

# Global United Technology Services Co., Ltd.

Report No.: GTS201807000230F01

# **FCC REPORT**

Autel Intelligent Tech. Corp., Ltd. **Applicant:** 

6th - 10th Floor, Bldg. B1, Zhiyuan, Xueyuan Rd., Xili, **Address of Applicant:** 

Nanshan, Shenzhen 518055, China

Autel Intelligent Tech. Corp., Ltd. Manufacturer/Factory:

Address of 6th - 10th Floor, Bldg. B1, Zhiyuan, Xueyuan Rd., Xili,

Nanshan, Shenzhen 518055, China Manufacturer/Factory:

**Equipment Under Test (EUT)** 

Product Name: MX-Sensor

Model No.: 1 Sensor, 4 in 1 Press in Sensor

Trade Mark: AUTEL

FCC ID: WQ8TPMSDF87E

FCC CFR Title 47 Part 15 Subpart C Section 15.231 **Applicable standards:** 

Date of sample receipt: July 30, 2018

Date of Test: July 31, 2018-August 13, 2018

Date of report issued: August 14, 2018

PASS \* Test Result:

Authorized Signature:

Robinson Lo **Laboratory Manager** 

This results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

In the configuration tested, the EUT complied with the standards specified above.



# 2 Version

Version No.	Date	Description
01	August 14, 2018	Original

Prepared By:	Bill. Yvan	Date:	August 14, 2018	
	Project Engineer			
Check By:	Andy w	Date:	August 14, 2018	
	Reviewer			



# 3 Contents

			Page
1	COV	ER PAGE	1
2	VFR	SION	2
_			
3	CON	TENTS	3
4	TES	T SUMMARY	4
	4.1	MEASUREMENT UNCERTAINTY	4
5	GEN	ERAL INFORMATION	5
	5.1	GENERAL DESCRIPTION OF EUT	5
	5.2	TEST MODE	
	5.3	DESCRIPTION OF SUPPORT UNITS	6
	5.4	TEST FACILITY	
	5.5	TEST LOCATION	6
	5.6	OTHER INFORMATION REQUESTED BY THE CUSTOMER	6
6	TES	T INSTRUMENTS LIST	7
7	TEG	T RESULTS AND MEASUREMENT DATA	g
•	7.1	ANTENNA REQUIREMENT	
	7.1 7.2	RADIATED EMISSION METHOD	
	7.2.1		
	7.2.7		
	7.3	20DB OCCUPY BANDWIDTH	
	7.4	DWELL TIME	
	7.5	DUTY CYCLE	
8		T SETUP PHOTO	
9	EUT	CONSTRUCTIONAL DETAILS	25



# 4 Test Summary

Test Item	Section in CFR 47	Result
Antenna Requirement	15.203	Pass
Conduction Emission	15.207	N/A
Field strength of the Fundamental Signal	15.231 (e)	Pass
Spurious Emissions	15.231 (e)/15.209	Pass
20dB Bandwidth	15.231 (c)	Pass
Dwell Time	15.231 (e)	Pass

Pass: The EUT complies with the essential requirements in the standard.

# 4.1 Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes		
Radiated Emission	9kHz ~ 30MHz	± 4.34dB	(1)		
Radiated Emission	30MHz ~ 1000MHz	± 4.24dB	(1)		
Radiated Emission	1GHz ~ 26.5GHz	± 4.68dB	(1)		
AC Power Line Conducted Emission 0.15MHz ~ 30MHz ± 3.45dB (1)					
Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.					



# 5 General Information

# 5.1 General Description of EUT

Product Name:	MX-Sensor		
Model No.:	1 Sensor, 4 in 1 Press in Sensor		
Test Model No:	1 Sensor		
Remark: All above models are	identical in the same PCB layout, interior structure and electrical circuits.		
The only difference is equipped	d with valve nozzles of different mounting modes for commercial purpose.		
Serial No.:	C970EL4		
Test sample(s) ID:	GTS201807000230-1		
Sample(s) Status:	Engineer sample		
Hardware Version:	V1		
Software Version:	V1.00		
Operation Frequency:	433.92MHz, 315MHz		
Modulation technology:	FSK, ASK		
Antenna Type:	Internal Antenna		
Antenna gain:	-14.32dBi (Max.), for TX/RX (433.92MHz) -19.32dBi(Max.), for TX/RX (315MHz)		
Power supply:	DC 3.0V		



#### 5.2 Test mode

Transmitting mode	Keep the EUT in transmitting mode.
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#### Per-test mode.

We have verified the construction and function in typical operation, The EUT was placed on three different polar directions; i.e. X axis, Y axis, Z axis. which only the worst case was shown in this test report and defined as follows:

	Axis	Χ	Υ	Z
433.92MHz	Field Strength(dBuV/m)	76.32	77.71	75.21
	Axis	Х	Υ	Z
315MHz	Field Strength(dBuV/m)	73.29	74.93	72.45

# 5.3 Description of Support Units

Manufacturer	Description	Model	Serial Number	
AUTEL	PROFESSIONAL SCAN TOOL	TS508	T85500000017	

## 5.4 Test Facility

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

### • FCC —Registration No.: 381383

Global United Technology Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in files. Registration 381383, January 08, 2018.

#### • Industry Canada (IC) —Registration No.: 9079A-2

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A-2, August 15, 2016

## 5.5 Test Location

All tests were performed at:

Global United Technology Services Co., Ltd.

No. 301-309, 3/F., Jinyuan Business Building, No.2, Laodong Industrial Zone,

Xixiang Road, Baoan District, Shenzhen, Guangdong, China

Tel: 0755-27798480 Fax: 0755-27798960

#### 5.6 Other Information Requested by the Customer

None.



# 6 Test Instruments list

Rad	Radiated Emission:					
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	July. 03 2015	July. 02 2020
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	June. 27 2018	June. 26 2019
4	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June. 27 2018	June. 26 2019
5	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	9120D-829	GTS208	June. 27 2018	June. 26 2019
6	Horn Antenna	ETS-LINDGREN	3160	GTS217	June. 27 2018	June. 26 2019
7	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
8	Coaxial Cable	GTS	N/A	GTS213	June. 27 2018	June. 26 2019
9	Coaxial Cable	GTS	N/A	GTS211	June. 27 2018	June. 26 2019
10	Coaxial cable	GTS	N/A	GTS210	June. 27 2018	June. 26 2019
11	Coaxial Cable	GTS	N/A	GTS212	June. 27 2018	June. 26 2019
12	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June. 27 2018	June. 26 2019
13	Amplifier(2GHz-20GHz)	HP	8349B	GTS206	June. 27 2018	June. 26 2019
14	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June. 27 2018	June. 26 2019
15	Band filter	Amindeon	82346	GTS219	June. 27 2018	June. 26 2019
16	Power Meter	Anritsu	ML2495A	GTS540	June. 27 2018	June. 26 2019
17	Power Sensor	Anritsu	MA2411B	GTS541	June. 27 2018	June. 26 2019
18	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	GTS588	June. 27 2018	June. 26 2019
19	Splitter	Agilent	11636B	GTS237	June. 27 2018	June. 26 2019
20	Loop Antenna	ZHINAN	ZN30900A	GTS534	June. 27 2018	June. 26 2019

Gene	General used equipment:					
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date
1	Barometer	ChangChun	DYM3	GTS257	June 27 2018	June 26 2019



# 7 Test results and Measurement Data

# 7.1 Antenna Requirement

Standard requirement: FCC Part15 C Section 15.203

#### 15.203 requirement:

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, 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.

## **EUT Antenna:**

The antenna type is Internal antenna.

Frequency	Max Gain
(MHz)	(dBi)
433.92	-14.32
315.00	-19.32





# 7.2 Radiated Emission Method

 . Natiated Lillission Metriod								
Test Requirement:	FCC Part15 C Section	on 15	5.231 (e)& S	Section 15.2	:09			
Test Method:	ANSI C63.10:2013							
Test Frequency Range:	9kHz to 5000MHz							
Test site:	Measurement Distar	nce: 3	3m					
Receiver setup:	Frequency		Detector	RBW	VB\	N	Value	
	9KHz-150KHz	Qı	uasi-peak	200Hz	6001	Hz	Quasi-peak	
	150KHz-30MHz	Qı	uasi-peak	9KHz 30		Hz	Quasi-peak	
	30MHz-1GHz	Qı	uasi-peak	100KHz	300K	Ήz	Quasi-peak	
	Above 1GHz		Peak	1MHz	ЗМЬ	Ηz	Peak	
	Above IGHZ		Peak	1MHz	10F	łz	Average	
Limit:	Frequency		Limit	(dBuV/m @	3m)		Remark	
(Field strength of the	433.92MHz			72.87 92.87			verage Value Peak Value	
fundamental signal)							verage Value	
	315MHz		67.66 87.66			Peak Value		
Limit: (Spurious Emissions)	Fundamental Frequence (MHz)	су	y Field Strength of fundamental (microvolts/meter)			eld Strength of Unwanted Emissions (microvolts/meter)		
	40.66 - 40.70		1,0	000		100		
	70 - 130			00	50			
	130 - 174			1,500 **		50	) to 1,50 **	
	174 - 260 260 - 470			5,000 **		1.5	1,50 0 to 5,00 **	
	Above 470			5,000		1,0	5,00	
			·	Class B (dBuV/m) (at 3M)				
	FREQUENCY (MHz)		PE	PEAK			AVERAGE	
	Above 1000		7-		<u> </u>		54	
	Or The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level whichever limit permits a higher field strength.							
Test setup:	Below 30MHz							
	Turn Table  EUT  < 80cm >   Test Antenna  Receiver  Preamplifier							
	Below 1GHz							



Report No.: GTS201807000230F01 Test Antenna Turn Table < 80cm Preamplifier« Above 1GHz Test Antenna < 1m ... 4m > Turn Table <150cm; Receiver+ Preamplifier-Test Procedure: 1. The EUT was placed on the top of a rotating table (0.8 meters for below 1GHz and 1.5 meters for above 1GHz) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna 3. The antenna height 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. 4. 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 rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. Test Instruments: Refer to section 6.0 for details Test mode: Refer to section 5.2 for details Test results: Pass



#### Measurement data:

# 7.2.1 Field Strength of The Fundamental Signal

#### 433.92MHz

#### Peak value:

Frequency (MHz)	Read	Antenna	Cable	Preamp	Lovol	Limit Line	Over	
	Level	Factor	Loss	Factor	Level Limit Line (dBuV/m)		Limit	polarization
	(dBuV)	(dB/m)	(dB)	(dB)	(aBuv/m)	(aBuv/m)	(dB)	
433.92	83.21	17.53	3.02	29.43	74.33	92.87	-18.54	Horizontal
433.92	86.59	17.53	3.02	29.43	77.71	92.87	-15.16	Vertical

## Average value:

Frequency (MHz)	Peak Value (dBuV/m)	Duty cycle factor	Average value (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
433.92	74.33	-18.70	55.63	72.87	-17.24	Horizontal
433.92	77.71	-18.70	59.01	72.87	-13.86	Vertical

#### 315 MHz

#### Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
315.00	84.63	15.28	2.44	29.29	73.06	87.66	-14.60	Horizontal
315.00	87.12	15.28	2.44	29.91	74.93	87.66	-12.73	Vertical

# Average value:

Frequency (MHz)	Peak Value (dBuV/m)	Duty cycle factor	Average value (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
315.00	73.06	-18.37	54.69	67.66	-12.97	Horizontal
315.00	74.93	-18.37	56.56	67.66	-11.10	Vertical

## Remark:

- 1. Final Level =Receiver Read level + Antenna Factor + Cable Loss Preamplifier Factor
- 2. Average value=Peak value + Duty cycle factor



## 7.2.2 Spurious Emissions

#### Measurement data:

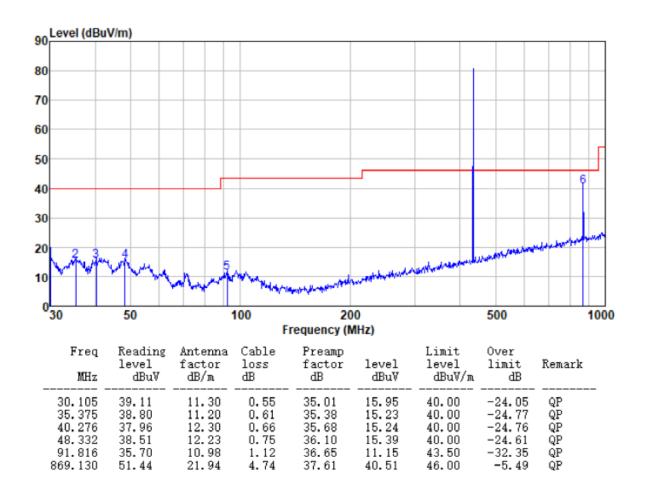
#### 9 kHz ~ 30 MHz

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

#### 433.92MHz

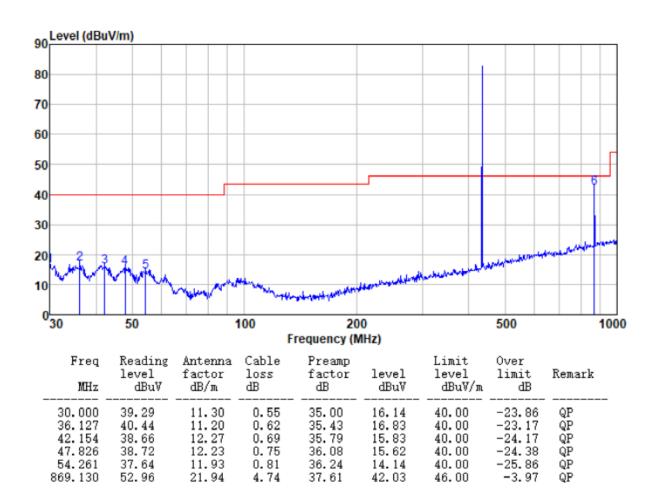
## **Below 1GHz:**

Mode:	Transmitting mode	Test by:	Bill
Temp./Hum.(%H):	26℃/56%RH	Polarziation:	Horizontal





Mode:Transmitting modeTest by:BillTemp./Hum.(%H):26 ℃/56%RHPolarziation:Vertical



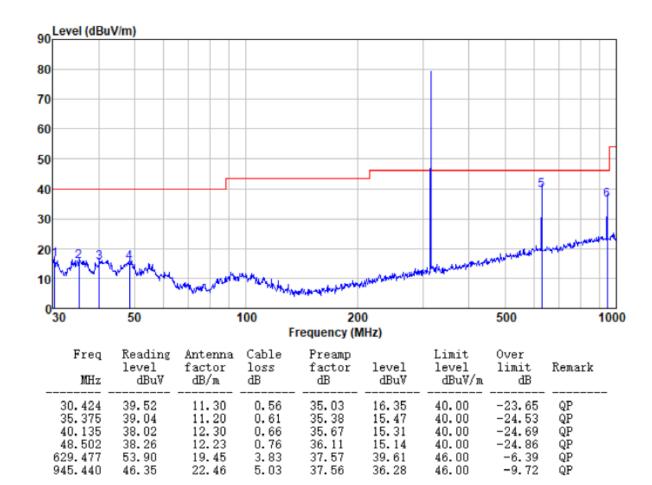


Report No.: GTS201807000230F01
315 MHz:

#### SIS WITZ:

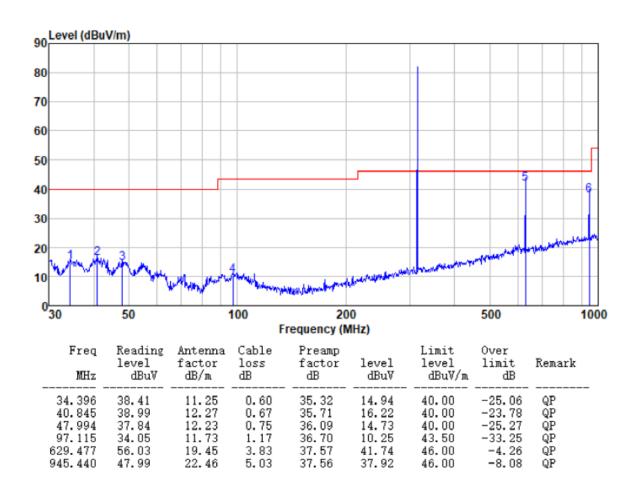
#### **Below 1GHz:**

Mode:Transmitting modeTest by:BillTemp./Hum.(%H):26℃/56%RHPolarziation:Horizontal





Mode:Transmitting modeTest by:BillTemp./Hum.(%H):26℃/56%RHPolarziation:Vertical





Above 1G:

Peak value: (433.92MHz)

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1735.68	51.91	25.05	4.82	34.00	47.78	72.87	-25.09	Vertical
2169.60	37.85	27.74	5.15	34.27	36.47	72.87	-36.40	Vertical
2603.52	39.74	27.82	5.58	33.78	39.36	72.87	-33.51	Vertical
1735.68	48.39	25.05	4.82	34.00	44.26	72.87	-28.61	Horizontal
2169.60	41.71	27.74	5.15	34.27	40.33	72.87	-32.54	Horizontal
2603.52	37.87	27.82	5.58	33.78	37.49	72.87	-35.38	Horizontal

Average value:

7trorago varac				•	•	
Frequency (MHz)	Level (dBuV/m)	Duty cycle factor	Average value (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1735.68	47.78	-18.70	29.08	52.87	-23.79	Vertical
2169.60	36.47	-18.70	17.77	52.87	-35.10	Vertical
2603.52	39.36	-18.70	20.66	52.87	-32.21	Vertical
1735.68	44.26	-18.70	25.56	52.87	-27.31	Horizontal
2169.60	40.33	-18.70	21.63	52.87	-31.24	Horizontal
2603.52	37.49	-18.70	18.79	52.87	-34.08	Horizontal

Above 1G:

Peak value: (315MHz)

Frequency (MHz)	Read	Antenna	Cable	Preamp	Lovol	evel Limit Line			
	Level	Factor	Loss	Factor	(dBuV/m) (dBuV/m)		Limit	Polarization	
	(dBuV)	(dB/m)	(dB)	(dB)	(ubuv/iii)	(ubuv/iii)	(dB)		
1260.00	40.75	25.55	4.51	33.18	37.63	67.66	-30.03	Vertical	
1890.00	37.57	25.70	4.90	34.26	33.91	67.66	-33.75	Vertical	
2520.00	34.70	27.58	5.51	33.88	33.91	67.66	-33.75	Vertical	
1260.00	39.55	25.55	4.51	33.18	36.43	67.66	-31.23	Horizontal	
1890.00	40.06	25.70	4.90	34.26	36.40	67.66	-31.26	Horizontal	
2520.00	37.35	27.58	5.51	33.88	36.56	67.66	-31.10	Horizontal	

Average value:

7tvorago varac	-					
Frequency (MHz)	Level (dBuV/m)	Duty cycle factor	Average value (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1260.00	37.63	-18.37	19.26	47.66	-28.40	Vertical
1890.00	33.91	-18.37	15.54	47.66	-32.12	Vertical
2520.00	33.91	-18.37	15.54	47.66	-32.12	Vertical
1260.00	36.43	-18.37	18.06	47.66	-29.60	Horizontal
1890.00	36.40	-18.37	18.03	47.66	-29.63	Horizontal
2520.00	36.56	-18.37	18.19	47.66	-29.47	Horizontal

# Remark:

- 1. Final Level =Receiver Read level + Antenna Factor + Cable Loss Preamplifier Factor
- 2. Average value=Peak value + Duty cycle factor



# 7.3 20dB Occupy Bandwidth

Test Requirement:	FCC Part15 C Section 15.231 (c)					
·	``					
Test Method:	ANSI C63.10:2013					
Limit:	The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900MHz. 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.					
Test setup:	Spectrum Analyzer  E.U.T  Non-Conducted Table  Ground Reference Plane					
Test Instruments:	Refer to section 6.0 for details					
Test mode:	Refer to section 5.2 for details					
Test results:	Pass					

#### **Measurement Data**

Test Frequency (MHz)	20dB bandwidth (MHz)	Limit (MHz)	Result
315.00	0.072	0.788	Pass
433.92	0.070	1.085	Pass

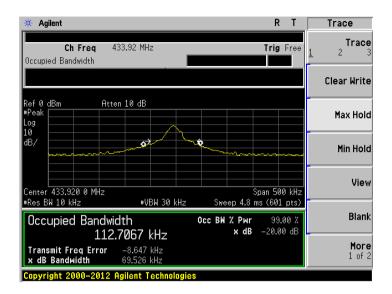
Note: Limit= Fundamental frequencyx0.25%

433.92×0.25%=1.085MHz 315×0.25%=0.788MHz

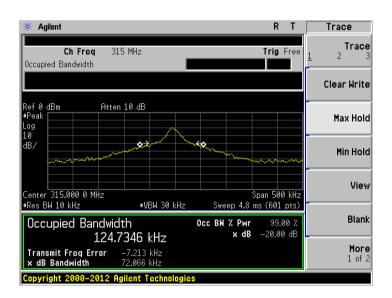


Test plot as follows: 433.92MHz

Report No.: GTS201807000230F01



#### 315MHz





# 7.4 Dwell Time

Test Requirement:	FCC Part15 C Section 15.231 (e)	
Test Method:	ANSI C63.10:2013	
Receiver setup:	RBW=100KHz, VBW=100KHz, span=0Hz, detector: Peak	
Limit:	Not more than 1 seconds Silent period: at least 30 times the duration of the transmission or more than 10 seconds	
Test setup:	Spectrum Analyzer  E.U.T  Non-Conducted Table  Ground Reference Plane	
Test Instruments:	Refer to section 6.0 for details	
Test mode:	Refer to section 5.2 for details	
Test results:	Pass	

## Measurement data:

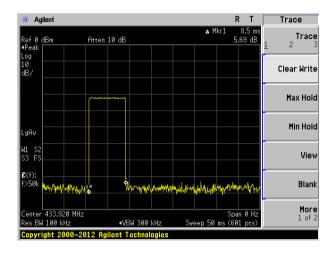
Frequency (MHz)	Duration of each TX (second)	Limit (second)	Result
433.92	0.0085	<1.0	Pass
315.00	0.0087	<1.0	Pass

# Silent period

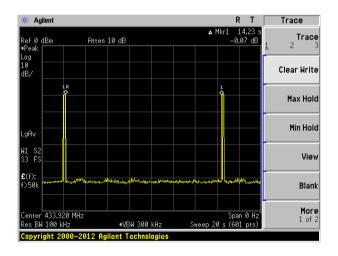
Frequency (MHz)	Duration of each TX (seconds):	Limit (seconds)	Result
433.92	14.23	At least 30 times the duration of the	Pass
315.00	14.17	transmission or more than 10 seconds	Pass



Test plot as follows: **433.92MHz** 

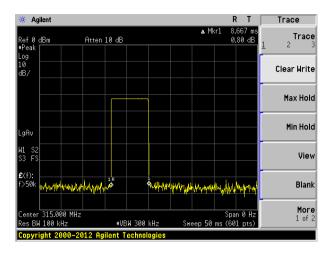


# Silent period

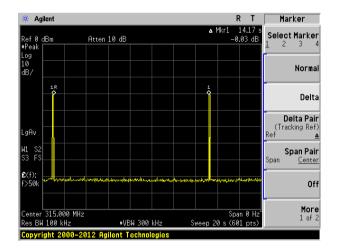




#### 315MHz



# Silent period





# 7.5 Duty Cycle

Test Requirement:	FCC Part15 C Section 15.231		
Test Method:	ANSI C63.10:2013		
Receiver setup:	RBW=100KHz, VBW=100KHz, span=0Hz, detector: Peak		
Limit:	No dedicated limit specified in the Rules.		
Test Procedure:	Place the EUT on the table and set it in transmitting mode.		
	2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.		
	3. Set centre frequency of spectrum analyzer=operating frequency.		
	4. Set the spectrum analyzer as RBW=100kHz, VBW=100KHz, Span=0Hz, Adjust Sweep=100ms to obtain the "worst-case" pulse on time		
	5. Repeat above procedures until all frequency measured was complete.		
Test setup:	Spectrum Analyzer  Non-Conducted Table  Ground Reference Plane		
Test Instruments:	Refer to section 6.0 for details		
Test mode:	Refer to section 5.2 for details		
Test results:	Pass		

#### Measurement data:

Calculate Formula: Duty cycle factor =20 log(Duty cycle)

Duty cycle=on time/0.1 seconds or period, whichever is less

Test data: 433.92MHz

> T on time =8.17 (ms) T period =70.33(ms)

Duty cycle=8.17/70.33=11.62%

Duty cycle factor =20 log(0.1162)=-18.70

315MHz

T on time =8.50(ms) T period =70.50(ms)

Duty cycle=8.5/70.50=12.06%

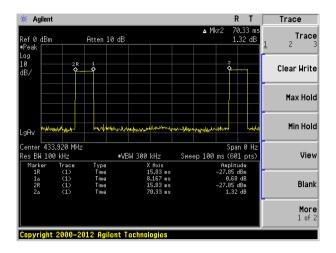
Duty cycle factor =20 log(0.1206)=-18.37



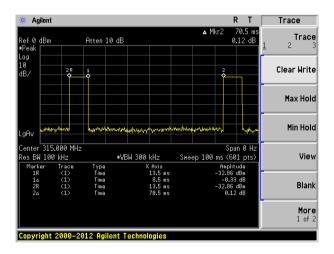
Test plot as follows:

433.92MHz

Report No.: GTS201807000230F01



315MHz

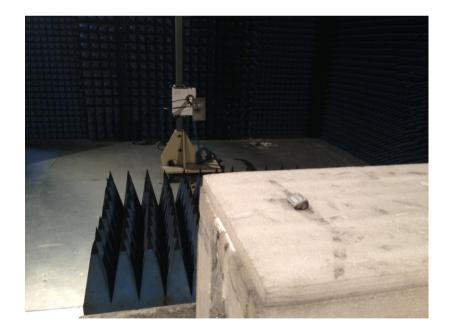




# 8 Test Setup Photo

Radiated Emission





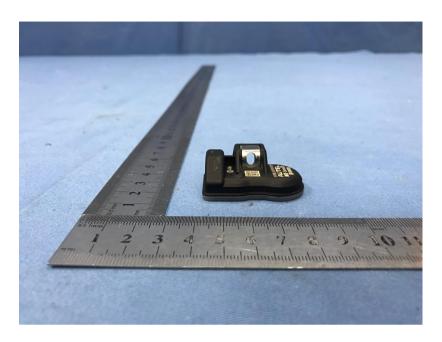


# 9 EUT Constructional Details



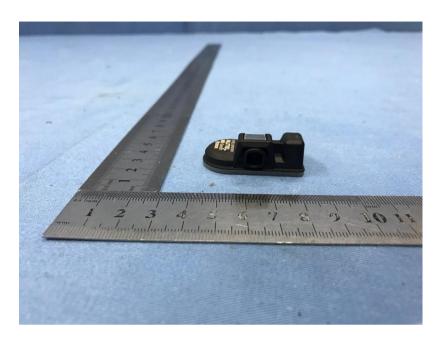












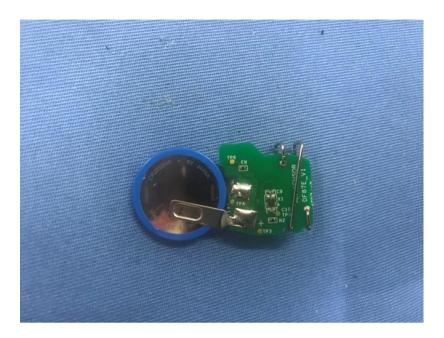












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