



TEST REPORT

Test Report No. : UL-RPT-RP-14186885-216-FCC

Applicant : Signify (China) Investment Co, Ltd
Model No. : 9290030171A
FCC ID : 2AGBW9290030171A
Technology : ZigBee (IEEE 802.15.4)
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 1.0
5. Result of the tested sample: **PASS**

Prepared by: Muhammad Faiq, Khan
Title: Project Engineer
Date: 11 November 2022

Approved by: Rachid, Acharkaoui
Title: Operations Manager
Date: 11 November 2022



Deutsche
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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.

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Table of Contents

1. Customer Information.....	4
1.1. Applicant Information	4
1.2. Manufacturer Information	4
2. Summary of Testing.....	5
2.1. General Information	5
Applied Standards	5
Location	5
Date information	5
2.2. Summary of Test Results	6
2.3. Methods and Procedures	6
2.4. Deviations from the Test Specification	6
3. Equipment Under Test (EUT)	7
3.1. Identification of Equipment Under Test (EUT)	7
3.2. Description of EUT	8
3.3. Modifications Incorporated in the EUT	8
3.4. Additional Information Related to Testing	9
3.5. Support Equipment	9
A. Support Equipment (In-house)	9
B. Support Equipment (Manufacturer supplied)	9
4. Operation and Monitoring of the EUT during Testing	10
4.1. Operating Modes	10
4.2. Configuration and Peripherals	11
5. Measurements, Examinations and Derived Results.....	12
5.1. General Comments	12
5.2. Test Results	13
5.2.1. Transmitter Maximum (Peak) Output Power	13
5.2.2. Transmitter Minimum 6 dB Bandwidth	16
5.2.3. Transmitter Radiated Emissions	18
5.2.4. Transmitter Band Edge Radiated Emissions	27
6. Measurement Uncertainty	31
7. Used equipment.....	32
8. Report Revision History	33

1. Customer Information

1.1.Applicant Information

Company Name:	Signify (China) Investment Co, Ltd
Company Address:	Building 9, No.888, Tianlin Road, 200233 Shanghai, China
Contact Person:	Mr. Tim Su
Contact E-Mail Address:	Tim.su@signify.com
Contact Phone No.:	+86 13482810669

1.2.Manufacturer Information

Company Name:	Insta GmbH
Company Address:	Hohe Steinert 10, 58509 Lüdenscheid, Germany
Contact Person:	Mr. T. Müller
Contact E-Mail Address:	t.mueller@insta.de
Contact Phone No.:	+49 2351 936-3420

2. Summary of Testing

2.1. General Information

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

Applied Standards

Location

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

Date information

Order Date:	20 January 2022
EUT arrived:	14 September 2022
Test Dates:	22 September 2022 to 28 September 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 ⁽¹⁾	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Part 15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Part 15.247(e)	Transmitter Power Spectral Density ⁽²⁾	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Part 15.247(b)(3)	Transmitter Maximum (Peak) Output Power	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Part 15.247(d) & 15.209(a)	Transmitter Radiated Emissions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Part 15.247(d) & 15.209(a)	Transmitter Band Edge Radiated Emissions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Note(s):

1. The DUT is a battery powered device.
2. In accordance with ANSI C63.10-2013 Section 11.10.1, PSD is not required if the maximum conducted output power is less than the PSD limit of 8 dBm / 3 kHz. The PSD level is therefore deemed to be equal to the measured total output power.

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

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:	Philips
Model Name or Number:	9290030171A
Test sample Serial Number:	DUT 3 (Radiated Test sample)
Hardware Version:	73405200
Software Version:	73781400
FCC ID:	2AGBW9290030171A

Brand Name:	Philips
Model Name or Number:	9290030171A
Test sample Serial Number:	DUT 7 (Radiated Test sample)
Hardware Version:	73405200
Software Version:	73781400
FCC ID:	2AGBW9290030171A

Brand Name:	Philips
Model Name or Number:	9290030171A
Test sample Serial Number:	DUT 11 (Radiated Test sample)
Hardware Version:	73405200
Software Version:	73781400
FCC ID:	2AGBW9290030171A

Brand Name:	Philips
Model Name or Number:	9290030171A
Test sample Serial Number:	DUT 1 (Conducted Test sample with SMA connector)
Hardware Version:	73405200
Software Version:	73781400
FCC ID:	2AGBW9290030171A

Brand Name:	Philips
Model Name or Number:	9290030171A
Test sample Serial Number:	DUT 5 (Conducted Test sample with SMA connector)
Hardware Version:	73405200
Software Version:	73781400
FCC ID:	2AGBW9290030171A

Brand Name:	Philips
Model Name or Number:	9290030171A
Test sample Serial Number:	DUT 10 (Conducted Test sample with SMA connector)
Hardware Version:	73405200
Software Version:	73781400
FCC ID:	2AGBW9290030171A

Note:

1. According to customer, there was no software available to configure the DUT into respective test modes. Therefore, customer provided the DUT's with permanently configured channels for the Radiated and conducted measurements. All the DUTs used in this test report are identical in performance.

3.2. Description of EUT

The equipment under test was a lightning control module with Model No. 9290030171A, supporting ZigBee (IEEE 802.15.4) operations in 2.4 - 2.4835 GHz ISM band.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Technology Tested:	ZigBee (IEEE 802.15.4) / (Digital Transmission System)		
Equipment Classification:	Digital Transmission System (DTS)		
Type of Unit:	Transceiver		
Operating Frequency Range:	2405 MHz to 2480 MHz		
Channel Spacing:	5 MHz		
Modulation:	O-QPSK		
Data Rate:	250 Kbit/s		
Temperature:	T _{nom}	25° C	
	T _{min}	0° C	
	T _{max}	40° C	
Maximum Measured Conducted Output Power:	6.56 dBm		
Peak Antenna Gain:	0.55 dBi		
Antenna Type:	Inverted F Antenna		
Antenna Details:	Integral Antenna		
Transmit Channels Tested:	Channel ID	RF Channel Number	Frequency (MHz)
	Bottom	11	2405
	Middle	18	2440
	Top	26	2480
Power Supply Requirement(s):	3 V DC via Internal battery		
Highest internally generated clock and/ or oscillator frequency:	38.4 MHz		

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	Laboratory AC/DC Power Supply	Aim - TTI	CPX400S	507111

B. Support Equipment (Manufacturer supplied)

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

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

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

- Zigbee Test Mode: Continuously transmitting modulated carrier with combination of
 - Data Rate: 250 kbps
 - Payload Type: PRBS9
 - Power Settings (MAX PWR): 6 dBm
 - Channels: Bottom / Middle / Top

4.2. Configuration and Peripherals

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

- The EUT was tested in a stand-alone configuration.
 - The EUT was not placed inside another device during testing for compliance requirements.
 - The EUT with its PCB was powered with external voltage supply cables.

EUT Power Supply:

- The EUT was powered with a 3V DC via external power supply to ensure a continuous current of 15mA.
- The battery was also equipped due to the ground conditions.

Test Mode Activation:

- The EUT was prepared to transmit continuously with max power when powered. Each EUT was configured to a single channel.

Conducted Measurements:

- All conducted measurements were carried out by using the EUT RF sample with SMA connector. The SMA RF cable's attenuation (maximum 0.5 dB@2.4GHz) was added to as a reference level offset to each of the conducted plots.

Radiated Measurements:

- All radiated measurements were carried out by using the EUT Radiated sample.
- Before starting final radiated measurements "worst case verification" with the EUT in Standing, Laying and 45° tilting position was performed.
- The EUT with its Integral antenna in standing position was found out to be the worst-case. Therefore, this report includes relevant test results
- The 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 to 100 cm.
- The radiated measurements above 30 MHz 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 V11.30.00 Software was used for the Radiated spurious emission measurements.

Duty Cycle Correction Details:

- 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 100% (duty cycle variations are less than $\pm 2\%$). Therefore, no Duty Cycle Correction Factor was necessary to the average measurements.

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 Maximum (Peak) Output Power

Test Summary:

Test Engineer:	Muhammad Faiq Khan	Test Date:	22 September 2022
Test Sample Serial Number:	DUT 1, DUT 5, DUT 10 (Conducted Test samples with SMA connector)		
Test Site Identification	SR 9		

FCC Reference:	Part 15.247(b)(3)
Test Method Used:	FCC KDB 558074 Section 8.3.1.1 referencing ANSI C63.10 Sections 11.9.1.1

Environmental Conditions:

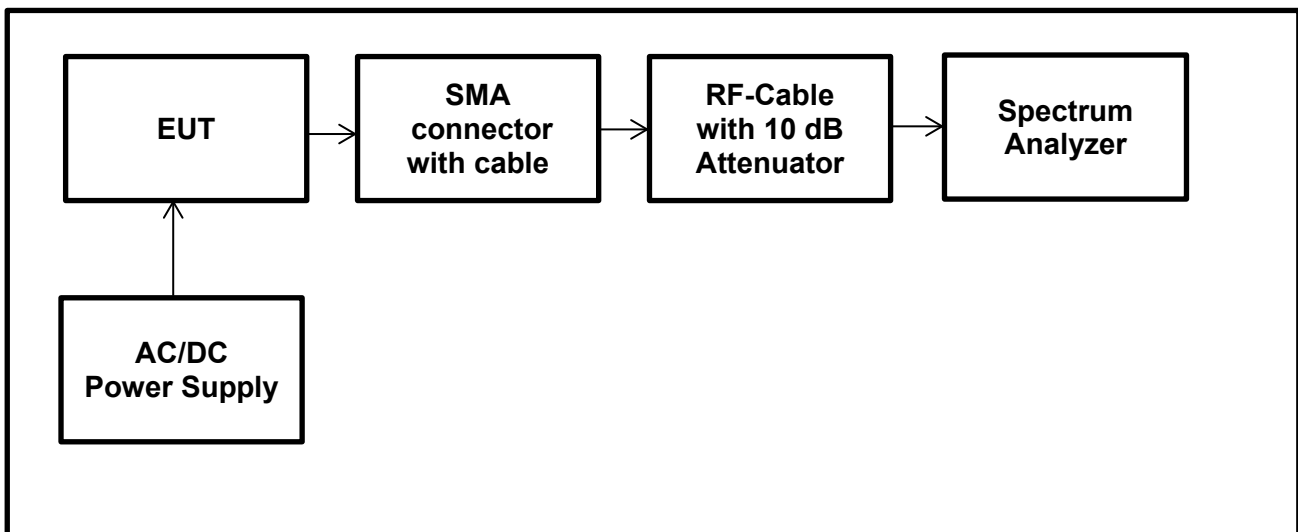
Temperature (°C):	24.3
Relative Humidity (%):	36.1

Notes:

3. The conducted power tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 8.3.1.1 with the RBW \geq DTS bandwidth referencing ANSI C63.10 Section 11.9.1.1.
4. The spectrum analyser resolution bandwidth was set to 3 MHz and video bandwidth of 10 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 10 MHz. A marker was placed at the peak of the signal and the results recorded in the table below.
5. The RF port on the EUT was connected to the spectrum analyser using suitable attenuation and RF cable. The measured values take into consideration the external attenuation correction factors.
 - o The SMA connector with RF Cable conncted to the EUT with maximum attenuation of 0.5 dB at the tested frequencies.
 - o The RF cable from the EUT to Analyzer with maximum attenuation of 0.5 dB at the tested frequencies including the 10 dB attenuator at the input of Spectrum Analyzer

Therefore, total a reference level offset 11.0 dB was added to each of the at the tested frequencies conducted plots.
6. The peak antenna gain was added to conducted power to obtain the EIRP.

Test Setup:



Transmitter Maximum (Peak) Output Power (continued)**Results : ZigBee - TX / PRBS9 / PWR MAX**

Channel	Conducted Peak Power (dBm)	Conducted Power Limit (dBm)	Margin (dB)	Result
Bottom	6.32	30.00	23.68	Complied
Middle	6.56	30.00	23.44	Complied
Top	6.25	30.00	23.75	Complied

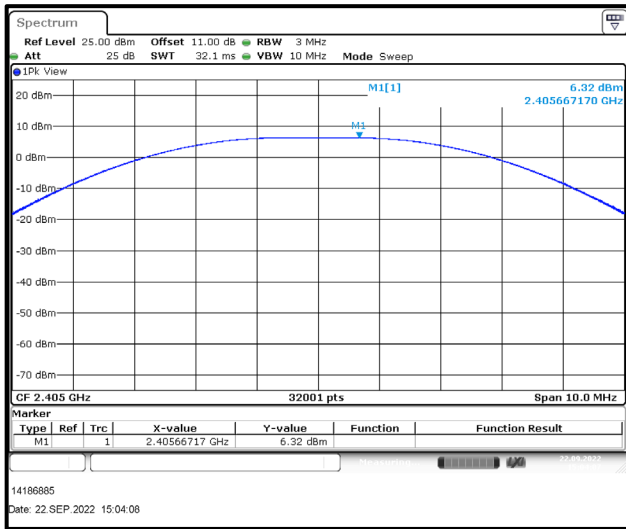
Results : ZigBee - TX / PRBS9 / PWR MAX / Antenna Gain

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
Bottom	6.32	0.55	6.87	36.00	29.13	Complied
Middle	6.56	0.55	7.11	36.00	28.89	Complied
Top	6.25	0.55	6.80	36.00	29.20	Complied

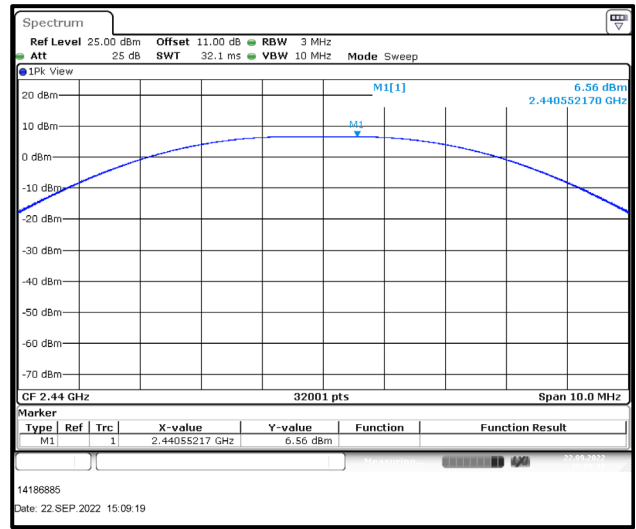
Result: Pass

Transmitter Maximum (Peak) Output Power (continued)

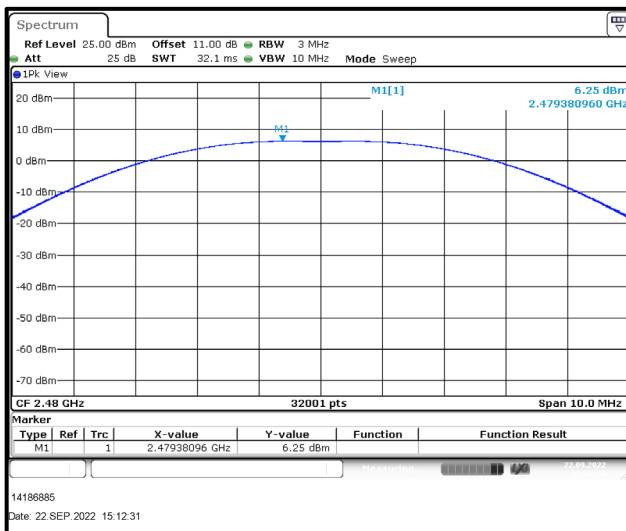
Plots : ZigBee - TX / PRBS9 / PWR MAX



Bottom Channel



Middle Channel



Top Channel

5.2.2. Transmitter Minimum 6 dB Bandwidth

Test Summary:

Test Engineer:	Muhammad Faiq Khan	Test Date:	22 September 2022
Test Sample Serial Number:	DUT 1, DUT 5, DUT 10 (Conducted Test samples with SMA connector)		
Test Site Identification	SR 9		

FCC Reference:	Part 15.247(a)(2)
Test Method Used:	FCC KDB 558074 Section 8.2 referencing ANSI C63.10:2013 Section 11.8.1 Option 1

Environmental Conditions:

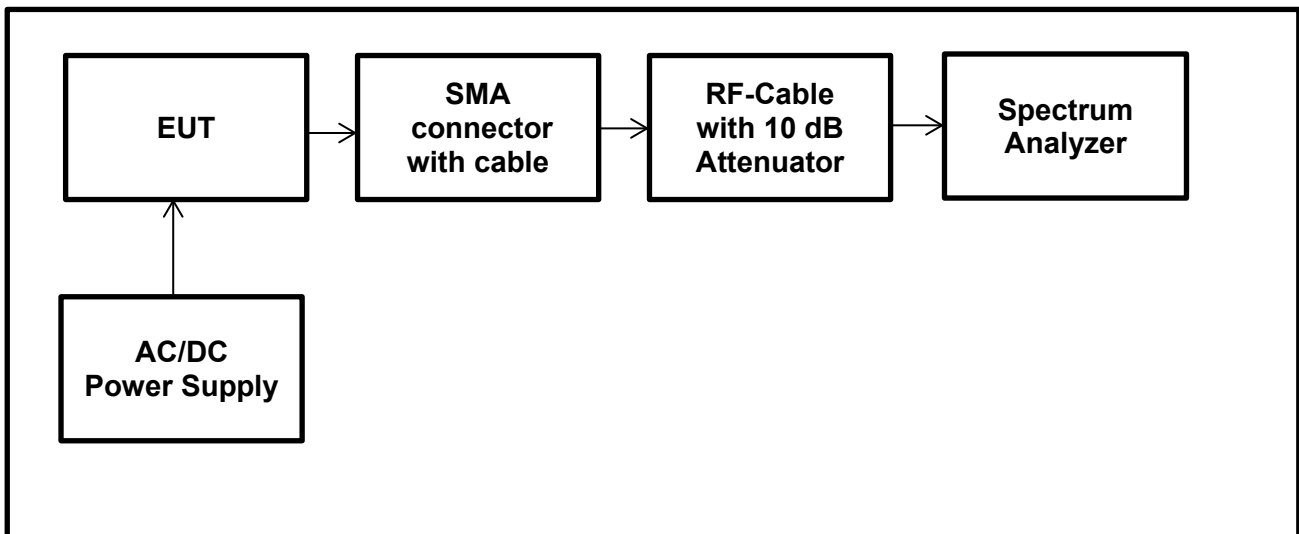
Temperature (°C):	24.3
Relative Humidity (%):	36.1

Notes:

1. The measurements were performed using the above configurations on the bottom, middle and top channels in accordance FCC KDB 558074 Section 8.2 referencing ANSI C63.10 Section 11.8 (11.8.1 Option 1 measurement procedure).
2. The spectrum analyser resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The DTS bandwidth was measured at 6 dB down from the peak of the signal.
3. The RF port on the EUT was connected to the spectrum analyser using suitable attenuation and RF cable. The measured values take into consideration the external attenuation correction factors.
 - o The SMA connector with RF Cable connected to the EUT with maximum attenuation of 0.5 dB at the tested frequencies.
 - o The RF cable from the EUT to Analyzer with maximum attenuation of 0.5 dB at the tested frequencies including the 10 dB attenuator at the input of Spectrum Analyzer

Therefore, total a reference level offset 11.0 dB was added to each of the at the tested frequencies conducted plots.

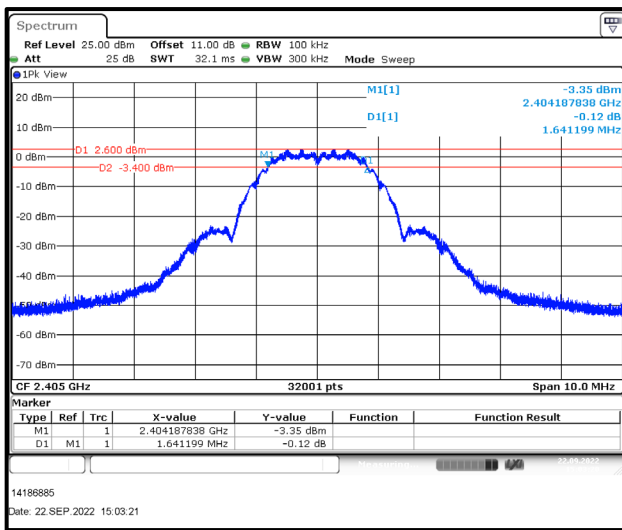
Test Setup:



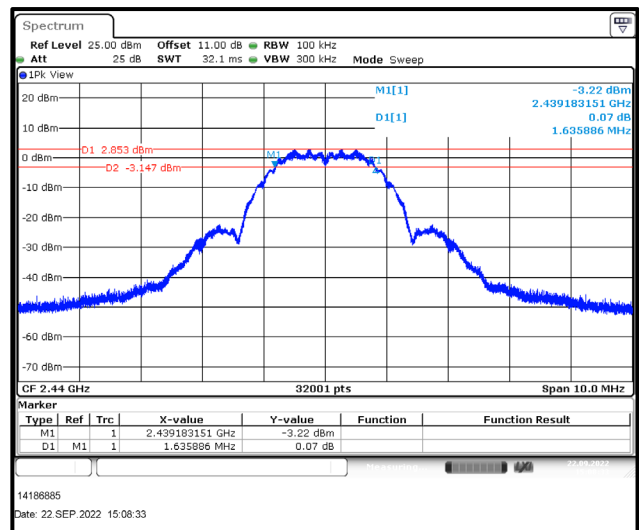
Transmitter Minimum 6 dB Bandwidth (continued)

Results : ZigBee - TX / PRBS9 / PWR MAX

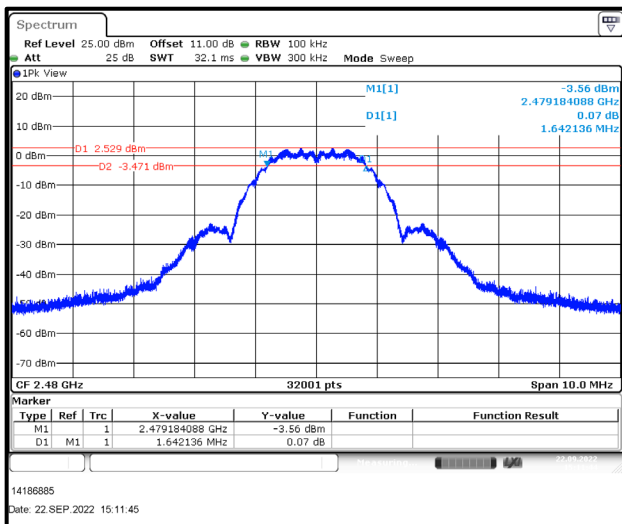
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	1641.199	≥ 500	1141.199	Complied
Middle	1635.886	≥ 500	1135.886	Complied
Top	1642.136	≥ 500	1142.136	Complied



Bottom Channel



Middle Channel



Top Channel

Result: **Pass**

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

Test Engineer:	Muhammad Faiq Khan	Test Date:	28 September 2022
Test Sample Serial Number:	DUT 7 (Radiated Test sample)		
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:

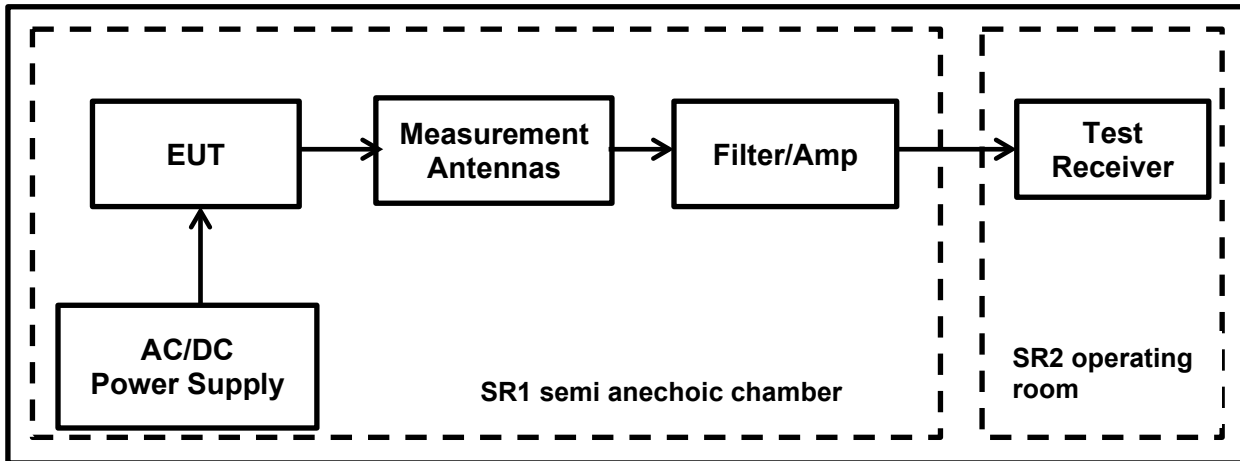
Temperature (°C):	23.1
Relative Humidity (%):	34.6

Note(s):

- 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 a 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.
- The EUT was configured with the following worst-case mode:
 - ZigBee | TX | PRBS9 | PWR MAX | Channel :Middle |
- 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.
- All emissions shown on the pre-scan plots were investigated and found to be below system noise floor.
- 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:

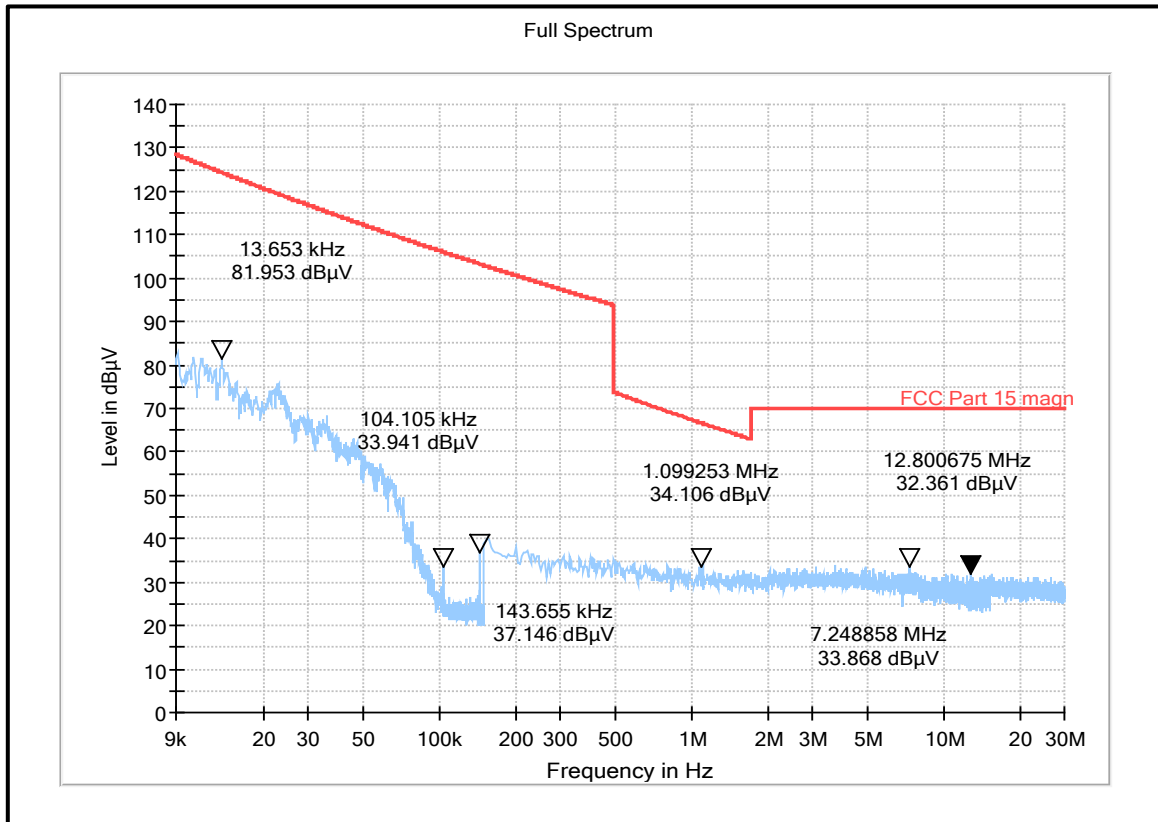


Transmitter Radiated Emissions (continued)

Results : ZigBee - TX / PRBS9 / Middle channel / PWR MAX

Frequency (MHz)	Loop Antenna Orientation	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
No critical spurious emissions were found					

Plot: Radiated Transmitter spurious emission from 9 kHz – 30 MHz



Result: Pass

Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineer:	Muhammad Faiq Khan	Test Date:	26 September 2022
Test Sample Serial Number:	DUT 7 (Radiated Test sample)		
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

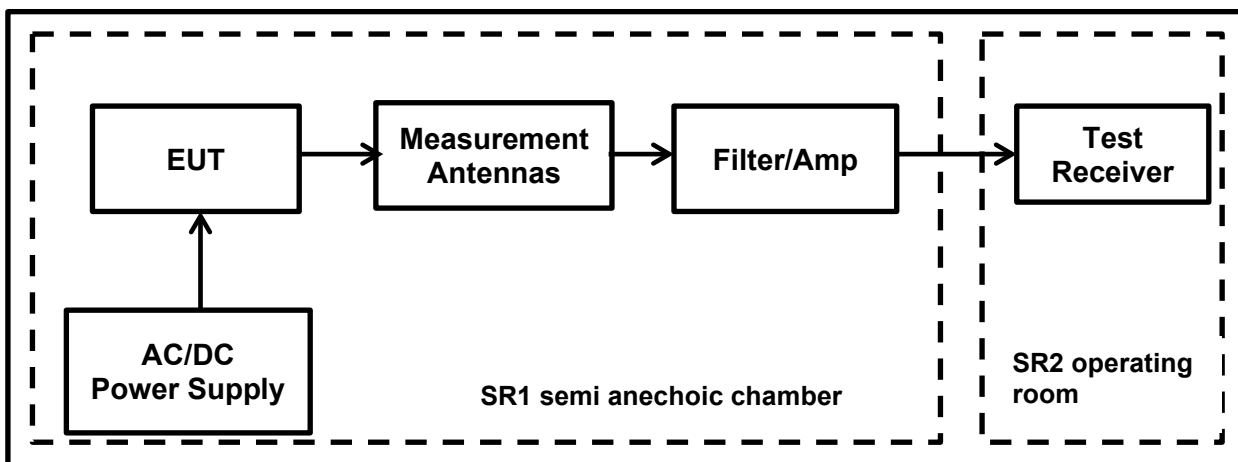
Environmental Conditions:

Temperature (°C):	20.9
Relative Humidity (%):	43.9

Note(s):

- 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.
- 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 EUT was configured with the following worst-case mode:
 - ZigBee | TX | PRBS9 | PWR MAX | Channel :Middle |
- 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 plots were investigated and found to be below system noise floor.

Test Setup:

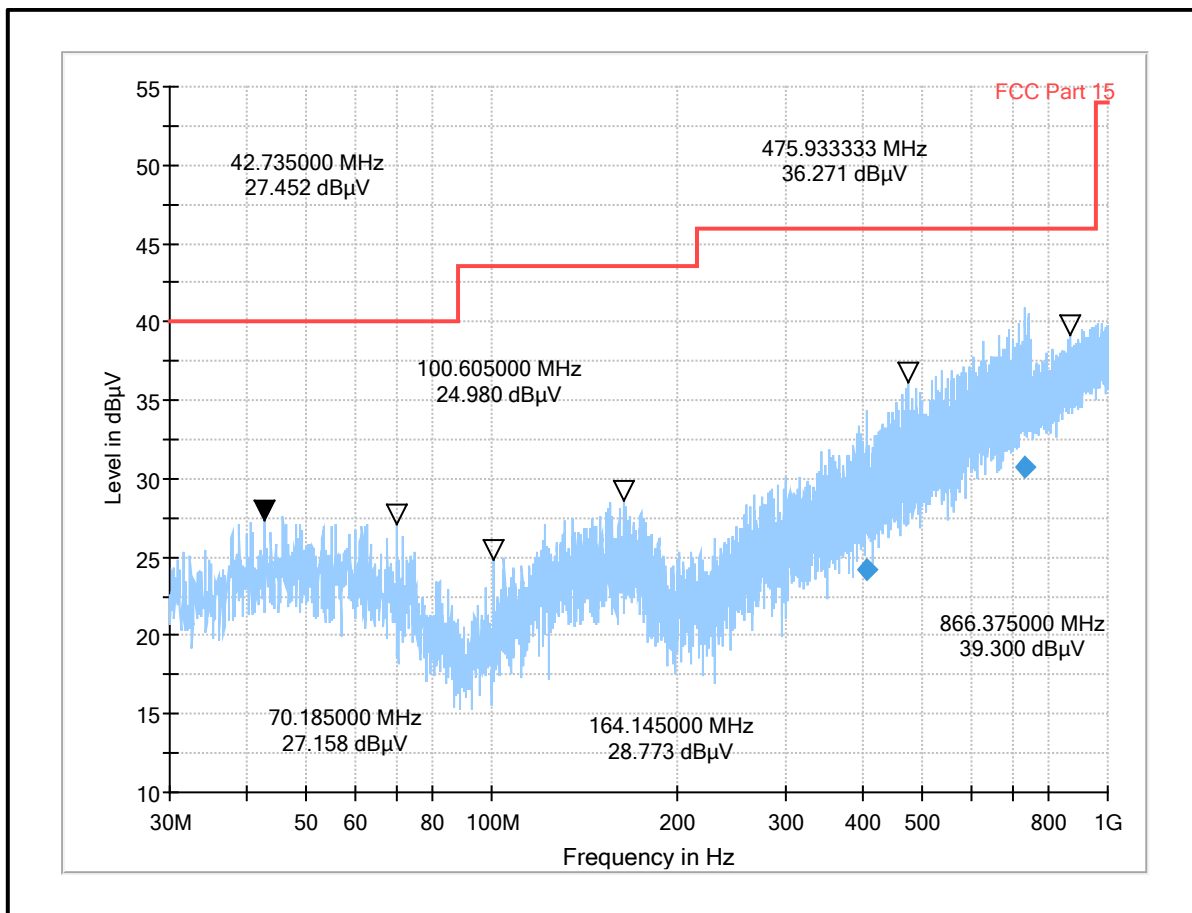


Transmitter Radiated Emissions (continued)

Results : ZigBee - TX / PRBS9 / Middle channel / PWR MAX

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
406.300000	Vertical	24.19	46.00	21.81	Complied
733.125000	Vertical	30.77	46.00	15.23	Complied

Plot: Radiated Transmitter spurious emission from 30 MHz – 1 GHz



Result: Pass

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

Test Engineer:	Muhammad Faiq Khan	Test Dates:	24 & 28 September 2022
Test Sample Serial Number:	DUT 7 (Radiated Test sample)		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.247(d), 15.209(a) & 15.205(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:

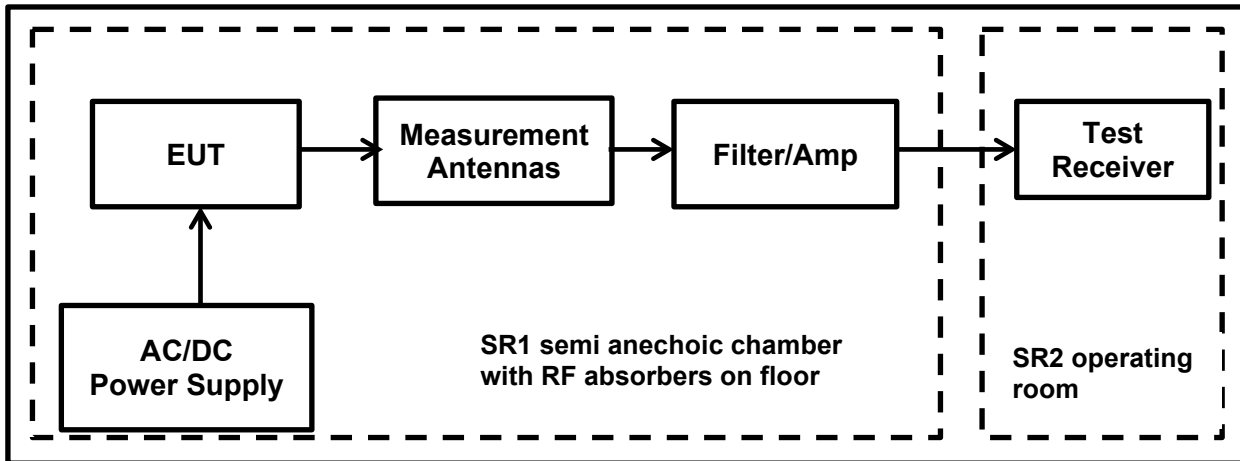
Temperature (°C):	21.5
Relative Humidity (%):	53.8

Note(s):

- 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.
- 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 EUT was configured with the following worst-case mode:
 - ZigBee | TX | PRBS9 | PWR MAX | Channel :Middle |
- 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.
- For frequency range between 1 GHz and 18 GHz, 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 Section 6.6.4.3 (Note 1), if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement."
- All emissions shown on the pre-scans were investigated and found to be below the noise floor of the measurement system.
- 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 26.5 GHz, on the pre-scan plots were investigated and found to be below system noise floor.

Transmitter Radiated Emissions (continued)

Test Setup:

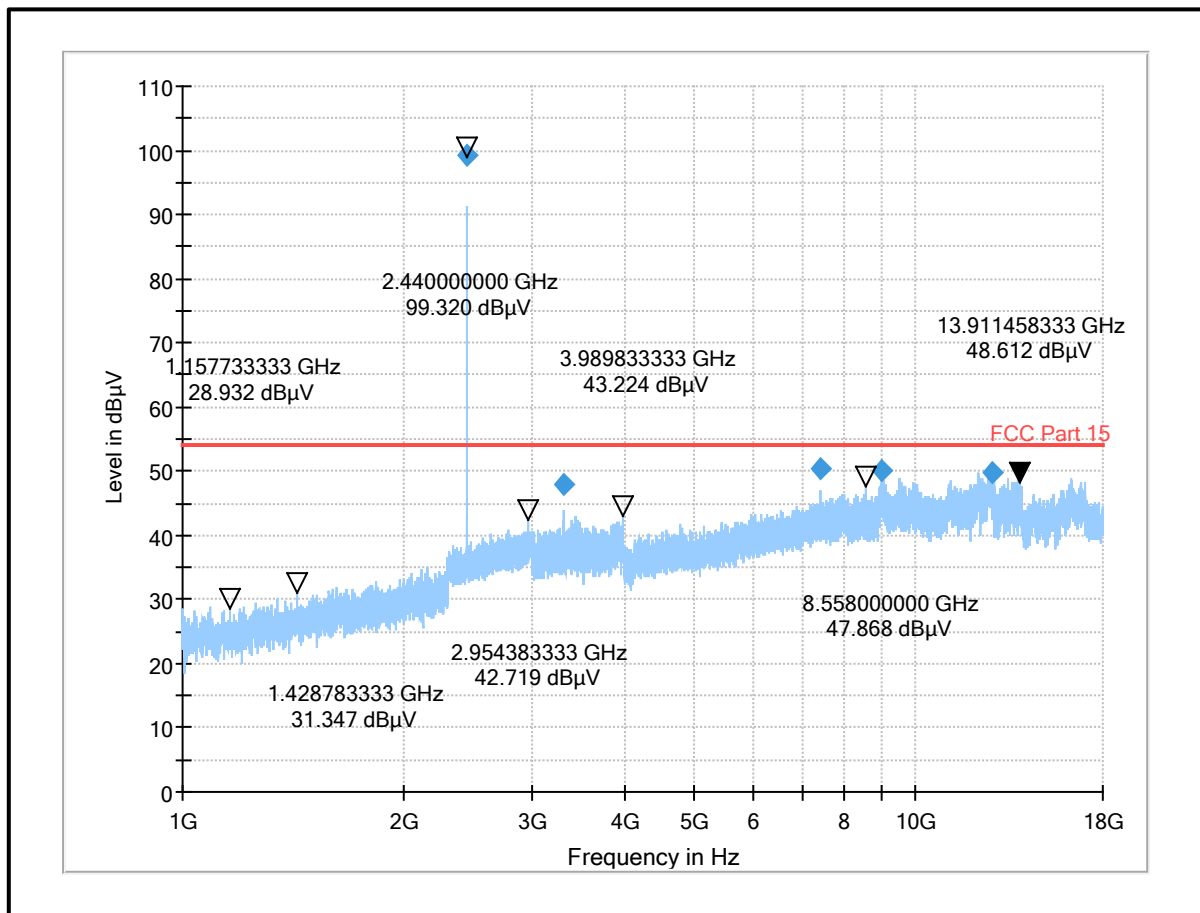


Transmitter Radiated Emissions (continued)

Results : ZigBee - TX / PRBS9 / Middle channel / PWR MAX

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
3302.000000	Vertical	47.82*	54.00	6.18	Complied
7421.666667	Vertical	50.48*	54.00	3.52	Complied
9000.666667	Vertical	49.96*	54.00	4.04	Complied
12695.000000	Horizontal	49.69*	54.00	4.31	Complied

Plot: Radiated Transmitter spurious emission from 1 GHz – 18 GHz



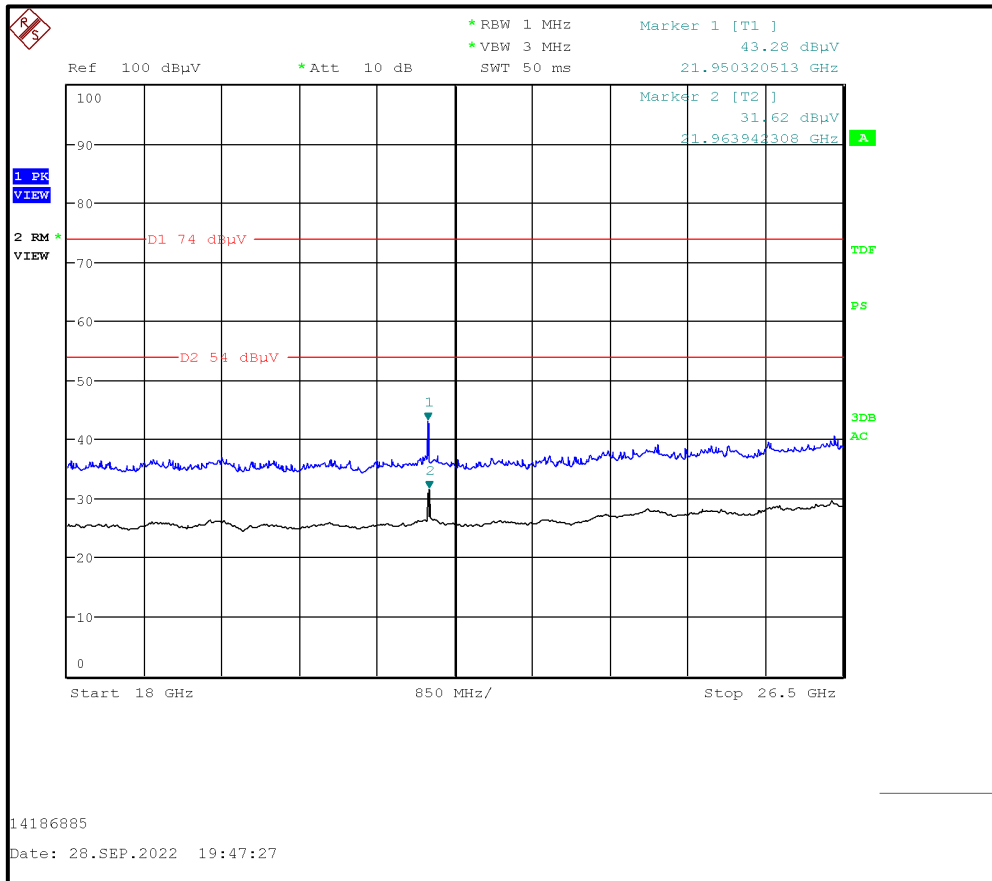
Result: Pass

Transmitter Radiated Emissions (continued)

Results : ZigBee - TX / PRBS9 / Middle channel / PWR MAX

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

Plot: Radiated Transmitter spurious emission from 18 GHz – 26.5 GHz



Result: Pass

5.2.4. Transmitter Band Edge Radiated Emissions**Test Summary:**

Test Engineer:	Muhammad Faiq Khan	Test Date:	24 September 2022
Test Sample Serial Number:	DUT 3 & DUT 11 (Radiated Test sample)		
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):	21.5
Relative Humidity (%):	53.8

Note(s):

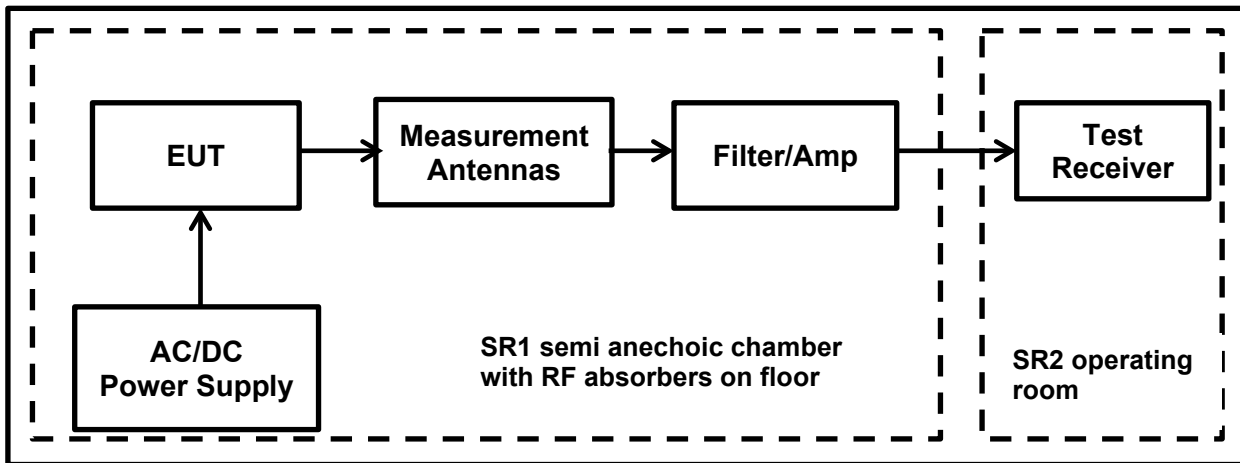
- The measurements were in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) with RF absorbers on the floor at a distance of 3 m. The EUT was placed at a height of 1.5 m above the test chamber floor in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 m to 4 m
- 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.
- 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.
- The restricted band peak measurements were performed in accordance with ANSI C63.10 Section 11.12.2.4.
- 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 and 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.
- 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.

Transmitter Band Edge Radiated Emissions (continued)

Note(s): (continued)

- 7. 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 100 % (duty cycle variations are less than $\pm 2\%$). Therefore, a Duty Cycle Correction Factor isn't applicable to the measured average values of the emissions.
- 8. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.

Test Setup:



Transmitter Band Edge Radiated Emissions (Continued)**Results : ZigBee - TX / PRBS9 / PWR MAX****Results: Lower Band Edge / Peak**

Frequency (MHz)	Peak Level (dB μ V/m)	-20 dBc Limit (dB μ V/m)	Margin (dB)	Result
2399.99	40.69	74.44	33.75	Complied
2400.00	40.69	74.44	33.75	Complied

Results: 2310 to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Peak Level (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)	Result
2366.70	45.18	74.00	28.82	Complied

Results: 2310 to 2390 MHz Restricted Band / Average

Frequency (MHz)	Average Level (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)	Result
2367.02	34.73	54.00	19.27	Complied

Results: Upper Band Edge / Peak

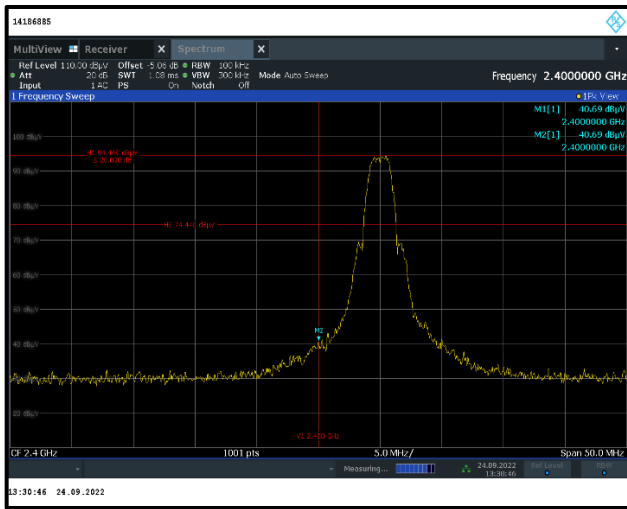
Frequency (MHz)	Peak Level (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)	Result
2483.50	60.73	74.00	13.27	Complied
2483.66	59.62	74.00	14.38	Complied

Results: Upper Band Edge / Average

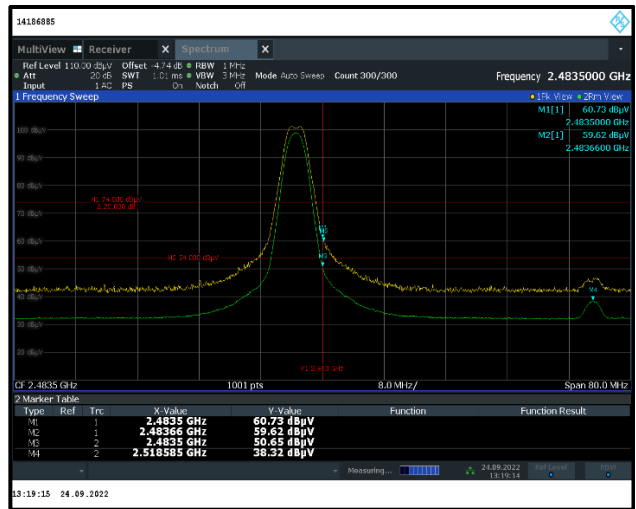
Frequency (MHz)	Average Level (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)	Result
2483.50	50.65	54.00	3.35	Complied
2518.58	38.32	54.00	15.68	Complied

Result: Pass

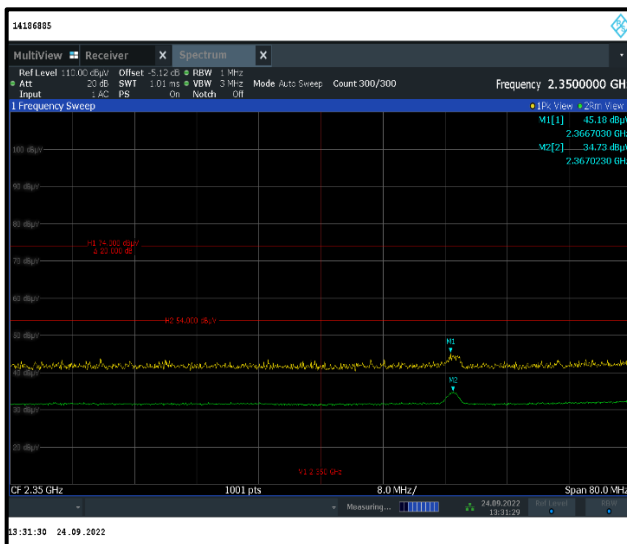
Transmitter Band Edge Radiated Emissions (Continued)
Results: ZigBee / Port X14 / PWR 12 dBm / Rod Antenna



Lower Band Edge Peak Measurement



Upper Band Edge Measurement



Restricted 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
AC Conducted Emissions	95%	±2.49 dB
Conducted Maximum Peak Output Power	95%	±0.59 dB
Minimum 6 dB Bandwidth	95%	±0.87 %
Radiated Spurious Emissions	95%	±3.10 dB
Band Edge Radiated Emissions	95%	±3.10 dB

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	13/07/2022	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	36
496	Rohde & Schwarz	Antenna, log. - periodical	HL050	100297	05/08/2020	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
669	Rohde & Schwarz	EMI Test Receiver	ESW 44	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 9

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
445	Huber & Suhner	RF Attenuator (10 dB)	6810.17.AC	--	lab verification	12
637	Rohde & Schwarz	Spectrum Analyzer	FSV40	101587	15/07/2022	12
-/-	Huber+Suhner	RF Cable -OSP120-DUT1	ST18/SMAm/S MAm/72	605505	lab verification	n/a
-/-	Testo	Thermo-Hygrometer	608-H1	07	lab verification	n/a
1603668	Siemens Matsushita Components	shielded room	--	B83117- B1422-T161	n/a	n/a

8. Report Revision History

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	33	-	Initial Version

--- END OF REPORT ---