



Test report No. : 4789726097-US-R0-V0  
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Issued date : Jan. 25, 2021  
FCC ID : YUYSSRC002

## **RADIO TEST REPORT**

**Product** : RF REMOTE CONTROL

**Model Name** : ZEN16SA

**Series Model** : ZEN16DA

**FCC ID** : YUYSSRC002

**Test Regulation** : FCC 47 CFR Part 15 Subpart C (Section 15.231)

**Received Date** : Nov. 30, 2020

**Test Date** : Dec. 12, 2020 ~ Jan. 15, 2021

**Issued Date** : Jan. 25, 2021

**Applicant** : San Hsin Plastech Co., Ltd.  
No.17 Jian Guo E. Rd., Taoyuan Dist., Taoyuan City  
33068, Taiwan

**Issued By** : Underwriters Laboratories Taiwan Co., Ltd.  
Building B and Building E, No. 372-7, Sec. 4, Zhongxing  
Rd., Zhudong Township, Hsinchu County, Taiwan



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Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

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## REVISION HISTORY

**Original Test Report No.: 4789726097-US-R0-V0**

[illegible]

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## 1. Attestation of Test Results

**APPLICANT:** San Hsin Plastech Co., Ltd.  
No.17 Jian Guo E. Rd., Taoyuan Dist., Taoyuan City 33068, Taiwan

**MANUFACTURER** San Hsin Plastech Co., Ltd.  
No.17 Jian Guo E. Rd., Taoyuan Dist., Taoyuan City 33068, Taiwan

**EUT DESCRIPTION:** RF REMOTE CONTROL

**BRAND:** ZENNO

**MODEL:** ZEN16SA

**SERIES MODEL:** ZEN16DA

**SAMPLE STAGE:** Engineering Verification Test sample

**DATE of TESTED:** Dec. 12, 2020 ~ Jan. 15, 2021

### APPLICABLE STANDARDS

STANDARD	Test Results
FCC 47 CFR PART 15 Subpart C (Section 15.231)	PASS

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:

Sally Lu  
Project Handler

Date : Jan. 25, 2021

Approved and Authorized By:

Mike Cai  
Engineer Project Associate

Date : Jan. 25, 2021

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## 2. Summary of Test Results

Summary of Test Results		
FCC Clause	Test Items	Result
15.209 / 15.231(b)	Radiated Emissions	PASS
15.231(c)	Emission Bandwidth Test	PASS
15.231(a)	De-activation	PASS

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### 3. Facilities and Accreditation

<b>Test Location</b>	Underwriters Laboratories Taiwan Co., Ltd.
<b>Address</b>	Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan
<b>Accreditation Certificate</b>	Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398. The full scope of accreditation can be viewed at <a href="http://accreditation.taftw.org.tw/taf/public/basic/viewApplyItems.action?unitNo=3398">http://accreditation.taftw.org.tw/taf/public/basic/viewApplyItems.action?unitNo=3398</a>

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#### 4. Measurement Uncertainty

For statement of conformity, accuracy method (Section 8.2.4 and 8.2.5 of ISO Guide 98-4) was applied as decision rule for measurement in this test report.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor  $k=2$ .

Test Item	Measurement Frequency Range	K	U(dB)
Radiated disturbance below 30MHz	9 kHz - 30 MHz	2	1.9
Radiated disturbance below 1 GHz	30MHz ~ 1GHz	2	5.4
Radiated disturbance above 1GHz	1GHz ~ 40GHz	2	4.7

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## 5. Equipment under Test

### 5.1. Description of EUT

<b>Product</b>	RF REMOTE CONTROL
<b>Brand Name</b>	ZENNO
<b>Model Name</b>	ZEN16SA
<b>Series Model</b>	ZEN16DA
<b>S/N</b>	ZEN16SA: NZE16SAW0122 ZEN16DA: NZE16DAW0122
<b>Operating Frequency</b>	433.92 MHz
<b>Modulation</b>	ASK
<b>Transfer Rate</b>	12kbps
<b>Number of Channel</b>	1
<b>Maximum Output Power</b>	86.65 dBuV/m
<b>Normal Voltage</b>	6 Vdc from 2 battery
<b>Software Version</b>	N/A

Note:

1. The models difference table as below:

<b>Model Name</b>	<b>Difference</b>
ZEN16SA	The PCB motherboard layout is the same, and the shell is designed with single-row button.
ZEN16DA	The PCB motherboard layout is the same, and the shell is designed with double-row buttons.

2. The EUT contains following accessory devices.

<b>Product</b>	<b>Brand</b>	<b>Model</b>	<b>Description</b>
Support	San Hsin	ABS707	-

3. The above EUT information is declared by manufacturer and for more detailed features description, please refer the manufacturer's or user's manual.

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## 5.2. Channel List

Channel	Freq. (MHz)
1	433.92MHz

## 5.3. Test Condition

Test Item	Test Site No.	Environmental Condition	Input Power	Test Date	Tested by
Radiated Spurious Emission	966-2	23~27°C / 63~69%RH	6 Vdc	Dec. 12, 2020 ~ Jan. 15, 2021	Patrick Kuan
Emission Bandwidth	966-2	23~27°C / 63~69%RH	6 Vdc	Dec. 12, 2020 ~ Jan. 15, 2021	Patrick Kuan
Deactivation Time	966-2	23~27°C / 63~69%RH	6 Vdc	Dec. 12, 2020 ~ Jan. 15, 2021	Patrick Kuan

FCC Test Firm Registration Number: 498077

## 5.4. Description Of Available Antennas

Ant. No.	Brand Name	Model Name	Ant. Type	Ant. Gain (dBi)
1	SH	Ant1	N/A	N/A

Note: The above antenna information was provided from customer and for more detailed features description, please refer the manufacturer's specification or user's manual.

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## 5.5. Test Mode Applicability and Tested Channel Detail

- The fundamental of the EUT was investigated in three orthogonal axes X-Y/Y-Z/-X-Z, it was determined that X-Y axis was worst-case. Therefore, all final radiated testing was performed with the EUT in X-Y axis.
- The EUT was powered by battery, AC power line conducted emission has no requirement.

Test item	Modulation Type	Available Channel	Test Channel
Radiated Emissions (Above 1GHz)	ASK	1	1
Radiated Emissions (Below 1GHz)	ASK	1	1
Emission Bandwidth	ASK	1	1
Deactivation Time	ASK	1	1



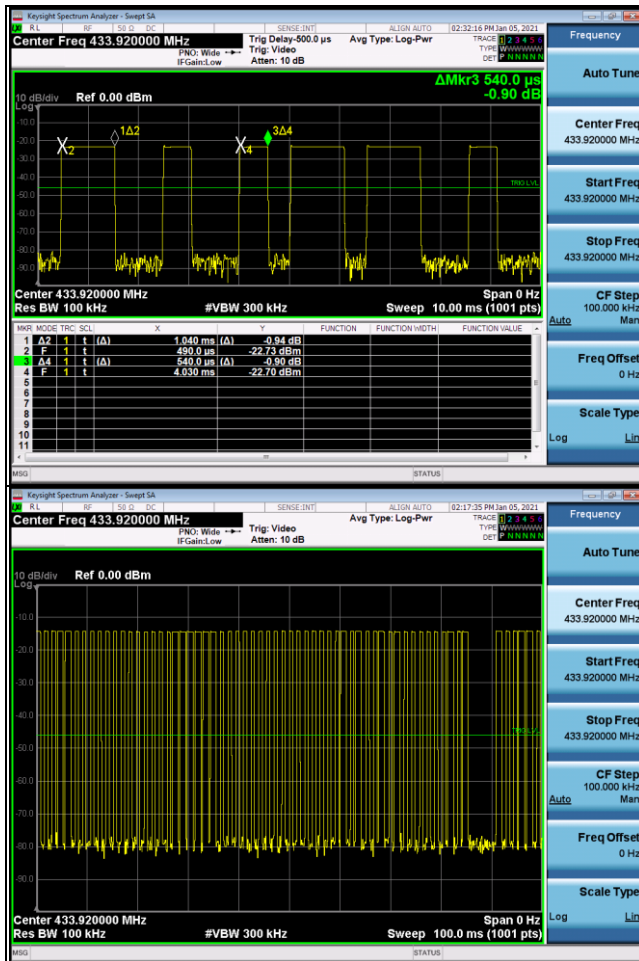
## 5.6. Duty Cycle of Test Signal

Long packet = 1.04 ms, Shot packet = 0.54 ms

Total on = ( 1.04ms x 18 ) + ( 0.54 ms x 45 ) = 43.02 ms

Duty Cycle = 43.02 ms / 100 ms = 43.02%

Duty factor =  $20\log(\text{Duty Cycle}) = 20\log(0.4302) = -7.33 \text{ dB}$





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## 6. Test Equipment

Test Equipment List					
Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
Radiated Spurious Emission					
Spectrum Analyzer	Keysight	N9010A	MY56070827	Nov. 11, 2020	1 year
EMI Test Receiver	Rohde & Schwarz	ESR7	101753	Nov. 17, 2020	1 year
Loop Antenna	ETS lindgren	6502	00213440	Dec. 25, 2020	1 year
Trilog-Broadband Antenna with 5dB Attenuator	Schwarzbeck & EMCI	VULB 9168 & N-6-05	9168-773 & AT-N0539	Feb. 11, 2020	1 year
Horn Antenna (1-18 GHz)	Schwarzbeck	BBHA 9120 D	01686	Dec. 23, 2020	1 year
Preamplifier (30-1000 MHz)	EMCI	EMC330E	980405	Feb. 4, 2020	1 year
Preamplifier (1-18 GHz)	EMCI	EMC051835BE	980406	Feb. 4, 2020	1 year
Cables	Hanyitek	K1K50-UP0264-K1K50-2500	170214-4 & 170425-2	Jul. 2, 2020	1 year

UL Software		
Description	Name	Version
Radiated measurement	EZ EMC	1.1.4.2
Conducted measurement	Keysight.TestSystem	1.0.0.0
AC power Line Conducted Emission	EZ EMC	1.1.4.2

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## 7. Description of Test Setup

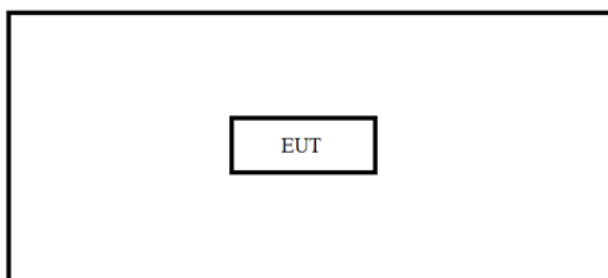
### Support Equipment

Equipment	Brand Name	Model Name	S/N	Remark
Battery	Energizer	CR2032	N/A	N/A

### Test Setup

After EUT is power on, it works in engineering mode to transmit signals.

### Setup Diagram for Test





## 8. Test Results

### 8.1 Radiated Spurious Emission

#### Requirements

Limits of Radiated Emission Measurement:

Fundamental Frequency (MHz)	Field Strength of Fundamental		Field Strength of Spurious	
	uV/meter	dBuV/meter	uV/meter	dBuV/meter
40.66 ~ 40.70	2250	67.04	225	48.04
70 ~ 130	1250	61.94	125	41.94
130 ~ 174	1250 ~ 3750	61.94 ~ 71.48	125 ~ 375	41.94 ~ 51.48
174 ~ 260	3750	71.48	375	51.48
260 ~ 470	3750 ~ 12500	71.48 ~ 81.94	375 ~ 1250	51.48 ~ 61.94
Above 470	12500	81.94	1250	61.94

Note:

- Where F is the frequency in MHz, the formula for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters = 56.81818(F)-6136.3636; for the band 260-470 MHz, uV/m at 3 meters = 41.6667(F)- 7083.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.
- The above field strength limits are specified at a distance of 3meters. The tighter limits apply at the band edges.

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

Frequency(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

Note:

- The lower limit shall apply at the transition frequencies.
- Emission level (dBuV/m) = 20 log Emission level (uV/m).
- For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

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## **Test Procedures**

[For 9 kHz ~ 30 MHz]

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. For measurement below 30MHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

[For above 30 MHz]

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna 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.
- d. 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 rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
- f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

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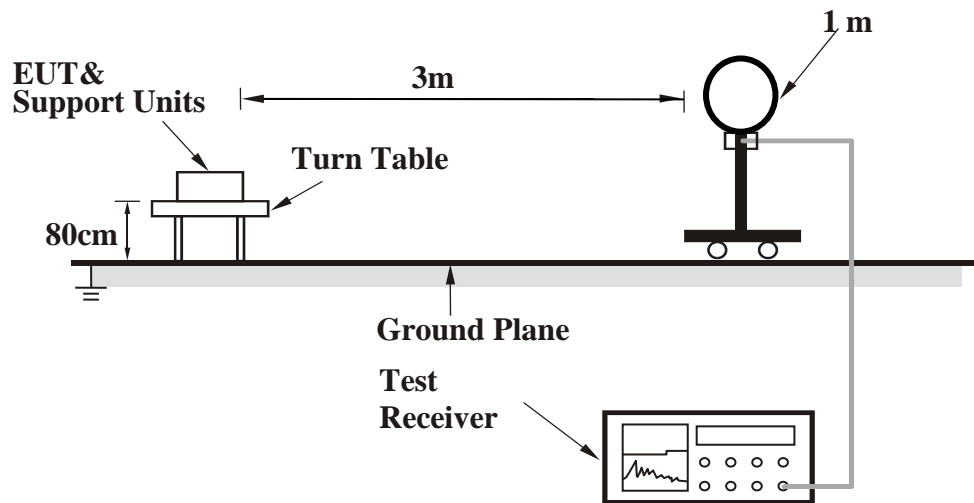


Note:

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
- The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
- The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is  $\geq 1/T$  (Duty cycle  $< 98\%$ ) or 10Hz (Duty cycle  $\geq 98\%$ ) for Average detection (AV) at frequency above 1GHz.

### **Test Setup**

<Frequency Range 9 kHz ~ 30 MHz>



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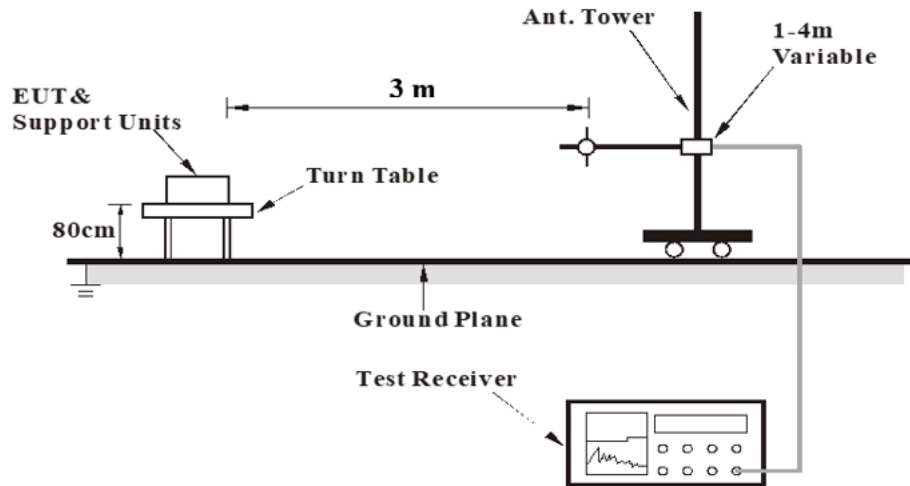
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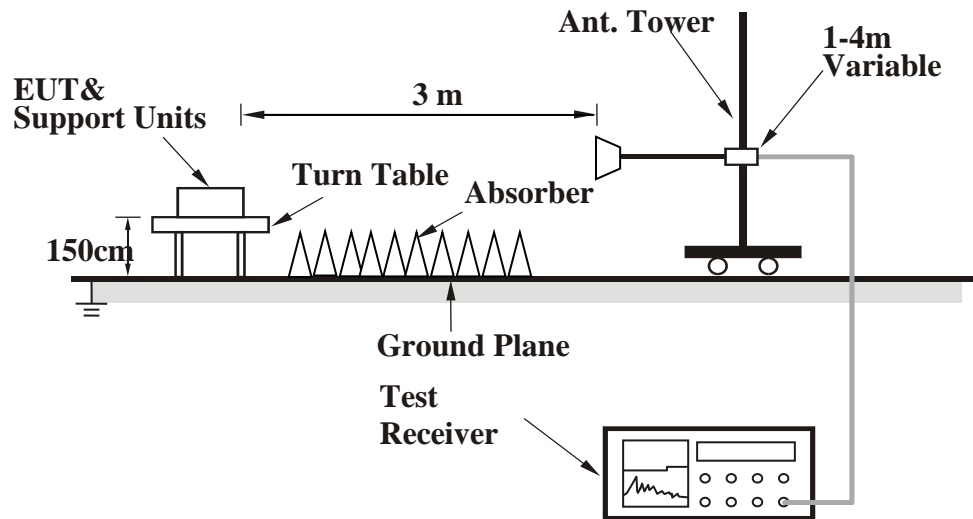




<Frequency Range 30 MHz ~ 1 GHz >



<Frequency Range above 1 GHz>



For the actual test configuration, please refer to the Setup Configurations.

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## Test Data

### Above 1GHz Data

EUT Test Condition		Measurement Detail	
Channel	1	Frequency Range	1 GHz ~ 5GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	1300	45.9	-7.63	38.27	74	-35.73	Peak
*	1500	42.2	-6.74	35.46	74	-38.54	Peak
*	1764	46.21	-6.92	39.29	74	-34.71	Peak
*	1960	46.17	-5.63	40.54	74	-33.46	Peak
*	2300	43.75	-3.17	40.58	74	-33.42	Peak
*	2868	41.98	-2.11	39.87	74	-34.13	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	1300	41.04	-7.63	33.41	74	-40.59	Peak
*	1756	55.32	-6.94	48.38	74	-25.62	Peak
*	1956	43.03	-5.64	37.39	74	-36.61	Peak
*	2300	40.75	-3.17	37.58	74	-36.42	Peak
*	2452	39.59	-3.26	36.33	74	-37.67	Peak
*	2968	40.94	-1.74	39.2	74	-34.8	Peak

#### Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. " \* ": The peak result under 20 dB above and complies with AVG limit, AVG result is deemed to comply with AVG limit.
6. The other emission levels were very low against the limit.
7. The AVG harmonic field strength = PK harmonic field strength + Duty Factor  
= PK harmonic field strength – 7.33dB

The duty factor could refer to section 5.6.

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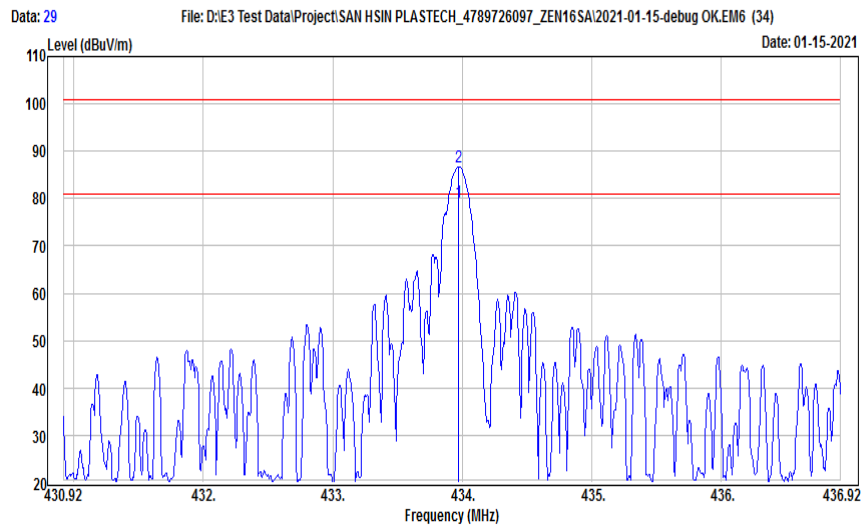
### 9 kHz ~ 30 MHz Data:

For 9 kHz to 30 MHz radiated emission have performed all modes of operation were investigated. The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

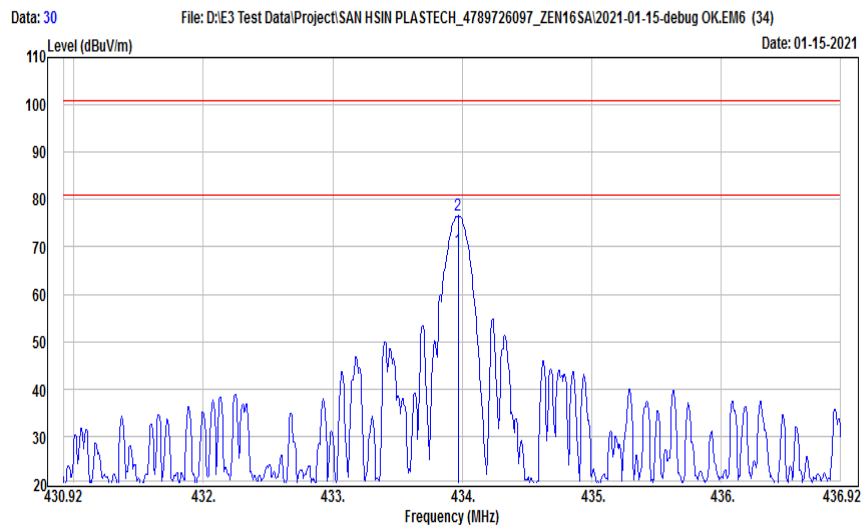
### 30 MHz ~ 1 GHz Data

EUT Test Condition		Measurement Detail	
Channel	1	Frequency Range	433.92 MHz

### Horizontal



### Vertical



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Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
@	433.974	-	-	79.32	80.83	-1.51	Average
@	433.974	92.95	-6.3	86.65	100.83	-14.18	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
@	433.968	-	-	69.21	80.83	-11.62	Average
@	433.968	82.84	-6.3	76.54	100.83	-24.29	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. The AVG harmonic field strength = PK harmonic field strength + Duty Factor  
= PK harmonic field strength – 7.33dB

The duty factor could refer to section 5.6.

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Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

Facsimile (FAX ) :+886-3-583-7948

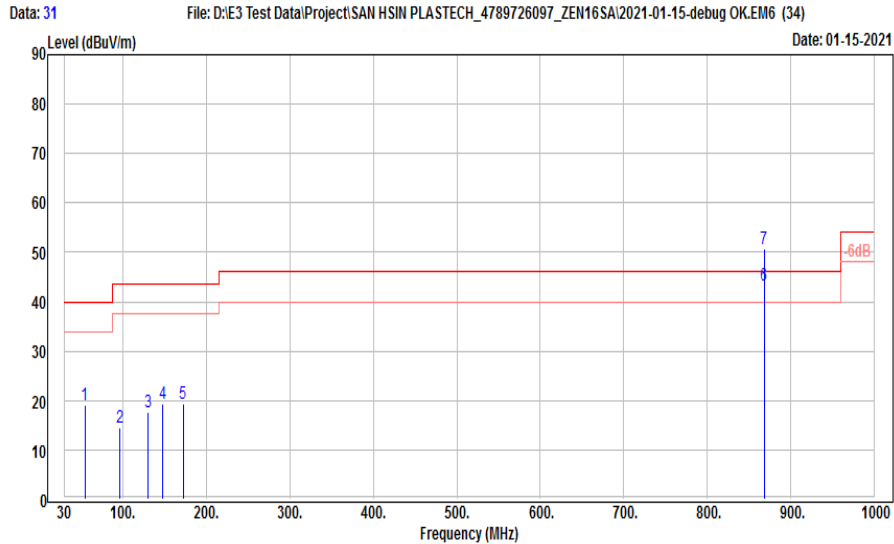
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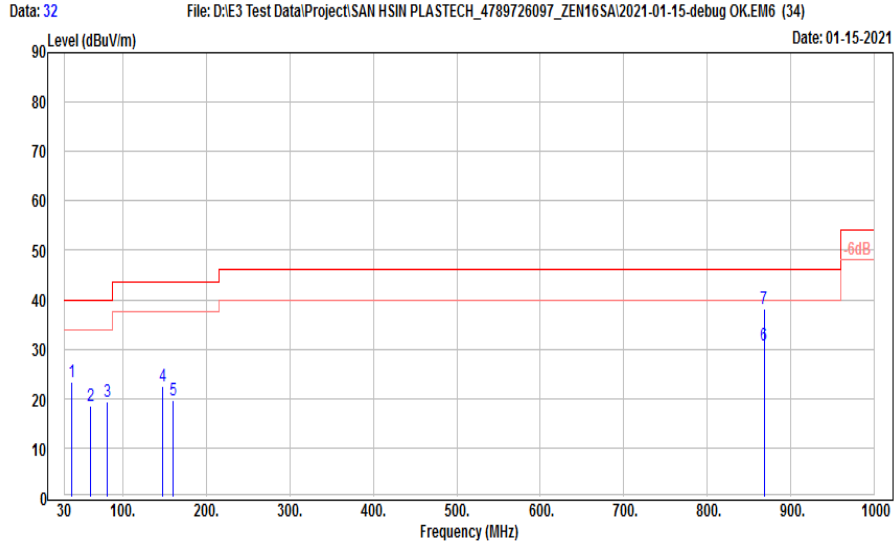
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EUT Test Condition		Measurement Detail	
Channel	1	Frequency Range	30 MHz ~ 1 GHz

## Horizontal



## Vertical



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Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	55.22	30.72	-11.55	19.17	40	-20.83	Peak
-	96.93	31.49	-16.83	14.66	43.5	-28.84	Peak
-	130.88	30.66	-12.89	17.77	43.5	-25.73	Peak
-	148.34	30.98	-11.68	19.3	43.5	-24.2	Peak
-	172.59	30.66	-11.38	19.28	43.5	-24.22	Peak
-	868.08	-	-	43.32	60.83	-17.51	Average
-	868.08	48.44	2.21	50.65	80.83	-30.18	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	39.7	35.26	-11.91	23.35	40	-16.65	Peak
-	62.01	30.8	-12.3	18.5	40	-21.5	Peak
-	82.38	36.36	-17.01	19.35	40	-20.65	Peak
-	148.34	34.29	-11.68	22.61	43.5	-20.89	Peak
-	160.95	30.65	-11.11	19.54	43.5	-23.96	Peak
-	868.08	-	-	30.9	60.83	-29.93	Average
-	868.08	36.02	2.21	38.23	80.83	-42.6	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. The peak result complies with QP limit, QP result is deemed to comply with QP limit.
5. The AVG harmonic field strength = PK harmonic field strength + Duty Factor  
= PK harmonic field strength – 7.33dB  
The duty factor could refer to section 5.6.

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Telephone :+886-2-7737-3000

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## 8.2 20dB Bandwidth Measurement

### Requirements

Limits of 20dB Bandwidth Measurement:

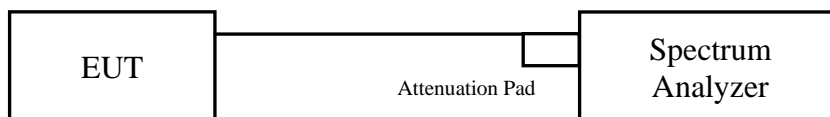
The bandwidth of the emission shall be no wider than 0.25% of the center frequency for device operating above 70 MHz and below 900 MHz.

Fundamental Frequency (MHz)	Limit Of Emission Bandwidth (kHz)
433.92	1084.8

### Test Procedure

- The EUT was placed on the turn table.
- The signal was coupled to the spectrum analyzer through an antenna.
- Set the appropriate resolution bandwidth and video bandwidth to 30 kHz then select Peak function to scan the channel frequency.
- The emission bandwidth was measured and recorded.

### Test Setup

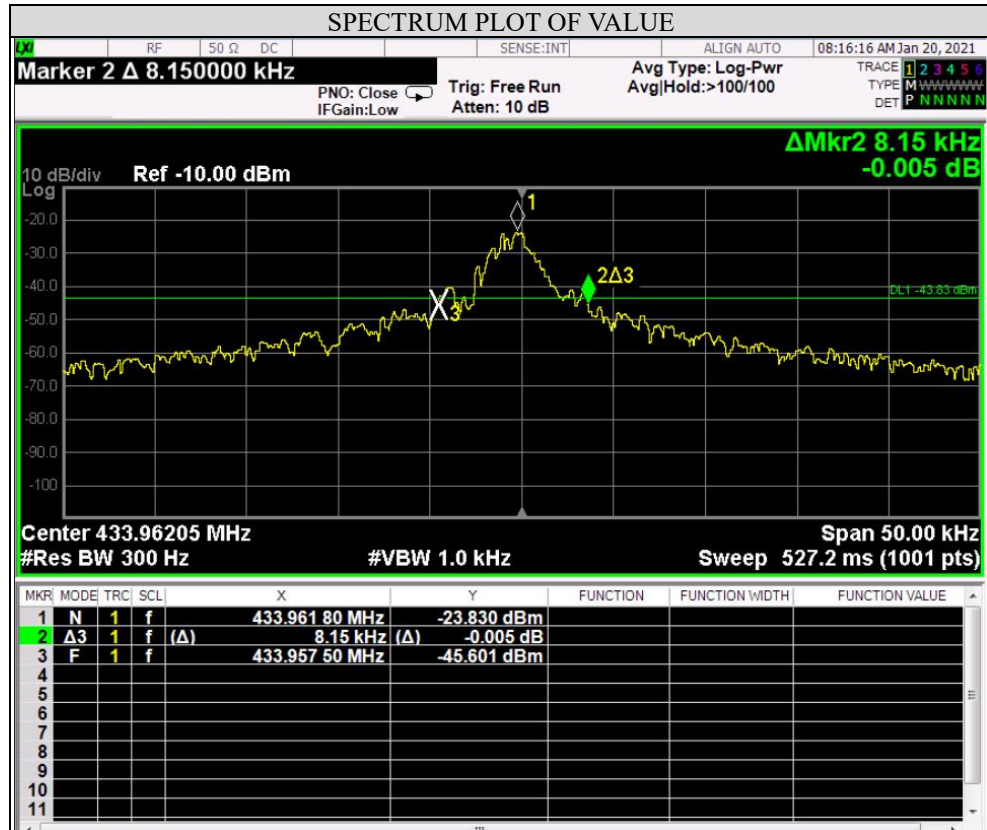


The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.



## Test Result

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Maximum Limit (MHz)	Pass / Fail
1	433.92	0.008	1.08	Pass



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## 8.3 Deactivation Time Measurement

### Requirements

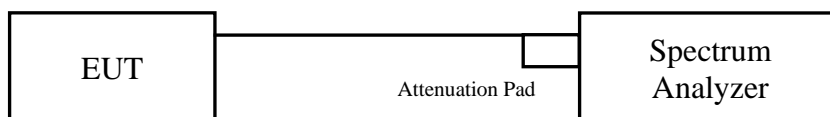
Limits Of Deactivation Time Measurement:

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

### Test Procedures

- The EUT was placed on the turning table.
- The signal was coupled to the spectrum analyzer through an antenna.
- Set the resolution bandwidth to 100kHz and video bandwidth to 300kHz. The spectrum analyser was turned to the centre frequency of the transmitter's and the analyser's marker function was used to determine the duration of transmission.
- The transmission duration was measured and recorded.

### Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

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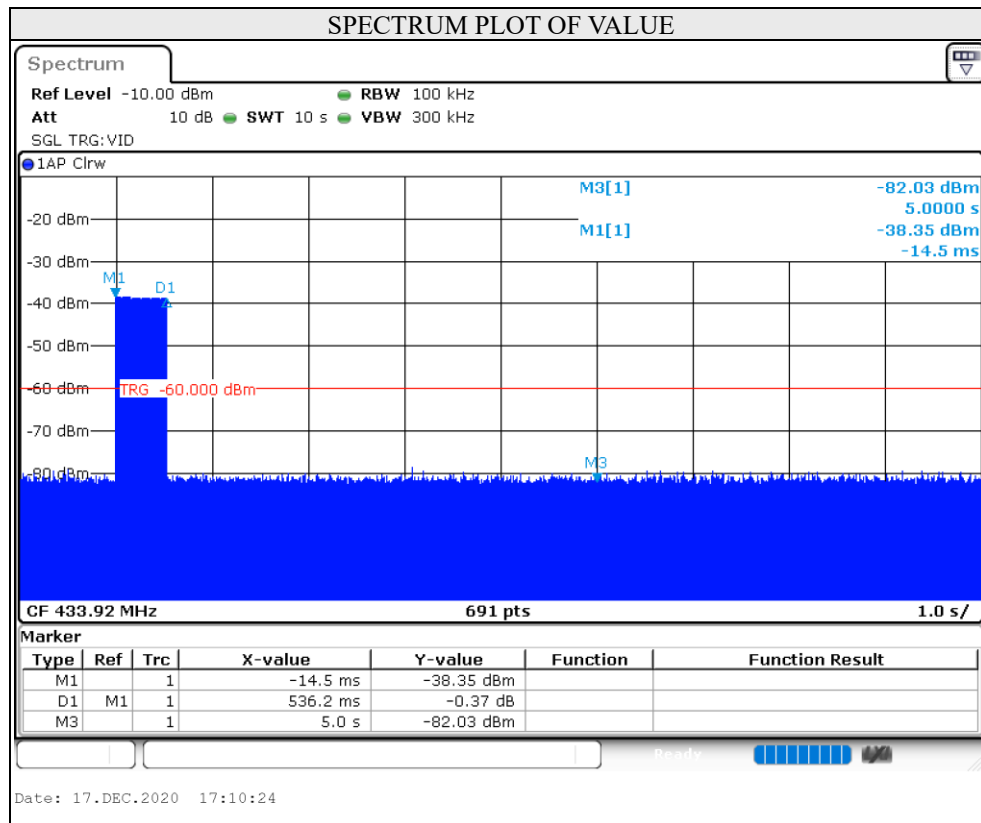
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## Test Results

Push Button	Frequency (Mhz)	Maximum Limit (Sec)	Pass/Fail
1	433.92	5	Pass



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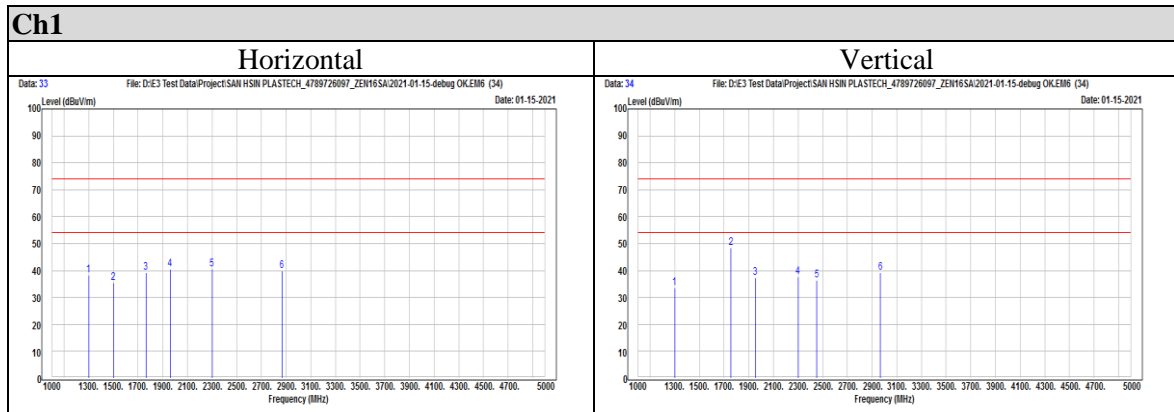
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## Appendix I Radiated Spurious Emission Measurement



### Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

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