

FCC PART 15.249

TEST REPORT

For

GODOX Photo Equipment Co.,Ltd.

19th Floor, Room 1902, Building Jinshan, 5033 Shennan East Road, Luohu District, Shenzhen
518001, China

FCC ID: 2ABYNTT685C

Report Type: Original Report		Product Type: Thinklite TTL Camera Flash	
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Report Number:	RDG150730001-00		
Report Date:	2015-08-11		
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *GODOX Photo Equipment Co.,Ltd.*'s product, model number: *TT685C(FCC ID: 2ABYNTT685C)* (the "EUT") in this report was a *Thinklite TTL Camera Flash*, was measured approximately: 19cm (L) x 7.6 cm (W) x 6.4 cm(H), rated input voltage: DC6V from 4×1.5V AA battery.

Note: the series product, model TT685C, TT685N are electrically identical, the difference between them is TT685C has hotshoe control function, and TT685N don't have this function, we selected TT685C for fully testing, the details was explained in the attached declaration letter.

** All measurement and test data in this report was gathered from production sample serial number: 150730001 (Assigned by BAACL.Dongguan). The EUT was received on 2015-08-03.*

Objective

This type approval report is prepared on behalf of *GODOX Photo Equipment Co.,Ltd.* in accordance with Part 2-Subpart J, and Part 15-Subparts A, B and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.209 and 15.249 rules.

Related Submittal(s)/Grant(s)

N/A

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

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 06, 2015.

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 for testing in engineering mode with maximum power output and switched the channels by key.

Channels list were provided by the manufacturer as follows:

Channel Number	Frequency (GHz)	Channel Number	Frequency (GHz)
1	2.4130	17	2.4395
2	2.4145	18	2.4410
3	2.4160	19	2.4430
4	2.4180	20	2.4445
5	2.4195	21	2.4460
6	2.4210	22	2.4480
7	2.4230	23	2.4495
8	2.4245	24	2.4510
9	2.4260	25	2.4530
10	2.4280	26	2.4545
11	2.4295	27	2.4560
12	2.4310	28	2.4580
13	2.4330	29	2.4595
14	2.4345	30	2.4610
15	2.4360	31	2.4630
16	2.4380	32	2.4645

Channel 1, 16, 32 were selected to test.

EUT Exercise Software

No software was used in test.

Equipment Modifications

No modifications were made to the EUT.

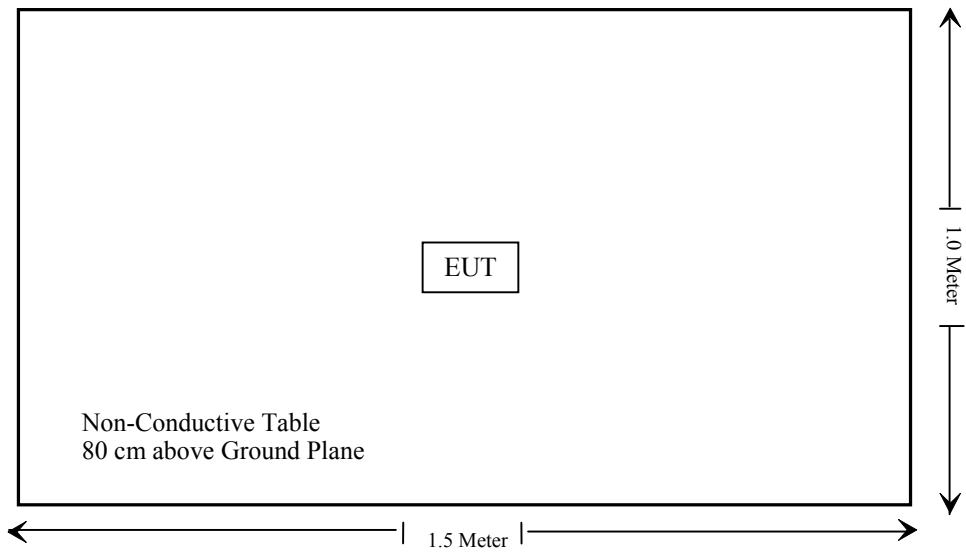
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

Cable Description	Shielding Type	Ferrite Core	Length (m)	From	To
/	/	/	/	/	/

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207(a)	Conduction Emissions	Not Applicable
15.205, §15.209, §15.249	Radiated Emissions	Compliance
§15.215 (c)	20 dB Bandwidth	Compliance
§15.249(d)	Outside of Band Emission (50dB attenuation)	Compliance

Not Applicable: The EUT is battery operated equipment.

FCC§15.203 - ANTENNA REQUIREMENT

Applicable Standard

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used.

Antenna Connector Construction

The EUT has one integral antenna arrangement, which was permanently attached and the antenna gain is 0dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliant.

FCC§15.205, §15.209&§15.249- RADIATED EMISSIONS

Applicable Standard

As per FCC§15.249 (a), except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

As per FCC§15.249 (c), Field strength limits are specified at a distance of 3 meters.

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

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

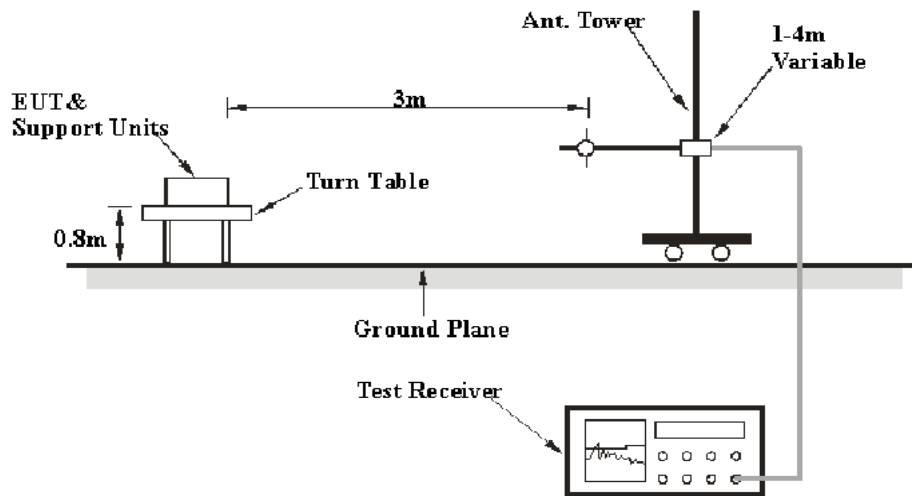
6G~18GHz: 5.23 dB

Table 1 – Values of U_{cispr}

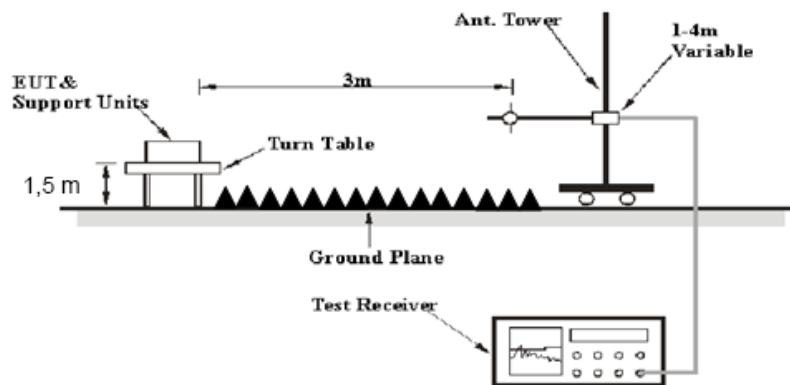
Measurement	U_{cispr}
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

EUT Setup

Below 1 GHz:



Above 1 GHz:



The radiated emission and out of band emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013 The specification used was the FCC 15.209/15.205 and FCC 15.249 limits.

Test Equipment Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	Ave.

Test Procedure

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

All data was recorded in the Quasi-peak detection mode from 30 MHz to 1GHz, peak and average detection mode above 1 GHz.

Corrected Amplitude & Margin Calculation

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

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

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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2015-05-09	2016-05-09
Sunol Sciences	Antenna	JB3	A060611-3	2014-07-28	2017-07-27
HP	Amplifier	8447E	2434A02181	2014-09-01	2015-09-01
R&S	Spectrum Analyzer	E4440A	SG43360054	2014-12-04	2015-12-04
ETS-Lindgren	Horn Antenna	3115	000 527 35	2012-09-06	2015-09-06
Mini-Circuit	Amplifier	ZVA-213-S+	054201245	2015-02-19	2016-02-19
R&S	Spectrum Analyzer	FSP 38	100478	2015-05-09	2016-05-09
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-01 1304	2014-06-16	2017-06-15
Quinstar	Amplifier	QLW- 18405536-JO	15964001001	2014-09-06	2015-09-06
N/A	Coaxial Cable	14m	N/A	2015-05-06	2016-05-06
N/A	Coaxial Cable	8m	N/A	2015-05-06	2016-05-06

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Results Summary

According to the data in the following table, the EUT complied with the FCC Part 15.209 & 15.205 & 15.249, with the worst margin reading of:

10.38 dB at 2413 MHz in the Horizontal polarization

Test Data**Environmental Conditions**

Temperature:	27.8 °C
Relative Humidity:	58%
ATM Pressure:	100.2 kPa

The testing was performed by Allen Qiao on 2015-08-05.

Test Mode: Transmitting

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB(1/m))					
Low Channel: 2413 MHz									
2413	59.01	PK	H	25.67	3.69	0.00	88.37	114.00	25.63
2413	54.26	AV	H	25.67	3.69	0.00	83.62	94.00	10.38
2413	54.5	PK	V	25.67	3.69	0.00	83.86	114.00	30.14
2413	49.77	AV	V	25.67	3.69	0.00	79.13	94.00	14.87
2390	27.41	PK	H	25.61	3.63	0.00	56.65	74.00	17.35
2390	13.73	AV	H	25.61	3.63	0.00	42.97	54.00	11.03
4826	37.62	PK	H	30.65	5.02	27.41	45.88	74.00	28.12
4826	29.03	AV	H	30.65	5.02	27.41	37.29	54.00	16.71
7239	31.85	PK	H	34.17	6.65	25.90	46.77	74.00	27.23
7239	19.05	AV	H	34.17	6.65	25.90	33.97	54.00	20.03
9652	30.25	PK	H	36.06	8.56	27.45	47.42	74.00	26.58
9652	17.91	AV	H	36.06	8.56	27.45	35.08	54.00	18.92
1885	35.67	PK	H	24.37	3.06	27.51	35.59	74.00	38.41
1885	23.35	AV	H	24.37	3.06	27.51	23.27	54.00	30.73
249.4	34.2	QP	H	12.18	1.91	21.49	26.80	46.00	19.20
Middle Channel: 2438 MHz									
2438	58.68	PK	H	25.74	3.76	0.00	88.18	114.00	25.82
2438	53.8	AV	H	25.74	3.76	0.00	83.30	94.00	10.70
2438	54.16	PK	V	25.74	3.76	0.00	83.66	114.00	30.34
2438	49.33	AV	V	25.74	3.76	0.00	78.83	94.00	15.17
4876	37.25	PK	H	30.78	5.15	27.42	45.76	74.00	28.24
4876	28.89	AV	H	30.78	5.15	27.42	37.40	54.00	16.60
7314	31.75	PK	H	34.35	6.74	25.88	46.96	74.00	27.04
7314	18.91	AV	H	34.35	6.74	25.88	34.12	54.00	19.88
9752	30.04	PK	H	36.30	8.61	27.23	47.72	74.00	26.28
9752	17.61	AV	H	36.30	8.61	27.23	35.29	54.00	18.71
3130	32.77	PK	H	27.62	6.92	27.43	39.88	74.00	34.12
3130	20.16	AV	H	27.62	6.92	27.43	27.27	54.00	26.73
1975	35.24	PK	H	24.55	3.06	27.49	35.36	74.00	38.64
1975	23.21	AV	H	24.55	3.06	27.49	23.33	54.00	30.67
249	34.1	QP	H	12.19	1.91	21.49	26.71	46.00	19.29
High Channel: 2464.5 MHz									
2464.5	58.57	PK	H	25.81	3.74	0.00	88.12	114.00	25.88
2464.5	53.74	AV	H	25.81	3.74	0.00	83.29	94.00	10.71
2464.5	53.09	PK	V	25.81	3.74	0.00	82.64	114.00	31.36
2464.5	49.25	AV	V	25.81	3.74	0.00	78.80	94.00	15.20
2483.5	27.51	PK	H	25.86	3.67	0.00	57.04	74.00	16.96
2483.5	13.97	AV	H	25.86	3.67	0.00	43.50	54.00	10.50
4929	37.1	PK	H	30.92	5.34	27.43	45.93	74.00	28.07
4929	28.41	AV	H	30.92	5.34	27.43	37.24	54.00	16.76
7393.5	31.3	PK	H	34.54	6.83	25.86	46.81	74.00	27.19
7393.5	18.43	AV	H	34.54	6.83	25.86	33.94	54.00	20.06
9858	29.6	PK	H	36.56	8.67	26.90	47.93	74.00	26.07
9858	17.14	AV	H	36.56	8.67	26.90	35.47	54.00	18.53
1885	35.38	PK	H	24.37	3.06	27.51	35.30	74.00	38.70
1885	23.27	AV	H	24.37	3.06	27.51	23.19	54.00	30.81
249.4	33.9	QP	H	12.18	1.91	21.49	26.50	46.00	19.50

FCC §15.215(c) – 20 dB BANDWIDTH TESTING

Applicable Standard

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the test table without connection to measurement instrument. Turn on the EUT. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-05-09	2016-05-09
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2015-05-06	2016-05-06
N/A	Coaxial Cable	0.1m	N/A	2015-05-06	2016-05-06

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	27.3°C
Relative Humidity:	59 %
ATM Pressure:	99.8 kPa

* The testing was performed by Allen Qiao on 2015-08-11.

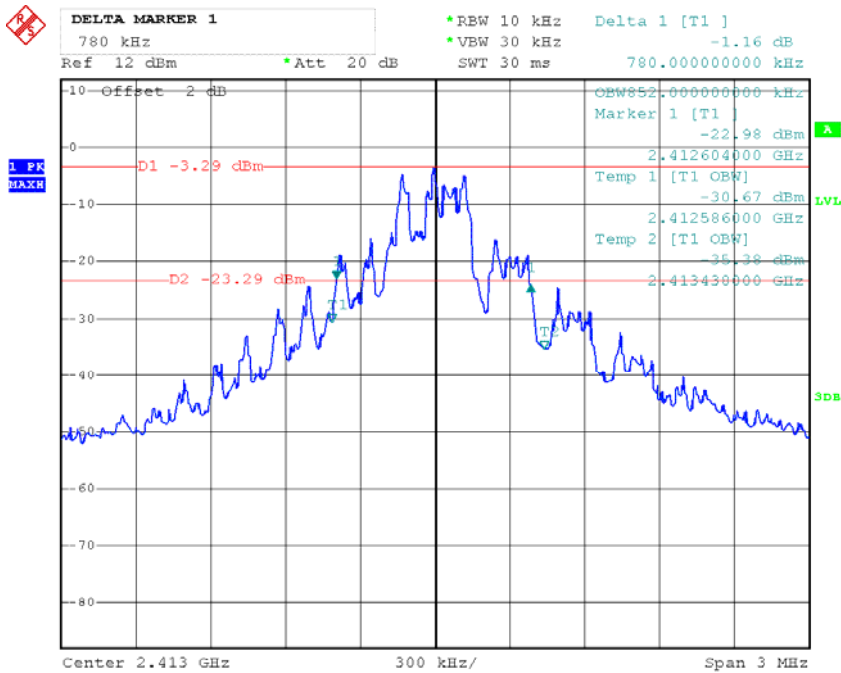
Test Result: Compliant.

Please refer to following tables and plots

Test Mode: Transmitting

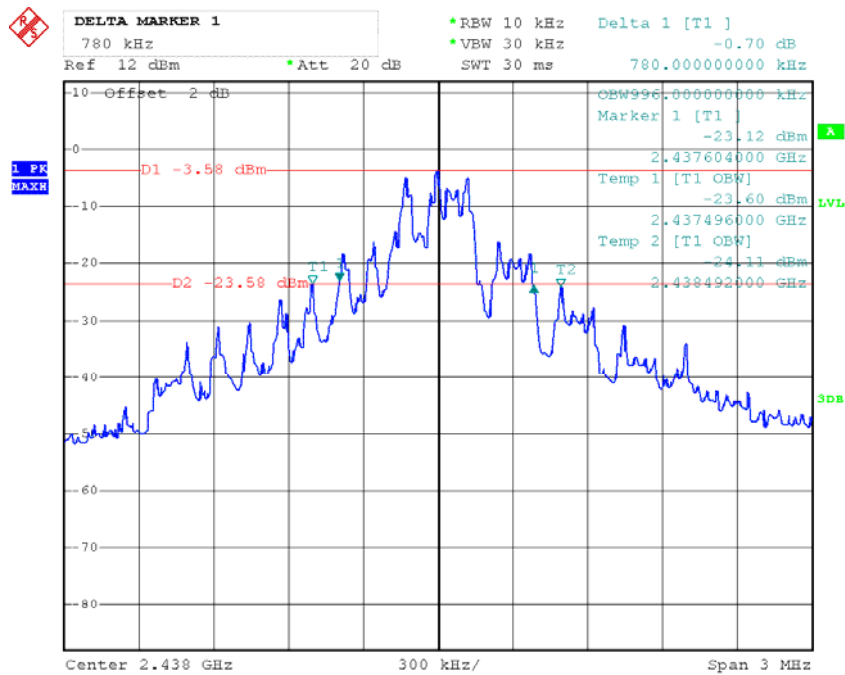
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
Low	2413	0.780
Middle	2438	0.780
High	2464.5	0.780

Low Channel



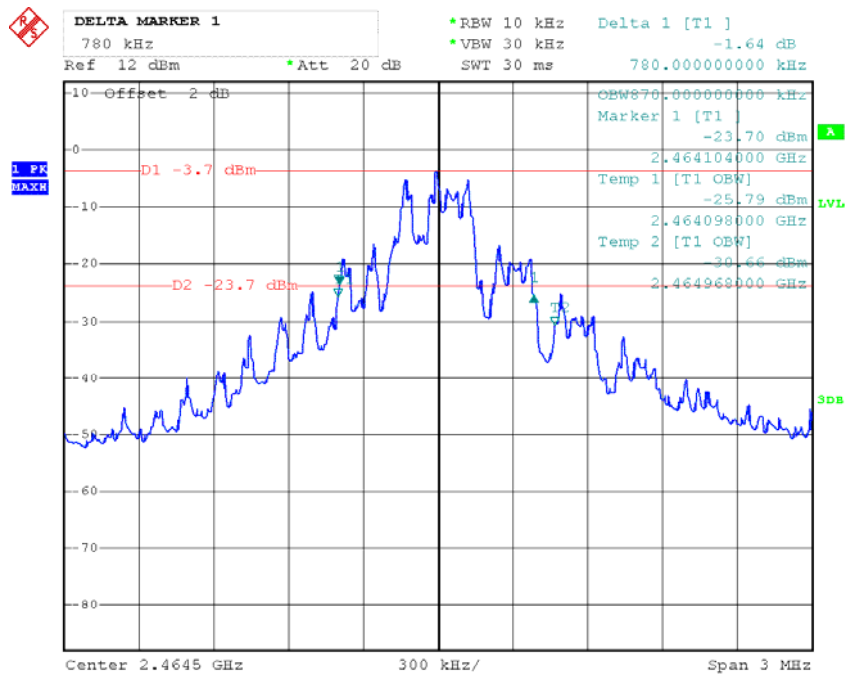
Date: 11.AUG.2015 13:46:36

Middle Channel



Date: 11.AUG.2015 13:49:41

High Channel



Date: 11.AUG.2015 13:37:22

FCC§15.249(d) - OUT OF BAND EMISSION (50 dB ATTENUATION)**Applicable Standard**

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-05-09	2016-05-09
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2015-05-06	2016-05-06
N/A	Coaxial Cable	0.1m	N/A	2015-05-06	2016-05-06

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data**Environmental Conditions**

Temperature:	27.3°C
Relative Humidity:	59 %
ATM Pressure:	99.8 kPa

* The testing was performed by Allen Qiao on 2015-08-11.

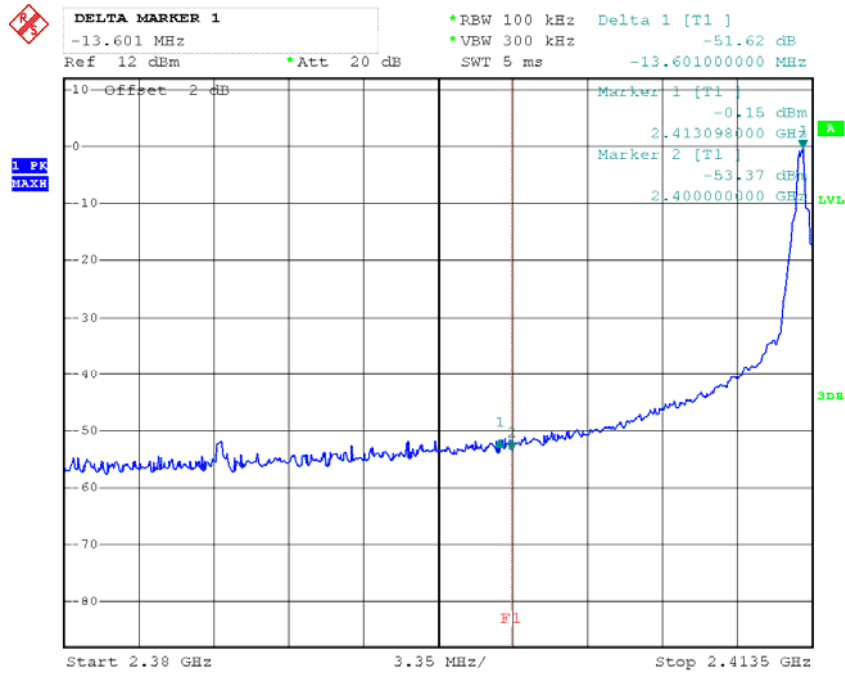
Test Result: Compliant.

Please refer to the following table and plots:

Band Edge	Delta Peak to Band Emission (dBc)	Delta Limit (dBc)
Left	51.47	50
Right	48.04 (note)	50

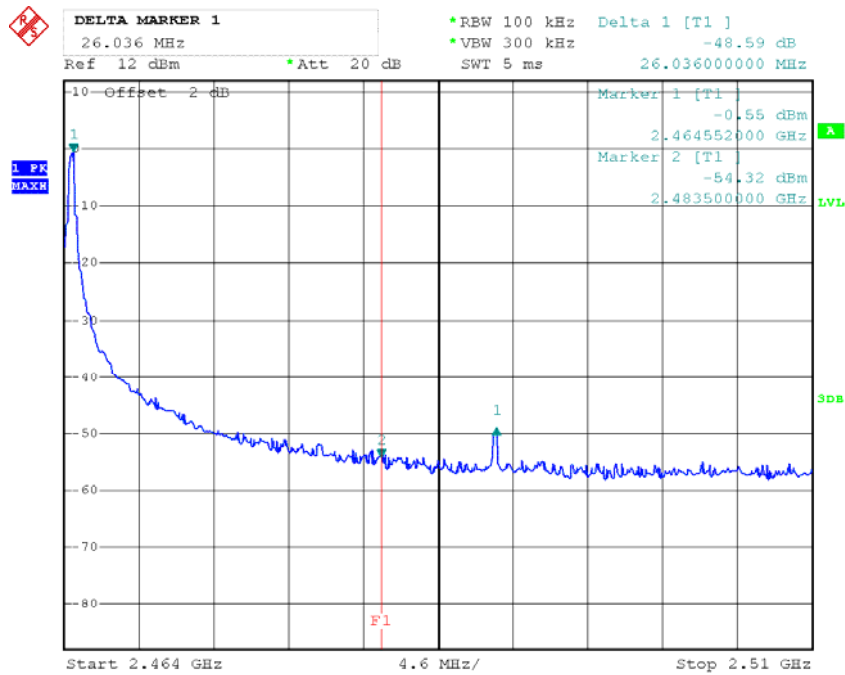
*Note: The right band emission compliant with the general radiated emission limits in §15.209.
Please refer to radiated emissions test section.*

Band Edge, Left Side



Date: 11.AUG.2015 13:44:49

Band Edge, Right Side



Date: 11.AUG.2015 13:39:27

DECLARATION LETTER

GODOX PHOTO EQUIPMENT CO.LTD
19th Floor,Room 1902,Building Jinshan,5033 Shennan East Road,Luohu
District,Shenzhen 518001,China
Telephone Number: 0755-25737526 Fax Number: 0755-25723423

DECLARATION OF SIMILARITY

2015-08-10

To:

Dear Sir or Madam:

We, GODOX PHOTO EQUIPMENT CO.LTD, hereby declare that product: Thinklite TTL Camera Flash, Model numbers: TT685C, TT685N are electrically identical with the same electromagnetic emissions and electromagnetic compatibility characteristics. Model Number: TT685N is electrically identical with the Model Number: TT685C that was certified by BACL. Their difference is as following:

TT685C has hotshoe control function, and TT685N don't have this function.

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

Best Regards,

Mrs Yuan 
Manager

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