Test Report

Report No.: MTi160615E001

Date of issue: Jul. 13, 2016

Sample Description:	GAVIN 2.4G digital transmitter set
Model(s):	GAVIN
Applicant:	JIANGXI DETRUM INTELLIGENT CONTROLS TECHNOLOGY CO., LTD
Address:	NORTH OF 2ND TORCH ROAD, HI-TECH INDUSTRIAL PARK, FENGCHENG CITY, JIANGXI PROVINCE, CHINA
Date of Test:	Jul. 01, 2016 to Jul.11, 2016

Shenzhen Microtest Co., Ltd.
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Test Result Certification	
Applicant's name:	**JIANGXI DETRUM INTELLIGENT CONTROLS TECHNOLOGY CO., LTD**
Address:	NORTH OF 2ND TORCH ROAD, HI-TECH INDUSTRIAL PARK, FENGCHENG CITY, JIANGXI PROVINCE, CHINA
Manufacture's Name:	**JIANGXI DETRUM INTELLIGENT CONTROLS TECHNOLOGY CO., LTD**
Address:	NORTH OF 2ND TORCH ROAD, HI-TECH INDUSTRIAL PARK, FENGCHENG CITY, JIANGXI PROVINCE, CHINA
Product description	
Product name:	GAVIN 2.4G digital transmitter set
Trademark:	**DETRUM**
Models name:	GAVIN
Standards:	FCC Part 15.247
Test Procedure:	ANSI C63.10-2013 558074 D01 DTS Meas Guidance v03r05

This device described above has been tested by Shenzhen Toby Technology Co., Ltd. and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

Tested by: David Chen

David Chen Jul. 13, 2016

Reviewed by: Leon Chen

Leon Chen Jul. 13, 2016

Approved by: Ares Liu

Ares Liu Jul. 13, 2016

Summary of Test Result

Item	FCC Part No.	Description of Test	Result
1	15.203	Antenna requirement	N/A*
2	15.207	AC power line conducted emission	Pass
3	15.247(b)(3)	Maximum peak output power	Pass
4	15.247(a)(2)	6dB emission bandwidth	Pass
5	15.247(e)	Power spectral density (PSD)	Pass
8	15.247(d)	Band edge spurious emission	Pass
9	15.247(d), 15.205, 15.209	Radiated emission	Pass

* not applicable, the EUT is powered by battery.

1 General description

1.1 Feature of equipment under test (EUT)

Product name:	GAVIN 2.4G digital transmitter set
Model name:	GAVIN
Operating frequency range:	2401MHz~2480MHz (the channel separation is 1MHz)
Modulation type:	DSSS
Power source:	DC 6V (4*AA battery) + 2S lithium battery
Antenna designation:	Monopoly antenna (Antenna Gain: 3dBi)
Hardware version:	V01.151028
Software version:	V01.0

1.2 Test frequency channel

Low	2401MHz
Middle	2441MHz
High	2480MHz

New battery is used during all test

1.3 EUT operation mode

During testing, RF test program provided by the manufacture to control the Tx operation followed the test requirement. The EUT is configured to transmit at the maximum power control level.

1.4 Test conditions

During the measurement the environmental conditions were within the listed ranges:

- Temperature: 20ºC~30ºC
- Humidity: 30%~70%
- Atmospheric pressure: 98kPa~101kPa

1.5 Ancillary equipment list

Equipment	Model Name	S/N	Manufacturer	Certificate type
/	/	/	/	/

1.6 Measurement uncertainty

Measurement Uncertainty for a Level of Confidence of 95 %, U=2xUc(y)

RF frequency	1 x 10-7
RF power, conducted	± 1 dB
Conducted emission(150kHz~30MHz)	± 2.5 dB
Radiated emission(30MHz~1GHz)	± 4.2 dB
Radiated emission (above 1GHz)	± 4.3 dB
Temperature	±1 degree
Humidity	± 5 %

2 Testing site

Test Site	Shenzhen Toby Technology Co., Ltd.
Test Site Location	1 A/F., Bldg.6, Yusheng Industrial Zone The National Road No.107 Xixiang Section 467, Shenzhen, Guangdong, China
FCC Registration No.:	811562
CNAS Registration No.:	CNAS L5813

3 List of test equipment

For AC power line conducted emission:

Equipment	Manufacturer	Model	Serial No.	Calibration Due
LISN	R&S	ENV216	101313	2016.12.06
LISN	SCHWARZBECK	NNLK 8129	8129245	2016.12.25
Pulse Limiter	SCHWARZBECK	VTSD 9561F	9716	2016.12.25
Test Cable	N/A	N/A	C01	2016.12.06
EMI Test Receiver	R&S	ESCI	101160	2016.12.06

For Radiated emission:

Equipment	Manufacturer	Model	Serial No.	Calibration Due
Log-Bicon Antenna	MESS-ELEKTRONIK	VULB 9160	3058	2016.12.11
Horn Antenna	Schwarzbeck	BBHA 9120D	631	2016.12.05
Horn Antenna	Schwarzbeck	BBHA 9170	373	2016.12.05
Test Cable	United Microwave	57793	1m	2016.12.05
Test Cable	United Microwave	A30A30-5006	10m	2016.12.05
Microwave Pre_amplifier	Agilent	8449B	3008A01714	2016.12.05
Pre-Amplifier	Anritsu	MH648A	M09961	2016.12.05
EMI Test Receiver	R&S	ESPI-7	101318	2016.12.05
Spctrum analyzer	Agient	E4470B	MY41441082	2017.06.01

For RF conducted emission:

Equipment	Manufacturer	Model	Serial No.	Calibration Due
EMI Test Receiver	R&S	ESCI	101160	2016.12.06

Note: the calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

4 Test Result

4.1 Antenna requirement

4.1.1 Requirement defined in FCC 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

4.1.2 EUT antenna description

The antenna of EUT is an internal permanently attached antenna; the maximum gain of the antenna is 3dBi. So the antenna meets the requirement of this part.

4.2 Maximum peak output power

4.2.1 Limits

Conducted peak output power limit is 1W (30dBm).

4.2.2 Test Method

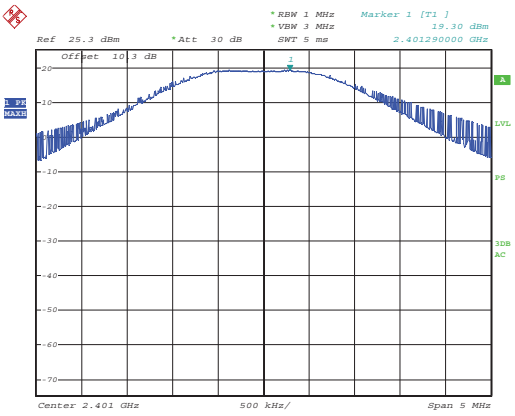
Use the following spectrum analyzer settings:
RBW = 1MHz (≥ 6dB bandwidth, see section 4.3)
VBW ≥ 3RBW
Detector = peak
Trace mode = max hold
Sweep time = auto couple
Allow trace to fully stabilize.
Use peak marker function to determine the peak amplitude level.

4.2.3 Test Result

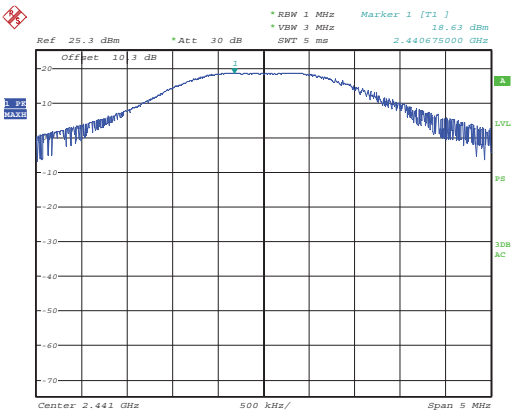
Frequency (MHz)	Peak output power (dBm)	Limit (dBm)
2401	19.3	30
2441	18.63	30
2480	17.85	30

Test plots as below:

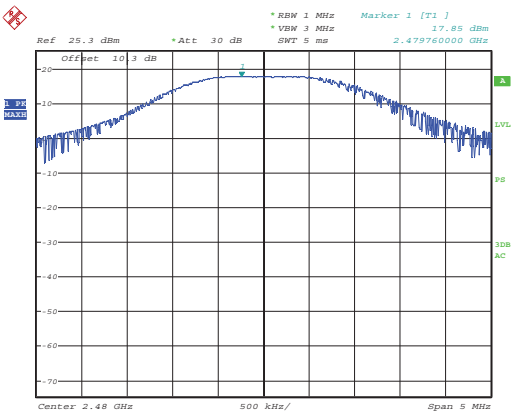
2401MHz



2441MHz



2480MHz



4.3 6dB emission bandwidth

4.3.1 Limits

The minimum 6 dB bandwidth shall be at least 500 kHz.

4.3.2 Test method

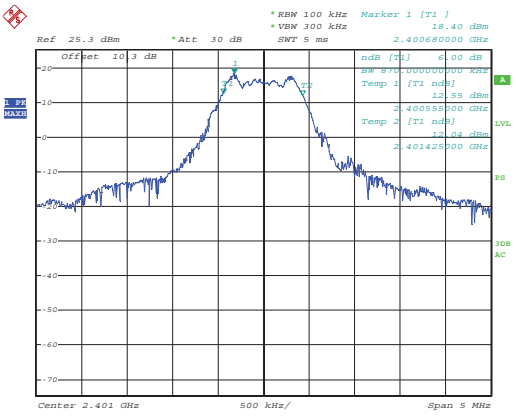
Use the following spectrum analyzer settings:
RBW = 100kHz
VBW ≥ 3RBW
Detector = peak
Trace mode = max hold
Sweep time = auto couple
Allow the trace to stabilize, measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

4.3.3 Test result

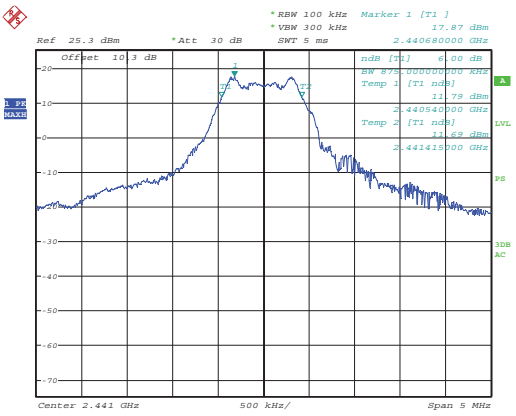
Frequency (MHz)	6dB emission bandwidth (MHz)	Limit
2401	0.87	500kHz
2441	0.875	
2480	0.885	

Test plots as below:

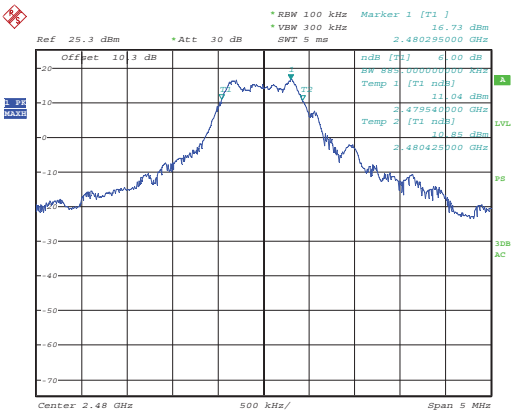
2401MHz



2441MHz



2480MHz



4.4 Power spectral density

4.4.1 Limits

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

4.4.2 Test method

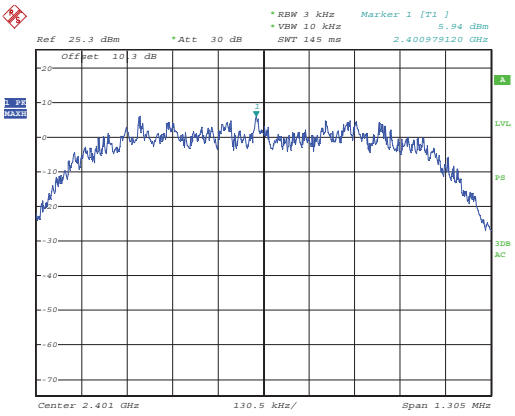
Span = 1.5 times DTS bandwidth (6dB emission bandwidth, see section 4.4)
RBW = 3kHz
VBW ≥ 3RBW
Detector = peak
Sweep time = auto
Trace mode = max hold
Allow the trace to stabilize. Use the peak marker function to determine the maximum amplitude level within the RBW.

4.4.3 Test result

Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
2401	5.94	8
2441	5.34	
2480	4.75	

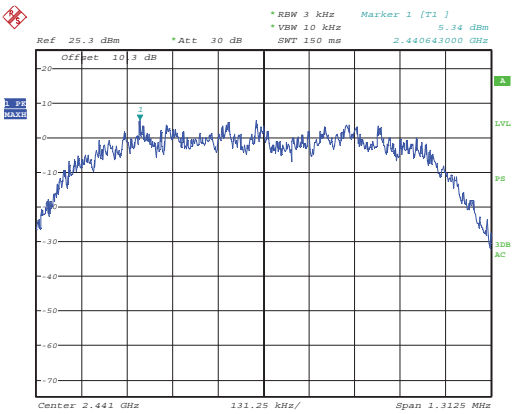
Test plots as below:

2401MHz



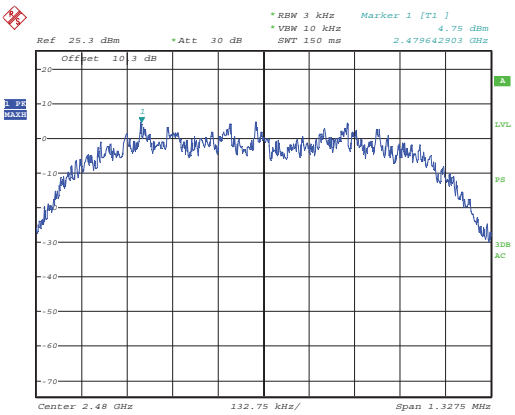
Date: 5.JUL.2016 15:55:13

2441MHz



Date: 5.JUL.2016 16:01:01

2480MHz



Date: 5.JUL.2016 16:04:45

4.5 Band edge spurious emission

4.5.1 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

4.5.2 Test method

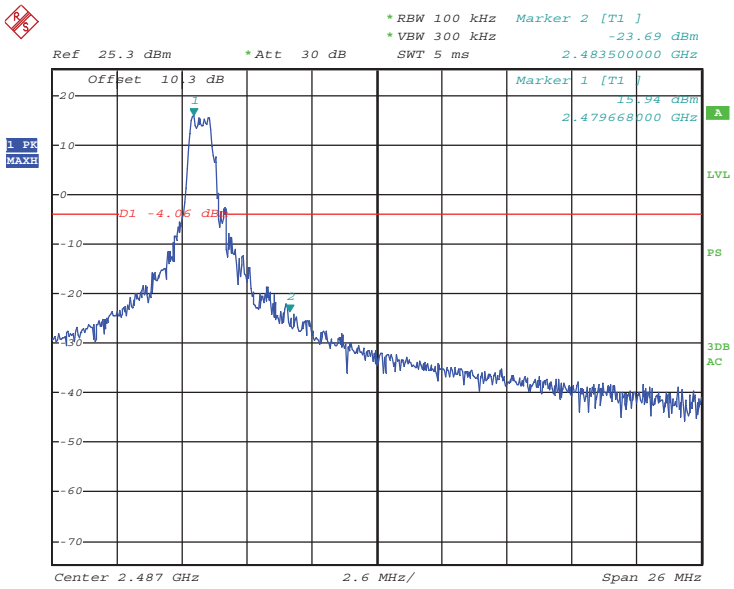
Use the following spectrum analyser settings:
Set RBW=100 kHz. VBW≥3RBW. Detector =peak, Sweep time = auto couple, Trace mode = max hold.

4.5.3 Test Result

Test plots as below:

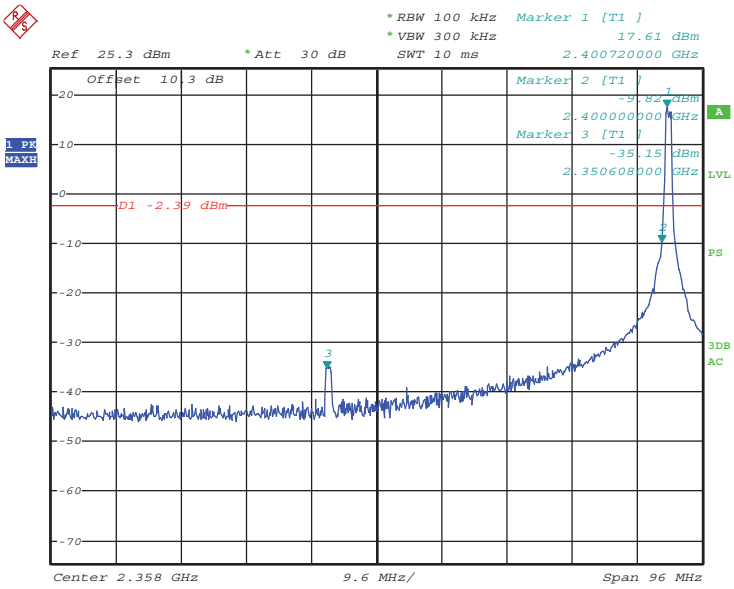
Band edge

High CH



Date: 5.JUL.2016 16:07:57

Low CH



Date: 5.JUL.2016 16:10:19

4.6 Radiated emission

4.6.1 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. Attenuation below the general limits defined in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits defined in §15.209(a).

Radiated emission limits defined in FCC 15.209:

Frequency (MHz)	Field strength μV/m	Field strength dBμV/m	Detector	Measurement distance
30-88	100	40	QP	3m
88-216	150	43.5	QP	
216-960	200	46	QP	
960-1000	500	46	QP	
Above 1000	500	54	AV	
Above 1000	5000	74	PK	

Restricted bands defined in FCC 15.205:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

4.6.2 Test method

1. The EUT is placed on a turntable, which is 0.8m above ground plane for test frequency range blew 1GHz, and 1.5m above ground plane for test frequency range above 1GHz.
2. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
3. Use the following spectrum analyzer settings:
Span = wide enough to fully capture the emission being measured, RBW = 1 MHz for f ≥ 1GHz, 100 kHz for f < 1 GHz, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Follow the guidelines in ANSI C63.4-2014 with respect to maximizing the emission by rotating the EUT, adjusting the measurement antenna height and polarization, etc. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, submit this data. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
5. Set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209.
6. The three orthogonal axis (x, y, z) are pre-tested, only the worst emission were reported

4.6.3 Test Result

Remark:
If the PK measured values lower than average mode limit, the EUT shall be deemed to meet average limits and then no additional average mode measurement performed.

Transmitter channel: 2401MHz					
Frequency	Ant. Polarization	Emission level	Limits	Detector	Result
(MHz)	H / V	dBμV/m	dBμV/m		
288	V	40.2	46	QP	Pass
288	H	27.3	46	QP	
2390	V	67.27	74	PK	
2390	V	50.6	54	AV	
2390	H	62.14	74	PK	
2390	H	45.95	54	AV	
4802	V	57.22	74	PK	
4802	V	40.87	54	AV	
4802	H	56.38	74	PK	
4802	H	40.09	54	AV	
7203	V	52.06	74	PK	
7203	H	52.15	74	PK	
Transmitter channel: 2441MHz					
Frequency	Ant. Polarization	Emission level	Limits	Detector	Result
(MHz)	H / V	dBμV/m	dBμV/m		
288	V	40.6	46	QP	Pass
288	H	28.1	46	QP	
4882	V	55.17	74	PK	
4882	V	38.66	54	AV	
4882	H	54.86	74	PK	
4882	H	38.2	54	AV	
7323	V	51.84	74	PK	
7323	H	52.15	74	PK	
Transmitter channel: 2480MHz					
Frequency	Ant. Polarization	Emission level	Limits	Detector	Result
(MHz)	H / V	dBμV/m	dBμV/m		
288	V	40.1	46	QP	Pass
288	H	27.5	46	QP	
2483.5	V	69.47	74	PK	
2483.5	V	52.9	54	AV	
2483.5	H	63.28	74	PK	
2483.5	H	46.79	54	AV	
4960	V	55.83	74	PK	
4960	V	39.79	54	AV	
4960	H	54.53	74	PK	
4960	H	38.13	54	AV	
7440	V	52.78	74	PK	
7440	H	52.43	74	PK	

----END OF REPORT----