


ELECTRO MAGNETIC TEST, INC.

 1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

**FCC PART 15.519, SUBPART F
TEST REPORT**
for
the
IPAS Pedestrian Tag
MODEL: PAS-K01-00

Prepared for

KYUNGWOO SYSTECH, INC.
 #401, Daeryung Post Tower 5, Gasan-dong,
 Geumcheon-gu, Seoul 153-702 South Korea

Prepared by:

ANDREAS DAVIDSSON

Approved by:

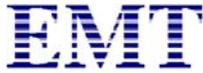
KEVIN BOTHMANN

ELECTRO MAGNETIC TEST, INC.
 1547 PLYMOUTH STREET
 MOUNTAIN VIEW, CALIFORNIA 94043
 (650) 965-4000

DATE: July 30, 2018

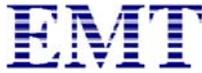
	REPORT BODY	APPENDICES				TOTAL
		A	B	C	D	
PAGES	24	17	13	2	2	58

This report shall not be reproduced except in full, without the written approval of Electro Magnetic Test, Inc.

**ELECTRO MAGNETIC TEST, INC.**1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

REVISION HISTORY

REVISION	DATE	COMMENTS	MODIFIED BY
1.0	July 30, 2018	Original Document	-
2.0	August 16, 2018	Updated minor details by request from client.	Andreas Davidsson



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

TABLE OF CONTENTS

GENERAL REPORT SUMMARY.....5

SUMMARY OF TEST RESULTS6

1. PURPOSE8

2.1 LOCATION OF TESTING9

2.2 TRACEABILITY STATEMENT9

2.3 COGNIZANT PERSONNEL9

2.4 DATE TEST SAMPLE WAS RECEIVED.....9

2.5 DISPOSITION OF THE TEST SAMPLE9

3. APPLICABLE DOCUMENTS.....10

4. DESCRIPTION OF TEST CONFIGURATION11

4.1 DESCRIPTION OF TEST CONFIGURATION – EMI11

4.1.1 Cable Construction and Termination12

5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT13

5.1 EUT AND ACCESSORY LIST13

5.2 EMI TEST EQUIPMENT14

6. TEST SITE DESCRIPTION16

6.1 TEST FACILITY DESCRIPTION16

6.2 EUT MOUNTING, BONDING AND GROUNDING16

6.3 FACILITY ENVIRONMENTAL CHARACTERISTICS16

7. TEST PROCEDURES.....17

7.1 OPERATIONAL LIMITATIONS.....17

7.2 RADIATED EMISSIONS18

7.2.1 Limits18

7.2.3 Test Procedure (Radiated).....19

7.3 UWB BANDWIDTH20

7.3.1 Limit (FCC PART 15 Section 15.519(b), 15.503(d)).....20

7.3.2 Test Procedure.....20

7.3.3 Test Result.....20

7.4 RADIATED EMISSIONS IN GPS BANDS21

7.4.1 Limit (FCC PART 15 Section 15.519(b), 15.503(d)).....21

7.4.2 Test Procedure.....21

7.4.3 Test Result.....21

7.5 PEAK EMISSIONS WITHIN A 50 MHZ BANDWITDH22

7.5.1 Limit (FCC PART 15 Section 15.519(e)).....22

7.5.2 Test Procedure.....22

7.5.3 Test Result.....22

7.6 ANTENNA REQUIREMENT23

7.6.1 Requirement (FCC PART 15 SECTION 15.203).....23

7.6.2 Test Result.....23

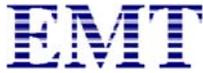
8. CONCLUSIONS / COMPLIANCE STATEMENT24

APPENDIX A.....1

APPENDIX B.....1

APPENDIX C.....1

APPENDIX D.....1



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

LIST OF APPENDICES

APPENDIX	TITLE
A	Radiated Data Sheets <ul style="list-style-type: none"> • Radiated Emissions Test Data • Peak Emissions Test Data • UWB Bandwidth Test Data
B	Test Setup Diagrams
C	Modifications To The EUT
D	Additional Models Covered Under This Report

LIST OF FIGURES

FIGURE	TITLE
1	Layout of 3 Meter Semi-Anechoic Chamber



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

GENERAL REPORT SUMMARY

This electromagnetic emission test report is generated by Electro Magnetic Test, Inc., which is an independent testing and consulting firm. The test report is based on testing performed Electro Magnetic Test, Inc. personnel according to the measurement procedure described in the test specification given below and in the "Test Procedures" section of this report.

The measurement data and conclusions appearing herein relate only to the sample tested and this report may not be reproduced in any form unless done so in full.

This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Federal Government.

The measurement data and conclusions contained in this test report are deemed satisfactory evidence of compliance with Industry Canada Interference-Causing Equipment Standard ICES-003, Issue 5, August 2012.

Electro Magnetic Test, Inc. is recognized by the following agencies for performing EMI/EMC testing:

COUNTRY	AGENCY	IDENTIFYING #
USA	Federal Communications Commission (FCC) (EMT's test site is recognized by the FCC)	Registration Number: 90576
USA, Canada, Taiwan, Australia/New Zealand, European Community	National Voluntary Lab Accreditation Program (NVLAP) (EMT is accredited by NVLAP. A copy of the NVLAP Scope Of Accreditation is available upon request.)	Lab Code: 200147-0
Canada	Industry Canada	File No.: IC 2804
Japan	Voluntary Control Council For Interference (VCCI)	A-0118
	Open Field Test Site "A"	-
	Mains Conducted Emissions Test Site "D"	-
	Telecom Conducted Emissions Test Site "D"	-
	3 Meter Semi-Anechoic Chamber Site "E"	-
	3 Meter Semi-Anechoic Chamber Site "E" (1GHz – 6GHz)	-
	Mains Conducted Emissions Test Site "E"	-
	Telecom Conducted Emissions Test Site "E"	-
Korea	Ministry of Information and Communication's Radio Research Laboratory (RRL) under the Asia Pacific Economic Cooperation (APEC) Mutual Recognition Arrangement (A copy of the Scope Of Accreditation is available upon request)	US0036
Taiwan	Bureau Of Standards, Metrology and Inspection (BSMI)	Reference Number: SL2-IN-E-1024
Australia / New Zealand	Australian Communications Authority (AUSTEL)	*

*These agencies do not issue an identifying number to test labs.


ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

GENERAL REPORT SUMMARY (CONTINUED)

Device Tested: IPAS Pedestrian Tag
 Model: PAS-K01-00
 S/N: 0000-18E080208

Product Description: When the pedestrian enters the warning or danger range, it makes vibration and beep alarm.

Modifications: The EUT was not modified during the testing.

Manufacturer: KYUNGWOO SYSTECH, INC.
 #401, Daeryung Post Tower 5, Gasan-dong, Geumcheon-gu,
 Seoul 153-702 South Korea

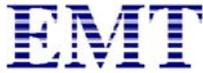
Test Date(s): 6/20/2018, 7/26/2018

Test Specifications: EMI requirements
 Limits: FCC Title 47, Part 15 Subpart F, Section 15.519
 Test Procedure: ANSI C63.10.2013

Test Deviations: The test procedure was not deviated from during the testing.

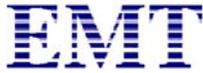
SUMMARY OF TEST RESULTS

TEST	DESCRIPTION	FCC STANDARD	REMARKS	RESULTS
7.1	Operational Limitations	15.519(a)	N/A	PASS
7.2	Radiated Emissions	15.519(c)	Radiated	PASS
7.3	UWB Bandwidth	15.519(b)	Radiated	PASS
7.4	Radiated Emissions in GPS Bands	15.519(d)	Radiated	PASS
7.5	Peak Emissions within a 50 MHz Bandwidth	15.519(e)	Radiated	PASS
7.6	Antenna Requirement	15.203	N/A	PASS

**ELECTRO MAGNETIC TEST, INC.**1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

TECHNICAL DESCRIPTION OF THE EUT

Manufacturer:	KYUNGWOO SYSTECH, INC.
Manufacturer Address:	#401, Daeryung Post Tower 5, Gasan-dong, Geumcheon-gu, Seoul 153-702 South Korea
EUT Name:	IPAS Pedestrian Tag
Model No:	PAS-K01-00
Operation frequency:	3993.6 MHz
Maximum Output Power:	54.6 dB μ v @ 3m

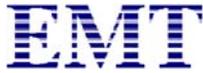


ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

1. PURPOSE

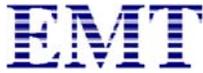
This document is a qualification test report based on the Electromagnetic Interference (EMI) tests performed on the IPAS Pedestrian Tag Model: PAS-K01-00. The EMI measurements were performed according to the measurement procedure described in ANSI C63.10-2013. The tests were performed in order to determine whether the electromagnetic emissions from the equipment under test, referred to as EUT hereafter, are within the specification limits defined in FCC Title 47, Part 15, Subpart F, Section 15.519.

**ELECTRO MAGNETIC TEST, INC.**1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

3. APPLICABLE DOCUMENTS

The following documents are referenced or used in the preparation of this EMI Test Report.

SPEC	TITLE
FCC Title 47, Part 15, Subpart F	FCC Rules - Radio frequency devices, Ultra Wideband Operation
FCC Publication 393764 D01 UWB FAQ v02	Ultra-Wide Band (UWB) Device Frequently Asked Questions, January 29, 2018
ANSI C63.10-2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

4. DESCRIPTION OF TEST CONFIGURATION

4.1 Description of Test Configuration – EMI

During testing the UWB radio was continuously transmitting. The EUT was tested in three positions; laying horizontally along the table without the support clip, set vertically along the table, and laying horizontally along the table with the support clip. The horizontal with the support clip was chosen for testing.

It was determined that the emissions were at their highest level when the EUT was operating in the above configuration. The EUT emissions were investigated in all 3 orthogonal planes. The final radiated data was taken in this mode of operation. All initial investigations were performed with the EMI receiver in manual mode scanning the frequency range continuously.



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

4.1.1 Cable Construction and Termination

The EUT did not have any cables that were set up during testing

**ELECTRO MAGNETIC TEST, INC.**1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT**5.1 EUT and Accessory List**

EQUIPMENT TYPE	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID
IPAS Pedestrian Tag (EUT)	Kyungwoo Systech, Inc.	PAS-K01-00	0000-18E080208	ZE8-PAS-K01-00


ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

5.2 EMI Test Equipment

EQUIPMENT TYPE	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. CYCLE
Spectrum Analyzer	Hewlett Packard	8566B	3024A20115	September 30, 2017	1 Year
RF Preselector	Hewlett Packard	85685A	3010A01157	September 30, 2017	1 Year
Quasi-Peak Adapter	Hewlett Packard	85650A	2430A00451	September 30, 2017	1 Year
Radiated EMI Software	Sector Design	N/A	Ver.1.4.6	N/A	N/A
EMI Receiver (Conducted EMI)	Rohde & Schwarz	ESU40	100295	July 18, 2018	1 Year
Conducted EMI Software	ETS-Lindgren	Tile!	Rev. 7.0.12.697	N/A	N/A
Preamplifier	Hewlett Packard	8447D	1937A02579	March 5, 2018	1 Year
RF Attenuator	Com Power	LIT-153A	531175	December 15, 2017	1 Year
LISN	Solar Electronics	Type 21107-50-TS-50-N	21107150701	January 2, 2018	1 Year
LISN	Solar Electronics	Type 21107-50-TS-50-N	21107150702	January 2, 2018	1 Year
LISN	Solar Electronics	Type 21107-50-TS-50-N	21107150703	January 2, 2018	1 Year
LISN	Solar Electronics	Type 21107-50-TS-50-N	21107150704	January 2, 2018	1 Year
TLISN (CAT5)	Fischer	F-071115-1057-1-09	091407	August 21, 2017	1 Year
LCL Adaptor	Fischer	T8ALCL-1	091407.02	August 21, 2017	1 Year
Biconical Antenna	Com Power	AB-100	01557	July 21, 2018	1 Year
Log Periodic Antenna	Com Power	AL-100	16001	June 20, 2017	1 Year
Antenna Mast	Com Power	AM-400	N/A	N/A	N/A
Turntable	Com Power	TT-100	N/A	N/A	N/A
Computer	Dell, Inc.	DHS	DNSV641	N/A	N/A
Printer	Hewlett Packard	C8124A	CN39A220ZD	N/A	N/A


ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

5.2 EMI Test Equipment (Continued)

EQUIPMENT TYPE	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. CYCLE
AC Power Source	California Instruments	5001iX-208	59036	August 30, 2017	1 Year
Harmonic/Flicker Meter	California Instruments	PACS-1	72711	August 30, 2017	1 Year
Harmonic/Flicker Test Software	California Instruments	CTS 4.0	V4.14.0	N/A	N/A
EMI Receiver	Rohde & Schwarz	ESU40	100127	February 2, 2018	1 Year
EMI Test Software	Rohde & Schwarz	EMC32	V8.54.0	N/A	N/A
BiConiLog Antenna	ETS-Lindgren	3143B	00206757	April 24, 2018	1 Year
Horn Antenna	ETS-Lindgren	3117	00109294	July 14, 2018	1 Year
Preamplifier	Rohde & Schwarz	TS-PR18	100056	December 12, 2017	1 Year
Antenna Mast	ETS-Lindgren	2171B	00150364	N/A	N/A
Turntable	ETS-Lindgren	2187-3.0	00118231	N/A	N/A
Computer	Dell, Inc.	Optiplex 745	4T50WC1	N/A	N/A
Multi-Function Controller	ETS-Lindgren	2090	00102270	N/A	N/A



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

6. TEST SITE DESCRIPTION

6.1 Test Facility Description

Please refer to the table below and section 7 of this report for the details of which sites were used for testing. All sites are located at 1547 Plymouth Street, Mountain View, California 94043.

Site Used For Test	Site Description
	Open Field Test Site "A"
	Mains Conducted Emissions Test Site "D"
X	3 Meter Semi-Anechoic Chamber Site "E"
	Mains Conducted Emissions Test Site "E"

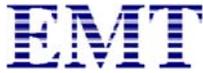
6.2 EUT Mounting, Bonding and Grounding

The EUT was mounted on a 1.0 by 1.5 meter non-conductive table 0.8 meters above the ground plane, with the height increased to 1.5 meters for radiated emissions testing above 1 GHz.

The EUT was not grounded.

6.3 Facility Environmental Characteristics

All tests were performed in a climate controlled building. The temperature was 23° C, humidity 53%, and barometric pressure 102.7 kPa.



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

7. TEST PROCEDURES

7.1 Operational Limitations

FCC 47 CFR Section 15.519 (a) (1)

A UWB device operating under the provisions of this section shall transmit only when it is sending information to an associated receiver. The UWB intentional radiator shall cease transmission within 10 seconds unless it receives an acknowledgement from the associated receiver that its transmission is being received. An acknowledgment of reception must continue to be received by the UWB intentional radiator at least every 10 seconds or the UWB device must cease transmitting.

The EUT was tested for this requirement and found to comply, please see the datasheets in Appendix A for the measurement results.

FCC 47 CFR Section 15.519 (a) (2)

The use of antennas mounted on outdoor structures, e.g., antennas mounted on the outside of a building or on a telephone pole, or any fixed outdoors infrastructure is prohibited. Antennas may be mounted only on the hand held UWB device.

The client has been informed of this requirement.

FCC 47 CFR Section 15.519 (a) (3)

UWB devices operating under the provisions of this section may operate indoors or outdoors.

The client has been informed of this requirement.



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

7.2 Radiated Emissions

7.2.1 Limits

General Requirements Limit (FCC PART 15 Section 15.209(a)(1))

Frequency of Emission (MHz)	Field Strength		Measurement Distance (Meters)
	$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$	
0.009-0.49	2400/F(kHz)		300
0.49-1.705	24000/F(kHz)		30
1.705-30	30		30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960*	500*	54*	3*

*Not applicable for above 960 MHz measurements

(FCC PART 15 Section 15.519(c))

The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in §15.209. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency in MHz	EIRP in dBm
960-1610	-75.3
1610-1990	-63.3
1990-3100	-61.3
3100-10600	-41.3
Above 10600	-61.3



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

7.2.3 Test Procedure (Radiated)

The Rohde & Schwarz ESU40 EMI receiver was used as a measuring meter while under software control by the Rohde & Schwarz EMC32 software. To increase the sensitivity of the instrument, the built in preamplifier was used from 9 KHz to 0.960 GHz. From 0.960 GHz to 1.610 GHz both built in and external preamplifiers were used. From 1.610 GHz to 40 GHz only external preamplifiers were used.

The EMI receiver was used in the peak detect mode with the "Max Hold" feature activated. In this mode, the EMI receiver records the highest measured reading over all the sweeps. The built in quasi-peak or average detector was used only for those readings which are marked accordingly on the data sheets.

The Loop Antenna, Broadband BiConiLog and horn antennas were used as transducers during the measurement. The Loop antenna was used from 9 KHz to 30 MHz, the BiConiLog antenna was used from 30 MHz to 1000 MHz and horn antennas were used from 1GHz – 40GHz. The frequency spans were wide (9 kHz to 150 kHz, 150 kHz to 30 MHz, 30 MHz to 88 MHz, 88 MHz to 216 MHz, 216 to 300 MHz, 300 MHz to 1 GHz, 1 GHz to 18 GHz and 18 GHz to 26.5 GHz) during preliminary investigations. Furthermore, the frequency span was reduced during the preliminary investigations as deemed necessary.

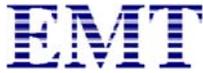
The 3 meter semi-anechoic chamber of Electro Magnetic Test, Inc. was used for radiated emission testing. This test site is set up according to ANSI C63.10-2013. Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The turntable supporting the EUT is remote controlled using a motor. The turntable permits EUT rotation of 360 degrees in order to maximize emissions. Also, the antenna mast allows height variation of the antenna from 1 meter to 4 meters. Data was collected in the worst case (highest emission) configuration of the EUT. The EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters (for E field radiated field strength).

The presence of non EUT signals was verified by turning the EUT off. In case a non EUT signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the other signal does not hide any emissions from the EUT. The EUT was tested at a 3 meter test distance (unless noted) from 30 MHz to 18 GHz. to obtain final test data.

Calculation Of Radiated Emission Test Data:

Amplitude - Gain + Antenna Factor + Cable Loss = Corrected Amplitude

Corrected Amplitude - Limit = Margin



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

7.3 UWB Bandwidth

7.3.1 Limit (FCC PART 15 Section 15.519(b), 15.503(d))

FCC PART 15 Section 15.519(b)

(b) The UWB bandwidth of a UWB system operating under the provisions of this section must be contained between 3100 MHz and 10600 MHz

Limit
UWB bandwidth within 3100 MHz and 10600 MHz

FCC PART 15 Section 15.503(d)

Ultra-wideband (UWB) transmitter. An intentional radiator that, at any point in time, has a fraction bandwidth equal to or greater than 0.20 or has a UWB bandwidth equal to or greater than 500 MHz, regardless of the fractional bandwidth

Limit
Fractional Bandwidth ≥ 0.20 Or UWB Bandwidth (10 dB below highest radiated emission) ≥ 500 MHz

7.3.2 Test Procedure

Set EUT and test equipment as indicted in Radiated Emissions Procedure

RBW: 1 MHz
 VBW: $\geq 3 \times$ RBW
 Detector: Peak
 Trace Mode: Max Hold

- (1) Set analyzer center frequency to center of signal.
- (2) Set measurement to 10 db down.
- (3) Wait for Trace to stabilize.
- (4) Mark delta of bandwidth frequency.
- (5) Compare marker to limit.

7.3.3 Test Result

The EUT meets the requirements. Please see the datasheets in Appendix A for the measurement results.


ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

7.4 Radiated Emissions in GPS Bands
7.4.1 Limit (FCC PART 15 Section 15.519(b), 15.503(d))

In addition to the radiated emission limits specified in the table in paragraph (c) of this section, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency in MHz	EIRP in dBm
1164-1240	-85.3
1559-1610	-85.3

7.4.2 Test Procedure

Set EUT and test equipment as indicted in Radiated Emissions Procedure

RBW: 1 MHz

VBW: $\geq 3 \times$ RBW

Detector: Peak

Trace Mode: Max Hold

- (1) Set analyzer center frequency to 1164-1240 MHz
- (2) Wait for the result to stabilize.
- (3) Compare peak emission to limit.
- (4) Repeat for frequency range 1559-1610 MHz.

7.4.3 Test Result

The EUT meets the requirements. Please see the datasheets in Appendix A for the measurement results.


ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

7.5 Peak Emissions within a 50 MHz Bandwidth
7.5.1 Limit (FCC PART 15 Section 15.519(e))

There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, $f(m)$. That limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, follow the procedures described in 15.521

Limit
0 dBm EIRP when using 50 MHz measurement bandwidth

7.5.2 Test Procedure

Set EUT and test equipment as indicated in Radiated Emissions Procedure

RBW: 3 MHz

VBW: \geq RBW

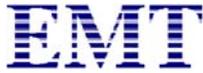
Detector: Peak

Trace Mode: Max Hold

- (1) Set analyzer center frequency to center of signal.
- (2) Let trace complete and turn on marker peak search mode.
- (3) Compare peak emission to limit.

7.5.3 Test Result

The EUT meets the requirements. Please see the datasheets in Appendix A for the measurement results and relevant calculations.

**ELECTRO MAGNETIC TEST, INC.**1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

7.6 Antenna Requirement

7.6.1 Requirement (FCC PART 15 SECTION 15.203)

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

7.6.2 Test Result

The antenna is permanently attached.



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

8. CONCLUSIONS / COMPLIANCE STATEMENT

Based upon the results contained in this report, Electro Magnetic Test, Inc. has determined that the IPAS Pedestrian Tag, Model: PAS-K01-00 meets all of the specification limits defined in FCC Title 47, Part 15, Subpart F, Section 15.519

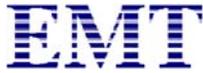


ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

APPENDIX A

RADIATED DATA SHEETS



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

Radiated Emissions

EUT:	IPAS Pedestrian Tag	Model Name:	PAS-K01-00
Test Mode:	UWB	Test Date:	6/20/2018
Test Engineer:	Andreas Davidsson	Measurement:	30 MHz to 1 GHz

Limit Calculation (960 GHz to 1.610 GHz):

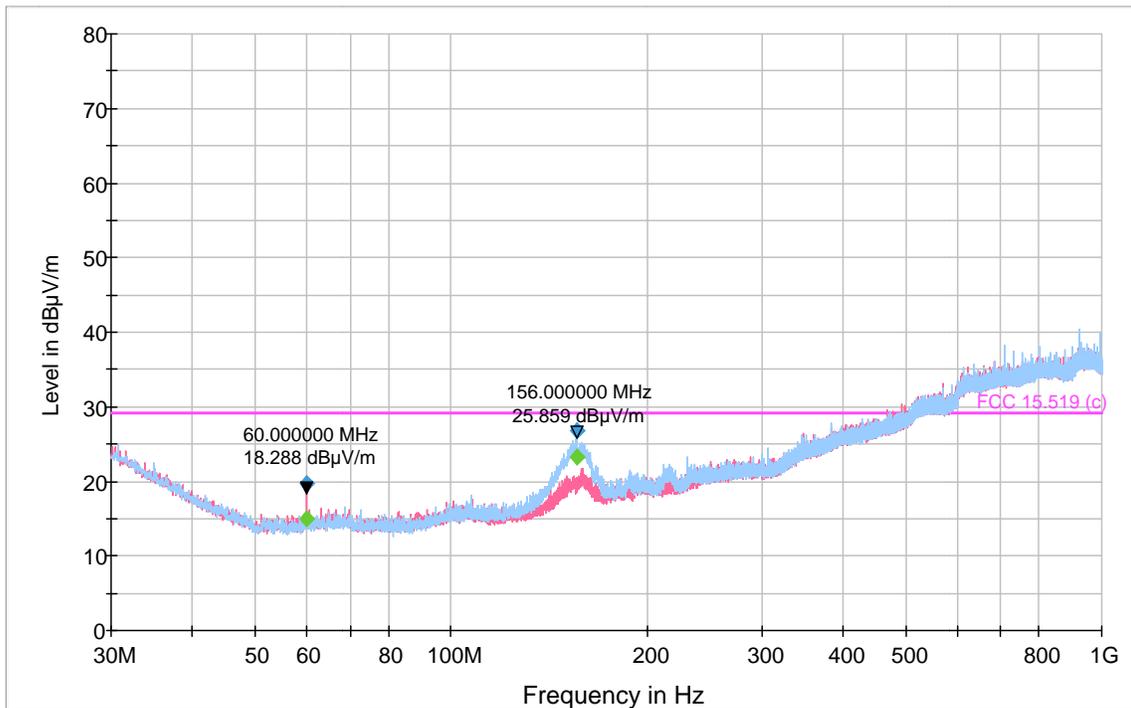
$E(\text{dB}\mu\text{V}/\text{m}) = 104.8 + \text{EIRP}(\text{dBm}) - 20\text{Log}(\text{Distance})$

Distance = 3 M

$E(\text{dB}\mu\text{V}/\text{m}) = 104.8 + (-75.3) - 20\text{Log}(3)$

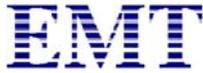
$E(\text{dB}\mu\text{V}/\text{m}) = 29.133$

FCC 15.519 (c) 30-1000MHz Radiated Scan 3m PK AVG



- FCC 15.519 (c)
- ◆ Final Result 1-PK+
- ◆ Preview Result 1V-PK+
- ◆ Final Result 2-QPK
- Preview Result 1H-PK+

Frequency (MHz)	QuasiPeak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
60.000000	14.9	114.0	V	37.0	11.6	14.20	29.10	PASS
156.000000	23.2	211.0	H	260.0	15.2	5.90	29.10	PASS



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

Radiated Emissions

EUT:	IPAS Pedestrian Tag	Model Name:	PAS-K01-00
Test Mode:	UWB	Test Date:	6/20/2018
Test Engineer:	Andreas Davidsson	Measurement:	1GHz to 1.610 GHz

Limit Calculation (1 GHz to 1.610 GHz):

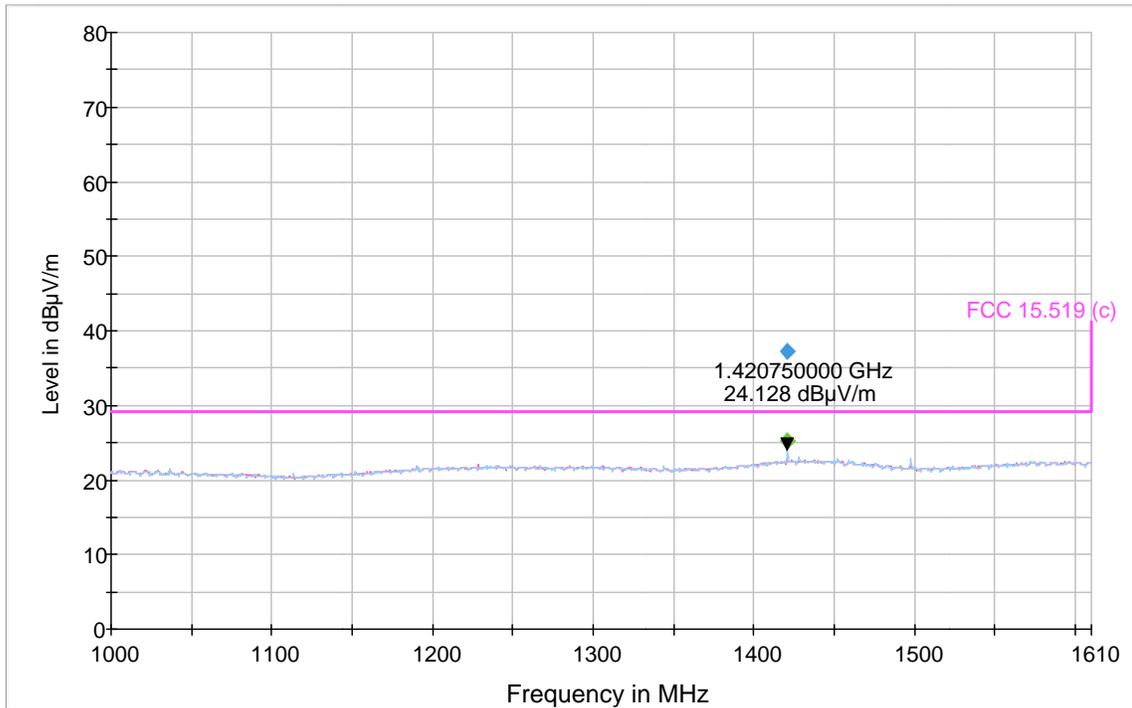
$E(\text{dB}\mu\text{V}/\text{m}) = 104.8 + \text{EIRP}(\text{dBm}) - 20\text{Log}(\text{Distance})$

Distance = 3 M

$E(\text{dB}\mu\text{V}/\text{m}) = 104.8 + (-75.3) - 20\text{Log}(3)$

$E(\text{dB}\mu\text{V}/\text{m}) = 29.133$

FCC 15.519 (c) 1000-1610MHz Radiated Scan 3m PK AVG



◆ FCC 15.519 (c) Final Result 1-PK+
 ◆ Preview Result 1V-AVG Final Result 2-AVG
 — Preview Result 1H-AVG

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
1420.750000	25.3	120.0	H	86.0	-2.8	3.90	29.10	



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

Radiated Emissions

EUT:	IPAS Pedestrian Tag	Model Name:	PAS-K01-00
Test Mode:	UWB	Test Date:	6/20/2018
Test Engineer:	Andreas Davidsson	Measurement:	1.610 GHz to 1.990 GHz

Limit Calculation (1.610 GHz to 1.990 GHz):

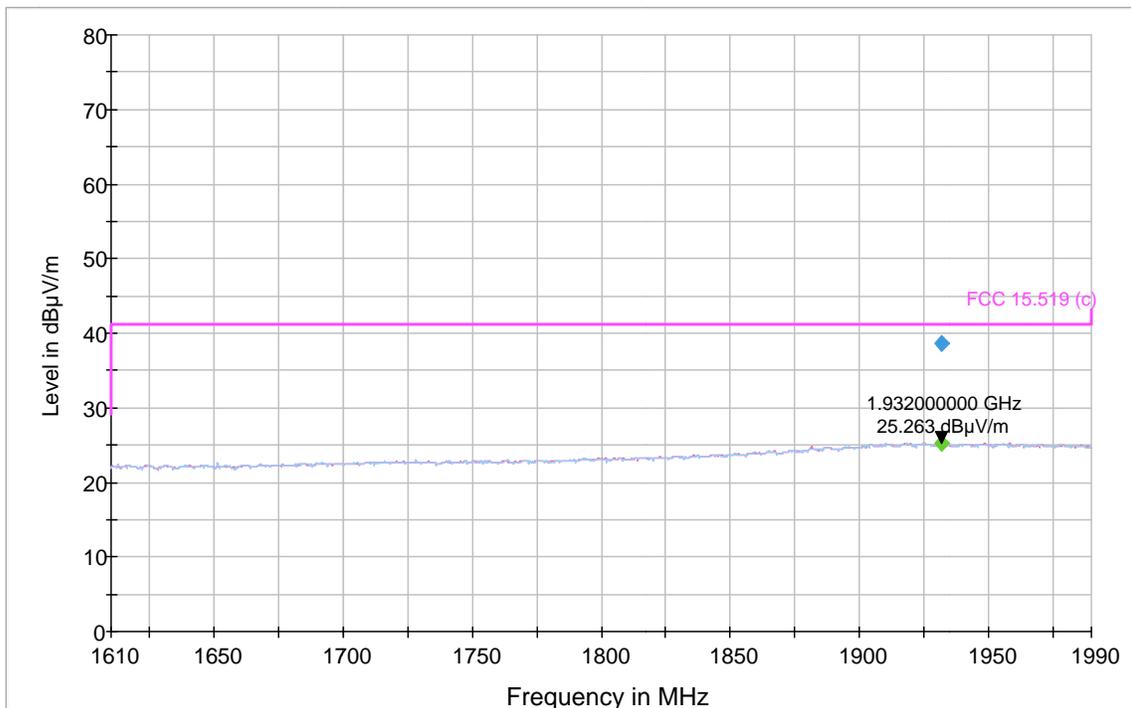
$E(\text{dB}\mu\text{V}/\text{m}) = 104.8 + \text{EIRP}(\text{dBm}) - 20\text{Log}(\text{Distance})$

Distance = 3 M

$E(\text{dB}\mu\text{V}/\text{m}) = 104.8 + (-63.3) - 20\text{Log}(3)$

$E(\text{dB}\mu\text{V}/\text{m}) = 41.13$

FCC 15.519 (c) 1610-1990MHz Radiated Scan 3m PK AVG



◆ FCC 15.519 (c) Final Result 1-PK+
 ◆ Preview Result 1V-AVG Final Result 2-AVG
 — Preview Result 1H-AVG

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
3072.000000	27.5	188.0	V	50.0	3.4	15.70	43.10	PASS



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

Radiated Emissions

EUT:	IPAS Pedestrian Tag	Model Name:	PAS-K01-00
Test Mode:	UWB	Test Date:	6/20/2018
Test Engineer:	Andreas Davidsson	Measurement:	1.990 GHz to 3.100 GHz

Limit Calculation (1.990 GHz to 3.100 GHz):

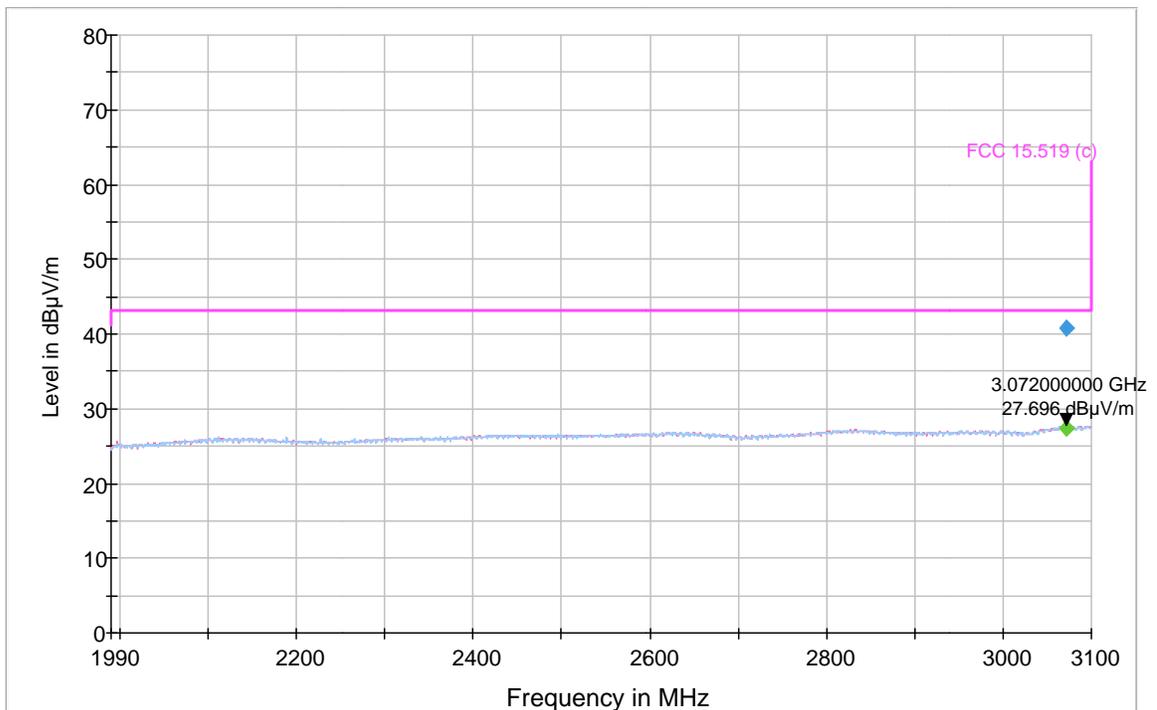
$E(\text{dB}\mu\text{V}/\text{m}) = 104.8 + \text{EIRP}(\text{dBm}) - 20\text{Log}(\text{Distance})$

Distance = 3 M

$E(\text{dB}\mu\text{V}/\text{m}) = 104.8 + (-61) - 20\text{Log}(3)$

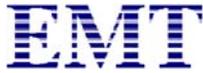
$E(\text{dB}\mu\text{V}/\text{m}) = 43.13$

FCC 15.519 (c) 1990-3100MHz Radiated Scan 3m PK AVG



◆ FCC 15.519 (c) Final Result 1-PK+
 ◆ Preview Result 1V-AVG Final Result 2-AVG
 Preview Result 1H-AVG

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
1932.000000	25.2	131.0	H	127.0	0.3	15.90	41.10	PASS



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

Radiated Emissions

EUT:	IPAS Pedestrian Tag	Model Name:	PAS-K01-00
Test Mode:	UWB	Test Date:	6/20/2018
Test Engineer:	Andreas Davidsson	Measurement:	3.100 GHz to 10.6 GHz

Limit Calculation (3.100 GHz to 10.6 GHz):

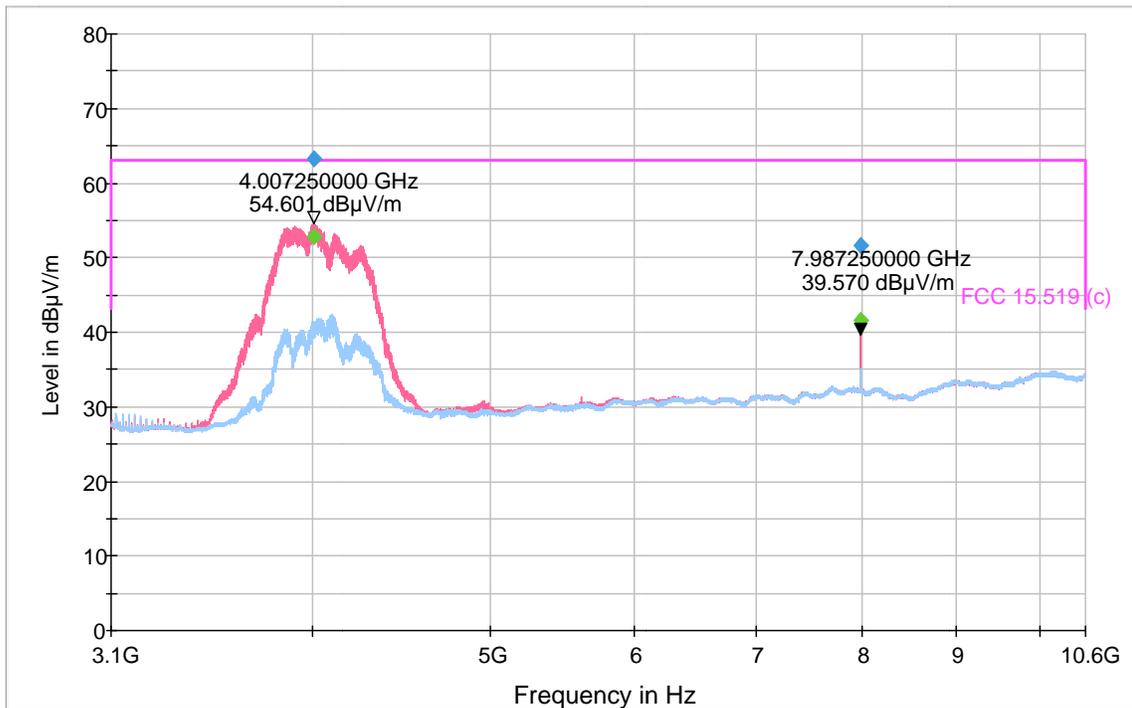
$E(\text{dB}\mu\text{V}/\text{m}) = 104.8 + \text{EIRP}(\text{dBm}) - 20\text{Log}(\text{Distance})$

Distance = 3 M

$E(\text{dB}\mu\text{V}/\text{m}) = 104.8 + (-41.3) - 20\text{Log}(3)$

$E(\text{dB}\mu\text{V}/\text{m}) = 63.13$

FCC 15.519 (c) 3100-10600MHz Radiated Scan 3m PK AVG



◆ FCC 15.519 (c) Final Result 1-PK+
 ◆ Preview Result 1V-AVG Final Result 2-AVG
 ◆ Preview Result 1H-AVG

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
4007.250000	52.9	100.0	V	296.0	4.8	10.30	63.10	PASS
7987.250000	41.5	334.0	V	190.0	11.1	21.60	63.10	PASS



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

Radiated Emissions

EUT:	IPAS Pedestrian Tag	Model Name:	PAS-K01-00
Test Mode:	UWB	Test Date:	6/20/2018
Test Engineer:	Andreas Davidsson	Measurement:	10.6 GHz to 18 GHz

Limit Calculation (10.6 GHz to 18 GHz):

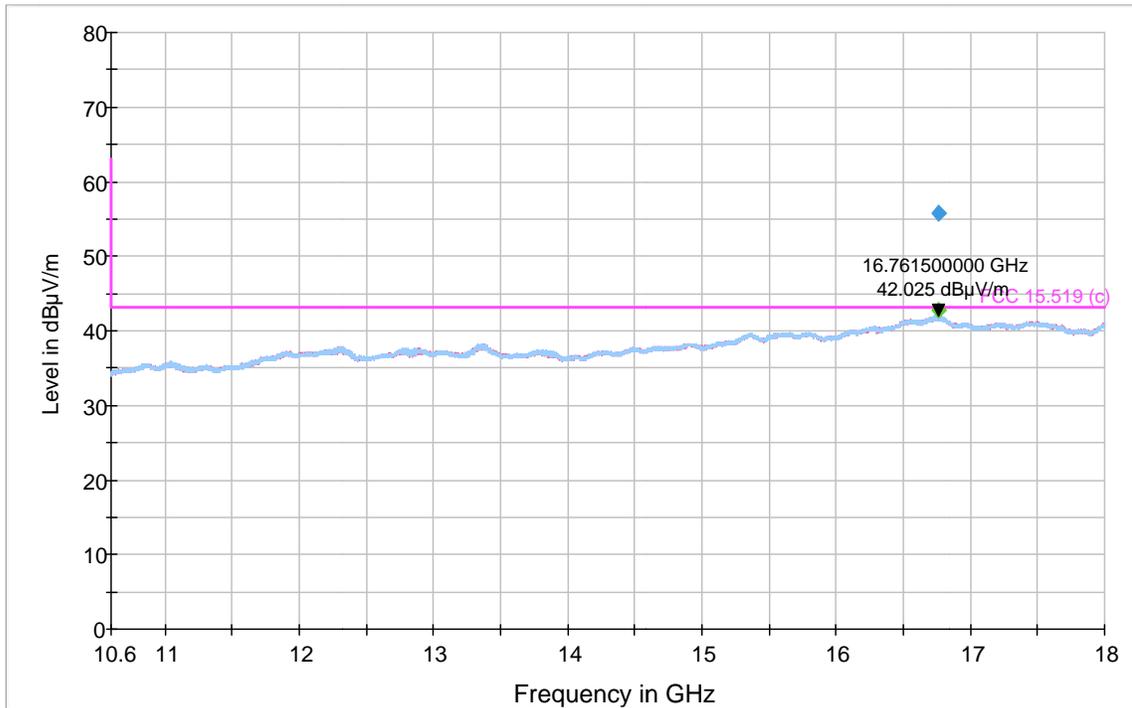
$E(\text{dB}\mu\text{V}/\text{m}) = 104.8 + \text{EIRP}(\text{dBm}) - 20\text{Log}(\text{Distance})$

Distance = 3 M

$E(\text{dB}\mu\text{V}/\text{m}) = 104.8 + (-61.3) - 20\text{Log}(3)$

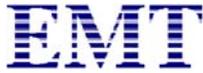
$E(\text{dB}\mu\text{V}/\text{m}) = 43.13$

FCC 15.519 (c) 10600-18000MHz Radiated Scan 3m PK AVG



◆ FCC 15.519 (c) Final Result 1-PK+
 ◆ Preview Result 1V-AVG Final Result 2-AVG
 Preview Result 1H-AVG

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
16761.500000	42.8	244.0	V	197.0	23.7	0.40	43.10	PASS



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

Radiated Emissions in GPS Bands

EUT:	IPAS Pedestrian Tag	Model Name:	PAS-K01-00
Test Mode:	UWB	Test Date:	7/26/2018
Test Engineer:	Andreas Davidsson	Measurement:	1164MHz to 1240 MHz and 1559 MHz to 1610 MHz

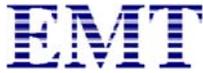
Limit Calculation (1164-1240 MHz and 1559-1610 MHz):

$$E(\text{dBuV/m}) = 116.2 + \text{EIRP}(\text{dBm}) - 20\text{Log}(\text{Distance})$$

Distance = 3 M

$$E(\text{dBuV/m}) = 104.8 + (-85.3) - 20\text{Log}(3)$$

$$E(\text{dBuV/m}) = 30.53$$

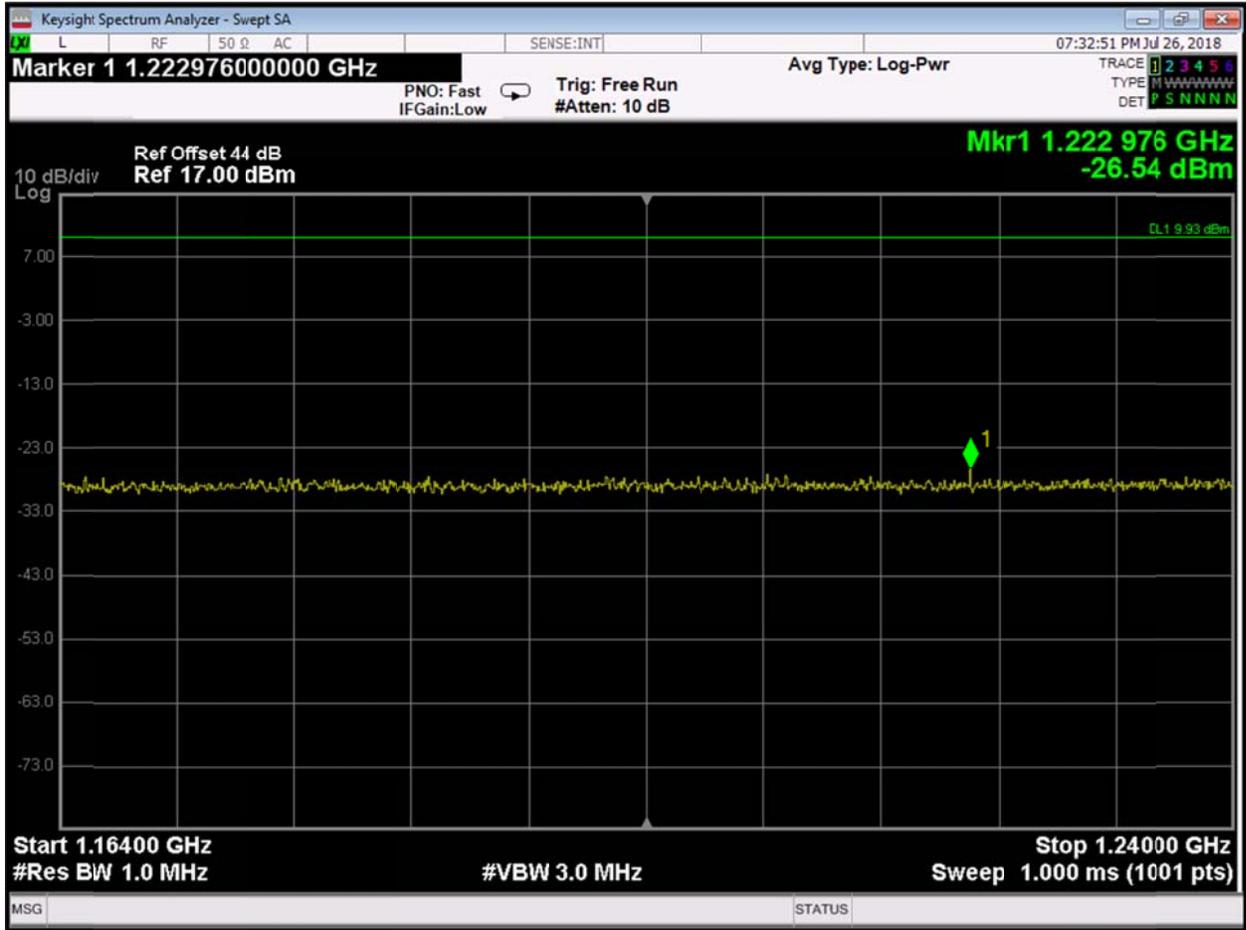


ELECTRO MAGNETIC TEST, INC.

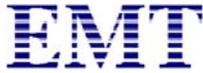
1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

Radiated Emissions in GPS Bands

EUT:	IPAS Pedestrian Tag	Model Name:	PAS-K01-00
Test Mode:	UWB	Test Date:	7/26/2018
Test Engineer:	Andreas Davidsson	Measurement:	1164MHz to 1240 MHz



1164-1240 MHz, Antenna Polarization

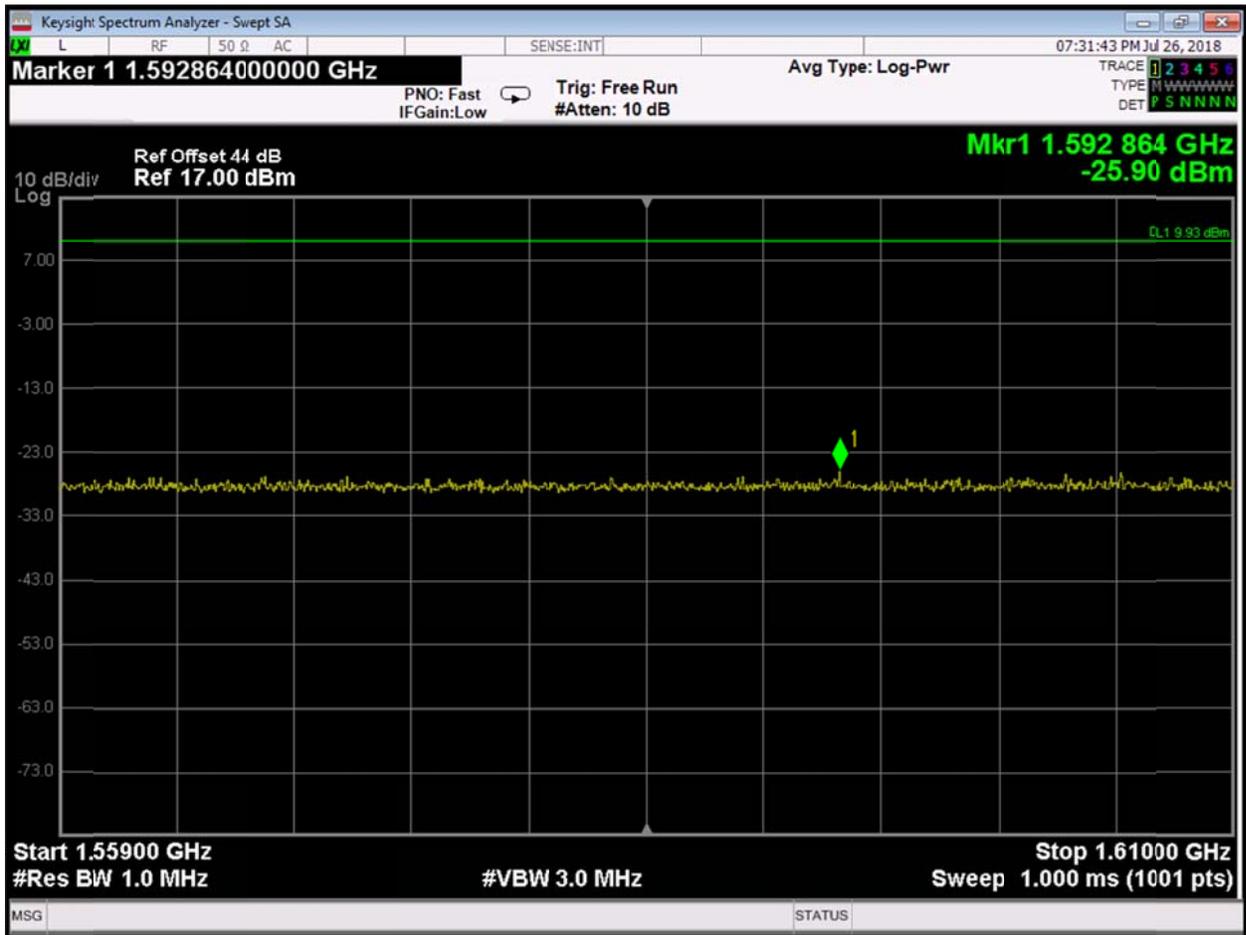


ELECTRO MAGNETIC TEST, INC.

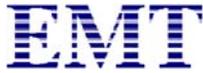
1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

Radiated Emissions in GPS Bands

EUT:	IPAS Pedestrian Tag	Model Name:	PAS-K01-00
Test Mode:	UWB	Test Date:	7/26/2018
Test Engineer:	Andreas Davidsson	Measurement:	1559 MHz to 1610 MHz



1559-1610 MHz, Antenna Polarization

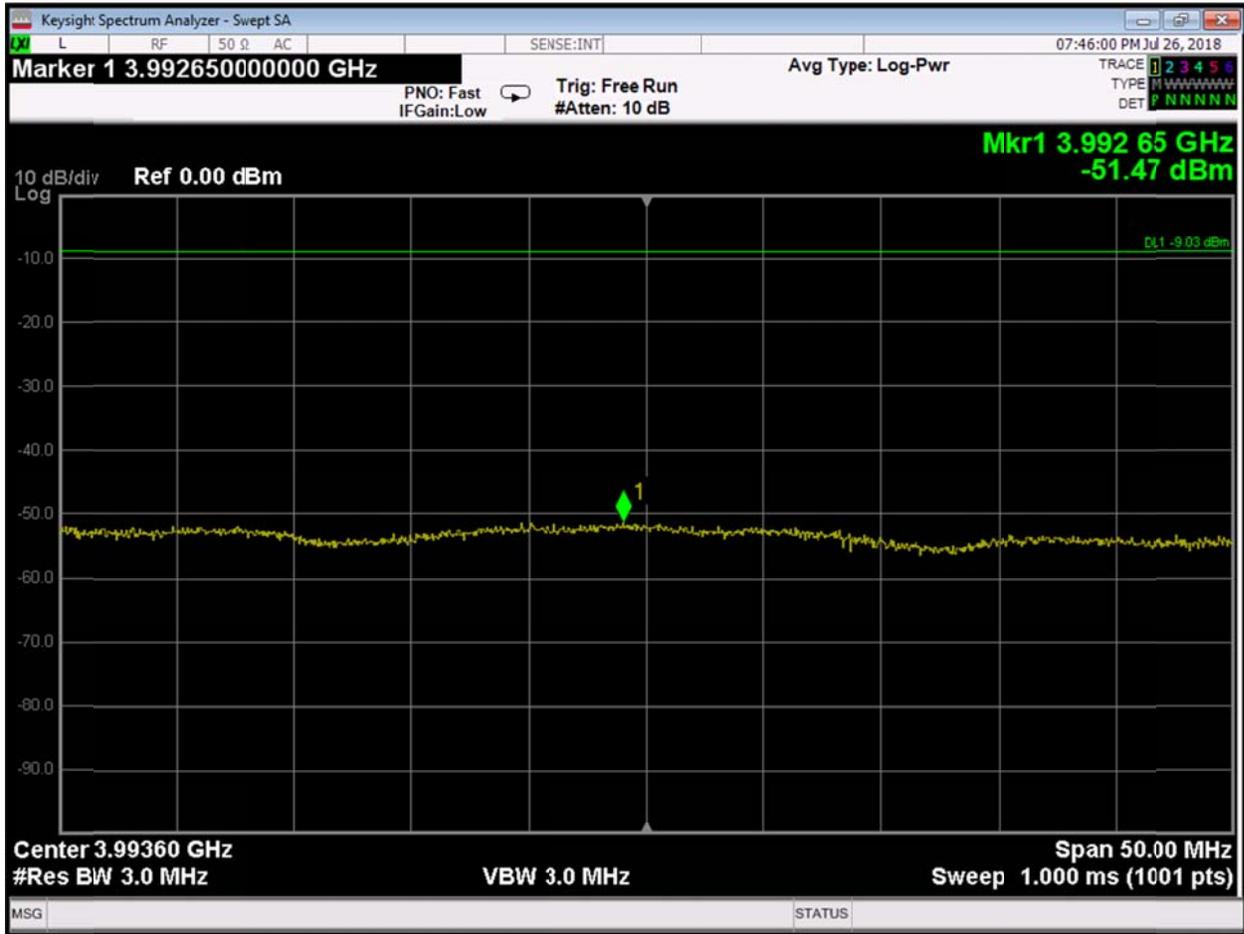


ELECTRO MAGNETIC TEST, INC.

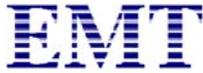
1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

Peak Emissions within a 50 MHz Bandwidths

EUT:	IPAS Pedestrian Tag	Model Name:	PAS-K01-00
Test Mode:	UWB	Test Date:	7/26/2018
Test Engineer:	Andreas Davidsson	Measurement:	Fundamental



Result Peak

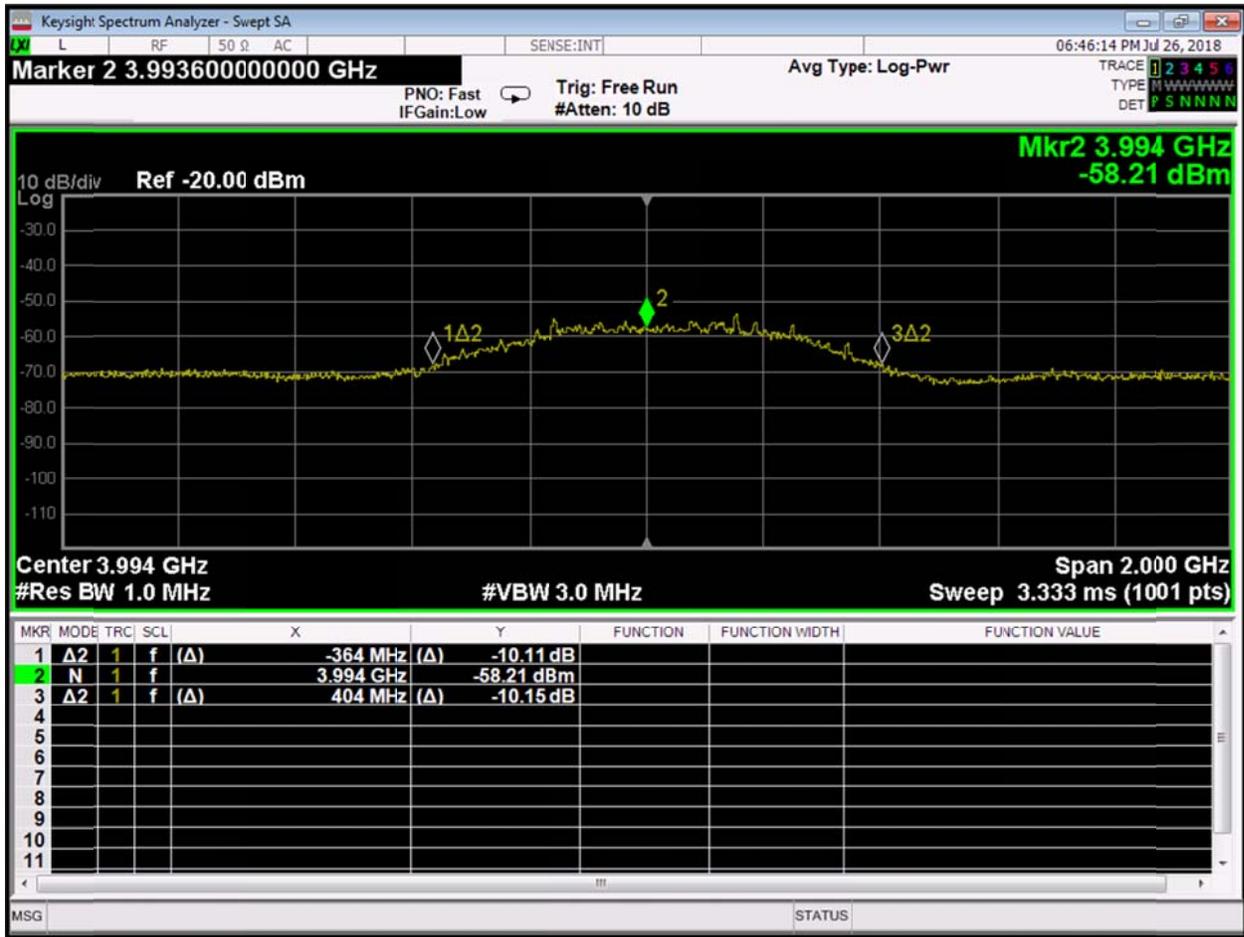


ELECTRO MAGNETIC TEST, INC.

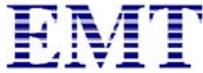
1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

Bandwidth Test

Company:	Kyungwoo Systech, Inc.	Test Date:	7/26/2018
EUT Name:	IPAS Pedestrian Tag	Test Engineer:	Andreas Davidsson
Model:	PAS-K01-00	Test Result:	PASS



Limit:	Test Result:	Conclusion:
10 dB bandwidth contained between 3100 to 10600 MHz	10 dB bandwidth contained between 3630 MHz and 4398 MHz	PASS
10 dB bandwidth \geq 500 MHz	768 MHz	PASS

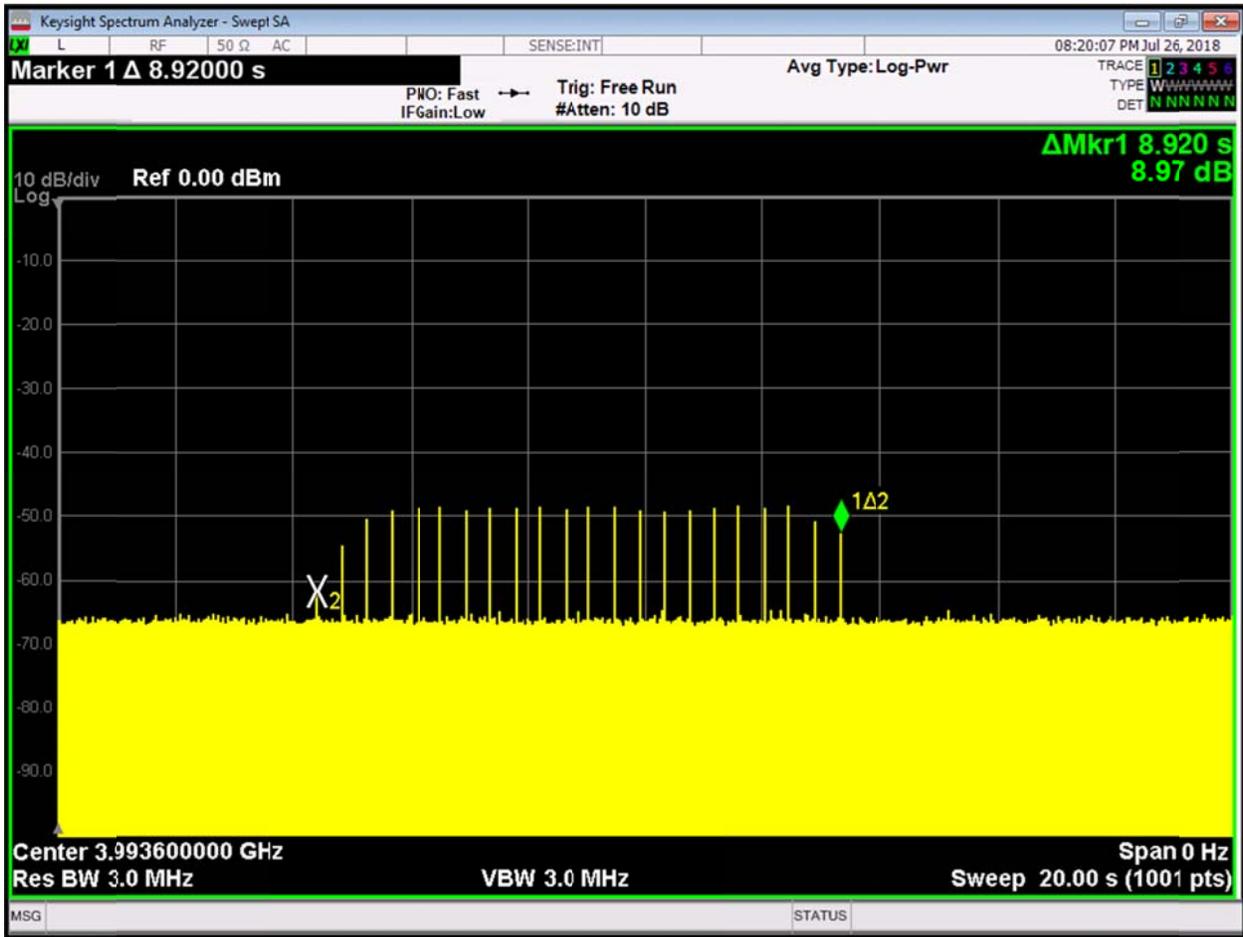


ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

Transmission Test

Company:	Kyungwoo Systech, Inc.	Test Date:	7/26/2018
EUT Name:	IPAS Pedestrian Tag	Test Engineer:	Andreas Davidsson
Model:	PAS-K01-00	Test Result:	PASS



Limit:	Test Result:	Conclusion:
An acknowledgment of reception must continue to be received by the UWB intentional radiator at least every 10 seconds or the UWB device must cease transmitting.	EUT stops transmission if it does not receive an acknowledgement within 10 seconds.	PASS



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

APPENDIX B

TEST SETUP DIAGRAMS



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

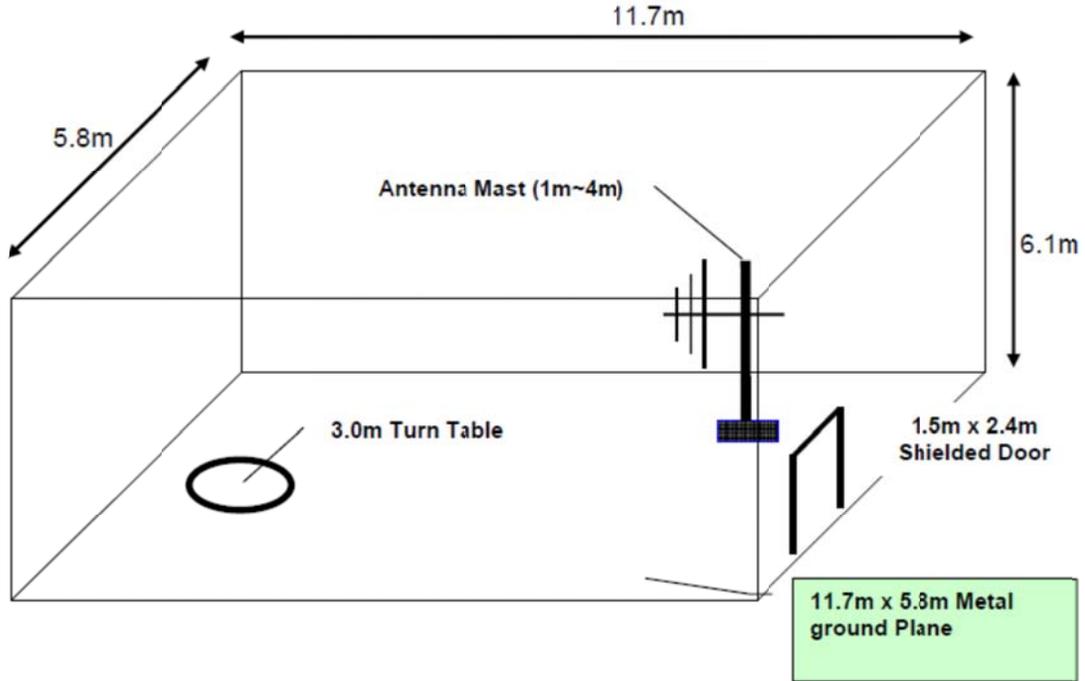


FIGURE 1 - LAYOUT OF 3 METER SEMI-ANECHOIC CHAMBER



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

APPENDIX C

MODIFICATIONS TO THE EUT



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

MODIFICATIONS TO THE EUT

No modifications were made to the EUT by Electro Magnetic Test, Inc. personnel during the testing.



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

APPENDIX D

***ADDITIONAL MODELS COVERED
UNDER THIS REPORT***



ELECTRO MAGNETIC TEST, INC.

1547 Plymouth Street, Mountain View, CA 94043 Tel: (650)965-4000 Fax: (650)965-3000

ADDITIONAL MODELS COVERED UNDER THIS REPORT

There are no additional models to be covered under this report.