

# EMC TEST REPORT

**Applicant:** Dragino Technology Co., Limited.

**Address of Applicant:** Room 202,BaoChengTai industrial park,No.8 CaiYun LongCheng Street,LongGang District, Shenzhen 518116, China

**Manufacturer/Factory:** Dragino Technology Co., Limited.

**Address of Manufacturer/Factory:** Room 202,BaoChengTai industrial park,No.8 CaiYun LongCheng Street,LongGang District, Shenzhen 518116, China

### Equipment Under Test (EUT)

**Product Name:** LoRaWAN Gateway

**Model No.:** DLOS8

**Trade Mark:** Dragino

**Applicable standards:** ETSI EN 301 489-1 V2.2.3 (2019-11)  
ETSI EN 301 489-3 V2.1.1 (2019-03)  
ETSI EN 301 489-19 V2.1.1 (2019-04)

**Date of sample receipt:** Oct. 12, 2020

**Date of Test:** Oct. 12 – Nov. 03, 2020

**Date of report issue:** Nov. 04, 2020

**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.



The image shows a circular stamp for GTS Global Testing Institute. The stamp contains the text 'GLOBAL TESTING INSTITUTE', 'GTS', and 'GLOBAL UNITED TECHNOLOGY SERVICES CO., LTD.'. A signature is written across the stamp, and the date 'Nov.' is written below it.



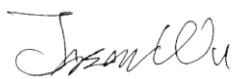
**Robinson Luo**  
**Laboratory Manager**

This results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

## 2 Version

Version No.	Date	Description
00	Nov. 04, 2020	Original

Prepared By:

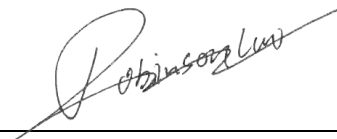


Date:

Nov. 04, 2020

Project Engineer

Check By:



Date:

Nov. 04, 2020

Reviewer

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## 4 Test Summary

<b>EMI Test</b>				
Test Item	Test Requirement	Test Method	Application	Result
Radiated Emission	ETSI EN 301 489-17	ETSI EN301 489-1	Enclosure	Pass
Conducted Emission	ETSI EN 301 489-17	ETSI EN301 489-1	AC port	Pass
Conducted Emission	ETSI EN 301 489-17	ETSI EN301 489-1	Telecommuni- cation port	Pass*
Harmonic Current Emissions	ETSI EN 301 489-17	ETSI EN301 489-1	AC port	N/A
Voltage Fluctuations and Flicker	ETSI EN 301 489-17	ETSI EN301 489-1	AC port	Pass
<b>EMS Test</b>				
ESD (Electrostatic Discharge)	ETSI EN 301 489-17	EN 61000-4-2	Enclosure	Pass
Radio frequency electromagnetic field (80 MHz to 6 000 MHz)	ETSI EN 301 489-17	EN 61000-4-3	Enclosure	Pass
EFT (Electrical Fast Transients)	ETSI EN 301 489-17	EN 61000-4-4	AC port	Pass
EFT (Electrical Fast Transients)	ETSI EN 301 489-17	EN 61000-4-4	Telecommuni- cation port	Pass*
Surge Immunity	ETSI EN 301 489-17	EN 61000-4-5	AC port	Pass
Surge Immunity	ETSI EN 301 489-17	EN 61000-4-5	Telecommuni- cation port	Pass*
Radio frequency, common mode	ETSI EN 301 489-17	EN 61000-4-6	AC port	Pass
Radio frequency, common mode	ETSI EN 301 489-17	EN 61000-4-6	Telecommuni- cation port	Pass*
Voltage Dips and Interruptions	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.*

*\* Reference to the EN 55032 & EN 55035 test report*

## 5 General Information

### 5.1 General Description of EUT

Product Name:	LoRaWAN Gateway
Model No.:	DLOS8
Power Supply:	AC/DC Adapter Model: TP02-120100E Input:AC100-240V, 50/60Hz Output: DC 12V, 1A
<b>Lora</b>	
Operation Frequency:	867.1MHz ~868.8MHz
Modulation type:	FSK
Antenna Type:	fibre-glass epoxy antenna
Antenna gain:	3dBi
<b>GPS</b>	
Modulation:	BPSK
Operation frequency:	1575.42MHz
Antenna type	Internal Antenna

## 5.2 Operating Modes

Operating mode	Detail description
Lora mode:	Keep the EUT in Lora communication status.
GPS mode	Keep the EUT in GPS receive mode.

## 5.3 Description of Support Units

None.
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## 5.4 Test Facility

<p>The test facility is recognized, certified, or accredited by the following organizations:</p> <ul style="list-style-type: none"> <li> <b>FCC —Registration No.: 381383</b>            Global United Technology 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 files. Registration 381383.         </li> <li> <b>IC —Registration No.: 9079A</b>            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         </li> <li> <b>NVLAP (LAB CODE:600179-0)</b>            Global United Technology Services Co., Ltd., is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP). LAB CODE:600179-0         </li> </ul>
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## 5.5 Test Location

RI test was performed at:
SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch, No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.
All other tests were performed at:
Global United Technology Services Co., Ltd. Address: No. 123-128, Tower A, Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102 Tel: 0755-27798480 Fax: 0755-27798960

## 5.6 Deviation from Standards

None.
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## 5.7 Abnormalities from Standard Conditions

None.
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## 5.8 Other Information Requested by the Customer

None.
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## 5.9 Monitoring of EUT for All Immunity Test

Visual:	Monitored the work status of the EUT
Audio:	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. 02 2020	July. 01 2025
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. 25 2020	June. 24 2021
4	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June. 25 2020	June. 24 2021
5	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D	GTS208	June. 25 2020	June. 24 2021
6	Horn Antenna	ETS-LINDGREN	3160	GTS217	June. 25 2020	June. 24 2021
7	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
8	Coaxial Cable	GTS	N/A	GTS213	June. 25 2020	June. 24 2021
9	Coaxial Cable	GTS	N/A	GTS211	June. 25 2020	June. 24 2021
10	Coaxial cable	GTS	N/A	GTS210	June. 25 2020	June. 24 2021
11	Coaxial Cable	GTS	N/A	GTS212	June. 25 2020	June. 24 2021
12	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June. 25 2020	June. 24 2021
13	Amplifier(2GHz-20GHz)	HP	84722A	GTS206	June. 25 2020	June. 24 2021
14	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June. 25 2020	June. 24 2021
15	Band filter	Amindeon	82346	GTS219	June. 25 2020	June. 24 2021
16	Power Meter	Anritsu	ML2495A	GTS540	June. 25 2020	June. 24 2021
17	Power Sensor	Anritsu	MA2411B	GTS541	June. 25 2020	June. 24 2021
18	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	GTS575	June. 25 2020	June. 24 2021
19	Splitter	Agilent	11636B	GTS237	June. 25 2020	June. 24 2021
20	Loop Antenna	ZHINAN	ZN30900A	GTS534	June. 25 2020	June. 24 2021
21	Breitband hornantenne	SCHWARZBECK	BBHA 9170	GTS579	Oct. 18 2020	Oct. 17 2021
22	Amplifier	TDK	PA-02-02	GTS574	Oct. 18 2020	Oct. 17 2021
23	Amplifier	TDK	PA-02-03	GTS576	Oct. 18 2020	Oct. 17 2021
24	PSA Series Spectrum Analyzer	Rohde & Schwarz	FSP	GTS578	June. 25 2020	June. 24 2021

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.15 2019	May.14 2022
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June. 25 2020	June. 24 2021
3	Coaxial Switch	ANRITSU CORP	MP59B	GTS225	June. 25 2020	June. 24 2021
4	ENV216 2-L-V-NETZNACHB.DE	ROHDE&SCHWARZ	ENV216	GTS226	June. 25 2020	June. 24 2021
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. 25 2020	June. 24 2021
8	Absorbing clamp	Elektronik-Feinmechanik	MDS21	GTS229	June. 25 2020	June. 24 2021
9	ISN	SCHWARZBECK	NTFM 8158	GTD565	June. 25 2020	June. 24 2021

Disturbance power						
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.15 2019	May.14 2022
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June. 25 2020	June. 24 2021
3	Coaxial Switch	ANRITSU CORP	MP59B	GTS225	June. 25 2020	June. 24 2021
4	Absorbing clamp	Elektronik-Feinmechanik	MDS21	GTS229	June. 25 2020	June. 24 2021
5	Coaxial Cable	GTS	N/A	GTS213	N/A	N/A
6	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
7	Thermo meter	KTJ	TA328	GTS233	June. 25 2020	June. 24 2021

Loop						
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.15 2019	May.14 2022
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June. 25 2020	June. 24 2021
3	TPIPLE-LOOP ANTENNA	EVERFINE	LLA-2	GTS539	June. 25 2020	June. 24 2021

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. 25 2020	June. 24 2021
2	Thermo meter	KTJ	TA328	GTS243	June. 25 2020	June. 24 2021



<b>Conducted Immunity</b>						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Signal Generator	ROHDE & SCHWARZ	SMB 100A	GTS553	June. 25 2020	June. 24 2021
2	CDN	LionCEL	CDN-M3-16	GTS554	June. 25 2020	June. 24 2021
3	CDN	CYBERTEK	EM 5070	GTS559	June. 25 2020	June. 24 2021
4	Power amplifier	rflight	NTWPA-00010475	GTS555	June. 25 2020	June. 24 2021
5	ATT	SUNWAVE	SJ-50-06DB	GTS556	June. 25 2020	June. 24 2021
6	Clamp	SCHAFFNER	KEMZ 801	GTS558	June. 25 2020	June. 24 2021

<b>Harmonic/ Flicker</b>						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Power Analyzer H/F	EMTEST	DPA500	GTS235	June. 25 2020	June. 24 2021
2	AC POWER SUPPLY	EMTEST	ACS500	GTS236	June. 25 2020	June. 24 2021
3	Thermo meter	KTJ	TA328	GTS256	June. 25 2020	June. 24 2021

<b>EFT, Surge, Voltage dips and Interruption</b>						
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. 25 2020	June. 24 2021
2	Clamp	EMTEST	HFK	GTS557	June. 25 2020	June. 24 2021
3	Thermo meter	KTJ	TA328	GTS238	June. 25 2020	June. 24 2021

<b>Surge (Signal ports and Telecommunication ports)</b>						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Ultra Compact Simulator	EM Test	UCS 500N7	SEM018-02	2020-04-11	2021-04-10
2	High Speed Coupling/Decoupling Network	EM Test	CNI 508N2	SEM018-05	2020-04-11	2021-04-10
3	Measurement Software	EM Test	IEC CONTROL V6.0.1	N/A	N/A	N/A

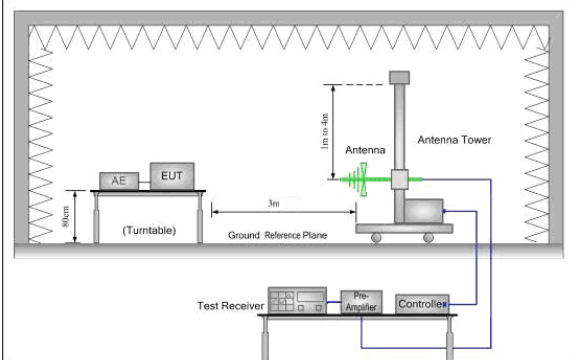
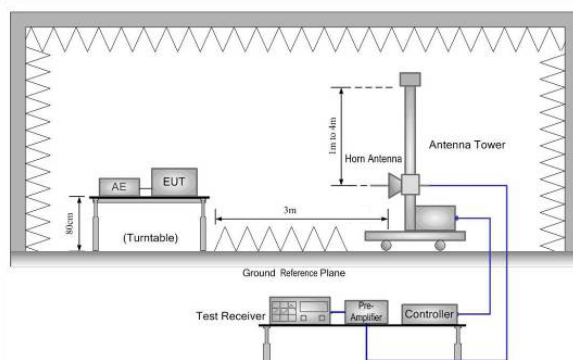
<b>Radiated Immunity</b>						
<b>Item</b>	<b>Test Equipment</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Inventory No.</b>	<b>Cal.Date (mm-dd-yy)</b>	<b>Cal.Due date (mm-dd-yy)</b>
1	Fully-Anechoic Chamber 2	Chang Zhou Zhong Shuo	854	SEM001-05	2020-05-09	2023-05-08
2	Power Sensor	Rohde & Schwarz	NRP-Z91	SEM009-09	2020-04-01	2021-03-31
3	Stacked Log.-Per.- Broadband Antenna (70MHz-10GHz)	Schwarzbeck	STLP 9129	SEM003-25	N/A	N/A
4	Signal Generator (9kHz-6GHz)	Rohde & Schwarz	SMB100A	SEM006-11	2020-04-01	2021-03-31
5	Broadband Amplifier (80MHz-1GHz)	Rohde & Schwarz	BBA150-BC250	SEM005-12	2020-09-23	2021-09-22
6	Broadband Amplifier(800MHz- 3GHz)	Rohde & Schwarz	BBA150-D110	SEM005-13	2020-04-01	2021-03-31
7	Broadband Amplifier(2.5GHz- 6GHz)	Rohde & Schwarz	BBA150-E60	SEM005-16	2020-04-11	2021-04-10
8	Measurement Software	Rohde & Schwarz	EMC32 V9.25.00	N/A	N/A	N/A

<b>General used equipment:</b>						
<b>Item</b>	<b>Test Equipment</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Inventory No.</b>	<b>Cal.Date (mm-dd-yy)</b>	<b>Cal.Due date (mm-dd-yy)</b>
1	Humidity/ Temperature Indicator	KTJ	TA328	GTS243	June. 25 2020	June. 24 2021
2	Barometer	ChangChun	DYM3	GTS255	June. 25 2020	June. 24 2021

## 7 EMC Requirements Specification in ETSI EN 301 489-3/-19

### 7.1 EMI (Emission)

#### 7.1.1 Radiated Emission

Test Requirement:	ETSI EN 301 489-3/-19				
Test Method:	ETSI EN 301 489-1 and EN 55032				
Test Frequency Range:	30MHz to 6GHz				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	30MHz-1GHz	Quasi-peak	120kHz	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				
					
Test setup:	Above 1GHz				
					

<p>Test Procedure:</p>	<p>■ <b>From 30MHz to 1GHz:</b></p> <ol style="list-style-type: none"> <li>1. The radiated emissions test was conducted in a semi-anechoic chamber.</li> <li>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.</li> <li>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.</li> <li>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.</li> </ol> <p>■ <b>Above 1GHz:</b></p> <ol style="list-style-type: none"> <li>1. The radiated emissions test was conducted in a fully-anechoic chamber.</li> <li>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.</li> <li>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.</li> <li>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.</li> </ol>
<p>Test environment:</p>	<p>Temp.: 25 °C    Humid.: 50%    Press.: 1 010mbar</p>
<p>Measurement Record:</p>	<p>Uncertainty: 3.8039dB (30MHz-200MHz) 3.9679dB (200MHz-1GHz) 4.29dB (1GHz-18GHz)</p>
<p>Test Instruments:</p>	<p>Refer to section 6.0 for details</p>
<p>Test mode:</p>	<p>Refer to section 5.2 for details and only show the worst mode.</p>
<p>Test results:</p>	<p>Pass</p>

**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
31.51	58.61	0.00	0.57	32.06	27.12	40.00	-12.88	Vertical
52.95	53.29	0.00	0.80	31.95	22.14	40.00	-17.86	Vertical
86.20	56.40	0.00	1.08	31.73	25.75	40.00	-14.25	Vertical
129.02	56.25	0.00	1.43	31.90	25.78	40.00	-14.22	Vertical
191.07	59.42	0.00	1.80	32.11	29.11	40.00	-10.89	Vertical
383.93	63.21	0.00	2.78	31.93	34.06	47.00	-12.94	Vertical
41.86	50.50	0.00	0.68	32.04	19.14	40.00	-20.86	Horizontal
80.08	53.50	0.00	1.03	31.76	22.77	40.00	-17.23	Horizontal
119.86	56.51	0.00	1.36	31.86	26.01	40.00	-13.99	Horizontal
191.75	59.51	0.00	1.80	32.12	29.19	40.00	-10.81	Horizontal
246.82	60.44	0.00	2.11	32.16	30.39	47.00	-16.61	Horizontal
893.86	65.85	0.00	4.83	31.19	39.49	47.00	-7.51	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
1045.00	44.35	24.61	4.33	32.84	40.45	70.00	-29.55	Vertical
1970.00	43.69	25.99	4.95	34.40	40.23	70.00	-29.77	Vertical
3035.00	38.97	28.56	6.00	33.28	40.25	74.00	-33.75	Vertical
3955.00	34.85	29.60	7.79	32.23	40.01	74.00	-33.99	Vertical
5000.00	34.66	31.96	8.76	32.18	43.20	74.00	-30.80	Vertical
5950.00	31.37	32.82	10.13	32.16	42.16	74.00	-31.84	Vertical
1225.00	43.82	25.45	4.49	33.13	40.63	70.00	-29.37	Horizontal
1860.00	43.61	25.56	4.89	34.23	39.83	70.00	-30.17	Horizontal
2820.00	39.41	28.41	5.78	33.53	40.07	70.00	-29.93	Horizontal
3745.00	36.10	29.30	7.42	32.48	40.34	74.00	-33.66	Horizontal
4860.00	32.37	31.83	8.64	32.11	40.73	74.00	-33.27	Horizontal
5770.00	31.94	32.61	9.88	32.26	42.17	74.00	-31.83	Horizontal

Notes:

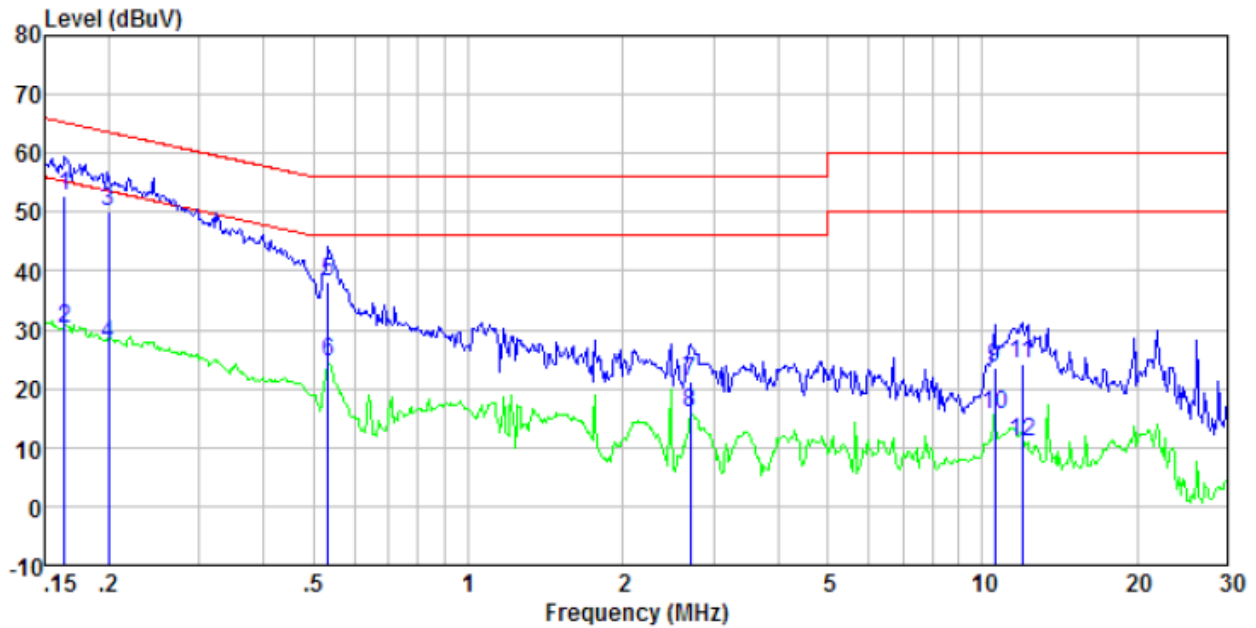
1. The EUT was test at 3m in field chamber.
2. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

## 7.1.2 Conducted Emissions

Test Requirement:	ETSI EN 301 489-3/-19					
Test Method:	ETSI EN 301 489-1 and EN 55032					
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:	<p>Remark:  E.U.T: Equipment Under Test  LISN: Line Impedance Stabilization Network  Test table height=0.8m</p>					
Test procedure	<ol style="list-style-type: none"> <li>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.</li> <li>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).</li> <li>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.</li> </ol>					
Test Instruments:	Temp.:	24 °C	Humid.:	51%	Press.:	1 010mbar
Measurement Record:	Uncertainty: 3.44dB					
Test Instruments:	Refer to section 6.0 for details					
Test mode:	Refer to section 5.2 for details and only show the worst mode.					
Test results:	Pass					

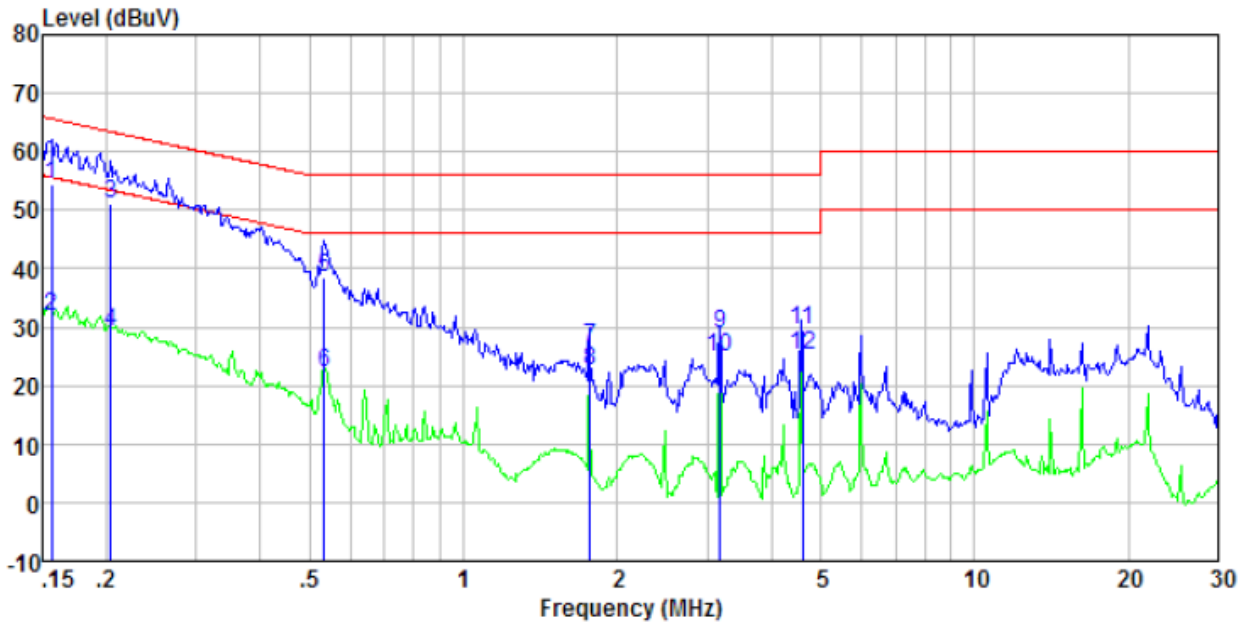
## Measurement Data

Line:



Freq MHz	Reading level dBuV	1ISN/ISN factor dB	Cable loss dB	level dBuV	Limit level dBuV	Over limit dB	Remark
0.164	52.31	0.40	0.08	52.79	65.25	-12.46	QP
0.164	29.69	0.40	0.08	30.17	55.25	-25.08	Average
0.200	49.54	0.40	0.11	50.05	63.62	-13.57	QP
0.200	27.14	0.40	0.11	27.65	53.62	-25.97	Average
0.535	37.70	0.30	0.11	38.11	56.00	-17.89	QP
0.535	24.22	0.30	0.11	24.63	46.00	-21.37	Average
2.707	20.97	0.20	0.19	21.36	56.00	-34.64	QP
2.707	15.38	0.20	0.19	15.77	46.00	-30.23	Average
10.564	23.19	0.20	0.20	23.59	60.00	-36.41	QP
10.564	15.07	0.20	0.20	15.47	50.00	-34.53	Average
11.933	23.88	0.20	0.20	24.28	60.00	-35.72	QP
11.933	10.64	0.20	0.20	11.04	50.00	-38.96	Average

Neutral:



Freq MHz	Reading level dBuV	LISN/ISN factor dB	Cable loss dB	level dBuV	Limit level dBuV	Over limit dB	Remark
0.156	54.04	0.40	0.08	54.52	65.65	-11.13	QP
0.156	31.21	0.40	0.08	31.69	55.65	-23.96	Average
0.204	50.68	0.40	0.11	51.19	63.45	-12.26	QP
0.204	28.63	0.40	0.11	29.14	53.45	-24.31	Average
0.535	38.23	0.30	0.11	38.64	56.00	-17.36	QP
0.535	21.67	0.30	0.11	22.08	46.00	-23.92	Average
1.770	26.28	0.20	0.17	26.65	56.00	-29.35	QP
1.770	22.30	0.20	0.17	22.67	46.00	-23.33	Average
3.185	28.49	0.20	0.19	28.88	56.00	-27.12	QP
3.185	24.50	0.20	0.19	24.89	46.00	-21.11	Average
4.604	29.02	0.20	0.17	29.39	56.00	-26.61	QP
4.604	24.88	0.20	0.17	25.25	46.00	-20.75	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



### 7.1.3 Harmonics Test Results

Test Requirement:	ETSI EN 301 489-17: EN 61000-3-2
Test Method:	N/A: See Remark Below
Remark:	<p>There is no need for Harmonics test to be performed on this product (rated power of 75W or less) in accordance with EN 61000-3-2. For further details, please refer to Clause 7, Note 1 of EN 61000-3-2</p> <p>Which states:</p> <p>“For the following categories of equipment limits are not specified in this edition of the standard.</p> <p>Note 1: Equipment with a rated power of 75W or less, other than lighting equipment.”</p>

### 7.1.4 Flicker Test Results

Test Requirement:	ETSI EN 301 489-3/-19, 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.
Test results:	Pass

### Measurement Data

	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.006	3.30	PASS
dmax [%]	0.061	4.00	PASS
dt [s]	0.000	0.50	PASS

## 7.2 Immunity

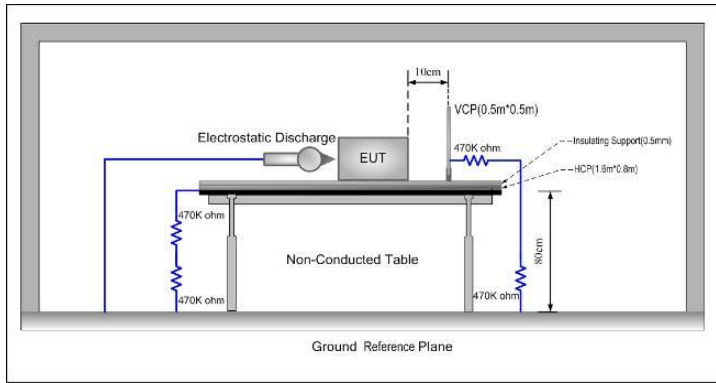
Performance Criteria of ETSI EN 301 489-1, clause 6	
<b>6.0 Introduction</b>	<p>The performance criteria are used to take a decision on whether a radio equipment passes or fails immunity tests.</p> <p>For the purpose of the present document two categories of performance criteria apply:</p> <ul style="list-style-type: none"> <li>• Performance criteria for continuous phenomena.</li> <li>• Performance criteria for transient phenomena.</li> </ul> <p>NOTE: Normally, the performance criteria depends upon the type of radio equipment and/or its intended application. Thus, the present document only contains general performance criteria commonly used for the assessment of radio equipment.</p>
<b>6.1 Performance criteria for continuous phenomena</b>	<p>During the test, the equipment shall:</p> <ul style="list-style-type: none"> <li>• continue to operate as intended;</li> <li>• not unintentionally transmit;</li> <li>• not unintentionally change its operating state;</li> <li>• not unintentionally change critical stored data.</li> </ul>
<b>6.2 Performance criteria for transient phenomena</b>	<p>For all ports and transient phenomena with the exception described below, the following applies:</p> <ul style="list-style-type: none"> <li>• The application of the transient phenomena shall not result in a change of the mode of operation (e.g. unintended transmission) or the loss of critical stored data.</li> <li>• After application of the transient phenomena, the equipment shall operate as intended.</li> </ul> <p>For surges applied to symmetrically operated wired network ports intended to be connected directly to outdoor lines the following criteria applies:</p> <ul style="list-style-type: none"> <li>• For products with only one symmetrical port intended for connection to outdoor lines, loss of function is allowed, provided the function is self-recoverable, or can be otherwise restored. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.</li> <li>• For products with more than one symmetrical port intended for connection to outdoor lines, loss of function on the port under test is allowed, provided the function is self-recoverable. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.</li> </ul>

<b>Performance Criteria of ETSI EN 301 489-3, clause 6</b>		
Criteria	During Test	After Test
A	Operate as intended No loss of function No unintentional responses	Operate as intended No loss of function No degradation of performance No loss of stored data or user programmable functions
B	May show loss of function No unintentional responses	Operate as intended Lost function(s) shall be self-recoverable No degradation of performance No loss of stored data or user programmable functions

Performance Criteria of ETSI EN 301 489-19, clause 6	
<b>6.1 General performance criteria</b>	<p>If the EUT is of a non specialized nature or the EUT is combined with an ancillary equipment, the test modulation, test arrangements, etc. as required in clause 4 shall apply.</p> <p>The EUT, for all immunity tests according to the present document, except the spot frequency test of the immunity test with radiated RF electromagnetic fields (see ETSI EN 301 489-1 [1], clause 9.2), shall be assessed for:</p> <ul style="list-style-type: none"> <li>• the storage of messages in the memory of the EUT at the start of the test;</li> <li>• unintentional responses of the EUT during the test;</li> <li>• the maintenance of the EUT memory assessed at the conclusion of the test;</li> <li>• the ability to receive and store messages at the conclusion of the test.</li> </ul> <p>For the spot frequency test of the immunity test with radiated RF electromagnetic fields (see ETSI EN 301 489-1 [1], clause 9.2) the EUT shall be assessed by monitoring the accuracy of the call received alert signal.</p>
<b>6.2 Performance criteria for Continuous phenomena applied to ROMES and ROGNSS receivers (CR)</b>	<p>For the EUT, excluding spot frequency tests as part of the immunity test with radiated RF electromagnetic fields (see ETSI EN 301 489-1 [1], clause 9.2):</p> <ul style="list-style-type: none"> <li>• the general performance criteria set out in clause 6.1;</li> <li>• during the test no false calls shall occur;</li> <li>• at the conclusion of the test comprising the series of individual exposures the EUT shall operate as intended with no loss of functions or stored data (messages), as declared by the manufacturer.</li> </ul> <p>For the spot frequency test as part of the immunity test with radiated RF electromagnetic fields (see ETSI EN 301 489-1 [1], clause 9.2) the EUT shall be assessed by monitoring the accuracy of the call received alert signal.</p>
<b>6.3 Performance criteria for Transient phenomena applied to ROMES and ROGNSS receivers (TR)</b>	<p>For the EUT:</p> <ul style="list-style-type: none"> <li>• the general performance criteria set out in clause 6.1;</li> <li>• during the test no false calls shall occur;</li> <li>• at the conclusion of the test comprising the series of individual exposures, the EUT shall operate as intended with no loss of function and/or stored data (messages), as declared by the manufacturer.</li> </ul>
<b>6.4 Performance criteria for equipment which does not provide a continuous communication link</b>	<p>The provision of ETSI EN 301 489-1 [1], clause 6.3 shall apply with the following modifications.</p> <p>For EUTs of a specialized nature and/or ancillary equipment tested on a stand alone basis the manufacturer shall define the method of test to determine the acceptable level of performance or degradation of performance during and/or after the test. Under these circumstances the manufacturer will also provide the following information:</p> <ul style="list-style-type: none"> <li>• the primary functions of the equipment to be tested during and after EMC stress;</li> </ul>

	<ul style="list-style-type: none"><li>• the intended functions of the EUT which shall be in accordance with the documentation accompanying the equipment;</li><li>• the pass/failure criteria for the equipment;</li><li>• the method of observing a degradation of performance of the equipment.</li></ul> <p>The assessment of the performance or the degradation of performance which shall be carried out during and/or at the conclusion of the tests, shall be simple, but at the same time give adequate proof that the primary functions of the equipment are operational.</p>
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## 7.2.1 Electrostatic Discharge

Test Requirement:	ETSI EN 301489-3/-19
Test Method:	EN 61000-4-2
Discharge Voltage:	Contact Discharge: $\pm 4\text{kV}$ Air Discharge: $\pm 2\text{kV}$ , $\pm 4\text{kV}$ , $\pm 8\text{kV}$ HCP/VCP: $\pm 4\text{kV}$
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:	<p><b>Air discharge:</b></p> <ol style="list-style-type: none"> <li>1. The test was applied on non-conductive surfaces of EUT.</li> <li>2. The round discharge tip of the discharge electrode was approached as fast as possible to touch the EUT.</li> <li>3. After each discharge, the discharge electrode was removed from the EUT.</li> <li>4. The generator was re-triggered for a new single discharge and repeated 10 times for each pre-selected test point.</li> <li>5. This procedure was repeated until all the air discharge completed</li> </ol> <p><b>Contact Discharge:</b></p> <ol style="list-style-type: none"> <li>1. The test was applied on conductive surfaces of EUT.</li> <li>2. the generator was re-triggered for a new single discharge and repeated 10 times for each pre-selected test point.</li> <li>3. the tip of the discharge electrode was touch the EUT before the discharge switch was operated.</li> </ol> <p><b>Indirect discharge for horizontal coupling plane</b></p> <ol style="list-style-type: none"> <li>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.</li> <li>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.</li> </ol>

	<p>3. Consideration should be given to exposing all sides of the EUT.</p> <p><b>Indirect discharge for vertical coupling plane</b></p> <p>1. At least 10 single discharges were applied to the center of one vertical edge of the coupling plane.</p> <p>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.</p> <p>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.</p>
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: Metal ring, LAN port, USB port			
	II: All plastic seam, DC port, Reset key			
<b>Direct discharge</b>				
Discharge Voltage (KV)	Type of discharge	Test points	Observations Performance	Result
± 4	Contact	I	A	Pass
± 2, ± 4, ± 8	Air	II	A	Pass
<b>Indirect discharge</b>				
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-Front/Back /Left/Right	Center of the VCP	A	Pass

Remark:

A: Normal performance within the specification limits.

## 7.2.2 Radiated Immunity

Test Requirement:	ETSI EN 301489-3/-19
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:	<ol style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>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).</li> <li>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.</li> <li>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.</li> <li>6. The test normally was performed with the generating antenna facing each side of the EUT.</li> <li>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.</li> <li>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.</li> </ol>



Test monitor:	<b>Traffic mode:</b> 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.					
	<b>Idle mode:</b> 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	Operating Mode	Antenna Polarization	EUT Face	Observations (Performance Criterion)
80 MHz-6 GHz	3 V/m	1 kHz, 80 % Amp. Mod, 1 % increment	Traffic mode	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

Remark:

A: normal performance within the specification limits.

Frequency	Level	Modulation	Operating Mode	Antenna Polarization	EUT Face	Observations (Performance Criterion)
80 MHz; 104 MHz; 136 MHz; 165 MHz; 200 MHz; 260 MHz; 330 MHz; 430 MHz; 560 MHz; 715 MHz ± 1 MHz; 920 MHz ± 1 MHz;	3 V/m	200Hz, 100 % modulated	GPS modes	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: normal performance within the specification limits

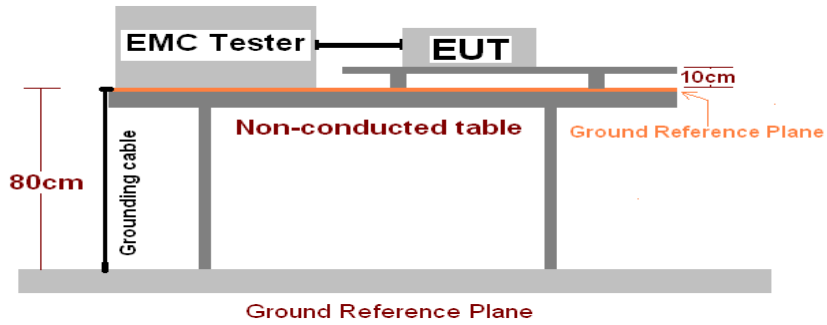
### 7.2.3 Radio frequency common mode

Test Requirement:	ETSI EN 301489-3/-19
Test Method:	EN 61000-4-6
Frequency range:	0.15MHz to 80MHz
Test Level:	3V rms on AC Ports (unmodulated emf into 150 Ω)
Performance Criterion:	Criterion A
Test setup:	
Test Procedure:	<ol style="list-style-type: none"> <li>1. 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).</li> <li>2. The disturbance signal described below is injected to EUT through CDN.</li> <li>3. The EUT operates within its operational mode(s) under intended climatic conditions after power on.</li> <li>4. Recording the EUT operating situation during compliance testing and decide the EUT immunity criterion.</li> </ol>
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	AC Mains	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

Test Requirement:	ETSI EN 301489-3/-19
Test Method:	EN 61000-4-4
Test Level:	1.0kV
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:	<ol style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>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.</li> <li>4. The length of power lines between the coupling device and the EUT is 0.5m</li> <li>5. The EUT is connected to the power mains through a coupling device that directly couples the EFT/B interference signal.</li> <li>6. Each of the Line and Neutral conductors is impressed with burst noise for 2 minutes.</li> </ol>
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

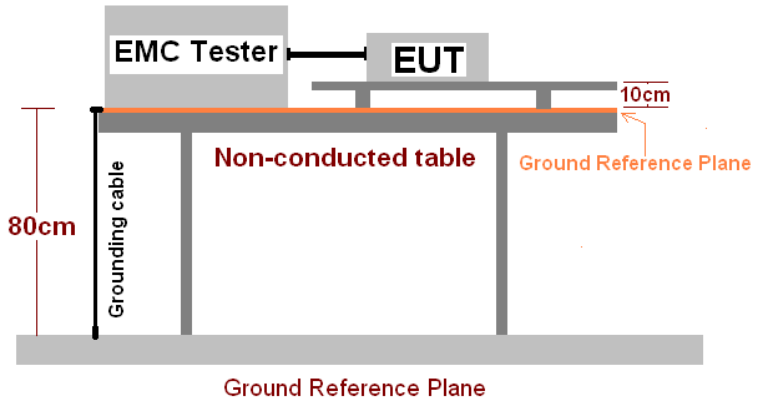
**Measurement Record:**

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

*Remark:*

*A: Normal performance within the specification limits.*

## 7.2.5 Surge

Test Requirement:	ETSI EN 301489-3/-19
Test Method:	EN 61000-4-5
Test Level:	1kV line to line: Differential mode
Polarity:	Positive & Negative
Generator source impedance:	2Ω (line-line coupling) 12Ω (line-earth coupling)
Test signal specification:	Rise time=1.2us, Duration time=50us; Test Interval: 60s between each surge;
No. of surges:	5 positive, 5 negative at 0°, 90°, 180°, 270°.
Performance Criterion:	Criterion B
Test setup:	 <p>The diagram illustrates the test setup. An EMC Tester and an EUT are positioned on a Non-conducted table. The table is supported by a Grounding cable and is positioned above a Ground Reference Plane. A 10cm gap is indicated between the table and the plane. The height of the table is 80cm.</p>
Test Procedure:	<ol style="list-style-type: none"> <li>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.</li> <li>2. At least 5 positive and 5 negative (polarity) tests with a maximum 1/min repetition rate are applied during test.</li> <li>3. Different phase angles are done individually.</li> <li>4. Record the EUT operating situation during compliance test and decide the EUT immunity criterion for above each test.</li> </ol>
Test environment:	Temp.: 26 °C    Humid.: 53%    Press.: 1 012mbar
Test Instruments:	Refer to section 6 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

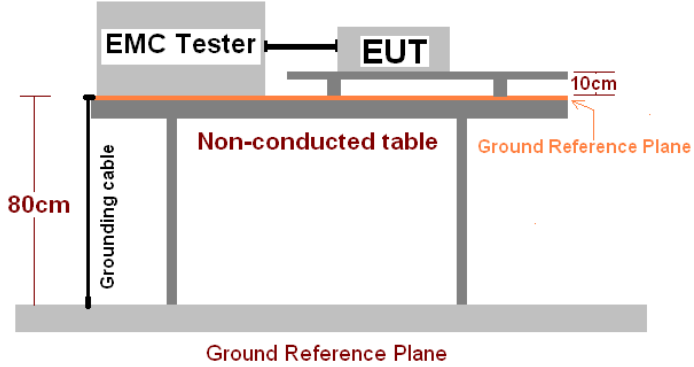
**Measurement Record:**

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

*Remark:*

*A. Normal performance within the specification limits.*

## 7.2.6 Voltage Dip and Voltage Interruptions

Test Requirement:	ETSI EN 301489-3/-19
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:	 <p>The diagram illustrates the test setup. An EMC Tester and an EUT are positioned on a non-conducted table. The table is 80cm high and is grounded. A grounding cable is connected to the table. The EUT is 10cm above the table surface. A ground reference plane is indicated at the base of the table.</p>
Test Procedure:	<ol style="list-style-type: none"> <li>1&gt;.The EUT and test generator were setup as shown on above setup photo.</li> <li>2&gt;.The interruptions are introduced at selected phase angles with specified duration.</li> <li>3&gt;.Record any degradation of performance.</li> </ol>
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	C

*Remarks:*

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

*C: During the test, the EUT stops work, but after the test, it can return to normal by operator.*

## 8 Test Setup Photo

Reference to the **appendix I** for details.

## 9 EUT Constructional Details

Reference to the **appendix II** for details.

-----End-----