



EMC Technologies (NZ) Ltd  
PO Box 68-307, Newton  
Auckland 1145  
New Zealand  
Phone 09 360 0862  
Fax 09 360 0861  
E-Mail Address: aucklab@ihug.co.nz  
Web Site: www.emctech.com.au

## **TEST REPORT**

**4RF SR+ SQ928M141 & FE928M141**  
**Point to Multi-point Digital Radio**

*tested to*

**47 Code of Federal Regulations**

**Part 15 - Radio Frequency Devices**

**Subpart A + B**

*for*

**4RF Limited**

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

## **Table of Contents**

<b>1. STATEMENT OF COMPLIANCE</b>	<b>3</b>
<b>2. RESULTS SUMMARY</b>	<b>3</b>
<b>3. INTRODUCTION</b>	<b>3</b>
<b>2. CLIENT INFORMATION</b>	<b>4</b>
<b>3. TEST SAMPLE DESCRIPTION</b>	<b>4</b>
<b>6. RESULTS</b>	<b>5</b>
<b>7. TEST EQUIPMENT USED</b>	<b>13</b>
<b>8. ACCREDITATIONS</b>	<b>13</b>
<b>9. PHOTOGRAPHS</b>	<b>14</b>

## 1. STATEMENT OF COMPLIANCE

The **4RF SR+ SQ928M141 & FE928M141 Point to Multi-point Digital Radio** complies with FCC Part 15 Subpart A + B as a Class A Device when the methods as described in ANSI C63.4 - 2003 are applied.

## 2. RESULTS SUMMARY

The results of testing, carried out between 25<sup>th</sup> April and 1<sup>st</sup> May 2014, are summarised below.

Clause	Parameter	Result
15.101	Equipment authorisation requirement.	The device tested is a receiver contained within a transceiver which has an ethernet port.
15.103	Exempted devices.	Device is not exempt as it contains a receiver and digital device.
15.107	Conducted Emissions 0.15 - 30 MHz	Complies with emissions within 20 dB of the applicable limits.
15.109	Radiated Emissions 30 - 2000 MHz	Complies with a 2.7 dB margin at 366.700 MHz in vertical antenna polarisation.
15.111	Antenna Terminal Disturbance 30 – 950 MHz	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.

## 2. CLIENT INFORMATION

**Company Name** 4RF Limited

**Address** 26 Glover Street  
Ngauranga  
Wellington

**Country** New Zealand

**Contact** Mr Paul Young

## 3. TEST SAMPLE DESCRIPTION

**Brand Name** Aprisa SR+

**Model Numbers** SQ928M141 & FE928M141

**Product** Point to Multi Point Digital Radio

**Manufacturer** 4RF Limited

**Manufactured in** New Zealand

**Designed in** New Zealand

**Serial Numbers** -

**FCC ID** UIPSQ928M141

The manufacturer has declared that the Aprisa SR+ SQ928M141 & FE928M141 are electrically identical such that the FCC ID: UIPSQ928M141 can be applied to both models.

The Aprisa SR+ FE928M141 comprises an Aprisa SR+ SQ928M141 in a 19" rack mount box with a duplexer mounted inside.

Full testing was carried out on the Aprisa SR+ SQ928M141 SR+ FE928M141 with limited testing, radiated emissions, carried out on the Aprisa SR+ FE928M141

## 6. RESULTS

### Standard

The sample was tested in accordance with 47 CFR Part 15 Subparts A and B as a Class A digital device.

### Methods and Procedures

The measurement methods and procedures as described in ANSI C63.4 - 2003 were used.

#### Section 15.107: Conducted emissions testing

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

The device was placed on top of the emissions table, which is 1 m x 1.5 m, 80 cm above the screened room floor which acts as the horizontal ground plane.

In addition the device was positioned 40 cm away from the screened room wall which acts as the vertical ground plane.

The artificial mains network was bonded to the screened room floor.

At all times the device was kept more than 80 cm from the artificial mains network.

The Class B limits have been applied.

Testing was carried out on the Aprisa SR+ SQ928M141 only.

The supplied plot is combined plot showing the worst case quasi peak and average results of both the phase and neutral lines to the representative AC to DC power supply.

Quasi peak and average detectors have been used with resolution bandwidths of 9 kHz.

Measurement uncertainty with a confidence interval of 95% is:

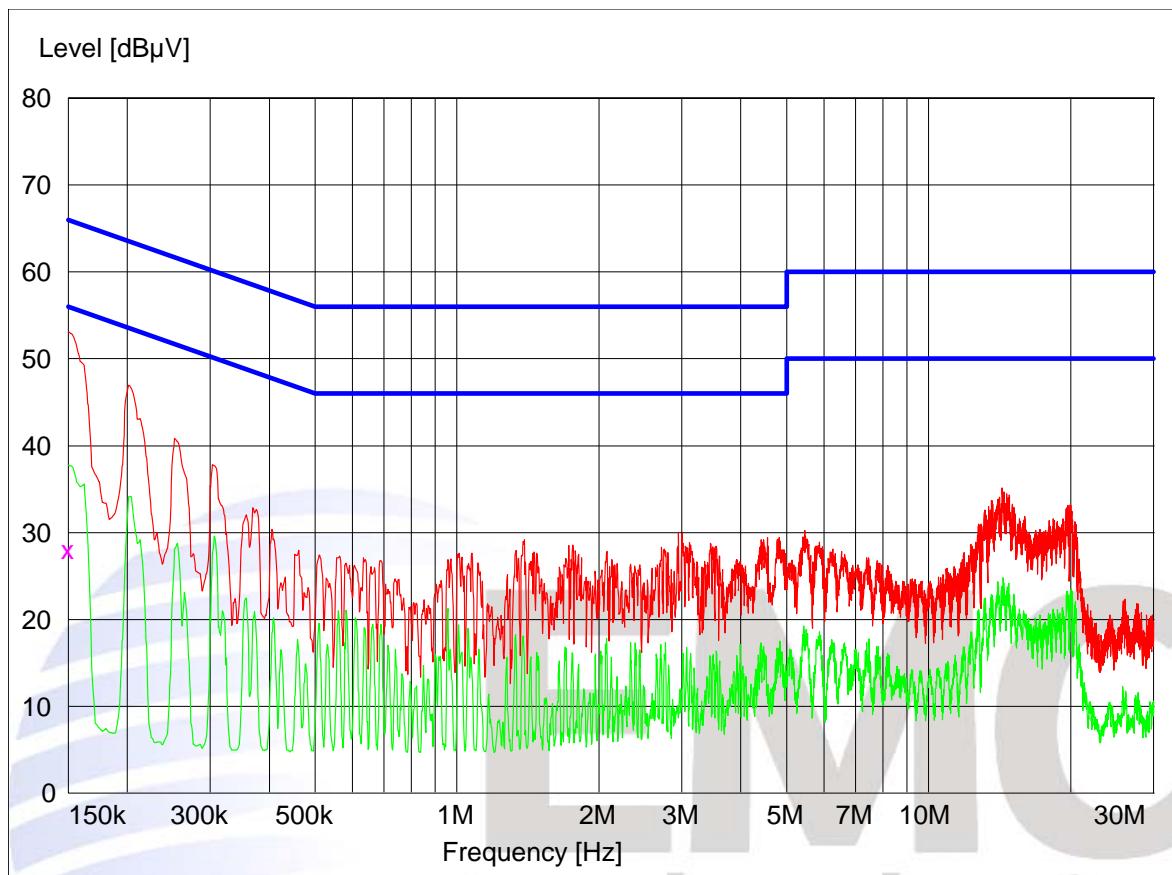
- AC Mains port  $(0.15 - 30 \text{ MHz}) \pm 2.8 \text{ dB}$

**Result:** Complies.

### Conducted Emissions – AC Input Power Port

**Setup:** The Aprisa SR+ SQ928M141 was powered by using a representative AC to DC power supply whilst in Receive mode.

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



#### Final Quasi-Peak Measurements

Frequency MHz	Level dB $\mu$ V	Limit dB $\mu$ V	Margin dB	Phase	Rechecks dB $\mu$ V
No emissions within 20 dB of the limit					

#### Final Average Measurements

Frequency MHz	Level dB $\mu$ V	Limit dB $\mu$ V	Margin dB	Phase	Rechecks dB $\mu$ V
No emissions within 20 dB of the limit					

## Section 15.109 – Radiated emissions

Radiated emission testing was carried out on both the Aprisa SR+ SQ928M141 & FE928M141 models over the frequency range of 30 to 2000 MHz.

Testing was carried out at the laboratory's open area test site - located at 670 Kawakawa Orere Rd, RD3, Papakura, New Zealand.

Before testing was carried out, a receiver Self Test and Internal Calibration was undertaken along with a check of all connecting cables and programmed antenna factors.

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

The Class A limits have been applied.

Measurements of the radiated field were attempted at 10 metres from the device.

Measurements below 2000 MHz were made using a Quasi Peak Detector with a bandwidth of 120 kHz.

Above 1000 MHz measurements were made using a Peak and an Average detector with a bandwidth of 1 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.

All emissions were measured in both vertical and horizontal antenna polarisations.

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

Level (dB $\mu$ V/m) = Receiver Reading (dB $\mu$ V) + Antenna Factor (dB/m) + Coax Loss (dB) – Amplifier Gain (dB)

Only levels with a margin of less than 20 dB when compared to the applicable limit have been recorded.

## Radiated emissions 30 – 2000 MHz

The device tested lying flat on top of the test table at height of 80 cm

The device was powered at 12 Vdc using a lead acid battery that was placed on the test site ground plane

50 ohm dummy loads were attached to the transmitting and receiving antenna ports

Attached to the device was a laptop computer that was attached to the Ethernet port.

Device was tested in standby / receive mode at 942.525 MHz

**Model tested:** Aprisa SR+ SQ928M141

Frequency MHz	Level dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Result	Antenna	Detector
44.000	24.0	39.1	15.1	Pass	Vertical	QP
44.500	22.0	39.1	17.1	Pass	Vertical	QP
44.800	25.6	39.1	13.5	Pass	Vertical	QP
45.000	24.6	39.1	14.5	Pass	Vertical	QP
45.200	26.2	39.1	12.9	Pass	Vertical	QP
45.600	25.3	39.1	13.8	Pass	Vertical	QP
45.800	26.5	39.1	12.6	Pass	Vertical	QP
56.000	29.0	39.1	10.1	Pass	Vertical	QP
58.400	25.0	39.1	14.1	Pass	Vertical	QP
60.200	27.1	39.1	12.0	Pass	Vertical	QP
60.800	24.2	39.1	14.9	Pass	Vertical	QP
62.000	21.3	39.1	17.8	Pass	Vertical	QP
62.200	20.5	39.1	18.6	Pass	Vertical	QP
62.800	19.0	39.1	20.1	Pass	Vertical	QP
63.000	19.0	39.1	20.1	Pass	Vertical	QP
68.900	18.2	39.1	20.9	Pass	Vertical	QP
69.000	20.4	39.1	18.7	Pass	Vertical	QP
85.400	19.6	39.1	19.5	Pass	Vertical	QP
86.000	22.5	39.1	16.6	Pass	Vertical	QP
86.200	19.0	39.1	20.1	Pass	Vertical	QP
87.200	22.1	39.1	17.0	Pass	Vertical	QP
87.400	19.0	39.1	20.1	Pass	Vertical	QP
87.600	23.0	39.1	16.1	Pass	Vertical	QP
87.800	21.8	39.1	17.3	Pass	Vertical	QP
88.000	19.2	39.1	19.9	Pass	Vertical	QP
93.600	22.7	43.5	20.8	Pass	Vertical	QP
94.400	24.8	43.5	18.7	Pass	Vertical	QP
98.400	27.3	43.5	16.2	Pass	Vertical	QP
106.800	24.6	43.5	18.9	Pass	Vertical	QP
300.000	33.6	46.4	12.8	Pass	Vertical	QP
300.000	42.1	46.4	4.3	Pass	Horizontal	QP
433.300	33.2	46.4	13.2	Pass	Horizontal	QP
600.000	27.2	46.4	19.2	Pass	Vertical	QP
800.000	27.0	46.4	19.4	Pass	Vertical	QP
800.000	26.1	46.4	20.3	Pass	Horizontal	QP

## Radiated emissions 30 – 2000 MHz

The device tested lying flat on top of the test table at height of 80 cm

The device was powered at 12 Vdc using a lead acid battery that was placed on the test site ground plane

50 ohm dummy loads were attached to the transmitting and receiving antenna ports

Attached to the device was a laptop computer that was attached to the Ethernet port.

Device was tested in standby / receive mode at 942.525 MHz

**Model tested:** Aprisa SR+ FE928M141

Frequency MHz	Level dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Result	Antenna	Detector
31.400	19.9	39.1	19.2	Pass	Vertical	QP
44.000	26.1	39.1	13.0	Pass	Vertical	QP
44.500	23.5	39.1	15.6	Pass	Vertical	QP
44.800	25.6	39.1	13.5	Pass	Vertical	QP
45.000	26.4	39.1	12.7	Pass	Vertical	QP
45.600	27.4	39.1	11.7	Pass	Vertical	QP
45.800	28.0	39.1	11.1	Pass	Vertical	QP
68.200	19.4	39.1	19.7	Pass	Vertical	QP
68.400	18.6	39.1	20.5	Pass	Vertical	QP
68.900	20.8	39.1	18.3	Pass	Vertical	QP
69.000	20.4	39.1	18.7	Pass	Vertical	QP
70.800	21.1	39.1	18.0	Pass	Vertical	QP
81.200	20.6	39.1	18.5	Pass	Vertical	QP
82.200	19.0	39.1	20.1	Pass	Vertical	QP
84.600	20.0	39.1	19.1	Pass	Vertical	QP
85.400	23.0	39.1	16.1	Pass	Vertical	QP
85.600	21.6	39.1	17.5	Pass	Vertical	QP
85.800	19.8	39.1	19.3	Pass	Vertical	QP
86.000	24.8	39.1	14.3	Pass	Vertical	QP
86.200	23.5	39.1	15.6	Pass	Vertical	QP
87.200	25.6	39.1	13.5	Pass	Vertical	QP
87.400	22.0	39.1	17.1	Pass	Vertical	QP
87.600	26.6	39.1	12.5	Pass	Vertical	QP
87.800	25.5	39.1	13.6	Pass	Vertical	QP
88.000	22.5	39.1	16.6	Pass	Vertical	QP
88.200	23.3	43.5	20.2	Pass	Vertical	QP
88.400	25.2	43.5	18.3	Pass	Vertical	QP
93.600	29.8	43.5	13.7	Pass	Vertical	QP
94.400	32.2	43.5	11.3	Pass	Vertical	QP
95.200	29.9	43.5	13.6	Pass	Vertical	QP
96.400	30.6	43.5	12.9	Pass	Vertical	QP
98.400	31.8	43.5	11.7	Pass	Vertical	QP

**Model tested:** Aprisa SR+ FE928M141 continued

Frequency MHz	Level dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Result	Antenna	Detector
100.000	32.6	43.5	10.9	Pass	Vertical	QP
101.600	26.5	43.5	17.0	Pass	Vertical	QP
102.600	26.8	43.5	16.7	Pass	Vertical	QP
102.800	26.4	43.5	17.1	Pass	Vertical	QP
104.200	26.6	43.5	16.9	Pass	Vertical	QP
106.800	25.6	43.5	17.9	Pass	Vertical	QP
300.000	29.8	46.4	16.6	Pass	Vertical	QP
300.000	38.0	46.4	8.4	Pass	Horizontal	QP
350.000	27.2	46.4	19.2	Pass	Vertical	QP
350.000	36.6	46.4	9.8	Pass	Horizontal	QP
366.600	32.5	46.4	13.9	Pass	Vertical	QP
366.600	40.4	46.4	6.0	Pass	Horizontal	QP
366.700	35.8	46.4	10.6	Pass	Vertical	QP
366.700	43.7	46.4	2.7	Pass	Horizontal	QP
366.800	26.3	46.4	20.1	Pass	Horizontal	QP
400.000	37.3	46.4	9.1	Pass	Vertical	QP
400.000	39.0	46.4	7.4	Pass	Horizontal	QP
420.000	26.3	46.4	20.1	Pass	Vertical	QP
420.000	29.9	46.4	16.5	Pass	Horizontal	QP
433.300	30.7	46.4	15.7	Pass	Vertical	QP
433.300	36.0	46.4	10.4	Pass	Horizontal	QP
433.400	29.5	46.4	16.9	Pass	Horizontal	QP
450.000	28.0	46.4	18.4	Pass	Horizontal	QP
500.000	27.5	46.4	18.9	Pass	Vertical	QP
600.000	28.2	46.4	18.2	Pass	Vertical	QP
800.000	30.5	46.4	15.9	Pass	Vertical	QP
800.000	28.2	46.4	18.2	Pass	Horizontal	QP

**Result:** Complies.

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests  $(30 \text{ MHz} - 2000 \text{ MHz}) \pm 4.1 \text{ dB}$

## Receiver radiated emissions

The device tested lying flat on top of the test table at height of 80 cm

The device was powered at 12 Vdc using a lead acid battery that was placed on the test site ground plane

50 ohm dummy loads were attached to the transmitting and receiving antenna ports

Attached to the device was a laptop computer that was attached to the Ethernet port.

Device was tested in standby / receive mode on the following receive frequencies:

929.525 MHz

931.525 MHz

942.525 MHz

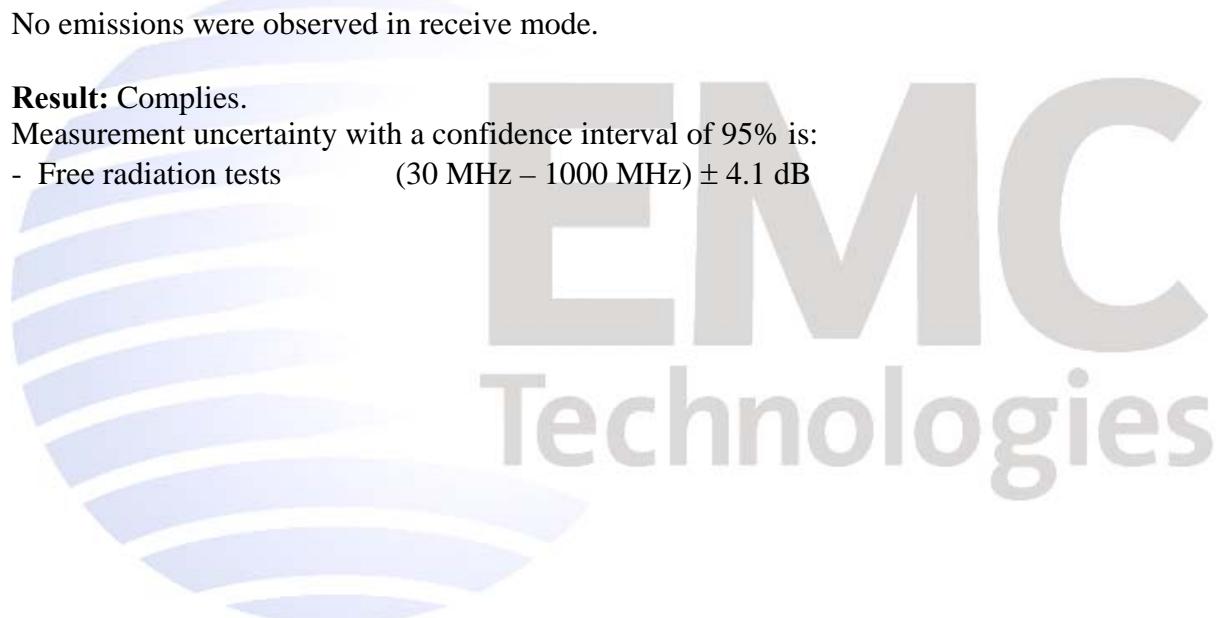
952.525 MHz

No emissions were observed in receive mode.

**Result:** Complies.

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (30 MHz – 1000 MHz)  $\pm$  4.1 dB



## **Section 15.111 - Receiver spurious emissions at antenna terminals**

Testing was carried out at the antenna port in standby / receive mode on the following receive frequencies:

929.525 MHz  
931.525 MHz  
942.525 MHz  
952.525 MHz

No emissions were observed in receive mode, testing was performed up to 5 GHz.

### **Limit:**

In accordance with CFR 47 Part 15, section 15.111 the power of any emission at the antenna terminal should not exceed 2 nW (-57.0 dBm).

**Result:** Complies.

**Measurement Uncertainty:**  $\pm 3.3$  dB.



## 7. TEST EQUIPMENT USED

Instrument	Manufacturer	Model	Serial #	Asset	Cal Due	Interval
Aerial Controller	EMCO	1090	9112-1062	3710	N/a	N/a
Aerial Mast	EMCO	1070-1	9203-1661	3708	N/a	N/a
Turntable	EMCO	1080-1-2.1	9109-1578	3709	N/a	N/a
VHF Balun	Schwarzbeck	VHA9103	-	3603	12/01/2015	1 year
Biconical	Schwarzbeck	BBA 9106	-	3612	12/01/2015	1 year
Log Periodic	Schwarzbeck	VUSLP 91111	9111-228	3785	12/01/2015	1 year
Horn Antenna	Electrometrics	RGA-60	6234	E1494	04/07/2014	1 year
Receiver	R & S	ESIB-40	100171	EMC4003	29/01/2015	1 year
Spectrum Analyzer	Hewlett Packard	E7405A	US39150142	RFS 3776	26/05/2014	1 year

## 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 July 2013.

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.

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.

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

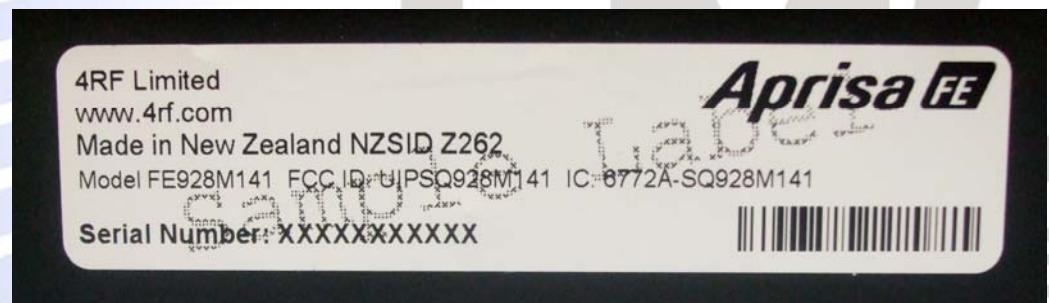
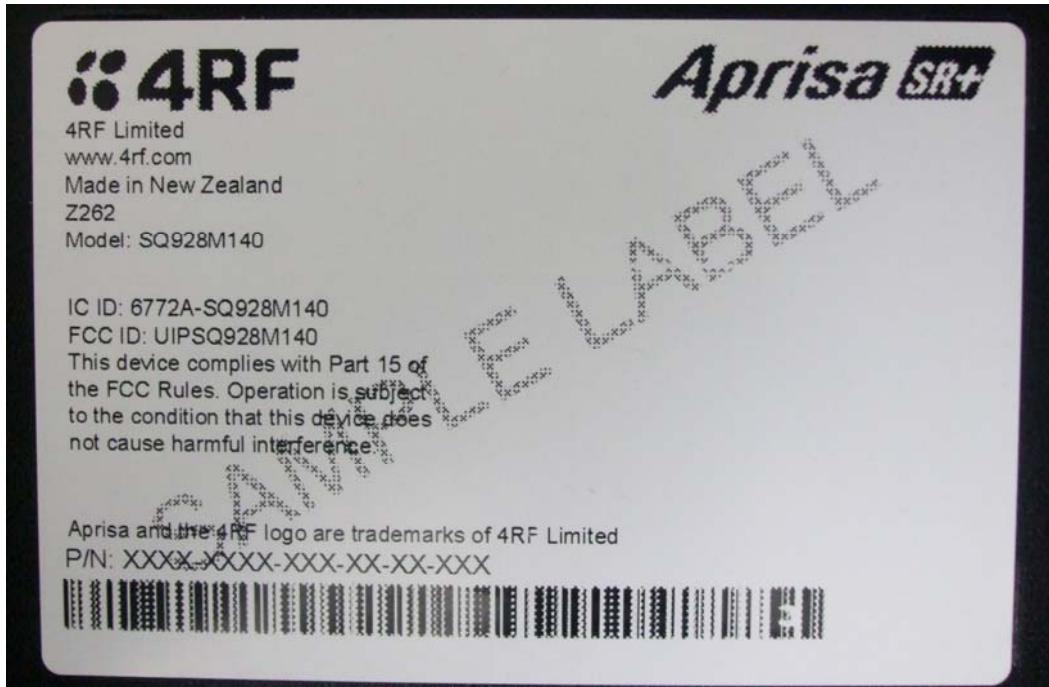
External photos of the device tested - SQ928M141



External photos of the device tested - FE928M141

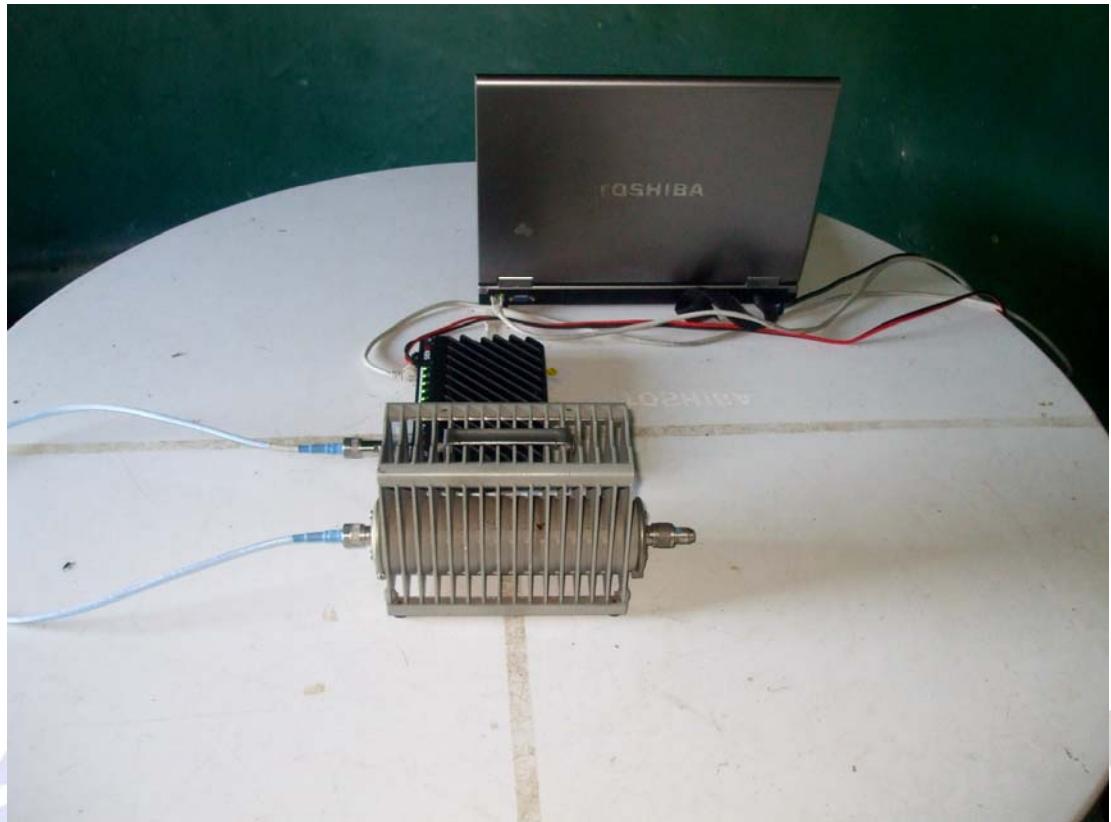


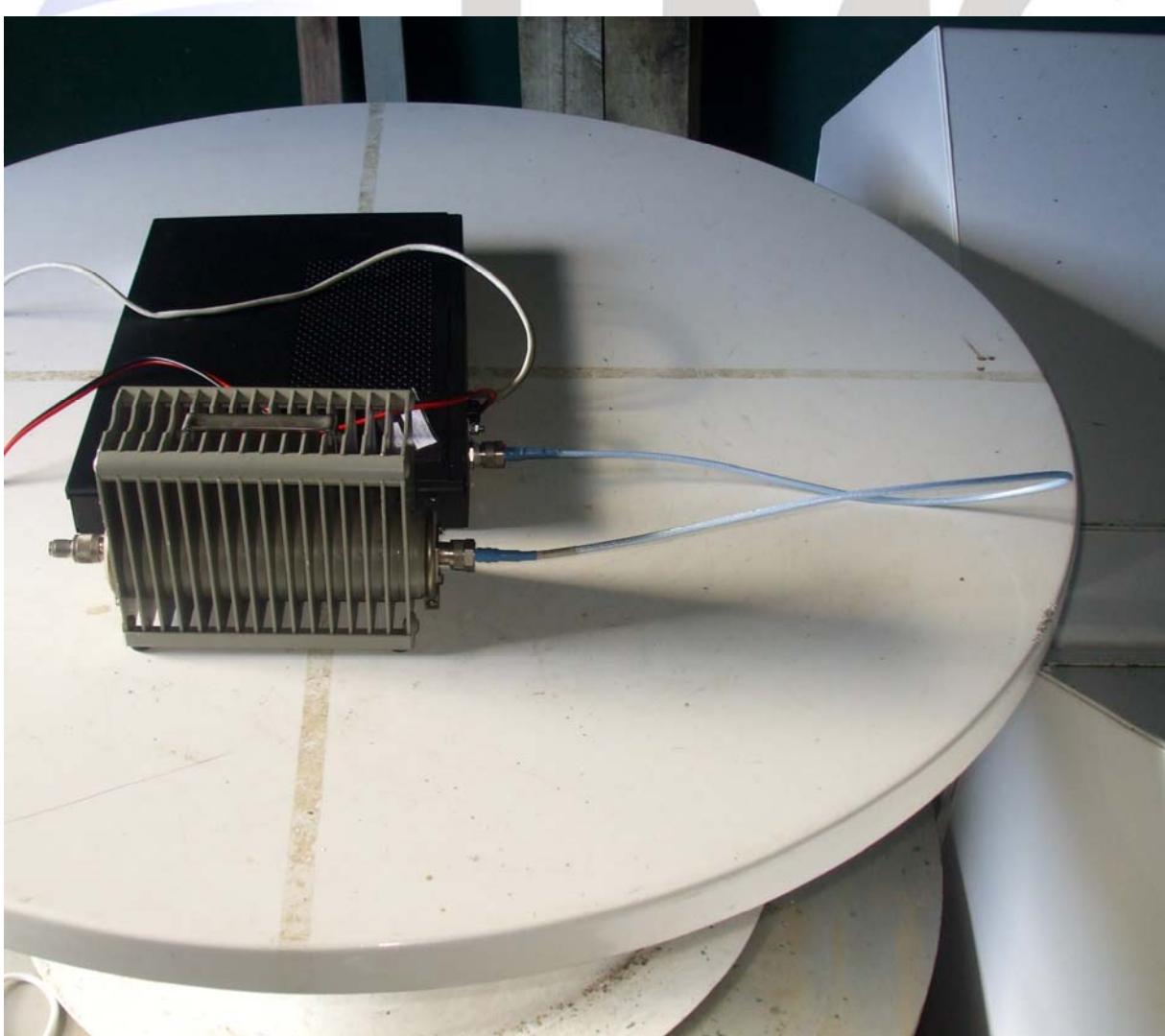
Labels



### Radiated emissions test set up photos







Conducted emissions setup

