


AS/NZS Test Report

Equipment : Bluetooth 5.1 Nano BLE Data Module
Model No. : BL653μ
Brand Name : Laird Connectivity
Applicant : Laird Connectivity, Inc.
Address : W66N220 Commerce Court, Cedarburg,
Wisconsin 53012, USA
Standard : AS/NZS 4268:2017
Received Date : Jun. 17, 2020
Tested Date : Aug. 21 ~ Nov. 12, 2020

We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by:


James Fan / Assistant Manager

Approved by:


Gary Chang / Manager

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Release Record

Report No.	Version	Description	Issued Date
AR061704NF	Rev. 01	Initial issue	Nov. 24, 2020

Summary of Test Results

Ref. Std. Clause (ACMA 4268)	Ref. Std. Clause (EN 300 330)	Test Items	Measured	Result
6.6	4.3.1	Permitted Range of Operating Frequencies	Note ¹	Note ¹
6.6	4.3.2	Operating Frequency Ranges	Note ¹	Note ¹
6.5	4.3.3	Modulation Bandwidth	Note ¹	Note ¹
6.3	4.3.4	Transmitter H-Field Requirements	Note ¹	Note ¹
6.3	4.3.5	Transmitter RF Carrier Current	Note ¹	Note ¹
6.3	4.3.6	Transmitter Radiated E-Field	Note ¹	Note ¹
6.4	4.3.7	Transmitter Conducted Spurious Emissions	Note ¹	Note ¹
6.4	4.3.8	Transmitter Radiated Spurious Domain Emission Limits < 30 MHz	Note ¹	Note ¹
6.4	4.3.9	Transmitter Radiated Spurious Domain Emission Limits > 30 MHz	Note ¹	Note ¹
-	4.3.10	Transmitter Frequency Stability	Note ¹	Note ¹
7.2	4.4.2	Receiver Spurious Emissions	Meet the requirement of limit.	Pass
---	4.4.3	Adjacent Channel Selectivity	Only for channelized systems.	N/A
---	4.4.4	Receiver Blocking Or Desensitization	Not for tagging systems.	N/A

Note¹: This test item is not required since the NFC function is passive only.

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

1 General Description

1.1 Information

1.1.1 Product Details

Model Name	Part Number	Remarks
BL653μ	453-00059	Chip Antenna
	453-00060	RF Trace Pin Antenna

1.1.2 Specification of the Equipment under Test (EUT)

RF General Information			
Frequency Range (MHz)	Modulation	Ch. Frequency (MHz)	Channel Number
13.553 – 13.567	NFC-ASK	13.56	1

1.1.3 Antenna Details

Manufacturer	Model	Laird Part Number	Type	Connector	Gain (dBi)
Laird	NanoBlue	EBL2400A1-10 MH4L	PCB Dipole	IPEX MHF4	2
Laird	FlexPIFA	001-0022	PCB Dipole	IPEX MHF4	2
Mag.Layers	EDA-8709-2G4 C1-B27-CY	0600-00057	Dipole	IPEX MHF4	2
Laird	mFlexPIFA	EFA2400A3S-1 0MH4L	PIFA	IPEX MHF4	2
Laird	Laird NFC	0600-00061	NFC	N/A	--
Yageo	ANT1608LL14R 2400A	N/A	Chip Antenna	N/A	2

1.1.4 EUT Operational Condition

Supply Voltage	Option 1: DC 5V from host Option 2: DC 3.3V from host Option 3: DC 1.7V from host
SW Version	v30.1.1.0

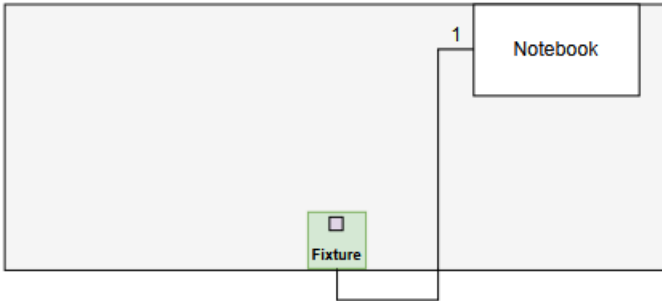
1.1.5 Accessories

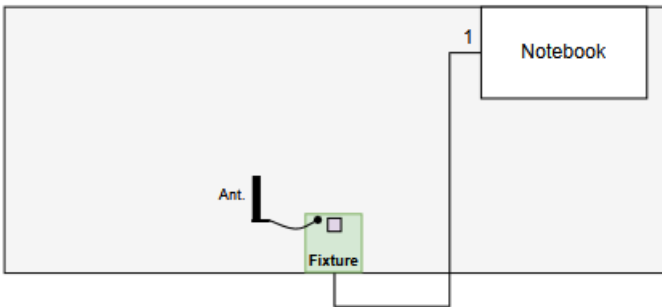
N/A

1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	S/N	Remarks
1	Notebook	DELL	Latitude E6430	DoC	---
2	Fixture	---	---	---	Provided by applicant.

1.3 Test Setup Chart

Test Setup Diagram (Test Configuration 1: Part No. 453-00059 with NFC antenna)	
	
No.	Signal cable / Length (m)
1	USB, 0.5m shielded.

Test Setup Diagram (Test Configuration 2: Part No. 453-00060 with Mag.Layers Dipole antenna + NFC antenna)	
	
No.	Signal cable / Length (m)
1	USB, 0.5m shielded.

1.4 Test Equipment List and Calibration Data

Test Item	Radiated Emission below 30 MHz				
Test Site	Open Area Test Site				
Test date	Nov. 12, 2020				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Receiver	R&S	ESR	102172	Aug. 20, 2020	Aug. 19, 2021
Loop Antenna	TESEQ	HLA 6120	31244	Mar. 03, 2020	Mar. 03, 2021
RF Cable-R10M	EMCI	EMCCFD400	CB017	Oct. 20, 2020	Oct. 19, 2021
Measurement Software	AUDIX	e3	5.041019k2	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Radiated Emissions				
Test Site	Fully-anechoic chamber 2 / (05CH02-WS)				
Test Date	Aug. 21, 2020				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	Agilent	N9010A	MY52221474	Oct. 17, 2019	Oct. 16, 2020
Bilog Antenna 30-1000MHz	SCHWARZBECK	VULB9168	9168-563	Jan. 04, 2020	Jan. 03, 2021
Preamplifier	EMC	EMC02325	980146	Oct. 18, 2019	Oct. 17, 2020
LF cable-0.8M	EMC	EMC8D-NM-NM-800	EMC8D-NM-NM-800-002	Oct. 15, 2019	Oct. 14, 2020
LF cable-3M	EMC	EMC8D-NM-NM-3000	131102	Oct. 15, 2019	Oct. 14, 2020
LF cable-10M	EMC	EMC8D-NM-NM-10000	131101	Oct. 15, 2019	Oct. 14, 2020
Measurement Software	AUDIX	e3	6.120210g	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

1.5 Testing Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

AS/NZS 4268:2017
EN 300 330 V2.1.1 (2017-02)

1.6 Deviation from Test Standard and Measurement Procedure

None

1.7 Measurement Uncertainty

The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)).

Measurement Uncertainty		
Test Item	Uncertainty	Limit
Radio Frequency	$\pm 0.34 \times 10^{-7}$	$\pm 1 \times 10^{-7}$
RF power, conducted	± 2.2 dB	± 1 dB
RF power, radiated	± 2.59 dB	± 6 dB
Temperature	± 0.4 °C	± 1 °C
Humidity	± 3.3 %	± 5 %

2 Test Configuration

2.1 Testing Facility

Test Laboratory	International Certification Corp.
Test Site	Open Area Test Site
Address of Test Site	No. 30-2, Ding Fwu Tsuen, Lin Kou District, New Taipei City, Taiwan, R.O.C.
Test Site	05CH02-WS
Address of Test Site (Kwei Shan II)	No. 14-1, Lane 19, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.

2.2 The Worst Test Modes and Channel Details

Test item	Test Mode	Test Channel (MHz)	Test Configuration
Radiated Measurement	NFC	13.56	1, 2
NOTE: 1. The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The Z-plane result was found as the worst case and was shown in this report. 2. Test Configurations are listed as below: 1) Test Configuration 1: Part No. 453-00059 with NFC antenna 2) Test Configuration 2: Part No. 453-00060 with Mag.Layers Dipole antenna + NFC antenna			

3 Receiver Test Results

3.1 Receiver Spurious Emissions

3.1.1 Limit of Receiver Spurious Emissions

Measurement below 30 MHz

Frequency $9 \text{ kHz} \leq f < 10 \text{ MHz}$	Frequency $10 \text{ MHz} \leq f < 30 \text{ MHz}$
5,5 dB μ A/m at 9 kHz descending 3 dB/oct	-25 dB μ A/m

Spurious Emissions Limit (Peak Power)	Frequency Range	Measurement Bandwidth
-56 dBW (2.5 μ W) e.i.r.p. (59 dB μ V/m at 10 metres)	< 150 kHz	1 kHz
	150 kHz – 30 MHz	10 kHz

Measurement above 30 MHz

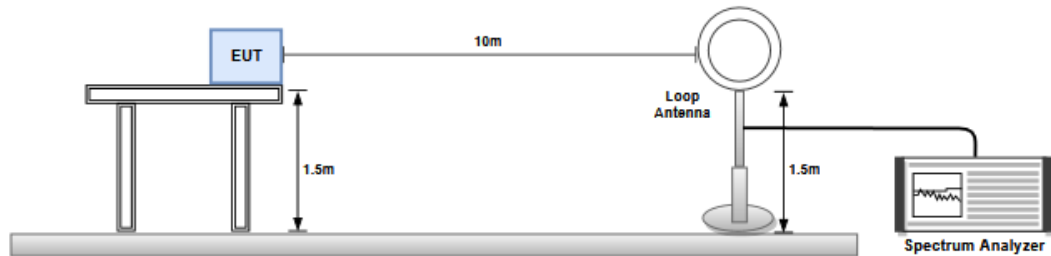
The measured values shall not exceed 2 nW e.r.p. (-57 dBm).

3.1.2 Test Procedures

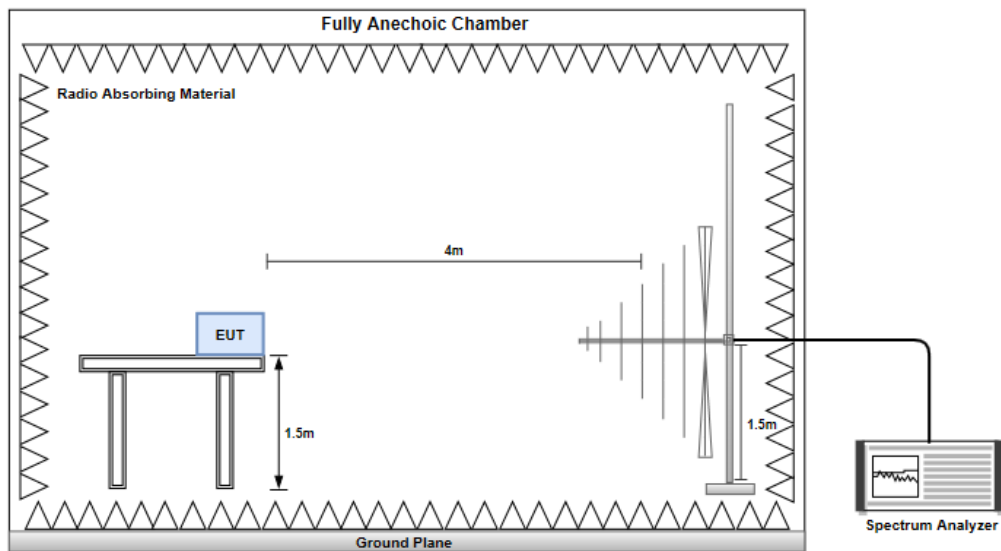
Reference to clause 6.3.1 of EN 300 330 V2.1.1 (2017-02).

3.1.3 Test Setup

Below 30MHz



Above 30MHz



Test Configuration 1: Part No. 453-00059 with NFC antenna

3.1.4 Receiver Spurious Emissions (Below 30MHz)

Ambient Condition	24°C / 55%	Tested By	Jack Li
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Receiver Emissions in the Range from 9kHz~30MHz Result						
Emission Freq. (MHz)	E-field (dBuV/m)	E-field to H-field Converted Factor (dB)	H-field (dBuA/m)	H-field Limit (dBuA/m at 10m)	Level Type	Margin (dB)
15.43	23.39	-51.5	-28.11	-25	PK	3.11

Note1: H-field (10m) = [E-field (10m)] + [E-field to H-field Converted Factor]

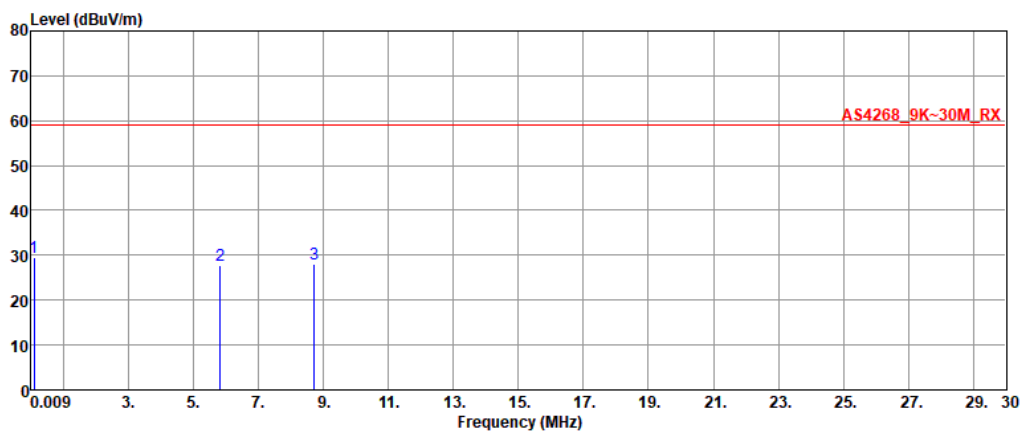
Test Freq. (MHz)

13.56

Test By :Nai Xu

Temperature:25

Humidity(%):65

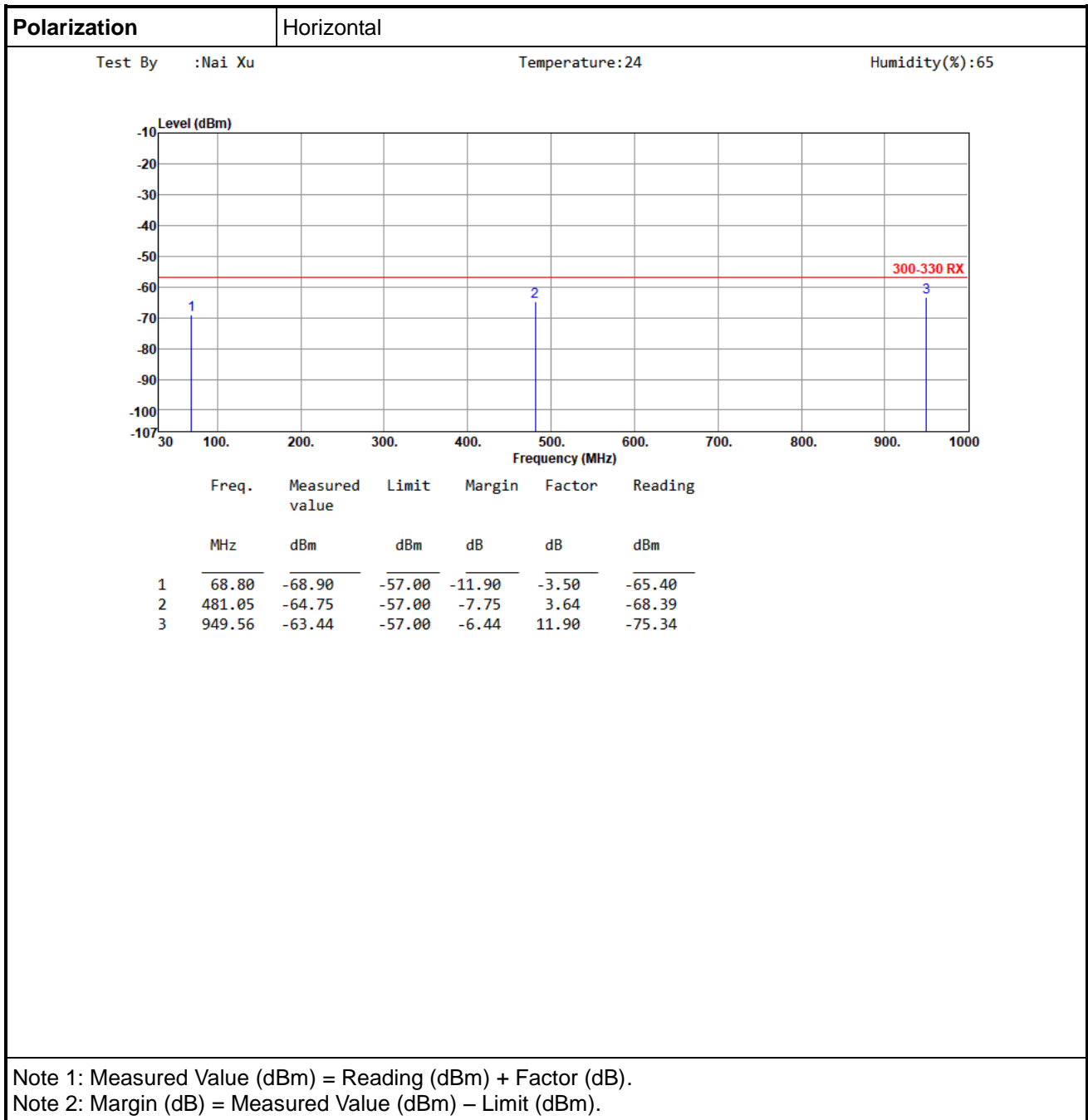


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBuV/m	dBuV/m	dB	dB	dBuV
1	0.09	29.45	59.00	-29.55	18.95	10.50
2	5.82	27.70	59.00	-31.30	19.95	7.75
3	8.72	28.09	59.00	-30.91	20.36	7.73

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)

Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

3.1.5 Receiver Spurious Emissions (Above 30MHz)



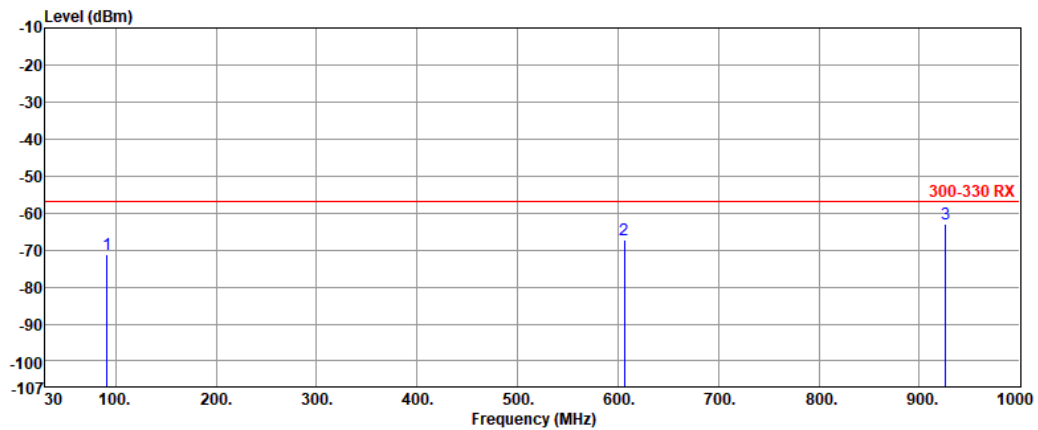
Polarization

Vertical

Test By :Nai Xu

Temperature:24

Humidity(%):65



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	91.11	-71.16	-57.00	-14.16	-4.18	-66.98
2	606.18	-67.21	-57.00	-10.21	6.14	-73.35
3	926.28	-62.93	-57.00	-5.93	11.51	-74.44

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB).

Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm).

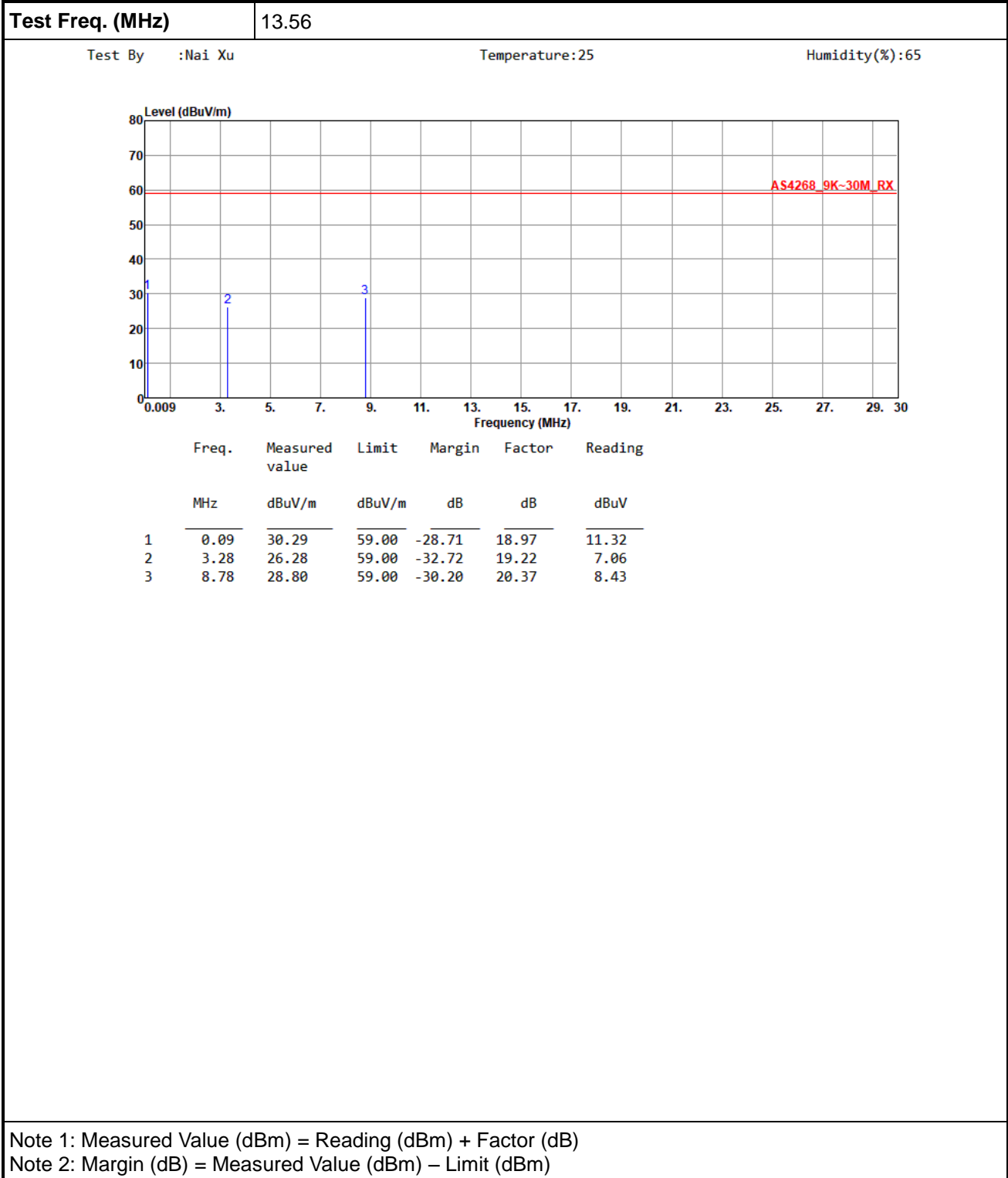
Test Configuration 2: Part No. 453-00060 with Mag.Layers Dipole antenna + NFC antenna

3.1.6 Receiver Spurious Emissions (Below 30MHz)

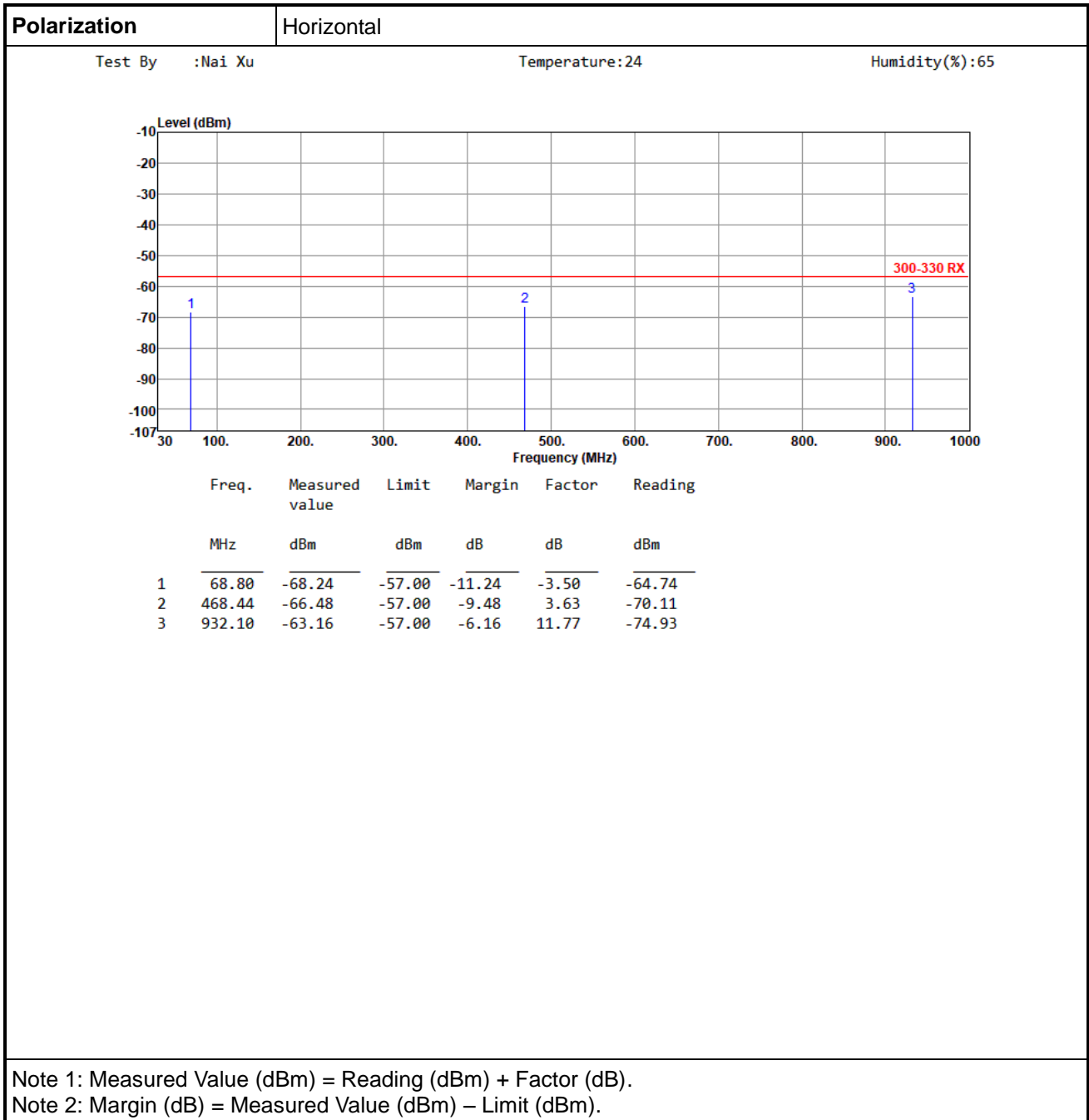
Ambient Condition	24°C / 55%	Tested By	Jack Li
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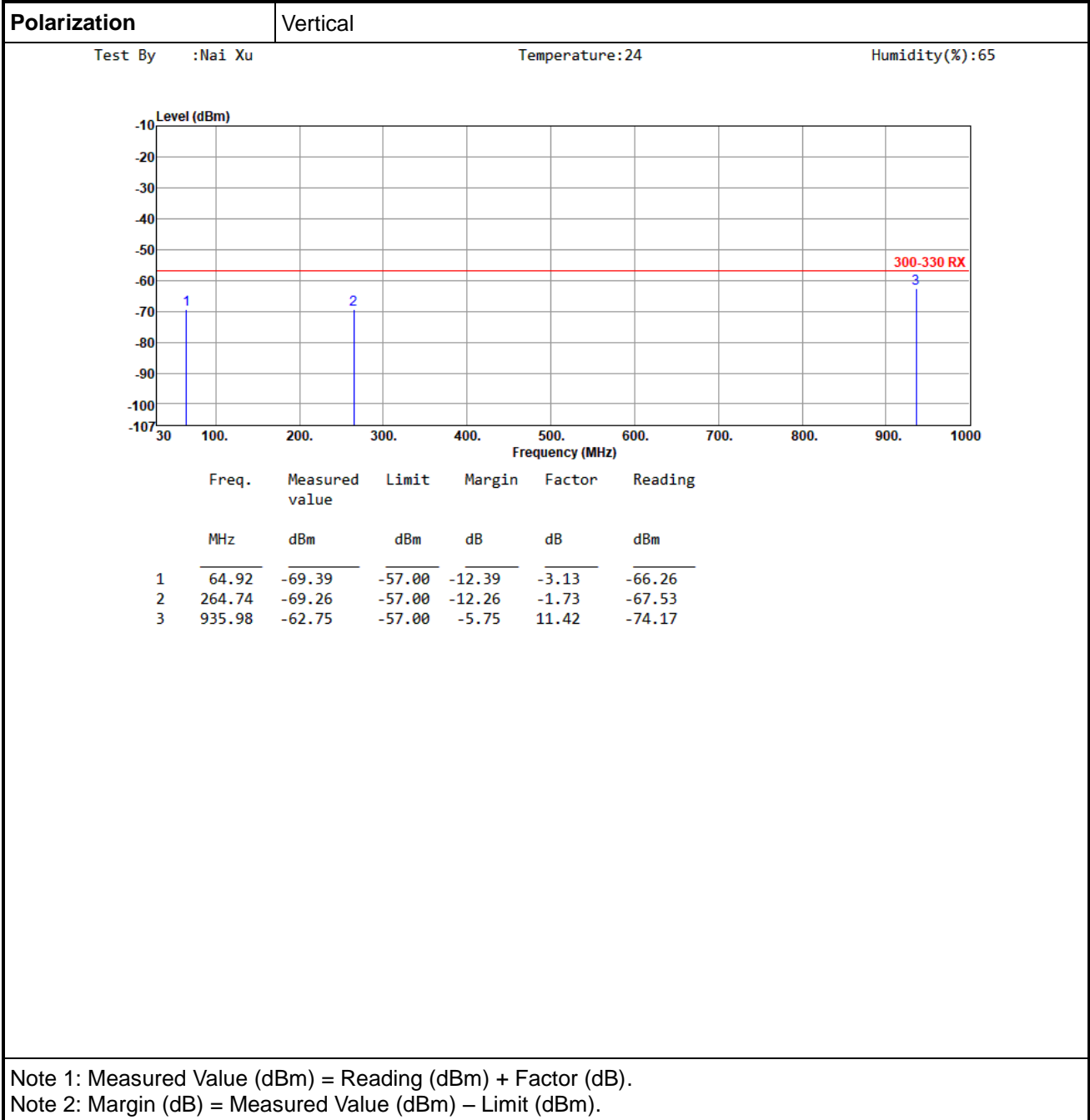
Receiver Emissions in the Range from 9kHz~30MHz Result						
Emission Freq. (MHz)	E-field (dBuV/m)	E-field to H-field Converted Factor (dB)	H-field (dBuA/m)	H-field Limit (dBuA/m at 10m)	Level Type	Margin (dB)
12.78	23.18	-51.5	-28.32	-25	PK	3.32

Note1: H-field (10m) = [E-field (10m)] + [E-field to H-field Converted Factor]



3.1.7 Receiver Spurious Emissions (Above 30MHz)





4 Photographs of the Test Configuration

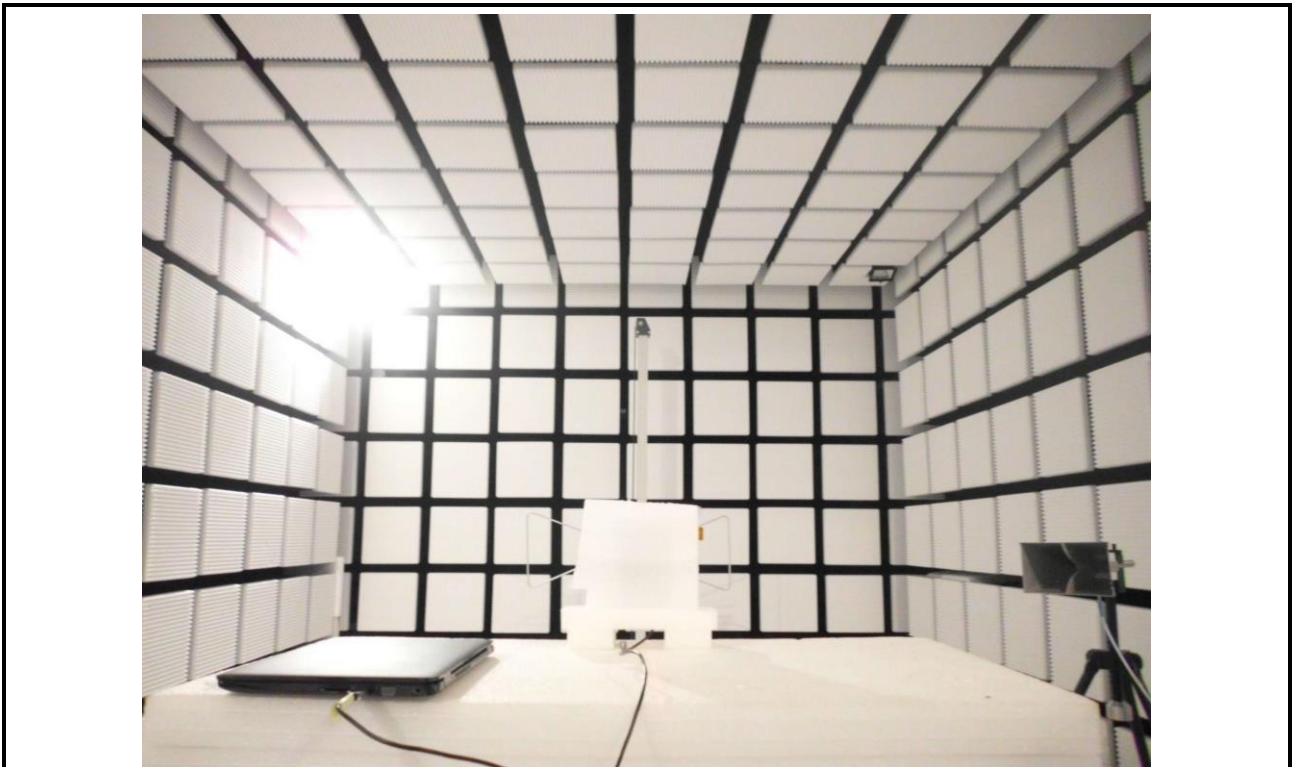
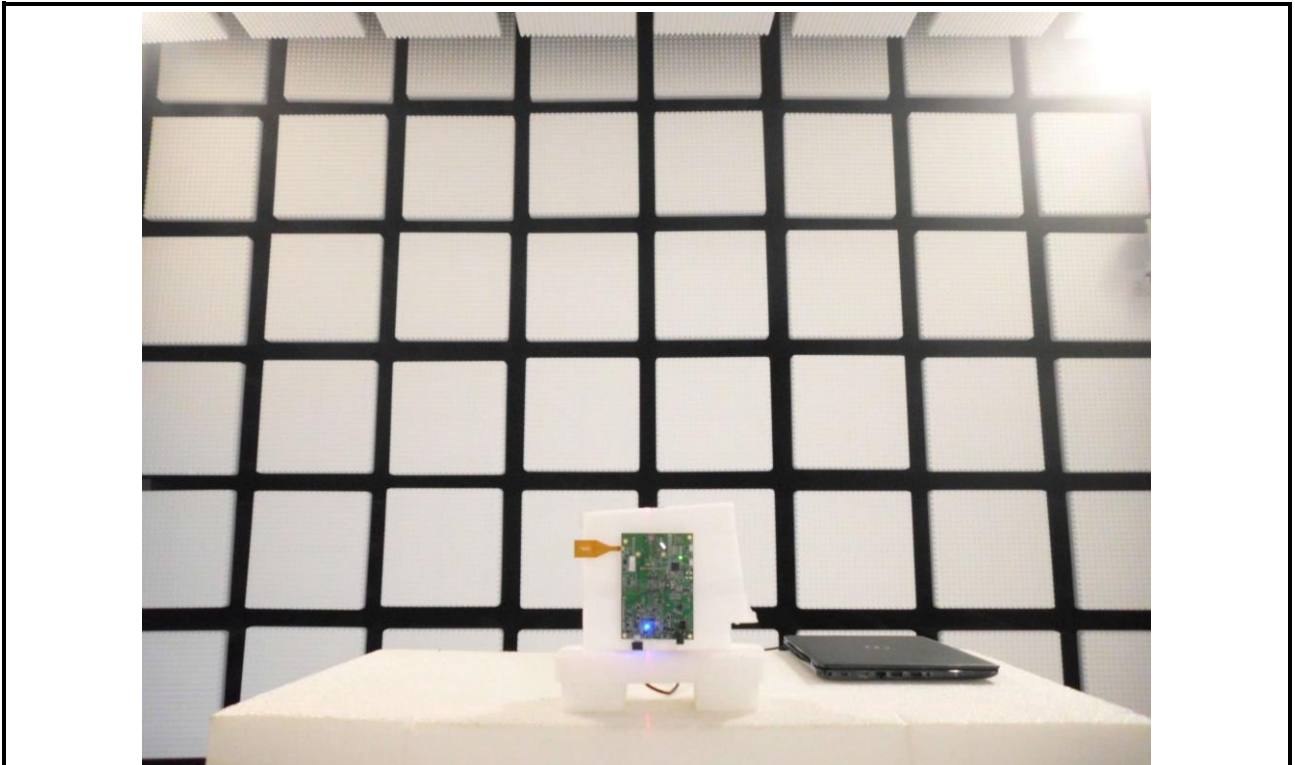
Spurious Emission below 30MHz Test (Test Configuration 1)



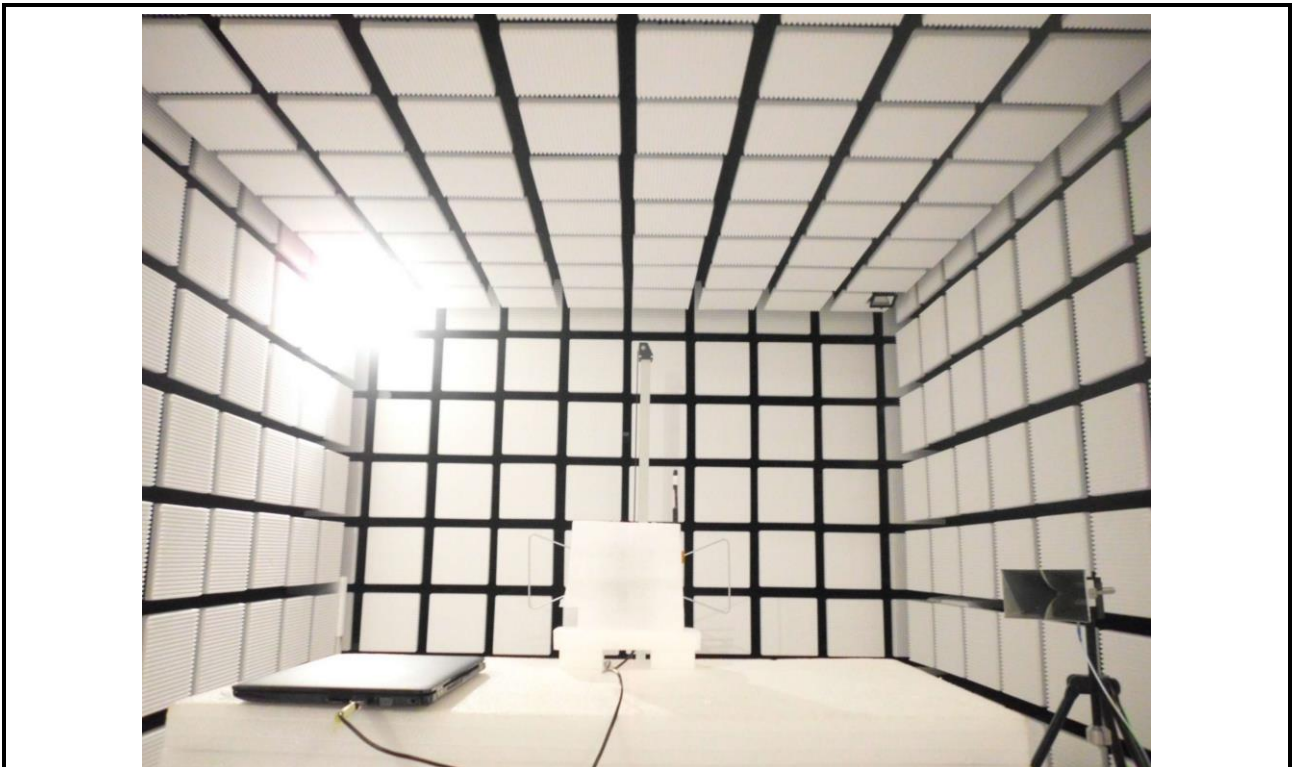
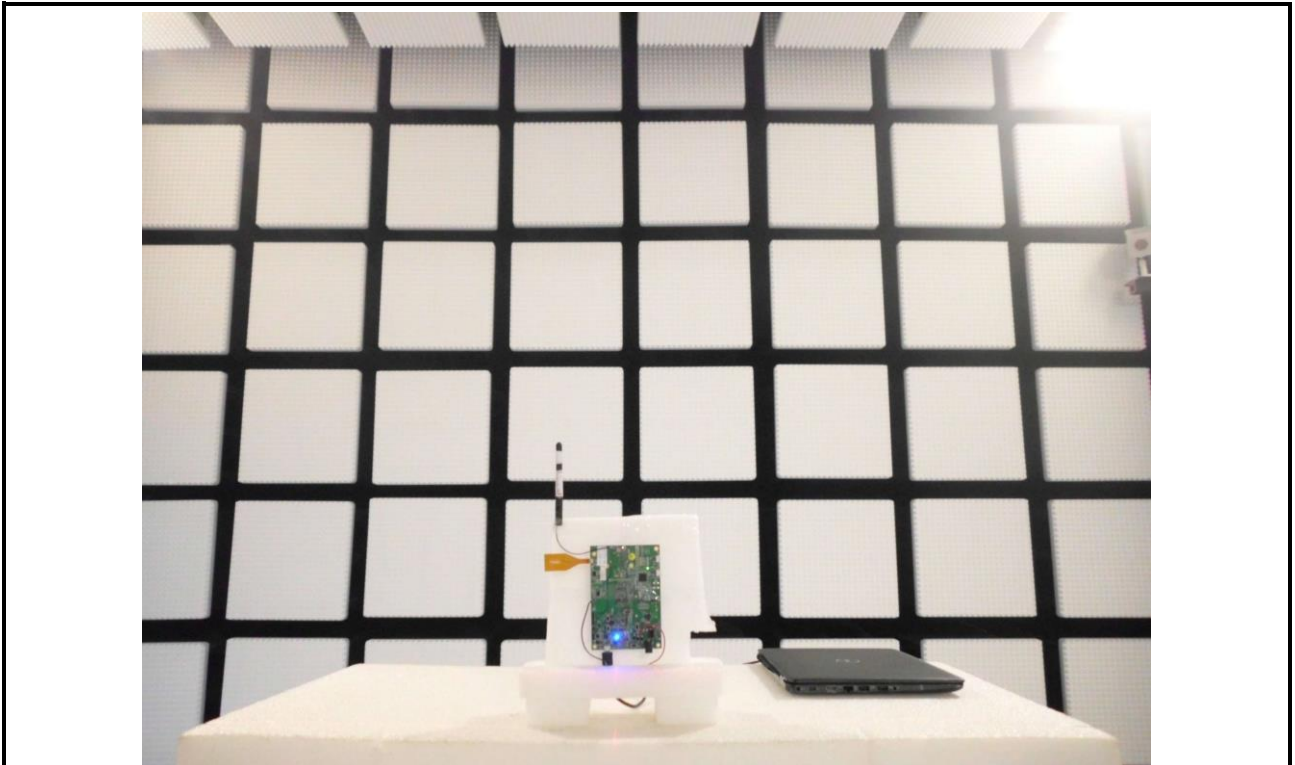
Spurious Emission below 30MHzTest (Test Configuration 2)



Spurious Emission above 30MHz Test (Test Configuration 1)



Spurious Emission above 30MHz Test (Test Configuration 2)



5 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website <http://www.icertifi.com.tw>.

Linkou

Tel: 886-2-2601-1640

No. 30-2, Ding Fwu Tsuen, Lin
Kou District, New Taipei City,
Taiwan, R.O.C.

Kwei Shan

Tel: 886-3-271-8666

No. 3-1, Lane 6, Wen San 3rd St.,
Kwei Shan District, Tao Yuan City
333, Taiwan, R.O.C.

Kwei Shan Site II

Tel: 886-3-271-8640

No. 14-1, Lane 19, Wen San 3rd
St., Kwei Shan District, Tao Yuan
City 333, Taiwan, R.O.C..

If you have any suggestion, please feel free to contact us as below information

Tel: 886-3-271-8666

Fax: 886-3-318-0155

Email: ICC_Service@icertifi.com.tw

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