

RADIO TEST REPORT

Product	:	Tire Pressure Monitoring System
Model Name	:	AI SENSOR
FCC ID	:	W55AISDB3N4
Test Regulation	:	FCC 47 CFR Part 15 Subpart C (Section 15.231)
Received Date	:	2023/5/29
Test Date	:	2023/6/12 ~ 2023/6/16
Issued Date	:	2023/7/3
Applicant	:	Oro Technology Co., Ltd. 3F, No.29, 21st Road, Industrial Park, Taichung 408, Taiwan
Issued By	:	Underwriters Laboratories Taiwan Co., Ltd. Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan



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REVISION HISTORY

Original Test Report No.: 4790838020-US-R0-V0

Revision	Test report No.	Date	Page revised	Contents
Original	4790838020-US-R0-V0	2023/7/3	-	Initial issue



Table of Contents

1.	Atte	station of Test Results4	
2.	Summary of Test Results5		
3.	Faci	lities and Accreditation6	
4.	Mea	surement Uncertainty7	
5.	Equ	ipment under Test8	
	5.1. 5.2. 5.3. 5.4. 5.5. 5.6.	Description of EUT8Channel List9Test Condition10Description of Available Antennas11Test Mode Applicability and Tested Channel Detail12Duty Cycle of Test Signal13	
6.	Test	Equipment15	
7.	Desc	cription of Test Setup16	
8.	Test	Results	
8 8 8	8.1. 8.2. 8.3.	Radiated Spurious Emission1720dB Bandwidth Measurement28Deactivation Time Measurement30	



1. Attestation of Test	1. Attestation of Test Results		
APPLICANT:	Oro Technology Co., Ltd. 3F, No.29, 21st Road, Industrial Park, Taichung 408, Taiwan		
MANUFACTURER:	Oro Technology Co., Ltd. 3F, No.29, 21st Road, Industrial Park, Taichung 408, Taiwan		
EUT DESCRIPTION:	Tire Pressure Monitoring System		
BRAND:	ORO		
MODEL:	AI SENSOR		
SAMPLE STAGE:	Design Verification Test sample		
DATE of TESTED:	2023/6/12 ~ 2023/6/16		
APPLICABLE STANDARDS			
S	TANDARDTest Results		
FCC 47 CFR PART 15 Subpart C (Section 15.231) PASS			

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:

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Sally Lu Project Handler Date : 2023/7/3

Approved and Authorized By:

Kent Liu Date : 2023/7/3 Senior Laboratory Engineer

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Doc No: Form-ULID-004737 (DCS:17-EM-F0876) / 6.1



2. Summary of Test Results

Summary of Test Results		
FCC Clause	Test Items	Result
15.209 / 15.231(b)	Radiated Emissions	PASS
15.231(c)	Emission Bandwidth Test	PASS
15.231(a)	Deactivation Time Measurement	PASS



3. Facilities and Accreditation

Test Location	Underwriters Laboratories Taiwan Co., Ltd.
Address	Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan
Accreditation Certificate	Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398.



4. Measurement Uncertainty

For statement of conformity, Simple acceptance (Section 4.3.4 of ISO Guide 115) was applied as decision rule for measurement in this test report.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor k=2.

Determining compliance based on the results of the compliance measurement, not considering measurement instrumentation uncertainty.

Measurement	Frequency	Uncertainty
Conducted disturbance at mains terminals ports	150kHz ~ 30MHz	±3.1 dB
RF Conducted	9 kHz - 40GHz	±2.3 dB
Radiated disturbance below 30MHz	9 kHz - 30 MHz	±3.2 dB
Radiated disturbance below 1 GHz	30MHz ~ 1GHz	±6.1 dB
Radiated disturbance above 1 GHz	1GHz ~ 40GHz	±5.1 dB



5. Equipment under Test

5.1. Description of EUT

Product	Tire Pressure Monitoring System	
Brand Name	ORO	
Model Name	AI SENSOR	
Operating Frequency	315 MHz 433.92 MHz	
Modulation	315 MHz: ASK 433.92 MHz: FSK	
Transfer Rate	9600 bps	
Number of Channel	2	
Maximum Output Power	315 MHz: 68.44 dBuV/m 433.92 MHz: 74.88 dBuV/m	
Normal Voltage	3Vdc from battery	
Sample ID	6121411 & 6121412	
Software Version	Continuous transmission by powering on	

Note:

1. The EUT contains following accessory devices:

Product	Brand	Model	Description
Valve	ORO	S02VA00014	-

2. The EUT could be supplied with rechargeable battery as the following table:

Brand Name	Model	Description
Murata	CR2050W	3V Lithium battery

3. The above EUT information is declared by manufacturer and for more detailed features description, please refer the manufacturer's or user's manual, the laboratory shall not be held responsible.



Test report No.	: 4790838020-US-R0-V0
Page	: 9 of 32
Issued date	: 2023/7/3
FCC ID	: W55AISDB3N4

5.2. Channel List

2 channels are provided to this EUT:

Channel	Frequency (MHz)
1	315

Channel	Frequency (MHz)
1	433.92



5.3. Test Condition

Test Item	Test Site No.	Environmental Condition	Input Power	Test Date	Tested by
Antenna Port Conducted Measurement	SR4	22~25°C/ 56~61%RH	3Vdc	2023/06/12~ 2023/06/16	Jubo Shen
Radiated Spurious Emission	966-2	22~25°C/ 56~61%RH	3Vdc	2023/06/12~ 2023/06/16	Jubo Shen

FCC Test Firm Registration Number: 498077

Sample Calculation:

Radiated Spurious Emission:

 Where relevant, the follow sample calculation is provided: Result Value (dBuV/m) = Reading Value (dBuV) + Correction Factor (dB/m). Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB) - Preamp Factor (dB). Example: Result Value (34.5dBuV/m) = Reading Value (40.1dBuV) + Antenna Factor (18.7dB/m) + Cable Loss (4.2dB) - Preamp Factor (28.5dB).

AC power Line Conducted Emission:

Where relevant, the follow sample calculation is provided: Result Value (dBuV) = Reading Value (dBuV) + Correction Factor (dB). Correction Factor (dB) = Insertion loss(dB) + Cable loss(dB). Example: Result Value (53.7dBuV) = Reading Value (35.1dBuV) + Insertion loss(18.1dB) + Cable loss(0.5dB).



Test report No.	: 4790838020-US-R0-V0
Page	: 11 of 32
Issued date	: 2023/7/3
FCC ID	: W55AISDB3N4

5.4. Description of Available Antennas

Ant. No.	Transmitter Circuit	Brand Name	Model Name	Ant. Type	Maximum Gain (dBi)
1	Chain (0)	ORO	M02AN00004	Monopole	315MHz: -20.89 433MHz: -19.90

Note: The above antenna information was provided from customer and for more detailed features description, please refer the manufacturer's specification or user's manual, the laboratory shall not be held responsible.



5.5. Test Mode Applicability and Tested Channel Detail

- The fundamental of the EUT was investigated in three orthogonal axes X-Y/Y-Z/X-Z, it was determined that Y-Z plane was worst-case. Therefore, all final radiated testing was performed with the EUT in Y-Z plane.
- The EUT has 3Vdc power source from battery. The test data of the 3Vdc was recorded in this report.
- For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.
- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

315MHz

Test Item	Modulation Type	Available Channel	Test Channel	Data Rate
Radiated Emissions	ASK	1	1	9600 bps
Radiated Emissions (Below 1GHz)	ASK	1	1	9600 bps
Antenna Port Conducted Measurement	ASK	1	1	9600 bps

433.92MHz

Test Item	Modulation Type	Available Channel	Test Channel	Data Rate
Radiated Emissions	FSK	1	1	9600 bps
Radiated Emissions (Below 1GHz)	FSK	1	1	9600 bps
Antenna Port Conducted Measurement	FSK	1	1	9600 bps



Test report No.	: 4790838020-US-R0-V0
Page	: 13 of 32
Issued date	: 2023/7/3
FCC ID	: W55AISDB3N4

5.6. Duty Cycle of Test Signal

Mode	Mode TX on (ms)		Duty Cycle (%)	Duty Cycle Correction Factor (dB)
315MHz	8.300	100.000	8.30%	-21.62

AVG factor = 20*Log (duty cycle in 100ms) = 20*Log(0.083) = -21.62 dB Duty Cycle Correction Factor for Emission AVG Factor = -21.62 dB Because= -21.62 less than -20, so Duty Cycle Correction Factor = -20 dB AVG= Peak + duty cycle correction factor AVG= Peak -20 dB

Spectrun	n				-					Spectr	um	J									
Ref Level Att Count 200	al 20.00 dBm 30 dB	SWT 100	e RB ms e VB	W 100 kHz W 300 kHz						Ref Le Att Count 2	vel 20.	00 dBm 30 dB	8 🖶 SWT 200	e RB ms e VB	W 100 kHz W 300 kHz						
GFSK @1Pk	View									GFSK 01	k View										
10 dBm			M1[1] -13.49 dBm 20.7000 ms M2[1] -13.50 dm				10 dBm-						M	11[1]				-13.43 dBm 22.0000 ms -13.45 dBm			
0 dBm							-	1 3	29.0000 ms	0 dBm-							+				30.2000 ms
-10 dBm		41 M2								-10 dBm-	41	42					мз				
-20 dBm										-20 dBm-								$\left \right $			
-30 dBm				\vdash						-30 dBm-											
-40 dBm										-40 dBm-								$\left \right $			
-50 dBm										-50 dBm-								$\left \right $			
-60 dBm-	Unit has it as a li		usulis.visit	uk hite waa sada	u Maandole Malillana	والعرادانطيق	la delina i la dolaren	ind softliked How	ม.เหล่ามเสียงได้	-60 dBm-	k inis	NÅ.	a interious visition	nd and the	Andraacindiilaan	harveleneisk	a.b	Worlder	Haddhadaa	adenticular	Howkhaddoon
under bei	a and at the table	r (1)	that was	terislerikes af	found contribution	end to blat th	all contractions of the	diedersteer tij	istori atventel:	~-76'8BH-	1	1. a d to			11221			- 1 10	ter teles d		
CF 315.0 N	MHz			2001	pts			1	10.0 ms/	CF 315.) MHz				2001	pts					20.0 ms/
Marker										Marker											
Type Re	ef Trc	X-value		Y-value	Funct	tion	Fun	ction Result	t	Туре	Ref Ti	nc	X-value		Y-value	Func	tion		Fun	tion Resu	ilt
M1	1	20.	7 ms	-13.48 dBr	m					M1		1	22.0	0 ms	-13.43 dB	m		_			
M2	1	29.	0 ms	-13.53 dBr	m					M2	_	1	30.2	2 ms	-13.45 dB	m		-			
M3	1	100.	Jms	-68.90 dBr	m					M3		1	123.1	1 ms	-13.47 dBr	m		_			



Mode	Mode TX on (ms)		Duty Cycle (%)	Duty Cycle Correction Factor (dB)
433.92MHz	8.300	100.000	8.30%	-21.62

AVG factor = 20*Log (duty cycle in 100ms) = 20*Log(0.083) = -21.62 dB Duty Cycle Correction Factor for Emission AVG Factor = -21.62 dB Because= -21.62 less than -20, so Duty Cycle Correction Factor = -20 dB AVG= Peak + duty cycle correction factor AVG= Peak -20 dB

Spectru	um	٦								S	pectru	m)									E
Ref Lev Att	vel 20	.00 dBm 30 dB	SWT 100 m	 RBW 100 kH VBW 300 kH 	iz iz					-	Ref Lev Att	el 20.0	0 dBm 30 dB	s 💩 SWT 200 r	e RBY	W 100 kHz W 300 kHz						
1Pk Vie	00/200 9W									GE	SK 1P	k View										
10 dBm-						M1[1]			-17.21 dBm 5.3000 ms -17.20 dBm	10	dBm—						N	11[1]				-17.26 dBr 27.9000 m -17.27 dBr
0 dBm-							-	-	13.6000 ms	0.0	dBm											36.1000 m
-10 dBm-										-1	0 dBm—											
	N 100	12									0 d0m	M1	M2					M	3			
-20 ubiii-										-2	D UBIII-											
-30 dBm-										-3	U dBm—											
-40 d8m-	-									-4	0 dBm—											
-50 d8m-	+									-5	0 dBm—	+										
-60 d8m-		Nightlet	Malakan Ma	ning in the second	Hontalianan	uller working by	uhidus hitarethi	usiki/weatmath	ng-work/halten,jachti	n. Ng	D dBm— D dBm— D dBm—	harry	4e	afinidi sin paning dan	hoise the	esterily in the ty	lodiereiseedeljelij	hinter the	ų	a. Managa ang kala	en an	en maintainte
Marker	92 MH	z		200	J1 pts				10.0 ms/	CF Ma	- 433.9 rker	2 MHZ				2001	t pts					20.0 ms/
Type	Ref 1	Inc	X-value	Y-value	Fur	nction	Fun	nction Resul	t i	T	ype R	ef Tri	:	X-value	1	Y-value	Fun	ction	1	Fun	ction Resul	lt
M1		1	5.3	ms -17.21 (dBm						M1		1	27.9	ms	-17.26 dB	3m					
M2		1	13.6	ms -17.20 (dBm						M2		1	36.1	ms	-17.27 dE	3m					
M3		1	100.0	ms -68.19 (dBm						M3		1	128.6	ms	-17.45 dB	3m					



6. Test Equipment

	Test Equipment List													
Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Expired date									
	R	adiated Spuriou	s Emission											
Spectrum Analyzer	Keysight	N9010A	MY56070827	2023/4/7	2024/4/6									
EMI Test Receiver	Rohde & Schwarz	ESR7	101754	2022/12/13	2023/12/12									
Loop Antenna	ETS lindgren	6502	00213440	2023/1/4	2024/1/3									
Trilog- Broadband Antenna with 5dB Attenuator	Schwarzbeck & EMCI	VULB 9168 & N-6-05	774 & AT- N0538	2023/2/13	2024/2/12									
Horn Antenna (1-18 GHz)	Schwarzbeck	BBHA 9120 D	01690	2022/12/21	2023/12/20									
Preamplifier (30-1000 MHz)	EMCI	EMC330E	980405	2023/6/7	2024/6/6									
Preamplifier (1-18 GHz)	EMCI	EMC051835BE	980406	2023/2/17	2024/2/16									
Cables	Hanyitek	K1K50- UP0264- K1K50-2500	170214-4 & 170425-2	2022/12/1	2023/11/30									

UL Software						
Description Name Version						
Radiated measurement	e3	6.191211 (V6)				
Conducted measurement	RF-Conducted-FCC 15247	ver 1.0				



7. Description of Test Setup

Support Equipment

ID	Equipment	Brand Name	Model Name	S/N	Remark
А	Valve	ORO	S02VA00014	NA	Provide by client

Test Setup

Continuous transmission by powering on.

Setup Diagram for Test



Under Table

Remote Site



8. Test Results

8.1. Radiated Spurious Emission

Requirements

Fundamental	Field Strength	of Fundamental	Field Strength of Spurious		
Frequency (MHz)	uV/meter dBuV/meter		uV/meter	dBuV/meter	
$40.66 \sim 40.70$	2250	67.04	225	48.04	
70 ~ 130	1250	61.94	125	41.94	
130 ~ 174	$1250 \sim 3750$	$61.94 \sim 71.48$	125 ~ 375	41.94 ~ 51.48	
174 ~ 260	3750	71.48	375	51.48	
260 ~ 470	$3750 \sim 12500$	$71.48 \sim 81.94$	375 ~ 1250	51.48 ~ 61.94	
Above 470	12500	81.94	1250	61.94	

Limits of Radiated Emission Measurement

Note:

- 1. Where F is the frequency in MHz, the formula for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters = 56.81818(F)-6136.3636; for the band 260-470 MHz, uV/m at 3 meters = 41.6667(F)-7083.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.
- 2. The above field strength limits are specified at a distance of 3meters. The tighter limits apply at the band edges.



Test report No.	: 4790838020-US-R0-V0
Page	: 18 of 32
Issued date	: 2023/7/3
FCC ID	: W55AISDB3N4

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

Frequency(MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

1. The lower limit shall apply at the transition frequencies.

2. Emission level $(dBuV/m) = 20 \log Emission level (uV/m)$.

3. For frequencies above 1000MHz, 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 20dB under any condition of modulation.



Test Procedures

[For 9 kHz ~ 30 MHz]

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. For measurement below 30MHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

[For above 30 MHz]

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
- f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.



Note:

- a. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
- b. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
- c. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98%) or 10Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.
- d. All modes of operation were investigated (includes all external accessories) and the worst-case emissions are reported, the other emission levels were low against the limit.
- e. Test data of Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
- f. Test data of Margin(dB) = Result value (dBuV/m) Limit value (dBuV/m).
- g. Test data of Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) Preamp Factor (dB).
- h. Test data of Notation "@" = Fundamental Frequency
- i. Test data of Notation " * " = The peak result under 20 dB above and complies with AVG limit, AVG result is deemed to comply with AVG limit.

Test Setup

<Frequency Range 9 kHz ~ 30 MHz>





<Frequency Range 30 MHz ~ 1 GHz >



<Frequency Range above 1 GHz>



For the actual test configuration, please refer to the Setup Configurations.



<u>Test Data</u>

Above 1 GHz

110010101			
Mode	ASK(315MHz)	Channel	1

Delevization	Natation	Frequency	Reading	Correct	Result	Limit	Margin	D a ma a mla
Folalization	INOLALIOII	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	Remark
	*	1260	44.03	-8.82	35.21	74	-38.79	РК
		1575	68.33	-8.25	60.08	74	-13.92	РК
		1575	48.33	-8.25	40.08	54	-13.92	AVG
		1890	67.45	-6.87	60.58	74	-13.42	РК
TT		1890	47.45	-6.87	40.58	54	-13.42	AVG
Horizontal		2205	69.36	-4.4	64.96	74	-9.04	РК
		2205	49.36	-4.4	44.96	54	-9.04	AVG
	*	2520	51.73	-4.3	47.43	74	-26.57	РК
	*	2835	51.88	-3	48.88	74	-25.12	РК
	*	3150	50.66	-1.76	48.9	74	-25.1	РК
	*	1260	43.14	-8.82	34.32	74	-39.68	РК
	*	1575	59.05	-8.25	50.8	74	-23.2	РК
	*	1890	59.84	-6.87	52.97	74	-21.03	РК
		2205	62.88	-4.4	58.48	74	-15.52	РК
Vertical		2205	42.88	-4.4	38.48	54	-15.52	AVG
	*	2520	51.94	-4.3	47.64	74	-26.36	РК
		2835	56.4	-3	53.4	74	-20.6	РК
		2835	36.4	-3	33.4	54	-20.6	AVG
	*	3150	54.1	-1.76	52.34	74	-21.66	PK

X, ASK(315MHz) (Ch 1)	TX,	ASK(315MHz)	(Ch 1)	
Radiated Spurious Emission, Hor	izontal Rad	iated Spurious	Emission, Ver	tical
ta: 43 File: D:E3 Test Data/Project/Oro/4790838020_Oro_Al Sensor/4790838020_Oro 100	5_Al Sensor.EM6 (44) Date: 06-21-2023 100 Level	File: D:E3 Test Data/Project/O (dBuV/m)	:0l4790838020_Oro_Al Sensor\4790838020_O	.ro_Al Sensor.EM6 (44) Date: 06-21-2023
90	90			
50	en			
3 5	70			
		2 1	8 9	
	50			
	40	1	7	
	30			
	20			
10	10			
0-1000 2000. 3000. 4000.	5000. 6000 0 1000	2000.	3000. 4000.	5000. 6000



Test report No.	: 4790838020-US-R0-V0
Page	: 23 of 32
Issued date	: 2023/7/3
FCC ID	: W55AISDB3N4

Mode	ode FSK(433.92MHz)		1

Dolorization	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Domorit
Polarization	Notation	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	Remark
	*	1301.76	55.87	-8.55	47.32	74	-26.68	PK
		1735.68	76.43	-7.85	68.58	74	-5.42	PK
		1735.68	56.43	-7.85	48.58	54	-5.42	AVG
		2169.6	71.39	-4.6	66.79	74	-7.21	PK
Horizontal		2169.6	51.39	-4.6	46.79	54	-7.21	AVG
Horizoittai		2605	61.81	-4	57.81	74	-16.19	PK
		2605	41.81	-4	37.81	54	-16.19	AVG
		3035	56.69	-2.05	54.64	74	-19.36	PK
		3035	36.69	-2.05	34.64	54	-19.36	AVG
		3470	52.59	-1.88	50.71	74	-23.29	РК
	*	1301.76	49.07	-8.55	40.52	74	-33.48	PK
		1735.68	71.46	-7.85	63.61	74	-10.39	PK
		1735.68	51.46	-7.85	43.61	54	-10.39	AVG
		2169.6	66.17	-4.6	61.57	74	-12.43	PK
		2169.6	46.17	-4.6	41.57	54	-12.43	AVG
Vertical		2605	60.5	-4	56.5	74	-17.5	PK
		2605	40.5	-4	36.5	54	-17.5	AVG
		3040	57.75	-2.04	55.71	74	-18.29	PK
		3040	37.75	-2.04	35.71	54	-18.29	AVG
		3470	56.98	-1.88	55.1	74	-18.9	РК
		3470	36.98	-1.88	35.1	54	-18.9	AVG

ГХ, FSK(433.92MHz) (Ch 1)					TX, FSK(433.92MHz) (Ch 1)					
adiated	Spurious	Emission,	Horizonta	1	Radia	ated Sp	urious I	Emissio	n, Vertic	al
a: 41 00 Level (dBuV/m)	File: D:\E3 Test DatalProject	Orol4790838020_Oro_Al Sensor	1790838020_Oro_Al Sensor.EM6 (4	4) Date: 06-21-2023	Data: 42 100 Level (dE	File: D:\ kuV/m)	E3 Test DatalProjectiOrol	1790838020_Oro_Al Se	nsori4790838020_Oro_Al S	ensor.EM6 (44) Date: 06-21-2023
0					90					
					80					
	3 5				70	3				
	,	9			60		7	9 11		
					50	1 2				
		•			40		6	8 10		
					20					
					10					
0 1000	2000.	3000. 4	000. 5000.	6000	0 1000	200	0.	3000.	4000.	5000. 6000



Test report No.	: 4790838020-US-R0-V0
Page	: 24 of 32
Issued date	: 2023/7/3
FCC ID	: W55AISDB3N4

Below 1 GHz

Mode	ASK(315MHz)	Channel	1

Polarization	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Domork
	Notation	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	Kelliark
		158.04	41.12	-20.35	20.77	43.5	-22.73	PK
		467.47	40.41	-14.32	26.09	46	-19.91	PK
		538.28	41.13	-13.03	28.1	46	-17.9	РК
Horizontal		629.46	46.85	-10.68	36.17	47.66	-11.49	РК
		629.46	35.85	-10.68	25.17	47.66	-22.49	AVG
		828.31	40.68	-7.26	33.42	46	-12.58	РК
		944.71	45.1	-5.35	39.75	46	-6.25	РК
		149.31	42.13	-20.66	21.47	43.5	-22.03	РК
		523.73	40.18	-13.29	26.89	46	-19.11	РК
		594.54	40.76	-11.37	29.39	46	-16.61	РК
Vertical		629.46	43.01	-10.68	32.33	47.66	-15.33	РК
		629.46	32.01	-10.68	21.33	47.66	-26.33	AVG
		835.1	39.63	-7.12	32.51	46	-13.49	PK
		944.71	45.02	-5.35	39.67	46	-6.33	PK





Test report No.	: 4790838020-US-R0-V0
Page	: 25 of 32
Issued date	: 2023/7/3
FCC ID	: W55AISDB3N4

Mode	FSK(433.92MHz)	Channel	1	

Delegization	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Domork
Folalization	Notation	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	Kelliark
		162.89	36.98	-17.33	19.65	43.5	-23.85	РК
		353.98	38.84	-14.99	23.85	46	-22.15	РК
		598.42	37.65	-8.13	29.52	46	-16.48	РК
Horizontal		756.53	36.19	-4.93	31.26	46	-14.74	РК
Horizoittai		810.85	37.37	-4.41	32.96	46	-13.04	РК
		868.08	36.11	-3.69	32.42	52.87	-20.45	РК
		868.08	25.11	-3.69	21.42	52.87	-31.45	AVG
		966.05	36.41	-2.17	34.24	54	-19.76	РК
		148.34	37.79	-17.73	20.06	43.5	-23.44	РК
		368.53	37.3	-14.4	22.9	46	-23.1	РК
		562.53	37.27	-9.4	27.87	46	-18.13	РК
Vartical		617.82	36.66	-7.7	28.96	46	-17.04	РК
vertical		790.48	36.78	-4.64	32.14	46	-13.86	РК
		868.08	35.56	-3.69	31.87	52.87	-21	РК
		868.08	24.56	-3.69	20.87	52.87	-32	AVG
		981.57	36.5	-2.19	34.31	54	-19.69	PK





Test report No.	: 4790838020-US-R0-V0
Page	: 26 of 32
Issued date	: 2023/7/3
FCC ID	: W55AISDB3N4

Mode	Fundam	ental ASK	(315MHz) Char	nnel 1			
_								
Polarization	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Domort
		(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	Remark
Horizontal		315	87.16	-18.72	68.44	87.66	-19.22	PK
		315	76.16	-18.72	57.44	67.66	-10.22	AVG
Vertical		315	85.85	-18.72	67.13	87.66	-20.53	PK
		315	74.85	-18.72	56.13	67.66	-11.53	AVG





Mode	Fundam	ental FSK	(433.92M)	Hz) Char	nnel 1			
Polarization	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Domort
		(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	Kelliark
Hamigantal		433.92	73.95	-5.27	68.68	92.87	-24.19	PK
Horizontai		433.92	62.95	-5.27	57.68	72.87	-15.19	AVG
Vertical		433.92	80.15	-5.27	74.88	92.87	-17.99	PK
		433.92	69.15	-5.27	63.88	72.87	-8.99	AVG



9 kHz ~ 30 MHz Data:

For 9 kHz to 30 MHz radiated emission have performed all modes of operation were investigated. The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

No non-compliance noted:

KDB 414788 D01 OATS and Chamber Correlation Justification

- Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

- OATs and chamber correlation testing had been performed and chamber measured test results is the worst case test result.

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30m open area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.



8.2. 20dB Bandwidth Measurement

Requirements

Limits of 20dB Bandwidth Measurement

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for device operating above 70 MHz and below 900 MHz.

Fundamental Frequency (MHz)	Limit of Emission Bandwidth (kHz)			
315	787.5			
433.92	1084.80			

Test Setup



Test Instruments

Refer to section 6 to get information of above instrument.

Test Procedure

- a. The EUT was placed on the turn table.
- b. The signal was coupled to the spectrum analyzer through an antenna.
- c. Set the resolution bandwidth to 3 kHz and video bandwidth to 10 kHz then select Peak function to scan the channel frequency.
- d. The emission bandwidth was measured and recorded.

Deviation from Test Standard

No deviation.

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<u>Test Data</u>

Channel	Frequency (MHz)	20dB Bandwidth (kHz)	Maximum Limit (kHz)	Pass / Fail
1	315	139.9	787.5	PASS
1	433.92	139.9	1084.80	PASS



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8.3. Deactivation Time Measurement

Requirements

Limits of Deactivation Time Measurement

- (1) A transmitter activated automatically shall cease transmission within 5 seconds after activation.
- (2) For automatically limiting operation that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

Test Setup



Test Instruments

Refer to section 6 to get information of above instrument.

Test Procedure

- a. The EUT was placed on the turning table.
- b. The signal was coupled to the spectrum analyzer through an antenna.
- c. Set the resolution bandwidth to 100kHz and video bandwidth to 100kHz. The spectrum analyser was turned to the centre frequency of the transmitter's and the analyser's marker function was used to determine the duration of transmission.
- d. The transmission duration was measured and recorded.

Deviation from Test Standard

No deviation.

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<u>Test Data</u>

Frequency (MHz)	Tx on time (ms)	Tx on time Limit (s)	Idle time (s)	Idle time Limit (s)	Pass/Fail
315	8.43	<1	29.98	10	PASS

			SPECT	RUM PLC)T OF VAI	LUE			
Spectru	m)							
Ref Leve	I -10.0	0 dBm	•	RBW 100 kHz				(*	
Att		10 dB 👄 SW	/T 100 ms 👄	VBW 300 kHz					
SGL	w								
•					D2[1]			-0.21 dB	
-20 dBm-								8.4271 ms	
M1					MILI			7.3268 ms	
-30 dBm		¥ —							
-40 dBm									
-50 dBm-	-								
-60 dBm									
-70 dBm-	+	+ +							
-80 dBm-									
سير فالله بنامي		والألبيان التقريبية ا	وتنافذ للأرزار ومأعا أنخاط	وراجه يتلغل بالغان والثلاق ومعاقداتها	فالأسطاقان ودازال وتداسه والتطلط		بناك سأطرا للحاب	الأرابين وبارتها وفأر	
Prost -	+	- Apple a lister	մեր ութերին հե	╢╢╗┲╗┲	an in a shirt an a shirt an a shirt an a shirt		a a filippine the state of the	an thigh and	
-100 dBm						1	r r		
CF 315.0	MHz			4000 pt	s			10.0 ms/	
Marker	- 1 -	1							
		- I V ·	zalue	Y-value	Function	Fun	ction Resu	lt	
Type F M1	tef Tru	<u>s x-v</u>	7.3268 ms	-31.19 dBm					
Type F M1 D2	M1	1 1	7.3268 ms 8.4271 ms	-31.19 dBm -0.21 dB					
M1 D2	M1	1 1	7.3268 ms 8.4271 ms	-31.19 dBm -0.21 dB					
Spectru			7.3268 ms 8.4271 ms	-31.19 dBm -0.21 dB					
Spectru Ref Leve	M1	2 X-V	7.3268 ms 8.4271 ms	-31.19 dBm -0.21 dB					
Spectru Ref Leve Att	M1 -10.0	0 dBm 10 dB • SW	7.3268 ms 8.4271 ms • RB /T 40 s • VB	-31.19 dBm -0.21 dB 3W 100 kHz 3W 300 kHz					
Spectru Ref Leve Att SGL • 1Pk Clrr	M1	0 dBm 10 dB • SW	7.3268 ms 8.4271 ms • RP /T 40 s • VP	-31.19 dBm -0.21 dB 3W 100 kHz 3W 300 kHz					
Spectru Ref Leve Att SGL • 1Pk Clru	M1	0 dBm 10 dB • SW	7.3268 ms 8.4271 ms • RB /T 40 s • VE	-31.19 dBm -0.21 dB 3W 100 kHz 3W 300 kHz	D2[1]			-4.95 dB	
Spectru Ref Leve Att SGL -20 dBm	M1	0 dBm 10 dB • SW	7.3268 ms 8.4271 ms • RE /T 40 s • VE	-31.19 dBm -0.21 dB 3W 100 kHz 3W 300 kHz	D2[1]			-4.95 dB 29.97749 s -24.75 dBm	
Type f M1 D2 Spectru Ref Levu Att SGL • 1Pk Clru -20 dBm-	M1	0 dBm 10 dB • SW	7.3268 ms 8.4271 ms • RE /T 40 s • VE	-31.19 dBm -0.21 dB 3W 100 kHz 3W 300 kHz	D2[1]		D2	-4.95 dB 29.97749 s -24.75 dBm 3.61090 s	
Type F M1 D2 Spectru Ref Levi Att SGL • 1Pk Clri -20 dBm- -30 dBm-		0 dBm 10 dB • SW	7.3268 ms 8.4271 ms • RE /T 40 5 • VE	-31.19 dBm -0.21 dB W 100 kHz 3W 300 kHz	D2[1] M1[1]		D2	-4.95 dB 29.97749 s -24.75 dBm 3.61090 s	
Type I M1 M1 D2 Spectru Ref Levi Att SGL ● 1Pk Clr -20 dBm ⁺ -30 dBm ⁻ -40 dBm ⁻		0 dBm 10 dB • SW	7.3268 ms 8.4271 ms • Re /T 40 s • Ve	-31.19 dBm -0.21 dB W 100 kHz 3W 300 kHz	D2[1] M1[1]		D2	-4.95 dB 29.97749 s -24.75 dBm 3.61090 s	
Type I MI D2 Spectru Ref Levi Att SGL • IPk Clr -20 dBm+ -30 dBm- -40 dBm-	tet Train M1	0 dBm 10 dB • SW	7.3268 ms 8.4271 ms • Re /T 40 s • Ve	-31.19 dBm -0.21 dB 3W 100 kHz 3W 300 kHz	D2[1] M1[1]			-4.95 dB 29.97749 s -24.75 dBm 3.61090 s	
Type I 1 1 D2 Spectru Ref Leve Att SGL ●1Pk Clr -20 dBm ⁺ -30 dBm ⁻ -40 dBm ⁻		0 dBm 10 dB • SW	7.3268 ms 8.4271 ms • Re /T 40 s • Ve	-31.19 dBm -0.21 dB 3W 100 kHz 3W 300 kHz	D2[1] M1[1]			-4.95 dB 29.97749 s -24.75 dBm 3.61090 s	
Type I M1 D2 Spectru Ref Levr Att SGL ●1Pk Clr -20 dBm ⁺ -30 dBm ⁻ -40 dBm ⁻ -50 dBm ⁻ -60 dBm ⁻		0 dBm 10 dB	7.3268 ms 8.4271 ms • Re /T 40 s • Ve	-31.19 dBm -0.21 dB 3W 100 kHz 3W 300 kHz	D2[1] M1[1]			-4.95 dB 29.97749 s -24.75 dBm 3.61090 s	
Type I Min D2 Spectru Ref Levr Att SGL ●1Pk Clr -20 dBm ⁺ -30 dBm ⁻ -40 dBm ⁻ -50 dBm ⁻ -60 dBm ⁻		0 dBm 10 dB	7.3268 ms 8.4271 ms • Re /T 40 s • Ve	-31.19 dBm -0.21 dB 3W 100 kHz 3W 300 kHz	D2[1] M1[1]		D2	-4.95 dB 29.97749 s -24.75 dBm 3.61090 s	
Type I M1 D2 Spectru Ref Leve Att SGL ●1Pk Clr -20 dBm ⁺ -30 dBm ⁻ -40 dBm ⁻ -50 dBm ⁻ -60 dBm ⁻		0 dBm 1 0 dB	7.3268 ms 8.4271 ms	-31.19 dBm -0.21 dB 3W 100 kHz 3W 300 kHz	D2[1] M1[1]			-4.95 dB 29.97749 s -24.75 dBm 3.61090 s	
Type I 1 1 D2 Spectru Ref Leve Att SGL IPk Cir -20 dBm ⁺ -30 dBm ⁻ -40 dBm ⁻ -50 dBm ⁻ -60 dBm ⁻ -70 dBm ⁻ -70 dBm ⁻	V V V V V V V V V V V V V V	0 dBm 1 0 dB	7.3268 ms 8.4271 ms	-31.19 dBm -0.21 dB	D2[1] M1[1]			-4.95 dB 29.97749 s -24.75 dBm 3.61090 s	
Type I 1 1 1 1 1 1 2 Spectru Ref Leve Att SGL IPk Clr -20 dBm30 dBm40 dBm40 dBm60 dBm60 dBm70 dBm80 dBm	v v v v v v v v v v v v v v	0 dBm 1 0 dB • SW	7.3268 ms 8.4271 ms • RE /T 40 s • VE	-31.19 dBm -0.21 dB	D2[1] M1[1]			-4.95 dB 29.97749 s -24.75 dBm 3.61090 s	
Type I M1 D1 D2 Spectru Ref Levo Att SGL 1Pk Clr -20 dBm ⁺ -30 dBm ⁻ -30 dBm ⁻ -50 dBm ⁻ -60 dBm ⁻ -60 dBm ⁻ -70 dBm ⁻ -90 dBm ⁻	V V V V V	0 dBm 1 1 1 0 dB • SW	7.3268 ms 8.4271 ms • RE // 40 s • VE	-31.19 dBm -0.21 dB	D2[1] M1[1]			-4.95 dB 29.97749 s -24.75 dBm 3.61090 s	
Type I 1 1 1 1 1 1 1 1 20 SGL 1 20 4 -20 -30 -30 -40 -50 -50 -70 -70 -80 -90 -100 0 -100		0 dBm 1 1 1 0 dB • SW	7.3268 ms 8.4271 ms • RE • VT 40 5 • VE	-31.19 dBm -0.21 dB 3W 100 kHz 300 kHz	D2[1] M1[1] M1[1]			-4.95 dB 29.97749 s -24.75 dBm 3.61090 s	
Type I M1 D2 Spectru Ref Levi Att SGL IPk Clr -20 dBm ⁺ -30 dBm ⁻ -50 dBm ⁻ -50 dBm ⁻ -60 dBm ⁻ -70 dBm ⁻ -90 dBm ⁻ -100 dBm ⁻		0 dBm 1 1 1 0 dB • SW	7.3268 ms 8.4271 ms • RE VT 40 s • VE	-31.19 dBm -0.21 dB	D2[1] M1[1] M1[1]			-4.95 dB 29.97749 s -24.75 dBm 3.61090 s	
Type I M1 D2 Spectru Ref Levi Att SGL IPk Clr -20 dBm ⁻¹ -30 dBm ⁻¹ -50 dBm ⁻¹ -60 dBm ⁻¹ -70 dBm ⁻¹ -80 dBm ⁻¹ -100 dBm ⁻¹ -100 dBm ⁻¹		0 dBm 1 1 1 10 dB • SW	7.3268 ms 8.4271 ms • RE VT 40 s • VE	-31.19 dBm -0.21 dB 3W 100 kHz 3W 300 kHz	D2[1] M1[1]			-4.95 dB 29.97749 s -24.75 dBm 3.61090 s	
Type I M1 D2 Spectru Ref Leva Att SGL ●1Pk Clr -20 dBm ⁺ -30 dBm ⁻ -40 dBm ⁻ -50 dBm ⁻ -60 dBm ⁻ -70 dBm ⁻ -90 dBm ⁻ -100 dBm CF 315.0 Marker	V V V V V V V V V V V V V V V V V V V	0 dBm 1 1 1 1 10 dB • SW	7.3268 ms 8.4271 ms	-31.19 dBm -0.21 dB W 100 kHz 3W 300 kHz	D2[1] M1[1]			-4.95 dB 29.97749 s 3.61090 s 3.61090 s	
Type I M1 D2 Spectru Ref Levr Att SGL ●1Pk Cir -20 dBm ⁺ -30 dBm ⁻ -40 dBm ⁻ -50 dBm ⁻ -60 dBm ⁻ -90 dBm ⁻ -100 dBm CF 315.0 Marker Type I	V V V V M1 V V V V V V V V V V V V V V V	2 X × 1 1 1 0 dBm 10 dB ● SW 1 10 dB ● SW 1 1 1 1 1 1 1 1 1 1 1 1 1	7.3268 ms 8.4271 ms	-31.19 dBm -0.21 dB 3W 100 kHz 3W 300 kHz 	D2[1] M1[1] S Function		D2	-4.95 dB 29.97749 s -24.75 dB 3.61090 s 3.61090 s	

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Test report No.	: 4790838020-US-R0-V0		
Page	: 32 of 32		
Issued date	: 2023/7/3		
FCC ID	: W55AISDB3N4		

Frequency (MHz)	Tx on time (ms)	Tx on time Limit (s)	Idle time (s)	Idle time Limit (s)	Pass/Fail	
433.92	8.42	<1	29.70	10	PASS	



END OF REPORT

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