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Project 15101-15

IEEE 802.15.4 Module

Class II Permissive Change Report

Prepared for:

Synapse Wireless, Inc.
500 Discovery Drive
Huntsville, AL 35806

By

Professional Testing (EMI), Inc.
1601 N. A.W. Grimes Blvd., Suite B
Round Rock, Texas 78665

February 28, 2014

Written by:

Larry Finn
Regulatory Design Engineer

Table of Contents

Revision	Description	Date
01	Initial Release	2014-2-11 Larry Finn
02	Revised per Leonard Urbanovsky	2014-2-13 Eric Lifsey
03	Revised per TCB comments	2014-2-28 Eric Lifsey

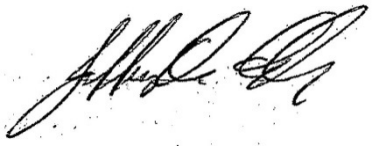
Certificate of Compliance

Applicant:	Synapse Wireless, Inc.
Applicant's Address:	500 Discovery Drive Huntsville, AL 35806
FCC ID:	U9O-RF200
IC ID:	7084A-RF200
Model:	RF200
Project Number:	15101-15

The **RF200 IEEE 802.15.4 Module** was tested utilizing the following documents and found to be in compliance with the required criteria.

Standard	Issue / Section / Part	Detail
FCC 47 CFR Part 15 C	15.247	Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.
FCC 47 CFR Part 15 C	15.209	Radiated emission limits; general requirements.
FCC 47 CFR Part 15 C	15.207	Conducted limits.
FCC 47 CFR Part 15 C	15.205	Restricted Bands of Operation
KDB718828	DR01	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247
KDB412172	D01	Guidelines for Determining the ERP and EIRP of an RF Transmitting System
OET Bulletin 65	Edition 97-01, Including Supplement C, Edition 01-01	Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
RSS-210	Issue 8	Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
RSS-Gen	Issue 3	General Requirements and Information for the Certification of Radio Apparatus
RSS-102	Issue 4	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

I, Jeffrey A. Lenk, for Professional Testing (EMI), Inc., being familiar with the FCC rules and test procedures, have reviewed the test setup, measured data, and this report. I believe them to be true and accurate.



Jeffrey A. Lenk
President

This report has been reviewed and accepted by Synapse Wireless, Inc. The undersigned is responsible for ensuring that the devices listed above, will continue to comply with the applicable rules.

_____
Representative of Synapse Wireless, Inc.

1 Introduction

1.1 Scope

The purpose of this test report is to demonstrate compliance with FCC and Industry Canada regulations pursuant to a Class II Permissive Change.

This Class II Permissive Change is being done to include a new antenna type to the RF200 device modular certification.

1.2 EUT Description

The Synapse Wireless RF200 Module is an IEEE 802.15.4 compliant RF module that is approved as an FCC Part 15 unlicensed modular transmitter.

Technical Details:

- Band of operation: 2405 - 2480 MHz
- Number of channels: 16
- Channel spacing 5 MHz
- Modulation format: O-QPSK
- Module Antenna(s) Type: External RP-SMA
- Module Operating Voltage: 2.0-3.6 VDC
- Detcon CXT Controller Host: System Operating Voltage 9-11.5 VDC

Manufacturer Information:

Synapse Wireless, Inc.
500 Discovery Drive
Huntsville, AL 35806

1.3 Antenna Configuration

The antenna being added to the modular grant is the L-com Model HG2405RD-RSP dipole antenna.

- Model: HG2405RD-RSP
- Manufacturer: L-com® Global Connectivity
- Maximum gain: 5.5dBi
- Frequency: 2400-2500MHz
- Type: Dipole
- Connector: Reverse Polarity SMA

1.4 EUT Operation

The EUT was powered via the CXT Controller using an internal Li-Ion battery pack.

1.5 EUT Modifications

No modifications were made to the EUT during evaluation. The unit supplied was a pre-production device.

1.6 Test Site

Measurements were made at the PTI semi-anechoic facility designated Site 45 (FCC 459644, IC 3036B-1) in Austin, Texas. The site is registered with the FCC under Section 2.948 and Industry Canada per RS-212, and is subsequently confirmed by laboratory accreditation (NVLAP). The test site is located at 11400 Burnet Road, Austin, Texas 78758, while the main office is located at 1601 North A.W. Grimes Boulevard, Suite B, Round Rock, Texas, 78665.

1.7 Equipment List

The following equipment was used for all testing.

Radiated Emissions Test Equipment List					
Tile! Software Version:		**4.2.A, May 23, 2010, 08:38:52 AM**			
Test Profile:		**Radiated Emissions_Profile Version October 12, 2011**			
Asset #	**Manufacturer**	**Model**	**Equipment Nomenclature**	**Serial Number**	**Calibration Due Date**
1509A	Braden	N/A	TDK 10M Chamber, NSA < 1 GHz	DAC-012915-005	7/29/2014
0586	HP	8447D	Preamp, 0.1-1300MHz, 26dB	1726A01364	1/7/2014
1930	Agilent	E4440A-239	Spectrum Analyzer, 3 Hz - 26.5 GHz	MY45304903	7/11/2014
1926	ETS-Lindgren	3142D	Antenna, Biconilog, 26 MHz - 6 GHz	00135454	7/29/2014
C027	N/A	RG214	Cable Coax, N-N, 25m	none	9/26/2014
1327	EMCO	1050	Controller, Antenna Mast	none	N/A
0942	EMCO	11968D	Turntable, 4ft.	9510-1835	N/A
1969	HP	11713A	Attenuator/Switch Driver	3748A04113	N/A
1780	ETS-Lindgren	3117	Antenna, Double Ridged Guide Horn, 1 - 18 GHz	00110313	1/30/2014
1509B	Braden	N/A	TDK 10M Chamber, VSWR > 1 GHz	DAC-012915-005	7/16/2014
1325	EMCO	1050	Controller, Antenna Mast	9003-1461	N/A
2004	Miteq	AFS44-00101800-2S-10P-44	Amplifier, 40dB, .1-18GHz	0	11/19/2014
C030	N/A	0	Cable Coax, N-N, 30m	none	9/26/2014

Table 1: Test Equipment List

1.8 Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a rotating turntable at a distance of 10 meters from the measurement antenna for measurements below 1GHz and 3m for measurements above 1GHz.

The EUT was operated under normal operating conditions.

Spurious/harmonic emissions above 1 GHz peak were measured with average and peak detection with a resolution bandwidth of 1 MHz and measured at a distance of 1 meter. Average detection was used to determine compliance of the EUT if the peak did not meet the average limit. Non-harmonic emissions must satisfy the average limit and the peak limit (20 dB above average). A diagram showing the test setup is given as Figure 1.

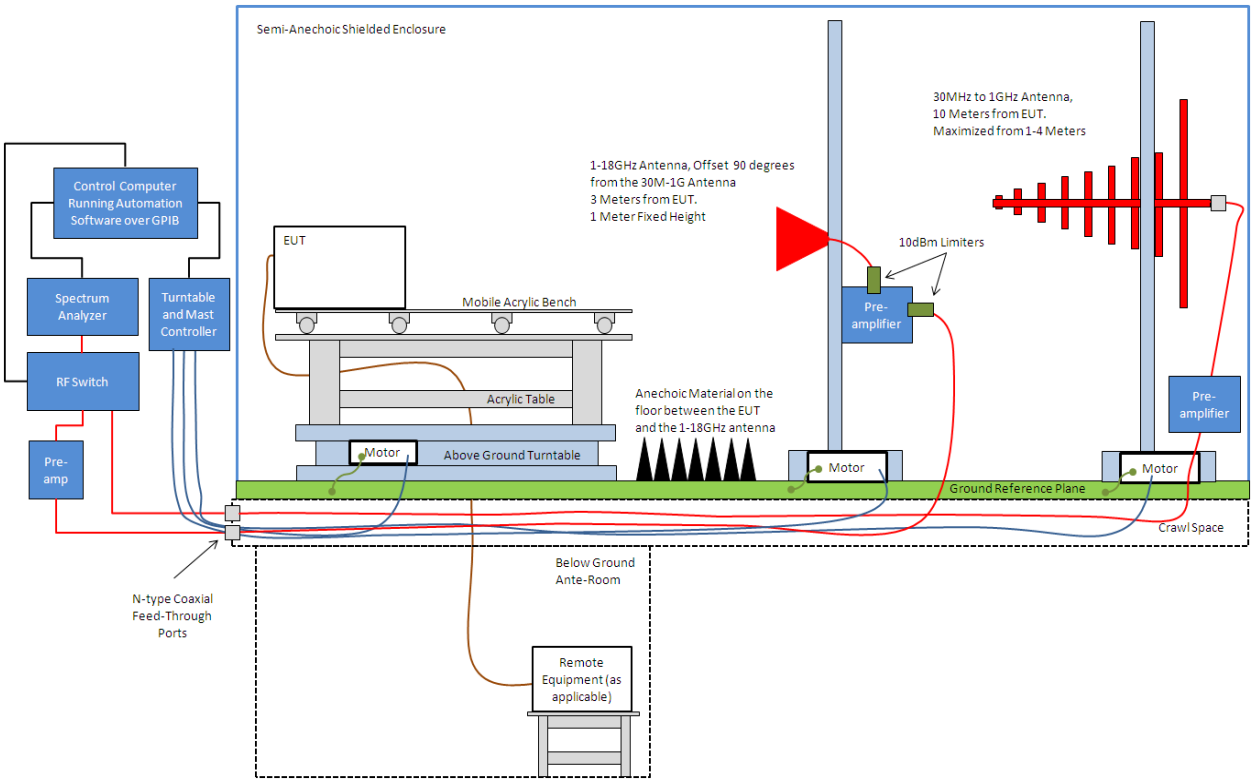


Figure 1: Radiated Emissions Test Setup

2 Test Summary

EUT transmitter characteristics are shown below in Table 2 and were used to select the proper tests to demonstrate compliance.

Professional Testing, EMI, Inc.			
FCC 15.247 / RSS-210: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz			
In accordance with: 47 CFR Part 15 C; RSS-210 Issue 8; KDB 718828			
Test Date(s): 11/7/13 - 1/23/14		EUT Serial #: RF200PD1	
Customer: Synapse Wireless, Inc.		EUT Part #: RF200	
Project Number: 15101-15		Test Technician: Eric Lifesy	
Purchase Order #: N/A		Supervisor: Rob McCollough	
Equip. Under Test: IEEE 802.15.4 Radio Module		Witness' Name: N/A	
Device Type: (•) Digital Modulation ( ) Frequency Hopping ( ) Hybrid System		Operating Frequency Range: ( ) 902-928 MHz (•) 2400-2483.5 MHz ( ) 5725-5850 MHz	
Antenna / Device Configuration: (•) Single Beam / Non-Fixed ( ) Fixed Point-to-Point ( ) Multiple Beams			
Device Power: ( ) AC Mains Powered / Hybrid (•) Battery Powered		Measurement Type: ( ) Conducted (•) Radiated	
Test Channels Number of Test Channels		Antenna Details Number of Antenna Ports	
3		1	
Channel	Frequency (MHz)	Number of Antenna Types	
Low	2405	1	
Mid	2440		
High	2480		
Modulation Schemes Number of Modulation Schemes		Device Details	
1		FCC ID:	U9O-RF200
Modulation Scheme List		IC ID:	7084A-RF200
O-QPSK		Number of Channels:	16
		Operating Frequency Range:	2405 - 2480 MHz
		Input Power Details:	9VDC

Table 2: EUT Characteristics

3 Test Results

3.1 Peak Output Power

Conducted output power measurements were made for the bottom, middle and top channels of the EUT.

3.1.1 Equipment Used

See Table 1 in Section 1.7.

3.1.2 Test Procedure

The Spectrum Analyzer was configured for 3MHz RBW with a 10MHz span for the power measurements.

3.1.3 Test Results

Professional Testing, EMI, Inc.

15.247b(3), RSS-210 A8.4: Peak Output Power for Systems Employing Digital Modulation

Test Date(s):	12/17/2013	EUT Serial #:	RF200PD1
Customer:	Synapse Wireless, Inc.	EUT Part #:	RF200
Project Number:	15101-15	Test Technician:	Eric Lifesy
Purchase Order #:	N/A	Supervisor:	Rob McCollough
Equip. Under Test:	IEEE 802.15.4 Radio Module	Witness' Name:	N/A

Peak Power Measurements (Peak Pwr Method / Average Pwr Method)

Channel	Frequency (MHz)	Port	Modulation	Ant.	Pol.	Corrected Test Data		Conducted Test Data Correction Factors				Ant. Factor	Corrected Antenna Port Peak Power			EIRP
						Radiated (dBuV/m)	Dist. (m)	CF1 (dB)	CF2 (dB)	CF3 (dB)	CF4 (dB)	Max (dB)	Value (dBm)	Limit (dBm)	Result (P/F)	Value (dBm)
Low	2405	1	O-QPSK	1	V	108.48	3	0	0	0	0	0.00	7.8	30	PASS	13.3
Low	2405	1	O-QPSK	1	H	95.55	3	0	0	0	0	0.00	-5.2	30	PASS	0.3
Mid	2440	1	O-QPSK	1	V	108.39	3	0	0	0	0	0.00	7.7	30	PASS	13.2
Mid	2440	1	O-QPSK	1	H	93.35	3	0	0	0	0	0.00	-7.4	30	PASS	-1.9
High	2480	1	O-QPSK	1	V	96.69	3	0	0	0	0	0.00	-4.0	30	PASS	1.5
High	2480	1	O-QPSK	1	H	79.67	3	0	0	0	0	0.00	-21.1	30	PASS	-15.6

Formulas Used for Calculations

EIRP to Field Strength Calculation

1.3.1. Field Strength Approach (linear terms):

$$eirp = p_t \times g_t = (E \times d)^2/30 \quad (1)$$

where:

- p_t = transmitter output power in watts,
- g_t = numeric gain of the transmitting antenna (unitless),
- E = electric field strength in V/m,
- d = measurement distance in meters (m).

$$erp = eirp/1.64 = (E \times d)^2/(30 \times 1.64) \quad (2)$$

where all terms are as previously defined.

Table 3: Peak Output Power

3.2 Band Edge Measurements

3.2.1 Test Procedure

Radiated band edge measurements were taken using a RBW of 1MHz. All band-edge levels were found to comply with the required limits for FCC and Industry Canada.

3.2.2 Test Results

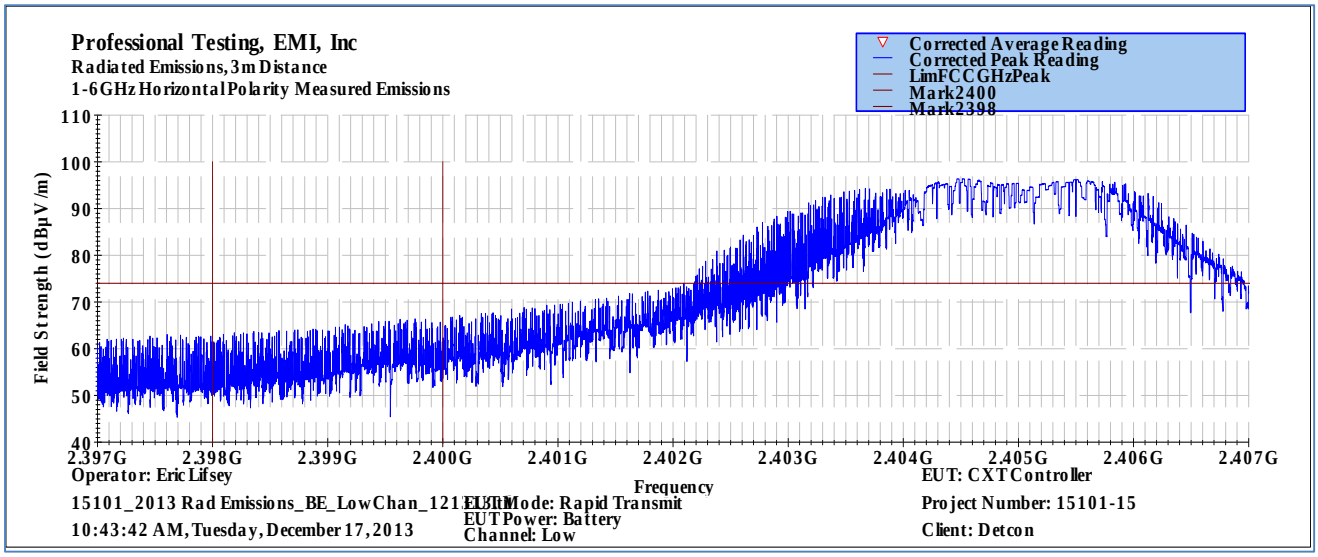


Figure 2: Lower Band Edge Measurement Results (Horizontal)

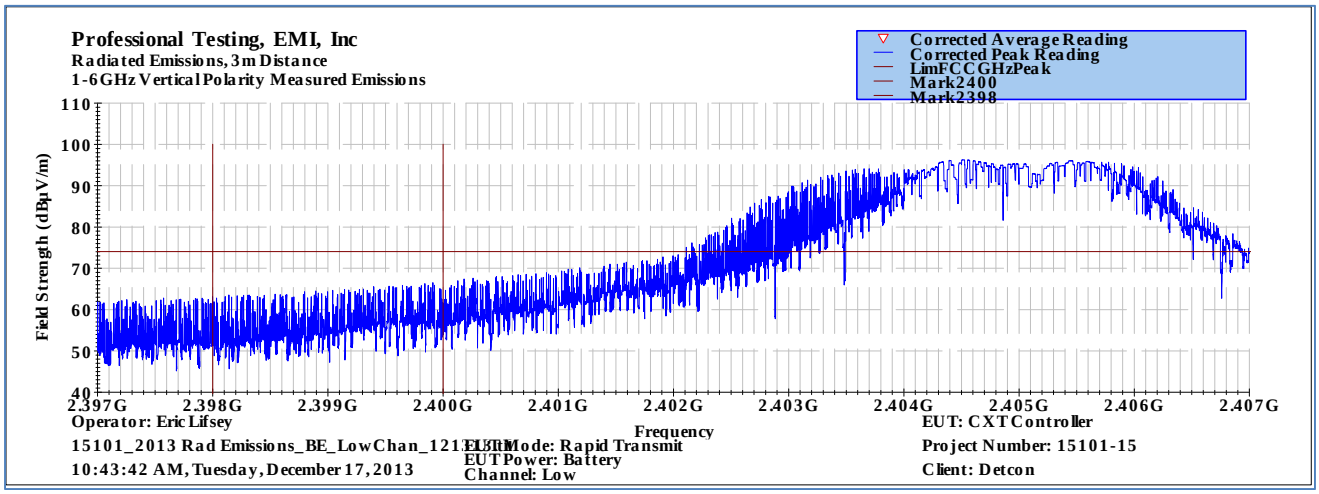


Figure 3: Lower Band Edge Measurement Results (Vertical)

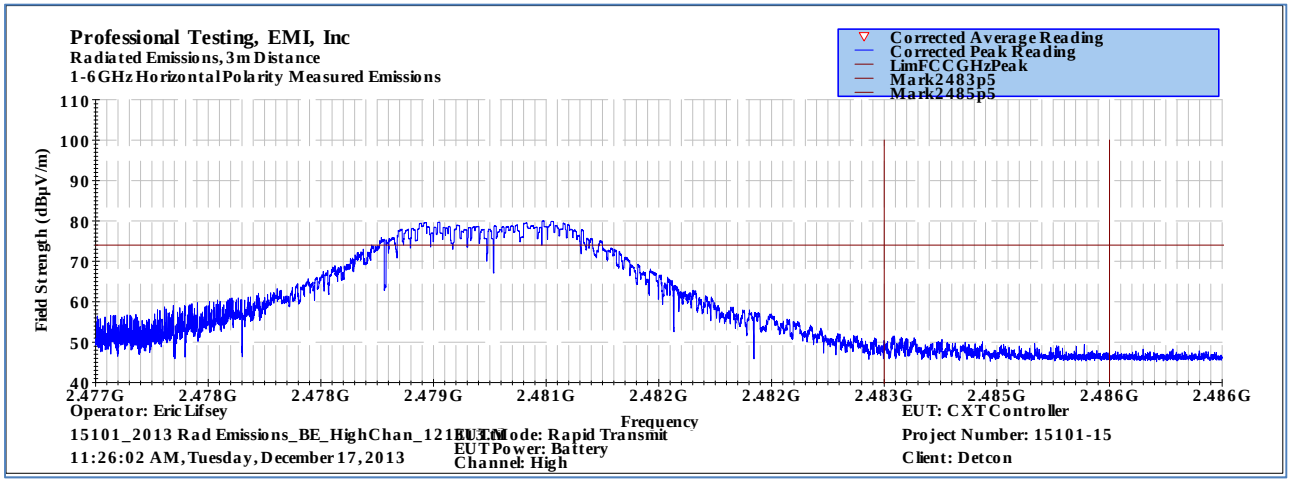


Figure 4: Upper Band Edge Measurement Results (Horizontal)

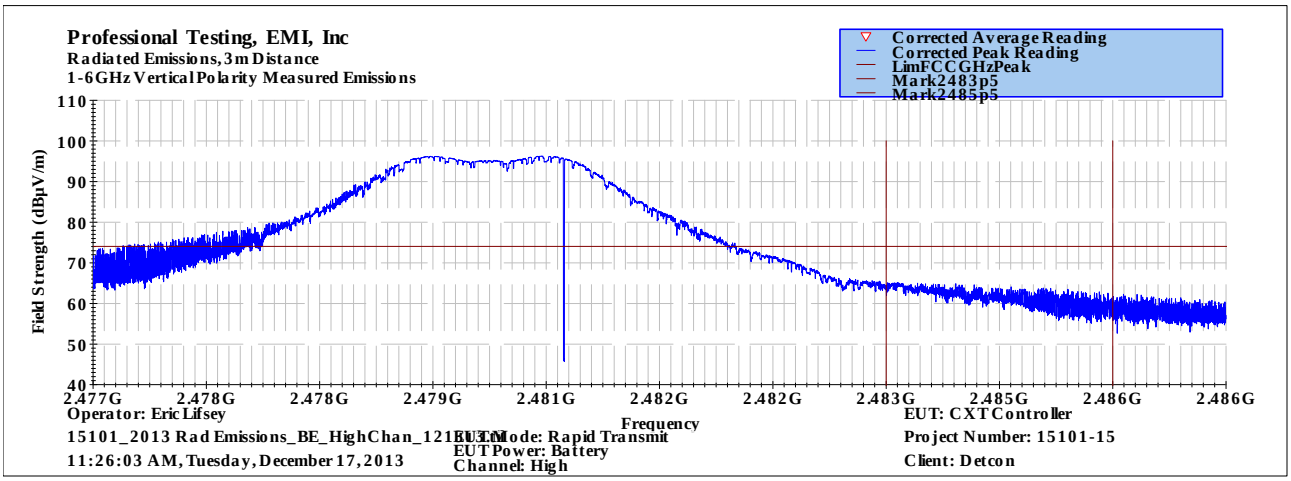


Figure 5: Upper Band Edge Measurement Results (Vertical)

Band-Edge (Restricted Band)																		
Meas. Config	Meas. Pol.	Measurement Frequency (MHz)	Emission Type	Restr. Band?	15.209 Limit (dBm)	Limit Type	Harmonic / Spurious Radiated (dBuV/m)	Dist. (m)	Corr. Factors N/A (dB)	N/A (dB)	N/A (dB)	Meas. Type --	Duty Cycle --	Duty Cycle (dB)	Corr. EIRP (dBm)	Limit Value (dBm)	Result (P/F)
1	V	2483.5	Band-Edge	Yes	-41.25	15.209	65.09	3	0	0	0	PEAK	0.02	0.0	-30.1	-21.2	PASS
1	V	2483.5	Band-Edge	Yes	-41.25	15.209	65.09	3	0	0	0	AVG	0.02	-20.0	-50.1	-41.2	PASS
1	H	2483.5	Band-Edge	Yes	-41.25	15.209	50.4	3	0	0	0	PEAK	0.02	0.0	-44.8	-21.2	PASS
1	H	2483.5	Band-Edge	Yes	-41.25	15.209	50.4	3	0	0	0	AVG	0.02	-20.0	-64.8	-41.2	PASS

Formulas Used for Calculations

EIRP to Field Strength Calculation

1.3.1. Field Strength Approach (linear terms):

$eirp = p_t \times g_t = (E \times d)^2/30$ (1)

where:

- p_t = transmitter output power in watts,
- g_t = numeric gain of the transmitting antenna (unitless),
- E = electric field strength in V/m,
- d = measurement distance in meters (m).

$erp = eirp/1.64 = (E \times d)^2/(30 \times 1.64)$ (2)

where all terms are as previously defined.

Duty Cycle Correction Factor per 15.35c

$$DCCF = 20\log_{10}(\text{Duty Cycle}_{meas})$$

Table 4: Restricted Band-Edge Measurement

The peak readings were corrected by the duty cycle of the transmitter to produce the average measurements. As the transmitter was on for only 2.06ms in the 100ms period, the duty cycle factor used was 20dB.

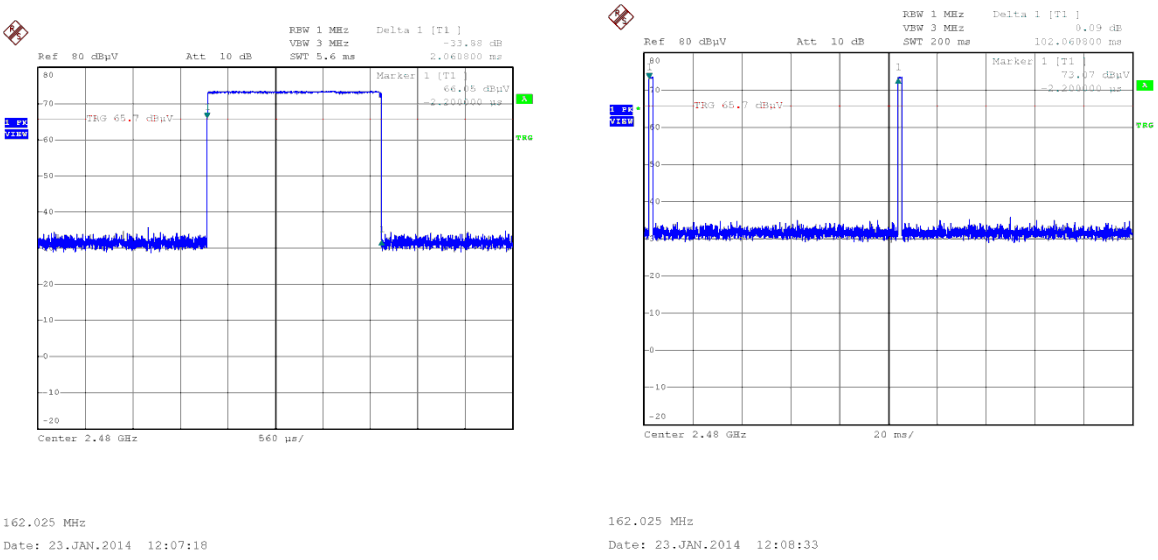


Figure 6: Transmitter Duty Cycle Parameters (Left: TX on, Right: TX Interval)

3.3 RF Exposure

MPE values were calculated using the EIRP levels produced by the new antenna.

Professional Testing, EMI, Inc.

15.247i, RSS-102: RF Exposure Analysis

Test Date(s):	12/17/2013	EUT Serial #:	RF200PD1
Customer:	Synapse Wireless, Inc.	EUT Part #:	RF200
Project Number:	15101-15	Test Technician:	Eric Lifesy
Purchase Order #:	N/A	Supervisor:	Rob McCollough
Equip. Under Test:	IEEE 802.15.4 Radio Module	Witness' Name:	N/A

Build Table

RF Exposure Calculations (●) Mobile (Ant >= 20cm) ( ) Portable (Ant < 20cm)

Channel	Frequency (MHz)	Port	Modulation	Peak Ant. Gain (dBi)	Pol.	EIRP (mW)		Minimum Exposure Distance (cm)	RF Field Density (mW/cm^2)	MPE Limit (mW/cm^2)	Result (P/F)
Low	2405	1	O-QPSK	1	V	21.141		20	4.21E-03	1.00	PASS
Low	2405	1	O-QPSK	1	H	1.077		20	2.14E-04	1.00	PASS
Mid	2440	1	O-QPSK	1	V	20.707		20	4.12E-03	1.00	PASS
Mid	2440	1	O-QPSK	1	H	0.649		20	1.29E-04	1.00	PASS
High	2480	1	O-QPSK	1	V	1.400		20	2.79E-04	1.00	PASS
High	2480	1	O-QPSK	1	H	0.028		20	5.53E-06	1.00	PASS

Formulas Used for Calculations

RF Power Density Calculation

$$S = \frac{PG}{4\pi R^2} \quad 3)$$

where: S = power density (in appropriate units, e.g. mW/cm^2)
P = power input to the antenna (in appropriate units, e.g., mW)
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

or:

$$S = \frac{EIRP}{4\pi R^2} \quad (4)$$

where: EIRP = equivalent (or effective) isotropically radiated power

Table 5: MPE Calculations

3.4 Radiated Spurious Emissions

Radiated emissions measurements were made from 30MHz to 26.5GHz (10 times the highest fundamental frequency).

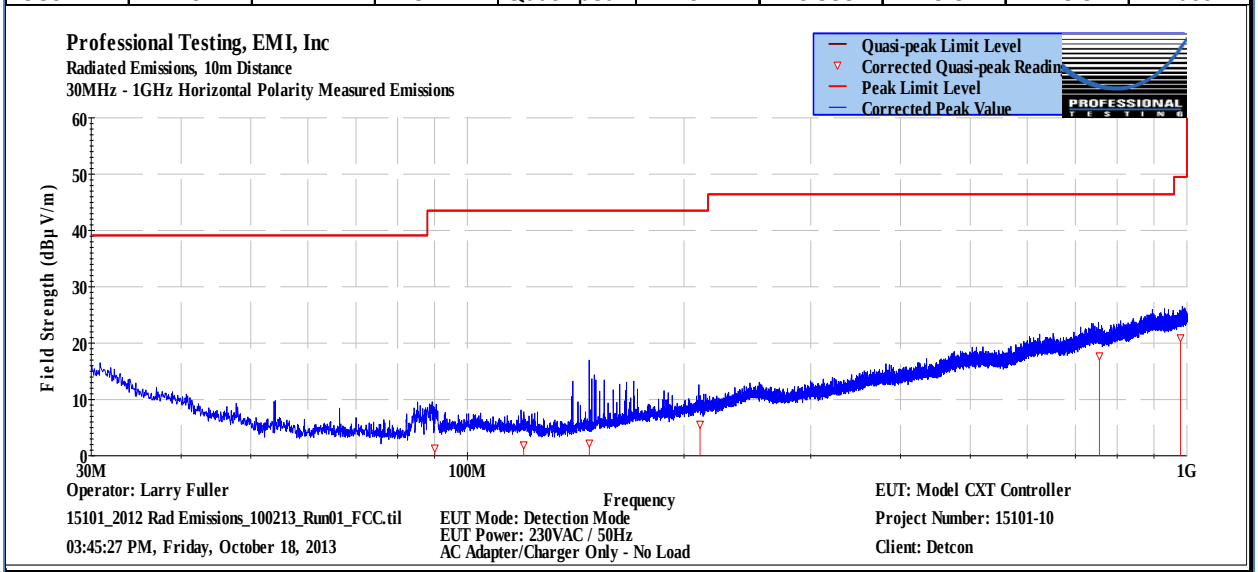
The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000MHz, peak and average measurements were made with RBW and VBW of 1 MHz and 3 MHz respectively.

3.4.1 Test Results

Professional Testing, EMI, Inc.			
Test Method:	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 (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	10/18/2013; 11/13/2013	EUT Serial #:	RF200PD1
Customer:	Synapse Wireless, Inc.	EUT Part #:	RF200
Project Number:	15101-10	Test Technician:	Larry Fuller
Purchase Order #:	109003-00	Supervisor:	Rob McCollough
Equip. Under Test:	IEEE 802.15.4 Wireless Module	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	9 VDC	EUT Power Frequency:	DC N/A
Antenna Orientation:	Vertical	Frequency Range:	30MHz to 1GHz
EUT Mode of Operation:		Detection Mode	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
89.7869	10	260	1.97	Quasi-peak	30.7	9.442	43.5	-34.1	Pass
119.29	10	32	2.13	Quasi-peak	31.9	10.866	43.5	-32.6	Pass
144.52	10	287	1.38	Quasi-peak	23.4	3.159	43.5	-40.3	Pass
210.111	10	27	1.68	Quasi-peak	22.9	6.456	43.5	-37.0	Pass
755.527	10	332	2.86	Quasi-peak	21.1	17.754	46.4	-28.6	Pass
980.147	10	127	3.72	Quasi-peak	20.4	20.955	49.5	-28.5	Pass



≤ 1GHz Vertical Antenna Polarity Measured Emissions

Table 6: <1GHz Vertical Polarization Radiated Emissions Measurements

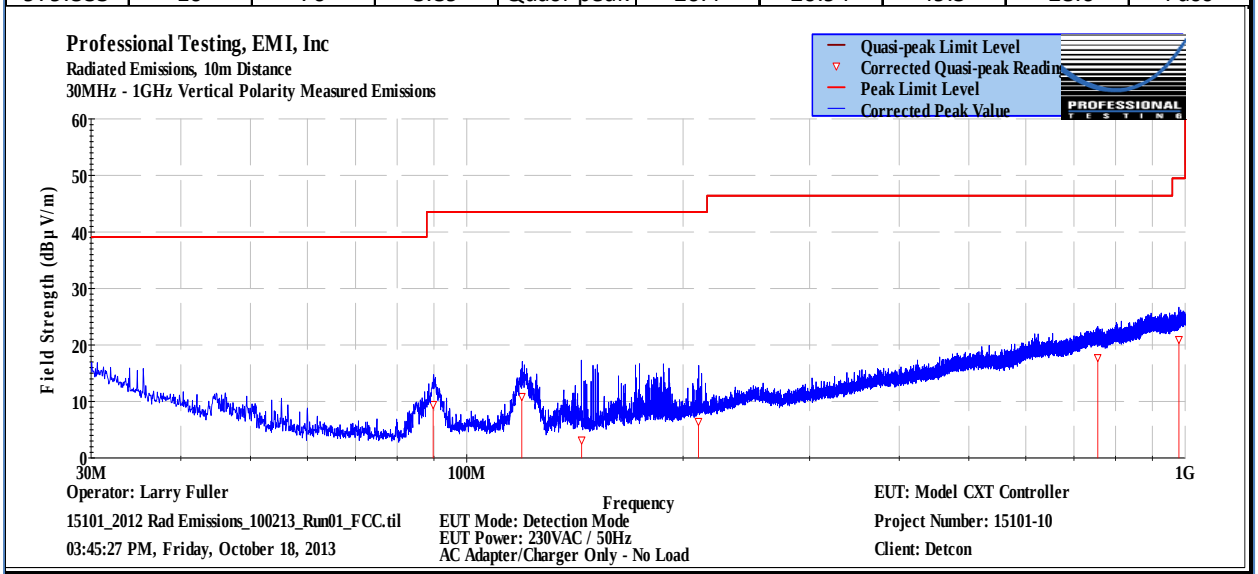
Professional Testing, EMI, Inc.

Test Method:	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 (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	10/18/2013; 11/13/2013	**EUT Serial #:**	RF200PD1
Customer:	Synapse Wireless, Inc.	**EUT Part #:**	RF200
Project Number:	15101-10	**Test Technician:**	Larry Fuller
Purchase Order #:	109003-00	**Supervisor:**	Rob McCollough
Equip. Under Test:	IEEE 802.15.4 Wireless Module	**Witness' Name:**	None

Radiated Emissions Test Results Data Sheet — **Page: 1 of 1**

EUT Line Voltage:	9 VDC	**EUT Power Frequency:**	DC N/A
Antenna Orientation:	Horizontal	**Frequency Range:**	30MHz to 1GHz
EUT Mode of Operation:		**Detection Mode**	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
90.0729	10	341	1.64	Quasi-peak	22.6	1.357	43.5	-42.1	Pass
119.768	10	265	1.45	Quasi-peak	23	1.932	43.5	-41.6	Pass
147.774	10	81	3.68	Quasi-peak	22.3	2.24	43.5	-41.3	Pass
210.514	10	159	3.29	Quasi-peak	22.1	5.591	43.5	-37.9	Pass
755.693	10	103	2.49	Quasi-peak	21.1	17.749	46.4	-28.7	Pass
979.883	10	76	3.89	Quasi-peak	20.4	20.94	49.5	-28.6	Pass



≤ 1GHz Horizontal Antenna Polarity Measured Emissions

Table 7: <1GHz Horizontal Polarization Radiated Emissions

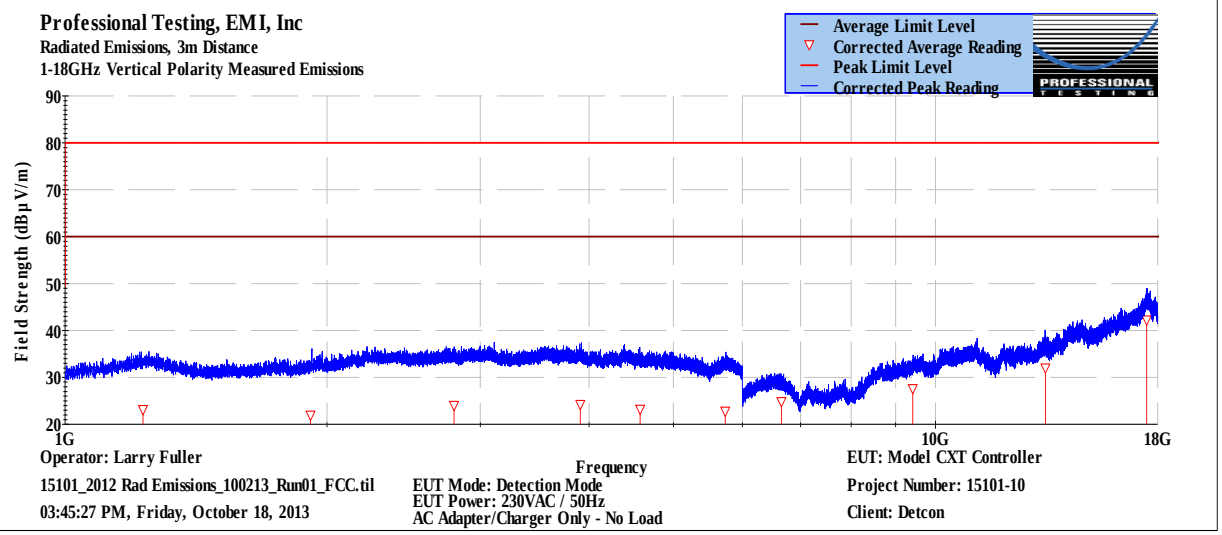
Professional Testing, EMI, Inc.

Test Method:	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 (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	10/18/2013; 11/13/2013	**EUT Serial #:**	RF200PD1
Customer:	Synapse Wireless, Inc.	**EUT Part #:**	RF200
Project Number:	15101-10	**Test Technician:**	Larry Fuller
Purchase Order #:	109003-00	**Supervisor:**	Rob McCollough
Equip. Under Test:	IEEE 802.15.4 Wireless Module	**Witness' Name:**	None

Radiated Emissions Test Results Data Sheet — **Page: 1 of 1**

EUT Line Voltage:	9 VDC	**EUT Power Frequency:**	DC N/A
Antenna Orientation:	Vertical	**Frequency Range:**	Above 1GHz
EUT Mode of Operation:		**Detection Mode**	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
1228.97	3	278	1	Average	75.9	23.143	60.0	-36.8	Pass
1914.54	3	212	1	Average	75.2	21.942	60.0	-38.0	Pass
2799	3	334	1	Average	75.2	24.008	60.0	-35.9	Pass
3908.19	3	21	1	Average	75.4	24.245	60.0	-35.7	Pass
4578.23	3	27	1	Average	74.3	23.22	60.0	-36.7	Pass
5733.94	3	21	1	Average	73.7	22.778	60.0	-37.2	Pass
6652.37	3	357	1	Average	71.7	24.858	60.0	-35.1	Pass
9418.92	3	344	1	Average	62.1	27.632	60.0	-32.3	Pass
13373.6	3	240	1	Average	59.9	32.03	60.0	-27.9	Pass
17481.5	3	273	1	Average	55.8	42.249	60.0	-17.7	Pass



> 1GHz Vertical Antenna Polarity Measured Emissions

Table 8: 1-18GHz Vertical Polarization Radiated Emissions

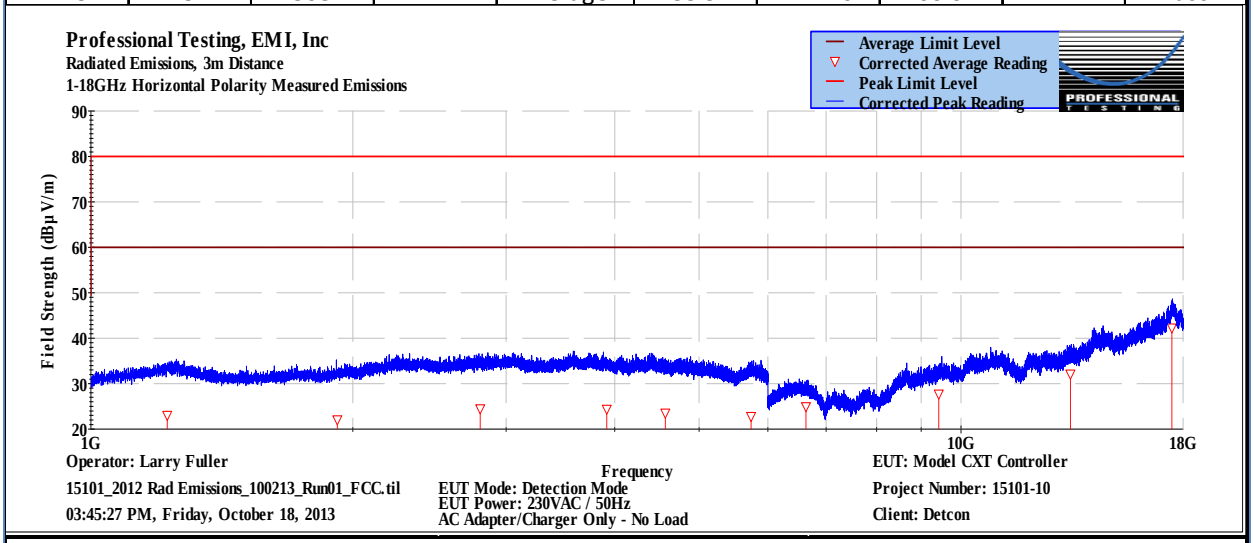
Professional Testing, EMI, Inc.

Test Method:	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 (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	10/18/2013; 11/13/2013	**EUT Serial #:**	RF200PD1
Customer:	Synapse Wireless, Inc.	**EUT Part #:**	RF200
Project Number:	15101-10	**Test Technician:**	Larry Fuller
Purchase Order #:	109003-00	**Supervisor:**	Rob McCollough
Equip. Under Test:	IEEE 802.15.4 Wireless Module	**Witness' Name:**	None

Radiated Emissions Test Results Data Sheet — **Page: 1 of 1**

EUT Line Voltage:	9 VDC	**EUT Power Frequency:**	DC N/A
Antenna Orientation:	Horizontal	**Frequency Range:**	Above 1GHz
EUT Mode of Operation:		Detection Mode	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
1223.87	3	342	1	Average	75.9	23.044	60.0	-36.9	Pass
1919.47	3	288	1	Average	75.3	22.056	60.0	-37.9	Pass
2801.7	3	51	1	Average	75.7	24.486	60.0	-35.5	Pass
3915.27	3	185	1	Average	75.5	24.376	60.0	-35.6	Pass
4572.16	3	131	1	Average	74.6	23.515	60.0	-36.4	Pass
5737.91	3	47	1	Average	73.7	22.786	60.0	-37.2	Pass
6636.47	3	339	1	Average	71.7	24.944	60.0	-35.0	Pass
9428.65	3	88	1	Average	62.1	27.72	60.0	-32.2	Pass
13356.7	3	111	1	Average	59.9	32.121	60.0	-27.8	Pass
17479.7	3	308	1	Average	55.9	42.276	60.0	-17.7	Pass



> 1GHz Horizontal Antenna Polarity Measured Emissions

Table 9: 1-18GHz Horizontal Polarization Radiated Emissions

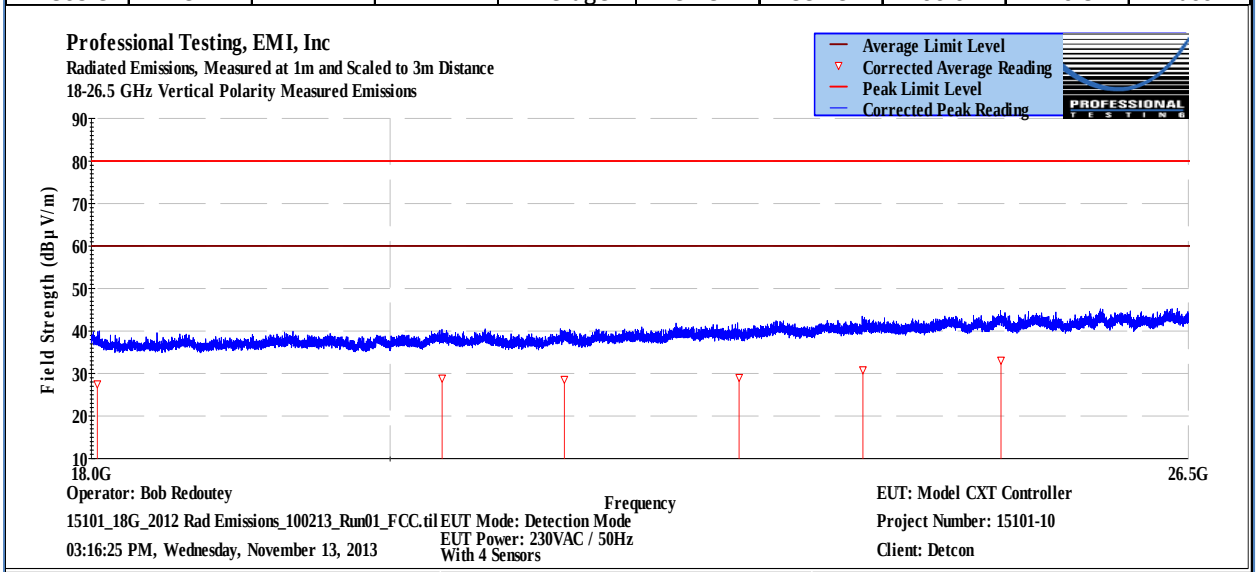
Professional Testing, EMI, Inc.

Test Method:	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 (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	10/18/2013; 11/13/2013	**EUT Serial #:**	RF200PD1
Customer:	Synapse Wireless, Inc.	**EUT Part #:**	RF200
Project Number:	15101-10	**Test Technician:**	Bob Redoutey
Purchase Order #:	109003-00	**Supervisor:**	Rob McCollough
Equip. Under Test:	IEEE 802.15.4 Wireless Module	**Witness' Name:**	None

Radiated Emissions Test Results Data Sheet — **Page: 1 of 1**

EUT Line Voltage:	9 VDC		**EUT Power Frequency:**	DC	N/A
Antenna Orientation:	Vertical		**Frequency Range:**	Above 1GHz	
EUT Mode of Operation:			Detection Mode		

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
18038.3	3	114	1	Average	31.2	27.557	60.0	-32.4	Pass
20369.7	3	240	1	Average	32.7	28.917	60.0	-31.0	Pass
21266.6	3	24	1	Average	32.4	28.622	60.0	-31.3	Pass
22618.8	3	258	1	Average	31.8	29.09	60.0	-30.9	Pass
23627.2	3	123	1	Average	32.5	30.88	60.0	-29.1	Pass
24805.8	3	141	1	Average	32.8	33.13	60.0	-26.8	Pass



> 1GHz Vertical Antenna Polarity Measured Emissions

Table 10: 18-26.5Hz Vertical Polarization Radiated Emissions

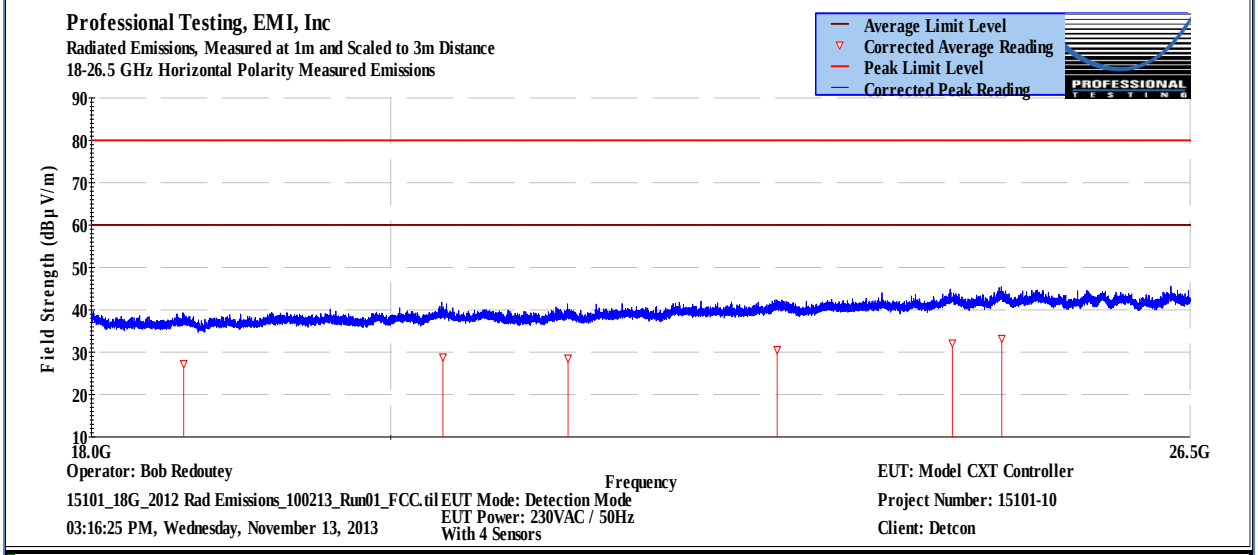
Professional Testing, EMI, Inc.

Test Method:	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 (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	10/18/2013; 11/13/2013	**EUT Serial #:**	RF200PD1
Customer:	Synapse Wireless, Inc.	**EUT Part #:**	RF200
Project Number:	15101-10	**Test Technician:**	Bob Redoutey
Purchase Order #:	109003-00	**Supervisor:**	Rob McCollough
Equip. Under Test:	IEEE 802.15.4 Wireless Module	**Witness' Name:**	None

Radiated Emissions Test Results Data Sheet — **Page: 1 of 1**

EUT Line Voltage:	9 VDC	**EUT Power Frequency:**	DC	N/A	
Antenna Orientation:	Horizontal	**Frequency Range:**	Above 1GHz		
EUT Mode of Operation:		**Detection Mode**			

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
18594.3	3	41	1	Average	31.2	27.281	60.0	-32.7	Pass
20371.3	3	271	1	Average	32.7	28.896	60.0	-31.1	Pass
21288.8	3	214	1	Average	32.4	28.596	60.0	-31.4	Pass
22915.2	3	105	1	Average	32.3	30.63	60.0	-29.3	Pass
24373.1	3	119	1	Average	32.7	32.166	60.0	-27.8	Pass
24800.9	3	174	1	Average	32.8	33.251	60.0	-26.7	Pass



> 1GHz Horizontal Antenna Polarity Measured Emissions

Table 11: 18-26.5Hz Horizontal Polarization Radiated Emissions

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