TEST REPORT

of

RE Directive (2014/53/EU)
EN 301 489-1/17

Product :	**Bluetooth 5.1 Module**
Brand:	**Fanstel**
Model:	**BM833AF, BM833A**
Model Difference:	**Antenna. Please see page 5 for detail**
Applicant:	**Fanstel Corporation, Taipei**
Address:	**10F-10, No. 79, Sec. 1, Hsin Tai Wu Rd., Hsi-Chih, New Taipei City 221 Taiwan**

Test Performed by:

International Standards Laboratory Corp. LT Lab.
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Report No.: **ISL-19LR264E489-R2**
Issue Date : **2022/02/07**

Testing Laboratory
0997

VERIFICATION OF COMPLIANCE

Applicant:	Fanstel Corporation, Taipei
Equipment Under Test:	Bluetooth 5.1 Module
Brand Name:	Fanstel
Model Number:	BM833AF, BM833A
Model Different:	Antenna. Please see page 5 for detail
Date of Test:	2019/9/10 ~2019/9/16
Date of EUT Received:	2019/9/6

APPLICABLE STANDARDS		
EN 301 489 –1 v2.2.3: 2019		EN 301 489 –17 v3.2.4: 2020
EMI:	EN 55032:2015 Class B	
EMS:	EN 55024: 2010+A1:2015	
	EN61000-4-2:2009	EN 61000-4-3:2006+A1:2008 +A2:2010

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

Remarks:

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of **International Standards Laboratory Corp.** or testing done by in connection with distribution or use of the product described in this report must be approved by **International Standards Laboratory Corp.** in writing.

Test By: Jason Chao **Date:** 2022/02/07

Jason Chao / Senior Engineer

Prepared By: Elisa Chen **Date:** 2022/02/07

Elisa Chen / Senior Engineer

Approved By: Jerry Liu **Date:** 2022/02/07

Jerry Liu / Technical Manager

Version

Version No.	Date	Description
00	2019/10/29	Initial creation of document
01	2022/02/07	Upgrade the standard version (See Note)

Note:
After comparing with two versions of EN 301 489 standards for this application, the difference is as below table. No testing and test report modified is needed, hence, the test configuration and test results of this report are citied from the original report.

Original rule	New rule	Remark
EN 301 489-1 V2.1.1 EN 301 489-17 V3.1.1	EN 301 489-1 V2.2.3 EN 301 489-17 V3.2.4	No tests need to be update

TABLE OF CONTENTS

1. General Description

1.1 Description of Equipment under Test (EUT)

Product Name:	Bluetooth 5.1 Module
Brand:	Fanstel
Model:	BM833AF, BM833A
Model different:	Antenna. Please see table below for detail.
Power Supply:	5Vdc by USB port
RF function	BT 5.1

Model Summaries

module	BM833A	BM833AF
Flash/RAM	192KB/24KB	192KB/24KB
Size	10.2x15x1.9mm	10.2 (15 antenna area) x 20.6 x1.9mm.
GPIO	32	32
Antenna	PCB Trace	PCB trace
Antenna Gain	0.01dBi	-0.88dBi
BT range, low interference	680 meters at 125Kbps, est.	1400 meters at 125 Kbps, est.

Remark: The above DUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.2 General Description of Applied Standards

The EUT According to the Specifications, it must comply with the requirements of the following standards:

ETSI EN 301 489-1 V2.2.3:
ElectroMagnetic Compatibility (EMC) standard for radio equipment and services;
Part 1: Common technical requirements; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU

ETSI EN 301 489-17 V3.2.4:
Part 17: Specific conditions for Broadband Data Transmission Systems; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU

EN 55032:2015+AC:2016, CISPR 32: 2015+COR1:2016:
Electromagnetic compatibility of multimedia equipment - Emission requirements.

1.3 Description of Test Modes:

The transmitter shall be modulated with normal test modulation as specified for that type of equipment. Where transmitters do not have a modulation input port, the internal equipment modulation shall be used.

The wanted signals and/or controls required to establish a communications link shall be defined by the manufacturer.

The transmitter shall be operated at its maximum rated RF output power as specified for that type of equipment. The manufacturer may provide a suitable companion receiver that can be used to set up a communications link and/or to receive messages.

The tests shall be made exercising all primary functions in the most representative mode consistent with typical applications. The test sample shall be configured in a manner consistent with typical installation practice.

Test Plan

Applicable standard		EN 301489-17	
Test Configuration		Config 1	Config 2
		EUT + Smart mobile phone	EUT + Smart mobile phone
Operation mode		BT link(BM833AF)	BT link(BM833A)
No.	**Description**		
1	radiated emission (30M-1GHz) (1-6GHz)	measured	pretest
2	conducted emission (DC Power)	N/A	N/A
3	conducted emission (AC Power)	measured	N/A
4	harmonic current emissions	N/A	N/A
5	voltage fluctuations and flicker	N/A	N/A
6	Conducted emission (wired network)	N/A	N/A
7	RF electromagnetic field (80MHz to 6GHz)	measured	measured
8	electrostatic discharge	measured	measured
9	fast transients common mode	N/A	N/A
10	RF common mode 0,15 MHz to 80 MHz	N/A	N/A
11	transients and surges	N/A	N/A
12	voltage dips and interruptions	N/A	N/A
13	surges, line to line and line to ground	N/A	N/A

Note 1: the test plan was accepted by the applicant

1.4 Test Facility:

The 10m anechoic chamber radiated emission measurement facilities used to collect the data are located at <LT Lab.> Address: No. 120, Lane 180, Hsin Ho Rd. Lung-Tan Dist., Tao Yuan City 325, Taiwan, The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

The 966 anechoic chamber radiated emission measurement (Above 1GHz) facilities used to collect the data are located at <LT Lab.> Address: No. 120, Lane 180, Hsin Ho Rd. Lung-Tan Dist., Tao Yuan City 325, Taiwan, The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

The AC power line conducted emission, flicker and all of immunity measurement facilities used to collect the data are located at <LT Lab.> Address: No. 120, Lane 180, Hsin Ho Rd. Lung-Tan Dist., Tao Yuan City 325, Taiwan, The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

1.5 Modification List:

No modification by International Standards Laboratory Corp.

1.6 Test Condition:

Refer to EN 301 489-1, Section 4 and EN 301 489-17, Section4 for the details.

1.7 Equipment List:

Location Con02	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Conduction 02	LISN 26	R&S	ENV216	102378	11/21/2018	11/21/2019
Conduction 02	LISN 23	R&S	ENV216	101477	07/31/2019	07/31/2020
Conduction 02	Conduction 02-1 Cable	WOKEN	CFD 300-NL	Conduction 02 -1	09/11/2019	09/11/2020
Conduction 02	EMI Receiver 14	ROHDE& SCHWARZ	ESCI	101034	05/31/2019	05/31/2020
Conduction 02	ISNT4 07	Teseq GmbH	ISN T400A	30449	08/02/2019	08/02/2020
Conduction 02	ISN T8 10	Teseq GmbH	ISN T800	42773	08/02/2019	08/02/2020

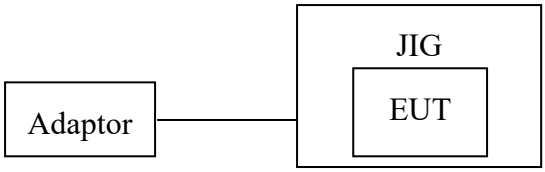
Location Chamber02	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Radiation (Chamber02)	BILOG Antenna 17	Schwarzbeck	Schwarzbeck VULB 9168+EMCI-N -6-05	645	03/06/2019	03/06/2020
Radiation (Chamber02)	Preamplifier 25	EMCI	EMC9135	980295	02/27/2019	02/27/2020
Radiation (Chamber02)	Coaxial Cable Chmb 02-10M-02	EMC	RG214U	Chmb 02-10M-02	09/16/2019	09/16/2020
Radiation (Chamber02)	EMI Receiver 12	ROHDE & SCHWARZ	ESCI	100804	08/30/2019	08/30/2020

Chamber 19(966)					
Equipment Type	**Manufacturer**	**Model Number**	**Serial Number**	**Last Cal.**	**Cal. Due.**
966 Chamber	Chance Most	Chamber 19	N/A	08/13/2019	08/12/2020
Spectrum analyzer	R&S	FSP40	100116	01/10/2019	01/09/2020
EMI Receiver	R&S	ESR3	102461	08/08/2018	08/07/2020
Loop Antenna(9K-30M)	EM	EM-6879	271	05/31/2019	05/30/2020
Bilog Antenna (30M-1G)	SCHWARZBECK	VULB9168 w 5dB Att	736	01/29/2019	01/28/2020
Horn antenna (1G-18G)	SCHWARZBECK	9120D	9120D-1627	06/17/2019	06/16/2020
Horn antenna (18G-26G)	Com-power	AH-826	081001	11/21/2017	11/20/2019
Horn antenna (26G-40G)	Com-power	AH-640	100A	03/29/2019	03/28/2021
Preamplifier (9k-1000M)	HP	8447F	3113A06362	01/14/2019	01/13/2020
Preamplifier(1G-26G)	Agilent	8449B	3008A02471	10/29/2018	10/28/2019
Preamplifier (26G-40G)	MITEQ	JS4-26004000-27 -5A	818471	05/06/2019	05/05/2020
RF Cable (9k-18G)	HUBER SUHNER	SUCOFLEX 104A	MY1397/4A	01/17/2019	01/16/2020
RF cable (18G~40G)	HUBER SUHNER	Sucoflex 102	27963/2&37421 /2	11/12/2018	11/11/2019
Turn Table	MF	Turn Table-19	Turn Table-19	N/A	N/A
Mast Tower	MF	JSDES-15A	1308283	N/A	N/A
Controller	MF	MF-7802BS	MF780208460	N/A	N/A
AC power source	T-Power	TFC-1005	40006471	N/A	N/A
Signal Generator	Anritsu	MG3692A	20311	01/09/2019	01/08/2020
2.4G Filter	Micro-Tronics	Brm50702	76	12/25/2018	12/24/2019
5G Filter	Micro-Tronics	Brm50716	005	12/25/2018	12/24/2019
Tunable Notch Filter (800 to 1000)	K&L	3TNF-00082	478	12/25/2018	12/24/2019
Tunable Notch Filter (1700 to 2000)	K&L	5TNF-00082	335	12/25/2018	12/24/2019
Band reject filter850	WI	Wrc814-859	3	12/25/2018	12/24/2019
Band reject filter900	WI	Wrc860-935	3	12/25/2018	12/24/2019
Band reject filter1800	WI	Wrc1690-1805	3	12/25/2018	12/24/2019
Band reject filter1900	WI	Wrc1830-1930	3	12/25/2018	12/24/2019
Test Software	Audix	E3 Ver:6.12023	N/A	N/A	N/A

Location	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
EN61K-4-2	ESD Gun 12	EM TEST	Dito	P1650188689	05/07/2019	05/07/2020
EN61K-4-2	ESD Gun 07	NoiseKen	ESS-2002EX	ESS0878638	01/31/2019	01/31/2020
EN61K-4-3	Broadband Log-Periodic Antenna	AR	AT1080	310698	N/A	N/A
EN61K-4-3	Horn Antenna RF-01	AR	ATS700M11G	0335864	N/A	N/A
EN61K-4-3	Amplifier 80Mz~1GHz 250W	AR	250W1000A	312494	N/A	N/A
EN61K-4-3	Amplifier 800MHz~4.2GHz 50W	AR	50S1G4M1	312762	N/A	N/A
EN61K-4-3	Amplifier 4.0~8.0GHz 35W	AR	35S4G8AM1	0335752	N/A	N/A
EN61K-4-3	Broadband Coupler 80M~1GHz	Amplifier Research	DC6180A	0341805	N/A	N/A
EN61K-4-3	Coaxial Cable	INSULATED	NPS-4806-2360-NP3	108599.003.01.03	N/A	N/A
EN61K-4-3	Broadband Coupler 0.8G~4.26GHz	AR	DC7144A	0335226	N/A	N/A
EN61K-4-3	Broadband Coupler 4G~8GHz	AR	DC7350A	0335817	N/A	N/A
EN61K-4-3	Signal Generator 07	ROHDE&SCHWARZ	SMB100A	107780	10/28/2018	10/28/2019
EN61K-4-4	EFT and SURGE Test System	EM TEST	UCS-500 M6B	V0728102674	02/14/2019	02/14/2020
EN61K-4-4	Capacitive Coupling Clamp	EM TEST	HFK	0907-106	02/14/2019	02/14/2020
EN61K-4-5	CDN-UTP8 ED3	EMC-PARTNER	CDN-UTP8	1509	04/02/2019	04/02/2020
EN61K-4-5	SURGE-TESTER	EMC Partner	MIG0603IN3	523	04/02/2019	04/02/2020
EN61K-4-6	CDN M2+M3 04	TESEQ	CDN M016	43257	09/10/2019	09/10/2020
EN61K-4-6	CDN T2 04	FCC Inc.	FCC-801-T2	02067	08/14/2019	08/14/2020
EN61K-4-6	CDN T4 06	FCC Inc.	FCC-801-T4	02068	06/24/2019	06/24/2020
EN61K-4-6	CDN T8-10_2	Teseq GmbH	CDN T8 10	41241	03/26/2019	03/26/2020
EN61K-4-6	Coaxial Cable 4-6 02-1			4-6 02-1	N/A	N/A
EN61K-4-6	Conducted Immunity Test System 02	Frankonia	CIT-10-75-DC	126B1301/2014	03/25/2019	03/25/2020
EN61K-4-6	EM-Clamp	Schaffner	KEMZ-801	19215	11/08/2018	11/08/2019
EN61K-4-8	Magnetic Field Immunity Loop	FCC	F-1000-4-8-L-1M	01037	05/27/2019	06/05/2020
EN61K-4-8	Magnetic Field Test Generator	FCC	F-1000-4-8-G-125A	01038	05/27/2019	06/05/2020
EN61K-4-11	Voltage Dip and UP Simulator	NoiseKen	VDS-2002	VDS0640162	11/06/2018	11/06/2019
EN61K-4-34	Voltage Dip and UP Simulator 50A	PRIMA	DRP61011CX	PR17096386	01/03/2019	01/03/2020
EN61K-3-2/3, EN61K-3-11-12	(Harmonic/Flicker) MX Series CTSH Compliance Test System	California Instruments	MX60T04GH 10400	72793	08/05/2019	08/05/2020

PS: N/A => The equipment does not need calibration.

1.8 Configuration of Tested System



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Smart phone

Table 1-1 Support Equipment Used in Tested System

Item	Equipment	Mrf/Brand	Model name	Series No	Data Cable	Power Cable
1	adaptor	Apple	A1385	N/A	N/A	Shielded /0.6m
2	Smart phone	hTC	PL99110	N/A	N/A	N/A

I/O Cable Condition of EUT and Support Units

Description	Path	Cable Length	Cable Type	Connector Type
USB power cable	Adaptor USB port to JIG micro USB port	0.6m	Non-Shielded	Metal Head

Note: All the above equipment/cables were placed in worse case positions to maximize emission signals during emission test.

Grounding: Grounding was in accordance with the manufacturer's requirements and conditions for the intended use.

1.9 Exclusion band

For EN301489-1

Exclusion band for transmitters or the transmitter part of transceivers

Channelized Equipment

For channelized equipment the exclusion band shall extend 250 % of the channel width either side of the transmitter centre frequency.

NOTE: Exclusion band of 250 % is based on the ITU Radio Regulations, as the boundary between OOB and Spurious Domain.

Non-Channelized Equipment

For non-channelized equipment the exclusion band shall extend 250 % of the occupied bandwidth either side of the transmitter centre frequency.

NOTE: Exclusion band of 250 % is based on the ITU Radio Regulations , as the boundary between OOB and Spurious Domain.

Exclusion band for receivers or the receiver part of transceivers

Channelized Equipment

For channelized equipment the exclusion band shall be calculated by using the following formulae:

For the lower edge for the exclusion band:

EXband(lower) = BandRX(lower) – nChWRX

and for the upper edge of the exclusion band:

EXband(upper) = BandRX(upper) + nChWRX

Where n = number of channel widths required for exclusion band.

For equipment that support multiple channel widths the Channel Width used should be the widest support by the EUT.

Where the present document is being used in a stand-alone basis (i.e. with no reference to other relevant radio technology parts of ETSI EN 301 489 series), the value of n shall be 1.

Non-Channelized Equipment

For non-channelized equipment the exclusion band shall be calculated by using the following formula: For the lower edge for the exclusion band:

EXband(lower) = BandRX(lower) – nBWRX

and for the upper edge of the exclusion band:

EXband(upper) = BandRX(upper) + nBWRX

Where n = multiple of whole bandwidths required to define exclusion band.

Bandwidth of Receiver is the occupied bandwidth of the corresponding transmitter signal.

Where the present document is being used in a stand-alone basis (i.e. with no reference to other relevant radio technology parts of ETSI EN 301 489 series), the value of n shall be 1

For EN301489-17

The frequencies on which the transmitter part of the EUT is intended to operate shall be excluded from conducted and radiated emission measurements when performed in transmit mode of operation.

The exclusion band for immunity testing of equipment operating in the 2,4 GHz band shall be:
lower limit of exclusion band = lowest allocated band edge frequency -120 MHz, i.e. 2 280 MHz;
upper limit of exclusion band = highest allocated band edge frequency +120 MHz, i.e. 2 603,5MHz.

The exclusion band for immunity testing of equipment operating in the 5 GHz Wi-Fi band shall be:
ower limit of exclusion band = lowest allocated band edge frequency -270 MHz, i.e. 4 880 MHz;
upper limit of exclusion band = highest allocated band edge frequency +270 MHz, i.e. 5 995 MHz.

The exclusion band for immunity testing of equipment operating in the 5,8 GHz band shall be:
lower limit of exclusion band = lowest allocated band edge frequency -270 MHz, i.e. 5 455 MHz;
as the immunity requirements have an upper frequency range of 6 GHz and any upper edge exclusion band would be greater than this for the 5,8 GHz band. The above frequency shall also be regarded as the upper end of the test range.

2. Radio Disturbance

EN 301 489-17
EN 55032 Class B

2.1 Test Configuration:

Refer to EN 301 489-1, Section 8.1.

2.2 Special Conditions:

EN 301489-17
No special conditions shall apply to UE in the scope of the present document.

2.3 Summary of Test Results

Test Items	Reference section	Result
Enclosure of ancillary equipment measured on a stand alone basis, EN 55032, Class B	EN 301 489-1 Section 8.2 EN 55032 Annex A.2	PASS
DC mains power input/output ports	EN 301 489-1 Section 8.3	N/A
AC mains power input/output ports EN55032, Class B	EN 301 489-1 Section 8.4 EN 55032 Annex A.3	PASS
Harmonic current emission, Class A	EN 301 489-1 Section 8.5 EN 61000-3-2	N/A
Voltage fluctuations and flicker	EN 301 489-1 Section 8.6 EN 61000-3-3	N/A
Telecommunication Port	EN 301 489-1 Section 8.7 EN 55032 Annex B.2	N/A

2.4 Enclosure of ancillary equipment measured on a standalone basis.

2.4.1 Test Method:

Standard	Description
EN 55032:2015+AC:2016	Electromagnetic compatibility of multimedia equipment – Emission requirements

Limits: ClassB

Frequency range MHz	Measurement		Class B limits dB(μV/m)
	Distance m	Detector type/ bandwidth	OATS/SAC
30 – 230	10	Quasi Peak / 120 kHz	30
230 – 1000	10		37
30 – 230	3		40
230 – 1000	3		47

Frequency range MHz	Measurement		Class B limits dB(μV/m)
	Distance m	Detector type/ bandwidth	FSOATS
1000 – 3000	3	Average / 1 MHz	50
3000 – 6000			54
1000 – 3000		Peak / 1 MHz	70
3000 – 6000			74

Highest internal frequency (Fx)	Highest measured frequency
Fx ≤ 108 MHz	1 GHz
108 MHz < Fx ≤ 500 MHz	2 GHz
500 MHz < Fx ≤ 1 GHz	5 GHz
Fx > 1 GHz	5 × Fx up to a maximum of 6 GHz
NOTE 1 For FM and TV broadcast receivers, Fx is determined from the highest frequency generated or used excluding the local oscillator and tuned frequencies. NOTE 2 Fx is defined in 3.1.19. of EN 55032	

The highest internal source of an EUT is above 1GHz.

2.4.2 Test Procedure:

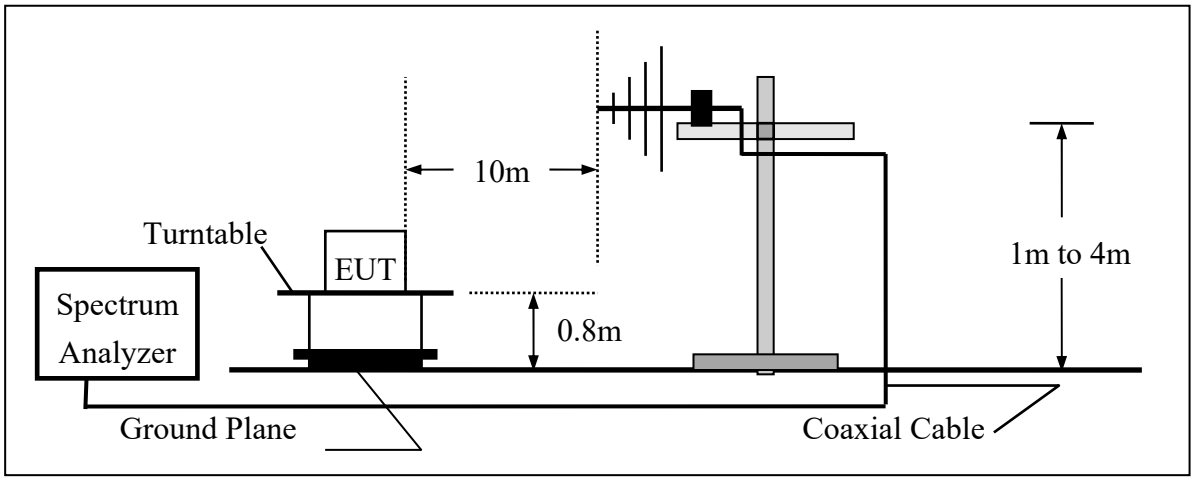
1. EUT was placed on an 0.8m wooden table.
2. Set up EUT with support units and turn on the power of all equipment.
3. Link the EUT with Telecommunication tester, setup the test mode. The transmitter operating at continuously mode and max output rated power.
4. The receive antenna is placed at 10m or 3m (3m for above 1GHz) distance from the EUT and search height from 1-4m.
5. The turntable was slowly rotated to locate the direction of maximum emission. Once maximum direction is determined, the search antenna was raised and lowered in both vertical and horizontal polarizations.

2.4.3 Test Instruments:

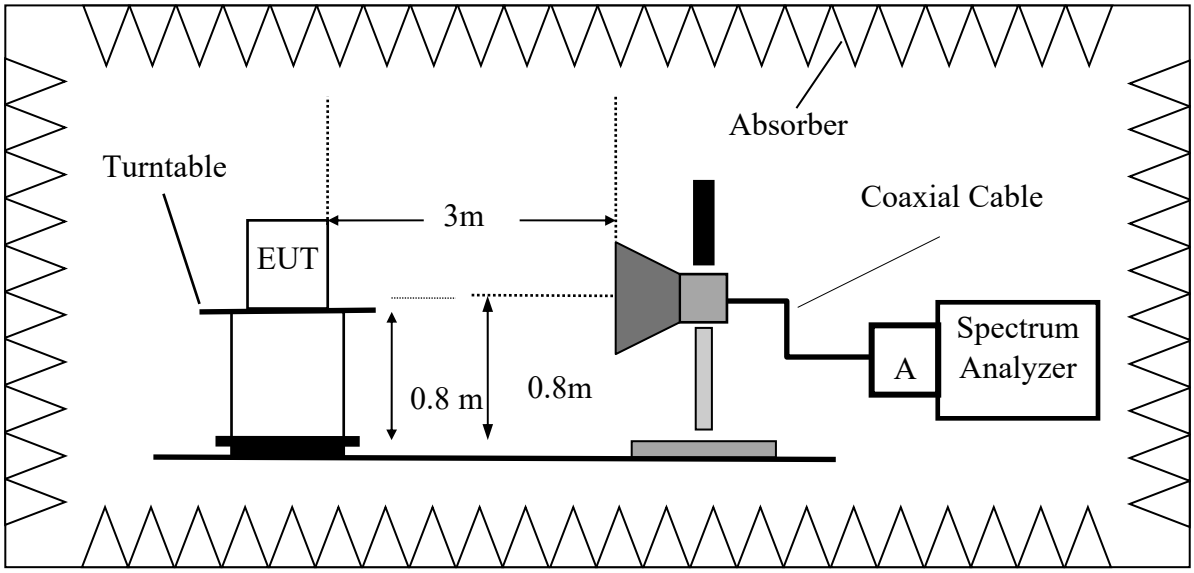
Refer to section 1.7 in this report

2.4.4 Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz

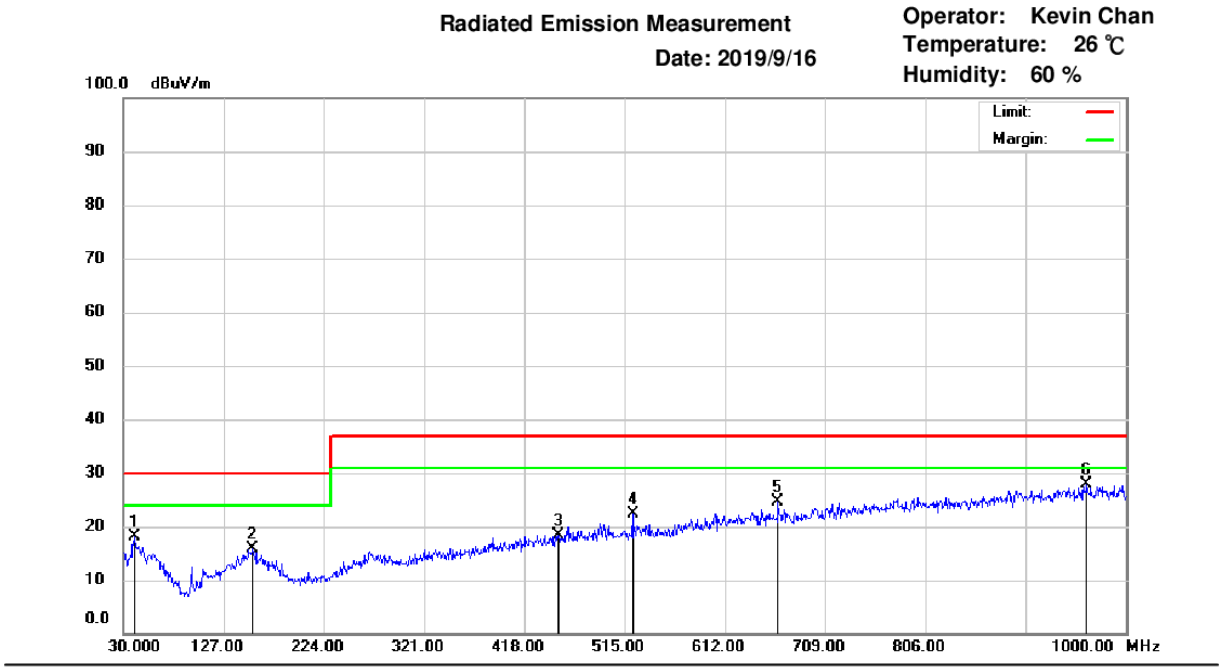


(B) Radiated Emission Test Set-UP Frequency Over 1 GHz

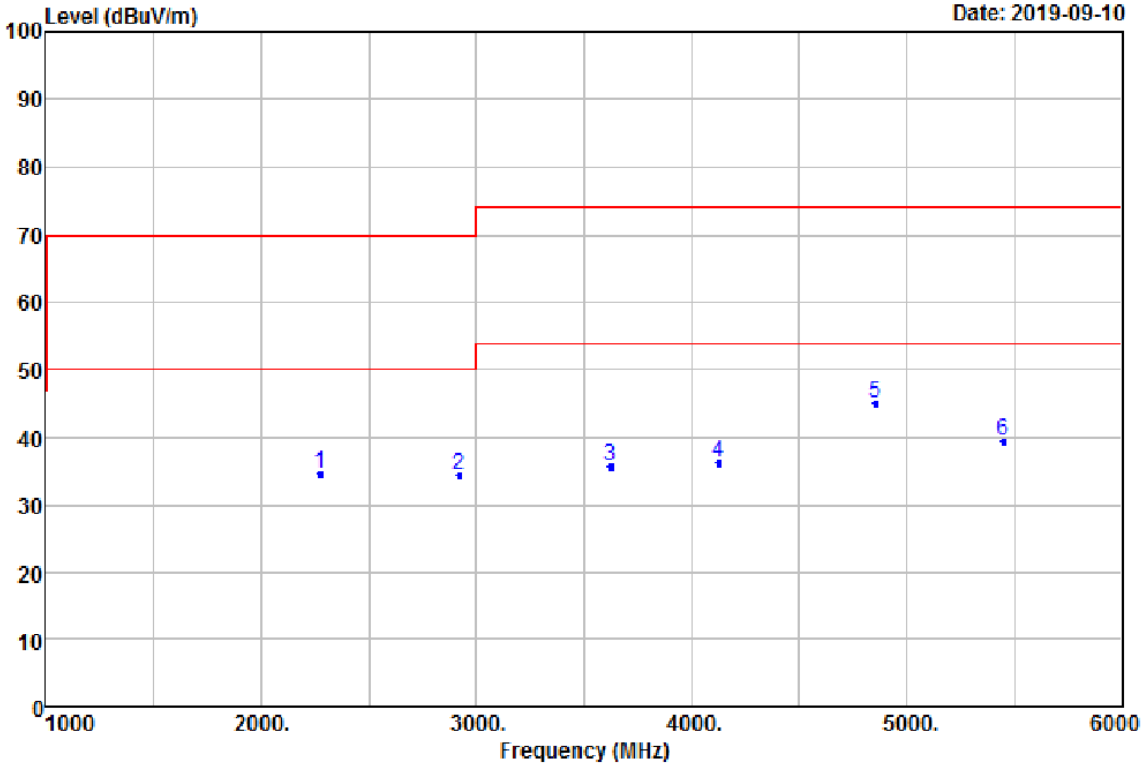


Radiated Emission Measurement Data

Operation Mode	Config 1



Mk.	Frequency (MHz)	RX_R (dBuV)	Correct Factor(dB/m)	Emission (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.Pos (cm)	Tab.Pos (deg.)	Detector
1	40.67	35.72	-17.70	18.02	30.00	-11.98	100	124	peak
2	155.13	31.65	-15.84	15.81	30.00	-14.19	100	0	peak
3	450.98	29.09	-10.62	18.47	37.00	-18.53	100	74	peak
4	522.76	31.98	-9.59	22.39	37.00	-14.61	100	145	peak
5	663.41	31.44	-6.86	24.58	37.00	-12.42	100	114	peak
6	962.17	30.19	-2.20	27.99	37.00	-9.01	100	71	peak

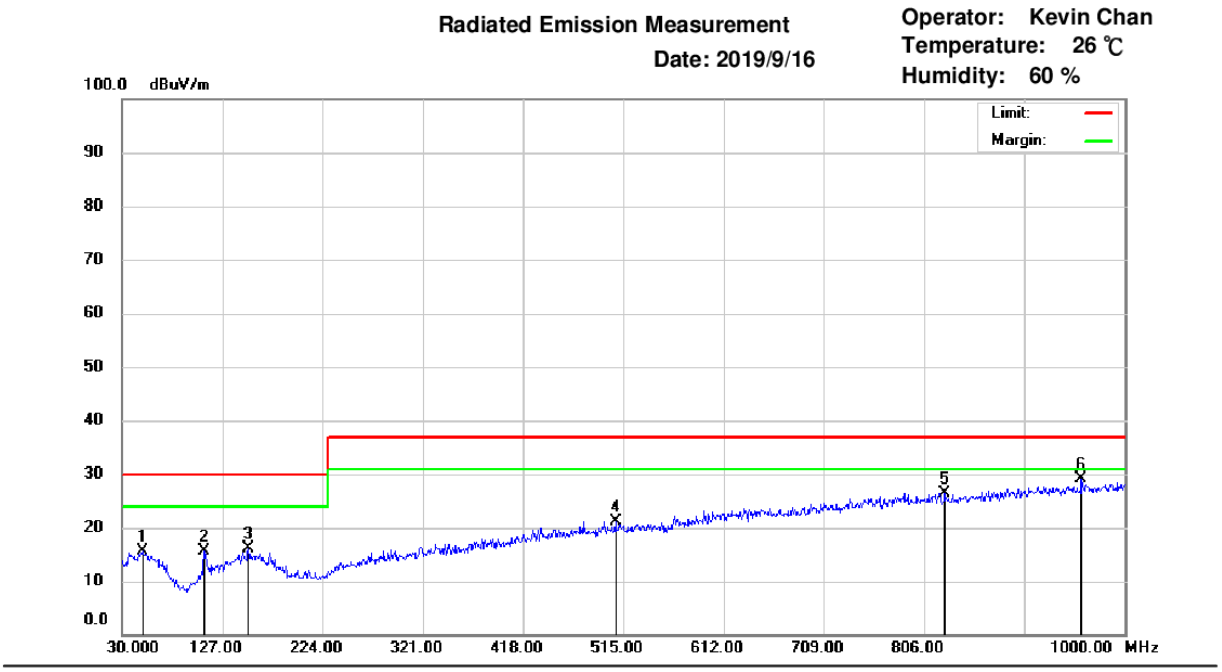


Condition: 55022/32 B PK 3m VERTICAL
Site : Chamber 19

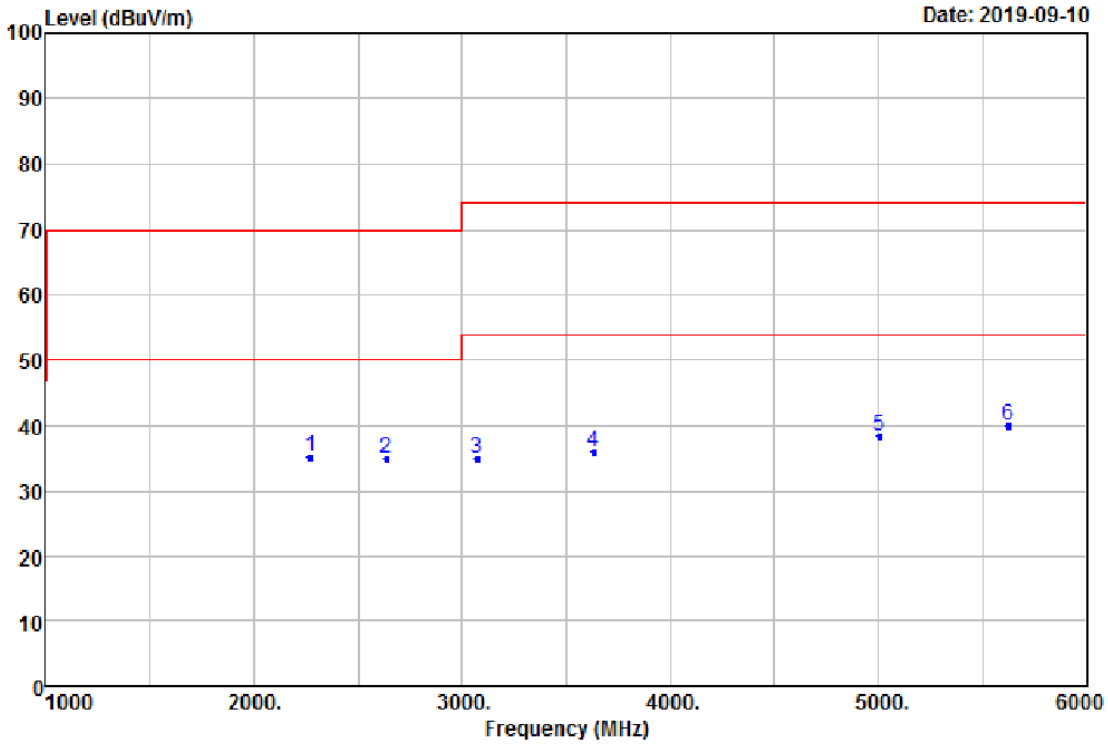
Operator : jason

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark	Pol/Phase
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	2275.00	50.32	-15.74	34.58	70.00	-35.42	Peak	VERTICAL
2	2920.00	49.34	-14.97	34.37	70.00	-35.63	Peak	VERTICAL
3	3625.00	49.17	-13.36	35.81	74.00	-38.19	Peak	VERTICAL
4	4125.00	48.05	-11.69	36.36	74.00	-37.64	Peak	VERTICAL
5	4855.00	54.28	-9.28	45.00	74.00	-29.00	Peak	VERTICAL
6	5450.00	47.34	-7.86	39.48	74.00	-34.52	Peak	VERTICAL

Operation Mode	Config 1



Mk.	Frequency (MHz)	RX_R (dBuV)	Correct Factor(dB/m)	Emission (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.Pos (cm)	Tab.Pos (deg.)	Detector
1	49.40	32.50	-16.92	15.58	30.00	-14.42	200	318	peak
2	109.54	35.32	-19.67	15.65	30.00	-14.35	370	360	peak
3	152.22	32.08	-16.00	16.08	30.00	-13.92	100	341	peak
4	507.24	31.06	-9.82	21.24	37.00	-15.76	300	325	peak
5	826.37	30.64	-4.17	26.47	37.00	-10.53	400	327	peak
6	958.29	31.47	-2.26	29.21	37.00	-7.79	100	135	peak



Condition: 55022/32 B PK 3m HORIZONTAL
Site : Chamber 19

Operator : jason

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark	Pol/Phase
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	2270.00	50.90	-15.75	35.15	70.00	-34.85	Peak	HORIZONTAL
2	2635.00	50.39	-15.48	34.91	70.00	-35.09	Peak	HORIZONTAL
3	3070.00	49.46	-14.53	34.93	74.00	-39.07	Peak	HORIZONTAL
4	3630.00	49.37	-13.34	36.03	74.00	-37.97	Peak	HORIZONTAL
5	5005.00	47.22	-8.90	38.32	74.00	-35.68	Peak	HORIZONTAL
6	5625.00	47.17	-7.30	39.87	74.00	-34.13	Peak	HORIZONTAL

2.5 DC power input/output ports measurement.

2.5.1 Test Method:

Standard	Description
EN 55032:2015+AC:2016	Electromagnetic compatibility of multimedia equipment – Emission requirements

Refer to section 8.3.2 of EN301489-1 for detail.

2.5.2 Limit:

Frequency range	Limit (quasi-peak) (dBµV)	Limit (average) (dBµV)
0,15 MHz to 0,5 MHz	66 to 56	56 to 46
> 0,5 MHz to 5 MHz	56	46
> 5 MHz to 30 MHz	60	50
NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.		

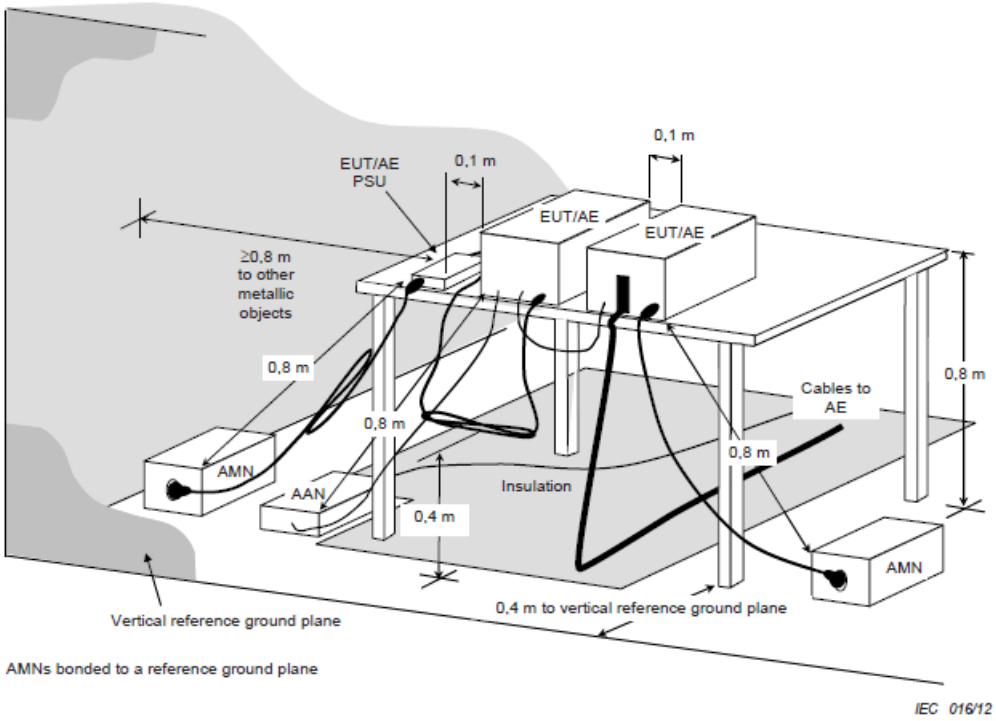
2.5.3 Test Procedure:

1. EUT was placed on an 0.8m wooden table above ground plane.
2. Set up EUT with support units and turn on the power of all equipment.
3. Link the EUT with Telecommunication tester, setup the test mode. The transmitter operating at continuously mode and max output rated power.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. Repeat above procedures until all frequency measured were complete.

2.5.4 Test Instruments:

Refer to section 1.7 in this report

2.5.5 Test SET-UP (Block Diagram of Configuration)



2.5.6 Measurement Result:

N/A,

2.6 AC Mains power input/output ports measurement.

2.6.1 Test Method:

Standard	Description
EN 55032:2015+AC:2016	Electromagnetic compatibility of multimedia equipment – Emission requirements

Refer to section 8.4.2 of EN301489-1 and 55032 Annex A for detail.

2.6.2 Limit: Refer to 2.5.2

2.6.3 Test Procedure: Refer to 2.5.3

2.6.4 Test Instruments: Refer to 2.5.4

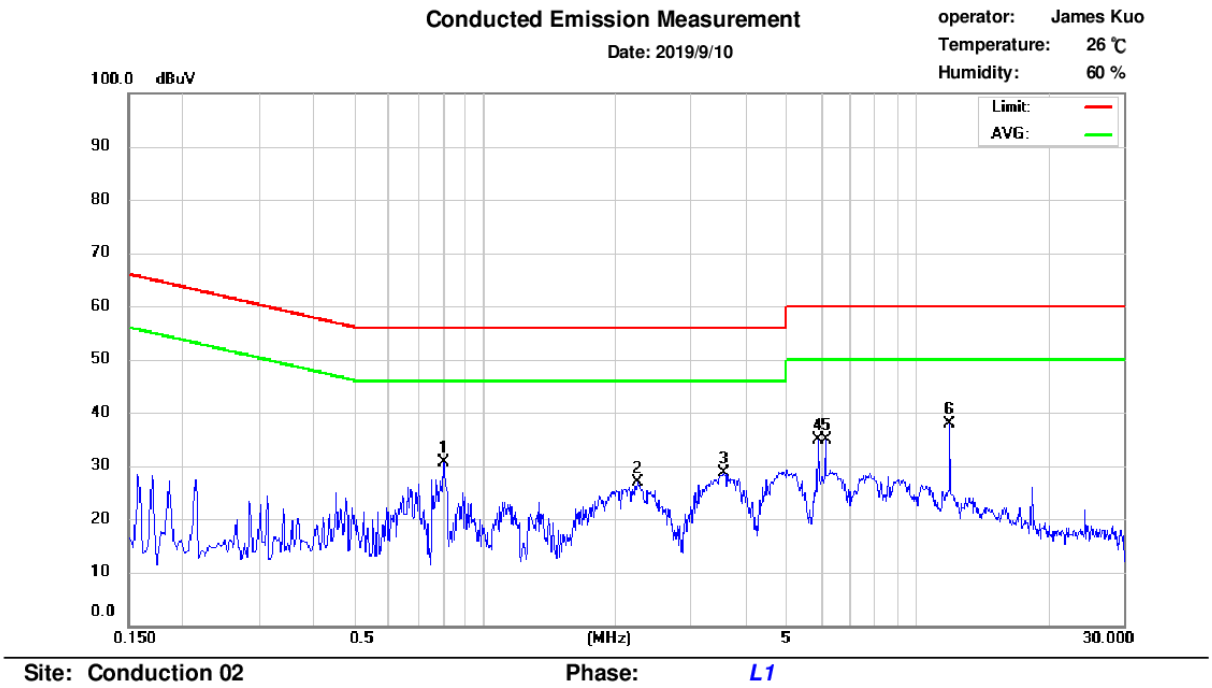
2.6.5 Conduction Emission Test Set-up: Refer to 2.5.5

2.6.6 Measurement Result:

Refer to next page for details.

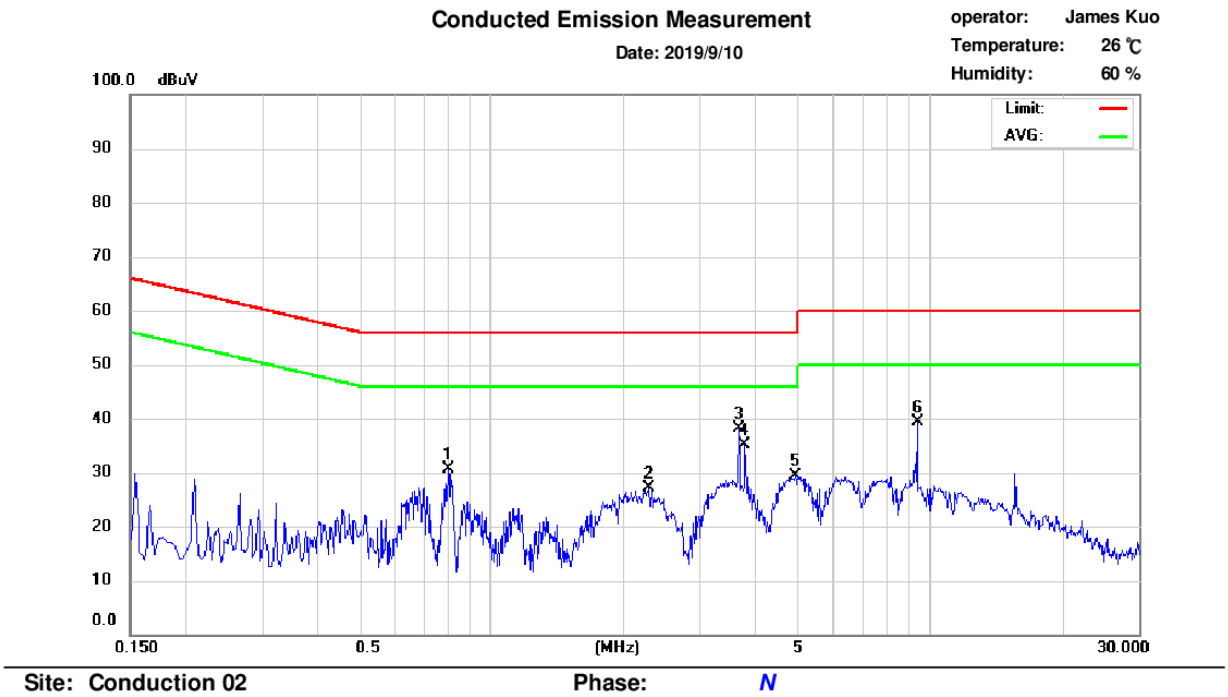
2.6.7 Measurement Data:

Operation Mode:	Config 1



No.	Frequency (MHz)	QP_R (dBuV)	AVG_R (dBuV)	Correct Factor (dB)	QP Emission (dBuV)	QP Limit (dBuV)	QP Margin (dB)	AVG Emission (dBuV)	AVG Limit (dBuV)	AVG Margin (dB)
1	0.802	16.35	7.45	9.65	26.00	56.00	-30.00	17.10	46.00	-28.90
2	2.250	12.39	4.17	9.70	22.09	56.00	-33.91	13.87	46.00	-32.13
3	3.578	14.29	5.68	9.73	24.02	56.00	-31.98	15.41	46.00	-30.59
4	5.902	11.12	2.41	9.77	20.89	60.00	-39.11	12.18	50.00	-37.82
5	6.138	14.41	5.50	9.78	24.19	60.00	-35.81	15.28	50.00	-34.72
6	11.902	11.11	2.52	9.87	20.98	60.00	-39.02	12.39	50.00	-37.61

Operation Mode:	Config 1



No.	Frequency (MHz)	QP_R (dBuV)	AVG_R (dBuV)	Correct Factor (dB)	QP Emission (dBuV)	QP Limit (dBuV)	QP Margin (dB)	AVG Emission (dBuV)	AVG Limit (dBuV)	AVG Margin (dB)
1	0.798	17.65	7.41	9.67	27.32	56.00	-28.68	17.08	46.00	-28.92
2	2.290	12.13	3.13	9.72	21.85	56.00	-34.15	12.85	46.00	-33.15
3	3.678	13.39	4.53	9.75	23.14	56.00	-32.86	14.28	46.00	-31.72
4	3.798	14.07	3.87	9.76	23.83	56.00	-32.17	13.63	46.00	-32.37
5	4.934	14.72	5.60	9.78	24.50	56.00	-31.50	15.38	46.00	-30.62
6	9.386	11.85	2.83	9.88	21.73	60.00	-38.27	12.71	50.00	-37.29

2.7 Harmonic Current Emissions (AC mains input port) measurement. Refer to EN 301 489-1 Section 8.5

2.7.1 Test Method: Refer to 61000-3-2:2014 and IEC 61000-3-2:2014

2.7.2 Limit

Table 1 – Limits for 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
$15 \le n \le 39$	$0,15 \frac{15}{n}$
Even harmonics	
2	1,08
4	0,43
6	0,30
$8 \le n \le 40$	$0,23 \frac{8}{n}$

Note :For Class B equipment, the harmonics of the input current shall not exceed the values given in table 1 multiplied by a factor of 1,5.

Table 2 – Limits for Class C equipment

Harmonic order n	Maximum permissible harmonic currrent expressed as a percentage of the input current at the fundamental frequency %
2	2
3	30 · λ *
5	10
7	7
9	5
11 ≤ n ≤ 39 (odd harmonics only)	3
* λ is the circuit power factor	

Table 3 – Limits for 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

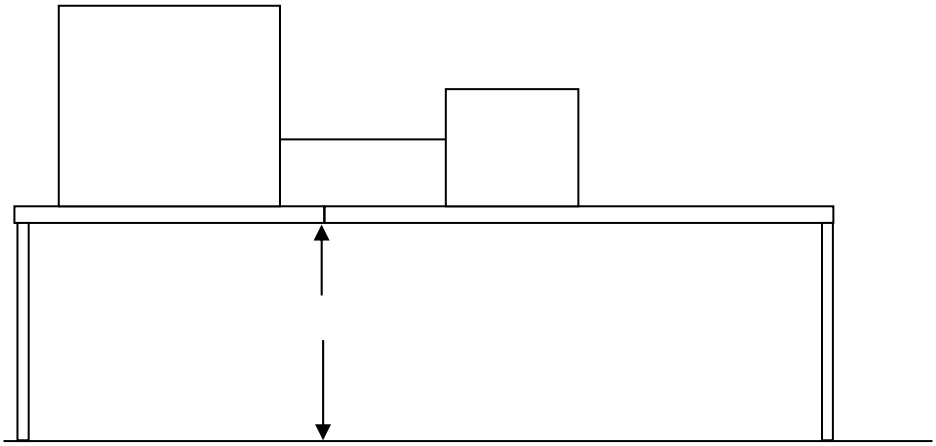
2.7.3 Test Procedure:

The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the maximum harmonic components under normal operating conditions for each successive harmonic component in turn.

2.7.4 Test Instruments:

Refer to section 1.7 in this report

2.7.5 Test Set-up



2.7.6 Measurement Result:

N/A

2.8 Voltage Fluctuations and Flicker (AC mains input port) measurement. Refer to EN 301 489-1 Section 8.6

2.8.1 Test Method: Refer to EN 61000-3-3:2013 and IEC 61000-3-3:2013

2.8.2 Limit

TEST ITEM	LIMIT
P_{st}	1.0
P_{lt}	0.65
D(t)(ms)	500ms
d_{max} (%)	4%
dc (%)	3.3%

2.8.3 Test Procedure:

The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the most unfavorable sequence of voltage changes under normal operating conditions.

2.8.4 Test Instruments:

Refer to section 1.7 in this report

2.8.5 Test Set-up

Refer to 2.7.5

2.8.6 Measurement Result: N/A

2.9 Telecommunication Port measurement. Refer to EN 301 489-1 Section 8.7

2.9.1 Test Method:

Standard	Description
EN 55032:2015+AC:2016	Electromagnetic compatibility of multimedia equipment – Emission requirements

Refer to section 8.7.2 of EN301489-1 for detail.

2.9.2 Limit: Limits for conducted emissions from telecommunication ports

Frequency range	**Voltage limits**		**Current limits**	
	Quasi-peak	Average	Quasi-peak	Average
0.15 MHz to 0.5 MHz	84 dBµV to 74 dBµV	74 dBµV to 64 dBµV	40 dBµA to 30 dBµA	30 dBµA to 20 dBµA
0.5 MHz to 30 MHz	74 dBµV	64 dBµV	30 dBµA	20 dBµA
NOTE 1: The limits decrease linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz. NOTE 2: The current and voltage disturbance limits are derived for use with an Impedance Stabilization Network (ISN) which presents a common mode (asymmetric mode) impedance of 150 Ωto the telecommunication port under test (conversion factor is 20 log10 150/I = 44dB NOTE 3: The emission requirement only applies to telecommunication ports as specified in EN 55032 . The provisional relaxation of 10 dB will be reviewed no later than 3 years after the date of withdrawal based on the results and interference cases seen in this period. Wherever possible it is recommended to comply with the limits without the provisional relaxation.				

2.9.3 Test Procedure: Refer to EN 55032

2.9.4 Test Instruments: Refer to 2.5.4

2.9.5 Conduction Emission Test Set-up: Refer to 2.5.5

2.9.6 Measurement Result: N/A

3.IMMUNITY

EN 301 489-17

3.1 Test Configuration:

Refer to EN 301 489-1, Section 9.1.

3.2 Special Conditions:

EN301489-17

No special conditions shall apply to UE in the scope of the present document.

3.3 Summary of Test Results:

Test Items	Reference Section	Result
Electrostatic discharge	EN 301 489-1 Section 9.3 EN 55024 Section 4.2.1	PASS
Radio frequency electromagnetic filed (80 to 6000MHz)	EN 301 489-1 Section 9.2 EN 55024 Section 4.2.3.1	PASS
Fast transients, common mode	EN 301 489-1 Section 9.4 EN 55024 Section 4.2.2	N/A
Surges	EN 301 489-1 Section 9.8 EN 55024 Section 4.2.5	N/A
Radio Frequency, common mode	EN 301 489-1 Section 9.5 EN 55024 Section 4.2.3.2	N/A
Voltage Dips and interruptions	EN 301 489-1 Section 9.7	N/A
Transients and surges in the vehicular environment	EN 301 489-1 Section 9.6	N/A

3.4 Performance Criteria Description:

3.4.1 EN301 489-17

The performance criteria are:
- performance criteria A for immunity tests with phenomena of a continuous nature;
- performance criteria B for immunity tests with phenomena of a transient nature;
- performance criteria C for immunity tests with power interruptions exceeding a certain time.

The equipment shall meet the minimum performance criteria as specified in the following table.

Criteria	During test	After test (i.e. as a result of the application of the test)
A	• Shall operate as intended. (See note). • Shall be no loss of function. • Shall be no unintentional transmissions.	• Shall operate as intended. • Shall be no degradation of performance. • Shall be no loss of function. • Shall be no loss of critical stored data.
B	• May be loss of function.	• Functions shall be self-recoverable. • Shall operate as intended after recovering. • Shall be no loss of critical stored data.
C	• May be loss of function.	• Functions shall be recoverable by the operator. • Shall operate as intended after recovering. • Shall be no loss of critical stored data.
NOTE	Operate as intended during the test allows a level of degradation: Minimum performance level: • For equipment that supports a PER or FER, the minimum performance level shall be a PER or FER less than or equal to 10 %. • For equipment that does not support a PER or a FER, the minimum performance level shall be no loss of the wireless transmission function needed for the intended use of the equipment.	

Performance criteria for Continuous phenomena
The performance criteria A shall apply.

Where the EUT is a transmitter in standby mode, unintentional transmission shall not occur during the test.

Performance criteria for Transient phenomena
The performance criteria B shall apply, except for voltage dips greater than or equal to 100 ms and voltage interruptions of 5000 ms duration, for which performance criteria C shall apply.

Where the EUT is a transmitter in standby mode, unintentional transmission shall not occur as a result of the application of the test.

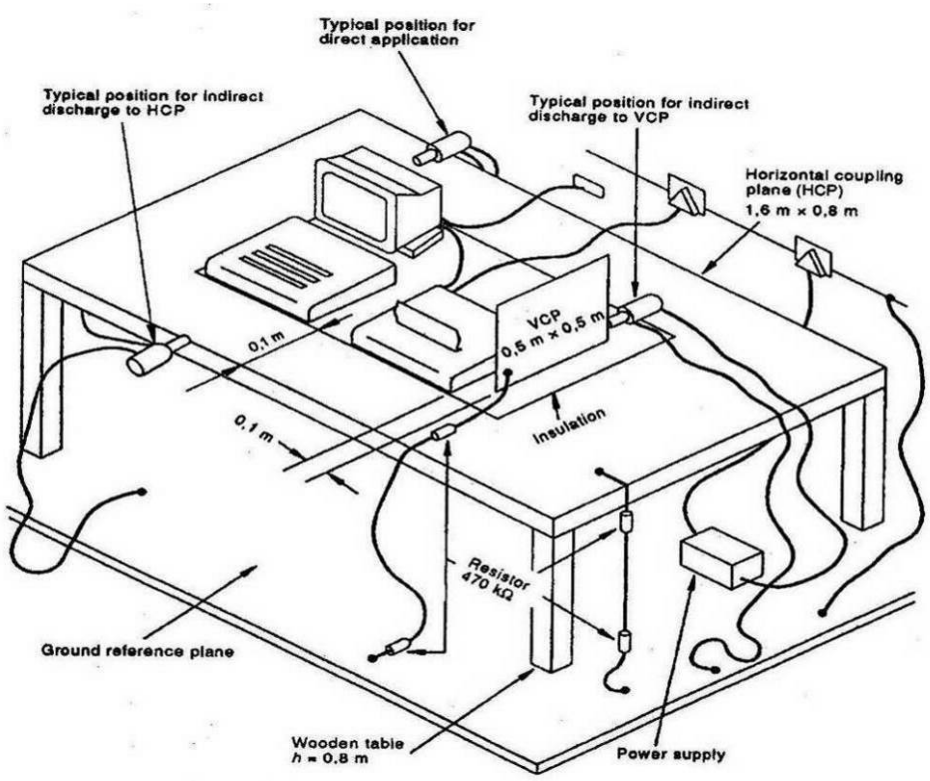
3.5 Electrostatic Discharge Measurement. Refer to EN 301 489-1 Section 9.3

3.5.1 Test Method and Procedure:
EN61000-4-2 and EN 301 489-1 Section 9.3.2.

3.5.2 Performance criteria:
Refer to EN 301 489-1 Section 9.3.3.

3.5.3 Test Instruments:
Refer to section 1.7 in this report

3.5.4 Test SET-UP (Block Diagram of Configuration)



3.5.5 Measurement Result:

Operation Mode:	Config 1,2	Test Date:	2019/9/11
Temperature:	24 ℃	Humidity:	45%
		Test By:	Jason

Basic Standard : EN61000-4-2
Discharge Impedance : 330 ohm / 150 pF
Discharge Voltage : Air Discharge:+/- 2 ~ 8 kV
Contact Discharge:+/- 2 ~ 4 kV
VCP/HCP:+/- 2 ~ 4 kV
Polarity : Positive/Negative
Number of Discharge : Minimum 10/50 times at each test point
Discharge Mode : Single Discharge
Discharge Period : 1 second minimum

Note 1:For contact discharge, the EUT shall be exposed to at least 50 discharges, 25 each at negative and positive polarity. For air discharge, A minimum of 10 single air discharges shall be applied

Note 2: Test point refer to test report Appendix 1

Air Discharge							
Test Levels						Results	
±2kV	Performance Criterion	±4kV	Performance Criterion	± 8kV	Performance Criterion	Pass	Fail
☐	☐A ☐B ☐C	☐	☐A ☐B ☐C	☐	☐A ☐B ☐C	☐	☐

Contact Discharge							
Test Levels						Results	
±2kV	Performance Criterion	±4kV	Performance Criterion	± 6kV	Performance Criterion	Pass	Fail
☒	☒A ☐B ☐C	☒	☒A ☐B ☐C	☐	☐A ☐B ☐C	☒	☐

Discharge To VCP							
Test Levels						Results	
±2kV	Performance Criterion	±4kV	Performance Criterion	± 6kV	Performance Criterion	Pass	Fail
☒	☒A ☐B ☐C	☒	☒A ☐B ☐C	☐	☐A ☐B ☐C	☒	☐

Discharge To HCP							
Test Levels						Results	
±2kV	Performance Criterion	±4kV	Performance Criterion	± 6kV	Performance Criterion	Pass	Fail
☒	☒A ☐B ☐C	☒	☒A ☐B ☐C	☐	☐A ☐B ☐C	☒	☐

Remark:

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

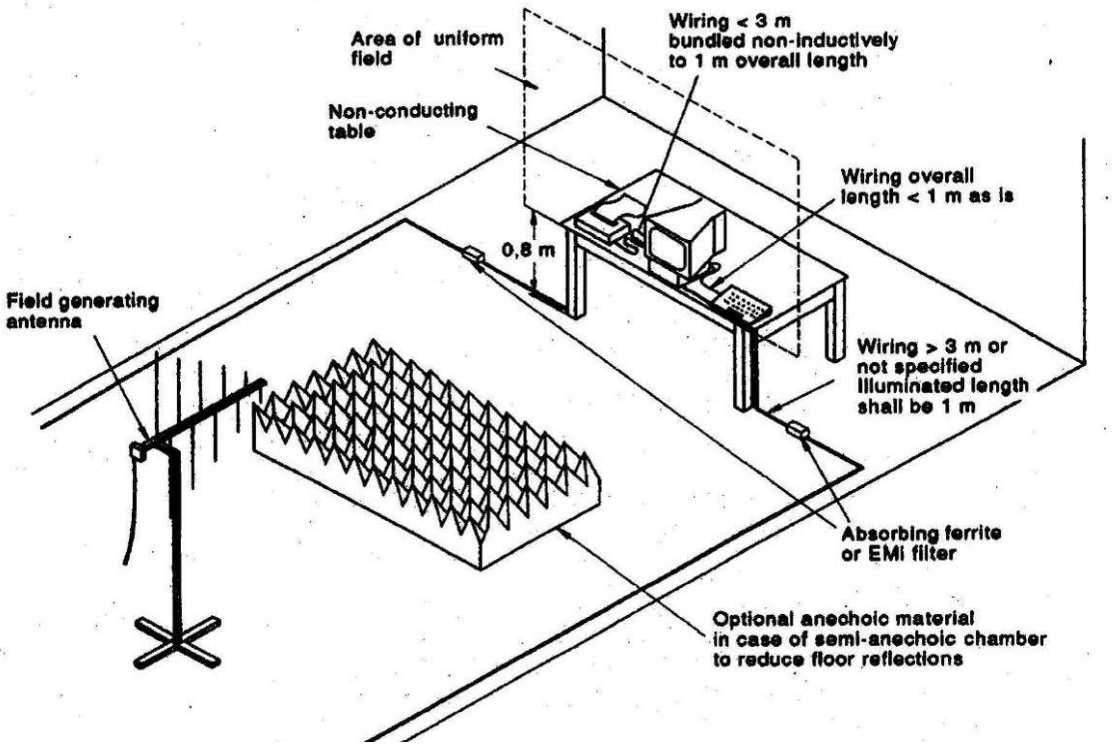
3.6 Radio Frequency Electromagnetic Filed (80MHz to 6GHz) Measurement. Refer to EN 301 489-1 Section 9.2

3.6.1 Test Method and Procedure:
EN61000-4-3 and EN 301 489-1 Section 9.2.2.

3.6.2 Performance criteria:
Refer to EN 301 489-1 Section 9.2.3.

3.6.3 Test Instruments:
Refer to section 1.7 in this report

3.6.4 Test SET-UP (Block Diagram of Configuration):
Test setup:



3.6.5 Measurement Result:
Refer to below for results.

3.6.6 Measurement Data:

Operation Mode:	Config 1,2	Test Date:	2019/9/11
Temperature:	25 ℃	Humidity:	50 %
		Test By:	Jason

Basic Standard : EN61000-4-3
Frequency range : 80 to 6000 MHz
Field strength : 3 V/m
Modulation : AM 80%, 1 kHz Sinewave
Frequency step : 1 % of fundamental
Polarity of Antenna : Horizontal and Vertical
Test distance : 3 m (EUT to antenna reference point)

No.	Frequency (MHz)	Antenna Orientation	Observation	EUT Orientation
1	80 - 6000	Vertical/Horizontal	CT, CR and A, the EUT to be continuously received with no timeouts	0 degree
2	80 - 6000	Vertical/Horizontal		90 degree
3	80 - 6000	Vertical/Horizontal		180 degree
4	80 - 6000	Vertical/Horizontal		270 degree

Remark:

A : No degradation in the performance of the EUT was observed.
N/A : Not Applicable.

3.7 Fast Transients, Common Mode Measurement. Refer to EN 301 489-1 Section 9.4

3.7.1 Test Method and Procedure:

EN61000-4-4: 2012, and EN 301 489-1 Section 9.4.2.

3.7.2 Performance criteria:

Refer to EN 301 489-1 Section 9.4.3.

3.7.3 Test Instruments

Refer to section 1.7 in this report

3.7.4 Test SET-UP (Block Diagram of Configuration):

Refer to Appendix 2 setup photo

3.7.5 Measurement Result:

N/A

3.8 Surges Measurement. Refer to EN 301 489-1 Section 9.8

3.8.1 Test Method and Procedure:

EN61000-4-5: 2014, and EN 301 489-1 Section 9.8.2.

3.8.2 Performance criteria:

Refer to EN 301 489-1 Section 9.8.3.

3.8.3 Test Instruments:

Refer to section 1.7 in this report

3.8.4 Test SET-UP (Block Diagram of Configuration):

Refer to Appendix 2 setup photo

3.8.5 Measurement Result:

N/A

3.9 Radio Frequency, Common Mode Measurement. Refer to EN 301 489-1 Section 9.5

3.9.1 Test Method and Procedure:

EN61000-4-6: 2014+AC:2015, and EN 301 489-1 Section 9.5.2.

3.9.2 Performance criteria:

Refer to EN 301 489-1 Section 9.5.3.

3.9.3 Test Instruments:

Refer to section 1.7 in this report

3.9.4 Test SET-UP (Block Diagram of Configuration):

Refer to Appendix 2 setup photo

3.9.5 Measurement Result:

N/A

3.10 Transients and surges in the vehicular environment measurement. Refer to EN 301 489-1 Section 9.6

3.10.1 Test Method and Procedure:

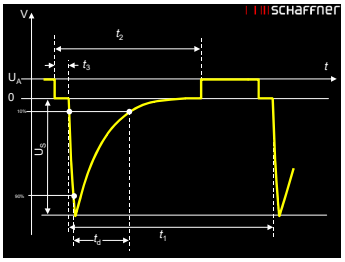
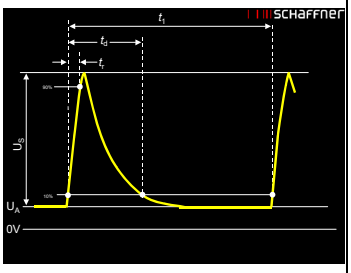
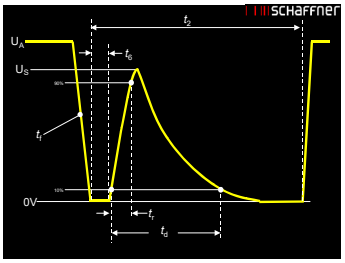
Refer to ISO 7637-2 for 12Vdc and 24Vdc equipment. , and EN 301 489-1 Section 9.6.2.

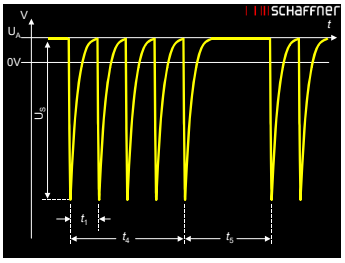
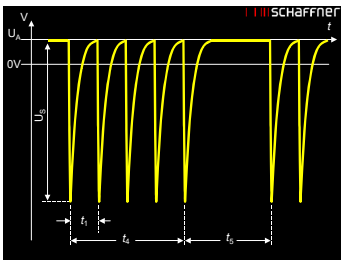
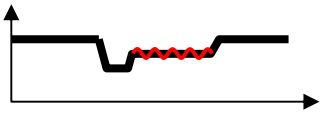
3.10.2 Performance criteria:

Refer to EN 301 489-1 Section 9.6.3.

3.10.3 Test Instruments:

Refer to section 1.7 in this report

Pulse	Us/Vs	Ri	Test parameters	Delay	Figure
ISO 7637-2 (2004) – Pulse 1	-450V	50.0 Ohm	td = 1.0ms, t1 = 2.5s, t2 = 200.0m	0.0 s	
ISO 7637-2 (2004) – Pulse 2A	37.5V	2.0 Ohm	td = 50.0us, t1 = 3.0s	0.0 s	
ISO 7637-2 (2004) – Pulse 2B	20.0V	0.0 Ohm	td = 1.0s	60.0 s	

ISO 7637-2 (2004) – Pulse 3A	-150V	50.0 Ohm	t1 = 100.0us, t4 = 10.0ms, t5 = 90.0ms	0.0 s	
ISO 7637-2 (2004) – Pulse 3B	150V	50.0 Ohm	t1 = 100.0us, t4 = 10.0ms, t5 = 90.0ms	0.0 s	
ISO 7637-2 (2004) – Pulse 4	-12V	0.0 Ohm	Ua = -5.0V, t7 = 70.0ms, t8 = 30.0ms, t9 + 10.0s, t10 = 10.0ms, t11 = 50.0ms	60.0 s	

3.10.4 Test SET-UP (Block Diagram of Configuration):

Refer to Appendix 2 setup photo.

3.10.5 Measurement Result:

N/A.

3.11 Voltage Dips and Interruptions Measurement. Refer to EN 301 489-1 Section 9.7

3.11.1 Test Method and Procedure:

EN61000-4-11: 2004, and EN 301 489-1 Section 9.7.2.

3.11.2 Performance criteria:

Refer to EN 301 489-1 Section 9.7.3.

3.11.3 Test Instruments

Refer to section 1.7 in this report

3.11.4 Test SET-UP:

Refer to Appendix 2 setup photo

3.11.5 Measurement Result:

N/A

APPENDIX 1

ESD TEST POINT

Photo 1

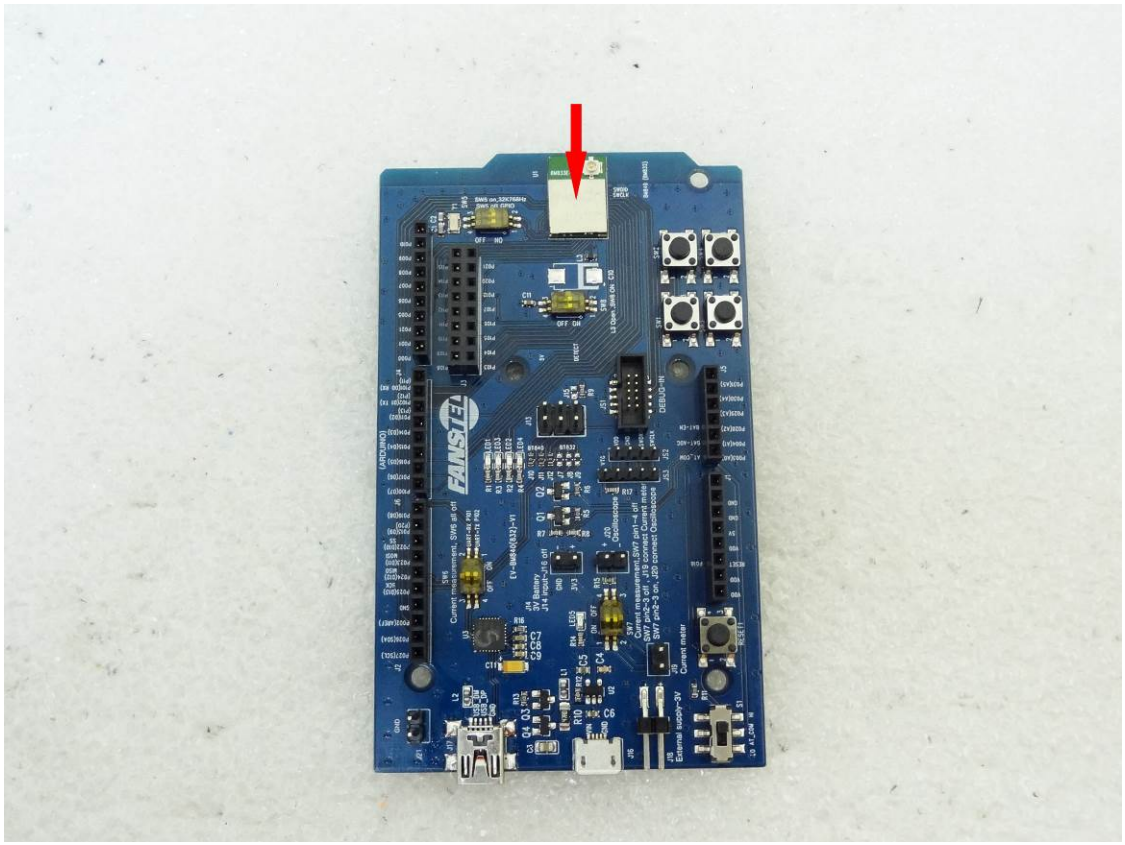


Photo 2

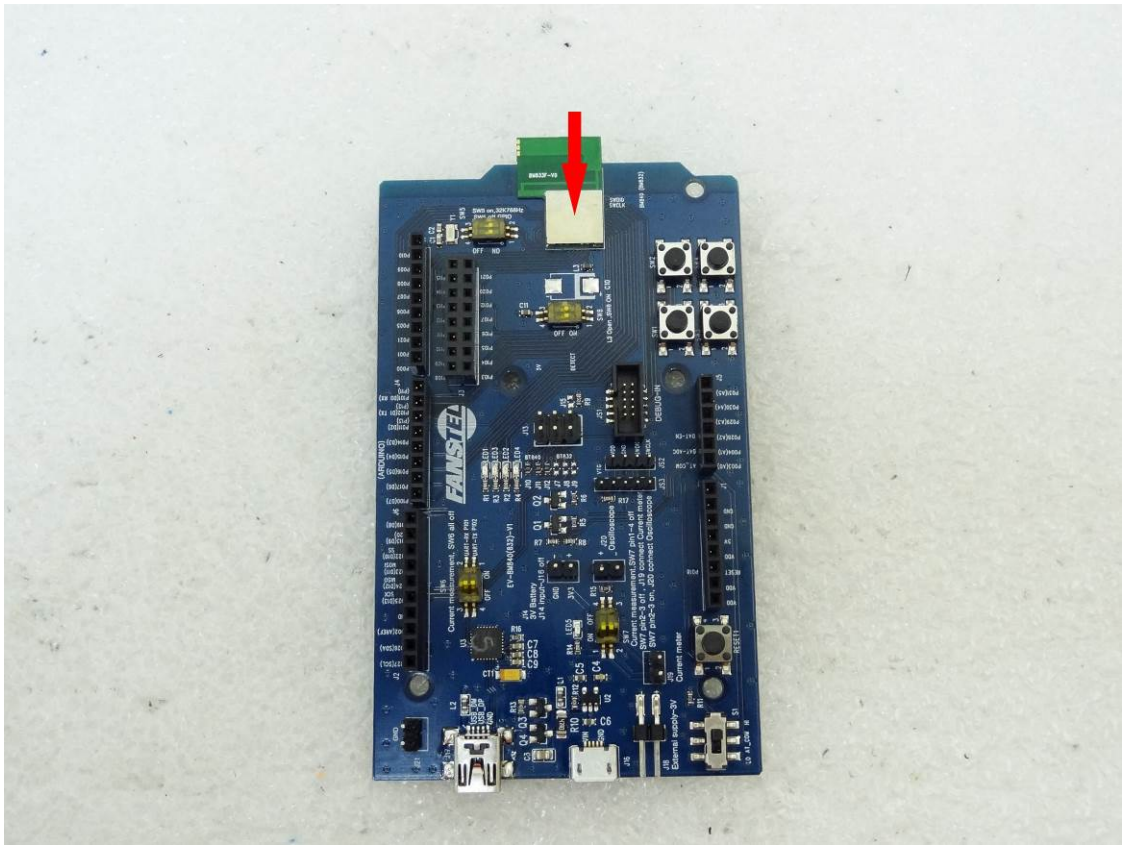
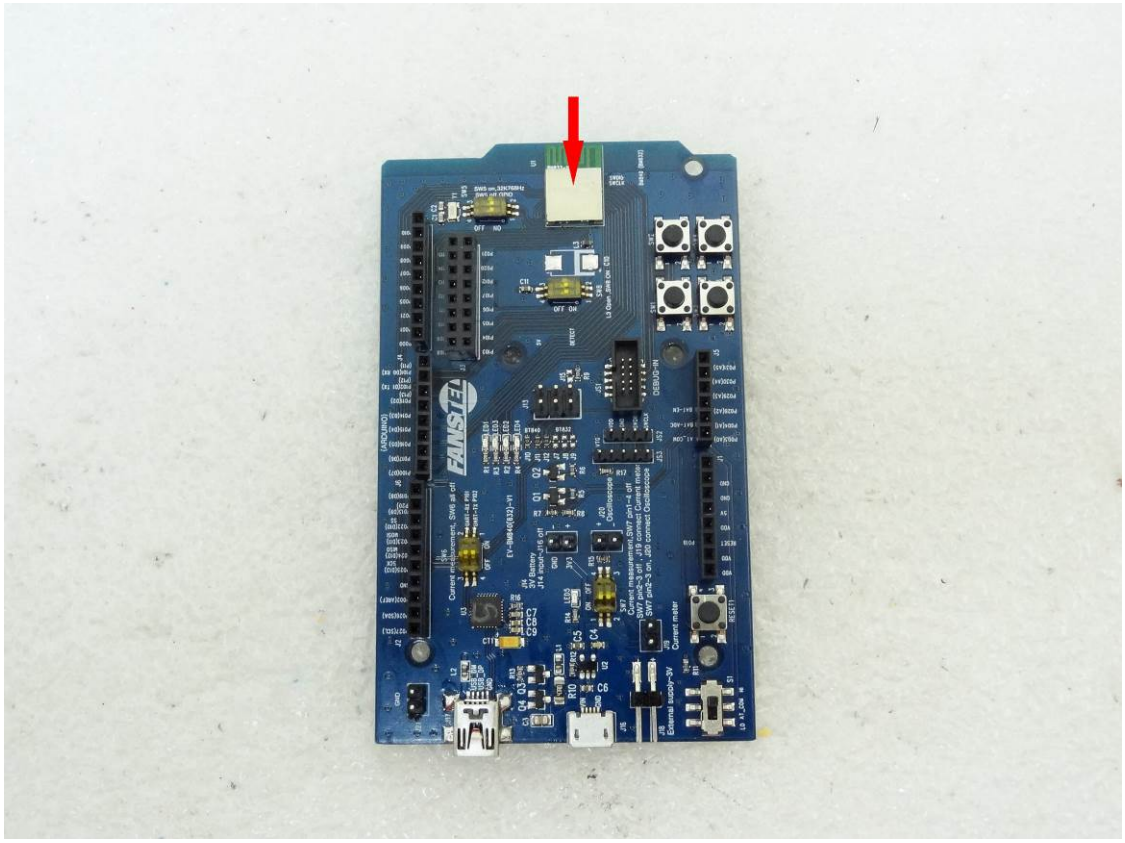


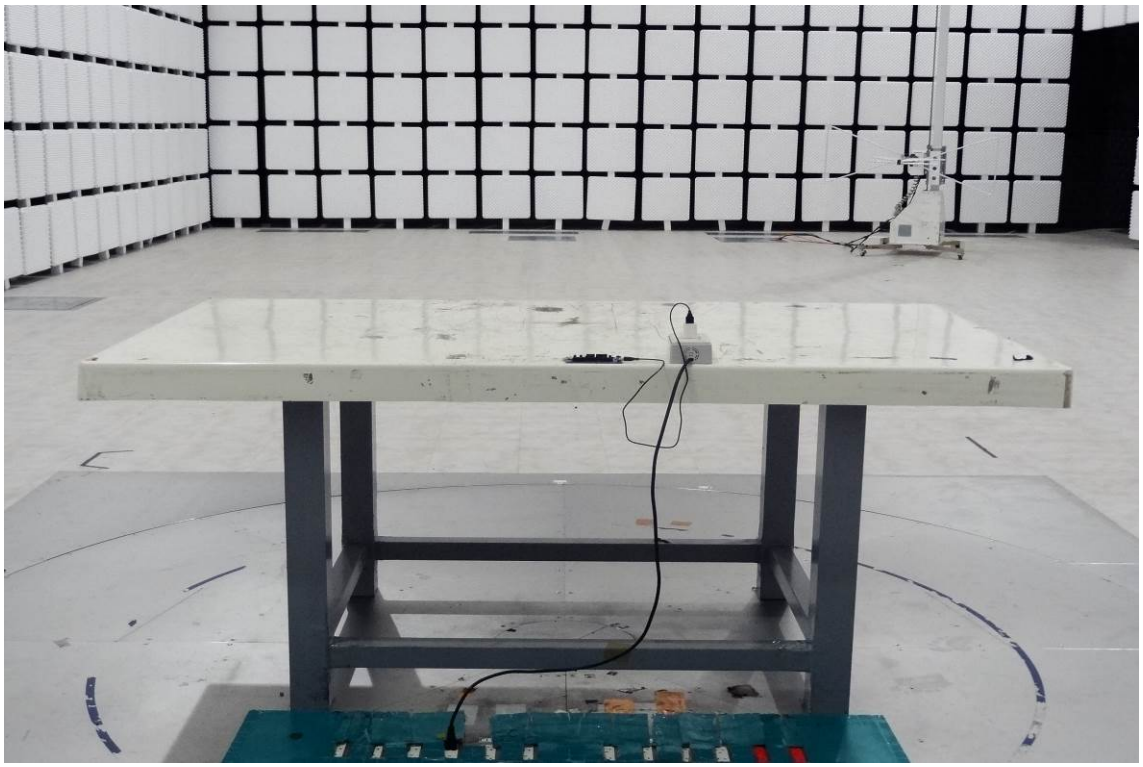
Photo 3

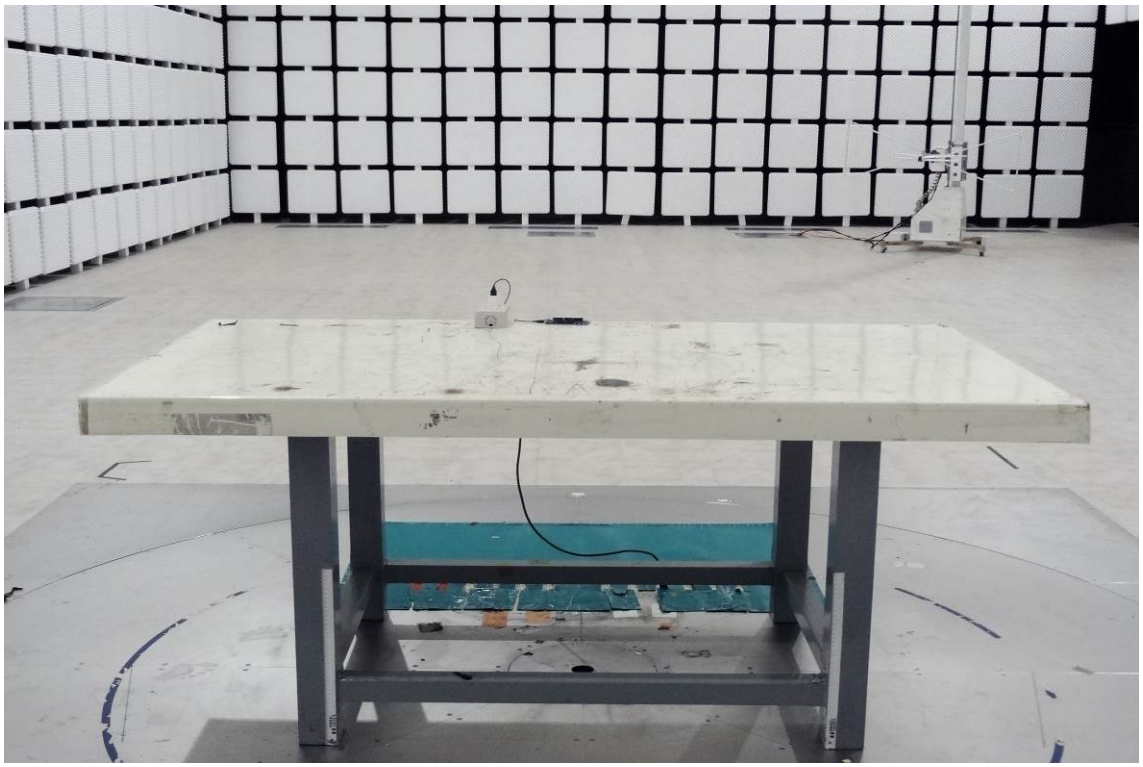


APPENDIX 2

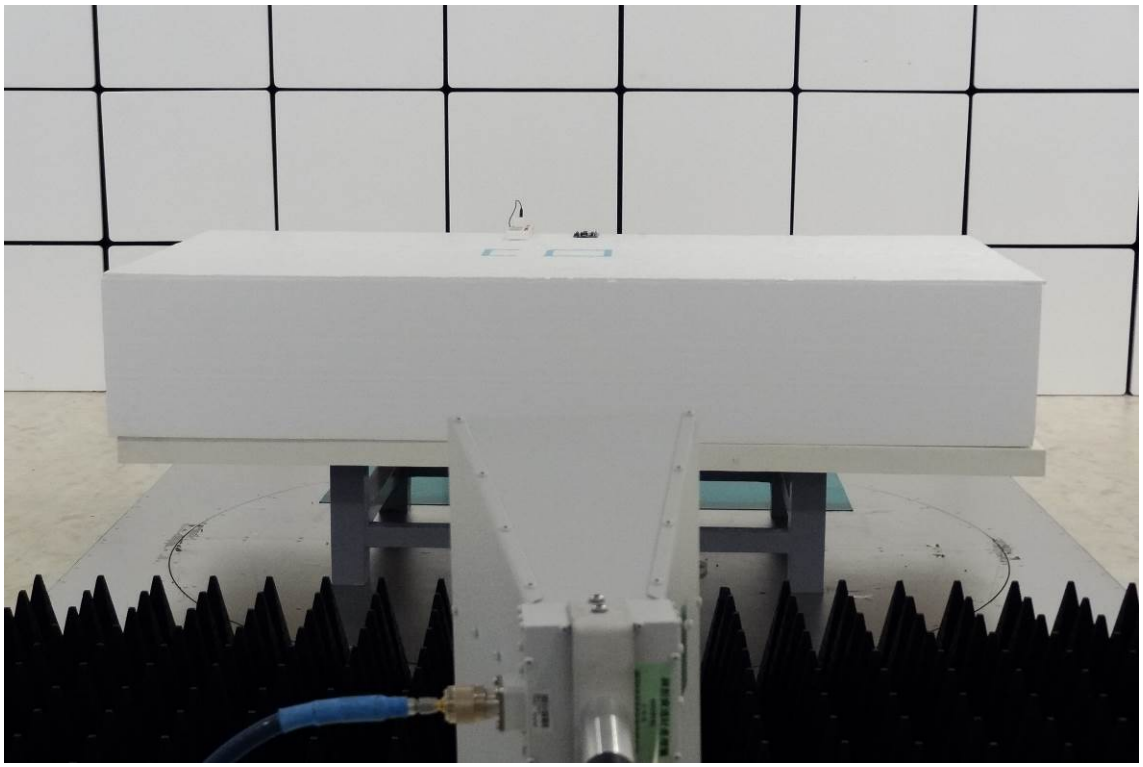
PHOTOGRAPHS OF TEST SETUP

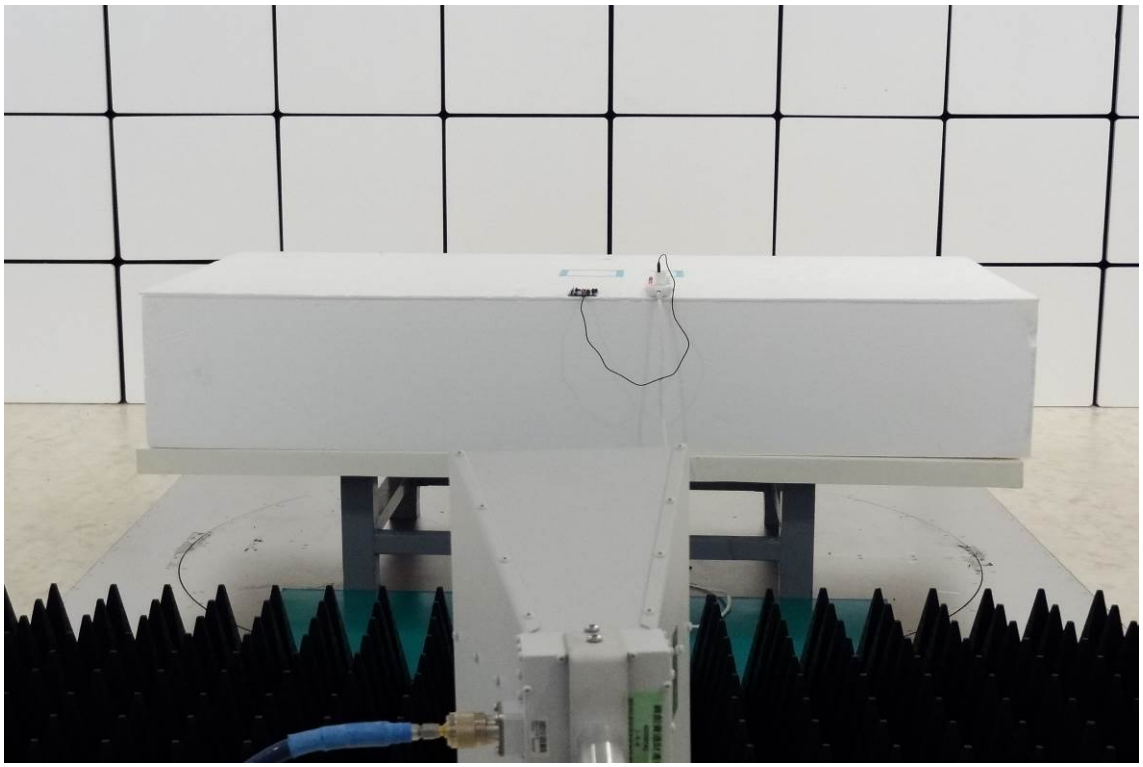
RADIATED EMISSION TEST



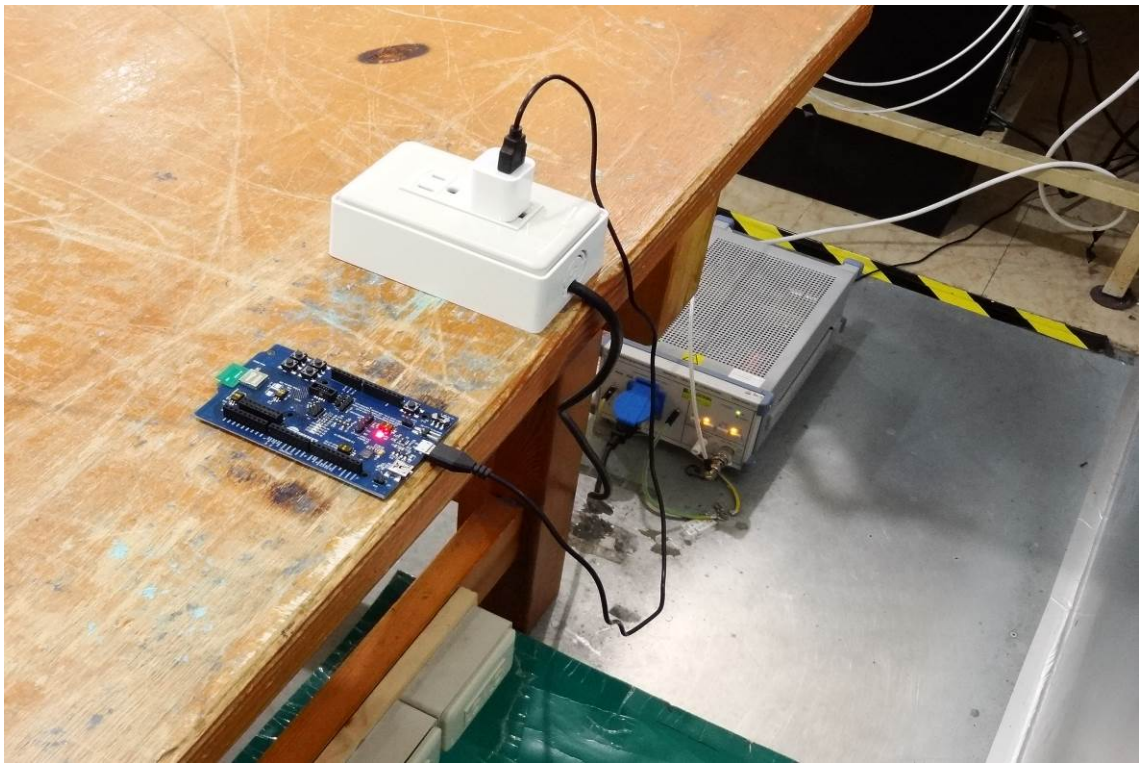


RADIATED EMISSION TEST



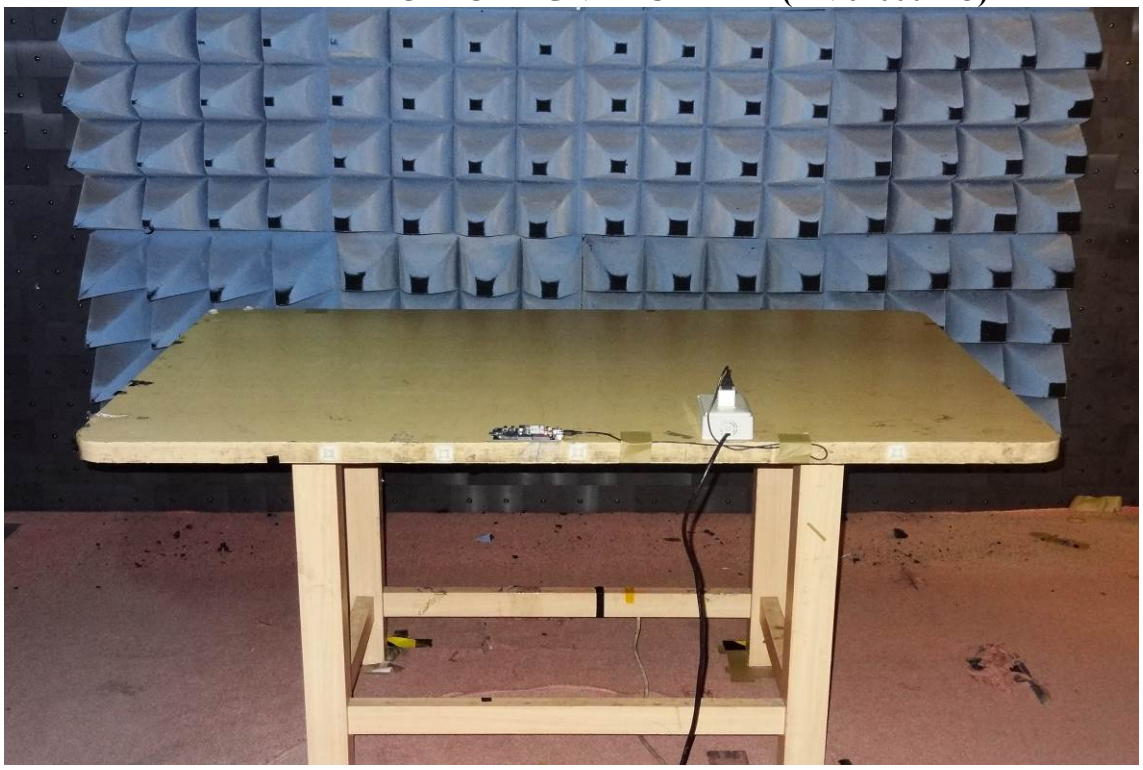


AC POWER LINE CONDUCTED EMISSION TEST



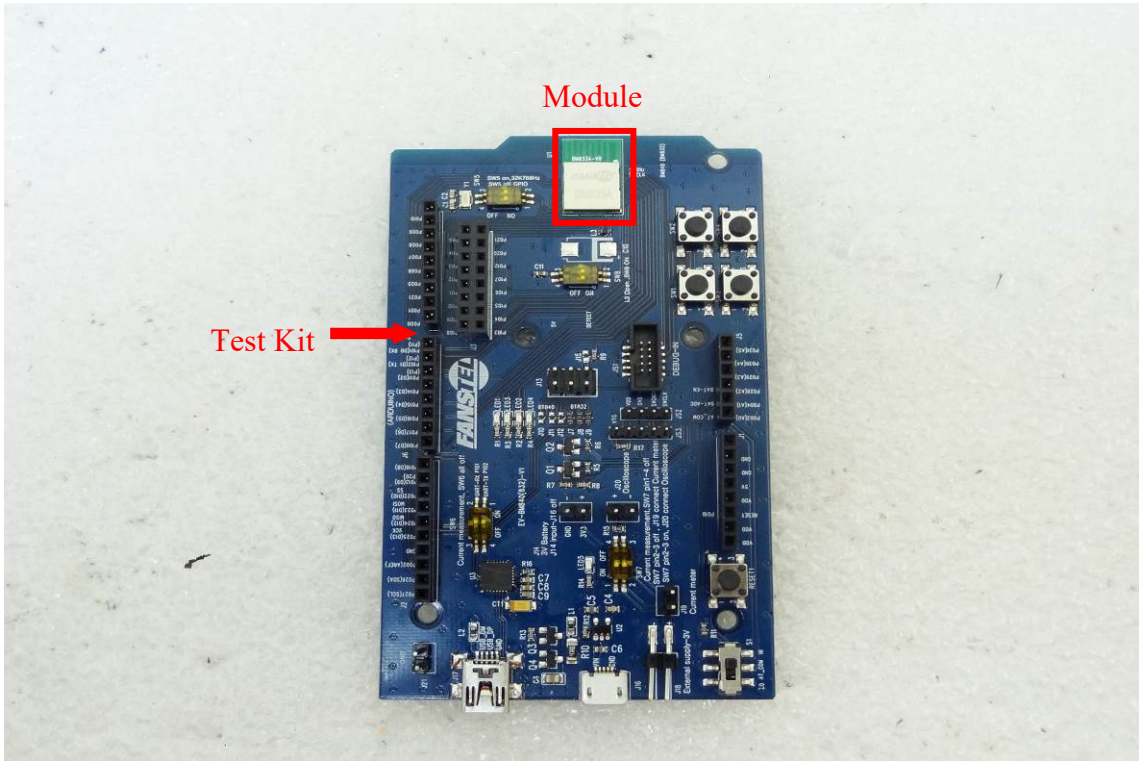
ELECTROSTATIC DISCHARGE TEST (EN 61000-4-2)

RADIATED ELECTROMAGNETIC FIELD (EN 61000-4-3)



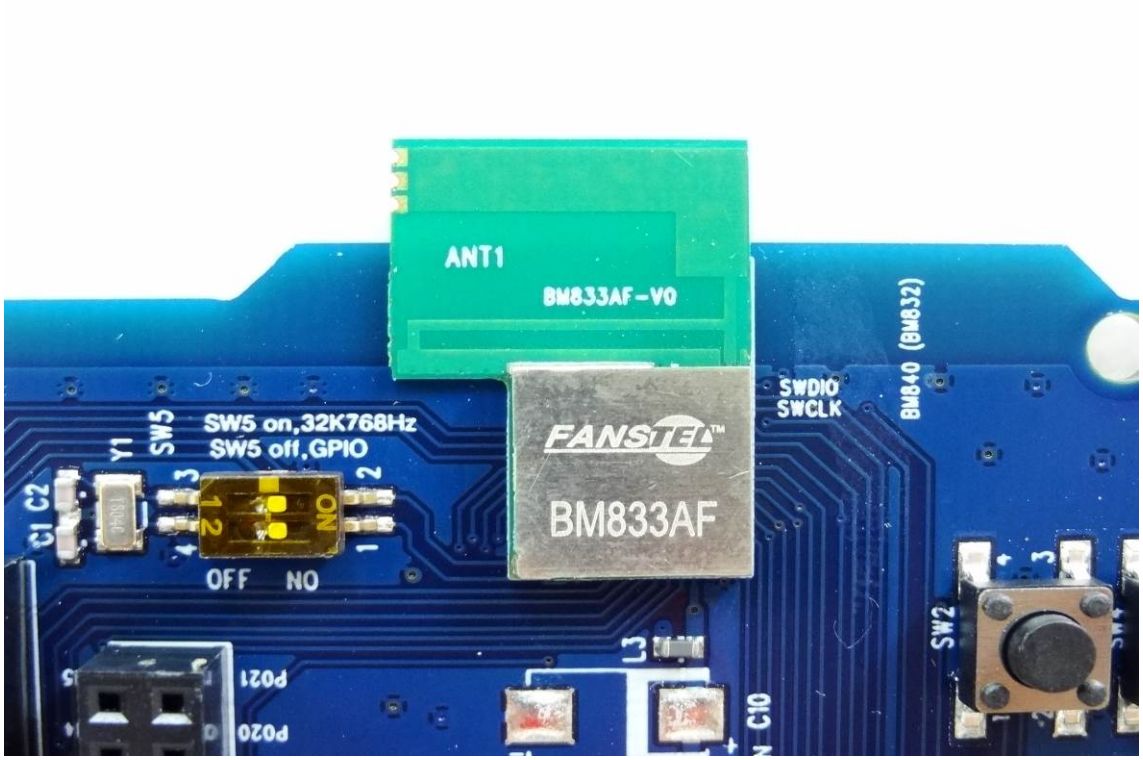
APPENDIX 3
PHOTOGRAPHS OF EUT

EUT 1

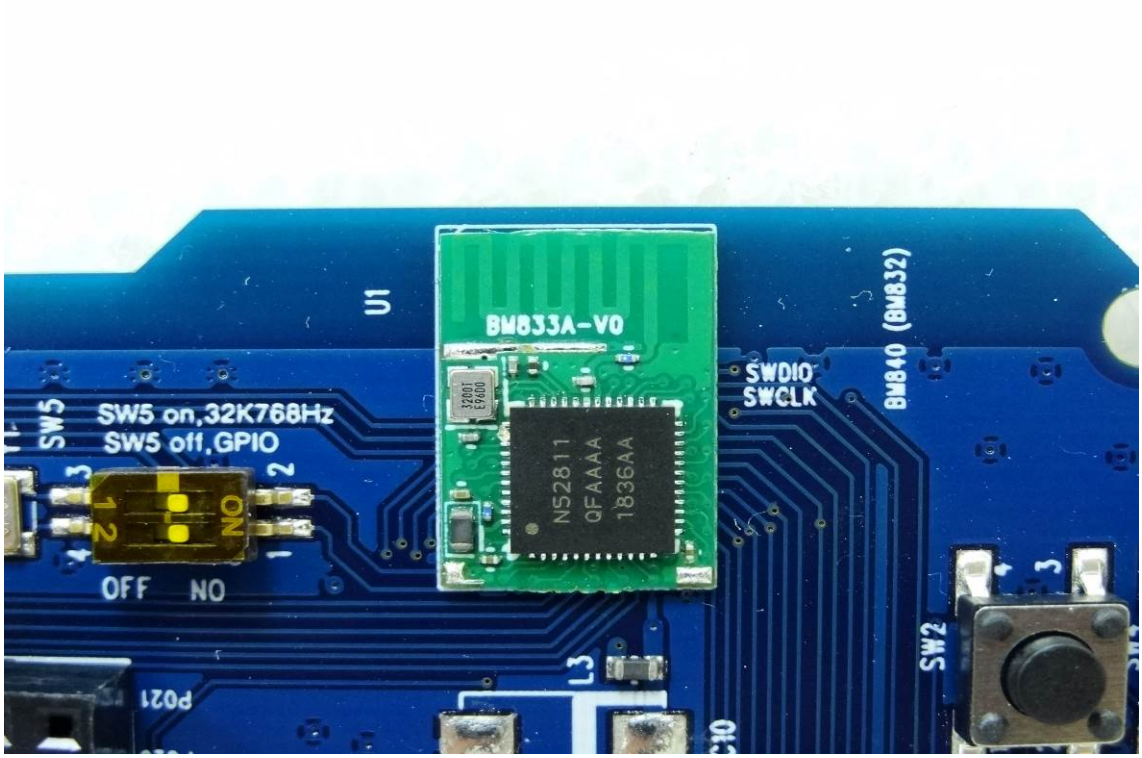


EUT 2 BM833A

EUT 3 BM833AF



EUT 4 BM833A



EUT 5 BM833AF

~ End of Report ~