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## **TEST REPORT**

**MiMOMax MWL-Tornado - \*H A/B/C\*  
700 MHz Upper A Block Tornado**

*tested to*

**Code of Federal Regulations (CFR) 47**

**Part 27 – Miscellaneous Wireless Communication Services**

*for*

**MiMOMax Wireless Limited**

This Test Report is issued with the authority of:

A handwritten signature in black ink, appearing to read "Andrew Cutler".

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**Andrew Cutler- General Manager**



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

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**EMC**  
Technologies

## 1. COMPLIANCE STATEMENT

The **MiMOMax MWL-Tornado-\*H A/B/C\* 700 MHz Upper A Block Tornado** complies with the limits defined in 47 CFR Part 27 and 47 CFR Part 2 when tested in-accordance with the test methods described in 47 CFR Part 2 and ANSI/ TIA-603-C.

## 2. RESULT SUMMARY

The results of testing carried out in April, May and June 2016 are summarised below.

Clause	Description	Result
27.50 2.1046	Power and antenna height limits Radio frequency power output	Complies Noted
27.51 2.1033	Equipment authorisation Equipment authorisation	Noted Noted
27.52 1.1310	RF Safety Radio frequency exposure limits	Complies Noted
2.1047 2.1049 2.202	Modulation type Occupied bandwidth Bandwidths	Noted Noted Noted
27.53	Emission Limits	Noted
27.53(c)	Operations in the 746 - 758 MHz and 776 - 788 MHz band	Noted
27.53(c)(1)	746 - 758 MHz band	Complies
27.53(c)(2)	776 - 788 MHz band	Complies
27.53(c)(3)	776 - 775 MHz and 793 - 805 MHz band	Complies
27.53(f)	1559 - 1610 MHz band	Complies
2.1051	Spurious emissions at antenna terminals	Noted
2.1053	Field strength of spurious radiations	Noted
27.54	Frequency Stability	Complies
2.1055	Frequency Stability	Noted
27.55	Field strength of spurious radiation	Not applicable

This report replaces report number 160218.1 with revised RF power measurements and revised Radiation Hazard Assessment calculations carried out.

### 3. ATTESTATION

This report describes the tests and measurements performed for the purpose of determining compliance with the specification with the following conditions:

**The client selected the test sample.**

**The report relates only to the sample tested.**

**This report does not contain corrections or erasures.**

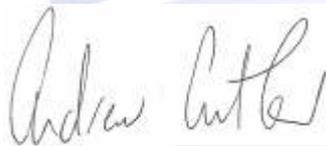
Measurement uncertainties with statistical confidence intervals of 95% are shown below test results. Both Class A and Class B uncertainties have been accounted for, as well as influence uncertainties where appropriate.

In addition this equipment has been tested in accordance with the requirements contained in the appropriate Commission regulations.

All compliance statements have been made with respect of the specification limit with no reference to the measurement uncertainty.

To the best of my knowledge, these tests were performed using measurement procedures that are consistent with industry or Commission standards and demonstrate that the equipment complies with the appropriate standards.

I further certify that the necessary measurements were made by EMC Technologies NZ Ltd, 47 MacKelvie Street, Grey Lynn, Auckland, New Zealand.



Andrew Cutler  
General Manager  
EMC Technologies NZ Ltd

## 4. CLIENT INFORMATION

**Company Name** MiMOMax Wireless Limited  
**Address** 540 Wairakei Road  
Christchurch 8053  
**Country** New Zealand  
**Contact** Zheng Li

## 5. TEST SAMPLE DESCRIPTION

**Brand Name** MiMOMax  
**Model Number** MWL-TORNADO-\*H A/B/C\*  
**Product** 700MHz Upper A Block Tornado  
**Manufacturer** MiMOMax Wireless Limited  
**Country of Origin** New Zealand  
**Serial Number** 26901753, 26901784.  
**FCC ID** XMK-MMXTRNB004

The sample tested has the following rated specifications:

### Rated Transmitter Output Power

0.250 watts

### FCC Frequency Bands

757.000 – 758.000 MHz  
787.000 – 788.000 MHz

### Test frequencies

Frequency (MHz)	Power (Watts)	Channel Bandwidth (kHz)	Occupied Bandwidth (kHz)
757.0500	0.250	12.5	10.3
757.0500	0.250	25.0	21.0
757.0500	0.250	50.0	42.0
787.9500	0.250	12.5	10.3
787.9500	0.250	25.0	21.0
787.9500	0.250	50.0	42.0

## **Modes of operation**

QPSK, 16QAM, 64QAM, 265QAM

## **Emission designators**

10k3W1W – digital speech and data

21k1W1W – digital speech and data

42k0W1W – digital speech and data

## **Power Supply**

DC voltage supply over the range of 10.5 Vdc to 60 Vdc

Typically 12.0 Vdc, 24.0 Vdc or 48.0 Vdc using lead acid batteries

## **Standard Temperature and Humidity**

Temperature: +15 °C to + 30°C maintained.

Relative Humidity: 20% to 75% observed.

## **Standard Test Power Source**

Standard Test Voltage: 20.0 Vdc

## **Extreme Temperature**

High Temperature: +50 °C maintained.

Low Temperature: -30 °C maintained.

## **Extreme Test Voltages**

High Voltage: 60.0 Vdc

Low Voltage: 10.5 Vdc



## 6. TEST RESULTS

### RF power output

Nominal Frequency: 757.050 MHz

Channel Bandwidth (KHz)	Modulation Type	Voltage (Vdc)	Measured Power (Watts)
12.5	QPSK	20.0	0.250
12.5	16-QAM	20.0	0.250
12.5	64-QAM	20.0	0.250
12.5	256-QAM	20.0	0.250
12.5	Without modulation	20.0	0.250
25.0	QPSK	20.0	0.250
25.0	16-QAM	20.0	0.250
25.0	64-QAM	20.0	0.250
25.0	256-QAM	20.0	0.250
25.0	Without modulation	20.0	0.250
50.0	QPSK	20.0	0.250
50.0	16-QAM	20.0	0.250
50.0	64-QAM	20.0	0.250
50.0	256-QAM	20.0	0.250
50.0	Without modulation	20.0	0.250

Nominal Frequency: 787.950 MHz

Channel Bandwidth (kHz)	Modulation Type	Voltage (Vdc)	Measured Power (dBm)
12.5	QPSK	20.0	0.250
12.5	16QAM	20.0	0.250
12.5	64QAM	20.0	0.250
12.5	256QAM	20.0	0.250
12.5	Without modulation	20.0	0.250
25.0	QPSK	20.0	0.250
25.0	16QAM	20.0	0.250
25.0	64QAM	20.0	0.250
25.0	256QAM	20.0	0.250
25.0	Without modulation	20.0	0.250
50.0	QPSK	20.0	0.250
50.0	16QAM	20.0	0.250
50.0	64QAM	20.0	0.250
50.0	256QAM	20.0	0.250
50.0	Without modulation	20.0	0.250

Measurements were carried out at the RF output terminals of the transmitter using spectrum analyser and a 30 dB power attenuator.

The transmitter has a rated output power of 0.250 watts.

The measured power has been shown to be within +/- 1 dB of the rated power

Testing was carried out on transmitter output terminal no 1.

A check of transmitter RF output terminal no 2 showed an identical output power level.

**Limits:**

Part 27 does not specify the transmitter output power.

Subpart C Section 27.50 (b)(1) states that fixed and base station transmitters in the 757 - 758 MHz band must not exceed 1000 watts ERP

Subpart C Section 27.50 (b)(4) states that fixed and base station transmitters in the 776 - 787 MHz band must not exceed 1000 watts ERP

Therefore the gain of any antenna system attached to this transmitter shall not exceed 36 dBd

**Result:** Complies

**Measurement Uncertainty:**  $\pm 0.5$  dB

## Radio Frequency Safety

As per Section 1.1310 transmitters are required to be operated in a manner that ensures the public is not exposed to RF energy levels in accordance with OST/OET Bulletin Number 65.

Calculations have been made using the General Public/Uncontrolled Exposure limits.

Minimum safe distances have been calculated below.

Power density,  $\text{mW/m}^2 = E^2/3770$

- General Population / Uncontrolled exposure limit will be  $0.504 \text{ mW/m}^2$   
( $f/1500 = 757 \text{ MHz}/1500$ )

As 757 MHz is the lowest frequency in the lowest band of operation in USA, this frequency has been used to give a worst case result.

The minimum distance from the antenna at which the MPE is met is calculated from the equation relating field strength in V/m, transmit power in watts, transmit antenna gain, transmitter duty cycle and separation distance in metres:

$$E, \text{ V/m} = (\sqrt{30 * P * G}) / d$$

### Uncontrolled

$$E = 0.504 \text{ mW/m}^2 = E^2/3770$$

$$E = \sqrt{0.504 * 3770}$$

$$E = 43.6 \text{ V/m}$$

The rated maximum transmitter power = 0.25 watts.

A duty cycle of 100% as the transmitter is a base station could possibly be operated for long periods of time.

The client has declared that this transmitter can be operated using a range of antennas with various gains, as detailed in the table below.

Antenna Type	Gain (dBi)	Max Gain (G)	Safe Distance (Metres)	Safe Distance (cm)
Panel Antenna	12	15.8	0.250	25.0
	9	7.9	0.177	17.7
Sectored	10	10.0	0.199	19.9
Low Profile	8	6.3	0.158	15.8
Omni	2.8	1.9	0.087	8.7
	5	3.2	0.112	11.2
	8	6.3	0.158	15.8

A sample calculation for the safe distance would be:

$$d = \sqrt{30 * P * G * DC} / E$$

$$d = \sqrt{30 * 0.25 * 15.8 * 1.0} / 43.6$$

$$d = 0.250 \text{ metres or } 25.0 \text{ cm}$$

**Result:** Complies if the safe distances defined above are applied.

## Emission types:

The following emission types are used:

QPSK, 16QAM, 64QAM, 256QAM

Each emission type can be used with channel bandwidths of 12.5, 25.0 and 50.0 kHz

The following emission designators have been applied

10k3W1W – digital speech and data

21k1W1W – digital speech and data

42k0W1W – digital speech and data

## Occupied Bandwidths

The client has declared the following occupied bandwidths for each channel bandwidth:

Frequency (MHz)	Power (Watts)	Channel Bandwidth (kHz)	Occupied Bandwidth (kHz)
757.0500	0.250	12.5, 25.0, 50.0	10.3, 21.1, 42.0
787.9500	0.250	12.5, 25.0, 50.0	10.3, 21.1, 42.0

Measurements have been made to verify these declared bandwidths using the generic frequencies that are listed in the table above.

The occupied bandwidth has been measured and compared against the occupied bandwidth declared by the client.

Measurements have been made of each modulation type using a spectrum analyser operating in occupied bandwidth mode.

Tabular results are provided with selected results plot provided of the worst case measurement for channel bandwidths of 12.5, 25.0 and 50.0 kHz.

**Result:** Complies

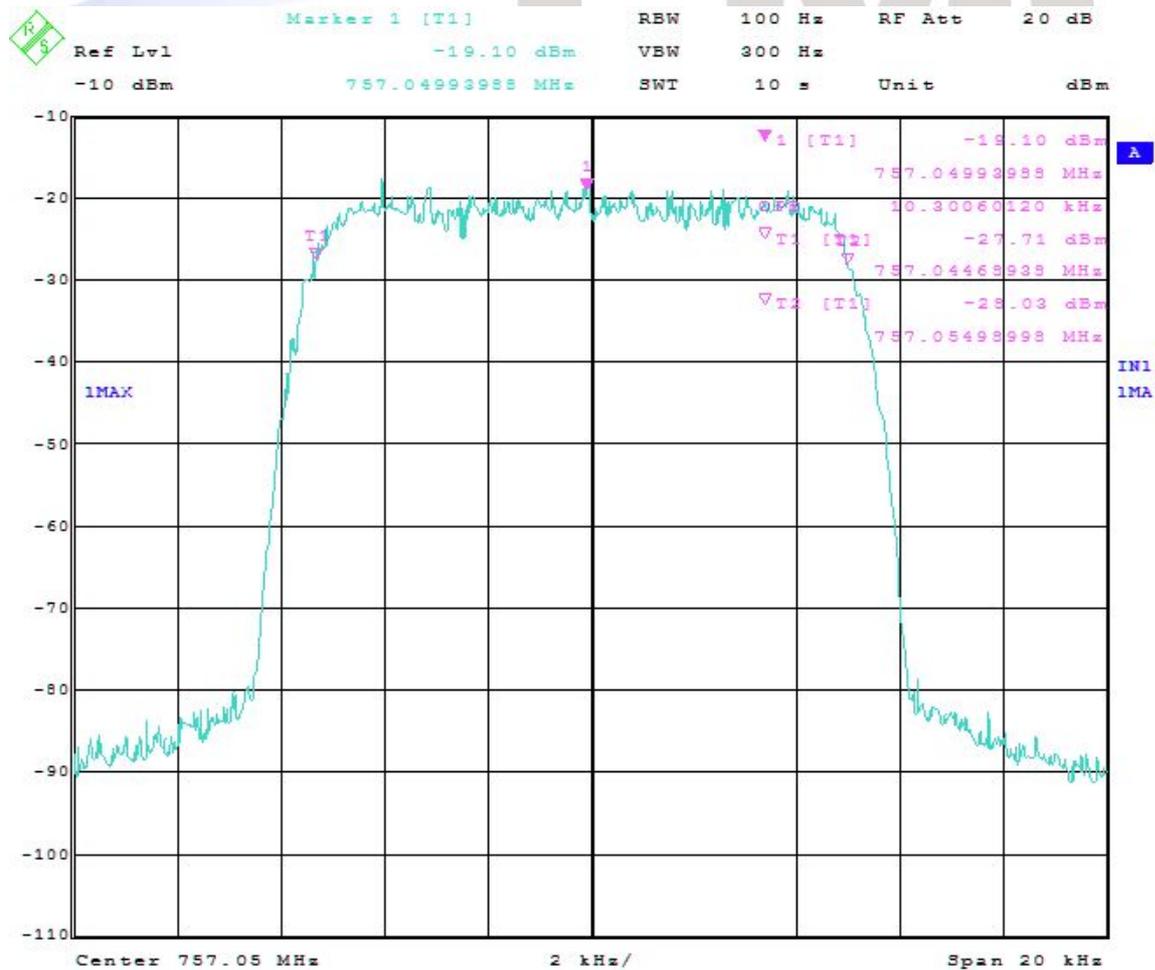
Nominal Frequency: 757.050 MHz

Emission Type	Channel Bandwidth (kHz)	Occupied Bandwidth (kHz)
QPSK	12.5	10.3
16QAM	12.5	10.2
64QAM	12.5	10.2
265QAM	12.5	10.2

Emission Type	Channel Bandwidth (kHz)	Occupied Bandwidth (kHz)
QPSK	25.0	21.1
16QAM	25.0	21.1
64QAM	25.0	21.0
265QAM	25.0	21.1

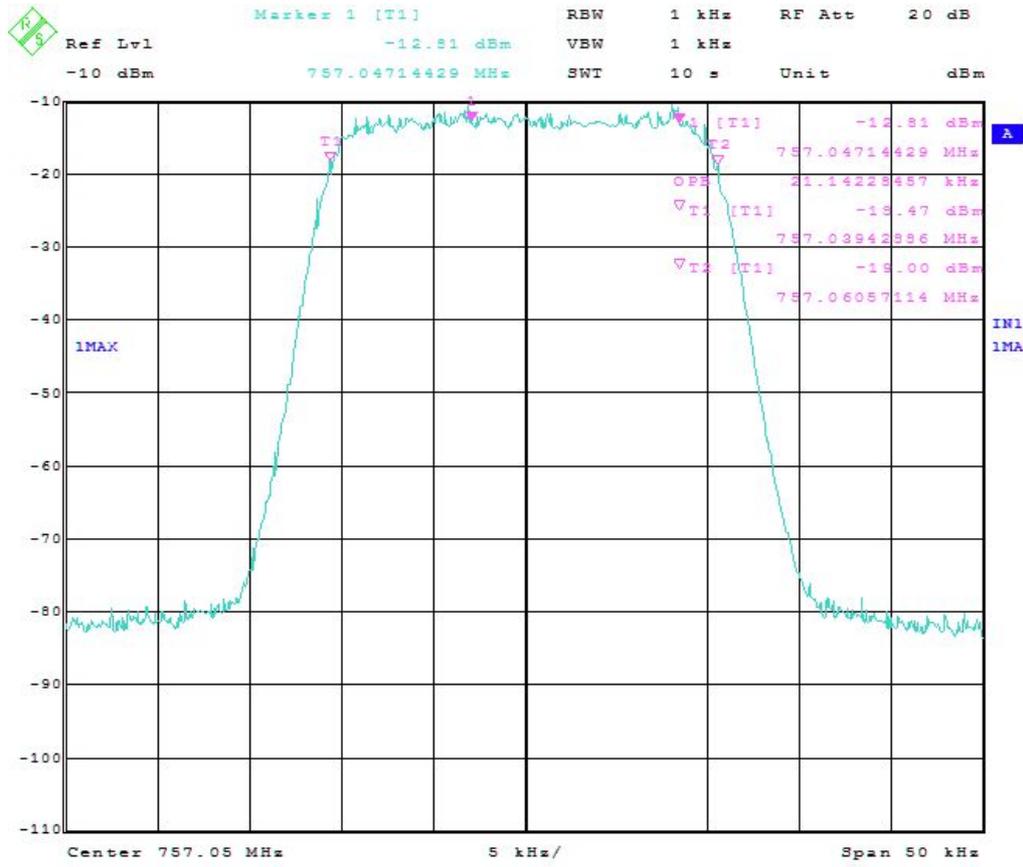
Emission Type	Channel Bandwidth (kHz)	Occupied Bandwidth (kHz)
QPSK	50.0	42.0
16QAM	50.0	42.0
64QAM	50.0	42.0
265QAM	50.0	41.9

QPSK 12.5 kHz Channel:



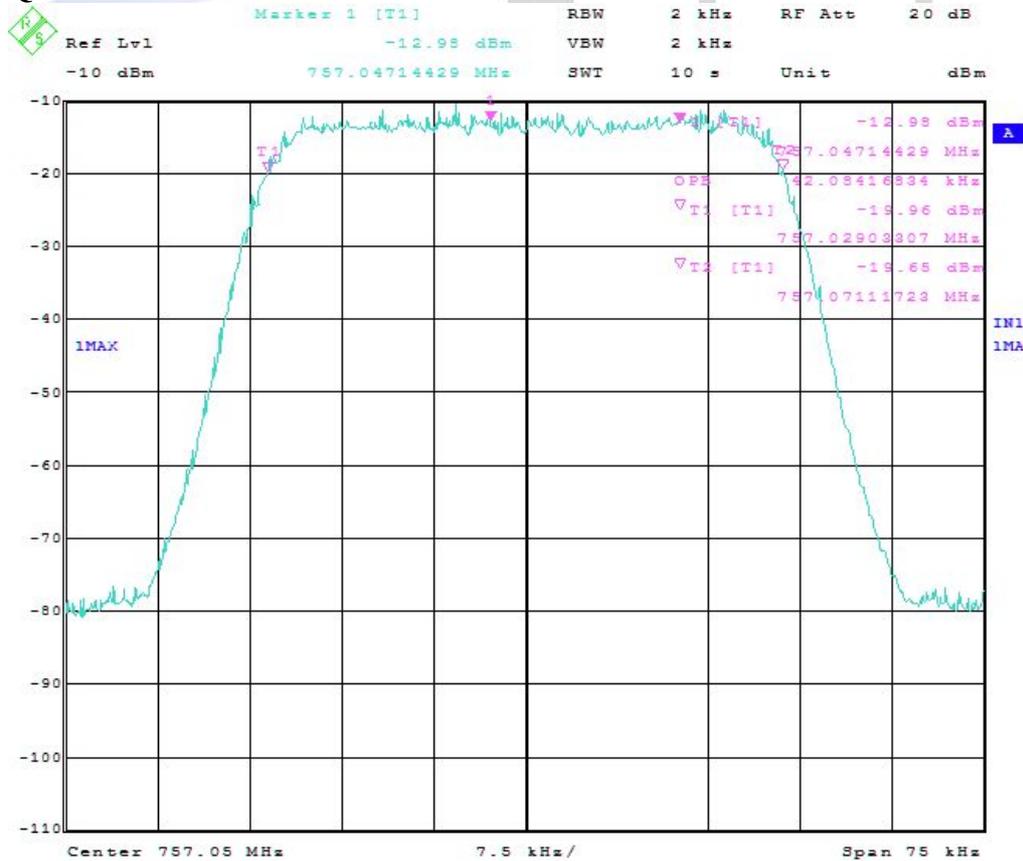
Date: 1.JAN.1997 02:57:56

### QPSK 25 kHz Channel:



Date: 1.JAN.1997 03:17:07

### QPSK 50 kHz Channel:



Date: 1.JAN.1997 04:01:58



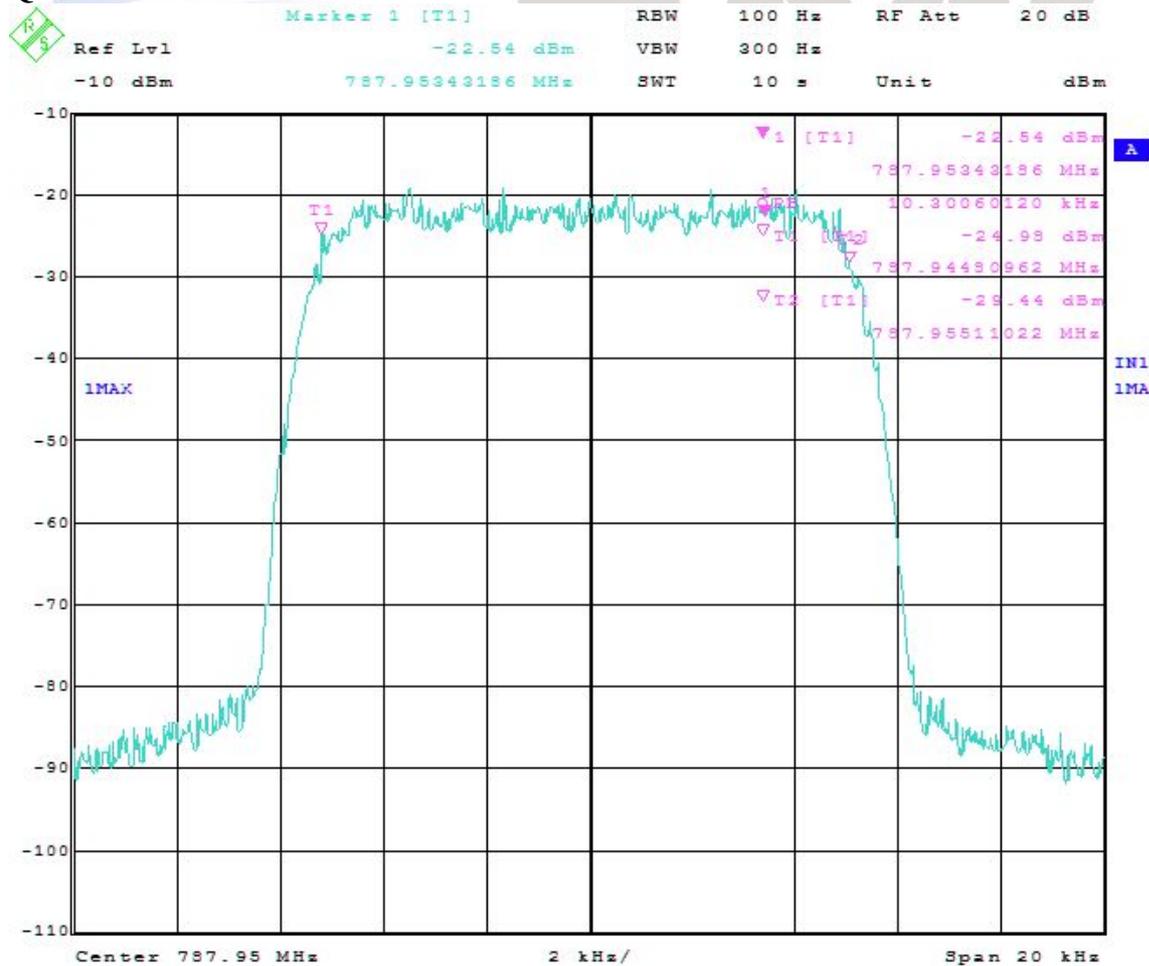
Nominal Frequency: 787.950 MHz

Emission Type	Channel Bandwidth (kHz)	Occupied Bandwidth (kHz)
QPSK	12.5	10.3
16QAM	12.5	10.3
64QAM	12.5	10.3
265QAM	12.5	10.3

Emission Type	Channel Bandwidth (kHz)	Occupied Bandwidth (kHz)
QPSK	25.0	20.9
16QAM	25.0	21.0
64QAM	25.0	21.0
265QAM	25.0	21.0

Emission Type	Channel Bandwidth (kHz)	Occupied Bandwidth (kHz)
QPSK	50.0	42.0
16QAM	50.0	42.0
64QAM	50.0	42.0
265QAM	50.0	42.0

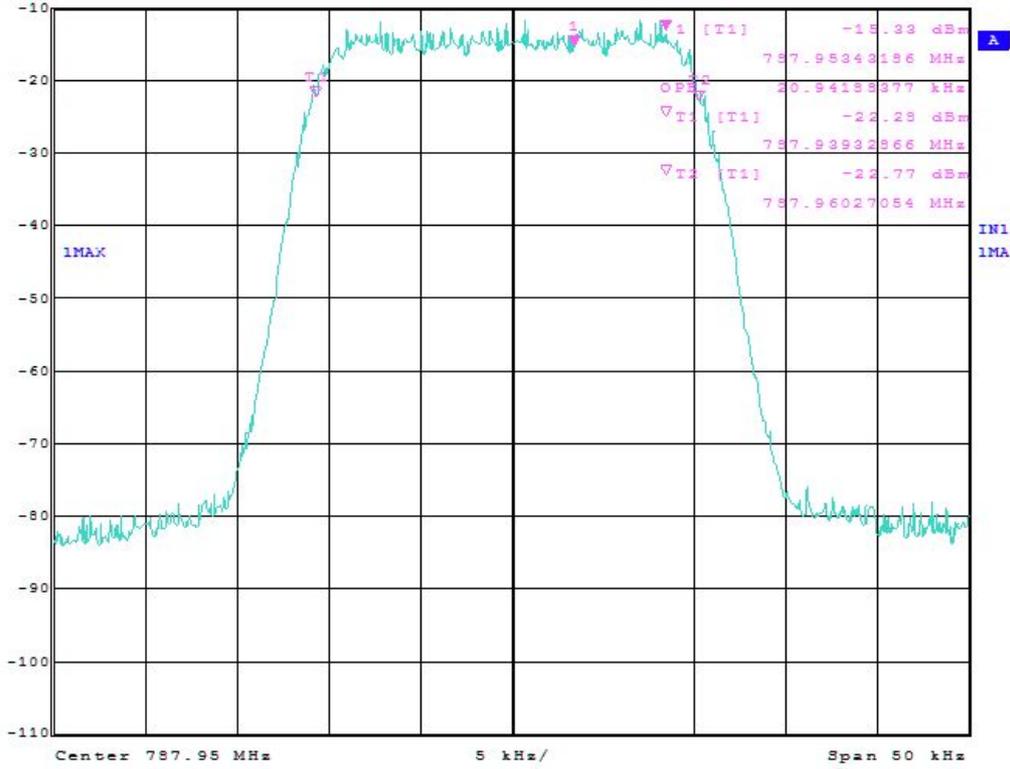
QPSK 12.5 kHz Channel:



Date: 1.JAN.1997 04:43:55

### QPSK 25 kHz Channel:

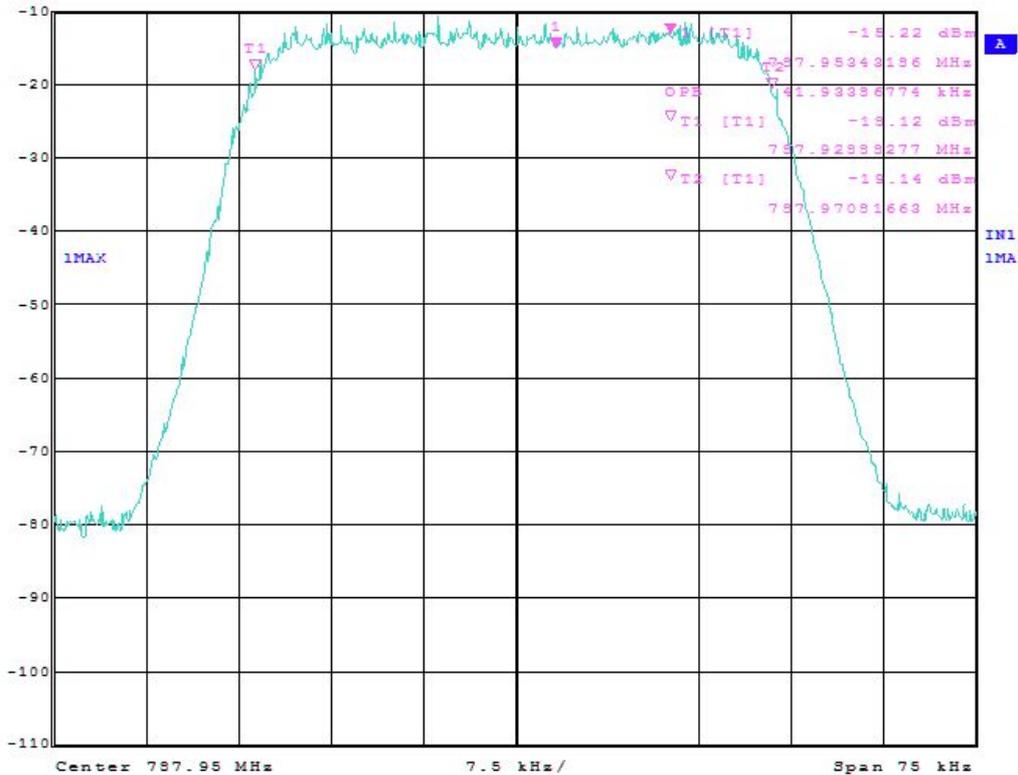
79
Marker 1 [T1]
RBW 1 kHz
RF Att 20 dB  
Ref Lvl -15.33 dBm
VBW 1 kHz  
-10 dBm
787.95343186 MHz
SWT 10 s
Unit dBm



Date: 1.JAN.1997 04:47:17

### QPSK 50 kHz Channel:

79
Marker 1 [T1]
RBW 2 kHz
RF Att 20 dB  
Ref Lvl -15.22 dBm
VBW 2 kHz  
-10 dBm
787.95343186 MHz
SWT 10 s
Unit dBm



Date: 1.JAN.1997 04:52:21

### Emission Limits: Section 27.54 (c)(1) and (c)(2)

Testing was carried out to show compliance with Section 27.54 (c)(1) and (c)(2) as the device can operated in the 757 -758 MHz band and the 787 - 788 MHz band.

Conducted measurements were made at the transmitter antenna terminal and radiated measurements were made at the open area test site.

As per Section 27.54 (c)(5) measurements were made using a resolution bandwidth of 100 kHz.

Measurements close the edges of each band were made using a resolution bandwidth of 30 kHz.

Measurements were made when the transmitter was operating on 757.050 MHz and also 787.950 MHz.

Measurements were made when the transmitter was modulated and not modulated when operating with a 12.5, 25.0 and 50.0 kHz channel bandwidths.

### Conducted measurement at the antenna terminals

#### Nominal Frequency: 757.050 MHz

Spurious emission (MHz)	Emission level (dBm)	Limit (dBm)
1514.100	-60.0 *	-13.0
2271.150	-60.0 *	-13.0
3028.200	-60.0 *	-13.0
3785.250	-60.0 *	-13.0
4542.300	-60.0 *	-13.0
5299.350	-60.0 *	-13.0
6056.400	-60.0 *	-13.0
6813.450	-60.0 *	-13.0
7570.500	-60.0 *	-13.0

#### Nominal Frequency: 787.950 MHz

Spurious emission (MHz)	Emission level (dBm)	Limit (dBm)
1575.900	-60.0 *	-13.0
2363.850	-60.0 *	-13.0
3151.800	-60.0 *	-13.0
3939.750	-60.0 *	-13.0
4727.700	-60.0 *	-13.0
5515.650	-60.0 *	-13.0
6303.600	-60.0 *	-13.0
7091.550	-60.0 *	-13.0
7879.500	-60.0 *	-13.0

\* noise floor measurement

In the 100 kHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of 30 kHz was used with the following levels being observed.

**Transmit Frequency: 757.050 MHz**

Observation Range (MHz)	Emission level (dBm)	Limit (dBm)
Less than 757.000	Less than -17.0	-13.0
Greater than 758.000	Less than -27.0	-13.0

**Transmit Frequency: 787.950 MHz**

Observation Range (MHz)	Emission level (dBm)	Limit (dBm)
Less than 787.000	Less than -27.0	-13.0
Greater than 788.000	Less than -17.0	-13.0

**Limit:**

As defined in Section 27.54 (c)(1) and (c)(2) the power of any emission outside of the 746 -758 MHz band and the 776 - 788 MHz band shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB.

With a rated transmitter power of 0.25 watts (+24.0 dBm) this gives a limit of -13.0 dBm.

Part 2.1051 states that emissions greater than 20 dB below the limit need not be specified.

Part 2.1057 states that the spectrum should be investigated up to the 10<sup>th</sup> harmonic if the transmitter operates below 10 GHz.

No measurements were made above the 10<sup>th</sup> harmonic.

**Result:** Complies.

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

## Field strength of the transmitter spurious emissions

The transmitter was tested while transmitting continuously while attached to a dummy load.

When operating in transmit mode no significant emissions were detected between the harmonic emissions that were detected.

The device was tested on an open area test site at a distance of 3 metres.

Testing was carried out at EMC Technologies NZ Ltd Open Area Test Site, which is located at Driving Creek, Orere Point, Auckland.

The level recorded is the signal generator output level in dBm less any gains / losses due to the coax cable and the dipole antenna.

**Nominal Frequency: 757.050 MHz**

Frequency (MHz)	Level (dBuV/m)	Level (dBm)	Limit (dBm)	Polarity	Margin (dB)	Result
1514.1000	42.2	-55.2	-13.0	Vertical	42.2	Pass
1514.1000	37.4	-60.0	-13.0	Horizontal	47.0	Pass
2271.1500	< 41.0	< -56.4	-13.0	Vertical	> 43.4	Pass
2271.1500	< 41.0	< -56.4	-13.0	Horizontal	> 43.4	Pass
3028.2000	< 41.0	< -56.4	-13.0	Vertical	> 43.4	Pass
3028.2000	< 41.0	< -56.4	-13.0	Horizontal	> 43.4	Pass
3785.2500	< 41.0	< -56.4	-13.0	Vertical	> 43.4	Pass
3785.2500	< 41.0	< -56.4	-13.0	Horizontal	> 43.4	Pass
4542.3000	< 41.0	< -56.4	-13.0	Vertical	> 43.4	Pass
4542.3000	< 41.0	< -56.4	-13.0	Horizontal	> 43.4	Pass
5299.3500	< 41.0	< -56.4	-13.0	Vertical	> 43.4	Pass
5299.3500	< 41.0	< -56.4	-13.0	Horizontal	> 43.4	Pass
6056.4000	< 41.0	< -56.4	-13.0	Vertical	> 43.4	Pass
6056.4000	< 41.0	< -56.4	-13.0	Horizontal	> 43.4	Pass
6813.4500	< 41.0	< -56.4	-13.0	Vertical	> 43.4	Pass
6813.4500	< 41.0	< -56.4	-13.0	Horizontal	> 43.4	Pass
7570.5000	< 41.0	< -56.4	-13.0	Vertical	> 43.4	Pass
7570.5000	< 41.0	< -56.4	-13.0	Horizontal	> 43.4	Pass

**Nominal Frequency: 787.950 MHz**

Frequency (MHz)	Level (dBuV/m)	Level (dBm)	Limit (dBm)	Polarity	Margin (dB)	Result
1575.9000	42.4	-55.0	-13.0	Vertical	42.0	Pass
1575.9000	37.9	-59.5	-13.0	Horizontal	46.5	Pass
2363.8500	34.5	-62.9	-13.0	Vertical	49.9	Pass
2363.8500	32.1	-65.3	-13.0	Horizontal	52.3	Pass
3151.8000	< 41.0	< -56.4	-13.0	Vertical	> 43.4	Pass
3151.8000	< 41.0	< -56.4	-13.0	Horizontal	> 43.4	Pass
3939.7500	< 41.0	< -56.4	-13.0	Vertical	> 43.4	Pass
3939.7500	< 41.0	< -56.4	-13.0	Horizontal	> 43.4	Pass
4727.7000	< 41.0	< -56.4	-13.0	Vertical	> 43.4	Pass
4727.7000	< 41.0	< -56.4	-13.0	Horizontal	> 43.4	Pass
5515.6500	< 41.0	< -56.4	-13.0	Vertical	> 43.4	Pass
5515.6500	< 41.0	< -56.4	-13.0	Horizontal	> 43.4	Pass
6303.6000	< 41.0	< -56.4	-13.0	Vertical	> 43.4	Pass
6303.6000	< 41.0	< -56.4	-13.0	Horizontal	> 43.4	Pass
7091.5500	< 41.0	< -56.4	-13.0	Vertical	> 43.4	Pass
7091.5500	< 41.0	< -56.4	-13.0	Horizontal	> 43.4	Pass
7879.5000	< 41.0	< -56.4	-13.0	Vertical	> 43.4	Pass
7879.5000	< 41.0	< -56.4	-13.0	Horizontal	> 43.4	Pass

**Limit:**

As defined in Section 27.54 (c)(1) and (c)(2) the power of any emission outside of the 746 -758 MHz band and the 776 - 788 MHz band shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB.

With a rated transmitter power of 0.25 watts (+24.0 dBm) this gives a limit of -13.0 dBm.

Part 2.1051 states that emissions greater than 20 dB below the limit need not be specified.

Part 2.1057 states that the spectrum should be investigated up to the 10<sup>th</sup> harmonic if the transmitter operates below 10 GHz.

No measurements were made above the 10<sup>th</sup> harmonic.

**Result:** Complies.

**Measurement Uncertainty:**  $\pm 4.1$  dB

### Emission Limits: Section 27.54 (c)(3)

Testing was carried out to show compliance with Section 27.54 (c)(3) with measurements made between 763 - 775 MHz and 793 - 805 MHz in a 6.25 kHz band segment.

In these bands the power of any emission shall be attenuated below the transmitter power (P) by at least  $76 + 10 \log(P)$ .

With a rated transmitter power of 0.25 watts (+24.0 dBm) this gives a limit of -46.0 dBm.

Conducted measurements were made at the transmitter antenna terminal.

Measurements were made when the transmitter was operating on 757.050 MHz and also 787.950 MHz using a spectrum analyser with a resolution bandwidth of 10 kHz.

Measurements were made when the transmitter was modulated and not modulated when operating with a 12.5, 25.0 and 50.0 kHz channel bandwidths.

### Conducted measurement at the antenna terminals

#### Transmit Frequency: 757.050 MHz

Observation Range (MHz)	Emission level (dBm)	Limit (dBm)
763 - 775	Less than -60.0	-46.0
793 - 805	Less than -60.0	-46.0

#### Transmit Frequency: 787.950 MHz

Observation Range (MHz)	Emission level (dBm)	Limit (dBm)
763 - 775	Less than -60.0	-46.0
793 - 805	Less than -60.0	-46.0

**Result:** Complies.

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

### Emission Limits: Section 27.54 (f)

For operations in the 746 - 763 MHz band (757 - 758 MHz band) and the 775 - 793 MHz band (787 - 788 MHz) emissions in the band 1559 - 1610 MHz shall be limited to -70 dBW/MHz isotropic radiated power (EIRP) for wideband signals and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.

The transmitter shall be tested with a representative antenna

Testing was carried out at the test site between 1559 - 1610 MHz using a peak detector with 1 MHz and a 1 kHz resolution bandwidth using both vertical and horizontal polarisations.

No wideband or discrete emissions were detected.

A log periodic antenna with a gain of approximately 10 dBi was attached to the transmitter which was considered to be typical.

Observation Band (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Polarity	Margin (dB)	RBW
1559.0 - 1610.0	< 45.0	55.2	Vertical	> 10.2	1 MHz
1559.0 - 1610.0	< 45.0	55.2	Horizontal	> 10.2	1 MHz
1559.0 - 1610.0	< 30.0	45.2	Vertical	> 15.2	1 kHz
1559.0 - 1610.0	< 30.0	45.2	Horizontal	> 15.2	1 kHz

Measurements were attempted at a distance of 3 metres which gave the following limits using the formula:

Field strength (V/m) = (square root (30 \* power (watts)))/ distance (metres)

This gave limits of 55.2 dBuV/m for wideband emissions and 45.2 for discrete emissions.

**Result:** Complies.

**Measurement Uncertainty:** ± 4.1 dB

## Frequency Stability

Frequency stability measurements were between - 30 °C and + 50°C in 10°C increments.

At each temperature the transmitter was given a period of 30 minutes to stabilise.

The transmitter was then turned on and the frequency error in Hz was measured after a period of 1 minute relative to the declared centre frequency.

### Nominal Frequency: 757.050 MHz

Temperature (°C)	Voltage 10.0 Vdc	Voltage 20.0 Vdc	Voltage 60.0 Vdc
+50	+52.0 Hz	+45.0 Hz	+33.0 Hz
+40	+54.0 Hz	+18.0 Hz	+96.0 Hz
+30	+76.0 Hz	+70.0 Hz	+91.0 Hz
+20	-10.0 Hz	+13.0 Hz	-12.0 Hz
+10	-40.0 Hz	0.0 Hz	-39.0 Hz
0	+6.0 Hz	-42.0 Hz	0.0 Hz
-10	-51.0 Hz	-84.0 Hz	-96.0 Hz
-20	+71.0 Hz	+56.0 Hz	+26.0 Hz
-30	-85.0 Hz	-76.0 Hz	-49.0 Hz

### Nominal Frequency: 787.950 MHz

Temperature (°C)	Voltage 10.0 Vdc	Voltage 20.0 Vdc	Voltage 60.0 Vdc
+50	+6.0 Hz	+4.0 Hz	+31.0 Hz
+40	+66.0 Hz	+44.0 Hz	+45.0 Hz
+30	+68.0 Hz	+43.0 Hz	+57.0 Hz
+20	-96.0 Hz	-96.0 Hz	-107.0 Hz
+10	-98.0 Hz	-97.0 Hz	-110.0 Hz
0	-98.0 Hz	-99.0 Hz	-127.0 Hz
-10	-113.0 Hz	-82.0 Hz	-70.0 Hz
-20	-136.0 Hz	-118.0 Hz	-153.0 Hz
-30	-135.0 Hz	-118.0 Hz	-129.0 Hz

### Limit:

Part 27.54 states that the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorised bands of operation.

The above results show a maximum frequency deviation of 153 Hz which equates to an error of  $153 \text{ Hz} / 787.950 \text{ MHz} = 0.194 \text{ ppm}$ .

**Result:** Complies

**Measurement Uncertainty:**  $\pm 30 \text{ Hz}$

## 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
Biconical Antenna	Schwarzbeck	BBA 9106	-	3612	03/02/2018	3 years
Horn Antenna	EMCO	3115	9511-4629	E1526	04/06/2017	3 years
Log Periodic Antenna	Schwarzbeck	VUSLP 91111	9111-228	3785	17/12/2017	3 years
Power Attenuator	JFW	50FH-030-100	-	-	N/a	N/a
Power Supply	Hewlett Packard	6032A	2743A-02859	E1069	N/a	N/a
Receiver	Rohde & Schwarz	ESIB-40	100171	4003	16/04/2017	1 year
Spectrum Analyzer	Hewlett Packard	E7405A	US39150142	3776	26/01/2017	1 year
Thermal chamber	Contherm	M180F	86025	E1129	01/06/2016	1 year
Thermometer	DSIR	RT200	035	E1049	01/06/2016	1 year
Turntable	EMCO	1080-1-2.1	9109-1578	3709	N/a	N/a
VHF Balun	Schwarzbeck	VHA9103	-	3603	03/02/2018	3 years

At the time of testing all test equipment was within calibration.

## 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 June 2014.

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.

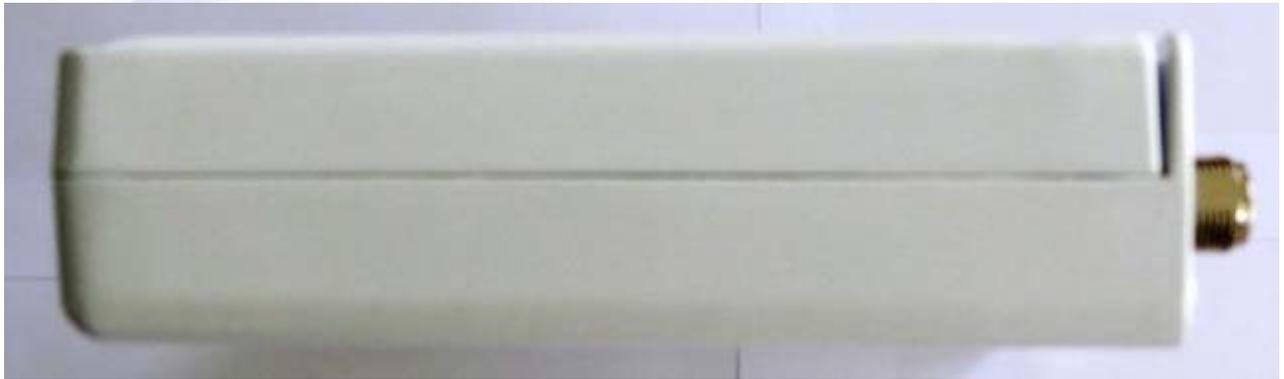
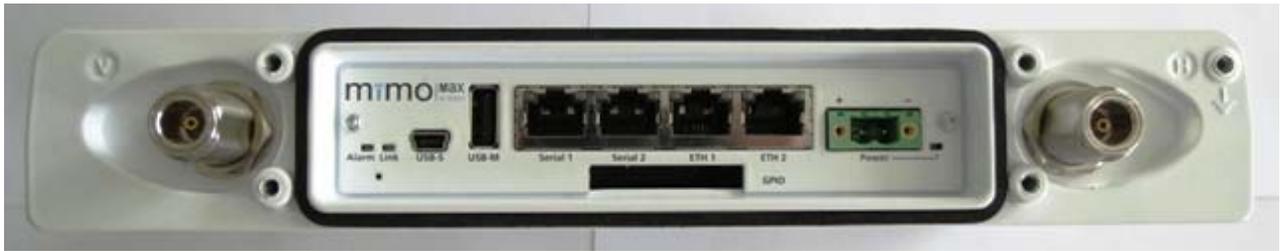
All measurement equipment has been calibrated in accordance with the terms of the EMC Technologies (NZ) Ltd International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025.

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





Radiated emissions test set up photos

