

# Adtran

## TEST REPORT

**SCOPE OF WORK**  
FCC TESTING– 834-5

**REPORT NUMBER**  
210304050SZN-004

**ISSUE DATE**                      **[REVISED DATE]**  
24 July 2021                      [-----]

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## TEST REPORT

Report No. : 210304050SZN-004  
Product : WiFi 5 Gigabit Router  
Model No. : 834-5  
FCC ID : HDC17600021F1

Applicant: Adtran  
901 Explorer Boulevard, Huntsville, Alabama 35806-2807, United States

Test Method/  
Standard: FCC Part 15 Subpart C;  
FCC KDB 558074 D01 v05r02  
FCC KDB 662911 D01 v02r01  
ANSI C63.10-2013

Conclusion: The sample as received complied with the FCC Part 15 Subpart C requirement.

Test By: Intertek Testing Services Shenzhen Ltd. Longhua Branch  
101, 201, Building B, No. 308 Wuhe Avenue, Zhangkengjing Community,  
GuanHu Subdistrict, LongHua District, Shenzhen, P.R. China.

Sample Receipt Date: 04 March 2021  
Test Conducted Date: 13 April 2021 to 07 June 2021  
Issue Date: 24 July 2021

**Prepared and Checked by:**

**Approved by:**

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**Jeff Liang**  
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**Intertek Testing Services Shenzhen Ltd. Longhua Branch**

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## MEASUREMENT/TECHNICAL REPORT

This report concerns (check one)      Original Grant       Class II Change

Equipment Type: DTS - Part 15 Digital Transmission Systems (Wi-Fi transmitter portion)

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)?      Yes       No

If yes, defer until : \_\_\_\_\_  
date

Company Name agrees to notify the Commission by: \_\_\_\_\_  
date

of the intended date of announcement of the product so that the grant can be issued on that date.

Transition Rules Request per 15.37?      Yes       No

If no, assumed Part 15, Subpart C for intentional radiator - the new 47 CFR [10-01-19] Edition] provision.

Report prepared by:

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## Table of Contents

<b>1.0</b>	<b>Summary of Test results</b>	<b>4</b>
<b>2.0</b>	<b>General Description</b>	<b>5</b>
2.1	Product Description	5
2.2	Related Submittal(s) Grants	5
2.3	Test Methodology	5
2.4	Test Facility	6
<b>3.0</b>	<b>System Test Configuration</b>	<b>7</b>
3.1	Justification	7
3.2	EUT Exercising Software	7
3.3	Special Accessories	7
3.4	Measurement Uncertainty	8
3.5	Equipment Modification	8
3.6	Support Equipment List and Description	8
<b>4.0</b>	<b>Measurement Results</b>	<b>9</b>
4.1	Maximum Conducted Output Power at Antenna Terminals	9
4.2	Minimum 6 dB RF Bandwidth	10
4.3	Maximum Power Density Reading	11
4.4	Out of Band Conducted Emissions	12
4.5	Out of Band Radiated Emissions	13
4.6	Transmitter Radiated Emissions in Restricted Bands	14
4.7	Field Strength Calculation	15
4.8	Radiated Spurious Emission	16
4.9	Conducted Emission	31
4.10	Radiated Emissions from Digital Section of Transceiver	34
4.11	Transmitter Duty Cycle Calculation and Measurements	35
<b>5.0</b>	<b>Equipment Photographs</b>	<b>36</b>
<b>6.0</b>	<b>Product Labelling</b>	<b>36</b>
<b>7.0</b>	<b>Technical Specifications</b>	<b>36</b>
<b>8.0</b>	<b>Instruction Manual</b>	<b>36</b>
<b>9.0</b>	<b>Confidentiality Request</b>	<b>36</b>
<b>10.0</b>	<b>Discussion of Pulse Desensitization</b>	<b>36</b>
<b>11.0</b>	<b>Test Equipment List</b>	<b>37</b>

## 1.0 Summary of Test results

Applicant: Adtran  
 Address: 901 Explorer Boulevard, Huntsville, Alabama 35806-2807, United States  
 Manufacturer: Adtran  
 Address: 901 Explorer Boulevard, Huntsville, Alabama 35806-2807, United States

**Model: 834-5**  
**FCC ID: HDC17600021F1**

TEST ITEM	REFERENCE	RESULTS
Max. Output power	15.247(b)(3)	Pass
6 dB Bandwidth	15.247(a)(2)	Pass
Max. Power Density	15.247(e)	Pass
Out of Band Antenna Conducted Emission	15.247(d)	Pass
Radiated Emission in Restricted Bands	15.247(d), 15.209, FCC 15.205	Pass
AC Conducted Emission	15.207	Pass
Antenna Requirement	15.203	Pass (See Notes)

Notes: The EUT uses an Integral Antenna which in accordance to Section 15.203 is considered sufficient to comply with the provisions of this section.

## 2.0 General Description

### 2.1 Product Description

The Equipment Under Test (EUT) is a WiFi 5 Gigabit Router with Wi-Fi function operating in 2412-2462MHz for 802.11b/g/n-HT20, 11 channels with 5MHz channel spacing and 2422-2452MHz for 802.11n-HT40, 7 channels with 5MHz channel spacing. The EUT is powered by 12Vdc via adapter Input: AC100~240V, 50/60Hz, 1.0A, Output 12Vdc, 3.0A. For more detailed features description, please refer to the user's manual.

Type of Modulation: BPSK, QPSK, 16QAM, 64QAM for OFDM; CCK, DQPSK, DBPSK for DSSS.

Transmit Path	Chain 1	Chain 2	Chain 3	Chain 4	Beamforming Gain
Max. ANT Gain (2.4G)	3.7dBi	4.7dBi	4.9dBi	4.7dBi	10.53dBi
Antenna Type	Integral antenna	Integral antenna	Integral antenna	Integral antenna	/

For electronic filing, the brief circuit description is saved with filename: descri.pdf.

### 2.2 Related Submittal(s) Grants

This is an application for certification of:

DTS- Part 15 Digital Transmission Systems (2.4GHz Wi-Fi transmitter portion).

Remaining portions are subject to the following procedures:

1. Bluetooth EDR function: Subject to FCC Certification and record in the test report: 210304050SZN-002.
2. Bluetooth BLE function: Subject to FCC Certification and record in the test report: 210304050SZN-003.
3. 5G WiFi function: Subject to FCC Certification and record in the test report: 210304050SZN-005.
4. Other Digital Function: Subject to FCC Part 15B SDOC.

### 2.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.10 (2013) and KDB 558074 D01 v05r02. Radiated emission measurement was performed in semi-anechoic chamber and conducted emission measurement was performed in shield room. For radiated emission measurement, preliminary scans were performed in the semi-anechoic chamber only to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

## 2.4 Test Facility

The Semi-anechoic chamber and shielded room used to collect the radiated data and conducted data are **Intertek Testing Services Shenzhen Ltd. Longhua Branch** and located at 101, 201, Building B, No. 308 Wuhe Avenue, Zhangkengjing Community, GuanHu Subdistrict, LongHua District, Shenzhen, P.R. China. This test facility and site measurement data have been fully placed on file with File Number: CN1188.

## 3.0 System Test Configuration

### 3.1 Justification

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, all cables were manipulated to produce worst case emissions. The EUT was powered by AC120V/60Hz input during the test.

On 802.11b/g/n-HT20/n-HT40 mode, four antennas were used and support MIMO and Beamforming function, and all data rate were tested and only the worst case data is shown in the report.

For maximizing emissions, the EUT was rotated through 360°, the EUT was placed on the styrene turntable with 0.8m up to 1GHz and 1.5 m above 1GHz. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance.

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000 MHz. The resolution is 1 MHz or greater for frequencies above 1000 MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

The rear of unit shall be flushed with the rear of the table.

Radiated emission measurement were performed the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

### 3.2 EUT Exercising Software

The EUT exercise program (provided by client) used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. The worst case configuration is used in all specified testing.

The parameters of test software setting:

During the test, Channel and power controlling software provided by the applicant was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the application and is going to be fixed on the firmware of the end product.

Test Software: MT7622 QA 0.0.1.93. exe

### 3.3 Special Accessories

N/A.



### 3.4 Measurement Uncertainty

When determining of the test conclusion, the Measurement Uncertainty of test has been considered.

### 3.5 Equipment Modification

Any modifications installed previous to testing by Adtran will be incorporated in each production model sold / leased in the United States.

No modifications were installed by Intertek Testing Services Shenzhen Ltd. Longhua Branch.

### 3.6 Support Equipment List and Description

Description	Manufacturer	Model No.
Portable computer	DELL	Latitude 3410
Network Cable	/	Unshielded, 150cm
AC/DC adapter	/	Model: S36B52-120A300-C4-6 Input: AC100~240V, 50/60Hz, 1.0A, Output 12Vdc, 3.0A

Applicant: Adtran

Date of Test: 27 May 2021

Model: 834-5

## 4.0 Measurement Results

### 4.1 Maximum Conducted Output Power at Antenna Terminals, FCC Rules 15.247(b)(3):

The antenna power of the EUT was connected to the input of a broadband peak RF power meter. The power meter have a video bandwidth that is greater than DTS bandwidth and utilize a fast-responding diode detector. Power was read directly at the EUT antenna terminals with cable loss added.

For antennas with gains of 6 dBi or less, maximum allowed Transmitter output is 1 watt (+30 dBm).

In MIMO mode (4Tx), Ant1+Ant2+Ant3+Ant4 Directional gain = 4.9dBi < 6 dBi.

In Beamforming mode (4Tx), Ant1+Ant2+Ant3+Ant4

$$\begin{aligned} \text{Directional gain} &= 10 \log[(10^{G1/20} + 10^{G2/20} + 10^{G3/20} + 10^{G4/20})^2 / N_{\text{ANT}}] \text{ dBi} \\ &= 10 \log[(10^{3.7/20} + 10^{4.7/20} + 10^{4.9/20} + 10^{4.7/20})^2 / 4] \text{ dBi} \\ &= 10.53 \text{ dBi} > 6 \text{ dBi.} \end{aligned}$$

Therefore, in beamforming mode, the conducted power limit is  $30 - (10.53 - 6) \text{ dBi} = 25.47 \text{ dBi}$

Cable loss: 1.0 dB    External Attenuation: 0 dB

Cable loss, external attenuation has been included in OFFSET function

Test Result: Please refer the Appendix of 210304050SZN-004

EUT max. output level = 26.83dBm (ANT 4\_ 802.11b SISO Mode)

EUT max. E.I.R.P = 26.83dBm +4.7dBi = 31.53dBm = 1442.33mW

For RF Exposure, the information is saved with filename: RF exposure.pdf.

Applicant: Adtran

Date of Test: 24 May 2021

Model: 834-5

#### 4.2 Minimum 6 dB RF Bandwidth, FCC Rule 15.247(a) (2):

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RES BW was set to 100 KHz according to FCC KDB 558074 D01 v05r02. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 6 dB lower than PEAK level. The 6dB bandwidth was determined from where the channel output spectrum intersected the display line.

Limit: The 6 dB Bandwidth is at least 500 kHz.

Test Result: Please refer the Appendix of 210304050SZN-004

Applicant: Adtran

Date of Test: 24 May 2021

Model: 834-5

#### 4.3 Maximum Power Density Reading, FCC Rule 15.247(e):

The Measurement Procedure PKPSD was set according to the FCC KDB 558074 D01 v05r02.

Antenna output of the EUT was coupled directly to spectrum analyzer; if an external attenuator and/or cable was used, these losses are compensated for with the analyzer OFFSET function.

Limit: The Power Density does not exceed 8dBm/3 kHz.

Test Result: Please refer the Appendix of 210304050SZN-004

Applicant: Adtran

Date of Test: 27 May 2021

Model: 834-5

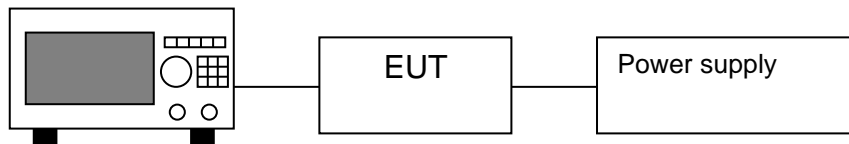
#### 4.4 Out of Band Conducted Emissions, RSS-247 5.5:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. The Measurement Procedure was set according to the FCC KDB 558074 D01 v05r02.

All other types of emissions from the EUT shall meet the general limits for radiated frequencies outside the passband.

The test plots showed all spurious emission up to the tenth harmonic were measured and they were found to be at least 20 dB below the highest level of the desired power in the passband.

Block Diagram:



Spectrum Analyzer

Test Result: Please refer the Appendix of 210304050SZN-009

Applicant: Adtran

Date of Test: 24 May 2021

Model: 834-5

4.5 Out of Band Radiated Emissions (for emissions in 4.4 above that are less than 20dB below carrier), FCC Rule 15.247(d):

For out of band emissions that are close to or that exceed the 20dB attenuation requirement described in the specification, radiated measurements were performed at a 3m separation distance to determine whether these emissions complied with the general radiated emission requirement.

Not required, since all emissions are more than 20dB below fundamental

See attached data sheet

Applicant: Adtran

Date of Test: 27 May 2021

Model: 834-5

#### 4.6 Transmitter Radiated Emissions in Restricted Bands, FCC Rule 15.35(b) (c):

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included. All measurements were performed with peak detection unless otherwise specified.

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

Applicant: Adtran

Date of Test: 27 May 2021

Model: 834-5

## 4.7 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

$$FS = RA + AF + CF - AG + PD$$

Where

- FS = Field Strength in dB $\mu$ V/m
- RA = Receiver Amplitude (including preamplifier) in dB $\mu$ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB
- PD = Pulse Desensitization in dB

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

$$FS = RA + AF + CF - AG + PD$$

### Example

Assume a receiver reading of 62.0 dB $\mu$ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB. The net field strength for comparison to the appropriate emission limit is 42 dB $\mu$ V/m. This value in dB $\mu$ V/m was converted to its corresponding level in  $\mu$ V/m.

$$RA = 62.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$PD = 0 \text{ dB}$$

$$FS = 62 + 7.4 + 1.6 - 29 + 0 = 42 \text{ dB}\mu\text{V/m}$$

Level in mV/m = Common Antilogarithm [(42 dB $\mu$ V/m)/20] = 125.9  $\mu$ V/m



Applicant: Adtran

Date of Test: 27 May 2021

Model: 834-5

#### 4.8 Radiated Spurious Emission

Worst Case Radiated Spurious Emission (802.11b-Channel 01)  
at 2390.000MHz  
is passed by 3.1dB margin.

For the electronic filing, the worst case radiated emission configuration photographs are saved with filename: radiated photos.pdf.

Applicant: Adtran

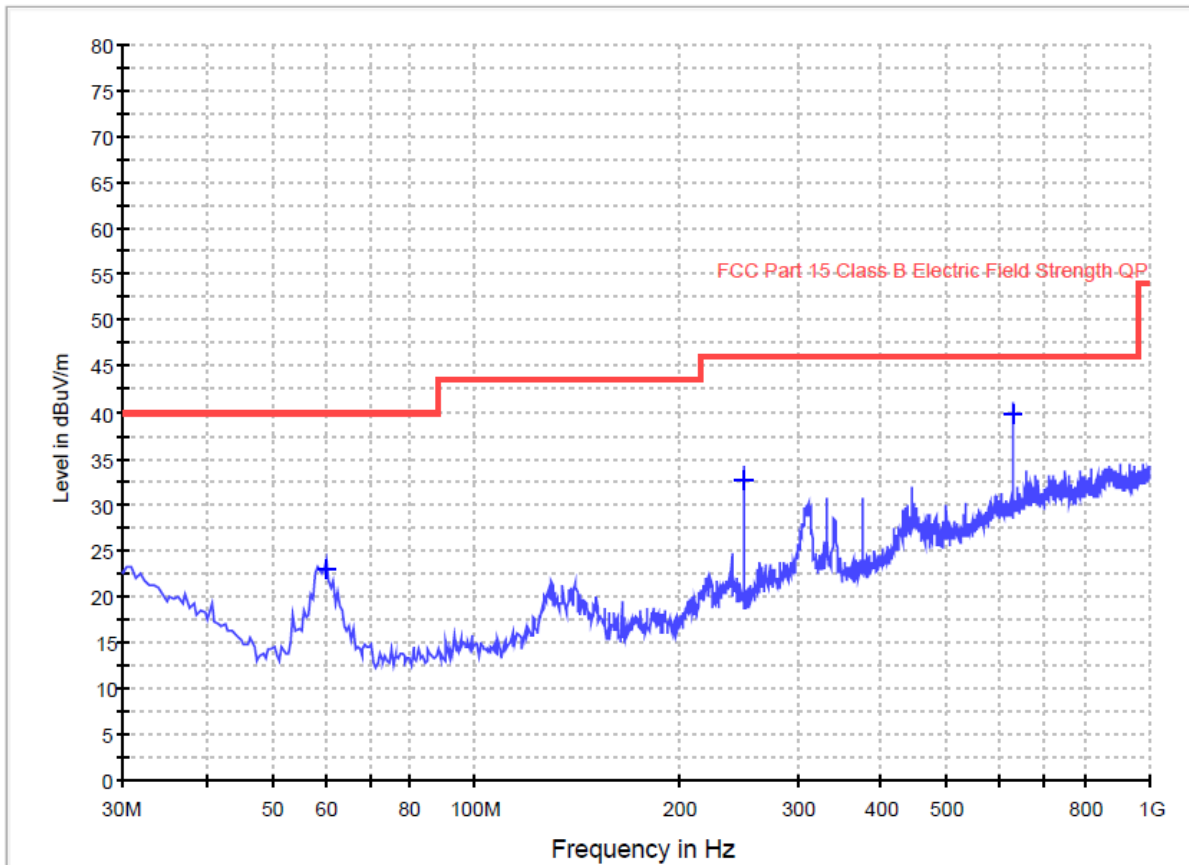
Date of Test: 27 May 2021

Worst Case Operating Mode:

Model: 834-5

Transmitting (802.11b-Channel 01)

ANT Polarity: Horizontal



Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
60.070000	22.9	1000.0	120.000	100.0	H	7.9	17.1	40.0
249.705000	32.7	1000.0	120.000	100.0	H	14.3	13.3	46.0
625.095000	40.0	1000.0	120.000	100.0	H	23.9	6.0	46.0

Remark:

1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dBμV/m) = Corr. (dB/m) + Read Level (dBμV)
3. Margin (dB) = Limit Line (dBμV/m) – Level (dBμV/m)

Applicant: Adtran

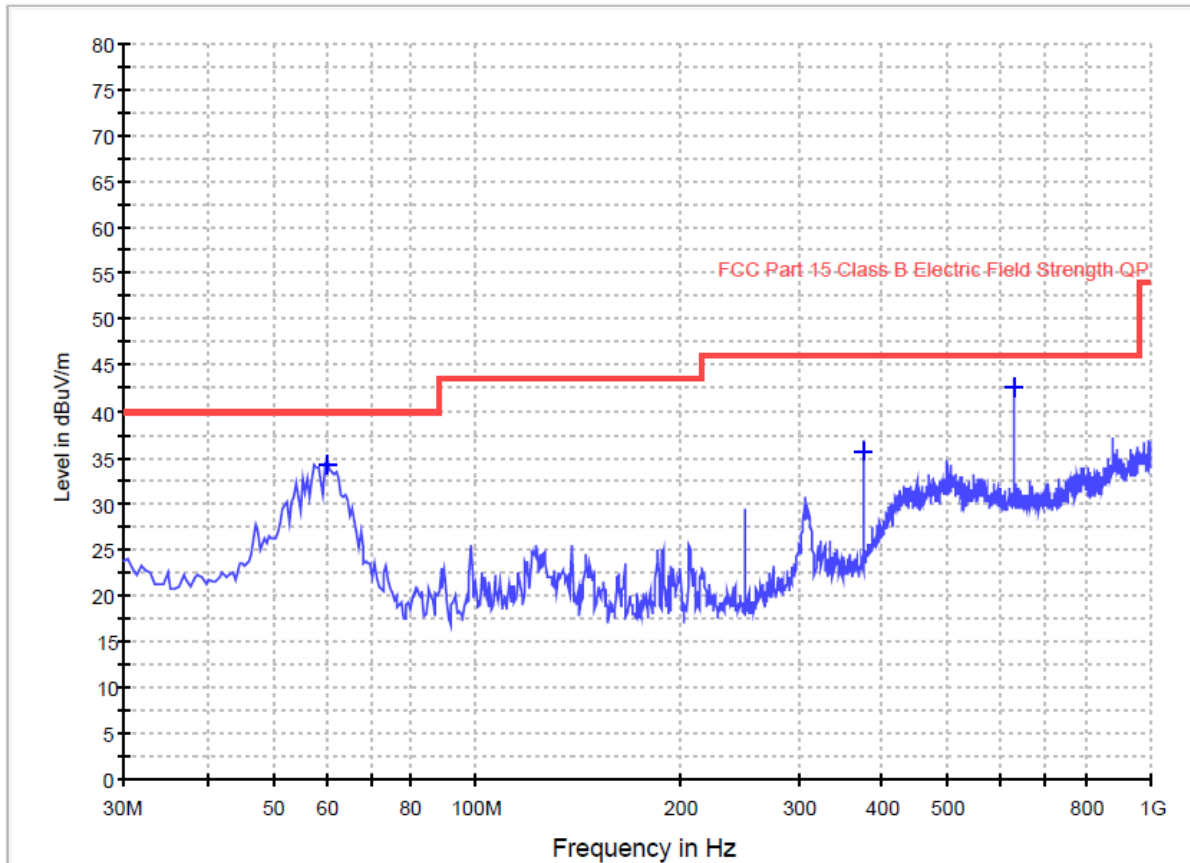
Date of Test: 27 May 2021

Worst Case Operating Mode:

Model: 834-5

Transmitting (802.11b-Channel 01)

ANT Polarity: Vertical



Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
60.070000	34.1	1000.0	120.000	100.0	V	7.9	5.9	40.0
374.835000	35.7	1000.0	120.000	100.0	V	18.3	10.3	46.0
625.024125	42.5	1000.0	120.000	100.0	V	23.9	3.5	46.0

Remark:

1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dBμV/m) = Corr. (dB/m) + Read Level (dBμV)
3. Margin (dB) = Limit Line (dBμV/m) – Level (dBμV/m)

Applicant: Adtran

Date of Test: 27 May 2021

Model: 834-5

Worst Case Operating Mode:

Transmitting (802.11b-Channel 01)

Note: SISO Mode ANT3

## Radiated Emissions (above 1GHz)

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Peak Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Vertical	*9608.000	54.0	36.8	33.5	50.7	74.0	-23.3
Vertical	*2390.000	66.4	36.4	29.1	59.1	74.0	-14.9

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Average Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Vertical	*9608.000	47.6	36.8	33.5	44.3	54.0	-9.7
Vertical	*2390.000	55.6	36.4	29.1	48.3	54.0	-5.7

- NOTES:
1. Peak detector is used, RBW=1MHz/VBW=3MHz for peak value and RBW=1MHz/VBW=10Hz for average value.
  2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
  3. Negative value in the margin column shows emission below limit.
  4. Horn antenna used for the emission over 1000MHz.
- \* Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

Applicant: Adtran

Date of Test: 27 May 2021

Worst Case Operating Mode:

Note: SISO mode ANT3

Model: 834-5

Transmitting (802.11b-Channel 06)

**Radiated Emissions (above 1GHz)**

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
Vertical	*4874.000	43.8	36.7	33.4	40.5	74.0	-33.5
Vertical	*9748.000	50.9	36.6	35.8	50.1	74.0	-23.9

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Vertical	*4874.000	42.5	36.7	33.4	39.2	54.0	-14.8
Vertical	*9748.000	37.4	36.6	35.8	36.6	54.0	-17.4

- NOTES:
1. Peak detector is used, RBW=1MHz/VBW=3MHz for peak value and RBW=1MHz / VBW=10Hz for average value.
  2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
  3. Negative value in the margin column shows emission below limit.
  4. Horn antenna used for the emission over 1000MHz.
- \* Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

Applicant: Adtran

Date of Test: 27 May 2021

Worst Case Operating Mode:

Note: SISO mode ANT3

Model: 834-5

Transmitting (802.11b-Channel 11)

### Radiated Emissions (above 1GHz)

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Peak Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Vertical	*2483.500	62.0	36.8	33.3	58.5	74.0	-15.5
Vertical	*7386.000	54.3	36.5	29.3	47.1	74.0	-26.9

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Average Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Vertical	*2483.500	51.2	36.8	33.3	47.7	54.0	-6.3
Vertical	*7386.000	43.4	36.5	29.3	36.2	54.0	-17.8

- NOTES:
1. Peak detector is used, RBW=1MHz/VBW=3MHz for peak value and RBW=1MHz / VBW=10Hz for average value.
  2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
  3. Negative value in the margin column shows emission below limit.
  4. Horn antenna used for the emission over 1000MHz.
- \* Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

Applicant: Adtran

Date of Test: 27 May 2021

Worst Case Operating Mode:

Note: SISO mode ANT3

Model: 834-5

Transmitting (802.11g-Channel 01)

### Radiated Emissions (above 1GHz)

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Peak Limit at 3m (dBμV/m)	Margin (dB)
Vertical	*4824.000	52.9	36.8	33.5	49.6	74.0	-24.4
Vertical	*2390.000	75.1	36.4	29.1	67.8	74.0	-6.2

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
Vertical	*4824.000	44.5	36.8	33.5	41.2	54.0	-12.8
Vertical	*2390.000	57.6	36.4	29.1	50.3	54.0	-3.7

- NOTES:
1. Peak detector is used, RBW=1MHz/VBW=3MHz for peak value and RBW=1MHz/VBW=10Hz for average value.
  2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
  3. Negative value in the margin column shows emission below limit.
  4. Horn antenna used for the emission over 1000MHz.
- \* Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

Applicant: Adtran

Date of Test: 27 May 2021

Model: 834-5

Worst Case Operating Mode:

Transmitting (802.11g-Channel 06)

Note: SISO mode ANT3

**Radiated Emissions (above 1GHz)**

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Peak Limit at 3m (dBμV/m)	Margin (dB)
Vertical	*4874.000	53.9	36.7	33.4	50.6	74.0	-23.4
Vertical	*7311.000	49.0	36.6	35.8	48.2	74.0	-25.8

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
Vertical	*4874.000	45.1	36.7	33.4	41.8	54.0	-12.2
Vertical	*7311.000	41.1	36.6	35.8	40.3	54.0	-13.7

- NOTES:
1. Peak detector is used, RBW=1MHz/VBW=3MHz for peak value and RBW=1MHz / VBW=10Hz for average value.
  2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
  3. Negative value in the margin column shows emission below limit.
  4. Horn antenna used for the emission over 1000MHz.
- \* Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.



Applicant: Adtran

Date of Test: 27 May 2021

Model: 834-5

Worst Case Operating Mode:

Transmitting (802.11g-Channel 11)

Note: SISO mode ANT3

## Radiated Emissions (above 1GHz)

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Peak Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Vertical	*2483.500	70.9	36.8	33.3	67.4	74.0	-6.6
Vertical	*7386.000	59.2	36.5	29.3	52.0	74.0	-22.0

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Average Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Vertical	*2483.500	53.5	36.8	33.3	50.0	74.0	-24.0
Vertical	*7386.000	50.7	36.5	29.3	43.5	54.0	-10.5

- NOTES:
1. Peak detector is used, RBW=1MHz/VBW=3MHz for peak value and RBW=1MHz / VBW=10Hz for average value.
  2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
  3. Negative value in the margin column shows emission below limit.
  4. Horn antenna used for the emission over 1000MHz.
- \* Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

Applicant: Adtran

Date of Test: 27 May 2021

Worst Case Operating Mode:

Note: SISO mode ANT3

Model: 834-5

Transmitting (802.11n20-Channel 01)

## Radiated Emissions (above 1GHz)

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Peak Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Vertical	*4824.000	54.4	36.8	33.5	51.1	74.0	-22.9
Vertical	*2390.000	77.0	36.4	29.1	69.7	74.0	-4.3

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Average Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Vertical	*4824.000	44.9	36.8	33.5	41.6	54.0	-12.4
Vertical	*2390.000	58.2	36.4	29.1	50.9	54.0	-3.1

- NOTES:
1. Peak detector is used, RBW=1MHz/VBW=3MHz for peak value and RBW=1MHz/VBW=10Hz for average value.
  2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
  3. Negative value in the margin column shows emission below limit.
  4. Horn antenna used for the emission over 1000MHz.
- \* Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

Applicant: Adtran

Date of Test: 27 May 2021

Worst Case Operating Mode:

Note: SISO mode ANT3

Model: 834-5

Transmitting (802.11n20-Channel 06)

**Radiated Emissions (above 1GHz)**

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Peak Limit at 3m (dBμV/m)	Margin (dB)
Vertical	*4874.000	55.8	36.7	33.4	52.5	74.0	-21.5
Vertical	*7311.000	52.4	36.6	35.8	51.6	74.0	-22.4

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
Vertical	*4874.000	44.7	36.7	33.4	41.4	54.0	-12.6
Vertical	*7311.000	40.4	36.6	35.8	39.6	54.0	-14.4

- NOTES:
1. Peak detector is used, RBW=1MHz/VBW=3MHz for peak value and RBW=1MHz / VBW=10Hz for average value.
  2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
  3. Negative value in the margin column shows emission below limit.
  4. Horn antenna used for the emission over 1000MHz.
- \* Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

Applicant: Adtran

Date of Test: 27 May 2021

Worst Case Operating Mode:

Note: SISO mode ANT3

Model: 834-5

Transmitting (802.11n20-Channel 11)

**Radiated Emissions (above 1GHz)**

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Peak Limit at 3m (dBμV/m)	Margin (dB)
Vertical	*2483.500	71.9	36.8	33.3	68.4	74.0	-5.6
Vertical	*7386.000	64.4	36.5	29.3	57.2	74.0	-16.8

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
Vertical	*2483.500	54.0	36.8	33.3	50.5	74.0	-23.5
Vertical	*7386.000	52.4	36.5	29.3	45.2	54.0	-8.8

- NOTES:
1. Peak detector is used, RBW=1MHz/VBW=3MHz for peak value and RBW=1MHz / VBW=10Hz for average value.
  2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
  3. Negative value in the margin column shows emission below limit.
  4. Horn antenna used for the emission over 1000MHz.
- \* Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

Applicant: Adtran

Date of Test: 27 May 2021

Worst Case Operating Mode:

Note: SISO mode ANT3

Model: 834-5

Transmitting (802.11n40-Channel 03)

### Radiated Emissions (above 1GHz)

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Peak Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Vertical	*4844.000	55.7	36.8	33.5	52.4	74.0	-21.6
Vertical	*2390.000	64.4	36.4	29.1	57.1	74.0	-16.9

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Average Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Vertical	*4844.000	46.9	36.8	33.5	43.6	54.0	-10.4
Vertical	*2390.000	49.3	36.4	29.1	42.0	54.0	-12.0

- NOTES:
1. Peak detector is used, RBW=1MHz/VBW=3MHz for peak value and RBW=1MHz/VBW=10Hz for average value.
  2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
  3. Negative value in the margin column shows emission below limit.
  4. Horn antenna used for the emission over 1000MHz.
- \* Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

Applicant: Adtran

Date of Test: 27 May 2021

Model: 834-5

Worst Case Operating Mode:

Transmitting (802.11n40-Channel 06)

Note: SISO mode ANT3

### Radiated Emissions (above 1GHz)

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Peak Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Vertical	*4874.000	54.0	36.7	33.4	50.7	74.0	-23.3
Vertical	*7311.000	53.1	36.6	35.8	52.3	74.0	-21.7

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Average Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Vertical	*4874.000	46.0	36.7	33.4	42.7	54.0	-11.3
Vertical	*7311.000	46.3	36.6	35.8	45.5	54.0	-8.5

- NOTES:
1. Peak detector is used, RBW=1MHz/VBW=3MHz for peak value and RBW=1MHz / VBW=10Hz for average value.
  2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
  3. Negative value in the margin column shows emission below limit.
  4. Horn antenna used for the emission over 1000MHz.
- \* Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

Applicant: Adtran

Date of Test: 27 May 2021

Worst Case Operating Mode:

Note: SISO mode ANT3

Model: 834-5

Transmitting (802.11n40-Channel 09)

## Radiated Emissions (above 1GHz)

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Peak Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Vertical	*2483.500	64.8	36.8	33.3	61.3	74.0	-12.7
Vertical	*7356.000	60.3	36.5	29.3	53.1	74.0	-20.9

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Average Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Vertical	*2483.500	46.9	36.8	33.3	43.4	74.0	-30.6
Vertical	*7356.000	49.8	36.5	29.3	42.6	54.0	-11.4

- NOTES:
1. Peak detector is used, RBW=1MHz/VBW=3MHz for peak value and RBW=1MHz / VBW=10Hz for average value.
  2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
  3. Negative value in the margin column shows emission below limit.
  4. Horn antenna used for the emission over 1000MHz.
- \* Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

Applicant: Adtran

Date of Test: 13 April 2021

Model: 834-5

#### 4.9 Conducted Emission

Worst Case Conducted Emission (802.11b-Channel 01)  
at 0.574000MHz  
is passed by 6.4dB margin.

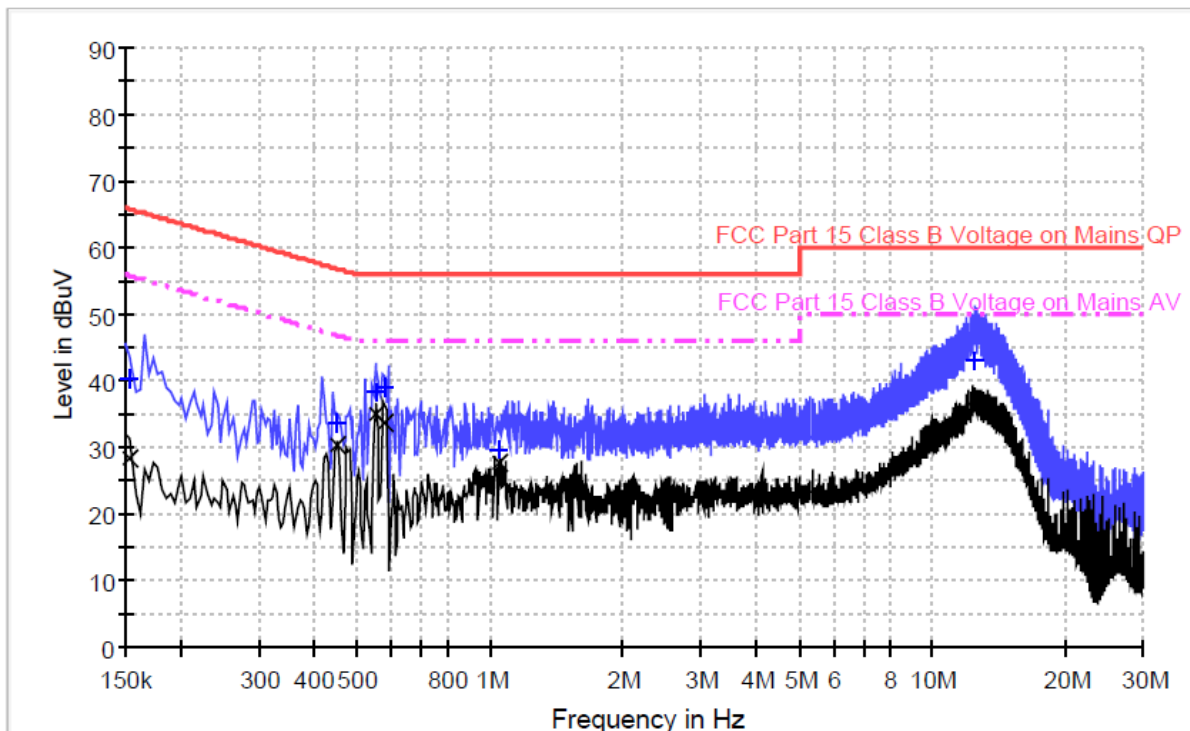
For the electronic filing, the worst case radiated emission configuration photographs are saved with filename: conducted photos.pdf.



Applicant: Adtran  
Date of Test: 13 April 2021  
Model: 834-5  
Worst Case Operating Mode: Transmitting (802.11b-Channel 01)  
Phase: Live

## Graphic / Data Table

### Conducted Emissions Pursuant to FCC 15.207: Emissions Requirement



#### Limit and Margin QP

Frequency (MHz)	QuasiPeak (dBuV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.154000	40.3	9.000	L1	9.6	25.5	65.8
0.450000	33.6	9.000	L1	9.6	23.3	56.9
0.550500	38.2	9.000	L1	9.6	17.8	56.0
0.578000	39.0	9.000	L1	9.6	17.0	56.0
1.046000	29.8	9.000	L1	9.7	26.2	56.0
12.430000	43.1	9.000	L1	9.9	16.9	60.0

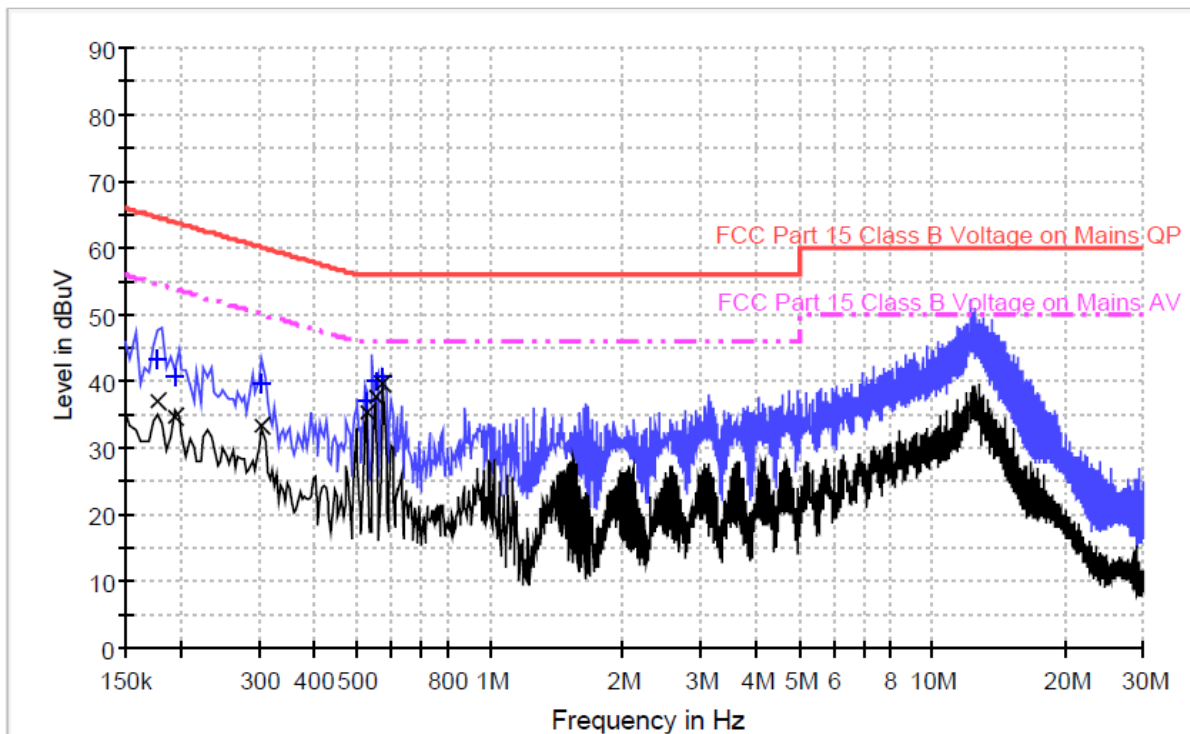
#### Limit and Margin AV

Frequency (MHz)	Average (dBuV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.154000	28.5	9.000	L1	9.6	27.3	55.8
0.450000	30.2	9.000	L1	9.6	16.7	46.9
0.550500	35.1	9.000	L1	9.6	10.9	46.0
0.578000	33.5	9.000	L1	9.6	12.5	46.0
1.046000	27.6	9.000	L1	9.7	18.4	46.0
12.430000	35.5	9.000	L1	9.9	14.5	50.0

Applicant: Adtran  
Date of Test: 13 April 2021  
Model: 834-5  
Worst Case Operating Mode: Transmitting (802.11b-Channel 01)  
Phase: Neutral

## Graphic / Data Table

### Conducted Emissions Pursuant to FCC 15.207: Emissions Requirement



#### Limit and Margin QP

Frequency (MHz)	QuasiPeak (dBuV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.178000	43.4	9.000	N	9.5	21.2	64.6
0.194000	40.7	9.000	N	9.5	23.2	63.9
0.306000	39.7	9.000	N	9.5	20.4	60.1
0.526000	37.2	9.000	N	9.5	18.8	56.0
0.550000	40.1	9.000	N	9.5	15.9	56.0
0.574000	40.8	9.000	N	9.5	15.2	56.0

#### Limit and Margin AV

Frequency (MHz)	Average (dBuV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.178000	36.9	9.000	N	9.5	17.7	54.6
0.194000	34.6	9.000	N	9.5	19.3	53.9
0.306000	33.3	9.000	N	9.5	16.8	50.1
0.526000	35.5	9.000	N	9.5	10.5	46.0
0.550000	37.8	9.000	N	9.5	8.2	46.0
0.574000	39.6	9.000	N	9.5	6.4	46.0

Applicant: Adtran

Date of Test: 27 May 2021

Model: 834-5

4.10 Radiated Emissions from Digital Section of Transceiver, FCC Ref: 15.109

Not required - No digital part

Test results are attached

Included in the separated report.

Applicant: Adtran  
Date of Test: 27 May 2021  
Model: 834-5

#### 4.11 Transmitter Duty Cycle Calculation and Measurements, FCC Rule 15.35(b), (c)

The EUT antenna output port was connected to the input of the spectrum analyzer. The analyzer center frequency was set to EUT RF channel carrier. The SWEP function on the analyzer was set to ZERO SPAN. The Transmitter ON time was determined from the resultant time-amplitude display:

	See attached spectrum analyzer chart (s) for Transmitter timing
	See Transmitter timing diagram provided by manufacturer
x	Not applicable, duty cycle was not used.

## 5.0 Equipment Photographs

For electronic filing, the photographs are saved with filename: external photos.pdf & internal photos.pdf.

## 6.0 Product Labeling

For electronic filing, the FCC ID label artwork and location is saved with filename: label.pdf.

## 7.0 Technical Specifications

For electronic filing, the block diagram and circuit diagram are saved with filename: block.pdf and circuit.pdf respectively.

## 8.0 Instruction Manual

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States.

## 9.0 Confidentiality Request

For electronic filing, the confidentiality request of the tested EUT is saved with filename: request.pdf.

## 10.0 Discussion of Pulse Desensitization

The determination of pulse desensitivity was made in accordance with Hewlett Packard Application Note 150-2, *Spectrum Analysis ... Pulsed RF*.

Pulse desensitivity is not applicable for this device since the transmitter transmits the RF signal continuously.

## 11.0 Test Equipment List

Equipment No.	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
SZ182-02	RF Power Meter	Anritsu	ML2496A	1302005	2021-05-10	2022-05-10
SZ182-02-01	Power Sensor	Anritsu	MA2411B	1207429	2021-05-10	2022-05-10
SZ061-13	BiConiLog Antenna	ETS	3142E	00217919	2019-06-10	2022-06-10
SZ185-01	EMI Receiver	R&S	ESCI	100547	2020-12-22	2021-12-22
SZ061-08	Horn Antenna	ETS	3115	00092346	2019-09-07	2021-09-07
SZ061-06	Active Loop Antenna	Electro-Metrics	EM-6876	217	2021-05-18	2023-05-18
SZ056-03	Spectrum Analyzer	R&S	FSP 30	101148	2021-05-10	2022-05-10
SZ056-08	Signal Analyzer	R&S	FSV 40	101430	2020-12-22	2021-12-22
SZ181-04	Preamplifier	Agilent	8449B	3008A02474	2021-05-10	2022-05-10
SZ188-01	Anechoic Chamber	ETS	RFD-F/A-100	4102	2018-12-15	2021-12-15
SZ062-02	RF Cable	RADIALL	RG 213U	--	2020-12-01	2021-06-01
SZ062-05	RF Cable	RADIALL	0.04-26.5GHz	--	2020-12-01	2021-06-01
SZ062-12	RF Cable	RADIALL	0.04-26.5GHz	--	2020-12-01	2021-06-01
SZ067-04	Notch Filter	Micro-Tronics	BRM50702-02	--	2021-05-11	2022-05-11
SZ185-02	EMI Test Receiver	R&S	ESCI	100692	2020-10-27	2021-10-27
SZ187-02	Two-Line V-Network	R&S	ENV216	100073	2020-05-12	2021-05-12
SZ188-03	Shielding Room	ETS	RFD-100	4100	2018-12-15	2021-12-15

\*\*\*\*\* End of Report\*\*\*\*\*