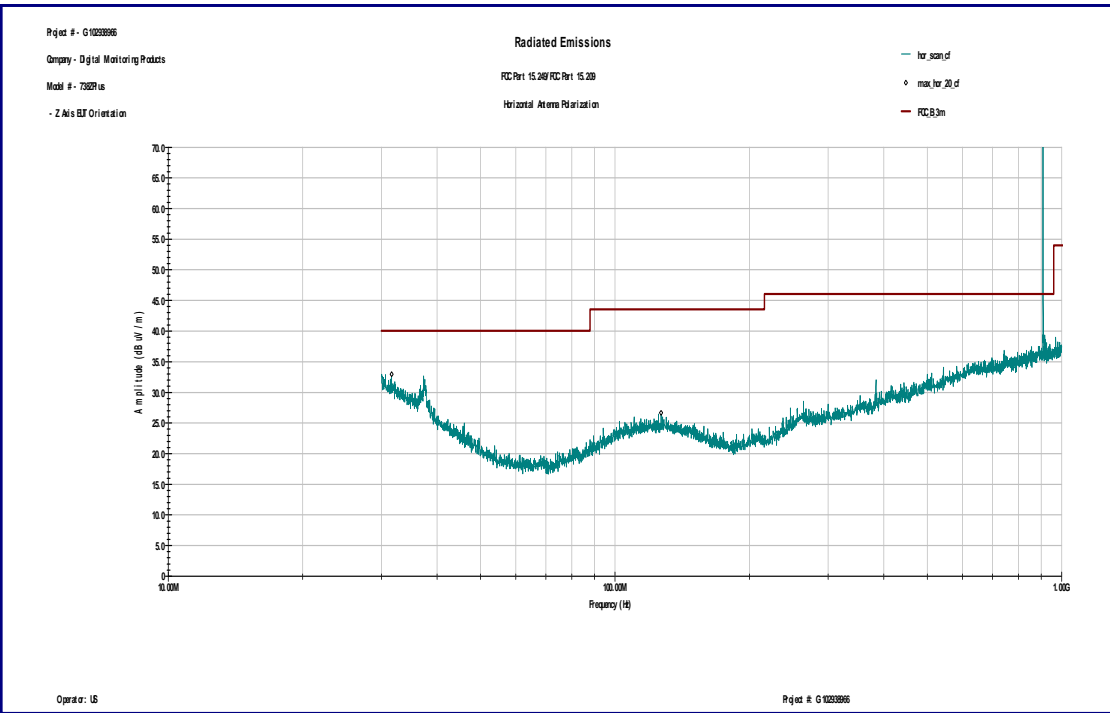
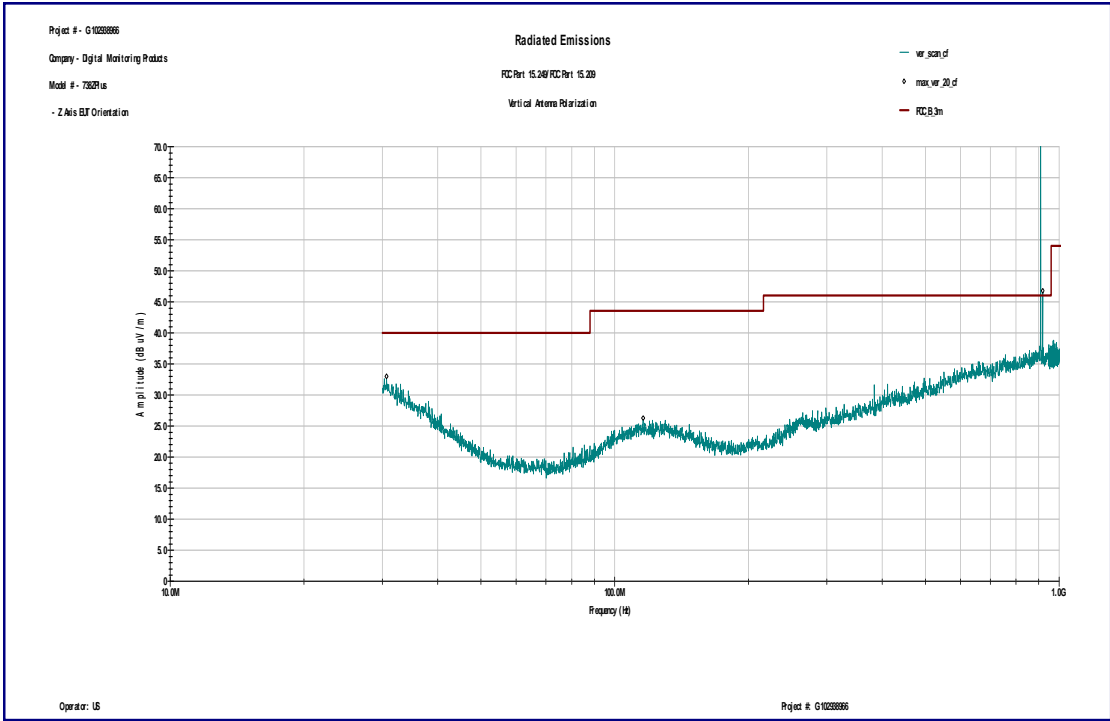
<b>Date:</b>	March 2, 2017	<b>Result: Pass</b>
<b>Tested by:</b>	Uri Spector	
<b>Standard:</b>	FCC 15.249(a) and (d) / RSS-210 A2.9	
<b>Test Point:</b>	Enclosure with antenna	
<b>Operation mode:</b>	See page 5	
<b>Environmental Conditions:</b>	23°C; 39%(RH); 96.7kPa	
<b>Equipment Verification:</b>	<input checked="" type="checkbox"/>	
<b>Note:</b>	1GHz-10GHz	

**Table 3.2.3**

Frequency MHz	Antenna Polarity	Peak Reading dB $\mu$ V	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB
2.728 GHz	V	56.8	31.9	40.4	48.3	54.0	-5.7
4.546 GHz	V	45.9	36.6	39.4	43.1	54.0	-10.9
2.728 GHz	H	54.7	31.9	40.4	46.2	54.0	-7.8
4.546 GHz	H	45.9	36.6	39.4	43.1	54.0	-10.9

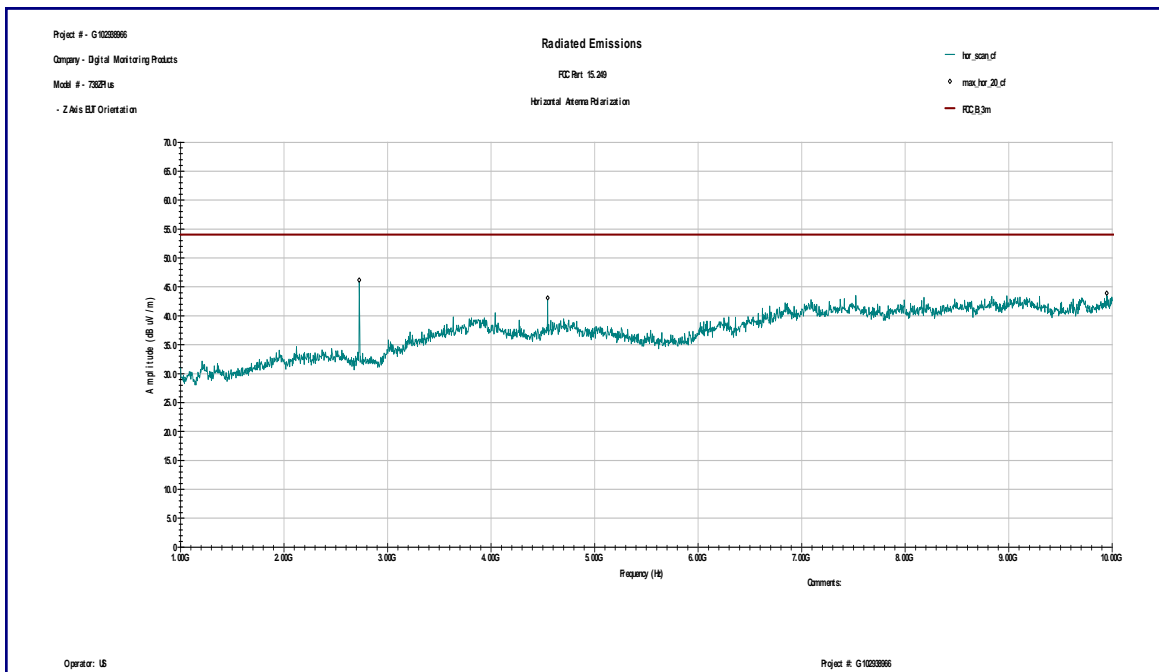
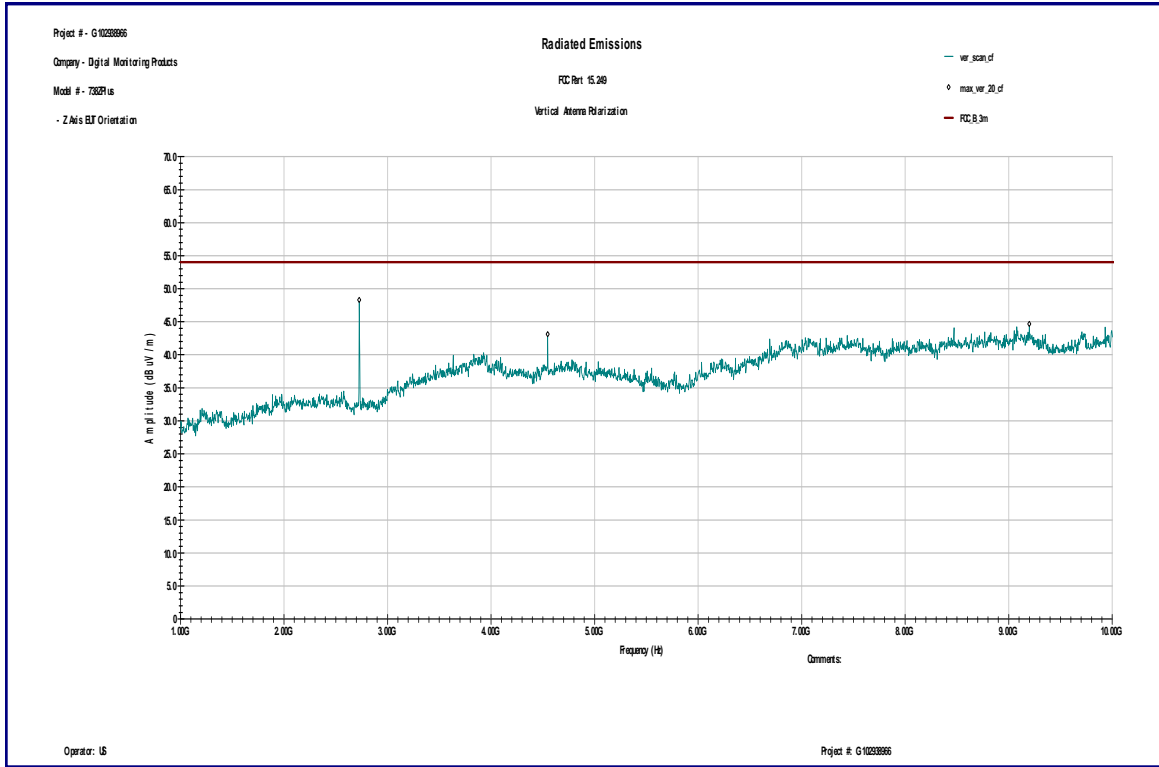


Graph 3.2.1 (Peak)





Graph 3.2.2 (Peak)





### 3.2.1 Average correction factor calculation

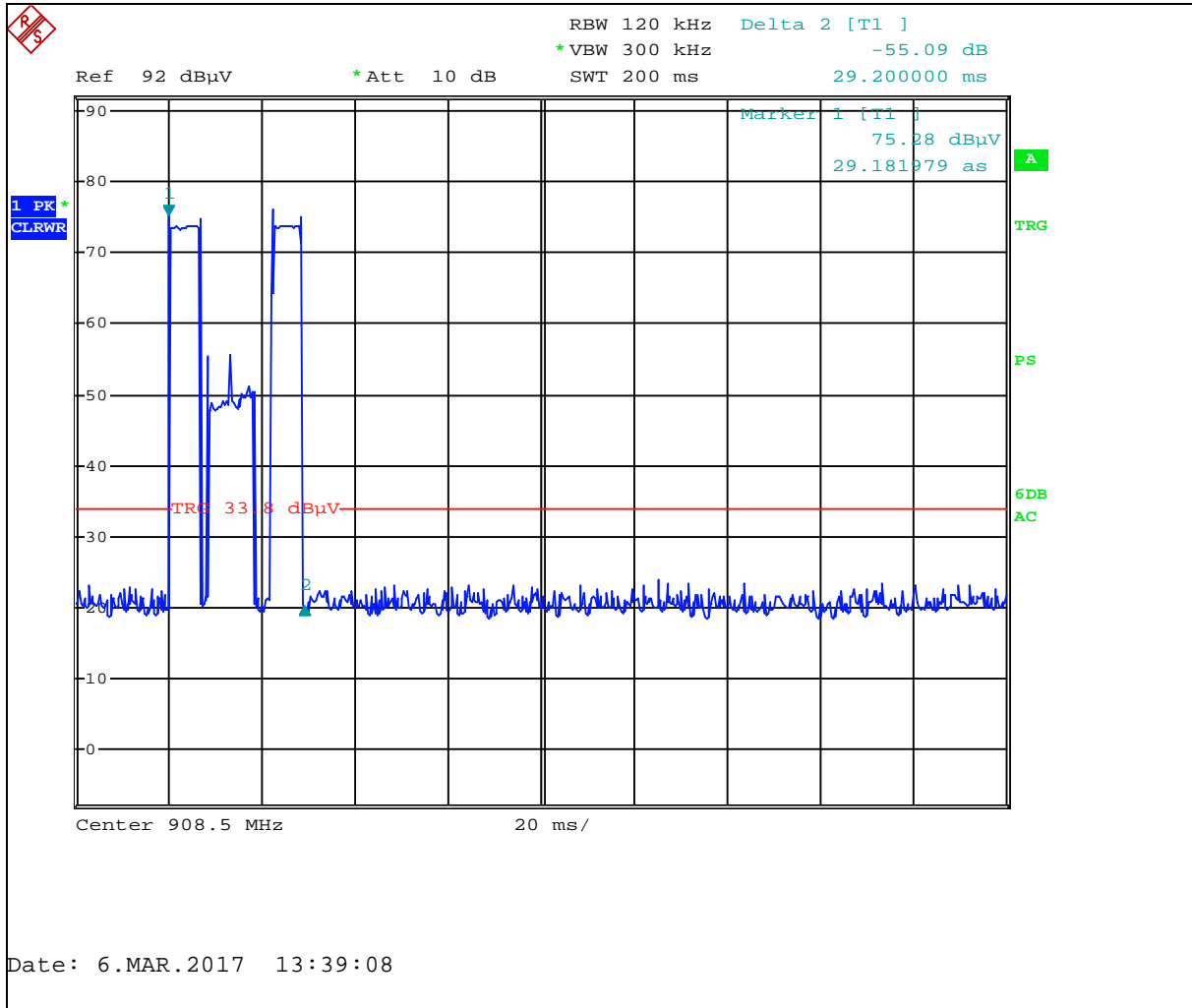
An Average correction factor is calculated by averaging one complete pulse train.

The pulse train exceeds 100ms. Therefore the measured field strength was determined during a 100ms interval  
Time with field strength is in its maximum value (length of pulses) = 29.2ms (see Graph 3.2.3)

Average Correction Factor =  $20\text{Log}(29.2\text{ms}/100\text{ms}) = -10.7\text{dB}$



Graph 3.2.3







### 3.3 Bandwidth of Emissions

Center Frequency of operation MHz	Measured 20dB bandwidth kHz	Measured 99% bandwidth kHz
908.41	320	276

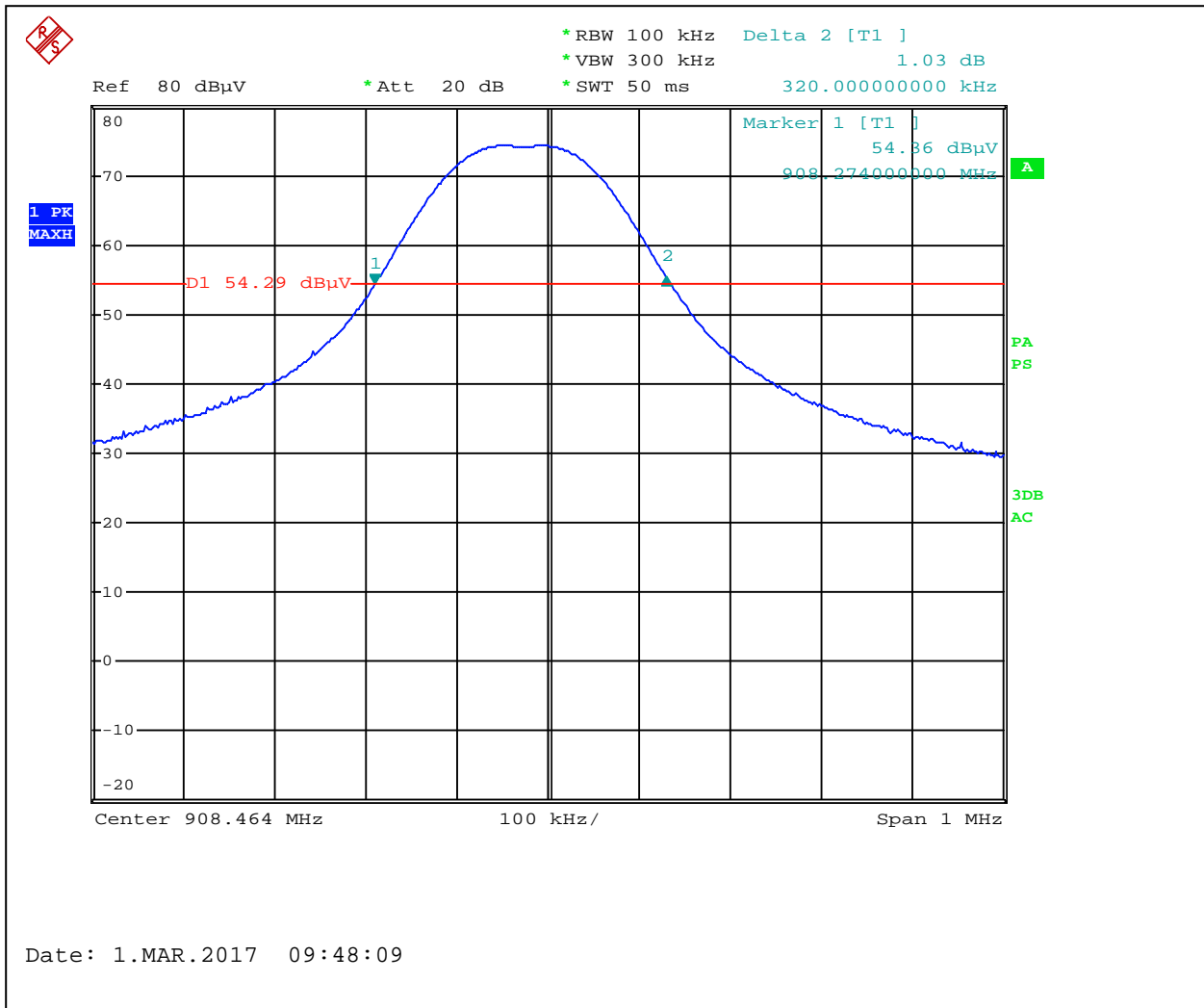
Graphs 3-3-1 and 3-3-2 are show bandwidth of emissions

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

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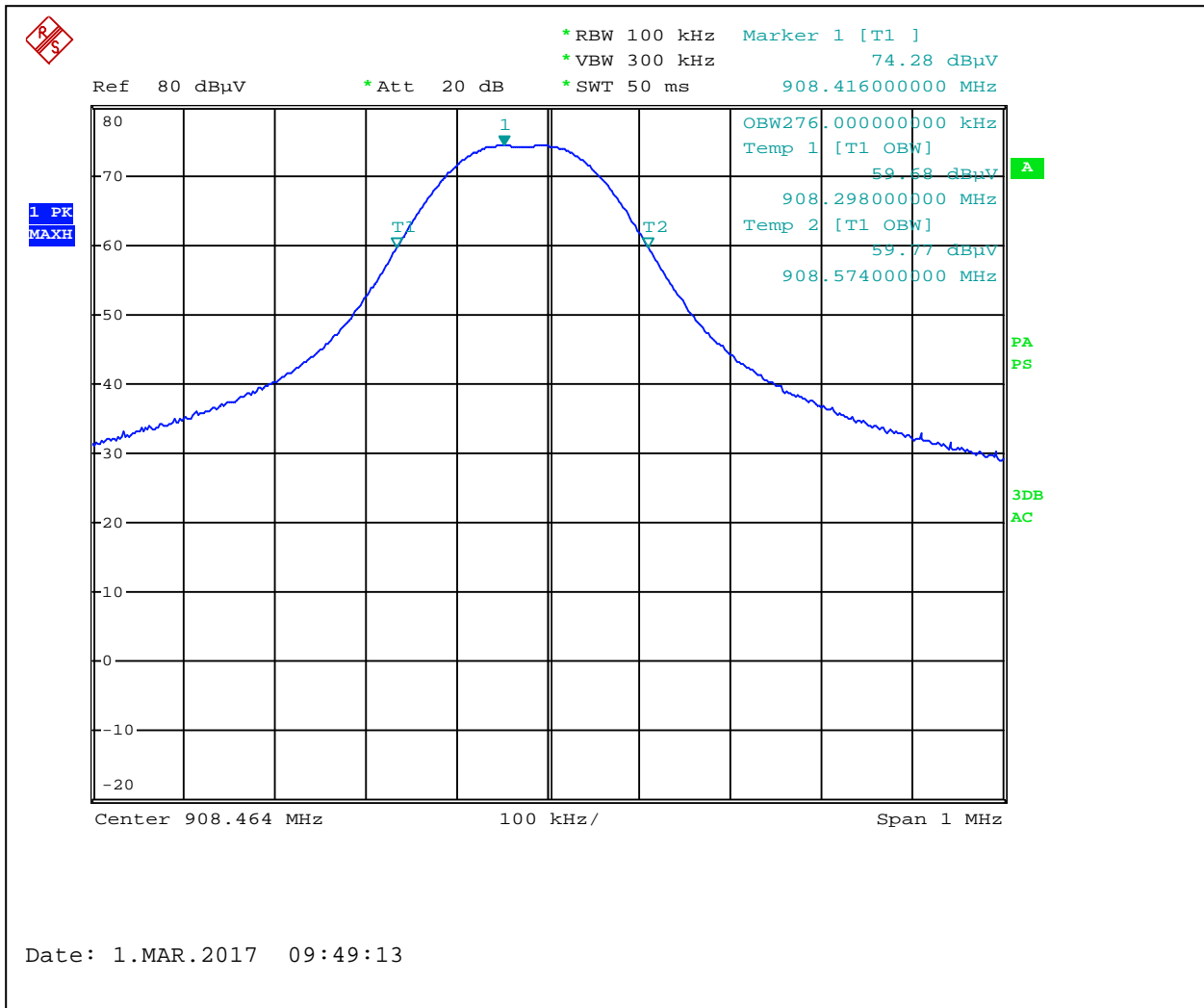


Graph 3.3.1





Graph 3.3.2



### 3.4 Transmitter power line conducted emissions

**Test location:**         OATS         Anechoic Chamber     Other

**Test result:**        **Pass**

**Frequency range:**                    0.15MHz-30MHz

**Max. Emissions margin:**        4.0dB below the limits

**Notes:**            None

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<b>Date:</b>	March 3, 2017	<b>Result: Pass</b>
<b>Tested by:</b>	Uri Spector	
<b>Standard:</b>	FCC 15.207	
<b>Test Point:</b>	Power Line	
<b>Operation mode:</b>	See page 5	
<b>Environmental Conditions:</b>	23.1°C; 39.2%(RH); 96.8kPa	
<b>Equipment Verification:</b>	<input checked="" type="checkbox"/>	
<b>Note:</b>	None	

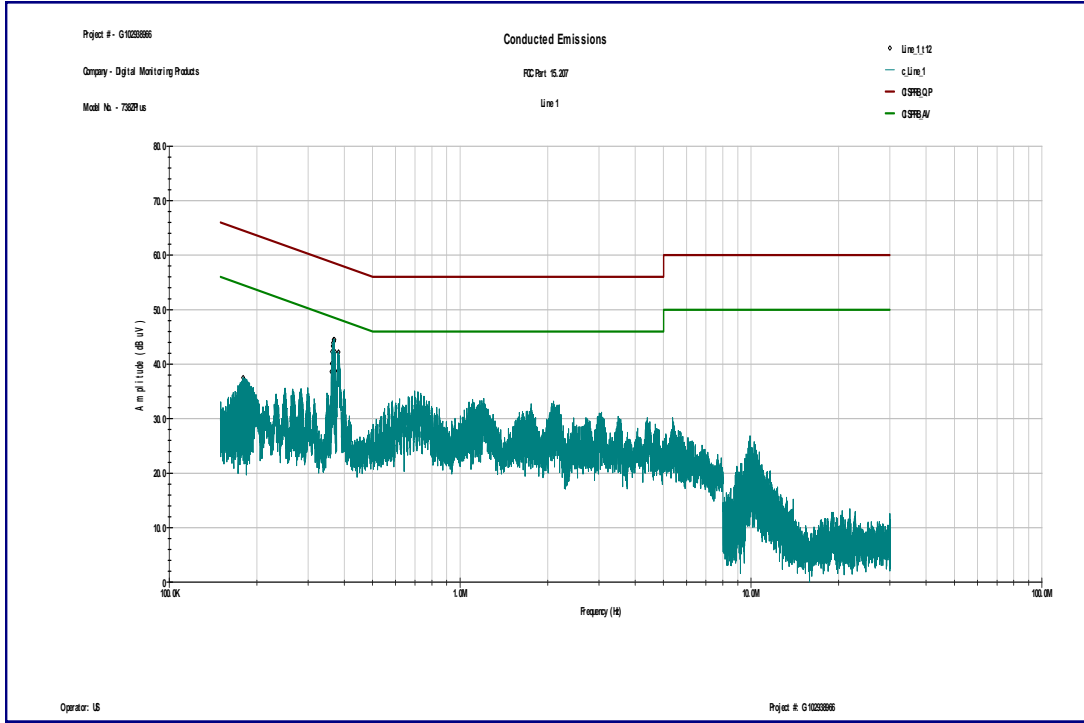
**Table 3.4.1**

<b>Line 1</b>					
Frequency	Peak dB $\mu$ V	QP Limit dB $\mu$ V	AVG Limit dB $\mu$ V	QP Margin dB	AVG Margin dB
179.6 KHz	37.5	64.5	54.5	-27.0	-17.0
367.17 KHz	44.5	58.6	48.6	-14.1	-4.1
369.81 KHz	44.5	58.5	48.5	-14.0	-4.0
371.05 KHz	42.2	58.5	48.5	-16.2	-6.2
372.13 KHz	38.8	58.5	48.5	-19.7	-9.7
381.86 KHz	42.2	58.2	48.2	-16.0	-6.0
<b>Line 2</b>					
Frequency	Peak dB $\mu$ V	QP Limit dBmV	AVG Limit dBmV	QP Margin dB	AVG Margin dB
360.51 KHz	38.4	58.7	48.7	-20.3	-10.3
364.38 KHz	40.4	58.6	48.6	-18.2	-8.2
379.51 KHz	39.7	58.3	48.3	-18.6	-8.6
380.1 KHz	40.3	58.3	48.3	-17.9	-7.9
382.64 KHz	40.1	58.2	48.2	-18.1	-8.1
383.42 KHz	39.3	58.2	48.2	-18.9	-8.9

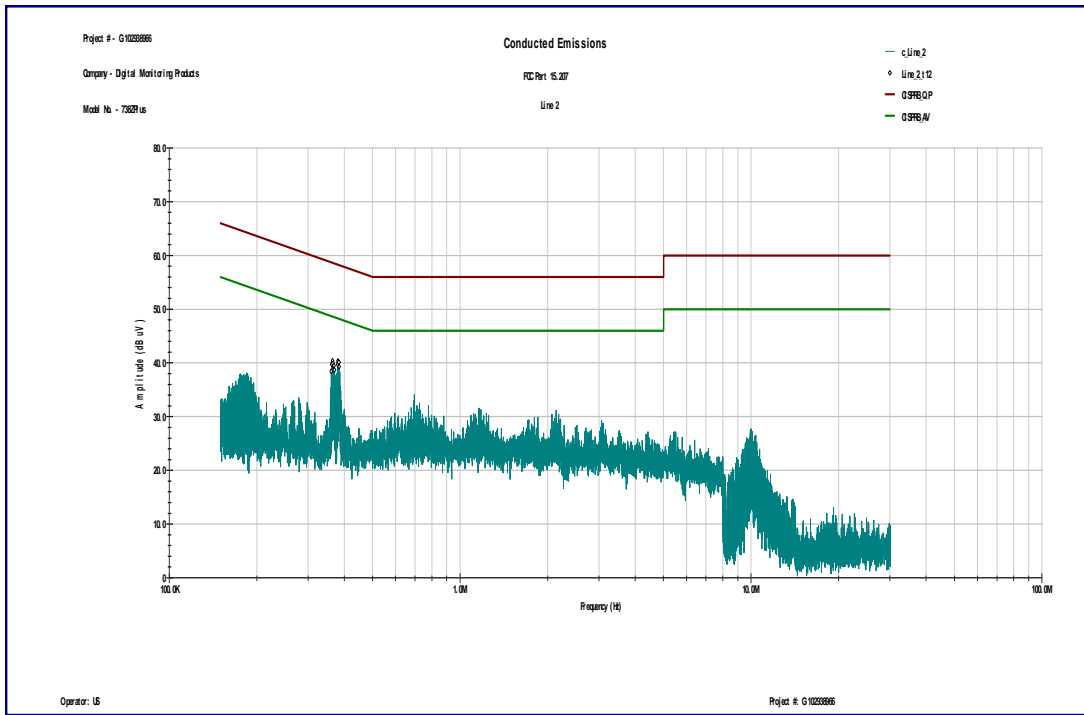


Graph 3.4.1

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-5000MHz

**Max. Emissions margin:** 7.6dB below the limits

**Notes:**

1. The EUT was tested for worst case emissions in Z axis configuration.
2. Signal generator transmitting frequency to activate receiver was excluded from the table

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<b>Date:</b>	March 2, 2017	<b>Result: Pass</b>
<b>Tested by:</b>	Uri Spector	
<b>Standard:</b>	FCC Part 15.109, Class B	
<b>Test Point:</b>	Enclosure	
<b>Operation mode:</b>	See page 5	
<b>Environmental Conditions:</b>	23°C; 39%(RH); 96.7kPa	
<b>Equipment Verification:</b>	<input checked="" type="checkbox"/>	
<b>Note:</b>	30MHz-1GHz	

**Table 3.5.1**

Frequency MHz	Antenna Polarity	Peak Reading dB $\mu$ V	Total C.F. dB1/m	Total at 3m dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB
30.069 MHz	V	11.9	20.4	32.2	40.0	-7.8
110.89 MHz	V	12.4	13.3	25.7	43.5	-17.9
30.0 MHz	H	12.0	20.4	32.4	40.0	-7.6
112.83 MHz	H	12.9	13.4	26.3	43.5	-17.2



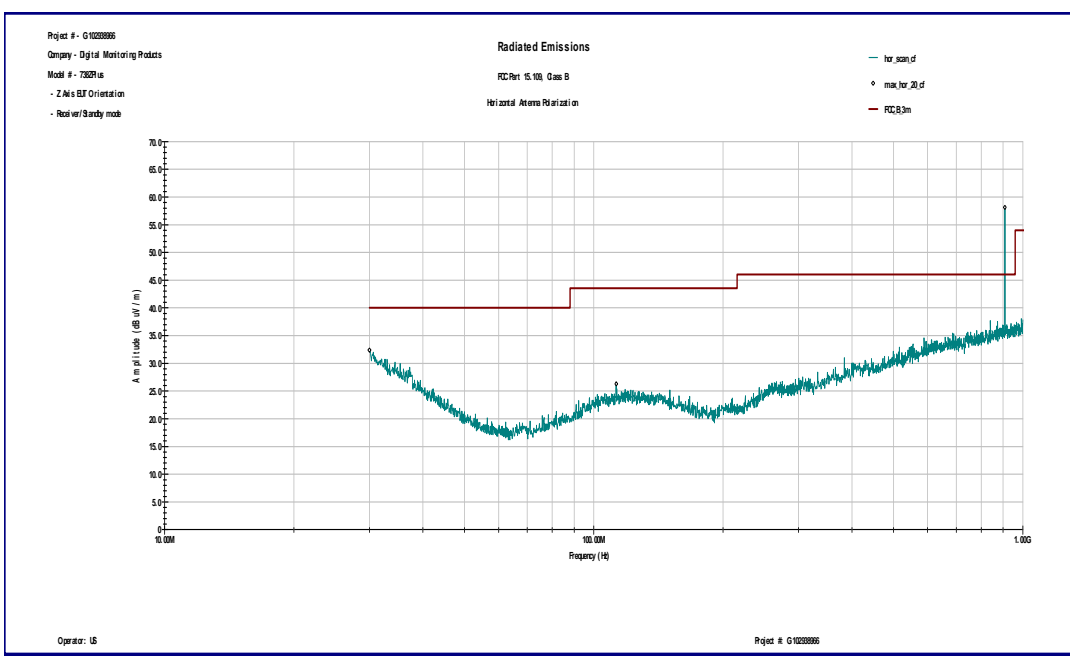
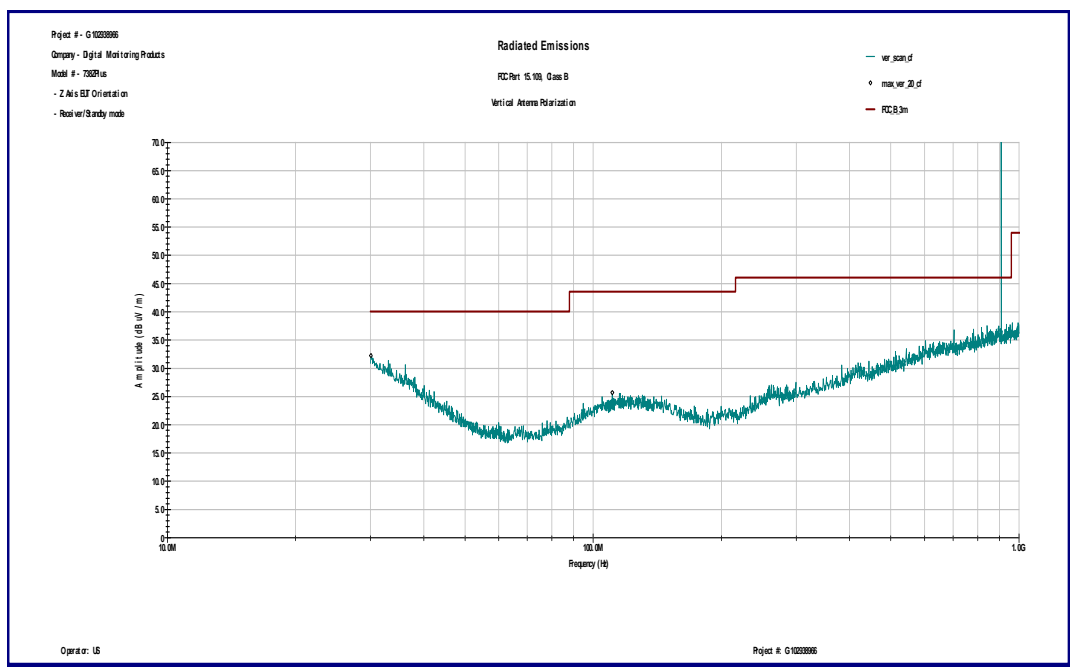
<b>Date:</b>	March 2, 2017	<b>Result: Pass</b>
<b>Tested by:</b>	Uri Spector	
<b>Standard:</b>	FCC Part 15.109, Class B	
<b>Test Point:</b>	Enclosure	
<b>Operation mode:</b>	See page 5	
<b>Environmental Conditions:</b>	23°C; 39%(RH); 96.7kPa	
<b>Equipment Verification:</b>	<input checked="" type="checkbox"/>	
<b>Note:</b>	1GHz-5GHz	

**Table 3.5.2**

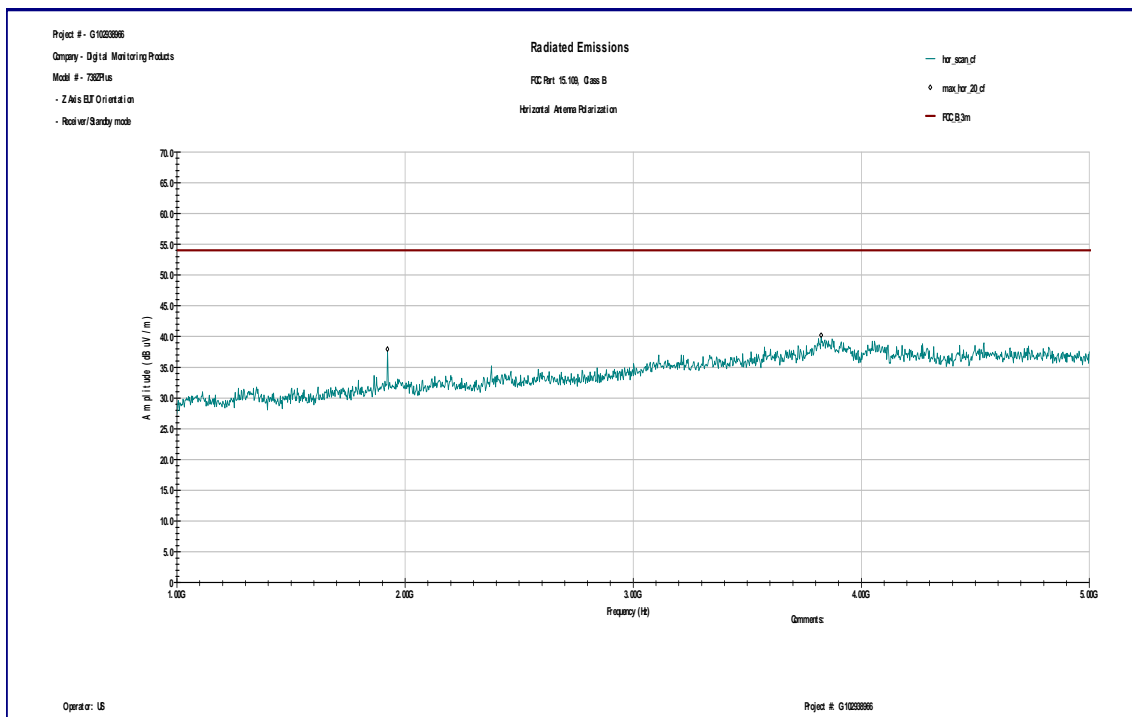
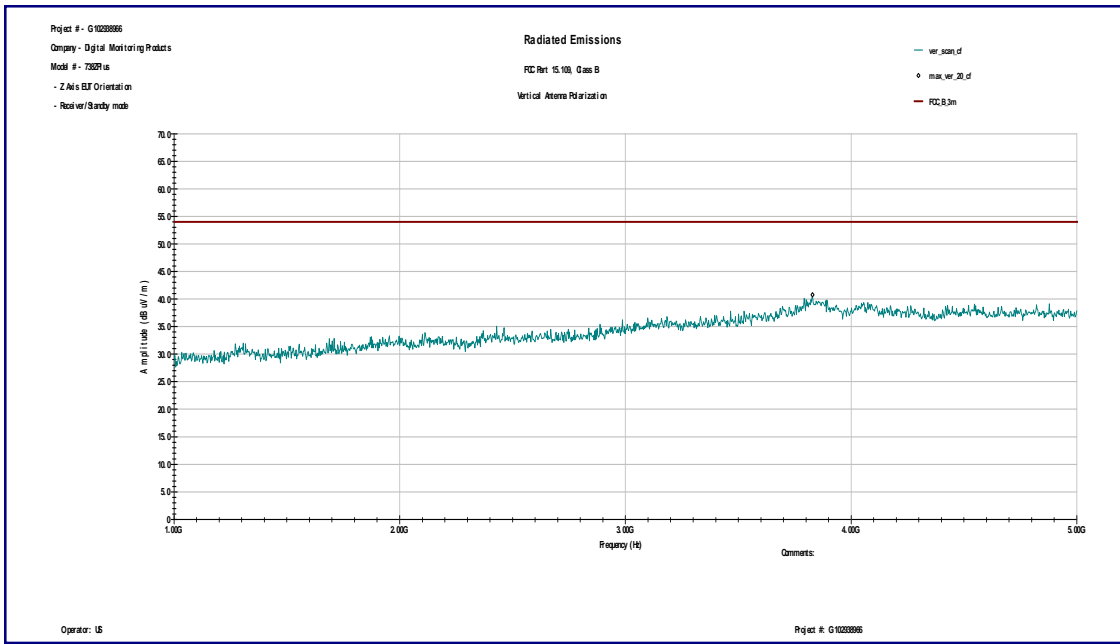
Frequency MHz	Antenna Polarity	Peak Reading dB $\mu$ V	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB
3.8293 GHz	V	44.2	36.6	40.1	40.7	54.0	-13.2
1.9227 GHz	H	49.0	30.0	41.0	37.9	54.0	-16.0
3.824 GHz	H	43.8	36.5	40.1	40.2	54.0	-13.8



Graph 3.5.1



## Graph 3.5.2





### 3.6 Digital device conducted emissions

**Test location:**             OATS             Anechoic Chamber     Other

**Test result:**            **Pass**

**Frequency range:**                    0.15MHz-30MHz

**Max. Emissions margin:**            5.4dB below the limits

**Notes:**            None

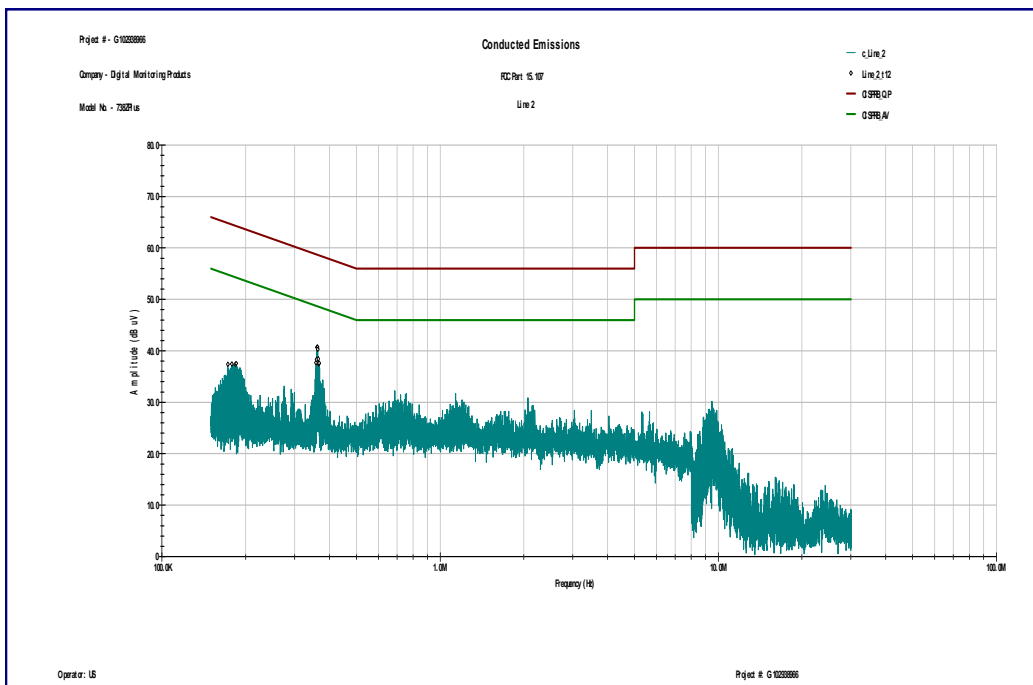
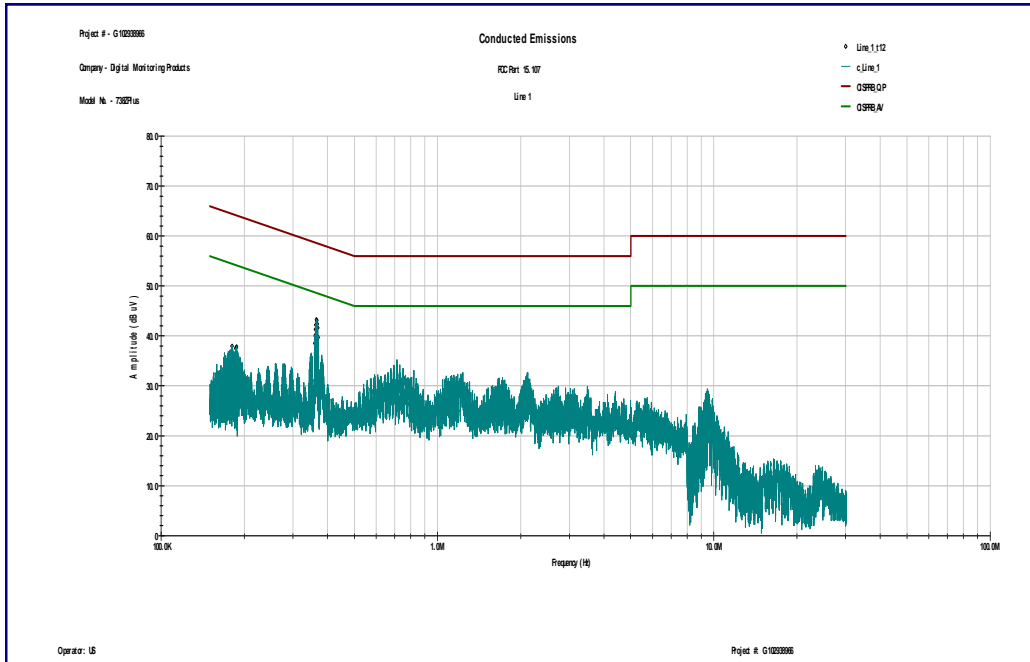
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<b>Date:</b>	March 3, 2017	<b>Result: Pass</b>
<b>Tested by:</b>	Uri Spector	
<b>Standard:</b>	FCC Part 15.107, Class B	
<b>Test Point:</b>	Power Line	
<b>Operation mode:</b>	See page 5	
<b>Environmental Conditions:</b>	23.1°C; 39.2%(RH); 96.8kPa	
<b>Equipment Verification:</b>	<input checked="" type="checkbox"/>	
<b>Note:</b>	None	

**Table 3.6.1**

<b>Line 1</b>					
Frequency	Peak dB $\mu$ V	QP Limit dB $\mu$ V	AVG Limit dB $\mu$ V	QP Margin dB	AVG Margin dB
180.37 KHz	37.9	64.5	54.5	-26.5	-16.5
187.44 KHz	37.8	64.2	54.2	-26.3	-16.3
361.9 KHz	41.3	58.7	48.7	-17.4	-7.4
364.38 KHz	43.2	58.6	48.6	-15.4	-5.4
365.62 KHz	43.1	58.6	48.6	-15.5	-5.5
367.02 KHz	42.4	58.6	48.6	-16.2	-6.2
<b>Line 2</b>					
Frequency	Peak dB $\mu$ V	QP Limit dBmV	AVG Limit dBmV	QP Margin dB	AVG Margin dB
172.6 KHz	37.4	64.8	54.8	-27.5	-17.5
178.43 KHz	37.5	64.6	54.6	-27.1	-17.1
184.95 KHz	37.5	64.3	54.3	-26.7	-16.7
359.42 KHz	38.3	58.7	48.7	-20.4	-10.4
362.06 KHz	40.8	58.7	48.7	-17.9	-7.9
363.45 KHz	40.3	58.7	48.7	-18.4	-8.4

## Graph 3.6.1





#### 4.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	INTERTEK ID	LAST CAL DATE	CAL DUE	USED
Spectrum Analyzer	R & S	FSP 40	100024	12559	01/26/2017	01/26/2018	<input checked="" type="checkbox"/>
Spectrum Analyzer	R & S	ESCI	100358	12909	10/31/2016	10/31/2017	<input checked="" type="checkbox"/>
Bicono-Log Antenna	Teseq	CBL6112D	32859	25289	10/03/2016	10/03/2017	<input checked="" type="checkbox"/>
Horn Antenna	EMCO	3115	9507-4513	9936	07/12/2016	07/12/2017	<input checked="" type="checkbox"/>
LISN	COM-Power	Li-215A	191970	172315	06/13/2016	06/13/2017	<input checked="" type="checkbox"/>
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1122951	13475	12/01/2016	12/01/2017	<input checked="" type="checkbox"/>
High Pass Filter	Reactel Inc.	7HS-1G-S1	0223	15275	VBU	VBU	<input checked="" type="checkbox"/>
System	Quantum Change	TILE! Instrument Control	Ver. 3.4.K.29	15259	VBU	VBU	<input checked="" type="checkbox"/>



## 5.0 Revision History

REVISION LEVEL	DATE	REPORT NUMBER	PREPARED	REVIEWED	NOTES
0	03-06-2013	102938966MIN-001	US	NS	Original Issue