



## TEST REPORT

**Application No.:** SZEM2006004629CR (SHEM2004003237CR)  
**FCC ID:** 2AWDCTB1000-W  
**Applicant:** Tsingoal (Beijing) Technology Co., Ltd  
**Address of Applicant:** Room 32021, Zhongtai Building, Shuangqing Road No.3, Haidian District, Beijing, China  
**Manufacturer:** Tsingoal (Beijing) Technology Co., Ltd  
**Address of Manufacturer:** Room 32021, Zhongtai Building, Shuangqing Road No.3, Haidian District, Beijing, China  
**Factory:** Beijing Yongshixinyu Electronic Technology Co., Ltd.  
**Address of Factory:** Maohua factory, houfengbozuodi Road, Shunyi District, Beijing, China  
**Equipment Under Test (EUT):**  
**EUT Name:** UWB Tag  
**Model No.:** Tb1000-w  
**Standard(s) :** 47 CFR Part 15, Subpart F  
**Date of Receipt:** 2020-04-29  
**Date of Test:** 2020-05-13 to 2020-05-23  
**Date of Issue:** 2020-05-25

<b>Test Result:</b>	<b>Pass*</b>
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\* In the configuration tested, the EUT complied with the standards specified above.

Keny Xu  
EMC Laboratory Manager



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Shenzhen Branch

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Revision Record			
Version	Description	Date	Remark
00	Original	2020-05-25	/

Authorized for issue by:			
		<b>Foray Chen /Project Engineer</b>	
		<b>Eric Fu /Reviewer</b>	



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## 2 Test Summary

Test Item	Test Requirement	Test method	Result
<b>Antenna Requirement</b>	47 CFR Part 15, Subpart C Section 15.203 & Subpart F Section 15.519 (a)(2)	ANSI C63.10 (2013)	PASS
<b>UWB Bandwidth</b>	47 CFR Part 15, Subpart F Section 15.503 (a)	ANSI C63.10 (2013)	PASS
<b>Dwell Time</b>	47 CFR Part 15, Subpart F Section 15.519 (a)(1)	ANSI C63.10 (2013)	PASS*
<b>Spurious Emissions</b>	47 CFR Part 15, Subpart F Section 15.519 (c)(d)/15.209	ANSI C63.10 (2013)	PASS
<b>EIRP</b>	47 CFR Part 15, Subpart F Section 15.519 (e)	ANSI C63.10 (2013)	PASS

\* The details please refer to section 7.3



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## 4 General Information

### 4.1 Details of E.U.T.

Power supply:	DC 3.7V 600mAh rechargeable battery
Test voltage:	DC 3.7V
Product category:	hand held
Antenna Gain:	0dBi
Antenna Type:	dielectric chip antenna
Modulation Type:	BPM-BPSK
Number of Channels:	1
Frequency range:	6.1GHz-6.9GHz

### 4.2 Description of Support Units

The EUT has been tested as an independent unit.

### 4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	$\pm 7.25 \times 10^{-8}$
2	Duty cycle	$\pm 0.37\%$
3	Occupied Bandwidth	$\pm 3\%$
4	Conduction emission	$\pm 3.0\text{dB}$ (150kHz to 30MHz)
5	RF conducted power	$\pm 0.75\text{dB}$
6	RF power density	$\pm 2.84\text{dB}$
7	Conducted Spurious emissions	$\pm 0.75\text{dB}$
8	RF Radiated power	$\pm 4.5\text{dB}$ (Below 1GHz) $\pm 4.8\text{dB}$ (Above 1GHz)
9	Radiated Spurious emission test	$\pm 4.5\text{dB}$ (Below 1GHz) $\pm 4.8\text{dB}$ (Above 1GHz)
10	Temperature test	$\pm 1^\circ\text{C}$
11	Humidity test	$\pm 3\%$
12	Supply voltages	$\pm 1.5\%$
13	Time	$\pm 3\%$

Remark:

The  $U_{\text{lab}}$  (lab Uncertainty) is less than  $U_{\text{cispr}}$  (CISPR Uncertainty), so the test results

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

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#### 4.4 Test Location

All tests were performed at:

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No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.

Tel: +86 755 2601 2053      Fax: +86 755 2671 0594

No tests were sub-contracted.

#### 4.5 Test Facility

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

- **A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

- **VCCI**

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

- **FCC –Designation Number: CN1178**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

- **Innovation, Science and Economic Development Canada**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

#### 4.6 Deviation from Standards

None

#### 4.7 Abnormalities from Standard Conditions

None

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## 5 Equipment List

General used equipment						
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date	
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-03	2019-09-26	2020-09-25	
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-04	2019-09-26	2020-09-25	
Humidity/ Temperature Indicator	Mingle	N/A	SEM002-08	2019-09-26	2020-09-25	
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2020-04-07	2021-04-06	

RE in Chamber <1GHz						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date	Cal. Due date
1	3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2017-08-05	2020-08-04
2	MXE EMI receiver(3Hz-3.6GHz)	KEYSIGHT	N9038A	SEM004-15	2019-12-16	2020-12-15
3	BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEM003-01	2017-06-27	2020-06-26
4	Pre-amplifier (0.1-1300MHz)	Agilent Technologies	8447D	SEM005-01	2020-04-01	2021-03-31
5	Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
6	Coaxial Cable	SGS	N/A	SEM025-01	2019-07-11	2020-07-10

RE in Chamber 2# >1GHz						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date (yyyy-mm-dd)	Cal. Due date (yyyy-mm-dd)
1	3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2018-03-13	2021-03-12
2	EXA Signal Analyzer (10Hz-44GHz)	Agilent Technologies Inc	N9010A	SEM004-12	2020-04-09	2021-04-08
3	BiConiLog Antenna (26-3000MHz)	ETS-Lindgren	3142C	SEM003-01	2017-06-27	2020-06-26
4	Horn Antenna (800MHz-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2018-04-13	2021-04-12
5	Amplifier (0.1-1300MHz)	HP	8447D	SEM005-02	2019-09-24	2020-09-23

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6	Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	SEM004-11	2019-09-24	2020-09-23
7	Measurement Software	AUDIX	e3 V8.2014-6- 27	N/A	N/A	N/A
8	Coaxial Cable	SGS	N/A	SEM026-01	2019-07-11	2020-07-10



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## 6 Radio Spectrum Technical Requirement

### 6.1 Antenna Requirement

#### 6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203 & 15.519(a)(2)

#### 6.1.2 Conclusion

Standard 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.

15.519(a) (2) requirement:

The use of antennas mounted on outdoor structures, e.g., antennas mounted on the outside of a building or on a telephone pole, or any fixed outdoors infrastructure is prohibited. Antennas may be mounted only on the hand held UWB device.

EUT Antenna:

The antenna is dielectric chip antenna and no consideration of replacement. The best case gain of the antenna is 0dBi.

Antenna location: Refer to Appendix(Internal Photos)



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## 7 Radio Spectrum Matter Test Results

### 7.1 Radiated Spurious Emissions

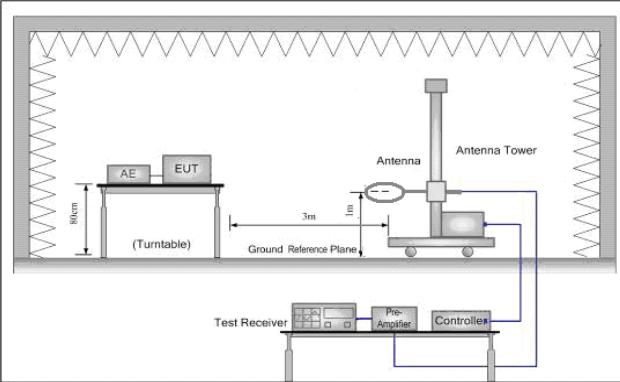
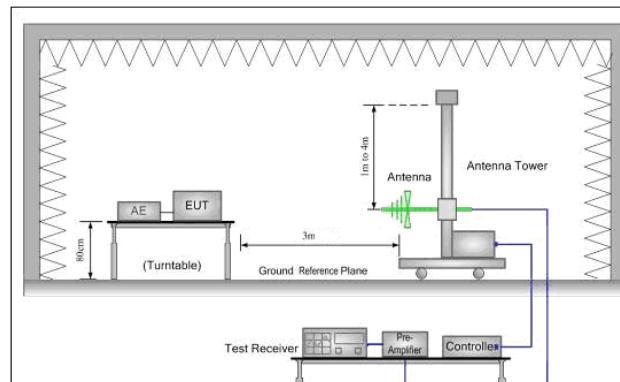
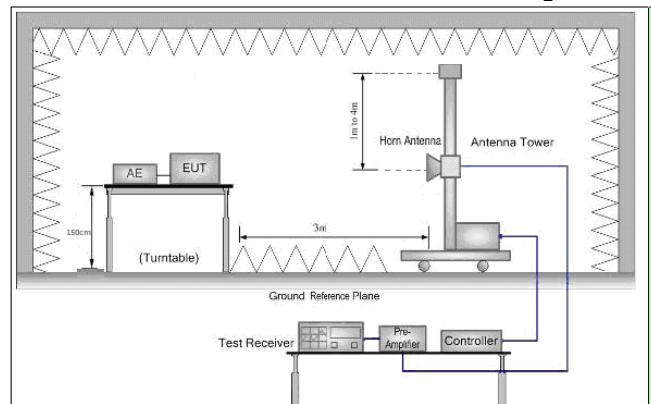
Test Requirement:	47 CFR Part 15, Subpart F Section 15.519 (c)(d)/15.209				
Test Method:	ANSI C63.10: 2013				
Test Site:	Measurement Distance: 3m				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
	0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
	0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
	0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
	0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	30MHz-960MHz	Quasi-peak	100 kHz	300kHz	Quasi-peak
Limit: (Spurious Emissions)	Above 960MHz	RMS	1MHz	3MHz	RMS
	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz-88MHz	100	40.0	Quasi-peak	3
	88MHz-216MHz	150	43.5	Quasi-peak	3
	216MHz-960MHz	200	46.0	Quasi-peak	3
	960MHz-1610MHz	-75.3 dBm (EIRP, RBW=1MHz)	RMS		3
	1610MHz-1990MHz	-63.3 dBm (EIRP, RBW=1MHz)	RMS		3
	1990MHz-3100MHz	-61.3 dBm (EIRP, RBW=1MHz)	RMS		3
	3100MHz-10600MHz	-41.3 dBm (EIRP, RBW=1MHz)	RMS		3
	3100MHz-10600MHz	0 dBm (EIRP, RBW=50MHz)	Peak		3
	Above 10600MHz	-61.3 dBm (EIRP, RBW=1MHz)	RMS		3
	1164MHz-1240MHz	-85.3 dBm (EIRP, RBW=1kHz)	RMS		3
	1559MHz-1610MHz	-85.3 dBm (EIRP, RBW=1kHz)	RMS		3

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Test Setup:	
	 <p>Figure 1. Below 30MHz</p>
	 <p>Figure 2. 30MHz to 1GHz</p>
	 <p>Figure 3. Above 1 GHz</p>

## Test Procedure:

- 1) For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- 2) For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- 3) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 4) 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.
- 5) 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to

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	<p>360 degrees to find the maximum reading.</p> <p>6) The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</p> <p>7) 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.</p> <p>8) Test the EUT in the lowest channel, the middle channel, the Highest channel</p> <p>9) The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, And found the X axis positioning which it is worse case.</p> <p>10) Repeat above procedures until all frequencies measured was complete.</p>
Exploratory Test Mode:	Transmitting mode
Final Test Mode:	Transmitting mode
Instruments Used:	Refer to section 4 for details
Test Results:	Pass

According to ANSI 63.10 Clause 10.3.9, the EIRP to field strength at a specified measurement distance of 3 m is below:

$$E (\text{dBuV/m}) = \text{EIRP}(\text{dBm}) + 95.3$$

Thus, the field strength limit for the test above 1GHz is below:

Frequency	Limit		Detector	Measurement Distance
	EIRP (dBm)	Field Strength (dBuV/m)		
960MHz-1610MHz	-75.3 (RBW=1MHz)	20.00	RMS	3
1610MHz-1990MHz	-63.3 (RBW=1MHz)	32.00	RMS	3
1990MHz-3100MHz	-61.3 (RBW=1MHz)	34.00	RMS	3
3100MHz-10600MHz	-41.3 (RBW=1MHz)	54.00	RMS	3
3100MHz-10600MHz	0 (RBW=50MHz)	95.3	Peak	3
Above 10600MHz	-61.3 (RBW=1MHz)	34.00	RMS	3
1164MHz-1240MHz	-85.3 (RBW=1kHz)	10.00	RMS	3
1559MHz-1610MHz	-85.3 (RBW=1kHz)	10.00	RMS	3



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**Measurement Data**

**7.1.1.1 Peak Power**

Field Strength for fundamental @ RBW=10MHz						
Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Polarization
6488	32.11	9.75	38.13	72.48	76.21	Horizontal
6488	32.11	9.75	38.13	72.12	75.85	Vertical

Calculated Field Strength of fundamental @ RBW=50MHz						
Frequency (MHz)	Measured Field Strength of fundamental (FS <sub>M</sub> ) (dBuV/m)	Calculated factor for RBW=10MHz to RBW=50MHz	Calculated Field Strength of fundamental (F <sub>Sc</sub> ) (dBuV/m)	Limit (dBuV/m)	Over Limit(dB)	Polarization
6488	76.21	13.98	90.19	95.30	-5.11	Horizontal
6488	75.85	13.98	89.83	95.30	-5.47	Vertical
		Note: F <sub>Sc</sub> = F <sub>M</sub> + 20log(50MHz/10MHz) = F <sub>M</sub> + 13.98				

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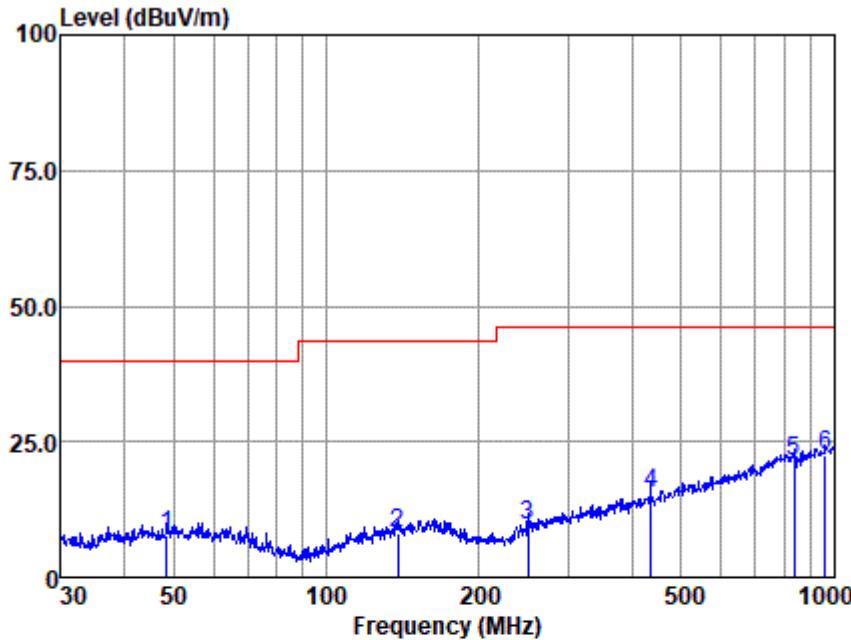
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## 7.1.1.2 Spurious Emissions

30MHz-960MHz



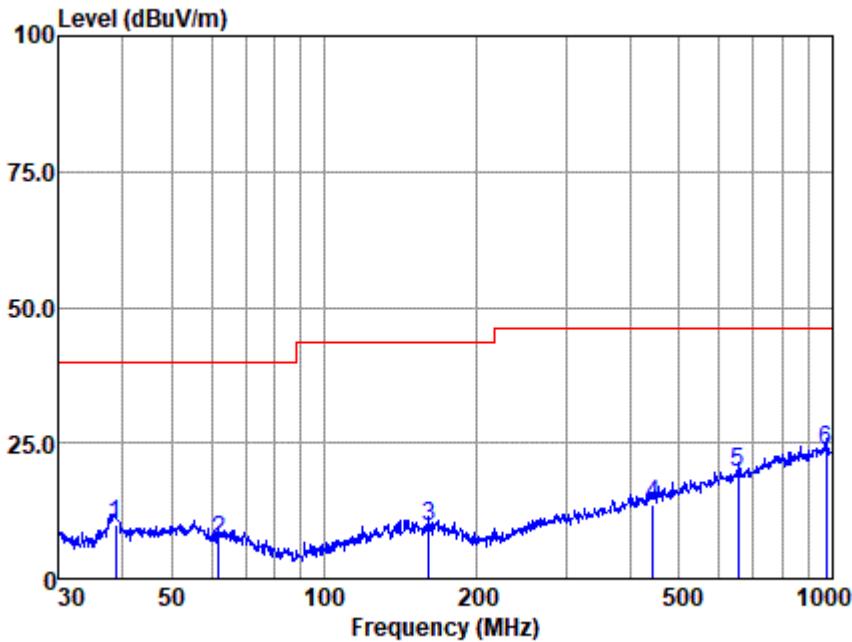
Antenna Polarity :HORIZONTAL

Freq	Read	Antenna	Cable	Preamp	Emission	Limit	Over	Remark
	Level	Factor	Loss	Factor	Level	Line	Limit	
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	48.502	35.58	13.64	1.03	42.33	7.92	40.00	-32.08 QP
2	138.387	36.48	12.40	1.62	42.25	8.25	43.50	-35.25 QP
3	249.425	37.97	11.63	2.21	42.10	9.71	46.00	-36.29 QP
4	435.590	37.98	16.56	2.76	41.81	15.49	46.00	-30.51 QP
5	833.317	37.16	22.50	3.77	41.87	21.56	46.00	-24.44 QP
6	962.162	35.70	24.00	4.02	41.27	22.45	46.00	-23.55 QP

Note: Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor

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Antenna Polarity :VERTICAL

Freq	Read	Antenna	Cable	Preamp	Emission	Limit	Over	Remark
	Level	Factor	Loss	Factor	Level	Line	Limit	
1 38.752	38.44	13.01	0.94	42.34	10.05	40.00	-29.95	QP
2 61.995	35.53	12.81	1.12	42.31	7.15	40.00	-32.85	QP
3 160.909	36.83	13.16	1.78	42.22	9.55	43.50	-33.95	QP
4 444.851	35.75	16.79	2.78	41.78	13.54	46.00	-32.46	QP
5 654.232	37.46	20.35	3.37	41.71	19.47	46.00	-26.53	QP
6 972.337	36.91	24.00	4.06	41.17	23.80	46.00	-22.20	QP

Note: Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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Test Data:

Transmitting with modulation Mode								
Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
<b>1164MHz ≤ f ≤ 1240MHz &amp; 1559MHz ≤ f ≤ 1610MHz</b>								
1214.64	22.16	2.16	37.01	17.75	5.06	10.00	-4.94	Vertical
1576.74	23.6	2.42	36.96	15.82	4.88	10.00	-5.12	Vertical
<b>960MHz ≤ f ≤ 3100MHz (except for above frequency range)</b>								
1472.64	23.11	2.44	36.91	24.51	13.15	20.00	-6.85	Vertical
2638.54	26.62	3.24	37.68	24.28	16.46	34.00	-17.54	Vertical
<b>f &gt; 3100MHz</b>								
3876.63	29.7	3.96	38.25	47.62	20.46	54.00	-33.54	Vertical
4428.98	30.00	4.73	38.37	46.58	19.64	54.00	-34.36	Vertical
6725.24	32.54	5.51	37.74	46.25	46.56	54.00	-7.44	Vertical
12175.54	35.74	7.00	36.97	22.81	28.58	34.00	-5.42	Vertical
13723.67	37.72	8.17	37.73	21.26	29.42	34.00	-4.58	Vertical
14253.24	38.55	8.91	38.26	18.25	27.45	34.00	-6.55	Vertical
<b>1164MHz ≤ f ≤ 1240MHz &amp; 1559MHz ≤ f ≤ 1610MHz</b>								
1182.68	22.03	2.15	37.02	17.78	4.94	10.00	-5.06	Horizontal
1584.78	23.62	2.42	36.96	15.94	5.02	10.00	-4.98	Horizontal
<b>960MHz ≤ f ≤ 3100MHz (except for above frequency range)</b>								
1008.24	21.24	2.15	37.1	27.25	13.54	20.00	-6.46	Horizontal
1949.87	25.2	2.82	37.17	27.79	18.64	34.00	-15.36	Horizontal
<b>f &gt; 3100MHz</b>								
3628.75	29.06	4.07	38.34	47.85	18.98	54.00	-35.02	Horizontal
5575.90	32.12	4.86	38.59	47.56	45.95	54.00	-8.05	Horizontal
7297.47	33.47	5.79	37.12	44.72	46.86	54.00	-7.14	Horizontal
12622.58	35.94	8.44	37.33	35.57	42.62	34.00	8.62	Horizontal
13754.24	37.78	8.42	37.75	19.28	27.73	34.00	-6.27	Horizontal
14674.20	38.67	9.32	38.20	16.43	26.22	34.00	-7.78	Horizontal

Remark:

- 1) Scan from 9kHz to 40GHz, The disturbance above 18GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

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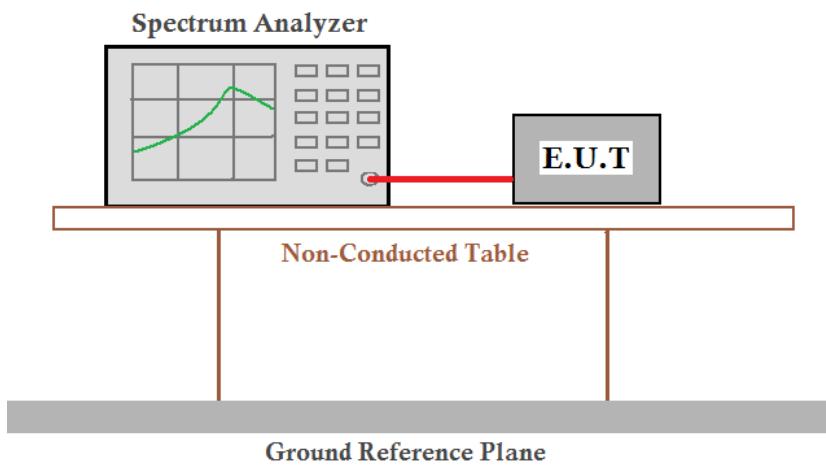
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## 7.2 UWB Bandwidth (10dB Bandwidth)

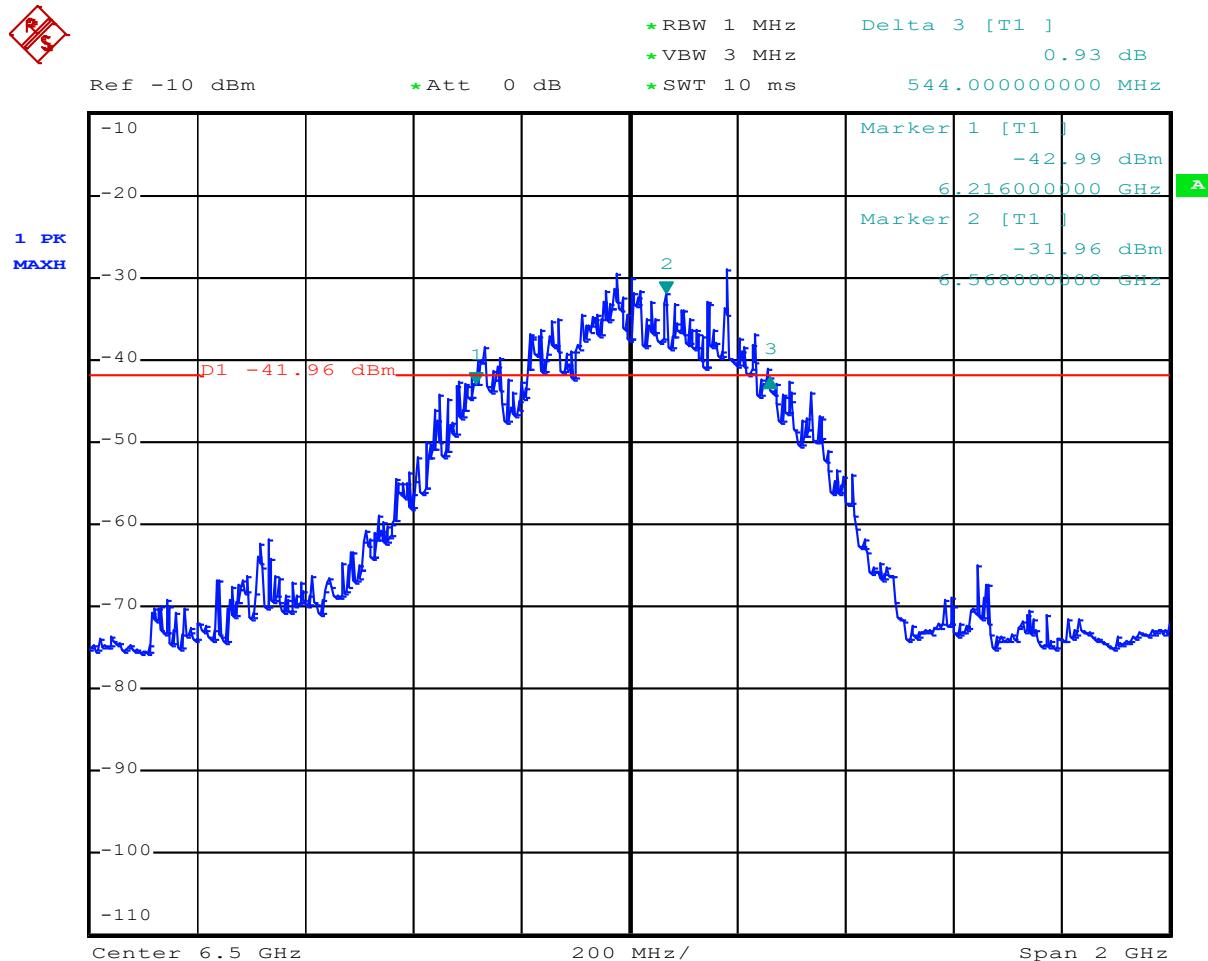
Test Requirement:	47 CFR Part 15F Section 15.503(a)
Test Method:	ANSI C63.10:2013
Test Setup:	 <p>The diagram illustrates the test setup for measuring UWB bandwidth. A Spectrum Analyzer is positioned above a Non-Conducted Table. A red line connects the Spectrum Analyzer to a device labeled 'E.U.T' (Equipment Under Test) which is placed on the table. The entire setup is resting on a Ground Reference Plane.</p>
Limit:	$\geq 500\text{MHz}$
Exploratory Test Mode:	Transmitter mode
Instruments Used:	Refer to section 4 for details
Test Results:	Pass

### Measurement Data

Test Frequency (MHz)	$F_L$ (MHz)	$F_H$ (MHz)	10dB bandwidth (MHz)	Limit (MHz)	Results
6488	6216	6760	544	$\geq 500\text{MHz}$	Pass



Test plot as follows:



Date: 11.MAY.2020 16:25:37



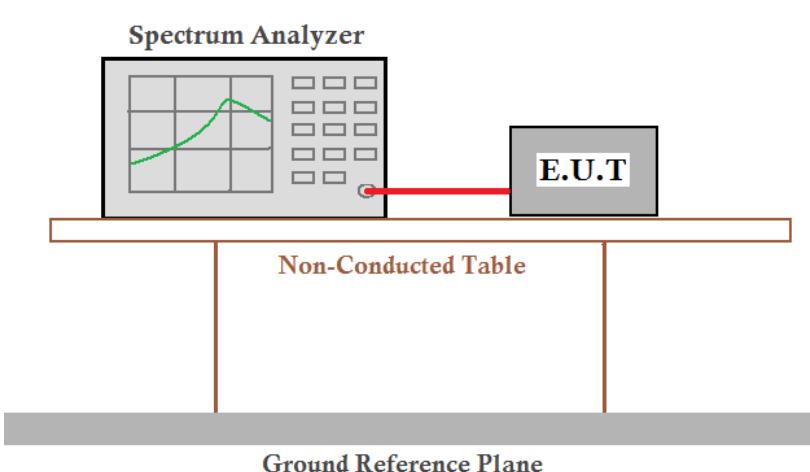
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### 7.3 Dwell Time

Test Requirement:	47 CFR Part 15F Section 15.519(a)(1)
Test Method:	ANSI C63.10:2013
Test Setup:	
Limit:	The UWB intentional radiator shall cease transmission within 10 seconds unless it receives an acknowledgement from the associated receiver that its transmission is being received
Exploratory Test Mode:	Operation mode
Instruments Used:	Refer to section 4 for details
Test Results:	Pass*

#### Measurement Data

The UWB Tag is a real-location system, When UWB Tag not establish communication with UWB gateway UWB Tag cease transmission but only transmission periodic signals used for re-establishment of a communication link. so UWB Tag is satisfied the requirement for 47 CFR Part 15F Section 15.519(a)(1).



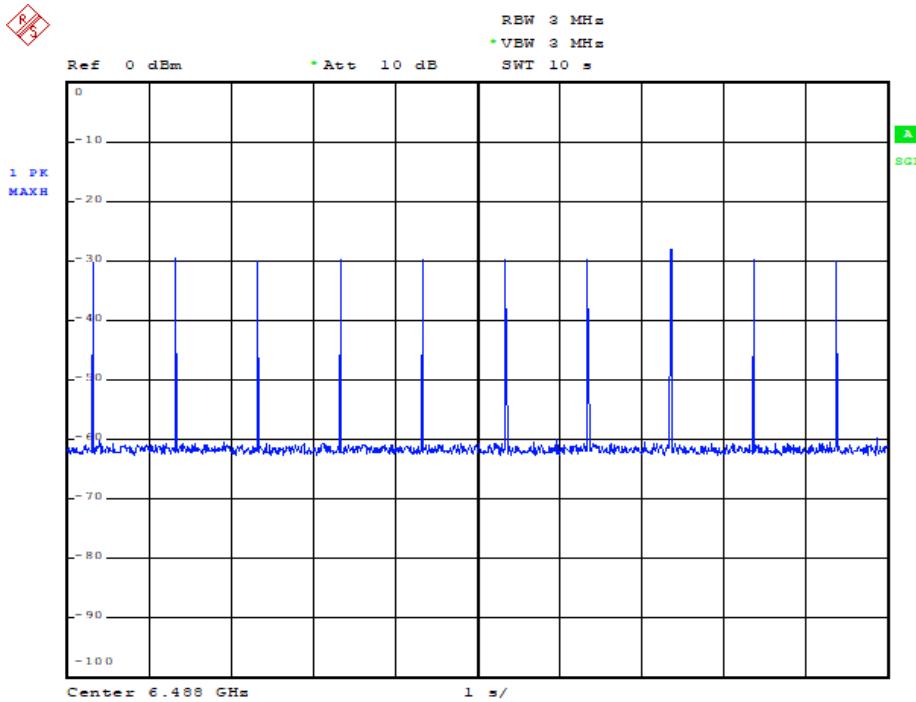
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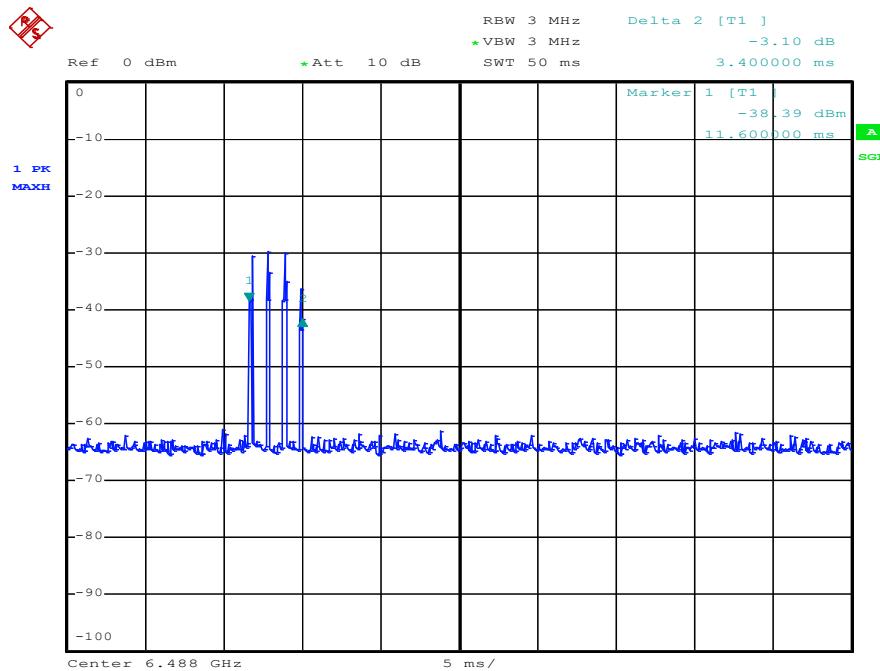
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## Establish communication with gateway-1



## Establish communication with gateway-2

Remark: EUT connected with two gateway, the number of signal burst is 2+N where N is the number of gateway which connected with EUT.



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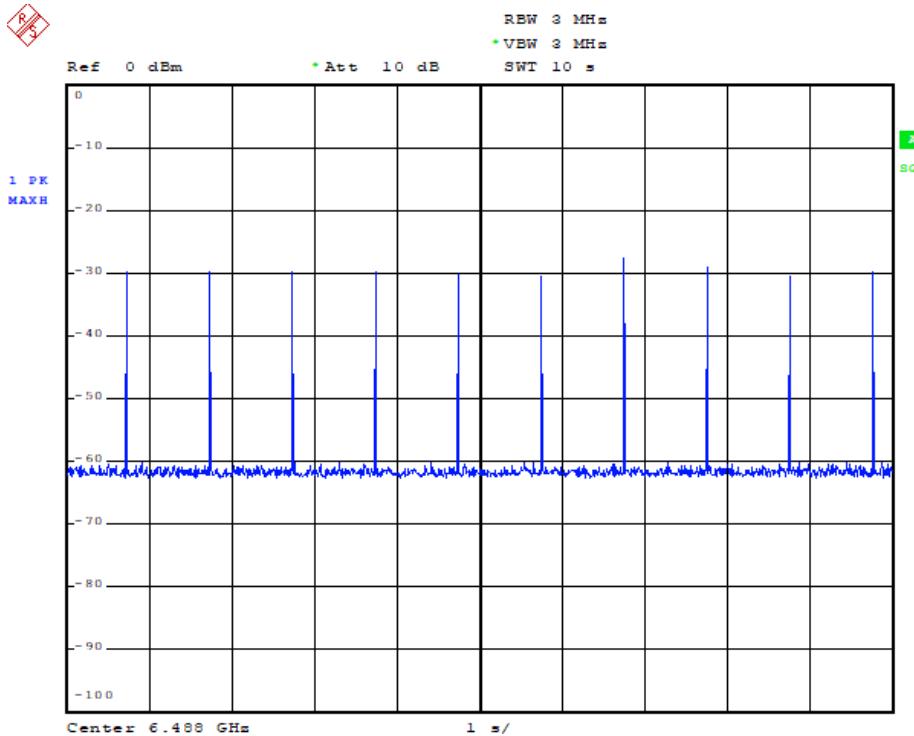
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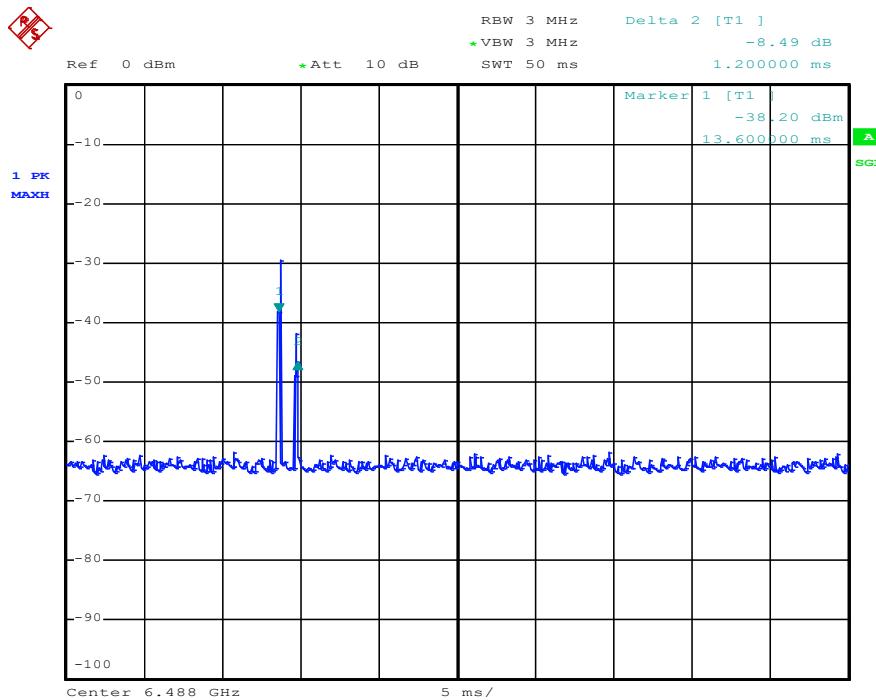
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## Disconnected with gateway-1



## Disconnected with gateway-2

Remark: EUT disconnected with gateway, EUT transmission two periodic signals



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## 8 Test Setup Photographs

Refer to the < Test Setup photos-FCC>.

## 9 EUT Constructional Details

Refer to the < External Photos > & < Internal Photos >.

- End of the Report -



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