

FCC 15.231 Report

for

FUTABA Corporation

**1080 Yabutsuka Chosei-son Chosei-gun
Chiba, 299-4395 Japan.**

Brand : Futaba
**Product Name : Transmitter for Radio
Remote Control Unit**
Model Name : FRN601U-T1
FCC ID : AZP-FRN601U-T1

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APPENDIX A TEST PHOTOGRAPHS

TEST REPORT CERTIFICATION

Applicant : FUTABA Corporation
Manufacture : FUTABA Corporation
Product Name : Transmitter for Radio Remote Control Unit
Model No. : FRN601U-T1
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. 03. 27 ~ 04. 10

Date of Report: 2015. 04. 13

Producer: 
(Tina Huang/Administrator)

Signatory: 
(Ben Cheng/Manager)

1. REPORT HISTORY

Revision	Date	Revision Summary	Report Number
0	2015. 04. 13	Original Report.	EM-F150189

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	Transmitter for Radio Remote Control Unit
Model Number	FRN601U-T1
Serial Number	N/A
Brand Name	Futaba
Applicant	FUTABA Corporation 1080 Yabutsuka Chosei-son Chosei-gun Chiba, 299-4395 Japan.
Manufacture	FUTABA Corporation 1080 Yabutsuka Chosei-son Chosei-gun Chiba, 299-4395 Japan.
Date of Receipt of Sample	2015. 03. 26

3.2. EUT Specifications Assessed in Current Report

Fundamental Range (MHz)	Channel Number	Modulation	Data Rate (bps)
317.35-318.35	20	FM-FSK	5000

Channel List			
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
0	317.35	10	317.90
1	317.40	11	317.95
2	317.45	12	318.00
3	317.50	13	318.05
4	317.55	14	318.10
5	317.60	15	318.15
6	317.65	16	318.20
7	317.70	17	318.25
8	317.80	18	318.30
9	317.85	19	318.35

3.3. Antenna Information

Manufacture	Antenna Type
N/A	Internal

	Item	Test Channel
Radiated Test Case	Radiated Spurious Emission and Fundamental Frequency	9
Conducted Test Case	Emission Bandwidth	9
	Periodic Operated	9

3.4. Tested Supporting System List

None

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
NVLAP Lab. Code	:	200077-0
TAF Accreditation No	:	1724

3.8. Measurement Uncertainty

Test Item	Frequency Range	Uncertainty
Radiation Test (Distance: 3m)	30MHz~1000MHz	± 5.3dB
	Above 1GHz	± 4.8dB

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	2014. 09. 15	1 Year
2.	Test Receiver	R & S	ESCS30	100338	2014. 06. 24	1 Year
3.	Amplifier	HP	8447D	2944A06305	2015. 02. 12	1 Year
4.	Bilog Antenna	TESEQ	CBL6112D	33821	2014. 08. 02	1 Year

4.1.2. Frequency Range Above 1GHz

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A-526	MY53400071	2014. 09. 15	1 Year
2.	Amplifier	Agilent	8449B	3008A00529	2015. 01. 22	1 Year
3.	Horn Antenna	EMCO	3115	9609-4927	2014. 06. 17	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

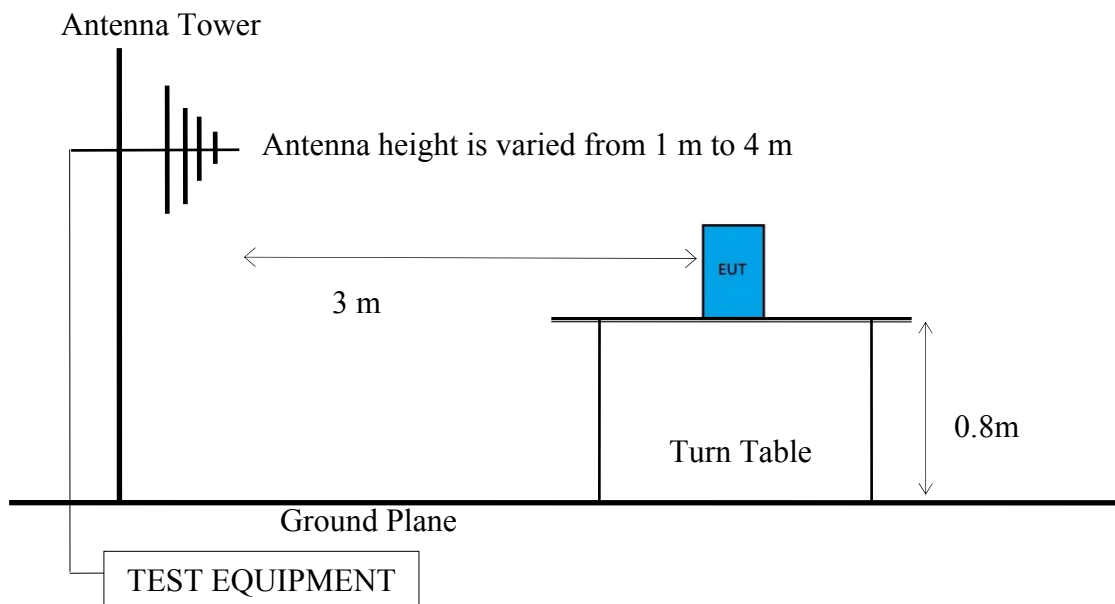
【Not applied for device powered by battery only.】

6. RADIATED EMISSION MEASUREMENT

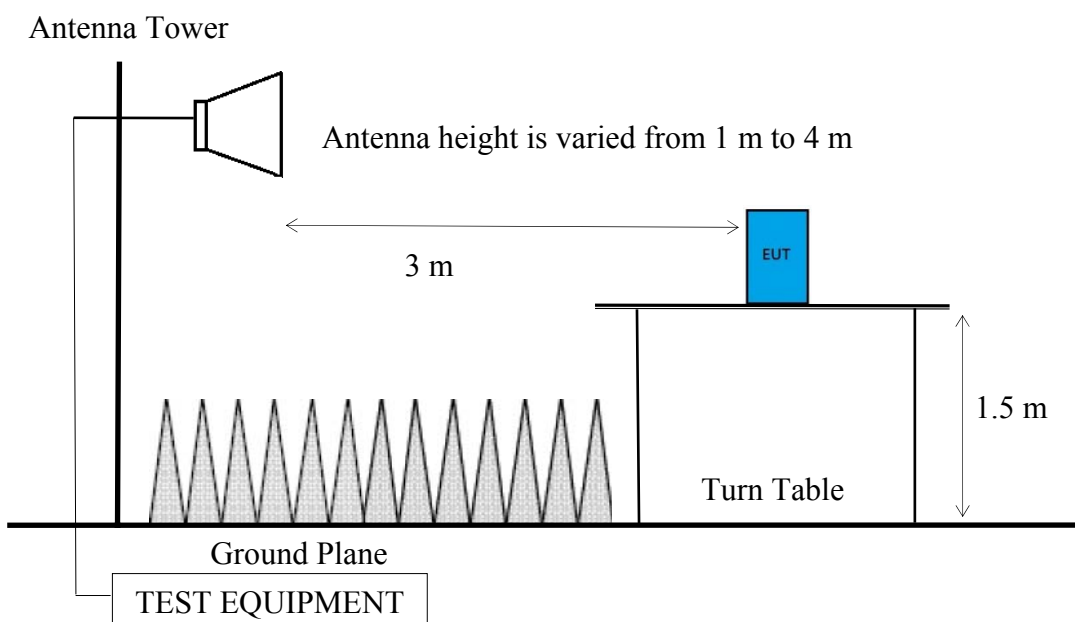
6.1. Block Diagram of Test Setup

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. Semi-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) dB μ V/m = 20 log (μ 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:
 $41.6667 \times 317.85 - 7083.3333 = 6160.427295 \mu\text{V/m} = 75.79 \text{dB}\mu\text{V/m}$
- (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 x 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

6.5. Test Results

PASSED.

The EUT emitted the fundamental frequency with data code at the stand, side and lying conditions.

Test Date	2015/04/10	Temp./Hum.	23°C/63%
Test Voltage	DC 4.5V		

6.5.1. Emissions Applied to General Requirement

6.5.1.1. Frequency Below 1 GHz

Frequency	TX 317.85MHz	EUT Position	lying
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
191.99	9.21	3.29	27.15	39.65	43.50	3.85	Peak
216.24	10.35	4.10	25.12	39.57	46.00	6.43	Peak
335.55	14.08	5.05	20.17	39.30	46.00	6.70	Peak
635.28	18.48	6.59	11.17	36.24	46.00	9.76	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
48.43	9.08	2.62	22.47	34.17	40.00	5.83	Peak
144.46	10.93	3.56	19.63	34.12	43.50	9.38	Peak
418.00	15.82	5.81	14.66	36.29	46.00	9.71	Peak
484.93	16.77	5.34	12.39	34.50	46.00	11.50	Peak
635.28	18.48	6.59	8.15	33.22	46.00	12.78	Peak

6.5.1.2. Frequencies above 1 GHz:

Frequency	TX 317.85MHz	EUT Position	lying
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
1194.88	25.71	2.36	16.95	45.02	54.00	8.98	Peak
1599.76	26.11	2.36	21.40	49.87	54.00	4.13	Peak

Antenna at Vertical Polarization

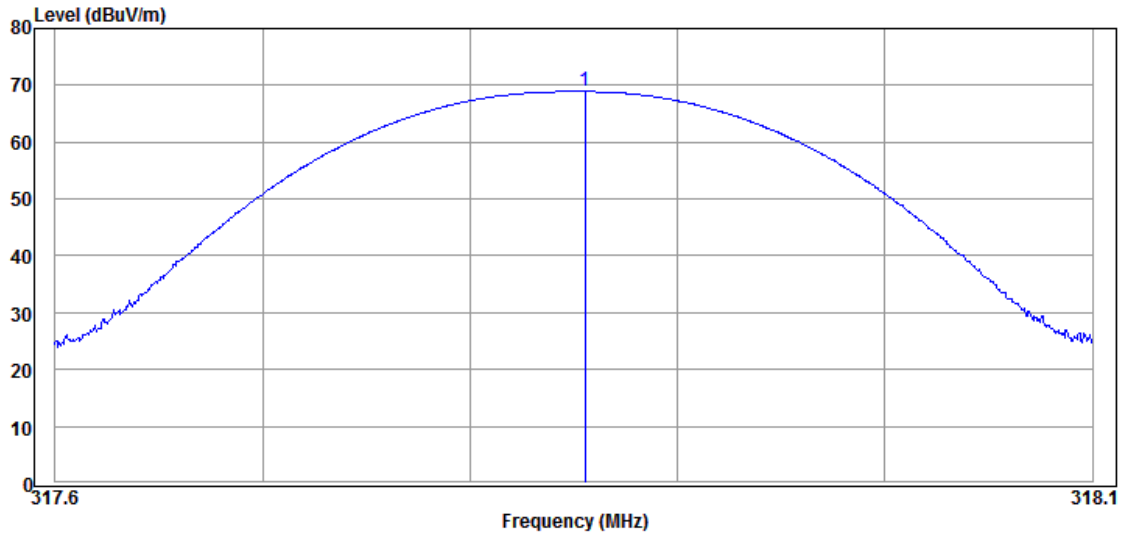
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
1194.88	25.71	2.36	22.12	50.19	54.00	3.81	Peak
1599.76	26.11	2.36	22.38	50.85	54.00	3.15	Peak

6.5.2. Emissions in Non-restricted Frequency Bands

All emission levels below the 15.209 general radiated emissions limits is not required.

6.5.3. Fundamental Frequency:

Frequency	TX 317.85MHz	EUT Position	lying
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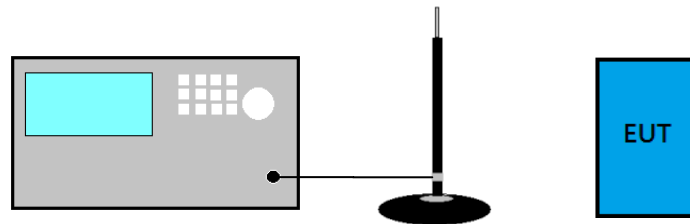
Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
317.86	13.60	4.86	50.44	68.90	75.79	6.89	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.

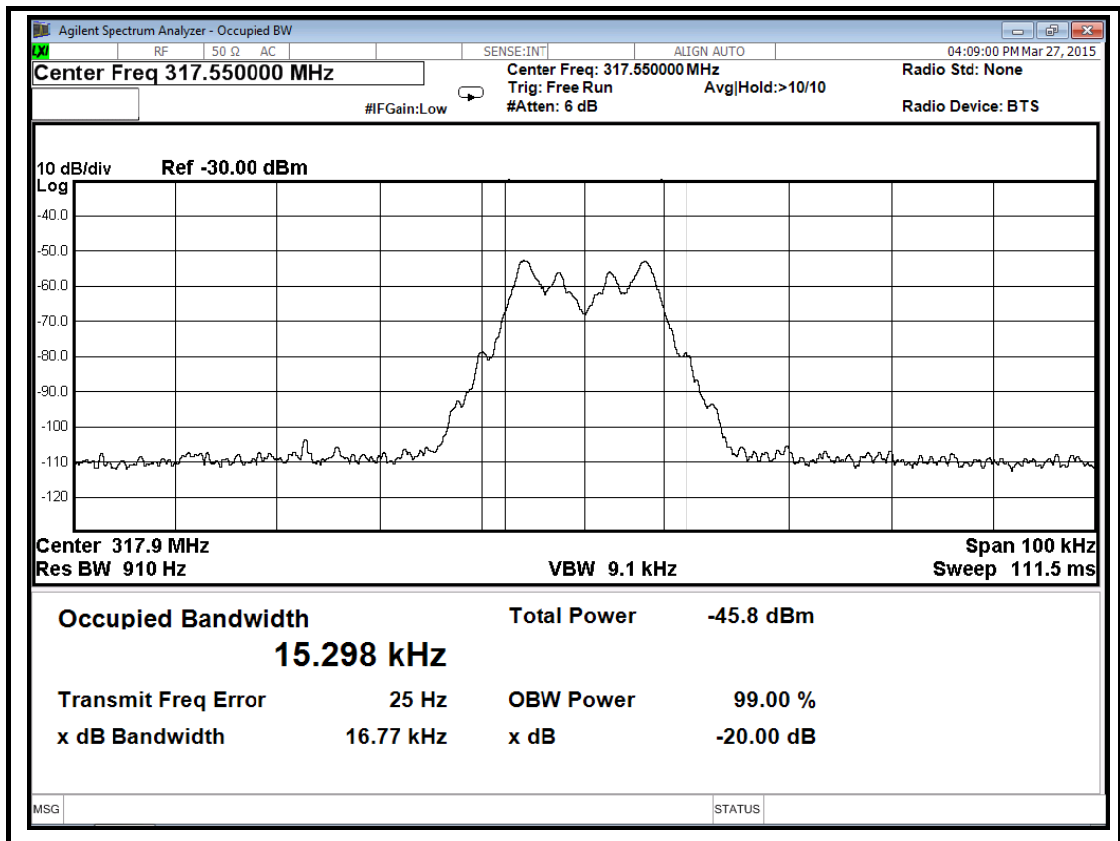
7.4. Test Results

Test Date	2015/03/27	Temp./Hum.	22°C/52%
Test Voltage	DC 4.5V	Frequency	TX 317.85MHz

7.4.1. Emission Bandwidth:

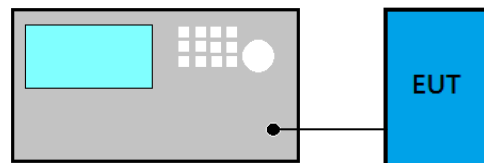
Center Frequency (MHz)	Occupied Bandwidth (MHz)	Tolerance (%)	Limit (%)
317.85	0.01677	0.005	0.25

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 1% of the span
- (3) VBW \geq RBW
- (4) Sweep = auto
- (5) Detector function = peak
- (6) Trace = max hold

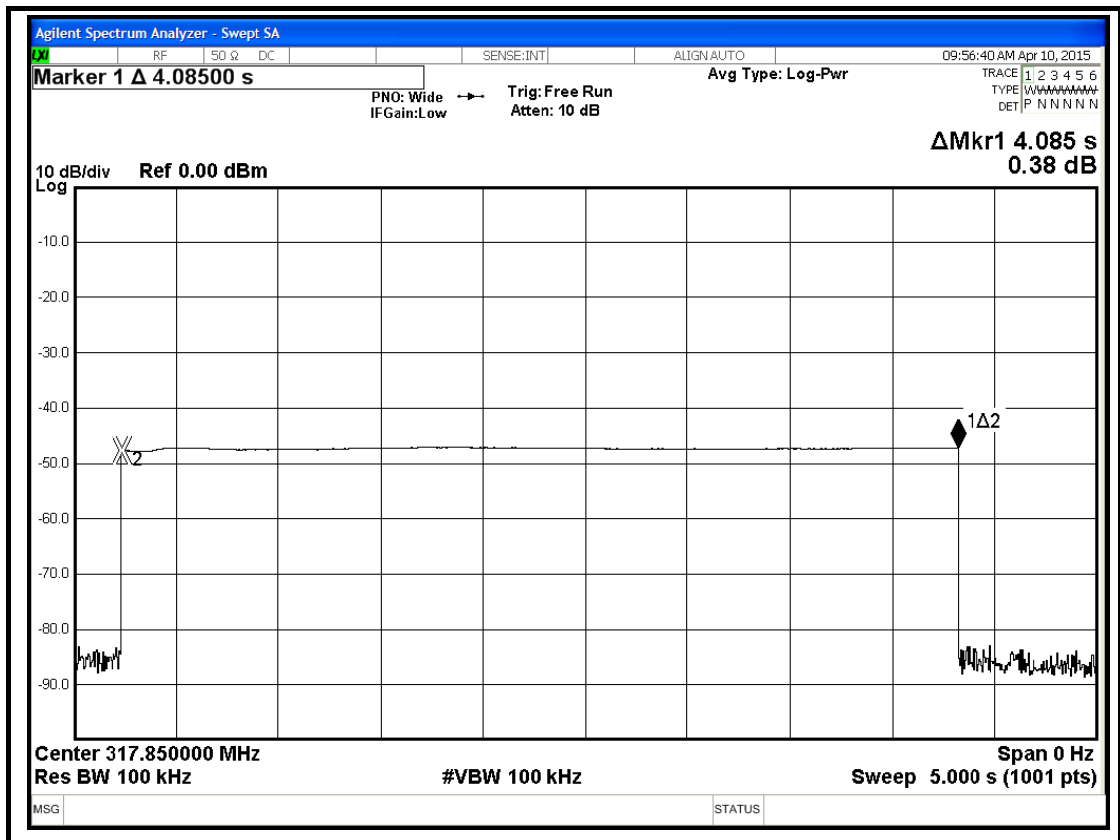
8.4. Test Results

Test Date	2015/04/10	Temp./Hum.	23°C/63%
Test Voltage	DC 4.5V	Frequency	TX 317.85MHz

8.4.1. Periodic Operated:

Center Frequency (MHz)	Time (Sec.)	Limit (Sec.)
317.85	4.085	< 5

8.4.2. Measurement Plot:



9. DEVIATION TO TEST SPECIFICATIONS

【NONE】