TEST REPORT

Part 15 Subpart C 15.249

Equipment under test MULTICOPTER

Model name LOBIT 100F

FCC ID 2AICO- LOBIT100F

Applicant DROGEN Co., Ltd.

Manufacturer DROGEN Co., Ltd.

Date of test(s) 2016.06.03 ~2016.06.20

Date of issue 2016.06.28

Issued to

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Revision history

Revision	Date of issue	Test report No.	Description
-	2016.06.28	KES-RF-16T0052	Initial

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1. General information

Applicant:	DROGEN Co., Ltd.
Applicant address:	D-1004, Smart Vally, 30 Songdomirae-ro, Yeonsu-gu, Incheon, 21990, Korea
Test site:	KES Co., Ltd.
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FCC rule part(s):	Part 15.249
FCC ID:	2AICO-LOBIT100F
Test device serial No.:	☒ Production ☐ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test	MULTICOPTER
Model:	LOBIT 100F
Derivative model	N/A
Power source	DC 3.7 V Li-ion Battery

- For 2.4G Band

Frequency range	2410 ㎒ ~ 2465 ㎒
Modulation technique	GFSK
Number of channels	12ch
Antenna specification	Antenna type: PCB, Peak gain: 1.0 ㏈i

- For 5.8G Band

Frequency range	5735 ㎒ ~ 5815 ㎒
Modulation technique	FM
Number of channels	17ch
Antenna specification	Antenna type: Wire, Peak gain: 1.0 ㏈i

1.2. Test configuration

The **DROGEN Co., Ltd. MULTICOPTER FCC ID: 2AICO-LOBIT100F** was tested per the guidance ANSI C63.10-2009 was used to reference the appropriate EUT setup for radiated spurious emissions testing.

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1.3. Frequency/channel operations

- For 2.4G Band

Ch.	Frequency (㎒)	Mode
01	2 412	GFSK
. .	. .	. .
06	2437	GFSK
. .	. .	. .
11	2 462	GFSK

- For 5.8G Band

Ch.	Frequency (㎒)	Mode
01	5 735	FM
. .	. .	. .
09	5 775	FM
. .	. .	. .
17	5 815	FM

1.4. Accessory information

Applicant	Equipment	Manufacturer	Model	Power source
-	-	-	-	-

1.5. Device modifications

N/A

1.6. Derivation model information

N/A

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2. Summary of tests

Reference	Parameter	Test results
15.249(a)	Field strength of fundamental	Pass
15.205 15.209 15.249(d)	Radiated spurious emission, Out-of-band emission	Pass
15.215(c)	20 dB bandwidth	Pass

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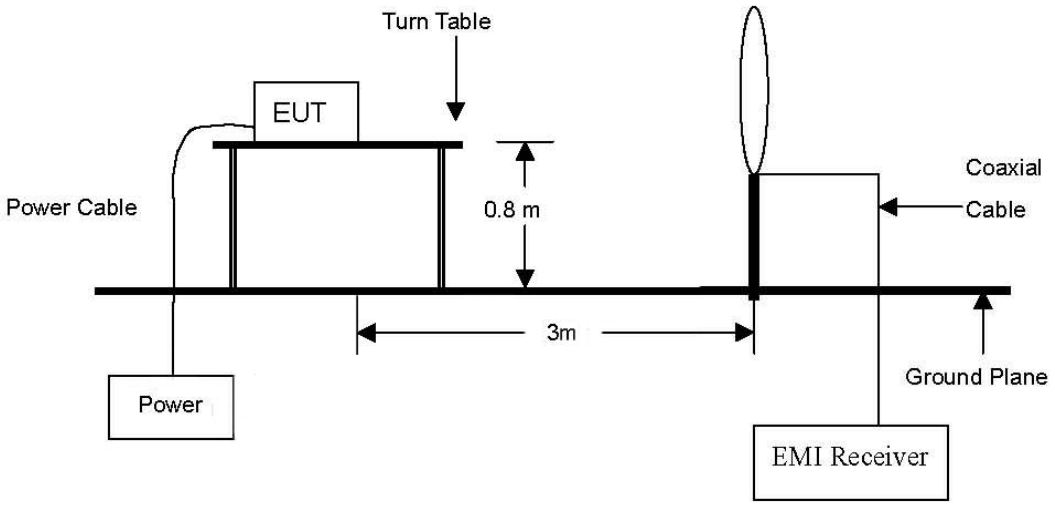
3. Test results

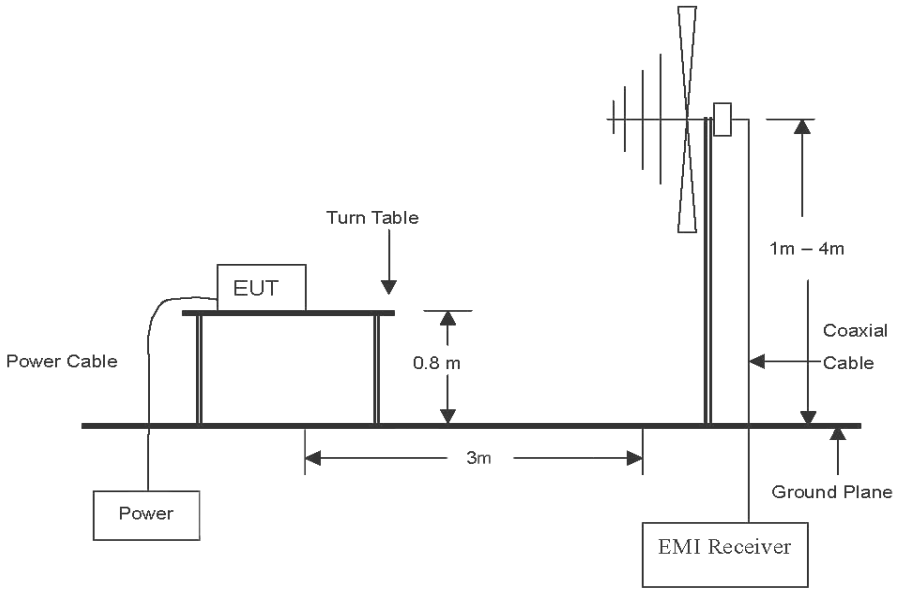
3.1 Field strength of fundamental & Radiated spurious emission & Out-of-band emission

Test setup

The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.



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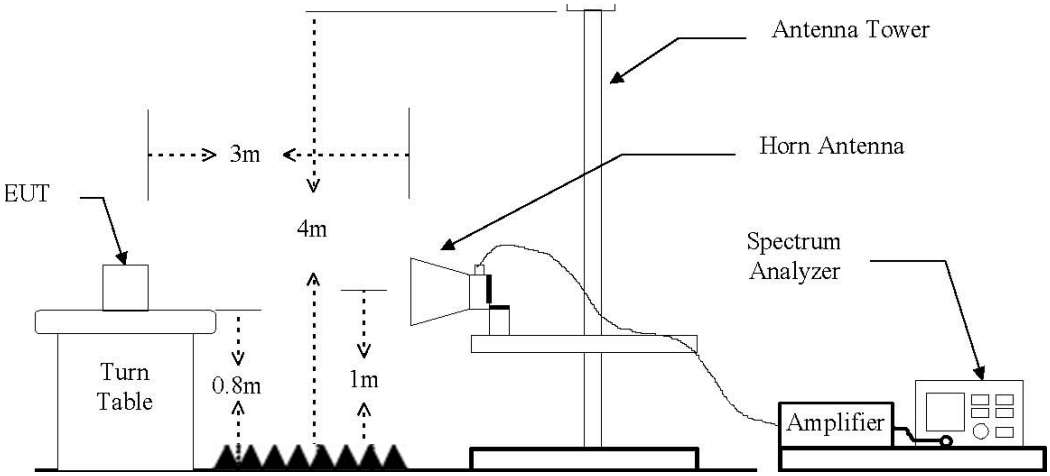
The diagram below shows the test setup that is utilized to make the measurements for emission from 1 ㎓ to the tenth harmonic of the highest fundamental frequency or to 40 ㎓ emissions, whichever is lower.



Test procedure below 30 ㎒

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
3. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test-receiver system was set to average or quasi peak detect function and Specified Bandwidth with Maximum hold mode.

Test procedure above 30 ㎒

1. Spectrum analyzer settings for $f < 1$ ㎓:
   ① Span = wide enough to fully capture the emission being measured
   ② RBW = 100 ㎑
   ③ VBW ≥ RBW
   ④ Detector = quasi peak
   ⑤ Sweep time = auto
   ⑥ Trace = max hold
2. Spectrum analyzer settings for $f \geq 1$ ㎓: Peak
   ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
   ② RBW = 1 ㎒
   ③ VBW ≥ 3 ㎒
   ④ Detector = peak
   ⑤ Sweep time = auto
   ⑥ Trace = max hold
   ⑦ Trace was allowed to stabilize

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3. Spectrum analyzer settings for $f \geq 1$ GHz: Average
   ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
   ② RBW = 1 MHz
   ③ VBW = 10 Hz
   ④ Set detector = Peak.
   ⑤ Set sweep time = auto.
   ⑥ Sweep = auto
   ⑦ Trace = max hold
   ⑧ Allow sweeps to continue until the trace stabilizes.

Note.

1. f<30 MHz, extrapolation factor of 40 dB/decade of distance. $F_d = 40\log(D_m/Ds)$
   $f \geq 30$ MHz, extrapolation factor of 20 dB/decade of distance. $F_d = 20\log(D_m/Ds)$
   Where:
   F_d = Distance factor in dB
   D_m = Measurement distance in meters
   D_s = Specification distance in meters
3. CF(Correction factors(dB)) = Antenna factor(dB/m) + Cable loss(dB) + or Amp. gain(dB) + or F_d(dB)
4. Field strength(dBμV/m) = Level(dBμV) + CF (dB) + or DCF(dB)
5. Margin(dB) = Limit(dBμV/m) - Field strength(dBμV/m)
6. Emissions below 18 GHz were measured at a 3 meter test distance while emissions above 18 GHz were measured at a 1 meter test distance with the application of a distance correction factor.
7. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z, it was determined that **Y orientation** was worst-case orientation; therefore, all final radiated testing was performed with the EUT in **Y orientation.**
8. The worst-case emissions are reported however emissions whose levels were not within 20 dB of respective limits were not reported.

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Limit

According to 15.209(a), for an intentional radiator devices, the general required of field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values：

Frequency (㎒)	Distance (Meters)	Radiated (㎶/m)
0.009 ~ 0.490	300	2 400 / F(㎑)
0.490 ~ 1.705	30	24 000 / F(㎑)
1.705 ~ 30.0	30	30
30 ~ 88	3	100**
88 ~ 216	3	150**
216 ~ 960	3	200**
Above 960	3	500

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 ~ 72 ㎒, 76 ~ 88 ㎒, 174 ~ 216 ㎒ or 470 ~ 806 ㎒. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

According to 15.249(a)

Fundamental frequency	Field strength of fundamental		Field strength of harmonics	
	mV/m	dBuV/m	uV/m	dBuV/m
902-928 MHz	50	94	500	54
2400-2483.5 MHz	50	94	500	54
5725-5875 MHz	50	94	500	54
24.0-24.25 GHz	250	108	2500	68

According to 15.249(d)

Emission radiated outside of the specified frequency bands, except harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated limit in FCC part 15C, Section 15.209, whichever is the lesser attenuation.

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Test result (Fundamental) – For 2.4G Band

Operating Frequency: 2 410 ㎒

Frequency (㎒)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2410.22	82.40	Peak	H	-0.84	-	81.56	114.00	32.44
2410.22	68.93	Peak	V	-0.84	-	68.09	114.00	45.91

Operating Frequency: 2 435 ㎒

Frequency (㎒)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2435.35	79.81	Peak	H	-0.71	-	79.10	114.00	34.90
2435.27	66.38	Peak	V	-0.71	-	65.67	114.00	48.33

Operating Frequency: 2 465 ㎒

Frequency (㎒)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2465.15	78.46	Peak	H	-0.55	-	77.91	114.00	36.09
2465.15	67.47	Peak	V	-0.55	-	66.92	114.00	47.08

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Test results (Spurious emission) – For 2.4G Band

- **Below 30 ㎒**

Operating Frequency: 2 410 ㎒ (Worst case)

Frequency (㎒)	Level (dBμV)	Ant. Pol. (H/V)	CF (dB)	F_d (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
No spurious emissions were detected within 20 ㏈ of the limit							

- **Below 1 000 ㎒**

Operating Frequency: 2 410 ㎒ (Worst case)

Frequency (㎒)	Level (dBμV)	Ant. Pol (H/V)	CF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
48.51	10.11	V	15.31	25.42	40.00	14.58
153.22	16.35	H	11.11	27.46	43.50	16.04
271.80	16.22	H	16.81	33.03	46.00	12.97
305.51	14.70	V	17.77	32.47	46.00	13.53
407.28	11.35	H	20.89	32.24	46.00	13.76
542.17	10.89	V	24.02	34.91	46.00	11.09

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- **Above 1 000 ㎒**

Operating Frequency: 2 410 ㎒

Frequency (㎒)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2382.64	43.48	Peak	H	-0.99	-	42.49	74.00	31.51
2385.15	42.14	Peak	V	-0.97	-	41.17	74.00	32.83
4821.27	35.53	Peak	H	8.19	-	43.72	74.00	30.28
4821.10	32.51	Peak	V	8.19	-	40.70	74.00	33.30

Operating Frequency: 2 435 ㎒

Frequency (㎒)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4871.12	38.97	Peak	H	8.55	-	47.52	74.00	26.48
4871.85	37.66	Peak	V	8.56	-	46.22	74.00	27.78

Operating Frequency: 2 465 ㎒

Frequency (㎒)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2483.56	42.25	Peak	H	-0.45	-	41.80	74.00	32.20
2483.82	41.87	Peak	V	-0.45	-	41.42	74.00	32.58
4931.32	39.11	Peak	H	8.98	-	48.09	74.00	25.91
4931.28	36.74	Peak	V	8.98	-	45.72	74.00	28.28

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Test result (Fundamental) – For 5.8G Band

Operating Frequency: 5 735 ㎒

Frequency (㎒)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5735.35	86.70	Peak	H	11.47	-	98.17	114.00	15.83
5735.35	84.23	Peak	V	11.47	-	95.70	114.00	18.30

Operating Frequency: 5 775 ㎒

Frequency (㎒)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5775.1	86.56	Peak	H	11.55	-	98.11	114.00	15.89
5775.10	83.14	Peak	V	11.55	-	94.69	114.00	19.31

Operating Frequency: 5 815 ㎒

Frequency (㎒)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5815.16	84.96	Peak	H	11.63	-	96.59	114.00	17.41
5815.20	81.98	Peak	V	11.63	-	93.61	114.00	20.39

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Test results (Spurious emission) – For 5.8G Band

- **Below 30 ㎒**

Operating Frequency: 5 735 ㎒ (Worst case)

Frequency (㎒)	Level (dBμV)	Ant. Pol. (H/V)	CF (dB)	F_d (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
No spurious emissions were detected within 20 ㏈ of the limit							

- **Below 1 000 ㎒**

Operating Frequency: 5 735 ㎒ (Worst case)

Frequency (㎒)	Level (dBμV)	Ant. Pol (H/V)	CF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
43.33	12.33	V	14.68	27.01	40.00	12.99
145.20	14.50	H	10.78	25.28	43.50	18.22
223.15	11.27	V	15.33	26.60	46.00	19.40
309.05	13.90	H	17.88	31.78	46.00	14.22
445.85	11.15	V	21.71	32.86	46.00	13.14
581.24	10.33	H	25.10	35.43	46.00	10.57

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- **Above 1 000 ㎒**

Operating Frequency: 5 735 ㎒

Frequency (㎒)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5724.89	45.25	Peak	H	11.45	-	56.70	74.00	17.30
5724.89	36.77	Avg	H	11.45	-	48.22	54.00	5.78
5724.89	44.78	Peak	V	11.45	-	56.23	74.00	17.77
5724.89	35.25	Avg	V	11.45	-	46.70	54.00	7.30
11470.25	33.79	Peak	H	25.06	-	58.85	74.00	15.15
11470.25	24.51	Avg	H	25.06	-	49.57	54.00	4.43
11470.25	32.51	Peak	V	25.06	-	57.57	74.00	16.43
11470.25	23.33	Avg	V	25.06	-	48.39	54.00	5.61

Operating Frequency: 5 775 ㎒

Frequency (㎒)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
11551.1	33.43	Peak	H	25.24	-	58.67	74.00	15.33
11551.1	24.70	Avg	H	25.24	-	49.94	54.00	4.06
11551.1	34.23	Peak	V	25.24	-	59.47	74.00	14.53
11551.1	24.91	Avg	V	25.24	-	50.15	54.00	3.85

Operating Frequency: 5 815 ㎒

Frequency (㎒)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5875.15	46.22	Peak	H	11.76	-	57.98	74.00	16.02
5875.15	37.1	Avg	H	11.76	-	48.86	54.00	5.14
5875.05	44.93	Peak	V	11.76	-	56.69	74.00	17.31
5875.05	35.31	Avg	V	11.76	-	47.07	54.00	6.93
11631.32	34.73	Peak	H	25.49	-	60.22	74.00	13.78
11631.32	24.24	Avg	H	25.49	-	49.73	54.00	4.27
11631.32	35.05	Peak	V	25.49	-	60.54	74.00	13.46
11631.32	24.97	Avg	V	25.49	-	50.46	54.00	3.54

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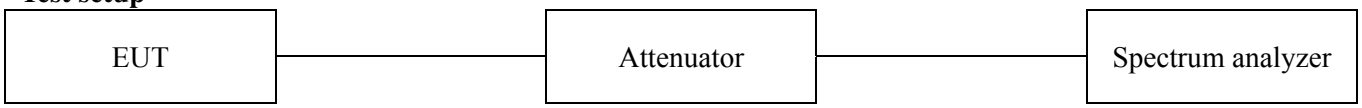
3.2 20 dB bandwidth

Test setup



Test procedure

1. Use the following spectrum analyzer setting
   Center frequency: Lowest, middle and highest channels
   Span = approximately 2 to 3 times the 20dB bandwidth
   RBW ≥ 1 % of the 20dB bandwidth
   VBW ≥ 3 x RBW
   Sweep = auto
   Detector function = peak
   Trace = max hold
2. 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 20 dB relative to the maximum level measured in the fundamental emission.

Limit

Not applicable

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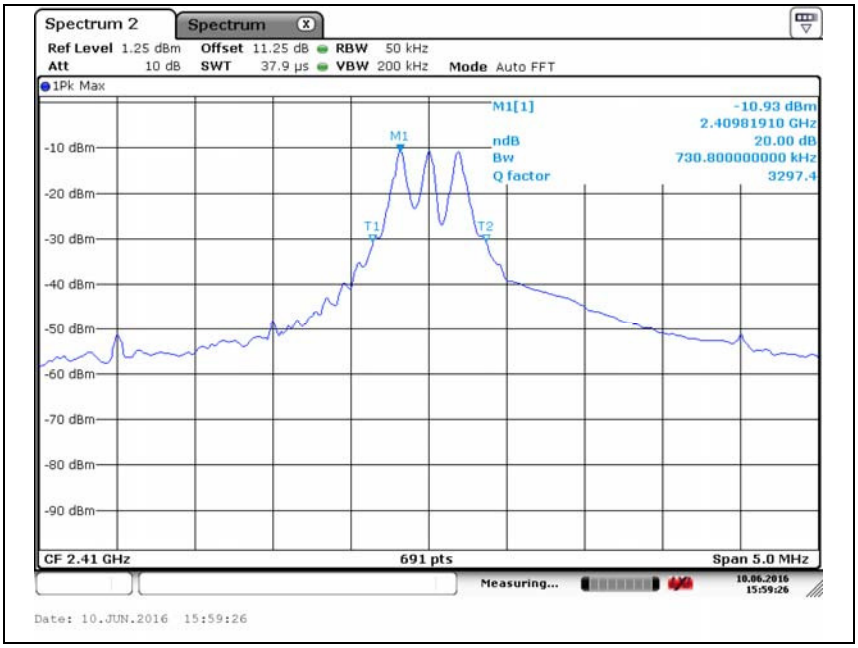
Test results

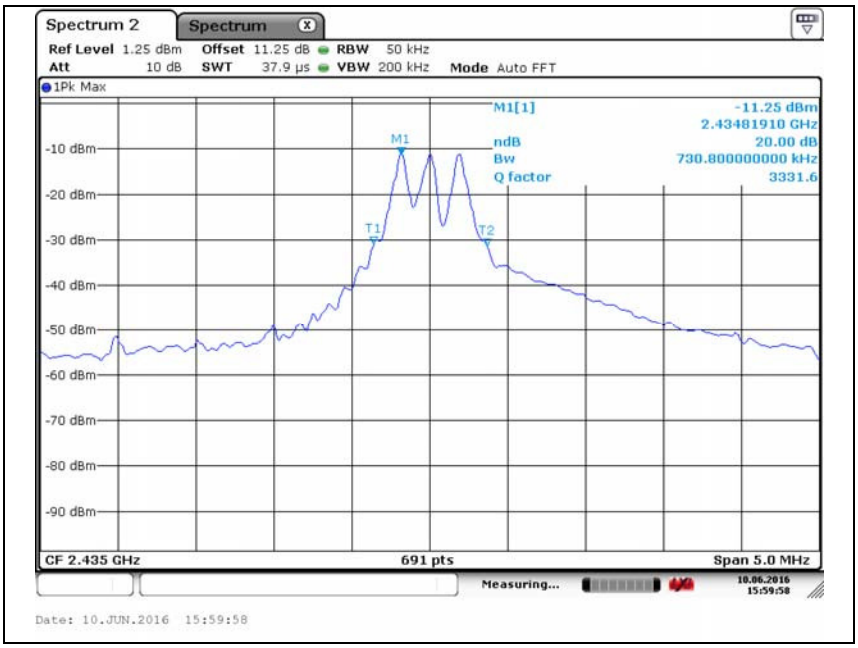
- **For 2.4G Band**

Operation mode	Frequency(㎒)	20 ㏈ bandwidth(㎒)	Limit
Transmission	2 410	0.731	-
	2 435	0.731	-
	2 465	0.738	-

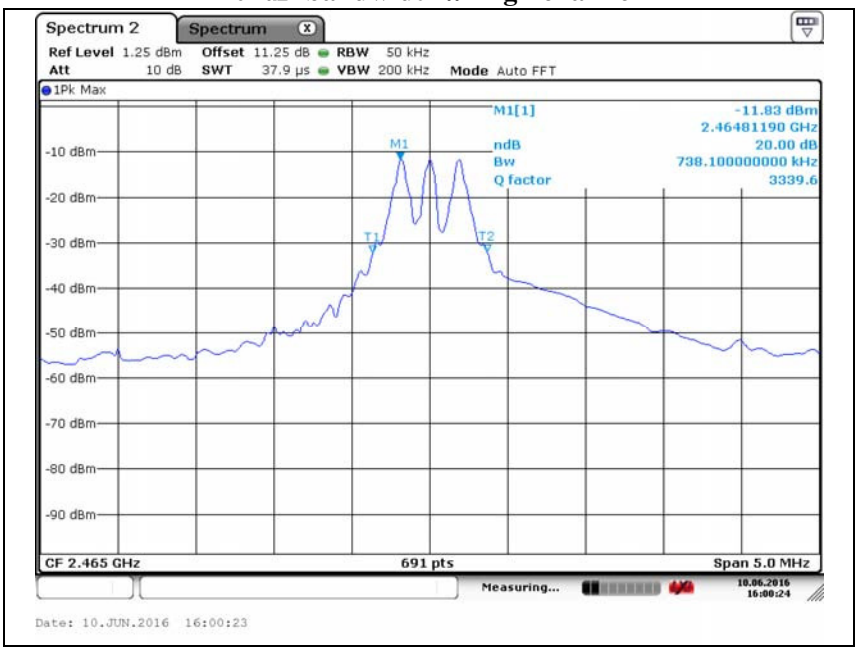
20 ㏈ bandwidth // Low channel



20 dB bandwidth // Middle channel



20 dB bandwidth // High channel



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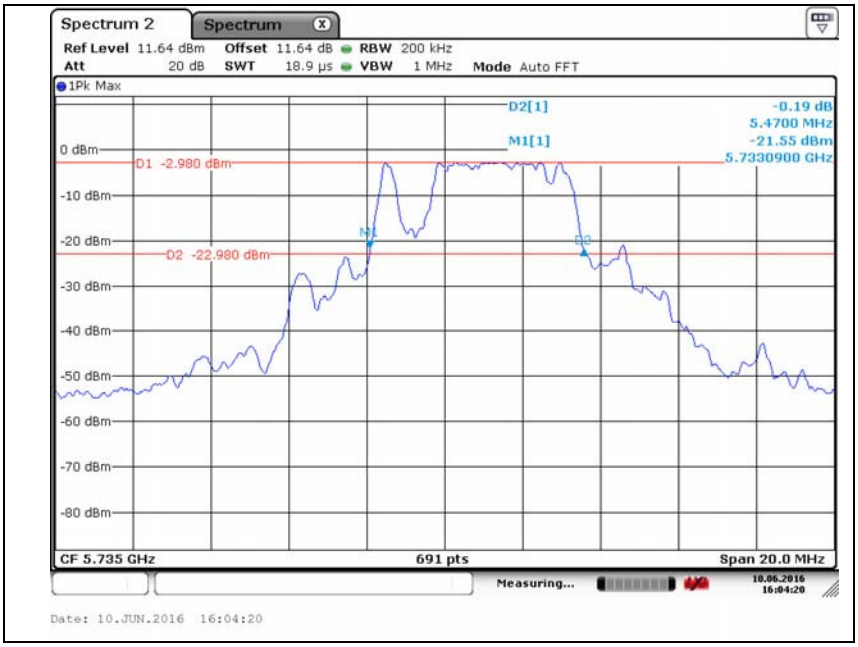
- **For 5.8G Band**

Operation mode	Frequency(㎒)	20 ㏈ bandwidth(㎒)	Limit
Transmission	5 735	5.470	-
	5 775	5.412	-
	5 815	5.644	-

20 ㏈ bandwidth // Low channel



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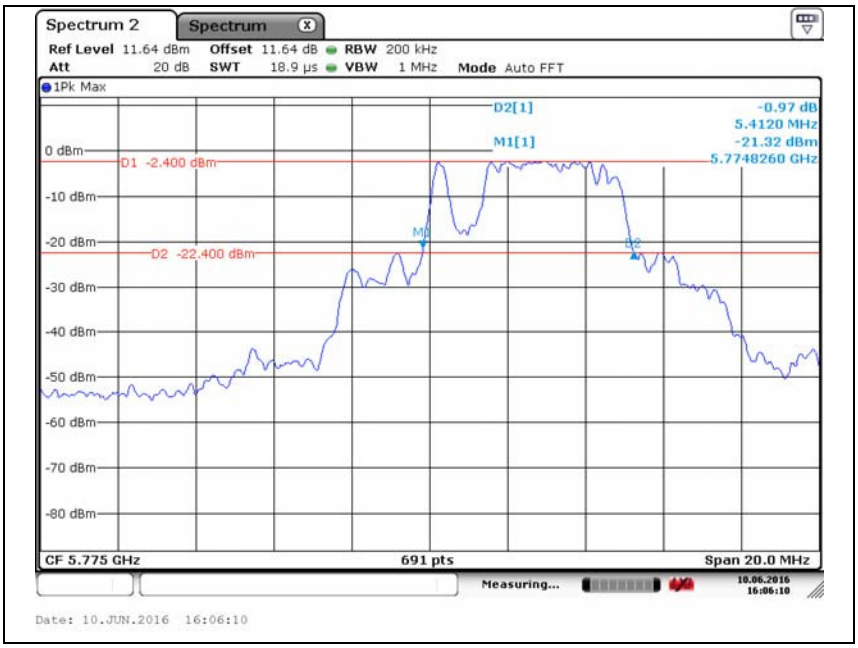
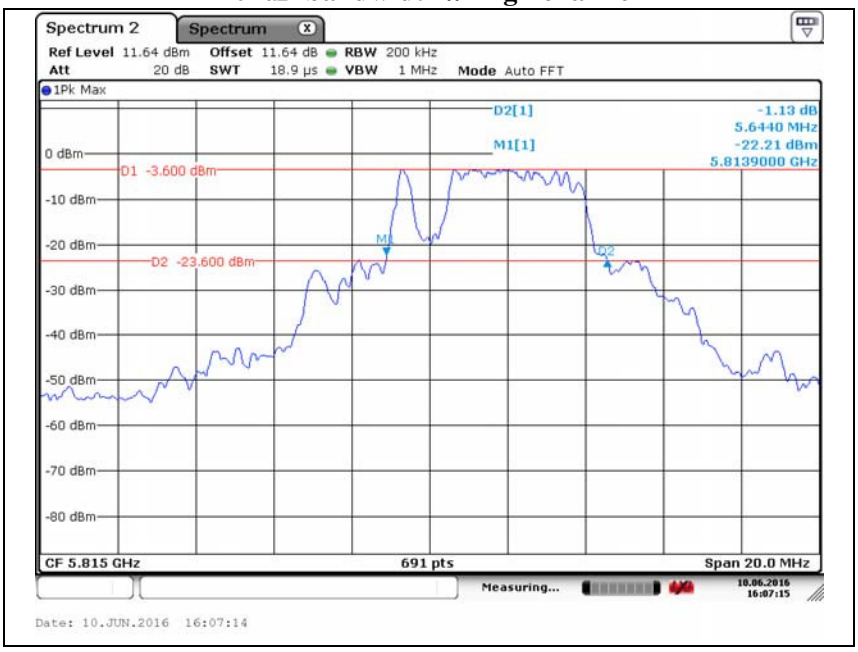
20 dB bandwidth // Middle channel



20 dB bandwidth // High channel



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The test results in the report only apply to the tested sample.

Appendix A. Measurement equipment

Equipment	Manufacturer	Model	Serial No.	Calibration interval	Calibration due
Spectrum analyzer	R&S	FSV30	100736	1 year	2016.07.25
8360B Series Swept Signal Generator	HP	83630B	3844A00786	1 year	2017.01.25
High Pass Filter	WAINWRIGHT INSTRUMENT	WHJS3000-10TT	1	1 year	2016.07.24
Low Pass Filter	WEINSCHEL	WLK1.0/18G-10TT	1	1 year	2016.07.24
Preamplifier	HP	8447F	2805A02570	1 year	2017.01.21
Brodband preamplifier	Schwarzbeck	BBV9718	9718-246	1 years	2016.10.23
Loop Antenna	R&S	HFH2-Z2.335.4711.52	826532	2 years	2017.03.03
Trilog-broadband antenna	Schwarzbeck	VULB 9168	9168-713	2 years	2017.05.15
Horn Antenna	A.H.	SAS-571	781	2 years	2017.05.07
Horn Antenna	Schwarzbeck	BBHA9170	BBHA9170550	2 years	2017.04.30
Broadband Amplifier	SCHWARZBECK	BBV-9721	PS9721-003	1 year	2017.01.25
EMI Test Receiver	R&S	ESR3	101781	1 year	2017.05.03
EMI Test Receiver	R&S	ESU26	100552	1 year	2017.04.24

Peripheral devices

Device	Manufacturer	Model No.	Serial No.
-	-	-	-

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