

Technical Data Sheet for Type2DT Measurement result

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Antenna Technical Support Section



Summary

<Content>

Antenna performance of EVB (on which Ignion's antenna is placed) for Type2DT was measured.

Condition	Comment	Antenna	[dB]	[dBi]		Isolation (Min.) [dB]		
			Total efficiency (Ave.)	Peak gain (Max.)		LoRa	GNSS	WiFi
1	Default	LoRa	-4.6	-0.2	LoRa-GNSS	14.3	14.3	
		GNSS	-2.8	1.3	LoRa-WiFi	19.8		20.5
		WiFi	-3.5	2.0	GNSS-WiFi		13.8	11.7
2	Optimized matching circuit from Condition 1	LoRa	-3.4	0.3	LoRa-GNSS	22.4	24.5	
		GNSS	-2.5	1.8	LoRa-WiFi	22.3		36.1
		WiFi	-2.6	3.6	GNSS-WiFi		12.8	11.9

*Measurement data doesn't have loss of measurement cable (0.4dB for LoRa band, 0.5dB for GNSS band, 0.6dB for WiFi band)

<Comment>

In Condition 1, it is confirmed that impedance of antenna is not matched for LoRa and WiFi bands. Therefore, we optimized matching circuit in Condition 2. As a result, it is confirmed that antenna performance is improved from Condition 1.

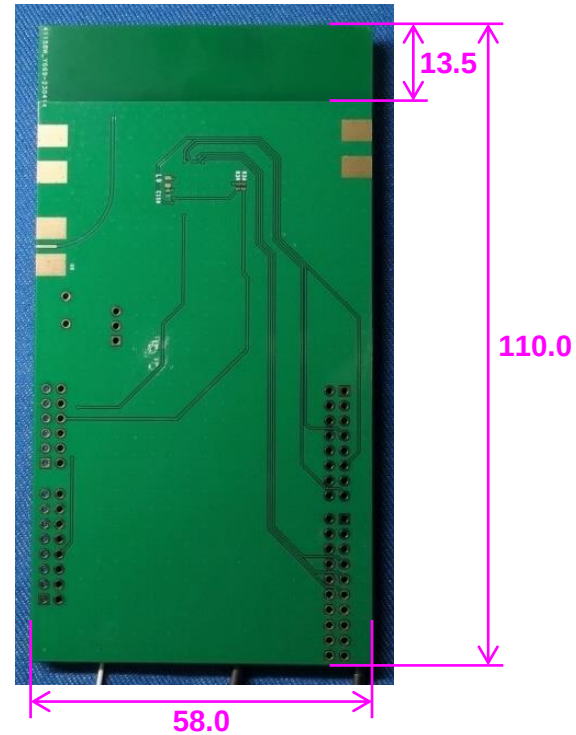
Please apply to matching circuit of Condition 2 shown on page 5, if antenna performance should improve.



1. Appearance
2. Measurement condition
3. Measurement direction
4. Measurement result

1. Appearance

<PCB>



UNIT : mm

2. Measurement condition

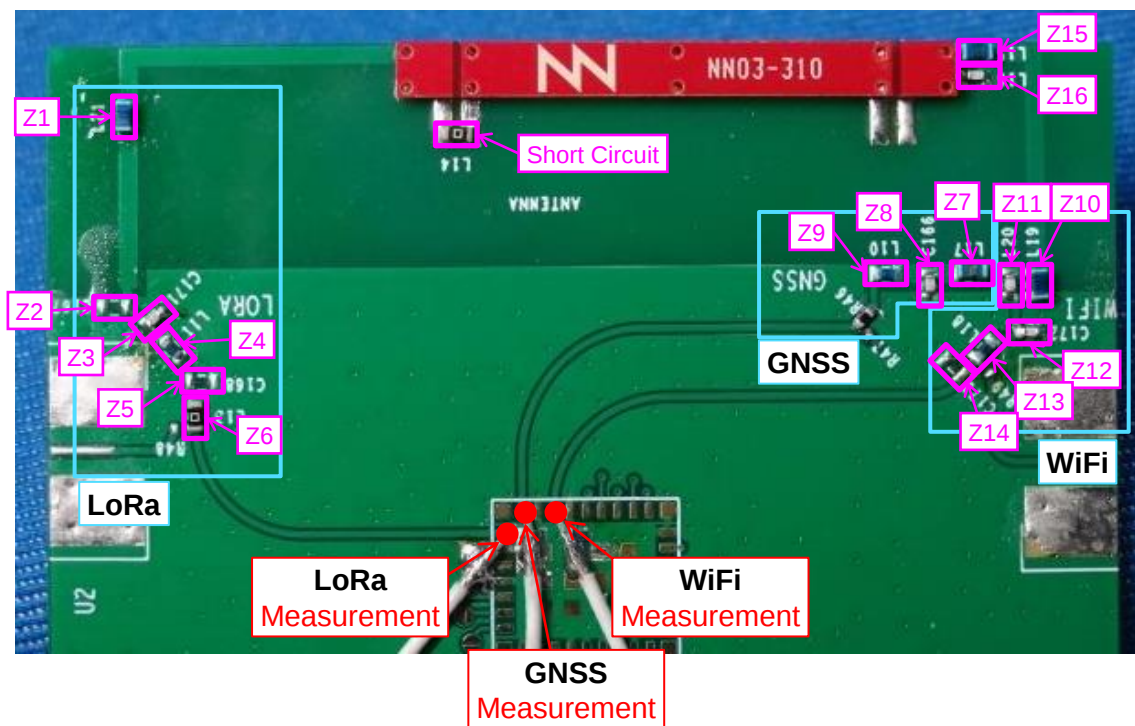
Condition	Memo
Condition 1	Default
Condition 2	Optimized matching circuit from Condition 1

	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8	Z9	Z10	Z11	Z12	Z13	Z14	Z15	Z16
Condition 1	16nH	Open	1.9pF	1.3nH	Open	0ohm	10nH	2.2pF	2.3nH	8.4nH	1.0pF	0.5pF	1.8nH	Open	28nH	0.8pF
Condition 2	16nH	Open	3.0pF	13nH	Open	0ohm	10nH	2.2pF	2.3nH	8.4nH	1.0pF	0.1pF	3.6nH	Open	28nH	0.8pF

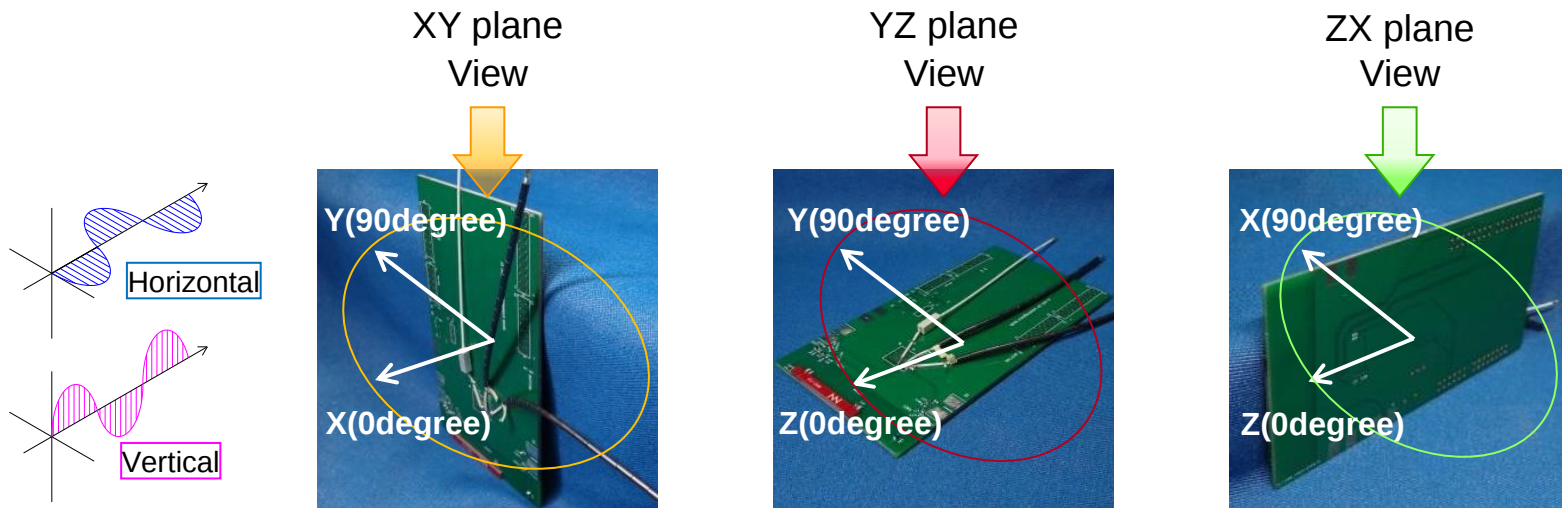
Size:1608 LQW18AN / Resistor

Size:1005 LQW15AN

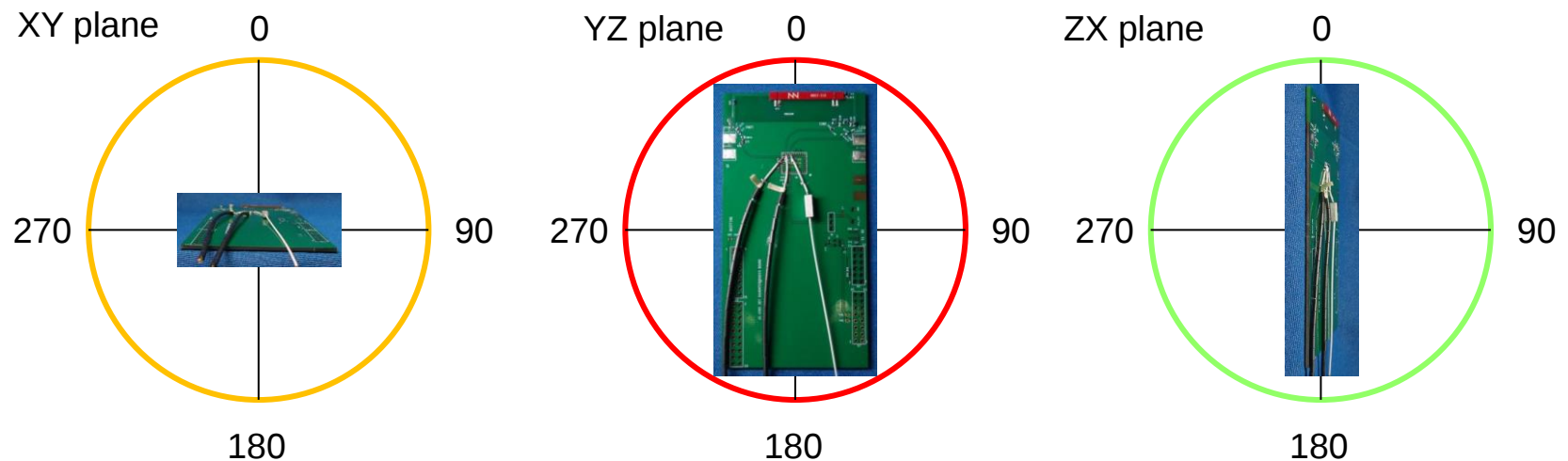
Size:1005 GJM15



3. Measurement direction



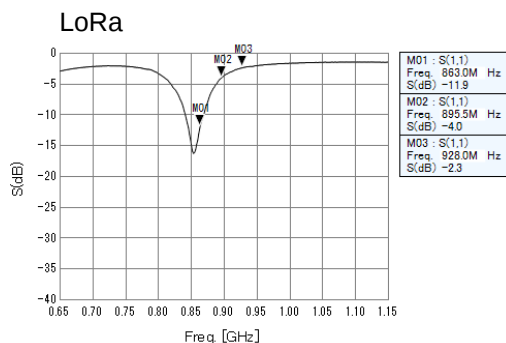
2D Directional indication



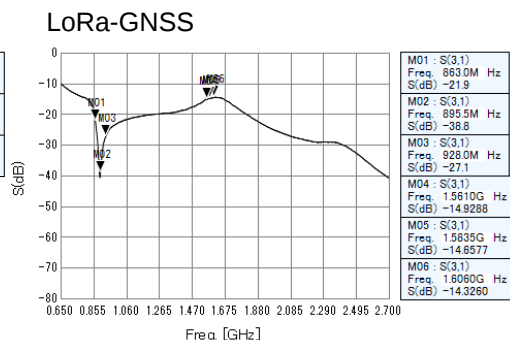
4. Measurement result

Condition 1: Default_ (LoRa)

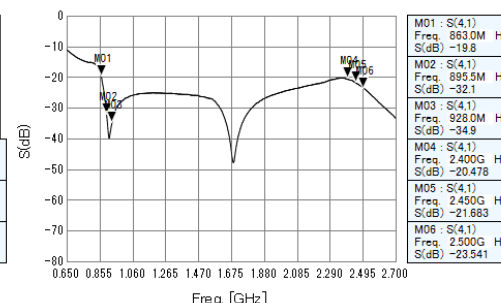
<Return Loss>



<Isolation>



LoRa-WiFi

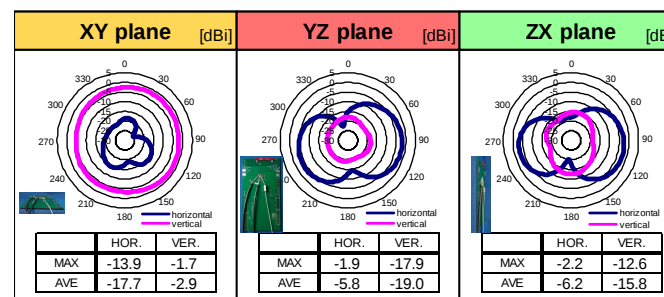


<Efficiency>

*Red color shows peak gain

LINEAR POLAMIZATION		XY-plane		YZ-plane		ZX-plane		Total Efficiency
		hor.	ver.	hor.	ver.	hor.	ver.	
863 MHz	MAX.	-12.2	-0.2	-0.5	-16.8	-0.4	-13.0	-2.9
	AVE.	-16.2	-1.3	-4.4	-17.9	-4.7	-15.5	
895.5 MHz	MAX.	-13.9	-1.7	-1.9	-17.9	-2.2	-12.6	-4.5
	AVE.	-17.7	-2.9	-5.8	-19.0	-6.2	-15.8	
928 MHz	MAX.	-17.5	-4.5	-4.5	-20.7	-5.7	-14.4	-7.6
	AVE.	-20.6	-6.1	-8.7	-22.1	-9.5	-17.3	

<Directivity>



@895.5MHz

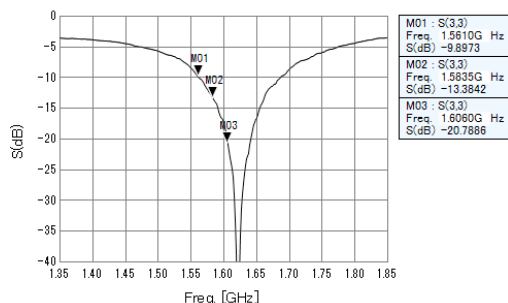


4. Measurement result

Condition 1: Default_ (GNSS)

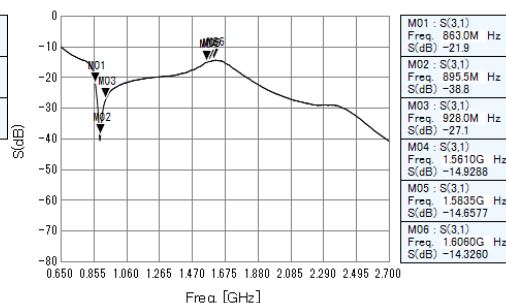
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GNSS

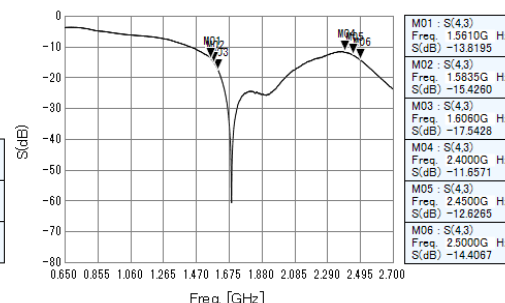


<Isolation>

LoRa-GNSS



GNSS-WiFi

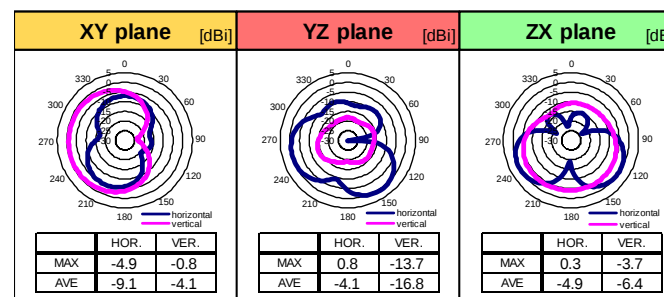


<Efficiency>

*Red color shows peak gain

LINEAR POLAMIZATION		XY-plane [dBi]		YZ-plane [dBi]		ZX-plane [dBi]		Total Efficiency
		hor.	ver.	hor.	ver.	hor.	ver.	
1561 MHz	MAX.	-5.4	-1.2	0.4	-14.2	0.1	-4.3	-3.2
	AVE.	-9.8	-4.3	-4.6	-17.2	-5.2	-7.1	
1583.5 MHz	MAX.	-4.9	-0.8	0.8	-13.7	0.3	-3.7	-2.8
	AVE.	-9.1	-4.1	-4.1	-16.8	-4.9	-6.4	
1606 MHz	MAX.	-4.6	-0.4	1.3	-13.6	0.4	-3.2	-2.4
	AVE.	-8.7	-3.9	-3.6	-16.8	-4.8	-5.8	

<Directivity>



@1583.5MHz

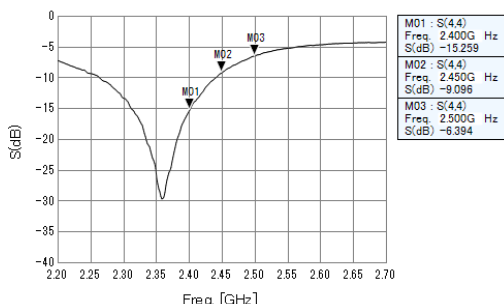


4. Measurement result

Condition 1: Default_ (WiFi)

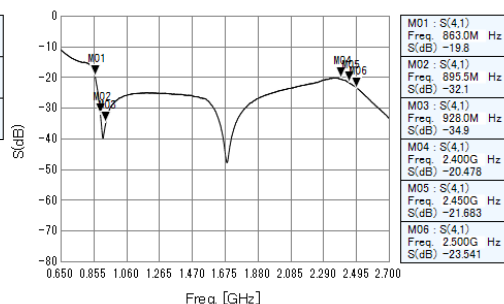
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WiFi

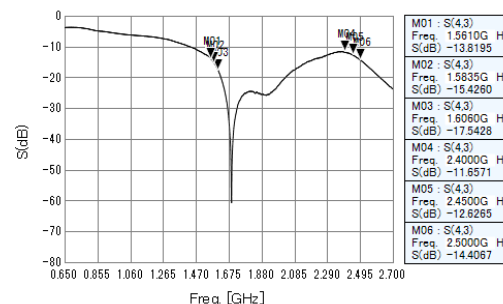


<Isolation>

LoRa-WiFi



GNSS-WiFi

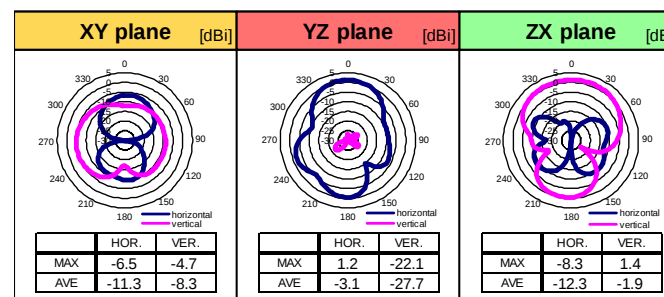


<Efficiency>

*Red color shows peak gain

LINEAR POLAMIZATION		XY-plane		YZ-plane		ZX-plane		Total Efficiency
		hor.	ver.	hor.	ver.	hor.	ver.	
2400 MHz	MAX.	-4.9	-3.2	1.7	-19.2	-5.4	2.0	-2.6
	AVE.	-9.6	-6.6	-2.5	-24.5	-9.8	-1.3	
2450 MHz	MAX.	-6.5	-4.7	1.2	-22.1	-8.3	1.4	-3.6
	AVE.	-11.3	-8.3	-3.1	-27.7	-12.3	-1.9	
2500 MHz	MAX.	-8.4	-6.4	0.7	-21.4	-10.9	0.8	-4.5
	AVE.	-13.0	-9.9	-3.7	-27.8	-15.5	-2.5	

<Directivity>



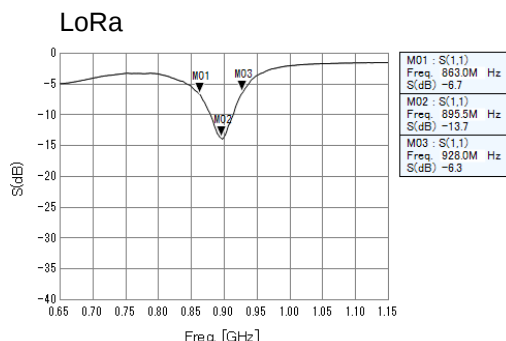
@2450MHz



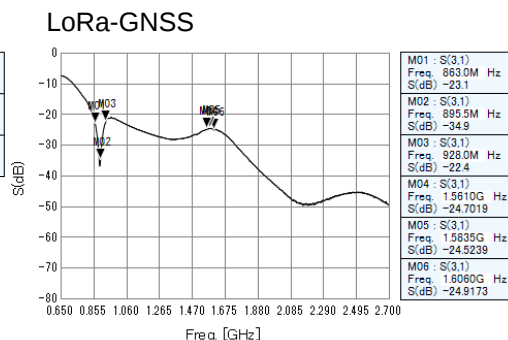
4. Measurement result

Condition 2: Optimized matching circuit from Condition 1_ (LoRa)

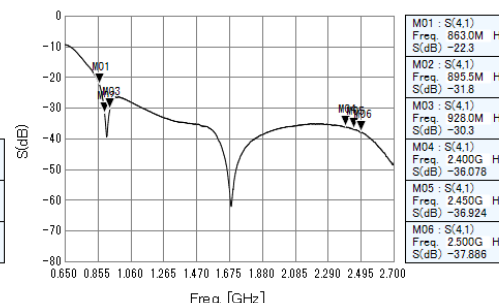
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<Isolation>



LoRa-WiFi

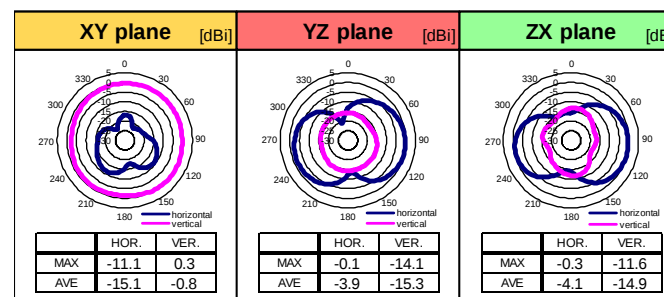


<Efficiency>

*Red color shows peak gain

LINEAR POLAMIZATION		XY-plane [dBi]		YZ-plane [dBi]		ZX-plane [dBi]		Total Efficiency
		hor.	ver.	hor.	ver.	hor.	ver.	
863 MHz	MAX.	-11.6	-0.4	-1.5	-15.7	-0.4	-15.0	-3.5
	AVE.	-16.2	-1.9	-5.3	-17.2	-5.1	-17.7	
895.5 MHz	MAX.	-11.1	0.3	-0.1	-14.1	-0.3	-11.6	-2.4
	AVE.	-15.1	-0.8	-3.9	-15.3	-4.1	-14.9	
928 MHz	MAX.	-13.1	-1.4	-1.7	-16.7	-2.2	-12.3	-4.5
	AVE.	-17.2	-2.9	-5.8	-17.7	-6.4	-15.1	

<Directivity>

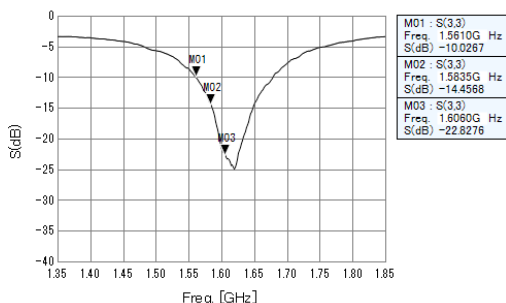


4. Measurement result

Condition 2: Optimized matching circuit from Condition 1_ (GNSS)

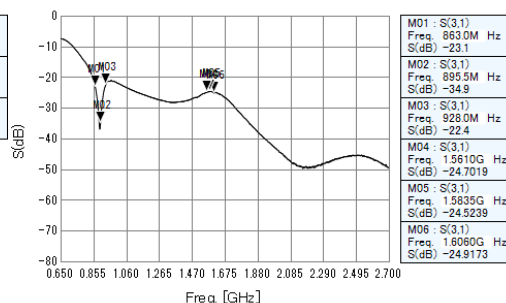
<Return Loss>

GNSS

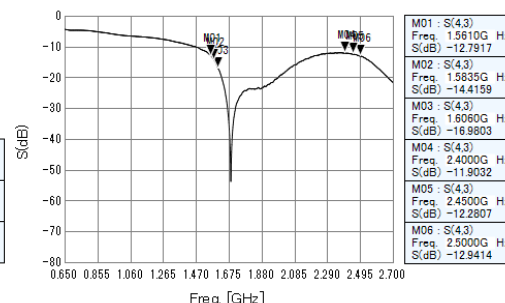


<Isolation>

LoRa-GNSS



GNSS-WiFi

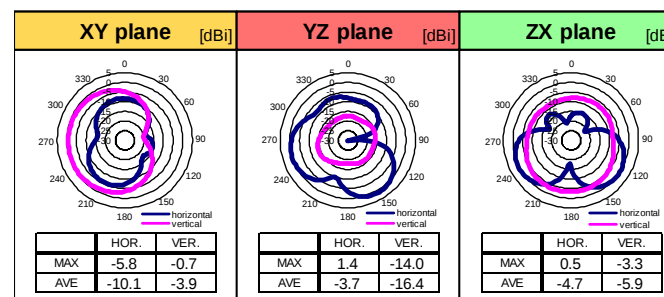


<Efficiency>

*Red color shows peak gain

LINEAR POLAMIZATION		XY-plane [dBi]		YZ-plane [dBi]		ZX-plane [dBi]		Total Efficiency
		hor.	ver.	hor.	ver.	hor.	ver.	
1561 MHz	MAX.	-6.4	-1.1	1.0	-14.5	0.3	-4.0	-2.9
	AVE.	-10.9	-4.1	-4.1	-16.7	-5.0	-6.6	
1583.5 MHz	MAX.	-5.8	-0.7	1.4	-14.0	0.5	-3.3	-2.5
	AVE.	-10.1	-3.9	-3.7	-16.4	-4.7	-5.9	
1606 MHz	MAX.	-5.4	-0.4	1.8	-13.8	0.7	-2.7	-2.2
	AVE.	-9.6	-3.8	-3.2	-16.4	-4.5	-5.3	

<Directivity>



@1583.5MHz

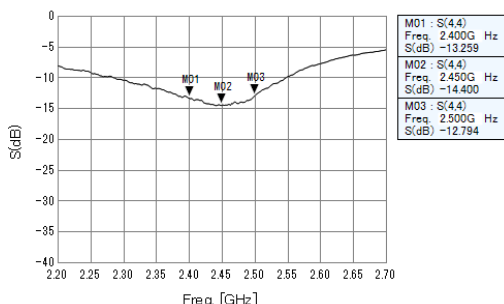


4. Measurement result

Condition 2: Optimized matching circuit from Condition 1_ (WiFi)

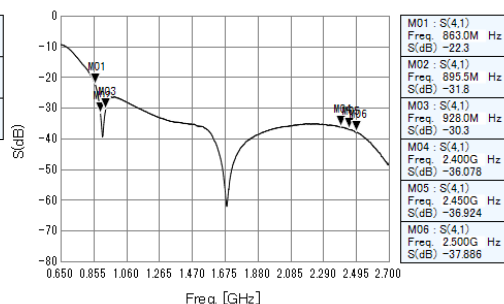
<Return Loss>

WiFi

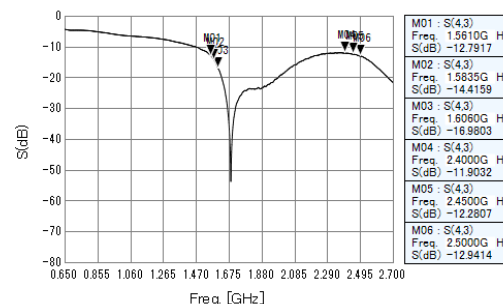


<Isolation>

LoRa-WiFi



GNSS-WiFi

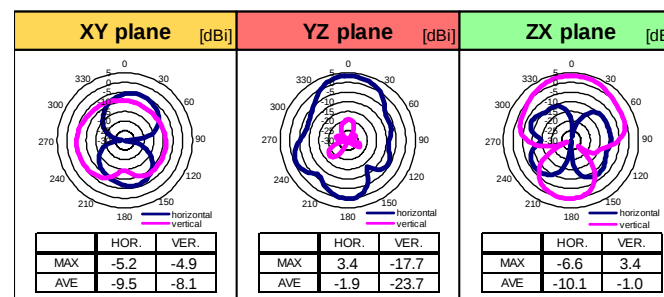


<Efficiency>

*Red color shows peak gain

LINEAR POLAMIZATION		XY-plane		YZ-plane		ZX-plane		Total Efficiency
		hor.	ver.	hor.	ver.	hor.	ver.	
2400 MHz	MAX.	-4.4	-4.1	3.0	-17.5	-5.0	3.0	-2.4
	AVE.	-8.5	-7.0	-2.2	-22.3	-8.9	-1.2	
2450 MHz	MAX.	-5.2	-4.9	3.4	-17.7	-6.6	3.4	-2.6
	AVE.	-9.5	-8.1	-1.9	-23.7	-10.1	-1.0	
2500 MHz	MAX.	-6.5	-6.3	3.6	-18.9	-8.6	3.5	-2.9
	AVE.	-10.6	-9.4	-1.9	-24.4	-12.2	-0.9	

<Directivity>



@2450MHz



4. Measurement result (Comparison)

<Measurement condition>

Condition	Memo
Condition 1	Default
Condition 2	Optimized matching circuit from Condition 1

<Measurement result>

Condition	Frequency [MHz]									[dB]			[%]	
	863	895.5	928	1561	1583.5	1606	2400	2450	2500	Average LoRa	Average GNSS	Average WiFi	Average LoRa	Average GNSS
Condition 1 LoRa	-2.9	-4.5	-7.6							-4.6			34.6	
Condition 1 GNSS				-3.2	-2.8	-2.4					-2.8			52.8
Condition 1 WiFi							-2.6	-3.6	-4.5			-3.5		44.8
Condition 2 LoRa	-3.5	-2.4	-4.5							-3.4			45.8	
Condition 2 GNSS				-2.9	-2.5	-2.2					-2.5			56.3
Condition 2 WiFi							-2.4	-2.6	-2.9			-2.6		54.4

Peak gain

Condition	Frequency [MHz]									[dBi]		
	863	895.5	928	1561	1583.5	1606	2400	2450	2500	Max. LoRa	Max. GNSS	Max. WiFi
Condition 1 LoRa	-0.2	-1.7	-4.5							-0.2		
Condition 1 GNSS				0.4	0.8	1.3					1.3	
Condition 1 WiFi							2.0	1.4	0.8			2.0
Condition 2 LoRa	-0.4	0.3	-1.4							0.3		
Condition 2 GNSS				1.0	1.4	1.8					1.8	
Condition 2 WiFi							3.0	3.4	3.6			3.6

Isolation

Condition	Frequency [MHz]									[dB]		
	863	895.5	928	1561	1583.5	1606	2400	2450	2500	Min. LoRa	Min. GNSS	Min. WiFi
Condition 1 LoRa-GNSS	21.9	38.8	27.1	14.9	14.7	14.3				14.3	14.3	
Condition 1 LoRa-WiFi	19.8	32.1	34.9				20.5	21.7	23.5	19.8		20.5
Condition 1 GNSS-WiFi				13.8	15.4	17.5	11.7	12.6	14.4		13.8	11.7
Condition 2 LoRa-GNSS	23.1	34.9	22.4	24.7	24.5	24.9				22.4	24.5	
Condition 2 LoRa-WiFi	22.3	31.8	30.3				36.1	36.9	37.9	22.3		36.1
Condition 2 GNSS-WiFi				12.8	14.4	17.0	11.9	12.3	12.9		12.8	11.9