Certification Test Report

FCC ID: OV5-WDSB
IC: 11137A-WDSB

FCC Rule Part: 15.247
ISED Canada Radio Standards Specification: RSS-247

Report Number: AT72155767-1C1

Manufacturer: Deere & Company
Model: Wireless Data Server; Model: WDSB

Test Begin Date: February 21, 2020
Test End Date: April 6, 2020

Report Issue Date: June 2, 2020

FOR THE SCOPE OF ACCREDITATION UNDER Certificate Number: 2955.09

This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the Federal Government.

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This report contains 31 pages

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1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and Innovation, Science, and Economic Development Canada's Radio Standards Specification RSS-247 for original certification.

1.2 Product Description

The John Deere Wireless Data Server (WDS) is a device on select John Deere equipment that broadcasts a local WiFi network in the 2.4GHz band.

This test report documents the compliance of the WLAN transceiver mode of operation.

Technical Information:

Detail	Description
Frequency Range	2412 – 2462 MHz
Number of Channels	802.11b/g/n (HT 20): 11
Modulation Format	802.11b: DSSS (DBPSK / DQPSK / CCK) 802.11g/n (HT 20): OFDM (BPSK / QPSK / 16QAM / 64QAM)
Data Rates	802.11b: 1 – 11 Mbps 802.11g: 6 – 54 Mbps 802.11n (HT 20): 6.5 – 72 Mbps
Number of Inputs/Outputs	1T1R
Operating Voltage	12Vdc
Antenna Type / Gain	External Dipole / 5dBi Max

Manufacturer Information:
Deere & Company
One John Deere Place
Moline, IL 61265

Test Sample Serial Number: PCWDSBA000024

Test Sample Condition: The test samples were provided in good working order with no visible defects.

1.3 Test Methodology and Considerations

All modes of operation, including all data rates, were evaluated and the data presented in this report represents the worst case where applicable. The worst-case data rate for 802.11b mode was 1Mbps. The worst-case data rate for 802.11g mode was 48Mbps. The worst-case data rate for 802.11n (HT 20) mode was MCS1.

For radiated emissions, the EUT was evaluated in three orthogonal orientations. The worst-case orientation was Y-position for band edge measurements and X-position for spurious emissions. See test setup photos for more information.

For RF Conducted measurements, the EUT was connected to the test equipment with a TNC to SMA adapter. The EUT was programmed to generate a continuously modulated signal on each channel evaluated.

Power setting during test – 802.11b:	16
Power setting during test – 802.11g:	22
Power setting during test – 802.11n (HT 20):	22

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following addresses:

TÜV SÜD America, Inc.
5945 Cabot Pkwy, Suite 100
Alpharetta, GA 30005
Phone: (678) 341-5900

2.2 Laboratory Accreditations/Recognitions/Certifications

TÜV SÜD America, Inc. is accredited to ISO/IEC 17025 by the American Association for Laboratory Accreditation/A2LA accreditation program and has been issued certificate number 2955.09 in recognition of this accreditation.

Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scopes of accreditation.

The Semi-Anechoic Chamber Test Sites and Conducted Emissions Sites have been fully described, submitted to, and accepted by the FCC, ISED Canada and the Japanese Voluntary Control Council for Interference by information technology equipment.

FCC Designation Accreditation Number:	US1233
FCC Test Site Registration Number:	967699
ISED Canada Lab Code:	23932
VCCI Member Number:	1831
• VCCI Registration Number	A-0295

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 20'W x 30'L x 20'H shielded enclosure. The chamber is lined with ETS-Lindgren Ferrite Absorber, model number FT-1500. The ferrite tile 600 mm x 600 mm (2.62 in x 23.62 in) panels and are mounted directly on the inner walls of the chamber shield.

The specular regions of the chamber are lined with additional ETS-Lindgren PS-600 hybrid absorber to extend its frequency range up to 18GHz and beyond.

The turntable is a 2m ETS-Lindgren Model 2170 and installed off the center axis is located 5'6" from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the shield using #8 solid copper wire.

The antenna mast is an EMCO 1060 and is remotely controlled from the control room for both antenna height and polarization.

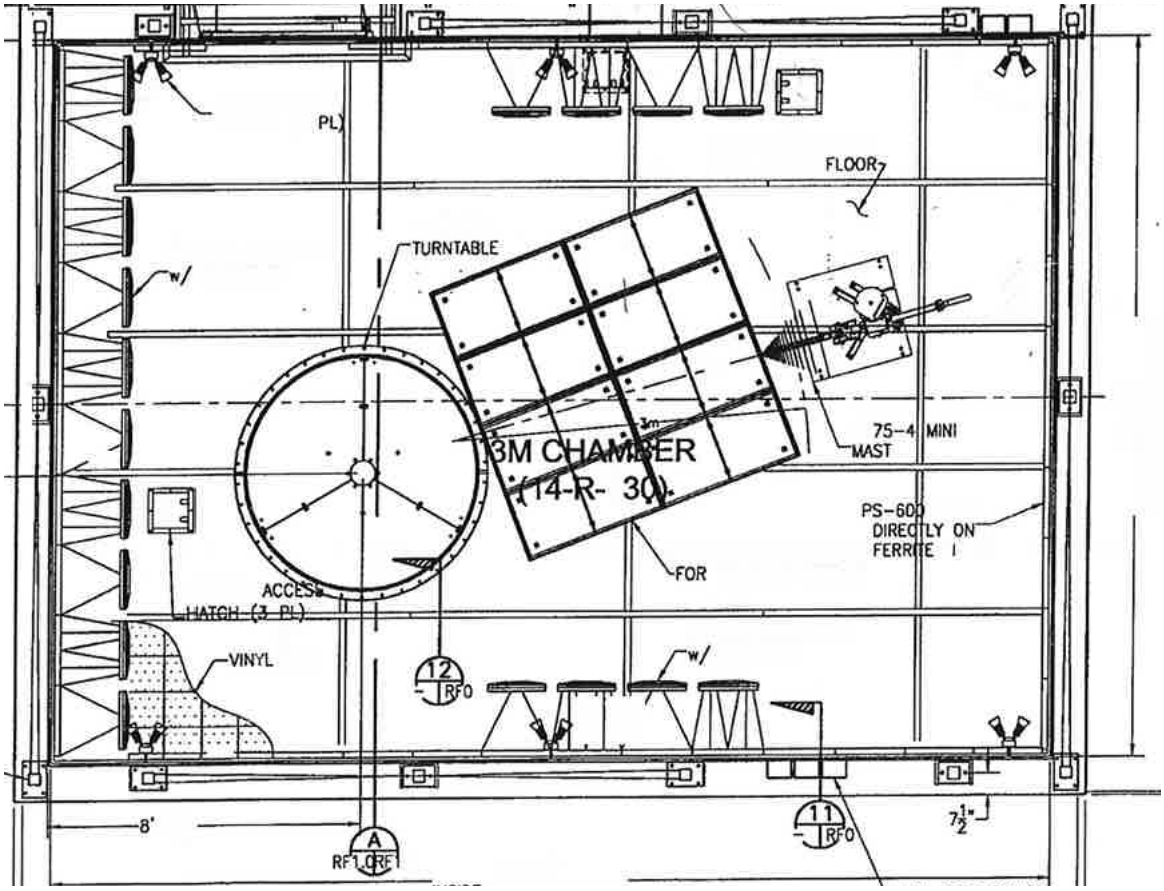


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.4 Conducted Emissions Test Site Description

2.4.1 Conducted Emissions Test Site

The AC mains conducted EMI site is located in the main EMC lab. It consists of a 12' x 10' horizontal coupling plane (HCP) as well as a 12'x8' vertical coupling plane (VCP). The HGP is constructed of 4' x 10' sheets of particle board sandwiched by galvanized steel sheets. These panels are bonded using 11AWG 1/8" x 2" by 10' galvanized sheet steel secured to the panels via by screws. The VCP is constructed of three 4'x8' sheets of 11AWG solid aluminum.

The HCP and VCP are electrically bonded together using 1"x1" angled aluminum secured with screws.

The site is of sufficient size to test tabletop and floor standing equipment in accordance with section 6.1.4 of ANSI C63.10.

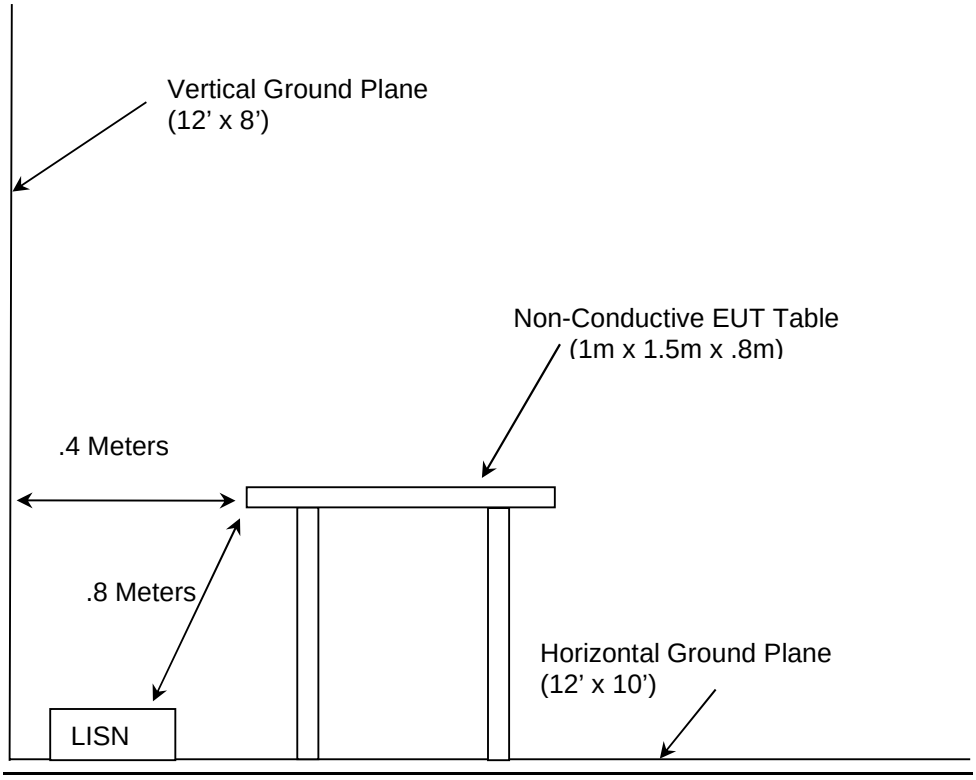


Figure 2.4.1-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2020
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2020
- FCC KDB 558074 D01 DTS Meas Guidance v05r02 - Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247, April 2, 2019
- ISED Canada Radio Standards Specification: RSS-247 – Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices, Issue 2, February 2017.
- ISED Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 5, April 2018 + Amendment 1, March 2019

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment

Asset ID	Manufacturer	Model	Equipment Type	Serial Number	Last Calibration Date	Calibration Due Date
213	TEC	PA 102	Amplifier	44927	07/22/2019	07/22/2020
335	Suhner	SF-102A	Cable (40GHZ)	882/2A	07/08/2019	07/08/2020
338	Hewlett Packard	8449B	High Frequency Pre-Amp	3008A01111	07/15/2019	07/15/2021
345	Suhner Sucoflex	102A	Cable 42(GHZ)	1077/2A	07/09/2019	07/09/2020
432	Microwave Circuits	H3G020G4	Highpass Filter	264066	05/31/2019	05/31/2020
622	Rohde & Schwarz	FSV40 (v3.40)	FSV Signal Analyzer 10Hz to 40GHz	101338	07/30/2018	07/30/2020
628	EMCO	6502	Active Loop Antenna 10kHz-30MHz	9407-2877	02/11/2019	11/02/2021
638	Rohde & Schwarz	OSP 120	Open Switch and Control Unit	101229	06/11/2019	06/11/2021
651	Rohde & Schwarz	TS-PR26	18GHz to 26.5GHz Pre-Amplifier	100023	07/10/2019	07/10/2020
652	Rohde & Schwarz	3160-09	High Frequency Antenna 18GHz to 26.5GHz	060922-21894	NCR	NCR
819	Rohde & Schwarz	ESR26	EMI Test Receiver	101345	11/1/2018	05/01/2020
827	(-)	TS8997 Rack Cable Set	TS8997 Rack Cable Set	N/A	05/01/2019	05/01/2020
836	ETS Lindgren	SAC Cable Set	SAC Cable Set includes 620, 837, 838	N/A	05/01/2019	05/01/2020
853	Teseq	CBL 6112D; 6804.17.A	Bilog Antenna; Attenuator	51616; 20181110A	10/15/2018	10/15/2020
857	ETS Lindgren	3117	Horn Antenna 1-18GHz	00153608	11/12/2019	11/12/2021
RE880	Rhode & Schwarz USA	Test Recever	R&S ESW44	1206247	11/06/2019	11/6/2020

NCR = No Calibration Required
NOTE: All test equipment was used only during active calibration cycles as reported above.

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model/Part Number	Serial Number
1	CANbus Interface Box	John Deere	CAN BOX	N/A
2	Greenstar 3 2630 Display	John Deere	GU2U	PCGU2UD460157
3	DC Power Supply	TekPower	TP3005T	483279

Table 5-2: Cable Description

Cable	Cable Type	Length	Shield	Termination
A	Harness (DC+CAN)	2m	No	DUT – 1
B	Harness (DC+CAN)	0.5m	No	1 – 2
C	DC Power	0.5m	No	1 – 3

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

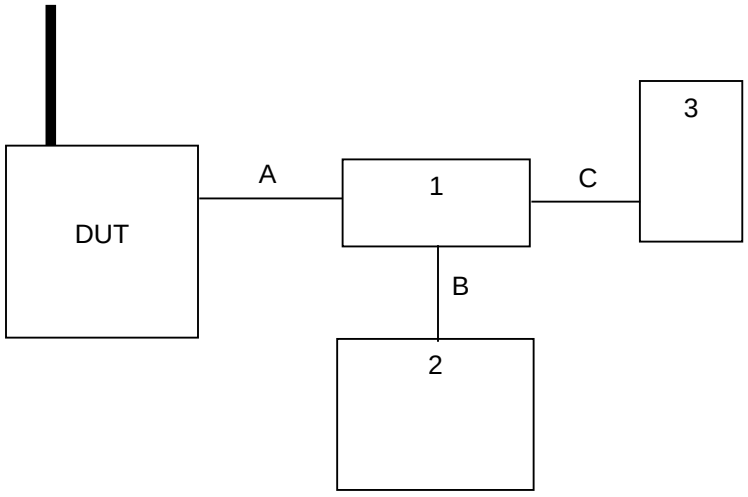


Figure 6-1: Test Setup Block Diagram

7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

Table 7-1 – Summary of Results

Section	Specification Clause		Test Description	Accreditation	Base Standard	Result
	Part 15C	ISED				
7.1	15.203	NA	Antenna Requirement	A2LA	NA	Compliant
7.2	15.207	RSS-GEN 8.8	Conducted Disturbance at Mains Terminals	A2LA	ANSI C63.10: 2013	Compliant
7.3	15.247(a)(2)	RSS-247 5.2(a) / RSS-GEN 6.7	6dB / 99% Bandwidth	A2LA	ANSI C63.10: 2013	Compliant
7.4	15.247(b)(3)	RSS-247 5.4(d)	Fundamental Emission Output Power	A2LA	ANSI C63.10: 2013	Compliant
7.5.1	15.247(d)	RSS-247 5.5	Emissions into Non-restricted Frequency Bands	A2LA	ANSI C63.10: 2013	Compliant
7.5.2	15.205, 15.209	RSS-Gen 8.9 / 8.10	Emissions into Restricted Frequency Bands	A2LA	ANSI C63.10: 2013	Compliant
7.6	15.247(e)	RSS-247 5.2(b)	Maximum Power Spectral Density in the Fundamental Emission	A2LA	ANSI C63.10: 2013	Compliant

7.1 Antenna Requirement – FCC 15.203

The EUT utilizes an external dipole antenna with a TNC connector. The gain of the antenna is 5dBi max.

7.2 Power Line Conducted Emissions – FCC 15.207, ISED Canada: RSS-Gen 8.8

7.2.1 Measurement Procedure

Conducted emissions were performed from 150kHz to 30MHz with the spectrum analyzer's resolution bandwidth set to 9kHz and the video bandwidth set to 30kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Corrected Reading - Applicable Limit

7.2.2 Measurement Results

AC conducted emissions measurements were not required. The device was DC powered with no facility for connection to AC mains.

7.3 6dB / 99% Bandwidth – FCC 15.247(a)(2), ISED Canada: RSS-247 5.2(a) / RSS-GEN 6.7

7.3.1 Measurement Procedure

The 6dB bandwidth was measured in accordance with the FCC KDB 558074 D01 Section 8.2 which references Subclause 11.8 of ANSI C63.10. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to 100 kHz. The Video Bandwidth (VBW) was set to ≥ 3 times the RBW. The trace was set to max hold with a peak detector active. The marker-delta function of the spectrum analyzer was utilized to determine the 6 dB bandwidth of the emission.

The occupied bandwidth measurement function of the spectrum analyzer was used to measure the 99% bandwidth. The span of the analyzer was set to capture all products of the modulation process, including the emission sidebands. The resolution bandwidth was set from 1% to 5% of the occupied bandwidth and the video bandwidth set to at least 3 times the resolution bandwidth. A peak detector was used.

7.3.2 Measurement Results

Performed by: Jeremy Pickens

Table 7.3.2-1: 6dB / 99% Bandwidth

Modulation	Frequency (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
802.11b	2412	10.15	16.10
	2437	10.15	16.00
	2462	10.15	16.10
802.11g	2412	16.45	16.50
	2437	16.40	16.50
	2462	16.50	16.50
802.11n(HT20)	2412	15.75	17.50
	2437	15.85	17.50
	2462	16.10	17.50

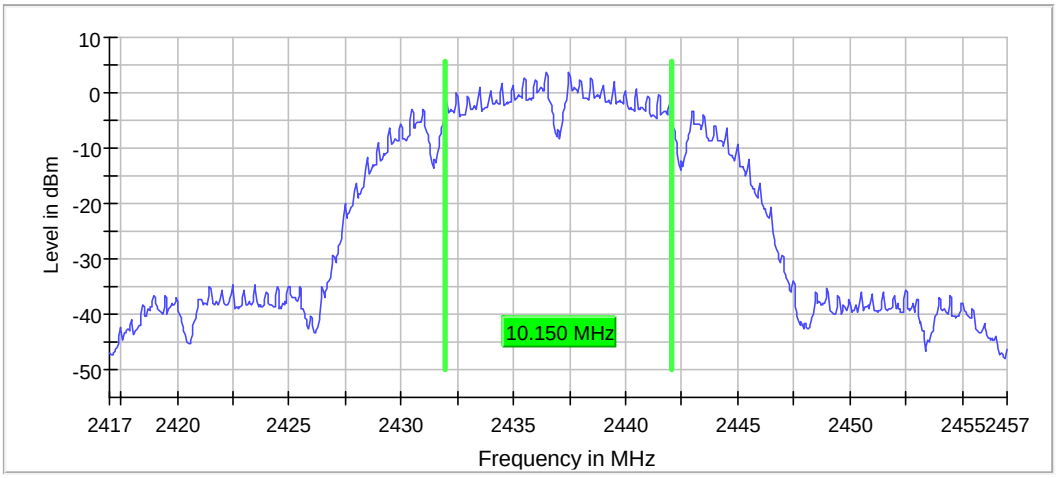


Figure 7.3.2-1: Sample Plot - 6dB BW

Table 7.3.2-2: Sample Measurement Settings (6dB BW)

Setting	Instrument Value	Target Value
Start Frequency	2.41700 GHz	2.41700 GHz
Stop Frequency	2.45700 GHz	2.45700 GHz
Span	40.000 MHz	40.000 MHz
RBW	100.000 kHz	~ 100.000 kHz
VBW	300.000 kHz	~ 300.000 kHz
SweepPoints	800	~ 800
Sweeptime	56.836 µs	AUTO
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	20 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.04 dB	0.50 dB

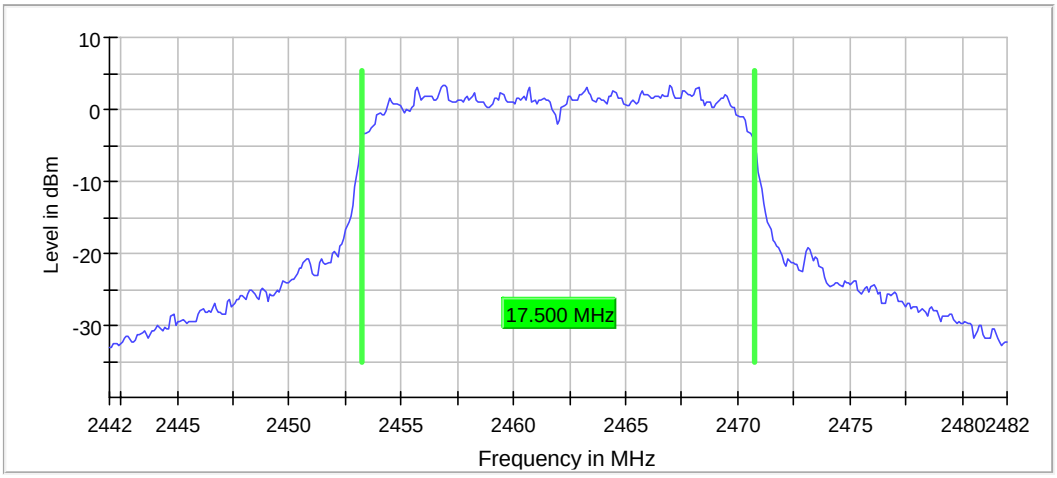


Figure 7.3.2-2: Sample Plot - 99% OBW

Table 7.3.2-3: Sample Measurement Settings (OBW)

Setting	Instrument Value	Target Value
Start Frequency	2.44200 GHz	2.44200 GHz
Stop Frequency	2.48200 GHz	2.48200 GHz
Span	40.000 MHz	40.000 MHz
RBW	200.000 kHz	>= 200.000 kHz
VBW	1.000 MHz	>= 600.000 kHz
SweepPoints	400	~ 400
Sweeptime	28.477 µs	AUTO
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	55 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.03 dB	0.30 dB

7.4 Fundamental Emission Output Power – FCC 15.247(b)(3), ISED Canada: RSS-247 5.4(d)

7.4.1 Measurement Procedure

The maximum conducted output power was measured in accordance with FCC KDB 558074 D01 DTS Meas Guidance utilizing peak methods and referencing Section 11.9.1.1 of ANS C63.10. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer applying suitable attenuation. Worst-case power across all data rates is reported.

7.4.2 Measurement Results

Performed by: Jeremy Pickens

Table 7.4.2-1: Conducted Output Power

Modulation	Frequency (MHz)	Peak Power (dBm)
802.11b	2412	15.0
	2437	15.4
	2462	15.6
802.11g	2412	20.2
	2437	20.8
	2462	20.9
802.11n(HT20)	2412	20.2
	2437	20.6
	2462	20.7

7.5 Emission Levels

7.5.1 Emissions into Non-restricted Frequency Bands – FCC 15.247(d); ISED Canada: RSS-247 5.5

7.5.1.1 Measurement Procedure

The unwanted emissions into non-restricted bands were measured conducted in accordance with FCC KDB 558074 D01 Section 8.5. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer applying suitable attenuation. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to 100 kHz. The Video Bandwidth (VBW) was set to ≥ 300 kHz. The resulting spectrum analyzer peak level was used to determine the reference level with respect to the 20 dBc limit at the band edges. The spectrum span was then adjusted for the measurement of spurious emissions from 30MHz to 25GHz, 10 times the highest fundamental frequency. The worst-case for each modulation was investigated at the lower and upper band edges.

7.5.1.2 Measurement Results

Performed by: Jeremy Pickens

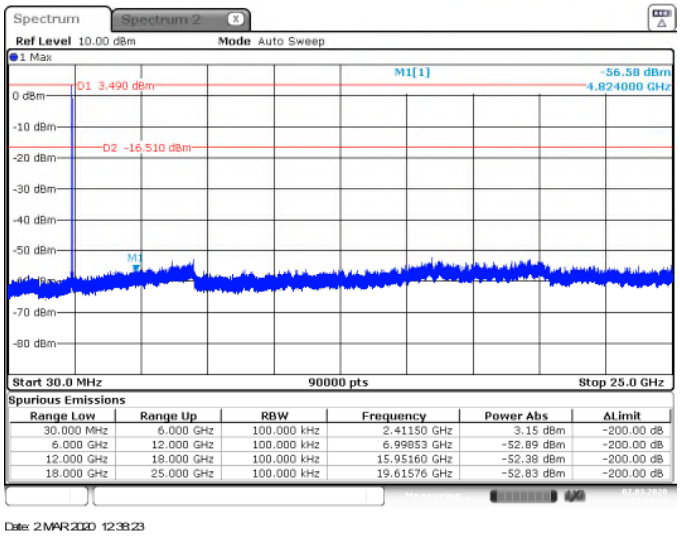


Figure 7.5.1.2-1: 802.11b – LCH – 30MHz–25GHz

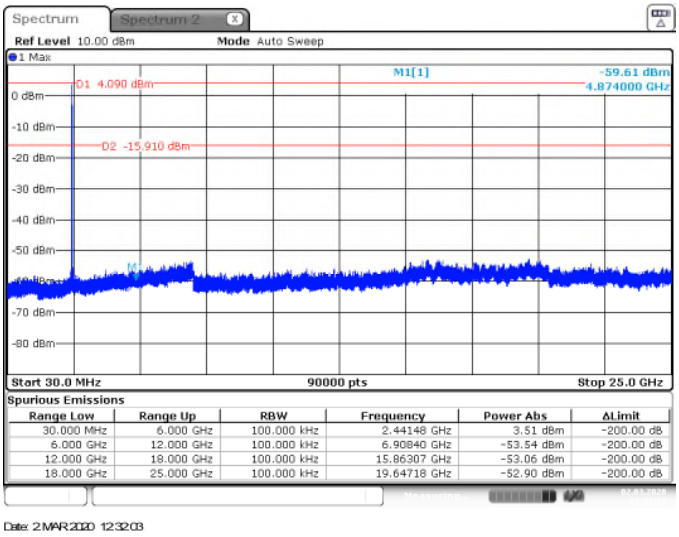


Figure 7.5.1.2-2: 802.11b – MCH – 30MHz–25GHz

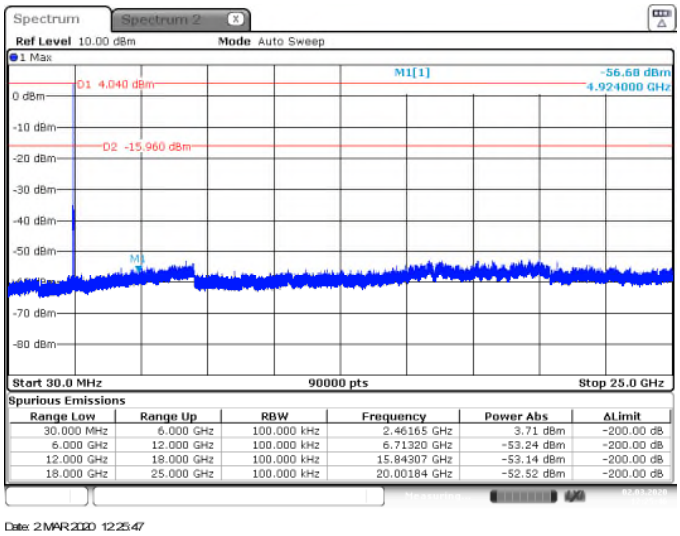


Figure 7.5.1.2-3: 802.11b – HCH – 30MHz–25GHz

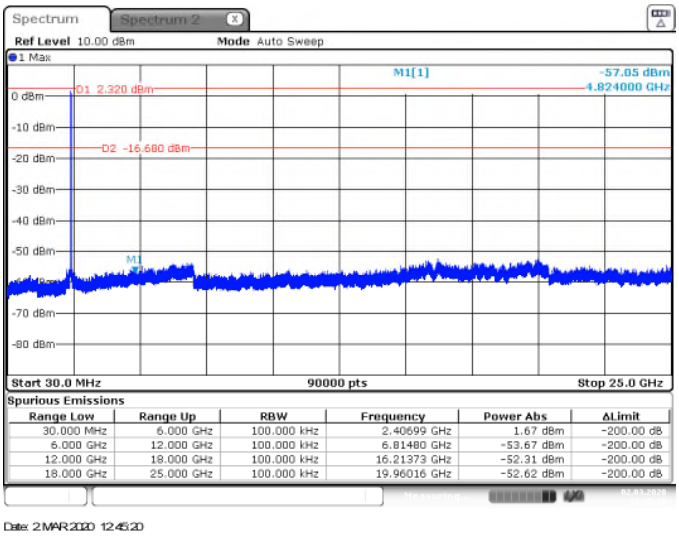


Figure 7.5.1.2-4: 802.11g – LCH – 30MHz–25GHz

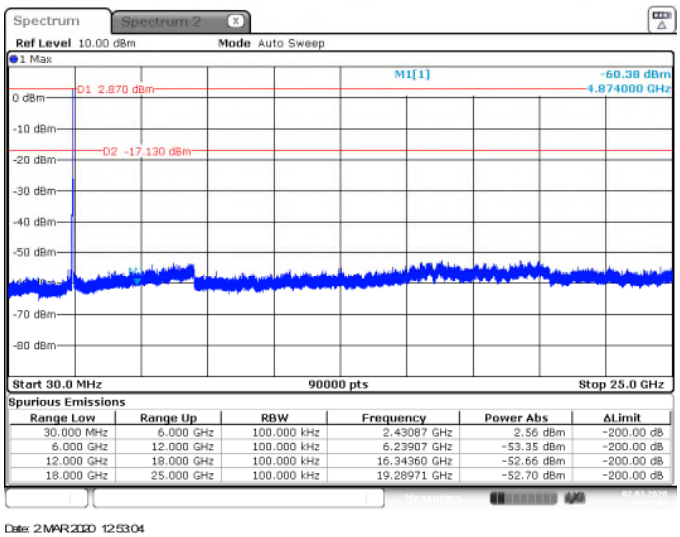


Figure 7.5.1.2-5: 802.11g – MCH – 30MHz–25GHz

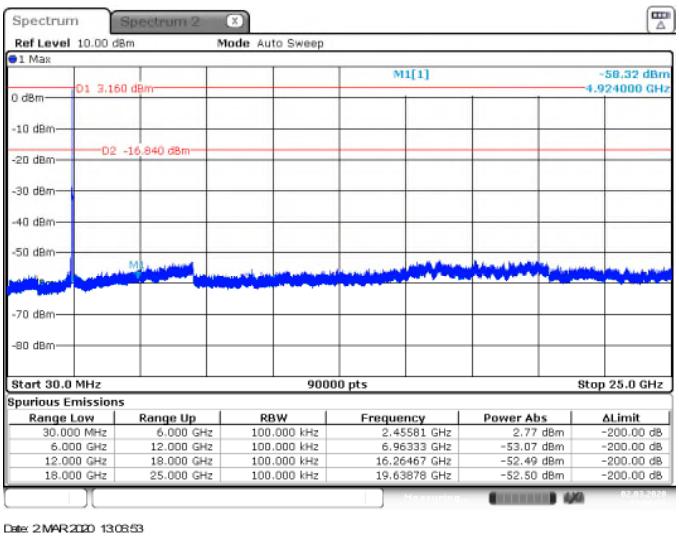


Figure 7.5.1.2-6: 802.11g – HCH – 30MHz–25GHz

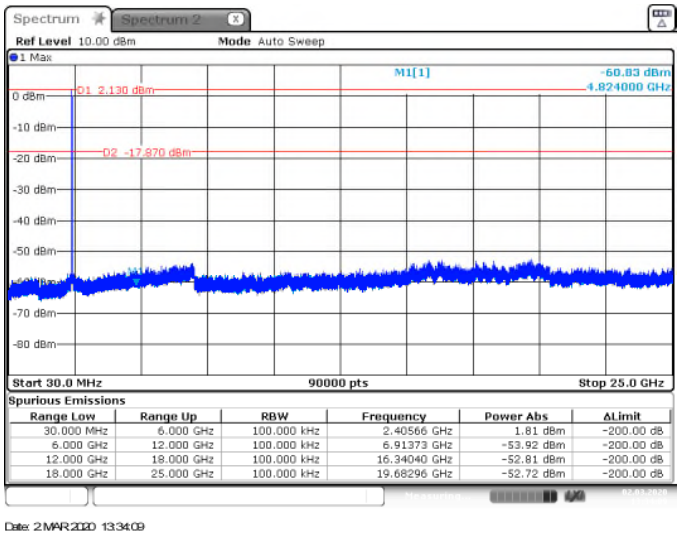


Figure 7.5.1.2-7: 802.11n – LCH – 30MHz–25GHz

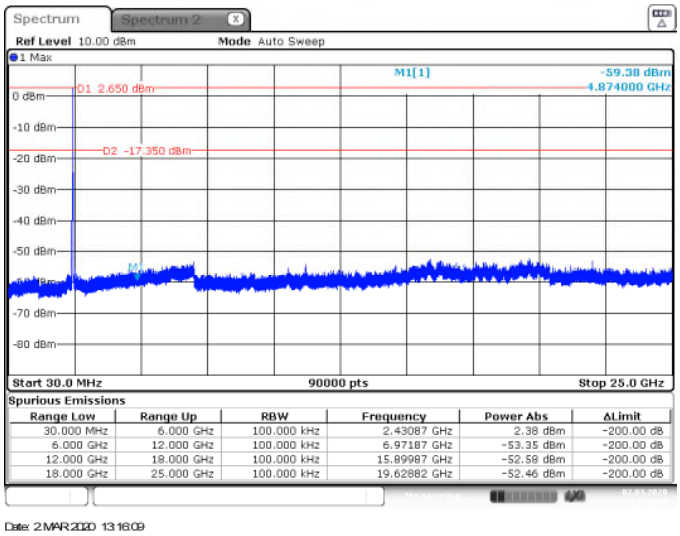


Figure 7.5.1.2-8: 802.11n – MCH – 30MHz–25GHz

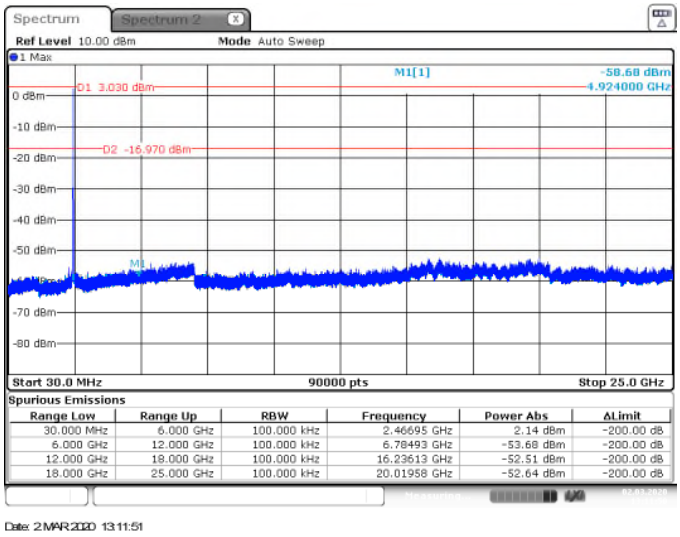


Figure 7.5.1.2-9: 802.11n – HCH – 30MHz–25GHz

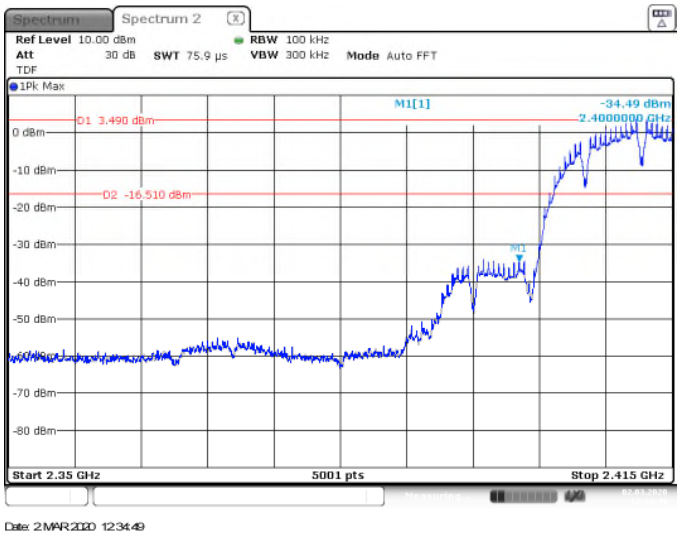


Figure 7.5.1.2-10: 802.11b – Lower Band-edge

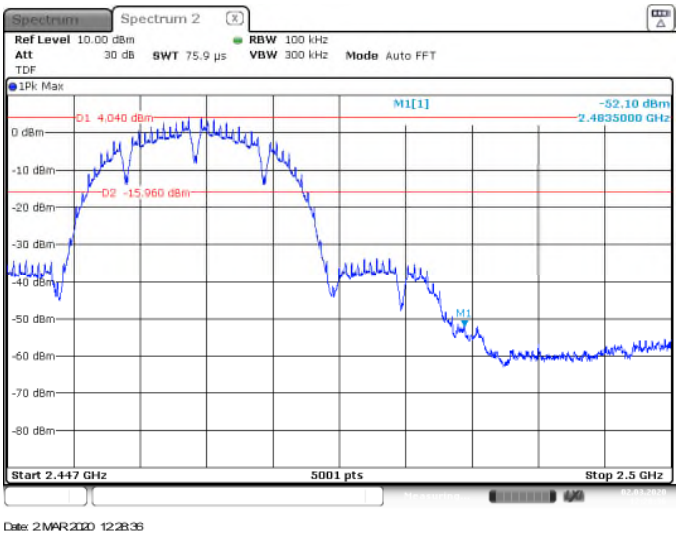


Figure 7.5.1.2-11: 802.11b – Upper Band-edge

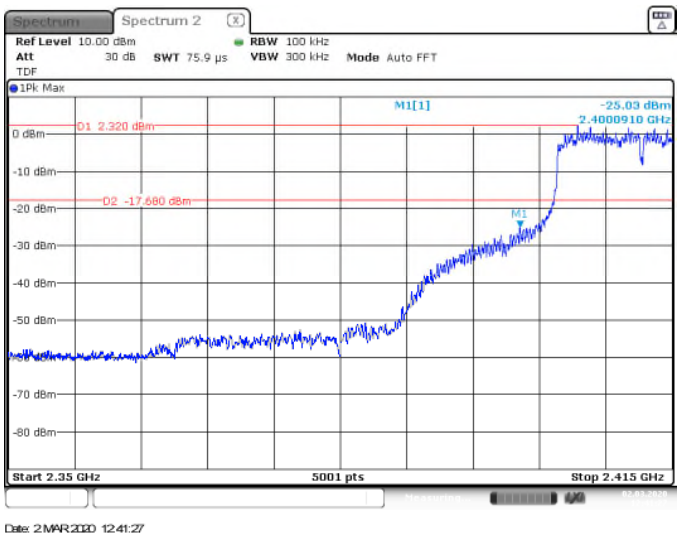


Figure 7.5.1.2-12: 802.11g – Lower Band-edge

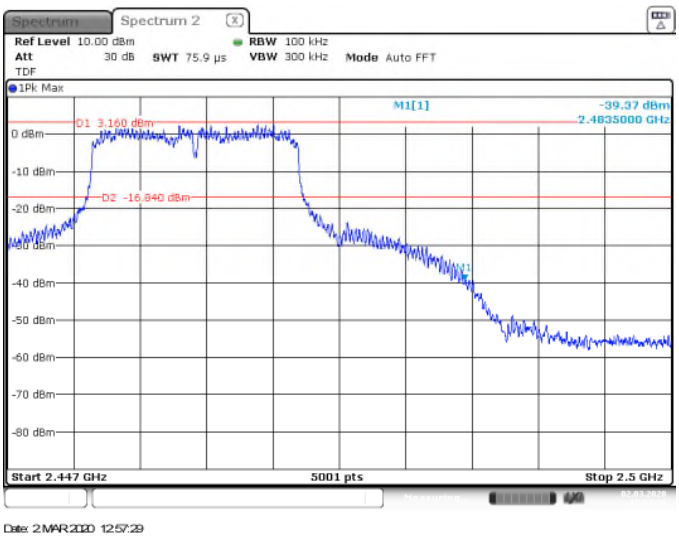


Figure 7.5.1.2-13: 802.11g – Upper Band-edge

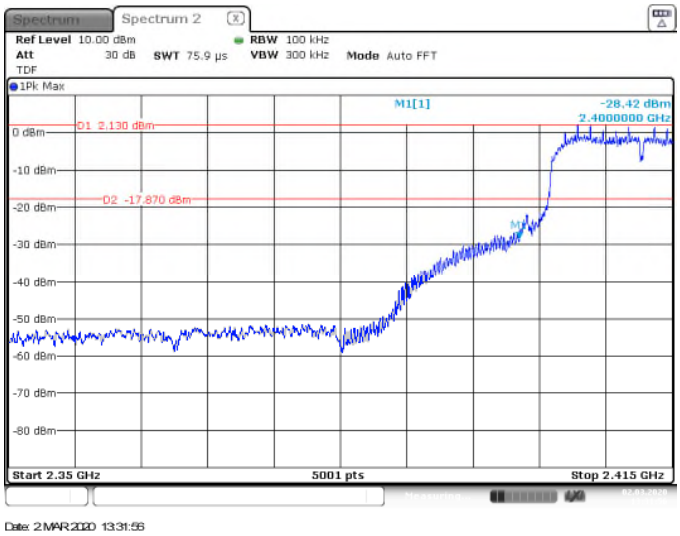


Figure 7.5.1.2-14: 802.11n20 – Lower Band-edge

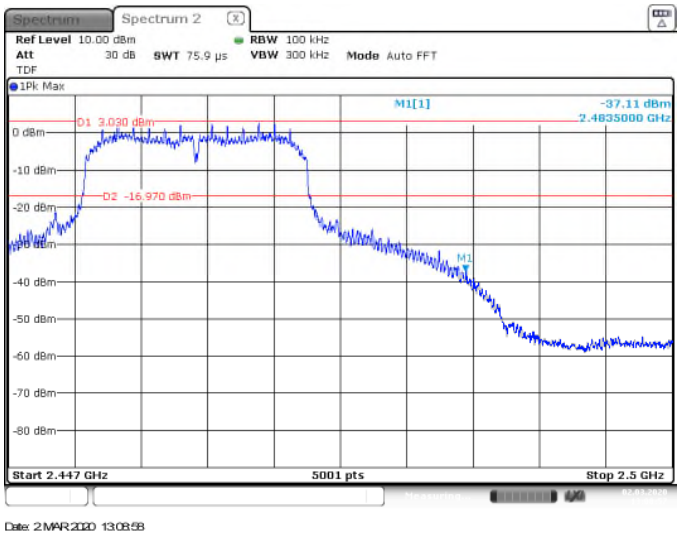


Figure 7.5.1.2-15: 802.11n20 – Upper Band-edge

7.5.2 Emissions into Restricted Frequency Bands – FCC: 15.205, 15.209; ISED Canada: RSS-Gen 8.9 / 8.10

7.5.2.1 Measurement Procedure

The unwanted emissions into restricted bands were measured radiated over the frequency range of 9kHz to 25GHz, 10 times the highest fundamental frequency.

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

Each emission found to be in a restricted band as defined by section 15.205, including any emission at the operational band-edge, was compared to the radiated emission limits as defined in section 15.209.

7.5.2.2 Measurement Results

Performed by: Jeremy Pickens

Radiated spurious emissions found in the band of 9kHz to 25GHz are reported in the Tables 7.5.2.2-1 to 7.5.2.2-3 below.

Table 7.5.2.2-1: Radiated Spurious Emissions Tabulated Data – 802.11b

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
2412 MHz										
2390	48.00	35.20	H	-1.17	46.83	34.03	74.0	54.0	27.2	20.0
2390	54.00	42.40	V	-1.17	52.83	41.23	74.0	54.0	21.2	12.8
4824	48.6	44.2	H	3.88	54.78	48.48	74.0	54.0	19.2	5.5
4824	48.6	43.3	V	3.88	52.58	44.28	74.0	54.0	21.4	9.7
2437 MHz										
4874	50.90	44.10	H	3.91	54.81	48.01	74.0	54.0	19.2	6.0
4874	48.60	40.70	V	3.91	52.51	44.61	74.0	54.0	21.5	9.4
2462 MHz										
2483.5	47.80	34.60	H	-0.96	46.84	33.64	74.0	54.0	27.2	20.4
2483.5	58.00	45.70	V	-0.96	57.04	44.74	74.0	54.0	17.0	9.3
4924	51.30	44.50	H	3.94	55.24	48.44	74.0	54.0	18.8	5.6
4924	48.90	41.20	V	3.94	52.84	45.14	74.0	54.0	21.2	8.9

Table 7.5.2.2-2: Radiated Spurious Emissions Tabulated Data – 802.11g

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
2412 MHz										
2390	72.50	52.70	V	-1.17	71.33	51.53	74.0	54.0	2.7	2.5
4824	50.4	44.1	H	3.88	54.28	47.98	74.0	54.0	19.7	6.0
4824	49.7	42.7	V	3.88	53.58	46.58	74.0	54.0	20.4	7.4
2437 MHz										
4874	47.5	37.9	H	3.91	51.41	41.81	74.0	54.0	22.6	12.2
4874	49.3	42.3	V	3.91	53.21	46.21	74.0	54.0	20.8	7.8
2462 MHz										
2483.5	71.2	51.8	V	-0.96	70.24	50.84	74.0	54.0	3.8	3.2
4924	48.60	39.90	H	3.94	52.54	43.84	74.0	54.0	21.5	10.2
4924	49.10	42.00	V	3.94	53.04	45.94	74.0	54.0	21.0	8.1

Table 7.5.2.2-3: Radiated Spurious Emissions Tabulated Data – 802.11n (HT 20)

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
2412 MHz										
2390	70.30	48.80	V	-1.17	69.13	47.63	74.0	54.0	4.9	6.4
4824	50.8	44	H	3.88	54.68	47.88	74.0	54.0	19.3	6.1
4824	48.8	39.6	V	3.88	52.68	43.48	74.0	54.0	21.3	10.5
2437 MHz										
4874	49.80	42.70	H	3.91	53.71	46.61	74.0	54.0	20.3	7.4
4874	48.60	39.90	V	3.91	52.51	43.81	74.0	54.0	21.5	10.2
2462 MHz										
2483.5	73.20	52.00	V	-0.96	72.24	51.04	74.0	54.0	1.8	3.0
4924	50.30	43.50	H	3.94	54.24	47.44	74.0	54.0	19.8	6.6
4924	48.80	40.30	V	3.94	52.74	44.24	74.0	54.0	21.3	9.8

7.5.2.3 Sample Calculation:

$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation: Peak – 802.11n

Corrected Level: 73.2 + -0.96 = 72.24dBuV/m
Margin: 74dBuV/m – 72.24dBuV/m = 1.8dB

Example Calculation: Average – 802.11n

Corrected Level: 52.00 + -0.96 - 0 = 51.04dBuV
Margin: 54dBuV – 51.04dBuV = 3.0dB

7.6 Maximum Power Spectral Density in the Fundamental Emission – FCC 15.247(e) ISED Canada: RSS-247 5.2(b)

7.6.1 Measurement Procedure

The power spectral density was measured in accordance with the FCC KDB 558074 D01 DTS Meas Guidance referencing Subclause 11.10 of ANSI C63.10. The PKPSD methods were applied. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer applying suitable attenuation. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to 100 kHz. The Video Bandwidth (VBW) was set to 300 kHz. Span was set to 1.5 times the channel bandwidth. The trace was set to single sweep with the Peak detector active.

7.6.2 Measurement Results

Performed by: Jeremy Pickens

Table 7.6.2-1: Power Spectral Density

Modulation	Frequency (MHz)	PSD (dBm)
802.11b	2412	3.261
	2437	4.476
	2462	4.543
802.11g	2412	2.232
	2437	2.960
	2462	2.829
802.11n(HT20)	2412	1.968
	2437	2.683
	2462	2.601

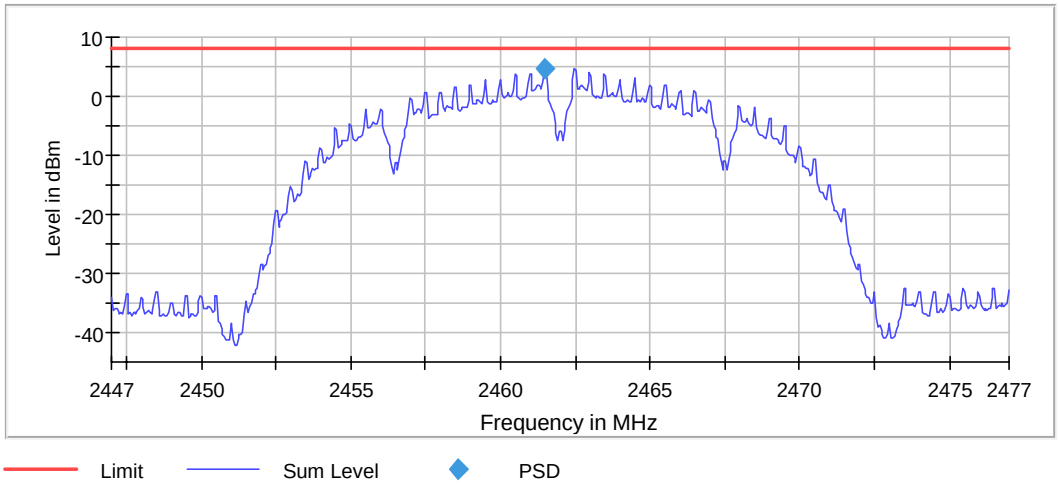


Figure 7.6.2-1: Sample PSD Plot

Table 7.6.2-2: Sample Measurement Settings (PSD)

Setting	Instrument Value	Target Value
Start Frequency	2.44700 GHz	2.44700 GHz
Stop Frequency	2.47700 GHz	2.47700 GHz
Span	30.000 MHz	30.000 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	600	~ 600
Sweeptime	1.040 ms	AUTO
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	Sweep
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	15 / max. 150	max. 150
Stable	2 / 2	2
Max Stable Difference	0.14 dB	0.50 dB

7.7 Duty Cycle

7.7.1 Measurement Procedure

The duty cycle was using a fast power sensor and meter in conjunction with the WMS32 software. The software recorded the on and off times over a sample period and reported the duty cycle.

7.7.2 Measurement Results

Performed by: Jeremy Pickens

The results for all the modes of operation are provided below.

Table 7.7.2-1 Duty Cycle Correction Factor

Mode	Data Rate	Duty Cycle (%)	Correction Factor (dB)
802.11b	1	99.4	0
802.11g	48	81.1	0.9
802.11n (HT 20)	MCS1	96.5	0.2

Note: The correction factor was calculated as 10*log (1/DC)

8 ESTIMATION OF MEASUREMENT UNCERTAINTY

The expanded laboratory measurement uncertainty figures (U_{Lab}) provided below correspond to an expansion factor (coverage factor) k = 1.96 which provide confidence levels of 95%.

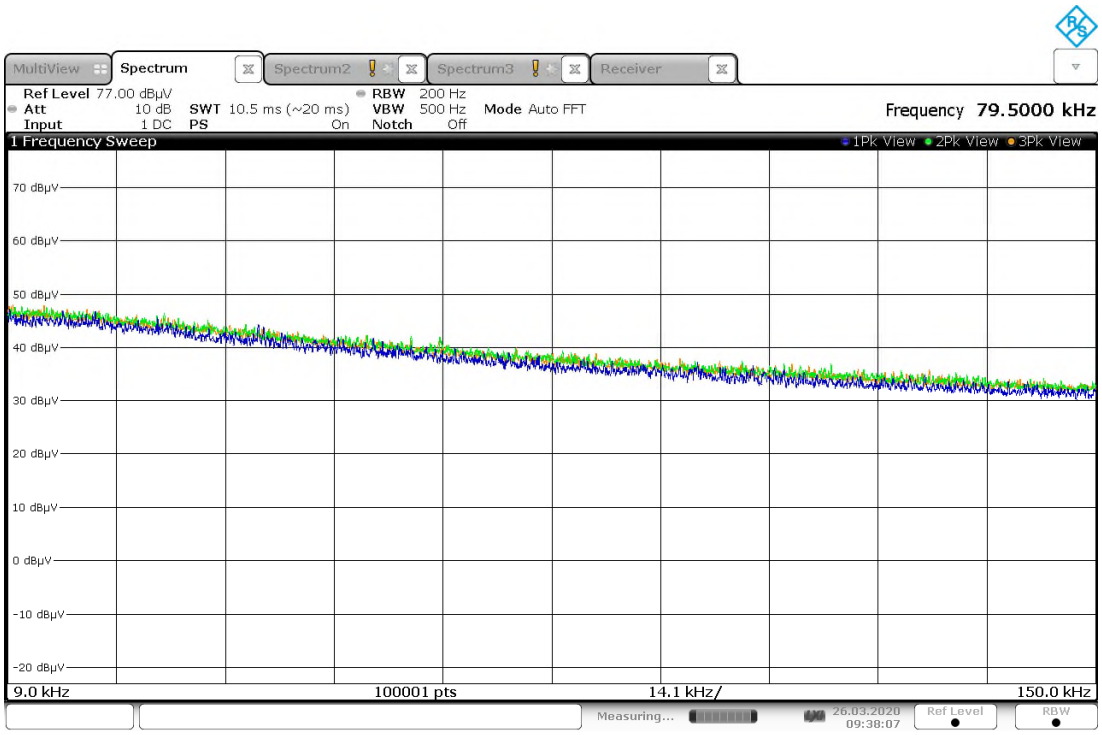
Table 8-1: Estimation of Measurement Uncertainty

Parameter	U_{lab}
Occupied Channel Bandwidth	± 0.009 %
RF Conducted Output Power	± 0.349 dB
Power Spectral Density	± 0.372 dB
Antenna Port Conducted Emissions	± 1.264 dB
Radiated Emissions ≤ 1 GHz	± 5.814 dB
Radiated Emissions > 1 GHz	± 4.318 dB
Temperature	± 0.860 °C
Radio Frequency	± 2.832×10^{-8}
AC Power Line Conducted Emissions	± 3.360 dB

9 CONCLUSION

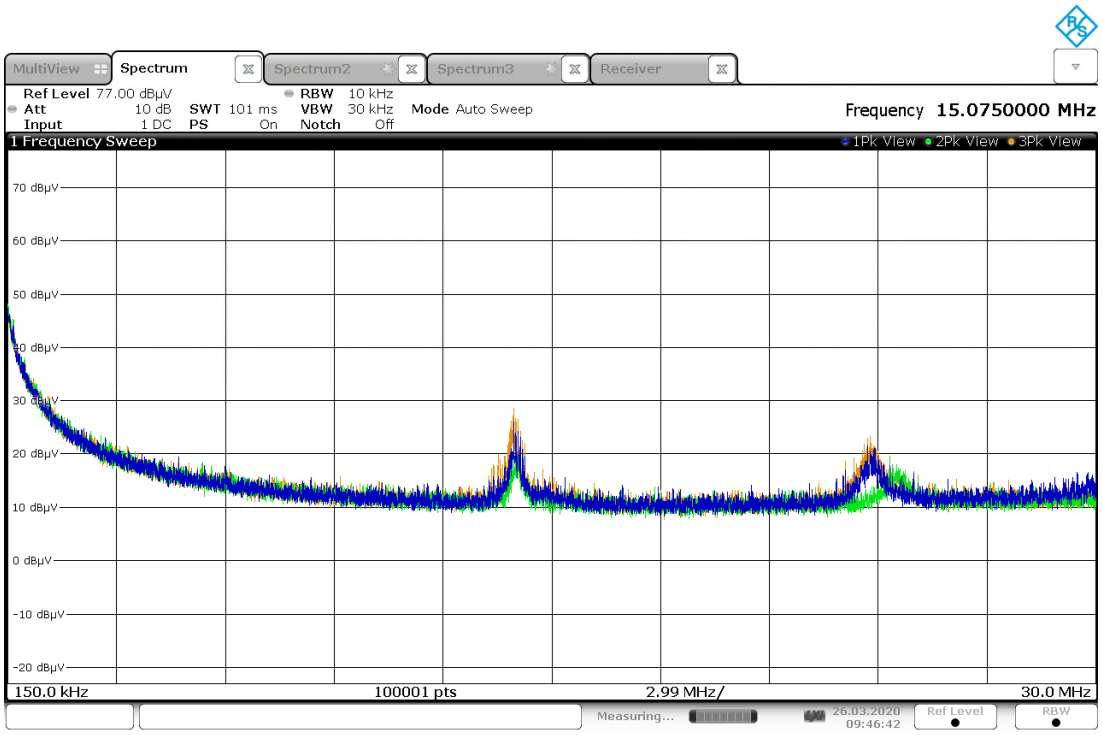
In the opinion of TUV SUD the WDSB, manufactured by Deere & Company meets the requirements of FCC Part 15 subpart C and ISED Canada's Radio Standards Specification RSS-247 for the tests documented herein.

Appendix A: Plots



09:38:08 26.03.2020

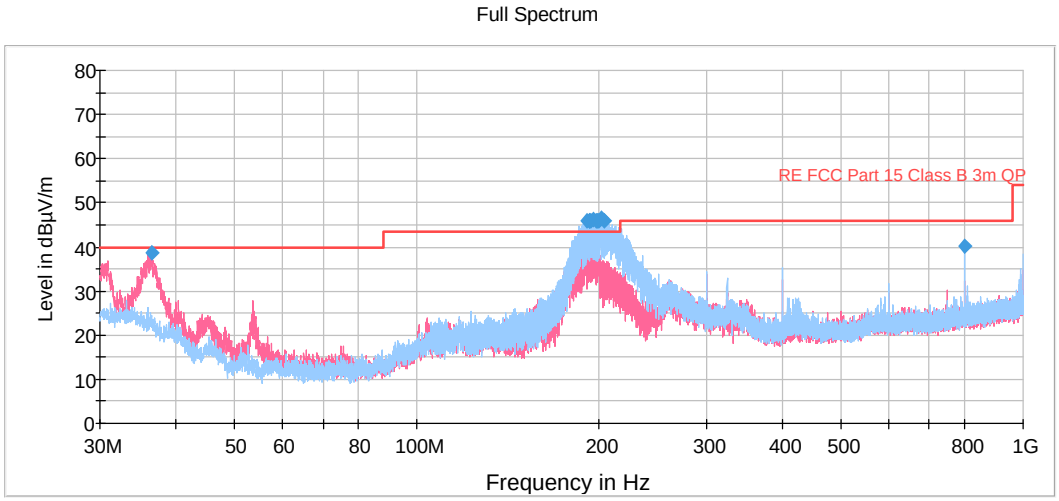
Figure A-1: Radiated Emissions – 9kHz-150kHz



09:46:42 26.03.2020

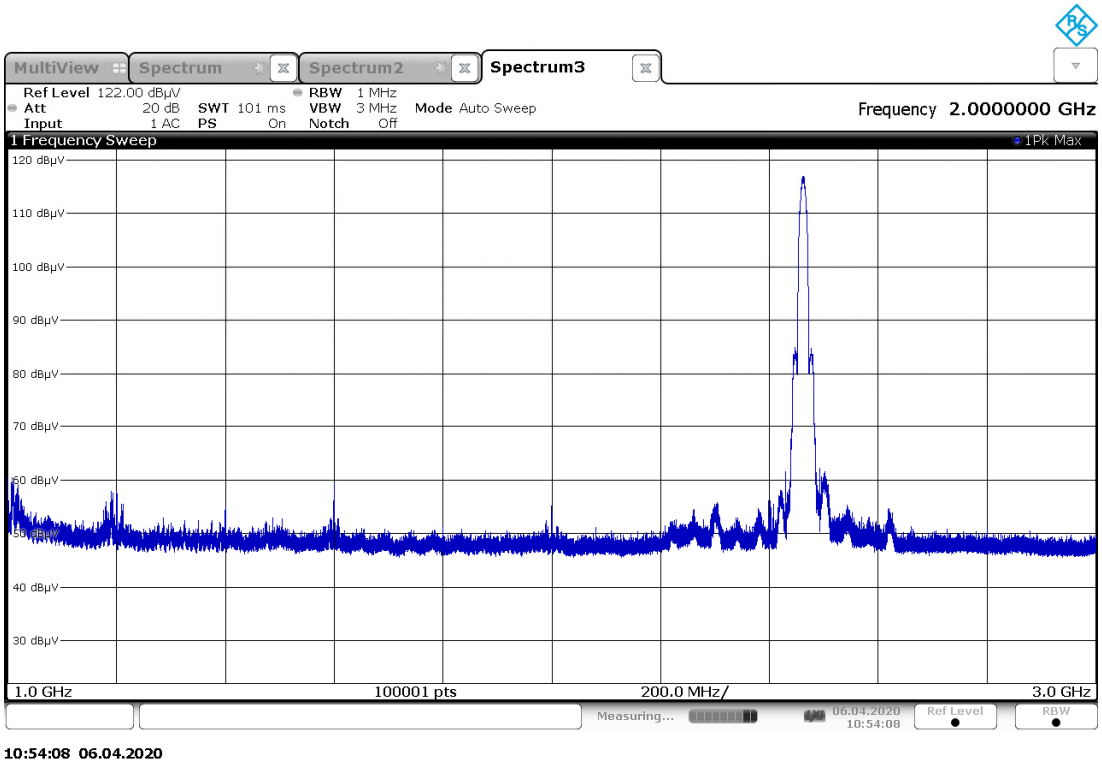
Note: Emissions above the noise floor are ambient not associated with the DUT.

Figure A-2: Radiated Emissions – 150kHz-30MHz



Note: Emissions above the noise floor are from the digital sections of the DUT and not associated with the radio.

Figure A-3: Radiated Emissions – 30MHz-1GHz



10:54:08 06.04.2020

Note: Emissions above the noise floor are from the digital sections of the DUT and not associated with the radio.

Figure A-4: Radiated Emissions – 1GHz-3GHz

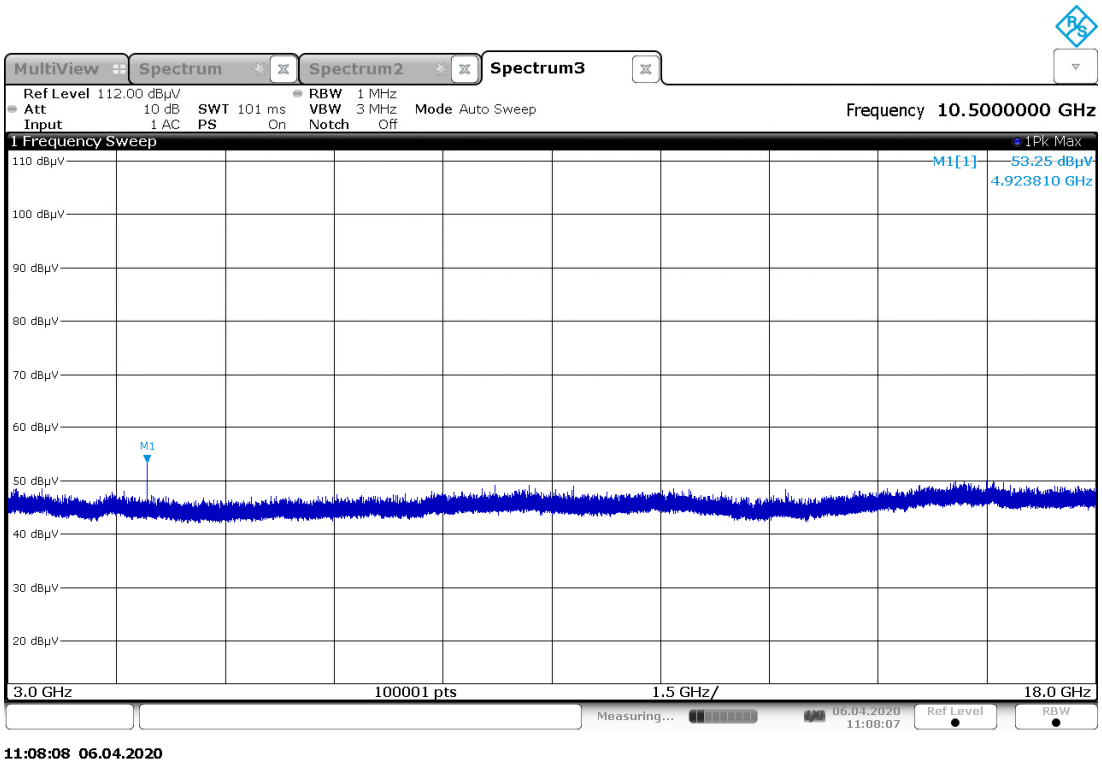


Figure A-5: Radiated Emissions – 3GHz-18GHz

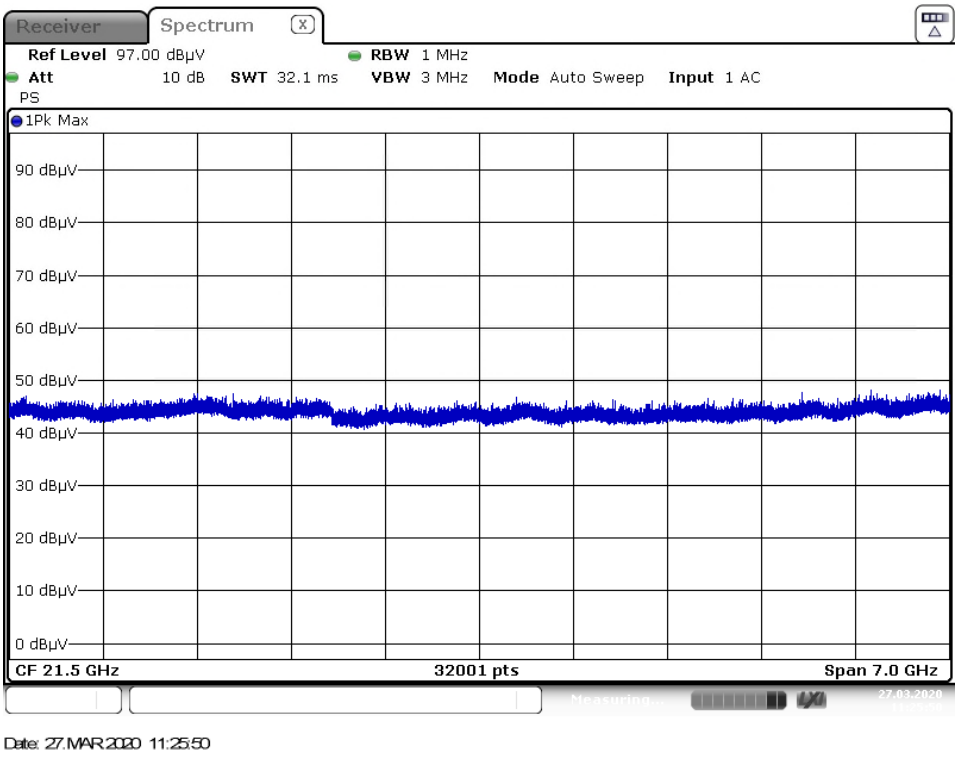


Figure A-6: Radiated Emissions – 18GHz-25GHz

END REPORT