

EVALUATION REPORT

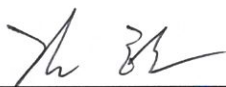
for Certification

Manufacturer: Summit Technology**130, Digital-ro, Namsung Plaza suite 611,****Geumcheon-gu, Seoul, South Korea****Attn: Mr. Yong-seong Park / Senior Director****Date of Issue: Aug. 23, 2019****Order Number: GETEC-C1-19-287****Test Report Number: GETEC-E3-19-009-R1****Test Site: GUMI UNIVERSITY EMC CENTER****CAB Designation Number: KR0033****RESPONSIBLE PARTY : Summit Technology****ADDRESS : 130, Digital-ro, Namsung Plaza suite 611, Geumcheon-gu, Seoul, South Korea****CONTACT PERSON : Mr. Yong-seong Park / Senior Director**

Rule Part(s) : FCC Part 15 Subpart E-UNII Devices § 15.407
Test Method : ANSI C63.10 (2013)
Equipment Class : Unlicensed National Information Infrastructure(NII)
EUT Type : Remote Controller
Type of Authority : Certification
Model Name : TRC-1480

This equipment has been shown to be in compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10 (2013)

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the vest of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Tested by,**Reviewed by,**
Hyun Kim, Senior Engineer
GUMI UNIVERSITY EMC CENTER
Jae-Hoon Jeong, Technical Manager
GUMI UNIVERSITY EMC CENTER

GETEC-QP-28-007 (Rev.03)

EMC CENTER

This test report only contains the result of a specific sample supplied by applicant for the testing.
It is not allowed to copy this report even partly without the approval of EMC center



Version

Test Report No.	Date	Description
GETEC-E3-19-009	Aug. 19, 2019	- First Approval Report
GETEC-E3-19-009-R1	Aug. 23, 2019	- Change manufacturer information





CONTENTS

1. GENERAL INFORMATION	5
2. INTRODUCTION	6
3. PRODUCT INFORMATION	7
3.1 DESCRIPTION OF EUT	7
3.2 DEFINITION OF MODELS	7
3.3 SUPPORT EQUIPMENT / CABLES USED	8
3.4 MODIFICATION ITEM(S)	8
4. ANTENNA REQUIREMENT - §15.203	9
4.1 DESCRIPTION OF ANTENNA	9
5. DESCRIPTION OF TESTS	9
5.1 TEST CONDITION	9
6. REFERENCES STANDARDS	9
7. SUMMARY OF TEST RESULTS	10
8. 26 DB BANDWIDTH MEASUREMENT	11
8.1 OPERATING ENVIRONMENT	11
8.2 TEST SET-UP (LAYOUT)	11
8.3 LIMIT	11
8.4 TEST EQUIPMENT USED	11
8.5 TEST TEST PROCEDURE	11
8.6 TEST RESULT	12
9. 6 DB BANDWIDTH MEASUREMENT	19
9.1 OPERATING ENVIRONMENT	19
9.2 TEST SET-UP (LAYOUT)	19
9.3 LIMIT	19
9.4 TEST EQUIPMENT USED	19
9.5 TEST PROCEDURE	19
9.6 TEST RESULT	20
10. MAXIMUM CONDUCTED OUTPUT POWER	27
10.1 OPERATING ENVIRONMENT	27
10.2 TEST SET-UP (LAYOUT)	27
10.3 LIMIT	27
10.4 TEST EQUIPMENT USED	27
10.5 TEST PROCEDURE	27
10.6 TEST RESULT	28
11. POWER SPECTRAL DENSITY MEASUREMENT	31
11.1 OPERATING ENVIRONMENT	31
11.2 TEST SET-UP (LAYOUT)	31
11.3 LIMIT	31
11.4 TEST EQUIPMENT USED	31
11.5 TEST PROCEDURE	31
11.6 TEST RESULT	32
12. FREQUENCY STABILITY	39
13. AC POWER LINE CONDUCTED EMISSION	87
13.1 OPERATING ENVIRONMENT	88



13.2 TEST SET-UP	88
13.3 MEASUREMENT UNCERTAINTY.....	88
13.4 LIMIT	89
13.5 TEST EQUIPMENT USED.....	89
13.6 TEST DATA FOR CONDUCTED EMISSION	89
14. RADIATED SPURIOUS & RESTRICTED BAND EDGE EMISSION.....	91
14.1 OPERATING ENVIRONMENT	92
14.2 TEST SET-UP.....	92
14.3 MEASUREMENT UNCERTAINTY	92
14.4 LIMIT	93
14.5 TEST EQUIPMENT USED.....	93
14.6 TEST DATA FOR RADIATED SPURIOUS EMISSION.....	94
14.7 TEST DATA FOR RADIATED RESTRICTED BAND EDGE EMISSION	97
15. SAMPLE CALCULATIONS.....	99
15.1 EXAMPLE 1 :	99
15.2 EXAMPLE 2 :	99
16. RECOMMENDATION & CONCLUSION.....	100
APPENDIX A – ATTESTATION STATEMENT	
APPENDIX B – LABELLING	
APPENDIX C – BLOCK DIAGRAM	
APPENDIX D – SCHEMATIC DIAGRAM	
APPENDIX E – TEST SETUP PHOTOGRAPH	
APPENDIX F – EXTERNAL PHOTOGRAPH	
APPENDIX G – INTERNAL PHOTOGRAPH	
APPENDIX H – USER’S MANUAL	
APPENDIX I – OPERATIONAL DESCRIPTION	
APPENDIX J – ANTENNA SPECIFICATION	
APPENDIX K – PART LIST	
APPENDIX L – RF EXPOSURE EVALUATION	



Scope: Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and / or unintentional radiators for compliance with technical rules and regulations of the Federal Communications Commission.

1. General Information

Applicant: Summit Technology

Applicant Address: 130, Digital-ro, Namsung Plaza suite 611, Geumcheon-gu, Seoul, South Korea

Manufacturer: Summit Technology

Manufacturer Address: 130, Digital-ro, Namsung Plaza suite 611, Geumcheon-gu, Seoul, South Korea

Contact Person: Mr. Yong-seong Park / Senior Director

Telephone Number: +82-2-6929-3161

- **FCC ID.** 2AT6QTRC1480
- **Equipment Class** Unlicensed National Information Infrastructure(NII)
- **EUT Type** Remote Controller
- **Model Name** TRC-1480
- **Rule Part(s)** FCC Part 15 Subpart E-UNII Devices § 15.407
- **Test Method** ANSI C63.10 (2013)
- **Type of Authority** Certification
- **Test Procedure(s)** ANSI C63.10 (2013), KDB789033 D02 General UNII Test Procedures New Rules v01r04(May 2,2017)
- **Dates of Test** Jul. 11, 2019 ~ Aug. 19, 2019
- **Place of Test** **GUMI UNIVERSITY EMC CENTER** (FCC Test firm Registration No.: 269701)
37 Yaeun-ro, Gumi-si, Gyeongsangbuk-do, 730-711, Republic of Korea
- **Test Report Number** GETEC-E3-19-009-R1
- **Dates of Issue** Aug. 23, 2019



2. Introduction

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Nose Emissions From Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2009) was used in determining radiated and conducted emissions emanating from **Summit Technology Remote Controller (Model name: TRC-1480)**

These measurement tests were conducted at **GUMI UNIVERSITY EMC CENTER**.

The site address is 37 Yaeun-ro, Gumi-si, Gyeongsangbuk-do, 730-711, Republic of Korea

This test site is one of the highest point of GUMI UNIVERSITY at about 200 kilometers away from Seoul city and 40 kilometers away from Daegu city. It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures. The detailed description of the measurement facility was found to be in compliance with the requirements of §2.948 according to ANSI C63.10 (2013)

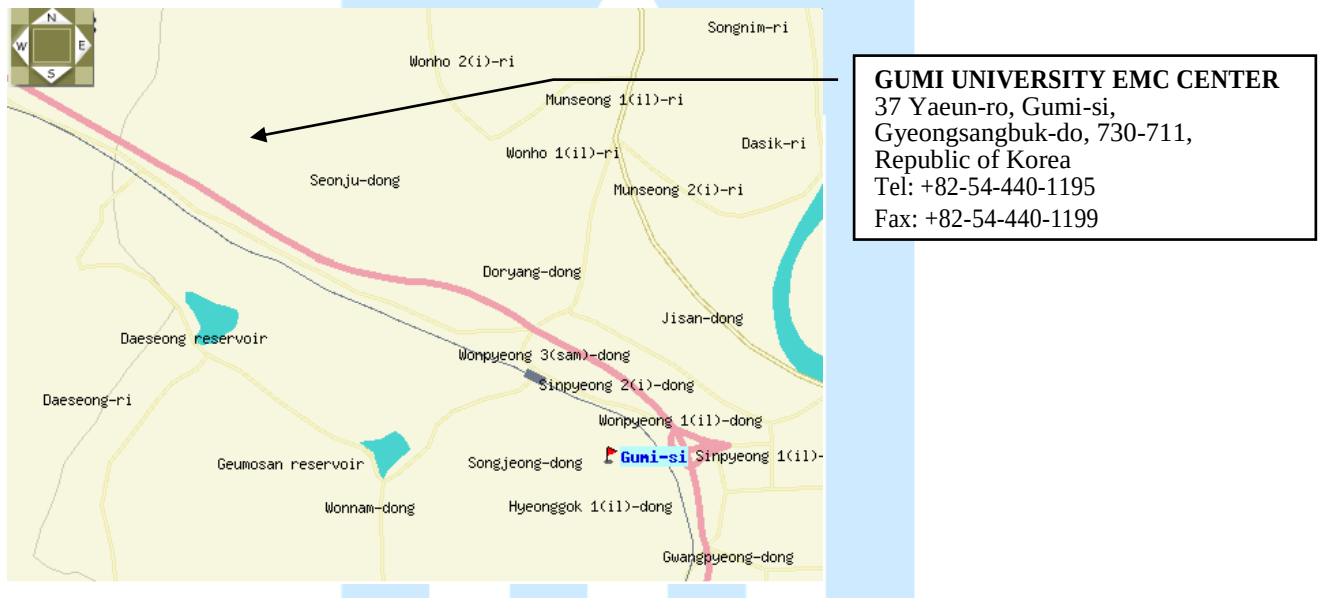


Fig 1. The map above shows the Gumi University in vicinity area.



3. Product Information

3.1 Description of EUT

The Equipment under Test (EUT) is the **Summit Technology Remote Controller (Model Name: TRC-1480) FCC ID.: 2AT6QTRC1480**

- Equipment	: Remote Controller	
- Model name	: TRC-1480	
- Serial number	: Proto type	
- Electrical Rating	: DC 3.7 V	
- Manufacturer	: Summit Technology	
- Frequency Range (DTS band)	TX 20 MHz BW:	2412 MHz - 2462 MHz
	RX 20 MHz BW:	2412 MHz - 2462 MHz
	TX 20 MHz BW:	5180 MHz - 5240 MHz (UNII 1) / 5260 MHz - 5320 MHz (UNII 2A) 5500 MHz - 5720 MHz (UNII 2C) / 5745 MHz - 5825 MHz (UNII 3)
	40 MHz BW:	5190 MHz - 5230 MHz (UNII 1) / 5270 MHz - 5310 MHz (UNII 2A) 5510 MHz - 5710 MHz (UNII 2C) / 5755 MHz - 5795 MHz (UNII 3)
	80 MHz BW:	5210 MHz (UNII 1) / 5290 MHz (UNII 2A) / 5530 MHz - 5690 MHz (UNII 2C) / 5775 MHz (UNII 3)
	RX 20 MHz BW:	5180 MHz - 5240 MHz (UNII 1) / 5260 MHz - 5320 MHz (UNII 2A) 5500 MHz - 5720 MHz (UNII 2C) / 5745 MHz - 5825 MHz (UNII 3)
	40 MHz BW:	5190 MHz - 5230 MHz (UNII 1) / 5270 MHz - 5310 MHz (UNII 2A) 5510 MHz - 5710 MHz (UNII 2C) / 5755 MHz - 5795 MHz (UNII 3)
	80 MHz BW:	5210 MHz (UNII 1) / 5290 MHz (UNII 2A) / 5530 MHz - 5690 MHz (UNII 2C) / 5775 MHz (UNII 3)
- Modulation	: BPSK, QPSK, QAM, CCK, OFDM	
- Antenna Specification	: Manufacturer: Electronic Device Works Antenna type : FPCB antenna Gain : 2.25 dBi (DTS) / 3.66 dBi (UNII 1) / 3.66 dBi (UNII 2A) / 3.24 dBi (UNII 2C) / 2.87 dBi (UNII 3)	
- Type (DFS)	: Client (without radar detection)	

3.2 Definition of models

-None.



3.3 Support Equipment / Cables used

3.3.1 Used Support Equipment

Description	Manufacturer	Model Name	S/N & FCC ID.
Notebook Computer ¹⁾	SAMSUNG	NT500R3W	S/N: 0Q2V91JJ100096T FCC ID.: N/A

Note)

1) The Support Equipment use only setting to the test mode.

3.3.2 System configuration

Description	Manufacturer	Model Name	S/N & FCC ID.
-	-	-	-

3.3.3 Used Cable(s)

Cable Name	Condition	Description
-	-	-

3.4 Modification Item(s)

-. None



4. Antenna Requirement - §15.203

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the applicant can be used with the device. The use of permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with this requirement.

4.1 Description of Antenna

The **Summit Technology Remote Controller**. comply with the requirement of §15.203 with a FPCB antenna permanently attached to the transmitter.

5. Description of tests

5.1 Test Condition

The EUT was installed, arranged and operated in a manner that is most representative of equipment as typically used.

The measurements were carried out while varying operating modes and cable positions within typically arrangement to determine maximum emission level.

The representative and worst test mode(s) were noted in the test report.

- Test Voltage / Frequency: 3.7 V / DC
- Operating condition during the test(s) :
 - . Continuous RF transmitting mode with nominal maximum RF output power.
 - . Operating channel frequency and modulation technology

	Mode	Available channel	Frequency	Modulation Technology
NII	802.11a	36 ~ 165	5180 ~ 5825 MHz	OFDM
	802.11n	36 ~ 165	5180 ~ 5825 MHz	OFDM
	802.11ac	36 ~ 165	5180 ~ 5825 MHz	OFDM

- . EUT set condition (Test Software)

Test Software	Tera Term Pro
Test Software version	2.3

6. References Standards

- FCC Part 15 (2009) Subpart E-UNII Devices §15.407
- ANSI C 63.10 (2013): American National Standard for Testing Unlicensed Wireless Devices
- KDB 789033 D02 General UNII Test Procedures New Rules v01r04 (May 2, 2017): Guidance for compliance testing of unlicensed national information infrastructure (UNII) devices (Part 15, Subpart E)



7. SUMMARY OF TEST RESULTS

FCC Part Section(s)	Test Description	Test Result
§15.407 (for Power Measurement)	26 dB Bandwidth	Pass
§15.407(e)	6 dB Bandwidth	Pass
§15.407(a)	Maximum Conducted Output Power	Pass
§15.407(h)1	Transmit Power Control (TPC)	N/A ¹⁾
§15.407(a)	Peak Power Spectral Density	Pass
§15.407(g)	Frequency Stability	Pass
§15.207	AC Conducted Emissions 150 kHz - 30 MHz	Pass
§15.407(b)	Undesirable Emissions	Pass
§15.205, § 15.407(b)(5),(6)	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Pass

1) E.I.R.P of TRC-1480 is less than the 500 mW.

Therefore, TPC test is not required for systems with an e.i.r.p of less than 500 mW

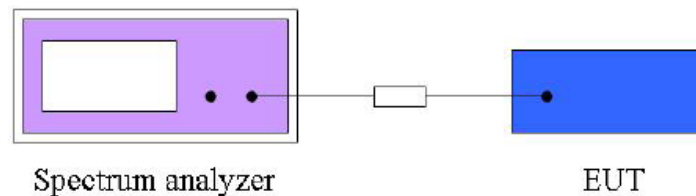


8. 26 dB Bandwidth Measurement

8.1 Operating environment

Temperature : 22.6 °C
Relative Humidity : 55.8 % R.H.

8.2 Test Set-up (Layout)



8.3 Limit

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz

8.4 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - FSV	Rohde & Schwarz	Spectrum Analyzer	101552	Apr. 11, 2020
■ - 10 dB Attenuator	Rohde & Schwarz	Attenuator 10 dB	SEP-10-14-046	Apr. 10. 2020
■ - WMS 32	Rohde & Schwarz	Testing Software	VER10.40.10	N/A

8.5 Test Test Procedure

- Set RBW = 200 kHz
- Set the video bandwidth (VBW) $\geq$ 600 kHz
- Detector = Max Peak
- Trace mode = Max Hold
- Sweep = Auto
- Allow the trace to stabilize
- Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1 %.



8.6 Test result

- Test Date : Aug. 19, 2019
- Reference Standard : Part 15 Subpart E, Sec. 15.407(for power measurement)
- Test Procedure(s) : ANSI C63.10 (2013), KDB 789033 D02 general UNII test procedures new rules v01r04 (May 2, 2017)
- Operating Condition : 802.11a/n/ac
- Power Source : DC 3.7 V

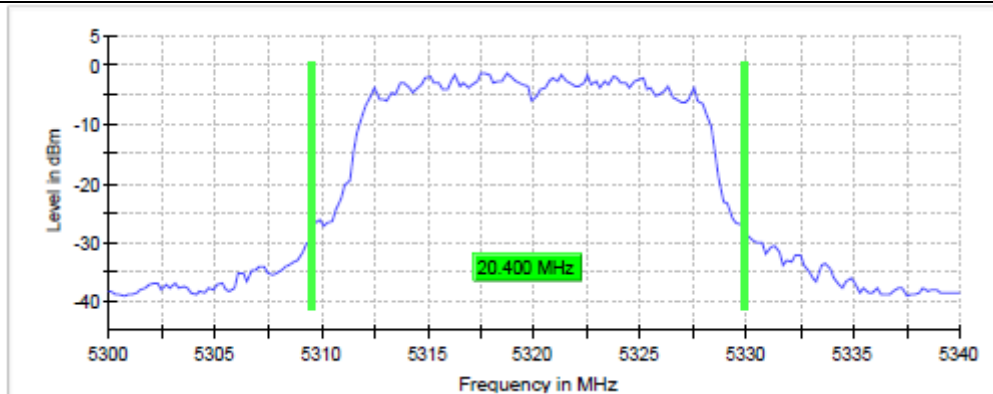
802.11a

Frequency (MHz)	Channel No.	26 dB Bandwidth (MHz)	Min. Limit (MHz)	Result
5180	36	19.80	N/A	Complies
5200	40	20.00	N/A	Complies
5240	48	20.20	N/A	Complies
5260	52	20.20	N/A	Complies
5300	60	20.40	N/A	Complies
5320	64	20.40	N/A	Complies
5500	100	20.40	N/A	Complies
5580	116	19.60	N/A	Complies
5720	144	20.00	N/A	Complies
5745	149	20.20	N/A	Complies
5785	157	19.80	N/A	Complies
5825	165	20.20	N/A	Complies

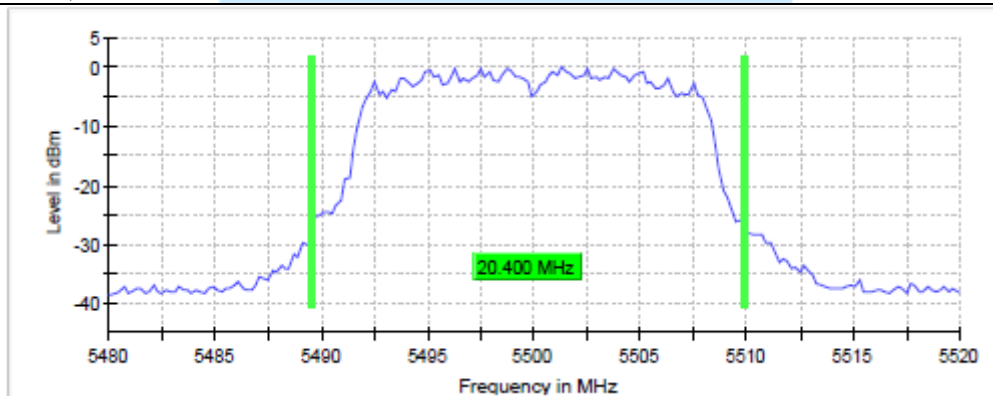


Test Plot on Configuration : 802.11a

5320 MHz (64 ch)



5500 MHz (100 ch)



Note: In order to simplify the report, attached plots were only the most wide channel.

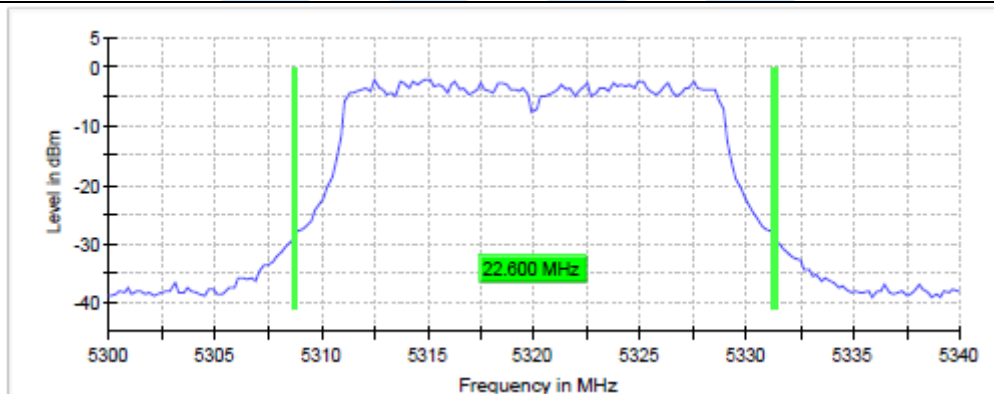


802.11n

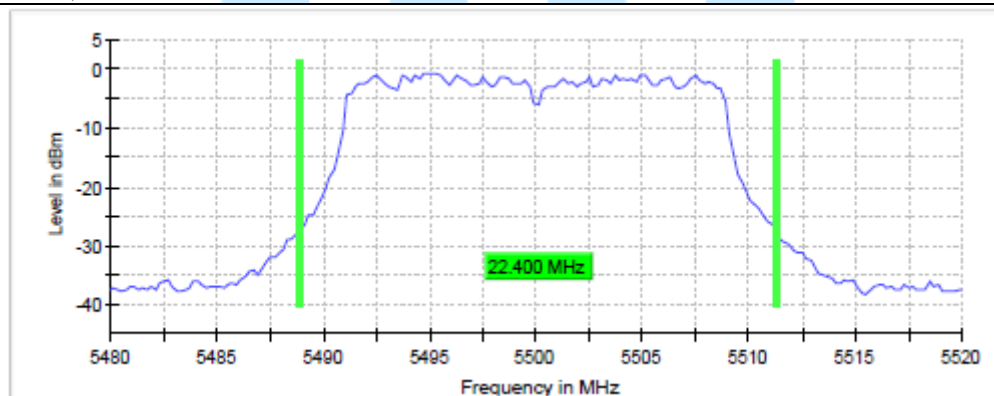
Frequency (MHz)	Channel No.	26 dB Bandwidth (MHz)	Min. Limit (MHz)	Result
5180	36	22.20	N/A	Complies
5200	40	22.00	N/A	Complies
5240	48	22.20	N/A	Complies
5260	52	22.20	N/A	Complies
5300	60	22.20	N/A	Complies
5320	64	22.60	N/A	Complies
5500	100	22.40	N/A	Complies
5580	116	22.40	N/A	Complies
5720	144	22.20	N/A	Complies
5745	149	22.20	N/A	Complies
5785	157	22.20	N/A	Complies
5825	165	22.20	N/A	Complies

Test Plot on Configuration : 802.11n

5320 MHz (64 ch)



5500 MHz (100 ch)



Note: In order to simplify the report, attached plots were only the most wide channel.

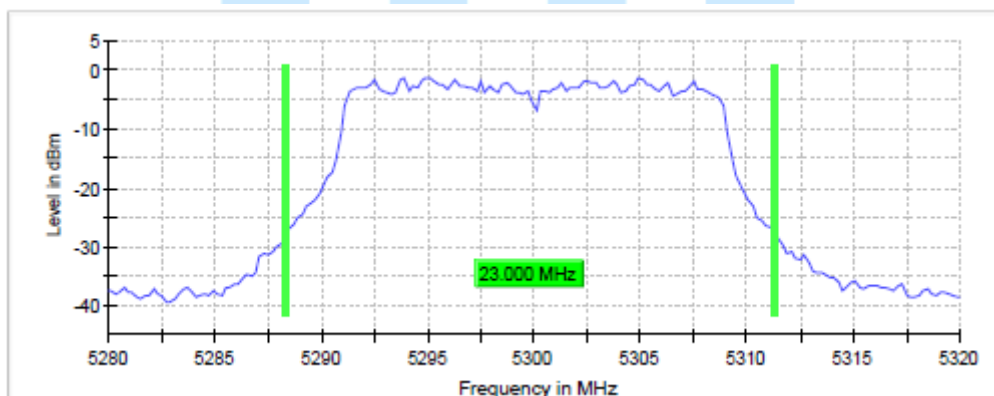


802.11ac

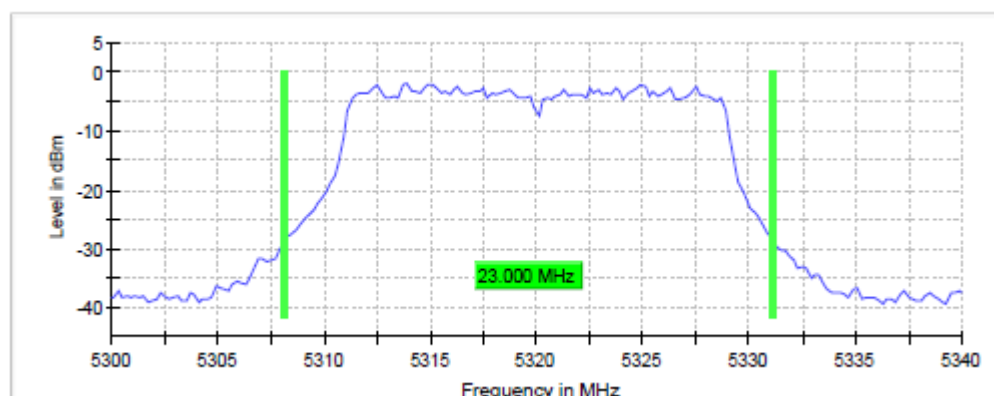
Frequency (MHz)	Channel No.	26 dB Bandwidth (MHz)	Min. Limit (MHz)	Result
5180	36	22.60	N/A	Complies
5200	40	22.60	N/A	Complies
5240	48	22.80	N/A	Complies
5260	52	22.80	N/A	Complies
5300	60	23.00	N/A	Complies
5320	64	23.00	N/A	Complies
5500	100	22.80	N/A	Complies
5580	116	22.80	N/A	Complies
5720	144	22.80	N/A	Complies
5745	149	22.80	N/A	Complies
5785	157	22.60	N/A	Complies
5825	165	23.00	N/A	Complies

Test Plot on Configuration : 802.11n

5300 MHz (60 ch)



5320 MHz (64 ch)



Note: In order to simplify the report, attached plots were only the most wide channel.

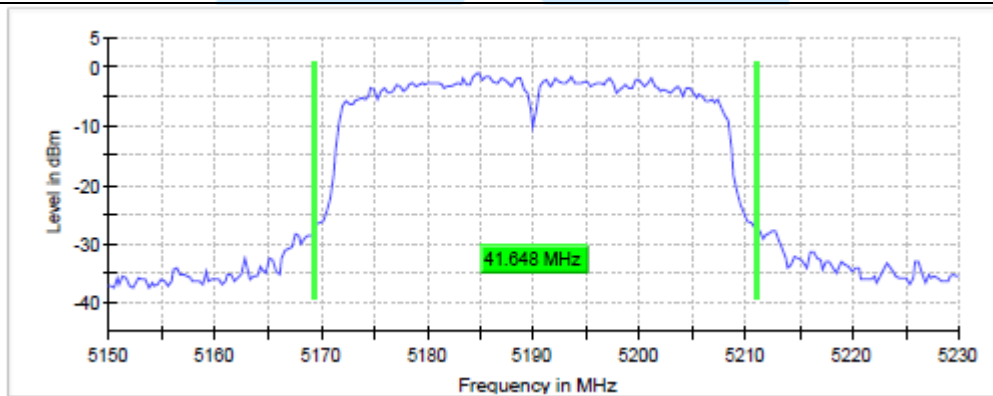


802.11n_HT40

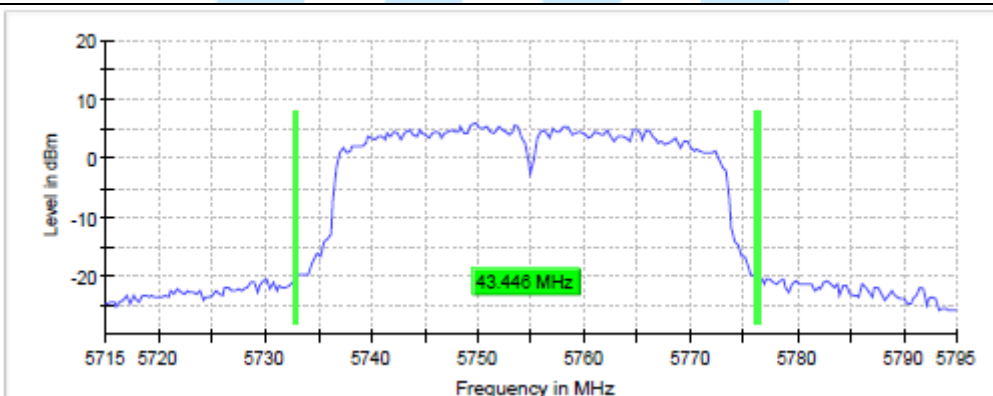
Frequency (MHz)	Channel No.	26 dB Bandwidth (MHz)	Min. Limit (MHz)	Result
5190	38	41.65	N/A	Complies
5230	46	40.15	N/A	Complies
5270	54	40.45	N/A	Complies
5310	62	41.35	N/A	Complies
5510	102	40.45	N/A	Complies
5550	110	41.05	N/A	Complies
5710	142	40.45	N/A	Complies
5755	151	43.45	N/A	Complies
5795	159	40.45	N/A	Complies

Test Plot on Configuration : 802.11n_HT40

5190 MHz (38 ch)



5755 MHz (151 ch)



Note: In order to simplify the report, attached plots were only the most wide channel.

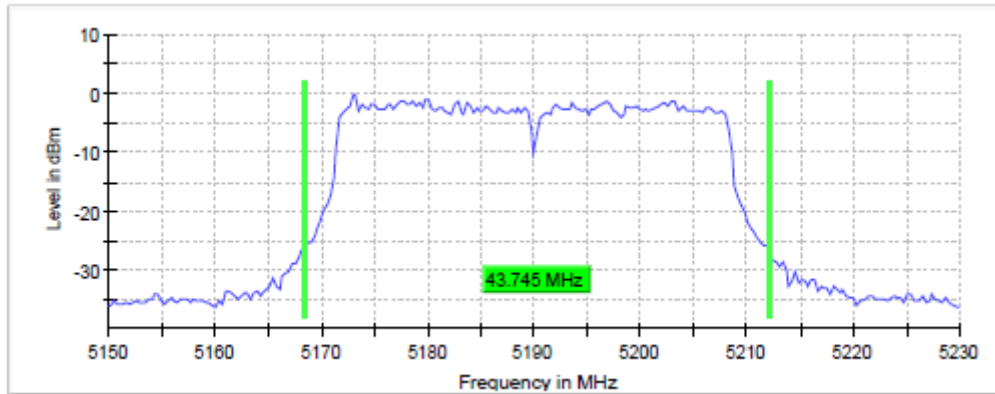


802.11ac_VHT40

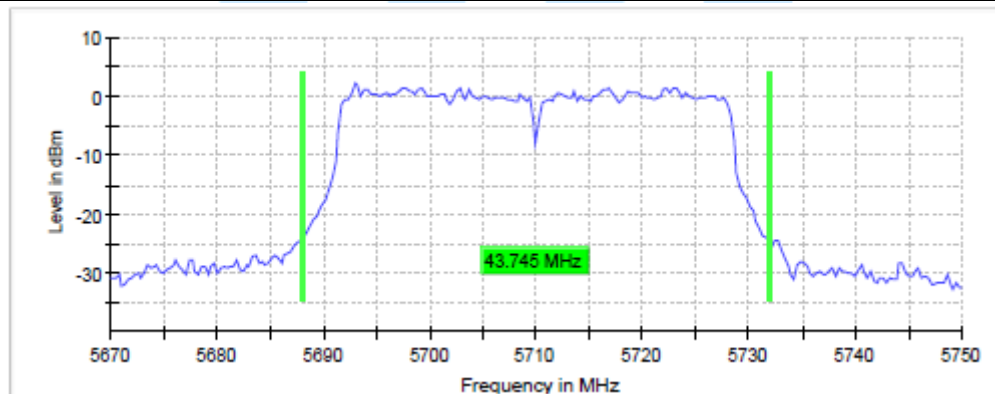
Frequency (MHz)	Channel No.	26 dB Bandwidth (MHz)	Min. Limit (MHz)	Result
5190	38	43.75	N/A	Complies
5230	46	42.85	N/A	Complies
5270	54	42.55	N/A	Complies
5310	62	42.85	N/A	Complies
5510	102	43.15	N/A	Complies
5550	110	43.15	N/A	Complies
5710	142	43.75	N/A	Complies
5755	151	43.75	N/A	Complies
5795	159	42.85	N/A	Complies

Test Plot on Configuration : 802.11n_HT40

5190 MHz (38 ch)



5710 MHz (142 ch)



Note: In order to simplify the report, attached plots were only the most wide channel.

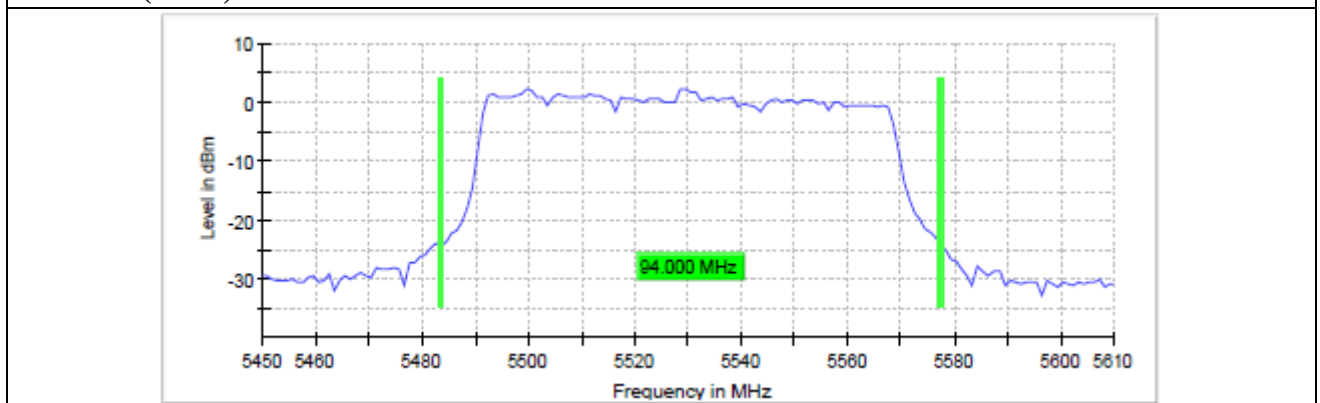


802.11ac_VHT80

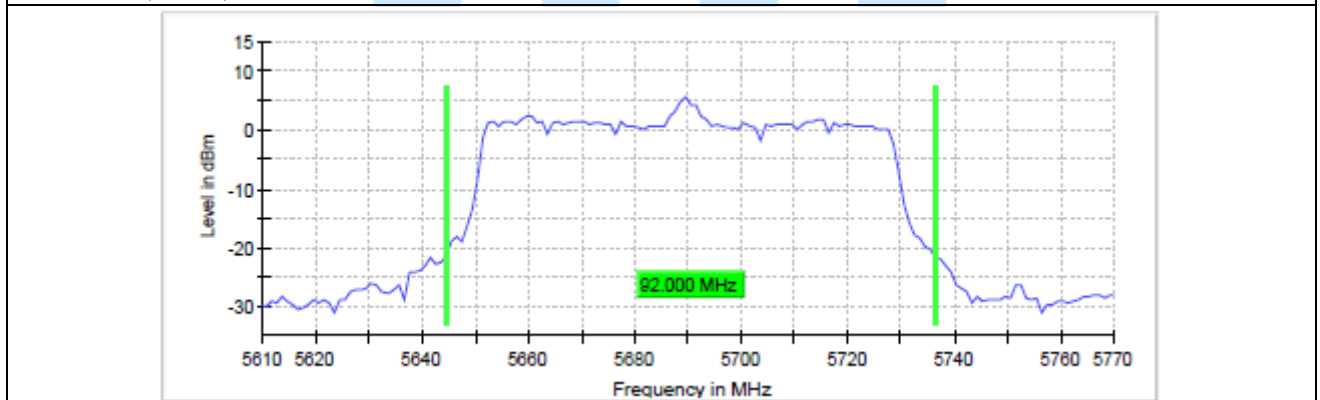
Frequency (MHz)	Channel No.	26 dB Bandwidth (MHz)	Min. Limit (MHz)	Result
5210	42	89.00	N/A	Complies
5290	58	89.00	N/A	Complies
5530	106	94.00	N/A	Complies
5690	138	92.00	N/A	Complies
5775	155	90.00	N/A	Complies

Test Plot on Configuration : 802.11n_HT40

5530 MHz (106 ch)



5690 MHz (138 ch)



Note: In order to simplify the report, attached plots were only the most wide channel.

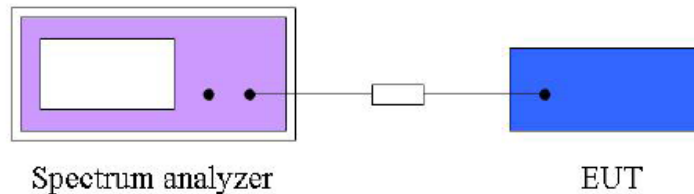


9. 6 dB Bandwidth Measurement

9.1 Operating environment

Temperature : 22.6 °C
Relative Humidity : 55.8 % R.H.

9.2 Test Set-up (Layout)



9.3 Limit

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz

9.4 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - FSV	Rohde & Schwarz	Spectrum Analyzer	101552	Apr. 11, 2020
■ - 10 dB Attenuator	Rohde & Schwarz	Attenuator 10 dB	SEP-10-14-046	Apr. 10. 2020
■ - WMS 32	Rohde & Schwarz	Testing Software	VER10.20.01	N/A

9.5 Test Procedure

- Set RBW = 100 kHz.
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.



9.6 Test result

- Test Date : Aug. 19, 2019
- Reference Standard : Part 15 Subpart E, Sec. 15.407(e)
- Test Procedure(s) : ANSI C63.10 (2013), KDB 789033 D02 general UNII test procedures new rules v01r04 (May 2, 2017)
- Operating Condition : 802.11a/n/ac
- Power Source : DC 3.7 V

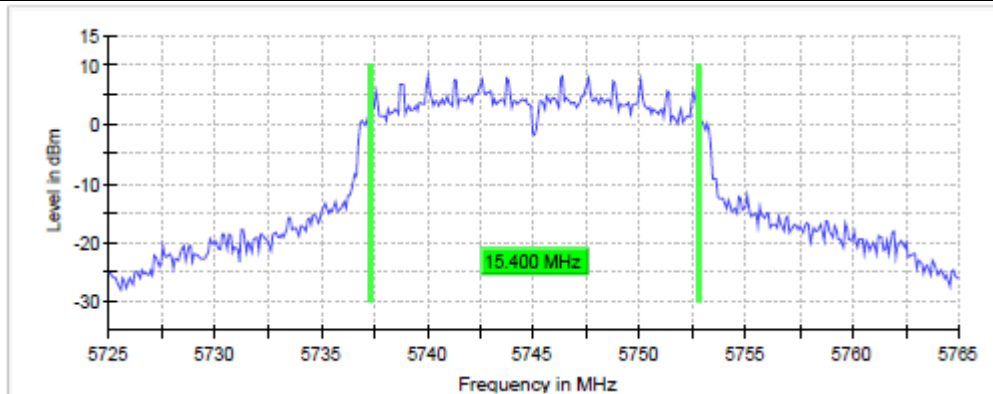
802.11a

Frequency (MHz)	Channel No.	Measured Bandwidth (MHz)	Minimum Bandwidth (MHz)	Result
5180	36	15.30	N/A	Complies
5200	40	15.30	N/A	Complies
5240	48	15.30	N/A	Complies
5260	52	15.30	N/A	Complies
5300	60	15.30	N/A	Complies
5320	64	15.30	N/A	Complies
5500	100	15.30	N/A	Complies
5580	116	15.30	N/A	Complies
5720	144	15.30	N/A	Complies
5745	149	15.40	N/A	Complies
5785	157	15.30	N/A	Complies
5825	165	15.30	N/A	Complies

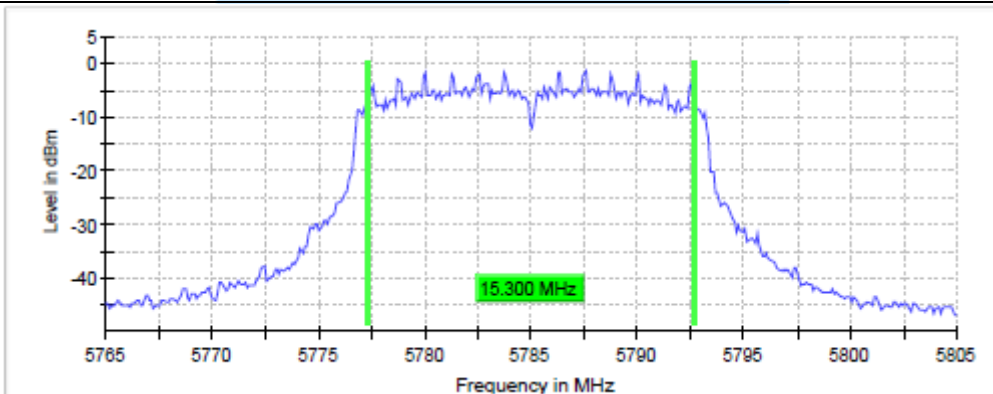


Test Plot on Configuration : 802.11a

5745 MHz (149 ch)



5785 MHz (157 ch)



Note: In order to simplify the report, attached plots were only the most wide channel.

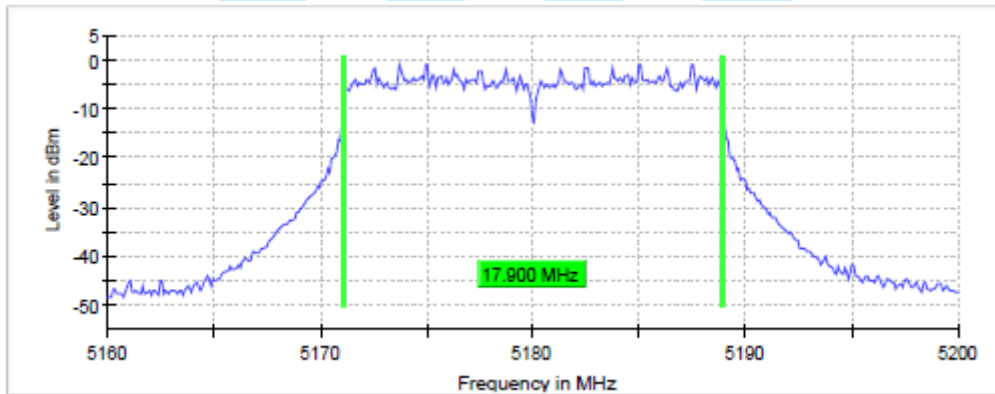


802.11n

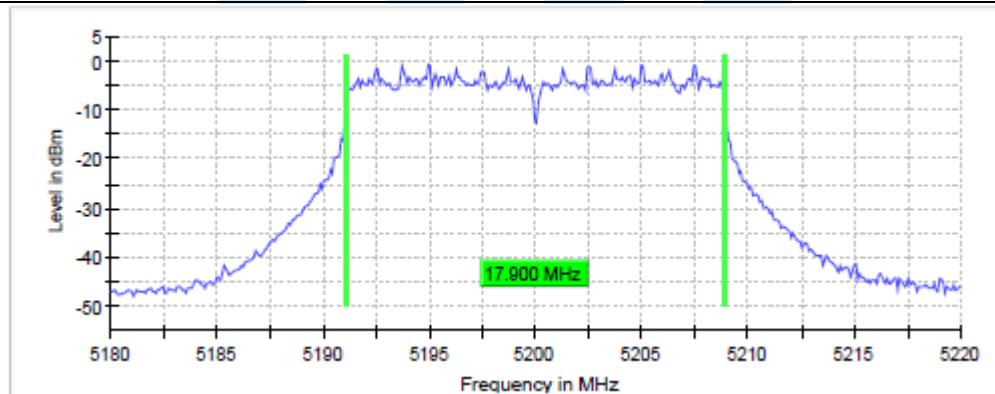
Frequency (MHz)	Channel No.	Measured Bandwidth (MHz)	Minimum Bandwidth (MHz)	Result
5180	36	17.90	N/A	Complies
5200	40	17.90	N/A	Complies
5240	48	17.90	N/A	Complies
5260	52	17.90	N/A	Complies
5300	60	17.90	N/A	Complies
5320	64	17.90	N/A	Complies
5500	100	17.90	N/A	Complies
5580	116	17.90	N/A	Complies
5720	144	17.90	N/A	Complies
5745	149	17.90	N/A	Complies
5785	157	17.80	N/A	Complies
5825	165	17.90	N/A	Complies

Test Plot on Configuration : 802.11n

5180 MHz (36 ch)



5200 MHz (40 ch)



Note: In order to simplify the report, attached plots were only the most wide channel.

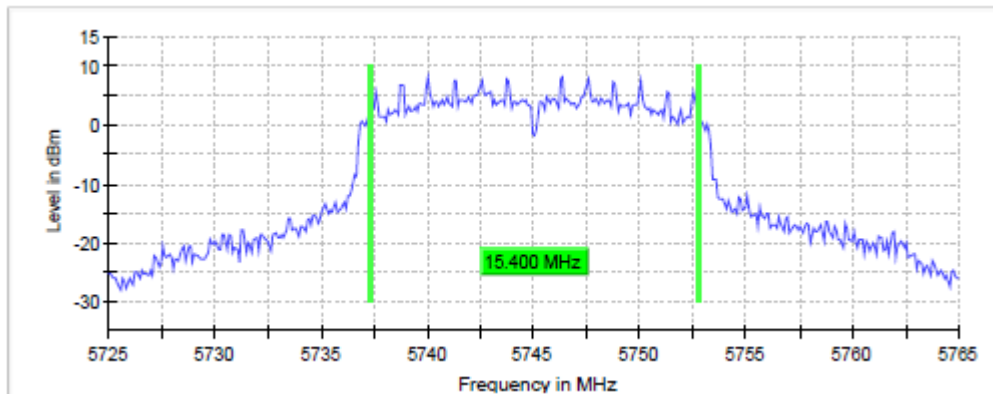


802.11ac

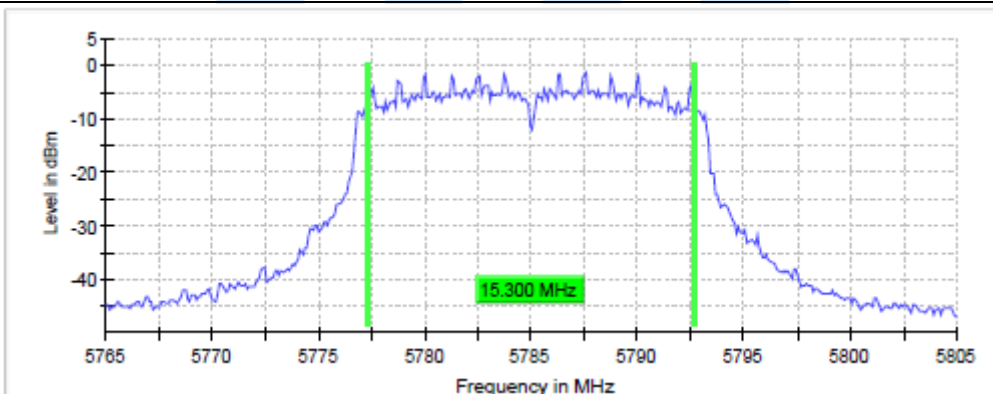
Frequency (MHz)	Channel No.	Measured Bandwidth (MHz)	Minimum Bandwidth (MHz)	Result
5180	36	15.30	N/A	Complies
5200	40	15.30	N/A	Complies
5240	48	15.30	N/A	Complies
5260	52	15.30	N/A	Complies
5300	60	15.30	N/A	Complies
5320	64	15.30	N/A	Complies
5500	100	15.30	N/A	Complies
5580	116	15.30	N/A	Complies
5720	144	15.30	N/A	Complies
5745	149	15.40	N/A	Complies
5785	157	15.30	N/A	Complies
5825	165	15.30	N/A	Complies

Test Plot on Configuration : 802.11n

5745 MHz (149 ch)



5785 MHz (157 ch)



Note: In order to simplify the report, attached plots were only the most wide channel.

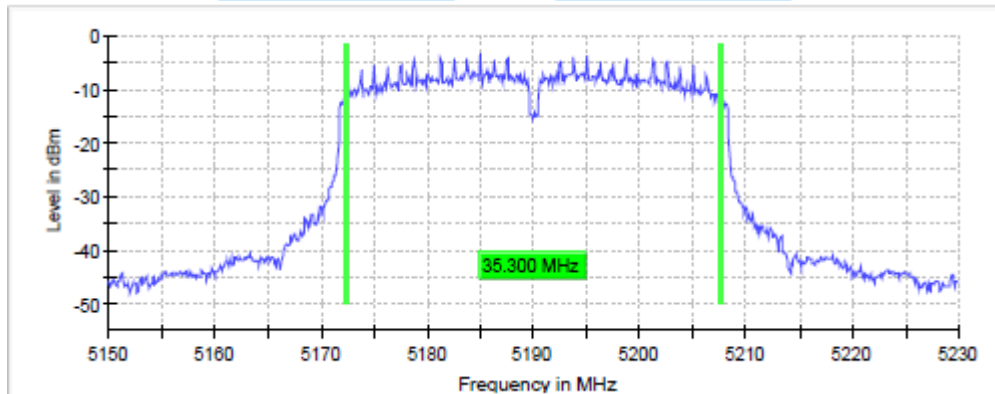


802.11n_HT40

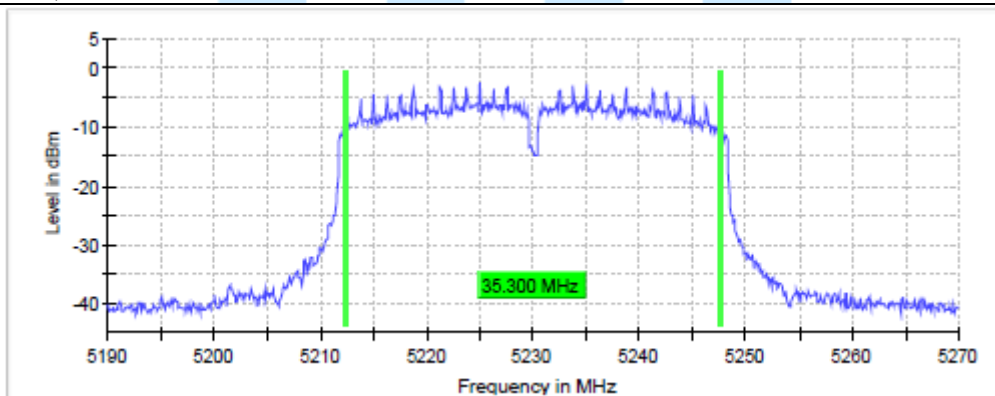
Frequency (MHz)	Channel No.	Measured Bandwidth (MHz)	Minimum Bandwidth (MHz)	Result
5190	38	35.30	N/A	Complies
5230	46	35.30	N/A	Complies
5270	54	35.30	N/A	Complies
5310	62	35.30	N/A	Complies
5510	102	35.30	N/A	Complies
5550	110	35.30	N/A	Complies
5710	142	35.30	N/A	Complies
5755	151	35.30	N/A	Complies
5795	159	35.30	N/A	Complies

Test Plot on Configuration : 802.11n_HT40

5190 MHz (38 ch)



5230 MHz (46 ch)



Note: In order to simplify the report, attached plots were only the most wide channel.

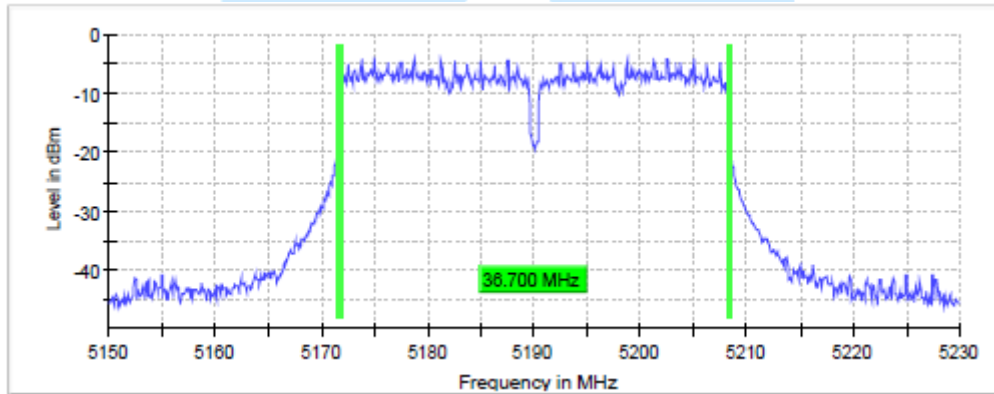


802.11ac_VHT40

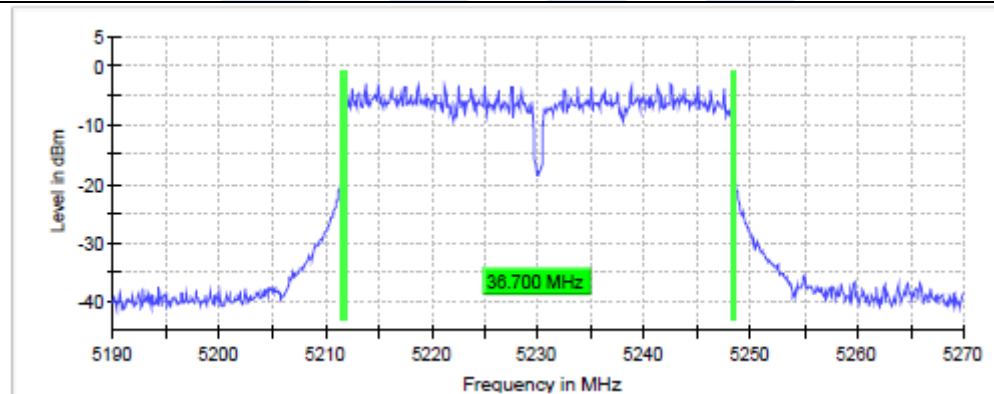
Frequency (MHz)	Channel No.	Measured Bandwidth (MHz)	Minimum Bandwidth (MHz)	Result
5190	38	36.70	N/A	Complies
5230	46	36.70	N/A	Complies
5270	54	36.60	N/A	Complies
5310	62	36.60	N/A	Complies
5510	102	36.70	N/A	Complies
5550	110	36.70	N/A	Complies
5710	142	36.70	N/A	Complies
5755	151	36.60	N/A	Complies
5795	159	36.60	N/A	Complies

Test Plot on Configuration : 802.11n_HT40

5190 MHz (38 ch)



5230 MHz (46 ch)



Note: In order to simplify the report, attached plots were only the most wide channel.

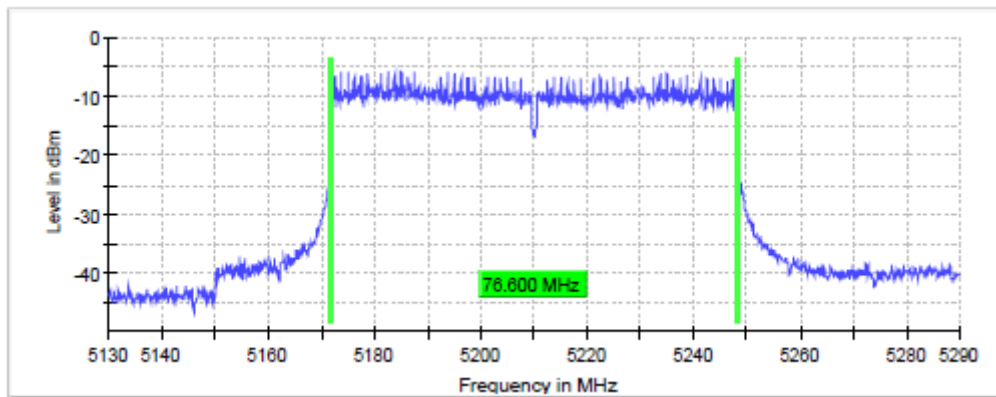


802.11ac_VHT80

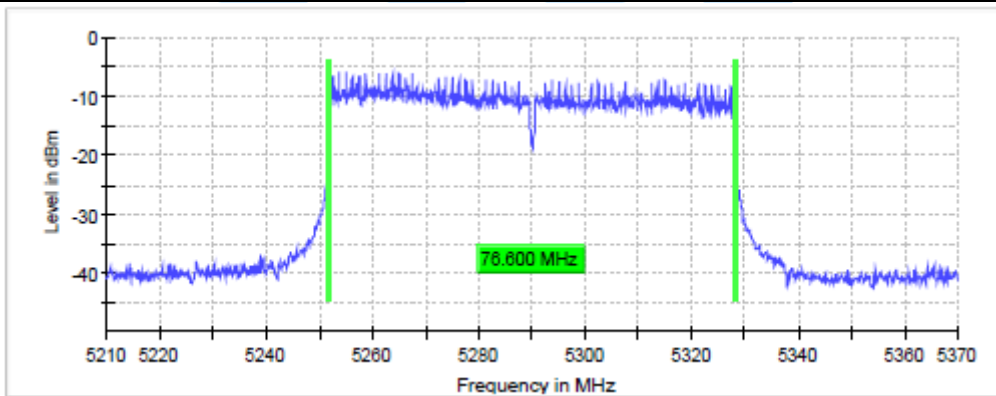
Frequency (MHz)	Channel No.	Measured Bandwidth (MHz)	Minimum Bandwidth (MHz)	Result
5210	42	76.60	N/A	Complies
5290	58	76.60	N/A	Complies
5530	106	76.60	N/A	Complies
5690	138	76.60	N/A	Complies
5775	155	76.60	N/A	Complies

Test Plot on Configuration : 802.11n_HT40

5210 MHz (42 ch)



5290 MHz (58 ch)



Note: In order to simplify the report, attached plots were only the most wide channel.

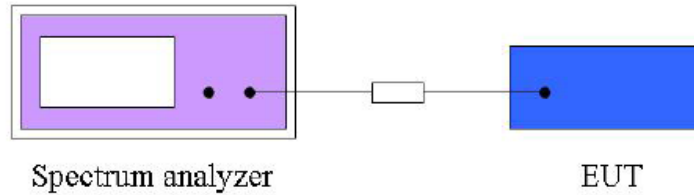


10. Maximum Conducted Output Power

10.1 Operating environment

Temperature : 22.6 °C
Relative Humidity : 55.8 % R.H.

10.2 Test Set-up (Layout)



10.3 Limit

For the 5.15-5.25 GHz band, 5.25-5.35 GHz and 5.47-5.725 GHz the maximum conducted output power over the frequency band of operation shall not exceed 250 mW.

5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

10.4 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - FSV	Rohde & Schwarz	Spectrum Analyzer	101552	Apr. 11, 2020
■ - 10 dB Attenuator	Rohde & Schwarz	Attenuator 10 dB	SEP-10-14-046	Apr. 10. 2020
■ - WMS 32	Rohde & Schwarz	Testing Software	VER10.40.10	N/A
■ - OSP120	Rohde & Schwarz	Open Switch and control platform	101329	Apr. 11. 2020

10.5 Test Procedure

- Measure the duty cycle.
- Set span to encompass the 26 dB EBW of the signal.
- RBW = 1 MHz.
- VBW $\geq$ 3 MHz.
- Number of points in sweep $\geq 2 \times \text{span} / \text{RBW}$.
- Sweep time = auto.
- Detector = RMS.
- Do not use sweep triggering. Allow the sweep to “free run”.
- Trace average at least 100 traces in power averaging(RMS) mode
- Integrated bandwidth = OBW
- Add $10\log(1/x)$, where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times.



10.6 Test Result

- Test Date : Aug. 19, 2019
- Reference Standard : Part 15 Subpart E, Sec. 15.407(a)
- Test Procedure(s) : ANSI C63.10 (2013), KDB 789033 D02 general UNII test procedures new rules v01r04 (May 2, 2017)
- Operating Condition : 802.11a/n/ac
- Power Source : DC 3.7 V

802.11a

Frequency (MHz)	Channel No.	Peak Power (dBm)	Measured Power (dBm)	DutyCycle (%)	Limit (dBm)	Result
5180	36	10.10	6.76	96.17	23.98	Complies
5200	40	10.30	6.91	96.17	23.98	Complies
5240	48	10.10	6.36	96.17	23.98	Complies
5260	52	9.90	6.19	96.17	23.98	Complies
5300	60	10.70	6.79	96.18	23.98	Complies
5320	64	9.70	6.09	96.18	23.98	Complies
5500	100	10.50	6.52	96.18	23.98	Complies
5580	116	9.60	6.16	95.92	23.98	Complies
5720	144	9.90	6.51	96.16	23.98	Complies
5745	149	9.40	6.20	96.15	30	Complies
5785	157	9.30	5.77	96.18	30	Complies
5825	165	9.80	6.03	96.18	30	Complies

802.11n_HT20

Frequency (MHz)	Channel No.	Peak Power (dBm)	Measured Power (dBm)	DutyCycle (%)	Limit (dBm)	Result
5180	36	12.00	6.53	73.96	23.98	Complies
5200	40	12.40	6.65	74.09	23.98	Complies
5240	48	11.80	6.35	73.91	23.98	Complies
5260	52	11.90	6.44	73.92	23.98	Complies
5300	60	12.80	6.99	73.98	23.98	Complies
5320	64	11.80	6.14	74.14	23.98	Complies
5500	100	12.00	6.74	74.01	23.98	Complies
5580	116	11.80	6.28	72.76	23.98	Complies
5720	144	12.30	6.68	74.02	23.98	Complies
5745	149	11.50	6.33	73.89	30	Complies
5785	157	11.30	5.88	74.07	30	Complies
5825	165	12.20	6.52	74.18	30	Complies



802.11ac_VHT20

Frequency (MHz)	Channel No.	Peak Power (dBm)	Measured Power (dBm)	DutyCycle (%)	Limit (dBm)	Result
5180	36	11.70	6.62	81.64	23.98	Complies
5200	40	12.40	6.77	81.65	23.98	Complies
5240	48	11.70	6.34	81.63	23.98	Complies
5260	52	11.80	6.36	81.63	23.98	Complies
5300	60	12.80	6.97	81.67	23.98	Complies
5320	64	11.70	6.01	81.69	23.98	Complies
5500	100	11.80	6.51	81.69	23.98	Complies
5580	116	11.60	6.17	80.59	23.98	Complies
5720	144	12.50	6.74	81.62	23.98	Complies
5745	149	12.60	6.87	81.59	30	Complies
5785	157	11.00	5.66	81.69	30	Complies
5825	165	12.20	6.43	81.75	30	Complies

802.11n_HT40

Frequency (MHz)	Channel No.	Peak Power (dBm)	Measured Power (dBm)	DutyCycle (%)	Limit (dBm)	Result
5190	38	9.80	6.70	85.96	23.98	Complies
5230	46	9.40	6.02	85.95	23.98	Complies
5270	54	8.90	5.73	85.97	23.98	Complies
5310	62	9.80	6.36	86.00	23.98	Complies
5510	102	9.50	6.44	85.99	23.98	Complies
5550	110	9.10	6.14	85.08	23.98	Complies
5710	142	9.00	6.03	85.93	23.98	Complies
5755	151	9.40	6.30	85.90	30	Complies
5795	159	8.60	5.59	85.98	30	Complies

802.11ac_VHT40

Frequency (MHz)	Channel No.	Peak Power (dBm)	Measured Power (dBm)	DutyCycle (%)	Limit (dBm)	Result
5190	38	11.80	6.84	64.53	23.98	Complies
5230	46	11.20	6.33	64.49	23.98	Complies
5270	54	11.20	6.08	64.49	23.98	Complies
5310	62	12.20	6.70	64.56	23.98	Complies
5510	102	11.80	6.82	64.60	23.98	Complies
5550	110	11.60	6.41	64.58	23.98	Complies
5710	142	11.30	6.20	64.47	23.98	Complies
5755	151	11.70	6.45	64.41	30	Complies
5795	159	10.70	5.85	62.82	30	Complies



802.11ac_VHT80

Frequency (MHz)	Channel No.	Peak Power (dBm)	Measured Power (dBm)	DutyCycle (%)	Limit (dBm)	Result
5210	42	11.50	6.24	52.01	23.98	Complies
5290	58	12.20	6.71	52.02	23.98	Complies
5530	106	12.50	6.72	52.12	23.98	Complies
5690	138	11.60	6.40	52.11	23.98	Complies
5775	155	11.70	6.11	51.88	30	Complies



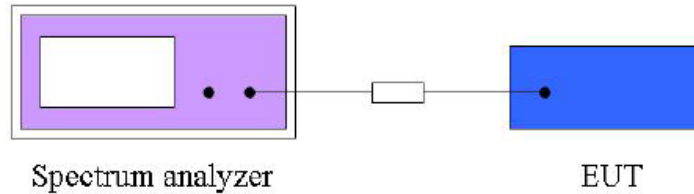


11. Power Spectral Density Measurement

11.1 Operating Environment

Temperature : 22.6 °C
Relative Humidity : 55.8 % R.H.

11.2 Test Set-up (Layout)



11.3 Limit

For the 5.15-5.25 GHz band, 5.25-5.35 GHz and 5.47-5.725 GHz the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

5.725-5.85 GHz the maximum power spectral density shall not exceed 30 dBm in any 1 megahertz band.

11.4 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - FSV	Rohde & Schwarz	Spectrum Analyzer	101552	Apr. 11, 2020
■ - 10 dB Attenuator	Rohde & Schwarz	Attenuator 10 dB	SEP-10-14-046	Apr. 10. 2020
■ - WMS 32	Rohde & Schwarz	Testing Software	VER10.20.01	N/A

11.5 Test Procedure

- Set span to encompass the entire emission bandwidth(EBW) of the signal.
- RBW = 1 MHz(510 kHz for UNII 3)
- VBW $\geq$ 3 MHz
- Number of points in sweep $\geq 2 \times \text{span} / \text{RBW}$.
- Sweep time = auto.
- Detector = RMS(i.e., power averaging), if available. Otherwise, use sample detector mode.
- Do not use sweep triggering. Allow the sweep to “free run”.
- Trace average at least 100 traces in power averaging(RMS) mode
- Use the peak search function on the spectrum analyzer to find the peak of the spectrum.
- If Method SA-2 was used, add $10 \log(1/x)$, where x is the duty cycle, to the peak of the spectrum.



11.6 Test Result

- Test Date : Aug. 19, 2019
- Reference Standard : Part 15 Subpart E, Sec. 15.407(a)
- Test Procedure(s) : ANSI C63.10 (2013), KDB 789033 D02 general UNII test procedures new rules v01r04 (May 2, 2017)
- Operating Condition : 802.11a/n/ac
- Power Source : DC 3.7 V

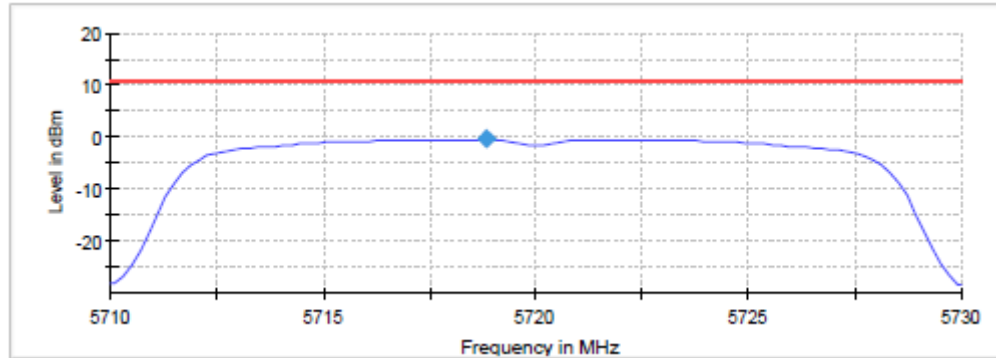
802.11a

Frequency (MHz)	Channel No.	Measured Power Density (dBm)	DutyCycle (%)	Limit (dBm)	Result
5180	36	-4.87	96.26	11	Complies
5200	40	-5.15	96.26	11	Complies
5240	48	-4.43	96.26	11	Complies
5260	52	-4.67	96.27	11	Complies
5300	60	-6.36	96.27	11	Complies
5320	64	-7.01	96.28	11	Complies
5500	100	-6.65	96.27	11	Complies
5580	116	-6.29	95.99	11	Complies
5720	144	-0.46	96.25	11	Complies
5745	149	0.11	96.25	30	Complies
5785	157	-8.43	96.27	30	Complies
5825	165	-8.65	96.28	30	Complies

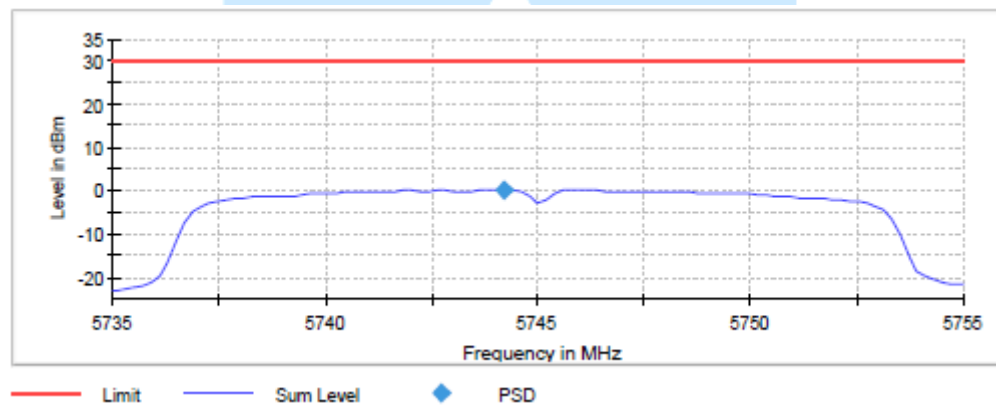


Test Plot on Configuration : 802.11n_HT40

5720 MHz (144 ch)



5745 MHz (149 ch)



Note: In order to simplify the report, attached plots were only the most wide channel.

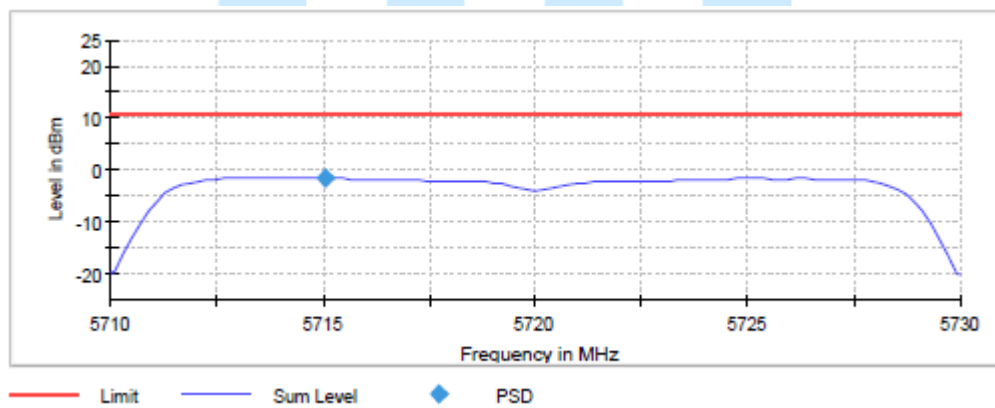


802.11n_HT20

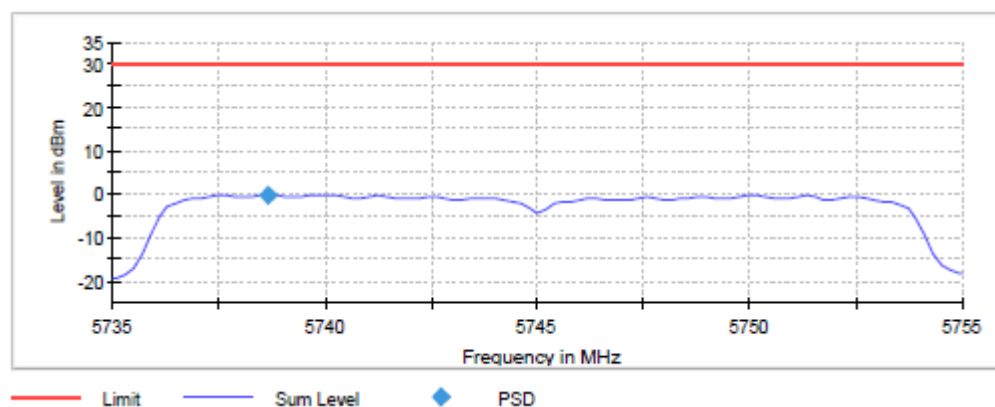
Frequency (MHz)	Channel No.	Measured Power Density (dBm)	DutyCycle (%)	Limit (dBm)	Result
5180	36	-5.47	74.73	11	Complies
5200	40	-5.52	74.74	11	Complies
5240	48	-5.16	74.72	11	Complies
5260	52	-4.88	74.72	11	Complies
5300	60	-6.69	74.79	11	Complies
5320	64	-7.46	74.81	11	Complies
5500	100	-6.97	74.72	11	Complies
5580	116	-6.66	73.34	11	Complies
5720	144	-1.53	74.70	11	Complies
5745	149	-0.12	74.66	30	Complies
5785	157	-8.62	74.80	30	Complies
5825	165	-9.06	74.66	30	Complies

Test Plot on Configuration : 802.11n_HT40

5720 MHz (144 ch)



5745 MHz (149 ch)



Note: In order to simplify the report, attached plots were only the most wide channel.

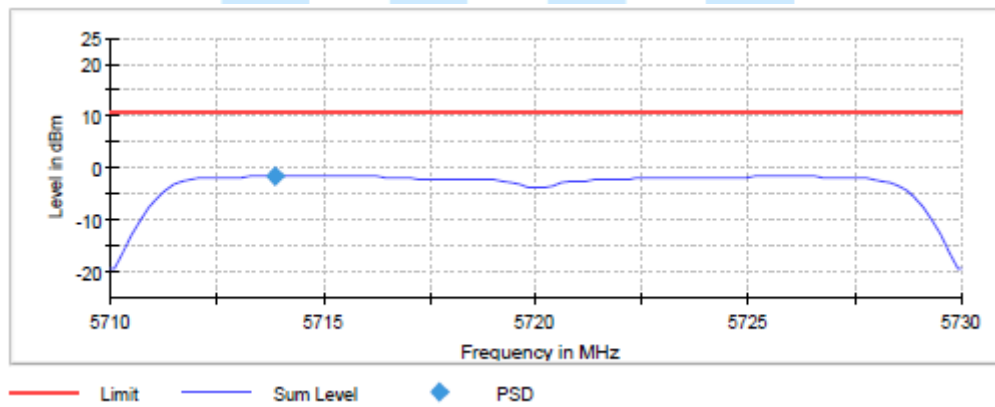


802.11ac_VHT20

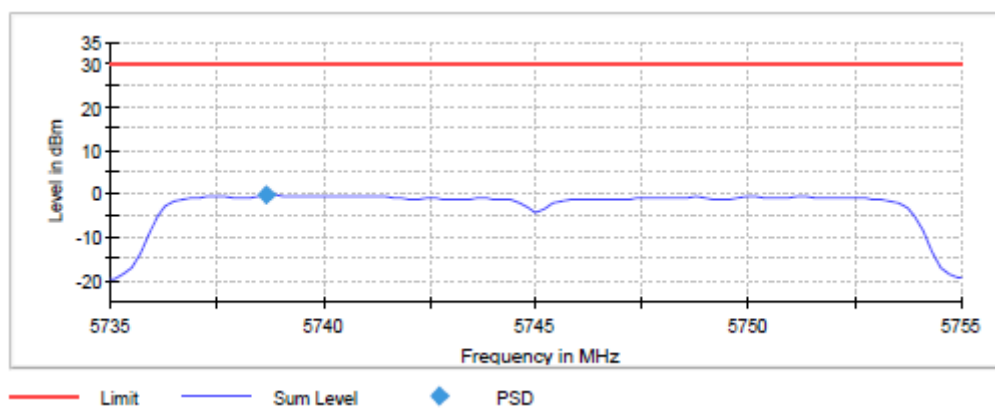
Frequency (MHz)	Channel No.	Measured Power Density (dBm)	DutyCycle (%)	Limit (dBm)	Result
5180	36	-5.53	82.10	11	Complies
5200	40	-5.65	82.10	11	Complies
5240	48	-5.31	82.10	11	Complies
5260	52	-4.80	82.07	11	Complies
5300	60	-6.87	82.14	11	Complies
5320	64	-7.33	82.15	11	Complies
5500	100	-6.93	82.15	11	Complies
5580	116	-6.65	80.90	11	Complies
5720	144	-1.45	82.07	11	Complies
5745	149	-0.23	82.04	30	Complies
5785	157	-8.79	82.14	30	Complies
5825	165	-9.23	82.17	30	Complies

Test Plot on Configuration : 802.11n_HT40

5720 MHz (144 ch)



5745 MHz (149 ch)



Note: In order to simplify the report, attached plots were only the most wide channel.

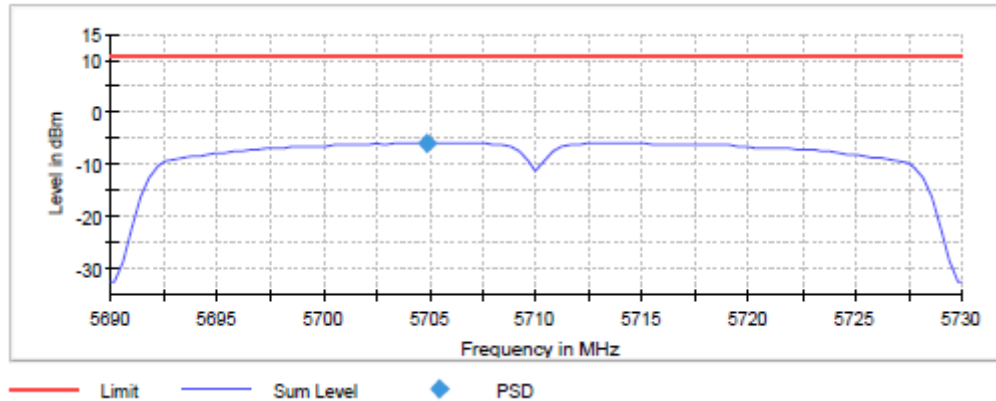


802.11n_HT40

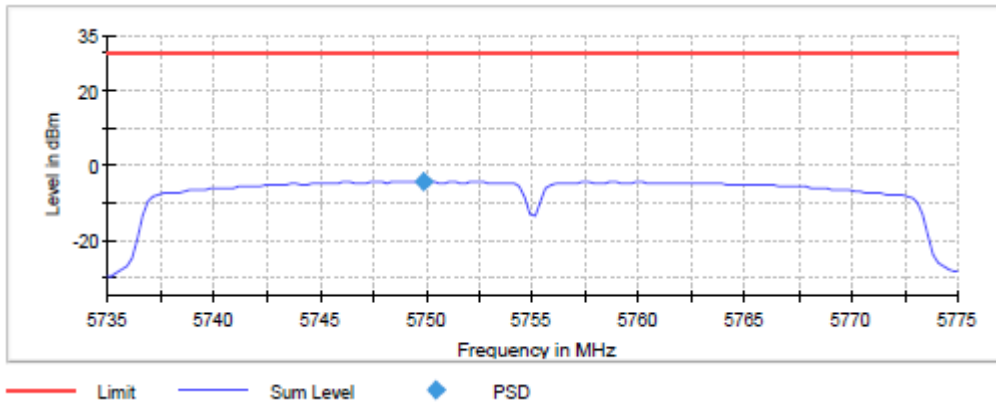
Frequency (MHz)	Channel No.	Measured Power Density (dBm)	DutyCycle (%)	Limit (dBm)	Result
5190	38	-8.67	86.31	11	Complies
5230	46	-7.96	86.31	11	Complies
5270	54	-8.39	86.31	11	Complies
5310	62	-10.05	86.35	11	Complies
5510	102	-9.93	86.35	11	Complies
5550	110	-8.76	85.45	11	Complies
5710	142	-5.91	86.30	11	Complies
5755	151	-4.25	89.24	30	Complies
5795	159	-11.39	86.35	30	Complies

Test Plot on Configuration : 802.11n_HT40

5710 MHz (142 ch)



5755 MHz (151 ch)



Note: In order to simplify the report, attached plots were only the most wide channel.

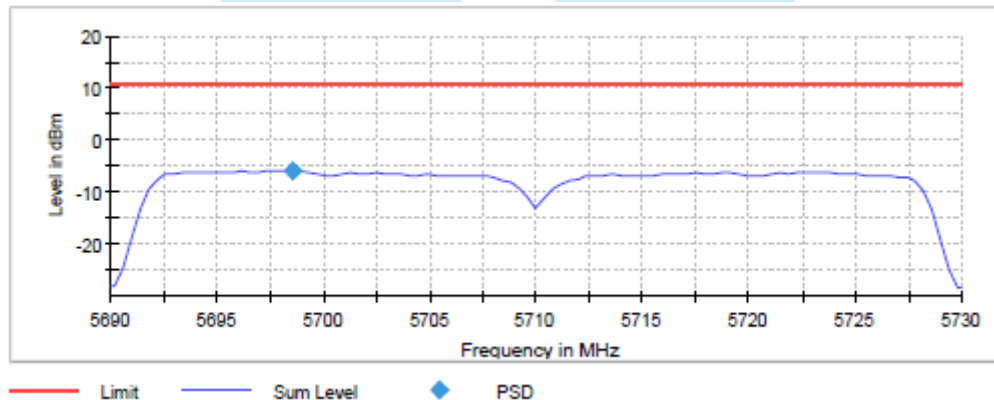


802.11ac_VHT40

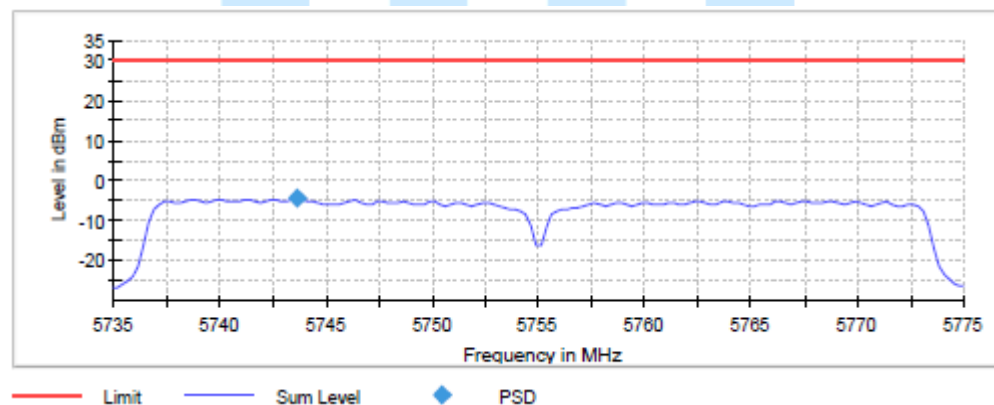
Frequency (MHz)	Channel No.	Measured Power Density (dBm)	DutyCycle (%)	Limit (dBm)	Result
5190	38	-8.41	65.41	11	Complies
5230	46	-7.65	65.36	11	Complies
5270	54	-7.99	65.38	11	Complies
5310	62	-9.58	65.44	11	Complies
5510	102	-9.58	65.46	11	Complies
5550	110	-9.31	65.47	11	Complies
5710	142	-5.95	65.34	11	Complies
5755	151	-4.50	65.28	30	Complies
5795	159	-11.07	63.82	30	Complies

Test Plot on Configuration : 802.11n_HT40

5710 MHz (142 ch)



5755 MHz (151 ch)



Note: In order to simplify the report, attached plots were only the most wide channel.

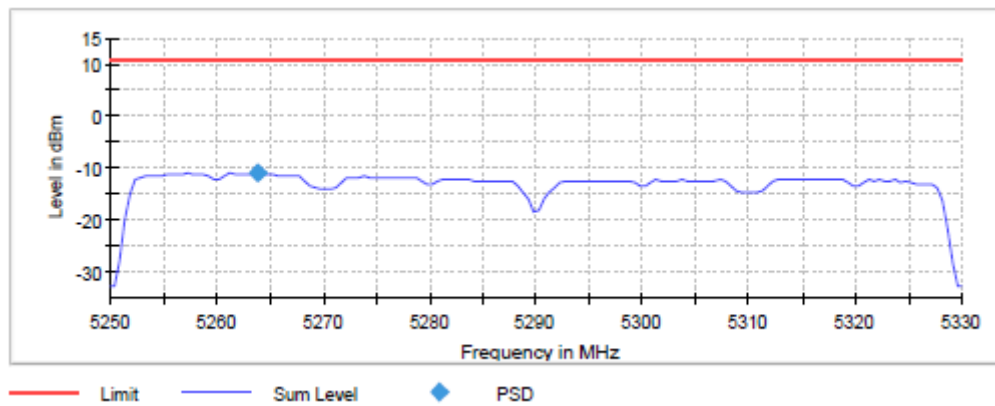


802.11ac_VHT80

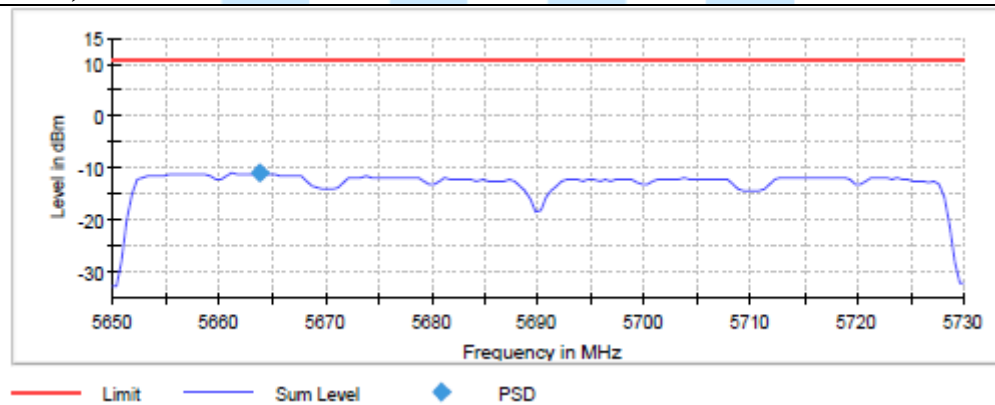
Frequency (MHz)	Channel No.	Measured Power Density (dBm)	DutyCycle (%)	Limit (dBm)	Result
5210	42	-10.56	53.21	11	Complies
5290	58	-11.03	53.24	11	Complies
5530	106	-11.40	53.30	11	Complies
5690	138	-11.02	53.31	11	Complies
5775	155	-11.16	53.17	30	Complies

Test Plot on Configuration : 802.11n_HT40

5290 MHz (58 ch)



5690 MHz (138 ch)



Note: In order to simplify the report, attached plots were only the most wide channel.



12. Frequency Stability

The EUT was placed inside an environmental chamber as the temperature in the chamber was varied between 0 °C and 40 °C. The temperature was incremented by 10 °C intervals and the unit was allowed to stabilize at each temperature before each measurement. The center frequency of the transmitting channel was evaluated at each temperature and the frequency deviation from the channel's center frequency was recorded.

802.11ac (VHT 20)_Startup (UNII 1 / 5 180 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5180022323	22323
		10	5180022880	22880
		20	5180001119	1119
		30	5179989335	-10665
		40	5179986530	-13470
Min.	3.50	20	5179988734	-11266
Max	4.20	20	5179988754	-11246

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 20)_2 minutes (UNII 1 / 5 180 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5180023227	23227
		10	5180020388	20388
		20	5180000382	382
		30	5179988903	-11097
		45	5179986454	-13546
Min.	3.50	20	5179988580	-11420
Max	4.20	20	5179988580	-11420

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 20)_5 minutes (UNII 1 / 5 180 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5180022157	22157
		10	5180021421	21421
		20	5180000135	135
		30	5179988843	-11157
		45	5179986275	-13725
Min.	3.50	20	5179988451	-11549
Max	4.20	20	5179988542	-11458

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 20)_10 minutes (UNII 1 / 5 180 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5180022066	22066
		10	5180020483	20483
		20	5179999878	-122
		30	5179988975	-11025
		45	5179986131	-13869
Min.	3.50	20	5179988482	-11518
Max	4.20	20	5179989353	-10647

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 20)_Startup (UNII 2A / 5 260 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5260022784	22784
		10	5260022445	22445
		20	5260001137	1137
		30	5259989145	-10855
		45	5259986172	-13828
Min.	3.50	20	5259988523	-11477
Max	4.20	20	5259988602	-11398

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 20)_2 minutes (UNII 2A / 5 260 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5260023468	23468
		10	5260020910	20910
		20	5260000458	458
		30	5259988851	-11149
		45	5259986310	-13690
Min.	3.50	20	5259991092	-8908
Max	4.20	20	5259988572	-11428

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 20)_5 minutes (UNII 2A / 5 260 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5260022578	22578
		10	5260021442	21442
		20	5260000021	21
		30	5259988884	-11116
		45	5259986390	-13610
Min.	3.50	20	5259988493	-11507
Max	4.20	20	5259988210	-11790

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 20)_10 minutes (UNII 2A / 5 260 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5260022472	22472
		10	5260020295	20295
		20	5259999871	-129
		30	5259988791	-11209
		45	5259986447	-13553
Min.	3.50	20	5259988431	-11569
Max	4.20	20	5259989181	-10819

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 20)_Startup (UNII 2C / 5 500 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5500024145	24145
		10	5500021394	21394
		20	5500001475	1475
		30	5499988827	-11173
		45	5499985969	-14031
Min.	3.50	20	5499988524	-11476
Max	4.20	20	5499988501	-11499

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 20)_2 minutes (UNII 2C / 5 500 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5500024492	24492
		10	5500020141	20141
		20	5500000912	912
		30	5499988821	-11179
		45	5499986117	-13883
Min.	3.50	20	5499988442	-11558
Max	4.20	20	5499988445	-11555

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 20)_5 minutes (UNII 2C / 5 500 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5500023918	23918
		10	5500020512	20512
		20	5500000194	194
		30	5499988851	-11149
		45	5499986164	-13836
Min.	3.50	20	5499988433	-11567
Max	4.20	20	5499987945	-12055

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 20)_10 minutes (UNII 2C / 5 500 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5500023898	23898
		10	5500020463	20463
		20	5500000193	193
		30	5499988780	-11220
		45	5499986396	-13604
Min.	3.50	20	5499988454	-11546
Max	4.20	20	5499989004	-10996

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 20)_Startup (UNII 3 / 5 745 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5745025589	25589
		10	5745025935	25935
		20	5745001990	1990
		30	5744988342	-11658
		45	5744985055	-14945
Min.	3.50	20	5744987732	-12268
Max	4.20	20	5744987850	-12150

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 20)_2 minutes (UNII 3 / 5 745 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5745026140	26140
		10	5745025145	25145
		20	5745001447	1447
		30	5744988354	-11646
		45	5744985154	-14846
Min.	3.50	20	5744987734	-12266
Max	4.20	20	5744987909	-12091

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 20)_5 minutes (UNII 3 / 5 745 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5745025600	25600
		10	5745025424	25424
		20	5745000764	764
		30	5744988364	-11636
		45	5744985095	-14905
Min.	3.50	20	5744987867	-12133
Max	4.20	20	5744988345	-11655

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 20)_10 minutes (UNII 3 / 5 745 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5745025542	25542
		10	5745025472	25472
		20	5745000723	723
		30	5744988168	-11832
		45	5744985135	-14865
Min.	3.50	20	5744988009	-11991
Max	4.20	20	5744989235	-10765

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 40)_Startup (UNII 1 / 5 190 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5190022123	22123
		10	5190020190	20190
		20	5190000864	864
		30	5189989369	-10631
		45	5189986515	-13485
Min.	3.50	20	5189988713	-11287
Max	4.20	20	5189988760	-11240

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 40)_2 minutes (UNII 1 / 5 190 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5190022487	22487
		10	5190019560	19560
		20	5190000352	352
		30	5189988969	-11031
		45	5189986664	-13336
Min.	3.50	20	5189988546	-11454
Max	4.20	20	5189988623	-11377

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 40)_5 minutes (UNII 1 / 5 190 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5190022063	22063
		10	5190020090	20090
		20	5190000077	77
		30	5189988953	-11047
		45	5189986394	-13606
Min.	3.50	20	5189988654	-11346
Max	4.20	20	5189988412	-11588

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 40)_10 minutes (UNII 1 / 5 190 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5190021972	21972
		10	5190019779	19779
		20	5189999862	-138
		30	5189988995	-11005
		45	5189986554	-13446
Min.	3.50	20	5189988502	-11498
Max	4.20	20	5189989339	-10661

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 40)_Startup (UNII 2A / 5 270 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5270022610	22610
		10	5270020650	20650
		20	5270000997	997
		30	5269989143	-10857
		45	5269986404	-13596
Min.	3.50	20	5269988641	-11359
Max	4.20	20	5269988760	-11240

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 40)_2 minutes (UNII 2A / 5 270 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5270023065	23065
		10	5270019869	19869
		20	5270000406	406
		30	5269988948	-11052
		45	5269986468	-13532
Min.	3.50	20	5269988539	-11461
Max	4.20	20	5269988623	-11377

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 40)_5 minutes (UNII 2A / 5 270 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5270022630	22630
		10	5270020264	20264
		20	5269999991	-9
		30	5269988958	-11042
		45	5269986598	-13402
Min.	3.50	20	5269988494	-11506
Max	4.20	20	5269988412	-11588

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 40)_10 minutes (UNII 2A / 5 270 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5270022528	22528
		10	5270019492	19492
		20	5269999891	-109
		30	5269988869	-11131
		45	5269986760	-13240
Min.	3.50	20	5269988463	-11537
Max	4.20	20	5269989339	-10661

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 40)_Startup (UNII 2C / 5 510 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5510024077	24077
		10	5510020971	20971
		20	5510001350	1350
		30	5509988885	-11115
		45	5509986229	-13771
Min.	3.50	20	5509988420	-11580
Max	4.20	20	5509988544	-11456

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 40)_2 minutes (UNII 2C / 5 510 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5510024264	24264
		10	5510020233	20233
		20	5510000947	947
		30	5509988920	-11080
		45	5509986329	-13671
Min.	3.50	20	5509988482	-11518
Max	4.20	20	5509988532	-11468

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 40)_5 minutes (UNII 2C / 5 510 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5510023968	23968
		10	5510020309	20309
		20	5510000115	115
		30	5509988948	-11052
		45	5509986235	-13765
Min.	3.50	20	5509988460	-11540
Max	4.20	20	5509987995	-12005

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 40)_10 minutes (UNII 2C / 5 510 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5510023904	23904
		10	5510019675	19675
		20	5510000295	295
		30	5509988738	-11262
		45	5509986326	-13674
Min.	3.50	20	5509988488	-11512
Max	4.20	20	5509989023	-10977

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 40)_Startup (UNII 3 / 5 755 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5755025769	25769
		10	5755025559	25559
		20	5755001727	1727
		30	5754988461	-11539
		45	5754985161	-14839
Min.	3.50	20	5754987982	-12018
Max	4.20	20	5754988049	-11951

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 40)_2 minutes (UNII 3 / 5 755 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5755025897	25897
		10	5755025210	25210
		20	5755001253	1253
		30	5754988489	-11511
		45	5754985168	-14832
Min.	3.50	20	5754987891	-12109
Max	4.20	20	5754987964	-12036

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 40)_5 minutes (UNII 3 / 5 755 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5755025620	25620
		10	5755025010	25010
		20	5755000975	975
		30	5754988480	-11520
		45	5754985208	-14792
Min.	3.50	20	5754988002	-11998
Max	4.20	20	5754987872	-12128

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 40)_10 minutes (UNII 3 / 5 755 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5755025569	25569
		10	5755025284	25284
		20	5755000981	981
		30	5754988366	-11634
		45	5754985296	-14704
Min.	3.50	20	5754988035	-11965
Max	4.20	20	5754988915	-11085

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 80)_Startup (UNII 1 / 5 210 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5210022242	22242
		10	5210019906	19906
		20	5210000591	591
		30	5209989324	-10676
		45	5209986496	-13504
Min.	3.50	20	5209988725	-11275
Max	4.20	20	5209988780	-11220

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 80)_2 minutes (UNII 1 / 5 210 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5210022372	22372
		10	5210019103	19103
		20	5210000168	168
		30	5209988996	-11004
		45	5209986629	-13371
Min.	3.50	20	5209988581	-11419
Max	4.20	20	5209988718	-11282

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 80)_5 minutes (UNII 1 / 5 210 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5210022120	22120
		10	5210019275	19275
		20	5210000089	89
		30	5209989004	-10996
		45	5209986754	-13246
Min.	3.50	20	5209988679	-11321
Max	4.20	20	5209988421	-11579

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 80)_10 minutes (UNII 1 / 5 210 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5210022081	22081
		10	5210019285	19285
		20	5209999837	-163
		30	5209989035	-10965
		45	5209986646	-13354
Min.	3.50	20	5209988553	-11447
Max	4.20	20	5209989334	-10666

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 80)_Startup (UNII 2A / 5 290 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5290023780	23780
		10	5290018145	18145
		20	5290000543	543
		30	5289989204	-10796
		45	5289986489	-13511
Min.	3.50	20	5289988838	-11162
Max	4.20	20	5289988809	-11191

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 80)_2 minutes (UNII 2A / 5 290 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5290022672	22672
		10	5290017905	17905
		20	5290000280	280
		30	5289989114	-10886
		45	5289986714	-13286
Min.	3.50	20	5289988750	-11250
Max	4.20	20	5289988745	-11255

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 80)_5 minutes (UNII 2A / 5 290 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5290022518	22518
		10	5290018365	18365
		20	5289999940	-60
		30	5289989074	-10926
		45	5289986826	-13174
Min.	3.50	20	5289988749	-11251
Max	4.20	20	5289988284	-11716

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 80)_10 minutes (UNII 2A / 5 290 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5290022500	22500
		10	5290018076	18076
		20	5289999926	-74
		30	5289989056	-10944
		45	5289986943	-13057
Min.	3.50	20	5289988673	-11327
Max	4.20	20	5289989353	-10647

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 80)_Startup (UNII 2C / 5 530 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5530025522	25522
		10	5530023128	23128
		20	5530000895	895
		30	5529988469	-11531
		45	5529985580	-14420
Min.	3.50	20	5529987941	-12059
Max	4.20	20	5529988121	-11879

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 80)_2 minutes (UNII 2C / 5 530 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5530024073	24073
		10	5530021979	21979
		20	5530000569	569
		30	5529988624	-11376
		45	5529985624	-14376
Min.	3.50	20	5529988092	-11908
Max	4.20	20	5529988142	-11858

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 80)_5 minutes (UNII 2C / 5 530 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5530024033	24033
		10	5530022222	22222
		20	5530000279	279
		30	5529988607	-11393
		45	5529985688	-14312
Min.	3.50	20	5529988122	-11878
Max	4.20	20	5529987927	-12073

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 80)_10 minutes (UNII 2C / 5 530 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5530024080	24080
		10	5530021960	21960
		20	5530000299	299
		30	5529988479	-11521
		45	5529985754	-14246
Min.	3.50	20	5529988217	-11783
Max	4.20	20	5529989079	-10921

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 80)_Startup (UNII 3 / 5 775 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5775027272	27272
		10	5775026005	26005
		20	5775001440	1440
		30	5774988431	-11569
		45	5774985176	-14824
Min.	3.50	20	5774987906	-12094
Max	4.20	20	5774988074	-11926

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 80)_2 minutes (UNII 3 / 5 775 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5775025841	25841
		10	5775025721	25721
		20	5775001198	1198
		30	5774988417	-11583
		45	5774985222	-14778
Min.	3.50	20	5774987940	-12060
Max	4.20	20	5774987938	-12062

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 80)_5 minutes (UNII 3 / 5 775 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5775025767	25767
		10	5775025832	25832
		20	5775001072	1072
		30	5774988351	-11649
		45	5774985123	-14877
Min.	3.50	20	5774987949	-12051
Max	4.20	20	5774987785	-12215

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



802.11ac (VHT 80)_10 minutes (UNII 3 / 5 775 000 000 Hz)

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)
100	3.7	0	5775025775	25775
		10	5775025643	25643
		20	5775001044	1044
		30	5774988251	-11749
		45	5774985185	-14815
Min.	3.50	20	5774988059	-11941
Max	4.20	20	5774988880	-11120

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.



13. AC Power line Conducted emission

-Test Description

The Line conducted emission test facility is inside a 4 m × 8 m × 2.5 m shielded enclosure. (Test firm Registration Number: 269701)

The EUT was placed on a non-conducting 1.0 m by 1.5 m table, which is 0.8 m in height and 0.4 m away from the vertical wall of the shielded enclosure.

The EUT is powered from the Rohde & Schwarz LISN (ENV216) and the support equipment is powered from the Rohde & Schwarz LISN (ENV216). Powers to the LISN are filtered by high-current high insertion loss power line filter.

Sufficient time for EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.

The RF output of the LISN was connected to the EMI test receiver (Rohde & Schwarz, ESCI).

Exploratory measurements were conducted to identify the highest emission by operating the EUT in a range of typical modes of operation, cable positions, system configuration and arrangement.

Based on exploratory measurements, the final measurements were conducted at the worst test conditions.

Exploratory measurements were scanned using Peak mode of EMI Test receiver from 150 kHz to 30 MHz with 20 ms sweep time. The final measurements were measured with Quasi-Peak and Average mode.

The bandwidth of EMI Test Receiver was set to 9 kHz. Interface cables were connected to the available interface ports of the test unit. Excess cable lengths were bundled at center with 30 cm ~ 40 cm.

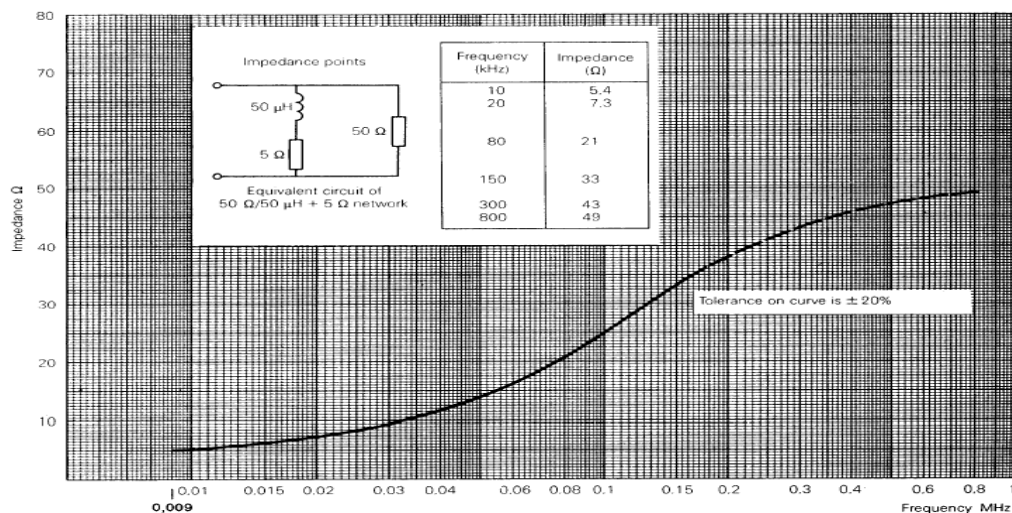


Fig 2. Impedance of LISN



13.1 Operating Environment

Temperature : 24.6 °C
Relative Humidity : 50.6 % R.H.

13.2 Test Set-up

The conducted emission measurements were performed in the shielded room.

The EUT was placed on wooden table, 0.8 m heights above the floor, 0.4 m from the reference ground plane (GRP) wall and 0.8 m from AMN & ISN.

AMN is bonded on horizontal reference ground plane.

The ground plane, which was electrically bonded to the shield room, ground system and all power lines entering the shield room, were filtered.

13.3 Measurement Uncertainty

The measurement uncertainty was calculated in accordance with ISO "Guide to the expression of uncertainty in measurement."

The measurement uncertainty was given with a confidence of 95 %.

Test Items	Uncertainty	Remark
Conducted emission (9 kHz ~ 150 kHz)	3.84 dB	Confidence level of approximately 95 % ($k = 2$)
Conducted emission (150 kHz ~ 30 MHz)	3.31 dB	Confidence level of approximately 95 % ($k = 2$)

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.

The listed uncertainties are the worst case uncertainty for the entire range of measurement. please note that the uncertainty values are provided for informational purposes only are not used in determining the PASS/FAIL results



13.4 Limit

RFI Conducted	FCC Limit(dBμV/m) Class B	
Freq. Range	Quasi-Peak	Average
150 kHz ~ 0.5 MHz	66 ~ 56*	56 ~ 46*
0.5 MHz ~ 5 MHz	56	46
5 MHz ~ 30 MHz	60	50
*Limits decreases linearly with the logarithm of frequency.		

13.5 Test Equipment used

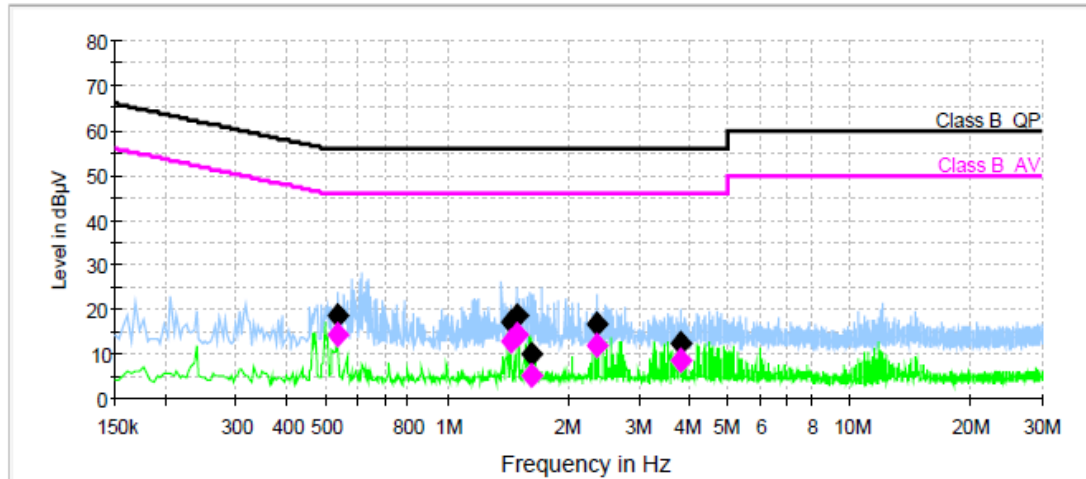
Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■- ESCI	Rohde & Schwarz	EMI test receiver	100237	Apr. 13, 2020
□- ENV216	Rohde & Schwarz	LISN	100172	Apr. 10, 2020
■- ENV216	Rohde & Schwarz	LISN	100173	Apr. 09, 2020
■- EMC 32	Rohde & Schwarz	Testing Software	VER8.53	N/A
■- ESCI	Rohde & Schwarz	EMI test receiver	100237	Apr. 13, 2020

13.6 Test data for Conducted Emission

-. Test Date : Jul. 11, 2019
 -. Reference Standard : Part 15 Subpart C, Sec. 15.207
 -. Test Procedure(s) : ANSI C63.10 (2013)
 -. Operating Condition : Charging mode
 -. Power Source : AC 120 V / 60 Hz
 -. Frequency rage : 0.15 MHz to 30 MHz
 -. Line : AC Power Line (Live and Neutral)
 -. Comment :



AC Power line Conducted emission



Class B_QP Class B_AV Preview Result 1-PK+
Preview Result 2-AVG Final Result 1-QPK Final Result 2-CAV

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.532675	18.9	1000.0	9.000	Off	L1	9.6	37.1	56.0	
1.440388	17.5	1000.0	9.000	Off	L1	9.7	38.5	56.0	
1.502519	18.8	1000.0	9.000	Off	L1	9.7	37.2	56.0	
1.630856	10.0	1000.0	9.000	Off	N	9.7	46.0	56.0	
2.347438	16.7	1000.0	9.000	Off	L1	9.8	39.3	56.0	
3.788238	12.4	1000.0	9.000	Off	N	9.8	43.6	56.0	

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.532675	14.2	1000.0	9.000	Off	L1	9.6	31.8	46.0	
1.440388	12.8	1000.0	9.000	Off	L1	9.7	33.2	46.0	
1.502519	14.2	1000.0	9.000	Off	L1	9.7	31.8	46.0	
1.630856	5.4	1000.0	9.000	Off	N	9.7	40.6	46.0	
2.347438	12.0	1000.0	9.000	Off	L1	9.8	34.0	46.0	
3.788238	8.7	1000.0	9.000	Off	N	9.8	37.3	46.0	

14. Radiated Spurious & Restricted Band Edge Emission

Exploratory Radiated measurements were conducted at the 3m semi anechoic chamber in order to identify the highest emission by operating the EUT in a range of typical modes of operation, cable positions, system configuration and arrangement.

Based on exploratory measurements, the final measurements were conducted at the worst test conditions.

Final measurements of below 1GHz were made at 3m or 10 m Chamber that complies with CISPR 16/ANSI C63.10. Above 1GHz final measurements were conducted at the 3m Chamber only.

For measurements above 1GHz, the bottom side of 3m chamber was installed with absorbers in order to meet SVSWR Limit.

Exploratory measurements were scanned using Peak mode of EMI Test receiver and final measurements were measured with Quasi-Peak mode (Below 1GHz) and Peak & Average mode (Above 1GHz).

The measurements were performed by rotating the EUT 360° and adjusting the receive antenna height from 1.0 m to 4.0 m. All frequencies were investigated in both horizontal and vertical antenna polarity.

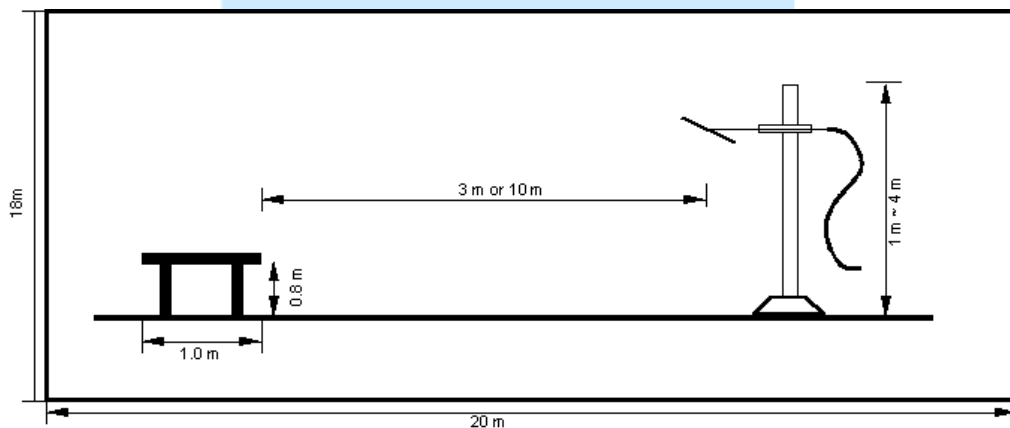


Fig 3. Dimensions of test site (Below 1GHz)

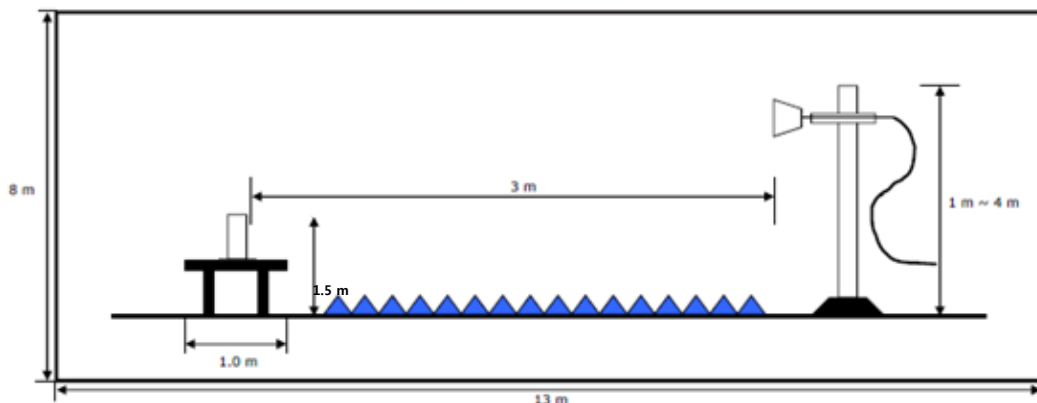


Fig 4. Dimensions of test site (Above 1GHz)



14.1 Operating environment

Temperature : 22.6 °C
Relative humidity : 63.6 % R.H.

14.2 Test set-up

A preliminary and final measurement was at 3 m anechoic chamber.

The EUT was placed on a non-conducting table.

For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane.

For emission measurements above 1 GHz, the table height is 1.5 m above the reference ground plane.

The turntable with EUT was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels.

This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

14.3 Measurement uncertainty

The measurement uncertainty was calculated in accordance with ISO “Guide to the expression of uncertainty in measurement”.

The measurement uncertainty was given with a confidence of 95 %.

Test items(Anechoic Chamber)	Uncertainty	Remark
Radiated emission (30 MHz ~ 300 MHz, 3 m, Vertical)	5.14 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (30 MHz ~ 300 MHz, 3 m, Horizontal)	5.10 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Vertical)	6.05 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Horizontal)	5.19 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (1 000 MHz ~ 6 000 MHz, 3 m, V/H)	5.77 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (6 000 MHz ~ 18 000 MHz, 3 m, V/H)	5.77 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (18 000 MHz ~ 26 000 MHz, 3 m, V/H)	5.61 dB	Confidence level of approximately 95 % ($k = 2$)

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.

The listed uncertainties are the worst case uncertainty for the entire range of measurement. please note that the uncertainty values are provided for informational purposes only are not used in determining the PASS/FAIL results



14.4 Limit

20 dB in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (microvolt/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2 400/F (kHz)	300
0.490 ~ 1.705	2 400/F (kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

14.5 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESU40	Rohde & Schwarz	EMI Test Receiver	100266	Apr. 12, 2020
■ - HFH2-Z2	Rohde & Schwarz	Loop Antenna	100041	Dec. 06, 2019
■ - VULB9160	Schwarzbeck	Broadband Test Antenna	3376	May 02, 2020
■ - BBHA9120D	Schwarzbeck	Horn Antenna	207	Sep. 14, 2019
■ - 3160-09	Schwarzbeck	Horn Antenna	218457	Feb. 12, 2020
■ - BBHA 9170	Schwarzbeck	Horn Antenna	766	Aug. 01, 2019
■ - TK-PA1840H	Testek	Preamplifier	170007-L	Apr. 14, 2020
■ - MCU066	maturo GmbH	Position Controller	1390306	N/A
■ - TT2.5SI	maturo GmbH	Turntable	1390307	N/A
■ - CO3000	Innco system GmbH	Position Controller	CO3000/1804/4 2760218/P	N/A
■ - MA4640-XP-ET	Innco system GmbH	Antenna Mast	5580916	N/A
■ - AFS 44 00101800-25-10P-44	MITEQ	Preamplifier	1258943	Apr. 10, 2020
■ - SCU-F1826-G47-BZ42-CSS	BONN Elektronik	Preamplifier	10003	Apr. 15, 2020
■ - WHKX3.0/18G-10SS	WAINWRIGHT INSTRUMENTS	High pass filter	SN31	Apr. 12, 2020
■ - WHKX7.0/18G-10SS	WAINWRIGHT INSTRUMENTS	High pass filter	SN33	Apr. 10, 2020
■ - EMC 32	Rohde & Schwarz	Testing Software	VER10.50.10	N/A



14.6 Test data for Radiated Spurious Emission

- Test Date : Jul. 30 , 2019 ~ Aug. 15, 2019
- Reference Standard : Part 15 Subpart E, Sec. 15.407(b)
- Measuring Distance : 3 m
- Resolution Bandwidth : 200 Hz, 9 kHz(Below 30 MHz) / 120 kHz(30 MHz ~ 1GHz) / 1 MHz(Above 1GHz)
- Detector mode : Quasi Peak detector mode / Peak detector mode / Average detector mode
- Power Source : DC 3.7 V
- Note : Through three orthogonal axes were investigated and the worst case is report

Radiated Spurious Emission (9 kHz to 30 MHz)

※ The reading of emissions are attenuated more than 10 dB below the permissible limits.

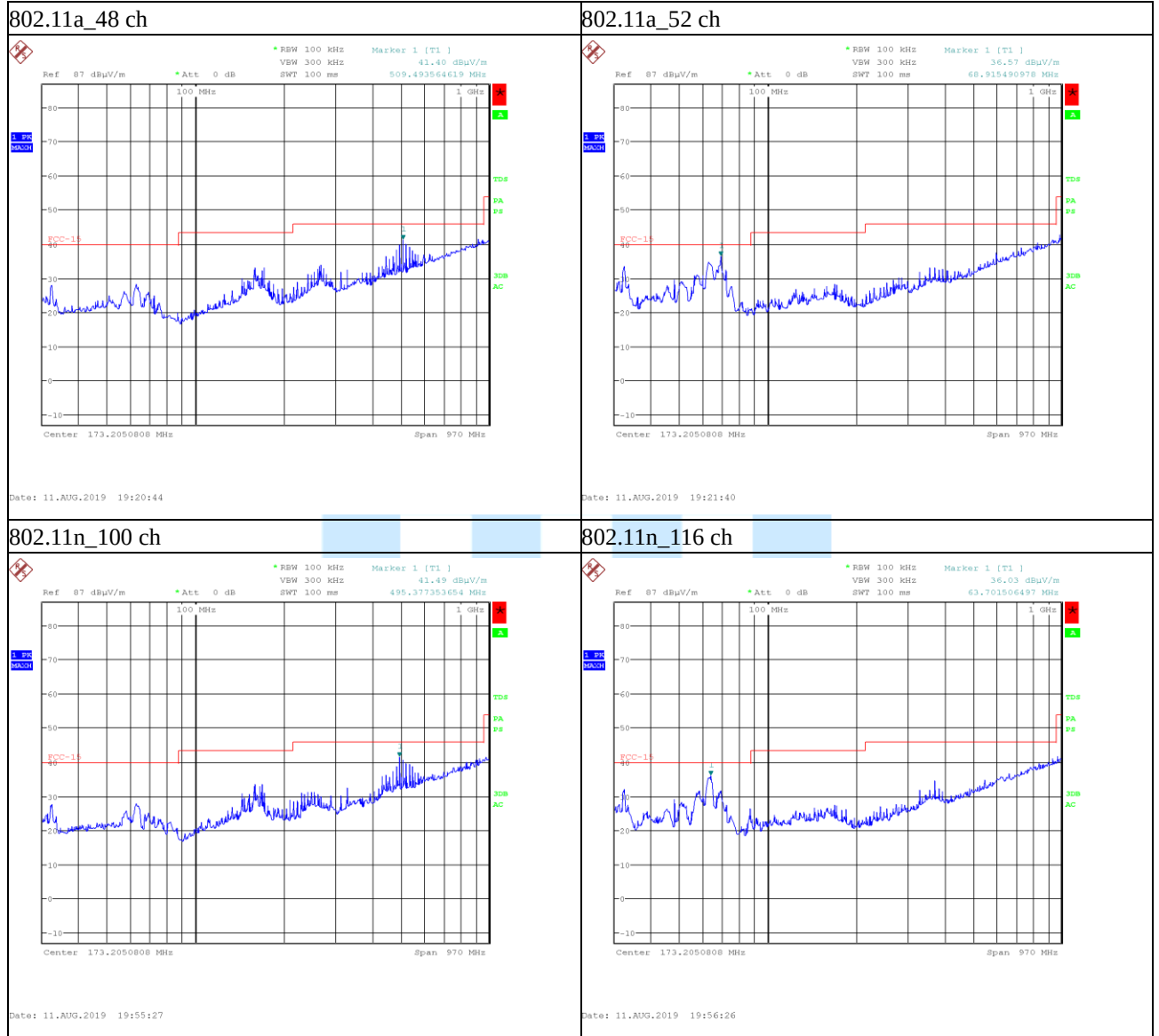
Radiated Spurious Emission (30 MHz to 1 000 MHz)

802.11 Standard	Ch.	Frequency [MHz]	Pol.	Reading [dBuV]	Transducer Factor [dB]	DCCF [dB]	Test Result [dBuV/m]	Limits [dBuV/m]	Margin [dB]	Detector Type
a	48	509.49	H	18.21	23.19	-	41.40	46.00	4.60	PK
	52	68.915	V	24.97	11.60	-	36.57	40.00	3.43	PK
n (HT20)	100	495.37	H	18.7	22.79	-	41.49	46.00	4.51	PK
	116	63.70	V	23.71	12.32	-	36.03	40.00	3.97	PK
n (HT40)	62	509.49	H	18.26	23.19	-	41.45	46.00	4.55	PK
	151	62.63	V	24.5	12.32	-	36.82	40.00	3.18	PK
ac (VHT20)	64	509.49	H	18.62	23.19	-	41.81	46.00	4.19	PK
	144	62.63	V	24	12.32	-	36.32	40.00	3.68	PK
ac (VHT40)	159	495.37	H	17.92	22.79	-	40.71	46.00	5.29	PK
	151	63.34	V	24.17	12.32	-	36.49	40.00	3.51	PK
ac (VHT80)	42	495.37	H	19.33	22.79	-	42.12	46.00	3.88	PK
	122	62.28	V	24.46	12.32	-	36.78	40.00	3.22	PK

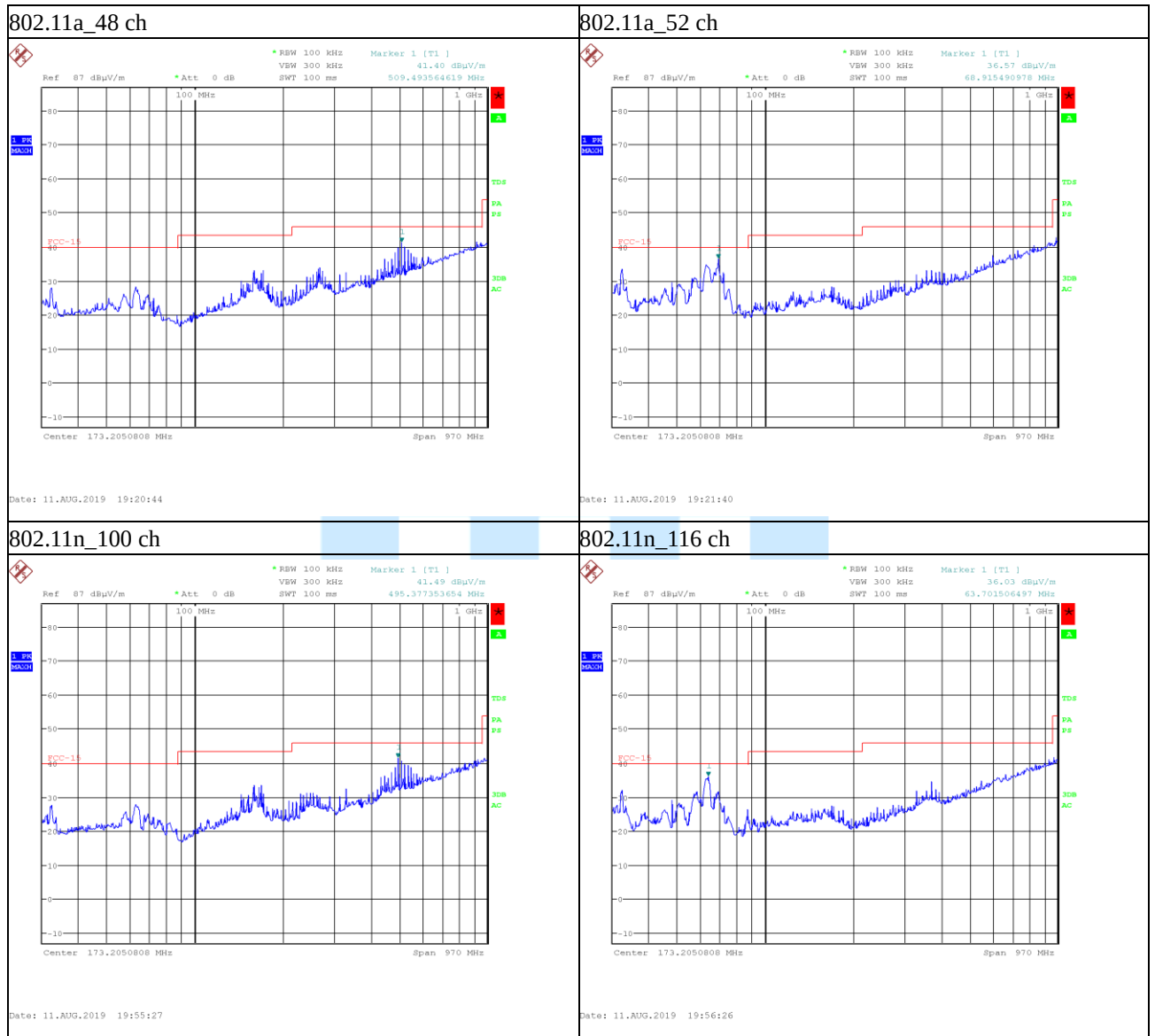
Note: In order to simplify the report, attached plots were only the most wide channel.



Test Plot on Configuration



Note: In order to simplify the report, attached plots were only the most wide channel.



Note: In order to simplify the report, attached plots were only the most wide channel.

Radiated Spurious Emission (1 GHz to 25 GHz)

✱ If the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.



14.7 Test data for Radiated Restricted Band Edge Emission

- Test Date : Aug. 13, 2019
- Reference Standard : Part 15 subpart E, Sec. 15.407(b)
- Measuring Distance : 3 m
- Resolution Bandwidth : 1 MHz
- Detector mode : Peak detector mode / Average detector mode
- Power Source : DC 3.7 V
- Note : Through three orthogonal axes were investigated and the worst case is report

802.11 Standard	Ch.	Frequency [MHz]	Pol.	Reading [dBuV]	Transducer Factor [dB]	DCCF [dB]	Test Result [dBuV/m]	Limits [dBuV/m]	Margin [dB]	Detector Type
a	100	5467.30	H	65.31	-2.06	-	63.25	74.00	10.75	PK
	165	5851.60	H	64.39	-1.13	-	63.26	74.00	10.74	PK
n (HT20)	100	5469.55	H	54.57	-2.06	-	52.51	74.00	21.49	PK
	165	5860.73	H	53.79	-1.11	-	52.68	74.00	21.32	PK
n (HT40)	102	5469.55	H	69.14	-2.06	-	67.08	74.00	6.92	PK
	62	5350.32	H	67.05	-2.65	-	64.40	74.00	9.60	PK
ac (VHT20)	36	5149.55	H	55.45	-3.65	-	51.80	74.00	22.20	PK
	100	5468.68	H	55.64	-2.06	-	53.58	74.00	20.42	PK
ac (VHT40)	102	5469.87	H	68.01	-2.06	-	65.95	74.00	8.05	PK
	102	5469.87	V	65.75	-2.06	-	63.69	74.00	10.31	PK
ac (VHT80)	106	5467.11	H	68.01	-2.06	-	65.95	74.00	8.05	PK
	155	5857.37	H	67.88	-1.11	-	66.77	74.00	7.23	PK

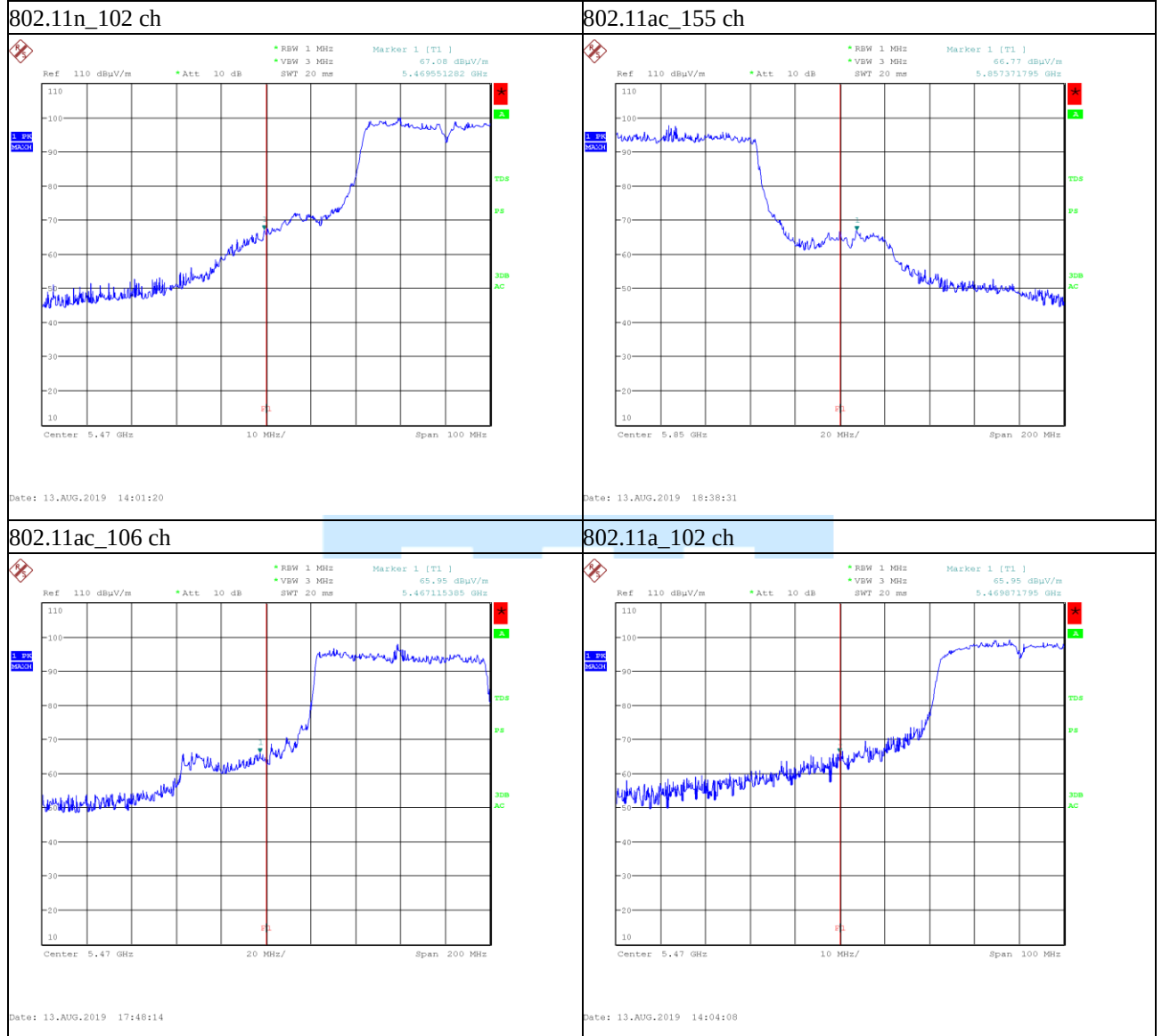
Note: In order to simplify the report, attached plots were only the most wide channel.

※ Test result = Reading: + Transducer Factor.

Where, ACF : Antenna Collection Factor,
CL = Cable loss + Preamplifier gain
Pol.: H(Horizontal), V(Vertical)



Test Plot on Configuration



Note: In order to simplify the report, attached plots were only the most wide channel.



15. Sample Calculations

$$\begin{aligned} \text{dB}\mu\text{V} &= 20 \text{ Log}_{10}(\mu\text{V}/\text{m}) \\ \text{dB}\mu\text{V} &= \text{dBm} + 107 \\ \mu\text{V} &= 10^{(\text{dB}\mu\text{V}/20)} \end{aligned}$$

15.1 Example 1 :

■ 20.3 MHz

Class B Limit	= 250 μV = 48 dB μV
Reading	= 39.2 dB μV
10 ^(39.2dBμV/20)	= 91.2 μV
Margin	= 48 dB μV - 39.2 dB μV
	= 8.8 dB

15.2 Example 2 :

■ 66.7 MHz

Class B Limit	= 100 $\mu\text{V}/\text{m}$ = 40.0 dB $\mu\text{V}/\text{m}$
Reading	= 31.0 dB μV
Antenna Factor + Cable Loss	= 5.8 dB
Total	= 36.8 dB $\mu\text{V}/\text{m}$
Margin	= 40.0 dB $\mu\text{V}/\text{m}$ – 36.8 dB $\mu\text{V}/\text{m}$
	= 3.2 dB



16. Recommendation & Conclusion

The data collected shows that the **Summit Technology Remote Controller (Model Name: TRC-1480)** was complies with §15.407 of the FCC Rules.

- The end -

