



# FCC TEST REPORT

**Test report  
On Behalf of  
TowBrite Inc.  
For  
TowBrite 433mhz TX  
Model No./HVIN: TBR433TX**

**FCC ID: 2AWK3-TBR433TX  
IC: 26388-TBR433TX**

**Prepared for :** TowBrite Inc.  
1612 Magic Morning Way, Greely, Ontario, K4P0C7, CANADA

**Prepared By :** Shenzhen Tongzhou Testing Co.,Ltd  
1th Floor, Building 1, Haomai High-tech Park, Huating Road 387, Dalang  
Street, Longhua, Shenzhen, China

**Date of Test:** Aug.11, 2020~ Aug.19, 2020

**Date of Report:** Aug.20, 2020

**Report Number:** TZ200801534-E

The test report apply only to the specific sample(s) tested under stated test conditions

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## TEST RESULT CERTIFICATION

**Applicant's name** ..... : **TowBrite Inc.**

**Address** ..... : **1612 Magic Morning Way, Greely, Ontario, K4P0C7, CANADA**

**Manufacture's Name** ..... : **TowBrite Inc.**

**Address** ..... : **1612 Magic Morning Way, Greely, Ontario, K4P0C7, CANADA**

### Product description

**Trade Mark:** N/A

**Product name** ..... : **TowBrite 433mhz TX**

**Model and/or type reference** : **TBR433TX**

FCC Rules and Regulations Part 15 Subpart C Section 15.231

**Standards** ..... : **RSS-GEN: Issue 5**

**RSS-210: Issue 10**

**ANSI C63.10: 2013**

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**Date of Test** ..... :

**Date (s) of performance of tests** ..... : **Aug.11, 2020~ Aug.19, 2020**

**Date of Issue** ..... : **Aug.20, 2020**

**Test Result** ..... : **Pass**

**Testing Engineer** :

*Anna Hu*

(Anna Hu)

**Technical Manager** :

*Hugo Chen*

(Hugo Chen)

**Authorized Signatory** :

*Andy Zhang*

(Andy Zhang)



### Revision History

Revision	Issue Date	Revisions	Revised By
000	Aug.20, 2020	Initial Issue	Andy Zhang



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## 1. GENERAL INFORMATION

### 1.1 Description of Device (EUT)

EUT	: TowBrite 433mhz TX
Model Number/HVIN	: TBR433TX
Model Declaration	: N/A
Test Model/HVIN	: TBR433TX
Power Supply	: DC12V
Hardware version	: V1.0
Software version	: V1.0
Sample ID	: TZ200801534-1#

#### SRD

Frenquency	: 433.2 MHz
Channel Number	: 1
Modulation Technology	: ASK
Data Rates	: 250 kBaud
Antenna Type And Gain	Integral Antenna /0.0dBi

*Note1: Antenna position refer to EUT Photos*



## 1.2 Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	Certificate
N/A	N/A	N/A	N/A	N/A

## 1.3 External I/O Cable

I/O Port Description	Quantity	Cable

## 1.4 Description of Test Facility

### FCC

Designation Number: CN1275

Test Firm Registration Number: 167722

Shenzhen Tongzhou Testing Co.,Ltd has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

### A2LA

Certificate Number: 5463.01

Shenzhen Tongzhou Testing Co.,Ltd has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

### IC

ISED#: 22033

CAB identifier: CN0099

Shenzhen Tongzhou Testing Co.,Ltd has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010



## 1.5 Statement of the Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the Shenzhen Tongzhou Testing Co.,Ltd’s quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

## 1.6 Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	±3.08dB	(1)
		30MHz~1000MHz	±4.42dB	(1)
		1GHz~40GHz	±4.06dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	±2.23dB	(1)

(1). This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

## 1.7 Description of Test Modes

The EUT has been tested under operating condition.

## 1.8 Frequency of Channels

Channel	Frequency(MHz)
1	433.2



## 2 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.

The radiated testing was performed at an antenna-to-EUT distance of 3 meters. All radiated and conducted emissions measurement was performed at Shenzhen Tongzhou Testing Co.,Ltd

### 2.1 EUT Configuration

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

### 2.2 EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.205, 15.207, 15.209 and 15.231 under the FCC Rules Part 15 Subpart C.

### 2.3 General Test Procedures

#### 2.3.1 Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013

### 2.4 Test Sample

The application provides 1 sample to meet requirement;

Sample ID	Description
TZ200801534-1#	Normal working





### 3 SYSTEM TEST CONFIGURATION

#### 3.1 Justification

The system was configured for testing in a normal transmits condition.

#### 3.2 EUT Exercise Software

N/A

#### 3.3 Special Accessories

No.	Equipment	Manufacturer	Model No.	Serial No.	Length	shielded/ unshielded	Notes
1	DC Source	Chrome	62012P-80-60	62012PD02811	/	/	/

#### 3.4 Block Diagram/Schematics

Please refer to the related document

#### 3.5 Equipment Modifications

Shenzhen Tongzhou Testing Co.,Ltd has not done any modification on the EUT.

#### 3.6 Test Setup

Please refer to the test setup photo.



## 4 SUMMARY OF TEST RESULTS

Applied Standard: FCC Part 15 Subpart C				
FCC Rules	IC standards	Description of Test	Sample ID	Result
§15.231(e)	RSS-210 Annex A.1.4	Transmission Time	TZ200801534-1#	Compliant
§15.231(e) §15.205 §15.209	RSS-210 Annex A.1.4 RSS-GEN 8.10 RSS-GEN 8.9	Radiated Emissions Measurement	TZ200801534-1#	Compliant
§15.231(c)	RSS-210 Annex A.1.3	99% Bandwidth Emissions	TZ200801534-1#	Compliant
/	RSS-210 Annex A	Duty cycle	TZ200801534-1#	Compliant
§15.209	RSS-GEN 8.3	Antenna Requirements	TZ200801534-1#	Compliant
§15.207(a)	RSS-GEN 8.8	AC power line conducted test	N/A	N/A

*Note1: Because this device is only power-supplied by DC 12V, the AC power line conducted test is not required.*



## 5 TEST RESULT

### 5.1 Transmission Time

#### 5.1.1 Limit

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.

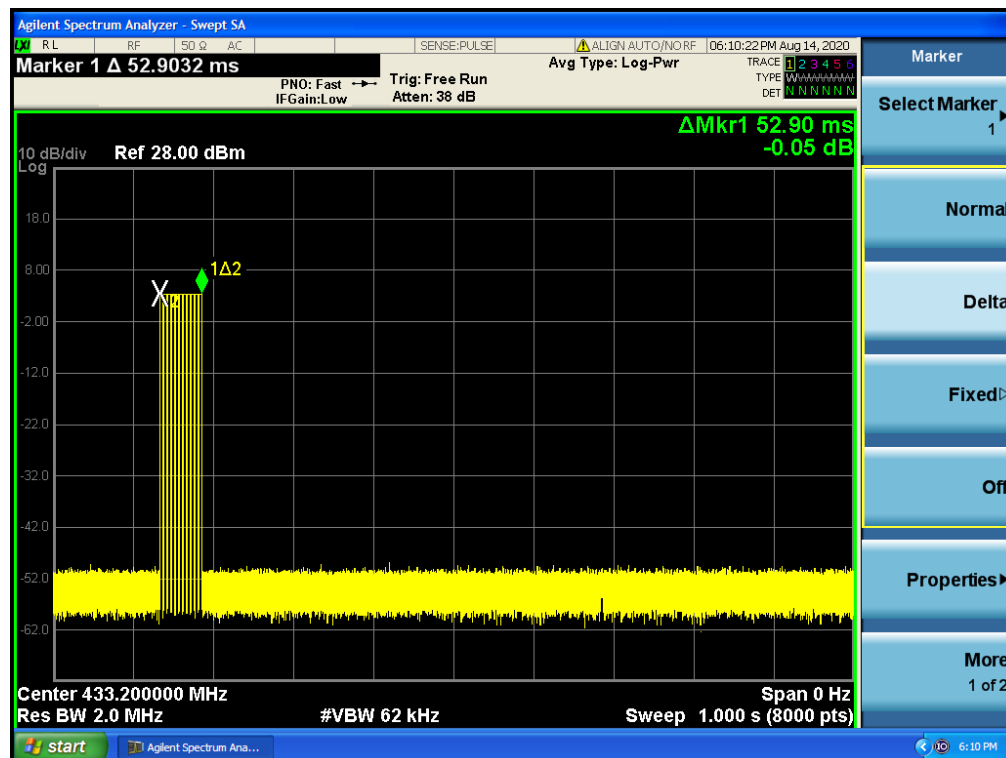
#### 5.1.2 Test Procedure

- EUT continued transmitting
- The test antenna which was connected to the spectrum analyser can receive the power of EUT.
- Set centre frequency of spectrum analyzer=operating frequency.
- Set the spectrum analyzer as RBW=100 kHz, VBW=300 KHz, Span=0Hz, Adjust the sweep time to capture the activation time, and record it.

#### 5.1.3 Test Results

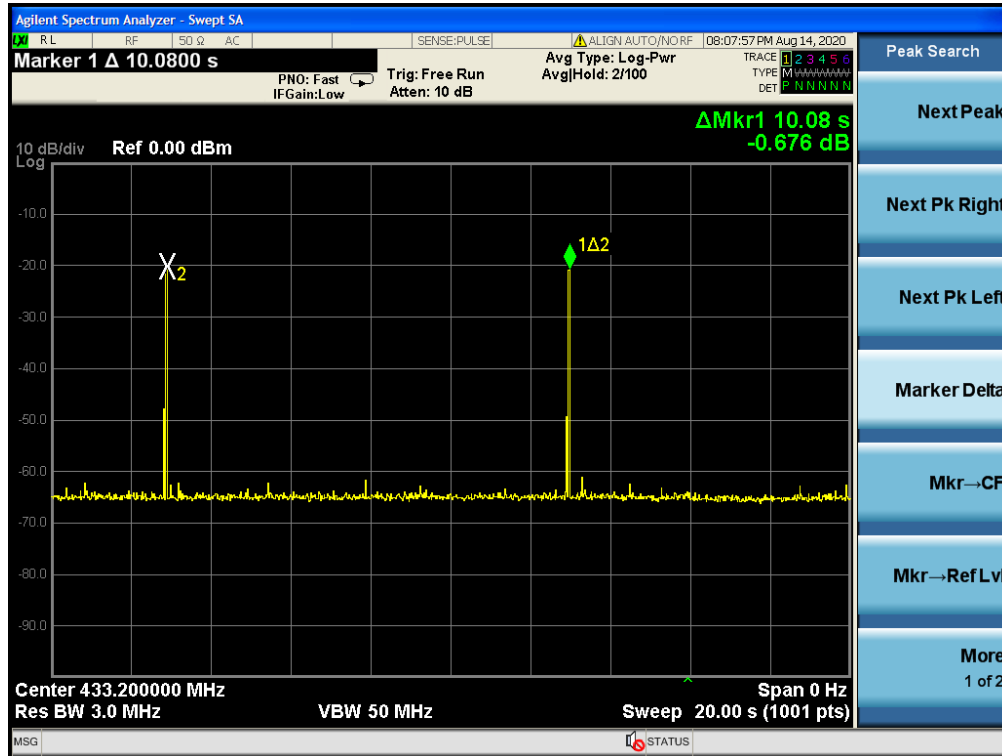
Temperature	25°C	Humidity	60%
Test Engineer	Anna Hu	Configurations	Normal working

Frequency (MHz)	Activation Time (s)	Upper Limit (s)	Conclusion
433.2	0.0529	1	PASS





Frequency (MHz)	Time between transmissions(s)	Lower Limit (s)	Conclusion
433.2	10.08	10	PASS





## 5.2 Radiated Emissions Measurement

### 5.2.1 Standard Applicable

15.231(e) In addition to the provisions of §15.205, 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 emission (microvolts/meter)
40.66-40.70	1,000	100
70-130	500	50
130-174	500 to 1,500 <sup>1</sup>	50 to 150 <sup>1</sup>
174-260	1,500	150
260-470	1,500 to 5,000 <sup>1</sup>	150 to 500 <sup>1</sup>
Above 470	5,000	500

<sup>1</sup>Linear interpolations.

15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(2)
13.36-13.41			

1\ Until February 1, 1999, this restricted band shall be 0.490-0.510MHz.

2\ Above 38.6

According to §15.247 (d): 20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (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

### 5.2.2 Measuring Instruments and Setting

Please refer to section 6 of equipment list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10 <sup>th</sup> carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB/VB 200Hz/1KHz for QP/AVG
Start ~ Stop Frequency	150kHz~30MHz / RB/VB 9kHz/30KHz for QP/AVG
Start ~ Stop Frequency	30MHz~1000MHz / RB/VB 120kHz/1MHz for QP

### 5.2.3 Test Procedures

#### 1) Sequence of testing 9 kHz to 30 MHz

##### Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.
- If the EUT is a floor standing device, it is placed on the ground.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

##### Premeasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 0.8 meter.
- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

##### Final measurement:

- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).
- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

## 2) Sequence of testing 30 MHz to 1 GHz

### Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

### Premeasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 to 3 meter.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

### Final measurement:

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ( $\pm 45^\circ$ ) and antenna movement between 1 and 4 meter.
- The final measurement will be done with QP detector with an EMI receiver.
- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

### 3) Sequence of testing 1 GHz to 18 GHz

#### Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

#### Premeasurement:

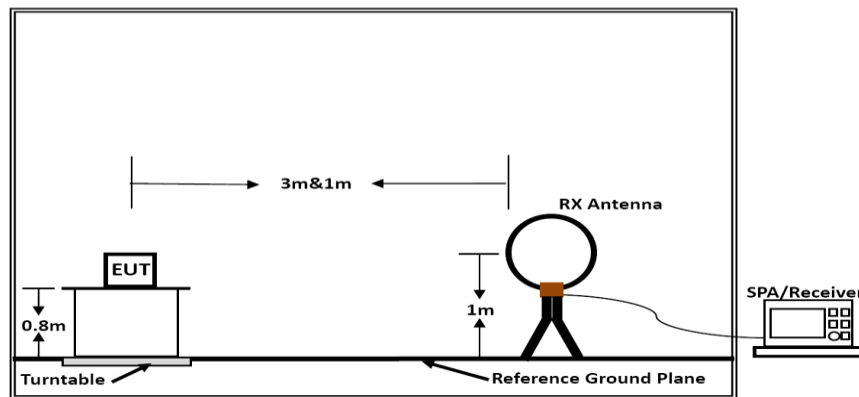
- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height scan range is 1 meter to 2.5 meter.
- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

#### Final measurement:

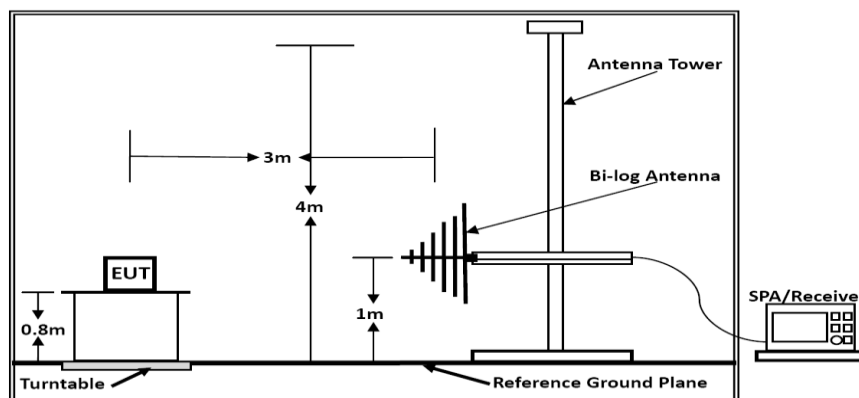
- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ( $\pm 45^\circ$ ) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.
- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.



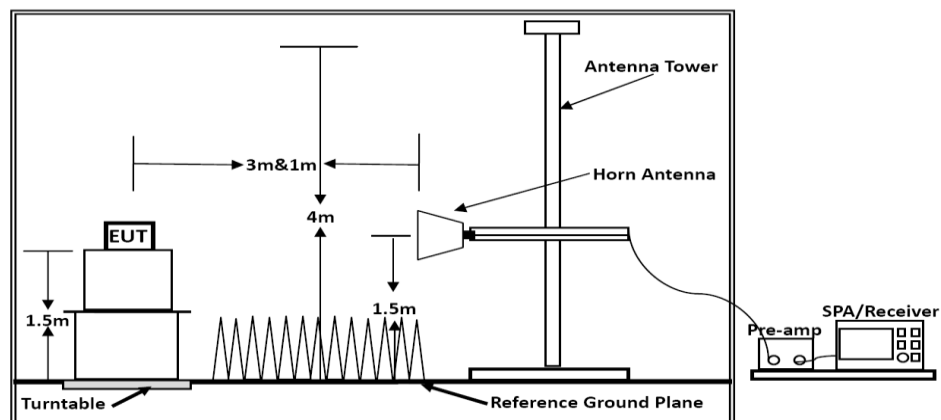
## 5.2.4 Test Setup Layout



Below 30MHz



Below 1GHz



Above 1GHz

Above 10 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade from 3m to 1.5m.

Distance extrapolation factor =  $20 \log (\text{specific distance [3m]} / \text{test distance [1.5m]})$  (dB);  
Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].



### 5.2.5 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

### 5.2.6 Results of Radiated Emissions (9 kHz~30MHz)

Temperature	25.5℃	Humidity	55.2%
Test Engineer	Anna Hu	Configurations	Normal working

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dBuV)	Remark
-	-	-	-	See Note

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

Distance extrapolation factor =  $40 \log (\text{specific distance} / \text{test distance})$  (dB);

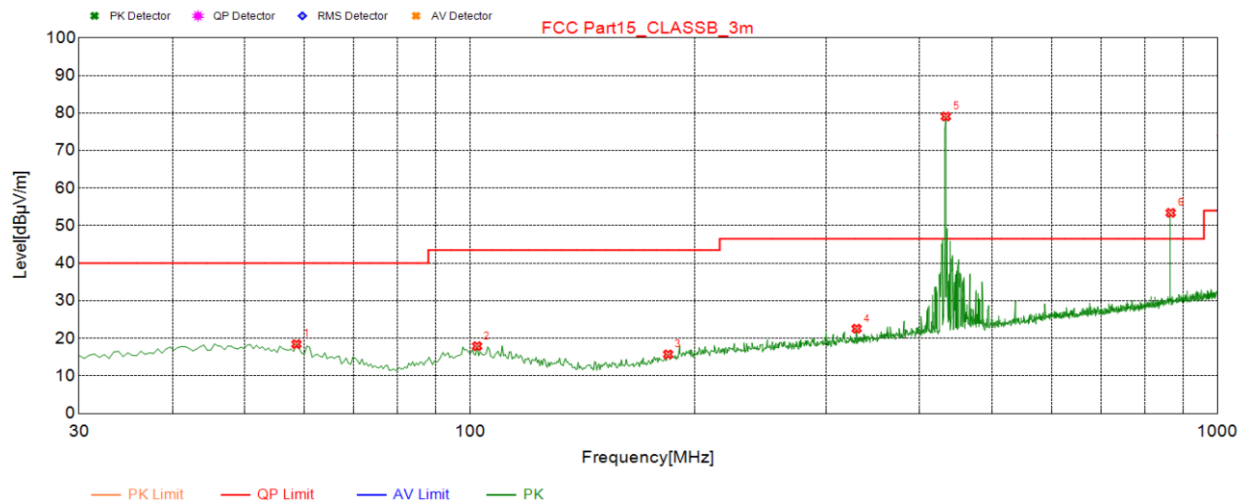
Limit line = specific limits (dBuV) + distance extrapolation factor.

### 5.2.7 Results of Radiated Emissions (30MHz~1GHz)

Temperature	25.5℃	Humidity	55.2%
Test Engineer	Anna Hu	Configurations	Normal working



Vertical:



Suspected List								
NO.	Freq. [MHz]	Result Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle[°]	Polarity
1	58.615	18.46	-15.44	40.00	21.54	200	349	Vertical
2	102.265	17.92	-15.98	43.50	25.58	200	159	Vertical
3	184.230	15.74	-17.03	43.50	27.76	100	350	Vertical
4	329.245	22.58	-12.00	46.50	23.92	100	0	Vertical
5	433.520	79.06	-9.37	46.50	-32.56	100	152	Vertical
6	866.625	53.41	-1.65	46.50	-6.91	100	169	Vertical

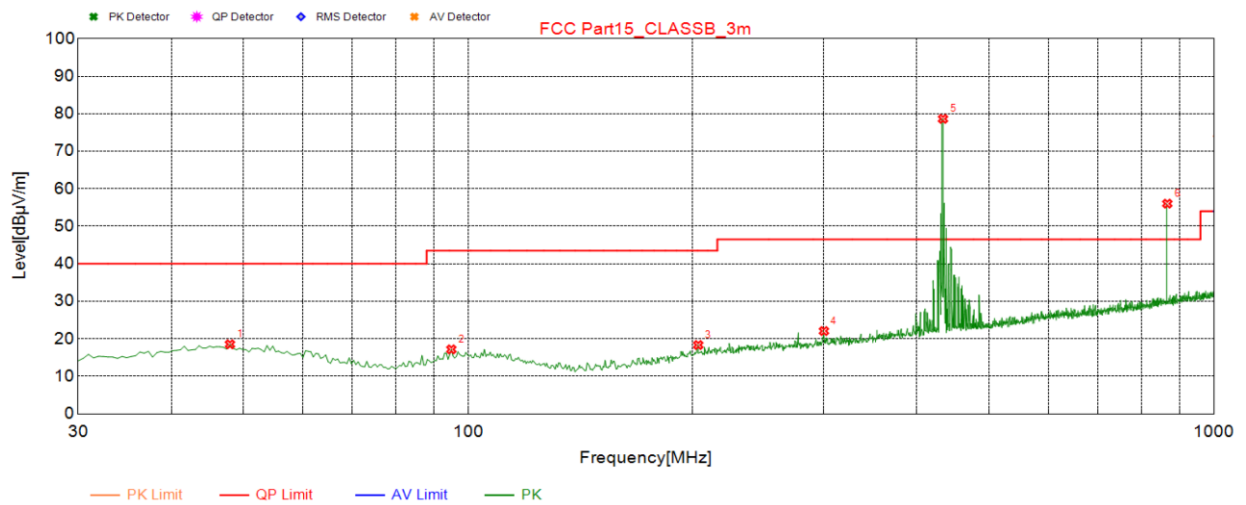
Frequency (MHz)	Peak Level (dBμV/m)	DC factor (dB)	Average Level (dBμV/m)	Limit (dBμV/m)	Result
433.52	79.06	-7.78	71.28	72.84	PASS
866.625	53.41	-7.78	45.63	52.84	PASS

Note:

- 1). Pre-scan all modes and recorded the worst case results in this report
- 2). Emission level (dBuV/m) = 20 log Emission level (uV/m).
- 3). Margin=Limit-Result Level



Horizontal:



Suspected List								
NO.	Freq. [MHz]	Result Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle[°]	Polarity
1	47.945	18.54	-14.07	40.00	21.46	300	330	Horizontal
2	94.990	17.18	-16.83	43.50	26.32	300	62	Horizontal
3	203.630	18.35	-15.33	43.50	25.15	300	146	Horizontal
4	300.145	22.07	-12.81	46.50	24.43	100	114	Horizontal
5	433.520	78.62	-9.37	46.50	-32.12	100	91	Horizontal
6	866.625	56.03	-1.65	46.50	-9.53	100	271	Horizontal

Frequency (MHz)	Peak Level (dBμV/m)	DC factor (dB)	Average Level (dBμV/m)	Limit (dBμV/m)	Result
433.52	78.62	-7.78	70.84	72.84	PASS
866.625	56.03	-7.78	48.25	52.84	PASS

Note:

- 1). Pre-scan all modes and recorded the worst case results in this report
- 2). Emission level (dBuV/m) = 20 log Emission level (uV/m).
- 3). Margin=Limit-Result Level



## 5.2.8 Results for Radiated Emissions (Above 1GHz)

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
1299.56	56.35	33.06	35.04	3.94	58.31	74.00	15.69	Peak	Horizontal
1299.56	41.51	33.06	35.04	3.94	43.47	54.00	10.53	Average	Horizontal
1732.43	54.86	33.06	35.04	3.94	56.82	74.00	17.18	Peak	Vertical
1732.43	43.62	33.06	35.04	3.94	45.58	54.00	8.42	Average	Vertical

## Notes:

- 1). Measuring frequencies from 9k~10th harmonic or 26.5GHz (which is less), No emission found between lowest internal used/generated frequency to 30MHz.
- 2). Radiated emissions measured in frequency range from 9k~10th harmonic or 26.5GHz (which is less) were made with an instrument using Peak detector mode.
- 3). Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4)  $\text{Measured} = \text{Reading} + \text{Ant. Fac} - \text{Pre. Fac.} + \text{Cab. Loss}$ ;  $\text{Margin} = \text{Limit} - \text{Measured}$

### 5.3 99% Bandwidth Emissions

#### 5.3.1 Limit

The 99% bandwidth of momentarily operated devices shall be less or equal to 0.25% of the centre frequency for devices operating between 70 MHz and 900 MHz. For devices operating above 900 MHz, the 99% bandwidth shall be less or equal to 0.5% of the centre frequency.

#### 5.3.2 Measuring Instruments and Setting

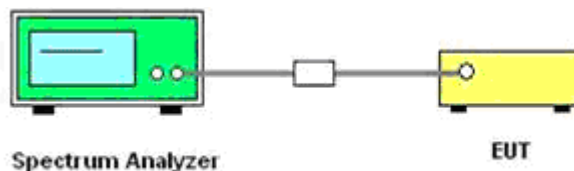
Please refer to section 6 of equipment list in this report. The following table is the setting of the Spectrum Analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	300 KHz
RBW	1 kHz
VBW	3 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

#### 5.3.3 Test Procedure

With the EUT's antenna attached and transmitting, the EUT's 99%Bandwidth/20dB Bandwidth power was received by the test antenna which was connected to the spectrum analyzer with the START and STOP frequencies set to the EUT's operation band.

#### 5.3.4 Test Setup Layout

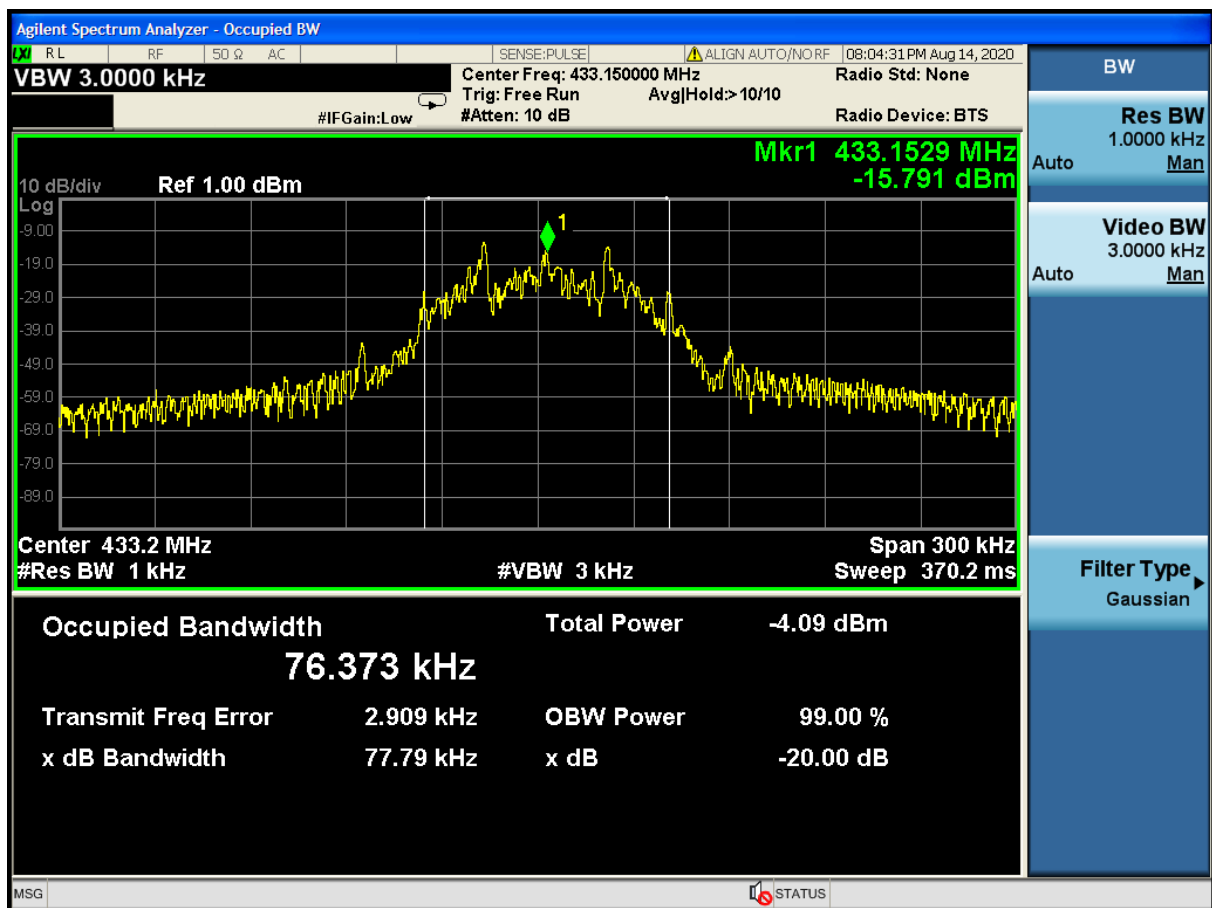


#### 5.3.5 Test Data

Temperature	25°C	Humidity	60%
Test Engineer	Anna Hu	Configurations	Normal working



Center Frequency of operation (MHz)	Maximum allowed bandwidth (KHz)	99% Bandwidth(KHz)	20dB Bandwidth(KHz)	Result
433.2	1083.0	76.373	77.79	PASS
<b>Maximum allowed bandwidth:</b>	<input checked="" type="checkbox"/> 0.25% of the centre operating frequency <input type="checkbox"/> 0.5% of the centre operating frequency			





## 5.4 Duty cycle

### 5.4.1 Limit

No dedicated limit specified in the Rules.

### 5.4.2 Test Procedure

- EUT continued transmitting
  - The test antenna which was connected to the spectrum analyser can receive the power of EUT.
- Set centre frequency of spectrum analyzer=operating frequency.
- Set the spectrum analyzer as RBW=100 kHz, VBW=300 KHz, Span=0Hz, Sweep time = 100ms, record the number of pulses.
- Adjust the sweep time to capture every single pulse type and time, and record it.

### 5.4.3 Test Data

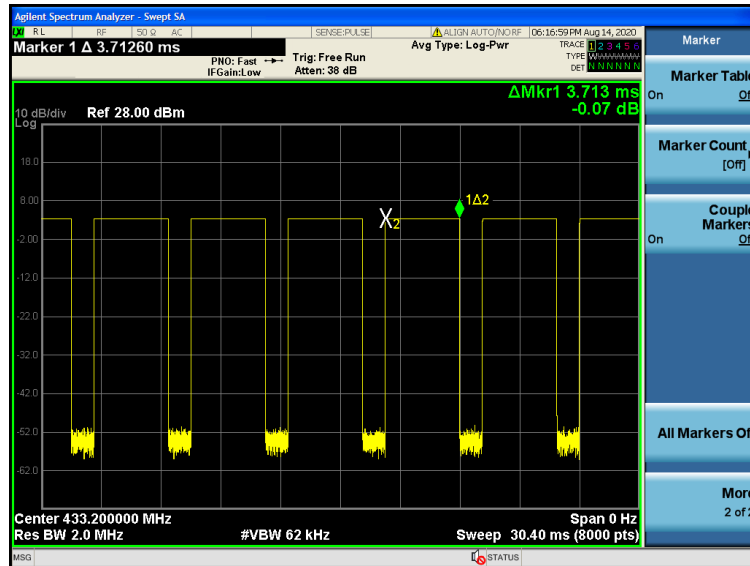
Temperature	25°C	Humidity	60%
Test Engineer	Anna Hu	Configurations	Normal working

$$T_{on} = (3.713 \times 11) \text{ ms} = 40.843 \text{ ms}$$

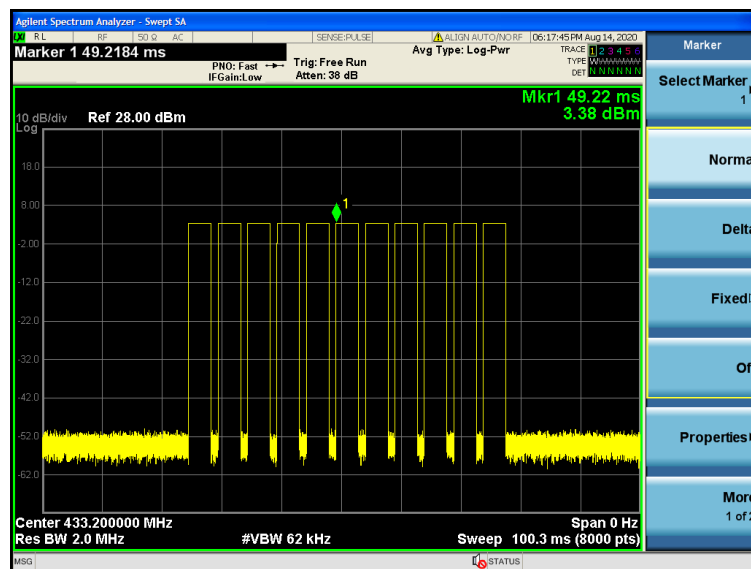
$$T_p = 100 \text{ (ms)}$$

$$\text{Duty cycle} = T_{on} / T_p \times 100\% = 3.52 / 100 \times 100\% = 40.843\%$$

$$\text{DC Correction Factor} = 20 \log (T_{on} / T_p) = 20 \log (0.40843) = -7.78 \text{ dB}$$







## 5.5 Antenna Requirements

### 5.5.1 Standard Applicable

According to antenna requirement of §15.203.

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

And according to §15.247(4)(1), system operating in the 2400-2483.5MHz bands that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

### 5.5.2 Antenna Connected Construction

#### 5.5.2.1. Standard Applicable

According to § 15.203, 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.

#### 5.5.2.2. Antenna Connector Construction

The directional gains of antenna refer to section 1.1 of this report, and the antenna is an Internal antenna connect to PCB board and no consideration of replacement. Please see EUT photo for details.

#### 5.5.2.3. Results: Compliance.



## 6. LIST OF MEASURING EQUIPMENTS

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
1	MXA Signal Analyzer	Keysight	N9020A	MY52091623	2020/1/2	2021/1/1
2	Power Sensor	Agilent	U2021XA	MY5365004	2020/1/2	2021/1/1
3	Power Meter	Agilent	U2531A	TW53323507	2020/1/2	2021/1/1
4	Wideband Antenna	schwarzbeck	VULB 9163	958	2019/11/16	2022/11/15
5	Horn Antenna	schwarzbeck	9120D-1141	1574	2019/11/16	2022/11/15
6	EMI Test Receiver	R&S	ESCI	100849/003	2020/1/2	2021/1/1
7	Controller	MF	MF7802	N/A	N/A	N/A
8	Amplifier	schwarzbeck	BBV 9743	209	2020/1/2	2021/1/1
9	Amplifier	Tonscend	TSAMP-0518 SE	--	2020/1/2	2021/1/1
10	RF Cable(below 1GHz)	HUBER+SUHNER	RG214	N/A	2020/1/2	2021/1/1
11	RF Cable(above 1GHz)	HUBER+SUHNER	RG214	N/A	2020/1/2	2021/1/1
12	Artificial Mains	ROHDE & SCHWARZ	ENV 216	101333-IP	2020/1/2	2021/1/1
12	EMI Test Software	ROHDE & SCHWARZ	ESK1	V1.71	N/A	N/A
14	RE test software	Tonscend	JS32-RE	V2.0.2.0	N/A	N/A
15	Test Software	Tonscend	JS1120-3	V2.5.77.0418	N/A	N/A



## **7. TEST SETUP PHOTOGRAPHS OF EUT**

Please refer to separated files for Test Setup Photos of the EUT.

## **8. PHOTOGRAPHS OF THE EUT**

Please refer to separated files for Photos of the EUT.

-----THE END OF REPORT-----