Communication IT Network Administration

Task Paper and Marking Criteria

I. Competition Task Paper

Task 1: Configuration for 5G communication network detection (13 marks)

1.1 Task background

5G mobile communication equipment must pass the network access test authentication by China Telecommunication Technology Labs of the Ministry of Industry and Information Technology before they are officially launched on the market to obtain the legal network access license. Now XX manufacturer has added one XX model 5G equipment, which needs to complete test tasks for authentication to obtain network access license. Before the test, the corresponding test environment should be set up and the base station startup configuration should be completed.

1.2 Task requirements

Competitors need to complete the base station startup configuration according to the base station startup engineering parameters.

Specific requirements for engineering parameters task are as follows:

Device	Parameter	Requirements for engineering parameters
Core network	Core network OAM address	182.34.39.25/24
	Core network AMF/SMF address	162.20.2.110/24
	Core network UPF address	162.50.6.120/24
	Core network mobile country code	460
	Core network mobile network code	0
	Core network TAC	4334
	WWID	180220
	Core network index	0
10G switch	Switch OAM port gateway	182.34.39.1/24
	Switch AMF/SMF port gateway	162.20.2.1/24
	Switch UPF port gateway	162.50.6.1/24
	Switch maintenance port gateway	182.34.39.1/24
	Switch service port gateway	162.50.6.1/24
	Switch SCTP link port gateway	142.128.8.1/24
Base station	Number of the cabinet for mounting the BBU	0
	BBU subrack number	0
	BBU subrack model	EMB6216
	Main control panel model	HSCTDa
	Slots for the main control panel	0
	Model of baseband board 1	HBPOF
	Slots for baseband board 1	3
	Model of baseband board 2	HBPOD
	Slots for baseband board 2	4

	Model of baseband board 3	HBPOD
	Slots for baseband board 3	5
	Base station SCTP link port index	0
	AAU1 model	TDAU5364N41
	AAU1 cell ID	1
	AAU1 operating bandwidth	100MHz
	AAU1 coverage	5Km
	AAU1 port configuration	Four ports
	Type of AAU1 antenna	HXMM6XD10M
	AAU1 antenna gain	23
	AAU1 layout mode	Normal mode
	Index for AAU1 optical port 1 connecting to the optical port of the baseband board	(3,0)
	Series of AAU1 optical port 1	1
	Index for AAU1 optical port 2 connecting to the optical port of the baseband board	-
	Series of AAU1 optical port 2	-
	Index for AAU1 optical port 3 connecting to the optical port of the baseband board	-
	Series of AAU1 optical port 3	-
	Index for AAU1 optical port 4 connecting to the optical port of the baseband board	-
	Series of AAU1 optical port 4	-
	AAU1 frame structure	format0
Resource transmission	Global PDCP user interface protection switch	Open
Cell	Effective coverage power (≥)	-85dBm

Task 2: Implementation of 5G communication network detection (50 marks)

2.1 Task background

5G communication network detection aims to strictly check the function, performance, reliability, compatibility and stability of products from the perspective of users, so as to experience the user experience in advance and improve the market competitiveness of products.

2.2 Task requirements

Now one XX type 5G base station of XX manufacturer has completed the configuration of base station parameters and started to transmit RF signals. Please test the radiation signal performance index according to the test specifications, and write the corresponding automated test script code according to the specified test items. After that, obtain the correct test results through the running code. Specific tasks are as follows:

Transmitter output power test

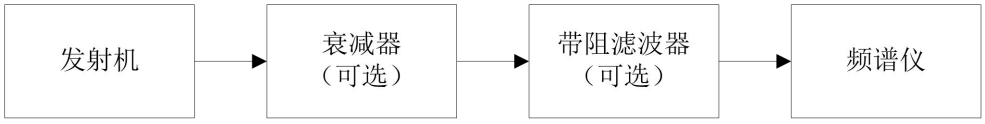

Figure 1

发射机	Transmitter
衰减器（可选）	Attenuator (optional)
带阻滤波器（可选）	Band-rejection filter (optional)
频谱仪	Spectrum analyzer

Case number:	5.1	Priority:	Required
Test Purpose:	Verify that the rated output power and stability of the tested equipment meet the requirements		
Reference networking:	Fig. 1		
Items assessed:	Wiring calibration for RF conduction test, signal bandwidth, signal center frequency point, NR-TDD signal frame structure, effective bandwidth of 5G signal, safe use of spectrum analyzer, spectrum analyzer program command, signal detection mode, automated test interface logic, etc.		
Preconditions:	1. Set up a test environment and calibrate path loss based the network, and add the path loss to the instrument; 2. Set the meter to external reference signal synchronization and frame trigger. Data acquisition is performed only in downlink time slot.		
Test steps:	1. According to the band and bandwidth specified in the equipment to be tested, the maximum number of carriers supported by the equipment is configured, and the power of each carrier is allocated according to the principle of equal power spectral density; 2. Start the transmitter with the NR working mode being NR-FR1-TM1.1, and transmit at maximum power; 3. For each carrier, test the integral power of all successive downlink subframes in the channel bandwidth for 20ms, and test the total integral power of all carriers; 4. Write the corresponding automated test script program according to the setting logic of the spectrum analyzer; 5. Run the automated test script program in Step 4 to obtain the detection results;		
Expected results:	When all detection results meet the following technical requirements, a pass can be given, otherwise the maximum transmitting power of each carrier in a single channel of macro station and micro station should be within ±1dB of its rated power;		
Notes:	The rated transmitting power in a single channel is defined as the rated power of the equipment divided by N (N is the number of equipment channels)		

Task 3: ICV configuration (12 marks)

3.1 Task background

In 2020, the Ministry of Housing and Urban-Rural Development and the Ministry of Industry and Information Technology jointly issued a document to organize the pilot project of coordinated development of smart city infrastructure and intelligent connected vehicles (hereinafter referred to as “smart city and ICVs”). 5G intelligent network is an important basis to realize smart city and ICVs, and the business application based on 5G smart network is also an important force driving the development of smart city and ICVs. A new automobile manufacturing enterprise, committed to the development of intelligent connection, vehicle-road cooperation of

new energy intelligent vehicles, fully verifies its new energy intelligent vehicle self-driving technology in the core area of 30 square kilometers in a pilot city economic development zone, within the scope of ICV infrastructure of 105 intersections.

3.2 Task requirements

According to the code and environment configuration specifications, the development environment and dependencies can be successfully loaded. Please correctly configure the 5G network environment of the system, and output the specified value. Next, edit the code and debug to ensure that it can run without error. The specified value can be output through the correctly run code. Verify whether the code and environment are correct. The program can correctly input the specified video given by the Test Project. Through the program, the lane lines in the specified video can be identified and marked with green color blocks.

4. Task: Intelligent connection debugging (25 marks)

4.1 Task background

For safe driving, through intelligent network connection, the vehicle can obtain the driving data of surrounding vehicles and the information sent by traffic lights and other roadside infrastructure. It can realize scenarios such as front collision warning, intersection collision warning, and green wave pass, which can significantly improve vehicle safety and traffic efficiency.

For complex scenarios at urban intersections, urban managers can carry out networked and intelligent transformation of urban intersections, collect the status information of lanes, vehicles and pedestrians, and send it to the platform for statistics and analysis, with a view to realize digital twinning of urban road traffic and dynamically form refined traffic control, including precise control of traffic signals, priority for special vehicles, and yielding to vulnerable traffic participants.

4.2 Task requirements

Competitors are required to connect the configured ICV to the dedicated 5G network in the workshop, and complete automatic driving on the designated sand table. The ICV must be able to identify all traffic lights and other road facilities as well as obstacles. After successful identification, the program can frame the identification of traffic lights or obstacles and display the corresponding names. The image must be transmitted to a designated large screen through the dedicated 5G network.

II. Marking Criteria

1. Marking criteria development principles

The evaluation principles of the Competition are formulated by the expert panel, which fully reflect the principle of making judgment in an “impartial, fair and scientific” manner. Most questions for the Competition are objective questions, and the result evaluation is encrypted without external interference. The following main aspects are assessed:

(1) Basic knowledge of 5G network.

(2) 5G network planning and deployment capability.

(3) Knowledge of 5G RF signal property.

(4) Basic principle of 5G spectrum analyzer.

(5) 5G RF index test basis.

(6) Automated test logic capability.

(7) 5G terminal service commissioning capability.

(8) Principle of 5G ICV.

(9) Service configuration capability of typical 5G+ industry application scenarios.

(10) Team communication and cooperation capability, emergency response capability.

2. Marking scheme

The marking criteria are developed by the expert panel. Competitors' implementation of 5G SA wireless access network planning and design, RF signal analysis and index verification, automated test script program design and writing, joint debugging of 5G terminal service, typical application scenarios of 5G+ industry are comprehensively assessed. In addition, the competitors' comprehensive capabilities such as selection of auxiliary materials for 5G detection environment, calibration of path loss, safe use of detection instruments, joint debugging of application, and team cooperation are also assessed.

The Competition is divided into four parts, i.e. configuration for 5G communication network detection, implementation of 5G communication network detection, ICV configuration and ICV debugging. The total marks in the four parts are the marks of the teams, according to which the teams will be ranked from high to low. The marks of each module and the marking rules for each competition phase are shown in Table 1 and Table 2 respectively.

Table 1 Marks of Each Module of the Competition

Competition phase	**Competition module**	**Marks**
Competition Phase I: 5G communication network detection task	Configuration for 5G communication network detection	13 marks
	Implementation of 5G communication network detection	50 marks
Competition Phase II: Configuration and debugging task of 5G ICV	ICV configuration	12 marks
	Intelligent network connection debugging	25 marks
Total		100 marks

Table 2 Detailed Rules for Marking

Competition module	**Main knowledge and technical points**	**Marks**	**Assessment method**

Configuration for 5G communication network detection (13%)	5G OM link configuration	0.5	Result marking (Objective)
	5G transmission link configuration	3.5	
	5G RF link configuration	3	
	5G cell parameter configuration	4.5	
	Parameter configuration for 5G base station system	1.5	
Implementation of 5G communication network detection (50%)	Detection environment setup	2	Result marking (Objective)
	Wiring calibration for RF conduction test	5	
	Output power test of 5G base station transmitter	6	
	Detection of ACLR of 5G base station	7	
	Detection of transient response of 5G base station transmitter	7	
	Detection of general scattering of 5G base station	6	
	Writing and running of automated test script program	17	
ICV configuration (12%)	Load the development environment and dependencies	3	Result marking (Objective)
	Edit the code and debug	6	
	Verify the code and environment correctness	3	
ICV debugging (25%)	Configuration of 5G communication network	5	Result marking (Objective)
	Debugging and operation of lane line identification code	5	
	Application of lane line identification code in 5G network	5	
	Target detection code in 5G network	5	
	Integrated application of 5G ICV	5	
Deductions for breaking rules	Deliberately damage the power supply and network equipment at the competition site	2-5 marks will be deducted	Jury president
	Disobey the judges' arrangement and disturb the order of the workshop	1-3 marks will be deducted	
	Deliberately interfere with other competitors during the Competition	1-2 marks will be deducted	
Total	100		

3. Marking method

The total result of the Competition is 100 marks. Each part will be marked separately and the marks will be included in the total score of the team.

Results marking and process marking (both are objective marking) are combined in the Competition. The jury president will summarize the results of each workstation in real time. After the results are re-checked and confirmed to be correct, the jury president and supervising arbitrators will sign for confirmation. For result marking, each part will be marked independently by two marking judges. The jury president will present the results of the workstations after the Competition. Upon re-checked and confirmed to be correct, the results will be announced after the jury president and supervising arbitrators sign for confirmation.

4. Marking process

4.1 For objective marking, the marking judges will score each workstation after each phase is over. The computer-based test will be exported from the Competition by corresponding marking judge. The corresponding marking judge will take screenshots and photos of the result marks and confirm the marks.

4.2 The marking results in each phase should be submitted to the jury president for summary.

4.3 Secondary encryption and primary encryption judges decrypt the numbers of each team to get their results.

5. Review and check

5.1 In order to ensure the accuracy of the evaluation results, the supervision and arbitration team will review the results of all teams that rank in the top 30% of the total results of the Competition. The rest of the results will be reviewed on a sampling basis, with a coverage rate of no less than 15%. If the error rate of review and sampling exceeds 5%, the jury will review all results. After the completion of the review on a sampling basis, the final result sheet will be generated, which will be signed by the jury president and handed over to the Executive Committee together with related paper documents such as the test projects, site record forms and confirmation forms.

5.2 All corrections to the marks should be explained to the jury president and recorded. Any problems identified during the review should be explained to the jury president and recorded.

5.3 The total marks of each competition content are the total marks of the teams, according to which the teams will be ranked from high to low. In the event of a tie, the jury will decide the ranking of the competitors based on the different marking priorities, in descending order of priority: implementation of 5G communication network detection > debugging of 5G ICV > configuration for 5G communication network detection > configuration of 5G ICV. If the comparison of marking priorities still fails to distinguish the overall ranking of the competitors, the marking judges will vote on all subjective marking items (judgment) of the Competition modules of the competitors with the same ranking. The competitor with higher votes will be ranked higher.