FCC TEST REPORT

Product Name:	Mobile Digital Video Recorder
Trade Mark:	N/A
Model No.:	MRK101029
Report Number:	210826003EMC-1
Test Standards:	FCC 47 CFR Part 15 Subpart B
FCC ID:	2A2GXMRA29
Test Result:	PASS
Date of Issue:	October 26, 2021

Prepared for:

Mobile Video Computing Solutions
1397 Piedmont, Suite 800, Troy, MI 48083

Prepared by:

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Date: October 26, 2021

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Version

Version No.	Date	Description
V1.0	October 26, 2021	Original

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1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Mobile Video Computing Solutions
Address of Applicant:	1397 Piedmont, Suite 800, Troy, MI 48083
Manufacturer:	Mobile Video Computing Solutions
Address of Manufacturer:	1397 Piedmont, Suite 800, Troy, MI 48083

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	Mobile Digital Video Recorder
Model No.:	MRK101029
Add. Model No.:	N/A
Trade Mark:	N/A
DUT Stage:	Identical Prototype
Rated Voltage:	☒ 12 VDC
Classification of digital devices:	Class B
Highest Internal Frequency:	1909.3 MHz
Sample Received Date:	August 31, 2021
Sample Tested Date:	September 13, 2021 to September 20, 2021

1.2.2 Description of Accessories

None

1.3 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

1) Support Equipment

Description	Manufacturer	Model No.	Serial Number	Supplied by
Lead-acid batteries	SACRED SUN	SP12-40	2015AP3055	UnionTrust
--	--	--	--	--

2) Support Cable

Description	Quantity	Cable Type	Length (m)	Supplied by
--	--	--	--	--

1.4 TEST LOCATION

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen,China 518109
Telephone: +86 (0) 755 2823 0888
Fax: +86 (0) 755 2823 0886

1.5 TEST FACILITY

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L9069
The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

A2LA-Lab Certificate No.: 4312.01
Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

ISED Wireless Device Testing Laboratories
CAB identifier: CN0032

FCC Accredited Lab.
Designation Number: CN1194
Test Firm Registration Number: 259480

1.6 DEVIATION FROM STANDARDS

None.

1.7 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.8 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

1.9 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Measurement Uncertainty
1	Conducted emission 9kHz-150kHz	±3.2 dB
2	Conducted emission 150kHz-30MHz	±2.7 dB
3	Radiated emission 9kHz-30MHz	± 4.7 dB
4	Radiated emission 30MHz-1GHz	± 4.6 dB
5	Radiated emission 1GHz-18GHz	± 4.4 dB
6	Radiated emission 18GHz-26GHz	± 4.6 dB
7	Radiated emission 26GHz-40GHz	± 4.6 dB

2. TEST SUMMARY

FCC 47 CFR Part 15 Subpart B Test Cases			
Test Item	**Test Requirement**	**Test Method**	**Result**
Conducted Emission	FCC 47 CFR Part 15.107	ANSI C63.4-2014	N/A(NOTE1)
Radiated Emission	FCC 47 CFR Part 15.109	ANSI C63.4-2014	PASS

Note1: Vehicle Use, and Battery-powered products

3. EQUIPMENT LIST

Radiated Emission Test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm dd, yyyy)**	**Cal. Due date (mm dd, yyyy)**
☒	3M SAC	ETS-LINDGREN	3M	Euroshiedpn-CT001270-1317	Jan. 22, 2021	Jan. 21, 2024
☒	Receiver	R&S	ESIB26	100114	Nov. 18, 2020	Nov. 17, 2021
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	Nov. 14, 2020	Nov. 13, 2021
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	Nov. 14, 2020	Nov.13, 2021
☒	Preamplifier	HP	8447F	2805A02960	Nov. 10, 2020	Nov. 9, 2021
☒	Double-Ridged Waveguide Horn Antenna	ETS-LINDGREN	3117-PA	00201541	Apr. 30, 2021	Apr. 29, 2022
☒	Pre-amplifier	ETS-Lindgren	00118385	00201874	Nov. 10, 2020	Nov. 9, 2021
☒	Wideband Radio Communication Tester	R&S	CMW500	120932	Apr. 22, 2021	Apr. 21, 2022
☒	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
☒	Test Software	Audix	e3	Software Version: 9.160323		

4. TEST CONFIGURATION

4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

4.1.1 Normal or Extreme Test Conditions

Environment Parameter	Selected Values During Tests		
Test Condition	Ambient		
	Temperature (°C)	Voltage (V)	Relative Humidity (%)
NT/NV	+15 to +35	12.0	20 to 75
Remark: 1) NV: Normal Voltage; NT: Normal Temperature			

4.1.2 Record of Normal Environment

Test Item	Temperature (°C)	Relative Humidity (%)	Pressure (kPa)	Tested by
Radiated Emission	25.1	50	100.03	Fire Huo

4.2 TEST MODES

Test Item	EMI Test Modes
Radiated Emission	Test Mode1: Monitoring mode (DC 12V) Test Mode2: Monitoring idle + WCDMA Band V RX mode (DC 12V) Test Mode3: Monitoring idle + LTE band 5 RX mode (DC 12V) Test Mode4: Monitoring idle + LTE Band 12 RX mode (DC 12V) Test Mode5: Monitoring idle + LTE Band 13 RX mode (DC 12V) Test Mode6: Monitoring idle + LTE Band 71 RX mode (DC 12V) Test Mode7: Monitoring idle + LTE Band 13 RX mode (DC 12V) Test Mode8: Monitoring idle + LTE Band 13 RX mode (DC 12V)
Remark: The above test modes in boldface were the worst cases, only the test data of these modes were reported.	

4.3 TEST SETUP

4.3.1 For Radiated Emissions test setup

Figure 1. 30MHz to 1GHz

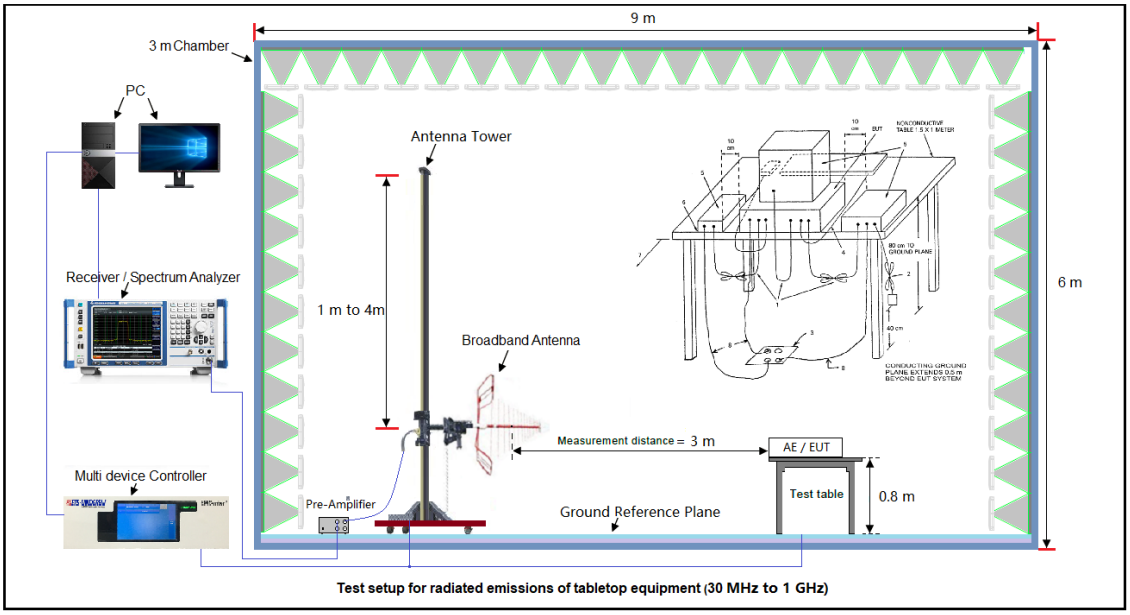
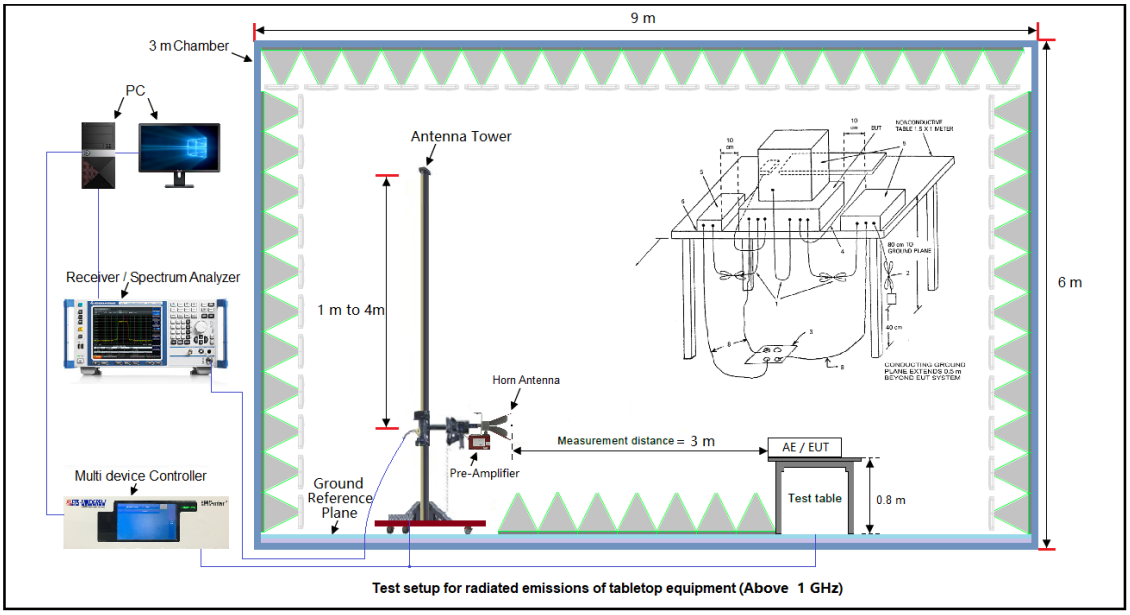


Figure 2. Above 1GHz



4.4 SYSTEM TEST CONFIGURATION

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000MHz. The resolution is 1 MHz or greater for frequencies above 1000MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic (according to KDB 896810 D02 SDoC FAQ v01r01) of the highest fundamental frequency or to 40 GHz, whichever is lower.

5. REFERENCE DOCUMENTS FOR TESTING

No.	Identity	Document Title
1	FCC 47 CFR Part15 Subpart B	Unintentional Radiators
2	ANSI C63.4-2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
3	KDB 174176 D01 Line Conducted FAQ v01r01	AC power-line conducted emission frequency asked questions
4	KDB 896810 D02 SDoC FAQ v01r02	Supplier's Declaration of Conformity frequency asked questions

6. EMC REQUIREMENTS SPECIFICATION

6.1 RADIATED EMISSION

Test Requirement: FCC 47 CFR Part 15.109

Test Method: ANSI C63.4-2014

Receiver Setup:

Frequency: (f) (MHz)	Detector type	Measurement receiver bandwidth	
		RBW	VBW
30 ≤ f ≤ 1 000	Quasi Peak	120 kHz	300 kHz
f ≥1000	Peak	1 MHz	3 MHz
	Average	1 MHz	3 MHz

Measured frequency range

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30.
1.705-108	1000.
108-500	2000.
500-1000	5000.
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower.

Limits:

Limits for Class A devices

Frequency (MHz)	limits at 3m (dBμV/m)		
	QP Detector	PK Detector	AV Detector
30-88	49.5	--	--
88-216	54.0	--	--
216-960	56.9	--	--
960 to 1000	60.0	--	--
Above 1000	--	80.0	60.0

Remark:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBμV/m) = 20 log Emission level (μV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

Test Setup: Refer to section 4.3.1 for details.

Test Procedures:

1. From 30 MHz to 1GHz test procedure as below:

1) The Product was placed on the non-conductive turntable 0.8 m above the ground at a chamber.
2) Set the spectrum analyzer/receiver in Peak detector, Max Hold mode, and 120 kHz RBW. Record the maximum field strength of all the pre-scan process in the full band when the antenna is varied between 1~4 m in both horizontal and vertical, and the turntable is rotated from 0 to 360 degrees.
3) For each frequency whose maximum record was higher or close to limit, measure its QP value: vary the antenna's height and rotate the turntable from 0 to 360 degrees to find the height and degree where Product radiated the maximum emission, then set the test frequency analyzer/receiver to QP Detector and specified bandwidth with Maximum Hold Mode, and record the maximum value.

2. Above 1GHz test procedure as below:

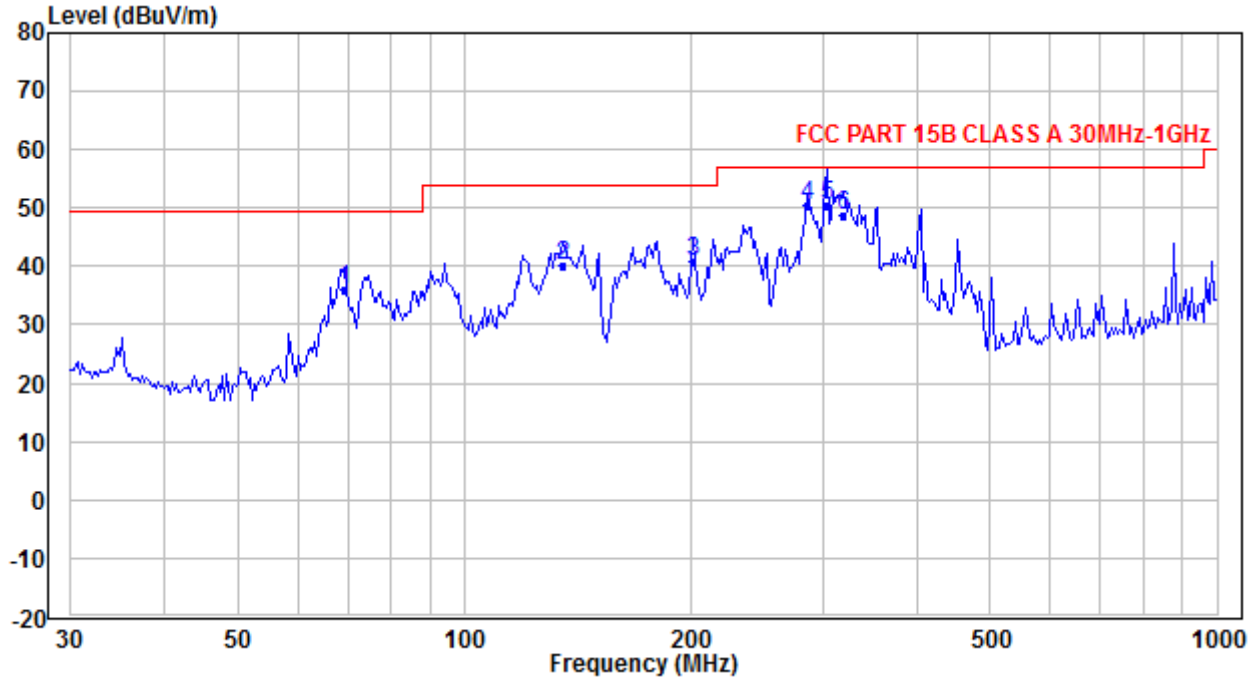
1) The Product was placed on the non-conductive turntable 0.8 m above the ground at a chamber.
2) Set the spectrum analyzer/receiver in Peak detector, Max Hold mode, and 1MHz RBW. Record the maximum field strength of all the pre-scan process in the full band when the antenna is varied in both horizontal and vertical, and the turntable is rotated from 0 to 360 degrees.
3) For each frequency whose maximum record was higher or close to limit, measure its AV value: rotate the turntable from 0 to 360 degrees to find the degree where Product radiated the maximum emission, then set the test frequency analyzer/receiver to AV value and specified bandwidth with Maximum Hold Mode, and record the maximum value.

Equipment Used: Refer to section 3 for details.

Test Result: Pass

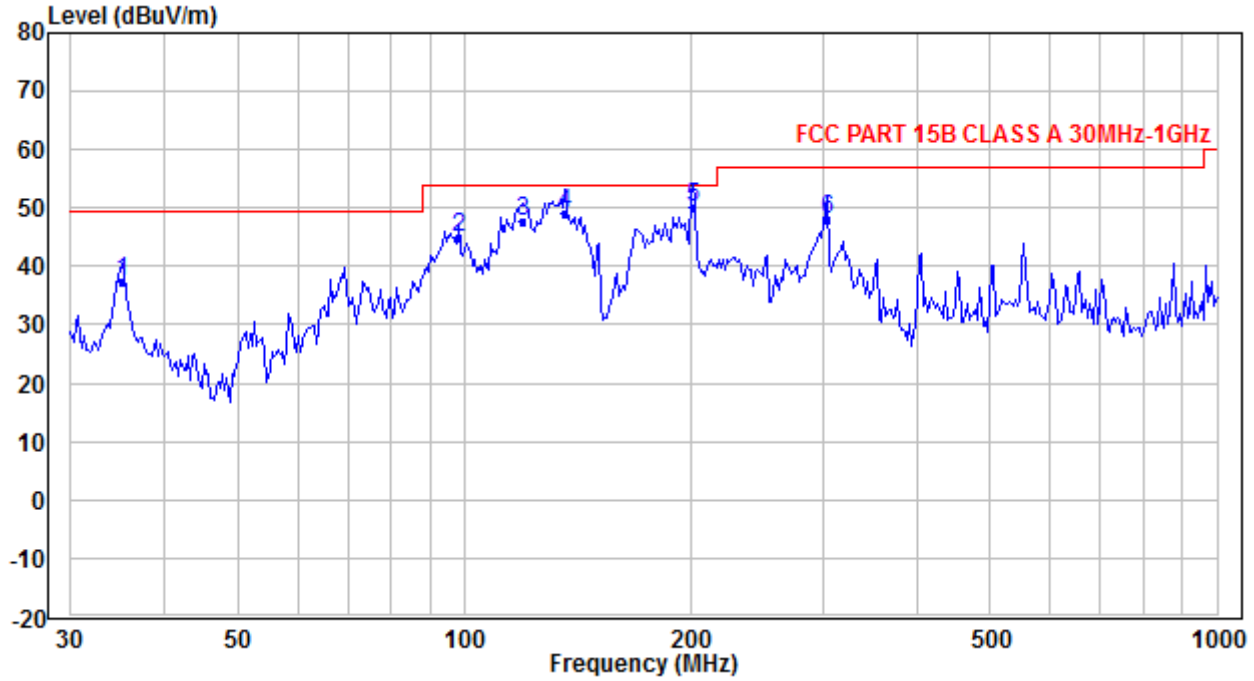
The worst measurement data as follows:

Below 1GHz(Quasi Peak):
Test Mode1
Horizontal



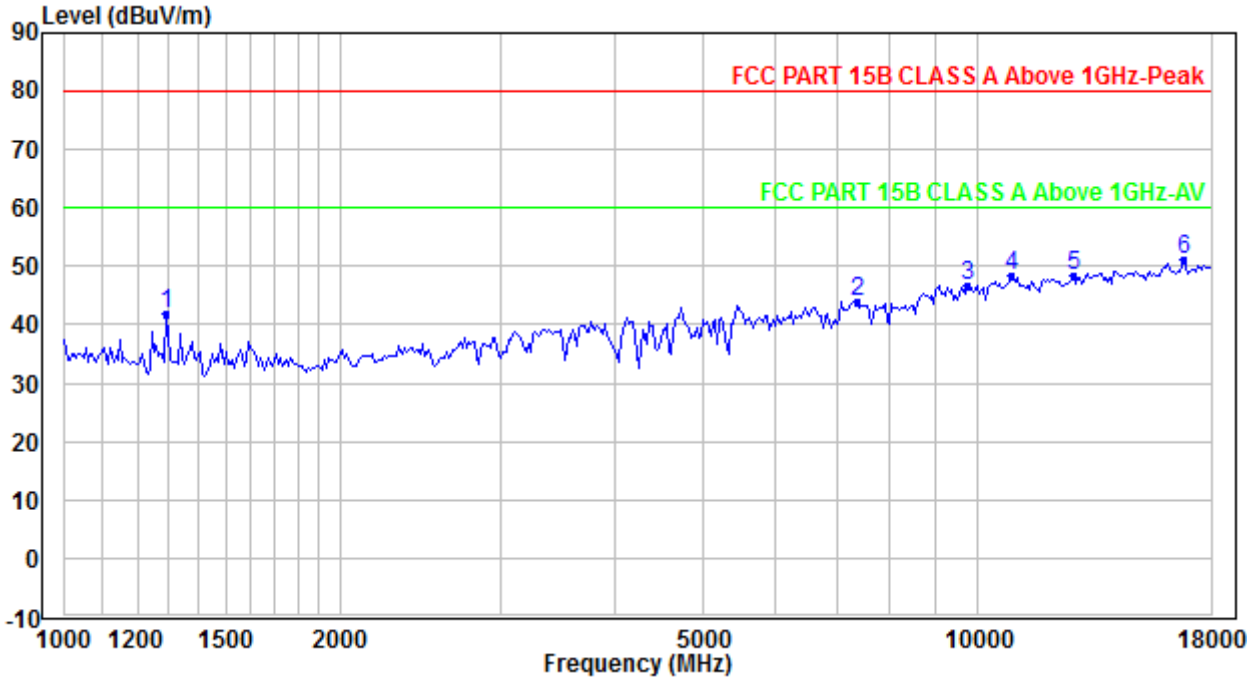
No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	69.230	53.26	-17.32	35.94	49.50	-13.56	QP
2	134.965	55.90	-15.74	40.16	54.00	-13.84	QP
3	201.454	51.67	-10.96	40.71	54.00	-13.29	QP
4*	286.265	57.61	-7.11	50.50	56.90	-6.40	QP
5	302.819	57.00	-6.53	50.47	56.90	-6.43	QP
6	318.088	54.88	-6.02	48.86	56.90	-8.04	QP

Vertical



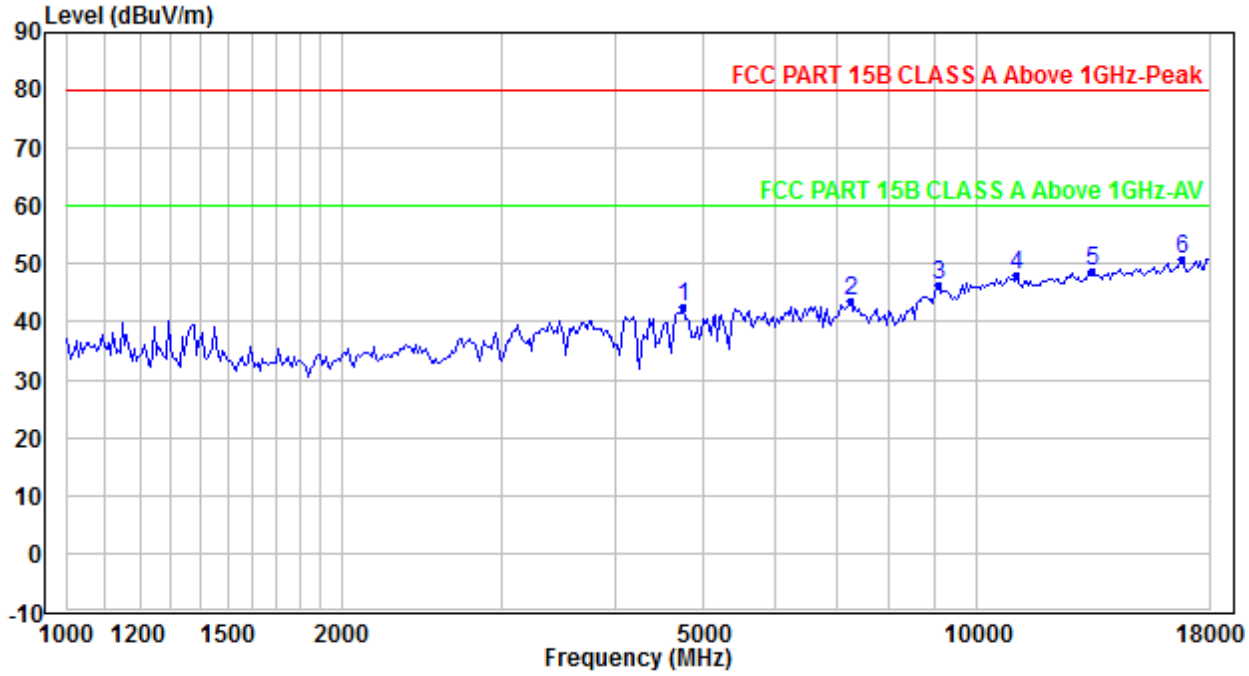
No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	35.016	42.58	-5.17	37.41	49.50	-12.09	QP
2	98.375	60.74	-15.88	44.86	54.00	-9.14	QP
3	119.767	63.65	-15.92	47.73	54.00	-6.27	QP
4	135.916	64.74	-15.71	49.03	54.00	-4.97	QP
5*	201.454	61.03	-10.96	50.07	54.00	-3.93	QP
6	302.819	54.41	-6.53	47.88	56.90	-9.02	QP

Above 1GHz(Peak & Average)
Test Mode1
Horizontal



No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	1290.284	54.72	-12.97	41.75	80.00	-38.25	Peak
2	7376.898	42.25	1.70	43.95	80.00	-36.05	Peak
3	9741.401	41.08	5.65	46.73	80.00	-33.27	Peak
4	10874.70	41.13	7.14	48.27	80.00	-31.73	Peak
5	12715.63	39.14	9.35	48.49	80.00	-31.51	Peak
6*	16791.35	38.62	12.61	51.23	80.00	-28.77	Peak

Vertical

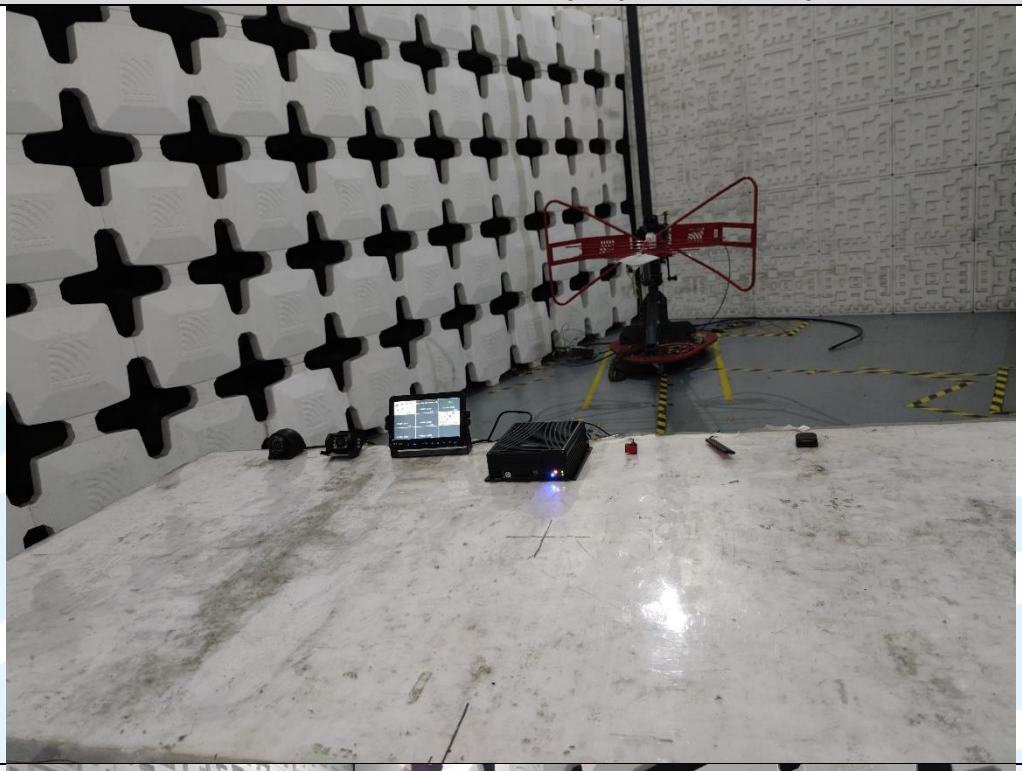


No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	4749.960	44.83	-2.38	42.45	80.00	-37.55	Peak
2	7249.817	42.12	1.49	43.61	80.00	-36.39	Peak
3	9087.293	41.44	5.09	46.53	80.00	-33.47	Peak
4	11065.32	40.58	7.38	47.96	80.00	-32.04	Peak
5	13396.09	37.49	11.30	48.79	80.00	-31.21	Peak
6*	16791.35	38.06	12.61	50.67	80.00	-29.33	Peak

Remark:

1. Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain, the value was added to Original Receiver Reading by the software automatically.
2. Result = Reading + Correct Factor.
3. Margin = Result – Limit
4. As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.

APPENDIX 1 PHOTOS OF TEST SETUP

Radiated emission Test Setup-1 (30 MHz~1 GHz)


Radiated emission Test Setup-2 (Above 1 GHz)

APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photos.

********** End of Report **********

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