BEC INCORPORATED

CERTIFICATION APPLICATION TEST REPORT

TEST STANDARDS:
FCC Part 15 Subpart C, IC RSS-Gen, IC RSS-247
DTS Intentional Radiator

EUT:
Legrand WNRLX3 Radiant Battery Devices with Netatmo

FCC ID: 2AU5D-WNZED
ISED ID: 25764-WNZED

REPORT#: BEC-2108-01

TEST DATES: 01/11/2021 – 03/15/2021

CUSTOMER:
Pass & Seymour/Legrand
50 Boyd Avenue
Syracuse, NY 13209

PREPARED BY: _____
Paul Banker**,** Test Engineer

REVIEWED and APPROVED BY: _____
Steve Fanella**,** Quality Manager

ACCREDITED
Testing Cert #2957.01

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Revision History

Revision #	Description of Changes	Date of Changes	Date Released
0	Test Report Initial Release	N/A	03/17/2021

1.0 Administrative Information

1.1 Project General Information

Project Number	BEC-2108				
Manufacturer	Legrand				
EUT Description	Legrand Model WNRLX3 Radiant Battery Devices with Netatmo				
Radio Type	Zigbee				
EUT Test Models	WNRL63	WNRL23	WNRL33	WNRL43	WNRL63
EUT Test Types	SMA connector on transmitter output: Antenna Conducted Configuration	Un-modified: Emissions Configuration	Un-modified: Emissions Configuration	Un-modified: Emissions Configuration	Un-modified: Emissions Configuration
EUT Serial Numbers	No Serial Number	No Serial Number	No Serial Number	No Serial Number	No Serial Number
EUT Samples	2108-02	2108-03	2108-04	2108-05	2108-06
FCC ID	2AU5D-WNZED				
ISED ID	25764-WNZED				
Zigbee Radio Chip Manufacturer	Atmel				
Zigbee Radio Chip Model	SAMR21E				
Frequency of Operation	Zigbee: 2405 – 2480 MHz				
Antenna Gain	+ 1.0 dBi				
FCC Classification	Digital Transmission System (DTS)				
Samples Received	01/11/2021				
Condition Received	Suitable for test				
Sample Type	Production units				
Software/Firmware Version	Zigbee: certifications_nlg_zb permanent stm32_boot0_app-jtag and TestRadio_v1				
Applicable FCC Rules	FCC Rules Part 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz Direct Sequence System				
Applicable ISED Rules	RSS-Gen: General Requirements for Compliance of Radio Apparatus & RSS-247: Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices				

1.2 Preface

This report documents product testing conducted to verify compliance of the specified EUT with applicable standards and requirements as identified herein. EUT, test instrument configurations, test procedures, and recorded data are generally described in this report. The reader is referred to the applicable test standards for detailed procedures. The following table summarizes the test results obtained during this evaluation.

1.3 Laboratory and Customer Information

Test Laboratory Location	BEC Incorporated 970 East High Street Pottstown, PA 19464
Test Personnel	Paul Banker / Steve Fanella / JR Fanella
BEC Laboratory Number FCC Registration	US1118
BEC Laboratory Number ISED Registration	7342A-1
Test Performed For	Pass & Seymour/Legrand 50 Boyd Avenue Syracuse, NY 13209
Customer Technical Contact	Collin Richards
Customer Reference Number	PO # SP017124-802

1.4 Measurement Uncertainty

Measurement	Measurement Distance	Range	Measurement Limit	Expanded Uncertainty
Radiated Disturbance Open Area Test Site	3 Meter	30 MHz – 1 GHz	Class A or B	3.93
Conducted Disturbance AC Mains	N/A	150 kHz – 30 MHz	Class A or B	2.69
Radio Frequency	N/A	1 MHz – 26.5 GHz	N/A	±0.086 ppm
RF power, conducted	N/A	1 MHz – 26.5 GHz	N/A	±1.48 dB
Conducted spurious emission of transmitter, valid up to 6 GHz	N/A	150 kHz – 26.5 GHz	N/A	±2.73 dB
Occupied Bandwidth	N/A	1 MHz – 26.5 GHz	N/A	±2 %
Temperature	N/A	15 – 35° C	N/A	±0.5 °C
Humidity	N/A	20 – 95 %	N/A	±2.5%

No adjustments to measured data presented in this report are required because all values of uncertainty are less that the CISPR 16-4-2:2018 recommendations. These uncertainties have a coverage factor of $k = 2$, which yields approximately a 95% level of confidence for the near-normal distribution typical of most measurement results.

1.5 Test Result Summary Table

The Legrand Model WNRLX3 Radiant Battery Device with Netatmo was tested and found to be compliant to the sections of the FCC Part 15 Subpart C and RSS-Gen RSS-247 standards listed below:

Report Section	FCC Part 15, Subpart C	RSS-Gen	RSS-247	Test Description	Result
4.1	15.203(b)	Annex A 10(g)		Antenna Requirement	**PASS**
4.2	15.204	8.3		External RF power amplifiers and antenna modifications	**PASS**
4.3	15.207	7.2		Conducted Limits (AC Power) 150 kHz – 30 MHz	**PASS**
4.4	15.205(a) 15.209	8.9, 8.10	3.3	Emissions in Non-Restricted and Restricted Frequency Band 30 MHz – 25 GHz	**PASS**
4.5	15.247(a)(2)		5.2 (a)	6 dB Occupied Bandwidth	**PASS**
4.6		6.7		99% Occupied Bandwidth	**PASS**
4.7	15.247(b)(3)		5.4 (d)	Maximum Conducted (Average) Power Output and EIRP	**PASS**
4.8	15.247(d)		5.5	Emissions in Restricted Frequency Bands 30 MHz – 25 GHz	**PASS**
4.9	15.247(e)		5.2 (b)	DTS maximum power spectral density level in the fundamental emission	**PASS**
4.10	15.247(d)		5.5	DTS band-edge emission measurements	**PASS**

Rationale for EUT operation: The EUT was tested using a Zigbee radio which contained test software that utilized O-QPSK modulation used in normal operation.

1.6 Condition of Received Sample

An evaluation of the EUT was conducted in order to verify test subject identity and condition and to ensure suitability for testing. No evidence of physical damage was noted. The test item condition was deemed acceptable for the performance of the requested test services.

1.7 Climatic Environment

Unless noted elsewhere in this report, the following were the ambient conditions in the laboratory during testing:

Temperature: 22 ° ± 5 °
Humidity: 50% ± 20%
Barometric Pressure: 1000mb ± 20%

1.8 Test Equipment

All test equipment is checked to manufacturer's specifications and, when applicable, have current N.I.S.T. traceable, ISO 9002 conforming certificates of calibration. Test equipment used for the tests described herein is listed in Appendix A.

2.0 Equipment Under Test

Unless otherwise noted in the individual test results sections, testing was performed on the EUT as follows.

2.1 EUT Description

The Legrand Model WNRLX3 is a family of wireless switches and dimmer with Netatmo. The Legrand Model WNRLX3 devices serve as an endpoint receiver for a nearby gateway device in an IOT network for smart lighting/electrical device control.

WNRL23- Radiant with Netatmo Wireless Switch with Zigbee Radio. Powered by 3V Lithium CR2032 Battery. Broadcasts Zigbee RF signal, serves as an endpoint receiver for a nearby gateway device in an IOT network for smart lighting/electrical device control.

WNRL33- Radiant with Netatmo Home/Away Wireless Switch with Zigbee Radio. Powered by 3V Lithium CR2032 Battery. Broadcasts Zigbee RF signal, serves as an endpoint receiver for a nearby gateway device in an IOT network for smart lighting/electrical device control.

WNRL43- Radiant with Netatmo Wake/Sleep Wireless Switch with Zigbee Radio. Powered by 3V Lithium CR2032 Battery. Broadcasts Zigbee RF signal, serves as an endpoint receiver for a nearby gateway device in an IOT network for smart lighting/electrical device control.

WNRL63- Radiant with Netatmo Wireless Tru-Universal Dimmer with Zigbee Radio. Powered by 3V Lithium CR2032 Battery. Broadcasts Zigbee RF signal, serves as an endpoint receiver for a nearby gateway device in an IOT network for smart lighting/electrical device control.

2.2 Product Category

FCC Part 15, Subpart C (Section 15.247), IC RSS-Gen, IC RSS-247

2.3 Product Classification

47 CFR Part 15, Subpart C, Section 15.247 “DTS Operation within the band of 900 – 928 MHz, 2400 – 2483.5 MHz, and 5725 – 5850 MHz.”

2.4 Test Configuration

The Legrand Model WNRLX3 Series models with Zigbee radio samples were tested at the Low Channel 11 at 2405 MHz, Middle Channel 18 at 2440 MHz and High Channel 26 at 2480 MHz. The Legrand Model WNRLX3 Series models with Zigbee radio samples contained control software that can utilize the O-QPSK modulation used in normal operation. The control software also allowed the tester to select an unmodulated transmit signal for the radio of the unit under test or to place the radio in a receive mode. The highest amplitude was determined to be when the radio transmitted without modulation. Whenever the testing requires that the maximum amplitude be used during testing, the EUTs were configured and tested without modulation. When modulation was required during specific testing, the EUTs were configured and tested with modulation.

2.5 Test Configuration Rationale

The Legrand Model WNRLX3 with Zigbee radio samples were powered under battery power and were supplied with software which controlled the operation of the Zigbee radio in a manner consistent with normal use.

2.6 EUT Zigbee Radio Details

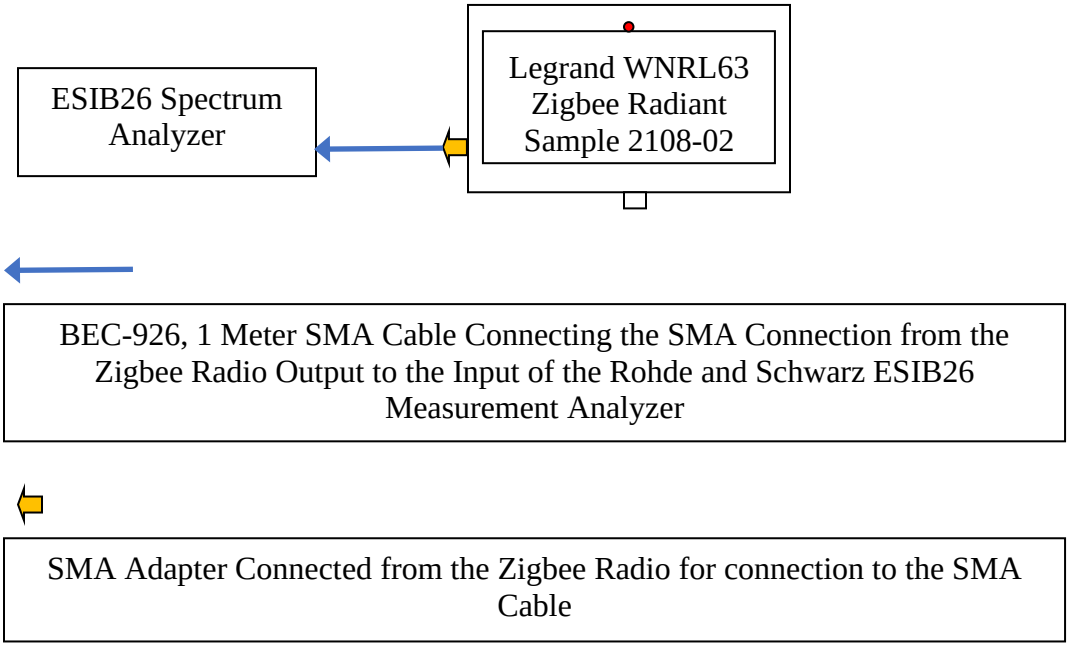
The Legrand Models WNRL23, WNRL33, WNRL43 and WNRL63 contain the following Zigbee radio. Below is the manufacturer, model number, part # and serial number information.

	EUT Test Models	Manufacturer	Model Number	Part Number	Serial #
Legrand Model WNRLX3 with Zigbee Radio	WNRL23 WNRL33 WNRL43	Atmel	SAMR21E	ATSAMR21E18A	ATSAMR21E18A-MUT
	WNRL63	Atmel	SAMR21E	ATSAMR21E19A	ATSAMR21E19A-MUT

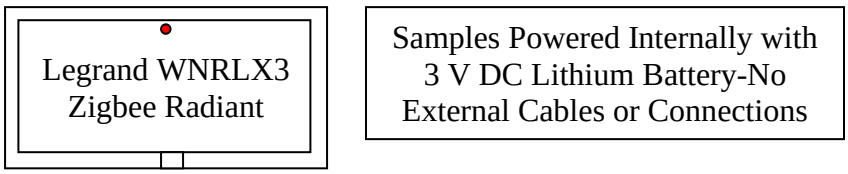
2.7 Test Configuration Diagrams – Zigbee Radio

Block diagrams of the EUT configuration showing interconnection cables are illustrated below. The drawing shows the physical hardware layout used for the tests along with I/O cables and AC power distribution. Diagrams show the Conducted Measurement configuration connection and Radiated Measurement configuration connection when testing the Zigbee Radio.

2.7.1 Zigbee Configuration – Conducted Measurement



2.7.2 Zigbee Configuration – Radiated Measurement



2.8 EUT Information, Interconnection Cabling and Support Equipment

EUT Hardware

Description	Manufacturer	Model	Serial Number	Sample Number
Radiant with Netatmo Wireless Tru-Universal Dimmer– Zigbee Radio Antenna Conducted Sample	Legrand	WNRL63	No Serial Number	2108-02
Radiant with Netatmo Wireless Switch-Zigbee Radio Radiated Sample	Legrand	WNRL23	No Serial Number	2108-03
Radiant with Netatmo Home/Away Wireless Switch-Zigbee Radio Radiated Sample	Legrand	WNRL33	No Serial Number	2108-04
Radiant with Netatmo Wake/Sleep Wireless Switch -Zigbee Radio Radiated Sample	Legrand	WNRL43	No Serial Number	2108-05
Radiant with Netatmo Wireless Tru-Universal Dimmer- Zigbee Radio Radiated Sample	Legrand	WNRL63	No Serial Number	2108-06

Interconnection Cable List (Conducted Measurement Test Setup)

Manufacturer	Model	Type	Shielding	Length	Description
Suhner	S04272B	High Frequency RF Cable 1 to 40 GHz	Double Braid	1 Meter	Measurement Cable from the Antenna SMA Connector to the R&S ESIB26 Receiver. Asset # BEC-962

Support Equipment

Description	Manufacturer	Model #	Serial #
3 V DC Lithium Battery	Panasonic	CR2032	No Serial Number

2.9 Test Signals and Test Modulation

By design this product does not have an external modulation input connector, therefore, normal internally generated modulation was used. The Zigbee radio was evaluated with and without normal internal modulation (O-QPSK). The un-modulated carrier produced higher output amplitude. Therefore, the un-modulated carrier was used for radiated emissions and antenna conducted measurements. The modulated carrier was used for antenna conducted measurements of bandwidth and power spectral density.

2.9.1 Zigbee Radio - Test Signals and Modulation

The EUT transmits to a discrete frequency on a specific channel. The Legrand WNRLX3 with Zigbee radio has 16 Channels available. The 16 Channels and frequencies that can be transmitted by the EUT are as follows:

Zigbee Channel	Frequency (MHz)	Zigbee Channel	Frequency (MHz)
11	2405	19	2445
12	2410	20	2450
13	2415	21	2455
14	2420	22	2460
15	2425	23	2465
16	2430	24	2470
17	2435	25	2475
18	2440	26	2480

For the required testing, the EUT was configured to transmit at low Channel 11 (2405 MHz), middle Channel 18 (2440 MHz) and high Channel 26 (2480 MHz). The Zigbee radio utilizes one modulation, O-QPSK.

2.10 Grounding

There were no ground connections used; the EUT is powered by a 3 V DC Lithium Battery.

2.11 EUT Modifications

With the exception for the attachment of an SMA connector directly to the antenna output on the main board of the Legrand Model WNRLX3, no modifications were made to the test samples.

2.12 EUT Pictures Legrand WNRLX3 Series With Zigbee Radio Samples

LEGRAND WNRL63 SAMPLE 2108-02 FRONT AND BACK SIDE

LEGRAND WNRL23 SAMPLE 2108-03 FRONT AND BACK SIDE

LEGRAND WNRL33 SAMPLE 2108-04 FRONT AND BACK SIDE

LEGRAND WNRL43 SAMPLE 2108-05 FRONT AND BACK SIDE

LEGRAND WNRL63 SAMPLE 2108-06 FRONT AND BACK SIDE

3.0 Applicable Requirements, Methods, and Procedures

3.1 Applicable Requirements

The results of the measurement of the radio disturbance characteristics of the EUT described herein may be applied and where appropriate, provide a presumption of compliance to one or more of the following requirements or to other requirements at the discretion of the customer, regulatory agencies, or other entities.

3.1.1 FCC Requirements

Code of Federal Regulations: Title 47 – Telecommunication

Chapter I - Federal Communications Commission

Sub-chapter A – General

Part 15 – Radio Frequency Devices

Subpart C - Intentional Radiators

3.1.2 Industry Canada Requirements

RSS-Gen Issue 5: General Requirements for Compliance of Radio Apparatus

RSS-247 Issue 2: Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.

3.1.3 Basic Test Methods and Test Procedures

558074 D01 DTS Meas Guidance v05r02, Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating under Section 15.247 of the FCC Rules.

ANSI C63.10-2013, American National Standard for Compliance Testing of Unlicensed Wireless Devices.

3.2 Deviations or Exclusions from the Requirements

No deviations or exclusions were made.

4.0 Test Results

4.1 Antenna Requirement (47 CFR 15.203)(RSS-GEN ANNEX A (10)(g))

The antenna used by the Legrand Model WNRLX3 Series is a quarter-wave, inverted F wire antenna. The antenna is mounted on the PCB inside the enclosure. There are no detachable parts of the antenna. The antenna is not replaceable, nor changeable, and therefore complies with the requirements of this section.

4.2 External RF power amps/antenna modifications (47 CFR 15.204)(RSS-GEN 8.3)

There are no RF power amplifier kits available to be used with the Legrand Model WNRLX3 Series. There are no detachable parts of the antenna. The antenna is not replaceable, nor changeable, and therefore complies with the requirements of this section.

4.3 Conducted Emissions AC Power Port (47 CFR 15.207)(RSS-GEN 7.2)

The Legrand Model WNRLX3 Series with Zigbee radio is a battery powered unit and therefore does not require the Conducted Emissions AC Power Port testing.

4.4 Emissions in Non-Restricted and Restricted Frequency Bands, 30 MHz - 25 GHz (47 CFR 15.205, 15.209)(RSS-GEN 8.9, 8.10)

The emissions from the Legrand Model WNRLX3 with Zigbee Radio, which fall in the restricted bands of operation, detailed in this section, comply with the limits of 15.209. The Legrand Model WNRLX3 was tested at three frequencies: Low (2405 MHz), Middle (2440 MHz) and High (2480 MHz). The modulation was O-QPSK.

Measurement of the signals was performed with the EUT on a turntable and a variable height antenna mast at 3 meters distance. The signals residing in restricted bands of operation are listed in the tables below.

4.4.1 Radiated Spurious Emissions Test Facility

OATS

The Open Area Test Site (OATS) is an all-weather facility with a wooden enclosure that contains a ground level 4-foot diameter turntable capable of rotating equipment 360 degrees. The enclosure is free of reflective metallic objects and extraneous electromagnetic signals. This non-metallic enclosure and the 3 and 10 meter test range existing outside the enclosure rest upon a protective insulating material, which in turn covers a flat, metal, continuous ground plane.

Instrumentation for remote control of the antenna mast, turntable, and other equipment are controlled by personnel indoors. The EUT and support peripherals required for EUT operation were placed on a table 80 cm high for tabletop equipment or directly on the turntable surface for floor standing equipment.

The test site complies with the attenuation measurements specified in ANSI C63.4.

SR#1

The Semi-Anechoic Shielded Room (SR#1) is a ferrite and absorber lined chamber which houses a 5-foot diameter turntable capable of rotating equipment 360 degrees and antenna mast for Horizontal and Vertical polarity measurements. The enclosure is free of reflective metallic objects and extraneous electromagnetic signals. This 3-meter shielded enclosure has a raised computer floor with metal tile bottoms providing a continuous ground plane.

Instrumentation for remote control of the antenna mast, turntable, and other equipment are controlled by personnel outside the chamber. The EUT and support peripherals required for EUT operation were placed on a table 80 cm high for tabletop equipment or directly on the turntable surface for floor standing equipment.

4.4.2 Emissions in Non-Restricted and Restricted Frequency Bands Test Procedure

Radiated Emissions 30 MHz – 40 GHz

The EMI receiver was set to quasi-peak mode for frequencies from 30MHz to 1GHz and the appropriate CISPR bandwidths were employed. The receiver was set to average mode for frequencies above 1GHz with the appropriate CISPR bandwidths were employed. Significant emissions found during the preliminary scans were maximized by rotating the turntable and varying the antenna height. Both horizontal and vertical antenna polarities were also investigated for suspect emissions. The signals are maximized and measured using the in house generated RADE or off the shelf TILE software. The support equipment and test item(s) were powered off in turn to determine the source of the emissions where appropriate.

Field strengths were calculated as follows:

Field Strength (dBµV/m) = Meter Reading (dBµV) + Antenna Factor (dB/m) + Cable Loss (dB) – Amplifier Gain (dB)

The EUTs were tested in the 30 to 1000 MHz, 1 to 18 GHz and then 18 to 25 GHz frequency ranges. Both the Legrand Model WNRLX3 with Zigbee radio samples were tested with the radio transmitting at low, middle and high frequencies and while in receive mode (non-transmission). The Zigbee radio was tested with an un-modulated signal which was determined to exhibit the highest amplitude.

The following tables are the highest emissions recorded and summarized. The use of the 15.209 limit table for restricted band emissions is not required but ensures compliance to 15.205 and 15.209. The signals in the tables that fall into the restricted bands, described in 15.205, are marked with an asterisk.

Photographs of the radiated emissions test setups are in Section 5 of this report.

4.4.3 Emissions in Frequency Bands 30 MHz – 1000 MHz WNRLX3 With Zigbee Radio

The closest measurements in this frequency range of 30 to 1000 MHz were those related to the Legrand Model WNRL43 and that data is shown in this report section 4.4.3.1. Samples for the Legrand Models WNRL23, WNRL33, WNRL43 and WNRL63 were all tested and data for all are available upon request. Test Dates were from 01/21/2021 to 01/22/2021.

4.4.3.1 Emissions in Frequency Bands 30 MHz – 1000 MHz WNRL43 With Zigbee Radio Test Results (01/21/2021)

Radiated emissions scans between 30 – 1000 MHz were made for the EUT configured for the low, middle and high transmission frequencies with an un-modulated transmit signal at maximum output and also with the radio in the Rx mode.

Legrand Model WNRL43 with Zigbee Radio, Low Channel 11, 2405 MHz, Un-modulated

Frequency	Peak	QP	Polarity	TT angle	Ant Height	Correction Factors	FCC 15.205/209 & RSS-247 3M Limit	Margin	Result
MHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB	
30.017	20.46	19.53	H	121	229	-0.50	40.00	-20.47	PASS
32.015	19.80	18.22	V	174	168	-1.88	40.00	-21.78	PASS
32.223	18.85	18.19	H	139	230	-1.94	40.00	-21.81	PASS
* 114.055	15.53	14.23	V	097	102	-7.25	43.52	-29.29	PASS
* 117.574	14.66	13.23	V	171	111	-6.93	43.52	-30.29	PASS
122.835	12.71	13.34	V	299	168	-6.68	43.52	-30.18	PASS
* 124.42	14.24	13.19	H	007	209	-6.67	43.52	-30.33	PASS
* 128.06	13.89	13.05	H	358	141	-6.74	43.52	-30.47	PASS
* 130.022	13.91	13.11	V	065	229	-6.82	43.52	-30.41	PASS
* 133.73	14.26	12.95	V	249	210	-6.96	43.52	-30.57	PASS
* 165.028	15.38	12.30	H	192	153	-7.50	43.52	-31.22	PASS
199.402	12.30	12.61	H	222	188	-7.14	43.52	-30.91	PASS
*Restricted Band Signal									

Legrand Model WNRL43 with Zigbee Radio, Middle Channel 18, 2440 MHz, Unmodulated

Frequency	Peak	QP	Polarity	TT angle	Ant Height	Correction Factors	FCC 15.205/209 & RSS-247 3M Limit	Margin	Result
MHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB	
31.011	20.53	19.02	H	272	121	-0.99	40.00	-20.98	PASS
31.286	20.36	18.73	V	185	173	-1.23	40.00	-21.27	PASS
* 110.644	13.78	12.66	H	207	156	-7.73	43.52	-30.86	PASS
* 114.651	13.82	13.23	V	040	132	-7.18	43.52	-30.29	PASS
* 115.533	13.66	12.95	H	294	204	-7.09	43.52	-30.57	PASS
* 115.905	15.57	13.19	V	032	131	-7.05	43.52	-30.33	PASS
* 120.764	14.42	13.09	V	224	104	-6.70	43.52	-30.43	PASS
* 121.007	14.88	13.29	H	259	163	-6.70	43.52	-30.23	PASS
* 126.906	14.25	12.97	V	299	252	-6.74	43.52	-30.55	PASS
* 127.136	15.52	13.09	H	107	121	-6.75	43.52	-30.43	PASS
* 130.321	15.69	12.97	H	065	151	-6.82	43.52	-30.55	PASS
* 130.975	12.46	12.89	V	116	185	-6.81	43.52	-30.63	PASS
*Restricted Band Signal									

Legrand Model WNRL43 with Zigbee Radio, High Channel 26, 2480 MHz, Un-modulated

Frequency	Peak	QP	Polarity	TT angle	Ant Height	Correction Factors	FCC 15.205/209 & RSS-247 3M Limit	Margin	Result
MHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB	
30.333	20.36	19.43	V	342	176	-0.65	40.00	-20.57	PASS
* 108.615	14.29	12.67	V	118	131	-8.05	43.52	-30.85	PASS
* 108.892	14.92	11.99	V	147	226	-8.02	43.52	-31.53	PASS
* 112.96	17.53	13.76	V	329	101	-7.38	43.52	-29.76	PASS
* 113.119	16.92	13.21	H	097	104	-7.35	43.52	-30.31	PASS
* 120.824	14.05	13.16	V	309	148	-6.70	43.52	-30.36	PASS
121.967	14.88	13.09	H	357	121	-6.69	43.52	-30.43	PASS
* 130.659	14.13	12.98	H	144	204	-6.81	43.52	-30.54	PASS
* 134.399	13.55	12.74	H	126	126	-7.02	43.52	-30.78	PASS
139.974	14.73	12.54	H	344	172	-7.23	43.52	-30.98	PASS
149.828	15.69	12.62	V	103	151	-7.23	43.52	-30.90	PASS
*Restricted Band Signal									

Legrand Model WNRL43 with Zigbee Radio, Rx Mode

Frequency	Peak	QP	Polarity	TT angle	Ant Height	Correction Factors	FCC 15.205/209 & RSS-247 3M Limit	Margin	Result
MHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB	
30.955	23.67	18.83	V	089	220	-0.95	40.00	-21.17	PASS
31.161	19.91	18.71	H	040	178	-1.12	40.00	-21.29	PASS
* 114.173	15.76	13.46	V	306	148	-7.24	43.52	-30.06	PASS
* 115.952	15.21	12.80	H	246	193	-7.04	43.52	-30.72	PASS
* 120.028	13.62	12.92	V	062	157	-6.71	43.52	-30.60	PASS
* 124.938	16.11	12.97	H	068	127	-6.67	43.52	-30.55	PASS
* 128.75	14.80	12.84	V	274	152	-6.73	43.52	-30.68	PASS
* 136.784	13.50	12.45	H	131	241	-7.14	43.52	-31.07	PASS
139.046	15.48	12.33	V	169	225	-7.24	43.52	-31.19	PASS
140.447	14.44	12.35	V	278	208	-7.27	43.52	-31.17	PASS
155.463	12.39	12.35	H	073	111	-7.20	43.52	-31.17	PASS
160.687	16.44	12.34	H	072	226	-7.25	43.52	-31.18	PASS
*Restricted Band Signal									

Test Results: The Legrand Model WNRLX3 with Zigbee Radio complies with the requirements of 47 CFR Part 15.205, 15.209 and RSS-Gen Section 8.10 for non-restricted and restricted bands of operation, between 30 MHz – 1 GHz, with a margin of 20.47 dB.

4.4.4 Emissions in Frequency Bands 1 - 18 GHz WNRLX3 With Zigbee Radio

The closest measurements in this frequency range of 1 to 18 GHz were those related to the Legrand Model WNRL63 and that data is shown in this report section 4.4.4.1. Samples for the Legrand Models WNRL23, WNRL33, WNRL43 and WNRL63 were all tested and data for all are available upon request. Test Dates were 01/14/2021, 01/18/2021 and 01/19/2021.

4.4.4.1 Emissions in Frequency Bands 1 - 18 GHz WNRL63 With Zigbee Radio Test Results (01/14/2021 and 01/18/2021)

Radiated emissions scans between 1 – 18 GHz were made for the EUT configured for the low, middle and high transmission frequencies with an un-modulated transmit signal at maximum output and also with the radio in the Rx mode.

Legrand Model WNRL63 with Zigbee Radio, Low Channel 11, 2405 MHz, Un-modulated

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable Angle	Antenna Height	Correction Factor	FCC 15.205/209: RSS-GEN/RSS-247 Average Limit	FCC 15.205/209: RSS-GEN/RSS-247 Average Margin	FCC 15.205/209: RSS-GEN/RSS-247 Peak Limit	FCC 15.205/209: RSS-GEN/RSS-247 Peak Margin	Result
GHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
4.17028 *	38.93	28.27	V	231	172	0.41	53.98	-25.71	73.98	-35.05	PASS
4.80902 *	51.59	49.82	H	360	196	1.60	53.98	-4.16	73.98	-22.39	PASS
4.80904 *	45.83	41.40	V	265	207	1.60	53.98	-12.58	73.98	-28.15	PASS
6.13912	39.46	30.70	V	301	139	3.35	53.98	-23.28	73.98	-34.52	PASS
7.21346	46.04	36.89	V	109	149	4.20	53.98	-17.09	73.98	-27.94	PASS
7.21360	49.43	43.71	H	348	172	4.21	53.98	-10.27	73.98	-24.56	PASS
9.05177 *	46.83	37.92	H	215	205	6.81	53.98	-16.06	73.98	-27.16	PASS
9.61821	50.89	43.20	H	005	168	7.23	53.98	-10.78	73.98	-23.09	PASS
9.61981	46.97	37.79	V	153	132	7.22	53.98	-16.19	73.98	-27.01	PASS
12.0224 *	49.59	41.32	H	010	115	8.32	53.98	-12.66	73.98	-24.39	PASS
12.0492 *	49.36	40.30	V	358	134	8.30	53.98	-13.69	73.98	-24.62	PASS
14.43170	57.76	47.59	H	092	162	12.83	53.98	-6.39	73.98	-16.22	PASS

*Restricted Band Signal

Legrand Model WNRL63 with Zigbee Radio, Middle Channel 18, 2440 MHz, Un-modulated

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable Angle	Antenna Height	Correction Factor	FCC 15.205/209: RSS-GEN/RSS-247 Average Limit	FCC 15.205/209: RSS-GEN/RSS-247 Average Margin	FCC 15.205/209: RSS-GEN/RSS-247 Peak Limit	FCC 15.205/209: RSS-GEN/RSS-247 Peak Margin	Result
GHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
4.87898 *	52.30	49.91	H	356	214	1.81	53.98	-4.07	73.98	-21.68	PASS
4.87903 *	44.31	37.75	V	034	204	1.81	53.98	-16.23	73.98	-29.67	PASS
5.45457 *	40.40	30.47	V	213	159	3.30	53.98	-23.51	73.98	-33.58	PASS
7.14095	43.65	34.60	H	142	187	3.92	53.98	-19.38	73.98	-30.33	PASS
7.31852 *	46.51	39.39	H	359	113	4.57	53.98	-14.59	73.98	-27.47	PASS
7.41173 *	43.34	35.12	V	157	152	4.71	53.98	-18.86	73.98	-30.64	PASS
9.75813	49.81	39.14	V	024	140	6.82	53.98	-14.84	73.98	-24.17	PASS
9.77959	45.85	37.76	H	289	153	6.80	53.98	-16.22	73.98	-28.13	PASS
12.1985 *	48.63	40.22	H	201	127	8.33	53.98	-13.76	73.98	-25.35	PASS
12.2073 *	49.36	39.87	V	268	167	8.34	53.98	-14.11	73.98	-24.62	PASS
14.62020	56.48	47.83	V	046	186	12.79	53.98	-6.15	73.98	-17.50	PASS
14.64440	56.38	47.66	H	067	151	12.75	53.98	-6.32	73.98	-17.60	PASS

*Restricted Band Signal

Legrand Model WNRL63 with Zigbee Radio, High Channel 26, 2480 MHz, Un-modulated

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable Angle	Antenna Height	Correction Factor	FCC 15.205/209: RSS-GEN/RSS-247 Average Limit	FCC 15.205/209: RSS-GEN/RSS-247 Average Margin	FCC 15.205/209: RSS-GEN/RSS-247 Peak Limit	FCC 15.205/209: RSS-GEN/RSS-247 Peak Margin	Result
GHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
3.86712 *	39.13	29.02	V	076	199	0.46	53.98	-24.96	73.98	-34.85	PASS
4.95901 *	41.91	33.30	V	139	103	1.85	53.98	-20.68	73.98	-32.07	PASS
4.95909 *	50.91	49.42	H	360	188	1.85	53.98	-4.56	73.98	-23.07	PASS
6.87463	42.46	34.10	H	233	110	3.64	53.98	-19.88	73.98	-31.52	PASS
7.32132 *	43.69	34.72	V	153	100	4.58	53.98	-19.26	73.98	-30.29	PASS
7.43067 *	45.25	34.82	V	078	143	4.71	53.98	-19.16	73.98	-28.73	PASS
7.47073 *	45.02	35.22	H	254	102	4.67	53.98	-18.76	73.98	-28.96	PASS
7.93201	45.73	36.73	H	062	139	5.16	53.98	-17.25	73.98	-28.25	PASS
9.92995	47.68	37.16	V	000	181	6.60	53.98	-16.82	73.98	-26.30	PASS
9.93906	46.67	37.57	H	183	127	6.59	53.98	-16.41	73.98	-27.31	PASS
12.4015 *	50.36	40.17	H	153	118	8.46	53.98	-13.81	73.98	-23.62	PASS
12.4229 *	49.27	40.57	V	041	100	8.51	53.98	-13.41	73.98	-24.71	PASS

*Restricted Band Signal

Legrand Model WNRL63 with Zigbee Radio, Rx Mode

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable Angle	Antenna Height	Correction Factor	FCC 15.205/209: RSS-GEN/RSS-247 Average Limit	FCC 15.205/209: RSS-GEN/RSS-247 Average Margin	FCC 15.205/209: RSS-GEN/RSS-247 Peak Limit	FCC 15.205/209: RSS-GEN/RSS-247 Peak Margin	Result
GHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
1.04163 *	31.02	19.96	H	326	164	-12.90	53.98	-34.02	73.98	-42.96	PASS
1.25297	49.20	40.37	V	048	207	8.66	53.98	-13.62	73.98	-24.78	PASS
1.25754	30.51	20.94	H	210	195	-11.94	53.98	-33.04	73.98	-43.47	PASS
1.32317 *	28.22	20.08	V	203	114	-11.76	53.98	-33.90	73.98	-45.76	PASS
1.60919 *	29.26	20.82	V	103	150	-10.32	53.98	-33.16	73.98	-44.72	PASS
1.64085 *	30.17	20.99	H	169	120	-10.28	53.98	-32.99	73.98	-43.81	PASS
1.88625	33.46	23.78	V	218	131	-7.54	53.98	-30.20	73.98	-40.52	PASS
2.50191	33.78	24.55	V	289	179	-5.37	53.98	-29.43	73.98	-40.20	PASS
10.06930	46.46	37.88	H	000	138	6.56	53.98	-16.10	73.98	-27.52	PASS

*Restricted Band Signal

Test Results: The Legrand Model WNRLX3 with Zigbee Radio complies with the requirements of 47 CFR Part 15.205, 15.209 and RSS-Gen Section 8.10 for non-restricted and restricted bands of operation between 1 – 18 GHz with an Average Margin of 4.07 dB.

4.4.5 Emissions in Frequency Bands 18 – 25 GHz WNRLX3 With Zigbee Radio

4.4.5.1 Emissions in Frequency Bands 18 – 25 GHz WNRLX3 With Zigbee Radio Test Results (01/12/2021 and 01/13/2021)

Radiated emissions scans between 18 – 25 GHz were measured for the Legrand models WNRL23, WNRL33 WNRL43 and WNRL63. All models were configured for the low, middle and high transmission frequencies with an unmodulated transmit signal at maximum output and also with the radio in the Rx mode. No measurable signals were detected. All scans are retained by BEC Incorporated and are available upon request.

Test Results: The Legrand Model WNRLX3 with Zigbee Radio complies with the requirements of 47 CFR Part 15.205 and RSS-Gen Section 8.10 for restricted bands of operation without measurable emissions between 18 and 25 GHz.

4.5 6 dB Occupied Bandwidth OBW (FCC Section 15.247(a)(2) RSS-247 5.2(a))

4.5.1 6 dB Occupied Bandwidth – Test Procedure

The transmission of the Zigbee radio produces a wide band, noise-like emission. Therefore, the procedure of KDB 550874 D01 Section 8.3.1.2, suggests the use of the integrated average power measurement of Section 8.3.2. The measurement is referenced to the OBW instead of the DTS Bandwidth. ANSI C63.10, Section 6.9.2., the relative measurement procedure was used. The SA span was 5 MHz, resolution bandwidth was 30 kHz and the video bandwidth was 100 kHz. O-QPSK modulation was used.

Spectrum Analyzer Settings During Measurements of Zigbee Radio

SA Settings			ANSI C63.10 Requirement
Span	5	MHz	2 to 5 times OBW
RBW	30	kHz	1 - 5 % of OBW
VBW	100	kHz	≈3 times RBW
Sweep Time	200	ms	Auto

4.5.1.1 6 dB Occupied Bandwidth Test Results WNRLX3 With Zigbee Radio (01/12/2021)

Legrand Model WNRLX3 with Zigbee Radio Low channel 11, 2405 MHz, O-QPSK Modulation

Legrand Model WNRLX3 with Zigbee Radio Middle channel 18, 2440 MHz, O-QPSK Modulation

Legrand Model WNRLX3 with Zigbee Radio High channel 26, 2480 MHz, O-QPSK Modulation

Channel	Frequency	Measured 6 dB BW	47 CFR 15.247(a)(2) & RSS-247 5.2 Minimum Limit	Margin	Result
	MHz	kHz	kHz	kHz	
11	2405.0	1242.5	500	742.5	Pass
18	2440.0	1242.5	500	742.5	Pass
26	2480.0	1412.8	500	912.8	Pass

Test Results: The 6 dB Occupied Bandwidth measurements for the Legrand Model WNRLX3 with Zigbee Radio were measured and are compliant to the minimum bandwidth requirements. The results are also used to select bandwidths and frequency spans for other radio measurements.

4.6 99% Occupied Bandwidth (RSS-247 5.2(a))

4.6.1 99% Occupied Bandwidth Test Procedure

RSS-GEN requires the measurement of the 99% bandwidth of the transmitter. The Zigbee radio utilizes only O-QPSK modulation.

ANSI C63.10, Section 6.9.3 permits the use of the automated, bandwidth measurement utility of the spectrum analyzer was used to measure the 99% bandwidth at each of the low, middle and high operating frequencies. The SA settings are listed in the table below.

Spectrum Analyzer Settings for Zigbee Radio Measurements.

SA Settings			ANSI C63.10 Requirements
Span	5	MHz	(1.5 to 5 times OBW)
RBW	30	kHz	(1 to 5% of OBW)
VBW	100	kHz	(3 X RBW)
Sweep Time	14	ms	

4.6.1.1 99% BW, WNRLX3 With Zigbee Radio Test Results (01/13/2021)

Legrand Model WNRLX3 with Zigbee Radio
Low Channel 11, 2405 MHz, O-QPSK Modulation

Legrand Model WNRLX3 with Zigbee Radio
Mid Channel 18, 2440 MHz, O-QPSK Modulation

Legrand Model WNRLX3 with Zigbee Radio
High Channel 26, 2480 MHz, O-QPSK Modulation

Channel	Frequency (MHz)	99% Occupied BW (MHz)
11	2405.0	2.3046
18	2440.0	2.3347
26	2480.0	2.3747

Test Results: The 99% Occupied Bandwidth measurements for the Legrand Model WNRLX3 with Zigbee Radio are displayed above and included in the ISED Un-licensed Radio application.

4.7 Maximum Conducted (Average) Output Power and EIRP (FCC Part 15.247(b)(3), RSS-247 Section 5.4(d))

4.7.1 Maximum Conducted (Average) Output Power Test Procedure

A conducted power measurement of the output frequency of the Zigbee radio was measured according to the guidance of KDB 550874 D01, Section 8.3.1.2. The modulated, transmitter output signal is wide-band and noise-like. Further guidance from the KDB document identified ANSI C63.10, Section 11.9.2.2.2., (Method AVGSA-1), as the measurement procedure. Spectrum analyzer parameters are listed for the Zigbee radio maximum conducted (average) output power. The un-modulated carrier was also measured for comparison.

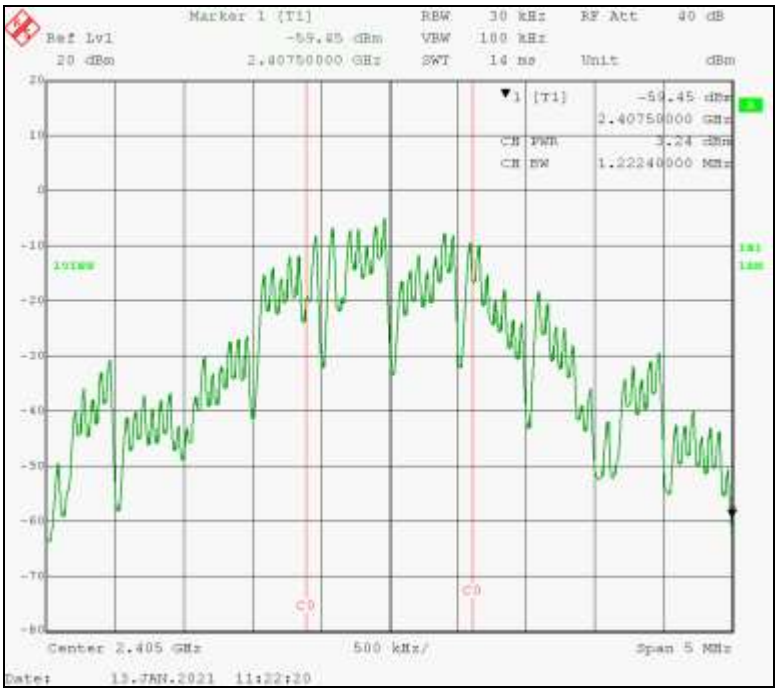
4.7.1.1 Maximum Conducted (Average) Output Power WNRLX3 With Zigbee Radio O-QPSK Modulation Test Results (01/13/2021)

Spectrum Analyzer Settings for Zigbee Radio Measurements

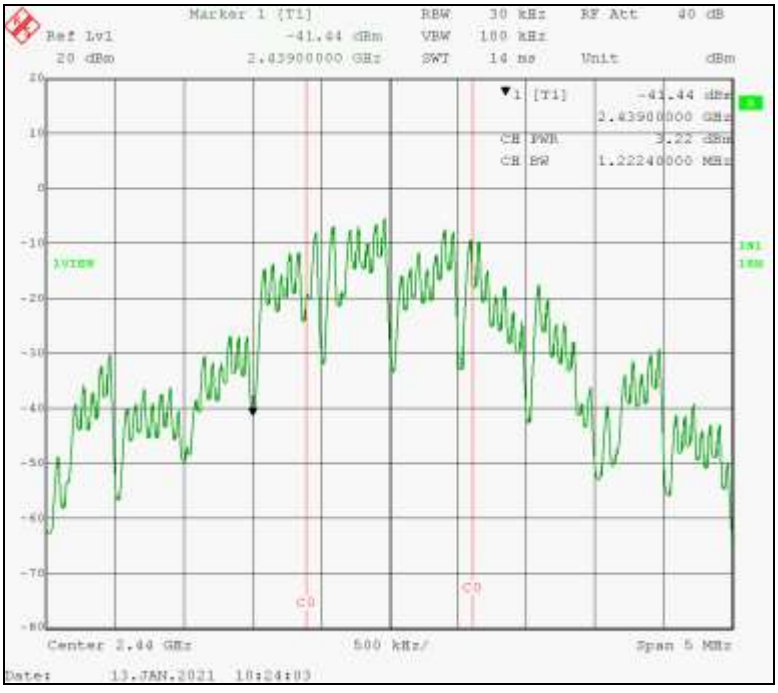
Zigbee Radio, O-QPSK modulation			
Spec Analyzer Settings			ANSI C63.10 requirement
Span	5	MHz	≥1.5 times OBW
RBW	30	kHz	1X to 5X OBW (Max 1 MHz)
VBW	100	kHz	≥ 3 X RBW
Sweep	14	ms	Auto

The RMS Detector was averaged over 100 traces.

Legrand Model WNRLX3 with Zigbee Radio
Low Channel 11, 2405 MHz, O-QPSK Modulation

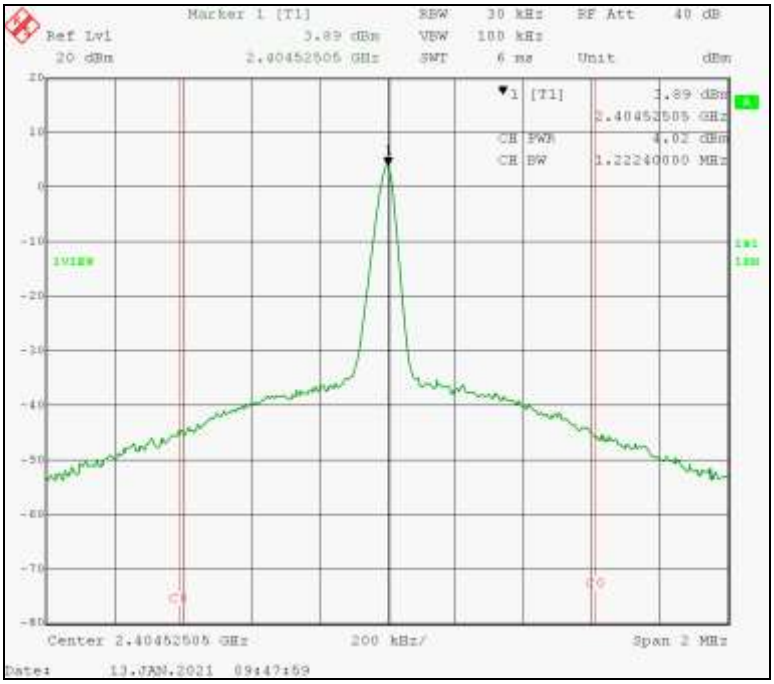


Legrand Model WNRLX3 with Zigbee Radio
Middle Channel 18, 2440 MHz, O-QPSK Modulation

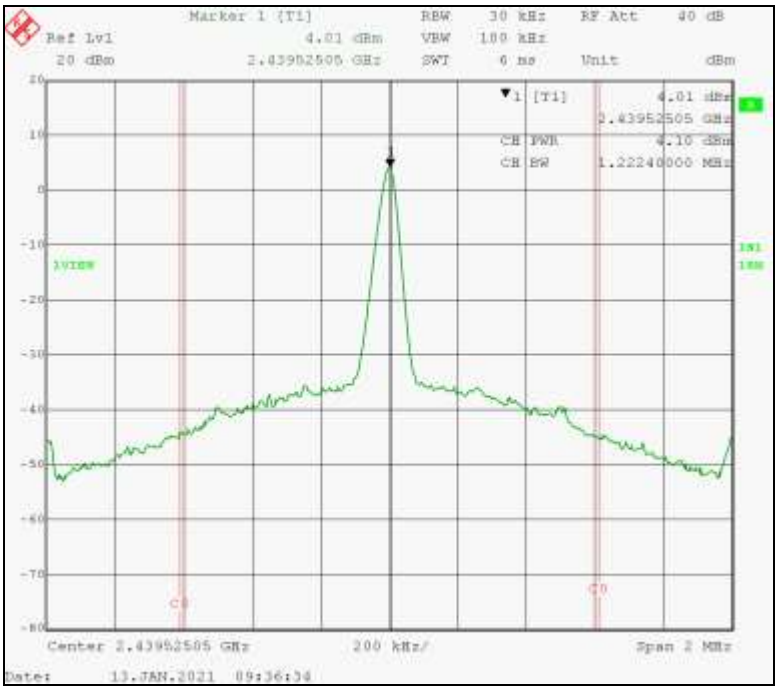


Legrand Model WNRLX3 with Zigbee Radio
High Channel 26, 2480 MHz, O-QPSK Modulation

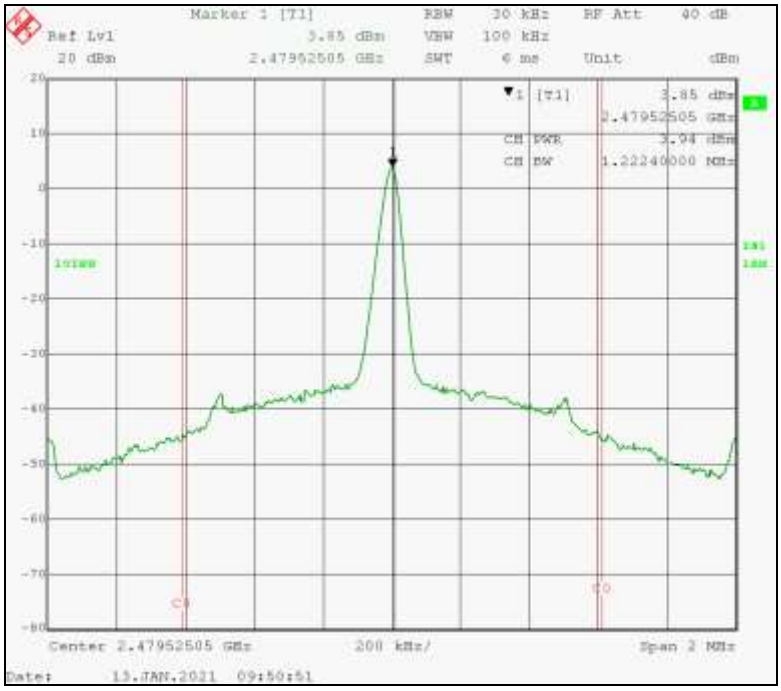
Legrand Model WNRLX3 with Zigbee Radio
Low Channel 11, 2405 MHz, No modulation



Legrand Model WNRLX3 with Zigbee Radio
Middle Channel 18, 2440 MHz, No modulation



Legrand Model WNRLX3 with Zigbee Radio
High Channel 26, 2480 MHz, No modulation



Channel	Modulation	Frequency (MHz)	Measured Level	Cable # 962 Loss	Total		Limit		Margin		Result
					dBm	Watts	dBm	Watts	dBm	Watts	
11	O-QPSK	2405.0	3.24	0.47	3.71	0.0023	30.00	1.000	-26.29	-0.998	Pass
18		2440.0	3.22	0.47	3.69	0.0023	30.00	1.000	-26.31	-0.998	Pass
26		2480.0	3.54	0.47	4.01	0.0025	30.00	1.000	-25.99	-0.997	Pass

Channel	Modulation	Frequency (MHz)	Measured Level	Cable # 962 Loss	Total		Limit		Margin		Result
					dBm	Watts	dBm	Watts	dBm	Watts	
11	None	2405.0	3.89	0.47	4.36	0.0027	30.00	1.000	-25.64	-0.997	Pass
18		2440.0	4.01	0.47	4.48	0.0028	30.00	1.000	-25.52	-0.997	Pass
26		2480.0	3.85	0.47	4.32	0.0027	30.00	1.000	-25.68	-0.997	Pass

Test Results: The Maximum Conducted (Average) Power Output measurements for the Legrand Model WNRLX3 with Zigbee Radio, modulated with O-QPSK and un-modulated, are compliant to the requirements of 47 CFR Part 15.247(b)(3) and ISED, RSS-247 Section 5.4(d).

4.7.1.2 EIRP Level WNRLX3 With Zigbee Radio Test Results (01/13/2021)

The Innovation, Science and Economic Development Canada (ISED), RSS-247 requires the calculation of the Effective Isotropic Radiated Power (EIRP) for the Legrand Model WNRLX3 with Zigbee Radio. Below is the tabular data, using measured power levels from the previous section.

Channel	Modulation	Frequency (MHz)	Transmitter Output Total		Antenna Gain		EIRP				Result
							Total		Limit	Margin	
			dBm	Watts	Isotropic	Numeric	dBm	Watts	Watts	Watts	
11	O-QPSK	2405.0	3.71	0.0023	1.00	1.2590	4.71	0.0030	4.00	-3.9970	Pass
18		2440.0	3.69	0.0023	1.00	1.2590	4.69	0.0029	4.00	-3.9971	Pass
26		2480.0	4.01	0.0025	1.00	1.2590	5.01	0.0032	4.00	-3.9968	Pass

Channel	Modulation	Frequency (MHz)	Transmitter Output Total		Antenna Gain		EIRP				Result
							Total		Limit	Margin	
			dBm	Watts	Isotropic	Numeric	dBm	Watts	Watts	Watts	
11	None	2405.0	4.36	0.0027	1.00	1.2590	5.36	0.0034	4.00	-3.9966	Pass
18		2440.0	4.48	0.0028	1.00	1.2590	5.48	0.0035	4.00	-3.9965	Pass
26		2480.0	4.32	0.0027	1.00	1.2590	5.32	0.0034	4.00	-3.9966	Pass

Test Results: The Effective Isotropic Radiated Power measurements for the Legrand Model WNRLX3 with Zigbee Radio, modulated with O-QPSK and un-modulated, are compliant to the requirements of ISED, RSS-247 Section 5.4(d).

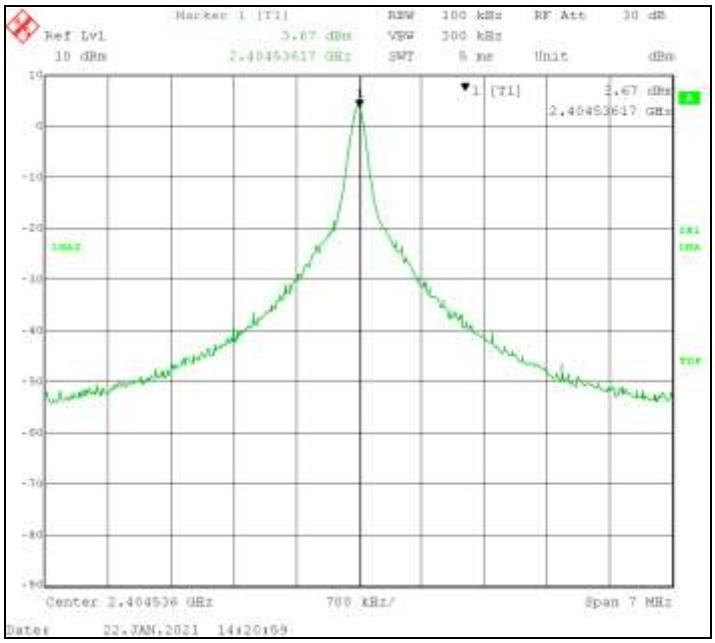
4.8 Emissions in Non-restricted Frequency Bands 30 MHz – 25 GHz (FCC Section 15.247(d), RSS-247 Sec.5)

4.8.1 Emissions in Non-restricted Frequency Bands 30 MHz – 25 GHz Test Procedure

558074 D01 DTS Meas Guidance advises using the maximum Power Spectral Density results to determine which carrier frequency and modulation to use when measuring emissions. The results of the Power Spectral Density test determined that the un-modulated carrier produced the highest transmission output level for the Zigbee radio. Receive Mode is also included for the Zigbee radio.

4.8.2 Emissions in Non-restricted Frequency Bands 30 MHz – 25 GHz 30 dB Reference Measurement.

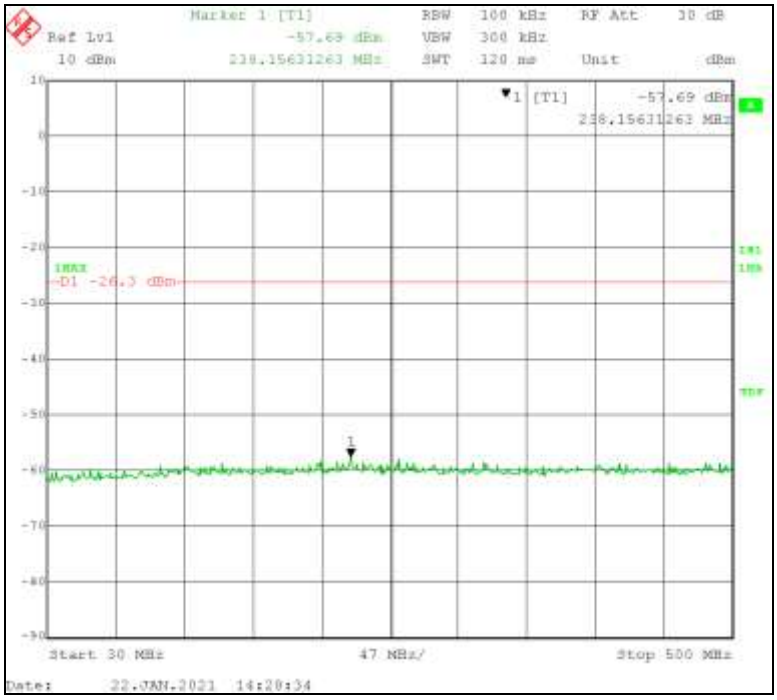
4.8.2.1 WNRLX3 With Zigbee Radio Reference Measurement (01/22/2021)



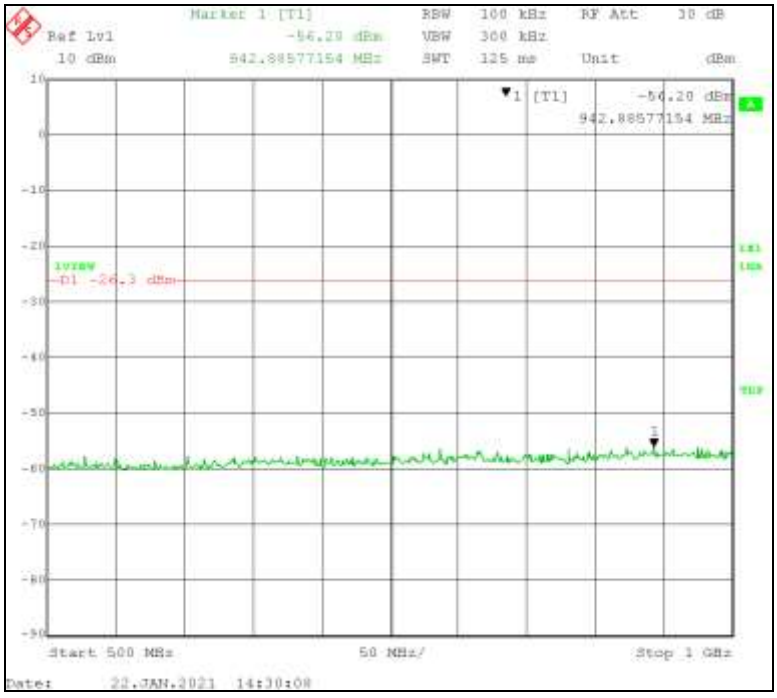
The peak level of 3.67 dBm is the maximum peak output of the Legrand Model WNRLX3 with Zigbee Radio. The conducted spurious emissions from the antenna port must be 30 dB down from this peak. The resultant limit is therefore -26.3 dBm. This limit is displayed on the plots below.

4.8.2.2 Emissions in Non-restricted Frequency Bands WNRLX3 With Zigbee Radio Test Results (01/22/2021)

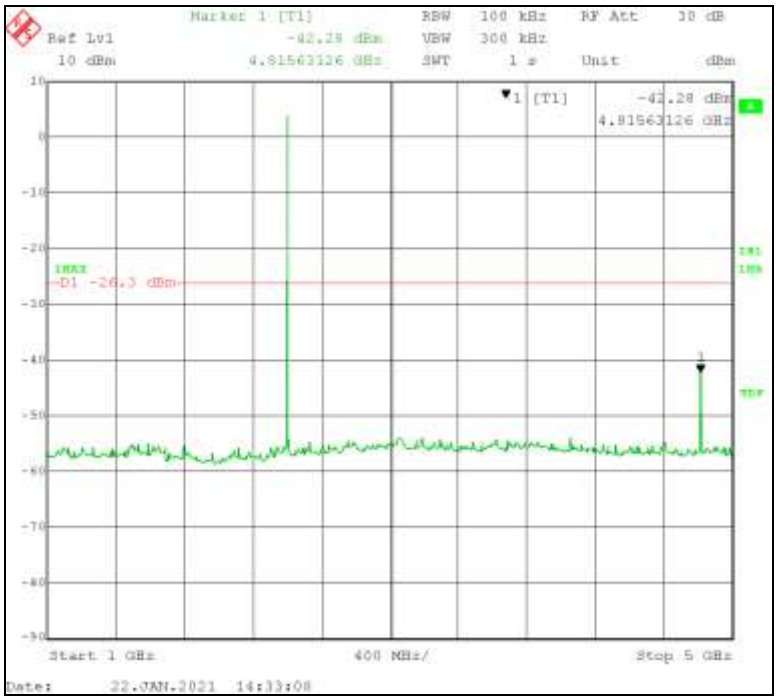
WNRLX3 With Zigbee Radio Transmitting: 30 MHz – 500 MHz (Without High Pass Filter)



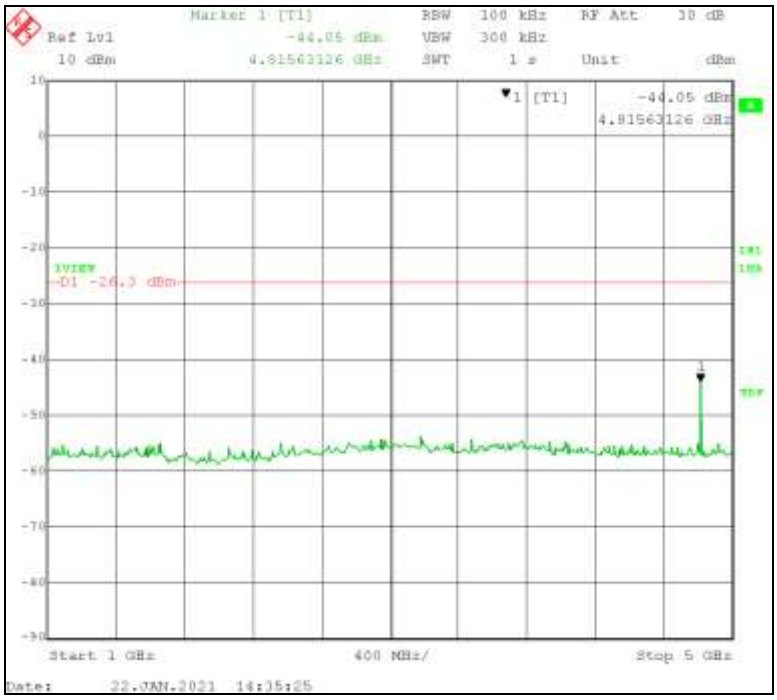
WNRLX3 With Zigbee Radio Transmitting: 500 MHz – 1000 MHz (Without High Pass Filter)



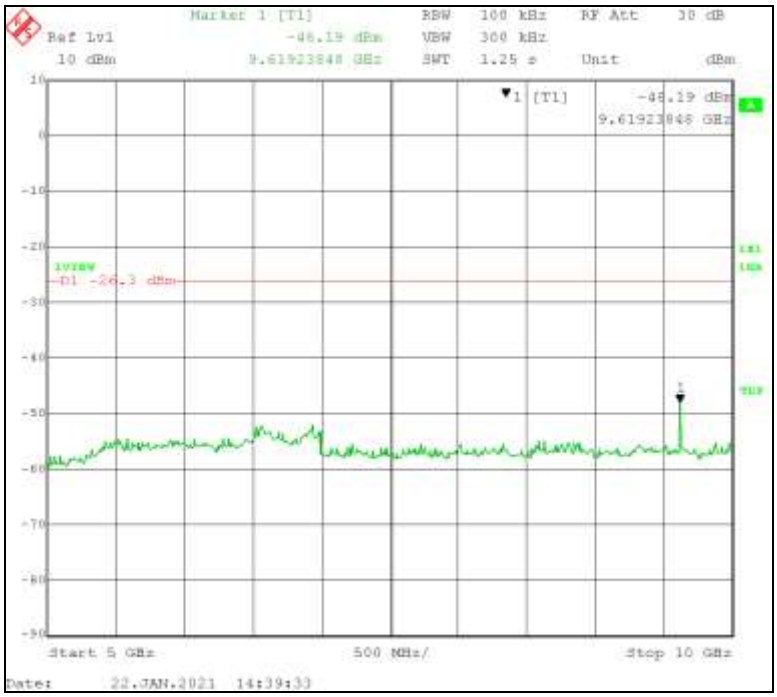
WNRLX3 With Zigbee Radio Transmitting (Without High Pass Filter): 1 GHz – 5 GHz



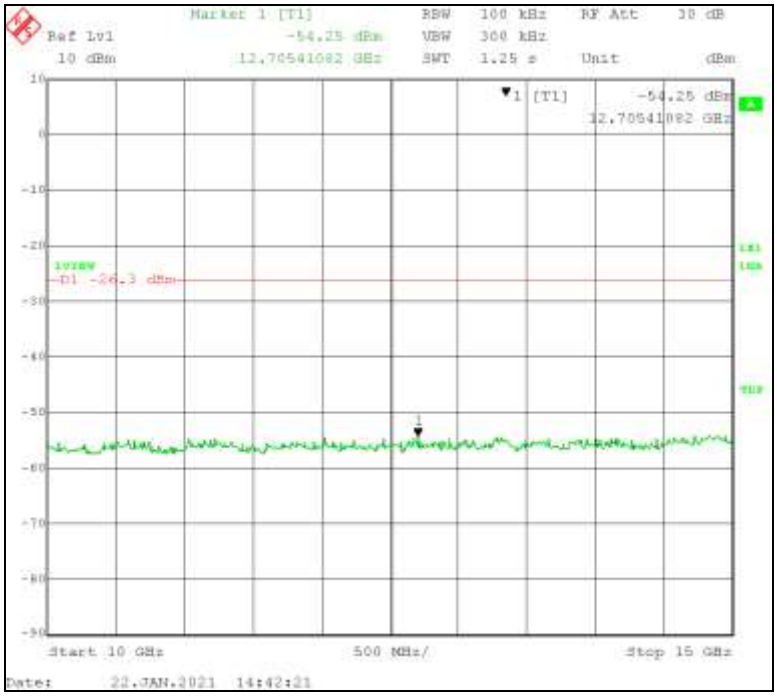
WNRLX3 With Zigbee Radio Transmitting (With High Pass Filter Installed): 1 GHz – 5 GHz



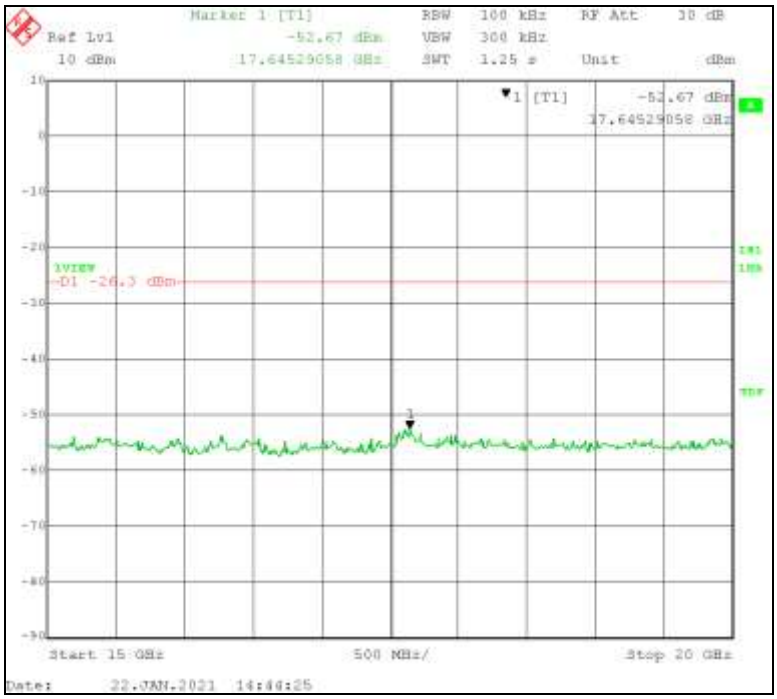
WNRLX3 With Zigbee Radio Transmitting (With High Pass Filter Installed): 5 GHz – 10 GHz



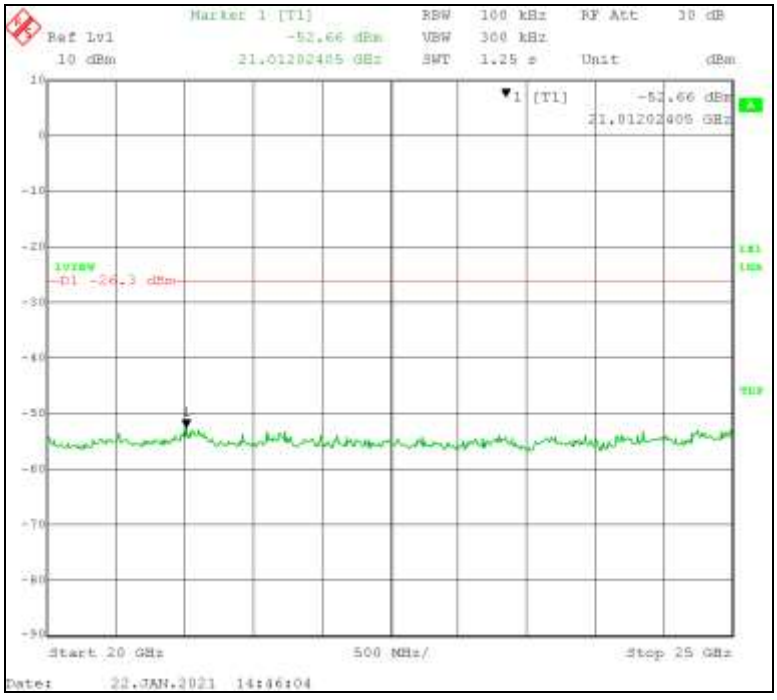
WNRLX3 With Zigbee Radio Transmitting (With High Pass Filter Installed): 10 GHz – 15 GHz



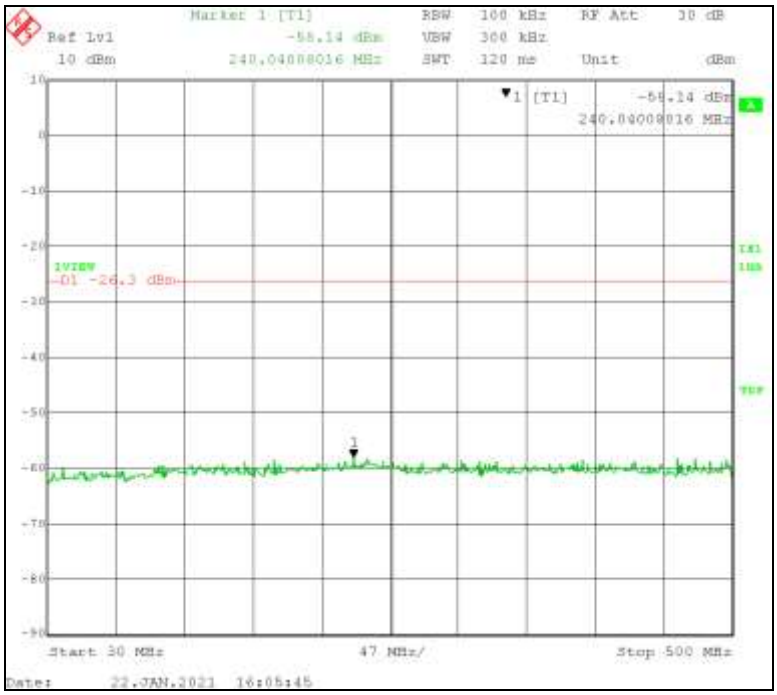
WNRLX3 With Zigbee Radio Transmitting (With High Pass Filter Installed): 15 GHz – 20 GHz



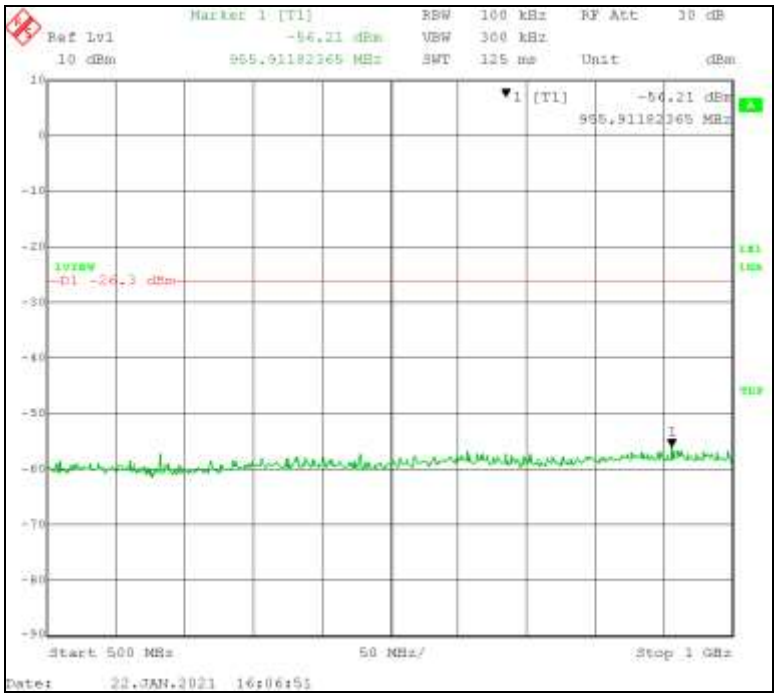
WNRLX3 With Zigbee Radio Transmitting (With High Pass Filter Installed): 20 GHz – 25 GHz



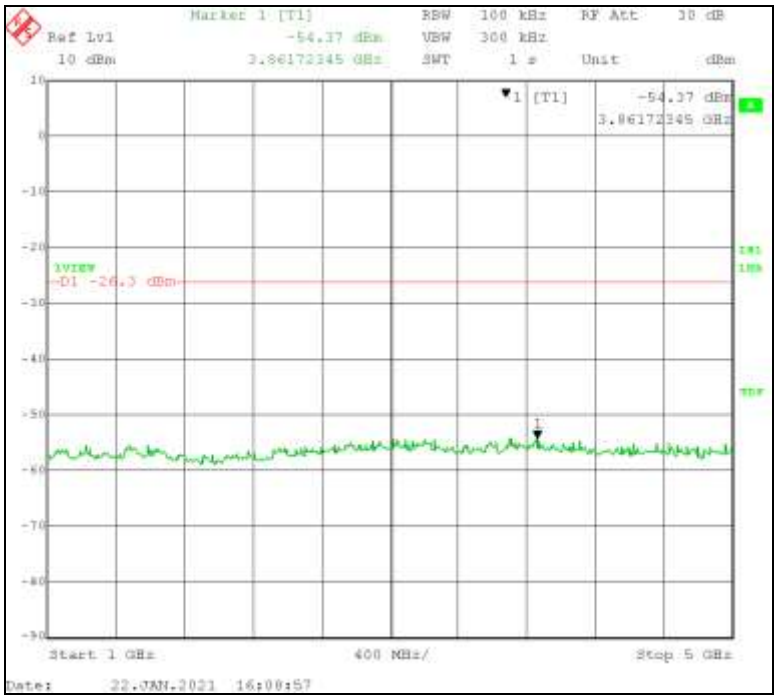
WNRLX3 With Zigbee Radio Receive Mode: 30 MHz – 500 MHz



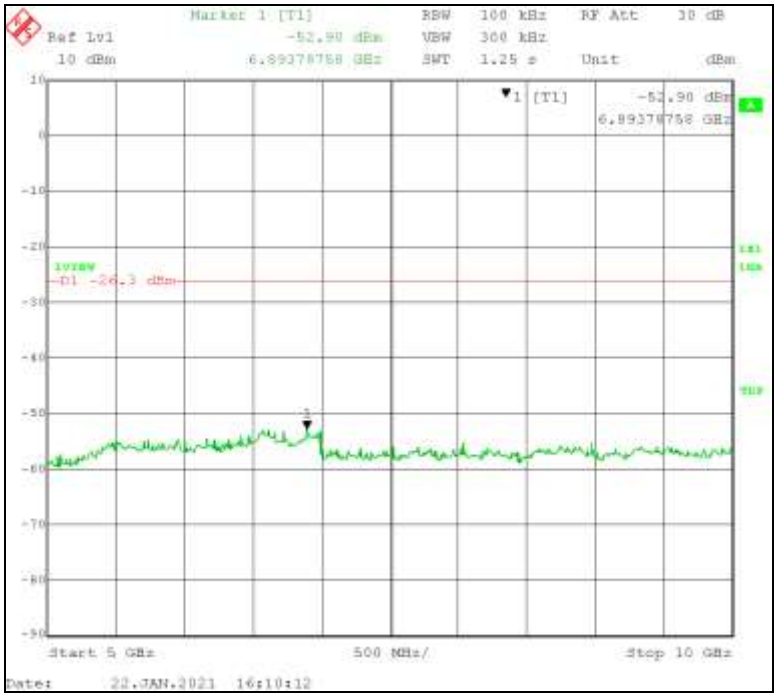
WNRLX3 With Zigbee Radio Receive Mode: 500 MHz – 1000 MHz



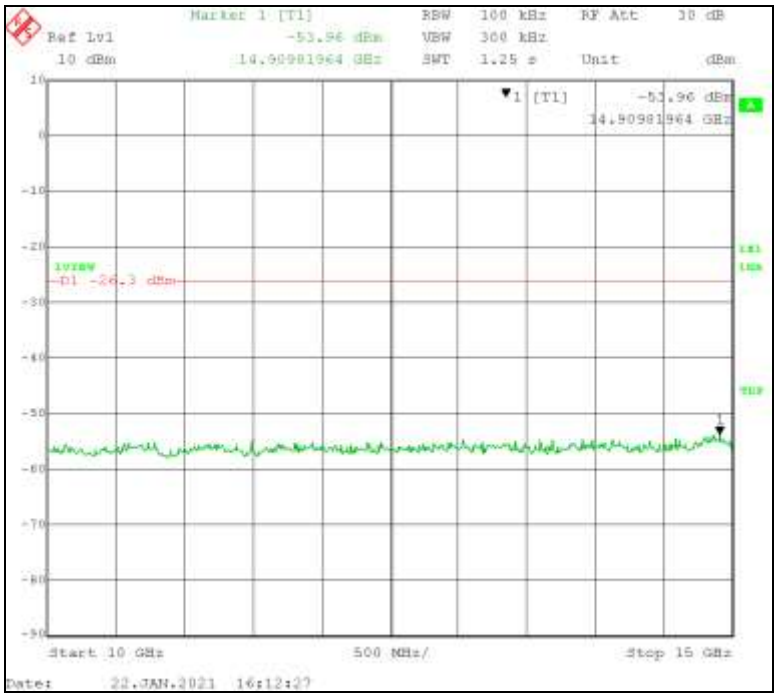
WNRLX3 With Zigbee Radio Receive Mode: 1 GHz – 5 GHz



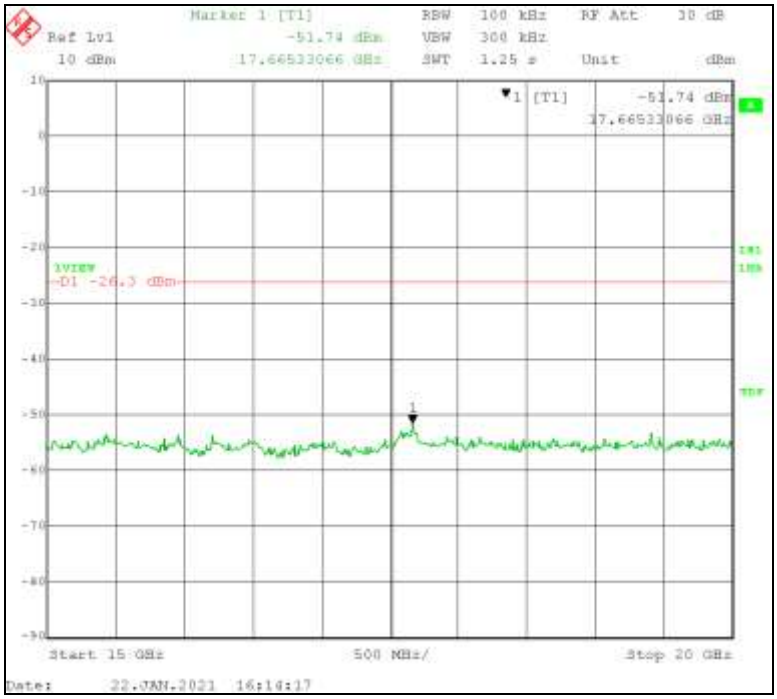
WNRLX3 With Zigbee Radio Receive Mode: 5 GHz – 10 GHz



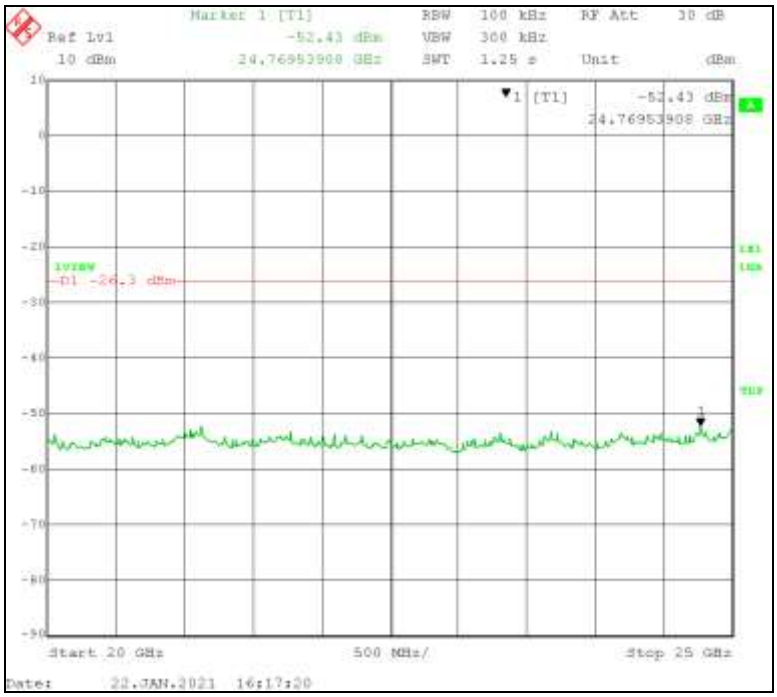
WNRLX3 With Zigbee Radio Receive Mode: 10 GHz – 15 GHz



WNRLX3 With Zigbee Radio Receive Mode: 15 GHz – 20 GHz



WNRLX3 With Zigbee Radio Receive Mode: 20 GHz – 25 GHz



Test Results: Emissions in Non-Restricted Frequency Bands, measured from the Legrand Model WNRLX3 with Zigbee Radio comply with the requirements of 47 CFR Part 15.247 (d) with 21.17 dB of margin.

4.9 Power Spectral Density (FCC Section 15.247(e), RSS-247 Section 5.2(b))

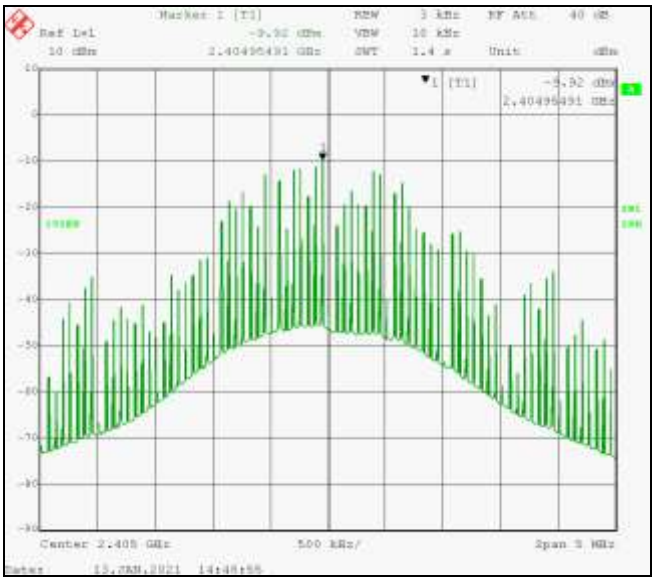
4.9.1 Power Spectral Density Test Procedure

A conducted, average, power measurement of the output frequency was measured for the Legrand WNRLX3 for each of the low, middle and high operating frequencies with modulation. The Zigbee radio was modulated with O-QPSK. Method AVGSA-1 was used to measure output power, therefore, method AVGPSD-1 with 3 kHz bandwidth, was used to measure Power Spectral Density.

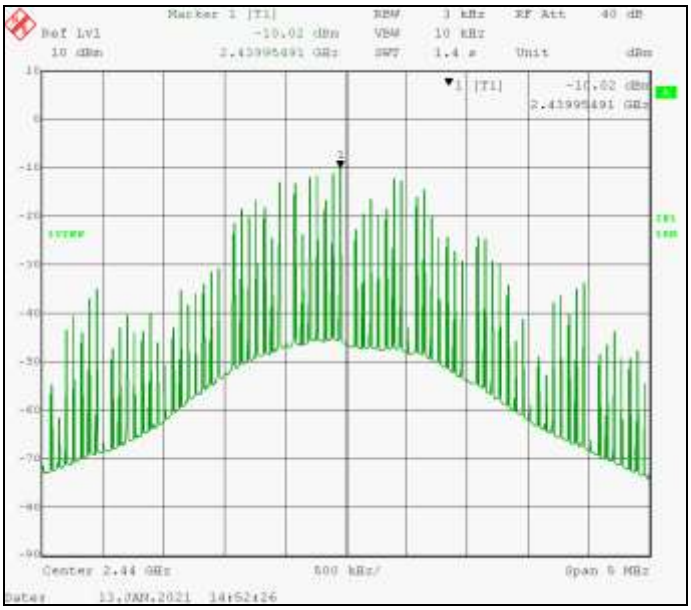
4.9.2 Power Spectral Density WNRLX3 With Zigbee Radio Test Results (01/13/2021)

Channel	Modulation	Frequency (MHz)	Measured Level (dBm)	Cable # 814 Loss (dB)	Total dBm	Limit dBm	Margin dBm
11	O-QPSK	2405.0	-9.92	0.47	-9.45	8.00	-17.45
18		2440.0	-10.02	0.47	-9.55	8.00	-17.55
26		2480.0	-10.55	0.47	-10.08	8.00	-18.08

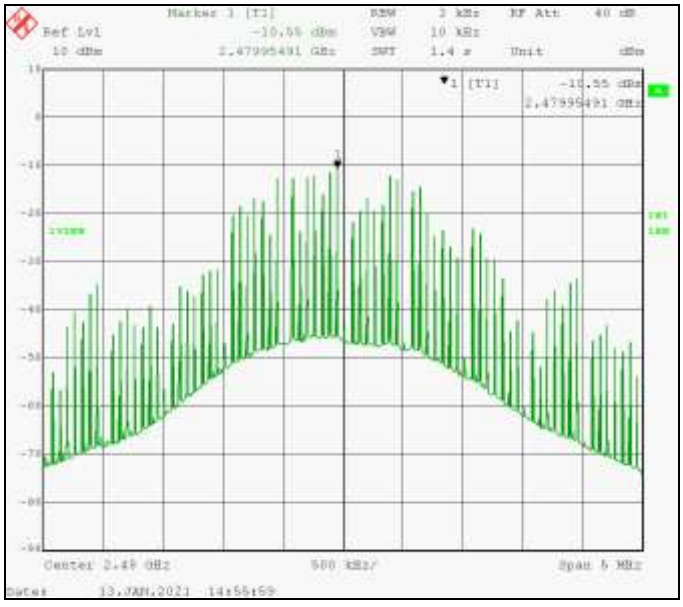
WNRLX3 With Zigbee Radio Low Channel 11 2405 MHz PSD



WNRLX3 With Zigbee Radio Middle Channel 18 2440 MHz PSD



WNRLX3 With Zigbee Radio High Channel 26 2480 MHz PSD



Test Results: The Power Spectral Density measurements of the Legrand Model WNRLX3 with Zigbee Radio are compliant with the limits specified in FCC Section 15.247(e) with margin of 19.26 dB.

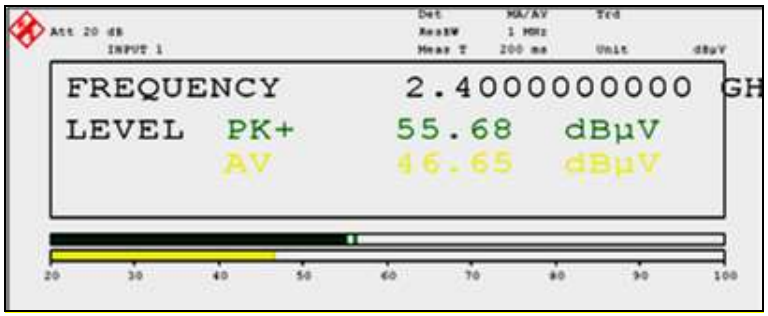
4.10 Band Edge Measurement (FCC Part 15.247(d), RSS-247 5.5)

4.10.1 Band Edge Measurement Test Procedure

The measurements of the band edges for the Zigbee radio were made using the radiated emission test procedure described in Section 4.4.2 of this report. The operating channels of the WNRLX3 did not fall within 2 MHz of an authorized band edge or restricted band edge, therefore the standard field strength test using standard EMC bandwidths was used for the measurements listed below. Measurements, horizontal and vertical polarizations, were made at the lower and upper authorized band-edges at 2.4 and 2.4835 GHz respectively.

4.10.2 Lower Band Edge Measurement Test Results – WNRLX3 (03/15/2021)

Zigbee Radio transmitting at 2.405 GHz, O-QPSK, Horizontal Polarization Measurement



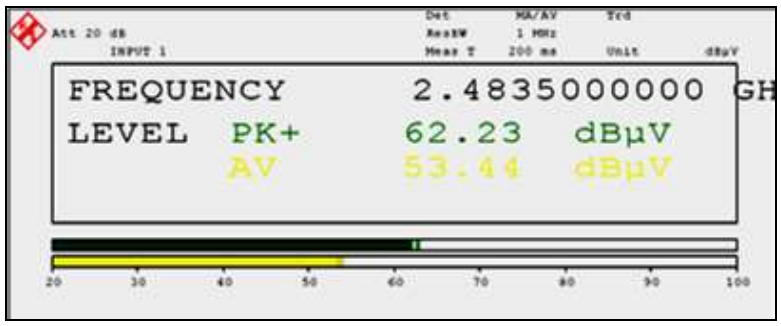
Zigbee Radio transmitting at 2.405 GHz, O-QPSK, Vertical Polarization Measurement

Frequency	Peak Level Corrected	Average Level Corrected	Antenna Polarity	Turntable Angle	Antenna Height	Correction Factor	FCC 15.205/209: RSS-GEN/RSS-247				
							Average Limit	Average Margin	Peak Limit	Peak Margin	Result
GHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
2.4000	50.16	41.13	H	267	158	-5.52	53.98	-12.85	73.98	-23.82	PASS
2.4000	52.74	44.02	V	311	163	-5.52	53.98	-9.96	74.98	-22.24	PASS

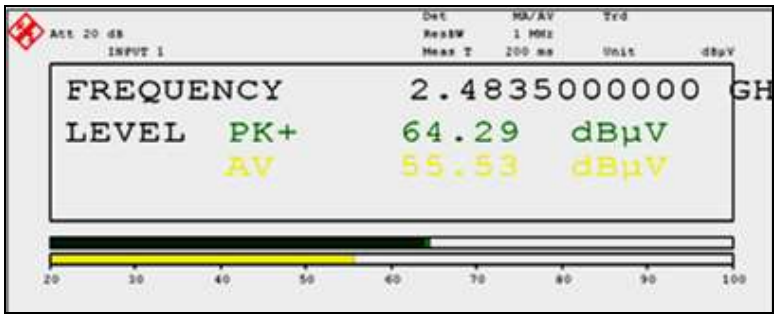
Test Results: Lower Band-edge measurement of the Legrand Model WNRLX3 with Zigbee Radio transmitting with O-QPSK modulation, is compliant to the FCC and ISED limits.

4.10.3 Upper Band Edge Measurement Test Results – WNRLX3

Zigbee Radio transmitting at 2.480 GHz, O-QPSK, Horizontal Polarization Measurement



Zigbee Radio transmitting at 2.480 GHz, O-QPSK, Vertical Polarization Measurement



Frequency	Peak Level Corrected	Average Level Corrected	Antenna Polarity	Turntable Angle	Antenna Height	Correction Factor	FCC 15.205/209: RSS-GEN/RSS-247				
							Average Limit	Average Margin	Peak Limit	Peak Margin	Result
GHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
2.4835	56.82	48.03	H	285	157	-5.41	53.98	-5.95	73.98	-17.16	PASS
2.4835	58.88	50.12	V	302	266	-5.41	53.98	-3.86	73.98	-15.10	PASS

Test Results: Upper Band-edge measurement of the Legrand Model WNRLX3 with Zigbee Radio transmitting with O-QPSK modulation, is compliant to the FCC and ISED limits.

5.0 Test Setup Pictures

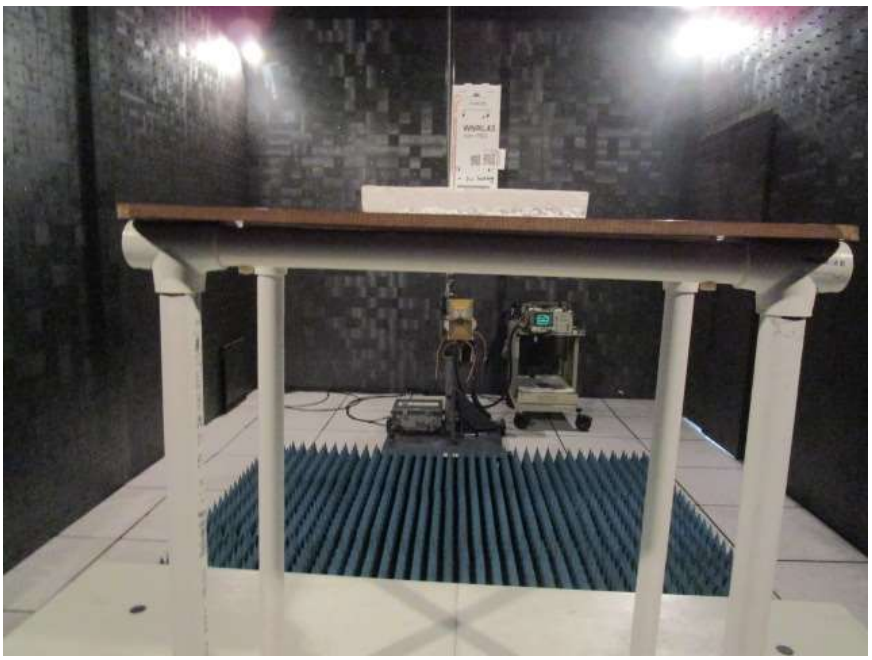
5.1 Antenna Conducted Emissions Test Setup Pictures

Antenna Conducted Emissions Legrand WNRLX3 With Zigbee Radio

5.2 Radiated Emissions Test Setup Pictures

30 MHz – 1000 MHz Test Setup Legrand WNRLX3 With Zigbee Radio

1 GHz - 18 GHz Test Setup Legrand WNRLX3 With Zigbee Radio



18 GHz - 25 GHz Test Setup Legrand WNRLX3 With Zigbee Radio

Appendix A – Test Equipment

Equipment	Manufacturer	Model #	Serial #	BEC #	Calibration Date	Calibration Cycle	Calibration Due Date
EMI Receiver (20 Hz – 26.5 GHz)	Rohde & Schwarz	ESIB 26	836119/006	1010	07/02/19	3 Years	07/02/22
Antenna (30 MHz - 6 GHz)	Sunol Sciences	JB6	A022108	712	06/26/18	3 Years	06/26/21
9kHz-3GHz EMC Analyzer	Agilent	E7402A	US39440162	883	02/27/18	3 Years	02/27/21
Antenna (30 MHz - 6 GHz)	Sunol Sciences	JB6	A020714	882	05/16/18	3 Years	05/16/21
Amplifier (.09 – 1300 MHz)	Hewlett Packard	8447F	3313A06658	807	01/13/21	2 Years	01/13/23
EMC Analyzer (9 kHz - 1.8 GHz)	Hewlett Packard	8593EM	3710A00214	1026	03/23/20	3 Years	03/23/23
Amplifier System (0.5 – 50 GHz)	Hewlett Packard	83015A 83017A	3123A00360 & 3332A00219	1027	10/13/20	2 Years	10/13/22
Double Ridged Horn Antenna (1 - 18 GHz)	Eaton	3115	2113	836	01/08/19	3 Years	01/08/22
Shielded Room #1	ETS Lindgren	12-2/2-0	4078	859	05/17/18	3 Years	05/17/21
OATS Site (30 MHz – 1 GHz)	BEC	N/A	N/A	705	08/03/20	1 Year	08/03/21
Intentional Radiator Testing High Frequency RF Test Cable	Suhner	S04272B	N/A	962	08/03/20	1 Year	08/03/21
Temp/Humidity Meter	Control Company	4096	151872672	780	04/08/19	2 Years	04/08/21

Software (Tile Instrument Control System)	Quantum Change/EMC Systems	Version 3	N/A	N/A	No Cal. Required	No Cal. Required	No Cal. Required
Radiated Emissions Test Software	BEC	RADE	2.2	N/A	No Cal. Required	No Cal. Required	No Cal. Required