TEST REPORT

Test Report No.: UL-RPT-RP-14110339-116-FCC

Applicant	:	Biobedded Systems GmbH
Model No.	:	ProSmap Module BLE0001
FCC ID	:	2A3TP-BLE0001
Technology	:	Bluetooth – Low Energy
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 1.2 supersede Version 1.1 with immediate effect**
   Test Report No. UL-RPT-RP-14110339-116-FCC Version 1.2, Issue Date 15 JUNE 2022 replaces
   Test Report No. UL-RPT-RP-14110339-116-FCC Version 1.1, Issue Date 17 MAY 2022, which is no longer valid.
5. Result of the tested sample: **PASS**

Prepared by: Muhammad Faiq Khan
Title: Laboratory Engineer
Date: 15 June 2022

Approved by: Ajit, Phadtare
Title: Lead Test Engineer
Date: 15 June 2022

DAkkS Deutsche Akkreditierungsstelle D-PL-19381-02-00

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

UL INTERNATIONAL GERMANY GMBH
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1. Customer Information

1.1. Applicant Information

Company Name:	Biobedded System GmbH
Company Address:	Tersteegenstr. 15 - D 46045 Oberhausen, GERMANY
Company Phone No.:	+49 - (0) 204 – 3945137
Company E-Mail:	info@biobedded.de
Contact Person:	Matthias Krzizan
Contact E-Mail Address:	krzizan@biobedded.de
Contact Phone No.:	+49 - (0) 204 – 3945137

1.2. Manufacturer Information

Company Name:	Biobedded System GmbH
Company Address:	Tersteegenstr. 15 - D 46045 Oberhausen, GERMANY
Company Phone No.:	+49 - (0) 204 – 3945137
Company E-Mail:	info@biobedded.de
Contact Person:	Matthias Krzizan
Contact E-Mail Address:	krzizan@biobedded.de
Contact Phone No.:	+49 - (0) 204 – 3945137

2. Summary of Testing

2.1. General Information

Applied FCC Rule Part(s)

Specification Reference:	47CFR15.247
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.247
Specification Reference:	47CFR15.207 and 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209

Location

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

Date Information

Order Date:	24 November 2021
EUT Arrived:	07 January 2022
Test Dates:	20 January 2022 to 17 May 2022
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	☒	☐	☐	☐
15.35(c)	Transmitter Duty Cycle (1)	☒	☐	☐	☐
15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth	☒	☐	☐	☐
15.247(b)(3)	Transmitter Maximum Peak Output Power	☒	☐	☐	☐
15.247(e)	Transmitter Power Spectral Density	☒	☐	☐	☐
15.247(d) & 15.209(a)	Transmitter Conducted Emissions	☐	☐	☒	☐
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					

Note(s):

1. The measurement was performed to assist in the calculation of the average measurements.

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
Reference:	FCC KDB 174176 D01 Line Conducted FAQ v01r01 June 3, 2015
Title:	AC Power-Line Conducted Emissions Frequently Asked Questions

2.4. Deviations from the Test Specification

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

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	ProSmap BLE Modul
Model Name or Number:	ProSmap Module BLE0001
Test Sample Serial Number:	F4:60:77:4E:9B:D8 (Conducted Test Sample with U.FL connector)
Hardware Version Number:	V2.33 (PCB Version)
Firmware Version Number:	simplelink_cc13x2_26x2_sdk_3_30_00_03
FCC ID:	2A3TP-BLE0001

Brand Name:	ProSmap BLE Modul
Model Name or Number:	ProSmap Module BLE0001
Test Sample Serial Number:	F4:60:77:4E:9D:A2 (Radiated Test Sample-INTERNAL ANTENNA)
Hardware Version Number:	V2.33 (PCB Version)
Firmware Version Number:	simplelink_cc13x2_26x2_sdk_3_30_00_03
FCC ID:	2A3TP-BLE0001
Antenna Details:	Internal Antenna
Antenna Type:	SMT Chip Antenna (Part Nr: 2119640001)
Declared Antenna Gain:	2.7 dBi

Brand Name:	ProSmap BLE Modul
Model Name or Number:	ProSmap Module BLE0001
Test Sample Serial Number:	F4:60:77:4E:9B:D8 (Radiated Test Sample-EXTERNAL ANTENNA)
Hardware Version Number:	V2.33 (PCB Version)
Firmware Version Number:	simplelink_cc13x2_26x2_sdk_3_30_00_03
FCC ID:	2A3TP-BLE0001
Antenna Details:	External Antenna
Antenna Type:	Triple Band Embedded Antenna (Part Nr: 2108792-1)
Declared Antenna Gain:	4.9 dBi

3.2. Description of EUT

The equipment under test was a Radio module with Model Nr: ProSmap Module BLE0001 supporting Bluetooth Low Energy operations in 2400-2483.5 MHz 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:	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	GFSK (Coded)	
	500 kbps	GFSK (Coded)	
	1 Mbps	GFSK (Uncoded)	
	2 Mbps	GFSK (Uncoded)	
Maximum Measured Conducted Output Power:	0.40 dBm		
Tested Antenna(s):	Internal Antenna	External Antenna	
Declared Antenna Gain:	2.7 dBi	4.9 dBi	
Antenna Type:	SMT Chip Antenna	Triple Band Embedded Antenna	
Antenna Details:	Part Nr: 2119640001	Part Nr: 2108792-1	
Transmit Channels Tested:	**Channel ID**	**RF Channel**	**Frequency(MHz)**
	Bottom	0	2402
	Middle	19	2440
	Top	39	2480
Power Supply Requirement(s):	3 V DC via External DC supply		
Highest internally generated clock and/ or oscillator frequency:	48 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 Power supply	Elektro Automatik	PS-2342-10 B	2814040002

B. Support Equipment (Manufacturer supplied)

Item	Description	Brand Name	Model Name or Number	Serial Number
1	Test Laptop with Test software: BTool v1.42.16	Dell	Latitude E6540	1WZVF12
2	Test Evaluation Board	Biobedded	-/-	-/-
3	U.FL to SMA (Female) RF Cable Length: 10 cm | Attenuation :0.5 dB@2.4 GHz	Multicomp PRO	R-132G7210100CB	-/-

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: 125 kbps / 500 kbps / 1 Mbps / 2 Mbps • Payload Type: PRBS9 • Power Settings (PWR): 0 dBm

4.2. Configuration and Peripherals

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

- In accordance with FCC rule section(s) 15.212(a)(1)(v), the EUT being a modular transmitter was tested in a stand-alone configuration.
- The EUT was mounted on Test Evaluation Board (a stand-alone PCB).
- The applicant or manufacturer supplied test setup instructions “ProSmap Modul BLE0001 - Test Setup Guide V1.0”; issued on 15.12.2021 was used to configure the EUT.

EUT Power Supply:

- The EUT was powered with 3 V DC via Laboratory Power supply.

Test Mode Activation:

- The EUT was mounted on Test adapter and can be connected with the Test laptop via USB-TTL cables supplied by the customer. The cables were only used to set the EUT in respective modes and were removed during the measurements.
- The test modes were activated using the test software / Radio Tool “BTool v1.4.16” supplied by the customer. This test software / Radio Tool was installed on the test laptop to enable continuous transmission and to select the required power levels and the test channels.

AC Conducted Emissions Measurements:

- The EUT radiated sample with Internal Chip Antenna and the radiated sample with external antenna were used for AC conducted emissions measurements.
- For AC conducted line emissions measurement the EUT was powered with 3 V DC via Laboratory Power supply. The measurements were carried out with 120 VAC / 60 Hz & 240 VAC / 60 Hz.
- The Toyo EMI Software EP5/CE Ver 4.0.1. was used for these measurements.

Conducted Measurements:

- All conducted measurements were carried out by using the EUT RF sample with U.FL connector and U.FL to SMA (Female) RF Cable supplied by the customer. 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 with internal chip antenna and the EUT RF sample with U.FL connector to which an external antenna was connected were used for radiated spurious emission & radiated band edge measurements.
- The internal chip antenna is integrated antenna & external aantenna was fixed mounted on the test evaluation board.
- As per the applicant’s declaration &/operational description of the EUT, the EUT is a tabletop equipment for its intended application. Therefore, EUT’s test setup placement was performed in accordance with ANSI C63.10 section 6.2.3.2 & section 6.12 Figure 4.

- Before starting final radiated measurements “worst case verification” with the EUT in Standing, Laying and 45° tilting position was performed.
- Following combinations of positions found to be the worst case that tend to produce maximum emissions
  - EUT + Internal Antenna: EUT & Antenna both in Laying Position
  - EUT + External Antenna: EUT & Antenna both in Standing Position

  Therefore, this report includes relevant test 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 80 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 V10.60.10 Software was used for the Radiated spurious emission measurements.

Duty Cycle Correction Details:

- As the EUT continuous transmission of the EUT ($D \geq 98\%$) can be achieved and EUT was transmitting continuously with a constant Duty Cycle of 100% (duty cycle variations are less than ±2%) on all supported modulation schemes & data rates . 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 AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Muhammad Faiq Khan	**Test Date:**	02 March 2022
Test Sample Serial Number:	F4:60:77:4E:9D:A2 (Radiated Test Sample-INTERNAL ANTENNA)		
Test Sample Serial Number:	F4:60:77:4E:9B:D8 (Radiated Test Sample-EXTERNAL ANTENNA)		
Test Site Identification	SR 7/8		

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

Environmental Conditions:

Temperature (°C):	23.4
Relative Humidity (%):	41.8

Settings of the Instrument

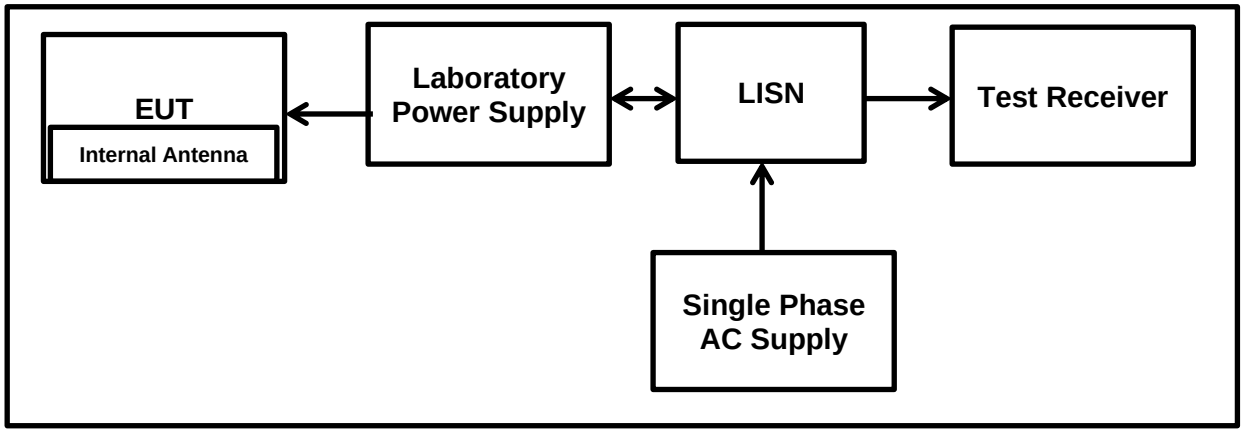
Detector	Quasi Peak/ Average Peak

Note(s):

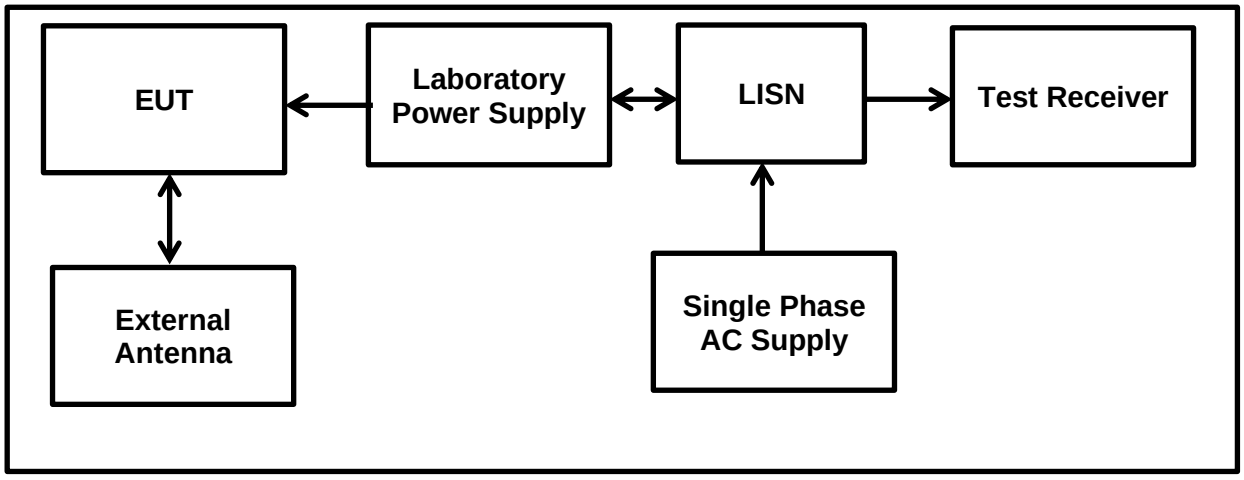
1. In accordance with FCC KDB 174176 Q4, tests were also performed with a 240 VAC 60 Hz single phase supply as this was within the voltage range marked on the 100-240 VAC~50/60 Hz power supply.
2. The EUT was powered with 3 V DC via Laboratory Power supply. This Laboratory Power supply in turn powered either with 120 VAC / 60 Hz or 240 VAC / 60 Hz.
3. The measurement was performed only on bottom channel as it was found out to be the worst-case w.r.t. maximum conducted output power and power spectral density measurements & worst case emission profile according to the initial radiated emission measurement.
4. The measurements were performed only with 125 kbps data rate since it was found out to be the worst-case w.r.t. maximum conducted output power and power spectral density measurements.
5. The EUT was configured with the following modes:
   - BT-LE | 125 kbps | PRBS9 | PWR 0 dBm | Bottom Channel | Internal Antenna
   - BT-LE | 125 kbps | PRBS9 | PWR 0 dBm | Bottom Channel | External Antenna
6. Pre-scans were performed, and markers placed on the highest live and neutral measured levels. Final measurements were performed on the marker frequencies and the results entered into the tables below.
7. The final measured value, for the given emission, in the table below incorporates the cable loss.
8. All other emissions shown on the pre-scan plot were investigated. Only the highest 6 emissions have been reported in the tables below in accordance with ANSI C63.10 section 6.2.5.
9. Measurements were performed in shielded room (SR7/ 8 Asset Number 1603671). The EUT was placed at a height of 80 cm above the reference ground plane and in a distance of 40 cm from the vertical ground plane at the edge of the table.
10. Measurement software used: Toyo EMI Software; CE measurement software EP5/CE Ver 4.0.1.

Transmitter AC Conducted Spurious Emissions (continued)

Test Setup / EUT+ Internal Antenna:



Test Setup / EUT+ External Antenna:



Transmitter AC Conducted Spurious Emissions (continued)

Results: BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / Internal Antenna

Results: Live / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.19448	Live	16.60	63.80	47.20	Complied
0.23122	Live	16.40	62.40	46.00	Complied
0.32738	Live	12.50	59.50	47.00	Complied
0.56600	Live	7.40	56.00	48.60	Complied
1.97215	Live	6.60	56.00	49.40	Complied
8.76014	Live	8.50	60.00	51.50	Complied

Results: Live / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.19448	Live	11.20	53.80	42.60	Complied
0.23122	Live	11.20	52.40	41.20	Complied
0.32738	Live	7.80	49.50	41.70	Complied
0.56600	Live	3.50	46.00	42.50	Complied
1.97215	Live	3.40	46.00	42.60	Complied
8.76014	Live	4.40	50.00	45.60	Complied

Results: Neutral / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.18199	Neutral	16.60	64.40	47.80	Complied
0.24482	Neutral	16.10	61.90	45.80	Complied
0.32641	Neutral	12.50	59.50	47.00	Complied
0.59836	Neutral	7.40	56.00	48.60	Complied
1.88926	Neutral	6.60	56.00	49.40	Complied
9.36948	Neutral	8.50	60.00	51.50	Complied

Transmitter AC Conducted Spurious Emissions (continued)

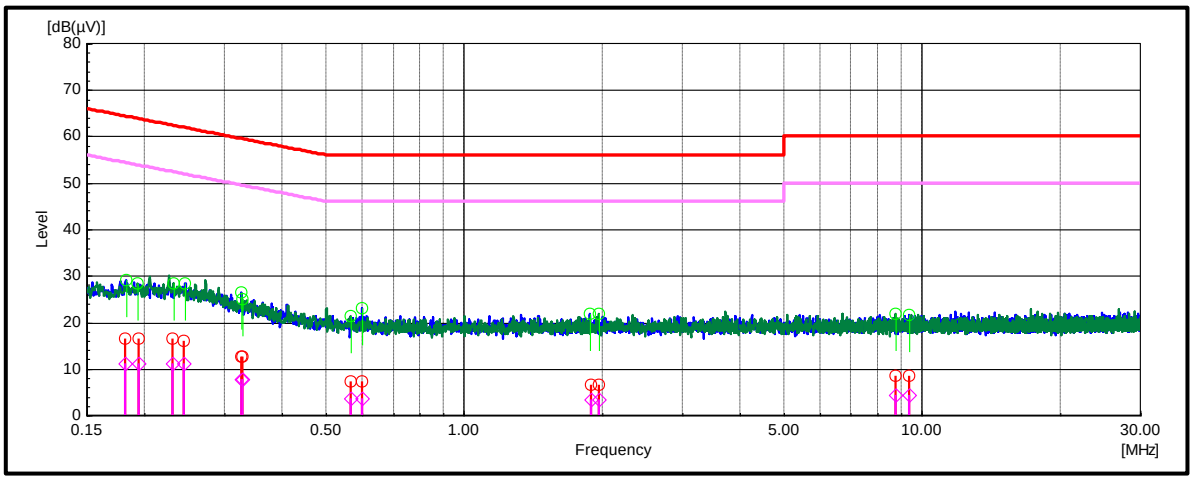
Results: BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / Internal Antenna

Results: Neutral / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.18199	Neutral	11.20	54.40	43.20	Complied
0.24482	Neutral	11.10	51.90	40.80	Complied
0.32641	Neutral	7.80	49.50	41.70	Complied
0.59836	Neutral	3.50	46.00	42.50	Complied
1.88926	Neutral	3.40	46.00	42.60	Complied
9.36948	Neutral	4.40	50.00	45.60	Complied

Result: Pass

Plot: Live and Neutral Line / 120 VAC 60 Hz



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

Transmitter AC Conducted Spurious Emissions (continued)

Results: BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / Internal Antenna

Results: Live / Quasi Peak / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.19911	Live	16.80	63.60	46.80	Complied
0.25416	Live	16.10	61.60	45.50	Complied
0.32114	Live	13.50	59.70	46.20	Complied
0.40347	Live	15.50	57.80	42.30	Complied
0.49396	Live	11.90	56.10	44.20	Complied
0.63419	Live	8.50	56.00	47.50	Complied

Results: Live / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.19911	Live	11.60	53.60	42.00	Complied
0.25416	Live	11.10	51.60	40.50	Complied
0.32114	Live	8.30	49.70	41.40	Complied
0.40347	Live	5.90	47.80	41.90	Complied
0.49396	Live	4.30	46.10	41.80	Complied
0.63419	Live	3.50	46.00	42.50	Complied

Results: Neutral / Quasi Peak / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.19878	Neutral	16.80	63.70	46.90	Complied
0.24680	Neutral	16.30	61.90	45.60	Complied
0.34906	Neutral	13.80	59.00	45.20	Complied
0.39644	Neutral	15.50	57.90	42.40	Complied
0.58912	Neutral	9.00	56.00	47.00	Complied
0.49224	Neutral	11.90	56.10	44.20	Complied

Transmitter AC Conducted Spurious Emissions (continued)

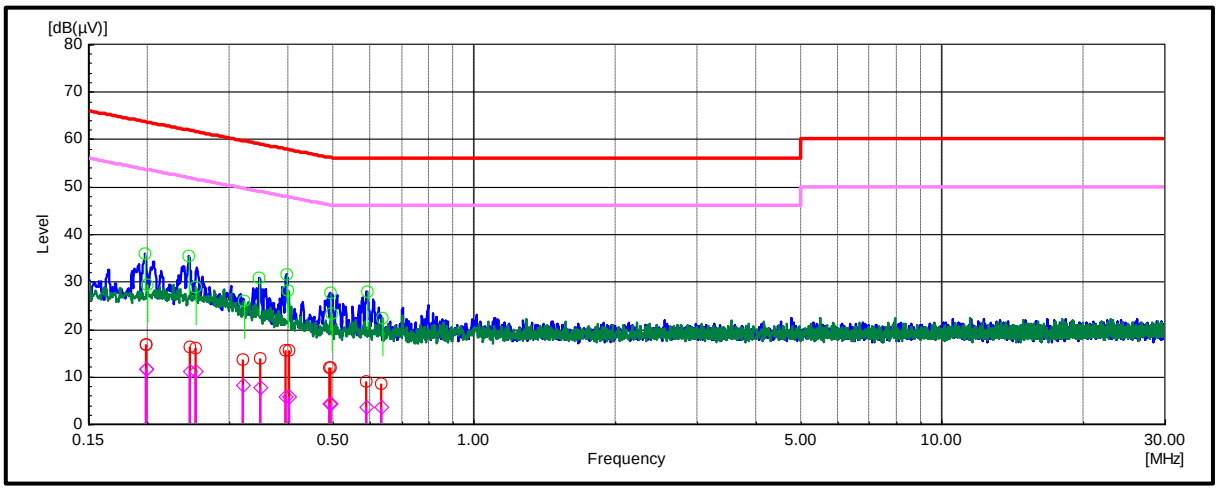
Results: BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / Internal Antenna

Results: Neutral / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.19878	Neutral	11.60	53.70	42.10	Complied
0.24680	Neutral	11.10	51.90	40.80	Complied
0.34906	Neutral	7.80	49.00	41.20	Complied
0.39644	Neutral	5.90	47.90	42.00	Complied
0.58912	Neutral	3.50	46.00	42.50	Complied
0.49224	Neutral	4.30	46.10	41.80	Complied

Result: Pass

Plot: Live and Neutral Line / 240 VAC 60 Hz



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

Transmitter AC Conducted Spurious Emissions (continued)

Results: BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / External Antenna

Results: Live / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.17956	Live	28.60	64.50	35.90	Complied
0.51824	Live	21.90	56.00	34.10	Complied
0.57134	Live	21.00	56.00	35.00	Complied
0.98377	Live	21.90	56.00	34.10	Complied
2.57715	Live	21.20	56.00	34.80	Complied
13.73347	Live	21.50	60.00	38.50	Complied

Results: Live / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.17956	Live	28.60	54.50	25.90	Complied
0.51824	Live	21.90	46.00	24.10	Complied
0.57134	Live	21.00	46.00	25.00	Complied
0.98377	Live	21.90	46.00	24.10	Complied
2.57715	Live	21.20	46.00	24.80	Complied
13.73347	Live	21.50	50.00	28.50	Complied

Results: Neutral / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.19058	Neutral	28.70	64.00	35.30	Complied
0.49319	Neutral	24.50	56.10	31.60	Complied
0.54529	Neutral	23.00	56.00	33.00	Complied
1.00140	Neutral	20.50	56.00	35.50	Complied
2.98597	Neutral	21.10	56.00	34.90	Complied
15.46693	Neutral	22.50	60.00	37.50	Complied

Transmitter AC Conducted Spurious Emissions (continued)

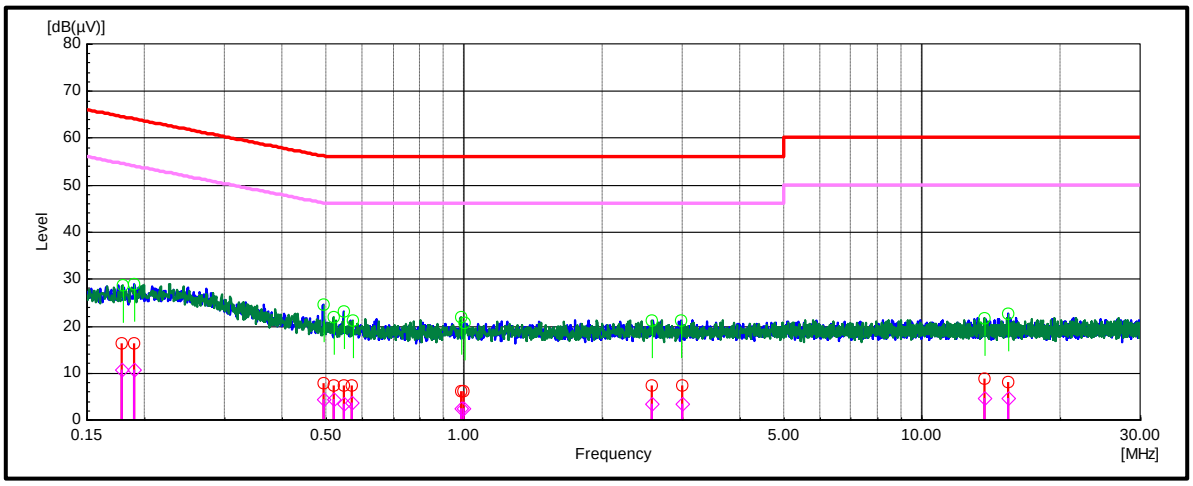
Results: BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / External Antenna

Results: Neutral / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.19058	Neutral	28.70	54.00	25.30	Complied
0.49319	Neutral	24.50	46.10	21.60	Complied
0.54529	Neutral	23.00	46.00	23.00	Complied
1.00140	Neutral	20.50	46.00	25.50	Complied
2.98597	Neutral	21.10	46.00	24.90	Complied
15.46693	Neutral	22.50	50.00	27.50	Complied

Result: Pass

Plot: Live and Neutral Line / 120 VAC 60 Hz



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

Transmitter AC Conducted Spurious Emissions (continued)

Results: BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / External Antenna

Results: Live / Quasi Peak / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.20661	Live	29.10	63.30	34.20	Complied
0.25471	Live	28.30	61.60	33.30	Complied
0.40200	Live	29.70	57.80	28.10	Complied
0.59138	Live	21.70	56.00	34.30	Complied
0.80180	Live	21.10	56.00	34.90	Complied
13.76353	Live	21.60	60.00	38.40	Complied

Results: Live / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.20661	Live	29.10	53.30	24.20	Complied
0.25471	Live	28.30	51.60	23.30	Complied
0.40200	Live	29.70	47.80	18.10	Complied
0.59138	Live	21.70	46.00	24.30	Complied
0.80180	Live	21.10	46.00	24.90	Complied
13.76353	Live	21.60	50.00	28.40	Complied

Results: Neutral / Quasi Peak / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.19709	Neutral	36.80	63.70	26.90	Complied
0.24669	Neutral	34.50	61.90	27.40	Complied
0.38998	Neutral	30.10	58.10	28.00	Complied
0.57836	Neutral	29.20	56.00	26.80	Complied
0.79780	Neutral	24.90	56.00	31.10	Complied
12.59118	Neutral	22.90	60.00	37.10	Complied

Transmitter AC Conducted Spurious Emissions (continued)

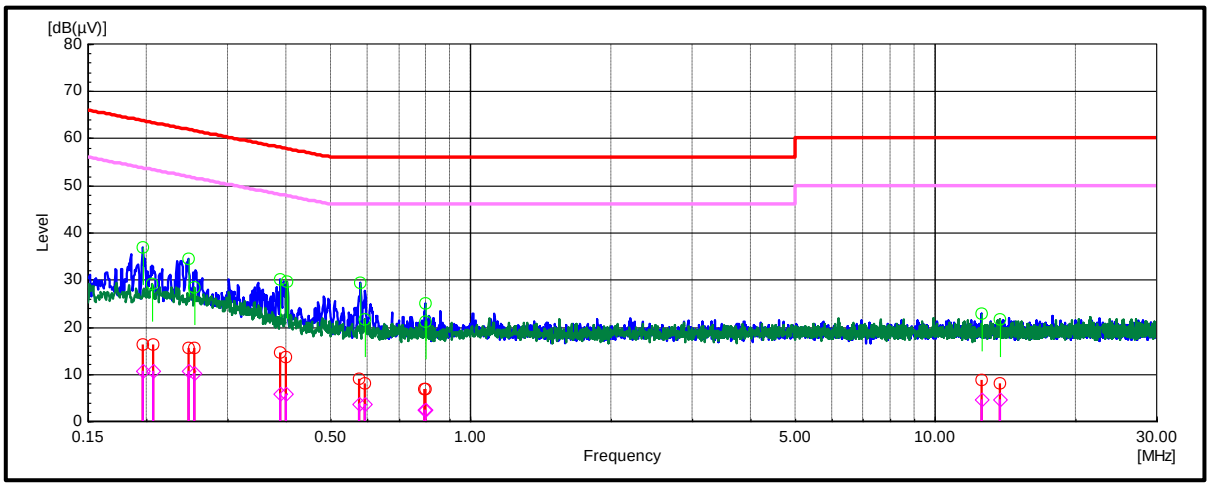
Results: BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / External Antenna

Results: Neutral / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.19709	Neutral	36.80	53.70	16.90	Complied
0.24669	Neutral	34.50	51.90	17.40	Complied
0.38998	Neutral	30.10	48.10	18.00	Complied
0.57836	Neutral	29.20	46.00	16.80	Complied
0.79780	Neutral	24.90	46.00	21.10	Complied
12.59118	Neutral	22.90	50.00	27.10	Complied

Result: Pass

Plot: Live and Neutral Line / 240 VAC 60 Hz



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

5.2.2. Transmitter Duty Cycle

Test Summary:

Test Engineer:	Muhammad Faiq Khan	**Test Date:**	07 March 2022
Test Sample Serial Number:	F4:60:77:4E:9B:D8 (Conducted Test Sample with U.FL 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):	22.6
Relative Humidity (%):	32.9

Note:

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

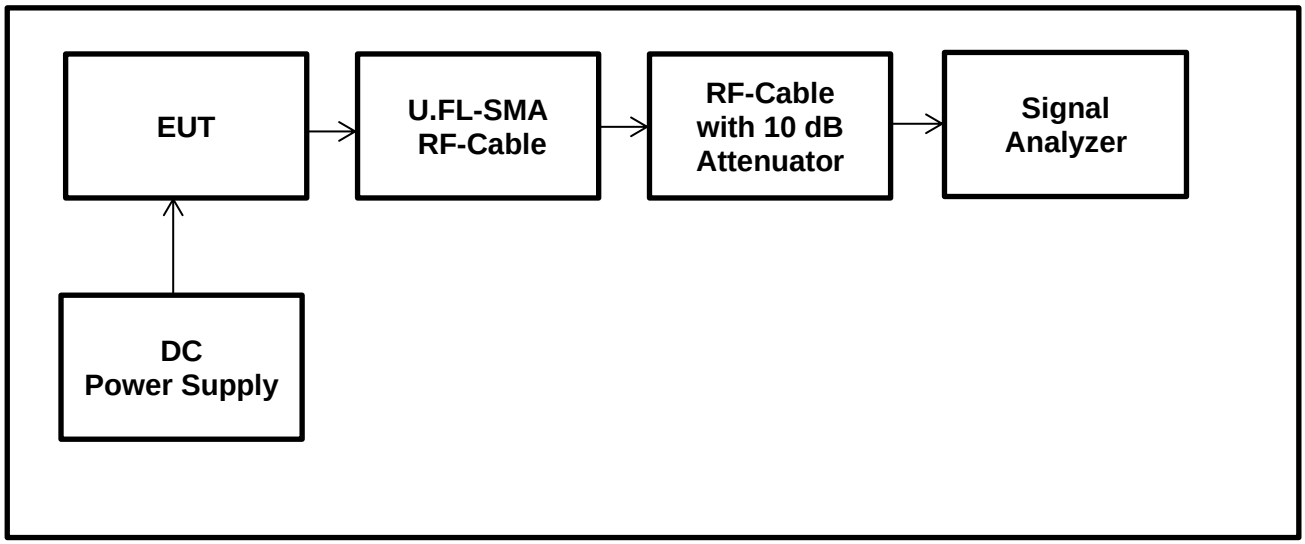
   Duty Cycle (%) = 100 X [On Time (T_{ON})] / [Period(T_{ON}+ T_{OFF}) or 100ms whichever is the lesser]

   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 take into consideration the external attenuation correction factors.
   - The U.FL to SMA RF Cable connected on the PCB with maximum attenuation of 0.5 dB at the tested frequencies.
   - The SMA 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.

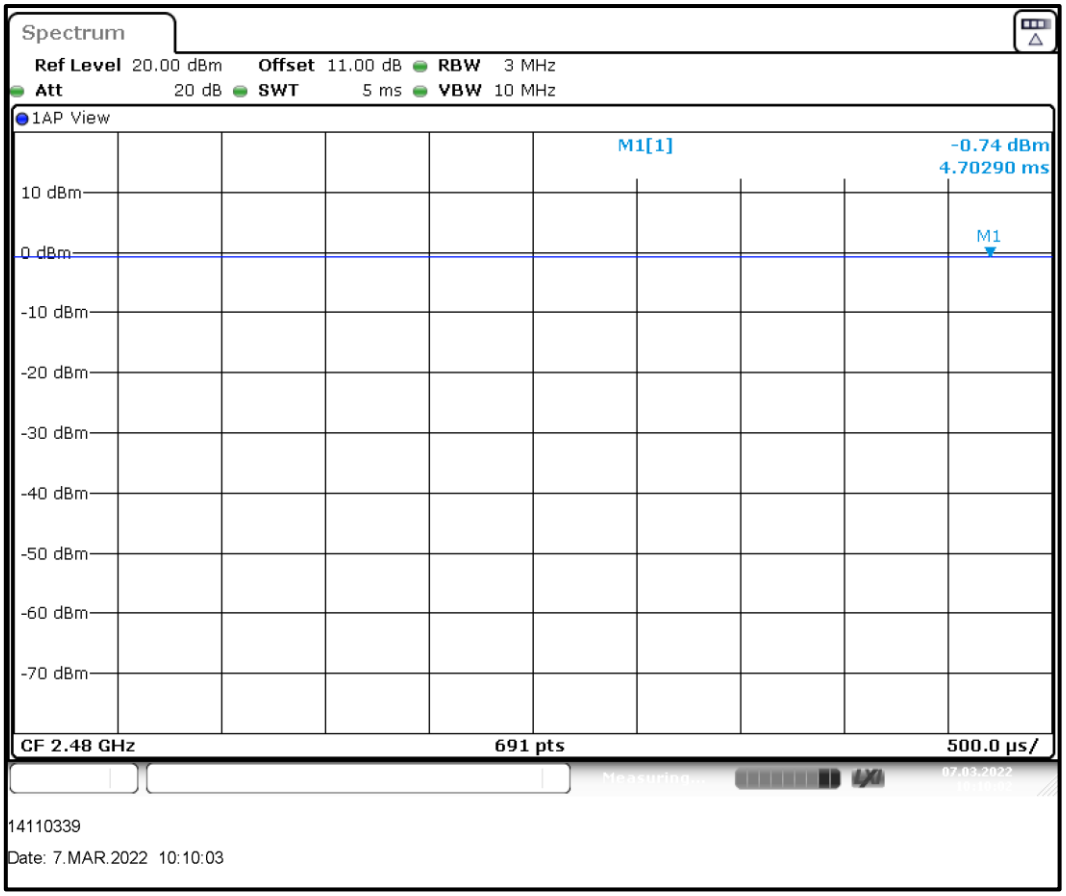
Test Setup:



Transmitter Duty Cycle (continued)

Results : BT-LE Mode / 125 kbps / PRBS9 / PWR 0 dBm / Top Channel

Pulse On Time (T_{ON}) (ms)	Pulse Period (T_{ON} +T_{OFF}) (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
--	--	100%	0.00

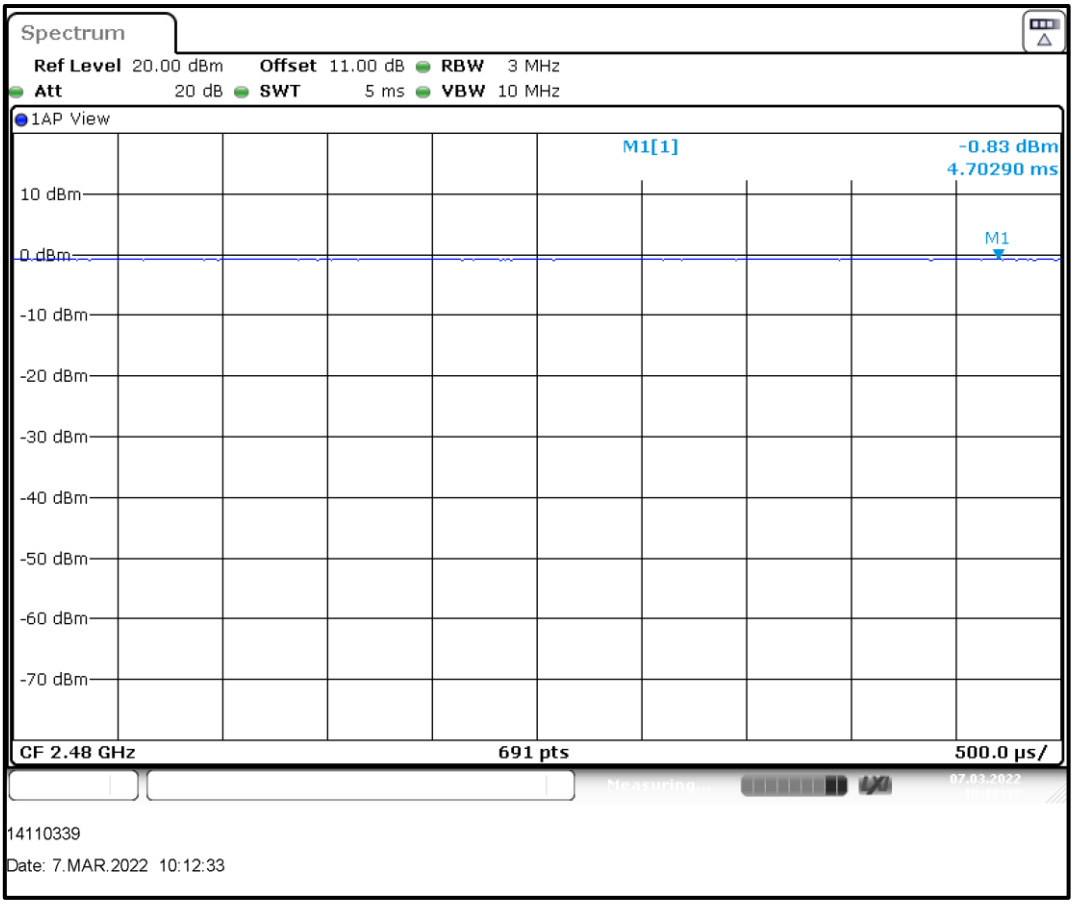


Result: Pass

Transmitter Duty Cycle (continued)

Results : BT-LE Mode / 500 kbps / PRBS9 / PWR 0 dBm / Top Channel

Pulse On Time (T_{ON}) (ms)	Pulse Period (T_{ON} +T_{OFF}) (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
--	--	100%	0.00

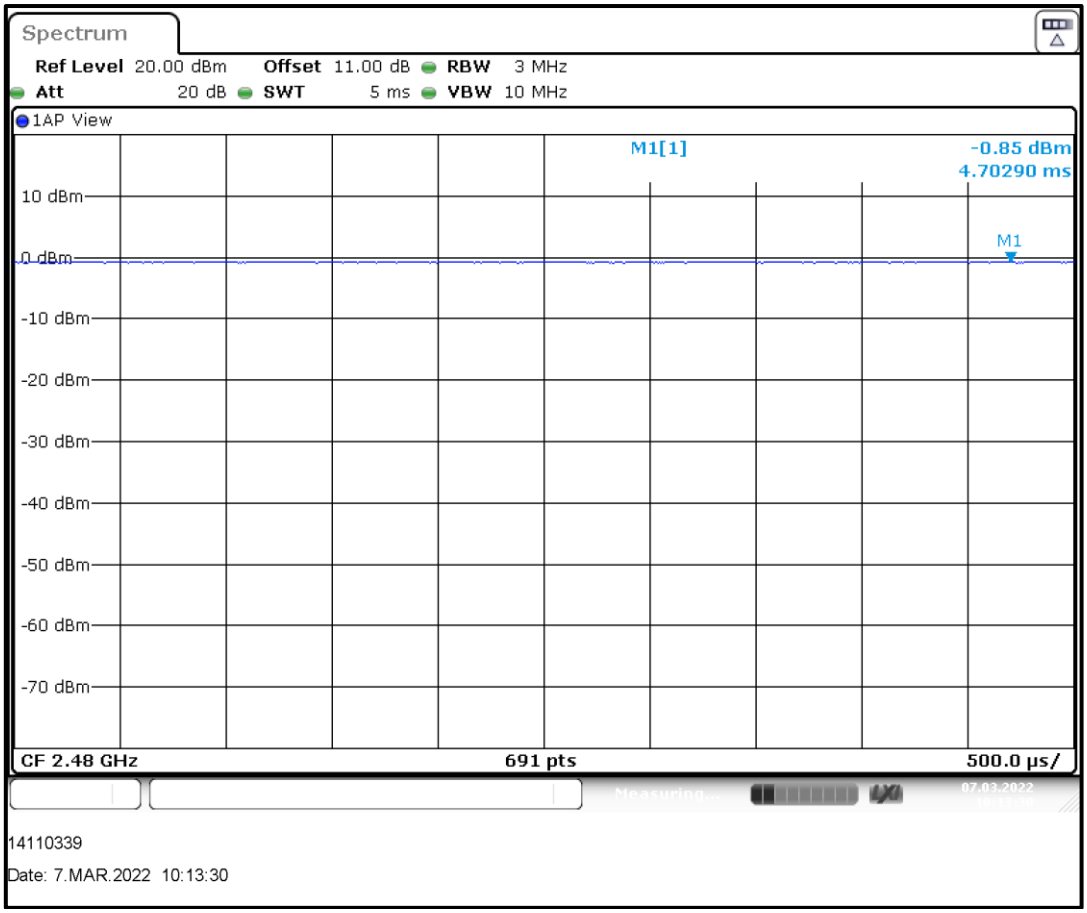


Result: Pass

Transmitter Duty Cycle (continued)

Results : BT-LE Mode / 1 Mbps / PRBS9 / PWR 0 dBm / Top Channel

Pulse On Time (T_{ON}) (ms)	Pulse Period (T_{ON} +T_{OFF}) (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
--	--	100%	0.00

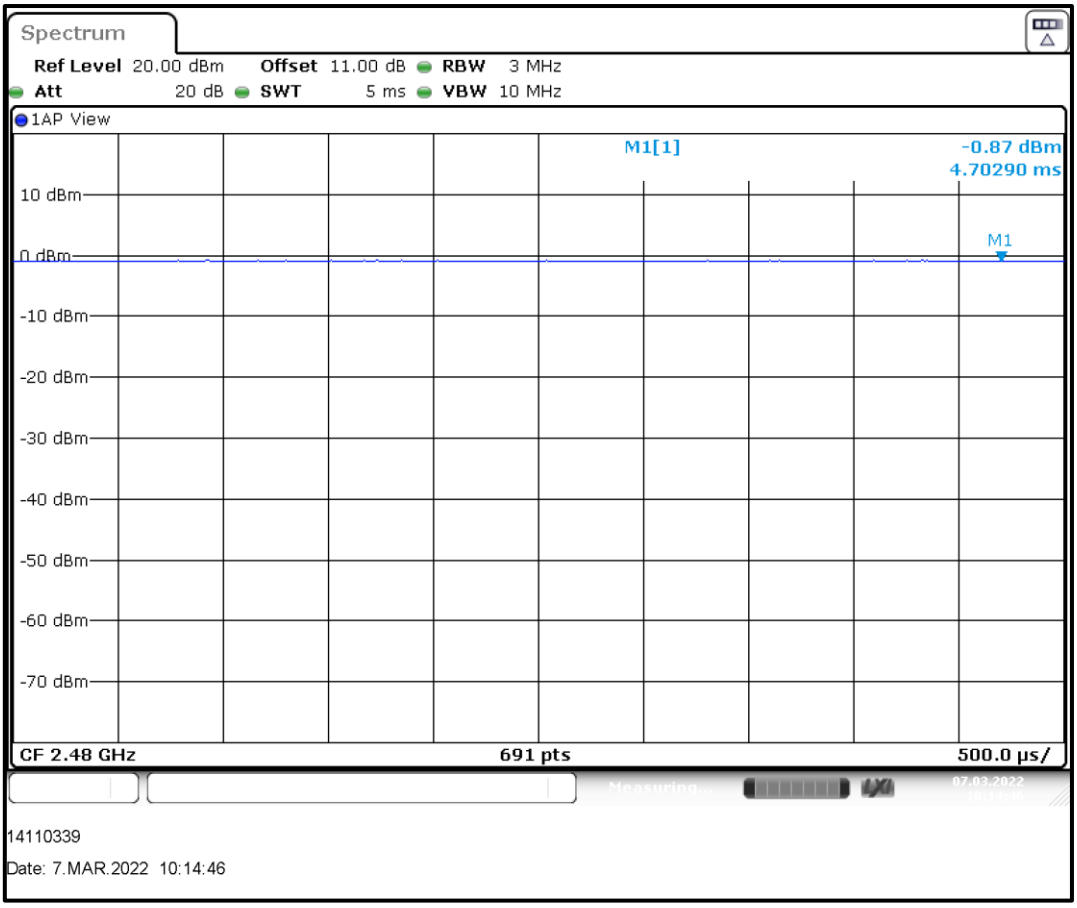


Result: Pass

Transmitter Duty Cycle (continued)

Results : BT-LE Mode / 2 Mbps / PRBS9 / PWR 0 dBm / Top Channel

Pulse On Time (T_{ON}) (ms)	Pulse Period (T_{ON} +T_{OFF}) (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
--	--	100%	0.00



Result: Pass

5.2.3. Transmitter 6 dB Bandwidth

Test Summary:

Test Engineer:	Muhammad Faiq Khan	**Test Date:**	07 March 2022
Test Sample Serial Number:	F4:60:77:4E:9B:D8 (Conducted Test Sample with U.FL 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:

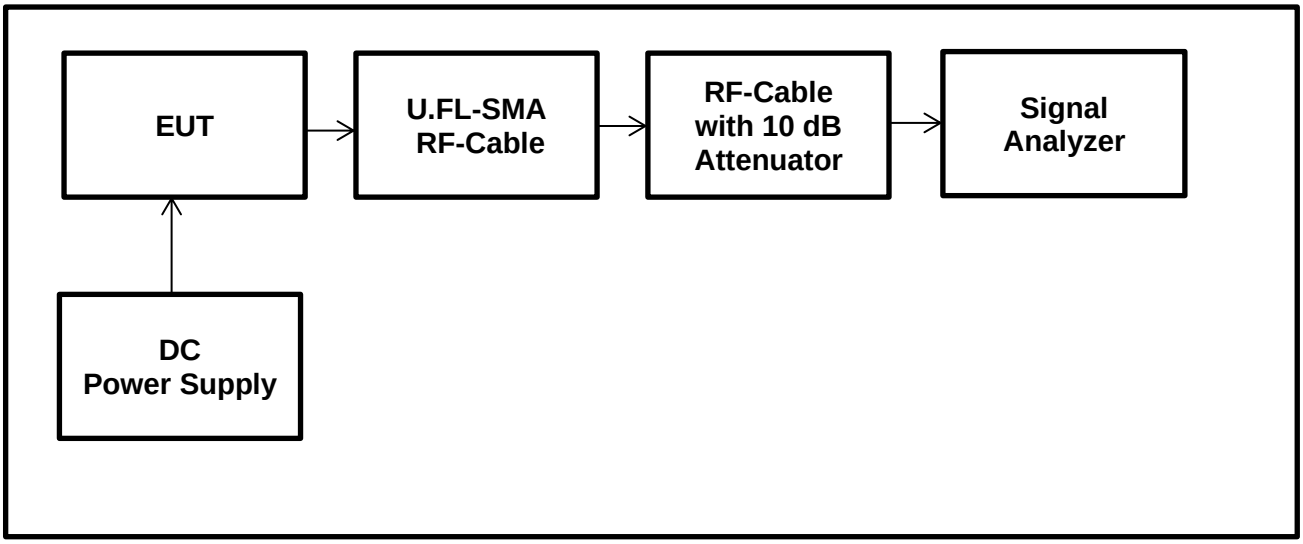
Temperature (°C):	22.9
Relative Humidity (%):	46.3

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.
   - The U.FL to SMA RF Cable connected on the PCB with maximum attenuation of 0.5 dB at the tested frequencies.
   - The SMA 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.

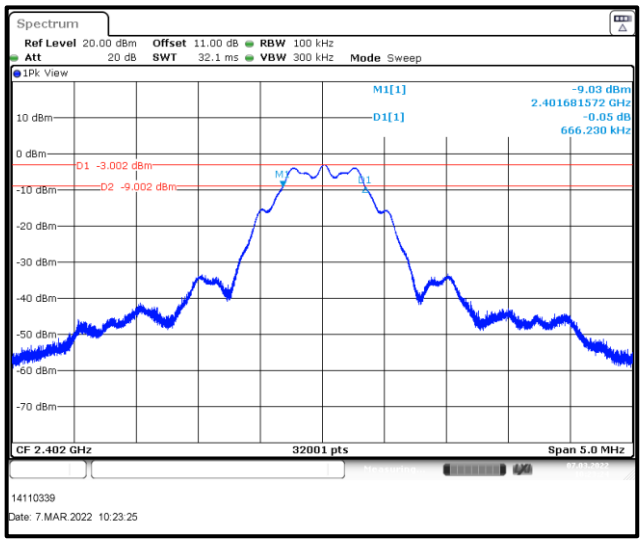
Test Setup:



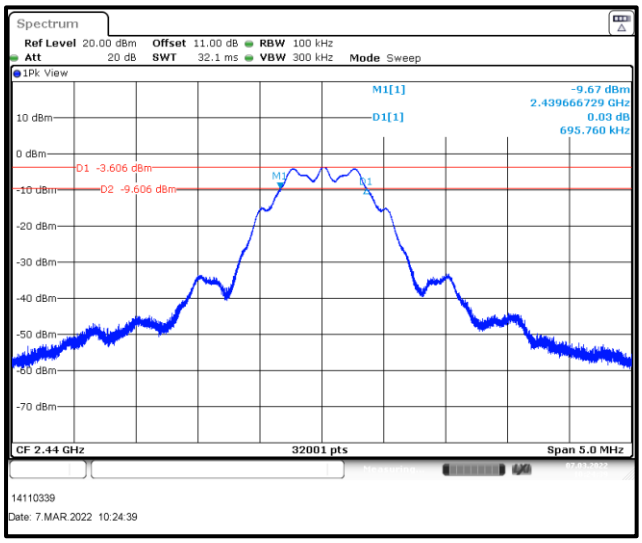
Transmitter Minimum 6 dB Bandwidth (continued)

Results: BT-LE Mode / 125 kbps / PRBS9 / PWR 0 dBm

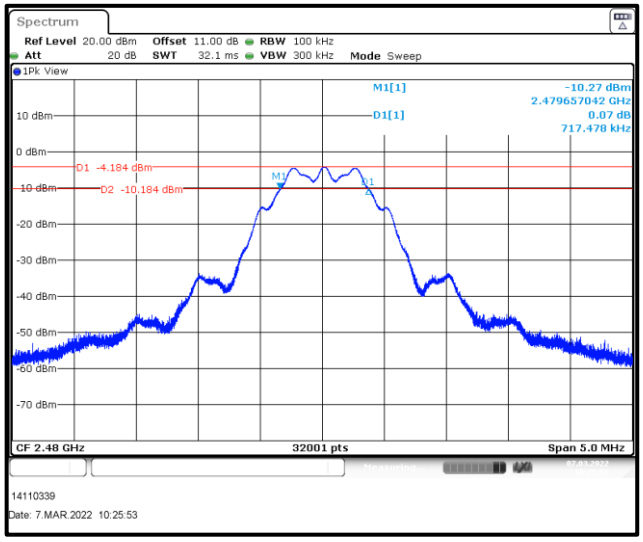
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	666.230	≥ 500	166.230	Complied
Middle	695.760	≥ 500	195.760	Complied
Top	717.478	≥ 500	217.478	Complied



Bottom Channel



Middle Channel



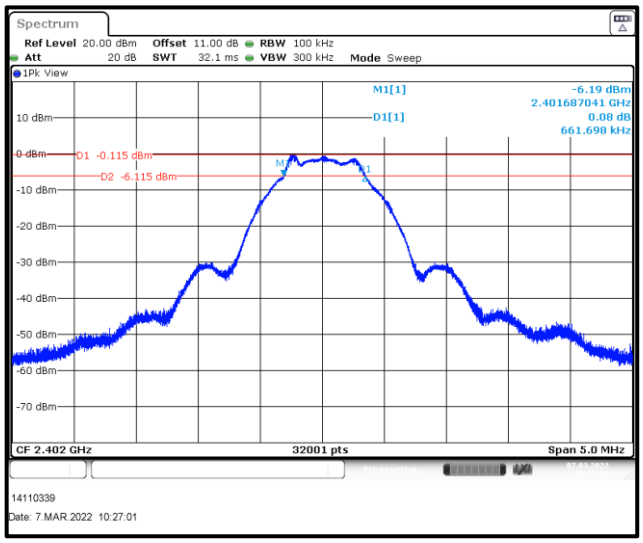
Top Channel

Result: Pass

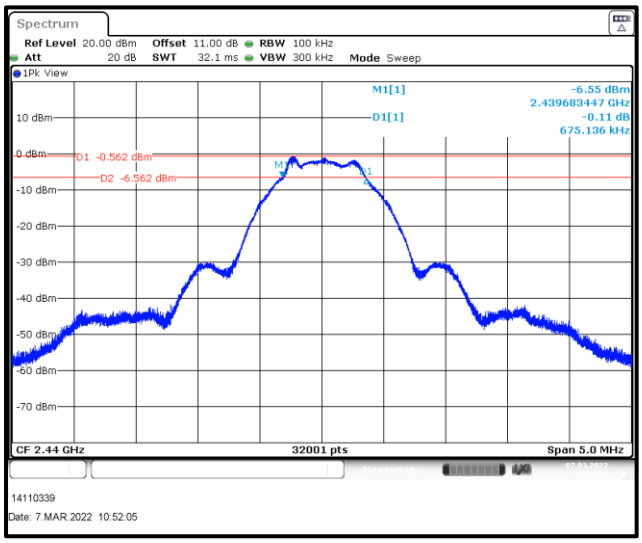
Transmitter Minimum 6 dB Bandwidth (continued)

Results: BT-LE Mode / 500 kbps / PRBS9 / PWR 0 dBm

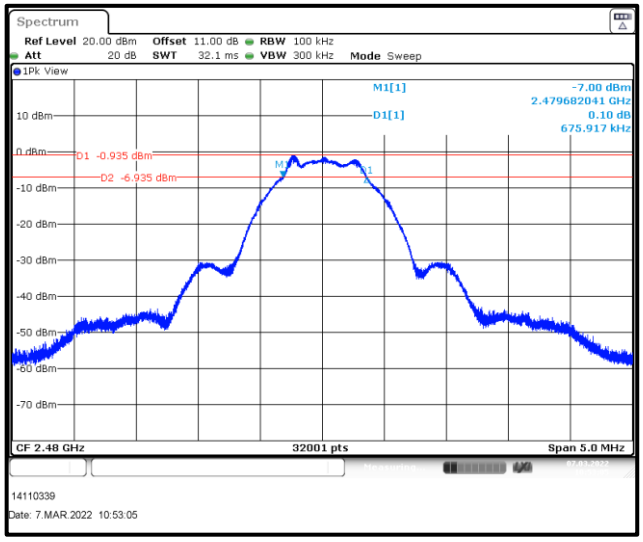
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	661.698	≥ 500	161.698	Complied
Middle	675.136	≥ 500	175.136	Complied
Top	675.917	≥ 500	175.917	Complied



Bottom Channel



Middle Channel



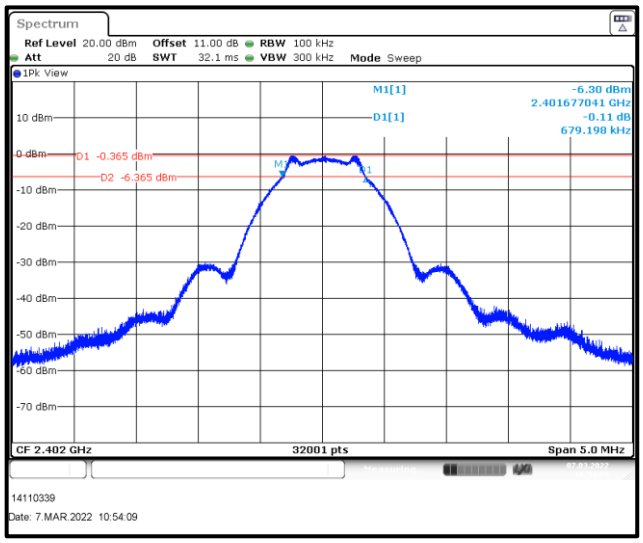
Top Channel

Result: Pass

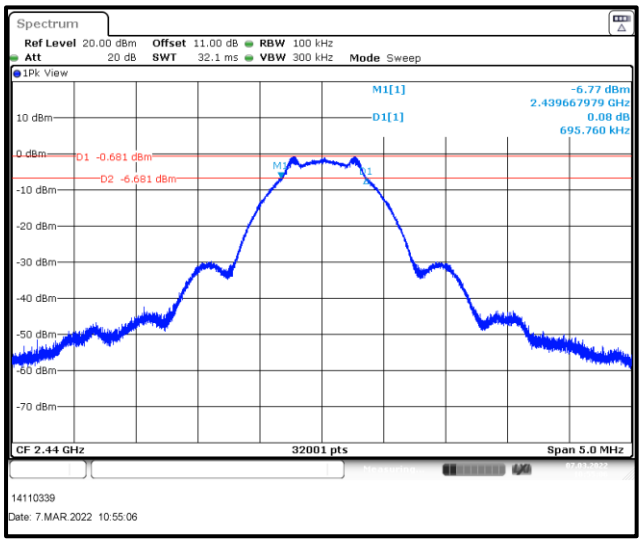
Transmitter Minimum 6 dB Bandwidth (continued)

Results: BT-LE Mode / 1 Mbps / PRBS9 / PWR 0 dBm

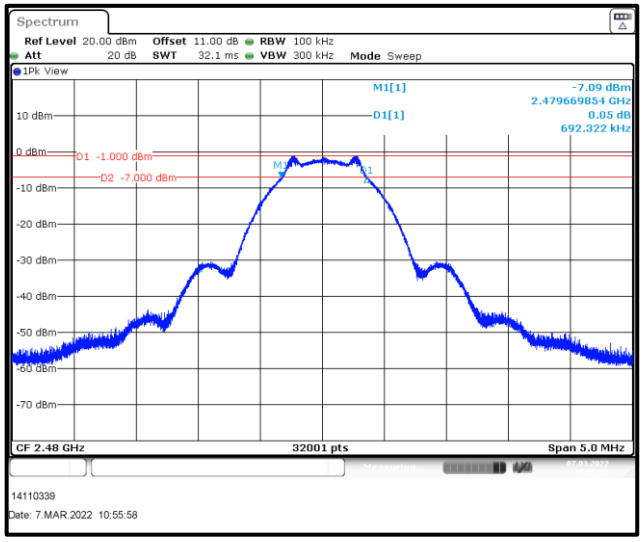
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	679.198	≥ 500	179.198	Complied
Middle	695.760	≥ 500	195.760	Complied
Top	692.322	≥ 500	192.322	Complied



Bottom Channel



Middle Channel



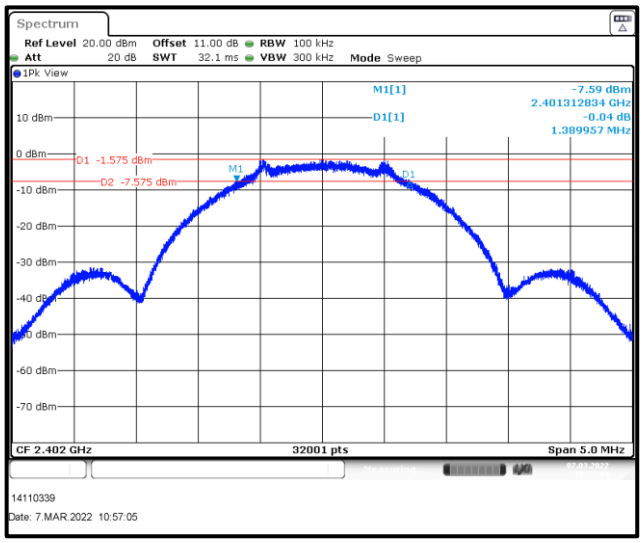
Top Channel

Result: Pass

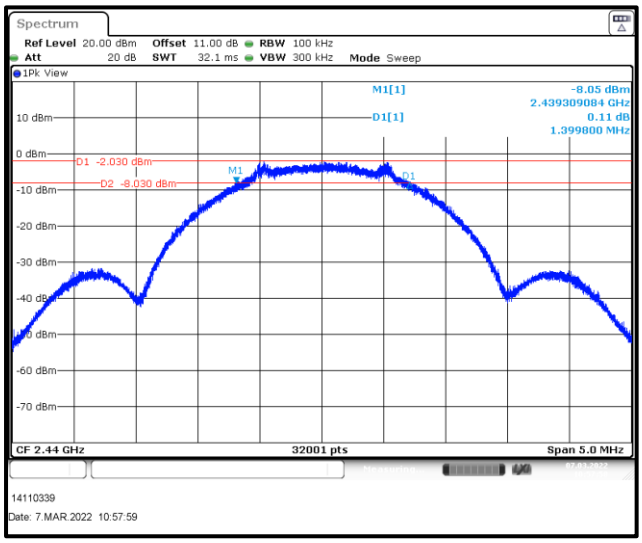
Transmitter Minimum 6 dB Bandwidth (continued)

Results: BT-LE Mode / 2 Mbps / PRBS9 / PWR 0 dBm

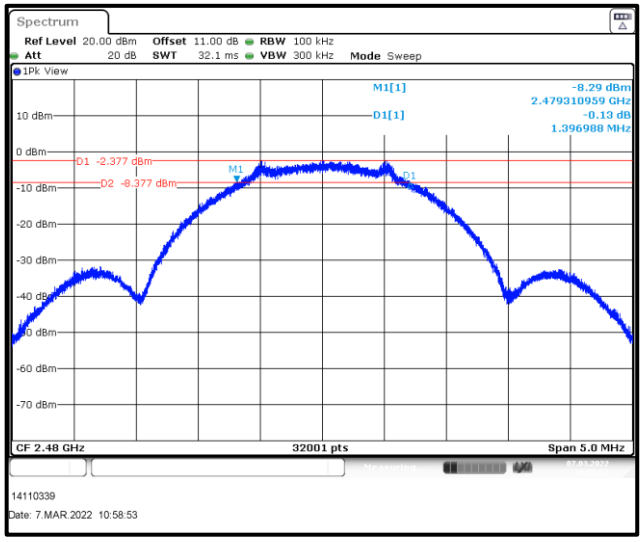
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	1389.957	≥ 500	889.957	Complied
Middle	1399.800	≥ 500	899.800	Complied
Top	1396.988	≥ 500	896.988	Complied



Bottom Channel



Middle Channel



Top Channel

Result: Pass

5.2.4. Transmitter Maximum Peak Output Power

Test Summary:

Test Engineer:	Muhammad Faiq Khan	**Test Date:**	24 January 2022
Test Sample Serial Number:	F4:60:77:4E:9B:D8 (Conducted Test Sample with U.FL 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 Section 11.9.1.1

Environmental Conditions:

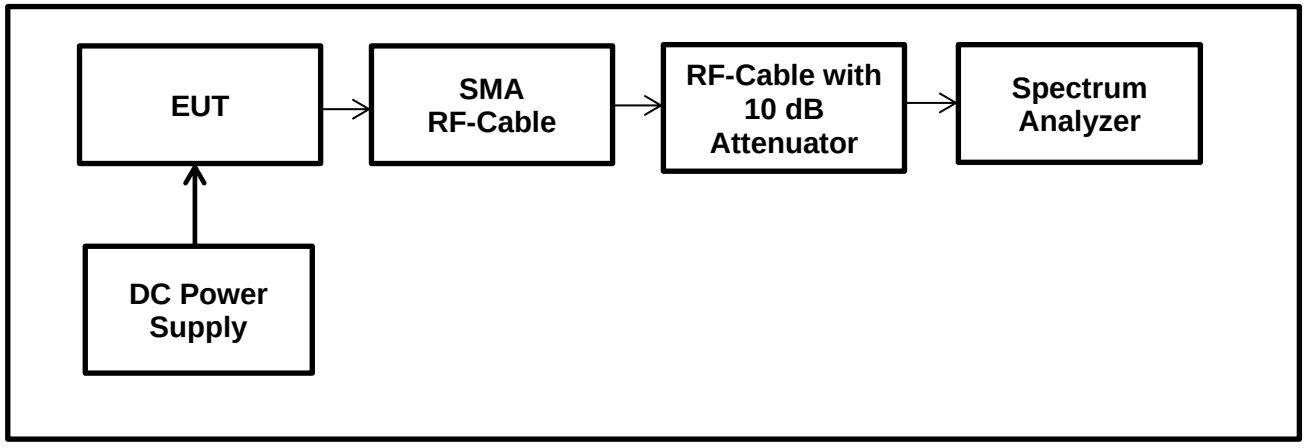
Temperature (°C):	22.9
Relative Humidity (%):	46.3

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 ≥ 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. 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.
   - The U.FL to SMA RF Cable connected on the PCB with maximum attenuation of 0.5 dB at the tested frequencies.
   - The SMA 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.
4. The declared antenna gains (for both Internal and External Antenna) were added to conducted power to obtain the relevant EIRP values.

Test Setup:



Transmitter Maximum Peak Output Power (continued)
Results: BT-LE Mode / 125 kbps / PRBS9 / PWR 0 dBm

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	0.40	30.00	29.60	Complied
Middle	0.15	30.00	29.85	Complied
Top	-0.29	30.00	30.29	Complied

Results: BT-LE Mode / 125 kbps / PRBS9 / PWR 0 dBm / Internal Antenna

Channel	Conducted Peak Power (dBm)	Declared Internal Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	0.40	2.7	3.10	36.00	32.90	Complied
Middle	0.15	2.7	2.85	36.00	33.15	Complied
Top	-0.29	2.7	2.41	36.00	33.59	Complied

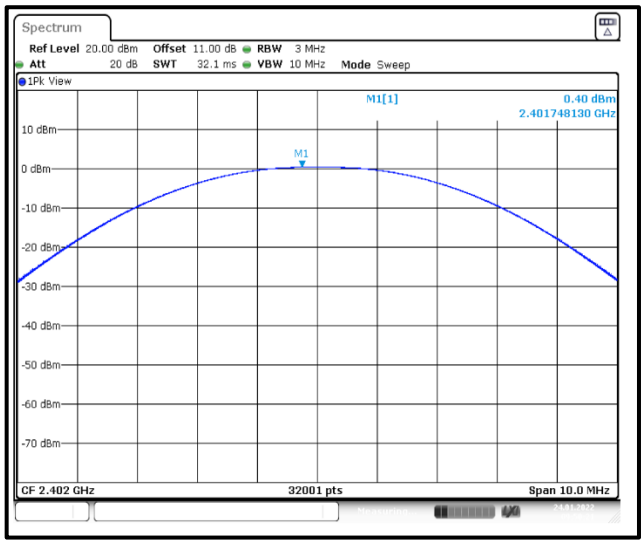
Results: BT-LE Mode / 125 kbps / PRBS9 / PWR 0 dBm / External Antenna

Channel	Conducted Peak Power (dBm)	Declared External Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	0.40	4.9	5.30	36.00	30.70	Complied
Middle	0.15	4.9	5.05	36.00	30.95	Complied
Top	-0.29	4.9	4.61	36.00	31.39	Complied

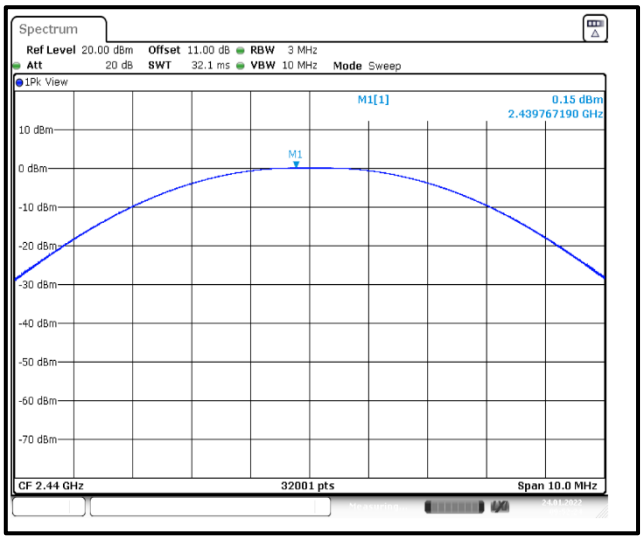
Result: Pass

Transmitter Maximum Peak Output Power (continued)

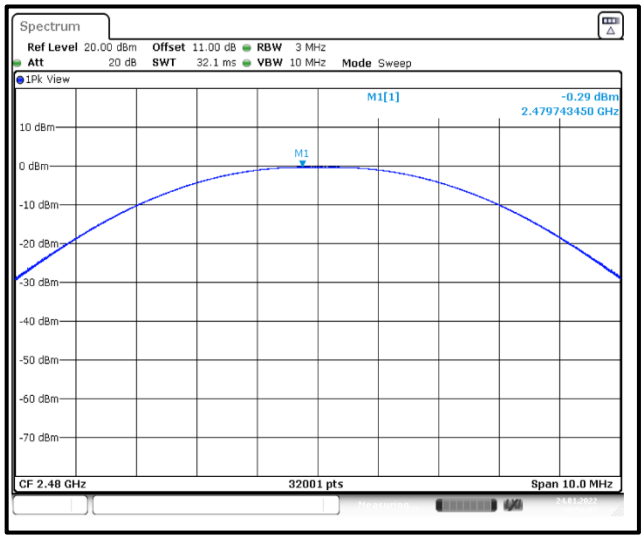
Results: BT-LE Mode / 125 kbps / PRBS9 / PWR 0 dBm



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)
Results: BT-LE Mode / 500 kbps / PRBS9 / PWR 0 dBm

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	0.39	30.00	29.61	Complied
Middle	0.13	30.00	29.87	Complied
Top	-0.30	30.00	30.30	Complied

Results: BT-LE Mode / 500 kbps / PRBS9 / PWR 0 dBm / Internal Antenna

Channel	Conducted Peak Power (dBm)	Declared Internal Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	0.39	2.7	3.09	36.00	32.89	Complied
Middle	0.13	2.7	2.83	36.00	33.13	Complied
Top	-0.30	2.7	2.40	36.00	33.60	Complied

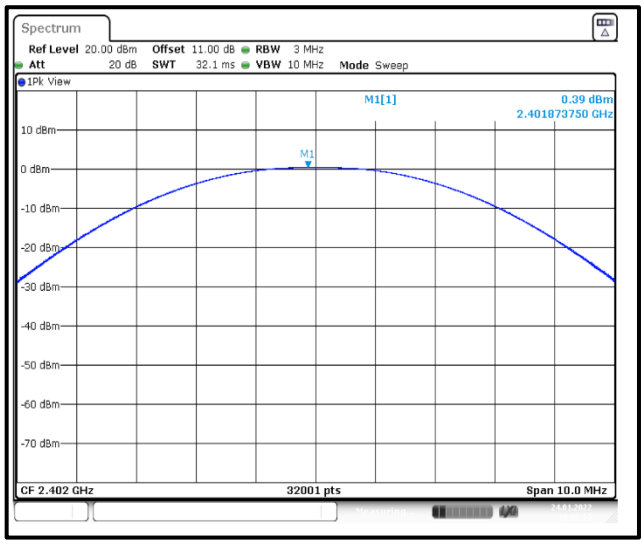
Results: BT-LE Mode / 500 kbps / PRBS9 / PWR 0 dBm / External Antenna

Channel	Conducted Peak Power (dBm)	Declared External Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	0.39	4.9	5.29	36.00	30.71	Complied
Middle	0.13	4.9	5.03	36.00	30.93	Complied
Top	-0.30	4.9	4.60	36.00	31.40	Complied

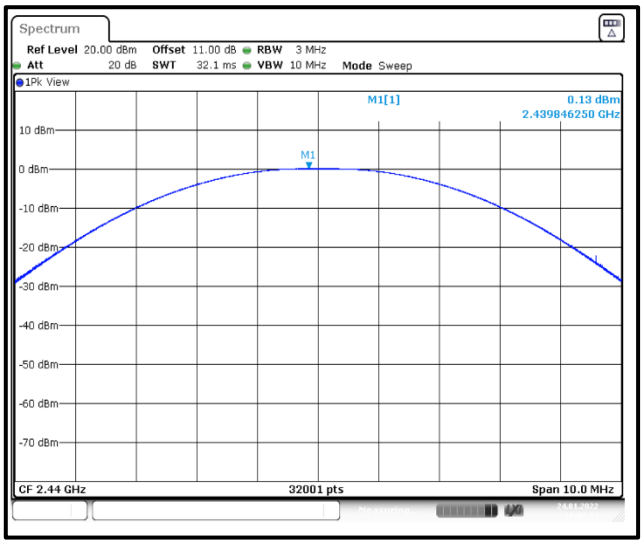
Result: Pass

Transmitter Maximum Peak Output Power (continued)

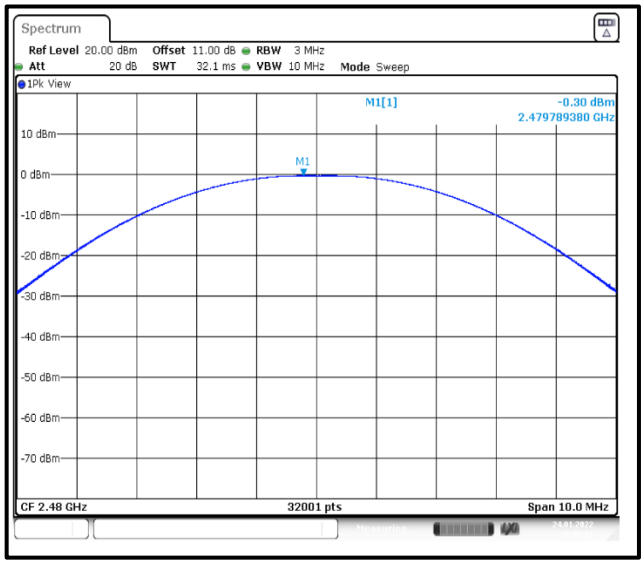
Results: BT-LE Mode / 500 kbps / PRBS9 / PWR 0 dBm



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)
Results: BT-LE Mode / 1 Mbps / PRBS9 / PWR 0 dBm

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	0.38	30.00	29.62	Complied
Middle	0.13	30.00	29.87	Complied
Top	-0.29	30.00	30.29	Complied

Results: BT-LE Mode / 1 Mbps / PRBS9 / PWR 0 dBm / Internal Antenna

Channel	Conducted Peak Power (dBm)	Declared Internal Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	0.38	2.7	3.08	36.00	32.88	Complied
Middle	0.13	2.7	2.83	36.00	33.13	Complied
Top	-0.29	2.7	2.41	36.00	33.59	Complied

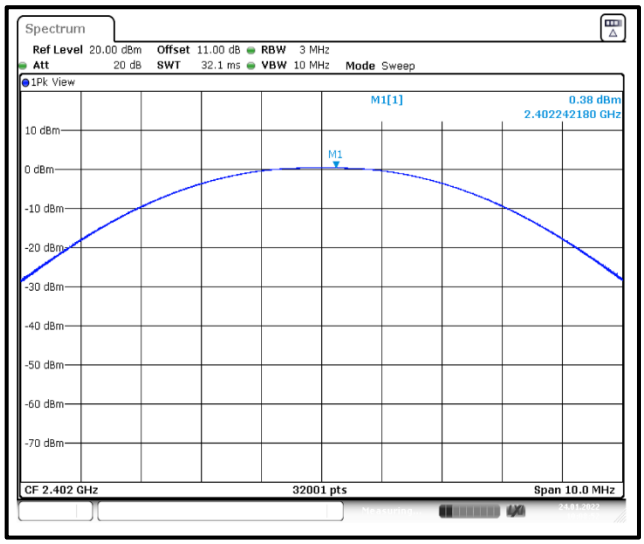
Results: BT-LE Mode / 1 Mbps / PRBS9 / PWR 0 dBm / External Antenna

Channel	Conducted Peak Power (dBm)	Declared External Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	0.38	4.9	5.28	36.00	30.72	Complied
Middle	0.13	4.9	5.03	36.00	30.93	Complied
Top	-0.29	4.9	4.61	36.00	31.39	Complied

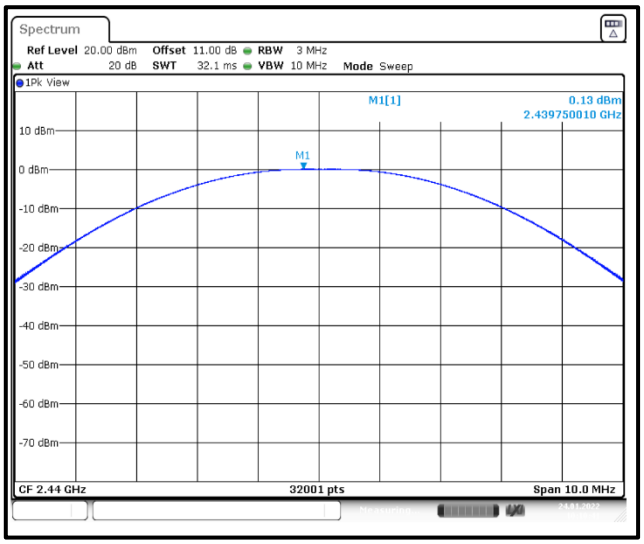
Result: Pass

Transmitter Maximum Peak Output Power (continued)

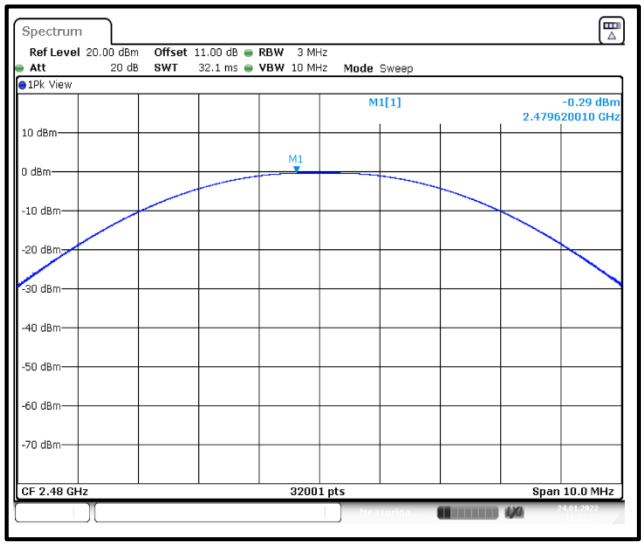
Results: BT-LE Mode / 1 Mbps / PRBS9 / PWR 0 dBm



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)
Results: BT-LE Mode / 2 Mbps / PRBS9 / PWR 0 dBm

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	0.38	30.00	29.62	Complied
Middle	0.15	30.00	29.85	Complied
Top	-0.28	30.00	30.28	Complied

Results: BT-LE Mode / 2 Mbps / PRBS9 / PWR 0 dBm / Internal Antenna

Channel	Conducted Peak Power (dBm)	Declared Internal Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	0.38	2.7	3.08	36.00	32.88	Complied
Middle	0.15	2.7	2.85	36.00	33.15	Complied
Top	-0.28	2.7	2.42	36.00	33.58	Complied

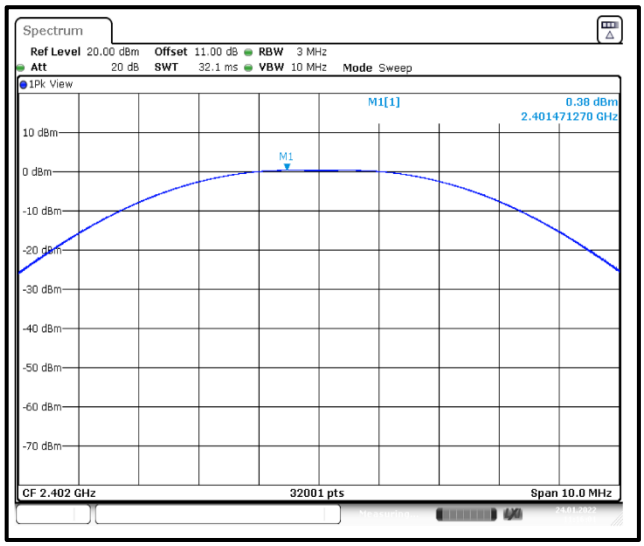
Results: BT-LE Mode / 2 Mbps / PRBS9 / PWR 0 dBm / External Antenna

Channel	Conducted Peak Power (dBm)	Declared External Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	0.38	4.9	5.28	36.00	30.72	Complied
Middle	0.15	4.9	5.05	36.00	30.95	Complied
Top	-0.28	4.9	4.62	36.00	31.38	Complied

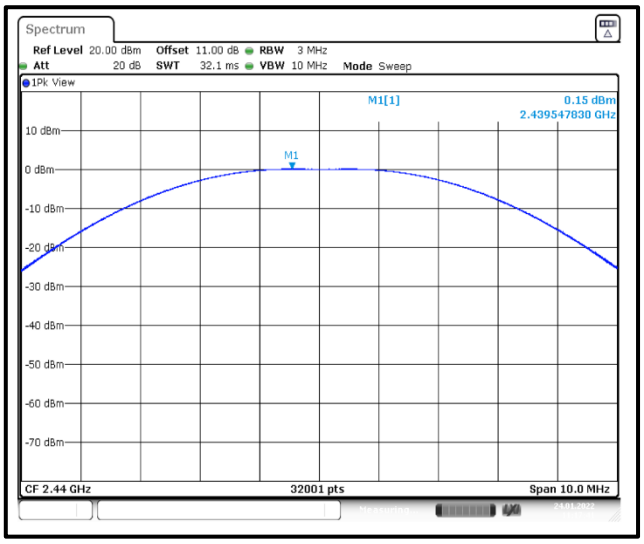
Result: Pass

Transmitter Maximum Peak Output Power (continued)

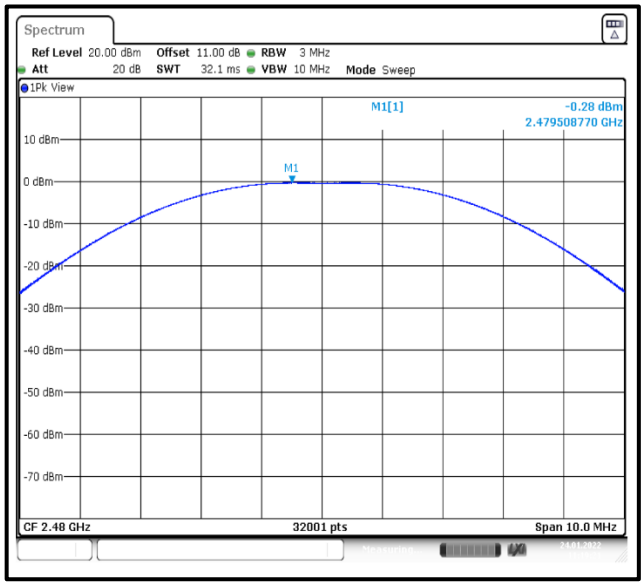
Results: BT-LE Mode / 2 Mbps / PRBS9 / PWR 0 dBm



Bottom Channel



Middle Channel



Top Channel

5.2.5. Transmitter Power Spectral Density

Test Summary:

Test Engineer:	Muhammad Faiq Khan	**Test Date:**	07 March 2022
Test Sample Serial Number:	F4:60:77:4E:9B:D8 (Conducted Test Sample with U.FL connector)		
Test Site Identification	SR 9		

FCC Reference:	Part 15.247(e)
Test Method Used:	FCC KDB 558074 Section 8.4 referencing ANSI C63.10 Sections 11.10.2

Environmental Conditions:

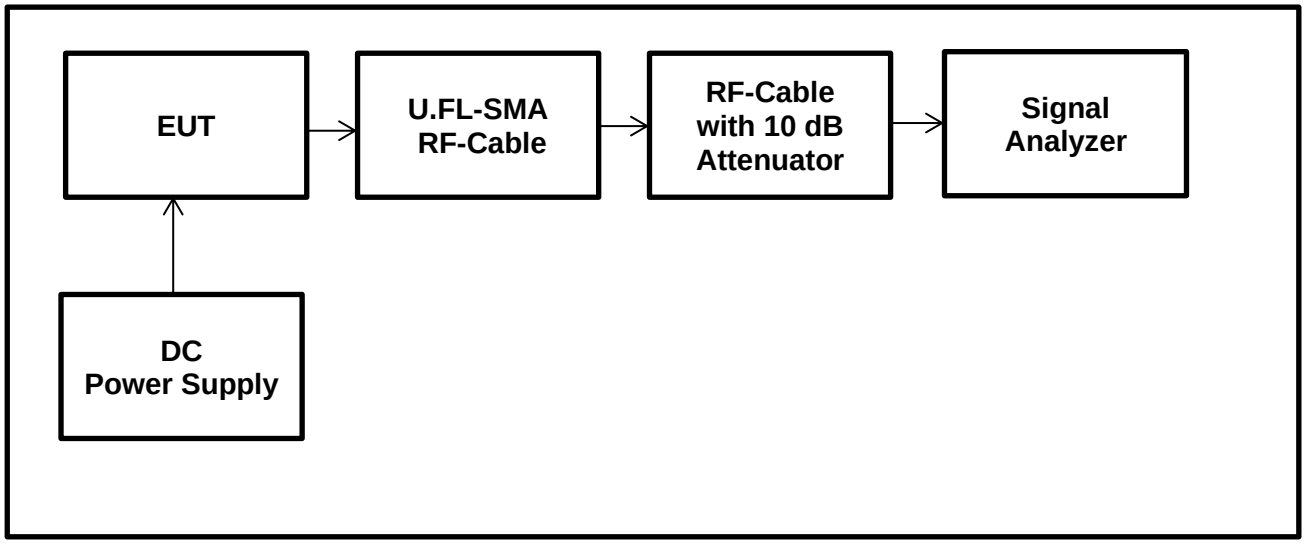
Temperature (°C):	22.9
Relative Humidity (%):	46.3

Notes:

1. The signal analyser resolution bandwidth was set to 3 kHz and video bandwidth 10 kHz. A Peak detector was used and sweep time was set to Auto. The span was set to 1.5 times the DTS bandwidth. The highest peak of the measured signal was recorded.
2. 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.
   - The U.FL to SMA RF Cable connected on the PCB with maximum attenuation of 0.5 dB at the tested frequencies.
   - The SMA 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.

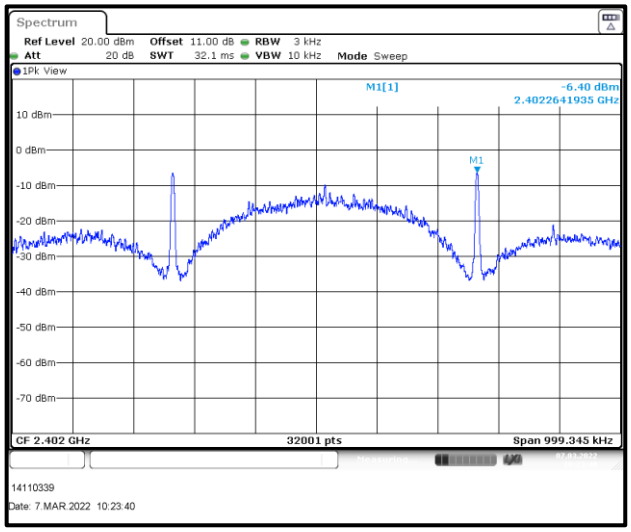
Test Setup:



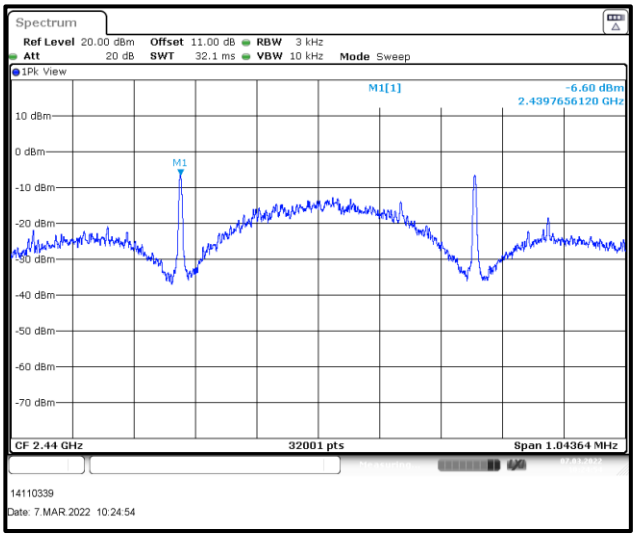
Transmitter Power Spectral Density (continued)

Results: BT-LE Mode / 125 kbps / PRBS9 / PWR 0 dBm

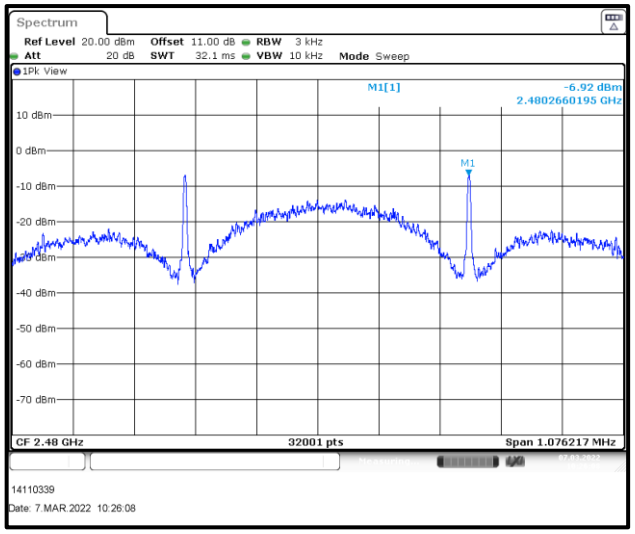
Channel	Output Power (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
Bottom	-6.40	8.00	14.40	Complied
Middle	-6.60	8.00	14.60	Complied
Top	-6.92	8.00	14.92	Complied



Bottom Channel



Middle Channel



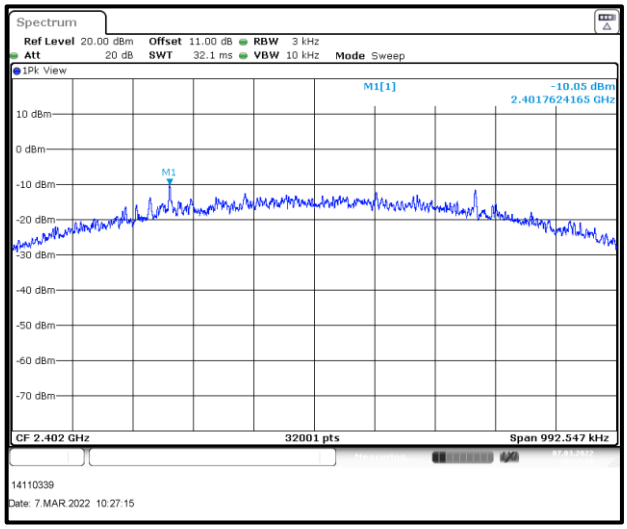
Top Channel

Result: Pass

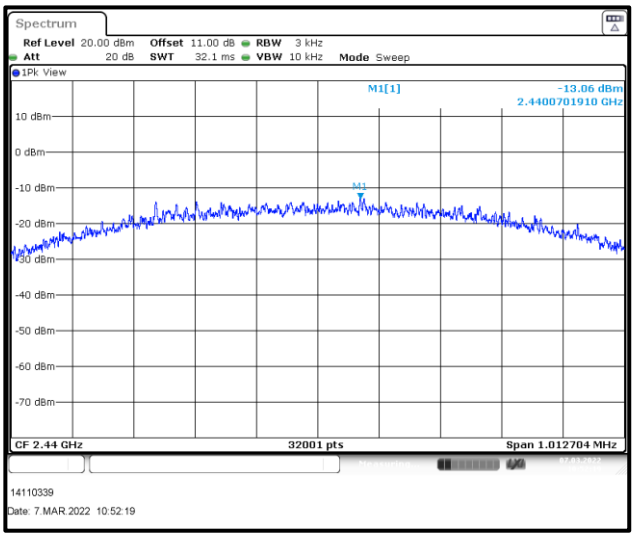
Transmitter Power Spectral Density (continued)

Results: BT-LE Mode / 500 kbps / PRBS9 / PWR 0 dBm

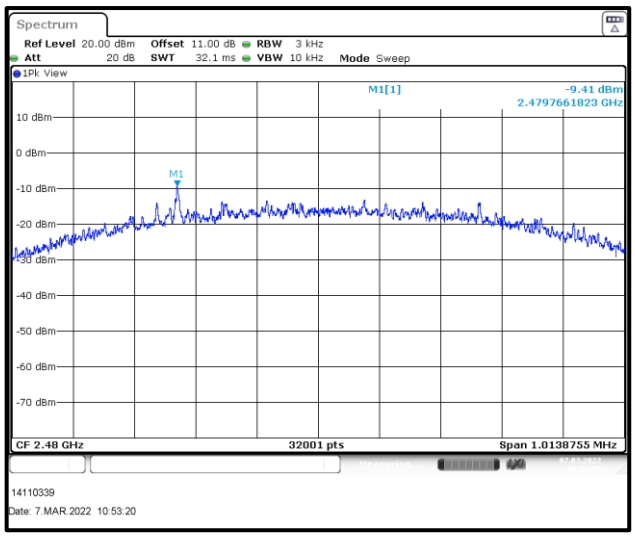
Channel	Output Power (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
Bottom	-10.05	8.00	18.05	Complied
Middle	-13.06	8.00	21.06	Complied
Top	-9.41	8.00	17.41	Complied



Bottom Channel



Middle Channel



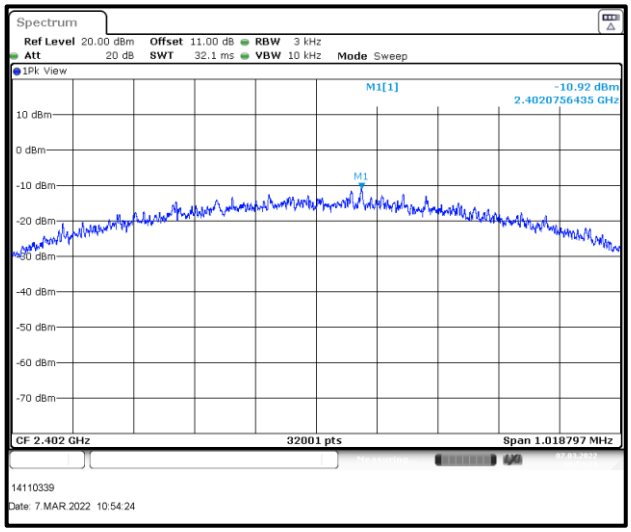
Top Channel

Result: Pass

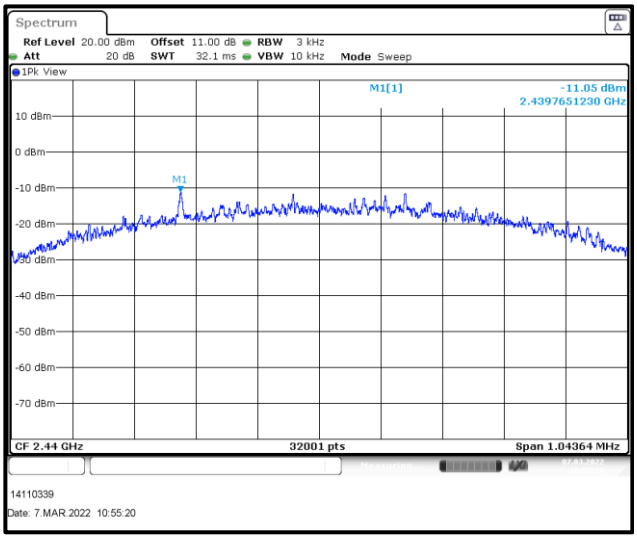
Transmitter Power Spectral Density (continued)

Results: BT-LE Mode / 1 Mbps / PRBS9 / PWR 0 dBm

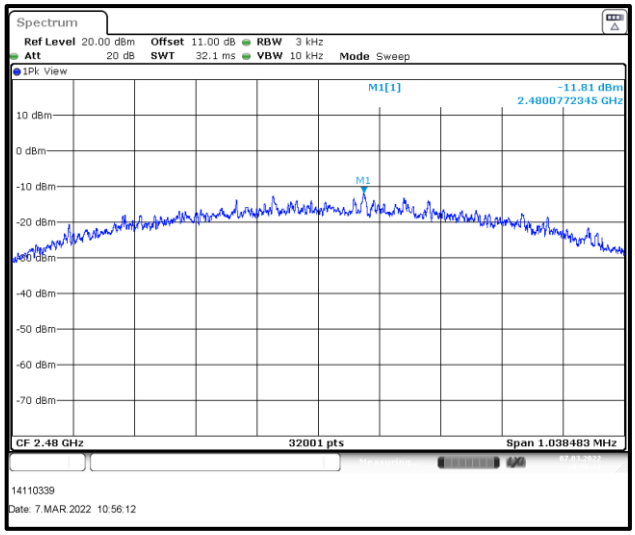
Channel	Output Power (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
Bottom	-10.92	8.00	18.92	Complied
Middle	-11.05	8.00	19.05	Complied
Top	-11.81	8.00	19.81	Complied



Bottom Channel



Middle Channel



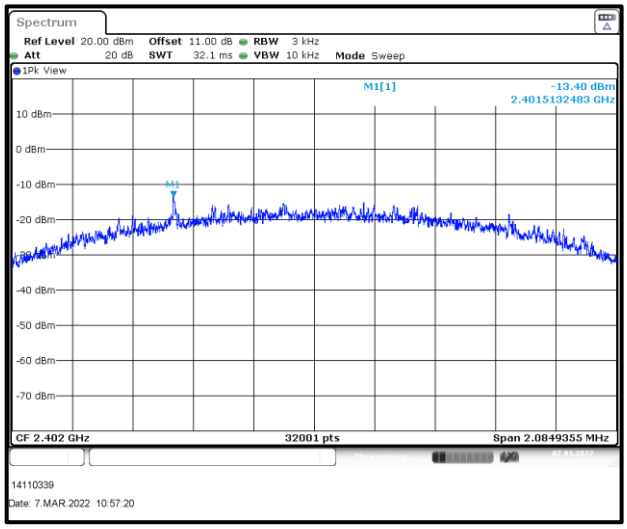
Top Channel

Result: Pass

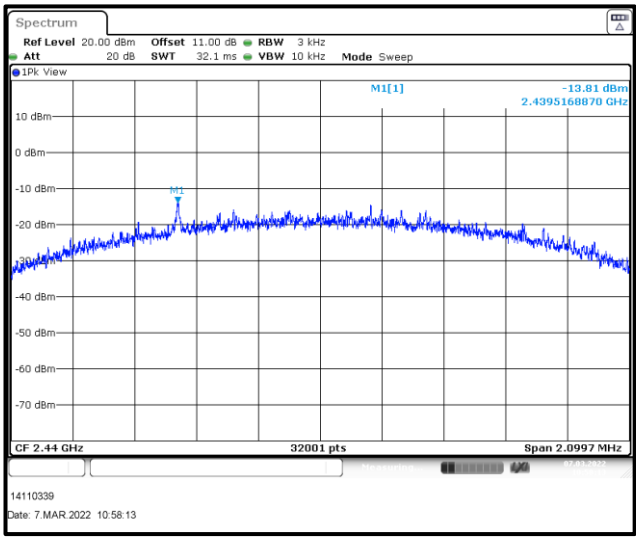
Transmitter Power Spectral Density (continued)

Results: BT-LE Mode / 2 Mbps / PRBS9 / PWR 0 dBm

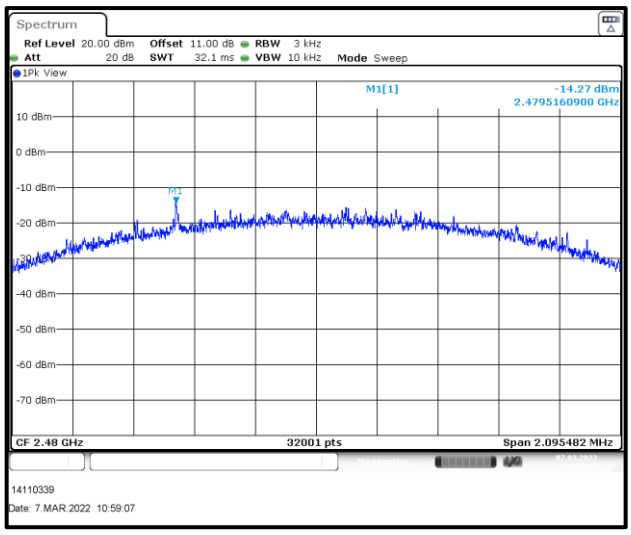
Channel	Output Power (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
Bottom	-13.40	8.00	21.40	Complied
Middle	-13.81	8.00	21.81	Complied
Top	-14.27	8.00	22.27	Complied



Bottom Channel



Middle Channel



Top Channel

Result: Pass

5.2.6. Transmitter Radiated Emissions

Test Summary:

Test Engineer:	Muhammad Faiq Khan	**Test Date:**	22 January 2022
Test Sample Serial Number:	F4:60:77:4E:9D:A2 (Radiated Test Sample-INTERNAL ANTENNA)		
Test Sample Serial Number:	F4:60:77:4E:9B:D8 (Radiated Test Sample-EXTERNAL ANTENNA)		
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):	21.1
Relative Humidity (%):	34.5

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 measurement distance of 3m.
3. Therefore, the limit values are extrapolated to a measurement distance of 3 m.

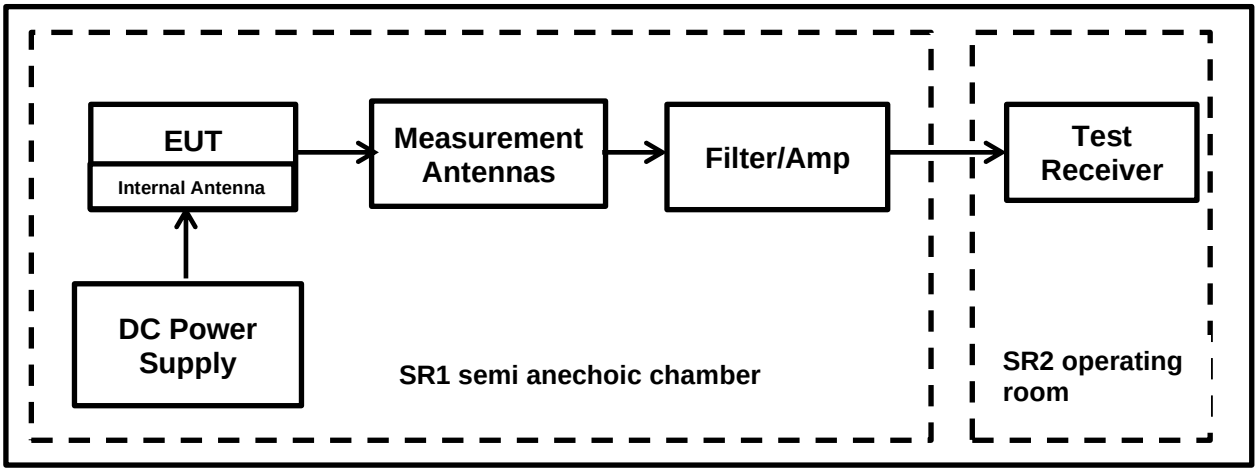
- 9 kHz- 490 kHz: limits extrapolated from 300 m to 3 m by adding 80 dB at 40 dB /decade.
- 490 kHz-1705 kHz: limits extrapolated from 30 m to 3 m by adding 40 dB at 40 dB /decade.

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 80 cm.
5. The measurement was performed only on bottom channel as it was found out to be the worst-case w.r.t. maximum conducted output power and power spectral density measurements & worst case emission profile according to the initial radiated emission measurement.
6. The measurements were performed only with 125 kbps data rate since it was found out to be the worst-case w.r.t. maximum conducted output power and power spectral density measurements.
7. 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.
8. Pre-scans were performed, and markers placed on the highest measured levels. The test receiver was set to:

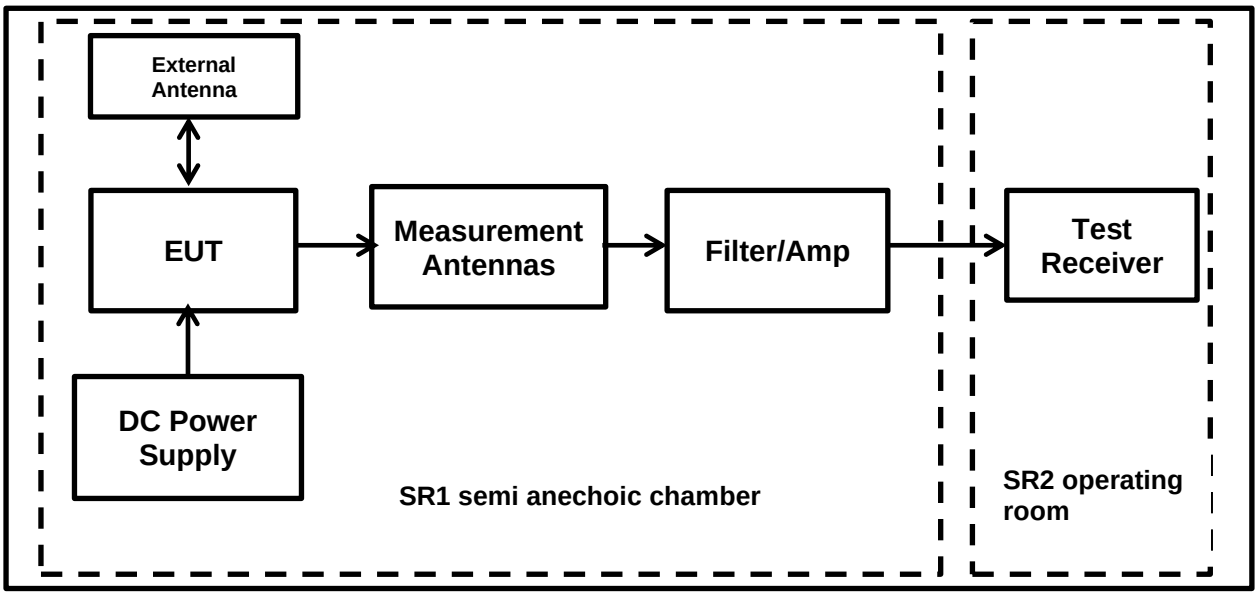
- Frequency range: 9 kHz-150 kHz: RBW: 1 kHz /VBW: 3 kHz
- Frequency range: 150 kHz – 30 MHz: RBW: 10 kHz /VBW: 30 kHz
- Detector: Max-Peak detector
- Trace Mode: Max Hold

Transmitter Radiated Emissions (continued)

Test Setup / EUT+ Internal Antenna:



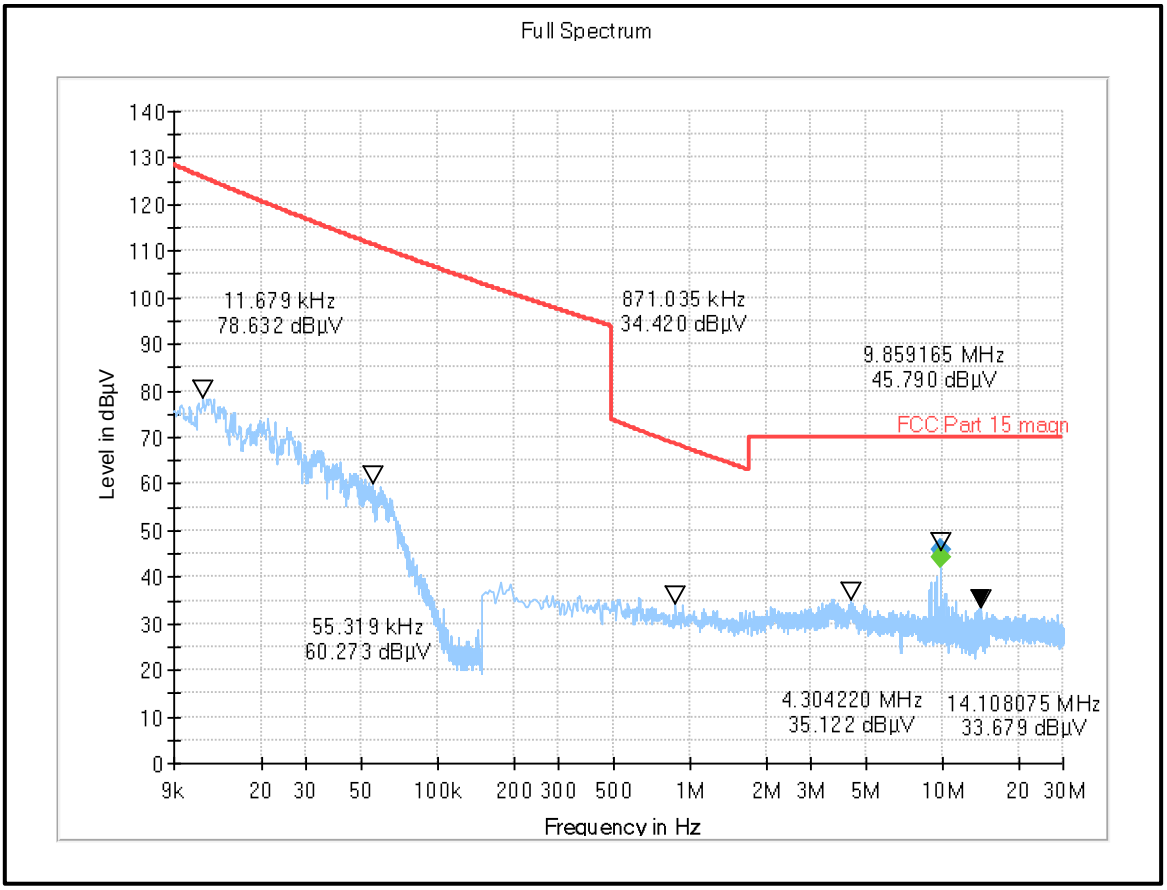
Test Setup / EUT+ External Antenna:



Transmitter Radiated Emissions (continued)
Results : BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / Internal Antenna

Frequency (MHz)	Loop Antenna Orientation	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
9.859165	90° to EUT	45.79	70.00	24.21	Complied

Plot: 9 kHz – 30 MHz: BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / Internal Antenna

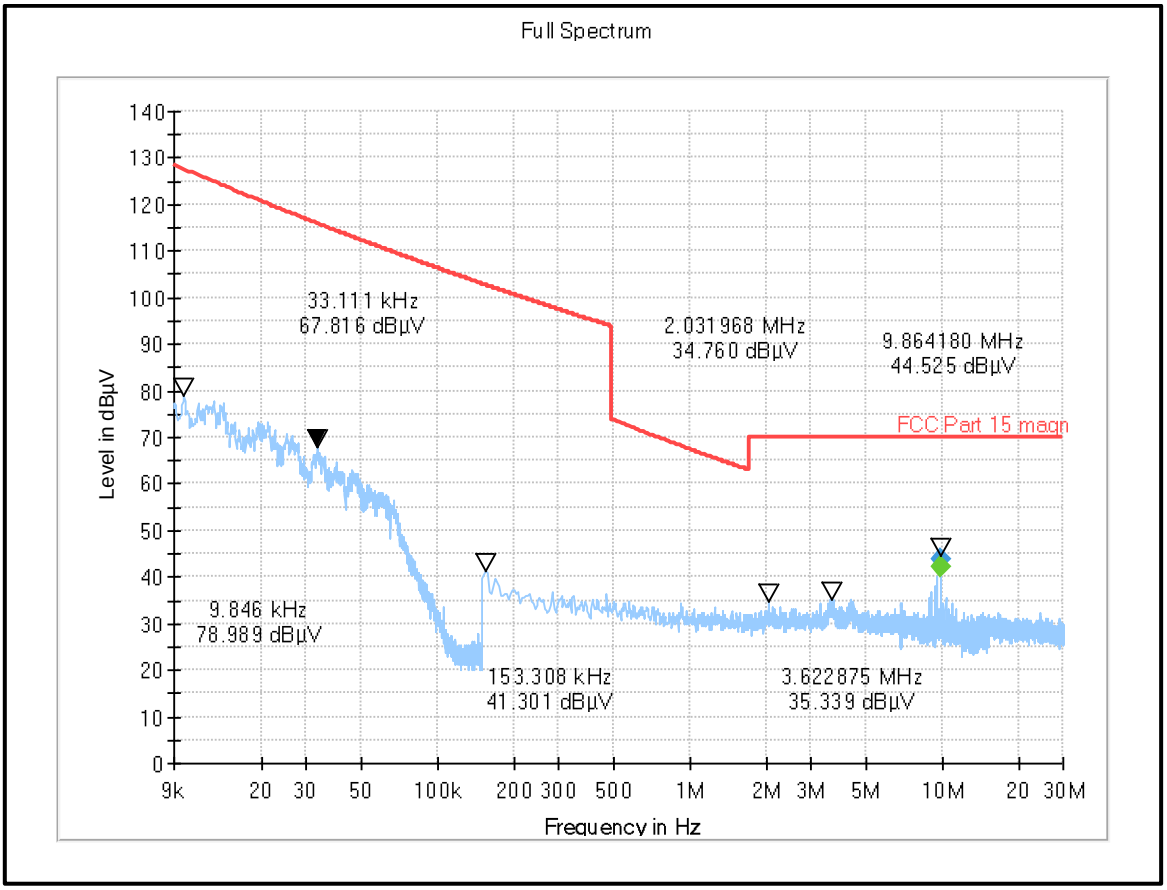


Result: Pass

Transmitter Radiated Emissions (continued)
Results : BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / External Antenna

Frequency (MHz)	Loop Antenna Orientation	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
9.861673	90° to EUT	43.89	70.00	26.11	Complied

Plot: 9 kHz – 30 MHz: BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / External Antenna



Result: Pass

Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineer:	Muhammad Faiq Khan	**Test Date:**	21 January 2022
Test Sample Serial Number:	F4:60:77:4E:9D:A2 (Radiated Test Sample-INTERNAL ANTENNA)		
Test Sample Serial Number:	F4:60:77:4E:9B:D8 (Radiated Test Sample-EXTERNAL ANTENNA)		
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:

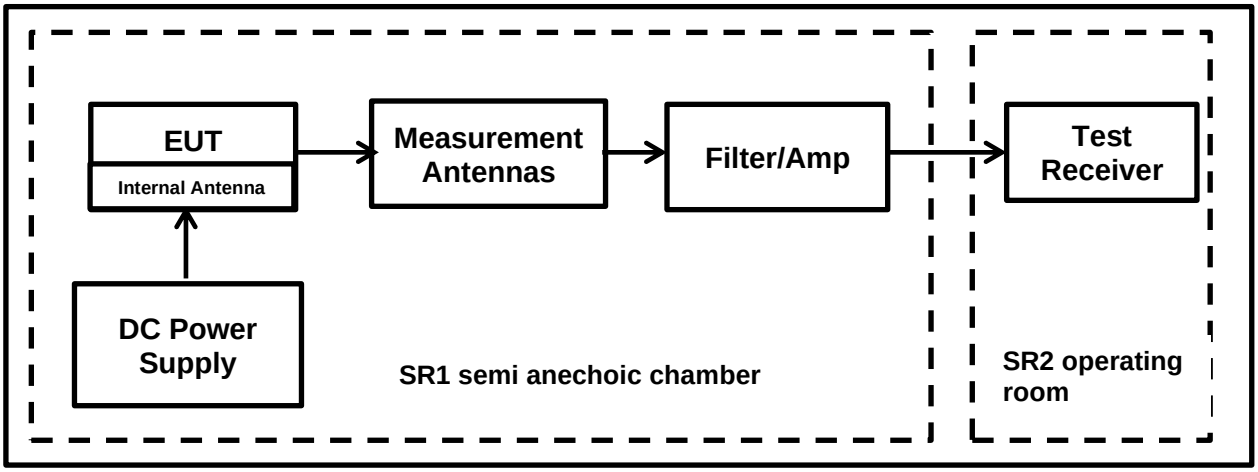
Temperature (°C):	22.5
Relative Humidity (%):	32.5

Note(s):

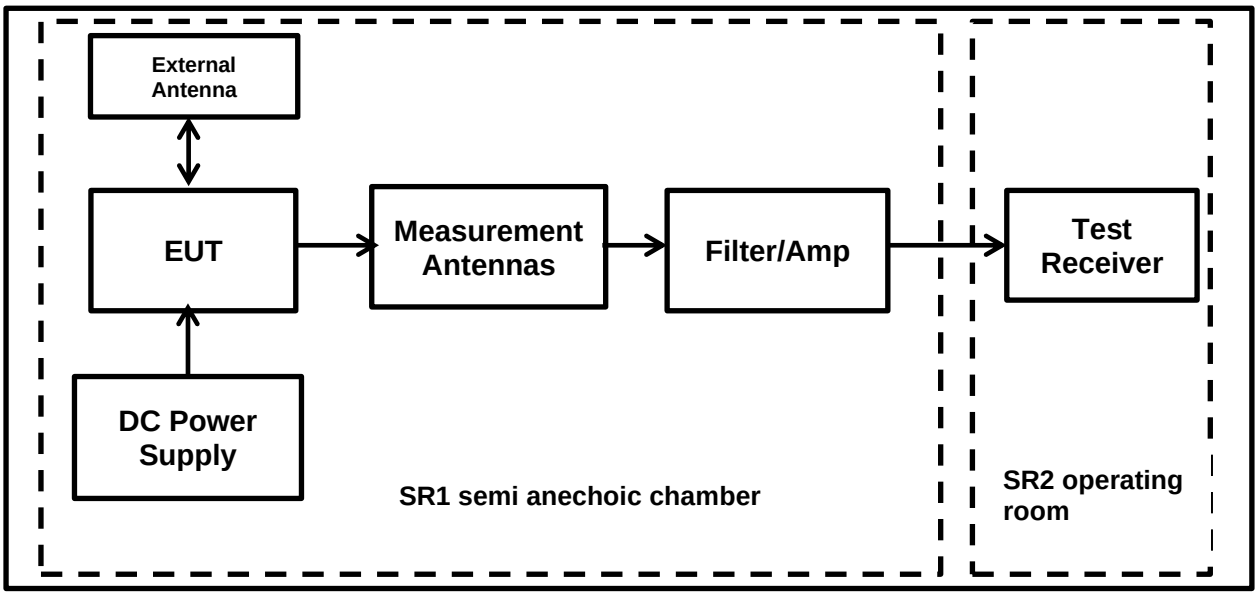
1. Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
2. Pre-scans were performed, and markers placed on the highest measured levels. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.
3. The measurement was performed only on bottom channel as it was found out to be the worst-case w.r.t. maximum conducted output power and power spectral density measurements & worst case emission profile according to the initial radiated emission measurement.
4. The measurements were performed only with 125 kbps data rate since it was found out to be the worst-case w.r.t. maximum conducted output power and power spectral density measurements.
5. All emissions shown on the pre-scan plots were investigated and found to be below system noise floor.

Transmitter Radiated Emissions (continued)

Test Setup / EUT+ Internal Antenna:



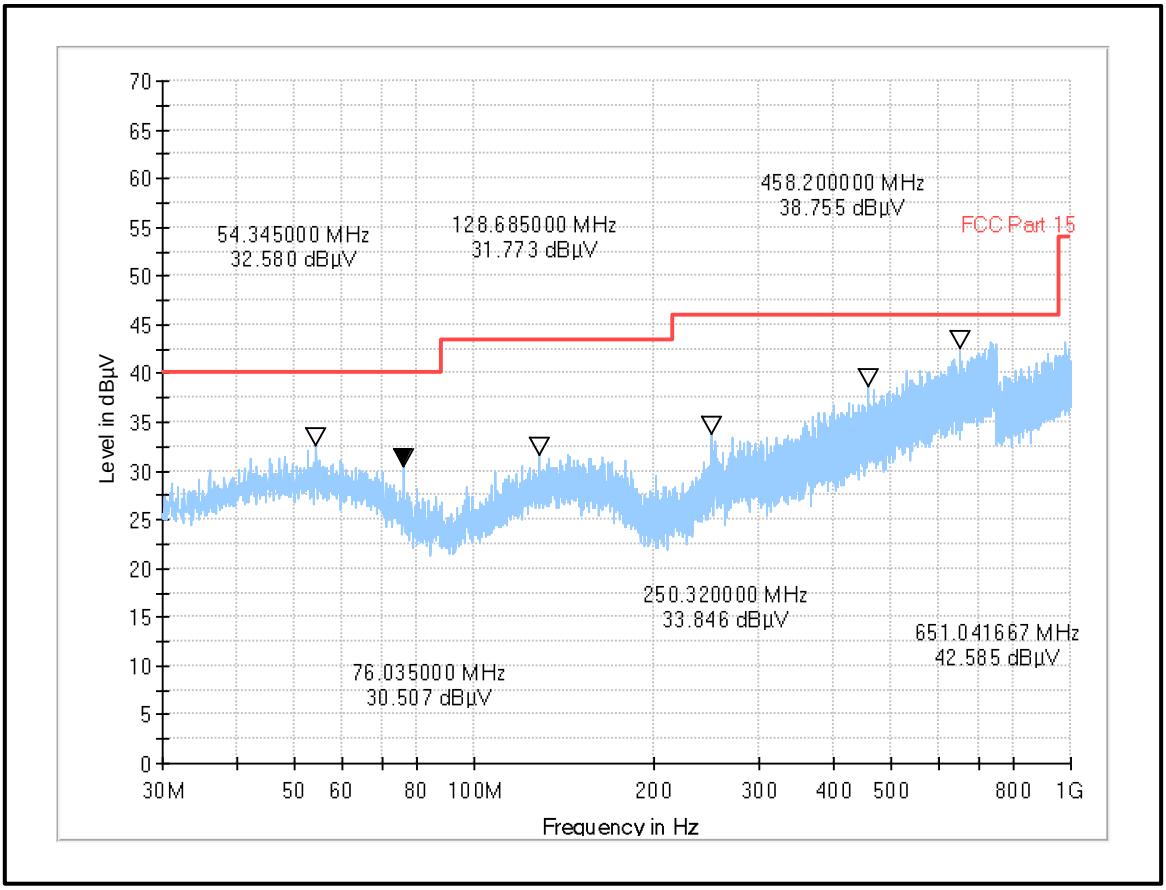
Test Setup / EUT+ External Antenna:



Transmitter Radiated Emissions (continued)
Results : BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / Internal Antenna

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

Plot: 30 MHz – 1 GHz: BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / Internal Antenna

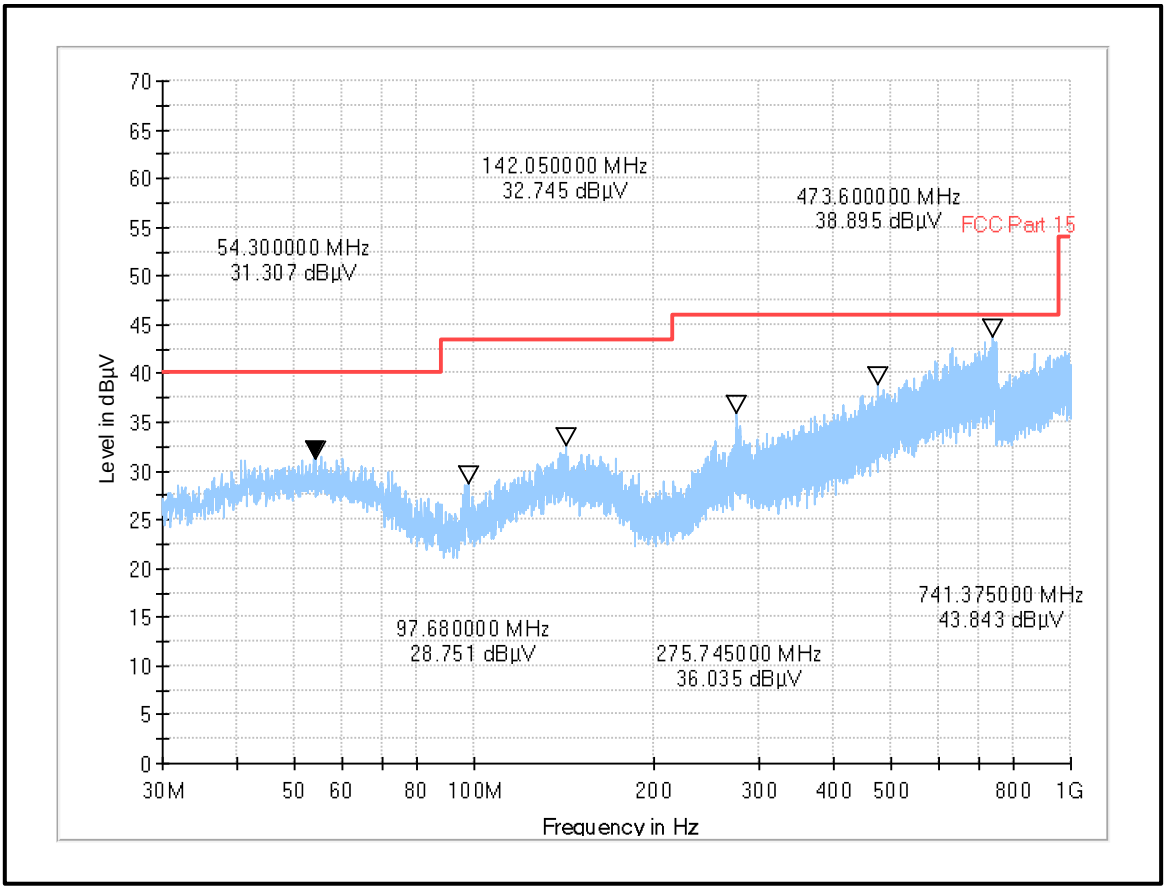


Result: Pass

Transmitter Radiated Emissions (continued)
Results : BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / External Antenna

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

Plot: 30 MHz – 1 GHz: BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / External Antenna



Result: Pass

Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineer:	Muhammad Faiq Khan	**Test Date:**	20 January 2022 to 17 May 2022
Test Sample Serial Number:	F4:60:77:4E:9D:A2 (Radiated Test Sample-INTERNAL ANTENNA)		
Test Sample Serial Number:	F4:60:77:4E:9B:D8 (Radiated Test Sample-EXTERNAL ANTENNA)		
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
Frequency Range	1 GHz to 26.5 GHz

Environmental Conditions:

Temperature (°C):	22.5 to 22.9
Relative Humidity (%):	32.9 to 39.1

Note(s):

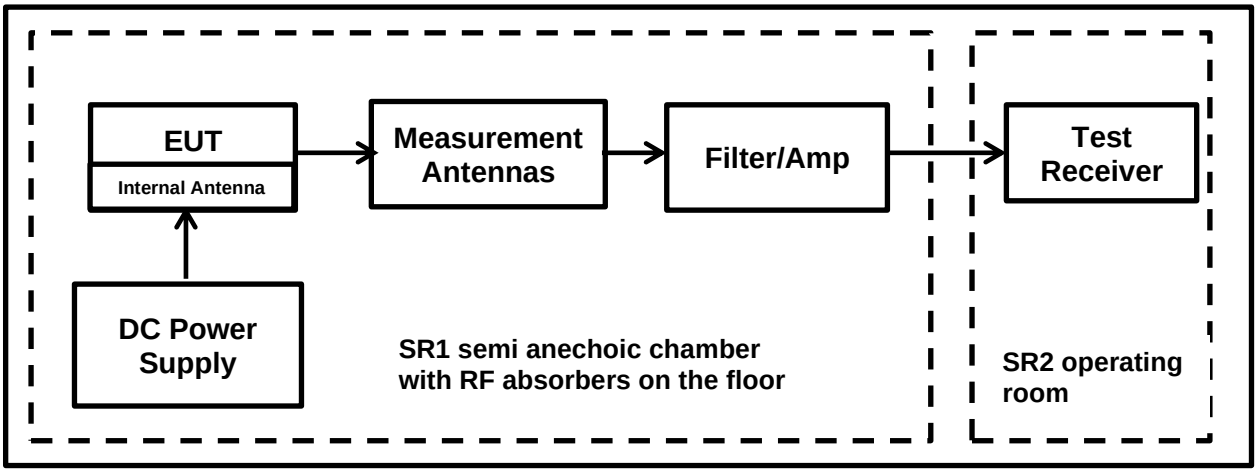
1. Pre-scans above 1 GHz were performed in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) with RF absorbers on the floor at a distance of 3 m. The EUT was placed at a height of 1.5 m above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a 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 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.
3. Pre-scans were performed, and marker placed on the highest measured level of the plot. The test receiver RBW was set to 1 MHz and VBW 3 MHz. The sweep time was set to auto.
4. The measurements were performed on Bottom, Middle and Top channels with 125 kbps data rate since it was found out to be the worst-case w.r.t. maximum conducted output power and power spectral density measurements.
5. 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.
6. *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."
7. The Restricted Band Emissions were performed in accordance with ANSI C63.10 Section 11.12.2.4 & 11.12.2.5.1.
8. As the EUT continuous transmission of the EUT (D ≥ 98%) can be achieved and EUT was transmitting continuously with a constant Duty Cycle of 100 % (duty cycle variations are less than ±2%). Therefore, a Duty Cycle Correction Factor isn't applicable to the measured average values of the emissions.

Transmitter Radiated Emissions (continued)

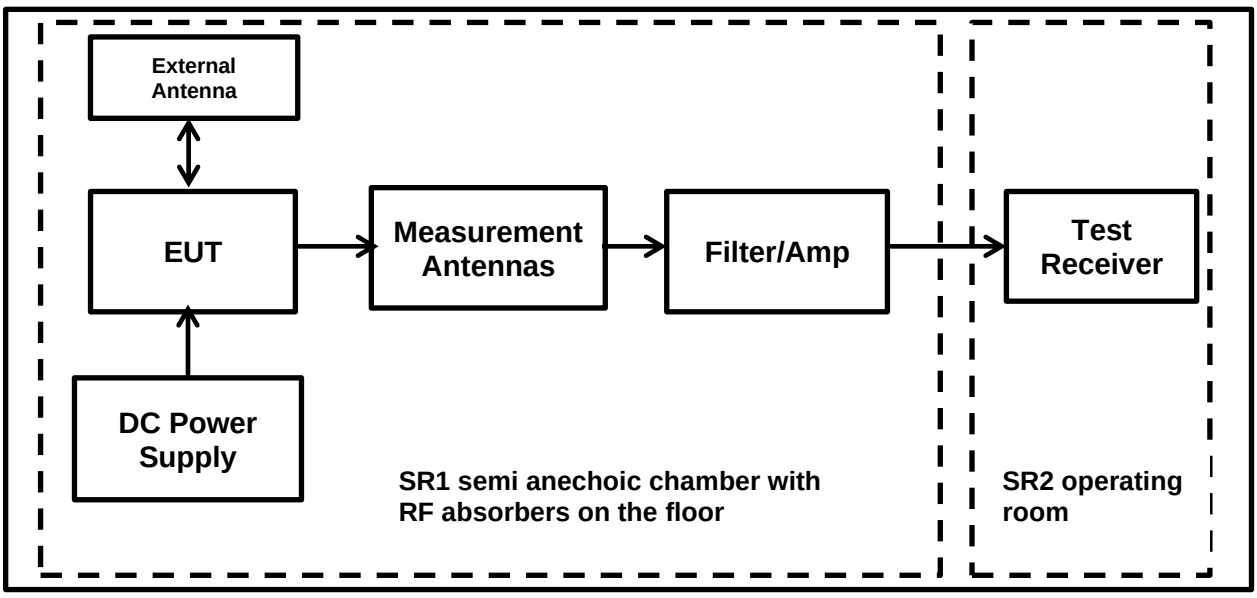
Note(s):

9. The Non-Restricted Band Emissions were performed in accordance with 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) measurements were performed with a peak detector and the -20 dBc limit applied.
10. All other emissions shown on the pre-scan plots were investigated and found to be below system noise floor.
11. 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.
12. The preliminary scans showed similar emission levels above 18 GHz, for each channel & modes of operation. Therefore, final radiated emissions measurements were performed with the EUT set to the Bottom Channel only.
13. 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.

Test Setup / EUT+ Internal Antenna:



Test Setup / EUT+ External Antenna:



Transmitter Radiated Emissions (continued)
Results : BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / Internal Antenna

Frequency (MHz)	Antenna Orientation	MaxPeak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
3998.666667	Horizontal	49.30	54.00	4.70	Complied
4803.333333	Horizontal	53.09	54.00	0.91	Complied

Note: The frequencies are represented with the blue point in the plot below.

Restricted Band Emission:

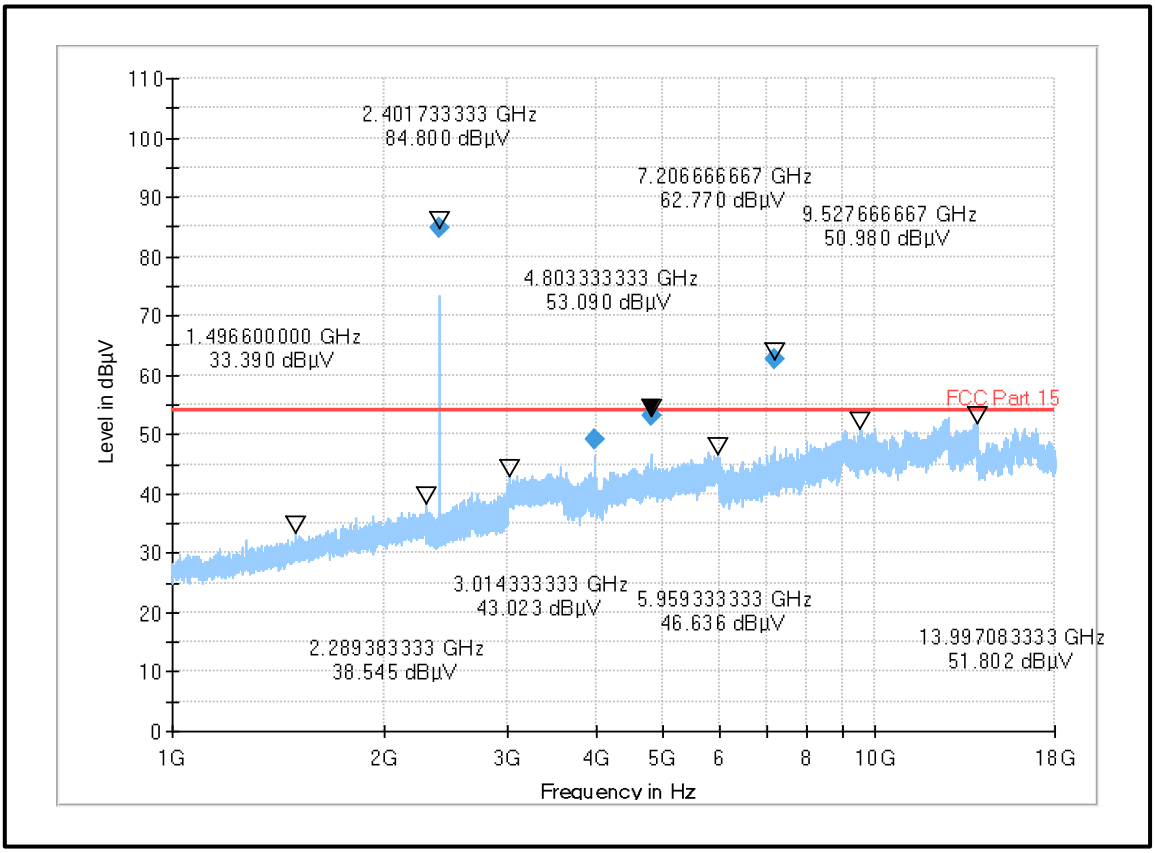
Frequency (MHz)	Antenna Orientation	MaxPeak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
4804.00	Horizontal	59.21	74.00	14.79	Complied

Frequency (MHz)	Antenna Orientation	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
4804.00	Horizontal	52.86	54.00	1.14	Complied

Non-Restricted Band Emission:

Frequency (MHz)	Antenna Orientation	MaxPeak Level (dBµV/m)	-20 dBc Peak Limit (dBµV/m)	Margin (dB)	Result
7205.34	Vertical	58.73	63.16	4.43	Complied

Plot: 1 GHz – 18 GHz: BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / Internal Antenna



Transmitter Radiated Emissions (continued)
Results : BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Middle Channel / Internal Antenna

Frequency (MHz)	Antenna Orientation	MaxPeak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
4876.666667	Vertical	52.30	54.00	1.70	Complied*

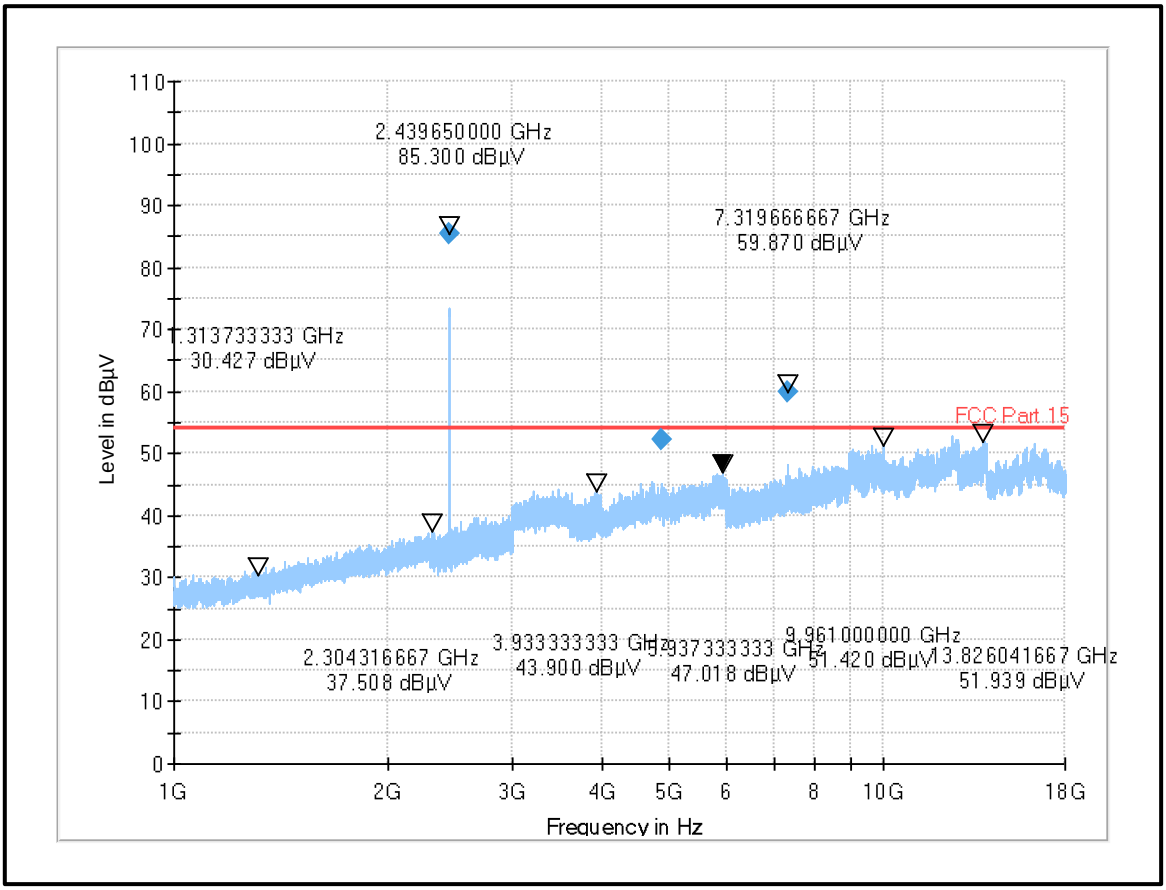
Note: The frequency is represented with the blue point in the plot below.

Restricted Band Emission:

Frequency (MHz)	Antenna Orientation	MaxPeak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
7319.46	Vertical	57.25	74.00	16.75	Complied

Frequency (MHz)	Antenna Orientation	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
7319.46	Vertical	51.26	54.00	2.74	Complied

Plot: 1 GHz – 18 GHz: BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Middle Channel / Internal Antenna



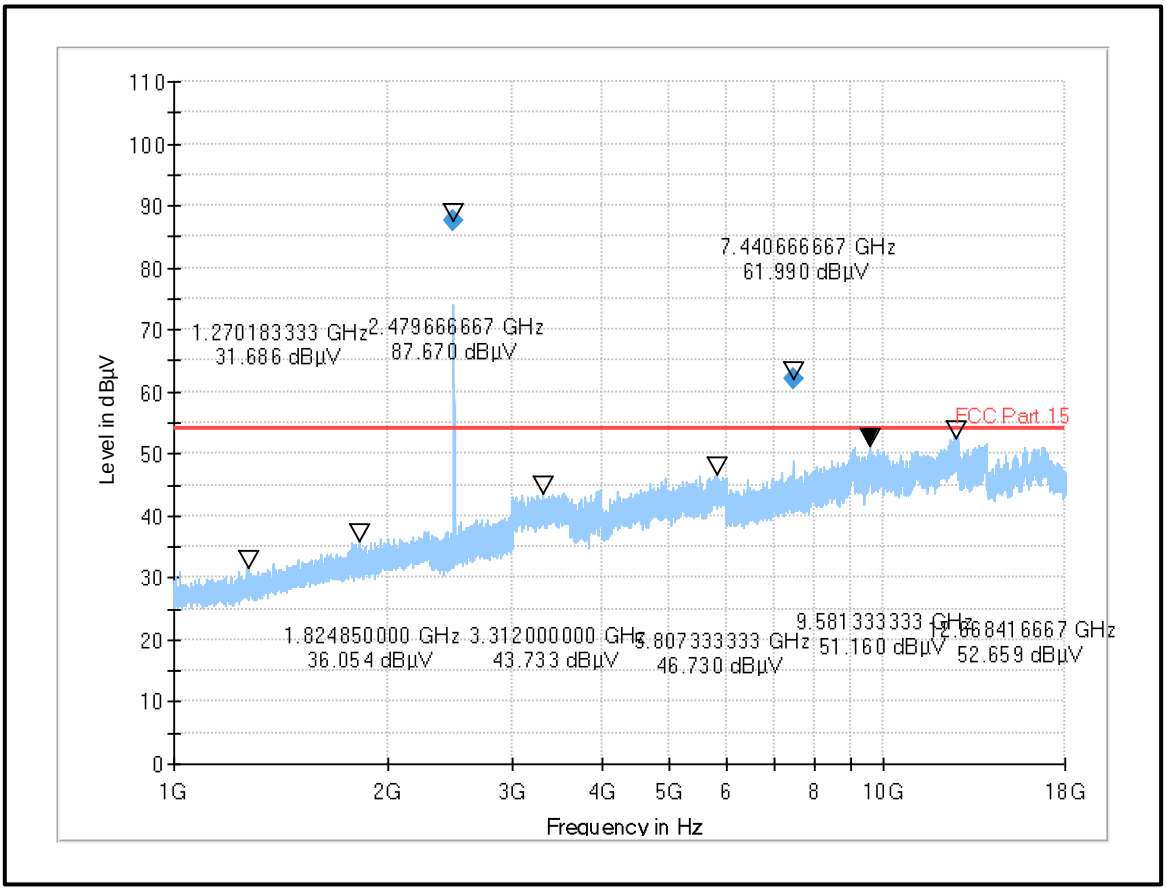
Transmitter Radiated Emissions (continued)
Results : BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Top Channel / Internal Antenna

Restricted Band Emission:

Frequency (MHz)	Antenna Orientation	MaxPeak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
7440.73	Vertical	55.19	74.00	18.81	Complied

Frequency (MHz)	Antenna Orientation	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
7440.78	Vertical	48.89	54.00	5.11	Complied

Plot: 1 GHz – 18 GHz: BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Top Channel / Internal Antenna



Transmitter Radiated Emissions (continued)
Results : BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / External Antenna

Restricted Band Emission:

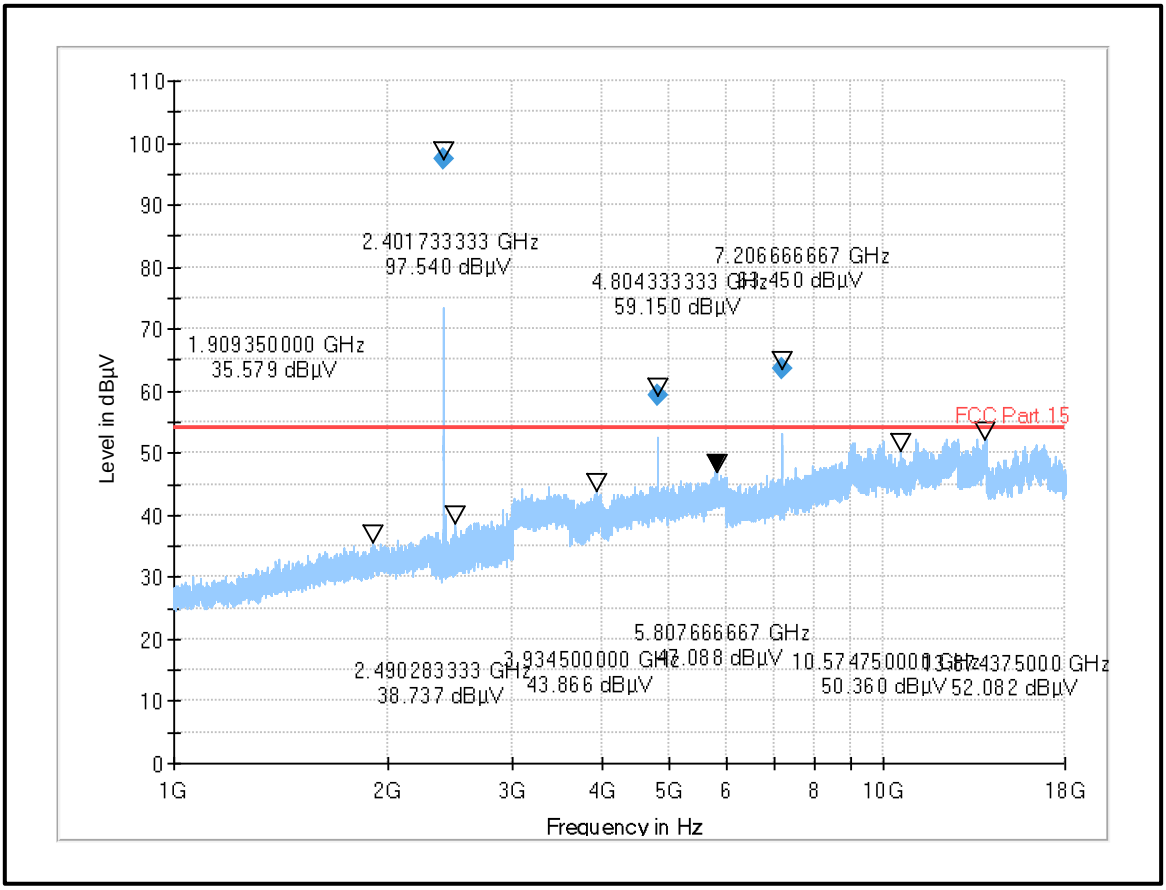
Frequency (MHz)	Antenna Orientation	MaxPeak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
4804.43	Horizontal	60.91	74.00	13.09	Complied

Frequency (MHz)	Antenna Orientation	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
4803.55	Horizontal	53.19	54.00	0.81	Complied

Non-Restricted Band Emission:

Frequency (MHz)	Antenna Orientation	MaxPeak Level (dBµV/m)	20 dBc Peak Limit (dBµV/m)	Margin (dB)	Result
7206.94	Horizontal	57.64	73.48	15.84	Complied

Plot: 1 GHz – 18 GHz: BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / External Antenna



Transmitter Radiated Emissions (continued)
Results : BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Middle Channel / External Antenna

Frequency (MHz)	Antenna Orientation	MaxPeak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
4880.333333	Horizontal	53.11	54.00	0.89	Complied

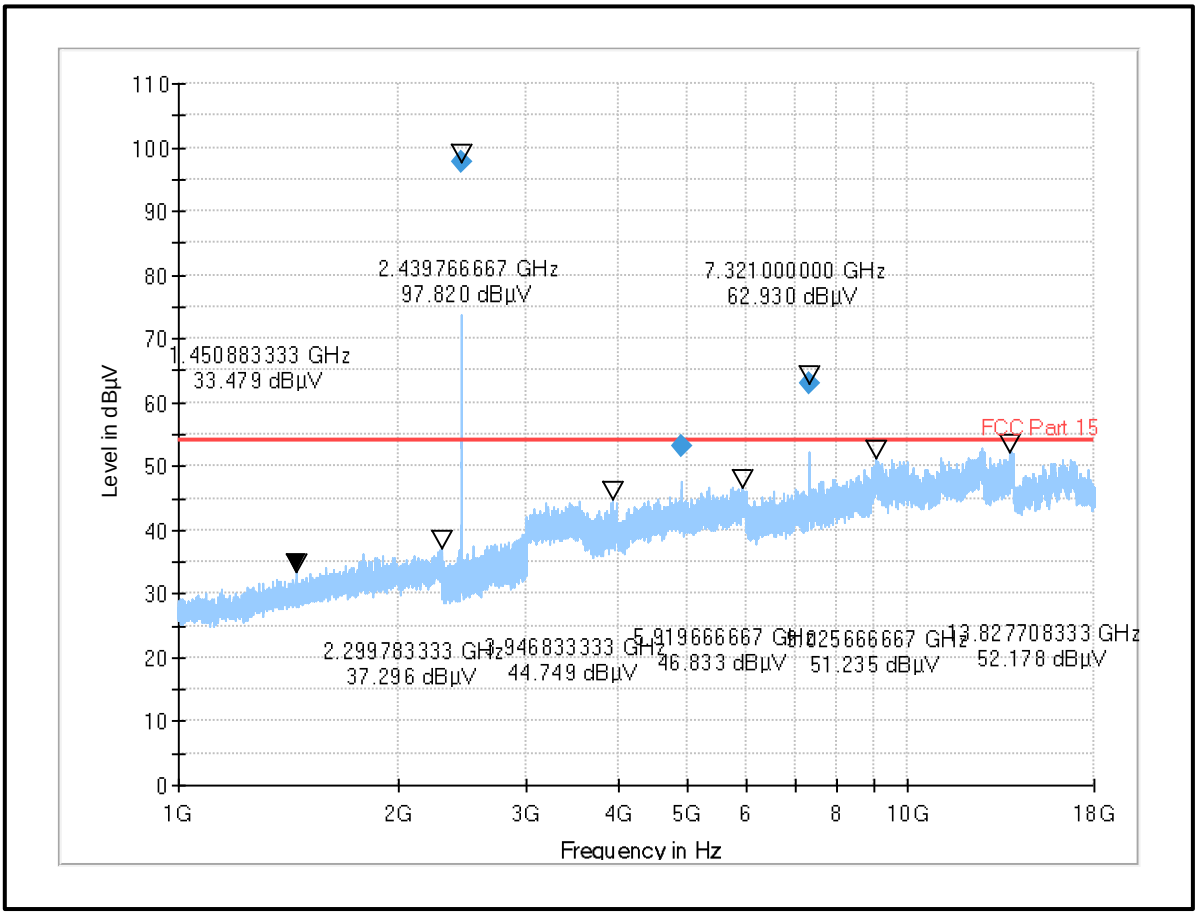
Note: The frequency is represented with the blue point in the plot below.

Restricted Band Emission:

Frequency (MHz)	Antenna Orientation	MaxPeak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
4879.79	Horizontal	58.57	74.00	15.43	Complied
7319.35	Horizontal	57.18	74.00	16.82	Complied

Frequency (MHz)	Antenna Orientation	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
4880.28	Horizontal	52.45	54.00	1.55	Complied
7319.35	Horizontal	50.66	54.00	3.34	Complied

Plot: 1 GHz – 18 GHz: BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Middle Channel / External Antenna



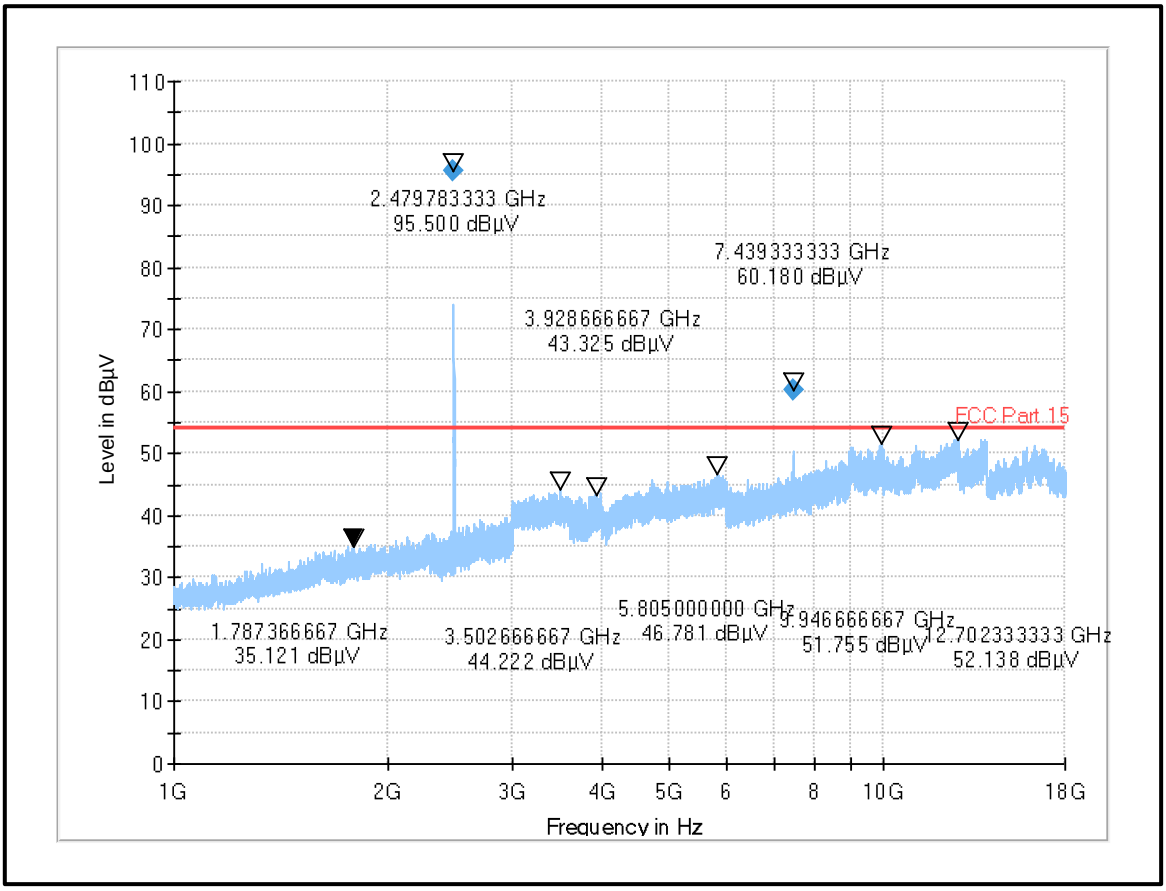
Transmitter Radiated Emissions (continued)
Results : BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Top Channel / External Antenna

Restricted Band Emission:

Frequency (MHz)	Antenna Orientation	MaxPeak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
7440.75	Horizontal	57.29	74.00	16.71	Complied

Frequency (MHz)	Antenna Orientation	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
7439.47	Horizontal	51.09	54.00	2.91	Complied

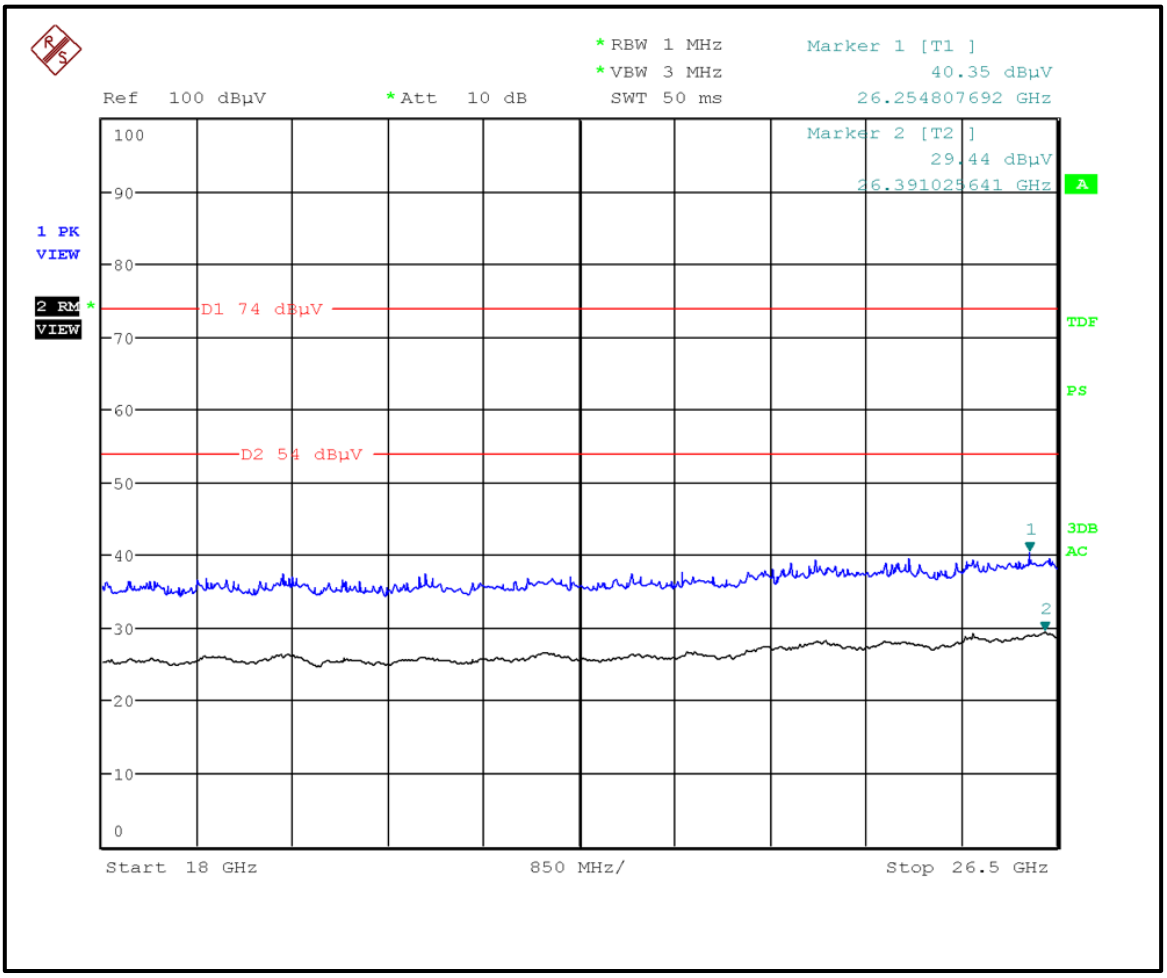
Plot: 1 GHz – 18 GHz: BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Top Channel / External Antenna



Transmitter Radiated Emissions (continued)
Results : BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / Internal Antenna

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

Plot: 18 GHz – 26.5 GHz: BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / Internal Antenna

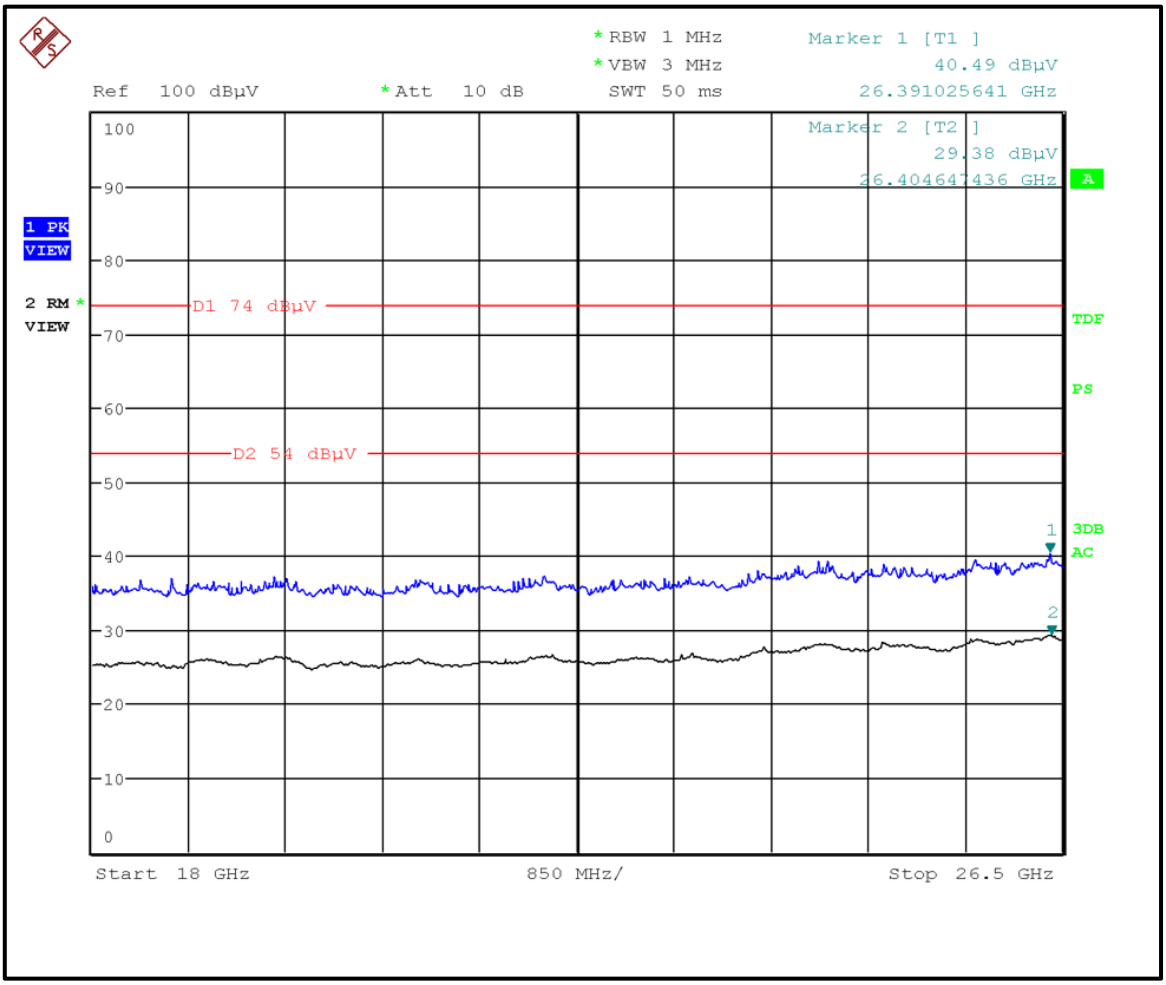


Result: Pass

Transmitter Radiated Emissions (continued)
Results : BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / External Antenna

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

Plot: 18 GHz – 26.5 GHz: BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Bottom Channel / External Antenna



Result: Pass

5.2.7. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	Muhammad Faiq Khan	**Test Date:**	20 January 2022
Test Sample Serial Number:	F4:60:77:4E:9D:A2 (Radiated Test Sample-INTERNAL ANTENNA)		
Test Sample Serial Number:	F4:60:77:4E:9B:D8 (Radiated Test Sample-EXTERNAL ANTENNA)		
Test Site Identification	SR ½		

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

Environmental Conditions:

Temperature (°C):	22.6
Relative Humidity (%):	32.9

Note(s):

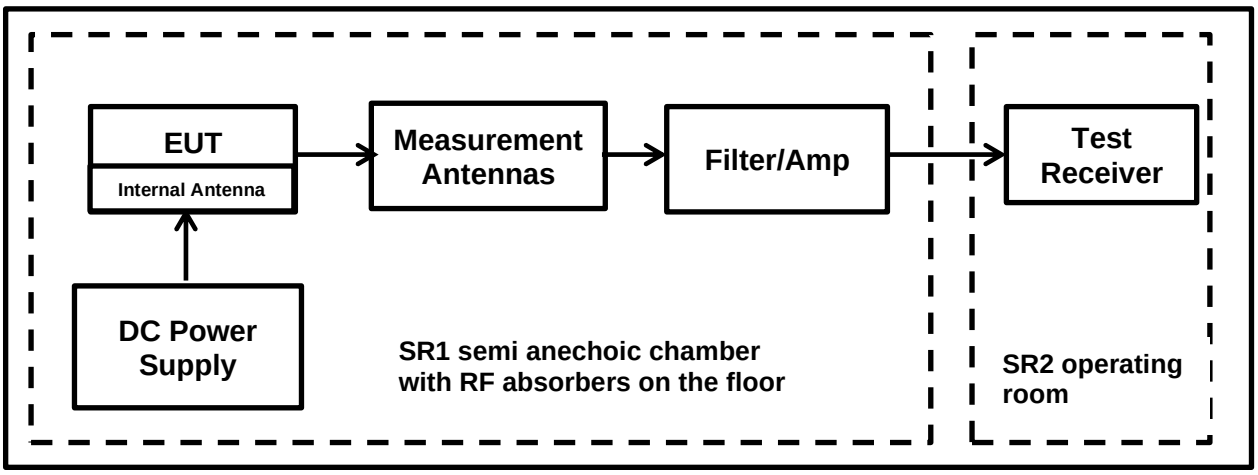
1. The measurements were in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) with RF absorbers on the floor at a distance of 3 m. The EUT was placed at a height of 1.5 m above the test chamber floor in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 m to 4 m
2. As the lower band edge falls within a non-restricted band, measurements were performed in accordance with FCC KDB 558074 Section 8.5 referencing ANSI C63.10 Section 11.11. As the maximum peak conducted output power was previously measured, in accordance with ANSI C63.10 Section 11.11.1(a) lower band edge measurement was performed with a peak detector and the -20 dBc limit applied.
3. As the lower band edge falls within a non-restricted band, only peak measurements are required. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The test receiver was left to sweep for a sufficient length of time in order to maximise the carrier level and out-of-band emissions. A marker and corresponding reference level line were placed on the peak of the carrier. Marker frequencies and levels were recorded.
4. The restricted band peak measurements were performed in accordance with ANSI C63.10 Section 11.12.2.4.
5. As the 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)

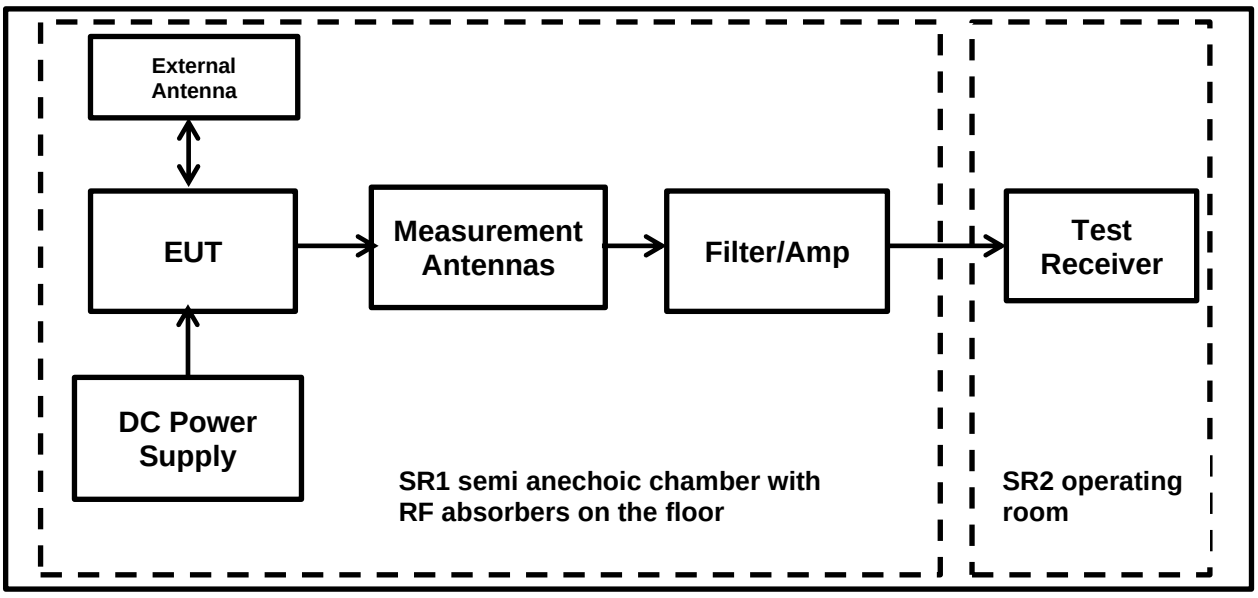
Note(s):

7. As the EUT continuous transmission of the EUT (D ≥ 98%) can be achieved and EUT was transmitting continuously with a constant Duty Cycle of 100 % (duty cycle variations are less than ±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 / EUT+ Internal Antenna:



Test Setup / EUT+ External Antenna:



Transmitter Band Edge Radiated Emissions (continued)

Results: BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Internal Antenna

Results: Lower Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
2380.44	42.13	63.16	21.03	Complied
2400.00	40.50	63.16	22.66	Complied

Results: 2310 to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2389.74	47.46	74.00	26.54	Complied

Results: 2310 to 2390 MHz Restricted Band / Average

Frequency (MHz)	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2386.92	36.20	54.00	17.80	Complied

Results: Upper Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2483.50	48.68	74.00	25.32	Complied
2485.16	46.90	74.00	27.10	Complied

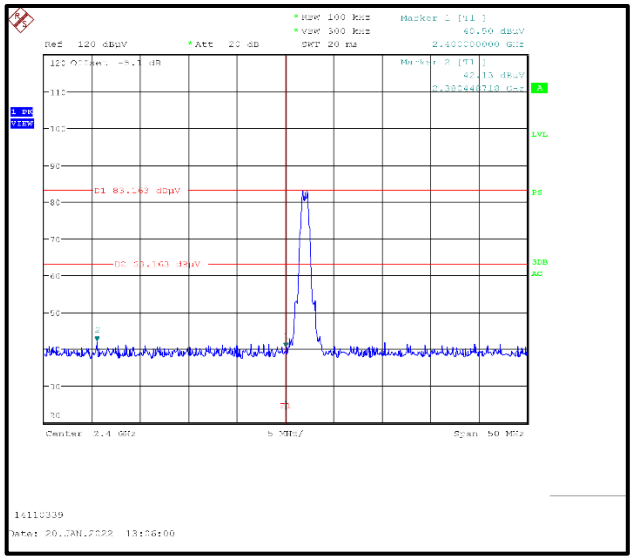
Results: Upper Band Edge / Average

Frequency (MHz)	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2483.50	40.71	54.00	13.29	Complied
2483.75	38.75	54.00	15.25	Complied

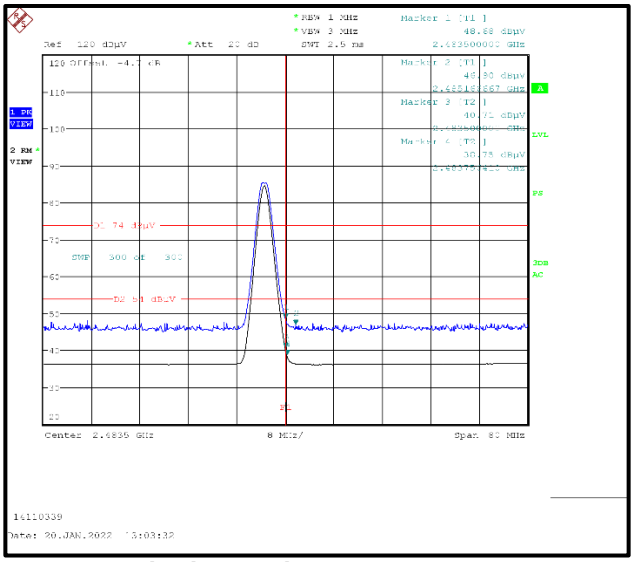
Result: Pass

Transmitter Band Edge Radiated Emissions (continued)

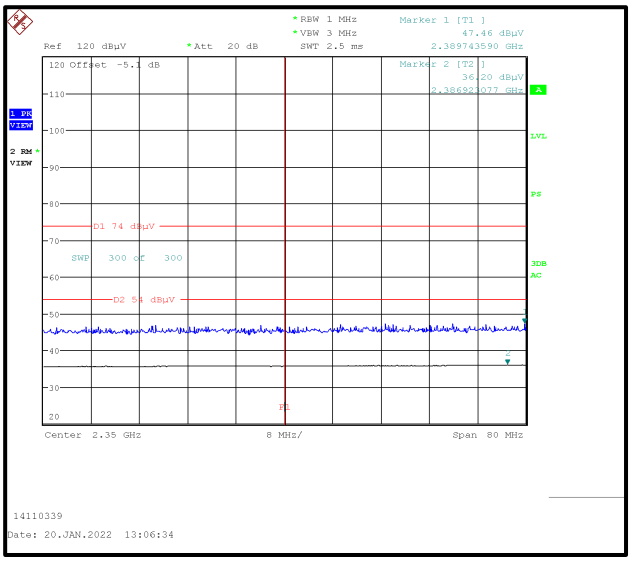
Results : BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / Internal Antenna



Lower Band Edge Peak Measurement



Upper Band Edge Peak & Average Measurement



2310 MHz to 2390 MHz Restricted Band

Result: Pass

Transmitter Band Edge Radiated Emissions (continued)

Results: BT-LE / 500 kbps / PRBS9 / PWR 0 dBm / Internal Antenna

Results: Lower Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
2399.03	42.02	65.8	23.56	Complied
2400.00	40.11	65.58	25.47	Complied

Results: 2310 to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2354.61	47.70	74.00	26.30	Complied

Results: 2310 to 2390 MHz Restricted Band / Average

Frequency (MHz)	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2388.33	36.19	54.00	17.81	Complied

Results: Upper Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2483.50	48.54	74.00	25.46	Complied
2495.29	49.06	74.00	24.94	Complied

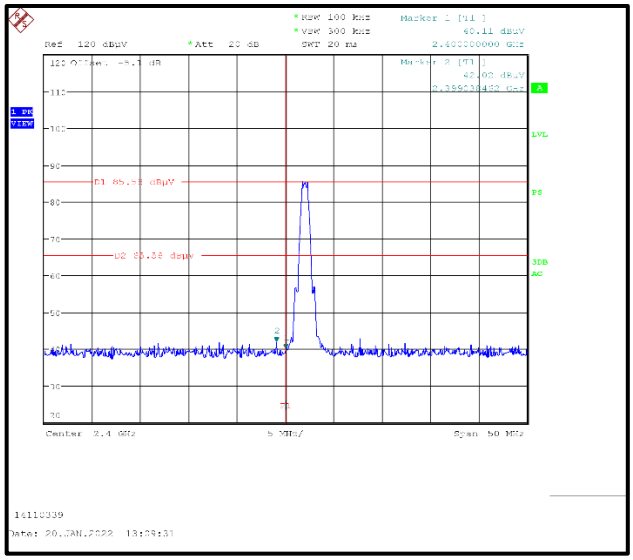
Results: Upper Band Edge / Average

Frequency (MHz)	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2483.50	40.89	54.00	13.11	Complied
2483.75	38.88	54.00	15.12	Complied

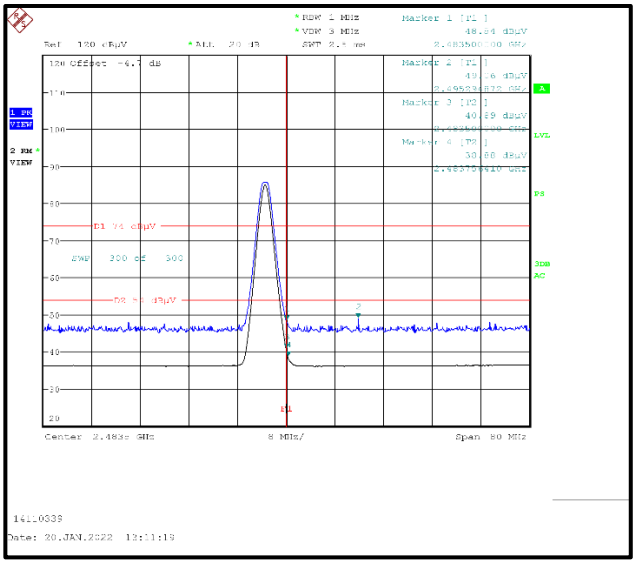
Result: Pass

Transmitter Band Edge Radiated Emissions (continued)

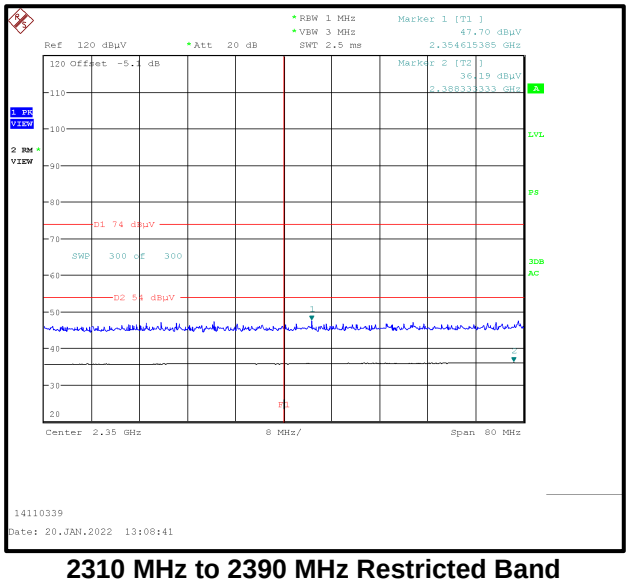
Results : BT-LE / 500 kbps / PRBS9 / PWR 0 dBm / Internal Antenna



Lower Band Edge Peak Measurement



Upper Band Edge Peak & Average Measurement



2310 MHz to 2390 MHz Restricted Band

Result: Pass

Transmitter Band Edge Radiated Emissions (continued)

Results: BT-LE / 1 Mbps / PRBS9 / PWR 0 dBm / Internal Antenna

Results: Lower Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
2377.16	42.33	66.31	23.98	Complied
2400.00	41.16	66.31	25.15	Complied

Results: 2310 to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2386.15	47.71	74.00	26.29	Complied

Results: 2310 to 2390 MHz Restricted Band / Average

Frequency (MHz)	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2388.46	36.18	54.00	17.82	Complied

Results: Upper Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2483.50	48.59	74.00	25.41	Complied
2486.83	47.66	74.00	26.34	Complied

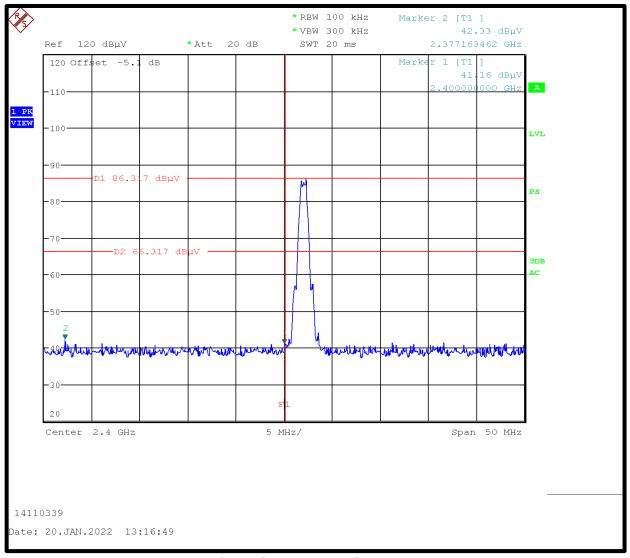
Results: Upper Band Edge / Average

Frequency (MHz)	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2483.50	40.86	54.00	13.14	Complied
2483.75	38.92	54.00	15.16	Complied

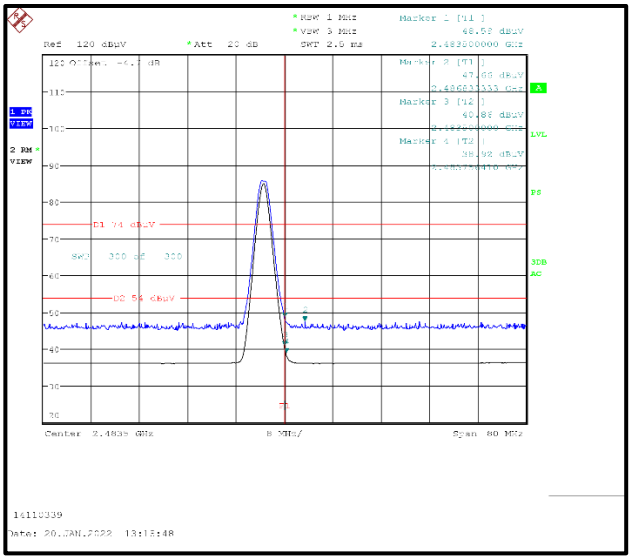
Result: Pass

Transmitter Band Edge Radiated Emissions (continued)

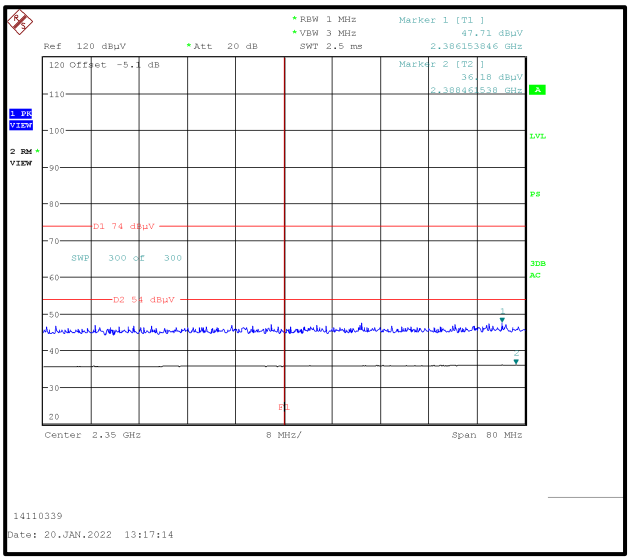
Results : BT-LE / 1 Mbps / PRBS9 / PWR 0 dBm / Internal Antenna



Lower Band Edge Peak Measurement



Upper Band Edge Peak & Average Measurement



2310 MHz to 2390 MHz Restricted Band

Result: Pass

Transmitter Band Edge Radiated Emissions (continued)

Results: BT-LE / 2 Mbps / PRBS9 / PWR 0 dBm / Internal Antenna

Results: Lower Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
2399.83	49.44	64.00	14.56	Complied
2400.00	52.79	64.00	11.21	Complied

Results: 2310 to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2362.69	47.50	74.00	26.50	Complied

Results: 2310 to 2390 MHz Restricted Band / Average

Frequency (MHz)	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2388.07	36.17	54.00	17.83	Complied

Results: Upper Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2483.50	51.86	74.00	22.14	Complied
2483.75	49.49	74.00	24.51	Complied

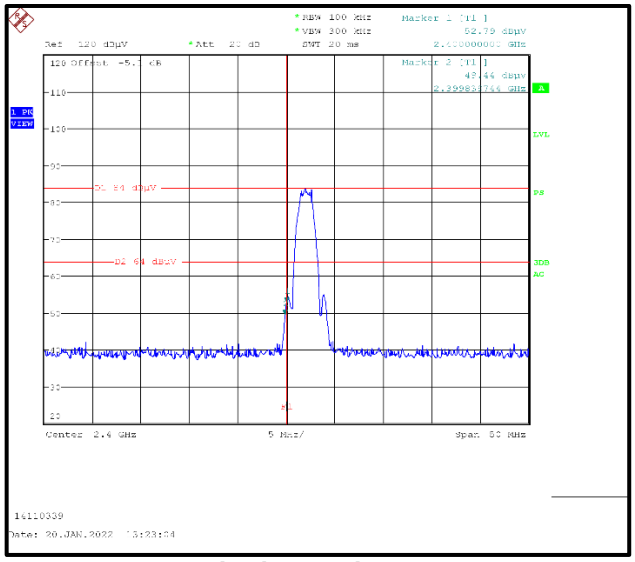
Results: Upper Band Edge / Average

Frequency (MHz)	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2483.50	43.52	54.00	10.48	Complied
2483.75	40.82	54.00	13.18	Complied

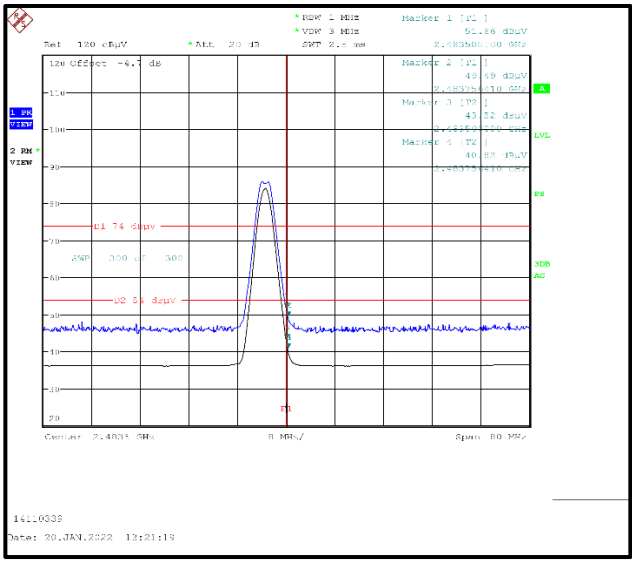
Result: Pass

Transmitter Band Edge Radiated Emissions (continued)

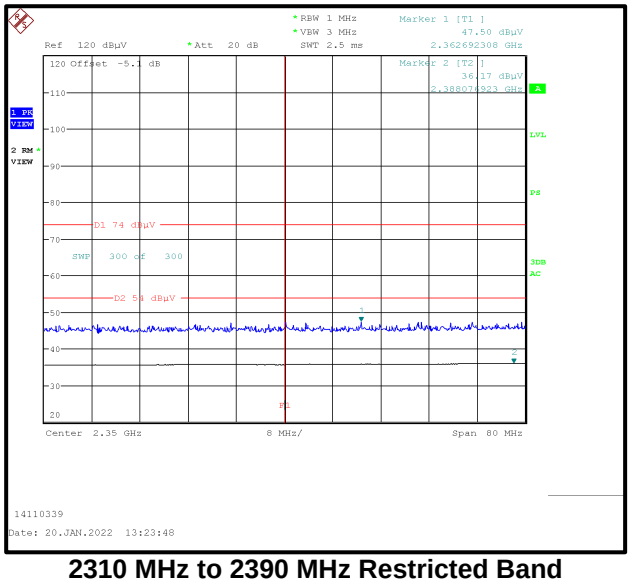
Results : BT-LE / 2 Mbps / PRBS9 / PWR 0 dBm / Internal Antenna



Lower Band Edge Peak Measurement



Upper Band Edge Peak & Average Measurement



2310 MHz to 2390 MHz Restricted Band

Result: Pass

Transmitter Band Edge Radiated Emissions (continued)

Results: BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / External Antenna

Results: Lower Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
2399.83	47.09	73.47	26.38	Complied
2400.00	54.41	73.47	19.06	Complied

Results: 2310 to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2364.48	47.88	74.00	26.12	Complied

Results: 2310 to 2390 MHz Restricted Band / Average

Frequency (MHz)	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2390.0	36.34	54.00	17.66	Complied

Results: Upper Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2483.50	53.58	74.00	20.42	Complied
2483.62	52.02	74.00	21.98	Complied

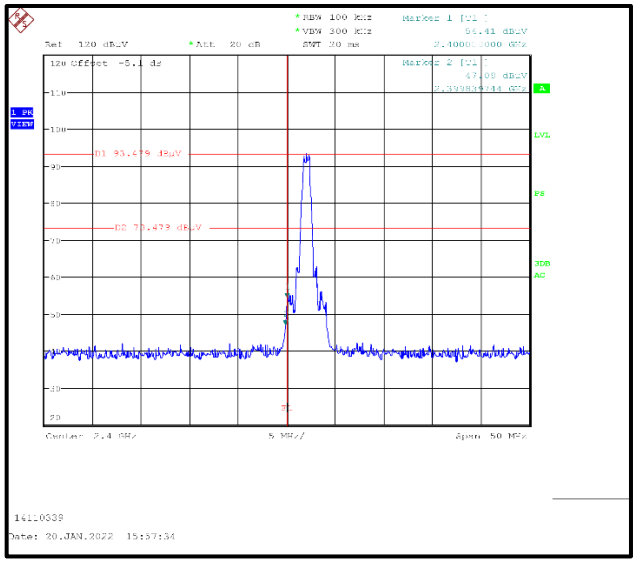
Results: Upper Band Edge / Average

Frequency (MHz)	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2483.50	46.80	54.00	7.20	Complied
2483.62	45.26	54.00	8.74	Complied

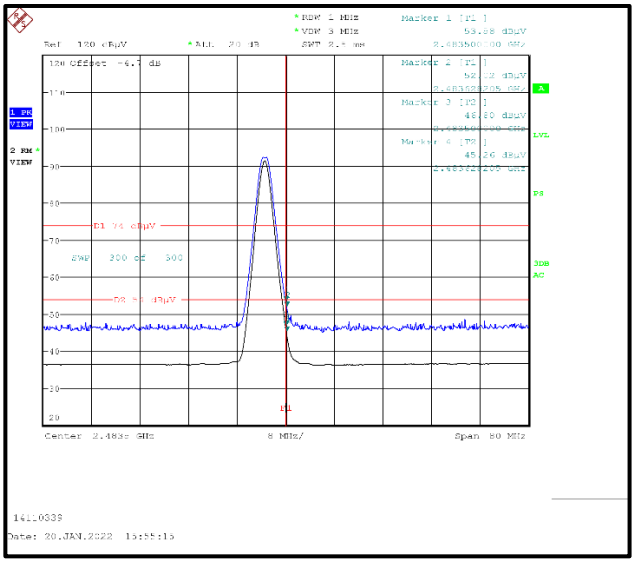
Result: Pass

Transmitter Band Edge Radiated Emissions (continued)

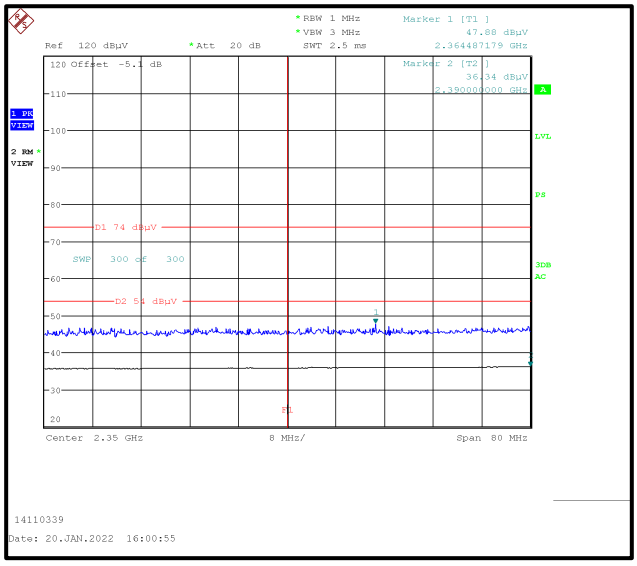
Results : BT-LE / 125 kbps / PRBS9 / PWR 0 dBm / External Antenna



Lower Band Edge Peak Measurement



Upper Band Edge Peak & Average Measurement



2310 MHz to 2390 MHz Restricted Band

Result: Pass

Transmitter Band Edge Radiated Emissions (continued)

Results: BT-LE / 500 kbps / PRBS9 / PWR 0 dBm / External Antenna

Results: Lower Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
2399.83	52.62	76.20	23.58	Complied
2400.00	55.81	76.20	20.39	Complied

Results: 2310 to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2383.84	48.01	74.00	25.99	Complied

Results: 2310 to 2390 MHz Restricted Band / Average

Frequency (MHz)	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2354.10	37.09	54.00	16.91	Complied

Results: Upper Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2483.50	55.44	74.00	18.56	Complied
2483.62	53.94	74.00	20.06	Complied

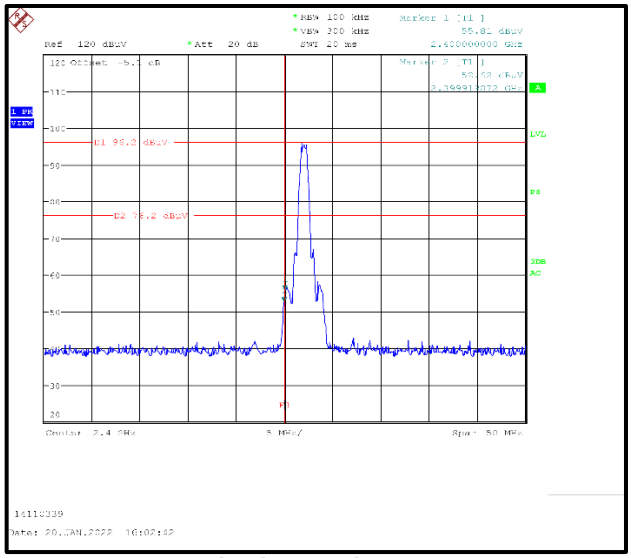
Results: Upper Band Edge / Average

Frequency (MHz)	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2483.50	48.30	54.00	5.70	Complied
2483.62	46.75	54.00	7.25	Complied

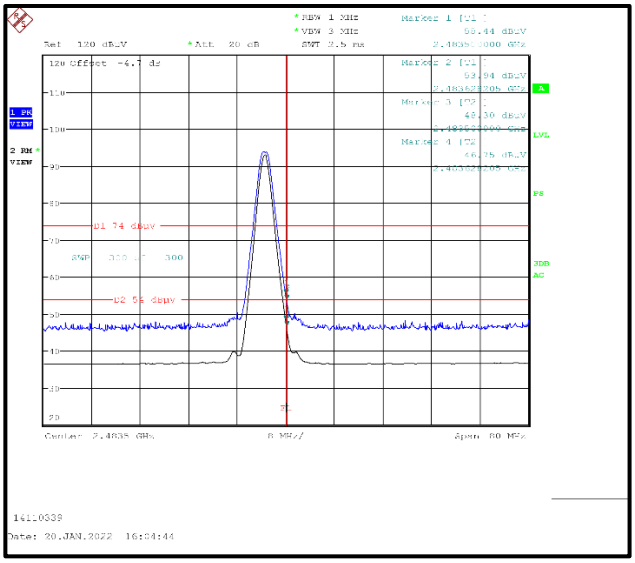
Result: Pass

Transmitter Band Edge Radiated Emissions (continued)

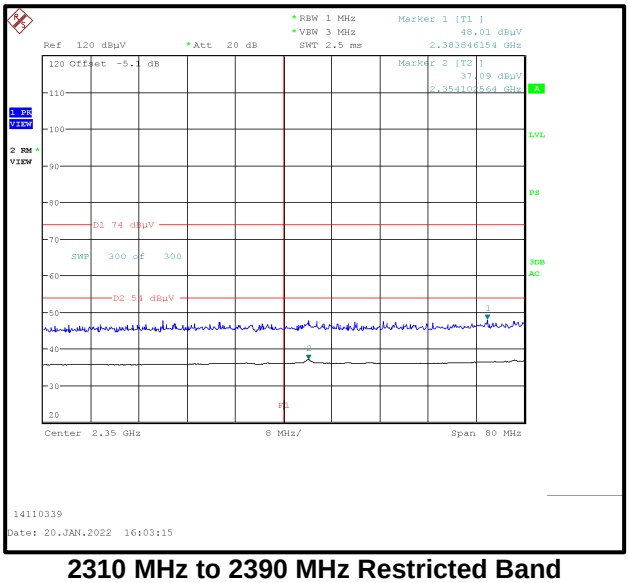
Results : BT-LE / 500 kbps / PRBS9 / PWR 0 dBm / External Antenna



Lower Band Edge Peak Measurement



Upper Band Edge Peak & Average Measurement



2310 MHz to 2390 MHz Restricted Band

Result: Pass

Transmitter Band Edge Radiated Emissions (continued)

Results: BT-LE / 1 Mbps / PRBS9 / PWR 0 dBm / External Antenna

Results: Lower Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
2399.91	47.64	76.46	28.82	Complied
2400.00	50.07	76.46	26.39	Complied

Results: 2310 to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2383.71	47.64	74.00	26.36	Complied

Results: 2310 to 2390 MHz Restricted Band / Average

Frequency (MHz)	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2354.10	37.02	54.00	16.98	Complied

Results: Upper Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2483.50	54.48	74.00	19.52	Complied
2483.75	51.74	74.00	22.26	Complied

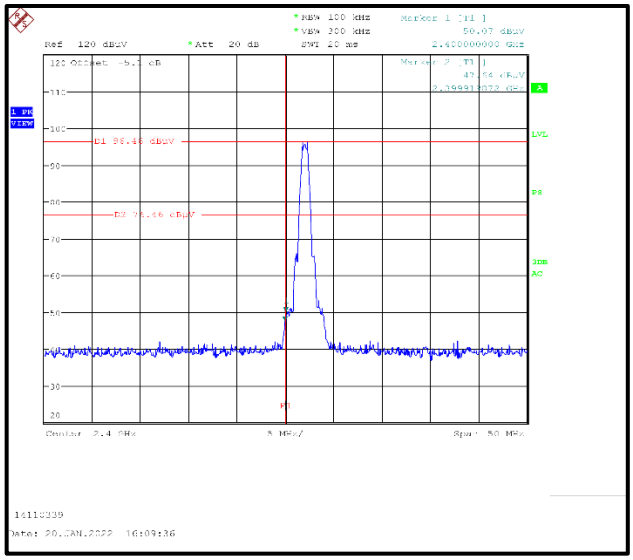
Results: Upper Band Edge / Average

Frequency (MHz)	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2483.50	47.92	54.00	6.08	Complied
2483.62	44.95	54.00	9.05	Complied

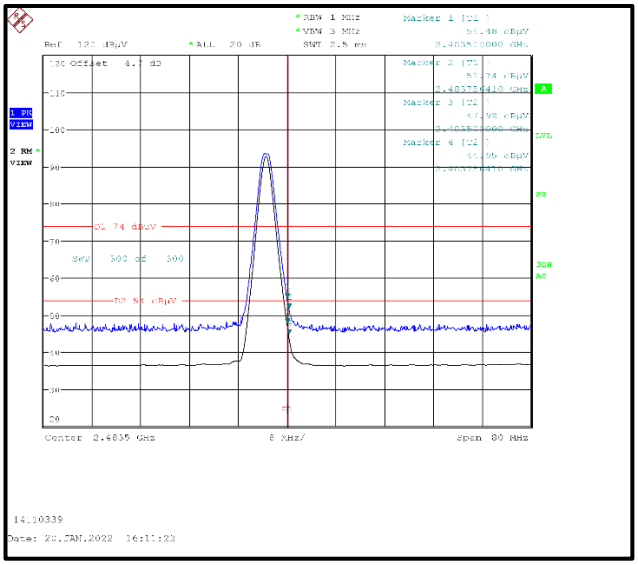
Result: Pass

Transmitter Band Edge Radiated Emissions (continued)

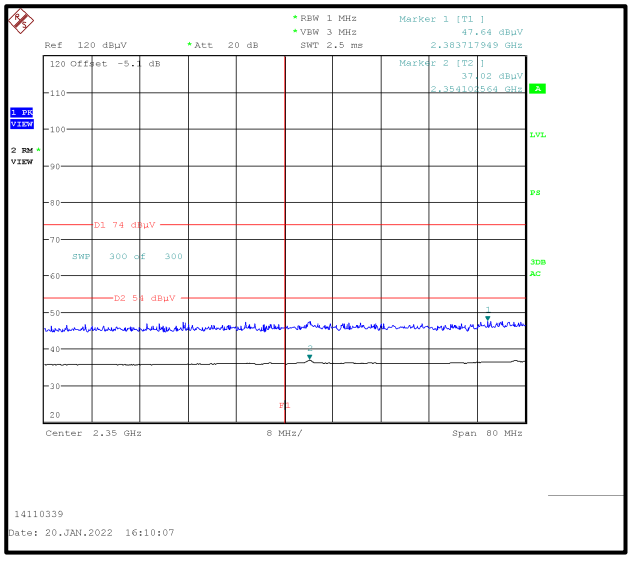
Results : BT-LE / 1 Mbps / PRBS9 / PWR 0 dBm / External Antenna



Lower Band Edge Peak Measurement



Upper Band Edge Peak & Average Measurement



2310 MHz to 2390 MHz Restricted Band

Result: Pass

Transmitter Band Edge Radiated Emissions (continued)

Results: BT-LE / 2 Mbps / PRBS9 / PWR 0 dBm / External Antenna

Results: Lower Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
2399.91	60.52	74.00	13.48	Complied
2400.00	61.87	74.00	12.13	Complied

Results: 2310 to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2387.94	48.18	74.00	25.82	Complied

Results: 2310 to 2390 MHz Restricted Band / Average

Frequency (MHz)	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2353.97	37.42	54.00	16.58	Complied

Results: Upper Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2483.50	59.10	74.00	14.90	Complied
2483.75	55.94	74.00	18.06	Complied

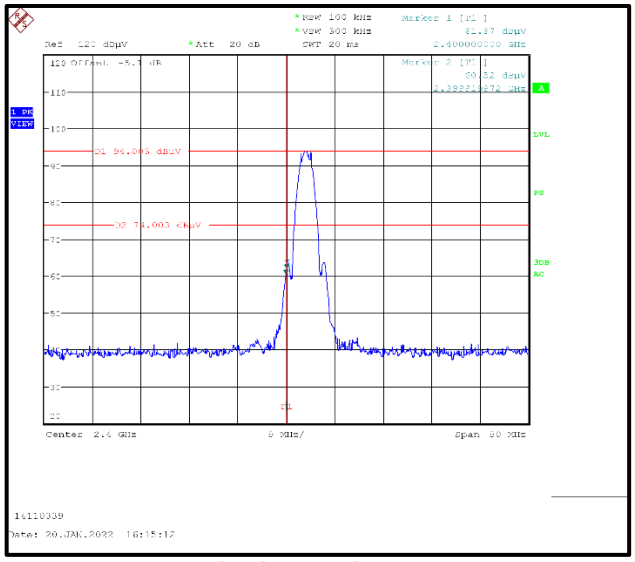
Results: Upper Band Edge / Average

Frequency (MHz)	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2483.50	51.22	54.00	2.78	Complied
2483.75	47.93	54.00	6.07	Complied

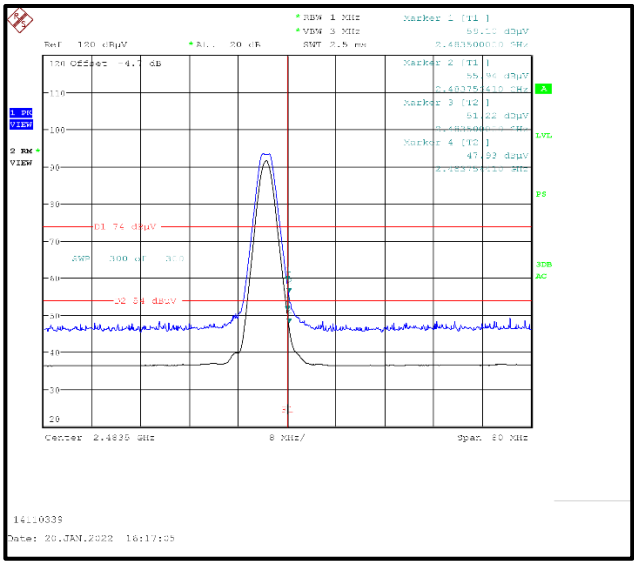
Result: Pass

Transmitter Band Edge Radiated Emissions (continued)

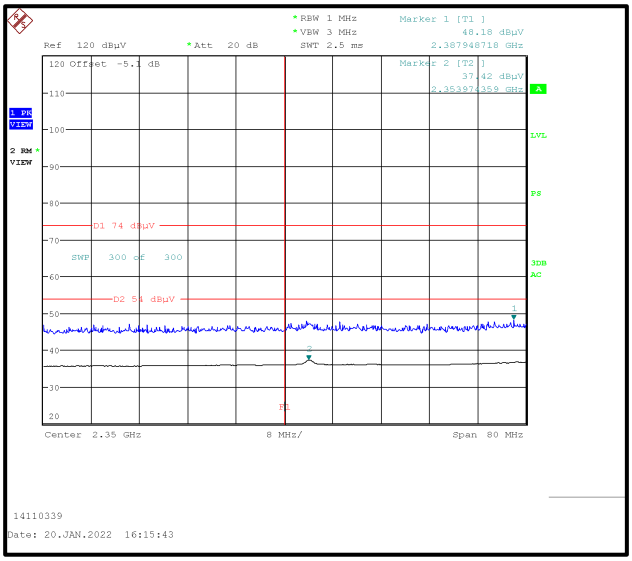
Results : BT-LE / 2 Mbps / PRBS9 / PWR 0 dBm / External Antenna



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
Conducted Maximum Peak Output Power	95%	±0.59 dB
Radiated Spurious Emissions	95%	±3.10 dB
Band Edge Radiated Emissions	95%	±3.10 dB
Transmitter Duty Cycle	95%	±3.4%
Minimum 6 dB Bandwidth	95%	±0.87 %
Spectral Power Density	95%	±0.59 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	14/07/2021	12
423	Bonn Elektronik	Amplifier, Low Noise Pre	BLMA 1840-1A	55929	16/07/2021	12
460	Deisel	Turntable	DT 4250 S	n/a	n/a	n/a
452	Schwarzbeck	Antenna, Trilog Broadband	VULB 9168	9168-240	02/09/2020	24
496	Rohde & Schwarz	Antenna, log. – periodical	HL050	100297	05/08/2020	36
607	Schwarzbeck	Antenna broadband horn antenna	BBHA 9170	9170-561	15/10/2019	36
587	Maturo	antenna mast, tilting	TAM 4.0-E	011/7180311	n/a	n/a
588	Maturo	Controller	NCD	029/7180311	n/a	n/a
591	Rohde & Schwarz	Receiver	ESU 40	100244/040	28/06/2021	12
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

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	14/07/2021	12
-/-	Huber+Suhner	RF Cable -OSP120-DUT1	ST18/SMAm/SMAm/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

Test site: SR 7/8

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
23	Rohde & Schwarz	Artificial Mains	ESH3-Z5	831767/013	14/07/2021	12
28	Rohde & Schwarz	Passive Probe	ESH2-Z3	none	11/07/2019	36
349	Rohde & Schwarz	Receiver, EMI Test	ESIB7	836697/009	13/07/2021	12
351	Rohde & Schwarz	network, Artificial Mains	ESH3-Z5	862770/018	14/07/2021	12
564	Teseq	Impedance 83tabilization network (ISN)	ISN T800	26076	14/07/2021	24
616	Rohde & Schwarz	ISN	ENY81-CA6	101656	07/07/2020	36
-/-	Testo	Thermo-Hygrometer	608-H1	08	lab verification	n/a
327	SPS	AC/DC power distribution system	PAS 5000	A2464 00/1 0200	lab verification	n/a

8. Report Revision History

Version Number	Revision Details		
	Page No(s)	**Clause**	**Details**
1.0	92	-	Initial Version
1.1	54	-	Notes updated
	56 - 58	-	Critical harmonics at 4.80 GHz re-measured and plot included
	61	-	Removed the pre-scan table
	66 - 68	-	Critical harmonics at 4.88 GHz remeasured and plot included
	73 - 74	-	Notes updated
Test Report Version 1.2 supersede Version 1.1 with immediate effect Test Report No. UL-RPT-RP-14110339-116-FCC Version 1.2, Issue Date 15 JUNE 2022 replaces Test Report No. UL-RPT-RP-14110339-116-FCC Version 1.1, Issue Date 17 MAY 2022, which is no longer valid.			
1.2	as below	as below	Current Version
	54 - 61	-	Removed the final measurement plots for harmonics.

--- END OF REPORT ---