TEST REPORT

Applicant Name : Seeed Technology Co., Ltd
Address : 9F, G3 Building, TCL International E City, Zhongshanyuan Road, Nanshan District, Shenzhen, Guangdong Province, P.R.C
Report Number : SZNS1220114-02176E-EM-02

Test Standard (s)

ETSI EN 301 489-1 V2.2.3 (2019-11)
ETSI EN 301 489-17 V3.2.4 (2020-09)

Sample Description

Product: Seeed XIAO BLE nRF52840/Seeed XIAO BLE nRF52840 Sense
Tested Model: XIAO-nRF52840 Sense
Multiple Model: XIAO-nRF52840
Date Received: 2022-01-14
Date of Test: 2022-01-17 to 2022-01-21
Report Date: 2022-01-25

Test Result:	Pass*

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

Prepared and Checked By:

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EMC Manager

ACCURATE TECHNOLOGY CO. LTD
ATC
APPROVED

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★".

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Seeed XIAO BLE nRF52840/Seeed XIAO BLE nRF52840 Sense
Tested Model	XIAO-nRF52840 Sense
Multiple Model	XIAO-nRF52840
Model difference	1. There are two kinds of samples, the difference between them is that: Seeed XIAO BLE nRF52840 Sense has attached microphone, but Seeed XIAO BLE nRF52840 has not; 2. Product Seeed XIAO BLE nRF52840 Sense corresponds to model- XIAO-nRF52840 Sense, and Seeed XIAO BLE nRF52840 corresponds to model- XIAO-nRF52840.
Trademark	N/A
Ratting	DC 5V from type C port
Sample serial number	SZNS1220114-02176E-EM -S1
Sample/EUT Status	Good condition

Objective

This test report is in accordance with 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 301 489-17 V3.2.4 (2020-09), ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems;
Harmonised Standard for ElectroMagnetic Compatibility.

The objective is to determine compliance with ETSI EN 301 489-1 V2.2.3 (2019-11), ETSI EN 301 489-17 V3.2.4 (2020-09).

Performance criterion

Performance criterion A

The equipment shall continue to operate as intended without operator intervention. No degradation of performance, loss of function or change of operating state is allowed below a performance level specified by the manufacturer when the equipment is used as intended.

The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

Performance criterion B

During the application of the disturbance, degradation of performance is allowed. However, no unintended change of actual operating state or stored data is allowed to persist after the test. After the test, the equipment shall continue to operate as intended without operator intervention; no degradation of performance or loss of function is allowed, below a performance level specified by the manufacturer, when

the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level (or the permissible performance loss), or recovery time, is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

Performance criterion C

Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions. A reboot or re-start operation is allowed.

Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

Test Methodology

All measurements contained in this report were conducted with ETSI EN 301 489-1 V2.2.3 (2019-11).

Test Facility

Name of Firm: Shenzhen Accurate Technology Co., Ltd
Site Location: 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of test at Shenzhen Accurate Technology Co., Ltd. (Shenzhen) is shown as below. And the uncertainty will be taken into consideration for the test data recorded in the report.

Item		**Expanded Measurement uncertainty**
Conducted Emissions	AC Mains	*2.72 dB (k=2, 95% level of confidence)*
Radiated emission	30MHz-1GHz	*4.28 dB (k=2, 95% level of confidence)*
	1GHz-18GHz	*4.98 dB (k=2, 95% level of confidence)*

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in a typical fashion (as normally used by a typical user)

Test Mode: Running
Note: The EUT will run RE program automatically after power it

Equipment Modifications

No modifications were made to the EUT.

Support Equipment List and Details

Manufacturer	Description	Model	Rating
Lenovo	Laptop	ThinkPad X240	INPUT:DC20V, 2.25A/3.25A/4.5A

External I/O Cable
N/A

Block Diagram of Test Setup

For Conducted emission:

SUMMARY OF TEST RESULTS

Rules	Description of Test	Result
§7.1	Reference to clauses EN 301 489-1 §8.4 AC mains power input/output ports	Compliance
	Reference to clauses EN 301 489-1 §8.3 DC power input/output ports	Not Applicable
	Reference to clauses EN 301 489-1 §8.2 Enclosure port of ancillary equipment measured on a stand alone basis	Compliance
	Reference to clauses EN 301 489-1 §8.5 Harmonic current emissions (AC mains input port)	Not Applicable
	Reference to clauses EN 301 489-1 §8.6 Voltage fluctuations and flicker (AC mains input port)	Not Applicable
	Reference to clauses EN 301 489-1 §8.7 Wired network ports	Not Applicable
§7.2	Reference to clauses EN 301 489-1 §9.2 Radio frequency electromagnetic field (80 MHz to 6000 MHz) (EN 61000-4-3)	Compliance
	Reference to clauses EN 301 489-1 §9.3 Electrostatic discharge (EN 61000-4-2)	Compliance
	Reference to clauses EN 301 489-1 §9.4 Fast transients, common mode (EN 61000-4-4)	Not Applicable
	Reference to clauses EN 301 489-1 §9.5 Radio frequency, common mode (EN 61000-4-6)	Not Applicable
	Reference to clauses EN 301 489-1 §9.6 Transients and surges in the vehicular environment (ISO 7637-2)	Not Applicable
	Reference to clauses EN 301 489-1 §9.8 Surges (EN 61000-4-5)	Not Applicable
	Reference to clauses EN 301 489-1 §9.7 Voltage dips and interruptions (EN 61000-4-11)	Not Applicable

Not Applicable: Please refer to Applicability overview tables in sections 7.1 and 7.2 of EN 301 489-1 requirements for Radio and ancillary equipment.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
EMI					
Rohde& Schwarz	Test Receiver	ESR	102725	2021/12/13	2021/12/12
Rohde&Schwarz	Spectrum Analyzer	FSV40	101949	2021/12/13	2021/12/12
SONOMA INSTRUMENT	Amplifier	310 N	186131	2021/11/09	2022/11/08
A.H. Systems, inc.	Preamplifier	PAM-0118P	135	2021/11/09	2022/11/08
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2021/07/06	2024/07/05
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
Unknown	RF Coaxial Cable	No.10	N050	2021/12/14	2021/12/13
Unknown	RF Coaxial Cable	No.11	N1000	2021/12/14	2021/12/13
Unknown	RF Coaxial Cable	No.12	N040	2021/12/14	2021/12/13
Unknown	RF Coaxial Cable	No.13	N300	2021/12/14	2021/12/13
Unknown	RF Coaxial Cable	No.14	N800	2021/12/14	2021/12/13
Radiated Emission Test Software: e3 19821b (V9)					
ESD					
TESEQ	ESD Tester	NSG 437	823	2021/12/17	2022/12/16

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RS					
TESEQ	RF-Generator	ITS 6006	37538	2021/12/13	2022/12/12
TESEQ	Power Amplifier(80 – 1000MHz)	CBA 1G-070	T44328	NCR	NCR
A&R	Linear Power Amplifier (1 – 6GHz)	AS0860-40/45	1060913	NCR	NCR
A&R	Trapezoidal Log Periodic Antenna	ATT700M12G	0357149	NCR	NCR
A&R	Log-Periodic Antenna	ATL80M1G	0356913	/	/
TESEQ	Power Meter	PM6006	73801	2021/12/24	2022/12/23

*** Statement of Traceability:** Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

§7.1 - CONDUCTED EMISSIONS

EUT Setup

Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per EN 301 489-1 measurement procedures. The specification used was with the EN 301 489-1 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

Corrected Factor & Margin Calculation

The Transd factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Transd Factor = LISN VDF + Cable Loss

The "**Over Limit**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Over Limit =Level –Limit
Level= reading level+ Transd Factor

Test Results Summary

According to the recorded data in following table, the EUT complied with the EN 301 489-1,

Test Data

N/A.

§7.1 - RADIATED EMISSIONS

Test System Setup

Below 1 GHz:

Above 1GHz:

The radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the CISPR 16-1-4:2012, CISPR 16-2-3:2010. The limit was specified in EN 301 489-1.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

During the radiated emission test, the EMI test receiver Setup was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
1 GHz – 6 GHz	1 MHz	3 MHz	-	Peak
1 GHz – 6 GHz	1 MHz	Reduce Video Bandwidth	-	Peak

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Factor = Antenna Factor + Cable Loss - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the limit for Class B. The equation for margin calculation is as follows:

Over Limit = Level-Limit.
Level = Read Level+Factor

Test Results Summary

According to the recorded data in following table, the EUT complied with the EN 301 489-1,

Test Data

Environmental Conditions

Temperature:	22 ℃
Relative Humidity:	60%
ATM Pressure:	101.0 kPa

The testing was performed by Bin.Deng on 2022-01-18

Job No.:	SZNS1220114-02176E-EM-02	Power:	230V 50Hz
Test standard:	EN301489-1	Test By:	Bin.D
EUT:	Seeed XIAO BLE nRF52840/Seeed XIAO BLE nRF52840 Sense	Test item:	Radiation Emission
Model No.:	XIAO-nRF52840 Sense	Temp.(℃)/Hum.(%):	22° C 60%RH
Applicant:	Seeed Technology Co., Ltd	Date:	2022.01.18

30 MHz-1 GHz:

Horizontal

Site : chamber
Condition: 3m HORIZONTAL
Job No. : SZNS1220114-02176E-EM
Test Mode: Running

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	58.305	-10.01	29.94	19.93	40.00	-20.07	Peak
2	100.978	-11.69	30.64	18.95	40.00	-21.05	Peak
3	139.851	-15.44	38.93	23.49	40.00	-16.51	Peak
4	198.849	-11.48	35.72	24.24	40.00	-15.76	Peak
5	347.875	-7.27	42.30	35.03	47.00	-11.97	Peak
6	920.093	1.55	33.03	34.58	47.00	-12.42	Peak

Vertical

Site : chamber
Condition: 3m VERTICAL
Job No. : SZNS1220114-02176E-EM
Test Mode: Running

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	51.843	-9.97	31.22	21.25	40.00	-18.75	Peak
2	111.152	-12.12	30.60	18.48	40.00	-21.52	Peak
3	191.493	-11.34	32.41	21.07	40.00	-18.93	Peak
4	216.024	-11.63	33.55	21.92	40.00	-18.08	Peak
5	426.334	-5.84	33.61	27.77	47.00	-19.23	Peak
6	797.580	-0.29	33.03	32.74	47.00	-14.26	Peak

1-6 GHz:

Horizontal

Site : chamber
Condition: 3m HORIZONTAL
Job No. : SZNS1220114-02176E-EM
Test Mode: Running

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	1593.333	-9.05	52.50	43.45	74.00	-30.55	Peak
2	2047.500	-7.29	50.33	43.04	74.00	-30.96	Peak
3	2401.944	-7.23	55.62	48.39	74.00	-25.61	Peak
4	3068.056	-5.85	50.43	44.58	74.00	-29.42	Peak
5	4348.056	-4.81	52.53	47.72	74.00	-26.28	Peak
6	5183.889	-2.65	51.51	48.86	74.00	-25.14	Peak

Vertical

Site : chamber
Condition: 3m VERTICAL
Job No. : SZNS1220114-02176E-EM
Test Mode: Running

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	1592.778	-9.05	56.08	47.03	74.00	-26.97	Peak
2	1992.500	-7.34	56.46	49.12	74.00	-24.88	Peak
3	2168.611	-7.22	56.19	48.97	74.00	-25.03	Peak
4	3191.111	-5.91	54.44	48.53	74.00	-25.47	Peak
5	4410.556	-4.78	51.74	46.96	74.00	-27.04	Peak
6	5351.389	-2.33	51.86	49.53	74.00	-24.47	Peak

Note**:**

1) Result = Reading + Factor
2) Margin = Limit– Result

§7.1 - HARMONIC CURRENT EMISSIONS

Not Applicable: Please refer to Applicability overview tables in sections 7.1 and 7.2 of EN 301 489-1 requ irements for Radio and ancillary equipment.

Note: The equipment is a module device.

§7.1-VOLTAGE FLUCTUATION AND FLICKER

Test System Setup

Test Standard

EN 61000-3-3:2013

Flicker Test Limits:

The limits shall be applicable to voltage fluctuations and flicker at the supply terminals of the equipment under test, measured or calculated according to clause 4 under test conditions described in clause 6 and annex A. Tests made to prove compliance with the limits are considered to be type tests.
The following limits apply:
– 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.

Note: The cycling frequency will be further limited by the Pst and Plt limit. For example: a dmax of 6 % producing a rectangular voltage change characteristic twice per hour will give a Plt of about 0,65.
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 energized 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. The limits shall not be applied to voltage changes associated with emergency switching or emergency interruptions.

Test Data

Not Applicable: Please refer to Applicability overview tables in sections 7.1 and 7.2 of EN 301 489-1 requ irements for Radio and ancillary equipment.

Note: The equipment is a module device.

§7.2 - RF ELECTROMAGNETIC FIELD (80 MHz to 6000 MHz)

Test System Setup

Test Standard

ETSI EN 301 489-1 V2.2.3 (2019-11) / EN 61000-4-3:2006+A1:2008 +A2: 2010

Test Level

Level	Field Strength (V/m)
1.	1
2.	3
3.	10
X.	Special

Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above the ground. The EUT is set 3 meters away from the transmitting antenna which is mounted on an antenna tower. Both horizontal and vertical polarizations of the antenna are set on test. Each of the four sides of EUT must be faced this transmitting antenna and measured individually.
In order to judge the EUT performance, a CCD camera, wireless router and CMW500 are used to monitor the EUT.

All the scanning conditions are as follows:

	Condition of Test	Remarks
1.	Field Strength	3 V/m (Test Level 2)
2.	Radiated Signal	Modulated
3.	Scanning Frequency	80 - 6000 MHz
4.	Frequency step	1%
5.	Dwell Time	1 Sec.

Test Data and Setup Photo

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	49 %
ATM Pressure:	101.0 kPa

The testing was performed by Caro Hu on 2022-01-20.

Modulation: Amplitude 80%, 1 kHz sine wave

Frequency Range (MHz)	Front Side (3 V/m)		Rear Side (3 V/m)		Left Side (3 V/m)		Right Side (3 V/m)	
	VERT	HORI	VERT	HORI	VERT	HORI	VERT	HORI
80-6000	A	A	A	A	A	A	A	A

Note: “A” stand for, during test, operate as intended No loss function, no degradation of performance,no unintentional transimissions.and after test, no degradation of performance, no loss of function, no loss of stored data or user programmable functions.

Test Setup Photo

§7.2 - ELECTROSTATIC DISCHARGE

Test System Setup

Remark: ■ is the tip of the electrode

EN 61000-4-2 specifies that a tabletop EUT shall be placed on a non-conducting table which is 80 centimeters above a ground reference plane and that floor mounted equipment shall be placed on a insulating support approximately 10 centimeters above a ground plane. During the tests, the EUT is positioned over a ground reference plane in conformance with this requirement.

For tabletop equipment, a 1.6 by 0.8-meter metal sheet (HCP) is placed on the table and connected to the ground plane via a metal strap with two 470 k Ohms resistors in series. The EUT and attached cables are isolated from this metal sheet by *0.5-millimeter* thick insulating material. A Vertical Coupling Plane (VCP) grounded on the ground plane through the same configuration as in the HCP is used.

Test Standard

ETSI EN 301 489-1 V2.2.3 (2019-11) / EN 61000-4-2:2009

Test Level

Level	Test Voltage Contact Discharge (±kV)	Test Voltage Air Discharge (±kV)
1.	2	2
2.	4	4
3.	6	8
4.	8	15
X.	Special	Special

Performance criterion: B

Test Procedure

Air Discharge:

This test is done on a non-conductive surface. 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 10 times for each pre-selected test point. This procedure shall be repeated until all the air discharge completed.

Contact Discharge:

All the procedure shall be same as Section 8.3.1 of EN 61000-4-2, except that the tip of the discharge electrode shall touch the EUT before the discharge switch is operated.

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. The discharge electrode positions vertically at a distance of 0.1m from the EUT and with the discharge electrode touching the coupling plane.

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 ×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 Data and Setup Photo

Environmental Conditions

Temperature:	25℃
Relative Humidity:	49 %
ATM Pressure:	101.0 kPa

The testing was performed by Caro Hu on 2022-01-20.

Table 1: Electrostatic Discharge Immunity (Air Discharge)

EN 61000-4-2 Test Points Location	Test Levels							
	-2 kV	+2 kV	-4 kV	+4 kV	-8 kV	+8 kV	-15 kV	+15 kV
/	/	/	/	/	/	/	/	/

Table 2: Electrostatic Discharge Immunity (Direct Contact)

EN 61000-4-2 Test Points Location	Test Levels							
	-2 kV	+2 kV	-4 kV	+4 kV	-6 kV	+6 kV	-8 kV	+8 kV
Type C Interface	/	/	A	A	/	/	/	/

Table 3: Electrostatic Discharge Immunity (Indirect Contact HCP)

EN 61000-4-2 Test Points Location	Test Levels							
	-2 kV	+2 kV	-4 kV	+4 kV	-6 kV	+6 kV	-8 kV	+8 kV
HCP	/	/	A	A	/	/	/	/

Table 4: Electrostatic Discharge Immunity (Indirect Contact VCP)

EN 61000-4-2 Test Points Location	Test Levels							
	-2 kV	+2 kV	-4 kV	+4 kV	-6 kV	+6 kV	-8 kV	+8 kV
Front Side	/	/	A	A	/	/	/	/
Back Side	/	/	A	A	/	/	/	/
Left Side	/	/	A	A	/	/	/	/
Right Side	/	/	A	A	/	/	/	/

Note: → **represents direct contact discharges.**
→ **No air discharges.**

Test Setup Photo

§7.2 - ELECTRICAL FAST TRANSIENT IMMUNITY

Test System Setup

Test Standard

ETSI EN 301 489-1 V2.2.3 (2019-11) / EN 61000-4-4: 2012

Test Level

Open Circuit Output Test Voltage ±10%		
Level	**On Power Supply Lines**	**On I/O (Input/Output) Signal data and control lines**
1	0.5 kV	0.25 kV
2	1 kV	0.5 kV
3	2 kV	1 kV
4	4 kV	2 kV
X	Special	Special

Performance Criterion: B

Test Procedure

The EUT was arranged for Power Line Coupling and for I/O Line Coupling through a capacitive clamp, where applicable. (Note: The I/O coupling test using a capacitive clamp is performed on the I/O interface cables that are longer in length than 3 meters.) A metal ground plane 2.4 meter by 2.0 meter was placed between the floor and the table and is connected to the earth by a 2.0 meter ground rod. The ground rod is connected to the test facility's electrical earth.

Test Data

N/A.

§7.2 - RF COMMON MODE

Test Setup

Test Standard

ETSI EN 301 489-1 V2.2.3 (2019-11) /EN 61000-4-6: 2014

Test Level

Level	Voltage Level (r.m.s.) (U_0)
1	1
2	3
3	10
X	Special

Performance Criterion: A

Note: "A" stand for, during test, operate as intended no loss function, no degradation of performance,no unintentional reansimissions.and after test, no degradation of performance, no loss of function, no loss of stored data or user programmable functions.

Test Procedure

1) Let the EUT work in test mode and test it.
2) The EUT are placed on an insulating support 0.1 m high above a ground reference plane. CDN (coupling and decoupling device) is placed on the ground plane about 0.3 m 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 150 kHz to 80 MHz using 3V signal level, and with the disturbance signal 80% amplitude modulated with a 1 kHz sine wave.
6) 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.
7) Recording the EUT operating situation during compliance testing and decide the EUT immunity criterion.

Test Data

N/A .

§7.2 - SURGES, LINE TO LINE AND LINE TO GROUND

Test System Setup

Test Standard

ETSI EN 301 489-1 V2.2.3 (2019-11) / EN 61000-4-5: 2014 + A1: 2017

Test Level

Level	Open Circuit Output Test Voltage ±10%	Performance Criterion	
		AC Mains	Signal Port
1	0.5 kV	/	/
2	1 kV	B	/
3	2 kV	/	/
4	4 kV	/	/
X	Special	/	/

Test Procedure

1) For line to line coupling mode, provide a 1.2/50μs voltage surge (at open-circuit condition) and a 8/20 μs current surge into a short circuit.
2) For telecommunication port, provide a 10/700μs voltage surge (at open-circuit condition) and a 5/320 μs current surge into a short circuit.
3) At least 5 positive and 5 negative (polarity) tests with a maximum 1/min repetition rate are conducted during test.
4) Different phase angles are done individually.
5) Record the EUT operating situation during compliance test and decide the EUT immunity criterion for above each test.

Test Data

N/A.

§7.2 - VOLTAGE DIPS AND INTERRUPTIONS IMMUNITY TEST

Test Setup

Test Standard

ETSI EN 301 489-1 V2.2.3 (2019-11) / EN 61000-4-11: 2004

Test Level

Test Level	Voltage dip and short interruptions (% Residual Voltage)	Duration (in period)	Performance criterion:
1	0	0.5	B
2	0	1	B
3	70	25	C
4	0	250	C

Test Procedure

1) The interruption is introduced at selected phase angles with specified duration.
2) Record any degradation of performance.

Test Data

N/A.

EXHIBIT A - EUT PHOTOGRAPHS

EXHIBIT B - TEST SETUP PHOTOGRAPHS

Radiated Emissions – Below 1 GHz

Radiated Emissions – Above 1 GHz

******* END OF REPORT *******