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Semua Pengarah Ukur dan Pemetaan Negeri
Semua Pengarah Ukur Bahagian / Pengarah Bahagian

PEKELILING KETUA PENGARAH UKUR DAN PEMETAAN
BILANGAN 4 TAHUN 2021

GARIS PANDUAN TEKNIKAL MENGENAI PERKHIDMATAN SISTEM *MALAYSIA REAL-TIME KINEMATIC GNSS NETWORK* (MyRTKnet) DI BAWAH PLATFORM *LEICA SPIDER BUSINESS CENTER* (SBC)

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1. TUJUAN

Pekeliling ini bertujuan untuk memaklumkan perkara berkaitan sistem *Malaysia Real-Time Kinematic GNSS Network* (MyRTKnet) serta memberikan garis panduan mengenai penggunaan produk dan perkhidmatan yang terkini kepada pengguna dan pengukur bagi menggunakan sistem MyRTKnet.

2. LATAR BELAKANG

2.1. Pekeliling ini akan merujuk kepada Pekeliling Ketua Pengarah Ukur dan Pemetaan Bilangan 9 Tahun 2005 iaitu Garis Panduan Mengenai Penggunaan Perkhidmatan *Malaysian RTK GPS Network* (MyRTKnet) yang dikeluarkan pada 6 September 2005, dan Surat Pekeliling Ketua Pengarah Ukur dan Pemetaan Bilangan 3 Tahun 2016 yang dikeluarkan pada 31 Oktober 2016 mengenai Perkhidmatan MyRTKnet di Bawah Platform SpiderNet.

2.2. Berdasarkan Pekeliling dan Surat Pekeliling tersebut, terdapat keperluan khusus untuk membatalkan dan menetapkan semula garis panduan yang baharu merujuk kepada perkembangan dan penggunaan teknologi semasa di peringkat Jabatan Ukur dan Pemetaan Malaysia (JUPEM). Penggunaan

teknologi *Global Positioning System* (GPS) atau *Global Navigation Satellite System* (GNSS) bagi kerja-kerja ukur dan pemetaan di Malaysia telah bermula sejak tahun 1989. Sehingga kini, pelbagai kaedah dan teknik pengukuran GNSS telah digunakan sesuai dengan kehendak dan tujuan sesuatu pengukuran itu dijalankan.

2.3. Menyedari tentang perkembangan ini dan untuk mempertingkatkan perkhidmatan Jabatan kepada pengguna-pengguna GNSS, terutamanya bagi membolehkan pengendalian ukuran GNSS secara lebih cepat dan tepat, JUPEM telah membangunkan perkhidmatan MyRTKnet melalui beberapa fasa sejak tahun 2002 sehingga kini. Sehingga tahun 2021, JUPEM telah membangunkan 97 buah *Continuously Operation Reference Station* (CORS) yang dibina khusus untuk mencerap data satelit GNSS pada setiap saat dan kemudiannya disalurkan ke Pusat Kawalan di Ibu Pejabat JUPEM dan Pusat Data Sektor Awam (PDSA) di Putrajaya.

2.4. Data cerapan GNSS yang dicerap secara berterusan ini membolehkan permodelan selisih yang mempengaruhi kualiti cerapan GNSS dijana dan seterusnya disalurkan dalam bentuk pembetulan koordinat kepada pengguna melalui talian komunikasi bagi tujuan pengukuran GNSS di lapangan dan pra-prosesan melalui laman sesawang.

3. PENGENALAN SISTEM MyRTKnet BAHARU

3.1. Sistem MyRTKnet semasa di bawah platform SpiderNet akan digantikan kepada platform *Spider Business Center* (SBC) yang akan dibuka penggunaannya secara rasmi kepada pengguna mulai **18 Oktober 2021** ini. Sehubungan itu, bagi membolehkan pengguna-pengguna mengakses kepada sistem baharu ini, maka domain web baharu adalah melalui pautan **www.myrtknet.gov.my** bagi memuat turun data GNSS iaitu RINEX CORS dan *Virtual* RINEX. Manakala bagi tujuan cerapan masa hakiki, pengguna perlu menggunakan *Internet Protocol* (IP) baru iaitu **pxy.myrtknet.gov.my** dan port 2101, 2102 atau 2103 akan dibuka kepada pengguna bagi mendapatkan enam (6) jenis perkhidmatan masa hakiki yang disediakan berdasarkan kepada kesesuaian alat penerima GNSS yang digunakan serta lokasi cerapan pengguna.

3.2. Oleh yang demikian, sistem MyRTKnet semasa yang menggunakan URL **www.rtknet3.gov.my** dan **pxy.rtknet3.gov.my** akan ditamatkan serentak dengan tarikh perlaksanaan sepenuhnya sistem MyRTKnet baru kelak.

4. PERKHIDMATAN-PERKHIDMATAN SISTEM MyRTKnet BAHARU

4.1. Perkhidmatan-perkhidmatan yang diberikan oleh sistem MyRTKnet baharu adalah dalam bentuk pembekalan data seperti dalam **Jadual 1**. Data-data yang dibekalkan kepada pengguna terdiri daripada data masa hakiki (*real-time*) dan juga data pasca-prosesan (*post-processed*) di mana penggunaannya bergantung kepada objektif pengukuran itu sendiri. Dalam pada itu, pengguna perlulah mematuhi spesifikasi pengukuran yang telah ditetapkan semasa mengendalikan kerja bagi mendapatkan hasil pengukuran yang baik.

Jadual 1: Jenis-jenis perkhidmatan yang dibekalkan oleh sistem MyRTKnet baharu

Bil.	Jenis Data	Ciri-Ciri Data
1.	Pembetulan *Master Auxiliary* (MAX)	Masa Hakiki
2.	Pembetulan *Individualized Master Auxiliary* (i-MAX)	Masa Hakiki
3.	Pembetulan Stesen Rujukan Maya *(Virtual Reference Station* (*VRS*))	Masa Hakiki
4.	Pembetulan Rujukan Tunggal (*Single Base*)	Masa Hakiki
5.	Pembetulan Rujukan Terhampir (*Nearest Base*)	Masa Hakiki
6.	Pembetulan *Differential* GNSS (D-GNSS) berasaskan jaringan (*Network Base* D-GNSS)	Masa Hakiki
7.	Data Maya RINEX (*Virtual RINEX Data*)	Pasca-Prosesan
8.	Data RINEX CORS (*RINEX Data*)	Pasca-Prosesan

5. GARIS PANDUAN MENGENAI SISTEM MyRTKnet

Maklumat lanjut mengenai perkhidmatan sistem MyRTKnet serta penggunaannya terkandung dalam garis panduan teknikal seperti di **Lampiran 'A'**. Antara intisari garis panduan teknikal tersebut adalah seperti berikut:

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9.	*CONDITIONS FOR DATA USE*
	GLOSSARY

6. TARIKH BERKUATKUASA

Pekeliling ini adalah berkuatkuasa mulai tarikh ianya dikeluarkan.

7. PEMBATALAN

Dengan berkuatkuasanya Pekeliling ini, maka Pekeliling Ketua Pengarah Ukur dan Pemetaan Bilangan 9 Tahun 2005 bertajuk Garis Panduan Mengenai Penggunaan Perkhidmatan *Malaysian RTK GPS Network* (MyRTKnet) dan Surat Pekeliling Ketua Pengarah Ukur dan Pemetaan Bilangan 3 Tahun 2016 bertajuk Perkhidmatan MyRTKnet di Bawah Platform SpiderNet adalah dengan ini dibatalkan.

Sekian, terima kasih.

"WAWASAN KEMAKMURAN BERSAMA 2030"
"BERKHIDMAT UNTUK NEGARA"

(DATO' Sr DR. AZHARI BIN MOHAMED)
Ketua Pengarah Ukur dan Pemetaan
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Malaysia Real-Time Kinematic GNSS Network (MyRTKnet) Guideline for Spider Business Centre (SBC) Platform

JABATAN UKUR DAN PEMETAAN MALAYSIA

2021

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1. INTRODUCTION

1.1. Network Real-Time Kinematic (RTK) GNSS survey method is the innovation of relative positioning whereby multiple receivers are linked by telecommunication network simultaneously in collecting observations.

1.2. Network RTK server continuously receives all the reference station observations and reduces them to a so-called “common ambiguity level”. The algorithms utilised to perform the task are specific to the Network RTK server software, namely Leica GNSS Spider. Once a common ambiguity level is found, the software employs the Network RTK methods such as Master Auxiliary (MAX), Individualized MAX (i-MAX) or Virtual Reference Station (VRS) to produce the RTK corrections for the rover. All Network RTK methods have the advantages of reducing the distance-dependent errors and therefore allowing large baseline lengths between the reference stations and the rovers.

1.3. This technical guideline presents the specifications of the Malaysia Real-Time Kinematic GNSS Network or MyRTKnet, which includes the system description, features, coverage, applications, products, services and design accuracy. The recommended standard procedures and guidelines for surveying using the facilities are also outlined.

2. MALAYSIA REAL-TIME KINEMATIC GNSS NETWORK (MyRTKnet) SYSTEM

MyRTKnet system is a new nationwide GNSS network and infrastructure system developed for GNSS users in Malaysia to provide the RTK and Differential GNSS (D-GNSS) services with unmatched accuracy and coverage for positioning applications across the country. As a wide-area satellite-based service, the broadcast MyRTKnet corrections can be obtained anywhere in Malaysia using a GNSS receiver that supports RTK corrections. The positioning data from MyRTKnet reference stations is optimised for Malaysia, resulting in superior centimetre-level accuracy with most GNSS receivers. In contrast to existing solutions, the MyRTKnet system provides better coverage and performance, a superior technology platform for continued accuracy improvements, plus the assurance of working with a national GNSS network infrastructure that ensures spatial integrity.

2.1. SYSTEM DESCRIPTION

2.1.1. MyRTKnet project had started in 2003, and the transitional period with additional reference stations are shown in **Table 1**. Currently, at Phase 4 of the implementation, the MyRTKnet system has 97 reference stations known as Continuously Operations Reference Station (CORS) forming the network, covering the whole of Peninsular Malaysia, Sabah and Sarawak (**Figure 1**). The stations track GNSS signals and send them via dedicated data lines to the network servers at JUPEM Headquarters located in Kuala Lumpur and Pusat Data Sektor Awam (PDSA) in Putrajaya, which manage and distribute GNSS correction data to subscribers in real-time. Therefore, the subscribers may receive the corrected data on their own devices via wireless technology using the internet-based infrastructure.

Table 1: Development Phases of MyRTKnet Stations

Phase	Year	MyRTKnet Stations				Total
		Peninsular Malaysia	Sabah	Sarawak	Labuan	
I	2003 - 2004	25	1	1	0	27
II	2007 - 2008	50	13	14	1	78
III	2014 - 2015	65	15	15	1	96
IV	2019 - Current	66	15	15	1	97

2.1.2. The services provided by MyRTKnet offer the flexibility of enabling both RTK and D-GNSS operations which require reliable internet coverage. Clear communications between the control centre and rovers via internet service providers in Malaysia eliminate problems associated with the radio broadcast.

2.1.3. MyRTKnet will broadcast continuously 24 hours a day and 7 days a week a 1 Hz dual-frequency data sampling rate using the Radio Technical Commission for Maritime Services (RTCM) and other industry-standard formats. **Figure 2** shows the conceptual diagram of MyRTKnet.

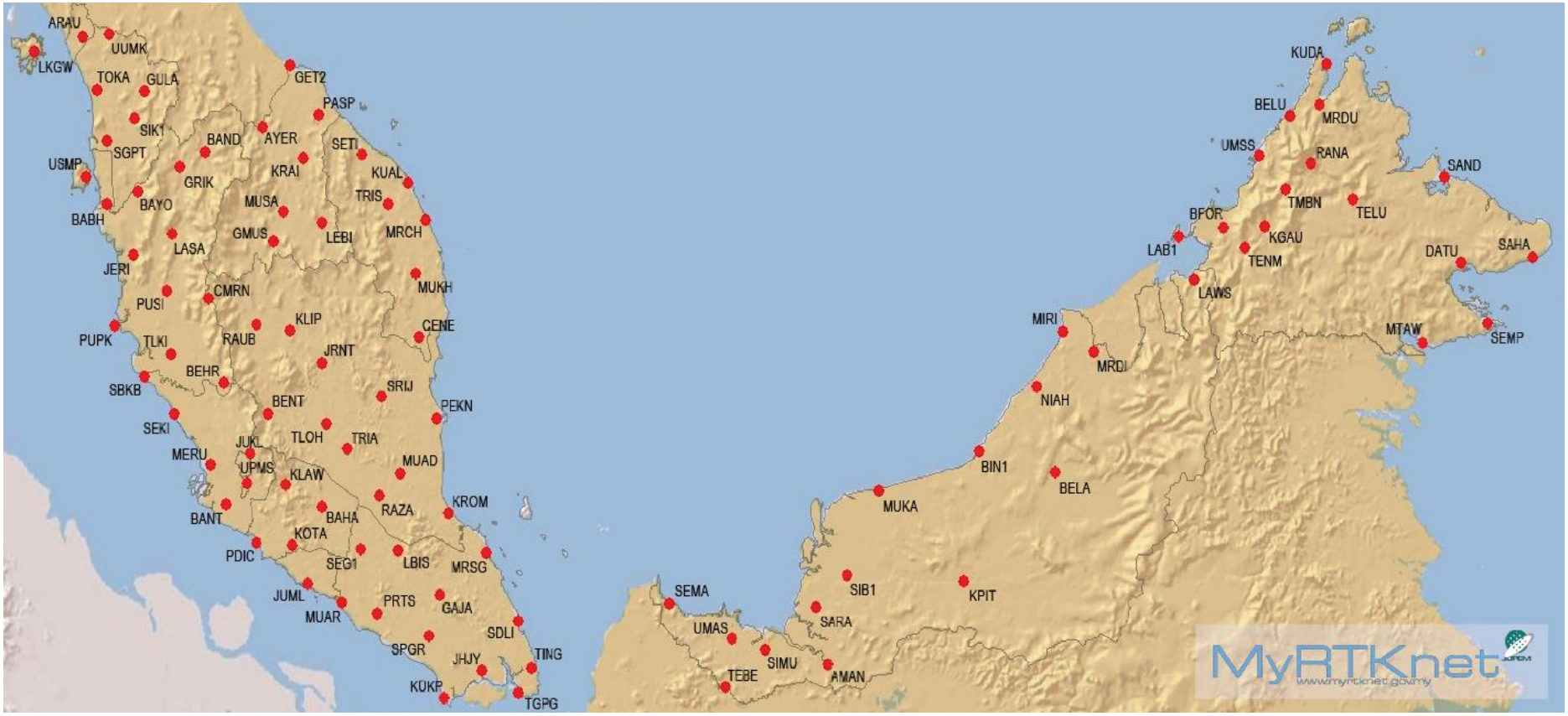

Figure 1: MyRTKnet Stations Distribution

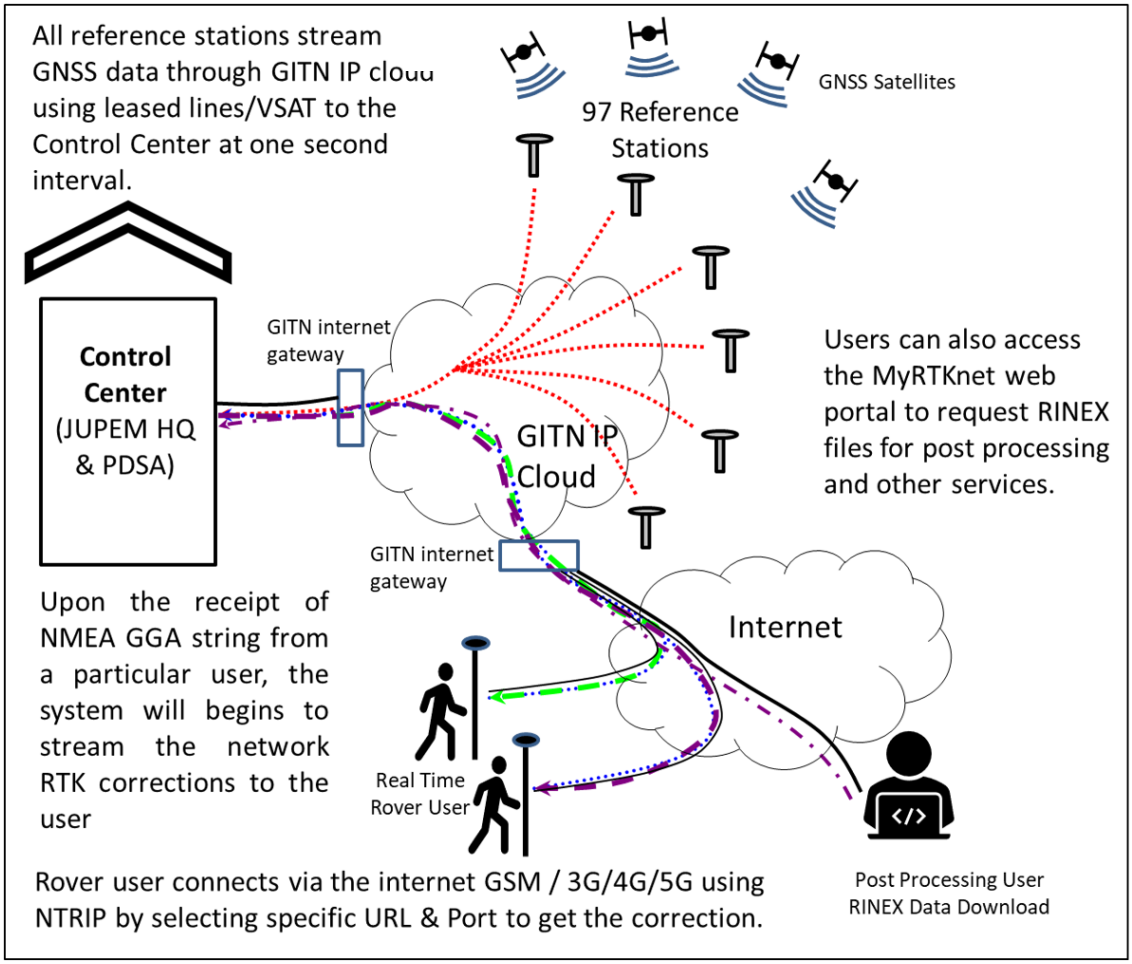

Figure 2: Conceptual Diagram of MyRTKnet System

2.2. FEATURES

2.2.1. MyRTKnet reduces the cost of physical infrastructure by eliminating the need to establish one own's base station as well as increasing productivity with the use of highly portable GNSS systems applications.

2.2.2. It provides a high-performance solution well-suited to the needs of Malaysian users concerning real-time data collection. The network, which includes the utilisation of data redundancy, transmission and processing layers, has a high degree of service reliability. At the same time, a website is made available to download GNSS RINEX data for post-processing solutions.

2.2.3. Amongst others, the network has the following characteristics:

(a) Nationwide coverage

(b) Supports real-time 3D positioning

(c) Compatible with global reference system (in the GDM2000 and GDM2020 systems)

(d) Enables attainment of sub-meter accuracy (± 0.3 m) with mapping grade GNSS receivers

(e) Enables attainment of cm-level accuracy (± 2.0 cm) with dual-frequency GNSS receivers

2.3. COVERAGE

The present coverage of MyRTKnet includes five network clusters that provide centimetre accuracy around all states in Malaysia (**Figure 3**) and a sparse network covering the whole nation. Other areas in the vicinity of a 30 km radius from the permanent reference stations will also achieve centimetre accuracy. This coverage is expected to be further densified in the years to come as JUPEM strives towards providing better GNSS facilities to users.

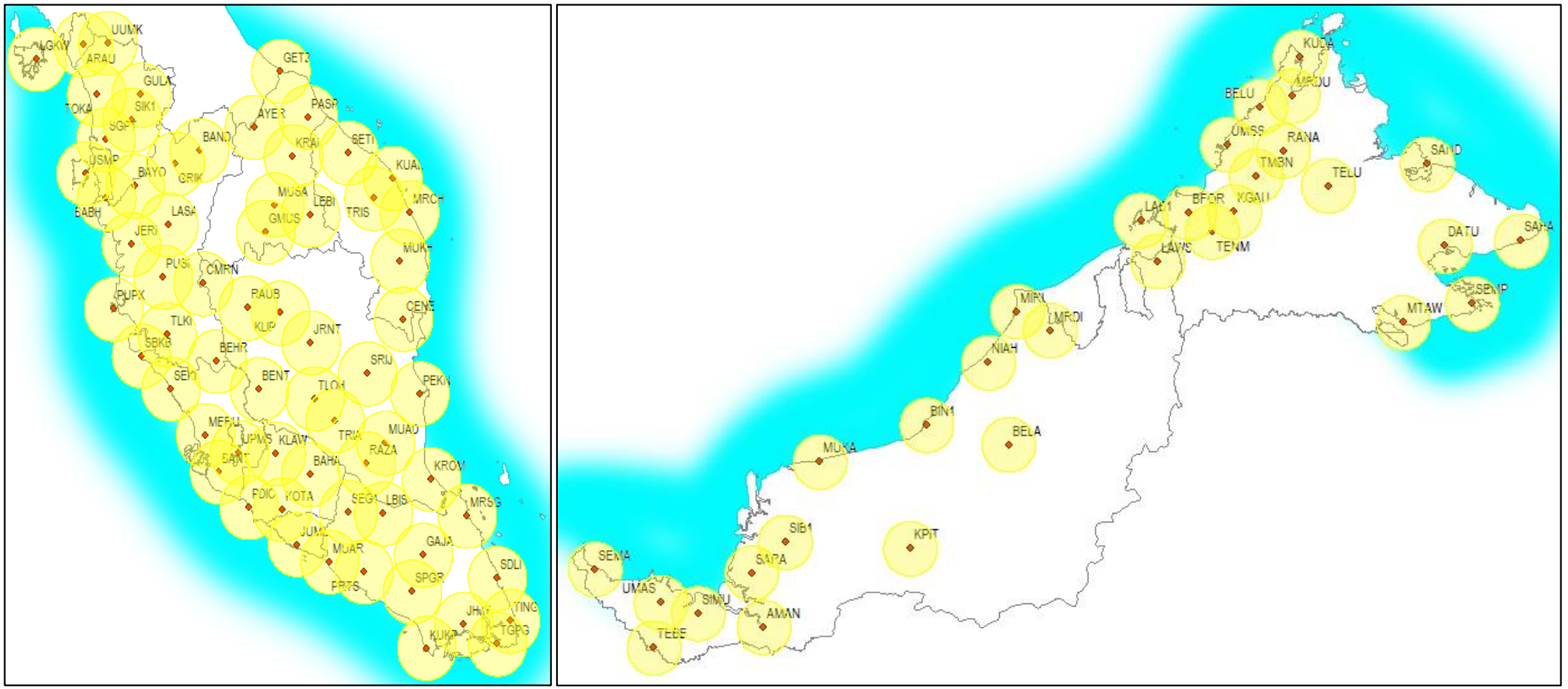

Figure 3: MyRTKnet Coverage

2.4. MyRTKnet SERVICES

MyRTKnet system provides various levels of GNSS correction and data. Their use will depend on the technique and application to be employed by the users. Data types such as MAX, i-MAX, Virtual Reference Station (VRS), Single Base, Nearest Base and Network Base D-GNSS are meant for real-time applications, whereas Virtual RINEX and CORS RINEX data are for post-processed applications.

2.4.1. Master Auxiliary (MAX)

(a) MAX is a new approach concerning the use and transmission of real-time network corrections. In the MAX Network RTK, the server sends full raw observations and coordinate information for a single reference station, known as the Master Station.

(b) In the MAX positioning, the coordinates and the biases of a single reference station (master station) are broadcasted to the rover in addition to the single differences (both corrections and coordinates) of the other stations in the network.

(c) For broadcast communication mediums, pre-defined cells, which may be created manually by the network operator, can be used to transmit master-auxiliary corrections, known as MAX, to the rovers. The rover user can connect to the correction service that is most relevant to their geographic location. Depending on the size of the network, multiple cells can be defined to optimise the transmission of data by reducing the number of stations that are contained in the correction messages.

2.4.2. Individualised MAX (i-MAX)

(a) In order to support the earlier model of rover receivers that are not able to interpret RTCM 3.x Network RTK messages, the system is able to produce individualised master-auxiliary corrections, known as i-MAX. These i-MAX corrections require two-way communications and may be transmitted in RTCM 2.3 and RTCM 3.0 formats. Unlike

other approaches, i-MAX uses a real reference station as the source for the network corrections, so there is consistency and traceability for the corrections received by the rover.

(b) Derivation of RTCM 2.3 Network Messages for the master station and offset messages for each Auxiliary Station are broadcasted or transmitted to the rover.

2.4.3. Virtual Reference Station (VRS)

(a) VRS is an integrated system that links and utilises data from permanent reference stations to model errors throughout the coverage area. This model is used to synthesise VRS near the user's location, which then provides a localised set of standard format correction messages to the roving receiver.

(b) To enable the modelling, the rover must provide its approximate position to the control centre. This is done via cellular modem using the standard NMEA GGA string. The control centre automatically receives this positioning information, interpolates and applies corrections for ephemeris, tropospheric and ionospheric errors and generates the VRS for that individual rover.

(c) It then produces a set of standard format correction messages as if they were coming from the VRS and transmits them via cellular modem back to the rover.

2.4.4. Single Base

This correction is provided for areas within 30 km from any of the MyRTKnet single permanent reference stations. The user is able to select the reference station required through an internet connection, and the corresponding differential data will be transmitted from the control centre to the rover.

2.4.5. Nearest Base

The concept of Nearest Base correction is quite similar to the Single Base service. However, for Nearest Base correction, the server will automatically select the nearest reference station to be the base station based on the location of the rover. The corresponding differential data will also be transmitted from the control centre to the rover.

2.4.6. Differential GNSS (D-GNSS)

This correction is provided for the whole of Peninsular Malaysia, Sabah, Sarawak and Labuan. This could be utilised in applications such as sub-meter mapping and navigation. Any receiver capable of handling Real-Time Corrections and cell phone data service can be used to receive D-GNSS solutions' Real-Time RTCM corrections. Distance dependant errors are eliminated for users' observations due to D-GNSS's array of base station locations.

2.4.7. Virtual RINEX Data

(a) Virtual RINEX data are GNSS RINEX format data generated by the MyRTKnet system based on approximate coordinates provided by users. These data are the VRS data that will be used as a reference by users for baseline computation.

(b) Within the larger limits of the MyRTKnet coverage, it provides data for post-processing of static survey sessions, enhancing the positions by order of one (1) cm limit. The data is available via JUPEM's password-protected internet website.

(c) The data can be downloaded at any interval ranging from one (1) second to sixty (60) seconds specified on JUPEM's website.

2.4.8. RINEX Data

The observed permanent reference station data in RINEX format are available for downloading through the website. These data can be obtained at any interval ranging from one (1) second to sixty (60) seconds for static or kinematic post-processing applications.

3. APPLICATIONS

3.1. MyRTKnet is well-suited to a wide variety of positioning applications which include:

(a) Geodesy

(b) Mapping and GIS

(c) Surveying including cadastral survey

(d) Marine

(e) Navigation

(f) Airborne applications

(g) Deformation monitoring

(h) Atmospheric study

(i) Scientific and geodynamic studies

3.2. Applications in land surveying are listed in **Table 2**, whereby amongst others, the suitability of rapid and real-time GNSS methods for such applications has been assessed. As would be evident from the list, the Network RTK method is, in practically all cases, advantageously applicable.

Table 2: Suitability of Positioning Methods

Application	Static & Rapid Static	Stop & Go Kinematic	Real-Time RTK	Network RTK (MyRTKnet)
Geodetic Control	♦	⊕	∅	∅
Network Densification	♦	⊕	♦	♦
Cadastral surveys	♦	⊕	♦	♦
Topographic surveys	♦	⊕	♦	♦
Large scale mapping	♦	⊕	♦	♦
Building surveys	∅	∅	♦	♦
Setting-out	∅	∅	♦	♦
♦ = well suited	**⊕ = partly suitable**		**∅ = unsuitable**	

4. ACCURACY

4.1. The design accuracy, as in **Table 3,** outlines the minimum performance anticipated from MyRTKnet real-time services. For higher accuracies, users may opt for the post-processing approach by obtaining the MyRTKnet data files (in Receiver Independent Exchange or RINEX format), which are stored and managed separately by Control Centre.

Table 3: Design Accuracy

Real-Time Services (Mountpoints)	Design Real-Time Accuracy@ 95% Confidence Level (single-point positioning mode)	
	Horizontal	Vertical
MAX	3.0 cm	6.0 cm
i-MAX	3.0 cm	6.0 cm
VRS	3.0 cm	6.0 cm
Single Base	3.0 cm	6.0 cm
Nearest Base	3.0 cm	6.0 cm
Network D-GNSS	30 cm	60 cm

4.2. It is apparent from the table that centimetre level accuracy would be achievable where RTK services are available. Additionally, such a level of accuracy could also be achieved within 30 km of MyRTKnet reference stations (Single Base). Overall performance will depend on uninterrupted data communication and GNSS system characteristics, including data transmission latency, atmospheric conditions, satellite geometry, baseline length, multipath effects and user instrumentation.

4.3. Subscribers may adopt several field procedures to improve the accuracy, including static occupation and careful planning for optimum satellite geometry.

4.4. Data latency is the time taken for the user to send his approximate position to the GNSS Spider Server and receive back correction in order to initialise positioning.

5. STANDARD PROCEDURES AND GUIDELINES

5.1. HARDWARE AND SOFTWARE FOR REAL-TIME OBSERVATION

5.1.1. In order to receive MyRTKnet corrections, users need to have a GNSS rover system, which is the GNSS receiver (Rover).

5.1.2. The hardware and software requirements to enable the use of various services of MyRTKnet are listed in **Table 4**.

Table 4: Hardware Requirements

Item	Services	Requirements
GNSS Receiver (Rover)	MAX, i-MAX & VRS	Dual-frequency with firmware and capable of receiving RTK corrections data and capable of accepting RTCM 2.3 or RTCM 3.0
	Single Base, Nearest Base & D-GNSS	Dual-frequency with firmware and capable of receiving RTK corrections data
	Virtual & CORS RINEX Data	Single or dual-frequency GNSS carrier phase receiver
Controller	All RTK Services	Enable NTRIP software and cellular network / internet connection (WiFi, GSM or 3G, 4G,5G)

Item	Services	Requirements
	CORS & Virtual RINEX Data	Not required

5.2. SOFTWARE FOR POST-PROCESSING

The software should be compatible with most of the GNSS manufacturers data formats, including different types of raw data or universal RINEX format and able to import Virtual or CORS RINEX data from the MyRTKnet system for post-processing. The software should be able to compute high-accuracy geodetic results, enabling seamless data post-processing among different brands of GNSS receivers using the following surveying modes: static, rapid static, kinematic, semi-kinematic, and so on for single and dual-frequency receivers. Virtual or CORS RINEX data can be downloaded from the MyRTKnet website **https://www.myrtknet.gov.my/sbc**.

5.3. EQUIPMENT CALIBRATION

5.3.1. The GNSS calibration tests that are needed to be conducted for the GNSS survey have been provided in the Director General of Survey and Mapping Circulars No. 6/1999 and 1/2008. The list of requirements to be fulfilled in performing the tests needed for using GNSS equipment in conjunction with MyRTKnet are as follows:

(a) Thse test shall be performed before any GNSS survey project using the services of MyRTKnet is carried out.

(b) The test can be carried out at JUPEM's GNSS / EDM Test Base or Primary GPS Network stations within the MyRTKnet coverage.

(c) The test shall be carried out by connecting any mobile receiver to a data cell phone and data collector (as recommended by the GNSS manufacturer).

(d) Cut-off angle of fifteen degrees (15°) should be applied.

5.3.2. Standard procedures for testing rover GNSS systems are as listed in **Table 5**.

Table 5: Procedures for the Testing of Rover GNSS System

Services	Requirement
MAX, i-MAX, VRS	• RTK mode with observation interval of five (5) seconds for 10 epochs of five (5) times initialisations. • Track at least five (5) satellites with a GDOP of less than six (6). • Observations have to be carried out on at least six (6) pillars. • Maximum allowable discrepancy: 30 mm in horizontal component and 60 mm in vertical component.
Single & Nearest Base	
D-GNSS	• RTK mode with observation interval of five (5) seconds for 10 epochs of five (5) times initialisation. • Track at least four (4) satellites with a GDOP of less than six (6). • Observations have to be carried out on at least 6 pillars. • Maximum allowable discrepancy: 50 cm in horizontal component and 1 m in vertical component.
Static	• Static mode with observation interval of at least fifteen (15) minutes for five (5) set of initialisations. • Track at least four (4) satellites with a GDOP of less than six (6). • Observations have to be carried out on at least six (6) pillars. • Maximum allowable discrepancy: 30 mm in horizontal component and 60 mm in vertical component.

5.4. DATA ACQUISITION

Guidelines for data acquisition using Network RTK such as MyRTKnet are listed in **Table 6**.

Table 6: Guidelines for Data Acquisition Using MyRTKnet

Item	MAX, i-MAX & VRS	Single & Nearest Base	D-GNSS
Network Coverage	Within dense network or maximum 3 km outside the dense network.	Within a 30 km radius of the nearest base reference station	Whole Malaysia
Observation Sessions	RTK mode with 10 observation epochs of five (5) seconds.	RTK mode with 10 observation epochs of five (5) seconds.	RTK mode with 10 observation epochs of five (5) seconds.
Satellite Geometry	Min. 5 satellites in view for the entire session.	Min. 5 satellites in view for the entire session.	Min. 4 satellites in view for the entire session.
Sky Coverage	At least 90% with telescopic antenna poles of up to 10 m being allowed.	At least 90% with telescopic antenna poles of up to 10 m being allowed.	At least 90% with telescopic antenna poles of up to 10 m being allowed.

6. REGISTRATION AND SUBSCRIPTION

6.1. All users will have to register with the MyRTKnet system in order to subscribe to the products and services of MyRTKnet. To subscribe as an authorised user, one can register at JUPEM eBiz under the Services Menu using the link **https://ebiz.jupem.gov.my**. However, a new user needs to register as a JUPEM eBiz user and become a Premier User before the registration with the MyRTKnet system.

6.2. Upon completion of the payment and confirmation, the user will receive a Username and Temporary Password via email to access the services. The registration and other related fees are based on *Perintah Fi dan Bayaran (Perkhidmatan, Data Ukur dan Pemetaan Serta Reproduksi)* 2010 as follows:

(a) Registration Fee - RM 1,000 for 12 months (1 year)

Users are able to enjoy all services in the MyRTKnet system: MAX, iMAX, VRS data, Single Base, Nearest Base data and Network Base D-GNSS data (real-time), as well as Virtual RINEX and CORS RINEX data (post-processed).

(b) Post-Process Data:

- Virtual RINEX Data - RM 1.00 per minute per one station
- CORS RINEX Data - RM 2.00 an hour per one station

7. DATA AVAILABILITY

MyRTKnet system allows the storage of RINEX and Virtual RINEX data in the database for the period of three (3) months from the current date, after which it shall be archived for future use.

8. EXCLUSION OF LIABILITY

JUPEM has endeavoured to ensure that MyRTKnet GNSS data made available to the public are free from errors and omissions. However, JUPEM does not warrant that the supplied data are free from errors or omissions. JUPEM shall not be in any way liable for any director indirect loss, damage or injury suffered by the use of such data.

9. CONDITIONS FOR DATA USE

The data is the sole property of the Director General of Survey and Mapping. They are supplied to registered users and are non-transferable.The data must not be sold, given away, traded, let, hired or otherwise dealt with. Users are permitted to use the data in demonstrations and displays, provided a statement acknowledging supply by JUPEM is displayed with the data or any derived product.

GLOSSARY

Ambiguity

The unknown integer number of cycles of the reconstructed carrier phase contained in an unbroken set of measurements from a single satellite passes at a single receiver.

Baseline

The length of the three-dimensional (3D) vector between a pair of stations for which simultaneous GNSS data has been collected and processed with differential techniques.

Carrier Frequency

Radio frequency that describes a smooth periodic signal at a given frequency.

Cut-off Angle

The minimum elevation angle below which no more GNSS satellites are tracked by the sensor.

D-GNSS

Differential GNSS. The term commonly used for a GNSS system that utilises differential code corrections to achieve an enhanced positioning accuracy of around 0.5 - 5.0 metre.

Ephemeris

A list of positions or locations of a celestial object as a function of time.

Epoch

A particular fixed instant of time used as a reference point on a time scare.

GDOP

Geometric dilution of precision.

Ionospheric Delay

A wave propagation through the ionosphere (which is a non-homogeneous and dispersive medium) experiences delay. Phase delay depends on electron content and affects carrier signals. Group delay depends on dispersion in the ionosphere as well, and affects signal modulation (codes). The phase and group delay are of the same magnitude but opposite sign.

Multipath error

A positioning error resulting from interference between radio waves which have travelled between the transmitter and the receiver by two paths of different electrical lengths.

NMEA

National Marine Electronics Association. Defined a standard (NMEA 0183) to enable marine electronics instruments, communication and navigation equipment to communicate. This standard is used to get time and position data out of GNSS instruments in many applications.

Post Processing

The process of computing positions in non-real-time, using data previously collected by GNSS receivers.

Rapid Static Survey

Term used in connection with the GNSS system for static survey with short observation times. This type of survey is made possible by the fast ambiguity resolution approach.

RINEX

Receiver INdependent Exchange format. A set of standard definitions and formats to promote the free exchange of GNSS data.

RTCM

Radio Technical Commission for Maritime services. Commission set up to define a differential data link to relay GNSS messages from a monitor station to a field user.

RTK

Real Time Kinematic. A term used to describe the procedure of resolving the phase ambiguity at the GNSS receiver so that the need for post-processing is removed.

Static Survey

The expression static survey is used in connection with GNSS for all non- kinematic survey applications. This includes the following operation modes:

- Static Survey
- Rapid Static Survey

Stop & Go Survey

The term of Stop & Go survey is used in connection with GNSS for a special kind of kinematic survey. After initialisation (determination of ambiguities) on the first site, the roving receiver has to be moved between the other sites without losing lock to the satellite signal. Only a few epochs are then necessary on the sites to get a solution with survey accuracy. Once loss of lock occurs, a new initialisation has to be done.

Topography

The form of the land of a particular region.