

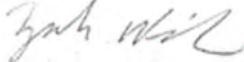
Test Report # 319379 A (WLAN)

Equipment Under Test: SmartCraft Connect

Test Date(s): August 6th – November 17th, 2020

Prepared for: Brunswick Corporation
Attn: Andrew Sember
W6250 Pioneer Road
Fond du Lac, WI 54936

Report Issued by: Zach Wilson, EMC Engineer

Signature: 

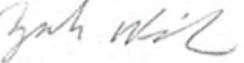
Date: 1/12/2021

Report Reviewed by: Adam Alger, Quality Manager

Signature: 

Date: 11/18/2020

Report Constructed by: Zach Wilson, EMC Engineer

Signature: 

Date: 10/29/2020

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Laird Connectivity Test Services in Review

The Laird Connectivity, Inc. laboratory located at W66 N220 Commerce Court Cedarburg, Wisconsin, 53012 USA is recognized through the following organizations:



A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025:2017 with Electrical (EMC) Scope

A2LA Certificate Number: 1255.01

Scope of accreditation includes all test methods listed herein unless otherwise noted



Federal Communications Commission (FCC) – USA

Accredited Test Firm Registration Number: 953492

Recognition of two 3 meter Semi-Anechoic Chambers



Innovation, Science and Economic Development Canada

Accredited U.S. Identification Number: US0218

Recognition of two 3 meter Semi-Anechoic Chambers

Company: Brunswick Corporation	Page 3 of 53	Name: SmartCraft Connect
Report: TR319379 A		Model: SCC-1
Job: C-3380		Serial: Engineering Sample

1 TEST REPORT SUMMARY

During **August 6th – November 17th, 2020** the Equipment Under Test (EUT), **SmartCraft Connect**, as provided by **Brunswick Corporation** was tested to the following requirements of the **Federal Communications Commission and Innovation, Science and Economic Development Canada**:

FCC 15.247 and RSS-247, DTS

Requirement	Description	Specification	Method	Result
FCC: 15.247 (a)(2) IC: RSS-247 5.2 (a)	Digital Modulation System 6 dB bandwidth	500 kHz	ANSI C63.10	Compliant
FCC: 2.1049 IC: RSS-GEN 6.7	Occupied Bandwidth	Reported	ANSI C63.10	Reported
FCC: 15.247 (b)(3) IC: RSS-247 5.4 (d)	Maximum Conducted Output Power	30 dBm	ANSI C63.10	Compliant
FCC: 15.247 (e) IC: RSS-247 5.2 (b)	Digital Modulation System Power Spectral Density	8 dBm / 3 kHz	ANSI C63.10	Compliant
FCC: 15.247 (d) IC: RSS-247 5.5	RF Spurious Emissions at the Transmitter Antenna Terminal	20 dBc	ANSI C63.10	Compliant
FCC: 15.247 (d) IC: RSS-GEN 8.10	Spurious Radiated Emissions in Restricted Bands	FCC 15.209 RSS-GEN 8.9	ANSI C63.10	Compliant
FCC: 2.1055 (d) IC: RSS-GEN 6.11	Frequency Stability	Reported	ANSI C63.10	Reported

Notice:

The results relate only to the item tested as configured and described in this report. Any additional configurations, modes of operation, or modifications made to the equipment under test after the specified test date(s) are at the decision of the client and may not apply to the data seen in this test report.

The decision rule for Pass / Fail assessment to the specification or standard listed in this test report has been agreed upon by the client and laboratory to be as follows:

Measurement Type	Rule
Emissions – Amplitude	1 dB below specified limit
Emissions – Frequency	1% less than the specification
Immunity	Tested at specified level

2 CLIENT INFORMATION

Company Name	Brunswick Corporation
Contact Person	Andrew Sember
Address	W6250 Pioneer Road Fond du Lac, WI 54936

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	SmartCraft Connect
Model Number	SCC-1
Serial Number	Engineering Sample
FCC ID	2APYL-GH19392020
IC ID	26775-HG19392020

2.2 Product Description

The EUT is a multimedia device for a motorboat. It is powered by 12VDC. The EUT contains the SILabs WFM200S022XNN WLAN 2.4 GHz Module with a Johanson Chip Antenna. The EUT also contains the SILabs EFR32BG21A010F1024IM32-BR BLE module with a Johanson Chip Antenna. The radios are not capable of simultaneous transmission.

2.3 Modifications Incorporated for Compliance

None noted at time of test

2.4 Deviations and Exclusions from Test Specifications

None noted at time of test

2.5 Channels and Orientations

The channels 1 (2412MHz), 6 (2437MHz), and 11 (2462MHz) were tested. Side and vertical orientations were tested.

2.6 Radio Programming

The radio is programmed via the customer created program; Mercury RF Tester, v1.0.4. This program was installed on a provided PC.

2.7 Power Tables

Power Settings Used			
Channel	Protocol	Data Rate	Power Setting
1	802.11g	6 Mbps	8
11	802.11g	6 Mbps	8
1	802.11g	54 Mbps	30
11	802.11g	54 Mbps	30
1	802.11b	1 Mbps	30
11	802.11b	1 Mbps	30
1	802.11b	11 Mbps	30
11	802.11b	11 Mbps	30
1	802.11n	MCS0	8
11	802.11n	MCS0	8
1	802.11n	MCS7	30
11	802.11n	MCS7	30

3 REFERENCES

Publication	Edition	Date	AMD 1
CFR 47 Part 15	-	2020	-
RSS-GEN	5	2014	2019
RSS-247	2	2017	-
ANSI C63.10		2013	

4 UNCERTAINTY SUMMARY

Using the guidance of the following publications the calculated measurement uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of $k = 2$.

References	Version / Date
CISPR 16-4-1	Ed. 2 (2009-02)
CISPR 16-4-2	Ed. 2 (2011-06)
CISPR 32	Ed. 1 (2012-01)
ANSI C63.23	2012
A2LA P103	February 4, 2016
A2LA P103c	August 10, 2015
ETSI TR 100-028	V1.3.1 (2001-03)

Measurement Type	Configuration	Uncertainty $\pm$
Radiated Emissions	Biconical Antenna	5.0 dB
Radiated Emissions	Log Periodic Antenna	5.3 dB
Radiated Emissions	Horn Antenna	4.7 dB
AC Line Conducted Emissions	Artificial Mains Network	3.4 dB
Telecom Conducted Emissions	Asymmetric Artificial Network	4.9 dB
Disturbance Power Emissions	Absorbing Clamp	4.1 dB
Radiated Immunity	3 Volts/meter	2.2 dB
Conducted Immunity	CDN/EM/BCI	2.4/3.5/3.4 dB
EFT Burst/Surge	Peak pulse voltage	164 volts
ESD Immunity	15 kV level	1377 Volts

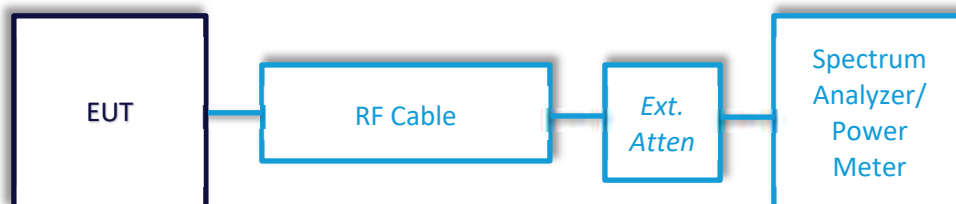
Parameter	ETSI U.C. $\pm$	U.C. $\pm$
Radio Frequency, from F0	1×10^{-7}	0.55×10^{-7}
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
Supply voltages	3 %	1 %

5 TEST DATA

5.1 Antenna Port Conducted Emissions

Description of Measurement	The direct measurement of emissions at the antenna port of the EUT is achieved by use of a RF connection to a spectrum analyzer or power meter. The cable and attenuator factors are loaded into the analyzer or power meter allowing for direct measurement readings without the need for further corrections.
Example Calculations	Measurement (dBm) + Cable factor (dB) + External Attenuator (dB) = Corrected Reading (dBm) Margin (dB) = Limit (dBm) – Corrected Reading (dBm)

Block Diagram



Instrumentation



Date : 29-Oct-2020 Test : Conducted Radio Job : C-3380
 PE : Zach Wilson Customer : Mercury Marine Quote : 319379

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	7/14/2019	7/14/2021	Active Calibration
2	AA 960144	Cable	Gore	EKD01D010720	5800373	12/9/2019	12/9/2020	Active Verification



Date : 6-Nov-2020 Test : Conducted Radio Job : C-3380
 PE : Zach Wilson Customer : Mercury Marine Quote : 319379

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	RE 20001	Power Analyzer	Keysight	8990B	MY51000458	7/14/2019	10/28/2021	Active Calibration
2	RE 20002	Power Sensor	Keysight	NI924A	MY55290003	10/27/2020	10/27/2021	Active Calibration

5.1.1 DTS and 99% Bandwidth

Operator	Shane Dock	QA	Jon Dilley
Temperature	22.7°C	R.H. %	47.5%
Test Date	8/13/2020	Location	Conducted Radio
Requirement	FCC 15.247 §a.2	Method	ANSI C63.10 §11.8.2 ANSI C63.10 §6.9.3

Limits:

DTS BW: > 500 kHz

99%: Reported

Test Parameters

Frequency	2412MHz, 2437MHz, 2462MHz	Setup	Conducted
RBW	DTS: 100kHz 99%: 200kHz	VBW	DTS: 300kHz 99%: 620kHz
Detector(s)	Max hold with peak detector	Span	30MHz

EUT Parameters

Input Power	12VDC	Mode	WLAN TX
Channels	1, 6, 11	Data Rates	802.11b: 1,11Mbps 802.11g: 6,54Mbps 802.11n: MCS0,MCS7

Data Tables

802.11b 1Mbps		
Channel	99% BW (kHz)	6 dB BW (MHz)
1	12693.00	8.05
6	12663.00	8.06
11	12634.00	8.08

802.11b 11Mbps		
Channel	99% BW (kHz)	6 dB BW (MHz)
1	14538.00	10.60
6	14585.00	9.94
11	14564.00	10.79

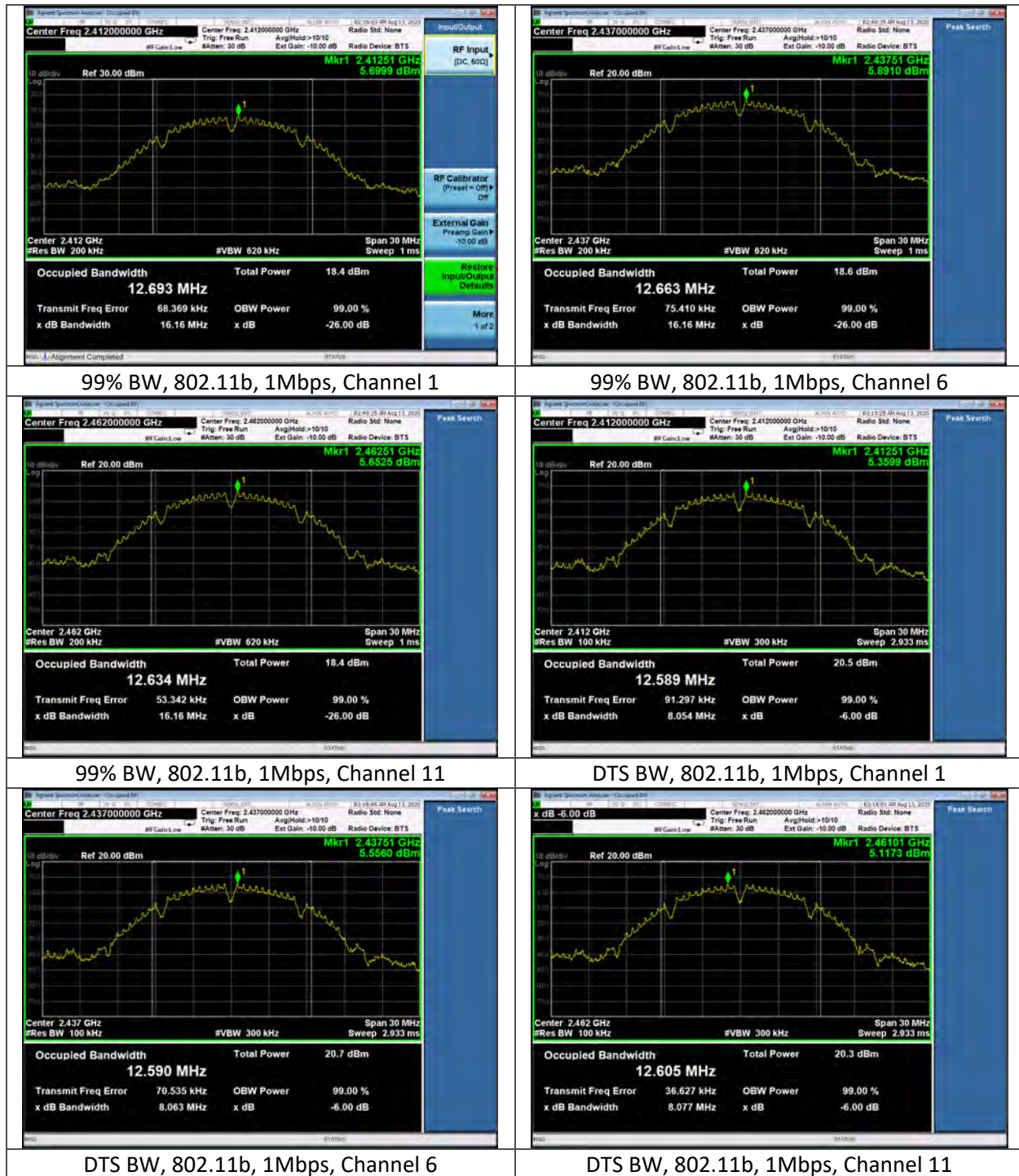
802.11g 6Mbps		
Channel	99% BW (kHz)	6 dB BW (MHz)
1	17053.00	14.06
6	17022.00	15.11
11	17025.00	15.11

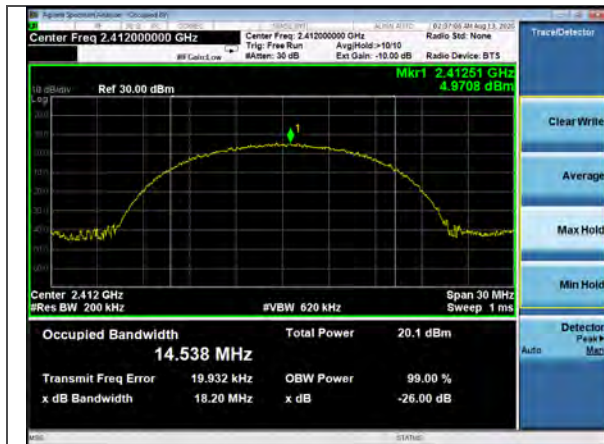
802.11g 54Mbps		
Channel	99% BW (kHz)	6 dB BW (MHz)
1	16518.00	16.47
6	16494.00	16.49
11	16494.00	16.48

802.11n MCS0		
Channel	99% BW (kHz)	6 dB BW (MHz)
1	17802.00	15.09
6	17796.00	15.11
11	17750.00	15.11

802.11n MCS7		
Channel	99% BW (kHz)	6 dB BW (MHz)
1	17583.00	17.62
6	17619.00	17.70
11	17633.00	17.63

Plots

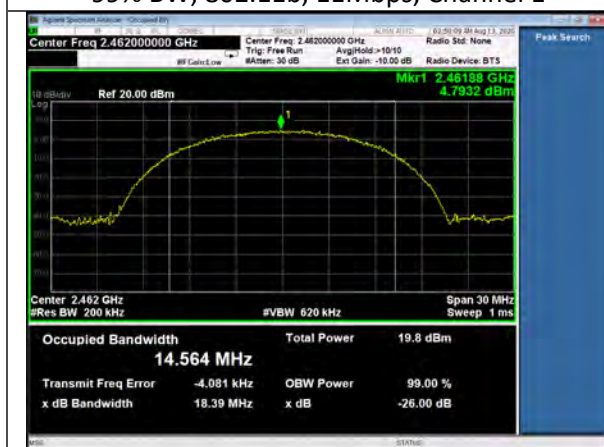




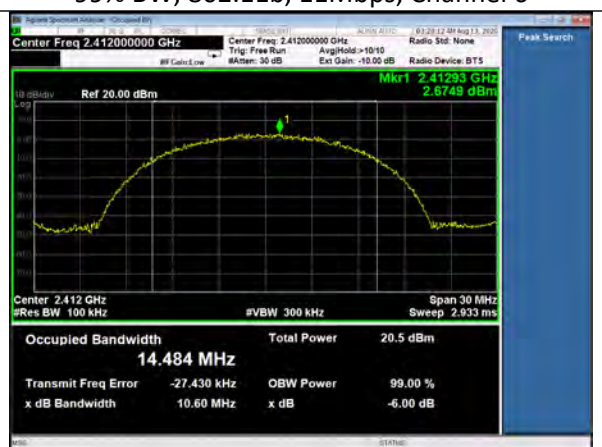
99% BW, 802.11b, 11Mbps, Channel 1



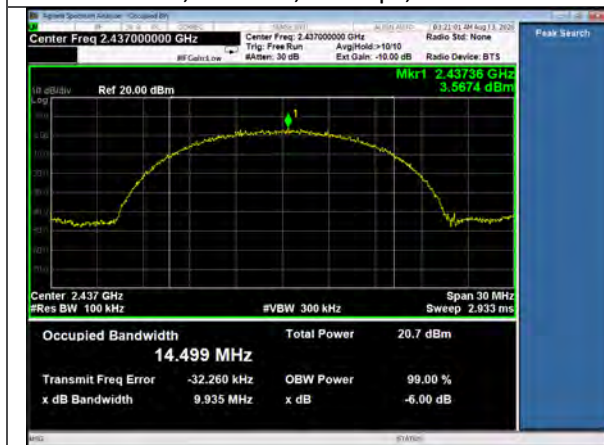
99% BW, 802.11b, 11Mbps, Channel 6



99% BW, 802.11b, 11Mbps, Channel 11



DTS BW, 802.11b, 11Mbps, Channel 1



DTS BW, 802.11b, 11Mbps, Channel 6



DTS BW, 802.11b, 11Mbps, Channel 11



99% BW, 802.11g, 6Mbps, Channel 1



99% BW, 802.11g, 6Mbps, Channel 6



99% BW, 802.11g, 6Mbps, Channel 11



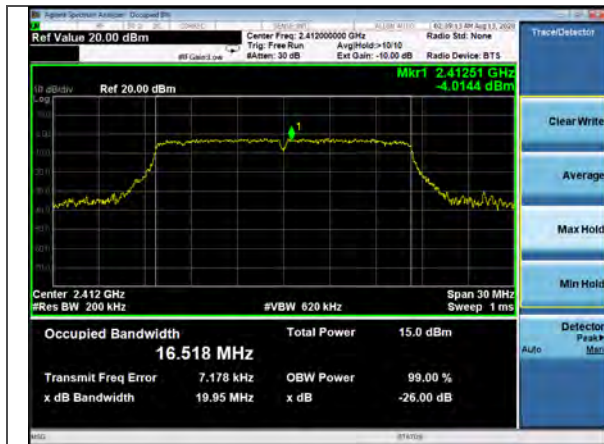
DTS BW, 802.11g, 6Mbps, Channel 1



DTS BW, 802.11g, 6Mbps, Channel 6



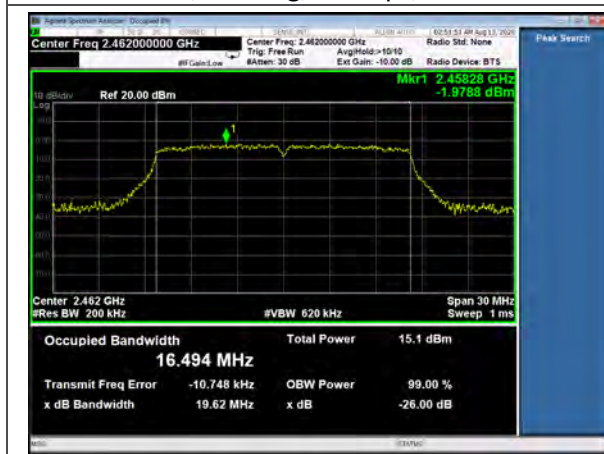
DTS BW, 802.11g, 6Mbps, Channel 11



99% BW, 802.11g, 54Mbps, Channel 1



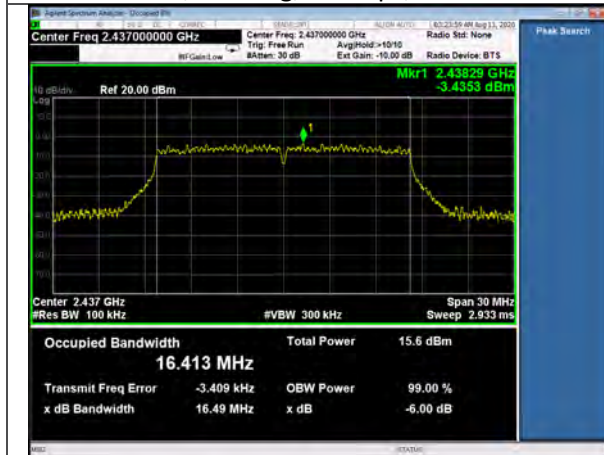
99% BW, 802.11g, 54Mbps, Channel 6



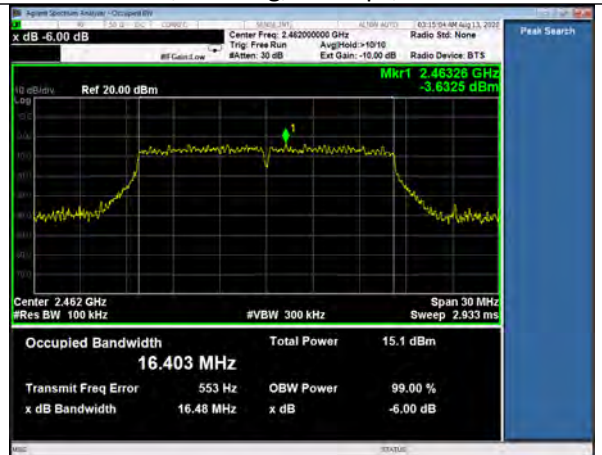
99% BW, 802.11g, 54Mbps, Channel 11



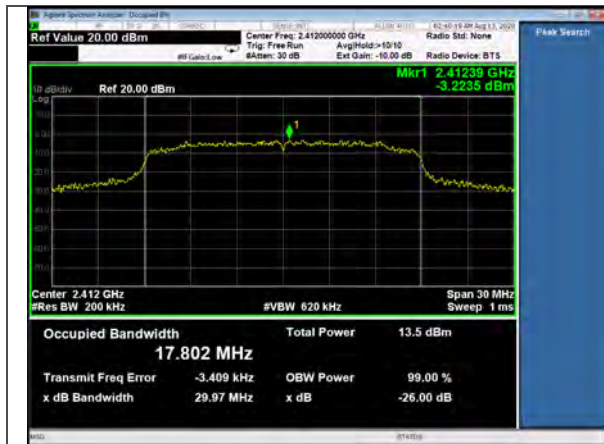
DTS BW, 802.11g, 54Mbps, Channel 1



DTS BW, 802.11g, 54Mbps, Channel 6



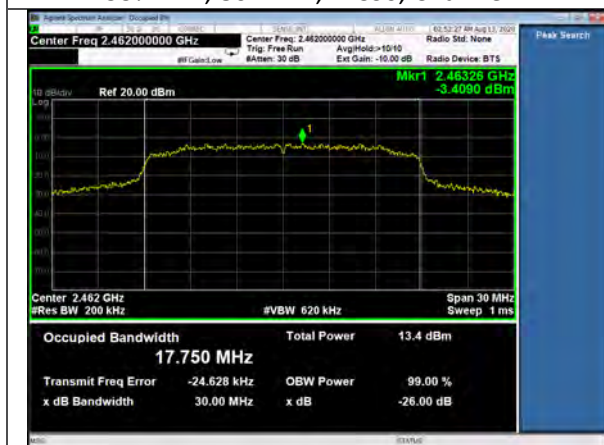
DTS BW, 802.11g, 54Mbps, Channel 11



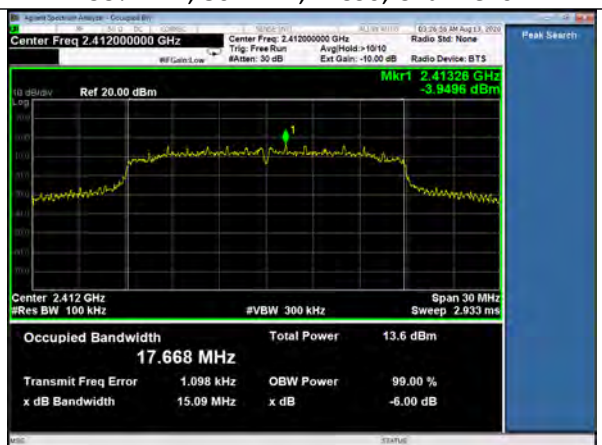
99% BW, 802.11n, MCS0, Channel 1



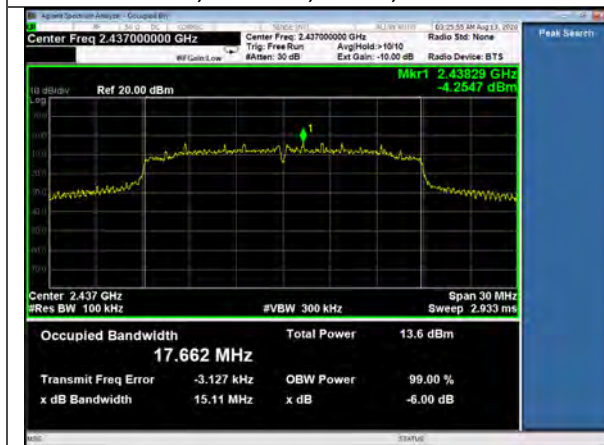
99% BW, 802.11n, MCS0, Channel 6



99% BW, 802.11n, MCS0, Channel 11



DTS BW, 802.11n, MCS0, Channel 1



DTS BW, 802.11n, MCS0, Channel 6



DTS BW, 802.11n, MCS0, Channel 11



5.1.2 Duty Cycle

Operator	Shane Dock	QA	Jon Dilley
Temperature	22.7°C	R.H. %	47.5%
Test Date	8/13/2020	Location	Conducted Radio
Method	ANSI C63.10 §11.6		

For reference only

Test Parameters

Frequency	2412MHz	Setup	Conducted
RBW	8Mhz	VBW	50MHz
Detector(s)	Clear write with RMS detector.	Span	0Hz

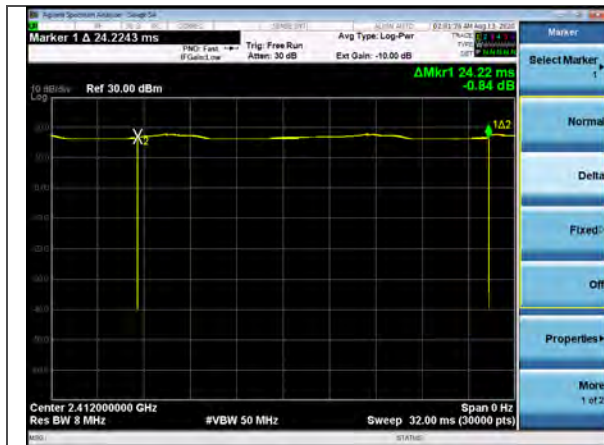
EUT Parameters

Input Power	12VDC	Mode	WLAN TX
Channels	1	Data Rates	802.11b: 1,11Mbps 802.11g: 6,54Mbps 802.11n: MCS0,MCS7

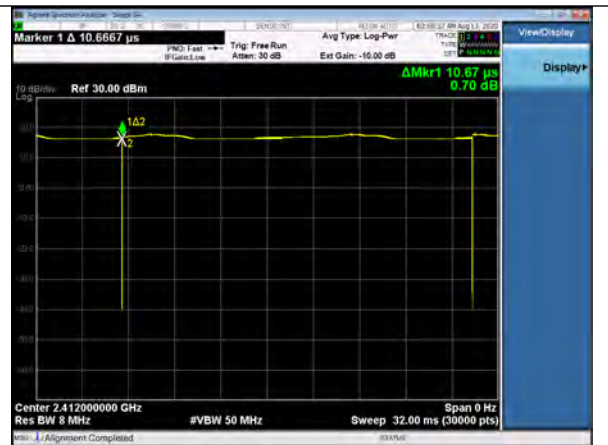
Data Tables

Protocol	Data Rate	Observation Period (ms)	On Time (ms)	Duty Cycle %
802.11b	1Mbps	24.230	24.220	99.96%
802.11b	11Mbps	2.380	2.377	99.87%
802.11g	6Mbps	4.048	4.032	99.60%
802.11g	54Mbps	0.484	0.467	96.49%
802.11n	MCS0	3.756	3.740	99.57%
802.11n	MCS7	0.424	0.408	96.20%

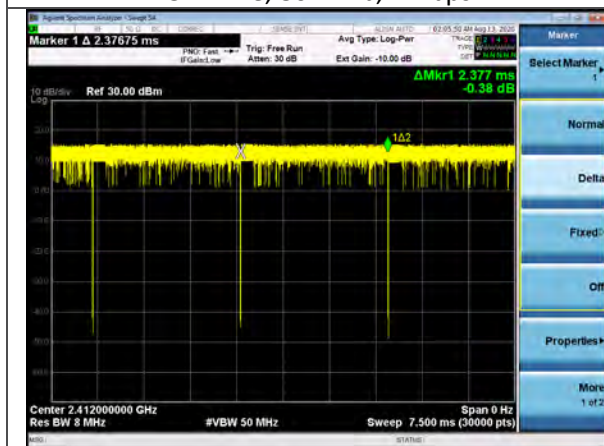
Plots



On Time, 802.11b, 1Mbps



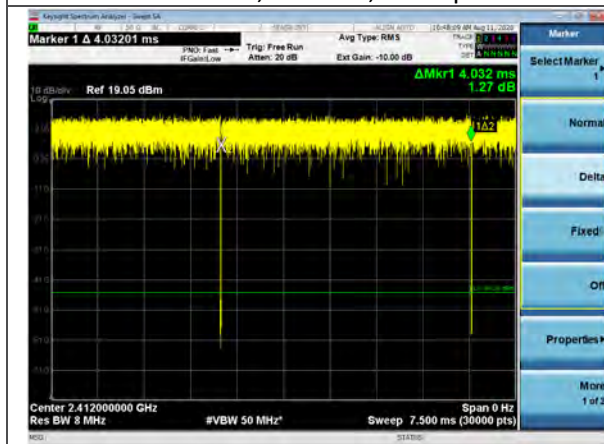
Off Time, 802.11b, 1Mbps



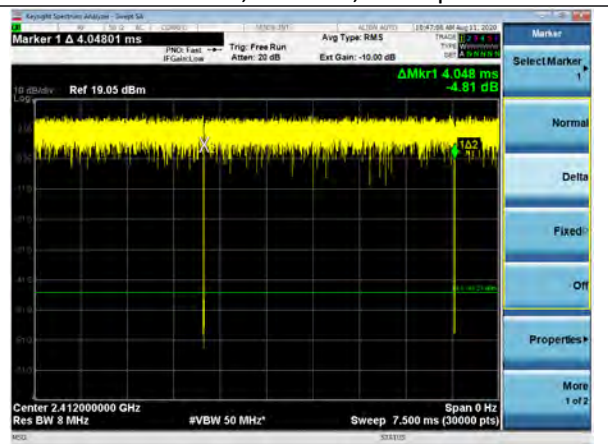
On Time, 802.11b, 11Mbps



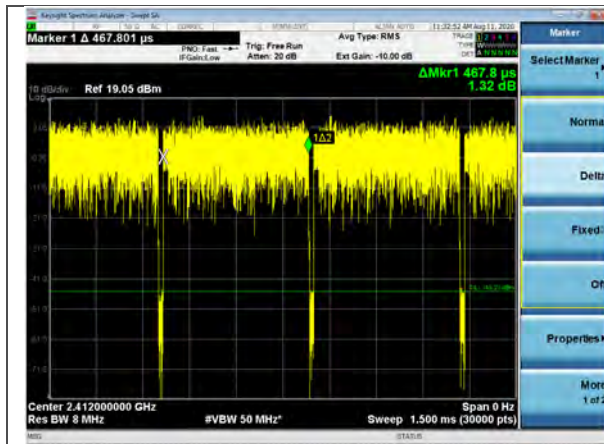
Off Time, 802.11b, 11Mbps



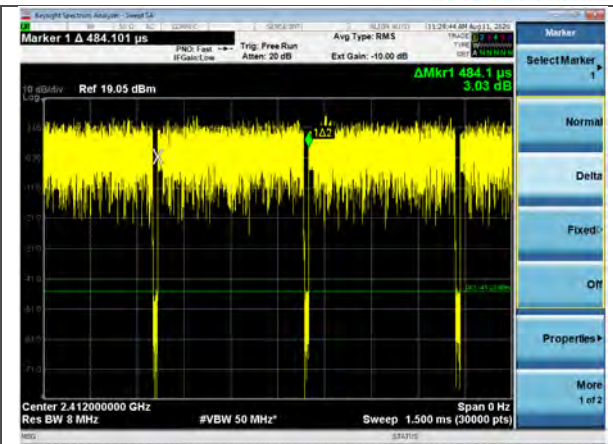
On Time, 802.11g, 6Mbps



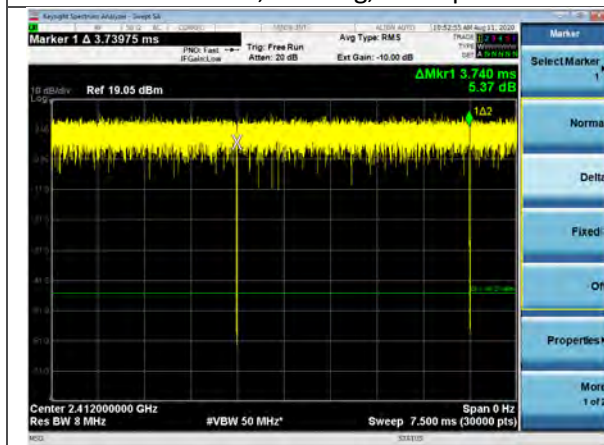
Observation Period, 802.11g, 6Mbps



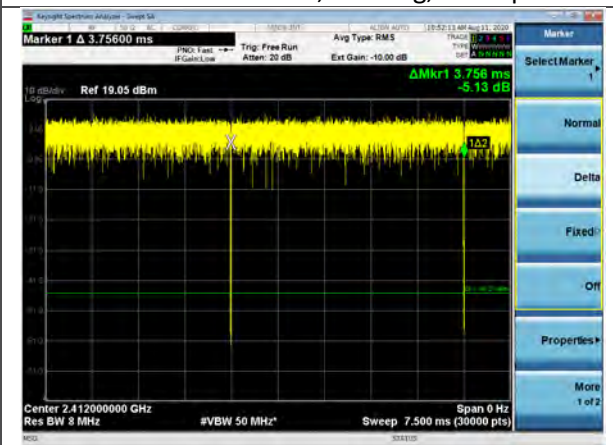
On Time, 802.11g, 54Mbps



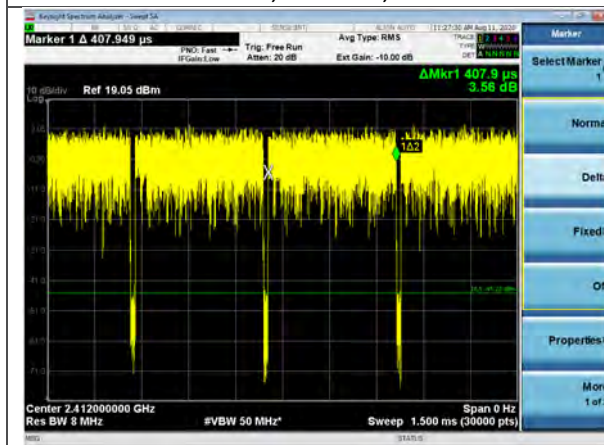
Observation Period, 802.11g, 54Mbps



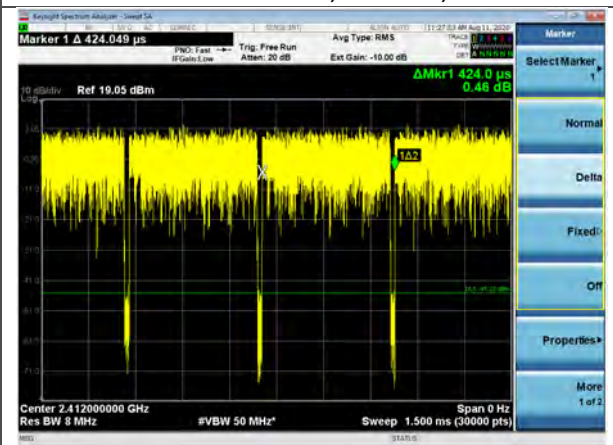
On Time, 802.11n, MCS0



Observation Period, 802.11n, MCS0



On Time, 802.11n, MCS7



Observation Period, 802.11n, MCS7

5.1.3 Output Power

Operator	Zach Wilson	QA	Anthony Smith
Temperature	21.6°C	R.H. %	32.9%
Test Date	11/5/2020	Location	Conducted Radio
Requirement	FCC 15.247 §b.3	Method	ANSI C63.10 §11.9.1.3

Limits:

1W/30dBm

Test Parameters

Frequency	2412MHz, 2437MHz, 2462MHz	Setup	Conducted Power Meter
Detector(s)	Peak		

EUT Parameters

Input Power	12VDC	Mode	WLAN TX
Channels	1, 6, 11	Data Rates	802.11b: 1,11Mbps 802.11g: 6,54Mbps 802.11n: MCS0,MCS7

Data Table

Channel	Protocol	Data Rate	Conducted Output Power (dBm)	Output Power Limit (dBm)	Margin (dB)
1	802.11b	1Mbps	16.0	30.0	14.0
6	802.11b	1Mbps	15.9	30.0	14.1
11	802.11b	1Mbps	15.9	30.0	14.1
1	802.11b	11Mbps	14.1	30.0	15.9
6	802.11b	11Mbps	14.0	30.0	16.0
11	802.11b	11Mbps	14.0	30.0	16.0
1	802.11g	6Mbps	13.4	30.0	16.6
6	802.11g	6Mbps	13.0	30.0	17.0
11	802.11g	6Mbps	13.1	30.0	16.9
1	802.11g	54Mbps	17.5	30.0	12.5
6	802.11g	54Mbps	16.9	30.0	13.1
11	802.11g	54Mbps	17.1	30.0	12.9
1	802.11n	MCS0	12.8	30.0	17.2
6	802.11n	MCS0	12.9	30.0	17.1
11	802.11n	MCS0	12.8	30.0	17.2
1	802.11n	MCS7	16.3	30.0	13.8
6	802.11n	MCS7	15.8	30.0	14.2
11	802.11n	MCS7	16.0	30.0	14.0

5.1.4 Power Spectral Density

Operator	Jon Dille	QA	Shane Dock
Temperature	21.8°C	R.H. %	24.8%
Test Date	11/17/2020	Location	Conducted Radio
Requirement	FCC 15.247 §e	Method	ANSI C63.10 §11.10.2

Limits:

8dBm/3kHz

Test Parameters

Frequency	2412MHz, 2437MHz, 2462MHz	Setup	Conducted
RBW	100kHz	VBW	300kHz
Detector(s)	Peak detector with max hold.	Span	1.5 times the DTS BW

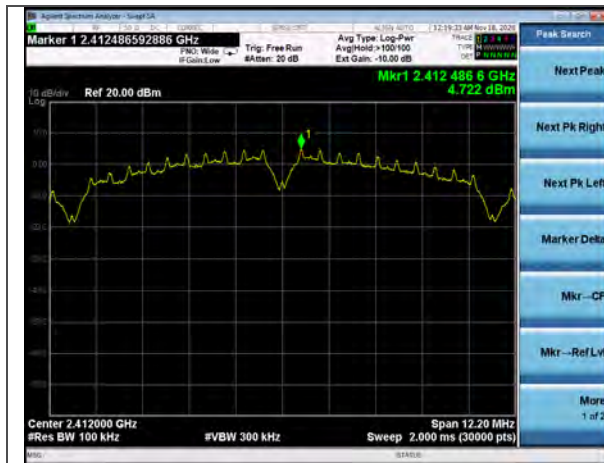
EUT Parameters

Input Power	12VDC	Mode	WLAN TX
Channels	1, 6, 11	Data Rates	802.11b: 1,11Mbps 802.11g: 6,54Mbps 802.11n: MCS0,MCS7

Data Tables

Channel	Protocol	Data Rate	Peak PSD (dBm/100kHz)	PSD Limit (dBm/3kHz)	Margin (dB)
1	802.11g	6Mbps	-5.7	8.0	13.7
6	802.11g	6Mbps	-5.6	8.0	13.6
11	802.11g	6Mbps	-6.0	8.0	14.0
1	802.11g	54Mbps	-4.5	8.0	12.5
6	802.11g	54Mbps	-4.3	8.0	12.3
11	802.11g	54Mbps	-4.5	8.0	12.5
1	802.11b	1Mbps	4.7	8.0	3.3
6	802.11b	1Mbps	4.8	8.0	3.2
11	802.11b	1Mbps	5.0	8.0	3.0
1	802.11b	11Mbps	2.1	8.0	5.9
6	802.11b	11Mbps	2.8	8.0	5.2
11	802.11b	11Mbps	2.0	8.0	6.0
1	802.11n	MCS0	-4.9	8.0	12.9
6	802.11n	MCS0	-4.9	8.0	12.9
11	802.11n	MCS0	-5.2	8.0	13.2
1	802.11n	MCS7	-6.1	8.0	14.1
6	802.11n	MCS7	-6.0	8.0	14.0
11	802.11n	MCS7	-6.2	8.0	14.2

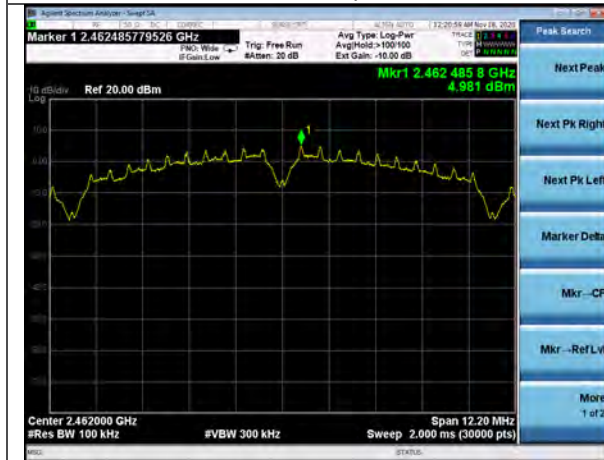
Plots



PSD, 802.11b, 1Mbps, Channel 1



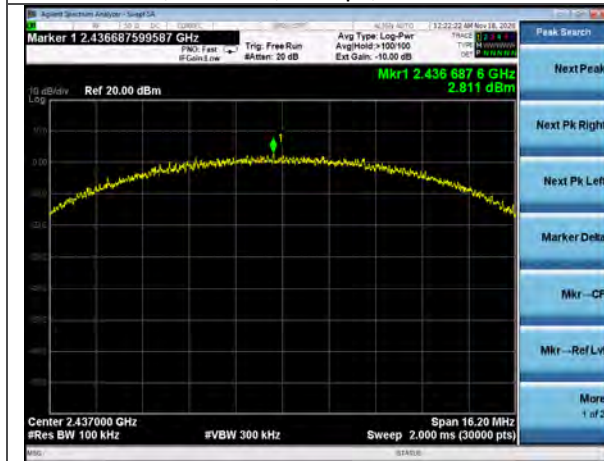
PSD, 802.11b, 1Mbps, Channel 6



PSD, 802.11b, 1Mbps, Channel 11



PSD, 802.11b, 11Mbps, Channel 1

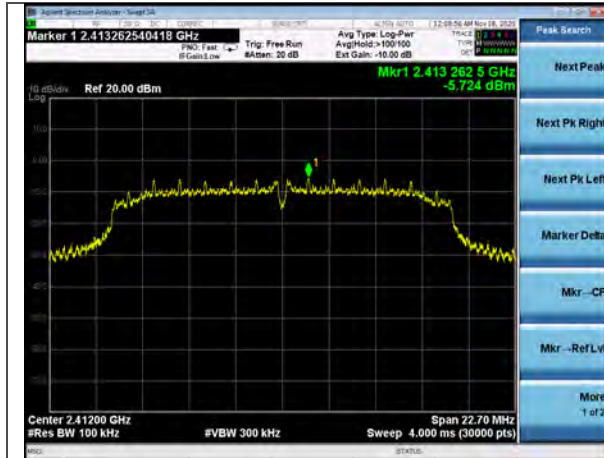


PSD, 802.11b, 1Mbps, Channel 6

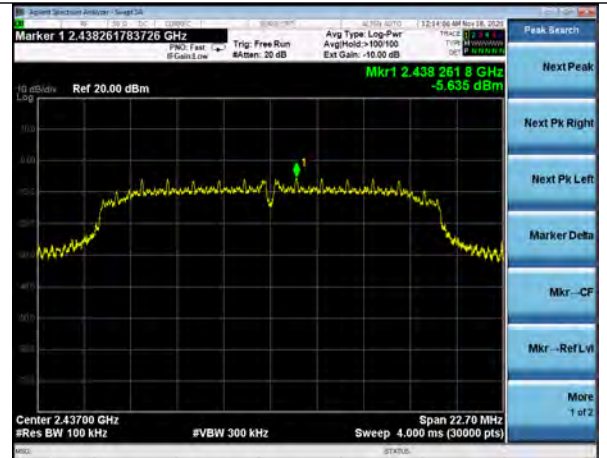


PSD, 802.11b, 11Mbps, Channel 11

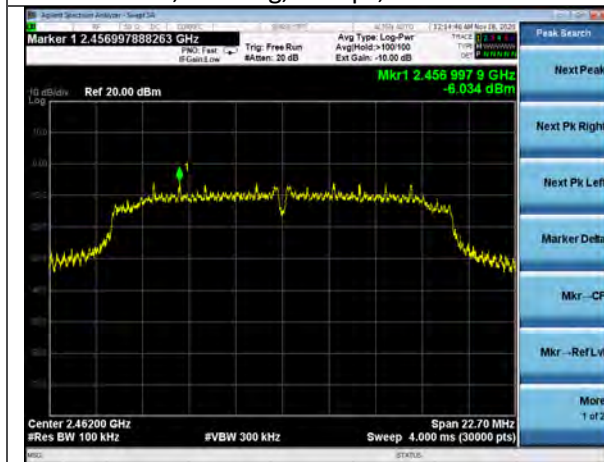
Company: Brunswick Corporation	Page 27 of 53	Name: SmartCraft Connect
Report: TR319379 A		Model: SCC-1
Job: C-3380		Serial: Engineering Sample



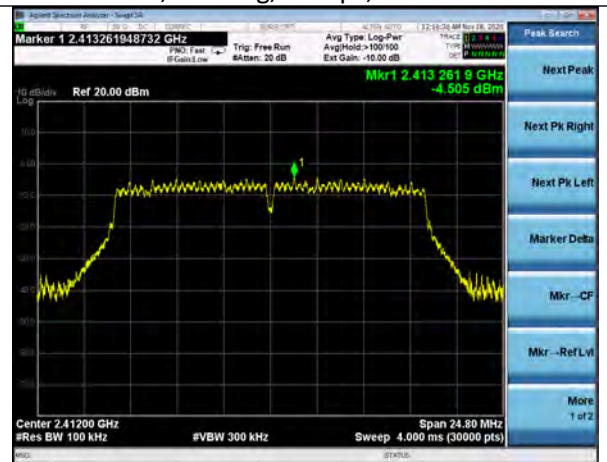
PSD, 802.11g, 6Mbps, Channel 1



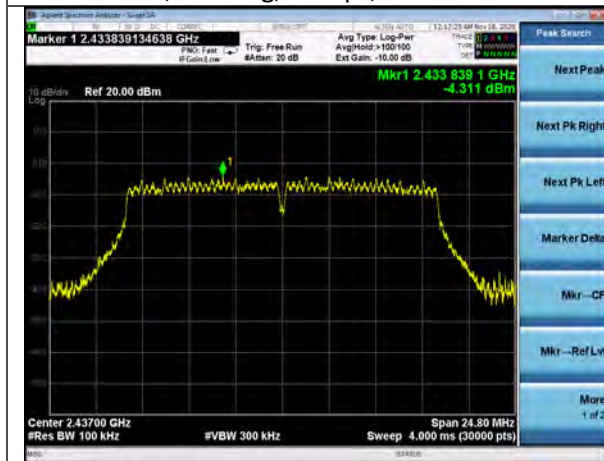
PSD, 802.11g, 6Mbps, Channel 6



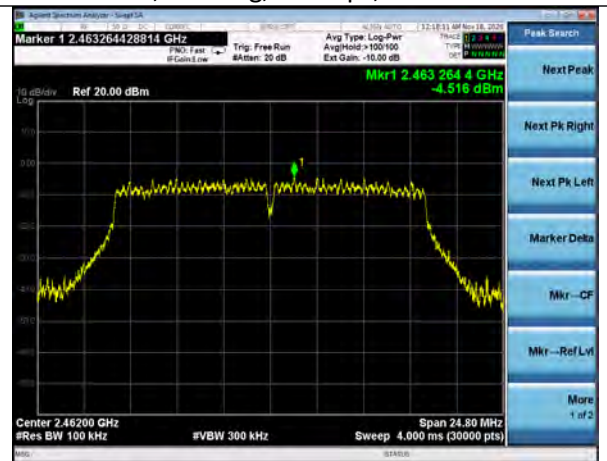
PSD, 802.11g, 6Mbps, Channel 11



PSD, 802.11g, 54Mbps, Channel 1



PSD, 802.11g, 54Mbps, Channel 6



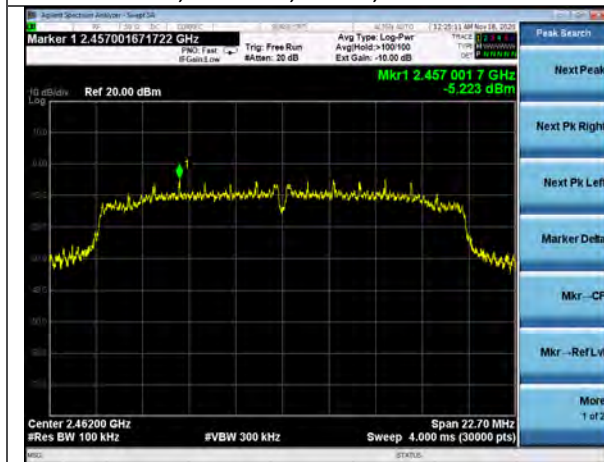
PSD, 802.11g, 54Mbps, Channel 11



PSD, 802.11n, MCS0, Channel 1



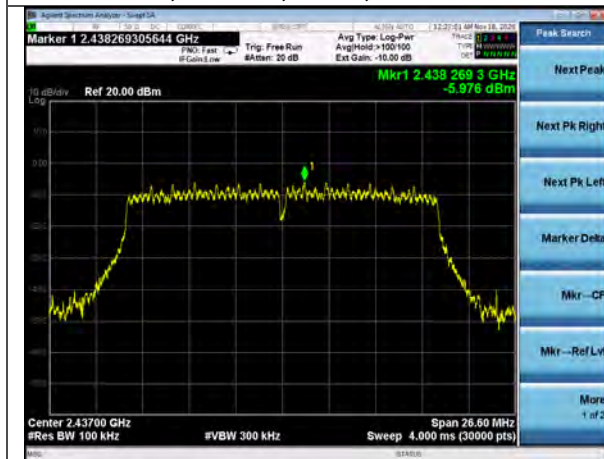
PSD, 802.11n, MCS0, Channel 6



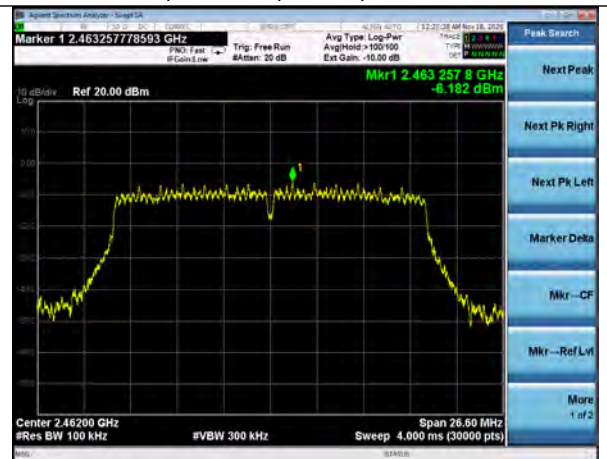
PSD, 802.11n, MCS0, Channel 11



PSD, 802.11n, MCS7, Channel 1



PSD, 802.11n, MCS7, Channel 6



PSD, 802.11n, MCS7, Channel 11

5.1.5 Conducted Transmitter Spurious

Operator	Shane Dock, Zach Wilson	QA	Jon Dille, Anthony Smith
Temperature	22.7°C	R.H. %	47.5%
Test Date	8/13/2020, 11/5/2020	Location	Conducted Radio
Requirement	FCC 15.247 §d	Method	ANSI C63.10 §11.11

Limits:

-20 dBc

Protocol	Data Rate	Channel	Reference Level (dBm)	Limit (dBm)
802.11b	1Mbps	1	3.5	-16.5
802.11b	1Mbps	11	3.9	-16.1
802.11b	11Mbps	1	1.0	-19.0
802.11b	11Mbps	11	1.4	-18.6
802.11g	6Mbps	1	-6.6	-26.6
802.11g	6Mbps	11	-6.0	-26.0
802.11g	54Mbps	1	-4.4	-24.4
802.11g	54Mbps	11	-4.3	-24.3
802.11n	MCS0	1	-7.4	-27.4
802.11n	MCS0	11	-4.8	-24.8
802.11n	MCS7	1	-5.9	-25.9
802.11n	MCS7	11	-6.0	-26.0

Test Parameters

Frequency	2412MHz, 2437MHz, 2462MHz	Setup	Conducted
RBW	100kHz	VBW	300kHz
Detector(s)	Max hold with peak detector for plots.	Span	30MHz

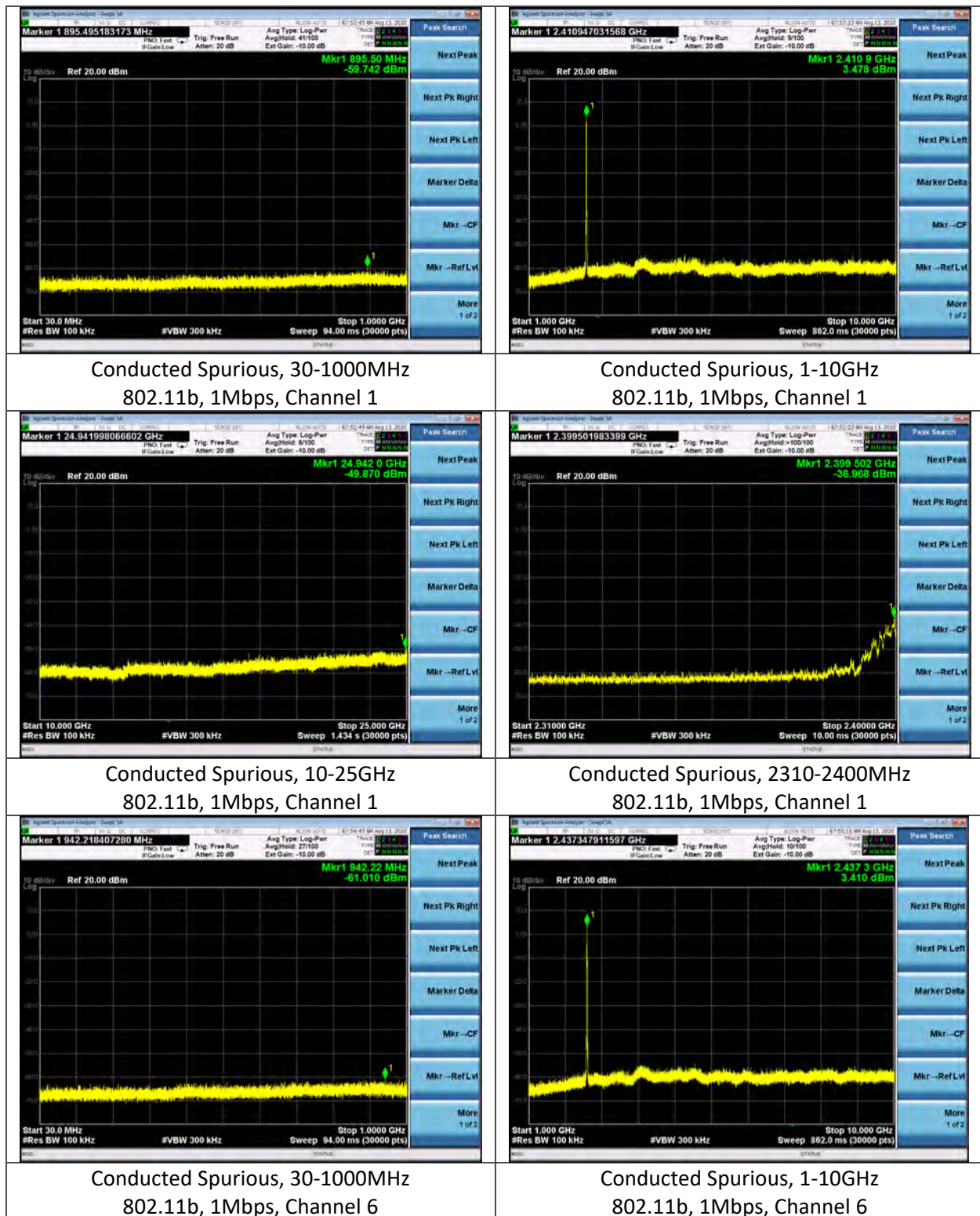
EUT Parameters

Input Power	12VDC	Mode	WLAN TX
Channels	1, 6, 11	Data Rates	802.11b: 1,11Mbps 802.11g: 6,54Mbps 802.11n: MCS0,MCS7

Data Table

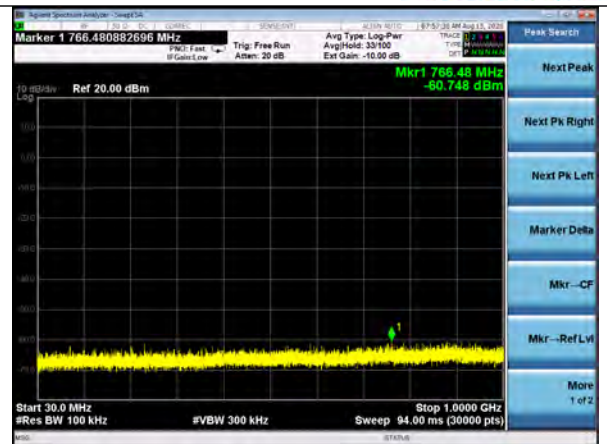
Channel	Protocol	Data Rate	Closest Emission to Margin (MHz)	Peak Reading (dBm)	Limit (dBm)	Margin (dBm)
1	802.11b	1Mbps	2399.5	-37.0	-15.3	21.7
11	802.11b	1Mbps	2486.0	-54.6	-15.0	39.6
1	802.11b	11Mbps	2397.0	-44.1	-17.9	26.2
11	802.11b	11Mbps	2487.0	-55.4	-18.0	37.4
1	802.11g	6Mbps	2399.1	-27.8	-25.7	2.1
11	802.11g	6Mbps	2483.9	-44.3	-26.0	18.3
1	802.11g	54Mbps	2399.0	-37.9	-24.5	13.4
11	802.11g	54Mbps	2483.6	-47.6	-24.5	23.1
1	802.11n	MCS0	2399.8	-28.5	-24.9	3.6
11	802.11n	MCS0	2483.5	-40.9	-25.2	15.7
1	802.11n	MCS7	2397.5	-44.0	-26.1	17.9
11	802.11n	MCS7	2484.2	-49.9	-26.2	23.7

Plots

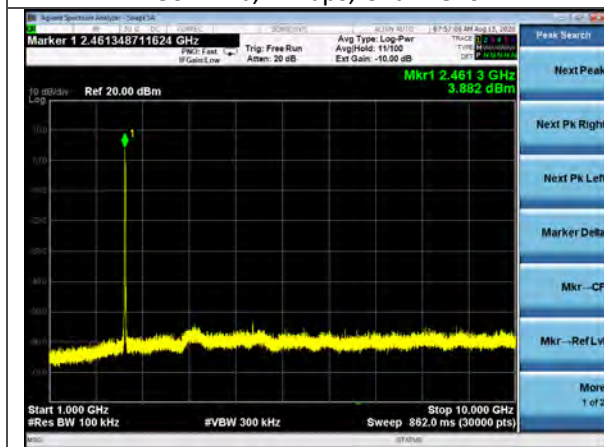




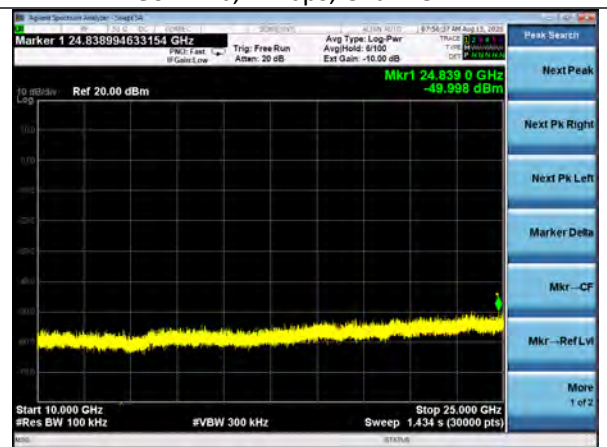
Conducted Spurious, 10-25GHz
802.11b, 1Mbps, Channel 6



Conducted Spurious, 30-1000MHz
802.11b, 1Mbps, Channel 11



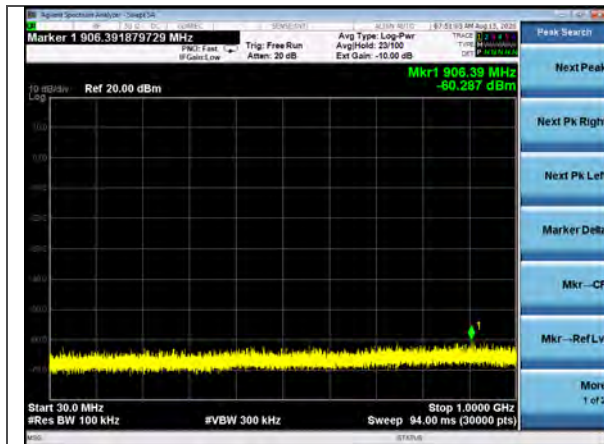
Conducted Spurious, 1-10GHz
802.11b, 1Mbps, Channel 11



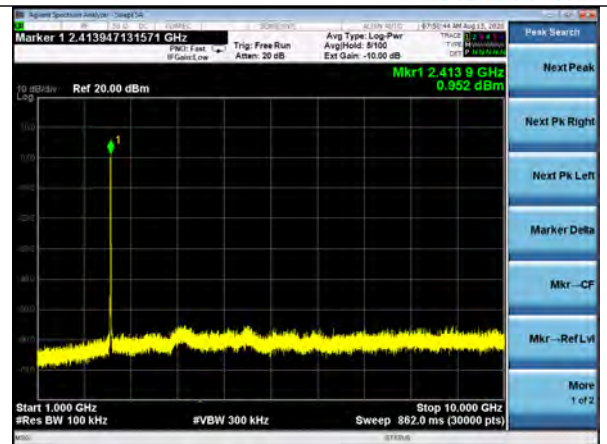
Conducted Spurious, 10-25GHz
802.11b, 1Mbps, Channel 11



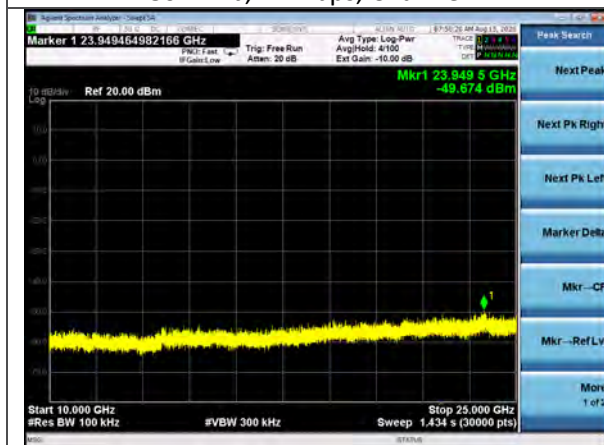
Conducted Spurious, 2483.5-2500MHz
802.11b, 1Mbps, Channel 11



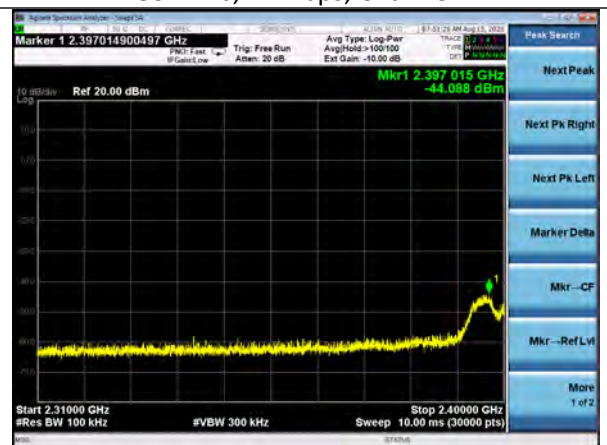
Conducted Spurious, 30-1000MHz
802.11b, 11Mbps, Channel 1



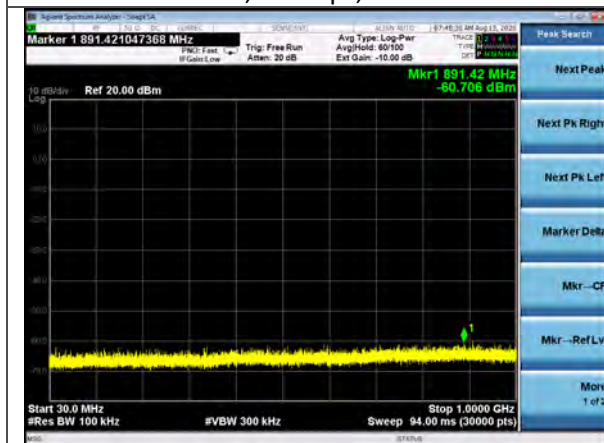
Conducted Spurious, 1-10GHz
802.11b, 11Mbps, Channel 1



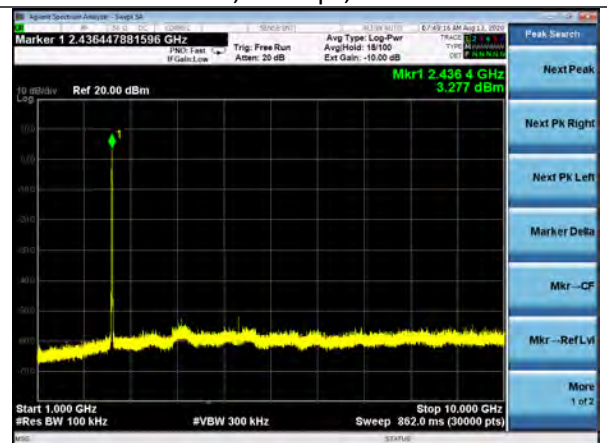
Conducted Spurious, 10-25GHz
802.11b, 11Mbps, Channel 1



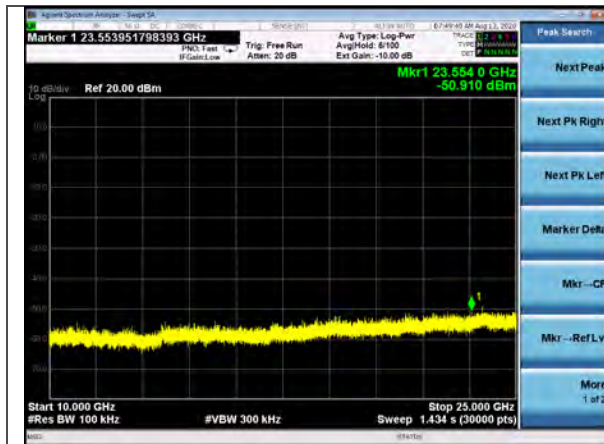
Conducted Spurious, 2310-2400MHz
802.11b, 11Mbps, Channel 1



Conducted Spurious, 30-1000MHz
802.11b, 11Mbps, Channel 6



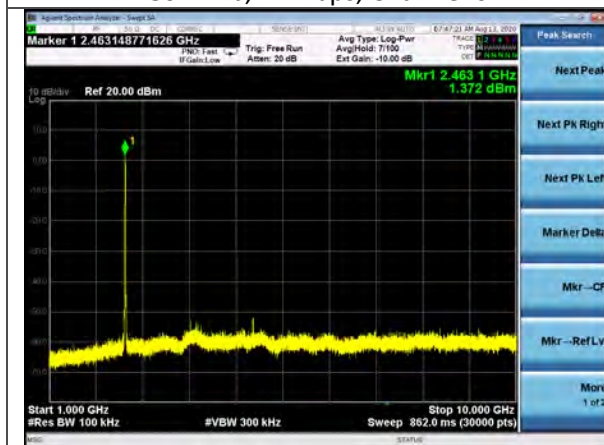
Conducted Spurious, 1-10GHz
802.11b, 11Mbps, Channel 6



Conducted Spurious, 10-25GHz
802.11b, 11Mbps, Channel 6



Conducted Spurious, 30-1000MHz
802.11b, 11Mbps, Channel 11



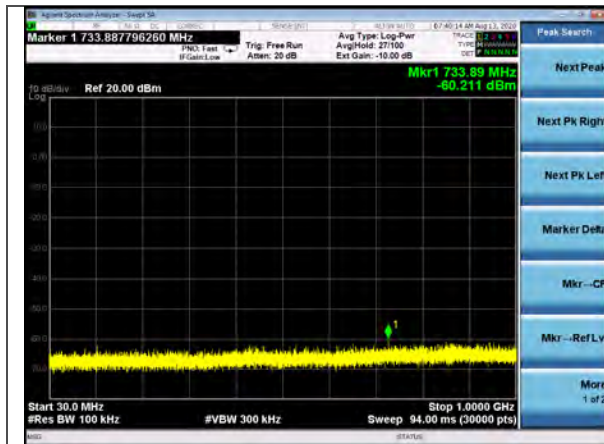
Conducted Spurious, 1-10GHz
802.11b, 11Mbps, Channel 11



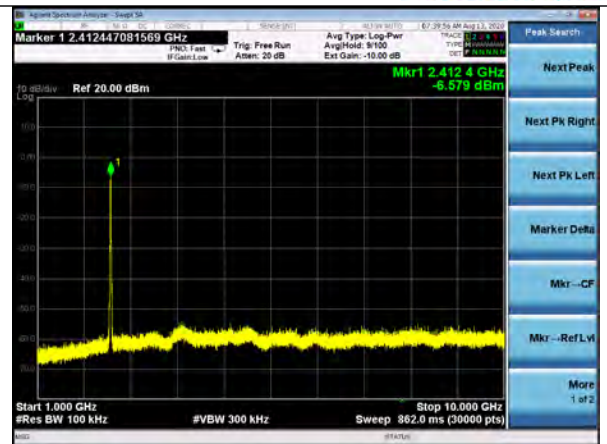
Conducted Spurious, 10-25GHz
802.11b, 11Mbps, Channel 11



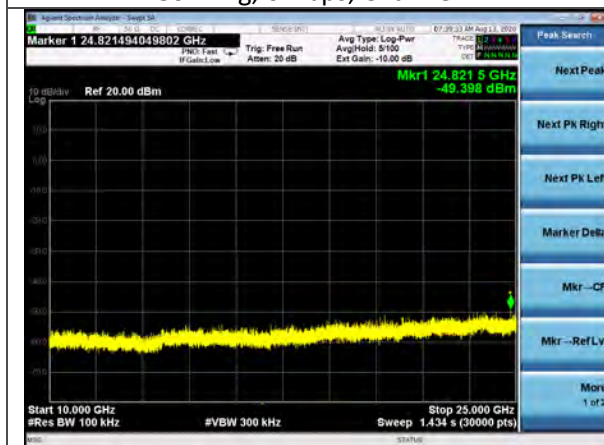
Conducted Spurious, 2483.5-2500MHz
802.11b, 11Mbps, Channel 11



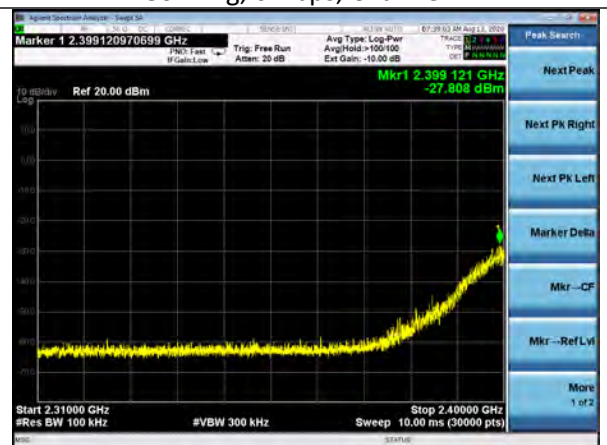
Conducted Spurious, 30-1000MHz
802.11g, 6Mbps, Channel 1



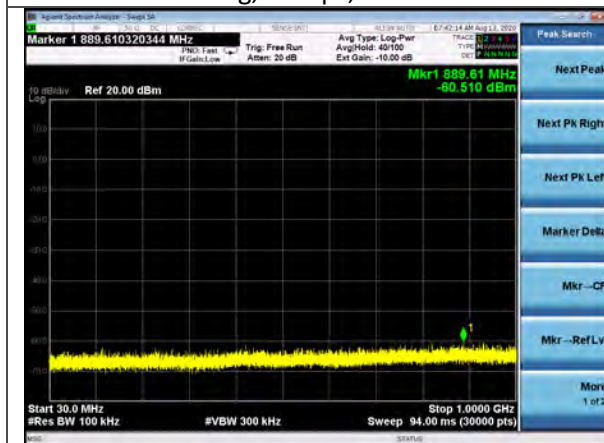
Conducted Spurious, 1-10GHz
802.11g, 6Mbps, Channel 1



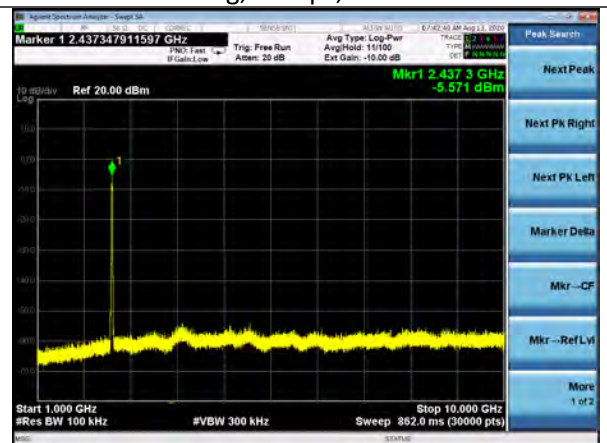
Conducted Spurious, 10-25GHz
802.11g, 6Mbps, Channel 1



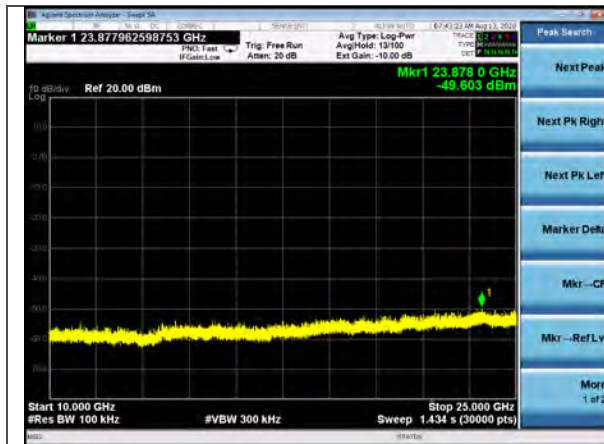
Conducted Spurious, 2310-2400MHz
802.11g, 6Mbps, Channel 1



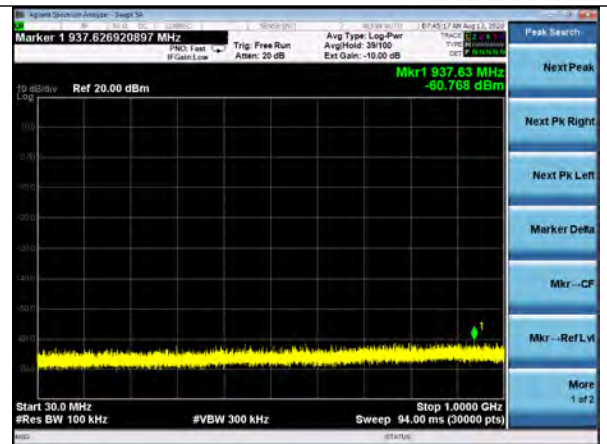
Conducted Spurious, 30-1000MHz
802.11g, 6Mbps, Channel 6



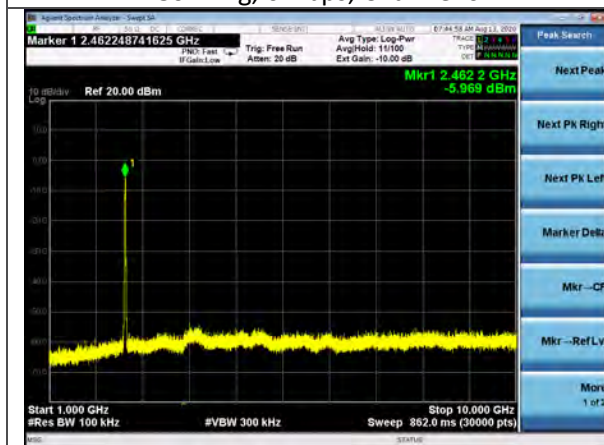
Conducted Spurious, 1-10GHz
802.11g, 6Mbps, Channel 6



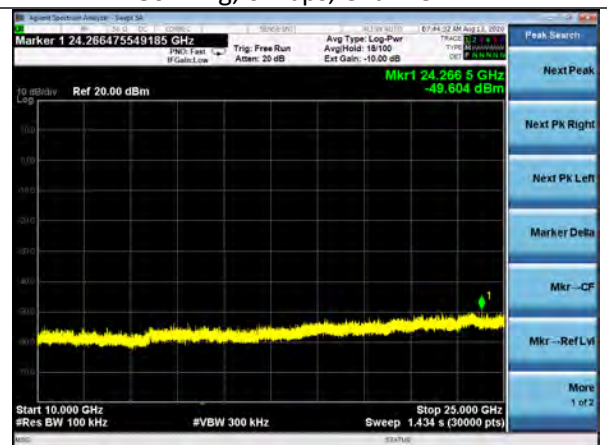
Conducted Spurious, 10-25GHz
802.11g, 6Mbps, Channel 6



Conducted Spurious, 30-100MHz
802.11g, 6Mbps, Channel 11



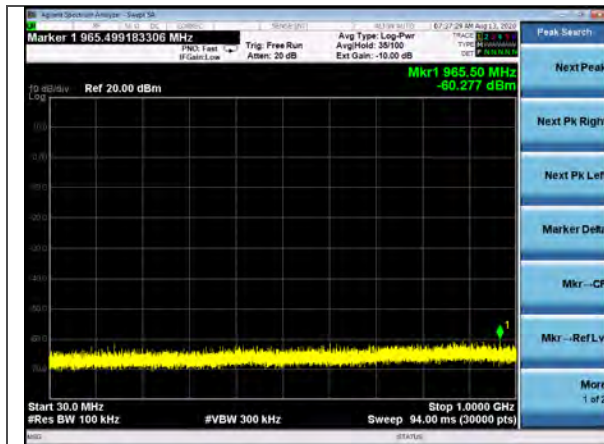
Conducted Spurious, 1-10GHz
802.11g, 6Mbps, Channel 11



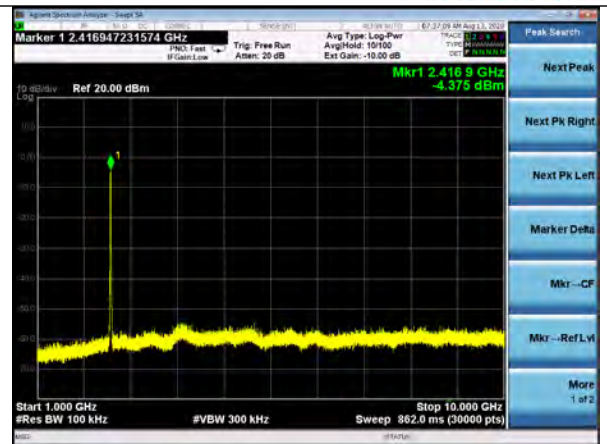
Conducted Spurious, 10-25GHz
802.11g, 6Mbps, Channel 11



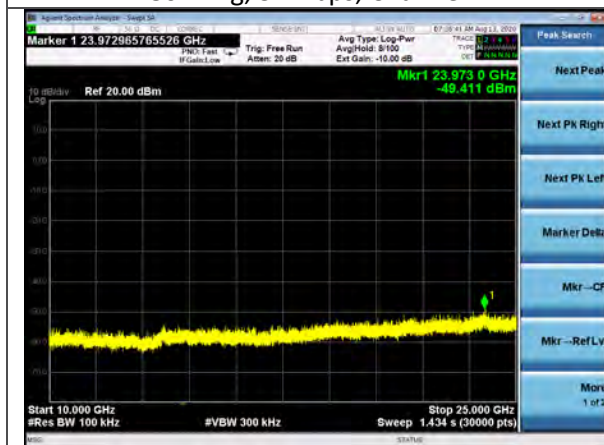
Conducted Spurious, 2483.5-2500MHz
802.11g, 6Mbps, Channel 11



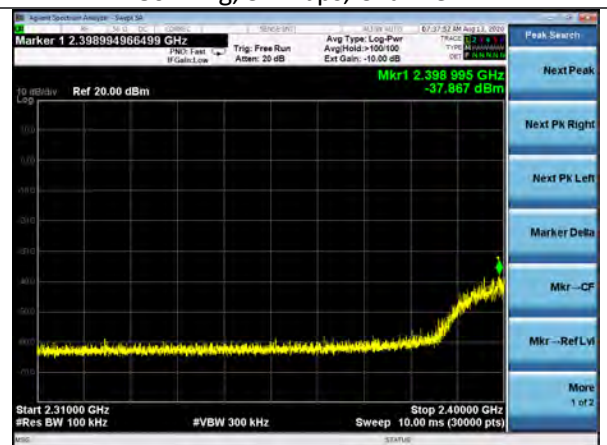
Conducted Spurious, 30-1000MHz
802.11g, 54Mbps, Channel 1



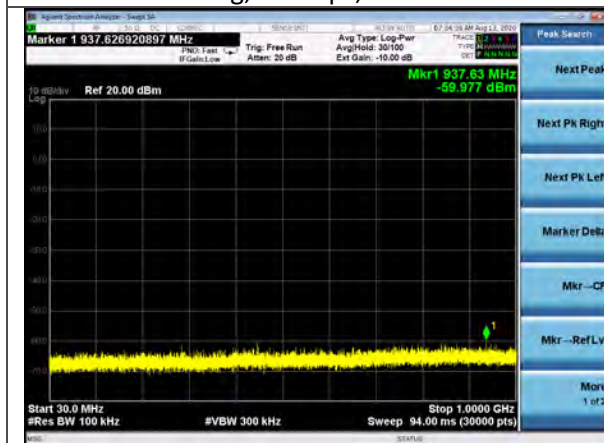
Conducted Spurious, 1-10GHz
802.11g, 54Mbps, Channel 1



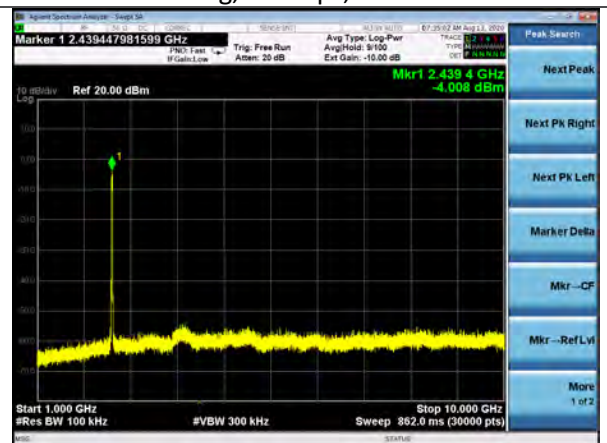
Conducted Spurious, 10-25GHz
802.11g, 54Mbps, Channel 1



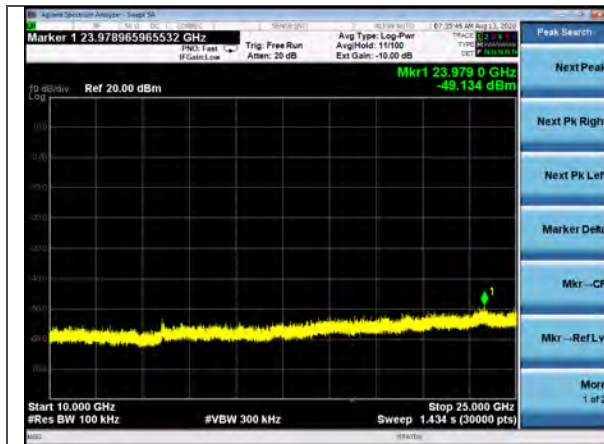
Conducted Spurious, 2310-2400MHz
802.11g, 54Mbps, Channel 1



Conducted Spurious, 30-1000MHz
802.11g, 54Mbps, Channel 6



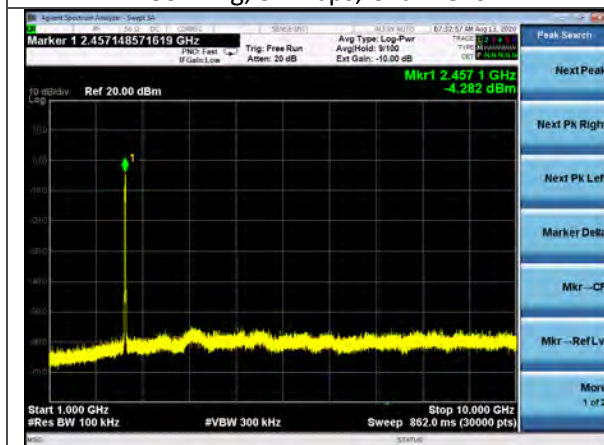
Conducted Spurious, 1-10GHz
802.11g, 54Mbps, Channel 6



Conducted Spurious, 10-25GHz
802.11g, 54Mbps, Channel 6



Conducted Spurious, 30-1000MHz
802.11g, 54Mbps, Channel 11



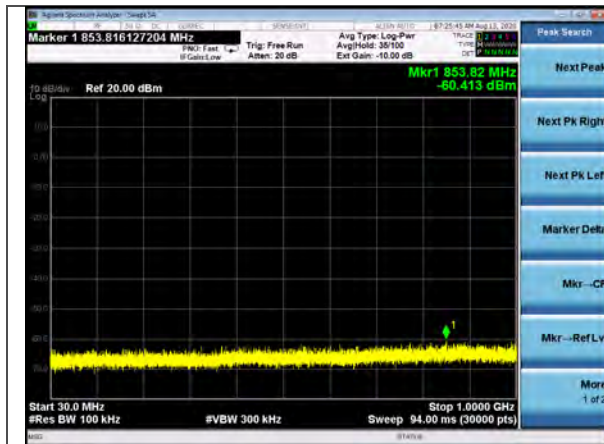
Conducted Spurious, 1-10GHz
802.11g, 54Mbps, Channel 11



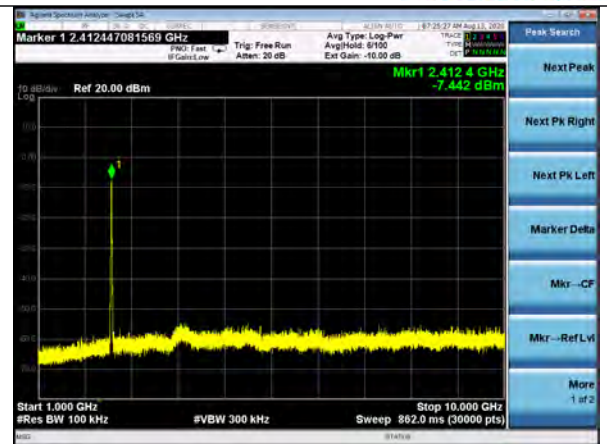
Conducted Spurious, 10-25GHz
802.11g, 54Mbps, Channel 11



Conducted Spurious, 2483.5-2500MHz
802.11g, 54Mbps, Channel 11



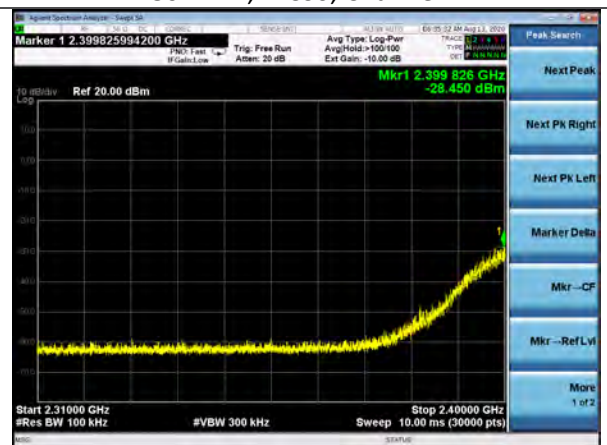
Conducted Spurious, 30-100MHz
802.11n, MCS0, Channel 1



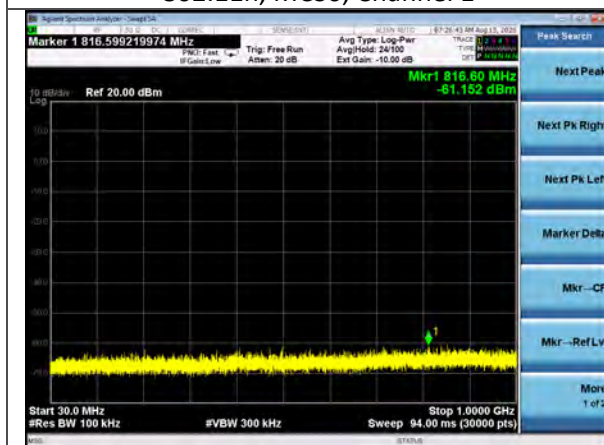
Conducted Spurious, 1-10GHz
802.11n, MCS0, Channel 1



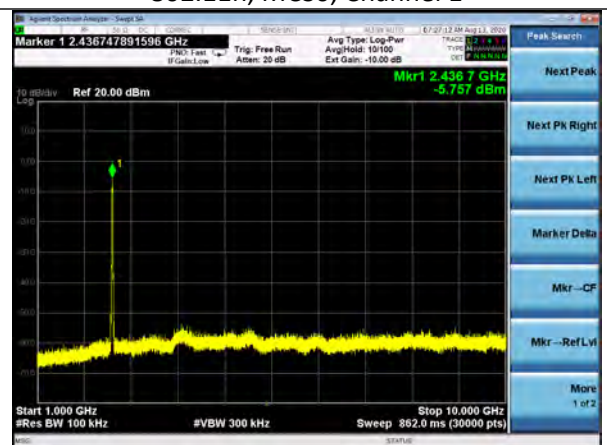
Conducted Spurious, 10-25GHz
802.11n, MCS0, Channel 1



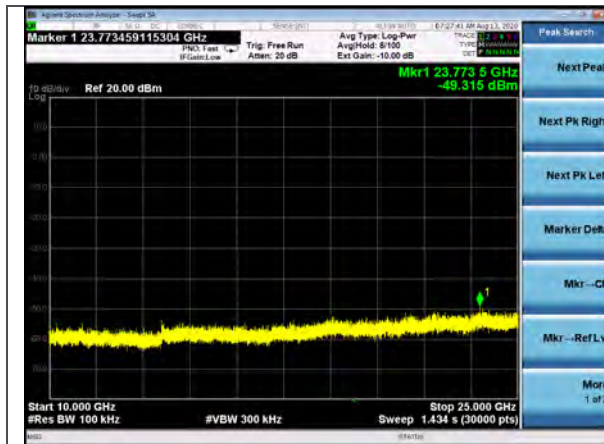
Conducted Spurious, 2310-2400MHz
802.11n, MCS0, Channel 1



Conducted Spurious, 30-100MHz
802.11n, MCS0, Channel 6



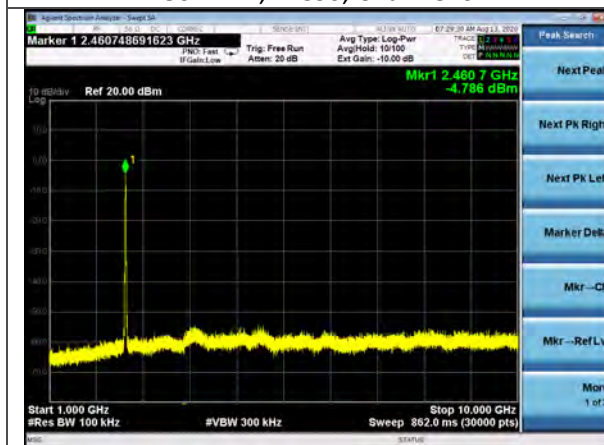
Conducted Spurious, 1-10GHz
802.11n, MCS0, Channel 6



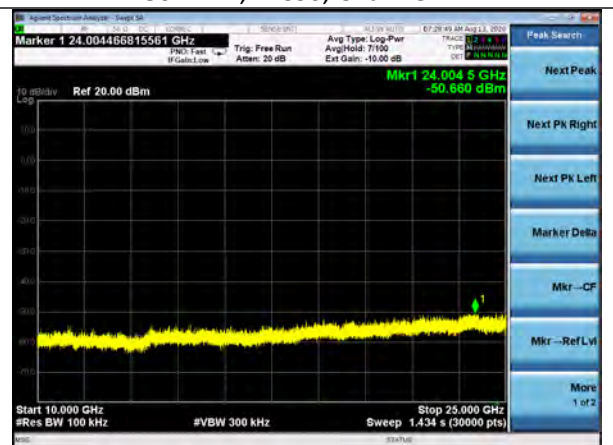
Conducted Spurious, 10-25GHz
802.11n, MCS0, Channel 6



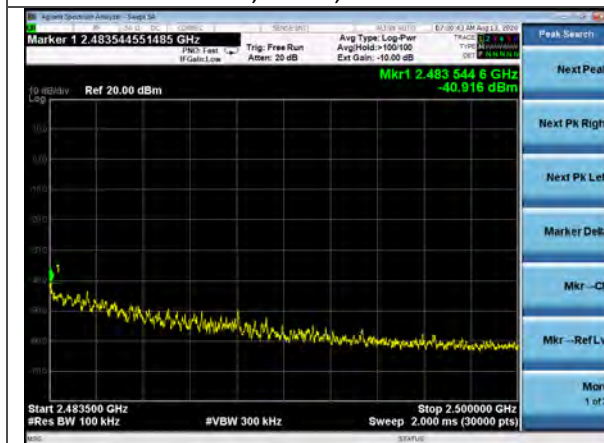
Conducted Spurious, 30-1000MHz
802.11n, MCS0, Channel 11



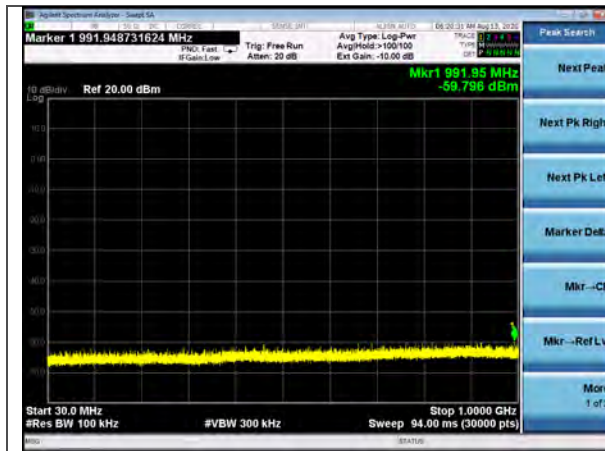
Conducted Spurious, 1-10GHz
802.11n, MCS0, Channel 11



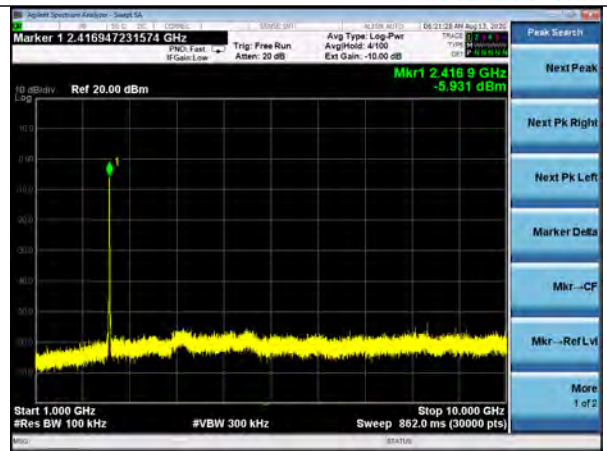
Conducted Spurious, 10-25GHz
802.11n, MCS0, Channel 11



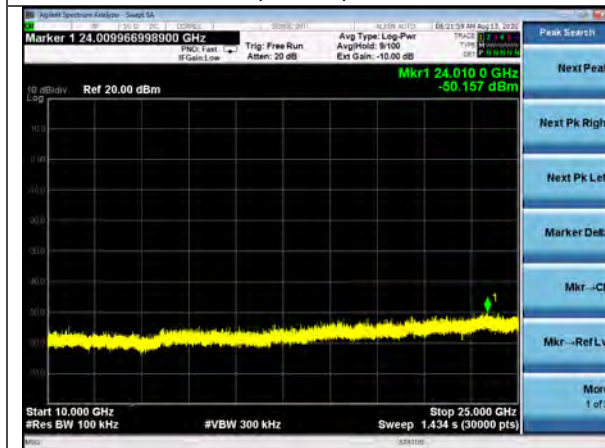
Conducted Spurious, 2483.5-2500MHz
802.11n, MCS0, Channel 11



Conducted Spurious, 30-1000MHz
802.11n, MCS7, Channel 1



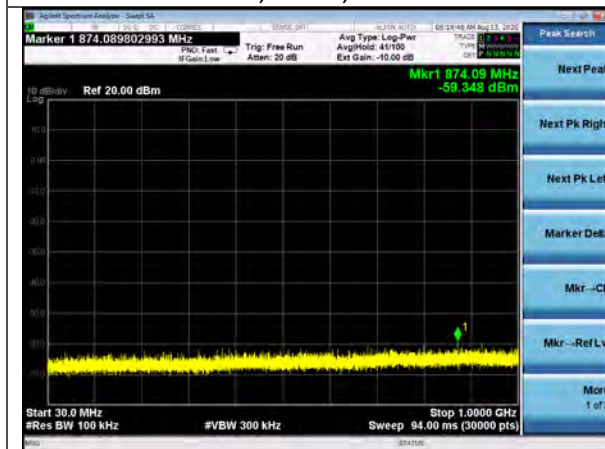
Conducted Spurious, 1-10GHz
802.11n, MCS7, Channel 1



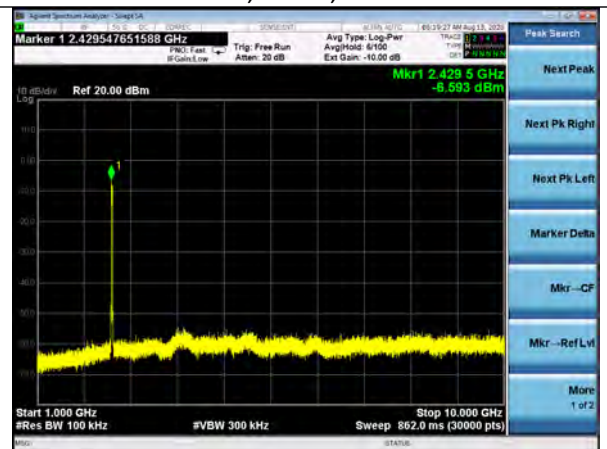
Conducted Spurious, 10-25GHz
802.11n, MCS7, Channel 1



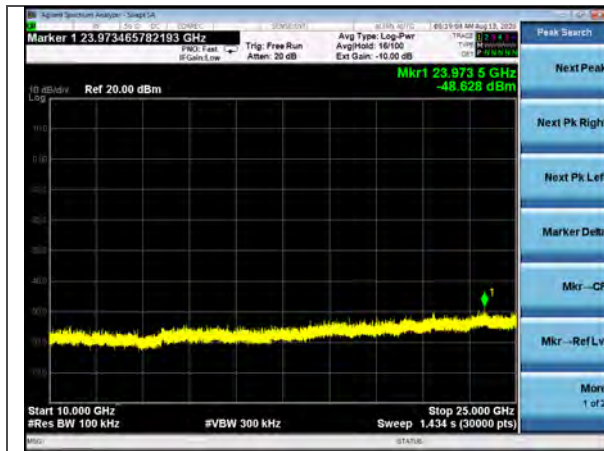
Conducted Spurious, 2310-2400MHz
802.11n, MCS7, Channel 1



Conducted Spurious, 30-1000MHz
802.11n, MCS7, Channel 6



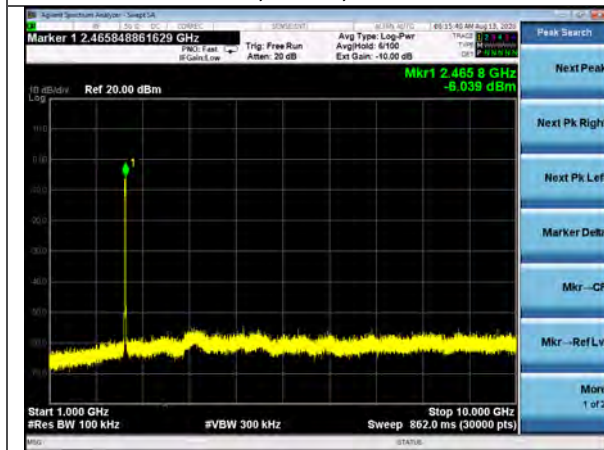
Conducted Spurious, 1-10GHz
802.11n, MCS7, Channel 6



Conducted Spurious, 10-25GHz
802.11n, MCS7, Channel 6



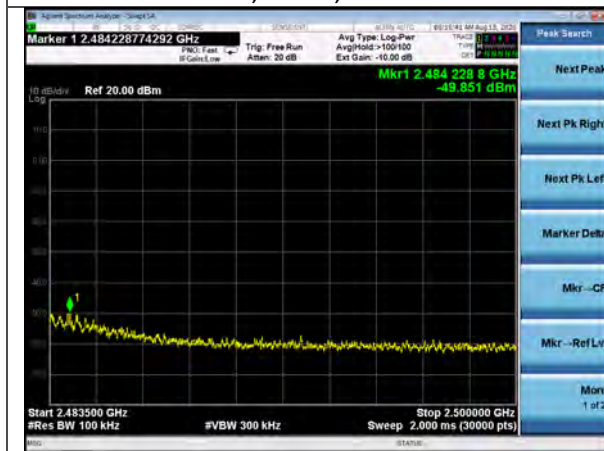
Conducted Spurious, 30-1000MHz
802.11n, MCS7, Channel 11



Conducted Spurious, 1-10GHz
802.11n, MCS7, Channel 11



Conducted Spurious, 10-25GHz
802.11n, MCS7, Channel 11



Conducted Spurious, 2483.5-2500MHz
802.11n, MCS7, Channel 11

5.1.6 Frequency Stability

Operator	Shane Dock	QA	Jon Dilley
Temperature	22.7°C	R.H. %	47.5%
Test Date	8/13/2020	Location	Conducted Radio
Requirement	FCC 2.1055 §d.1	Method	ANSI C63.10 §6.8.2

Limits:

Reported Only

Test Parameters

Frequency	2412MHz, 2437MHz, 2462MHz	Setup	Conducted
RBW	100kHz	VBW	300kHz
Detector(s)	RMS detector with average hold	Span	30MHz

EUT Parameters

Input Power	11.7VDCn 13.8VDC, 15.9VDC	Mode	WLAN TX CW
Channels	1, 6, 11	Data Rates	CW Wave

Data Table

	Input Voltage (VDC)			Deviation (Hz)
	11.7	13.8	15.9	
Channel	Frequency (Hz)	Voltage 2 Freq. (Hz)	Voltage 3 Freq. (Hz)	
1	2412000775	2411998558	2412004158	5600
6	2437002042	2436998658	2437002725	4067
11	2461998892	2462003042	2462004442	5550

5.2 Radiated Emissions

Description of Measurement	The frequency spectrum is investigated for intentional and / or unintentional signals emanating from the EUT by use of a standardized test site and measurement antenna. The antenna, cable, pre-amp, and other necessary measurement system correction factors are loaded onto the EMI receiver / spectrum analyzer when the measurements are performed allowing the data to be gathered and reported as corrected values. The maximum emissions from the EUT are determined by turn-table azimuth rotation (360°) and scanning of the measurement antenna. Maximized levels are noted at degree values of azimuth, measurement antenna height, and measurement antenna polarity.
Example Calculations	Measurement (dBμV) + Cable factor (dB) + Other (dB) + Antenna Factor (dB/m) = Corrected Reading (dBμV/m) Margin (dB) = Limit (dBμV/m) - Corrected Reading (dBμV/m) Example at 4000 MHz: Reading = 40 dBμV + 3.4 dB + 0.9 dB + 6.5 dB/m = 50.8 dBμV/m Average Limit = 20 log (500) = 54 dBμV/m Margin = 54 dBμV/m - 50.8 dBμV/m = 3.2 dB

Block Diagram



5.2.1 Radiated Emissions 30-1000 MHz

Operator	Jon Dille	QA	Anthony Smith
Temperature	24.0°C	R.H. %	46.00%
Test Date	8/6/2020	Location	Chamber 3
Requirement	FCC 15.209, RSS-GEN	Method	ANSI C63.10

Limits: FCC 15.209, RSS-GEN @ 3m

Frequency (MHz)	Quasi Peak Limit (dBμV/m)
30-88	40.0
88-216	43.5
216-960	46.0
960-1000	54.0

Test Parameters

Frequency	30-1000MHz	Distance	3 m
Detector(s)	Max hold with peak detector for plots. Quasi peak detector for final measurement.	Table height	80 cm
RBW	120kHz	VBW	1.2MHz

Instrumentation



Date : 29-Oct-2020 Test : Radiated Emissions 209 Job : C-3380
 PE : Zach Wilson Customer : Mercury Marine Quote : 319379

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	EE 960203	Analyzer - EMI Receiver	Keysight	N9038A	MY56400072	7/14/2020	7/14/2021	Active Calibration
2	AA 960194	Antenna - Biconical	A.H. Systems, Inc	SAS-540	780	9/21/2019	9/22/2021	Active Calibration
3	LSC-300	Cable	Chamber 3 Emiss -	-	-	8/9/2019	8/9/2021	Active Verification
4	AA 960195	Antenna - Log Periodic	A.H. Systems, Inc	SAS-512-2	557	7/24/2020	7/24/2021	Active Calibration

EUT Parameters

Input Power	12VDC via Bench Supply	Mode	WLAN Transmit
EUT Orientations	Side, Vertical	Data Rates	802.11b: 1,11Mbps 802.11g: 6,54Mbps 802.11n: MCS0,MCS7
Channels	1,6,11	Notes	Showing worst case plots only.

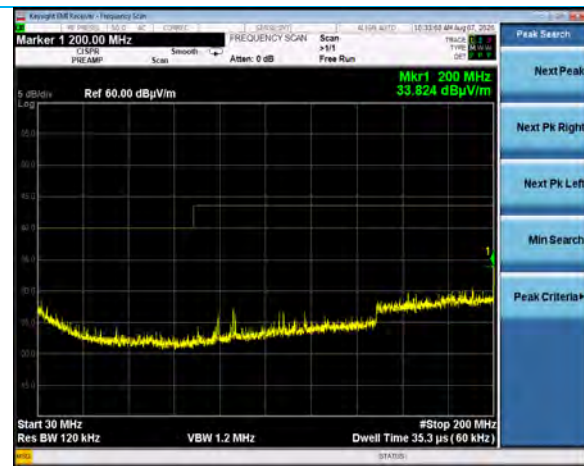
Data Table

Frequency (MHz)	Antenna Polarity	EUT Orientation	Channel	Data Rate	Height (cm)	Azimuth (degree)	Quasi-Peak Reading (dBμV/m)	Quasi-Peak Limit (dBμV/m)	Quasi-Peak Margin (dB)
182.3	Horizontal	Vertical	6	802.11b 1Mbps	199	0	25.5	43.5	18.0
408.0	Horizontal	Vertical	6	802.11g 6Mbps	100	0	39.4	46.0	6.7
408.0	Horizontal	Vertical	6	802.11b 11Mbps	100	0	39.4	46.0	6.6
408.0	Horizontal	Vertical	6	802.11b 1Mbps	100	0	31.5	46.0	14.5
408.0	Vertical	Side	6	802.11b 1Mbps	150	265	40.0	46.0	6.0

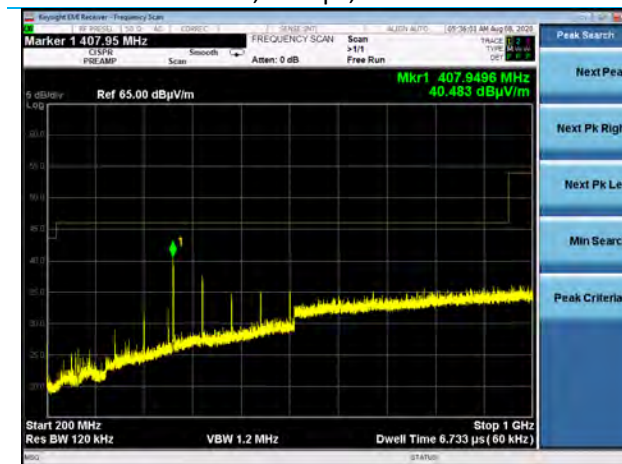
Plots



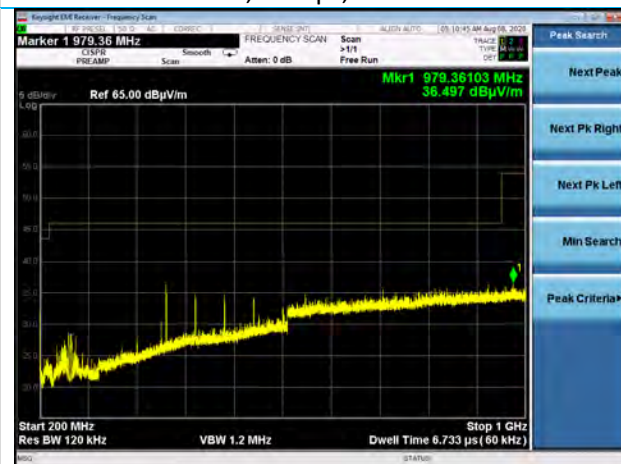
30-200 MHz, Horizontal Antenna, Vertical EUT
802.11b, 1Mbps, Channel 1



30-200 MHz, Vertical Antenna, Vertical EUT
802.11b, 1Mbps, Channel 1



200-1000 MHz, Horizontal Antenna, Vertical EUT
802.11b, 1Mbps, Channel 6



200-1000 MHz, Vertical Antenna, Vertical EUT
802.11b, 1Mbps, Channel 6

5.2.2 Radiated Emissions 1-25 GHz

Operator	Anthony Smith	QA	Braden Smith
Temperature	21.9°C, 22.2°C	R.H. %	62.3%, 65.0%
Test Date	8/10/2020, 8/13/2020	Location	Chamber 5, Chamber 3
Requirement	FCC 15.209, RSS-GEN	Method	ANSI C63.10

Limits: FCC 15.209, RSS-GEN @ 3m

Frequency (MHz)	Average Limit (dBμV/m)	Peak Limit (dBμV/m)
1-25 GHz	54	74

Test Parameters

Frequency	1-25 GHz	Distance	3 m
Detector(s)	Max hold with peak detector for plots. Reduced VBW method in relation to duty cycle for average measurements.	Table height	150 cm
RBW	1MHz	VBW	Peak: 3MHz Average: 802.11b, 1Mbps, 50Hz Average: 802.11b, 11Mbps, 430Hz Average: 802.11g, 6Mbps, 250Hz Average: 802.11g, 54Mbps, 3kHz Average: 802.11n, MCS0, 270Hz Average: 802.11n, MCS7, 3kHz

Instrumentation



Date : 29-Oct-2020 Test : Radiated Emissions 209 Job : C-3380
PE : Zach Wilson Customer : Mercury Marine Quote : 319379

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	EE 960203	Analyzer - EMI Receiver	Keysight	N9038A	MY56400072	7/14/2020	7/14/2021	Active Calibration
2	AA 960171	Cable	A.H. Systems, Inc	SAC-26G-6	386	9/21/2019	12/31/2020	Active Verification
3	AA 960153	Filter - High Pass 2.4 GHz	KwM	HPF-L-14186	7272-04	8/9/2019	7/16/2021	Active Calibration
4	AA 960081	Antenna - Double Ridge Horn	EMCO	3115	6907	10/18/2019	10/18/2020	Active Calibration
5	EE 960096	Antenna - Low Noise Amplifier	Mini-Circuits	ZVA-213X-S+	40201429	10/18/2019	10/18/2020	Active Calibration

Company: Brunswick Corporation	Page 49 of 53	Name: SmartCraft Connect
Report: TR319379 A		Model: SCC-1
Job: C-3380		Serial: Engineering Sample

EUT Parameters

Input Power	12VDC via Bench Supply	Mode	WLAN Transmit
EUT Orientations	Side, Vertical	Data Rates	802.11b: 1,11Mbps 802.11g: 6,54Mbps 802.11n: MCS0,MCS7
Channels	1,6,11	Notes	Showing worst case plots only.

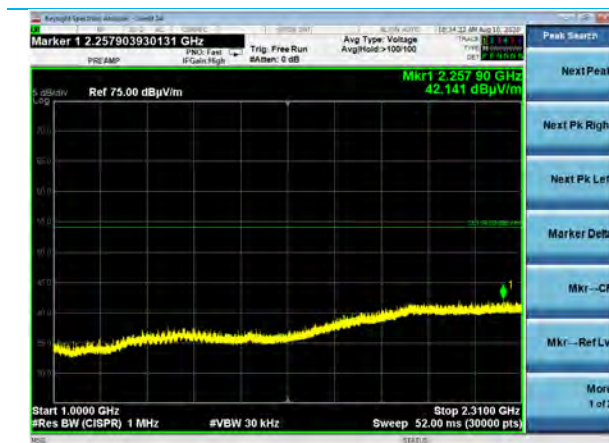
Data Tables

Frequency (MHz)	Antenna Polarity	Data Rate	Channel	Height (cm)	Azimuth (degree)	Average Reading (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	Peak Reading (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)
2343.9	Vertical	802.11b 1Mbps	1	158	320	40.6	54.0	13.4	57.2	74.0	16.8
2546.7	Vertical	802.11b 1Mbps	1	292	263	41.8	54.0	12.2	59.7	74.0	14.3
2483.5	Vertical	802.11b 1Mbps	11	144	0	41.4	54.0	12.6	51.5	74.0	22.5
2390.0	Vertical	802.11g 6Mbps	1	205	93	49.3	54.0	4.7	64.7	74.0	9.3
2483.5	Vertical	802.11g 6Mbps	11	205	92	52.0	54.0	2.0	65.2	74.0	8.8
2484.2	Vertical	802.11g 6Mbps	11	205	92	49.0	54.0	5.0	69.3	74.0	4.7
2483.6	Vertical	802.11g 54Mbps	11	200	93	49.9	54.0	4.1	66.2	74.0	7.8
2483.7	Vertical	802.11g 54Mbps	11	200	93	47.0	54.0	7.0	67.8	74.0	6.2
2389.9	Vertical	802.11g 54Mbps	1	205	93	46.6	54.0	7.4	60.7	74.0	13.3
2483.5	Vertical	802.11n MCS0	11	205	93	52.9	54.0	1.1	70.1	74.0	3.9
2390.0	Vertical	802.11n MCS0	1	205	93	49.9	54.0	4.1	65.2	74.0	8.8
2390.0	Vertical	802.11n MCS0	1	205	93	51.6	54.0	2.4	67.9	74.0	6.1

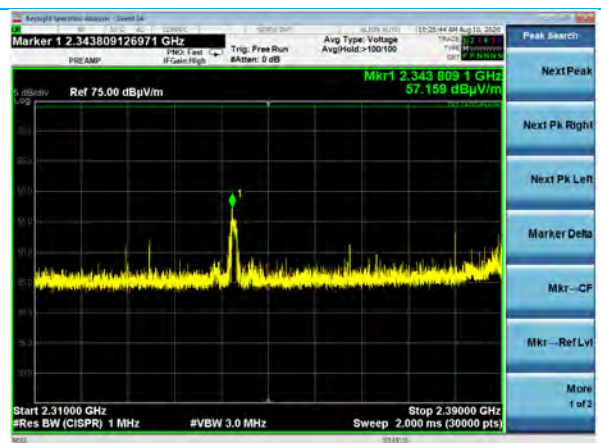
Frequency (MHz)	Antenna Polarity	Data Rate	Channel	EUT Orientation	Height (cm)	Azimuth (degree)	Average Reading (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	Peak Reading (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)
4923.9	Vertical	802.11b, 1Mbps	11	Side	105	14	35.3	54.0	18.7	43.5	74.0	30.5
4924.0	Horizontal	802.11b, 1Mbps	11	Side	155	190	37.9	54.0	16.1	44.7	74.0	29.3
4923.9	Horizontal	802.11b, 1Mbps	11	Vertical	140	53	38.1	54.0	15.9	44.2	74.0	29.8
4923.9	Vertical	802.11b, 1Mbps	11	Vertical	145	53	38.0	54.0	16.0	44.5	74.0	29.5
4824.0	Horizontal	802.11b, 1Mbps	1	Vertical	145	55	42.0	54.0	12.0	47.4	74.0	26.6
4873.9	Horizontal	802.11b, 1Mbps	6	Vertical	145	54	39.2	54.0	14.8	45.3	74.0	28.7

Frequency (MHz)	Antenna Polarity	Data Rate	Channel	EUT Orientation	Height (cm)	Azimuth (degree)	Average Reading (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	Peak Reading (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)
7386.7	Vertical	802.11b, 1Mbps	11	Side	185	193	33.8	54.0	20.2	45.0	74.0	29.0
7386.7	Horizontal	802.11b, 1Mbps	11	Side	125	284	35.8	54.0	18.2	45.8	74.0	28.2
7386.7	Horizontal	802.11b, 1Mbps	11	Vertical	142	59	35.0	54.0	19.0	45.2	74.0	28.8
7386.7	Vertical	802.11b, 1Mbps	11	Vertical	170	52	35.2	54.0	18.8	45.3	74.0	28.7
7311.7	Horizontal	802.11b, 1Mbps	6	Side	140	281	35.1	54.0	18.9	45.0	74.0	29.0

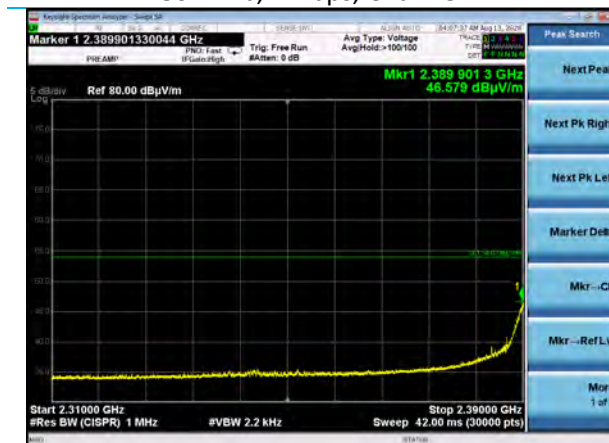
Plots



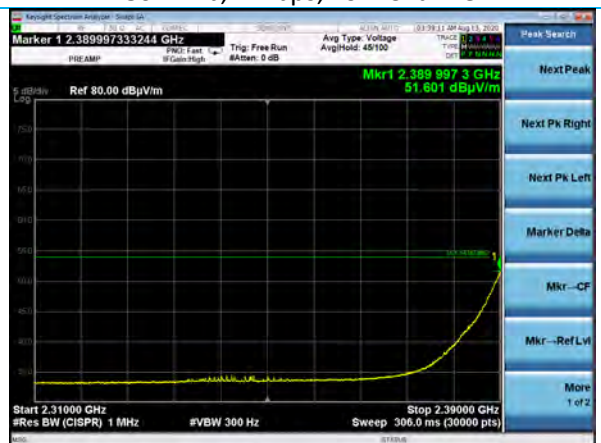
1000-2310 MHz, Vertical Antenna, Vertical EUT
802.11b, 1Mbps, Channel 1



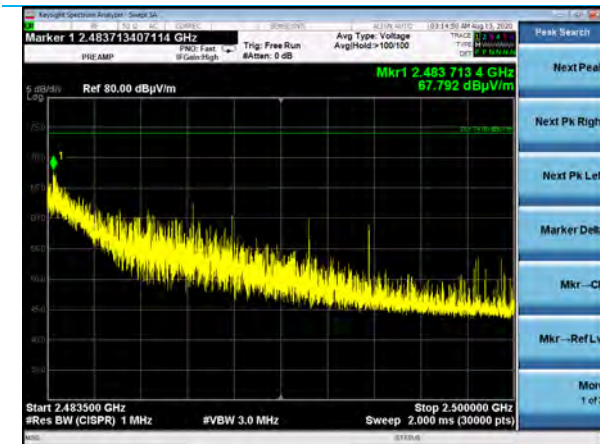
2310-2390 MHz, Vertical Antenna, Vertical EUT
802.11b, 1Mbps, Low Channel



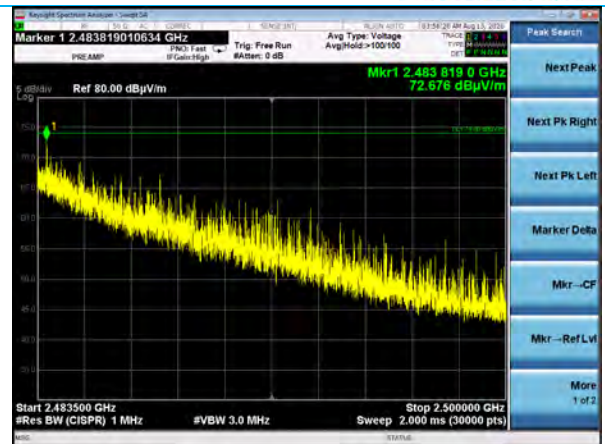
2310-2390 MHz, Vertical Antenna, Vertical EUT
802.11g, 6Mbps, Low Channel



2310-2390 MHz, Vertical Antenna, Vertical EUT
802.11n, MCS0, Low Channel



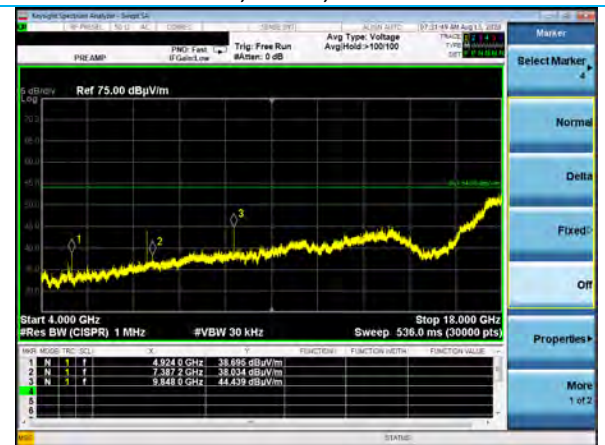
2483.5-2500 MHz, Vertical Antenna, Side EUT
802.11g, 54Mbps, Channel 11



2483.5-2500 MHz, Vertical Antenna, Side EUT
802.11n, MCS0, Channel 11



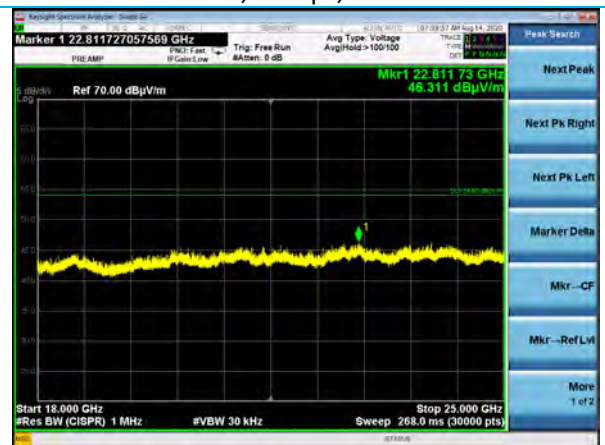
2.5-4 GHz, Vertical Antenna, Vertical EUT
802.11b, 1Mbps, Channel 11



4-18 GHz, Horizontal Antenna, Side EUT
802.11b, 1Mbps, Channel 1



4-18 GHz, Vertical Antenna, Side EUT
802.11b, 1Mbps, Low Channel



18-25 GHz, Vertical Antenna, Vertical EUT
802.11b, 1Mbps, Channel 11

6 REVISION HISTORY

Version	Date	Notes	Person
1	10/30/2020	Initial Draft	Zach Wilson
2	11/13/2020	Revised per internal review	Zach Wilson

END OF REPORT