



2026

BRICS SKILLS COMPETITION

(BRICS+ FUTURE SKILLS & TECH CHALLENGE)

5G Communication Network Construction and Operation & Maintenance Application BRICS-FS-20

Test Project_Offline

June, 2026

Task 1 5G Network Optimization

I . Network plan

Task requirements:

Fill in the data according to the "Competition Task Specification," then calculate and output the relevant parameters, including uplink resource proportion, downlink resource proportion, sector throughput, final path loss, required base stations for uplink and downlink, and power calculations (including transmission powers for downlink channels such as SSS, PSS, PBCH, PDCCH, CSI-RS, and Prach).

Mission Task Description		
5G Capacity Planning	Carrier Aggregation Level	2
	Number of base stations covering the respective areas	3
	Total number of mobile terminal Users in the region	2500
	5G Frequency Bands	FR1
	MIMO layers (Uplink)	2
	MIMO layers (Downlink)	8
	Modulation mode	256
	Scaling factor	1
	code efficiency	(948/1024)
	Subcarrier spacing	30
	Number of allocated PRBs	217
	The number of subcarriers contained in a PRB	12

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	Downlink Speed(kbps)	2400
	Uplink Rate(kbps)	1024
	Operator Market Share (%)	50
	5G Device Penetration Rate (%)	30
	Average Uplink Throughput per Regional User (Mbps)	10
	Average Downlink Throughput per User (Mbps)	21
	5G Frame Structure Configuration	5 Single Cycle
	Special Slot Ratio	6:04:04
5 G Coverage Planning	5Gfrequency range	FR1
	modulation mode	64QAM
	Subcarrier spacing	30
	Number of allocated PRBs	217
	The number of subcarriers contained in a PRB	12
	model	eMBB
	Base station coverage area(m2)	80000
	Base station height (m)	30
	Receiving end height(m)	3
	Average Street Width(m)	10
	Average building height(m)	22
	Base Station Antenna Type	32
	Single-antenna transmission	31

	power (dBm)	
	Uplink Terminal Antenna Type	2
	Uplink single-antenna transmission power (dBm)	23
	Data channel power loss caused by pilot/control voltage boosting	0
	Other losses in the transmission antenna	0
	Other loss in receiving devices	0
	receiver noise	7
	Thermal Noise Coefficient	-174
	Interference density at the receiver of the data channel	-146
	Uplink receiver noise	5
	Interference density at the receiver of the uplink data channel	-140
	Interference Margin	3
	h_arqgain	0
	Uplink receiver margin	0
	Uplink h_arq gain	0
	Shadow fading in data channels	11
	Selection/Macro diversity gain	1
	Uplink Selection/Macrodivergence Gain	0

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	Penetration loss	26
	Uplink penetration loss	5
	Other Gains	3
	Other Uplink Gains	0
	Base station frequencyGHz	5
	Model in eMBB scenarios	City Macro StationCity Macro StationUma
5 G Power calculation	AAU/RRUpower	240
	5G Cell Configuration	5G S1NR+S3LTE20M
	4G Cell Power	40
	frequency range	2.6G
	5GAntenna Type	64
	小区功率 license 配置数量(一个 license=20W)	12
	5G bandwidth	273
	SCS	30
	SSS's RE power offset	2
	PSS RE power offset	2
	PBCH RE power offset	2
	RE power offset of the common PDCCH	2
	Dedicated PDCCH RE power offset	2
	Broadband CQI measurement	-3

	CSI-RS transmit power offset	
	PDSCH Transmission Power Offset	2
	PDSCH DMRS Transmission Power Offset	2
	UE's maximum transmission power	24
	Leading Code Format	1
	Maximum number of preamble transmissions	3
	PRACH Power Increase Step Size	2
	Expected receiving power of the pilot code at the base station	-110
	Minimum Access Level	-128

Output result: Based on the scenario conditions provided in the "Competition Task Document Data," calculate the required base stations in the target area as well as the physical channel and reference signal transmission power.

Capacity Estimation Answer Details	Answer Value
Carrier Aggregation Level	
Number of Cells Covered by Base Station	
Uplink MIMO Layers	
Downlink MIMO Layers	
Modulation Scheme	
Scaling Factor	
Coding Efficiency	

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Subcarrier Spacing (SCS)	
Number of Allocated PRBs	
5G Frequency Band	
Number of Subcarriers Contained in One PRB	
Downlink Rate (kbps)	
Uplink Rate (kbps)	
Total Number of Mobile Terminal Users in the Area	
5G Operator Market Share (%)	
5G Terminal Penetration Rate (%)	
Average Uplink Throughput per User in Area (Mbps)	
Average Downlink Throughput per User in Area (Mbps)	
5G Frame Structure Configuration	
Special Slot Configuration Ratio	
Downlink Resource Proportion (%)	
Uplink Resource Proportion (%)	
Equivalent Downlink TBS	
Equivalent Uplink TBS	
Number of Base Stations Required for Uplink Capacity	
Number of Base Stations Required for Downlink Capacity	
Maximum Uplink Throughput per Cell (Mbps)	
Maximum Downlink Throughput per Cell (Mbps)	
Final Number of Base Stations Required for Capacity	
Downlink Coverage Answer Details	Answer Value
Coverage Area per Base Station Cell	

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Single Antenna Transmit Power	
Base Station Antenna Type	
Data Channel Power Loss Caused by Pilot/Control Channel Power Boost	
Other Transmit Antenna Losses	
Other Receiver Device Losses	
Receiver Noise Figure	
Thermal Noise Density	
Receiver Interference Density of Data Channel	
Interference Margin and Other Margins	
HARQ Gain	
Shadow Fading Margin of Data Channel	
eMBB Scenario Model	
Selection / Macro Diversity Gain	
Penetration Loss	
Other Gains	
Base Station Antenna Height (m)	
Terminal Height (m)	
Average Street Width (m)	
Average Building Height (m)	
Base Station Operating Frequency (GHz)	
Total Downlink Transmit Power (dBm)	
Equivalent Downlink Transmit Power	
Total Noise & Interference Density of Downlink Data Channel	
Channel Bandwidth Occupied by Data Channel	

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Effective Noise Power of Downlink Data Channel	
Signal-to-Noise Ratio (SNR)	
Receiver Sensitivity of Downlink Data Channel	
Hardware Link Budget of Downlink Data Channel	
Final Downlink Path Loss	
2D Downlink Coverage Radius	
Estimated Number of Sites for Downlink Coverage	
Signal-to-Noise Ratio (SNR)	
Uplink Coverage Answer Details	Answer Value
Coverage Area per Base Station Cell	
Single Antenna Transmit Power	
Base Station Antenna Type	
Data Channel Power Loss Caused by Pilot/Control Channel Power Boost	
Other Transmit Antenna Losses	
Other Receiver Device Losses	
Receiver Noise Figure	
Thermal Noise Density	
Receiver Interference Density of Data Channel	
Interference Margin and Other Margins	
HARQ Gain	
Shadow Fading Margin of Data Channel	
eMBB Scenario Model	
Selection / Macro Diversity Gain	
Penetration Loss	

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Other Gains	
Base Station Antenna Height (m)	
Terminal Height (m)	
Average Street Width (m)	
Average Building Height (m)	
Base Station Operating Frequency (GHz)	
Total Uplink Transmit Power (dBm)	
Equivalent Uplink Transmit Power	
Total Noise & Interference Density of Uplink Data Channel	
Effective Noise Power of Uplink Data Channel	
Receiver Sensitivity of Uplink Data Channel	
Hardware Link Budget of Uplink Data Channel	
Final Uplink Path Loss	
2D Uplink Coverage Radius	
Estimated Number of Sites for Uplink Coverage	
Power Calculation Answer Details	Answer Value
AAU/RRU Transmit Power	
5G Cell Configuration	
4G Cell Transmit Power	
Frequency Band	
5G Antenna Type	
Number of Licensed Configurable Cell Power Resources	
5G System Bandwidth	
Subcarrier Spacing (SCS)	

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SSS RE Power Offset	
PSS RE Power Offset	
PBCH RE Power Offset	
Common PDCCH RE Power Offset	
Dedicated PDCCH RE Power Offset	
Wideband CQI Measurement CSI-RS Transmit Power Offset	
PDSCH RE Power Offset	
PDSCH DMRS Transmit Power Offset	
UE Maximum Transmit Power	
Preamble Format	
Maximum Preamble Transmission Times	
PRACH Power Ramping Step Size	
Target Preamble Received Power at Base Station	
Minimum Access Level	
Total NR Cell Transmit Power	
Maximum Configurable Cell Transmit Power via NMS	
Reference Value of Cell RE Power	
SSS RE Power	
PSS RE Power	
PBCH RE Power	
Common PDCCH RE Power	
Dedicated PDCCH RE Power	
Wideband CQI Measurement CSI-RS Transmit Power	
PDSCH RE Power	

PDSCH DMRS Transmit Power	
PRACH Target Received Power	
Path Loss	
UE Transmit Power on PRACH Channel	

II、Data collection

Task Requirements : Use tools such as GPS, compass, rangefinder, inclinometer, and multimeter to collect key indoor and outdoor information of the planned site.

Result output:

- 1、Selection of 5G Indoor and Outdoor Information Collection Tools
- 2、Planning the outdoor engineering survey information for the site
- 3、Planning indoor site survey information for the site
- 4、The acceptance results of Broussonetia papyrifera

III、Network Testing

Task Requirements:

- 1、Select the appropriate testing equipment and complete the pre-test tasks including equipment connection, software installation, and driver installation.
- 2、Conduct tests and analyze sampling points to plan site test results。
- 3、Analyze and test KPI indicators

Result output:

- 1、Preparation of tools before testing
- 2、Pre-test equipment connection, software installation, driver installation, test task configuration
- 3、Export test KPI metrics

IV、Signal Analysis

Task Requirements:

- 1、LOG playback
- 2、Network testing signaling, events, and parameter analysis
- 3、Select the correct optimization plan based on the analysis results and submit it for approval.

Result output:

- 1、Network Test Issue Analysis Results
- 2、Optimization plan selection and reporting

V、End-to-end optimization

Task Requirements:

- 1、Alarm Analysis and Handling
- 2、Analyze issues based on front-end testing metrics and back-end KPI indicators, and resolve problems by adjusting relevant parameters.
- 3、The optimized network status is verified through backend metrics and test results.

Result output:

- 1、Alarm handling result.
- 2、Modify background parameters according to different scenarios including coverage, handover, latency, rate, capacity, and dropped calls.

VI、Full Network Optimization

Task Requirements:

- 1、Alarm Analysis and Handling
- 2、Analyze issues based on front-end testing metrics and back-end KPI indicators, and resolve problems by adjusting relevant parameters.
- 3、The optimized network status is verified through backend metrics and test results.

Result output:

- 1、Alarm handling result
- 2、Modify background parameters based on different scenarios such as mobility, access, and retention.

Task 2 5G-based Digital and Intelligent Operations Management

I 、 Network process deployment

Task Requirements:

- 1 、 According to the task, complete the construction of the intelligent operation and maintenance system.
- 2 、 Cables are selected from the circuit diagram, while equipment such as servers and computers are chosen from the legend library.

Result output:

- 1 、 Completed the framework construction of the intelligent operation and maintenance platform, and conducted verification and preservation.

II 、 Data cleaning, mining

Task Requirements:

- 1、 According to the platform mission statement requirements, apply key intelligent operation and maintenance technologies to import 4G MR/MDT data.
- 2、 Invoke Python database tools for data traversal, filtering, and statistical analysis

Result output:

- 1、 According to the requirements of 5G planned sites, rasterize the imported data to identify areas with weak 5G coverage.。

III、 5G site planning and PCI planning

Task Requirements:

- 1、 View task instructions and requirements
- 2、 Invoke large model application tools to refine the algorithm process design
- 3、 Identify weak 5G coverage areas in counties/districts for site planning.
- 4、 Perform PCI planning for newly planned 5G sites

Result output:

- 1、 According to the requirements of 5G site planning, combined with the application of large model tools, improve relevant algorithms, perform calculations for adding new sites in 5G weak

coverage areas, identify the locations requiring new site construction, and conduct automated PCI planning.

IV、 Large Screen Display

Task Requirements:

1、 According to the task requirements, complete the partial data visualization interface display, requiring the use of line charts and radar charts.

Result output:

Display the line chart and radar chart of the task-required data on the large screen interface to facilitate intuitive visualization of the algorithm results.



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