450MHz – 470MHz Consolidated Audit Report

Compiled, Analysed and Prepared by**:** Ndumiso Dana

Contributors:

(a) Nomsa Sojane
(b) Yvonne Chiloane
(c) Regional Monitoring Officers
(d) Gert Visser
(e) Louis Pieterse
(f) Glynn Fourie

May 2010

Contents

1. Introduction and Background

International Mobile Telecommunications is the global standard for third generation (3G) wireless communications, defined by a set of interdependent ITU Recommendations (e.g. ITU-R M.1457 which detailed specifications of the radio interfaces). IMT provides a framework for worldwide wireless access by linking the diverse systems of terrestrial and/or satellite based networks and takes advantage of the synergies between digital mobile telecommunications technologies and systems for fixed and mobile wireless access systems. The 450-470 MHz bands were part of the frequency bands identified by the ITU for this purpose. This band is allocated for Fixed and Mobile applications. Applications for Fixed are fixed links and Trunking while application for Mobile is simplex operations. However, Resolution 224 (Rev. WRC-07) asks for sharing studies in the UHF sub-bands to develop harmonized frequency arrangements in the 450-470 MHz band. Monitoring these bands nationwide provides ICASA with data which would enable us to make informed decisions about the sharing and future use of this band.

This band could be used to provide mobile and fixed services to the rural and underserved regions using the IMT technologies. Worldwide adoption of 450-470MHz band as IMT would facilitate the following:

- Economies of scale will drive reduced prices for Infrastructure and Handsets.
- Greater harmonization of frequency usage among different countries and regions of the world.
- Greater acceptance by administrations to use the frequency band for CDMA450 networks.
- Strengthen development and growth of the CDMA450 market.

2. Methodology

ITU-R SM.182-5 recommendation was used which set the requirements for conducting occupancy measurements of the radio-frequency spectrum and specific relevant parameters. The spectrum database was used to verify the results obtained from spectrum management monitoring software (Argus). Occupancy measurements were run over a period of one week, 24 hours per day. This time ensures that all peak and off-peak traffic is covered. A frequency is regarded as being occupied when a received signal exceeds a preset threshold in the order of around 1 dBµV/m. This is also a reasonable level for squelch adjustments of radio sets.

To determine the occupancy of a frequency, detailed measurement of various parameters is not needed, therefore fast scanning receivers can be used instead of measuring all of the various parameters. These measurements are made in the centre of a coverage area and the equipment is left alone during the scan period. All channels used in the measurement area are scanned at once. The measurement results are stored for a later evaluation and display the occupancy of each channel in separate graphics over time. In this task, occupancy of the UHF band allocated to shared private company networks in the range 450.00 MHz to 470.00 MHz countrywide was measured. The private company networks are trunked networks which supports data services. The measurement was done on trunked networks for one week from Monday to Friday and they are in the range of 450.00 MHz to 470.00 MHz.

An automatic measurement mode task was configured on Argus software to run for a 24 hour period over 5 days. The measurement was done for one week from Monday to Friday. The results were stored on the local hard disk of the monitoring station and later transferred to CMO and evaluated. These results display occupancy charts and diagrams for each of the measured frequencies over time, in various formats. The measurement results from all the relevant monitoring stations were then manually analysed with the help of Spectrum Licensing on the Spectrum License Database. These results are reflected in this report.

3. Results and analysis

Number and percentage of scanned, inactive, active licensed, active unlicensed and inactive frequencies.	PE	JHB	BFN	DBN	CPT	Total
Number of frequency scanned	1600	1600	1600	1600	1600	8000
Number of inactive frequencies	1570	1560	1556	1543	1552	7781
Percentage of inactive frequencies	98.12%	97.50%	97.25%	96.43%	97%	97.26%
Number of active licensed frequencies	6	8	16	13	20	63
Percentage of active licensed frequencies	0.37%	2%	1.75%	0.81%	0.67%	0.78%
Number of active unlicensed frequencies	24	32	28	44	28	156
Percentage of active unlicensed frequencies	1.50%	0.50%	1.75%	2.75%	1.75%	1.95%
Number of licensed inactive frequencies	88	740	43	184	289	1344
Percentage of licensed inactive frequencies	5.61%	47.44%	2.76%	11.75%	18.06%	16.80%

Table A1: Number and percentage of frequency scanned, inactive frequencies, active licensed frequencies, active unlicensed frequencies and inactive frequencies.

4. Analysis

- Active licensed frequencies – possibility of migration depends on services (i.e. emergency / crucial) being offered by the licensee. Sharing could be considered pending utilisation of spectrum. Should migration be the preferred option, it is not envisaged that this would be a difficult process given the small number of licensed active users in this band.
- Active unlicensed frequencies – inspectors / interference team will be tasked to identify these unlicensed users (e.g. Cape Town has 28 active unlicensed frequencies, PE has 24 active unlicensed frequencies, JHB has 32 unlicensed frequencies and BFN has 84 unlicensed frequencies).
- Licensed inactive – communication with the licensee is needed to determine the use of the spectrum and possibility of releasing the frequency. This will be communicated to Spectrum Licensing.
- The bulk licences on the ICASA's Spektrum database was not developed to capture more than one system per licence and the channel number of the 450 MHz band plan was used instead of the specific frequency channel assigned. This means that specific frequencies that have been identified by the Audit as unlicensed may be licensed and not captured on the system. This will be further investigated, although it forms a very small percentage and does not affect the unoccupied percentage audited.
- 16.8% of Licensees recorded as being inactive measured over the period were found to be under utilising the spectrum as per their license conditions.

5. Conclusion

- Given the amount of unoccupied spectrum (e.g. 80.4625%), it is clear that this band is being under-utilised.
- The utilized portion of this band is very small (e.g 16.8%), it should not be difficult to migrate these users out of this band and it is suggested that this band be deployed for IMT technology.
- The regional offices would be given the unlicensed frequency list for further investigation.
- It is recommended that a database clean-up/consolidation be conducted as the user information was spread over several databases. Some fields on the data base were not populated and some key fields were left blank. The criteria utilised was that of the software scan done over the period of time indicating that these licensed users were inactive during the period of measurements.

6. References

[1] ITU-R SM.182-5 recommendation was used which set the requirements for conducting occupancy measurements of the radio-frequency spectrum and specific relevant parameters.

[2] The spectrum database was used to verify the results obtained from spectrum management monitoring software (Argus).

APPENDIX A – Index of tables

APPENDIX B – Measurement Results

Frequency (MHz)	Licence number	Licensee	Percentage occupancy
451.95	N/L		100%
451.9625	N/L		100%
451.975	N/L		100%
451.9875	N/L		100%
452	N/L		100%
452.0125	N/L		100%
452.025	N/L		100%
452.0375	N/L		100%
452.05	N/L		100%
452.0625	N/L		100%
452.075	N/L		100%
452.0875	N/L		100%
452.1125	N/L		100%
452.125	N/L		100%
452.1375	N/L		100%
452.15	N/L		100%
452.1625	N/L		100%
452.175	N/L		100%
452.1875	N/L		100%
452.2	N/L		100%
452.2125	N/L		100%
452.225	N/L		100%
452.3375	N/L		100%
455.4375	N/L		100%

Table A2: Active frequencies which are 100% occupied in JHB and to be investigated.

Frequency (MHz)	Licence number	Licensee	Percentage occupancy
455.2125	N/L	N/L	95.14%
455.4125	N/L	N/L	99.93%
456.262	N/L	N/L	71.18%
459.0375	N/L	N/L	27.01%
459.775	N/L	N/L	26.13%
461.2125	N/L	N/L	60.11%
461.2375	N/L	N/L	59.57%
467.1127	N/L	N/L	0.53%

Table A3: Active and unlicensed frequencies in JHB and to be investigated.

Frequency (MHz)	Licence number	Licensee	Percentage occupancy
451.1	2720762 x2	Eskom Eastern Cape distributor	95.14%
452.25	4482236	Eskom Enterprises (PTY) LTD	99.93%
452.325	4482236	Eskom Enterprises (PTY) LTD	71.18%
452.475	4482236	Eskom Enterprises (PTY) LTD	27.01%
452.675	4482236 x2	Eskom Enterprises (PTY) LTD	26.13%
455	2515425	Transnet	60.11%
461.225	4854386x90	Autopage(PTY) LTD	63.37%

Table A4: Active and licensed frequencies in JHB.

Frequency (MHz)	Licence number	Licensee	Percentage occupancy
451.8	N/L		100%
451.8125	N/L		100%
451.9625	N/L		100%
451.975	N/L		100%
452.175	N/L		100%
452.1875	N/L		100%
455.65	N/L		100%

455.6625	N/L		100%
465.825	N/L		100%

Table A5: Active frequencies which are 100% occupied in BFN and to be investigated.

Frequency (MHz)	Licence Number	Licensee	Percentage occupancy
450.0125	N/L	N/L	85.99%
450.3125	N/L	N/L	38.22%
451.1625	N/L	N/L	13.38%
453.75	N/L	N/L	15.92%
460.0375	N/L	N/L	38.85%
460.0625	N/L	N/L	45.06%
460.125	N/L	N/L	5.10%
460.2875	N/L	N/L	37.58%
461.2125	N/L	N/L	44.59%
462.4375	N/L	N/L	29.94%
462.4625	N/L	N/L	19.75%
462.675	N/L	N/L	19.11%
462.975	N/L	N/L	14.01%
464.1625	N/L	N/L	9.11%
464.3125	N/L	N/L	9.55%
465.825	N/L	N/L	22.93%
468.6375	N/L	N/L	27.39%
468.6625	N/L	N/L	13.38%
469.9125	N/L	N/L	10.83%

Table A6: Active and unlicensed frequencies in BFN and to be investigated.

Frequency (MHz)	Licence number	Licensee	Percentage occupancy
450.025	2282752	Mangaung Local Municipality	59.87%
	5039884	Dihlabeng Local Municipality	
450.075	2030196	Bloemfontein Stadsraad Van	84.08%
	1889736	Bloemfontein Municipality	
	5038971	Dihlabeng Local Municipality	
450.3	1348949	Mangaung Local Municipality	94.27%
452.65	4512368	Sentech Limited	36.31%
	4512577	Sentech Limited	
460.025	2282752	Mangaung Local Municipality: Emergency	61.15%
462.425	4512368	Sentech Limited	42.04%
	4512577	Sentech Limited	
462.65	4512577	Sentech Limited	99.36%
	4512368	Sentech Limited	
464.375	4915812	Transnet	13.38%
467.175	2779495	Francois Agencies cc	12.74%

Table A7: Active and licensed frequencies in BFN.

Frequency (MHz)	Licence number	Licensee	Percentage occupancy
452	N/L		100%
452.0125	N/L		100%
452.05	N/L		100%
45.0875	N/L		100%
425.1	N/L		100%
452.125	N/L		100%
452.175	N/L		100%
452.1875	N/L		100%
452.25	N/L		100%
452.325	N/L		100%
455.125	N/L		100%
455.1375	N/L		100%
455.2	N/L		100%
455.2125	N/L		100%
462.325	N/L		100%

Table A8: Active frequencies which are 100% occupied in P.E and to be investigated.

Frequency (MHz)	Licence number	Licensee	Percentage occupancy
425.025	N/L	N/L	93.04%
452.4375	N/L	N/L	53.72%
452.7125	N/L	N/L	49.59%
455.3625	N/L	N/L	74.38%
458.9875	N/L	N/L	51.24%
459.9625	N/L	N/L	36.36%
462.25	N/L	N/L	85.12%
468.375	N/L	N/L	78.51%
463.4125	N/L	N/L	98.35%

Table A9: Active and unlicensed frequencies in P.E and to be investigated.

Frequency (MHz)	Licence number	Licensee	Percentage occupancy
452.425	4512939	Sentech Limited	53.72%
	4512921	Sentech Limited	
	4512640	Sentech Limited	
	4512947	Sentech Limited	
452.45	4512640	Sentech Limited	53.72%
	4512939	Sentech Limited	
	4512921	Sentech Limited	
	4512947	Sentech Limited	
452.75	4512921	Sentech Limited	27.27%
	4512640	Sentech Limited	
	4512947	Sentech Limited	
462.45	4512921	Sentech Limited	49.69%
	4512640	Sentech Limited	
	4512947	Sentech Limited	
	4512939	Sentech Limited	
462.75	4512939	Sentech Limited	47.93%
	4512912	Sentech Limited	
	4512640	Sentech Limited	
	4512947	Sentech Limited	
463.4	4854185	Autopage (Pty) Ltd	98.35%

Table A10: Active and licensed frequencies in P.E.

Frequency (MHz)	Licence number	Licensee	Percentage occupancy
451.9875	N/L		100%
452	N/L		100%
452.0125	N/L		100%
452.025	N/L		100%
452.0375	N/L		100%
452.05	N/L		100%
452.0625	N/L		100%
452.0875	N/L		100%
452.1125	N/L		100%
452.1375	N/L		100%
452.1625	N/L		100%
452.175	N/L		100%
452.1875	N/L		100%
452.2	N/L		100%
452.2125	N/L		100%
455	N/L		100%
455.0125	N/L		100%
455.0375	N/L		100%
455.1	N/L		100%
455.1125	N/L		100%
455.1625	N/L		100%
455.225	N/L		100%
455.3625	N/L		100%

Table A11: Active frequencies which are 100% occupied in DBN and to be investigated.

Frequency (MHz)	Licence number	Licensee	Percentage occupancy
450.0375	N/L	N/L	77.43%
450.0625	N/L	N/L	68.40%
451.1	N/L	N/L	27.78%
452.1	N/L	N/L	99.31%
452.15	N/L	N/L	39.24%
452.3	N/L	N/L	96.53%
455.025	N/L	N/L	20.49%
455.0625	N/L	N/L	26.39%
455.375	N/L	N/L	24.31%
455.3875	N/L	N/L	32.29%
455.4125	N/L	N/L	36.81%
455.425	N/L	N/L	30.21%
455.4375	N/L	N/L	23.96%
455.45	N/L	N/L	29.17%
455.4875	N/L	N/L	27.78%
455.5375	N/L	N/L	20.49%
455.8375	N/L	N/L	20.83%
456.4375	N/L	N/L	20.49%
456.6125	N/L	N/L	55.21%
463.7	N/L	N/L	36.46%
465.9375	N/L	N/L	23.26%

Table A12: Active and unlicensed frequencies in DBN and to be investigated.

Frequency (MHz)	Licence number	Licensee	Percentage occupancy
450.05	1356489	Abaqulisi Municipality	71.53%
451.35	4564768	Province of kwaZulu-Natal	32.29%
453.025	5100579	Natal Sharks Board	21.18%
453.2	4706474	Omni Communications	45.49%
453.725	2709120	Frame textile Corporation	26.13%
453.7375	4572234	Imperial Car rental	23.26%
453.8375	5033804	SA Ports Operations	29.51%
457.2	1052464	Mittal Steel	20.49%
458.175	4825783	Siyaphambili Communication	42.36%
460.05	1349772	Durban City Electricity	67.01%
463.95	1148323	Shell SA	31.25%
464.025	1936591	Durban Water Wonderland	24.31%
464.5	5168372	Namandla Roads & Civils	22.22%

Table A13: Active and licensed frequencies in DBN.

Frequency (MHz)	Licence number	Licensee	Percentage occupancy
451.9625	N/L	100%	100%
452.0375	N/L	100%	100%
452.05	N/L	100%	100%
452.0625	N/L	100%	100%
452.0875	N/L	100%	100%
452.1	N/L	100%	100%
455.0375	N/L	100%	100%
455.075	N/L	100%	100%
4551875	N/L	100%	100%
455.0375	N/L	100%	100%

Table A14: Active frequencies which are 100% occupied in CPT and to be investigated.

Frequency (MHz)	Licence number	Licensee	Percentage occupancy
452	N/L	N/L	96.90%
452.0125	N/L	N/L	94.70%
452.025	N/L	N/L	41.10%
452.125	N/L	N/L	68.20%
452.1875	N/L	N/L	40.60%
452.2125	N/L	N/L	65.80%
453.9375	N/L	N/L	20.70%
455.0625	N/L	N/L	26.60%
455.0875	N/L	N/L	21.50%
455.25	N/L	N/L	76.00%
455.2875	N/L	N/L	23.26%
455.4347	N/L	N/L	25.50%
455.725	N/L	N/L	69.00%
457.5375	N/L	N/L	21.18%
460.8875	N/L	N/L	23.60%
466.225	N/L	N/L	23.80%
466.4625	N/L	N/L	26.80%
466.75	N/L	N/L	38.20%

Table A15: Active and unlicensed frequencies in CPT and to be investigated.

Frequency (MHz)	Licence number	Licensee	Percentage occupancy
452.05	2539900	SAPS, Swiftnet	100.00%
452.0625	2539900	SAPS	100.00%
452.45	4512954	Sentech Limited	100.00%
	512551		
452.525	2235203	Lazer Communications	25.95%
452.65	4512954	Sentech Limited	100.00%
	4512551		
452.75	4512954	Sentech Limited	100.00%
	4512551		
458.075	2355178	Golden Arrow Bus Services	20.60%
458.125	2642708	Stellenbosch Irrigation Board	20.20%
459.35	4811596	Lazer Armed Response Services	27.70%
459.775	2538401	Airports Company of South Africa	22.20%
460.4	1676681	Saldanha Steel	42.36%
460.55	1349434	City of Cape Town	48.40%

Table A16: Active and licensed frequencies in CPT.

APPENDIX C – Measurement parameters and sites used

ESVN 20	SETTINGS
IF bandwidth	15 kHz
Demodulation	FM
Step width	12.5 kHz
Detector	Average
Priority	Low
Antenna type	HK 014 Omni Directional

Table A17: Measurement parameters.

MONITORING SITE	DATE
RDPCONT (Roodepoort) 450MHz – 455MHz	08/12/2008
JHBCONT (Block D Pinmill) 455MHz – 460MHz	09/12/2008
JHBCONT (Block D Pinmill) 460MHz – 465MHz	03/02/2009
RDPCONT (Roodepoort) 465MHz – 470MHz	09/02/2009
BFN (Bloemfontein) 450MHz – 470MHz	13/05/2009
PE (Port Elizabeth) 450MHz – 470MHz	01/06/2009
DBNCONT(Durban) 450MHz – 470MHz	28/07/2009
CPT (Cape Town) 450MHz – 470MHz	28/07/2009
CPT (Durbanville) 450MHz – 470MHz	27/07/2009

Table A18: Sites used.

APPENDIX D – Pie charts showing percentages of active unlicensed frequency, under utilised licensed spectrum, unoccupied spectrum and active licensed frequencies.

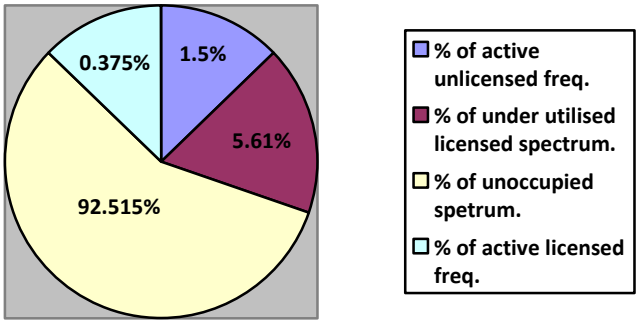


Chart 1: Results for Port Elizabeth.

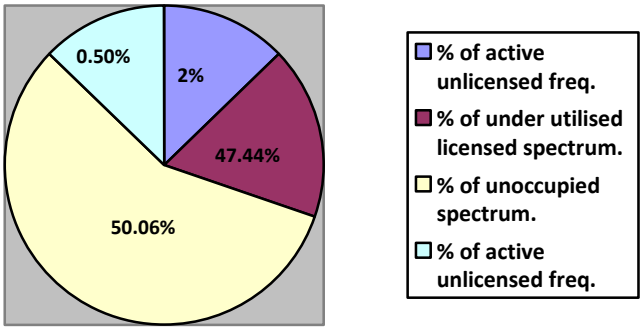


Chart 2: Results for Johannesburg

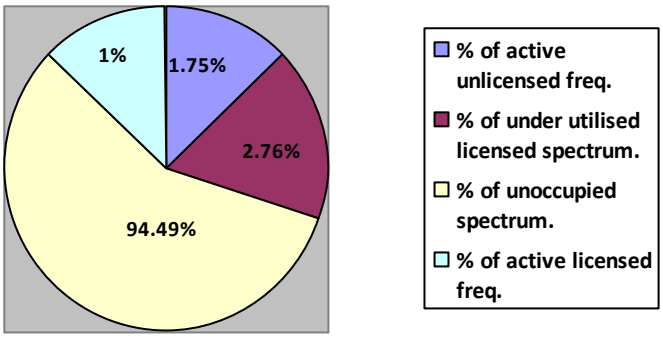


Chart 3: Results for Bloemfontein

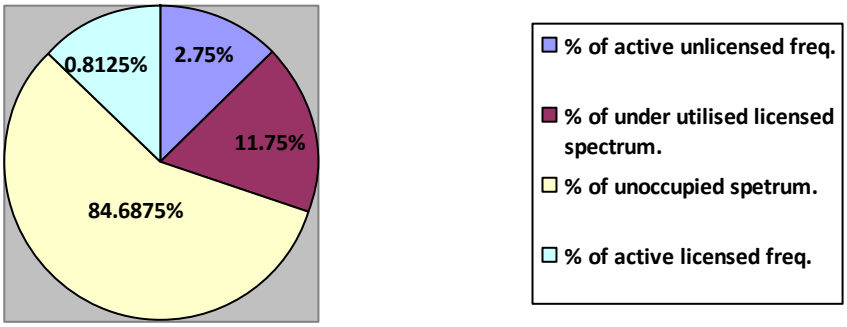


Chart 4: Results for Durban

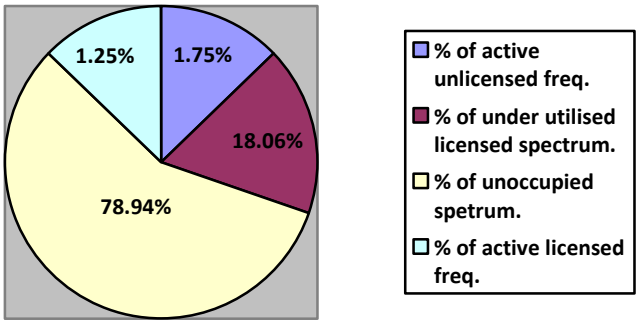


Chart 5: Results for Cape Town

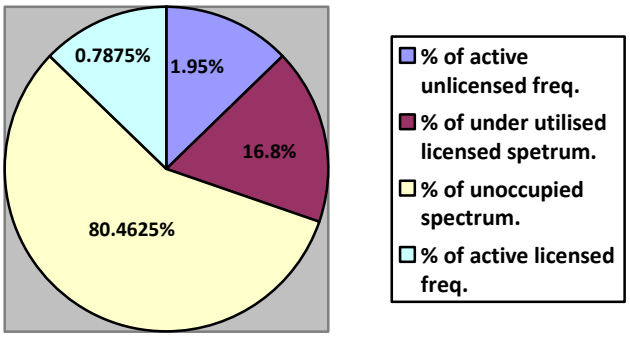
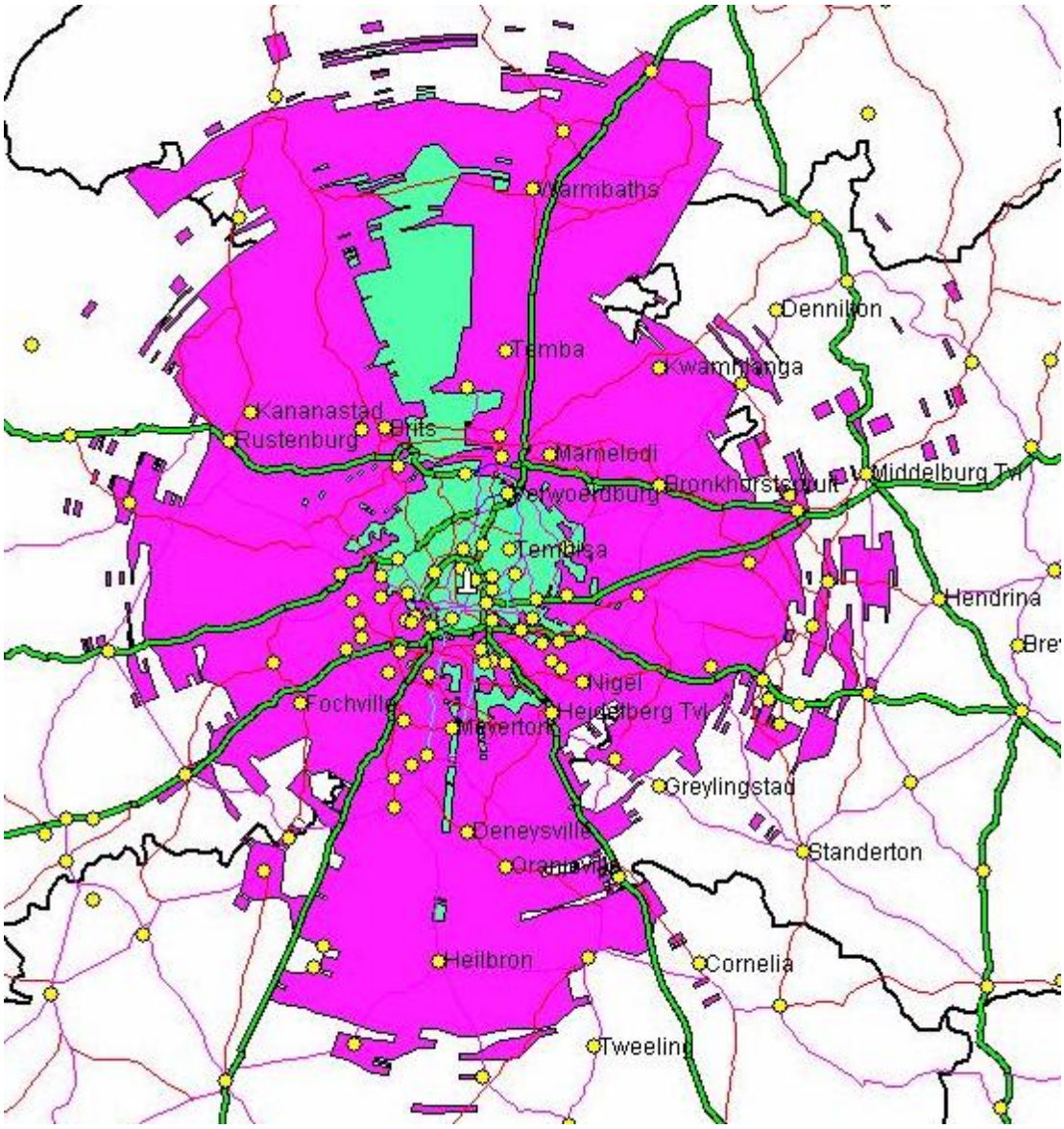


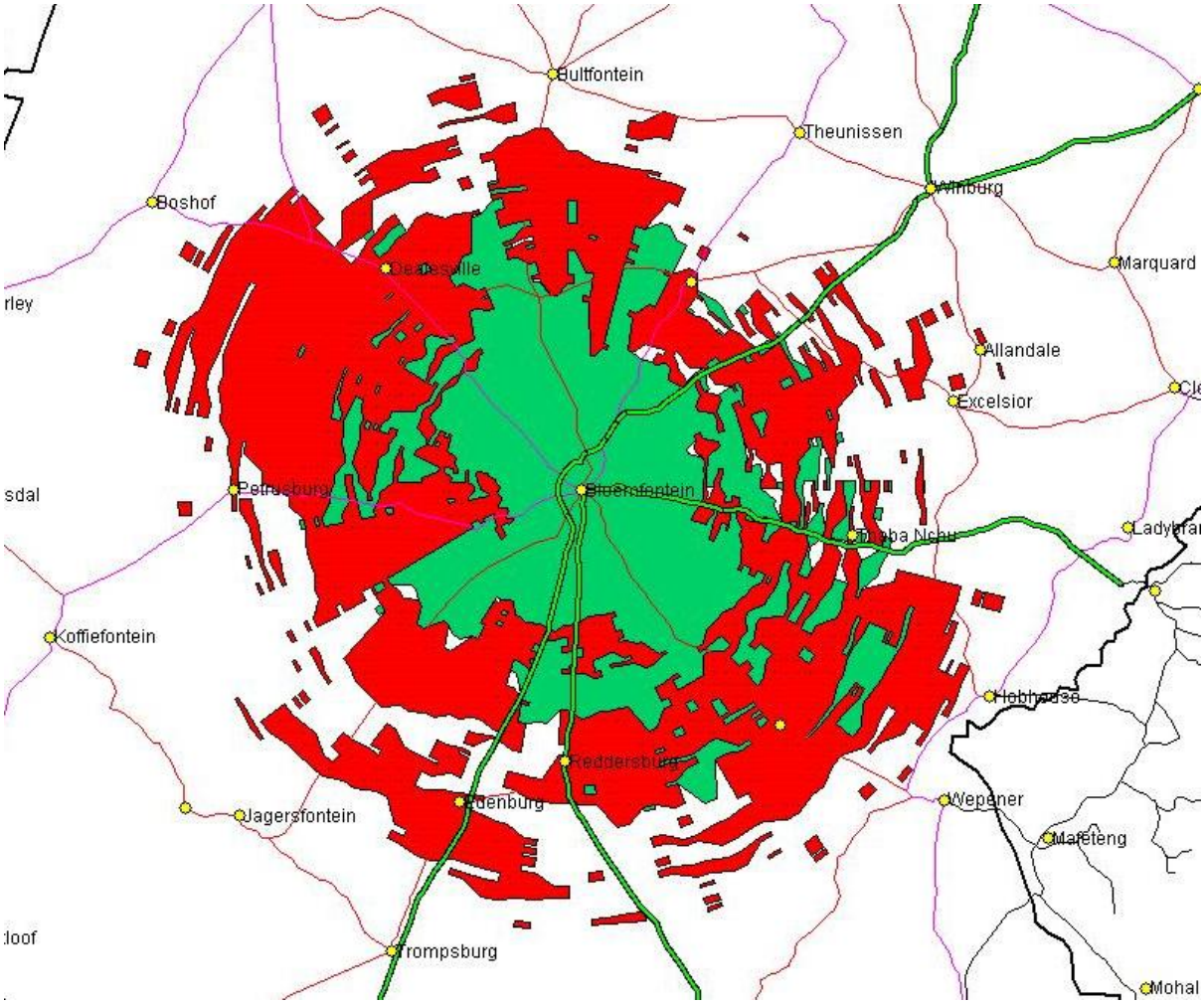
Chart 6: Consolidated Results

APPENDIX E – Coverage areas



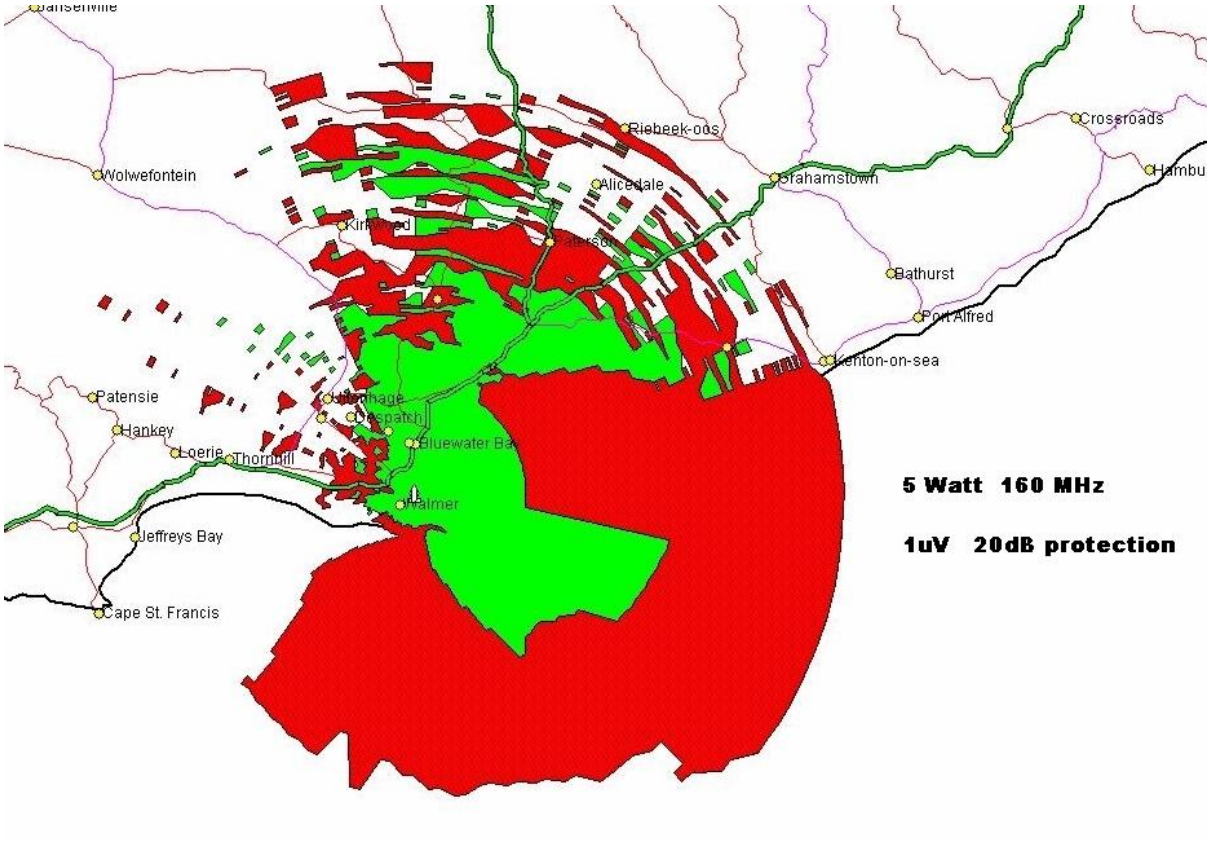
- Green is the coverage area.
- Purple is the protection area(20dB).

Figure 1: Pin Mill Farm site coverage area



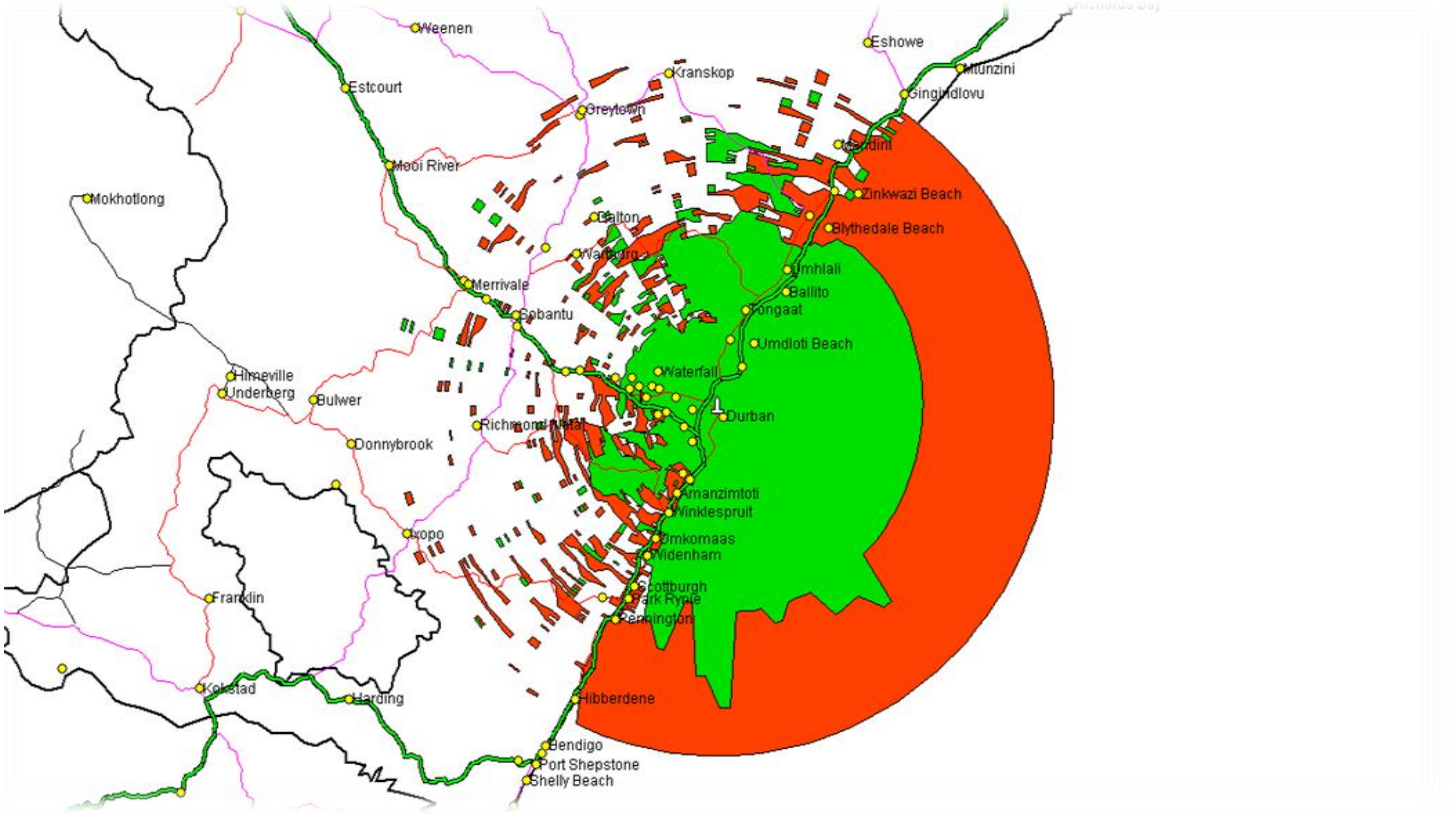
- Green is the coverage area.
- Red is the protection area(20dB).

Figure 2: Bloemfontein site coverage area



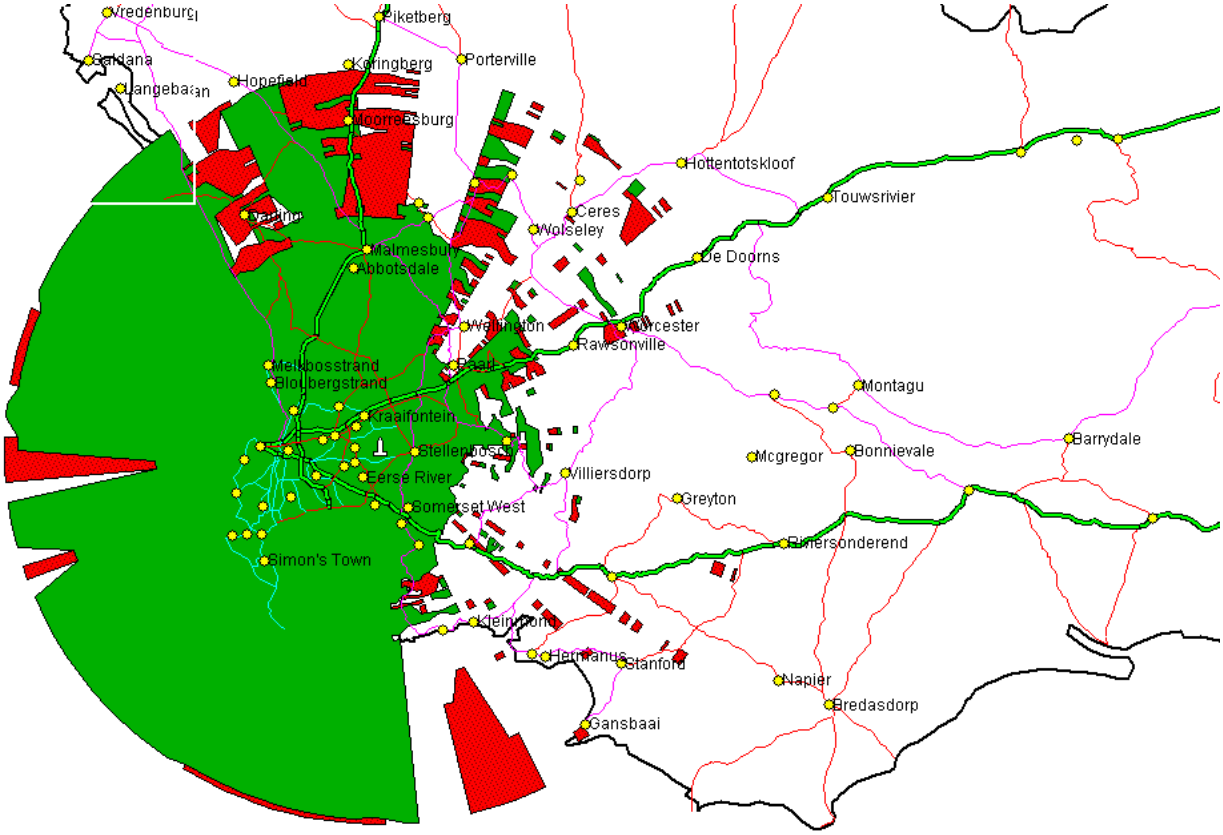
- Green is the coverage area.
- Red is the protection area(20dB).

Figure 3: Port Elizabeth site coverage area



- Green is the coverage area.
- Red is the protection area(20dB).

Figure 3: Durban site coverage area



- Green is the coverage area.
- Red is the protection area(20dB)

Figure 4: Cape Town site coverage area