

FCC PART 15.231



TEST REPORT

For

Hangzhou Hamaton Tyre Valves Co., Ltd.

12 East Zhenxing Road, Linping, Yuhang, Hangzhou, China

FCC ID: Z27HTS2A315

| | |
|--|---|
| Report Type: Original Report | Product Type: TPMS Sensor |
| Test Engineer: | Ares Liu  |
| Report Number: | R2SH130130051-00A |
| Report Date: | 2013-03-20 |
| Reviewed By: | Ivan Cao  EMC Leader |
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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).

TABLE OF CONTENTS

| | |
|---|-----------|
| GENERAL INFORMATION..... | 3 |
| PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) | 3 |
| OBJECTIVE | 3 |
| RELATED SUBMITTAL(S)/GRANT(S)..... | 3 |
| TEST METHODOLOGY | 3 |
| TEST FACILITY | 3 |
| SYSTEM TEST CONFIGURATION..... | 4 |
| JUSTIFICATION | 4 |
| EQUIPMENT MODIFICATIONS | 4 |
| BLOCK DIAGRAM OF TEST SETUP | 4 |
| SUMMARY OF TEST RESULTS | 5 |
| FCC §15.203 - ANTENNA REQUIREMENT..... | 6 |
| APPLICABLE STANDARD | 6 |
| FCC §15.205, §15.209, §15.231 (E) - RADIATED EMISSIONS | 7 |
| MEASUREMENT UNCERTAINTY | 7 |
| EUT SETUP | 7 |
| EMI TEST RECEIVER SETUP..... | 8 |
| TEST EQUIPMENT LIST AND DETAILS..... | 8 |
| TEST PROCEDURE | 9 |
| APPLICABLE STANDARD | 9 |
| CORRECTED AMPLITUDE & MARGIN CALCULATION | 9 |
| TEST RESULTS SUMMARY | 9 |
| TEST DATA | 10 |
| FCC §15.231(C) – 20 DB BANDWIDTH TESTING..... | 15 |
| REQUIREMENT | 15 |
| TEST EQUIPMENT LIST AND DETAILS..... | 15 |
| TEST PROCEDURE | 15 |
| TEST DATA | 15 |
| ENVIRONMENTAL CONDITIONS..... | 15 |
| FCC §15.231(E) - DEACTIVATION TESTING | 17 |
| APPLICABLE STANDARD | 17 |
| EUT SETUP | 17 |
| TEST EQUIPMENT LIST AND DETAILS..... | 17 |
| TEST DATA | 18 |
| DECLARATION LETTER | 25 |

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The Hangzhou Hamaton Tyre Valves Co., Ltd.'s product, model number: JDI-1001 (FCC ID: Z27HTS2A315) (the "EUT") in this report is a TPMS Sensor, which was measured approximately: 6.5 cm (L) x 5.5 cm (W) x 1.5 cm (H), rated input voltage: DC 3V from battery.

Note: the series product, model JDI-1001, DVT-1001, PRO-1, DVT-1006, PRO-6, DVT-1007, PRO-7, are electrically identical, and the difference between them please refers to the attached declaration letter.

We selected Model : JDI-1001, DVT-1006, DVT-1007 for measurement and test , the sample serial number: 130130051-1001,130130051-1006,130130051-1007 (Assigned by BACL, Dongguan). The EUT was received on 2013-02-27.

Objective

This document is a test report based on the Electromagnetic Interference (EMI) tests performed on the EUT. The EMI measurements were performed according to the measurement procedure described in ANSI C63.4-2003.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.209, 15.35(c) and 15.231 rules.

Related Submittal(s)/Grant(s)

No related submittal(s).

Test Methodology

All measurements contained in this report were conducted with ANSI C63.4 - 2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Dongguan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industrial Zone, Tangxia, Dongguan, Guangdong, China

Test site at Bay Area Compliance Laboratories Corp. (Dongguan) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 02, 2012. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 273710. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

SYSTEM TEST CONFIGURATION

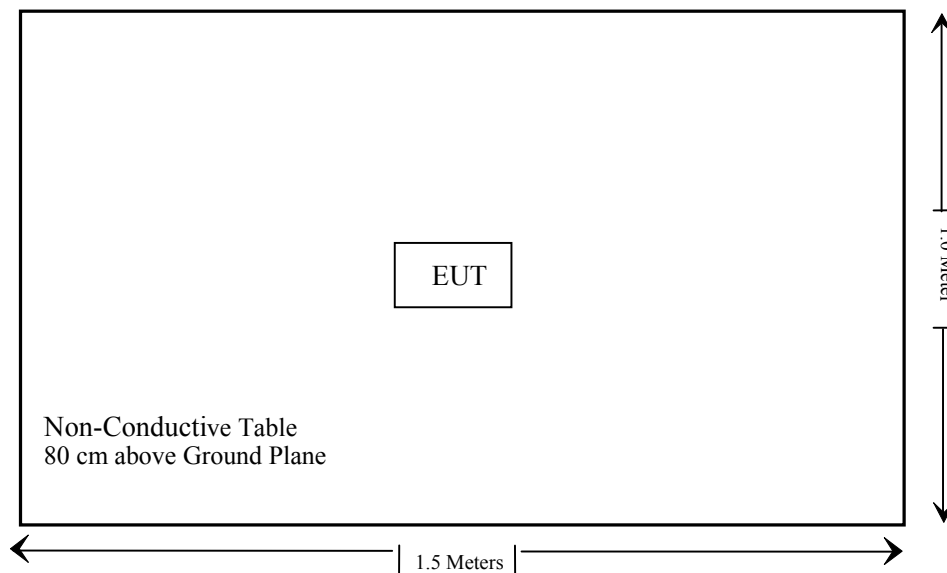
Justification

The system was configured in testing mode which was provided by manufacturer.

Equipment Modifications

No modifications were made to the unit tested.

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

| FCC Rules | Description of Test | Result |
|-------------------------------|------------------------|------------|
| §15.203 | Antenna Requirement | Compliance |
| §15.207 (a) | Conducted Emissions | N/A* |
| §15.205, §15.209, §15.231 (e) | Radiated Emissions | Compliance |
| §15.231 (c) | 20dB Bandwidth Testing | Compliance |
| §15.231 (e) | Deactivation Testing | Compliance |

Note: N/A * The EUT is powered by battery only.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

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.

Result: Compliant.

The EUT has an internal antenna soldered on the PCB, which complied with §15.203. Please refer to the EUT Internal photos.

FCC §15.205, §15.209, §15.231 (e) - RADIATED EMISSIONS

Measurement Uncertainty

Compliance or non-compliance with a disturbance limit shall be determined in the following manner:

If U_{lab} is less than or equal to U_{cispr} of Table 1, then:

- 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.

If U_{lab} is greater than U_{cispr} of Table 1, then:

- compliance is deemed to occur if no measured disturbance level, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit.

Based on CISPR 16-4-2: 2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Dongguan) is:

30M~200MHz: 5.0 dB

200M~1GHz: 6.2 dB

1G~6GHz: 4.45 dB

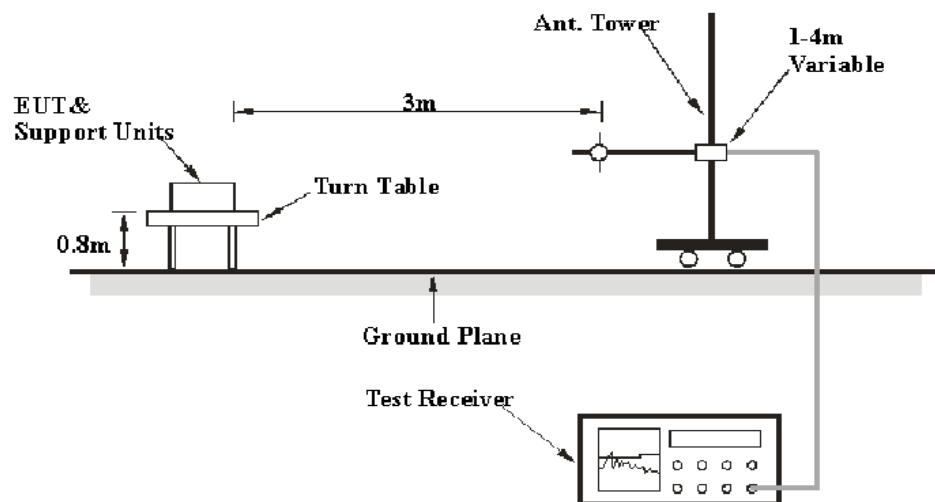
6G~18GHz: 5.23 dB

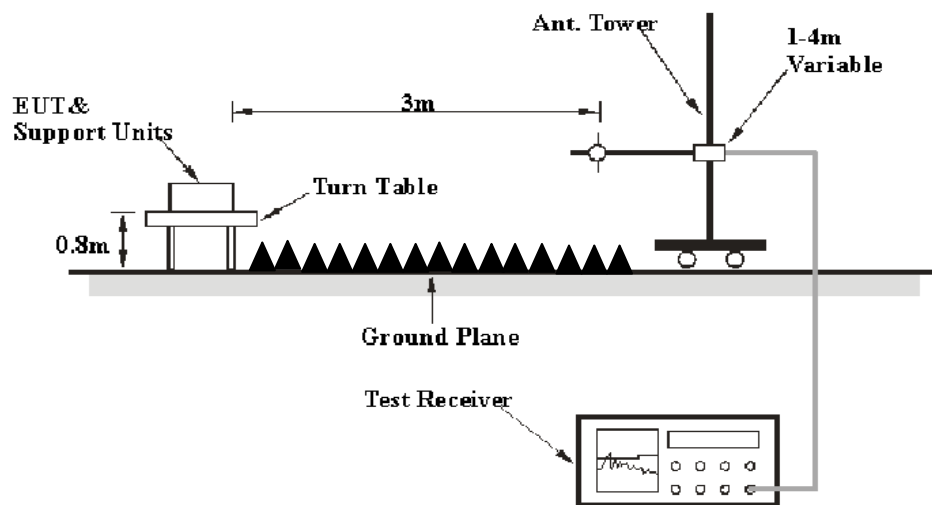
Table 1 – Values of U_{cispr}

| Measurement | U_{cispr} |
|--|-------------|
| Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz) | 6.3 dB |
| Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz) | 5.2 dB |
| Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz) | 5.5 dB |

EUT Setup

Below 1 GHz:



Above 1 GHz:

The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.4 - 2009. The specification used was the FCC 15 §15.209, §15.205 and §15.231.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

EMI Test Receiver Setup

The system was investigated from 30 MHz to 4 GHz.

During the radiated emission test, the test receiver was set with the following configurations:

| <i>Frequency Range</i> | <i>RBW</i> | <i>Video B/W</i> | <i>Detector</i> |
|-------------------------------|-------------------|-------------------------|------------------------|
| 30MHz – 1000 MHz | 100 kHz | 300 kHz | PK |
| 1000 MHz – 4000 MHz | 1 MHz | 3 MHz | PK |

Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---------------------|--------------------|--------------|----------------------|-------------------------|-----------------------------|
| Rohde & Schwarz | EMI Test Receiver | ESCI | 100035 | 2012-05-14 | 2013-05-13 |
| Sunol Sciences | Hybrid Antennas | JB3 | A060611-1 | 2011-09-06 | 2013-09-05 |
| HP | Pre-amplifier | 8447E | 2434A02181 | 2012-10-08 | 2013-10-07 |
| R&S | Spectrum Analyzer | FSEM 30 | DE31388 | 2012-03-15 | 2013-03-14 |
| ETS-LINDGREN | Horn Antenna | 3115 | 000 527 35 | 2012-09-06 | 2014-09-05 |
| Mini-Circuit | Amplifier | ZVA-213-S+ | 054201245 | 2013-01-30 | 2014-01-29 |

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

According to §15.231, Intentional radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector

Applicable Standard

According to §15.231 (e), 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 | 1,000 | 100 |
| 70-130 | 500 | 50 |
| 130-174 | 500 to 1,500 * | 50 to 150 * |
| 174-260 | 1,500 | 150 |
| 260-470 | 1,500 to 5,000* | 150 to 500* |
| Above 470 | 5,000 | 500 |

*Linear interpolations.

The above field strength limits are specified at a distance of 3-meters the tighter limits apply at the band edges.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Loss and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Loss} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Results Summary

According to the data in the following table, the EUT complied with the CFR47 §15.205, §15.209, §15.231 (e), with the worst margin reading of:

1.76 dB at 1260 MHz in the Horizontal polarization

Test Data**Environmental Conditions**

| | |
|---------------------------|----------|
| Temperature: | 25.6 ° C |
| Relative Humidity: | 62 % |
| ATM Pressure: | 100.8kPa |

The testing was performed by Ares Liu on 2013-02-28.

Test mode: Transmitting

Field Strength(Peak)

| Frequency | Receiver | Rx Antenna | | Cable loss (dB) | Amplifier Gain (dB) | Corrected Amplitude (dBμV/m) | §15.231 | |
|-----------------------------|-------------------|----------------|----------------|-----------------------|---------------------------|------------------------------------|-------------------|----------------|
| (MHz) | Reading (dBμV) | Polar (H/V) | Factor (dB) | | | | Limit (dBμV/m) | Margin (dB) |
| Operating Frequency:315 MHz | | | | | | | | |
| 315 | 66.54 | H | 14.42 | 2.19 | 0.00 | 83.15 | 87.66 | 4.51 |
| 315 | 49.61 | V | 14.42 | 2.19 | 0.00 | 66.22 | 87.66 | 21.44 |
| 630 | 24.23 | H | 20.02 | 3.06 | 0.00 | 47.31 | 67.66 | 20.35 |
| 630 | 22.36 | V | 20.02 | 3.06 | 0.00 | 45.44 | 67.66 | 22.22 |
| 945 | 28.15 | H | 23.18 | 3.72 | 0.00 | 55.05 | 67.66 | 12.61 |
| 945 | 24.06 | V | 23.18 | 3.72 | 0.00 | 50.96 | 67.66 | 16.70 |
| 1260 | 41.58 | H | 25.26 | 2.68 | 0.00 | 69.52 | 74.00 | 4.48 |
| 1260 | 34.55 | V | 25.26 | 2.68 | 0.00 | 62.49 | 74.00 | 11.51 |
| 1575 | 34.92 | H | 26.00 | 3.11 | 0.00 | 64.02 | 74.00 | 9.98 |
| 1575 | 31.25 | V | 26.00 | 3.11 | 0.00 | 60.35 | 74.00 | 13.65 |
| 1890 | 29.97 | H | 28.07 | 3.41 | 0.00 | 61.46 | 74.00 | 12.54 |
| 1890 | 32.02 | V | 28.07 | 3.41 | 0.00 | 63.51 | 74.00 | 10.49 |
| 2205 | 46.59 | H | 29.95 | 3.47 | 27.68 | 52.33 | 74.00 | 21.67 |
| 2205 | 40.67 | V | 29.95 | 3.47 | 27.68 | 46.41 | 74.00 | 27.59 |
| 2520 | 44.96 | H | 31.57 | 3.77 | 27.87 | 52.44 | 74.00 | 21.56 |
| 2520 | 39.11 | V | 31.57 | 3.77 | 27.87 | 46.59 | 74.00 | 27.41 |
| 2835 | 50.02 | H | 31.13 | 4.70 | 27.57 | 58.29 | 74.00 | 15.71 |
| 2835 | 44.14 | V | 31.13 | 4.70 | 27.57 | 52.41 | 74.00 | 21.59 |
| 3150 | 47.35 | H | 31.14 | 4.91 | 27.66 | 55.74 | 74.00 | 18.26 |
| 3150 | 45.25 | V | 31.14 | 4.91 | 27.66 | 53.64 | 74.00 | 20.36 |

*Within measurement uncertainty!

Field Strength (Average)

| Frequency (MHz) | Peak Measurement @ 3m (dBμV/m) | Polar (H/V) | Duty Cycle Correction Factor (dB) | Average Amp. (dBμV/m) | §15.231 | |
|-----------------------------|---|----------------|--|-----------------------------|-------------------|----------------|
| | | | | | Limit (dBμV/m) | Margin (dB) |
| Operating Frequency:315 MHz | | | | | | |
| 315 | 83.15 | H | -17.28 | 65.87 | 67.66 | 1.79* |
| 315 | 66.22 | V | -17.28 | 48.94 | 67.66 | 18.72 |
| 630 | 47.31 | H | -17.28 | 30.03 | 47.66 | 17.63 |
| 630 | 45.44 | V | -17.28 | 28.16 | 47.66 | 19.50 |
| 945 | 55.05 | H | -17.28 | 37.77 | 47.66 | 9.89 |
| 945 | 50.96 | V | -17.28 | 33.68 | 47.66 | 13.98 |
| 1260 | 69.52 | H | -17.28 | 52.24 | 54.00 | 1.76 * |
| 1260 | 62.49 | V | -17.28 | 45.21 | 54.00 | 8.79 |
| 1575 | 64.02 | H | -17.28 | 46.74 | 54.00 | 7.26 |
| 1575 | 60.35 | V | -17.28 | 43.07 | 54.00 | 10.93 |
| 1890 | 61.46 | H | -17.28 | 44.18 | 54.00 | 9.82 |
| 1890 | 63.51 | V | -17.28 | 46.23 | 54.00 | 7.77 |
| 2205 | 52.33 | H | -17.28 | 35.05 | 54.00 | 18.95 |
| 2205 | 46.41 | V | -17.28 | 29.13 | 54.00 | 24.87 |
| 2520 | 52.44 | H | -17.28 | 35.16 | 54.00 | 18.84 |
| 2520 | 46.59 | V | -17.28 | 29.31 | 54.00 | 24.69 |
| 2835 | 58.29 | H | -17.28 | 41.01 | 54.00 | 12.99 |
| 2835 | 52.41 | V | -17.28 | 35.13 | 54.00 | 18.87 |
| 3150 | 55.74 | H | -17.28 | 38.46 | 54.00 | 15.54 |
| 3150 | 53.64 | V | -17.28 | 36.36 | 54.00 | 17.64 |

*Within measurement uncertainty!

Note:

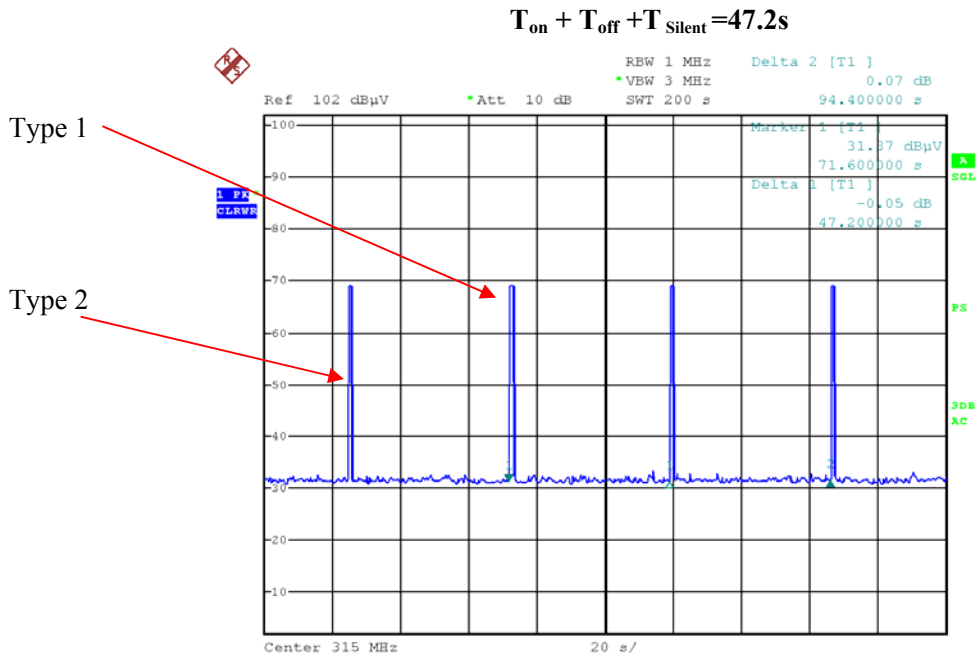
The maximum duty cycle was the model: JDI-1001, which was declared by manufacturer. Please refer the declaration letter in the last page of the report.

Calculate Average value based on Duty Cycle Correction Factor:

Duty cycle= $T_{ON}/100ms=(25.8-6*0.18-30*0.24-8*0.48)ms/100ms=13.68\%$

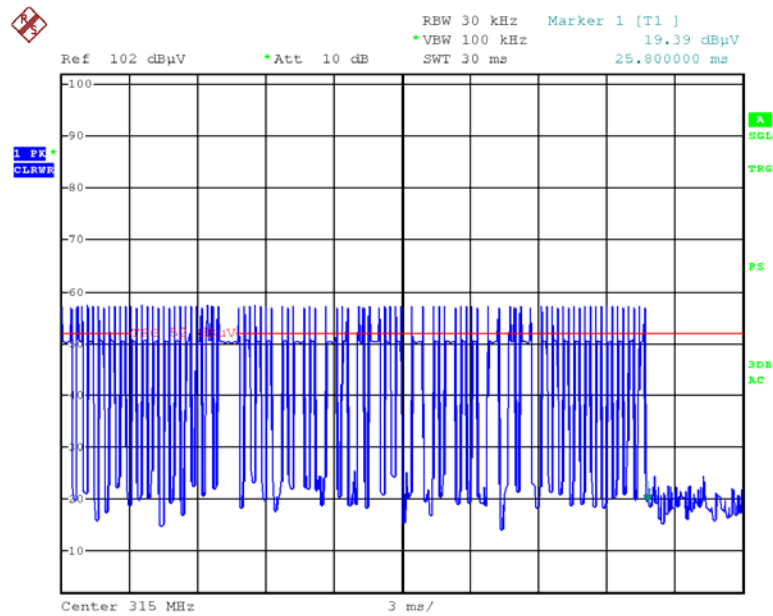
Duty cycle correction factor = $20*\log(duty\ cycle)=20*\log(13.68\%)=-17.28\ dB$

Please refer to following plot.



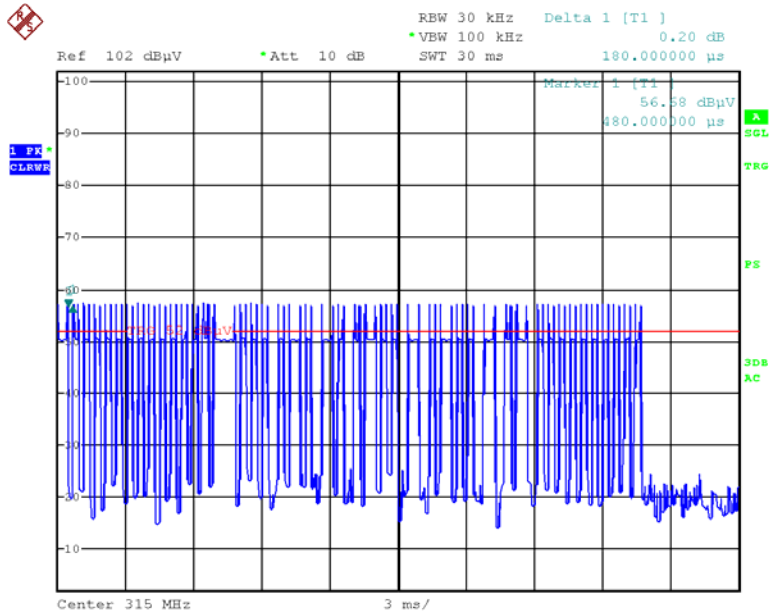
Date: 28.FEB.2013 09:25:09

Type 1: $T_{on} + T_{off} = 25.8ms < 100ms$



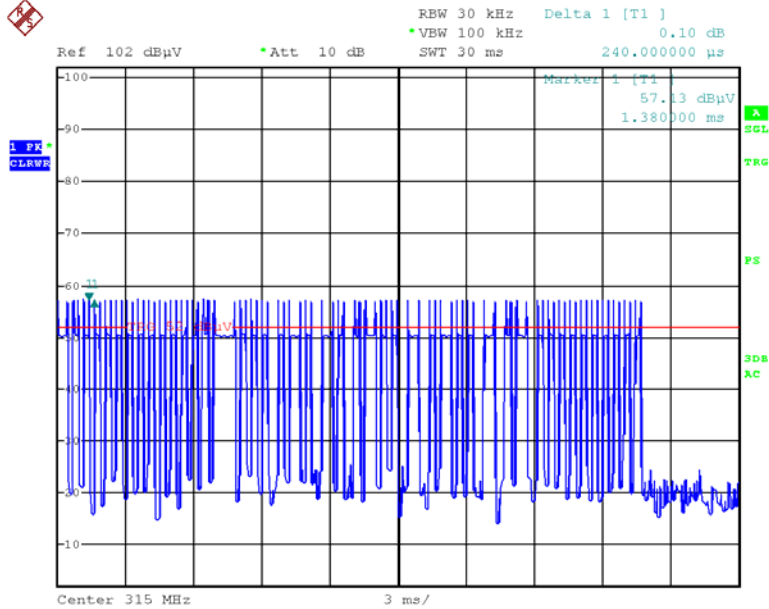
Date: 28.FEB.2013 09:32:14

Type 1: 6 pcs 180us T_{off}

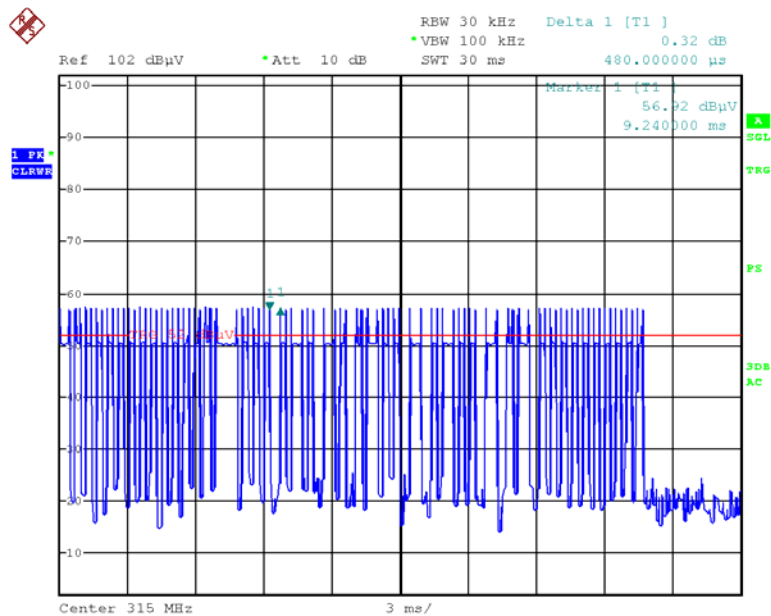


Date: 28.FEB.2013 09:32:31

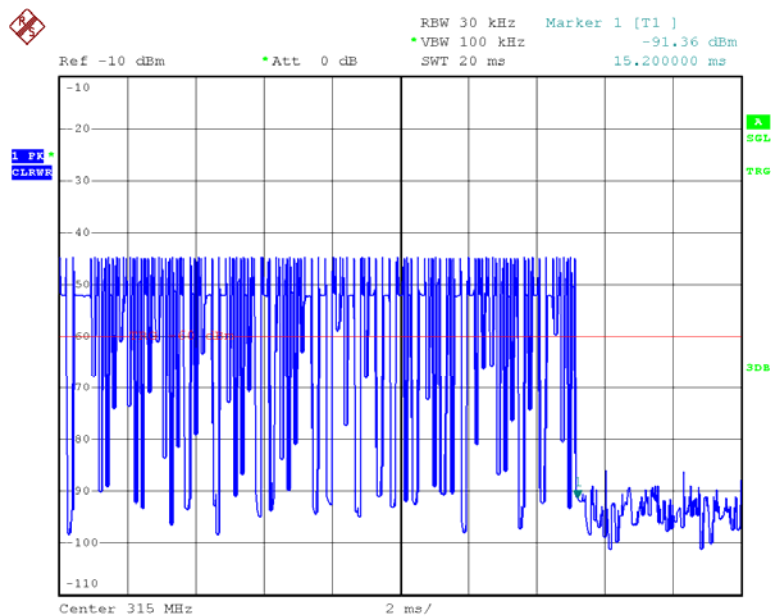
Type 1: 30 pcs 240us T_{off}



Date: 28.FEB.2013 09:32:57

Type 1: 8 pcs 480us T_{off}

Date: 28.FEB.2013 09:35:53

Type 2: T_{on} + T_{off} = 15.2 ms

Date: 13.MAR.2013 10:18:59

FCC §15.231(c) – 20 dB BANDWIDTH TESTING**Requirement**

Per 15.231(c), The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|-----------------|-------------------|---------|---------------|------------------|----------------------|
| Rohde & Schwarz | Spectrum Analyzer | FSEM 30 | 1079 8500 | 2012-10-9 | 2013-10-8 |

Test Procedure

With the EUT's antenna attached, the waveform was received by the test antenna which was connected to the spectrum analyzer, plot the 20 dB bandwidth.

Test Data**Environmental Conditions**

| | |
|--------------------|----------|
| Temperature: | 25.6° C |
| Relative Humidity: | 62% |
| ATM Pressure: | 100.8kPa |

The testing was performed by Ares Liu on 2013-02-28.

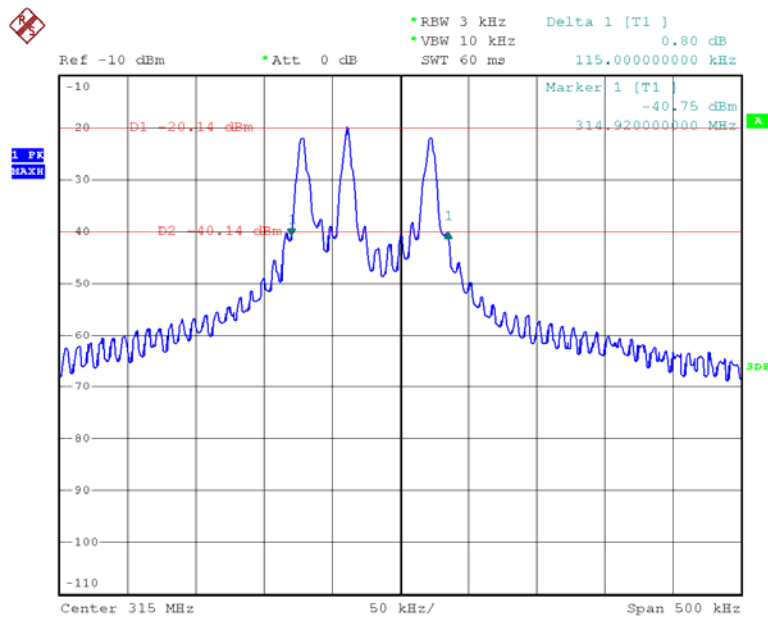
Test Mode: Transmitting

Please refer to following table and plot.

| Channel Frequency (MHz) | 20 dB Bandwidth (kHz) | Limit (kHz) | Result |
|-------------------------|-----------------------|-------------|--------|
| 315 | 155 | 787.5 | Pass |

Note: Limit = 0.25% * Center Frequency = 0.25% * 315 MHz = 0.7875 MHz

20 dB Bandwidth



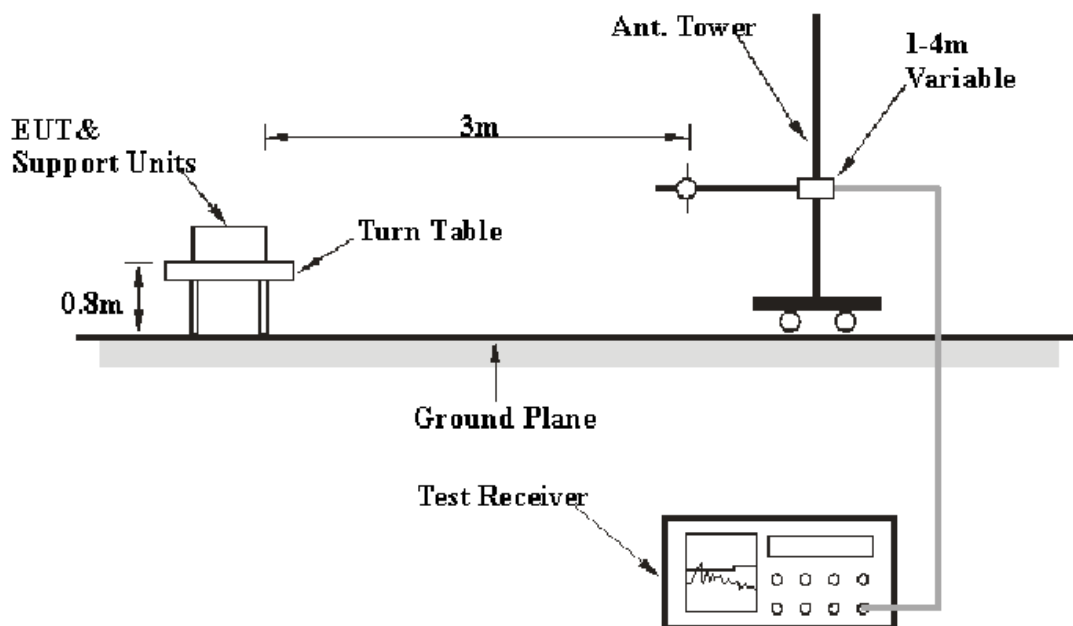
Date: 28.FEB.2013 11:22:35

FCC §15.231(e) - DEACTIVATION TESTING

Applicable Standard

Per §15.231(e), 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.

EUT Setup



The deactivation test was performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.4 - 2009. The specification used was the FCC 15.231(e) limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|-----------------|-------------------|-------|---------------|------------------|----------------------|
| Rohde & Schwarz | EMI Test Receiver | ESCI | 101121 | 2012-10-8 | 2013-10-7 |
| Sunol Sciences | Hybrid Antennas | JB3 | A060611-1 | 2011-9-6 | 2013-9-5 |
| HP | Pre-amplifier | 8447E | 2434A02181 | 2012-10-8 | 2013-10-7 |

Test Data**Environmental Conditions**

| | |
|---------------------------|--------------------|
| Temperature: | 23.8 °C~24.5 °C |
| Relative Humidity: | 54 %~65% |
| ATM Pressure: | 100.1 kPa~100.9kPa |

The testing was performed by Ares Liu from 2013-02-27 to 2013-03-20.

Test Mode: Transmitting

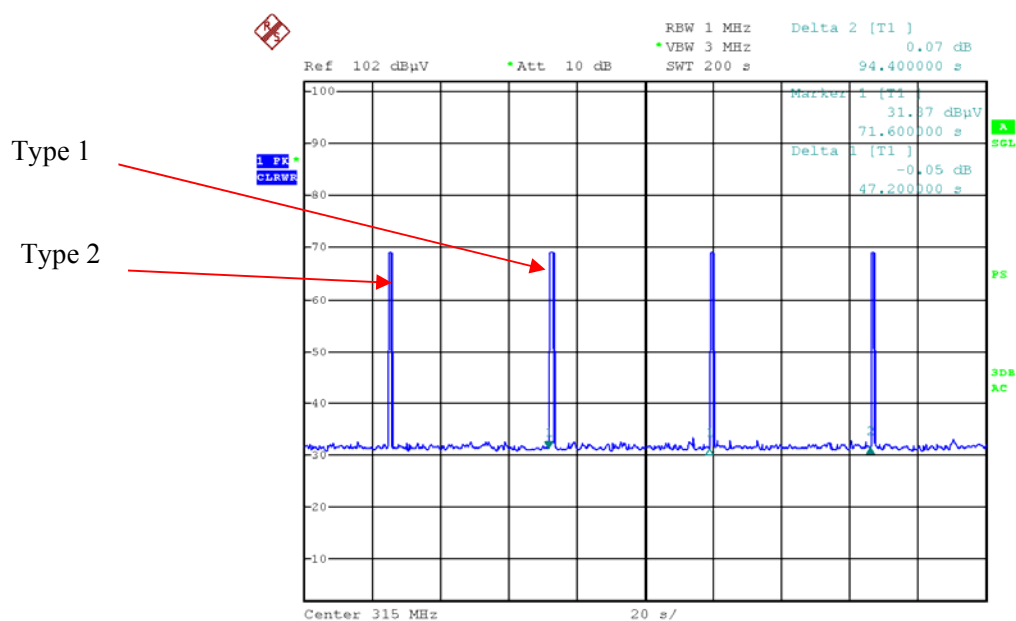
Test Result: Compliance. Please refer to following plot.

Model: JDI-1001

| Period time | Duration time | Silent time | Silent time Limit | Result |
|-------------|---------------|-------------|--------------------------------|--------|
| 47.2s | 25.8ms | 47.17s | >10s and >30* Duration time | Pass |

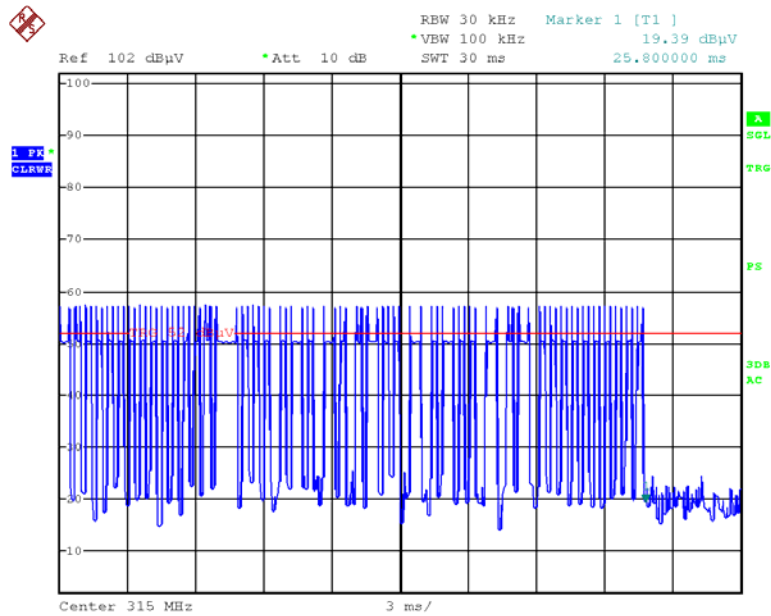
Note: The maximum duration time is 25.8ms, please refer the plots below.
Silent time= Period time- Duration time

Period time:47.2s



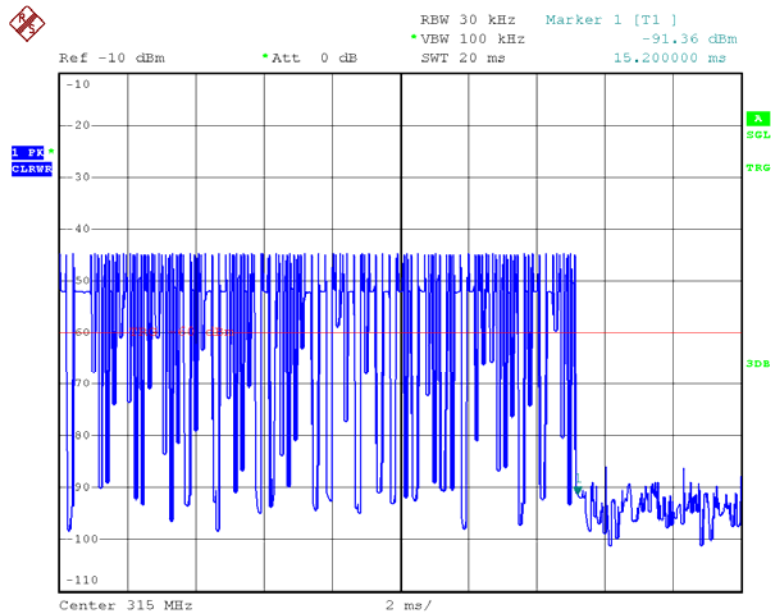
Date: 28.FEB.2013 09:25:09

Type 1 Duration time:25.8ms



Date: 28.FEB.2013 09:32:14

Type 2 Duration time:15.2ms



Date: 13.MAR.2013 10:18:59

Model: DVT-1006

| Period time | Duration time | Silent time | Silent time Limit | Result |
|-------------|---------------|-------------|--------------------------------|--------|
| 17.2s | 15.2ms | 17.18s | >10s and >30* Duration time | Pass |

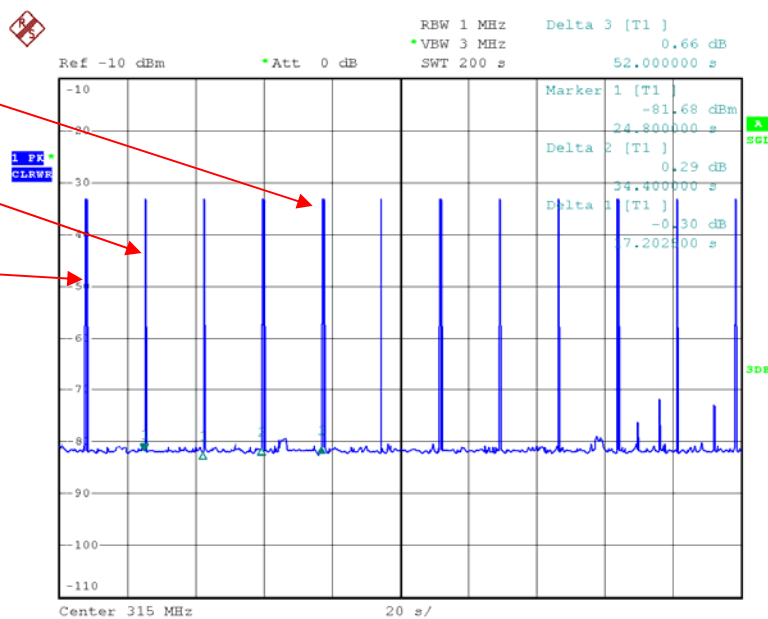
Note: The maximum duration time is 15.2ms, please refer the plots below.
 Silent time= Period time- Duration time

Period time:17.2s

Type 1

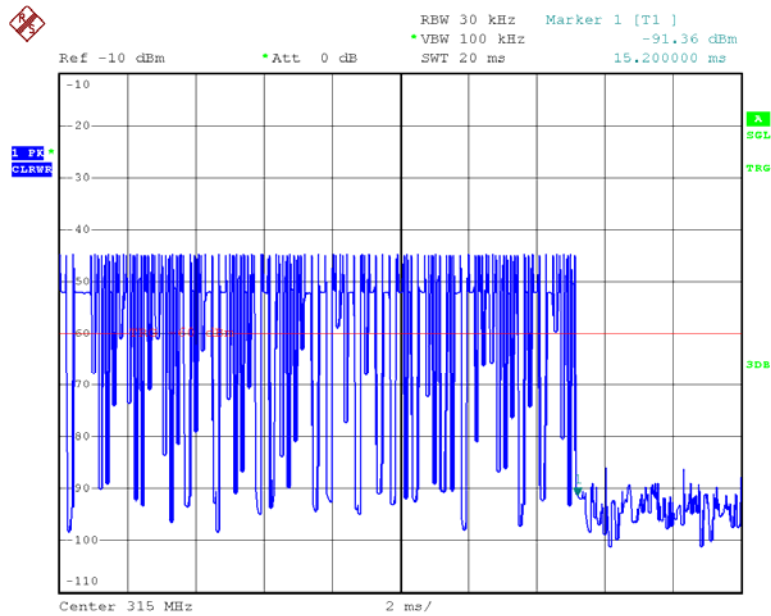
Type 2

Type 3



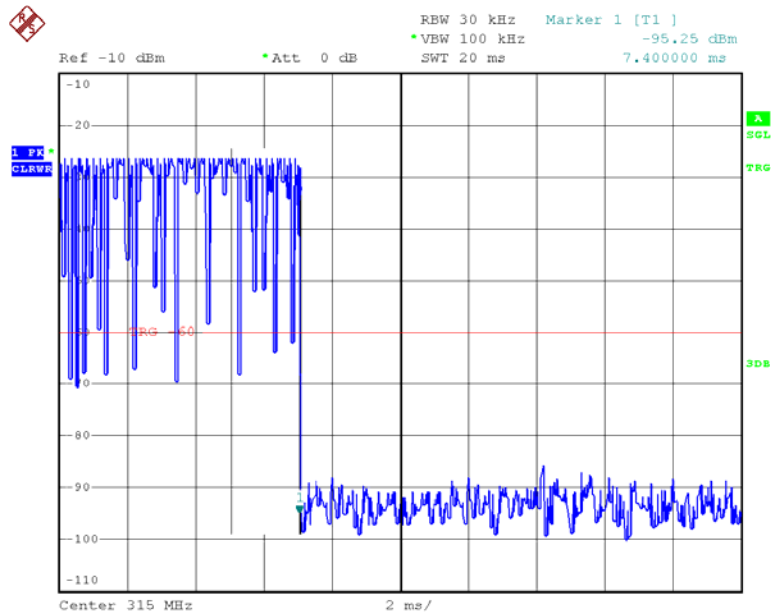
Date: 13.MAR.2013 09:56:36

Type 1 Duration time:15.2ms



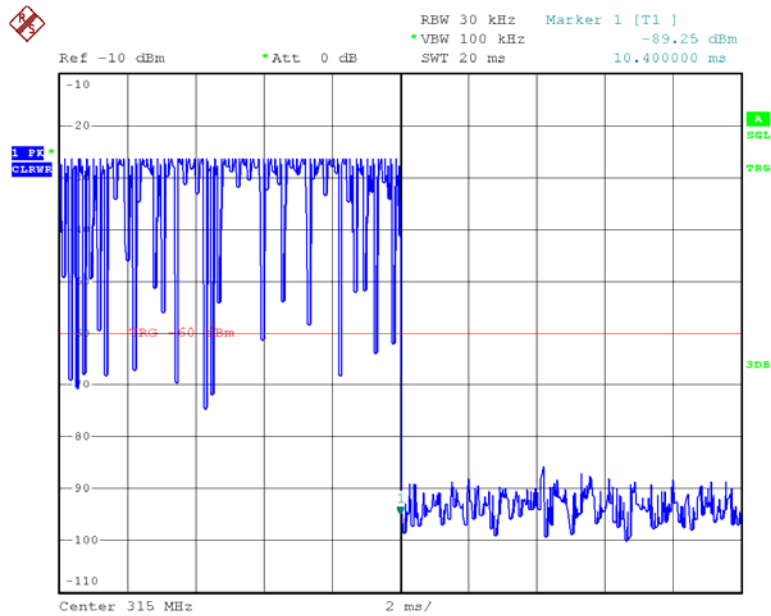
Date: 13.MAR.2013 10:10:50

Type 2 Duration time:7.4ms



Date: 12.MAR.2013 11:11:48

Type 3 Duration time:10.4ms

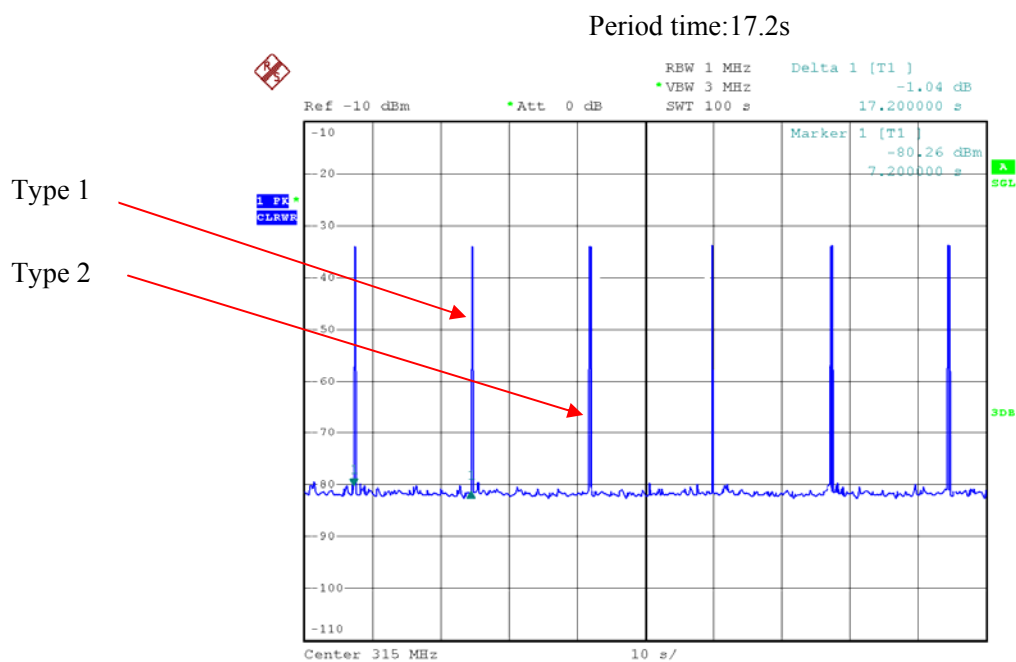


Date: 12.MAR.2013 11:21:48

Model: DVT-1007

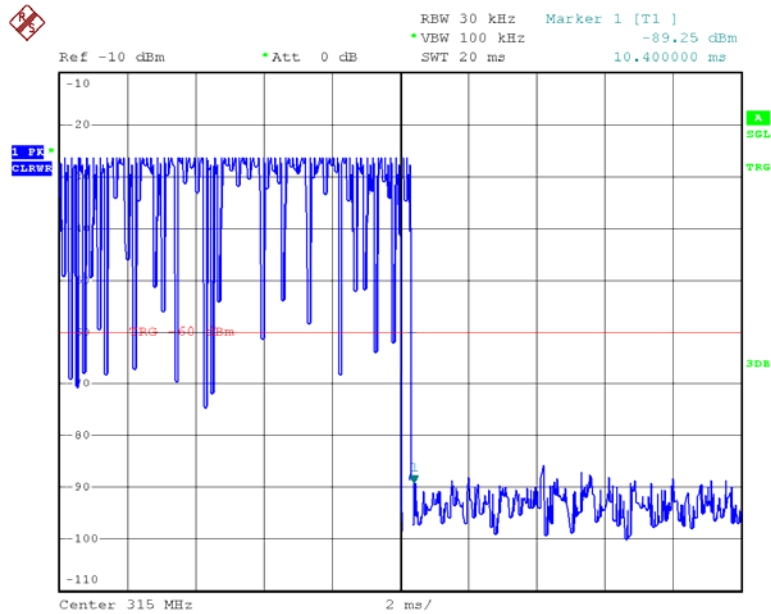
| Period time | Duration time | Silent time | Silent time Limit | Result |
|-------------|---------------|-------------|--------------------------------|--------|
| 17.2s | 15.2ms | 17.18s | >10s and >30* Duration time | Pass |

Note: The maximum duration time is 15.2ms, please refer the plots below.
Silent time= Period time- Duration time



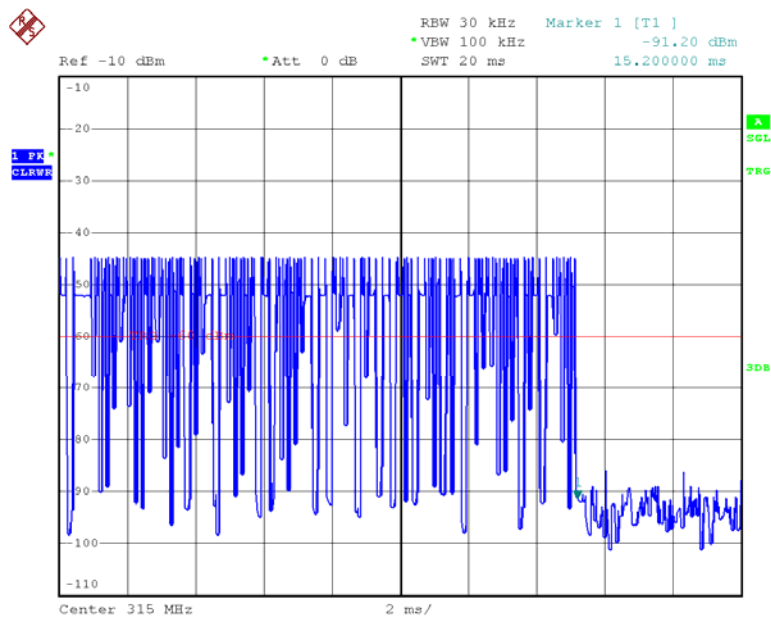
Date: 12.MAR.2013 11:13:39

Type 1 Duration time:10.4 ms



Date: 12.MAR.2013 11:48:13

Type 2 Duration time:15.2ms



Date: 13.MAR.2013 10:50:50

DECLARATION LETTER



Hangzhou Hamaton Tyre Valves Co., Ltd.
12 East Zhenxing Road, Linping, Yuhang, Hangzhou, China
Tel: 86-571-86159905 Fax: 86-571-86159905

DECLARATION OF SIMILARITY

Mar 7, 2013

To:
Bay Area Compliance Laboratories Corp. (Dongguan)
No.69 Pulongcun, Puxinhu Industrial Zone, Tangxia, Dongguan, Guangdong, China
Tel: +86 769 86858888 Fax: +86 769 86858891
<http://www.baclcorp.com>

Dear Sir or Madam:

We, Hangzhou Hamaton Tyre Valves Co., Ltd., hereby declare that product: TPMS sensor, model(s): JDI-1001, DVT-1001, PRO-1, DVT-1006, PRO-6, DVT-1007, PRO-7, are all with the same hardware design, and electrically identical with the same electromagnetic emissions and electromagnetic compatibility characteristics. And they were tested by BACL, the results of which are featured in BACL project: R2SH130130051

A description of the differences between the tested model and those that are declared similar areas follows:

JDI-1001, DVT-1001, PRO-1, DVT-1006, PRO-6, DVT-1007, PRO-7, are using different name and may use different housing color and assemble with different valves;

JDI-1001, DVT-1001, PRO-1, DVT-1006, PRO-6, DVT-1007, PRO-7, have different frame structure and modulation in their Radio Frequency signal as following:

For JDI-1001, DVT-1001, Pro-1: frame1 (FSK) + frame2 (ASK) + frame3 (ASK) in one package. The frame width: frame1 is 15ms, frame2 is 26ms, and frame3 is 26ms. Space between packages is 48 seconds. The modulation for frame1 is FSK, frame2 is ASK, and frame3 is ASK;

For DVT-1006, Pro-6: 2*frames1 (ASK) + 2*frames2 (FSK) + 2*frames3 (FSK) + 2*frames4 (FSK) in one package. The frame width: frame1 is 15ms, frame2 is 7.5ms, frame3 is 10ms, and frame 4 is 10 ms, Space between packages is 17 seconds. The modulation for frame1 is ASK, frame2 is FSK, frame3 is FSK, and frame4 is FSK;

For DVT-1007, Pro-7: 2*frames1 (FSK) + 2*frames2 (FSK) + 2*frames3 (ASK) in one package. The frame width: frame1 is 15ms, frame2 is 10ms, and frame3 is 10ms, Space between packages is 17 seconds. The modulation for frame1 is FSK, frame2 is FSK, and frame3 is ASK.

(Note: ASK and FSK are different modulation set by software.)

Please contact me should there be need for any additional clarification or information.

Best Regards,

Weibo Zhang
Quality Supervisor

A handwritten signature in black ink, appearing to read 'Weibo Zhang', written over the printed name.

*****END OF REPORT*****