

Test Report No.: UL-RPT-RP-14858998-616-FCC

Applicant * : Valeo Equipement Electrique Moteur

Model No. * : View PLUS

FCC ID * : 2BCXA-VIEWPLUS

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 1.0
5. Result of the tested sample: **Pass**
6. All information marked with a (*) were provided by customer / applicant or authorized representative



Prepared by: Muhammad Faiq Khan
Title: Project Engineer
Date: 14 November 2023



Approved by: Rachid, Acharkaoui
Title: Operations Manager
Date: 14 November 2023



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

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1. Customer Information *

1.1.Applicant Information

Company Name:	Valeo Equipement Electrique Moteur
Company Address:	10, Rue du Revolay - 38070 - St Quentin Fallavier (FRANCE)
Contact Person:	Louis RENOUE
Contact E-Mail Address:	louis.renou@valeo.com
Contact Phone No.:	+33474825063

1.2.Manufacturer Information

Company Name:	Valeo Equipement Electrique Moteur
Company Address:	10, Rue du Revolay - 38070 - St Quentin Fallavier (FRANCE)
Contact Person:	Louis RENOUE
Contact E-Mail Address:	louis.renou@valeo.com
Contact Phone No.:	+33474825063

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 15.209

Location

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

Date Information

Order Date:	20.June 2023
EUT Arrived:	14 September 2023
Test Dates:	13 October 2023 to 24 October 2023
EUT Returned:	-/-

2.2. Summary of Test Results

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

Note(s):

1. The EUT will be mounted on a Cycle and will be powered via battery therefore AC conducted emissions not performed.
2. The measurement was performed to assist the average measurements.
3. 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:	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:	Cyclee
Model Name or Number:	View plus
Test Sample Serial Number:	230216163251 (Radiated Test sample)
Hardware Version Number:	SAA28354 Rev.i
Firmware Version Number:	1.2.22
Software Version:	e52a096b92d3dde3ae2d06e4b0d4eb8caa600521
FCC ID:	2BCXA-VIEWPLUS

Brand Name:	Cyclee
Model Name or Number:	View plus
Test Sample Serial Number:	230224141644 (Conducted Test sample with SMA connector)
Hardware Version Number:	SAA28354 Rev.i
Firmware Version Number:	1.2.22
FCC ID:	2BCXA-VIEWPLUS

3.2. Description of EUT *

The equipment under test was a User Interface for EPAC supporting Bluetooth Low Energy operations in 2400-2483.5MHz ISM band.

3.3. Modifications Incorporated in the EUT

Following modifications were applied to the EUT during testing.

EUT Radiated => Cable connection routed outside casing to pilot RF in DTM mode. Software changed to a software compatible with nRF Connect for DTM mode testing.

EUT Conducted => Cable connection routed outside casing to pilot RF in DTM mode. Cable SMA connection routed from Antenna bypass to outside casing for Radio testing. Software changed to a software compatible with nRF Connect for DTM mode testing.

3.4. 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):	125 kbps (S8)	GFSK (Coded)	
	500 kbps(S2)	GFSK (Coded)	
	1 Mbps	GFSK	
	2 Mbps	GFSK	
Maximum Conducted Output Power:	-8.59 dBm		
Peak Antenna Gain of the system:	1.85 dBi		
Antenna Type:	PCB Antenna		
Antenna Details:	Integrated antenna		
Transmit Channels Tested:	Channel ID	RF Channel	Frequency (MHz)
	Bottom	37	2402
	Middle	17	2440
	Top	39	2480
Power Supply Requirement(s):	12V DC via external power supply or battery		
Highest internally generated clock and/ or oscillator frequency:	HFCLK 64 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	Test Laptop With Test Software nRF connect V3.7.1	HP	ProBook 650	5CG614419V

B. Support Equipment (Manufacturer supplied) *

Item	Description	Brand Name	Model Name or Number	Serial Number
1	Steering control	Visteon	-/-	-/-

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
 - Bluetooth Low Energy (BLE) | PRBS9 | 1 Mbps | Bottom / Middle / Top Channel | PWR -8 dBm
 - Bluetooth Low Energy (BLE) | PRBS9 | 2 Mbps | Bottom / Middle / Top Channel | PWR -8 dBm
 - Bluetooth Low Energy (BLE) | PRBS9 | S8 | Bottom / Middle / Top Channel | PWR -8 dBm
 - Bluetooth Low Energy (BLE) | PRBS9 | S2 | Bottom / Middle / Top Channel | PWR -8 dBm

4.2. Configuration and Peripherals

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

EUT Power Supply:

- The EUT was powered with 12 V DC via external power supply.

Test Mode Activation:

- The EUT can be connected with the Test laptop via UART-USB cable. The laptop was removed from the measuring area during the measurement.
- The steering control connected to the EUT was connected for representative purposes and was not active during the measurements.
- The test modes for the measurements were activated using the test software / Radio Tool "nRF Connect V3.7.1". 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 connected on the PCB antenna port. The attenuation of the SMA RF cable between the EUT antenna connector and spectrum analyzer 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 laying 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 ($D \geq 98\%$) cannot be achieved and EUT was transmitting continuously with 58.45% duty cycle (+/- 2% tolerance) for 2 Mbps data rate. Duty Cycle Correction Factor of 2.33 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:	13 October 2022
Test Sample Serial Number:	230224141644 (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):	22.4
Relative Humidity (%):	48.1

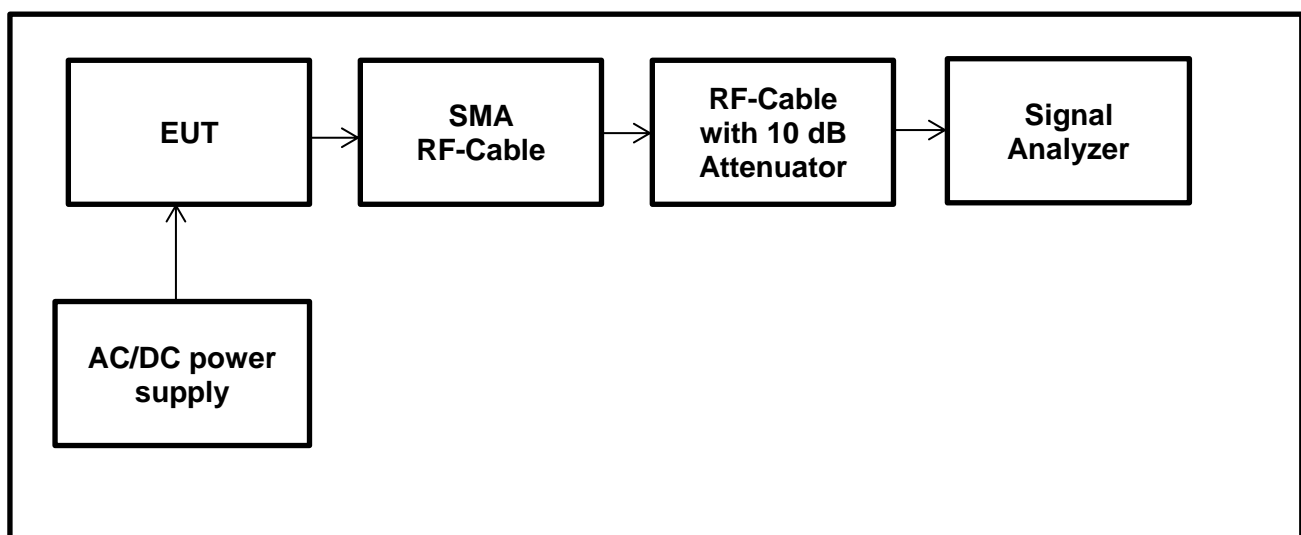
Note:

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

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

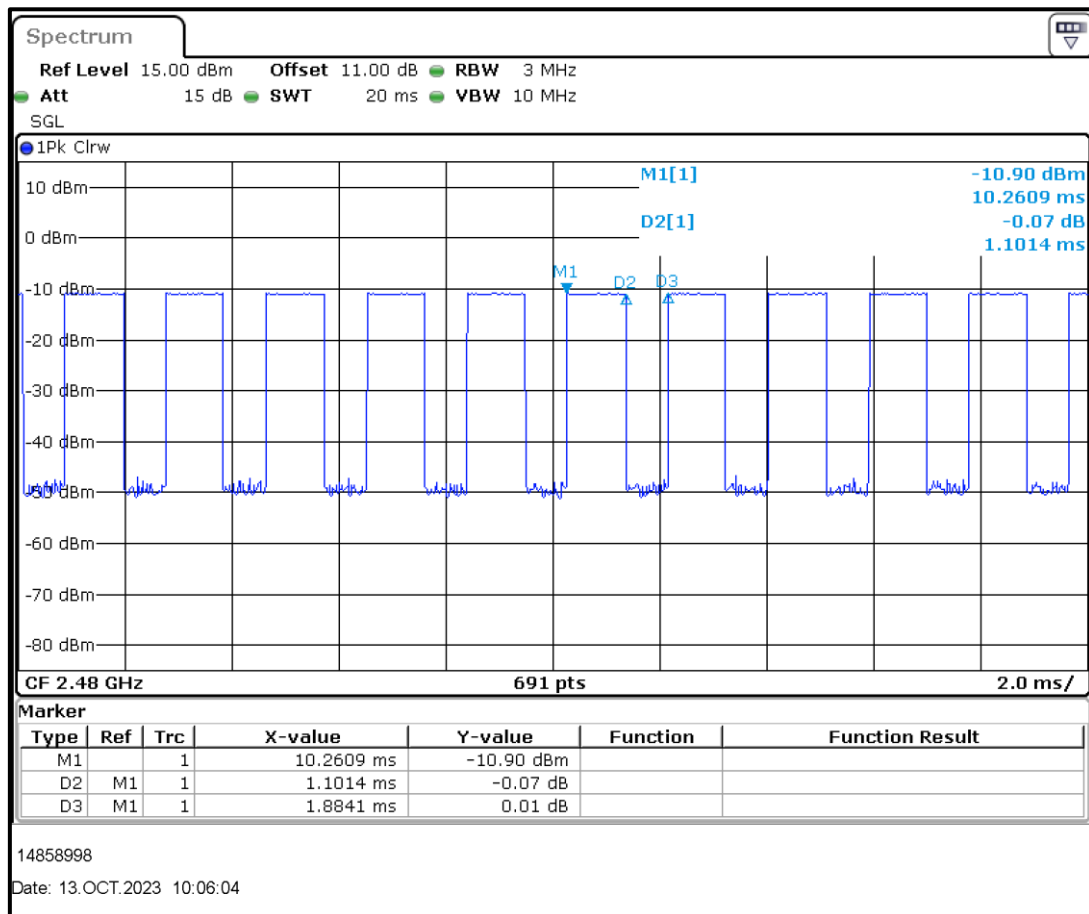
$$\text{Duty Cycle Correction Factor} = 10 \log 1 / [\text{On Time } (T_{ON})] / [\text{Period}(T_{ON} + T_{OFF}) \text{ or } 100\text{ms whichever is the lesser}]$$
- All conducted measurements were carried out by using the EUT RF sample with SMA cable connected on the PCB antenna port. The combined attenuation of the SMA RF cable between the EUT antenna connector and spectrum analyser was 1dB @2.4GHz plus the 10 dB extra attenuation and the values were added to as a reference level offset to each of the conducted plots.

Test Setup:



Transmitter Duty Cycle (continued)**Results: BT-LE / 2 Mbps / PRBS9 / PWR -8 dBm / Top Channel**

Pulse On Time (T _{ON}) (ms)	Pulse Period (T _{ON} + T _{OFF}) (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
1.1014	1.8841	58.45	2.33

**Result: Pass**

5.2.2. Transmitter Minimum 6 dB Bandwidth**Test Summary:**

Test Engineer:	Muhammad Faiq Khan	Test Date:	13 October 2023
Test Sample Serial Number:	230224141644 (Conducted Test sample with SMA connector)		
Test Site Identification	SR 9		

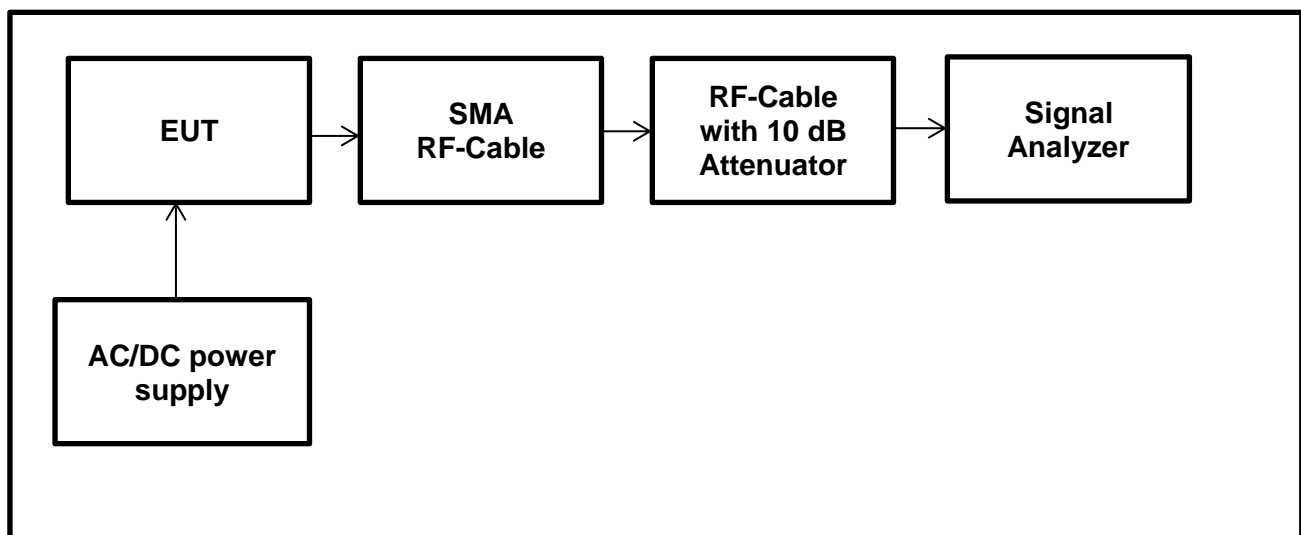
FCC Reference:	Part 15.247(a)(2)
Test Method Used:	FCC KDB 558074 Section 8.2 referencing ANSI C63.10:2013 Section 11.8.1 Option 1

Environmental Conditions:

Temperature (°C):	22.4
Relative Humidity (%):	48.1

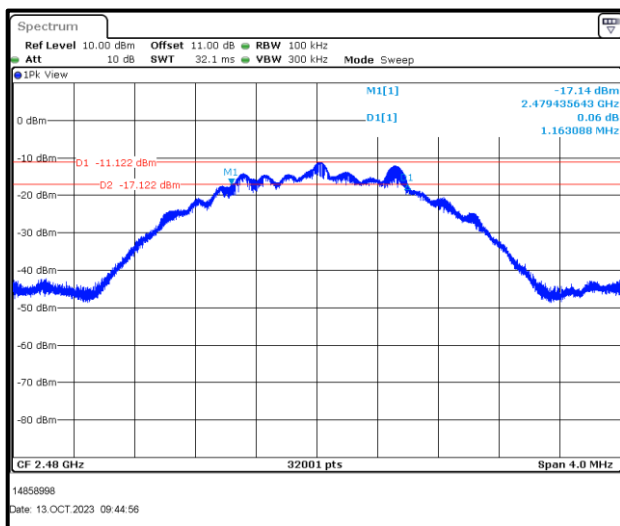
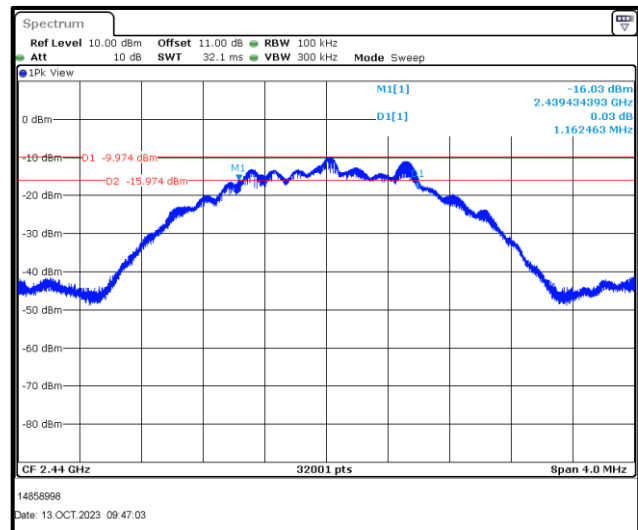
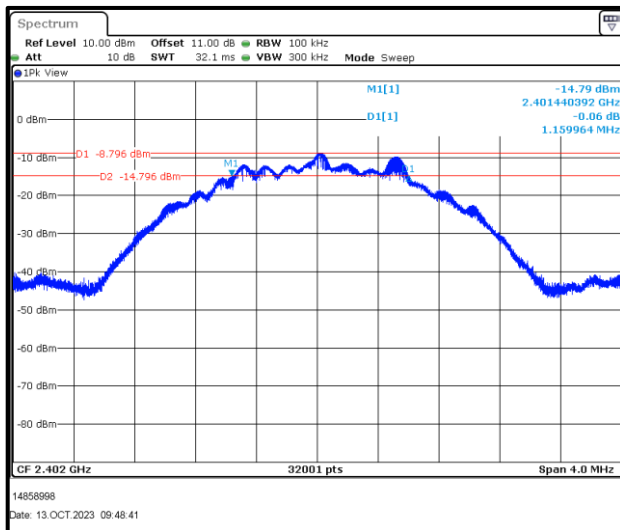
Notes:

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. All conducted measurements were carried out by using the EUT RF sample with SMA cable connected on the PCB antenna port. The combined attenuation of the SMA RF cable between the EUT antenna connector and spectrum analyser was 1dB @2.4GHz plus the 10 dB extra attenuation and the values were added to as a reference level offset to each of the conducted plots.

Test Setup:

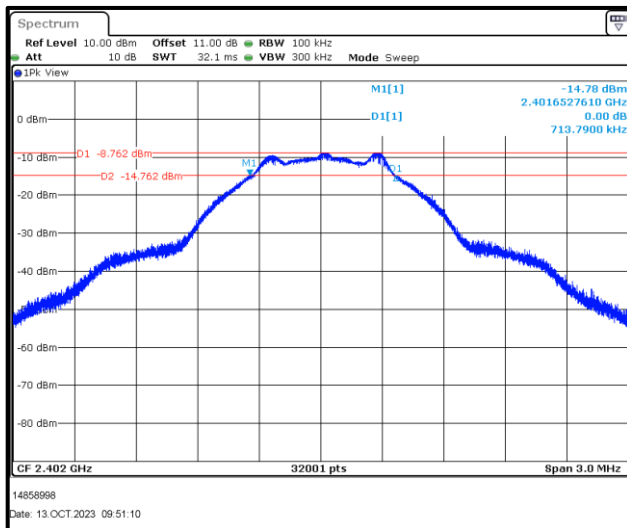
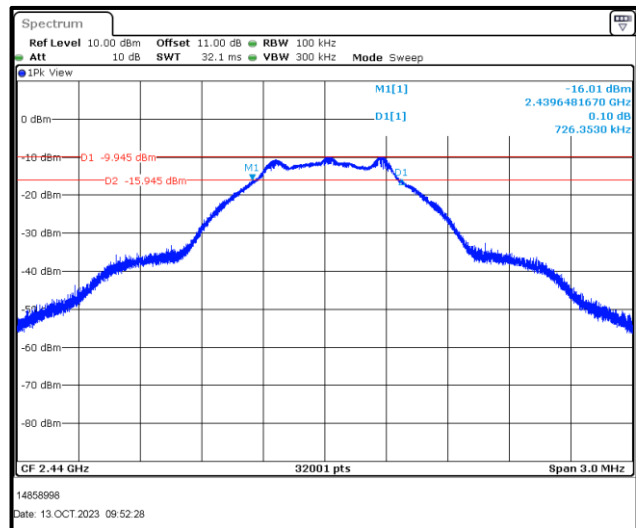
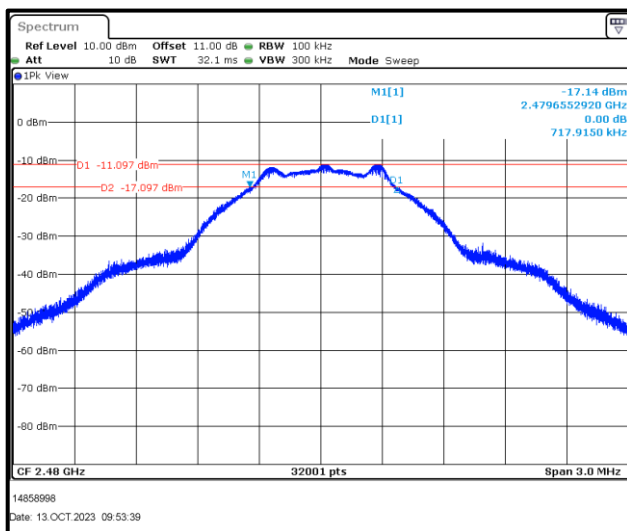
Transmitter Minimum 6 dB Bandwidth (continued)**Results: BT-LE / 2 Mbps / PRBS9 / PWR -8 dBm**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	1159.96	≥ 500	659.96	Complied
Middle	1162.46	≥ 500	662.46	Complied
Top	1163.08	≥ 500	663.08	Complied

**Result: Pass**

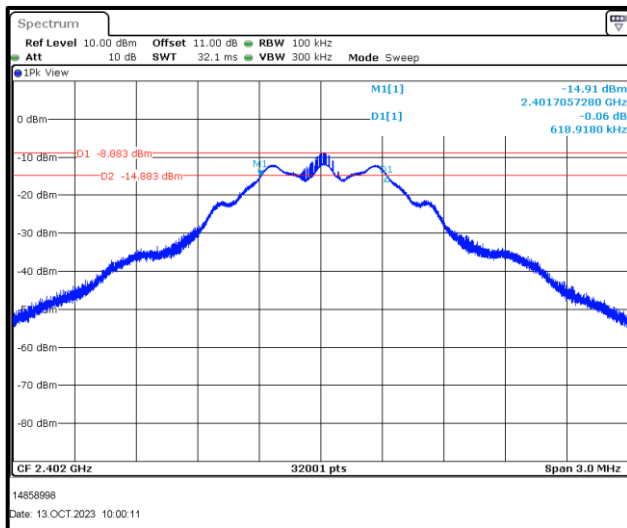
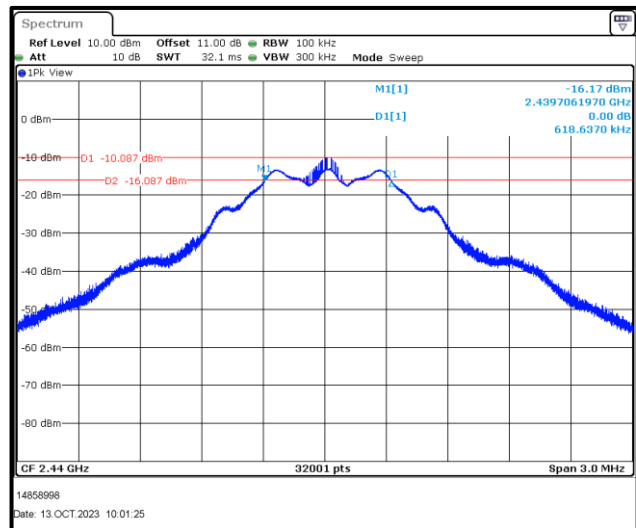
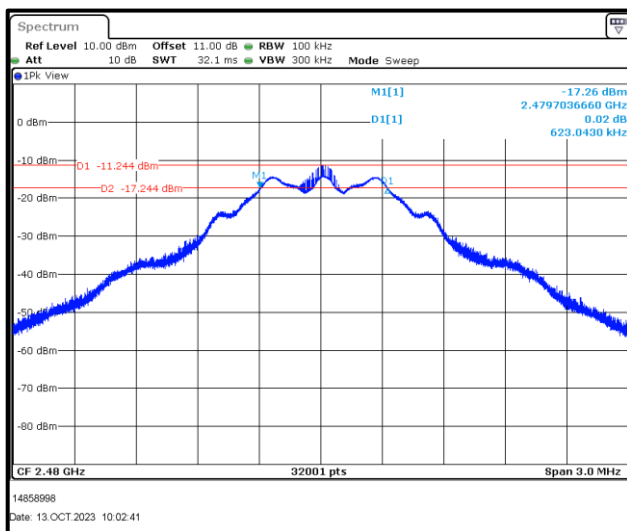
Transmitter Minimum 6 dB Bandwidth (continued)**Results: BT-LE / 1 Mbps / PRBS9 / PWR -8 dBm**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	713.790	≥ 500	213.790	Complied
Middle	726.353	≥ 500	226.353	Complied
Top	717.915	≥ 500	217.915	Complied

**Bottom Channel****Middle Channel****Top Channel****Result: Pass**

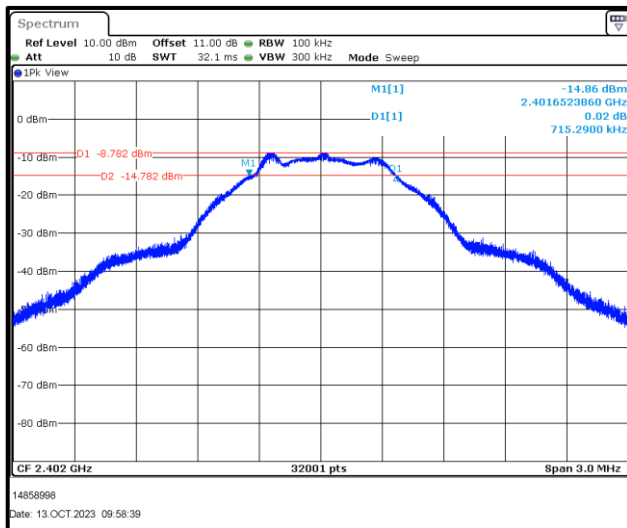
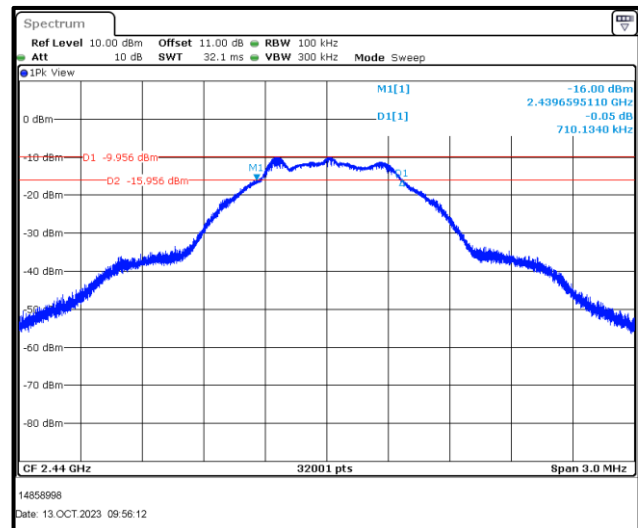
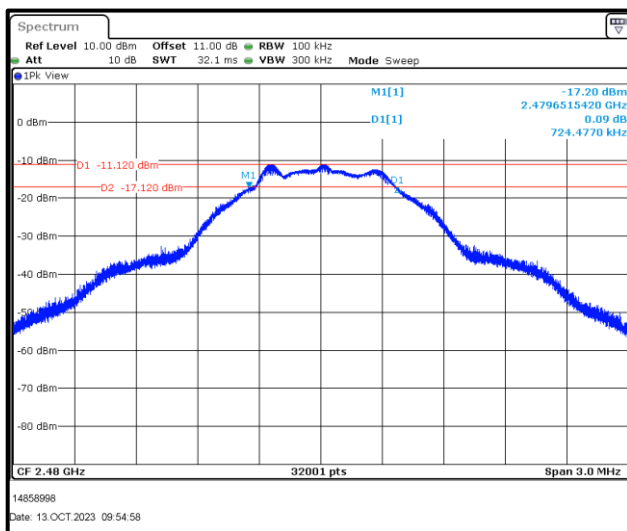
Transmitter Minimum 6 dB Bandwidth (continued)**Results: BT-LE / S8 / PRBS9 / PWR -8 dBm**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	618.918	≥ 500	118.918	Complied
Middle	618.637	≥ 500	118.637	Complied
Top	623.043	≥ 500	123.043	Complied

**Bottom Channel****Middle Channel****Top Channel****Result: Pass**

Transmitter Minimum 6 dB Bandwidth (continued)**Results: BT-LE / S2 / PRBS9 / PWR -8 dBm**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	715.290	≥ 500	215.290	Complied
Middle	710.134	≥ 500	210.134	Complied
Top	724.477	≥ 500	224.477	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:	13 October 2022
Test Sample Serial Number:	230224141644 (Conducted Test sample with SMA connector)		
Test Site Identification	SR 9		

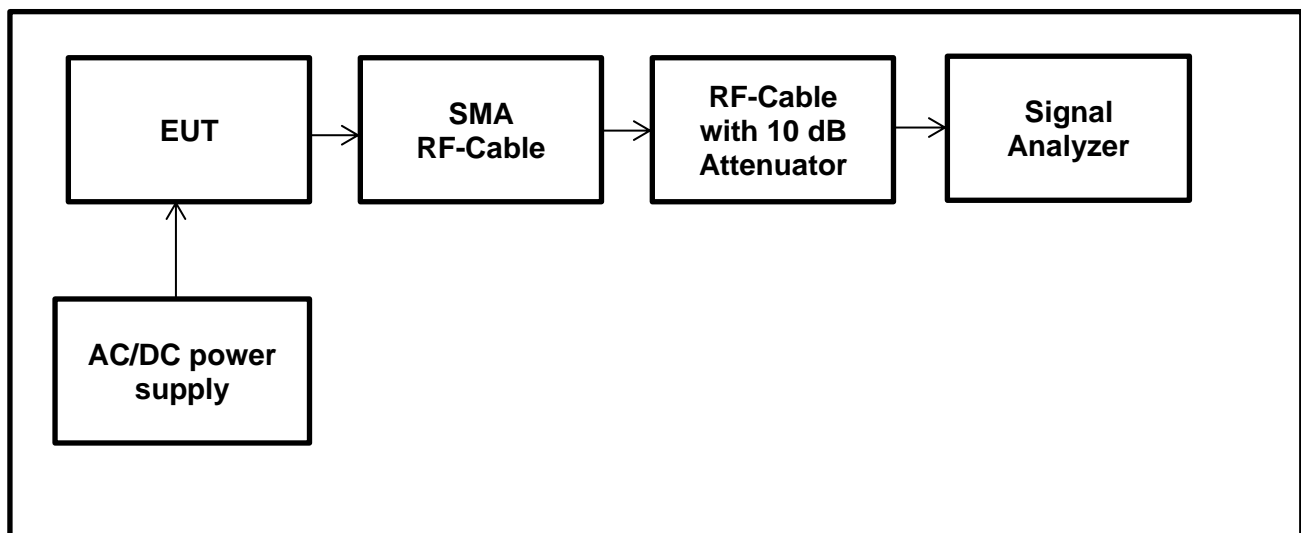
FCC Reference:	Part 15.247(b)(3)
Test Method Used:	FCC KDB 558074 Section 8.3.1.3 referencing ANSI C63.10 Sections 11.9.1.1

Environmental Conditions:

Temperature (°C):	22.4
Relative Humidity (%):	48.1

Notes:

1. 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.
2. The signal 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.
3. All conducted measurements were carried out by using the EUT RF sample with SMA cable connected on the PCB antenna port. The combined attenuation of the SMA RF cable between the EUT antenna connector and spectrum analyser was 1dB @2.4GHz plus the 10 dB extra attenuation and the values were added to as a reference level offset to each of the conducted plots.
4. The declared antenna gain was added to conducted power to obtain the relevant EIRP values.

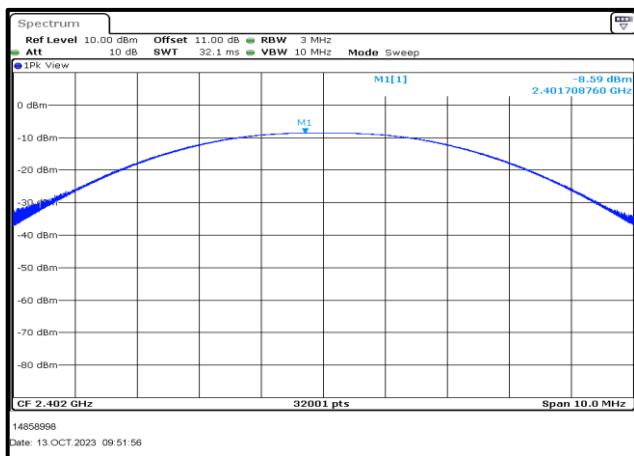
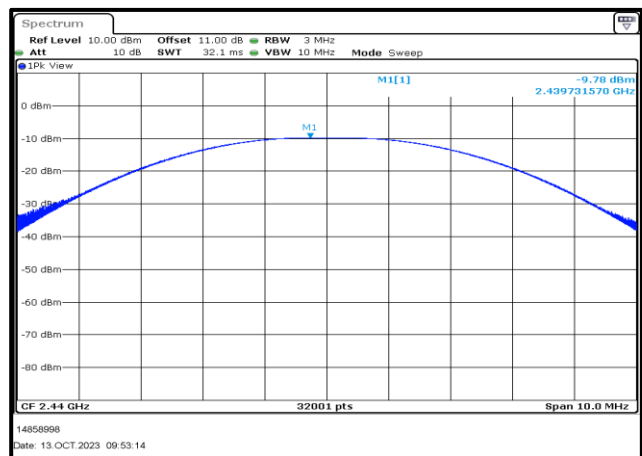
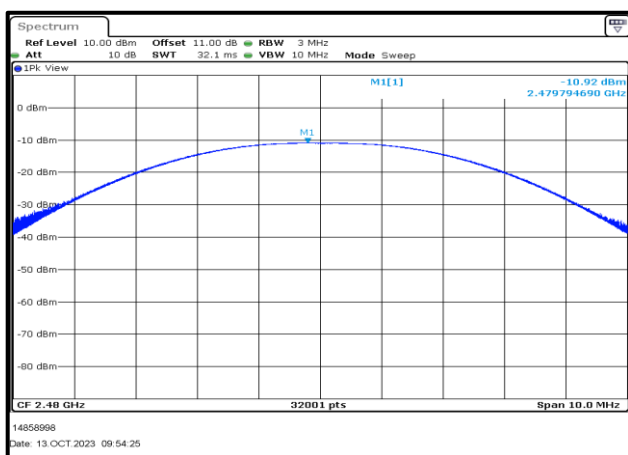
Test Setup:

Transmitter Maximum Peak Output Power (continued)**Results: BT-LE / 1 Mbps / PRBS9 / PWR -8 dBm**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	-8.59	30.00	38.59	Complied
Middle	-9.78	30.00	39.78	Complied
Top	-10.92	30.00	40.92	Complied

Results: BT-LE / 1 Mbps / PRBS9 / PWR -8 dBm

Channel	Conducted Peak Power (dBm)	Declared Stitched Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	-8.59	1.85	-6.74	36.00	42.74	Complied
Middle	-9.78	1.85	-7.93	36.00	43.93	Complied
Top	-10.92	1.85	-9.07	36.00	45.07	Complied

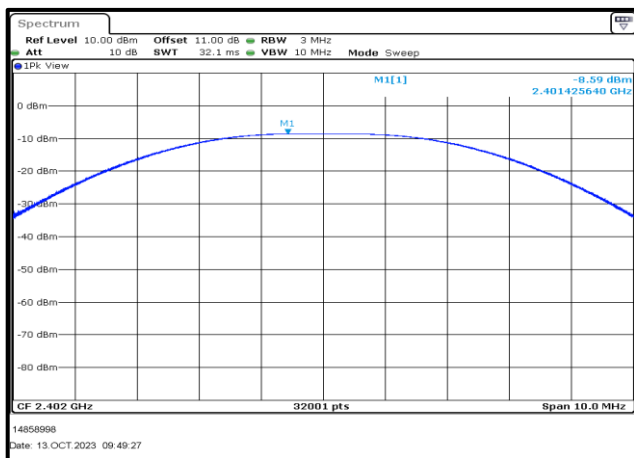
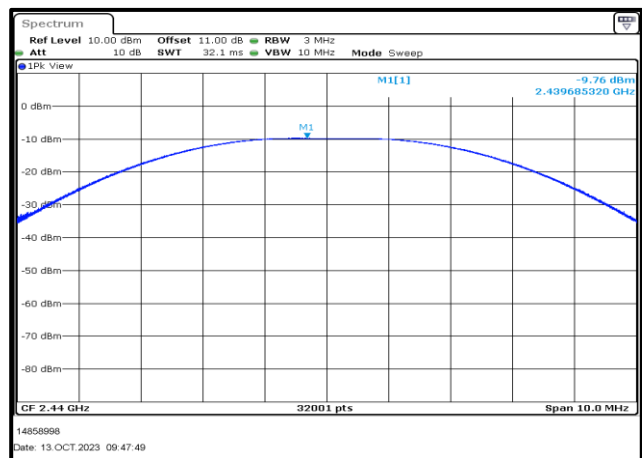
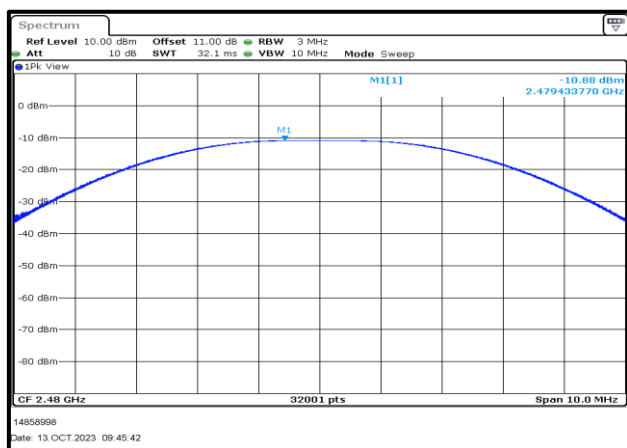
Result: Pass**Plots: BT-LE / 1 Mbps / PRBS9 / PWR -8 dBm****Bottom Channel****Middle Channel****Top Channel**

Transmitter Maximum Peak Output Power (continued)**Results: BT-LE / 2 Mbps / PRBS9 / PWR -8 dBm**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	-8.59	30.00	38.59	Complied
Middle	-9.76	30.00	39.76	Complied
Top	-10.88	30.00	40.88	Complied

Results: BT-LE / 2 Mbps / PRBS9 / PWR -8 dBm

Channel	Conducted Peak Power (dBm)	Declared Stitched Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	-8.59	1.85	-6.74	36.00	42.74	Complied
Middle	-9.76	1.85	-7.91	36.00	43.91	Complied
Top	-10.88	1.85	-9.03	36.00	45.03	Complied

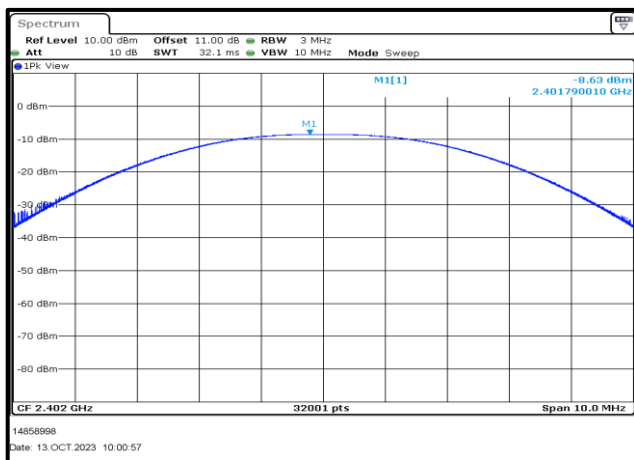
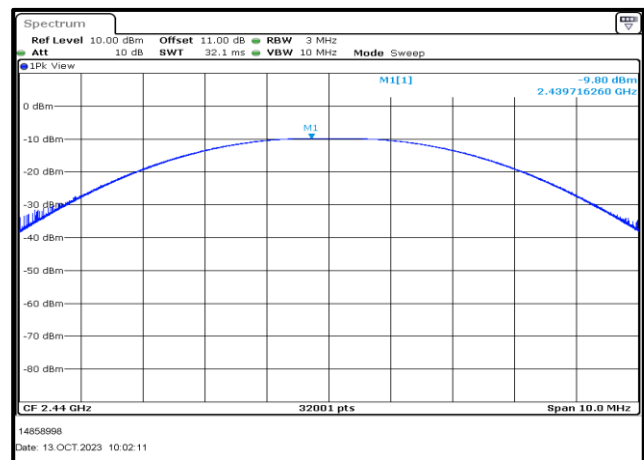
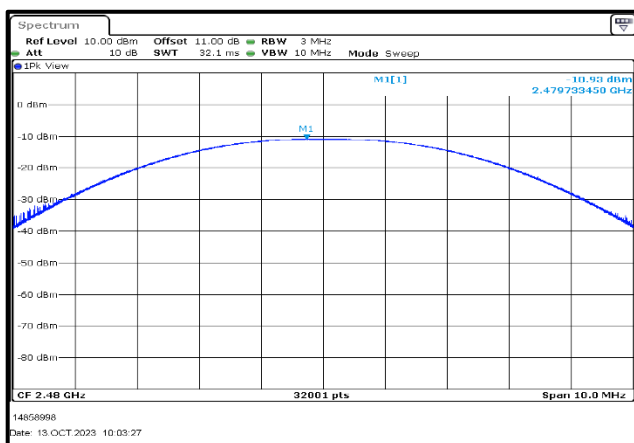
Result: Pass**Plots: BT-LE / 2 Mbps / PRBS9 / PWR -8 dBm****Bottom Channel****Middle Channel****Top Channel**

Transmitter Maximum Peak Output Power (continued)**Results: BT-LE / S8 / PRBS9 / PWR -8 dBm**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	-8.63	30.00	38.63	Complied
Middle	-9.80	30.00	39.80	Complied
Top	-10.93	30.00	40.93	Complied

Results: BT-LE / S8 / PRBS9 / PWR -8 dBm

Channel	Conducted Peak Power (dBm)	Declared Stitched Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	-8.63	1.85	-6.78	36.00	42.78	Complied
Middle	-9.80	1.85	-7.95	36.00	43.95	Complied
Top	-10.93	1.85	-9.08	36.00	45.08	Complied

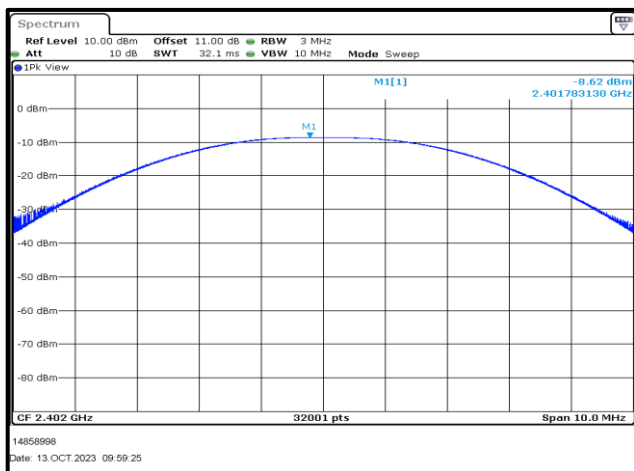
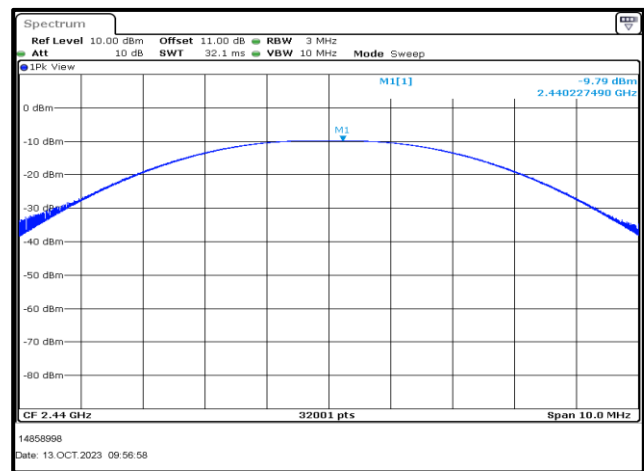
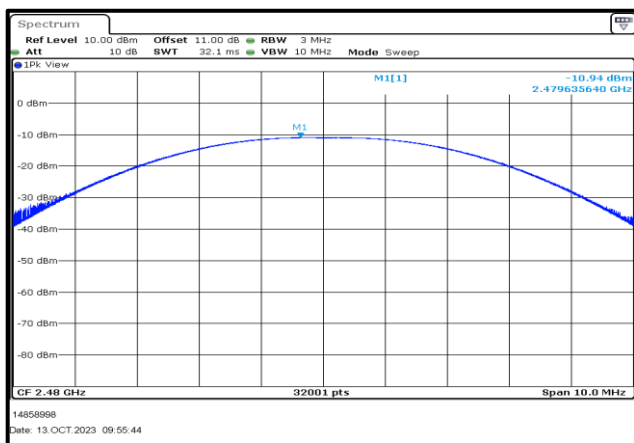
Result: Pass**Plots: BT-LE / S8 / PRBS9 / PWR -8 dBm****Bottom Channel****Middle Channel****Top Channel**

Transmitter Maximum Peak Output Power (continued)**Results: BT-LE / S2 / PRBS9 / PWR -8 dBm**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	-8.62	30.00	38.62	Complied
Middle	-9.79	30.00	39.79	Complied
Top	-10.94	30.00	40.94	Complied

Results: BT-LE / S2 / PRBS9 / PWR -8 dBm

Channel	Conducted Peak Power (dBm)	Declared Stitched Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	-8.62	1.85	-6.77	36.00	42.77	Complied
Middle	-9.79	1.85	-7.94	36.00	43.94	Complied
Top	-10.94	1.85	-9.09	36.00	45.09	Complied

Result: Pass**Plots: BT-LE / S2 / PRBS9 / PWR -8 dBm****Bottom Channel****Middle Channel****Top Channel**

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

Test Engineer:	Muhammad Faiq Khan	Test Date:	24 October 2023
Test Sample Serial Number:	230216163251 (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:

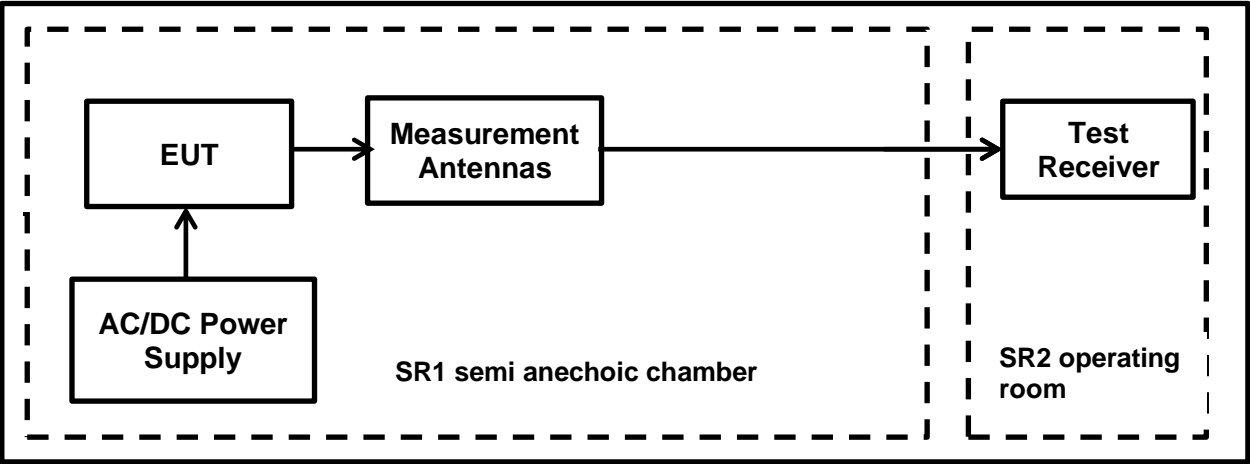
Temperature (°C):	23.3
Relative Humidity (%):	45.0

Notes:

- In accordance with FCC KDB 414788 D01 Radiated Test Site & ANSI C63.10 clause 5.2 an alternative test site that can demonstrate equivalence to an open area test site may be used. Therefore, the measurement was performed in a Semi Anechoic Chamber. (The OATS / SAC comparison data is available upon request).
- The limits are specified at a test distances of 30 and 300 metres. However, as specified in FCC Section 15.31 (f)(2) & ANSI C63.10 clause 6.4.3, measurements may be performed at a closer distance and the measured level extrapolated to the specified measurement distance using the method described in clauses 6.4.4, specifically sub-clause 6.4.4.1 which specifies that the measured level shall be extrapolated to the specified distance by conservatively presuming that the field strength decays at 40 dB/decade.
Therefore, measurements were performed at a measurement distance of 3 m.
- Therefore, the limit values are extrapolated to a measurement distance of 3 m.
 - 9 kHz- 490 kHz: limits extrapolated from 300 m to 3 m by adding 80 dB at 40 dB /decade.
 - 490 kHz-1705 kHz: limits extrapolated from 30 m to 3 m by adding 40 dB at 40 dB /decade.
- Measurements below 30 MHz were performed in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) at a distance of 3 m. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. The measurement loop antenna height was 100 cm.
- The EUT was configured with the following modes as it was determined to be the worst-case w.r.t output power measured.
 - BT-LE | 2 Mbps | PRBS9 | PWR -8 dBm | Bottom Channel
- The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
- Pre-scans were performed, and markers placed on the highest measured levels. The test receiver was set to:
 - Frequency range: 9 kHz-150 kHz: RBW: 1 kHz /VBW: 3 kHz
 - Frequency range: 150 kHz – 30 MHz: RBW: 10 kHz /VBW: 30 kHz
 - Detector: Max-Peak detector
 - Trace Mode: Max Hold

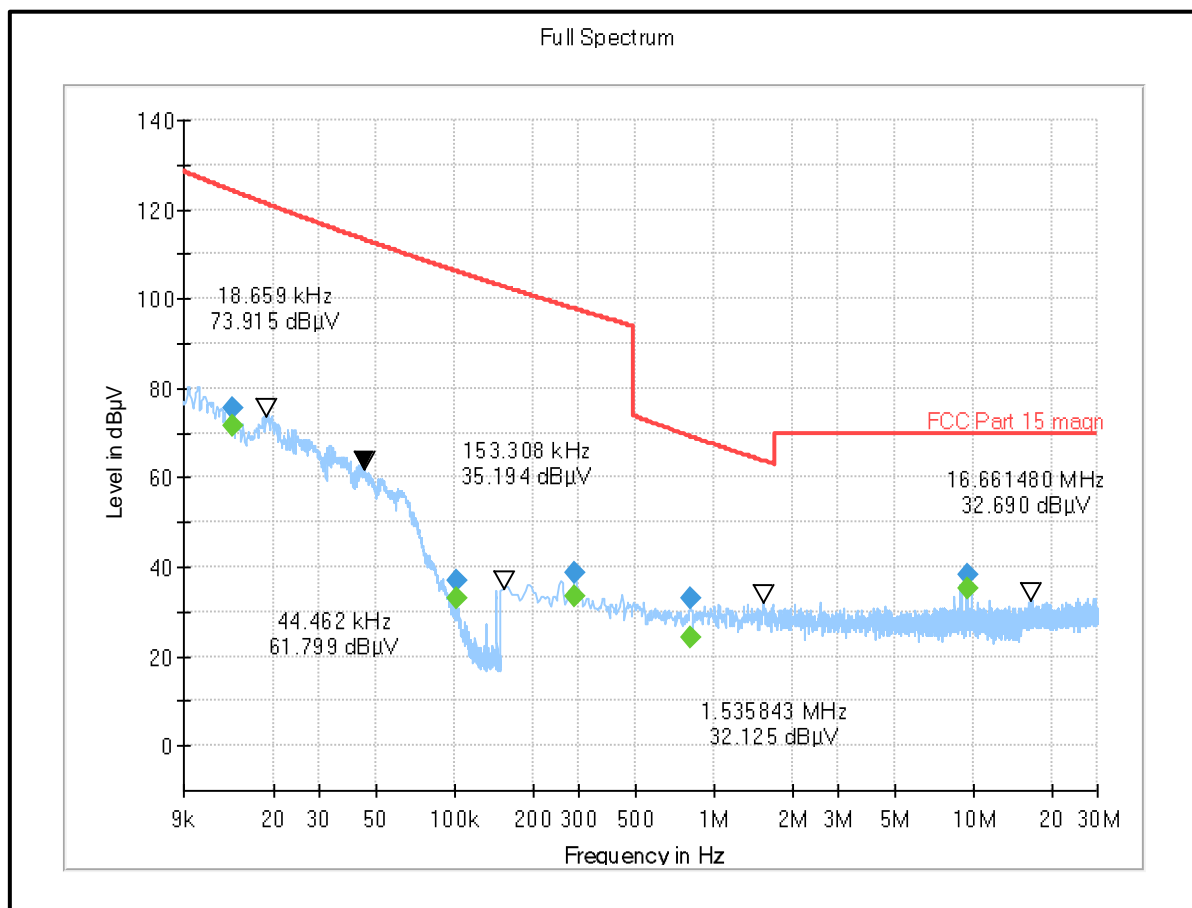
Transmitter Radiated Emissions (continued)

Test Setup:



Transmitter Radiated Emissions (continued)**Results: BT-LE | 2 Mbps | PRBS9 | PWR -8 dBm | Bottom Channel**

Frequency (MHz)	Loop Antenna Orientation	MaxPeak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
0.013865	90° to EUT	75.72	124.20	48.48	Complied
0.101496	90° to EUT	36.97	106.18	69.21	Complied
0.288915	0° to EUT	38.87	97.78	58.91	Complied
0.811500	90° to EUT	32.99	69.21	36.22	Complied
9.470.503	90° to EUT	38.45	70.00	31.55	Complied

Plot: 9 kHz – 30 MHz: BT-LE | 2 Mbps | PRBS9 | PWR -8 dBm | Bottom Channel**Result: Pass**

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

Test Engineer:	Muhammad Faiq Khan	Test Date:	24 October 2023
Test Sample Serial Number:	230216163251 (Radiated Test sample)		
Test Site Identification	SR 1/2		

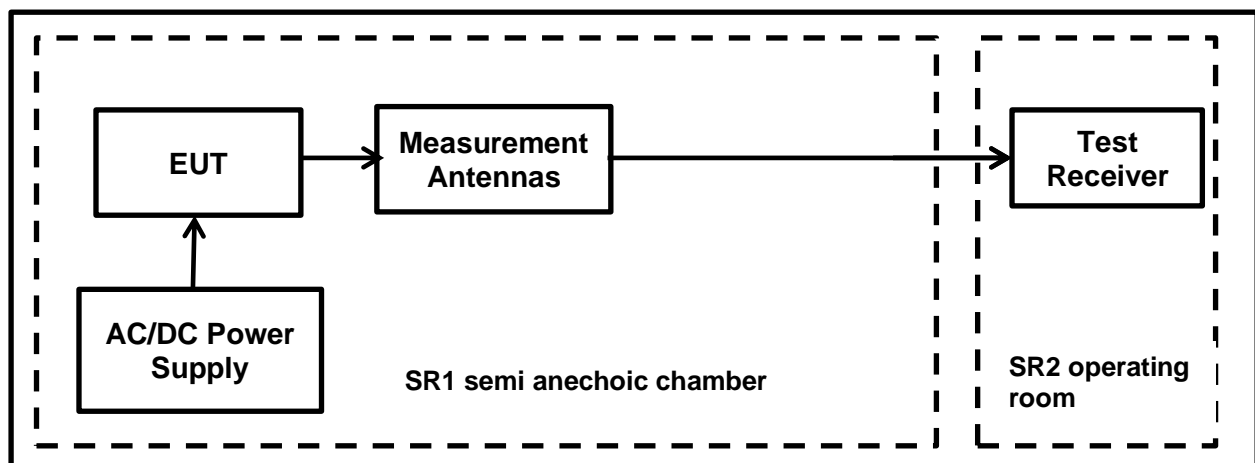
FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	FCC KDB 558074 Sections 8.5 & 8.6 referencing ANSI C63.10 Sections 11.11 and 11.12 ANSI C63.10:2013 Sections 6.3 and 6.5
Frequency Range:	30 MHz to 1000 MHz

Environmental Conditions:

Temperature (°C):	23.3
Relative Humidity (%):	45.0

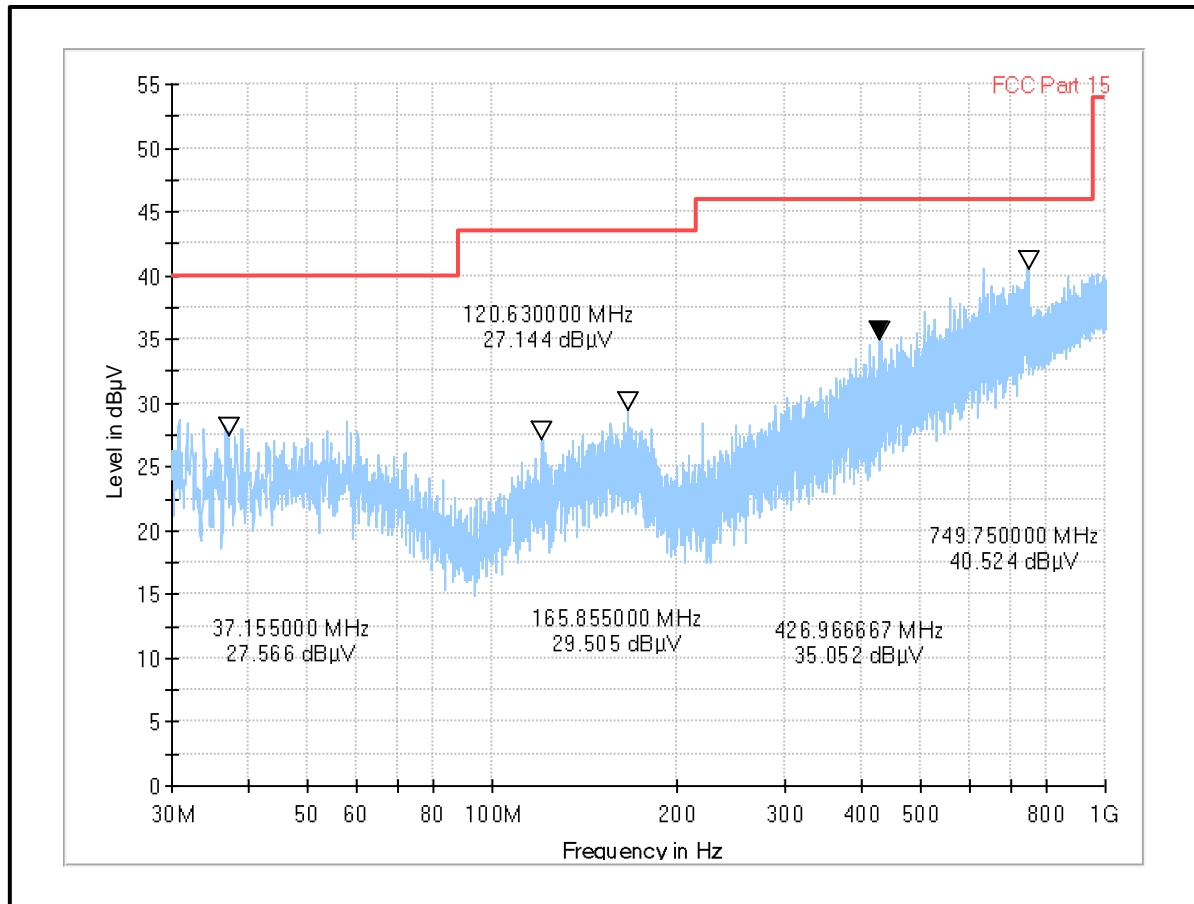
Note(s):

- Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
- The EUT was configured with the following modes as it was determined to be the worst-case w.r.t output power measured.
 - BT-LE | 2 Mbps | PRBS9 | PWR -8 dBm | Bottom Channel
- Pre-scans were performed, and markers placed on the highest measured levels. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.
- The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
- All other emissions shown on the pre-scan plot were investigated and found to be below the measurement system noise floor.

Test Setup:

Transmitter Radiated Emissions (continued)**Results: BT-LE / 2 Mbps / PRBS9 / Bottom Channel / PWR -8 dBm**

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
No critical emissions were detected					

Plot: 30 MHz – 1GHz: BT-LE / 2 Mbps / PRBS9 / PWR -8 dBm / Bottom Channel**Result: Pass**

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

Test Engineer:	Muhammad Faiq Khan	Test Date:	24 October 2023
Test Sample Serial Number:	230216163251 (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:

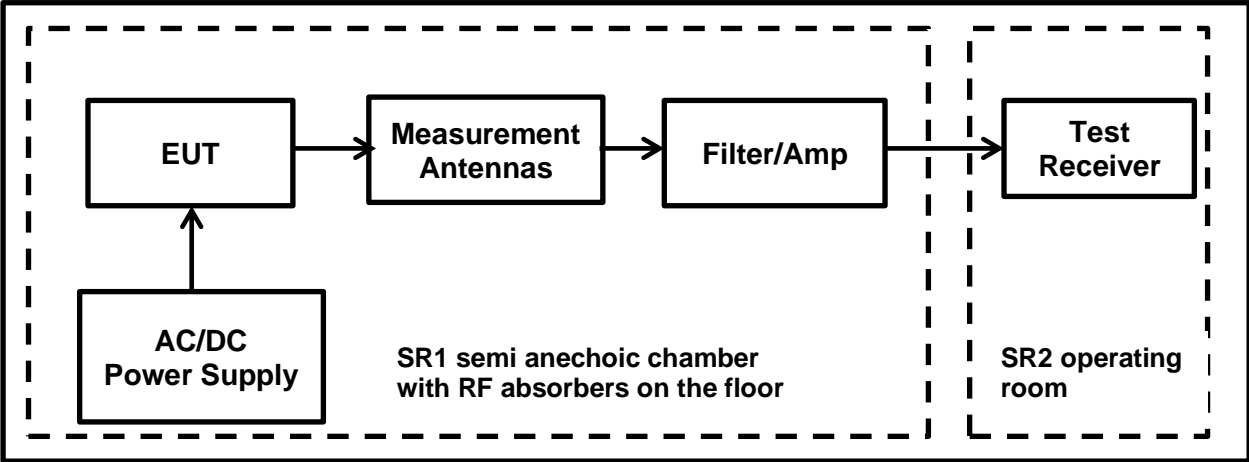
Temperature (°C):	23.3
Relative Humidity (%):	45.0

Notes:

- Pre-scans above 1 GHz were performed in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) with RF absorbers on the floor at a distance of 3 m. The EUT was placed at a height of 1.5 m above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 m above the test chamber floor, in line with the EUT. Final measurements above 1 GHz were performed in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) with absorber on the floor at a distance of 3 m. The EUT was placed at a height of 1.5 m above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 m to 4 m.
- The EUT was configured with the following modes as it was determined to be the worst-case w.r.t output power measured.
 - BT-LE | 2 Mbps | PRBS9 | PWR -8 dBm | Bottom Channel
- Pre-scans were performed, and a marker placed on the highest measured level of the appropriate plot. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz the sweep time was set to auto.
- The emissions shown at frequencies approximately 2.4 GHz to 2.4835 GHz on the 1 GHz to 18 GHz plots are the EUT fundamental for the tested channel.
- In accordance with ANSI C63.10-2013 Section 5.3.3 & 6.5.3 measurements above 18 GHz were performed at closer distance (1 m); because at specified measurement distance (3m) for compliance the instrumentation noise floor was typically close to the radiated emission limit.
- For frequency range between 18 GHz and 25 GHz, no critical emissions were found. All emissions shown on the pre-scans were investigated and found to be below the noise floor of the measurement system

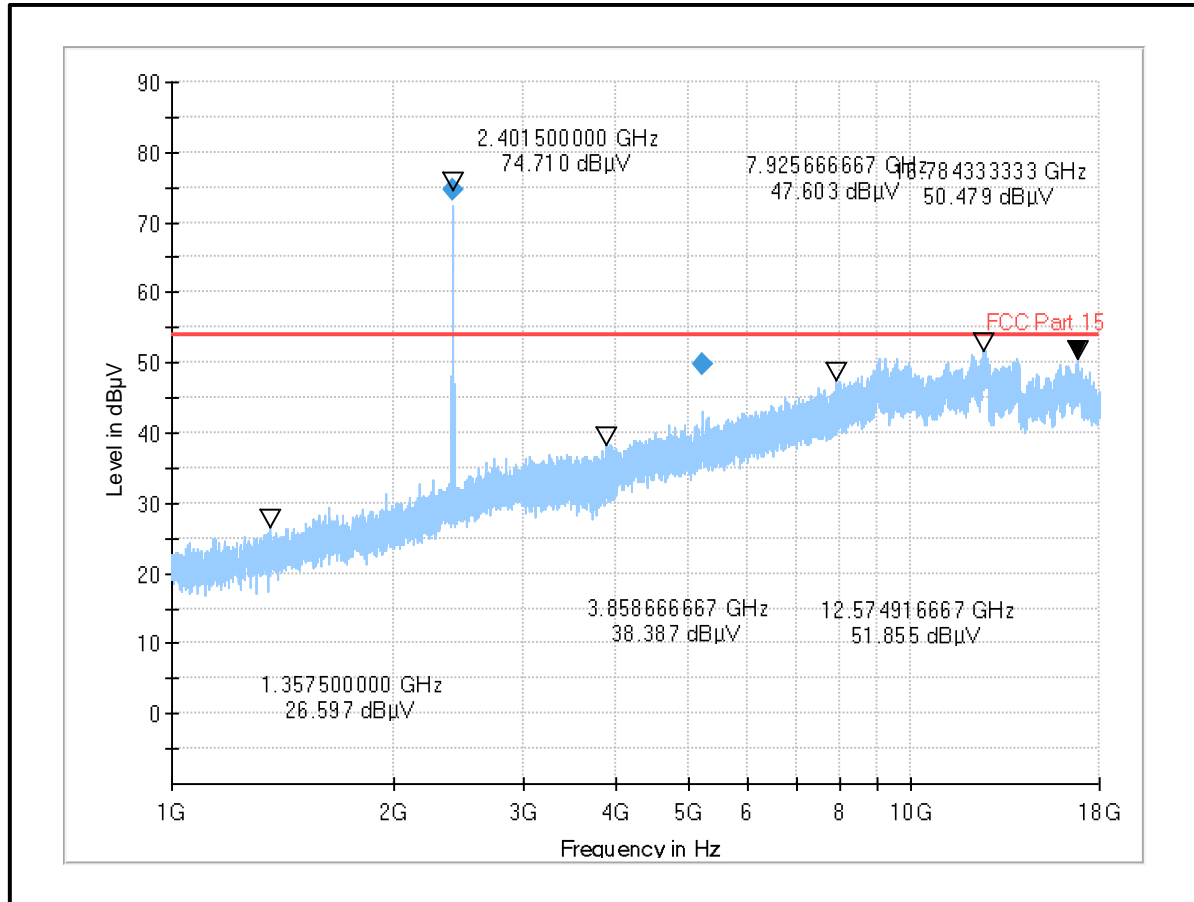
Transmitter Radiated Emissions (continued)

Test Setup:



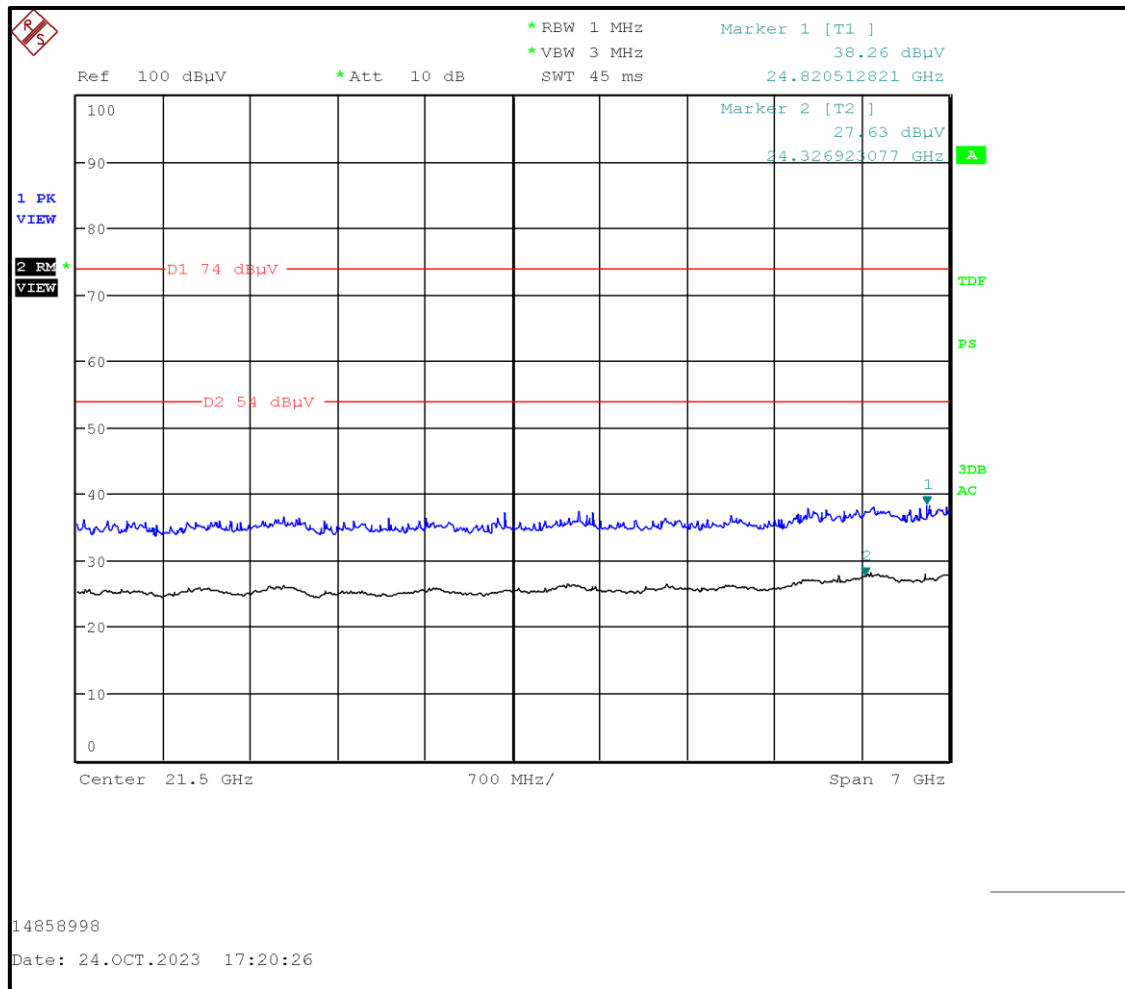
Transmitter Radiated Emissions (continued)**Results: BT-LE / 2 Mbps / PRBS9 / Bottom Channel / PWR -8 dBm**

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5210.000000	Vertical	49.80	54.00	4.20	Complied

Plot: 1 GHz – 18 GHz: BT-LE / 2 Mbps / PRBS9 / PWR -8 dBm / Bottom Channel**Result: Pass**

Transmitter Radiated Emissions (continued)**Results: BT-LE / 2 Mbps / PRBS9 / Bottom Channel / PWR -8 dBm**

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

Plot: 18 GHz – 25 GHz: BT-LE / 2 Mbps / PRBS9 / PWR -8 dBm / Bottom Channel**Result: Pass**

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

Test Engineer:	Muhammad Faiq Khan	Test Date:	24 October 2023
Test Sample Serial Number:	230216163251 (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:

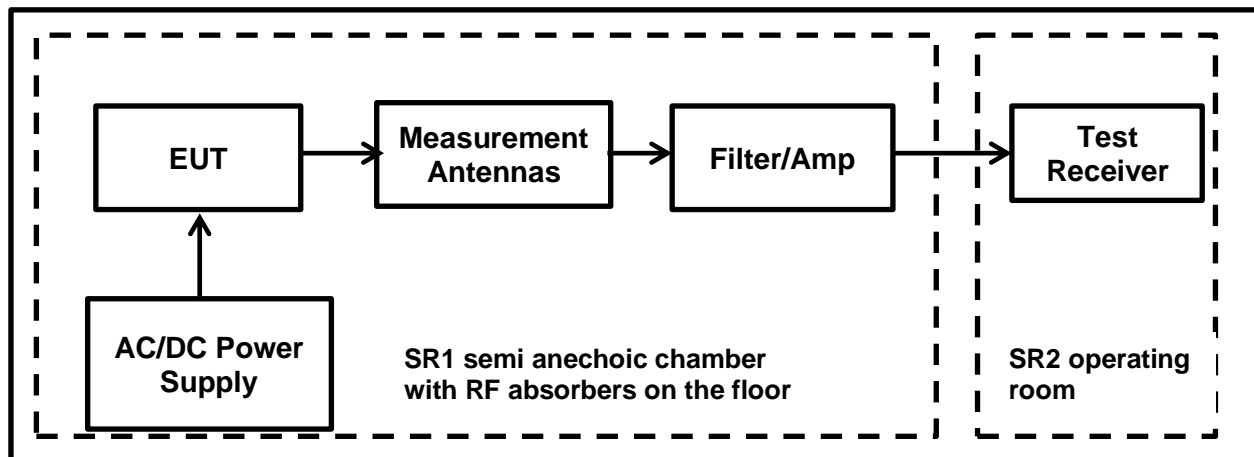
Temperature (°C):	23.3
Relative Humidity (%):	45.0

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. 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.
- 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 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.
- 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.
- The measurement was performed only with 2 Mbps data rate as it was determined to be the worst-case w.r.t output power measured and has the widest bandwidth.

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

8. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
9. As the continuous transmission of the EUT ($D \geq 98\%$) cannot be achieved and EUT was transmitting continuously with 58.45% duty cycle (+/- 2% tolerance) for 2 Mbps data rate. Duty Cycle Correction Factor of 2.33 dB was added to all average measurements.

Test Setup:

Transmitter Band Edge Radiated Emissions (continued)**Results: BT-LE / 2 Mbps / PRBS9 / PWR -8 dBm****Results: Lower Band Edge / Peak**

Frequency (MHz)	Peak Level (dB μ V/m)	-20 dBc Limit (dB μ V/m)	Margin (dB)	Result
2387.81	51.30	55.53	4.23	Complied
2400.00	43.10	55.53	12.43	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
2385.84	55.49	74.00	18.51	Complied

Results: 2310 to 2390 MHz Restricted Band / Average

Frequency (MHz)	Average Level (dB μ V/m)	Duty Cycle Correction Factor (dB)	Corrected Average Level (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)	Result
2387.88	48.11	2.33	50.44	54.00	3.56	Complied

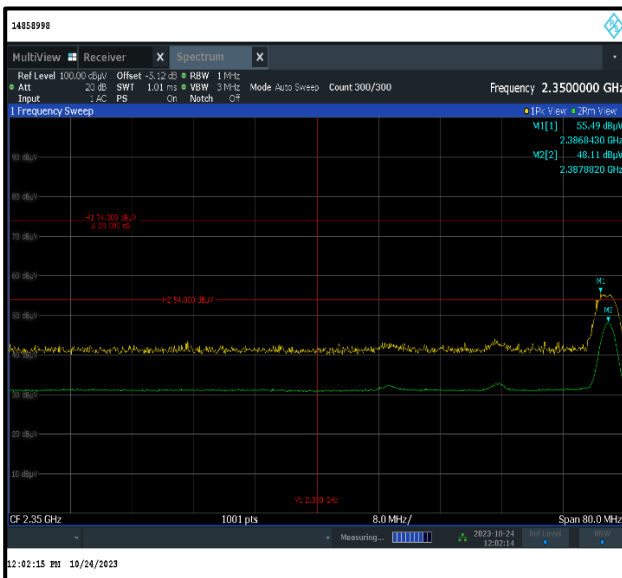
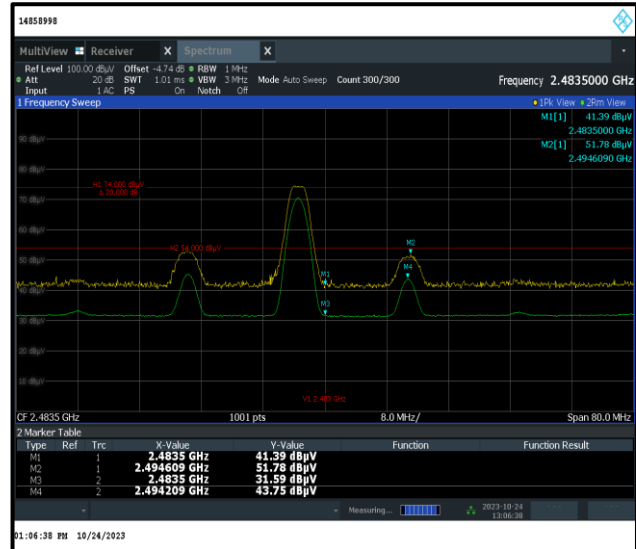
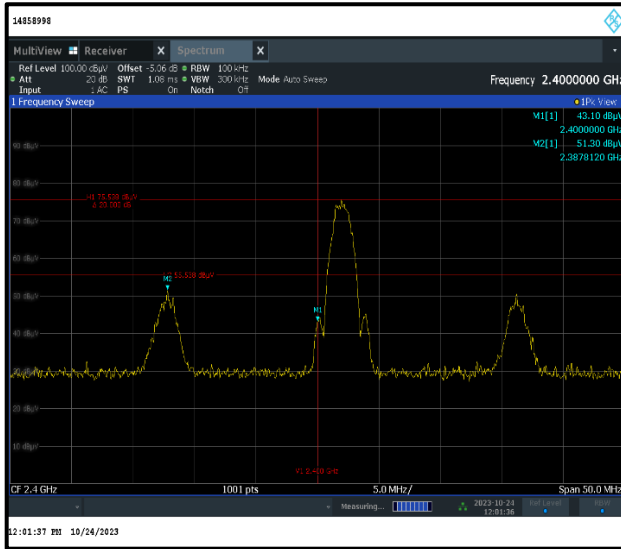
Results: Upper Band Edge / Peak

Frequency (MHz)	Peak Level (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)	Result
2483.50	41.39	74.00	32.61	Complied
2494.60	51.78	74.00	22.22	Complied

Results: Upper Band Edge / Average

Frequency (MHz)	Average Level (dB μ V/m)	Duty Cycle Correction Factor (dB)	Corrected Average Level (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)	Result
2483.50	31.59	2.33	33.92	54.00	20.08	Complied
2494.20	43.75	2.33	46.08	54.00	7.92	Complied

Result: Pass

Transmitter Band Edge Radiated Emissions (continued)**Results: BT-LE / 2 Mbps / PRBS9 / PWR -8 dBm****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	18/07/2023	36
377	BONN Elektronik	Amplifier, Low Noise Pre	BLMA 0118-1A	025294B	18/07/2023	12
460	Deisel	Turntable	DT 4250 S	n/a	n/a	n/a
465	Schwarzbeck	Antenna, Trilog Broadband	VULB 9168	9168-240	02/09/2020	42
496	Rohde & Schwarz	Antenna, log. - periodical	HL050	100297	22/08/2022	24
588	Maturo	Controller	NCD	029/7180311	n/a	n/a
591	Rohde & Schwarz	Receiver	ESU 40	100244/040	13/07/2023	12
669	Rohde & Schwarz	EMI Test Receiver	ESW 44	103087	13/07/2023	18
607	Schwarzbeck	Antenna broadband horn antenna	BBHA 9170	9170-561	15/10/2019	48
608	Rohde & Schwarz	Switch Matrix	OSP 120	101227	lab verification	n/a
628	Maturo	Antenna mast	CAM 4.0-P	224/19590716	n/a	n/a
629	Maturo	Kippeinrichtung	KE 2.5-R-M	MAT002	n/a	n/a
-/-	Testo	Thermo-Hygrometer	608-H1	01	lab verification	n/a
328	SPS	AC/DC power distribution system	PAS 5000	A2464 00/2 0200	lab verification	n/a
1603665	Siemens Matsushita Components	semi-anechoic chamber SR1/ 2	-/-	B83117-A1421-T161	n/a	n/a
681	Maturo	Antenna mast, tilting	BAM4.5-P	402/0718.1	n/a	n/a

Test site: SR 9

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
625	Schwarzbeck	Antenna, H-field	HFSL 7101	109	lab verification only relative measurements	n/a
637	Rohde & Schwarz	Spectrum Analyser	FSV40	101587	12/07/2023	12
327	SPS	AC/DC power distribution system	PAS 5000	A2464 00/1 0200	lab verification	n/a
-/-	Testo	Thermo-Hygrometer	608-H1	07	lab verification	n/a
645	Weiss Umwelttechnik	Climatic Chamber	LabEvent T/110/70/3	5822619794 0010	lab verification	n/a

8. Report Revision History

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	38	-	Initial Version

--- END OF REPORT ---