

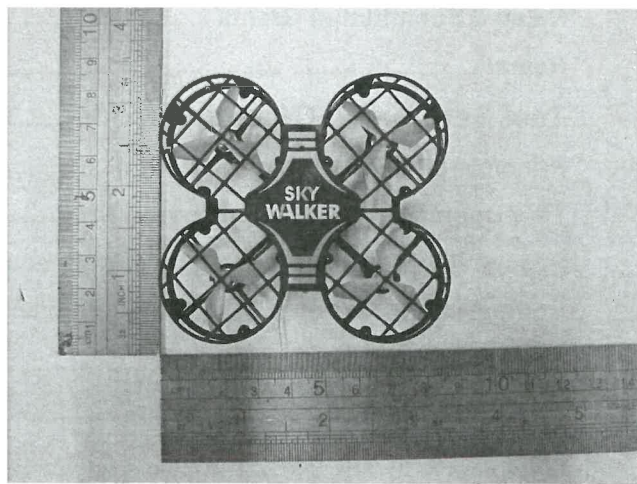


Prüfbericht-Nr.: <i>Test Report No.:</i>	50147643 001	Auftrags-Nr.: <i>Order No.:</i>	144184117	Seite 1 von 16 <i>Page 1 of 16</i>	
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	16.05.2018		
Auftraggeber: <i>Client:</i>	Shantou Helicute Model Aircraft Industrial Co., Ltd. Jiangbei Road, Longtian, Guangyi Street, Chenghai District, Shantou City, Guangdong Province, China				
Prüfgegenstand: <i>Test item:</i>	Short Range Device - Copter with Wi-Fi Camera				
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	Please refer to "Models" on page 4				
Auftrags-Inhalt: <i>Order content:</i>	FCC Certification				
Prüfgrundlage: <i>Test specification:</i>	FCC Part 15 Subpart C ANSI C63.10-2013				
Wareneingangsdatum: <i>Date of receipt:</i>	09.07.2018				
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000772402-001				
Prüfzeitraum: <i>Testing period:</i>	11.07.2018 - 24.07.2018				
Ort der Prüfung: <i>Place of testing:</i>	TÜV Rheinland Hong Kong Ltd.				
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland Hong Kong Ltd.				
Prüfergebnis*: <i>Test result*:</i>	Pass				
geprüft von / tested by:		kontrolliert von / reviewed by:			
					
24.07.2018	Tung Chan / Test Engineer	24.07.2018	Mika Chan / Project Manager		
Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>
Sonstiges / Other: FCC ID: 2AKPPFLTH823					
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>			
<p>* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet</p> <p>Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested</p>					
<p>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.</p> <p><i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i></p>					

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Product information

Manufacturers declarations

	Transceiver
Operating frequency range	2417 MHz
Type of modulation	Other type of spread spectrum
Number of channels	1
Channel separation	5 MHz
Type of antenna	Wire Antenna
Antenna gain (dBi)	0.17 dBi
Power level	fix
Type of equipment	stand alone radio device
Connection to public utility power line	No
Nominal voltage	V_{nor} : 3.8 VDC
Independent Operation Modes	Transmitting

Product function and intended use

The equipment under test (EUT) is a Bluetooth low energy device.

FCC ID: 2AKPPFLTH823

Models	Product description
W60, W760, W735, W768, W831, W835, W855, X655, LW9601, LW9801, LW9612, LW6306, BTHW-Q02, BTHW-Q02T, BTH05, BTQ05, BTHW-Q04, BTH07, BTQ07	Short Range Device - Copter with Wi-Fi Camera

Submitted documents

Circuit Diagram
 Block Diagram
 Technical Description
 User manual
 Label

Independent Operation Modes

The basic operation modes are:

- Transmitting mode.

For further information refer to User Manual

Related Submittal(s) Grants

This is a single application for certification of the transmitter.

Remark

The test results in this test report are only relevant to the tested sample and does not involve any assessment in the production.

Test Set-up and Operation Mode

Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

Test Operation and Test Software

Test operation should refer to test methodology.

- During test, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power was selected according to the instruction given by the manufacturer (55aa010210). The setting of the RF output power expected by the customer shall be fixed on the firmware of the final end product.

Special Accessories and Auxiliary Equipment

- None

Countermeasures to achieve EMC Compliance

- none

Test Methodology

Radiated Emission

The radiated emission measurements of the transmitter part were performed according to the procedures in ANSI C63.10-2013.

For measurement below 1GHz - the equipment under test (EUT) was placed at the middle of the 80 cm height turntable. For measurement above 1GHz - the EUT was placed at the middle of the 1.5 m height turntable and RF absorbing material was placed on ground plane between turntable and measuring antenna. During the testing, the EUT was operated standalone and arranged for maximum emissions. The EUT was tested in three orthogonal planes.

The investigation is performed with the EUT rotated 360°, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained.

All radiated tests were performed at an antenna to EUT with 3 meters distance, unless stated otherwise in particular parts of this test report.

Field Strength Calculation

The field strength at 3 m was established by adding the meter reading of the spectrum analyzer to the factors associated with antenna correction factor, cable loss, preamplifiers and filter attenuation.

The equation is expressed as follow:

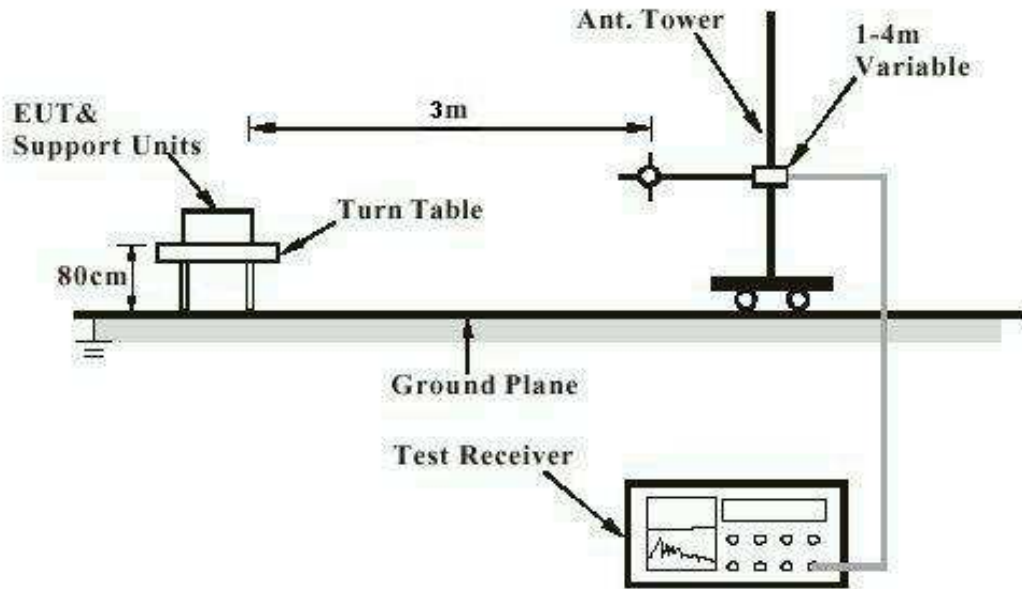
$$FS = R + AF + CF + FA - PA$$

Where FS = Field Strength in dBuV/m at 3 meters.
R = Reading of Spectrum Analyzer in dBuV.
AF = Antenna Factor in dB.
CF = Cable Attenuation Factor in dB.
FA = Filter Attenuation Factor in dB.
PA = Preamplifier Factor in dB.

FA and PA are only be used for the measuring frequency above 1 GHz.

Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



Note: Measurements above 1 GHz are done with a table height of 1.5m. In addition, there is RF absorbing material on the floor of the test site for above 1GHz measurement.

Diagram of Measurement Equipment Configuration for Mains Conduction Measurement (if applicable)

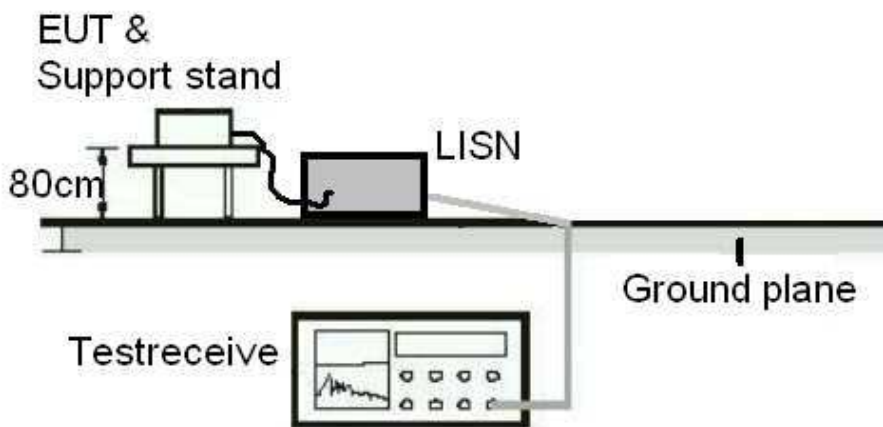
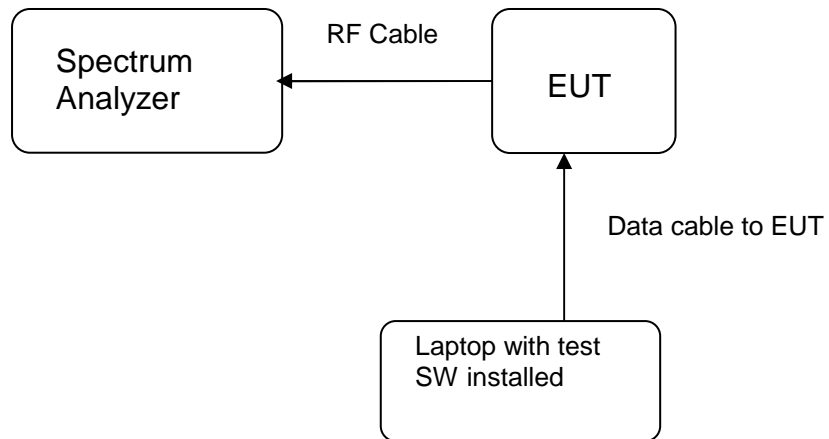


Diagram of Equipment Configuration for Antenna-port Conducted Measurement (if applicable)



Test Facility

Test Laboratory Information

TÜV Rheinland Hong Kong Ltd.

Address: 3-4, 11/F., Fou Wah Industrial Building, 10-16 Pun Shan Street, Tsuen Wan, N.T., Hong Kong

Tel.: +852 2192 1000

Fax: +852 2192 1001

Email service-gc@tuv.com

Web: www.tuv.com

The test facility is recognized or accredited by the following organizations:

FCC

Type	: Accredited Test Firm
Designation Number	: HK0013
Test Firm Registration Number	: 371735
Scope	: Intentional Radiators

List of Test and Measurement Instruments

Radiated Emission

Equipment	Manufacturer	Type	Cal. Date	Due Date
Semi-anechoic Chamber	Frankonia	Nil	23-Apr-18	23-Apr-19
Test Receiver	R & S	ESU40	12-Jun-18	12-Jun-19
Bi-conical Antenna	R & S	HK116	21-Mar-18	21-Mar-20
Log Periodic Antenna	R & S	HL223	22-Mar-18	22-Mar-20
Cable with I-Joint Conector	Huber+Suhner	CNM-NMCMILX800-473	11-Dec-17	11-Dec-19
Active Loop Antenna	EMCO	6502	30-Oct-17	30-Oct-18
Semi-anechoic Chamber (SiteVSWR)	Frankonia	Nil	17-May-18	17-May-19
Double-Ridged Waveguide Horn	EMCO	3116	17-Jun-17	17-Jun-19
Double-Ridged Waveguide Horn	EMCO	3117	22-Jun-17	22-Jun-19
Cable with I-Joint Conector	Huber+Suhner	CNM-NMCMILX800-473	11-Dec-17	11-Dec-19
Microwave amplifer 0.5-26.5GHz, 25dB gain	HP	83017A	18-Jul-17	18-Jul-19
Preamplifier 18GHz to 40GHz with cable (EMC656)	A.H. Systems, Inc.	PAM-1840VH	29-Jan-18	29-Jan-19
High Pass Filter (cutoff freq. =1000MHz)	Trilithic	23042	30-Oct-17	30-Oct-19
High Frequency Cable	Pasternack	PE3VNA4001-3M	29-Jan-18	29-Jan-19
Horn Antenna	EMCO	3115	28-Mar-18	28-Mar-20

Radio Test

Equipment	Manufacturer	Type	Cal. Date	Due Date
Spectrum Analyzer	R & S	FSP30	03-May-18	02-May-19

Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions measurements is ± 4.81 dB (9kHz to 30MHz) and ± 4.62 dB (30MHz to 200MHz) and ± 5.67 dB (200MHz to 1000MHz) and is ± 5.07 dB (1GHz to 8.2GHz) and ± 4.58 dB (8.2GHz to 12.4GHz) and ± 4.78 dB (12.4GHz to 18GHz)

The estimated combined standard uncertainty for antenna conducted emission is ± 2.1 dB

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor of $k=2$, which for the level of confidence is approximately 95%.

Results FCC Part 15 – Subpart C

FCC 15.203 – Antenna Requirement 1		Pass	
FCC Requirement: No antenna other than that furnished by the responsible party shall be used with the device			
Results:	a) Antenna type:	Wire antenna	
	b) Manufacturer and model no:	N/A	
	c) Peak Gain:	0.17 dBi	
Verdict: Pass			
FCC 15.204 – Antenna Requirement 2		N/A	
FCC Requirement: An intentional radiator may be operated only with the antenna with which it is authorized. If an antenna is marketed with the intentional radiator, it shall be of a type which is authorized with the intentional radiator.			
Results: Only one integral antenna can be used.			
Verdict: N/A			
FCC 15.207 – Conducted Emission on AC Mains		N/A	
There is no AC power input or output ports on the EUT.			
FCC 15.247 (a)(2) – 6dB Bandwidth Measurement		Pass	
FCC Requirement: Systems using digital modulation techniques may operate in the 902 – 928 MHz, 2400 – 2483.5 MHz, and 5725 – 5850 MHz bands. The minimum 6dB bandwidth shall be at least 500kHz.			
Test Specification : ANSI C63.10 – 2013 Test date : 23.07.2018 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 3.8 VDC Temperature : 23°C Humidity : 50%			
Results: For test protocols please refer to Appendix 1			
Channel frequency (MHz)	6 dB left (MHz)	6 dB right (MHz)	6dB bandwidth (kHz)
2417	2408.720	2425.280	16.560

FCC 15.247(b)(3) – Maximum Peak Couducted Output Power			Pass
FCC Requirement: For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850MHz bands: 1 Watt (30dBm)			
Test Specification : ANSI C63.10 – 2013 Test date : 24.07.2018 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 3.8VDC Temperature : 23°C Humidity : 50%			
Results: For test protocols please refer to Appendix 1			
Frequency (MHz)	Measured Output Power (dBm)	Limit (W/dBm)	Verdict
2417	13.63	1 / 30.0	Pass

FCC 15.247(e) – Power Spectral Density			Pass
FCC Requirement: For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.			
Test Specification : ANSI C63.10 – 2013 Test date : 24.07.2018 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 3.8VDC Temperature : 23°C Humidity : 50%			
Results: For test protocols please refer to Appendix 1.			
Operating frequency (MHz)	Power density (dBm)	Limit (dBm)	Verdict
2417	-7.21	8.0	Pass

FCC 15.247(d) – Spurious Conducted Emissions					Pass
Test Specification : ANSI C63.10 – 2013 Test date : 24.07.2018 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 3.8VDC Temperature : 23°C Humidity : 50%					
FCC Requirement: 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.					
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate. Only the worst cases is shown below. For test protocols refer to Appendix 1					
Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2417	7920.000	-41.47	-7.21	-34.26	Pass

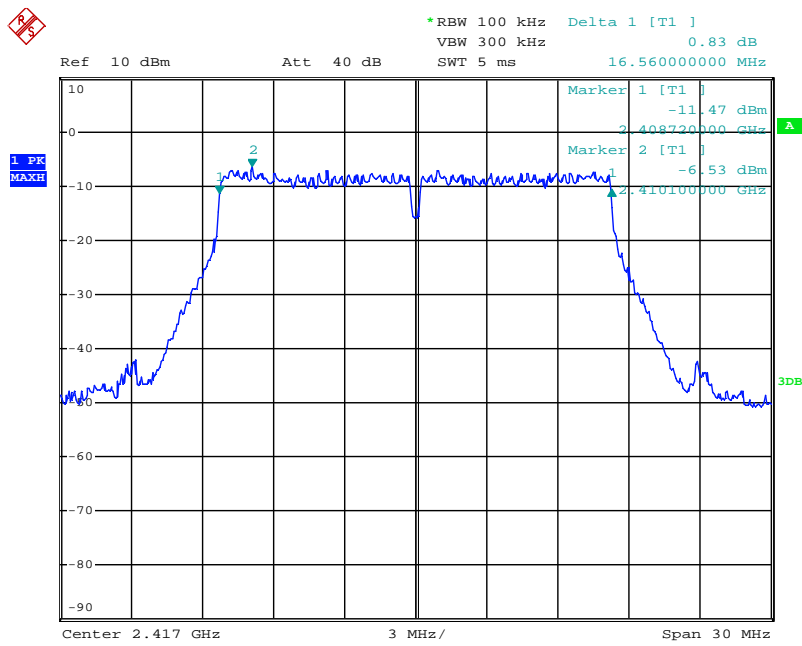
FCC 15.205 – Radiated Emissions in Restricted Frequency Bands		Pass
Test Specification : ANSI C63.10 – 2013 Test Specification : 17.07.2018 Mode of operation : Tx mode Port of testing : Enclosure Frequency range : 9kHz – 25GHz Supply voltage : 3.8VDC Temperature : 23°C Humidity : 50%		
FCC Requirement: In any 100kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in section 15.205(a), must also comply with the radiated emission limits specified in section 15.205(c).		
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate. All three transmit frequency modes comply with the field strength within the restricted bands. There is no spurious found below 30MHz.		
Mode: 2417MHz TX		Vertical Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2390.000	33.6	74.0 / PK
2390.000	20.0	54.0 / AV
4836.000	37.5	74.0 / PK
4836.000	24.2	54.0 / AV
7249.000	43.2	74.0 / PK
7249.000	29.6	54.0 / AV
Mode: 2417 MHz TX		Horizontal Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2390.000	33.7	74.0 / PK
2390.000	19.8	54.0 / AV
4819.147	37.3	74.0 / PK
4819.147	23.4	54.0 / AV
7228.721	42.9	74.0 / PK
7228.721	29.1	54.0 / AV

Appendix 1

Test Results

6 dB Bandwidth Measurement

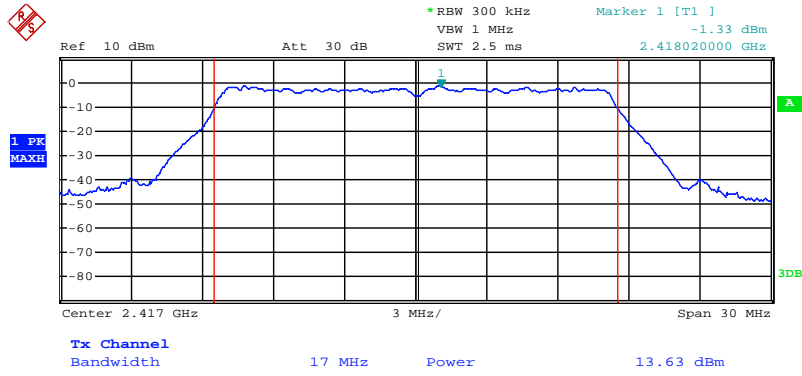
TX frequency: 2417MHz



Date: 23.JUL.2018 16:46:30

Maximum Peak Conducted Output power

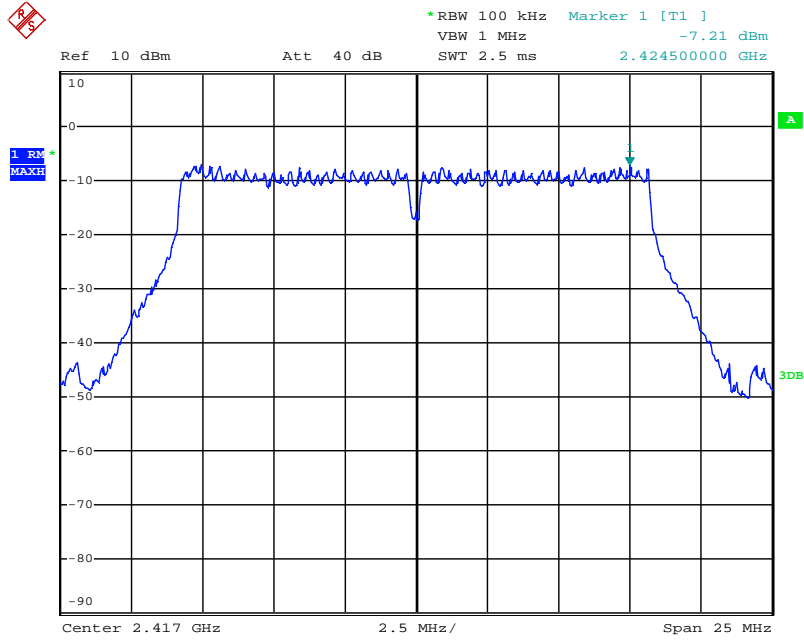
TX frequency: 2417MHz



Date: 24.JUL.2018 11:22:38

Power Spectral Density

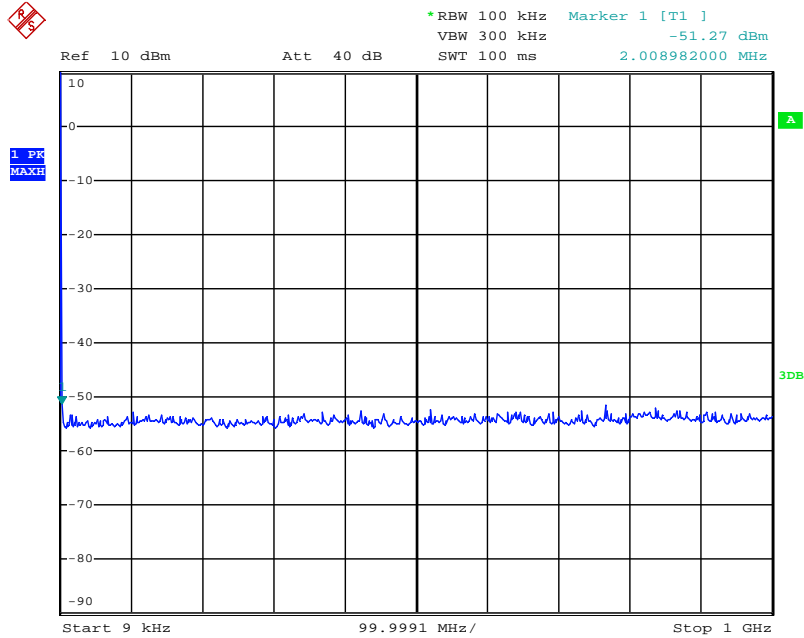
TX frequency: 2417MHz



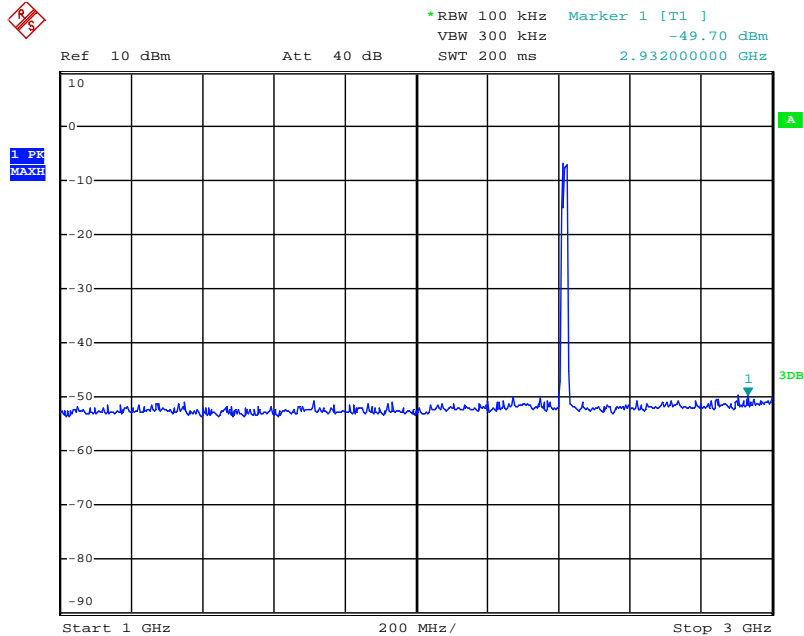
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Spurious Conducted Emissions

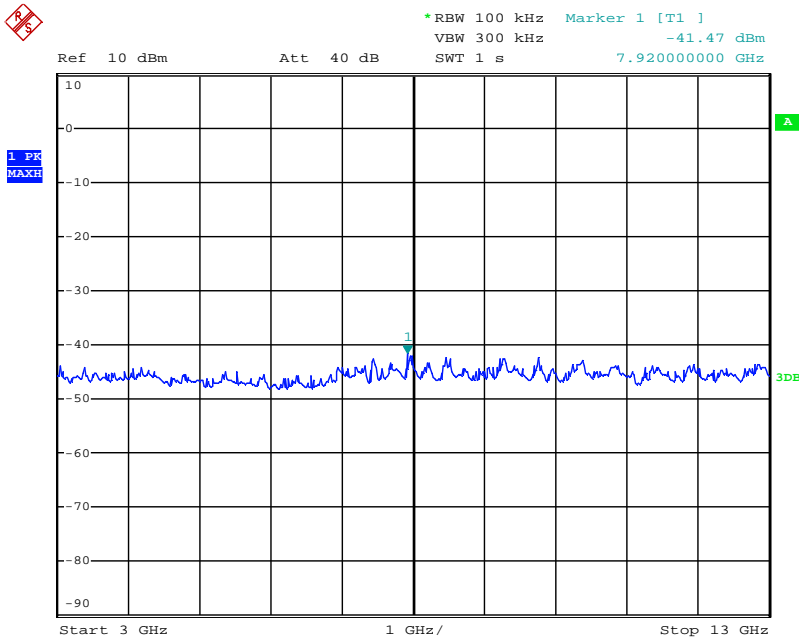
TX frequency: 2417MHz



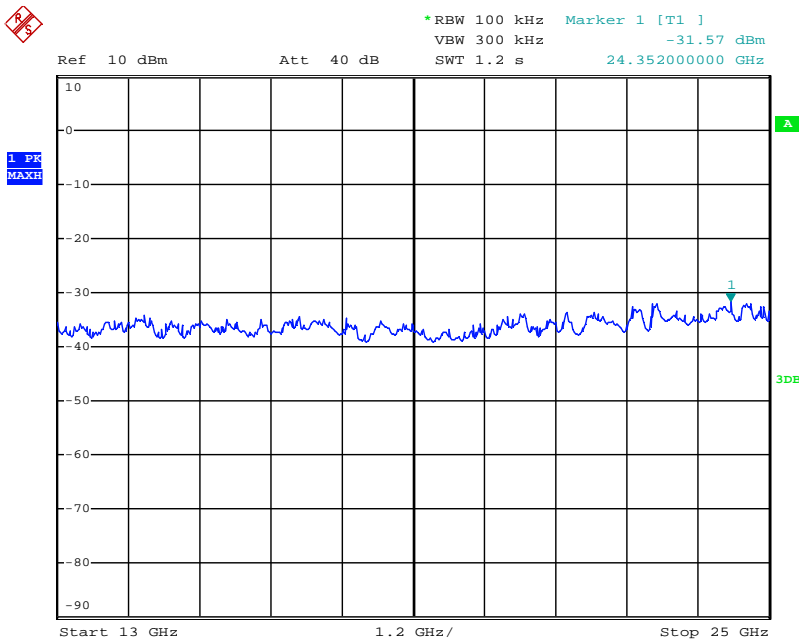
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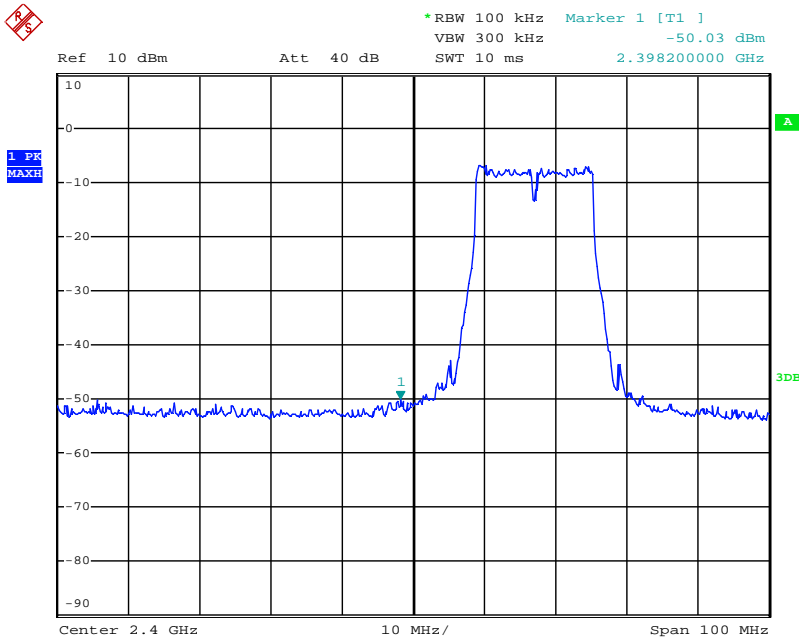
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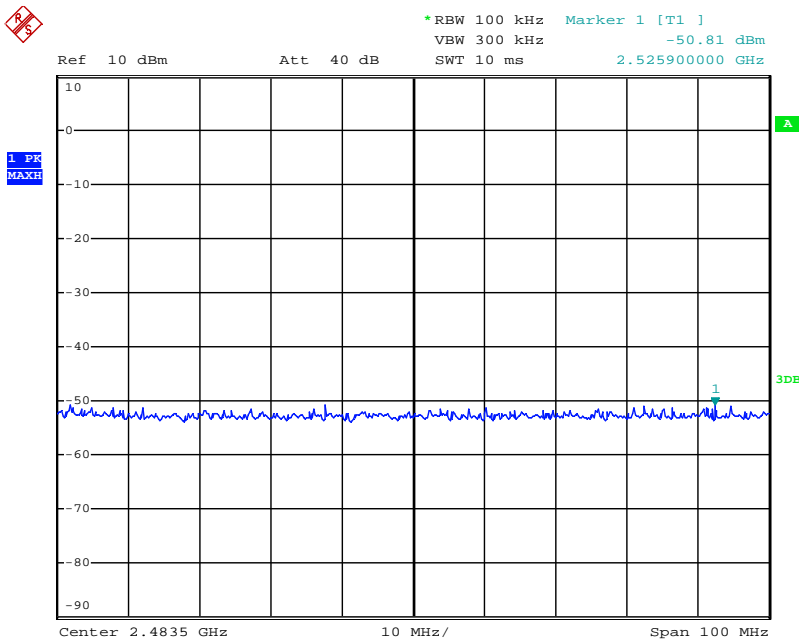
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Date: 24.JUL.2018 11:31:18



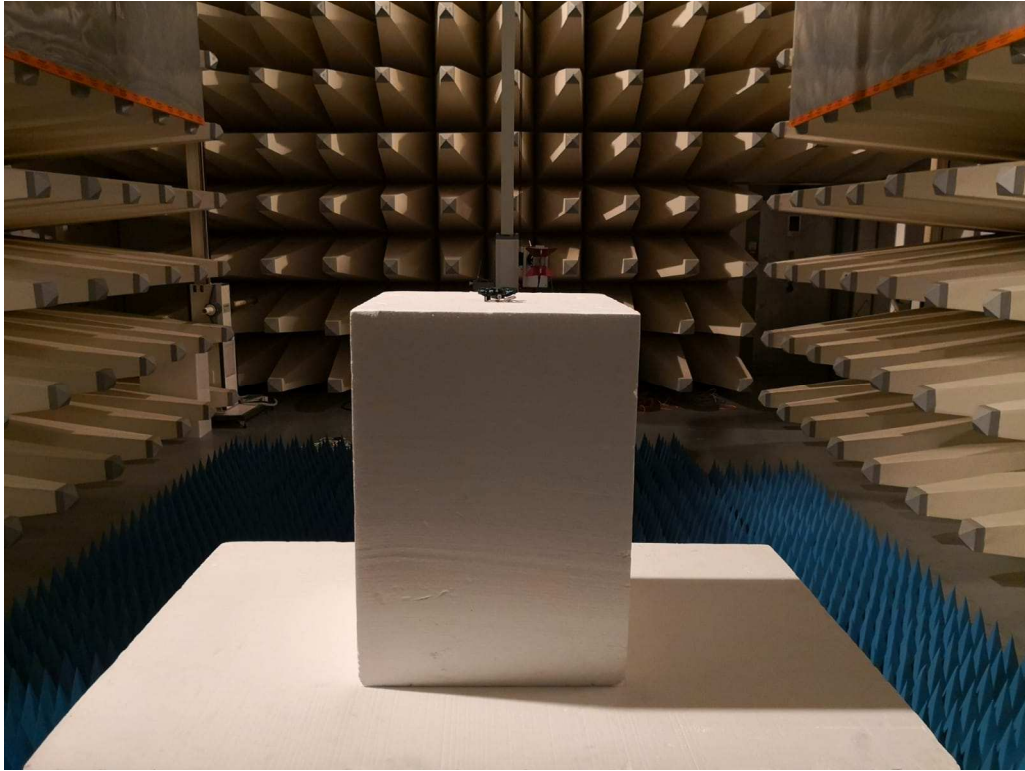
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Date: 24.JUL.2018 11:35:09

Appendix 2

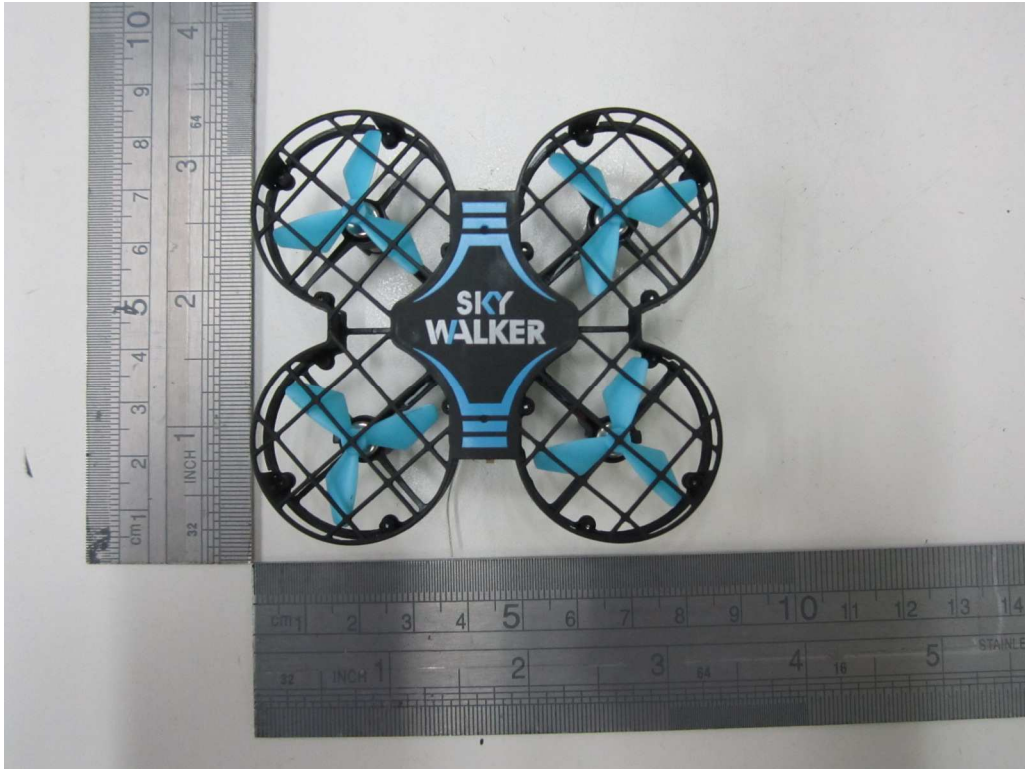
Test Setup Photos



Set-up for Radiated Emission

Appendix 3

EUT External Photos



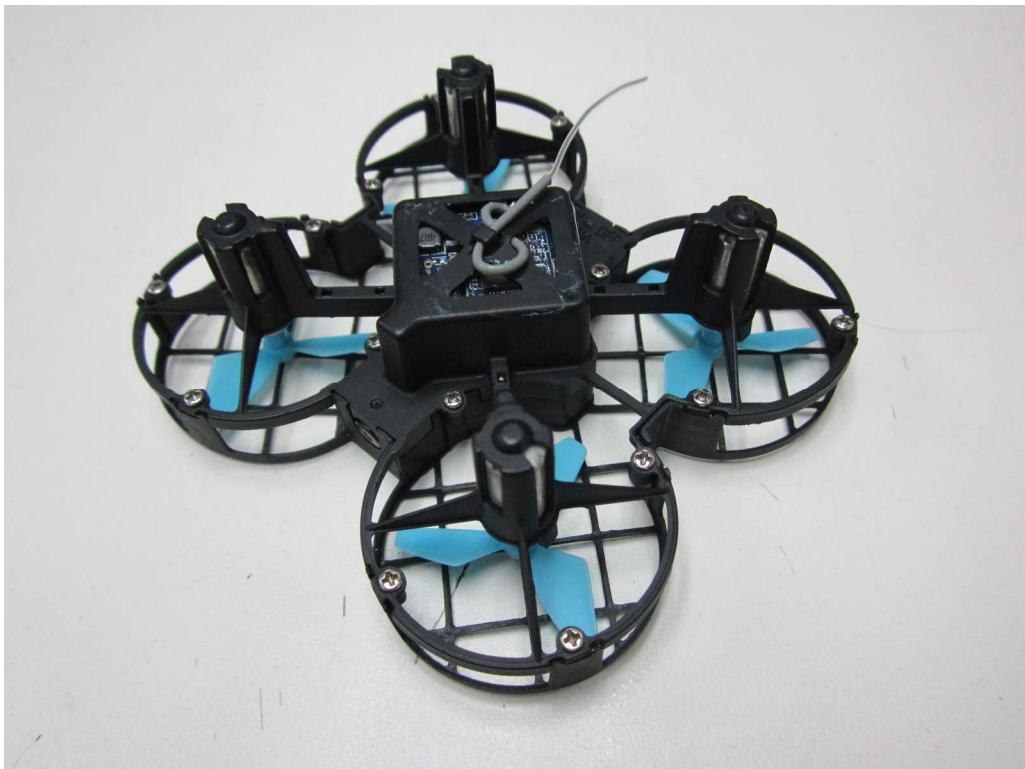
External View



External View



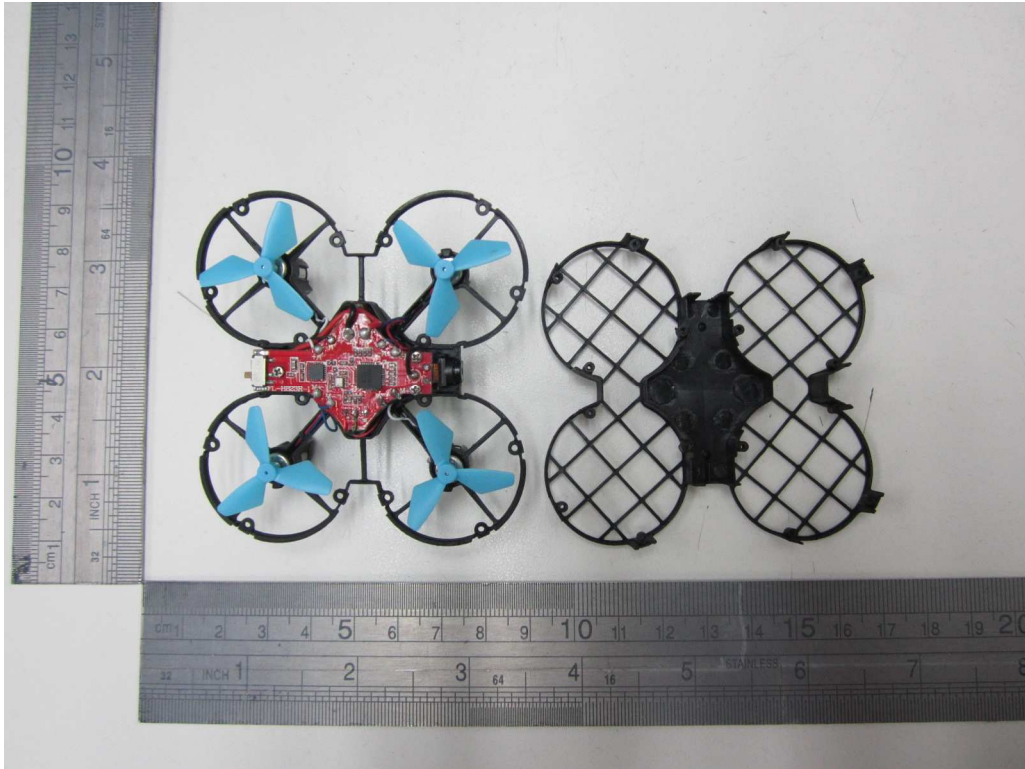
External View



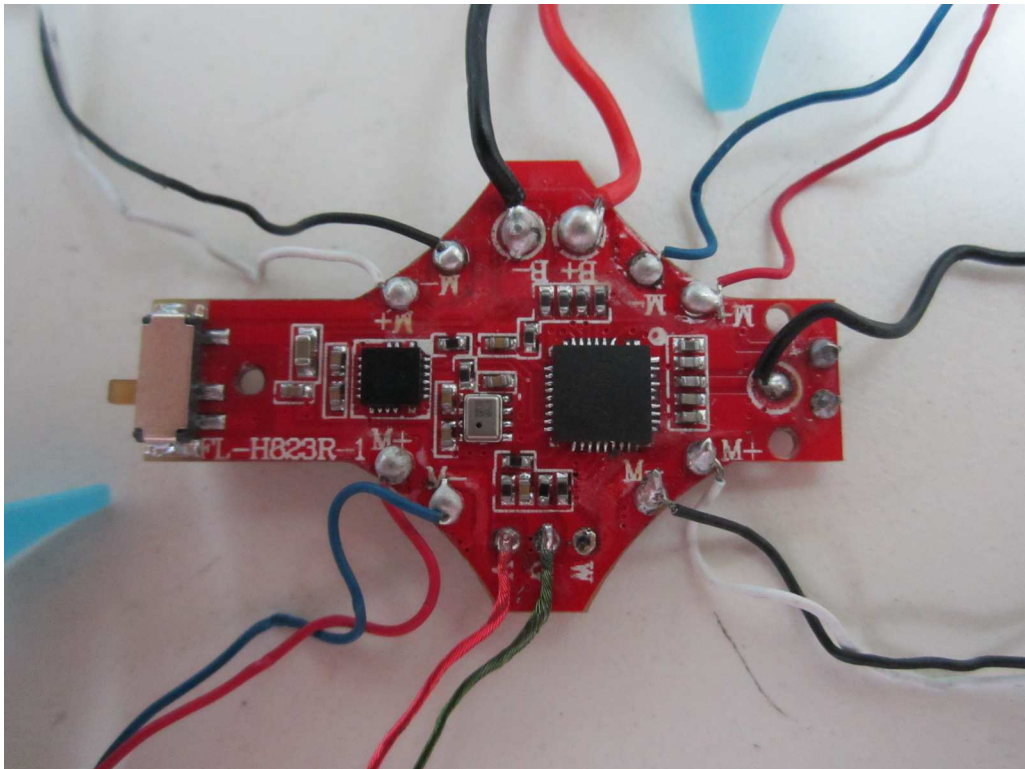
External View

Appendix 4

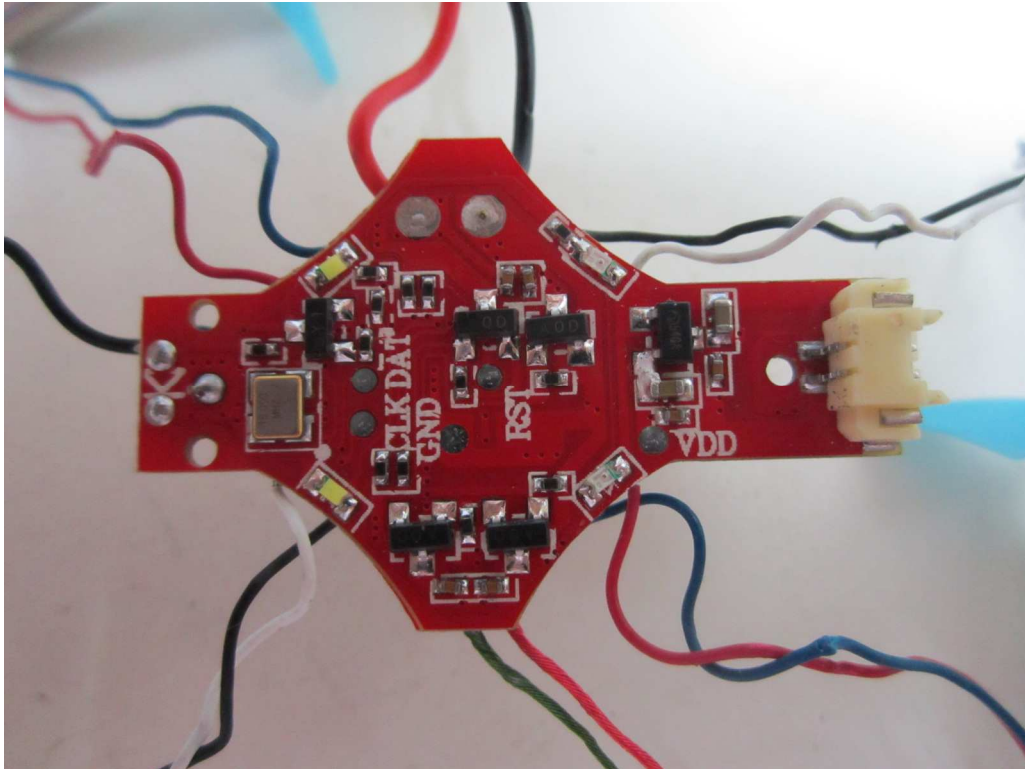
EUT Internal Photos



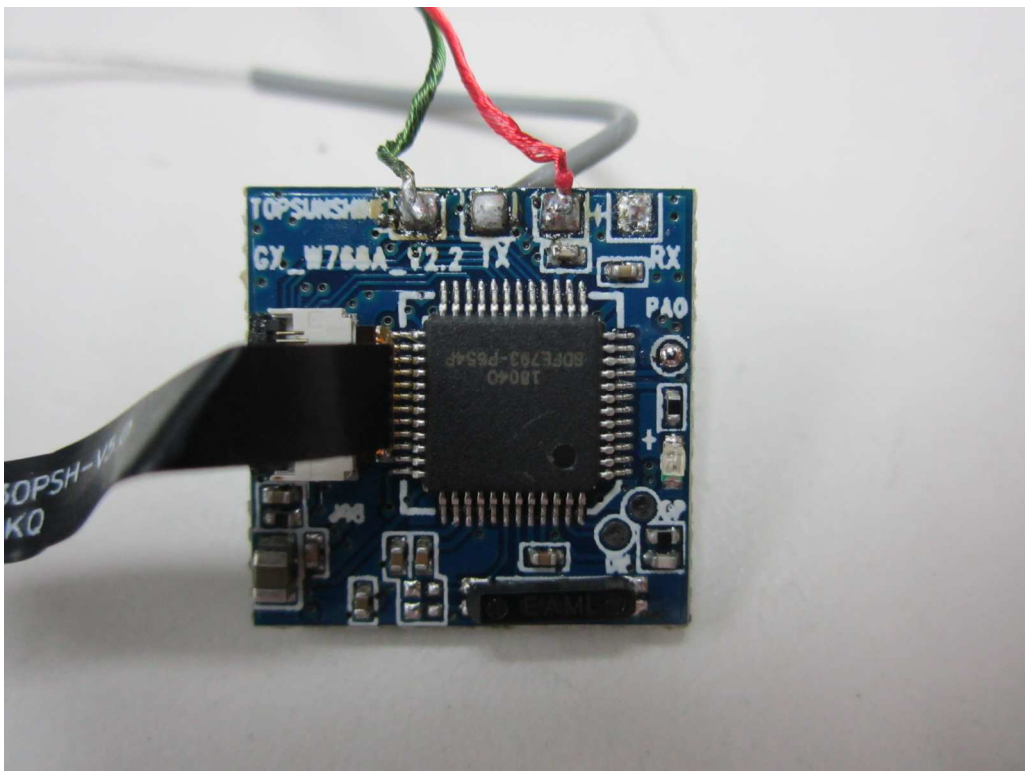
Internal View



Internal View

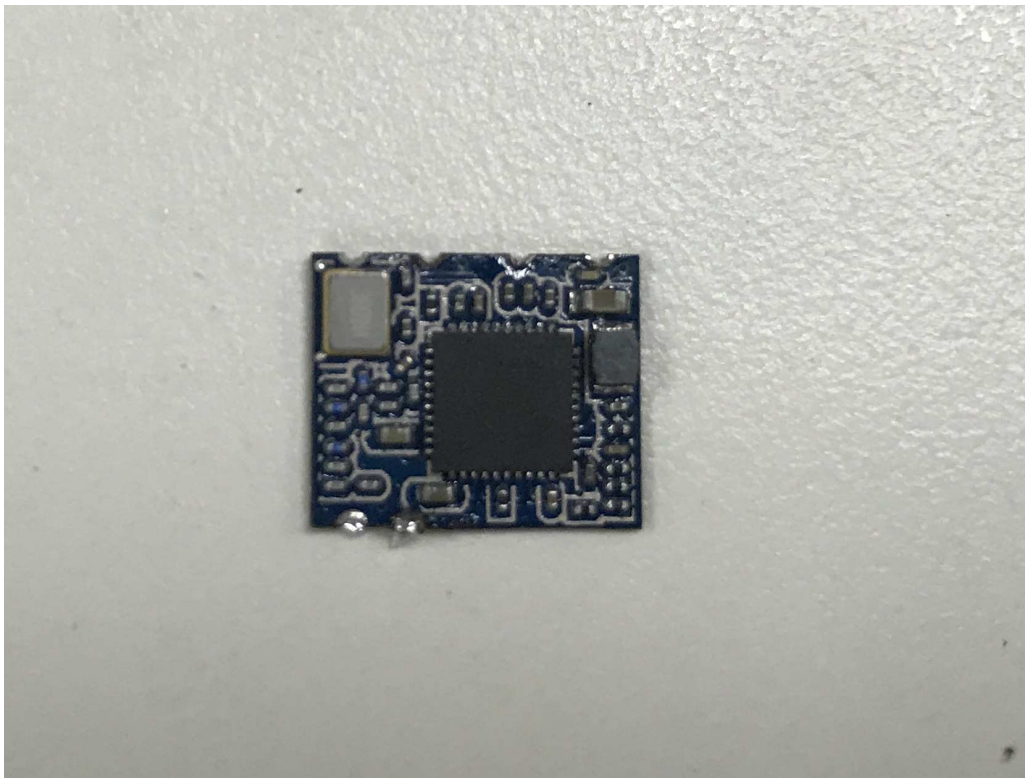


Internal View

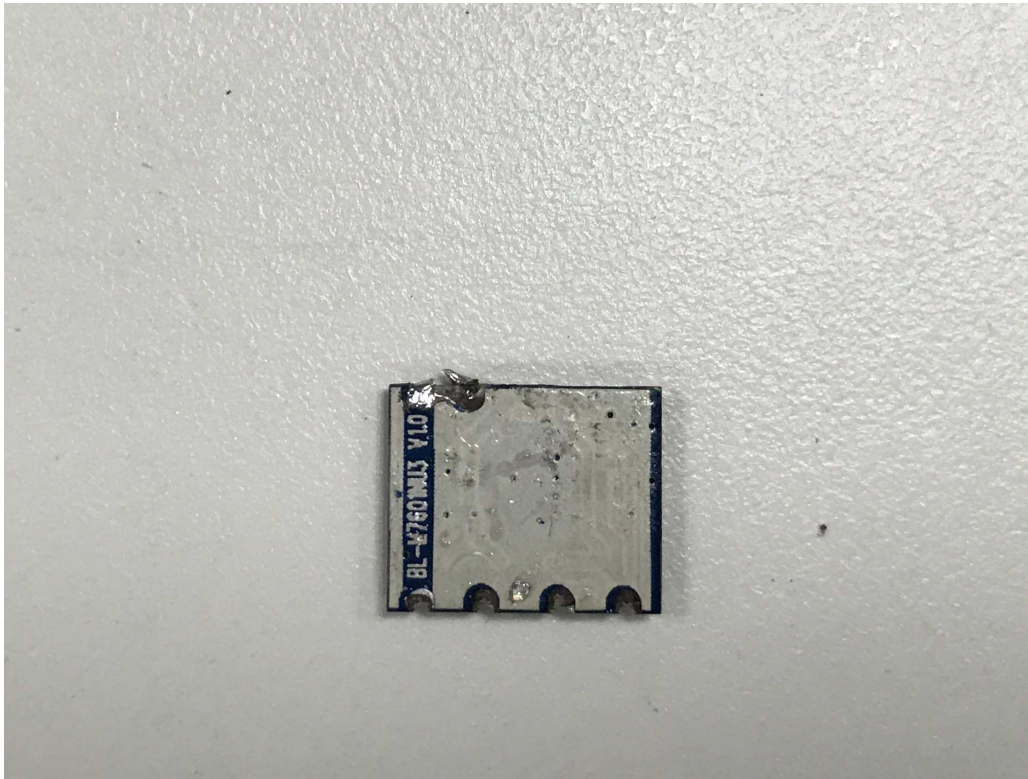




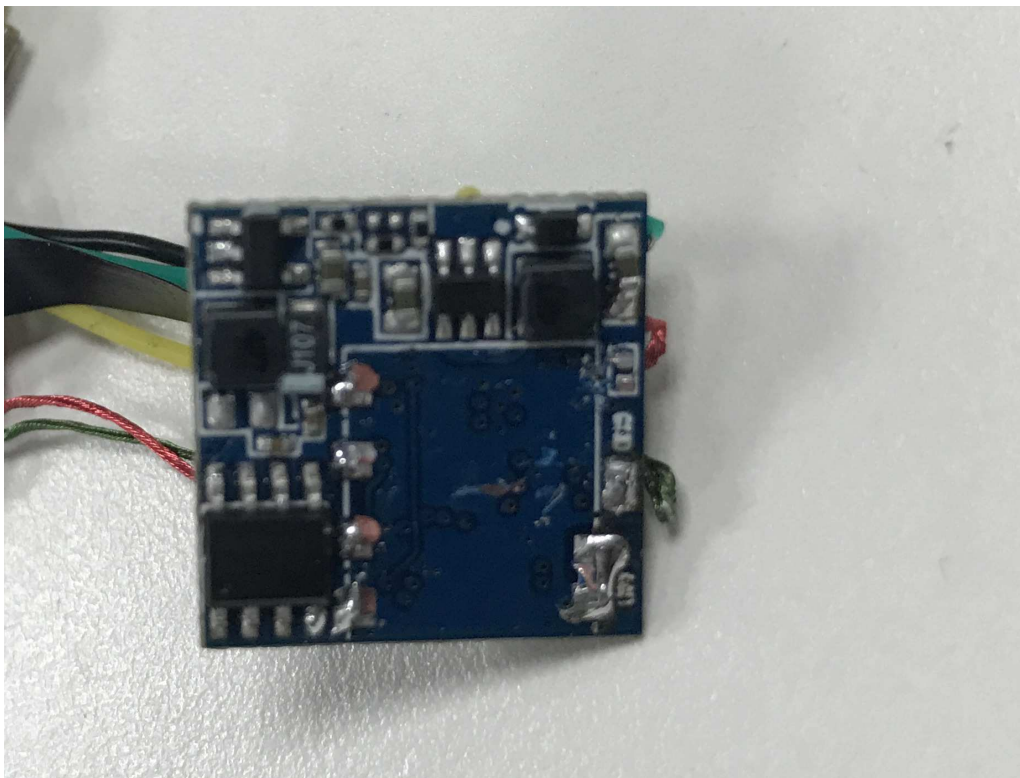
Internal View



Internal View



Internal View



Internal View

Appendix 5

RF Exposure Information

Maximum transmitter power:

Frequency (MHz)	Maximum peak output power (dBm)	Output power(mW)
2417	13.63	23.07

According to the manufacturer's installation instruction, the EUT operating in standalone mobile exposure conditions which minimum test separation distance is 20cm between the antenna and radiating structures of the device and nearby persons.

For Maximum Permissible Exposure (MPE) evaluation, the maximum power density at 20 cm from this mobile transmitter shall be less than the General Population / Uncontrolled MPE limit in OET Bulletin 65 and meet the requirement listed in KDB447498.

Evaluation:

The maximum conducted output power of WIFI is 23.07mW,

$$\begin{aligned} \text{The power density at 20cm} &= (23.07\text{mW} \times 1.04) / 4\pi R^2 \\ &= 0.0048 \text{ mWcm}^{-2} \end{aligned}$$

Conclusion:

In the frequency range of 1,500 - 100,000MHz, the MPE limit is 1.0 mWcm⁻² for general population and uncontrolled exposure. As the measured power density at 20cm from the transmitter is lower than the MPE limit, the compliance to the MPE limit can be ensured by indicating the minimum 20cm separation between the transmitter's radiating structures and body of the user or nearby persons.