Eswatini Communications Commission

Band Plan for VHF / UHF Two-Way Radio Communications (PMR) Services Bands Eswatini 2019

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1 Introduction

1.1 Background

Private Mobile Radio (PMR) or as it is sometimes called Professional Mobile Radio is widely used for businesses as a very convenient way of communicating. It typically refers to radio trunking services that provide two-way mobile radio communications for mobile users to connect to PMR voice telephony and data networks. PMR offers a two-way communications service that permits users to talk over a short distance on a simple local system or wide-area, even nation-wide on a more complex system, without incurring any costs on the calls. This has been widely adopted by many organizations who work in areas where it is unlikely to be coverage, e.g. power utilities and emergency and safety services where everyone in that space must hear of be aware of what is being communicated.

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 PMR services systems in Eswatini.

Currently there is an extensive use of these frequencies for VHF and UHF voice and data communications, this is not to say that there is a very high demand as there is still a lot of unused channels in the PMR bands. It can be noted however that there is no control in the usage of the frequencies. A further analysis of the services deployed in the PMR bands identified that there are bands which are utilized but the utilization is not based on the recommended channelling arrangements which are proposed in ITU recommendations and also in the Harmonised Radio Frequency Channelling Arrangements for SADC.

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 national frequency allocation plan (NFAP), therefore, in accordance with the tenants of the Electronic Communications Act, 2013, the proposed band plan for VHF/UHF 2-way radio communications (PMR) Services bands is being issued, as the Commission desires to promote the efficient use of radio frequency spectrum resources to achieve the much desired socio-economic transformation of the country.

1.2 Intention of the Commission

The Commission, in accordance with the Electronic Communications Act 2013 [Act No. 09 of 2013] and the Electronic Communications (Radio Communications and Frequency Spectrum) Regulations), 2016, intends to publish a band plan for VHF/UHF 2-way radio communications (PMR) Services bands which gives channelling structure for currently assigned spectrum and also recommend 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 following decisions and plans for the different VHF/UHF 2-way radio communications (PMR) Services bands:

1.2.1 Channelling Arrangement in the VHF bands (30.01 – 267 MHz)

The channelling arrangement for this band for the frequency bands 30.1 to 267.0 MHz are presented in this section and the channelling arrangements are given as illustrated in Table 1 below: based on Annex 1 of ITU recommendation ITU-R M.478-5

Table 1: Channelling arrangement for VHF band in PMR service

Segment	Service Allocation	Segment frequency limits (MHz)	Paired segment	Channel bandwidth (kHz)	Channel centre frequency formula	Range of 'n' values	First/last channel centre frequency
A	Government (Single frequency)	30.01000 – 31.0100	-	12.5	30.0100 + n (0.0125)	1 to 79	30.0225 MHz 30.9975 MHz
B	Government (Two frequency, base/repeater)	31.0100 – 33.5100	D	12.5	31.0100 + n (0.0125)	1 to 199	31.0225 MHz 33.4975 MHz
C	Government (Single frequency)	33.5100 – 34.0100	-	12.5	33.5100 + n (0.0125)	1 to 39	33.5225 MHz 33.9975 MHz
D	Government (Two frequency, base/repeater)	34.0100 – 36.5100	B	12.5	34.0100 + n (0.0125)	1 to 199	34.0225 MHz 36.4975 MHz
E	Government (Single frequency)	36.5100 – 37.5100	-	12.5	36.5100 + n (0.0125)	1 to 79	36.5225 MHz 37.4975 MHz
F	Land mobile/radio astronomy (Single frequency)	37.5100 – 39.0000	-	12.5	37.5100 + n (0.0125)	1 to 119	37.5225 MHz 38.9975 MHz
G	Land mobile (Single frequency)	39.9860 – 42.0000	-	12.5	39.9860 + n (0.0125)	1 to 161	39.9985 MHz 41.9985 MHz
H	Land mobile (Single frequency)	44.0000 – 44.7700	-	12.5	44.0000 + n (0.0125)	1 to 61	44. 0125 MHz 44.7625 MHz
I	Land mobile (Two frequency)	44.7700 – 45.3000	M	12.5	44.7700 + n (0.0125)	1 to 42	44.7825 MHz 45.2950 MHz
J	Land mobile/meteor burst (Two frequency)	45.3000 – 46.6100	N	12.5	45.3000 + n (0.0125)	1 to 104	45.3125 MHz 46.6000 MHz

K	Land mobile/ meteor bust, Cordless Telephony (Two frequency)	46.6100 – 46.9000	0	12.5	46.6100 + n (0.0125)	1 to 23	46.6225 MHz 46.8975 MHz
L	Land mobile/Cordless Telephony (Two frequency)	46.9000 – 46.9700	P	12.5	46.9000 + n (0.0125)	1 to 5	46.9125 MHz 46.9625 MHz
M	Land Mobile (Single frequency)	46.9700 – 47.5000	I	12.5	46.9700 + n (0.0125)	1 to 42	46.9825 MHz 47.4950 MHz
N	Land mobile/meteor burst (Two frequency)	47.5000 – 48.8100	J	12.5	47.5000 + n (0.0125)	1 to 104	47.5125 MHz 48.8000 MHz
O	Land mobile/ meteor bust, Cordless Telephony (Two frequency)	48.8100 – 49.1000	K	12.5	48.8100 + n (0.0125)	1 to 23	48.8225 MHz 49.0975 MHz
P	Land mobile/Cordless Telephony (Two frequency)	49.1000 – 49.1750	L	12.5	49.1000 + n (0.0125)	1 to 5	49.1125 MHz 49.1625 MHz
Q	Land mobile (Single frequency)	49.1750 – 50.000	-	12.5	49.1750 + n (0.0125)	1 to 65	49. 1875 MHz 49.9875 MHz
R	Land mobile (Two frequency)	54.0000 – 57.0000	S	12.5	54.0000 + n (0.0125)	1 to 239	54.0125 MHz 56.9875 MHz
S	Land mobile (Two frequency)	57.0000 – 60.0000	R	12.5	57.0000 + n (0.0125)	1 to 239	57.0125 MHz 59.9875 MHz
T	Land mobile (Single frequency)	60.0000 – 64.0000	-	12.5	60.0000 + n (0.0125)	1 to 319	60.0125 MHz 63.9875 MHz
U	Land mobile (Two frequency)	64.0000 – 67.0000	V	12.5	64.0000 + n (0.0125)	1 to 239	64.0125 MHz 66.9875 MHz
V	Land mobile (Two frequency)	67.0000 – 70.0000	U	12.5	67.0000 + n (0.0125)	1 to 239	67.0125 MHz 69.9875 MHz
W	Land mobile (Two frequency)	70.0000 – 71.8000	Y	12.5	70.0000 + n (0.0125)	1 to 143	70.0125 MHz 71.7875 MHz
X	Land mobile (Single frequency)	71.8000 – 73.0000	-	12.5	71.8000 + n (0.0125)	1 to 95	71.8125 MHz 73.0000 MHz
Y	Land mobile (Two frequency)	73.0000 – 74.8000	W	12.5	73.0000 + n (0.0125)	1 to 143	73.0125 MHz 74.7875 MHz
Z	Land mobile (Two frequency)	75.2000 – 78.2000	AA	12.5	75.2000 + n (0.0125)	1 to 239	75.2125 MHz 78.1875 MHz
AA	Land mobile (Two frequency)	78.2000 – 81.2000	Z	12.5	78.2000 + n (0.0125)	1 to 239	78.2125 MHz 81.1875 MHz
AB	Land mobile (Single frequency)	81.2000 – 83.0000	-	12.5	81.2000 + n (0.0125)	1 to 143	81.2125 MHz 82.9875 MHz
AC	Land mobile (Two frequency)	83.0000 – 84.5000	AE	12.5	83.0000 + n (0.0125)	1 to 119	83.2125 MHz 84.4875 MHz
AD	Land mobile (Single frequency)	84.5000 – 86.0000	-	12.5	84.5000 + n (0.0125)	1 to 119	84.5125 MHz 85.9875 MHz
AE	Land mobile (Two frequency)	86.0000 – 87.5000	AC	12.5	86.0000 + n (0.0125)	1 to 119	86.0125 MHz 87.4875 MHz
AF	Land mobile (Two frequency)	138.0000 – 140.1000	AJ	12.5	138.0000 + n (0.0125)	1 to 167	138.0125 MHz 140.0875 MHz
AG	Land mobile (Two frequency)	140.1000 – 140.5000	AK	12.5	140.1000 + n (0.0125)	1 to 31	140.1125 MHz 140.4875 MHz
AH	Land mobile (Two frequency) Alarms	140.5000 – 141.0000	AR	12.5	140.5000 + n (0.0125)	1 to 39	140.5125 MHz 140.9875 MHz
AI	Land mobile (Single frequency)	141.0000 – 141.5000	-	12.5	141.0000 + n (0.0125)	1 to 39	141.0125 MHz 141.4875 MHz

AJ	Land mobile (Single frequency)	141.5000 – 143.6000	AF	12.5	141.5000 + n (0.0125)	1 to 167	141.5125 MHz 143.5875 MHz
AK	Land mobile (Two frequency)	143.6000 – 144.0000	AG	12.5	143.6000 + n (0.0125)	1 to 31	143.6125 MHz 143.9875 MHz
AL	Land mobile (Two frequency)	146.0000 – 148.0000	AT	12.5	146.0000 + n (0.0125)	1 to 159	146.0125 MHz 146.9875 MHz
AM	Land mobile (Two frequency)	148.0000 – 148.9500	AU	12.5	148.0000 + n (0.0125)	1 to 75	148.0125 MHz 148.9375 MHz
AN	Land mobile (Single frequency)	148.9500 – 149.9000	-	12.5	149.0000 + n (0.0125)	1 to 75	148.9625 MHz 149.8875 MHz
AO	Land mobile/ LEO systems (Single frequency)	149.9000 – 150.05000	-	12.5	149.0000 + n (0.0125)	1 to 83	149.0125 MHz 150.0375 MHz
AP	Land mobile/ paging (Single frequency)	150.0500 – 151.0000	-	12.5	150.0000 + n (0.0125)	1 to 75	150.0625 MHz 150.9875 MHz
AQ	Land mobile/ (Single frequency)	151.0000 – 152.0500	-	12.5	151.0000 + n (0.0125)	1 to 83	151.0000 MHz 152.0375 MHz
AR	Land mobile/ (Two frequency)	152.0500 – 152.5500	AH	12.5	152.0500 + n (0.0125)	1 to 39	152.0625 MHz 152.5375 MHz
AS	Land mobile/ (Single frequency)	152.5500 – 153.0500	-	12.5	152.5500 + n (0.0125)	1 to 39	152.5625 MHz 153.0375 MHz
AT	Land mobile (Two frequency)	153.0500 – 155.0500	AL	12.5	153.0500 + n (0.0125)	1 to 159	153.0625 MHz 155.0375 MHz
AU	Land mobile (Two frequency)	155.0500 – 156.0000	AM	12.5	155.0500 + n (0.0125)	1 to 75	155.0625 MHz 155.9875 MHz
AV	Land mobile (Two frequency)	156.0000 – 156.3750	AY	12.5	156.0000 + n (0.0125)	1 to 29	156.0125 MHz 156.3625 MHz
AW	Land mobile (Single frequency) International distress selective (digital) calling at 156.525 MHz, and 156.8 MHz,	156.3750 – 156.8750	-	12.5	156.3750 + n (0.0125)	1 to 39	156.3750 MHz 156.8625 MHz
AX	Land mobile (Two frequency)	156.8750 – 160.6000	BA	12.5	156.8750 + n (0.0125)	1 to 297	156.8875 MHz 160.5875 MHz
AY	Land mobile (Two frequency)	160.6000 – 160.9750	AV	12.5	160.6000 + n (0.0125)	1 to 29	160.6125 MHz 160.9625 MHz
AZ	Land mobile (Single frequency)	160.9750 – 161.4750	-	12.5	160.9750 + n (0.0125)	1 to 39	160.9875 MHz 161.4625 MHz
BA	Land mobile (Two frequency)	161.4750 – 165.2000	AX	12.5	161.4750 + n (0.0125)	1 to 297	161.4875 MHz 165.1875 MHz
BB	Land mobile (Two frequency)	165.2000 – 169.40000	BD	12.5	165.2000 + n (0.0125)	1 to 335	165.2125 MHz 169.3875 MHz
BC	Land mobile (Single frequency)	169.4000 – 169.8000	-	12.5	169.4000 + n (0.0125)	1 to 31	169.4125 MHz 169.7875 MHz
BD	Land mobile (Two frequency)	169.8000 – 174.0000	BB	12.5	169.8000 + n (0.0125)	1 to 335	169.8125 MHz 173.9875 MHz
BE	(Single frequency)	238.0000 – 242.9500	-	12.5	238.0000 + n (0.0125)	1 to 395	238.0125 MHz 242.9375 MHz
BF	Land mobile (Two frequency)	254.0000 – 257.0000	BH	12.5	254.0000 + n (0.0125)	1 to 239	254.0125 MHz 256.9875 MHz
BG	Land mobile (Single frequency)	257.0000 – 260.0000	-	12.5	257.0000 + n (0.0125)	1 to 239	257.0125 MHz 259.9875 MHz
BH	Land mobile (Two frequency)	260.0000 – 263.0000	BF	12.5	260.0000 + n (0.0125)	1 to 239	260.0125 MHz 262.9875 MHz
BI	Land mobile (Single frequency)	263.0000 – 267.0000	-	12.5	263.0000 + n (0.0125)	1 to 319	263.0125 MHz 266.9875 MHz

1.2.2 Channel Arrangement in the UHF bands (335.4 – 470 MHz)

The channelling arrangement for this band for the frequency bands 335.4 to 470 MHz are presented in this section and the channelling arrangements are given as illustrated in Table 2 below: based on Annex 1 of ITU recommendation ITU-R M.478-5.

Table 2: Channelling arrangement for UHF band in PMR service

Segment	Service Allocation	Segment frequency limits (MHz)	Paired segment	Channel bandwidth (kHz)	Channel centre frequency formula	Range of 'n' values	First/last channel centre frequency
A	Land mobile (Single frequency)	335.4000 – 336.0000	-	12.5	335.4000 + n (0.0125)	1 to 47	335.4125 MHz 336.9875 MHz
B	Land mobile (Two frequency, base/repeater)	346.0000 – 348.0000	D	12.5	346.0000 + n (0.0125)	1 to 159	346.0125 MHz 347.9875 MHz
C	Land mobile (Single frequency)	348.0000 – 350.0000	-	12.5	348.0000 + n (0.0125)	1 to 159	348.0125 MHz 349.9875 MHz
D	Land mobile (Two frequency, base/repeater)	350.0000 – 352.0000	B	12.5	350.0000 + n (0.0125)	1 to 159	350.0125 MHz 351.9875 MHz
E	Land mobile (Single frequency)	352.0000 – 356.0000	-	12.5	352.0000 + n (0.0125)	1 to 319	352.0125 MHz 355.9875 MHz
F	Land mobile/radio astronomy (Two frequency)	366.0000 – 368.9000	H	12.5	366.0000 + n (0.0125)	1 to 231	366.0125 MHz 368.8875 MHz
G	Land mobile (Single frequency)	368.9000 – 375.0000	-	12.5	368.9000 + n (0.0125)	1 to 487	368.9125 MHz 374.9875 MHz
H	Land mobile (Two frequency)	375.0000 – 377.9000	F	12.5	375.0000 + n (0.0125)	1 to 231	375. 0125 MHz 377.8875 MHz
I	Land mobile (Single frequency)	377.9000 – 380.0000	-	12.5	377.9000 + n (0.0125)	1 to 167	377.0125 MHz 379.9875 MHz
J	Land mobile/digital systems (Two frequency)	380.0000 – 389.0000	K	12.5	380.0000 + n (0.0125)	1 to 791	380.0125 MHz 389.8875 MHz
K	Land mobile/ digital systems (Two frequency)	390.0000 – 399.9000	J	12.5	390.0000 + n (0.0125)	1 to 791	390.0125 MHz 399.8875 MHz
L	Land mobile (Single frequency)	406.1000 – 407.6250	-	12.5	406.1000 + n (0.0125)	1 to 121	406.1125 MHz 407.6125 MHz
M	Land Mobile (Two frequency)	407.6250 – 417.6250	N	12.5	407.6250 + n (0.0125)	1 to 799	407.6375 MHz 417.6125 MHz
N	Land mobile (Two frequency)	417.6250 – 427.6250	M & O	12.5	417.6250 + n (0.0125)	1 to 799	417.6375 MHz 427.6125 MHz
O	Land mobile (Two frequency)	427.6250 – 430.0000	N	12.5	427.6250 + n (0.0125)	1 to 189	420.6375 MHz 425.9875 MHz
P	Land mobile (Two frequency)	440.0000 – 441.0000	S	12.5	440.0000 + n (0.0125)	1 to 79	440.0125 MHz 440.9875 MHz
Q	Land mobile (Single frequency)	441.0000 – 441.1000	-	12.5	441.0000 + n (0.0125)	1 to 7	441.0125 MHz 441.0875 MHz
R	Land mobile (Two frequency)	441.1000 – 445.0000	U	12.5	441.1000 + n (0.0125)	1 to 311	441.125 MHz 444.9875 MHz
S	Land mobile (Two frequency)	445.0000 – 446.0000	P	12.5	445.0000 + n (0.0125)	1 to 79	445.0125 MHz 445.9875 MHz
T	Land mobile (Single frequency)	446.0000 – 446.1000	-	12.5	446.0000 + n (0.0125)	1 to 7	446.0125 MHz 446.09875 MHz

	PMR 446						
U	Land mobile (Two frequency)	446.1000 – 450.0000	R	12.5	446.1000 + n (0.0125)	1 to 311	446.1125 MHz 449.9875MHz
V	Land mobile (single frequency)	450.0000 450.4875	-	12.5	450.0125 + n (0.0125)	1 to 37	450.0250 MHz 450.4750 MHz
W	Land mobile (Two frequency)	450.4875 451.5125	AA	12.5	450.48125 + n (0.0125)	1 to 82	450.49375 451.50625
X	Land mobile (Two frequency)	451.5125 452.5000	AB	12.5	451.50625 + n (0.0125)	1 to 79	451.51875 452.49375
Y	Land mobile (Two frequency)	452.5000 457.50625	AD	12.5	452.5 + n (0.0125)	1 to 400	452.5125 457.5000
Z	Land mobile (Two frequency)	457.50625 459.9875	AE	12.5	457.5 + n (0.0125)	1 to 198	457.5125 459.9750
AA	Land mobile (Two frequency)	459.9875 461.0125	W	12.5	459.98125 + n (0.0125)	1 to 82	459.99375 461.00625
AB	Land mobile (Two frequency)	461.0125 462.0000	X	12.5	461.00625 + n (0.0125)	1 to 79	461.01875 461.99375
AC	Land mobile (single frequency)	462.0000 462.50625		12.5	462.0 + n (0.0125)	1 to 40	462.0125 462.5000
AD	Land mobile (Two frequency)	462.50625 467.50625	Y	12.5	462.5 + n (0.0125)	1 to 400	462.5125 467.5000
AE	Land mobile (Two frequency)	467.50625 469.9875	Z	12.5	467.5 + n (0.0125)	1 to 198	467.5125 469.9750
AF	Land mobile (Single frequency)	469.9875 470.0000		12.5	469.9875 + n (0.0125)	1	470.0000

2 Development of the Band Plan for PMR

2.1 Background

This section presents the spectrum allocations for PMR services in the ENFAP and channelling arrangements for each of the allocated bands of frequencies. This plan only presents channelling arrangements that will enable the operation of only PMR services, thus channelling arrangements for radiolocation and amateur services are beyond the scope of this plan.

Annex 1 of ITU-R M.478-5 gives the preferred technical characteristics for VHF and UHF land mobile equipment using F3E class of emission. One of the key technical characteristics given in this annex is the recommended separation of the transmit and receive frequencies for full duplex operation. This separation is meant to prevent internal coupling in the communication devices. For this plan, minimum separation of 3 MHz, 4 MHz, 5 MHz and 7 MHz are used in developing the full duplex frequency pairs within the bands of interest. It should be noted that for all PMR applications in the Kingdom a channel bandwidth of 12.5 kHz will be used. However, any other special cases will be considered on a case by case bases for possible approval to deploy equipment requiring 25 kHz bandwidth, particularly for digital systems.

Section 2.1 of this plan below present all PMR frequency allocation in the ENFAP. The specific channelling arrangements of VHF bands and UHF bands are presented in section 2.2 and section 2.3 respectively. The specific channels in each of the PMR frequency bands are presented in Annex 1 of this document.

2.2 PMR Allocations in the National Frequency Allocation Plan

In The Eswatini National Frequency Allocation Plan (ENFAP) published in August 2017 indicates several allocations of frequency bands to PMR services. The PMR frequency bands presented in the ENFAP range from 30.01 MHz to 470 MHz which fall within the Very High Frequency (VHF) and Ultra High Frequency (UHF) ranges. Table 1 below presents all PMR bands as per the allocations in the ENFAP.

Table 3: VHF and UHF frequency allocations for PMR Services in the ENFAP

Frequency Band	Frequency Range	Utilisation	Additional Information
VHF	**30.01 - 37.5 MHz**	Government use PMR	
	37.5 - 38.25 MHz	PMR Radio astronomy	
	38.25 - 39 MHz	PMR	
	39.986 - 40.02 MHz	PMR	

	40.02 - 40.98 MHz	PMR ISM (40.66-40.70 MHz) SRD applications (40.66-40.77 MHz)	Common international SRD band; see ITU-R Rec.SM. [SRD]
	40.98 - 41.015 MHz	PMR	
	41.015 – 42 MHz	PMR	
	44 – 47 MHz	PMR Meteor Burst (45.3-46.9 MHz) CT0 Cordless Telephony BTx (46.61-46.97 MHz)	Paired with (47.5-49.1MHz)
	47 – 50 MHz	PMR Meteor Burst (47.5-49.1 MHz) CT0 Cordless Telephony MTx (49.67-49.97 MHz)	Paired with 45.3-46.9 MHz Paired with (46.61-46.97 MHz)
	54 – 68 MHz	PMR	
	68 - 74.8 MHz	PMR and/or PAMR	
	75.2 - 87.5 MHz	PMR and/or PAMR	
	138 - 143.6 MHz	PMR and/or PAMR	
	143.6 - 143.65 MHz	PMR and/or PAMR	
	143.65 – 144 MHz	PMR and/or PAMR	
	146 – 148 MHz	PMR and/or PAMR	
	150.05 – 153 MHz	PMR and/or PAMR Paging	
	153 – 154 MHz	PMR and/or PAMR	
	154 – 156 MHz	PMR and/or PAMR	
	157.450 - 160.6 MHz	PMR and/or PAMR	
	162.050 – 174 MHz	PMR and/or PAMR	
	238 - 242.95 MHz	PMR and/or PAMR	
	254 – 267 MHz	PMR and/or PAMR	
UHF	**335.4 – 336 MHz**	PMR and/or PAMR	
	346.0 - 356.0 MHz	PMR and/or PAMR	
	366.0 - 380.0 MHz	PMR and/or PAMR	
	380.0 - 387.0 MHz	PPDR	Paired with 390.0-397.0 MHz To be used mainly for digital systems.
	387.0 - 390.0 MHz	PMR and/or PAMR	Paired with 397.0-399.9 MHz To be used mainly for digital

			systems.
	390.0 - 397.0 MHz	PPDR	Paired with 380.0-387.0 MHz To be used mainly for digital systems.
	397.0 - 399.9 MHz	PMR and/or PAMR	Paired with 387.0-390.0 MHz To be used mainly for digital systems.
	406.1 – 410 MHz	PMR and/or PAMR PPDR	
	410 – 420 MHz	PMR and/or PAMR PPDR	
	420 – 430 MHz	PMR and/or PAMR PPDR	
	440 – 450 MHz	PMR and/or PAMR PPDR PMR446 (446-446.1 MHz) FIXED (telemetry, dual frequency alarm systems)	
	450 – 470 MHz	Fixed links (PTP) IMT (450-470 MHz) PMR and/or PAMR	This band is currently used for a variety of fixed and mobile systems in the various SADC countries. This band is also identified for IMT (Res.224 applies).

NB: The detailed band plan (channel arrangements) is available on the ESCCOM website.

3 Current Usage in the PMR Bands

In the Kingdom of Eswatini there are several frequencies which are in use in both the VHF and UHF PMR frequency bands. A number of the current usage cases are not in correspondence with the proposed plan due to a number of reasons. Some of the reasons include that some of the assignments were based on different channel spacing/separations which are 6.25 kHz, 25 kHz, 3.125 kHz or other different channel separations which are not according to this plan. The current usage in the PMR bands in the Kingdom of Eswatini can be categorized based on the following:

a. We have a number of frequencies which are being used but these frequencies do not conform to the proposed plan, that is the frequencies do not appear in the plan at all.
b. There are usages which do not conform to the proposed plan but they have one of the frequencies in a channel appearing in the proposed plan but not paired correctly.
c. There are channels which according to the proposed plan they are paired when in their current usage they are used as simplex channels.

Some channels are currently in use and the channel arrangements are according to the proposed plan.

NB: Information on usage can be provided to the respective Spectrum Users on request from the Commission.

4 PMR-446

4.1 Analogue and Digital PMR446 Channels

PMR 446 refers to radio equipment intended to be used on collective frequencies shared by multiple users without coordination. In the kingdom of Eswatini, the PMR 446 band (446.0 to 446.1 MHz) meets these criteria and its use is not subject to licensing. This band is also harmonized in the SADC region through the CRASA- Harmonization framework for Cross Border PMR Services in SADC Region. There is a wide range of "PMR 446" equipment on the market which is intended exclusively to use the PMR 446 frequency band. Although the PMR 446 frequency band can be used without a license, some rules are nevertheless required so that all users enjoy the same conditions and they do not interfere with each other excessively. These rules have been concretized in the schedule under regulation 7 of the Electronic Communications (Radio Communications and Frequency Spectrum) Regulations 2016. There are 8 channels in the PMR 446 band.

Table 4: PMR 446 frequency channels

Frequency band	Channels	Utilization	Relevant Standard	Comments
446.0 – 446.1	446.000625 MHz	Mobile (single-frequency PMR 446)	EN 300-296 EN 301 489-5 EN 60950	For the PMR 446 short-range low-power shared-frequency voice communication on service as per ERC Decision CEPT/ERC/DEC (98)25.
	446.018755 MHz			
	446.03125 MHz			
	446.05625 MHz			
	446.06875 MHz			
	446.08125 MHz			
	446.09375 MHz			

4.2 Interference on PMR446 users

The Analogue and Digital PMR446 services are operated on a non-interference and non-protected basis. It is a therefore a condition of licence-exempt operation that users of PMR446 equipment select a channel that does not cause interference problems for other users.

4.3 PMR446 Base Stations

The use of PMR 446 equipment must be strictly restricted to mobile basis only for it to meet the license-exempt operation requirements in the kingdom. Thus PMR 446 equipment that is designed for base station use, or mobile equipment that is configured as a base station is not allowed to be used in this band since this equipment is unlikely to meet the license-exempt operational requirements.

4.4 Use of non-License exempt equipment

The operation of non-license-exempt equipment or use on any other PMR 446 equipment that does not meet the PMR 446 license-exempt operation requirements is strictly prohibited in this band

5 Technical Provisions

The preferred technical characteristics for VHF and UHF land mobile equipment shall be according to Annex 1 of ITU-R Recommendation M.478-5 which gives the characteristics for VHF and UHF land mobile equipment using F3E class of emission.

5.1 Necessary Bandwidth

The ITU Radio Regulations (RR) defines the necessary bandwidth as following;

> For a given class of emission, the necessary bandwidth is the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions.

The preferred channel separation for the Kingdom of Eswatini is 12.5kHz and the corresponding necessary bandwidth is 11kHz.

5.2 Transmitter Characteristics

5.2.1 Frequency Tolerance

Within the temperature ranges applicable in the kingdom, and for specified ranges of primary supply voltages, the frequency error of any carrier emission should not exceed the values given in ***Table 6*** below;

Table 5: Frequency Tolerance Limits

Channel Separation (kHz)	**Frequency error limit (kHz)**			
	Below 47 MHz	47 – 137 MHz	Above 137 to 300 MHz	Above 300 to 500 MHz
12.5	± 0.6	± 1.00	± 1.00 (B) ± 1.50 (M)	± 1.00 (B) ± 1.50 (M)(1)

B: base station.
M: mobile or handheld portable equipment
(1): For handheld portable equipment having integral power supplies, the frequency error given shall not exceed over a temperature range of 0° to +30 °C. Under extreme temperature conditions, the frequency error shall not exceed:
±2,50 kHz for a channel separation of 12.5 kHz between 300 and 500 MHz.

5.2.2 Maximum permisible frequency deviation

The maximum permissible frequency deviation corresponding to the channel spacing is ±2.5 kHz for the channel spacing of 12.5kHz.

5.2.3 Adjascent Channel Power

At least 60 dB below carrier power in a bandwidth of 8.5 kHz. (Class A specifies 50 dB from 512 to 940 MHz). In each case, it is not necessary to reduce the adjacent channel power below 0.25 μW. (Class A specifies 50 μW rather than 0.25 μW.)

5.2.4 Conducted Spurious Transmissions

Spurious emissions on discrete frequencies, when measured in a non-reactive load equal to the nominal output impedance of the transmitter, should not exceed 2.5 μW for transmitter carrier powers up to 25 W. For carrier powers in excess of 25 W, the level of any spurious emission should be at least 70 dB below the carrier power. (Class A specifies 50 μW rather than 2.5 μW. Class E specifies that any conducted spurious emissions should not exceed the values given in ***Table 7*** below.)

Table 6: Conducted spurious emissions in transmitters

Frequency range	9 kHz to 1 GHz	Above 1 to 4 GHz or above 1 to 12.75 GHz [(1)]
Tx operating (μW)	0.25	01.00
Tx standby (nW)	2.0	20.0

[(1)]: The frequency range is equal to 1-4 GHz for equipment operating below 470 MHz and to 1-12.75 GHz for equipment operating above 470 MHz.

5.2.5 Cabinet Radiation

The cabinet radiated power should not exceed 25 μW. The hand portable equipment should not exceed 2.5 μW. In some radio environments, a lower value may be required. (Class E specifies that cabinet radiation should not exceed the values given in ***Table 8*** below.)

Table 7: Cabinet radiation for transmitters

Frequency range	30 MHz to 1 GHz	Above 1 to 4 GHz
Tx operating (μW)	0.25	01.00
Tx standby (nW)	2.0	20.0

5.2.6 Attenuation of the Intermodulation of Base Station transmitters

In the case of multiple transmitters operation at a base station site, the attenuation of intermodulation, due to the non-linearity of the output stage of the transmitter, should be at least 20 dB. In some conditions even higher values of attenuation might be necessary and may be obtained by means of appropriate protection devices. (Class A and Class E both specify 40 dB using a method of measurement different from IEC 489).

5.3 Receiver Characteristics

All parameters except the conducted spurious emissions and the cabinet radiation are not the subject of regulation in the kingdom, however these specifications may be mandatory for the regulating equipment using Class E standards. Measurements shall be performed using Measured Usable Sensitivity (MUS).

5.3.1 Reference Sensitivity

The reference sensitivity should be less than 2.0 μV, e.m.f., for a given reference signal-to-noise ratio at the output of the receiver (see Note 1).

5.3.2 Adjacent channel selectivity

The adjacent channel selectivity should not be less than 60 dB (see Note 3).

5.3.3 Radio Frequency Intermodulation

When measured using an interfering frequency combination of twice and four times the channel spacing separated from the receiving frequency, the intermodulation response rejection ratio should not be less than 70 dB (see Notes 3 and 4).

5.3.4 Co-channel rejection

When a wanted signal is applied in the presence of an interfering signal on the same frequency, the ratio of interference-to-signal is not less than –8 dB for 25 kHz channel spacing and not less than –12 dB for 12.5 kHz channel spacing.

5.3.5 Spurious response

At any frequency separated from the nominal frequency of the receiver by more than one channel spacing, the spurious response rejection ratio should not be less than 70 dB. (Class A specifies 60 dB for handheld portables.)

5.3.6 Conduted Spurious Emmissions

The power of any spurious emission measured at the antenna terminals with matched termination, on any discrete frequency, should not exceed 2.0 nW. (Class A specifies 20 nW. Class E specifies that any conducted spurious emission should not exceed the values given in ***Table 9***.)

Table 8: Conducted spurious emission in receivers

Frequency range	**9 kHz to 1 GHz**	**Above 1 to 4 GHz or above 1 to 12.75 GHz (1)**
Limit (nW)	2.0	20.0

(1): The frequency range is equal to 1-4 GHz for equipment operating below 470 MHz and to 1-12.75 GHz for equipment operating above 470 MHz.

5.3.7 Cabinet Radiation

The effective radiated power of any spurious emission on any frequency from 25 MHz to 1 000 MHz should not exceed 4.0 nW and from 1 000 MHz to 3 000 MHz should not exceed 20 nW. (Class A specifies this limitation as a field strength at a distance of 3 m as listed in ***Table 10***. Class E specifies that any cabinet radiation should not exceed the values given in ***Table 11***.)

Table 9: Class A cabinet radiation for receivers

Frequency range	**30-88 MHz**	**88-216 MHz**	**216-960 MHz**	**960 MHz to 1 GHz**
Limit (μV/m)	100	150	200	500

Table 10: Class E cabinet radiation for receivers

Frequency range	**30 MHz to 1 GHz**	**Above 1 to 4 GHz**
Limit (nW)	2.0	20.0

NOTE 1 - Class E specifies a measurement method which uses 20 dB SINAD and 6 dB degradation, and a psophometric filter.

NOTE 2 - Class E specifies the measurement use SUS (see Note 5).

NOTE 3 - Some countries require at least 65 dB for the frequency range 500-1 000 MHz. Class A specifies 50 dB for handheld portable equipment, and Class E specifies 65 dB for mobile and handheld portable.

NOTE 4 - Class A and Class E both specify that measurement frequencies should be the combination of 50 and 100 kHz displaced from the reference frequency.

NOTE 5 - (Measured Usable Sensitivity) MUS and (Specified Usable Sensitivity) SUS are defined in IEC Doc. 12F(S) 216 which has been approved to be the draft international standard (DIS).

5.4 Station Characteristics

Station characteristics are defined according to the Frequency of transmission and the transmit power of the station.

5.4.1 Radio Frequency Band operation

According to the Table of Frequency Allocations contained in RR Article 8 or the Eswatini National Frequency Allocation Plan; in particular, the bands of 35, 80, 160, 300 and 450 MHz.

5.4.2 Separation of Tx and Rx for full duplex operation

35 MHz band: 4 MHz
80 MHz band: 3 MHz
160 MHz band: 3 MHz
300 MHz band: 4 MHz
450 MHz band: 5 MHz

The above are practical minimum values determined by cost and isolation required; smaller separations are possible using higher quality and more costly duplexers.
In practice, the actual separations used may be other than the values given and may be determined by other factors than were used in this Recommendation. Frequencies should preferably be assigned with a constant separation between the transmit and receive frequencies over the whole of a band or the sub bands within a band.

5.4.3 Effective radiated power and antenna height

It is recognized that the responsibility for limiting the effective radiated power and antenna height over the average level of the ground rests with the Commission, taking into account:

- the general requirement not to radiate more power than is necessary and not to use larger antenna heights than necessary;
- the required range and communication quality;
- the frequency band of operation;
- the terrain over which service is required;
- special conditions, e.g. diversity reception at remote receiving stations;
- the potential intra-service or inter-service effects between the mobile service and other radio services.

5.4.4 Antenna Polarization

Vertically polarized.

6 Conclusion and Recommendations

The Commission has established a proposed plan for the migration of Spectrum users who are currently not aligned with the PMR band plan. There were several use cases in the PMR bands which were not aligned with the proposed plan and it is recommended that there be engagements so that all misallocated frequencies / channels are migrated to new channels for purposes of re-alignment.