

FCC 15.231 Report

for

Chungear Industrial Co., Ltd

106 Kanho Rd., Taichung, Taiwan

**Product Name : Ceiling Fan Remote
Controller (Transmitter)**
Model Name : TR121B
FCC ID : KUJCE10410

TABLE OF CONTENTS

Description	Page
TEST REPORT CERTIFICATION	3
1. REPORT HISTORY.....	4
2. SUMMARY OF TEST RESULTS	5
3. GENERAL INFORMATION	6
3.1. Description of EUT	6
3.2. EUT Specifications Assessed in Current Report.....	6
3.3. Antenna Information	6
3.4. Tested Supporting System List	7
3.5. Setup Configuration	8
3.6. Operating Condition of EUT	8
3.7. Description of Test Facility	8
3.8. Measurement Uncertainty	9
4. MEASUREMENT EQUIPMENT LIST.....	10
4.1. Radiated Emission Measurement.....	10
4.2. RF Conducted Measurement.....	10
5. CONDUCTED EMISSION MEASUREMENT.....	11
6. RADIATED EMISSION MEASUREMENT	12
6.1. Block Diagram of Test Setup	12
6.2. Radiated Emission Limits	13
6.3. Test Procedure	15
6.4. Measurement Result Explanation	16
6.5. Test Results.....	16
7. EMISSION BANDWIDTH MEASUREMENT	21
7.1. Block Diagram of Test Setup	21
7.2. Specification Limits	21
7.3. Test Procedure	21
7.4. Test Results.....	22
8. PERIODIC OPERATED MEASUREMENT	23
8.1. Block Diagram of Test Setup	23
8.2. Specification Limits	23
8.3. Test Procedure	23
8.4. Test Results.....	24
9. DEVIATION TO TEST SPECIFICATIONS.....	25

APPENDIX A TEST PHOTOGRAPHS

TEST REPORT CERTIFICATION

Applicant : Chungear Industrial Co., Ltd
Manufacture : Chungear Industrial Co., Ltd
Product Name : Ceiling Fan Remote Controller (Transmitter)
Model No. : TR121B
Serial No. : N/A
Brand : Futaba

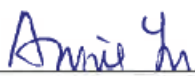
Applicable Standards:

FCC Rules and Regulations Part 15 Subpart C, Oct. 2014
ANSI C63.10:2013

AUDIX Technology Corp. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report. **AUDIX Technology Corp.** does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens and samples.

Date of Test: 2015. 10. 26 ~ 29

Date of Report: 2015. 11. 03

Producer: 
(Annie Yu/Administrator)

Signatory: 
(Ben Cheng/Manager)

1. REPORT HISTORY

Revision	Date	Revision Summary	Report Number
0	2015. 11. 03	Original Report.	EM-F150653

2. SUMMARY OF TEST RESULTS

Rule	Description	Results
15.207	Conducted Emission	N/A, Note
15.209/15.231(b)	Radiated Spurious Emission and Fundamental Frequency	PASS
15.231(c)	Emission Bandwidth	PASS
15.231(a)(1)	Periodic Operated	PASS
15.203	Antenna Requirement	PASS
Note: The EUT powered by battery only, thus conducted emission is not required.		

3. GENERAL INFORMATION

3.1. Description of EUT

Product	Ceiling Fan Remote Controller (Transmitter)
Model Number	TR121B
Serial Number	N/A
Brand Name	Futaba
Applicant	Chungear Industrial Co., Ltd 106 Kanho Rd., Taichung, Taiwan
Manufacture	Chungear Industrial Co., Ltd 106 Kanho Rd., Taichung, Taiwan
Device Category	☐ Outdoor Access Point ☐ Fixed point-to-point Access Point ☐ Indoor Access Point ☒ Mobile and Portable client device
Date of Receipt of Sample	2015. 10. 22

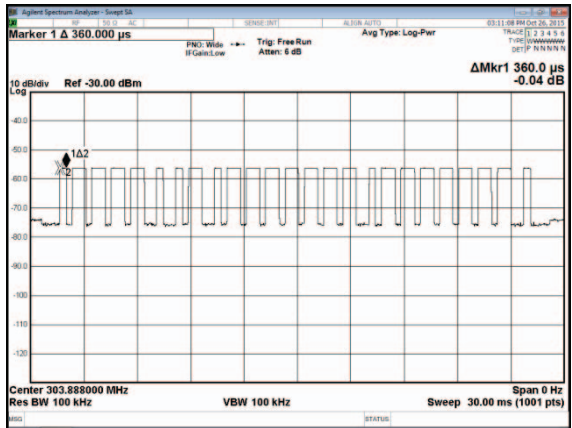
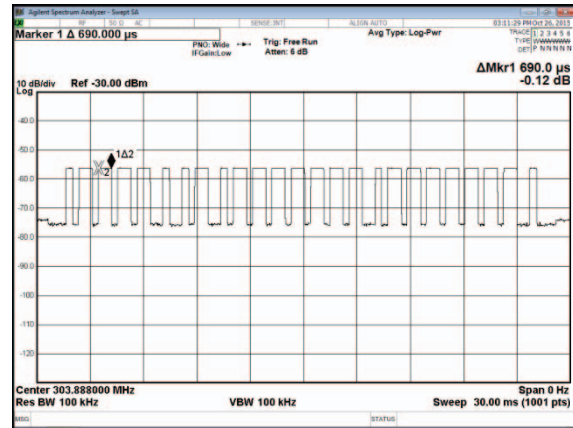
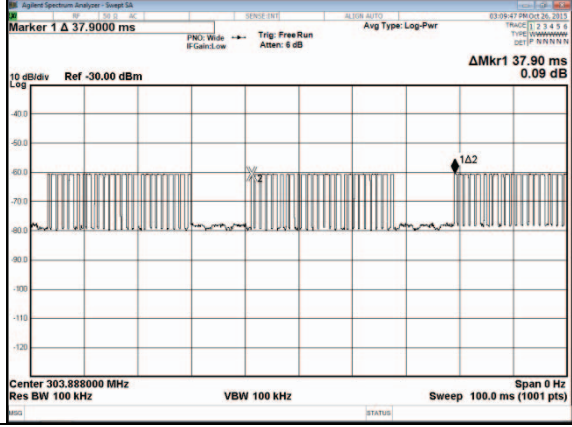
3.2. EUT Specifications Assessed in Current Report

Fundamental Range (MHz)	Channel Number	Modulation	Data Rate (bps)
303.88	1	ASK	---

3.3. Antenna Information

Manufacture	Antenna Type
N/A	Internal

3.4. Tested Supporting System List

Frequency (MHz)	Duty Cycle Correction Factor (dB)
303.88	-7.90
The complete envelope includes 2 types of frame A and B.	
Frame A: 	Frame B: 
TX ON in 100ms: 	
There are 6 A frames and 19 B frames in 37.90ms, so Duty Cycle Correction Factor $= 20\log (\text{cumulative on}/T) = 20\log \{[0.360(\text{ms}) * 6 + 0.690(\text{ms}) * 19] / 37.90\text{ms}\}$ $= 20\log [15.27\text{ms} / 37.90\text{ms}] = -7.90$	

3.5. Setup Configuration



3.6. Operating Condition of EUT

To Set EUT on RF function under continues transmitting and choosing channel.

3.7. Description of Test Facility

Test Firm Name	:	AUDIX Technology Corporation EMC Department No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan
Test Location & Facility	:	Semi-Anechoic Chamber No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan May 11, 2012 File on Federal Communication Commission Registration Number: 90993 Fully Anechoic Chamber No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan
NVLAP Lab. Code	:	200077-0
TAF Accreditation No	:	1724

3.8. Measurement Uncertainty

Test Item	Frequency Range	Uncertainty
Radiation Test (Distance: 3m)	30MHz~300MHz	± 3.64dB
	300MHz~1000MHz	± 4.07dB
	Above 1GHz	± 2.94dB

Remark: Uncertainty = $ku_c(y)$

Test Item	Uncertainty
Emission Bandwidth (20dB)	± 0.2kHz
Periodic Operated	± 0.05s

4. MEASUREMENT EQUIPMENT LIST

4.1. Radiated Emission Measurement

4.1.1. Frequency Range 30MHz~1000MHz

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A-526	MY53400071	2015. 09. 14	1 Year
2.	Test Receiver	R & S	ESCS30	100338	2015. 06. 24	1 Year
3.	Amplifier	HP	8447D	2944A06305	2015. 02. 12	1 Year
4.	Bilog Antenna	TESEQ	CBL6112D	33821	2015. 02. 27	1 Year

4.1.2. Frequency Range Above 1GHz

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	E4446A	US44300366	2015. 08. 20	1 Year
2.	Amplifier	Sonoma	310N	187161	2015. 06. 17	1 Year
3.	Horn Antenna	ETS-Lindgren	3117	00135902	2015. 03. 06	1 Year

4.2. RF Conducted Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9030A-526	MY53310269	2014. 11. 08	1 Year
2.	Wide Band Antenna	Diamond	RH799	N/A	N.C.R	N.C.R

5. CONDUCTED EMISSION MEASUREMENT

【Not applied for device powered by battery only.】

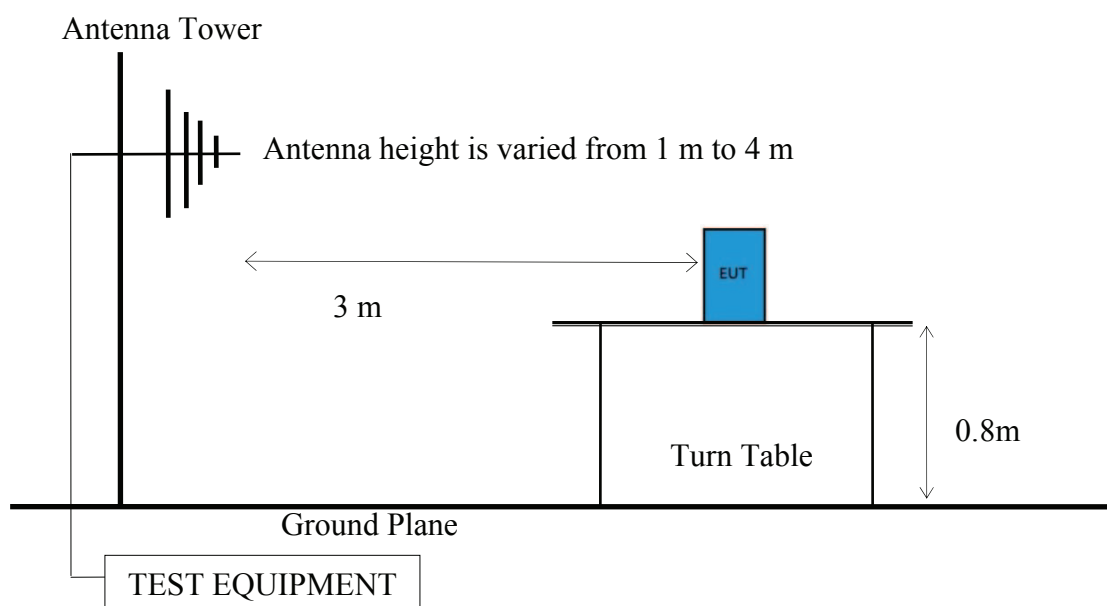
6. RADIATED EMISSION MEASUREMENT

6.1. Block Diagram of Test Setup

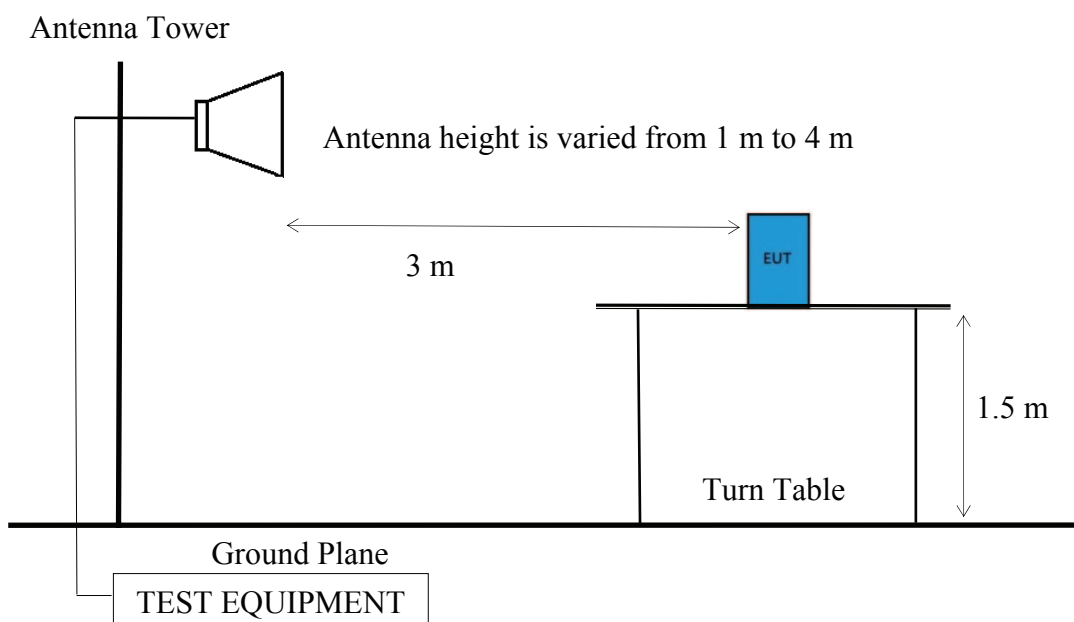
6.1.1. Block Diagram of connection between EUT and simulators

Indicated as section 3.5

6.1.2. Setup Diagram for 30-1000 MHz



6.1.3. Fully Anechoic Chamber (3m) Setup Diagram for above 1GHz



6.2. Radiated Emission Limits

6.2.1. General Limit

Any emission which falls in restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified as below.

Frequency (MHz)	Distance (m)	Field Strengths Limits	
		$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
Above 960	3	500	54.0
Above 1000	3	74.0 $\text{dB}\mu\text{V/m}$ (Peak) 54.0 $\text{dB}\mu\text{V/m}$ (Average)	

Remark : (1) $\text{dB}\mu\text{V/m} = 20 \log (\mu\text{V/m})$

- (2) The tighter limit applies to the edge between two frequency bands.
- (3) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
- (4) Fundamental and emission fall within operation band are exempted from this section.
- (5) Pursuant to ANSI C63.10: 6.6.4.3, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.

6.2.2. Limite for Fundamental Frequency

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 emissions (microvolts/meter)
40.66-40.70	2,250	225
70-130	1,250	125
130-174	¹ 1,250 to 3,750	¹ 125 to 375
174-260	3,750	375
260-470	¹ 3,750 to 12,500	¹ 375 to 1,250
Above 470	12,500	1,250
¹ :Linear Interpolations		

Remark : (1) $\text{dB}\mu\text{V/m} = 20 \log (\mu\text{V/m})$

- (2) The tighter limit applies to the edge between two frequency bands.
- (3) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
- (4) Where limit of Fundamental Freq. is calculated by:
Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, $\mu\text{V/m}$ at 3 meters = $56.81818(F) - 6136.3636$; for the band 260-470 MHz, $\mu\text{V/m}$ at 3 meters = $41.6667(F) - 7083.3333$.
The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.
- (5) The limits in this table are based on CFR 47 Part 15.231(b).

6.3. Test Procedure

The EUT setup on the turn find table which has 1.5 m height to the ground. The turn table rotated 360 degrees and antenna varied from 1 m to 4 m to find the maximum emission level. Both horizontal and vertical polarization are required. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

Frequency below 1 GHz:

Spectrum Analyzer is used for pre-testing with following setting:

- (1) RBW = 120KHz
- (2) VBW $\geq 3 \times$ RBW.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.
- (7) When peak-detected value is lower than limit that the measurement using the Q.P. detector is not required. Otherwise using Q.P. for finally measurement.

Frequency above 1GHz to 10th harmonic:

Peak Measurement:

- (1) RBW = 1 MHz
- (2) VBW $\geq 3 \times$ RBW.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.
- (7) When peak-detected value is lower than limit that the measurement using the average detector is not required. Otherwise using average detector for finally measurement.

Average Measurement:

☐ **Option 1:**

- (1) RBW = 1 MHz
- (2) VBW = 1/T
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.

☒ **Option 2:**

Average Emission Level = Peak Emission Level + D.C.C.F.

6.4. Measurement Result Explanation

- ☒ Peak Emission Level = Antenna Factor + Cable Loss + Meter Reading
☐ Average Emission Level = Antenna Factor + Cable Loss + Meter Reading
☒ Average Emission Level = Peak Emission Level + DCCF
Duty Cycle Correction Factor (DCCF) = $20\log(TX_{on}/TX_{on+off})$ presented in section 3.4
☐ EPR = Peak Emission Level - 95.2 dB - 2.14 dB

6.5. Test Results

PASSED.

EUT is Portable Device, and 3 axis were assessed. The worst scenario for Radiated Spurious Emission as ☒ Lie ☐ Side ☐ Stand

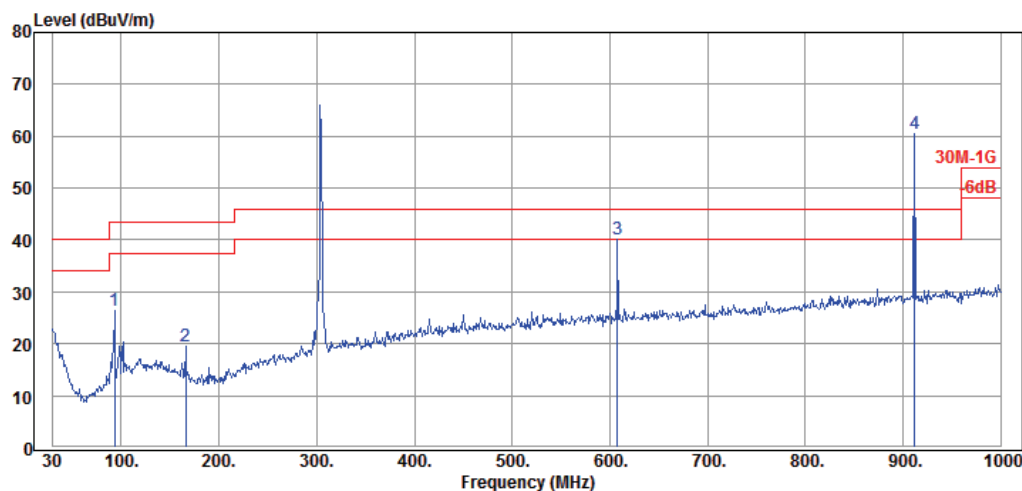
Test Date	2015/10/29	Temp./Hum.	24°C/52%
Test Voltage	DC 3V		

6.5.1. Emissions Applied to General Requirement

6.5.1.1. Frequency Below 1 GHz

Frequency	TX 303.88MHz	EUT Position	Lie
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Antenna at Horizontal Polarization



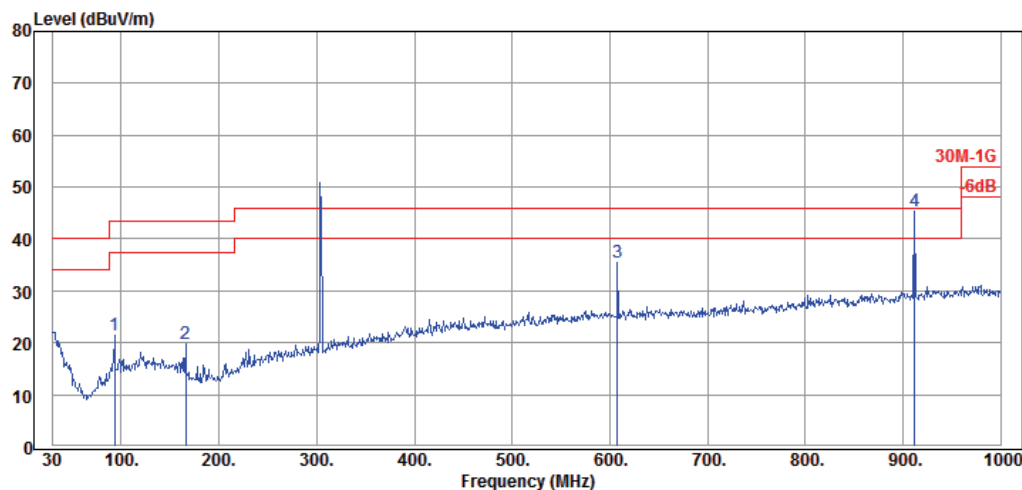
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
93.05	9.67	3.17	13.46	26.30	43.50	17.20	Peak
165.80	9.65	3.73	6.03	19.41	43.50	24.09	Peak
608.12	18.36	6.52	15.38	40.26	46.00	5.74	Peak
*911.73	20.65	7.62	32.12	60.39	74.93	14.54	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
*911.73	60.39	-7.90	52.49	54.93	2.44	Average

Remark: “*” is the Frequency not fall in the restricted band.

Frequency	TX 303.88MHz	EUT Position	Lie
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Antenna at Vertical Polarization



Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
93.05	9.67	3.17	8.49	21.33	43.50	22.17	Peak
165.80	9.65	3.73	6.37	19.75	43.50	23.75	Peak
608.12	18.36	6.52	10.62	35.50	46.00	10.50	Peak
*911.73	20.65	7.62	17.08	45.35	74.93	29.58	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
*911.73	45.35	-7.90	37.45	54.93	17.48	Average

Remark: “*” is the Frequency not fall in the restricted band.

6.5.1.2. Frequencies above 1 GHz:

Frequency	TX 303.88MHz	EUT Position	Lie
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Antenna at Horizontal Polarization

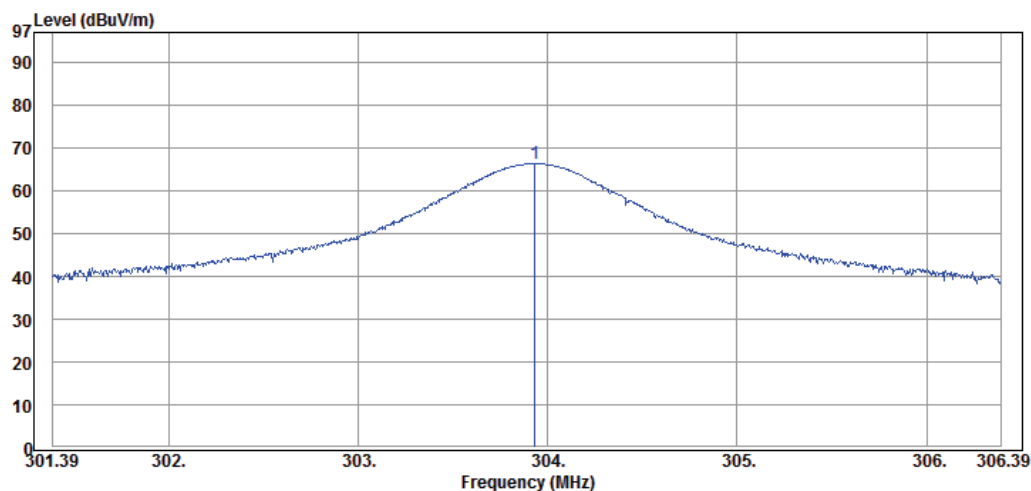
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
1215.04	28.06	3.69	19.51	51.26	74.00	22.74	Peak
1520.80	28.24	4.16	14.55	46.95	74.00	27.05	Peak
1823.20	30.28	4.74	12.74	47.76	74.00	26.24	Peak
2128.96	31.77	5.43	23.66	60.86	74.00	13.14	Peak
2431.36	32.20	5.76	15.41	53.37	74.00	20.63	Peak
2735.44	32.58	6.11	11.35	50.04	74.00	23.96	Peak
3039.04	32.89	6.25	10.72	49.72	74.00	24.28	Peak
3343.96	32.83	6.90	15.56	55.29	74.00	18.71	Peak
3647.56	32.96	7.31	6.14	46.41	74.00	27.59	Peak
3951.16	33.27	7.15	11.00	51.42	74.00	22.58	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
1215.04	51.26	-7.90	43.36	54.00	10.64	Average
1520.80	46.95	-7.90	39.05	54.00	14.95	Average
1823.20	47.76	-7.90	39.86	54.00	14.14	Average
2128.96	60.86	-7.90	52.96	54.00	1.04	Average
2431.36	53.37	-7.90	45.47	54.00	8.53	Average
2735.44	50.04	-7.90	42.14	54.00	11.86	Average
3039.04	49.86	-7.90	41.96	54.00	12.04	Average
3343.96	55.29	-7.90	47.39	54.00	6.61	Average
3647.56	46.41	-7.90	38.51	54.00	15.49	Average
3951.16	51.42	-7.90	43.52	54.00	10.48	Average

Remark: The emissions at vertical polarization not reported for there is no emission be found.

6.5.2. Fundamental Frequency:

Frequency	TX 303.88MHz	EUT Position	Lie
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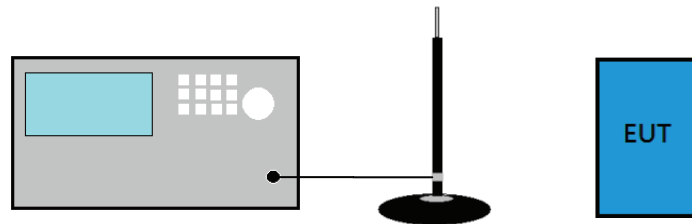
Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
303.94	13.22	4.70	48.39	66.31	74.93	8.62	Peak

Remark: Horizontal is the strongest polarization and peak value has complied with limit, so vertical won't be listed in test report.

7. EMISSION BANDWIDTH MEASUREMENT

7.1. Block Diagram of Test Setup



7.2. Specification Limits

The bandwidth of emission shall be no wider than 0.25% of the center frequency for device operating above 70MHz and below 900MHz. Bandwidth is determined at the points 20dB down from the modulated carrier.

7.3. Test Procedure

- (1) Set RBW close to 1-5 % of OBW.
- (2) Set $VBW \geq RBW$.
- (3) Detector = Peak.
- (4) Trace mode = max hold.
- (5) Sweep = auto couple.
- (6) Allow the trace to stabilize.
- (7) Setting channel bandwidth function x dB to -20 dB to record the final bandwidth.

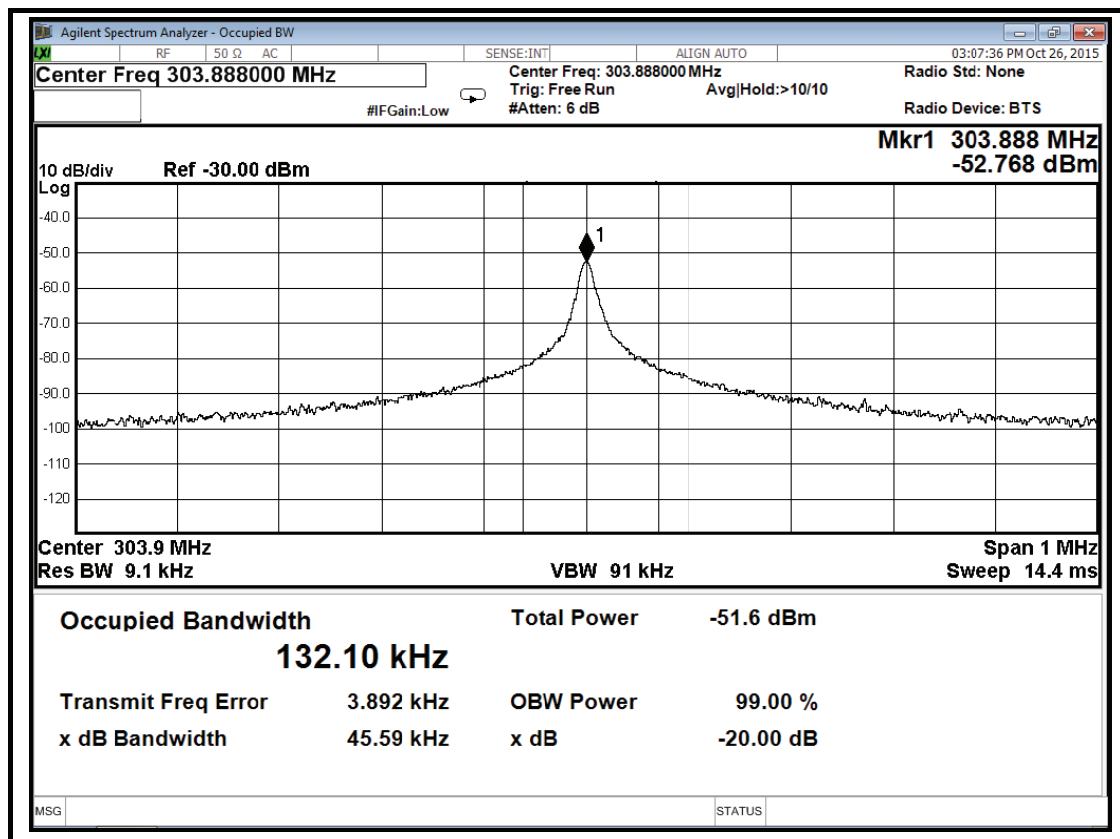
7.4. Test Results

Test Date	2015/10/26	Temp./Hum.	24°C/52%
Test Voltage	DC 3V	Frequency	TX 303.88MHz

7.4.1. Emission Bandwidth:

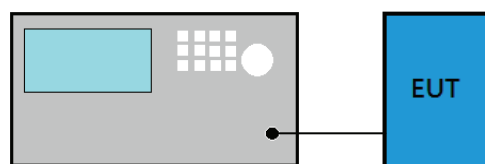
Center Frequency (MHz)	Occupied Bandwidth (MHz)	Tolerance (%)	Limit (%)
303.88	0.13210	0.0434	0.25

7.4.2. Measurement Plot:



8. PERIODIC OPERATED MEASUREMENT

8.1. Block Diagram of Test Setup



8.2. Specification Limits

The operation of this device is manually operated transmitter that is automatically deactivated the transmitter within not more than 5 seconds of being released

8.3. Test Procedure

- (1) Span = zero
- (2) RBW $\geq$ 100kHz
- (3) VBW $\geq$ RBW
- (4) Sweep = 5s
- (5) Detector function = peak
- (6) Trace = single sweep

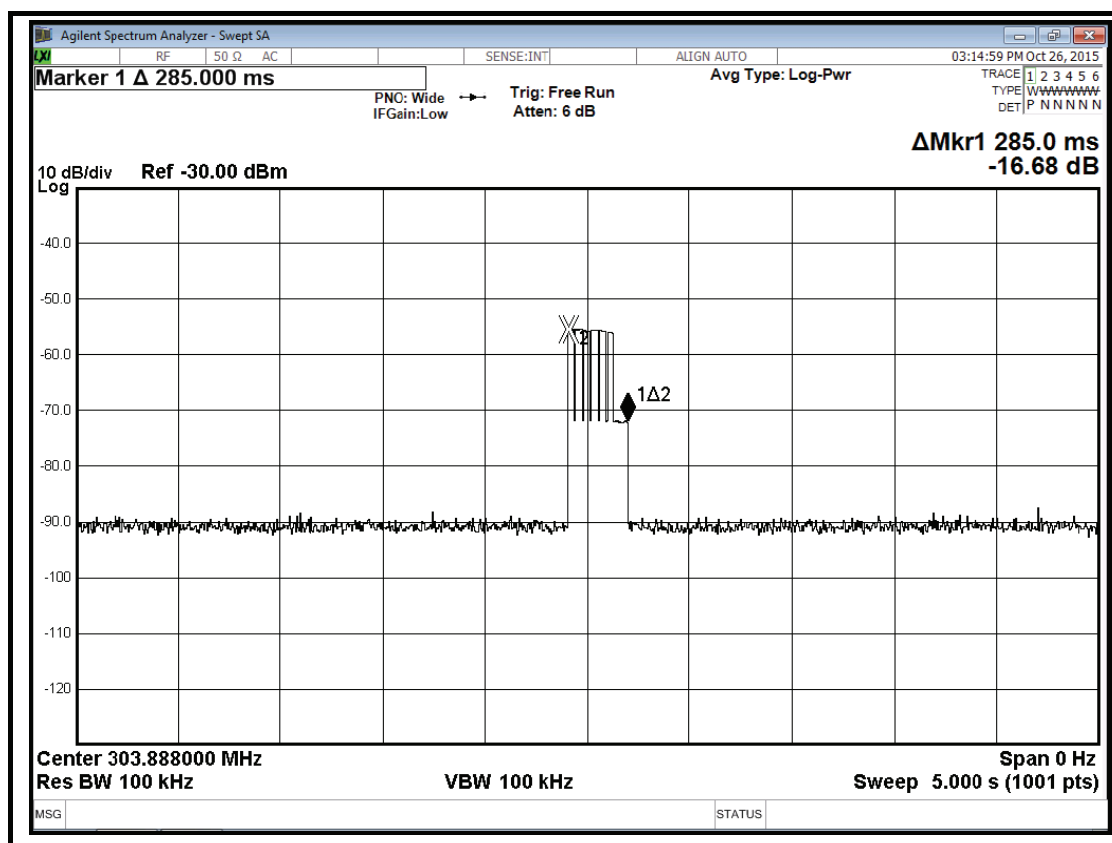
8.4. Test Results

Test Date	2015/10/26	Temp./Hum.	24°C/52%
Test Voltage	DC 3V	Frequency	TX 303.88MHz

8.4.1. Periodic Operated:

Center Frequency (MHz)	Time (Sec.)	Limit (Sec.)
303.88	0.285	< 5

8.4.2. Measurement Plot:



9. DEVIATION TO TEST SPECIFICATIONS

【NONE】