

# ANTENNA TEST REPORT

## Test Place

Company Name	UL Japan, Inc. Ise EMC Lab.
Address	4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 Japan
Telephone Number	+81-596-24-8999

## Equipment Under Test (EUT)

Description	Data Logger
Manufacturer	TandD Corporation
Model Number	TR45A
Frequency of Operation	2402 MHz to 2480 MHz
Antenna Type	Inverted F

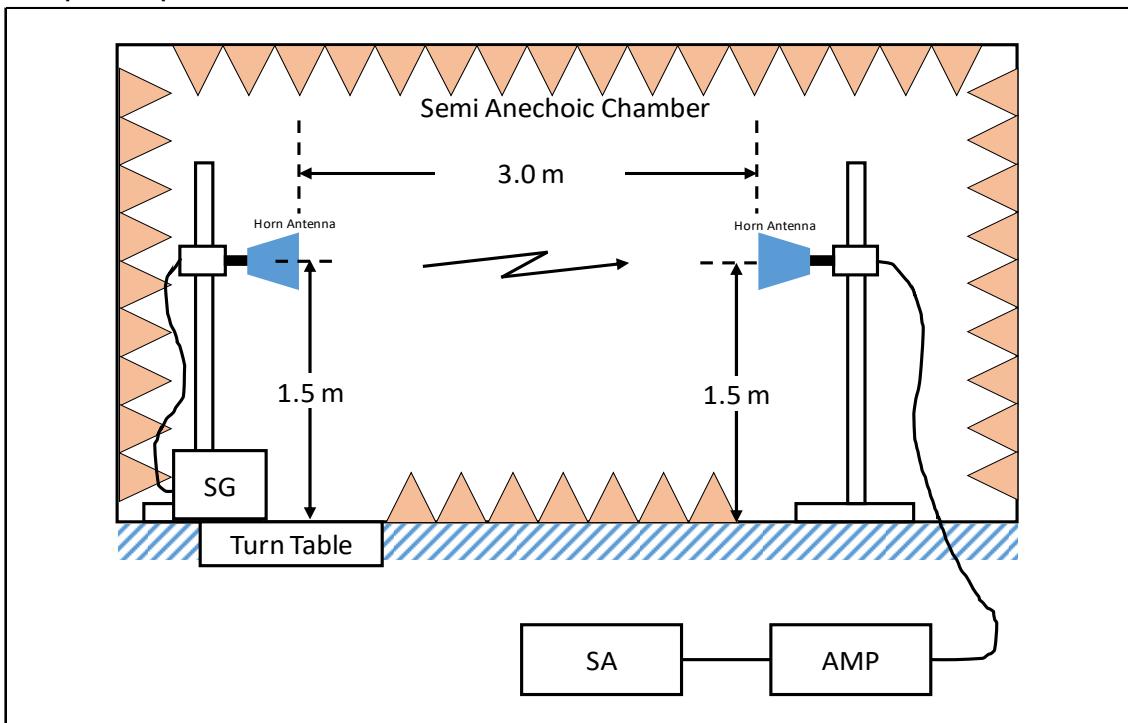
For the shape of the antenna is refer to Internal Photo.

## Test Procedure

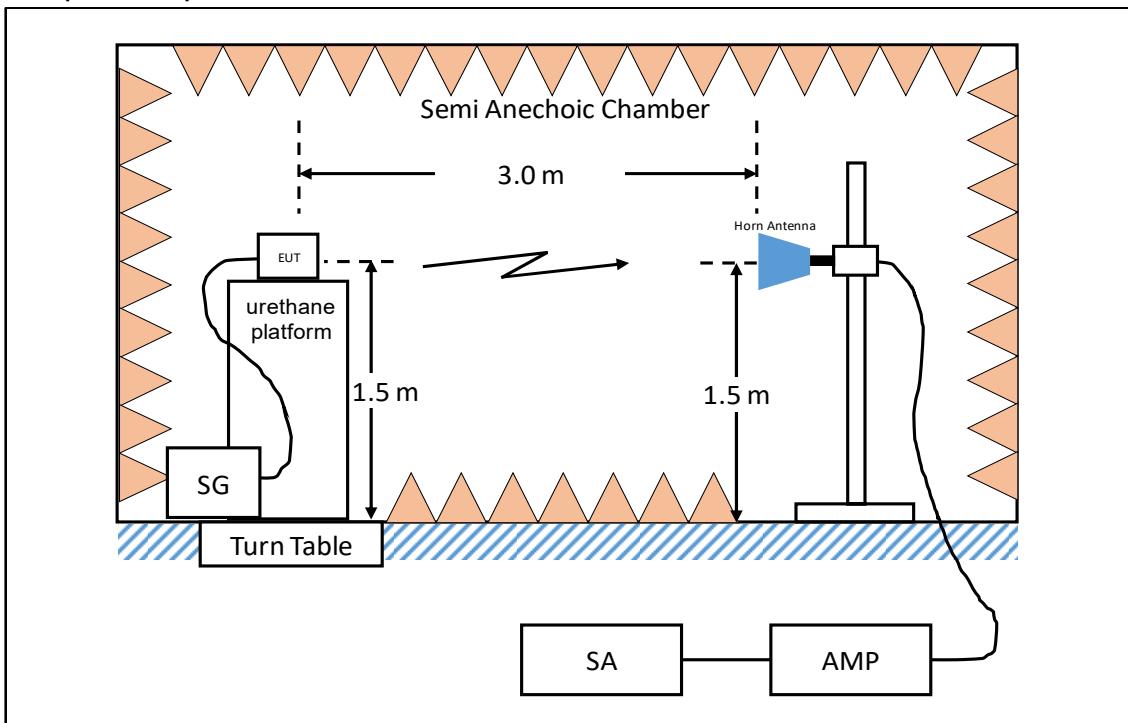
Test configuration	EUT was placed on a platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane. The measurements were performed for both vertical and horizontal antenna polarization with the Spectrum Analyzer. The setup are shown in Figure 1.
Test procedure	<p>Step 1 The tests have been measured in semi anechoic chamber at the distance of 3 m between the Substitution Antenna and the measuring Antenna, both Antennas were placed for the height 1.5 m. The Substitution Antenna has been connected to the Signal Generator.</p> <p>Step 2 The output power of the Signal Generator was setting value calculated by compensating the finite difference in the Antenna gain of Substitution Antenna.</p> <p>Step 3 The electric field strength at the distance of 3 m is received via the measurement antenna, and the reference value at that time is measured with a spectrum analyzer.</p> <p>Step 4 The measurements were performed for both vertical and horizontal antenna polarization.</p> <p>Step 5 Exchanged the Substitution Antenna to the EUT, the output power of the Signal Generator was setting value calculated by 0 dBm at the input of EUT.</p> <p>Step 6 The EUT was rotated a full revolution and recorded the electric field strength for each degree.</p> <p>Step 7 Calculate and record the difference from the value recorded in Step 6 to the value recorded in Step 3.</p> <p>Step 8 The measurement in steps 5 to 7 repeated with both vertical and horizontal antenna polarization, each position of XY, YZ and ZX-plane of EUT.</p>

**Figure 1: Test Setup**

**Setup for step 1 to 4**



**Setup after step 5**



SG: Signal Generator

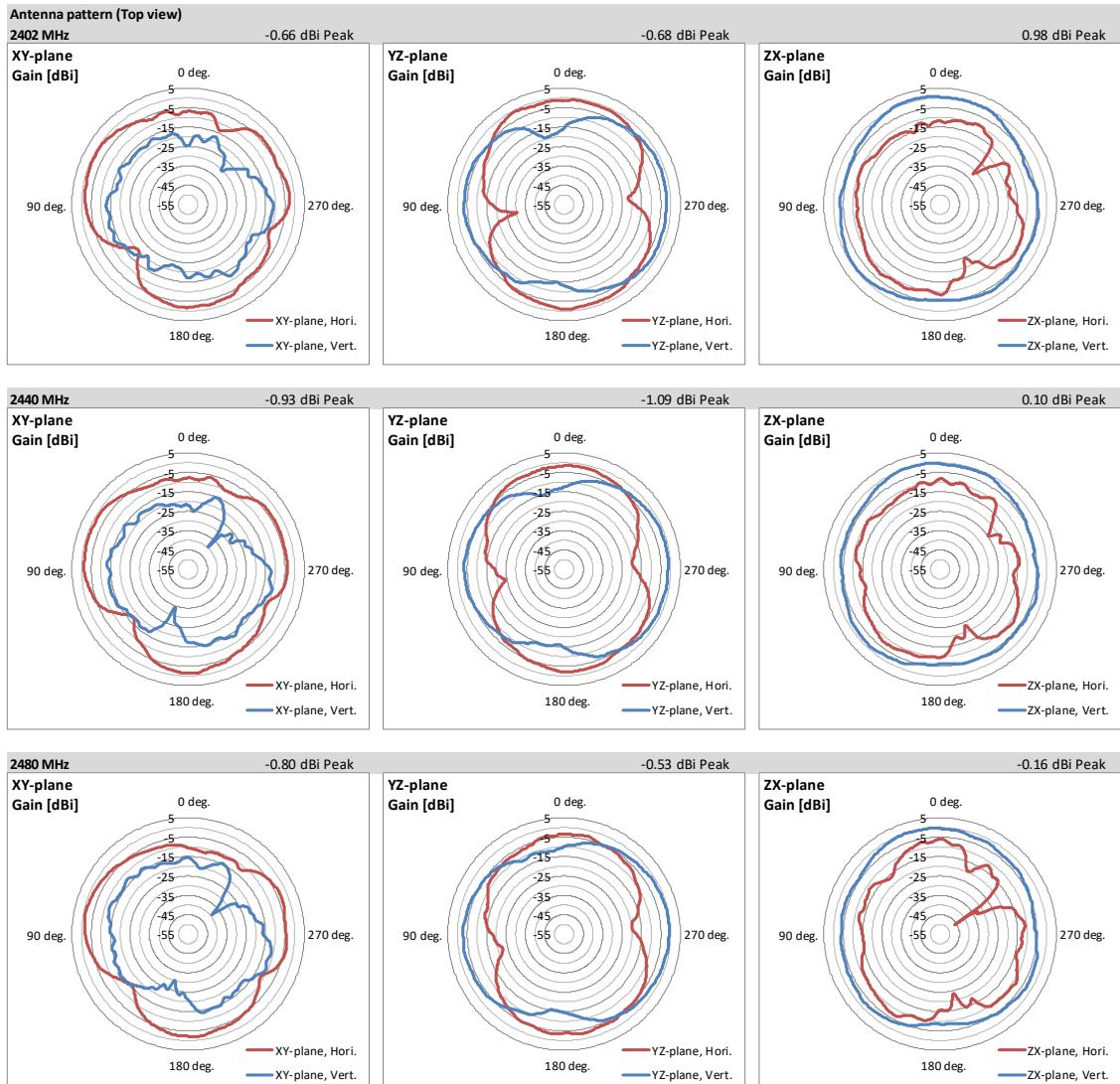
SA: Spectrum Analyzer

AMP: Pre Amplifier

## Test Data

### Antenna Pattern and Gain

Test place Ise EMC Lab.  
 Semi Anechoic Chamber No.4  
 Date August 27, 2024  
 Temperature / Humidity 23 deg. C / 68 % RH  
 Engineer Yuichiro Yamazaki  
 Mode Tx



Antenna gain [UNIT: dBi]

Peak	Frequency [MHz]	2402	2440	2480
Peak gain		0.98	0.10	-0.16

Average				
Frequency [MHz]	2402	2440	2480	
XY-plane Hori.	-4.42	-4.57	-5.04	
XY-plane Vert.	-16.19	-16.36	-15.78	
XY-plane Avg (H/V)	-7.15	-7.30	-7.70	
YZ-plane Hori.	-4.27	-5.31	-6.63	
YZ-plane Vert.	-5.02	-4.81	-4.27	
YZ-plane Avg (H/V)	-4.63	-5.05	-5.29	
ZX-plane Hori.	-11.61	-11.32	-11.19	
ZX-plane Vert.	-2.43	-2.91	-3.30	
ZX-plane Avg (H/V)	-4.94	-5.33	-5.66	
Total	-5.44	-5.79	-6.09	

Hori. : Horizontal  
 Vert. : Vertical

Average : Result of averaging the true value of the value of each degree of angle.

Yellow highlighted area: Maximum Antenna Gain [dBi]

## **Test Instruments**

### **Test Equipment**

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
APG	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	2023/12/13	24
APG	244710	Thermo-Hygrometer	HIOKI E.E. CORPORATION	LR5001	231202104	2024/01/25	12
APG	141545	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201148	2024/02/01	12
APG	142230	Measure, Tape, Steel	KOMELON	KMC-36	-	-	-
APG	142017	AC4_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	2023/04/14	24
APG	141899	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY46180655	2024/05/09	12
APG	141508	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	557	2024/05/17	12
APG	141581	MicroWave System Amplifier	Keysight Technologies Inc	83017A	00650	2023/10/05	12
APG	141393	Microwave Cable	Junkosha	MWX221	1604S254(1 m) / 1608S088(5 m)	2024/07/06	12
APG	158264	Signal Generator	Keysight Technologies Inc	N5182A	MY50142539	2023/09/13	12
APG	197219	Microwave cable	Huber+Suhner	SF126E/11PC35/11PC35/2000MM	536999/126E	2024/03/19	12
APG	141514	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	01611	2024/06/25	12

**\*Hyphens for Last Calibration Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.**

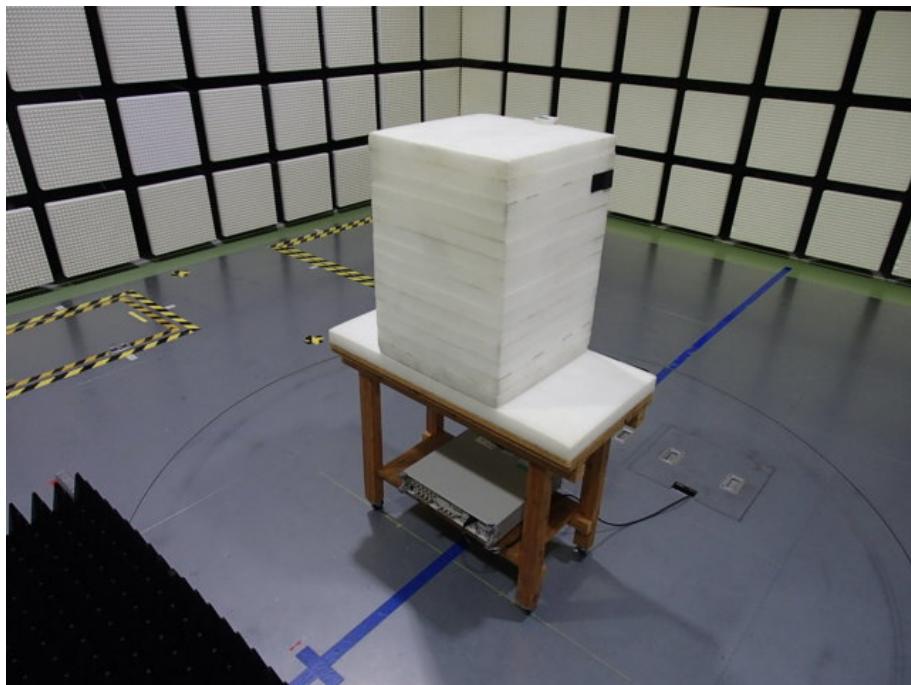
**The expiration date of the calibration is the end of the expired month.  
As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.**

**All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.**

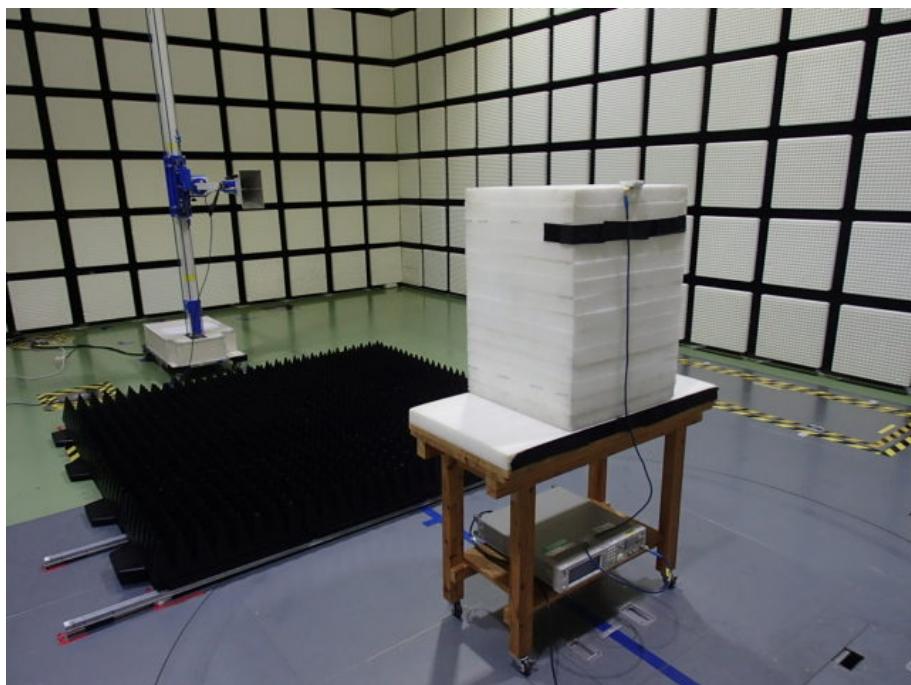
**Test item: APG: Antenna Pattern and Gain**

## Photographs of Test Setup

### Test setup (Overall view)

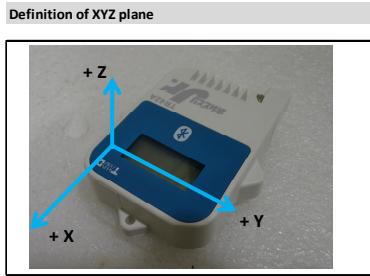
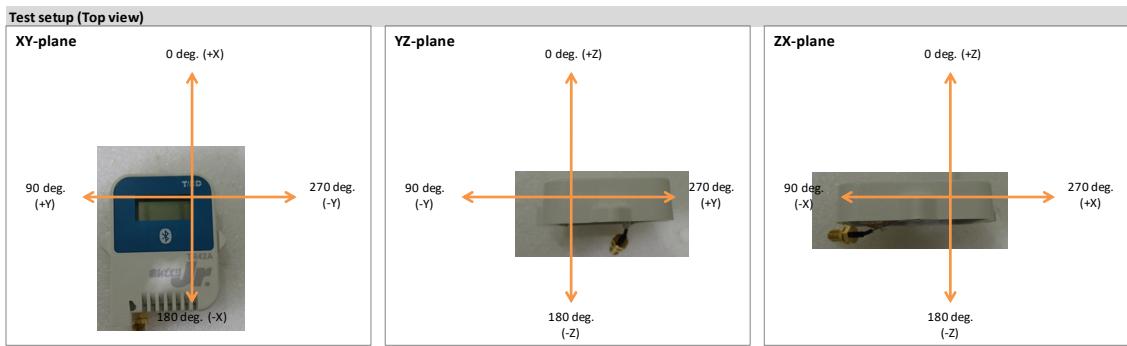


**Photo 1**



**Photo 2**

## Test setup (Top view)



\*The photo shows the connection cable to SG removed.

**End of Report**