TEST REPORT

Test Report No.: UL-RPT-RP-14775495-816-FCC

Applicant *	:	ELECTROSTAR GmbH
Model No. *	:	GCT30-42
FCC ID *	:	TXTGCT3042
Technology *	:	Bluetooth – Low Energy
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 1.2 supersede Version 1.1 with immediate effect**
   Test Report No. UL-RPT-RP-14775495-816-FCC Version 1.2, Issue Date 07 MAY 2024 replaces
   Test Report No. UL-RPT-RP-14775495-816-FCC Version 1.1, Issue Date 03 APRIL 2024, which is no longer valid.
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: 07 May 2024

Approved by: Rachid, Acharkaoui
Title: Operations Manager
Date: 07 May 2024

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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STU.CTECHLab@ul.com

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Table of Contents

1. Customer Information *

1.1. Applicant Information

Company Name:	ELECTROSTAR GmbH
Company Address:	Hans-Zinser-Str 1-3 , 73061 Ebersbach an der Fils
Contact Person:	Bernd Lustig
Contact E-Mail Address:	+49 7163 9988 246
Contact Phone No.:	bernd.lustig@starmix.de

1.2. Manufacturer Information

Company Name:	Robert Bosch Power Tools GmbH
Company Address:	70538 Stuttgart, GERMANY
Contact Person:	Jana Bieser
Contact E-Mail Address:	+49 711 758 3871
Contact Phone No.:	Jana.Bieser@de.bosch.com

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:	20 April 2023
EUT Arrived:	01 June 2023
Test Dates:	05 June 2023 to 09 June 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 (3)	☐	☐	☐	☒
Part 15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth	☒	☐	☐	☐
Part 15.35(c)	Transmitter Duty Cycle (2)	☒	☐	☐	☐
Part 15.247(e)	Transmitter Power Spectral Density (1)	☐	☐	☒	☐
Part 15.247(b)(3)	Transmitter Maximum (Peak) Output Power	☒	☐	☐	☐
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: Where not otherwise specified or communicated in writing, statements of conformity (e.g. Pass/Fail) are established according to the following decision rule: considering the ILAC G8:2019 chapter 4.2.1 (simple acceptance rule). This leads to a maximum 50% of false accept or false reject when the measured value equals the tolerance limit. See ILAC-G8:09/2019 for further details.					

Note(s):

1. 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. The measurement was performed to assist the average measurements.
3. The EUT is a battery powered device.

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 or Number:	GCT30-42
Test Sample Serial Number:	Not Serialised (Radiated Test Sample)
Hardware Version Number:	3.4
Firmware Version Number:	2.2
FCC ID:	TXTGCT3042

Brand Name:	BOSCH
Model Name or Number:	GCT30-42
Test Sample Serial Number:	Not Serialised (Conducted Test Sample with SMA connector)
Hardware Version Number:	3.4
Firmware Version Number:	2.2
FCC ID:	TXTGCT3042

3.2. EUT Family Models / Parts *

Part Numbers:	1600A02GH1 (EU)
Part Numbers:	1600A02GH2 (KR/JP)
Part Numbers:	1600A02GH3
Part Numbers:	1600A02GH4

Note(s):

1. According to customer declaration all the above-mentioned models (part numbers) are identical with the tested EUT and only differ in the printing label.

3.3. Description of EUT *

The equipment under test was a Smart Tag (GCT30-42) with BT LE interface, supporting Bluetooth Low Energy operations in 2400-2483.5MHz ISM band.

3.4. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.5. Additional Information Related to Testing *

Technology Tested:	Bluetooth – Low Energy		
FCC Equipment Classification:	Digital Transmission System (DTS)		
Type of Unit:	Transceiver		
Operating Frequency Range:	2402 MHz to 2480 MHz		
Channel Spacing:	2 MHz		
Tested Data Rate(s) & Modulation(s):	1 Mbps	GFSK	
Maximum Conducted Output Power:	2.25 dBm		
Declared Antenna Gain:	-0.6 dBi		
Antenna Type:	Integrated Antenna		
Antenna Details:	PCB Antenna		
Transmit Channels Tested:	**Channel ID**	**RF Channel**	**Frequency (MHz)**
	Bottom	0	2402
	Middle	19	2440
	Top	39	2480
Power Supply Requirement(s):	5V DC via USB cable		
Highest internally generated clock and/ or oscillator frequency:	Internal RC Oscillator 16MHz External crystal 32MHz		

3.6. 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	Test Laptop With Test software BlueNRG GUI v4.5.0	HP	ProBook 440 G6	5CD941CVQY

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):
☒ BT-LE Test Mode: Continuously transmitting modulated carrier with combination of • Data Rate: 1 Mbps | Packet Type: PRBS9 | Power Settings: 5 | Channel: Bottom / Middle / Top

4.2. Configuration and Peripherals

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

EUT Power Supply:

- The EUT was powered with 5 V DC through a USB Cable via Laptop:

Test Mode Activation:

- The EUT can be connected with the Test laptop via USB cable. The laptop was removed from the measuring area during the measurement.
- The test modes were activated using the test software / Radio Tool “BlueNRG GUI v4.5.0”. This test software / Radio Tool was installed on the test laptop to enable continuous transmission and to select the required test channels.

Conducted Measurements:

- All conducted measurements were carried out by using the EUT RF sample with SMA cable soldered on the PCB. 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:

- The EUT radiated sample was used for radiated spurious emission and band edge measurements.
- Before starting the measurement, the EUT was evaluated for the worst-case position w.r.t to maximum radiated power measured in standing, laying and 45° tilting positions. The EUT integrated antenna in standing position was found out to be the worst-case. Therefore, this report includes relevant results.
- 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 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 continuous transmission of the EUT (D ≥ 98%) cannot be achieved and EUT was transmitting continuously with 85.59% duty cycle (+/- 2% tolerance). Duty Cycle Correction Factor of 0.67 dB was added to all 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 Duty Cycle

Test Summary:

Test Engineer:	Muhammad Faiq Khan	**Test Date:**	05 June 2022
Test Sample Serial Number:	Not Serialised (Conducted Test Sample with SMA connector)		
Test Site Identification	SR 9		

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):	23.6
Relative Humidity (%):	51.1

Note:

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

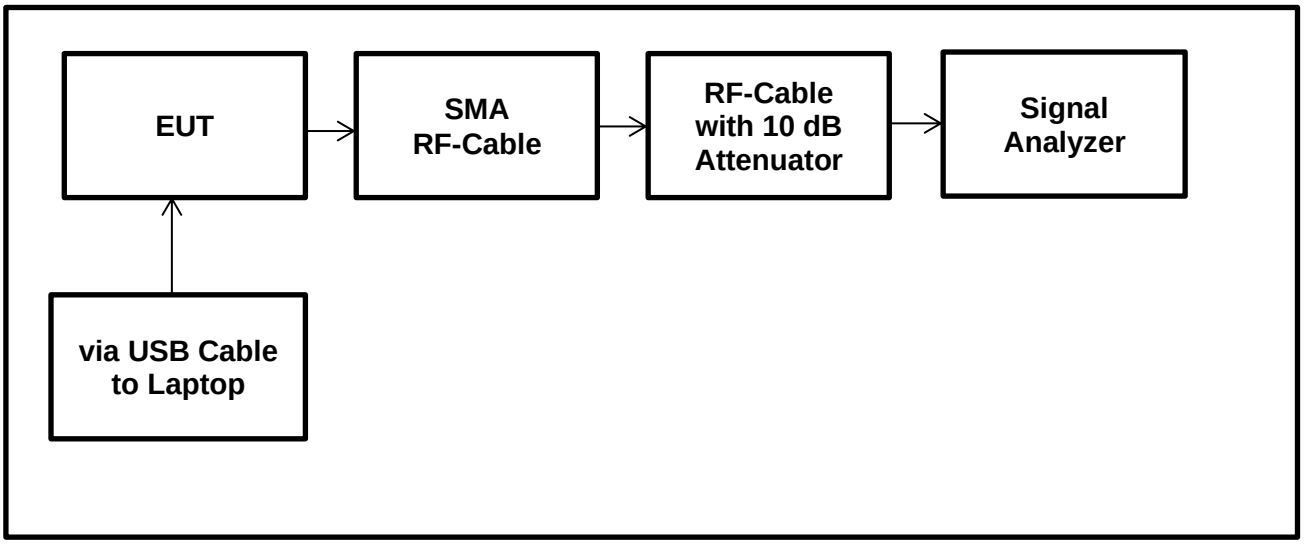
   Duty Cycle (%) = 100 X [On Time (T_{ON})] / [Period(T_{ON}+ T_{OFF}) or 100ms whichever is the lesser]

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

2. The RF port on the EUT was connected to the spectrum analyser using suitable attenuation and RF cable. The measured values takes into consideration the external attenuation correction factors.
   - The SMA (Female) RF Cable soldered on PCB with maximum attenuation of 0.5 dB at the tested frequencies.
   - The RF cable attenuation maximum 0.5 dB@2.4GHz from the EUT to Analyzer including the 10 dB attenuation 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

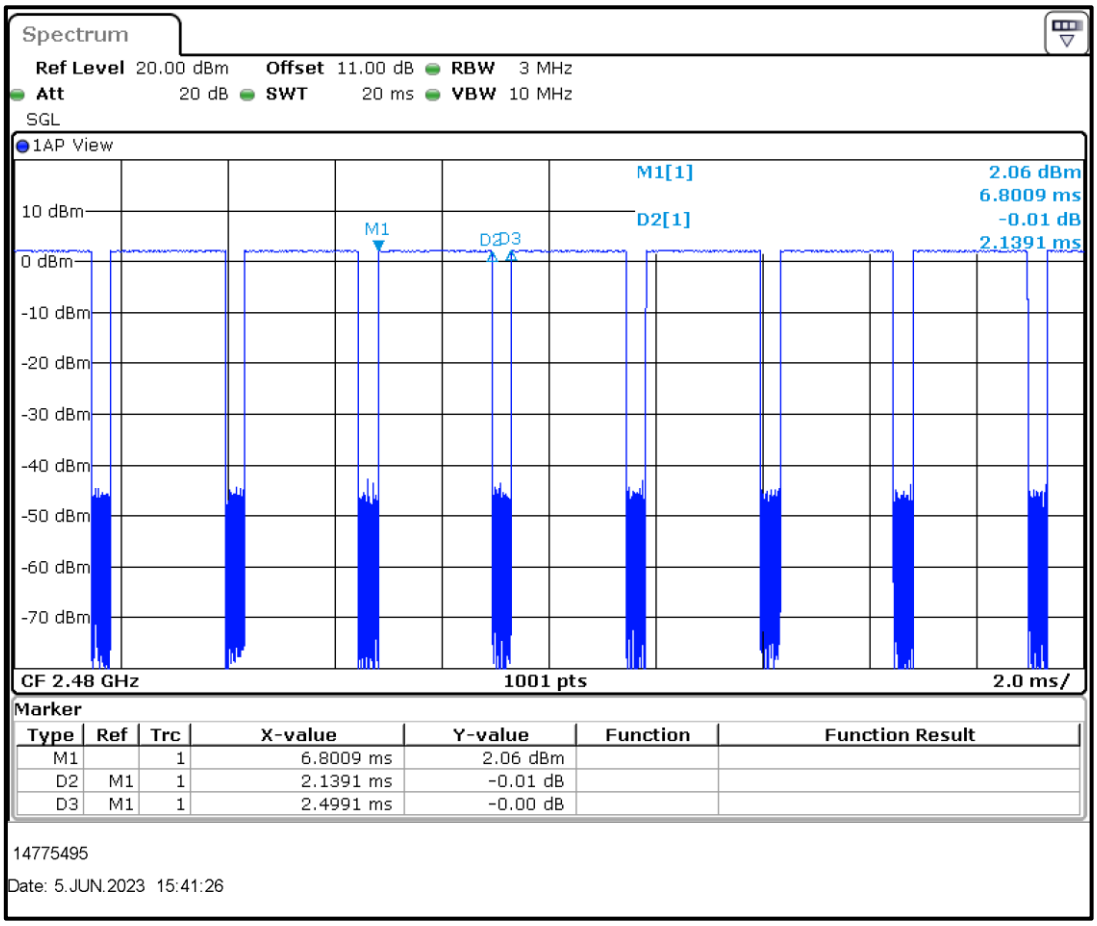
Test Setup:



Transmitter Duty Cycle (continued)

Results: BT-LE / 1 Mbps / PRBS9 / PWR 5 / Bottom Channel

Pulse On Time (T_{ON}) (ms)	Pulse Period (T_{ON} +T_{OFF}) (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
2.1391	2.4991	85.59	0.67



Result: Pass

5.2.2. Transmitter Minimum 6 dB Bandwidth

Test Summary:

Test Engineer:	Muhammad Faiq Khan	**Test Date:**	05 June 2023
Test Sample Serial Number:	Not Serialised (Conducted Test Sample 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:

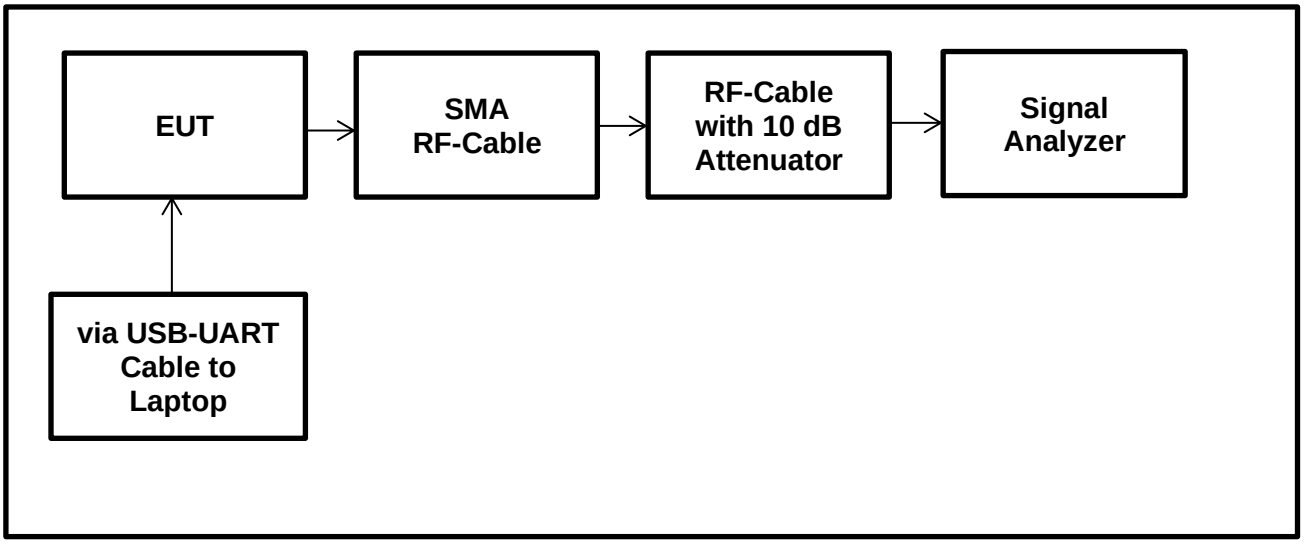
Temperature (°C):	23.6
Relative Humidity (%):	51.1

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 takes into consideration the external attenuation correction factors.
   - The SMA (Female) RF Cable soldered on PCB with maximum attenuation of 0.5 dB at the tested frequencies.
   - The RF cable attenuation maximum 0.5 dB@2.4GHz from the EUT to Analyzer including the 10 dB attenuation 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.

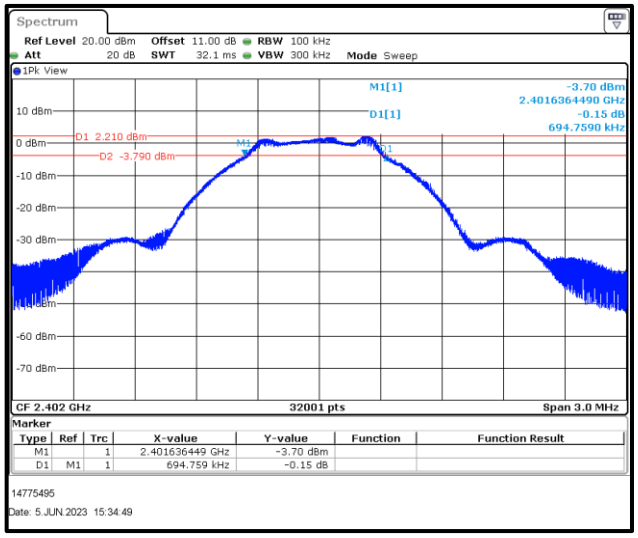
Test Setup:



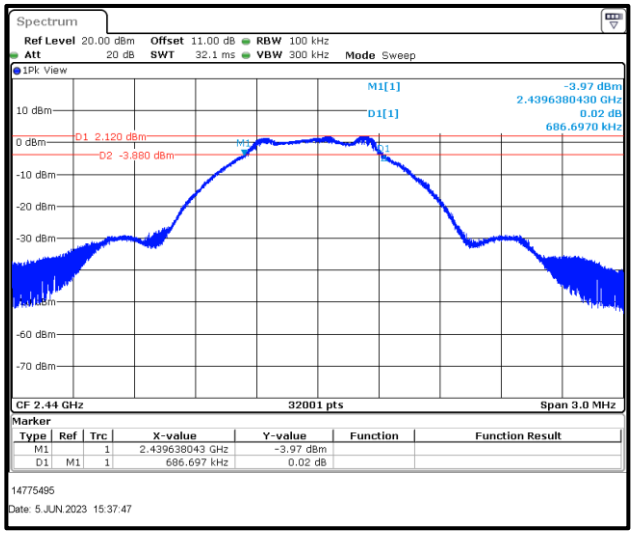
Transmitter Minimum 6 dB Bandwidth (continued)

Results: BT-LE / 1 Mbps / PRBS9 / PWR 5

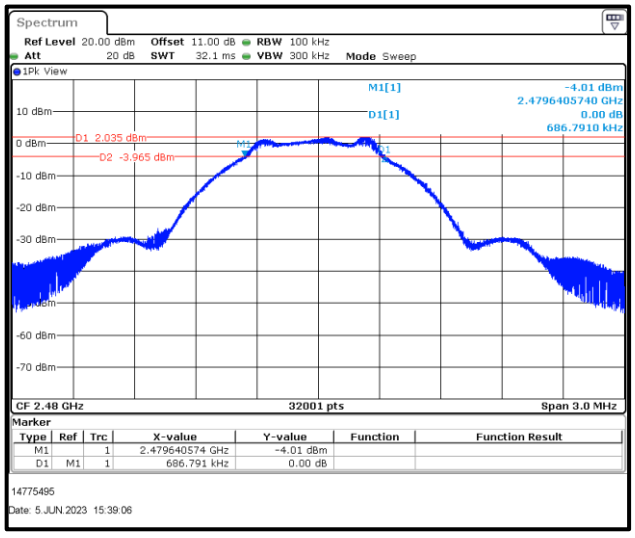
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	694.759	≥ 500	194.759	Complied
Middle	686.697	≥ 500	186.697	Complied
Top	686.791	≥ 500	186.791	Complied



Bottom Channel



Middle Channel



Top Channel

Result: Pass

5.2.3. Transmitter Maximum (Peak) Output Power

Test Summary:

Test Engineer:	Muhammad Faiq Khan	**Test Date:**	05 June 2023
Test Sample Serial Number:	Not Serialised (Conducted Test Sample 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:

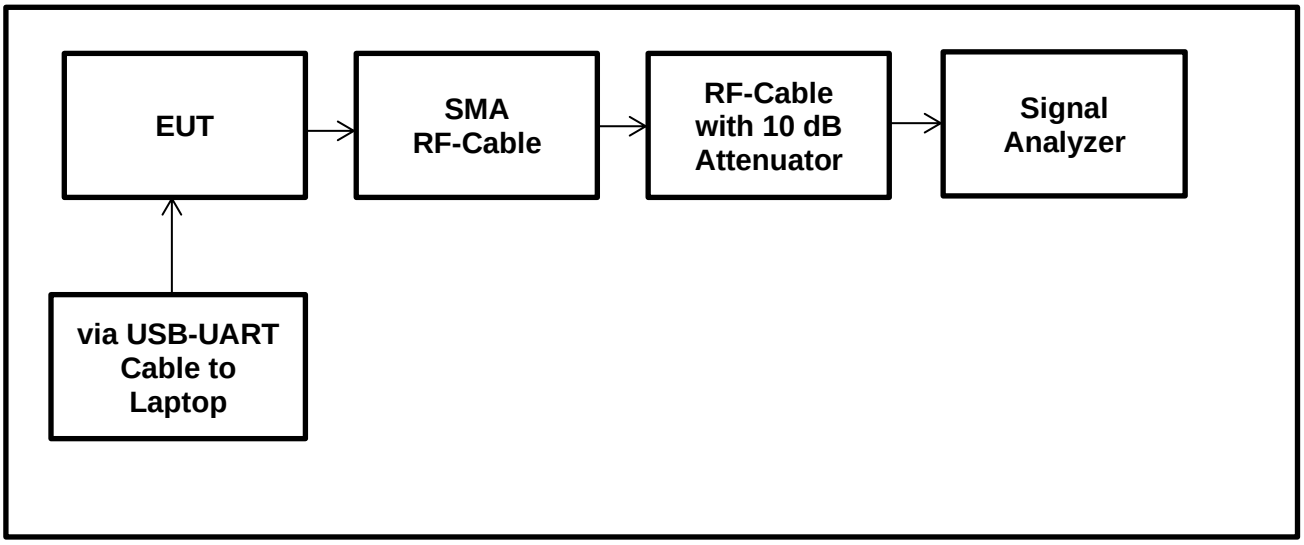
Temperature (°C):	23.6
Relative Humidity (%):	51.1

Notes:

1. Final measurements were performed using the below configurations on the bottom, middle and top channels.
2. The EUT was transmitting at <98% duty cycle and testing was performed in accordance with ANSI C63.10 Section 11.9.1.1 RBW ≥ DTS bandwidth Method.
3. The RF port on the EUT was connected to the spectrum analyser using suitable attenuation and RF cable. The measured values takes into consideration the external attenuation correction factors.
   - The SMA (Female) RF Cable soldered on PCB with maximum attenuation of 0.5 dB at the tested frequencies.
   - The RF cable attenuation maximum 0.5 dB@2.4GHz from the EUT to RF power meter including the 10 dB attenuation at the input of RF power meter.

   Therefore, total a reference level offset 11.0 dB was added to each of measured value at the tested frequencies.
4. The declared antenna gain was added to conducted power to obtain the relevant EIRP values.

Test Setup:



Transmitter Maximum Peak Output Power (continued)

Results: BT-LE / 1 Mbps / PRBS9 / PWR 5

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	2.25	30.00	27.75	Complied
Middle	2.18	30.00	27.82	Complied
Top	2.10	30.00	27.90	Complied

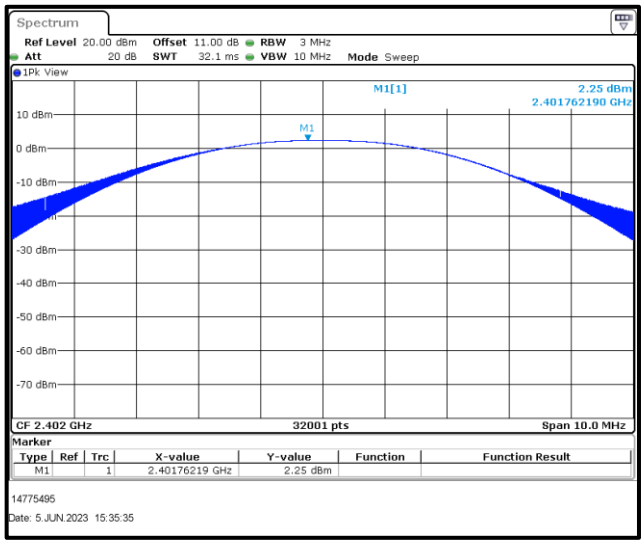
Results EIRP: BT-LE / 1 Mbps / PRBS9 / PWR 5

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	2.25	-0.6	1.65	36.00	34.35	Complied
Middle	2.18	-0.6	1.58	36.00	34.42	Complied
Top	2.10	-0.6	1.50	36.00	34.50	Complied

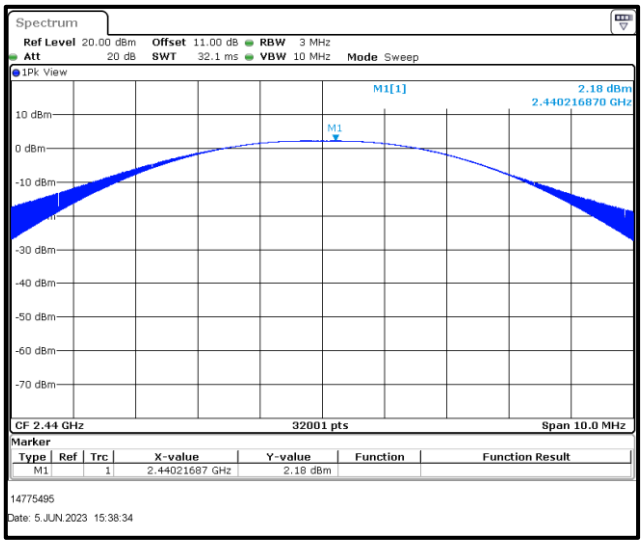
Result: Pass

Transmitter Maximum Peak Output Power (continued)

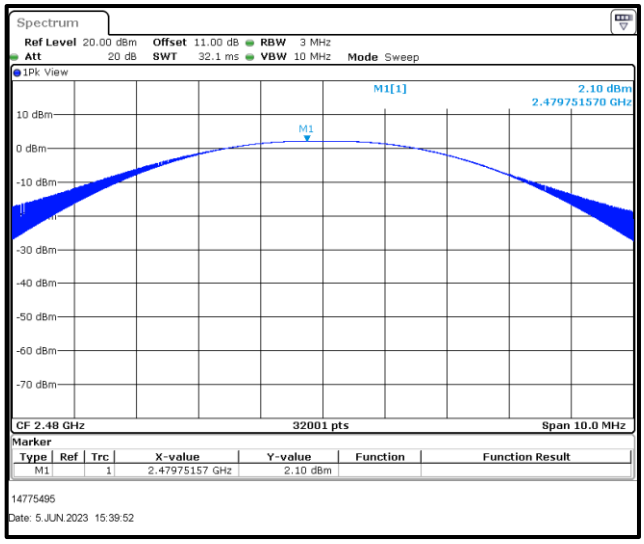
Plots: BT-LE / 1 Mbps / PRBS9 / PWR 5



Bottom Channel



Middle Channel



Top Channel

5.2.4. Transmitter Radiated Emissions

Test Summary:

Test Engineer:	Muhammad Faiq Khan	**Test Date:**	09 June 2023
Test Sample Serial Number:	Not Serialised (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:

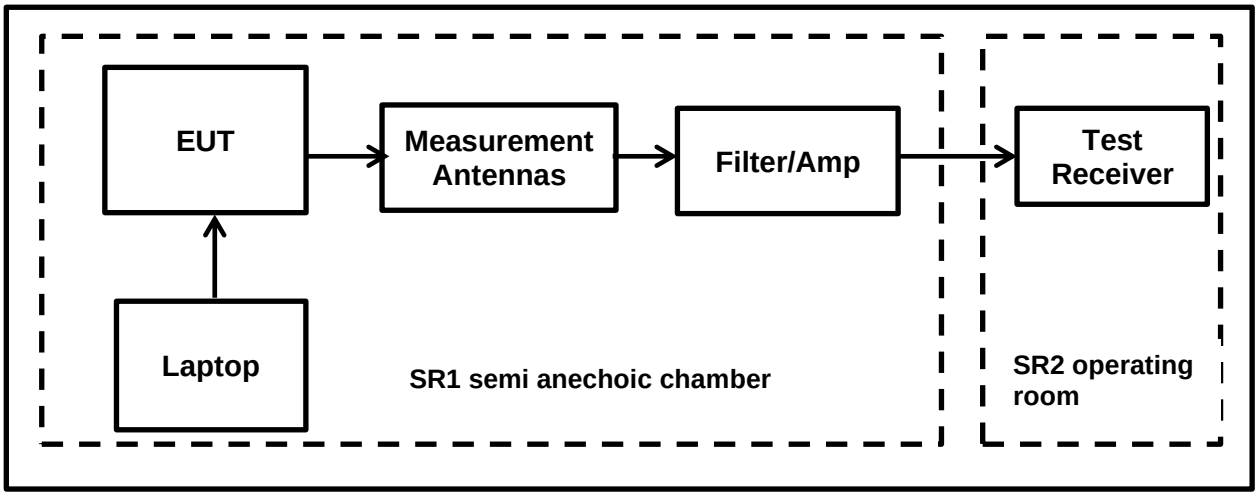
Temperature (°C):	24.1
Relative Humidity (%):	50.8

Notes:

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.
   Therefore, measurements were performed at a measurement distance of 3 m.
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. 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.
5. The EUT was configured with the following worst-case mode w.r.t output power:
   - BT-LE | 1 Mbps | PRBS9 | PWR 5 | Bottom Channel
6. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
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: 300 Hz / VBW: 1 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:

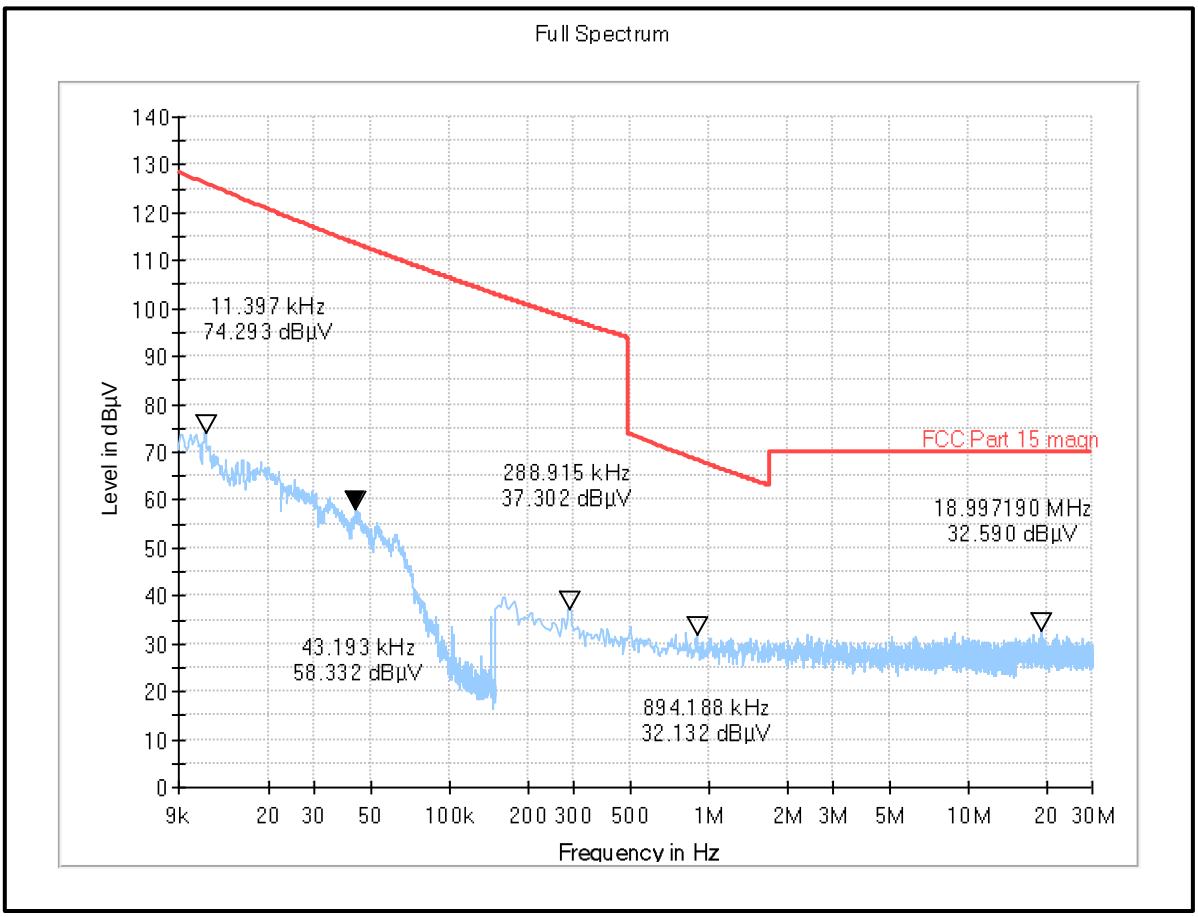


Transmitter Radiated Emissions (continued)

Results: BT-LE / 1 Mbps / PRBS9 / Bottom Channel / PWR 5

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

Plot: 9 kHz – 30 MHz: BT-LE / 1 Mbps / PRBS9 / PWR 5 / Bottom Channel



Result: Pass

Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineer:	Muhammad Faiq Khan	**Test Date:**	12 June 2023
Test Sample Serial Number:	Not Serialised (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

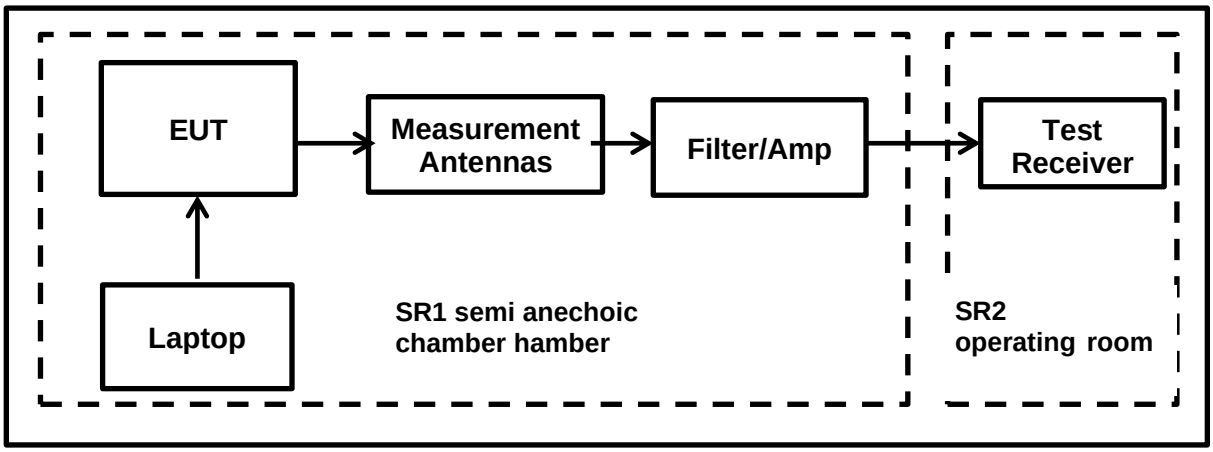
Environmental Conditions:

Temperature (°C):	23.5
Relative Humidity (%):	49.0

Note(s):

1. 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.
2. The EUT was configured with the following worst-case mode w.r.t output power:
    - BT-LE | 1 Mbps | PRBS9 | PWR 5 | Bottom Channel
3. 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.
4. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
5. All other emissions shown on the pre-scan plot were investigated and found to be below the measurement system noise floor.

Test Setup:

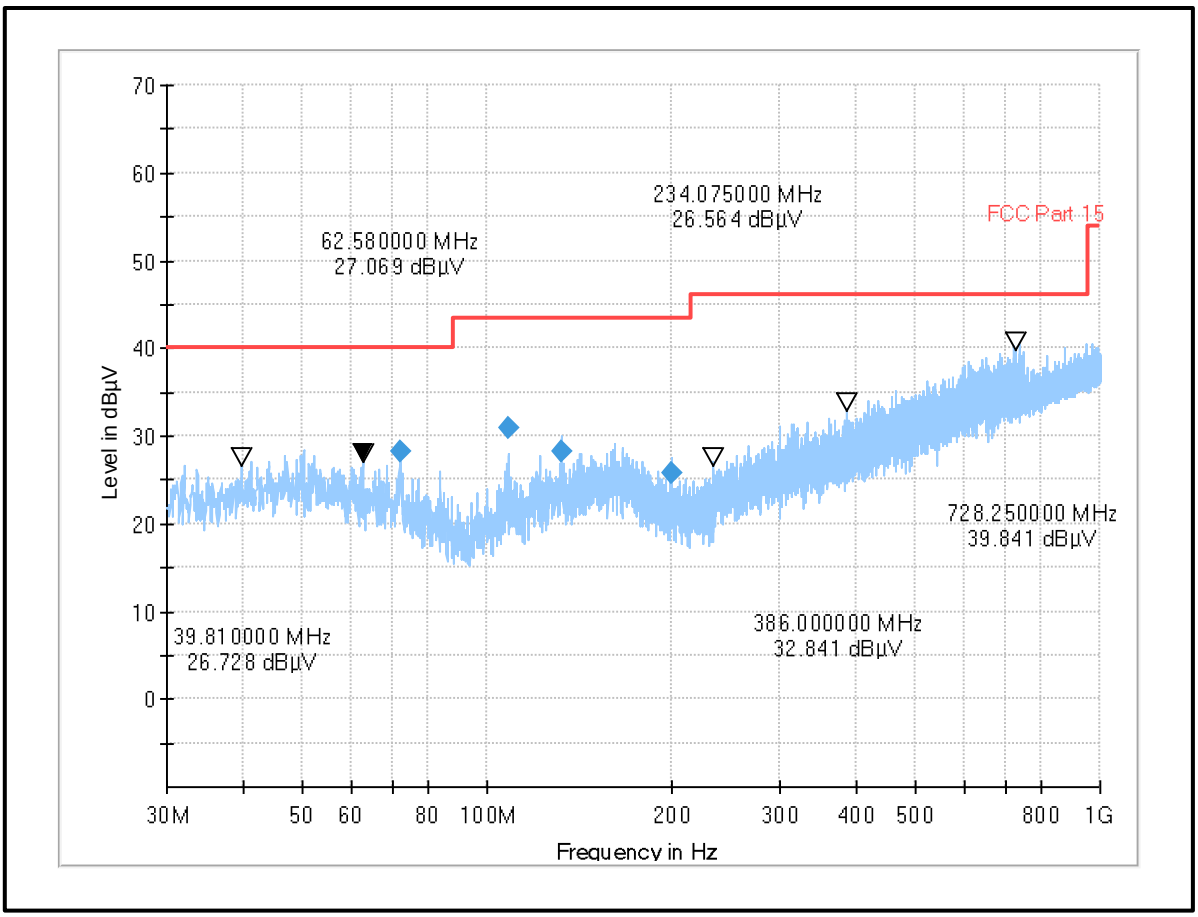


Transmitter Radiated Emissions (continued)

Results: BT-LE / 1 Mbps / PRBS9 / Bottom Channel / PWR 5

Frequency (MHz)	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Antenna Polarization	Result
72.210000	28.31	40.00	11.69	Vertical	Complied
108.255000	30.94	43.50	12.56	Vertical	Complied
132.375000	28.23	43.50	15.27	Vertical	Complied
199.965000	25.71	43.50	17.79	Vertical	Complied

Plot: 30 MHz – 1GHz: BT-LE / 1 Mbps / PRBS9 / PWR 5 / Bottom Channel



Result: Pass

Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineer:	Muhammad Faiq Khan	**Test Date:**	07 June 2023
Test Sample Serial Number:	Not Serialised (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 6.6
Frequency Range:	1 GHz to 25 GHz

Environmental Conditions:

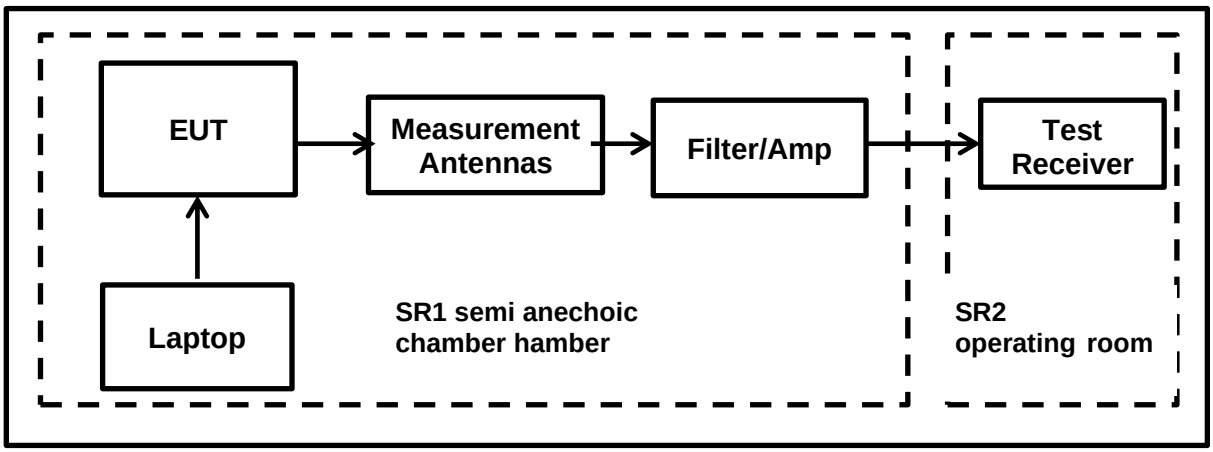
Temperature (°C):	25.6
Relative Humidity (%):	43.1

Notes:

1. 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.
2. The EUT was configured with the following worst-case mode w.r.t output power:
    - BT-LE | 1 Mbps | PRBS9 | PWR 5 | Bottom Channel
3. 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.
4. 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.
5. The Restricted Band Emissions were performed in accordance with ANSI C63.10 Section 11.12.2.4 & 11.12.2.5.1.
6. 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.
7. 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.
8. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.

Transmitter Radiated Emissions (continued)

Test Setup:

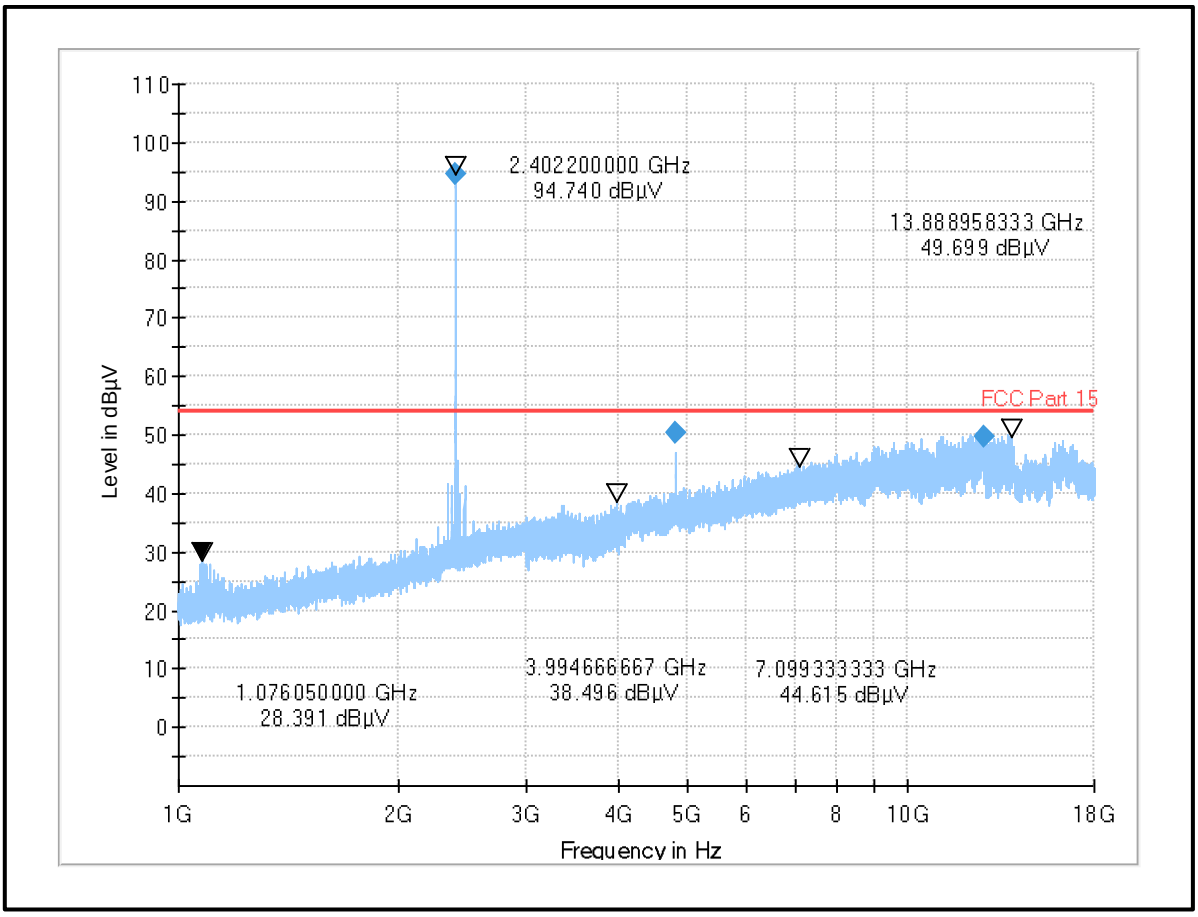


Transmitter Radiated Emissions (continued)

Results: BT-LE / 1 Mbps / PRBS9 / Bottom Channel / PWR 5

Frequency (MHz)	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Antenna Polarization	Result
4803.666667	50.43	54.00	3.57	Vertical	Complied
12687.208333	49.73	54.00	4.27	Horizontal	Complied

Plot: 1 GHz – 18 GHz: BT-LE / 1 Mbps / PRBS9 / PWR 5 / Bottom Channel



Result: Pass

Transmitter Radiated Emissions (continued)

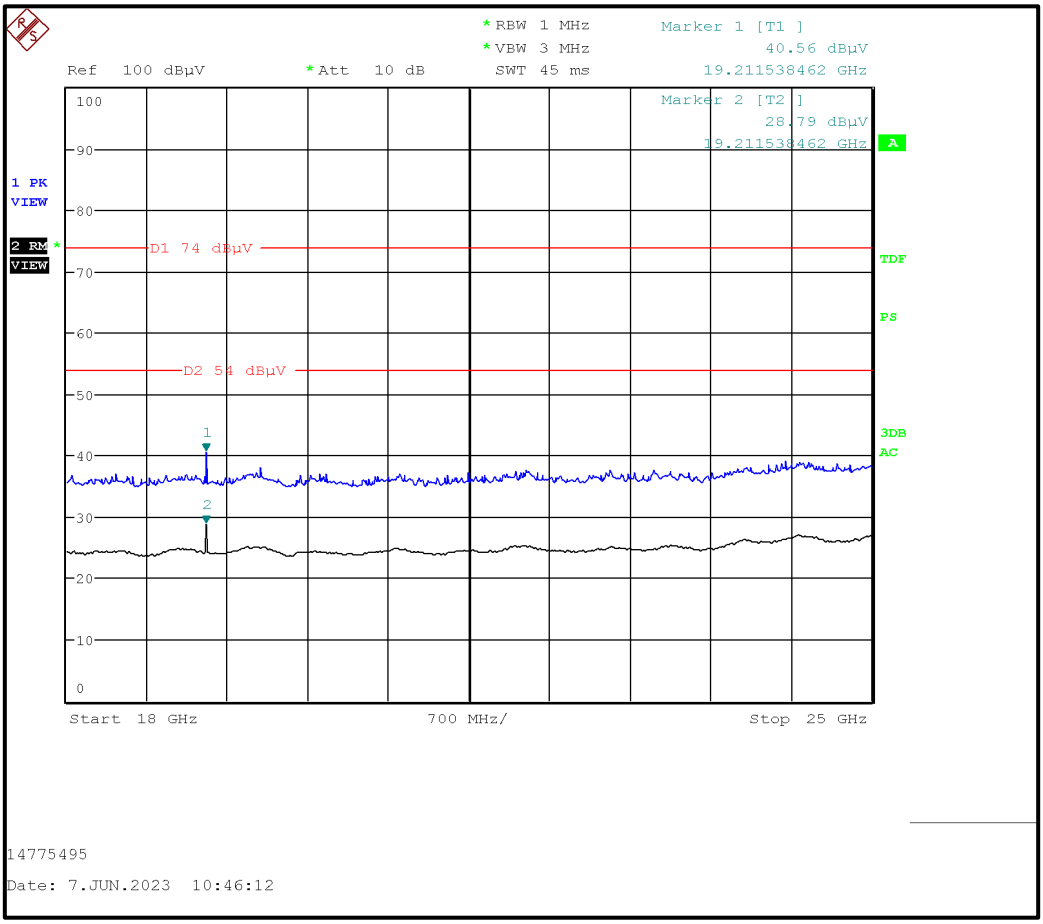
Results: BT-LE / 1 Mbps / PRBS9 / Bottom Channel / PWR 5

Restricted Band Emission:

Frequency (GHz)	MaxPeak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Antenna Polarization	Result
19.2115	41.92	74.00	32.08	Horizontal	Complied

Frequency (GHz)	Average Level (dBµV/m)	Corrected Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Antenna Polarization	Result
19.2115	31.51	32.18	54.00	21.82	Horizontal	Complied

Plot: 18 GHz – 25 GHz: BT-LE / 1 Mbps / PRBS9 / PWR 5 / Bottom Channel



Result: Pass

5.2.5. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	Muhammad Faiq Khan	**Test Date:**	07 June 2023
Test Sample Serial Number:	Not Serialised (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
	FCC KDB 558074 Section 8.7 referencing ANSI C63.10:2013 Sections 6.10.4, 6.10.5, 11.13

Environmental Conditions:

Temperature (°C):	25.6
Relative Humidity (%):	43.1

Note(s):

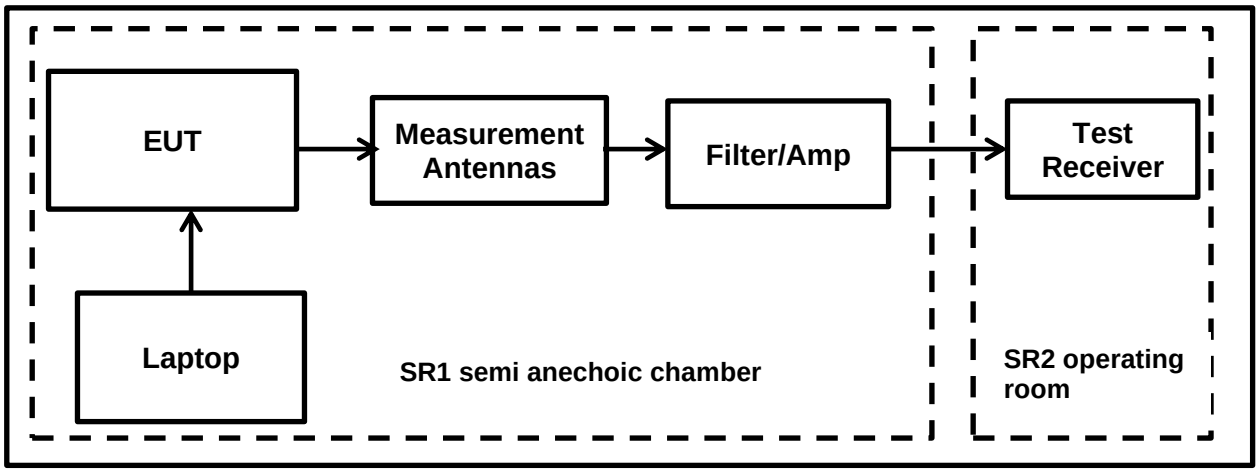
1. The measurements were in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) with RF absorbers on the floor at a distance of 3 m. The EUT was placed at a height of 1.5 m above the test chamber floor in the centre of the chamber turntable. Maximum emission levels were determined by height searching 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 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 300 sweeps 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.
6. 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. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
8. As the continuous transmission of the EUT (D ≥ 98%) cannot be achieved and EUT was transmitting continuously with 85.59% duty cycle (+/- 2% tolerance). Duty Cycle Correction Factor of 0.67 dB was added to all average measurements.

Test Setup:



Transmitter Band Edge Radiated Emissions (continued)

Results: BT-LE / 1 Mbps / PRBS9 / PWR 5

Results: Lower Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
2399.85	58.89	77.67	18.78	Complied
2400.00	56.61	77.67	21.06	Complied

Results: 2310 to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2389.72	58.24	74.00	15.76	Complied

Results: 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
2338.01	38.56	0.67	39.23	54.00	14.77	Complied

Results: Upper Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2483.50	66.01	74.00	7.99	Complied
2483.58	66.10	74.00	7.90	Complied

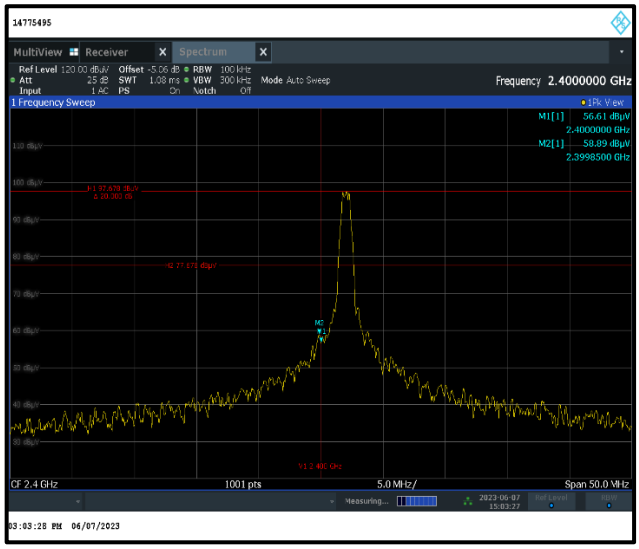
Results: Upper Band Edge / Average

Frequency (MHz)	Average Level (dBµV/m)	Duty Cycle Correction Factor (dB)	Corrected Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2483.50	40.66	0.67	41.33	54.00	12.67	Complied
2483.58	41.78	0.67	42.45	54.00	11.55	Complied

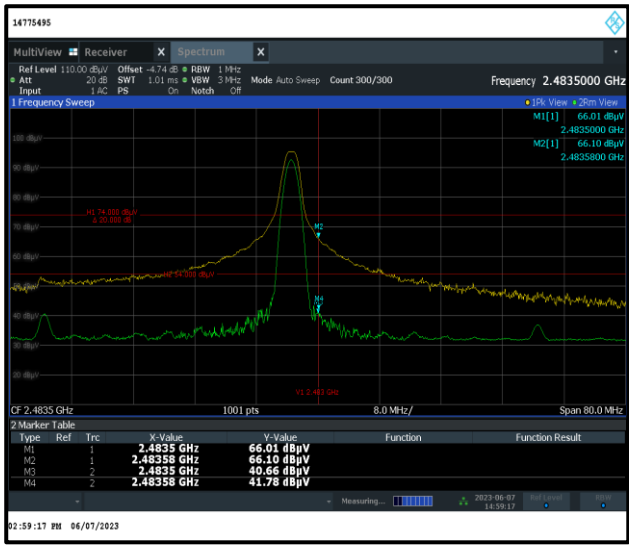
Result: Pass

Transmitter Band Edge Radiated Emissions (continued)

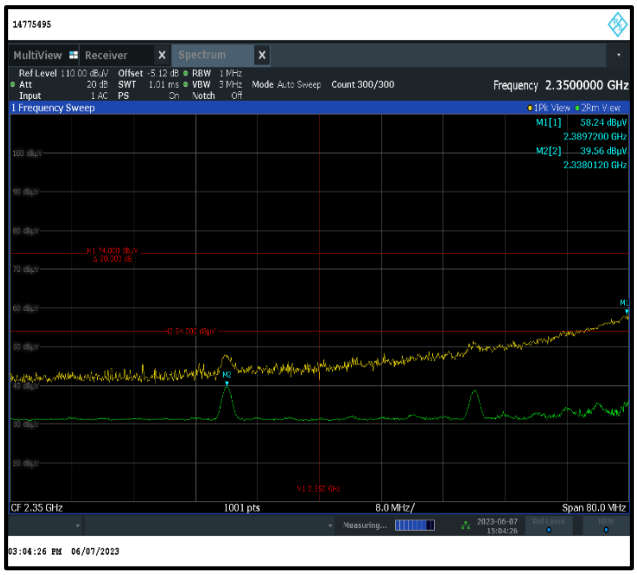
Results: BT-LE / 1 Mbps / PRBS9 / PWR 5



Lower Band Edge Peak Measurement



Upper Band Edge Peak & Average Measurement



2310 MHz to 2390 MHz Restricted Band

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
Minimum 6 dB Bandwidth	95%	±0.87 %
Transmitter Duty Cycle	95%	±3.4%
Conducted Maximum Peak Output Power	95%	±0.59 dB
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
423	Bonn Elektronik	Amplifier, Low Noise Pre	BLMA 1840-1A	55929	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	42
495	Rohde & Schwarz	Antenna, log. - periodical	HL050	100296	06/08/2021	24
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	13/07/2022	12
669	Rohde & Schwarz	EMI Test Receiver	ESW 44	103087	03/02/2022	18
607	Schwarzbeck	Antenna broadband horn antenna	BBHA 9170	9170-561	2019-10-15	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

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	12/07/2023	12
-/-	Testo	Thermo-Hygrometer	608-H1	07	lab verification	n/a
-/-	Huber & Suhner	RF Cable (up to 18 GHz)	-/-	-/-	lab verification	n/a
327	SPS	AC/DC power distribution system	PAS 5000	A2464 00/1 0200	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
1.1	1	Front page	Standard updated
	5	2.1	Standard updated
	7	3.2	EUT Models / Parts updated
Test Report Version 1.2 supersede Version 1.1 with immediate effect Test Report No. UL-RPT-RP-14775495-816-FCC Version 1.2, Issue Date 07 MAY 2024 replaces Test Report No. UL-RPT-RP-14775495-816-FCC Version 1.1, Issue Date 03 APRIL 2024, which is no longer valid.			
1.2	**Page No(s)**	**Clause**	**Details**
	1 & 7	Front & 3.1	FCC ID updated
	6	2.3	Methods and procedures table updated
	8	3.5	Antenna gain info updated
	16	5.2.3	Antenna gain info and result table updated

--- END OF REPORT ---