Introduction

Short Range Devices (SRD) operating in the frequency range 25 MHz to 1 000 MHz must comply to Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU for non-specific radio equipment. The Spectrum management part of this standard refers to the EN 300 220 standard.

Devices operating in under this standard are license free and the physical layer access is regulated by the local regulator. ICASA is the regulator for all intentional radiators in South Africa.

When Alliances like WI-FI, Blue Tooth, LTE make use of the radio spectrum, specific instruments are available to manage devices under test (DUT) during the certification process. These instruments can place the DUT in the desired configuration mode so no further action from customer is required. This is called non-signaling tests.

For devices operating as SRD, non-signaling tests are not very common. To test these devices, signaling tests are required and involve the customer to provide devices with special engineering modes to enable the lab to perform the desired tests. This document will guide the customer how to prepare devices for EN 300 220 certification testing.

Spectrum Regulation

The non-specific short-range device category covers all kinds of radio devices, regardless of the application or the purpose, which fulfil the technical conditions as specified for a given frequency band. Typical uses include telemetry, telecommand, alarms, data transmissions in general and other applications. These radio equipment types are capable of operating in all or any part of the frequency bands given in table below.

Table 1: SRDs frequency ranges

		Short Range Devices frequency ranges
	Transmit and receive	26,957 MHz to 27,283 MHz
	Transmit and receive	40,660 MHz to 40,700 MHz
	Transmit and receive	138,2 MHz to 138,45 MHz
	Transmit and receive	169,4 MHz to 169,8125 MHz
	Transmit and receive	433,040 MHz to 434,790 MHz
	Transmit and receive	863 MHz to 876 MHz
	Transmit and receive	915 MHz to 921 MHz
NOTE:	It should be noted that not all frequency bands in table 1 are implemented in all European countries. Annex B provides an overview of radio interfaces which are harmonised in the European Union. Annex C provides an overview of national radio interfaces not harmonised in the European Union.	

Devices operating in South Africa must operate in the one of the bands in the table below and must comply to the limits of Table 2 for each band.

Table 2: ICASA regularity limits

Frequency band (MHz)	**Maximum Power** (dBm)	**Channel Spacing** (kHz)	**Duty Cycle** (%)
433.04 - 434.79	0	none	100
433.04 - 434.79	10	none	10
433.04 - 434.79	10	25	100
433.04 - 434.79	20	none	1
868.0 - 868.6	14	25	1
868.7 - 869.2	14	none	0.1
869.4 - 869.65	27	25	10
869.7 - 870.0	7	none	100

The frequency start and stop bands in the above table refers to the band-edge of the band. The DUT operating frequency cannot be on the band-edge frequency but must fall within this band.

Test Signals

A test signal, according to ETSI EN 300 220, is a modulated or unmodulated carrier generated by the DUT to facilitate a test. During the assessment the EUT must generate one or more of the following test signals:

Table 3: Test signals

Test signal	Description
D-M1	A test signal consisting of an unmodulated carrier. This test signal is optional but helps to simplify some tests.
D-M2	A test signal consisting of a modulated carrier representative of normal operation and generating the greatest occupied RF bandwidth. The preferred test signal consists of a pseudo-random bit sequence of at least 511 bits. This sequence shall be continuously repeated.
D-M2a	A test signal as described in D-M2 but generated intermittently. The generated RF signals shall be the same for each transmission except for the data sequence, occur regularly in time, be accurately repeatable and their timing duration shall represent normal operation of the EUT except for compliance with a duty cycle limit.
D-M3	A test signal representative of normal operation of the EUT. This signal shall be agreed between the test laboratory and the manufacturer in case selective messages are used and are generated or decoded within the equipment. The agreed test signal may be formatted and may contain error detection and correction.

Test Power Source

All tests should be performed using power supplies wherever possible, including tests on DUT designed for battery-only use. For battery powered equipment, power leads should be connected to the DUT's supply terminals (and monitored with a digital voltmeter) but the battery should remain present, electrically isolated from the rest of the equipment, possibly by putting tape over its contacts.

The presence of these power cables can, however, can affect the measured performance of the EUT. For this reason, they should be made to be "transparent" as far as the testing is concerned. This can be achieved by routing them away from the EUT and down to the either the screen, ground plane or facility wall (as appropriate) by the shortest possible paths.

Precautions should be taken to minimize pick-up on these leads (e.g. the leads could be twisted together, loaded with ferrite beads at 0,15 m spacing or otherwise loaded).

The manufacturer is responsible to prepare the device with leads to connect an external power supply for testing.

Frequency Channels

Measurement must be performed on the lowest and the highest operating frequencies as declared by the manufacturer. Additional frequencies may be tested. If the DUT is using more than 1 operating channel, the manufacturer must provide a method to select between these channels.

Test Conditions

The DUT will be tested under normal and extreme temperature and extreme voltage conditions simultaneously. These extreme conditions shall be declared by the manufacturer.

RF connection

For equipment with an integral antenna or with an antenna connection other than a conventional 50 Ω coaxial connector, conducted measurements must be made on such equipment by access to an internal connector or fitting of a temporary connector.

For devices with an integral antenna, two sets of devices must be submitted to the test laboratory, one fitted with a temporary antenna connector with the integral antenna disconnected and another device with the internal antenna connected.

Operating Manual

If a technical person is not attending the certification testing, an operating manual must be provided. This manual must give short overview of device and detail description on how to configure the DUT for different test modes.

Test Plan

For any of the tests below the measurements must be performed with the device operating at the highest power level and highest RF transfer rate or bandwidth at which the transmitter is intended to operate.

Table 4: Test Plan

Parameter to be tested	Preferred Test Signal(s)	Frequency Channels	Test Conditions	Preferred RF connection	Comments
Effective Radiated Power	D-M1 or D-M2	Bot and Top	Extreme	Both	Conducted only for extreme conditions
Maximum E.R.P. Spectral Density	D-M3	Bot and Top	Normal	Conducted	
Duty cycle	D-M3	Any	Normal	Any	
Occupied Bandwidth	D-M2 or D-M2a	Bot and Top	Normal	Conducted	
Frequency Error	D-M1 or D-M2	Any	Extreme	Conducted	
Tx Out of Band Emissions	D-M2 or D-M2a	Bot and Top	Normal	Conducted	
Transmit Spurious Emissions	D-M1 or D-M2 or D-M2a	Any	Normal	Both	Conducted only if external connector
Transient Power	D-M3	Bot and Top	Normal	Conducted	
Adjacent Channel Power	D-M2 or D-M2a or D-M3	Bot and Top	Extreme	Conducted	Only when channel width < 25KHz
Transmitter under Low Voltage	D-M1 or D-M2 or D-M2a or D-M3	Any	Normal	Conducted	
Adaptive Power Control	D-M3	Any	Normal	Conducted	Only if using APC
Receiver sensitivity	D-M3	Any	Normal	Conducted	
Adjacent channel selectivity	D-M3	Any	Normal	Conducted	Only for CAT1 receivers
Receiver saturation at Adjacent Channel	D-M3	Any	Normal	Conducted	Only for CAT1 receivers
Spurious response rejection	D-M3	Any	Normal	Conducted	Only for CAT1 receivers
Blocking	D-M3	Any	Normal	Conducted	
Behaviour at high wanted signal level	D-M3	Any	Normal	Conducted	Only for CAT1 receivers