



TESTING LABORATORY  
CERTIFICATE#4323.01



FCC PART 15.231

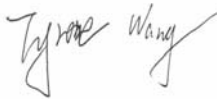

## TEST REPORT

For

**Keystone Automotive Operations, Inc.**

44 Tunkhannock Avenue Exeter, PA 18643 United States

**FCC ID: 2AWOX-LDTR02**

<b>Report Type:</b> Original Report	<b>Product Type:</b> Wireless Remote
<b>Project Engineer:</b>	<u>Tyrone Wang</u> 
<b>Report Number:</b>	<u>RXM201118051-00A</u>
<b>Report Date:</b>	<u>2020-12-03</u>
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## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

Applicant	Keystone Automotive Operations, Inc.
Tested Model	LDTR-wr001
Product Type	Wireless Remote
Power Supply	DC 3V from battery
RF Function	SRD
Operating Band/Frequency	314~316 MHz
Channel Number	8
Modulation Type	FSK
Antenna Type	PCB Antenna
*Maximum Antenna Gain	0.0 dBi

*Note: The maximum antenna gain was provided by the applicant.*

*\*All measurement and test data in this report was gathered from production sample serial number: 20201118051. (Assigned by the BACL. The EUT supplied by the applicant was received on 2020-11-18)*

### Objective

This test report is prepared on behalf of *Keystone Automotive Operations, Inc.* 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/grant.

### 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. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

**Measurement Uncertainty**

Item		Uncertainty
AC Power Lines Conducted Emissions		3.19 dB
RF conducted test with spectrum		0.9dB
Radiated emission	30MHz~1GHz	6.11dB
	1GHz~6GHz	4.45dB
	6GHz ~18GHz	5.23dB
Occupied Bandwidth		0.5kHz
Temperature		1.0°C
Humidity		6%

**Test Facility**

The Test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01 and CAB identifier CN0004 under the ISED requirement. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

**SYSTEM TEST CONFIGURATION****Justification**

Channel List:

Channel	Frequency (MHz)
1	314.00
2	314.25
3	314.50
4	314.75
5	315.25
6	315.50
7	315.75
8	316.00

All buttons triggered the same RF parameters (Contain bandwidth, power level and duty cycle).

**EUT Exercise Software**

No software was used during the test.

**Equipment Modifications**

No modification was made to the EUT.

**Support Equipment List and Details**

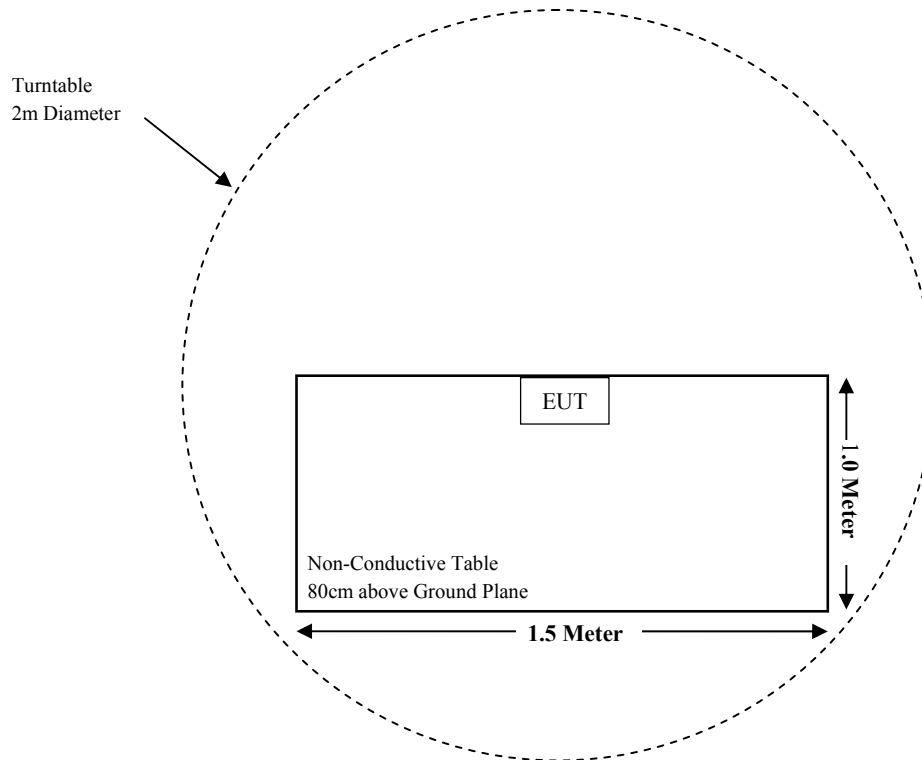
Manufacturer	Description	Model	Serial Number
/	/	/	/

**External I/O Cable**

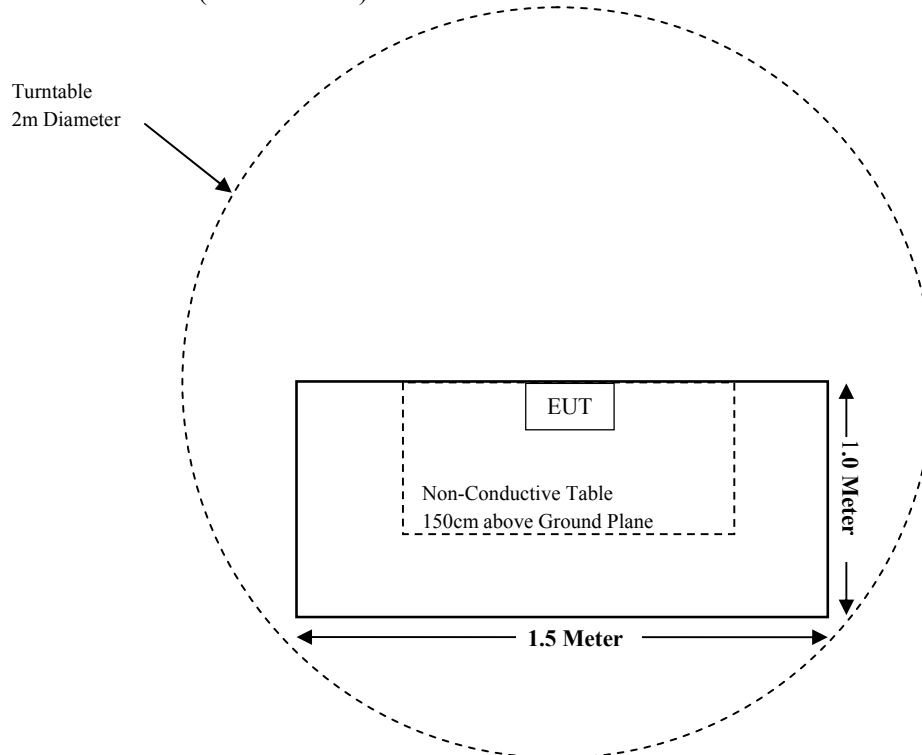
Cable Description	Length (m)	From Port	To Port
/	/	/	/

## Block Diagram of Test Setup

For Radiated Emissions(Below 1GHz):



For Radiated Emissions(Above 1GHz):



**SUMMARY OF TEST RESULTS**

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliant
§15.207(a)	Conducted Emissions	Not applicable (See Note)
§15.205, §15.209, §15.231(b)	Radiated Emissions	Compliant
§15.231 (a) (1)	Deactivation	Compliant
§15.231 (c)	20dB Emission Bandwidth	Compliant

Note: The EUT is powered by battery.

**TEST EQUIPMENT LIST**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
<b>Radiated Emission Test(Chamber 1#)</b>					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2019-12-14	2020-12-13
Rohde & Schwarz	Signal Analyzer	FSV40	101116	2020-07-28	2021-07-27
Sunol Sciences	Broadband Antenna	JB3	A090314-1	2020-08-05	2023-08-04
Sonoma Instrunent	Pre-amplifier	310N	171205	2020-08-14	2021-08-13
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-8	008	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2020-08-15	2021-08-14
<b>Radiated Emission Test(Chamber 2#)</b>					
Rohde & Schwarz	EMI Test Receiver	ESU40	100207	2020-04-01	2021-03-31
ETS-LINDGREN	Horn Antenna	3115	9207-3900	2020-07-15	2023-07-14
A.H.Systems,inc	Amplifier	PAM-0118P	512	2020-02-20	2021-02-19
Narda	Attenuator	10dB	010	2020-08-15	2021-08-14
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2019-12-12	2020-12-11
MICRO-COAX	Coaxial Cable	Cable-11	011	2019-12-12	2020-12-11
MICRO-COAX	Coaxial Cable	Cable-12	012	2019-12-12	2020-12-11
MICRO-COAX	Coaxial Cable	Cable-13	013	2019-12-12	2020-12-11

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



## **FCC§15.203 - ANTENNA REQUIREMENT**

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### **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 Connected Construction**

The EUT has a PCB antenna which was permanently attached and the antenna gain is 0.0 dBi; fulfill the requirement of this section. Please refer to EUT photos.

**Result:** Compliant.

**FCC §15.205, §15.209, §15.231 (b) - RADIATED EMISSIONS****Applicable Standard**

FCC §15.205, §15.209, §15.231 (b)

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

<b>Fundamental frequency (MHz)</b>	<b>Field strength of fundamental (microvolts/meter)</b>	<b>Field strength of spurious emission (microvolts/meter)</b>
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

Note: \*\* means Linear interpolations

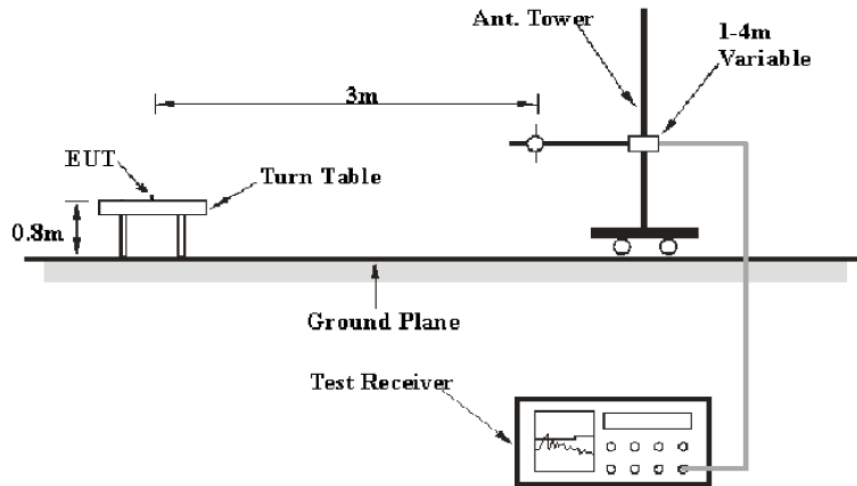
(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(2) Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in §15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

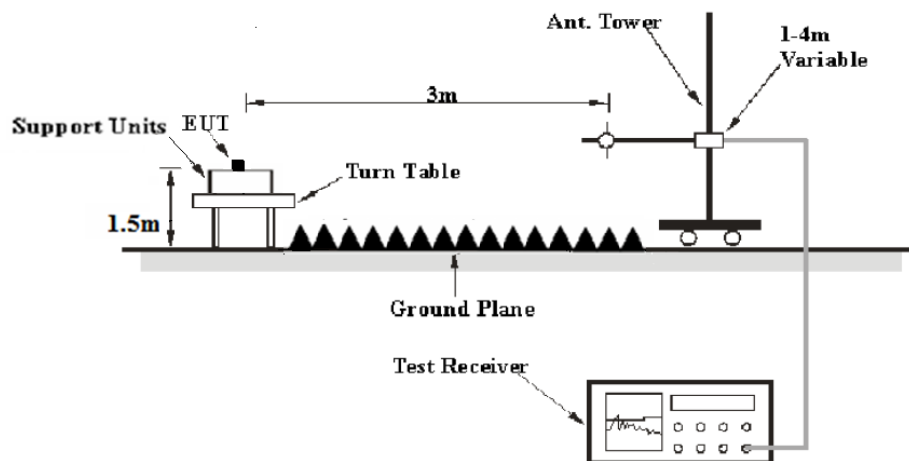
(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

## EUT Setup

### Below 1GHz:



### 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 EMI test Receiver was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	100 kHz	300 kHz	/	PK
1000MHz – 4000MHz	1MHz	3MHz	/	PK

## Test Procedure

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

## Corrected Amplitude & Margin Calculation

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

Corrected Amplitude (dBμV /m) = Meter Reading (dBμV) + Antenna Factor (dB/m) + Cable Loss (dB) - Amplifier Gain (dB)

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin (dB) = Limit (dBμV/m) – Corrected Amplitude (dBμV /m)

## Test Results Summary

According to the data in the following table, the EUT complied with the FCC §15.205, §15.209, §15.231 (b).

## Test Data

### Environmental Conditions

Temperature:	24.7 °C
Relative Humidity:	51 %
ATM Pressure:	101.7 kPa

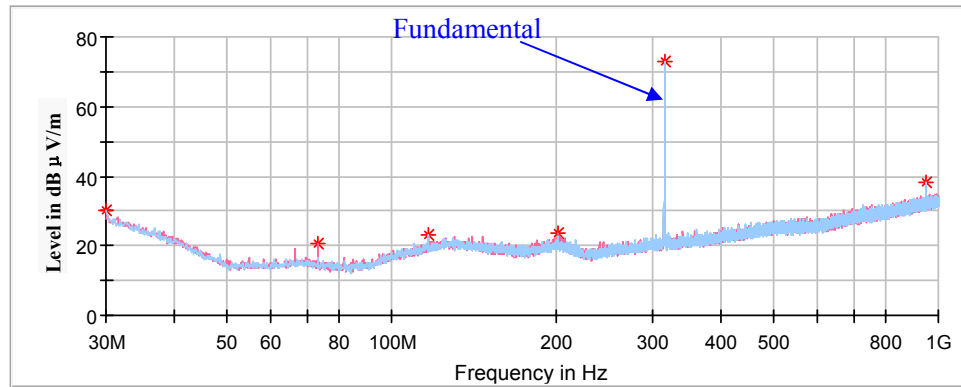
*The testing was performed by Tyrone Wang on 2020-11-24.*

*Test mode: Transmitting*

**Frequency: 314.0 MHz**

**30MHz-1GHz (FSK modulation)**

*(Pre-scan in the X,Y and Z axes of orientation, the worst case Y-axis of orientation was recorded.)*

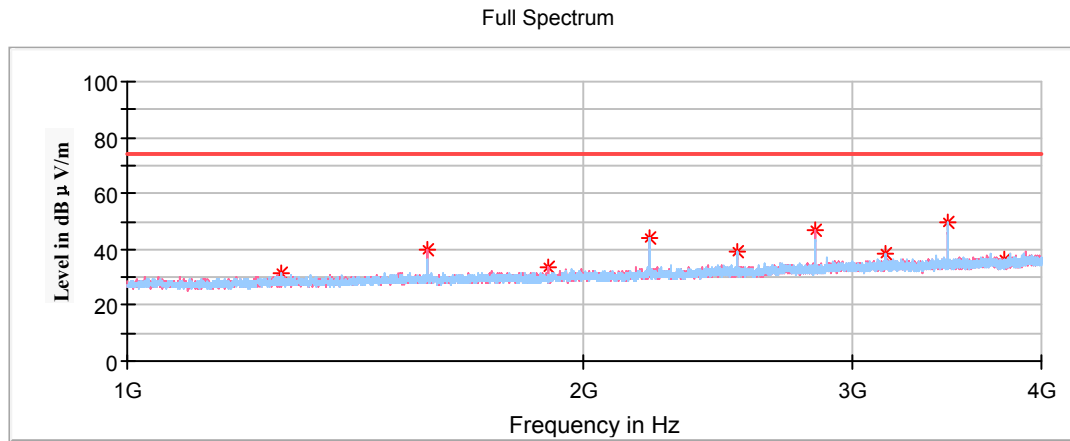


Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	Max Peak (dBμV/m)	Height (cm)	Polar (H/V)				
30.00	30.10	200.00	H	209.00	-4.60	55.56	25.46
73.29	20.58	200.00	V	212.00	-17.40	40.00	19.42
116.58	23.12	100.00	H	104.00	-12.50	43.50	20.38
202.18	23.80	100.00	V	299.00	-11.70	55.56	31.76
314.00	72.91	100.00	H	62.00	-10.60	75.56	2.65
946.53	38.31	200.00	H	0.00	1.00	55.56	17.25

Note: If the spurious emissions maximized peak measured value complies with the QP/Average limit, it is unnecessary to perform QP/Average measurement.

**1GHz-4 GHz (FSK modulation)**

(Pre-scan in the X,Y and Z axes of orientation, the worst case **Y-axis of orientation** was recorded.)



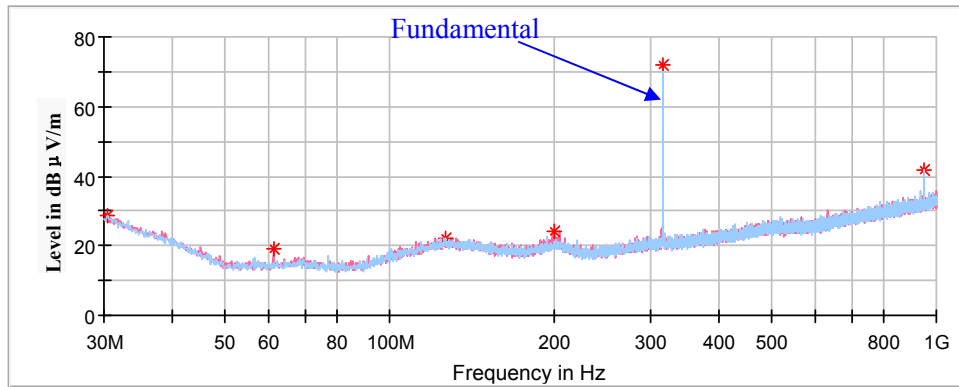
Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV/m)	Height (cm)	Polar (H/V)				
1256	31.47	150	H	213	-17.7	55.56	24.09
1570	39.92	150	V	325	-16.1	54.00	14.08
1884	33.27	150	H	0	-15.1	55.56	22.29
2198	44.26	150	H	198	-6.4	55.56	11.30
2512	39.47	150	V	339	-4.3	55.56	16.09
2826	47.18	150	H	0	-13.7	54.00	6.82
3140	38.29	150	H	7	-12.4	55.56	17.27
3454	49.96	150	V	12	-10.9	55.56	5.60
3768	36.48	150	V	358	-9.7	54.00	17.52

Note: If the spurious emissions maximized peak measured value complies with the Average limit, it is unnecessary to perform an Average measurement.

**Frequency: 316.0 MHz**

**30MHz-1GHz (FSK modulation)**

(Pre-scan in the X,Y and Z axes of orientation, the worst case **Y-axis of orientation** was recorded.)

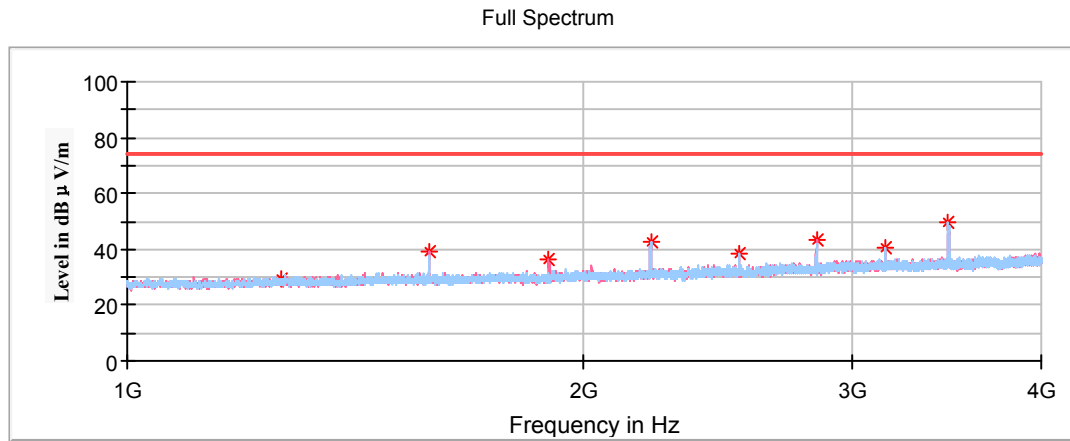


Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	Max Peak (dBμV/m)	Height (cm)	Polar (H/V)				
30.37	28.59	100	V	358	-3.9	55.68	27.09
61.29	19.16	200	V	273	-17.3	55.68	36.52
126.88	22.39	100	H	234	-11.3	43.50	21.11
200.72	24.33	200	V	220	-12.3	55.68	31.35
316.00	72.10	200	V	112	-10.2	75.68	3.58
947.98	41.80	200	V	268	1.2	55.68	13.88

Note: If the spurious emissions maximized peak measured value complies with the QP/Average limit, it is unnecessary to perform QP/Average measurement.

**1GHz-4 GHz (FSK modulation)**

(Pre-scan in the X,Y and Z axes of orientation, the worst case **Y-axis of orientation** was recorded.)



Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV/m)	Height (cm)	Polar (H/V)				
1264.00	29.20	150	V	29	-17.60	55.68	26.48
1580.00	39.02	200	V	353	-16.10	54.00	14.98
1896.00	36.15	150	V	2	-14.90	55.68	19.53
2212.00	42.39	200	H	198	-6.40	54.00	11.61
2528.00	38.62	150	V	339	-4.30	55.68	17.06
2844.00	43.65	200	V	340	-13.60	54.00	10.35
3160.00	40.73	150	H	69	-12.30	55.68	14.95
3487.00	49.40	150	H	69	-10.80	55.68	6.28

Note: If the spurious emissions maximized peak measured value complies with the Average limit, it is unnecessary to perform an Average measurement.



## **FCC §15.231(a) (1) - DEACTIVATION TESTING**

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### **Applicable Standard**

Per FCC §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.

### **Test Procedure**

1. With the EUT's antenna attached, the waveform was received by the test antenna which was connected 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 Data**

#### **Environmental Conditions**

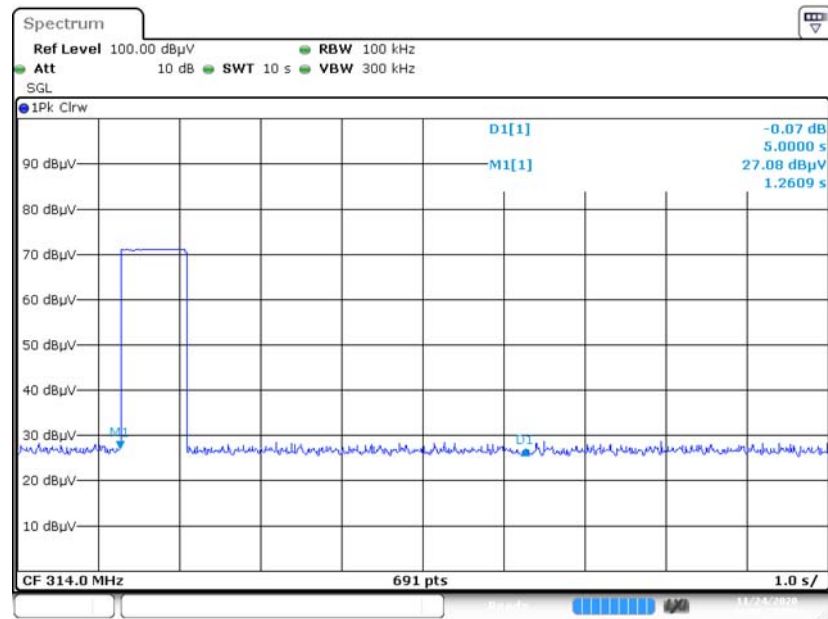
<b>Temperature:</b>	24.7 °C
<b>Relative Humidity:</b>	53 %
<b>ATM Pressure:</b>	101.8 kPa

*The testing was performed by Tyrone Wang on 2020-11-24.*

*Test mode: Transmitting*

Channel Frequency (MHz)	Limit (s)	Result
314.0	<5	Pass

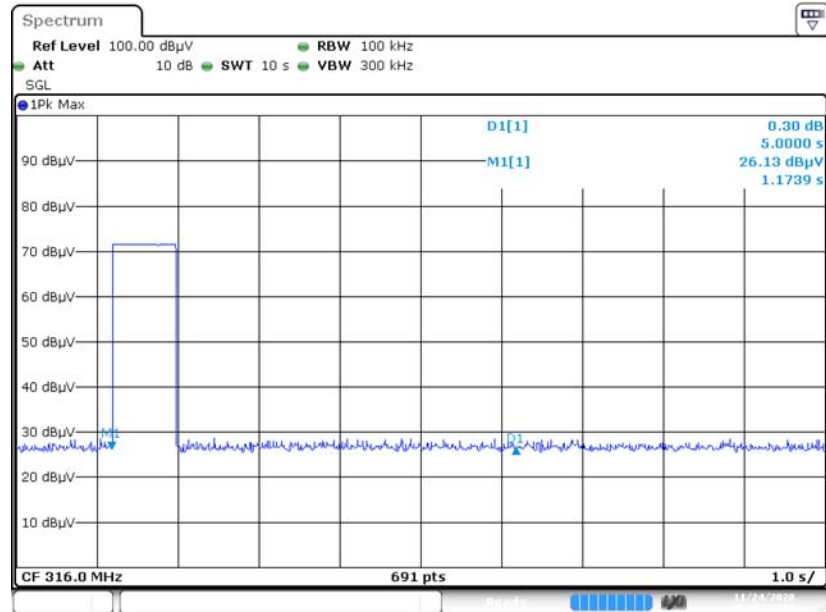
$T_{\text{stop}} < 5\text{s}$



Date: 24 NOV. 2020 18:05:55

Channel Frequency (MHz)	Limit (s)	Result
316.0	<5	Pass

$T_{stop} < 5s$



Date: 24.NOV.2020 17:48:38

**FCC §15.231(c) - 20dB EMISSION BANDWIDTH TESTING**

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**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 waveform was received by the test antenna which was connected to the spectrum analyzer, plot the 20 dB bandwidth.

**Test Data****Environmental Conditions**

<b>Temperature:</b>	24.7 °C
<b>Relative Humidity:</b>	51 %
<b>ATM Pressure:</b>	101.2~101.3 kPa

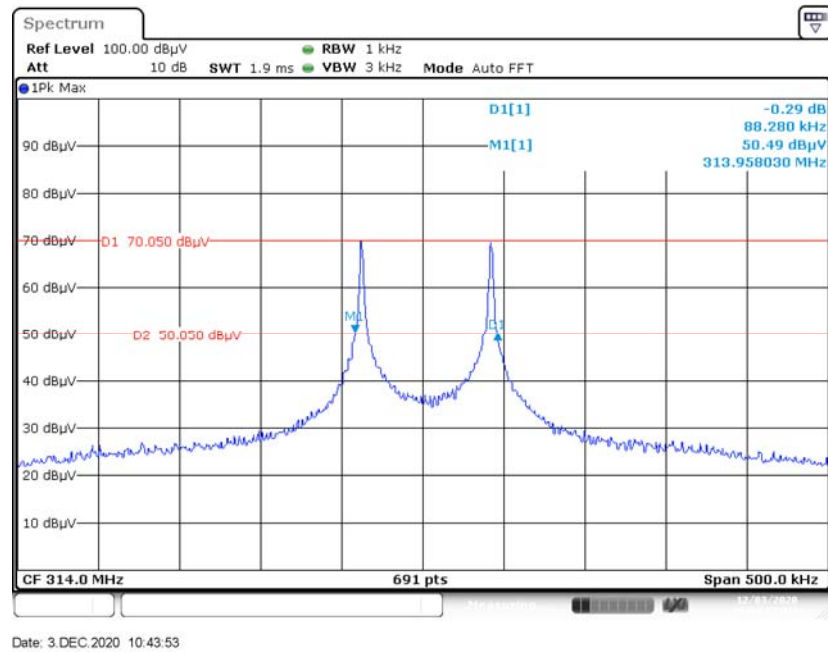
*The testing was performed by Tyrone Wang on 2020-12-03.*

*Test Mode: Transmitting*

Channel Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)	Result
314.0	88.28	785.0	Pass

**Note:** Limit = 0.25% \* Center Frequency = 0.25% \* 314.0 MHz = 785 kHz

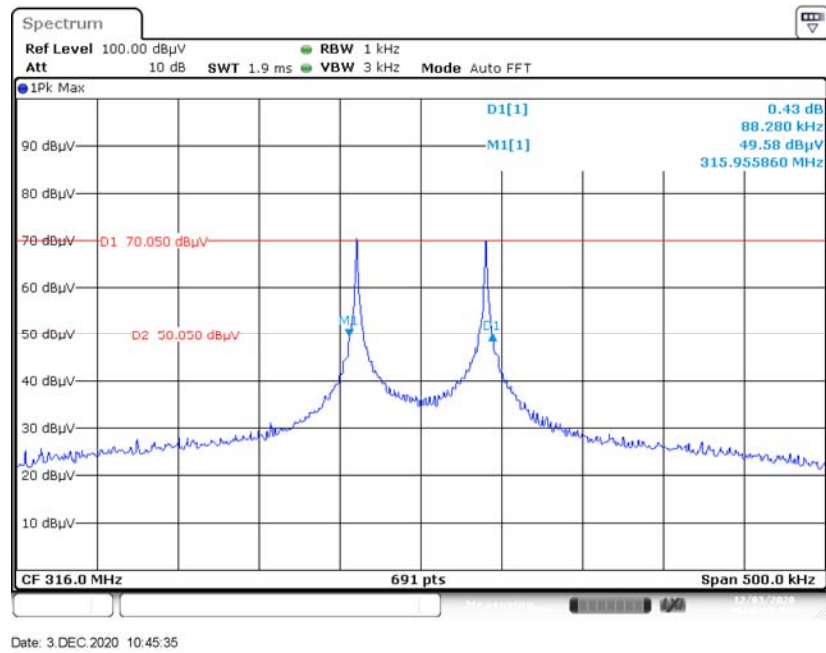
### 20 dB Emission Bandwidth



Channel Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)	Result
316.0	88.28	790.0	Pass

**Note:** Limit = 0.25% \* Center Frequency = 0.25% \* 316.0 MHz = 790.0 kHz

### 20 dB Emission Bandwidth



### **Declarations**

1: BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '\*'. Customer model name, addresses, names, trademarks etc. are not considered data.

2: Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

3: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

4: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.

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