TEST REPORT

Test Report No.: UL-RPT-RP-13831825-316-FCC

Applicant	:	InFarm Indoor Urban Farming GmbH
Model No.	:	Infarm Gateway
FCC ID	:	Contains 2A2CI-INF001-WF & Contains 2A2CI-INF001-CL
Technology	:	WLAN 2.4 GHz (802.11 b, g, n)
Test Standard(s)	:	FCC Parts 15.207, 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 1.1 supersede Version 1.0 with immediate effect**
   Test Report No. UL-RPT-RP-13831825-316-FCC Version 1.1, Issue Date 08 APRIL 2022 replaces
   Test Report No. UL-RPT-RP-13831825-316-FCC Version 1.0, Issue Date 31 MARCH 2022, which is no longer valid.
5. Result of the tested sample: **PASS**

Prepared by: Sercan, Usta
Title: Laboratory Engineer
Date: 08 April 2022

Approved by: Ajit, Phadtare
Title: Lead Test Engineer
Date: 08 April 2022

Deutsche Akkreditierungsstelle D-PL-19381-02-00

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

UL INTERNATIONAL GERMANY GMBH
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1. Customer Information

1.1. Applicant Information

Company Name:	InFarm Indoor Urban Farming GmbH
Company Address:	Colditzstr. 30 12099 Berlin, Germany
Company Phone No.:	+49 (0) 30991916590
Company E-Mail:	info@infarm.com
Contact Person:	Ibrahim Oguz Yildirim
Contact E-Mail Address:	ibrahimoguz.yildirim@infarm.com
Contact Phone No.:	+49 (0) 30991916590

1.2. Manufacturer Information

Company Name:	InFarm Indoor Urban Farming GmbH
Company Address:	Colditzstr. 30 12099 Berlin, Germany
Company Phone No.:	+49 (0) 30991916590
Company E-Mail:	info@infarm.com
Contact Person:	Ibrahim Oguz Yildirim
Contact E-Mail Address:	ibrahimoguz.yildirim@infarm.com
Contact Phone No.:	+49 (0) 30991916590

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:	47CFR15.207 and 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209

Location

Location of Testing:	UL International Germany GmbH Hedelfinger Str. 61 70327 Stuttgart Germany
Test Firm Registration:	399704

Date information

Order Date:	17 May 2021
EUT arrived:	11 August 2021
Test Dates:	27 August 2021 to 22 March 2022
EUT returned:	-/-

2.2. Summary of Test Results

Clause	Measurement	Complied	Did not comply	Not performed	Not applicable
Part 15.207	Transmitter AC Conducted Emissions	☒	☐	☐	☐
Part 15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth(2)	☐	☐	☒	☐
Part 15.35(c)	Transmitter Duty Cycle(1)	☒	☐	☐	☐
Part 15.247(e)	Transmitter Power Spectral Density(2)	☐	☐	☒	☐
Part 15.247(b)(3)	Transmitter Maximum Output Power(2)	☐	☐	☒	☐
Part 15.247(d) & 15.209(a)	Transmitter Radiated Emissions	☒	☐	☐	☐
Part 15.247(d) & 15.209(a)	Transmitter Band Edge Radiated Emissions	☒	☐	☐	☐

Note(s):

1. The measurement was performed to assist in the calculation of the average measurements.
2. As per applicant's declaration FCC pre-approved radio module is integrated within the EUT therefore, only partial testing is performed.
   For further details refer FCC pre-approved radio module's (Model: v1.1 | FCC ID: 2APW6-FIN0110-CM2) | Report No. CCISE190808003| Ver 00 | Issue Date: 27-Dec-2019 | Centre Testing Shenzhen Zhongjian Nanfang Testing Co., Ltd.

2.3. Methods and Procedures

Reference:	ANSI C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Reference:	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
Title:	FCC KDB 996369 D04 Module Integration Guide v02 October 13, 2020
Reference:	Modular Transmitter Integration Guide Guidance for Host Product Manufacturers
Reference:	FCC KDB 174176 D01 Line Conducted FAQ v01r01 June 3, 2015
Title:	AC Power-Line Conducted Emissions Frequently Asked Questions

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:	Infarm
Model Name or Number:	Infarm Gateway
Test Sample Serial Number:	100101000221 (RF Test Sample with External SMA Connectors)
Hardware Version Number:	1.1.0
Firmware Version Number:	W15.68.19.p48-15.26.19.p48
FCC ID:	Contains 2A2CI-INF001-WF & Contains 2A2CI-INF001-CL

Brand Name:	MobileMark
Model:	SMW-414 multiband, 4-cable Global Cellular/LTE, WiFi & GPS
Test Sample Serial Number:	N/A
Additional Info:	External Antenna (Acre)

3.2. Description of EUT

The equipment under test was a host product supporting Bluetooth Low Energy (BLE), WiFi 2.4 GHz operations in 2.4 - 2.4835 GHz ISM band, WiFi 5 GHz operations in U-N-II bands and Cellular operations in UMTS Band 2 & 5, LTE Band 2, 4, 5, 7& 12 bands.

3.3. Modifications Incorporated in the EUT

Following modifications were applied to the EUT during testing.

- In order to avoid unwanted emissions from EUT as part of EUT filtering two ferrites (Manufacturer: Würth Elektronik | Type: 742 717 33 | Passthrough) was placed just outside the EUT's enclosure and near AC/DC power supply on the DC power supply cable.

  Therefore, manufacturer must include these additional ferrites on the AC/DC power supply cable; to ensure compliant results.

3.4. Additional Information Related to Testing

Category of Equipment:	WLAN 2.4 GHz (IEEE 802.11b, g, n) Digital Transmission System		
Type of Radio Device:	Transceiver		
Power Supply Requirement(s):	Nominal	6 - 24 (V) DC (Used voltage 12 V DC)	
Temperature Requirement(s):	Nominal	25°C	
	Minimum	-25°C	
	Maximum	70°C	
Relative Humidity	30%		
Supported Transmit Operating Mode(s):	802.11b/g/n HT20 (Note 1)		
Worst Case Data Rates:	802.11b HT20	1 Mbps (SISO) (Note 1) (Note 2)	
Worst Case Modulation Types:	802.11b HT20	DBPSK	
Nominal Channel Bandwidth:	20 MHz		
Antenna Type:	Multiband External Antenna		
Antenna Details:	4-Cable Multiband| SMW-414 multiband| MobileMark l SMA Connector I Cable 2		
Antenna Gain:	5 dBi		
Transmit Frequency Range:	2412 MHz to 2462 MHz		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	1	2412
	Middle	6	2437
	Top	11 (Note 2)	2462
Highest Frequency Generated or Used in the EUT or on which the EUT operates or tunes	5290 MHz (oscillator freq. for RF application) 1200 MHz (oscillator freq. for internal functionality e.g. bus/ CPU clock etc)		
Scope of Partial Host Product Testing:	FCC KDB 996369 D04 Section 3.0		
Has modular transmitter been fully tested by the module grantee on the required number of channels, modulation types, and modes?	☒ Yes	☐ No	☐ Not Known
Are emissions occurring due to the intermixing of emissions with the other transmitters, digital circuitry, or due to physical properties of the host product (enclosure) checked & measured?	☒ Yes	☐ No	☐ Not Stated
Frequency Range of Radiated Measurements:	FCC Part 15.33(a)(1): intentional radiator operates below 10 GHz: to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.		

(Note 1) For further details refer FCC pre-approved radio module's (Model: v1.1 | FCC ID: 2APW6-FIN0110-CM2) | Report No. CCISE190808003| Ver 00 | Issue Date: 27-Dec-2019 | Centre Testing Shenzhen Zhongjian Nanfang Testing Co., Ltd.
(Note 2) In accordance with FCC KDB 996369 D04 Section 3.4 (b) the Host Product testing has been performed on unwanted (spurious) radiated emissions on the worst-case modulation and channel per frequency range as shown in original filing (Model: v1.1 | FCC ID: 2APW6-FIN0110-CM2)

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	Laptop (labtool v2.0.0.93 software installed)	HP	Probook 650 G1	5CG6143YWB
2	Ethernet Cable (2m)	N/A	N/A	N/A

B. Support Equipment (Manufacturer supplied)

Item	Description	Brand Name	Model Name or Number	Serial Number
1	AC/DC Power Supply	Phoenix Contact	UNO-PS/1AC/12DC/100W	290299702051P1207 2020/12/17V

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes / Worst Case Identification

The EUT was tested in the following operating mode(s):
☒ Transmitter / Modulated Carrier Continuous Transmissions Mode WLAN 2.4 GHz, Worst Cases**: 802.11b I 1 Mbps I Power Settings: 12 (Max)
** These worst-case data rates are taken from FCC pre-approved radio module's (Model: v1.1 | FCC ID: 2APW6-FIN0110-CM2) | Report No. CCISE190808003| Ver 00 | Issue Date: 27-Dec-2019 | Centre Testing Shenzhen Zhongjian Nanfang Testing Co., Ltd. ** In accordance with FCC KDB 996369 D04 Section 3.4 (b) the Host Product testing has been performed on unwanted (spurious) radiated emissions on the worst-case modulation and channel per frequency range as shown in original filing

4.2. Configuration and Peripherals

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

- The applicant supplied documents containing the setup instructions and commands

  “Setting up direct test mode (DTM) on the balenaFin.pdf” and ‘’Labtool commands guide.pdf”

EUT Power Supply:

- The EUT was powered by 12 V DC power supply via AC/DC adapter.

Test Mode Activation:

- The test modes were activated using labtool v2.0.0.93 software which supplied by customer.
- The EUTs were configured to transmit test modes continuously with maximum power level.

AC Conducted Emissions Measurements:

- The EUT radiated sample was used for AC conducted emissions measurements.
- The Toyo EMI Software EP5/CE Ver 4.0.1. was used for these measurements.
- The AC conducted line emissions measurements were carried out with 120 V AC / 60 Hz & 240 V AC / 60 Hz.

Radiated Measurements:

- In accordance with ANSI C63.26, the EUT allows for the connection of external accessories, including external electrical control signals; hence EUT has been tested with the listed equipment under section 3.5 B which form part of a system. Therefore, were used for radiated spurious emission, measurements.
- Before starting final radiated spurious emission measurements “worst case verification” with the EUT in Standing-position & Laying-position and different positions of the antenna was performed by Lab.
- The EUT in Standing-position was found to be the worst case therefore this report includes relevant results.
- Antenna’s 3 input cables connected to EUT directly. 1 GPS port terminated with 50 Ohm termination.
- The radiated spurious emissions below 30 MHz were performed with the EUT positioned on the turn table and rotating 360 degrees while the loop antenna height was set to 80 cm.
- Radiated spurious emissions were performed with the EUT positioned on the turn table and rotating 360 degrees while the antenna height varies from 1 to 4 m over the measurement frequency range.
- R&S® EMC32 V10.60.10 Software was used for the Radiated spurious emission measurements.

Duty Cycle Correction Details:

- As the EUT continuous transmission of the EUT (D ≥ 98%) can be achieved and EUT was transmitting continuously with a constant Duty Cycle of ≥ 98% (duty cycle variations are less than ±2%). Therefore, a Duty Cycle Correction Factor of was not needed.

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 AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Asim Shahzad	**Test Dates:**	26 & 29 November 2021
Test Sample Serial Number:	100101000221(RF Test Sample with External SMA Connectors)		
Test Site Identification	SR 7/8		

FCC Reference:	Part 15.207
Test Method Used:	ANSI C63.10 Section 6.2 / FCC KDB 174176 and notes below

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	35

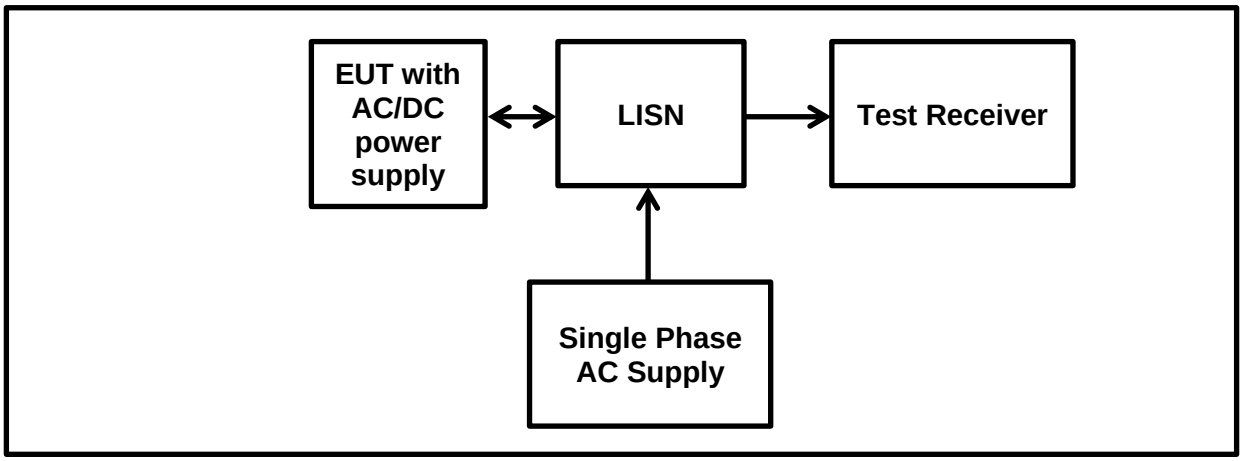
Settings of the Instrument

Detector	Quasi Peak/ Average Peak

Note(s):

1. Measurements were performed in shielded room (SR7/ 8 Asset Number 1603671). The EUT was placed at a height of 10 cm above the reference ground plane and in a distance of 40 cm from the vertical ground plane at the edge of the table.
2. Measurement software used: Toyo EMI Software; CE measurement software EP5/CE Ver 4.0.1.
3. The EUT was plugged into a AC/DC Power Supply. The Power Supply was connected to 120 VAC / 60 Hz and 240 VAC / 60 Hz single phase supply via a LISN.
4. In accordance with FCC KDB 174176 Q4, tests were performed with a 240 VAC 60 Hz single phase supply as this was within the voltage range marked on the 100-240 VAC~50/60 Hz power supply.
5. The EUT was configured on WLAN 2.4 802.11b Mode :1 Mbps | Power Settings: 12 | Top Channel
6. All other emissions shown on the pre-scan plot were investigated. Only the highest 6 emissions have been reported in the tables below in accordance with ANSI C63.10 section 6.2.5.
7. The final measured value, for the given emission, in the table below incorporates the cable loss. Calculation: Level = test receiver reading + path loss (cable attenuation + correction LISN).

Test setup:



Transmitter AC Conducted Spurious Emissions (continued)

Results: 802.11b / 20 MHz / 1 Mbps / MAX PWR / Top Channel

Results: 120 VAC 60 Hz / Live / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.15171	Live	40.70	65.90	25.20	Complied
0.17148	Live	37.50	64.90	27.40	Complied
0.35288	Live	35.50	58.90	23.40	Complied
2.00056	Live	20.60	56.00	35.40	Complied
3.65341	Live	16.40	56.00	39.60	Complied
9.87341	Live	22.30	60.00	37.70	Complied

Results: 120 VAC 60 Hz / Live / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.15171	Live	24.10	55.90	31.80	Complied
0.17148	Live	21.10	54.90	33.80	Complied
0.35288	Live	33.30	48.90	15.60	Complied
2.00056	Live	16.40	46.00	29.60	Complied
3.65341	Live	13.00	46.00	33.00	Complied
9.87341	Live	16.70	50.00	33.30	Complied

Results: 120 VAC 60 Hz / Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.18027	Neutral	33.00	64.50	31.50	Complied
0.24231	Neutral	24.20	62.00	37.80	Complied
0.34858	Neutral	32.90	59.00	26.10	Complied
2.79569	Neutral	21.40	56.00	34.60	Complied
5.99798	Neutral	16.40	60.00	43.60	Complied
9.51071	Neutral	21.80	60.00	38.20	Complied

Transmitter AC Conducted Spurious Emissions (continued)

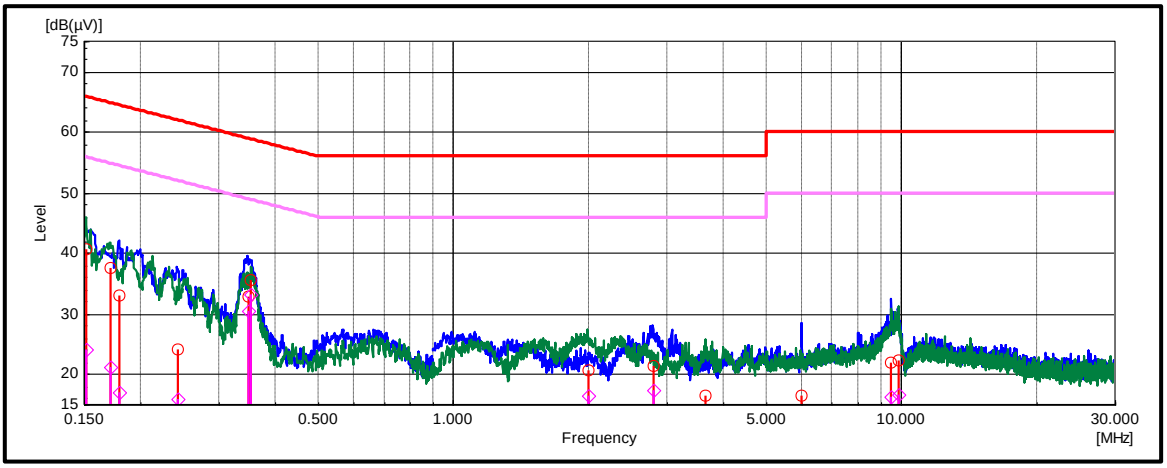
Results: 802.11b / 20 MHz / 1 Mbps / MAX PWR / Top Channel

Results: 120 VAC 60 Hz / Neutral / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.18027	Neutral	17	54.5	37.5	Complied
0.24231	Neutral	15.9	52	36.1	Complied
0.34858	Neutral	30.4	49	18.6	Complied
2.79569	Neutral	17.4	46	28.6	Complied
5.99798	Neutral	10.8	50	39.2	Complied
9.51071	Neutral	16.3	50	33.7	Complied

Result: Pass

Plot: 120 VAC 60 Hz / Live and Neutral Line



Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Transmitter AC Conducted Spurious Emissions (continued)

Results: 802.11b / 20 MHz / 1 Mbps / MAX PWR / Top Channel

Results: 240 VAC 60 Hz / Live / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.15608	Live	32.80	65.70	32.90	Complied
0.21588	Live	29.30	63.00	33.70	Complied
0.36122	Live	33.00	58.70	25.70	Complied
2.00563	Live	23.30	56.00	32.70	Complied
9.77890	Live	22.90	60.00	37.10	Complied
15.99695	Live	14.10	60.00	45.90	Complied

Results: 240 VAC 60 Hz / Live / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.15608	Live	19.0	55.70	36.70	Complied
0.21588	Live	16.60	53.00	36.40	Complied
0.36122	Live	26.60	48.70	22.10	Complied
2.00563	Live	18.30	46.00	27.70	Complied
9.77890	Live	17.50	50.00	32.50	Complied
15.99695	Live	9.10	50.00	40.90	Complied

Results: 240 VAC 60 Hz / Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.16014	Neutral	32.30	65.50	33.20	Complied
0.23538	Neutral	25.10	62.30	37.20	Complied
0.34847	Neutral	29.40	59.00	29.60	Complied
1.21339	Neutral	25.30	56.00	30.70	Complied
2.93834	Neutral	22.70	56.00	33.30	Complied
9.65996	Neutral	24.80	60.00	35.20	Complied

Transmitter AC Conducted Spurious Emissions (continued)

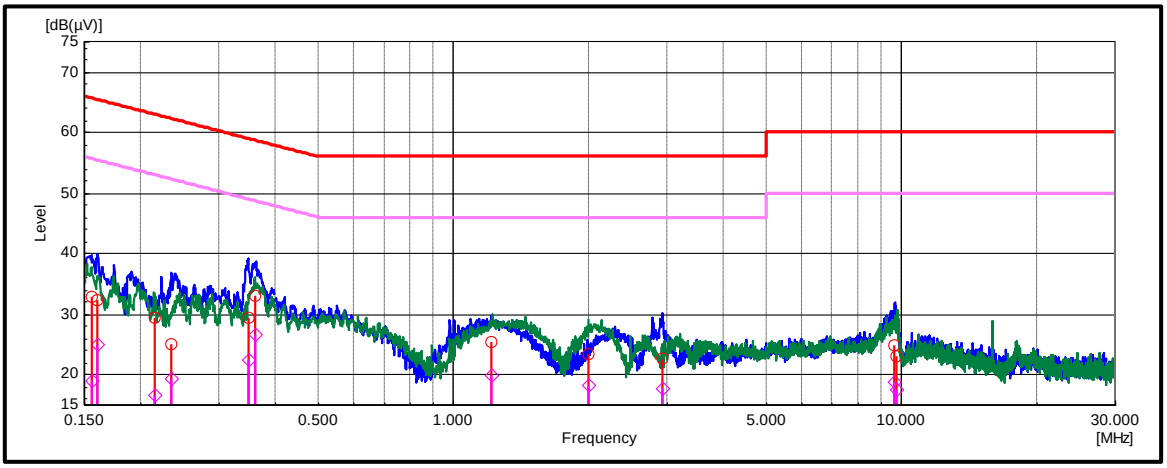
Results: 802.11b / 20 MHz / 1 Mbps / MAX PWR / Top Channel

Results: 240 VAC 60 Hz / Neutral / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.16014	Neutral	24.90	55.50	30.60	Complied
0.23538	Neutral	19.30	52.30	33.00	Complied
0.34847	Neutral	22.40	49.00	26.60	Complied
1.21339	Neutral	19.90	46.00	26.10	Complied
2.93834	Neutral	17.80	46.00	28.20	Complied
9.65996	Neutral	18.80	50.00	31.20	Complied

Result: Pass

Plot: 240 VAC 60 Hz / Live and Neutral Line



Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

5.2.2. Transmitter Duty Cycle

Test Summary:

Test Engineer:	Sercan Usta	**Test Date:**	24 November 2021
Test Sample Serial Number:	100101000221(RF Test Sample with External SMA Connectors)		
Test Site Identification	SR 1/2		

FCC Reference:	Part 15.35(c)
Test Method Used:	FCC KDB 558074 Section 6.0 referencing ANSI C63.10 Section 11.6

Environmental Conditions:

Temperature (°C):	24.9
Relative Humidity (%):	57.0

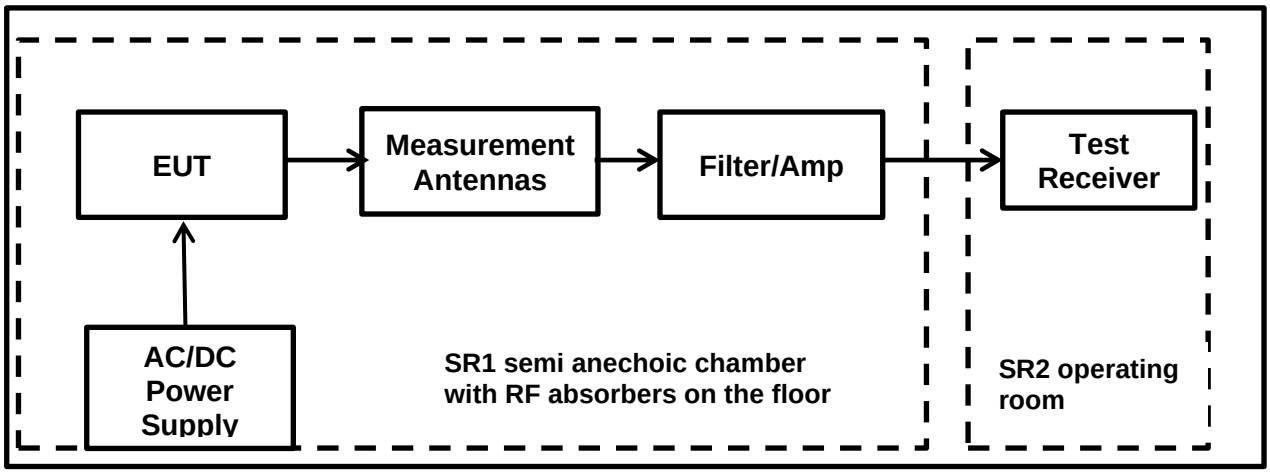
Notes:

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

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

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

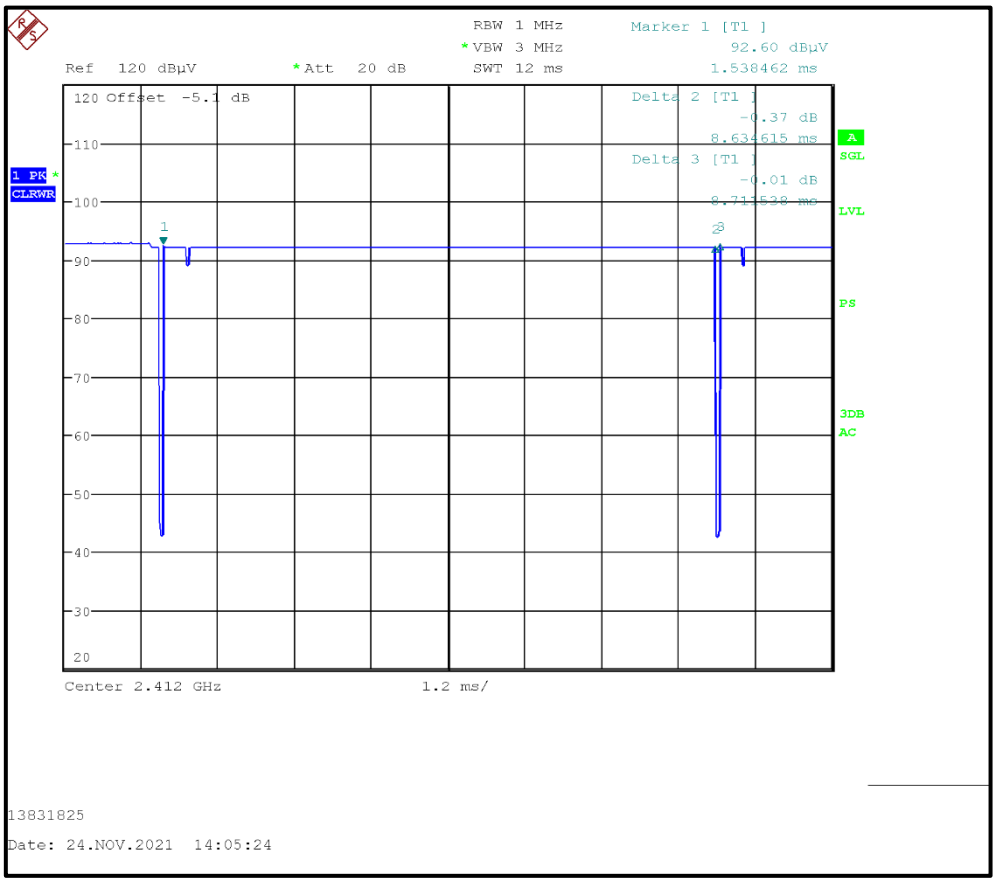
Test Setup:



Transmitter Duty Cycle (continued)

Results: 802.11b / 20 MHz / 1 Mbps / MAX PWR / Top Channel

Pulse On Time (T_{ON}) (ms)	Pulse Period (T_{ON} +T_{OFF}) (µs)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
8.634	8.712	99.10	0.00



Result: Pass

5.2.3. Transmitter Radiated Emissions

Test Summary:

Test Engineer:	Sercan Usta	**Test Date:**	16 November 2021
Test Sample Serial Number:	100101000221(RF Test Sample with External SMA Connectors)		
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:

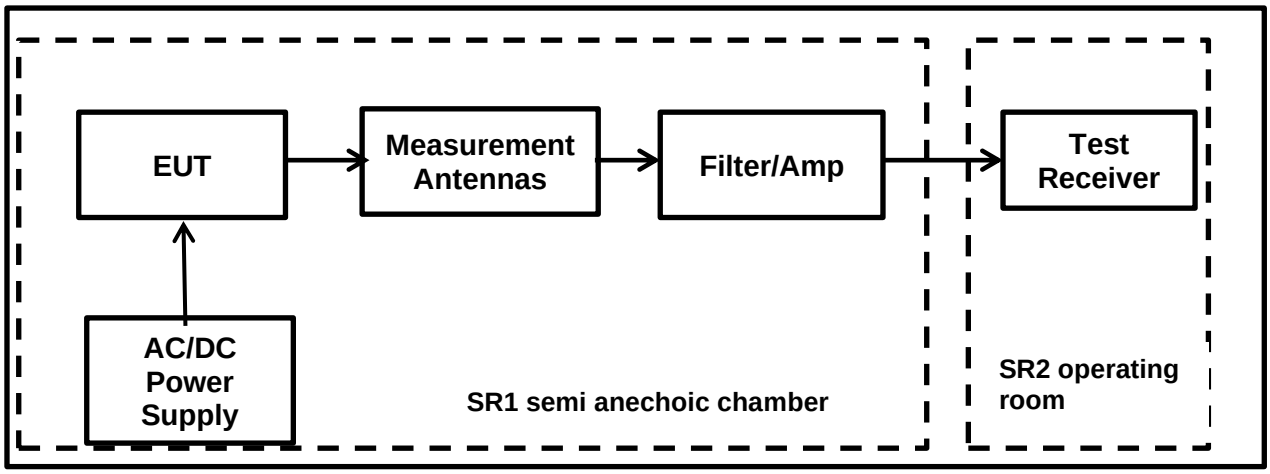
Temperature (°C):	23.1
Relative Humidity (%):	34.6

Note(s):

1. 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).
2. 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.
3. 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.
4. The preliminary scans showed similar emission levels below 1 GHz, for each channel. Therefore, final radiated emissions measurements were performed with the EUT set to the following worst-case modes:
    - 802.11b: 1 Mbps | Power Settings: Max | Top Channel
5. All emissions shown on the pre-scans were investigated and found to be > 20 dB below the applicable limits.
6. 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 80 cm.
7. 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

Transmitter Radiated Emissions (continued)

Test Setup:

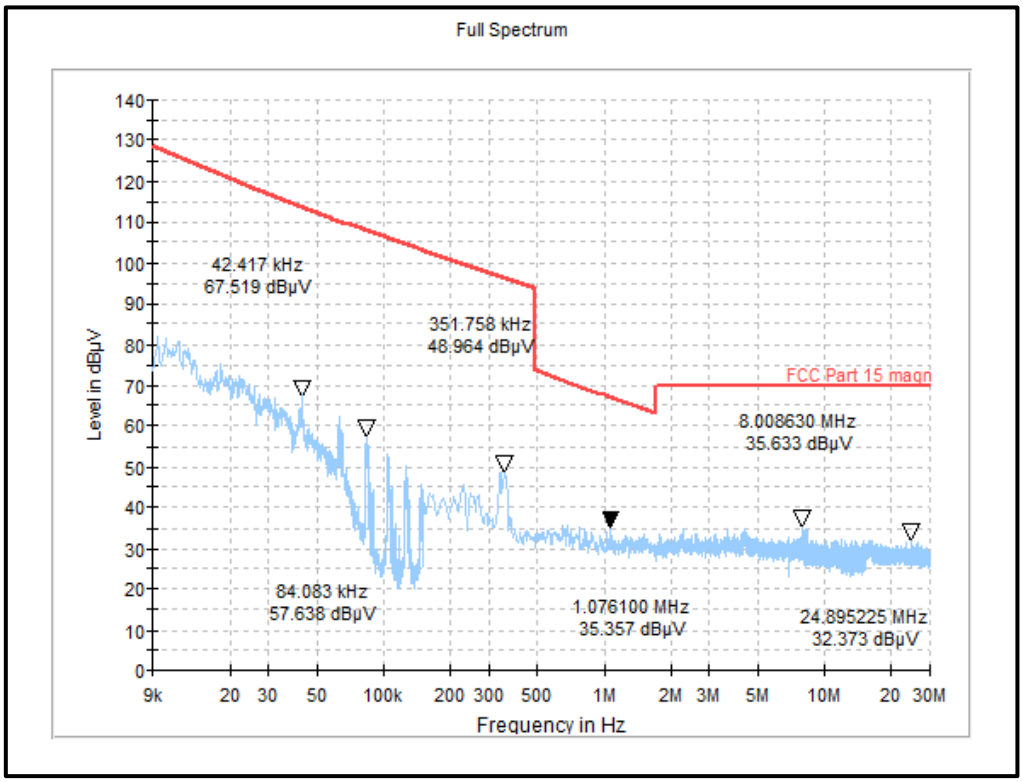


Transmitter Radiated Emissions (continued)

Results: 802.11b / 20 MHz / 1 Mbps / MAX PWR / Top Channel

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

Plot: 9 kHz – 30 MHz: 802.11b / 20 MHz / 1 Mbps / MAX PWR / Top Channel



Result: Pass

Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineer:	Sercan Usta	**Test Date:**	12 November 2021 & 22 March 2022
Test Sample Serial Number:	100101000221(RF Test Sample with External SMA Connectors)		
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:

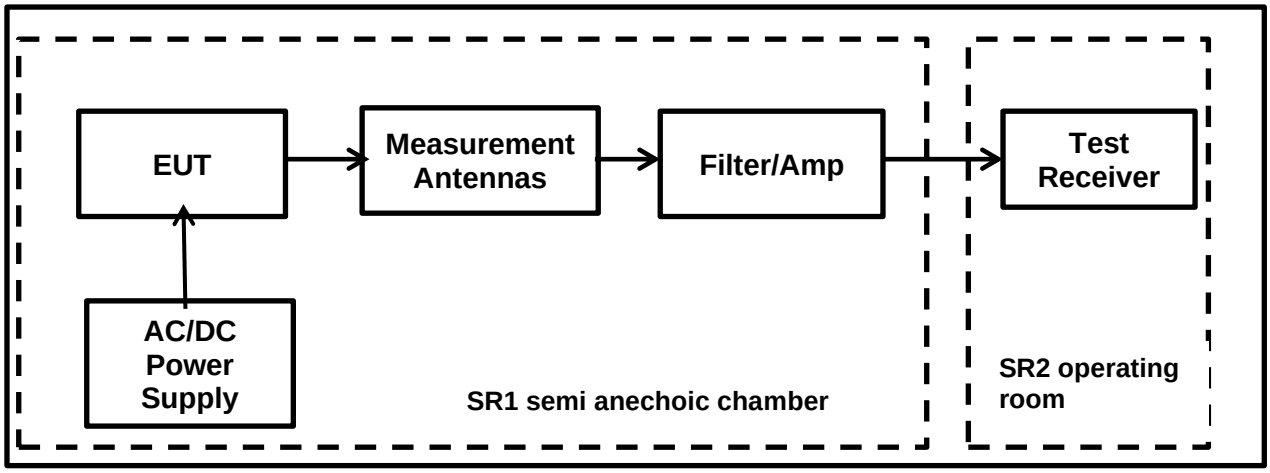
Temperature (°C):	24.5 & 25
Relative Humidity (%):	46.7 & 34

Note(s):

1. Measurements below 1 GHz 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. Maximum emission levels were determined by height searching the measurement antenna over the range 1 m to 4 m.
2. 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.
3. Final measurements were performed with the test receiver resolution bandwidth was set to 120 kHz and video bandwidth 500 kHz. A Quasi peak detector was used, sweep time was set to auto and trace mode was Max Hold.
4. The testing has been performed on unwanted (spurious) radiated emissions on the worst-case modulation as shown in original filing and the preliminary scans showed similar emission levels below 1 GHz, for each channel. Therefore, final radiated emissions measurements were performed with the EUT set to the following worst-case modes:
    - 802.11b: 1 Mbps | Power Settings: Max | Top Channel
5. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
6. All other emissions shown on the pre-scan plots were investigated and found to be below system noise floor.

Transmitter Radiated Emissions (continued)

Test Setup:

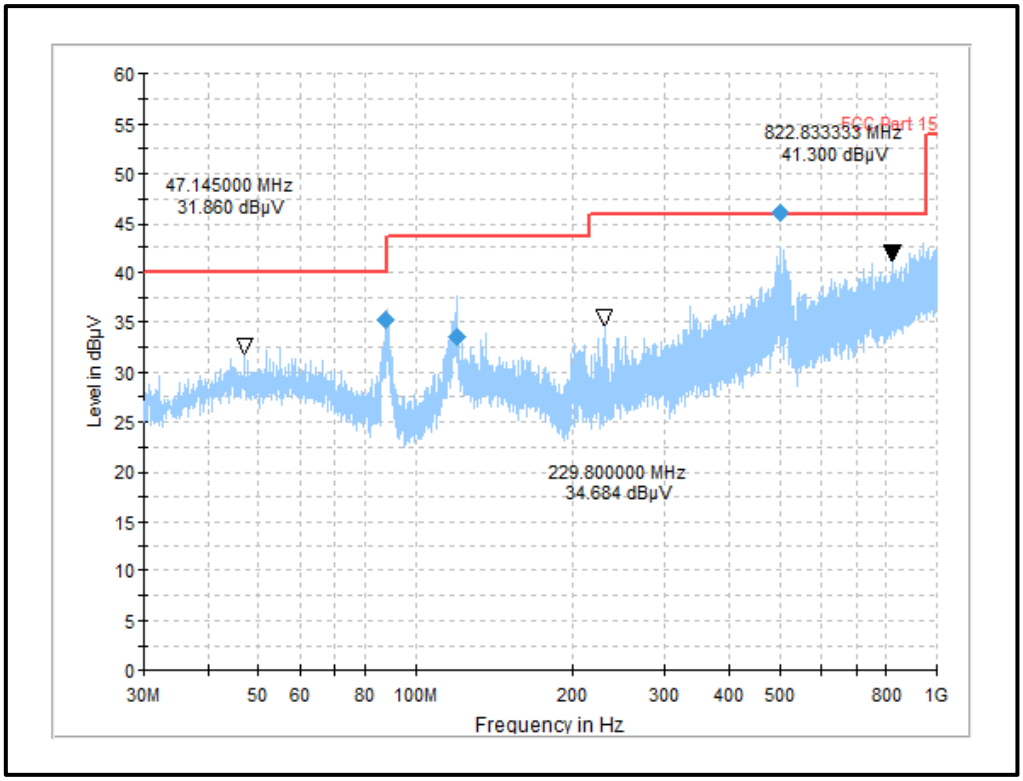


Transmitter Radiated Emissions (continued)

Results: 802.11b / 20 MHz / 1 Mbps / MAX PWR / Top Channel

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
87.78	Vertical	35.12	40.00	4.88	Complied
120.14	Vertical	33.56	43.50	9.94	Complied

Plot: 30 MHz – 1GHz: 802.11b / 20 MHz / 1 Mbps / MAX PWR / Top Channel



Pre-scan with MaxPeak Detector

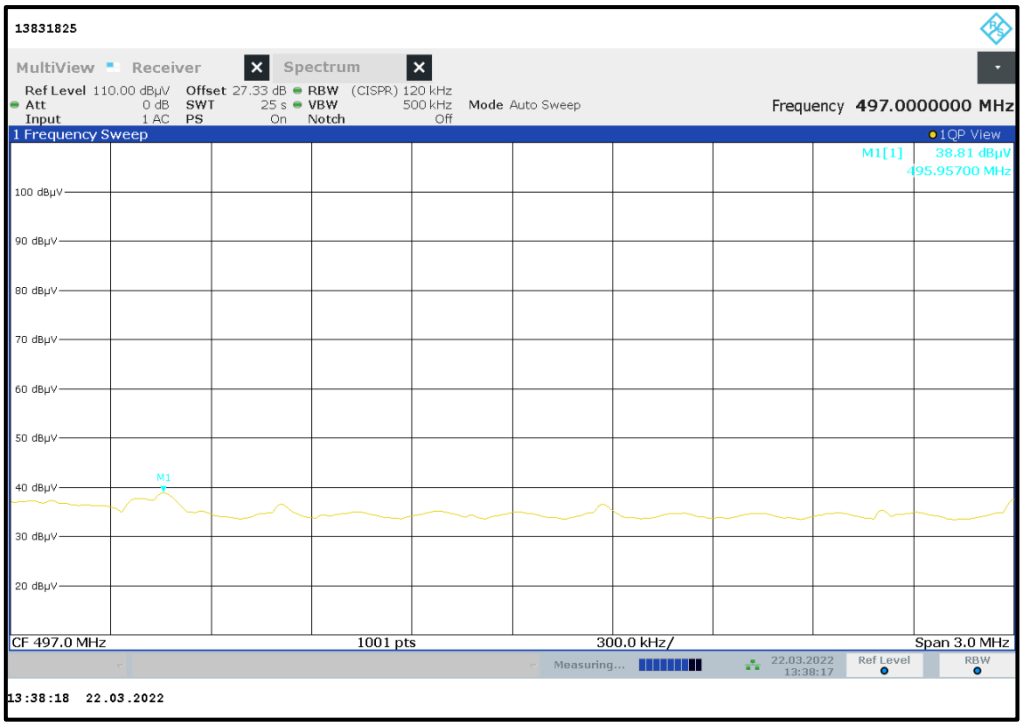
Result: Pass

Transmitter Radiated Emissions (continued)

Results: Final Measurment @ 497 MHz

Frequency (MHz)	Antenna Polarization	Quasi-Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
495.96	Vertical	38.81	46.00	7.19	Complied

Plot: Final Measurment @ 497 MHz : 802.11b / 20 MHz / 1 Mbps / MAX PWR / Top Channel



Final Measurment @ 497 MHz with QuasiPeak Detector

Result: Pass

Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineer:	Sercan Usta	**Test Date:**	27 August 2021
Test Sample Serial Number:	100101000221(RF Test Sample with External SMA Connectors)		
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 25 GHz

Environmental Conditions:

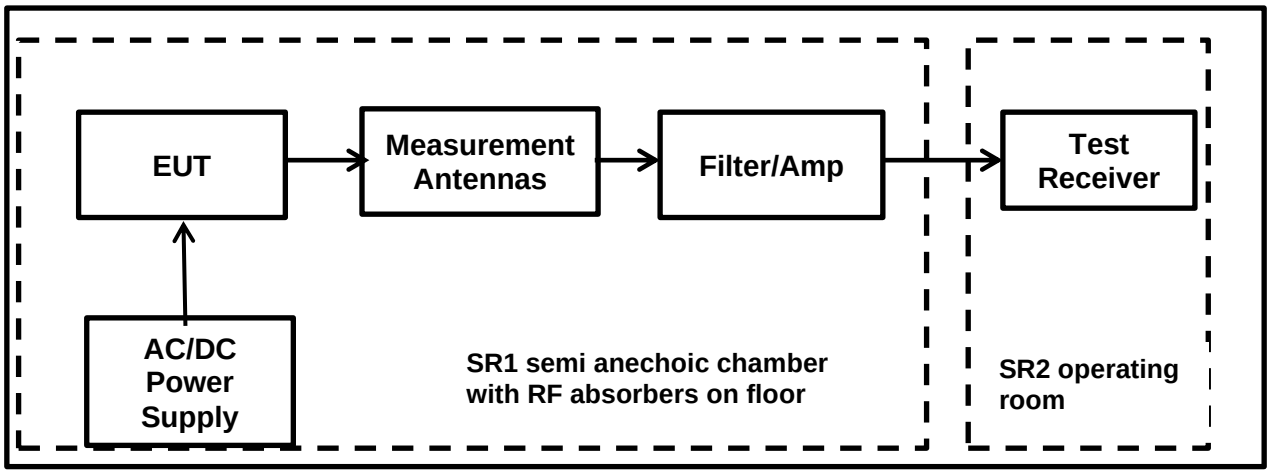
Temperature (°C):	24.0
Relative Humidity (%):	44.8

Note(s):

1. 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.
2. Pre-scans 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 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.
3. For frequency range between 1 GHz and 18 GHz, all emissions shown on the pre-scan plots were investigated and found to be below system noise floor.
4. The testing has been performed on unwanted (spurious) radiated emissions on the worst-case modulation as shown in original filing and the preliminary scans showed similar emission levels above 18 GHz, for each channel. Therefore, final radiated emissions measurements were performed with the EUT set to the following worst-case modes:
    - 802.11b: 1 Mbps | Power Settings: Max | Top Channel
5. 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.
6. For frequency range between 18 GHz and 25 GHz, no critical emissions were found.

Transmitter Radiated Emissions Test setup

Test Setup:

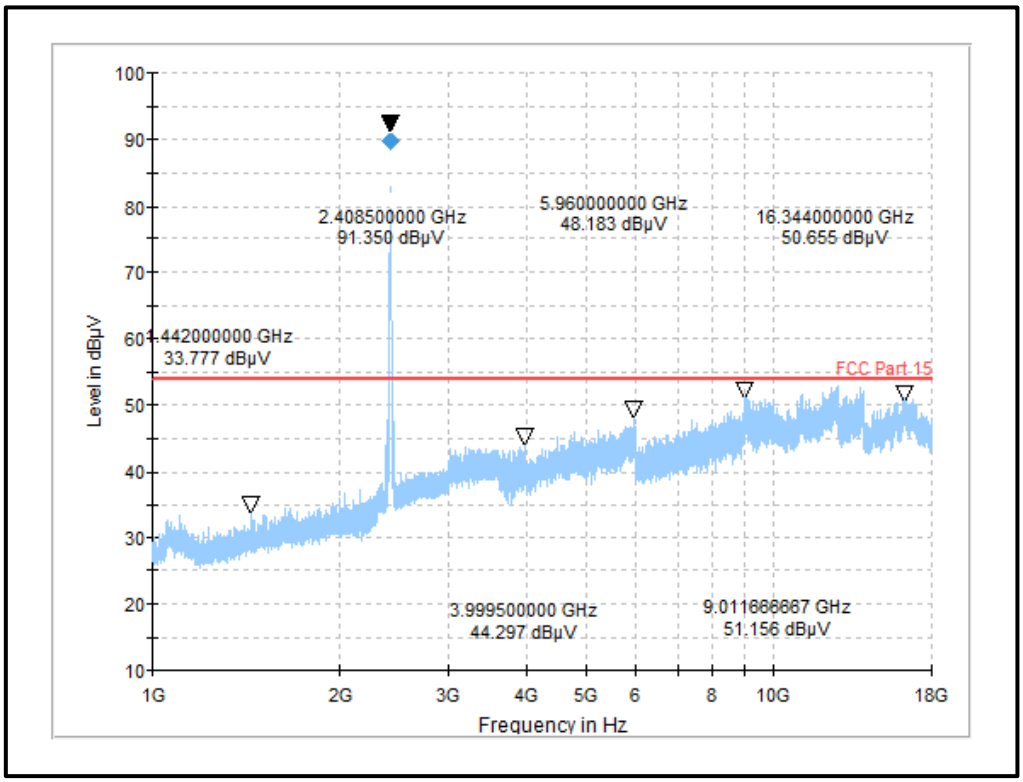


Transmitter Radiated Emissions (continued)

Results: 802.11b / 20 MHz / 1 Mbps / MAX PWR / Bottom Channel

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
No critical emissions were found					

Plot: 1 GHz – 18 GHz: 802.11b / 20 MHz / 1 Mbps / MAX PWR / Bottom Channel



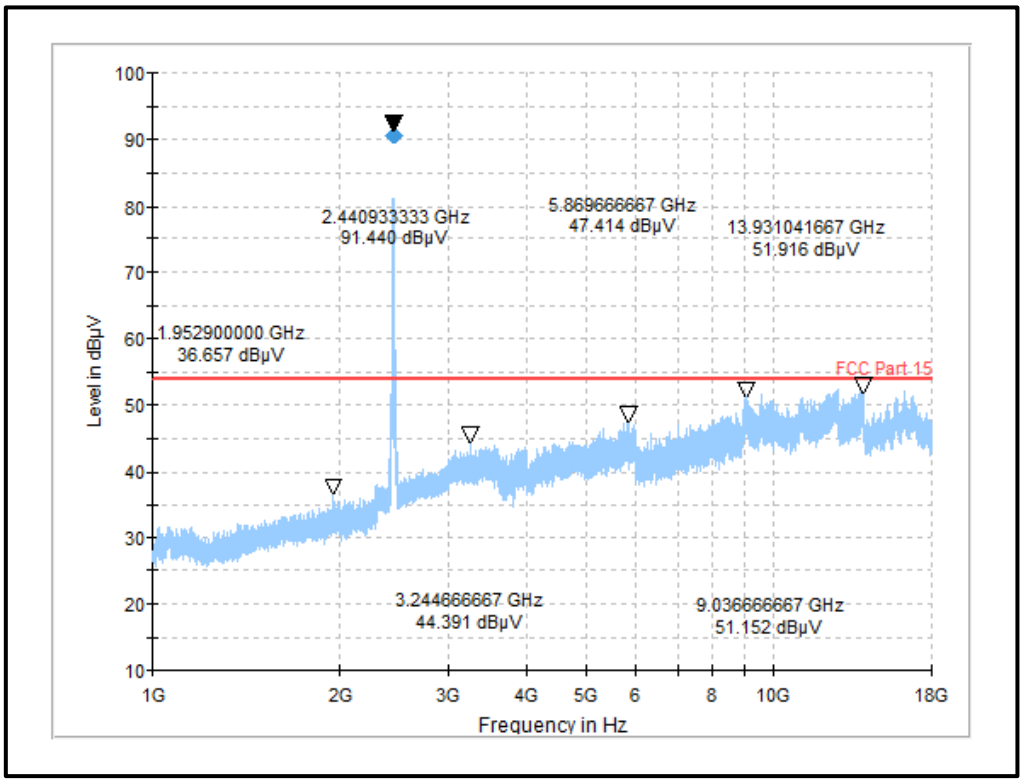
Result: Pass

Transmitter Radiated Emissions (continued)

Results: 802.11b / 20 MHz / 1 Mbps / MAX PWR / Middle Channel

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
No critical emissions were found					

Plot: 1 GHz – 18 GHz: 802.11b / 20 MHz / 1 Mbps / MAX PWR / Middle Channel



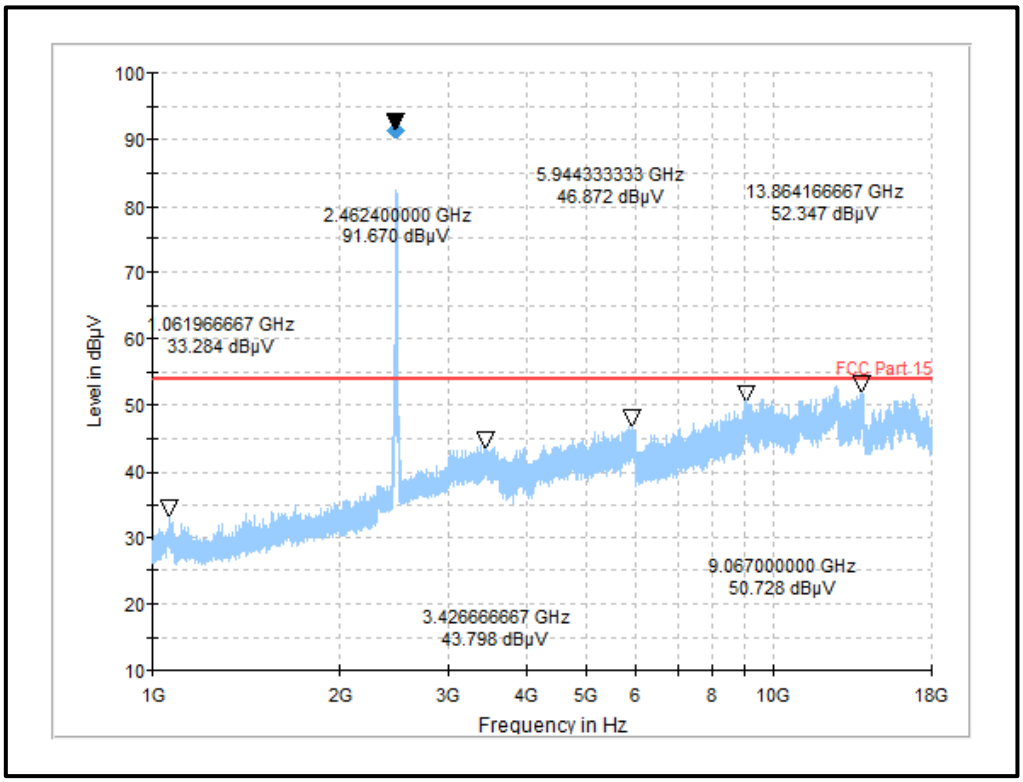
Result: Pass

Transmitter Radiated Emissions (continued)

Results: 802.11b / 20 MHz / 1 Mbps / MAX PWR / Top Channel

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
No critical emissions were found					

Plot: 1 GHz – 18 GHz: 802.11b / 20 MHz / 1 Mbps / MAX PWR / Top Channel



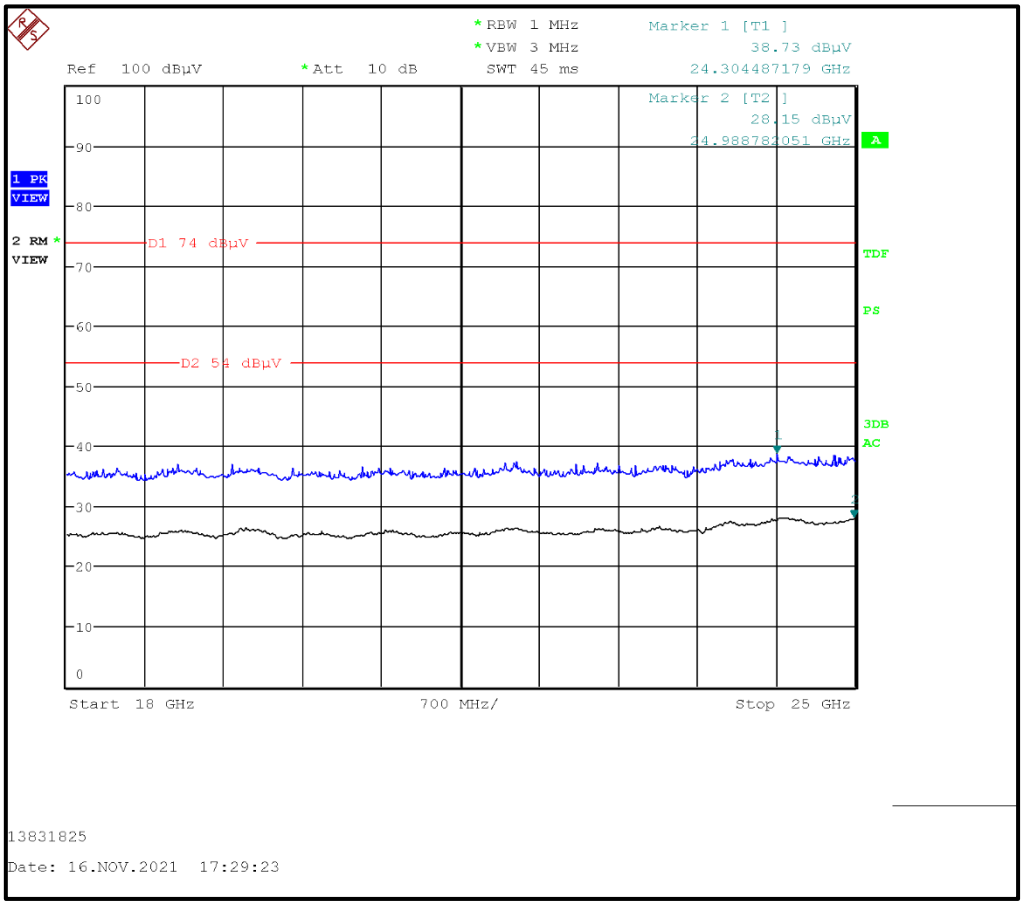
Result: Pass

Transmitter Radiated Emissions (continued)

Results: 802.11b / 20 MHz / 1 Mbps / MAX PWR / Top Channel

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

Plot: 18 GHz – 25 GHz: 802.11b / 20 MHz / 1 Mbps / MAX PWR / Top Channel



Result: Pass

5.2.4. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	Sercan Usta	**Test Date:**	27 August 2021
Test Sample Serial Number:	100101000221(RF Test Sample with External SMA Connectors)		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.247(d) & 15.209(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):	24.9
Relative Humidity (%):	57.0

Note(s):

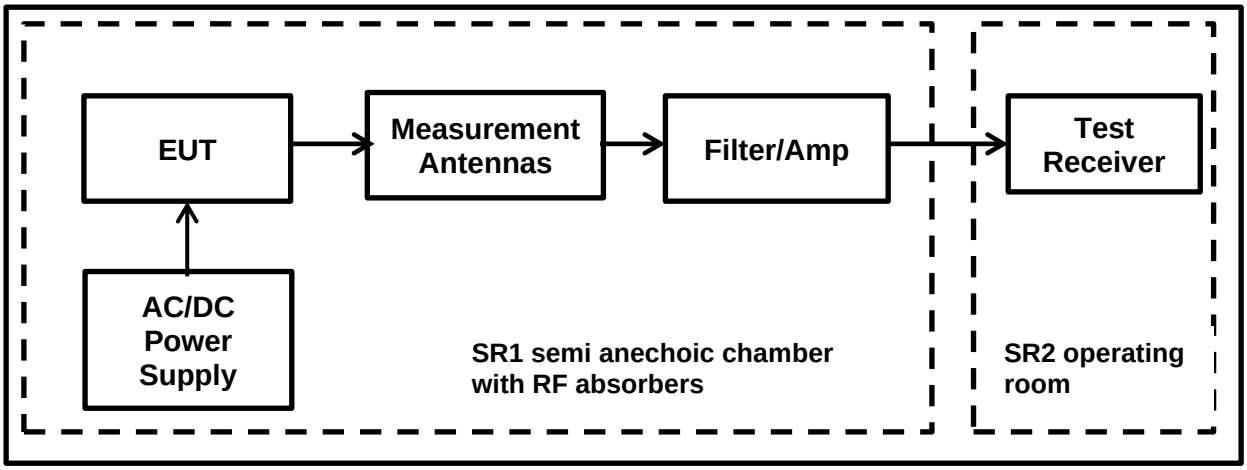
1. The measurements were in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) with RF absorbers on the floor at a distance of 3 m. The EUT was placed at a height of 1.5 m above the test chamber floor in the centre of the chamber turntable. Maximum emission levels were determined by height searching 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.
   As the maximum peak conducted 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 a sufficient length of time 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 ($D \geq 98\%$) achieved no duty cycle correction calculated.
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 linear 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 continuous transmission of the EUT ($D \geq 98\%$) can be achieved and EUT was transmitting continuously with a constant Duty Cycle of 99.10 % (duty cycle variations are less than ±2%). Therefore, a Duty Cycle Correction isn't necessary to correct the measured average values.

Test Setup:



Transmitter Band Edge Radiated Emissions (continued)

Results: 802.11b / 20 MHz / 1 Mbps / MAX PWR

Results: Lower Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
2397.83	43.09	69.75	26.66	Complied
2400.00	39.43	69.75	30.32	Complied

Results: 2310 to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2368.33	46.36	74.0	27.64	Complied

Results: 2310 to 2390 MHz Restricted Band / Average

Frequency (MHz)	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2381.54	36.63	54.0	17.37	Complied

Results: Upper Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2483.50	45.35	74.0	28.65	Complied
2508.88	48.06	74.0	25.94	Complied

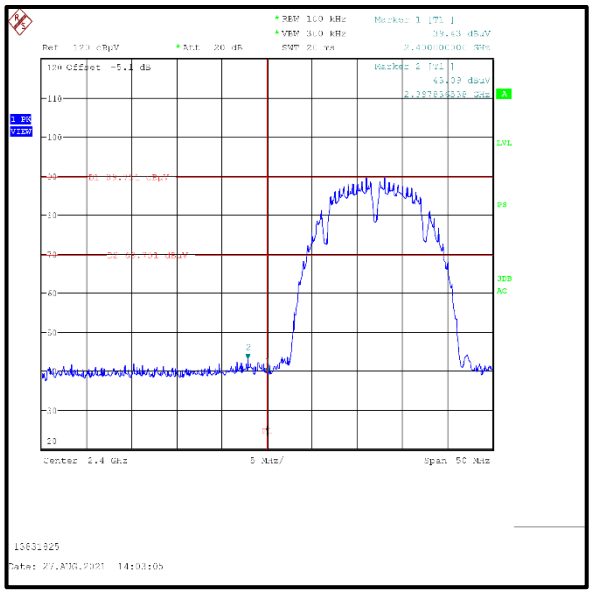
Results: Upper Band Edge / Average

Frequency (MHz)	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2483.50	36.27	54.0	17.73	Complied
2522.09	36.41	54.0	17.59	Complied

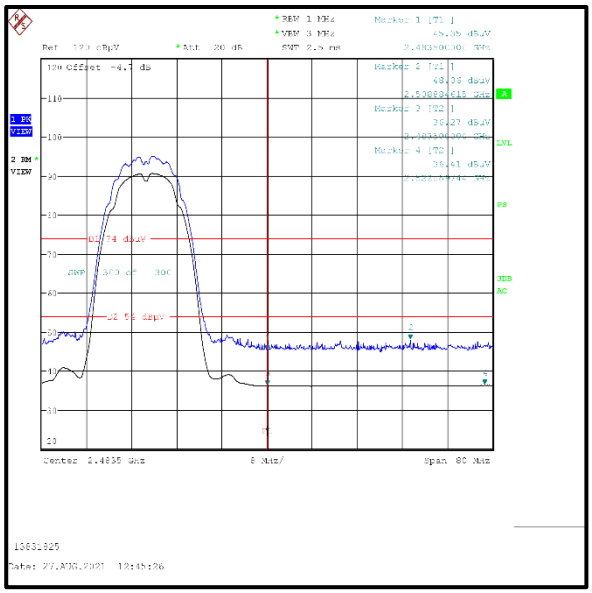
Result: Pass

Transmitter Band Edge Radiated Emissions (continued)

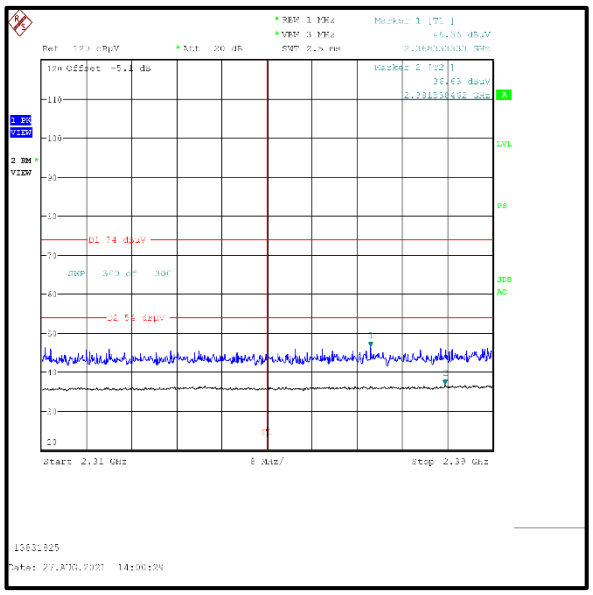
Results: 802.11b / 20 MHz / 1 Mbps / MAX PWR



Lower Band Edge Measurement



Upper Band Edge Measurement



2310 MHz to 2390 MHz Restricted Band Plot

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
AC Conducted Spurious Emissions	95%	±2.49 dB
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	10/07/2020	36
377	BONN Elektronik	Amplifier, Low Noise Pre	BLMA 0118-1A	025294B	16/07/2021	12
423	Bonn Elektronik	Amplifier, Low Noise Pre	BLMA 1840-1A	55929	16/07/2021	12
460	Deisel	Turntable	DT 4250 S	n/a	n/a	n/a
452	Schwarzbeck	Antenna, Trilog Broadband	VULB 9168	9168-240	02/09/2020	24
496	Rohde & Schwarz	Antenna, log. - periodical	HL050	100297	05/08/2020	36
607	Schwarzbeck	Antenna broadband horn antenna	BBHA 9170	9170-561	15/10/2019	36
587	Maturo	antenna mast, tilting	TAM 4.0-E	011/7180311	n/a	n/a
588	Maturo	Controller	NCD	029/7180311	n/a	n/a
591	Rohde & Schwarz	Receiver	ESU 40	100244/040	28/06/2021	12
669	Rohde & Schwarz	EMI Test Receiver	ESW44	103087	03/02/2022	12
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
1603665	Siemens Matsushita Components	semi-anechoic chamber SR1/ 2	-/-	B83117-A1421-T161	n/a	n/a

Test site: SR 7/8

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
23	Rohde & Schwarz	Artificial Mains Network	ESH3-Z5	831767/013	14/07/2021	12
349	Rohde & Schwarz	Receiver, EMI Test	ESIB7	836697/009	13/07/2021	12
-/-	Testo	Thermo-Hygrometer	608-H1	08	lab verification	n/a
327	SPS	AC/DC power distribution system	PAS 5000	A2464 00/1 0200	lab verification	n/a

8. Report Revision History

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	38	-	Initial Version
Test Report Version 1.1 supersede Version 1.0 with immediate effect Test Report No. UL-RPT-RP-13831825-316-FCC Version 1.1, Issue Date 08 APRIL 2022 replaces Test Report No. UL-RPT-RP-13831825-316-FCC Version 1.0, Issue Date 31 MARCH 2022, which is no longer valid.			
1.1	as below	as below	Current Version
	1	-	“Infarm Gateway WiFI” replaced with “Infarm Gateway”
	1	-	“2A2CI-INF001-WF” replaced with “"Contains 2A2CI-INF001-WF" and "Contains 2A2CI-INF001-CL"
	7	3.1	“Infarm Gateway WiFI” replaced with “Infarm Gateway” “2A2CI-INF001-WF” replaced with “"Contains 2A2CI-INF001-WF" and "Contains 2A2CI-INF001-CL"”
	7	3.2	Description of EUT updated
	8	3.4	Max power detail deleted
	23-26	5.2.3	Notes updated & plots renamed

--END of Test Report--