



REGULATORY COMPLIANCE TEST REPORT

FCC CFR 47 15.247, RSS-247 Issue 2

Report No.: BSTR81-U4 Rev A

Company: Bright Star Engineering, Inc.

Model: MPOD3-C

REGULATORY COMPLIANCE TEST REPORT

Company: Bright Star Engineering, Inc.

Model: MPOD3-C

To: FCC 15.247, RSS-247 Issue 2

Test Report Serial No.: BSTR81-U4 Rev A

This report supersedes: NONE

Applicant: Bright Star Engineering, Inc.
299 Ballardvale Street, suite 5
Wilmington, Massachusetts 01887
USA

Issue Date: 27th October 2020

This Test Report is Issued Under the Authority of:

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MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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1. ACCREDITATION, LISTINGS & RECOGNITION

1.1. TESTING ACCREDITATION

MiCOM Labs, Inc. is an accredited Electrical testing laboratory per the international standard ISO/IEC 17025:2017. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; <http://www.a2la.org/scopepdf/2381-01.pdf>



Accredited Laboratory

A2LA has accredited

MICOM LABS

Pleasanton, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).



Presented this 24th day of February 2020.



Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2381.01
Valid to November 30, 2021

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

1.2. RECOGNITION

MiCOM Labs, Inc has widely recognized wireless testing and certification capabilities. In addition to being recognized for Testing and Certification under Phase 2 agreements with Canada, Europe and Japan, our international recognition includes Conformity Assessment Body designation under Phase 1 agreements with APEC MRA countries. MiCOM Labs test reports are accepted globally.

Country	Recognition Body	Status	MRA Phase	Identification No.
USA	Federal Communications Commission (FCC)	TCB	-	US0159 Test Firm Designation#: US1084
Canada	Industry Canada (ISED)	FCB	APEC MRA 2	US0159 ISED#: 4143A
Japan	MIC (Ministry of Internal Affairs and Communication)	CAB	Japan MRA 2	RCB 210
	Japan Approvals Institute for Telecommunication Equipment (JATE)			
	VCCI			
Europe	European Commission	NB	EU MRA 2	A-0012 NB 2280
Mexico	Instituto Federal de Telecomunicaciones (IFT)	CAB	Mexico MRA 1	US0159
Australia	Australian Communications and Media Authority (ACMA)	CAB	APEC MRA 1	US0159
Hong Kong	Office of the Telecommunication Authority (OFTA)			
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)			
Singapore	Infocomm Development Authority (IDA)			
Taiwan	National Communications Commission (NCC) Bureau of Standards, Metrology and Inspection (BSMI)			
Vietnam	Ministry of Communication (MIC)			

EU MRA – European Union Mutual Recognition Agreement

NB – Notified Body

APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement. Recognition agreement under which test lab is accredited to regulatory standards of the APEC member countries.

MRA Phase I - recognition for product testing

Phase II – recognition for both product testing and certification

1.3. PRODUCT CERTIFICATION

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard ISO/IEC 17065:2012. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.02. MiCOM Labs test schedule is available at the following URL; <http://www.a2la.org/scopepdf/2381-02.pdf>



United States of America – Telecommunication Certification Body (TCB)
Industry Canada – Certification Body, CAB Identifier – US0159
Europe – Notified Body (NB), NB Identifier - 2280
Japan – Recognized Certification Body (RCB), RCB Identifier - 210

2. DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft	26 th October 2020	Draft for comment This report covers spurious emissions performed on a host device per FCC KDB 996369 D02 'Frequently asked questions and answers about modules'. Technologies covered: 2.4GHz CCK and OFDM
Rev A	27 th October 2020	Initial Release

In the above table the latest report revision will replace all earlier versions.

3. TEST RESULT CERTIFICATE

Manufacturer: Bright Star Engineering, Inc. 299 Ballardvale Street, suite 5 Wilmington Massachusetts 01887 USA	Tested By: MiCOM Labs, Inc. 575 Boulder Court Pleasanton California 94566 USA
Model: MPOD3-C	Telephone: +1 925 462 0304 Fax: +1 925 462 0306
Type Of Equipment: Wireless Data Communication / Automotive Diagnostics	
S/N's: MP3-000064	
Test Date(s): 19 th – 21 st October 2020	Website: www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC CFR 47 Part 15 Subpart C 15.247 (DTS) ISED RSS-247 Issue 2	EQUIPMENT COMPLIES

MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

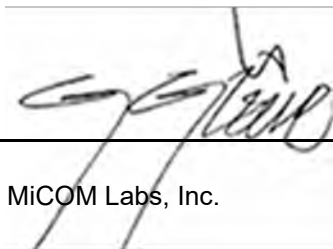
Notes:

1. This document reports conditions under which testing was conducted and the results of testing performed.
2. Details of test methods used have been recorded and kept on file by the laboratory.
3. Test results apply only to the item(s) tested.

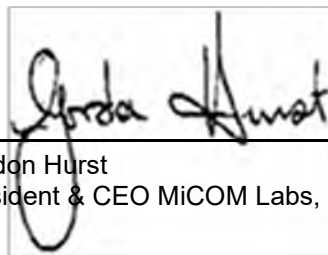
Approved & Released for MiCOM Labs, Inc. by:



Graeme Grieve
Quality Manager MiCOM Labs, Inc.



Gordon Hurst
President & CEO MiCOM Labs, Inc.



4. REFERENCES AND MEASUREMENT UNCERTAINTY

4.1. Normative References

REF.	PUBLICATION	YEAR	TITLE
I	KDB 662911 D01 & D02	Oct 31 2013	Guidance for measurement of output emission of devices that employ single transmitter with multiple outputs or systems with multiple transmitters operating simultaneously in the same frequency band
II	KDB 558074 D01 v05r02	2nd April 2019	Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices operating under section 15.247 of the FCC Rules.
III	A2LA	October 2019	R105 - Requirement's When Making Reference to A2LA Accreditation Status
IV	KDB 996369 D02	October 23, 2015	Frequently asked questions and answers about modules
V	ANSI C63.10	2013	American National Standard for Testing Unlicensed Wireless Devices
VI	ANSI C63.4	2014	American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
VII	CISPR 32	2015	Electromagnetic compatibility of multimedia equipment - Emission requirements
VIII	ETSI TR 100 028	2001-12	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
IX	FCC 47 CFR Part 15.247	2020	Radio Frequency Devices; Subpart C – Intentional Radiators
X	ICES-003	Issue 6 Jan 2016; Updated April 2019	Information Technology Equipment (Including Digital Apparatus) – Limits and methods of measurement.
XI	M 3003	Edition 3 Nov.2012	Expression of Uncertainty and Confidence in Measurements
XII	RSS-247 Issue 2	Feb 2017	Digital Transmission Systems (DTSSs), Frequency Hopping System (FHSs) and Licence-Exempt Local Area Network (LE-LEN) Devices
XIII	RSS-Gen Issue 5	March 2019 Amendment 1	General Requirements for Compliance of Radio Apparatus
XIV	FCC 47 CFR Part 2.1033	2020	FCC requirements and rules regarding photographs and test setup diagrams.
	KDB 789033 D02 V02r01	14th December, 2017	Guidelines For Compliance Testing Of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E

4.2. Test and Uncertainty Procedure

Conducted and radiated emission measurements were conducted in accordance with American National Standards Institute ANSI C63.4, listed in the Normative References section of this report.

Measurement uncertainty figures are calculated in accordance with ETSI TR 100 028 Parts 1 and 2.

Measurement uncertainties stated are based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95 % in accordance with UKAS document M 3003 listed in the Normative References section of this report.

5. PRODUCT DETAILS AND TEST CONFIGURATIONS

5.1. Technical Details

Details	Description
Purpose:	Test of the Bright Star Engineering, Inc. MPOD3-C to FCC CFR 47 Part 15 Subpart C 15.247 (DTS). Radio Frequency Devices; Subpart C – Intentional Radiators
Applicant:	Bright Star Engineering, Inc. 299 Ballardvale Street, suite 5 Wilmington Massachusetts 01887 USA
Manufacturer:	Bright Star Engineering, Inc.
Laboratory performing the tests:	MiCOM Labs, Inc. 575 Boulder Court Pleasanton California 94566 USA
Test report reference number:	BSTR81-U4
Date EUT received:	18th October 2020
Standard(s) applied:	FCC CFR 47 Part 15 Subpart C 15.247 (DTS) ISED RSS 247 Issue 2
Dates of test (from - to):	19th – 22nd October 2020
No of Units Tested:	1
Product Family Name:	MicroPod 3
Model(s):	MPOD3-C
Location for use:	Indoors and Outdoors
Declared Frequency Range(s):	2400 - 2483.5 MHz;
Type of Modulation:	CCK, OFDM
EUT Modes of Operation:	802.11b; g; HT-20; HT-40;
Declared Nominal Output Power (dBm):	See Laird Technologies Test Report: TR 316356 A
Transmit/Receive Operation:	Transceiver
Rated Input Voltage and Current:	12 Vdc 120 mA
Operating Temperature Range:	Nominal: 20 °C Max: +60 °C Min: -20 °C
Equipment Dimensions:	1.82 x 0.94 x 2.85 in
Weight:	0.11 lbs
Hardware Rev:	Rev 7/5
Software Rev:	0.4.1

5.2. Scope Of Test Program

Bright Star Engineering, Inc. MPOD3-C

The scope of the test program was to test the Bright Star Engineering, Inc. MPOD3-C, configurations in the frequency ranges 2400 - 2483.5 MHz for compliance against the following specification:

FCC CFR 47 Part 15 Subpart C 15.247 (DTS)

Radio Frequency Devices; Subpart C – Intentional Radiators

ISSED RSS-247 Issue 2

Digital Transmission Systems (DTS), Frequency Hopping System (FHSs) and License-Exempt Local Area Network (LE-LEN) Devices

NOTE: As a result of incorporating a wireless module into the MPOD3-C this report reflects the required host level spurious emissions testing required under KDB 996369 D02 'Frequently asked questions and answers about modules'.

The wireless module was tested by Laird Technologies Sterling LW5B module. See the Laird Technologies Test Report: TR 316356 A for DTS technologies.

5.3. Equipment Model(s) and Serial Number(s)

Type (EUT/Support)	Equipment Description (Including Brand Name)	Mfr.	Model No.	Serial No.
EUT	Automotive Diagnostics	Bright Star Engineering Inc.	MPOD3	MP3-000064
Support	Laptop	HP	14-dk0002dx	
Support	Access Point	TP-Link	AC1750	

5.4. Antenna Details

Type	Manufacturer	Model	Family	Gain (dBi)	BF Gain	Dir BW	X-Pol	Frequency Band (MHz)
Integral	Johanson	2450AD14A5500	Chip	1.0	-	-	-	2400-2483.5

BF Gain - Beamforming Gain

Dir BW - Directional BeamWidth

X-Pol - Cross Polarization

5.5. Cabling and I/O Ports

Port Type	Port Description	Qty	Screened (Yes/ No)	Length
MiniUSB	USB	1	N	< 3M
J1962	Test Harness	1	N	< 3M

Equipment Details

The following is a description of supporting equipment used during the test program.

5.6. Test Configurations

Results for the following configurations are provided in this report:

DC Host powered

5.7. Equipment Modifications

The following modifications were required to bring the equipment into compliance:

1. NONE

5.8. Deviations from the Test Standard

The following deviations from the test standard were required in order to complete the test program:

1. NONE

6. TEST SUMMARY

List of Measurements

Test Header	Result	Data Link
6 dB & 99% Bandwidth	Not Tested	Note 1
Conducted Output Power	Not Tested	Note 1
Power Spectral Density	Not Tested	Note 1
Emissions	Complies	-
(1) Conducted Emissions	Not Tested	Note 1
(i) Conducted Spurious Emissions	Not Tested	Note 1
(ii) Conducted Band-Edge Emissions	Not Tested	Note 1
(2) Radiated Emissions	Complies	
(i) TX Spurious & Restricted Band Emissions	Complies	View Data
(ii) Restricted Edge & Band-Edge Emissions	Complies	View Data
(3) Digital Emissions (0.03 - 1 GHz)	Not Tested	Note 2
(4) AC Wireline Emissions	Not Tested	Note 1
Maximum Permissible Exposure	Not Tested	Note 1
RF Unique Connector	Not Tested	Note 1

*Note 1: See Laird Technologies Test Report TR 316356 A (DTS) for test results

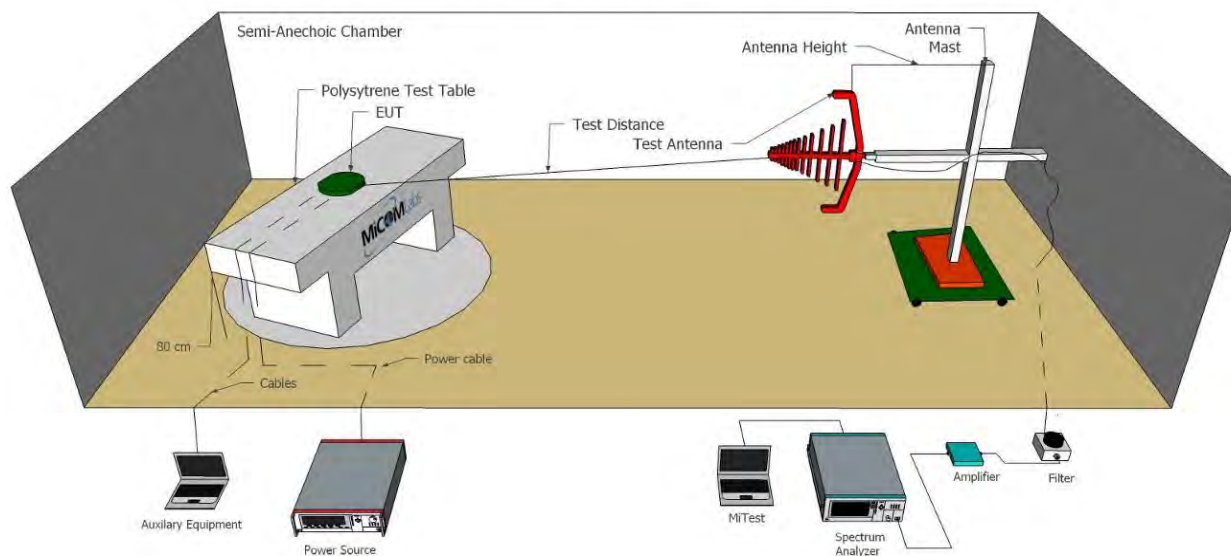
*Note 2: See MiCOM Labs test report BSTR80-U2 for Unintentional Emissions

7. TEST EQUIPMENT CONFIGURATION(S)

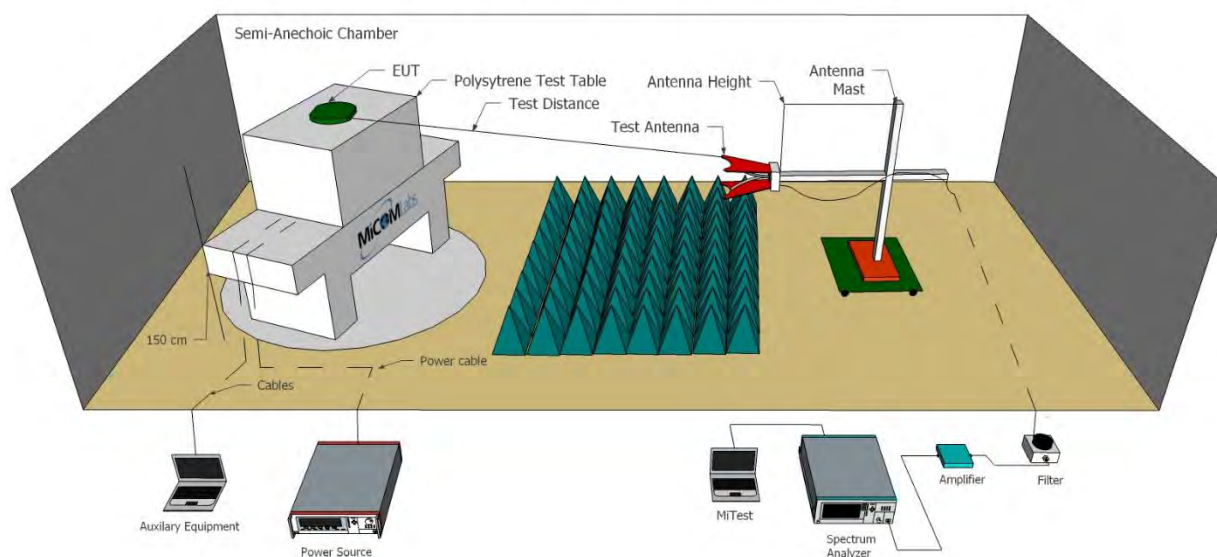
7.1. Radiated Emissions - 3m Chamber

Test Setup for Radiated Emissions for above and below 1 GHz

Radiated Emissions Below 1GHz Test Setup



Radiated Emissions Above 1GHz Test Setup



A full system calibration was performed on the test station and any resulting system losses (or gains) were taken into account in the production of all final measurement data.

Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
170	Video System Controller for Semi Anechoic Chamber	Panasonic	WV-CU101	04R08507	Not Required
287	Rohde & Schwarz 40 GHz Receiver	Rhode & Schwarz	ESIB40	100201	8 Oct 2021
298	3M Radiated Emissions Chamber Maintenance Check	MiCOM	3M Chamber	298	26 Nov 2020
338	Sunol 30 to 3000 MHz Antenna	Sunol	JB3	A052907	4 Apr 2021
378	Rohde & Schwarz 40 GHz Receiver with Generator	Rhode & Schwarz	ESIB40	100107/040	12 Mar 2021
396	2.4 GHz Notch Filter	Microtronics	BRM50701	001	4 Dec 2020
397	Amp 10 - 2500MHz	MiCOM Labs	Amp 10 - 2500 MHz	NA	9 Dec 2020
399	ETS 1-18 GHz Horn Antenna	ETS	3117	00154575	12 Dec 2020
406	Amplifier for Radiated Emissions	MiCOM Labs	40dB 1 to 18GHz Amp	0406	9 Dec 2020
410	Desktop Computer	Dell	Inspiron 620	WS38	Not Required
411	Mast/Turntable Controller	Sunol Sciences	SC98V	060199-1D	Not Required
412	USB to GPIB Interface	National Instruments	GPIB-USB HS	11B8DC2	Not Required
413	Mast Controller	Sunol Science	TWR95-4	030801-3	Not Required
414	DC Power Supply 0-60V	HP	6274	1029A01285	Cal when used
415	Turntable Controller	Sunol Sciences	Turntable Controller	None	Not Required
447	MiTest Rad Emissions Test Software	MiCOM	Rad Emissions Test Software Version 1.0	447	Not Required
462	Schwarzbeck cable from Antenna to Amplifier.	Schwarzbeck	AK 9513	462	4 Dec 2020
463	Schwarzbeck cable from Amplifier to Bulkhead.	Schwarzbeck	AK 9513	463	4 Dec 2020
464	Schwarzbeck cable from Bulkhead to Receiver	Schwarzbeck	AK 9513	464	4 Dec 2020
466	Low Pass Filter DC-1500 MHz	Mini-Circuits	NLP-1750+	VUU10401438	4 Dec 2020
480	Cable - Bulkhead to Amp	SRC Haverhill	157-3050360	480	4 Dec 2020
481	Cable - Bulkhead to Receiver	SRC Haverhill	151-3050787	481	4 Dec 2020
510	Barometer/Thermometer	Control Company	68000-49	170871375	20 Dec 2020
518	Cable - Amp to Antenna	SRC Haverhill	157-3051574	518	4 Dec 2020
CC05	Confidence Check	MiCOM	CC05	None	4 Dec 2020

8. MEASUREMENT AND PRESENTATION OF TEST DATA

The measurement and graphical data presented in this test report was generated automatically using state-of-the-art technology creating an easy to read report structure. Numerical measurement data is separated from supporting graphical data (plots) through hyperlinks. Numerical measurement data can be reviewed without scrolling through numerous graphical pages to arrive at the next data matrix.

Plots have been relegated into the Appendix 'Graphical Data'.

Test and report automation was performed by [MiTest](#). [MiTest](#) is an automated test system developed by MiCOM Labs. [MiTest](#) is the first cloud based modular test system enabling end-to-end automation of regulatory compliance testing for conducted RF testing.



The MiCOM Labs "[MiTest](#)" Automated Test System" (Patent Pending)

9. TEST RESULTS

9.1. Radiated Emissions

Radiated Test Conditions for Radiated Spurious and Band-Edge Emissions (Restricted Bands)			
Standard:	FCC CFR 47 Part 15 Subpart C 15.247 (DTS) ISSED RSS 247 Issue 2	Ambient Temp. (°C):	20.0 - 24.5
Test Heading:	Radiated Spurious and Band-Edge Emissions	Rel. Humidity (%):	32 - 45
Standard Section(s):	FCC: 15.205, 15.209 RSS-247 5.5	Pressure (mBars):	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Radiated Spurious and Band-Edge Emissions (Restricted Bands)

Radiated emissions for restricted bands above 1 GHz are measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode. Depending on the frequency band spanned a notch filter and waveguide filter was used to remove the fundamental frequency. The highest emissions relative to the limit are listed for each frequency spanned. Measurements on any restricted band frequency or frequencies above 1 GHz are based on the use of measurement instrumentation employing peak and average detectors. All measurements were performed using a resolution bandwidth of 1 MHz.

Test configuration and setup for Radiated Spurious and Band-Edge Measurement were per the Radiated Test Set-up specified in this document.

Limits for Restricted Bands

Peak emission: 74 dBuV/m

Average emission: 54 dBuV/m

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data.

$$FS = R + AF + CORR - FO$$

where:

FS = Field Strength

R = Measured Spectrum analyzer Input Amplitude

AF = Antenna Factor

CORR = Correction Factor = CL – AG + NFL

CL = Cable Loss

AG = Amplifier Gain

FO = Distance Falloff Factor

NFL = Notch Filter Loss or Waveguide Loss

Example:

Given receiver input reading of 51.5 dBmV; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB and Notch Filter Loss of 1 dB. The Field Strength (FS) of the measured emission is:

$$FS = 51.5 + 8.5 + 1.3 - 26.0 + 1 = 36.3 \text{ dBmV/m}$$

Conversion between dBmV/m (or dBmV) and mV/m (or mV) are as follows:

$$\text{Level (dBmV/m)} = 20 * \text{Log (level (mV/m))}$$

$$40 \text{ dBmV/m} = 100 \text{ mV/m}$$

$$48 \text{ dBmV/m} = 250 \text{ mV/m}$$

Restricted Bands of Operation (15.205)

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

Frequency Band			
MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46

2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

(b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

(c) Except as provided in paragraphs (d) and (e) of this section, regardless of the field strength limits specified elsewhere in this subpart, the provisions of this section apply to emissions from any intentional radiator.

(d) The following devices are exempt from the requirements of this section:

(1) Swept frequency field disturbance sensors operating between 1.705 and 37 MHz provided their emissions only sweep through the bands listed in paragraph (a) of this section, the sweep is never stopped with the fundamental emission within the bands listed in paragraph (a) of this section, and the fundamental emission is outside of the bands listed in paragraph (a) of this section more than 99% of the time the device is actively transmitting, without compensation for duty cycle.

(2) Transmitters used to detect buried electronic markers at 101.4 kHz which are employed by telephone companies.

(3) Cable locating equipment operated pursuant to §15.213.

(4) Any equipment operated under the provisions of §15.253, 15.255, and 15.256 in the frequency band 75-85 GHz, or §15.257 of this part.

(5) Biomedical telemetry devices operating under the provisions of §15.242 of this part are not subject to the restricted band 608-614 MHz but are subject to compliance within the other restricted bands.

(6) Transmitters operating under the provisions of subparts D or F of this part.

(7) Devices operated pursuant to §15.225 are exempt from complying with this section for the 13.36-13.41 MHz band only.

(8) Devices operated in the 24.075-24.175 GHz band under §15.245 are exempt from complying with the requirements of this section for the 48.15-48.35 GHz and 72.225-72.525 GHz bands only, and shall not exceed the limits specified in §15.245(b).

(9) Devices operated in the 24.0-24.25 GHz band under §15.249 are exempt from complying with the requirements of this section for the 48.0-48.5 GHz and 72.0-72.75 GHz bands only, and shall not exceed the limits specified in §15.249(a).

(e) Harmonic emissions appearing in the restricted bands above 17.7 GHz from field disturbance sensors operating under the provisions of §15.245 shall not exceed the limits specified in §15.245(b).

9.1.1. TX Spurious & Restricted Band Emissions

Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	Integral	Variant:	802.11b
Antenna Gain (dBi):	1.0	Modulation:	CCK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2412.00	Data Rate:	1 Mbit/s
Power Setting:	Max	Tested By:	SB

Test Measurement Results

1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#1	2184.17	49.62	1.93	-12.78	38.77	Peak (NRB)	Vertical	100	0	--	--	Pass
#2	4653.80	59.47	2.83	-12.42	49.88	Max Peak	Vertical	102	36	74.0	-24.1	Pass
#3	4653.80	39.06	2.83	-12.42	29.47	Max Avg	Vertical	102	36	54.0	-24.5	Pass
#4	4659.05	56.25	2.81	-12.45	46.61	Max Peak	Horizontal	108	33	74.0	-27.4	Pass
#5	4659.05	38.62	2.81	-12.45	28.98	Max Avg	Horizontal	108	33	54.0	-25.0	Pass
#6	7237.10	46.63	3.64	-7.88	42.39	Peak (NRB)	Horizontal	100	0	--	--	Pass

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	Integral	Variant:	802.11b
Antenna Gain (dBi):	1.0	Modulation:	CCK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2437.00	Data Rate:	1 Mbit/s
Power Setting:	Max	Tested By:	SB

Test Measurement Results

1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#1	3423.47	52.69	2.43	-12.09	43.03	Peak (NRB)	Vertical	151	0	--	--	Pass
#2	4874.16	60.87	2.92	-12.52	51.27	Max Peak	Horizontal	98	139	74.0	-22.7	Pass
#3	4874.16	56.14	2.92	-12.52	46.54	Max Avg	Horizontal	98	139	54.0	-7.5	Pass
#4	7310.11	57.62	3.62	-7.87	53.37	Max Peak	Horizontal	196	97	74.0	-20.6	Pass
#5	7310.11	50.29	3.62	-7.87	46.04	Max Avg	Horizontal	196	97	54.0	-8.0	Pass

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	Integral	Variant:	802.11b
Antenna Gain (dBi):	1.0	Modulation:	CCK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2462.00	Data Rate:	1 Mbit/s
Power Setting:	Max	Tested By:	SB

Test Measurement Results

1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#1	3322.13	56.48	2.37	-12.04	46.81	Peak (NRB)	Vertical	160	360	--	--	Pass
#2	4653.70	64.27	2.83	-12.42	54.68	Max Peak	Vertical	141	218	74.0	-19.3	Pass
#3	4653.70	40.77	2.83	-12.42	31.18	Max Avg	Vertical	141	218	54.0	-22.8	Pass
#4	4868.57	53.40	2.94	-12.52	43.82	Max Peak	Horizontal	190	179	74.0	-30.2	Pass
#5	4868.57	39.30	2.94	-12.52	29.72	Max Avg	Horizontal	190	179	54.0	-24.3	Pass
#6	7380.49	50.20	3.59	-7.83	45.96	Max Peak	Horizontal	153	171	74.0	-28.0	Pass
#7	7380.49	37.09	3.59	-7.83	32.85	Max Avg	Horizontal	153	171	54.0	-21.2	Pass

Note: click the links in the above matrix to view the graphical image (plot).

9.1.2. Restricted Edge & Band-Edge Emissions

2390 MHz Radiated Lower Band-Edge Emissions

		Band-Edge Freq	Limit 74.0dBμV/m	Limit 54.0dBμV/m	Power Setting
Operational Mode	Operating Frequency (MHz)	MHz	dBμV/m	dBμV/m	
802.11b	2412.00	2390.00	60.77	48.41	Max
802.11g	2412.00	2390.00	60.89	47.74	Max
802.11n HT-20	2412.00	2390.00	59.59	47.74	Max
802.11n HT-40	2422.00	2390.00	59.41	47.74	Max

2483.5 MHz Radiated Higher Band-Edge Emissions

		Band-Edge Freq	Limit 74.0dBμV/m	Limit 54.0dBμV/m	Power Setting
Operational Mode	Operating Frequency (MHz)	MHz	dBμV/m	dBμV/m	
802.11b	2462.00	2483.50	61.08	48.17	Max
802.11g	2462.00	2483.50	60.35	48.17	Max
802.11n HT-20	2462.00	2483.50	61.39	48.17	Max
802.11n HT-40	2452.00	2483.50	61.52	48.17	Max

Click on the links to view the data.

Equipment Configuration for 2390 MHz Radiated Band-Edge Emissions

Antenna:	Integral	Variant:	CCK
Antenna Gain (dBi):	1.0	Modulation:	802.11b
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2412.00	Data Rate:	6
Power Setting:	Max	Tested By:	SB

Test Measurement Results

2310.00 - 2420.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#1	2385.59	26.82	2.01	31.94	60.77	Max Peak	Horizontal	164	354	74.0	-13.2	Pass
#2	2385.81	14.46	2.01	31.94	48.41	Max Avg	Horizontal	164	354	54.0	-5.6	Pass
#3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for 2390 MHz Radiated Band-Edge Emissions

Antenna:	Integral	Variant:	802.11g
Antenna Gain (dBi):	1.0	Modulation:	OFDM
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2412.00	Data Rate:	6 MBIt/s
Power Setting:	Max	Tested By:	SB

Test Measurement Results

2310.00 - 2420.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#1	2380.96	26.97	2.01	31.91	60.89	Max Peak	Horizontal	164	354	74.0	-13.1	Pass
#2	2390.00	13.76	2.02	31.96	47.74	Max Avg	Horizontal	164	354	54.0	-6.3	Pass
#3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for 2390 MHz Radiated Band-Edge Emissions

Antenna:	Integral	Variant:	802.11n HT20
Antenna Gain (dBi):	1.0	Modulation:	OFDM
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2412.00	Data Rate:	6.5 Mbit/s
Power Setting:	Max	Tested By:	SB

Test Measurement Results

2310.00 - 2420.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#1	2388.24	25.62	2.02	31.95	59.59	Max Peak	Horizontal	164	354	74.0	-14.4	Pass
#2	2390.00	13.76	2.02	31.96	47.74	Max Avg	Horizontal	164	354	54.0	-6.3	Pass
#3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for 2390 MHz Radiated Band-Edge Emissions

Antenna:	Integral	Variant:	802.11n HT40
Antenna Gain (dBi):	1.0	Modulation:	OFDM
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2422.00	Data Rate:	13.5 Mbit/s
Power Setting:	Max	Tested By:	SB

Test Measurement Results

2310.00 - 2442.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#1	2390.00	13.76	2.02	31.96	47.74	Max Avg	Horizontal	164	353	54.0	-6.3	Pass
#2	2390.00	25.43	2.02	31.96	59.41	Max Peak	Horizontal	164	353	74.0	-14.6	Pass
#3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for 2483.5 MHz Radiated Band-Edge Emissions

Antenna:	Integral	Variant:	802.11b
Antenna Gain (dBi):	1.0	Modulation:	CCK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2462.00	Data Rate:	1 Mbit/s
Power Setting:	Max	Tested By:	SB

Test Measurement Results

2450.00 - 2520.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#2	2510.85	13.79	2.06	32.32	48.17	Max Avg	Horizontal	167	351	54.0	-5.8	Pass
#3	2515.65	26.71	2.04	32.33	61.08	Max Peak	Horizontal	167	351	74.0	-12.9	Pass
#1	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for 2483.5 MHz Radiated Band-Edge Emissions

Antenna:	Integral	Variant:	802.11g
Antenna Gain (dBi):	1.0	Modulation:	OFDM
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2462.00	Data Rate:	6 Mbit/s
Power Setting:	Max	Tested By:	SB

Test Measurement Results

2450.00 - 2520.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#2	2485.74	26.00	2.02	32.33	60.35	Max Peak	Horizontal	167	351	74.0	-13.7	Pass
#3	2510.71	13.79	2.06	32.32	48.17	Max Avg	Horizontal	167	351	54.0	-5.8	Pass
#1	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for 2483.5 MHz Radiated Band-Edge Emissions

Antenna:	Integral	Variant:	802.11n HT20
Antenna Gain (dBi):	1.0	Modulation:	OFDM
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2462.00	Data Rate:	6.5 Mbit/s
Power Setting:	Max	Tested By:	SB

Test Measurement Results

2450.00 - 2520.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#2	2506.95	27.01	2.06	32.32	61.39	Max Peak	Horizontal	167	351	74.0	-12.6	Pass
#3	2510.99	13.79	2.06	32.32	48.17	Max Avg	Horizontal	167	351	54.0	-5.8	Pass
#1	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for 2483.5 MHz Radiated Band-Edge Emissions

Antenna:	Integral	Variant:	802.11n HT40
Antenna Gain (dBi):	1.0	Modulation:	OFDM
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2452.00	Data Rate:	13.5 Mbit/s
Power Setting:	Max	Tested By:	SB

Test Measurement Results

2450.00 - 2520.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#2	2490.93	27.17	2.03	32.32	61.52	Max Peak	Horizontal	167	351	74.0	-12.5	Pass
#3	2512.40	13.80	2.05	32.32	48.17	Max Avg	Horizontal	167	351	54.0	-5.8	Pass
#1	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Note: click the links in the above matrix to view the graphical image (plot).

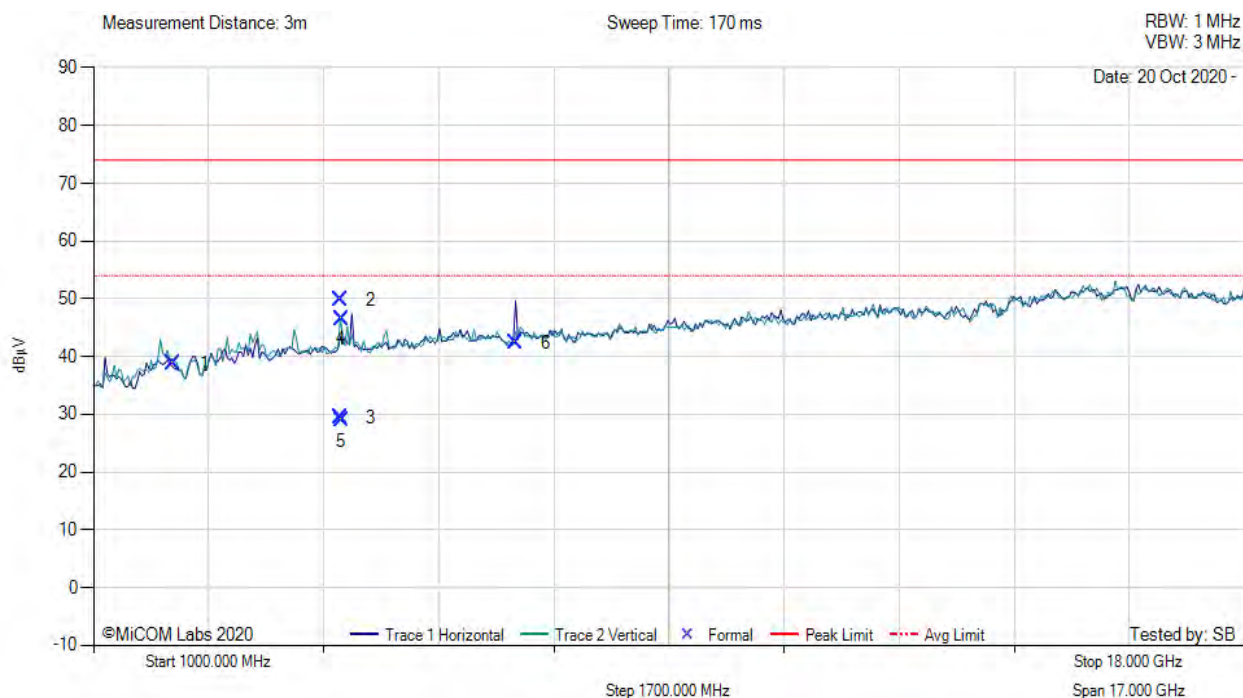
A. APPENDIX - GRAPHICAL IMAGES

A.1.1. Radiated Emissions

A.1.1.1. TX Spurious & Restricted Band Emissions



Variant: CCK, Test Freq: 2412.00 MHz, Power Setting: Max, Duty Cycle (%): 99

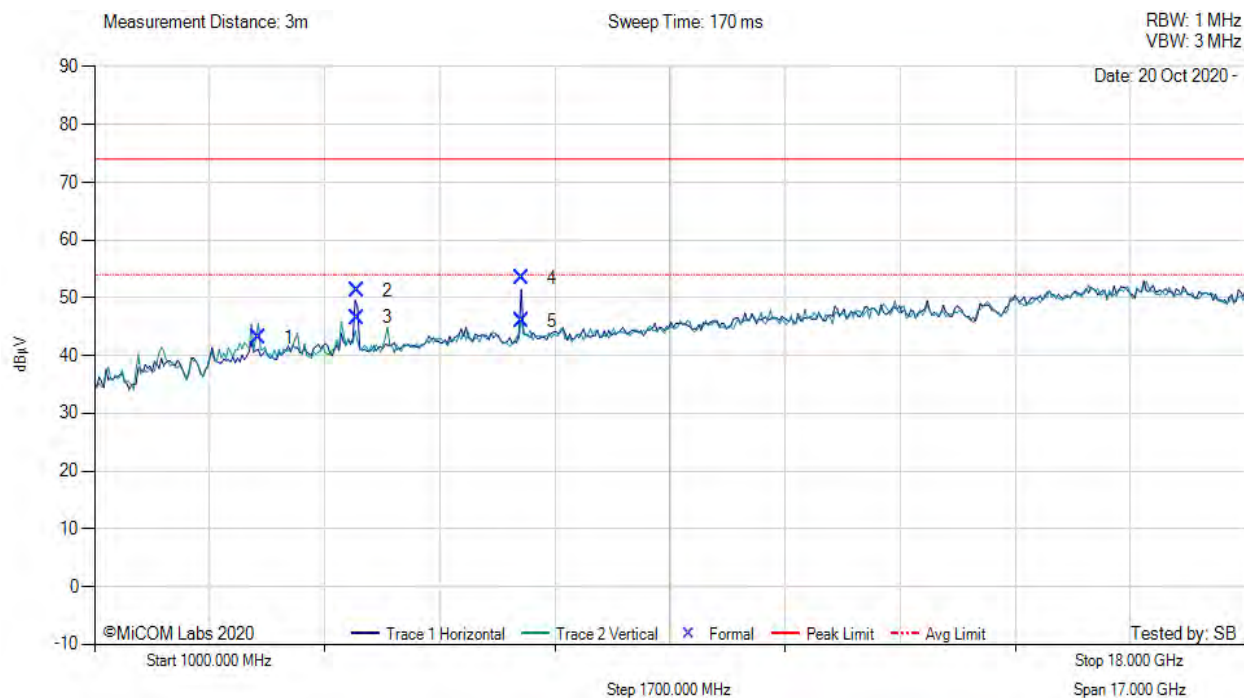


1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
1	2184.17	49.62	1.93	-12.78	38.77	Peak (NRB)	Vertical	100	0	--	--	Pass
2	4653.80	59.47	2.83	-12.42	49.88	Max Peak	Vertical	102	36	74.0	-24.1	Pass
3	4653.80	39.06	2.83	-12.42	29.47	Max Avg	Vertical	102	36	54.0	-24.5	Pass
4	4659.05	56.25	2.81	-12.45	46.61	Max Peak	Horizontal	108	33	74.0	-27.4	Pass
5	4659.05	38.62	2.81	-12.45	28.98	Max Avg	Horizontal	108	33	54.0	-25.0	Pass
6	7237.10	46.63	3.64	-7.88	42.39	Peak (NRB)	Horizontal	100	0	--	--	Pass

[back to matrix](#)



Variant: CCK, Test Freq: 2437.00 MHz, Power Setting: Max, Duty Cycle (%): 99

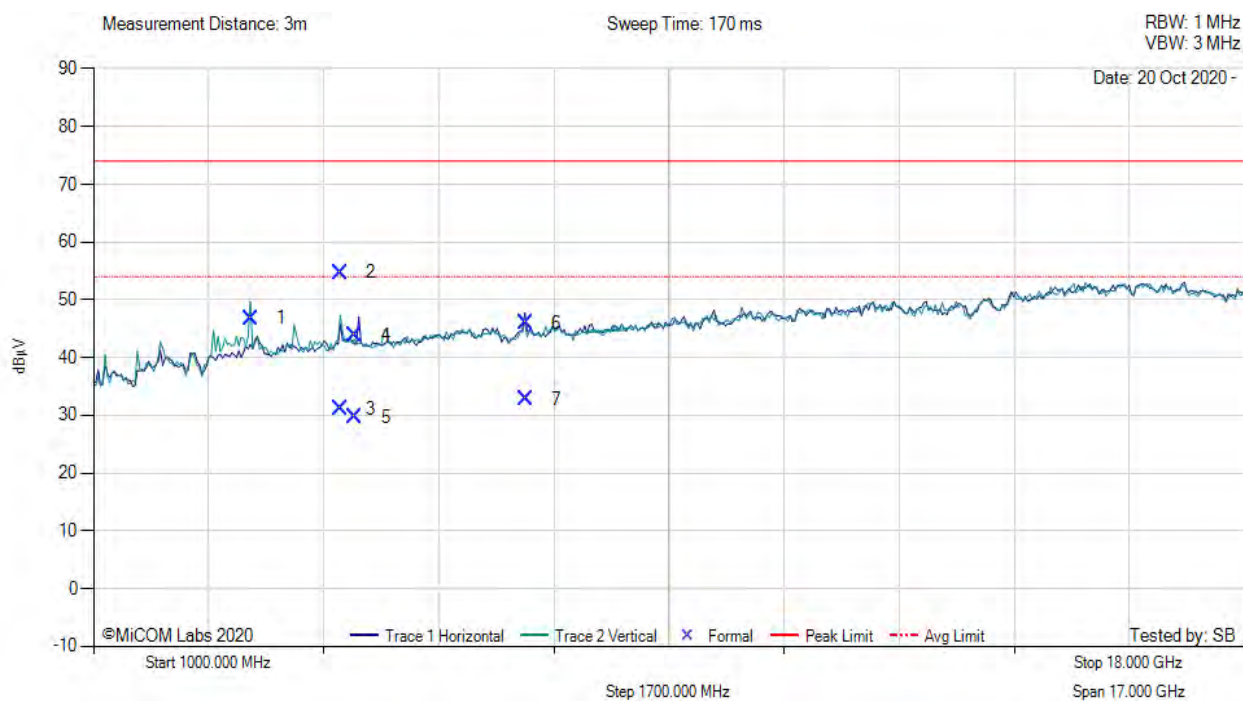


1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass/Fail
1	3423.47	52.69	2.43	-12.09	43.03	Peak (NRB)	Vertical	151	0	--	--	Pass
2	4874.16	60.87	2.92	-12.52	51.27	Max Peak	Horizontal	98	139	74.0	-22.7	Pass
3	4874.16	56.14	2.92	-12.52	46.54	Max Avg	Horizontal	98	139	54.0	-7.5	Pass
4	7310.11	57.62	3.62	-7.87	53.37	Max Peak	Horizontal	196	97	74.0	-20.6	Pass
5	7310.11	50.29	3.62	-7.87	46.04	Max Avg	Horizontal	196	97	54.0	-8.0	Pass

[back to matrix](#)



Variant: CCK, Test Freq: 2462.00 MHz, Power Setting: Max, Duty Cycle (%): 99



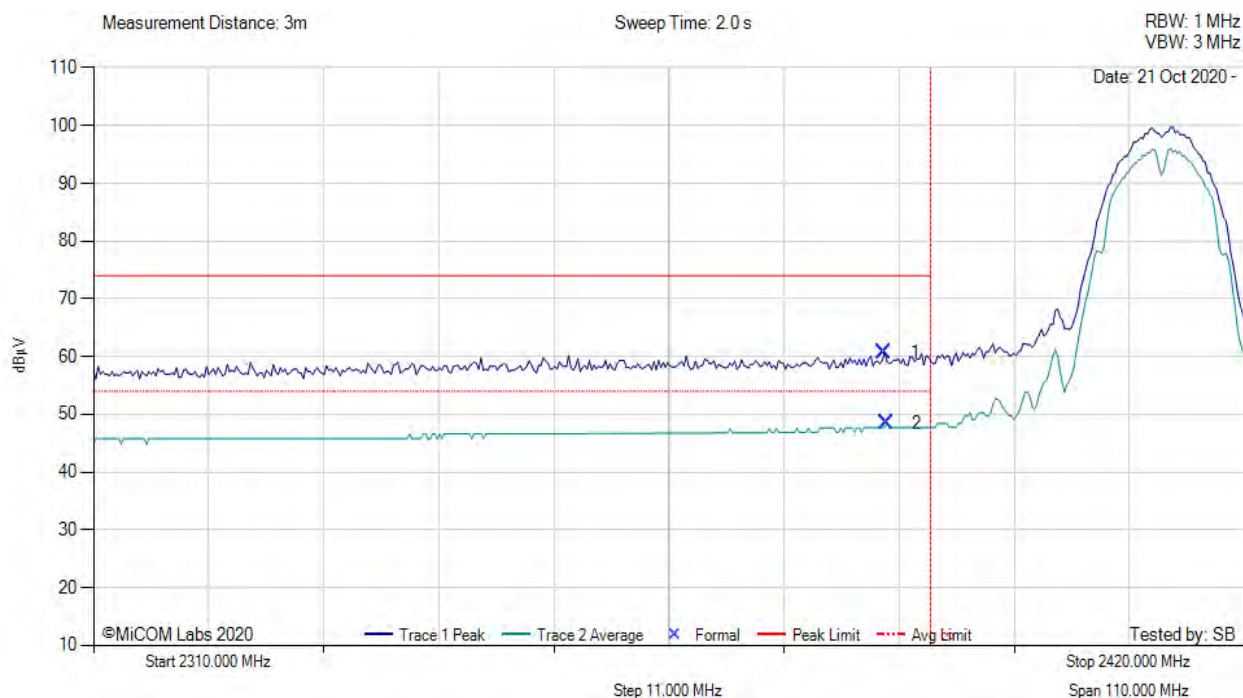
1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
1	3322.13	56.48	2.37	-12.04	46.81	Peak (NRB)	Vertical	160	360	--	--	Pass
2	4653.70	64.27	2.83	-12.42	54.68	Max Peak	Vertical	141	218	74.0	-19.3	Pass
3	4653.70	40.77	2.83	-12.42	31.18	Max Avg	Vertical	141	218	54.0	-22.8	Pass
4	4868.57	53.40	2.94	-12.52	43.82	Max Peak	Horizontal	190	179	74.0	-30.2	Pass
5	4868.57	39.30	2.94	-12.52	29.72	Max Avg	Horizontal	190	179	54.0	-24.3	Pass
6	7380.49	50.20	3.59	-7.83	45.96	Max Peak	Horizontal	153	171	74.0	-28.0	Pass
7	7380.49	37.09	3.59	-7.83	32.85	Max Avg	Horizontal	153	171	54.0	-21.2	Pass

[back to matrix](#)

A.1.1.2. Restricted Edge & Band-Edge Emissions



Variant: CCK, Test Freq: 2412.00 MHz, Power Setting: Max, Duty Cycle (%): 99

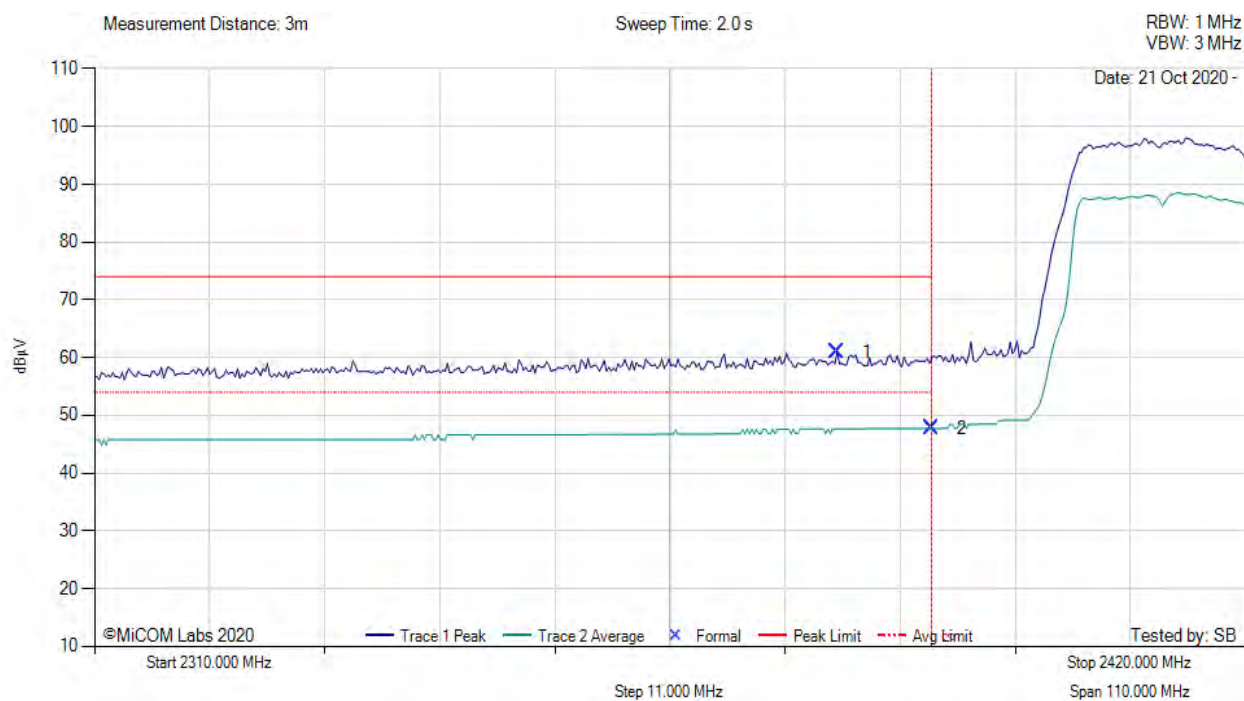


2310.00 - 2420.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
1	2385.59	26.82	2.01	31.94	60.77	Max Peak	Horizontal	164	354	74.0	-13.2	Pass
2	2385.81	14.46	2.01	31.94	48.41	Max Avg	Horizontal	164	354	54.0	-5.6	Pass
3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

[back to matrix](#)



Variant: 802.11g, Test Freq: 2412.00 MHz, Power Setting: Max, Duty Cycle (%): 99

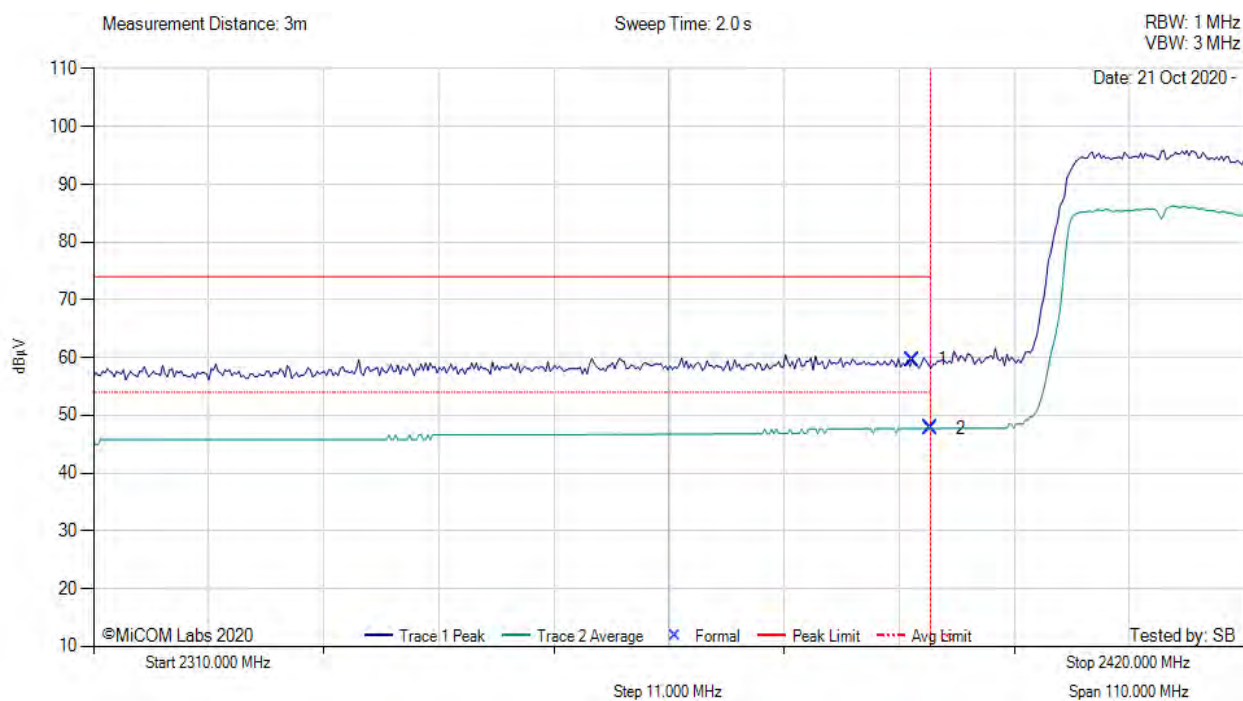


2310.00 - 2420.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
1	2380.96	26.97	2.01	31.91	60.89	Max Peak	Horizontal	164	354	74.0	-13.1	Pass
2	2390.00	13.76	2.02	31.96	47.74	Max Avg	Horizontal	164	354	54.0	-6.3	Pass
3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

[back to matrix](#)



Variant: 802.11n HT-20, Test Freq: 2412.00 MHz, Power Setting: Max, Duty Cycle (%): 99

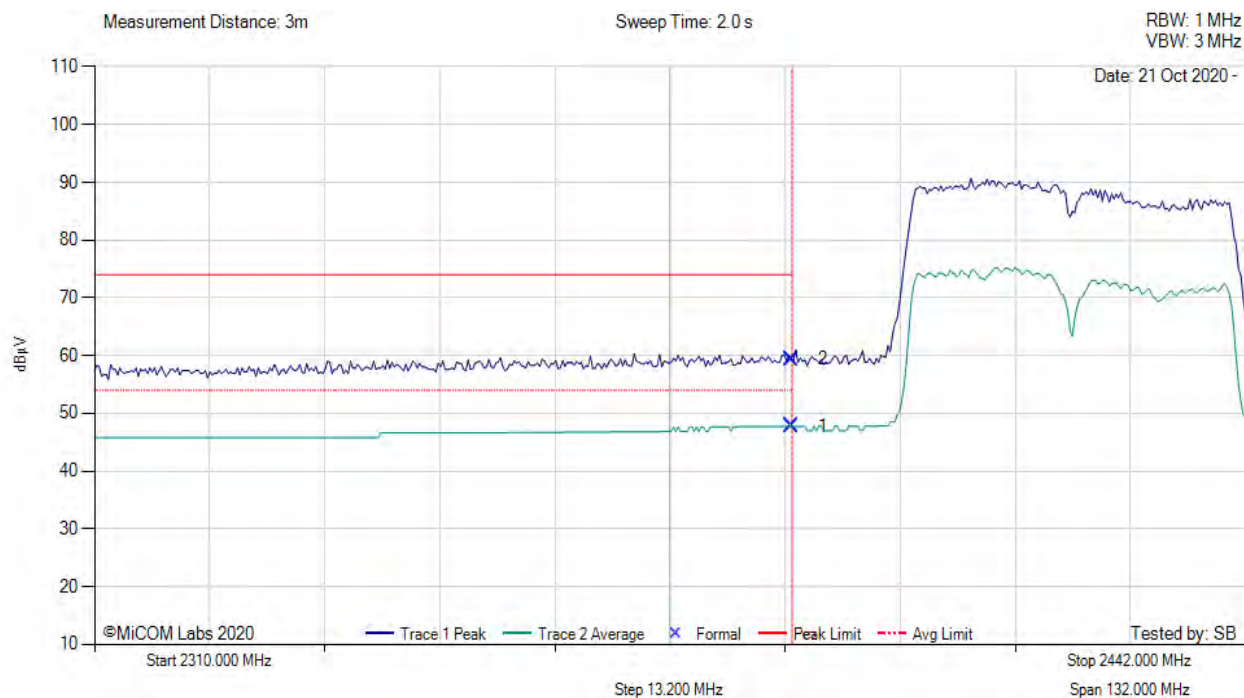


2310.00 - 2420.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
1	2388.24	25.62	2.02	31.95	59.59	Max Peak	Horizontal	164	354	74.0	-14.4	Pass
2	2390.00	13.76	2.02	31.96	47.74	Max Avg	Horizontal	164	354	54.0	-6.3	Pass
3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

[back to matrix](#)



Variant: 802.11n HT-40, Test Freq: 2422.00 MHz, Power Setting: Max, Duty Cycle (%): 99

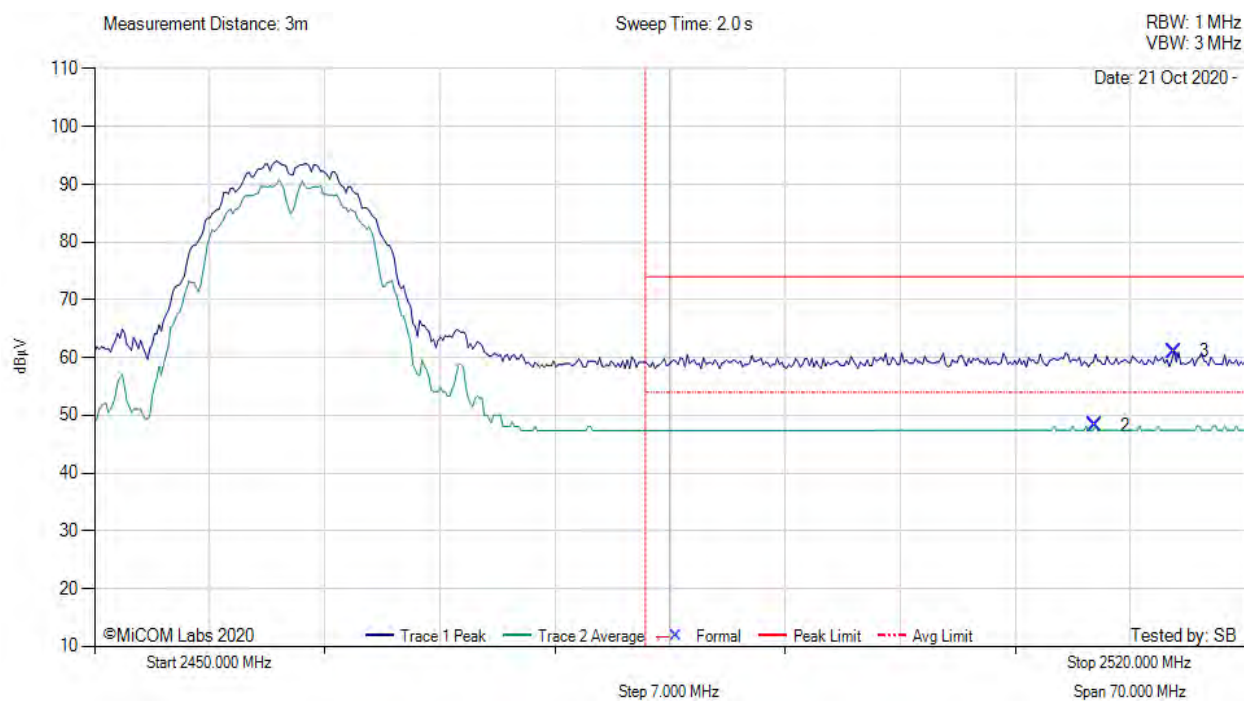


2310.00 - 2442.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
1	2390.00	13.76	2.02	31.96	47.74	Max Avg	Horizontal	164	353	54.0	-6.3	Pass
2	2390.00	25.43	2.02	31.96	59.41	Max Peak	Horizontal	164	353	74.0	-14.6	Pass
3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

[back to matrix](#)



Variant: CCK, Test Freq: 2462.00 MHz, Power Setting: Max, Duty Cycle (%): 99

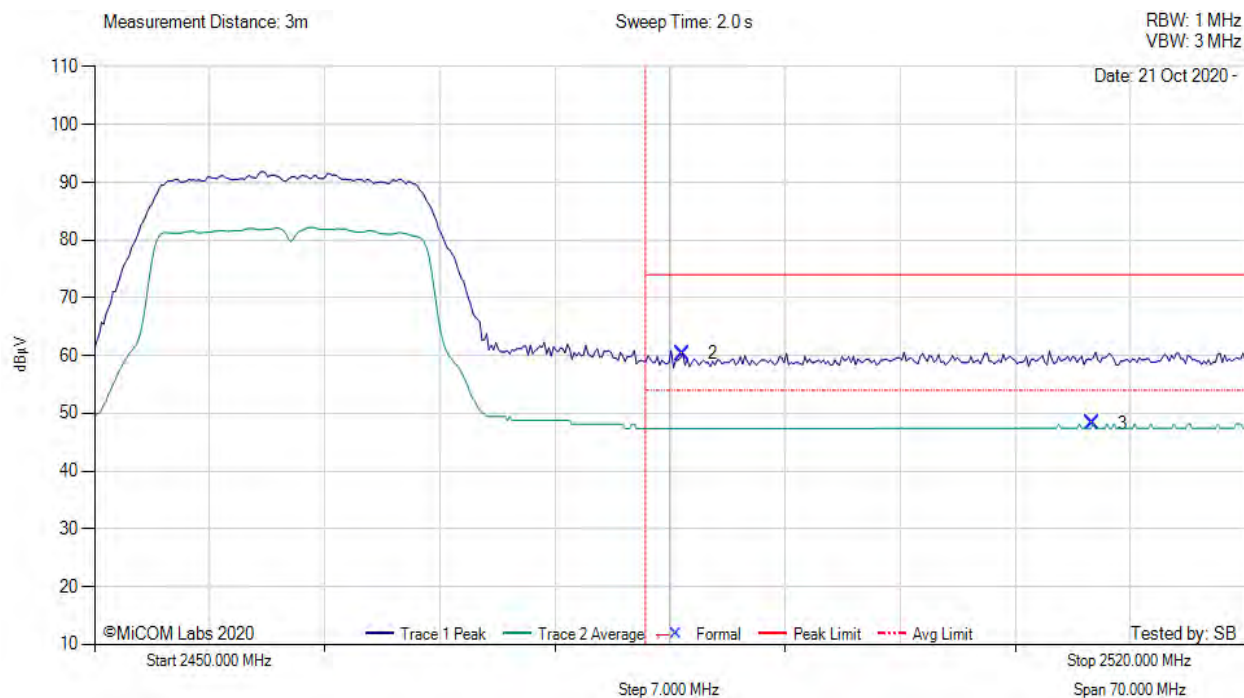


2450.00 - 2520.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
2	2510.85	13.79	2.06	32.32	48.17	Max Avg	Horizontal	167	351	54.0	-5.8	Pass
3	2515.65	26.71	2.04	32.33	61.08	Max Peak	Horizontal	167	351	74.0	-12.9	Pass
1	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

[back to matrix](#)



Variant: OFDM, Test Freq: 2462.00 MHz, Power Setting: Max, Duty Cycle (%): 99

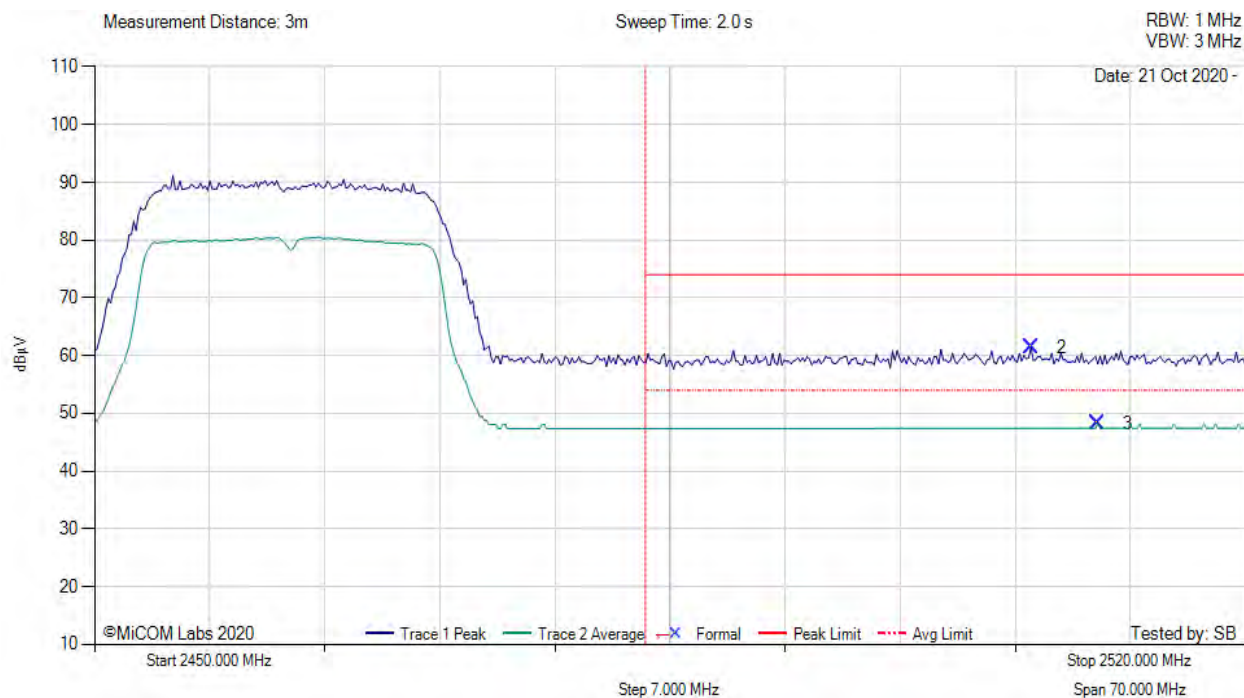


2450.00 - 2520.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
2	2485.74	26.00	2.02	32.33	60.35	Max Peak	Horizontal	167	351	74.0	-13.7	Pass
3	2510.71	13.79	2.06	32.32	48.17	Max Avg	Horizontal	167	351	54.0	-5.8	Pass
1	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

[back to matrix](#)



Variant: OFDM, Test Freq: 2462.00 MHz, Power Setting: Max, Duty Cycle (%): 99

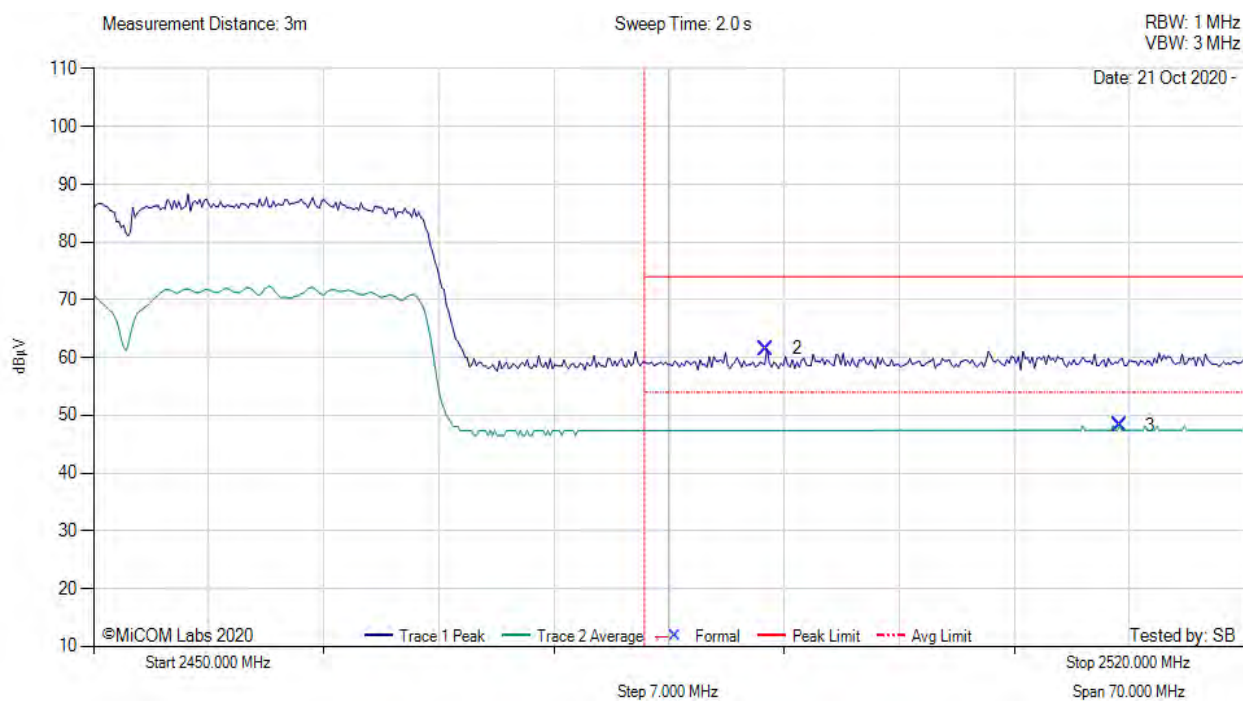


2450.00 - 2520.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
2	2506.95	27.01	2.06	32.32	61.39	Max Peak	Horizontal	167	351	74.0	-12.6	Pass
3	2510.99	13.79	2.06	32.32	48.17	Max Avg	Horizontal	167	351	54.0	-5.8	Pass
1	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

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Variant: OFDM, Test Freq: 2452.00 MHz, Power Setting: Max, Duty Cycle (%): 99



2450.00 - 2520.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
2	2490.93	27.17	2.03	32.32	61.52	Max Peak	Horizontal	167	351	74.0	-12.5	Pass
3	2512.40	13.80	2.05	32.32	48.17	Max Avg	Horizontal	167	351	54.0	-5.8	Pass
1	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

[back to matrix](#)



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