



# Regulation of Ultra-Wideband Technology

## **Abstract**

Based on article (103) of the Republic of Iraq constitution and as to CMC authorities pursuant to the valid order No. (65) For the year 2004 and according to the license terms, or any other applicable laws or regulations issued by CMC whether currently valid ones or those adopted later, the regulation of Ultra-Wideband Technology (UWB) has been arranged in accordance with the International Telecommunications Union (ITU) recommendations and to the best global trials in this regards.

## **Goals and objectives**

The purpose of this regulation is to identify Ultra-Wideband Technology (UWB) and indicating the terms and conditions that would be applicable to various applications may be used in this technology.

## **Executive Summary**

This regulation has been prepared in accordance with best global trials in that respect, and as to the International Telecommunications Union (ITU) recommendations. It includes procedures, terms and conditions by which approvals for using (UWB) applications are being granted.

## **Article one / Definitions**

**Commission:** Communications and Media Commission

**Ultra–Wideband Technology:** is a short range of radio telecommunications technology that involves generating and transmitting intended for the radio frequencies capacity that spread across a huge range of frequencies and might interfere with several frequency ranges distributed among radio telecom services.

**Ultra-Wideband Transmitting:** Generator radiation by using UWB technology.

**Activity factor:** is a part of the time by which a device uses UWB technology in transmission process.

**Maximum PSD Power:** Maximum Power of Spectrum Density: is the highest signal intensity measured for any frequency direction within specified range.

**Power Medium:** a UWB device must be set up for transmitting with maximum possible and continuous power. The power is measured by identifying bandwidth of 1 MHz, and R.M.S detector, and average time of 1 ms or less.

**Operating Cycle:** is known as an Operating Cycle for these regularity provisions as a ratio expressed by percentage for the duration in which the transmitter is in “Operating Condition” for a certain period as indicated in technical requirements.

**The pulse:** is UWB transitory and short radioactive signal. Its period is nominally equal to the corresponding inverted domain dB 10-UWB.

**Burst:** is a transmitted signal. Its time duration is not linked with its domain width.

### Abbreviations related to Ultra-Wideband:

Abbreviations	Meaning
<b>GPR</b>	Ground Penetrating Radar
<b>PRF</b>	Pulse Repetition Frequency
<b>PSD</b>	Power Spectral Density
<b>SRR</b>	Short-Range Radar
<b>UWB</b>	Ultra-Wideband
<b>SRD</b>	Short Range Devices
<b>WPR</b>	Wall Probing Radar
<b>ODC</b>	Object Discrimination and Characterization
<b>BAM</b>	Binary Antipodal Modulation

## **Article Two: Terms and Conditions**

Devices that are using UWB technology must have the followings:

- 1- They must not cause interferences to the other licensed radio-telecom systems, and should not require protection against any interference caused by other radio telecom services that are operating on frequency bands within the same ranges.
- 2- They should be capable to enforce a technique of interference mitigation that was mentioned in appendix (B) to provide additional protection for wireless telecommunications services according to the requirements mentioned in appendix (A). Both are attached to this regulation.
- 3- They shouldn't allow external controlling equipments to amend these devices' to be functioning in a method that may contradict this regulation.
- 4- Names or trademarks; must be fixed on equipments referring to the importer or manufacturer, with the model imported, or source of origin. Trademarks must be clear and readable and cant' be easily removed.
- 5- Terms and conditions should meet the technical requirements mentioned in appendix (A) attached.
- 6- Manufacturing, or importing, or selling devices of UWB technology are not allowed unless getting CMC approval on devices qualities. All companies and institutions that are dealing with such equipments must register with CMC before manufacturing or importing or selling.
7. It is prohibited to transfer licensed UWB devices from a qualified user to another or to different site unless obtaining CMC approval.
8. Providing required protection for safety services.
9. Providing required protection for services operating in frequency bands which are listed in Radio Regulations No. 340.5, as described below:

**All types of broadcast are prohibited in the bands below:**

1427-1400 MHz

2700-2690 MHz

Except those guaranteed by number 422.5

10.7-10.68 GHz	Except those guaranteed by number 483.5
15.4-15.35 GHz	Except those guaranteed by number 511.5
24-23.6 GHz	
31.5-31.3 GHz	
31.8-31.5 GHz	at Region 2
49.04-48.94 GHz	from stations mounted on air
50.4-50.2 GHz	
54.25-52.6 GHz	
92-86 GHz	
102-100 GHz	
111.8-109.5 GHz	
116-114.25 GHz	
151.5-148.5 GHz	
167-164 GHz	
185-182 GHz	
191.8-190 GHz	
209-200 GHz	
231.5-226 GHz	
252-250 GHz	(International Radio Communications Conference 2003)



### Article Three: Applications that are using (UWB) technology:

1. **Radar shooting device:** It is a device used to capture images of objects blocked by obstacle, exploring for objects inside the walls and across them.
2. **Ground Penetrating Radar (GPR):** It is a radar camera that works usually when it is in direct contact with earth or very close to it, in order to detect underground layers existed, or drawing layers maps. Although these devices are basically used to study the "underground layers," it is possible to expand the term range "land" to mean any electrical insulated item that wastes energy.
3. **Radar shooting device inside walls:** It is a sensor manufactured for the purpose of examining soles of walls and drawing maps for it. The wall is usually built of reinforced concrete structure, or of a similar silencing heavy texture material to absorb most of the radio waves energy that are crushing the walls. Typical applications include walls built of reinforced concrete, retention walls, tunnels' linings, mines walls, bridges side



walls, or any other physical heavy dense textures structure which is thick enough to scatter and absorbs most of transmitted signal force from the shooting device.

4. **Wall imaging radar:** It is a sensor used to send a signal across silenced structure such as wall or roof to inspect movement of people locations, or objects existed at the other side of the wall. These devices are designed intentionally to raise transferring level of energy to the maximum limit across any silenced structure. Such products may include items like location pins prepared for the purpose of indicating hidden positions of objects behind the walls, thin or light dense walls enough to absorb the transmitted signal, such as walls built of gypsum or plaster material or any similar walls.
5. **Communications with (UWB) domain device:** It is a short-range communications device, transmitting and/or receiving transferred data among devices.
6. **(UWB) Measurement domain device:** It is a device used to measure the distance or location.
7. **Imaging device for medical purposes:** It is a Sensor used to explore a location or objects motion through human or animal bodies.
8. **Exploring and tacking sites devices:** It is a combined sensor net installed in keenly tasted sites to indicate a remote device location by using (UWB) technology.
9. **Radars devices mounted on vehicles:** They are devices Mounted on land transportation vehicles to detect people movement or nearby objects.
10. **The multi-functional device:** It is a device that facilitates implementing many (UWB) applications, such as shooting images by radar, radars mounted on vehicles, sensing and tracking locations and communications' functions by using shared platform.

## **Article Four:**

Impact on radio communications services: It is necessary to provide protection for all radio communications services against interferences that may occur by devices using (UWB) technology, as such global technology was inserted, more attention should be paid to the protection of active services and safety service within other services, for there is direct impact on operating (UWB) specific devices for protecting human life and properties. The following two sub-sections explain the two types:

- 1- Safety Services:** Civil and marine aviation systems depend upon radio frequencies that can be used globally. The safety services, such as radio-navigation service, satellite radio-navigation and marines mobile service (MMS), are considered as radio communications services used to protect human life and properties, mobile aviation service may allocate a (route), and aviation mobile-satellite service may allocate a (route) too for communications related to safety and aviation regularity. The safety service often works in conditions in which interferences extremely affect receiving and weaken the provided radio safety communications. Therefore special attention must be paid for safety protection services.
- 2- Active Services:** includes Radio Astronomy Science Service process (RAS), Earth Exploring Satellite Service (EESS) (active), and Space Researches Service (SRS) (active) that measure radiations normally occurred of very low power levels, and contains key information related to the ongoing physical operation. Relevant frequency bands are basically identified by fixed unchangeable physical features such as (molecular resonance). These features are being supported by scientific activities such as weather forecasts, then, frequency bands are considered as an important natural resource. Even the low levels of receiving interferences at the active sensors access may have implications that would reduce the usage of active service domain. In addition to what have been mentioned above sensors are not always able to differentiate between natural radiations and the artificial ones. In this respect, the number 340.5 of active radio services regulations allows to deploy and operate their systems, example: EESS Earth Exploring Satellite Service (active) monitors the earth and its atmosphere in entire world. Improper measurements in one territory or more would affect the capability of reliable weather forecasts of the whole world which might leave severe impacts on economy and public safety. Therefore,

particular attention must be paid for the protection of the active services requirements.

## Appendix (A)

### Technical requirements of different devices that operate with ultra-wideband (UWB) technology

#### 1. Ultra wideband devices used for the purposes of Short Range Communications (SRD)

Application Type	UWB devices used for the purposes of Short Range Communication (SRD)					
Frequency band	Operates in all, or in any parts of the following bands:- (4.8GHz)-(3.1GHz) (9GHz)-(6GHz) They can also operate out of these frequency bands, but should be bound by the following limits.					
Radioactive emissions limits	Frequency (GHz)	Maximum value of spectral density power average (dBm/MHz)	Maximum peak power (Measured in 50dBm/MHz)	usage	License requirements	Other requirements
	Less than 1.6	90-	50-	Opened	Exempted of getting radio licenses	ultra-wideband devices Must be provided with integrated antenna, or exit compass linked to the dedicated device
	2.7-1.6	85-	45-			
	3.4-3.1	70-	36-			
	3.8-3.4	80-	40-			
	4.8-3.8	70-	30-			UWB devices which achieved all needed requirements are not allowed to be , installed in a fixed place outdoors, or linked with fixed external antenna, or used in aviation samples or in plane, or in any other aviation forms
	6-4.8	70-	30-			
	8.5-6	41.3-	Zero			
	9-8.5	65-	25-			
	10.6-9	65-	25-			
	More than 10.6	85-	45-			



## 2. Ground and Walls Penetrating Radar (GPR and WPR)

Application Type	Ground and Walls Penetrating Radar (GPR and WPR)						
Frequency Band (MHz)	It must not exceed the frequency band limits (12.4) MHz – (30) GHz						
Radioactive emissions limits	frequency band (MHz)	Maximum average value of spectral power density Equivalent Isotropic Radiating power (EIRP) for any unwanted emissions (dBm/MHz)	Frequency band (MHz)	Maximum peak power for any unwanted emissions (ERP)	usage	License requirements	Other requirements
Radioactive emissions limits	230 <	-65	230-30	-44.5 dBm/120 KHz	Only for the purposes related to applying law, and for fire attack and emergency rescue, and scientific research, and trading mining and construction	radio license is required to be obtained	Ground & walls penetration Radars should be designed to operate on touching the ground or come close to the ground or to the walls and must be directed towards the ground or the walls
	-230 1000	-60	1000-230>	-37.5 dBm/120 KHz			
	-1000 1600	-65	18000-1000>	-30 dBm/ MHz	Ground & walls penetration Radars must contain such technique to stop the device functioning. It is a task to halt the device activity when manual using stops.		
	-1600 3400	-51.3					
	-3400 5000	-41.3					
	-5000 6000	-51.3					
	6000>	-65					

### 3. Walls Imaging Radar

Application Type	Walls Imaging Radar.								
UWB field	Less than 960 MHz		1990-10600 MHz						
	Radioactive emissions limits of clarification field to Resolution Bandwidth (1) MHz		Radioactive emissions limits of clarification field to Resolution Bandwidth (1) MHz		usage	License requirements			
Radioactive emissions limits	Frequency (MHz)	Equivalent Isotropic Radiating Power (EIRP-dBm)	Frequency (MHz)	Equivalent Isotropic Radiating Power (EIRP-dBm)	Usage is limited on law enforcement authorities, risqué, emergency and fire attack institutions	radio license is required			
	1610-960	-65.3	1610-960	-46.3					
	1990-1610	-53-3	10600-1610	-41.3					
	More than 1990	-51.3	More than 10600	-51.3					
	Radioactive emissions limits Resolution to clarification field Bandwidth (1) KHz		Radioactive emissions limits Resolution to clarification field Bandwidth (1) KHz						
	Frequency (MHz)	Equivalent Isotropic Radiating Power (EIRP-dBm)	Frequency (MHz)	Equivalent Isotropic Radiating Power (EIRP-dBm)					
	1240-116	-75.3	1240-116	-65.3					
	1610-1559	-75.3	1610-1559	-65.3					
							Other requirements		
							The device that is working within less than 960 MHz bandwidth must contain a manual control key that works on shutting down within 10 seconds once operator press the bottom		

## 4- Radio monitoring devices

Application type	Radio Monitoring Devices			
Space of UWB	1990- 10600 MHz			
Radioactive emissions limits	Limits of radioactive emissions for clarification field (resolution bandwidth) (1) MHz		Usage	Licensing requirements
	Frequency (MHz)	Radiation Capacity Equivalent Isotropic Radiating Power (EIRP) (dBm)	Using is limited to the fix monitoring devices which run by the law enforcement entities and rescue authorities in case of emergency and fire-fighting, or by licensees authorized manufacture company or licensees in oil fields or energy projects.	radio license is required
	960-1610	53,3-		
	1990-1610	51,3-		
	1990-10600	41,3-		
	more than 10600	51,3-		
	Limits of radioactive emissions for clarification field (resolution bandwidth) Not less than (1) KHz			
	Frequency (MHz)	Radiation Capacity Equivalent Isotropic Radiating power (EIRP, dBm)		
	1240-1164	63,3-		
	1610-1559	63,3-		

## 5- Medical shooting devices

Application type	Medical Shooting Devices				
UWB Frequency Space	3100-10600 MHz				
Radioactive emissions limits	Limits of radioactive emissions for clarification field (resolution bandwidth) (1) MHz		Usage	Licensing requirements	Other requirements
	Frequency (MHz)	Radiation Capacity Equivalent Isotropic Radiating Power (EIRP) (dBm)	Usage is limited to the medical shooting devices under directing or supervision by a doctor or licensee in medical care sector	Radio license is required	The device should have a manual control key which working on operation shutting down within (10) seconds after being pressed by the operator
	960-1610	65,3-			
	1610-1990	53,3-			
	3100-1990	51,3-			
	10600-3100	41,3-			
	more than 10600	51,3-			
	Limits of radioactive emissions for clarification field (resolution bandwidth) (1) KHz				
	Frequency (MHz)	Radiation Capacity (EIRP, dBm)			
	1240-1164	75,3-			
	1559-1610	75,3-			



## 6- Objects Distinguishing and Classification Devices (ODC)

Application type	Objects Distinguishing and Classification Devices (ODC)				
UWB Frequency Space	Working in all or part of frequency band (8,5-2,2) GHz				
	Fixed applications		Moving applications	Licensing requirements	Other requirements
Frequency (GHz)	Maximum Average of spectral density for equivalent isotropic Radiating power radioactive capacity (EIRP-dBm)	Maximum Average of Spectral Density for equivalent Isotropic Radiating power radioactive capacity ((EIRP, dBm/MHz))	Maximum Average of spectral density for equivalent isotropic Radiating power radioactive capacity (EIRP-dBm)		
Less than 1,73	85-		85-	Free of obtaining radio license	<p>A-Fixed applications should achieve the following requirements:</p> <p>1-Transmitter should be shut down if the device isn't working (Operating sensor).</p> <p>2-Transmitter must be installed in fixed equipments.</p> <p>B-Un-fixed application should achieve the following requirements :</p> <p>1- Shutting down the transmitter if the device isn't working (Operation sensor).</p> <p>2-Touching the tested material or should be available in a nearby location. emissions</p>
2,2-1,73	65-	70-	70-		
2,5-2,2	50-		50-		
2,69-2,5	65-	70-	65-		
2,7-2,69	55-	75-	70-		
2,9-0,7	50-	70-	70-		
3,4-2,9	50-	70-	70-		
3,8-3,4	50-	70-	50-		
4,8-3,8	50-		50-		
5-4,8	55-	75-	55-		
5,25-5	50-		50-		
5,35-5,25	50-	60-	60-		
5,6-5,35	50-		50-		
5,65-5,6	50-	65-	65-		

5,725-5,65	50-	60-	60-	should be directed towards items required to be tested.
8,5-5,725	50-		50-	
10,6-8,5	65-		65-	
Higher than 10,6	85-		85-	

<b>Notes</b>	<p>In order to protect the radio services, unfixed installation applications should fulfill the following requirements of the total radiating power:</p> <p>A- In the frequency domains (2,69-2,5) GHz, and (5-4,8) GHz, the spectral density to the total radiated power must be less than the maximum of Spectral density of equivalent isotropic radiating power radioactive capacity (EIRP) by (10d B)</p> <p>B- In the frequency domains (3,8-3,4) GHz, the spectral density to the total radiating power must be less than the maximum of Spectral density of equivalent isotropic radiating power radioactive capacity (EIRP) (EIRP) by (5d B)</p>
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## 7- Building Material Analyses Devices (BMA)

Application type	Building Material Analyses Devices (BMA)			
UWB Frequency Domain	Working in all or part of the frequency band (8,5-2,2) GHz			
Frequency (GHz)	Maximum Average of spectral density for equivalent isotropic Radiating power radioactive capacity (EIRP) (dBm/MHz)	Usage	License requirements	Other requirements
Less than 1,73	85-	Includes skilled workers, experts, arts historians, architects, designers, environmentalists, civil engineers, in addition to ordinary users who works by themselves.	Exempted of obtaining radio license.	1- devices should be designed so that do not radiate in free space and working only when placed in a location that allow them transmitting direct waves to the material that absorb those waves such as walls and other construction material that absorb emissions
2,2-1,73	65-			
2,5-2,2	50-			
2,69-2,5	65-			
2,7-2,69	55-			
2,7-2,9	50-			
2,9-3,4	70-			
3,4-4,8	50-			
5-4,8	55-			
8,5-5	50-			
More than 8,5	85-			

notes	To protect the radio astronomy service (RAS) in domains (2,69-2,7)GHz and (5-4,8) GHz , the frequency density of total radiating power should be less than (dBm/MHz65-)
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## Appendix B

### **UWB Necessary Techniques for Reducing Interferences**

Frequency domains between (4.8-3.1) GHz and (9-8.5) GHz require techniques that reduce interferences and allowing UWB devices to coexistence with other radio telecommunications systems: low duty cycle technique (LDC), Detection and avoidance technology (DAA) which is a technique that has been used to ensure protection for terminal devices to serve wideband wireless access (BWA) and radiolocation applications (Radiolocation).

#### **1- Low Duty Cycle Technique (LDC)**

It is necessary to know the written relationship between the emission limits in UWB devices and the technique of low duty cycle. When increasing LDC technique and reducing the emission capacity power, the same impact must be given similar to the proposed original limits. Note, that the unlimited written relation (unbounded trade-off power and duty cycle) isn't possible to be applied here, because the law of dealing with DC technique and the emission power is only possible (applicable) in a written method and within certain limits.

#### ❖ Technical requirements for the low duty cycle (LDC)

The major technical requirements for the low duty cycle technique LDC of the single ultra wide band device (single UWB devices) that is included in the Report: ECC/DEC/(06)04 (2).

- Ton maximum (ton max)= 5 Mil/second
- Toff medium (toffmean)  $\geq 38$  Mil/second (medium rate during one second)
- Total Toff ( $\sum$ Toff)  $> 950$  Mil/second per each second.
- Total Ton ( $\sum$ Ton)  $< 18$  second per each hour.



## Abbreviations definition:

- **Ton**: is the time period for a (burst) regardless of number of pulses included.
- **Toff**: is the time interval between two consecutive pulses when the emission of UWB is inactive position.

In case of UWB devices that are used in tracking locations applications (UWB devices for location tracking applications (LT2)). The major requirements or determinants are:

- **Ton maximum (Ton max) = 25 mil/second**
- **Toff medium (Toffmean)  $\geq 38$  mil/second (medium average within one second)**
- **Toff total ( $\sum$ Toff)  $> 950$  Mil/second per each second**
- **Ton total ( $\sum$ Ton)  $< 900$  mil/second per each minute.**

## 2- Detection and avoidance technology (DAA)

Applying detection and avoidance technology (DAA) achieve the enhance possibility for the coexistence with the other radio communications systems.

The technical requirements of detection and avoidance technology in frequency domains mentioned above based on active radio systems features. Note that the concept of the detection and avoidance technology has high flexibility, this concept depend on the definition of (Zones) areas when the level of radiating power from UWB is permitted. These (Zones) are defined by (Isolation) principle between (victim) device/system and UWB device.

❖ Detection and Avoidance Technology DAA Requirements:

- UWB device should be able to monitor the environment of wireless frequency within the period of the minimum limit stated in the table of technical requirements table for detection and avoidance technology (DAA) listed in the regulation before starting calling across UWB device to discover any running signal that might be negatively affective, and to determine the region in which it will be serving in.
- UWB devices must be continuously able to discover any variation in wireless frequency setting, and shift to the emissions level within the maximum period of time for detection and avoidance, according to the service that was negatively affected.

**Reliable sources in the process of issuing this regulation.**

serial	Sources
1	Recommendation ITU-REC-SM.1754
2	Recommendation ITU-REC-SM. 1755
3	Recommendation ITU-REC-SM. 1756
4	Recommendation ITU-REC-SM.1757
5	State of Oman/ Telecommunications Regulatory Commission/ UWB Regulatory Technique.
6	Communication and Information Technology Commission/ Kingdom of Saudi Arabia/ Operational features for ultra wide band devices.