RF Test Report

Project Number: 4724254 **Proposal:** SUW-202101000320

Report Number: 4724254EMC09 **Revision Level:** 1

Client: Deere & Company

Equipment Under Test: JDLink R Modem - 4G

Model Number: MA4R

FCC ID: OV5-MA4R

IC ID: 11137A-MA4R

Applicable Standards: ANSI C63.10: 2013 (FCC Part 15 Subpart C, § 15.247)
RSS-247, Issue 2
RSS-GEN Issue 5

Report issued on: 12 January 2022

Test Result: Compliant

FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER: 3212.01
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.

Prepared by: Jeremy Pickens, RF Lab Manager

Reviewed by: David Schramm, Operations Manager

Remarks: This report details the results of the testing carried out on one sample; the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

Table of Contents

1 Summary of Test Results

Test Description	Test Specification		Test Result
Bandwidth	15.247(a)(2)	RSS-247 5.2(a) RSS-GEN 6.7	Compliant
Peak Output Power	15.247(b)(3)	RSS-247 5.4 (d)	Compliant
Power Spectral Density	15.247(e)	RSS-247 5.2 (b)	Compliant
Conducted Spurious Emissions / Band Edge	15.247(d)	RSS-247 5.5	Compliant
Field Strength of Spurious Radiation	15.247(d)	RSS-247 5.5	Compliant
Emissions in Restricted Frequency Bands	15.205, 15.209	RSS-GEN 8.9, 8.10	Compliant
Antenna Requirement	15.203	RSS-GEN 6.8	Compliant
AC Powerline Conducted Emissions	15.107, 15.207	RSS-GEN 8.8	NA[1]

1) The device has no facility for connection to the AC mains.

1.1 *Modifications Required for Compliance*

None

2 General Information

2.1 *Client Information*

Name:	Deere & Company
Address:	One John Deere Place
City, State, Zip, Country:	Moline, IL 61265, USA

2.2 *Test Laboratory*

Name:	SGS North America, Inc.
Address:	620 Old Peachtree Road NW, Suite 100
City, State, Zip, Country:	Suwanee, GA 30024, USA
Accrediting Body:	A2LA
Type of lab:	Testing Laboratory
Certificate Number:	3212.01
Designation Number:	US1126
CAB Identifier:	US0186

2.3 *General Information of EUT*

Product Description:	JDLink R Modem - 4G
Model Number:	MA4R
Serial Numbers:	PCMA4MA200091
Frequency Range:	2412 – 2462 MHz
Data Modes:	802.11b, 802.11g, 802.11nHT20, 802.11nHT40
Antenna:	Port WF1 (WLAN only) - External Dipole– (1.8dBi) Port WF2 - External Proprietary – (-2.62 to -0.44dBi)
Rated Voltage:	9 – 32Vdc
Test Voltage:	12Vdc
Sample Received Date:	10 April 2021
Dates of testing:	20– 27 April 2021

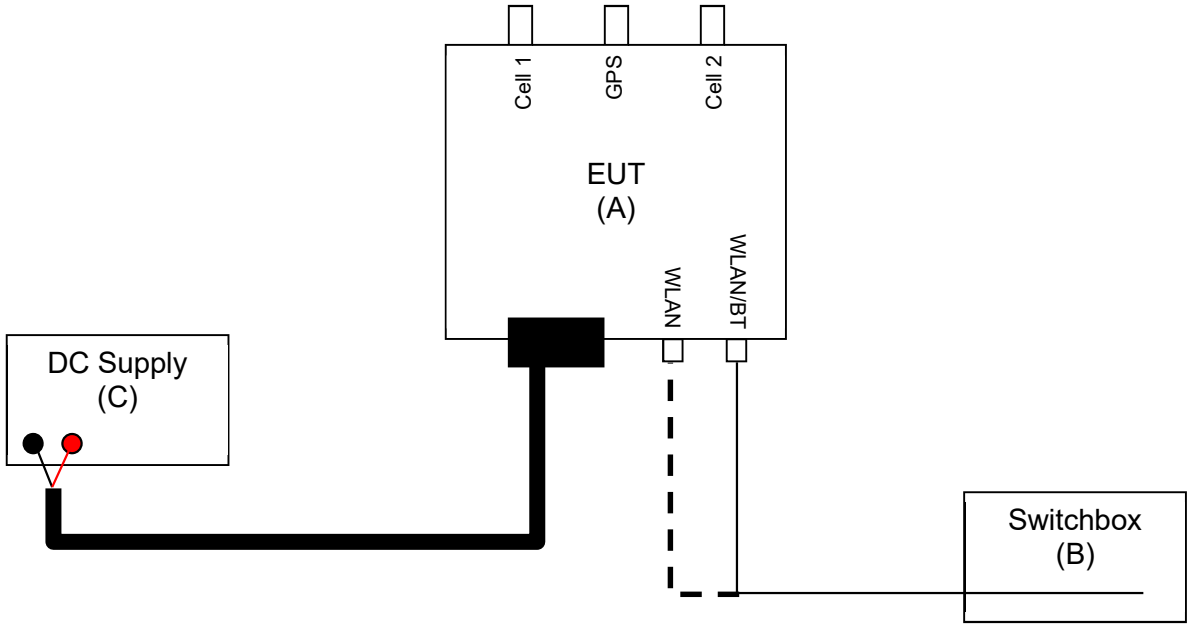
2.4 *Operating Modes and Conditions*

Using WL commands through the Linux backbone, the EUT was programmed to transmit on low, mid and high channels in all necessary modulation and modes of operation. The worst-case data rates were determined to be:

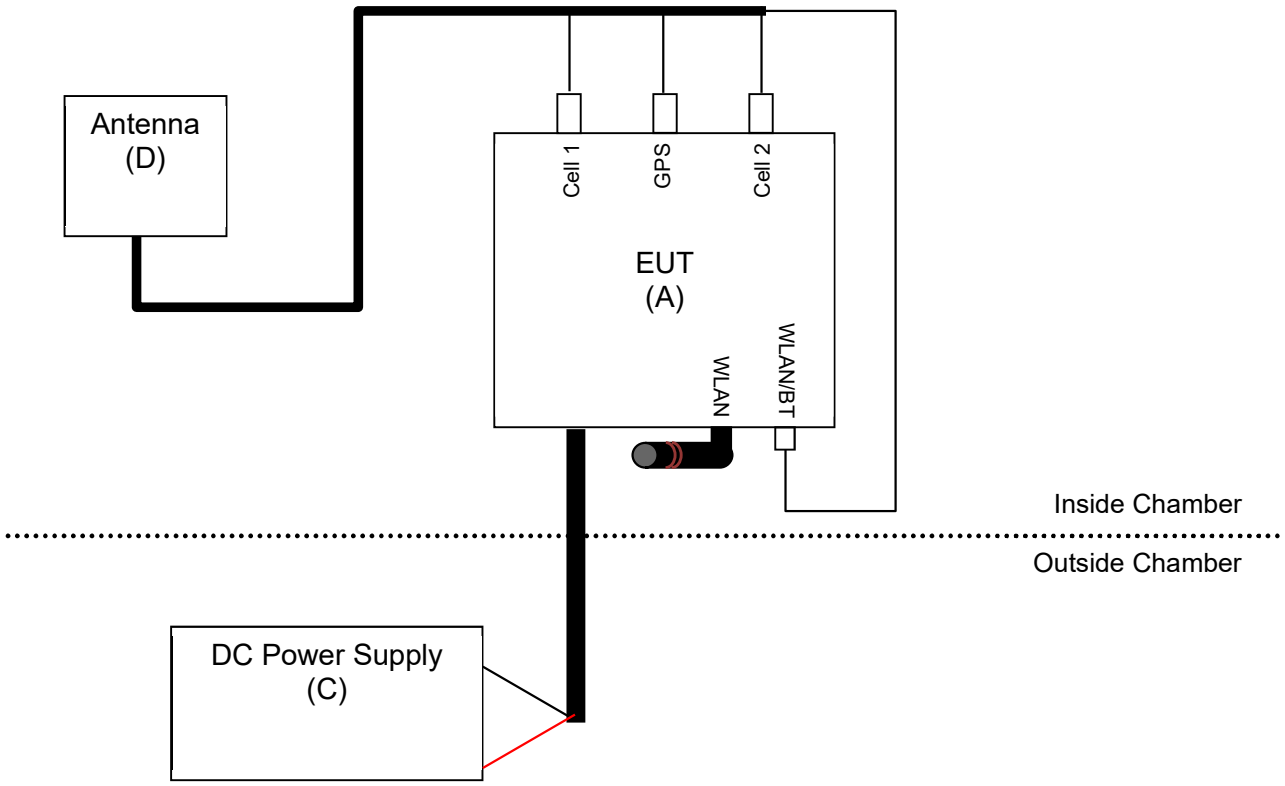
- 802.11b, 2Mbps
- 802.11g, 48Mbps
- 802.11nHT20, MCS5
- 802.11nHT40, MCS3

The wl command power setting for all testing was 20000

2.5 *EUT Connection Block Diagram – Conducted Measurements*



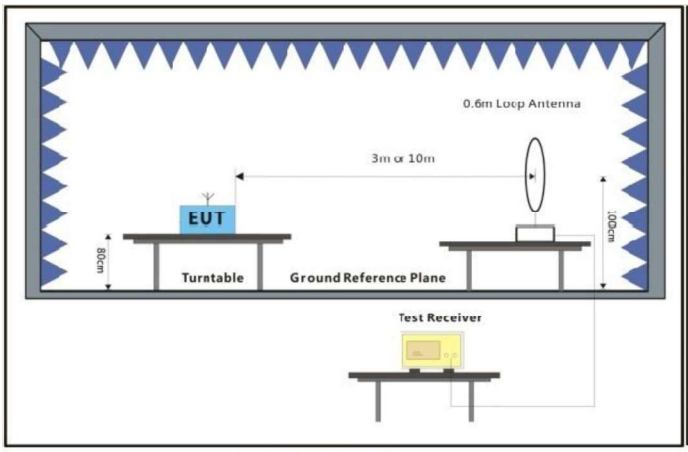
2.6 *EUT Connection Block Diagram – Radiated Measurements*



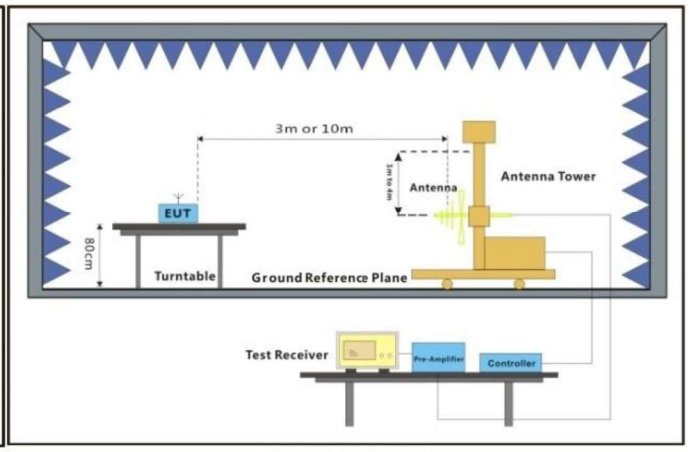
2.7 *System Configurations*

Device reference	Manufacturer	Description	Model Number	Serial Number
A	Deere & Company	JDLink R Modem - 4G	MA4M	PCMA4MA200091
B	TSTPASS	Switchbox	SB1	SUW_0001
C	Rigol	DC Power Supply	DP711	DP7A202200419
D	PCTEL	LTE/Wi-Fi/GPS/GLONASS Antenna	PFA10882	Sample ID: 20210400113

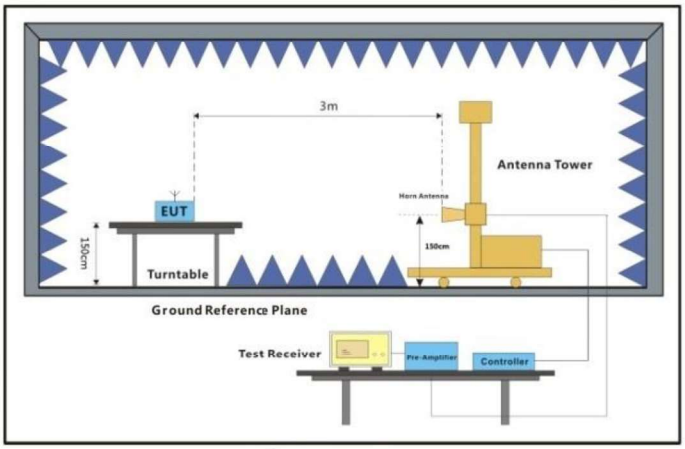
2.8 *Configuration Diagrams (Radiated)*



Below 30MHz



30MHz-1GHz



Above 1GHz

3 Bandwidth

3.1 *Test Result*

Test Description	Test Specification		Test Result
6 dB Bandwidth 99% Occupied Bandwidth	15.247(a)(2)	RSS-247 5.2(a) RSS-GEN 6.7	Compliant

3.2 *Test Method*

The procedures from ANSI C63.10: 2013 clause 11.8 and 558074 D01 DTS Meas Guidance v05r2 were used to determine the 6 dB bandwidth.

The procedures from ANSI C63.10: 2013 clause 6.9.2 were used to measure the 99% Occupied Bandwidth.

3.3 *Test Site*

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	25.0 °C
Relative Humidity:	38.9 %
Atmospheric Pressure:	97.9 kPa

3.4 *Test Equipment*

Test End Date: 21-Apr-2021 Tester: JOP

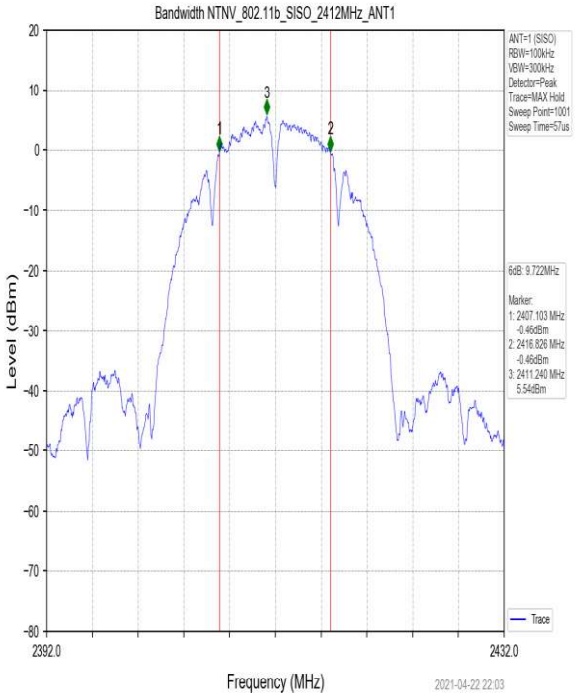
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
DC POWER SUPPLY, PROGRAMMABLE	DP711	RIGOL	18027	VBU	VBU
RF Cable SMA	HULL150A-29P-29P-36	HASCO COMPONENTS	19101	16-Mar-2021	16-Mar-2022
RF CABLE SMA	HULL150A-29P-29P-36	HASCO COMPONENTS	19102	16-Mar-2021	16-Mar-2022
TSTPASS SWITCHBOX	SB1	TSTPASS	20168	CNR	CNR
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	27-Dec-2019	27-Dec-2021

3.5 *Test Data – 6dB Bandwidth*

Frequency (MHz)	Mode	ANT No.	6dB BW (MHz)	Limit (MHz)	Verdict
2412	802.11b	WF2	9.722	≥0.5	PASS
2437	802.11b	WF2	9.936	≥0.5	PASS
2462	802.11b	WF2	10.101	≥0.5	PASS
2412	802.11g	WF2	15.153	≥0.5	PASS
2437	802.11g	WF2	15.467	≥0.5	PASS
2462	802.11g	WF2	15.459	≥0.5	PASS
2412	802.11n20	WF2	15.154	≥0.5	PASS
2437	802.11n20	WF2	15.143	≥0.5	PASS
2462	802.11n20	WF2	15.148	≥0.5	PASS
2422	802.11n40	WF2	33.913	≥0.5	PASS
2437	802.11n40	WF2	33.892	≥0.5	PASS
2452	802.11n40	WF2	33.889	≥0.5	PASS

Sample Plot

Low Channel – 802.11b (2412MHz)

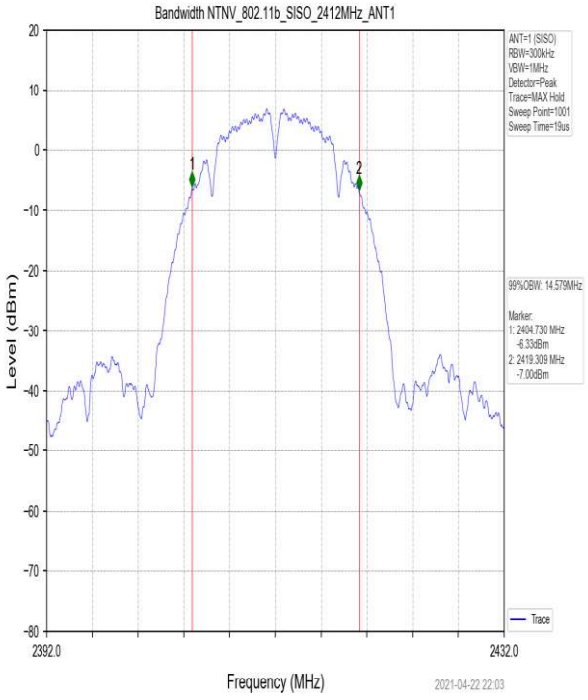


3.6 *Test Data – 99% Bandwidth*

Frequency (MHz)	TX Type	ANT No.	OBW (MHz)	Verdict
2412	802.11b	WF2	14.579	Reported
2437	802.11b	WF2	14.602	Reported
2462	802.11b	WF2	14.573	Reported
2412	802.11g	WF2	16.398	Reported
2437	802.11g	WF2	16.693	Reported
2462	802.11g	WF2	16.273	Reported
2412	802.11n20	WF2	17.668	Reported
2437	802.11n20	WF2	17.996	Reported
2462	802.11n20	WF2	17.596	Reported
2422	802.11n40	WF2	35.902	Reported
2437	802.11n40	WF2	36.037	Reported
2452	802.11n40	WF2	35.880	Reported

Sample Plot

Low Channel – 802.11b (2412MHz)



4 Peak Output Power

4.1 *Test Result*

Test Description	Test Specification		Test Result
Peak Output Power	15.247(b)(3)	RSS-247 S5.4 (d)	Compliant

4.2 *Test Method*

Fundamental peak power measurements were recorded using the procedures from ANSI C63.10: 2013 clause 11.9 and KDB 558074 D01 Measurement Guidance v05r2.

Limit

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. For using antennas with greater than 6dBi of gain, the limit is reduced in dB by the amount the gain exceeds 6dBi (e.g. for a 7.4dBi antenna, the limit is reduced from 30dBm to 28.6dBm)

4.3 *Test Site*

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	25.0 °C
Relative Humidity:	38.9 %
Atmospheric Pressure:	97.9 kPa

4.4 *Test Equipment*

Test End Date: 21-Apr-2021 Tester: JOP

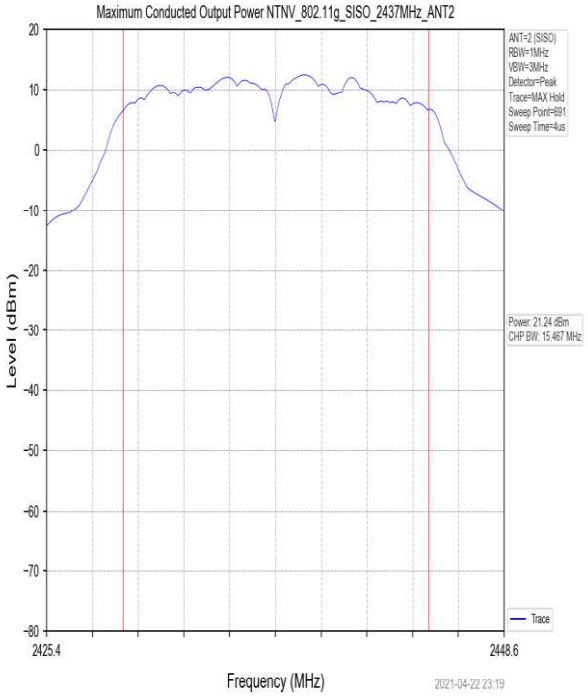
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
DC POWER SUPPLY, PROGRAMMABLE	DP711	RIGOL	18027	VBU	VBU
RF Cable SMA	HULL150A-29P-29P-36	HASCO COMPONENTS	19101	16-Mar-2021	16-Mar-2022
RF CABLE SMA	HULL150A-29P-29P-36	HASCO COMPONENTS	19102	16-Mar-2021	16-Mar-2022
TSTPASS SWITCHBOX	SB1	TSTPASS	20168	CNR	CNR
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	27-Dec-2019	27-Dec-2021

4.5 *Test Data*

Frequency (MHz)	TX Type	ANT No.	Peak Output Power (dBm)	Limit (dBm)	Verdict
2412	802.11b	WF1	15.44	30	PASS
2437	802.11b	WF1	16.43	30	PASS
2462	802.11b	WF1	15.46	30	PASS
2412	802.11g	WF1	18.84	30	PASS
2437	802.11g	WF1	21.24	30	PASS
2462	802.11g	WF1	17.47	30	PASS
2412	802.11n20	WF1	18.88	30	PASS
2437	802.11n20	WF1	21.05	30	PASS
2462	802.11n20	WF1	17.49	30	PASS
2412	802.11b	WF2	16.54	30	PASS
2437	802.11b	WF2	17.18	30	PASS
2462	802.11b	WF2	17.97	30	PASS
2412	802.11g	WF2	16.98	30	PASS
2437	802.11g	WF2	19.56	30	PASS
2462	802.11g	WF2	17.55	30	PASS
2412	802.11n20	WF2	16.84	30	PASS
2437	802.11n20	WF2	19.74	30	PASS
2462	802.11n20	WF2	17.64	30	PASS
2422	802.11n40	WF2	14.89	30	PASS
2437	802.11n40	WF2	15.34	30	PASS
2452	802.11n40	WF2	15.58	30	PASS

Sample Plot

Mid Channel – 802.11g, Port WF1 (2437MHz)



5 Power Spectral Density

5.1 *Test Result*

Test Description	Test Specification		Test Result
Power Spectral Density	15.247(e)	RSS-247 S5.2 (b)	Compliant

5.2 *Test Method*

Power spectral density measurements were recorded using the procedures from ANSI C63.10: 2013 clause 11.10 and KDB 558074 D01 Measurement Guidance v05r2.

Limit
The limit is 8 dBm.

5.3 *Test Site*

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	25.0 °C
Relative Humidity:	38.9 %
Atmospheric Pressure:	97.9 kPa

5.4 *Test Equipment*

Test End Date: 21-Apr-2021 Tester: JOP

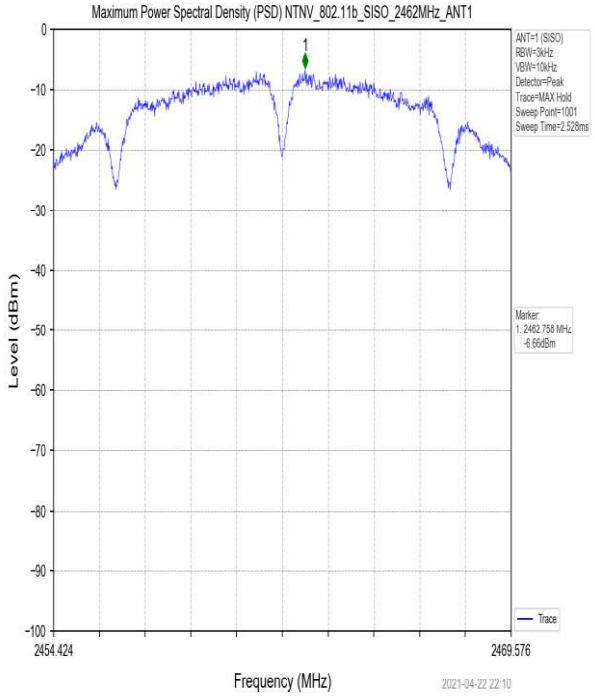
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
DC POWER SUPPLY, PROGRAMMABLE	DP711	RIGOL	18027	VBU	VBU
RF Cable SMA	HULL150A-29P-29P-36	HASCO COMPONENTS	19101	16-Mar-2021	16-Mar-2022
RF CABLE SMA	HULL150A-29P-29P-36	HASCO COMPONENTS	19102	16-Mar-2021	16-Mar-2022
TSTPASS SWITCHBOX	SB1	TSTPASS	20168	CNR	CNR
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	27-Dec-2019	27-Dec-2021

5.5 *Test Data*

Frequency (MHz)	TX Type	ANT No.	Peak PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
2412	802.11b	WF1	-8.91	≤8	PASS
2437	802.11b	WF1	-8.15	≤8	PASS
2462	802.11b	WF1	-9.11	≤8	PASS
2412	802.11g	WF1	-12.71	≤8	PASS
2437	802.11g	WF1	-10.65	≤8	PASS
2462	802.11g	WF1	-13.88	≤8	PASS
2412	802.11n20	WF1	-13.92	≤8	PASS
2437	802.11n20	WF1	-11.22	≤8	PASS
2462	802.11n20	WF1	-13.87	≤8	PASS
2412	802.11b	WF2	-7.16	≤8	PASS
2437	802.11b	WF2	-6.71	≤8	PASS
2462	802.11b	WF2	-6.66	≤8	PASS
2412	802.11g	WF2	-14.14	≤8	PASS
2437	802.11g	WF2	-13.48	≤8	PASS
2462	802.11g	WF2	-14.40	≤8	PASS
2412	802.11n20	WF2	-15.48	≤8	PASS
2437	802.11n20	WF2	-12.55	≤8	PASS
2462	802.11n20	WF2	-14.51	≤8	PASS
2422	802.11n40	WF2	-19.61	≤8	PASS
2437	802.11n40	WF2	-18.87	≤8	PASS
2452	802.11n40	WF2	-19.84	≤8	PASS

Sample Plot

Mid Channel – 802.11b, Port WF2 (2437MHz)



6 Conducted Spurious Emissions / Band Edge

6.1 *Test Result*

Test Description	Test Specification		Test Result
Conducted Spurious Emissions	15.247(d)	RSS-247 S5.5	Compliant

6.2 *Test Method*

Spurious emissions in non-restricted frequency bands were recorded using the methods defined in ANSI C63.10: 2013 clause 11.11 and KDB 558074 D01 Measurement Guidance v05r2.

Lowest, middle, and highest channels were investigated.

Because the maximum conducted peak output power was used to determine compliance with the output power limits, the limit in any 100 kHz band outside of the authorized band is 20 dB below the maximum in-band peak level.

6.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	23.2 °C
Relative Humidity:	41.2 %
Atmospheric Pressure:	99.1 kPa

6.4 *Test Equipment*

Test End Date: 21-Apr-2021 Tester: JOP

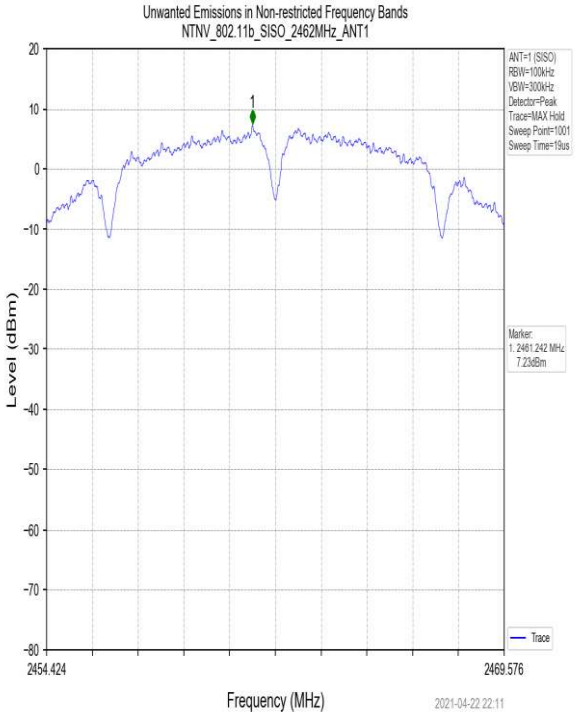
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
DC POWER SUPPLY, PROGRAMMABLE	DP711	RIGOL	18027	VBU	VBU
RF Cable SMA	HULL150A-29P-29P-36	HASCO COMPONENTS	19101	16-Mar-2021	16-Mar-2022
RF CABLE SMA	HULL150A-29P-29P-36	HASCO COMPONENTS	19102	16-Mar-2021	16-Mar-2022
TSTPASS SWITCHBOX	SB1	TSTPASS	20168	CNR	CNR
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	27-Dec-2019	27-Dec-2021

6.5 *Test Data*

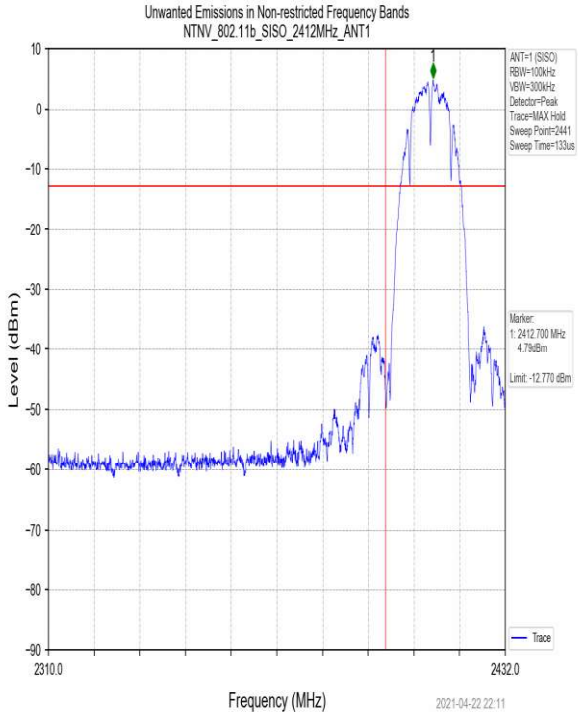
Frequency (MHz)	TX Type	ANT No.	Spurious Conducted Emission (dBm)	Limit (dBm)	Verdict
2412	802.11b	WF2	Refer to test graph	-12.77	PASS
2437	802.11b	WF2	Refer to test graph	-12.77	PASS
2462	802.11b	WF2	Refer to test graph	-12.77	PASS
2412	802.11g	WF2	Refer to test graph	-16.77	PASS
2437	802.11g	WF2	Refer to test graph	-16.77	PASS
2462	802.11g	WF2	Refer to test graph	-16.77	PASS
2412	802.11n20	WF2	Refer to test graph	-16.35	PASS
2437	802.11n20	WF2	Refer to test graph	-16.35	PASS
2462	802.11n20	WF2	Refer to test graph	-16.35	PASS
2422	802.11n40	WF2	Refer to test graph	-23.11	PASS
2437	802.11n40	WF2	Refer to test graph	-23.11	PASS
2452	802.11n40	WF2	Refer to test graph	-23.11	PASS

802.11b

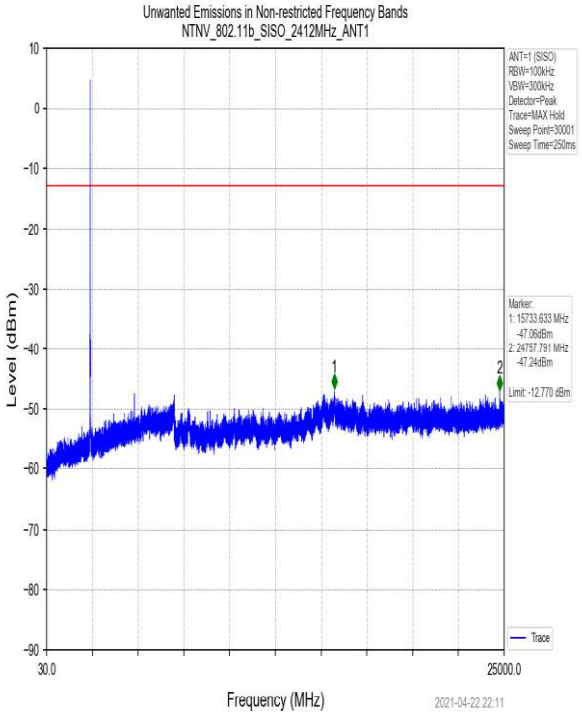
In-Band Reference



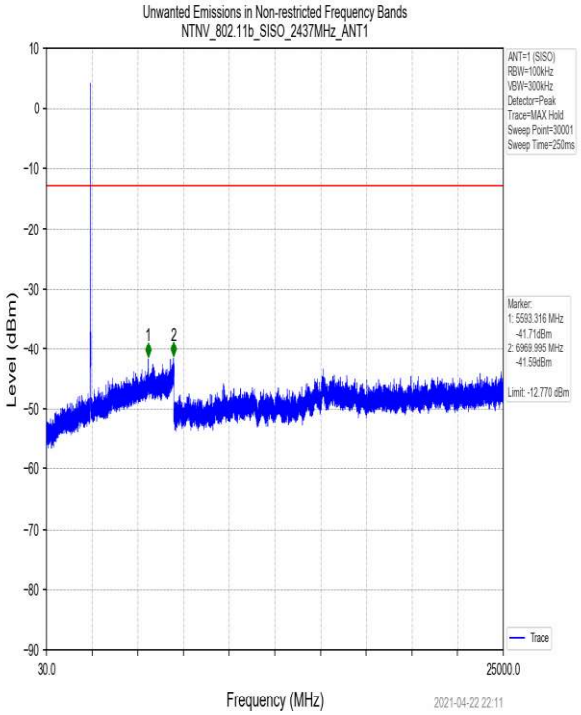
Lower Band Edge - Low Channel (2402MHz)



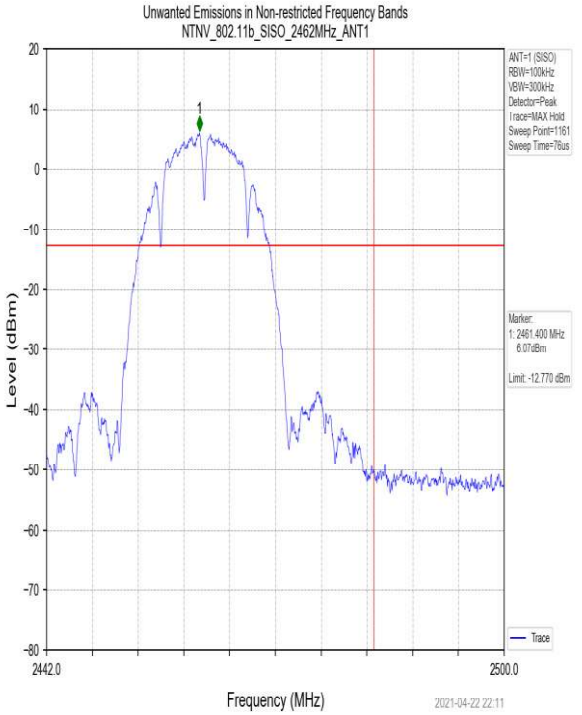
Full Spectrum - Low Channel (2402MHz)



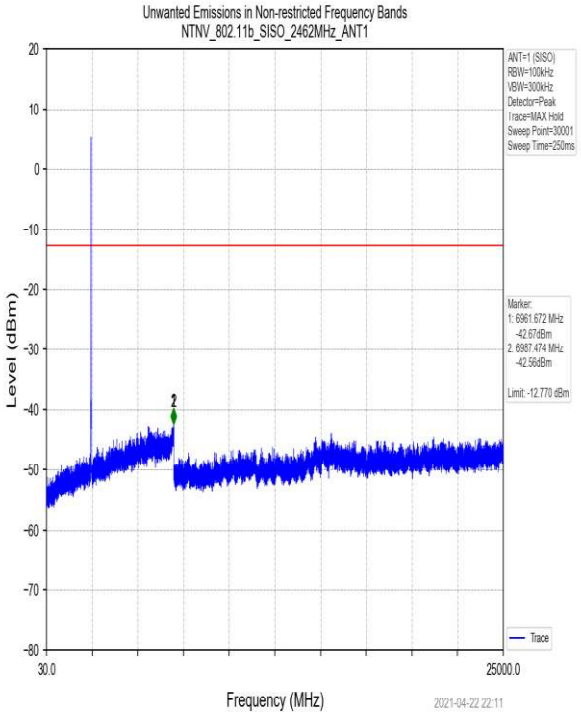
Full Spectrum - Mid Channel (2440MHz)



Upper Band Edge – High Channel (2480MHz)

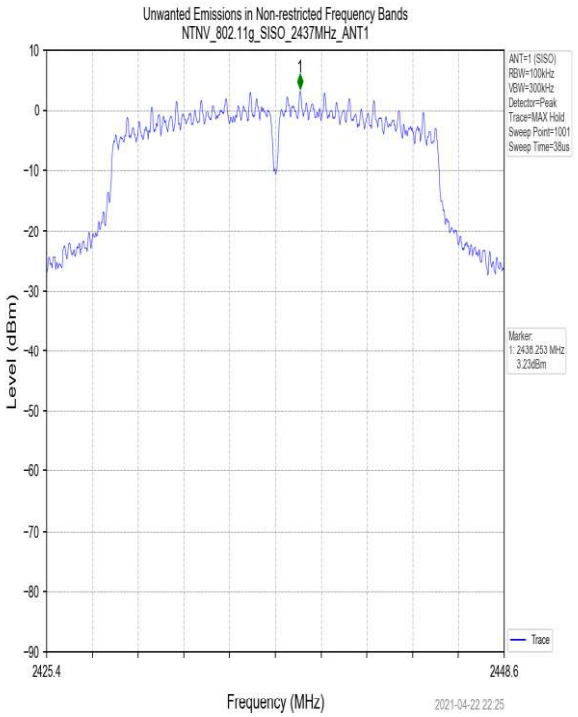


Full Spectrum - High Channel (2480MHz)

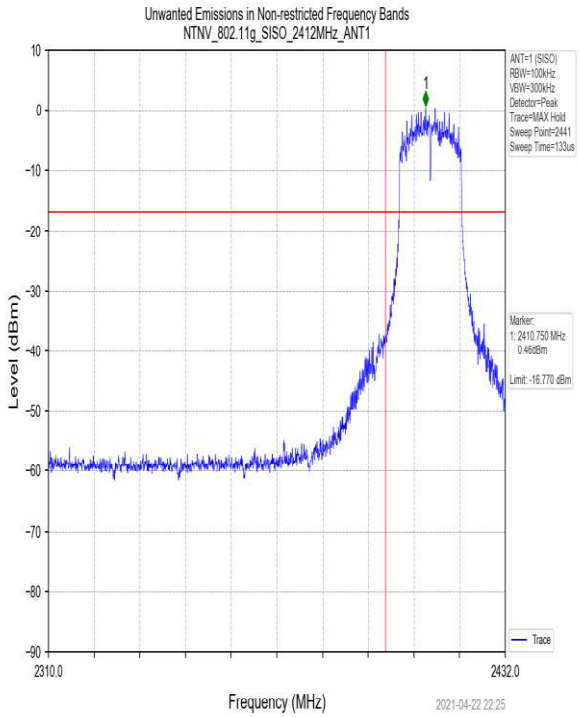


802.11g

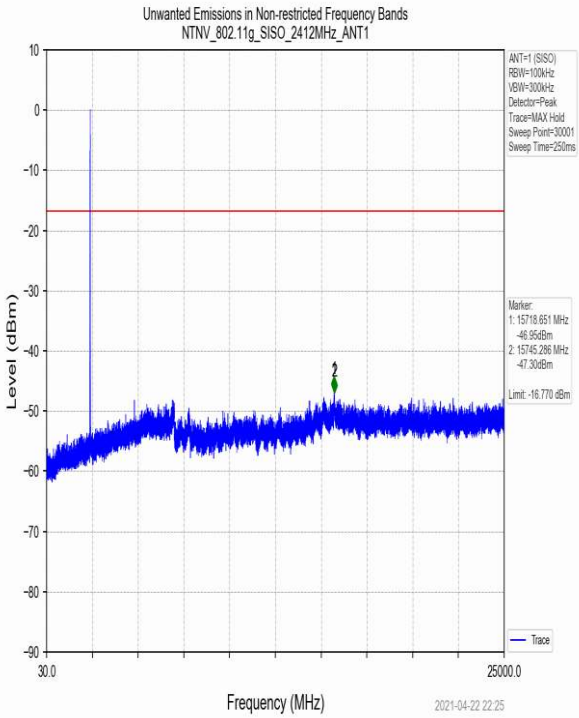
In-Band Reference



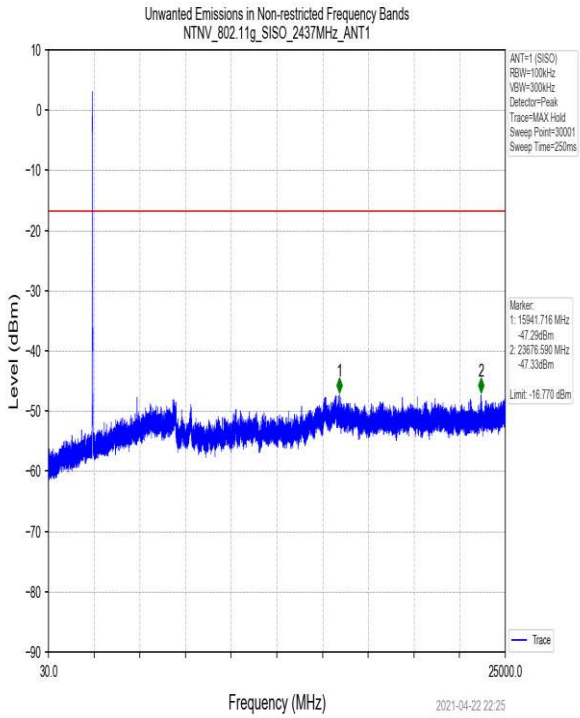
Lower Band Edge - Low Channel (2402MHz)



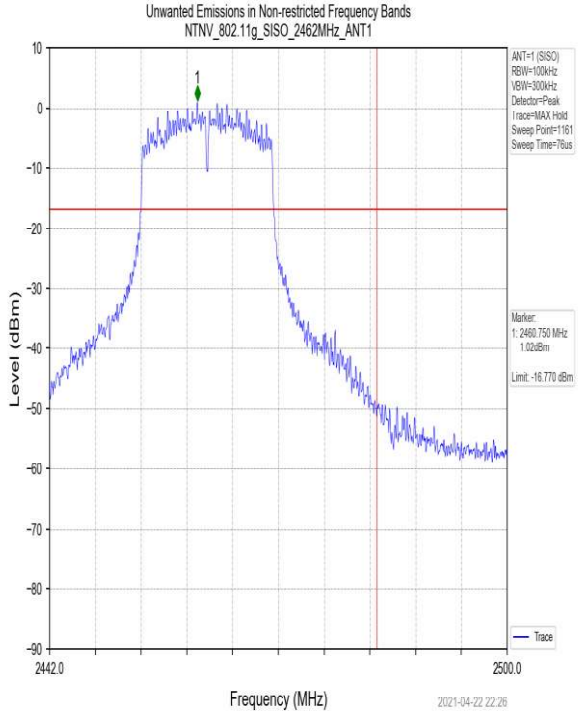
Full Spectrum - Low Channel (2402MHz)



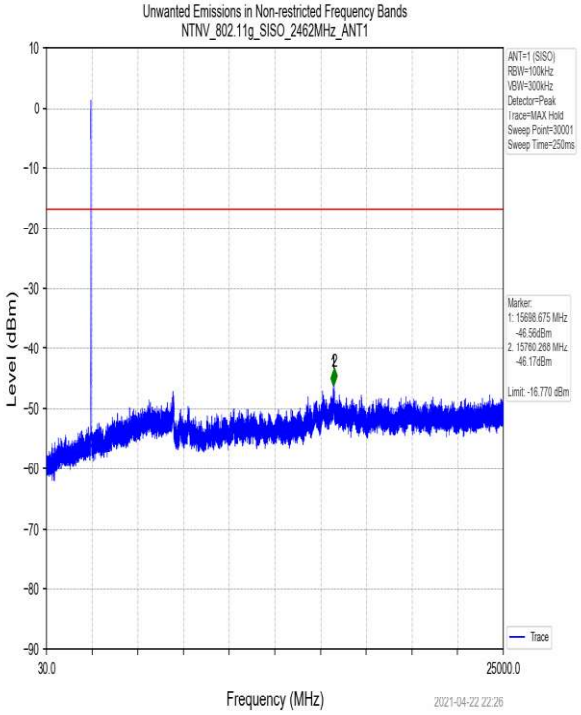
Full Spectrum - Mid Channel (2440MHz)



Upper Band Edge – High Channel (2480MHz)

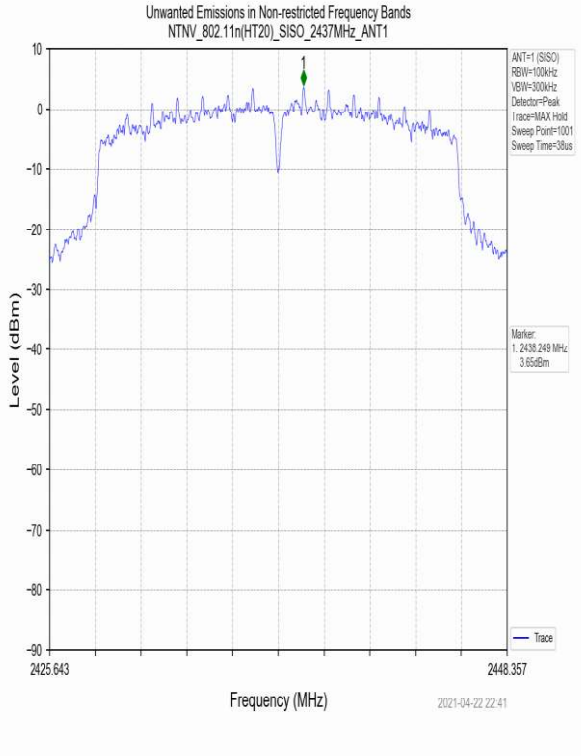


Full Spectrum - High Channel (2480MHz)

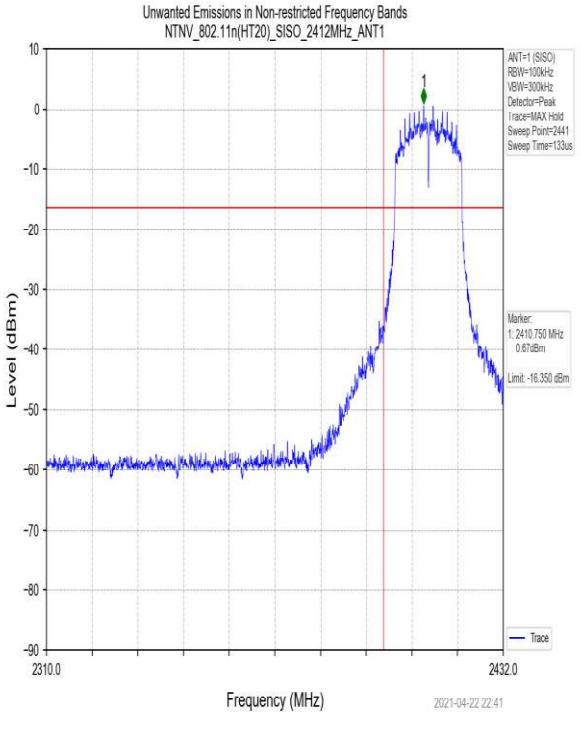


802.11n20

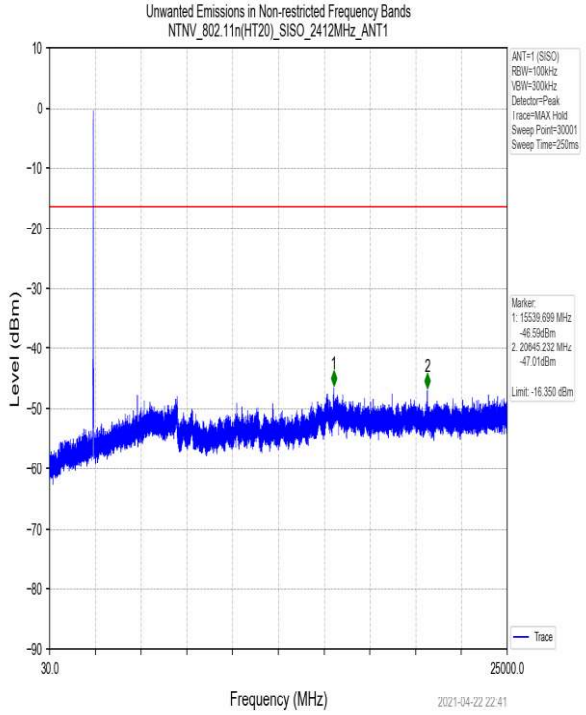
In-Band Reference



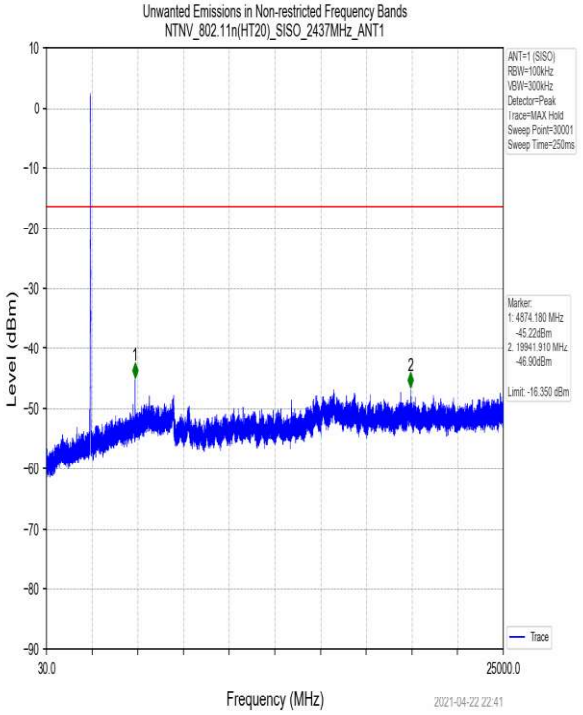
Lower Band Edge - Low Channel (2402MHz)



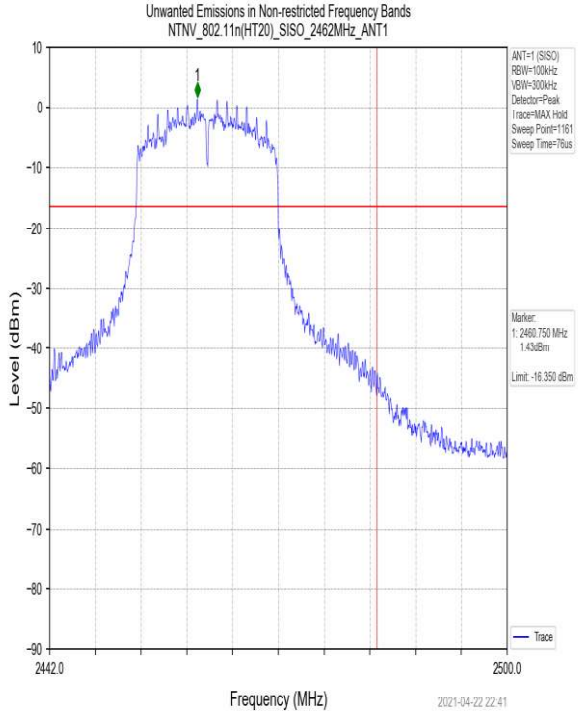
Full Spectrum - Low Channel (2402MHz)



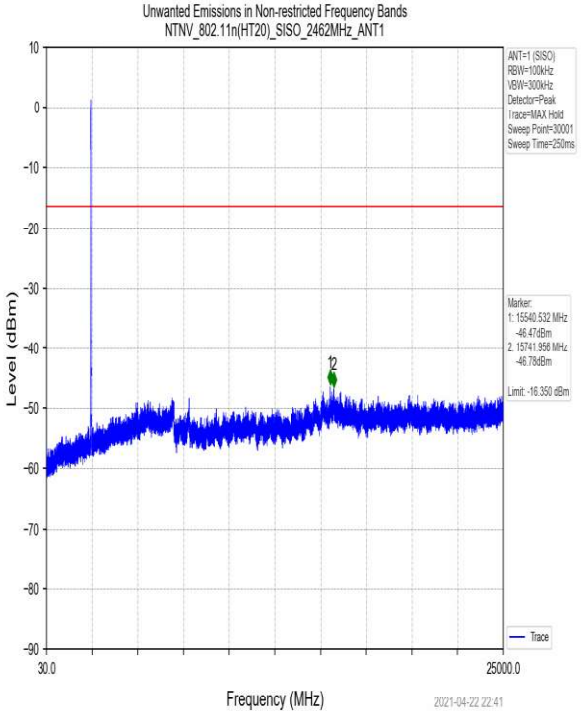
Full Spectrum - Mid Channel (2440MHz)



Upper Band Edge – High Channel (2480MHz)

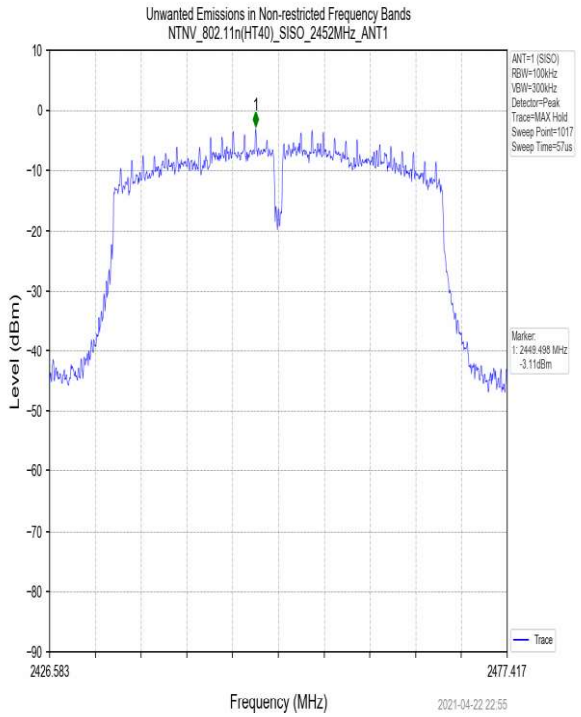


Full Spectrum - High Channel (2480MHz)

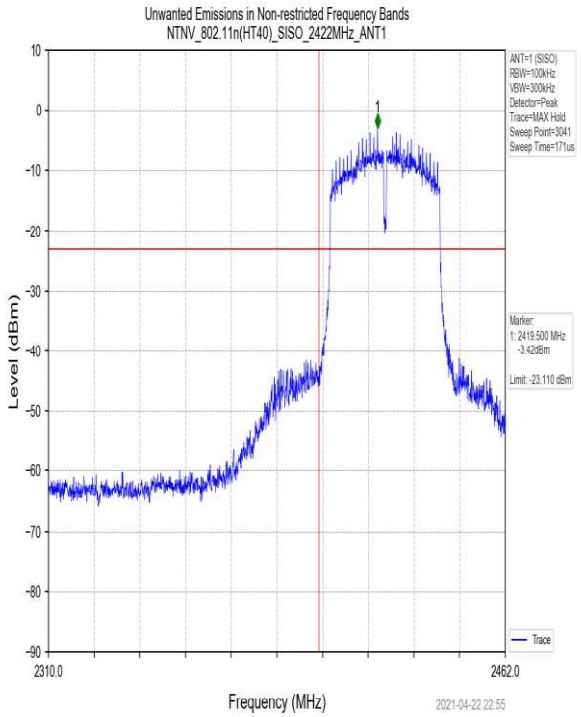


802.11n40

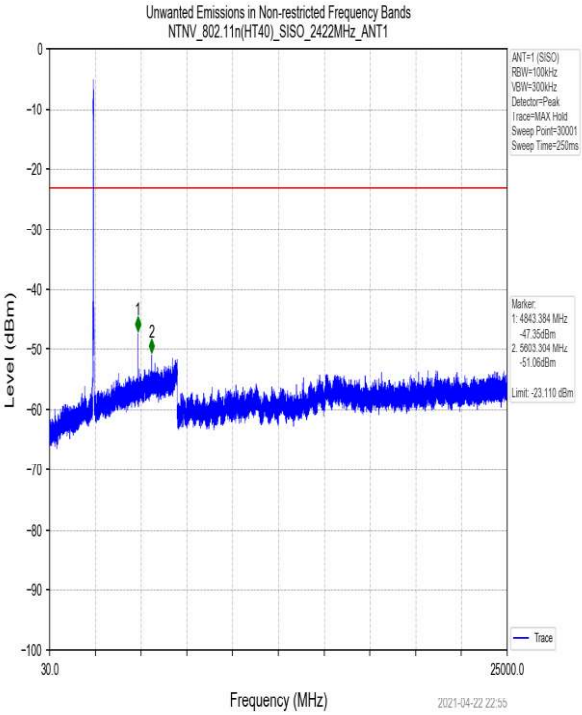
In-Band Reference



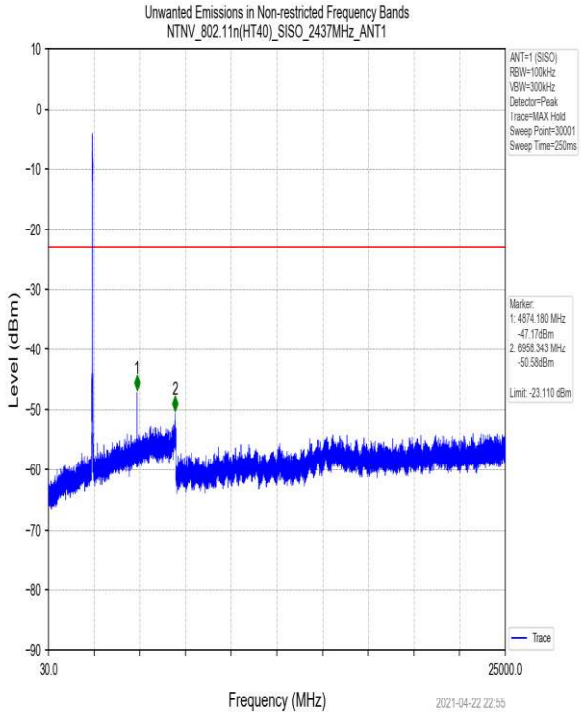
Lower Band Edge - Low Channel (2402MHz)



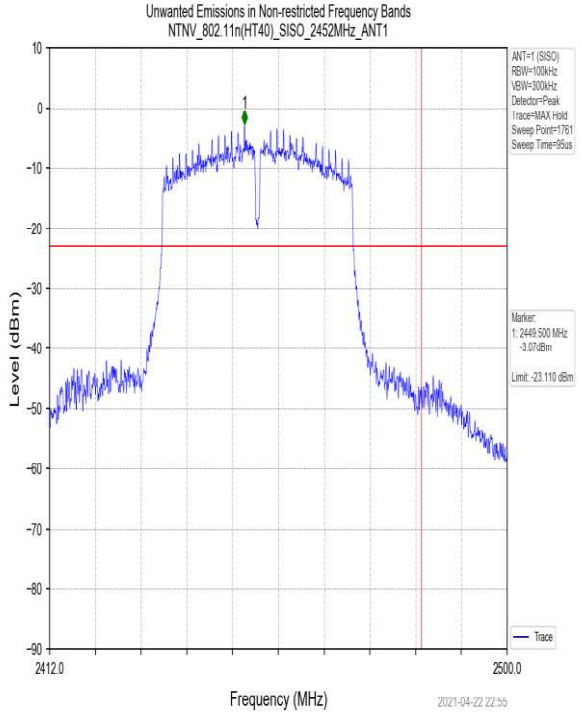
Full Spectrum - Low Channel (2402MHz)



Full Spectrum - Mid Channel (2440MHz)



Upper Band Edge – High Channel (2480MHz)



Full Spectrum - High Channel (2480MHz)