Prüfbericht-Nr.: *Test Report No.:*	**50223940 001**	**Auftrags-Nr.:** *Order No.:*	114085340 **Seite 1 von 37** *Page 1 of 37*
Kunden-Referenz-Nr.: *Client Reference No.:*	N/A	**Auftragsdatum:** *Order date:*	28-Dec-2018
Auftraggeber: *Client:*	AAEON Technology Inc. 5F, No. 135, Lane 235, Pao Chiao Rd., Hsin-Tien Dist., New Taipei City 23145, Taiwan, R.O.C		
Prüfgegenstand: *Test item:*	LoRa Long Range Node Board		
Bezeichnung / Typ-Nr.: *Identification / Type No.:*	xAIOT-ILND01x ; (x - Where x may be any combination of alphanumeric characters or "-" or blank for marketing purpose.)		
Auftrags-Inhalt: *Order content:*	EN 300 220 Test Report		
Prüfgrundlage: *Test specification:*	EN 300 220-1 V3.1.1 EN 300 220-2 V3.1.1		
Wareneingangsdatum: *Date of receipt:*	04-Jan-2019		
Prüfmuster-Nr.: *Test sample No.:*	A000862828-001, 002		
Prüfzeitraum: *Testing period:*	29-Jan-2019 - 31-Jan-2019		
Ort der Prüfung: *Place of testing:*	EMC/RF Laboratory Taipei		
Prüflaboratorium: *Testing laboratory:*	TUV Rheinland Taiwan Ltd.		
Prüfergebnis*: *Test result*:*	Pass		

geprüft von / *tested by*:

11-Feb-2019 Jack Chang / Project Manager

Datum *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*

kontrolliert von / *reviewed by*:

11-Feb-2019 Ryan Chen/ Project Manager

Datum *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*

Sonstiges / *Other*:

Zustand des Prüfgegenstandes bei Anlieferung: Prüfmuster vollständig und unbeschädigt
Condition of the test item at delivery: *Test item complete and undamaged*

* Legende:	1 = sehr gut	2 = gut	3 = befriedigend	4 = ausreichend	5 = mangelhaft
	P(ass) = entspricht o.g. Prüfgrundlage(n)		F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
Legend:	*1 = very good*	*2 = good*	*3 = satisfactory*	*4 = sufficient*	*5 = poor*
	P(ass) = passed a.m. test specification(s)		*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

V04

TEST SUMMARY

5.1.1 FREQUENCY ERROR
RESULT: Pass

5.1.2 EFFECTIVE RADIATED POWER (CONDUCTED)
RESULT: Passed

5.1.3 OCCUPIED BANDWIDTH
RESULT: Passed

5.1.4 OUT OF BAND EMISSIONS
RESULT: Passed

5.1.5 UNWANTED EMISSIONS IN THE TX SPURIOUS DOMAIN
RESULT: Passed

5.1.6 TRANSIENT POWER
RESULT: Passed

5.1.7 DUTY CYCLE
RESULT: Passed

5.1.8 ADJACENT CHANNEL POWER
RESULT: N/A

5.1.9 ADAPTIVE POWER CONTROL
RESULT: N/A

5.1.10 SHORT TERM BEHAVIOR
RESULT: N/A
Non-applicable. The EUT operation band is out of specified in annex C, table C.1 and NRI.

5.2.1 RX SPURIOUS EMISSIONS
RESULT: Passed

5.2.2 RX SENSITIVITY LEVEL
RESULT: N/A

5.2.3 CLEAR CHANNEL ASSESSMENT THRESHOLD
RESULT: N/A

5.2.4 POLITE SPECTRUM ACCESS TIMING PARAMETERS
RESULT: N/A

5.2.5 ADAPTIVE FREQUENCY AGILITY
RESULT: N/A

5.2.6 BLOCKING
RESULT: Passed

CONTENTS

1. General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix 1: IUT Photos

(File Name: 50223940 001 AppendixP)

Appendix 2: Test Result of Radiated Emissions

(File Name: 50223940 001 AppendixD)

Table 1: Applied Standard and Test Levels

Radio
EN 300 220-1 V 3.1.1 EN 300 220-2 V 3.1.1

1.2 Decision Rule of conformity

The decision rule of conformity of this test report is following the requirements of the requested standard in the quotation, and agreed among testing laboratory and manufacturer (applicant) to exclude the consideration of Measurement Uncertainty, unless it is required by the specific standard.

2. Test Sites

2.1 Test Laboratory

TUV Rheinland Taiwan Ltd.
Taipei Office

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

2.2 Test Facilities

TUV Rheinland Taiwan Ltd.
Taipei Office

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

2.3 List of Test and Measurement Instruments

Table 2: List of Test and Measurement Equipment

Kind of Equipment	Manu-facturer	Type	S/N	Last Calibration	Next Calibration
Test Software	Farad	EZ_EMC	Ver. TUV3A1	N/A	N/A
EMI Test Receiver	R&S	ESR 7	101062	2018/10/01	2019/10/01
Spectrum Analyzer	R&S	FSV 40	100921	2018/05/02	2019/05/02
EXA Signal Analyzer	KEYSIGHT	N9010A	MY52221334	2018/02/05	2019/02/05
Preamplifier (30MHz -1GHz)	HP	8447F	2805A03335	2018/08/22	2019/08/22
Pre-Amplifier (1GHz~18GHz)	EM Electronics	EM01G18G	060649	2018/08/24	2019/08/24
Bilog Antenna	TESEQ	CBL 6111D	29802	2018/08/22	2019/08/22
Horn Antenna	ETS-Lindgren	3117	00138160	2018/06/01	2019/06/01
Horn Antenna (18GHz~40GHz)	COM-POWER	AH-840	101031	2018/12/22	2019/12/22
Loop Antenna	Schwarzbeck	FMZB 1513	1513-076	2018/06/21	2019/06/21
Temp. & Humid. Chamber	Giant Force	GCT-099-40-S	MAF0103-007	2017/03/09	2019/03/09
LISN (1 phase)	R&S	ENV216	101243	2018/06/18	2019/06/18
LISN	R&S	ENV216	101262	2018/06/22	2019/06/22
Test Software	Agilent	300328 testsystem	V1.9.1	N/A	N/A
Power sensor	Agilent	U2021XA	MY54020001	2018/03/31	2019/03/31

2.4 Uncertainty of Measurement

According to the requirement of clause 4.4 of EN 300 220-1 V3.1.1, the value of the measurement uncertainty of each parameter is listed as below:

Table 3: Measurement Uncertainty

Parameter	Uncertainty
Radio frequency	±0,5 ppm
RF power, conducted	±1,5 dB
Conducted spurious emission of transmitter, valid up to 6 GHz	±3 dB
Conducted emission of receivers	±3 dB
Radiated emission of transmitter, valid up to 6 GHz	±6 dB
Radiated emission of receiver, valid up to 6 GHz	±6 dB
RF level uncertainty for a given BER	±1,5 dB
Radiated emission of receiver, valid up to 26 GHz	± 6 dB
Occupied BandWidth	±5 %
Temperature	±2,5 °C
Humidity	±2,5 °C

3. General Product Information

3.1 Product Function and Intended Use

The EUT is suitable for Sub-1GHz IEEE 802.15.4 and ISM applications. It contains a 868MHz compatible module enabling the user to communicate data through a Wireless interface.
The Module has RF Shield and an RF output pad. The RF output is routed to external SMA connector in the host board.
For details refer to the User Guide, Data Sheet and Circuit Diagram.

3.2 Ratings and System Details

Table 4: Technical Specification of EUT

Technical Specification	Value
Kind of Equipment	LoRa Long Range Node Board
Operating Frequency	868.1MHz, 868.3MHz, 868.5MHz
Number of Channels	3
Extreme Temperature Range	0~60 ºC
Operation Voltage	5V
Modulation	PSK
Antenna Gain	External antenna(RFA-LORA-F17M3-B70-1): 2dBi

3.3 Independent Operation Modes

Testing basic operation modes are:

A. Transmitting
B. Receiving
C. Standby
D. Normal
E. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The equipment under test (EUT) were configured to measure its maximum power level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Setup for testing: Test samples are provided with a USB interface and spectial Firmware which makes it possible to control them through a test software installed on a notebook computer.

This software(Performance analyzer) was running on the laptop computer connected to the EUT. It was used to enable the operation modes listed in section 3.3 as appropriate.

The samples were used as follows:
Conducted: A000862828-001, 002
Radiation(External Antenna RFA-LORA-F17M3-B70-1): A000862828-001

4.3 Special Accessories and Auxiliary Equipment

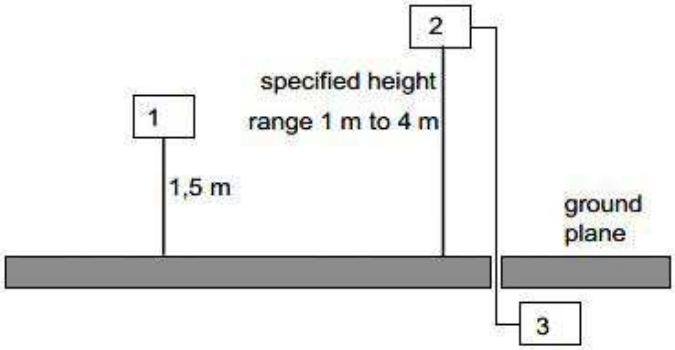
None.

4.4 Countermeasures to Achieve Compliance

The test sample which has been tested contained the noise suppression parts as can be seen in the Photo documentation. No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



1) EUT
2) Measurement antenna
3) Measurement equipment

Diagram of Measurement Equipment Configuration for Conducted Transmitter Measurement

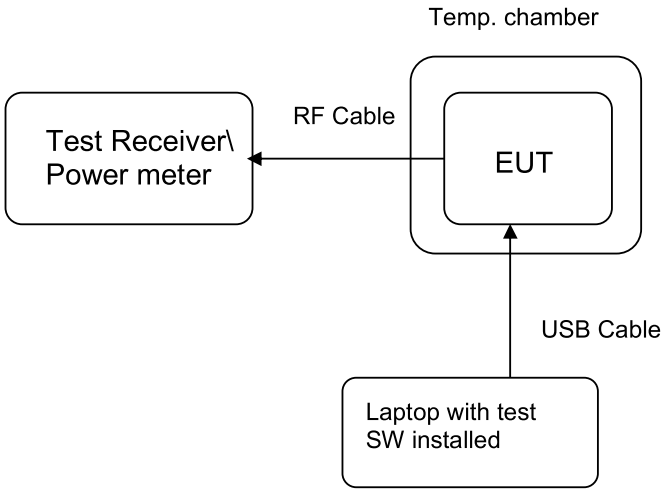
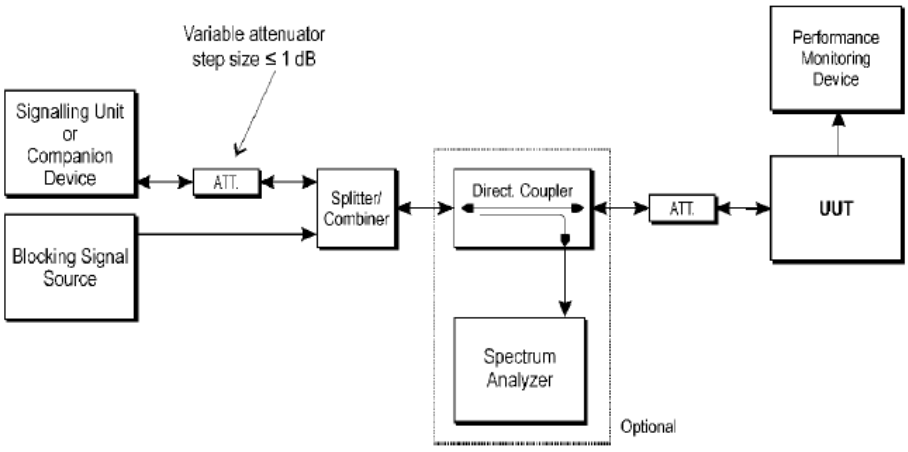


Diagram of Measurement Equipment Configuration for Conducted Receiver blocking Measurement



5. Test Results RADIO

5.1 Transmitter Requirement & Test Suites

5.1.1 Frequency error

RESULT: **Pass**

Test procedure: EN 300 220-1 V3.1.1 clause 5.7

Test Setup

Date of testing	:	29-Jan-2019
Input Voltage	:	DC 5V
Operation mode	:	A
Ambient temperature	:	20-24 °C
Relative humidity	:	40-50 %
Atmospheric pressure	:	100-103 kPa

Table 5: Test result of Frequency error

Low Channel

TEST CONDITION	Channel	Measurement	Freq. Error	Limit
Temp.	MHz	MHz	ppm	ppm
0 °C	868.1	868.09993	-0.08	±100
25 °C	868.1	868.10011	0.12	±100
60 °C	868.1	868.10039	0.45	±100

High Channel

TEST CONDITION	Channel	Measurement	Freq. Error	Limit
Temp.	MHz	MHz	ppm	ppm
0 °C	868.5	868.49996	-0.05	±100
25 °C	868.5	868.50014	0.16	±100
60 °C	868.5	868.50041	0.47	±100

5.1.2 Effective radiated power (Conducted)

RESULT: **Passed**

Test procedure: EN 300 220-1 V3.1.1 clause 5.2.2.1

Test Setup

Date of testing	:	29-Jan-2019
Input Voltage	:	DC 5V
Operation mode	:	A
Ambient temperature	:	20-24 °C
Relative humidity	:	40-50 %
Atmospheric pressure	:	100-103 kPa

Table 6: Test result of effective radiated power

Antenna Assembly Gain (dBi):				2
Cable Loss=				10.71
TEST CONDITIONS		TRANSMITTER POWER (dBm)		
		0 deg C	25	60 deg C
Frequency		5V		
868.1MHz	Read Power	-1.41	-1.49	-1.69
	e.r.p*	9.15	9.07	8.87
868.3MHz	Read Power	-1.41	-1.50	-1.70
	e.r.p*	9.15	9.06	8.86
868.5MHz	Read Power	-1.41	-1.50	-1.70
	e.r.p*	9.15	9.06	8.86

*ERP= Reading Power+Antenna Gain+Path Loss-2.15

5.1.3 Occupied Bandwidth

RESULT: **Passed**

Test procedure: EN 300 220-1 V3.1.1 clause 5.6.3.4

Test Setup

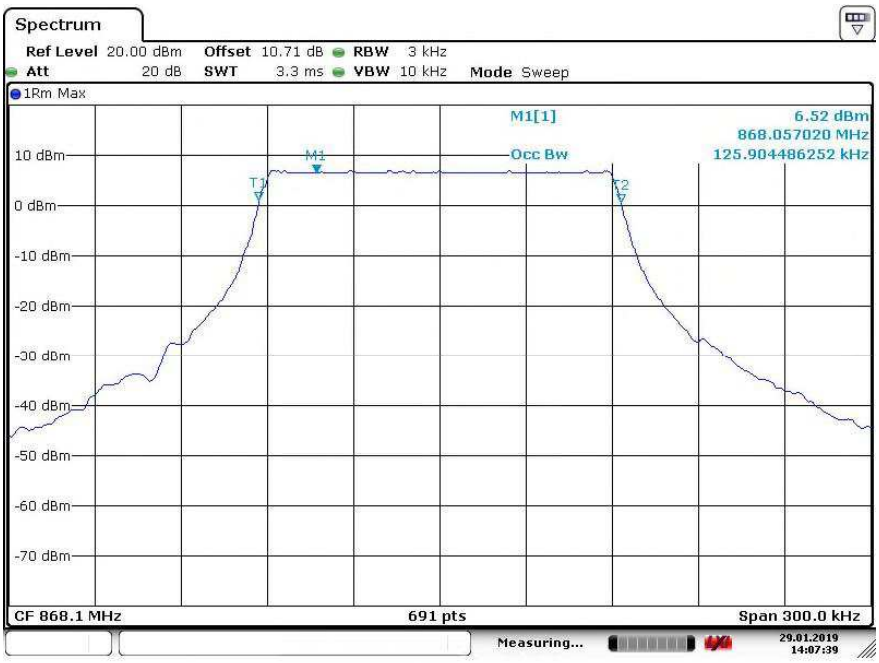
Input Voltage	:	DC 5V
Operation mode	:	A
Ambient temperature	:	20-24 °C
Relative humidity	:	40-50 %
Atmospheric pressure	:	100-103 kPa

Table 7: Test result of Occupied Bandwidth

Modulation	Channel Frequency (MHz)	99% Bandwidth (KHz)
Low Channel	868.1	125.9
High Channel	868.5	125.9

Test Plot of Occupied Bandwidth, (Normal Temperature)

Low CH



Date: 29.JAN.2019 14:07:38

Test Plot of Occupied Bandwidth, (Normal Temperature)

High CH

Date: 29.JAN.2019 10:54:01

5.1.4 Out Of Band Emissions

RESULT: **Passed**

Test procedure: EN 300 220-1 V3.1.1 clause 5.8.3.4

Test Setup

Input Voltage	:	DC 5V
Operation mode	:	A
Ambient temperature	:	20-24 °C
Relative humidity	:	40-50 %
Atmospheric pressure	:	100-103 kPa

The test was done in the conducted setup and the defined IUT antenna gain is not included in the test result, due to the result is far from the limit so the technical judgment of the ERP value will still be under the limits.

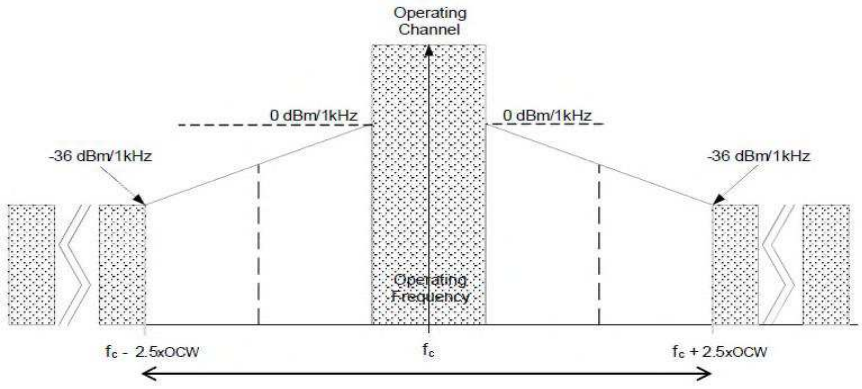


Figure 5: Out Of Band Domain for Operating Channel with reference BW

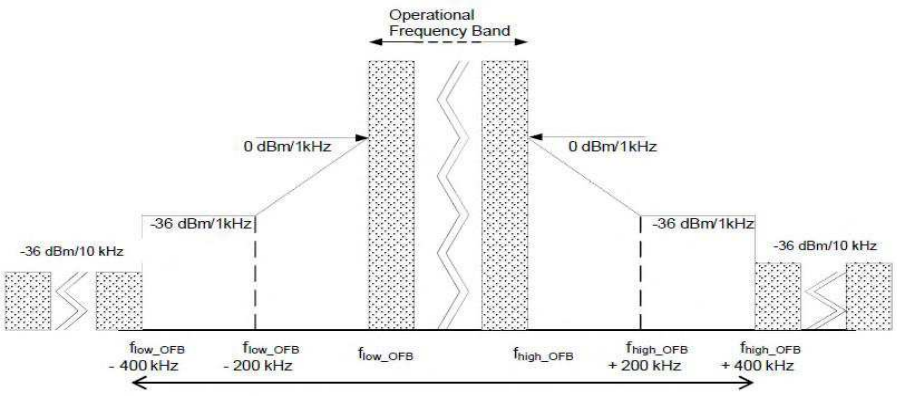
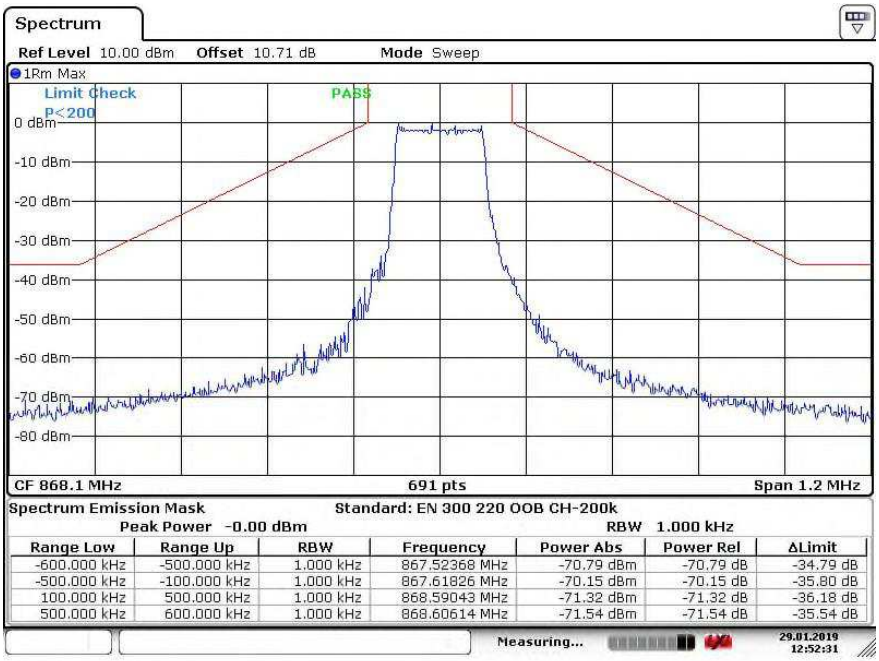


Figure 6: Out Of Band Domain for Operational Frequency Band with reference BW

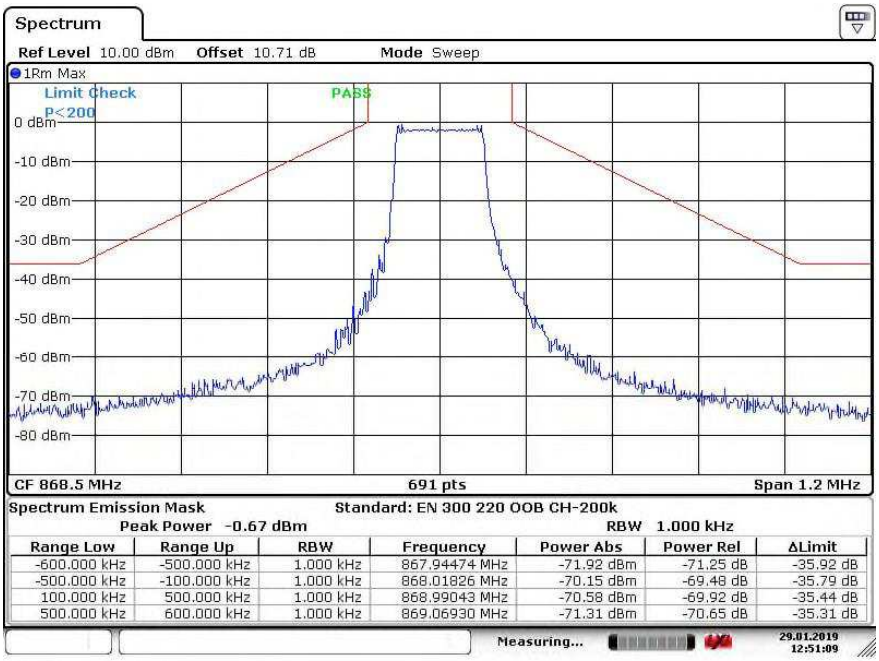
Test Plot of Operating Channel

Low CH



Date: 29.JAN.2019 12:52:31

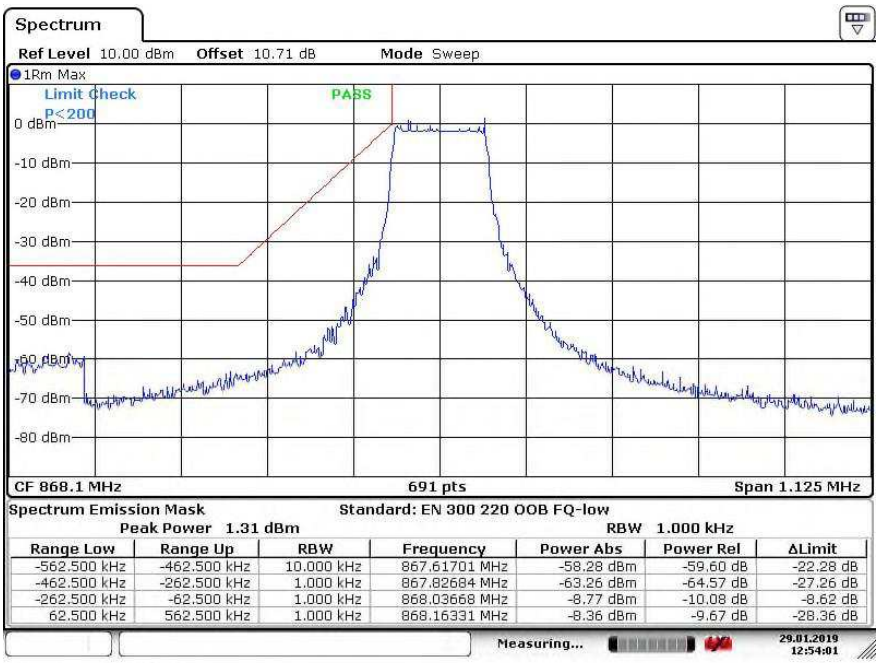
High CH



Date: 29.JAN.2019 12:51:09

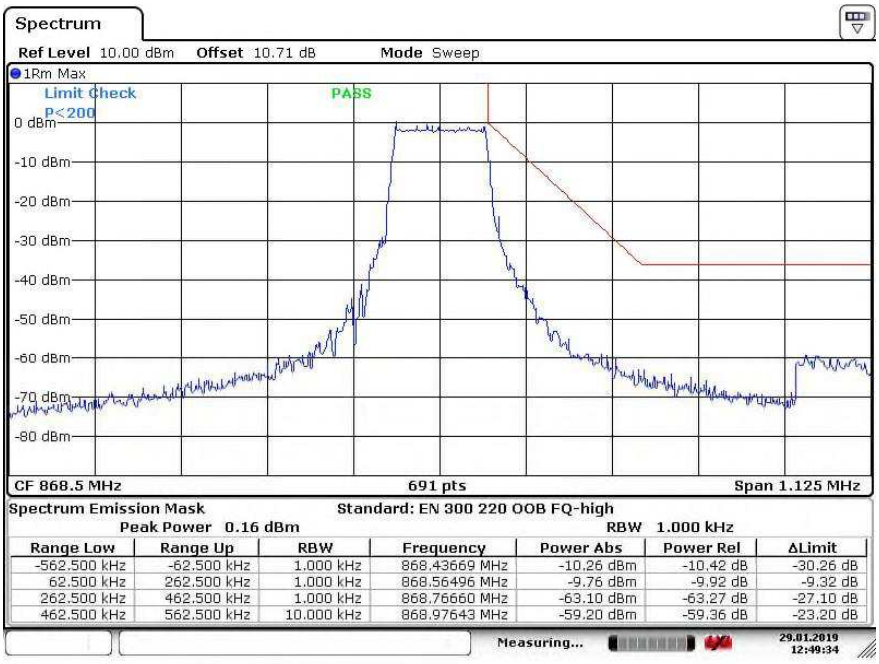
Test Plot of operational frequency band

Low CH



Date: 29.JAN.2019 12:54:01

High CH



Date: 29.JAN.2019 12:49:34

5.1.5 Unwanted emissions in the TX spurious domain

RESULT: **Passed**

Test procedure: EN 300 220-1 V3.1.1 clause 5.9.1.1

Test Setup

Input Voltage	:	DC 5V
Operation mode	:	A
Ambient temperature	:	20-24 °C
Relative humidity	:	40-50 %
Atmospheric pressure	:	100-103 kPa

Please refer to Appendix D: Test result of Radiated Emissions

5.1.6 Transient power

RESULT: **Passed**

Test procedure: EN 300 220-1 V3.1.1 clause 5.10.3.2

Date of testing	:	30-Jan-2019
Input Voltage	:	DC 5V
Operation mode	:	A
Ambient temperature	:	20-24 °C
Relative humidity	:	40-50 %
Atmospheric pressure	:	100-103 kPa

Table 8: Test result of Transient power

Test Freq. (MHz)	Reading dBm	Result dBm/kHz	Limit
867.997	-41.72	-41.72	0 dBm
868.203	-38.96	-38.96	0 dBm
868.3	-47.5	-62.7288	0 dBm
867.9	-48.84	-64.0688	0 dBm
867.6	-55.95	-75.95	0 dBm
868.6	-56.92	-76.92	0 dBm
866.8	-46.64	-71.4112	-27 dBm
869.4	-58.51	-83.2812	-27 dBm

5.1.7 Duty cycle

RESULT: **Passed**

Test procedure: EN 300 220-1 V3.1.1 clause 5.5.2.2

Test Setup

Date of testing : 30-Jan-2019
Input Voltage : DC 5V
Operation mode : A

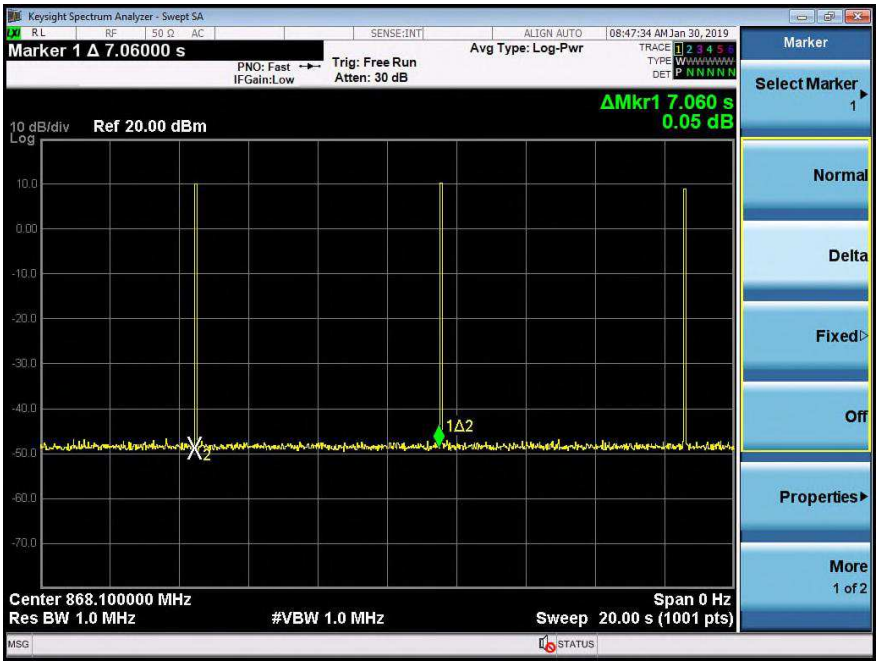
Ambient temperature : 20-24 °C
Relative humidity : 40-50 %
Atmospheric pressure : 100-103 kPa

Table 9: Test result of Duty cycle

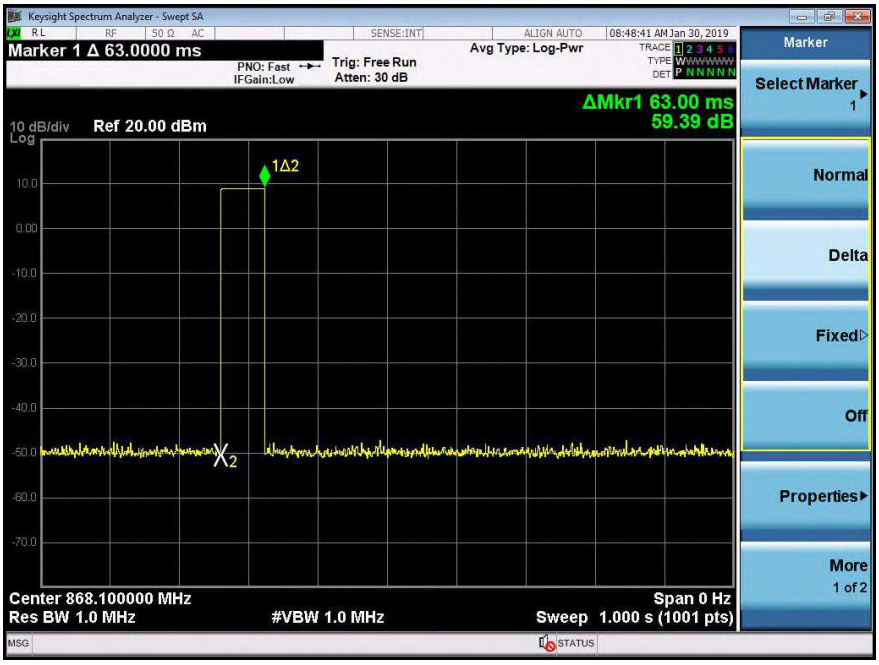
Frequency (MHz)	Duty cycle	Limit
868.1	0.89%	≤ 1%

Test Plot of Duty cycle

On+Off



On



5.1.8 Adjacent channel power

RESULT: **N/A**

Test procedure: EN 300 220-1 V3.1.1 clause 4.3.7

This requirement is not applicable because this device OCW > 25 kHz.

5.1.9 Adaptive Power Control

RESULT: **N/A**

Non-applicable. The EUT does not support Adaptive Power Control function.

5.1.10 Short term behavior

RESULT: **N/A**

Non-applicable. The EUT operation band is out of specified in annex C, table C.1 and NRI.

5.2 Receiver Requirement & Test Suites

5.2.1 RX Spurious emissions

RESULT: **Passed**

Please refer to Appendix D: Test result of Radiated Emissions

5.2.2 RX sensitivity level

RESULT: **N/A**

Non-applicable. The EUT does not support polite spectrum access function

5.2.3 Clear channel assessment threshold

RESULT: **N/A**

Non-applicable. The EUT does not support polite spectrum access function

5.2.4 Polite spectrum access timing parameters

RESULT: **N/A**

Non-applicable. The EUT does not support polite spectrum access function

5.2.5 Adaptive Frequency Agility

RESULT: **N/A**

Non-applicable. The EUT does not support adaptive frequency agility function.

5.2.6 Blocking

RESULT: **Passed**

Test procedure: EN 300 220-1 V3.1.1 clause 5.18.6.4

Test Setup

Date of testing	:	30-Jan-2019
Input Voltage	:	DC 5V
Operation mode	:	D
Ambient temperature	:	20-24 °C
Relative humidity	:	40-50 %
Atmospheric pressure	:	100-103 kPa

This device is Category 2 equipment which is standard performance level of receiver.

Receiver category 2				
Operating Frequency:	868.1 MHz			
Blocking frequency	Blocking Level at EUT	level from Signal source A	Status	Limit
Lower OC frequency (MHz):	(dBm)	(dBm)		
866.00	-36.19	-93.03	Pass	≥ -69 dBm
858.00	-26.34		Pass	≥ -44 dBm
824.60	-22.8		Pass	
Upper OC frequency (MHz):	(dBm)	(dBm)		
870.20	-35.1	-93.03	Pass	≥ -69 dBm
878.20	-24.02		Pass	≥ -44 dBm
911.61	-21.33		Pass	

As per Table 32 of EN 300 220-1 V3.1.1
Sp = 10log RB khz – 117 dBm
10 log(125) -117= -96.03 dBm
Level from signal source A = -93.03 dBm

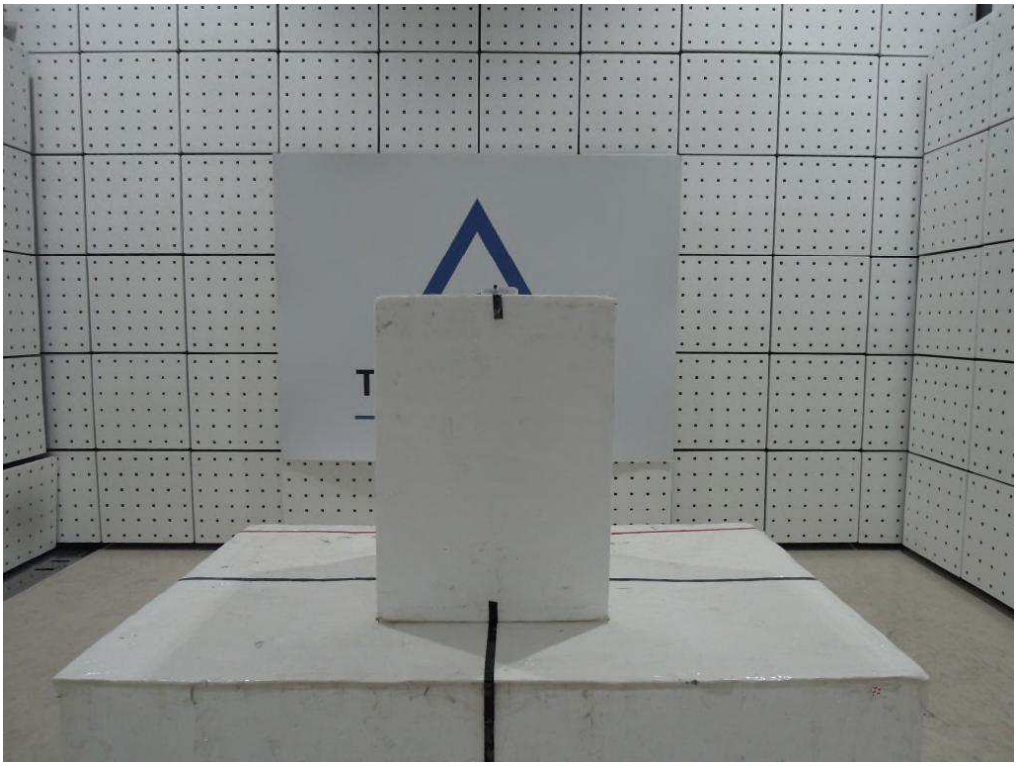
This device is Category 2 equipment which is standard performance level of receiver.

Receiver category 2				
Operating Frequency: 868.5 MHz				
Blocking frequency	Blocking Level at EUT	level from Signal source A	Status	Limit
Lower OC frequency (MHz):	(dBm)	(dBm)		
866.40	-38.09	-93.03	Pass	≥ -69 dBm
858.40	-29.27		Pass	≥ -44 dBm
824.98	-24.63		Pass	
Upper OC frequency (MHz):	(dBm)	(dBm)		
870.60	-39.91	-93.03	Pass	≥ -69 dBm
878.60	-28.9		Pass	≥ -44 dBm
912.03	-24.86		Pass	

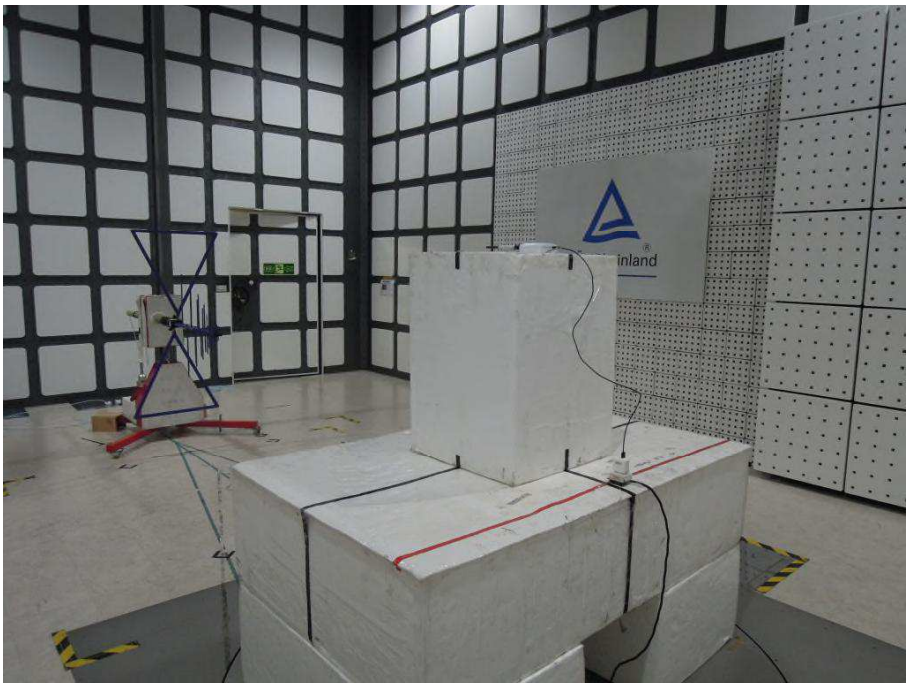
As per Table 32 of EN 300 220-1 V3.1.1
Sp = 10log RB khz – 117 dBm
10 log(125) -117= -96.03 dBm
Level from signal source A = -93.03 dBm

6. Photographs of the Test Set-Up

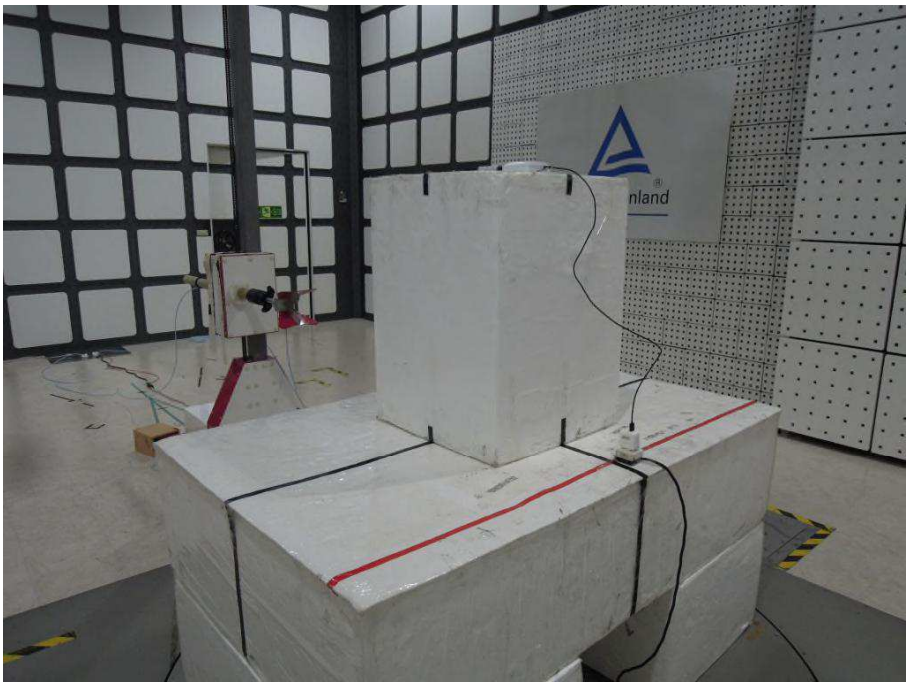
Photograph 1: Setup for Radiated Emission (Front)



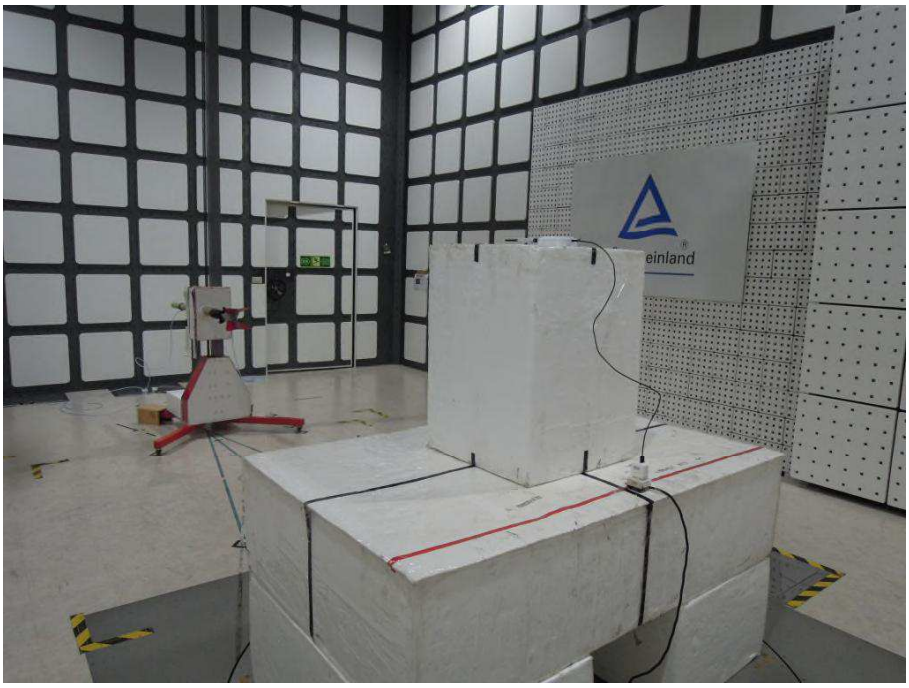
Photograph 2: Set-up for Radiated Emission (Rear View 1)



Photograph 3: Set-up for Radiated Emission (Rear View 2)

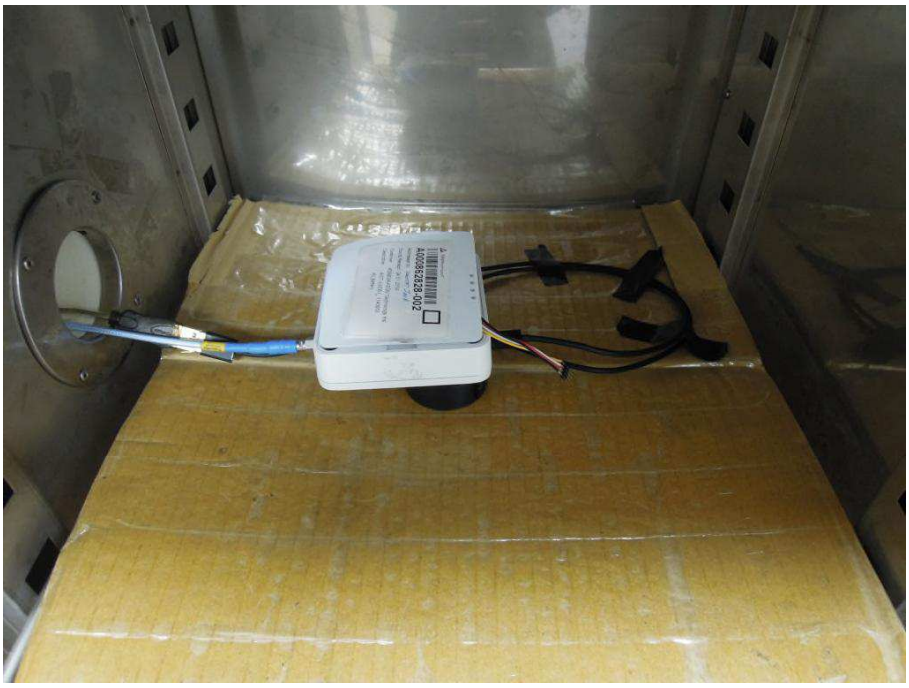


Photograph 4: Set-up for Radiated Emission (Rear View 3)



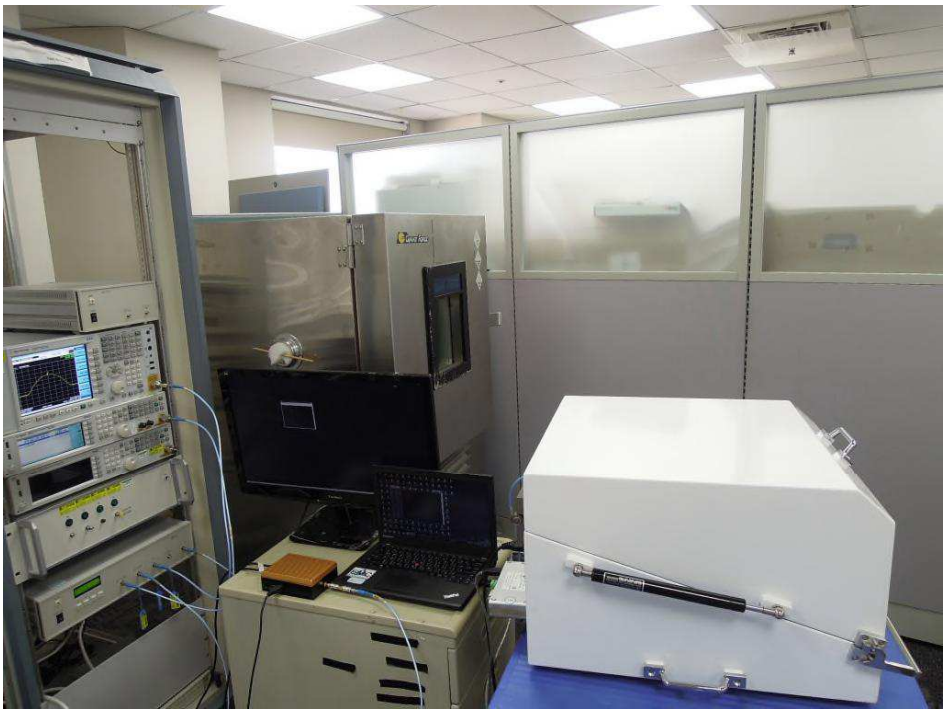
Photograph 5: Set-up for Conducted Testing

Photograph 6: Set-up for Conducted Testing

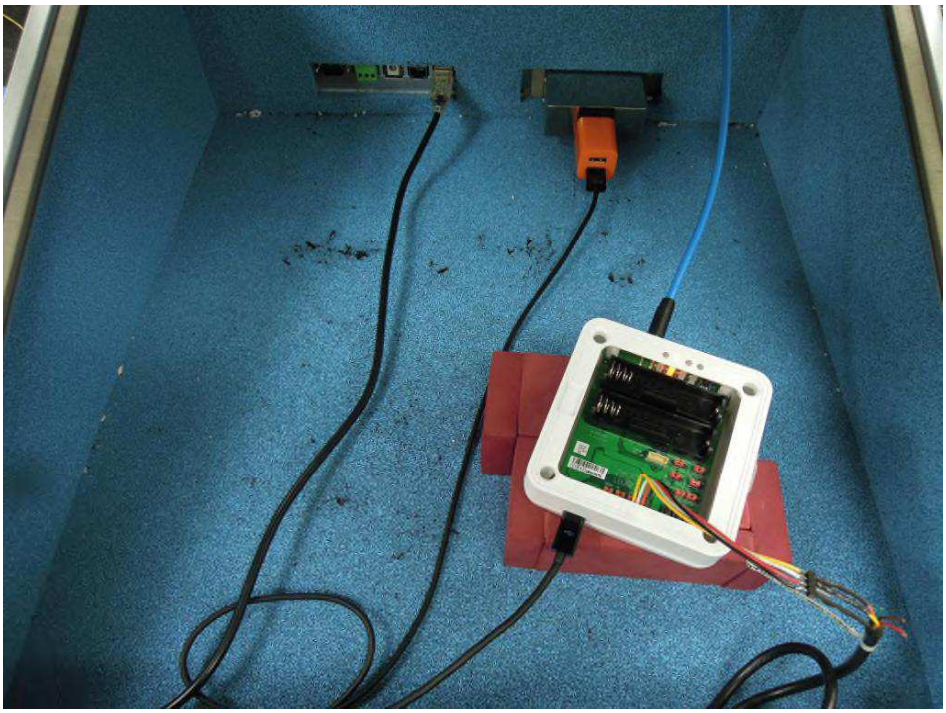


Photograph 7: Set-up for Conducted Testing

Photograph 8: Set-up for Conducted Blocking Testing



Photograph 9: Set-up for Conducted Blocking Testing



7. List of Tables

8. List of Photographs