



# TEST REPORT

**Test Report No. : UL-RPT-RP-13298054-616-FCC**

**Applicant** : ST Sportservice GmbH  
**Model No.** : EQTrackerV4  
**FCC ID** : 2AXIALTRA072  
**Technology** : 902 – 928 MHz (DTS)  
**Test Standard(s)** : FCC Parts 15.207, 15.209(a) & 15.247

For details of applied tests refer to test result summary

1. This test report shall not be reproduced in full or partial, without the written approval of UL International Germany GmbH.
2. The results in this report apply only to the sample tested.
3. The test results in this report are traceable to the national or international standards.
4. Test Report Version 1.0
5. Result of the tested sample: **PASS**

Prepared by: Sercan, Usta  
Title: Laboratory Engineer  
Date: 09 November 2021

Approved by: Ajit, Phadtare  
Title: Lead Test Engineer  
Date: 09 November 2021



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.

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## **Table of Contents**

<b>1. Customer Information.....</b>	<b>4</b>
1.1. Applicant Information	4
1.2. Manufacturer Information	4
<b>2. Summary of Testing.....</b>	<b>5</b>
2.1. General Information	5
Applied Standards	5
Location	5
Date information	5
2.2. Summary of Test Results	6
2.3. Methods and Procedures	6
2.4. Deviations from the Test Specification	6
<b>3. Equipment Under Test (EUT) .....</b>	<b>7</b>
3.1. Identification of Equipment Under Test (EUT)	7
3.2. Description of EUT	7
3.3. Modifications Incorporated in the EUT	7
3.4. Additional Information Related to Testing	8
3.5. Support Equipment	9
A. Support Equipment (In-house)	9
B. Support Equipment (Manufacturer supplied)	9
<b>4. Operation and Monitoring of the EUT during Testing .....</b>	<b>10</b>
4.1. Operating Modes	10
4.2. Configuration and Peripherals	10
<b>5. Measurements, Examinations and Derived Results .....</b>	<b>11</b>
5.1. General Comments	11
5.2. Test Results	12
5.2.1. Transmitter AC Conducted Spurious Emissions	12
5.2.2. Transmitter Minimum 6 dB Bandwidth	18
5.2.3. Transmitter Duty Cycle	20
5.2.4. Transmitter Power Spectral Density	23
5.2.5. Transmitter Maximum Peak Output Power	25
5.2.6. Transmitter Radiated Emissions	27
5.2.7. Transmitter Band Edge Radiated Emissions	36
<b>6. Measurement Uncertainty .....</b>	<b>39</b>
<b>7. Used equipment .....</b>	<b>40</b>
<b>8. Report Revision History .....</b>	<b>41</b>

## **1. Customer Information**

### **1.1.Applicant Information**

<b>Company Name:</b>	ST Sportservice GmbH
<b>Company Address:</b>	Wiesenring 11, 04159 Leipzig, Germany
<b>Company Phone No.:</b>	+49 341 4621 100
<b>Company E-Mail:</b>	info@st-sportservice.com
<b>Contact Person:</b>	Daniel Keiser
<b>Contact E-Mail Address:</b>	Keiser.D@st-sportservice.com
<b>Contact Phone No.:</b>	+49 341 4621 221

### **1.2.Manufacturer Information**

<b>Company Name:</b>	ST Sportservice GmbH
<b>Company Address:</b>	Wiesenring 11, 04159 Leipzig, Germany
<b>Company Phone No.:</b>	+49 341 4621 100
<b>Company E-Mail:</b>	info@st-sportservice.com
<b>Contact Person:</b>	Daniel Keiser
<b>Contact E-Mail Address:</b>	Keiser.D@st-sportservice.com
<b>Contact Phone No.:</b>	+49 341 4621 221

## **2. Summary of Testing**

### **2.1. General Information**

#### **Applied Standards**

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

#### **Location**

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

#### **Date information**

<b>Order Date:</b>	25 March 2020
<b>EUT arrived:</b>	06 May 2021 to 02 November 2021
<b>Test Dates:</b>	02 June 2021 to 03 November 2021
<b>EUT returned:</b>	-/-

## 2.2. Summary of Test Results

Clause	Measurement	Complied	Did not comply	Not performed	Not applicable
Part 15.207	Transmitter AC Conducted Emissions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Part 15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Part 15.35(c)	Transmitter Duty Cycle <sup>(1)</sup>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Part 15.247(e)	Transmitter Power Spectral Density	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Part 15.247(b)(3)	Transmitter Maximum Peak Output Power	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Part 15.247(d)/15.209(a)	Transmitter Radiated Emissions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Part 15.247(d)/15.209(a)	Transmitter Band Edge Radiated Emissions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### Note:

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

## 2.3. Methods and Procedures

<b>Reference:</b>	ANSI C63.10-2013
<b>Title:</b>	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
<b>Reference:</b>	FCC KDB 558074 D01 DTS Meas Guidance v05r02 April 2, 2019
<b>Title:</b>	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
<b>Reference:</b>	FCC KDB 174176 D01 Line Conducted FAQ v01r01 June 3, 2015
<b>Title:</b>	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)**

<b>Brand Name:</b>	SWISS TIMING
<b>Model Name or Number:</b>	EQTrackerV4
<b>Serial Number:</b>	LTRA072 F2 0103 (Radiated Test Sample)
<b>Hardware Version Number:</b>	V4
<b>Software Version Number:</b>	eqtr4_stm32_radiotest-1.8
<b>FCC ID</b>	2AXIALTRA072

<b>Brand Name:</b>	SWISS TIMING
<b>Model Name or Number:</b>	EQTrackerV4
<b>Serial Number:</b>	LTRA072 F2 0105 (Conducted Test Sample)
<b>Hardware Version Number:</b>	V4
<b>Software Version Number:</b>	eqtr4_stm32_radiotest-1.8
<b>FCC ID</b>	2AXIALTRA072

#### **3.2. Description of EUT**

The equipment under test was a dual band GNSS (L1 / L2) Equestrian Horse Tracking device supporting short range device operations in 902 – 928 MHz (DTS) band.

#### **3.3. Modifications Incorporated in the EUT**

No modifications were applied to the EUT during testing.

**3.4. Additional Information Related to Testing**

<b>Category of Equipment:</b>	902 – 928 MHz (DTS)	
<b>Type of Radio Device:</b>	Transceiver	
<b>Power Supply Requirement(s):</b>	$V_{nom}$	3.7 V DC
	$V_{min}$	3.2 V DC
	$V_{max}$	4.2 V DC
<b>Type of Power Supply</b>	3.6 V DC using Internal Rechargeable Battery	
<b>Temperature Requirement(s):</b>	$T_{nom}$	+ 25 ° C
	$T_{min}$	0 ° C
	$T_{max}$	+ 50 ° C
<b>Ambient Relative Humidity</b>	0-95 %	
<b>Operational Frequency bands</b>	902 – 928 MHz	
<b>Modulation Type:</b>	OQPSK	
<b>Data Rate:</b>	250 kBit/s	
<b>Antenna Gain</b>	Max 2.4 dBi / 0.25 dBd @ 902 – 928 MHz	
<b>Antenna Type</b>	OnBoard SMD 868/915 Antenna	
<b>Antenna Details:</b>	Model: PROANT PRO-OB-471   Proant AB	
<b>Transmit / Receive Frequency Range:</b>	917.50 MHz	
<b>Transmit / Receive Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Frequency (MHz)</b>
	Single	917.50



### **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	Conrad Electronic	PS-2403D	N/A
2	Test Laptop with Test Software	HP	HP Probook 650 G1	5CG614419V

#### **B. Support Equipment (Manufacturer supplied)**

Item	Description	Brand Name	Model Name or Number	Serial Number
1	Configuration Device	SWISS TIMING	GPS_Radio32 V2 (LTRA073)	LTRA073 F2 0007
2	Configuration Ethernet Cable (5m)	Metz Connect	142M2X15050	N/A
3	DC Power Cable (3.5m)	Phoenix	SAC-8P- 5,0-PUR/M12FS SH	N/A
4	Configuration Device's External Dipole Antenna	PROCOM	FLX900/GSM-FME	N/A
5	Configuration Cradle	Swiss Timing	LALI041-CONFIG	N/A
6	Charging Cradle	Swiss Timing	LALI041-CHARGE	N/A
7	Conducted Configuration Sample with External Antenna	Tallysman	TW3872	N/A

## **4. Operation and Monitoring of the EUT during Testing**

### **4.1. Operating Modes**

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

- ☒ Continuously transmitting (with maximum possible duty cycle) modulated carrier with maximum power setting.

### **4.2. Configuration and Peripherals**

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

- The applicant supplied a document containing the setup instructions "EQU-RTK\_Radiotest-Tool\_Instructions.pdf" Draft Version 0.2, issue date April 2021 was used to configure the EUTs.

#### **EUT Power supply:**

- The EUT was powered with 3.7 V DC via laboratory DC power supply which in turn was connected to 120 VAC / 60 Hz single phase supply.

#### **Test Mode Activations:**

- The EUT was configured into required TX test modes using the eqtr4\_radiotest I 0.1.5 software supplied by customer
- The GPS\_Radio32 V2 (LTRA073) Radio device with external antenna was used to configure the test modes on EUT.
- As the EUT continuous transmission of the EUT ( $D \geq 98\%$ ) cannot be achieved and EUT was transmitting continuously with a constant Duty Cycle of 1.304 % (duty cycle variations are less than  $\pm 2\%$ ).
- Therefore, a Duty Cycle Correction Factor of 18.85 dB was added to all average measurements to compute the corrected average values of the emissions that would have been measured had the test been performed at 100% Duty Cycle.

#### **AC Conducted Measurements:**

- The EUT radiated sample with fully discharged internal battery in a continuous charging mode, was used for AC conducted emissions measurements.
- AC Conducted Line Measurements were performed with 120 VAC / 60 Hz & 240 VAC / 60 Hz.

#### **Conducted Measurements:**

- The specially prepared conducted sample with temporary RF connector were used for all conducted measurements.
- The SMA (Female) RF cable's attenuation (maximum 0.5 dB @ 917.5 MHz) was added to a reference level offset to each of the conducted plots.

#### **Radiated Measurements:**

- The EUT radiated sample with fully charged internal battery was used for radiated testing.
- Before starting final radiated measurements "worst case verification" with the EUT in Standing-position & Laying-position was performed by Lab. The EUT in Laying-position was found to be the worst case therefore this report includes relevant results.
- Radiated measurements below 30 MHz were performed with the EUT positioned on the turn table and rotating 360 degrees while the loop antenna height was set to 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.

## **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:	Devang Chauhan	Test Date:	29 June 2021
Test Sample Serial Number:	LTRA072 F2 0103 (Radiated Test Sample)		
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:

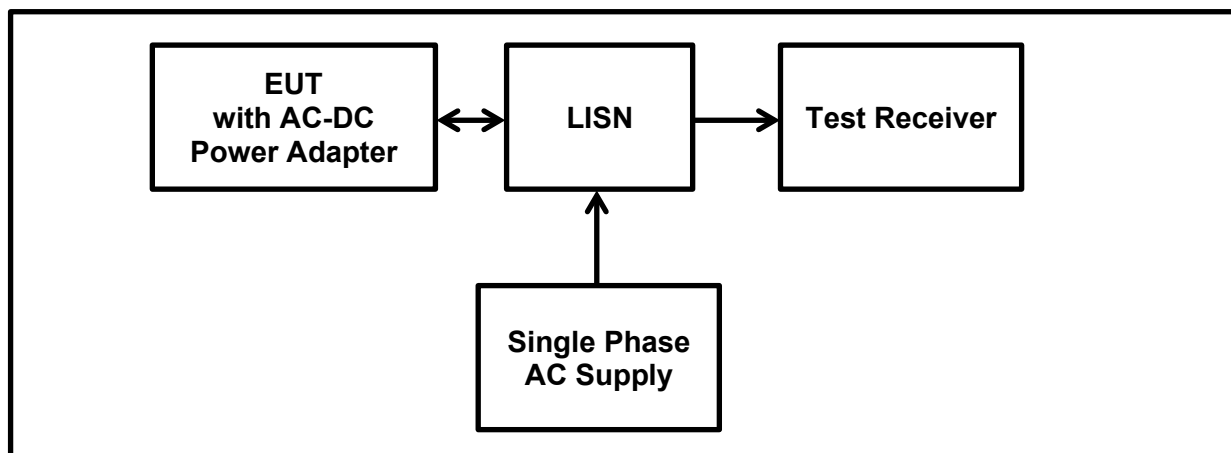
Temperature (°C):	25.2
Relative Humidity (%):	54.3

#### Settings of the Instrument

Detector	Quasi Peak/ Average Peak
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#### Note(s):

1. The EUT was placed into the Charging Cradle which was connected to AC/DC Power Supply. The Power Supply was connected to 120 VAC / 60 Hz single phase supply via a LISN.
2. In accordance with FCC KDB 174176 Q4, tests were performed with a 240 VAC 60 Hz single phase supply as this was within the voltage range marked on the 100-240 VAC~50/60 Hz power supply.
3. The EUT was configured on 917.50 MHz | OQPSK | Max Power Settings.
4. 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.
5. The final measured value, for the given emission, in the table below incorporates the cable loss.
6. All other emissions shown on the pre-scan plot were investigated and found to be ambient or >20 dB below the applicable limit or below the measurement system noise floor.
7. 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.
8. Measurement software used: Toyo EMI Software; CE measurement software EP5/CE Ver 4.0.1.

**Transmitter AC Conducted Spurious Emissions (continued)****Test setup:**

**Transmitter AC Conducted Spurious Emissions (continued)****Results: Live / Quasi Peak / 120 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.1534	Live	47.6	65.8	18.2	Complied
0.1853	Live	45.4	64.2	18.8	Complied
0.7659	Live	37.6	56.0	18.4	Complied
1.8870	Live	28.3	56.0	27.7	Complied
3.7003	Live	26.5	56.0	29.5	Complied
12.4651	Live	27.2	60.0	32.8	Complied

**Results: Live / Average / 120 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.1534	Live	30.7	55.8	25.1	Complied
0.1853	Live	30.8	54.2	23.4	Complied
0.7659	Live	31.8	46.0	14.2	Complied
1.8870	Live	23.0	46.0	23.0	Complied
3.7003	Live	20.0	46.0	26.0	Complied
12.4651	Live	21.3	50.0	28.7	Complied

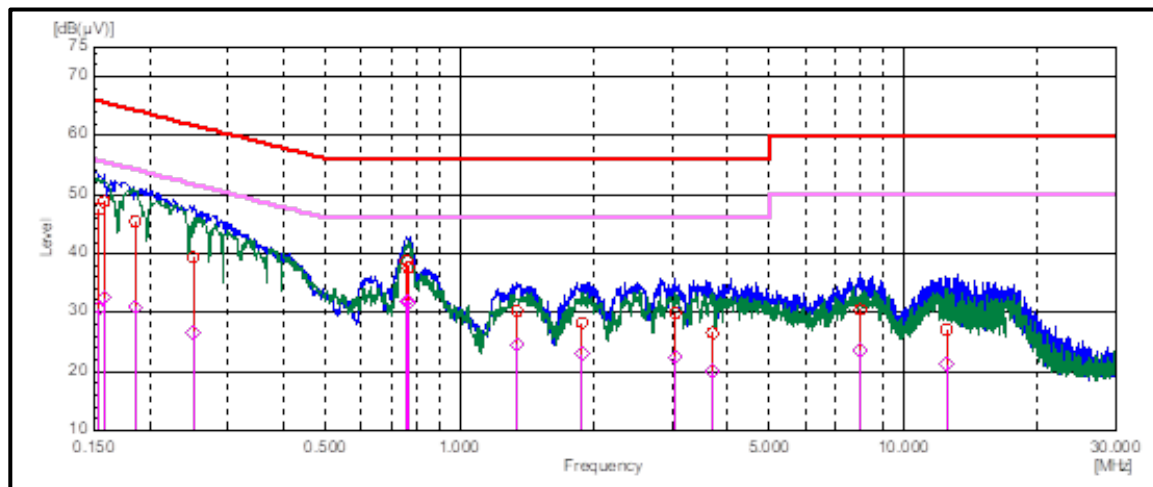
**Results: Neutral / Quasi Peak / 120 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.1570	Neutral	48.8	65.6	16.8	Complied
0.2501	Neutral	39.4	61.8	22.4	Complied
0.7558	Neutral	38.8	56.0	17.2	Complied
1.3438	Neutral	30.3	56.0	25.7	Complied
3.0618	Neutral	29.9	56.0	26.1	Complied
7.9760	Neutral	30.5	60.0	29.5	Complied

**Results: Neutral / Average / 120 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.1570	Neutral	32.5	55.6	23.1	Complied
0.2501	Neutral	26.5	51.8	25.3	Complied
0.7558	Neutral	31.9	46.0	14.1	Complied
1.3438	Neutral	24.6	46.0	21.4	Complied
3.0618	Neutral	22.5	46.0	23.5	Complied
7.9760	Neutral	23.6	50.0	26.4	Complied

**Result: Pass**

**Transmitter AC Conducted Spurious Emissions (continued)****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: Live / Quasi Peak / 240 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.1553	Live	40.6	65.7	25.1	Complied
0.2443	Live	35.4	61.9	26.5	Complied
0.7934	Live	37.9	56.0	18.1	Complied
1.5894	Live	33.0	56.0	23.0	Complied
7.0877	Live	29.6	60.0	30.4	Complied
10.9108	Live	27.8	60.0	32.2	Complied

**Results: Live / Average / 240 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.1553	Live	27.8	55.7	27.9	Complied
0.2443	Live	25.7	51.9	26.2	Complied
0.7934	Live	33.6	46.0	12.4	Complied
1.5894	Live	29.2	46.0	16.8	Complied
7.0877	Live	24.1	50.0	25.9	Complied
10.9108	Live	21.9	50.0	28.1	Complied

**Results: Neutral / Quasi Peak / 240 VAC 60 Hz**

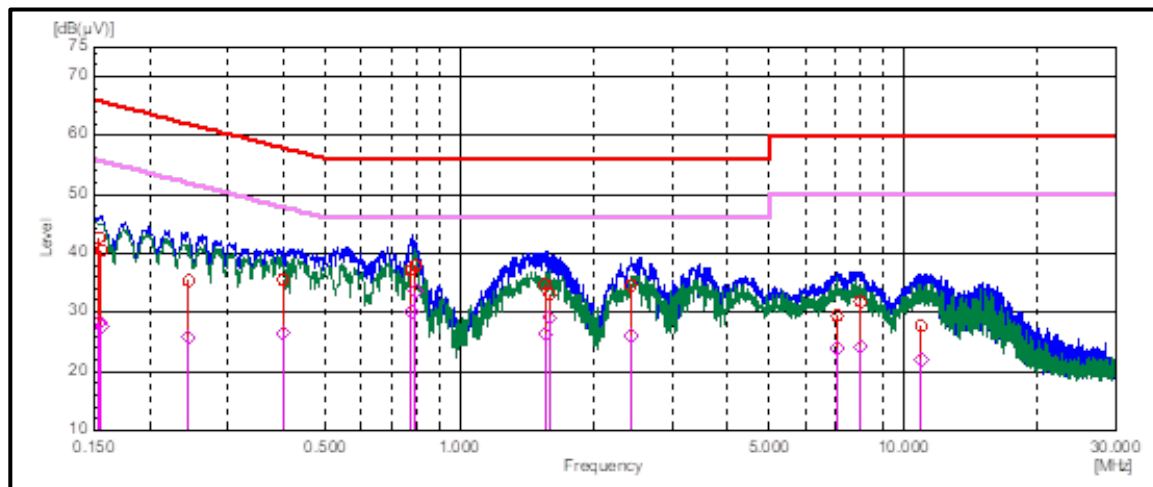
Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.1536	Neutral	42.7	65.8	23.1	Complied
0.3984	Neutral	35.7	57.9	22.2	Complied
0.7775	Neutral	37.2	56.0	18.8	Complied
1.5503	Neutral	34.8	56.0	21.2	Complied
2.4307	Neutral	34.5	56.0	21.5	Complied
7.9992	Neutral	31.9	60.0	28.1	Complied

**Results: Neutral / Average / 240 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.1536	Neutral	28.3	55.8	27.5	Complied
0.3984	Neutral	26.5	47.9	21.4	Complied
0.7775	Neutral	30.1	46.0	15.9	Complied
1.5503	Neutral	26.3	46.0	19.7	Complied
2.4307	Neutral	26.0	46.0	20.0	Complied
7.9992	Neutral	24.2	50.0	25.8	Complied

**Result: Pass**



**Transmitter AC Conducted Spurious Emissions (continued)****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 Minimum 6 dB Bandwidth****Test Summary:**

<b>Test Engineer:</b>	Sercan Usta	<b>Test Date:</b>	21 June 2021
<b>Test Sample Serial Number:</b>	LTRA072 F2 0105 (Conducted Test Sample)		
<b>Test Site Identification</b>	SR 9		

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

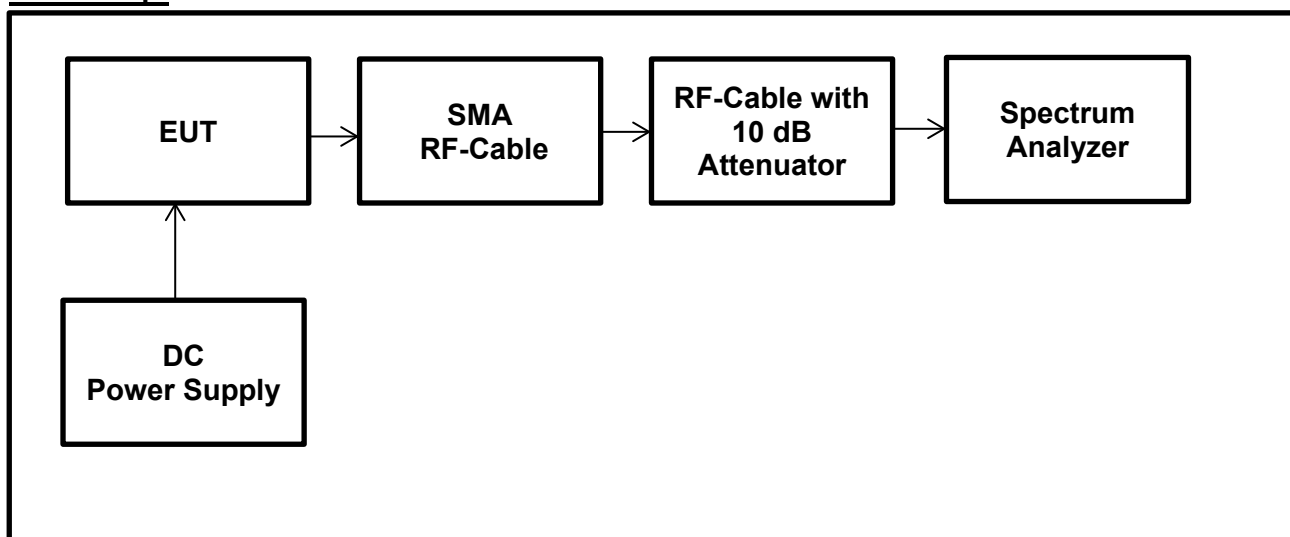
**Environmental Conditions:**

<b>Temperature (°C):</b>	26.6
<b>Relative Humidity (%):</b>	50.7

**Notes:**

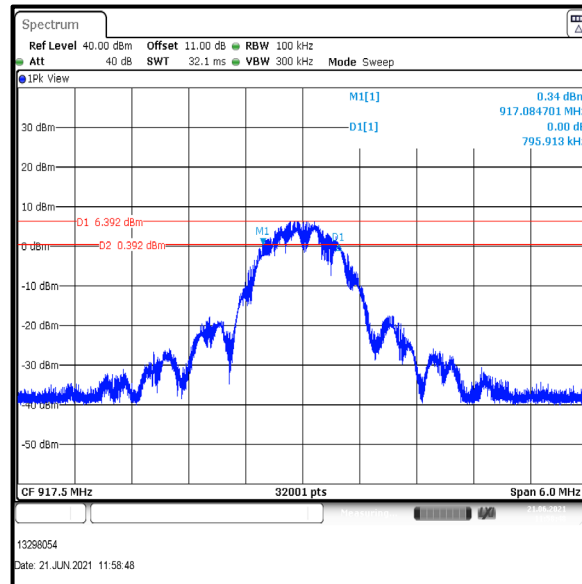
1. The 6 dB DTS bandwidth tests were performed using a spectrum analyzer in accordance with FCC KDB 558074 Section 8.2 referring ANSI C63.10:2013 Section 11.8.1 Option 1 measurement procedure.
2. The spectrum analyzer resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector 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 analyzer using suitable attenuation and RF cable. The measured values take into consideration the external attenuation correction factors.
  - The SMA (Female) RF Cable soldered on PCB with maximum attenuation of 0.5 dB at the tested frequencies.
  - The RF cable 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:**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Single	795.913	≥ 500	295.913	Complied

**Single Channel****Result: Pass**

**5.2.3. Transmitter Duty Cycle****Test Summary:**

<b>Test Engineer:</b>	Sercan Usta	<b>Test Date:</b>	02 June 2021
<b>Test Sample Serial Number:</b>	LTRA072 F2 0105 (Conducted Test Sample)		
<b>Test Site Identification</b>	SR 9		

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

**Environmental Conditions:**

<b>Temperature (°C):</b>	26.6
<b>Relative Humidity (%):</b>	50.7

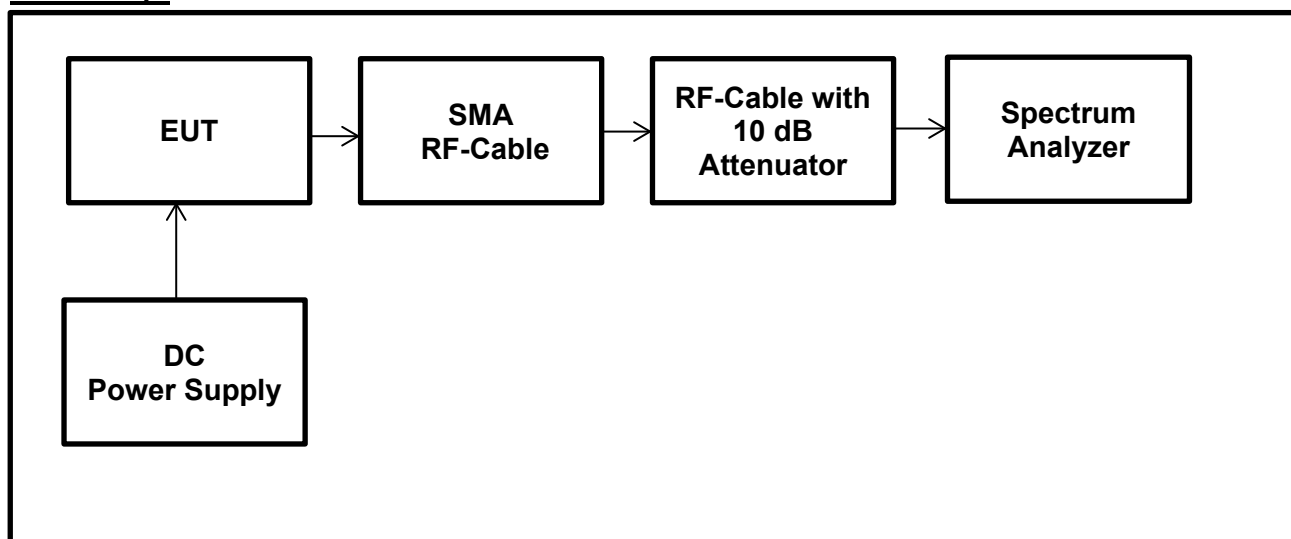
**Note:**

- As per applicant's declaration EUT supports
  - Pulsed Emissions (periodic pulse train)
  - Maximum possible "On time" ( $t_{ON}$ ) = 2 ms
  - Total period (T) = 200 ms
- As EUT's total period (T) exceeds 100 ms; a Sweep triggering method was applied to ensure that measurements are made only during transmissions at the maximum power control level.
- The TRIGGER was set on the spectrum analyzer to capture the greatest amount of pulse "ON time" over 100 ms.
- The 100 ms period that contains the maximum "on time" found with summing the duration of all of the pulses within the pulse train [i.e.,  $t_{ON} = \Sigma(t_1 + t_2 + \dots t_n)$ ] was determined.
- Finally, Duty cycle was calculated by dividing the total maximum "ON time" by 100 ms ( $t_{ON}/100$  ms).  

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

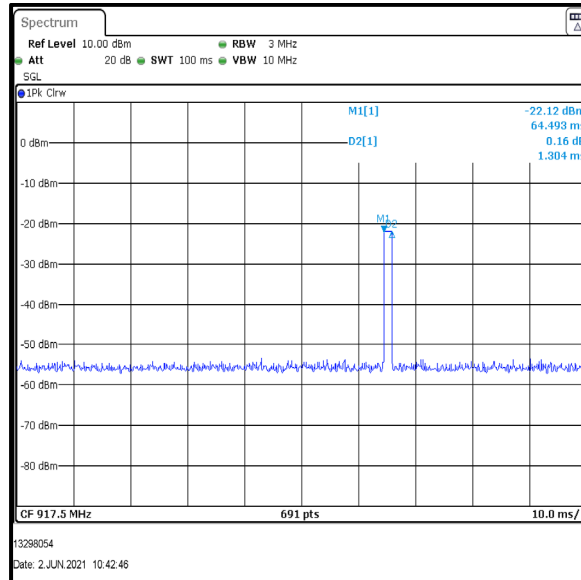
$$\text{Duty Cycle Correction Factor} = 10 \log 1 / [\text{On Time } (T_{ON})] / [\text{Period}(T_{ON} + T_{OFF}) \text{ or } 100\text{ms whichever is the lesser}]$$
- The RF port on the EUT was connected to the spectrum analyzer using suitable attenuation and RF cable. The measured values take into consideration the external attenuation correction factors.
  - The SMA (Female) RF Cable soldered on PCB with maximum attenuation of 0.5 dB at the tested frequencies.
  - The RF cable 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.

**Transmitter Duty Cycle (continued)****Test Setup:**

**Transmitter Duty Cycle (continued)****Results:**

Pulse On Time (T <sub>ON</sub> ) (ms)	Pulse Period (T <sub>ON</sub> + T <sub>OFF</sub> ) (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
1.304	100.000	1.304	18.85



**5.2.4.Transmitter Power Spectral Density****Test Summary:**

<b>Test Engineer:</b>	Sercan Usta	<b>Test Date:</b>	03 November 2021
<b>Test Sample Serial Number:</b>	LTRA072 F2 0105 (Conducted Test Sample)		
<b>Test Site Identification</b>	SR 9		

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

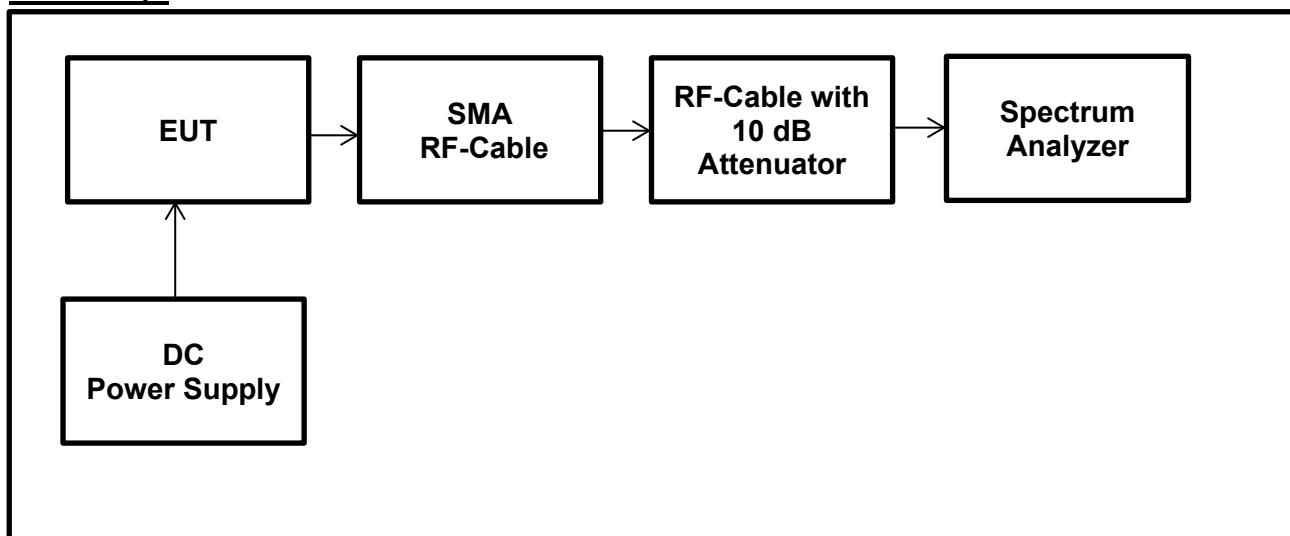
**Environmental Conditions:**

<b>Temperature (°C):</b>	26.6
<b>Relative Humidity (%):</b>	50.7

**Note(s):**

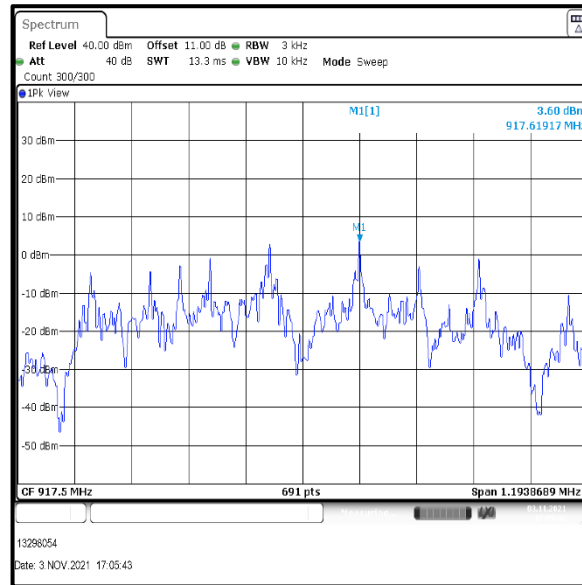
1. The EUT was transmitting at < 98% duty cycle and testing was performed in accordance with ANSI C63.10 Section 11.10.2 Method PKPSD.
2. The spectrum analyzer resolution bandwidth was set to 3 kHz and video bandwidth 10 kHz. A Peak detector was used and sweep time was set to Auto. The span was set to 1.5 times the DTS bandwidth. The highest peak of the measured signal was recorded.
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 SMA (Female) RF Cable soldered on PCB with maximum attenuation of 0.5 dB at the tested frequencies.
  - The RF cable from the EUT to Analyzer with maximum attenuation of 0.5 dB at the tested frequencies including the 10 dB attenuator at the input of Spectrum Analyzer

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

**Test Setup:**

**Transmitter Power Spectral Density (continued)****Results:**

Channel	Peak Output Power (dBm/3 kHz)	Limit (dBm/3kHz)	Margin (dB)	Result
Single	3.60	8.0	4.40	Complied

**Single Channel****Result: Pass**



**5.2.5.Transmitter Maximum Peak Output Power****Test Summary:**

<b>Test Engineer:</b>	Sercan Usta	<b>Test Date:</b>	03 November 2021
<b>Test Sample Serial Number:</b>	LTRA072 F2 0105 (Conducted Test Sample)		
<b>Test Site Identification</b>	SR 9		

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

**Environmental Conditions:**

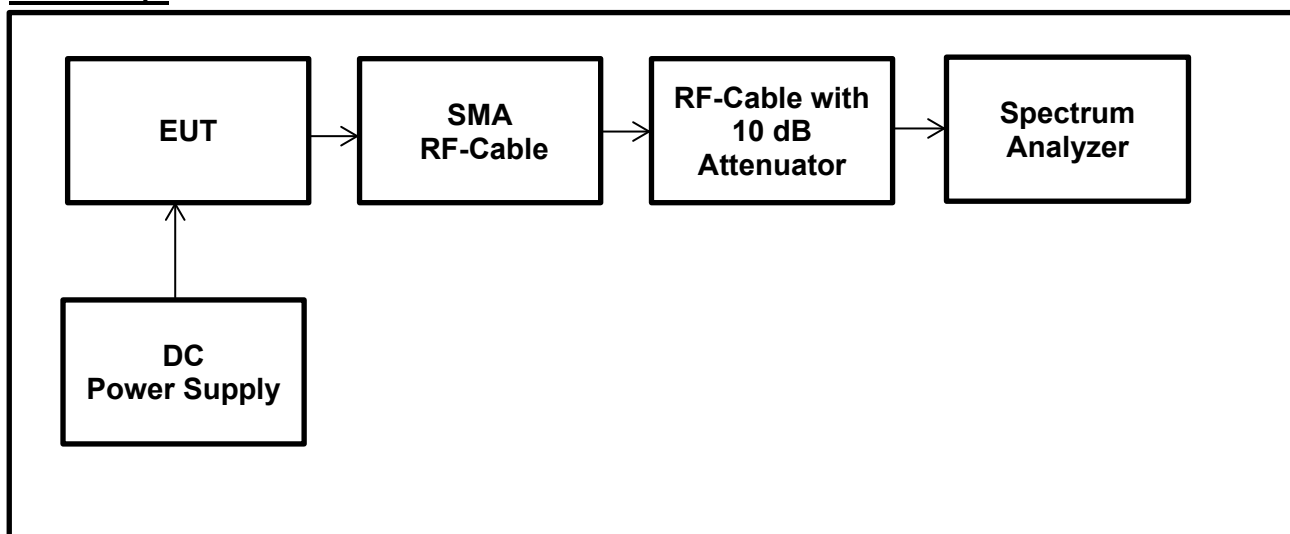
<b>Temperature (°C):</b>	26.6
<b>Relative Humidity (%):</b>	50.7

**Notes:**

1. The conducted power tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 8.3.1.1 with the RBW  $\geq$  DTS bandwidth referencing ANSI C63.10 Section 11.9.1.1.
2. The spectrum analyzer 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 SMA (Female) RF Cable soldered on PCB with maximum attenuation of 0.5 dB at the tested frequencies.
  - The RF cable from the EUT to Analyzer with maximum attenuation of 0.5 dB at the tested frequencies including the 10 dB attenuator at the input of Spectrum Analyzer

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

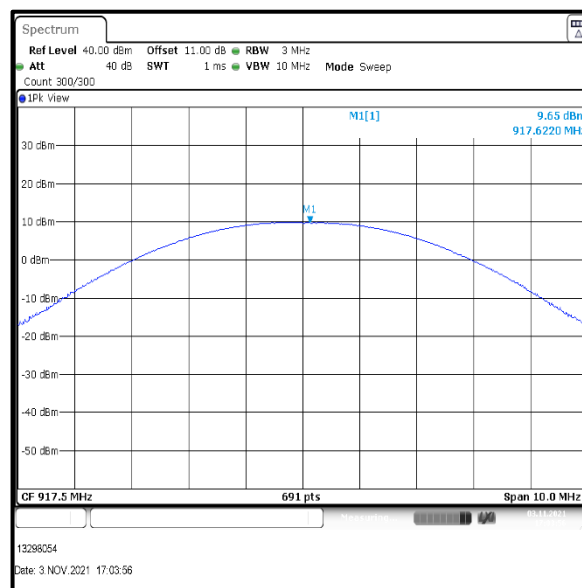
4. The measurement was made with highest possible duty cycle.
5. The declared antenna gain (in dBd) was added to conducted power to obtain the ERP.

**Test Setup:**

**Transmitter Maximum Peak Output Power (continued)****Results:**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Single	9.65	30.0	20.35	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBd)	ERP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Single	9.65	0.25	9.90	36.0	26.10	Complied

**Single Channel****Result: Pass**

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

<b>Test Engineer:</b>	Sercan Usta	<b>Test Date:</b>	14 June 2021
<b>Test Sample Serial Number:</b>	LTRA072 F2 0103 (Radiated Test Sample)		
<b>Test Site Identification</b>	SR 1/2		

<b>FCC Reference:</b>	Parts 15.247(d) & 15.209(a)
<b>Test Method Used:</b>	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
<b>Frequency Range</b>	9 kHz to 30 MHz

**Environmental Conditions:**

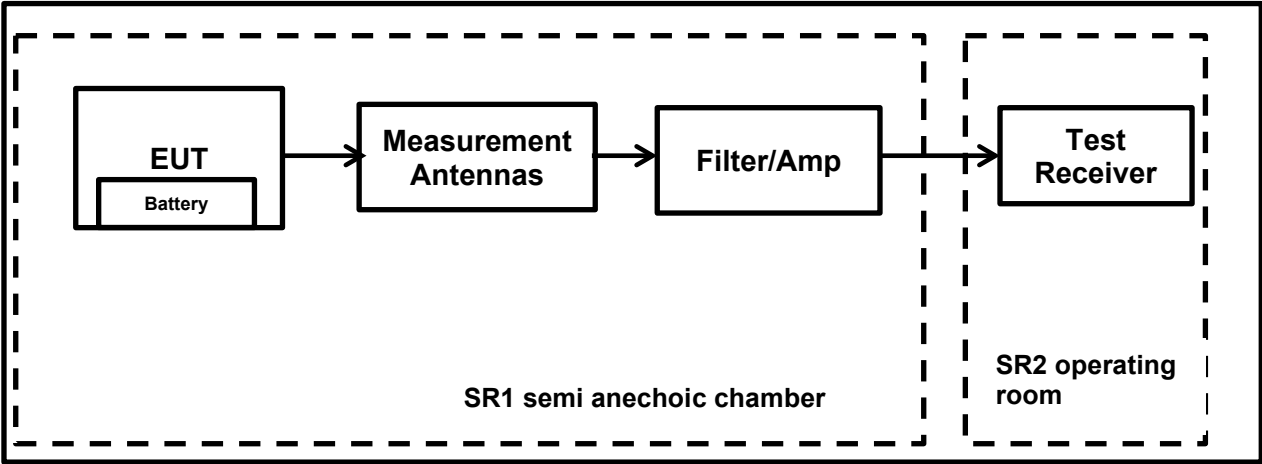
<b>Temperature (°C):</b>	23.8
<b>Relative Humidity (%):</b>	40.3

**Note(s):**

- In accordance with FCC KDB 414788 D01 Radiated Test Site & ANSI C63.10 clause 5.2 an alternative test site that can demonstrate equivalence to a open area test site may be used. Therefore, the measurement was performed in a Semi Anechoic Chamber. (The OATS / SAC comparison data is available upon request).
- The limits are specified at a test distances of 30 and 300 metres. However, as specified in FCC Section 15.31 (f)(2) & ANSI C63.10 clause 6.4.3, measurements may be performed at a closer distance and the measured level extrapolated to the specified measurement distance using the method described in clauses 6.4.4, specifically sub-clause 6.4.4.1 which specifies that the measured level shall be extrapolated to the specified distance by conservatively presuming that the field strength decays at 40 dB/decade.  
  
Therefore, measurements were performed at a measurement distance of 3 m.
- Therefore, the limit values are extrapolated to a measurement distance of 3 m.
  - 9 kHz- 490 kHz: limits extrapolated from 300 m to 3 m by adding 80 dB at 40 dB /decade.
  - 490 kHz-1705 kHz: limits extrapolated from 30 m to 3 m by adding 40 dB at 40 dB /decade.
- Measurements below 30 MHz were performed in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) at a distance of 3 meters. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable.
- All emissions shown on the pre-scan plots were investigated and found to be below system noise floor.
- Pre-scans were performed and markers placed on the highest measured levels. The test receiver was set to:
  - Frequency range: 9 kHz-150 kHz : RBW: 1 kHz /VBW: 3 kHz
  - Frequency range: 150 kHz – 30 MHz: RBW: 10 kHz /VBW: 30 kHz
  - Detector: Max-Peak detector

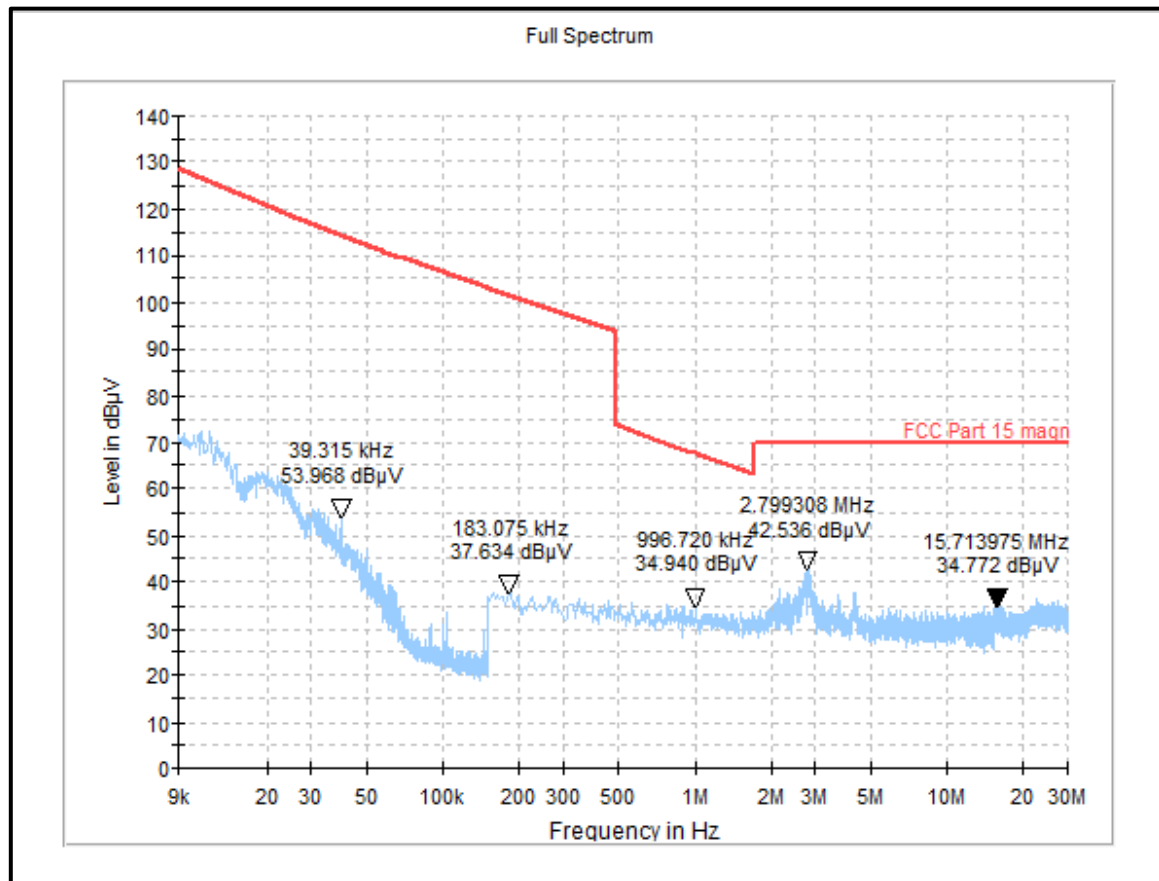
**Transmitter Radiated Emissions (continued)**

**Test Setup:**



**Transmitter Radiated Emissions (continued)****Results:**

Frequency (MHz)	Loop Antenna Orientation	MaxPeak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
No spurious emissions were detected					

**Plot: 9 KHz - 30 MHz : Single Channel****Result: Pass**

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

<b>Test Engineer:</b>	Sercan Usta	<b>Test Date:</b>	07 June 2021
<b>Test Sample Serial Number:</b>	LTRA072 F2 0103 (Radiated Test Sample)		
<b>Test Site Identification</b>	SR 1/2		

<b>FCC Reference:</b>	Parts 15.247(d) & 15.209(a)
<b>Test Method Used:</b>	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
<b>Frequency Range</b>	30 MHz to 1000 MHz

**Environmental Conditions:**

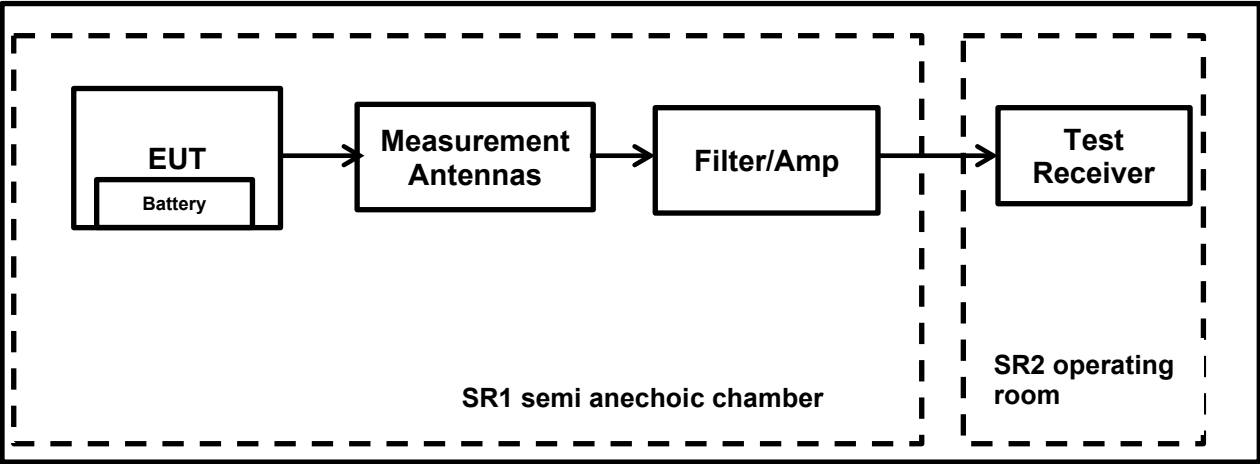
<b>Temperature (°C):</b>	23.8
<b>Relative Humidity (%):</b>	51.2

**Note(s):**

1. Measurements below 1 GHz were performed in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) at a distance of 3 m. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 m to 4 m.
2. The emissions shown at frequencies between approximately around 917.50 MHz on the 30 MHz to 1 GHz plot is the EUT fundamental for the given channel.
3. Pre-scans were performed and markers placed on the highest measured levels. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.
4. All emissions shown on the pre-scans were investigated and found to be below the noise floor of the measurement system.

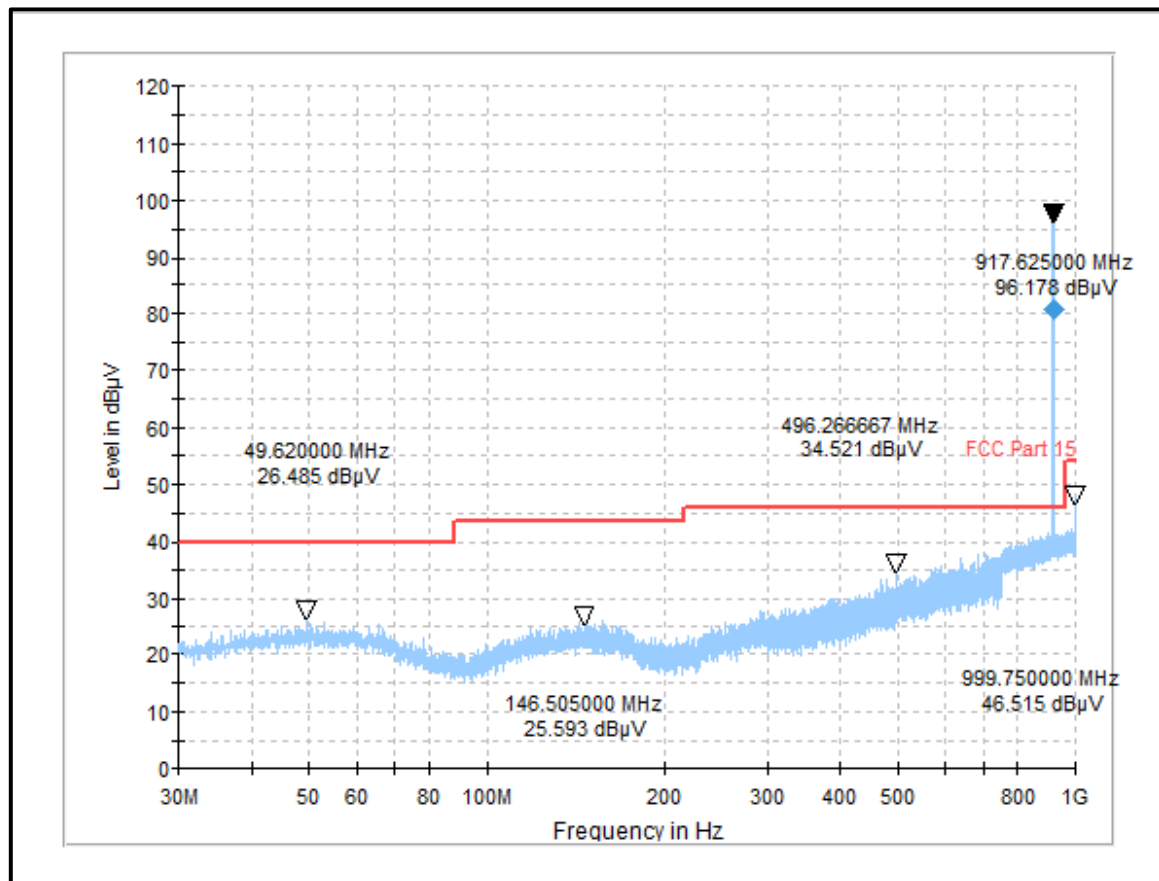
**Transmitter Radiated Emissions (continued)**

**Test Setup:**



**Transmitter Radiated Emissions (continued)****Results:**

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
No spurious emissions were detected					

**Plot: 30 MHz – 1GHz : Single Channel****Result: Pass**



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

<b>Test Engineer:</b>	Sercan Usta	<b>Test Date:</b>	14 June 2021
<b>Test Sample Serial Number:</b>	LTRA072 F2 0103 (Radiated Test Sample)		
<b>Test Site Identification</b>	SR1/2		

<b>FCC Reference:</b>	Parts 15.247(d) & 15.209(a)
<b>Test Method Used:</b>	FCC KDB 558074 Sections 8.5 & 8.6 referencing ANSI C63.10 Sections 11.11 and 11.12 ANSI C63.10:2013 Sections 6.3 and 6.6
<b>Frequency Range</b>	1 GHz to 10 GHz

**Environmental Conditions:**

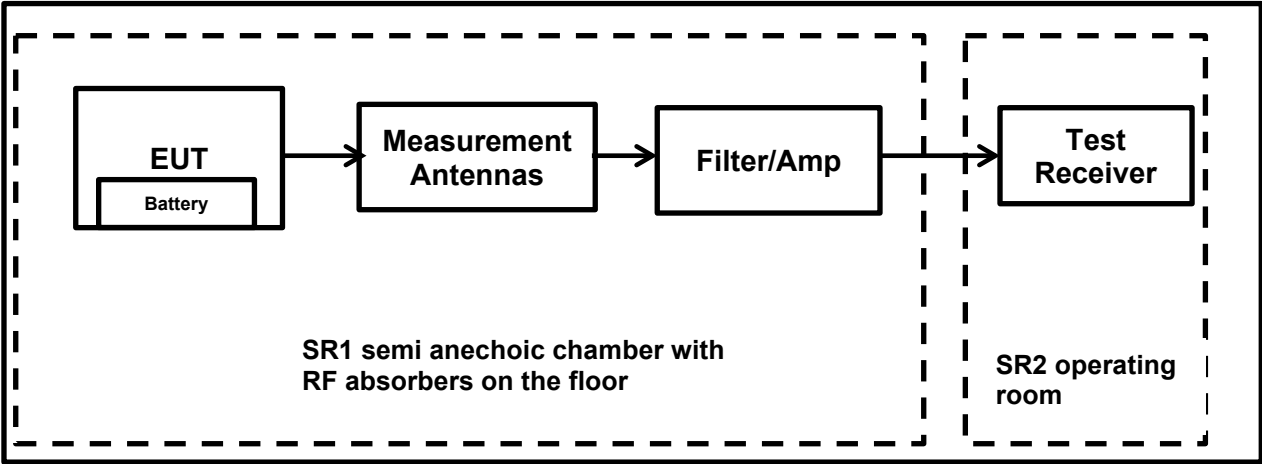
<b>Temperature (°C):</b>	23.8
<b>Relative Humidity (%):</b>	40.3

**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. Pre-scans were performed and a marker placed on the highest measured level of the appropriate plot. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto.
3. All emissions shown on the pre-scans were investigated and found to be below the noise floor of the measurement system.

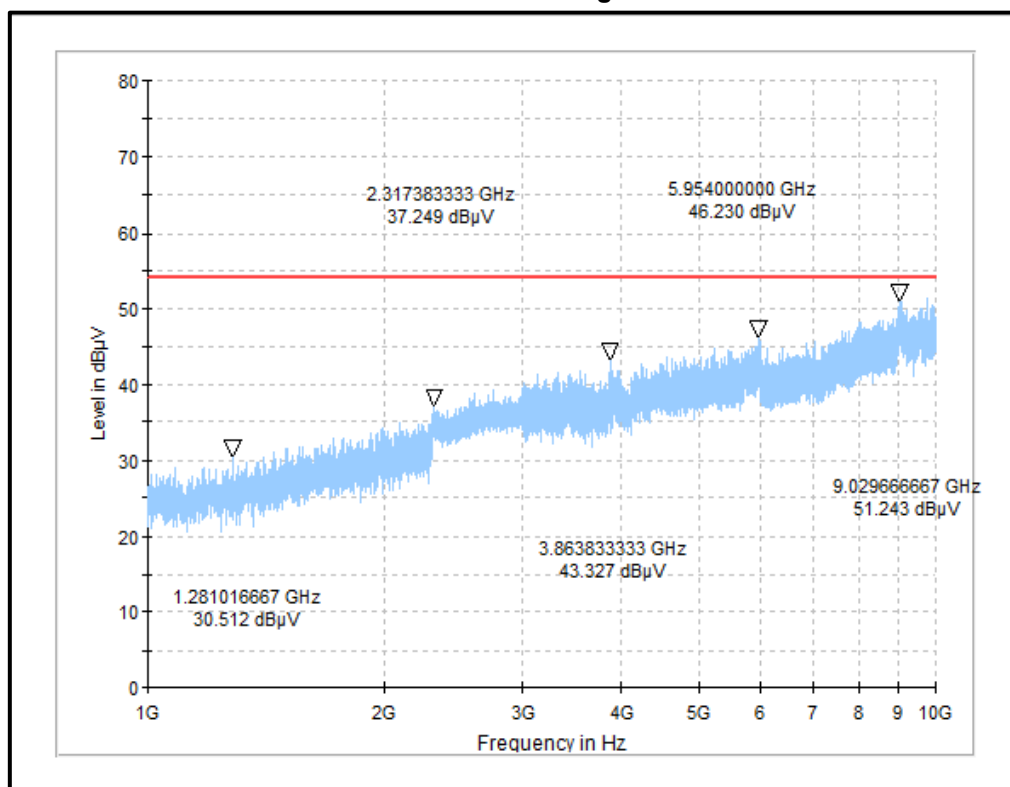
**Transmitter Radiated Emissions (continued)**

**Test Setup:**



**Transmitter Radiated Emissions (continued)****Results:**

Frequency (MHz)	Antenna Polarization	Peak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
No spurious emissions were detected					

**Plot: 1 GHz – 10GHz: Single Channel**

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

<b>Test Engineer:</b>	Sercan Usta	<b>Test Date:</b>	08 July 2021
<b>Test Sample Serial Number:</b>	LTRA072 F2 0103 (Radiated Test Sample)		
<b>Test Site Identification</b>	SR 1/2		

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

**Environmental Conditions:**

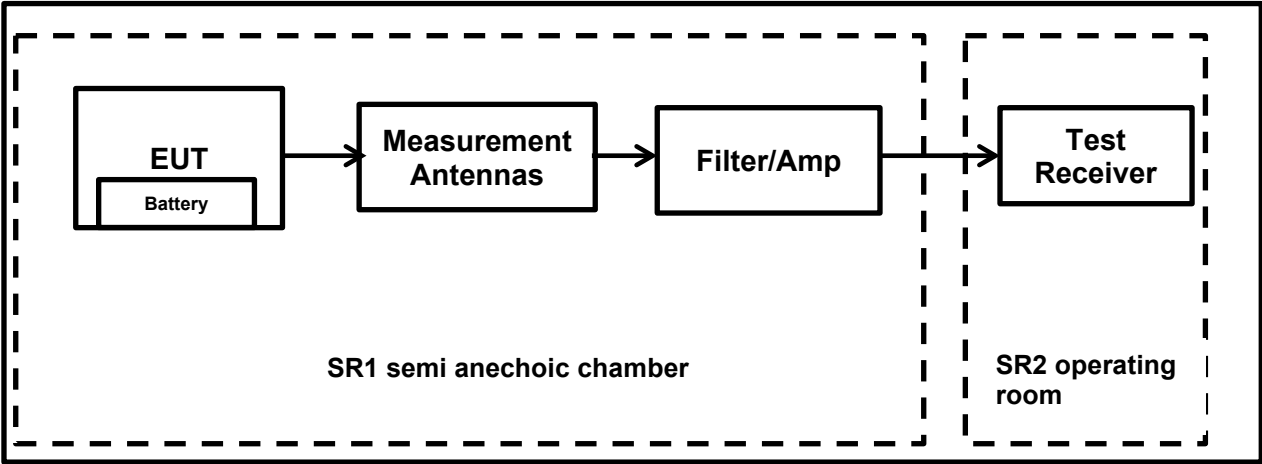
<b>Temperature (°C):</b>	24.3
<b>Relative Humidity (%):</b>	45.6

**Note(s):**

1. The measurements were in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) 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. In accordance with FCC 15.247(d) emissions radiated outside of the specified operating frequency bands, shall be attenuated by at least 20 dB below level of the fundamental in the 100 kHz bandwidth.
3. As the lower band edge & upper band edge fall 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) band edge measurements were performed with a peak detector and the -20 dBc limit applied.
4. 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.
5. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.

**Transmitter Band Edge Radiated Emissions (Continued)**

**Test Setup:**

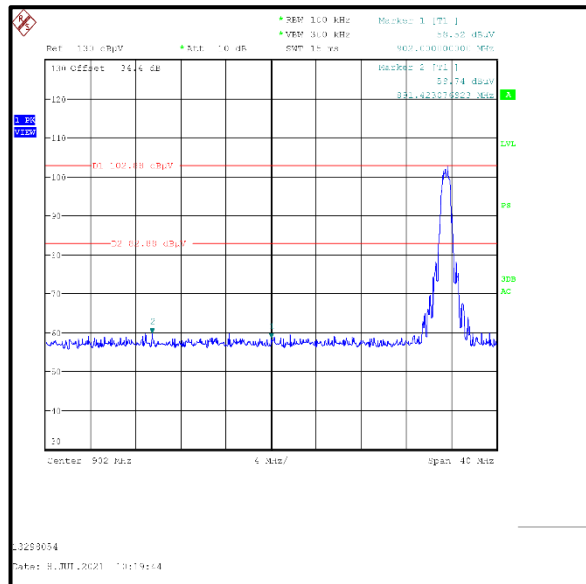
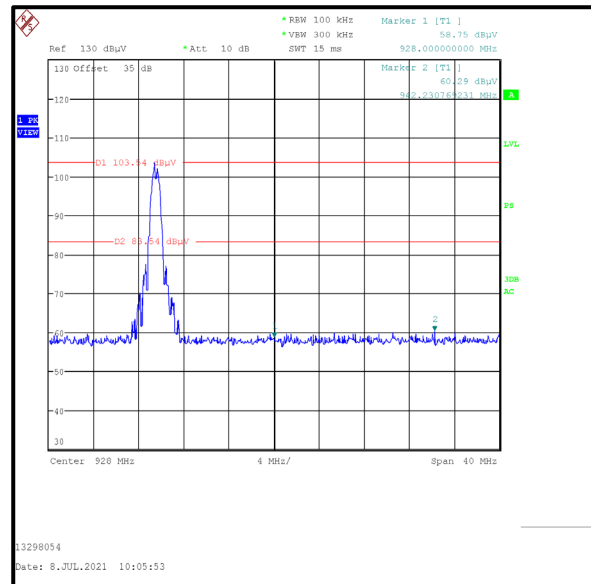


**Transmitter Band Edge Radiated Emissions (Continued)****Results: Lower Band Edge / Peak**

Frequency (MHz)	Antenna Polarization	Peak Level (dB $\mu$ V/m)	-20 dBc Limit (dB $\mu$ V/m)	Margin (dB)	Result
891.42	Horizontal	59.74	82.88	23.14	Complied
902.00	Horizontal	58.52	82.88	24.36	Complied

**Results: Upper Band Edge / Peak**

Frequency (MHz)	Antenna Polarization	Peak Level (dB $\mu$ V/m)	-20 dBc Limit (dB $\mu$ V/m)	Margin (dB)	Result
928.00	Horizontal	58.75	83.54	24.79	Complied
942.23	Horizontal	60.29	83.54	23.25	Complied

**Plots:****Lower Band Edge Peak Measurement****Upper Band Edge Peak Measurement****Result: Pass**

## 6. Measurement Uncertainty

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	95%	±2.49 dB
Conducted Maximum Peak Output Power	95%	±0.59 dB
Radiated Spurious Emissions	95%	±3.10 dB
Band Edge Radiated Emissions	95%	±3.10 dB
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	08/07/2020	12
460	Deisl	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-Periodic Broadband	HL050	100297	05/08/2020	24
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 7/8

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
23	Rohde & Schwarz	Artificial Mains Network	ESH3-Z5	831767/013	07/07/2020	12
28	Rohde & Schwarz	Passive Probe	ESH2-Z3	none	11/07/2020	12
349	Rohde & Schwarz	Receiver, EMI Test	ESIB7	836697/009	09/07/2020	12
351	Rohde & Schwarz	network, Artificial Mains	ESH3-Z5	862770/018	07/07/2020	12
564	Teseq	Impedance stabilisation network (ISN)	ISN T800	26076	07/07/2020	24
-/-	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

### Test site: SR 9

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
445	Huber & Suhner	RF Attenuator (10dB)	6810.17.AC	--	lab verification	12
637	Rohde & Schwarz	Spectrum Analyzer	FSV40	101587	13/07/2021	12
-/-	Testo	Thermo-Hygrometer	608-H1	07	lab verification	n/a
-/-	Huber & Suhner	RF Cable (upto 18GHz)	-/-	-/-	lab verification	n/a
1603668	Siemens Matsushita Components	shielded room		B83117-B1422-T161	n/a	n/a



## 8. Report Revision History

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	41	-	Initial Version