SGS-CSTC Standards Technical Services Co., Ltd.
Shenzhen Branch

No. 1 Workshop, M-10, Middle section, Science & Technology Park,
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TEST REPORT

Application No.:	SZEM1512007923CR
Applicant:	Shenzhen Hubsan Intelligent Co., Ltd.
Manufacturer:	Shenzhen Hubsan Intelligent Co., Ltd.
Factory:	DONGGUAN TENGSHENG INDUSTRIAL CO., LTD.
Product Name:	HUBSAN FPV X4 BRUSHLESS
Model No.(EUT):	H501S
Add Model No.:	23899
Trade Mark:	HUBSAN
Standards:	EN 301 489-1 V1.9.2 (2011-09)
	EN 301 489-3 V1.6.1 (2013-08)
Date of Receipt:	2015-12-28
Date of Test:	2016-01-19 to 2016-03-14
Date of Issue:	2016-04-08
Test Result:	**PASS ***

* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

The CE mark as shown below can be used, under the responsibility of the manufacturer, after completion of an EC Declaration of Conformity and compliance with all relevant EC Directives.

Authorized Signature:

Jack Zhang
EMC Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.
If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.
The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. All test results in this report can be traceable to National or International Standards.

2 Test Summary

Applied Standards			
According to the specifications of the manufacture,The EUT must complies with the requirements of EN 301 489-1 V1.9.2 (2011-09) EN 301 489-3 V1.6.1 (2013-08)			
Electromagnetic Compatibility (EMC) Part			
Electromagnetic Interference (EMI)			
Test Items	**Test Method**	**Reference Clause**	**Result**
Radiated Emission	EN 55022:2010	EN 301 489-1 V1.9.2 (2011-09) Clause 8.2	PASS
Conducted Emission (AC port)	EN 55022:2010	EN 301 489-1 V1.9.2 (2011-09) Clause 8.4	PASS
Harmonic Emission on AC, 50Hz to 2kHz	EN 61000-3-2:2014	EN 301 489-1 V1.9.2 (2011-09) Clause 8.5	PASS
Flicker Emission on AC	EN 61000-3-3:2013	EN 301 489-1 V1.9.2 (2011-09) Clause 8.6	PASS
Electromagnetic Susceptibility(EMS)			
ESD (Electrostatic Discharge)	EN 61000-4-2:2009	EN 301 489-1 V1.9.2 (2011-09) Clause 9.3	PASS
Radiated Immunity, 80MHz to 2.7 GHz	EN 61000-4-3:2006 +A1:2008+A2:2010	EN 301 489-1 V1.9.2 (2011-09) Clause 9.2	PASS
EFT (Electrical Fast Transients)	EN 61000-4-4:2012	EN 301 489-1 V1.9.2 (2011-09) Clause 9.4	PASS
Surge Immunity	EN 61000-4-5:2014	EN 301 489-1 V1.9.2 (2011-09) Clause 9.8	PASS
Injected Currents 150kHz to 80MHz	EN 61000-4-6:2014	EN 301 489-1 V1.9.2 (2011-09) Clause 9.5	PASS
Voltage Dips and Interruptions	EN 61000-4-11:2004	EN 301 489-1 V1.9.2 (2011-09) Clause 9.7	PASS

Remark:

Tx: In this whole report Tx (or tx) means Transmitter.

Rx: In this whole report Rx (or rx) means Receiver.

N/A: In this whole report not application

Model No.: H501S, 23899

Only the model H501S was tested, since the electrical circuit design, layout, components used and internal wiring were identical for all above models, only different on model No..

3 Contents

4 General Information

4.1 Client Information

Applicant:	Shenzhen Hubsan Intelligent Co., Ltd.
Address of Applicant:	13th Floor, Bldg 1C, Shenzhen Software Industry Base, Xuefu Road, Nanshan District, Shenzhen, China.
Manufacturer:	Shenzhen Hubsan Intelligent Co., Ltd.
Address of Manufacturer:	13th Floor, Bldg 1C, Shenzhen Software Industry Base, Xuefu Road, Nanshan District, Shenzhen, China.
Factory:	DONGGUAN TENGSHENG INDUSTRIAL CO., LTD.
Address of Factory:	A22# Luyi Street, Tianxin Village, Tangxia Town, Dong guan, China

4.2 General Description of EUT

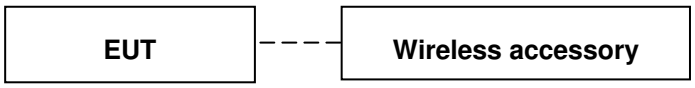
Product Name:	HUBSAN FPV X4 BRUSHLESS
Model No.:	H501S
Trade Mark:	HUBSAN
Carrier Frequency:	5730MHz-5845MHz
Modulation Type:	FM
Channel Spacing:	5MHz
Sample Type:	Fixed production
The highest working frequency(except RF modulator):	16MHz
Antenna gain:	4.0dBi
Antenna Type:	Integral
Power Supply:	Rechargeable battery DC 7.4V, 2700mAh Battery: charge by adapter Adapter model:TDX-1201000 Input: AC 100-240V, 50/60Hz Output: DC 12V, 1A
Cable:	DC cable: 115cm, unshielded.
Test Voltage:	AC230V 50Hz

4.3 Details of Test Mode

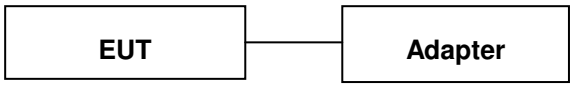
Test Mode:	
mode 1	Wireless mode
mode 2	Charge mode

4.4 Configuration of EUT

Mode1



Mode2



4.5 Description of Support Units

The EUT has been tested with associated equipment below.

Description	Manufacturer	Model No.
Remote controller	Supplied by client	H901A

4.6 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch E&E Lab

No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China 518057

Telephone: +86 (0) 755 2601 2053 Fax: +86 (0) 755 2671 0594

No tests were sub-contracted.

4.7 Test Facility

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

• **CNAS (No. CNAS L2929)**

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

• **A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• **VCCI**

The 10m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-823, R-4188, T-1153 and C-2383 respectively.

• **FCC – Registration No.: 556682**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No.: 556682.

• **Industry Canada (IC)**

The 3m Semi-anechoic chambers and the 10m Semi-anechoic chambers of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-2, 4620C-3.

4.8 Deviation from Standards

None.

4.9 Abnormalities from Standard Conditions

None.

4.10 Other Information Requested by the Customer

None.

4.11 Monitoring of EUT for the Immunity Test

Visual: Monitored the light, movement and receiver status of the EUT.

Audio: None

4.12 Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty
1	Conduction emission	3.45dB (9kHz to 150kHz)
		3.0dB (150kHz to 30MHz)
2	Radiated emission	4.5dB (30MHz-1GHz)
		4.8dB (1GHz-6GHz)
3	Temperature test	1℃
4	Humidity test	3%
5	DC power test	0.5 %

5 Equipment List

RE in Chamber						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. date (yyyy-mm-dd)**	**Cal.Due date (yyyy-mm-dd)**
1	10m Semi-Anechoic Chamber	SAEMC	FSAC1018	SEL0303	2015-08-01	2016-08-01
2	EMI Test Receiver (9k-3GHz)	Rohde & Schwarz	ESCI	SEL0175	2015-05-13	2016-05-13
3	EMI Test software	AUDIX	E3	SEL0050	N/A	N/A
4	Coaxial cable	SGS	N/A	SEL0288	2015-05-13	2016-05-13
5	Coaxial cable	SGS	N/A	SEL0275	2015-05-13	2016-05-13
6	Coaxial cable	SGS	N/A	SEL0274	2015-05-13	2016-05-13
7	Trilog-Broadband Antenna(30M-1GHz)	Schwarzbeck	VULB9168	SEM003-17	2016-01-26	2017-01-26
8	Pre-amplifier	Sonoma Instrument Co	310N	SEL0298	2015-05-13	2016-05-13
9	Loop Antenna	ETS-LINDGREN	6502	SEL0802	2015-08-14	2016-08-14

Conducted Emission						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. date (yyyy-mm-dd)**	**Cal.Due date (yyyy-mm-dd)**
1	Shielding Room	ZhongYu Electron	GB-88	SEL0042	2015-05-13	2016-05-13
2	LISN	Rohde & Schwarz	ENV216	SEL0152	2015-10-09	2016-10-09
3	LISN	ETS-LINDGREN	3816/2	SEL0021	2015-05-13	2016-05-13
4	8 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN-T8-02	EMC0120	2015-08-30	2016-08-30
5	4 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN-T4-02	EMC0121	2015-08-30	2016-08-30
6	2 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN-T2-02	EMC0122	2015-08-30	2016-08-30
7	EMI Test Receiver	Rohde & Schwarz	ESCI	SEL0022	2015-05-13	2016-05-13
8	Coaxial Cable	SGS	N/A	SEL0025	2015-05-13	2016-05-13

Harmonics / Flicker test						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. date (yyyy-mm-dd)**	**Cal.Due date (yyyy-mm-dd)**
1	AC Power Source	California Instruments	5001ix	SEL0052	2015-05-13	2016-05-13
2	Power Analyzer	California Instruments	PACS-1	SEL0051	2015-05-13	2016-05-13
3	CTS 3.0 Software	California Instruments	N/A	SEL0087	N/A	N/A

ESD						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. date (yyyy-mm-dd)**	**Cal.Due date (yyyy-mm-dd)**
1	ESD Simulator	SCHAFFNER	NSG 438	SEL0035	2016-03-16	2017-03-16
2	ESD Ground Plane	SGS(3m*3m)	N/A	SEL0004	N/A	N/A

EFT, Surge, Voltage dips and Interruption, Power-frequency Magnetic Field						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. date (yyyy-mm-dd)**	**Cal.Due date (yyyy-mm-dd)**
1	EMC Immunity Test System	Thermo ELECTRON	EMC Pro Plus	SEL0007	2015-10-09	2016-10-09
2	Pro Plus Capacitive Clamp	Thermo ELECTRON	N/A	SEL0008	N/A	N/A
3	Magnetic Field Immunity Loop	FCC	F-1000-4-8/ 9/10-L-1M	SEL0010	2015-10-09	2016-10-09
4	High speed signal Surge CDN	EMC PARTNER	CDN-UTP	EMC2060	2015-05-13	2016-05-13

Conducted Immunity						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. date (yyyy-mm-dd)**	**Cal.Due date (yyyy-mm-dd)**
1	RF-Generator	SCHAFFNER	NSG 2070	SEL0039	2015-10-09	2016-10-09
2	Coupling/Decoupling Network	SCHAFFNER	CDN M016	SEL0040	2015-10-09	2016-10-09
3	EM CLAMP	SCHAFFNER	KEMZ 801	SEL0041	2015-10-09	2016-10-09

Radiated Immunity						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. date (yyyy-mm-dd)**	**Cal.Due date (yyyy-mm-dd)**
1	Fully-Anechoic Chamber 2	Chang Zhou Zhong Shuo	854	SEL0169	2014-06-10	2017-06-10
2	Power Sensor	Rohde & Schwarz	NRP-Z91	SEL0809	2015-06-09	2016-06-09
3	Power Sensor	Rohde & Schwarz	NRP-Z91	SEL0810	2015-06-09	2016-06-09
4	Software EMC32	Rohde & Schwarz	EMC32-S	SEL0082	N/A	N/A
5	Log-periodic Antenna (0.07-3GMHz)	Schwarzbeck	VUSLP9111E	SEL0804	N/A	N/A
6	Signal Generator	Rohde & Schwarz	SMB100A	SEL0805	2015-06-05	2016-06-05
7	Broadband Amplifier (80MHz-1GHz)	Rohde & Schwarz	BBA150-BC250	SEL0806	2015-10-31	2016-10-31
8	Broadband Amplifier (800MHz-3GHz)	Rohde & Schwarz	BBA150-D110	SEL0807	2015-10-31	2016-10-31
9	Open Switch and Control Unit	Rohde & Schwarz	OSP130	SEL0808	2015-10-31	2016-10-31
10	Universal Radio Communication Tester	Rohde & Schwarz	CMU 200	SEL0091	2015-10-23	2016-10-23
11	Universal Radio Communication Tester	Rohde & Schwarz	CMW 500	SEL0368	2016-01-14	2017-01-14
12	Audio Analyzer	Rohde & Schwarz	UPV	SEL0193	2015-10-09	2016-10-09
13	Conditioning Amplifier	Brüel & Kjaer	2690-OS2	SEL0106	2015-04-29	2016-04-29
14	Amplifier	Rohde & Schwarz	75A250A	SEL0108	2015-04-25	2016-04-25

General used equipment						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. date (yyyy-mm-dd)**	**Cal.Due date (yyyy-mm-dd)**
1	Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEL0101	2015-10-12	2016-10-12
2	Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEL0102	2015-10-12	2016-10-12
3	Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEL0103	2015-10-12	2016-10-12
4	Barometer	Changchun Meteorological Industry Factory	DYM3	SEL0088	2015-05-13	2016-05-13

6 EMC Requirements Specification in EN 301 489-1/-3

6.1 EMI (Emission)

6.1.1 Radiated Emission

Reference Clause: EN 301 489-1 Clause 8.2.2

Test Method: EN 55022

EUT Operation:

Ambient: Temp.: 25.0 °C Humid.: 50 % Press.: 1015 mbar

Test Mode: Mode 1,2

Test Status: Pretest the EUT at different test modes and found the mode 1 which is worst case, the test worst case mode 1 is recorded in the report.

Receive Setup:

Frequency range (MHz)	Detector	RBW	VBW
30-1000	Quasi-peak	120kHz	300kHz

Limit:

Frequency	Limit(@10m)	Remark
30MHz-230MHz	30dBuv/m	QP value
230MHz-1GHz	37dBuv/m	QP value

Test Setup:

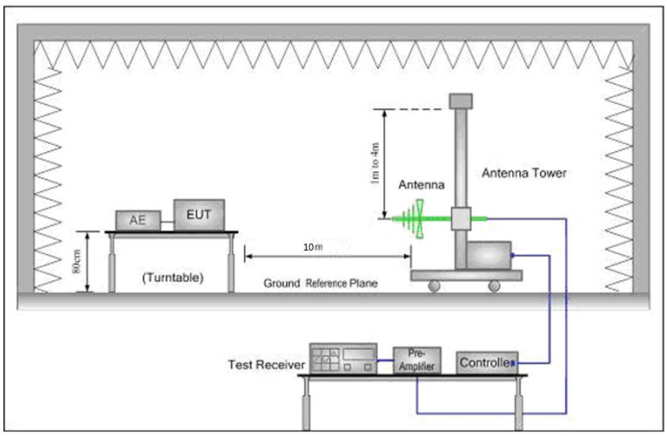


Figure 1. 30MHz to 1GHz

Test Procedure:

1. From 30 MHz to1GHz test procedure as below:

1) The radiated emissions were tested in a semi-anechoic chamber.
2) The EUT is placed on a turntable, which is 0.8m above ground plane.
3) The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
4) EUT is set 10m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions.
5) Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6) And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7) Repeat above procedures until the measurements for all frequencies are complete.

2. Above 1GHz test procedure as below:

1) Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber.

Equipment Used: Refer to section 5 for details.

Measurement Data:

Mode 1:

Below 1GHz (QP)

Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarity
33.328	6.70	12.59	32.66	33.49	20.12	30	-9.88	Vertical
52.575	6.95	12.57	32.66	26.53	13.39	30	-16.61	Vertical
64.887	7.00	11.02	32.65	30.31	15.68	30	-14.32	Vertical
103.080	7.22	9.70	32.65	35.69	19.96	30	-10.04	Vertical
222.950	7.72	10.35	32.58	31.08	16.57	30	-13.43	Vertical
996.500	9.60	22.84	30.92	25.34	26.86	37	-10.14	Vertical
91.495	7.20	8.80	32.65	28.22	11.57	30	-18.43	Horizontal
169.005	7.50	12.51	32.60	27.87	15.28	30	-14.72	Horizontal
232.532	7.76	10.85	32.58	27.74	13.77	37	-23.23	Horizontal
350.477	8.25	13.85	32.54	27.61	17.17	37	-19.83	Horizontal
636.134	8.99	19.36	32.61	26.61	22.35	37	-14.65	Horizontal
938.833	9.55	22.65	31.48	25.96	26.68	37	-10.32	Horizontal

Remark: Level = Read Level + Antenna Factor + Cable Loss – Preamp Factor.

6.1.2 Conducted Emission

Reference Clause: EN 301 489-1 Clause 8.4.2

Test Method: EN 55022

Detector: Peak for pre-scan (9kHz Resolution Bandwidth)

Quasi-Peak if maximized peak within 6dB of Quasi-Peak limit

EUT Operation:

Ambient: Temp.: 20.0 °C Humid.: 45 % Press.: 1015 mbar

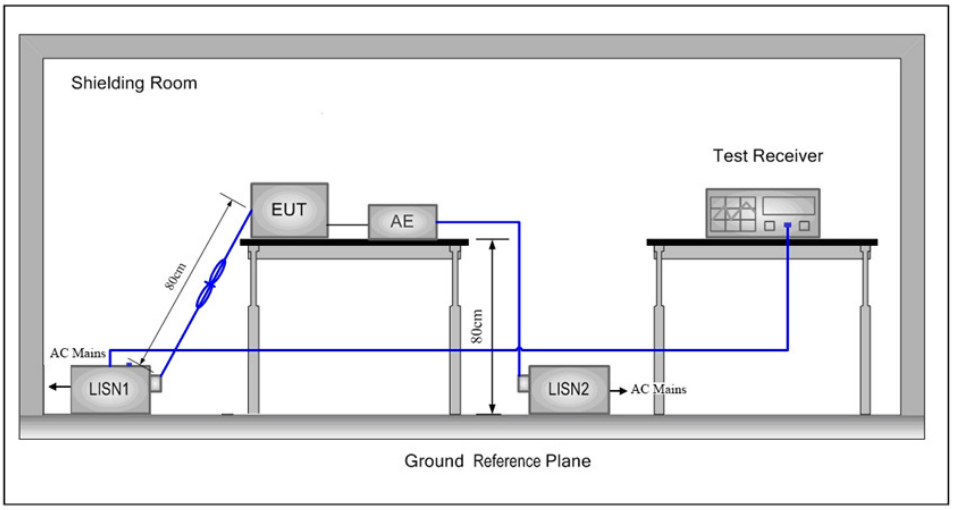
Test Mode: Mode 2

Equipment Used: Refer to section 5 for details.

Limit: Limits for conducted disturbance at the mains ports of class B

Frequency Range (MHz)	Class B Limit (dBuV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
NOTE 1: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		
NOTE 2: The lower limit is applicable at the transition frequency.		

Test Setup:



Test Procedure:

1) The mains terminal disturbance voltage test was conducted in a shielded room.

2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.

3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground

reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane.

4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.

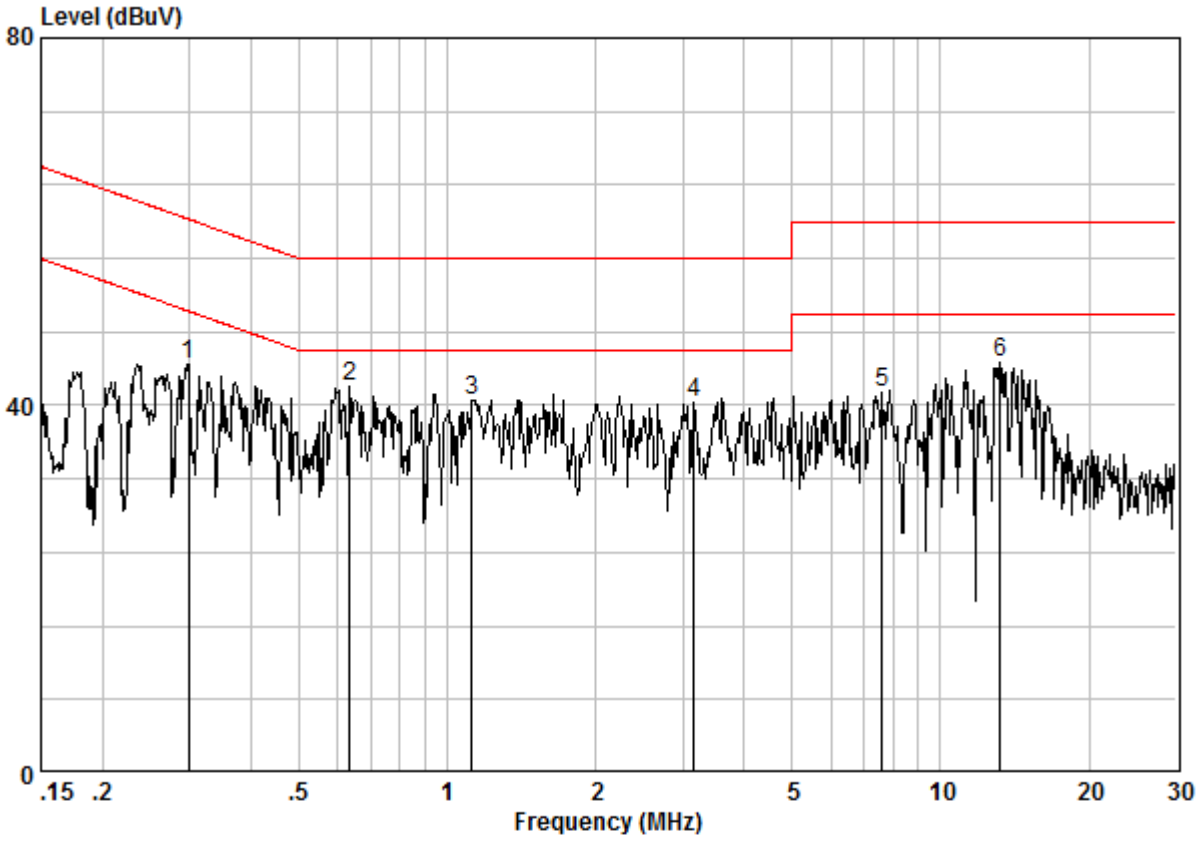
Measurement Data:

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

Mode 2

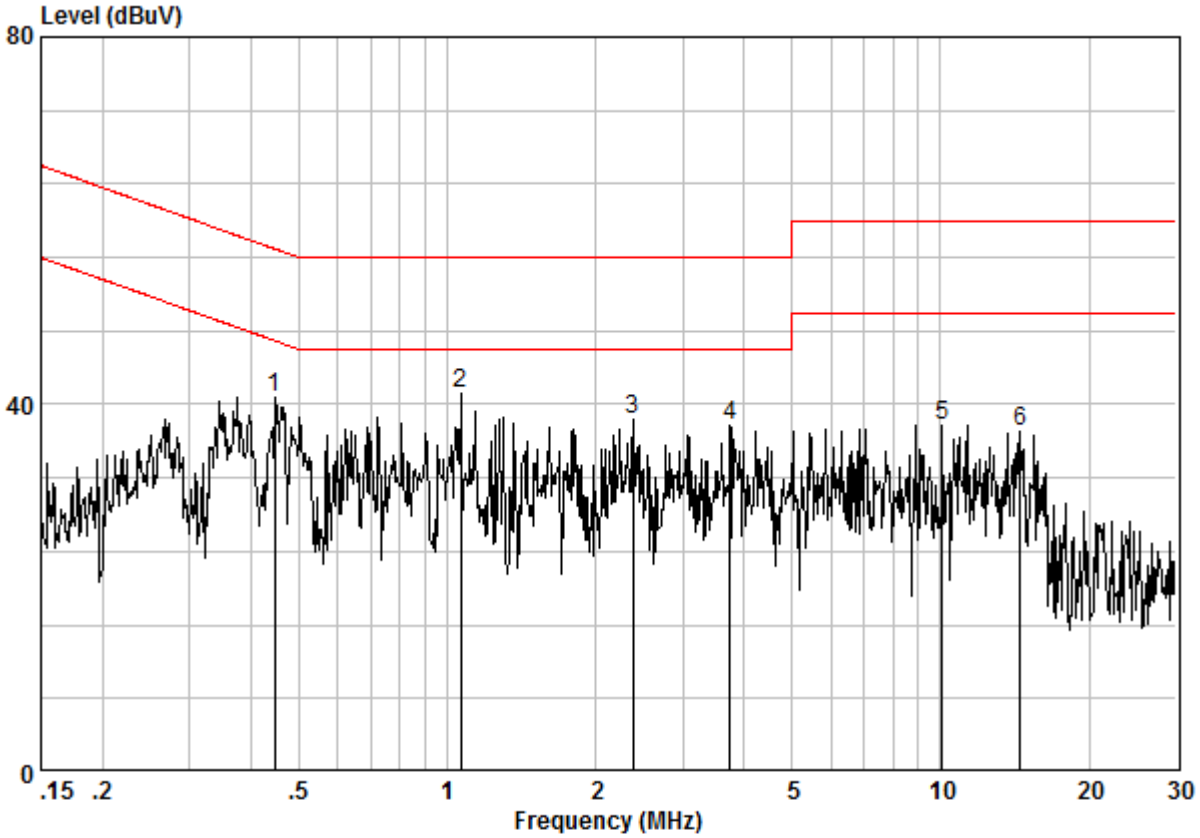
Live Line:



Site : Shielding Room
Condition : CE LINE
Job No. : 7923CR
Test Mode : 2

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.29869	0.01	9.59	34.95	44.55	50.28	-5.73	Peak
2 @	0.63383	0.02	9.61	32.38	42.01	46.00	-3.99	Peak
3	1.123	0.02	9.62	31.00	40.63	46.00	-5.37	Peak
4	3.156	0.02	9.62	30.73	40.37	46.00	-5.63	Peak
5	7.606	0.01	9.69	31.68	41.38	50.00	-8.62	Peak
6	13.197	0.01	9.74	34.85	44.60	50.00	-5.40	Peak

Neutral Line:



Site : Shielding Room
Condition : CE NEUTRAL
Job No. : 7923CR
Test Mode : 2

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.44679	0.01	9.62	31.19	40.82	46.93	-6.11	Peak
2 @	1.065	0.02	9.65	31.44	41.11	46.00	-4.89	Peak
3	2.384	0.02	9.67	28.60	38.29	46.00	-7.71	Peak
4	3.740	0.02	9.68	28.03	37.72	46.00	-8.28	Peak
5	10.072	0.01	9.79	28.01	37.81	50.00	-12.19	Peak
6	14.517	0.01	9.89	27.14	37.05	50.00	-12.95	Peak

6.1.3 Harmonics Test Results

Reference Clause: EN 301 489-1 Clause 8.5

Test Method: EN 61000-3-2

Test Result: See Remark Below

Remark:

There is no need for Harmonics test to be performed on this product (rated power is less than 75W) in accordance with EN 61000-3-2:2014.

For further details, please refer to Clause 7 of EN 61000-3-2 which states:

"For the following categories of equipment, limits are not specified in this standard.

- equipment with a rated power of 75W or less, other than lighting equipment."

6.1.4 Flicker Test Results

Reference Clause: EN 301 489-1 Clause 8.6

Test Method: EN 61000-3-3

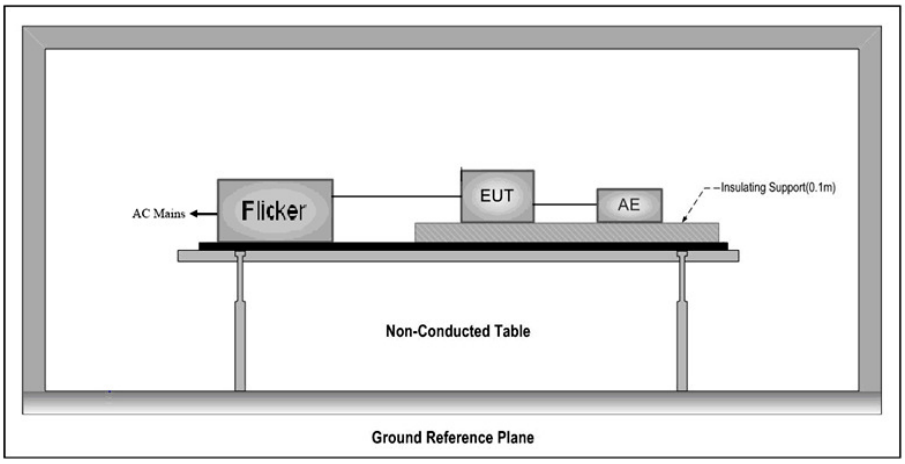
EUT Operation:

Ambient: Temp.: 20.0 °C Humid.:58 % Press.:1015mbar

Test Mode: Mode 2

Equipment Used: Refer to section 5 for details.

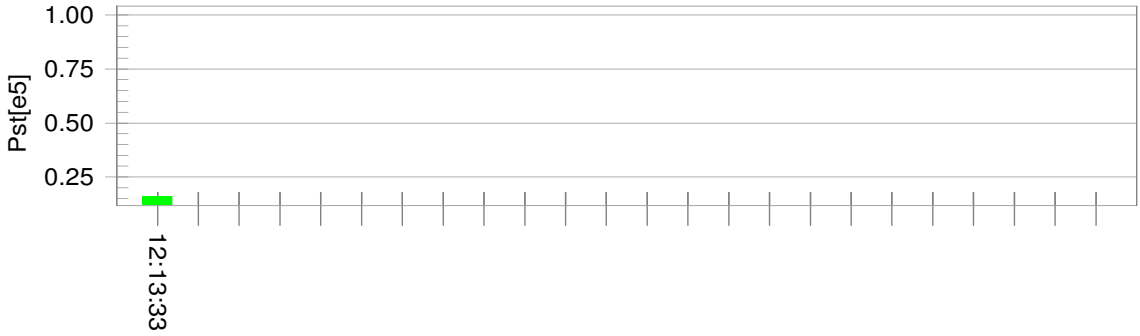
Test Setup:



Test Data:

Test Result: Pass **Status: Test Completed**

Pst_i and limit line **European Limits**



Plt and limit line

Parameter values recorded during the test:

Vrms at the end of test (Volt):	**230.09**			
Highest dt (%):	**0.00**	**Test limit (%):**	**3.30**	**Pass**
Time(mS) > dt:	**0.0**	**Test limit (mS):**	**500.0**	**Pass**
Highest dc (%):	**0.00**	**Test limit (%):**	**3.30**	**Pass**
Highest dmax (%):	**0.00**	**Test limit (%):**	**4.00**	**Pass**
Highest Pst (10 min. period):	**0.160**	**Test limit:**	**1.000**	**Pass**

6.2 EMS (Immunity)

Performance Criteria of EN 301 489-3, sub clause 6.3 table 4.

Class 1 SRD Equipment		
Criteria	During Test	After Test
A	Operated as intended, No loss of function, For equipment Type II the minimum performance shall be 12dB SINAD, No unintentional responses.	Operated as intended, No loss of function, For equipment Type II the communication link shall be maintained. No Degradation of performance, No loss of data or user programmable functions
B	May be loss of function (one or more) No unintentional responses	Operated as intended, Loss functions shall be self- recoverable, No Degradation of performance, No loss of data or user programmable functions
Class 2 SRD Equipment		
Criteria	During Test	After Test
A	Operated as intended, No loss of function, For equipment Type II the minimum performance shall be 6dB SINAD, No unintentional responses.	Operated as intended, No loss of function, For equipment Type II the communication link shall be maintained. No Degradation of performance, No loss of data or user programmable functions
B	May be loss of function (one or more), No unintentional responses	Operate as intended, Loss functions shall be self- recoverable, No Degradation of performance, No loss of data or user programmable functions
Class 3 SRD Equipment		
Criteria	During Test	After Test
A & B	May be loss of function (one or more), No unintentional respond.	Operate as intended, for equipment Type II the communication link may be lost, but shall be recoverable by user. No Degradation of performance. Loss functions shall be self- recoverable.

Remark: The EUT belong to class 3.

6.2.1 Radiated Immunity

Reference Clause: EN 301 489-1 Clause 9.2.2

Test Method: EN 61000-4-3

EUT Operation:

Ambient: Temp.: 20.0 °C Humid.: 51 % Press.:1010 mbar

Test Mode: Mode 1,2

Criterion Required: A

Instruments Used: Refer to section 5 for details.

Test Setup:

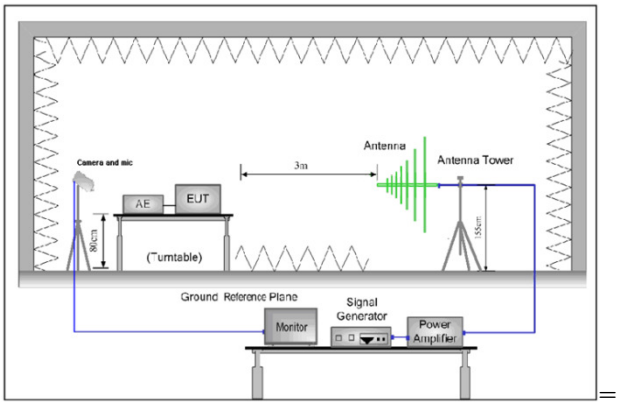


Figure 1. 80MHz to 1GHz, 1.4GHz to 2.7GHz

Test Procedure:

1) For table-top equipment, the EUT was placed in the chamber on a non-conductive table 0.8m high. For arrangement of floor-standing equipment, the EUT was mounted on a non-conductive support 0.1m above the supporting plane. For human body-mounted equipment, the EUT may be tested in the same manner as table top items.
2) If possible, a minimum of 1 m of cable is exposed to the electromagnetic field. Excess length of cables interconnecting units of the EUT shall be bundled low-inductively in the approximate center of the cable to form a bundle 30 cm to 40 cm in length.
3) The EUT was initially placed with one face coincident with the calibration plane. The EUT face being illuminated was contained within the UFA (Uniform Field Area).
4) The frequency ranges to be considered were swept with the signal modulated and pausing to adjust the RF signal level or to switch oscillators and antennas as necessary. Where the frequency range was swept incrementally, the step size was not exceed 1% of the preceding frequency value.
5) The dwell time of the amplitude modulated carrier at each frequency was not be less than the time necessary for the EUT to be exercised and to respond, and was not less than 0.5s.
6) The test normally was performed with the generating antenna facing each side of the EUT.
7) The polarization of the field generated by each antenna necessitates testing each selected side twice, once with the antenna positioned vertically and again with the antenna positioned horizontally.
8) The EUT was performed in a configuration to actual installation conditions,

a video camera, test data and/or an audio monitor were used to monitor the performance of the EUT.

Test Results:

Frequency	Level	Modulation	EUT Face	Antenna Polaxis	Result / Observations
80MHz-1GHz, 1.4GHz to 2.7GHz	3V/m	1kHz, 80% Amp. Mod, 1% increment Dwell time: 3 seconds	Top	V	A
				H	A
			Under	V	A
				H	A
			Other Face	V	A
				H	A

Reaction of EUT:

A: Normal performance within the specification limits.

6.2.2 ESD

Reference Clause: EN 301 489-1 Clause 9.3.2

Test Method: EN61000-4-2

EUT Operation:

Ambient: Temp.: 22.0 °C Humid.: 53 % Press.: 1015 mbar

Test Mode: Mode 1,2

Criterion Required: B

Discharge Impedance: 330 Ω / 150 pF

Polarity: Positive & Negative

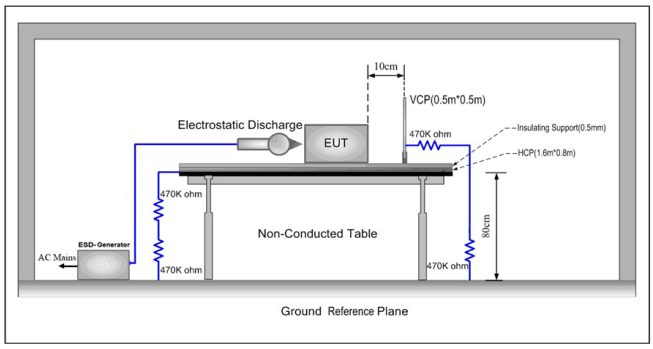
Number of Discharge: Minimum 10 times at each test point

Discharge Mode: Single Discharge

Discharge Period: 1 second minimum

Equipment Used: Refer to section 5 for details.

Test Setup:



Test set-up for tabletop equipment

Test Procedure:

1) Contact discharges to the conductive surfaces and to coupling planes:

Air discharge at slots and apertures, and insulating surfaces:

On those parts of the EUT where it was not possible to perform contact discharge testing, the equipment was investigated to identify user accessible points where breakdown may occur. This investigation was restricted to those areas normally handled by the user. A minimum of 10 single air discharges were applied to the selected test point for each such area.

The application of electrostatic discharges to the contacts of open connectors was not required by this standard.

2) The EUT was put on a 0.8m high wooden table for table-top equipment or 0.1m high for floor standing equipment standing on the ground reference plane(GRP).

3) A horizontal coupling plane(HCP) 1.6m by 0.8m in size was placed on the table, and the EUT with its cables were isolated from the HCP by an insulating support thick than 0.5mm. The VCP 0.5m by 0.5m in size & HCP were constructed from the same material type & thinkmess as that of the GRP, and connected to the GRP via a 470kΩ resistor at each end. The distance between EUT and any of the other metallic surface excepted the GRP, HCP and VCP was greater than 1m.

4) During the contact discharges, the tip of the discharge electrode was touch

the EUT before the discharge switch is operated. During the air discharges, the round discharge tip of the discharge electrode was approached as fast as possible to touch the EUT.

5) After each discharge, the ESD generator was removed from the EUT, the generator was then retriggered for a new single discharge. For ungrounded product, a discharge cable with two resistances was used after each discharge to remove remnant electrostatic voltage. 10 times of each polarity single discharge were applied to HCP and VCP.

Test Results:

Observations: Test Point:

1. All insulated enclosure and seams.
2. All accessible metal parts of the enclosure.

Direct Application Test Results

Direct Application			Test Results	
Discharge Level (kV)	Pulse No.	Test Point	Contact Discharge	Air Discharge
± 2,4,8	10 for every level	1	N/A	A
± 4	10 for every level	2	A	N/A

Indirect Application for tabletop equipment Test Results

Indirect Application		Test Results	
Discharge Level (kV)	Pulse No.	Horizontal Coupling	Vertical Coupling
± 4	10 for every level	A	A

Remark:

A: No performance degradation during test.

N/A: Not applicable

6.2.3 RF Common Mode 0.15MHz to 80MHz

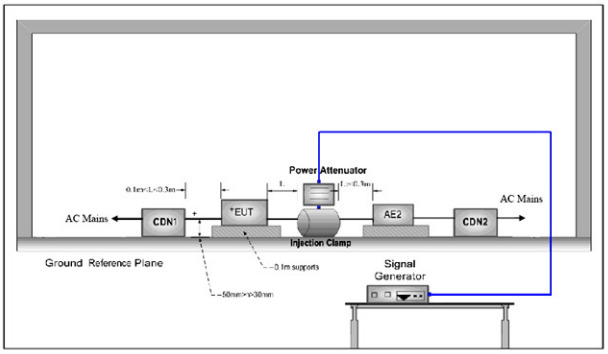
Reference Clause: EN 301 489-1 Clause 9.5.2
Test Method: EN 61000-4-6
Criterion Required: A
EUT Operation:

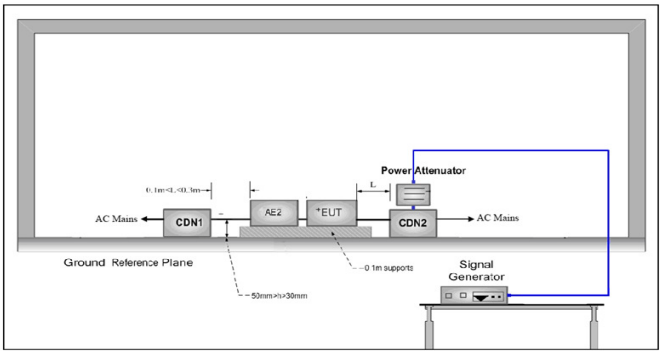
Ambient: Temp.:20.0 °C Humid.: 58 % Press.: 1015 mbar

Test Mode: Mode 2

Equipment Used: Refer to section 5 for details.

Test Setup:





Test Procedure:

1) The EUT was placed on an insulating support of 0.1m height above a ground reference Plane, arranged and connected to satisfy its functional requirement. All cables exiting the EUT was supported at a height of at least 30 mm above the ground reference plane.

2) The coupling and decoupling devices were required, they were located between 0.1m and 0.3m from the EUT. This distance was to be measured horizontally from the projection of the EUT on to the ground reference plane to the coupling and decoupling device.

3) Each AE, used with clamp injection, shall be placed on an insulating support 0.1m above the ground reference plane. A decoupling network shall be installed on each cable between the EUT and AE except the cable under test. All cables connected to each AE, other than those being connected to the EUT, shall be provided with decoupling networks. The decoupling networks connected to each AE (except those on cables between the EUT and AE) shall be applied no further than 0.3m from the AE. The cable(s) between the AE and the decoupling network (s) or in between the AE and the injection clamp shall not be bundled nor wrapped and shall be kept between 30mm and 50mm above the ground reference plane.

4) The frequency range was swept from 150kHz to 80MHz, using the signal levels established during the setting process, and with the disturbance signal 80 % amplitude modulated with a 1kHz sine wave, pausing to adjust the RF signal level or to change coupling devices as necessary. Where the frequency was swept incrementally, the step size does not exceed 1% of the preceding frequency value. The dwell time of the amplitude modulated carrier at each frequency was not less than the time necessary for the EUT

to be exercised and to respond, and was not less than 0.5 s.

6.2.3.1 Test Results

EMI Phenomenon	Frequency Range	Immunity Level	Basic Standard	Operating Mode	Reaction of EUT
Radio-frequency common mode	0.15-80MHz	3 V/m; 1kHz; 80% AM dwell time 3s	EN 61000-4-6	Above mode	A

Reaction of EUT:
A: Normal performance within the specification limits.

6.2.4 Electrical Fast Transients (EFT)

Reference Clause: EN 301 489-1 Clause 9.4.2

Test Method: EN 61000-4-4

Test Level: ± 1.0kV on AC port

Polarity: Positive & Negative

Repetition Frequency: 5kHz

Burst Period: 300ms

Test Duration: 2 minute per level & polarity

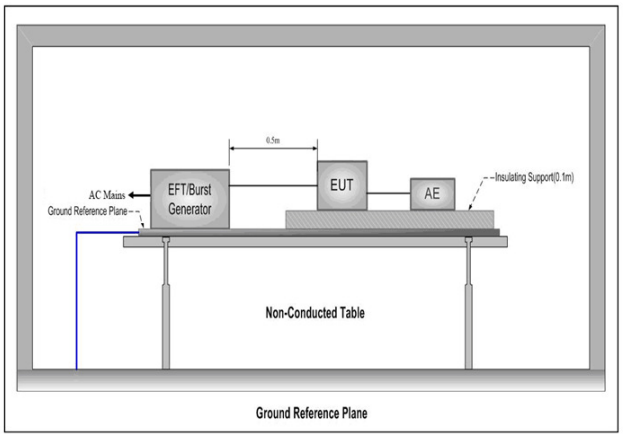
EUT Operation:

Ambient: Temp.: 20.0 °C Humid.:58 % Press.: 1015 mbar

Test Mode: Mode 2

Equipment Used: Refer to section 5 for details.

Test Setup:



For AC port

Test Procedure:

1) The EUT was placed on a ground reference plane(GRP) insulated by an insulating support 0.1m thick and the GRP was placed on a 0.8m high wooden table for table-top equipment. For floor standing equipment, the EUT was placed on a 0.1m high wooden support above the GRP.

2) The GRP shall project beyond the EUT and the clamp by at least 0.1m on all sides. The distance between the EUT and any other of the metallic surface except the GRP was greater than 0.5m. All cables to the EUT was placed on the insulation support 0.1m above GRP. A cable not subject to EFT was routed as far as possible from cable under test to minimize the coupling between the cables.

3) The length of signal and power cable between the EUT and EFT generator was 0.5m. If the cable is a non-detachable supply cable more than 0.5m, the excess length of this cable shall be folded to avoid a flat coil and situated at a distance of 0.1m above the GRP.

4) The EUT was conducted the below specified test voltages for line and neutral or line, neutral and earth simultaneously (for telecommunication, single, control and DC port line with capacitive coupling clamp), 120 seconds duration. If the equipment contains identical ports, only one was tested; multicomputer cables, such as a 50-pair telecommunication cable,

were tested as a single cable. Cables did not be split or divided into groups of conductors for this test; interface ports, which were intended by the manufacturer to be connected to data cables not longer than 3 m, did not be tested.

Test Results

Lead under Test	Level (kV)	Coupling Direct/Clamp	EUT operating mode	Observations (Performance Criterion)
Live, Neutral	± 1.0	Direct	Above mode	A

Remark:

A: No performance degradation during test.

6.2.5 Surge

Reference Clause: EN 301 489-1 Clause 9.8.2

Test Method: EN 61000-4-5

Test Level: For AC port

1) ± 1kV Live to Neutral

Criterion Required: B

Polarity: Positive & Negative

Interval: 60s between each surge

No. of Surges: 5 positive, 5 negative at 0°, 90°, 180°, 270°.

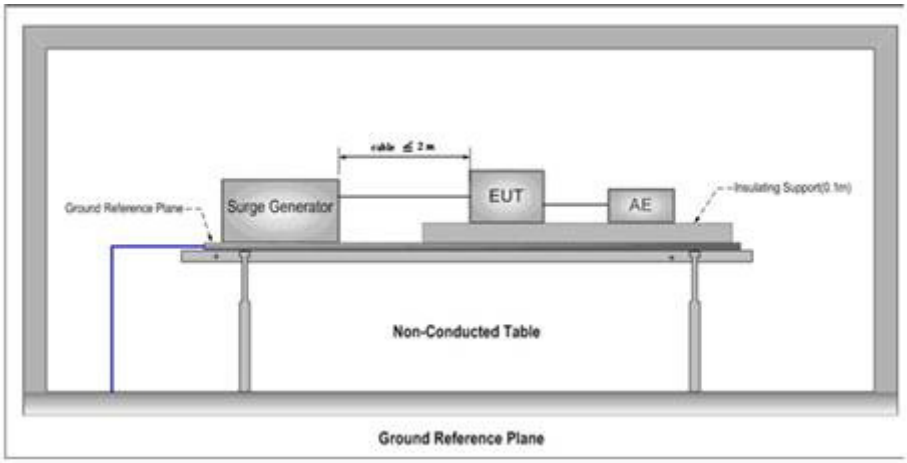
EUT Operation:

Ambient: Temp.: 24.0 °C Humid.: 49 % Press.: 1025 mbar

Test Mode: Mode 2

Equipment Used: Refer to section 5 for details.

Test Setup:



For AC port

Test Procedure:

1) The EUT was placed on a ground reference plane(GRP) insulated by an insulating support 0.1 m thick and the GRP was placed on a 0.8m high wooden table for table-top equipment. For floor standing equipment, the EUT was placed on a 0.1m high wooden support above the GRP.

2) The 1.2/50 μs surge was to be applied to the EUT power supply terminals via the capacitive coupling network. Decoupling networks were required in order to avoid possible adverse effects on equipment not under test that may be powered by the same lines and to provide sufficient decoupling impedance to the surge wave so that the specified wave may be applied on the lines under test.

3) The power cord between the EUT and the coupling/decoupling network was not exceed 2 m in length. The interconnection line between the EUT and the coupling/ decoupling network shall not exceed 2 m in length.

4) The EUT was conducted 0.5 kV and 1 kV test voltage for line to line and line to neutral and conducted 0.5 kV, 1 kV and 2 kV test voltage for line to earth

and neutral to earth, five positive pulses and five negative pulses each at 0°, 90°, 180° and 270° for a.c. power ports and five positive pulses and five negative surge pulses for d.c. power ports (for telecommunication port, It was 0.5 kV for indoor cable longer than 10m line to ground and 0.5kV,1kV test voltage for outdoor cable line to ground, five positive pulses and five negative surge pulses), The test levels were applied on the EUT with a 2 Ω generator source impedance for power supply terminals and 40Ω output impedance for interconnection lines. The tests were done at repetition rate one per minute.

Test Results:

For AC port (2 line)					
Pulse No	**Line-Line**	**Level (kV)**	**Surge interval**	**phase (deg)**	**Observation (Performance Criterion)**
1–5	L-N	+1	60s	0°	A
6–10	L-N	-1	60s	0°	A
11–15	L-N	+1	60s	90°	A
16–20	L-N	-1	60s	90°	A
21–25	L-N	+1	60s	180°	A
26–30	L-N	-1	60s	180°	A
31–35	L-N	+1	60s	270°	A
36–40	L-N	-1	60s	270°	A

Remark:

A: No performance degradation during test.

6.2.6 Voltage Dips and Interruptions

Reference Clause: EN 301 489-1 Clause 9.7.2

Test Method: EN 61000-4-11

Test Level: Voltage dip: 0 % residual voltage for 0.5 cycle;
Voltage dip: 0 % residual voltage for 1 cycle;
Voltage dip: 70 % residual voltage for 25 cycles;
Voltage interruption: 0 % residual voltage for 250 cycles.

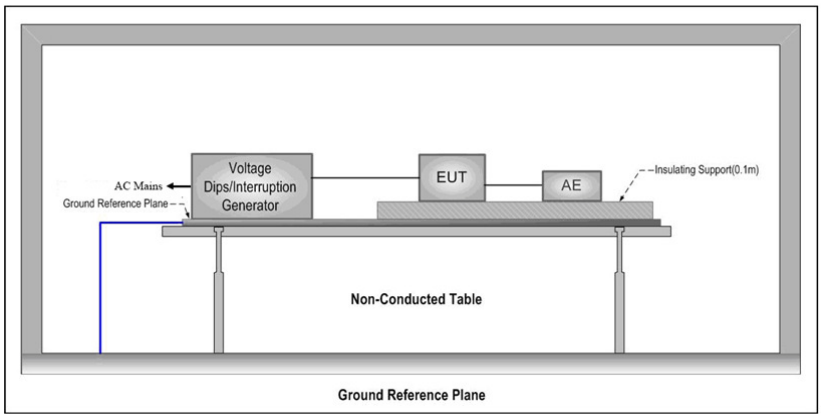
No. of Dips / Interruptions: 3 per Level

EUT Operation:

Ambient: Temp.: 20.0 °C Humid.: 58 % Press.:1015 mbar

Test Mode: Mode 2

Test Setup:



Test Procedure:

1) The EUT was placed on a ground reference plane(GRP) insulated by an insulating support 0.1 m thick and the GRP was placed on a 0.8m high wooden table for table-top equipment. For floor standing equipment, the EUT was placed on a 0.1m high wooden support above the GRP.
2) The test was performed with the EUT connected to the test generator with the shortest power supply cable as specified by the EUT manufacturer.
3) The EUT was tested for each selected combination of test level and duration with a sequence of three dips /interruptions with intervals of 10 s minimum. Each representative mode of operation was tested.
4) For EUT with more than one power cord, each power cord was tested individually.

Equipment Used: Refer to section 5 for details.

Test Results:

EUT operating mode	% U_T	Phase	Duration of dropout in Periods	No. of dropout	Time between dropout	Observations (Performance Criterion)
Above modes	0	0°&180°	0.5	3	10s	A
Above modes	0	0°&180°	1	3	10s	A
Above modes	70	0°&180°	25	3	10s	A
Above modes	0	0°&180°	250	3	10s	B

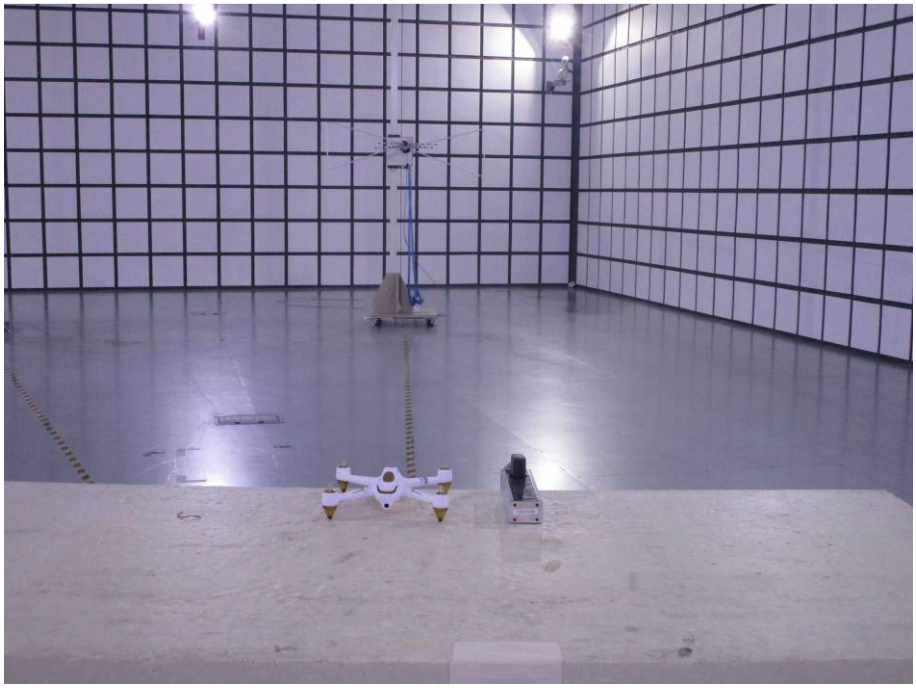
A: No performance degradation during test.

B: The EUT stop being charged during the test. It can recover automatically after the test.

7 Photographs–EUT Test Setup

Test Model No.: H501S

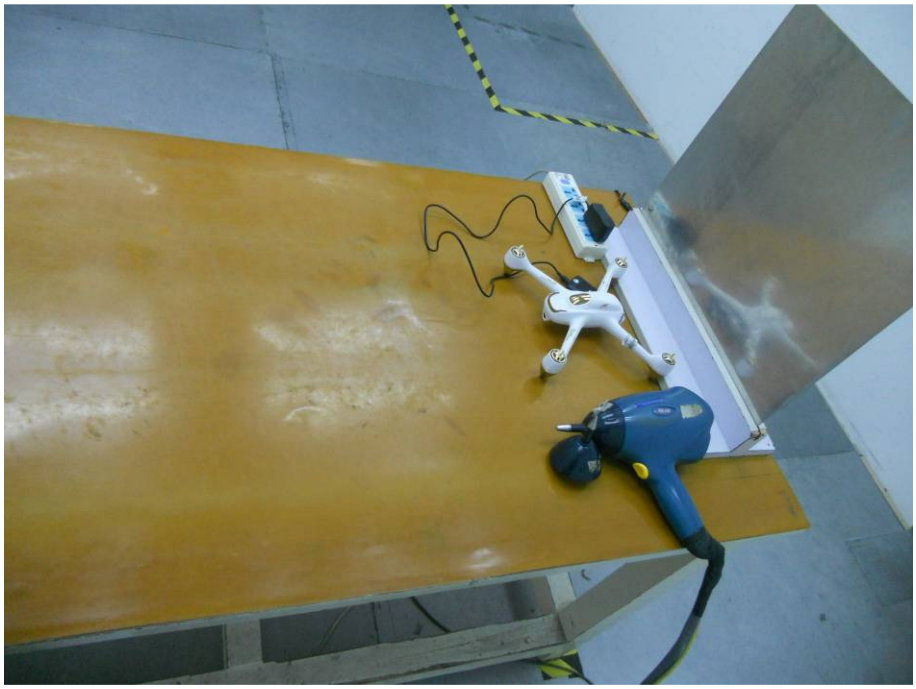
7.1 Radiated Emission

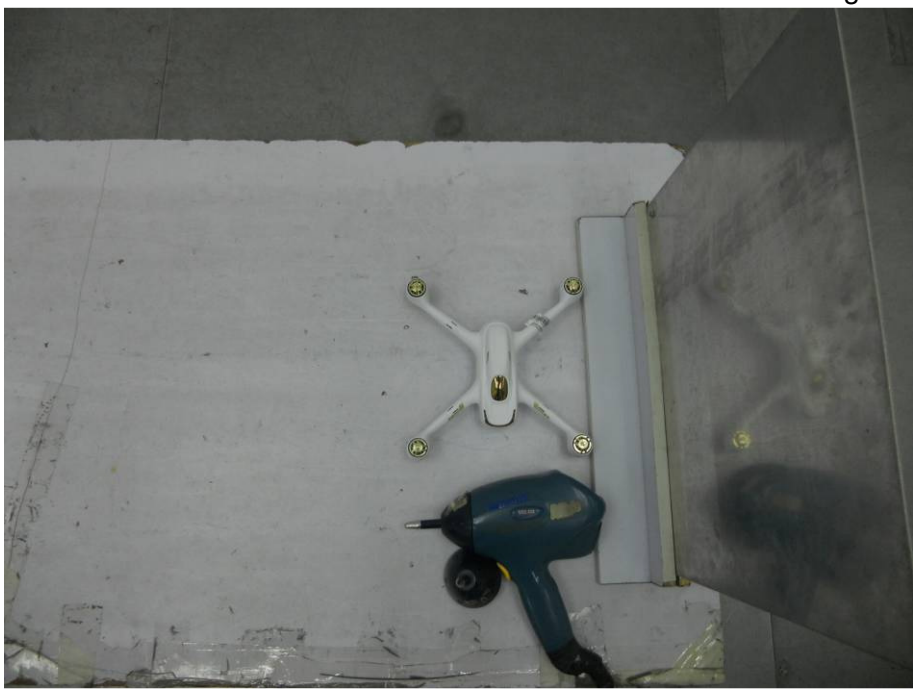


7.2 Conducted Emission

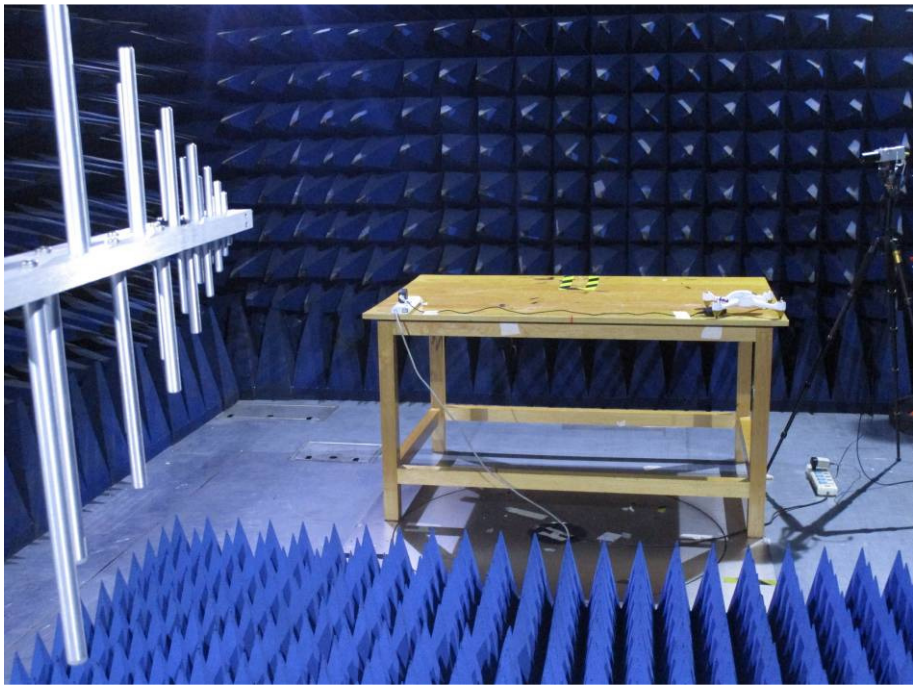
7.3 Flicker

7.4 ESD

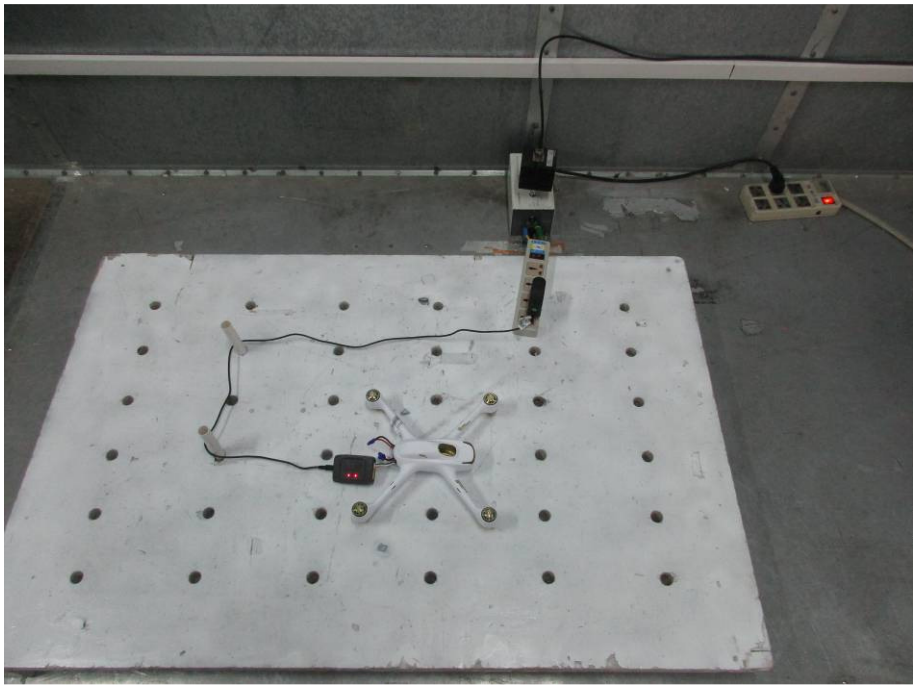




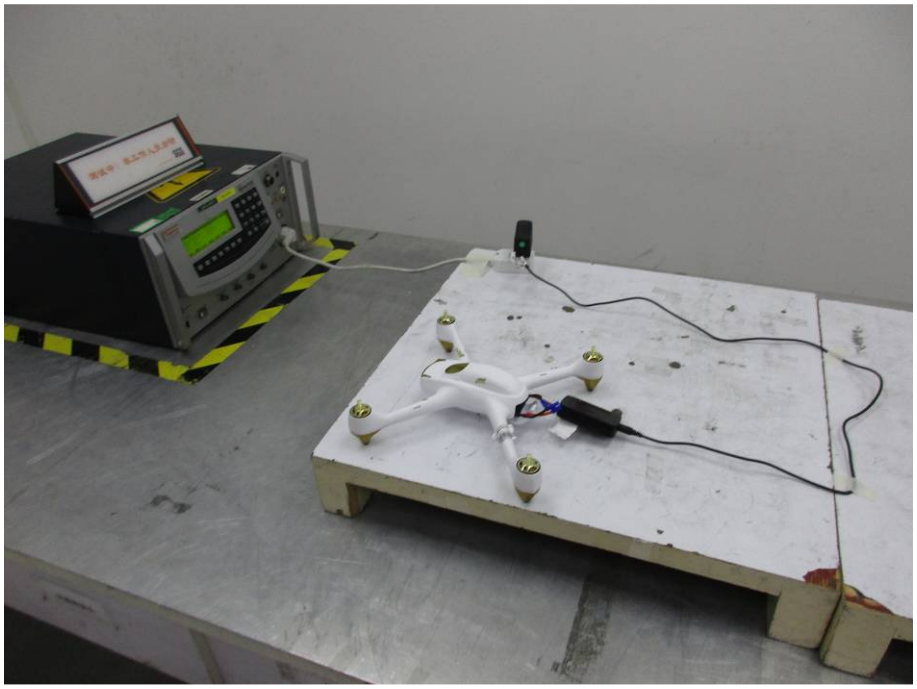
7.5 Radiated Immunity



7.6 RF Common Mode



7.7 EFT / Surge / Voltage Dips and Interruptions



8 Photographs–EUT Constructional Details