



TEST REPORT

Test Report No. : UL-RPT-RP-13298054-1816-FCC

Applicant : ST Sportservice GmbH
Model No. : GPS_Radio32 V2 (LTRA073)
FCC ID : 2AXIALTRA073
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 1.1 supersede Version 1.0 with immediate effect**
Test Report No. UL-RPT-RP-13298054-1816-FCC Version 1.1, Issue Date 10 NOVEMBER 2021 replaces
Test Report No. UL-RPT-RP-13298054-1816-FCC Version 1.0, Issue Date 09 NOVEMBER 2021, which is no longer valid.
5. Result of the tested sample: **PASS**

Prepared by: Sercan, Usta
Title: Laboratory Engineer
Date: 10 November 2021

Approved by: Ajit, Phadtare
Title: Lead Test Engineer
Date: 10 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.

This page has been left intentionally blank.

Table of Contents

1. Customer Information.....	4
1.1. Applicant Information	4
1.2. Manufacturer Information	4
2. Summary of Testing.....	5
2.1. General Information	5
Applied Standards	5
Location	5
Date information	5
2.2. Summary of Test Results	6
2.3. Methods and Procedures	6
2.4. Deviations from the Test Specification	6
3. Equipment Under Test (EUT)	7
3.1. Identification of Equipment Under Test (EUT)	7
3.2. Description of EUT	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
4. Operation and Monitoring of the EUT during Testing	10
4.1. Operating Modes	10
4.2. Configuration and Peripherals	10
5. Measurements, Examinations and Derived Results	11
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 Average Output Power	25
5.2.6. Transmitter Radiated Emissions	27
5.2.7. Transmitter Band Edge Radiated Emissions	36
6. Measurement Uncertainty	39
7. Used equipment	40
8. Report Revision History	41

1. Customer Information

1.1.Applicant Information

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

1.2.Manufacturer Information

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

2. Summary of Testing

2.1. General Information

Applied Standards

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

Location

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

Date information

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

2.2. Summary of Test Results

Clause	Measurement	Complied	Did not comply	Not performed	Not applicable
Part 15.207	Transmitter AC Conducted Emissions	<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 ⁽¹⁾	<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 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

Reference:	ANSI C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Reference:	KDB 558074 D01 15.247 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:	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:	SWISS TIMING
Model Name or Number:	GPS_Radio32 V2 (LTRA073)
Serial Number:	LTRA073 F2 0010
Hardware Version Number:	V2
Software Version Number:	radioeth_radiotest_ism-1.6
FCC ID	2AXIALTRA073

Brand Name:	AMPHENOL PROCOM
Model Name or Number:	FSP 900/...-SMA
Antenna Gain:	2.15 dBi / 0.0 dBd @ 820 – 960 MHz
Antenna Type:	External ½ λ-Dipole
Additional Details:	Short range device operations in 902 – 928 MHz (DTS) band.

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

Category of Equipment:	902 – 928 MHz (DTS) Short Range Device (SRD)	
Type of Radio Device:	Transceiver	
Power Supply Requirement(s):	V _{nom}	12-24 V DC max. 1.2 A
Type of Power Supply	12-24 V DC max. 1.2 A using External Supply	
Temperature Requirement(s):	T _{nom}	+ 25 °C
	T _{min}	0°C
	T _{max}	+ 50 °C
Ambient Relative Humidity:	0-95 %	
Operational Frequency Bands:	902 – 928 MHz	
Modulation Type:	OQPSK	
Data Rate:	250 kBit/s	
Antenna Type:	External ½ λ-Dipole	
Antenna Gain:	2.15 dBi / 0.0 dBd @ 820 – 960 MHz	
Antenna Details:	Model: FSP 900/...-SMA AMPHENOL PROCOM	
Transmit / Receive Frequency Range:	917.50 MHz	
Transmit / Receive Channels Tested:	Channel ID	Channel Frequency (MHz)
	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	EQTrackerV4	LTRA072 F2 0105 (Conducted Sample)
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	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

EUT Power supply:

- The EUT was powered via 12 V DC was powered by laboratory DC power supply which was in turn connected to 120 VAC / 60 Hz single phase supply.

Test Mode Activations:

- The EUT was configured into required TX test modes using the software which supplied by customer eqtr4_radiotest I 0.1.5
- The EQTrackerV4 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 19.565 % (duty cycle variations are less than $\pm 2\%$).
- Therefore, a Duty Cycle Correction Factor of 7.09 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 sample with permanent external antenna connected & 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 EUT with permanent external antenna connector was used for all conducted measurements.

Radiated Measurements:

- The EUT sample with permanent external antenna connected 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:	LTRA073 F2 0010		
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:

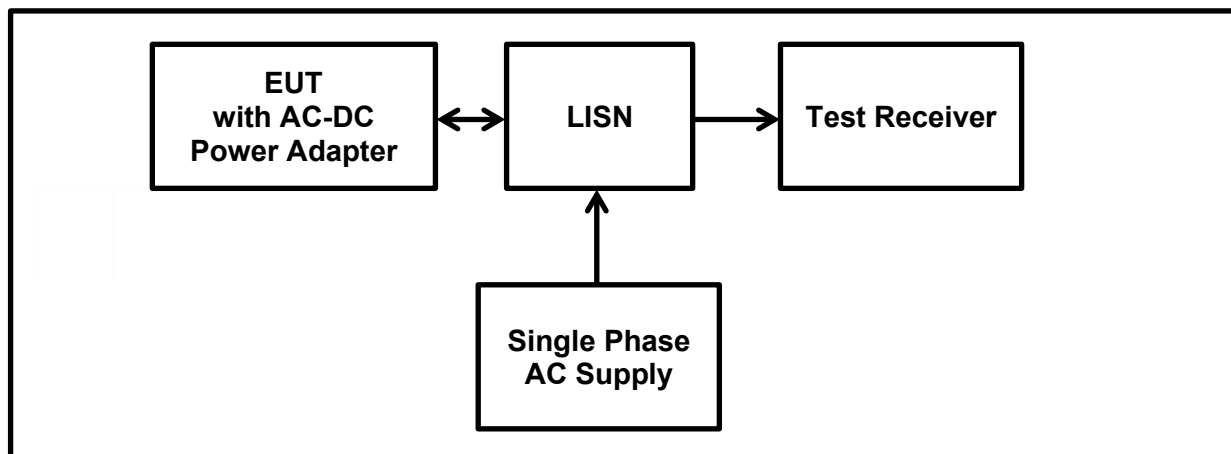
Temperature (°C):	25.2
Relative Humidity (%):	54.3

Settings of the Instrument

Detector	Quasi Peak/ Average Peak
----------	--------------------------

Note(s):

1. The EUT was powered via 12 V DC was powered by laboratory DC power supply which was in turn 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 μ V)	Limit (dB μ V)	Margin (dB)	Result
0.1570	Live	17.4	64.9	47.5	Complied
0.2354	Live	16.5	61.7	45.2	Complied
0.7618	Live	9.5	60.0	50.5	Complied
10.1510	Live	14.3	60.0	45.7	Complied
11.5676	Live	21.1	60.0	38.9	Complied
14.6300	Live	11.8	60.0	48.2	Complied

Results: Live / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.1570	Live	11.6	54.9	43.3	Complied
0.2354	Live	11.1	51.7	40.6	Complied
0.7618	Live	5.3	50.0	44.7	Complied
10.1510	Live	9.0	50.0	41.0	Complied
11.5676	Live	13.2	50.0	36.8	Complied
14.6300	Live	8.1	50.0	41.9	Complied

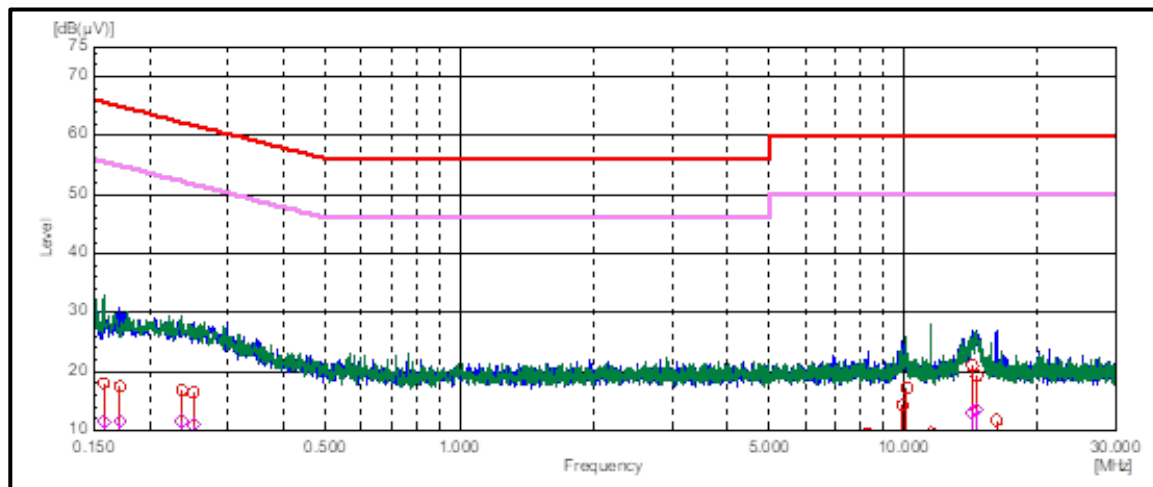
Results: Neutral / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.1711	Neutral	18.1	65.6	47.5	Complied
0.2509	Neutral	16.8	62.3	45.5	Complied
8.3005	Neutral	8.0	56.0	48.0	Complied
9.9264	Neutral	17.3	60.0	42.7	Complied
14.3042	Neutral	9.5	60.0	50.5	Complied
16.1649	Neutral	19.2	60.0	40.8	Complied

Results: Neutral / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.1711	Neutral	11.6	55.6	44.0	Complied
0.2509	Neutral	11.6	52.3	40.7	Complied
8.3005	Neutral	4.4	46.0	41.6	Complied
9.9264	Neutral	8.5	50.0	41.5	Complied
14.3042	Neutral	5.3	50.0	44.7	Complied
16.1649	Neutral	13.5	50.0	36.5	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 μ V)	Limit (dB μ V)	Margin (dB)	Result
0.1623	Live	16.8	63.5	46.7	Complied
0.3819	Live	13.6	57.9	44.3	Complied
1.3440	Live	7.4	56.0	48.6	Complied
4.4534	Live	12.4	60.0	47.6	Complied
14.5666	Live	18.5	60.0	41.5	Complied
15.2246	Live	11.1	60.0	48.9	Complied

Results: Live / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.1623	Live	11.6	55.3	43.7	Complied
0.3819	Live	6.6	48.2	41.6	Complied
1.3440	Live	3.4	46.0	42.6	Complied
4.4534	Live	4.3	46.0	41.7	Complied
14.5666	Live	12.8	50.0	37.2	Complied
15.2246	Live	7.5	50.0	42.5	Complied

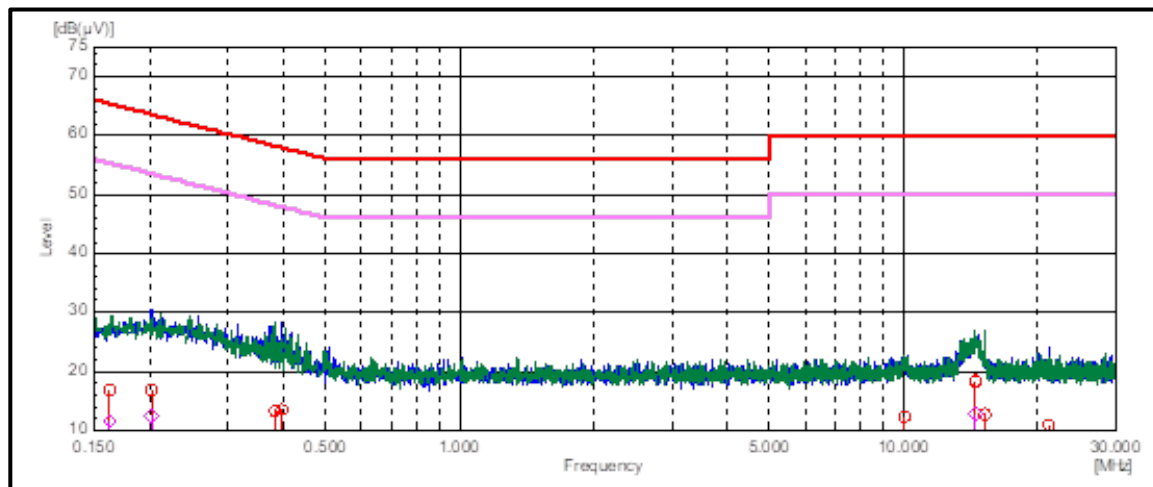
Results: Neutral / Quasi Peak / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.2021	Neutral	16.8	65.3	48.5	Complied
0.3962	Neutral	13.3	58.2	44.9	Complied
1.0223	Neutral	7.3	56.0	48.7	Complied
10.0650	Neutral	8.9	56.0	47.1	Complied
14.5204	Neutral	18.3	60.0	41.7	Complied
21.2352	Neutral	12.8	60.0	47.2	Complied

Results: Neutral / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.2021	Neutral	12.6	53.5	40.9	Complied
0.3962	Neutral	6.6	47.9	41.3	Complied
1.0223	Neutral	3.5	46.0	42.5	Complied
10.0650	Neutral	8.0	50.0	42.0	Complied
14.5204	Neutral	12.8	50.0	37.2	Complied
21.2352	Neutral	6.2	50.0	43.8	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:**

Test Engineer:	Sercan Usta	Test Date:	21 June 2021
Test Sample Serial Number:	LTRA073 F2 0010		
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

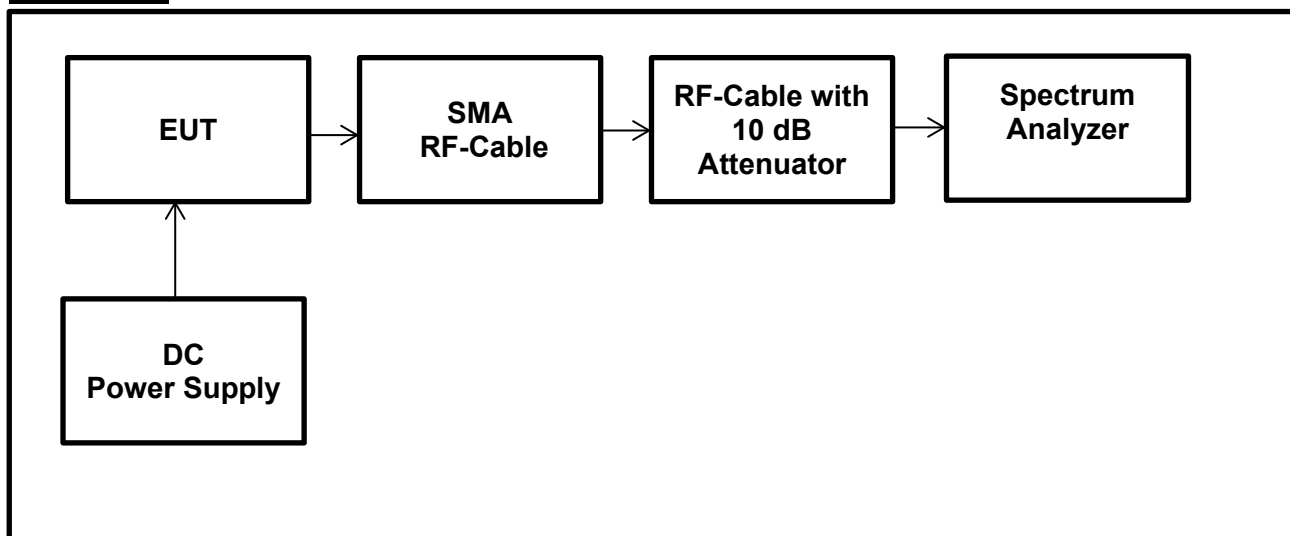
Environmental Conditions:

Temperature (°C):	26.6
Relative Humidity (%):	50.7

Notes:

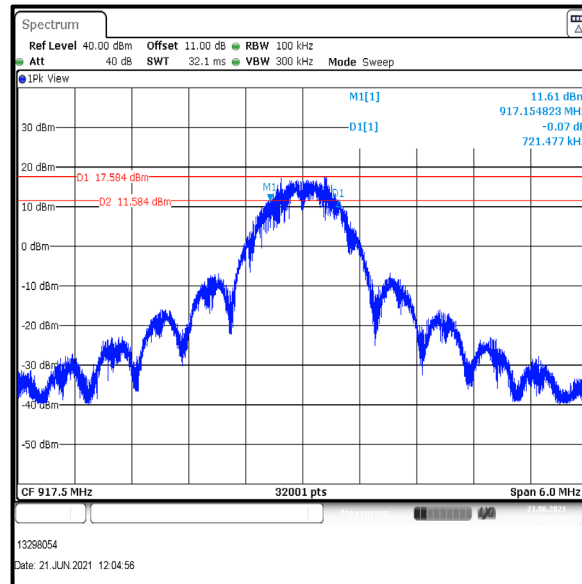
1. The 6 dB DTS bandwidth tests were performed using a spectrum analyzer in accordance with FCC KDB 558074 Section 8.2 referring ANSI C63.10:2013 Section 11.8.1 Option 1 measurement procedure.
2. The spectrum analyzer resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector 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 RF cable from the EUT to Analyzer with maximum attenuation of 1 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	721.477	≥ 500	221.477	Complied

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

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

Test Engineer:	Sercan Usta	Test Date:	02 June 2021
Test Sample Serial Number:	LTRA073 F2 0010		
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):	26.6
Relative Humidity (%):	50.7

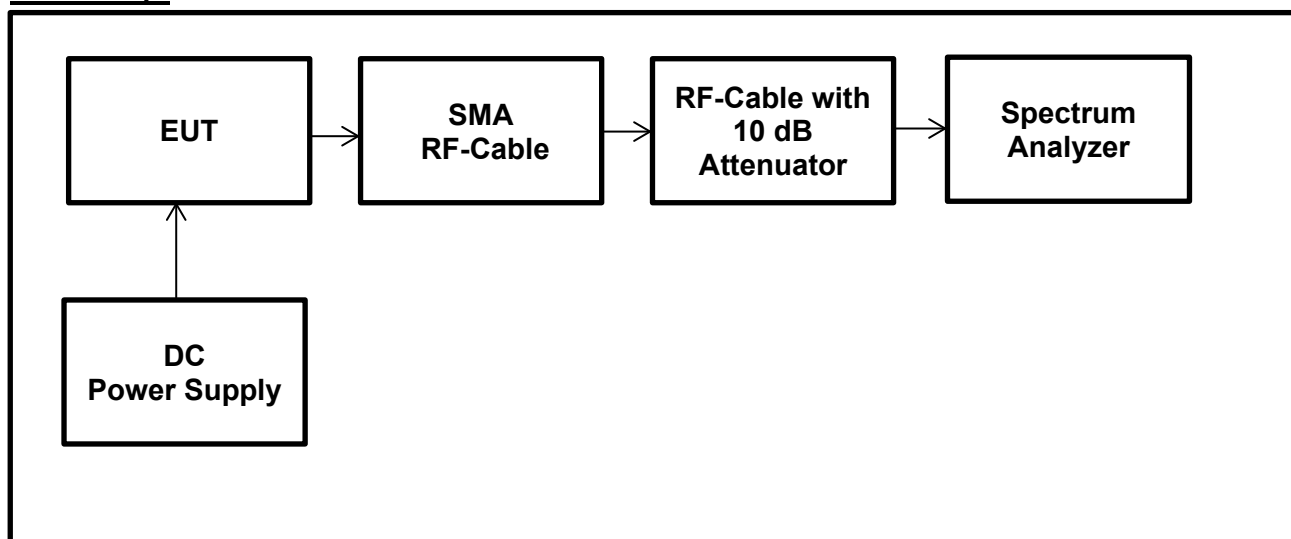
Note:

- As per applicant's declaration EUT supports
 - Pulsed Emissions (periodic pulse train)
 - Maximum possible "On time" (t_{ON}) = 50 ms
 - Total period (T) = 5 s
- 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).

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

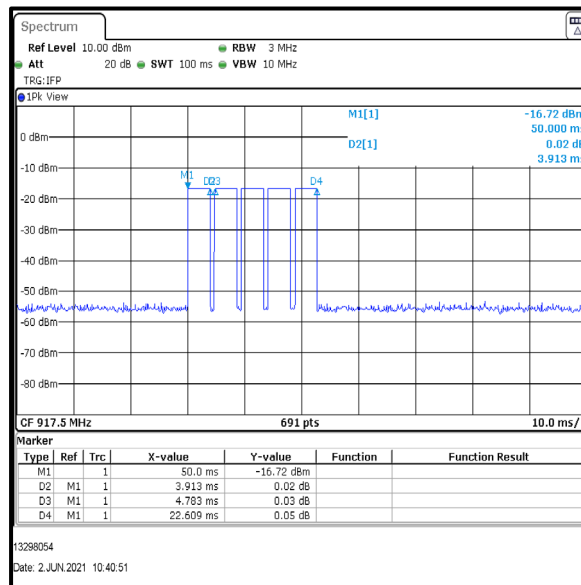
$$\text{Duty Cycle Correction Factor} = 10 \log 1 / [\text{On Time } (T_{ON})] / [\text{Period}(T_{ON} + T_{OFF}) \text{ or } 100\text{ms whichever is the lesser}]$$
- The RF port on the EUT was connected to the spectrum analyzer using suitable attenuation and RF cable. The measured values take into 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:**

Single Pulse On Time (ms)	Number of Pulses in 100 ms	Total Pulse On Time (T _{ON}) (ms)	Pulse Period (T _{ON} + T _{OFF}) (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
3.913	5	19.565	100.000	19.565%	7.09



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

Test Engineer:	Sercan Usta	Test Date:	03 November 2021
Test Sample Serial Number:	LTRA073 F2 0010		
Test Site Identification	SR 9		

FCC Reference:	Part 15.247(e)
Test Method Used:	FCC KDB 558074 Sections 8.4 referencing ANSI C63.10 Sections 11.10.5

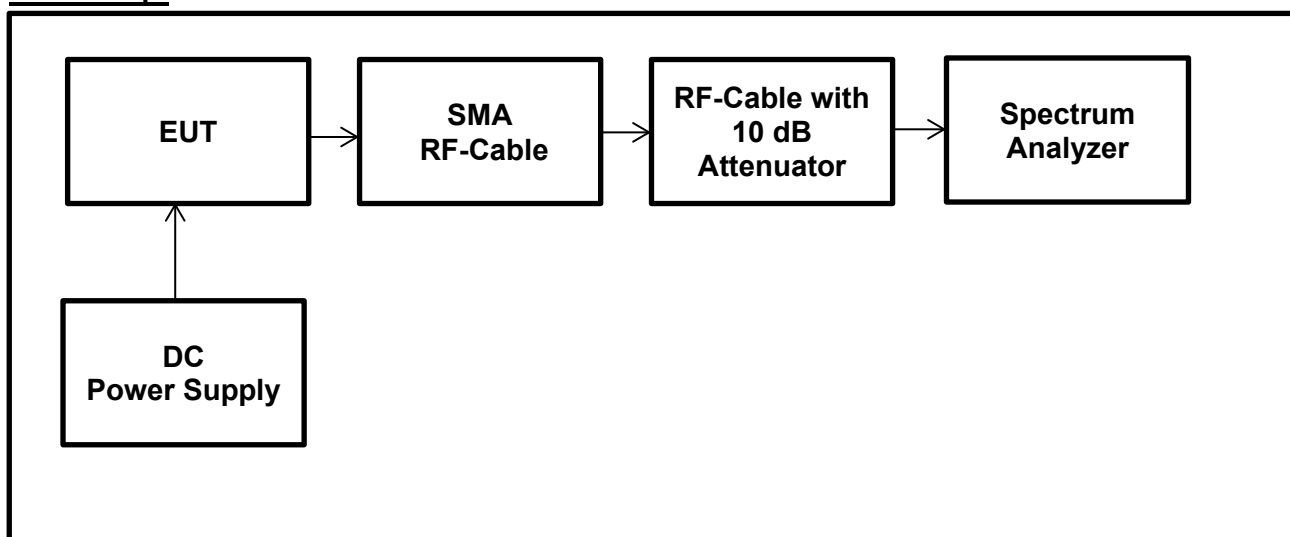
Environmental Conditions:

Temperature (°C):	25.6
Relative Humidity (%):	52.8

Note(s):

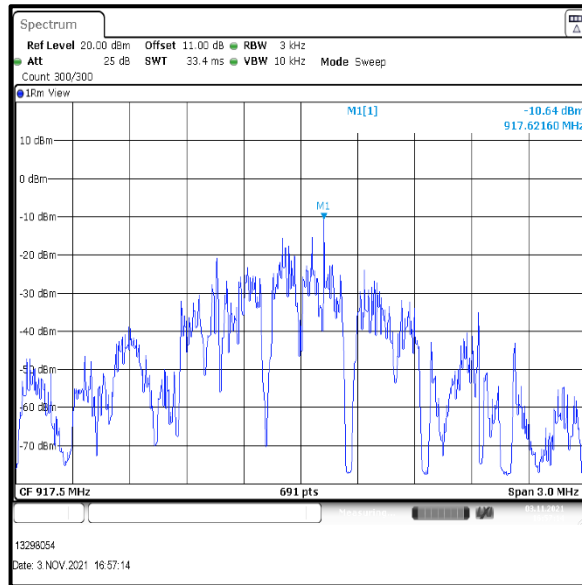
1. As the EUT was transmitting at < 98% duty cycle and testing was performed in accordance with ANSI C63.10 Section 11.10.5 Method AVGPSSD-2.
2. The spectrum analyzer resolution bandwidth was set to 3 kHz and video bandwidth 10 kHz. An Average detector with trace averaging (rms) mode over a 300traces was used and sweep time was set to Auto. The span was set to more than 1.5 times the DTS bandwidth. The highest peak of the measured signal was recorded.
3. The Duty Cycle Correction Factor (dB) was then added to the measured PSD to compute the average PSD during the actual transmission time.
4. The RF port on the EUT was connected to the spectrum analyser using suitable attenuation and RF cable. The measured values take into consideration the external attenuation correction factors.
 - o The RF cable from the EUT to Analyzer with maximum attenuation of 1 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	Average Output Power (dBm/3 kHz)	Duty Cycle Correction	Corrected Average Output Power (dBm/3 kHz)	Limit (dBm/3kHz)	Margin (dB)	Result
Single	-10.64	7.09	-3.55	8.0	11.55	Complied

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

5.2.5. Transmitter Average Output Power**Test Summary:**

Test Engineer:	Sercan Usta	Test Date:	03 November 2021
Test Sample Serial Number:	LTRA073 F2 0010		
Test Site Identification	SR 9		

FCC Reference:	Part 15.247(b)(3)
Test Method Used:	FCC KDB 558074 Section 8.3.2.2 referencing ANSI C63.10 Section 11.9.2.2.4

Environmental Conditions:

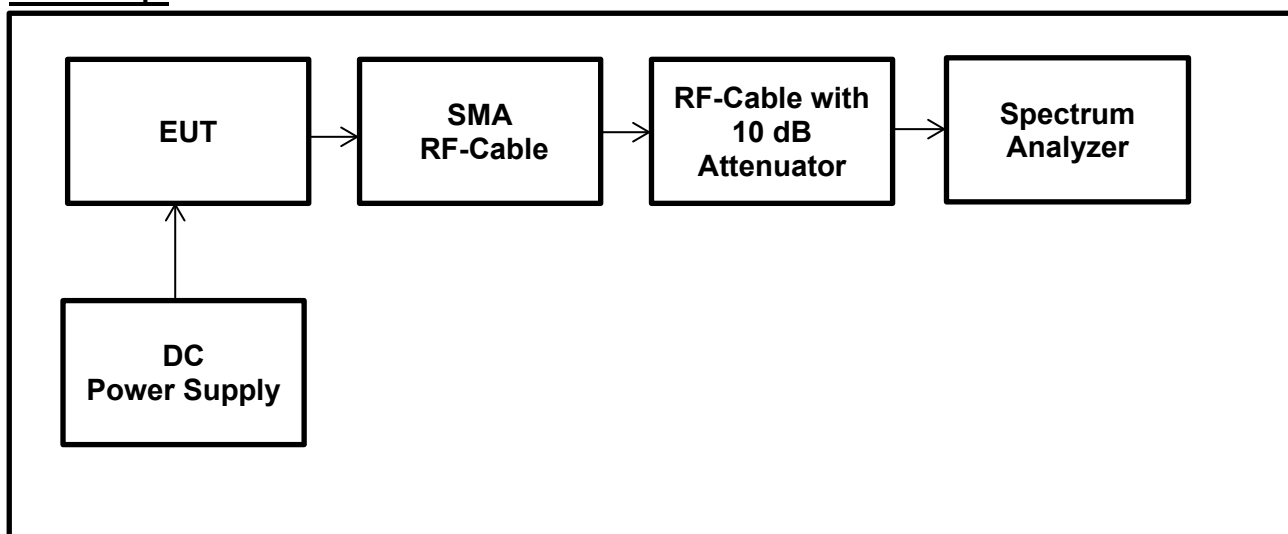
Temperature (°C):	25.6
Relative Humidity (%):	52.8

Notes:

- As the EUT was transmitting at < 98% duty cycle, the conducted power measurements were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 8.3.2.2 referencing ANSI C63.10 Section 11.9.2.2.4 Method AVGSA-2 procedure.
- 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.
- The Duty Cycle Correction Factor (dB) was then added to the measured power to compute the average power during the actual transmission time.
- 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 RF cable from the EUT to Analyzer with maximum attenuation of 1 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.

- The declared antenna gain (in dBd) was added to conducted power to obtain the ERP.

Test Setup:

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

Channel	Conducted Average Power (dBm)	Duty Cycle Correction	Corrected Conducted Average Power (dBm)	Conducted Output Power Limit (dBm)	Margin (dB)	Result
Single	7.38	7.09	14.47	30.0	15.53	Complied

Channel	Corrected Conducted Average Power (dBm)	Declared Antenna Gain (dBd)	ERP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Single	14.47	0.0	14.47	36.0	21.53	Complied

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

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

Test Engineer:	Sercan Usta	Test Date:	14 June 2021
Test Sample Serial Number:	LTRA073 F2 0010		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	FCC KDB 558074 Sections 8.5 & 8.6 referencing ANSI C63.10 Sections 11.11 and 11.12 ANSI C63.10:2013 Sections 6.3 and 6.4
Frequency Range	9 kHz to 30 MHz

Environmental Conditions:

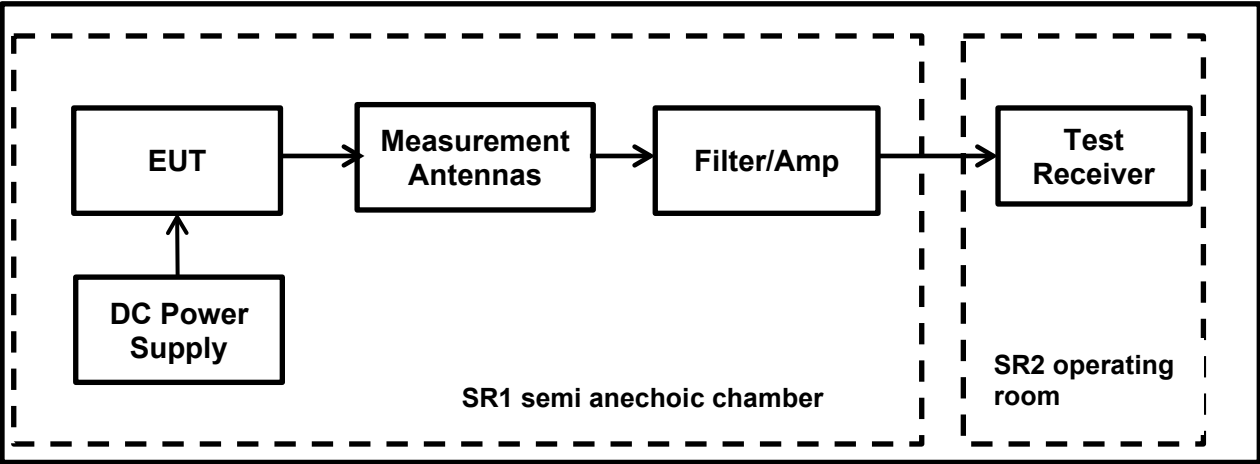
Temperature (°C):	23.8
Relative Humidity (%):	40.3

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.
- All emissions shown on the pre-scan plots were investigated and found to be below system noise floor.
- 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.
- 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

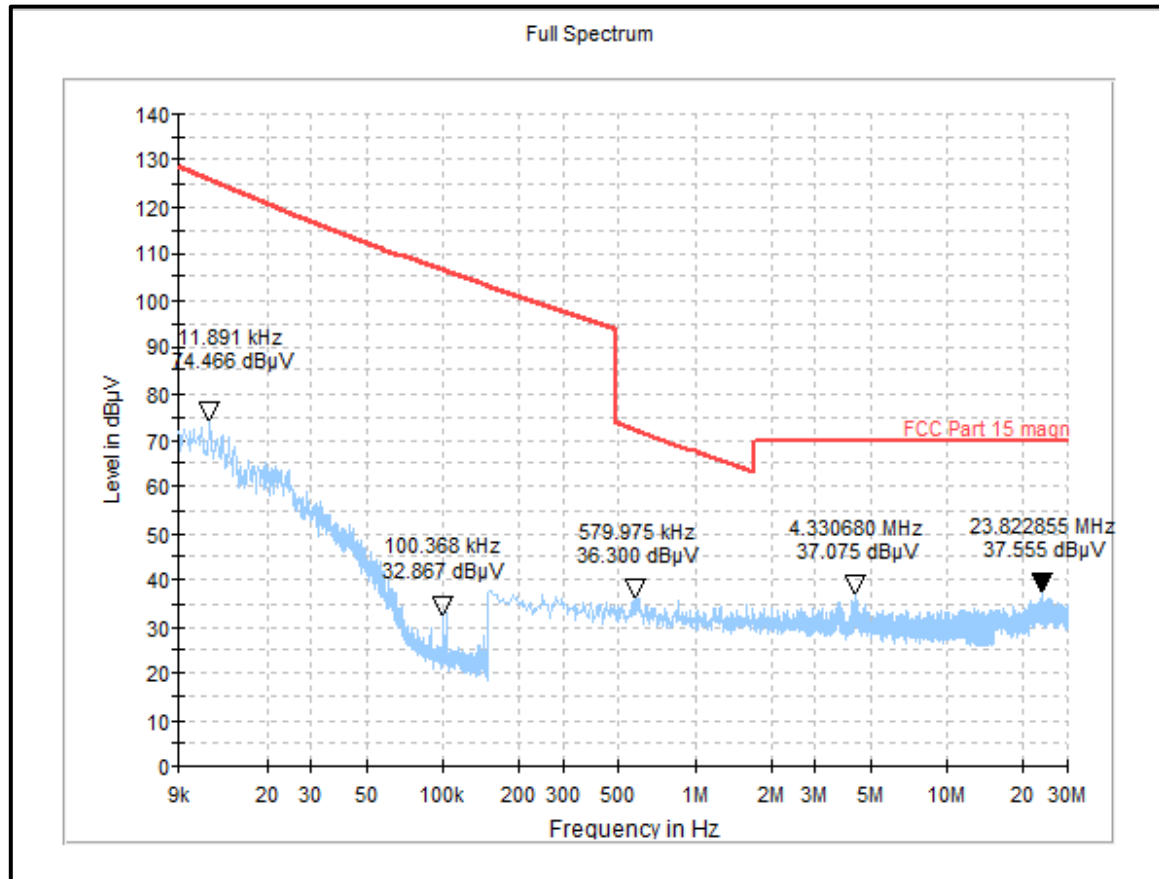
Transmitter Radiated Emissions (continued)

Test Setup:



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

Frequency (MHz)	Loop Antenna Orientation	MaxPeak Level (dB μ V/m)	Limit (dB μ 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:**

Test Engineer:	Sercan Usta	Test Date:	07 June 2021
Test Sample Serial Number:	LTRA073 F2 0010		
Test Site Identification	SR 1/2		

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

Environmental Conditions:

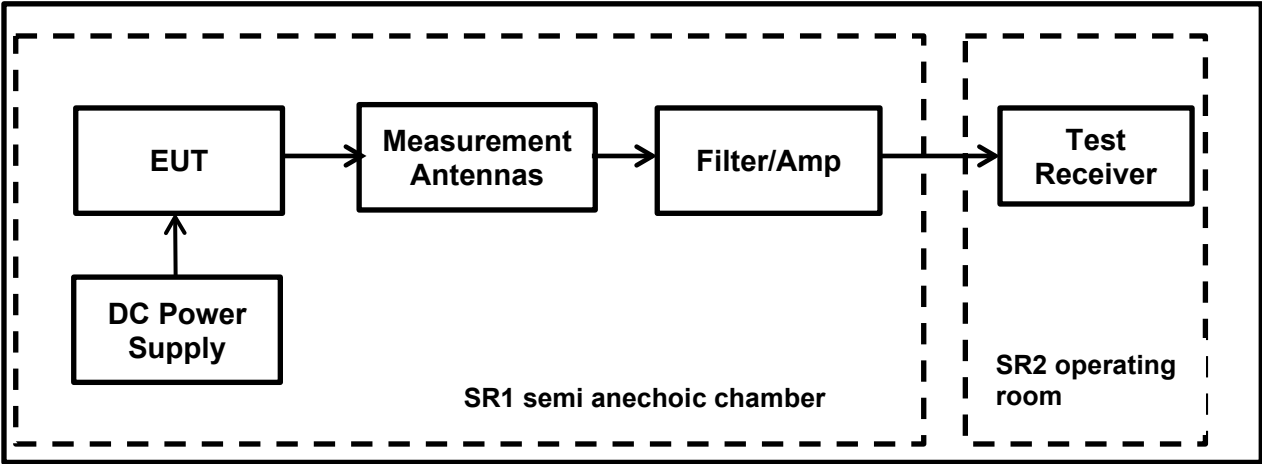
Temperature (°C):	23.8
Relative Humidity (%):	51.2

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.

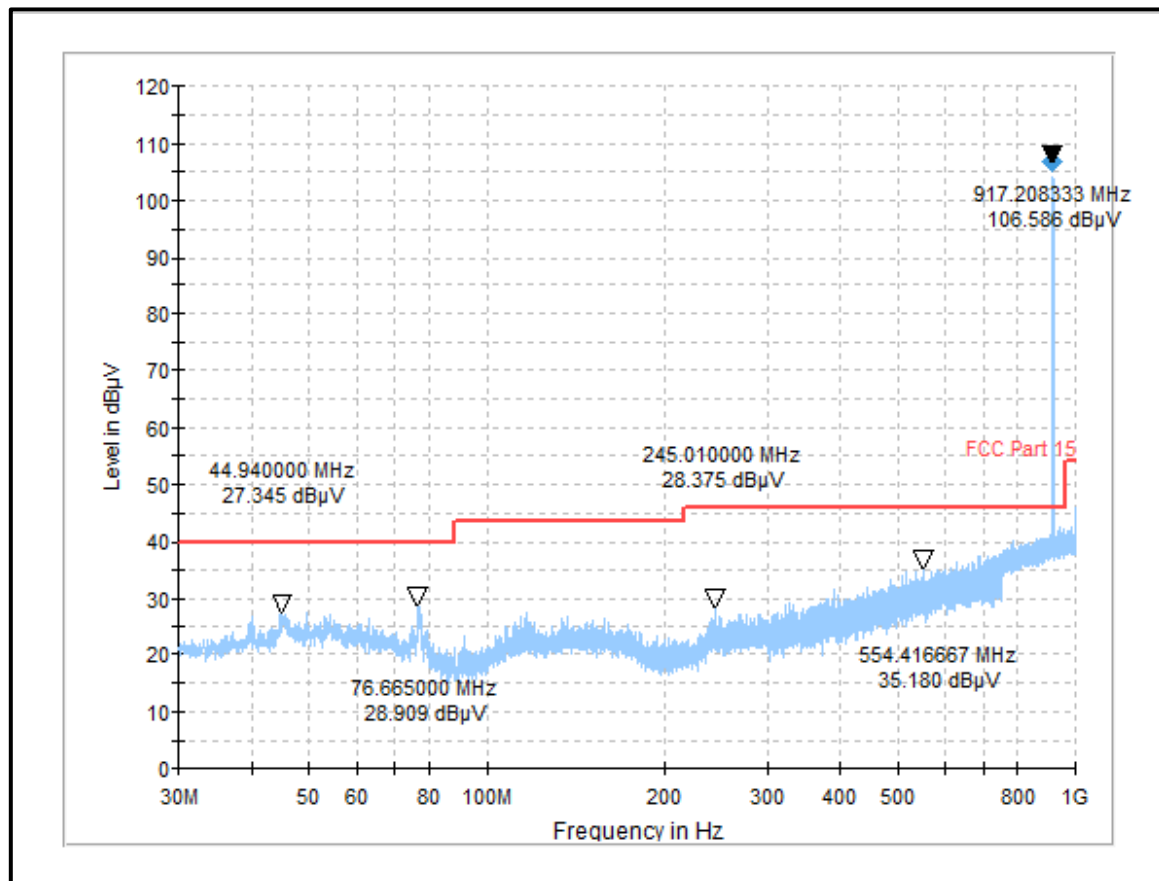
Transmitter Radiated Emissions (continued)

Test Setup:



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

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

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

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

Test Engineer:	Sercan Usta	Test Date:	14 June 2021
Test Sample Serial Number:	LTRA073 F2 0010		
Test Site Identification	SR1/2		

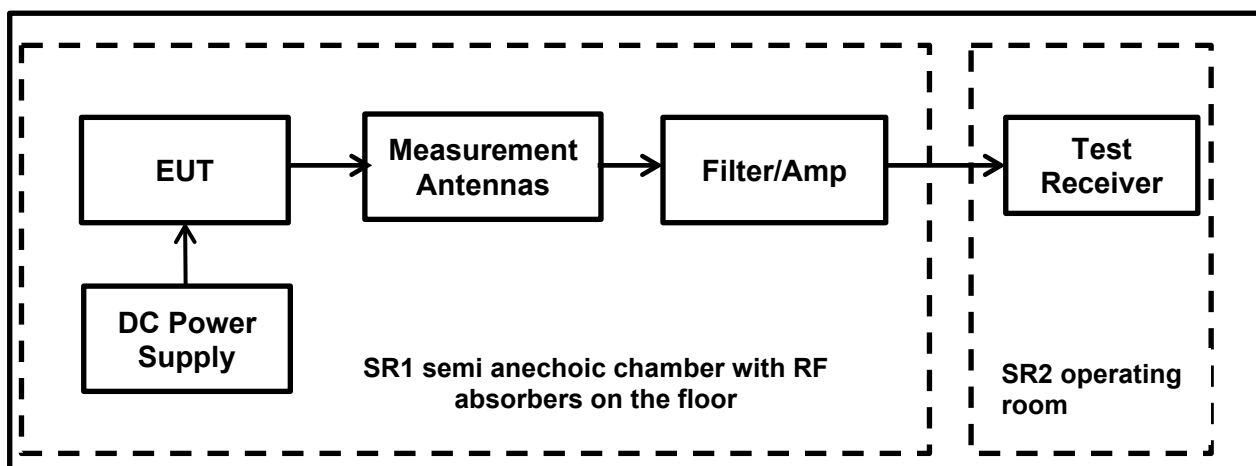
FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	FCC KDB 558074 Sections 8.5 & 8.6 referencing ANSI C63.10 Sections 11.11 and 11.12 ANSI C63.10:2013 Sections 6.3 and 6.6
Frequency Range	1 GHz to 10 GHz

Environmental Conditions:

Temperature (°C):	23.8
Relative Humidity (%):	40.3

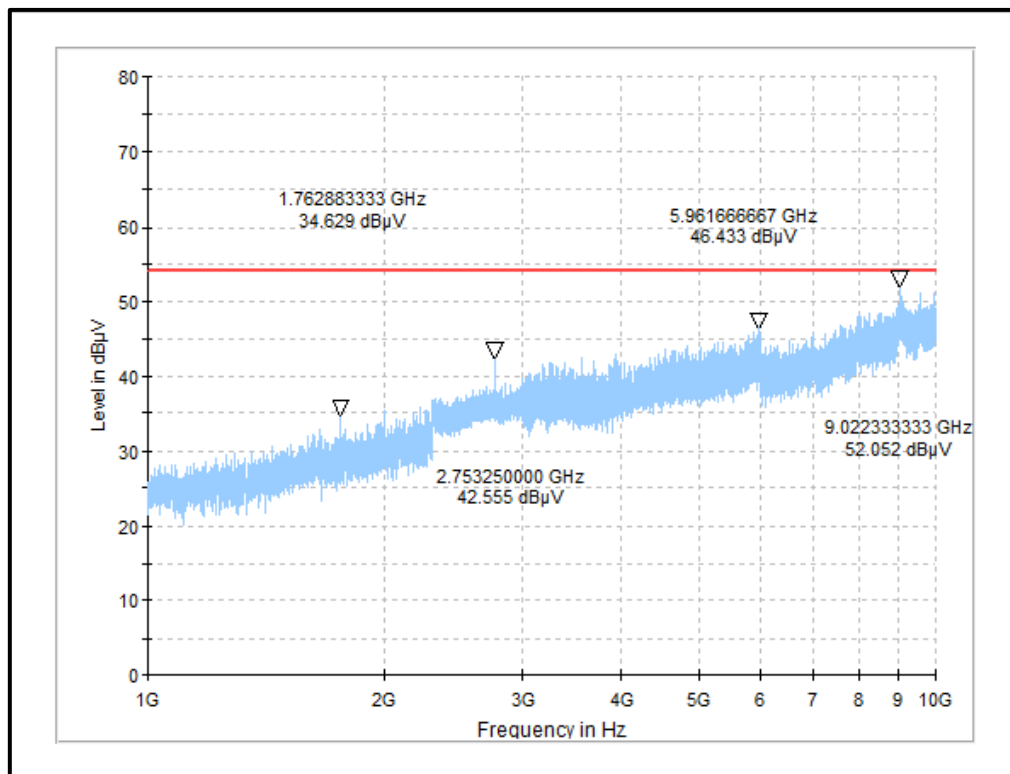
Note(s):

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 μ V/m)	Limit (dB μ 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:**

Test Engineer:	Sercan Usta	Test Date:	08 July 2021
Test Sample Serial Number:	LTRA073 F2 0010		
Test Site Identification	SR 1/2		

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
	ANSI C63.10:2013 Sections 6.10.4

Environmental Conditions:

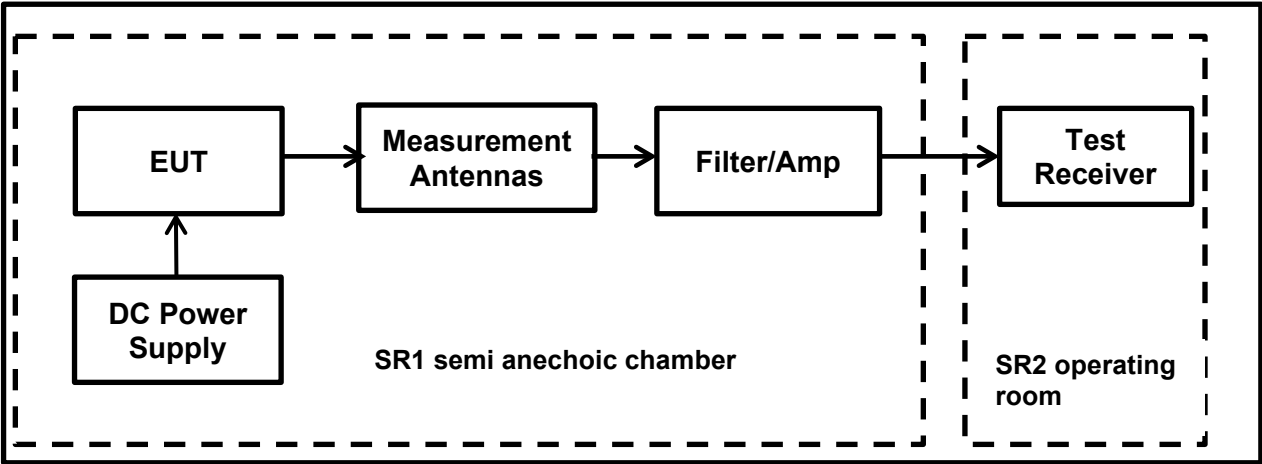
Temperature (°C):	24.3
Relative Humidity (%):	45.6

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. As the EUT complies with the conducted power limits based on the use of RMS averaging over a time interval, in accordance with FCC 15.247(d) emissions radiated outside of the specified operating frequency bands, shall be attenuated by at least 30 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 average conducted output power was previously measured, in accordance with ANSI C63.10 Section 11.11.1(b) band edge measurements were performed with a peak detector and the -30 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:

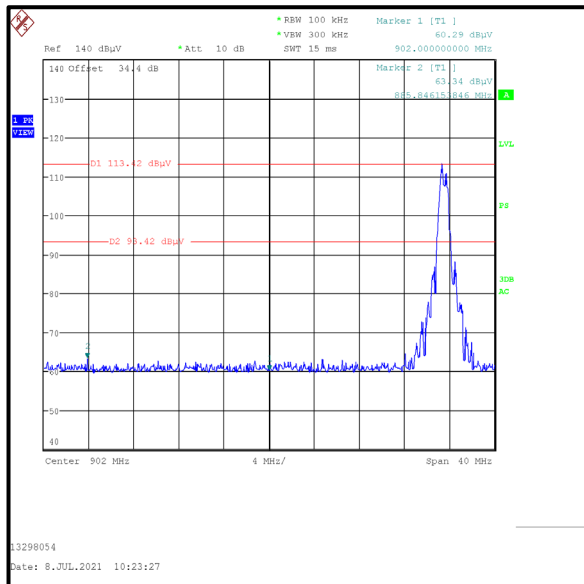
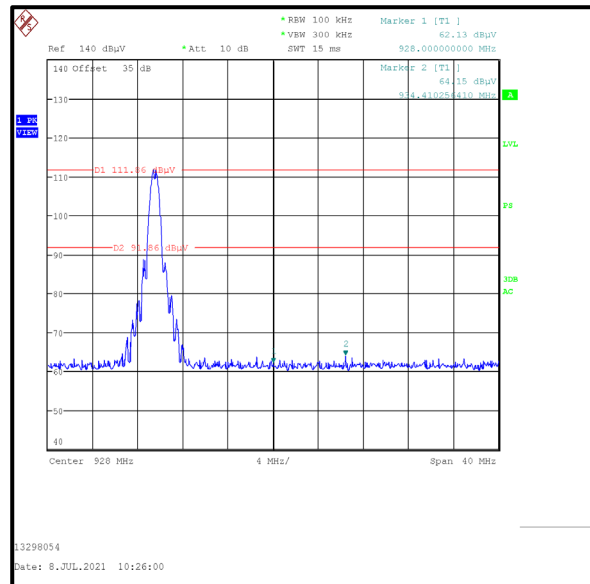


Transmitter Band Edge Radiated Emissions (Continued)**Results: Lower Band Edge / Peak**

Frequency (MHz)	Antenna Polarization	Peak Level (dB μ V/m)	-30 dBc Limit (dB μ V/m)	Margin (dB)	Result
885.85	Horizontal	63.34	83.42	20.08	Complied
902.00	Horizontal	60.29	83.42	23.13	Complied

Results: Upper Band Edge / Peak

Frequency (MHz)	Antenna Polarization	Peak Level (dB μ V/m)	-30 dBc Limit (dB μ V/m)	Margin (dB)	Result
928.00	Horizontal	62.13	81.86	19.73	Complied
934.41	Horizontal	64.15	81.86	17.71	Complied

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

Note: Although Plot indicate -20 dBc lines, as the maximum average conducted output power was measured, -30 dBc limit applied.

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 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	-	-	Initial Version
Test Report Version 1.1 supersede Version 1.0 with immediate effect Test Report No. UL-RPT-RP-13298054-1816-FCC Version 1.1, Issue Date 10 NOVEMBER 2021 replaces Test Report No. UL-RPT-RP-13298054-1816-FCC Version 1.0, Issue Date 09 NOVEMBER 2021, which is no longer valid.			
1.1	As below	As below	Current Version
	26	5.2.5	Results table's column 5 corrected to 'Conducted Output Power Limit (dBm)'
	40	7	Test site: SR 9- Equipment ID 637- Calibration Date corrected to 13/07/2021