MCMC SRSP- 544 BWA
14 March 2007

Standard Radio System Plan

REQUIREMENTS FOR BROADBAND WIRELESS ACCESS (BWA) SYSTEMS OPERATING IN THE FREQUENCY BAND FROM 1790 MHz to 1800 MHz

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1.0 GLOSSARY

1.1 The terms used in this document may be found in the document SRSP Glossary which can be downloaded from MCMC website. (http://www.mcmc.gov.my/what_we_do/spectrum/srsp.asp)

REQUIREMENTS FOR BROADBAND WIRELESS ACCESS (BWA) SYSTEMS OPERATING IN THE FREQUENCY BAND FROM 1790 MHz to 1800 MHz

2.0 INTENT

2.1 This Standard Radio System Plan (SRSP) states the requirements for the utilization of the frequency bands 1790 MHz to 1800 MHz for Broadband Wireless Access (BWA) systems in Malaysia.

2.2 BWA systems are two-way point-to-multipoint radio systems consisting of BWA distribution hub stations and their associated subscriber fixed or mobile stations (or BWA access devices).

2.3 The intended services of BWA are to provide last mile fixed and mobile connectivity to subscribers within the coverage areas of the hub stations. The services that may be offered ranges from basic voice to broadband multimedia and high-speed data.

2.4 In general, this SRSP is designed to provide information on the minimum requirements in the use of the frequency band as described in the Spectrum Plan (see **Appendix A**). It provides information on technical characteristics of radio systems, frequency channelling, coordination initiatives in order to maximise the utilisation, minimise interference and optimise the usage of the band. It is intended to regulate the usage of spectrum and does not attempt to establish any detail equipment standards.

3.0 GENERAL

3.1 Technical characteristics of equipment used in this system shall conform to any applicable Malaysian standards, international standards, International Telecommunications Union (ITU) and its radio regulations as agreed and as adopted by Malaysia.

3.2 All BWA installations must comply with safety rules as defined by applicable standards.

3.3 The equipment used shall be certified under the Communications and Multimedia (Technical Standards) Regulations 2000.

3.4 The band 1790 MHz to 1800 MHz is located between the existing GSM 1800 base station transmit and receive frequency duplex gap of 1785 MHz and 1805 MHz. The gap is provided after considering the available duplex filter technologies in system and mobile terminals.

3.5 The allocation and allotment of these frequency bands and this SRSP are subject to review from time to time for more efficient utilisation and management of spectrum, or for the improvement of the services offered by such systems.

3.6 The following provides an overview of the BWA technologies likely to be introduced in this band.

3.6.1 iBurst

iBurst is a wide-area broadband access system promoted by Kyocera Japan. It utilizes smart adaptive antenna technology to maximise BTS range and capacity. It operates in a 5 MHz bandwidth in TDD mode and each 5 MHz band supports eight radio frequencies carrier with 625 kHz separation as illustrated in exhibit 2 to support 1Mbps Downlink subscriber connections.

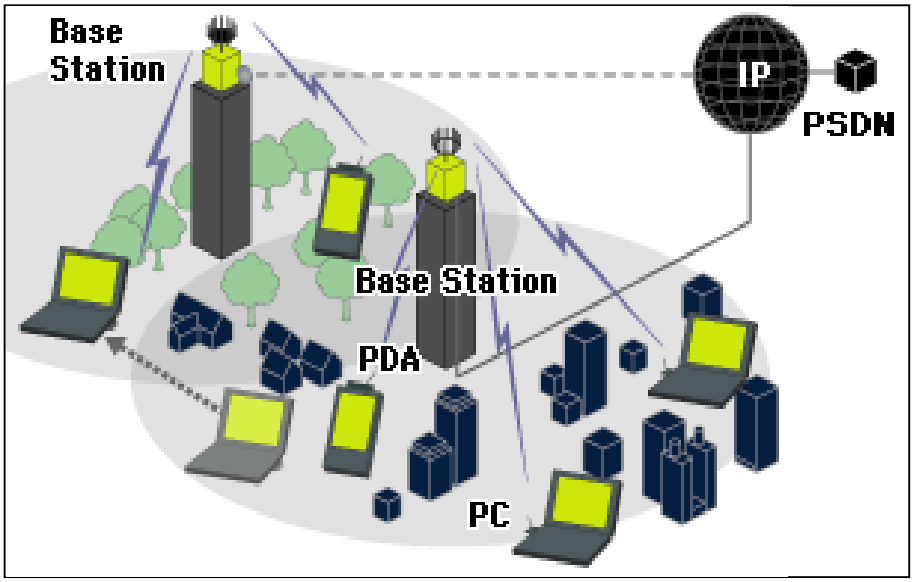


Exhibit 1: iBurst wide-area broadband access system (Source: Kyocera)

It uses the HC-SDMA (High Capacity Spatial Division Multiple Access) system which adopts the frequency, time division and spatial division multiplexing techniques to maximise available base station time slots. The available user timeslots are shown in exhibit 2 and are calculated as follows i.e. (8 Carriers x 3 Timeslot − 1 BCH Timeslot) X 3 Spatial Channels = 69 Timeslots.

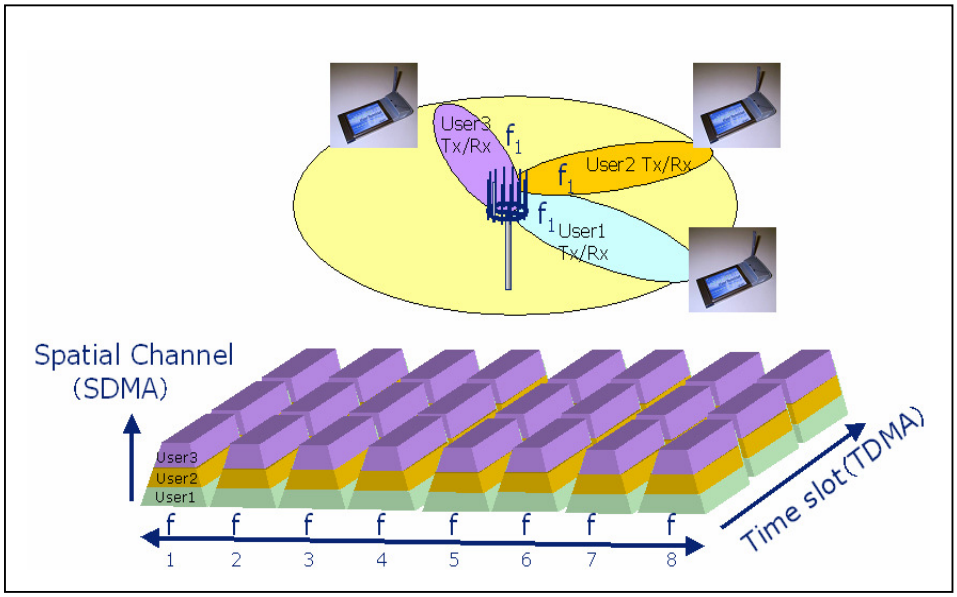


Exhibit 2: HC-SDMA (High Capacity Spatial Division Multiple Access) system (Source: Kyocera)

3.6.2 Others

Another possible candidate technology to use the band is the UMTS Terrestrial Radio Access Time Division Duplex (or UTRA TDD) and Beijing Xinwei Telecom's Synchronous Coded Division Multiple Access Wireless Local Loop system (or TDD-SCDMA).

3.7 It is to be noted that the band is not limited to the implementation of the above technologies and with rapid advancement in access technologies, new emerging systems may be developed that may provide better efficiency in spectrum usage such as new air interfaces for new advance systems. It is the intent of this SRSP to facilitate the introduction of such technologies for the benefit of the industry.

4.0 CHANNELLING PLAN

4.1 The SRSP defines a frequency band 1790 MHz to 1800 MHz providing a total bandwidth of 10 MHz for the BWA systems.

4.2 The BWA system operating in the frequency bands uses a simplex/TDD frequency plan. The 1790 MHz to 1800 MHz band is divided into two sub blocks of 5 MHz bandwidth each. The first sub-block is 1790MHz to 1795MHz and the second sub-block is 1795MHz to 1800MHz.

4.3 As noted in paragraph 3.4, the BWA frequency band sits in between the duplex gap of the GSM1800 system. A minimum of 5 MHz guard band (i.e. 1785MHz to 1790 MHz and 1800 MHz to 1805 MHz) on both sides of the BWA band are reserved to protect the existing GSM1800 system. However,

this criteria alone is not adequate to mitigate interference and that BWA systems in the bands must further observe both the Base Station (BTS) and User Terminal (UT) spectrum edge masks to prevent interference to GSM1800 systems.

4.4 The BWA service provider may adjust the operational parameters to optimise the use of the band subject to operations within the block edge spectrum masks as specified in this document.

4.5 The proposed frequency band plan has been designed to maximise the utilisation, minimise interference and optimise the usage of the band.

5.0 REQUIREMENTS FOR USAGE OF SPECTRUM

5.1 This SRSP covers the minimum key characteristics considered necessary in order to make the best use of the available frequencies.

5.2 In some cases, a radio system conforming to the requirements of this SRSP may require modifications if interference is caused to other radio stations or systems.

5.3 This use of the frequency bands for BWA is limited to only direct radio connection between a hub station and subscribers in a point-to-point or point-to-multipoint configuration. Due to the spectrum mask for the BWA UT, it should be noted that operations in the second sub-block 1795MHz to 1800MHz will need to ensure that the UT is adequately separated from a GSM mobile terminal such that the unwanted emission level received at any GSM1800 terminal in near the UT is below -126dBm/100kHz. It is envisaged that due to the potential interference and that the separation of the UT and GSM1800 subscriber terminals cannot be mitigated in a practical way, the second sub-block shall not be used for subscriber access but may be used for BTS back-hauling or BTS-BTS mesh linking or other purposes subject to clearance of technical analysis.

5.4 The BWA service provider shall used digital technologies that promote spectral efficiency. Capacity enhancing digital techniques are developing rapidly and such techniques that promote efficient use of spectrum, without reducing quality of service are encouraged.

5.5 It is noted that there is potential of interference created by the introduction of BWA in this band. However, cases of potential interference between existing GSM 1800 systems and the new BWA system could be mitigated and managed with coordinated site planning, installation, appropriate guard bands and operations within the specified masks to avoid/reduce interference.

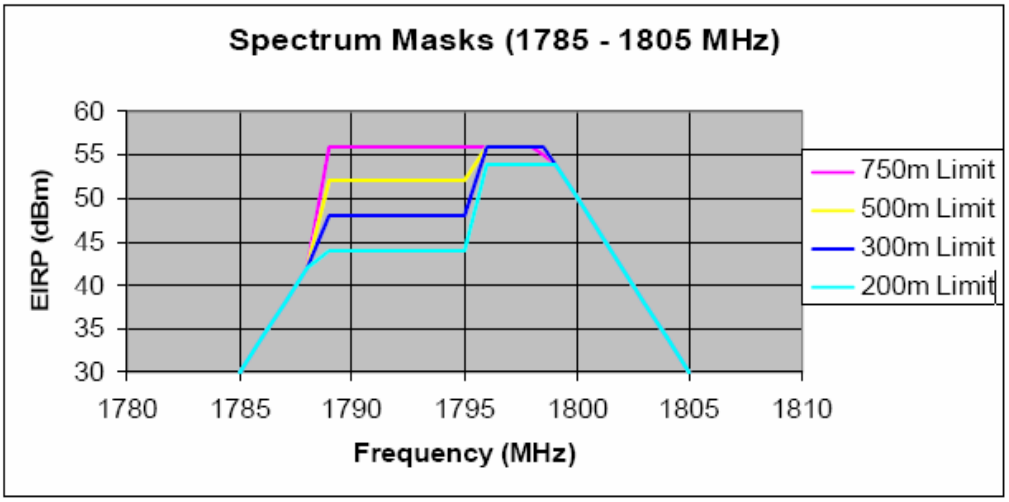
5.6 It should further be noted that the introduction of the BWA in this band is allowed to operate without causing any interferences to all existing (see paragraph 8.3) assigned stations. Its coexistence in particular with the existing GSM1800, and the mitigation of interference may require adopting a number of engineering solutions based on industry best practise guidelines and recommendations described in this document. The operating recommendations as stated below are to be fully observed and complied by the BWA system at all time, unless subsequently modified and updated in this document:

5.6.1 The OFCOM industry consultation document on 'Award of available spectrum: 1785 – 1805 MHz, Annex C', recommends adherence to the specifications of a Block Edge Mask must be complied (see exhibit 3 for BWA BTS and exhibit 4 for BWA UT);

5.6.2 Outside the spectrum band (1785 MHz to 1805 MHz) the unwanted emissions level = -126 dBm/100 kHz;

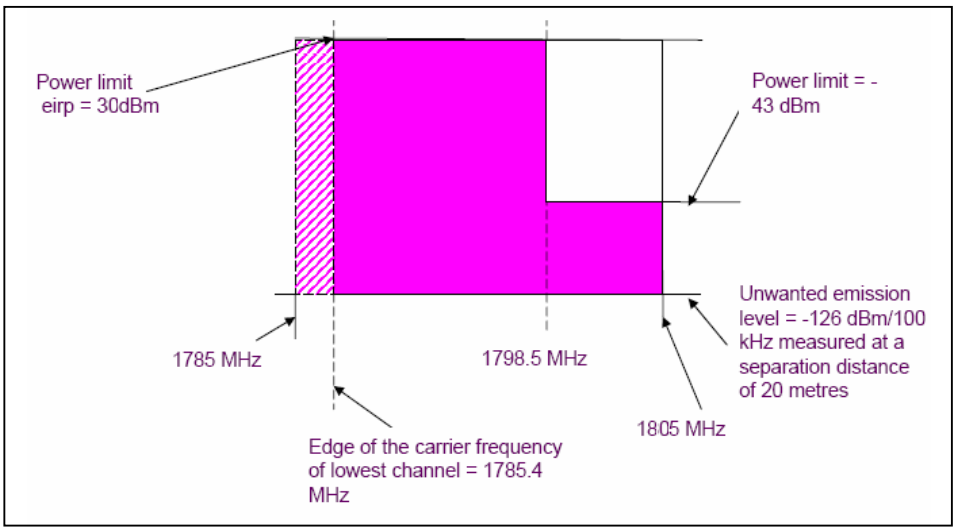
5.6.3 The BWA UT shall meet the power limit as in exhibit 4;

Exhibit 3: BWA Transmit (Base station) Spectrum Mask



Note: Outside the Spectrum Band (1785 – 1805 MHz) the unwanted emission level = -126 dBm/100 kHz measured at a separation distance of 20m [Source: OFCOM]

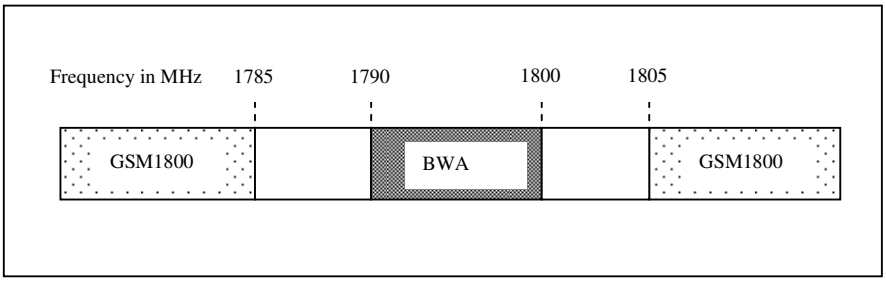
Exhibit 4: BWA Access Device (User terminal [UT]) Spectrum Mask
[Source OFCOM]



5.6.4 BWA must use smart adaptive antenna array technology which performs beam forming targeted at user terminals (UTs) within the BWA base stations (BS) service area, to achieve power efficiency and minimising interference to other systems; and

5.6.5 A minimum 5 MHz guard at either end of the allocated BWA spectrum are reserved for protection of existing GSM1800 cellular mobile services from interference by the BWA system. This minimum guard is depicted in exhibit 5 below.

Exhibit 5: Band Plan in the 1800 MHz



5.6.6 BWA service provider must observe base station (BTS) location/placement guidelines during the network design and planning stages. The guidelines include but are not limited to the combination of the following measures:-

5.6.6.1 horizontal distance discrimination between GSM1800 and BWA BTS;
5.6.6.2 avoiding direct BTS antenna face-to-face arrangement;

5.6.6.3 incorporating BWA BTS antenna tilt;
5.6.6.4 reducing BWA BTS transmitting power; and/or
5.6.6.5 if necessary to reduce the occupied bandwidth (or number of frequency carriers in multicarrier systems) used in the service.

It is envisaged that the above measures may assist to reduce potential interference to existing GSM1800 networks in addition to other measures specified in this document.

5.6.7 When interference to an operational GSM1800 BTS occurs, it may be necessary to deploy external filters in the BWA BTS to reduced to an acceptable level its effected on existing assigned GSM 1800 BTS.

5.6.7.1 A suitable transmit band pass filter is to be installed in all interfering BWA BTSs (current evaluation suggests that an additional 80db rejection at band ≤1785MHz and ≥1805MHz may be an effective solution).

5.6.8 The total maximum composite effective isotropic radiated power (eirp) of the BWA BTS shall not exceed +56dBm in both sub-blocks. Such composite power is calculated as follows:-

[23dbm + 10 log (number of antenna element, usually 12 elements) + 10 log (number of carriers = 8) + Antenna Gain (dBi)]

5.6.9 No BWA BTS shall be installed at less that **250 meters** radius from an existing GSM 1800 BTS when the composite power limit (+44dBm eirp) is in compliance to the spectrum edge mask in Exhibit 3 for operations in the first frequency sub-block. At other power limits as well as the other frequency sub-block, the appropriate distances and limitations as indicated in this paragraph must be observed. The distance requirement may be reduced to a minimum of 200 meters [Note: Interference begins to occur at 200m from one iBurst transmitter (Paragraph 9.5); 200m is thus the minimum distance allowed] with additional measures taken as specified in paragraph 5.6.6. Details Results of the Joint MCMC-Mobif-Celcos Interference and Co-existence testing between iBurst and GSM 1800 systems as in Appendix E.

5.6.10 In-building BWA system solutions and Common Antennae System with GSM1800 are not allowed.

5.7 It is to be noted that the mandatory minimum quality of service (QoS) imposed on public cellular service calls for a service design with a minimum signal strength of -95 dBm at a minimum Carrier to Interference (C/I) ratio of 18 dB (for EDGE). BWA service provider must at all time ensure that their system introduction in a GSM1800 coverage area does not introduce additional interference or noise that will degrade the above mentioned parameters.

5.8 BWA and GSM1800 service providers or other affected parties will be required to participate in the coordination process so that the BWA BTS may be fully coordinated before it is put into service. The coordination process as provided in Appendix B shall be implemented to ensure coordination is completed before the apparatus assignment is issued by the Commission to the BWA service provider. The Commission may further require the affected parties to coordinate directly where necessary to ensure effectiveness of the coordination process.

5.9 It is also to be noted that the GSM 1800 service providers may from time to time reengineer their existing network and may re-locate existing BTSs. Any reengineering exercise of existing GSM1800 BTS sites nearby the existing BWA base station, the BWA system operator shall at their cost make adjustments to their system to ensure no interference to the GSM 1800 system. Re-engineering includes adjustment to antenna height, tilt, or orientation, new antenna characteristics, re-location within 50m of existing site (Note: more than 50m, it is considered as a new site), cell splitting, parameter settings and frequency re-tuning.

5.10 For new GSM1800 BTS sites after the effective date of the SRSP (see paragraph 7), GSM1800 service providers will need to consider the presence of a BWA BTS site when applying for their AA. They are encouraged to use the same approach to avoid interference to their BTS.

5.11 When potential interference between assigned radio systems cannot be resolved by the parties concerned, the parties shall inform the Commission, and after consultation with the parties concerned, the Commission will decide the necessary modifications and schedule of modifications to resolve the interference.

5.12 The Commission will require applicants and/or licensees to cooperate in the selection and use of the assigned frequencies in order to minimize interference, thereby obtaining the most effective use of the authorized spectrum.

5.13 When interference from the BWA systems to any existing assigned stations or systems is detected, the BWA system operator shall at their cost resolve the interference within 24 hours. If the interference is not resolved within 24 hours, the BWA system operator shall cease transmissions immediately at the said interfering BWA BTS until a suitable solution can be found.

5.14 The frequency bands 1790 MHz to 1800 MHz is also used by neighbouring countries for other services. It shall be noted that close co-ordination with these countries will be necessary to prevent any frequency interference in the border areas. Thus usage of the bands within 15 kilometres of the Malaysian border area may be subject to the provision of sharing arrangement with the neighbouring countries.

5.15 The band 1710 to 1880 MHz is one of the frequency bands identified at the WRC 2000 for IMT-2000. It is to be noted that by **23 December 2013**, parts of the band 1710 to 1880 MHz may be used to implement IMT systems.

6.0 PRINCIPLES OF ASSIGNMENT

6.1 Authorisation to use the BWA spectrum for the base station apparatus is by way of Apparatus Assignment (AA) and BWA access device is by way of Class Assignment (CA). Please refer to www.mcmc.gov.my for the conditions of use in the Notification of Issuance of Class Assignment for the BWA access device.

6.2 The paragraphs below contain the eligibility, information and documents to be submitted for the AA application.

6.2.1 The eligibility criteria for the service provider is that the applicant must be a holder of a valid Network Facilities Provider Individual (NFP(I)) licence that provides radiocommunication transmitters and links.

6.2.2 The applicant shall:

6.2.2.1 submit a Detailed Business Plan including details of the roll out plan acceptable by the Commission;

6.2.2.2 upon the approval of the Detailed Business Plan by the Commission, submit application for an AA in accordance with the geographic areas specified in the Detailed Business Plan; and

6.2.2.3 prior to the issuance of the AA, provide to the Commission an Irrevocable Bank Guarantee to guarantee performance and compliance with the conditions of the AA and the Detailed Business Plan, payable on demand, either in part or in full, for the amount of RM2,500,000 per 5MHz block of bandwidth (Ringgit Malaysia Two Million and Five Hundred Thousand only) from a licensed financial institution in Malaysia in the form and substance agreed by the Commission, which shall be valid for the period of the AA.

6.2.3 The application for an AA shall be based on the committed roll out plan as specified in the Detailed Business Plan. For spectrum which are not utilised or under utilised or not covered by the roll out plan, the Commission may allow other NFP(I) licensees to apply for an AA.

6.2.4 AA issued to successful applicant shall be subject to further additional conditions specified in Appendix C.

6.3 The AA for these bands shall be valid for a period of five years or such lesser period as specified in the AA. AA holders may re-apply for a new assignment at least 60 days before the expiry date.

6.4 Issuance of an AA is also subject to successful co-ordination among assigned stations and with neighbouring countries where it applies.

7.0 IMPLEMENTATION PLAN

7.1 This SRSP shall be effective on the date of issuance of this document.

8.0 CO-ORDINATION REQUIREMENTS

8.1 Use of these frequency bands shall require co-ordination with the neighbouring countries within the following coordination zones of 15 kilometres from the Malaysian border with our neighbouring countries. Note that the above co-ordination distance is continuously being reviewed with administrations of our neighbouring countries.

8.2 The Commission will use the coordination process as mentioned in **Appendix B** to ensure that BWA BTS are coordinated before AA are issued. In particular, it is important that GSM1800 service providers confirm and ensure that the GSM1800 BTS AA that they have obtained from the Commission has accurate and updated information on the location coordinates. Information on the location of all GSM1800 BTS is available in the Commission website for the reference of the BWA applicant to refer in their survey and submission of application.

8.3 Noting that the development of new GSM 1800 BTS sites are an ongoing process such as annual capacity enhancement sites and the new T1 and T2 sites, as well as to ensure that such BTS sites which has already been planned and those currently under development are taken into consideration in the coordination process. Such sites will be considered as falling under the category of existing sites for the purpose of coordination. GSM1800 BTS sites planned after 2007 will be considered as new and need to take into consideration existing assigned BWA BTS.

8.4 In the event of any interference, the Commission will require affected users to carry out an operator-to-operator coordination. In the event that the interference remained unresolved after 24 hours by the operators, the affected parties may escalate the matter to the Commission for a resolution. The Commission will decide the necessary modifications and schedule of modifications to resolve the interference.

8.5 Noting paragraph 8.3 above, if deemed necessary, a Technical Planning Coordination Committee (TPCC) formed among service providers of GSM1800 and BWA may be set up to facilitate smooth development of BTS sites of both parties. The terms of reference or working arrangements will be drawn up by the TPCC.

9.0 REFERENCES

9.1 Spectrum Plan Issue November 2006 Edition.

9.2 The Joint Consultative Document of the Office of Communications United Kingdom (OFCOM) and Commission for Communications Regulation (ComReg) on the 'Award of available spectrum: 1785 – 1805 MHz' Annex C, technical information on Interference.

9.3 Digital cellular telecommunications system (Phase 2+); Radio Transmission and Reception (3GPP TS 05.05 version 8.20.0 Release 1999)

9.4 Spectrum mask iBurst BTS, UTC, UTU and UTD (See appendix D)

9.5 Results of the Joint MCMC-Mobif-Celcos Interference and Co-existence testing between iBurst and GSM 1800 systems, Jan 15, 2007 (See appendix E)

9.6 Recommendation ITU-R M.1036-2 – Frequency arrangements for implementation of Terrestrial IMT-2000 in the bands 806-960MHz, 1710-2025MHz, 2110-2200MHz and 2500-2690MHz

9.7 ACMA: Strategies for Wireless Access Services: 1785-1805 MHz – Discussion paper on proposals for Regional and Remote Broadband Wireless Access Services in the Band 1785-1805MHz

9.8 ACMA: Rational for proposed 1785-1805 MHz BWA Technical Framework

Issued by:

Malaysian Communications and Multimedia Commission
14 March 2007

APPENDIX A

Extract from Spectrum Plan

Frequency Band (MHz)	ITU Allocation			Malaysian Allocation
	Region 1	Region 2	Region 3	
1710 - 1930	**FIXED** **MOBILE** 5.380 5.384A 5.388A 5.149 5.341 5.385 5.386 5.387 5.388			**FIXED** **MOBILE** 5.380 5.384A 5.388A 5.149 5.341 5.385 5.388 MLA3 MLA44 MLA52 MLA53

Footnotes:

MLA3 Notification of Issuance of Class Assignments

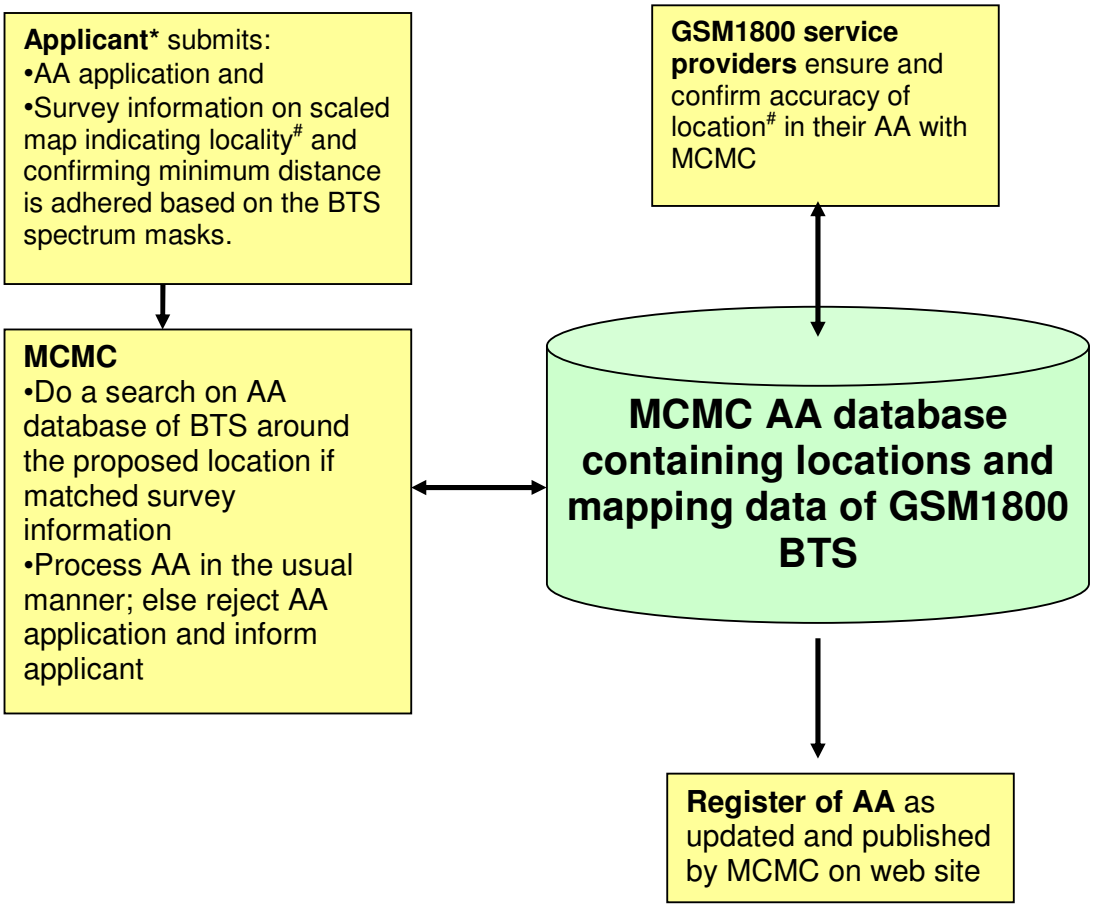
MLA 44 Frequency Spectrum 806 MHz to 960 MHz, 1710 MHz to 1885 MHz, 2504 MHz to 2688 MHz planned for IMT 2000 extension band

MLA52 Standard Radio System Plan: Requirements for Mobile Services Operating in the Frequency Bands 1710 MHz to 1785 MHz and 1805 MHz to 1880 MHz

MLA53 Standard Radio System Plan: Requirements for International Mobile Telecommunications-2000 (IMT-2000) Services Operating in the Frequency Bands 1885 MHz to 2025 MHz and 2110 MHz to 2200 MHz

APPENDIX B

Coordination Process for BWA-GSM1800 BTS



*** Note**: Applicant – means a **BWA applicant** up to end 2007. After 2007, it means either **BWA or GSM1800 applicant**.

 # Note: Coordinates in database should be use with care and prudence by the BWA in planning and submission for AA and must be supplemented with actual site verification. It should be noted that a 1 second error in location coordinate may result in a location error of 30m whereas a 1 minute error, 1.8km.

APPENDIX C

Conditions of AA

The issuance of the AA in the frequency band 1790MHz to 1800MHz shall be subject to the following conditions:

(a) that the AA issued shall be cancelled upon the cancellation of the Network Facility Provider Individual Licence of the AA holder;

(b) that the AA issued shall be suspended upon the suspension of the Network Facility Provider Individual Licence of the AA holder;

(c) that AA holder shall comply with the Detailed Business Plan submitted to the Commission *in toto* unless modified with the approval of the Commission;

(d) that there shall be no change in the shareholding of Network Facility Provider Individual Licence holder for a period of five years from the date of issuance of the first AA to the licensee;

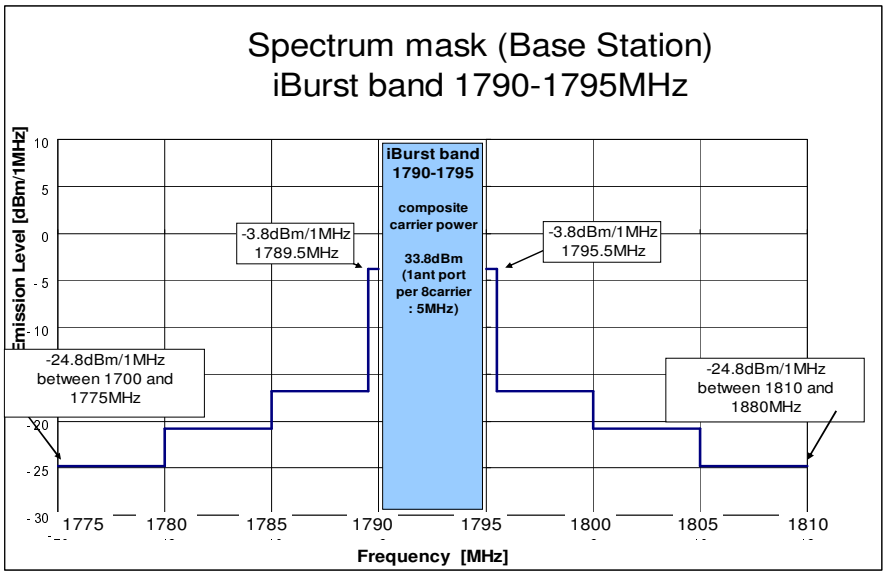
(e) that Network Facility Provider Individual Licence holder shall submit a half yearly report to the Commission outlining the steps taken to implement the Detailed Business Plan. The report shall be submitted to the Commission not later than 31 July and 31 January of each year for reporting period from January to June and from July to December respectively.

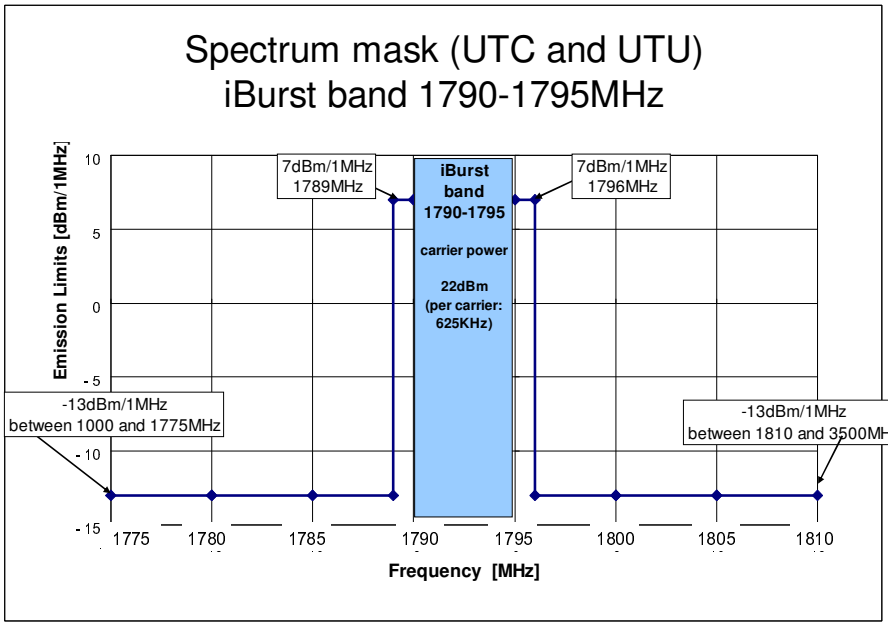
(f) that the performance bond submitted to the Commission be valid for the period on the AA.

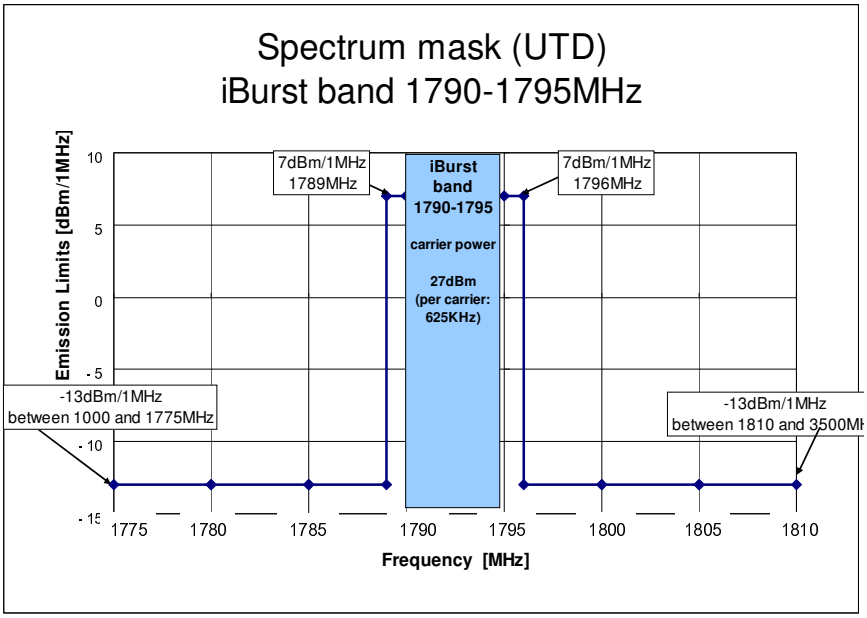
(g) that the Commission is entitled to call on the guarantee provided pursuant to paragraph 6.2.2.3 of the **MCMC SRSP 544 BWA** by the AA holder in the event of non-compliance of the terms and conditions of the AA. The right of the Commission to call on the guarantee is without prejudice to its right to take relevant action against the AA holder under the Act and subsidiary legislation made under it

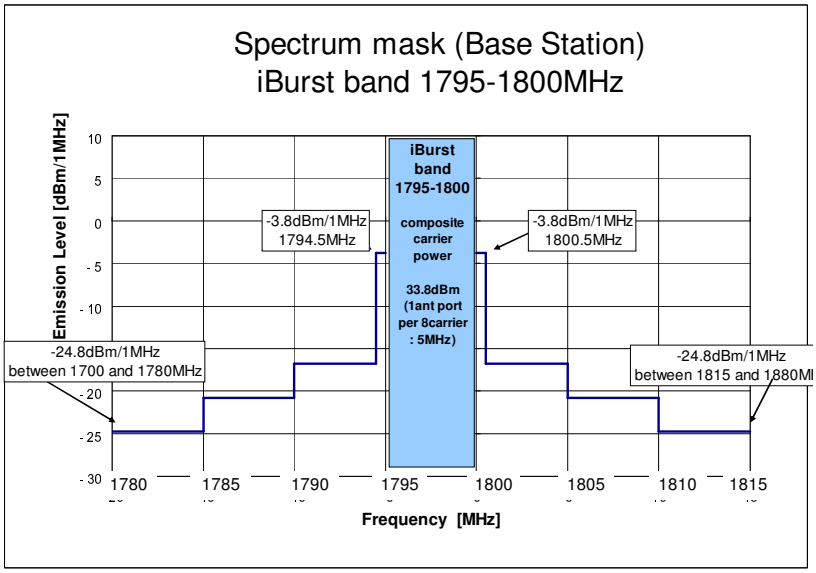
APPENDIX D

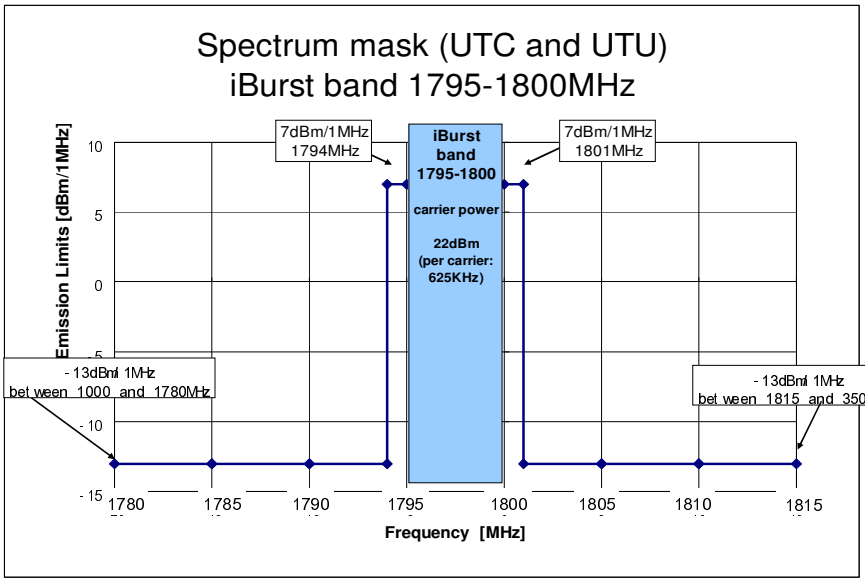
Set of iBurst spectrum masks [Source Kyocera]

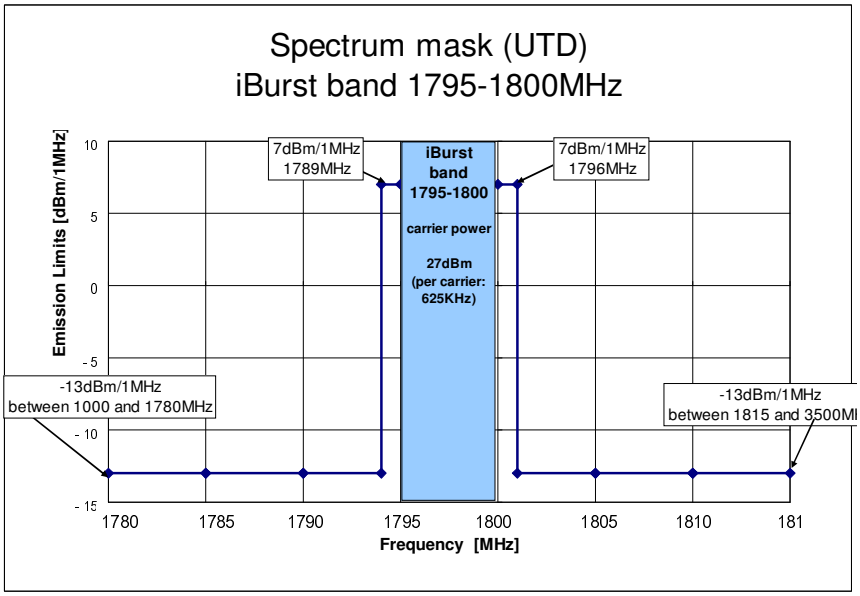





Spectrum mask (UTD)
iBurst band 1790-1795MHz
Emission Limits [dBm/1MHz]
10
5
0
- 5
- 10
- 15
7dBm/1MHz
1789MHz
7dBm/1MHz
1796MHz
iBurst
band
1790-1795
carrier power
27dBm
(per carrier:
625KHz)
-13dBm/1MHz
between 1000 and 1775MHz
-13dBm/1MHz
between 1810 and 3500MH
1775
1780
1785
1790
1795
1800
1805
1810
Frequency [MHz]


Spectrum mask (Base Station)
iBurst band 1795-1800MHz
Emission Level [dBm/1MHz]
10
5
0
- 5
- 10
- 20
- 25
- 30
-3.8dBm/1MHz
1794.5MHz
iBurst
band
1795-1800
composite
carrier
power
33.8dBm
(1ant port
per 8carrier
: 5MHz)
-3.8dBm/1MHz
1800.5MHz
-24.8dBm/1MHz
between 1700 and 1780MHz
-24.8dBm/1MHz
between 1815 and 1880MI
1780
1785
1790
1795
1800
1805
1810
1815
Frequency [MHz]


Spectrum mask (UTC and UTU)
iBurst band 1795-1800MHz
Emission Limits [dBm/1MHz]
10
5
0
-10
-15
7dBm/1MHz
1794MHz
7dBm/1MHz
1801MHz
iBurst
band
1795-1800
carrier power
22dBm
(per carrier:
625KHz)
- 13dBm/ 1MHz
bet ween 1000 and 1780MHz
- 13dBm/ 1MHz
bet ween 1815 and 350
1780
1785
1790
1795
1800
1805
1810
1815
Frequency [MHz]


Spectrum mask (UTD)
iBurst band 1795-1800MHz
Emission Limits [dBm/1MHz]
10
5
0
-5
-10
-15
7dBm/1MHz
1789MHz
7dBm/1MHz
1796MHz
iBurst
band
1795-1800
carrier power
27dBm
(per carrier:
625KHz)
-13dBm/1MHz
between 1000 and 1780MHz
-13dBm/1MHz
between 1815 and 3500MI
1780
1785
1790
1795
1800
1805
1810
181
Frequency [MHz]

APPENDIX E

Title: Results of the Joint MCMC-Mobif-Celcos Interference and Co-existence testing between iBurst and GSM 1800 systems	
Date: 06 February 2007 Revision No.:03 Start date: Jan 15 2007	Contributors: Celcom-DiGi-Maxis-Mobif-MCMC Owner: Malaysian Communications and Multimedia Commission (MCMC) Department: Spectrum Planning Management

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Rakuram Gandhi	Maxis Communications Bhd
Cham Yin Gee	Digi Telecommunications Sdn Bhd
Ameer Suresan bin Abdullah	Digi Telecommunications Sdn Bhd
Moriani Mohamed	Digi Telecommunications Sdn Bhd
Mike Townshend	Digi Telecommunications Sdn Bhd
Kevin Khoo Jenn Mang	Digi Telecommunications Sdn Bhd
Toh Swee Hoe	Malaysian Communications and Multimedia Commission
Tuan Hj. Najib Ismail	Malaysian Communications and Multimedia Commission
Syed Khairulazrin	Malaysian Communications and Multimedia Commission
Zul Rushdi	Malaysian Communications and Multimedia Commission
Abdul Mubin Mohd Zain	Malaysian Communications and Multimedia Commission
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Yoshitsugu Hirata	Kyocera
Takashi Tsuji	Kyocera
Yoichiro Fujitsuka	Kyocera

Abstract:
This report is on the results taken from tests conducted between the GSM Mobile Basestation, iBurst Basestation, Customer Premises Equipment (UTU, UTD, UTC) and Mobile Station.

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1.0 Preamble

A request to the existing GSM operators and Mobif to co-operate for a test trial to simulate the conditions of co-existence of GSM technology and iBurst technology will be carried out soonest possible as agreed in the meetings between the celcos, Mobif and MCMC.

The trial will include test cases to comply the draft SRSP version 3 drafted by the existing GSM operators as agreed by the existing GSM operators, Mobif and MCMC.

This version has incorporated all comments from all parties including MCMC, celcos and Mobif. This version will be adopted as the final version of trial cases document to be used for the trial.

The key objectives for the test are to gauge the impact of the interference on GSM voice quality and data modulation scheme, based on the scenarios stated below:-

a. MoBif BS impact to GSM BTS
b. MoBif CPE impact to GSM BTS/Inbuilding
c. MoBif BS impact to MS
d. MoBif CPE impact to GSM MS

The joint testing was conducted at DiGi's office Lot 30, Celcom's office Lot20 and Subang Hi-Tech area from 15-Jan-07 to 24-Jan-07 (8 days).

The report is based on the result and findings of the test cases. The raw data captured on TEMS, BTS and iBurst shall be kept for a duration of maximum 1 year.

2.0 Test Setup

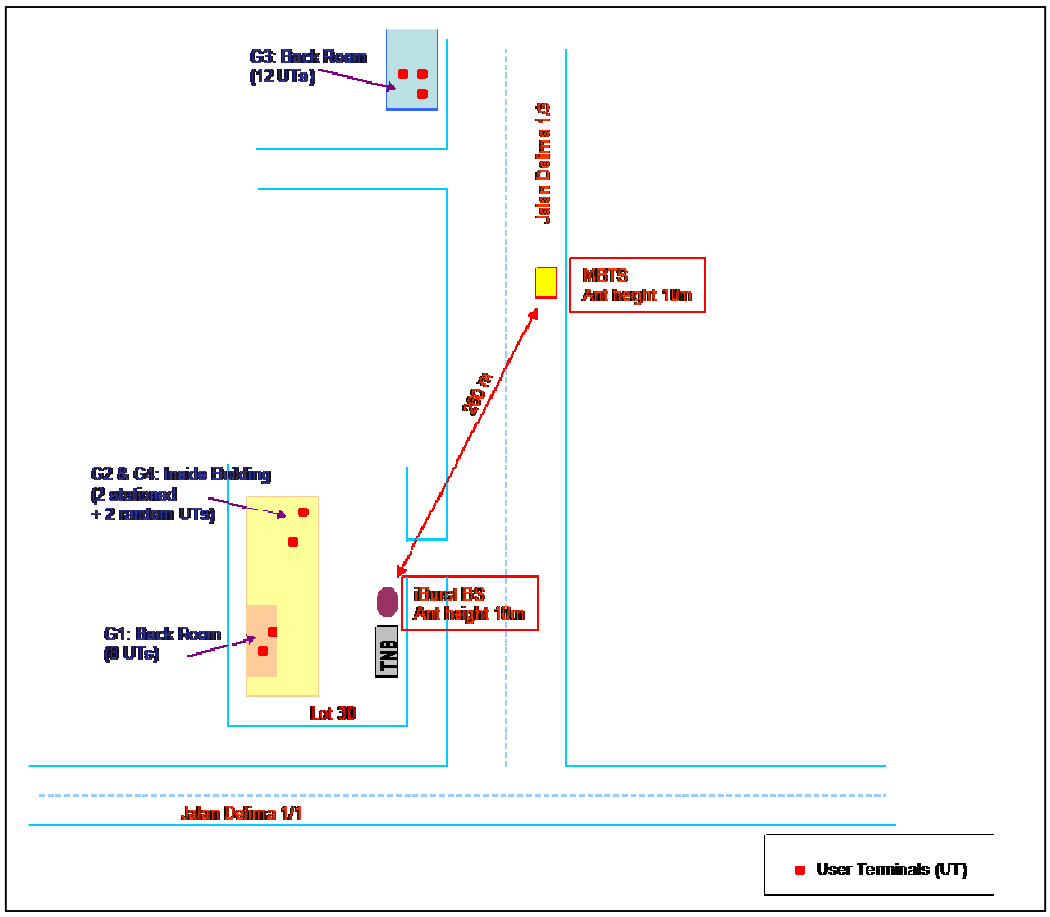

Diagram 1: Map locations and setup

3.0 Test Measurement

3.1 iBurst EiRP Measurement

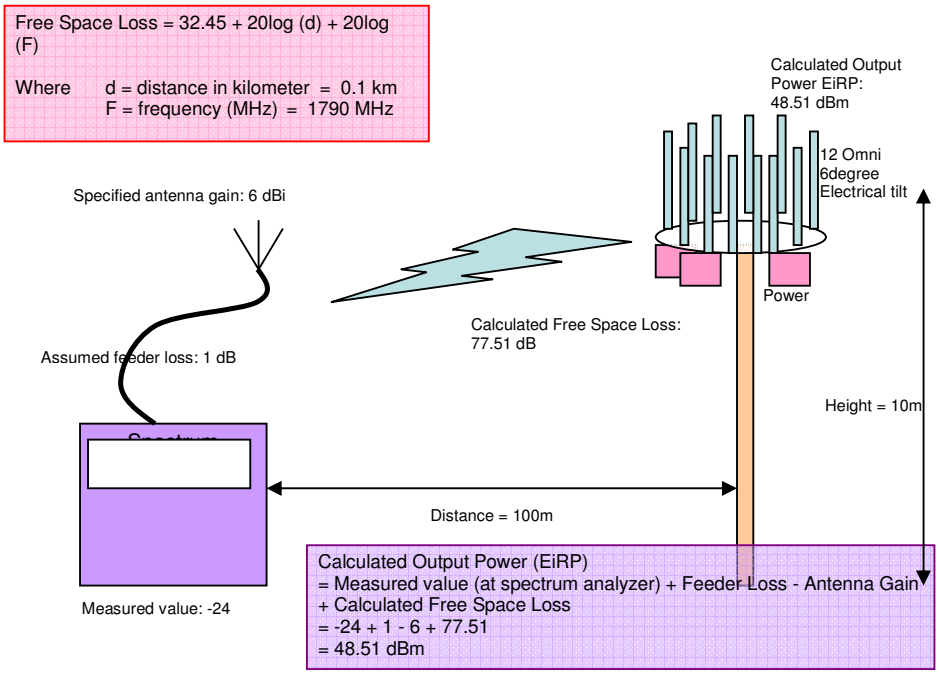

Diagram 2: EiRP measurement

Methodology of iBurst EiRP measurement:

1) The BS antennas were located at 10m above ground.
2) The spectrum analyzer is placed at a distance of 100m away along Jalan Delima 1/3 from the iBurst antenna. Using received antenna of 6 dBi and feeder loss of 1 dB.
3) The iBurst BS is cease of TCH transmission. Only broadcast channel (BCH) is transmitting at channel 1 (of the band 1790 to 1795 MHz)
4) Feeder cable loss from the Power Amplifier (PA) to the antenna port is about 1 dB.

Result:

The measured value using spectrum analyzer of -24 dBm off air.

Calculated output power (EiRP) = 48.51 dBm

3.2 iBurst Port Measurement

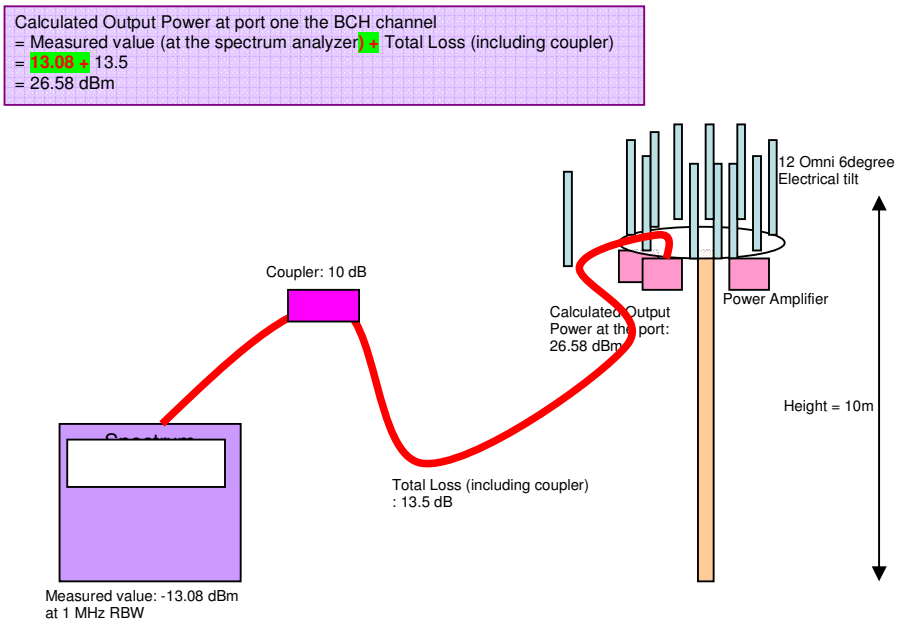

Diagram 3: Port Measurement

Methodology of iBurst Port measurement:

1) The BS antenna is located at 10m above ground.
2) One of the 12 iBurst BS omni antenna is removed from the port. The measurement will be taken from the PA (power amplifier) connected to the spectrum analyzer.
3) The spectrum analyzer is connected to a 10dB coupler before connecting to the PA.
4) The iBurst BS is cease of TCH transmission. Only broadcast channel (BCH) is transmitting at channel 1 (of the band 1790 to 1795 MHz)
5) Measurement is taken and recorded.
6) Then the feeder and the coupler loss are measured using the spectrum analyzer. Measurement is recorded.

Result:

The measured value using spectrum analyzer of **13.08 dBm**.

The output power per port is 26.58 dBm.

3.3 Calculation of output power

Calculation per channel (625 kHz) on BCH

= Measured output power from port (as indicated in the diagram 3 above) + 10 Log (number of antenna) + antenna gain

= 26.58 + 10log (12) + 11

= 26.58 + 10.8 + 11

= 48.38 dBm

Calculation per 5 MHz carrier

= Measured output power from port (as indicated in the diagram 3 above) + 10 Log (number of antenna) + 10 Log (number of channel) + antenna gain

= 26.58 + 10log (12) + 10log (8) + 11

= 26.58 + 10.8 + 9.03 + 11

= 57.40 dBm

4.0 TEST 1: PART 1 METHODOLOGY (BS – BTS)

(1) GSM MBTS were placed 260m away from MoBif BS.
(2) The MBTS antennas height were 9.5m (cell 11661) and 8.5m (cell 11662).
(3) MoBif servers were pre-prepared with multiple files of 600MBYTE for 24 simultaneous downloading.
(4) 8 CPEs were placed inside the room of Lot 30.
(5) 2 CPEs were placed inside the Lot 30 building.
(6) 12 CPEs were placed inside Celcom building at Lot 20.
(7) 2 CPEs were placed randomly outdoor and indoor.
(8) GSM BTS (2 sectors) were tuned to frequency 1879.4 and 1879.8 MHz
(9) MoBif BS were tuned to frequency 1790 to 1795 MHz @ 23 dBm/channel/port with 69 TS/channel with automatic BS and MS power control. The BCH channel was set to channel number 1 (first channel).
(10) Both MoBif BS and GSM BTS were in services.
(11) All CPEs continuously download 600MBYTE files simultaneously.
(12) Testing continuous for 3 hours in the morning and 3 hours in the afternoon.
(13) The Idle Channel Measurement statistics were collected as the final results.

4.1 Result

Test 1: Part 1

11661

Hour	(% of readings without iBurst ON – in dBm)	(% of readings with iBurst ON – in dBm)
	-109	-109

Table 1: Idle measurement on cell 11661 for Test 1: Part 1

11662

Hour	(% of readings without iBurst ON – in dBm)	(% of readings with iBurst ON – in dBm)
	-109	-109

Table 2: Idle measurement on cell 11662 for Test 1: Part 1

4.2 Comments

The observation is that there is no change in the readings based on the resolution of the idle measurement. The resolution referred to is that of band 1, which is from -110 to -108dBm.

5.0 TEST 1: PART 2 METHODOLOGY (BS – BTS)

(1) GSM MBTS were placed 260m away from MoBif BS.
(2) The MBTS antennas height were 9.5m (cell 11661) and 8.5m (cell 11662).
(3) MoBif servers were pre-prepared with multiple files of 600MBYTE for 24 simultaneous downloading.
(4) 24 CPEs were placed inside Celcom building at Lot 20.
(5) GSM BTS (2 sectors) were tuned to frequency 1879.4 and 1879.8 MHz
(6) MoBif BS were tuned to frequency 1790 to 1795 MHz @ 23 dBm/channel/port with 69 TS/channel with automatic BS and MS power control. The BCH channel was set to channel number 1 (first channel).
(7) Both MoBif BS and GSM BTS were in services.
(8) All CPEs continuously download 600MBYTE files simultaneously.
(9) Testing continuous for 3 hours in the morning and 3 hours in the afternoon.
(10) The Idle Channel Measurement statistics were collected as the final results.

5.1 Result

Test 1: Part 2

11661

Hour	(% of readings without iBurst ON – in dBm)	(% of readings with iBurst ON – in dBm)
	-109	-109

Table 3: Idle measurement on cell 11661 for Test 1: Part 2

11662

Hour	(% of readings without iBurst ON – in dBm)	(% of readings with iBurst ON – in dBm)
	-109	-109

Table 4: Idle measurement on cell 11662 for Test 1: Part 2

Kyocera result

Downlink Frame error rate (FER) measurement

Celcom building (data from 1 UTU)

Mod Class	detect	data OK	Error rate
0	19.995	189480	1%
1	2928	2884	2%
2	529	505	5%
3	39	2	95%
4	17	0	100%
5	6	0	100%
6	13	0	100%
7	16	0	100%
8	14	0	100%

Celcom building (data from 1 UTC)

Mod Class	detect	data OK	Error rate
0	71807	67651	6%
1	19220	18554	3%
2	35163	34654	1%
3	1828	1764	4%
4	103	71	31%
5	22	0	100%
6	24	0	100%
7	26	0	100%
8	202	0	100%

Table 5: Downlink FER measurement at Celcom building for Test 1 Part 2

Uplink Frame Error Rate Measurement

			FER			
UTID		Place	Number of Frame	Number of No Error Frame	Number of Error	FER
1264386400039	UTU	G3	2200	2197	3	0.14%
1264386400014	UTU	G3	2340	2270	70	2.99%
1264386400034	UTU	G3	2400	2392	8	0.33%
1264404220486	UTD	G3	1981	1586	395	19.94%
1264386400043	UTU	G3	2000	1978	22	1.10%
1264386000007	UTC	G3	2000	1995	5	0.25%
1264404220488	UTD	G3	1962	1508	454	23.14%
1264386000022	UTC	G3	2800	2795	5	0.18%
1264386400033	UTC	G3	1986	1981	5	0.25%
1264386400032	UTU	G3	2400	2377	23	0.96%
1264386400025	UTU	G3	2000	1993	7	0.35%
1264386400042	UTC	G3	2000	1987	13	0.65%
1264386400023	UTU	G3	2000	1993	7	0.35%
1264386400037	UTU	G3	2000	1988	12	0.60%
1264386400020	UTU	G3	2200	2189	11	0.50%
1264386400006	UTU	G3	2000	1986	14	0.70%
1264386400012	UTU	G3	2200	2193	7	0.32%
1264386000021	UTC	G3	2200	2188	12	0.55%
1264386000020	UTC	G3	2360	2351	9	0.38%
1264386400035	UTU	G3	2200	2187	13	0.59%
1264386400036	UTU	G3	2200	2186	14	0.64%
1264386400038	UTU	G3	2000	1999	1	0.05%
1264386400030	UTU	G3	2400	2391	9	0.38%
0	0	0	0	0	0	0

Table 6: Uplink FER measurement at Celcom building for Test 1 Part 2

Note: Place identified as G1 is the location inside the back room at DiGi's office at Lot 30, G2 are located inside DiGi's office at Lot 30, G3 are located at Celcom's office at Lot 20, and G4 are located outdoor/indoor of DiGi's office at Lot 30.

5.2 Comments

The observation is that there is no change in the readings based on the resolution of the idle measurement. The resolution referred to is that of band 1, which is from -110 to -108dBm.

iBurst CPE performance is within normal operating limits. It should be noted that 2 units of CPE UTD devices having higher FER which is not attributed to interference but could be due to minor fault.

6.0 Test 2 Methodology (CPE – BTS)

1. GSM MBTS were placed 260m away from MoBif BS.
2. The MBTS antennas height were 9.5m (cell 11661) and 8.5m (cell 11662).
3. A micro GSM BTS were placed inside the room of Lot 30.
4. MoBif servers and CPE/UT were pre-prepared with multiple files of 600MBYTE for 24 simultaneous either downloading or uploading.
5. 8 CPEs were placed inside the room of Lot 30.
6. 2 CPEs were placed inside the Lot 30 building.
7. 12 CPEs were placed inside Celcom building at Lot 20.
8. 2 CPEs were placed randomly outdoor.
9. GSM BTS (2 sectors) were tuned to frequency 1879.4 and 1879.8 MHz
10. MoBif BS were tuned to frequency 1790 to 1795 MHz @ 23 dBm/channel with 69 TS/channel with automatic BS and MS power control. The BCH channel was set to channel number 1 (first channel).
11. Both MoBif BS and GSM BTS were in services.
12. All CPEs continuously upload 600MBYTE files simultaneously.
13. Testing continuous for 3 hours in the morning and 3 hours in the afternoon.
14. The Idle Channel Measurement statistics were collected as the final results.

6.1 Result

28386

Hour	(% of readings without iBurst ON – in dBm)	(% of readings with iBurst ON – in dBm)
	-109	-109

Table 7: Idle measurement for cell 28386 for Test 2

Kyocera result

Downlink Frame error rate (FER) measurement

Lot30 back room (data from 1 UTU)

Mod Class	detect	data OK	Error rate
0	2	0	100%
1	2	0	100%
2	2	0	100%
3	0	0	-
4	98	93	5%
5	875	864	1%
6	1390	1364	2%
7	26142	25866	1%
8	143521	141712	1%

Celcom building (data from 1 UTC)

Mod Class	detect	data OK	Error rate
0	5489	5431	1%
1	12845	12710	1%
2	126371	125871	0%
3	20576	20392	1%
4	1119	1103	1%
5	92	73	21%
6	22	10	55%
7	2	0	100%
8	9	0	100%

Lot 30 near BS (data from 1 UTU)

Mod Class	detect	data OK	Error rate
0	0	0	-
1	0	0	-
2	0	0	-
3	0	0	-
4	0	0	-
5	0	0	-
6	0	0	-
7	38	36	5%
8	43698	43494	0%

Table 8: Downlink FER measurement for Test 2

Uplink Frame Error Rate measurement

UTD		Place	FER			
			Number of Frame	Number of No Error Frame	Number of Error	FER
1264404220486	UTD	G1	2000	1990	10	0.50%
1264386400025	UTU	G1	1559	1479	80	5.13%
1264386400042	UTC	G1	2200	2144	56	2.55%
1264386400043	UTU	G1	2000	1982	18	0.90%
1264386000022	UTC	G1	2000	1989	11	0.55%
1264386400039	UTU	G3	2000	1978	22	1.10%
1264386400036	UTU	G1	2000	1974	26	1.30%
1264386400014	UTU	G3	2000	1982	18	0.90%
1264386400020	UTU	G3	2000	1984	16	0.80%
1264386400035	UTU	G3	2400	2341	59	2.46%
1264386400012	UTU	G3	2200	2152	48	2.18%
1264386400034	UTU	G1	2200	2159	41	1.86%
1264386400032	UTU	G3	2400	2389	11	0.46%
1264386400033	UTC	G3	2400	2390	10	0.42%
1264386400006	UTU	G1	2000	1996	4	0.20%
1264386000020	UTC	G3	2200	2192	8	0.36%
1264386400031	UTU	G3	2000	1962	38	1.90%
1264404220488	UTD	G3	2200	2159	41	1.86%
1264386400037	UTU	G3	2000	1997	3	0.15%
1264386400038	UTU	G2	2200	2183	17	0.77%
1264386400030	UTU	G2	2000	1995	5	0.25%
1264386000007	UTC	G4	2000	1998	2	0.10%
1264386400029	UTU	G3	2000	1996	4	0.20%
1264386000021	UTC	G4	2600	2577	23	0.88%

Table 9: Uplink FER measurement for Test 2

Note: Place identified as G1 is the location inside the back room at DiGi's office at Lot 30, G2 are located inside DiGi's office at Lot 30, G3 are located at Celcom's office at Lot 20, and G4 are located outdoor/indoor of DiGi's office at Lot 30.

6.2 Comments

The observation is that there is no change in the readings based on the resolution of the idle measurement. The resolution referred to is that of band 1, which is from -110 to -108dBm.

iBurst CPE performance is within normal operating limits. No interference observed in the CPE.

7.0 Test 3 Methodology (MS – BS)

1. GSM MBTS were placed 260m away from MoBif BS.
2. The MBTS antennas height were 9.5m (cell 11661) and 8.5m (cell 11662).
3. MoBif servers were pre-prepared with multiple files of 600MBYTE for 24 simultaneous downloading.
4. 8 CPEs were placed inside the room of Lot 30.
5. 2 CPEs were placed inside the Lot 30 building.
6. 12 CPEs were placed inside Celcom building at Lot 20.
7. 2 CPEs were placed randomly outdoor.
8. GSM BTS (2 sectors) were tuned to frequency 1805.2 and 1805.6 MHz
9. MoBif BS were tuned to frequency 1795 to 1800 MHz @ 23 dBm/channel with 69 TS/channel with automatic BS and MS power control. The BCH channel was set to channel number 8 (last channel).
10. Both MoBif BS and GSM BTS were in services.
11. All CPEs continuously download 600MBYTE files
12. 2 TEMS of which 1 for voice and another for data were setup.
13. The TEMS were stationed 10m away from MoBif BS.
14. The quality level of the TEMS were measured.

7.1 Result

Note: Both voice and data results were obtained using TEMS v5.

Table 10: TEMS Voice – SQI Distribution (%)

Test Case No.	Test Conducted	SQI Distribution (%)			Total
		0 to 4 (worse)	4 to 16	16 to 30 (best)	
Test No.3	10 Meter from Mobif BS - Session01	23	8	69	100
	10 Meter from Mobif BS - Session02	23	11	66	100
	References_BS_Off_Lot 30_DiGi	19	0	81	100

Table 11: TEMS Voice - RxLev Distribution (%)

Test Case No.	Test Conducted	RxLev sub (dBm) Distribution (%)						Total
		0 to -55	-55 to -65	-65 to -75	-75 to -85	-85 to -95	-95 to -110	
Test No.3	10 Meter from Mobif BS - Session01	0	0	3	53	43	4	100
	10 Meter from Mobif BS - Session02	0	0	1	58	39	3	100
	References_BS_Off_Lot 30_DiGi	0	0	5	69	28	3	100

Table 12: TEMS Voice – RxQual Distribution (%)

Test Case No.	Test Conducted	RxQual sub Distribution (%)			Total
		0 to 3 (best)	4 to 5	6 to 7 (worse)	
Test No.3	10 Meter from Mobif BS - Session01	62	18	20	100
	10 Meter from Mobif BS - Session02	56	22	22	100
	References_BS_Off_Lot 30_DiGi	89	5	6	100

Table 13: TEMS Data – RxLev Distribution (%)

Test Case No.	Test Conducted	Log files	RxLev sub (dBm) Distribution (%)						Total
			0 to -55	-55 to -65	-65 to -75	-75 to -85	-85 to -95	-95 to -110	
Test No.3	10 Meter from Mobif BS - Session01	data_0122_01.log	0	0	1	48	47	4	100
		data_0122_02.log							
	10 Meter from Mobif BS - Session02	data_0122_01.log	0	0	2	53	42	3	100
	References_BS_Off_Lot 30_DiGi	1910_data_0122_01.log	0	3	8	72	14	3	100

Table 14: TEMS Data – Coding Scheme DL (%)

Test Case No.	Test Conducted	Log files	Coding Scheme DL (%)				Total
			CS1	CS2	CS3	CS4	
Test No.3	10 Meter from Mobif BS - Session01	data_0122_01.log	12.39	24.25	16.86	46.5	100
		data_0122_02.log					
	10 Meter from Mobif BS - Session02	data_0122_01.log	7.36	11.06	15	66.58	100
	References_BS_Off_Lot 30_DiGi	1910_data_0122_01.log	0	6.68	3.02	90.3	100

Kyocera result

Downlink Frame error rate (FER) measurement

Lot30 back room (data from 1 UTU)

Mod Class		data OK	Error rate
0	0	0	-
1	0	0	-
2	0	0	-
3	8	6	25%
4	144	127	12%
5	956	893	7%
6	1597	1515	5%
7	27290	26989	1%
8	173828	173211	0%

Celcom building (data from 1 UTU)

Mod Class	detect	data OK	Error rate
0	5666	5497	3%
1	15597	15277	2%
2	140291	139391	1%
3	19192	19103	0%
4	576	551	4%
5	127	67	47%
6	137	27	80%
7	232	4	98%
8	426	0	100%

Lot 30 near BS (data from 1 UTU)

Mod Class	detect	data OK	Error rate
0	0	0	-
1	2	0	100%
2	0	0	-
3	0	0	-
4	4	2	50%
5	2	2	0%
6	26	26	0%
7	513	511	0%
8	207477	206292	1%

Table 15: Downlink FER measurement for Test 3

Uplink Frame Error Rate measurement

UTID		Place	FER			
			Number of Frame	Number of No Error Frame	Number of Error	FER
1264386400012	UTU	G3	2200	2155	45	2.05%
1264404220488	UTD	G3	2200	2170	30	1.36%
1264386400035	UTU	G3	2000	1979	21	1.05%
1264386400037	UTU	G3	2000	1982	18	0.90%
1264386400020	UTU	G3	2000	1987	13	0.65%
1264386400033	UTC	G3	2200	2182	18	0.82%
1264386400039	UTU	G3	2200	2174	26	1.18%
1264386400031	UTU	G3	2400	2379	21	0.88%
1264386400014	UTU	G3	2400	2356	44	1.83%
1264386400023	UTU	G3	2400	2374	26	1.08%
1264386000021	UTC	G4	2000	1983	17	0.85%
1264386000007	UTC	G4	2000	1982	18	0.90%
1264386000020	UTC	G3	2000	1976	24	1.20%
1264386400030	UTU	G2	2000	1952	48	2.40%
1264386400038	UTU	G2	2000	1969	31	1.55%
1264386400032	UTU	G3	2000	1962	38	1.90%
1264386400034	UTU	G1	2200	2166	34	1.55%
1264386400006	UTU	G1	1933	1909	54	2.75%
1264386400025	UTU	G1	2132	2174	8	0.37%
1264386400042	UTC	G1	2000	1960	40	2.00%
1264386000022	UTC	G1	1936	1955	41	2.05%
1264404220486	UTD	G1	2400	2272	128	5.33%
1264386400045	UTU	G1	2139	2174	25	1.14%
1264386400036	UTU	G1	2331	2294	67	0.028

Table 16: Downlink FER measurement for Test 3

Note: Place identified as G1 is the location inside the back room at DiGi's office at Lot 30, G2 are located inside DiGi's office at Lot 30, G3 are located at Celcom's office at Lot 20, and G4 are located outdoor/indoor of DiGi's office at Lot 30

7.2 Comments

It is observed that the voice RxQual and SQI have degraded based on Table 10 and Table 12 above.

Referring to Table 13, it is observed that there is a slight shift of the signal strength distribution but the values are still within the Time 2 requirement (-95 dBm minimum)

Referring to Table 14, it is observed that there is a slight shift downwards (from CS4 to CS1) of the data coding.

iBurst CPE performance is within normal operating limits. No interference observed in the CPE.

8.0 Test 4 Methodology (CPE - MS)

1. GSM MBTS were placed 260m away from MoBif BS.
2. The MBTS antennas height were 9.5m (cell 11661) and 8.5m (cell 11662).
3. A micro GSM BTS were placed inside the room of Lot 30.
4. MoBif servers and CPE/UT were pre-prepared with multiple files of 600MBYTE for 24 simultaneous either downloading or uploading.
5. 8 CPEs were placed inside the room of Lot 30.
6. 2 CPEs were placed inside the Lot 30 building.
7. 12 CPEs were placed inside Celcom building at Lot 22.
8. 2 CPEs were placed randomly outdoor or indoor.
9. GSM BTS (2 sectors) were tuned to frequency 1805.4 and 1805.8 MHz
10. MoBif BS were tuned to frequency 1795 to 1800 MHz @ 23 dBm/channel with 69 TS/channel with automatic BS and MS power control. The BCH channel was set to channel number 8 (last channel).
11. Both MoBif BS and GSM BTS were in services.
12. Minimum of 8 CPEs placed next to the MS (GSM) continuously upload 600MBYTE files
13. 2 TEMS of which 1 for voice and another for data were setup.
14. The TEMS were placed inside the room inside Lot 20 together with the CPEs.
15. The quality level of the TEMS is measured.

8.1 Result

Note: Voice results were obtained using TEMS v7 while data results were obtained using TEMS v5.

Table 17: TEMS Voice – SQI Distribution (%)

Test Case No.	Test Conducted	SQI Distribution (%)			Total
		0 to 4 (worse)	4 to 16	16 to 30 (best)	
Test No.4	Side by side	4.2	9.6	86.2	100
	3 Meter away from CPE	2.2	12	85.8	100
	References_BS_Off_Lot 20_Celcom	3	13.4	83.6	100

Table 18: TEMS Voice – RXLev Distribution (%)

Test Case No.	Test Conducted	RxLev sub (dBm) Distribution (%)		Total
		0 to -95	-95 to -110	
Test No.4	Side by side	97.7	2.3	100
	3 Meter away from CPE	95	5	100
	References_BS_Off_Lot 20_Celcom	95.3	4.7	100

Table 19: TEMS Voice – RxQual Distribution (%)

Test Case No.	Test Conducted	RxQual sub Distribution (%)			Total
		0 to 2 (best)	3 to 5	6 to 7 (worse)	
Test No.4	Side by side	66.4	21.2	12.6	100.2
	3 Meter away from CPE	65.4	20.5	14.1	100
	References_BS_Off_Lot 20_Celcom	77	10	13	100

Table 20: TEMS Data – RxLev Distribution (%)

Test Case No.	Test Conducted	Log files	RxLev sub (dBm) Distribution (%)						Total
			0 to -55	-55 to -65	-65 to -75	-75 to -85	-85 to -95	-95 to -110	
Test No.4	Side by side	1600_data_0122_01.log	0	0	9	25	57	9	100
		1635_data_0122_01.log							
	3 Meter away from CPE	1715_data_0122_01.log	0	0	2	1	57	40	100
		1750_data_0122_01.log							
	References_BS_Off_Lot 20_Celcom	1825_data_0122_01.log	0	3	8	10	55	24	100

Table 21: TEMS Data – Coding Scheme DL (%)

Test Case No.	Test Conducted	Log files	Coding Scheme DL (%)				Total
			CS1	CS2	CS3	CS4	
Test No.4	Side by side	1600_data_0122_01.log	22.07	21.74	36.26	19.93	100
		1635_data_0122_01.log					
	3 Meter away from CPE	1715_data_0122_01.log	6.63	18.05	27.61	47.71	100
		1750_data_0122_01.log					
	References_BS_Off_Lot 20_Celcom	1825_data_0122_01.log	4.84	12.18	25.82	57.16	100

Kyocera result

Downlink Frame error rate (FER) measurement

Celcom building 0.1 m from TEMS (data from 1 UTU)

Mod Class	detect	data OK	Error rate
0	150194	129824	14%
1	19951	16639	17%
2	9414	8344	11%
3	321	90	72%
4	255	23	91%
5	261	4	98%
6	173	0	.00%
7	195	0	.00%
8	240	0	.00%

Celcom building 3m from TEMS (data from 1 UTU)

Mod Class	detect	data OK	Error rate
0	103035	81354	21%
1	528	159	70%
2	1092	29	97%
3	712	0	.00%
4	457	0	.00%
5	140	0	.00%
6	188	0	.00%
7	127	0	.00%
8	1237	0	.00%

Table 22: Downlink FER measurement for Test 4

Note: CPEs moved away from TEMS. TEMS are stationary.

Uplink Frame Error Rate measurement

UTD		Place	FER			
			Number of Frame	Number of No Error Frame	Number of Error	FER
1264386400042	UTC	G1	2000	1979	21	1.05%
1264386400025	UTU	G1	2000	1922	78	3.90%
1264386400033	UTC	G3	2000	1986	14	0.70%
1264386000020	UTC	G3	2200	2172	28	1.27%
1264386400043	UTU	G1	2000	1964	36	1.80%
1264386400037	UTU	G3	1949	1946	3	0.15%
1264386400032	UTU	G3	2400	2375	25	1.04%
1264386400006	UTU	G1	2800	2695	105	3.75%
1264386000022	UTC	G1	3000	2950	50	1.67%
1264404220486	UTD	G1	2000	1948	52	2.60%
1264386000021	UTC	G4	2000	1979	21	1.05%
1264386400030	UTU	G2	2353	2336	17	0.72%
1264386400020	UTU	G3	2200	2187	13	0.59%
1264386400039	UTU	G3	2000	1995	5	0.25%
1264386400031	UTU	G3	2000	1989	11	0.55%
1264386400014	UTU	G3	2000	1976	24	1.20%
1264386400023	UTU	G3	2000	1991	9	0.45%
1264386400036	UTU	G1	2000	1995	5	0.25%
1264386000007	UTC	G4	2200	2187	13	0.59%
1264386400034	UTU	G1	2000	1960	40	2.00%
1264386400038	UTU	G2	2000	1998	2	0.10%
1264386400012	UTU	G3	2000	1992	8	0.40%
1264404220488	UTD	G3	2000	1993	7	0.35%
1264386400035	UTU	G3	2000	1905	95	0.048

Table 23: Uplink FER measurement for Test 4

Note: Place identified as G1 is the location inside the back room at DiGi's office at Lot 30, G2 are located inside DiGi's office at Lot 30, G3 are located at Celcom's office at Lot 20, and G4 are located outdoor/indoor of DiGi's office at Lot 30

8.2 Comments

Referring to Table 18, it is observed the values are still within the Time 2 requirement (-95 dBm minimum) before and after iBurst ON.

Referring to Table 21, it is observed that there is a shift downwards (from CS4 to CS1) of the data coding, especially in the case of “side by side” TEMS and CPEs.

Referring to Table 20, the discrepancies in the result could be due to multipath fading as well as measurement taken at different time/condition.

The iBurst signal strength at Celcom’s office, Lot 20 is low and together with multipath fading has caused an increase in the Frame Error Rate (FER) which is normal.

9.0 Additional Test Methodology (BS – BTS at 200m)

(1) GSM MBTS were placed 200m away from MoBif BS.
(2) The MBTS antennas were relocated at 6m (cell 11662) and 7m (cell 11661) from ground level.
(3) MoBif servers were pre-prepared with multiple files of 600MBYTE for 24 simultaneous downloading.
(4) 24 CPEs were placed inside Celcom building at Lot 20.
(5) GSM BTS (2 sectors) were tuned to frequency 1879.4 and 1879.8 MHz
(6) MoBif BS were tuned to frequency 1790 to 1795 MHz @ 23 dBm/channel with 69 TS/channel with automatic BS and MS power control. The BCH channel was set to channel number 1 (first channel).
(7) Both MoBif BS and GSM BTS were in services.
(8) All CPEs continuously download 600MBYTE files simultaneously.
(9) Testing continuous for 3 hours in the morning and 3 hours in the afternoon.
(10) The Idle Channel Measurement statistics were collected as the final results.
(11) All 24 CPEs were placed at a location of CPEs received signals < -90 dBm and inline with the direction of iBurst equipment and behind the GSM MBTS.
(12) Testing continuous for 3 hours in the morning and 3 hours in the afternoon.
(13) The Idle Channel Measurement statistics will be collected as the final results.

9.1 Result

11661

Hour	(% of readings without iBurst ON – in dBm)	(% of readings with iBurst ON – in dBm)
	-109	-109

Table 24: Idle measurement for cell 11661 for Additional Test

11662

Hour	(% of readings without iBurst ON – in dBm)	(% of readings with iBurst ON – in dBm)
	-109	-108.9817

Table 25: Idle measurement for cell 11662 for Additional Test

9.2 Comments

From Table 25, it is observed that there is an increase in Interference on Idle (IOI) for cell 11662.

10.0 Definition

Abbreviations/Word	Meaning	Descriptions
UTU	User Terminal with USB connection	
UTC	User Terminal PCMCIA card	
UTD	User Terminal for Desktop	
BS	iBurst Base Station	
CPE	iBurst user terminal Also known as UT = User terminal	
BTS	GSM Base Transceiver Station	
MS	GSM Mobile Station	
BCH	Broadcast Channel	
Mod Class	Modulation Class	Explained in the Reference below
Detect	No of frame sent or received	
Data OK	No of frame sent or received successfully	
Error Rate	Percentage of failure frame sent or received	

11.0 References

1. Modulation Class:

Mod Class	Modulation Technique	Throughput
0	BPSK	Lowest ↓ Highest
1	BPSK +	
2	QPSK	
3	QPSK +	
4	8PSK	
5	8PSK +	
6	12 QAM	
7	16 QAM	
8	24 QAM	

2. Equipment requirement and setup

iBurst	GSM 1800
1 base station	1 base station + 1 micro base station (to be placed inside the room of Lot 30)
12 antennas (11dBi x polarized) 6 degree electrical tilt	1 antennas (14.5 dBi x polarized)
EMS system	TX link, BSC, MSC
Packet service switch (PDSN)	Transmission to switch
User Terminals 24 wireless card (22 built in antenna + 2 external antenna) 24 x Laptops	Mobile Stations TEMS Laptops GSM Handphones
Test equipment FTP server iBurst benchmarking tool (Chariot test)	Test equipment - 4 TEMS - ICM statistics 2 x Spectrum Analyzer Measuring Tape

3. Idle Measurement Calculation for presentation

Interference band	Interference level *I*	Weightage	% of readings per hour before	Readings to take for before	% of readings per hour after	Readings to take for after
1	I <= -108 dBm	1	a	= a x 1	q	= q x 1
2	-108 < I <= -104 dBm	4	b	= b x 4	r	= r x 4
3	-104 < I <= -98 dBm	9	c	= c x 9	s	= s x 9
4	-98 < I <= -88 dBm	17	d	= d x 17	t	= t x 17
5	-88 dBm < I	46	e	= e x 46	u	= u x 46
				Sum (all above)	Sum (q,r,s,t,u)	Sum (all above)

For Comparison of data

Hour	Sum(% of readings per hour before)	Sum(% of readings per hour after)
1	A	Q
2	B	R
3	C	S
4	D	T
5	E	U
6	F	V
	Median (A,B,C,D,E,F)	Median (Q,R,S,T,U,V)

Note:

If Median (A,B,C,D,E,F) > Median (Q,R,S,T,U,V), then Interference is proven

12.0 Diagram

13.0 Tables

14.0 Photos:

Photo 1: iBurst BS at Lot 30 DiGi's office

Photo 2: GSM MBTS at Subang Hi-Tech