

FCC- TEST REPORT

Report Number : **68.960.15.014.01** Date of Issue: July 21, 2015

Model : **Runner-250**

Product Type : R/C Helicopter

Applicant : GUANGZHOU Walkera Technology Co.,LTD

Address : Taishi Industrial Park, Dongchong Town, Nansha District,
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Production Facility : GUANGZHOU Walkera Technology Co.,LTD

Address : Taishi Industrial Park, Dongchong Town, Nansha District,
511475 Guangzhou, China

Test Result : **Positive** **Negative**

Total pages including
Appendices : 24

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2 Details about the Test Laboratory

Details about the Test Laboratory

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
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3 Description of the Equipment under Test

Description of the Equipment Under Test

Product:	R/C Helicopter
Model no.:	Runner-250
FCC ID:	S29RUNNER-250
Rating Voltage:	DC 11.1V By Li-ion battery
RF Transmission Frequency:	5725-5850MHz
No. of Operated Channel:	4 (5733MHz, 5771MHz, 5809MHz, 5847MHz)
Modulation:	FSK
Duty Cycle:	≥98%
Antenna Type:	Integral Antenna
Antenna Gain:	3dBi
Description of the EUT:	The Equipment Under Test (EUT) is a helicopter with a 5.8G Transmitter system and a 2.4G Receive system.

4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2014 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to KDB558074 D01 DTS Meas Guidance v03r02 and ANSI C63.10 (2013).

5 Summary of Test Results

Technical Requirements					
FCC Part 15 Subpart C					
Test Condition		Pages	Test Result		
			Pass	Fail	N/A
§15.207	Conducted emission AC power port	---	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
§15.247 (b) (1)	Conducted peak output power	10	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(a)(1)	20dB bandwidth	---	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
§15.247(a)(1)	Carrier frequency separation	---	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
§15.247(a)(1)(iii)	Number of hopping frequencies	---	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
§15.247(a)(1)(iii)	Dwell Time	---	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
§15.247(a)(2)	6dB bandwidth and 99% Occupied Bandwidth	11	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(e)	Power spectral density	13	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(d)	Spurious RF conducted emissions	14	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(d)	Band edge	18	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(d) & §15.209	Spurious radiated emissions for transmitter	20	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.203	Antenna requirement	See note 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Remark 1: N/A – Not Applicable.

Note 1: The EUT uses a integral antenna, which gain is 3.0dBi. According to §15.203, it is considered sufficiently to comply with the provisions of this section.

6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: S29RUNNER-250 complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules.

SUMMARY:

All tests according to the regulations cited on page 5 were

■ - Performed

□ - **Not** Performed

The Equipment under Test

■ - **Fulfills** the general approval requirements.

□ - **Does not** fulfill the general approval requirements.

Sample Received Date: June 16, 2015

Testing Start Date: June 16, 2015

Testing End Date: July 21, 2015

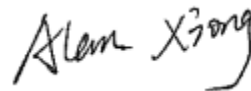
- TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch -

Reviewed by:

Prepared by:



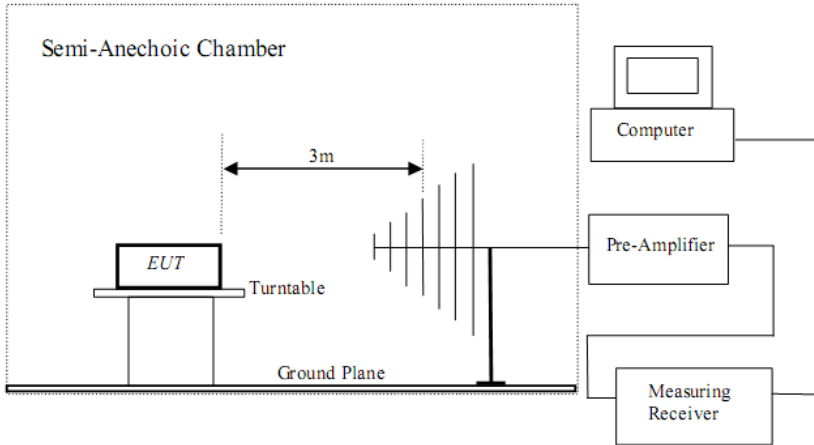
John Zhi
EMC Project Manager



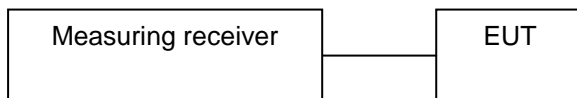
Alan Xiong
EMC Project Engineer

7 Test Setups

7.1 Radiated test setups



7.2 Conducted RF test setups



8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
---	---	---	---

9 Technical Requirement

9.1 Conducted peak output power

Test Method

1. Use the following spectrum analyzer settings:
RBW > the 6 dB bandwidth of the emission being measured, VBW \geq 3RBW, Span \geq 3RBW
Sweep = auto, Detector function = peak, Trace = max hold.
2. Add a correction factor to the display.
3. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power.

Limits

According to §15.247 (b) (1), conducted peak output power limit as below:

Frequency Range MHz	Limit W	Limit dBm
5725-5875	≤ 1	≤ 30

Test result as below table

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 5733MHz	0.44	Pass
Middle channel 5809MHz	0.16	Pass
High channel 5847MHz	-0.92	Pass

9.2 6dB bandwidth

Test Method

1. Use the following spectrum analyzer settings:
RBW=100K, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Use the automatic bandwidth measurement capability of an instrument, may be employed using the X Db bandwidth mode with X set to 6 Db, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 Db.
3. Allow the trace to stabilize, record the X Db Bandwidth value.

Limit

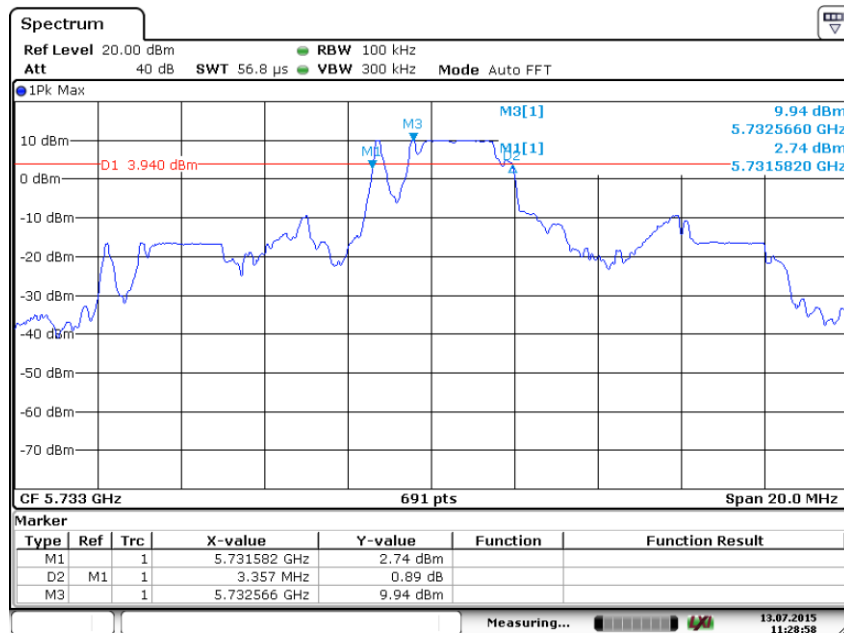
Limit [kHz]

≥500

Test result

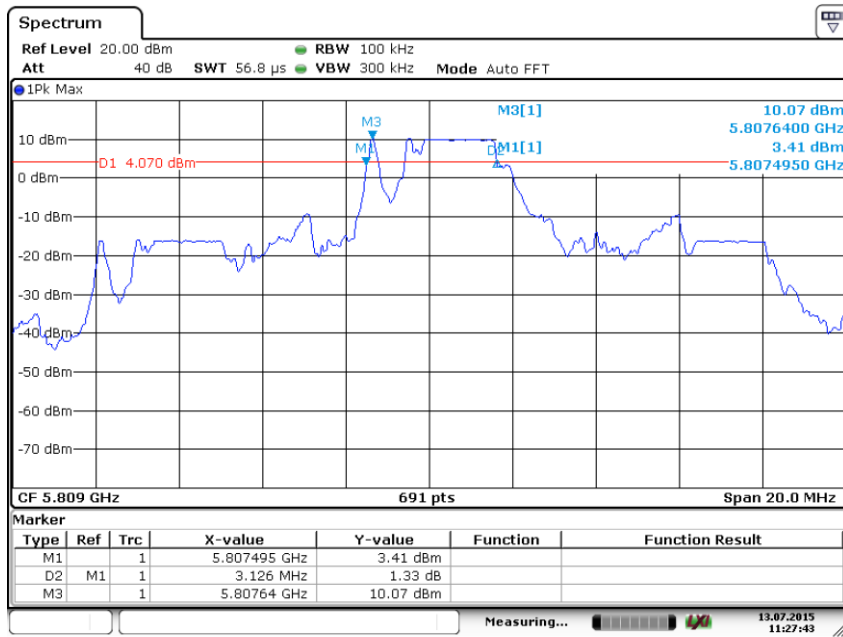
Frequency MHz	6dB bandwidth kHz	Result
Low channel 5733MHz	3357	Pass
Middle channel 5809MHz	3126	Pass
High channel 5847MHz	3184	Pass

5733MHz



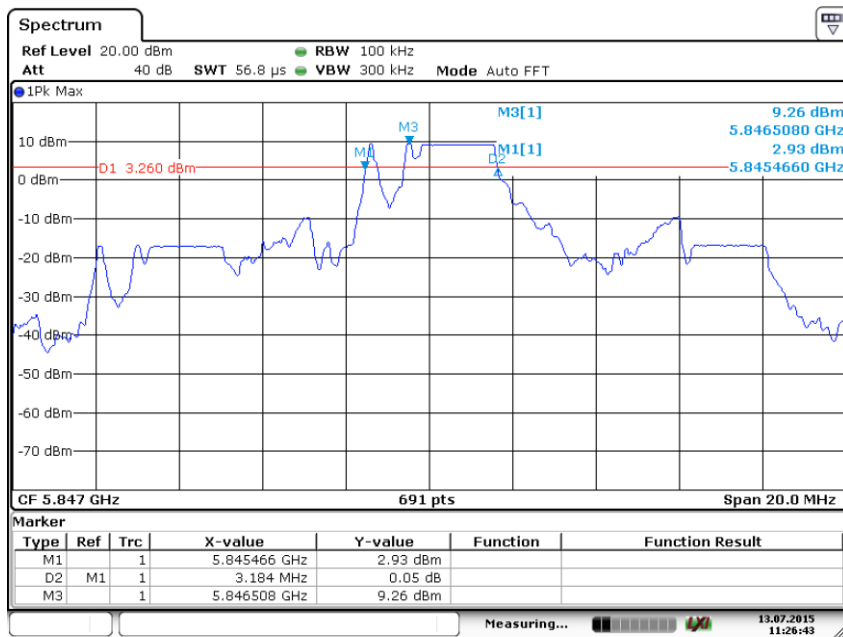
Date: 13.JUL.2015 11:28:58

5809MHz



Date: 13.JUL 2015 11:27:42

5847MHz



Date: 13.JUL 2015 11:26:43



9.3 Power spectral density

Test Method

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance:

1. Set analyzer center frequency to DTS channel center frequency.
 RBW=3kHz,VBW≥3RBW,Span=1.5 times DTS bandwidth, Detector=Avergae, Sweep=auto, The number of measurement points in the sweep≥2x span/RBW, Employ trace averaging (RMS) mode over a minimum of 100 traces.
2. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
3. Repeat above procedures until other frequencies measured were completed.

Limit

Limit [dBm]

≤8

Test result

Frequency MHz	Power spectral density dBm	Result
Low channel 5733MHz	-5.36	Pass
Middle channel 5809MHz	-4.63	Pass
High channel 5847MHz	-5.68	Pass

9.4 Spurious RF conducted emissions

Test Method

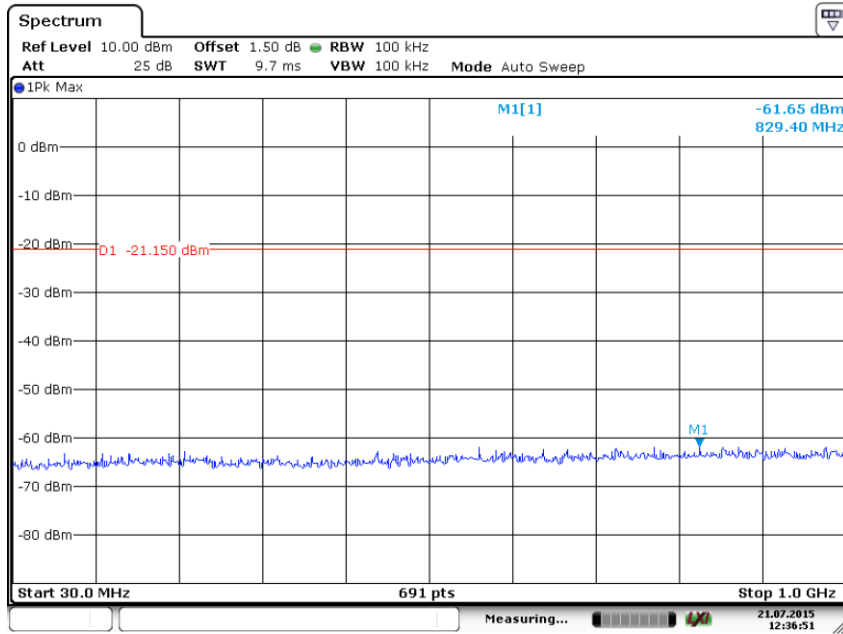
1. Establish a reference level by using the following procedure:
 - a. Set RBW=100 kHz. VBW \geq 3RBW. Detector =peak, Sweep time = auto couple, Trace mode = max hold.
 - b. Allow trace to fully stabilize, use the peak marker function to determine the maximum PSD level.
2. Use the maximum PSD level to establish the reference level.
 - a. Set the center frequency and span to encompass frequency range to be measured.
 - b. Use the peak marker function to determine the maximum amplitude level. Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements, report the three highest emissions relative to the limit.
3. Repeat above procedures until other frequencies measured were completed.

Limit

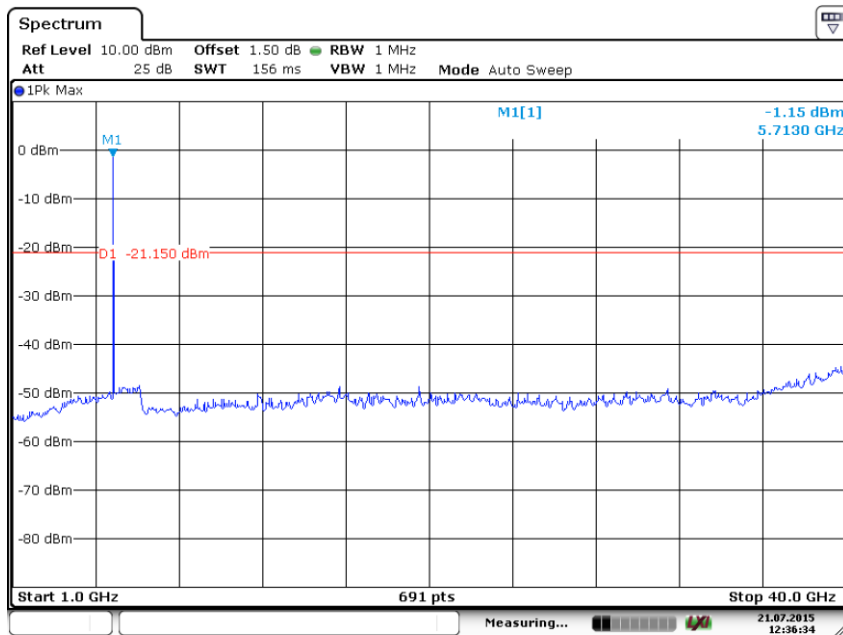
Frequency Range MHz	Limit (dBc)
30-25000	-20

Spurious RF conducted emissions

5733MHz

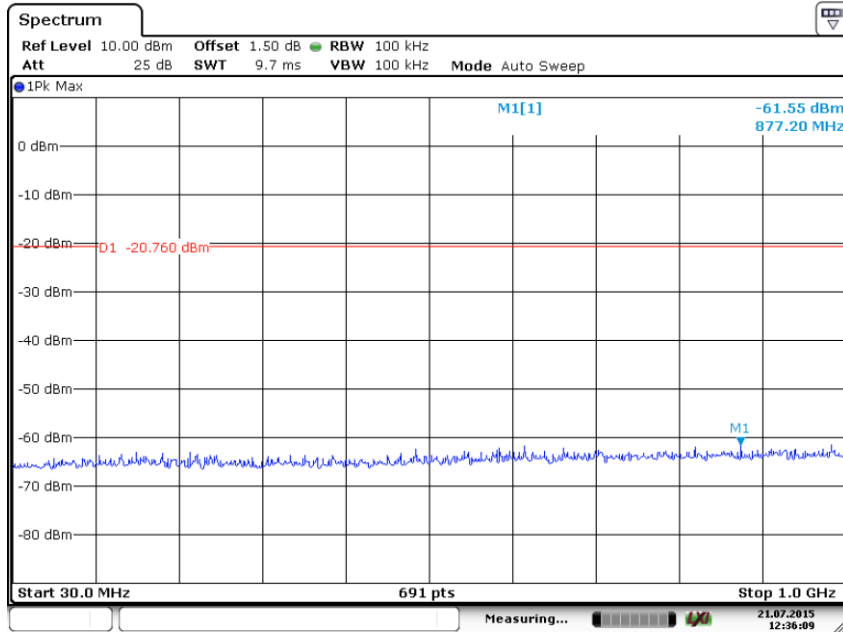


Date: 21.JUL.2015 12:36:50

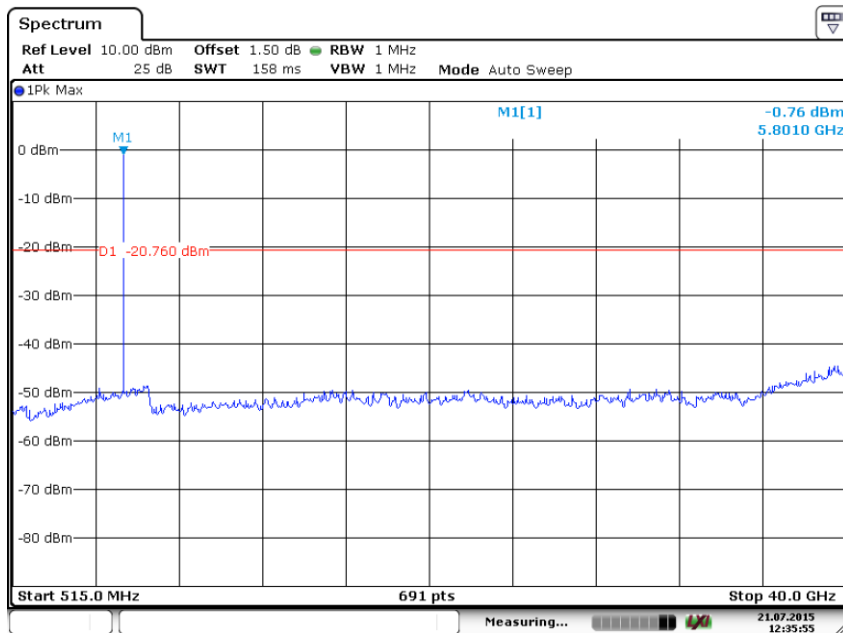


Date: 21.JUL.2015 12:36:34

5809MHz

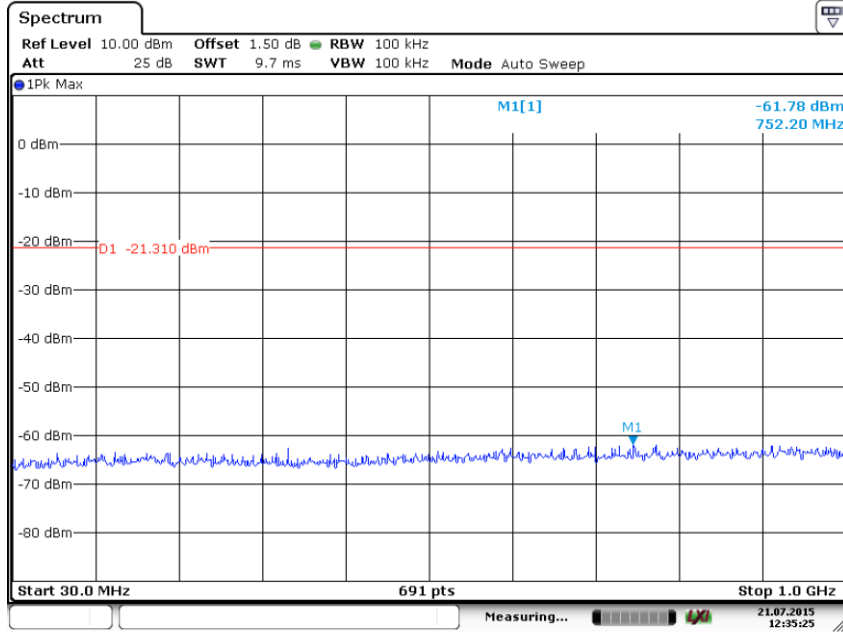


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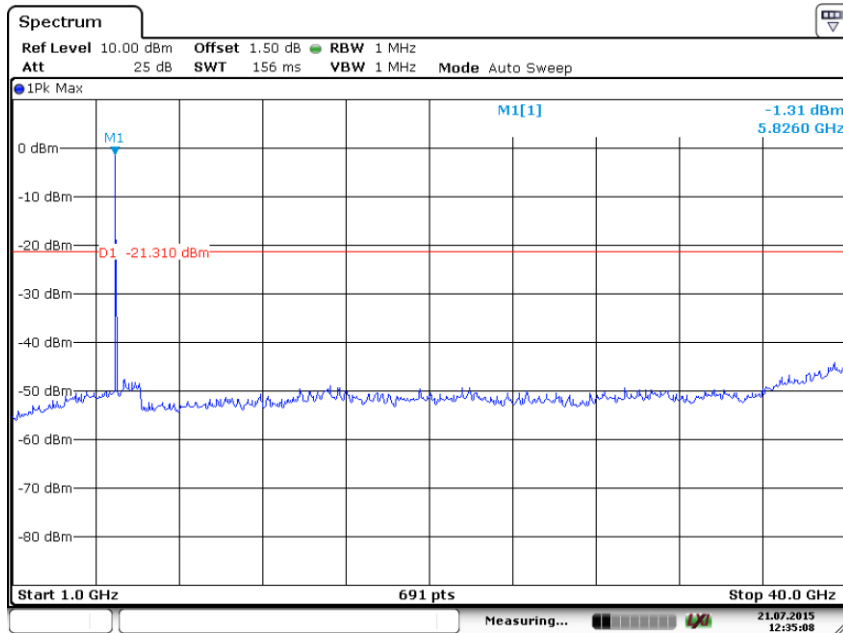


Date: 21.JUL.2015 12:35:55

5847MHz



Date: 21.JUL.2015 12:35:25



Date: 21.JUL.2015 12:35:08

9.5 Band edge

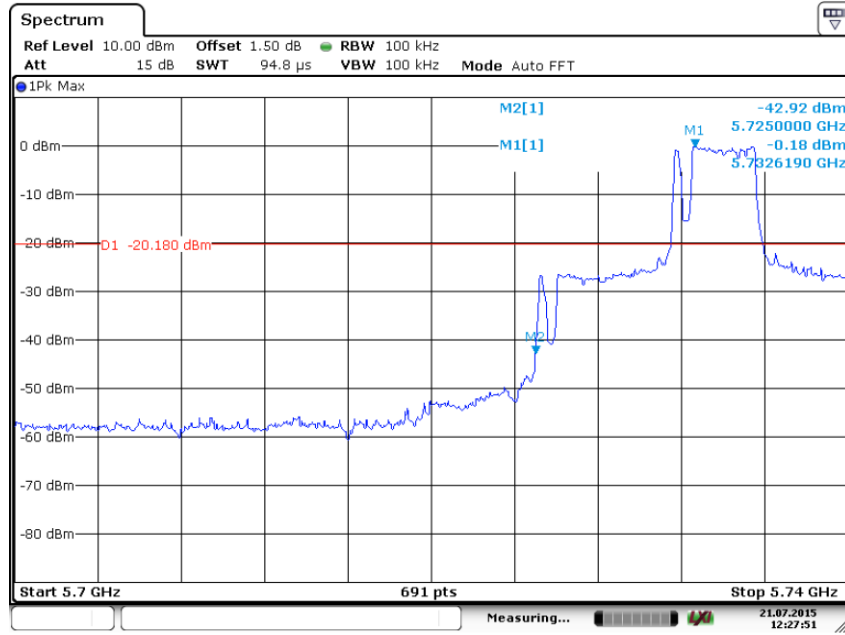
Test Method

- 1 Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 kHz, VBW \geq RBW, Sweep = auto, Detector function = peak, Trace = max hold.
- 2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
- 3 The level displayed must comply with the limit specified in this Section.

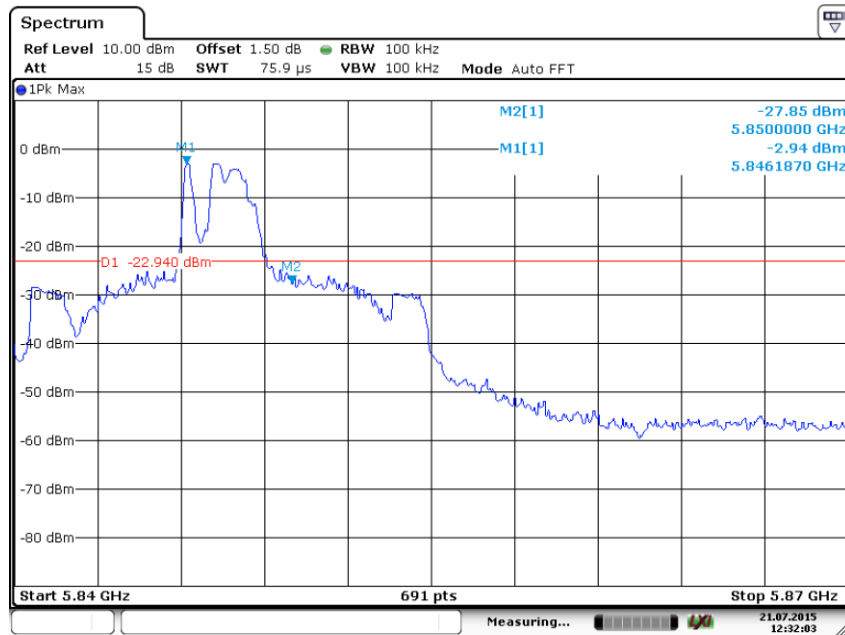
Limit

Frequency Range MHz	Limit (dBc)
30-25000	-20

Test result



Date: 21.JUL.2015 12:27:51



Date: 21.JUL.2015 12:32:02

9.6 Spurious radiated emissions for transmitter

Test Method

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
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 $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz, VBW \geq RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Follow the guidelines in ANSI C63.4-1992 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. If the duty cycle per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from $20\log(\text{duty cycle}/100 \text{ ms})$, in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

Limit

According to part 15.247(d), the radio emission outside the operating frequency band 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. Radiated emissions which fall in the restricted bands, as defined in section 15.205, must comply with the radiated emission limits specified in section 15.209.

Frequency MHz	Field Strength uV/m	Field Strength dB μ V/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

Spurious radiated emissions for transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

Transmitting spurious emission test result as below:

5733MHz

Fundamental emission level		93.10	dB μ V/m	Ave		
Limited for emission outside of restricted bands:		73.10	dB μ V/m	Ave		
Frequency	Emission Level	Polarization	Limit	Detector	Margin	Result
MHz	dBuV/m		dBμV/m		dBμV/m	
58.55	18.13	Horizontal	40.00	QP	21.87	Pass
160.10	18.83	Horizontal	43.50	QP	24.67	Pass
302.27	29.49	Horizontal	46.00	QP	16.51	Pass
50.13	18.22	Vertical	40.00	QP	21.78	Pass
160.16	23.91	Vertical	43.50	QP	19.59	Pass
252.01	22.44	Vertical	43.50	QP	21.06	Pass
*11466	46.99	Horizontal	54	Ave	7.01	Pass
*11466	52.55	Vertical	54	Ave	1.45	Pass
17199	46.83	Horizontal	73.10	Ave	26.27	Pass
17199	47.04	Vertical	73.10	Ave	26.06	Pass

5809MHz

Fundamental emission level		93.10	dB μ V/m	Ave		
Limited for emission outside of restricted bands:		73.10	dB μ V/m	Ave		
Frequency	Emission Level	Polarization	Limit	Detector	Margin	Result
MHz	dBuV/m		dBμV/m		dBμV/m	
*11618	47.04	Horizontal	54	Ave	6.96	Pass
*11618	52.27	Vertical	54	Ave	1.73	Pass
17427	47.93	Horizontal	73.10	Ave	25.17	Pass
17427	48.32	Vertical	73.10	Ave	24.78	Pass

5847MHz

Fundamental emission level		93.10	dB μ V/m	Ave		
Limited for emission outside of restricted bands:		73.10	dB μ V/m	Ave		
Frequency	Emission Level	Polarization	Limit	Detector	Margin	Result
MHz	dBuV/m		dBμV/m		dBμV/m	
*11694	48.26	Horizontal	54	Ave	5.74	Pass
*11694	51.20	Vertical	54	Ave	2.80	Pass
17541	48.26	Horizontal	73.10	Ave	25.84	Pass
17541	47.37	Vertical	73.10	Ave	25.73	Pass

Remark:

- (1) AV Emission Level= PK Emission Level+20log (duty cycle)
- (2) Testing is carried out with frequency range 30MHz to 40GHz, which above 2th harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (3) "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.

10 Test Equipment List

List of Test Instruments

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
C	Signal Analyzer	Rohde & Schwarz	FSV40	101030	2015-8-17
RE	EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2015-8-17
	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2017-8-17
	Horn Antenna	Rohde & Schwarz	HF907	102294	2017-8-17
	Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2015-8-17
	3m Semi-anechoic chamber	TDK	9X6X6	----	2019-5-29

C - Conducted RF tests

- Conducted peak output power
- 6dB bandwidth
- Power spectral density
- Spurious RF conducted emissions
- Band edge



11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty

Items	Extended Uncertainty
Radiation emission	Horizontal: 4.83dB; (30MHz-1GHz) Vertical: 4.91dB; (30MHz-1GHz) Horizontal: 4.89dB; (1Hz-18GHz) Vertical: 4.88dB; (1Hz-18GHz)