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

Antenna Under Test (AUT)

Description	WLAN ANTENNA
Manufacturer	TOPCON CORPORATION
Model Number	1007695-01
Frequency of Operation	2402 MHz to 2480 MHz
Antenna Type	Chip Antenna

Test Procedure

Test configuration	AUT 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.
Test procedure	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. 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. 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. Step 4 The measurements were performed for both vertical and horizontal antenna polarization. Step 5 Exchanged the Substitution Antenna to the measuring Antenna, the output power of the Signal Generator was setting value calculated by 0 dBm at the input of EUT. Step 6 The EUT was rotated a full revolution and recorded the electric field strength for each degree. Step 7 Calculate and record the difference from the value recorded in Step 6 to the value recorded in Step 3. 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 measuring Antenna. Step 9 Then the results of Step 8 were recorded. Step 10 Calculate the difference between step 9 and the Output Power of measuring Antenna and recorded the calculated results.

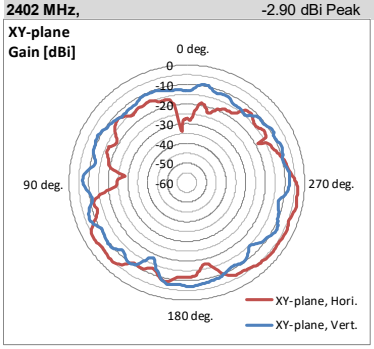
Test Data

Antenna Pattern and Gain

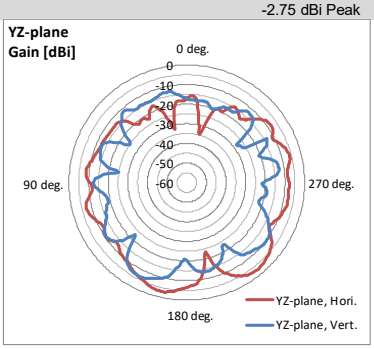
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.2	No.3
Date	July 2, 2023	July 14, 2023
Temperature / Humidity	23 deg. C / 50 % RH	21 deg. C / 52 % RH
Engineer	Yuta Moriya	Kiyoshiro Okazaki
Mode	Tx 2442 MHz	Tx 2402 MHz & 2480 MHz

Antenna pattern (Top view)

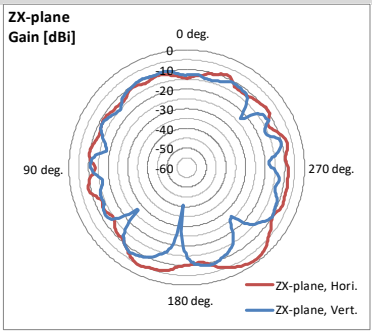
2402 MHz, -2.90 dBi Peak



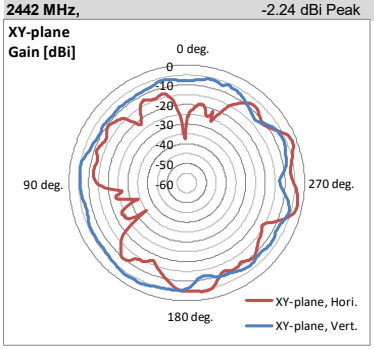
-2.75 dBi Peak



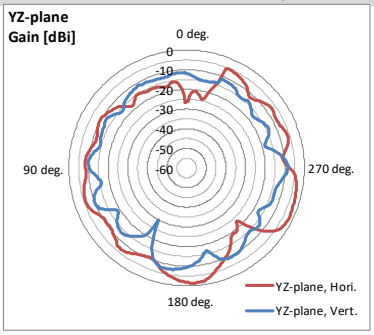
-1.41 dBi Peak



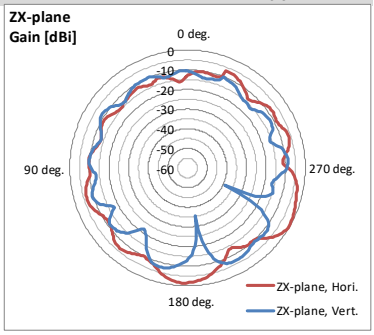
2442 MHz, -2.24 dBi Peak



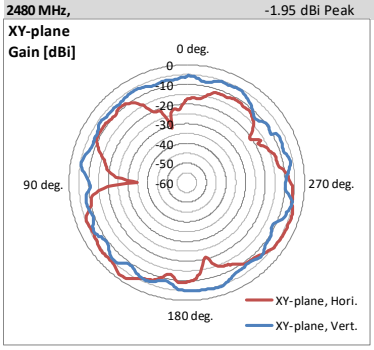
-1.37 dBi Peak



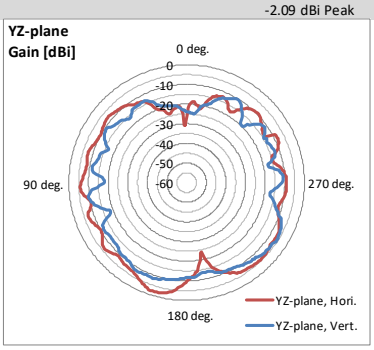
-0.51 dBi Peak



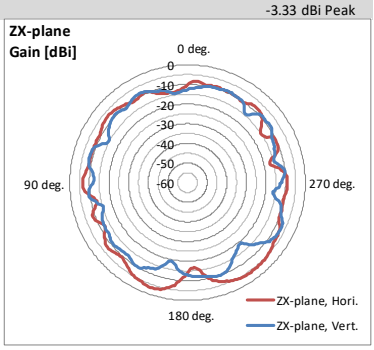
2480 MHz, -1.95 dBi Peak



-2.09 dBi Peak



-3.33 dBi Peak



Antenna gain [UNIT: dBi]

Peak

Frequency [MHz]	2442
Peak gain	-0.51

Hori.:Horizontal
Vert.:Vertical

Average (Result of averaging the true value of the value for each degree of angle)

Frequency [MHz]		2402	2442	2480
XY-plane	Hori.	-9.14	-9.79	-8.82
	Vert.	-9.98	-7.26	-7.21
	Avg (H/V)	-9.54	-8.35	-7.94
YZ-plane	Hori.	-9.00	-7.71	-8.75
	Vert.	-13.75	-12.13	-11.64
	Avg (H/V)	-10.75	-9.38	-9.96
ZX-plane	Hori.	-8.62	-7.38	-8.25
	Vert.	-12.40	-11.02	-10.99
	Avg (H/V)	-10.11	-8.83	-9.41
Total		-10.11	-8.83	-9.02

Yellow highlighted area: Maximum Antenna Gain [dBi]

Test Instruments

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
APG	MSA-13	141900	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46185823	2023/06/16	12
APG	MCC-218	141394	Microwave Cable	Junkosha	MWX221	1607S141(1 m) / 1608S264(5 m)	2022/09/12	12
APG	MPA-10	141579	Pre Amplifier	Keysight Technologies Inc	8449B	3008A02142	2023/02/14	12
APG	MHA-06	141512	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	254	2022/10/20	12
APG	MHA-21	141508	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	557	2023/05/17	12
APG	MSG-23	213581	Signal Generator	Rohde & Schwarz	SMW200A	107688	2023/02/07	12
APG	MCC-244	197219	Microwave cable	Huber+Suhner	SF126E/11PC35/11PC35/2000MM	536999/126E	2023/03/09	12
APG	MAEC-02	142004	AC2_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	2022/05/30	24
APG	MOS-41	192300	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0013	2022/12/17	12
APG	MMM-01	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	2022/08/12	12
APG	MJM-27	142228	Measure, Tape, Steel	KOMELON	KMC-36	-	-	-
APG	MAEC-03	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	2022/05/23	24
APG	MOS-13	141554	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1301	2023/01/13	12
APG	MMM-08	141532	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201197	2023/01/17	12
APG	MJM-16	142183	Measure	KOMELON	KMC-36	-	2022/10/03	12
APG	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
APG	MSA-16	141903	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46186390	2023/01/16	12
APG	MCC-265	234602	Microwave Cable	Huber+Suhner	SF126E/11PC35/11PC35/1000M, 5000M	537063/126E / 537074/126E	2023/03/16	-
APG	MPA-11	141580	MicroWave System Amplifier	Keysight Technologies Inc	83017A	MY39500779	2023/03/08	12
APG	MHA-20	141507	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	258	2022/11/14	12
APG	MHA-30	141514	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	01611	2023/06/22	12
APG	MSA-13	141900	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46185823	2023/06/16	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