



FCC PART 15.249 TEST REPORT

For

Hobbico Inc

2904 Research Road, Champaign, IL USA

FCC ID: IYF2051

Report Type: Original Report	Product Name: Vusion Houseracer 125 FPV-R
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Report Number: <u>RDG161215011B</u>	
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The **Hobbico Inc**'s product, model number: **RISE0208 (FCC ID: IYF2051)** (the "EUT") in this report was a **Vusion Houseracer 125 FPV-R**, which was measured approximately: 16.6 cm (L) x 16.6 cm (W) x 5.5 cm(H), rated input voltage: DC3.7V from LiPo battery.

**All measurement and test data in this report was gathered from final production sample, serial number: 161215011 (assigned by the BAACL, Chengdu). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2016-12-19, and EUT conformed to test requirement.*

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)

Granted with the part of system with FCC ID: IYFJ2000.

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.

The uncertainty of any RF tests which use conducted method measurement is ± 3.17 dB, the uncertainty of any radiation on emissions measurement is:

30M~200MHz: ± 4.7 dB;
200M~1GHz: ± 6.0 dB;
1G~6GHz: ± 5.13 dB;
6G~25GHz: ± 5.47 dB;

And the uncertainty will not be taken into consideration for all test data recorded in the report.

Test Facility

The test site used by BACL to collect test data is located in the 5040, HuiLongWan Plaza, No. 1, ShaWan Road, JinNiu District, ChengDu, China.

Test site at BACL 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 April 24, 2015. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 560332. 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, which was provided by the manufacturer.

For 5.8GHz band, 25 channels are provided:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	5740	10	5785	19	5830
2	5745	11	5790	20	5835
3	5750	12	5795	21	5840
4	5755	13	5800	22	5845
5	5760	14	5805	23	5850
6	5765	15	5810	24	5855
7	5770	16	5815	25	5860
8	5775	17	5820	/	/
9	5780	18	5825	/	/

3 channels were tested: 5740MHz, 5800MHz, 5860 MHz.

EUT Exercise Software

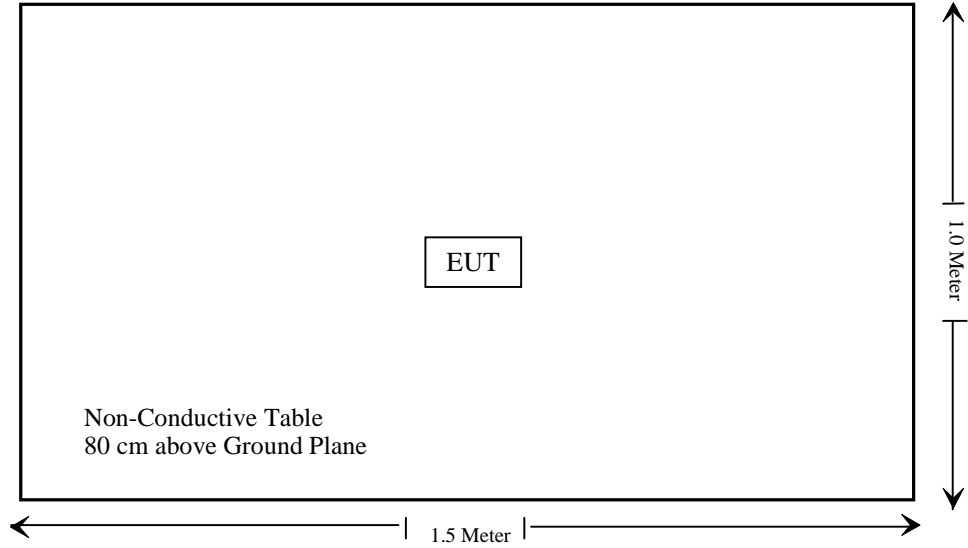
No software was used in test.

Equipment Modifications

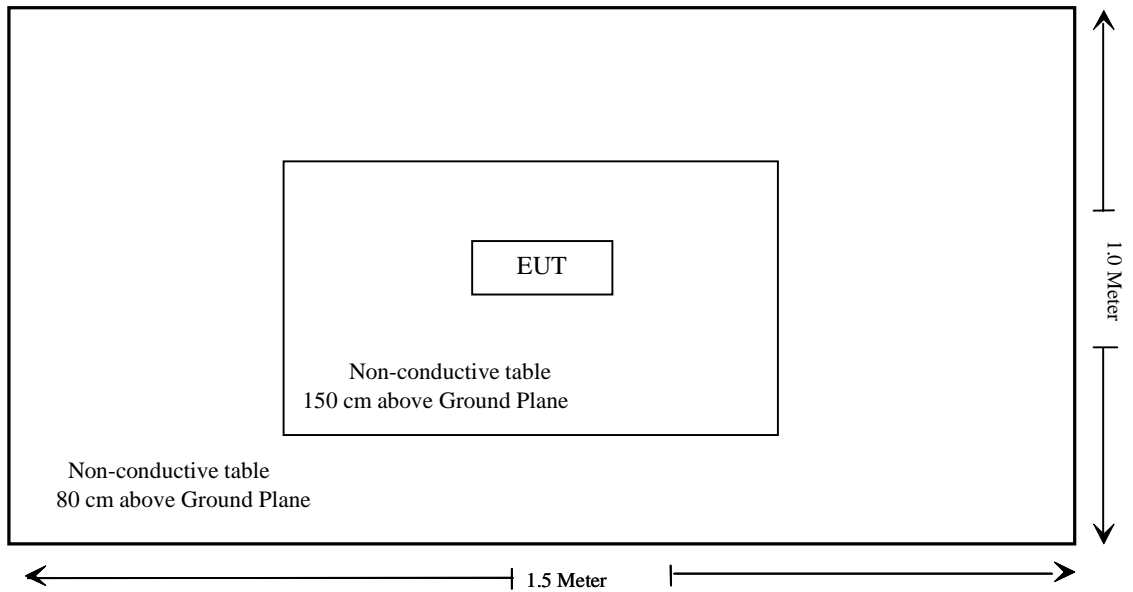
No modifications were made to the EUT.

Block Diagram of Test Setup

Below 1GHz:



Above 1GHz:



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)	Out-of-band emissions (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 for 5.8GHz Tx, and the antenna gain is 1.5dBi, another antenna for 2.4GHz Rx , which were permanently attached, 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. (Chengdu) is:

30M~200MHz: ±4.7 dB;

200M~1GHz: ±6.0 dB;

1G~6GHz: ±5.13dB;

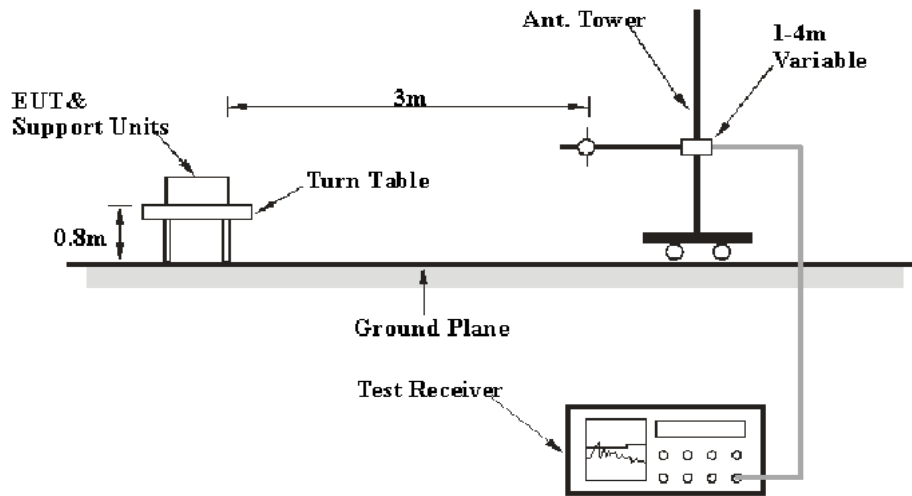
6G~25GHz: ±5.47 dB;

Table 1 – Values of U_{cispr}

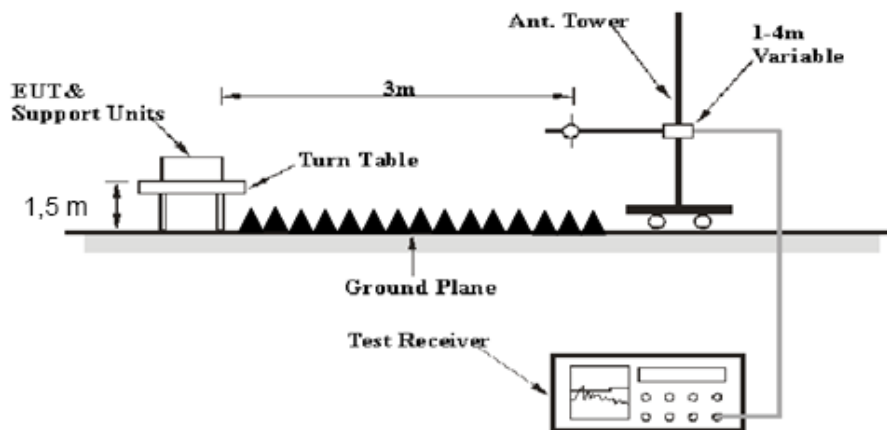
Measurement	U_{cispr}
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

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 40 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
Agilent	Amplifier	8447D	2944A10442	2016-12-02	2017-12-01
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2016-12-02	2017-12-01
Sunol Sciences	Broadband Antenna	JB3	A101808	2016-04-10	2019-04-09
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2016-12-02	2017-12-01
ETS	Horn Antenna	3115	003-6076	2016-12-02	2017-12-01
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-0113024	2014-06-16	2017-06-15
Mini-circuits	Amplifier	ZVA-183-S+	771001215	2016-05-20	2017-05-19
EMCT	Semi-Anechoic Chamber	966	N/A	2015-04-24	2018-04-23
N/A	RF Cable (below 1GHz)	NO.1	N/A	2016-11-10	2017-11-09
N/A	RF Cable (below 1GHz)	NO.4	N/A	2016-11-10	2017-11-09
N/A	RF Cable (above 1GHz)	NO.2	N/A	2016-11-10	2017-11-09
Ducommun Technologies	Horn Antenna	ARH-2823-02	1007726-01 1312	2016-08-18	2017-08-18
Quinstar	Amplifier	QLW-18405536-JO	15964001032	2016-08-18	2017-08-18
Agilent	Spectrum Analyzer	8564E	5943A01752	2016-08-18	2017-08-18

* **Statement of Traceability:** BACL (Chengdu) attested 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.

Test Data

Environmental Conditions

Temperature:	22.3 °C
Relative Humidity:	70 %
ATM Pressure:	101.4 kPa

The testing was performed by Lorin Bian on 2017-01-04.

Test Mode: Transmitting

30MHz-40GHz:

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: 5740 MHz									
5740	62.89	PK	H	32.59	5.73	0	101.21	114	12.79
5740	51.8	AV	H	32.59	5.73	0	90.12	94	3.88
5740	64.53	PK	V	32.59	5.73	0	102.85	114	11.15
5740	55.49	AV	V	32.59	5.73	0	93.81	94	0.19
5725	25.66	PK	V	32.57	5.72	26.63	37.32	74	36.68
5725	14.77	AV	V	32.57	5.72	26.63	26.43	54	27.57
11480	36.09	PK	V	37.98	8.22	26.02	56.27	74	17.73
11480	26.5	AV	V	37.98	8.22	26.02	46.68	54	7.32
17220	34.68	PK	V	42.91	10.8	25.97	62.42	74	11.58
17220	24.96	AV	V	42.91	10.8	25.97	52.7	54	1.3
2057	34.51	PK	V	24.71	3.04	26.83	35.43	74	38.57
2057	24.38	AV	V	24.71	3.04	26.83	25.3	54	28.7
3362	37.31	PK	V	26.23	3.97	26.54	40.97	74	33.03
3362	27.38	AV	V	26.23	3.97	26.54	31.04	54	22.96
381.14	47.02	QP	H	15.72	1.35	28.04	36.05	46	9.95
417.03	46.15	QP	H	16.7	1.49	28.37	35.97	46	10.03
Middle Channel: 5800 MHz									
5800	64.49	PK	H	32.66	5.78	0	102.93	114	11.07
5800	54.74	AV	H	32.66	5.78	0	93.18	94	0.82
5800	64.63	PK	V	32.66	5.78	0	103.07	114	10.93
5800	55.24	AV	V	32.66	5.78	0	93.68	94	0.32
11600	36.53	PK	V	38.04	8.21	25.99	56.79	74	17.21
11600	27.25	AV	V	38.04	8.21	25.99	47.51	54	6.49
17400	35.28	PK	V	43.74	11.1	26.23	63.89	74	10.11
17400	24.75	AV	V	43.74	11.1	26.23	53.36	54	0.64
2104	36.27	PK	V	24.55	3.04	26.83	37.03	74	36.97
3092	31.7	AV	V	24.72	3.57	26.44	33.55	54	20.45
3187	39.3	PK	V	25.25	3.71	26.48	41.78	74	32.22
3187	29.68	AV	V	25.25	3.71	26.48	32.16	54	21.84
381.14	47.21	QP	H	15.72	1.35	28.04	36.24	46	9.76
417.03	46.29	QP	H	16.7	1.49	28.37	36.11	46	9.89
High Channel: 5860 MHz									
5860	62.38	PK	H	32.73	5.84	0	100.95	114	13.05
5860	52.89	AV	H	32.73	5.84	0	91.46	94	2.54
5860	63.44	PK	V	32.73	5.84	0	102.01	114	11.99
5860	53.96	AV	V	32.73	5.84	0	92.53	94	1.47
5875	25.92	PK	V	32.75	5.85	26.65	37.87	74	36.13
5875	14.53	AV	V	32.75	5.85	26.65	26.48	54	27.52
11720	37.55	PK	V	38.09	8.19	25.96	57.87	74	16.13
11720	27.5	AV	V	38.09	8.19	25.96	47.82	54	6.18
17580	33.4	PK	V	44.46	11.16	26.29	62.73	74	11.27
17580	23.01	AV	V	44.46	11.16	26.29	52.34	54	1.66
2278	38.19	PK	V	23.95	3.02	26.86	38.3	74	35.7
2278	27.9	AV	V	23.95	3.02	26.86	28.01	54	25.99
3359	37.67	PK	V	26.21	3.97	26.54	41.31	74	32.69
3359	27.96	AV	V	26.21	3.97	26.54	31.6	54	22.4
381.14	47.29	QP	H	15.72	1.35	28.04	36.32	46	9.68
417.03	46.21	QP	H	16.7	1.49	28.37	36.03	46	9.97

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
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2016-09-21	2017-09-20
N/A	RF Cable	N/A	N/A	Each Time	/

* **Statement of Traceability:** BAAC (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	23.4 °C
Relative Humidity:	47 %
ATM Pressure:	101.4 kPa

* The testing was performed by Lorin Bian on 2017-01-03.

Test Result: Compliant.

Please refer to following tables and plots

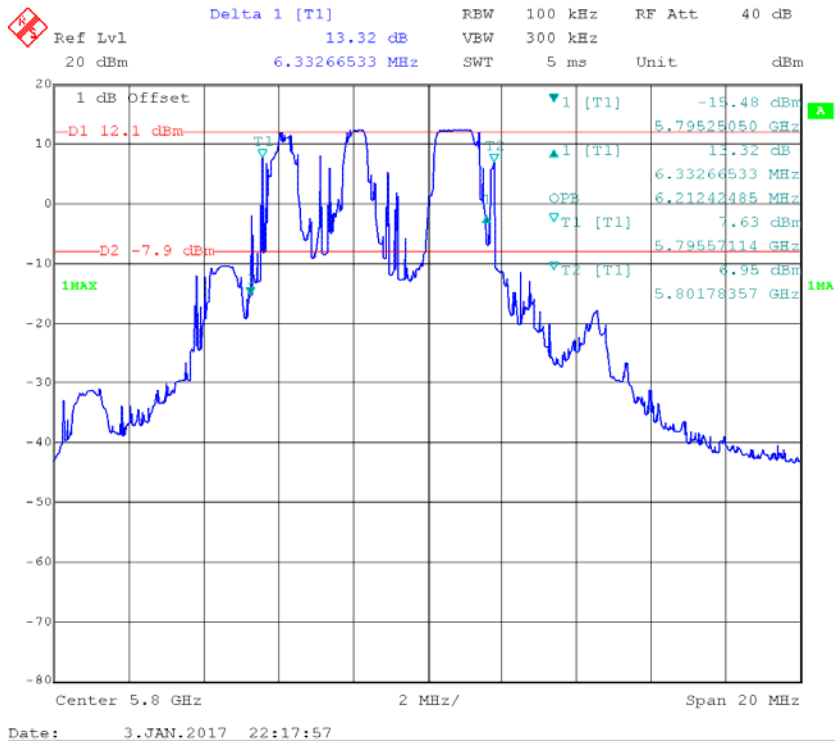
Test Mode: Transmitting

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
Low	5740	7.214
Middle	5800	6.333
High	5860	6.293

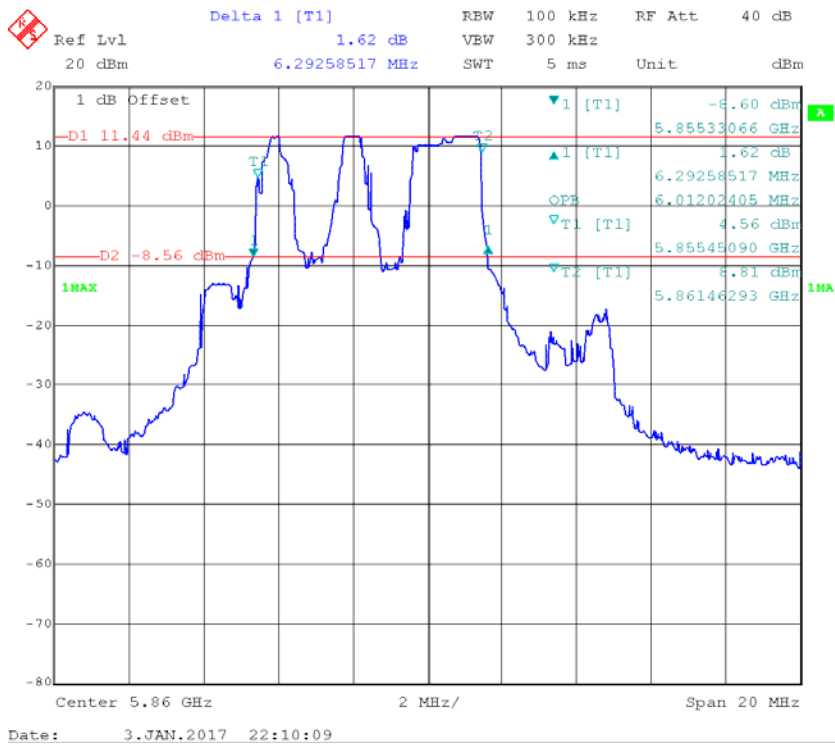
Low Channel



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	831929/005	2016-09-21	2017-09-20
N/A	RF Cable	N/A	N/A	Each Time	/

* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	23.4 °C
Relative Humidity:	47 %
ATM Pressure:	101.4 kPa

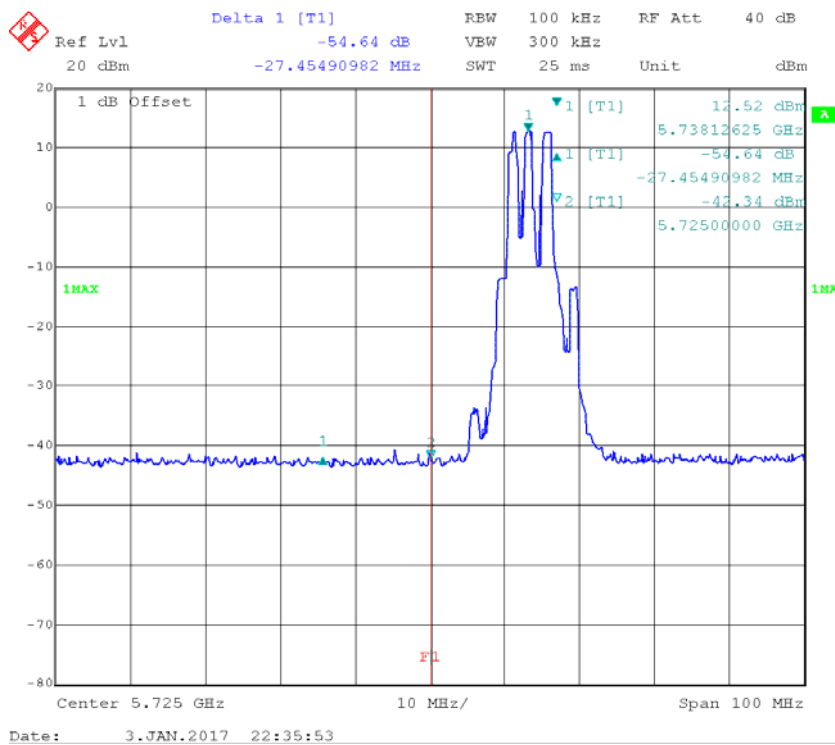
* The testing was performed by Lorin Bian on 2017-01-03.

Test Result: Compliant.

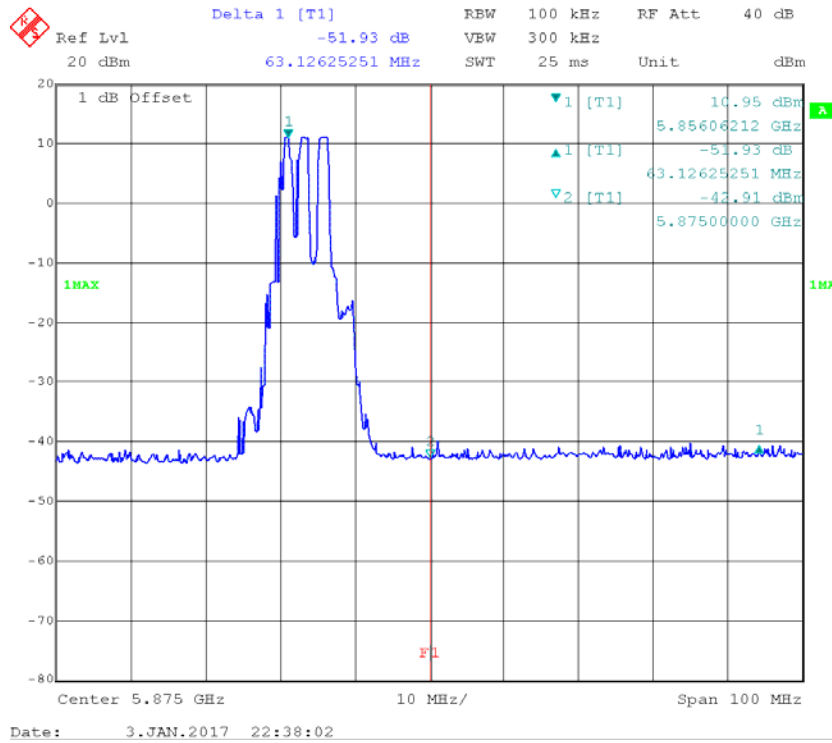
Please refer to the following table and plots:

Band Edge	Delta Peak to Band Emission (dBc)	Delta Limit (dBc)
Left	54.64	50
Right	51.93	50

Band Edge, Left Side



Band Edge, Right Side



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