

FCC PART 15.231

TEST REPORT

For

Autel Intelligent Tech. Corp., Ltd.

6th - 10th Floor, Bldg. B1, Zhiyuan, Xueyuan Rd., Xili, Nanshan, Shenzhen, 518055, China

FCC ID: WQ8301B315

Report Type:		Product Type:			
Original Report		MX-Sensor			
Test Engineer:	Sewen Guo		Sewen	G WO	
Report Number:	RSZ15101000)9-00			
Report Date:	2015-11-13		· .		
Reviewed By:	RF Engineer		Jimmy	xiao	
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Note: This test report is prepared for the customer shown above and for the equipment described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

Report No.: RSZ151010009-00

Bay Area Compliance Laboratories Corp. (Shenzhen)

TABLE OF CONTENTS

GENERAL INFORMATION	
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	3
OBJECTIVE	
RELATED SUBMITTAL(S)/GRANT(S)	
TEST FACILITY	
SVSTEM TEST CONFICURATION	5
JUSTICICATION	
SPECIAL ACCESSORIES	
EQUIPMENT MODIFICATIONS	5
BLOCK DIAGRAM OF TEST SETUP	5
SUMMARY OF TEST RESULTS	7
FCC §15.203 - ANTENNA REQUIREMENT	8
APPLICABLE STANDARD	8
ANTENNA CONNECTOR CONSTRUCTION	8
FCC §15.205, §15.209, §15.231 (B), §15.231 (E) - RADIATED EMISSIONS	9
APPLICABLE STANDARD	9
Measurement Uncertainty	
EUT SETUP	
EIVII TEST RECEIVER SETUP TEST PROCEDURE	11
TEST EQUIPMENT LIST AND DETAILS	
CORRECTED AMPLITUDE & MARGIN CALCULATION	
TEST RESULTS SUMMARY	
TEST DATA	
FCC §15.231(A) (2) - DEACTIVATION TESTING	21
APPLICABLE STANDARD	
TEST PROCEDURE	
TEST DATA	
FCC §15.231(C) – 20 DB EMISSION BANDWIDTH TESTING	23
APPLICABLE STANDARD	
Test Procedure	
TEST EQUIPMENT LIST AND DETAILS	
IEST DATA	
FCC §15.231(E) – TRANSMISSION AND SILENT PERIOD TESTING	26
APPLICABLE STANDARD	
TEST FOURPMENT LIST AND DETAILS	
TEST DATA	
PRODUCT SIMILARITY DECLARATION LETTER	29

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Autel Intelligent Tech. Corp., Ltd.*'s product, model number: 8920C (FCC ID: WQ8301B315) (or the "EUT") in this report was a *MX-Sensor*, which was measured approximately: 54.2 mm (L) x 29.4 mm (W) x 19.1 cm (H), rated input voltage: DC 3V battery.

Note: The series product, model 8920J, 8920C2 and 8920C are electrically identical, they are different from model number and shell shape due to marketing purposes. Model 8920C was selected for fully testing. Detailed information is stated and guaranteed by the applicant which was explained in the attached declaration letter.

*All measurement and test data in this report was gathered from production sample serial number: 1506746 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2015-10-10.

Objective

This test report is prepared on behalf of *Autel Intelligent Tech. Corp., Ltd.* All the test measurements were performed according to the measurement procedure described in ANSI C63.10 - 2013.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, section 15.203, 15.205, 15.209, 15.35(c) and 15.231 rules.

Related Submittal(s)/Grant(s)

No related submittal(s).

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10 - 2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement uncertainty with radiated emission is 5.91 dB for 30MHz-1GHz.and 4.92 dB for above 1GHz, 1.95dB for conducted measurement.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China.

Test site at Bay Area Compliance Laboratories Corp. (Shenzhen) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on October 31, 2013. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.10 - 2013.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 382179. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

SYSTEM TEST CONFIGURATION

Justification

The system was configured for testing in a typical fashion (as normally used by a typical user).

Special Accessories

No special accessories was used

Equipment Modifications

No modification was made to the EUT.

Block Diagram of Test Setup

Below 1GHz:

	EUT	
		-
Non-Conductive Table 80 cm above Ground Plane		
	1 5 Meters	\longrightarrow

Bay Area Compliance Laboratories Corp. (Shenzhen)

Report No.: RSZ151010009-00

Above 1GHz:



FCC Part 15.231

Page 6 of 29

SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207 (a)	Conducted Emissions	Not Applicable
§15.205, §15.209, §15.231(b)(e)	Radiated Emissions	Compliance
§15.231 (c)	20dB Emission Bandwidth	Compliance
§15.231 (a) (2)	Deactivation	Compliance
§15.231 (e)	Transmission Time, Silent period	Compliance

Not Applicable: The EUT is powered by battery only.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

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.

Antenna Connector Construction

The EUT has an internal antenna arrangement which was permanently attached and the antenna gain is -4dBi; fulfill the requirement of this section. Please refer to EUT photos.

Result: Compliant.

FCC §15.205, §15.209, §15.231 (b), §15.231 (e) - RADIATED EMISSIONS

Applicable Standard

FCC §15.205, §15.209, §15.231 (b), §15.231 (e)

According to FCC §15.231(b), the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field Strength of Fundamental (Microvolts /meter)	Field Strength of spurious emissions ((Microvolts /meter)
40.66-40.70	2250	225
70-130	1250	125
130-174	1250 to 3750**	125 to 375**
174-260	3750	375
260-470	3750 to 12500**	375 to 1250**
Above 470	12500	1250

*Linear interpolations.

The above field strength limits are specified at a distance of 3-meters the tighter limits apply at the band edges.

According to §15.231 (e), intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this section, except the field strength table in paragraph (b) of this section is replaced by the following:

Fundamental frequency (MHz)	Field Strength of Fundamental (Microvolts /meter)	Field Strength of spurious emissions (Microvolts /meter)
40.66-40.70	1000	100
70-130	500	50
130-174	500 to 1500**	50 to 150**
174-260	1500	150
260-470	1500 to 5000**	150 to 500**
Above 470	5000	500

**Linear interpolations.

The above field strength limits are specified at a distance of 3-meters the tighter limits apply at the band edges.

Bay Area Compliance Laboratories Corp. (Shenzhen)

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of radiation emissions at Bay Area Compliance Laboratories Corp. (Shenzhen) is 5.91 dB for 30MHz-1GHz and 4.92 dB for above 1GHz, and it will not be taken into consideration for the test data recorded in the report.

EUT Setup

Below 1 GHz:



Above 1 GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10 - 2013. The specification used was the FCC 15 § 15.209, 15.205 and 15.231.

EMI Test Receiver Setup

The system was investigated from 30 MHz to 4 GHz.

During the radiated emission test, the test receiver was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30MHz - 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1 MHz	3 MHz	/	PK

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All final data was recorded in the Quasi-peak detection mode from 30MHz to 1GHz, Peak detection mode above 1 GHz.

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	101122	2014-11-03	2015-11-03
Rohde & Schwarz	EMI Test Receiver	ESCI	101122	2015-11-03	2016-11-03
HP	Amplifier	HP8447E	1937A01046	2015-05-06	2016-05-06
Sunol Sciences	Broadband Antenna	JB1	A040904-2	2014-12-07	2017-12-06
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2014-12-11	2015-12-11
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2015-04-23	2016-04-23
Sunol Sciences	Horn Antenna	DRH-118	A052304	2014-12-29	2017-12-28

Test Equipment List and Details

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Loss and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude = Meter Reading + Antenna Loss + Cable Loss - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 5.8 dB means the emission is 5.8 dB below the limit. The equation for margin calculation is as follows:

Margin = Limit –Corrected Amplitude

Test Results Summary

According to the data in the following table, the EUT complied with the <u>FCC §15.205, §15.209, §15.231</u> (e), the worst margin reading as below:

10.47 dB at 3150.00 MHz in the Vertical polarization, ASK modulation

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_{\rm m}$$
 ++ $U_{(Lm)} \leq L_{\rm lim}$ ++ $U_{\rm cispr}$

In BACL, $U_{(Lm)}$ is less than + U_{cispr} , if L_m is less than L_{lim} , it implies that the EUT complies with the limit.

Bay Area Compliance Laboratories Corp. (Shenzhen)

Test Data

Environmental Conditions

Temperature:	25 - 26 °C
Relative Humidity:	49 - 50 %
ATM Pressure:	100.0 - 101.0 kPa

The testing was performed by Sewen Guo on 2015-11-02 and 2015-11-12.

Test mode: Transmitting

Pre-scan with the three models (8920C, 8920J, 8920C2), the worst case is model 8920C.

30MHz-4GHz (ASK Modulation):

	Re	eceiver	Rx Antenna		Corrected Corrected		FCC Part 15.231(b)/205/209			
Frequency (MHz)	Reading (dBµV)	Detector (PK/QP/Ave.)	Degree	Height (m)	Polar (H/V)	Factor (dB)	Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comment
315.00	82.01	РК	239	1.4	Н	-12.17	69.84	95.62	25.78	Fundamental
315.00	80.35	РК	210	1.8	V	-12.17	68.18	95.62	27.44	Fundamental
1260.00	51.36	РК	212	1.5	Н	-0.38	50.98	75.62	24.64	Harmonic
1260.00	50.85	РК	250	1.1	V	-0.38	50.47	75.62	25.15	Harmonic
2205.00	53.78	РК	18	1.3	Н	4.39	58.17	74.00	15.83	Harmonic
2205.00	52.07	РК	36	1.1	V	4.39	56.46	74.00	17.54	Harmonic
2520.00	50.13	РК	220	1.6	Н	6.29	56.42	75.62	19.20	Harmonic
2520.00	48.72	РК	147	1.7	V	6.29	55.01	75.62	20.61	Harmonic
2835.00	48.96	РК	166	1.4	Н	6.71	55.67	74.00	18.33	Harmonic
2835.00	49.58	РК	213	1.2	V	6.71	56.29	74.00	17.71	Harmonic
3150.00	51.76	РК	109	2.2	Н	12.19	63.95	75.62	11.67	Harmonic
3150.00	52.96	РК	150	1.8	V	12.19	65.15	75.62	10.47	Harmonic

Field Strength of Average Emission									
	Peak		Duty Cvcle	Corrected	FCC Part 15.231(b)/205/209				
Frequency (MHz)	Measurement @3m (dBµV/m)	Polar (H/V)	Correction Factor (dB)	Ampitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comment		
315.00	69.84	Н	-20.7	49.14	75.62	26.48	Fundamental		
315.00	68.18	V	-20.7	47.48	75.62	28.14	Fundamental		
1260.00	50.98	Н	-20.7	30.28	55.62	25.34	Harmonic		
1260.00	50.47	V	-20.7	29.77	55.62	25.85	Harmonic		
2205.00	58.17	Н	-20.7	37.47	54.00	16.53	Harmonic		
2205.00	56.46	V	-20.7	35.76	54.00	18.24	Harmonic		
2520.00	56.42	Н	-20.7	35.72	55.62	19.90	Harmonic		
2520.00	55.01	V	-20.7	34.31	55.62	21.31	Harmonic		
2835.00	55.67	Н	-20.7	34.97	54.00	19.03	Harmonic		
2835.00	56.29	V	-20.7	35.59	54.00	18.41	Harmonic		
3150.00	63.95	Н	-20.7	43.25	55.62	12.37	Harmonic		
3150.00	65.15	V	-20.7	44.45	55.62	11.17	Harmonic		

Note 1:

Corrected Amplitude = Corrected Factor + Reading Corrected Factor = Antenna factor (Rx) + cable loss – amplifier factor Margin = Limit - Corr. Amplitude

Note 2:

Calculate Average value based on Duty Cycle correction factor: Ton1 = 34*Pulses=34*0.160ms = 5.44msTon2 = 2*Pulses=2*0.551ms = 1.10msTon3 = 8*Pulses=8*0.298ms = 2.38msTp = 96.79msDuty cycle = (Ton1+Ton2+Ton3)/Tp = (5.44+1.10+2.38)ms/96.79ms = 0.092Duty Cycle Corrected Factor = 20lg (Duty cycle) = 20lg0.092 = -20.7 dB Average = Peak – Duty Cycle Corrected Factor



Duty Cycle 1

Duty Cycle 2



FCC Part 15.231

Page 15 of 29



Duty Cycle 4



FCC Part 15.231

Page 16 of 29



30MHz-4GHz (FSK Modulation):

	Receiver			Rx Ar	itenna	Corrected	Corrected	FCC I	Part 15.231(e)/205/209
Frequency (MHz)	Reading (dBµV)	Detector (PK/QP/Ave.)	Turntable Degree	Height (m)	Polar (H/V)	Factor (dB)	Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comment
315.00	80.19	РК	243	1.4	Н	-12.17	68.02	87.66	19.64	Fundamental
315.00	79.57	РК	214	1.6	V	-12.17	67.40	87.66	20.26	Fundamental
1260.00	50.23	РК	229	2.3	Н	-0.38	49.85	74.00	24.15	Harmonic
1260.00	51.67	РК	78	2.1	V	-0.38	51.29	74.00	22.71	Harmonic
1575.00	53.28	PK	210	1.8	Н	1.41	54.69	74.00	19.31	Harmonic
1575.00	52.57	РК	49	1.2	V	1.41	53.98	74.00	20.02	Harmonic
1890.00	51.03	РК	199	1.1	Н	3.23	54.26	74.00	19.74	Harmonic
1890.00	49.78	РК	153	1.6	V	3.23	53.01	74.00	20.99	Harmonic
2205.00	50.12	РК	222	2.1	Н	4.39	54.51	74.00	19.49	Harmonic
2205.00	49.58	РК	247	1.7	V	4.39	53.97	74.00	20.03	Harmonic
2520.00	50.36	РК	29	1.6	Н	6.29	56.65	74.00	17.35	Harmonic
2520.00	51.57	РК	14	1.5	V	6.29	57.86	74.00	16.14	Harmonic
2835.00	50.16	РК	233	2.4	Н	6.71	56.87	74.00	17.13	Harmonic
2835.00	51.76	РК	247	2.1	V	6.71	58.47	74.00	15.53	Harmonic

FCC Part 15.231

Page 17 of 29

Field Strength of Average Emission							
F	Peak		Duty Cycle	Corrected	FCC Part 15.231(e)/205/209		
Frequency (MHz)	Measurement @3m (dBμV/m)	Polar (H/V)	Correction Factor (dB)	Ampitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comment
315.00	68.02	Н	-19.7	48.32	67.66	19.34	Fundamental
315.00	67.40	V	-19.7	47.70	67.66	19.96	Fundamental
1260.00	49.85	Н	-19.7	30.15	54.00	23.85	Harmonic
1260.00	51.29	V	-19.7	31.59	54.00	22.41	Harmonic
1575.00	54.69	Н	-19.7	34.99	54.00	19.01	Harmonic
1575.00	53.98	V	-19.7	34.28	54.00	19.72	Harmonic
1890.00	54.26	Н	-19.7	34.56	54.00	19.44	Harmonic
1890.00	53.01	V	-19.7	33.31	54.00	20.69	Harmonic
2205.00	54.51	Н	-19.7	34.81	54.00	19.19	Harmonic
2205.00	53.97	V	-19.7	34.27	54.00	19.73	Harmonic
2520.00	56.65	Н	-19.7	36.95	54.00	17.05	Harmonic
2520.00	57.86	V	-19.7	38.16	54.00	15.84	Harmonic
2835.00	56.87	Н	-19.7	37.17	54.00	16.83	Harmonic
2835.00	58.47	V	-19.7	38.77	54.00	15.23	Harmonic

Note 1:

Corrected Amplitude = Corrected Factor + Reading Corrected Factor = Antenna factor (Rx) + cable loss – amplifier factor Margin = Limit - Corr. Amplitude

Note 2:

Calculate Average value based on Duty Cycle correction factor: Duty cycle factor = 20*lg(Ton/Tp) = 20*lg(10.4/100) = -19.7 dB Average = Peak – Duty Cycle Corrected Factor



Duty Cycle 1

Duty Cycle 2



Bay Area Compliance Laboratories Corp. (Shenzhen)



Duty Cycle 3

FCC §15.231(a) (2) - DEACTIVATION TESTING

Applicable Standard

Per FCC §15.231(a) (2), a transmitter activated automatically shall cease transmission within 5 seconds after activation.

Test Procedure

- 1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 2. Set center frequency of spectrum analyzer=operating frequency.
- 3. Set the spectrum analyzer as RBW=100k VBW=300k Span=0Hz.
- 4. Repeat above procedures until all frequency measured was complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2014-12-11	2015-12-11

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	26 °C
Relative Humidity:	55 %
ATM Pressure:	100.1 kPa

The testing was performed by Sewen Guo on 2015-11-12.

Test mode: Transmitting

Test Result: Compliant, please refer to following plot.

Report No.: RSZ151010009-00

ASK&FSK modulation:



FCC §15.231(c) – 20 dB EMISSION BANDWIDTH TESTING

Applicable Standard

Per 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. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Test Procedure

With the EUT's antenna attached, the waveforzm was received by the test antenna which was connected to the spectrum analyzer, plot the 20 dB bandwidth.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2014-12-11	2015-12-11

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements, traceable to traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	26 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Sewen Guo on 2015-11-02.

Test Mode: Transmitting

Please refer to following table and plot.

ASK&FSK modulation:

Channel Frequency	20 dB Emission Bandwidth	<limit< th=""><th>Result</th></limit<>	Result
(MHz)	(kHz)	(kHz)	
315	66	787.5	Pass

Note: Limit = 0.25% * center frequency = 0.25% * 315 MHz = 787.5 kHz 20dB bandwidth = 66 kHz <787.5 kHz

20 dB Emission Bandwidth



FSK modulation:

Channel Frequency	20 dB Emission Bandwidth	<limit< th=""><th>Result</th></limit<>	Result
(MHz)	(kHz)	(kHz)	
315	120	787.5	Pass

Note: Limit = 0.25% * center frequency = 0.25% * 315 MHz = 787.5 kHz 20dB bandwidth = 120 kHz <787.5 kHz

20 dB Emission Bandwidth



FCC §15.231(e) – TRANSMISSION AND SILENT PERIOD TESTING

Applicable Standard

Per FCC §15.231(e), devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so 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 Procedure

- 5. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 6. Set center frequency of spectrum analyzer=operating frequency.
- 7. Set the spectrum analyzer as RBW=100kHz, VBW=300kHz, Span=0Hz.
- 8. Repeat above procedures until all frequency measured was complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2014-12-11	2015-12-11

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements, traceable to traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	26 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Sewen Guo on 2015-11-12.

Test Mode: Transmitting

Deactivation

Transmission period (s)	Limit (s)	Result
0.251	< 1	Pass

Silent period

Silent period (s)	Limit (s)	Result
13.35	> 10	Pass

Note: The silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

The duration time is 0.251s, $0.251 \times 30 = 7.53s$.

Test Result: Compliant, please refer to following plot



Transmission period



Silent period

FCC Part 15.231

Page 28 of 29

PRODUCT SIMILARITY DECLARATION LETTER

Autel Intelligent Tech. Corp., Ltd. 6th - 10th Floor, Bldg. B1, Zhiyuan, Xueyuan Rd., Xili, Nanshan Shenzhen China Tel: (86)755-86147779 Fax: (86)755-86147758

2015-12-7

Product Similarity Declaration

To Whom It May Concern,

We, Autel Intelligent Tech. Corp., Ltd., hereby declare that we have a product named as MX-Sensor (Model number: 8920C) was tested by BACL, meanwhile, for our marketing purpose, we would like to list a series models (8920J, 8920C2) on reports and certificate, only model number different and shell shape have little difference, don't affect the electromagnetic compatibility. 8920C adopts ultrasound shell and plug-in valve, 8920J uses the glue shell and screw fixing valve, 8920C2 adopts ultrasound shell and screw fixing valve. No other changes are made to them.

We confirm that all information above is true, and we'll be responsible for all the consequences. Please contact me if you have any question.

Signature:

Frank Li

Frankli

President

***** END OF REPORT *****