

CUSTOMER : HYUNDAI MOBIS.

DATE : 2025.05.13.

SPECIFICATIONS FOR APPROVAL

PRODUCT NAME : WiFi Dual Band & BT Antenna

MODEL NAME : ccNC WiFi Dual Band & BT + WiFi 5G Antenna 

CUSTOMER P/N : M3012001351 

APPROVAL	REMARK

APPENDIX

Designed	Checked	Approved	LG Innotek Co., Ltd.	
				
Y. H. KIM	K. Y. LEE	W. K. JUNG	DOCUMENT No.	
			PAGE	14

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(CUSTOMER P/NO : M3012001351)

1. ANT Features(WiFi)

- Dual Bands Wi-Fi ANT
- Main Frequency: 2.45GHz, 5.5GHz
- Frequency range
: From 2.40 to 2.50GHz, 5GHz~6GHz
- Operating temperature range
: -35 to +95°C (typ.)
- Wi-Fi ANT Material : Printed on FR-4
- Core0 ANT Size (18.3mm x 15.5 mm)
- Core1 ANT Size (33.45mm x 9.7 mm)

1.1. Antenna Characteristics

WiFi Core0 5GHz, Core1 2.4GHz + 5GHz

Antenna Performance				
Parameter	Min	Typ	Max	Unit
Frequency Range	2400	2450	2500	MHz
	5000	5500	6000	MHz
Directivity	-	Omni	-	-
Full Bands Average Gain(core0)	-	-	-4.24	dBi
Full Bands Average Gain(core1)	-	-	-5.43	
Full Bands Average Peak Gain(core0)		-	2.73	
Full Bands Average Peak Gain(core1)		-	1.35	
V.S.W.R 2GHz	3:1	-	-	Under
V.S.W.R 5GHz	4:1	-	-	Under
Impedance		50		Ohm
Radiation Material		Printed		



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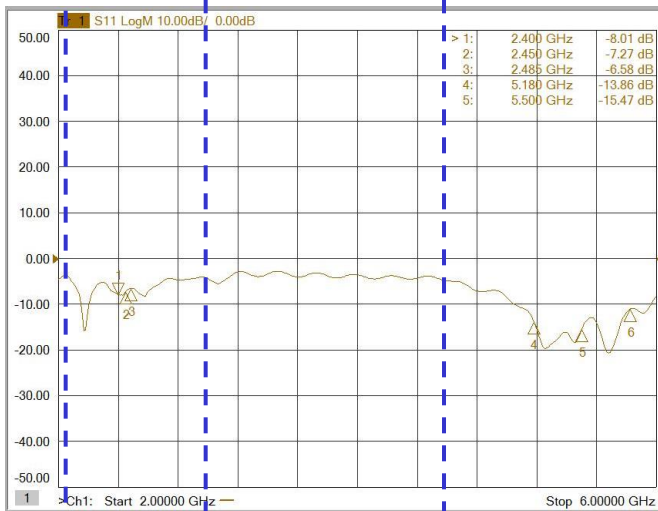
REV 1.2 (6 / 14)

(CUSTOMER P/NO : M3012001351)

3. Test Data

3.1 Network Data (BT Core0 + WiFi 5GHz Antenna)

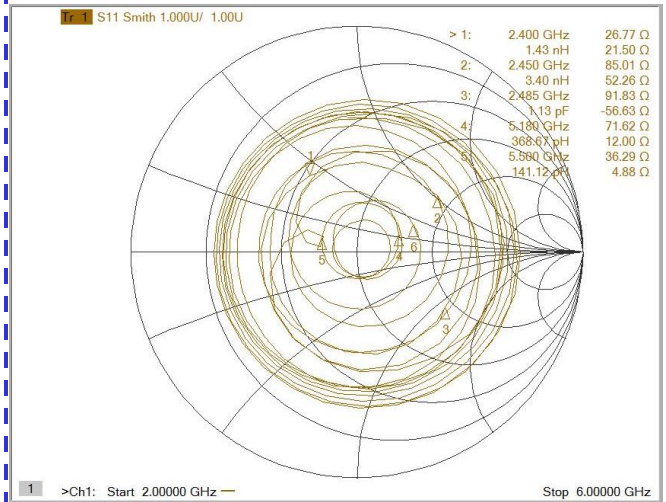
Return Loss



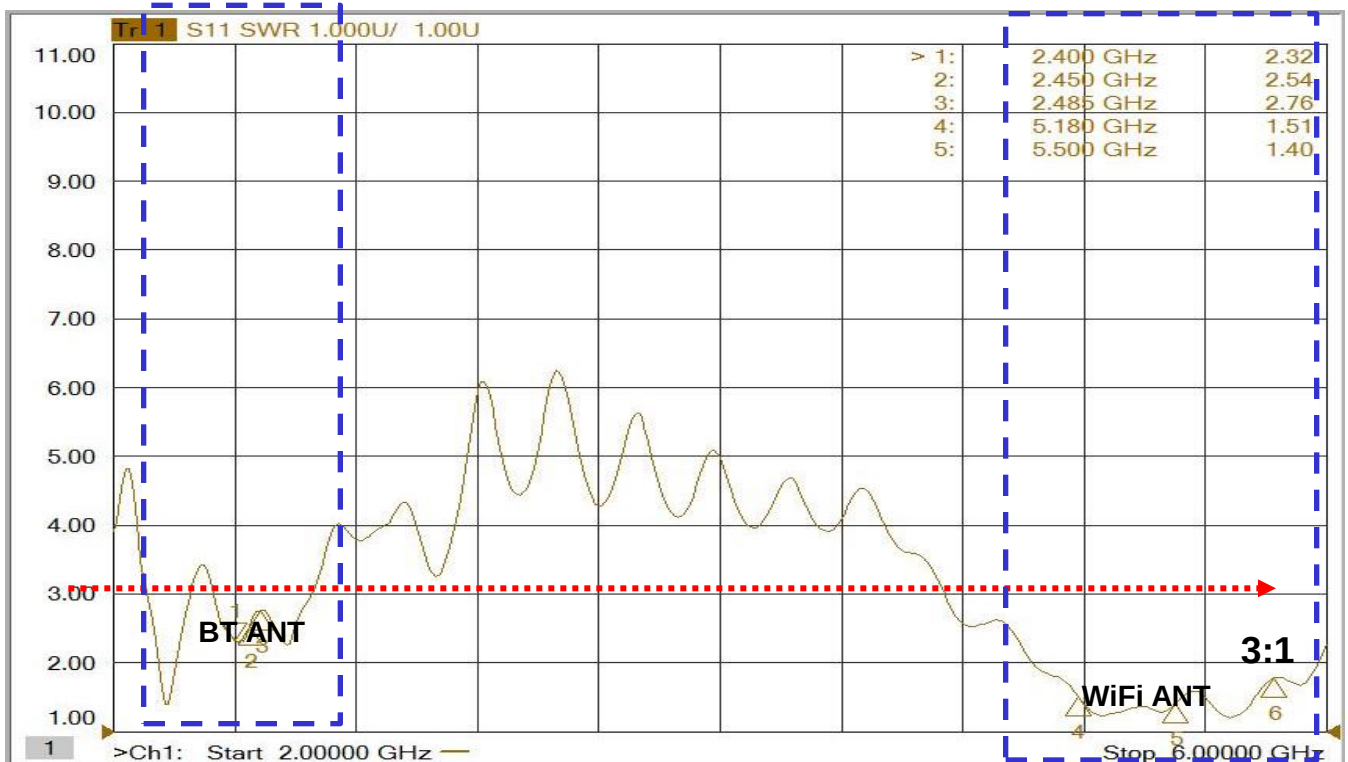
BT ANT

WiFi ANT

Smith Chart



SWR



BT ANT

WiFi ANT

3:1

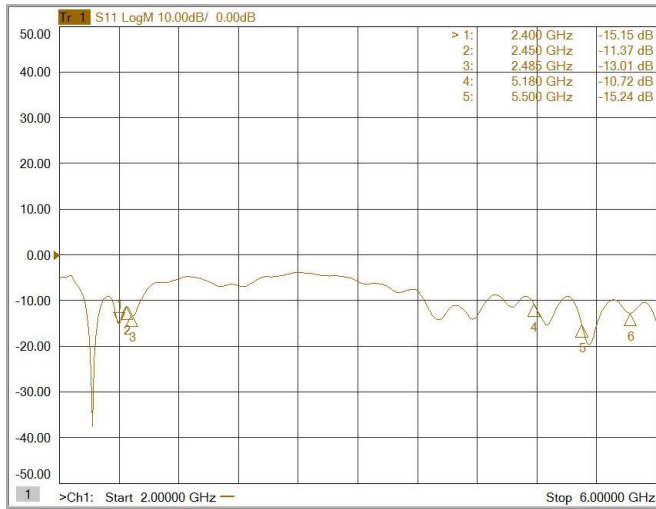
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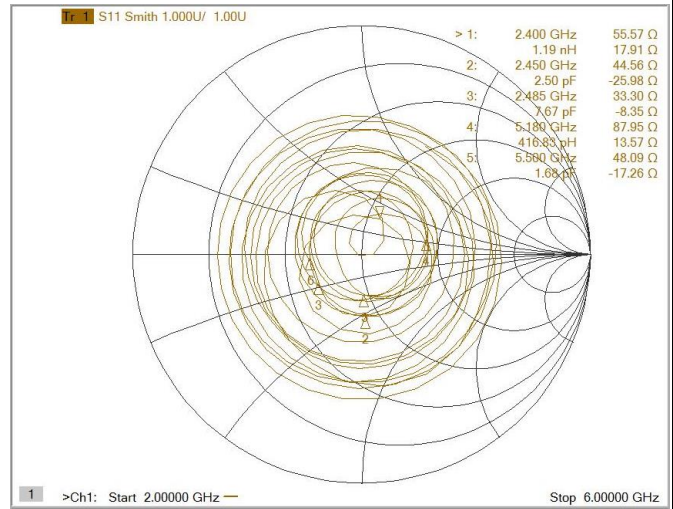
(CUSTOMER P/NO : M3012001351)

3.2 Network Data(WiFi Core1 WiFi Only 2.4GHz 5GHz Dual Antenna)

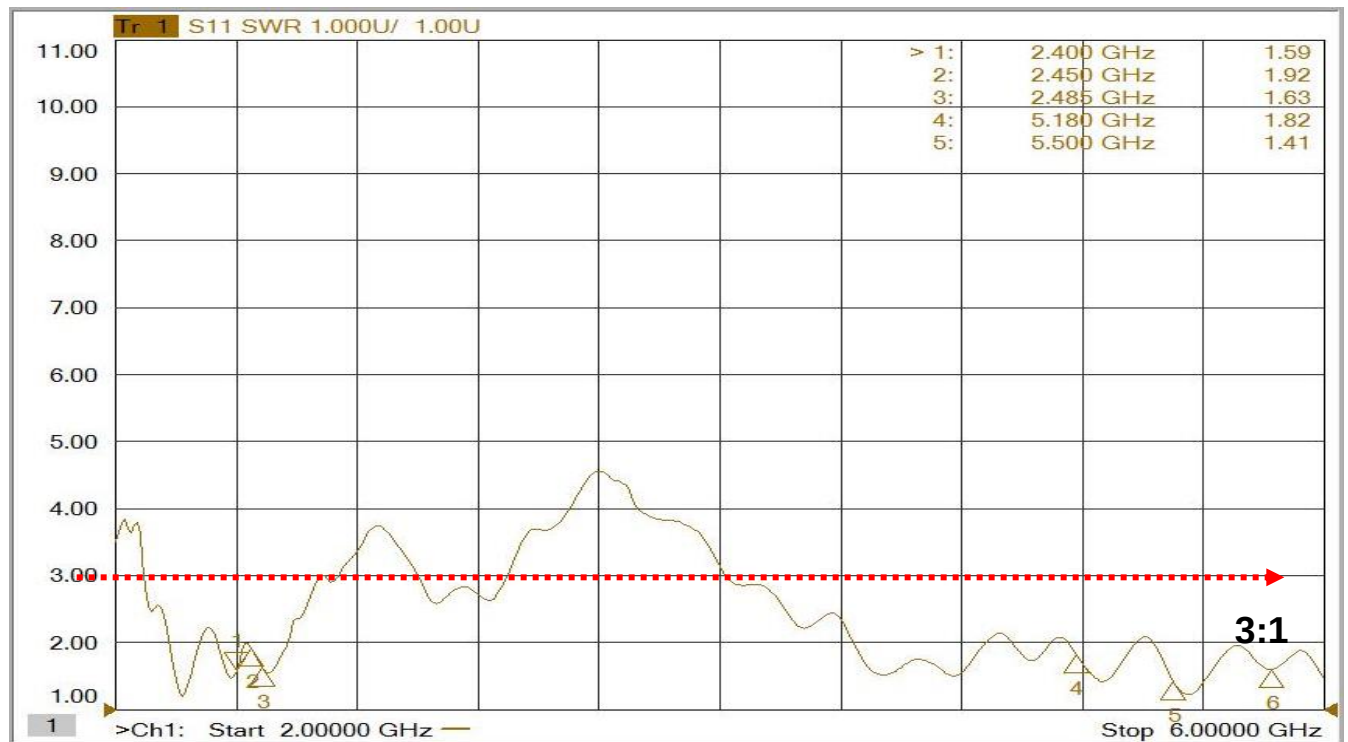
Return Loss



Smith Chart



SWR



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(CUSTOMER P/NO : M3012001351)

3.3 Efficiency (BT : core 0 2.4GHz)

BT Core0 2.4GHz Antenna

	1	2	3	4	5	6	7	8	9
Frequency [MHz]	2400	2410	2420	2430	2440	2450	2460	2470	2480
Efficiency [dB]	-8.44	-8.44	-7.42	-6.66	-5.90	-5.54	-6.53	-7.91	-8.99
Efficiency [%]	14.3	14.3	18.1	21.6	25.7	27.9	22.2	16.2	12.6
TRG _θ [dB]	-9.80	-9.74	-8.72	-8.08	-7.43	-7.09	-8.25	-9.88	-11.06
Gain _{θ Peak} [dB]	-2.31	-2.04	-1.67	-1.54	-1.68	-1.47	-2.64	-4.49	-4.94
Gain _{θ Min} [dB]	-31.88	-32.72	-33.27	-25.32	-24.13	-27.70	-28.91	-32.69	-32.03
TRG _φ [dB]	-14.13	-14.32	-13.31	-12.19	-11.18	-10.75	-11.38	-12.29	-13.22
Gain _{φ Peak} [dB]	-7.43	-6.91	-5.34	-3.90	-2.81	-2.51	-3.97	-5.99	-7.02
Gain _{φ Min} [dB]	-40.98	-27.53	-35.71	-24.09	-28.35	-29.35	-31.83	-31.88	-44.48
UHRG [dB]	-11.00	-11.02	-10.08	-9.40	-8.75	-8.46	-9.49	-10.76	-11.79
UHRG/TRG [%]	55.5	55.3	54.3	53.2	51.9	51.0	50.6	51.8	52.5
H-Plane	-9.05	-9.10	-8.08	-7.32	-6.78	-6.59	-7.77	-8.98	-9.70
E1-Plane, AVG [dB]	-8.30	-8.17	-7.63	-8.33	-8.31	-7.65	-8.74	-9.87	-9.82
E2-Plane, AVG [dB]	-15.25	-14.86	-13.73	-12.69	-11.54	-11.17	-12.23	-13.95	-15.27
Peak Gain [dB]	-2.22	-1.89	-1.48	-1.34	-1.48	-1.38	-2.63	-3.56	-2.85
Directivity [dB]	6.22	6.55	5.94	5.32	4.42	4.16	3.90	4.35	6.15
Minimum Gain [dB]	-21.96	-20.78	-16.40	-13.56	-13.35	-13.37	-17.03	-22.21	-22.37
Average Efficiency	-7.16 dB		19.22 %						

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(CUSTOMER P/NO : M3012001351)	

3.4 Efficiency (WiFi : core 0 5GHz, Core 1 2.4GHz + 5GHz)

WiFi core1 2GHz Antenna

	1	2	3	4	5
Frequency [MHz]	2412	2420	2450	2460	2485
Efficiency [dB]	-5.54	-5.58	-5.85	-5.36	-4.42
Efficiency [%]	28.0	27.7	26.0	29.1	36.1
TRG ₉ [dB]	-7.69	-7.62	-7.57	-7.06	-6.36
Gain _{9 Peak} [dB]	-0.43	-1.13	-2.32	-1.81	-0.65
Gain _{9 Min} [dB]	-26.23	-29.77	-29.45	-26.12	-25.85
TRG ₉ [dB]	-9.62	-9.84	-10.70	-10.24	-8.86
Gain _{9 Peak} [dB]	-2.67	-2.05	-1.51	-1.53	-1.23
Gain _{9 Min} [dB]	-26.96	-33.32	-30.25	-29.34	-27.13
UHRG [dB]	-8.18	-8.13	-8.32	-7.84	-6.89
UHRG/TRG [%]	54.4	55.6	56.5	56.4	56.7
H-Plane	-7.12	-7.03	-7.49	-7.32	-6.05
E1-Plane, AVG [dB]	-7.22	-7.41	-6.63	-5.87	-6.15
E2-Plane, AVG [dB]	-11.29	-11.71	-12.43	-11.70	-10.35
Peak Gain [dB]	0.19	-0.46	-0.61	-0.26	0.14
Directivity [dB]	5.72	5.12	5.24	5.10	4.57
Minimum Gain [dB]	-13.55	-14.60	-26.68	-22.35	-13.45
Average Efficiency	-5.35	dB		29.37	%

WiFi core1 5GHz Antenna

[illegible]

WiFi core0 5GHz Antenna

[illegible]

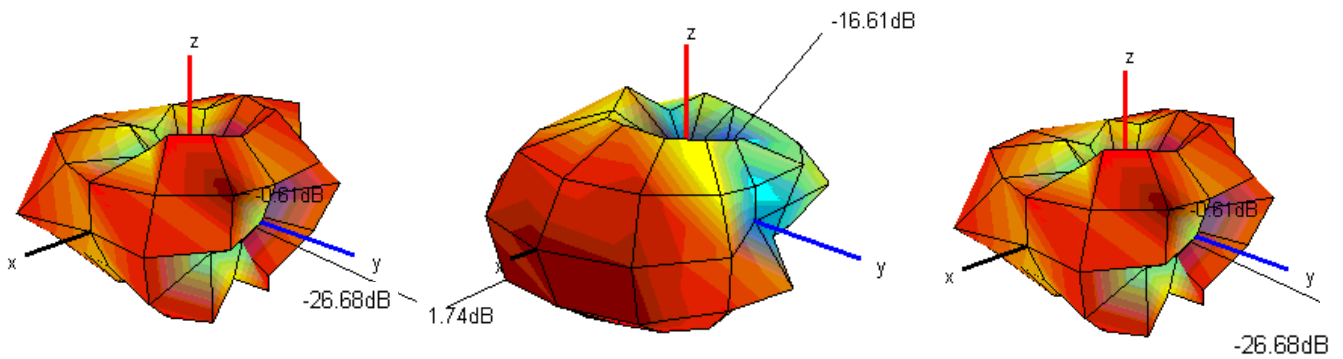
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3.5 Radiation Pattern

WiFi

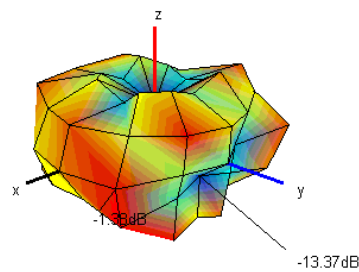


<2.45GHz core1>

<5.50GHz core0>

<5.50GHz core1>

BT



<2.45GHz>

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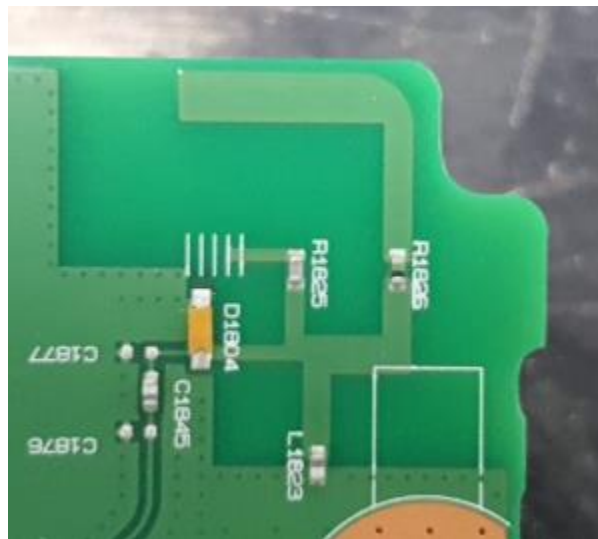
REV 1.2 (11 / 14)

(CUSTOMER P/NO : M3012001351)

4. Mechanical Specification

Part	Specification	Unit
Antenna Dimension(Core0) BT + WiFi 5GHz	18.3 x 15.5	[mm]
Antenna Dimension(Core1) WiFi 2.4GHz 5GHz Dual	33.45 x 9.7	[mm]

BT + WiFi 5GHz Antenna



WiFi Only Core 1 2.4GHz 5GHz Dual Antenna



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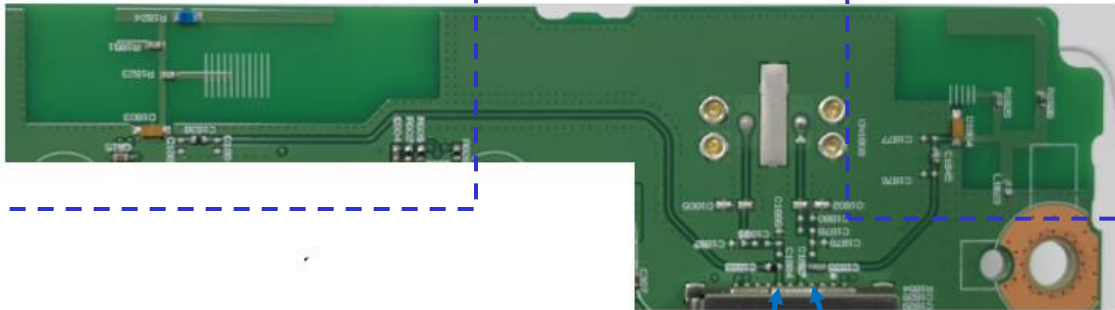
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(CUSTOMER P/NO : M3012001351)

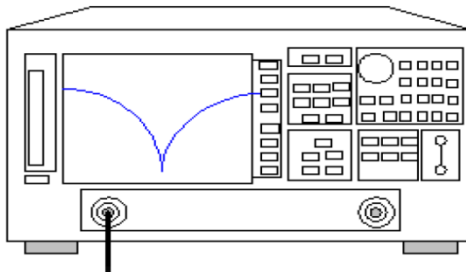
4.1 Antenna Return Loss measurement

WiFi only (core 1)
2.4GHz + 5GHz

BT + WiFi (core 0)
BT 2.4GHz, WiFi 5GHz



Network Analyzer
(Agilent N5222A)



Test point

Test point

Additive Semi-rigid Cable for measeurment

- A) 1-port network calibration for RF Cable.
- B) Port Extension for semi-rigid cable effect.
- C) Connect RF cable to semi-rigid cable of module.
- D) Set frequency range and Data format of network analyzer
- E) Verify return loss of the antenna below -6[dB]

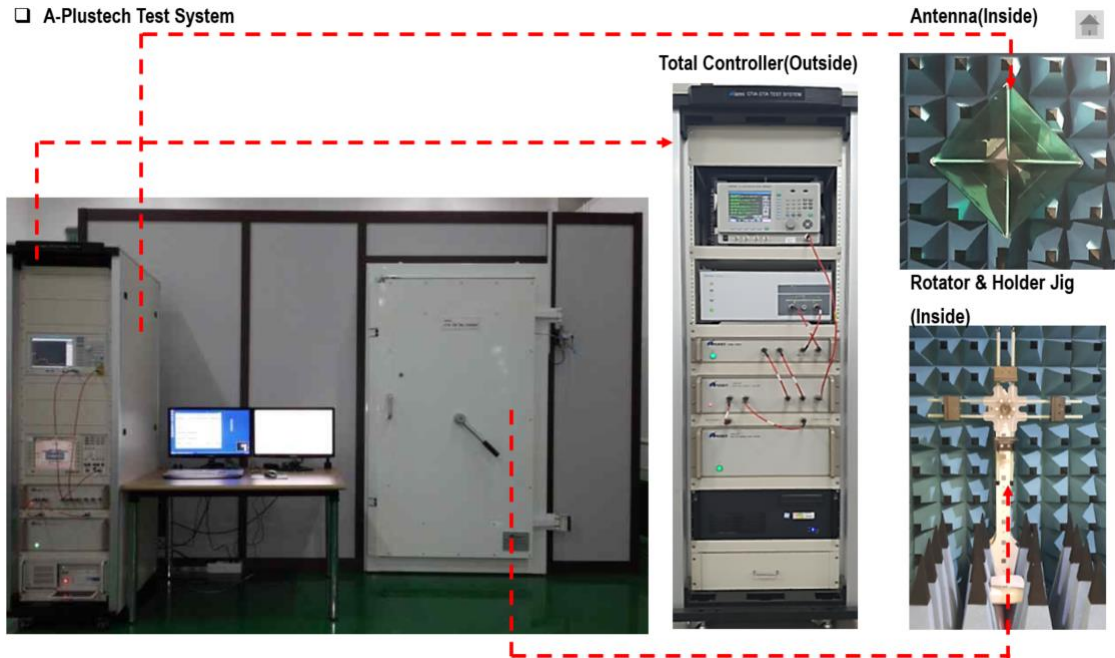
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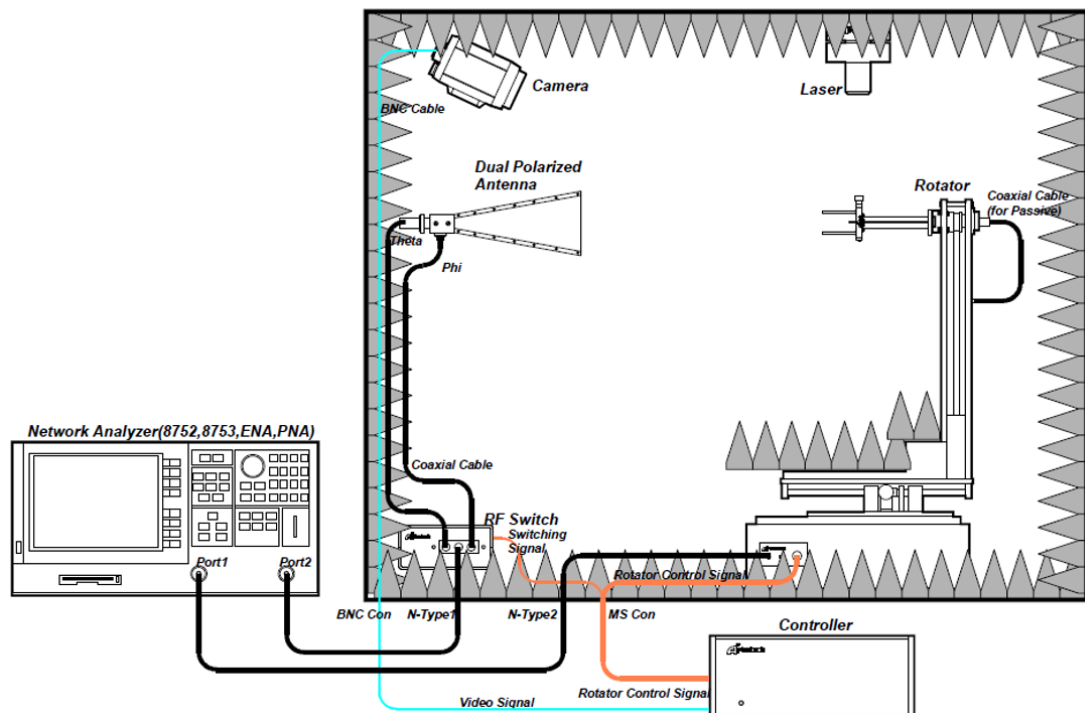
(CUSTOMER P/NO : M3012001351)

5. ANT Test Condition

□ A-Plustech Test System



CTIA OTA (Over The Air)TEST 3D Anechoic Chamber
(4 × 2.5 × 2.5 m)



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(CUSTOMER P/NO : M3012001351)

6. Additional information

1) Table of calibrated equipment

- Network Analyzer(N5222A) Agilent Technologies
- Electronic Calibration Module(N4691) Keysight

2) Test dates

- 2022.07.04

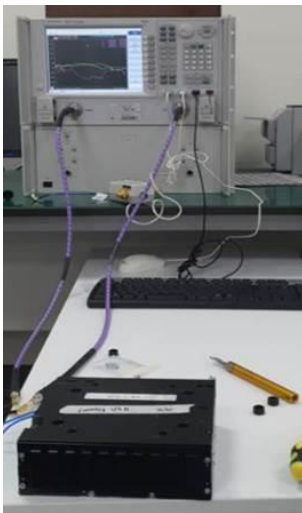
3) Names of test personnel

- Kim Young Hwan, LG Innotek

4) Names of commercial test software

- Athene Passive Test Ver 2.6.3A, Aplustech

5) Test setup photos



6) Description of how measurements are made

6-1) Network

- Connect the semi-ridged cable to ANT Core0, Core1 of ccNC
- Connect the network cable to each ANT
- Measure the Return loss, Smith chart and SWR of Core0, Core1

6-2) Chamber

- Fix the SET to the rotator in the chamber
- Connect the Passive cable of chamber to semi-ridged cable
- Measuring progress in Theta and Phi angles to 360 degrees in 30-degree increments using a passive gain tool