

APPLICATION CERTIFICATION  
On Behalf of  
Opal Manufacturing Co., Ltd.

Motor Diver Spinner  
Model No.: 360

FCC ID: Z3L-360TX

Prepared for : Opal Manufacturing Co., Ltd.  
Address : 88 Hengping Road East, Henggang Town, Longgang  
District, Shenzhen, China

Prepared by : ACCURATE TECHNOLOGY CO., LTD  
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Report Number : ATE20112048  
Date of Test : September 27-29, 2011  
Date of Report : September 30, 2011

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APPENDIX I ( TEST CURVES) (10 pages)



## 1. GENERAL INFORMATION

### 1.1. Description of Device (EUT)

EUT : Motor Diver Spinner  
Model Number : 360

Power Supply : DC 1.5V ("AA" batteries 1×)

Operation Frequency : 433.92MHz

Applicant : Opal Manufacturing Co., Ltd.  
Address : 88 Hengping Road East, Henggang Town, Longgang District, Shenzhen, China

Manufacturer : Opal Manufacturing Co., Ltd.  
Address : 88 Hengping Road East, Henggang Town, Longgang District, Shenzhen, China

Date of sample received : September 27, 2011

Date of Test : September 27-29, 2011

## 1.2.Description of Test Facility

EMC Lab	: Accredited by TUV Rheinland Shenzhen
	Listed by FCC The Registration Number is 752051
	Listed by Industry Canada The Registration Number is 5077A-2
	Accredited by China National Accreditation Committee for Laboratories The Certificate Registration Number is L3193
Name of Firm	: ACCURATE TECHNOLOGY CO., LTD
Site Location	: F1, Bldg. A, Changyuan New Material Port, Keyuan Rd. Science & Industry Park, Nanshan, Shenzhen, Guangdong P.R. China

## 1.3.Measurement Uncertainty

Conducted Emission Expanded Uncertainty = 2.23dB, k=2

Radiated emission expanded uncertainty = 3.08dB, k=2  
(9kHz-30MHz)

Radiated emission expanded uncertainty = 4.42dB, k=2  
(30MHz-1000MHz)

Radiated emission expanded uncertainty = 4.06dB, k=2  
(Above 1GHz)

## 2. MEASURING DEVICE AND TEST EQUIPMENT

**Table 1: List of Test and Measurement Equipment**

Kind of equipment	Manufacturer	Type	S/N	Calibrated until
EMI Test Receiver	Rohde&Schwarz	ESCS30	100307	Jan. 15, 2012
EMI Test Receiver	Rohde&Schwarz	ESPI3	101526/003	Jan. 15, 2012
Spectrum Analyzer	Agilent	E7405A	MY45115511	Jan. 15, 2012
Pre-Amplifier	Rohde&Schwarz	CBLU118354 0-01	3791	Jan. 15, 2012
Loop Antenna	Schwarzbeck	FMZB1516	1516131	Jan. 15, 2012
Bilog Antenna	Schwarzbeck	VULB9163	9163-323	Jan. 15, 2012
Horn Antenna	Schwarzbeck	BBHA9120D	9120D-655	Jan. 15, 2012
Horn Antenna	Schwarzbeck	BBHA9170	9170-359	Jan. 15, 2012
LISN	Rohde&Schwarz	ESH3-Z5	100305	Jan. 15, 2012
LISN	Schwarzbeck	NSLK8126	8126431	Jan. 15, 2012

### 3. OPERATION OF EUT DURING TESTING

#### 3.1.Operating Mode

**A mode**(Continuous Tx Mode )

**B mode**(Single Spin Tx Mode)

The mode is used: **A mode**

(All possible modes of operation were investigated, A mode is worst case)

#### 3.2.Configuration and peripherals

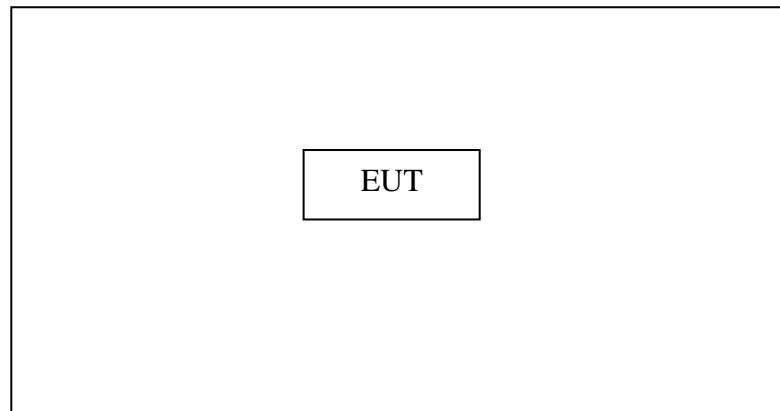


Figure 1 Setup: Transmitting mode

## 4. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
Section 15.207	Conducted Emission	N/A
Section 15.231(b)	Radiated Emission	Compliant
Section 15.231(c)	20dB Bandwidth	Compliant
Section 15.231(a)(1)	Release Time Measurement	Compliant

The product is a manually operated Remote Control transmitter.

Section 15.231 (a) (2), (3), (4) and (5) are not applicable.

## 5. THE FIELD STRENGTH OF RADIATION EMISSION

### 5.1. Block Diagram of Test Setup

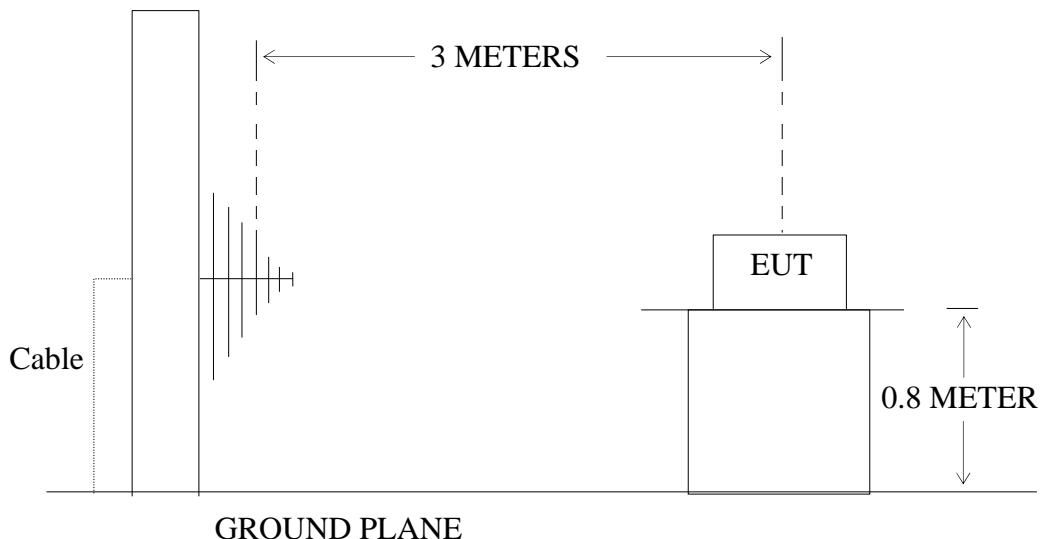
#### 5.1.1. Block diagram of connection between the EUT and simulators



(EUT: Motor Diver Spinner)

#### 5.1.2. Semi-Anechoic Chamber Test Setup Diagram

ANTENNA ELEVATION VARIES FROM 1 TO 4 METERS



(EUT: Motor Diver Spinner)

## 5.2.The Field Strength of Radiation Emission Measurement Limits

### 5.2.1.Radiation Emission Measurement Limits According to FCC Part 15 Section 15.231(b)

Frequency Range of Fundamental [MHz]	Field Strength of Fundamental Emission [Average] [ $\mu$ V/m]	Field Strength of Spurious Emission [Average] [ $\mu$ V/m]
40.66-40.70	2250	225
70-130	1250	125
130-174	1250-3750	125-375
174-260	3750	375
260-470	3750-12500	375-1250
Above 470	12500	1250

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,  $\mu$ V/m at 3 meters =  $56.81818(F) - 6136.3636$ ; for the band 260-470 MHz,  $\mu$ 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.

### 5.2.2.Restricted Band Radiation Emission Measurement Limits According to FCC part 15 Section 15.205 and Section15.209.

## 5.3.Configuration of EUT on Measurement

The following equipment is installed on Radiated Emission Measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

### 5.3.1. Motor Diver Spinner (EUT)

Model Number : 360  
 Serial Number : N/A  
 Manufacturer : Opal Manufacturing Co., Ltd.

## 5.4.Operating Condition of EUT

### 5.4.1.Setup the EUT and simulator as shown as Section 5.1.

### 5.4.2.Turn on the power of all equipment.

### 5.4.3. Let the EUT work in TX mode measure it.

## 5.5. Test Procedure

The EUT and its simulators are placed on a turntable, which is 0.8 meter high above ground. The turntable can rotate 360 degrees to determine the position of the maximum emission level. EUT is set 3.0 meters away from the receiving antenna, which is mounted on an antenna tower. The antenna can be moved up and down between 1.0 meter and 4 meters to find out the maximum emission level. Broadband antenna (calibrated bi-log antenna) is used as receiving antenna. Both horizontal and vertical polarizations of the antenna are set on measurement. In order to find the maximum emission levels, all of the EUT location must be manipulated according to ANSI 63.4 on radiated emission measurement. The EUT was tested in 3 orthogonal planes.

The bandwidth of test receiver is set at 120 kHz in 30-1000 MHz, and 1 MHz in 1000-5000 MHz.

The frequency range from 30 MHz to 5000 MHz is checked.

**5.6.The Field Strength of Radiation Emission Measurement Results  
PASS.**

The frequency range 30MHz to 5000MHz is investigated.

Date of Test:	September 28, 2011	Temperature:	25°C
EUT:	Motor Diver Spinner	Humidity:	50%
Model No.:	360	Power Supply:	DC 1.5V
Test Mode:	TX	Test Engineer:	Pei

Frequency (MHz)	Reading (dB $\mu$ V/m)	Factor Corr.	Average Factor	Result(dB $\mu$ V/m)		Limit(dB $\mu$ V/m)		Margin(dB)		Polarization
	PEAK	(dB)	(dB)	AV	PEAK	AV	PEAK	AV	PEAK	
<b>433.920</b>	<b>54.20</b>	<b>22.95</b>	<b>-8.05</b>	<b>69.09</b>	<b>77.14</b>	<b>80.8</b>	<b>100.8</b>	<b>-11.71</b>	<b>-23.66</b>	Horizontal
867.036	30.04	28.63	-8.05	50.62	58.67	60.8	80.8	-10.18	-22.13	
*1300.110	62.53	-12.20	-8.05	42.28	50.33	54.0	74.0	-11.72	-23.67	
1733.790	60.49	-10.39	-8.05	42.05	50.10	60.8	80.8	-18.75	-30.70	
2167.419	58.36	-8.40	-8.05	41.91	49.96	60.8	80.8	-18.89	-30.84	
2600.245	54.58	-6.72	-8.05	39.81	47.86	60.8	80.8	-20.99	-32.94	
3034.521	53.77	-4.93	-8.05	40.79	48.84	60.8	80.8	-20.01	-31.96	
3467.375	48.84	-3.33	-8.05	37.46	45.51	60.8	80.8	-23.34	-35.29	
*3901.383	49.85	-2.10	-8.05	39.70	47.75	54.0	74.0	-14.3	-26.25	
*4334.198	51.08	-1.94	-8.05	41.09	49.14	54.0	74.0	-12.91	-24.86	
*4767.852	49.22	-0.49	-8.05	40.65	48.73	54.0	74.0	-13.35	-25.27	
<b>433.920</b>	<b>54.80</b>	<b>22.94</b>	<b>-8.05</b>	<b>69.69</b>	<b>77.74</b>	<b>80.8</b>	<b>100.8</b>	<b>-11.11</b>	<b>-23.06</b>	Vertical
867.1340	30.32	28.63	-8.05	50.90	58.95	60.8	80.8	-9.9	-21.85	
*1300.439	63.10	-12.20	-8.05	42.85	50.90	54.0	74.0	-11.15	-23.10	
1733.597	61.05	-10.39	-8.05	42.61	50.66	60.8	80.8	-18.19	-30.14	
2167.419	58.65	-8.40	-8.05	42.20	50.25	60.8	80.8	-18.60	-30.55	
2600.245	57.07	-6.72	-8.05	42.30	50.35	60.8	80.8	-18.50	-30.45	
3034.521	54.31	-4.93	-8.05	41.33	49.38	60.8	80.8	-19.47	-31.42	
3467.375	53.31	-3.33	-8.05	41.93	49.98	60.8	80.8	-18.87	-30.82	
*3901.383	50.67	-2.10	-8.05	40.52	48.57	54.0	74.0	-13.48	-25.43	
*4334.198	50.65	-1.94	-8.05	40.66	48.71	54.0	74.0	-13.34	-25.29	
*4767.852	49.32	-0.49	-8.05	40.78	48.83	54.0	74.0	-13.22	-25.17	

Note:

1. Emissions attenuated more than 20 dB below the permissible value are not reported.
2. \*: Denotes restricted band of operation.

Measurements were made using a peak detector and average detector. Any emission falling within the restricted bands of FCC Part 15 Section 15.205 were compliance with the emission limit of FCC Part 15 Section 15.209.

3. The field strength is calculated by adding the antenna factor, high pass filter loss(if used) and cable loss, and subtracting the amplifier gain(if any)from the measured reading. The basic equation calculation is as follows:

Result = Reading + Corrected Factor

Where Corrected Factor = Antenna Factor + Cable Loss + High Pass Filter Loss – Amplifier Gain

4. FCC Limit for Average Measurement =  $41.6667(433.92)-7083.3333 = 10996.68116 \mu\text{V/m} = 80.8 \text{ dB}\mu\text{V/m}$

5. Pulse Desensitization Correction Factor

Pulse Width (PW) = 21.25ms

$1/\text{PW} = 1/21.25\text{ms} = 0.04706 \text{ kHz}$

RBW (100 kHz) >  $1/\text{PW}$  (0.04706 kHz)

Therefore PDCF is not needed

6. The spectral diagrams in appendix I display the measurement of peak values.

## 6. 20DB OCCUPIED BANDWIDTH

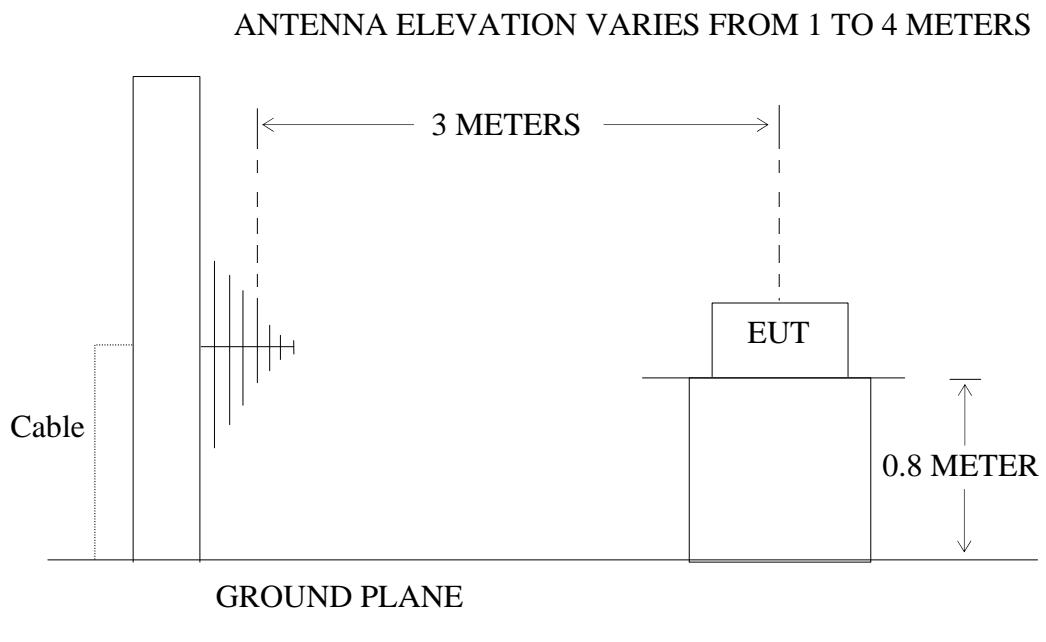
### 6.1. Block Diagram of Test Setup

#### 6.1.1. Block diagram of connection between the EUT and simulators



(EUT: Motor Diver Spinner)

#### 6.1.2. Semi-Anechoic Chamber Test Setup Diagram



### 6.2. The Bandwidth of Emission Limit According To FCC Part 15 Section

#### 15.231(c)

The bandwidth of emission shall be no wider than 0.25% of the center frequency. Therefore, the bandwidth of the emission limit is  $433.92 \text{ MHz} \times 0.25\% = 1084.80 \text{ kHz}$ . Bandwidth is determined at the two points 20 dB down from the top of modulated carrier.

### 6.3.EUT Configuration on Measurement

The following equipment are installed on the bandwidth of emission Measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

#### 6.3.1.Motor Diver Spinner (EUT)

Model Number : 360  
Serial Number : N/A  
Manufacturer : Opal Manufacturing Co., Ltd.

### 6.4.Operating Condition of EUT

6.4.1.Setup the EUT and simulator as shown as Section 6.1.

6.4.2.Turn on the power of all equipment.

6.4.3.Let the EUT work in TX mode measure it.

### 6.5.Test Procedure

6.5.1.Set SPA Center Frequency = Fundamental frequency, RBW = 10 kHz, VBW = 30 kHz, Span = 500 kHz.

6.5.2.Set SPA Max hold, Mark peak, -20 dB.

## 6.6.Measurement Result

**The EUT does meet the FCC requirement.**

-20 dB bandwidth = 61.00 kHz < 1084.80 kHz.

The spectral diagrams in appendix I.

## 7. RELEASE TIME MEASUREMENT

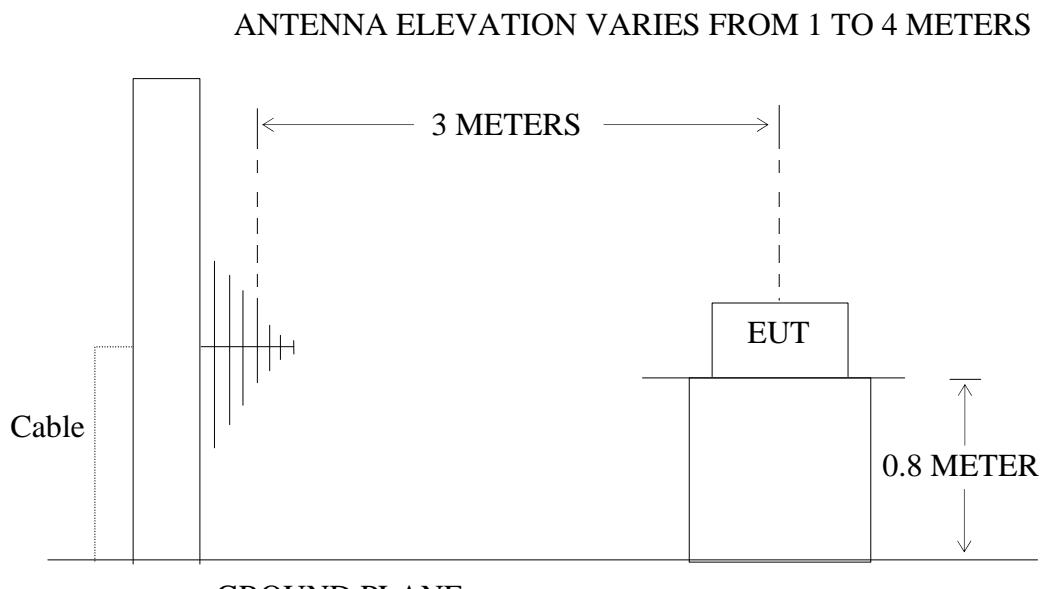
### 7.1. Block Diagram of Test Setup

#### 7.1.1. Block diagram of connection between the EUT and simulators



(EUT: Motor Diver Spinner)

#### 7.1.2. Semi-Anechoic Chamber Test Setup Diagram



(EUT: Motor Diver Spinner)

### 7.2. Release Time Measurement According To FCC Part 15 Section 15.231(a)

Section 15.231(a) (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

### 7.3.EUT Configuration on Measurement

The following equipment are installed on Release Time Measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

#### 7.3.1. Motor Diver Spinner (EUT)

Model Number : 360  
Serial Number : N/A  
Manufacturer : Opal Manufacturing Co., Ltd.

### 7.4.Operating Condition of EUT

7.4.1. Setup the EUT and simulator as shown as Section 7.1.

7.4.2. Turn on the power of all equipment.

7.4.3. Let the EUT work in TX mode measure it.

### 7.5.Test Procedure

7.5.1. Set SPA Center Frequency = Fundamental frequency, RBW = 100 kHz, VBW = 300 kHz, Span = 0 Hz. Sweep time = 5 s.

7.5.2. Set EUT as normal operation and press Transmitter button.

7.5.3. Set SPA View. Delta Mark time.

## 7.6. Measurement Result

**The release time less than 5 seconds.**

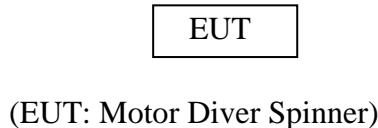
Release Time= 2.65s

The spectral diagrams in appendix I.

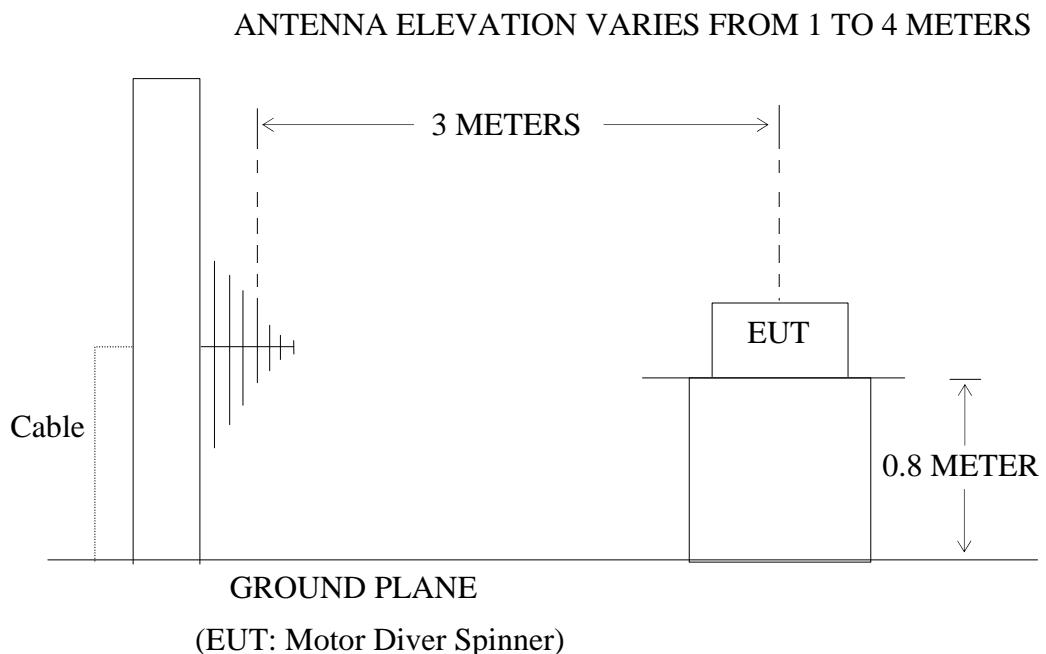
## 8. AVERAGE FACTOR MEASUREMENT

### 8.1. Block Diagram of Test Setup

#### 8.1.1. Block diagram of connection between the EUT and simulators



#### 8.1.2. Semi-Anechoic Chamber Test Setup Diagram



### 8.2. Average factor Measurement according to ANSI 63.4: 2003

**ANSI 63.4: 2003 Section 13.1.4.2** Devices transmitting pulsed emissions and subject to a limit requiring an average detector function for radiated emissions shall initially be measured with an instrument that uses a peak detector. A radiated emission measured with a peak detector may then be corrected to a true average using the appropriate factor for emission duty cycle. This correction factor relates the measured peak level to the average limit and is derived by averaging absolute field strength over one complete pulse train that is 0.1 s, or less, in length. If the pulse train is longer than 0.1 s, the average shall be determined from the average absolute field strength during the 0.1 s interval in which the field strength is at a maximum. Instructions on calculating the duty cycle of a transmitter with pulsed emissions are provided in ANSI 63.4 H.4, step j.

**Average factor in dB = 20 log (duty cycle)**

### 8.3.EUT Configuration on Measurement

The following equipment are installed on average factor Measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

#### 8.3.1. Motor Diver Spinner (EUT)

Model Number : 360  
 Serial Number : N/A  
 Manufacturer : Opal Manufacturing Co., Ltd.

### 8.4.Operating Condition of EUT

- 8.4.1. Setup the EUT and simulator as shown as Section 8.1.
- 8.4.2. Turn on the power of all equipment.
- 8.4.3. Let the EUT work in TX mode measure it.

### 8.5.Test Procedure

- 8.5.1. The time period over which the duty cycle is measured is 100 milliseconds, or the repetition cycle, whichever is a shorter time frame. The worst case (highest percentage on) duty cycle is used for the calculation.
- 8.5.2. Set SPA Center Frequency = Fundamental frequency, RBW = 100 kHz, VBW = 300 kHz, Span = 0 Hz.
- 8.5.3. Set EUT as normal operation.
- 8.5.4. Set SPA View. Delta Mark time.

## 8.6. Measurement Result

**The duty cycle is simply the on time divided by the period:**

The duration of one cycle = 53.60 ms

Effective period of the cycle =  $(0.51 \times 15) + (1.36 \times 10)$  ms = 21.25 ms

$$DC = 21.25 \text{ ms} / 53.6 \text{ ms} = 0.396$$

**Therefore, the average factor is found by  $20\log 0.396 = -8.05 \text{ dB}$**

The spectral diagrams in appendix I.

## APPENDIX I (Test Curves)



## ACCURATE TECHNOLOGY CO., LTD.

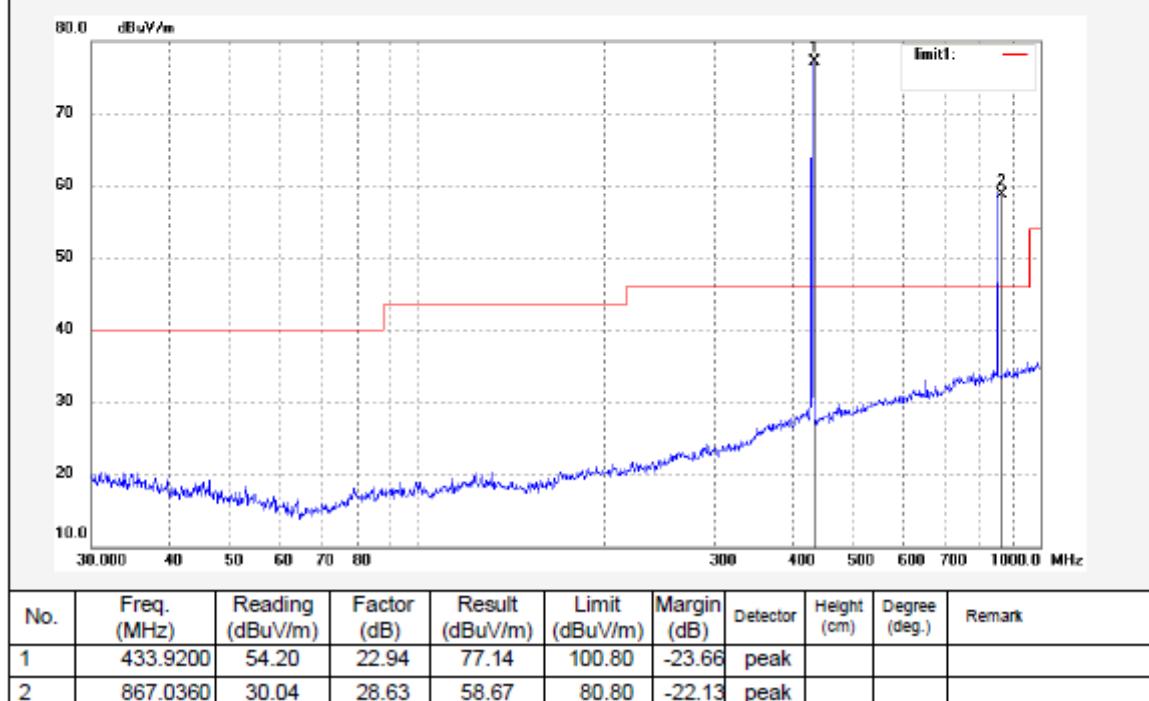
F1,Bldg,A,Changyuan New Material Port Keyuan Rd,  
Science & Industry Park,Nanshan Shenzhen,P.R.China

Site: 966 chamber

Tel:+86-0755-26503290

Fax:+86-0755-26503396

Job No.:	Kai #1007	Polarization:	Horizontal
Standard:	FCC Class B 3M Radiated	Power Source:	DC 1.5V
Test item:	Radiation Test	Date:	2011/09/28
Temp.( C)/Hum.(%)	24 C / 48 %	Time:	10:56:37
EUT:	Motor Diver Spinner	Engineer Signature:	Kai
Mode:	TX	Distance:	3m
Model:	360		
Manufacturer:	Opal Manufacturing Co.,Ltd		
Note:	Report No.:ATE20112048		

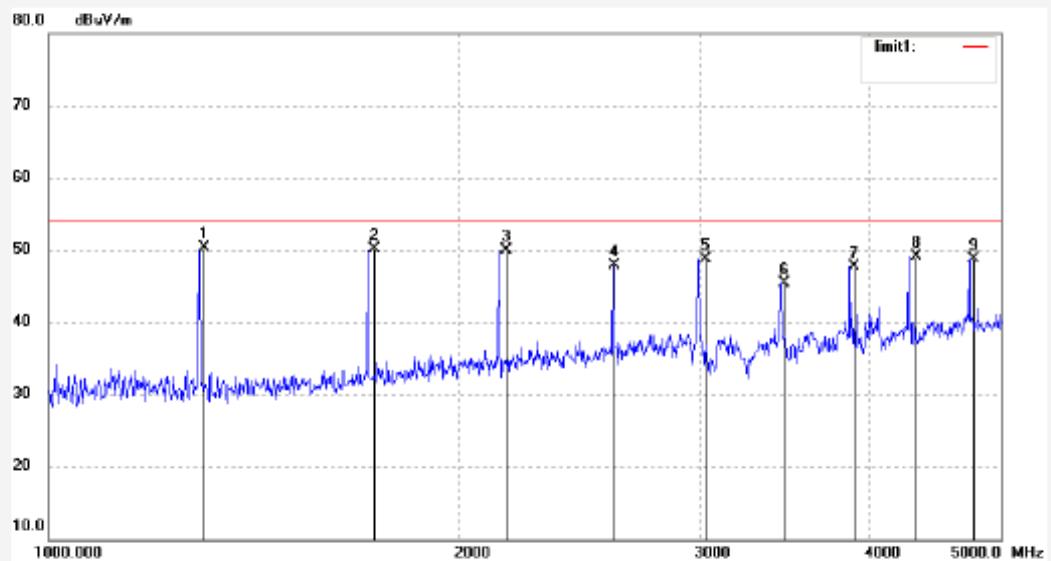




ACCURATE TECHNOLOGY CO., LTD.

F1,Bldg,A,Changyuan New Material Port Keyuan Rd,  
Science & Industry Park,Nanshan Shenzhen,P.R.ChinaSite: 966 chamber  
Tel:+86-0755-26503290  
Fax:+86-0755-26503396

Job No.: Kai #1017	Polarization: Horizontal
Standard: FCC Class B 3M Radiated	Power Source: DC 1.5V
Test item: Radiation Test	Date: 2011/09/28
Temp.( C)/Hum.(%) 24 C / 48 %	Time: 11:54:41
EUT: Motor Diver Spinner	Engineer Signature: Kai
Mode: TX	Distance: 3m
Model: 360	
Manufacturer: Opal Manufacturing Co.,Ltd	
Note: Report No.:ATE20112048	



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	1300.110	62.53	-12.20	50.33	74.00	-23.67	peak			
2	1733.790	60.49	-10.39	50.10	80.80	-30.70	peak			
3	2167.419	58.36	-8.40	49.96	80.80	-30.84	peak			
4	2600.245	54.58	-6.72	47.86	80.80	-32.94	peak			
5	3034.521	53.77	-4.93	48.84	80.80	-31.96	peak			
6	3467.375	48.84	-3.33	45.51	80.80	-35.29	peak			
7	3901.383	49.85	-2.10	47.75	74.00	-26.25	peak			
8	4334.198	51.08	-1.94	49.14	74.00	-24.86	peak			
9	4767.852	49.22	-0.49	48.73	74.00	-25.27	peak			

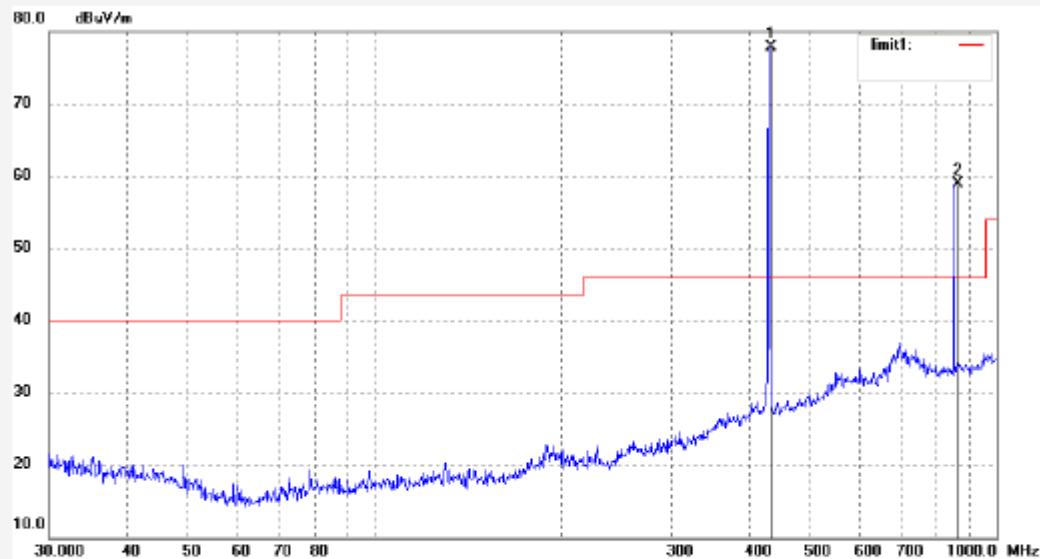


## ACCURATE TECHNOLOGY CO., LTD.

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Science & Industry Park,Nanshan Shenzhen,P.R.China

Site: 966 chamber  
Tel:+86-0755-26503290  
Fax:+86-0755-26503396

Job No.:	Kai #1008	Polarization:	Vertical
Standard:	FCC Class B 3M Radiated	Power Source:	DC 1.5V
Test item:	Radiation Test	Date:	2011/09/28
Temp.( C)/Hum.(%)	24 C / 48 %	Time:	11:00:33
EUT:	Motor Diver Spinner	Engineer Signature:	Kai
Mode:	TX	Distance:	3m
Model:	360		
Manufacturer:	Opal Manufacturing Co.,Ltd		
Note:	Report No.:ATE20112048		



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	433.9200	54.80	22.94	77.74	100.80	-23.06	peak			
2	867.1340	30.32	28.63	58.95	80.80	-21.85	peak			

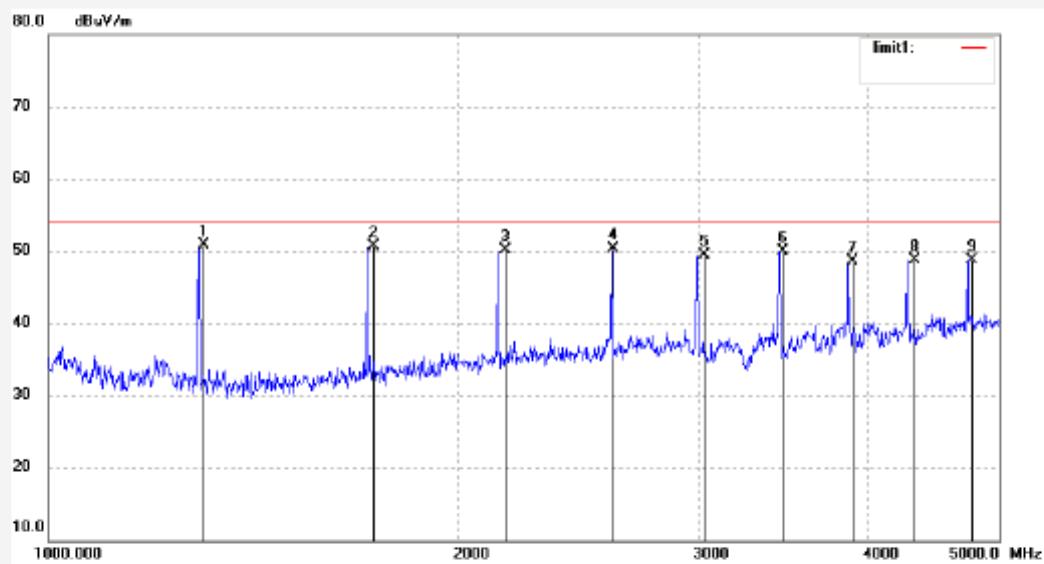


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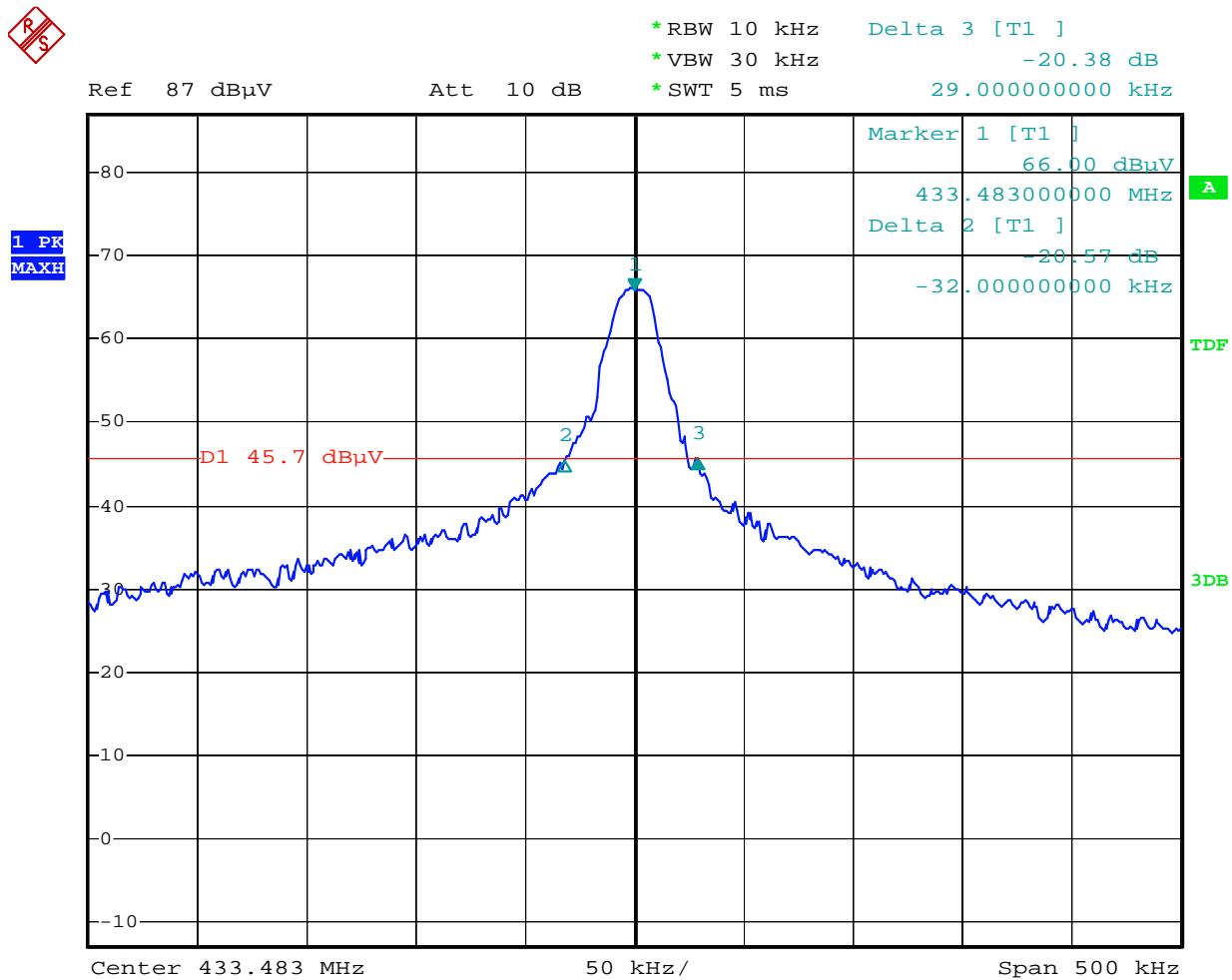
F1,Bldg,A,Changyuan New Material Port Keyuan Rd,  
Science & Industry Park,Nanshan Shenzhen,P.R.China

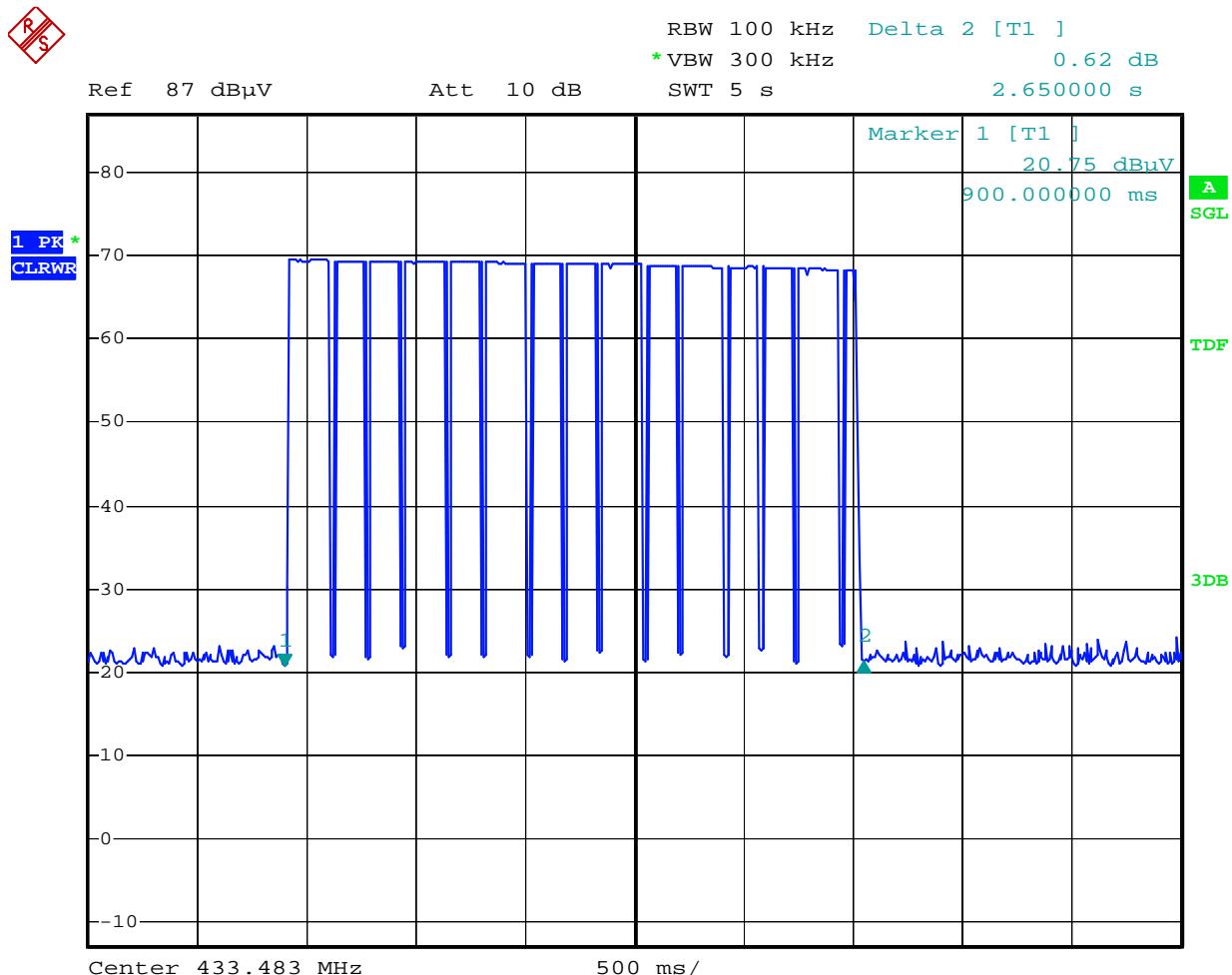
Site: 966 chamber  
Tel:+86-0755-26503290  
Fax:+86-0755-26503396

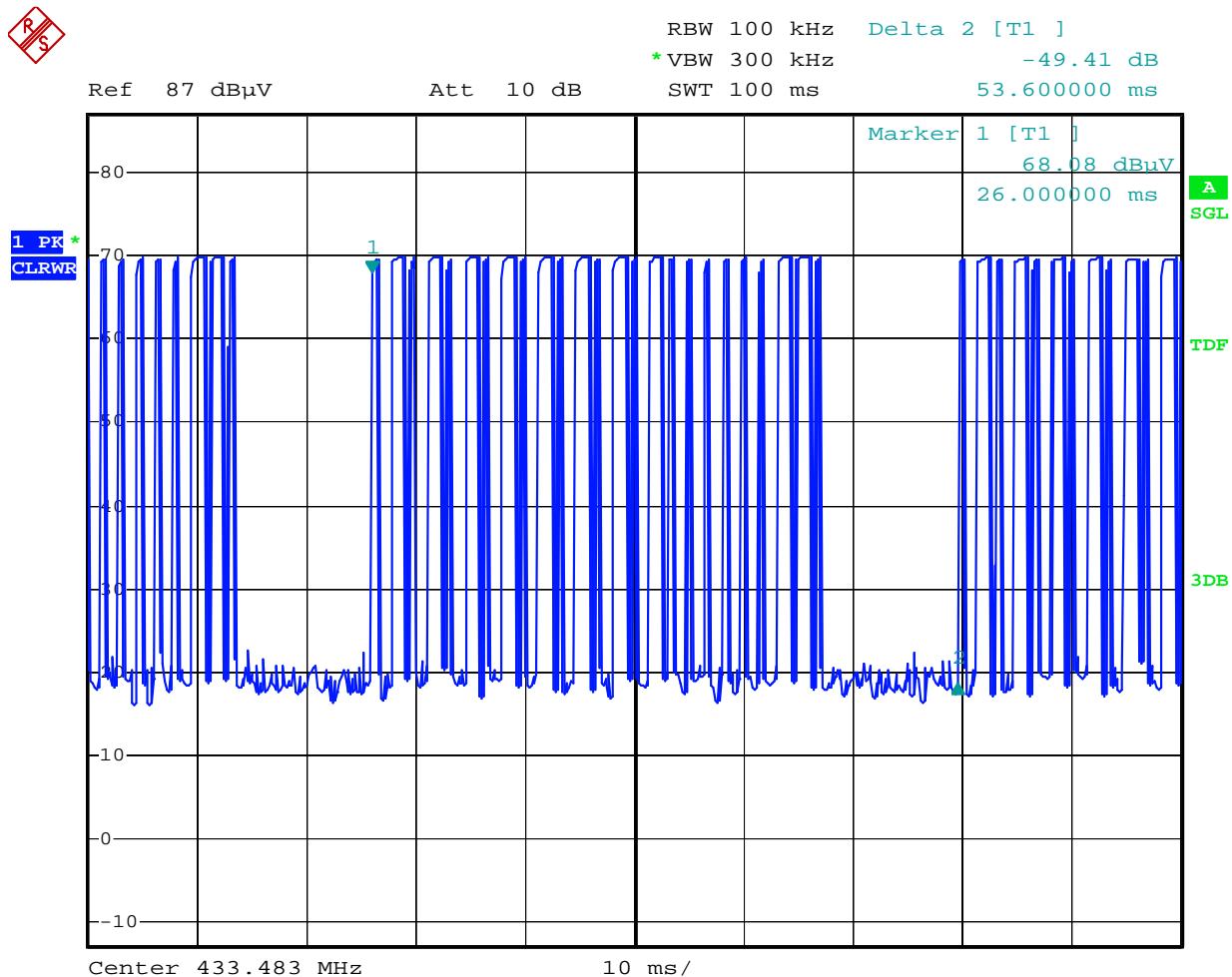
Job No.: Kai #1018	Polarization: Vertical
Standard: FCC Class B 3M Radiated	Power Source: DC 1.5V
Test item: Radiation Test	Date: 2011/09/28
Temp.( C)/Hum.(%) 24 C / 48 %	Time: 11:58:52
EUT: Motor Diver Spinner	Engineer Signature: Kai
Mode: TX	Distance: 3m
Model: 360	
Manufacturer: Opal Manufacturing Co.,Ltd	
Note: Report No.:ATE20112048	



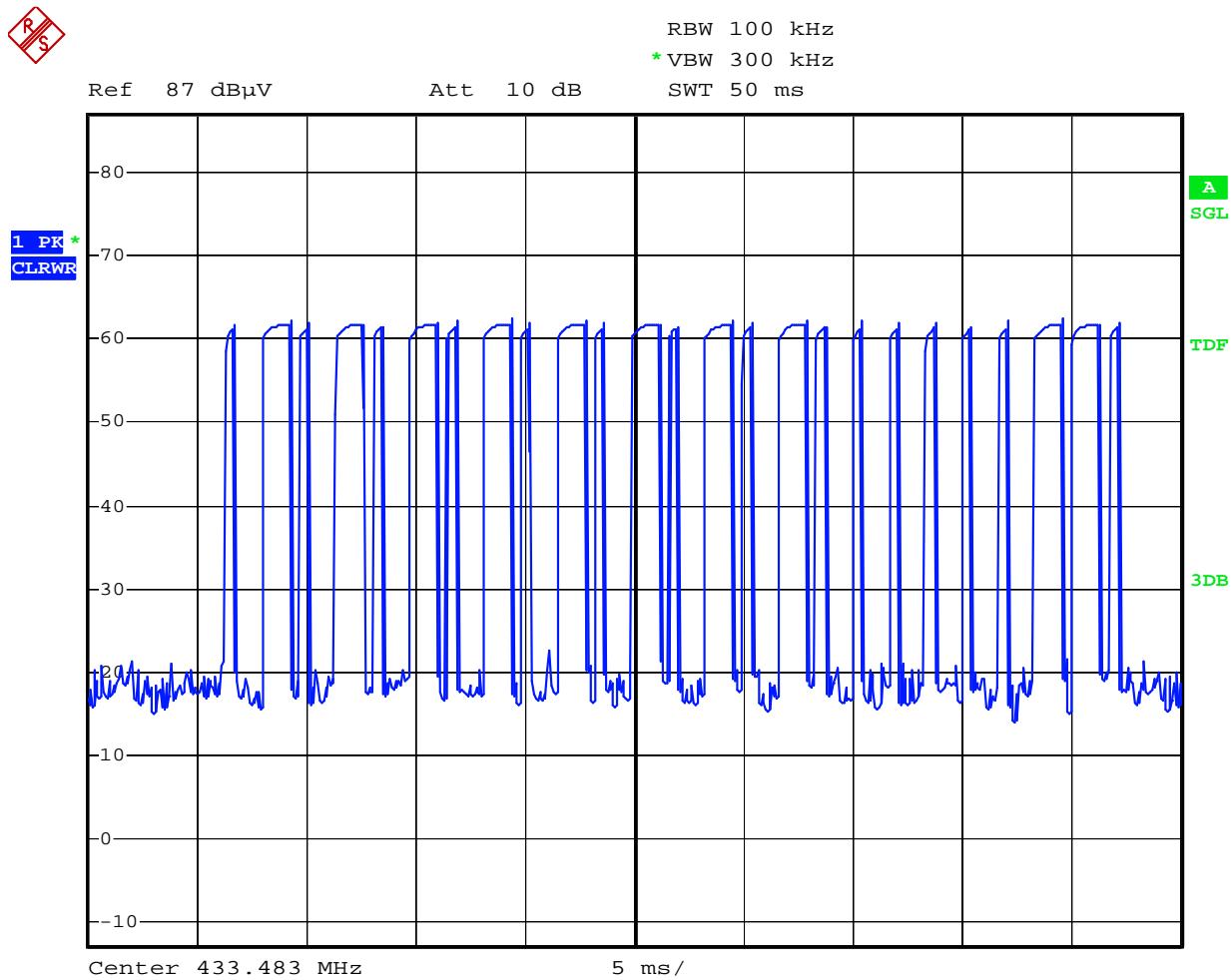
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	1300.439	63.10	-12.20	50.90	74.00	-23.10	peak			
2	1733.597	61.05	-10.39	50.66	80.80	-30.14	peak			
3	2167.419	58.65	-8.40	50.25	80.80	-30.55	peak			
4	2600.245	57.07	-6.72	50.35	80.80	-30.45	peak			
5	3034.521	54.31	-4.93	49.38	80.80	-31.42	peak			
6	3467.375	53.31	-3.33	49.98	80.80	-30.82	peak			
7	3901.383	50.67	-2.10	48.57	74.00	-25.43	peak			
8	4334.198	50.65	-1.94	48.71	74.00	-25.29	peak			
9	4767.852	49.32	-0.49	48.83	74.00	-25.17	peak			



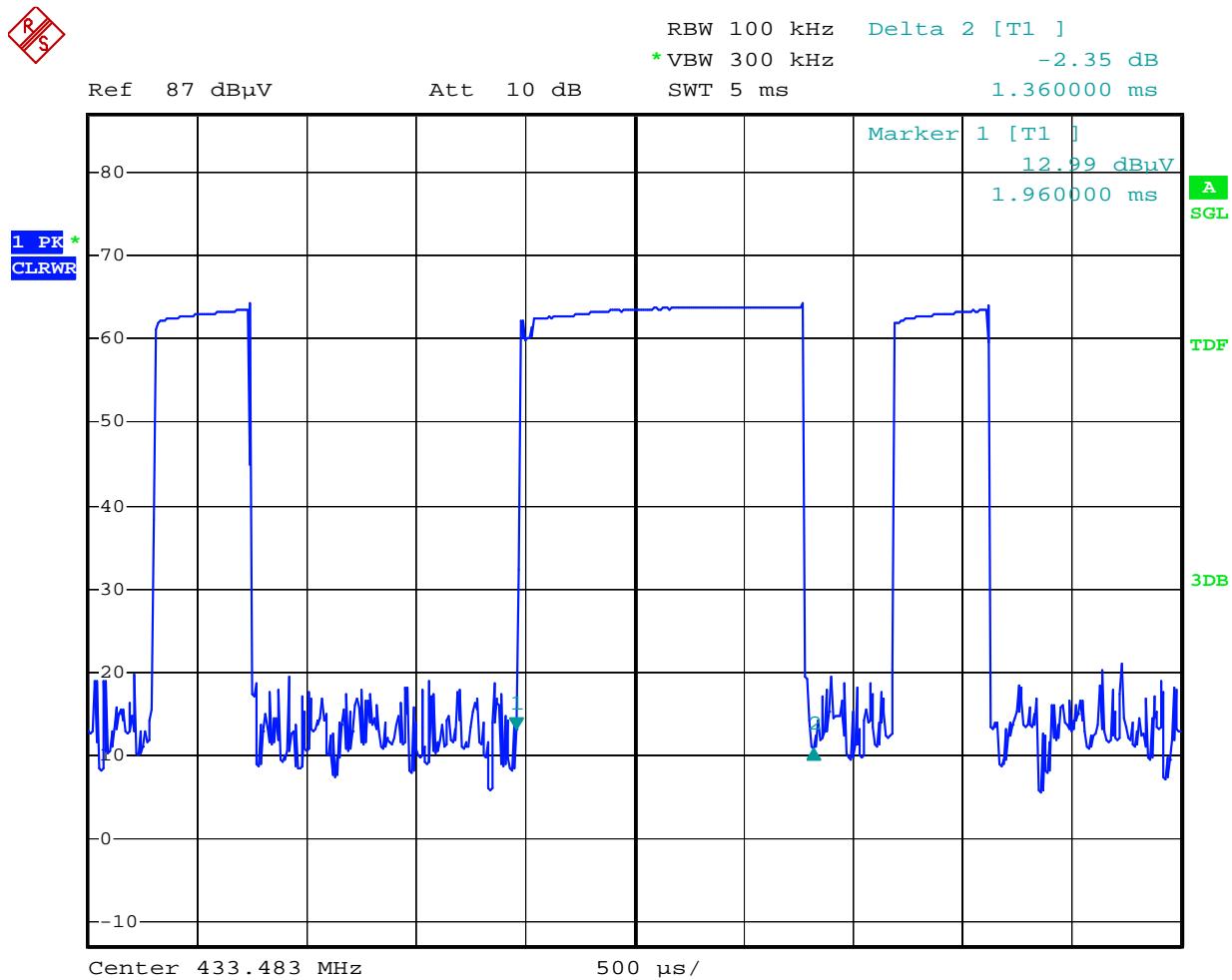




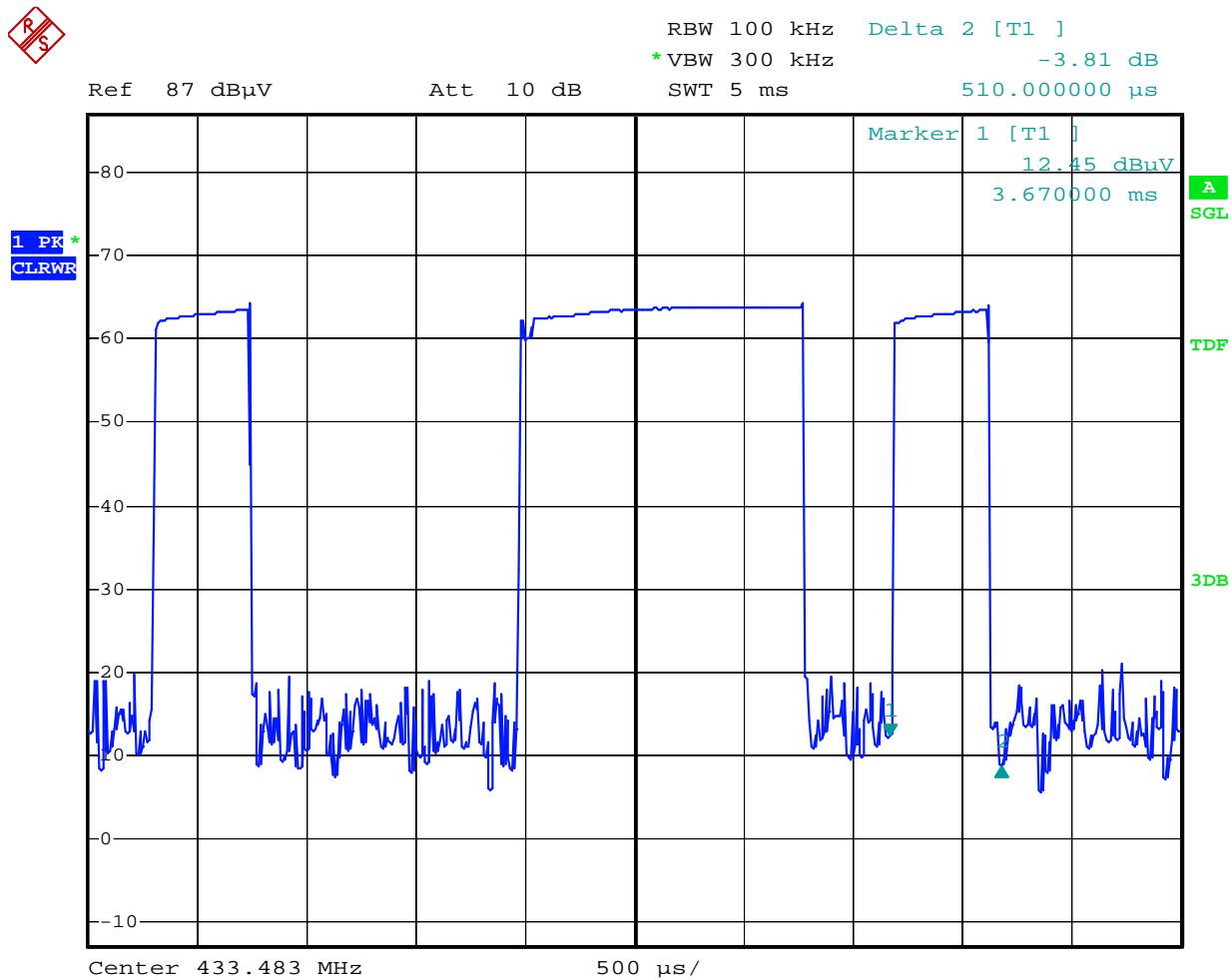
The graph shows the pattern of coding during the signal transmission.  
 The duration of one cycle = 53.6 ms.



The graph shows the pattern of coding during the signal transmission.



The graph shows the duration of 'on' signal. From marker 1 to marker 2, duration is 1.36 ms.



The graph shows the duration of 'on' signal. From marker 1 to marker 2, duration is 0.51 ms.