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ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT





Applicant: Jay Switches India Private Limited

Plot No.407, Udyog Vihar, Phase-3, Gurugram, Haryana-

122016, India

Product Name: Assy RKE(Remote Key Entry)

Brand Name: Jay with Citroen Logo

Model No.: J-2814-00-00

Model Difference: N/A

Report Number: E2/2021/C0117

FCC ID 2A4CI-J-2814-00-00

Issue Date: January 26, 2022

Date of Test: January 3, 2022 ~ January 4, 2022

Date of EUT Received: December 28, 2021

Approved By Arma Heigh

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Central RF Lab The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT comply with FCC rule part §15.231.

The results of this report relate only to the sample identified in this report.

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Revision History						
Report Number	Revision	Description	Issue Date	Revised By	Remark	
E2/2021/C0117	00	Original.	January 26, 2022	Susan Lin		

Note:

1 . The remark "*" indicates modification of the report upon requests from certification body.

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GENERAL INFORMATION

1.1 **Product Description**

Product Name:	Assy RKE(Remote Key Entry)
Brand Name:	Jay with Citroen Logo
Model No.:	J-2814-00-00
Model Difference:	N/A
Hardware Version:	SCX Version V0.3
Firmware Version:	Version 2.6
EUT Series No.:	Conducted: PJ21C192013 Radiated: PJ21C192019
Power Supply:	3Vdc from Lithium Battery
Test Software (Name/Version):	Default

1.2 RF specification

Radio Technology:	Short Range Radio
Operating Frequency:	433.92MHz
Transmit Power:	71.68 dBuV/m @ 3m (Peak)
Modulation Technique:	FSK
Number of Channels:	1 Channel
Antenna Type:	PCB Trace Antenna

Note: Antenna information is provided by the applicant.

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1.3 Test Methodology

FCC Part 15, Subpart C §15.231 ANSI C63.10:2013

1.4 **Test Facility**

Laboratory	Test Site Address	Test Site Name	FCC Designation number	IC CAB identifier
		SAC 1		
		SAC 3		
		Conduction 1		
	No.134, Wu Kung Road, New Taipei	Conducted 1		TW3702
	Industrial Park, Wuku District, New	Conducted 2	TW0027	
	Taipei City, Taiwan.	Conducted 3		
		Conducted 4		
		Conducted 5		
SGS Taiwan Ltd.		Conducted 6		
Central RF Lab.		Conduction C	- - -	
(TAF code 3702)		SAC C		
(TAF Code 3702)	No 0 Krii 4 4 D.L. Quint au Binti 4	SAC D		
		SAC G		
		Conducted A		
	No.2, Keji 1st Rd., Guishan District,	Conducted B	TW0028	
	Taoyuan City, Taiwan 333	Conducted C		
		Conducted D		
		Conducted E		
		Conducted F		
		Conducted G		

Note: Test site name is remarked on the equipment list in each section of this report as an indication where measurements occurred in specific test site and address.

1.5 **Special Accessories**

There are no special accessories used while test was conducted.

1.6 **Equipment Modifications**

There was no modification incorporated into the EUT.

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SYSTEM TEST CONFIGURATION

2.1 **EUT Configuration**

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 **EUT Exercise**

The Transmitter was operated in the normal operating mode. The Tx frequency was fixed which was for the purpose of the measurements.

Test Procedure 2.3

2.3.1 **Conducted Emissions**

The EUT is a placed on a table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz. The CISPR Quasi-Peak and Average detector mode is employed. The two LISNs provide 50uH/50 ohm of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

2.3.2 **Radiated Emissions**

The EUT is a placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

2.4 **Measurement Results Explanation Example**

2.4.1 Radiated Emission Test Sites For Measurements From 9 kHz To 30

Radiated emission below 30MHz is measured in a 9m*6m*6m semi-anechoic chamber, the measurements correspond to those obtained at an open-field

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

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2.4.2 For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

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2.5 Test Configuration

Conducted Setup



Radiated Setup



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SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207	AC Power Line Conducted Emission	N/A
§15.231(b)	Radiated Emission	Compliant
§15.231(c)	Emission Bandwidth	Compliant
§15.35 (c)	Duty Cycle Test (Determining average factor from a complete pulse train)	Compliant
§15.231(a)(1)	Transmission Ceased Time	Compliant
§15.203	Antenna Requirement	Compliant

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4 DESCRIPTION OF TEST MODES

4.1 Operating Frequencies

FREQUENCY 433.925MHZ

4.2 The Worst Test Modes and Channel Details

The field strength of radiated emission was measured as the EUT positioned in different orthogonal planes (E1/E2/H) based on actual usage of the EUT to pre-scan the emissions for determining the worst case scenario.

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MEASUREMENT UNCERTAINTY

Test Items	Unc	ertainty	1
AC Power Line Conducted Emission	+/-	2.34	dB
Frequency Stability	+/-	1.53	Hz
Emission Bandwidth	+/-	1.53	Hz
Temperature	+/-	0.4	Ô
Humidity	+/-	3.5	%
DC / AC Power Source	+/-	1	%

Radiated Spurious Emission Measurement Uncertainty						
	+/-	2.57	dB	9kHz~30MHz		
Polorization: Vartical	+/-	4.85	dB	30MHz - 1000MHz		
Polarization: Vertical	+/-	4.45	dB	1GHz - 18GHz		
	+/-	4.24	dB	18GHz - 40GHz		
	+/-	2.57	dB	9kHz~30MHz		
Polarization: Horizontal	+/-	4.37	dB	30MHz - 1000MHz		
	+/-	4.45	dB	1GHz - 18GHz		
	+/-	4.24	dB	18GHz - 40GHz		

Note:

- 1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
- 2. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

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MEASUREMENT EQUIPMENT USED

6.1 **Conducted Emission Measurement**

Conducted Emission Test Site: Conducted A						
EQUIPMENT TYPE MFR MODEL SERIAL NUMBER LAST CAL. CAL DUE.						
H-Loop Near Field Antenna	LANGER EMV- Technik	LF-R 400	02-1597	N.C.R	N.C.R	
Spectrum Analyzer	KEYSIGHT	N9010A	MY57120290	04/06/2021	04/05/2022	
DC Block	PASTERNACK	PE8210	RF153	11/18/2021	11/17/2022	

6.2 **Radiated Emission Measurement**

Radiated Emission Test Site: SAC C							
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.		
Broadband Antenna	SCHWARZBECK	VULB 9168	9168-300	10/19/2021	10/18/2022		
Horn Antenna	SCHWARZBECK	BBHA9120D	1187	01/11/2021	01/10/2022		
Loop Antenna	ETS.LINDGREN	6502	143303	05/07/2021	05/06/2022		
EMI Test Receiver	R&S	ESU 40	100363	04/28/2021	04/27/2022		
Pre-Amplifier	EMC Instruments	EMC330	980096	11/18/2021	11/17/2022		
Pre-Amplifier	EMC Instruments	EMC0011830	980199	11/18/2021	11/17/2022		
Pre-Amplifier	EMC Instruments	EMC184045B	980135	10/27/2021	10/26/2022		
Attenuator	Marvelous	WATT-218FS-10	RF20	11/18/2021	11/17/2022		
Band Rejection Filter	Micro-Tronics	BRM50701-01	RF201	11/18/2021	11/17/2022		
Coaxial Cable	Huber Suhner	SUCOFLEX 104	MY17388/4	11/18/2021	11/17/2022		
Coaxial Cable	Huber Suhner	RG 214/U	W22.03	11/18/2021	11/17/2022		
Test Software	audix	e3	20923 sgs Ver.9	N.C.R	N.C.R		

NOTE: N.C.R refers to Not Calibrated Required.

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CONDUCTED EMISSIONS TEST

7.1 **Standard Applicable**

According to §15.207, frequency within 150 kHz to 30MHz shall not exceed the limit table as below.

Frequency range	Limits (dBuV)			
MHz	Quasi-peak	Average		
0.15 to 0.50	66 to 56	56 to 46		
0.50 to 5	56	46		
5 to 30	60	50		

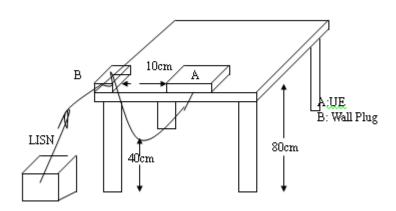
Note

- 1. The lower limit shall apply at the transition frequencies
- 2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

7.2 **EUT Setup**

- 1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
- 2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
- 3. The LISN was connected with 120Vac/60Hz power source.

7.3 Test Set-up:



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7.4 Measurement Procedure

- 1. The EUT was placed on a table which is 0.8m above ground plane.
- 2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 3. Repeat above procedures until all frequency measured were complete.

7.5 Measurement Result

N/A; Powered from Lithium Battery.

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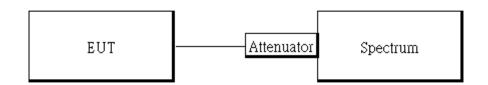
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8 DUTY CYCLE MEASUREMENT

8.1 Applicable Standard

According to 15. 35(c), the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification.

8.2 Test Setup



8.3 Measurement Procedure

- 1. The EUT was placed on a turn table which is 0.8m above ground plane.
- 2. Set EUT normal operating mode.
- 3. Set SPA Center Frequency = fundamental frequency, RBW, VBW= 100kHz, Span = 0 Hz. Adjacent sweep.
- 4. Set SPA View. Mark delta.

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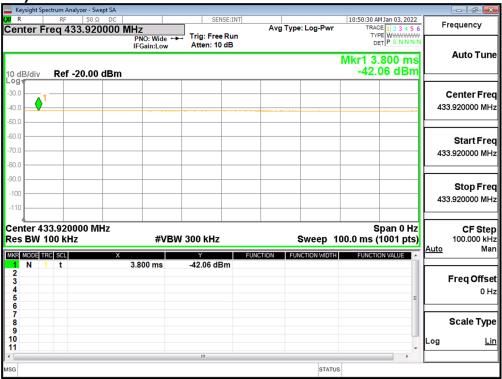
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8.4 Measurement Results:

Ton = 100(ms)



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EMISSION BANDWIDTH

9.1 Applicable Standard

According to 15.231 (c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

9.2 **Test Setup**

Refer to section 8.2 of this report.

9.3 **Measurement Procedure**

- The EUT was placed on a turn table which is 0.8m above ground plane. 1.
- 2. Set EUT as transmitting mode.
- Set SPA Center Frequency = fundamental frequency, RBW=1% to 5% OBW, VBW= 3 x RBW, Span = large enough to capture all products of the modulation process.
- Set SPA -20dB Occupied bandwidth. 4.

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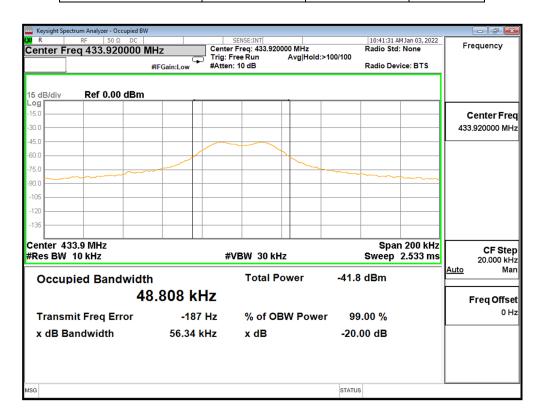
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9.4 **Measurement Results**

The center frequency fc is 433.92MHz, according to the Rules, section 15.231(C), the Bandwidth of Center Frequency at -20dB should be calculated as following:

433.92 X 0.0025 = 1.0848 (MHz)

Frequency(MHz)	OBW (MHz)	Limit (MHz)	Result
433.92	0.05634	1.0848	Pass



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10 TRANSMISSION CEASED TIME MEASUREMENT:

15.231 (a) (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

10.1 **Test Setup**

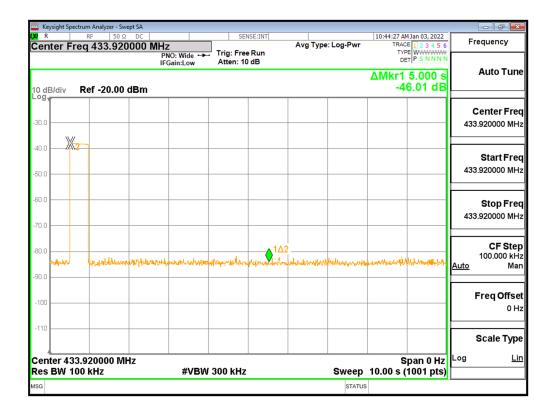
Refer to 8.2 of this report.

10.2 Measurement Procedure

- 1. The EUT was placed on a turn table which is 0.8m above ground plane.
- Set SPA Center Frequency = fundamental frequency, RBW=100kHz, VBW= 100kHz, Span =0Hz. Sweep Time= 5s.
- 3. Set EUT as normal operation and press Transmitter bottom for 2 s approximately,
- 4. Set SPA Max hold. Delta Mark.

10.3 Measurement Results

The release time is less than 5 s.



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11 RADIATED EMISSION TEST

Standard Applicable 11.1

According to 15.231(b), the field strength of emissions from Intentional Radiators operated under this section shall not exceed the following:

operated under this section shall not exceed the following.						
Fundamental Frequency	Field S	trength of	Field Strength of			
	Fundamental		Spurious			
(MHz)	(dBuV/m)	(uV/m)	(dBuV/m)	(uV/m)		
40.66 - 40.70	67.04	2,250	47	225		
70 - 130	61.94	1,250	41.9	125		
130 - 174	* 61.94 - 71.48	* 1,250 -3,750	* 41.9 – 51.48	* 125 to 375		
174 - 260	71.48	3,750	51.48	375		
260 - 470	* 71.48 - 81.94	* 3,750 - 12,500	* 51.48 – 61.94	* 375 to 1250		
above 470	81.94	12,500	61.94	1250		

11.2 Remark:

- Emission level in dBuV/m=20 log (uV/m)
- Measurement was performed at an antenna to the closed point of EUT distance of meters.
- 3. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of § 15.205
- Emission spurious frequency which appearing within the Restricted Bands specified in provision of §15.205, then the general radiated emission limits in § 15.209 apply.
- For the band 130-174MHz, uV/m at 3meters = 56.81818(F) 6136.3636; For the band 260-470MHz uV/m at 3meters = 41.6667(F) - 7083.3333; Where F is the frequency in MHz.

Fundamental Frequency (MHz)	41.6667(F) - 7083.3333 (uV/m)	Limit (dBuV/m)	
433.92	10989.597825	80.82	

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11.3 **Measurement Procedure**

- The EUT was placed on a turn table which is 0.8m above ground plane.
- 2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
- 3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
- 4. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.
- 5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 7. Repeat above procedures until all frequency of the interest measured were complete.

11.4 Auxiliary Procedure (Setting on Spectrum to capture the reading of emission level):

- (1) Span = wide enough to fully capture the emission being measured
- (2) RBW = 1 MHz for $f \ge 1$ GHz, 100 kHz for f < 1 GHz, VBW \ge RBW, Sweep = auto, Detector function = peak, Trace = max hold
- (3) For average measurement: use duty cycle correction factor method per 15.35(c) Duty Cycle = On time/100 milliseconds On time = N1*L1+N2*L2+...+N(n-1)*L(n-1)+N(n)*L(n)Where N1 is number of type 1 pulses, L1 is length of type 1 pulses, etc. Average Emission Level = Peak Emission Level + 20*log (duty Cycle)

Test was measured starting from 9kHz to 10th harmonic of the fundamental frequency. and data containing the worst result above 30MHz are shown on the test report.

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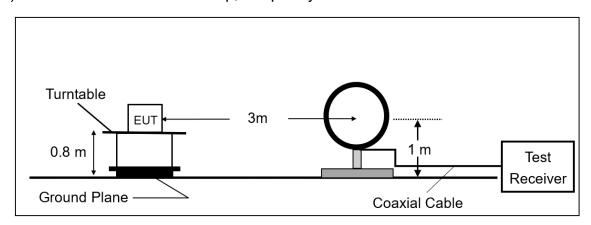
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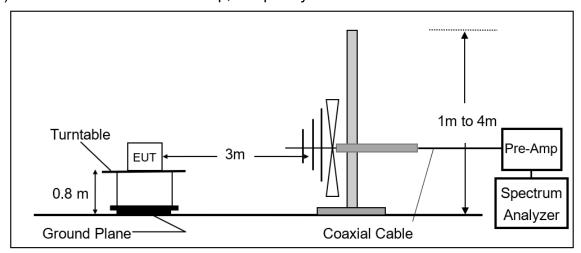
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11.5 **Test Setup**

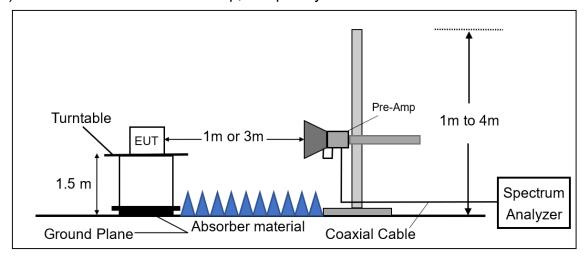
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz.



(B) Radiated Emission Test Set-Up, Frequency From 30MHz to 1000MHz.



(C) Radiated Emission Test Set-Up, Frequency Above 1GHz.



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11.6 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where	•	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

Remark:

The limit of the emission level is expressed in dBuV/m, which converts 20*log(uV/m)

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dBµV/m) + Cable Loss(dB) – Pre Amplifier Gain(dB)

Measurement Results of Radiated Spurious Emissions from 9 kHz to 30 MHz

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit per 15.31(o) was not reported.

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Measurement Result 11.8

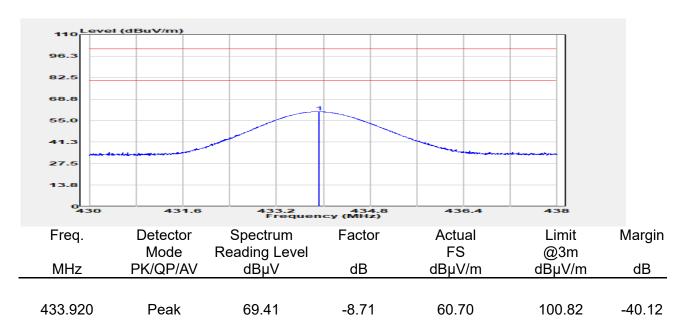
11.8.1 Field Strength of Fundamental

Report Number :E2/2021/C0117 **Test Site** :SAC C

Operation Mode Test Date :2022-01-13 :433.92MHz

Test Frequency :433.92MHz Temp./Humi. :20.6/70 Test Mode Antenna Pol. :Main :Vertical

EUT Pol :E2 Plane Engineer :Andy Wang



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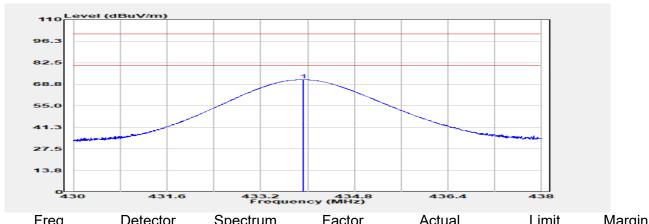
:E2/2021/C0117 Test Site :SAC C Report Number

Operation Mode :433.92MHz **Test Date** :2022-01-13

Test Frequency :433.92MHz Temp./Humi. :20.6/70

Test Mode Antenna Pol. :Main :Horizontal

EUT Pol :Andy Wang :E2 Plane Engineer



1 104.	Mode	Reading Level	1 40101	FS	@3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dBµV/m	dBµV/m	dB
433.920	Peak	80.39	-8.71	71.68	100.82	-29.14

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11.8.2 Field Strength of Spurious Emission

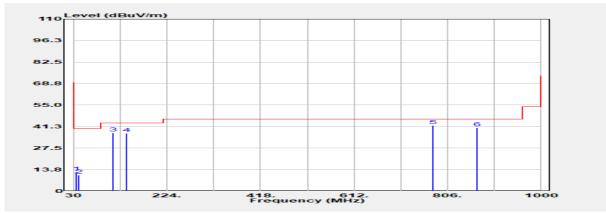
Report Number :E2/2021/C0117 **Test Site** :SAC C

Operation Mode :433.92MHz **Test Date** :2022-01-04

Test Frequency Temp./Humi. :20.6/70 :433.92MHz

Test Mode :TX Antenna Pol. :Vertical

EUT Pol :E2 Plane :Andy Wang Engineer



dB
27.78
29.83
-6.23
-6.61
-4.09
-5.35
2

Note: Average Actual = Peak Actual + Average Factor

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Report Number :E2/2021/C0117 Test Site :SAC C

Operation Mode :433.92MHz Test Date :2022-01-04

Test Frequency :433.92MHz Temp./Humi. :20.6/70

Test Mode :TX Antenna Pol. :Horizontal

EUT Pol :E2 Plane Engineer :Andy Wang



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dBμV/m	dBµV/m	dB
35.820	QP	32.80	-16.13	16.67	40.00	-23.33
139.610	Peak	48.65	-14.68	33.97	43.50	-9.53
558.650	Peak	42.94	-5.84	37.10	46.00	-8.90
782.720	Peak	42.84	-0.60	42.24	46.00	-3.76
867.840	Peak	40.33	0.47	40.80	46.00	-5.20
970.900	Peak	41.39	2.27	43.66	54.00	-10.34

Note: Average Actual = Peak Actual + Average Factor

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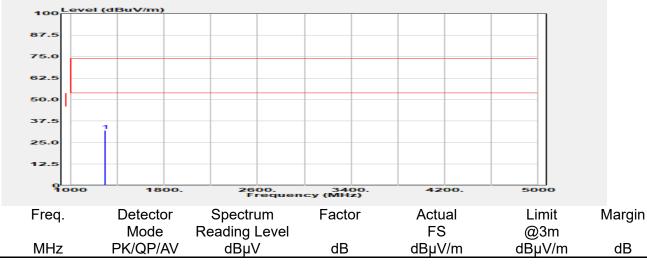
:E2/2021/C0117 Test Site :SAC C Report Number

Operation Mode :433.92MHz **Test Date** :2022-01-04

Test Frequency Temp./Humi. :20.6/70 :433.92MHz

Test Mode :TX Antenna Pol. :Vertical

EUT Pol :E2 Plane Engineer :Andy Wang



Peak 1301.760 33.08 -0.9032.19 74.00 -41.81

Note: Average Actual = Peak Actual + Average Factor

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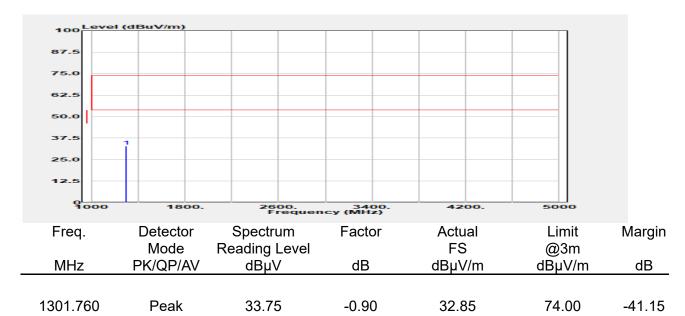
:E2/2021/C0117 Test Site :SAC C Report Number

Operation Mode :433.92MHz **Test Date** :2022-01-04

Test Frequency Temp./Humi. :20.6/70 :433.92MHz

Test Mode :TX Antenna Pol. :Horizontal

EUT Pol :E2 Plane Engineer :Andy Wang



Note: Average Actual = Peak Actual + Average Factor

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12 ANTENNA REQUIREMENT

Standard Applicable: 12.1

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§ 15.211, 15.213, 15.217, 15.219, 15.221, or § 15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

Antenna Connected Construction:

The antenna is designed as permanently attached and no consideration of replacement. Please see EUT photo for details.

~ End of Report ~

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