FCC PART 15.249

TEST REPORT

For

Hobbico, Inc.

2904 Research Road, Champaign, Illinois U.S.A. 61821

FCC ID: IYFFPVT1

Report Type:	**Product Type:**
Original Report	Tactic FPV-T1 5.8GHz 25mW Transmitter

Test Engineer:	Mike Hu
Report Number:	RSZ150817002-00
Report Date:	2015-09-29
Reviewed By:	Jimmy Xiao RF Engineer
Prepared By:	Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Hobbico, Inc.'s* product, model number: *TACZ5000 (FCC ID: IYFFPVT1)* or the "EUT" in this report was a *Tactic FPV-T1 5.8GHz 25mW Transmitter*, *which* was measured approximately: 4.3 cm (L) x 2.5 cm (W) x 1.1 cm (H), rated with input voltage: DC 12V.

**All measurement and test data in this report was gathered from production sample serial number: 1506043 (Assigned by BACL, Shenzhen).The EUT supplied by the applicant was received on 2015-08-17.*

Objective

This type approval report is prepared on behalf of *Hobbico, Inc.* 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)

No related submittal(s).

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 radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement uncertainty with radiated emission is 5.91 dB for 30MHz-1GHz.and 4.92 dB for above 1GHz, 1.95dB for conducted measurement.

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China.

Test site at Bay Area Compliance Laboratories Corp. (Shenzhen) 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 October 31, 2013. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2009.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 382179. 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 a testing mode which provided by manufacturer:

AV video signal was used as the Input signal from the DVD video player.

Equipment Modifications

No modifications were made to the unit tested.

Support Equipment List and Details

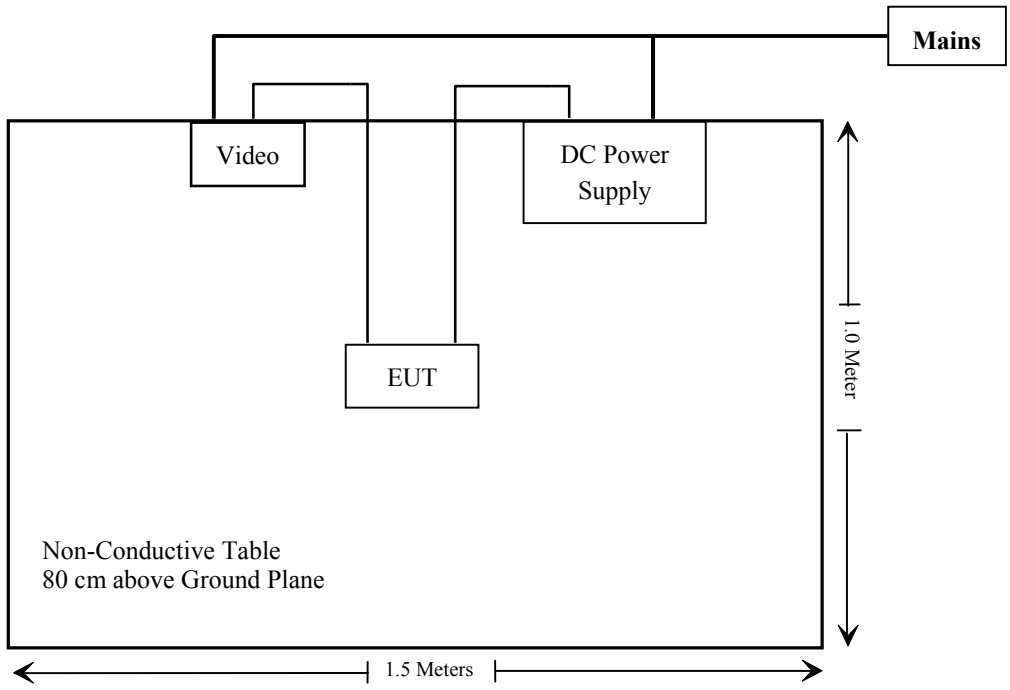
Manufacturer	Description	Model	Serial Number
GWINSTEK	DC Power Supply	GPS-3030DD	N/A
Philips	DVD video player	DVP5986K/93	KX1A0713545698

Support Cable Descriptions

Cable Description	Length (m)	From Port	To
Un-shielding detachable AV Video Cable	3.0	DVD video player	EUT
Un-shielding detachable AC Power Cable	2.0	DVD video player	Mains
Un-shielding detachable AC Power Cable	2.0	DC Power Supply	Mains
Un-shielding detachable DC Power Cable	1.5	DC Power Supply	EUT

Block Diagram of Test Setup

For radiated emission:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207(a)	Conduction Emissions	Compliance
15.205, §15.209, §15.249	Radiated Emissions	Compliance
§15.215(c)	20dB Emission Bandwidth	Compliance
§15.249(d)	Outside of Band Emission (50dB attenuation)	Compliance

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 external RP-SMA port antenna, the antenna gain is 3.0 dBi; fulfill the requirement of this section. Please refer to the external photos.

Result: Compliant.

FCC §15.107 – AC LINE CONDUCTED EMISSIONS

Applicable Standard

According to FCC §15.107

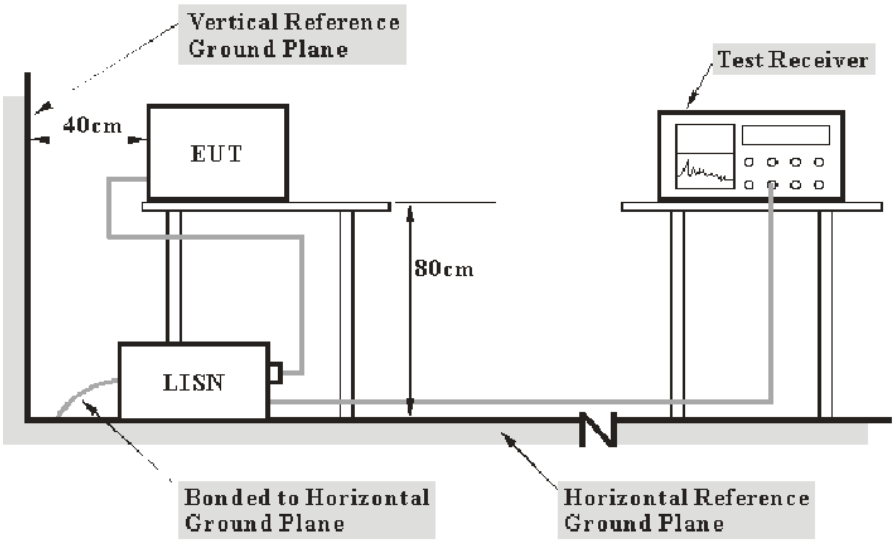
Measurement Uncertainty

Input quantities to be considered for conducted disturbance measurements maybe receiver reading, attenuation of the connection between LISN/ISN and receiver, LISN/ISN voltage division factor, LISN/ISN VDF frequency interpolation and receiver related input quantities, etc.

Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of conducted disturbance test at Bay Area Compliance Laboratories Corp. (Shenzhen) is shown as below. And the uncertainty will not be taken into consideration for the test data recorded in the report

Port	Measurement uncertainty
AC Mains	3.26 dB (k=2, 95% level of confidence)
CAT 3	3.70 dB (k=2, 95% level of confidence)
CAT 5	3.86 dB (k=2, 95% level of confidence)
CAT 6	4.64 dB (k=2, 95% level of confidence)

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The measurement procedure of EUT setup is according with per ANSI C63.10-2013. The related limit was specified in FCC Part 15.207.

The spacing between the peripherals was 10 cm.

The DC power supply was connected to a 120 VAC/60 Hz power source.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

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

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter was connected to the first LISN and the other relevant equipments were conncected to the second LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2015-06-03	2016-06-03
Rohde & Schwarz	LISN	ENV216	3560.6650.12-101613-Yb	2014-12-01	2015-12-01
Rohde & Schwarz	LISN	ESH2-Z5	892107/021	2015-06-09	2016-06-09
Rohde & Schwarz	Transient Limitor	ESH3Z2	DE25985	2015-05-14	2016-05-14
Rohde & Schwarz	CE Test software	EMC 32	V8.53	NCR	NCR

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

Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN/ISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Correction Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation

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

Margin = Limit – Corrected Amplitude

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.107, the worst margin as below:

9.5 dB at **0.459190 MHz** in the **Line** onducted mode

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level is in compliance with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL., $U_{(Lm)}$ is less than U_{cispr}, if L_m is less than L_{lim}, it implies that the EUT complies with the limit.

Test Data

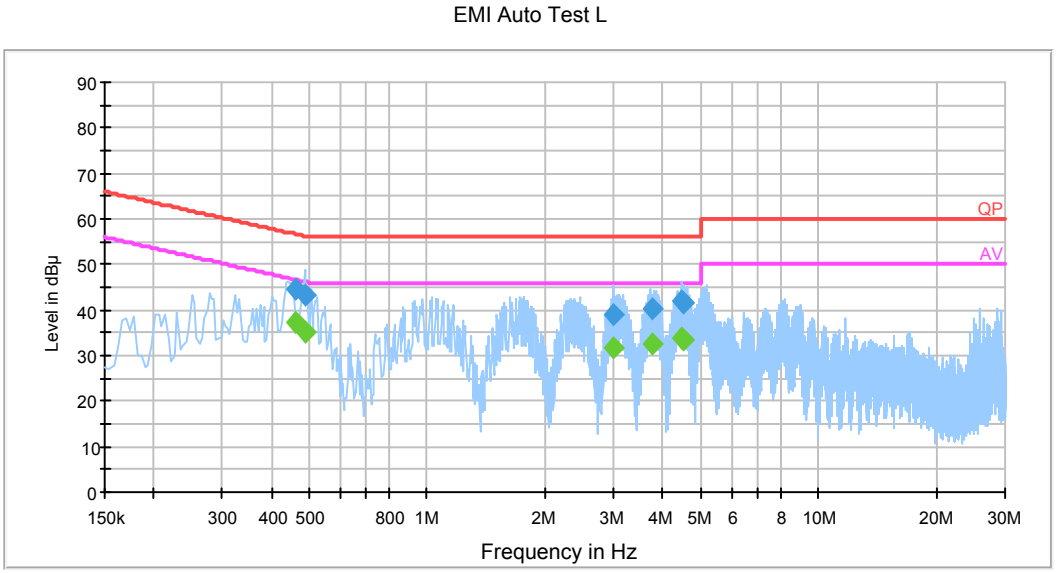
Environmental Conditions

Temperature:	27 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Mike Hu on 2015-09-16.

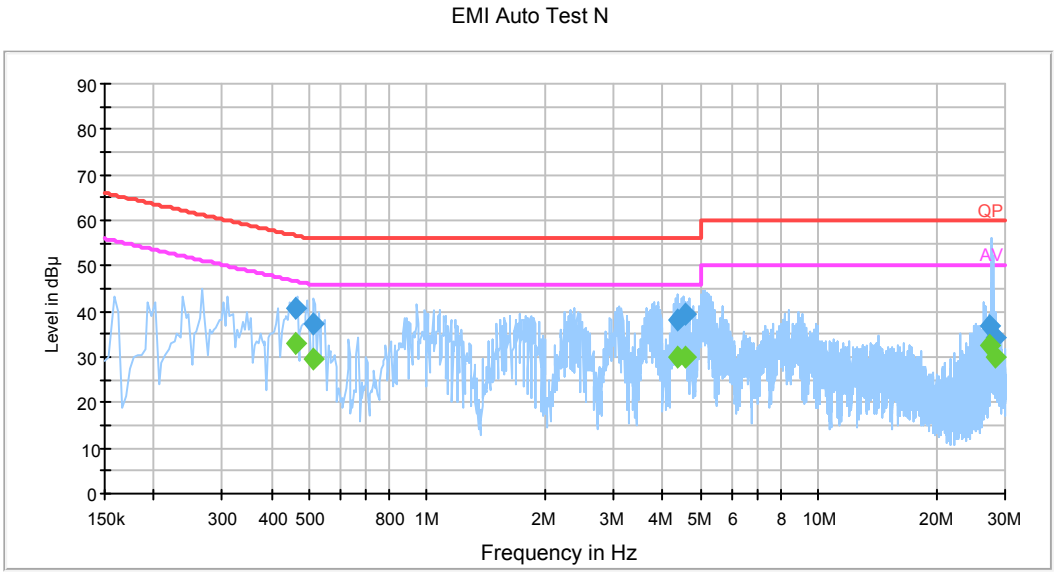
EUT Operation Mode: Transmitting

AC 120V/60 Hz, Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.459190	44.6	19.2	56.7	12.1	QP
0.459190	37.2	19.2	46.7	9.5	Ave.
0.486710	43.3	19.3	56.2	13.0	QP
0.486710	35.0	19.3	46.2	11.3	Ave.
2.997150	39.1	19.4	56.0	16.9	QP
2.997150	31.7	19.4	46.0	14.3	Ave.
3.762230	40.3	19.4	56.0	15.7	QP
3.762230	32.7	19.4	46.0	13.3	Ave.
4.479250	41.8	19.4	56.0	14.2	QP
4.479250	34.0	19.4	46.0	12.0	Ave.
4.530590	41.8	19.5	56.0	14.2	QP
4.530590	33.6	19.5	46.0	12.4	Ave.

AC 120V/60 Hz, Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.463010	40.5	19.2	56.6	16.1	QP
0.463010	33.0	19.2	46.6	13.6	Ave.
0.514290	37.4	19.2	56.0	18.6	QP
0.514290	29.5	19.2	46.0	16.5	Ave.
4.360510	38.0	19.4	56.0	18.0	QP
4.360510	30.1	19.4	46.0	15.9	Ave.
4.570170	39.6	19.4	56.0	16.4	QP
4.570170	29.9	19.4	46.0	16.1	Ave.
27.343310	36.7	19.8	60.0	23.3	QP
27.343310	32.4	19.8	50.0	17.6	Ave.
28.320590	34.3	19.8	60.0	25.7	QP
28.320590	30.2	19.8	50.0	19.8	Ave.

Note:
1) Correction Factor =LISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter Attenuation
The corrected factor has been input into the transducer of the test software.
2) Corrected Amplitude = Reading + Correction Factor
3) Margin = Limit – Corrected Amplitude

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.

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.

Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of radiation emissions at Bay Area Compliance Laboratories Corp. (Shenzhen) is 5.91 dB for 30MHz-1GHz, 4.92 dB for above 1GHz, and it will not be taken into consideration for the test data recorded in the report

Test Equipment Setup

The spectrum analyzer or receiver is set as:

Below 1000MHz:

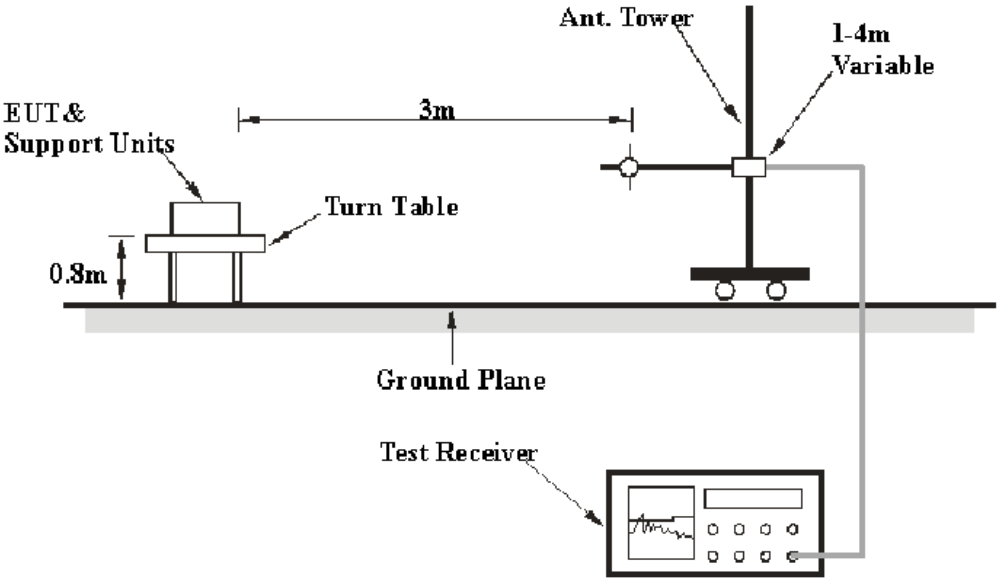
RBW = 100 kHz / VBW = 300 kHz / Sweep = Auto

Above 1000MHz:

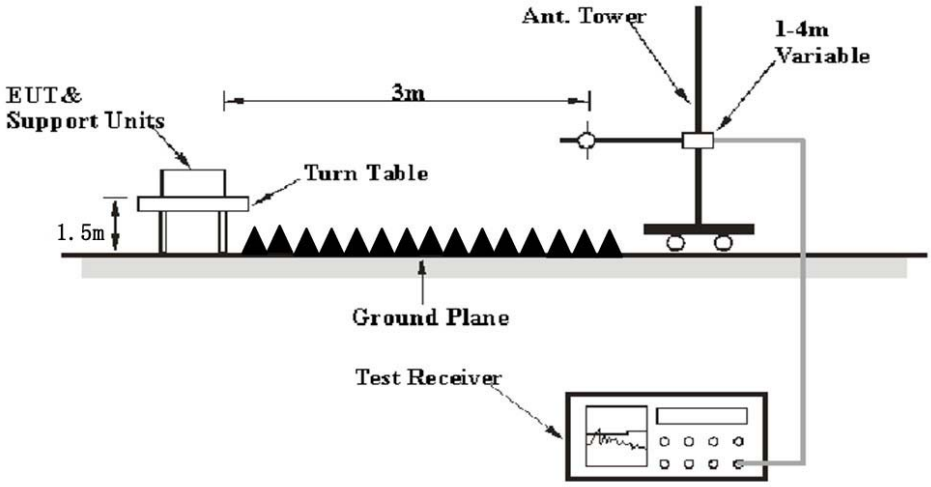
Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto
Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

EUT Setup

Below 1G:



Above 1GHz:



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 Procedure

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

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 mete, and the EUT is placed on a turntable, which is 0.8 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

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:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - 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:

Margin = Limit – Corrected Amplitude

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	Amplifier	HP8447E	1937A01046	2015-05-06	2016-05-06
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2014-11-03	2015-11-03
Sunol Sciences	Bi-log Antenna	JB1	A040904-2	2014-12-07	2017-12-06
A.H. System	Horn Antenna	SAS-200/571	135	2013-02-10	2016-02-10
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2014-12-11	2015-12-11
Rohde & Schwarz	EMI Test Receiver	ESR	1316.3003K03-101746-zn	2015-06-13	2016-06-13
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2015-04-03	2016-04-03
DUCOMMUN	Pre-amplifier	ALN-22093530-01	991373-01	2015-08-03	2016-08-03
EMCO	Horn Antenna	3115	9903-5766	NCR	NCR
Rohde & Schwarz	Auto test Software	EMC32	V9.10	NCR	NCR

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

Test Results Summary

According to the data in the following table, the worst margin reading as below:

6.32 dB at **5733.00 MHz** in the **Vertical** polarization for **Low** Channel

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL, $U_{(Lm)}$ is less than U_{cispr}, if L_m is less than L_{lim}, it implies that the EUT complies with the limit.

Test Data

Environmental Conditions

Temperature:	27 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Mike Hu on 2015-09-16.

Test Mode: Transmitting

30 MHz to 40 GHz:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.249/15.205/15.209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel (5733 MHz)									
257.36	42.69	QP	217	1.6	H	-14.4	28.29	46	17.71
5733.00	64.32	PK	342	1.4	H	15.54	79.86	114	34.14
5733.00	60.04	Ave.	342	1.4	H	15.54	75.58	94	18.42
5733.00	77.02	PK	287	2.3	V	15.54	92.56	114	21.44
5733.00	72.14	Ave.	287	2.3	V	15.54	87.68	94	6.32
2385.71	36.57	PK	151	1.4	V	4.97	41.54	74	32.46
2385.71	19.87	Ave.	151	1.4	V	4.97	24.84	54	29.16
5362.54	35.84	PK	160	2.1	V	14.67	50.51	74	23.49
5362.54	20.67	Ave.	160	2.1	V	14.67	35.34	54	18.66
11466.00	36.25	PK	134	1.8	H	24.27	60.52	74	13.48
11466.00	21.24	Ave.	134	1.8	H	24.27	45.51	54	8.49
Middle Channel (5800 MHz)									
257.36	41.92	QP	167	1.5	H	-14.4	27.52	46	18.48
5800.00	65.28	PK	170	1.1	H	15.19	80.47	114	33.53
5800.00	61.07	Ave.	170	1.1	H	15.19	76.26	94	17.74
5800.00	77.52	PK	175	1.8	V	15.19	92.71	114	21.29
5800.00	72.39	Ave.	175	1.8	V	15.19	87.58	94	6.42
2485.67	36.84	PK	294	1.6	V	6.29	43.13	74	30.87
2485.67	19.57	Ave.	294	1.6	V	6.29	25.86	54	28.14
5452.84	36.84	PK	212	1.3	H	16.70	53.54	74	20.46
5452.84	20.77	Ave.	212	1.3	H	16.70	37.47	54	16.53
11600.00	35.47	PK	190	2.3	V	25.21	60.68	74	13.32
11600.00	21.68	Ave.	190	2.3	V	25.21	46.89	54	7.11

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.249/15.205/15.209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
High Channel (5866 MHz)									
257.36	42.75	QP	67	1.5	H	-14.4	28.35	46	17.65
5866.00	66.88	PK	161	1.4	H	15.23	82.11	114	31.89
5866.00	62.49	Ave.	161	1.4	H	15.23	77.72	94	16.28
5866.00	77.70	PK	123	1.3	V	15.23	92.93	114	21.07
5866.00	72.11	Ave.	123	1.3	V	15.23	87.34	94	6.66
2486.44	35.67	PK	102	2.2	H	6.29	41.96	74	32.04
2486.44	20.45	Ave.	102	2.2	H	6.29	26.74	54	27.26
5428.57	36.54	PK	99	1.1	V	14.67	51.21	74	22.79
5428.57	20.88	Ave.	99	1.1	V	14.67	35.55	54	18.45
11732.00	35.97	PK	185	2.2	V	25.21	61.18	74	12.82
11732.00	21.32	Ave.	185	2.2	V	25.21	46.53	54	7.47

Note:
Corrected Amplitude = Corrected Factor + Reading
Corrected Factor = Antenna Factor (Rx) + Cable Loss – Amplifier Factor
Margin = Limit - Corr. Amplitude

FCC§15.215(c) - 20dB EMISSION BANDWIDTH

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 without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. 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 indicated 20dB 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
Rohde & Schwarz	Signal Analyzer	FSIQ26	837405/023	2015-08-22	2016-08-22

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

Test Data

Environmental Conditions

Temperature:	27 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

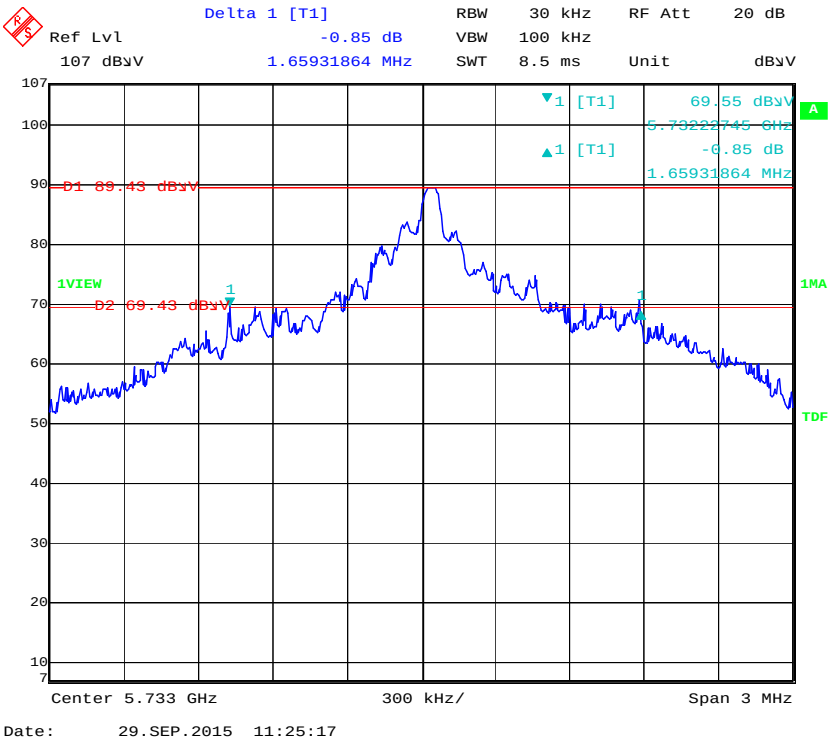
The testing was performed by Mike Hu on 2015-09-29.

Test Mode: Transmitting

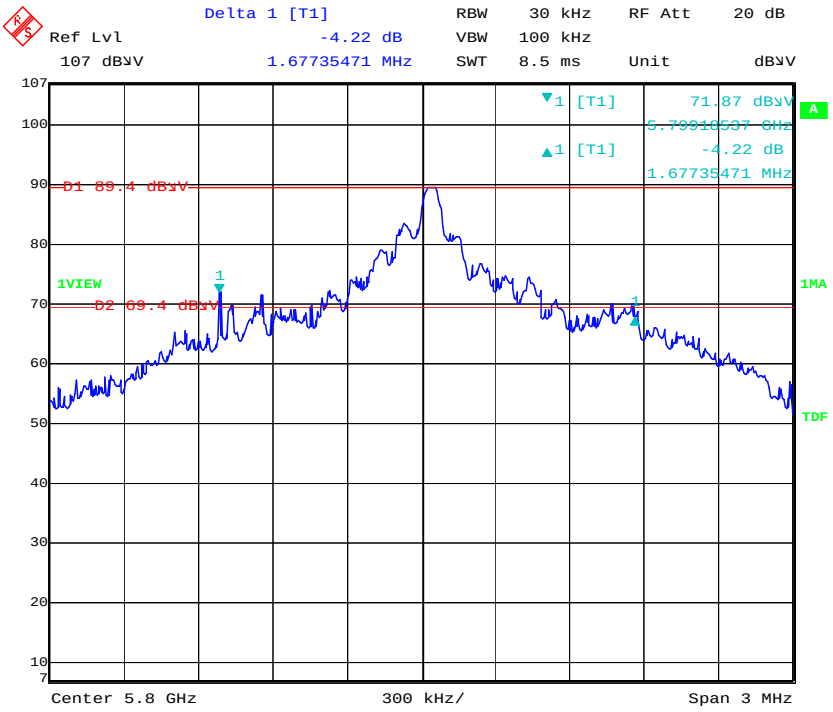
Pleas refer to the following table and plots.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	5733	1.659
Middle	5800	1.677
High	5866	1.527

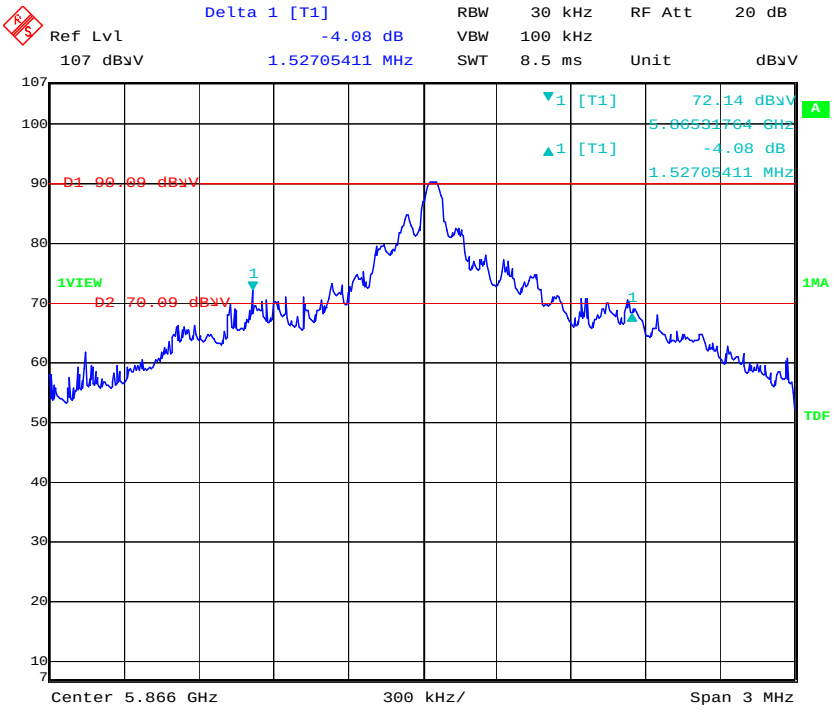
Low Channel



Middle Channel



High Channel



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
Rohde & Schwarz	Signal Analyzer	FSIQ26	837405/023	2015-08-22	2016-08-22

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

Test Data

Environmental Conditions

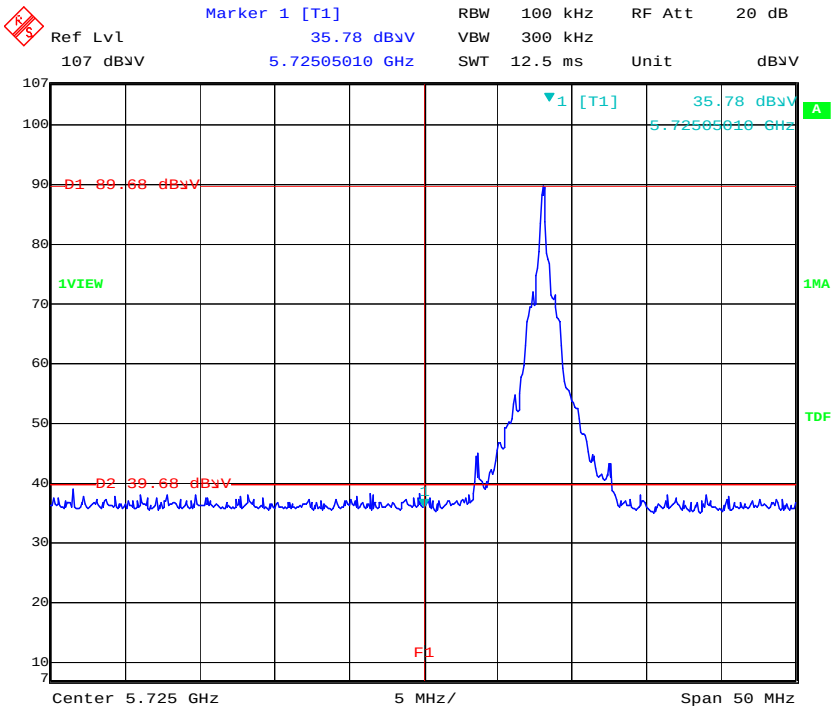
Temperature:	27 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Mike Hu on 2015-09-29.

Test Result: Compliant.

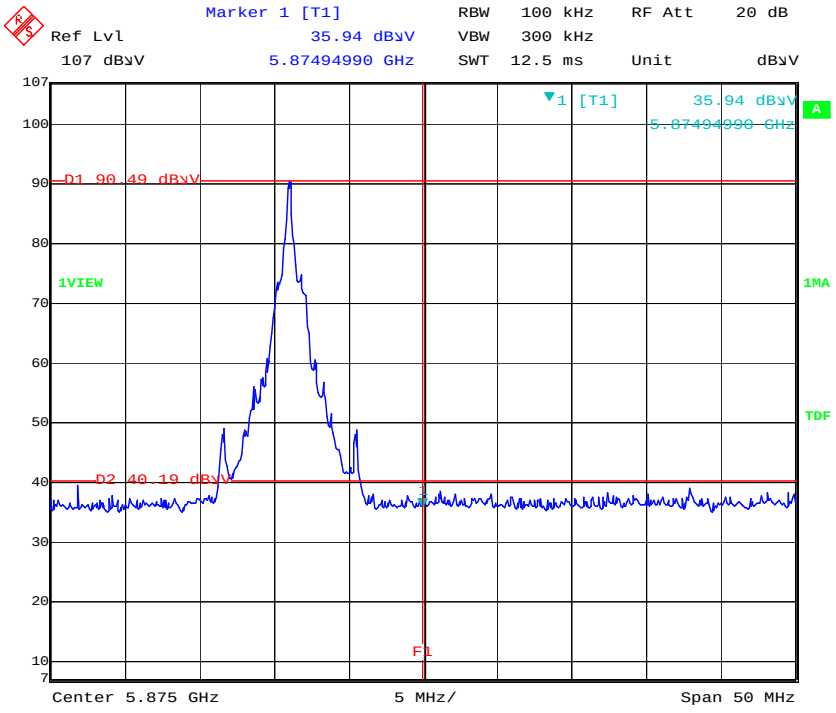
Please refer to the following plots:

Band edge -Left Side



Date: 29.SEP.2015 12:31:19

Band edge –Right Side



Date: 29.SEP.2015 12:33:00

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