Test Report of FCC Part 15 C for FCC Certificate

On Behalf of

HONGKONG KINGDOM INTERNATIONAL TRADE CO., LTD.

Product description:	**Waterproof Radio Firing System**
Model No.:	**KFE2203D, KFE2203E, KFE2209, KFE2204, KFE2204D**
FCC ID:	**XVN-KFE2203E**

Prepared for: **HONGKONG KINGDOM INTERNATIONAL TRADE CO., LTD.**

202#, JIEFANG ROAD, LIUYANG 410300 CHANGSHA HUNAN China

Prepared by: **Bontek Compliance Laboratory Ltd**

1/F, Block East H-3, OCT Eastern Ind. Zone, Qiaocheng East Road, Nanshan, Shenzhen, China
Tel: 86-755-86337020
Fax: 86-755-86337028

Report No.: BCT09JR-1026E
Issue Date: Oct 29, 2009
Test Date: Oct 21~29, 2009

Test by: Kendy Wang

Reviewed By: Tony Wu

TABLE OF CONTENTS

1 - GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant:	**HONGKONG KINGDOM INTERNATIONAL TRADE CO., LTD.**
Address of applicant:	202#, JIEFANG ROAD, LIUYANG 410300 CHANGSHA HUNAN China
Manufacturer:	**LIUYANG KINGDOM CO., LTD.**
Address of manufacturer:	NO 768#, XINSHUYUAN, LIUYANG CITY, HUNAN PROVINCE, CHINA.

General Description of E.U.T

Items	Description
EUT Description:	Waterproof Radio Firing System
Trade Name:	KINGDOM
Model No.:	KFE2203E
Supplementary Model No.:	KFE2203D, KFE2209, KFE2204, KFE2204D
Rated Voltage	DC 12V for battery
Frequency range	315.056MHz
Number of channels	1
Antenna Type:	Built-in Antenna
Channel Separation	None
Product Class:	Low Power Communication Device Transmitter

** The test data gathered are from the production sample provided by the manufacturer.*

1.2 Test Standards

The following Declaration of Conformity report of EUT is prepared in accordance with

FCC Rules and Regulations Part 15 Subpart C Section 15.231

The objective of the manufacturer is to demonstrate compliance with the described above standards.

1.3 Test Summary

For the EUT described above. The standards used were FCC Part 15 Subpart C Section 15.231 for Emissions

Tests Carried Out Under FCC Part 15 Subpart C

Standard	Test Items	Status	Application
Part 15 Subpart C Section 15.231	Disturbance Voltage at The Mains Terminals	×	NO AC Input
	Radiation Emission	√	
	20dB Bandwidth	√	
	Duty Cycle	√	
	Transmission time	√	
	Antennal requirement	√	

√ Indicates that the test is applicable
× Indicates that the test is not applicable

1.4 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.

The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the Operating Instructions.

The maximum emission levels emanating from the device are compared to the Part 15 Subpart C Section 15.231 limits for radiation emissions and the measurement results contained in this test report show that EUT is to be technically compliant with FCC requirements.

All measurement required was performed at Bontek Compliance Testing Laboratory Ltd at 1/F, Block East H-3, OCT Eastern Ind. Zone, Qiaocheng East Road, Nanshan, Shenzhen, China

1.5 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

FCC – Registration No.: 338263
Bontek Compliance Testing Laboratory Ltd, EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 338263, March, 2008.

IC Registration No.: 7631A
The 3m alternate test site of Bontek Compliance Testing Laboratory Ltd EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration NO.: 7631A on August 2009.

CNAS - Registration No.: L3923
Bontek Compliance Testing Laboratory Ltd,to ISO/IEC 17025:25 General Requirements for the Competence of Testing and Calibration Laboratories(CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing. The acceptance letter from the CNAS is maintained in our files: Registration:L3923,February,2009.

1.6 Test Equipment List and Details

Equipment	Manufacturer	Model No.	Last Cal	Calibration Period
EMI Test Receiver	R&S	ESCI	2009-2-22	1 year
EMI Test Receiver	R&S	ESPI7	2009-2-22	1 year
Amplifier	HP	8447D	2009-2-22	1 year
Single Power Conductor Module	FCC	FCC-LISN-5-50-1-01-CISPR25	2009-2-22	1 year
TRILOG Broadband Test-Antenna	SCHWARZBECK	VULB9163	2009-2-22	1 year
Horn Antenna	SCHWARZBECK	BBHA9120A	2009-2-27	1 year
High Field Biconical Antenna	ELECTRO-METRICS	EM-6913	2009-2-27	1 year
Log Periodic Antenna	ELECTRO-METRICS	EM-6950	2009-2-27	1 year
Remote Active Vertical Antenna	ELECTRO-METRICS	EM-6892	2009-2-27	1 year
Power Clamp	SCHWARZBECK	MDS-21	2009-2-22	1 year
Teo Line Single Phase Module	SCHWARZBECK	NSLK8128	2009-3-31	1 year
Positioning Controller	C&C	CC-C-1F	2009-2-22	1 year
`Electrostatic Discharge Simulator	TESEQ	NSG437	2009-3-31	1 year
Fast Transient Burst Generator	SCHAFFNER	MODULA6150	2009-2-22	1 year
Fast Transient Noise Simulator	Noiseken	FNS-105AX	2009-2-22	1 year
Capacitive Coupling Clamp	TESEQ	CDN8014	2009-2-22	1 year
Color TV Pattern Genenator	PHILIPS	PM5418	2009-2-22	1 year
Power Frequency Magnetic Field Generator	EVERFINE	EMS61000-8K	2009-2-22	1 year
Triple-Loop Antenna	EVERFINE	LLA-2	2009-2-22	1 year

2 - SYSTEM TEST CONFIGURATION

2.1 Justification

The system was configured for testing in a typical fashion (as normally used by a typical user).

2.2 EUT Exercise Software

The EUT exercising program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. The software offered by manufacture, can let the EUT being normal operation.

2.3 Equipment Modifications

The EUT tested was not modified by Bontek.

2.4 Basic Test Setup Block Diagram

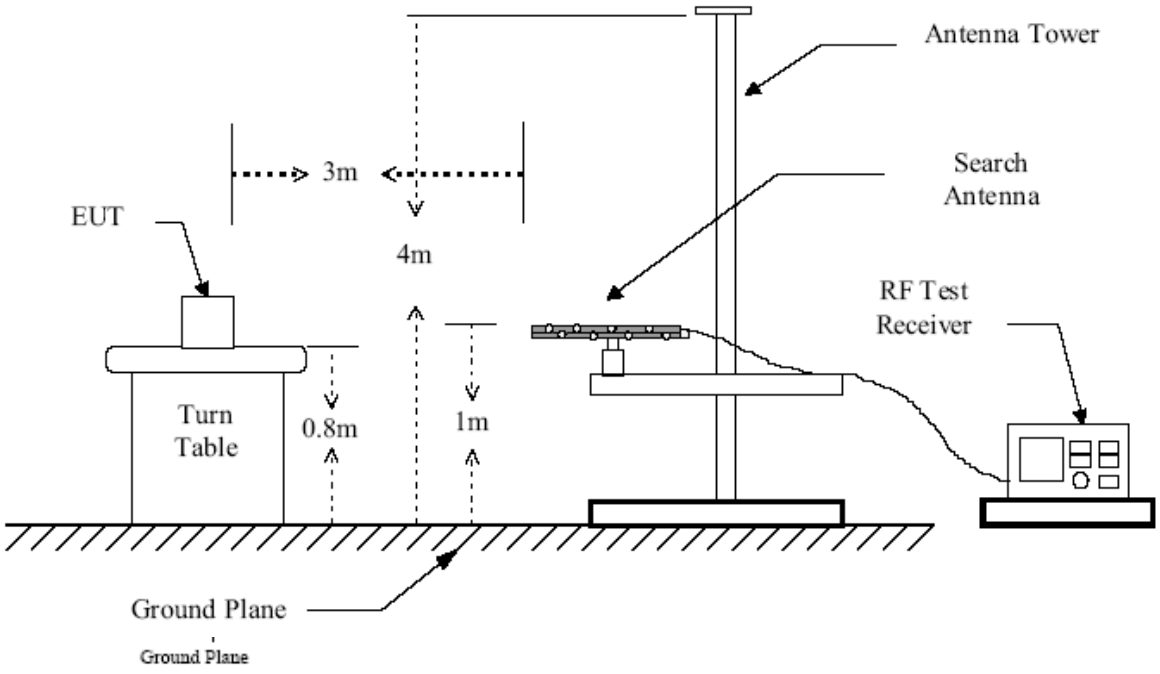


Figure 1 : Frequencies measured below 1 GHz configuration

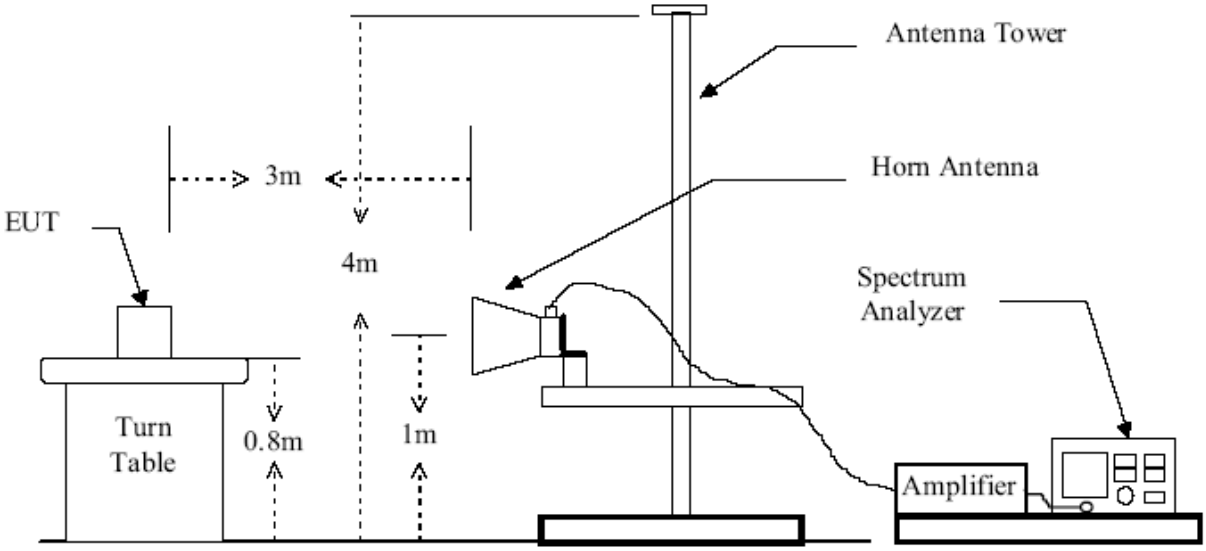


Figure 2 : Frequencies measured above 1 GHz configuration

3- RADIATED DISTURBANCES

3.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement is ±4.0 dB.

3.2 Limit of Radiated Disturbances

According to 15.231(b), the field strength of emissions from Intentional Radiators operated under this section shall not exceed the following:

Fundamental Frequency	Field Strength of Fundamental		Field Strength of Spurious	
(MHz)	(dBuV/m)	(uV/m)	(dBuV/m)	(uV/m)
40.66 - 40.70	67.04	2,250	47.04	225
70 - 130	61.94	1,250	41.94	125
130 - 174	* 61.94 - 71.48	* 1,250 -3,750	* 41.94 - 51.48	* 125 - 375
174 - 260	71.48	3,750	51.48	375
260 - 470	* 71.48 - 81.94	* 3,750 - 12,500	* 51.48 - 61.94	* 375 - 1,250
above 470	81.94	12,500	61.94	1,250

** linear interpolations
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, uV/m at 3 meters = 56.81818(F) - 6136.3636; for 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.]

3.3 EUT Setup

The radiated emission tests were performed in the in the 3-meter anechoic chamber, using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC Part 15 Subpart B limits.

The EUT was placed on the center of the test table. In the frequency range below 1 GHz, Ultra-Broadband Antenna horn-antenna is used. In the frequency range above 1 GHz horn-antenna is used. Test setup refer to **Section 2.5 Basic Test Setup Block Diagram** of this report.

Maximum emission emitted from EUT was determined by manipulating the EUT, support equipment, interconnecting cables and varying the mode of operation and the levels in the final result of the test were recorded with the EUT running in the operating mode that maximum emission was emitted.

3.4 Test Receiver Setup

According to FCC Part 15 rule, the frequency was investigated from 30 to 4000 MHz. During the radiated emission test, the test receiver was set with the following configurations:

Test Receiver Setting for frequency range below 1000MHz:

Detector……..Peak & Quasi-Peak
IF Band Width……100KHz
Frequency Range……30MHz to 1000MHz
Turntable Rotated……0 to 360 degrees

Test Receiver Setting for frequency range above 1000MHz:

Detector……..Peak
IF Band Width……1MHz
Frequency Range……1000MHz to 4000MHz
Turntable Rotated……0 to 360 degrees

Antenna Position:

Height……1m to 4m
Polarity……...Horizontal and Vertical

3.5 Test Procedure

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

1). Configure the EUT according to ANSI C63.4:2003.

2). The EUT was placed on the top of the turntable 0.8 meter above ground.

3). The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.

4). Power on the EUT and all the supporting units.

5). The turntable was rotated by 360 degrees to determine the position of the highest radiation.

6). The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of both horizontal and vertical polarization.

7). For each suspected emission, the antenna tower was scanned (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.

8). Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode. Then all data was recorded in the peak detection mode. Quasi-peak readings performed only when an emission was found to be marginal (within -10 dBμV of specification limits), and are distinguished with a "**QP**" in the data plots.

3.6 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude Indicated reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Transd.

Transd.= Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dBμV means the emission is 7dBμV below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. –Limit

3.7 Radiated Emissions Test Result

Temperature (℃) : 22~23	EUT: Waterproof Radio Firing System
Humidity (%RH): 50~54	M/N: KFE2203E
Barometric Pressure (mbar): 950~1000	Operation Condition: Normal

Test plots see following pages

433.84 MHz Tx in operation							
Maximum Frequency (MHz)	**Emission Position and Level**					**Limit**	**Margin**
	Polarity	**m**	**Deg°**	**Transd**	**dBµV/m**	**dBµV/m**	**dBµV/m**
42.456	V	1.85	156.0	20.8	22.32	40.00	17.68
59.322	V	1.40	90.0	21.5	21.45	40.00	18.55
94.351	V	1.60	105.0	23.2	22.33	40.00	17.67
315.056	V	1.65	65.0	23.1	55.43	75.62	20.19
630.112	V	1.95	155.0	23.5	32.54	46.00	13.46
945.168	V	1.30	85.0	24.1	31.65	55.62	23.97
1260.224	V	---	---	---	---	55.62	---
1575.280	V	---	---	---	---	55.62	---
1890.336	V	---	---	---	---	55.62	---
2205.392	V	---	---	---	---	55.62	---
Maximum Frequency (MHz)	**Emission Position and Level**					**Limit**	**Margin**
	Polarity	**m**	**Deg°**	**Transd**	**dBµV/m**	**dBµV/m**	**dBµV/m**
42.456	H	1.35	165.0	20.8	24.36	40.00	15.64
59.322	H	1.55	175.0	21.5	21.32	40.00	18.68
94.351	H	1.65	85.0	23.2	20.41	40.00	19.59
315.056	H	1.15	45.0	23.1	55.42	75.62	20.20
630.112	H	1.45	135.0	23.5	33.43	46.00	12.57
945.168	H	1.75	90.0	24.1	31.08	55.62	24.54
1260.224	H	1.85	30.0	24.1	30.21	55.62	25.41
1575.280	H	---	---	---	---	55.62	---
1890.336	H	---	---	---	---	55.62	---
2205.392	H	---	---	---	---	55.62	---

Remark:

--- Means that The emission level of the rest measuring harmonic up to 5GHz are so low below applicable limit in operation mode, so the result were not recorded.

4- 20dB BANDWIDTH

4.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement is ±4.0 dB.

4.2 Limit of 20dB Bandwidth

In accordance with Part15.231(c), the fundamental frequency bandwidth was kept within 0.25% of the center frequency for devices operating>70MHz and <900MHz.

Fundamental Frequency (MHz)	Limit of 20dB Bandwidth (kHz)
315.056	315056x0.0025=787.64

4.3 EUT Setup

The radiated emission tests were performed in the in the 3-meter anechoic chamber, using the setup accordance with the ANSI C63.4-2003.

The EUT was placed on the center of the nonmetal table which is 0.8 meter above a grounded turntable. The turntable can rotate 360 degrees to determine the azimuth of the maximum emission level.

Maximum emission emitted from EUT was determined by manipulating the EUT, support equipment, interconnecting cables and varying the mode of operation and the levels in the final result of the test were recorded with the EUT running in the operating mode that maximum emission was emitted.

4.4 Test Procedure

1) Turn on the transmitter, and set it to transmit the pulse train continuously.

2) Set Test Receiver into spectrum analyzer mode, Tune the spectrum analyzer to the transmitter carrier frequency, and set the spectrum analyzer resolution bandwidth(RBW) to 10kHz and video bandwidth(VBW) to 10kHz, then select Peak function to scan the channel frequency.

3) The 20dB bandwidth was measured and recorded.

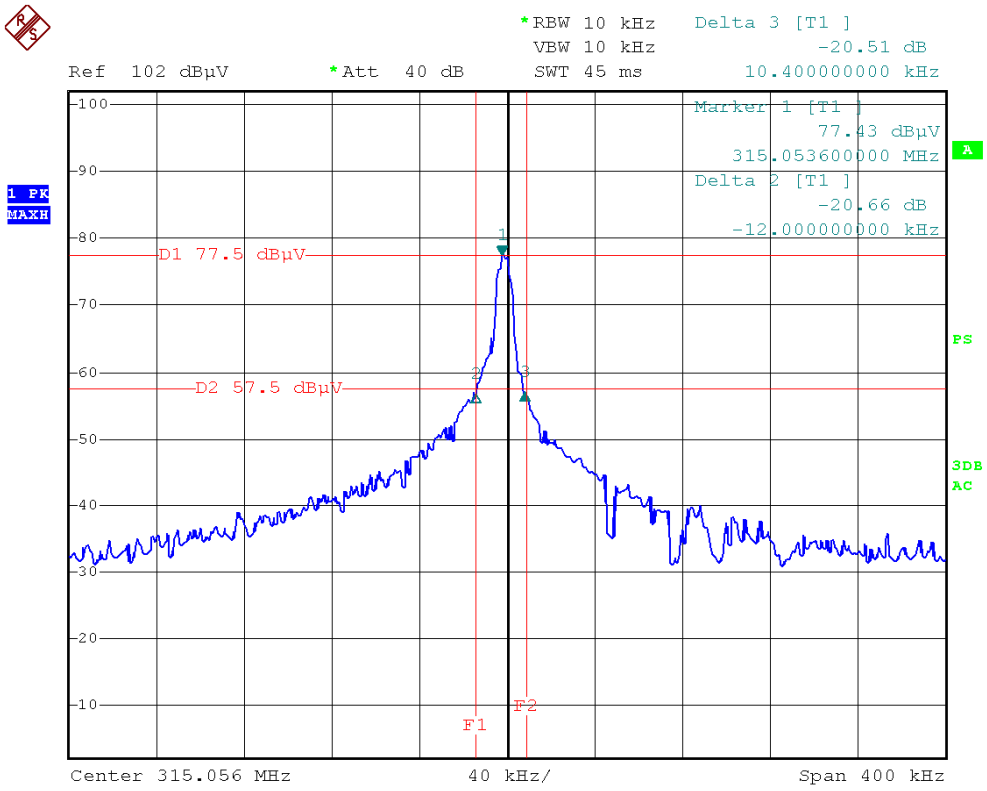
Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

4.5 Emissions within Band Edges Test Result

Temperature (℃) : 22~23	EUT: Waterproof Radio Firing System
Humidity (%RH): 50~54	M/N: KFE2203E
Barometric Pressure (mbar): 950~1000	Operation Condition: Normal

Test plots see following pages

Fundamental Frequency (MHz)	20dB Bandwidth (kHz)	Maximum Limit (kHz)	Pass/Fail
315.056	22.4	787.64	Pass



Date: 28.OCT.2009 10:03:57

5- Duty Cycle

5.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement is ±4.0 dB.

5.2 EUT Setup

The radiated emission tests were performed in the in the 3-meter anechoic chamber, using the setup accordance with the ANSI C63.4-2003.

The EUT was placed on the center of the nonmetal table which is 0.8 meter above a grounded turntable. The turntable can rotate 360 degrees to determine the azimuth of the maximum emission level.

5.3 Test Procedure

1) The EUT was placed on a turntable which is 0.8m above ground plane.

2) Set EUT operating in continuous transmitting mode

3) Set Test Receiver into spectrum analyzer mode, Tune the spectrum analyzer to the transmitter carrier frequency, and set the spectrum analyzer resolution bandwidth(RBW) to 1000kHz and video bandwidth(VBW) to 1000kHz, Span was set to 0Hz.

4) The Duty Cycle was measured and recorded.

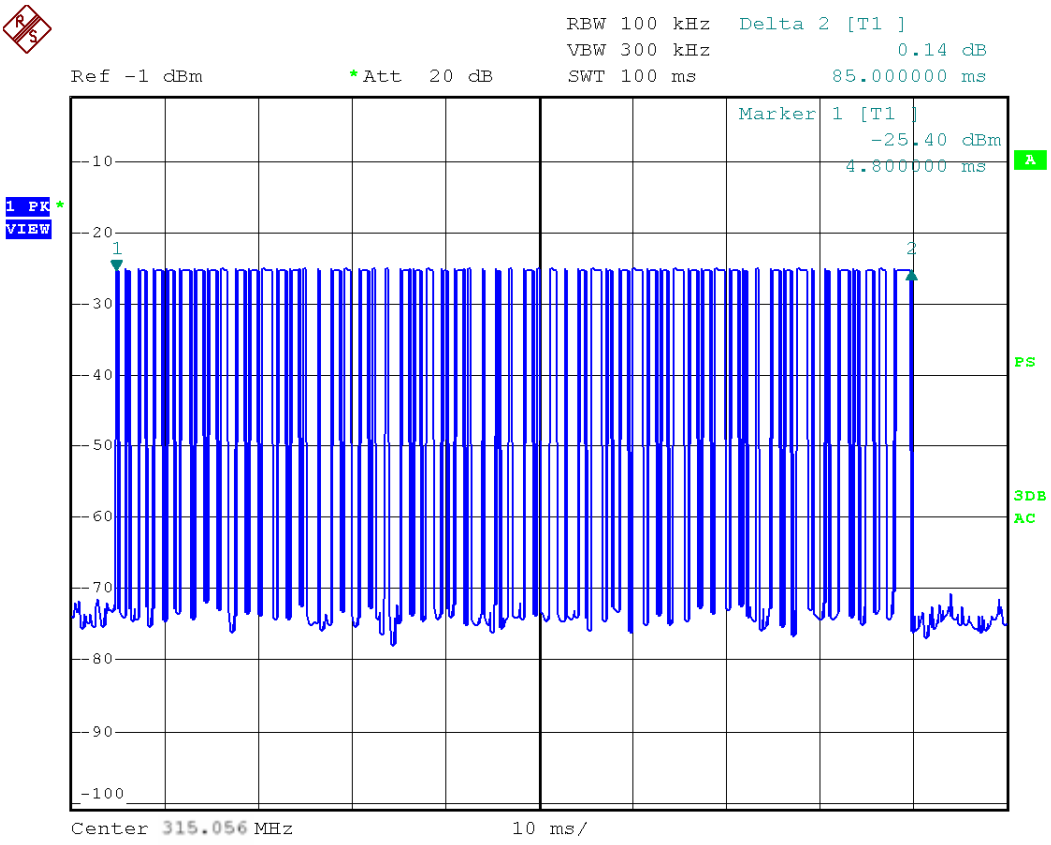
5.4 Measurement Result

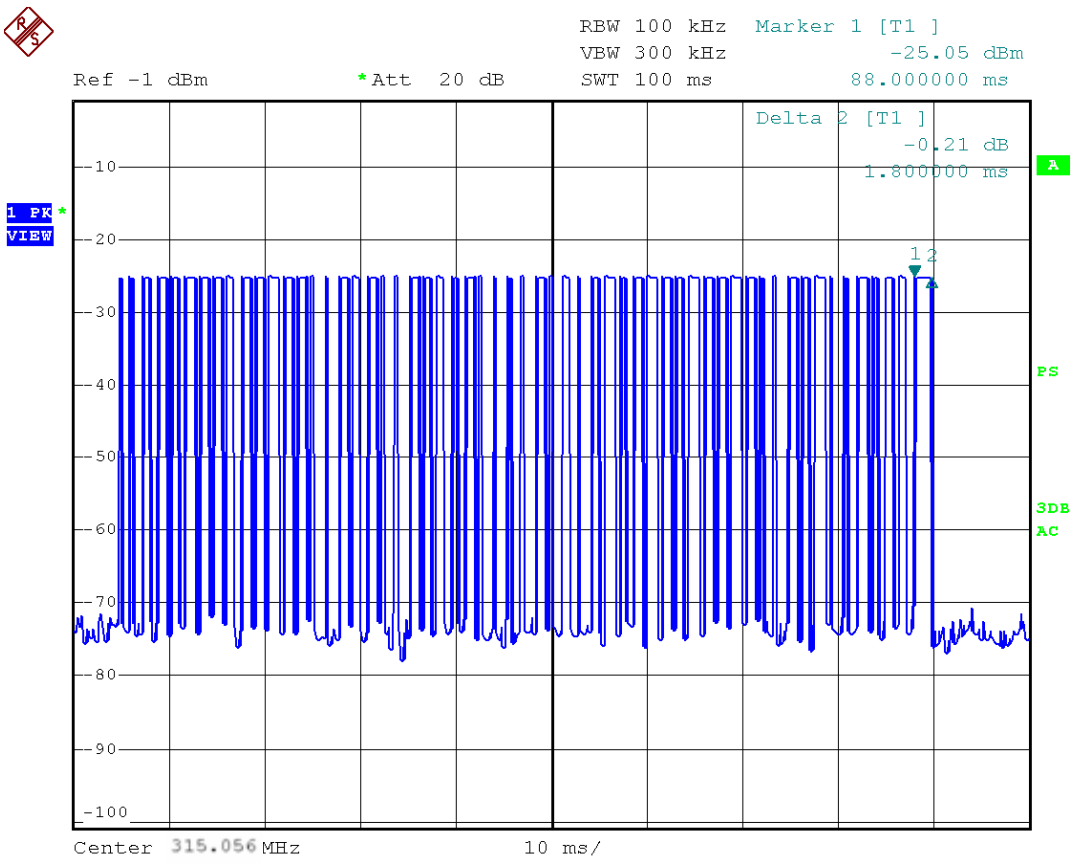
Temperature (℃) : 22~23	EUT: Waterproof Radio Firing System
Humidity (%RH): 50~54	M/N: KFE2203E
Barometric Pressure (mbar): 950~1000	Operation Condition: Normal

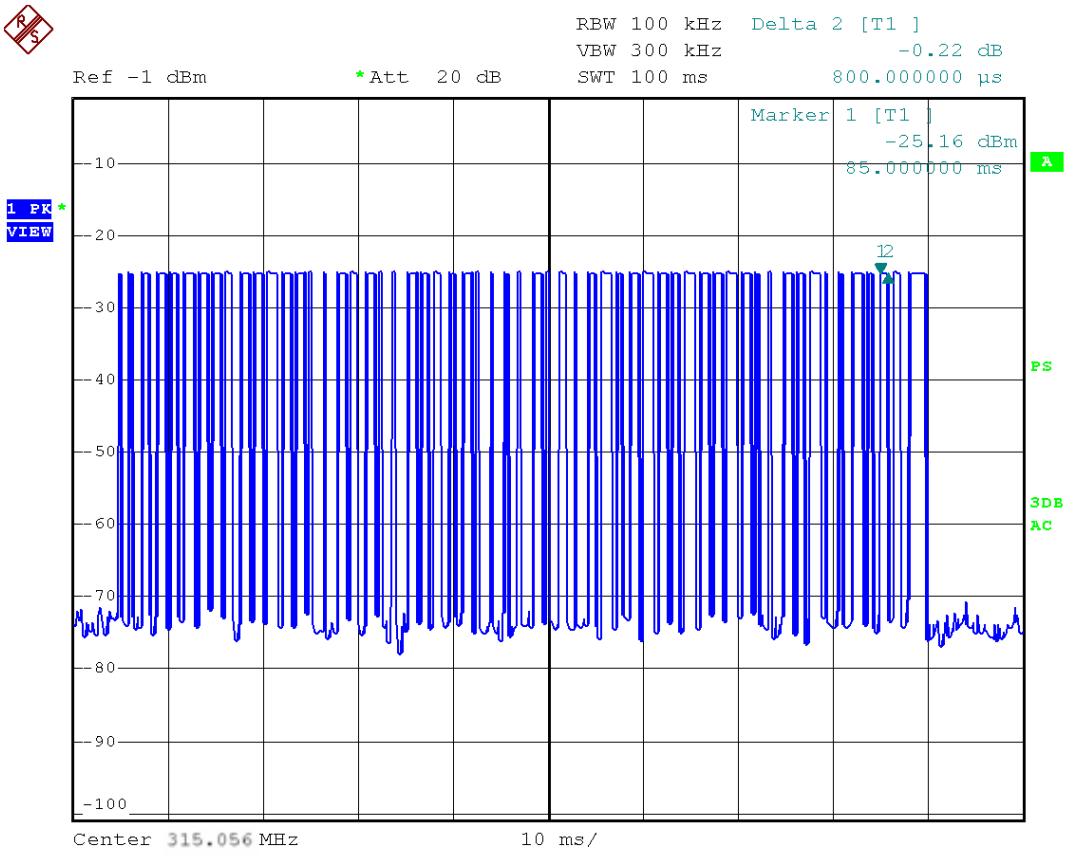
Test plots see following pages

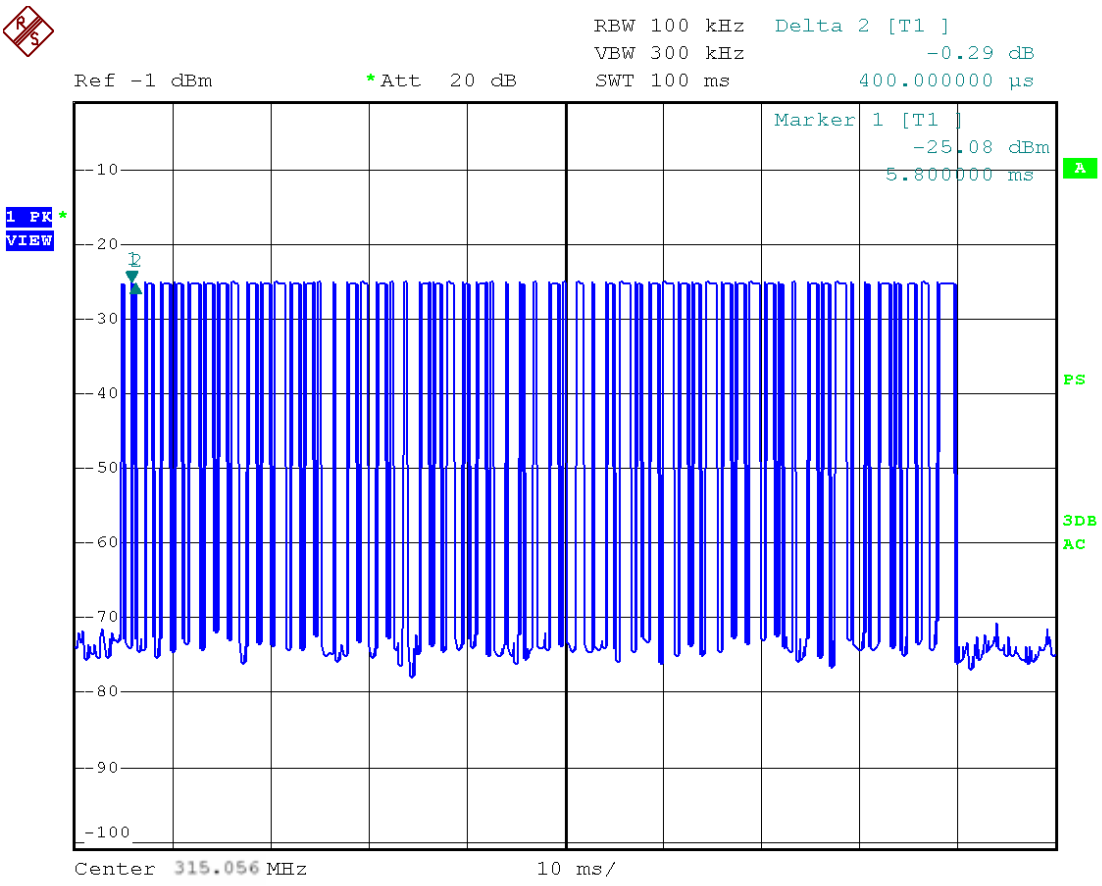
Total Pulse Time of Transmitter = 1.8 msec×1 + 0. 8msec×36+0.4msec×20= 38.6msec

The Duty Cycle= 20*log(38.6/85)= -6.85dB


RBW 100 kHz
Delta 2 [T1]
VBW 300 kHz
0.14 dB
Ref -1 dBm
*Att 20 dB
SWT 100 ms
85.000000 ms
Marker 1 [T1]
-25.40 dBm
4.800000 ms
1 PK
VIEW
A
PS
3DB
AC
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
Center 315.056 MHz
10 ms/


RBW 100 kHz
VBW 300 kHz
SWT 100 ms
Marker 1 [T1]
-25.05 dBm
88.000000 ms
Ref -1 dBm
*Att 20 dB
Delta 2 [T1]
-0.21 dB
1.800000 ms
1 PK
VIEW
A
PS
3DB
AC
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
Center 315.056 MHz
10 ms/


RBW 100 kHz
Delta 2 [T1]
VBW 300 kHz
-0.22 dB
Ref -1 dBm
*Att 20 dB
SWT 100 ms
800.000000 µs
Marker 1 [T1]
-25.16 dBm
85.000000 ms
1 PK
VIEW
A
PS
3DB
AC
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
Center 315.056 MHz
10 ms/


RBW 100 kHz
Delta 2 [T1]
VBW 300 kHz
-0.29 dB
Ref -1 dBm
*Att 20 dB
SWT 100 ms
400.000000 µs
Marker 1 [T1]
-25.08 dBm
5.800000 ms
1 PK
VIEW
A
PS
3DB
AC
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
Center 315.056 MHz
10 ms/

6- Transmission Time

6.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement is ±4.0 dB.

6.2 EUT Setup

The radiated emission tests were performed in the in the 3-meter anechoic chamber, using the setup accordance with the ANSI C63.4-2003.

The EUT was placed on the center of the nonmetal table which is 0.8 meter above a grounded turntable. The turntable can rotate 360 degrees to determine the azimuth of the maximum emission level.

6.3 Test Procedure

3) The EUT was placed on a turntable which is 0.8m above ground plane.

4) Set EUT operating in continuous transmitting mode

3) Set Test Receiver into spectrum analyzer mode, Tune the spectrum analyzer to the transmitter carrier frequency, and set the spectrum analyzer resolution bandwidth(RBW) to 1000kHz and video bandwidth(VBW) to 1000kHz, Span was set to 0Hz.

5) The Transmission time was measured and recorded.

6.4 Limit of Transmission time

In accordance with Part15.231(a)(2), A transmitter activated automatically shall cease transmission within 5 seconds afteractivation

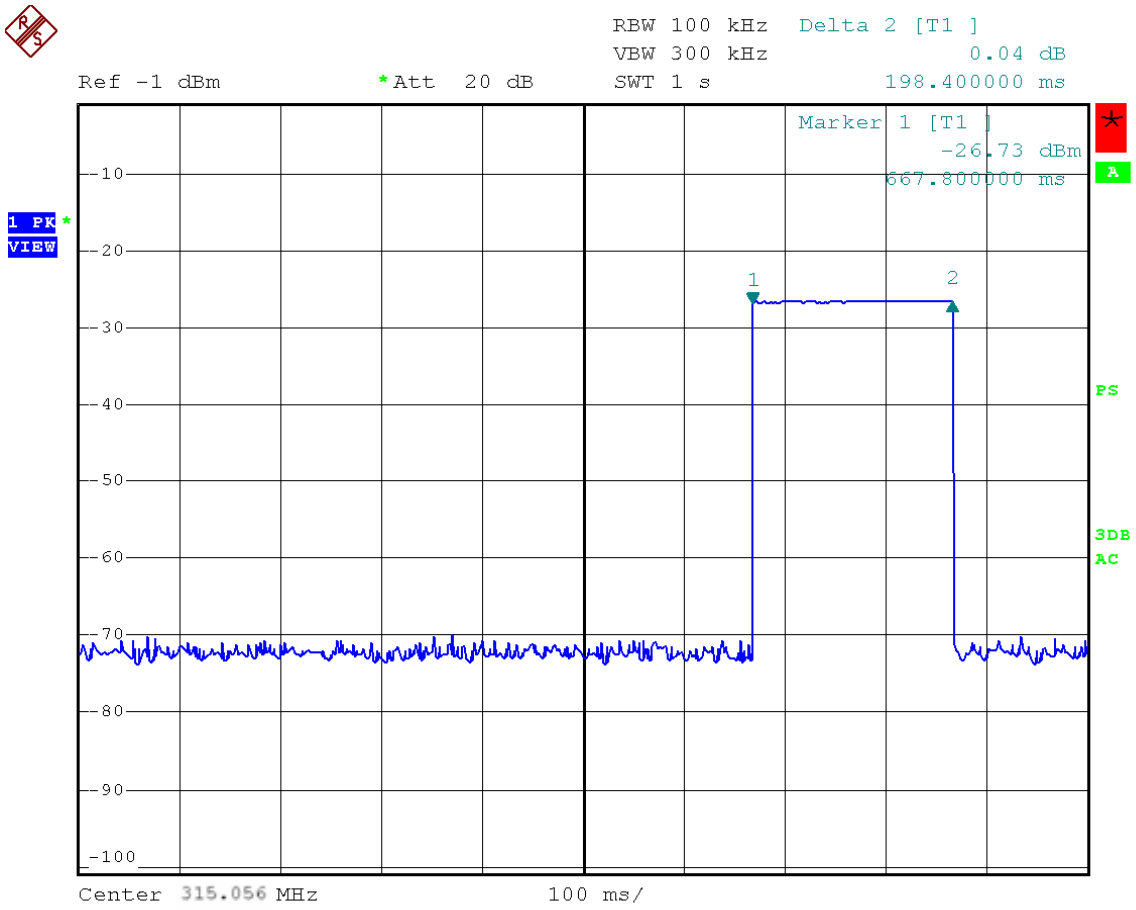
Fundamental Frequency (MHz)	Limit of Transmission (S)
315.056	5

6.5 Transmission Time Test Result

Temperature (℃) : 22~23	EUT: Waterproof Radio Firing System
Humidity (%RH): 50~54	M/N: KFE2203E
Barometric Pressure (mbar): 950~1000	Operation Condition: Normal

Test plots see following pages

Fundamental Frequency (MHz)	Transmission time (S)	Maximum Limit (S)	Pass/Fail
315.056	0.1984	5	Pass



7- ANTENNA REQUIREMENT

7.1 Standard Applicable

Section 15.203:

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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

7.2 Antenna Connected Construction

The antenna connector is designed with permanent attachment and no consideration of replacement.