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TEST REPORT

VX Sport VX Log-340b Data Logging Transceiver

tested to

47 Code of Federal Regulations

Part 15 - Radio Frequency Devices

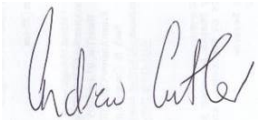
Subpart C – Intentional Radiators

Section 15.247 – Operation in the band 902 – 928 MHz

for

Visuallex Sport International Ltd

This Test Report is issued with the authority of:



Andrew Cutler- General Manager

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

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1. STATEMENT OF COMPLIANCE

The **VX Sport VX-340b Data Logging Transceiver** complies with FCC Part 15 Subpart C as an Intentional Radiator when the methods as described in ANSI C63.4 - 2003 and those defined in FCC Public Notice DA 00-705 are applied.

2. RESULTS SUMMARY

The results from testing carried out between October 23rd and November 2nd 2012, 22nd and 25th of March and 4th April 2013 are summarised in the following table:

Clause	Parameter	Result
15.201	Equipment authorisation requirement	Certification required
15.203	Antenna requirement	Complies
15.204	External PA and antenna modifications	Complies
15.205	Restricted bands of operation	Complies
15.207	Conducted limits	Complies
15.209	Radiated emission limits	Complies
15.247		
(a)(1)(i)	Frequency hopping requirements	Complies
(b)(2)	Peak output power	Complies
(b)(4)	Antenna gains greater than 6 dBi	Complies
(c)	Directional antenna gains greater than 6 dBi	Not applicable
(d)	Out of band emissions	Complies
(e)	Power spectral density	Not applicable
(f)	Hybrid systems	Not applicable
(g)	Use of all channels	Noted
(h)	Intelligent frequency hopping	Noted
(i)	Radio frequency hazards	Complies

3. INTRODUCTION

This report describes the tests and measurements performed for the purpose of determining compliance with the specification.

The client selected the test sample.

This report relates only to the sample tested.

This report contains no corrections or erasures.

Measurement uncertainties with statistical confidence intervals of 95% are shown below test results. Both Class A and Class B uncertainties have been accounted for, as well as influence uncertainties where appropriate.

4. CLIENT INFORMATION

Company Name	Visuallex Sport International Ltd
Address	PO Box 27054 Marion Square Wellington 6141
Country	New Zealand
Contact	Mr Andrew Fordyce

5. DESCRIPTION OF TEST SAMPLE

Brand Name	VX Sport
Model Number	VX Log-340b
Product	Data Logging Transceiver
Manufacturer	Visuallex Sport International Ltd
Country of Origin	New Zealand
Serial Number	1405160
FCC ID	SR2VSIL340B

The device that was tested and has the following specifications:

Rated output power:	25 mW (+14.0 dBm)
Antenna:	Integral antenna
Antenna gain:	0 dBi
FCC band:	902.0 – 928.0 MHz
Test frequencies:	921.000 MHz, 924.000 MHz, 926.900 MHz
Number of channels:	60
Channel spacing:	100 kHz
Frequency deviation:	+/- 20 kHz
Modulation type:	Frequency hopping spread spectrum (GFSK)
Hopping sequence:	Pseudo random sequence.
Transmitter time on:	14 ms
Power Supply:	3.7 Vdc lithium battery.
Port:	USB port for charging internal battery only
Frequencies in use:	32.768 kHz watch crystal 26.0 MHz transceiver crystal

6. SETUPS AND PROCEDURES

Standard

The sample was tested in accordance with 47 CFR Part 15 Subpart C and in particular section 15.247

Methods and Procedures

The following measurement methods and procedures have been applied:

- ANSI C63.4 – 2003

- FCC Public Notice DA 00-0705

Section 15.201: Equipment authorisation requirement

This device will require Certification as detailed in Subpart J of Part 2 as it contains a frequency hopping spread spectrum transmitter that operates in the 900 MHz band.

Section 15.203: Antenna requirement

This device has an internal antenna and it does not have an antenna port

Result: Complies

Section 15.204: External radio frequency power amplifiers and antenna modifications

An external power amplifier is not supplied with this device.

The equipment manual contains a warning about modifications to the device including the antennas.

Result: Complies.

Section 15.205: Restricted bands of operation

The transmitters contained within this device operate in the 902 - 928 MHz band which is covered by Section 15.247.

Result: Complies.

Section 15.207: Conducted emissions testing

This device is charged via a USB port.

Typically it would be charged when attached to a laptop computer using the USB port power supply and therefore it can be indirectly powered using the AC public mains.

Conducted emission testing has been carried out when the device was attached to a laptop computer that was powered at 120 Vac 60 Hz.

Conducted emissions testing was carried out over the frequency range of 150 kHz to 30 MHz at the Laboratory's MacKelvie Street premises in a 2.4 m x 2.4 m x 2.4 m screened room.

Testing was carried out in accordance with section 15.207(a) using a measuring receiver and a 50 uH / 50 ohm artificial mains network which is also known as a line impedance stabilisation network (LISN).

Measurements on both the phase and neutral lines were made using either a Quasi Peak or an Average detector with a 9 kHz bandwidth.

The supplied conducted emission plot is a combined plot showing the worst case of the Peak, Quasi Peak and Average levels for both phase and neutral.

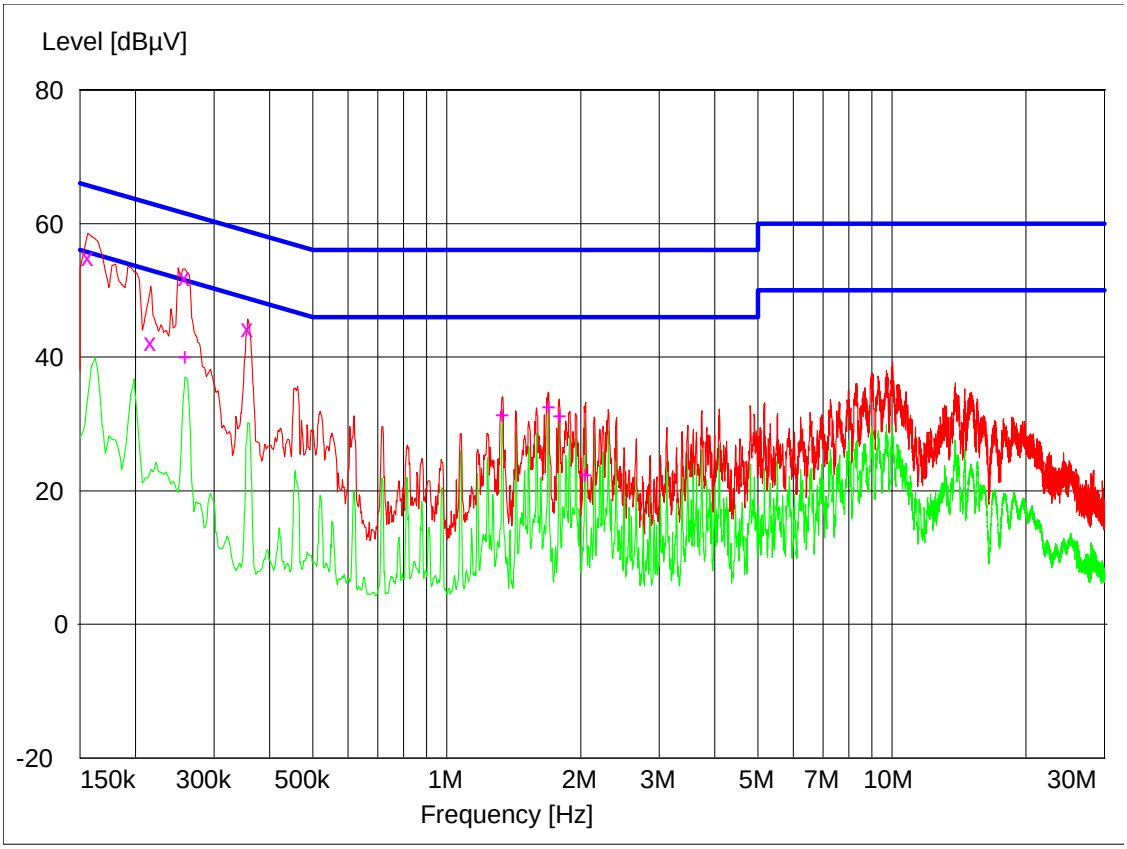
The Class B conducted limits have been applied

Result: Complies
Measurement uncertainty with a confidence interval of 95% is:
Conducted emissions tests (0.15 - 30 MHz) ± 2.2 dB

Conducted Emissions – AC Input Power Port

Setup:	Device tested charging internal battery when attached to the USB port of a laptop computer that was powered at 120 Vac.

Peak ---	Average --	Quasi Peak X	Average +



Final Quasi-Peak Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.156000	54.90	65.7	10.8	N	
0.216000	42.30	63.0	20.7	N	
0.258000	52.00	61.5	9.5	N	
0.357000	44.40	58.8	14.4	N	

Final Average Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.258000	40.00	51.5	11.5	N	
1.332000	31.40	46.0	14.6	N	
1.689000	32.50	46.0	13.5	N	
1.788000	31.10	46.0	14.9	N	
2.045000	22.40	46.0	23.6	N	

Section 15.209: Radiated emission limits, general requirements

Testing was carried out at the laboratory's open area test site - located at Driving Creek, Orere Point, Auckland, New Zealand.

This site conforms to the requirements of CISPR 16 and ANSI C63.4 - 2003.

Radiated emissions' testing was carried out over the frequency range of 10 kHz to 10 GHz as the device operates in the 900 MHz band and it contains a 32.768 kHz watch crystal and a 26.0 MHz transceiver crystal.

Below 30 MHz:

As the device contains an oscillator that operates below 30 MHz measurements were made between 9 kHz – 30 MHz at the open area test site over a distance of 10 metres using a loop antenna the centre of which was 1 metre above the ground.

The general limits described in 15.209 have been applied with the 300 metre and 30 metre limits being extrapolated by a factor of 40 dB per decade as allowed for in section 15.31(d)(2).

Between 9 – 90 kHz and between 110 – 490 kHz an Average detector and a Peak detector were used.

Where a peak detector was used the limit was increased by +20 dB

Between 90 kHz and 110 kHz band between 490 kHz and 30 MHz a Quasi Peak detector was used.

No emissions were detected from this device over the range of 9 kHz – 30 MHz

Result: Complies.
Measurement uncertainty with a confidence interval of 95% is:
- Free radiation tests (10 kHz – 30 MHz) ± 4.8 dB

Above 30 MHz:

Above 30 MHz measurements were attempted at a distance of 3 metres.

A receiver with a quasi-peak detector with a 120 kHz bandwidth was used between 30 – 1000 MHz and between 1000 – 10,000 MHz a peak detector and an average detector were used with a 1 MHz bandwidth.

When an emission is located, it is positively identified and its maximum level is found by rotating the automated turntable, and by varying the antenna height, where appropriate, with an automated antenna tower.

Measurements were attempted in both vertical and horizontal antenna polarisations.

The emission level was determined in field strength by taking the following into consideration:

Level (dBμV/m) = Receiver Reading (dBμV) + Antenna Factor (dB) + Coax Loss (dB)

No specific general emissions were detected from the device between 30 – 24000 MHz.

The only emissions observed were from the transmitter that are detailed in section 15.247(c) – Out of band emissions.

Result: Complies.
Measurement uncertainty with a confidence interval of 95% is:
- Free radiation tests (30 MHz – 24000 MHz) ± 4.1 dB

Section 15.247(a)(1) - Channel occupancy / bandwidth

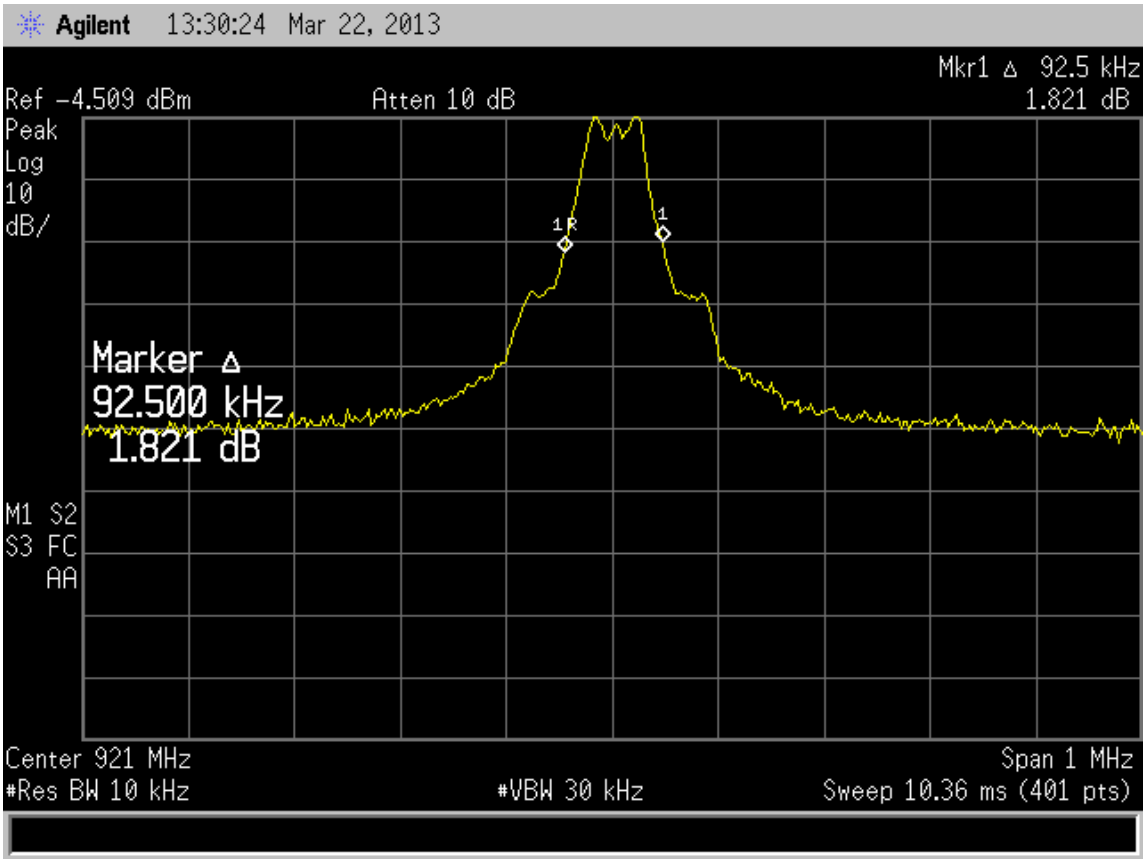
This device has been configured to operate using 60 channels spaced at 100 kHz.

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth whichever is greater with the maximum 20 dB bandwidth being 500 kHz.

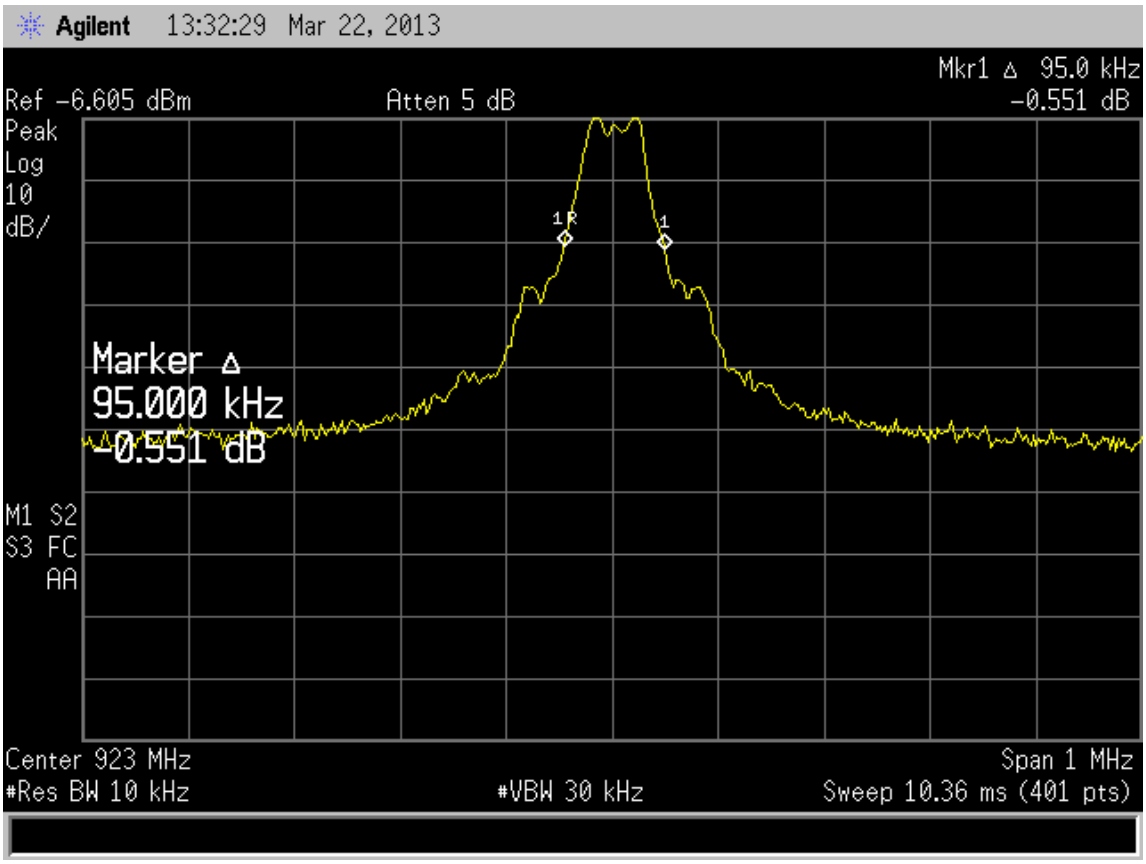
Using a span of 1 MHz and a resolution bandwidth of 10 kHz (video bandwidth of 30 kHz) the 20 dB bandwidth has been measured to be:

Frequency (MHz)	20 dB BW (kHz)
921.000	92.5
924.000	95.0
926.900	92.5

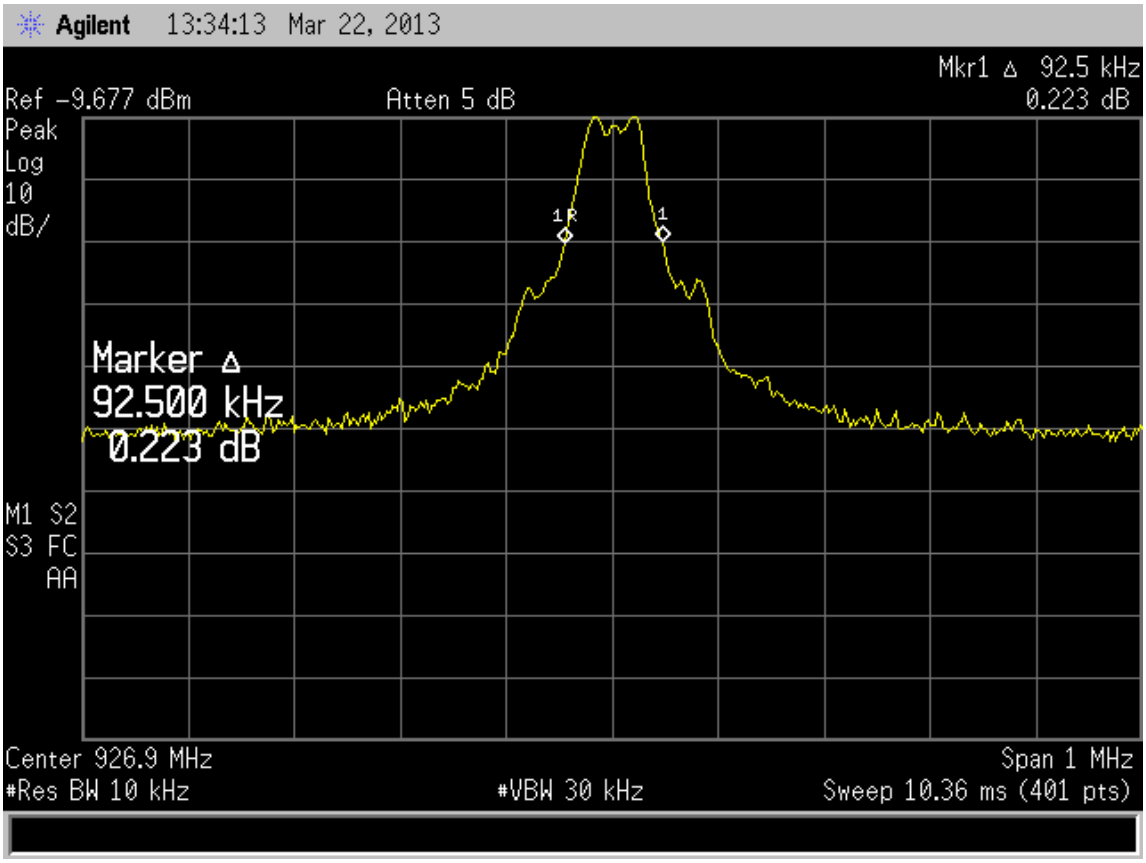
921.0 MHz



923.0 MHz

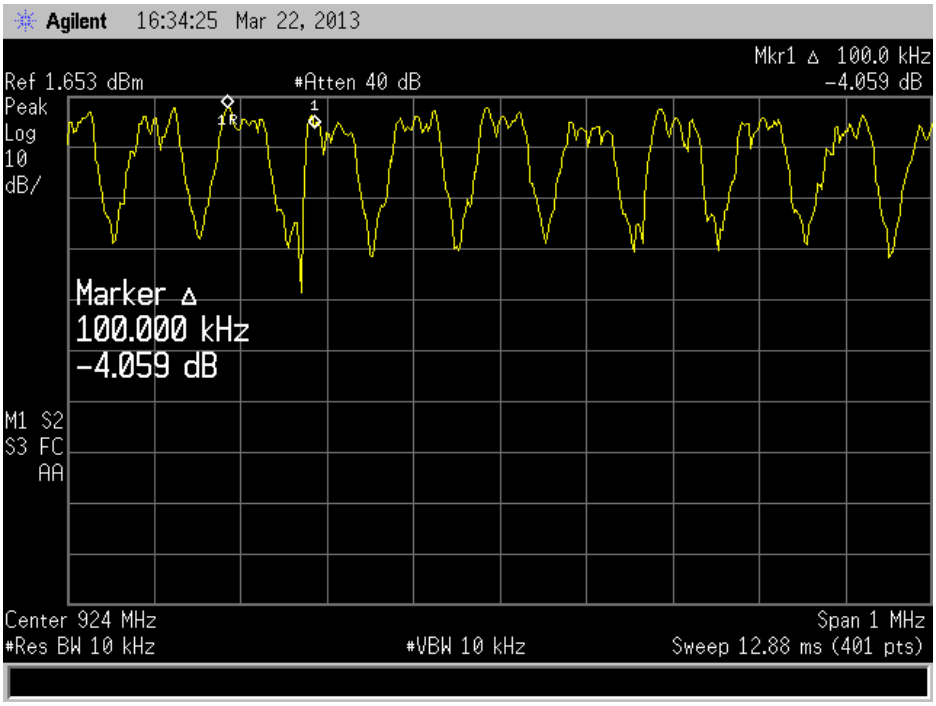


926.9 MHz

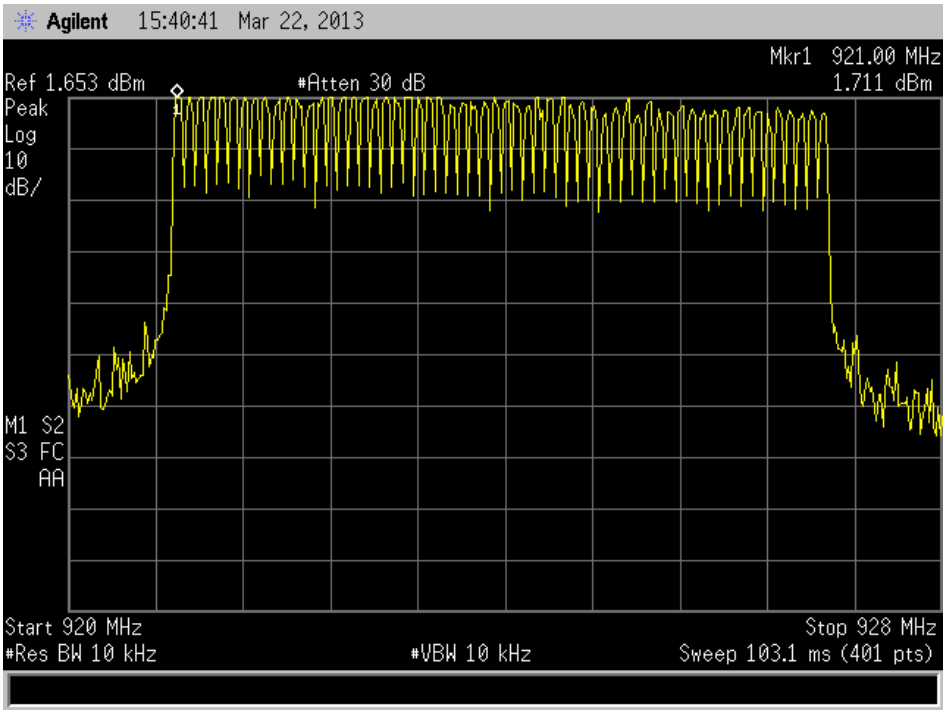


As the 20 dB bandwidth is less than 250 kHz a minimum of 50 channels must be used.

It can be seen that this device uses 60 channels between 921 – 926.9 MHz giving a channel spacing of 100 kHz.



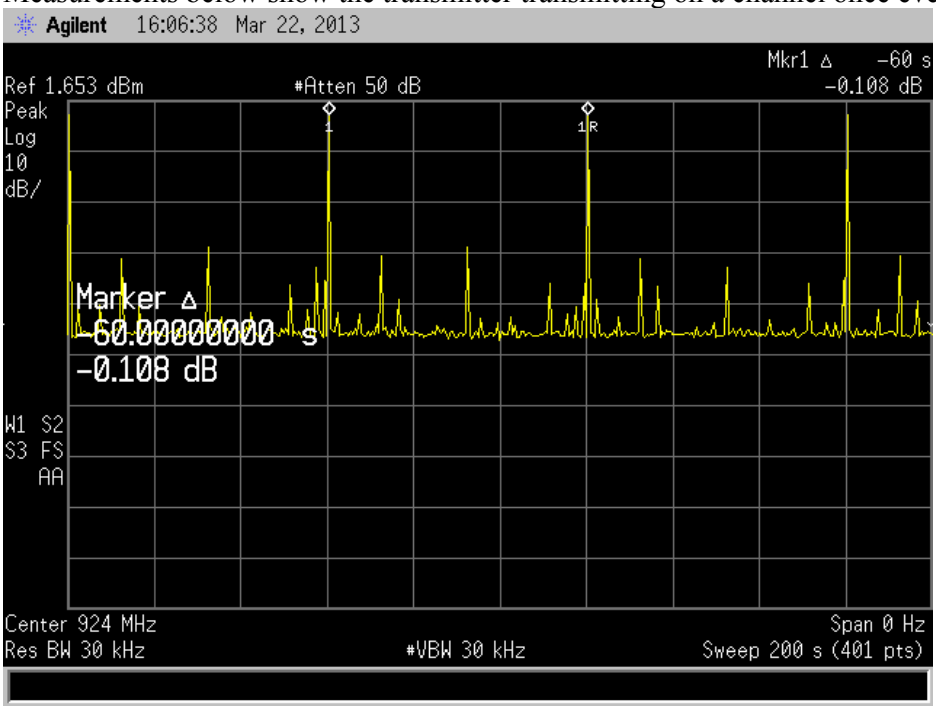
Below it can be seen that 60 channels are in operation between 921.0 MHz and 926.9 MHz



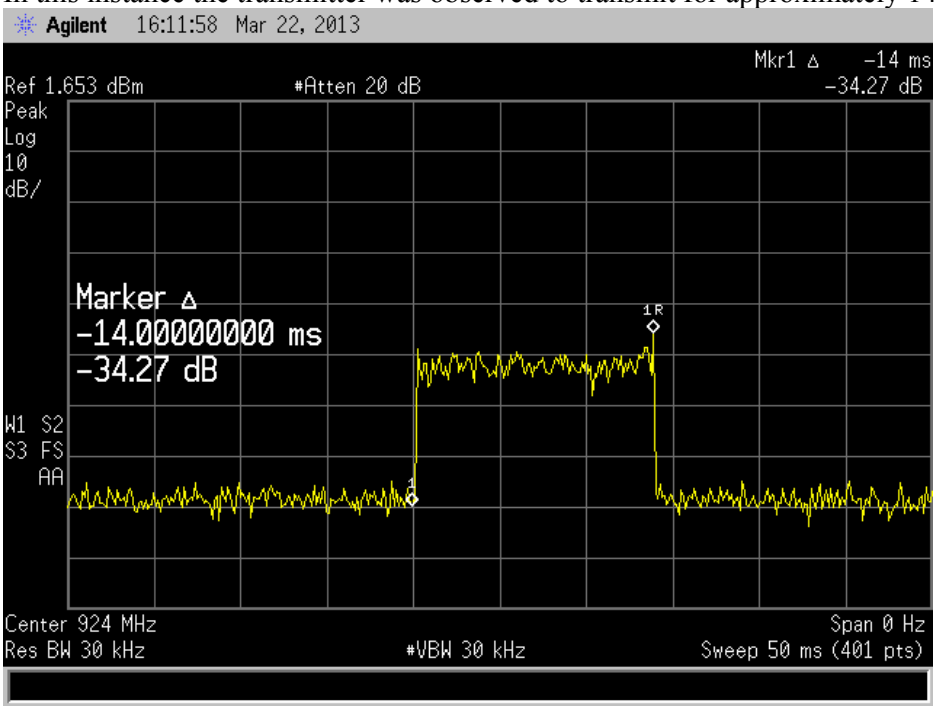
As the 20 dB bandwidth is less than 250 kHz the average time of occupancy on any frequency shall not be greater than 0.4 seconds in any 20 second period.

The client advises that this device will transmit on a channel once every second for no more than 14 ms and then move to the next channel moving through all of the channels in a pseudo random order over a period of 60 seconds.

Measurements below show the transmitter transmitting on a channel once every 60 seconds



In this instance the transmitter was observed to transmit for approximately 14 ms



Result: Complies

Section 15.247 (b)(4) Radiated transmitter power

Testing was carried out at EMC Technologies NZ Ltd Open Area Test Site, which is located at Driving Creek, Orere Point, Auckland. Details of this site have been filed with the Commission, Registration Number: 90838, which was last updated in February 2011.

The radiated power measurements were carried out as the device has an integral antenna.

The device was placed on the test table top which was a total of 0.8 m above the test site ground plane.

Measurements of the radiated field were made with the antenna located at a 3 m horizontal distance from the boundary of the device under test.

The emission was measured in both vertical and horizontal antenna polarisations, and with the device orientated in x, y and z axes.

The Z axis was found to give the highest emissions in Vertical and X axis are the highest in horizontal.

Frequency (MHz)	Level (dBµV/m)	Power (dBm)	Limit (dBm)	Polarity	Margin (dB)
921.000	107.0	11.8	30.0	Vertical	18.2
921.000	111.0	15.8	30.0	Horizontal	14.2
926.900	102.0	6.8	30.0	Vertical	23.2
926.900	103.0	7.8	30.0	Horizontal	22.2

Limit:
The conducted power shall not exceed 1 watt (+30 dBm) and the antenna system gain shall not exceed 6 dBi. Therefore the radiated power shall not exceed +36 dBm EiRP.

Result: Complies
Measurement Uncertainty: ±4.1dB

Section 15.247 (c) – Out of band emissions

A number of out of band emissions have been shown to fall within the restricted bands of operation as defined in section 15.205(a).

Radiated emission measurements were carried out with the limits as per section 15.209 applied when these emissions fell within the restricted bands.

In any 100 kHz bandwidth outside the frequency band of operation, the RF power produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

Testing was carried out at EMC Technologies NZ Ltd Open Area Test Site, which is located at Driving Creek, Orere Point, Auckland. Details of this site have been filed with the Commission, Registration Number: 90838, which was last updated in January 2010.

The device was placed on the test table top which was a total of 0.8 m above the test site ground plane.

Measurements of the radiated field were made with the antenna located at a 3 m horizontal distance from the boundary of the device under test.

Measurements below 1000 MHz were made using an Quasi Peak Detector with a bandwidth of 120 kHz.

Measurements above 1000 MHz were made using an average detector with a bandwidth of 1.0 MHz and also a peak detector with a bandwidth of 1.0 MHz.

When an emission is located, it is positively identified and its maximum level is found by rotating the automated turntable, and by varying the antenna height with an automated antenna tower. The emission is measured in both vertical and horizontal antenna polarisations.

The emission level is determined in field strength by taking the following into consideration:

Level (dBμV/m) = Receiver Reading (dBμV) + Antenna Factor (dB) + Coax Loss (dB)

Measurements were attempted up to 10fc on each operating frequency with no emissions being detected within 20 dB of the restricted frequency limit or the -20 dBc limit at each of these frequencies when this antenna was utilised.

Frequency: 921.000 MHz

Frequency (MHz)	Vertical (dBµV/m)	Horizontal (dBµV/m)	Limit (dBµV)	Polarity	Margin (dB)	Detector	Res BW
1842.0000	62.0	-	87.0	Vertical	25.0	Peak	100 kHz
1842.0000	-	80.0	91.0	Horizontal	11.0	Peak	100 kHz
2763.0000	60.0	59.0	74.0	Vertical	14.0	Peak	1 MHz
2763.0000	47.0	47.0	54.0	Vertical	7.0	Average	1 MHz
3684.0000	46.0	45.0	74.0	Vertical	28.0	Peak	1 MHz
3684.0000	35.1	34.0	54.0	Vertical	18.9	Average	1 MHz
4605.0000	44.0	44.0	74.0	Vertical	74.0	Peak	1 MHz
4605.0000	32.0	32.0	54.0	Vertical	54.0	Average	1 MHz
5526.0000	47.0	47.0	87.0	Vertical	40.0	Peak	100 kHz
6447.0000	50.0	50.0	87.0	Vertical	37.0	Peak	100 kHz
7368.0000	56.0	56.0	74.0	Vert/Hort	18.0	Peak	1 MHz
7368.0000	43.0	43.0	54.0	Vert/Hort	11.0	Average	1 MHz
8289.0000	56.0	56.0	74.0	Vert/Hort	18.0	Peak	1 MHz
8289.0000	43.0	43.0	54.0	Vert/Hort	11.0	Average	1 MHz
9210.0000	57.0	57.0	74.0	Vert/Hort	17.0	Peak	1 MHz
9210.0000	44.0	44.0	54.0	Vert/Hort	10.0	Average	1 MHz

Frequency: 926.900 MHz

Frequency (MHz)	Vertical (dBµV/m)	Horizontal (dBµV/m)	Limit (dBµV)	Polarity	Margin (dB)	Detector	Res BW
1853.8000	64.5	-	82.0	Vertical	17.5	Peak	100 kHz
1853.8000	-	71.3	83.0	Horizontal	11.7	Peak	100 kHz
2780.7000	59.4	59.0	74.0	Vertical	14.6	Peak	1 MHz
2780.7000	45.9	46.0	54.0	Horizontal	8.1	Average	1 MHz
3707.6000	46.0	45.0	74.0	Horizontal	29.0	Peak	1 MHz
3707.6000	35.1	34.0	54.0	Vertical	20.0	Average	1 MHz
4634.5000	44.0	44.0	74.0	Vertical	74.0	Peak	1 MHz
4634.5000	32.0	32.0	54.0	Vertical	54.0	Average	1 MHz
5561.4000	47.0	47.0	82.0	Vertical	35.0	Peak	100 kHz
6488.3000	50.0	50.0	82.0	Vertical	32.0	Peak	100 kHz
7415.2000	56.0	56.0	74.0	Vert/Hort	18.0	Peak	1 MHz
7415.2000	43.0	43.0	54.0	Vert/Hort	11.0	Average	1 MHz
8342.1000	56.0	56.0	74.0	Vert/Hort	18.0	Peak	1 MHz
8342.1000	43.0	43.0	54.0	Vert/Hort	11.0	Average	1 MHz
9269.0000	57.0	57.0	74.0	Vert/Hort	17.0	Peak	1 MHz
9269.0000	44.0	44.0	54.0	Vert/Hort	10.0	Average	1 MHz

Result: Complies
Measurement Uncertainty: ±4.1 dB

Band edge measurements:

At the band edges of 902 MHz and 928 MHz all emissions are required to be attenuated by more than 20 dB relative to the highest emission level observed in the band of operation.

At the test site radiated band edge measurements were made using a 100 kHz resolution bandwidth as follows:

Radiated band edge measurements

Frequency (MHz)	Vertical (dBµV/m)	Horizontal (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Polarity
902.000	35.8	-	87.0	51.2	Vertical
902.000	-	35.9	91.0	55.1	Horizontal
928.000	38.5	-	82.0	43.5	Vertical
928.000	-	38.3	83.0	44.7	Horizontal

It can be seen that all emissions are contained within the band of 902 – 928 MHz.

Result: Complies
Radiated Measurement Uncertainty: ±4.1 dB

Section 15.247(i) – Radio Frequency Hazard Information

As per Section 15.247 (i) spread spectrum transmitters operating in the 902-928 MHz band are required to be operated in a manner that ensures that the public is not exposed to RF energy levels in accordance with CFR 47, Section 1.1307(b)(1).

In accordance with Section 1.1310 this device would be classed as a portable device and therefore Section 2.1093 will apply.

Section 2.1093 requires SAR measurements to be carried out.

However the transmitter may come into close contact with humans so a SAR evaluation has been carried out in accordance with KDB Publication 447498 D01 General RF Exposure Guidance v05 dated October 24, 2012.

Clause 4.3.1 1 has been applied to this device as the power output is very low.

At 921 MHz the transmitter continuous peak output power was determined to be 38.0 mW

The highest frequency in use is 926.9 MHz.

This device is a frequency hopping spread spectrum device where a the transmitter operates for 14 ms on a channel and then moves to the next channel 1 second latter.

The device has 60 channels and it takes 60 seconds to operate on all channels.

Therefore a time averaging factor of (14 ms / 1000 ms) 0.014 has been applied to the continuous peak power of 38 mW which gives 0.532 mW

A 5 mm safe distance has been applied

The 1-g SAR safe distance was calculated as follows:

1-g SAR = (P (mW) / x (mm)) * (√ f (GHz))

1-g SAR = (0.532 mW / 5 mm) * √0.9269 GHz) = 0.102

The 1-g SAR threshold level, for distances < 50 mm, is ≤ 3.0.

The device will therefore meet the requirements of Section 2.1093 without any further testing by falling below the 1-g SAR threshold level.

Result: Complies

7. TEST EQUIPMENT USED

Instrument	Manufacturer	Model	Serial No	Asset Ref	Cal Due
Aerial Controller	EMCO	1090	9112-1062	RFS 3710	N/a
Aerial Mast	EMCO	1070-1	9203-1661	RFS 3708	N/a
Biconical Antenna	Schwarzbeck	BBA 9106	-	RFS 3613	17 Jan 2014
Receiver	R & S	ESCS 30	847124/020	E1595	22 Aug2013
Receiver	R & S	ESIB-40	100171	R-27-1	20 Oct 2013
Receiver	R & S	ESHS 10	828404/005	RFS 3728	22 Aug 2013
Spectrum Analyser	Hewlett Packard	E7405A	US39150142	3776	26 Feb 2015
Log Periodic	Schwarzbeck	VUSLP 9111	9111-228	3785	30 Jan 2015
Horn Antenna	EMCO	3115	9511-4629	E1526	21 Feb 2014
Mains Network	R & S	ESH2-Z5	881362/034	3628	29 Jul 2014
Variac	General Radio	1592	-	RFS 3690	N/a
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709	N/a
VHF Balun	Schwarzbeck	VHA 9103	-	RFS 3613	30 Jan 2014
Bandpass Filter	Telonic Berkley	3000-5-5EE	11014-1	4012	N/a
Bandpass Filter	Telonic Berkley	1500-5-5EE	00069-2	4011	N/a
Loop Antenna	EMCO	6502	9003-2485	3798	9 May 2014

8. ACCREDITATIONS

Testing was carried out in accordance with EMC Technologies Ltd registration with the Federal Communications Commission as a listed facility, registration number: 90838, which was updated in Februrary, 2011.

All testing was carried out in accordance with the terms of EMC Technologies (NZ) Ltd International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025, 2005.

All measurement equipment has been calibrated in accordance with the terms of the EMC Technologies (NZ) Ltd International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025, 2005

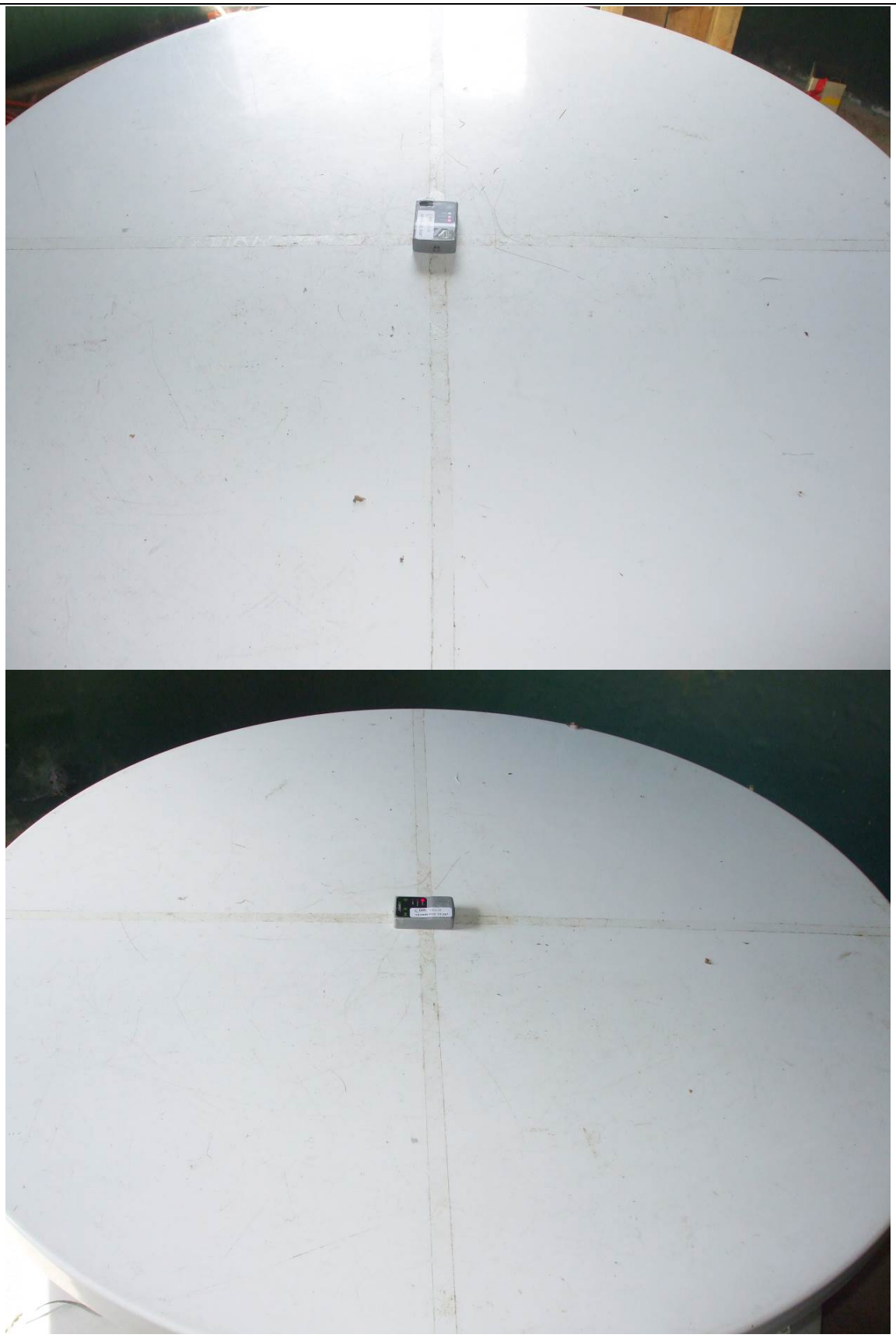
International Accreditation New Zealand has Mutual Recognition Arrangements for testing and calibration with various accreditation bodies in a number of economies.
This includes NATA (Australia), UKAS (UK), SANAS (South Africa), NVLAP (USA), A2LA (USA), SWEDAC (Sweden). Further details can be supplied on request.

9. PHOTOGRAPHS

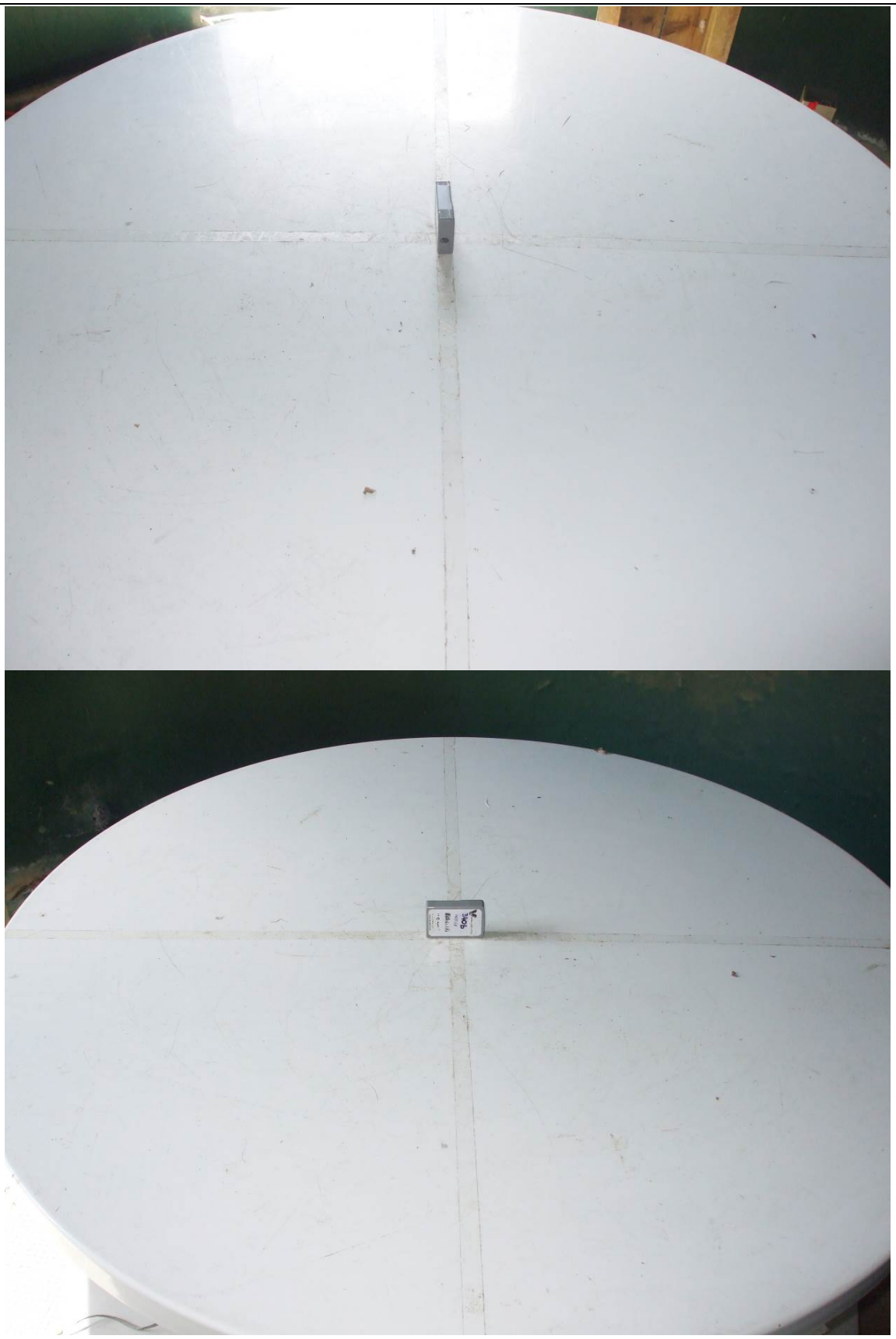
External views

Conducted emissions setup

Radiated emissions setup
X axis



Y axis



Z axis