

AS/NZS CISPR 32:2015

TEST REPORT

For

Pycom Ltd

High Point 9 Sydenham Road, Guildford Surrey GU1 3RX, Surrey, United Kingdom

Tested Model: LoPy4 1.0

Report Type: Original Report	Product Name: LoPy4 Module
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Report Number: RSHA180625001-18	
Report Date: 2019-02-16	
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant	Pycom Ltd
Test Model	LoPy4 1.0
Product	LoPy4 Module
Dimension	55mm (L)* 20 mm (W)*10 mm(H)
Highest Operation Frequency	2480MHz
Rate Voltage	DC 3.4-5.5V

**All measurement and test data in this report was gathered from production sample serial number: 20180625001.
(Assigned by the BACL. The EUT supplied by the applicant was received on 2018-06-25)*

Objective

This test report is prepared on behalf of *Pycom Ltd* in accordance with AS/NZS CISPR 32:2015 electromagnetic compatibility of multimedia equipment –Emission requirement.

The objective of the manufacturer is to determine compliance with AS/NZS CISPR 32:2015.

Related Submittal(s)/Grant(s)

No related submittal(s).

Test Methodology

CISPR 16-1-1: 2015, Specification for radio disturbance and immunity measuring apparatus and methods Part 1-1: Radio disturbance and immunity measuring apparatus- Measuring apparatus.

CISPR 16-1-4:2010+A2:2017, Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-4: Radio disturbance and immunity measuring apparatus – Antennas and test sites for radiated disturbance measurements.

CISPR 16-2-1: 2014, Specification for radio disturbance and immunity measuring apparatus and methods- Part2-1: Methods of measurement of disturbance and immunity- Conducted disturbance measurements.

CISPR 16-2-3: 2016, Specification for radio disturbance and immunity measuring apparatus and methods - Part2-3: Methods of measurement of disturbances and immunity- Radiated disturbance measurements.

CISPR 16-4-2: 2011+A1:2014, Specification for radio disturbance and immunity measuring apparatus and methods-Part 4-2: Uncertainties, statistics and limit modeling-Measurement instrumentation uncertainty.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 Meters.

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

FINAL

SYSTEM TEST CONFIGURATION

Justification

The system was configured for testing in normal condition.

Test mode: RF Communication

EUT exercise software

No exercise software was used to test.

Equipment Modifications

No modification was made to the EUT.

Support Equipment List and Details

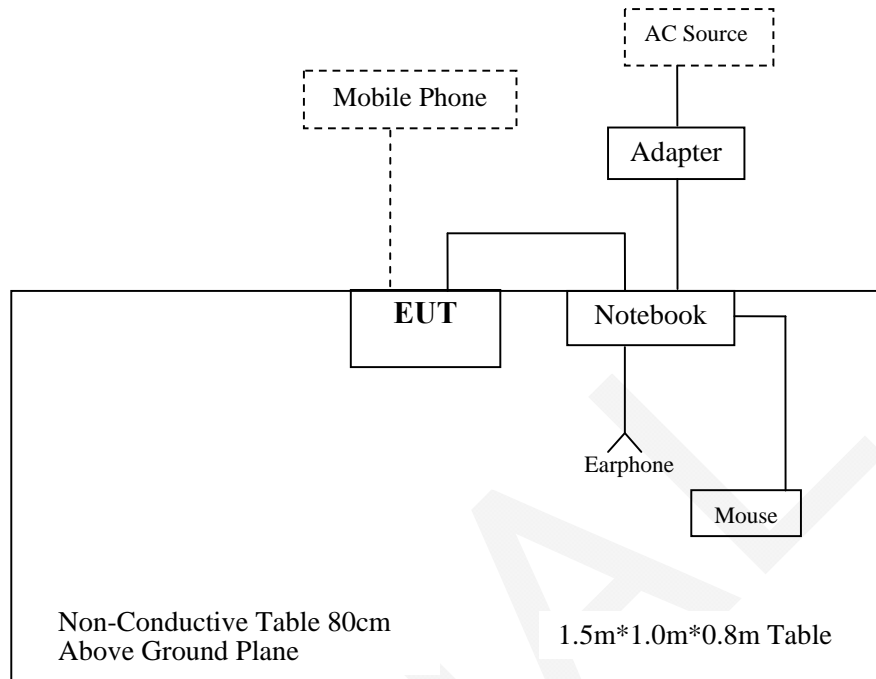
Manufacturer	Description	Model	Serial Number
HP	Notebook	0T7570	00045-644-490-410
HUAWEI	Mobile phone	EVA-TL00	862266039775394
Logitech	Mouse	M-U0026	HS529HB
BOLD	Earphone	/	/

External I/O Cable

Cable Description	Length (m)	From/Port	To
Power Cable	1.2	Notebook	Adapter
USB Cable	1.0	EUT	Notebook
Mouse USB Cable	1.0	Notebook1	Mouse

Block Diagram of Radiated Test Setup

Test mode: RF Communication



SUMMARY OF TEST REPORT**AS/NZS CISPR 32:2015**

RULE	DESCRIPTION	RESULTS
A.3	Disturbance Voltages	Compliance
A.2	Radiated Electromagnetic Disturbance	Compliance

Measurement Uncertainty

Item		Measurement Uncertainty	U_{cispr}
AMN	9kHz~30MHz	3.19 dB	3.4 ~ 3.8 dB

Vertical Reference Ground Plane

40cm

EUT

80cm

LISN

Bonded to Horizontal Ground Plane

Horizontal Reference Ground Plane

Test Receiver

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.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCS30	834115/007	2018-11-12	2019-11-11
ROHDE&SCHWARZ	LISN	ENV216	3560655016	2018-11-12	2019-11-11
BACL	BACL-EMC	V1.0	CE001	--	--
MICRO-COAX	Coaxial Cable	Cable-6	006	2018-09-08	2019-09-07

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

Corrected Factor & Margin Calculation

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

$$\text{Correction Amplitude} = \text{Meter Reading} + \text{VDF} + \text{Cable Loss} + \text{Transient Limiter Attenuation}$$

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

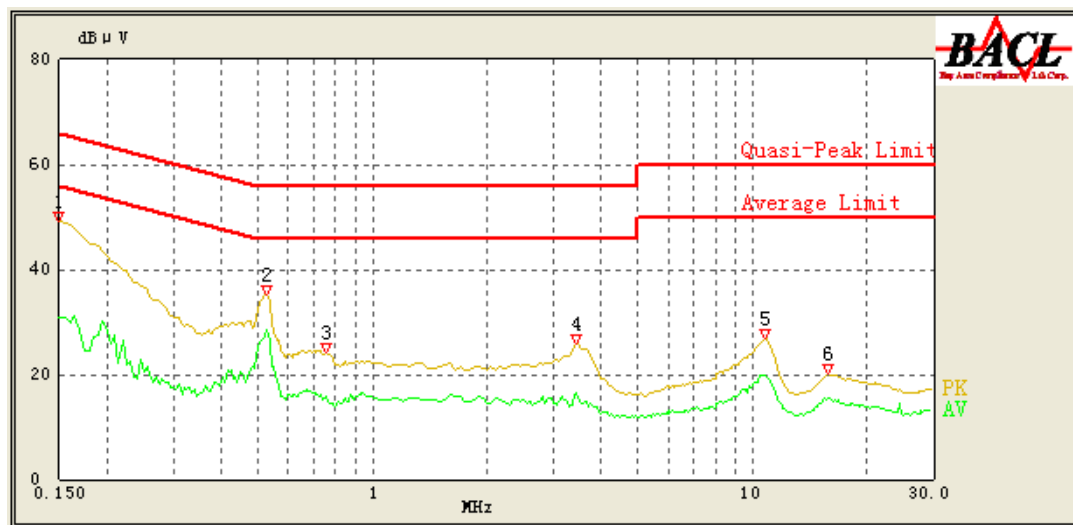
$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Data**Environmental Conditions**

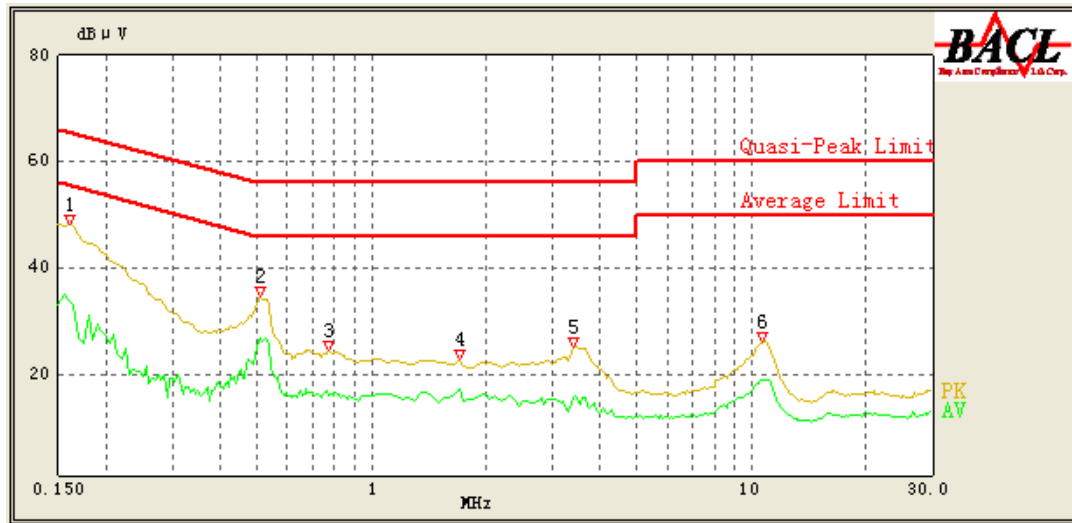
Temperature:	22°C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Iris Tuo on 2019-01-15.

Test mode: RF Communication

AC Main Port - Line:

No.	Frequency (MHz)	Reading (dBμV)	Correction (dB)	Limit (dBμV)	Margin (dB)	Detector (PK/AV/QP)
1	0.150	49.02	16.06	66.00	16.98	QP
	0.150	30.80	16.06	56.00	25.20	AV
2	0.525	35.11	16.06	56.00	20.89	QP
	0.525	28.55	16.06	46.00	17.45	AV
3	0.755	24.08	15.94	56.00	31.92	QP
	0.755	15.77	15.94	46.00	30.23	AV
4	3.450	25.82	15.85	56.00	30.18	QP
	3.450	16.36	15.85	46.00	29.64	AV
5	10.800	26.77	16.08	60.00	33.23	QP
	10.800	19.79	16.08	50.00	30.21	AV
6	15.850	20.02	16.25	60.00	39.98	QP
	15.800	15.38	16.25	50.00	34.62	AV

AC Main Port - Neutral:

No.	Frequency (MHz)	Reading (dBμV)	Correction (dB)	Limit (dBμV)	Margin (dB)	Detector (PK/AV/QP)
1	0.160	48.33	16.06	65.71	17.38	QP
	0.160	33.78	16.06	55.71	21.93	AV
2	0.510	34.58	16.10	56.00	21.42	QP
	0.510	26.83	16.10	46.00	19.17	AV
3	0.775	24.45	15.98	56.00	31.55	QP
	0.770	16.04	15.98	46.00	29.96	AV
4	1.700	23.01	15.92	56.00	32.99	QP
	1.700	17.17	15.92	46.00	28.83	AV
5	3.400	25.35	15.89	56.00	30.65	QP
	3.400	15.58	15.89	46.00	30.42	AV
6	10.650	26.03	15.99	60.00	33.97	QP
	10.600	18.92	15.99	50.00	31.08	AV

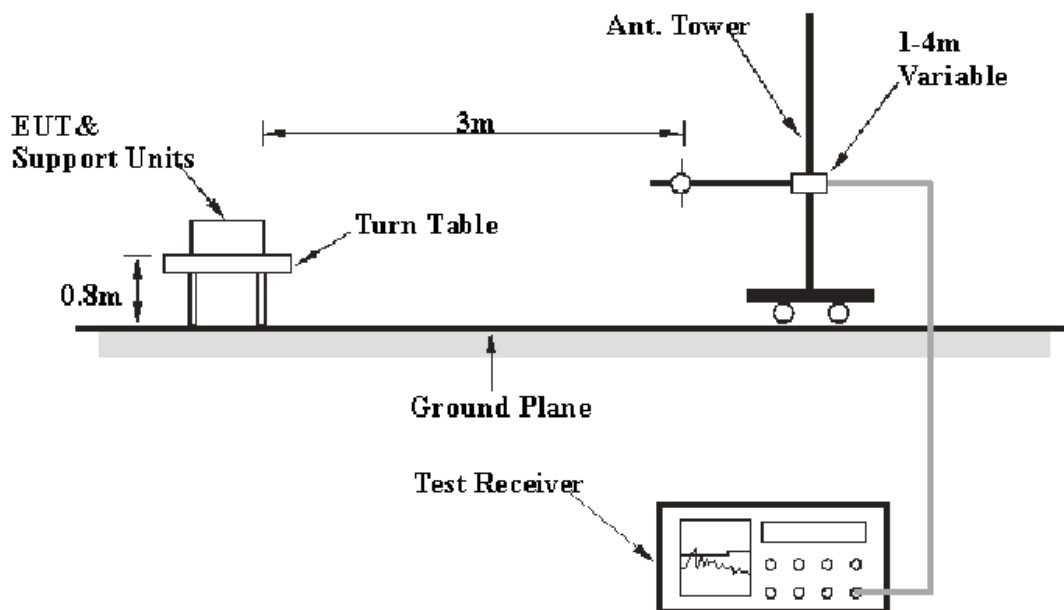
AS/NZS CISPR 32:2015 §A.2 - Radiated Electromagnetic Disturbances**Measurement Uncertainty**

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.

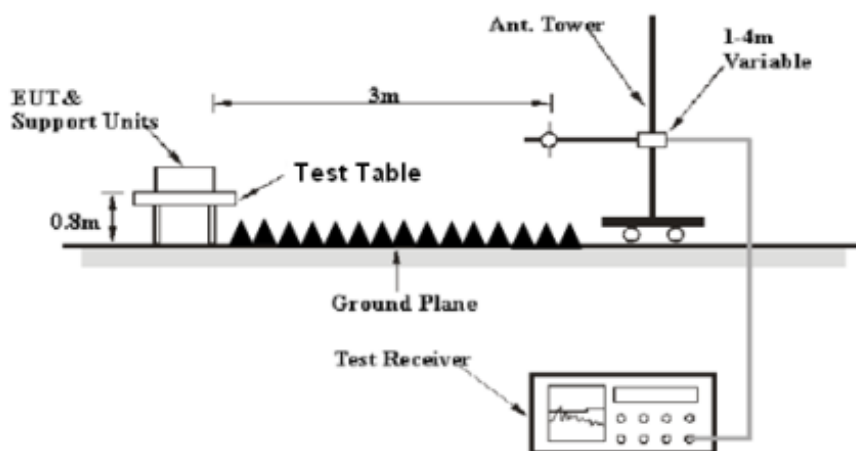
Item		Measurement Uncertainty	U_{cispr}
Radiated Emission	30MHz~1GHz	6.11dB	6.3 dB
	1GHz~6GHz	4.45dB	5.2 dB

Test System Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, the setup of EUT is according with CISPR 16-1-4:2010+A2:2017, CISPR16-2-3:2016 measurement procedure, the related limit was specified in the AS/NZS CISPR 32: 2015.

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 system was investigated from 30 MHz to 6 GHz.

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

Frequency Range	RBW	Video B/W	IF B/W	Detector
30MHz – 1000 MHz	120 kHz	300 kHz	120kHz	QP
Above 1 GHz	1MHz	3 MHz	/	Peak
	1MHz	3 MHz	1MHz	AVG

Test Procedure

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

All data was recorded in the Quasi-peak detection mode from 30MHz to 1GHz, Peak and average detection mode above 1 GHz.

Corrected Amplitude & Margin Calculation

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

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

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

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Sonoma Instrument	Amplifier	310N	185700	2018-08-14	2019-08-13
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2018-11-12	2019-11-11
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2019-01-09	2022-01-08
Champrotek	Chamber	Chamber A	T-KSEMC049	-	-
Champrotek	Chamber	Chamber B	T-KSEMC080	-	-
R&S	Auto test Software	EMC32	100361	-	-
ETS	Horn Antenna	3115	6229	2019-01-11	2022-01-10
Rohde & Schwarz	EMI Receiver	ESU40	100207	2018-08-27	2019-08-26
A.H.Systems, inc	Amplifier	2641-1	466	2018-09-11	2019-09-10
MICRO-COAX	Coaxial Cable	Cable-8	008	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-4	004	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-5	005	2018-08-15	2019-08-14

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

Test Data

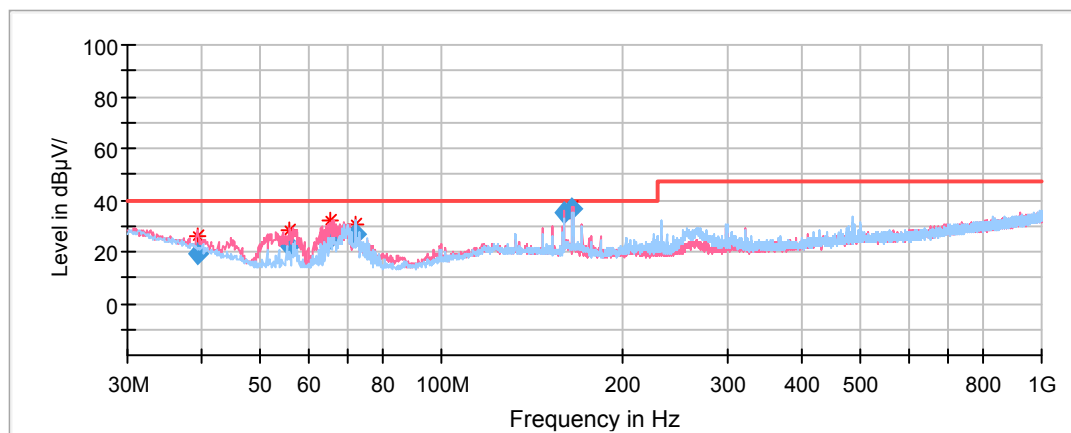
Environmental Conditions

Temperature:	27 °C
Relative Humidity:	48 %
ATM Pressure:	101.0 kPa

The testing was performed by Iris Tuo on 2019-01-14.

Test mode: RF Communication

1) Below 1GHz



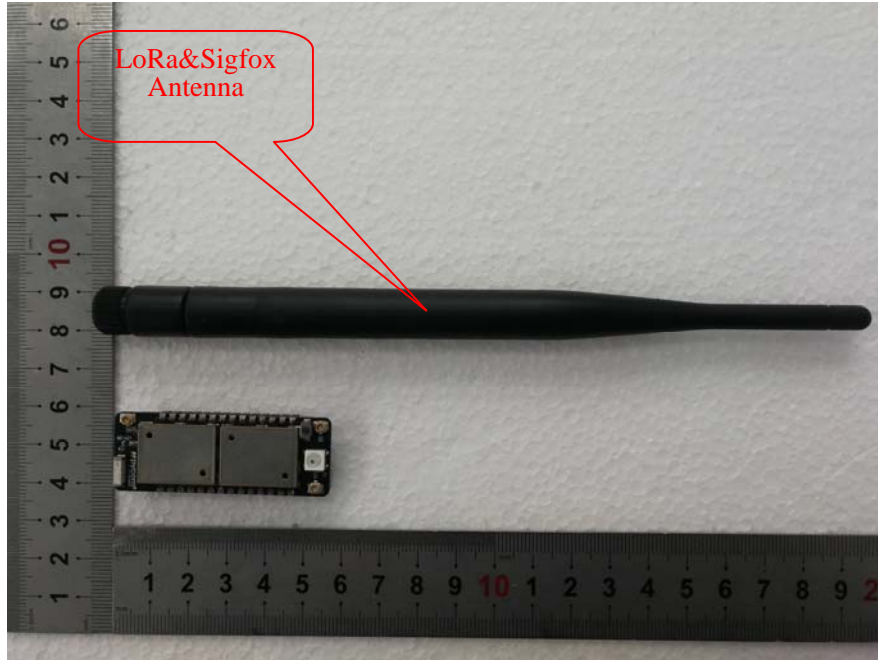
Frequency (MHz)	Quasi-Peak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
39.344900	19.53	40.00	20.47	101.0	V	118.0	-10.7
55.935800	22.12	40.00	17.88	101.0	V	42.0	-18.2
65.043450	25.05	40.00	14.95	101.0	V	73.0	-18.0
72.026850	26.42	40.00	13.58	199.0	H	200.0	-17.8
159.994100	34.88	40.00	5.12	101.0	V	234.0	-13.2
165.586050	36.50	40.00	3.50	101.0	V	306.0	-13.4

Above 1 GHz

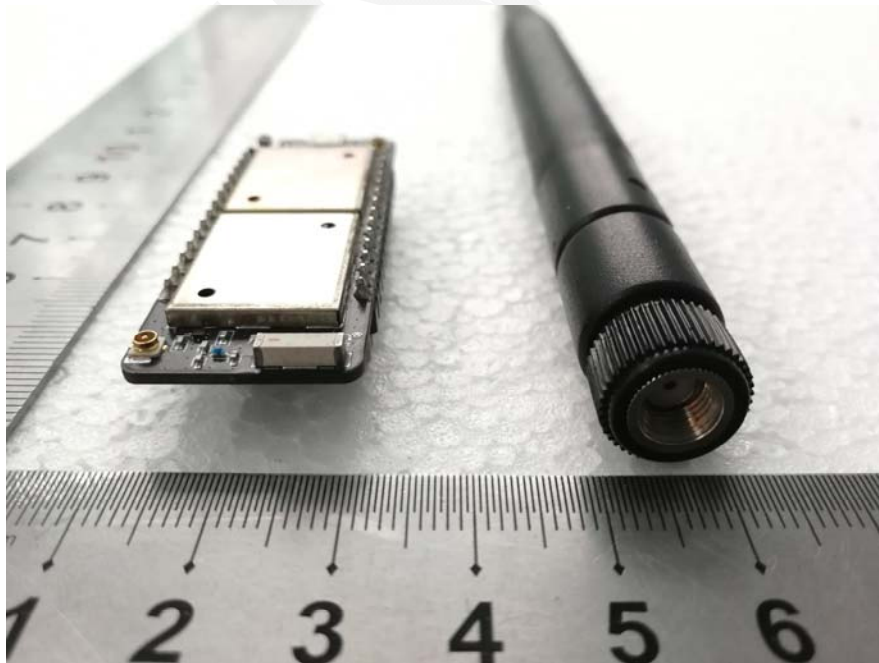
Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1332.000000	39.88	---	70.00	30.12	100.0	V	53.0	-2.2
1332.000000	---	28.99	50.00	21.01	100.0	V	53.0	-2.2
1804.000000	44.43	---	70.00	25.57	100.0	V	0.0	0.8
1804.000000	---	31.86	50.00	18.14	100.0	V	0.0	0.8
2913.000000	46.54	---	70.00	23.46	200.0	V	216.0	5.5
2913.000000	---	34.93	50.00	15.07	200.0	V	216.0	5.5
3216.000000	51.55	---	74.00	22.45	200.0	H	261.0	6.6
3216.000000	---	47.81	54.00	6.19	200.0	H	261.0	6.6
4156.000000	48.08	---	74.00	25.92	200.0	V	265.0	9.2
4156.000000	---	37.84	54.00	16.16	200.0	V	265.0	9.2
5940.000000	---	40.61	54.00	13.39	200.0	H	351.0	12.9
5940.000000	50.77	---	74.00	23.23	200.0	H	351.0	12.9

EXHIBIT A - EUT PHOTOGRAPHS

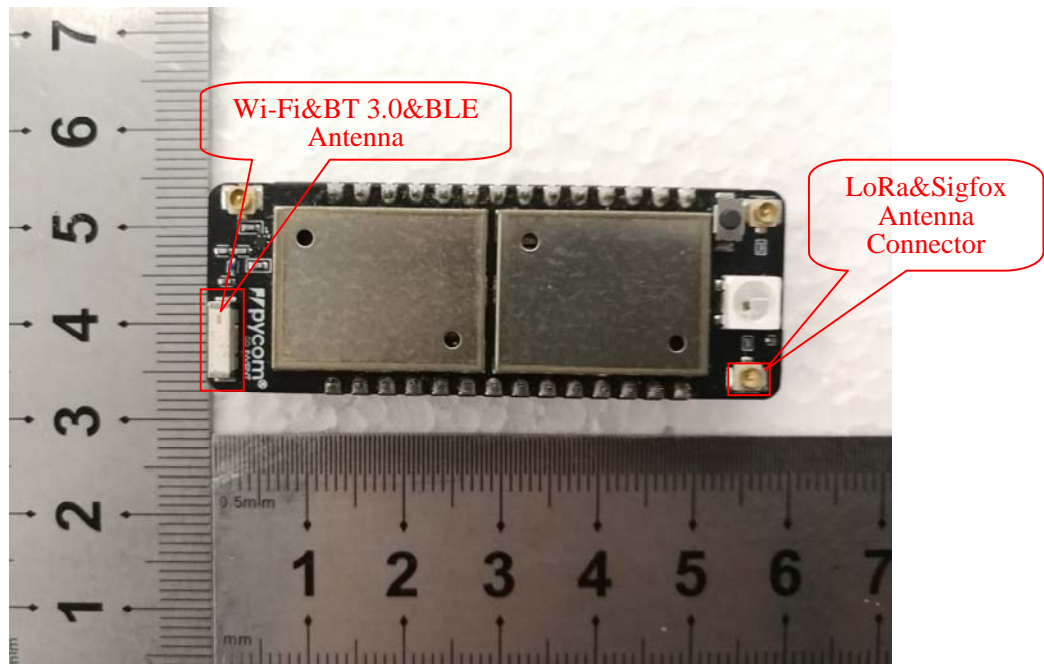
EUT – All View



EUT – Antenna Port View



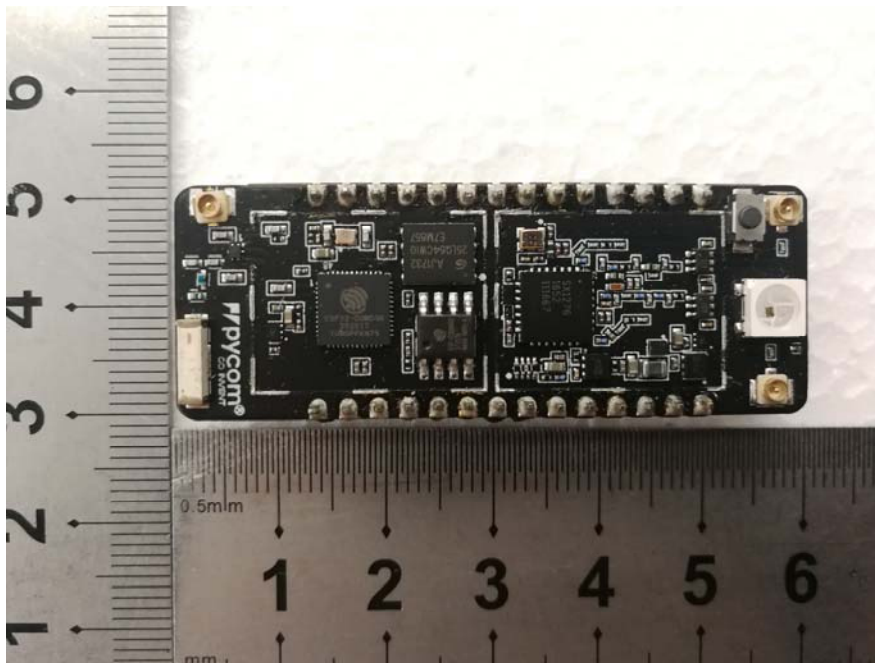
EUT - Top View



EUT - Bottom View



EUT - Shielding off View



EUT – IC Chip View

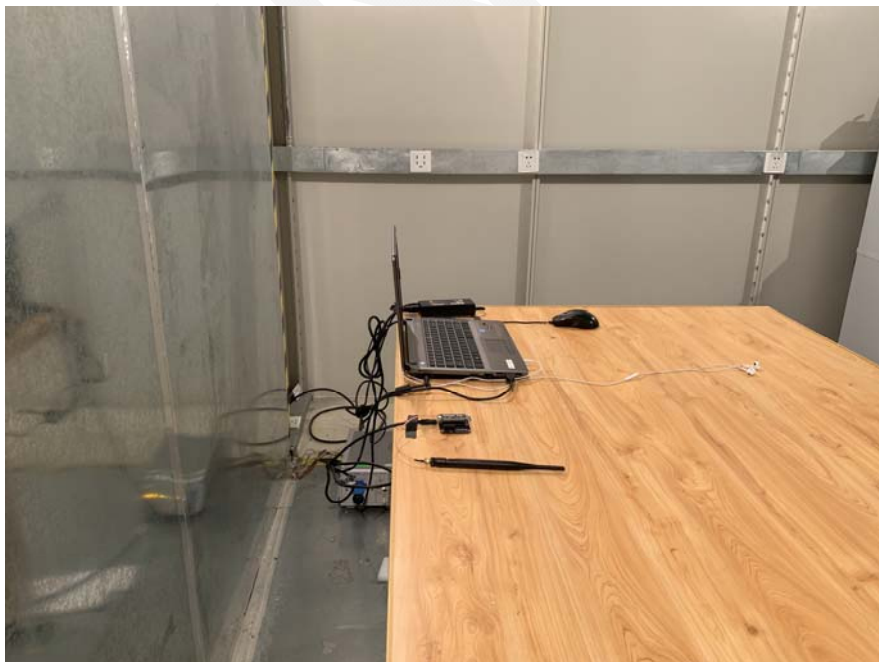


EXHIBIT B - TEST SETUP PHOTOGRAPHS

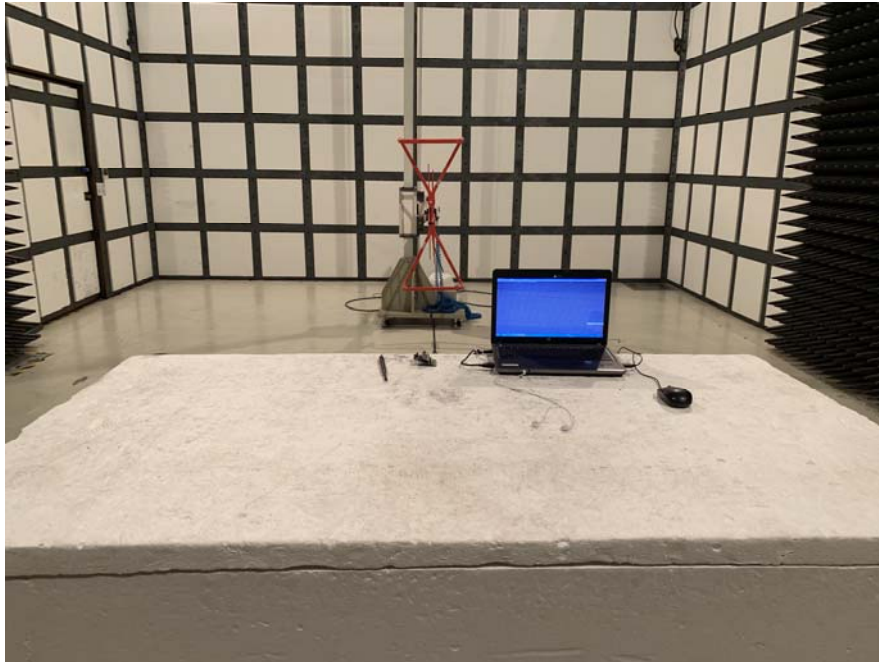
Disturbance Voltage - Front View (Main Port)



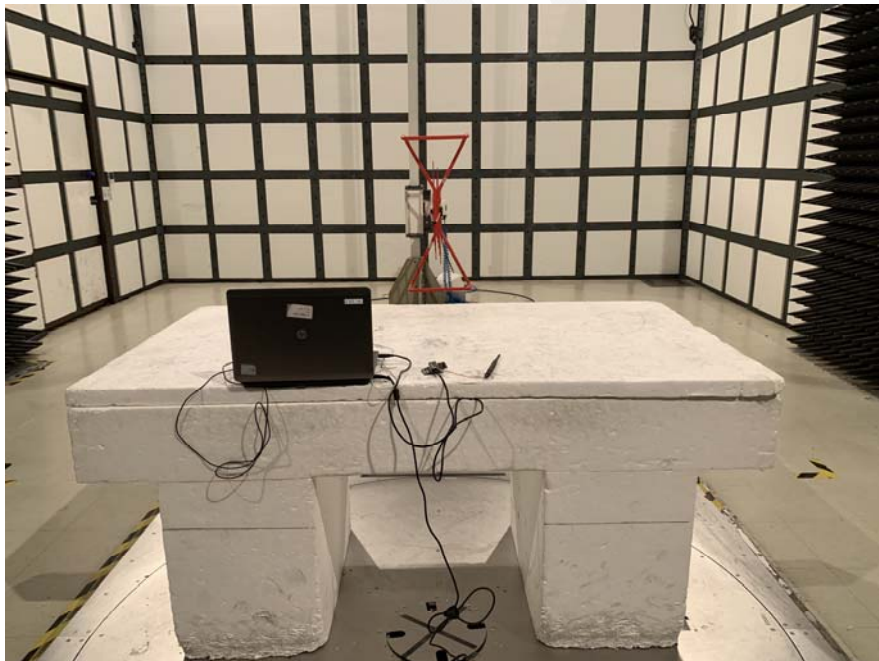
Disturbance Voltage - Rear View (Main Port)



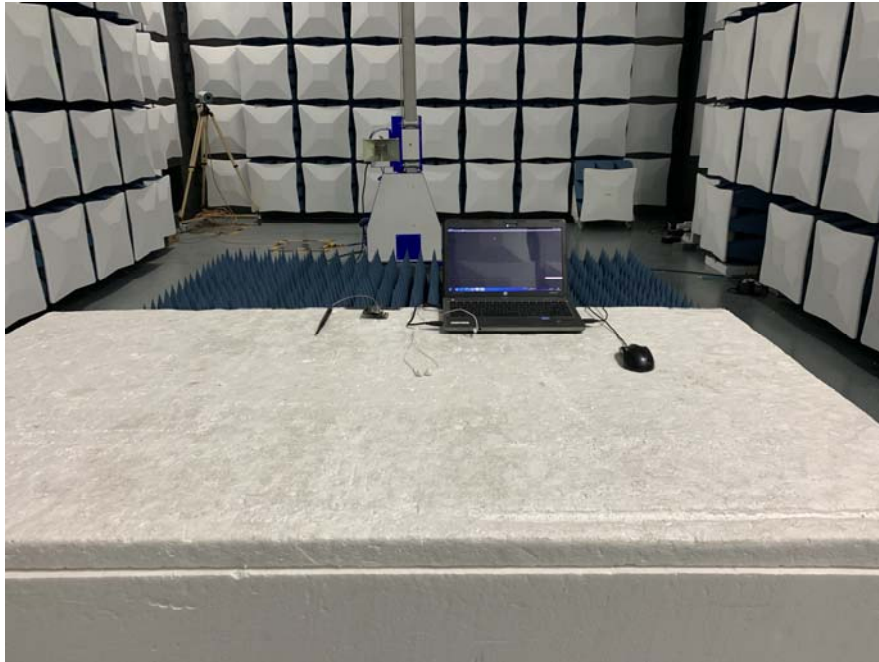
Radiated Electromagnetic Disturbance – Front View (Below 1GHz)



Radiated Electromagnetic Disturbance – Rear View (Below 1GHz)



Radiated Electromagnetic Disturbance – Side View (Above 1GHz)



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