


TEST REPORT

For EMC

Report Reference No...... : **CHTEW19120164** Report verification: 

Project No...... : **SHT1910069002EW**

Applicant's name..... : **Xeelas**

Address..... : Spaarneplein 2, 2515VK Den Haag, Netherlands

Manufacturer..... : Xeelas

Address..... : Spaarneplein 2, 2515VK Den Haag, Netherlands

Test item description : **Series S**

Trade Mark : -

Model/Type reference..... : IP67

Listed Model(s) : -

Standard : **ETSI EN 301 489-1 V2.2.3 (2019-11)**
ETSI EN 301 489-19 V2.1.1 (2019-04)
Draft ETSI EN 301 489-52 V1.1.0 (2016-11)

Date of receipt of test sample..... : Nov 13, 2019

Date of testing..... : Nov 14, 2019- Dec 23, 2019

Date of issue..... : Dec 24, 2019

Result..... : **PASS**

Compiled by
(position+printedname+signature)....:

Supervised by
(position+printedname+signature).....:

Approved by
(position+printedname+signature).....:

Testing Laboratory Name :
Address.....:

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The test report merely correspond to the test sample.

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1. Test standards and Report version

1.1. Test Standards

The tests were performed according to following standards:

[ETSI EN 301 489-1 V2.2.3 \(2019-11\)](#)–ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard for ElectroMagnetic Compatibility
[ETSI EN 301 489-19 V2.1.1 \(2019-04\)](#)–ElectroMagnetic Compatibility (EMC) standard for radio equipment and services;Part 19: Specific conditions for Receive Only Mobile Earth Stations (ROMES) operating in the 1,5 GHz band providing data communications and GNSS receivers operating in the RNSS band (ROGNSS) providing positioning, navigation, and timing data;Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU
[Draft ETSI EN 301 489-52 V1.1.0 \(2016-11\)](#)–Electromagnetic Compatibility (EMC) standard for radio equipment and services;Part 52: Specific conditions for Cellular Communication Mobile and portable (UE) radio and ancillary equipment;Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU

1.2. Report version information

Revision No.	Date of issue	Description
N/A	2019-12-24	Original

2. Test Description

Emission			
Test Item	Standard requirement	Result	Test Engineer
RadiatedEmission	EN301 489-1 Clause 8.2	Pass	Yuantao Liang
Conducted Emission(AC Mains)	EN301 489-1 Clause 8.4	N/A	N/A
Harmonic Current Emissions	EN301 489-1 Clause 8.5	N/A	N/A
Voltage Fluctuations and Flicker	EN301 489-1 Clause 8.6	N/A	N/A

Immunity			
Test Item	Standard requirement	Result	Test Engineer
Radio Frequency Electromagnetic Field	EN301 489-1 Clause 9.2	Pass	Pan Xie
Electrostatic Discharge	EN301 489-1 Clause 9.3	Pass	Si Ding
Fast Transients (common mode)	EN301 489-1 Clause 9.4	N/A	N/A
Radio frequency (common mode)	EN301 489-1 Clause 9.5	N/A	N/A
Voltage Dips and Interruptions	EN301 489-1 Clause 9.7	N/A	N/A
Surges	EN301 489-1 Clause 9.8	N/A	N/A

Note: The measurement uncertainty is not included in the test result.

3. Summary

3.1. Client Information

Applicant:	Xeelas
Address:	Spaarneplein 2, 2515VK Den Haag, Netherlands
Manufacturer:	Xeelas
Address:	Spaarneplein 2, 2515VK Den Haag, Netherlands

3.2. Product Description

Product Name:	Series S		
Trade Mark:	-		
Model/Type reference:	IP67		
Listed Model(s)::	-		
Power supply:	DC 24V		
Battery voltage:	DC 2.4V		
Hardware version:	REV4B		
Software version:	V0.6.3		
2G			
Operation Band:	<input checked="" type="checkbox"/> GSM900	<input checked="" type="checkbox"/> DCS1800	
Supported type:	<input checked="" type="checkbox"/> GPRS	<input checked="" type="checkbox"/> EGPRS	
4G			
Operation Band:	<input checked="" type="checkbox"/> FDD Band 1	<input checked="" type="checkbox"/> FDD Band 3	<input checked="" type="checkbox"/> FDD Band 8
	<input checked="" type="checkbox"/> FDD Band 20	<input checked="" type="checkbox"/> FDD Band 28	
Supported type:	<input checked="" type="checkbox"/> QPSK	<input checked="" type="checkbox"/> 16QAM	
GNSS			
Operation Band:	1.57542GHz		

3.3. Accessory Equipment information

Battery	
Manufacturer :	
Model No. :	

3.4. EUT operation mode

Test mode	2G #1		4G #3		GNSS
	Link	Idle	Link	Idle	
CL2	■				
CI2		■			
CL4			■		
CI4				■	
GNSS					■

Note:

- 1) #1: Contains these all support type in section 3.2
- 2) #2: Contains these all support type in section 3.2
- 3) * is represent the following meaning in the test report
 - CL*: CL2, CL4
 - CI*: CI2, CI4
 - C**: CL2, CI2, CL4, CI4
- 4) Operation channel as follows:
 - 2G, 4G: shall be setting the middle ARFCN range.

Pre-scan above all test mode, found below test mode which it was worse case mode, so only show the test data for worse case mode on the test report.

Test item	Test mode (Worse case mode)
Radiated Emission	CL2
Conducted Emission(AC Mains)	N/A
Harmonic Current Emissions	N/A
Voltage Fluctuations and Flicker	N/A
Radio Frequency Electromagnetic Field	All modes
Electrostatic Discharge	All modes
Fast Transients (common mode)	N/A
Radio frequency (common mode)	N/A
Voltage Dips and Interruptions	N/A
Surges	N/A

3.5. Modifications

No modifications were implemented to meet testing criteria.

4. Test Environment

4.1. Address of the test laboratory

4.2. Test Facility

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

CNAS-Lab Code: L1225

Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories,

A2LA-Lab Cert. No. 3902.01

Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC-Registration No.: 762235

Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files.

IC-Registration No.: 5377A

Two 3m Alternate Test Site of Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377A

ACA

Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

4.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature:	25°C
Relative Humidity	55 %
Air Pressure	989 hPa

4.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements and is documented in the Co., Ltd quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for is reported:

Test Item	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.90 dB	(1)
Radiated Emission	1~18GHz	4.96 dB	(1)
Conducted Disturbance	0.15~30MHz	3.02 dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=1.96$

4.5. Equipments Used during the Test

● Radiated Emission-6th test site							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	HTWE0127	SAC-3m-02	C11121	2018/09/30	2021/09/29
●	EMI Test Receiver	R&S	HTWE0099	ESCI	100900	2019/10/26	2020/10/25
●	Ultra-Broadband Antenna	SCHWARZBECK	HTWE0119	VULB9163	546	2017/04/05	2020/04/04
●	Pre-Amplifier	SCHWARZBECK	HTWE0295	BBV 9742	N/A	2019/11/14	2020/11/13
●	RF Connection Cable	HUBER+SUHNER	HTWE0062-01	N/A	N/A	2019/08/21	2020/08/20
●	RF Connection Cable	HUBER+SUHNER	HTWE0062-02	SUCOFLEX104	501184/4	2019/05/27	2020/05/26
●	Test Software	R&S	N/A	ES-K1	N/A	N/A	N/A

● Radiated emission-7th test site							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	HTWE0122	SAC-3m-01	N/A	2018/09/30	2021/09/29
●	Spectrum Analyzer	R&S	HTWE0098	FSP40	100597	2019/10/26	2020/10/25
●	Horn Antenna	SCHWARZBECK	HTWE0126	9120D	1011	2017/04/01	2020/03/31
●	Broadband Pre-amplifier	SCHWARZBECK	HTWE0201	BBV 9718	9718-248	2019/05/23	2020/05/22
●	RF Connection Cable	HUBER+SUHNER	HTWE0121-01	RE-7-FH	N/A	2019/05/10	2020/05/09
●	Test Software	Audix	N/A	E3	N/A	N/A	N/A

● Conducted Emission							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Shielded Room	Albatross projects	HTWE0114	N/A	N/A	2018/09/28	2023/09/27
●	EMI Test Receiver	R&S	HTWE0111	ESCI	101247	2019/10/26	2020/10/25
●	Artificial Mains	SCHWARZBECK	HTWE0113	NNLK 8121	573	2019/10/23	2020/10/22
●	Pulse Limiter	R&S	HTWE0033	ESH3-Z2	100499	2019/10/23	2020/10/22
●	RF Connection Cable	HUBER+SUHNER	HTWE0113-02	ENVIROFLE X_142	EF-NM-BNCM-2M	2019/10/23	2020/10/22
●	Test Software	R&S	N/A	ES-K1	N/A	N/A	N/A

● Harmonic Current Emissions, Voltage Fluctuations and Flicker							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Purified Power Source	California instruments	HTWE0019	HFS500	54513	2019/10/26	2020/10/25
●	Harmonic And Flicker Analyzer	EM TEST	HTWE0018	DPA503S1	0500-10	2019/10/26	2020/10/25
●	Test Software	EM TEST	N/A	DPA	N/A	N/A	N/A

● Voltage Dips and Interruptions							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Purified Power Source	California instruments	HTWE0019	HFS500	54513	2019/10/26	2020/10/25
●	Test Software	California instruments	N/A	CIGUII-5001iX	N/A	N/A	N/A

● Radio Frequency Electromagnetic Field							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	HTWE0127	SAC-3m-02	C11121	2018/09/30	2021/09/29
●	Signal Generator	R&S	HTWE0276	SMB100A	114360	2019/08/15	2020/08/14
●	Amplifier	R&S	HTWE0277	BBA150-BC500	102664	2019/09/02	2020/09/01
●	Amplifier	R&S	HTWE0285	BBA150 D200	102728	2019/03/14	2020/03/13
●	Amplifier	R&S	HTWE0288	BBA150 E200	102729	2019/03/15	2020/03/14
●	Power Head	R&S	HTWE0278	NRP18A	101010	2019/08/15	2020/08/14
●	Power Head	R&S	HTWE0279	NRP18A	101011	2019/08/15	2020/08/14
●	Transmit Antenna	Schwarzbeck	HTWE0280	STLP9129	00044	2017/07/12	2020/07/11
●	Field Probe	ETS-LINDGREN	HTWE0321	HI-6153	00130812	2018/01/17	2020/01/16
●	Test Software	R&S	N/A	EMC32	100916	N/A	N/A
●	Audio analyzer	R&S	HTWE3008	UPV	101371	2019/09/09	2020/09/08
●	Radio communication tester	R&S	HTWE0287	CMW500	137688-Lv	2019/10/26	2020/10/25

● Electrical fast transient/burst immunity test, Surge immunity test							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Ultra Compact Simulator	EM TEST	HTWE0004	UCS500M6	0500-19	2019/10/23	2020/10/22
●	Surge Generator	EM TEST	HTWE0003	TSS500M4	1100-04	2019/10/23	2020/10/22
●	3-Phase Coupling Network	EM TEST	HTWE0005	CNI503 S5/16A	0606-01	2019/10/23	2020/10/22
●	Coupling Clamp	EM TEST	HTWE0007	HFK	1501-14	2019/10/23	2020/10/22
●	Test Software	EM TEST	N/A	ISM IEC	N/A	N/A	N/A

● Electrostatic Discharge							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	ESD Simulator	EM TEST	HTWE0001	DITO	0301-04	2019/08/14	2020/08/13

● Radio frequency (common mode)							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Signal Generator	IFR	HTWE0022	2023A	202304/060	2019/10/26	2020/10/25
●	Amplifier	AR	HTWE0023	75A250	302205	2019/10/26	2020/10/25
●	6db Attenuator	EMTEST	HTWE0025	ATT6/75	0010230A	2018/10/28	2020/10/27
○	EM Clamp	LÜTHI	HTWE0028	EM101	335625	2018/10/28	2020/10/27
●	Test Software	AR	N/A	SW1004	N/A	N/A	N/A
●	CDN	EMTEST	HTWE0155	CDN M3	0802-03	2019/10/23	2020/10/22
○	CDN	EMTEST	HTWE0154	CDN M2	5100100100 12	2019/10/23	2020/10/22
○	CDN	EMTEST	HTWE0153	CDN M1/32A	0202-05	2019/10/23	2020/10/22
○	CDN	EMTEST	HTWE0156	CDN M4- N/32A	5100106600 01	2019/10/23	2020/10/22
●	Audio analyzer	R&S	HTWE3008	UPV	101371	2019/10/11	2020/10/11
●	Radio communication tester	R&S	HTWE0287	CMW500	137688-Lv	2019/10/26	2020/10/25

5. Test conditions and Results

5.1. EMISSION

5.1.1. Radiated Emission

LIMIT

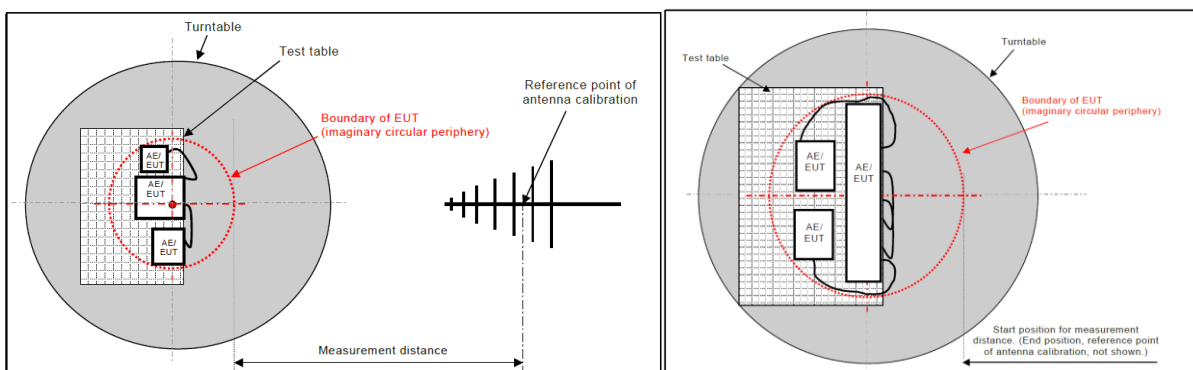
Please refer to ETSI EN301489-1 Clause 8.2.3, Table 4 and CENELEC EN 55032 Annex A Table A.4 & A.5

Frequency range (MHz)	Quasi-peak limitsdB μ V/m@3m
30~230	40
230~1000	47

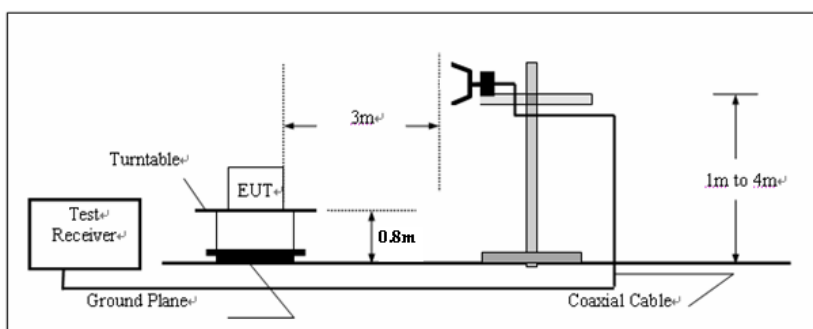
Frequency range (GHz)	Average limitsdB μ V/m@3m	Peak limitsdB μ V/m@3m
1 ~ 3	50	70
3 ~ 6	54	74

TEST CONFIGURATION

➤ below 1000MHz:



➤ Above 1000MHz



TEST PROCEDURE

Please refer to ETSI EN 301 489-1 Clause 8.2.3 and CENELEC EN 55032 Clause 6.3 for the measurement methods

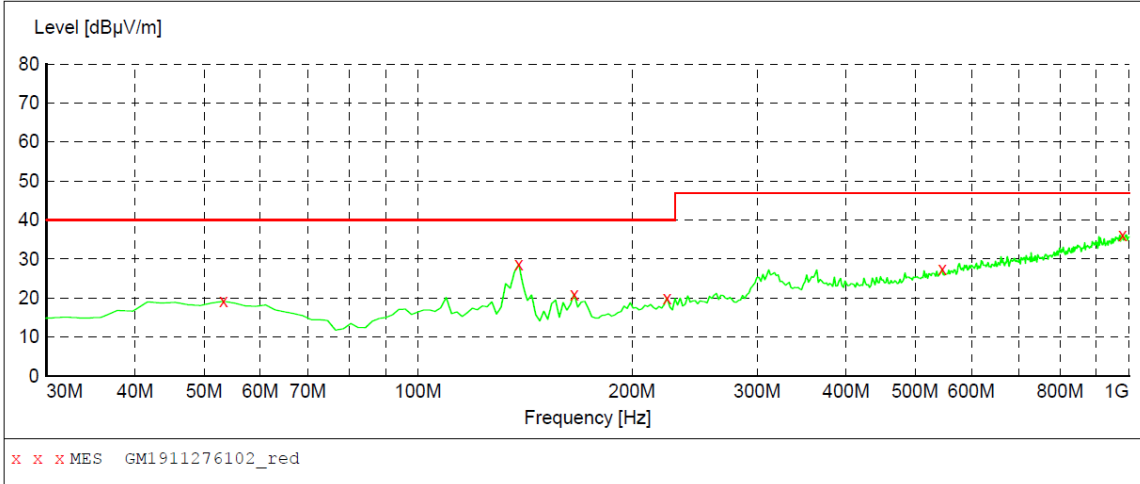
TEST MODE:

Please refer to the Clause 3.4

TEST RESULTS

Passed Not Applicable

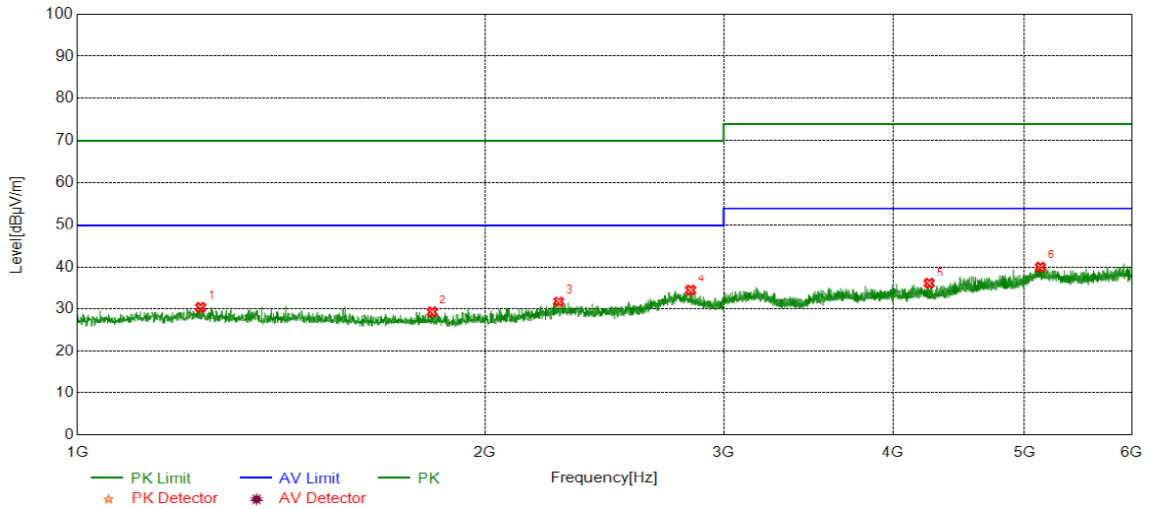
Polarization **Horizontal**



MEASUREMENT RESULT: "GM1911276102_red"

11/27/2019 9:45PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
53.280000	19.20	-8.6	40.0	20.8	QP	100.0	360.00	HORIZONTAL
138.640000	28.60	-13.5	40.0	11.4	QP	300.0	282.00	HORIZONTAL
165.800000	21.00	-12.5	40.0	19.0	QP	100.0	66.00	HORIZONTAL
224.000000	20.10	-9.2	40.0	19.9	QP	100.0	216.00	HORIZONTAL
546.040000	27.50	0.1	47.0	19.5	QP	100.0	127.00	HORIZONTAL
978.660000	36.30	8.9	47.0	10.7	QP	300.0	205.00	HORIZONTAL

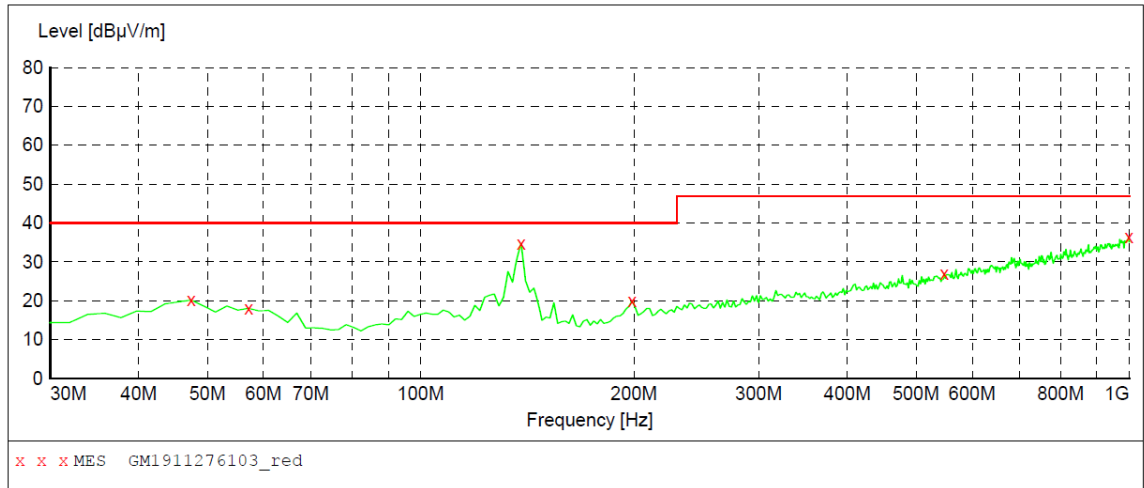


Suspected Data List

NO.	Freq. [MHz]	Reading [dBµV/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Polarity	Detector
1	1233.125	36.08	-5.74	30.34	70.00	39.66	Horizontal	PK
2	1828.125	35.14	-5.81	29.33	70.00	40.67	Horizontal	PK
3	2266.250	34.29	-2.55	31.74	70.00	38.26	Horizontal	PK
4	2835.625	32.97	1.51	34.48	70.00	35.52	Horizontal	PK
5	4253.750	32.25	3.79	36.04	74.00	37.96	Horizontal	PK
6	5139.375	31.24	8.87	40.11	74.00	33.89	Horizontal	PK

Polarization

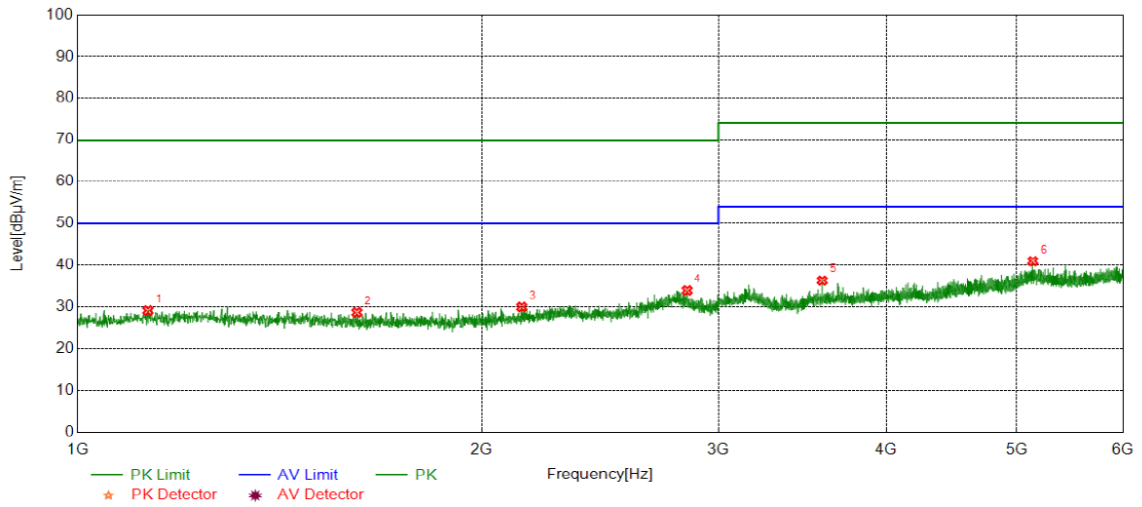
Vertical



MEASUREMENT RESULT: "GM1911276103_red"

11/27/2019 9:48PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	20.20	-8.6	40.0	19.8	QP	100.0	22.00	VERTICAL
57.160000	18.10	-8.7	40.0	21.9	QP	100.0	0.00	VERTICAL
138.640000	34.80	-13.5	40.0	5.2	QP	100.0	187.00	VERTICAL
198.780000	20.00	-9.0	40.0	20.0	QP	100.0	274.00	VERTICAL
547.980000	27.10	0.1	47.0	19.9	QP	100.0	33.00	VERTICAL
998.060000	36.40	9.4	47.0	10.6	QP	100.0	286.00	VERTICAL



Suspected Data List								
NO.	Freq. [MHz]	Reading [dBµV/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Polarity	Detector
1	1128.125	35.77	-6.59	29.18	70.00	40.82	Vertical	PK
2	1614.375	35.00	-6.25	28.75	70.00	41.25	Vertical	PK
3	2141.250	33.59	-3.58	30.01	70.00	39.99	Vertical	PK
4	2843.125	32.59	1.39	33.98	70.00	36.02	Vertical	PK
5	3584.375	34.95	1.39	36.34	74.00	37.66	Vertical	PK
6	5142.500	32.09	8.88	40.97	74.00	33.03	Vertical	PK

5.1.2. Conducted Emission (DC Mains)

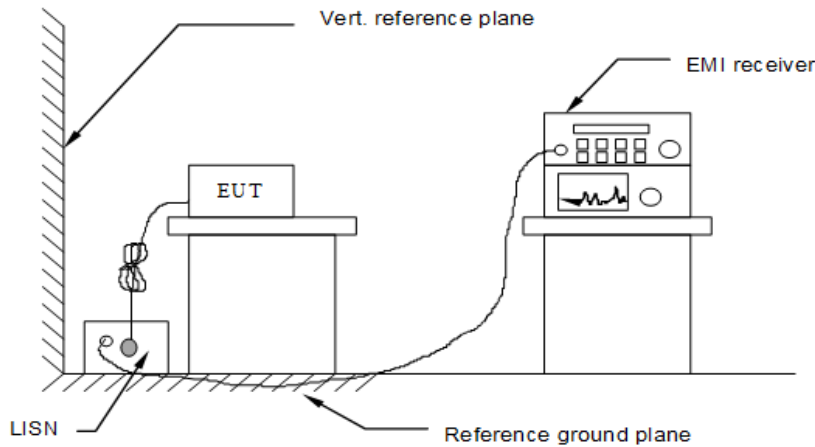
LIMIT

Please refer to ETSI EN301489-1 Clause 8.3.3.

Table 5: Limits for conducted emissions

Frequency range	Limit (quasi-peak) (dB μ V)	Limit (average) (dB μ V)
0,15 MHz to 0,5 MHz	79	66
0,5 MHz to 30 MHz	73	60

TEST CONFIGURATION



TEST PROCEDURE

Please refer to ETSI EN 301 489-1 Clause 8.4.3 and CENELEC EN 55032 Annex A3 Table A.8

TEST MODE:

Please refer to the Clause 3.4

TEST RESULTS

Passed Not Applicable

5.1.3. Harmonic Current Emission

LIMIT

EN61000-3-2 Clause 7

➤ Class A equipment

Harmonic order n	Maximum permissible harmonic current A
Odd harmonics	
3	2,30
5	1,14
7	0,77
9	0,40
11	0,33
13	0,21
$15 \leq n \leq 39$	$0,15 \frac{15}{n}$
Even harmonics	
2	1,08
4	0,43
6	0,30
$8 \leq n \leq 40$	$0,23 \frac{8}{n}$

➤ Class B equipment

not exceed the values given in Class A limit multiplied by a factor of 1,5

➤ Class C equipment

Active input power >25 W

Harmonic order n	Maximum permissible harmonic current expressed as a percentage of the input current at the fundamental frequency %
2	2
3	$30 \cdot \lambda^*$
5	10
7	7
9	5
$11 \leq n \leq 39$ (odd harmonics only)	3

* λ is the circuit power factor

Active input power ≤ 25 W

Harmonic order n	Maximum permissible harmonic current per watt mA/W	Maximum permissible harmonic current A
3	3,4	2,30
5	1,9	1,14
7	1,0	0,77
9	0,5	0,40
11	0,35	0,33
$13 \leq n \leq 39$ (odd harmonics only)	$\frac{3,85}{n}$	See Table 1

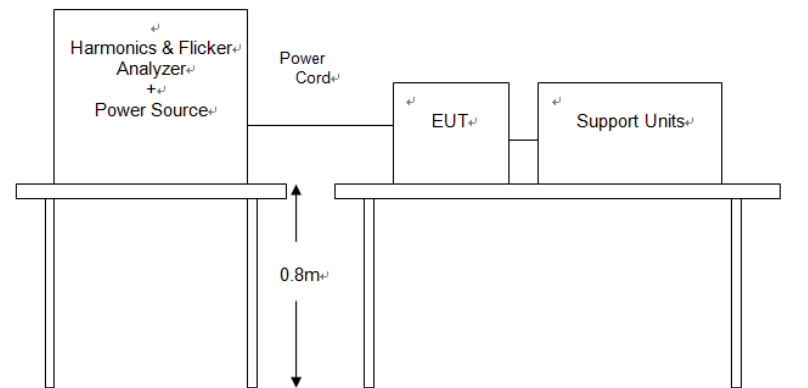
OR

the third harmonic current, expressed as a percentage of the fundamental current, shall not exceed 86 % and the fifth harmonic current shall not exceed 61 %. Also, the waveform of the input current shall be such that it reaches the 5 % current threshold before or at 60°, has its peak value before or at 65° and does not fall below the 5 % current threshold before 90°, referenced to any zero crossing of the fundamental supply voltage. The current threshold is 5 % of the highest absolute peak value that occurs in the measurement window, and the phase angle measurements are made on the cycle that includes this absolute peak value

➤ **Class D equipment**

Harmonic order n	Maximum permissible harmonic current per watt mA/W	Maximum permissible harmonic current A
3	3,4	2,30
5	1,9	1,14
7	1,0	0,77
9	0,5	0,40
11	0,35	0,33
13 ≤ n ≤ 39 (odd harmonics only)	$\frac{3,85}{n}$	See Table 1

TEST CONFIGURATION



TEST PROCEDURE

Please refer to EN61000-3-2 for the measurement methods.

TEST RESULTS

Passed Not Applicable

Note: The power of the EUT is less than 75W, So this test item is not applicable.

5.1.4. Voltage Fluctuation and Flicker

LIMIT

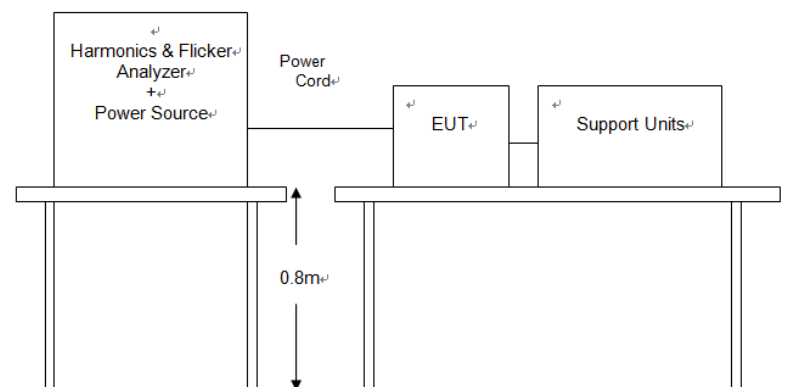
Please refer to EN61000-3-3

- the value of Pst shall not be greater than 1,0;
- the value of Plt shall not be greater than 0,65;
- the value of d(t) during a voltage change shall not exceed 3,3 % for more than 500 ms;
- the relative steady-state voltage change, dc, shall not exceed 3,3 %;
- the maximum relative voltage change dmax, shall not exceed
 - a) 4 % without additional conditions;
 - b) 6 % for equipment which is:
 - switched manually, or
 - switched automatically more frequently than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds), or manual restart, after a power supply interruption.
 - c) 7 % for equipment which is
 - attended whilst in use (for example: hair dryers, vacuum cleaners, kitchen equipment such as mixers, garden equipment such as lawn mowers, portable tools such as electric drills), or
 - switched on automatically, or is intended to be switched on manually, no more than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds) or manual restart, after a power supply interruption.

In the case of equipment having several separately controlled circuits in accordance with 6.6, limits b) and c) shall apply only if there is delayed or manual restart after a power supply interruption; for all equipment with automatic switching which is energised immediately on restoration of supply after a power supply interruption, limits a) shall apply; for all equipment with manual switching, limits b) or c) shall apply depending on the rate of switching.

Pst and Plt requirements shall not be applied to voltage changes caused by manual switching.

TEST CONFIGURATION



TEST PROCEDURE

Please refer to EN61000-3-3 for the measurement methods.

TEST RESULTS

Passed Not Applicable

5.2. IMMUNITY

Performance criteria

- **EN301489-19:**

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, shall be assessed for:

- *the storage of messages in the memory of the EUT at the start of the test;*
- *unintentional responses of the EUT during the test;*
- *the maintenance of the EUT memory assessed at the conclusion of the test;*
- *the ability to receive and store messages at the conclusion of the test.*

Performance criteria for Continuous phenomena applied to ROMES and ROGNSS receivers (CR)

For the EUT, excluding spot frequency tests as part of the immunity test with radiated RF electromagnetic fields:

- *the general performance criteria set out*
- *during the test no false calls shall occur;*
- *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.*

Performance criteria for Transient phenomena applied to ROMES and ROGNSS receivers (TR)

For the EUT:

- *the general performance criteria set out ;*
- *during the test no false calls shall occur;*
- *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.*

Performance criteria for equipment which does not provide a continuous communication link

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:

- *the primary functions of the equipment to be tested during and after EMC stress;*
- *the intended functions of the EUT which shall be in accordance with the documentation accompanying the equipment;*
- *the pass/failure criteria for the equipment;*
- *the method of observing a degradation of performance of the equipment.*

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.

- **EN301489-52**

(1) GSM and DCS Performance Criteria

The establishment and maintenance of a communications link, the assessment of RXQUAL, and the assessment of the audio breakthrough by monitoring the speech output signal level, are used as performance criteria to ensure that all primary functions of the transmitter and receiver are evaluated during the immunity tests. In addition, the test shall also be performed in idle mode to ensure the transmitter does not unintentionally operate.

The maintenance of a communications link shall be assessed using an indicator which may be part of the test system or the EUT.

If an equipment is of a specialized nature, such that the performance criteria described in the following clauses 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

The performance criteria specified by the manufacturer shall give the same degree of immunity protection as called for in the following clauses.

Performance criteria for Continuous phenomena applied to Transmitters (CT)

A communication link shall be established at the start of the test, and maintained during the test,

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).

NOTE: When there is a high level background noise present the filter bandwidth can be reduced down to a minimum of 40 Hz.

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. 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.

Performance criteria for Transient phenomena applied to Transmitters (TT)

A communications link shall be established at the start of the test,

At the conclusion of each exposure the EUT shall operate with no user noticeable loss of the communication link. 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.

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.

Performance criteria for Continuous phenomena applied to Receivers (CR)

A communications link shall be established at the start of the test,

During the test, the RXQUAL of the downlink shall not exceed the value of three, measured during each individual exposure in the test sequence.

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).

NOTE: When there is a high level background noise present the filter bandwidth can be reduced down to a minimum of 40 Hz.

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.

Performance criteria for Transient phenomena applied to Receivers (TR)

A communications link shall be established at the start of the test,

At the conclusion of each exposure the EUT shall operate with no user noticeable loss of the communication link.

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.

(2) CDMA Direct Spread (UTRA and E-UTRA) Performance Criteria

The maintenance of a communications link shall be assessed by using an indicator, which may be part of the test system or the equipment under test.

If an equipment is of a specialized nature, that the performance criteria described in the following clauses 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 testing, as required by the present document.

The performance criteria specified by the manufacturer shall give the same degree of immunity protection as called for in the following clauses.

In addition, the test shall also be performed in idle mode to ensure the transmitter does not unintentionally operate.

The requirements apply to all types of UTRA and E-UTRA (FDD or TDD) for the UE.

Performance criteria for continuous phenomena (CT, CR)

A communication link shall be established at the start of the test, and maintained during the test

In the speech mode, the performance criteria shall be that the Up Link and Down Link speech output levels shall be at least 35 dB less than the recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centred on 1 kHz

NOTE: When there is a high level of background audio noise present, the filter bandwidth can be reduced down to a minimum of 40 Hz.

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.

In addition to confirming the above performance in traffic mode, the test shall be performed in idle mode, and the transmitter shall not unintentionally operate.

UTRA

In the data transfer mode, the performance criteria can be one of the following:

- *if the BER is used, it shall not exceed 0,001 during the test sequence;*
- *if the BLER is used, it shall not exceed 0,01 during the test sequence.*

The BLER calculation shall be based on evaluating the CRC on each transport block

E-UTRA

In the data transfer mode, the performance criteria shall be that the throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channel as specified in annex C in ETSI TS 136 101 [9] with parameters specified in tables 7.3.1-1 and 7.3.1-2 in ETSI TS 136 101 [9] during the test sequence.

Performance criteria for Transient phenomena (TT, TR)

A communications link shall be established at the start of the test

At the conclusion of each exposure the EUT shall operate with no user noticeable loss of the communication link.

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.

In addition to confirming the above performance in traffic mode, the test shall also be performed in idle mode, and the transmitter shall not unintentionally operate

5.2.1. Electrostatic Discharge

PERFORMANCE CRITERION

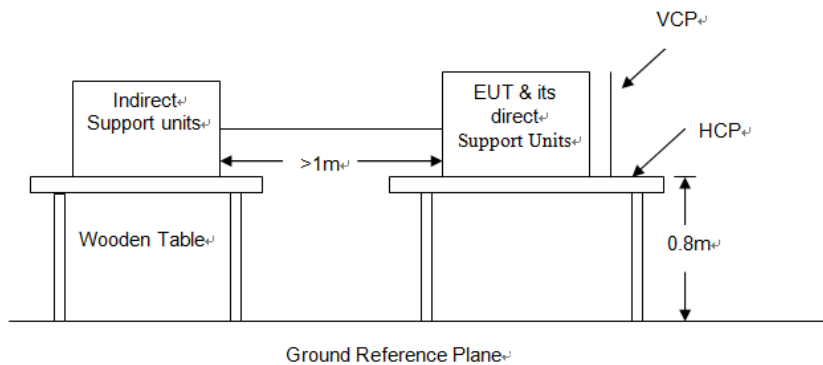
Standard	Criterion
ETSI EN301489-19	TR
ETSI EN301489-52	TT, TR

TEST LEVEL

Contact Discharge at $\pm 2\text{kV}$, $\pm 4\text{kV}$;

Air Discharge at $\pm 2\text{kV}$, $\pm 4\text{kV}$, $\pm 8\text{kV}$

TEST CONFIGURATION



TEST PROCEDURE

Please refer to ETSI EN 301 489-1 Clause 9.3.2 and EN 61000-4-2 for the measurement methods.

Contact Discharge:

The ESD generator is held perpendicular to the surface to which the discharge is applied and the tip of the discharge electrode touch the surface of EUT. Then turn the discharge switch. The generator is then re-triggered for a new single discharge and repeated at least 10 times for each pre-selected test point. This procedure shall be repeated until all the air discharge completed.

Air Discharge:

Air discharge is used where contact discharge can't be applied. The round discharge tip of the discharge electrode shall be approached as fast as possible to touch the EUT. After each discharge, the discharge electrode shall be removed from the EUT. The generator is then re-triggered for a new single discharge and repeated at least 10 times for each pre-selected test point. This procedure shall be repeated until all the air discharge completed.

Indirect discharge for horizontal coupling plane:

At least 10 single discharges shall be applied to the horizontal coupling plane, at points on each side of the EUT.

Indirect discharge for vertical coupling plane:

At least 10 single discharges shall be applied to the center of one vertical edge of the coupling plane. The coupling plane, of dimensions 0.5m X 0.5m, is placed parallel to, and positioned at a distance of 0.1m from the EUT. Discharges shall be applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated.

TEST MODE

Please refer to the Clause 3.4

TEST RESULTS

Passed Not Applicable

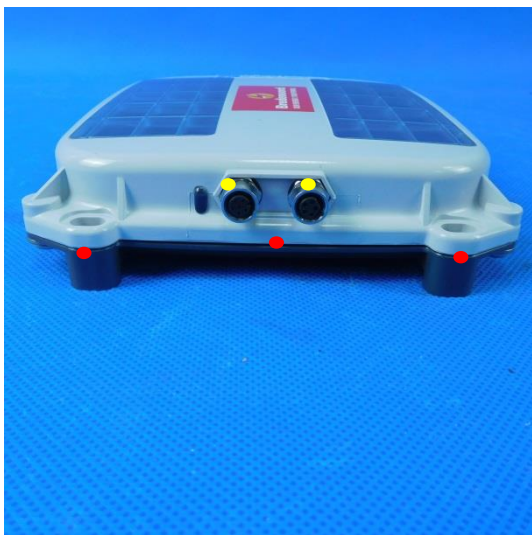
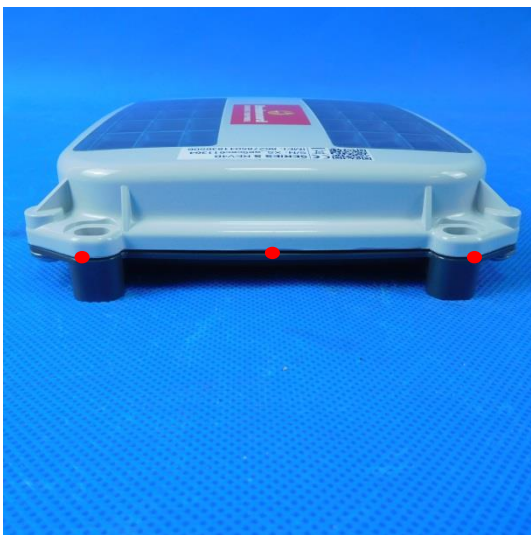
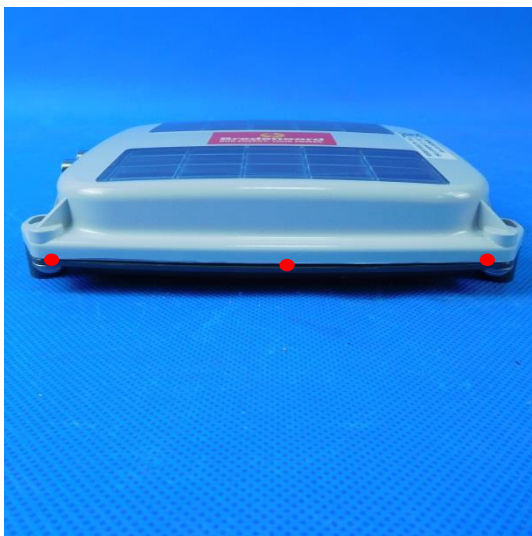
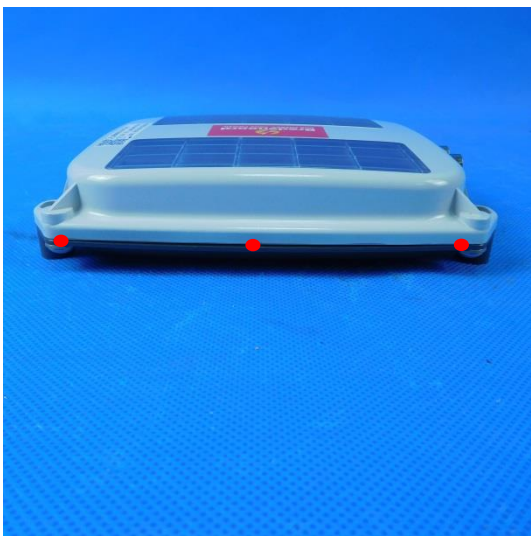
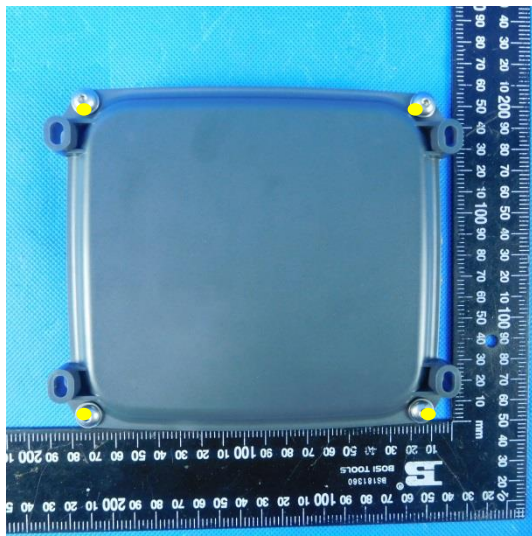
Test mode		C**			
Type	Type of discharge	Discharge voltage (kV)	Observations Performance	CriteriaLevel	Result
Direct	Contact discharge	±2	No degradation in performance of the EUT was observed (A)	TT/TR	Pass
		±4	A	TT/TR	
	Air discharge	±2	A	TT/TR	
		±4	A	TT/TR	
		±8	A	TT/TR	
Indirect	HCP (6 sides)	±2	A	TT/TR	Pass
		±4	A	TT/TR	
	VCP (4 sides)	±2	A	TT/TR	
		±4	A	TT/TR	

Test mode		GNSS			
Type	Type of discharge	Discharge voltage (kV)	Observations Performance	CriteriaLevel	Result
Direct	Contact discharge	±2	No degradation in performance of the EUT was observed (A)	TR	Pass
		±4	A	TR	
	Air discharge	±2	A	TR	
		±4	A	TR	
		±8	A	TR	
Indirect	HCP (6 sides)	±2	A	TR	Pass
		±4	A	TR	
	VCP (4 sides)	±2	A	TR	
		±4	A	TR	

Note:

The ancillary equipment's specification for an acceptable level of performance or degradation of performance during and/or after the ESD tests.

Contact discharge-Yellow, Air discharge-Red



5.2.2. Radio Frequency Electromagnetic Field

PERFORMANCE CRITERION

Standard	Criterion
ETSI EN301489-19	CR
ETSI EN301489-52	CT, CR

TEST LEVEL

Test frequency range: 80MHz~6000MHz

Level: 3V/m (unmodulation)

Modulation type: Amplitude Modulation, 80% depth

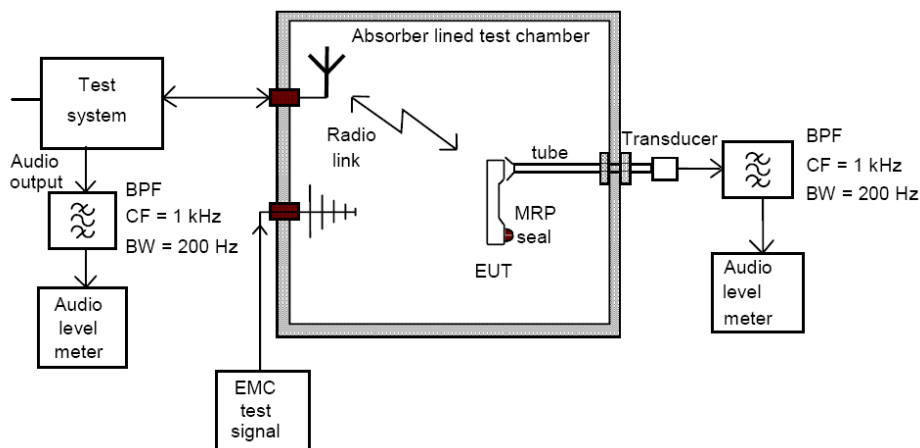
Modulated signal: 1KHz sinusoidal audio signal, 400Hz sinusoidal audio signal for audio breakthrough

Frequency increment step: 1%

Dwell time: 3 seconds

A spot frequency test shall be performed at 920 MHz \pm 1 MHz using a test level of 3 V/m (measured unmodulated) 100 % modulated by 200 Hz pulses of equal mark to space ratio.

TEST CONFIGURATION



TEST PROCEDURE

Please refer to ETSI EN 301 489-1 Clause 9.2.2 and EN 61000-4-3 for the measurement methods.

TEST MODE

Please refer to the Clause 3.4

TEST RESULTS

Passed Not Applicable

Test mode:		CL*			
Type	Antenna Polarity	Observation item	Test Result	Limit	Result
GSM 900	H/V	BER	0.00069	<0.001	Pass
DCS 1800	H/V	BER	0.00057	<0.001	Pass
LTE Band 1	H/V	Throughput	99.11	>95	Pass
LTE Band 3	H/V	Throughput	99.20	>95	Pass
LTE Band 8	H/V	Throughput	98.74	>95	Pass
LTE Band 20	H/V	Throughput	99.35	>95	Pass
LTE Band 28	H/V	Throughput	98.07	>95	Pass

Test mode:		CI*		
Type	Antenna Polarity	Observations (Performance Criterion)	CriteriaLevel	Result
GSM 900	H/V	A	CT / CR	Pass
DCS 1800	H/V	A	CT / CR	Pass
LTE Band 1	H/V	A	CT / CR	Pass
LTE Band 3	H/V	A	CT / CR	Pass
LTE Band 8	H/V	A	CT / CR	Pass
LTE Band 20	H/V	A	CT / CR	Pass
LTE Band 28	H/V	A	CT / CR	Pass

Test mode:		GNSS		
Antenna Polarity	Observations (Performance Criterion)	CriteriaLevel	Result	
H/V	<i>No degradation in performance of the EUT was observed (A)</i>	CR	Pass	

Additional test for GPS mode

Test mode:		GNSS		
Antenna Polarity	Frequency	Observations (Performance Criterion)	Criteria Level	Result
H/V	80 MHz 104 MHz 136 MHz 165 MHz 200 MHz 260 MHz 330 MHz 430 MHz 560 MHz 714 MHz 716 MHz 919 MHz 921 MHz	<i>No degradation in performance of the EUT was observed (A)</i>	CR	Pass

5.2.3. Fast Transients Common Mode(DC Port)

PERFORMANCE CRITERION

Standard	Criterion
ETSI EN301489-19	TR
ETSI EN301489-52	TT, TR

TEST LEVEL

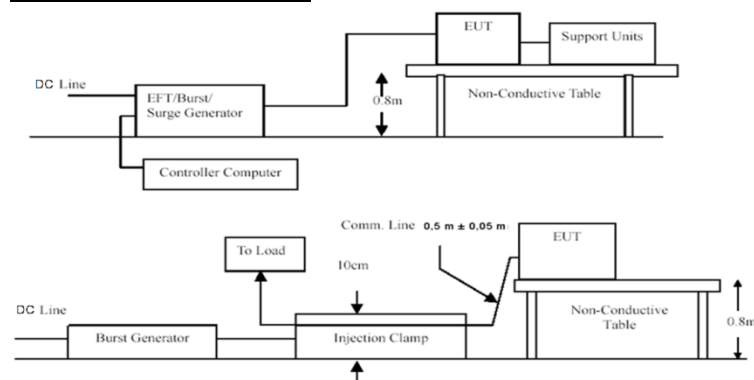
Level: 1KV for AC port, 0.5KV for signal port

Impulse Frequency: 5 kHz;

Tr/Td: 5/50ns;

Burst Duration: 15ms; Burst Period: 3Hz

TEST CONFIGURATION



TEST PROCEDURE

Please refer to ETSI EN 301 489-1 Clause 9.4.2 and EN 61000-4-4 for the measurement methods.

TEST MODE

Please refer to the Clause 3.4

TEST RESULTS

Passed Not Applicable

5.2.4. Surge

PERFORMANCE CRITERION

Standard	Criterion
ETSI EN301489-19	TR
ETSI EN301489-52	TT, TR

TEST LEVEL

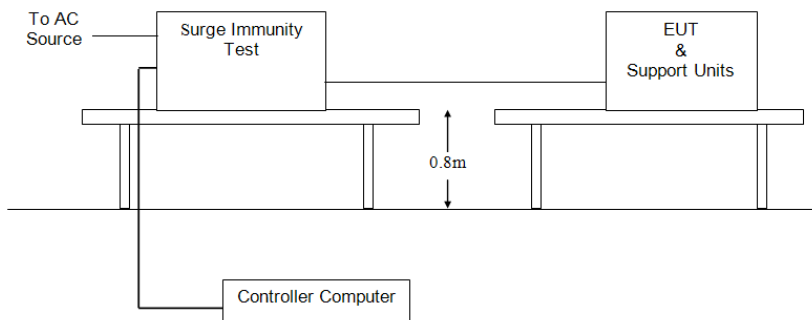
Level: 1kV for line to line, 2kV for line to ground

Voltage Waveform: 1.2/50 us; Current Waveform: 8/20 us

Pluse quantity: 5, interval time: 60 seconds

Phase: 0°, 90°, 180°, 270°

TEST CONFIGURATION



TEST PROCEDURE

Please refer to ETSI EN 301 489-1 Clause 9.8.2 and EN 61000-4-5 for the measurement methods.

TEST MODE

Please refer to the Clause 3.4

TEST RESULTS

Passed Not Applicable

5.2.5. Radio frequency common mode

PERFORMANCE CRITERION

Standard	Criterion
ETSI EN301489-19	CR
ETSI EN301489-52	CT, CR

TEST LEVEL

Test frequency range: 150kHz~80MHz

Level: 3Vrms

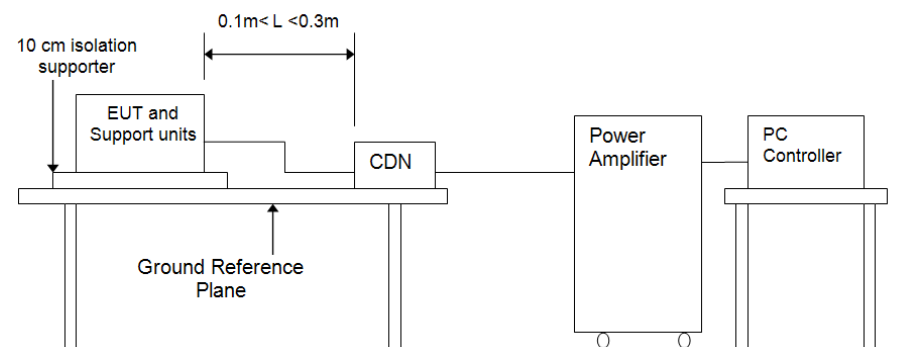
Modulation type: Amplitude Modulation, 80% depth

Modulated signal: 1KHz sinusoidal audio signal, 400Hz sinusoidal audio signal for audio breakthrough

Frequency increment step: 1%

Dwell time: 3 seconds

TEST CONFIGURATION



TEST PROCEDURE

Please refer to ETSI EN 301 489-1 Clause 9.5.2 and EN 61000-4-6 for the measurement methods.

TEST MODE

Please refer to the Clause 3.4

TEST RESULTS

Passed Not Applicable

5.2.6. Voltage dips and interruptions

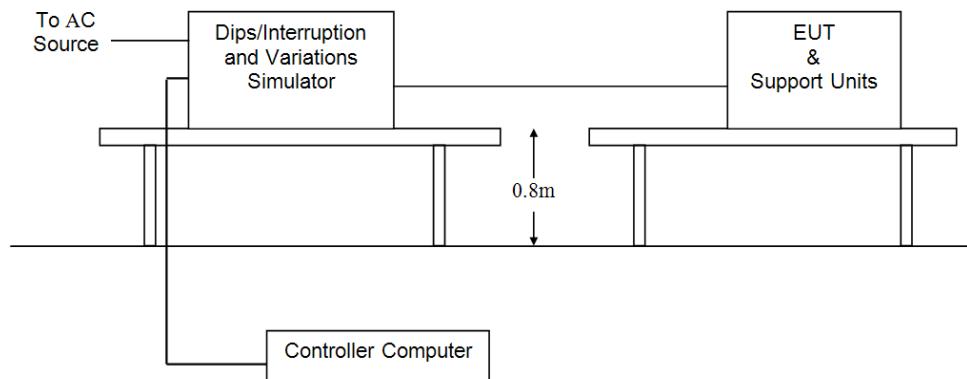
PERFORMANCE CRITERION

Standard	Criterion
ETSI EN301489-19	TR
ETSI EN301489-52	TT, TR

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
 Dip quantity: 3, interval time: 10 seconds

TEST CONFIGURATION



TEST PROCEDURE

Please refer to ETSI EN 301 489-1 Clause 9.7.2 and EN 61000-4-11 for the measurement methods.

TEST MODE

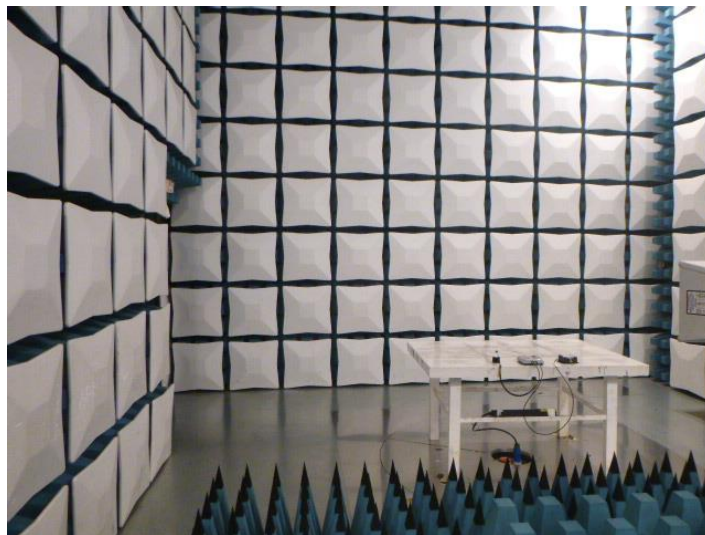
Please refer to the Clause 3.4

TEST RESULTS

Passed Not Applicable

6. Test Setup Photos of the EUT

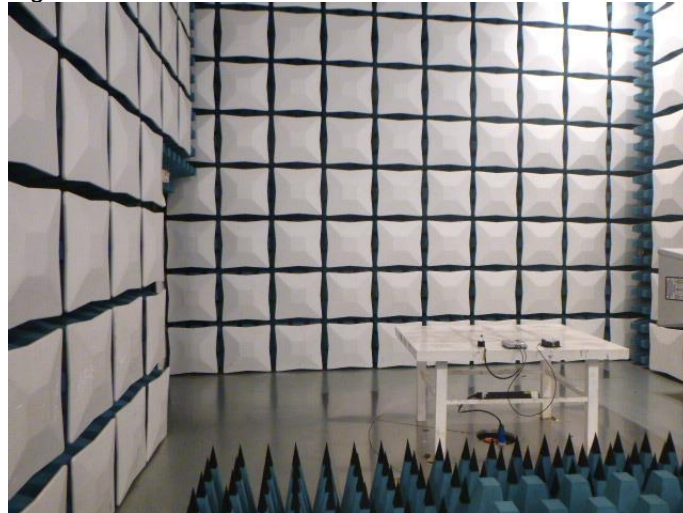
Radiated Emission



Electrostatic Discharge



Radio Frequency Electromagnetic Field



7. External and Internal Photos of the EUT

Reference to the test report No. CHTEW19120161

-----*End of Report*-----