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**Fixed Terrestrial Services Band Plan 2022 for
Eswatini**

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Table of Contents

| | | |
|------|--|----|
| 1 | Introduction | 4 |
| 1.1 | Background | 4 |
| 1.2 | Intention of the Commission | 4 |
| 2 | Development of the Band Plan for Fixed Services Bands..... | 24 |
| 2.1 | Introduction | 24 |
| 2.2 | Radio Frequency Channel Arrangements | 24 |
| 2.3 | List of Frequency bands and adopted Recommendations..... | 26 |
| 2.4 | Channel Arrangements for Different Fixed Services Bands..... | 27 |
| 3 | Current Usage in the Fixed Services Bands | 54 |
| 3.1 | 1.4GHz Band..... | 54 |
| 3.2 | 2GHz Band..... | 54 |
| 3.3 | 2.4 GHz Band..... | 54 |
| 3.4 | 4GHz Band..... | 55 |
| 3.5 | 5GHz Band..... | 55 |
| 3.6 | 7GHz Band..... | 55 |
| 3.7 | Lower 8GHz Band | 56 |
| 3.8 | Upper 8GHz Band..... | 57 |
| 3.9 | 10.5 GHz Band..... | 57 |
| 3.10 | 11GHz Band..... | 57 |
| 3.11 | 13GHz Band..... | 58 |
| 3.12 | 14GHz Band..... | 59 |
| 3.13 | 15GHz Band..... | 59 |
| 3.14 | 18GHz Band..... | 59 |
| 3.15 | 23GHz Band..... | 61 |
| 3.16 | 26GHz Band..... | 61 |
| 3.17 | 28GHz Band..... | 61 |
| 3.18 | 31GHz Band..... | 62 |
| 3.19 | 32GHz Band..... | 62 |
| 3.20 | 38GHz Band..... | 62 |
| 3.21 | 42GHz Band..... | 62 |
| 3.22 | 52 GHz Band..... | 62 |

| | | |
|------|--------------------------------------|----|
| 3.23 | 70/80GHz Band..... | 62 |
| 3.24 | 94GHz Band..... | 62 |
| 4 | Conclusion and Recommendations | 64 |
| 4.1 | Spectrum Assignment | 64 |
| 4.2 | 4GHz Band..... | 64 |
| 4.3 | Lower 6GHz and Upper 6GHz..... | 64 |
| 4.4 | Lower 8GHz Band | 65 |
| 4.5 | 14GHz | 65 |

List of Tables

| | | |
|-----------|---|----|
| Table 1: | Channelling Arrangement in 1.4GHz Band – Option 1 | 6 |
| Table 2: | Channelling Arrangement in 1.4GHz Band – Option 2 | 6 |
| Table 3: | Channelling Arrangement in 2GHz Band | 7 |
| Table 4: | Channelling Arrangement in 2.4GHz Band | 7 |
| Table 5: | Channelling Arrangement in 4GHz Band | 9 |
| Table 6: | Channelling Arrangement in 5GHz Band | 10 |
| Table 7: | Channelling Arrangement in 7GHz Band | 10 |
| Table 8: | Channelling Arrangement in the lower 8GHz Band | 11 |
| Table 9: | Channelling Arrangement in the Upper 8GHz Band based on 14MHz Bandwidth | 11 |
| Table 10: | Channelling Arrangement in the upper 8GHz Band based on 7MHz Bandwidth..... | 12 |
| Table 11: | Channelling Arrangement in the 10.5GHz Band..... | 12 |
| Table 12: | Channelling Arrangement in the 11GHz Band..... | 13 |
| Table 13: | Channelling Arrangement in the 13GHz Band..... | 13 |
| Table 14: | Channelling Arrangement in the 14GHz Band..... | 14 |
| Table 15: | Channelling Arrangement in the 15GHz Band..... | 14 |
| Table 16: | Channelling Arrangement in the 18GHz Band..... | 15 |
| Table 17: | Channelling Arrangement in the 23GHz Band..... | 17 |
| Table 18: | Channelling Arrangement in the 26GHz Band..... | 18 |
| Table 19: | Channelling Arrangement in the 28GHz Band..... | 18 |
| Table 20: | Channelling Arrangement in the 31GHz Band..... | 19 |
| Table 21: | Channelling Arrangement in the 32GHz Band..... | 19 |
| Table 22: | Channelling Arrangement in the 38GHz Band..... | 20 |
| Table 23: | Channelling Arrangement in the 42GHz Band..... | 20 |
| Table 24: | Channelling Arrangement in the 52GHz Band..... | 21 |
| Table 25: | Channelling Arrangement in the 70/80GHz Band | 21 |
| Table 26: | TDD Channelling Arrangement in the 94GHz Band..... | 22 |
| Table 27: | FDD Channelling Arrangement in the 94GHz Band | 22 |
| Table 28: | List of Frequency bands and adopted recommendations | 26 |
| Table 29: | Channel assignments in the 2.4GHz band | 54 |
| Table 30: | Channel Assignments in 5GHz Band | 55 |
| Table 31: | Channel Assignments in 7GHz Band | 55 |
| Table 32: | Channel Usage in 7GHz Band | 56 |
| Table 33: | Channel Assignments in lower 8GHz Band..... | 56 |
| Table 34: | Channel Usage in lower 8GHz Band..... | 56 |

| | |
|--|----|
| Table 35: Channel Assignment in upper 8GHz Band..... | 57 |
| Table 36: Channel Assignment in upper 8GHz Band..... | 57 |
| Table 37: Channel Assignment in 11GHz Band..... | 57 |
| Table 38: Channel Assignment in 13GHz Band..... | 59 |
| Table 39: Channel Assignment in 15GHz Band..... | 59 |
| Table 40: Channel Assignment in 18GHz Band..... | 60 |
| Table 41: Channel Assignment in 23GHz Band..... | 61 |
| Table 42: Channel Assignment in 26GHz Band..... | 61 |
| Table 43: Channel Assignment in 26GHz Band..... | 62 |
| Table 45: Recommended Assignments in the 4GHz band | 64 |
| Table 46: Recommended Assignments in the Lower 8GHz band | 65 |

List of Figures

| | |
|--|----|
| Figure 1 Radio frequency channel arrangements for the three possible schemes considered..... | 25 |
| Figure 2: RF Channel arrangement for FWS operating in 2300 – 2500MHz..... | 30 |
| Figure 3: Channel arrangement in the 4GHz Band..... | 30 |
| Figure 4: Channel arrangement in the 4GHz Band..... | 31 |
| Figure 5: Usage scheme under the 7GHz band..... | 32 |
| Figure 6: Channelling arrangement in the Lower 8GHz band..... | 33 |
| Figure 7: Channelling arrangement in the Upper 8GHz band..... | 35 |
| Figure 8: 28 MHz block plan for 10.5GHz band | 35 |
| Figure 9: 30 MHz block plan for 10.5GHz | 35 |
| Figure 10: Channel arrangement for 11GHz Band..... | 36 |
| Figure 11: Channelling arrangement for 13GHz band..... | 37 |
| Figure 12: Channelling arrangement for 14GHz band..... | 38 |
| Figure 13: Channelling arrangement for 15GHz band..... | 38 |
| Figure 14: Channelling arrangement for 18GHz band..... | 40 |
| Figure 15: Channelling arrangement for 13GHz band..... | 41 |
| Figure 16: Channelling arrangement for 26GHz band..... | 42 |
| Figure 17: Channelling arrangement for 28GHz band..... | 43 |
| Figure 18: Channelling arrangement in the 32GHz band | 45 |
| Figure 19: Channelling arrangement in the 38GHz band | 46 |
| Figure 20: Channelling arrangement in the 42GHz band | 48 |
| Figure 21: Spectrum allocation and channel distribution in the 70 / 80 GHz band | 50 |
| Figure 22: Combining the 250 MHz channels from 71-76/81-86 GHz bands into a single FDD arrangement..... | 51 |
| Figure 23: Combining the 250 MHz channels from single 71-76 GHz or 81-86 GHz band into separate FDD arrangement with duplex separation of 2.5 GHz..... | 51 |
| Figure 24: Occupied Spectrum in 92 to 95 GHz band note 1 and note 2..... | 52 |

1 Introduction

1.1 Background

Fixed services are widely used by Communications service providers for backhaul, broadcasting, and other large-scale data transmissions. They can be thought of as the backbone of the digital economy and ensuring efficient use of fixed services bands can help achieve the growth of the Communications sector for the Kingdom of Eswatini.

In the country, the management and use of radio frequency spectrum resources is guided by the Electronic Communication Act, 2013 and the Electronic Communications (Radio Communications and Frequency Spectrum) Regulations, 2016. The National Frequency Allocation Plan (NFAP) further provides a clear structure on the allocation of spectrum resources to different services. The current NFAP identifies a number of spectrum bands which can be used for Terrestrial Fixed Service systems in Eswatini.

The Commission recognises that there is a legal and regulatory requirement to propose band channelling arrangements for the different services in accordance with national priorities and the NFAP. Therefore, in accordance with the tenants of the Electronic Communications Act, 2013, the channelling plan for Fixed Services bands is based on technology neutrality, meaning that the Commission does not impose the technology used in service deployment in any of the bands, thereby promoting the use of radio frequency spectrum resources to achieve socio-economic transformation of the country. The Fixed Services Band Plan ensures the harmonisation of radio frequency channel arrangements of key frequency bands allocated to fixed services. It however, does not address issues of frequency sharing and coordination, spectrum licensing, frequency migration or re-farming.

1.2 Intention of the Commission

The Commission, in accordance with the Electronic Communications Act 2013 and the Electronic Communications (Radiocommunications and Frequency Spectrum) Regulations, 2016, developed and published a fixed services band plan in 2018. However, due to changes emanating from the outcomes of the World

Radiocommunications Conference of 2019 (WRC-19), the band plan requires a review in order to incorporate the changes. Therefore, the Commission intends to publish a reviewed band plan for Terrestrial Fixed Services bands which gives channelling structure for all bands currently allocated to Fixed services. It also outlines the currently assigned spectrum and also recommends steps to be taken in order to ensure that all assignments are according to the proposed band plan.

The Radio Communications and Frequency Spectrum Regulations 2016 state the following requirements in relation to radio frequency spectrum band plans:

5. (1) *The Commission may in accordance with section 34 of the Act, prepare a national frequency allocation plan.*

(2) The National Frequency Allocation plan shall fall under the Radio Frequency Plan and shall be detailed and provide a description of how a band is allocated.

(3) Radio Frequency Spectrum Band Plans shall specify the purposes for which bands may be used, arising from Government policy initiatives or public demand.

(4) Radio Frequency Spectrum band plans may specify or propose –

(a) detailed frequency channelling arrangements;

(b) technical and other requirements; or

(c) principles or assignment and implementation for the detailed allocation of the radio frequency spectrum between types of services.

(5) Radio Frequency Band Plans shall be subject to consultation.

The document presents the different frequency bands allocated for Fixed Services in Eswatini as well as the channelling arrangements for the allocated bands. The following are decisions and plans for the different Terrestrial Fixed Services bands:

1.2.1 1.4GHz Band

The proposed channelling arrangement for this band is the band 1350 – 1375 MHz paired with 1492 – 1517 MHz as presented in the NFAP and in Annex 1 to ITU-R Recommendation F.1242. This arrangement provides for 12 full-

duplex channels of 2 MHz paired, with a transmitter-receiver duplex spacing of 142 MHz, the channelling arrangement is as shown in Table 1.

Table 1: Channelling Arrangement in 1.4GHz Band – Option 1

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|------------|------------------|------------|------------------|
| 1 | 1351,5 | 1' | 1493,5 |
| 2 | 1353,5 | 2' | 1495,5 |
| 3 | 1355,5 | 3' | 1497,5 |
| 4 | 1357,5 | 4' | 1499,5 |
| 5 | 1359,5 | 5' | 1501,5 |
| 6 | 1361,5 | 6' | 1503,5 |
| 7 | 1363,5 | 7' | 1505,5 |
| 8 | 1365,5 | 8' | 1507,5 |
| 9 | 1367,5 | 9' | 1509,5 |
| 10 | 1369,5 | 10' | 1511,5 |
| 11 | 1371,5 | 11' | 1513,5 |
| 12 | 1373,5 | 12' | 1515,5 |

An alternative channelling arrangement in the 1.4GHz band which provides for 12 full-duplex channels of 2 MHz paired, with a transmitter-receiver duplex spacing of 52 MHz is shown Table 2:

Table 2: Channelling Arrangement in 1.4GHz Band – Option 2

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|------------|------------------|------------|------------------|
| 1 | 1353,75 | 1' | 1495,75 |
| 2 | 1357,25 | 2' | 1499,25 |
| 3 | 1360,75 | 3' | 1502,75 |
| 4 | 1364,25 | 4' | 1506,25 |
| 5 | 1367,75 | 5' | 1509,75 |
| 6 | 1371,25 | 6' | 1513,25 |
| 7 | 1374,75 | 7' | 1516,75 |
| 8 | 1378,25 | 8' | 1520,25 |
| 9 | 1381,75 | 9' | 1523,75 |
| 10 | 1385,25 | 10' | 1527,25 |
| 11 | 1388,75 | 11' | 1530,75 |
| 12 | 1392,25 | 12' | 1534,25 |

1.2.2 2GHz Band

The proposed channelling arrangement for this band is the band 2025 – 2110 MHz paired with 2200 – 2290 MHz as presented in Annex 1 to ITU-R Recommendation F.1098. This arrangement provides for 6 full-duplex channels of 14 MHz paired, with a transmitter-receiver duplex spacing of 175 MHz. Current assignments in this band (EPTC) shall be realigned to conform to this channelling arrangements. The channelling arrangement is as shown in **Table 3**.

Table 3: Channelling Arrangement in 2GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|------------|------------------|------------|------------------|
| 1 | 2032.5 | 1' | 2207.5 |
| 2 | 2046.5 | 2' | 2221.5 |
| 3 | 2060.5 | 3' | 2235.5 |
| 4 | 2074.5 | 4' | 2249.5 |
| 5 | 2088.5 | 5' | 2263.5 |
| 6 | 2102.5 | 6' | 2277.5 |

1.2.3 2.4GHz Band

The channel arrangement for the 2.4 GHz band (2300 – 2500 MHz) as presented in Annex 1 to ITU-R Recommendation F.746, This arrangement provides for 80 full-duplex channels of 1 MHz paired: The channelling arrangement is as shown in **Table 4**.

Table 4: Channelling Arrangement in 2.4GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|------------|------------------|------------|------------------|
| 1 | 2308 | 1' | 2402 |
| 2 | 2309 | 2' | 2403 |
| 3 | 2310 | 3' | 2404 |
| 4 | 2311 | 4' | 2405 |
| 5 | 2312 | 5' | 2406 |
| 6 | 2313 | 6' | 2407 |
| 7 | 2314 | 7' | 2408 |
| 8 | 2315 | 8' | 2409 |
| 9 | 2316 | 9' | 2410 |
| 10 | 2317 | 10' | 2411 |
| 11 | 2318 | 11' | 2412 |
| 12 | 2319 | 12' | 2413 |

| | | | |
|----|------|-----|------|
| 13 | 2320 | 13' | 2414 |
| 14 | 2321 | 14' | 2415 |
| 15 | 2322 | 15' | 2416 |
| 16 | 2323 | 16' | 2417 |
| 17 | 2324 | 17' | 2418 |
| 18 | 2325 | 18' | 2419 |
| 19 | 2326 | 19' | 2420 |
| 20 | 2327 | 20' | 2421 |
| 21 | 2328 | 21' | 2422 |
| 22 | 2329 | 22' | 2423 |
| 23 | 2330 | 23' | 2424 |
| 24 | 2331 | 24' | 2425 |
| 25 | 2332 | 25' | 2426 |
| 26 | 2333 | 26' | 2427 |
| 27 | 2334 | 27' | 2428 |
| 28 | 2335 | 28' | 2429 |
| 29 | 2336 | 29' | 2430 |
| 30 | 2337 | 30' | 2431 |
| 31 | 2338 | 31' | 2432 |
| 32 | 2339 | 32' | 2433 |
| 33 | 2340 | 33' | 2434 |
| 34 | 2341 | 34' | 2435 |
| 35 | 2342 | 35' | 2436 |
| 36 | 2343 | 36' | 2437 |
| 37 | 2344 | 37' | 2438 |
| 38 | 2345 | 38' | 2439 |
| 39 | 2346 | 39' | 2440 |
| 40 | 2347 | 40' | 2441 |
| 41 | 2348 | 41' | 2442 |
| 42 | 2349 | 42' | 2443 |
| 43 | 2350 | 43' | 2444 |
| 44 | 2351 | 44' | 2445 |
| 45 | 2352 | 45' | 2446 |
| 46 | 2353 | 46' | 2447 |
| 47 | 2354 | 47' | 2448 |
| 48 | 2355 | 48' | 2449 |
| 49 | 2356 | 49' | 2450 |
| 50 | 2357 | 50' | 2451 |
| 51 | 2358 | 51' | 2452 |
| 52 | 2359 | 52' | 2453 |
| 53 | 2360 | 53' | 2454 |
| 54 | 2361 | 54' | 2455 |
| 55 | 2362 | 55' | 2456 |
| 56 | 2363 | 56' | 2457 |
| 57 | 2364 | 57' | 2458 |

| | | | |
|----|------|-----|------|
| 58 | 2365 | 58' | 2459 |
| 59 | 2366 | 59' | 2460 |
| 60 | 2367 | 60' | 2461 |
| 61 | 2368 | 61' | 2462 |
| 62 | 2369 | 62' | 2463 |
| 63 | 2370 | 63' | 2464 |
| 64 | 2371 | 64' | 2465 |
| 65 | 2372 | 65' | 2466 |
| 66 | 2373 | 66' | 2467 |
| 67 | 2374 | 67' | 2468 |
| 68 | 2375 | 68' | 2469 |
| 69 | 2376 | 69' | 2470 |
| 70 | 2377 | 70' | 2471 |
| 71 | 2378 | 71' | 2472 |
| 72 | 2379 | 72' | 2473 |
| 73 | 2380 | 73' | 2474 |
| 74 | 2381 | 74' | 2475 |
| 75 | 2382 | 75' | 2476 |
| 76 | 2383 | 76' | 2477 |
| 77 | 2384 | 77' | 2478 |
| 78 | 2385 | 78' | 2479 |
| 79 | 2386 | 79' | 2480 |
| 80 | 2387 | 80' | 2481 |

1.2.4 4GHz Band

The channelling arrangement for the 4GHz band is on the band 3600 – 4200 MHz and as presented in section 6 of Annex 1 to ITU-R Recommendation F.635. In this channel arrangement there are 9 full-duplex channels of 30 MHz paired, with a transmitter-receiver duplex spacing of 320 MHz. The channelling arrangement is as shown in *Table 5*

Table 5: Channelling Arrangement in 4GHz Band

| Channel Nr | Centre Frequency | Channel Nr | Centre Frequency |
|------------|------------------|------------|------------------|
| 1 | 3 620 | 1' | 3 940 |
| 2 | 3 650 | 2' | 3 970 |
| 3 | 3 680 | 3' | 4 000 |
| 4 | 3 710 | 4' | 4 030 |
| 5 | 3 740 | 5' | 4 060 |
| 6 | 3 770 | 6' | 4 090 |
| 7 | 3 800 | 7' | 4 120 |
| 8 | 3 830 | 8' | 4 150 |
| 9 | 3 860 | 9' | 4 180 |

1.2.5 5GHz Band

The 5GHz band is allocated for Government Use according to the National Frequency Allocation Plan 2017. The Channelling arrangement is as presented in Annex 1 of ITU-R Recommendation F.1099 where there are 7 full-duplex channels of 40 MHz paired, with a transmitter-receiver duplex spacing of 300 MHz. The channelling arrangement is as shown in *Table 6*

Table 6: Channelling Arrangement in 5GHz Band

| Channel Nr | Centre Frequency | Channel Nr | Centre Frequency |
|------------|------------------|------------|------------------|
| 1 | 4 430 | 1' | 4 730 |
| 2 | 4 470 | 2' | 4 770 |
| 3 | 4 510 | 3' | 4 810 |
| 4 | 4 540 | 4' | 4 850 |
| 5 | 4 590 | 5' | 4 890 |
| 6 | 4 630 | 6' | 4 930 |
| 7 | 4 670 | 7' | 4 970 |

1.2.6 7GHz Band

The channelling arrangement in the 7GHz band is in the band 7 110 – 7 750 MHz and is as presented in ITU-R Recommendation F.385 Annex 3 where there are 5 full-duplex channels of 28MHz paired, with a transmitter-receiver separation of 340MHz covering the lower part of the 7GHz band and 5 full-duplex channels of 28MHz paired, with a transmitter-receiver separation of 168MHz covering the upper part of the band. The channelling arrangements are as shown in *Table 7*

Table 7: Channelling Arrangement in 7GHz Band

| Channel Nr | Centre Frequency | Channel Nr | Centre Frequency |
|------------|------------------|------------|------------------|
| 1l | 7 121 | 1l' | 7 317 |
| 2l | 7 149 | 2l' | 7 345 |
| 3l | 7 177 | 3l' | 7 373 |
| 4l | 7 205 | 4l' | 7 401 |
| 5l | 7 233 | 5l' | 7 429 |
| 1h | 7 457 | 1h' | 7 625 |
| 2h | 7 485 | 2h' | 7 653 |
| 3h | 7 513 | 3h' | 7 681 |
| 4h | 7 541 | 4h' | 7 709 |
| 5h | 7 569 | 5h' | 7 737 |

1.2.7 Lower 8GHz Band

The channelling arrangement in the lower 8GHz band is in the band 7 725 – 8 275 MHz and is as presented in ITU-R Recommendation F.386 Annex 6 where there are 8 full-duplex channels of 29.5MHz paired, with a transmitter-receiver separation of 311.32MHz. The channelling arrangements are as shown in **Table 8**

Table 8: Channelling Arrangement in the lower 8GHz Band

| Channel Nr | Centre Frequency | Channel Nr | Centre Frequency |
|------------|------------------|------------|------------------|
| 1 | 7 747.70 | 1' | 8 059.02 |
| 2 | 7 777.35 | 2' | 8 088.67 |
| 3 | 7 807.00 | 3' | 8 118.32 |
| 4 | 7 836.65 | 4' | 8 147.97 |
| 5 | 7 866.30 | 5' | 8 177.62 |
| 6 | 7 895.95 | 6' | 8 207.27 |
| 7 | 7 925.60 | 7' | 8 236.92 |
| 8 | 7 955.25 | 8' | 8 266.57 |

1.2.8 Upper 8GHz Band

The channelling arrangement in the upper 8GHz band is in the band 8 275 – 8 500 MHz and is as presented in ITU-R Recommendation F.386 Annex 2. This band has been designated for medium and low capacity digital fixed wireless systems using 14 MHz and 7 MHz respectively. The medium capacity channel arrangement allows for 6 full-duplex channels of 14 MHz paired, with a transmitter-receiver separation of 119MHz while the low capacity channel arrangement allows for 12 full-duplex channels of 7 MHz paired, with a transmitter-receiver duplex spacing of 126MHz. The channelling arrangements are as shown in **Table 9** and **Table 10**.

Table 9: Channelling Arrangement in the Upper 8GHz Band based on 14MHz Bandwidth

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|------------|------------------|------------|------------------|
| 1 | 8293 | 1' | 8412 |
| 2 | 8307 | 2' | 8426 |
| 3 | 8321 | 3' | 8440 |
| 4 | 8335 | 4' | 8454 |
| 5 | 8349 | 5' | 8468 |
| 6 | 8363 | 6' | 8482 |

Table 10: Channelling Arrangement in the upper 8GHz Band based on 7MHz Bandwidth

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|------------|------------------|------------|------------------|
| 1 | 8286 | 1' | 8412 |
| 2 | 8293 | 2' | 8419 |
| 3 | 8300 | 3' | 8426 |
| 4 | 8307 | 4' | 8433 |
| 5 | 8314 | 5' | 8440 |
| 6 | 8321 | 6' | 8447 |
| 7 | 8328 | 7' | 8454 |
| 8 | 8335 | 8' | 8461 |
| 9 | 8342 | 9' | 8468 |
| 10 | 8349 | 10' | 8475 |
| 11 | 8356 | 11' | 8482 |
| 12 | 8363 | 12' | 8489 |

1.2.9 10.5GHz Band

The channelling arrangement in the 10.5GHz band is in the band 10.15 – 10.3 GHz paired with 10.5 – 10.65 GHz and is as presented in ITU-R Recommendation F.1568 Annex 2 where there are 5 full-duplex channels of **30MHz** paired, with a transmitter-receiver duplex spacing of 350MHz. The channelling arrangement is as shown in *Table 11*

Table 11: Channelling Arrangement in the 10.5GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|------------|------------------|------------|------------------|
| 1 | 10 165 | 1' | 10 515 |
| 2 | 10 195 | 2' | 10 545 |
| 3 | 10 225 | 3' | 10 575 |
| 4 | 10 255 | 4' | 10 605 |
| 5 | 10 285 | 5' | 10 635 |

1.2.10 11GHz Band

The channelling arrangement in the 11GHz band is in the band 10.7 – 11.7 GHz and is as presented in ITU-R Recommendation F.387 where there are 12 full-duplex channels of 40MHz paired, with a transmitter-receiver duplex spacing of 490MHz. The channelling arrangement is as shown in *Table 12*

Table 12: Channelling Arrangement in the 11GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|------------|------------------|------------|------------------|
| 1 | 10 735 | 1' | 11 225 |
| 2 | 10 775 | 2' | 11 265 |
| 3 | 10 815 | 3' | 11 305 |
| 4 | 10 855 | 4' | 11 345 |
| 5 | 10 895 | 5' | 11 385 |
| 6 | 10 935 | 6' | 11 425 |
| 7 | 10 975 | 7' | 11 465 |
| 8 | 11 015 | 8' | 11 505 |
| 9 | 11 055 | 9' | 11 545 |
| 10 | 11 095 | 10' | 11 585 |
| 11 | 11 135 | 11' | 11 625 |
| 12 | 11 175 | 12' | 11 665 |

1.2.11 13GHz Band

The channelling arrangement in the 13GHz band is in the band 12.75 – 13.25 GHz and is as presented in ITU-R Recommendation F.497 where there are 8 full-duplex channels of 28MHz paired, with a transmitter-receiver duplex spacing of 266MHz. The channelling arrangement is as shown in **Table 13**

Table 13: Channelling Arrangement in the 13GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|------------|------------------|------------|------------------|
| 1 | 12 765 | 1' | 13 031 |
| 2 | 12 793 | 2' | 13 059 |
| 3 | 12 821 | 3' | 13 087 |
| 4 | 12 849 | 4' | 13 115 |
| 5 | 12 877 | 5' | 13 143 |
| 6 | 12 905 | 6' | 13 171 |
| 7 | 12 933 | 7' | 13 199 |
| 8 | 12 961 | 8' | 13 227 |

1.2.12 14GHz Band

The channelling arrangement in the 14GHz band is in the band 14.25 – 14.5 GHz and is as presented in in Annex 3 to ITU-R Recommendation F.746 where there are 4 full-duplex channels of 28MHz paired, with a transmitter-receiver

duplex spacing of 140MHz. The channelling arrangement is as shown in **Table 14**

Table 14: Channelling Arrangement in the 14GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|------------|------------------|------------|------------------|
| 1 | 14 263 | 1' | 14 403 |
| 2 | 14 291 | 2' | 14 431 |
| 3 | 14 319 | 3' | 14 459 |
| 4 | 14 347 | 4' | 14 487 |

1.2.13 15GHz Band

The channelling arrangement in the 15GHz band is in the band 14.5 – 15.35 GHz and is as presented in ITU-R Recommendation F.636 where there are 15 full-duplex channels of 28MHz paired, with a transmitter-receiver duplex spacing of 616MHz. The channelling arrangement is as shown in **Table 15**.

Table 15: Channelling Arrangement in the 15GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|------------|------------------|------------|------------------|
| 1 | 14 515 | 1' | 15 131 |
| 2 | 14 543 | 2' | 15 159 |
| 3 | 14 571 | 3' | 15 187 |
| 4 | 14 599 | 4' | 15 215 |
| 5 | 14 627 | 5' | 15 243 |
| 6 | 14 655 | 6' | 15 271 |
| 7 | 14 683 | 7' | 15 299 |
| 8 | 14 711 | 8' | 15 327 |
| 9 | 14 739 | 9' | 15 355 |
| 10 | 14 767 | 10' | 15 383 |
| 11 | 14 795 | 11' | 15 411 |
| 12 | 14 823 | 12' | 15 439 |
| 13 | 14 851 | 13' | 15 467 |
| 14 | 14 879 | 14' | 15 495 |
| 15 | 14 907 | 15' | 15 523 |

1.2.14 18GHz Band

The channelling arrangement in the 18GHz band is in the band 17.7 – 19.7 GHz and is as presented in ITU-R Recommendation F.595 Annex 1 where there are 131 full-duplex channels of 7.5 MHz paired, with a transmitter-receiver

duplex spacing of 1010MHz. The channelling arrangement is as shown in Table 16.

Table 16: Channelling Arrangement in the 18GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|-------------------|-------------------------|-------------------|-------------------------|
| 1 | 17710.0 | 1' | 18720.0 |
| 2 | 17717.5 | 2' | 18727.5 |
| 3 | 17725.0 | 3' | 18735.0 |
| 4 | 17732.5 | 4' | 18742.5 |
| 5 | 17740.0 | 5' | 18750.0 |
| 6 | 17747.5 | 6' | 18757.5 |
| 7 | 17755.0 | 7' | 18765.0 |
| 8 | 17762.5 | 8' | 18772.5 |
| 9 | 17770.0 | 9' | 18780.0 |
| 10 | 17777.5 | 10' | 18787.5 |
| 11 | 17785.0 | 11' | 18795.0 |
| 12 | 17792.5 | 12' | 18802.5 |
| 13 | 17800.0 | 13' | 18810.0 |
| 14 | 17807.5 | 14' | 18817.5 |
| 15 | 17815.0 | 15' | 18825.0 |
| 16 | 17822.5 | 16' | 18832.5 |
| 17 | 17830.0 | 17' | 18840.0 |
| 18 | 17837.5 | 18' | 18847.5 |
| 19 | 17845.0 | 19' | 18855.0 |
| 20 | 17852.5 | 20' | 18862.5 |
| 21 | 17860.0 | 21' | 18870.0 |
| 22 | 17867.5 | 22' | 18877.5 |
| 23 | 17875.0 | 23' | 18885.0 |
| 24 | 17882.5 | 24' | 18892.5 |
| 25 | 17890.0 | 25' | 18900.0 |
| 26 | 17897.5 | 26' | 18907.5 |
| 27 | 17905.0 | 27' | 18915.0 |
| 28 | 17912.5 | 28' | 18922.5 |
| 29 | 17920.0 | 29' | 18930.0 |
| 30 | 17927.5 | 30' | 18937.5 |
| 31 | 17935.0 | 31' | 18945.0 |
| 32 | 17942.5 | 32' | 18952.5 |
| 33 | 17950.0 | 33' | 18960.0 |
| 34 | 17957.5 | 34' | 18967.5 |
| 35 | 17965.0 | 35' | 18975.0 |
| 36 | 17972.5 | 36' | 18982.5 |
| 37 | 17980.0 | 37' | 18990.0 |
| 38 | 17987.5 | 38' | 18997.5 |
| 39 | 17995.0 | 39' | 19005.0 |
| 40 | 18002.5 | 40' | 19012.5 |
| 41 | 18010.0 | 41' | 19020.0 |
| 42 | 18017.5 | 42' | 19027.5 |
| 43 | 18025.0 | 43' | 19035.0 |
| 44 | 18032.5 | 44' | 19042.5 |
| 45 | 18040.0 | 45' | 19050.0 |
| 46 | 18047.5 | 46' | 19057.5 |
| 47 | 18055.0 | 47' | 19065.0 |
| 48 | 18062.5 | 48' | 19072.5 |

| | | | |
|-----|---------|------|---------|
| 49 | 18070.0 | 49' | 19080.0 |
| 50 | 18077.5 | 50' | 19087.5 |
| 51 | 18085.0 | 51' | 19095.0 |
| 52 | 18092.5 | 52' | 19102.5 |
| 53 | 18100.0 | 53' | 19110.0 |
| 54 | 18107.5 | 54' | 19117.5 |
| 55 | 18115.0 | 55' | 19125.0 |
| 56 | 18122.5 | 56' | 19132.5 |
| 57 | 18130.0 | 57' | 19140.0 |
| 58 | 18137.5 | 58' | 19147.5 |
| 59 | 18145.0 | 59' | 19155.0 |
| 60 | 18152.5 | 60' | 19162.5 |
| 61 | 18160.0 | 61' | 19170.0 |
| 62 | 18167.5 | 62' | 19177.5 |
| 63 | 18175.0 | 63' | 19185.0 |
| 64 | 18182.5 | 64' | 19192.5 |
| 65 | 18190.0 | 65' | 19200.0 |
| 66 | 18197.5 | 66' | 19207.5 |
| 67 | 18205.0 | 67' | 19215.0 |
| 68 | 18212.5 | 68' | 19222.5 |
| 69 | 18220.0 | 69' | 19230.0 |
| 70 | 18227.5 | 70' | 19237.5 |
| 71 | 18235.0 | 71' | 19245.0 |
| 72 | 18242.5 | 72' | 19252.5 |
| 73 | 18250.0 | 73' | 19260.0 |
| 74 | 18257.5 | 74' | 19267.5 |
| 75 | 18265.0 | 75' | 19275.0 |
| 76 | 18272.5 | 76' | 19282.5 |
| 77 | 18280.0 | 77' | 19290.0 |
| 78 | 18287.5 | 78' | 19297.5 |
| 79 | 18295.0 | 79' | 19305.0 |
| 80 | 18302.5 | 80' | 19312.5 |
| 81 | 18310.0 | 81' | 19320.0 |
| 82 | 18317.5 | 82' | 19327.5 |
| 83 | 18325.0 | 83' | 19335.0 |
| 84 | 18332.5 | 84' | 19342.5 |
| 85 | 18340.0 | 85' | 19350.0 |
| 86 | 18347.5 | 86' | 19357.5 |
| 87 | 18355.0 | 87' | 19365.0 |
| 88 | 18362.5 | 88' | 19372.5 |
| 89 | 18370.0 | 89' | 19380.0 |
| 90 | 18377.5 | 90' | 19387.5 |
| 91 | 18385.0 | 91' | 19395.0 |
| 92 | 18392.5 | 92' | 19402.5 |
| 93 | 18400.0 | 93' | 19410.0 |
| 94 | 18407.5 | 94' | 19417.5 |
| 95 | 18415.0 | 95' | 19425.0 |
| 96 | 18422.5 | 96' | 19432.5 |
| 97 | 18430.0 | 97' | 19440.0 |
| 98 | 18437.5 | 98' | 19447.5 |
| 99 | 18445.0 | 99' | 19455.0 |
| 100 | 18452.5 | 100' | 19462.5 |
| 101 | 18460.0 | 101' | 19470.0 |
| 102 | 18467.5 | 102' | 19477.5 |
| 103 | 18475.0 | 103' | 19485.0 |

| | | | |
|-----|---------|------|---------|
| 104 | 18482.5 | 104' | 19492.5 |
| 105 | 18490.0 | 105' | 19500.0 |
| 106 | 18497.5 | 106' | 19507.5 |
| 107 | 18505.0 | 107' | 19515.0 |
| 108 | 18512.5 | 108' | 19522.5 |
| 109 | 18520.0 | 109' | 19530.0 |
| 110 | 18527.5 | 110' | 19537.5 |
| 111 | 18535.0 | 111' | 19545.0 |
| 112 | 18542.5 | 112' | 19552.5 |
| 113 | 18550.0 | 113' | 19560.0 |
| 114 | 18557.5 | 114' | 19567.5 |
| 115 | 18565.0 | 115' | 19575.0 |
| 116 | 18572.5 | 116' | 19582.5 |
| 117 | 18580.0 | 117' | 19590.0 |
| 118 | 18587.5 | 118' | 19597.5 |
| 119 | 18595.0 | 119' | 19605.0 |
| 120 | 18602.5 | 120' | 19612.5 |
| 121 | 18610.0 | 121' | 19620.0 |
| 122 | 18617.5 | 122' | 19627.5 |
| 123 | 18625.0 | 123' | 19635.0 |
| 124 | 18632.5 | 124' | 19642.5 |
| 125 | 18640.0 | 125' | 19650.0 |
| 126 | 18647.5 | 126' | 19657.5 |
| 127 | 18655.0 | 127' | 19665.0 |
| 128 | 18662.5 | 128' | 19672.5 |
| 129 | 18670.0 | 129' | 19680.0 |
| 130 | 18677.5 | 130' | 19687.5 |
| 131 | 18685.0 | 131' | 19695.0 |

1.2.15 23GHz Band

The channelling arrangement in the 23GHz band is in the band 21.2 – 23.6 GHz and is as presented in ITU-R Recommendation F.637 Annex 1 where there are 10 full-duplex channels of 112 MHz paired, with a transmitter-receiver duplex spacing of 1232MHz. The channelling arrangement is as shown in **Table 17**.

Table 17: Channelling Arrangement in the 23GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|------------|------------------|------------|------------------|
| 1 | 21 280 | 1' | 22 512 |
| 2 | 21 392 | 2' | 22 624 |
| 3 | 21 504 | 3' | 22 736 |
| 4 | 21 616 | 4' | 22 848 |
| 5 | 21 728 | 5' | 22 960 |
| 6 | 21 840 | 6' | 23 072 |
| 7 | 21 952 | 7' | 23 184 |
| 8 | 22 064 | 8' | 23 296 |
| 9 | 22 176 | 9' | 23 408 |
| 10 | 22 288 | 10' | 23 520 |

1.2.16 26GHz Band

The channelling arrangement in the 26GHz band is in the band 24.5-26.5 GHz and is as presented in ITU-R Recommendation F.748 Annex 1 where there are 8 full-duplex channels of 112 MHz paired, with a transmitter-receiver duplex spacing of 1008MHz. The channelling arrangement is as shown in **Table 18**.

Table 18: Channelling Arrangement in the 26GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|------------|------------------|------------|------------------|
| 1 | 24605 | 1' | 25613 |
| 2 | 24717 | 2' | 25725 |
| 3 | 24829 | 3' | 25837 |
| 4 | 24941 | 4' | 25949 |
| 5 | 25053 | 5' | 26061 |
| 6 | 25165 | 6' | 26173 |
| 7 | 25277 | 7' | 26285 |
| 8 | 25389 | 8' | 26397 |

1.2.17 28GHz Band

The channelling arrangement in the 28GHz band is in the band 27.5-29.5 GHz and is as presented in ITU-R Recommendation F.748 Annex 2 where there are 8 full-duplex channels of 112 MHz paired, with a transmitter-receiver duplex spacing of 1008MHz. The channelling arrangement is as shown in **Table 19**.

Table 19: Channelling Arrangement in the 28GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|------------|------------------|------------|------------------|
| 1 | 27604.5 | 1' | 28612.5 |
| 2 | 27716.5 | 2' | 28724.5 |
| 3 | 27828.5 | 3' | 28836.5 |
| 4 | 27940.5 | 4' | 28948.5 |
| 5 | 28052.5 | 5' | 29060.5 |
| 6 | 28164.5 | 6' | 29172.5 |
| 7 | 28276.5 | 7' | 29284.5 |
| 8 | 28388.5 | 8' | 29396.5 |

1.2.18 31GHz Band

The channelling arrangement in the 32GHz band is in the band 31.0 -31.3 GHz and is as presented in ITU-R Recommendation F.746 Annex 5 where there are 6 full-duplex channels of 50 MHz paired, with a transmitter-receiver duplex spacing of 150MHz. The channelling arrangement is as shown in **Table 20**.

Table 20: Channelling Arrangement in the 31GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|-------------------|-------------------------|-------------------|-------------------------|
| 1 | 31 025 | 1' | 31 175 |
| 2 | 31 075 | 2' | 31 225 |
| 3 | 31 125 | 3' | 31 275 |
| 4 | 31 175 | 4' | 31 025 |
| 5 | 31 225 | 5' | 31 075 |
| 6 | 31 275 | 6' | 31 125 |

For two-way operation in either radio-frequency channel arrangement, the go-return separation is 150 MHz.

1.2.19 32GHz Band

The channelling arrangement in the 32GHz band is in the band 31.8- 33.4 GHz and is as presented in ITU-R Recommendation F.1520 Annex 1 where there are 12 full-duplex channels of 56 MHz paired, with a transmitter-receiver duplex spacing of 812MHz. The channelling arrangement is as shown in **Table 21**

Table 21: Channelling Arrangement in the 32GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|-------------------|-------------------------|-------------------|-------------------------|
| 1 | 31 899 | 1' | 32 711 |
| 2 | 31 955 | 2' | 32 767 |
| 3 | 32 011 | 3' | 32 823 |
| 4 | 32 067 | 4' | 32 879 |
| 5 | 32 123 | 5' | 32 935 |
| 6 | 32 179 | 6' | 32 991 |
| 7 | 32 235 | 7' | 33 047 |
| 8 | 32 291 | 8' | 33 103 |
| 9 | 32 347 | 9' | 33 159 |
| 10 | 32 403 | 10' | 33 215 |
| 11 | 32 459 | 11' | 33 271 |
| 12 | 32 515 | 12' | 33 327 |

1.2.20 38GHz Band

The channelling arrangement in the 38GHz band is in the band 37.0 – 39.5 GHz and is as presented in ITU-R Recommendation F.749 Annex 1 where there are 20 full-duplex channels of 56 MHz paired, with a transmitter-receiver duplex spacing of 1260MHz. The channelling arrangement is as shown in **Table 22**.

Table 22: Channelling Arrangement in the 38GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|------------|------------------|------------|------------------|
| 1 | 37 086 | 1' | 38 346 |
| 2 | 37 142 | 2' | 38 402 |
| 3 | 37 198 | 3' | 38 458 |
| 4 | 37 254 | 4' | 38 514 |
| 5 | 37 310 | 5' | 38 570 |
| 6 | 37 366 | 6' | 38 626 |
| 7 | 37 422 | 7' | 38 682 |
| 8 | 37 478 | 8' | 38 738 |
| 9 | 37 534 | 9' | 38 794 |
| 10 | 37 590 | 10' | 38 850 |
| 11 | 37 646 | 11' | 38 906 |
| 12 | 37 702 | 12' | 38 962 |
| 13 | 37 758 | 13' | 39 018 |
| 14 | 37 814 | 14' | 39 074 |
| 15 | 37 870 | 15' | 39 130 |
| 16 | 37 926 | 16' | 39 186 |
| 17 | 37 982 | 17' | 39 242 |
| 18 | 38 038 | 18' | 39 298 |
| 19 | 38 094 | 19' | 39 354 |
| 20 | 38 150 | 20' | 39 410 |

1.2.21 42 GHz Band

The channelling arrangement in the 42GHz band is in the band 40.5 - 43.5 GHz and is as presented in ITU-R Recommendation F.2005 Annex 1 where there are 12 full-duplex channels of 112 MHz paired, with a transmitter-receiver duplex spacing of 1500MHz. The channelling arrangement is as shown in **Table 23**.

Table 23: Channelling Arrangement in the 42GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|------------|------------------|------------|------------------|
| 1 | 40 606 | 1' | 42 106 |
| 2 | 40 718 | 2' | 42 218 |
| 3 | 40 830 | 3' | 42 330 |
| 4 | 40 942 | 4' | 42 442 |
| 5 | 41 054 | 5' | 42 554 |
| 6 | 41 166 | 6' | 42 666 |
| 7 | 41 278 | 7' | 42 778 |
| 8 | 41 390 | 8' | 42 890 |
| 9 | 41 502 | 9' | 43 002 |
| 10 | 41 614 | 10' | 43 114 |
| 11 | 41 726 | 11' | 43 226 |
| 12 | 41 838 | 12' | 43 338 |

1.2.22 52 GHz Band

The channelling arrangement in the 52GHz band is in the band 51.4 - 52.6 GHz and is as presented in ITU-R Recommendation F.1496 Annex 1 where there are 9 full-duplex channels of 56 MHz paired, with a transmitter-receiver duplex spacing of 112MHz. The channelling arrangement is as shown in Table 24.

Table 24: Channelling Arrangement in the 52GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|------------|------------------|------------|------------------|
| 1 | 51 468 | 1' | 52 084 |
| 2 | 51 524 | 2' | 52 140 |
| 3 | 51 580 | 3' | 52 196 |
| 4 | 51 636 | 4' | 52 252 |
| 5 | 51 692 | 5' | 52 308 |
| 6 | 51 748 | 6' | 52 364 |
| 7 | 51 804 | 7' | 52 420 |
| 8 | 51 860 | 8' | 52 476 |
| 9 | 51 916 | 9' | 52 532 |

1.2.23 70/80 GHz Band

The channelling arrangement in the 70/80GHz band is in the band 71-76 GHz and 81-86 GHz and is as presented in Annex 1 and Annex 2 to ITU-R F.2006 where there are 19 full-duplex channels of 250 MHz paired, with a transmitter-receiver duplex spacing of 10GHz. The channelling arrangement is as shown in Table 25.

Table 25: Channelling Arrangement in the 70/80GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|------------|------------------|------------|------------------|
| 1 | 71 250 | 1' | 81 250 |
| 2 | 71 500 | 2' | 81 500 |
| 3 | 71 750 | 3' | 81 750 |
| 4 | 72 000 | 4' | 82 000 |
| 5 | 72 250 | 5' | 82 250 |
| 6 | 72 500 | 6' | 82 500 |
| 7 | 72 750 | 7' | 82 750 |
| 8 | 73 000 | 8' | 83 000 |
| 9 | 73 250 | 9' | 83 250 |
| 10 | 73 500 | 10' | 83 500 |
| 11 | 73 750 | 11' | 83 750 |
| 12 | 74 000 | 12' | 84 000 |
| 13 | 74 250 | 13' | 84 250 |
| 14 | 74 500 | 14' | 84 500 |
| 15 | 74 750 | 15' | 84 750 |
| 16 | 75 000 | 16' | 85 000 |

| | | | |
|----|--------|-----|--------|
| 17 | 75 250 | 17' | 85 250 |
| 18 | 75 500 | 18' | 85 500 |
| 19 | 75 750 | 19' | 85 750 |

1.2.24 94 GHz Band

The channelling arrangement in the 94GHz band is in the band 92.0 - 95.0 GHz and is as presented in Annex 1 and Annex 2 to ITU-R F.2004, where there are 6 full-duplex channels of 50 MHz paired, with a transmitter-receiver duplex spacing of 150MHz. The channelling arrangement for TDD is as shown in **Table 26** and for FDD in **Table 27**.

Table 26: TDD Channelling Arrangement in the 94GHz Band

| Channel Nr | Centre frequency |
|------------|------------------|
| 1 | 92 100 |
| 2 | 92 200 |
| 3 | 92 300 |
| 4 | 92 400 |
| 5 | 92 500 |
| 6 | 92 600 |
| 7 | 92 700 |
| 8 | 92 800 |
| 9 | 92 900 |
| 10 | 93 000 |
| 11 | 93 100 |
| 12 | 93 200 |
| 13 | 93 300 |
| 14 | 93 400 |
| 15 | 93 500 |
| 16 | 93 600 |
| 17 | 93 700 |
| 18 | 93 800 |
| 19 | 93 900 |
| 22 | 94 200 |
| 23 | 94 300 |
| 24 | 94 400 |
| 25 | 94 500 |
| 26 | 94 600 |
| 27 | 94 700 |
| 28 | 94 800 |
| 29 | 94 900 |

Table 27: FDD Channelling Arrangement in the 94GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|------------|------------------|------------|------------------|
| 1 | 92 100 | 1' | 93 600 |
| 2 | 92 200 | 2' | 93 700 |
| 3 | 92 300 | 3' | 93 800 |

| | | | |
|----|--------|-----|--------|
| 4 | 92 400 | 4' | 93 900 |
| 7 | 92 700 | 7' | 94 200 |
| 8 | 92 800 | 8' | 94 300 |
| 9 | 92 900 | 9' | 94 400 |
| 10 | 93 000 | 10' | 94 500 |
| 11 | 93 100 | 11' | 94 600 |
| 12 | 93 200 | 12' | 94 700 |
| 13 | 93 300 | 13' | 94 800 |
| 14 | 93 400 | 14' | 94 900 |

2 Development of the Band Plan for Fixed Services Bands

2.1 Introduction

In developing the band plan, the Commission considered regional harmonisation and cooperation within Eswatini as well as the SADC region, by taking into consideration the SADC region Frequency Allocation Plan (SADC FAP Edition 2020) which was developed by CRASA with a view to harmonise, to the extent possible, not only the frequency allocations but also the radio-frequency channel arrangements in key PTP, PTMP and access frequency bands. Furthermore, ITU-R recommendations were also considered in calculating the required parameters to be used for the different fixed services bands.

2.2 Radio Frequency Channel Arrangements

In the case of fixed wireless systems (mainly PTP links), ITU-R Recommendation F.746 addresses three possible schemes for frequency channel arrangements as indicated in **Figure 1**.

The main parameters are defined as:

XS = radio frequency separation between the centre frequencies of adjacent radio frequency channels on the same polarisation and in the same direction of transmission;

YS = radio frequency separation between the centre frequencies of the go and return radio frequency channels which are nearest to each other (innermost channels);

ZS = radio frequency separation between the centre frequencies of the outermost radio frequency channels and the edge of the frequency band (also known as guard-band). Where the upper and lower guard-band differ in size, these are referred to as *Z1S* and *Z2S* for the lower and upper separations respectively. Where the go and return frequency, bands are not contiguous such that there

are another allocation/s in the gap between the Tx and Rx band, ZS_i will be defined for the innermost edges of both sub-bands and will be included in YS ;

DS = Tx/Rx duplex spacing defined as the radio frequency separation between corresponding go and return channels within a given channel arrangement.

For more detail on these and other relevant parameters, Recommendation ITU-R F.746 should be consulted.

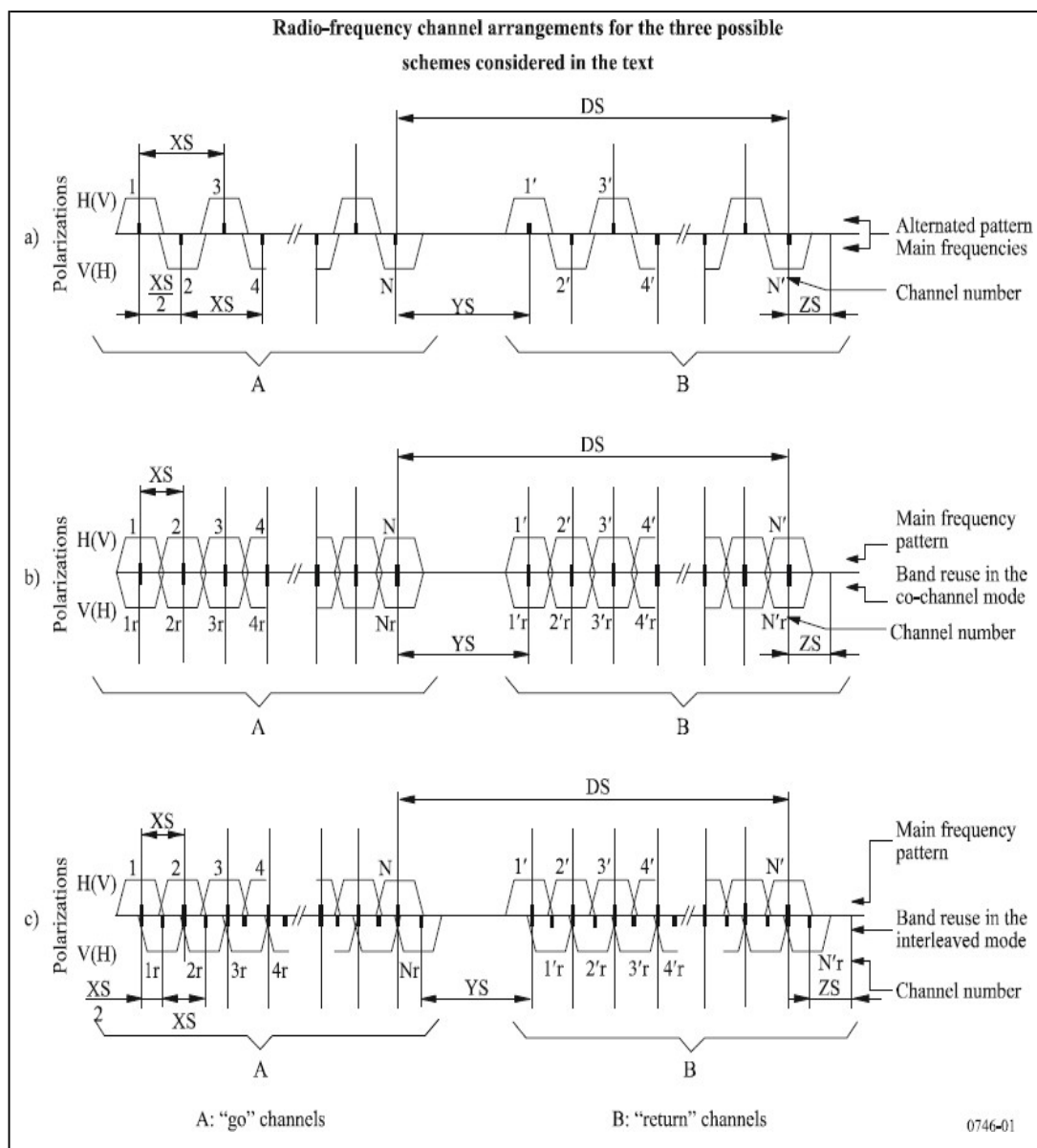


Figure 1 Radio frequency channel arrangements for the three possible schemes considered.

2.3 List of Frequency bands and adopted Recommendations

The Eswatini National Frequency Allocation Plan 2020, which was developed in line with the SADC Radio Frequency Allocation Plan (edition 2020) and the ITU Region 1 Radio Frequency Allocation Plan, allocates and earmarks the following frequency bands for fixed services, particularly fixed links, in Eswatini.

Table 28: List of Frequency bands and adopted recommendations

| Section | Frequency Band | Frequency band channeling arrangement | Bandwidth (MHz) | ITU-R Recommendation or Reports |
|---------|----------------|---------------------------------------|-----------------|--|
| 2.4.1 | 1.4 GHz | 1 350 – 1 375//1 492 – 1 517 MHz | 25 | ITU---R F.1242 |
| 2.4.2 | 2 GHz | 2 025-2 110 MHz//2 200-2 290 MHz | 85//90 | ITU---R F.1098 |
| 2.4.3 | 2.4 GHz | 2 300 – 2 500 MHz | 200 | ITU---R F.746, Annex 1 |
| 2.4.4 | 4 GHz | 3 600 – 4 200 MHz | 600 | ITU---R F.635, Annex 1 |
| 2.4.5 | 5 GHz | 4 400 – 5 000 MHz | 600 | ITU---R F.1099, Annex 1 |
| 2.4.6 | 7 GHz | 7 110 – 7 750 MHz | 640 | ITU---R F385, Annex 3 |
| 2.4.7 | Lower 8 GHz | 7 750 – 8 275 MHz | 525 | ITU---R F.386, Annex 6 |
| 2.4.8 | Upper 8 GHz | 8 275 – 8 500 MHz | 225 | ITU---R F.386, Annex 1 |
| 2.4.9 | 10.5 GHz | 10.15-10.3 GHz//10.5-10.65 GHz | 150 or 150 | ITU---R F.1568, Annex 1 |
| 2.4.10 | 11 GHz | 10.7 – 11.7 GHz | 1000 | ITU---R F.387 |
| 2.4.11 | 13 GHz | 12.75 – 13.25 GHz | 500 | ITU---R F.497 |
| 2.4.12 | 14 GHz | 14.25 – 14.5 GHz | 250 | ITU---R F.746, Annex 3 |
| 2.4.13 | 15 GHz | 14.5 – 15.35 GHz | 850 | ITU---R F.636 |
| 2.4.14 | 18 GHz | 17.7 – 19.7 GHz | 2000 | ITU---R F.595, Annex 1 |
| 2.4.15 | 23 GHz | 21.2-23.6 GHz or 22.0-23.6 GHz | 2400 or 1600 | ITU---R F.637, Annex 1 ITU---R F.637, Annex 2 |
| 2.4.16 | 26 GHz | 24.5 – 26.5 GHz | 2000 | ITU---R F.748, Annex 1 |
| 2.4.17 | 28 GHz | 27.5 – 29.5 GHz | 2000 | ITU---R F.748, Annex 2 |
| 2.4.18 | 31 GHz | 31.0 – 31.3 GHz | 300 | ITU---R F.746, Annex 5 |
| 2.4.19 | 32 GHz | 31.8 – 33.4 GHz | 1600 | ITU---R F.1520, Annex 1 |
| 2.4.20 | 38 GHz | 37.0 – 39.5 GHz | 2500 | ITU---R F.749, Annex 1 |

| | | | | |
|---------------|-----------|-----------------------------|------|-------------------------|
| 2.4.21 | 42 GHz | 40.5 – 43.5 GHz | 3000 | ITU---R F.2005, Annex 1 |
| 2.4.22 | 52 GHz | 51.4 – 52.6 GHz | 1200 | ITU---R F.1496, Annex 1 |
| 2.4.23 | 70/80 GHz | 71 – 76 GHz and 81 – 86 GHz | 5000 | ITU---R F.2006 |
| 2.4.24 | 94 GHz | 92.0 – 94 GHz | 2000 | ITU---R F.2004 |

2.4 Channel Arrangements for Different Fixed Services Bands

This section reflects the preferred RF channel arrangement for Eswatini for each radio frequency band listed in **Table 28**.

2.4.1 Channel Arrangement in the 1.4 GHz band.

a) In Eswatini, the preferred RF channel arrangement for the 1.4 GHz band (1350 – 1375 MHz paired with 1492 – 1517 MHz) is as presented in Annex 1 to ITU-R Recommendation F.1242. This band is best suited for low and medium capacity systems operating over long distances using fixed links. The RF channel arrangement in Annex 1 of Recommendation ITU-R F.1242 provides for 12 go and return channels of 2 MHz bandwidth each and a transmitter-receiver duplex spacing of 142 MHz, which is derived as follows:

Let F_0 be the band centre frequency of **1433.5 MHz**,

F_n be the centre frequency of a radio-frequency channel in the lower half of the band,

$F'n$ be the centre frequency of a radio-frequency channel in the upper half of the band,

then the frequencies of individual channels with a carrier spacing (bandwidth) of 2 MHz are expressed by the following relationships:

$$F_n = f_0 - 84 + 2 n$$

$$F'n = f_0 + 58 + 2 n$$

where $n = 1, 2, 3, \dots 12$.

Channel arrangements with lower carrier spacings (1 MHz, 0.5 MHz and 0.25 MHz) are possible by means of further channel subdivision. Furthermore, channel arrangements with carrier spacing of 3.5 MHz are possible by means of

concatenation of the 0.5 MHz plan. The frequencies of individual channels are expressed by the following relationship:

$$F_n = F_0 - 83.25 + 3.5 n$$

$$F'_n = F_0 + 58.75 + 3.5 n$$

where $n = 1, 2, 3 \dots 6$;

- b) The second portion of the 1.4 GHz band (1375 – 1400 MHz paired with 1427 – 1452 MHz) as presented in Annex 1 to ITU-R Recommendation F.1242 provides for 12 go and return channels of 2 MHz bandwidth each and a transmitter-receiver duplex spacing of 52 MHz, which is derived as follows:

$$F_0 = 1413.5 \text{ MHz,}$$

$$F_n = F_0 - 39 + 2 n$$

$$F'_n = F_0 + 13 + 2 n, \text{ where } n = 1, 2, 3, \dots 12.$$

Channel arrangements with lower carrier spacings (1 MHz, 0.5 MHz and 0.25 MHz) are possible as well, by means of further channel subdivision. Also, channel arrangements with carrier spacing of 3.5 MHz are possible by means of concatenation of the 0.5 MHz plan. The frequencies of individual channels are expressed by the following relationship:

$$F_n = F_0 - 38.25 + 3.5 n$$

$$F'_n = F_0 + 13.75 + 3.5 n$$

where $n = 1, 2, 3, \dots 6$;

2.4.2 Channel Arrangement in the 2 GHz band.

Eswatini adopts the RF channel arrangement for the 2 GHz band (2025 – 2110 MHz paired with 2200 – 2290 MHz) as presented in the SADC channel arrangement and in Annex 1 to ITU-R Recommendation F.1098. The 2 GHz band has technical and economic advantages for low capacity digital systems including, for example, provisioning of fixed links operating over long distances. RF channel arrangement in Annex 1 of the Recommendation ITU-R F.1098 provides for 6 go and return channels of 14 MHz each and with a transmitter-receiver duplex

spacing of 175 MHz. These channels can be further sub-divided into channels of 7 MHz, 3.5 MHz or 1.75 MHz, depending on the system capacity requirements.

Channelling plan development for band 2025-2110MHz

Channel xCentre frequencies on either side (lower and upper) of band are obtained after substituting and computing in the following equations:

Let $F_n = F_0 - 136.5 + 14n$: Lower centre frequencies

$F_{n'} = F_0 + 38.5 + 14n$: Upper centre frequencies

$F_n/F_{n'}$: centre frequencies either side of band

F_0 : centre frequency of band = **2155MHz**

where $n = 1, 2, 3, 4, \dots$

| Tx-Lower band | Centre gap (MHz) | Rx-Upper band | Duplex separation (MHz) |
|---------------|------------------|---------------|-------------------------|
| 2025-2110 | 90 | 2200 to 2290 | 175 |

2.4.3 Channel Arrangement in the 2.4 GHz band

The radio frequency channel arrangement for the 2.4 GHz band (2300 – 2500 MHz) as presented in Annex 1 to ITU-R Recommendation F.746, is based on an adjacent channel spacing of 1 MHz, and is derived as follows:

Let $F_0 = 2\,394\text{ MHz}$, be the reference frequency of the frequency pattern,

F_n be the centre frequency of one radio-frequency channel in the lower half of the band (MHz),

$F_{n'}$ be the centre frequency of one radio-frequency channel in the upper half of the band (MHz),

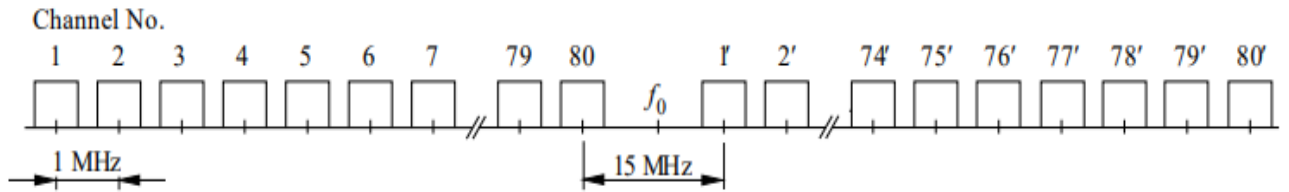
then the centre frequencies of the individual channels can be expressed by the following relationships:

$$F_n = F_0 - 87 + n$$

$$F_{n'} = F_0 + 7 + n$$

where: $n = 1, 2, 3, \dots, 80$.

**Radio-frequency channel arrangement for up to 300 telephone channel
FWSs operating in the 2 300-2 500 MHz band**



E0746-0

Figure 2: RF Channel arrangement for FWS operating in 2300 – 2500MHz

2.4.4 Channel Arrangement in the 4 GHz band

Eswatini reserved the 4 GHz band (3600 – 4200 MHz) for Fixed services and Fixed Satellite on a co-primary basis. The preferred RF channel arrangement for this band is as presented in section 6 of Annex 1 to ITU-R Recommendation F.635. In this channel arrangement there are 9 go and 9 return channels of 30 MHz each, with centre frequencies as follows:

F_n: centre frequency of one RF channel in the lower half of the band

F'_n: centre frequency of one RF channel in the upper half of the band

F_n = 4 200 – 10 m, where **m = 58, 55, 52, 49, 46, 43, 40, 37, 34**

F'_n = 4200 – 10 m, where **m = 26, 23, 20, 17, 14, 11, 8, 5, 2.**

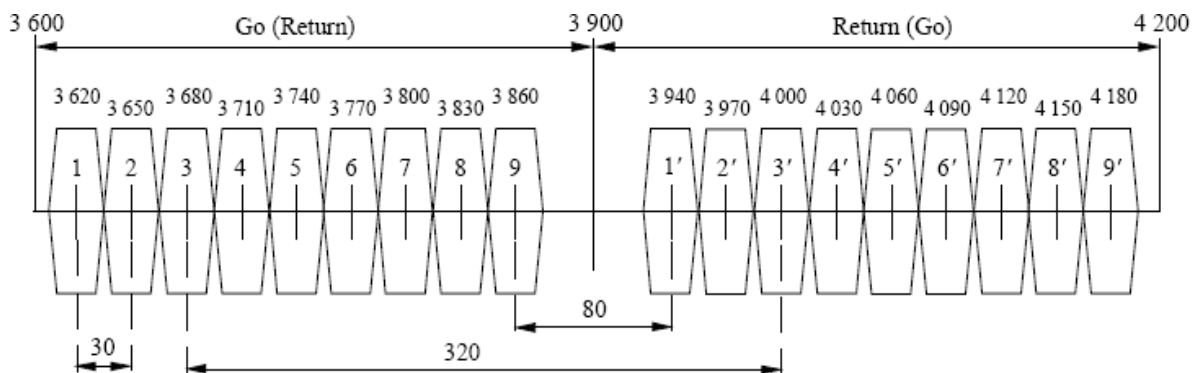


Figure 3: Channel arrangement in the 4GHz Band

2.4.5 Channel Arrangement in the 5 GHz band.

In Eswatini the 5 GHz band (4 400 – 5 000 MHz) is reserved for Government use and the preferred channel arrangement for this band is as presented in Annex 1 of ITU-R Recommendation F.1099. In this channel arrangement there are 7 go and 7 return channels of 40 MHz each, with centre frequencies as following;

Let F_0 be the frequency (MHz) of the centre of the band, **$F_0 = 4\,700$ MHz,**

F_n be the centre frequency (MHz) of one RF channel in the lower half of the band,

F'_n be the centre frequency (MHz) of one RF channel in the upper half of the band,

$$F_n = F_0 - 310 + 40n$$

$$F'_n = F_0 - 10 + 40n, \quad \text{where: } n = 1, 2, 3, 4, 5, 6 \text{ or } 7.$$

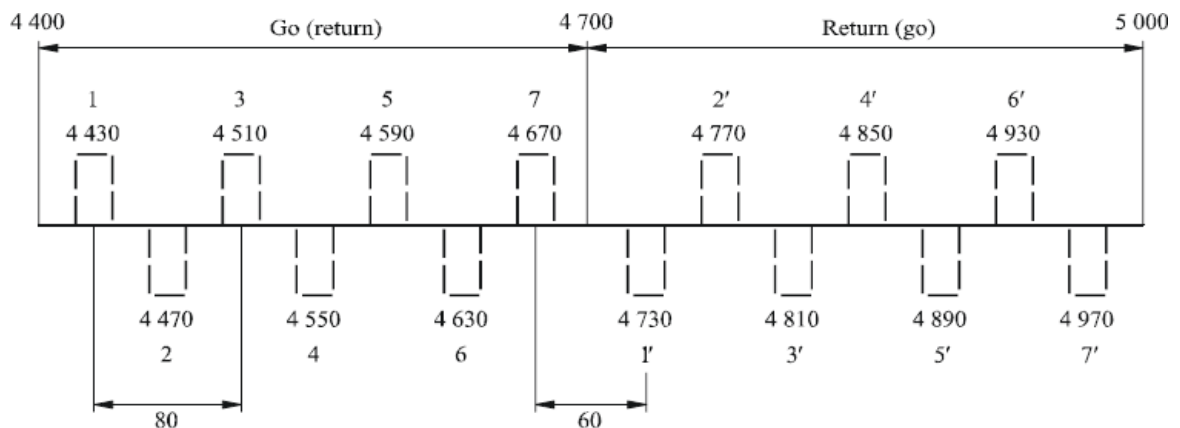
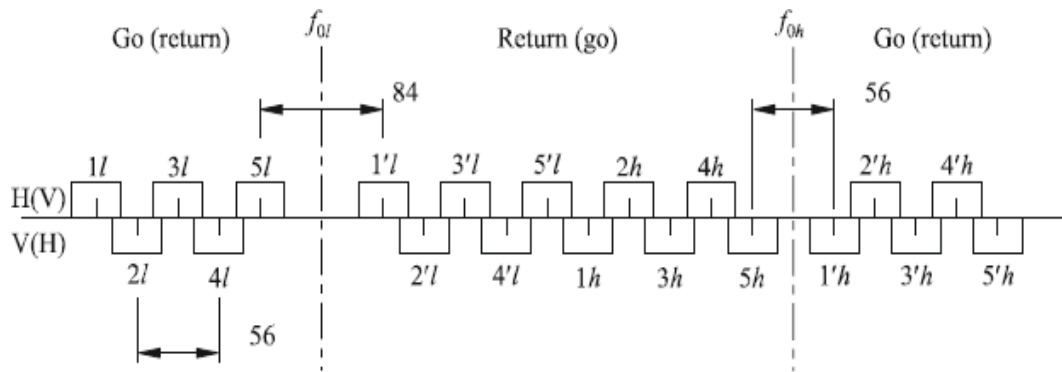


Figure 4: Channel arrangement in the 4GHz Band

2.4.6 Channel Arrangement in the 7 GHz band.

The preferred RF channel arrangement for the L7 and the U7 GHz bands (7 110 – 7 750 MHz) in Eswatini is as presented in ITU-R Recommendation F.385 Annex 3. This channel arrangement consists of a lower and upper part as depicted in the diagram below. The 7 GHz band can be used for medium and high capacity systems.



0385-04

Figure 5: Usage scheme under the 7GHz band

The RF channel centre frequencies for the 7 GHz band (based on 28 MHz channels) are represented by the following relationships;

Let **F0l** be the frequency at the centre of the lower part of the band:

$$\mathbf{F0l = 7275 \text{ MHz,}}$$

F0h be the frequency at the centre of the higher part of the band:

$$\mathbf{F0h = 7597 \text{ MHz,}}$$

Fnl be the centre frequency of one RF channel in the lower half of the lower part of the band,

Fnl' be the centre frequency of one RF channel in the upper half of the lower part of the band,

Fnh be the centre frequency of one RF channel in the lower half of the higher part of the band,

Fnh' be the centre frequency of one RF channel in the upper half of the higher part of the band,

Then the frequencies (MHz) of the individual channels are expressed by the following relationships:

$$\mathbf{Fnl = F0l - 182 + 28 n}$$

$$\mathbf{Fnl' = F0l + 14 + 28 n}$$

$$\mathbf{Fnh = F0h - 168 + 28 n}$$

$$F_{nh'} = F_{0h} + 28n \quad \text{where: } n = 1, 2, 3, 4, 5.$$

2.4.7 Channel Arrangement in the Lower 8 GHz band.

The preferred Lower 8 GHz band (7 725 – 8 275 MHz) RF channel arrangement in Eswatini is as presented in Figure 7 of ITU-R Recommendation F.386 (Annex 6) which CRASA also adopted. This channel arrangement provides for 8 go and 8 return channels that can be used for digital systems up to 140 Mbit/s or SDH. A co-channel arrangement if also possible, using the same channel centre frequencies as indicated in .

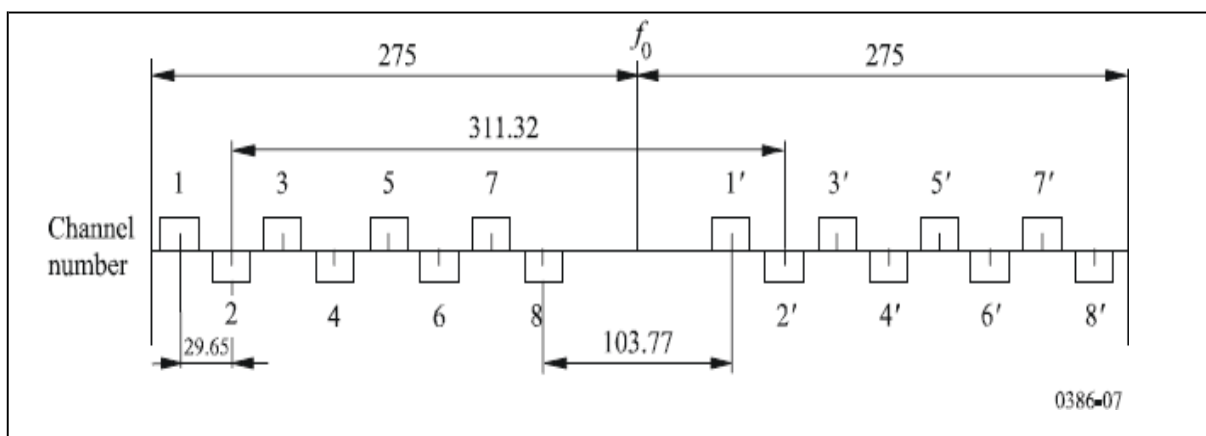


Figure 6: Channelling arrangement in the Lower 8GHz band

The RF channel centre frequencies for the L8 GHz band (based on 29.65 MHz channels) are represented by the following relationships;

Let F_0 be the frequency of the centre of the band of frequencies occupied (MHz),

F_n be the centre frequency of one RF channel in the lower half of this band (MHz),

$F'n$ be the centre frequency of one RF channel in the upper half of this band (MHz),

$$F_0 = 8000 \text{ MHz.}$$

then the frequencies (MHz) of the individual channels are expressed by the following relationships:

$$F_n = F_0 - 281.95 + 29.65n$$

$$F'n = F0 + 29.37 + 29.65 n$$

where: $n = 1, 2, 3, 4, 5, 6, 7$ or 8 .

2.4.8 Channel Arrangement in the Upper 8 GHz band.

The preferred Upper 8 GHz band (8 275 – 8 500 MHz) RF channel arrangement in Eswatini is as presented in Figure 2 of ITU-R Recommendation F.386 (Annex 2). This band can be used for medium and low capacity digital fixed wireless systems (34Mb/s and 8*2Mb/s) using 14MHz and 7MHz channels respectively.

The RF channel centre frequencies for the U8 GHz band are represented by the following relationships;

Let **F0** be the frequency of the centre of the band of frequencies occupied

Fn be the centre frequency of one RF channel in the lower half of band

F'n be the centre frequency of on RF channel in the upper half of band

$$F0 = 8\,387.5\text{MHz}$$

The following relationships are used to express the individual channels for systems with a capacity of 34Mb/s:

$$Fn = F0 - 108.5 + 14n \quad : \text{Lower half of band}$$

$$Fn = F0 + 10.5 + 14n \quad : \text{Upper half of band}$$

where $n = 1, 2, 3, 4, 5$ or 6 .

Relationships for systems with a capacity of 8*2Mb/s:

$$Fn = F0 - 108.5 + 7n \quad : \text{Lower half of band}$$

$$F'n = F0 + 17.5 + 14n \quad : \text{Upper half of band}$$

where $n=1, 2, 3, 4, 5, 6, \dots, 12$.

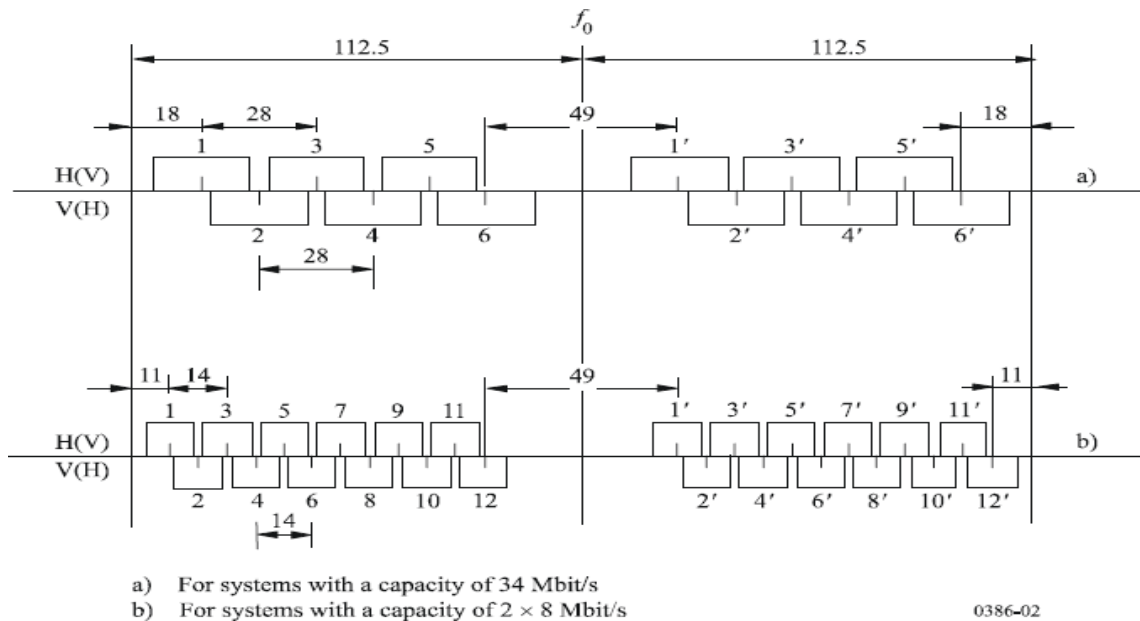


Figure 7: Channelling arrangement in the Upper 8GHz band

2.4.9 Channel Arrangement in the 10.5 GHz band.

The preferred RF channel arrangement in the 10.5 GHz band (10.15 – 10.3 GHz paired with 10.5 – 10.65 GHz) in Eswatini is as presented in Figure 1 and Figure 2 of ITU-R Recommendation F.1568 (Annex 1 and Annex 2). This channel arrangement provides two options to be used in this band, namely a 28 MHz plan and a 30 MHz plan which both provide 5 go and 5 return channels.

28 MHz block plan for the ranges 10.15-10.3/10.5-10.65 GHz
 (Frequencies in MHz)

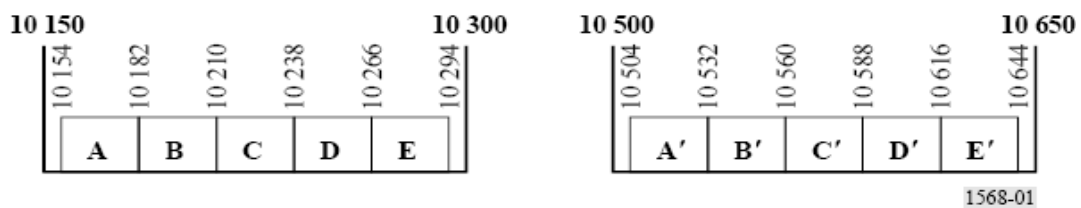


Figure 8: 28 MHz block plan for 10.5GHz band

30 MHz block plan for the ranges 10.15-10.3/10.5-10.65 GHz
 (Frequencies in MHz)

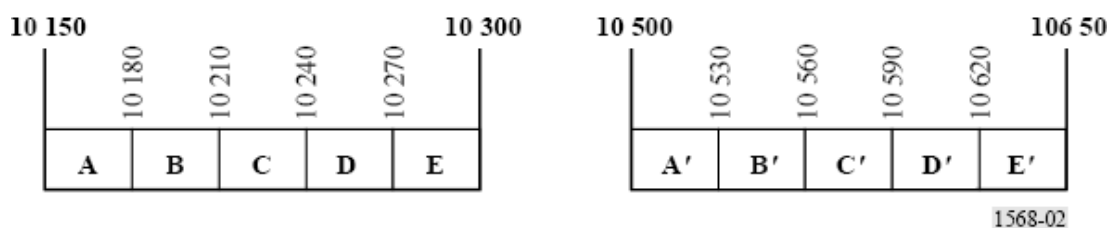


Figure 9: 30 MHz block plan for 10.5GHz

2.4.12 Channel Arrangement in the 11 GHz band.

The preferred RF channel arrangement in the 11 GHz band (10.7 – 11.7) in Eswatini is as presented in Figure 2 of ITU-R Recommendation F.387. This band may be used for low, medium and high capacity fixed service applications. This preferred channel arrangement allows for 12 go and 12 return channels based on 40MHz each. The centre frequency of the 11 GHz band is **F0 = 11 200 MHz**.

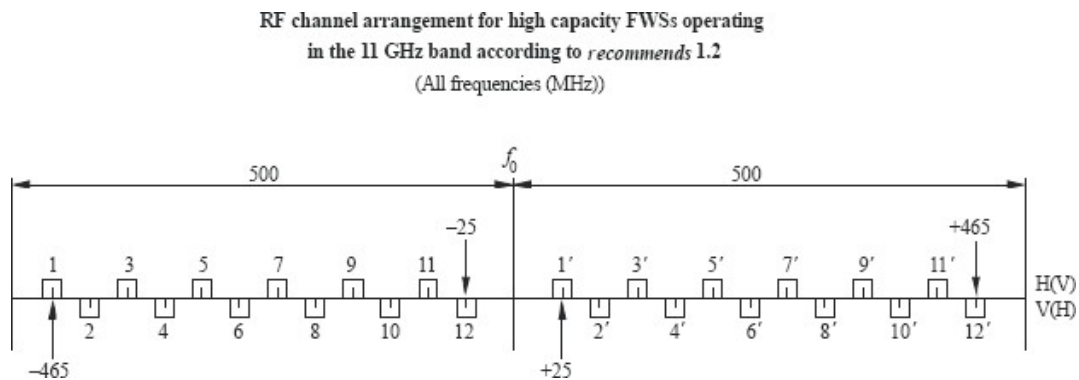


Figure 10: Channel arrangement for 11GHz Band

This channel arrangement is in accordance with recommends 1.2 for Recommendation ITU-R F.387. The advantage of this arrangement is that it does not encroach into the 10.68-10.7 GHz.

The RF channel centre frequencies for the 11 GHz band (based on 40 MHz channels) are represented by the following relationships;

$$F_n = F_0 - 505 + 40n \quad : \text{ lower half of the band}$$

$$F'_n = F_0 - 15 + 40n \quad : \text{ upper half of the band}$$

where: $n = 1, 2, 3, \dots, 12$.

2.4.13 Channel Arrangement in the 13 GHz band

The preferred RF channel arrangement for the 13 GHz band (12.75 – 13.25 GHz) in Eswatini is as presented in Figure 1 of ITU-R Recommendation F.497, which CRASA also adopted. This channel arrangement provides for 8 go and 8 return channels with a channel separation of 28 MHz that can be used for high capacity systems up to 140 Mbit/s or SDH. The centre frequency for the 13 GHz band plan is **F0 = 12 996 MHz**.

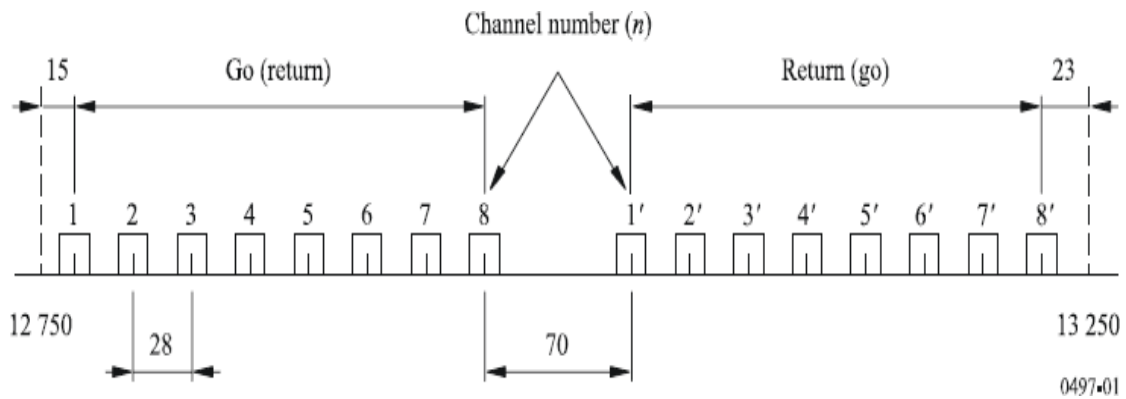


Figure 11: Channelling arrangement for 13GHz band

The RF channel center frequencies for the 13 GHz band (based on 40 MHz channels) are represented by the following relationships;

Let $F_n = F_0 - 259 + 28n$: Lower half centre frequencies
 $F'_n = F_0 + 7 + 28n$: Upper half centre frequencies
 where $n = 1,2,3,4,5,6,7$ or 8

2.4.14 Channel Arrangement in the 14 GHz band.

The preferred RF channel arrangement in the 14 GHz band (14.25 – 14.5 GHz) in Eswatini is as presented by Figure 3 in Annex 3 to ITU-R Recommendation F.746. This band is an extension of the 13 GHz band that allows for the operation of medium and low capacity fixed digital systems. This preferred channel arrangement allows for 4 go and return channels based on 28 MHz bandwidth each. Other, channel spacings of 14, 7 and 3.5 MHz are also possible by means of further channel subdivision. The channel center frequency of the 14 GHz band is **F₀ = 11 701 MHz** and the channel center frequencies of the individual channels are represented by the following relationships;

Let $F_n = F_0 + 2534 + 28n$
 $F'_n = F_0 + 2674 + 28n$
 where $n = 1,2,3,4$.

Radio-frequency channel arrangement in the frequency band 14.25-14.5 GHz
(All frequencies in MHz)

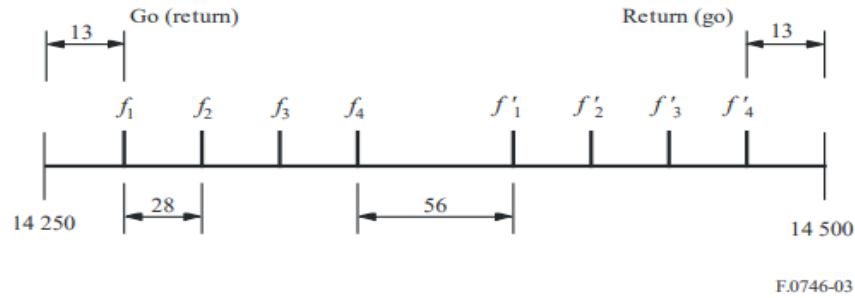
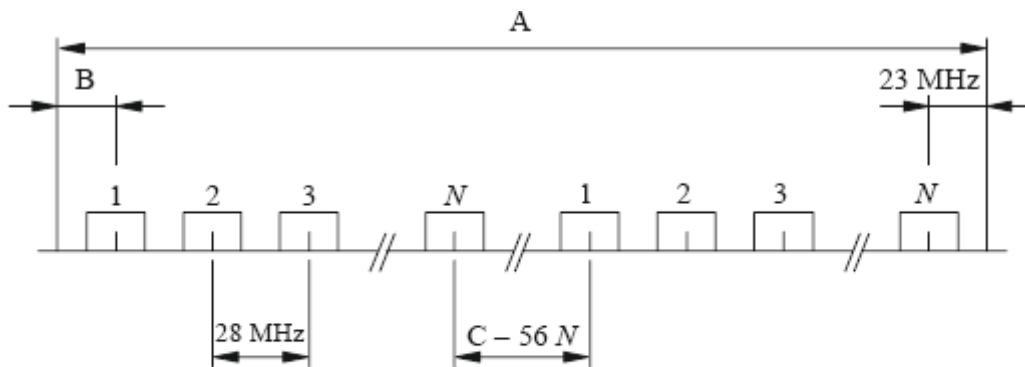


Figure 12: Channelling arrangement for 14GHz band

2.4.15 Channel Arrangement in the 15 GHz band.

The preferred RF channel arrangement for medium capacity systems operating in the 15 GHz band (14.5 – 15.35 GHz) in Eswatini uses 28 MHz channel spacing and is as presented in Figure 1 of ITU-R Recommendation F.636. This channel arrangement provides for 15 go and 15 return channels of 28 MHz each and is depicted in the figure below.



(For the band 14.4-15.35 GHz: A = 950 MHz, B = 17 MHz, C = 966 MHz
For the band 14.5-15.35 GHz: A = 850 MHz, B = 15 MHz, C = 868 MHz)

0636-01

Figure 13: Channelling arrangement for 15GHz band

The RF channel centre frequencies for the 15 GHz band (based on 28 MHz channels) are represented by the following relationships;

Let $F_0 = 11\,701\text{ MHz}$: reference frequency in the 15 GHz band plan

$F_n = F_0 + 2\,786 + 28n$: Lower half centre frequencies

$F'_n = F_0 + 3\,626 + 28(N - n)$: Upper half centre frequencies

Where $n = 1, 2, 3, 4, \dots, N$. with $N \leq 15$

2.4.16 Channel Arrangement in the 18 GHz band.

The preferred RF channel arrangement for low, medium and high capacity systems operating in the 18 GHz Band (17.7 – 19.7 GHz) in Eswatini is as presented in Figure 1 of ITU-R Recommendation F.595. This Recommendation provides for various channel spacing options including, amongst others, 220 MHz, 110 MHz, 55 MHz and 27.5 MHz. In Eswatini the 7.5 MHz channel spacing option has also been adopted to accommodate low capacity systems where such a channel arrangement provides for 131 duplex channels of 7.5 MHz each. The preferred channel arrangements are as indicated in the figure below.

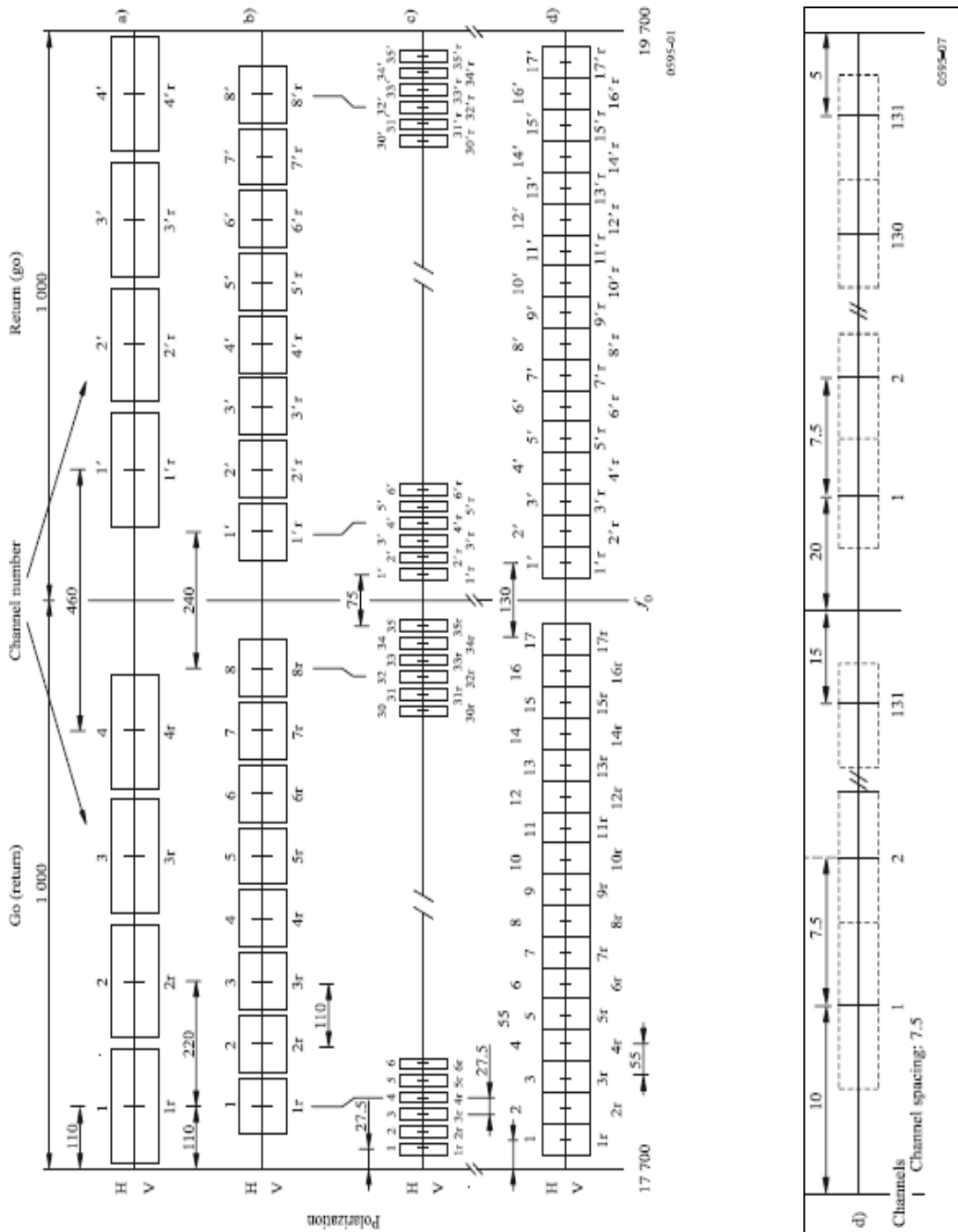


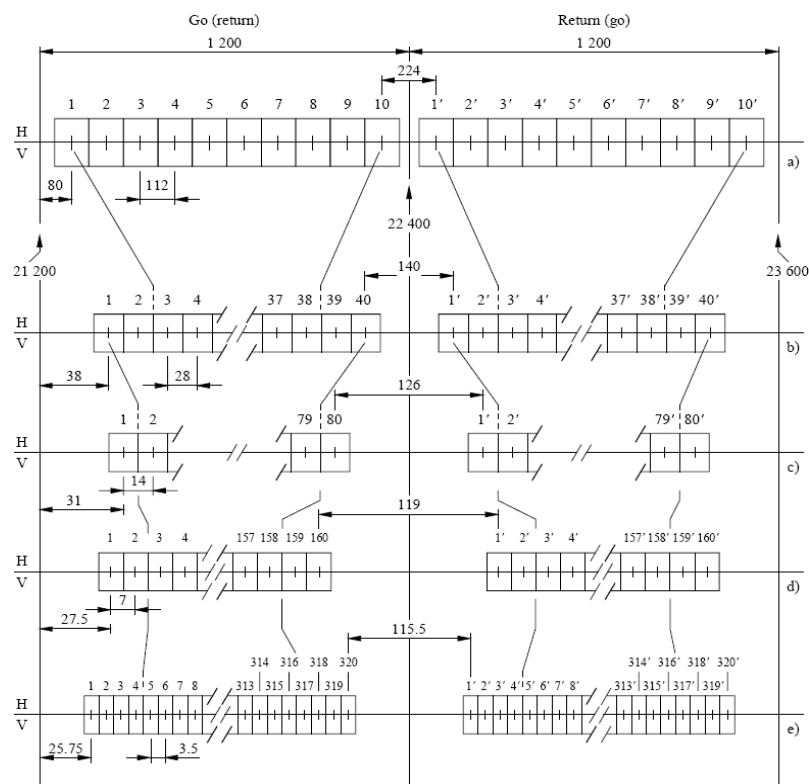
Figure 14: Channelling arrangement for 18GHz band

2.4.17 Channel Arrangement in the 23 GHz band.

The preferred RF channel arrangement for the 23 GHz band in Eswatini is as presented in ITU---R Recommendation F.637. In this recommendation, there are two RF channel arrangement options which are based on Annex 1 and Annex3. Option 1 uses the frequency band 21.2 – 23.6 GHz and is based on Annex 1, whereas Option

2 uses the frequency band 22.0 – 23.6 GHz. In the case of Eswatini, option 1 is more applicable since there already exist some deployments below 22.0 GHz within this band.

In Option 1, the RF channel arrangement for low, medium and high capacity systems operating in the frequency band 21.2 – 23.6 GHz is as presented in Figure 1 of ITU-R Recommendation F.595. This recommendation provided for various channel spacing options including 112 MHz, 28 MHz, 14 MHz, 7 MHz and 3.5 MHz and is indicated in the figure below. The centre frequency for the 23 GHz band plan is **F0 = 22 400 MHz** (Option 1).



0637-01

Figure 15: Channelling arrangement for 13GHz band

2.4.18 Channel Arrangement in the 26 GHz band.

The preferred RF channel arrangement for low, medium and high capacity systems operating in the frequency band 24.5-26.5 GHz in Eswatini is as presented in Figure 1 of ITU-R Recommendation F.748 (Annex 1). Although this recommendation

addresses the 25 GHz, 26 GHz and 28 GHz bands, in Eswatini the frequency range 24.5-26.5 GHz is addressed as one frequency band (25 GHz and 26 GHz).

ITU-R Recommendation F.748 provides for various channel spacing options including 112 MHz, 56 MHz, 28 MHz, 14 MHz, 7 MHz and 3.5 MHz and is indicated in the figure below. The centre frequency for the 26 GHz band plan is **F0 = 25 501 MHz**.

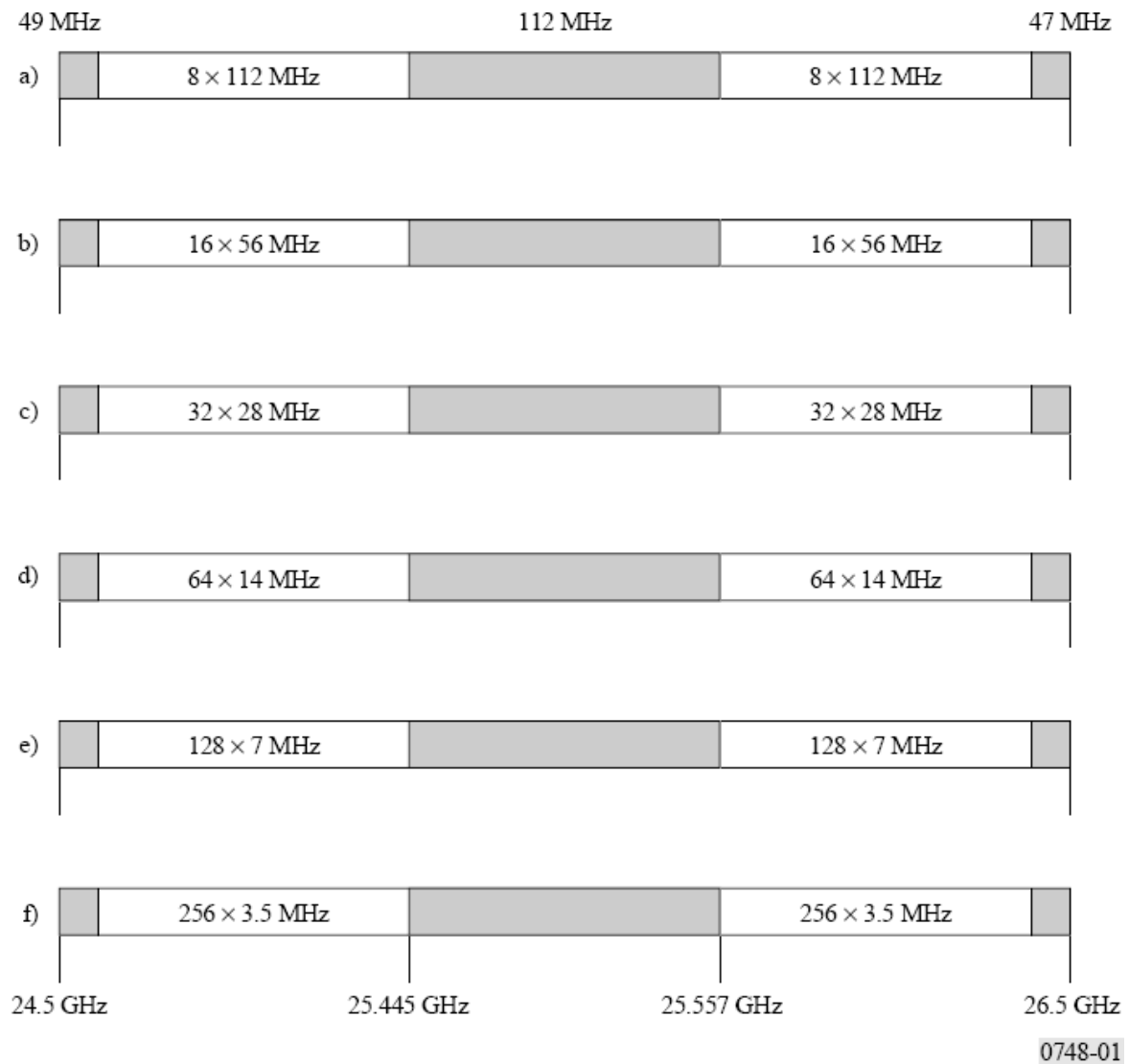


Figure 16: Channelling arrangement for 26GHz band

2.4.19 Channel Arrangement in the 28 GHz band.

The preferred RF channel arrangement for low, medium and high capacity systems operating in the frequency band 27.5-29.5 GHz in Eswatini is as presented in Figure 2 of ITU-R Recommendation F.748 (Annex 2), which provides for various channel spacing options including 112 MHz, 56 MHz, 28 MHz, 14 MHz, 7 MHz and 3.5 MHz

and is indicated in the figure below. The centre frequency for the 28 GHz band plan is **F0 = 28 500.5 MHz**.

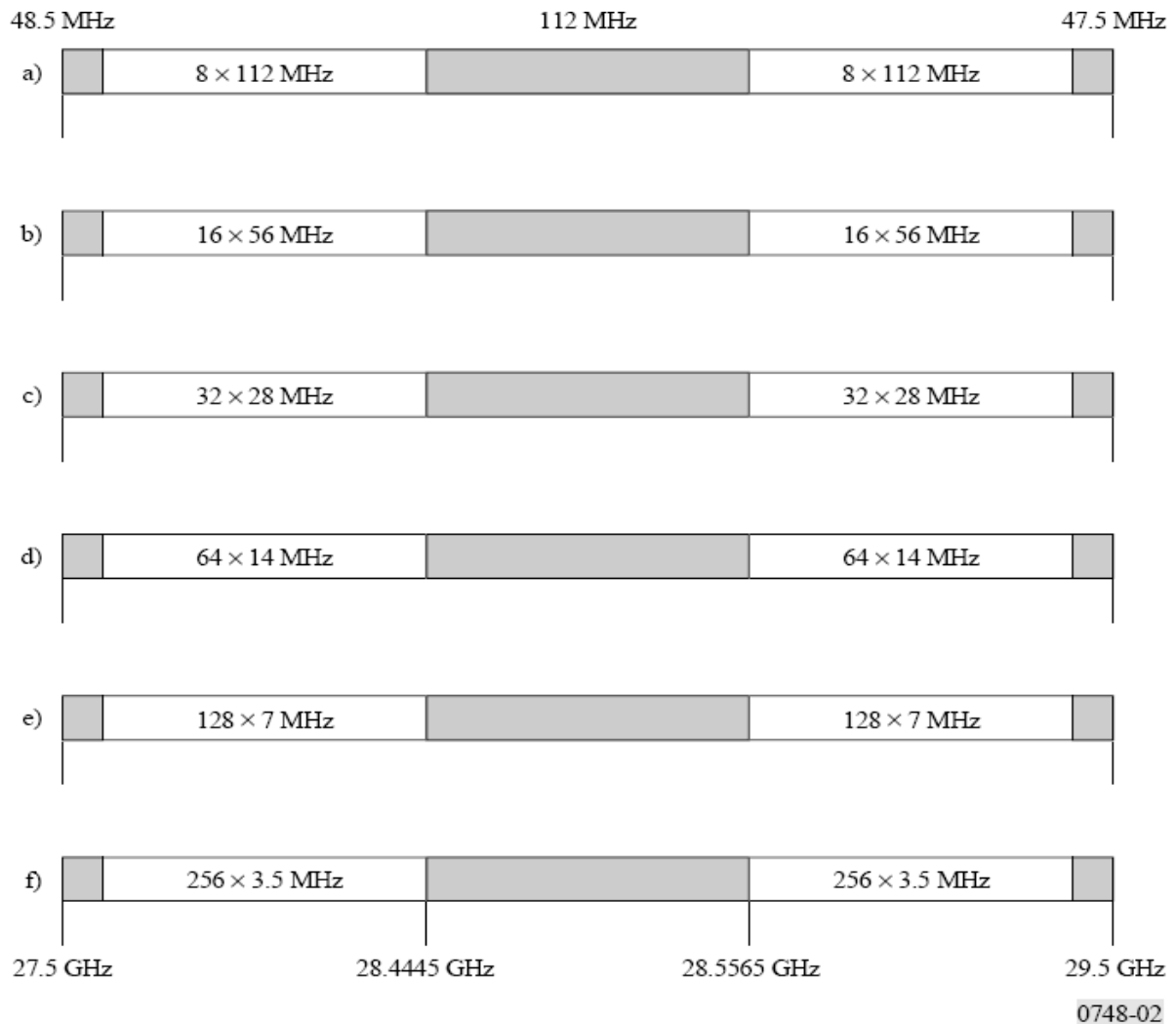


Figure 17: Channelling arrangement for 28GHz band

2.4.20 Channel Arrangement in the 31 GHz band

The preferred RF channel arrangement for the 31 GHz band (31.0 -31.3 GHz) in Eswatini is as presented in Annex 5 to ITU-R Recommendation F.746. This channel arrangement provides for 6 go and return channels of 50 MHz channel spacing. The option of 25 MHz channel spacing can be obtained by subdividing the 50 MHz channels. The channel center frequency of the 31 GHz band, based on 50 MHz channel spacing is **F0 = 30 975 MHz** and the channel center frequencies of the individual channels are represented by the following relationships;

Let $F_n = F_0 + 50n$

where: $n = 1, 2, 3, 4, 5, 6$

The radio-frequency channel arrangement with 25 MHz channels can be represented as follows:

$F_n = F_0 + 25n$

where: $n = 1, 2, 3, \dots, 12$

$F_0 = 30\,987.5 \text{ MHz.}$

For two-way operation in either radio-frequency channel arrangement, the go-return separation is 150 MHz.

2.4.21 Channel Arrangement in the 32 GHz band.

The preferred RF channel arrangement for HDFS systems operating in the frequency band 31.8- 33.4 GHz in Eswatini is as presented in Figure 1 of ITU-R Recommendation F.1520 (Annex 1). This recommendation provides for various channel spacing options including 56 MHz, 28 MHz, 14 MHz, 7 MHz and 3.5 MHz and is indicated in the figure below.

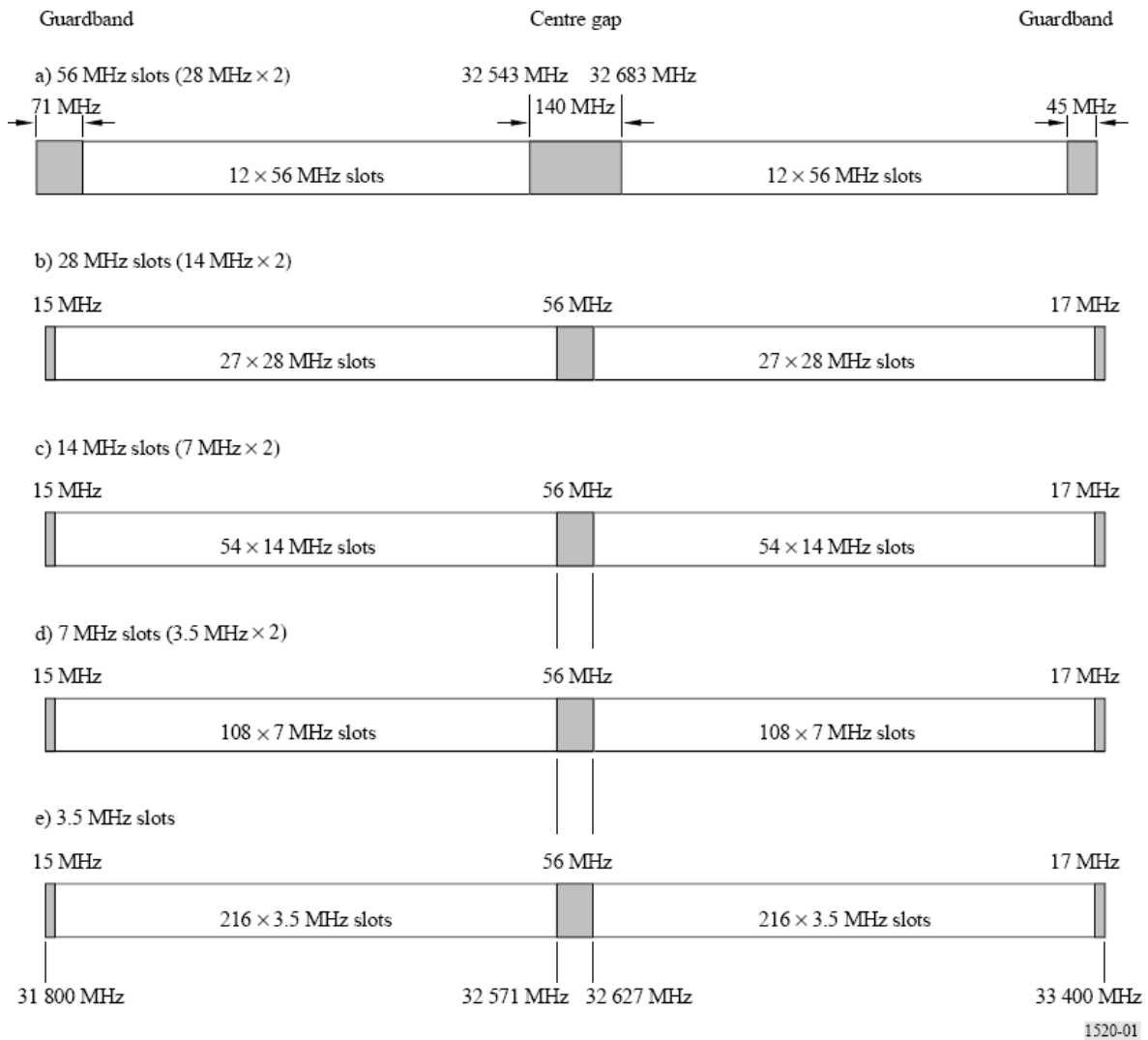


Figure 18: Channelling arrangement in the 32GHz band

2.4.22 Channel Arrangement in the 38 GHz band

The preferred RF channel arrangement for low, medium and high capacity systems operating in the frequency band 37.0 – 39.5 GHz in Eswatini is as presented in Figure 1 of ITU-R Recommendation F.749 (Annex 1). Recommendation F.749 provides for various channel spacing options including 140 MHz, 56 MHz, 28 MHz, 14 MHz, 7 MHz and 3.5 MHz and is indicated in the figure below. The centre frequency for the 38 GHz band plan is **F0 = 38 248 MHz**. The 38 GHz band can be used for PTP, PTMP and BWA systems.

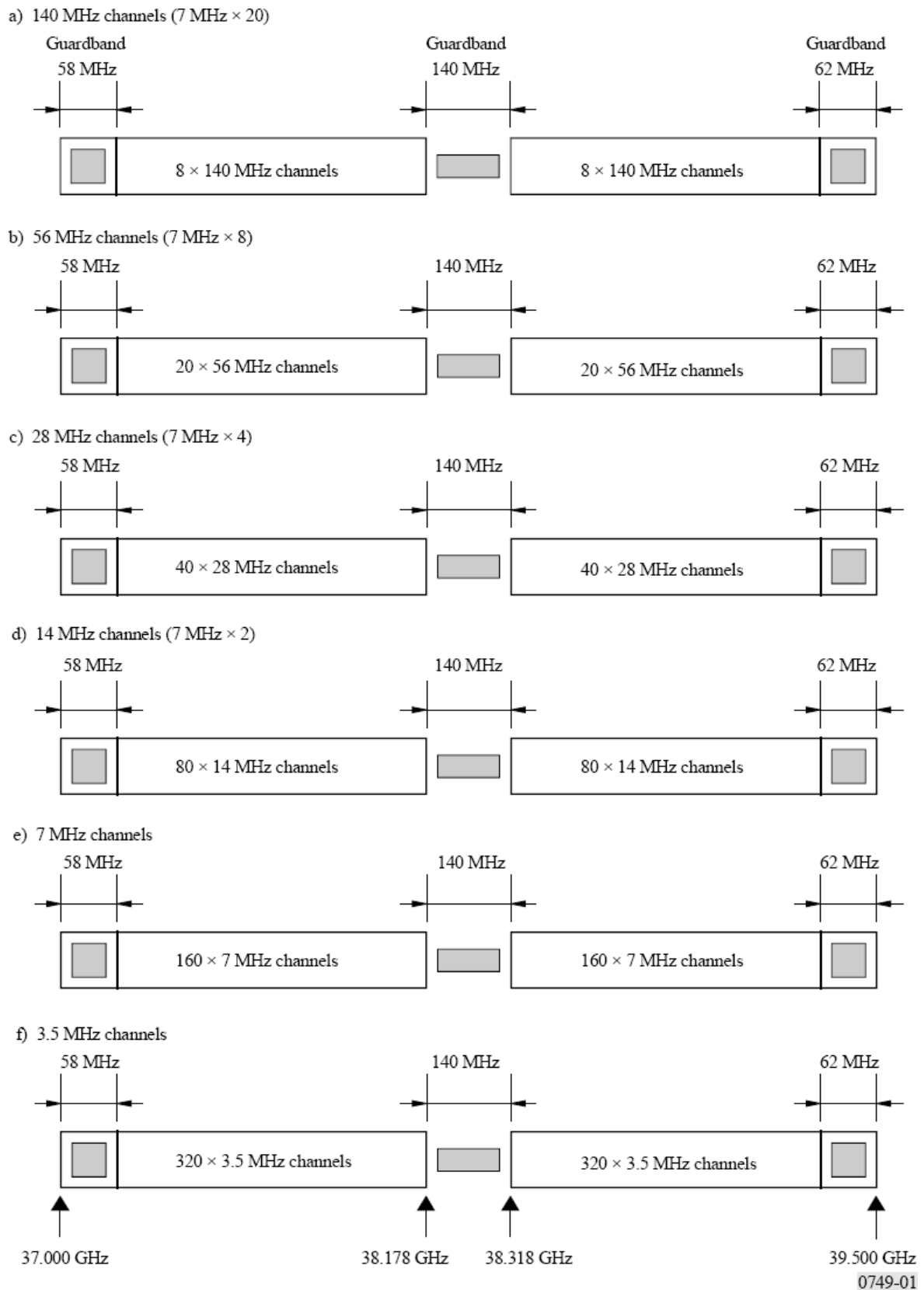


Figure 19: Channelling arrangement in the 38GHz band

2.4.23 Channel Arrangement in the 42 GHz band.

The preferred RF channel arrangement for medium and high capacity systems operating in the frequency band 40.5 – 43.5 GHz in Eswatini is as presented Annex 1 to ITU-R Recommendation F.2005. This preferred radio-frequency channel arrangement is based on multiples of basic channels of 7 MHz width merged to form higher channel widths up to 112 MHz with duplex spacing 1 500 MHz. In Eswatini the preferred channel widths are 56 MHz and 112 MHz. The frequencies of individual channels based on 112 MHz and 56 MHz channels are expressed by the following relationships;

Let $F_0 = 42\,000$ MHz;

a) for systems with a carrier spacing of 112 MHz:

$$F_n = F_0 - 1\,506 + 112n$$

$$F'_n = F_0 - 6 + 112n$$

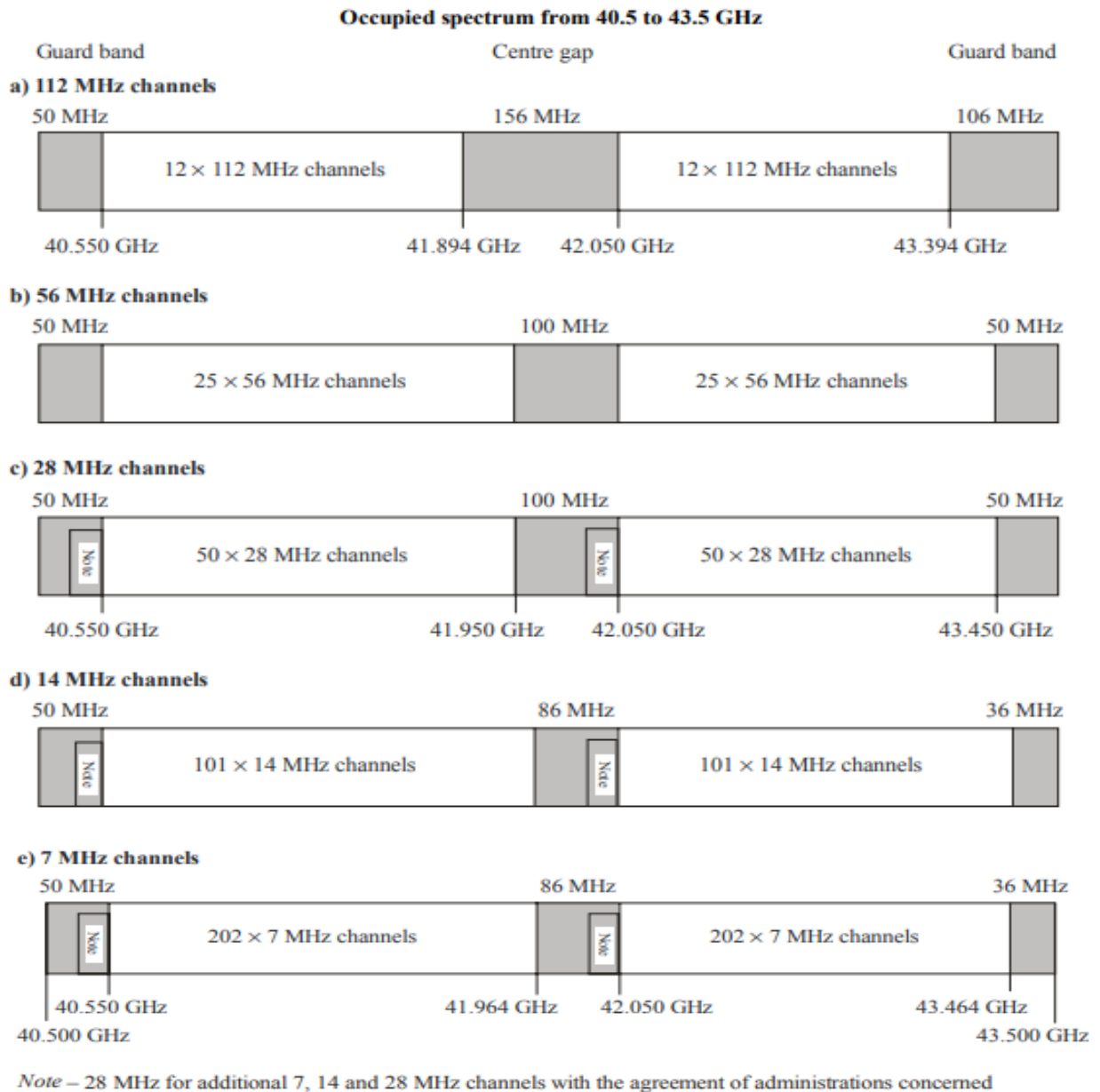
where: $n = 1, 2, 3, \dots, 12$

b) for systems with a carrier spacing of 56 MHz:

$$F_n = F_0 - 1\,478 + 56n$$

$$F'_n = F_0 + 22 + 56n$$

where: $n = 1, 2, 3, \dots, 25$



F.2005-01

Figure 20: Channelling arrangement in the 42GHz band

2.4.24 Channel Arrangement in the 52 GHz band.

The preferred RF channel arrangement for medium capacity systems operating in the frequency band 51.4 – 52.6 GHz in Eswatini is as presented Annex 1 to ITU-R F.1496. The propagation characteristics of the 51.4-52.6 GHz band are ideally suited for use of short-range digital point-to-point radio links in high-density applications in fixed services networks. This preferred channel arrangement provides for channel separations of 56 MHz, 28 MHz, 14 MHz, 7 MHz and 3.5 MHz with a duplex separation

of 112 MHz. The center frequencies for the individual channels for 56 MHz and 28 MHz channel separations are derived as follows:

Let $F_0 = 51\,412$ MHz,

a) for systems with a channel separation of 56 MHz:

$$F_n = F_0 + 56n$$

$$F'_n = F_0 + 616 + 56n, \quad \text{where: } n = 1, 2, \dots, 9$$

b) for systems with a channel separation of 28 MHz:

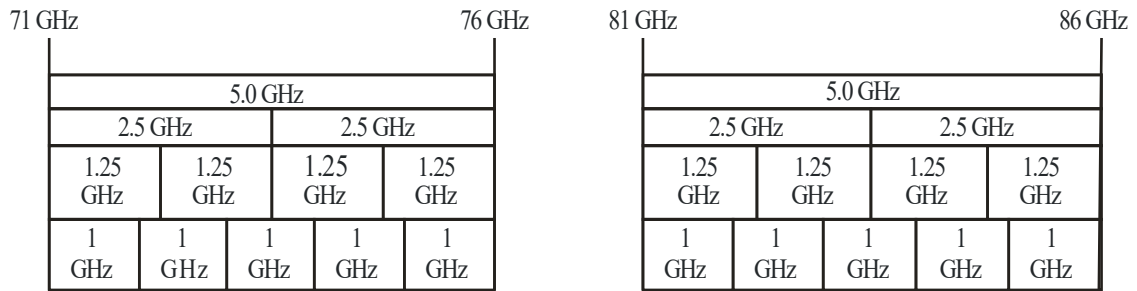
$$F_n = F_0 + 14 + 28n$$

$$F'_n = F_0 + 630 + 28n, \quad \text{where: } n = 1, 2, 3, \dots, 18$$

2.4.25 Channel Arrangement in the 70 GHz/ 80GHz band.

The preferred RF channel arrangement for medium and high capacity systems operating in the frequency band 71-76/81-86 GHz is as presented in Annex 1 and Annex 2 to ITU-R F.2006. The propagation characteristics in these bands are ideally suited for use of short-range high capacity digital radio links in high-density networks. The Recommendation ITU-R F.2006 provides radio-frequency channel and block arrangements for fixed wireless systems operating in the 71-76/81-86 GHz range, which may be used for broadband applications and other high-speed networks.

In Eswatini, a flexible sub-band or block arrangement that can accommodate various fixed wireless technologies, whilst remaining consistent with good spectrum management principles, including provision for inter-systems/services operation and overall spectrum efficiency; is adopted. The block arrangements are in accordance to Annex 1, while the sub-band/channel arrangements are in accordance to Annex 2 of ITU-R 2006 as show below;



F.2006-01

Figure 21: Spectrum allocation and channel distribution in the 70 / 80 GHz band

Basic 250 MHz channels in the 71-76 GHz and 81-86 GHz bands

Let F_0 be the reference frequency of:

71 000 MHz for the band 71-76 GHz,

81 000 MHz for the band 81-86 GHz

then the center frequencies of individual channels with 250 MHz separation, are expressed by the following relationship:

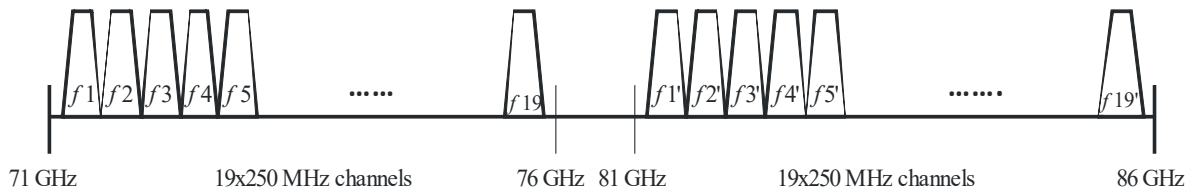
$$F_n = F_0 + 250n$$

where: $n = 1, 2, 3, \dots, 19$ for each band

The 19 basic 250 MHz channels derived as above maintain 125 MHz guard band (i.e. $ZS = 250$ MHz as defined in recommendation ITU-R F.746) at each four band edges.

There two arrangements (paring and aggregating) that can be achieved from these frequency bands as presented below;

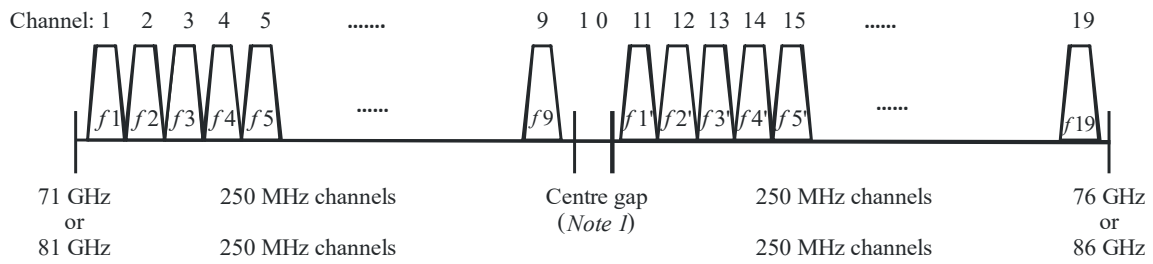
- a) The principle of using the 2×19 basic channels from within the bands 71-76 GHz and 81-86 GHz jointly in a single duplex FDD arrangement with 10 GHz duplex separation is described in the **Figure 22**.



F.2006-02

Figure 22: Combining the 250 MHz channels from 71-76/81-86 GHz bands into a single FDD arrangement

b) The principle of using the 2×19 basic channels within a single band 71-76 GHz or 81-86 GHz with two separate FDD arrangement with duplex separation of 2.5 GHz is shown in **Figure 23**.



Note 1 – Wider centre gap may be obtained with wider duplex separation (e.g. centre gap made by basic channels 9, 10 and 11 resulting in 2.75 GHz duplex separation).

F.2006-03

Figure 23: Combining the 250 MHz channels from single 71-76 GHz or 81-86 GHz band into separate FDD arrangement with duplex separation of 2.5 GHz

2.4.26 Channel Arrangement in the 94 GHz band.

The preferred RF channel arrangement for medium and high capacity systems operating in the frequency band 92.0 – 95 GHz is as presented in Annex 1 and Annex 2 to ITU-R F.2004. The channel arrangements as presented in Annex 1 and Annex 2 provide for TDD and FDD systems respectively. The RF channel arrangements for both TDD and FDD are shown below as follows;

a) Radio-frequency channel arrangements in the band 92.0-95.0 GHz for systems using TDD.

Let: $F_0 = 92\ 000\ \text{MHz}$,

then the center frequencies of individual channels are expressed by the following relationships:

- i. for systems with a channel separation of 100 MHz:

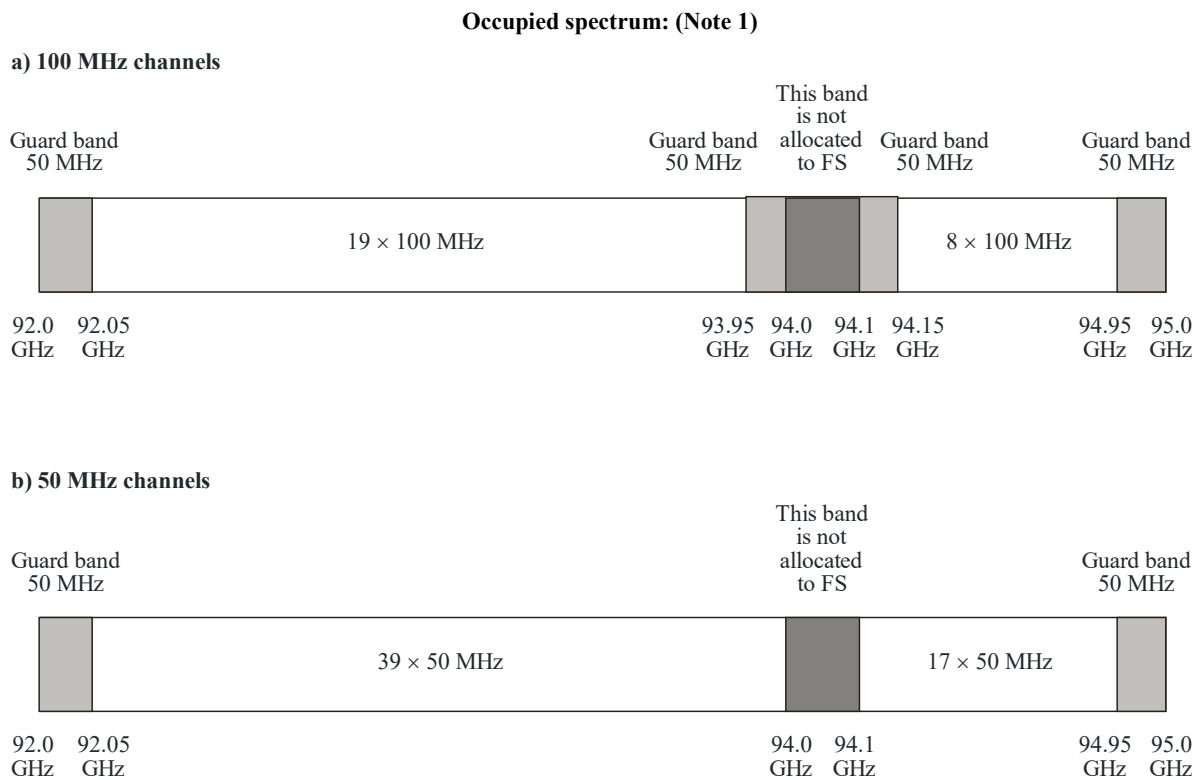
$$F_n = F_0 + 100n$$

where: $n = 1, 2, \dots, 19, 22, 23, \dots, 29$ (Notes 1 and 2)

- ii. for systems with a channel separation of 50 MHz:

$$F_n = F_0 + 25 + 50n$$

where: $n = 1, 2, \dots, 39, 43, 44, \dots, 58$ (Note 1).



Note 1 – Figure 1 gives occupied spectrum in the 92.0-95.0 GHz for the systems using TDD. Channels with $n = 20$ and 21 of the 100 MHz arrangement and $N = 40$ and 41 of the 50 MHz arrangement are not to be used.

Note 2 – Channel arrangements with a carrier spacing of 200, 300, ..., MHz are possible by channel concatenation.

F.2004-01

Figure 24: Occupied Spectrum in 92 to 95 GHz band note 1 and note 2

- b) Radio-frequency channel arrangement in the band 92.0-95.0 GHz for systems using FDD with duplex separation of 1500 MHz.

Let $F_0 = 92\,000\text{ MHz}$,

then the frequencies (MHz) of individual channels are expressed by the following relationships:

- i. for systems with a channel separation of 100 MHz:

$$F_n = F_0 + 100n$$

$$F'_n = F_0 + 1\,500 + 100n$$

where $n = 1, 2, 3, 4, 7, 8, \dots, 14$ (Notes 1 and 2)

- ii. for systems with a channel separation of 50 MHz:

$$F_n = F_0 + 25 + 50n$$

$$F'_n = F_0 + 1\,525 + 50n$$

where $n = 1, 2, 3, \dots, 9, 12, 13, \dots, 28$ (Note 1).

3 Current Usage in the Fixed Services Bands

An assessment of frequency assignment registers reveals that there are current terrestrial fixed services assignments deployed in the bands presented in this plan. A closer interrogation of the frequency assignment registers showed that some of the assignments are still not according to the ITU recommendations and are also not according to the proposed channeling arrangements in the CRASA harmonized Radio Frequency Channeling Arrangements for Terrestrial Fixed and Mobile Systems in SADC. This discrepancy was observed and noted in the previous Band Plan for Terrestrial Fixed Services Eswatini 2018. Therefore, this section presents all the current assignments in all the fixed services bands and the summary of the usage of the bands is shown in Annex A.

3.1 1.4GHz Band

Currently there are no assignments in this band in Eswatini, and this means that all twelve (12) channels are available for assignment.

3.2 2GHz Band

Currently there are no assignments in this band in Eswatini, and this means that all twelve (12) channels are available for assignment.

3.3 2.4 GHz Band

Currently there are 21 links assigned to EPTC in this band which occupy 7 channels, meaning that 73 channels are available for assignment. The assigned channels are as shown in

Table 29: Channel assignments in the 2.4GHz band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|------------|------------------|------------|------------------|
| 1 | 2308 | 1' | 2402 |
| 5 | 2312 | 5' | 2406 |
| 9 | 2316 | 9' | 2410 |
| 13 | 2320 | 13' | 2414 |
| 17 | 2324 | 17' | 2418 |
| 21 | 2328 | 21' | 2422 |
| 25 | 2332 | 25' | 2426 |

3.4 4GHz Band

Currently there are no assignments in this band in Eswatini, and this means that all twelve (12) channels are available for assignment.

3.5 5GHz Band

There are currently two assignments in the 5 GHz band which are being utilized for last mile connectivity of the microwave links used by Eswatini Nation Fire & Emergency Services:

Table 30: Channel Assignments in 5GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency | User |
|------------|------------------|------------|------------------|---|
| 6 | 4 630 | 6' | 4 930 | Eswatini Nation Fire & Emergency Services |
| 7 | 4 670 | 7' | 4 970 | Eswatini Nation Fire & Emergency Services |

There are 5 channels available for assignment in this band (Channel 1, 2, 3, 4, 5).

3.6 7GHz Band

Currently nine out of the ten go and return channels have been assigned and are being utilized for microwave and CDMA by EPTC, microwave by Eswatini Mobile and microwave by MICT DTT.

Table 31: Channel Assignments in 7GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency | User |
|------------|------------------|------------|------------------|----------------------------------|
| 1l | 7 121 | 1l' | 7 317 | EPTC, Eswatini Mobile |
| 2l | 7 149 | 2l' | 7 345 | EPTC, MICT DTT, Eswatini Mobile |
| 3l | 7 177 | 3l' | 7 373 | EPTC, Eswatini Mobile |
| 4l | 7 205 | 4l' | 7 401 | EPTC, MICT DTT, Eswatini Mobile |
| 5l | 7 233 | 5l' | 7 429 | EPTC CDMA Backhauling, Jenny SWZ |
| 1h | 7 457 | 1h' | 7 625 | Eswatini Mobile, |
| 2h | 7 485 | 2h' | 7 653 | Eswatini Mobile |
| 4h | 7 541 | 4h' | 7 709 | Eswatini Mobile |
| 5h | 7 569 | 5h' | 7 737 | Eswatini Mobile |

There are also other assignments in this band which do not conform to the channeling arrangement and are assigned to MTN Eswatini. The assignments are shown below:

Table 32: Channel Usage in 7GHz Band

| Transmit Frequency | Receive Frequency | User |
|--------------------|-------------------|--------------|
| 7 156 | 7 310 | MTN Eswatini |
| 7 456 | 7 701 | MTN Eswatini |
| 7 512 | 7 757 | MTN Eswatini |
| 7 596 | 7 841 | MTN Eswatini |

3.7 Lower 8GHz Band

There are currently four (4) channels which are assigned in this band for EPTC and Eswatini Mobile as shown in the table below:

Table 33: Channel Assignments in lower 8GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency | User |
|------------|------------------|------------|------------------|-----------------|
| 1 | 7 747.70 | 1' | 8 059.02 | EPTC, |
| 2 | 7 777.35 | 2' | 8 088.67 | EEC |
| 3 | 7 807.00 | 3' | 8 118.32 | EEC, EPTC |
| 4 | 7 836.65 | 4' | 8 147.97 | EEC |
| 5 | 7866.30 | 5' | 8177.62 | EEC |
| 7 | 7 925.60 | 7' | 8 236.92 | Eswatini Mobile |
| 8 | 7 955.25 | 8' | 8 266.57 | Eswatini Mobile |

There are also other assignments in this band which do not conform to the channeling arrangement and were assigned to EEC and MTN Eswatini. These affect all the other channels and renders them un-usable. The assignments are shown below:

Table 34: Channel Usage in lower 8GHz Band

| Transmit Frequency | Receive Frequency | User |
|--------------------|-------------------|------------------------------|
| 7 926 | 8 192 | MTN Eswatini |
| 7 940 | 8 206 | MTN Eswatini |
| 7 954 | 8 220 | MTN Eswatini |
| 7 982 | 8 248 | MTN Eswatini |
| 7 996 | 8 262 | MTN Eswatini |
| 8 010 | 8 276 | MTN Eswatini |
| 8 030 | 8 296 | Eswatini Electricity company |
| 8 052 | 8 318 | MTN Eswatini |
| 8 066 | 8 332 | MTN Eswatini |
| 8 071 | 8 337 | MTN Eswatini |
| 8 094 | 8 360 | Eswatini Electricity company |
| 8 098 | 8 364 | Eswatini Electricity company |
| 8 108 | 8 374 | MTN Eswatini |

| | | |
|-------|-------|------------------------------|
| 8 112 | 8 378 | Eswatini Electricity company |
| 8 122 | 8 388 | Eswatini Electricity company |

3.8 Upper 8GHz Band

In this band, the spectrum is assigned on 7MHz or channels can be paired to have an assignment on 14MHz. Currently in this band we have one channel (Channel 4) assigned on the 7MHz bandwidth as shown below:

Table 35: Channel Assignment in upper 8GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency | User |
|------------|------------------|------------|------------------|-------------------------------|
| 4 | 8307 | 4' | 8433 | Eswatini Electricity Company. |

This means that there are 11 channels available for assignment on 7MHz or 5 channels in the 14MHz.

Also, four (4) channels based on the 14 MHz bandwidth are assigned in this band as shown below;

Table 36: Channel Assignment in upper 8GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency | User |
|------------|------------------|------------|------------------|-------------------------------|
| 1 | 8 293 | 1' | 8 412 | Eswatini Electricity Company. |
| 2 | 8 307 | 2' | 8 426 | Eswatini Electricity Company. |
| 3 | 8 321 | 3' | 8 440 | Eswatini Electricity Company. |
| 4 | 8 335 | 4' | 8 454 | Eswatini Electricity Company. |

3.9 10.5 GHz Band

Currently there are no channel assignments in this band.

3.10 11GHz Band

In this band, all of the available channels have been assigned to a number of operators and the trend shows an increase in applications for this band. The assignment in this band are shown below as follows;

Table 37: Channel Assignment in 11GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency | User |
|------------|------------------|------------|------------------|--|
| 1 | 10 735 | 1' | 11 225 | His Majesty's Correctional Services (10.73-11.22), Eswatini Nation Fire & Emergency Services, |

| | | | | |
|----|--------|-----|--------|---|
| | | | | Ministry of ICT (GCS), Jenny Swaziland, Ministry of Health |
| 2 | 10 775 | 2' | 11 265 | Royal Eswatini Police Service, Ministry of ICT (GCS), Eswatini Broadcasting and Information Service, Jenny Swaziland, Ministry of Health |
| 3 | 10 815 | 3' | 11 305 | Eswatini Nation Fire & Emergency Services, Ministry of ICT (GCS), Jenny Swaziland, Touch IT, Ministry of Health |
| 4 | 10 855 | 4' | 11 345 | Eswatini Nation Fire & Emergency Services, Jenny Swaziland, Sincephetelo Motor Vehicle Accident Fund, Touch IT |
| 5 | 10 895 | 5' | 11 385 | Eswatini Nation Fire & Emergency Services, Jenny Swaziland, Ministry of Health |
| 6 | 10 935 | 6' | 11 425 | Eswatini Nation Fire & Emergency Services, Eswatini Broadcasting and Information Service, Ministry of Health |
| 7 | 10 975 | 7' | 11 465 | Eswatini Nation Fire & Emergency Services, Sincephetelo Motor Vehicle Accident Fund, Touch IT, Eswatini Broadcasting and Information Service |
| 8 | 11 015 | 8' | 11 505 | Royal Eswatini Police Service, Jenny Swaziland, Sincephetelo Motor Vehicle Accident Fund, Ministry of Health |
| 9 | 11 055 | 9' | 11 545 | Royal Eswatini Police Service, Ministry of Health |
| 10 | 11 095 | 10' | 11 585 | Royal Eswatini Police Service, Ministry of Health |
| 11 | 11 135 | 11' | 11 625 | Royal Eswatini Police Service, Ministry of ICT (GCS), Touch IT, Ministry of Health |
| 12 | 11 175 | 12' | 11 665 | Ministry of ICT (GCS), Touch IT, Eswatini Broadcasting and Information Service |

3.11 13GHz Band

In this band, six (6) of the available channels have been assigned to MTN Eswatini.

Table 38: Channel Assignment in 13GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency | User |
|------------|------------------|------------|------------------|--------------|
| 1 | 12 765 | 1' | 13 031 | MTN Eswatini |
| 2 | 12 793 | 2' | 13 059 | MTN Eswatini |
| 3 | 12 821 | 3' | 13 087 | MTN Eswatini |
| 4 | 12 849 | 4' | 13 115 | MTN Eswatini |
| 5 | 12 877 | 5' | 13 143 | MTN Eswatini |
| 6 | 12 905 | 6' | 13 171 | MTN Eswatini |

This means that there are two (2) channels available for assignment.

3.12 14GHz Band

Currently there are no assignments in this band in Eswatini, and this means that all four (4) channels are available for assignment

3.13 15GHz Band

In this band, ten (10) of the available channels have been assigned to EPTC and Eswatini Mobile as shown in the table below:

Table 39: Channel Assignment in 15GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency | User |
|--------------|-------------------|---------------|-------------------|---|
| 1 | 14 515 | 1' | 15 131 | EPTC (microwave/wireless local loop) |
| 3 | 14 571 | 3' | 15 187 | EPTC (wireless local loop) |
| 7 | 14 683 | 7' | 15 299 | Eswatini Mobile (microwave) |
| 8 | 14 711 | 8' | 15 327 | Eswatini Mobile (microwave) |
| 9 | 14 739 | 9' | 15 355 | Eswatini Mobile (microwave) |
| 10 | 14 767 | 10' | 15 383 | Eswatini Mobile (microwave) |
| 11 | 14 795 | 11' | 15 411 | Eswatini Mobile (microwave) |
| 12 | 14 823 | 12' | 15 439 | Eswatini Mobile (microwave) |
| 13 | 14 851 | 13' | 15 467 | Eswatini Mobile (microwave) |
| 14 | 14 879 | 14' | 15 495 | Eswatini Mobile (microwave) |

This means that there are six (6) channels available for assignment.

3.14 18GHz Band

In this band, there are forty-nine (49) channels which have been assigned to MTN Eswatini for microwave backhauling and Real Image as shown in the table below:

Table 40: Channel Assignment in 18GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency | User |
|------------|------------------|------------|------------------|--------------------------|
| 1 | 17710.0 | 1' | 18720.0 | MTN Eswatini (microwave) |
| 2 | 17717.5 | 2' | 18727.5 | MTN Eswatini (microwave) |
| 39 | 17995.0 | 39' | 19005.0 | MTN Eswatini (microwave) |
| 40 | 18002.5 | 40' | 19012.5 | MTN Eswatini (microwave) |
| 41 | 18010.0 | 41' | 19020.0 | MTN Eswatini (microwave) |
| 42 | 18017.5 | 42' | 19027.5 | MTN Eswatini (microwave) |
| 43 | 18025.0 | 43' | 19035.0 | MTN Eswatini (microwave) |
| 44 | 18032.5 | 44' | 19042.5 | MTN Eswatini (microwave) |
| 45 | 18040.0 | 45' | 19050.0 | MTN Eswatini (microwave) |
| 46 | 18047.5 | 46' | 19057.5 | MTN Eswatini (microwave) |
| 47 | 18055.0 | 47' | 19065.0 | MTN Eswatini (microwave) |
| 48 | 18062.5 | 48' | 19072.5 | MTN Eswatini (microwave) |
| 49 | 18070.0 | 49' | 19080.0 | MTN Eswatini (microwave) |
| 50 | 18077.5 | 50' | 19087.5 | MTN Eswatini (microwave) |
| 56 | 18122.5 | 56' | 19132.5 | MTN Eswatini (microwave) |
| 58 | 18137.5 | 58' | 19147.5 | MTN Eswatini (microwave) |
| 59 | 18145.0 | 59' | 19155.0 | MTN Eswatini (microwave) |
| 66 | 18197.5 | 66' | 19207.5 | MTN Eswatini (microwave) |
| 67 | 18205.0 | 67' | 19215.0 | MTN Eswatini (microwave) |
| 68 | 18212.5 | 68' | 19222.5 | MTN Eswatini (microwave) |
| 69 | 18220.0 | 69' | 19230.0 | MTN Eswatini (microwave) |
| 70 | 18227.5 | 70' | 19237.5 | MTN Eswatini (microwave) |
| 76 | 18272.5 | 76' | 19282.5 | MTN Eswatini (microwave) |
| 77 | 18280.0 | 77' | 19290.0 | MTN Eswatini (microwave) |
| 84 | 18332.5 | 84' | 19342.5 | MTN Eswatini (microwave) |
| 91 | 18385.0 | 91' | 19395.0 | MTN Eswatini (microwave) |
| 92 | 18392.5 | 92' | 19402.5 | MTN Eswatini (microwave) |
| 95 | 18415.0 | 95' | 19425.0 | MTN Eswatini (microwave) |
| 99 | 18445.0 | 99' | 19455.0 | MTN Eswatini (microwave) |
| 100 | 18452.5 | 100' | 19462.5 | MTN Eswatini (microwave) |
| 102 | 18467.5 | 102' | 19477.5 | MTN Eswatini (microwave) |
| 103 | 18475.0 | 103' | 19485.0 | MTN Eswatini (microwave) |
| 106 | 18497.5 | 106' | 19507.5 | MTN Eswatini (microwave) |
| 109 | 18520.0 | 109' | 19530.0 | MTN Eswatini (microwave) |
| 110 | 18527.5 | 110' | 19537.5 | MTN Eswatini (microwave) |
| 118 | 18587.5 | 118' | 19597.5 | Real Image (microwave) |
| 119 | 18595.0 | 119' | 19605.0 | Real Image (microwave) |
| 120 | 18602.5 | 120' | 19612.5 | Real Image (microwave) |
| 121 | 18610.0 | 121' | 19620.0 | Real Image (microwave) |
| 122 | 18617.5 | 122' | 19627.5 | Real Image (microwave) |
| 123 | 18625.0 | 123' | 19635.0 | Real Image (microwave) |
| 124 | 18632.5 | 124' | 19642.5 | Real Image (microwave) |
| 125 | 18640.0 | 125' | 19650.0 | Real Image (microwave) |
| 126 | 18647.5 | 126' | 19657.5 | Real Image (microwave) |
| 127 | 18655.0 | 127' | 19665.0 | Real Image (microwave) |
| 128 | 18662.5 | 128' | 19672.5 | Real Image (microwave) |
| 129 | 18670.0 | 129' | 19680.0 | Real Image (microwave) |
| 130 | 18677.5 | 130' | 19687.5 | Real Image (microwave) |

| | | | | |
|-----|---------|------|---------|------------------------|
| 131 | 18685.0 | 131' | 19695.0 | Real Image (microwave) |
|-----|---------|------|---------|------------------------|

This means that there are ninety-six (96) channels which are available for assignment.

3.15 23GHz Band

There are currently five (5) go and return channels that have been assigned in this band and are being utilized for microwave by MTN Eswatini as shown in the table below:

Table 41: Channel Assignment in 23GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency | User |
|------------|------------------|------------|------------------|------------------------------|
| 1 | 21 280 | 1' | 22 512 | Eswatini Electricity Company |
| 2 | 21 392 | 2' | 22 624 | Eswatini Electricity Company |
| 5 | 21 728 | 5' | 22 960 | MTN Eswatini (microwave) |
| 6 | 21 840 | 6' | 23 072 | MTN Eswatini (microwave) |
| 7 | 21 952 | 7' | 23 184 | MTN Eswatini (microwave) |
| 8 | 22 064 | 8' | 23 296 | MTN Eswatini (microwave) |
| 9 | 22 176 | 9' | 23 408 | MTN Eswatini (microwave) |

This leaves five (5) available channels for assignment.

3.16 26GHz Band

There are currently three (3) go and return channels that have been assigned in this band based on 56 MHz bandwidth and are being utilized for microwave by as shown in the table below:

Table 42: Channel Assignment in 26GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency | User |
|------------|------------------|------------|------------------|-----------------|
| 5 | 24 801 | 5' | 25 809 | Eswatini Mobile |
| 6 | 24 857 | 6' | 25 865 | Eswatini Mobile |
| 7 | 24 913 | 7' | 25 921 | Eswatini Mobile |

3.17 28GHz Band

Currently there are no assignments in this band in Eswatini, and this means that all eight (8) channels are available for assignment.

3.18 31GHz Band

Currently there are no assignments in this band in Eswatini, and this means that all six (6) channels are available for assignment.

3.19 32GHz Band

There is currently one (1) go and return channel that have been assigned in this band based on 56 MHz bandwidth and are being utilized for microwave by as shown in the table below:

Table 43: Channel Assignment in 26GHz Band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency | User |
|------------|------------------|------------|------------------|-----------------|
| 5 | 32 123 | 5' | 32 935 | Eswatini Mobile |

3.20 38GHz Band

Currently there are no assignments in this band in Eswatini, and this means that all twenty (20) channels are available for assignment.

3.21 42GHz Band

Currently there are no assignments in this band in Eswatini, and this means that all twelve (12) channels are available for assignment.

3.22 52 GHz Band

Currently there are no assignments in this band in Eswatini, and this means that all nine (9) channels are available for assignment.

3.23 70/80GHz Band

Currently there are no assignments in this band in Eswatini, and this means that all nineteen (19) channels are available for assignment.

3.24 94GHz Band

Currently there are no assignments in this band in Eswatini, and this means that all twenty-nine (29) channels are available for assignment.

4 Conclusion and Recommendations

Below is a summary of the recommended actions with respect to the implementation of the band plan:

4.1 Spectrum Assignment

The Commission in implementing this plan is using the regime of per link assignment where each link is considered individually as opposed to a nationwide assignment of spectrum in the terrestrial fixed services band. However, in the event that a particular licensee makes extensive use of a particular frequency range for the deployment of fixed links and feels it may be more cost effective to apply for the exclusive use of that particular range over a geographical area that encompasses all current and planned fixed link deployments, the licensee may be allowed to apply for the exclusive use based on the sterilized area.

4.2 4GHz Band

It is recommended that since the above assignments do not conform to the preferred channel arrangement for the 4 GHz band, these users should be re-assigned frequencies that shall conform with the preferred channel arrangement. As such EPTC can be assigned the following frequency channels in the 4 GHz band;

Table 44: Recommended Assignments in the 4GHz band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|------------|------------------|------------|------------------|
| 1 | 3 620 | 1' | 3 940 |
| 4 | 3 710 | 4' | 4 030 |
| 5 | 3 740 | 5' | 4 060 |

4.3 Lower 6GHz and Upper 6GHz

Based on future projections of having the 6GHz band extended for Wi-Fi applications, we have engaged EPTC to ascertain their usage of this band and they have indicated that they no longer utilize this band. This gives direction concerning a way forward as well as provide guidance on the decision to support the extension of the Wi-Fi bands at WRC-23.

4.4 Lower 8GHz Band

It is recommended that the assignments which are not conforming to the channeling plan must be re-aligned to the channeling plan. This will require the engagement of MTN Eswatini and EEC in order to change their assignments. These licensees can be reassigned their channels as follows:

Table 45: Recommended Assignments in the Lower 8GHz band

| Channel Nr | Centre frequency | Channel Nr | Centre frequency |
|-------------------|-------------------------|-------------------|-------------------------|
| 2 | 7 777.35 | 2' | 8 088.67 |
| 3 | 7 807.00 | 3' | 8 118.32 |
| 4 | 7 836.65 | 4' | 8 147.97 |
| 5 | 7 866.30 | 5' | 8 177.62 |

4.5 14GHz

EPTC in this band is currently utilizing one channel which carries one link however it is not according to the proposed channelling arrangement. It is recommended that they be engaged in order to have them align with the current band plan.

Appendix A

Summary of Channel Assignments in the Fixed Services Bands

| Service | Frequency Band | Assigned Spectrum | Available Spectrum |
|----------------------|-------------------------------|--|--|
| Point-to-Point links | 1.4 GHz (BW: 2 MHz) | - | All channels |
| | 2 GHz (BW: 14MHz) | Chl 1, 4 | Chl 2, 3, 5, 6 |
| | 2.4 GHz (BW: 1 MHz) | Chl 1, 5, 9, 13, 17, 21, 25 | All other channels |
| | 4 GHz (BW: 30MHz) | Chl 1, 4, 5 | Chl 2, 3, 6, 7, 8, 9 |
| | 5 GHz (BW: 40MHz) | Chl 6, 7 | Chl 1, 2, 3, 4, 5 |
| | 7 GHz (BW: 28MHz) | Chl 1l, 2l, 3l, 4l, 5l, 1h, 2h, 4h, 5h | Chl 3h |
| | Lower 8 GHz (BW: 29.65MHz) | Chl 1, 3, 7, 8 | Chl 2, 4, 5, 6 |
| | Upper 8 GHz (BW: 7MHz) | Chl 4 | Chl 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12 |
| | Upper 8 GHz (BW: 14MHz) | Chl 2 | Chl 1, 3, 4, 5, 6 |
| | 10.5 GHz (BW: 28MHz) | - | Chl 1, 2, 3, 4, 5 |
| | 11 GHz (BW: 40MHz) | All Channels | - |
| | 13 GHz (BW: 28MHz) | Chl 1, 2, 3, 4, 5, 6 | Chl 7, 8 |
| | 14 GHz (BW: 28 MHz) | - | All channels |
| | 15 GHz (BW: 28MHz) | Chl 1, 3, 7, 8, 9, 13 | Chl 2, 4, 5, 6, 10, 11, 12, 13, 15 |
| | 18 GHz (BW: 7.5 MHz) 131 Chls | (35 channels) | (96 channels) |
| | 23 GHz (BW: 112MHz) | Chl 5, 6, 7, 8, 9 | Chl 1, 2, 3, 4, 10 |
| | 26 GHz (BW: 112MHz) | - | (8 channels) |
| | 28 GHz (BW: 112MHz) | - | (8 channels) |
| | 31 GHz (BW: 50 MHz) | - | All channels |
| | 32 GHz (BW: 56MHz) | - | (12 channels) |
| | 38 GHz (BW: 56MHz) | - | (20 channels) |
| | 38 GHz (BW: 140MHz) | - | (8 channels) |
| | 42 GHz (BW: 112 MHz) | - | All channels |
| | 52 GHz (BW: 56 MHz) | - | All channels |
| | 70/80 GHz (BW: 250 MHz) | - | All channels |
| | 94 GHz (BW: 100 MHz) | - | All channels |