EMC REPORT

Applicant:	Dragino Technology Co., Limited
Address of Applicant:	Room 1101, City Invest Commercial Center, No.546 QingLinRoad, LongCheng Street, LongGang District, Shenzhen 518116, China
Manufacturer/ Factory:	Dragino Technology Co., Limited
Address of Manufacturer/ Factory:	Room 1101, City Invest Commercial Center, No.546 QingLinRoad, LongCheng Street, LongGang District, Shenzhen 518116, China

Equipment Under Test (EUT)

Product Name:	LoRa IoT Gateway
Model No.:	LG01, LG01-P, LG01-S, MS14N-P, MS14N-S
Applicable standards:	ETSI EN 301 489-1 V2.2.0 (2017-03) ETSI EN 301 489-3 V2.1.1 (2017-03) ETSI EN 301 489-17 V3.2.0 (2017-03)
Date of sample receipt:	June 15, 2017
Date of Test:	June 15-20, 2017
Date of report issue:	June 20, 2017
Test Result :	PASS *

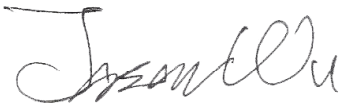
* In the configuration tested, the EUT complied with the standards specified above.

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. The protection requirements with respect to electromagnetic compatibility contained in Directive 2014/53/EU are considered.

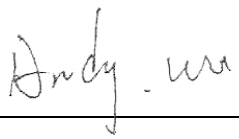
Robinson Lo
Laboratory Manager

2 Version

Version No.	Date	Description
00	*June 20, 2017*	*Original*

Prepared By:  ***Date:*** *June 20, 2017*

Project Engineer

Check By:  ***Date:*** *June 20, 2017*

Reviewer

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4 Test Summary

EMI Test				
Test Item	Test Requirement	Test Method	Application	Result
Radiated Emission	ETSI EN 301 489-3 ETSI EN 301 489-17	ETSI EN301 489-1	Enclosure	Pass
Conducted Emission	ETSI EN 301 489-3 ETSI EN 301 489-17	ETSI EN301 489-1	AC port/ Telecommunication port	Pass
Harmonic Current Emissions	ETSI EN 301 489-3 ETSI EN 301 489-17	ETSI EN301 489-1	AC port	N/A
Voltage Fluctuations and Flicker	ETSI EN 301 489-3 ETSI EN 301 489-17	ETSI EN301 489-1	AC port	Pass
EMS Test				
ESD (Electrostatic Discharge)	ETSI EN 301 489-3 ETSI EN 301 489-17	EN 61000-4-2	Enclosure	Pass
Radiated Immunity, 80MHz to 6 GHz	ETSI EN 301 489-3 ETSI EN 301 489-17	EN 61000-4-3	Enclosure	Pass
EFT (Electrical Fast Transients	ETSI EN 301 489-3 ETSI EN 301 489-17	EN 61000-4-4	AC port/ Telecommunication port	Pass
Surge Immunity	ETSI EN 301 489-3 ETSI EN 301 489-17	EN 61000-4-5	AC port/ Telecommunication port	Pass
Injected Currents 150kHz to 80MHz	ETSI EN 301 489-3 ETSI EN 301 489-17	EN 61000-4-6	AC port/ Telecommunication port	Pass
Voltage Dips and Interruptions	ETSI EN 301 489-3 ETSI EN 301 489-17	EN 61000-4-11	AC port	Pass

Remark:
Pass: The EUT complies with the essential requirements in the standard.
N/A: Not applicable

5 General Information

5.1 General Description of EUT

Product Name:	LoRa IoT Gateway
Model No.:	LG01, LG01-P, LG01-S, MS14N-P, MS14N-S
Test Model No.:	LG01
Remark: All above models are identical in the same PCB layout, interior structure and electrical circuits. The only differences are the model name and *LG01 include LG01-P and LG01-S.* *LG01-S with terminal and 868 module* *LG01-P without terminal and 868 module* *MS14N-P with termina* *MS14N-S without terminal*	
WiFi	
Operation Frequency:	2412MHz~2472MHz(802.11b/802.11g/802.11n(H20)) 2422MHz~2462MHz(802.11n(H40))
Channel Numbers:	13 for 802.11b/802.11g/802.11n(HT20) 9 for 802.11n(HT40)
Channel Separation:	5MHz
Modulation Type: (IEEE 802.11b)	Direct Sequence Spread Spectrum(DSSS)
Modulation Type: (IEEE 802.11g/802.11n)	Orthogonal Frequency Division Multiplexing(OFDM)
Antenna Type:	Integrated antenna
Antenna Gain:	3.3dBi (Declared by manufacturer)
868.1MHz	
Operation Frequency:	868.1MHz(Declared by manufacturer)
Occupied bandwidth	200kHz (Declared by manufacturer)
Antenna type:	Integrated antenna
Antenna Gain:	2.5dBi (Declared by manufacturer)
Modulation type:	FSK(Declared by manufacturer)
Power supply:	Adapter Input: AC100-240V 50-60Hz 0.5A Output: DC12V 0.1-1.3A

5.2 Operating Modes

Operating mode	Detail description
Operation mode	Keep the EUT working normally.

5.3 Description of Support Units

Manufacturer	Description	Model	Serial Number
Apple	PC	A1278	C1MN99ERDTY3
Lenovo	PC	E40-80	MP14ZYYD
DELL	KEYBOARD	SK-8115	N/A
DELL	MOUSE	MOC5UO	N/A

5.4 Test Facility

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

● **FCC —Registration No.: 600491**

Global United Technology Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fuly described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in files. Registration 600491, June 22, 2016.

● **Industry Canada (IC) —Registration No.: 9079A-2**

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. Has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A-2, August 15, 2016.

5.5 Test Location

RI test was performed at:

China Shenzhen Academy of Metrology and Quality Inspection,
Metrology and Quality Inspection building, Central Section of LongZhu Road, Nan Shan, Shenzhen, China.

All other tests were performed at:

Global United Technology Services Co., Ltd.
Address: No. 301-309, 3/F., Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China
Tel: 0755-27798480
Fax: 0755-27798960

5.6 Deviation from Standards

None.

5.7 Abnormalities from Standard Conditions

None.

5.8 Other Information Requested by the Customer

None.

6 Equipment Used during Test

Radiated Emission:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	July. 03 2015	July. 02 2020
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	June. 29 2016	June. 28 2017
4	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June. 29 2016	June. 28 2017
5	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	9120D-829	GTS208	June. 29 2016	June. 28 2017
6	Horn Antenna	ETS-LINDGREN	3160	GTS217	June. 29 2016	June. 28 2017
7	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
8	Coaxial Cable	GTS	N/A	GTS213	June. 29 2016	June. 28 2017
9	Coaxial Cable	GTS	N/A	GTS211	June. 29 2016	June. 28 2017
10	Coaxial cable	GTS	N/A	GTS210	June. 29 2016	June. 28 2017
11	Coaxial Cable	GTS	N/A	GTS212	June. 29 2016	June. 28 2017
12	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June. 29 2016	June. 28 2017
13	Amplifier(2GHz-20GHz)	HP	8349B	GTS206	June. 29 2016	June. 28 2017
14	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June. 29 2016	June. 28 2017
15	Band filter	Amindeon	82346	GTS219	June. 29 2016	June. 28 2017
16	Constant temperature and humidity box	Oregon Scientific	BA-888	GTS248	June. 29 2016	June. 28 2017
17	D.C. Power Supply	Instek	PS-3030	GTS232	June. 29 2016	June. 28 2017
18	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	GTS588	June. 29 2016	June. 28 2017
19	Splitter	Agilent	11636B	GTS237	June. 29 2016	June. 28 2017

Conducted Emission						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	Shielding Room	ZhongYu Electron	7.3(L)x3.1(W)x2.9(H)	GTS252	May.16 2014	May.15 2019
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June. 29 2016	June. 28 2017
3	Coaxial Switch	ANRITSU CORP	MP59B	GTS225	June. 29 2016	June. 28 2017
4	Artificial Mains Network	SCHWARZBECK MESS	NSLK8127	GTS226	June. 29 2016	June. 28 2017
5	Coaxial Cable	GTS	N/A	GTS227	N/A	N/A
6	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
7	Thermo meter	KTJ	TA328	GTS233	June. 29 2016	June. 28 2017

ESD						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	ESD Simulator	KIKUSUI	KES4021A	GTS242	June. 29 2016	June. 28 2017
2	Thermo meter	KTJ	TA328	GTS243	June. 29 2016	June. 28 2017

Conducted Immunity						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	Signal Generator	SCHLODER	CDG-6000-25	GTS553	June. 29 2016	June. 28 2017
2	CDN	SCHLODER	CDN-M2+3	GTS554	June. 29 2016	June. 28 2017
3	ATT	SCHLODER	ATT-6DB-100	GTS556	June. 29 2016	June. 28 2017
4	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	GTS588	June. 29 2016	June. 28 2017

Flicker						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	HARMONIC/FLICKER ANALYZER	KIKUSUI	KHA1000	GTS235	June. 29 2016	June. 28 2017
2	AC POWER SUPPLY	KIKUSUI	PCR4000LE	GTS236	June. 29 2016	June. 28 2017
3	LINE IMPEDANCE NETWORK	KIKUSUI	LIN1020JF	GTS237	June. 29 2016	June. 28 2017
4	Thermo meter	KTJ	TA328	GTS256	June. 29 2016	June. 28 2017

EFT, Surge, Voltage dips and Interruption						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	EMTEST system	EMTEST	UCS500N	GTS239	June. 29 2016	June. 28 2017
2	Thermo meter	KTJ	TA328	GTS238	June. 29 2016	June. 28 2017

Radiated Immunity:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Serial NO.**	**Cal.Date (mm-dd-yy)**	**Cal.Due Date (mm-dd-yy)**
1	Signal Generator	Rohde & Schwarz	SMT03	100059	Jan. 16 2017	Jan. 15 2018
2	Power Amplifier	AR	150W1000	300999	Jan. 16 2017	Jan. 15 2018
3	Power Amplifier	AR	25S1G4AM1	305993	Jan. 16 2017	Jan. 15 2018
4	Power Amplifier	AR	150A220M6	305965	Jan. 16 2017	Jan. 15 2018
5	Broadband antenna	CHASE	CBL6111C	2576	Jan. 16 2017	Jan. 15 2018
6	Horn Antenna	AR	AT4002A	2783	Jan. 16 2017	Jan. 15 2018
7	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	N/A	Jan. 16 2017	Jan. 15 2018

General used equipment:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	Humidity/ Temperature Indicator	Shanghai	ZJ1-2B	GTS243	June.29 2016	June. 28 2017
2	Barometer	ChangChun	DYM3	GTS255	June. 29 2016	June. 28 2017

7 EMC Requirements Specification in ETSI EN 301 489-3/17

7.1 EMI (Emission)

7.1.1 Radiated Emission

Test Requirement:	ETSI EN 301 489-3/17
Test Method:	ETSI EN 301 489-1 and CISPR16-2-3
Test Frequency Range:	30MHz to 6GHz
Test site:	Measurement Distance: 3m

Receiver setup:

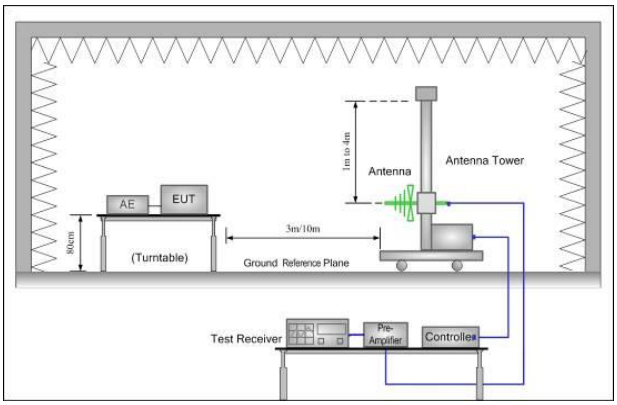
Frequency	Detector	RBW	VBW	Remark
30MHz-1GHz	Quasi-peak	100kHz	300kHz	Quasi-peak Value
Above 1GHz	Peak	1MHz	3MHz	Peak Value
	AV	1MHz	3MHz	Average Value

Limit:

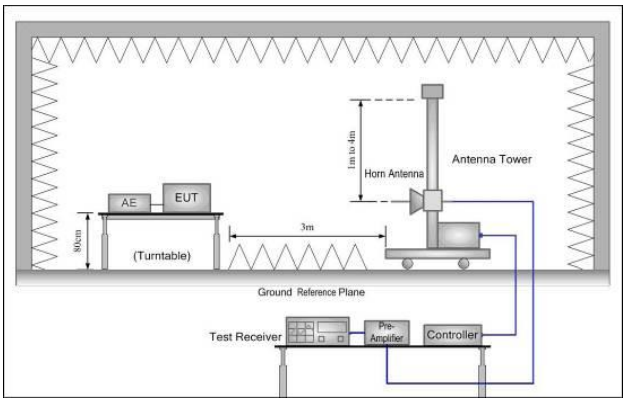
Frequency	Limit (dBuV/m @3m)	Remark
30MHz-230MHz	40.00	Quasi-peak Value
230MHz-1GHz	47.00	Quasi-peak Value
1GHz-3GHz	50.00	Average Value
	70.00	Peak Value
3GHz-6GHz	54.00	Average Value
	74.00	Peak Value

Test setup:

Below 1GHz



Above 1GHz



Test Procedure:	■ **From 30MHz to 1GHz:** 1. The radiated emissions test was conducted in a semi-anechoic chamber. 2. 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, but separated from metallic contact with the ground reference plane by 0.1m of insulation. 3. Before final measurements of radiated emissions, a pre-scan was performed in the spectrum mode with the peak detector to find out the maximum emissions spectrum plots of the EUT. 4. The frequencies of maximum emission were determined in the final radiated emissions measurement. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the maximum disturbance. Measurements were performed for both horizontal and vertical antenna polarization. ■ **Above 1GHz:** 1. The radiated emissions test was conducted in a fully-anechoic chamber. 2. 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, but separated from metallic contact with the ground reference plane by 0.1m of insulation. 3. Before final measurements of radiated emissions, a pre-scan was performed in the spectrum mode with the peak detector to find out the maximum emission spectrum plots of the EUT. 4. The frequencies of maximum emission were determined in the final radiated emissions measurement. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the maximum disturbance. Measurements were performed for both horizontal and vertical antenna polarization.					
Test environment:	Temp.:	25 °C	Humid.:	50%	Press.:	1 010mbar
Measurement Record:						Uncertainty: ± 4.5dB
Test Instruments:	Refer to section 6.0 for details					
Test mode:	Refer to section 5.2 for details					
Test results:	Pass					

Remark:
1. Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Measurement Data

Below 1GHz

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarity
31.18	46.37	11.30	0.56	30.09	28.14	40.00	-11.86	Vertical
43.97	41.29	12.25	0.71	30.02	24.23	40.00	-15.77	Vertical
70.58	33.50	7.38	0.94	29.85	11.97	40.00	-28.03	Vertical
108.27	32.36	11.50	1.26	29.64	15.48	40.00	-24.52	Vertical
145.35	37.91	7.43	1.54	29.43	17.45	40.00	-22.55	Vertical
776.88	27.12	20.94	4.37	29.20	23.23	47.00	-23.77	Vertical
36.00	34.97	11.20	0.62	30.06	16.73	40.00	-23.27	Horizontal
56.00	36.14	11.67	0.83	29.95	18.69	40.00	-21.31	Horizontal
110.57	26.76	11.20	1.28	29.63	9.61	40.00	-30.39	Horizontal
250.30	26.09	11.85	2.12	29.65	10.41	47.00	-36.59	Horizontal
497.68	32.89	17.44	3.29	29.31	24.31	47.00	-22.69	Horizontal
790.62	25.83	21.16	4.42	29.20	22.21	47.00	-24.79	Horizontal

Above 1GHz

Peak measurement

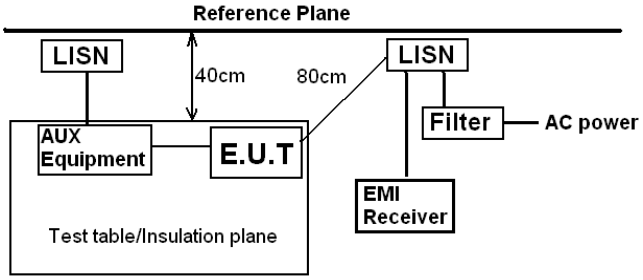
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarity
1505.00	41.14	25.21	4.68	33.62	37.41	70.00	-32.59	Vertical
2695.00	38.16	28.16	5.67	33.66	38.33	70.00	-31.67	Vertical
3710.00	36.24	29.25	7.36	32.52	40.33	74.00	-33.67	Vertical
4725.00	32.70	31.68	8.53	32.05	40.86	74.00	-33.14	Vertical
5495.00	32.71	31.98	9.49	32.42	41.76	74.00	-32.24	Vertical
5955.00	30.37	32.84	10.13	32.16	41.18	74.00	-32.82	Vertical
1395.00	37.80	25.59	4.61	33.42	34.58	70.00	-35.42	Horizontal
2065.00	36.61	26.64	5.04	34.38	33.91	70.00	-36.09	Horizontal
2605.00	35.06	27.82	5.58	33.78	34.68	70.00	-35.32	Horizontal
3290.00	35.09	28.38	6.54	32.99	37.02	74.00	-36.98	Horizontal
4070.00	33.28	29.83	7.94	32.09	38.96	74.00	-35.04	Horizontal
5620.00	29.93	32.32	9.67	32.36	39.56	74.00	-34.44	Horizontal

Remark:

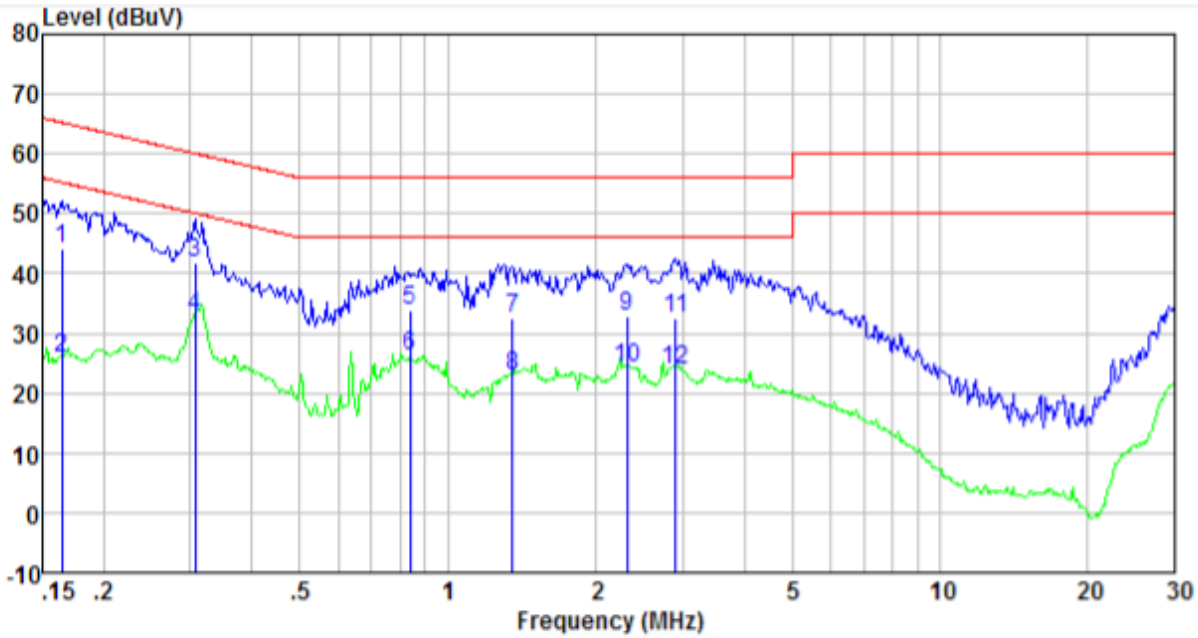
1. The EUT was test at 3m in field chamber.
2. If the average limit is met when using a Peak detector, the EUT shall be deemed to meet both peak and average limits. And measurement with the average detector is unnecessary.

7.1.2 Conducted Emissions

7.1.2.1 AC port

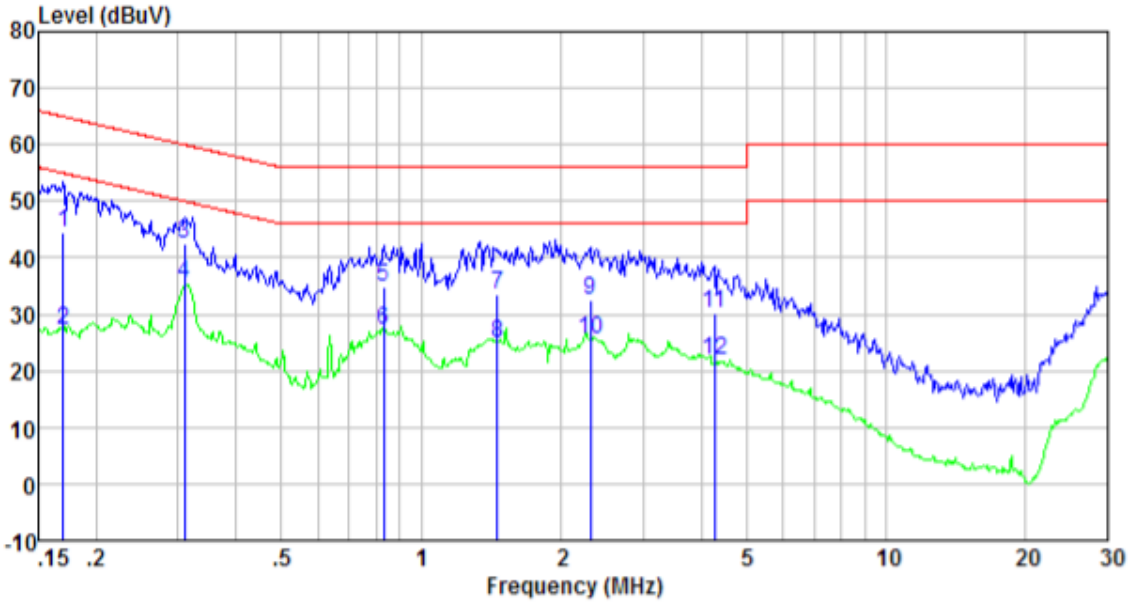
Test Requirement:	ETSI EN 301 489-3/17
Test Method:	ETSI EN 301 489-1
Test Frequency Range:	150kHz to 30MHz
Class / Severity:	Class B
Receiver setup:	RBW=9kHz, VBW=30kHz
Limit:	Frequency range (MHz) / Limit (dBuV): Quasi-peak / Average 0.15-0.5: 66 to 56* / 56 to 46* 0.5-5: 56 / 46 5-30: 60 / 50 * Decreases with the logarithm of the frequency.
Test setup:	 *Remark:* *E.U.T: Equipment Under Test* *LISN: Line Impedence Stabilization Network* *Test table height=0.8m*
Test procedure	1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network(L.I.S.N.). The provide a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to EN55032 Class B on conducted measurement.
Test Instruments:	Temp.: 24 °C | Humid.: 51% | Press.: 1 010mbar
Measurement Record:	Uncertainty: ± 3.45dB
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Line:



Freq MHz	Reading level dBuV	lISN/ISN factor dB	Cable loss dB	level dBuV	Limit level dBuV	Over limit dB	Remark
0.164	43.64	0.42	0.12	44.18	65.25	-21.07	QP
0.164	25.45	0.42	0.12	25.99	55.25	-29.26	Average
0.307	41.16	0.44	0.10	41.70	60.06	-18.36	QP
0.307	32.35	0.44	0.10	32.89	50.06	-17.17	Average
0.839	33.47	0.26	0.13	33.86	56.00	-22.14	QP
0.839	25.72	0.26	0.13	26.11	46.00	-19.89	Average
1.352	32.25	0.23	0.13	32.61	56.00	-23.39	QP
1.352	22.58	0.23	0.13	22.94	46.00	-23.06	Average
2.309	32.39	0.20	0.15	32.74	56.00	-23.26	QP
2.309	23.89	0.20	0.15	24.24	46.00	-21.76	Average
2.900	32.22	0.20	0.15	32.57	56.00	-23.43	QP
2.900	23.59	0.20	0.15	23.94	46.00	-22.06	Average

Neutral:

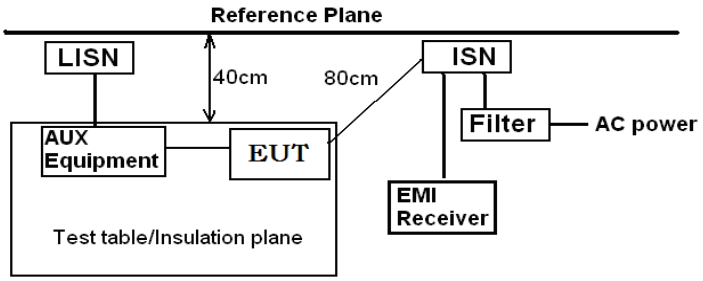


Freq MHz	Reading level dBuV	lISN/ISN factor dB	Cable loss dB	level dBuV	Limit level dBuV	Over limit dB	Remark
0.169	44.06	0.41	0.12	44.59	64.99	-20.40	QP
0.169	26.75	0.41	0.12	27.28	54.99	-27.71	Average
0.310	42.06	0.42	0.10	42.58	59.97	-17.39	QP
0.310	34.92	0.42	0.10	35.44	49.97	-14.53	Average
0.830	34.38	0.23	0.13	34.74	56.00	-21.26	QP
0.830	26.70	0.23	0.13	27.06	46.00	-18.94	Average
1.456	33.11	0.20	0.13	33.44	56.00	-22.56	QP
1.456	24.68	0.20	0.13	25.01	46.00	-20.99	Average
2.309	32.11	0.20	0.15	32.46	56.00	-23.54	QP
2.309	25.07	0.20	0.15	25.42	46.00	-20.58	Average
4.269	29.96	0.21	0.15	30.32	56.00	-25.68	QP
4.269	21.61	0.21	0.15	21.97	46.00	-24.03	Average

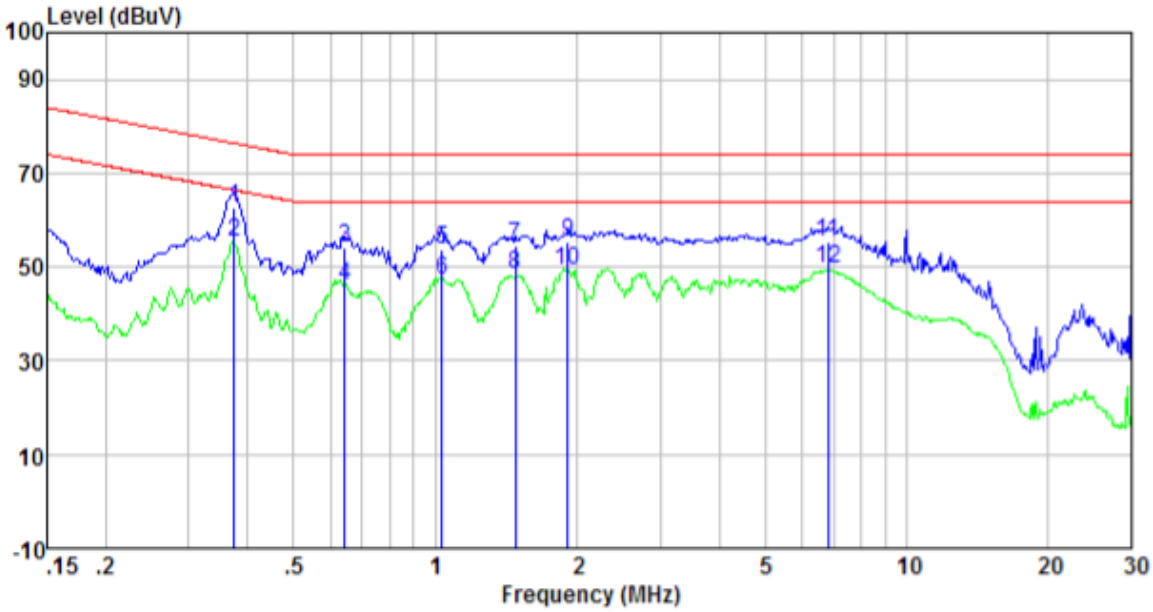
Notes:

1. *An initial pre-scan was performed on the live and neutral lines with peak detector.*
2. *Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.*
3. *Final Level =Receiver Read level + LISN Factor + Cable Loss*
4. *If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.*

7.1.2.2 Signal ports and Telecommunication ports

Test Requirement:	ETSI EN 301 489-3/17
Test Method:	ETSI EN 301 489-1
Test Frequency Range:	150kHz to 30MHz
Class / Severity:	Class B
Receiver setup:	RBW=9kHz, VBW=30kHz
Limit:	Frequency range (MHz) / Limit (dBµV): Quasi-peak / Average 0.15-0.5: 84 to 74* / 74 to 64* 0.5-30: 74 / 64 * Decreases with the logarithm of the frequency.
Test setup:	 *Remark:* *E.U.T: Equipment Under Test* *ISN: Impedence Stabilization Network* *Test table height=0.8m*
Test procedure:	1. The E.U.T and simulators are connected to the telecommunication port through an impedance stabilization network(ISN). The provide a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through an LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs). 3. The signal line is checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to EN55032 Class B on conducted measurement.
Test environment:	Temp.: 24 °C / Humid.: 51% / Press.: 1012mbar
Measurement Record:	Uncertainty: ±3.45dB
Test Instruments:	Refer to section 6 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data



Freq MHz	Reading level dBuV	lISN/ISN factor dB	Cable loss dB	level dBuV	Limit level dBuV	Over limit dB	Remark
0.375	53.38	9.38	0.10	62.86	76.39	-13.53	QP
0.375	45.91	9.38	0.10	55.39	66.39	-11.00	Average
0.644	44.81	9.24	0.13	54.18	74.00	-19.82	QP
0.644	36.56	9.24	0.13	45.93	64.00	-18.07	Average
1.032	44.47	9.20	0.13	53.80	74.00	-20.20	QP
1.032	38.01	9.20	0.13	47.34	64.00	-16.66	Average
1.480	45.16	9.18	0.13	54.47	74.00	-19.53	QP
1.480	39.02	9.18	0.13	48.33	64.00	-15.67	Average
1.908	46.03	9.13	0.14	55.30	74.00	-18.70	QP
1.908	40.01	9.13	0.14	49.28	64.00	-14.72	Average
6.805	46.11	9.00	0.17	55.28	74.00	-18.72	QP
6.805	40.30	9.00	0.17	49.47	64.00	-14.53	Average

7.1.3 Harmonics Test Results

Test Requirement:	ETSI EN 301 489-3/17: EN 61000-3-2
Test Method:	N/A: 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. For further details, please refer to Clause 7, Note 1 of EN 61000-3-2 Which states: "For the following categories of equipment limits are not specified in this edition of the standard. Note 1: Equipment with a rated power of 75W or less, other than lighting equipment."

7.1.4 Flicker Test Results

Test Requirement:	ETSI EN 301 489-3/17: EN 61000-3-3					
Test Method:	EN 61000-3-3					
Class/Severity:	Clause 5 of EN 61000-3-3					
Measurement Time:	10 min					
Detector:	As per EN 61000-3-3					
Test Instruments:	Temp.:	24 °C	Humid.:	51%	Press.:	1 010mbar
Test Instruments:	Refer to section 6.0 for details					
Test mode:	Refer to section 5.2 for details, Only show test data of the worse mode on the test report.					
Test results:	Pass					

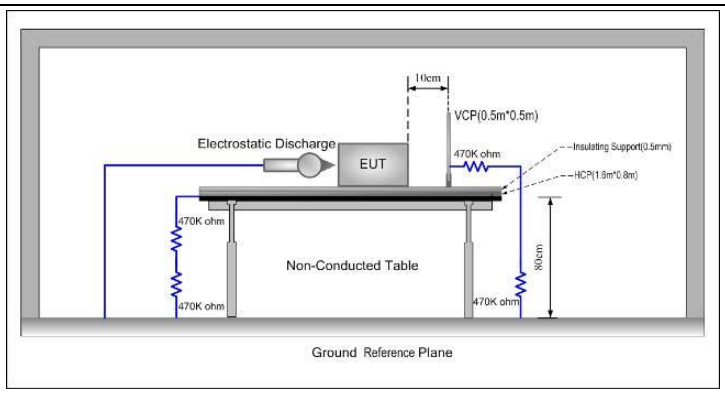
Measurement Data

	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.011	3.30	PASS
dmax [%]	0.069	4.00	PASS
dt [s]	0.000	0.50	PASS

7.2 Immunity

Performance Criteria of ETSI EN 301 489-3/-7/-17/-24, clause 6	
Continuous phenomena applied to transmitters (CT)	1. During the test, the uplink speech output level shall be at least 35 dB less than the previously recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centred on 1 kHz (audio breakthrough check). 2. At the conclusion of the test, the EUT shall operate as intended with no loss of user control functions or stored data, and the communication link shall have been maintained. 3. In addition to confirming the above performance during a call, the test shall also be performed in idle mode, and the transmitter shall not unintentionally operate.
Transient phenomena applied to Transmitters (TT)	1. At the conclusion of each exposure the EUT shall operate with no user noticeable loss of the communication link. 2. At the conclusion of the total test comprising the series of individual exposures, the EUT shall operate as intended with no loss of user control functions or stored data, as declared by the manufacturer, and the communication link shall have been maintained. 3. In addition to confirming the above performance during a call, the test shall also be performed in idle mode, and the transmitter shall not unintentionally operate.
Continuous phenomena applied to Receivers (CR)	1. During the test, the RXQUAL of the downlink shall not exceed the value of three, measured during each individual exposure in the test sequence. 2. During the test, the downlink speech output level shall be at least 35 dB less than the previously recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centred on 1 kHz (audio breakthrough check). 3. At the conclusion of the test, the EUT shall operate as intended with no loss of user control the The communication link shall have been maintained.
Transient phenomena applied to Receivers (TR)	1. At the conclusion of each exposure the EUT shall operate with no user noticeable loss of the communication link. 2. At the conclusion of the total test comprising the series of individual exposures, the EUT shall operate as intended with no loss of user control functions or stored data, as declared by the manufacturer, and the communication link shall have been maintained
Ancillary equipment tested on a stand alone basis	If ancillary equipment is intended to be tested on a stand alone basis, the performance criteria described in the clauses above are not appropriate, then the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after the immunity tests. The performance specification shall be included in the product description and documentation.

7.2.1 Electrostatic Discharge

Test Requirement:	ETSI EN 301 489-3/17
Test Method:	EN 61000-4-2
Discharge Voltage:	Contact Discharge:±4kV Air Discharge: ±2kV, ±4kV, ±8kV HCP/VCP: ±4kV
Polarity:	Positive & Negative
Number of Discharge:	Contact Discharge: Minimum 10 times at each test point, Air Discharge: Minimum 10 times at each test point.
Discharge Mode:	Single Discharge
Discharge Period:	1 second minimum
Limit:	Criteria B
Test setup:	
Test Procedure:	**Air discharge:** 1. The test was applied on non-conductive surfaces of EUT. 2. The round discharge tip of the discharge electrode was approached as fast as possible to touch the EUT. 3. After each discharge, the discharge electrode was removed from the EUT. 4. The generator was re-triggered for a new single discharge and repeated 10 times for each pre-selected test point. 5. This procedure was repeated until all the air discharge completed **Contact Discharge:** 1. The test was applied on conductive surfaces of EUT. 2. the generator was re-triggered for a new single discharge and repeated 10 times for each pre-selected test point. 3. the tip of the discharge electrode was touch the EUT before the discharge switch was operated. **Indirect discharge for horizontal coupling plane** 1. At least 10 single discharges shall be applied at the front edge of each HCP opposite the centre point of each unit of the EUT and 0.1m from the front of the EUT. 2. The long axis of the discharge electrode shall be in the plane of the HCP and perpendicular to its front edge during the discharge. 3. Consideration should be given to exposing all sides of the EUT.

	Indirect discharge for vertical coupling plane 1. At least 10 single discharges were applied to the center of one vertical edge of the coupling plane. 2. The coupling plane, of dimensions 0.5m X 0.5m, was placed parallel to, and positioned at a distance of 0.1m from the EUT. 3. Discharges were applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated.					
Test environment:	Temp.:	24 °C	Humid.:	51%	Press.:	1 010mbar
Test Instruments:	Refer to section 6.0 for details					
Test mode:	Refer to section 5.2 for details					
Test results:	Pass					

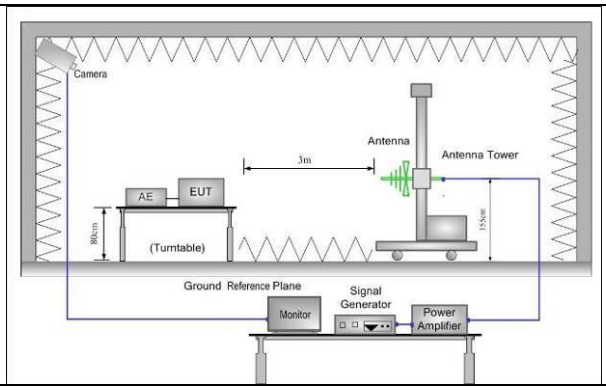
Measurement Record:

Test points:	I: All metallic parts			
	II: Seams. Holes			
Direct discharge				
Discharge Voltage (KV)	**Type of discharge**	**Test points**	**Observations Performance**	**Result**
± 4	Contact	I	A	Pass
± 2, ± 4, ± 8	Air	II	A	Pass
Indirect discharge				
Discharge Voltage (KV)	**Type of discharge**	**Test points**	**Observation Performance**	**Result**
± 4	HCP-Bottom/Top/ Front/Back/Left/Right	Edge of the HCP	A	Pass
± 4	VCP-Bottom/Top/ Front/Back/Left/Right	Center of the VCP	A	Pass

Remark:

A: No degradation in performance of the EUT was observed.

7.2.2 Radiated Immunity

Test Requirement:	ETSI EN 301 489-3/17
Test Method:	EN 61000-4-3
Frequency range:	80MHz to 6GHz
Test Level:	3V/m
Modulation:	80%, 1kHz Amplitude Modulation
Performance Criterion:	Criteria A
Test setup:	
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 0,5 s. 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 and/or a audio monitor were used to monitor the performance of the EUT.
Test monitor:	**Traffic mode:**

	1. The test system shall simulate a Base Station (BS) with Broadcast Control Channel/Common Control Channel (BCCH/CCCH) on one carrier. 2. The EUT shall be synchronized to the BCCH, listening to the CCCH and able to respond to paging messages.					
	Idle mode: 1. The test system shall simulate a Base Station (BS) with Broadcast Control Channel/Common Control Channel (BCCH/CCCH) on one carrier. 2. The EUT shall be synchronized to the BCCH, listening to the CCCH and able to respond to paging messages.					
Test environment:	Temp.:	25 °C	Humid.:	52%	Press.:	1 010mbar
Test Instruments:	Refer to section 6.0 for details					
Test results:	Pass					

Measurement Record:

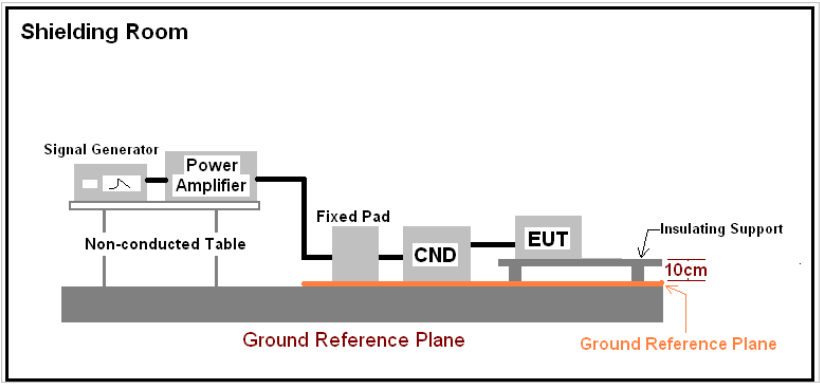
Frequency	Level	Modulation	Antenna Polarization	EUT Face	Observations (Performance Criterion)
80 MHz-6 GHz	3 V/m	1 kHz, 80 % Amp. Mod, 10 % increment, dwell time=3seconds	V	Front	A
			H		A
			V	Rear	A
			H		A
			V	Left	A
			H		A
			V	Right	A
			H		A
			V	Top	A
			H		A
			V	Bottom	A
			H		A

Remarks:

A: No degradation in performance of the EUT was observed.

7.2.3 Radio frequency common mode

7.2.3.1 AC port

Test Requirement:	ETSI EN 301 489-3/17					
Test Method:	EN 61000-4-6					
Frequency range:	0.15MHz to 80MHz					
Test Level:	3V rms on AC Ports (unmodulated emf into 150 Ω)					
Modulation:	80%, 1kHz Amplitude Modulation					
Performance Criterion:	Criteria A					
Test setup:						
Test Procedure:	1. Let the EUT work in test mode and test it. 2. The EUT are placed on an insulating support 0.1m high above a ground reference plane. CDN (coupling and decoupling device) is placed on the ground plane about 0.3m from EUT. Cables between CDN and EUT are as short as possible, and their height above the ground reference plane shall be between 30 and 50 mm (where possible). 3. The disturbance signal described below is injected to EUT through CDN. 4. The EUT operates within its operational mode(s) under intended climatic conditions after power on. 5. The frequency range is swept from 0.150MHz to 80MHz using 3V signal level, and with the disturbance signal 80% amplitude modulated with a 1kHz sine wave.The rate of sweep shall not exceed $1.5*10^{-3}$decades/s. Where the frequency is swept incrementally; the step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value. 6. Recording the EUT operating situation during compliance testing and decide the EUT immunity criterion.					
Test environment:	Temp.:	24 °C	Humid.:	51%	Press.:	1 010mbar
Test Instruments:	Refer to section 6.0 for details					
Test results:	Pass					

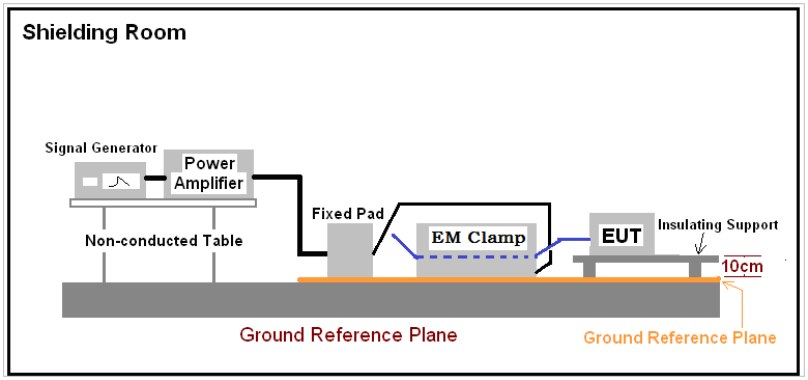
Measurement Record:

Frequency	Injected Position	Test Level	Modulation	Step Size	Dwell Time	Observations (Performance Criterion)
150kHz to 80MHz	AC Main	3Vrms	80%, 1kHz Amp. Mod.	1%	2s	A

Remark:

A: No degradation in performance of the EUT was observed.

7.2.3.2 Signal ports and Telecommunication ports

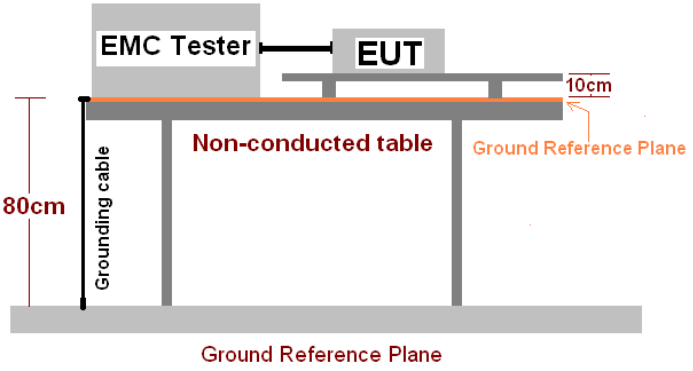
Test Requirement:	ETSI EN 301 489-3/17					
Test Method:	EN 61000-4-6					
Frequency range:	0.15MHz to 80MHz					
Test Level:	3V rms					
Performance Criterion:	Criterion A					
Test setup:						
Test Procedure:	1. The EUT are placed on an insulating support 0.1m high above a ground reference plane. EM Clamp is placed on the ground plane about 0.3m from EUT. Cables between EM clamp and EUT are as short as possible, and their height above the ground reference plane shall be between 30 and 50 mm (where possible). 2. The signal line were place in the EM clamp. 3. The disturbance signal described below is injected to EUT through EM clamp. 4. The EUT operates within its operational mode(s) under intended climatic conditions after power on. 5. Recording the EUT operating situation during compliance testing and decide the EUT immunity criterion.					
Test environment:	Temp.:	24 °C	Humid.:	51%	Press.:	1 012mbar
Test Instruments:	Refer to section 6 for details					
Test mode:	Refer to section 5.2 for details					
Test results:	Pass					

Measurement Record:

Frequency	Injected Position	Level	Modulation	Observations (Performance Criterion)	Result
150kHz to 80MHz	Clamp	3Vrms	1 kHz, 80 % Amp. Mod, 1 % increment, dwell time=2seconds	A (No degradation in performance of the EUT was observed.)	Pass

7.2.4 Electrical Fast Transients

7.2.4.1 AC port

Test Requirement:	ETSI EN 301 489-3/17					
Test Method:	EN 61000-4-4					
Test Level:	1.0kV on AC port					
Polarity:	Positive & Negative					
Repetition Frequency:	5kHz					
Burst Duration:	15ms					
Burst Period:	300ms					
Test Duration:	2 minute per level & polarity					
Performance Criterion:	B					
Test setup:						
Test Procedure:	1. The EUT and its simulators were placed on the ground reference plane and were insulated from it by a wood support 0.1m + 0.01m thick. The ground reference plane was 1m*1m metallic sheet with 0.65mm minimum thickness. 2. This reference ground plane was project beyond the EUT by at least 0.1m on all sides and the minimum distance between EUT and all other conductive structure, except the ground plane was more than 0.5m. 3. All cables to the EUT was placed on the wood support, cables not subject to EFT/B was routed as far as possible from the cable under test to minimize the coupling between the cables. 4. The length of the signal and power lines between the coupling device and the EUT is 0.5m **Test on Signal Ports, Telecommunication Ports and Control Ports:** The EFT interference signal is through a coupling clamp device couples to the signal and control lines of the EUT with burst noise for 2 minutes. **Test on power supply ports:** 1. The EUT is connected to the power mains through a coupling device that directly couples the EFT/B interference signal. 2. Each of the Line and Neutral conductors is impressed with burst noise for 2 minutes.					
Test environment:	Temp.:	26 °C	Humid.:	54%	Press.:	1 010mbar

Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

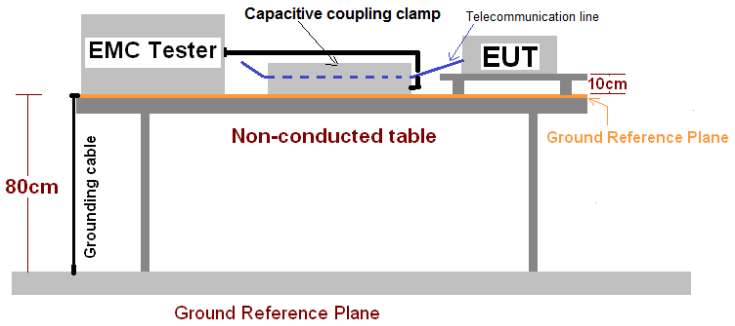
Measurement Record:

Lead under Test	Level (±kV)	Coupling Direct/Clamp	Observations (Performance Criterion)	Result
L	± 1.0	Direct	A	Pass
N	± 1.0	Direct	A	Pass
L-N	± 1.0	Direct	A	Pass

Remark:

A: No degradation in performance of the EUT was observed.

7.2.4.2 Signal ports and Telecommunication ports

Test Requirement:	ETSI EN 301 489-3/17					
Test Method:	EN 61000-4-4					
Test Level:	0.5KV					
Polarity:	Positive & Negative					
Test signal specification:	Rise time=5ns, Duration time=50ns; Burst Duration=15ms, Burst Period=300ms; Repetition Frequency=5KHz					
Test Duration:	2 minute per level & polarity					
Performance Criterion:	Criterion B					
Test setup:						
Test Procedure:	1. The EUT and its simulators were placed on the ground reference plane and were insulated from it by a wood support 0.1m + 0.01m thick. The ground reference plane was 1m*1m metallic sheet with 0.65mm minimum thickness. 2. The capacitive coupling clamp were placed on the ground reference plane. 3. This reference ground plane was project beyond the EUT by at least 0.1m on all sides and the minimum distance between EUT and all other conductive structure, except the ground plane was more than 0.5m. 4. The length of the signal lines between the coupling device and the EUT is 0.5m 5. The signal line were place in the campacitive coupling clamp, and the clamp itself shall be closed as much as possible to provide maximum coupling 6. The EFT interference signal is through a coupling clamp device couples to the signal and control lines of the EUT with burst noise for 2 minutes.					
Test environment:	Temp.:	26 °C	Humid.:	54%	Press.:	1 012mbar
Test Instruments:	Refer to section 6 for details					
Test mode:	Refer to section 5.2 for details					
Test results:	Pass					

Measurement Record:

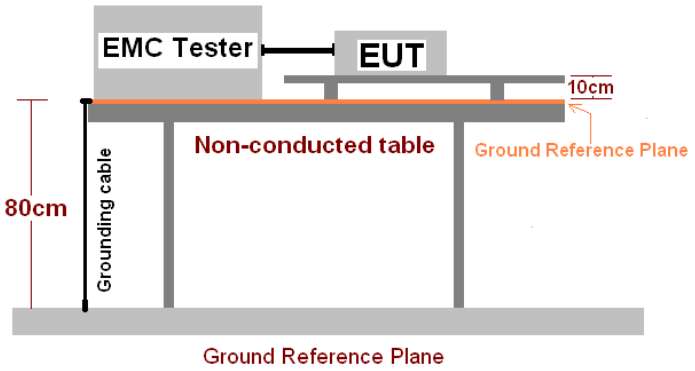
Lead under Test	Level (kV)	Coupling Direct/Clamp	Observations (Performance Criterion)	Result
Signal line	± 0.5	Clamp	A	Pass

Remark:

A: No degradation in performance of the EUT was observed.

7.2.5 Surge

7.2.5.1 AC ports

Test Requirement:	ETSI EN 301 489-3/17					
Test Method:	ETSI EN 61000-4-5					
Test Level:	±1kV Live to Neutral: Differential mode ±2kV Live to PE: Common mode					
Polarity:	Positive & Negative					
Test Interval:	60s between each surge					
No. of surges:	5 positive, 5 negative at 0°, 90°, 180°, 270°.					
Performance Criterion:	B					
Test setup:						
Test Procedure:	1. For line-to-line coupling mode, provide a 1kV 1.2/50us voltage surge (at open-circuit condition) and 8/20us current surge to EUT selected points, and for active line / neutral lines to ground are same except test level is 2kV. 2. At least 5 positive and 5 negative (polarity) tests with a maximum 1/min repetition rate are applied during test. 3. Different phase angles are done individually. 4. Record the EUT operating situation during compliance test and decide the EUT immunity criterion for above each test.					
Test environment:	Temp.:	26 °C	Humid.:	53%	Press.:	1 010mbar
Test Instruments:	Refer to section 6.0 for details					
Test mode:	Refer to section 5.2 for details					
Test results:	Pass					

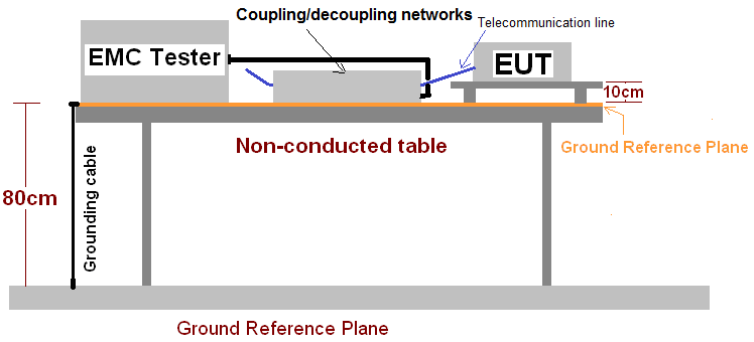
Measurement Record:

Location	Level(kV)	Pulse No	Surge Interval	Phase(deg)	Observations (Performance Criterion)
L-N	±1	5	60s	0, 90, 180, 270	A

Remark:

A: No degradation in performance of the EUT was observed.

7.2.5.2 Signal ports and Telecommunication ports

Test Requirement:	ETSI EN 301 489-3/17
Test Method:	EN 61000-4-5
Test Level:	1kV Line to earth
Polarity:	Positive & Negative
Generator source impedance:	42Ω (line-earth coupling)
Test signal specification:	Rise time=10us, Duration time=700us; Test Interval: 60s between each surge;
No. of surges:	5 positive, 5 negative
Performance Criterion:	Criterion C
Test setup:	
Test Procedure:	1. For Coupling/decoupling networks mode, provide a 1kV 10/700us voltage surge 2. At least 5 positive and 5 negative (polarity) tests with a maximum 1/min repetition rate are applied during test. 3. Different phase angles are done individually. 4. Record the EUT operating situation during compliance test and decide the EUT immunity criterion for above each test.
Test environment:	Temp.: 26 °C | Humid.: 53% | Press.: 1 012mbar
Test Instruments:	Refer to section 6 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

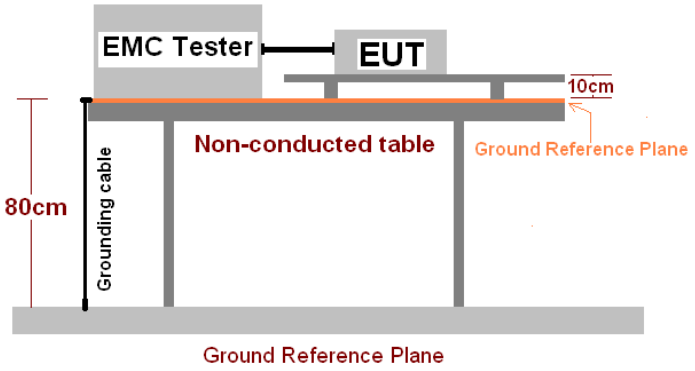
Measurement Record:

Location	Level(kV)	Pulse No	Surge Interval	Observations (Performance Criterion)	Result
Signal port	± 1	5	60s	A	Pass

Remark:

A: No degradation in performance of the EUT was observed.

7.2.6 Voltage Dip and Voltage Interruptions

Test Requirement:	ETSI EN 301 489-3/17					
Test Method:	EN 61000-4-11					
Test Level:	0% of VT(Supply Voltage) for 0.5 period 0% of VT(Supply Voltage) for 1.0 period 70% of VT(Supply Voltage) for 25 period 0% of VT(Supply Voltage) for 250 period					
No. of Dips / Interruptions:	3 per Level					
Performance Criterion:	0% VD, 0.5 period----Performance criterion: B 0% VD, 1 period----Performance criterion: B 70% VD, 25 period----Performance criterion: C 0% VI, 250 period----Performance criterion: C					
Test setup:						
Test Procedure:	1>.The EUT and test generator were setup as shown on above setup photo. 2>.The interruptions are introduced at selected phase angles with specified duration. 3>.Record any degradation of performance.					
Test environment:	Temp.:	26 °C	Humid.:	53%	Press.:	1 010mbar
Test Instruments:	Refer to section 6.0 for details					
Test mode:	Refer to section 5.2 for details					
Test results:	Pass					

Measurement Record:

Test Level U_T	Duration (Periods)	Phase angle	No of dropout	Time between dropout	Observations (Performance Criterion)
0%	0.5	0°, 90°, 180°, 270°	3	10s	A
0%	1.0	0°, 90°, 180°, 270°	3	10s	A
70%	25	0°, 90°, 180°, 270°	3	10s	A
0%	250	0°, 90°, 180°, 270°	3	10s	B

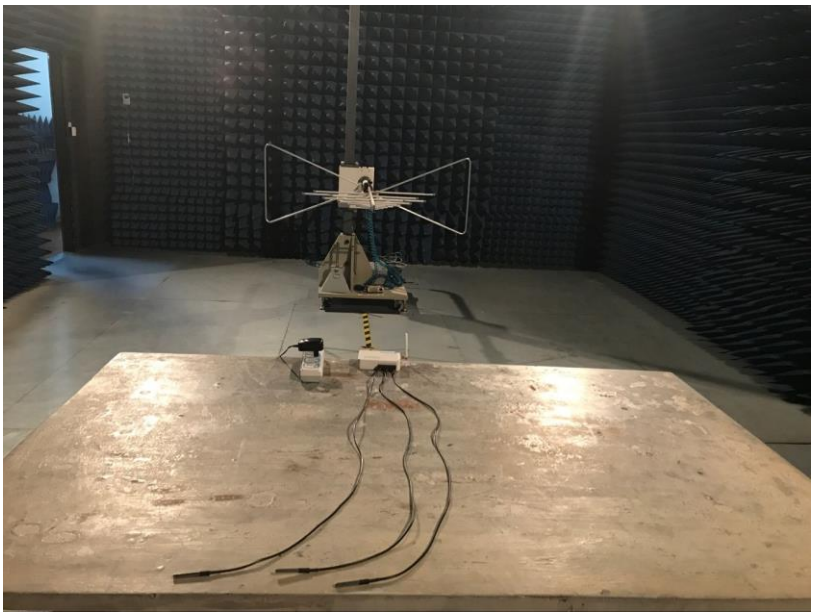
Remark:

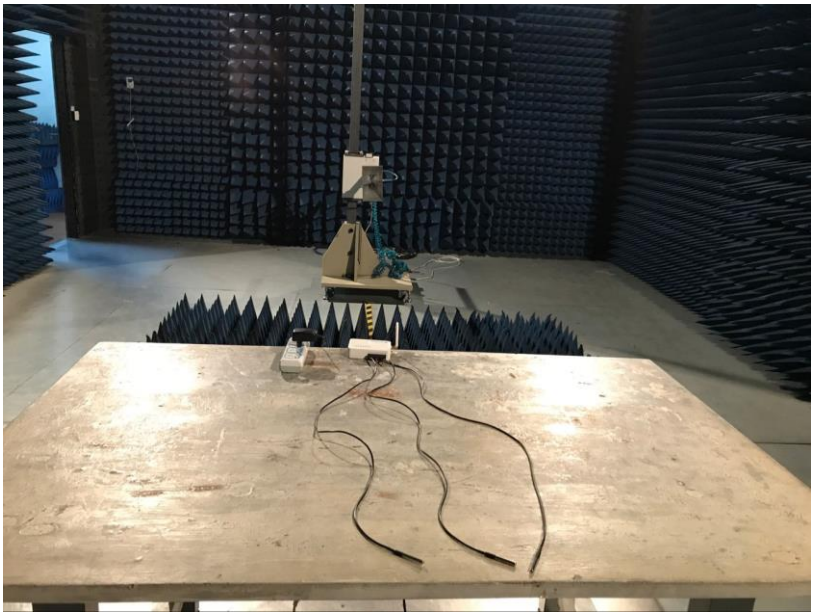
A: No degradation in performance of the EUT was observed.

B: During the test, the adapter stops work, but after the test, it can automatically return to normal.

8 Test Setup Photo

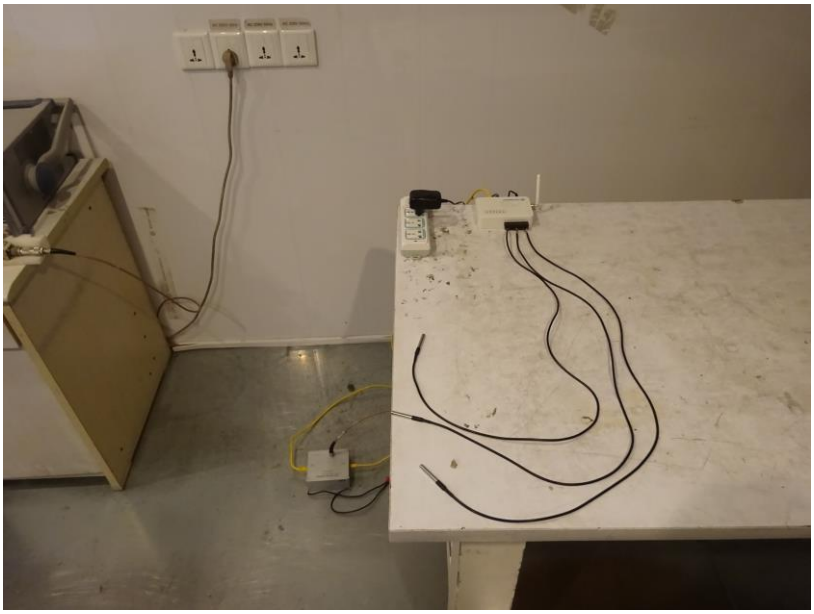
Radiated Emission





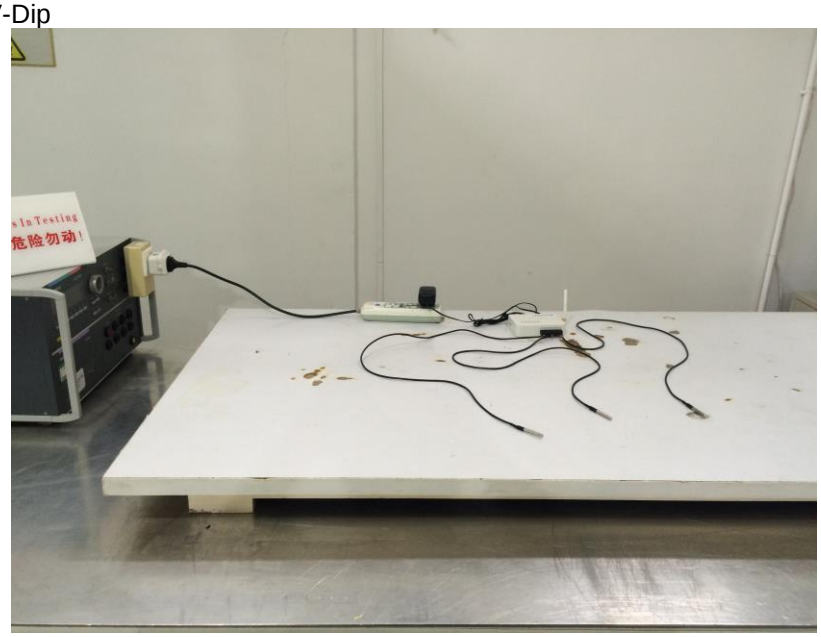
Conducted Emission（AC Port）

Conducted Emission（Telecommunication Port）

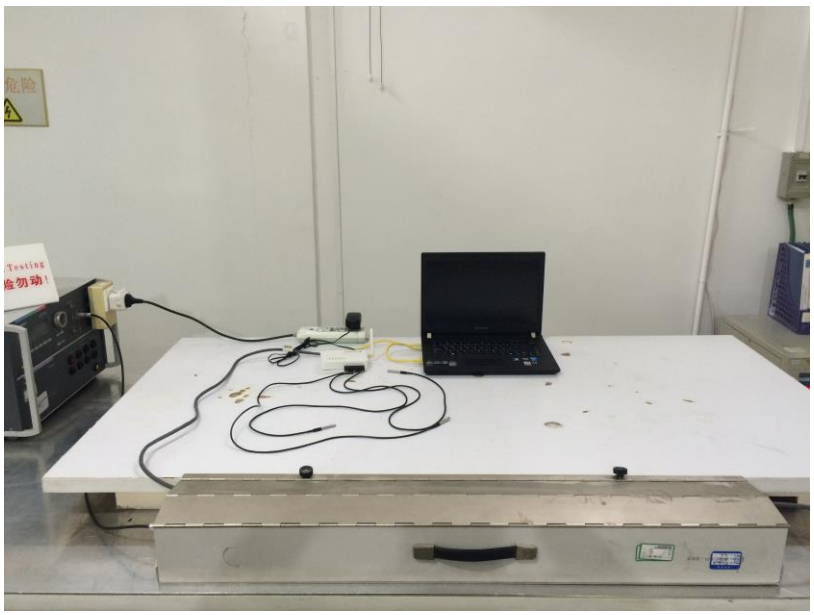


ESD

Surge/EFT/V-Dip



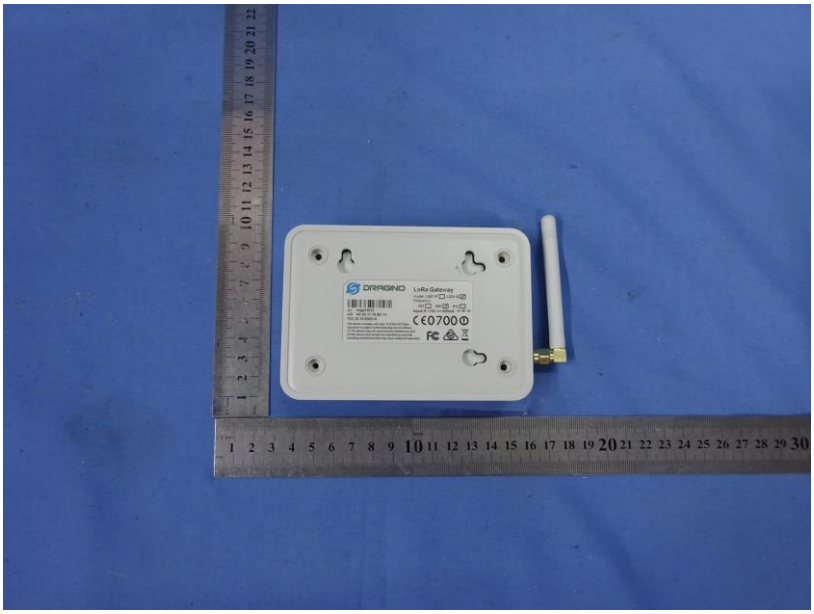
EFT（Telecommunication Port）



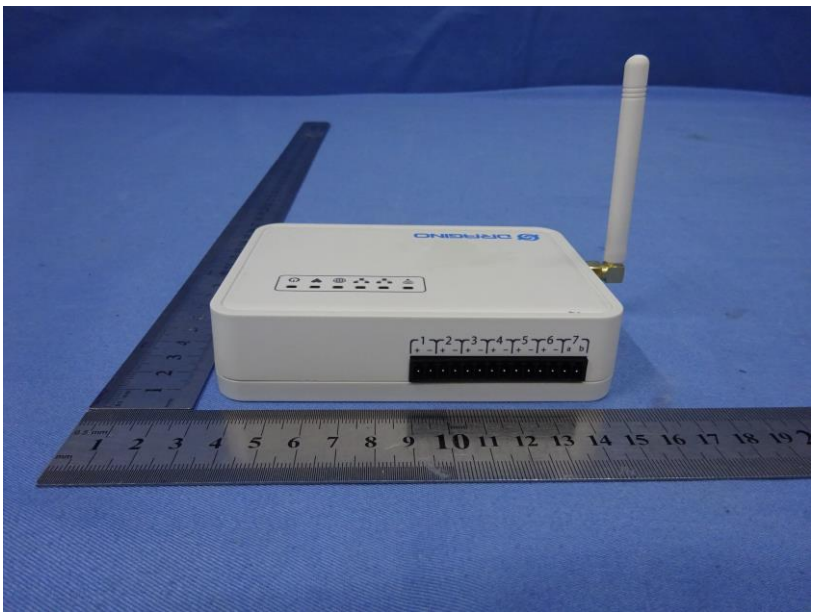
Flicker

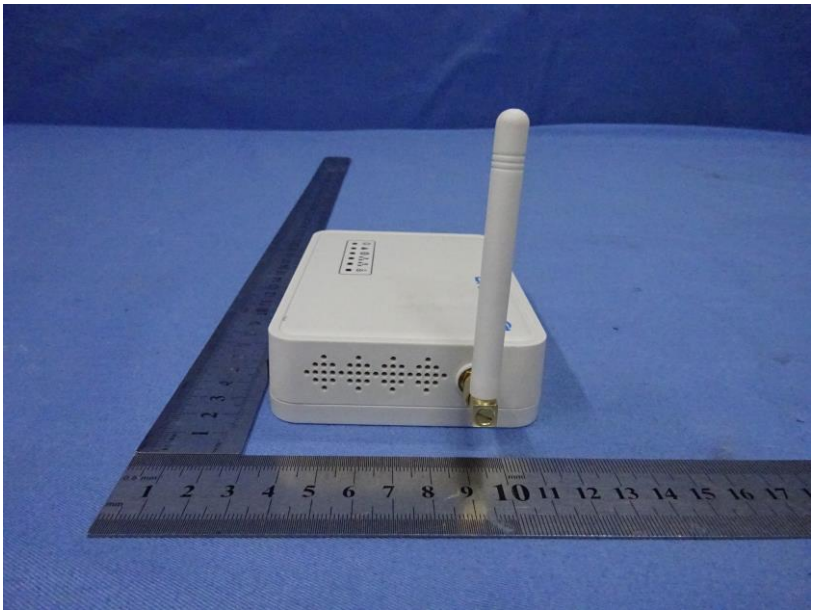
RS

9 EUT Constructional Details

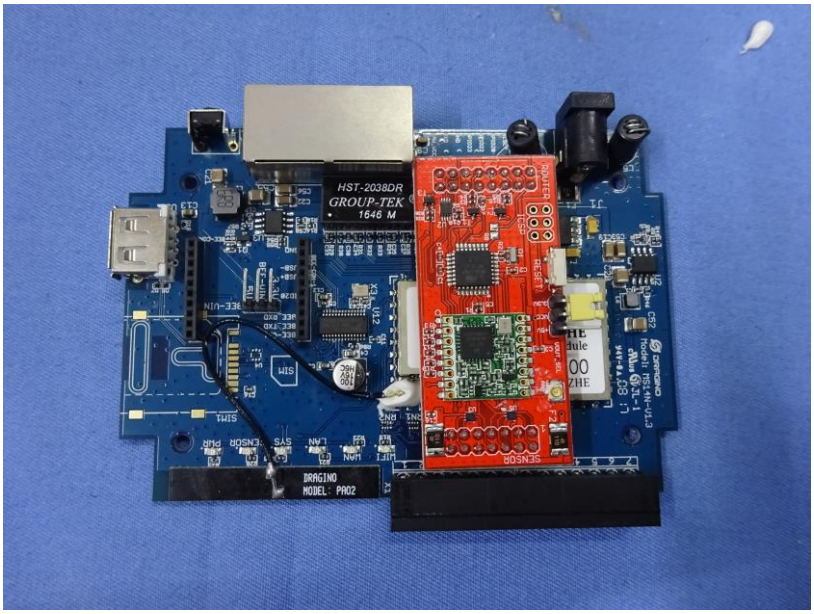

DRAGINO
LoRa Gateway

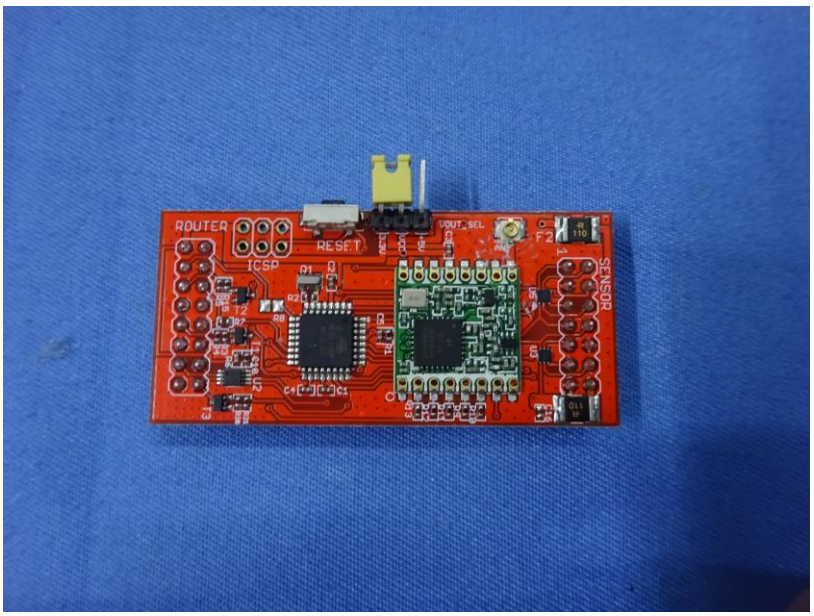

DRAGINO
WAN
LAN
9-15V 500mA
toggle

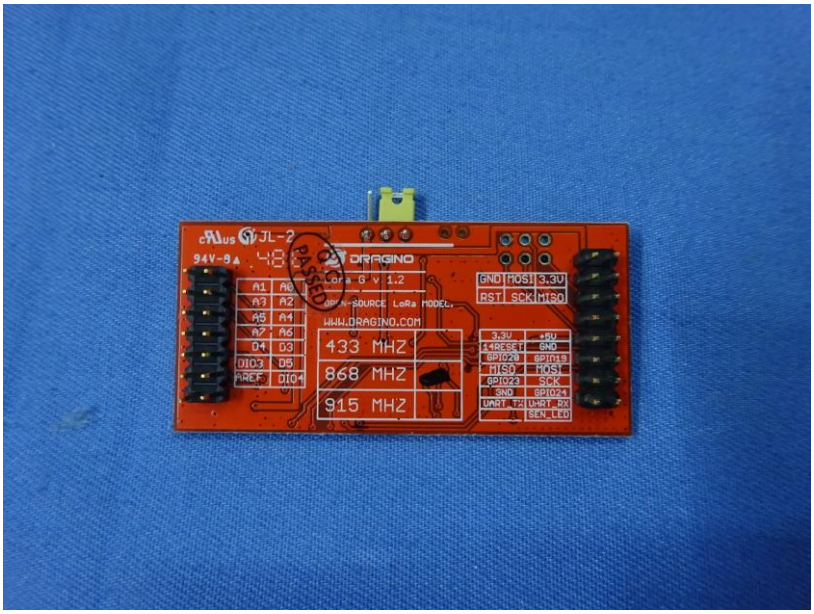




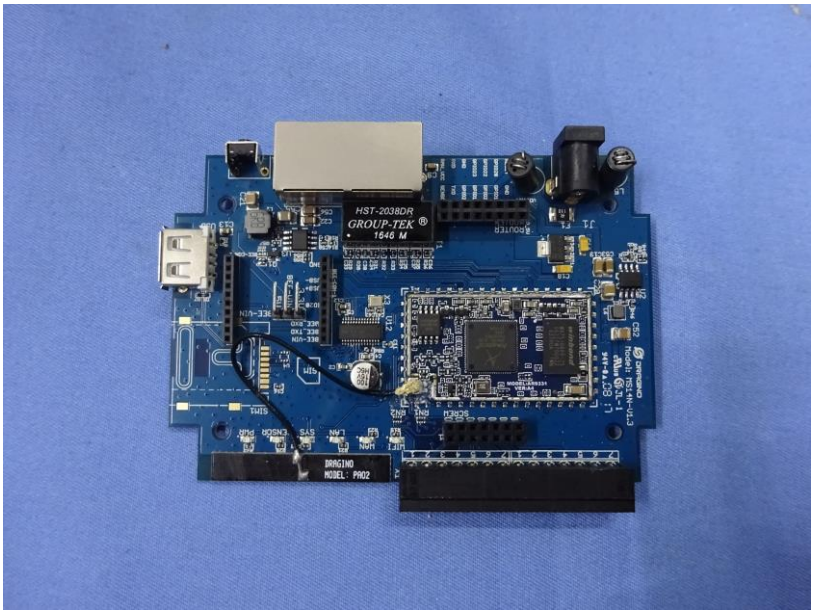

DRAGINO
LoRa Gateway
model: LG01-P LG01-S
frequency:
433 868 915
input: 9 ~15V 500mA
sn: heg423825
wifi: A8:40:41:16:E6:74
FCC ID: ZHZMS14
This device complies with part 15 of the FCC Rules.
Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) this device must accept any interference received,
including interference that may cause undesired operation.

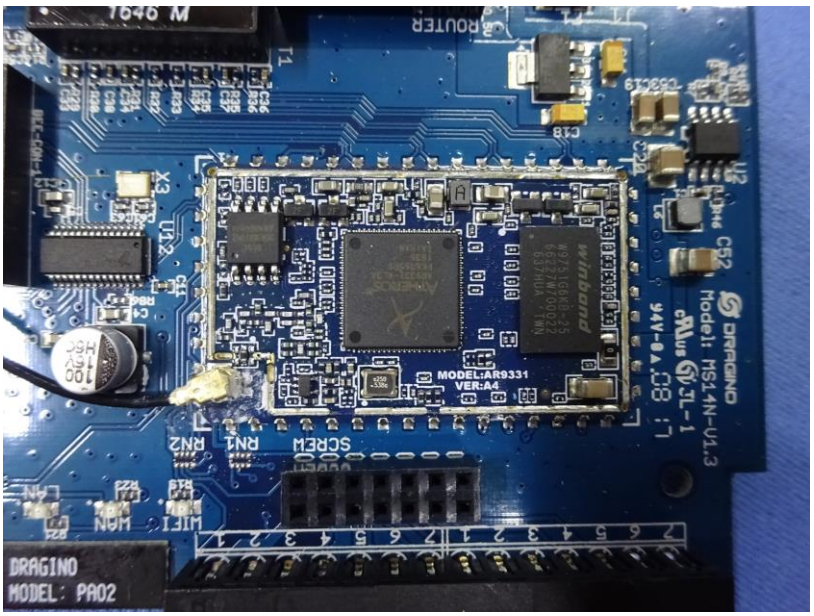

HST-2038DR
GROUP-TEK
1646 M
DRAGINO
MODEL: PA02

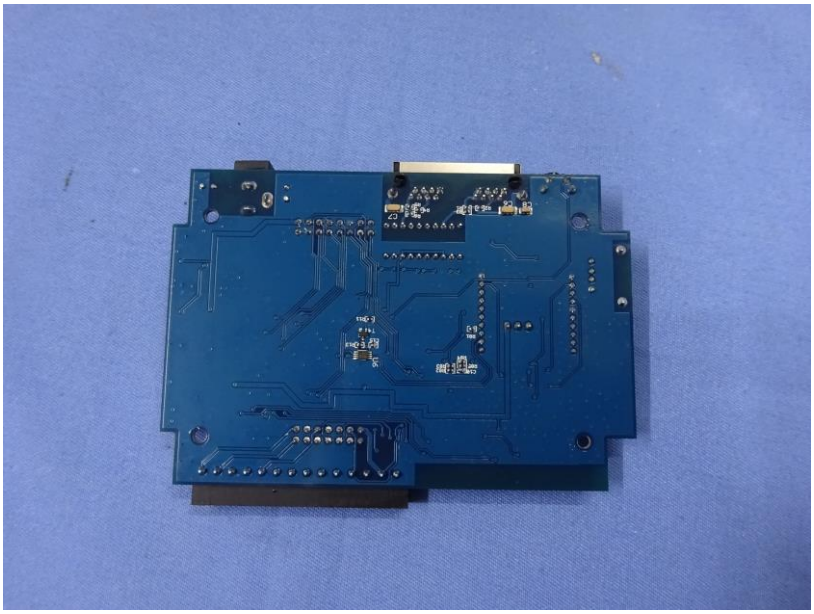

ROUTER
RESET
ICSP
VOUT_SEL
SENSOR

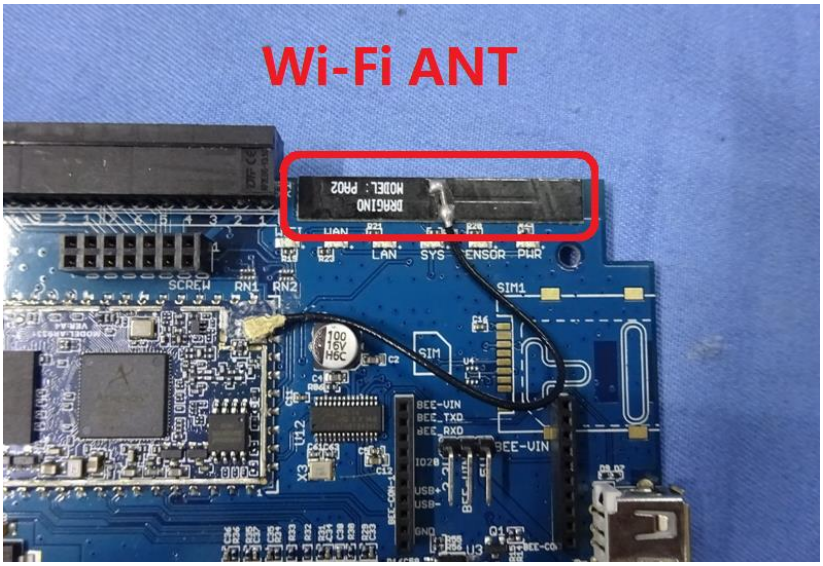

DRAGINO
Lora G V 1.2
WWW.DRAGINO.COM
433 MHZ
868 MHZ
915 MHZ

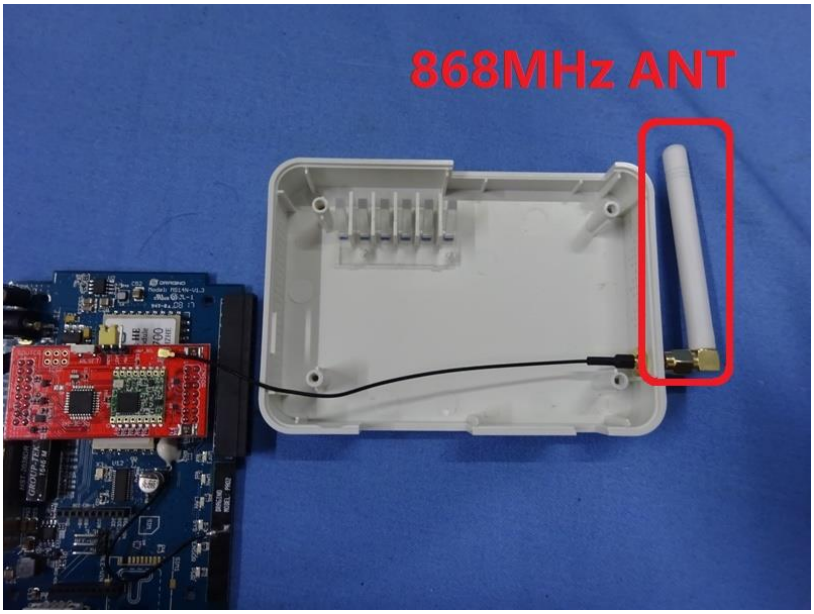

DRAGINO
Model: HE
WiFi IoT Module
CE0700
FCC ID:ZHZHE


HST-2038DR
GROUP-TEK
1646 M
DRAGINO
MODEL: PA02


1646 M
ROUTER
MODEL:AR9331
VER:A4
Model: MS14N-V1.3
DRAGINO
DRAGINO
MODEL: PA02




Wi-Fi ANT
LAN
SYS
SIM1
SIM



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