



**IDA'S DECISION AND EXPLANATORY MEMORANDUM ON
THE REGULATORY FRAMEWORK FOR DEVICES USING ULTRA-WIDEBAND
TECHNOLOGY**

24 SEPTEMBER 2007

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PART I: INTRODUCTION

1. On 1 March 2007, IDA issued a public consultation on the “Regulatory framework for devices using Ultra-Wideband (UWB) technology”. IDA has proposed the following three types of UWB applications and their operating frequency bands and peak emissions. IDA has also proposed an emission mask to be adopted as specifications for UWB devices. At the close of the consultation, submissions from 14 organisations¹ were received.
 - (a) UWB Consumer and business Data Communication Systems: Licence-exemption approach for such systems which comply with the UWB technical specifications and which operate with peak emission within the 3400 MHz and 10600 MHz band. UWB devices with interference mitigation techniques may be allowed at a higher peak emission within the 3400 to 4800 MHz band;
 - (b) UWB vehicular radar devices: Licence-exemption approach for UWB vehicular radar devices which comply with the UWB technical specifications and which operate with peak emission within 21650 – 29500 MHz and 77000 – 81000 MHz; and
 - (c) UWB imaging systems: Individually license, on a case-by-case basis, systems which operate with peak emission below the 960 MHz or in the 3400 to 10600 MHz band.

PART II: GENERAL POSITIONS OF RESPONDENTS TO THE CONSULTATION ON THE PROPOSED REGULATORY FRAMEWORK FOR DEVICES USING ULTRA-WIDEBAND TECHNOLOGY

2. IDA would like to thank the respondents for their views and comments. Respondents to the consultation broadly fall under three groups: equipment manufacturers, mobile operators and spectrum users. UWB equipment manufacturers are supportive of IDA's proposals and felt that the emission mask can be further relaxed in terms of frequency bandwidth and power limit. Mobile operators, while not objecting to IDA's proposals, suggested UWB devices be

¹ Alereon, Bosch, Civil Aviation Authority of Singapore (CAAS), Intel, Motorola, Mobile One Pte Ltd, Nortel, NXP, Short Range Automotive Radar Frequency Allocation (SARA), Singapore Telecommunications Limited, StarHub Pte Ltd, Time Derivative, WiMedia and WiQuest.

subjected to type approval and licensing conditions as safeguards to protect their mobile services. Lastly, one spectrum user expressed concern on potential interference to their aeronautical facilities and recommended that UWB users seek their consent before operating UWB devices.

PART III: OVERVIEW OF COMMENTS RECEIVED AND IDA'S VIEWS AND DECISIONS

IDA's Policy Objective

3. As stated in the consultation, IDA's policy objective is to adopt a regulatory framework whereby as many UWB devices as possible can be allowed to be operated on without causing interference to other authorised services. IDA recognises that while UWB technology holds many benefits for a wide range of new applications and devices, such benefits could be outweighed if UWB devices were to cause interference to other spectrum users. Balancing between the need for promoting efficient use of spectrum by innovative technology and for managing potential interference, IDA will adopt a simple, effective and flexible implementation approach to regulate the use of UWB devices.

(A) GENERAL ISSUES

Co-existence of UWB devices with other radiocommunication

4. IDA invited views on the proposal to allow UWB devices operate in frequency bands which have been assigned and allocated for use by other radiocommunication services. Most respondents agreed that the emission limits of UWB devices without any mitigation techniques will adequately protect the existing services. Some respondents to the consultation also cited studies of the ITU-R, ECC TG3 and IEEE to show that UWB emissions will not cause significant interference to other licensed bands.
5. One mobile operator submitted that IDA should impose permissible transmission power of such transceivers. The respondent further commented that IDA should consider a minimum separation distance between UWB transceivers and the in-building antennae used by the mobile operators. Another mobile operator recommended IDA to conduct tests first to ensure that the proposed emission mask is low enough to minimise the interference caused by the UWB devices. One spectrum user recommended cross usage of these frequency bands be avoided in the fixed-satellite, fixed services and radionavigation bands as it could result in dire consequences on aviation operations. This respondent felt that UWB devices have not been tested for their compatibility with aeronautical facilities.

IDA'S ASSESSMENT

6. IDA is of the view that it is not practical to develop guidelines to prescribe the usage of UWB devices and the minimum separation distance between such devices and other equipment. This is because usage of UWB devices eventually will be ubiquitous and it is difficult to enforce such guidelines. In the event that usage of UWB device needs to be regulated in some fashion to give protection to existing and future services, a class licensing approach could be an option. The need for such an approach however is not apparent at this time. IDA notes that the proposed UWB emission mask is designed with stringent emission limits established by the ECC after extensive studies and tests. IDA is therefore of the view that further compatibility tests² are not essential as long as UWB devices comply with IDA's technical specifications.
7. On compatibility of UWB devices with aeronautical facilities, IDA notes that while there are no practical measurements on the compatibility with aeronautical facilities, simulation results presented in the ITU-R SM.1757 document have illustrated that the worst case UWB (e.i.r.p of -80.3 dBm/MHz) can still provide adequate protection to aeronautical radio services (effectively 4-5 dBm/MHz higher than the proposed emission limit). Also, regulations established in the US and Europe have demonstrated that technical specifications and operating conditions are both effective in ensuring protection to aeronautical radio services. IDA's position is that it is operationally more effective for users or operators of systems or equipment to restrict usage of UWB devices within their premises if they think their systems or equipment are vulnerable to receiving interference from UWB device

(B) UWB CONSUMER AND BUSINESS DATA COMMUNICATION SYSTEMS

(B1) Licence-exemption for UWB consumer and business data communication systems

8. In the consultation, IDA proposed to adopt a licence-exemption approach for UWB consumer and business data communication systems within the 3400 MHz and 10600 MHz band. Most respondents are supportive of this proposal given that it is consistent with ITU's recommendations and that it maximises economic benefits of global deployment of UWB technology. Two mobile operators urged IDA to impose type-approval requirements for UWB devices before they are allowed to be used in Singapore while one equipment manufacturer commented that operating restrictions should be implemented to provide sufficient and effective mitigation against potential harmful interference. One respondent however opposed having a licence-exemption approach citing that the broad frequency bandwidth encompasses the bands used for radio navigational aids and radars.

² While the interference scenarios for co-existence studies carried out in the ITU-R have shown varying degrees of interference to other services under close proximity distance, the measured signal level at 0.5 meter from a UWB device operating in the 2G/3G mobile bands is around -110 dBm/MHz, which is unlikely to affect the signal level of a cellular system.

9. IDA notes that the proposed licence-exempt approach is no difference from the framework established in Japan, Korea, the US and Europe where UWB devices complying with technical specifications are licence-exempt on a non-interference and non-protection basis. IDA's proposed emission mask in fact largely follows Europe's stringent specifications. IDA agrees that type approval is necessary to ensure UWB devices operate in accordance with certification by manufacturers or conformance bodies. As such, UWB devices will be subject to IDA's type approval framework to ensure that they operate according to our technical specifications. With these measures in place to check the performance of UWB devices, IDA is of the view that users of UWB devices should not be unnecessarily inconvenienced by having to take up a licence. On the other hand, a simplified licence-exempt approach for UWB devices will help to facilitate the adoption of UWB technology.

(B2) Higher emission level for UWB devices implemented with mitigation techniques

10. IDA has proposed to allow UWB devices which are capable of reducing interference using certain mitigation techniques³ to transmit at a higher emission level (-41.3 dBm/MHz) within the 3400 to 4800 MHz band, as compared to generic UWB devices. Some respondents highlighted that IDA should include an additional note to allow UWB devices to operate at -41.3 dBm/MHz in the 4.2-4.8 GHz band, without mitigation techniques until 31 December 2010, while another respondent stated that mitigation techniques are unproven at this time and therefore, should not adopt higher emission limits until it is proven to be effective. Similarly, two mobile operators did not support this proposal and question the need for higher emission level and the effectiveness of mitigation techniques. One respondent also commented that an unlicensed approach is not prudent and should not be allowed near Airport and aeronautical facilities due to the presence of its radio equipment.

IDA'S ASSESSMENT

11. IDA notes that Europe, Korea and Japan already allow UWB devices with mitigation techniques to transmit at higher emission limit and would adopt new mitigation techniques such as Detect and Avoid (DAA) to minimise potential interference with radiocommunication services. IDA agrees with the comments from UWB manufacturers, that mitigation techniques will be primarily taken care of by the UWB industry itself, and that the industry will develop mitigation techniques to safeguard other spectrum users.
12. On the suggestion to allow UWB devices in the 4200 - 4800 MHz band without mitigation techniques until the end of 2010 as adopted by the European Commission (EC), IDA is agreeable to adopt this date as the cut-off date for the

³ Mitigation techniques as defined in ITU-R SM.1757 and ITU-R SM.2057 can be used to reduce the risk of interference and helps to ensure compatibility of UWB devices with existing radio services.

first generation UWB devices to be used under the emission mask already established in Europe. After this date, only the new generation of UWB devices will be allowed to be used. Existing first generation of UWB devices however can continue to be used but only for the life span of equipment. On the concern on use of devices near the airport and aeronautical facilities, IDA will align with international practice and adopt appropriate regulations or guidelines when they are developed by the EC or other regimes.

(C) UWB VEHICULAR RADAR DEVICES

13. Generally, respondents felt that the proposed licence-exempt approach for UWB vehicular devices will facilitate greater use of such devices and help promote public safety. The technical specification to be adopted should also be harmonised for the cross border movement of vehicles. Respondents did not raise any objection to adopt licence-exemption approach for UWB vehicular radar devices. IDA notes that no country has implemented individual licensing for vehicular radars and would therefore adopt licence-exempt for UWB vehicular radar devices.

(D) UWB IMAGING SYSTEMS

(D1) Licensing of UWB imaging systems

14. IDA proposed to license, on a case-by-case basis, the use of UWB imaging systems with peak emission below the 960 MHz or in the 3400 to 10600 MHz band. Being a niche technology and not for mass-market consumption, respondents were largely favourable towards the licensing approach. Other respondents have suggested implementing licensing guidelines that specify the location where the UWB imaging system may operate, as well as adopting a feedback system to confirm the locations of UWB imaging systems. However, one respondent is concerned with possible disruption of GSM900 mobile service and felt that UWB imaging systems should not be allowed to operate in the 960 MHz band.
15. IDA is of the view that UWB imaging systems complying with the proposed emission limits are not likely to degrade mobile service. According to the detailed studies carried out by the International Telecommunication Union (ITU) and Europe's Electronic Communications Committee (ECC), the likelihood of interference, if any, is low. IDA agrees with the mobile operators' proposals to type approve UWB imaging systems to ensure that only imaging systems complying with technical specification are allowed to be sold in Singapore. On the suggestion to include licensing guidelines to specify the location where the UWB imaging system may operate and to notify mobile operators each time a licence is issued, IDA considers it not practical to specify in advance the permitted locations for UWB systems to operate. IDA also does not consider it necessary to inform mobile operators of licensees of imaging systems. In any

event, should any imaging system operating within the emission limit be found to cause interference to other authorised services, such system is required to cease operation under the existing IDA's regulation. Taking into account respondents' comments and the type approval and interference control measures that are or will be in place, IDA is of the view that there are merits to also licence-exempt UWB imaging systems that comply with the emission limits.

(D2) Licensing conditions to safeguard existing users

16. IDA sought comments whether new licensing conditions are required as further safeguards to existing users in the band below 960 MHz or in the 3400 to 10600 MHz band, as well as the safeguard measures that could be adopted. One respondent stated that aeronautical compatibility standards should be applied prior to licensing such equipment, especially for consumers/business devices and imaging systems. It proposed that IDA advises them of the licensed users of such UWB imaging systems and ensures that users are trained and certified in operating these systems. It further proposed that users seek their agreement whenever they operate UWB imaging systems near or at the airport and aeronautical facilities. In addition, their personnel may be present whenever such systems are in use. Two other respondents recommended the use of electromagnetic shielding or licensing fees as possible licensing conditions.
17. Mobile operators proposed to include in the licensing conditions requirements such as maximum emission level; permissible usage location/area; maximum number of UWB imaging systems operating at the same time and place; and procedures to be adhered to by UWB users when interference occurs, etc.

IDA'S ASSESSMENT

18. On the requirement for users to seek permission of owners of premises to operate UWB systems, IDA considers such requirements are best imposed and enforced by the concerned parties where UWB systems are to be used within their premises. IDA believes that UWB imaging systems are likely to be operated by entities having trained staff. There is therefore no necessity to impose staff training requirement on the users. Where UWB imaging systems are used outside their premises, IDA considers it unrealistic to advise them of users of the systems and to ensure that they are trained or certified.
19. On mobile operators' recommendations, IDA agrees to limit the maximum emission level to give adequate protection to existing services. IDA will incorporate the UWB emission mask in the technical specification to define the minimum and maximum technical requirements for UWB systems. IDA is however not agreeable to specify permissible usage locations as it is impractical to produce such an exhaustive list. In terms of interference resolution, IDA will however continue to investigate any reported case of interference and take appropriate measures to resolve the interference. Based on past experience, IDA

considers the current arrangement whereby both interfering and interfered parties coordinate as a first step in resolving interference has worked well and should continue before IDA's investigation.

20. In summary, IDA considers the licensing conditions proposed by respondents focusing on imposing technical and interference resolution requirements, as well as controlling usage of UWB imaging systems generally or in or around certain locations. With adoption of the stringent emission mask, IDA is of the view that the technical and interference prevention requirement can be mostly taken care of by its type approval specifications and existing interference regulations. There is no need to impose further restrictions on users. Also, the technical specifications and emission mask to be adopted should be able to ensure the compatible operation of UWB imaging systems and other services under normal circumstances. Any concern pertaining to the usage of UWB imaging systems in certain situations in our view can be more effectively addressed by existing regulations or other mechanisms rather than through a licensing regime which may pose unnecessary barriers to the use of UWB systems. As stated in paragraph 15, IDA is of the view that UWB imaging systems that comply with the technical specifications and emission mask need not be licensed.

(D3) Licensing fee structure for UWB

21. In the consultation, IDA sets out the principle of the licensing fee framework is to ensure responsible use of UWB imaging devices and to safeguard existing users from possible interference. Most respondents are supportive of the licensing fee structure for UWB devices operating beyond the proposed emission limit. The respondents reasoned that no other regulatory agency, including the ITU-R, has recommended or implemented licensing fees for devices operating within emission limits. One respondent suggested that the licensing fee structure should reflect its usage and independent of a fee structure while a number of respondents commented that licensing fees are inappropriate for high volume UWB consumer devices as this would otherwise render UWB technology uneconomical and stifle innovation.
22. IDA agrees that licensing fees are not appropriate for high volume consumer devices and imposition of a licensing fee on such devices may deter development of UWB technology. In the absence of any objection from respondents, IDA will adopt an annual spectrum fee and station licence of \$300 and \$50 respectively for individually licensed UWB systems.

(E) OTHER COMMENTS

23. Several respondents opined that the emission mask could be further relaxed in certain frequency bands and power limit since the proposed suppression limit of -85 dBm/MHz at 3.4 GHz is extremely difficult to meet without a transition band. The respondents submitted that the UWB industry generally requires a more

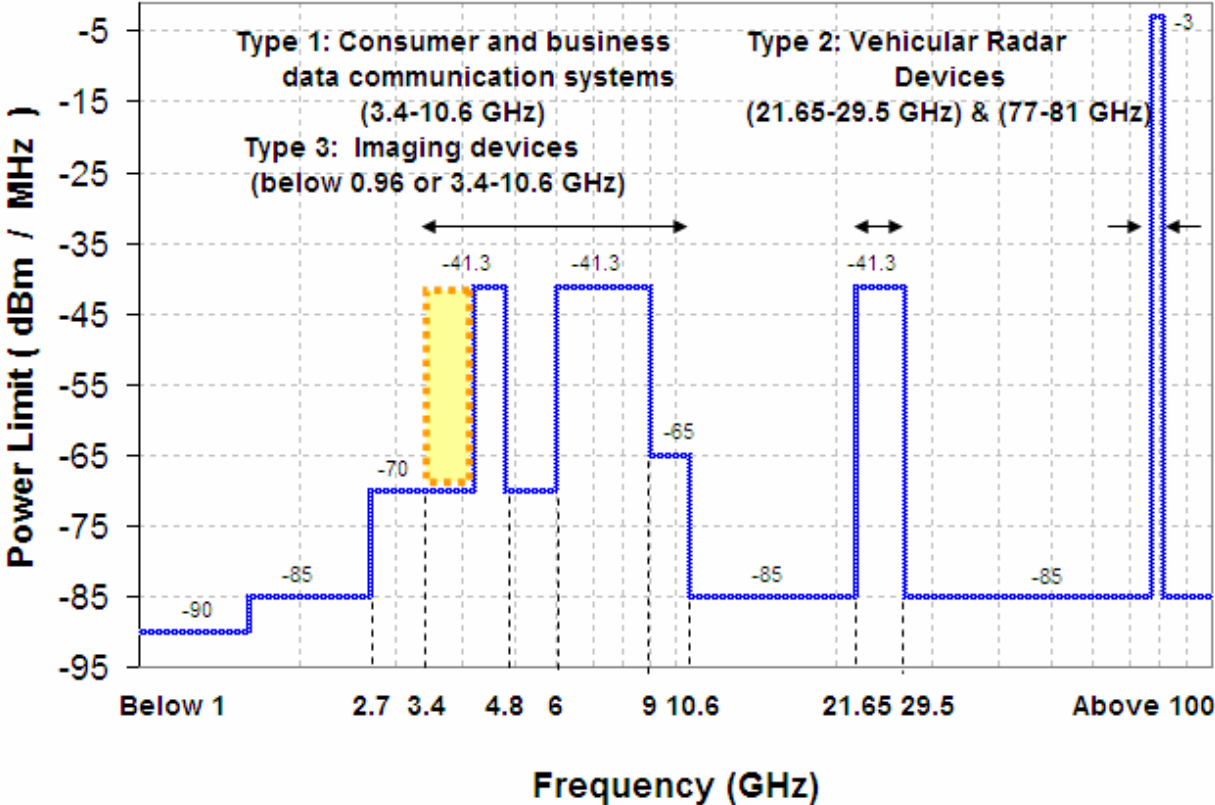
reasonable and practical emission limit to measure. In addition, respondents argued that opening up more frequency bands would help to ensure Singapore's regulations are harmonised with countries like the US, Europe, Korea and Japan.

24. IDA recognises that most UWB devices in the market now are classified as the first generation product which generally operates at higher emission limit over a wider spectrum bandwidth. To better reflect the practical operating emission limit, IDA will increase the emission limits in the transition band from 2.7 GHz to 3.4 GHz to -70 dBm/MHz, up by 15 dBm/MHz. In addition, the band from 6 GHz to 8.5 GHz will be extended to 9 GHz. IDA however is not agreeable to extend downward the band from 3.4 GHz to 3.1 GHz for UWB devices because of the concern of potential interference to aeronautical radar and mobile services. IDA is also not agreeable to increase the transmit power in the 6 GHz to 9 GHz band, since the emission limit proposed by IDA, being in line with the US and Europe, should enable most UWB devices to work satisfactorily. Notwithstanding the above, IDA will review the emission limits from time to time and relax specifications where there are evidence showing compatibility of UWB technology with existing services.

PART IV: CONCLUSION

25. IDA will be proposing changes to the existing regulations to implement a regulatory framework on usage of UWB devices. Subject to administrative and gazetting process, which is expected to take effect by end of 2007, IDA will implement the following regulatory framework:
- a To licence-exempt UWB devices that comply with IDA's technical specifications and emission mask as shown in the Annex;
 - b To allow sale of UWB devices that comply with IDA's specifications and emission mask. Such devices are subject to IDA's equipment registration of type approval framework; and
 - c To allow usage of UWB devices which operate outside the emission mask, by exception on a case-by-case basis and subject to licensing. Annual spectrum fee of \$300 and station licence fee of \$50 are applicable for a licensed UWB system/device.
26. Upon gazetting of the licence-exempt scheme, information relating to licensing and type approval of UWB devices for sale and use in Singapore will be published on IDA's website www.ida.gov.sg under Polices & Regulation.

Specifications on UWB Emission Limits



Note: UWB devices with mitigation techniques are allowed to operate at a level of -41.3 dBm/MHz in the frequency band from 3.4 to 4.2 GHz. Otherwise, the emission limit is capped at -70 dBm/MHz.