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Antenna Gain Measurement for Nokia G6

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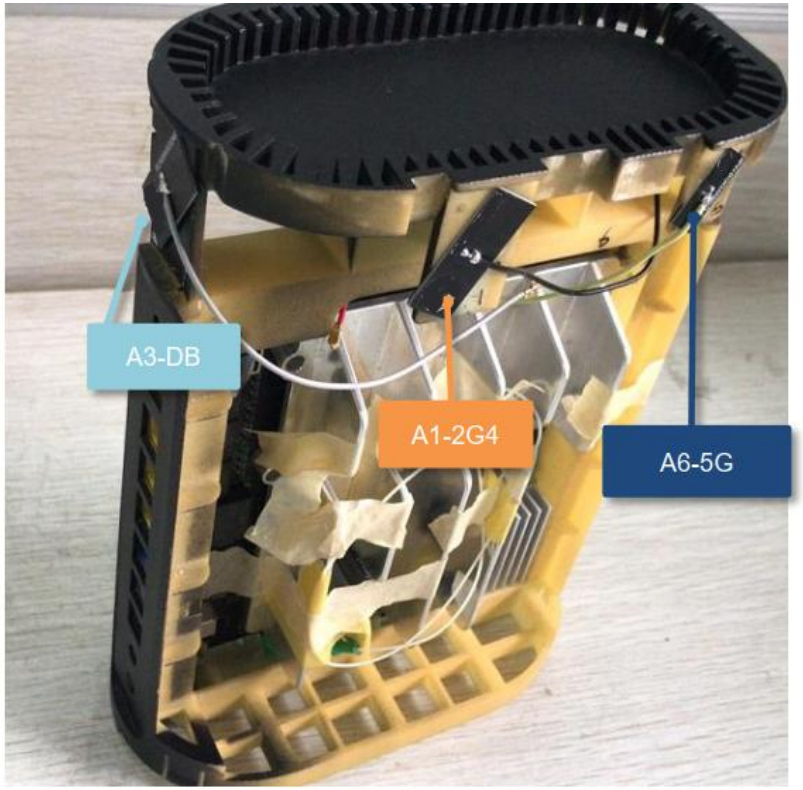
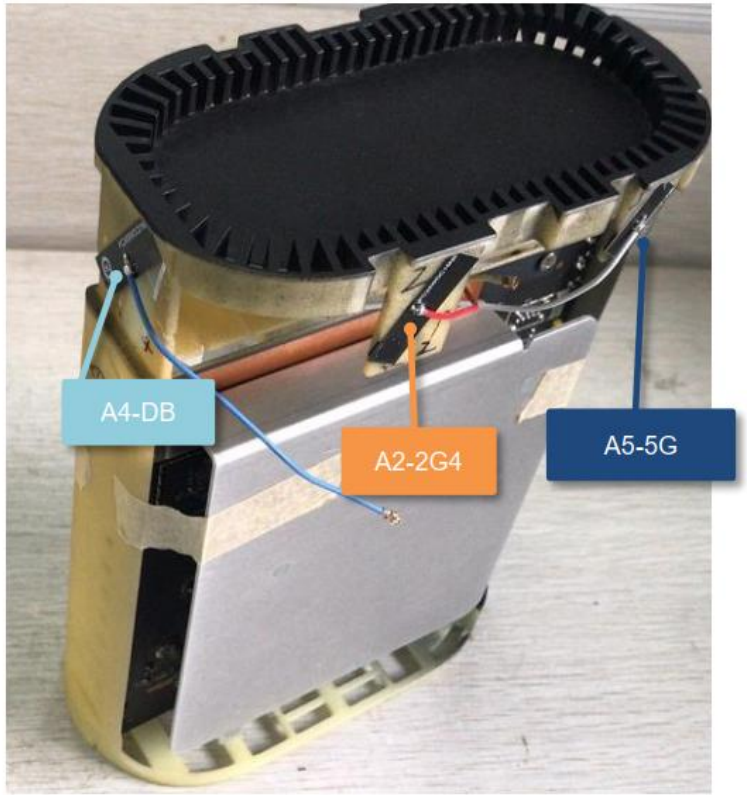
Antenna System description

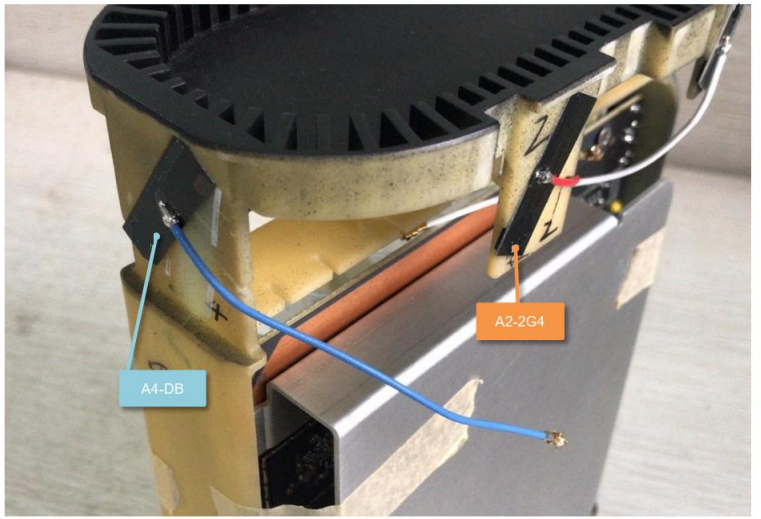
– 6 x dipole type internal antennas and don't have beam steering
  - 2 x 2.4GHz band antennas
  - 2 x dual band(2.4GHz+5GHz) antennas
  - 2 x 5GHz band antennas

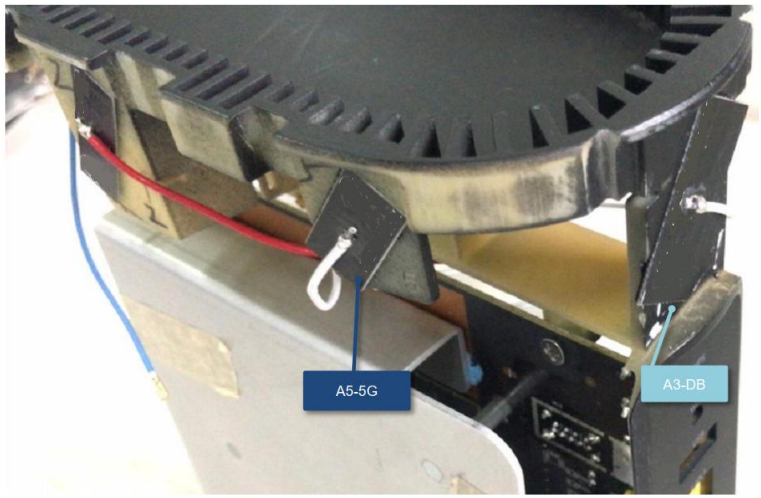




Antenna System Description

- Antenna system description:
  - A1,A2 - 2.4G band antennas
  - A3,A4 - dual band antennas (2.4GHz+5GHz)
  - A5,A6 – 5G band antennas





Measurement Quantity

- The composite gain is based on FCC document 662911. Part e (ii)

$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

where

Each antenna is driven by no more than one spatial stream;

N_{SS} = the number of independent spatial streams of data;

N_{ANT} = the total number of antennas

$g_{j,k} = 10^{G_k / 20}$ if the kth antenna is being fed by spatial stream j, or zero if it is not;

G_k is the gain in dBi of the kth antenna.

Reference: FCC document, "Emissions Testing of Transmitters with Multiple Outputs in the Same Band", 662911 D01 Multiple Transmitter Output v02r01

2. Measurement Quantity

- The composite gain is based on FCC document 662911. Part d (ii)

d) *Unequal antenna gains, with equal transmit powers.* For antenna gains given by G_1, G_2, …, G_N dBi

(ii) If all transmit signals are *completely uncorrelated*, then

$$\text{Directional gain} = 10 \log[(10^{G1/10} + 10^{G2/10} + \ldots + 10^{GN/10})/N_{ANT}] \text{ dBi}$$

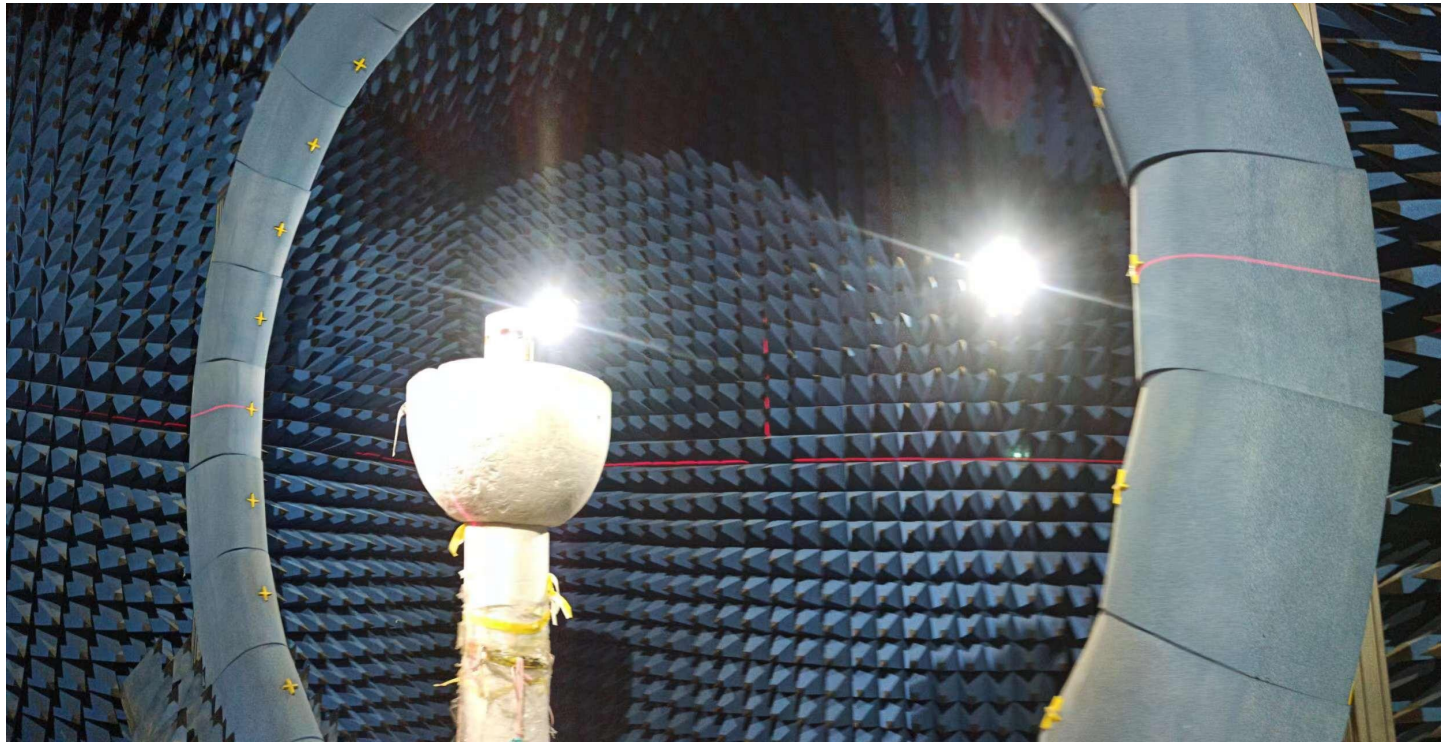
Reference: FCC document, "Emissions Testing of Transmitters with Multiple Outputs in the Same Band", 662911 D01 Multiple Transmitter Output v02r01

Measurement Method

- Use Gain-transfer method to perform directional gain measurement.

Measurement Environment

- CATR (Compact antenna test range)
  - MVG Satimo SG24 chamber
    - LxWxH : 5mx5mx5m
    - Measurement Frequency Range: 600MHz-6000MHz



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Beamforming Gain

2.4G 非Beamforming												
Antenna Gain	2400				2450				2490			
	A1	A2	A3	A4	A1	A2	A3	A4	A1	A2	A3	A4
	2.75	3.04	2.24	3.78	2.92	2.41	2.07	3.32	3.56	2.49	2.09	3.28
Power Direction Gain（the maximum individual antenna gain）	3.78				3.32				3.56			
PSD Direction Gain（direction gain）	5.90				5.80				5.80			

5G 非Beamforming												
Antenna Gain	5200				5500				5800			
	A3	A4	A5	A6	A3	A4	A5	A6	A3	A4	A5	A6
	3.37	4.54	3.24	3.97	3.71	3.24	3.25	4.08	3.61	2.89	4.37	4.69
Power Direction Gain（the maximum individual antenna gain）	4.54				4.08				4.69			
PSD Direction Gain（direction gain）	5.90				5.90				5.90			

2.4G Beamforming			
	2400	2450	2490
Power Direction Gain（the maximum individual antenna gain）	3.78	3.32	3.56
PSD Direction Gain（direction gain）	5.90	5.80	5.80

5G Beamforming			
	5200	5500	5800
Power Direction Gain（the maximum individual antenna gain）	4.54	4.08	4.69
PSD Direction Gain（direction gain）	5.90	5.90	5.90

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