



Solutions

TEST REPORT

Test Report No.: UL-RPT-RP-14978163-116-FCC-WLAN 2.4GHz

Applicant * : Robert Bosch GmbH
Model No. * : CTP3NA
FCC ID * : 2AUXS-CTP3NA
Technology * : WLAN 2.4 GHz (802.11 b, g, n, ax)
Test Standard(s) : **FCC Parts 15.209(a) & 15.247**

For details of applied tests refer to test result summary

1. This test report shall not be reproduced in full or partial, without the written approval of UL International Germany GmbH.
2. The results in this report apply only to the sample tested.
3. The test results in this report are traceable to the national or international standards.
4. Test Report Version 1.0
5. Result of the tested sample: **Pass**
6. All information marked with a (*) were provided by customer / applicant or authorized representative

Prepared by: Muhammad Faiq Khan
Title: Project Engineer
Date: 09 November 2023

Approved by: Rachid, Acharkaoui
Title: Operations Manager
Date: 09 November 2023



Deutsche
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This laboratory is accredited by DAkkS.
The tests reported herein have been performed in
accordance with its' terms of accreditation.

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1. Customer Information *

1.1. Applicant Information

Company Name:	Robert Bosch GmbH
Company Address:	Robert-Bosch-Platz 1 70839 Gerlingen GERMANY
Contact Person:	Karin Silberhorn
Contact E-Mail Address:	karin.silberhorn@de.bosch.com
Contact Phone No.:	+49 5121-49-7662

1.2. Manufacturer Information

Company Name:	Robert Bosch GmbH
Company Address:	Robert-Bosch-Platz 1 70839 Gerlingen GERMANY
Contact Person:	Karin Silberhorn
Contact E-Mail Address:	karin.silberhorn@de.bosch.com
Contact Phone No.:	+49 5121-49-7662

2. Summary of Testing

2.1. General Information

Applied Standards

Specification Reference:	47CFR15.247
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.247
Specification Reference:	47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.209

Location

Location of Testing:	UL International Germany GmbH Hedelfinger Strasse. 61, 70327 Stuttgart, GERMANY
Registration Number:	399704

Date Information

Order Date:	19 September 2023
EUT Arrived:	20 September 2023
Test Dates:	20 September 2023 to 28 September 2023
EUT Returned:	

2.2. Summary of Test Results

DIGITAL TRANSMISSION SYSTEMS (DTS): 2400-2483.5 MHz					
FCC Part 15 Clause	Compliance Test Description	Test Result			
		C	N.C.	N.P.	N.A.
15.207	Transmitter AC Power Line Conducted Emissions ⁽¹⁾	☐	☐	☐	☒
Part 15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth ⁽³⁾	☐	☐	☒	☐
Part 15.35(c)	Transmitter Duty Cycle ⁽²⁾	☒	☐	☐	☐
Part 15.247(e)	Transmitter Power Spectral Density ⁽³⁾	☐	☐	☒	☐
Part 15.247(b)(3)	Transmitter Maximum (Peak) Output Power ⁽³⁾	☐	☐	☒	☐
15.247(d) & 15.209(a)	Transmitter Radiated Emissions	☒	☐	☐	☐
15.247(d) & 15.209(a)	Transmitter Band Edge Radiated Emissions	☒	☐	☐	☐
C: COMPLIED N.C.: NOT COMPLIED N.P.: NOT PERFORMED N.A.: NOT APPLICABLE					
Decision rule: If the decision rule is not included in the applied customer specification or testing standard, the binary statement for simple acceptance, as defined in ILAC G8: 2019 Section 4.2.1, is applied as the decision rule for a pass/ fail statement. If the measured value is on the limit, the result is defined as a pass. In this case the risk of a false positive is 50%. For further information regarding risk assessment refer to ILAC G8: 2019.					

Note(s):

1. The EUT is vehicular equipment and will be powered by the battery of the vehicle, therefore no AC conducted emission tests are required.
2. The measurement was performed to assist the other average measurements.
3. At the client's request, only partial testing was performed for the radiated spurious emissions and the band edge radiated emissions as the EUT is a host product that contains a pre-certified radio module (Model: ATC6NPL002C)

2.3. Methods and Procedures

Reference:	ANSI C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Reference:	FCC KDB 558074 D01 DTS Meas. Guidance v05r02 April 2, 2019
Title:	Guidance for compliance measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section 15.247 of the FCC rules

2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT) *

Brand Name:	Bosch
Model Name:	CTP3NA
Model Number:	CTP3NA Ext
Test Sample Serial Number:	1150003350
Hardware Version:	C2
Software Version:	DAIMLER_CTP3_ISTANBUL_RC2_HF2_S.010
FCC ID:	2AUXS-CTP3NA

3.2. Description of EUT *

The equipment under test was an In-Vehicle-Telematic-Unit, contains Model Name: CTP3NA, supporting WLAN 2.4 GHz, WLAN 5 GHz, Bluetooth LE and Bluetooth BR/EDR technologies.

While testing Bluetooth LE EUT were operating in 2400-2483.5 MHz ISM band. All other supported radio technologies were either switched off or were in idle mode.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing *

Category of Equipment:	WLAN 2.4 GHz (IEEE 802.11b, g, n, ax)		
Type of Radio Device:	Transceiver		
Highest internally generated clock and/ or oscillator frequency:	radio frequency: WiFi 5GHz: 5825 MHz internal clock frequency: 125MHz		
Power Supply Requirement(s):	Nominal	24 V DC via external power supply	
Tested Data rates:	802.11b	1 Mbps ^(Note 1)	2 Mbps ^(Note 1)
	802.11g	54 Mbps ^(Note 1)	
	802.11n HT40	MCS0 ^(Note 1)	
	802.11ax40	MCS0 (RU484_65) ^(Note 1)	
Nominal Channel Bandwidth:	20 MHz, 40MHz, 80MHz		
Declared Antenna Gain:	6.2 dBi		
Antenna Type:	combinatorial Antenna		
Antenna Details:	A 006 820 39 75		
Transmit Frequency Range:	2412 MHz to 2462 MHz		
Transmit Channels Tested: 20 MHz	Channel ID	Channel Number	Frequency (MHz)
	Bottom	1 ^(Note 1)	2412
	Middle	6 ^(Note 1)	2437
	Top	11 ^(Note 1)	2462
Transmit Channels Tested: 40 MHz	Channel ID	Channel Number	Frequency (MHz)
	Bottom	3	2422
	Top	9	2452
^(Note 1) At the client's request, only partial testing was performed on worst-case data rates defined by customer.			

3.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

A. Support Equipment (In-house)

Item	Description	Brand Name	Model Name or Number	Serial Number
1	-/-	-/-	-/-	-/-

B. Support Equipment (Manufacturer supplied) *

Item	Description	Brand Name	Model Name or Number	Serial Number
1	Laptop	Fujitsu	H770	DS1U006875

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):

☒ Transmitter / Modulated Carrier Continuous Transmissions Mode WLAN 2.4 GHz, Worst Case:

- 802.11b | 20 MHz | 1 Mbps | Bottom Channel ⁽¹⁾
- 802.11b | 20 MHz | 2 Mbps | Bottom/Top Channel ⁽²⁾
- 802.11g | 20 MHz | 54 Mbps | Bottom/Middle/Top Channel ⁽¹⁾
- 802.11n | 40 MHz | MCS0 | Bottom Channel ⁽²⁾
- 802.11ax | 40 MHz | MCS0 (RU484_65) | Top Channel ⁽²⁾

⁽¹⁾ According to customer declaration the unwanted (spurious) radiated emissions measurement was performed on this mode.

⁽²⁾ According to customer declaration this mode was used for Band edge measurements.

4.2. Configuration and Peripherals

The EUT was tested in the following configuration(s):

EUT Power Supply:

- The EUT was powered with 24V DC via an external AC/DC power supply

Test Mode Activation:

- The EUT can be connected to the Test laptop via USB supplied by the customer.
- The test modes were activated by the terminal software "xxx". The commands to setup the respective modes and power were defined by the customer.

Radiated Measurements:

- As per the applicant's declaration &/operational description of the EUT, the EUT is a tabletop equipment for its intended application. Therefore, EUT's test setup placement was performed in accordance with ANSI C63.10 section 6.2.3.2 & section 6.12 Figure 4.
- The worst case position was declared by the customer.
- Radiated measurements below 30 MHz were performed with the EUT positioned on the turn table and rotating 360 degrees while the loop antenna height was set at 100 cm.
- Radiated measurements above 30 MHz were performed with the EUT positioned on the turn table and rotating 360° while the antenna height varies from 1 to 4 m over the measurement frequency range.
- R&S® EMC32 V11.30 Software was used for the Radiated spurious emission measurements.

Duty Cycle Correction Details:

- As the continuous transmission of the EUT ($D \geq 98\%$) can be achieved and EUT was transmitting continuously at Duty Cycles of 100 % (duty cycle variations are less than $\pm 2\%$ at the respective data rate) for b-mode 2 Mbps. Therefore, No Duty Cycle Correction Factors were added to all average measurements.
- As the continuous transmission of the EUT ($D \geq 98\%$) cannot be achieved and EUT was transmitting continuously at Duty Cycles of 97.64 % and 40.12% (duty cycle variations are less than $\pm 2\%$ at the respective data rate) for n-mode HT40 MCS0 and ax-mode HT40 MCS0 respectively. Therefore, Duty Cycle Correction Factor of 0.10 dB and 3.97 dB was added to all average measurements, to compute the corrected average values of the emissions that would have been measured had the test been performed at 100% Duty Cycle.

5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to Section 6 *Measurement Uncertainty* for details.

In accordance with DAkkS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

5.2. Test Results

5.2.1. Transmitter Duty Cycle

Test Summary:

Test Engineer:	Muhammad Faiq Khan	Test Date:	21 September 2023 & 28 September 2023
Test Sample Serial Number:	1150003350		
Test Site Identification	SR 1/2		

FCC Reference:	Part 15.35(c)
Test Method Used:	FCC KDB 558074 Section 9.b) referencing ANSI C63.10 Section 7.5

Environmental Conditions:

Temperature (°C):	23.8 to 24.8
Relative Humidity (%):	45.1 to 52.1

Notes:

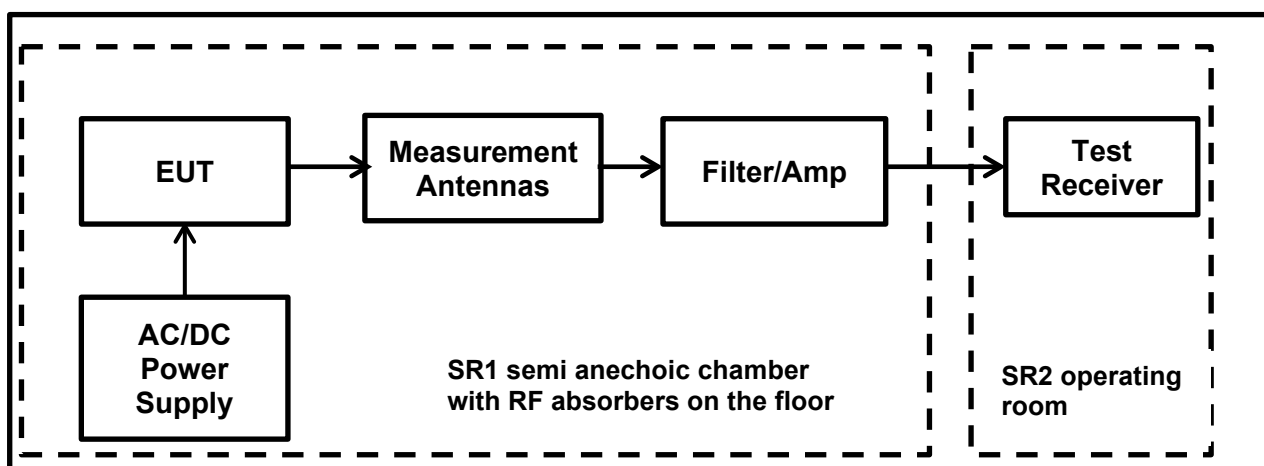
- The transmitter duty cycle was measured using a spectrum analyser in the time domain and calculated by using the following calculation:

$$\text{Duty Cycle (\%)} = 100 \times [\text{On Time } (T_{ON})] / [\text{Period}(T_{ON} + T_{OFF}) \text{ or } 100\text{ms whichever is the lesser}]$$

$$\text{Duty Cycle Correction Factor} = 10 \log 1 / [\text{On Time } (T_{ON})] / [\text{Period}(T_{ON} + T_{OFF}) \text{ or } 100\text{ms whichever is the lesser}]$$

- Duty Cycle Correction Factor for b-mode 2 Mbps: 0.00 dB
- Duty Cycle Correction Factor for n-mode HT40 MCS0: 0.10 dB
- Duty Cycle Correction Factor for ax-mode HT40 MCS0: 3.97 dB

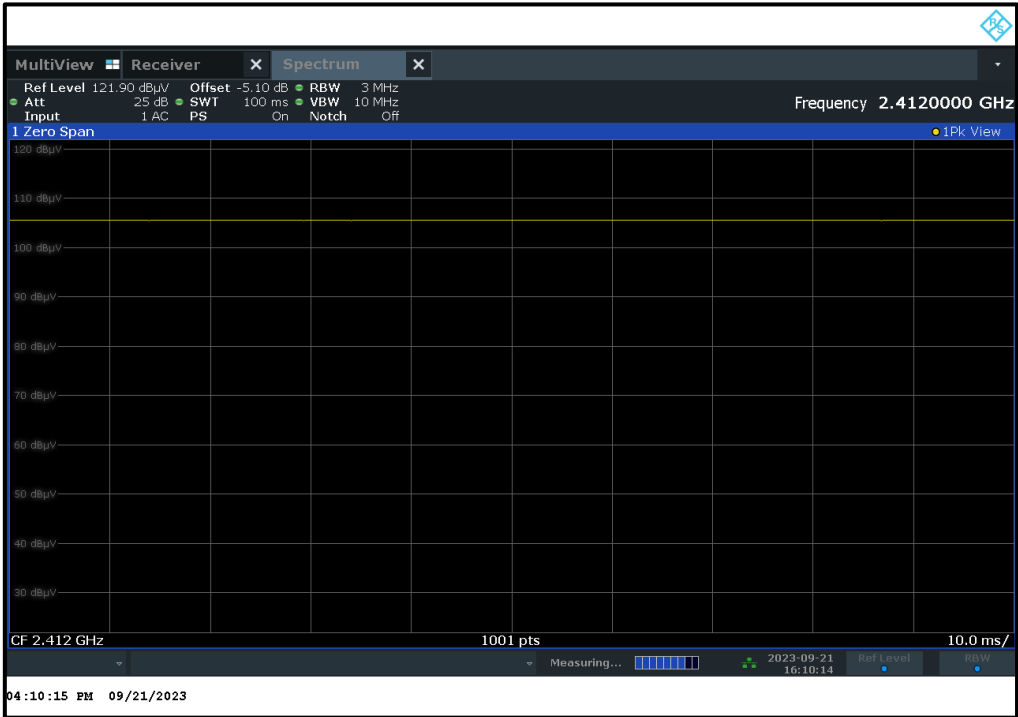
Test Setup:



Transmitter Duty Cycle (continued)

Results: AC-DC Power Supply / 802.11b / 20 MHz / 2 Mbps / PWR 12

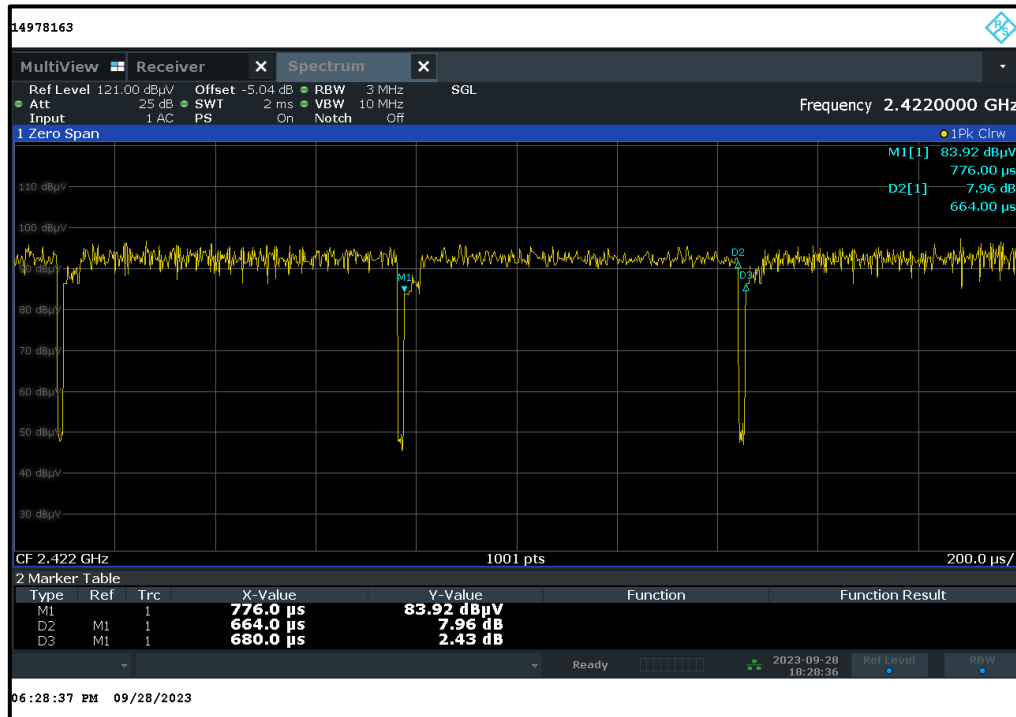
Duty Cycle (%)	Duty Cycle Correction Factor (dB)
100.00	0.00



Result: Pass

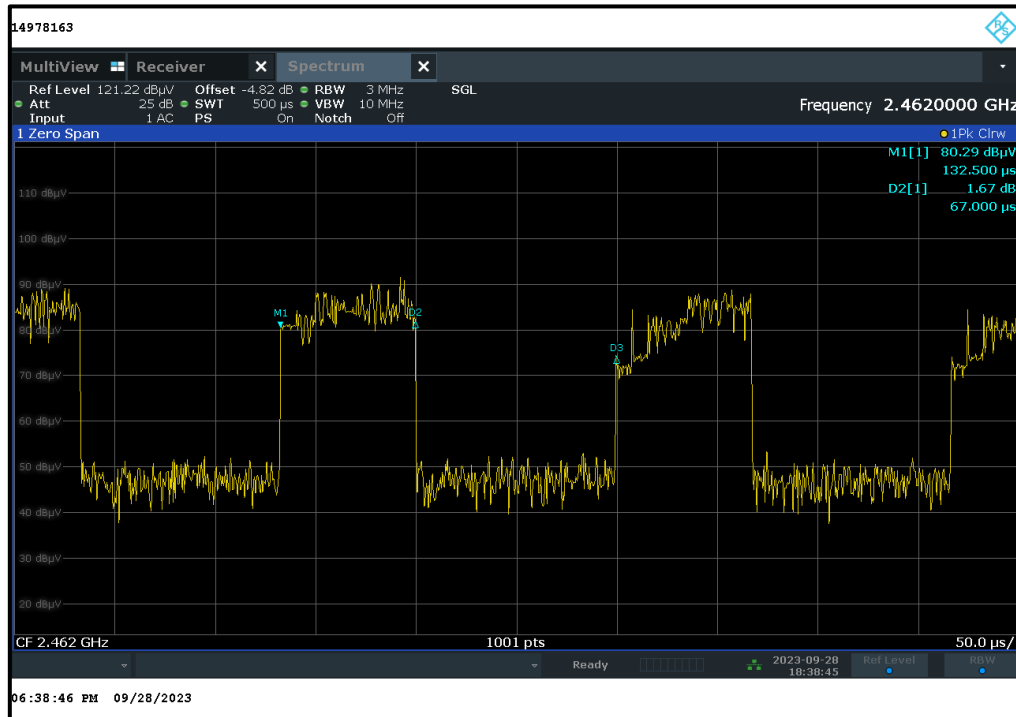
Transmitter Duty Cycle (continued)**Results: AC-DC Power Supply / 802.11n / 40 MHz / MCS0 / PWR 8**

Pulse On Time (T _{ON}) (ms)	Pulse Period (T _{ON} + T _{OFF}) (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
0.6640	0.6800	97.64	0.10

**Result: Pass**

Transmitter Duty Cycle (continued)**Results: AC-DC Power Supply / 802.11ax / 40 MHz / MCS0 / PWR 5**

Pulse On Time (T _{ON}) (ms)	Pulse Period (T _{ON} + T _{OFF}) (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
0.06700	0.16700	40.12	3.97

**Result: Pass**

5.2.2. Transmitter Radiated Emissions**Test Summary:**

Test Engineer:	Abbas Al-Hussainy	Test Date:	26 September 2023
Test Sample Serial Number:	1150003350		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	FCC KDB 558074 Sections 8.5 & 8.6 referencing ANSI C63.10 Sections 11.11 and 11.12 ANSI C63.10:2013 Sections 6.3 and 6.4
Frequency Range	9 kHz to 30 MHz

Environmental Conditions:

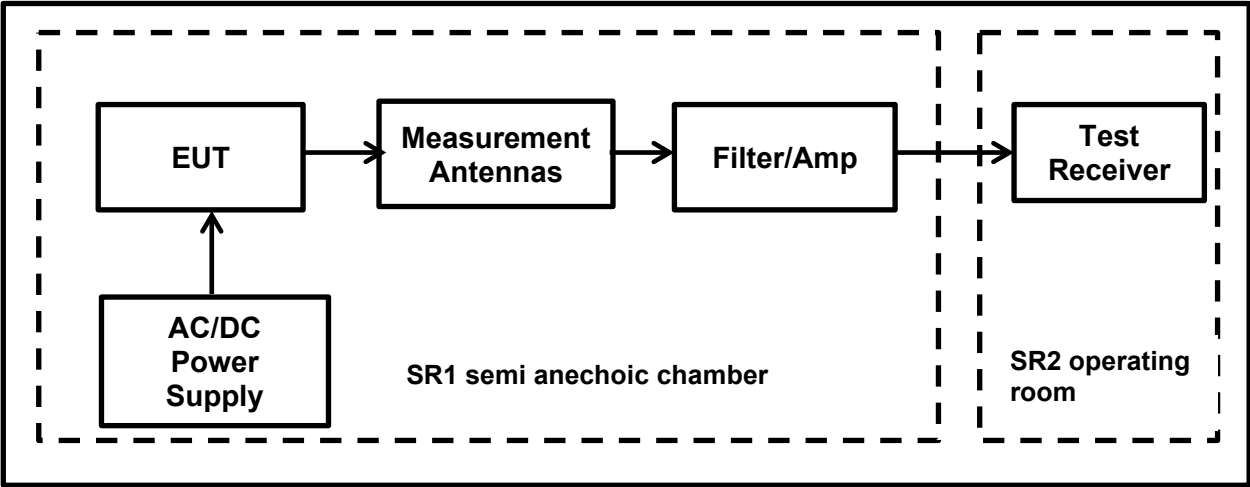
Temperature (°C):	23.7
Relative Humidity (%):	45.7

Notes:

- In accordance with FCC KDB 414788 D01 Radiated Test Site & ANSI C63.10 clause 5.2 an alternative test site that can demonstrate equivalence to an open area test site may be used. Therefore, the measurement was performed in a Semi Anechoic Chamber. (The OATS / SAC comparison data is available upon request).
- The limits are specified at a test distances of 30 and 300 metres. However, as specified in FCC Section 15.31 (f)(2) & ANSI C63.10 clause 6.4.3, measurements may be performed at a closer distance and the measured level extrapolated to the specified measurement distance using the method described in clauses 6.4.4, specifically sub-clause 6.4.4.1 which specifies that the measured level shall be extrapolated to the specified distance by conservatively presuming that the field strength decays at 40 dB/decade.
Therefore, measurements were performed at a measurement distance of 3 m.
- Therefore, the limit values are extrapolated to a measurement distance of 3 m.
 - 9 kHz- 490 kHz: limits extrapolated from 300 m to 3 m by adding 80 dB at 40 dB /decade.
 - 490 kHz-1705 kHz: limits extrapolated from 30 m to 3 m by adding 40 dB at 40 dB /decade.
- Measurements below 30 MHz were performed in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) at a distance of 3 m. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. The measurement loop antenna height was 100 cm.
- The radiated emissions measurements were performed with the EUT set to the following worst-case mode.
 - WLAN 2.4 GHz | b-Mode | 20 MHz | 1 Mbps | Bottom channel | PWR 12
 - WLAN 2.4 GHz | g-Mode | 20 MHz | 54 Mbps | Bottom/Middle/Top channel | PWR 8/12/8
- The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
- Pre-scans were performed, and markers placed on the highest measured levels. The test receiver was set to:
 - Frequency range: 9 kHz-150 kHz: RBW: 1 kHz /VBW: 3 kHz
 - Frequency range: 150 kHz – 30 MHz: RBW: 10 kHz /VBW: 30 kHz
 - Detector: Max-Peak detector
 - Trace Mode: Max Hold

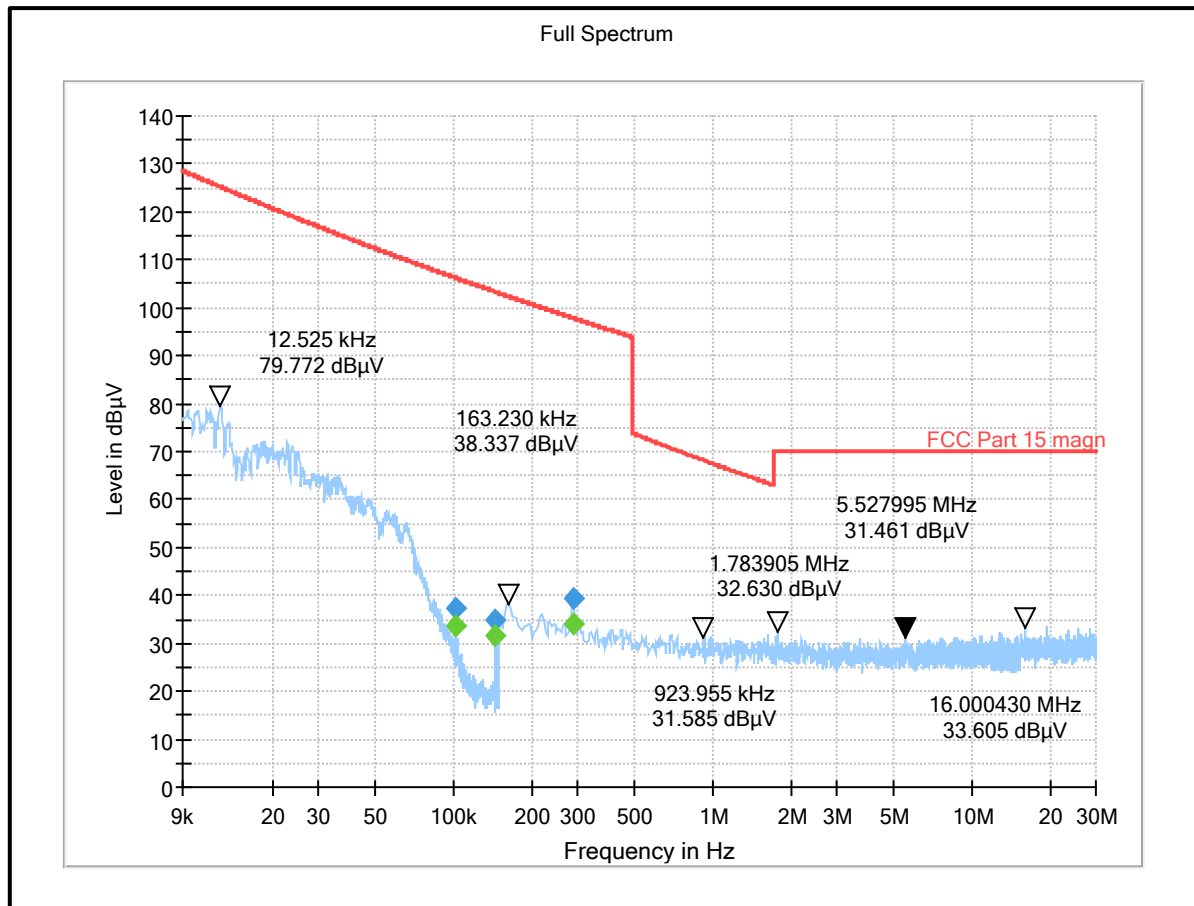
Transmitter Radiated Emissions (continued)

Test Setup:



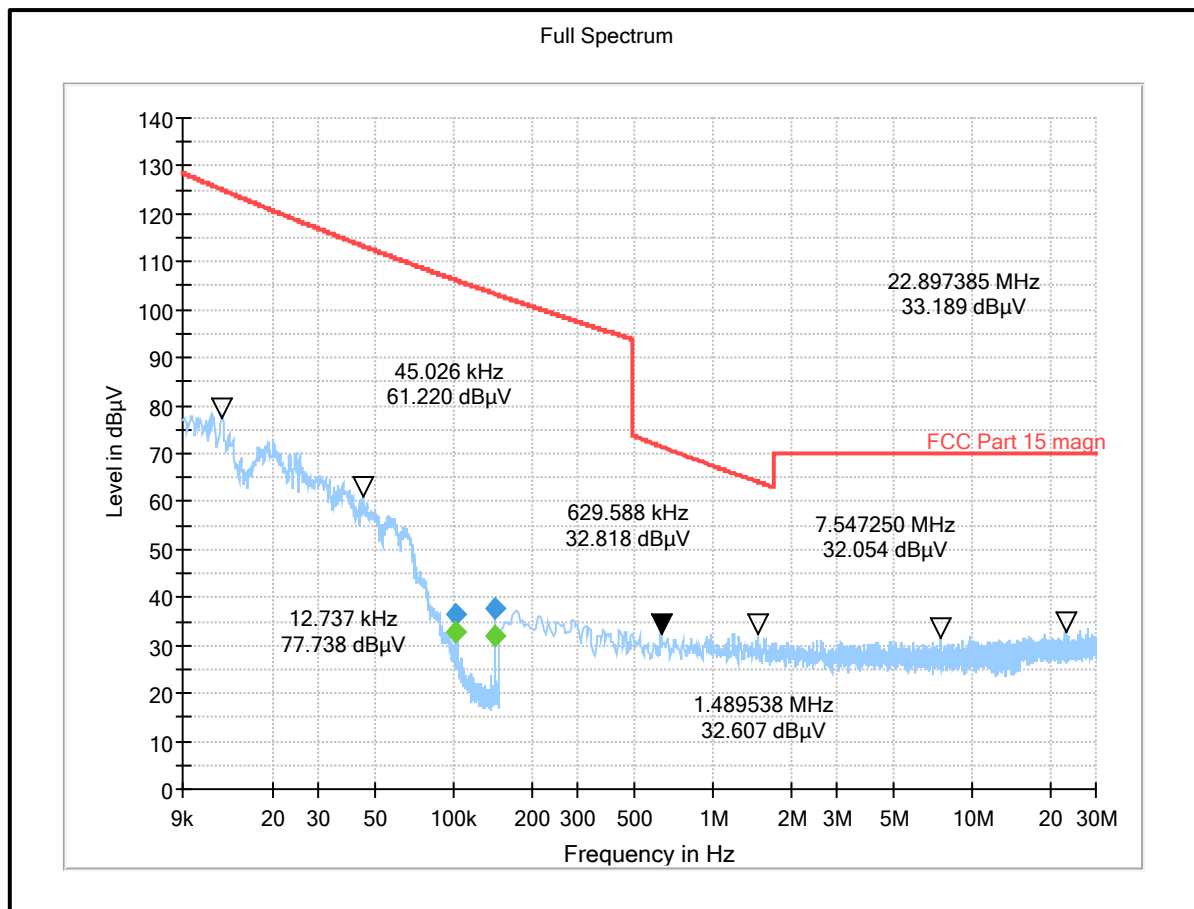
Transmitter Radiated Emissions (continued)**Results: 802.11b / 20 MHz / 1 Mbps / Bottom Channel / PWR 12**

Frequency (MHz)	Loop Antenna Orientation	MaxPeak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
0.101567	90° to the EUT	37.08	106.18	69.09	Complied
0.144995	0° to the EUT	34.88	103.24	68.36	Complied
0.288915	0° to the EUT	39.21	97.78	58.57	Complied

Plot: 9 kHz – 30 MHz: Results: 802.11b / 20 MHz / 1 Mbps / Bottom Channel / PWR 12**Result: Pass**

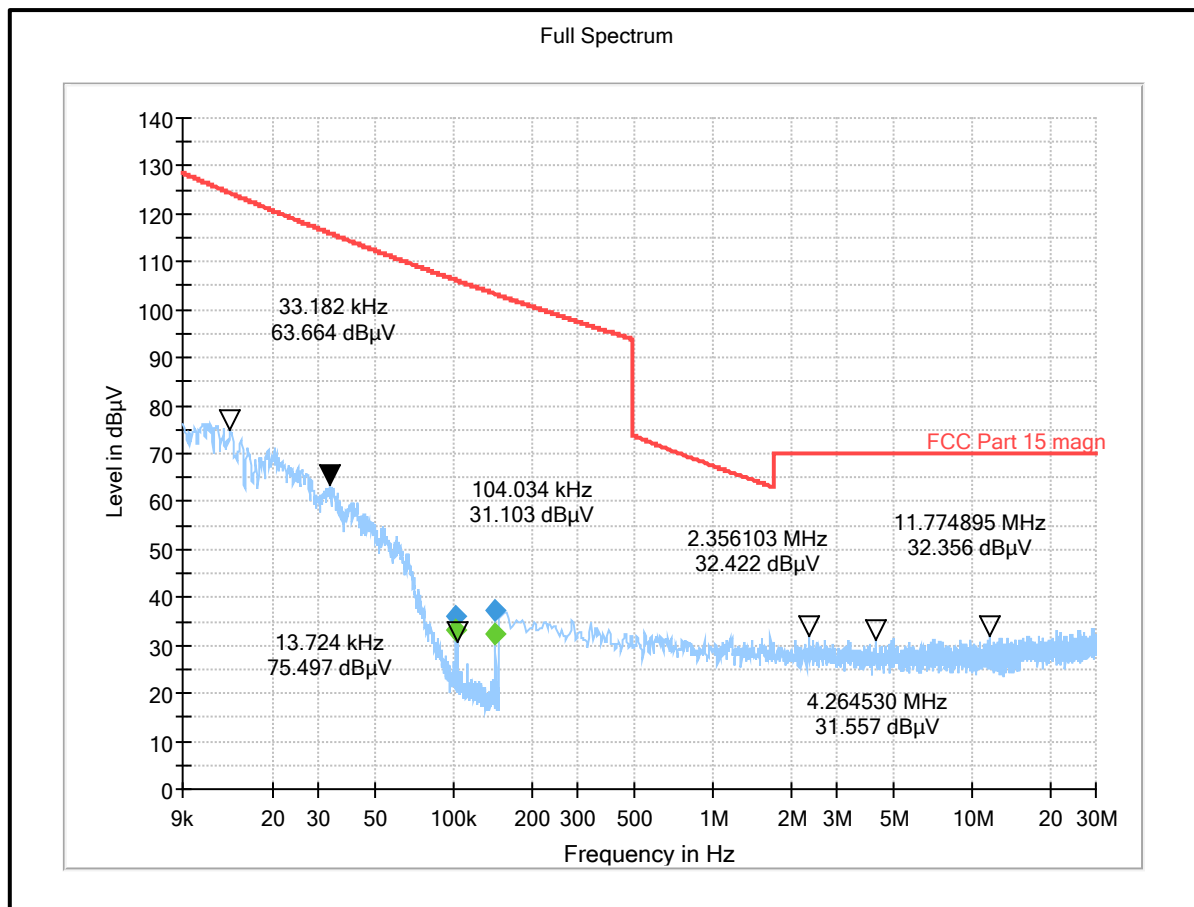
Transmitter Radiated Emissions (continued)**Results: 802.11g / 20 MHz / 54 Mbps / Bottom Channel / PWR 8**

Frequency (MHz)	Loop Antenna Orientation	MaxPeak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
0.101496	90° to the EUT	36.55	106.18	69.63	Complied
0.144713	0° to the EUT	37.71	103.26	65.55	Complied

Plot: 9 kHz – 30 MHz: Results: 802.11g / 20 MHz / 54 Mbps / Bottom Channel / PWR 8**Result: Pass**

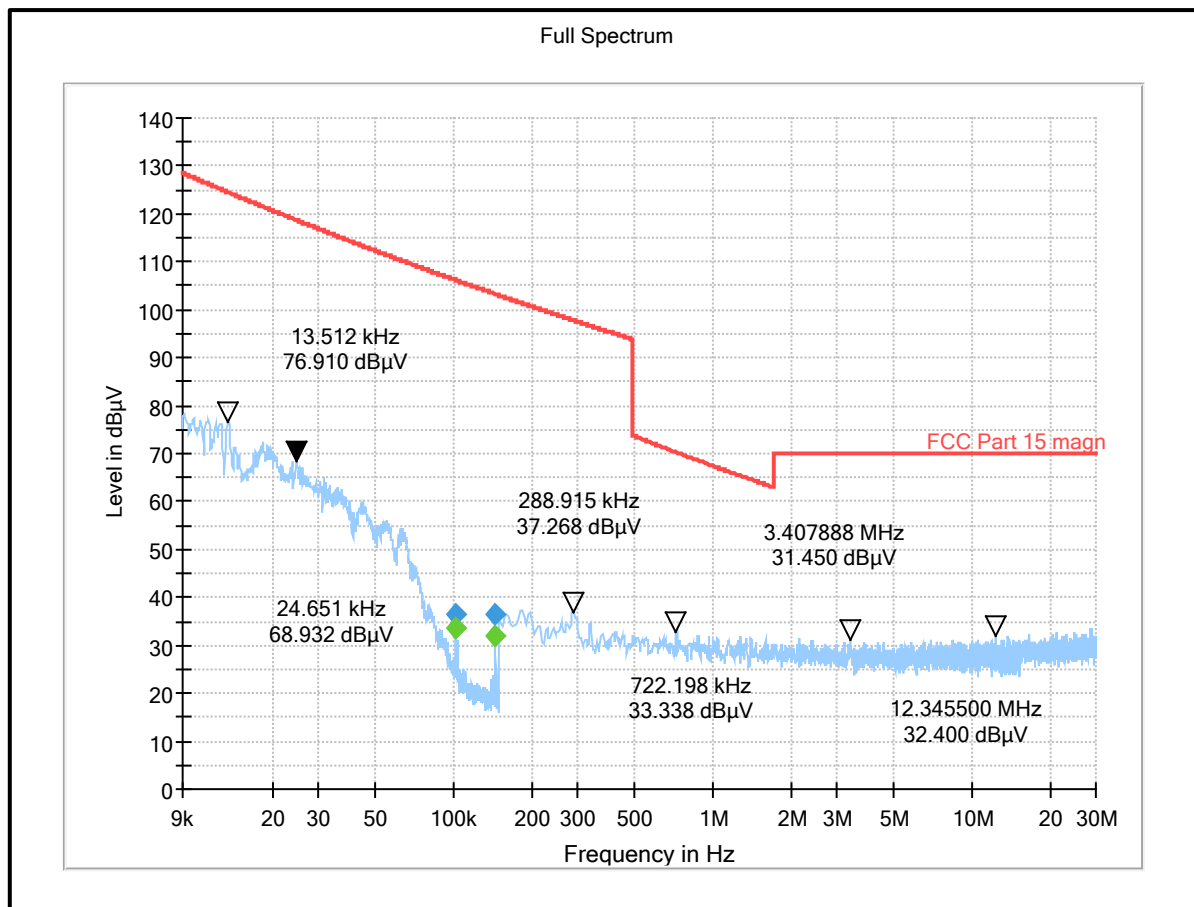
Transmitter Radiated Emissions (continued)**Results: 802.11g / 20 MHz / 54 Mbps / Middle Channel / PWR 12**

Frequency (MHz)	Loop Antenna Orientation	MaxPeak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
0.101496	90° to the EUT	36.11	106.18	70.07	Complied
0.144783	0° to the EUT	37.45	103.25	65.80	Complied

Plot: 9 kHz – 30 MHz: Results: 802.11g / 20 MHz / 54 Mbps / Middle Channel / PWR 12**Result: Pass**

Transmitter Radiated Emissions (continued)**Results: 802.11g / 20 MHz / 54 Mbps / Top Channel / PWR 8**

Frequency (MHz)	Loop Antenna Orientation	MaxPeak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
0.101496	90° to the EUT	36.30	106.18	69.88	Complied
0.144854	0° to the EUT	36.34	103.25	66.91	Complied

Plot: 9 kHz – 30 MHz: Results: 802.11g / 20 MHz / 54 Mbps / Top Channel / PWR 8**Result: Pass**

Transmitter Radiated Emissions (continued)**Test Summary:**

Test Engineer:	Muhammad Faiq Khan	Test Date:	22 September 2023
Test Sample Serial Number:	1150003350		
Test Site Identification	SR 1/2		

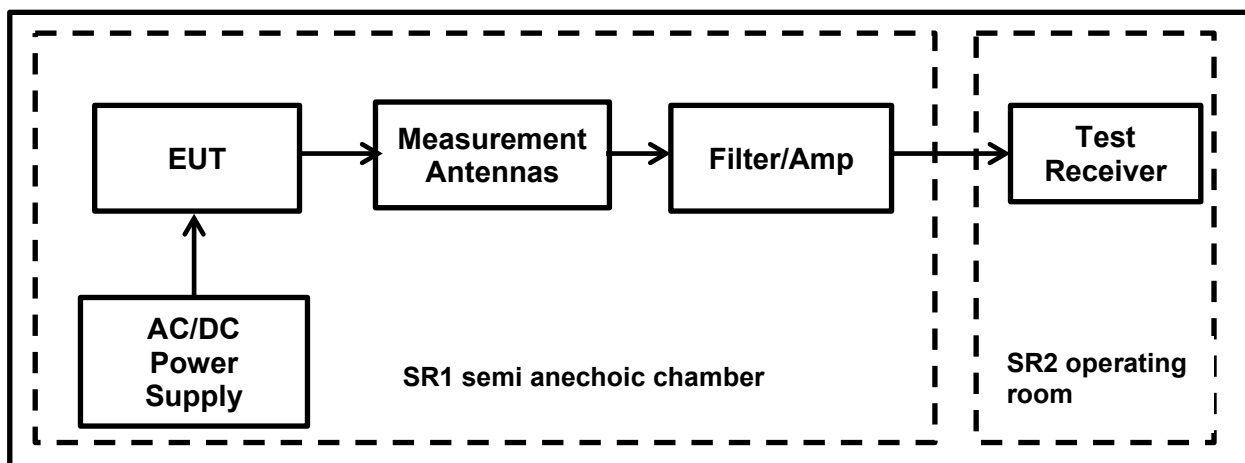
FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	FCC KDB 558074 Sections 8.5 & 8.6 referencing ANSI C63.10 Sections 11.11 and 11.12 ANSI C63.10:2013 Sections 6.3 and 6.5
Frequency Range:	30 MHz to 1000 MHz

Environmental Conditions:

Temperature (°C):	23.8
Relative Humidity (%):	53.0

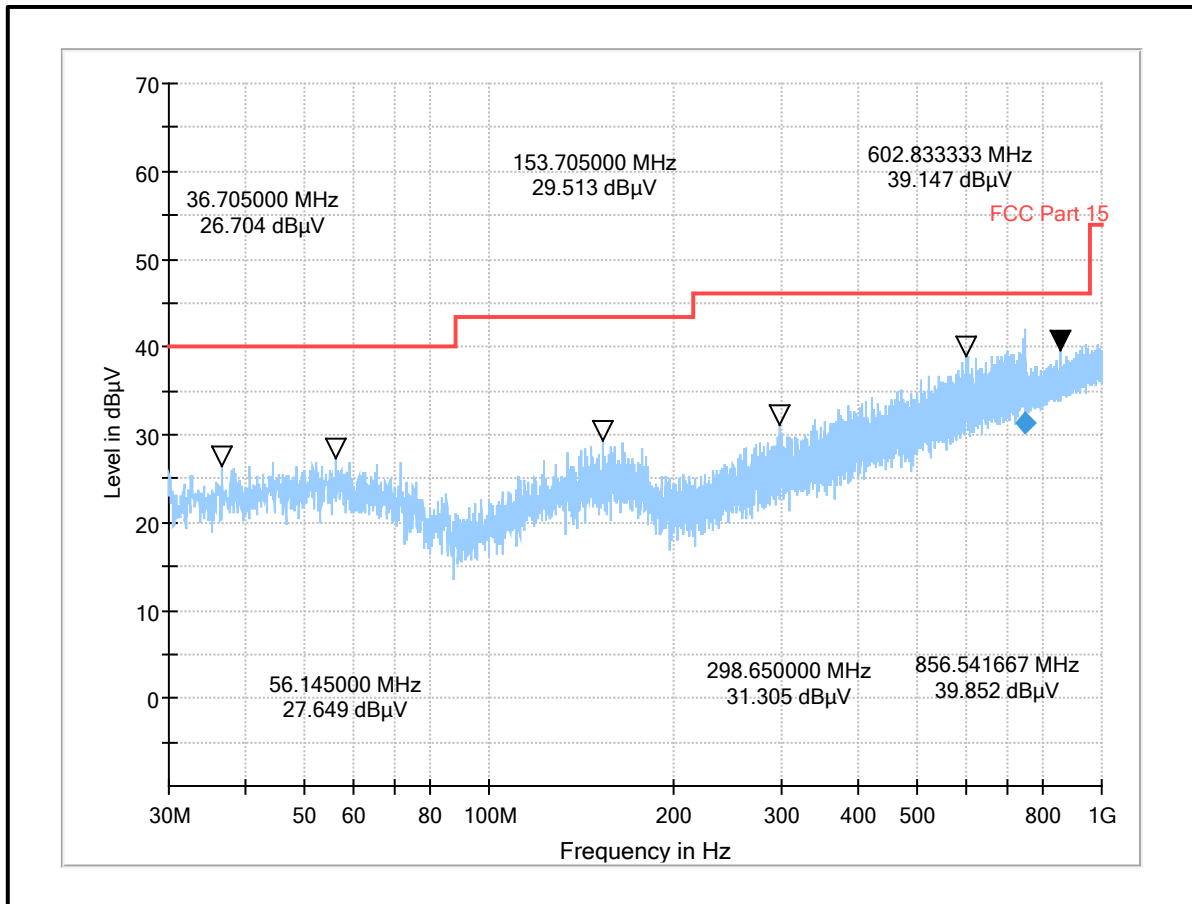
Note(s):

- Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
- The radiated measurements were performed with EUT set to the following worst-case mode.
 - WLAN 2.4 GHz | b-Mode | 20 MHz | 1 Mbps | Bottom channel | PWR 12
 - WLAN 2.4 GHz | g-Mode | 20 MHz | 54 Mbps | Bottom/Middle/Top channel | PWR 8/12/8
- Pre-scans were performed, and markers placed on the highest measured levels. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.
- The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
- All other emissions shown on the pre-scan plot were investigated and found to be below the measurement system noise floor.

Test Setup:

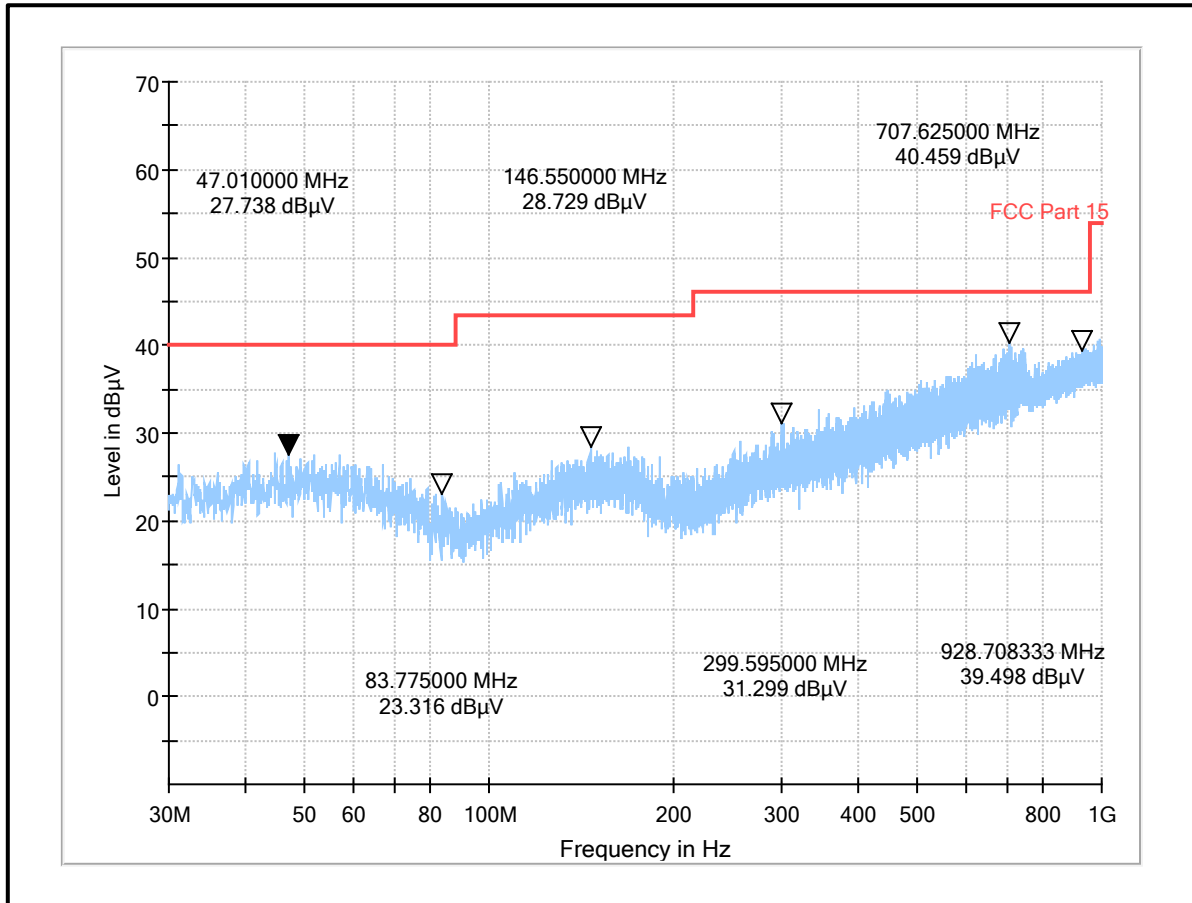
Transmitter Radiated Emissions (continued)**Results: 802.11b / 20 MHz / 1 Mbps / Bottom Channel / PWR 12**

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
747.750000	Horizontal	31.29	46.00	14.71	Complied

Plot: 30 MHz – 1GHz: 802.11b / 20 MHz / 1 Mbps / Bottom Channel / PWR 12**Result: Pass**

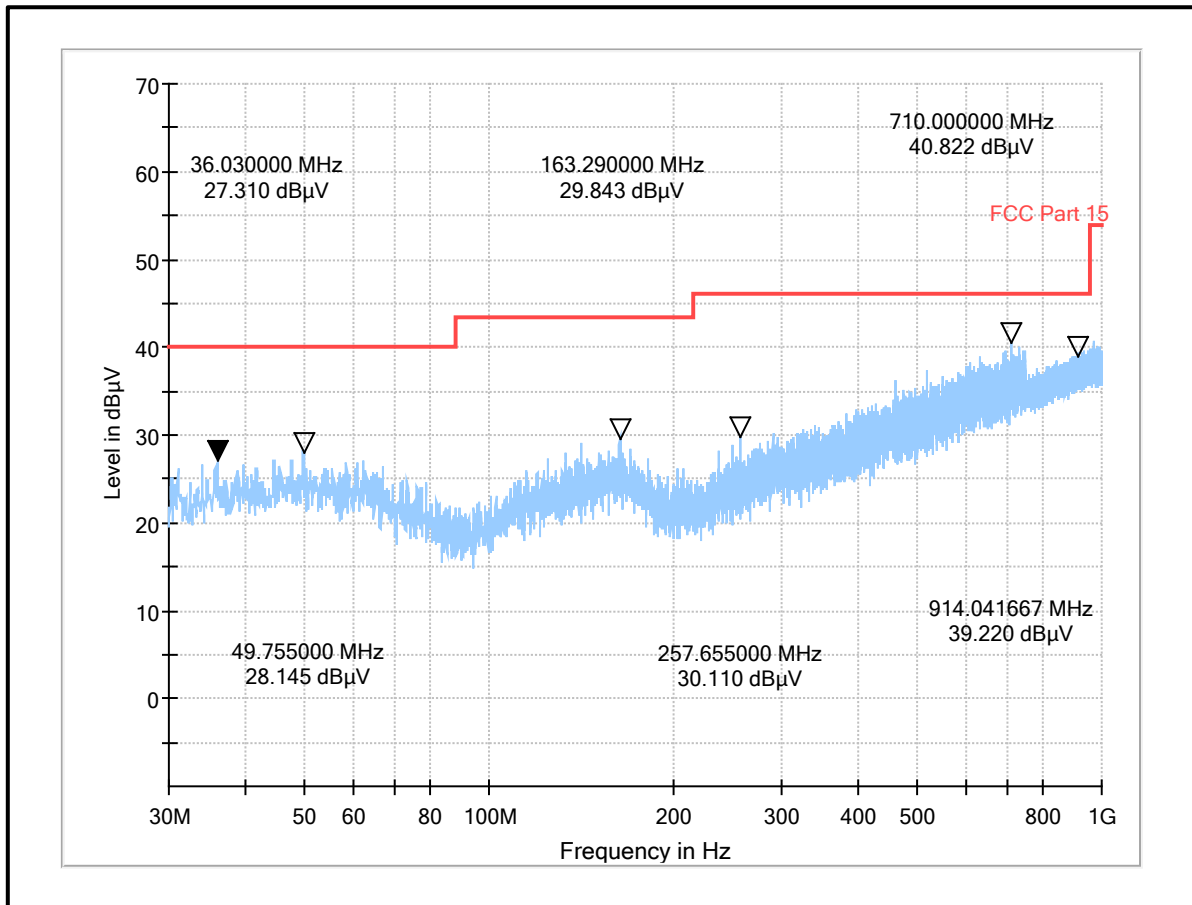
Transmitter Radiated Emissions (continued)**Results: 802.11g / 20 MHz / 54 Mbps / Bottom Channel / PWR 8**

Frequency (MHz)	Antenna Polarization	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
All emissions were below the level of the measurement system noise floor.					

Plot: 30 MHz – 1GHz: 802.11g / 20 MHz / 54 Mbps / Bottom Channel / PWR 8**Result: Pass**

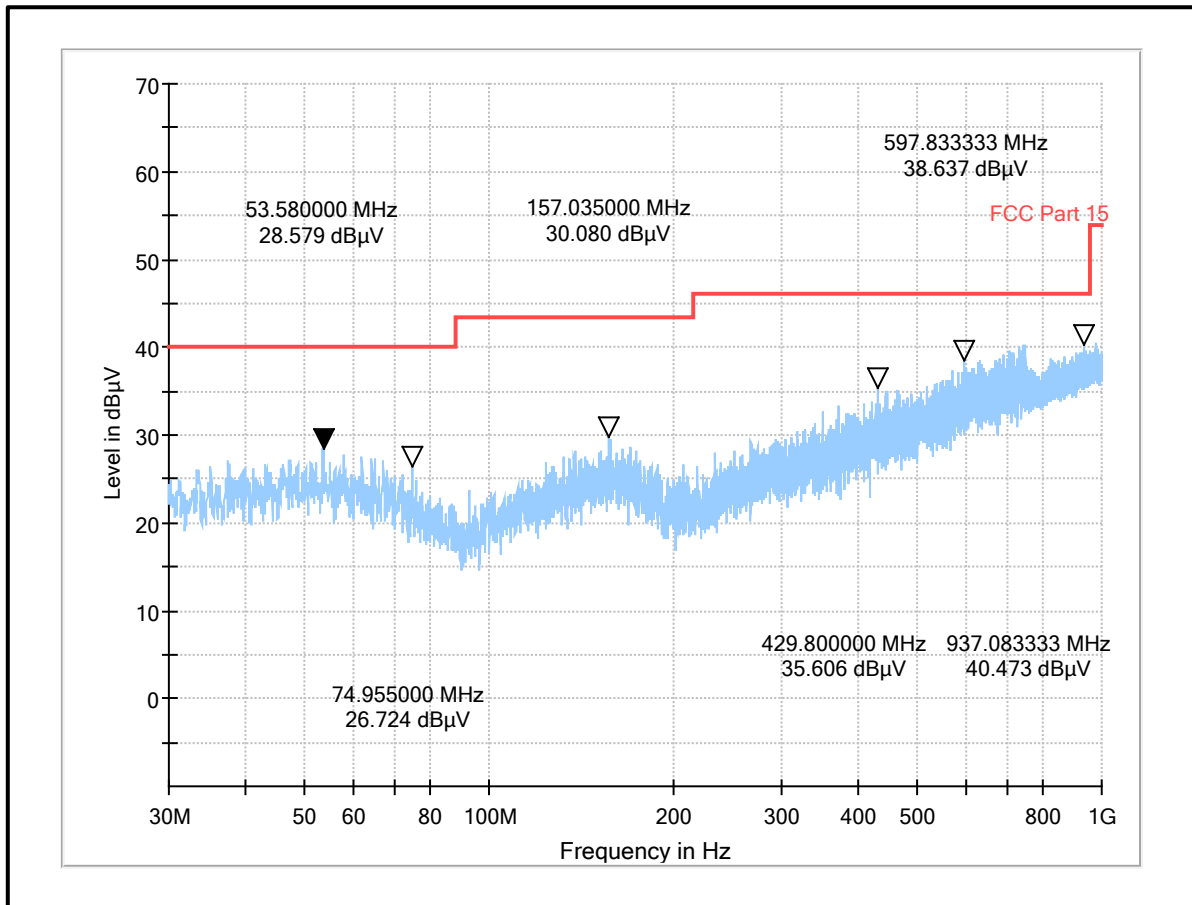
Transmitter Radiated Emissions (continued)**Results: 802.11g / 20 MHz / 54 Mbps / Middle Channel / PWR 12**

Frequency (MHz)	Antenna Polarization	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
All emissions were below the level of the measurement system noise floor.					

Plot: 30 MHz – 1GHz: 802.11g / 20 MHz / 54 Mbps / Middle Channel / PWR 12**Result: Pass**

Transmitter Radiated Emissions (continued)**Results: 802.11g / 20 MHz / 54 Mbps / Top Channel / PWR 8**

Frequency (MHz)	Antenna Polarization	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
All emissions were below the level of the measurement system noise floor.					

Plot: 30 MHz – 1GHz: 802.11g / 20 MHz / 54 Mbps / Top Channel / PWR 8**Result: Pass**

Transmitter Radiated Emissions (continued)**Test Summary:**

Test Engineer:	Muhammad Faiq Khan	Test Date:	20 September 2023 & 27 September 2023
Test Sample Serial Number:	1150003350		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	FCC KDB 558074 Sections 8.5 & 8.6 referencing ANSI C63.10 Sections 11.11 and 11.12 ANSI C63.10:2013 Sections 6.3 and 6.6
Frequency Range:	1 GHz to 26.5 GHz

Environmental Conditions:

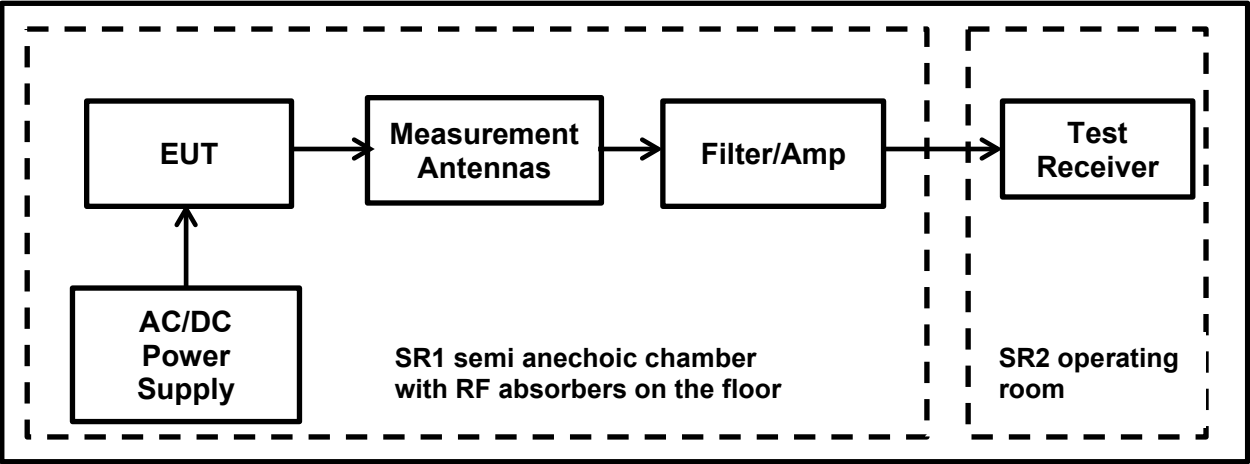
Temperature (°C):	23.2 to 24.0
Relative Humidity (%):	47.4 to .50.0

Notes:

- Pre-scans above 1 GHz were performed in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) with RF absorbers on the floor at a distance of 3 m. The EUT was placed at a height of 1.5 m above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 m above the test chamber floor, in line with the EUT. Final measurements above 1 GHz were performed in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) with absorber on the floor at a distance of 3 m. The EUT was placed at a height of 1.5 m above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 m to 4 m.
- The radiated measurements were performed with the EUT set to the following worst-case mode.
 - WLAN 2.4 GHz | b-Mode | 20 MHz | 1 Mbps | Bottom channel | PWR 12
 - WLAN 2.4 GHz | g-Mode | 20 MHz | 54 Mbps | Bottom/Middle/Top channel | PWR 8/12/8
- Pre-scans were performed, and a marker placed on the highest measured level of the appropriate plot. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz the sweep time was set to auto.
- The emissions shown at frequencies approximately 2.4 GHz to 2.4835 GHz on the 1 GHz to 18 GHz plots are the EUT fundamental for the tested channel.
- The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
- In accordance with ANSI C63.10-2013 Section 5.3.3 & 6.5.3 measurements above 18 GHz were performed at closer distance (1 m); because at specified measurement distance (3m) for compliance the instrumentation noise floor was typically close to the radiated emission limit.
- For frequency range between 18 GHz and 25 GHz, no critical emissions were found. All emissions shown on the pre-scans were investigated and found to be below the noise floor of the measurement system

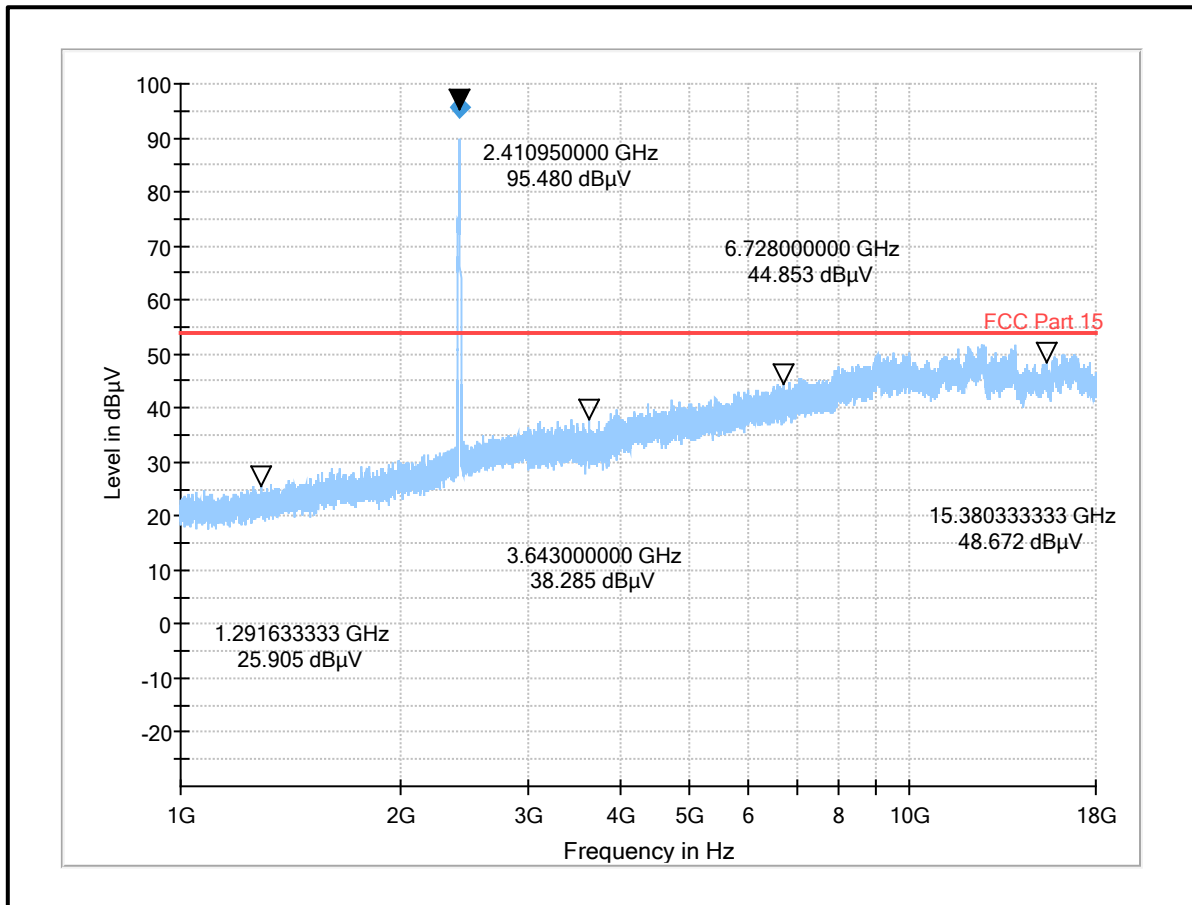
Transmitter Radiated Emissions (continued)

Test Setup:



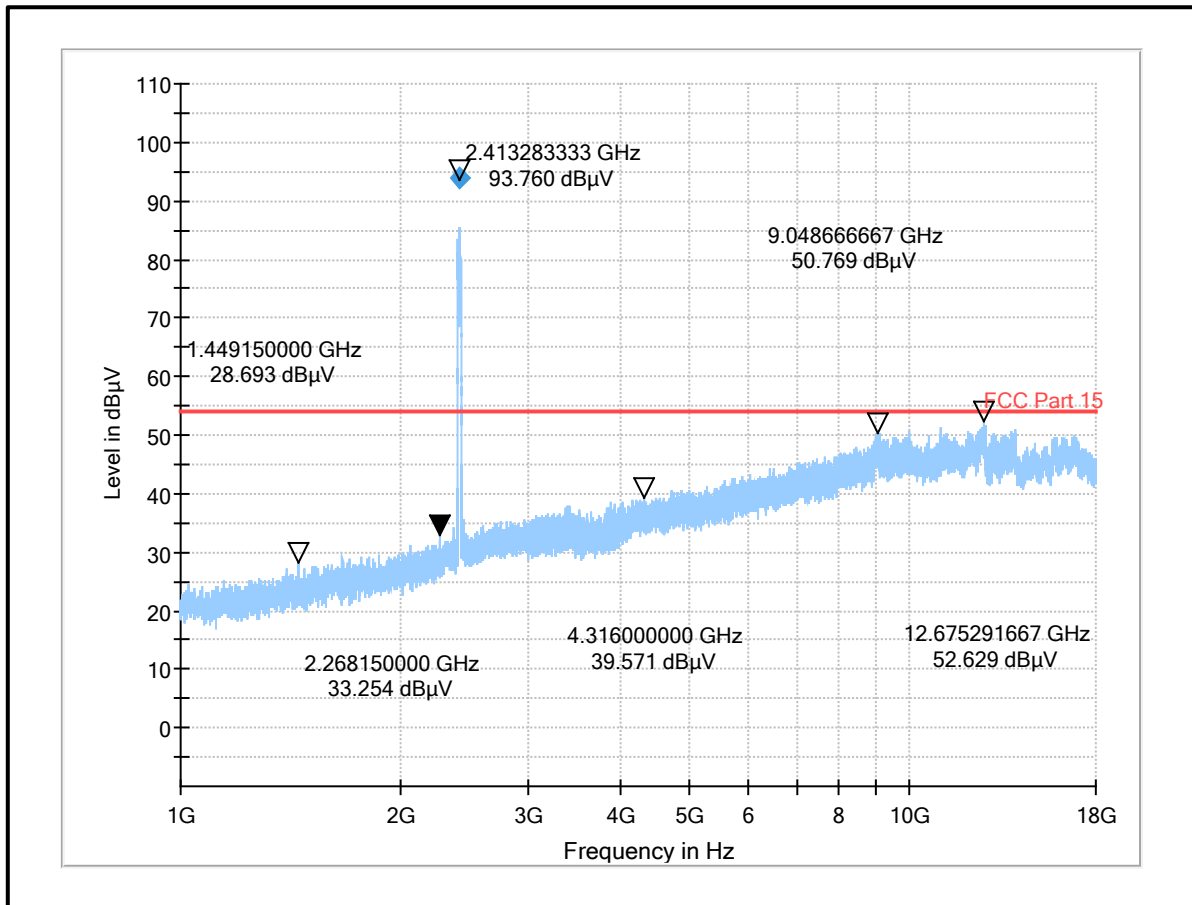
Transmitter Radiated Emissions (continued)**Results: 802.11b / 20 MHz / 1 Mbps / Bottom Channel / PWR 12**

Frequency (MHz)	Antenna Polarization	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
All emissions were below the level of the measurement system noise floor.					

Plot: 1 GHz – 18 GHz: 802.11b / 20 MHz / 1 Mbps / Bottom Channel / PWR 12**Result: Pass**

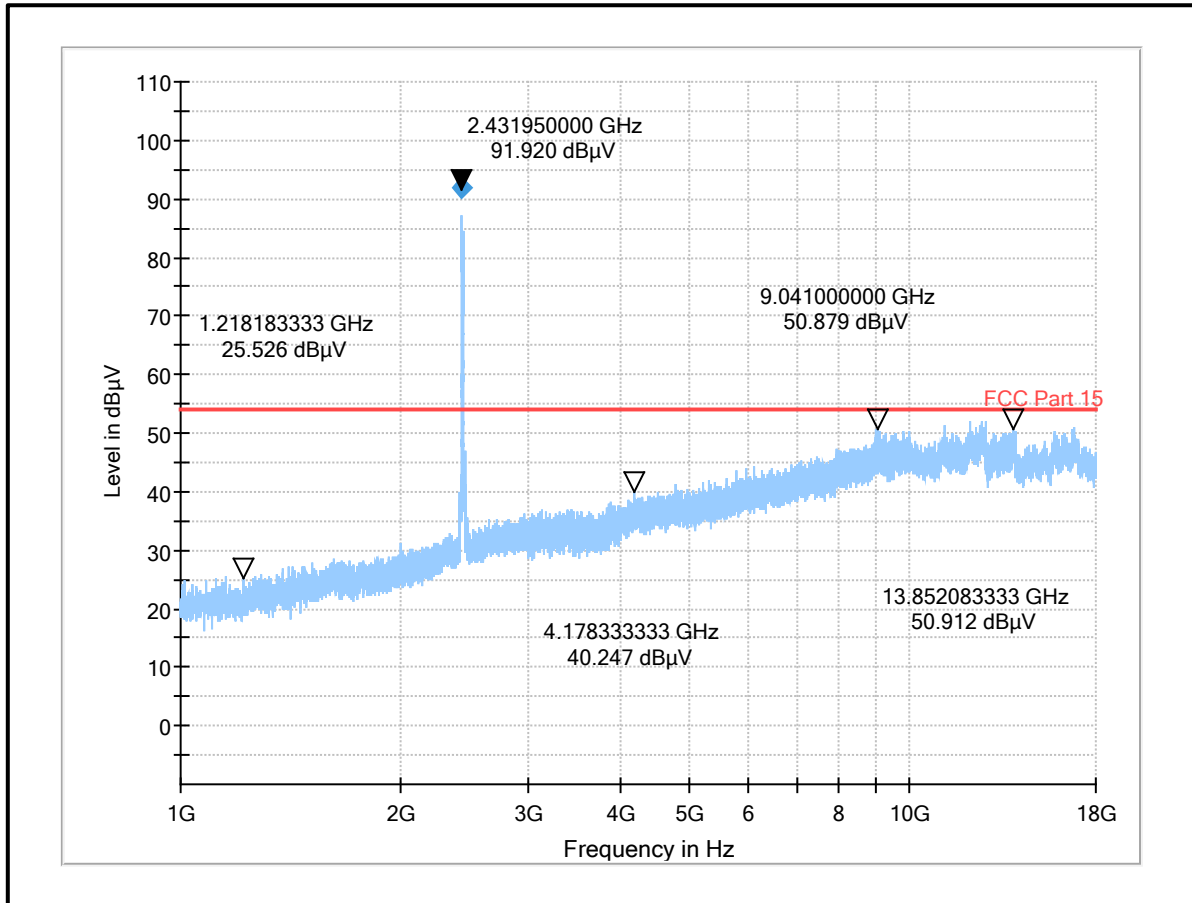
Transmitter Radiated Emissions (continued)**Results: 802.11g / 20 MHz / 54 Mbps / Bottom Channel / PWR 8**

Frequency (MHz)	Antenna Polarization	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
All emissions were below the level of the measurement system noise floor.					

Plot: 1 GHz – 18 GHz: 802.11g / 20 MHz / 54Mbps / Bottom Channel / PWR 8**Result: Pass**

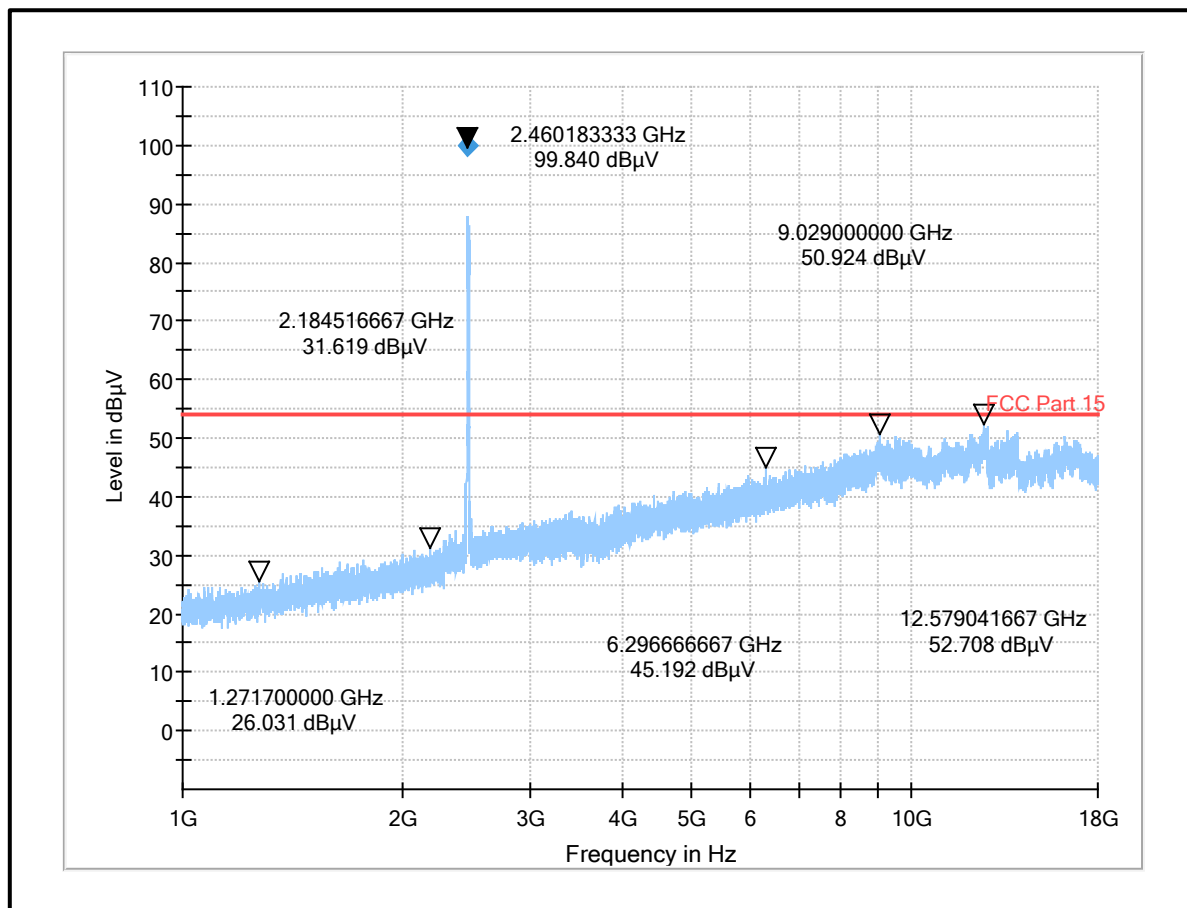
Transmitter Radiated Emissions (continued)**Results: 802.11g / 20 MHz / 54 Mbps / Middle Channel / PWR 12**

Frequency (MHz)	Antenna Polarization	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
All emissions were below the level of the measurement system noise floor.					

Plot: 1 GHz – 18 GHz: 802.11g / 20 MHz / 54Mbps / Middle Channel / PWR 12**Result: Pass**

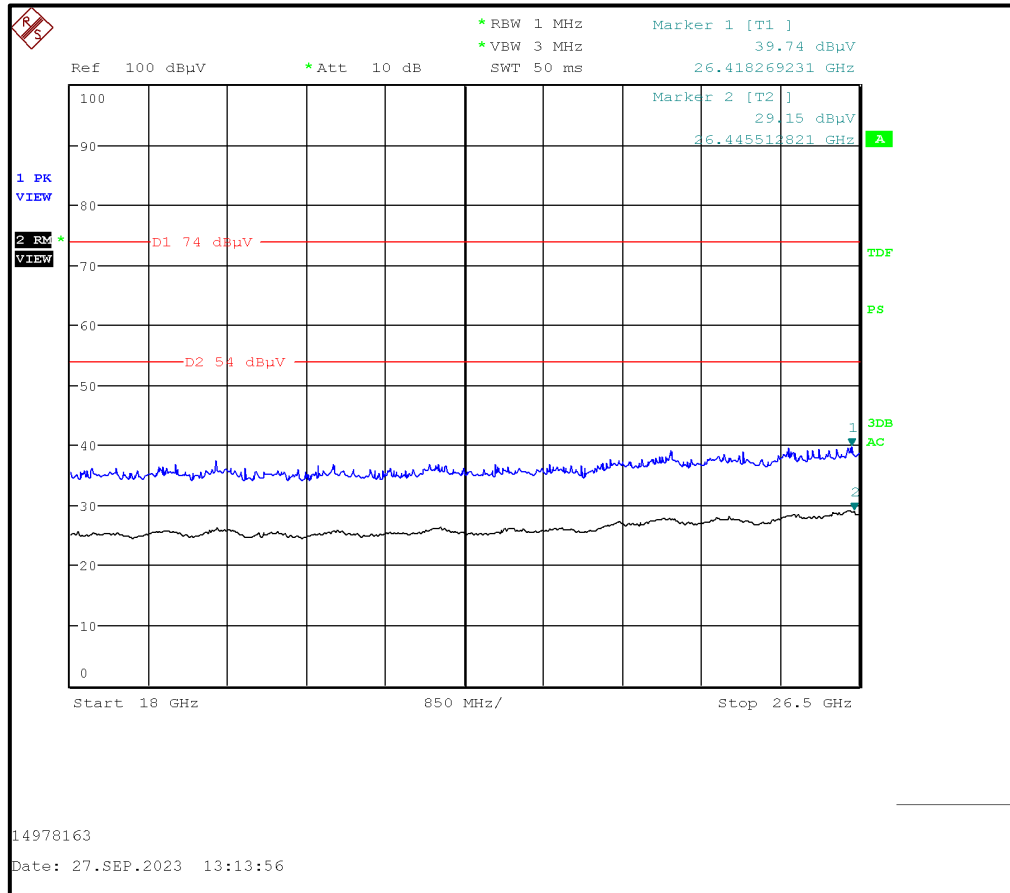
Transmitter Radiated Emissions (continued)**Results: 802.11g / 20 MHz / 54 Mbps / Top Channel / PWR 8**

Frequency (MHz)	Antenna Polarization	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
All emissions were below the level of the measurement system noise floor.					

Plot: 1 GHz – 18 GHz: 802.11g / 20 MHz / 54Mbps / Top Channel / PWR 8**Result: Pass**

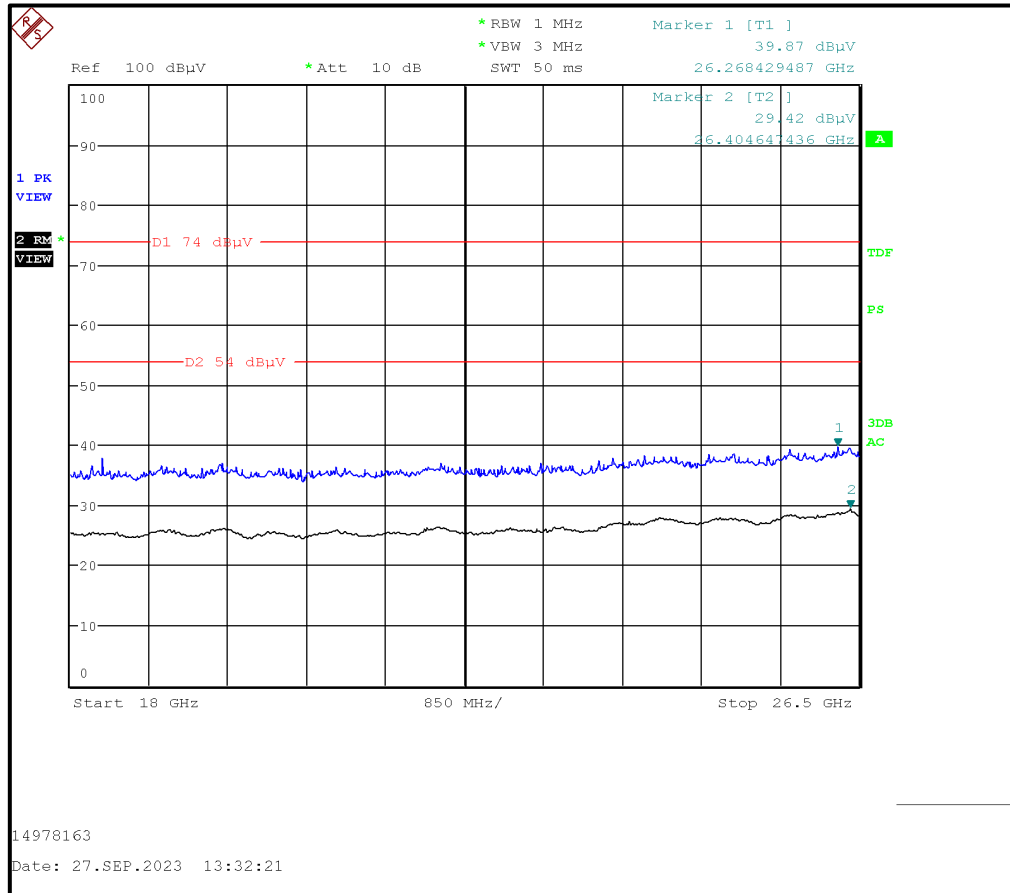
Transmitter Radiated Emissions (continued)**Results: 802.11b / 20 MHz / 1 Mbps / Bottom Channel / PWR 12**

Frequency (MHz)	Antenna Polarization	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
All emissions were below the level of the measurement system noise floor.					

Plot: 18 GHz – 26.5 GHz: 802.11b / 20 MHz / 1 Mbps / Bottom Channel / PWR 12**Result: Pass**

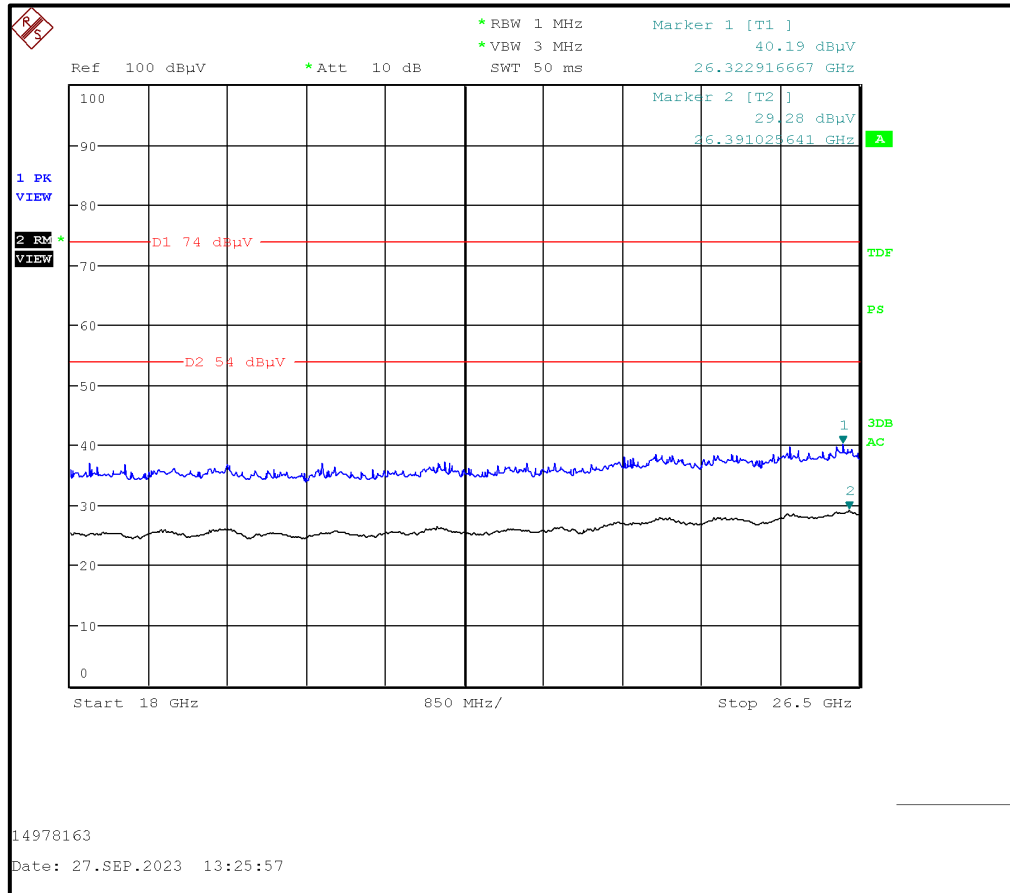
Transmitter Radiated Emissions (continued)**Results: 802.11g / 20 MHz / 54 Mbps / Bottom Channel / PWR 8**

Frequency (MHz)	Antenna Polarization	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
All emissions were below the level of the measurement system noise floor.					

Plot: 18 GHz – 26.5 GHz: 802.11g / 20 MHz / 54 Mbps / Bottom Channel / PWR 8**Result: Pass**

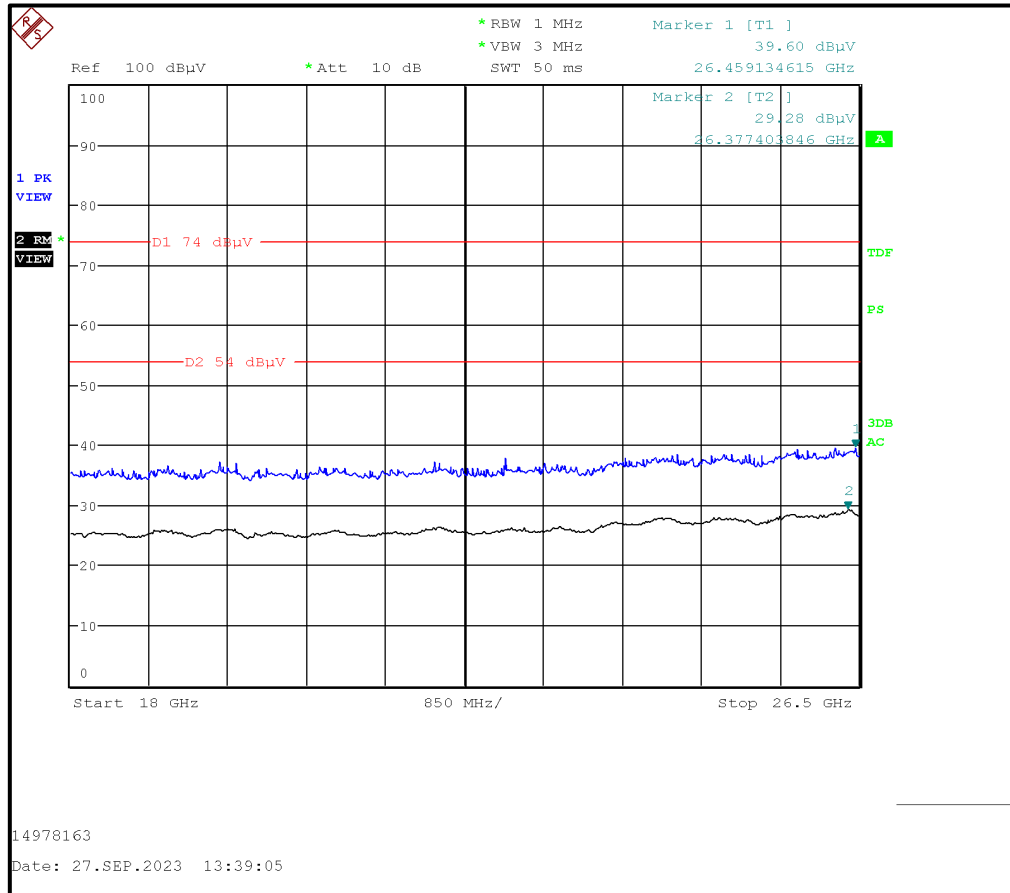
Transmitter Radiated Emissions (continued)**Results: 802.11g / 20 MHz / 54 Mbps / Middle Channel / PWR 12**

Frequency (MHz)	Antenna Polarization	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
All emissions were below the level of the measurement system noise floor.					

Plot: 18 GHz – 26.5 GHz: 802.11g / 20 MHz / 54 Mbps / Middle Channel / PWR 12**Result: Pass**

Transmitter Radiated Emissions (continued)**Results: 802.11g / 20 MHz / 54 Mbps / Top Channel / PWR 8**

Frequency (MHz)	Antenna Polarization	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
All emissions were below the level of the measurement system noise floor.					

Plot: 18 GHz – 26.5 GHz: 802.11g / 20 MHz / 54 Mbps / Top Channel / PWR 8**Result: Pass**

5.2.3. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	Muhammad Faiq Khan	Test Date:	21 September 2023 & 27 September 2023
Test Sample Serial Number:	1150003350		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.247(d), 15.209(a) & 15.205(a)
Test Method Used:	DTS emissions in non-restricted frequency bands: FCC KDB 558074 Section 8.5 referencing ANSI C63.10:2013 Sections 11.11
	DTS emissions in restricted frequency bands: FCC KDB 558074 Section 8.6 referencing ANSI C63.10:2013 Sections 11.12
	ANSI C63.10:2013 Sections 6.10.4, 6.10.5

Environmental Conditions:

Temperature (°C):	23.8 to 24.8
Relative Humidity (%):	45.1 to 52.1

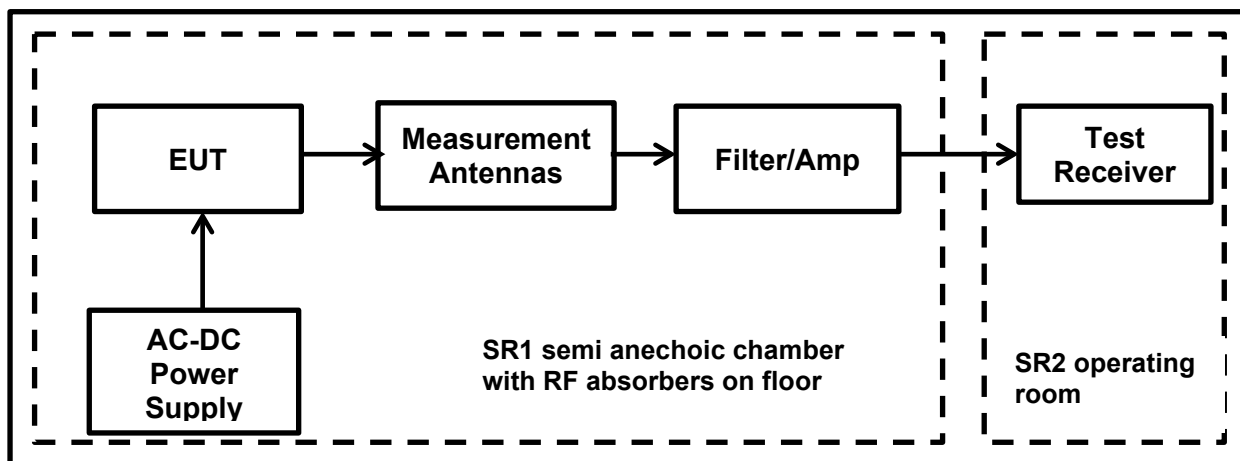
Note(s):

1. The measurements were in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) with RF absorbers on the floor at a distance of 3 m. The EUT was placed at a height of 1.5 m above the test chamber floor in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 m to 4 m
2. As the lower band edge falls within a non-restricted band, measurements were performed in accordance with FCC KDB 558074 Section 8.5 referencing ANSI C63.10 Section 11.11. Since maximum conducted (Peak) output power was previously measured in accordance with ANSI C63.10 Section 11.11.1(a) lower band edge measurement was performed with a peak detector and the -20 dBc limit applied.
3. As the lower band edge falls within a non-restricted band, only peak measurements are required. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The test receiver was left to sweep for 300 sweeps in order to maximise the carrier level and out-of-band emissions. A marker and corresponding reference level line were placed on the peak of the carrier. Marker frequencies and levels were recorded.
4. The restricted band peak measurements were performed in accordance with ANSI C63.10 Section 11.12.2.4.
5. As the EUT continuous transmission of the EUT ($D \geq 98\%$) cannot be achieved and the duty cycle is constant (duty cycle variations are less than $\pm 2\%$), the restricted band average measurements were performed in accordance with ANSI C63.10 Section 11.12.2.5.2.
6. As the upper band edge falls within a restricted band both peak and average measurements were recorded by placing a marker at the edge of the band. For peak measurements the test receiver resolution bandwidth was set to 1 MHz and the video bandwidth 3 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. For average measurements the test receiver resolution bandwidth was set to 1 MHz and the video bandwidth 3 MHz. A RMS detector in power averaging mode was used. The test receiver was left to sweep for a sufficient length of time in order to maximise the carrier level and out-of-band emissions. A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent restricted band of operation (where a higher level emission was present). Marker frequencies and levels were recorded.

Transmitter Band Edge Radiated Emissions (continued)**Note(s): (continued)**

7. There is a restricted band 10 MHz below the lower band edge. The test receiver was set up as follows: the RBW set to 1 MHz, the VBW set to 3 MHz, with the sweep time set to auto couple. Peak and average measurements were performed with their respective detectors. Markers were placed on the highest point on each trace.
8. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
9. **As the EUT was transmitting continuously with a Duty Cycle of $\leq 98\%$, following Duty Cycle Correction Factor were added to all average measurements.
Duty Cycle Correction Details (as mentioned below):
 - 802.11n(HT40) I MCS0: 97.67 % (duty cycle variations are less than $\pm 2\%$). Therefore, a Duty Cycle Correction Factor of 0.10 dB was added to all average measurements
 - 802.11ax(HT40) I MCS0: 40.12 % (duty cycle variations are less than $\pm 2\%$). Therefore, a Duty Cycle Correction Factor of 3.97 dB was added to all average measurements

to compute the corrected average values of the emissions that would have been measured had the test been performed at 100% Duty Cycle.

Test Setup:

Transmitter Band Edge Radiated Emissions (Continued)**Results: AC-DC Power Supply / 802.11b / 20 MHz / 2 Mbps / PWR 12****Results: Lower Band Edge / Peak**

Frequency (MHz)	Peak Level (dB μ V/m)	-20 dBc Limit (dB μ V/m)	Margin (dB)	Result
2397.00	47.68	75.66	27.98	Complied
2400.00	39.52	75.66	36.14	Complied

Results: Lower Band Edge / 2310 to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Peak Level (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)	Result
2387.40	43.58	74.00	30.42	Complied

Results: Lower Band Edge / 2310 to 2390 MHz Restricted Band / Average

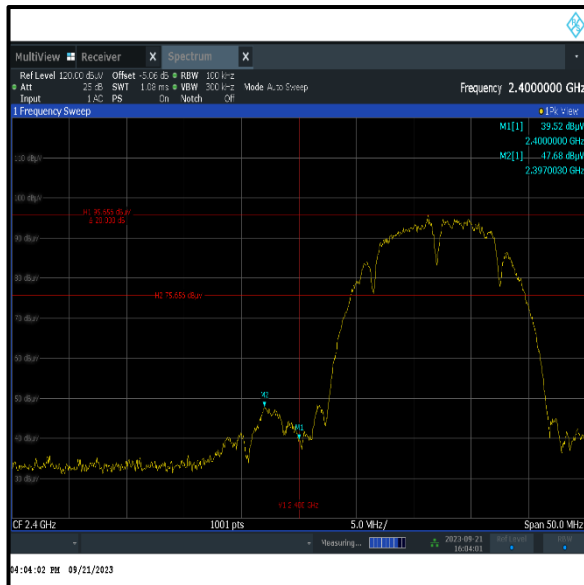
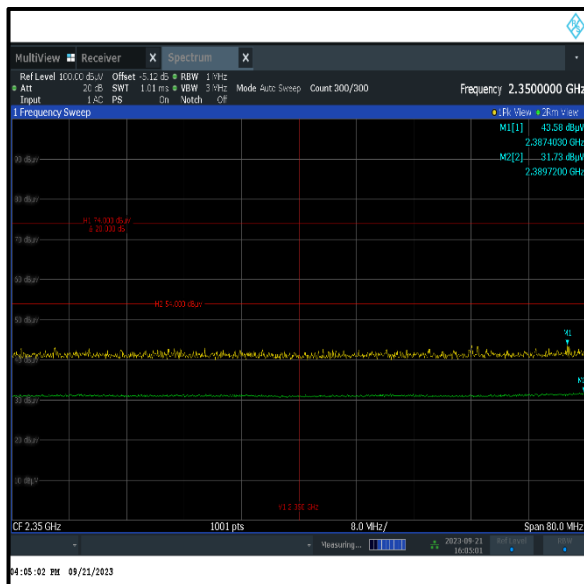
Frequency (MHz)	Average Level (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)	Result
2389.72	31.73	54.00	22.27	Complied

Results: Upper Band Edge / Peak

Frequency (MHz)	Peak Level (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)	Result
2483.50	50.46	74.00	23.54	Complied
2483.58	52.20	74.00	21.80	Complied

Results: Upper Band Edge / Average

Frequency (MHz)	Peak Level (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)	Result
2483.50	40.90	54.00	13.10	Complied
2483.58	40.71	54.00	13.29	Complied

Transmitter Band Edge Radiated Emissions (Continued)**Results: AC-DC Power Supply / 802.11b / 20 MHz / 2 Mbps / PWR 12****Lower Band Edge Peak Measurement****Upper Band Edge Measurement****Restricted Band Edge Measurement****Result: Pass**

Transmitter Band Edge Radiated Emissions (Continued)**Results: AC-DC Power Supply / 802.11n / 40 MHz / MCS0 / PWR 8****Results: Lower Band Edge / Peak**

Frequency (MHz)	Peak Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
2398.30	44.60	69.43	24.83	Complied
2400.00	39.05	69.43	30.38	Complied

Results: Lower Band Edge / 2310 to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2389.56	51.10	74.00	22.90	Complied

Results: Lower Band Edge / 2310 to 2390 MHz Restricted Band / Average

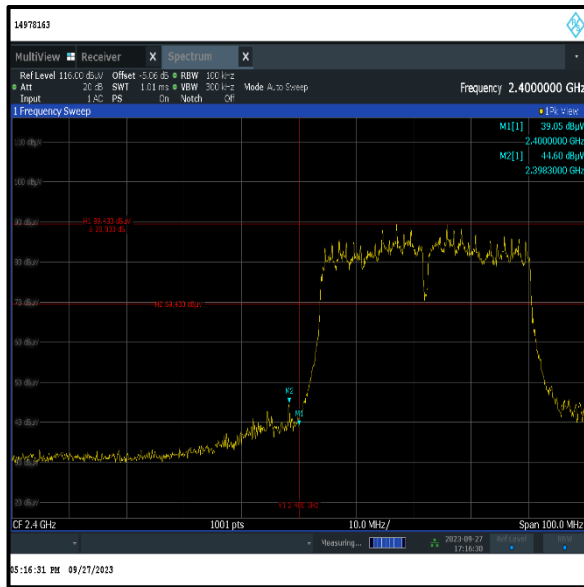
Frequency (MHz)	Average Level (dBµV/m)	Duty Cycle Correction Factor (dB)	Corrected Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2389.96	36.17	0.10	36.27**	54.00	17.73	Complied

Results: AC-DC Power Supply / 802.11ax / 40 MHz / MCS0 / PWR 5**Results: Upper Band Edge / Peak**

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2483.50	51.94	74.00	22.06	Complied
2483.90	53.35	74.00	20.65	Complied

Results: Upper Band Edge / Average

Frequency (MHz)	Peak Level (dBµV/m)	Duty Cycle Correction Factor (dB)	Corrected Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2483.50	33.37	3.97	37.34**	54.00	16.66	Complied
2487.20	33.85	3.97	37.82**	54.00	16.18	Complied

Transmitter Band Edge Radiated Emissions (Continued)**Results: AC-DC Power Supply / 802.11n / 40 MHz / MCS0 / PWR 8****Lower Band Edge Peak Measurement****Restricted Band Edge Measurement****Result: Pass****Results: AC-DC Power Supply / 802.11ax / 40 MHz / MCS0 / PWR 5****Upper Band Edge Measurement****Result: Pass**

6. Measurement Uncertainty

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Confidence Level (%)	Calculated Uncertainty
Radiated Spurious Emissions	95%	±3.10 dB
Band Edge Radiated Emissions	95%	±3.10 dB
Transmitter Duty Cycle	95%	±3.4%

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

7. Used equipment

Test site: SR 1/2

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
1	Rohde & Schwarz	Antenna, Loop	HFH2-Z2	831247/012	18/07/2023	36
377	BONN Elektronik	Amplifier, Low Noise Pre	BLMA 0118-1A	025294B	18/07/2023	12
423	Bonn Elektronik	Amplifier, Low Noise Pre	BLMA 1840-1A	55929	18/07/2023	12
460	Deisel	Turntable	DT 4250 S	n/a	n/a	n/a
465	Schwarzbeck	Antenna, Trilog Broadband	VULB 9168	9168-240	02/09/2020	42
496	Rohde & Schwarz	Antenna, log. - periodical	HL050	100297	22/08/2022	24
588	Maturo	Controller	NCD	029/7180311	n/a	n/a
591	Rohde & Schwarz	Receiver	ESU 40	100244/040	13/07/2023	12
669	Rohde & Schwarz	EMI Test Receiver	ESW 44	103087	13/07/2023	18
607	Schwarzbeck	Antenna broadband horn antenna	BBHA 9170	9170-561	15/10/2019	48
608	Rohde & Schwarz	Switch Matrix	OSP 120	101227	lab verification	n/a
628	Maturo	Antenna mast	CAM 4.0-P	224/19590716	n/a	n/a
629	Maturo	Kippeinrichtung	KE 2.5-R-M	MAT002	n/a	n/a
-/-	Testo	Thermo-Hygrometer	608-H1	01	lab verification	n/a
328	SPS	AC/DC power distribution system	PAS 5000	A2464 00/2 0200	lab verification	n/a
1603665	Siemens Matsushita Components	semi-anechoic chamber SR1/ 2	-/-	B83117-A1421-T161	n/a	n/a
681	Maturo	Antenna mast, tilting	BAM4.5-P	402/0718.1	n/a	n/a

8. Report Revision History

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	44	-	Initial Version

--- END OF REPORT ---