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***Communications for all in East Africa***

**3rd EACO WRC-23 preparatory meeting (17th-19th/08/2021)**

CHAPTER 3 (Science issues)

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| **Input Document**  |

**Agenda Item 1.12**

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| ***Part A: Description*** |
| *to conduct, and complete in time for WRC 23, studies for a possible new secondary allocation to the Earth exploration-satellite (active) service for spaceborne radar sounders within the range of frequencies around 45 MHz, taking into account the protection of incumbent services, including in adjacent bands, in accordance with Resolution* ***656 (Rev. WRC 19)****;*Resolution **656 (Rev. WRC 19) -** *Possible secondary allocation to the Earth exploration-satellite service (active) for spaceborne radar sounders in the range of frequencies around 45 MHz.* |
| ***Part B: Key Elements – the notables*** |
| This agenda item seeks a new secondary allocation to the Earth exploration-satellite (EESS) (active) service for spaceborne radar sounders within a range of frequencies around 45 MHz while considering the protection of incumbent services including those in adjacent bands.The following are the notables in respect to this Agenda Item;1. There is an interest in using active spaceborne sensors in the vicinity of the frequency range 40-50 MHz for measurements of the Earth’s subsurface to provide radar maps of subsurface scattering layers with the intent to locate water/ice/fossil deposits.
2. The active spaceborne sensors can provide unique information on physical properties of the Earth and other planets and require specific frequency ranges depending on the physical phenomena to be observed.

Therefore;A secondary allocation for EESS (active) in the 40-50 MHz frequency range will enable the operation of a scientific mission that will produce sub-surface data with a vertical resolution of 5-7 m. The mission’s scientific objectives are:1. to understand the global thickness, inner structure, and the thermal stability of the Earth’s ice sheets (e.g. in Greenland and Antarctica-*see fig 1*) as an observable parameter of Earth climate evolution, and
2. to understand the occurrence, distribution, and dynamics of the Earth fossil aquifers in desert environments such as those in northern Africa *(see fig 1)* and the Arabian Peninsula as key elements in understanding recent paleoclimatic changes.

*Figure 1: Coverage area for Spaceborne radar sounders (yellow circles)* |
| ***Part C: Current Status of Band*** |
| **Part A: RR Article 5**Provides the following in terms of the international frequency allocation of the frequency band 40-50 MHz and adjacent bands.

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| Allocation to services |
| Region 1 | Region 2 | Region 3 |
| **24 990-25 005** STANDARD FREQUENCY AND TIME SIGNAL (25 000 kHz) |
| **25 005-25 010** STANDARD FREQUENCY AND TIME SIGNAL Space research |
| **25 010-25 070** FIXED MOBILE except aeronautical mobile |
| **25 070-25 210** MARITIME MOBILE |
| **25 210-25 550** FIXED MOBILE except aeronautical mobile |
| **25 550-25 670** RADIO ASTRONOMY5.149 |
| **25 670-26 100** BROADCASTING |
| **26 100-26 175** MARITIME MOBILE 5.132 |
| **26 175-26 200** FIXED |
| 26 200-26 350FIXEDMOBILE except aeronauticalmobileRadiolocation 5.132A5.133A | 26 200-26 420FIXEDMOBILE except aeronauticalmobileRADIOLOCATION 5.132A | 26 200-26 350FIXEDMOBILE except aeronauticalmobileRadiolocation 5.132A |
| 26 350-27 500FIXEDMOBILE except aeronauticalMobile5.150 | 26 350-27 500FIXEDMOBILE except aeronauticalmobile5.150 |
| 26 420-27 500FIXEDMOBILE except aeronauticalmobile5.150 |
| 27.5-28 METEOROLOGICAL AIDSFIXEDMOBILE |
| 28-29.7 AMATEURAMATEUR-SATELLITE |
| 29.7-30.005 FIXEDMOBILE |
| 30.005-30.01 SPACE OPERATION (satellite identification)FIXEDMOBILESPACE RESEARCH |
| 30.01-37.5 FIXEDMOBILE |
| 37.5-38.25 FIXED MOBILE Radio astronomy 5.149 |
| 38.25-39FIXEDMOBILE | 38.25-39.986FIXEDMOBILE | 38.25-39.5FIXEDMOBILE |
| 39-39.5FIXEDMOBILERadiolocation 5.132A5.159 |
| 39.5-39.986FIXEDMOBILE | 39.5-39.986FIXEDMOBILERADIOLOCATION 5.132A |
| 39.986-40.02FIXEDMOBILESpace research | 39.986-40FIXEDMOBILERADIOLOCATION 5.132ASpace research |
| 40-40.02FIXEDMOBILESpace research |
| 40.02-40.98 FIXED MOBILE 5.150 |
| 40.98-41.015 FIXEDMOBILESpace research5.160 5.161 |
| 41.015-42 FIXEDMOBILE5.160 5.161 5.161A |
| **42-42.5**FIXEDMOBILERadiolocation 5.132A5.160 5.161B | **42-42.5**FIXEDMOBILE5.161 |
| **44-47** FIXED MOBILE 5.162 5.162A |
| **47-50**BROADCASTING5.162A 5.163 5.164 5.165 | **47-50**FIXEDMOBILE | **47-50**FIXEDMOBILEBROADCASTING5.162A |
| **50-52**BROADCASTINGAmateur 5.166A 5.166B 5.166C5.166D 5.166E 5.169 5.169A5.169B5.162A 5.164 5.165 | **50-54**AMATEUR**52-68** 5.162A 5.167 5.167A 5.168 5.170 |
| **52-68** BROADCASTING5.162A 5.163 5.164 5.1655.169 5.169A 5.169B 5.171 |
| **54-68**BROADCASTINGFixedMobile5.172 | **54-68**FIXEDMOBILEBROADCASTING5.162A |

**Part B: African common allocations and typical applications as per AfriSAP**AfriSAP provides the following in terms of the African common allocations and typical utilizations for the frequency range 40 – 50MHz and adjacent bands.

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| **ITU Region 1 Allocation and footnotes** | **African Common Allocation (s) and footnotes** | **Typical Application** |
| 24 990-25 005 kHzSTANDARD FREQUENCY AND TIME SIGNAL (25 000 kHz) | 24 990-25 005 kHzSTANDARD FREQUENCY AND TIME SIGNAL (25 000 kHz) |  |
| 25 005-25 010 kHzSTANDARD FREQUENCY AND TIME SIGNALSpace research | 25 005-25 010 kHzSTANDARD FREQUENCY AND TIME SIGNALSpace research |  |
| 25 010-25 070 kHzFIXEDMOBILE except aeronautical mobile | 25 010-25 070 kHzFIXEDMOBILE except aeronautical mobile | Fixed and Mobile applications |
| 25 070-25 210 kHzMARITIME MOBILE | 25 070-25 210 kHzMARITIME MOBILE | Maritime applications |
| 25 210-25 550 kHzFIXEDMOBILE except aeronautical mobile | 25 210-25 550 kHzFIXEDMOBILE except aeronautical mobile | Fixed and Mobile Applications |
| 25 550-25 670 kHzRADIO ASTRONOMY5.149 | 25 550-25 670 kHzRADIO ASTRONOMY5.149 | Radio Astronomy (Observations of decametric radiation) |
| 25 670-26 100 kHzBROADCASTING | 25 670-26 100 kHzBROADCASTING | HF Sound Broadcasting |
| 26 100-26 175 kHzMARITIME MOBILE 5.132 | 26 100-26 175 kHzMARITIME MOBILE 5.132 | Maritime applications |
| 26 175-26200 kHzFIXEDMOBILE except aeronautical mobile | 26 175-26 200 kHzFIXEDMOBILE except aeronautical mobile | Fixed ApplicationsMobile systems (single frequency)CB Radio (26.96-27.410 MHz) |
| **26 200-26 350 kHz**FIXEDMOBILE except aeronautical mobileRadiolocation 5.132A | **26 200-26 350 kHz**FIXEDMOBILE except aeronautical mobileRadiolocation 5.132A | Fixed and mobile applications |
| **26 350-27 500 kHz**FIXEDMOBILE except aeronautical mobile5.150 | **26 350-27 500 kHz**FIXEDMOBILE except aeronautical mobile5.150 | Fixed and mobile applicationsInductive/non-specific SRD applications (26 957-27 283 kHz):* Wireless control devices

Measurement equipment |
| 27.5-28 MHzMETEOROLOGICAL AIDSFIXEDMOBILE | 27.5-28 MHzMETEOROLOGICAL AIDSFIXEDMOBILE | Fixed and mobile applicationsMeteorological applications |
| 28-29.7 MHzAMATEURAMATEUR-SATELLITE | 28-29.7 MHzAMATEURAMATEUR-SATELLITE | Amateur communicationsAmateur-satellite communications |
| 29.7-30.005 MHzFIXEDMOBILE | 29.7-30.005 MHzFIXEDMOBILE | Fixed Applications |
| 30.005-30.01 MHzSPACE OPERATION (satellite identification)FIXEDMOBILESPACE RESEARCH | 30.005-30.01 MHzSPACE OPERATION (satellite identification)FIXEDMOBILESPACE RESEARCH |  |
| 30.01-37.5 MHzFIXEDMOBILE | 30.01-37.5 MHzFIXEDMOBILE | Fixed and mobile applicationsPrivate Mobile Radio (walkie talkies) |
| 37.5-38.25 MHzFIXEDMOBILERadio astronomy5.149 | 37.5-38.25 MHzFIXEDMOBILERadio astronomy5.149 | Private Mobile Radio (walkie talkies)Radio Astronomy (Observations of decametric radiation) |
| 38.25-39 MHzFIXEDMOBILE | 38.25-39 MHzFIXEDMOBILE | Private Mobile Radio (walkie talkies)Mobile applications |
| **39-39.5 MHz**FIXEDMOBILERadiolocation 5.132A5.159 | **39-39.5 MHz**FIXEDMOBILERadiolocation 5.132A | Mobile applications |
| **39.5-39.986 MHz**FIXEDMOBILE | **39.5-39.986 MHz**FIXEDMOBILE |  |
| 39.986-40.02 MHzFIXEDMOBILESpace research | 39.986-40.02 MHzFIXED MOBILESpace research | Private Mobile Radio (walkie talkies) |
| 40.02-40.98 MHzFIXEDMOBILE5.150 | 40.02-40.98 MHzFIXEDMOBILE5.150  | Private Mobile Radio (walkie talkies)Fixed applicationsSRD (40.66 – 40.7 MHz):* Radio Microphone
* Wireless control devices

Measurement equipment |
| 40.98-41.015 MHzFIXEDMOBILESpace research5.160 5.161 | 40.98-41.015 MHzFIXEDMOBILESpace research5.160[AddA4] | Private Mobile Radio (walkie talkies) |
| 41.015-42MHzFIXEDMOBILE5.160 5.161 | 41.015-42 MHzFIXEDMOBILE5.160[AddA4] | Private Mobile Radio (walkie talkies)Fixed Applications |
| **42-42.5 MHz**FIXEDMOBILERadiolocation 5.132A5.160 5.161B | **42-42.5 MHz**FIXEDMOBILERadiolocation 5.132A5.160[AddA4] |  |
| **42.5-44 MHz**FIXEDMOBILE5.160 5.161 5.161A  | **42.5-44 MHz**FIXEDMOBILE5.160[AddA4] | Fixed and mobile applications |
| 44-47 MHzFIXEDMOBILE5.162 5.162A | 44-47 MHzFIXEDMOBILE | Private Mobile Radio (walkie talkies)Meteor Burst (45.3-46.9 MHz) |
| 47-50 MHzBROADCASTING5.162A 5.163 5.164 5.165 | 47-50 MHzBROADCASTING5.164[AddA14] 5.165 [AddA12] | Private Mobile Radio (walkie talkies)Meteor Burst (47.5-49.1 MHz) Broadcasting systems |
| 50-52 MHzBROADCASTINGAmateur 5.166A 5.166B 5.166C 5.166D 5.166E 5.169 5.169A 5.169B5.162A 5.164 5.165  | 50-52 MHzBROADCASTINGAmateur 5.166B 5.166C 5.169[AltA10] 5.169A[AltA10] 5.169B[UseL5]5.164[AddA14] 5.165 | Broadcasting systems |
| 52-68 MHzBROADCASTING5.162A 5.163 5.164 5.165 5.169 5.169A 5.169B 5.171  | 52-68 MHzBROADCASTING5.164[AddA14] 5.165 [AddA12] 5.169[AltA10] 5.169A[AltA10] 5.169B[UseL5] 5.171[AddA11] | Broadcasting systems |

To satisfy the requirements/invite of **RES 656 (Rev. WRC 19),** WP 7C responsible for the AI considered services within a frequency range ± 15MHz from the frequency 45MHz. Table 1 below lists incumbent services that could be impacted.

|  |  |
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| **Services** | **Frequency band (MHz)** |
| **25-40** | **40-50** | **50-65** |
| Standard Frequency and Time | [24.99-25.005] |  |  |
|  | 39.986-40.02 |  |
| Fixed | [25.01-25.07] | 37.5-50 | [68-74.8] |
| [25.21-25.33] |  |  |
| [26.175-28] |  |  |
| [29.7-30.005] |  |  |
| [37.5-38.02] |  |  |
| [38.25-39.986] |  |  |
| Mobile | [25.01-25.07] | 37.5-50 | [68-74.8] |
| [25.21-25.33] |  |  |
| [27.5-28] |  |  |
| [29.7-30.006] |  |  |
| Maritime Mobile | [25.07-25.21] | 44-47 |  |
| [26.1-26.175] |  |  |
| Radio Astronomy | [25.55-25.67] |  |  |
| 37.5-38.25 |  |  |
| Broadcasting | [25.67-26.1] | 47-50 | [50-68] |
|  |  | [68-72] |
| Meteorological Aids | [27.5-28] |  |  |
| Amateur/Amateur Satellite | [28-29.7] |  | 50-54 |
| Space Research |  | 39.986-40.02 |  |
|  | 40.98-41.015 |  |
| Radiolocation |  | 39.986-40.02 | [54-68] |
|  | 42-42.5 | [68-72] |
|  | 41-441 |  |
|  | 41.015-41.6652 |  |
|  | 43.35-442 |  |
|  | 46-683 |  |
| 1 Radio Regulations (RR) **5.161** allocates the radiolocation service (RLS) in the 41-44 MHz band in Iran (Islamic Republic of) and Japan on a secondary basis.2 RR **5.161A** allocates the 41.015-41.665 MHz and 43.35-44 MHz bands to the RLS on a primary basis in Korea (Rep. of) and the Unites States.3 RR **5.162A** allocates the 46-68 MHz band to the RLS on a secondary basis to 32 countries. |

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| ***Part D: Conclusion of the results of studies, if any*** |
| Compatibility studies between the radar sounders and incumbent services operating in the 40-50 MHz frequency band are yet to be completed. However, the following have preliminarily been established.1. PDR ITU-R RS 2455-1, which among others highlights
2. spaceborne radar sounders operational characteristics based on description in **ITU-R RS 2042,**
3. two study analysis methodologies.
* Static methodology and,
* Dynamic methodology
1. typical emission spectrum mask for radar sounders operating in the range 40-50 MHz

aaf2e240-c7d0-46ff-84da-f7a6cdb0f1a1*Figure 2: Chirp Emission Spectrum*1. The typical operation time of radar sounders, i.e. local hours of 3 a.m. to 6 a.m
2. Pfd and spectral pfd levels on the earth’s service;
* power flux-density (pfd) of −93.3 dB(W/m2) at 45 MHz at the surface of the Earth,
* spectral pfd of -163.3 dB(W/m2-Hz) at 45MHz
1. service protection criteria whereby maximum interference levels for incumbent services within the 40-50MHz frequency band are highlighted (*see table 2 below)*

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| **Service** | ***I/N*(dB)** | **Channelbandwidth (kHz)** | **Maximum interference level (dBW/channel bandwidth)** |
| Fixed | −6 | 36  | −141.4 |
| Mobile | −10 | 16 | −148.9 |
| Broadcasting | −10 | 9\* | −151.4 |
| Space Research | −6 | 1 | −157 |
| Radiolocation | −6 | 125 | −136 |
| \* The appropriate value for channel bandwidth used in the calculations for the Broadcasting service needs further investigation. Information from ITU-R Recommendations, WP6A, and other sources indicate that values of bandwidth could possibly range from 9 kHz to 3 MHz. This will be investigated in future studies. |

1. Draft CMP text for the Agenda Item towards WRC-23

Preliminary study results indicate that;1. With the static analysis methodology,
2. Broadcasting and space research services are compatible with operations of spaceborne radar sounders in the frequency range 40-50MHz
3. incumbent fixed, mobile, and radiolocation will require further assessment (dynamic analysis.
4. With the dynamic analysis methodology,

 Results of this analysis methodology are yet to be concluded. |
| ***Part E: Options and Associated Implications*** |
| These are yet to be established |
| ***Part F: Preliminary EACO Common View and/or Position*** |
| Support the ITU-R technical and regulatory studies to satisfy the invite under Resolution 656, while ensuring the protection of incumbent services in the frequency band 40-50 MHz and in the adjacent bandsnoting that**,** the scientific objectives of this application have significant global humanitarian benefits to the understanding of the environmental changes and climatic evolutions. |
| ***Part G: Recommendations and Way Forward*** |
| EACO invites member states to:1. Follow-up the studies under this agenda item and to ensure the protection of existing radio services in the band 40-50 MHz and radio services in adjacent bands,
2. Continue following up and participate in the development of the PDN ITU-R RS.2455,
3. Participate in any further sharing and compatibility studies that will be conducted, as well as regulatory considerations,
4. Propose updates to the African Common Proposal based on the developments of this Agenda Item.
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| ***Part H: Other Regional Groups and international organizations Preliminary Positions***  |
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| **RCC** | The RCC Administrations support conducting studies for a new secondary allocation to the Earth exploration-satellite (active) service within the range of frequencies around 45 MHz. |
| **ASMG** | Follow-up the studies under this agenda item and to ensure the protection of existing radio services in the band 40-50 MHz and radio services in adjacent bands. |
| **APT** | Of the view that a possible new secondary allocation could be considered to the Earth exploration-satellite service (active) for spaceborne radar sounders within the range of frequencies around 45 MHz if ITU-R studies show that the protection of in-band and adjacent band incumbent services could be ensured while not imposing any additional restrictions onto those services. |

 |