

ROBE LIGHTING S.R.O

TEST REPORT

SCOPE OF WORK

HUMAN RF EXPOSURE – DMX/RDM MODULE, TYPE RW 001

REPORT NUMBER

105040075ATL-002B

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HUMAN RF EXPOSURE TEST REPORT

(FULL COMPLIANCE)

Report Number: 105040075ATL-002B

Project Number: G105040075

Report Issue Date: June 23, 2022

Report Revision Date: February 5, 2023

Model(s) Tested: DMX/RDM MODULE, TYPE RW 001

Standards: CFR47 FCC §1.1310 (2022),
CFR47 FCC §1.1307(b) (2022),
CFR47 FCC §2.1093 (2022),
RSS-102 (2021)

Tested by:
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Client:
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1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary

Section	Test full name	Result
3	Client Information	--
4	Description of Equipment Under Test and Variant Models	--
5	System Setup and Method	--
6	Human RF exposure CFR47 FCC §1.1310 (2022), CFR47 FCC §1.1307(b) (2022), CFR47 FCC §2.1093 (2022), RSS-102 (2021)	Pass
7	Revision History	--

3 Client Information

This EUT was tested at the request of:

Client: ROBE Lighting s.r.o.
 Hazovice 2090
 Roznov pod Radhostem
 Czech Republic

Contact: Libor Blinka
Telephone: +420 (5) 7166-9272
Email: libor.blinka@robe.cz

4 Description of Equipment Under Test and Variant Models

Manufacturer: ROBE Lighting s.r.o.
 Hazovice 2090
 Roznov pod Radhostem
 Czech Republic

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
DMX/RDM MODULE, TYPE RW 001	ROBE Lighting s.r.o.	DMX/RDM Module, Type RW001	201217
External AC Adapter	Sunny Computer Technology Europe S.R.O	SYS1421-0605-W2E	N/A

Receive Date:	06/06/2022
Received Condition:	Good
Type:	Production

Description of Equipment Under Test (provided by client)

ROBE wireless DMX/RDM module has full support for wireless communication protocols at entertainment market. Modul is based on well known LumenRadio RF technology, with implemented wire interface for connection with Robe products. RF output for MCX interface antenna as standard output.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Power	Rated Frequency	Number of Phases
100-240 VAC	0.5 Amps	50/60 Hz	Single

Note: Output is +5VDC at 1.2 Amps

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Continuously transmitting

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	None

Radio/Receiver Characteristics	
Frequency Band(s)	2402-2480 MHz
Modulation Type(s)	GFSK
Data Rates	250 kbps
Power Setting During Test	Max
Maximum Output Power	Low Channel (2401.988): +22.07 dBm (Conducted) Mid Channel (2440.018 MHz): +21.579 dBm (Conducted) High Channel (2480.042 MHz): +20.623 dBm (Conducted)
Test Channels	Low Channel (2402 MHz) Mid Channel (2440 MHz) High Channel (2480 MHz)
Occupied Bandwidth	Low Channel (2402.1 MHz): 854.1 kHz Mid Channel (2440 MHz): 846.36 kHz High Channel (2480 MHz): 852.03 kHz
20 dB Bandwidth	Low Channel (2402.1 MHz): 875.3 kHz Mid Channel (2440 MHz): 872.5 kHz High Channel (2480 MHz): 880.8 kHz
Frequency Hopper: Number of Hopping Channels	75 hopping channels
Frequency Hopper: Channel Dwell Time	225 ms
Frequency Hopper: Max interval between two instances of use of the same channel	50.5 ms
MIMO Information (# of Transmit and Receive antenna ports)	3
Equipment Type	Standalone
Antenna Type and Gain	PCB (Johanson Technology: P/N 2450AT18A100), 0.5 dBi External (Sectron: AW-A24G-2M260), 0 dBi External, (TopBlue: TP-928) +2.0 +/- 0.5 dBi

Antenna Requirement – FCC: Section 15.203

The PCB antenna is a mounted antenna and the antenna is permanently attached to the board. The board also provides an MCX connection for external antenna. This satisfies the requirements of Section 15.203.

Variant Models:

The following variant models were not tested as part of this evaluation, but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

None

5 Human RF Exposure

5.1 Maximum Permissible Exposure (MPE) Calculation

FCC Human RF Exposure Limits:

The FCC §1.1310 The criteria listed in table 1 was used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices shall be evaluated according to the provisions of §2.1093 of this chapter.

Part §1.1310 Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/f	*900/f ²	6
30-300	61.4	0.163	1.0	6
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*100	30
1.34-30	824/f	2.19/f	*180/f ²	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

(1) Occupational/controlled exposure limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when a person is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure. The phrase *fully aware* in the context of applying these exposure limits means that an exposed person has received written and/or verbal information fully explaining the potential for RF exposure resulting from his or her employment. With the exception of *transient* persons, this phrase also means that an exposed person has received appropriate training regarding work practices relating to controlling or mitigating his or her exposure. Such training is not required for *transient* persons, but they must receive written and/or verbal information and notification (for example, using signs) concerning their exposure potential and appropriate means available to mitigate their exposure. The phrase *exercise control* means that an exposed person is allowed to and knows how to reduce or avoid exposure by administrative or engineering controls and work practices, such as use of personal protective equipment or time averaging of exposure.

(2) General population/uncontrolled exposure limits apply in situations in which the general public may be exposed, or in which persons who are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

RSS-102 Issue 5 Exposure Limits:

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)				
Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²¹	83	90	-	Instantaneous*
0.1-10	-	0.73/ f	-	6**
1.1-10	87/ f ^{0.5}	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ f ^{0.25}	0.1540/ f ^{0.25}	8.944/ f ^{0.5}	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 f ^{0.3417}	0.008335 f ^{0.3417}	0.02619 f ^{0.6834}	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ f ^{1.2}
150000-300000	0.158 f ^{0.5}	4.21 x 10 ⁻⁴ f ^{0.5}	6.67 x 10 ⁻⁵ f	616000/f ^{1.2}

Note: f is frequency in MHz.
* Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

1.2 Summary:

An MPE calculation was performed to show that the device is compliant with FCC Part 2.1091. The maximum power density was calculated for each transmitter at a separation distance of 20 cm.

For each transmitter the maximum RF exposure at a 20 cm distance using the formula:

$$ConductedPower_{mW} = 10^{ConductedPower(dBm)/10}$$

$$PowerDensity = \frac{ConductedPower_{mW} \times Ant.Gain}{4\pi \times (20_{cm})^2}$$

Power Density = [EIRP] / [4π x (D_{cm})²]

The maximum conducted power of 22.07dBm at 2401.988MHz from Intertek report #: 105040075ATL-001d (page 9) was used to calculate the maximum power density at a separation distance of 20 cm.

EIRP = Conducted power + Array Gain + Antenna gain in dBi
 = 22.07 + 0.5 dB + 2 dBi
 = **24.57 dBm** or **286.4mW**

Power Density = [EIRP] / [4π x (D_{cm})²]
 = [286.4] / [4π x (20cm)²]
 = [286.4] / [5026.55]
 = **0.0570 mW/cm²** or **0.0000570 W/m²**

FCC CFR47 Part §1.1310 Limit at 2401.998 MHz = 1 mW/cm²

RSS-102 Issue 5 Exposure Limit at 2401.998 MHz is 0.02619*f^(0.6834) = 0.02619*2401.99^(0.6834) or 5.351 W/m²

The calculated maximum power density at 20 cm distance is less than the limit for general population / uncontrolled exposure for both FCC CFR47 §1.1310 Limits for Maximum Permissible Exposure (MPE) and RSS-102 ISSUE 5 Exposure Limit. The EUT met the Maximum Permissible Exposure (MPE) limit.

Result: SAR measurement not required.

6 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	06/23/2022	105040075ATL-002	<i>DA</i>	KPS <i>LPS</i>	Original Issue
1	09/30/2022	105040075ATL-002a	<i>DA</i>	KPS <i>LPS</i>	Address correction on page 2 and calculation based on max power.
2	02/05/2023	105040075ATL-002B	Jeff H.	KPS <i>LPS</i>	Updated MPE calculation