SAR EVALUATION REPORT

FCC 47 CFR § 2.1093
IEEE Std. 1528-2013

For
DJI Ronin 4D Video Transmitter

Model: TX2

FCC ID: 2ANDR-TX2202109

Report Number: 4789980498.1-3-14

Issue Date: October 19, 2021

Prepared for
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Prepared by
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Revision History

Rev.	Date	Revisions	Revised By
V1.0	October 19, 2021	Initial Issue	\

Note:

1. The Measurement result for the sample received is<Pass> according to < IEEE Std. 1528-2013> when <Accuracy Method> decision rule is applied.
2. This report is only published to and used by the applicant, and it is not for evidence purpose in China.

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1. Attestation of Test Results

Applicant Name	SZ DJI Osmo Technology Co.,Ltd.	
Address	4F, Jingkou Community Comprehensive Service Building, No. 83 Bishui Road North, Guangming Street, Guangming District, Shenzhen	
Manufacturer	SZ DJI Osmo Technology Co.,Ltd.	
Address	4F, Jingkou Community Comprehensive Service Building, No. 83 Bishui Road North, Guangming Street, Guangming District, Shenzhen	
EUT Name	DJI Ronin 4D Video Transmitter	
Model	TX2	
Sample Status	Normal	
Sample Received Date	June 07, 2021	
Date of Tested	September 28, 2021 ~ October 19, 2021	
Applicable Standards	FCC 47 CFR § 2.1093 IEEE Std. 1528-2013 KDB publication	
SAR Limits (W/Kg)		
Exposure Category	Peak spatial-average (1g of tissue)	Extremities (hands, wrists, ankles, etc.) (10g of tissue)
General population / Uncontrolled exposure	1.6	4
The Highest Reported SAR (W/kg)		
RF Exposure Conditions	**Frequency Band**	
	5 GHz	**2.4G**
Body (1-g)	0.95	0.215
Simultaneous Transmission (1-g)	1.415	
Test Results	Pass	
Prepared By: Dean Hua Dean Hua Engineer Project Associate	Reviewed By: Shawn Wen Laboratory Leader	Approved By: Stephen Guo Laboratory Manager

2. Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IEEE STD 1528-2013 the following FCC Published RF exposure KDB procedures:

- 248227 D01 802.11 Wi-Fi SAR
- 447498 D01 General RF Exposure Guidance
- 690783 D01 SAR Listings on Grants
- 865664 D01 SAR measurement 100 MHz to 6 GHz
- 865664 D02 RF Exposure Reporting

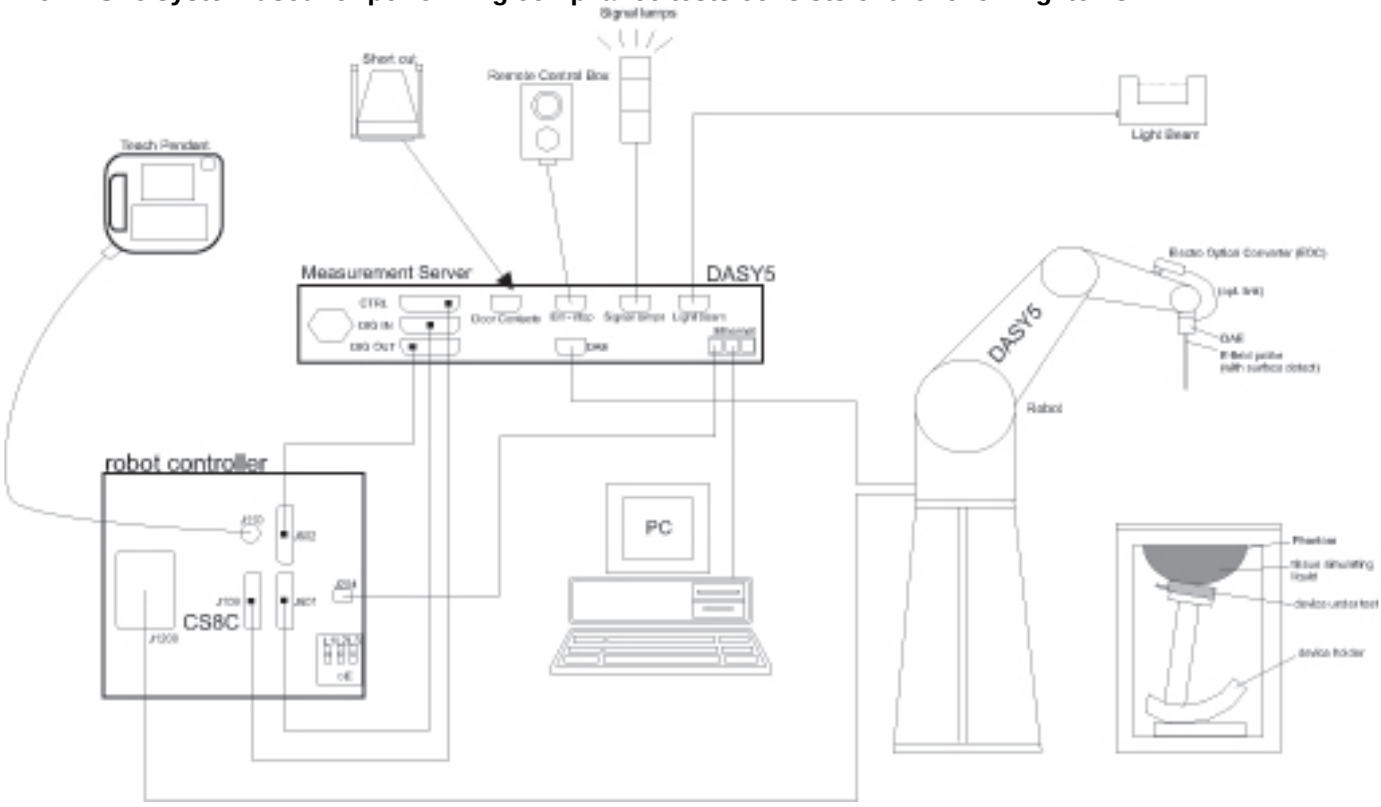
3. Facilities and Accreditation

Test Location	UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch.
Address	Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China
Accreditation Certificate	**A2LA (Certificate No.: 4102.01)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch has been assessed and proved to be in compliance with A2LA. **FCC (FCC Recognized No.: CN1187)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules **IC(Company No.: 21320)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch has been registered and fully described in a report filed with Industry Canada. The Company Number is 21320. **VCCI (Registration No.: G-20019, R-20004, C-20012 and T-20011)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch has been assessed and proved to be in compliance with VCCI, the Membership No. is 3793. Facility Name: Chamber D, the VCCI registration No. is G-20019 and R-20004 Shielding Room B , the VCCI registration No. is C-20012 and T-20011
Description	All measurement facilities use to collect the measurement data are located at Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China

4. SAR Measurement System & Test Equipment

4.1. SAR Measurement System

The DASY5 system used for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running Win7 and the DASY52 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

4.2. SAR Scan Procedures

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in Db) is specified in the standards for compliance testing. For example, a 2 Db range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 Db is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Area Scan Parameters extracted from KDB 865664 D01 v01r04 SAR Measurement 100 MHz to 6 GHz

<table>
<tr><td></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td>Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td>Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
</table>

Step 3: Zoom Scan

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

Zoom Scan Parameters extracted from KDB 865664 D01 v01r04 SAR Measurement 100 MHz to 6 GHz

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ 1.5·$\Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.

* When zoom scan is required and the *reported* SAR from the area scan based *1-g SAR estimation* procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

Step 4: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in Db from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

Step 5: Z-Scan (FCC only)

The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation the extrapolated distance should not be greater than the step size in Z-direction.

4.3. Test Equipment

The measuring equipment used to perform the tests documented in this report has been calibrated in accordance with the manufacturers' recommendations, and is traceable to recognized national standards.

Name of equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
ENA Network Analyzer	Keysight	E5080A	MY55100583	2021.12.04
Dielectric Probe kit	SPEAG	SM DAK 040 SA	1155	NCR
DC power supply	Keysight	E36103A	MY55350020	2021.12.04
Signal Generator	Rohde & Schwarz	SME06	837633\001	2021.12.04
BI-Directional Coupler	WERLATONE	C8060-102	3423	2021.12.04
Peak and Average Power Sensor	Keysight	E9323A	MY55440013	2021.12.05
Peak and Average Power Sensor	Keysight	E9323A	MY55420006	2021.12.05
Dual Channel PK Power Meter	Keysight	N1912A	MY55416024	2021.12.05
Amplifier	CORAD TECHNOLOGY LTD	AMF-4D-00400600-50-30P	1983561	NCR
Dosimetric E-Field Probe	SPEAG	EX3DV4	7383	2021.11.30
Data Acquisition Electronic	SPEAG	DAE3	427	2022.4.08
Dipole Kit 2450 MHz	SPEAG	D2450V2	977	2021.12.04
Dipole Kit 5 GHz	SPEAG	D5GHzV2	1231	2021.12.07
Software	SPEAG	DASY52	N/A	NCR
Twin Phantom	SPEAG	SAM V5.0	1805	NCR
ELI Phantom	SPEAG	ELI V5.0	1235	NCR
Thermometer	/	GX-138	150709653	2021.12.09
Thermometer	VICTOR	ITHX-SD-5	18470005	2021.12.10

Note:

1) Per KDB865664D01 v01r04 requirements for dipole calibration, the test laboratory has adopted three-year extended calibration interval. Each measured dipole is expected to evaluate with the following criteria at least on annual interval in Appendix C.

a) There is no physical damage on the dipole;

b) System check with specific dipole is within 10% of calibrated value;

c) The most recent return-loss result, measured at least annually, deviates by no more than 20% from the previous measurement. Refer to App E dipole calibration record.

d) The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within 5Ω from the previous measurement. Refer to App E dipole calibration record.

e) Network analyzer probe calibration against air, distilled water and a shorting block performed before measuring liquid parameters.

5. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and 10-g SAR within a frequency band is < 3.75 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std. 1528-2013 is not required in SAR reports submitted for equipment approval. The equivalent ratio (1.5/1.6) is applied to extremity and occupational exposure conditions.

6. Device Under Test (DUT) Information

6.1. DUT Description

The DUT named DJI Ronin 4D Video Transmitter uses the DJI™ O3 image transmission technology to establish a wireless connection to Video transmitter. Users can monitor the camera live view and control the camera via the monitor. Hand grips can be mounted to the remote monitor cage on the monitor for remote control. It has 4 antennas supporting two of them transmitter in simultaneous in group ant 0&1, ant 0&3, ant 2&1, ant 2&3.	
Dimension	Overall (Length x Width x Height): 300 mm x 260 mm x 260 mm

6.2. Wireless Technology

Frequency band	Bandwidth		Modulation
	Narrow Band	Wide Band	
2.4 GHz 2400-2483.5 MHz	1.4 MHz,3 MHz	10MHz, 20MHz, 40MHz	OFDM
5.2 GHz 5150-5350MHz	/	20MHz, 40MHz	
5.6 GHz 5470-5725MHz	/	20MHz, 40MHz	
5.8 GHz 5725-5850MHz	1.4 MHz,3 MHz	10MHz, 20MHz, 40MHz	

7. Conducted Output Power Measurement and tune-up tolerance

7.1. Power measurement result

Frequency Band	Bandwidth	Channel/ Frequency	ant0		ant1		ant2		ant3	
			tune up	Output Power	tune up	Output Power	tune up	Output Power	tune up	Output Power
2.4G	1.4M	2403.5	13	12.43	13	13	13.5	12.56	13	12.67
		2435.5		12.64		12.48		13.02		12.7
		2469.5		12.93		12.23		12.82		12.43
	1.4M CA Mode	2405.12	13.5	13.15	14	**13.51**	13.5	13.11	13	12.82
		2437.12		12.93		12.82		12.62		12.76
		2471.12		**13.23**		12.47		12.02		12.39
	3M	2404.5	13	12.87	13	12.88	13	12.75	13	12.39
		2434.5		12.46		12.54		12.84		12.62
		2467.5		12.56		12.08		12.57		12.26
	3M CA Mode	2407.2	13.5	12.99	13	12.97	13.5	**13.14**	13	12.52
		2437.2		12.85		12.77		13.13		**12.84**
		2470.2		13.05		12.44		12.87		12.43
	10M	2407.5	23.5	23.14	23.5	23.01	23	**22.93**	23.5	**23.03**
		2437.5		22.85		22.29		22.86		22.94
		2467.5		22.63		22.27		22.35		22.04
	20M	2412.5	23.5	22.8	23.5	**23.14**	22.5	22.46	23	21.85
		2437.5		**23.23**		22.71		22.43		22.51
		2462.5		23.03		22.72		22.38		22.58
	40M	2422.5	21.5	20.21	21	20.2	20.5	19.76	20.5	19.88
		2437.5		21.1		20.4		20.22		20.18
		2452.5		20.43		20.58		19.93		20.22
5.2G	20M	5180	12	10.92	13	11.97	12.5	11.55	12.5	11.67
		5200		11.66		12.64		11.95		12.16
		5240		11.71		12.41		12.22		11.79
	40M	5190	14.5	14.43	15.5	14.78	15	14.83	14.5	14.34
		5230		14.45		15.04		14.73		14.39
	20M	5260	19.5	18.51	19	18.53	19	18.83	19	**18.91**
		5300		19.02		18.15		18.01		18.39
		5320		**19.16**		18.17		16.91		18.62
	40M	5270	18.5	18.42	20	**19.85**	19.5	**19.02**	19	18.72
		5310		18.21		19.43		17.75		18.86
5.5G	20M	5500	18.5	17.07	19.5	18.93	19	17.85	18.5	18.09
		5600		18.16		18.66		18.36		17.87
		5700		18.02		19.24		18.24		17.86
	40M	5510	19.5	18.75	20.5	19.36	20	18.84	19.5	**19.35**
		5590		18.87		**20.15**		**19.98**		19.14
		5670		**19.03**		18.86		19.24		18.21
5.8G	1.4M	5726.5	13.5	**13.16**	12.5	12.02	12.5	11.57	12.5	12.35
		5786.5		11.57		11.54		12.16		12.13

		5846.5		11.41		11.56		12.38		12.42
	1.4M CA Mode	5728.12	13	12.74	12	11.94	12.5	11.46	12.5	12.37
		5788.12		11.56		11.67		12.07		12.12
		5848.12		12.42		11.53		12.36		12.42
	3M	5727.5	13	12.75	12.5	12.11	13	12.17	13	**12.84**
		5787.5		11.38		11.83		12.68		12.64
		5844.5		11.95		11.51		**12.98**		12.52
	3M CA Mode	5730.2	13.5	13.11	13.5	12.33	13	11.06	13	11.86
		5790.2		12.46		**13.31**		12.47		12.62
		5847.2		12.86		13.03		12.78		12.38
	10M	5730.5	23.5	**23.13**	23	22.69	23	22.06	22.5	22.04
		5786.5		22.42		22.14		22.63		21.73
		5844.5		22.13		21.88		22.82		21.52
	20M	5735.5	23	22.67	23.5	**23.17**	23.5	22.21	23	22.58
		5786.5		21.23		22.67		22.92		22.25
		5839.5		22.21		22.34		**23.21**		**22.64**
	40M	5745.5	17.5	17.21	19	18.63	18.5	17.04	19	18.58
		5786.5		16.05		17.92		17.84		17.94
		5829.5		16.56		17.87		18.11		17.83

Note:

1) As per KDB 447498 sec.4.1.d) at the maximum rated output power and within the tune-up tolerance range specified for the product, but not more than 2 dB lower than the maximum tune-up tolerance limit.
2) For the sef-defined 2.4G and 5GHz technology, the maximum output power mode was selected to performed SAR testing per each narrow band and wide band.

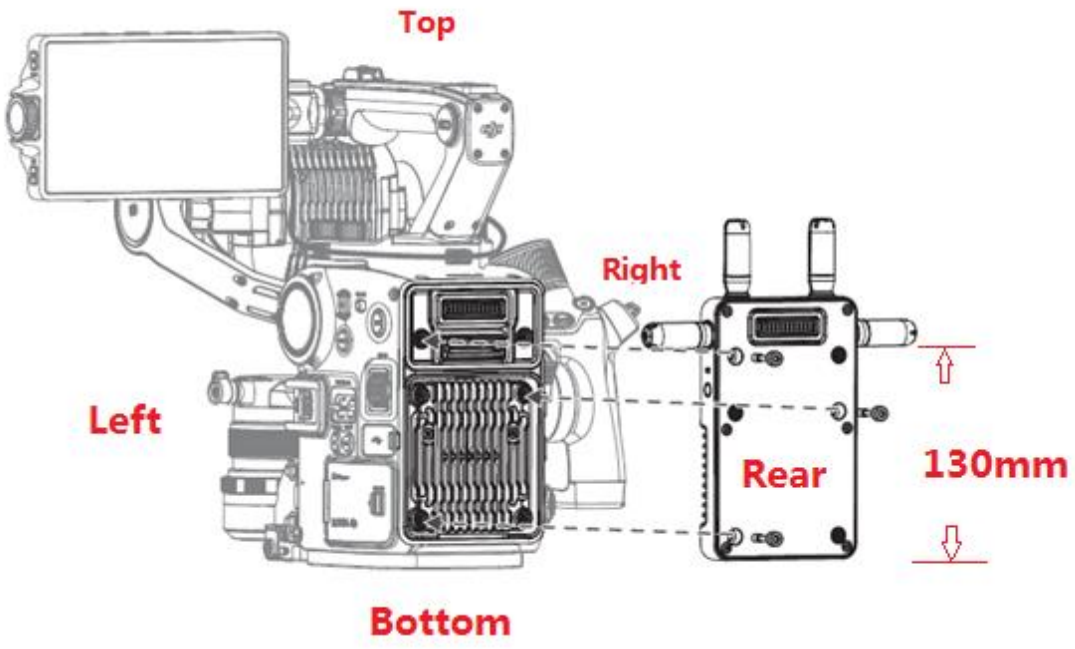
8. RF Exposure Conditions

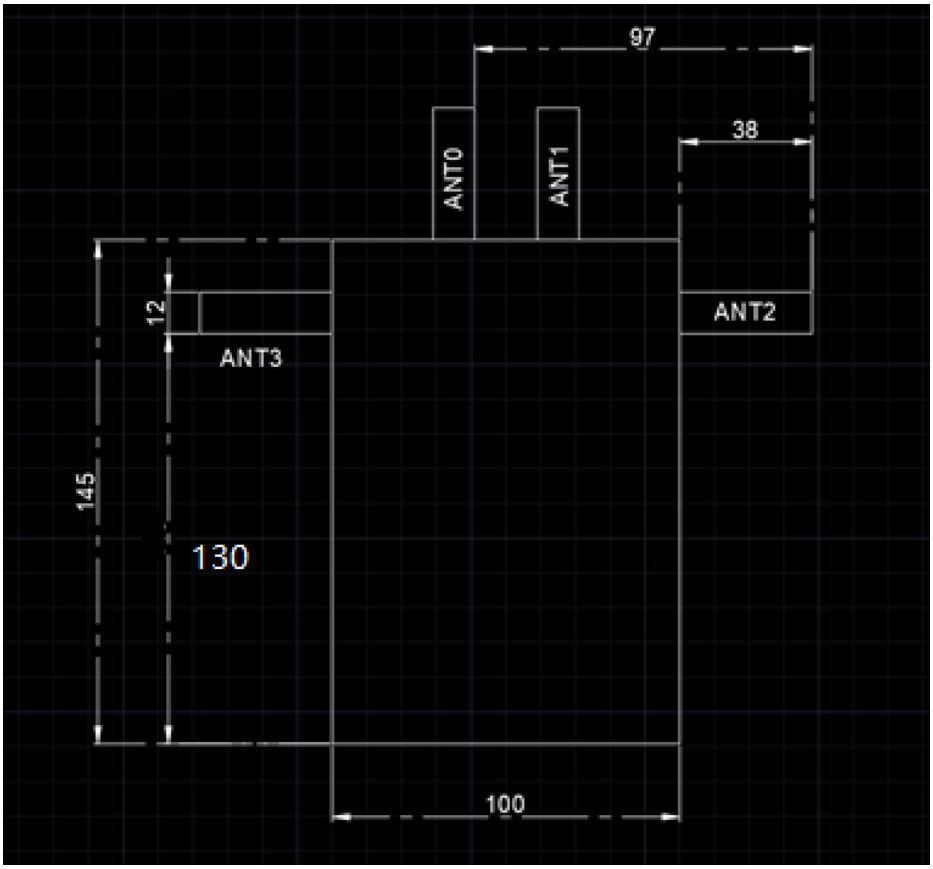
According to the description of the user manual, the EUT will be used the DJITM O3 image transmission technology to establish a wireless connection to Video transmitter. Users can monitor the camera live view and control the camera via the monitor. Hand grips can be mounted to the remote monitor cage on the monitor for remote control as below photos.

According to the product instructions, when people operating this device, the people will grasp the left and right sides of handle, the Left/ Right hands is exposed to the RF radiation. The minimum distance from the antenna of EUT to the arm is 45mm.The rear surface will close to the human chest and the minimum use distance is 200mm. Please refer to Appendix A, “Photographs showing intended use and supporitng test separation distances”.

When the operator sits down and the device is placed on the legs for operation, the Bottom surface will contact the human thigh, the minimum distance of antenna to the bottom surface is 130mm.

There is a screen at the top surface for monitoring, this surface will not close to any part of body, also the Front surface is far away the body. So Top surface/Front do not need to be evaluated.





Per FCC KDB 447498 D01:
1. The 1-g SAR and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for product specific 10-g SAR, where:

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

2. The SAR exclusion threshold for distances >50mm is defined by the following equation, as illustrated in KDB 447498 D01 Appendix B:
a) at 100 MHz to 1500 MHz
[Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm)·(f(MHz)/150)] mW
b) at > 1500 MHz and ≤ 6 GHz
[Power allowed at numeric Threshold at 50 mm in step 1) + (test separation distance - 50 mm)·10] mW

3. The test separation distances required for a device to demonstrate SAR or MPE compliance must be sufficiently conservative to support the operational separation distances required by the device and its antennas and radiating structures. For devices such as tablets and transmitters embedded in keyboard sections of laptop computers that are typically used in close proximity to users, the test separation distance is determined by the smallest distance between the outer surface of the device and the user. For larger devices, as the antenna operational separation distance increases to where the SAR characteristics of the device and its antennas are not directly influenced by the user, such as antennas along the top and upper side edges of laptop computer displays or opposite and adjacent edges of tablets, the test separation distance is normally determined by the closest separation between the antenna and the user.

The FCC SAR evaluation is not required according the following calculation for exclusion.

Left Surface for Ant 0/3:
Right Surface for Ant 1/2:

Frequency (MHz)		Frequency (MHz)	Power (dBm)	Power (mW)	Separation Distance (mm)	Calculated Result	Threshold	SAR Test
2.4G	Narrow Band	2471.12	14.0	25.12	45	0.877	3.0	Excluded
	Wide Band	2467.5	23.5	223.87	45	7.815	3.0	Required
5.2G	Narrow Band	/	/	/	/	/	/	Excluded
	Wide Band	5310	20	100	45	5.121	3.0	Required
5.6G	Narrow Band	/	/	/	/	/	/	Excluded
	Wide Band	5670	20.5	112.2	45	5.937	3.0	Required
5.8G	Narrow Band	5847.2	13.5	22.39	45	1.203	3.0	Excluded
	Wide Band	5844.5	23.5	223.87	45	12.027	3.0	Required

Left Surface for Ant 1/2:
Right Surface for Ant 0/3:

Frequency (MHz)		Frequency (MHz)	Power (dBm)	Power (mW)	Power allowed at 50mm	Separation Distance (mm)	Calculated Result(mW)	SAR Test
2.4G	Narrow Band	2471.12	14.0	25.12	95.42	142	1015.42	Excluded
	Wide Band	2467.5	23.5	223.87	95.49	142	1015.49	Excluded
5.2G	Narrow Band	/	/	/	/	/	/	Excluded
	Wide Band	5310	20	100	65.09	142	985.09	Excluded
5.6G	Narrow Band	/	/	/	/	/	/	Excluded
	Wide Band	5670	20.5	112.2	62.99	142	982.99	Excluded
5.8G	Narrow Band	5847.2	13.5	22.39	62.03	142	982.03	Excluded
	Wide Band	5844.5	23.5	223.87	62.05	142	982.05	Excluded

Note:
The separation distance is, the distance from antenna to the edge of EUT+ the distance from edge of EUT to the arm.

Rear Surface:

Frequency (MHz)		Frequency (MHz)	Power (dBm)	Power (mW)	Power allowed at 50mm	Separation Distance (mm)	Calculated Result(mW)	SAR Test
2.4G	Narrow Band	2471.12	14.0	25.12	95.42	200	1595.42	Excluded
	Wide Band	2467.5	23.5	223.87	95.49	200	1595.49	Excluded
5.2G	Narrow Band	/	/	/	/		/	Excluded
	Wide Band	5310	20	100	65.09	200	1565.09	Excluded
5.6G	Narrow Band	/	/	/	/		/	Excluded
	Wide Band	5670	20.5	112.2	62.99	200	1562.99	Excluded
5.8G	Narrow Band	5847.2	13.5	22.39	62.03	200	1562.03	Excluded
	Wide Band	5844.5	23.5	223.87	62.05	200	1562.05	Excluded

Bottom Side:

Frequency (MHz)		Frequency (MHz)	Power (dBm)	Power (mW)	Power allowed at 50mm	Separation Distance (mm)	Calculated Result(mW)	SAR Test
2.4G	Narrow Band	2471.12	14.0	25.12	95.42	130	895.42	Excluded
	Wide Band	2467.5	23.5	223.87	95.49	130	895.49	Excluded
5.2G	Narrow Band	/	/	/	/	/	/	Excluded
	Wide Band	5310	20	100	65.09	130	865.09	Excluded
5.6G	Narrow Band	/	/	/	/	/	/	Excluded
	Wide Band	5670	20.5	112.2	62.99	130	862.99	Excluded
5.8G	Narrow Band	5847.2	13.5	22.39	62.03	130	862.03	Excluded
	Wide Band	5844.5	23.5	223.87	62.05	130	862.05	Excluded

According to above evaluated, the EUT should be performed SAR measurement at Left surface and Right surface, test distance is 45mm (from the edge of antenna to the inside of the arm), however the length of the handle exceeds 45mm, the test cannot be carried out according to the plan, moreover, if unloading the handle, the device cannot work normally. But in order to evaluate SAR more strictly, we removed the handle, the EUT is placed under the phantom, and the edge of antenna is 45mm away from phantom for testing.

9. Dielectric Property Measurements & System Check

9.1. Dielectric Property Measurements

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized.
The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.
Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

Tissue Dielectric Parameters

FCC KDB 865664 D01 v01r04 SAR Measurement 100 MHz to 6 GHz

Target Frequency (MHz)	Head		Body	
	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5000	36.2	4.45	49.3	5.07
5100	36.1	4.55	49.1	5.18
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5400	35.8	4.86	48.7	5.53
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5700	35.4	5.17	48.3	5.88
5800	35.3	5.27	48.2	6.00

IEEE Std 1528-2013
Refer to Table 3 within the IEEE Std 1528-2013

Dielectric Property Measurements Results:

Liquid	Freq.	Liquid Parameters				Deviation(%)		Limit (%)	Temp. (℃)	Test Date
		Measured		Target						
		ε_r	σ	ε_r	σ	ε_r	σ			
Head 2450	2360	40.88	1.75	39.36	1.72	3.86	1.74	±5	21.3	2021.10.18
	2450	40.81	1.86	39.2	1.8	4.11	3.33			
	2540	40.33	1.88	39.09	1.9	3.17	-1.05			
Head 5250	5160	36.77	4.66	36.03	4.61	2.05	1.08	±5	21.3	2021.10.18
	5250	36.28	4.78	35.93	4.71	0.97	1.49			
	5340	36.18	4.79	35.83	4.8	0.98	-0.21			
Head 5600	5500	36.18	4.92	35.64	4.96	1.52	-0.81	±5	21.3	2021.10.18
	5600	35.78	5.05	35.53	5.07	0.70	-0.39			
	5700	35.2	5.11	35.41	5.17	-0.59	-1.16			
Head 5750	5660	35.72	5.04	35.46	5.13	0.73	-1.75	±5	21.3	2021.10.18
	5750	34.61	5.21	35.36	5.22	-2.12	-0.19			
	5840	34.23	5.31	35.27	5.3	-2.95	0.19			

9.2. System Check

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

System Performance Check Measurement Conditions:

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ±0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm for measurements > 3 GHz.
- The DASY system with an E-Field Probe was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm (above 1GHZ) and 15mm (below 1GHz) from dipole center to the simulating liquid surface.
- For area scan, standard grid spacing for head measurements is 15 mm in x- and y- dimension(≤2GHz), 12 mm in x- and y-dimension(2-4 GHz) and 10mm in x- and y- dimension(4-6GHz).
- For zoom scan, Δ x_{zoom}, Δ y_{zoom}≤ 2GHz - ≤8mm, 2-4GHz - ≤5 mm and 4-6 GHz-≤4mm; Δ z_{zoom} ≤3GHz - ≤5 mm, 3-4 GHz- ≤4mm and 4-6GHz-≤2mm.
- Distance between probe sensors and phantom surface was set to 3 mm except for 5 GHz band. For 5GHz band, Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was set to 100 mW or 250 mW depend on the certificate of the dipoles.
- The results are normalized to 1 W input power.

System Check Results

The 1-g and 10-g SAR measured with a reference dipole, using the required tissue-equivalent medium at the test frequency, must be within 10% of the manufacturer calibrated dipole SAR target.

T.S. Liquid		Measured Results		Target (Ref. value)	Delta (%)	Limit (%)	Temp. (℃)	Test Date
		Zoom Scan (W/Kg)	Normalize to 1W (W/Kg)					
Head 2450	1-g	5.35	53.5	53.7	-0.37	±10	21.3	2021.10.18
	10-g	2.43	24.3	25	-2.80	±10		
Head 5250	10-g	7.74	77.4	78.6	-1.53	±10	21.3	2021.10.18
	10-g	2.2	22	22.5	-2.22	±10		
Head 5600	10-g	8.61	86.1	80.4	7.09	±10	21.3	2021.10.18
	10-g	2.43	24.3	22.5	8.00	±10		
Head 5750	1-g	8.38	83.8	80	4.75	±10	21.3	2021.10.18
	10-g	2.4	24	22.8	5.26	±10		

10. Measured and Reported (Scaled) SAR Results

As per KDB 447498 sec.4.1.e), When SAR or MPE is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as reported.

Scaled SAR calculation formula:

Scaled SAR = Tune-up in mW / Conducted power in mW * Duty cycle (if available) * SAR value

SAR Test Reduction criteria are as follows:

KDB 447498 D01 General RF Exposure Guidance:

A）Per KDB447498 D01 v06, all SAR measurement results are scaled to the maximum tune-up tolerance limit to demonstrate SAR compliance.

B）Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

- ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz.
- ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz.
- ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz.

Per KDB865664 D01 v01r04:

For each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/Kg; if the deviation among the repeated measurement is ≤ 20%, and the measured SAR <1.45W/Kg, only one repeated measurement is required.

Note:
The same procedure is applied to extremity SAR evaluation, and the corresponding limitation is 2.5 times of 1-g SAR.

10.1. SAR Test Results of 2.4G.

Frequency	Scenario and Distance (45mm)	Test Mode	Channel/ Frequency	Power (dBm)		SAR Value	Power Drift	Duty Factor (%)	Scaled (W/Kg)
				Tune-up	Meas.	1-g (W/kg)			
Ant 0									
2.4G	Left Side	20M	2437.5	23.50	23.23	0.202	0.13	100.00	**0.215**
Ant 1									
2.4G	Right Side	20M	2412.5	23.50	23.14	0.195	-0.05	100.00	**0.212**
Ant 2									
2.4G	Right Side	10M	2407.5	23.0	22.93	0.172	-0.17	100.00	**0.175**
Ant 3									
2.4G	Left Side	10M	2407.5	23.5	23.03	0.087	0.12	100.00	**0.097**

Note:
For all modes the device was put into operation by using an own control software to program the test mode required to select the continuous transmission with 100% duty cycle. The output power of the device was set to transmit at maximum power for all tests.

10.2. SAR Test Results of 5.2G

Frequency	Scenario and Distance (45mm)	Test Mode	Channel/ Frequency	Power (dBm)		SAR Value	Power Drift	Duty Factor (%)	Scaled (W/Kg)
				Tune-up	Meas.	1-g (W/kg)			
Ant 0									
5.2G	Left Side	20M	5320	19.5	19.16	0.279	-0.06	100.00	**0.302**
Ant 1									
5.2G	Right Side	40M	5270	20.0	19.85	0.225	-0.10	100.00	**0.233**
Ant 2									
5.2G	Right Side	40M	5270	19.5	19.02	0.156	0.04	100.00	**0.174**
Ant 3									
5.2G	Left Side	20M	5260	19.0	18.91	0.025	0.03	100.00	**0.025**

Note:
For all modes the device was put into operation by using an own control software to program the test mode required to select the continuous transmission with 100% duty cycle. The output power of the device was set to transmit at maximum power for all tests.

10.3. SAR Test Results of 5.5G

Frequency	Scenario and Distance (45mm)	Test Mode	Channel/ Frequency	Power (dBm)		SAR Value	Power Drift	Duty Factor (%)	Scaled (W/Kg)
				Tune-up	Meas.	1-g (W/kg)			
Ant 0									
5.5G	Left Side	40M	5670	19.5	19.03	0.333	0.17	100.00	**0.371**
Ant 1									
5.5G	Right Side	40M	5590	20.5	20.15	0.120	0.20	100.00	**0.130**
Ant 2									
5.5G	Right Side	40M	5590	20.0	19.98	0.462	0.08	100.00	**0.464**
Ant 3									
5.5G	Left Side	40M	5510	19.5	19.35	0.057	0.07	100.00	**0.057**

Note:
For all modes the device was put into operation by using an own control software to program the test mode required to select the continuous transmission with 100% duty cycle. The output power of the device was set to transmit at maximum power for all tests.

10.4. SAR Test Results of 5.8G.

Frequency	Scenario and Distance (45mm)	Test Mode	Channel/ Frequency	Power (dBm)		SAR Value	Power Drift	Duty Factor (%)	Scaled (W/Kg)
				Tune-up	Meas.	1-g (W/kg)			
Ant 0									
5.8G	Left Side	10M	5730.5	23.5	23.13	0.565	-0.02	100.00	**0.615**
Ant 1									
5.8G	Right Side	20M	5735.5	23.5	23.17	0.391	-0.01	100.00	**0.422**
Ant 2									
5.8G	Right Side	20M	5839.5	23.5	23.21	0.885	0.01	100.00	**0.946**
5.8G	Right Side	20M	5786.5	23.5	22.92	0.831	0.08	100.00	**0.950**
Ant 3									
5.8G	Left Side	20M	5839.5	23.0	22.64	0.428	0.05	100.00	**0.465**

Note:
For all modes the device was put into operation by using an own control software to program the test mode required to select the continuous transmission with 100% duty cycle. The output power of the device was set to transmit at maximum power for all tests.

Worst case with handle									
Frequency	Scenario and Distance (70mm)	Test Mode	Channel/ Frequency	Power (dBm)		SAR Value	Power Drift	Duty Factor (%)	Scaled (W/Kg)
				Tune-up	Meas.	1-g (W/kg)			
Ant 2									
5.8G	Right Side	20M	5839.5	23.5	23.21	0.693	-0.02	100.00	**0.741**

11. Simultaneous Transmission SAR Analysis

Per FCC KDB 447498D01, SAR compliance for simultaneous transmission must be considered when the maximum duration of overlapping transmissions, including network hand-offs, is greater than 30 seconds. This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis.

The Simultaneous Transmission Possibilities of this device are as below:

Simultaneously transmission					
Condition	Antenna 0	Antenna 1	Antenna 2	Antenna 3	Support (YES/NO)
1	✓	✓			YES
2	✓			✓	YES
3		✓	✓		YES
4			✓	✓	YES

Note:
1) 2.4GHz and 5GHz can't transmit in simultaneous.

11.1. Simultaneous Transmission calculation.

All the value stated in the table below are the worst case found for standalone measurement with disregard of the transmission mode or channel where the worst case was found.

Frequency	ANT				Sum			
	ant0	ant1	ant2	ant3	ANT0&1	ANT0&3	ANT2&1	ANT2&3
2.4G	0.215	0.212	0.175	0.097	0.427	0.312	0.387	0.272
5G	0.615	0.422	0.950	0.465	1.037	1.08	1.372	1.415

Note:
1) For 2.4G and 5G SAR was evaluated for each antenna transmitting in standalone mode. The SAR distributions in MIMO mode were verified and the hot spots were sufficiently separated such that the two chains can be treated independently. So the highest SAR value across both chains in SISO mode represents the SAR value for MIMO mode.
2) For the maximum SUM 1-g SAR ≤ 1.6 W/Kg, the SPLSR analysis is not required.

Appendixes

Refer to separated files for the following appendixes.

4789980498.1-3-14-SAR_App A Photo(STC_180days)

4789980498.1-3-14-SAR_App B System Check Plots

4789980498.1-3-14-SAR_App C Highest Test Plots

4789980498.1-3-14-SAR_App D Cal. Certificates

4789980498.1-3-14-SAR_App E Dipole Calibration Record

---------End of Report---------