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TEST REPORT

MWL-TORNADO-*A/B/CA/B*
Fixed Link Digital Transceiver

tested to the

Code of Federal Regulations (CFR) 47

Part 90 –Private Land Mobile Services

for

MiMOMax Wireless Ltd

This Test Report is issued with the authority of:

Andrew Cutler- General Manager

IANZ ACCREDITED LABORATORY

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

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1. COMPLIANCE STATEMENT

The **MiMOMAX MWL-TORNADO-*A/B/CA/B* Fixed Link Digital Transceiver** complies with the limits defined in 47 CFR Part 90 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 25th to 30th August 2014 are summarised below.

Clause	Description	Result
90.203	Certification required	Noted
2.1046 90.205	RF power output Power and antenna height limits	Noted Complies
2.1047 2.1047(a) 2.1047(b)	Modulation Characteristics Low pass filter response Modulation limiting characteristics	Noted Noted Noted
2.1049 2.202 90.207 90.209 90.210	Occupied bandwidth Bandwidths Types of emissions Bandwidth limitations Emission masks	Noted Noted Complies Complies Complies
2.1051	Spurious emissions at antenna terminals	Complies
2.1053	Field strength of spurious radiation	Complies
2.1055 90.213	Frequency stability Frequency stability	Noted Complies
90.214	Transient frequency behaviour	Complies
1.1310	Radio frequency exposure limits	Complies

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.

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

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

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 Ltd
Address	175 Roydvale Avenue Christchurch, 8053
Postal Address	PO Box 1645 Christchurch 8140
Country	New Zealand
Contact	Mr Paul Daigneault

5. TEST SAMPLE DESCRIPTION

Brand Name	MiMOMax
Model Number	MWL-TORNADO-*A/B/CA/B*
Product	Fixed Link Digital Transceiver (400 – 470 MHz)
Manufacturer	MiMOMAX Wireless Ltd
Manufactured in	New Zealand
Designed in	New Zealand
Serial Numbers	23001101, 23001215, 23001222
FCC ID	XMK-MMXTRNAB003

Product overview

The MiMOMax Tornado Digital Link is an ultra-spectrally efficient, long range point to multipoint remote radio. The radio unit has built in intelligent network features for Critical Network Infrastructure, providing economic SCADA and telemetry solutions for critical network infrastructure.

The MiMOMax DLN utilises multiple input, multiple output technology (2X2 MIMO). The multiple input/ outputs consist of 2 or 4 antenna connections depending on the duplexer configuration. Antenna connections provide simultaneous Tx/Rx on orthogonal antenna polarisations.

Product specifications

RF Frequency Range:	400.000 - 470.000 MHz
FCC Frequency Range:	406.100 - 470.000 MHz
Supply Voltage:	10.5 – 60.0 Vdc
Channel spacing's:	12.5 kHz and 25.0 kHz
Modulation Types:	QPSK, 16 / 64 / 256QAM
Rated RF Power output:	+24 dBm Outputs x 2
Frequency stability:	≤ +/-1.5 ppm
Receiver input:	50 Ohm N-Type connectors x 2
Test Frequency:	469.975 MHz
Emission Designators:	20K0W1W where 25.0 kHz channelling is used
	10K0W1W where 12.5 kHz channelling is used

Power Supply

The equipment is powered using an external DC supply.

Standard Temperature and Humidity

Temperature:	+15°C to + 30°C maintained.
Relative Humidity:	20% to 75% observed.

Standard Test Power Source

Nominal Voltage:	24.0 Vdc.
Standard Test Voltage:	24.0 V dc.

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

Certification required

Part 90.203(j)

4) Applications for part 90 certification of transmitters designed to operate on frequencies in the 150.8–162.0125 MHz, 173.2–173.4 MHz, and/or 421–512 MHz bands, received on or after January 1, 2011,

(ii) 12.5 kHz for multi-bandwidth mode equipment with a maximum channel bandwidth of 12.5 kHz if it is capable of operating on channels of 6.25 kHz or less;

(iii) 25 kHz for multi-bandwidth mode equipment with a maximum channel bandwidth of 25 kHz if it is capable of operating on channels of 6.25 kHz or less; and

(iv) Up to 25 kHz if the equipment meets the efficiency standard of paragraph (j)(5) of this section.

(5), Applications for part 90 certification of transmitters designed to operate on frequencies in the 150.8–162.0125 MHz, 173.2–173.4 MHz, and/or 421–512 MHz bands, after January 1, 2011, must include a certification that the equipment meets a spectrum efficiency standard of one voice channel per 6.25 kHz of channel bandwidth.

Additionally, if the equipment is capable of transmitting data, has transmitter output power greater than 500 mW, and has a channel bandwidth of more than 6.25 kHz, the equipment must be capable of supporting a minimum data rate of 4800 bits per second per 6.25 kHz of channel bandwidth.

Result: Complies.

RF power output

Measurements were carried out at the RF output terminals of the transmitter using a 30 dB power attenuator and a 50 Ω dummy load.

Measurements were carried out when the transmitter was not being modulated.

Testing was carried out at maximum rated power output of +24.0 dBm

Port 1

Frequency (MHz)	Voltage (Vdc)	Rated (dBm)	Measured (dBm)
469.975	24.0	24.0	24.7
469.975	60.0	24.0	24.7
469.975	10.5	24.0	24.7

Port 2

Frequency (MHz)	Voltage (Vdc)	Rated (dBm)	Measured (dBm)
469.975	24.0	24.0	24.7
469.975	60.0	24.0	24.7
469.975	10.5	24.0	24.7

Limits:

90.205 Power and antenna height limits,

(s) The output power shall not exceed by more than 20 percent either the output power shown in the Radio Equipment List [available in accordance with § 90.203(a)(1)] for transmitters included in this list or when not so listed, the manufacturer's rated output power for the particular transmitter specifically listed on the authorization.

Result: Complies.
Measurement Uncertainty: ± 0.5 dB

Part 90.207 – Emission types:

The following emission types are used:

25.0 kHz channelling: 20K0W1W
12.5 kHz channelling: 10K0W1W

Part 90.209 – Bandwidth limitations:

The customer has declared that the authorised bandwidth to be 10.0 kHz for operations in a 12.5 kHz channelling plan and 20.0 kHz for operations in a 25.0 kHz channelling plan when using the emission designator W1W.

Using the formulas contained in Part 2.202 and information supplied by the client the necessary bandwidth calculation for data transmission is:

The necessary bandwidth has been calculated in accordance with ITU-R Recommendation SM853-1 where

$B_n = 2 \times R \times K / \log2(S)$

Where R = bit rate:
Where K = is a factor relating to the modulation type and filter roll off:
Where S = modulation order:

For 25 kHz channel operations

256QAM	R = 160 kbps	log2(S) = 8	K = 0.5	$B_n = 2 \times 160 \times 0.5 / 8 =$ 20.0 kHz
64QAM	R = 120 kbps	log2(S) = 6	K = 0.5	$B_n = 2 \times 120 \times 0.5 / 6 =$ 20.0 kHz
16QAM	R = 80 kbps	log2(S) = 4	K = 0.5	$B_n = 2 \times 80 \times 0.5 / 4 =$ 20.0 kHz
QPSK	R = 40 kbps	log2(S) = 2	K = 0.5	$B_n = 2 \times 40 \times 0.5 / 2 =$ 20.0 kHz

For 12.5 kHz channel operations

256QAM	R = 80 kbps	log2(S) = 8	K = 0.5	$B_n = 2 \times 80 \times 0.5 / 8 =$ 10.0 kHz
64QAM	R = 60 kbps	log2(S) = 6	K = 0.5	$B_n = 2 \times 60 \times 0.5 / 6 =$ 10.0 kHz
16QAM	R = 40 kbps	log2(S) = 4	K = 0.5	$B_n = 2 \times 40 \times 0.5 / 4 =$ 10.0 kHz
QPSK	R = 20 kbps	log2(S) = 2	K = 0.5	$B_n = 2 \times 20 \times 0.5 / 2 =$ 10.0 kHz

Measurements have been made to confirm these calculations.

Initially power measurements are made using a resolution bandwidth of 120 kHz using a peak detector which is used as a reference level on the spectrum analyser.

The resolution bandwidth is then changed to 100 Hz and the reference level minus 23 dB (99%) absolute bandwidth points determined

Emission	Channel Spacing (kHz)	Measured (kHz)	Declared Bandwidth (kHz)
QPSK	12.5	9.700	10.000
QAM16	12.5	9.950	10.000
QAM64	12.5	9.900	10.000
QAM256	12.5	9.975	10.000

Emission	Channel Spacing (kHz)	Measured (kHz)	Declared Bandwidth (kHz)
QPSK	25.0	19.400	20.000
QAM16	25.0	19.200	20.000
QAM64	25.0	19.000	20.000
QAM256	25.0	19.400	20.000

Result: Complies.

Spectrum Masks

Part 90.210 (2) states equipment designed to operate with a 25 kHz channel bandwidth must meet the requirements of Emission Mask B or C, as applicable. Equipment designed to operate with a 12.5 kHz channel bandwidth must meet the requirements of Emission Mask D.

Masks C and D have been applied as the transmitter has no audio low pass filter.

The transmitter can operate in the band 421-512 MHz using an authorised bandwidth of 11.25 kHz and channel spacing of 12.5 kHz and an authorised bandwidth of 20 kHz and a channel spacing of 25 kHz.

Measurements have been made of each modulation type using a spectrum analyser operating in peak hold mode and a 30 dB attenuator.

Initially power measurements are made using a resolution bandwidth of 120 kHz.

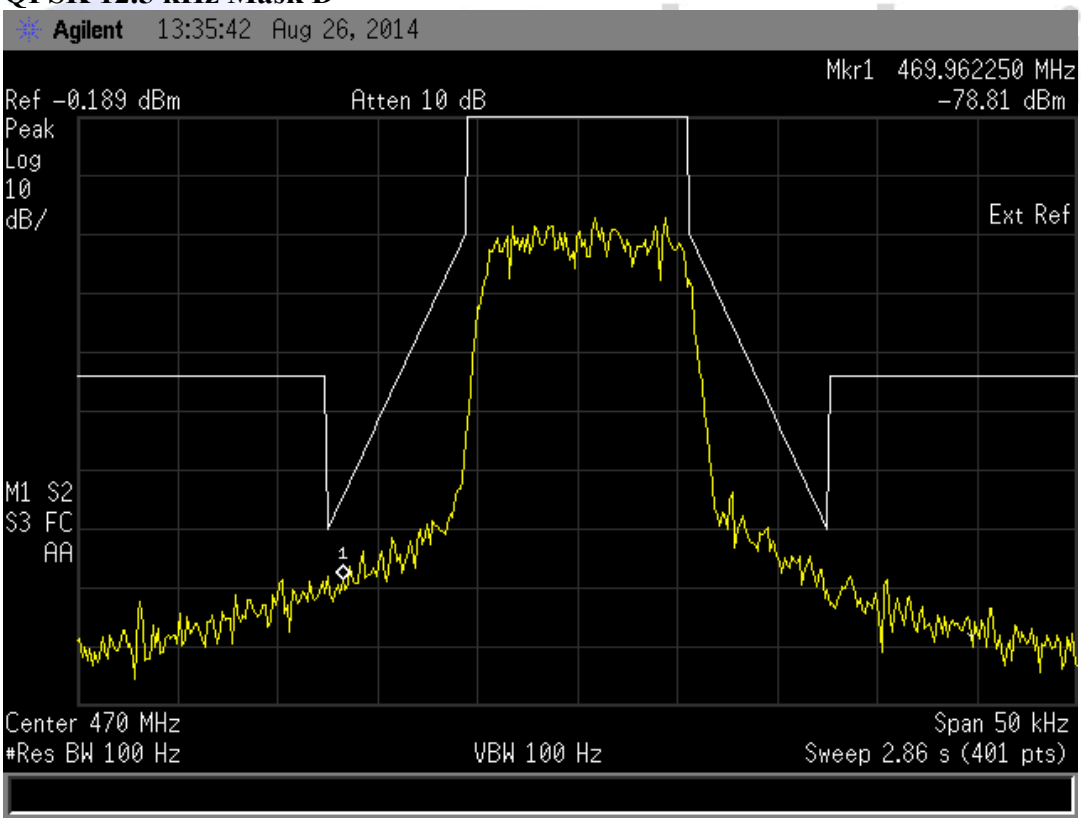
This level is used as a reference level on the spectrum analyser.

The resolution bandwidth is then changed to 100 Hz and the reference level minus 23 dB (99%) absolute bandwidth points determined.

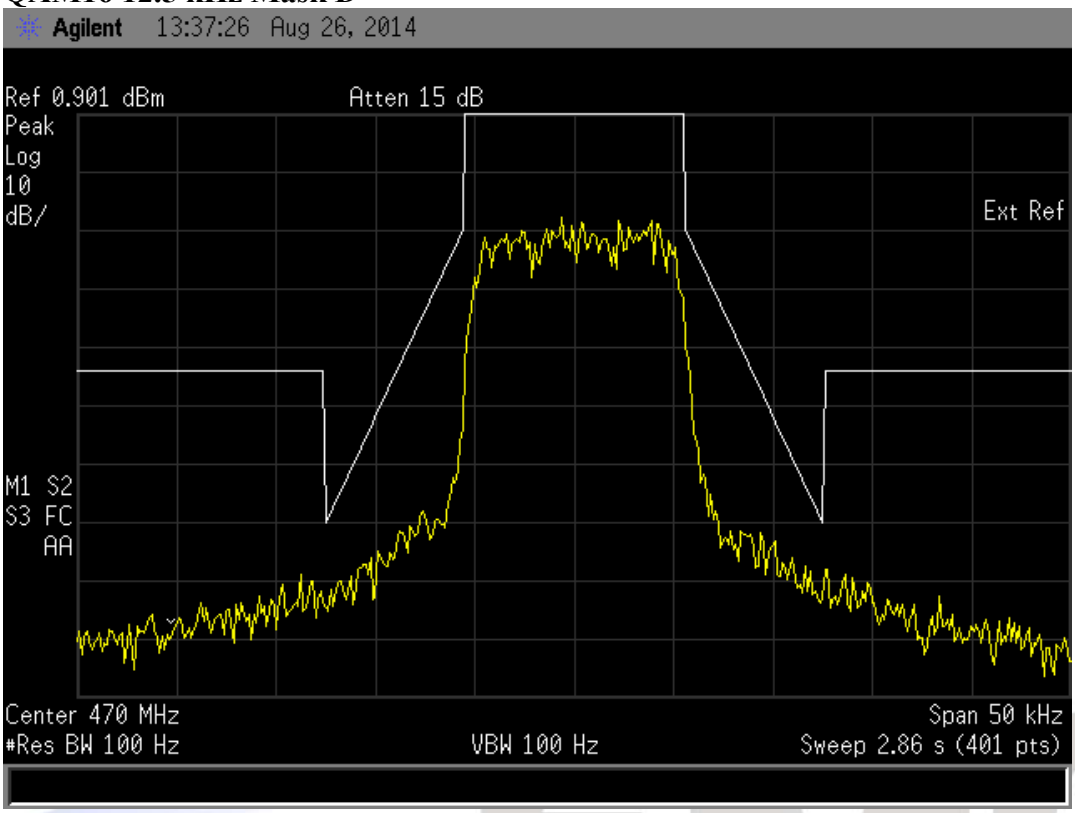
Measurements were made with the spectrum analyser operating in peak hold centred on the allocated frequency.

Result: Complies.

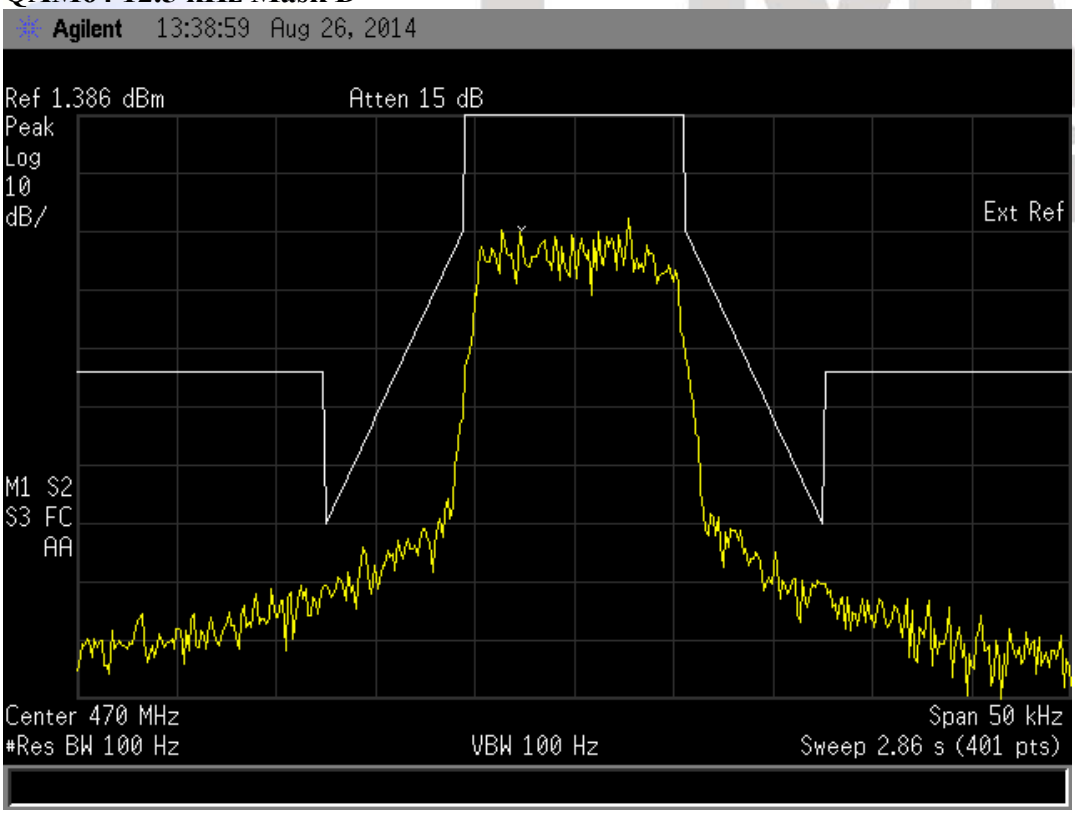
QPSK 12.5 kHz Mask D



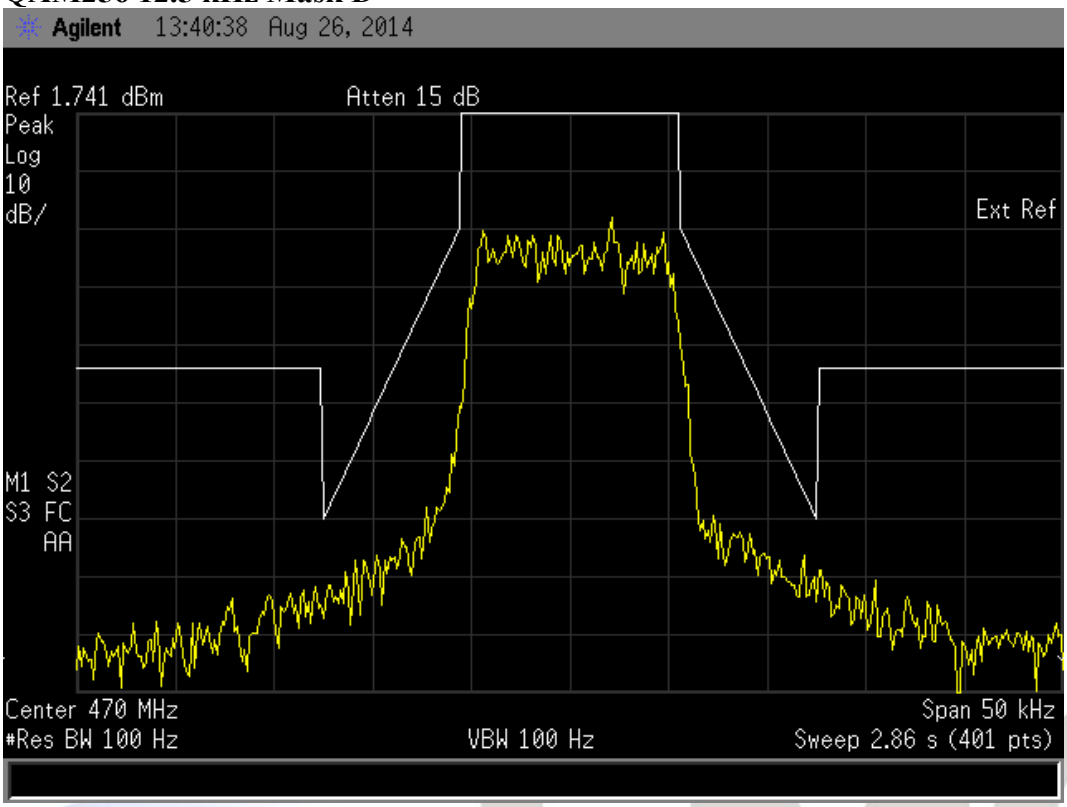
QAM16 12.5 kHz Mask D



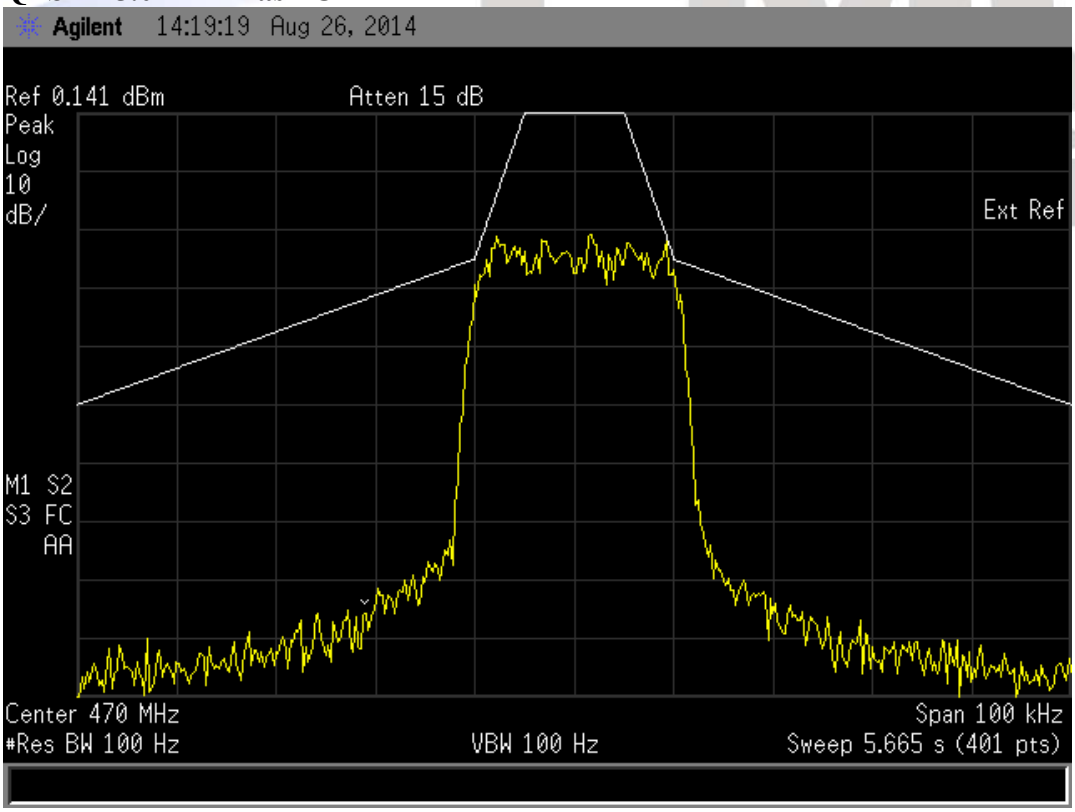
QAM64 12.5 kHz Mask D



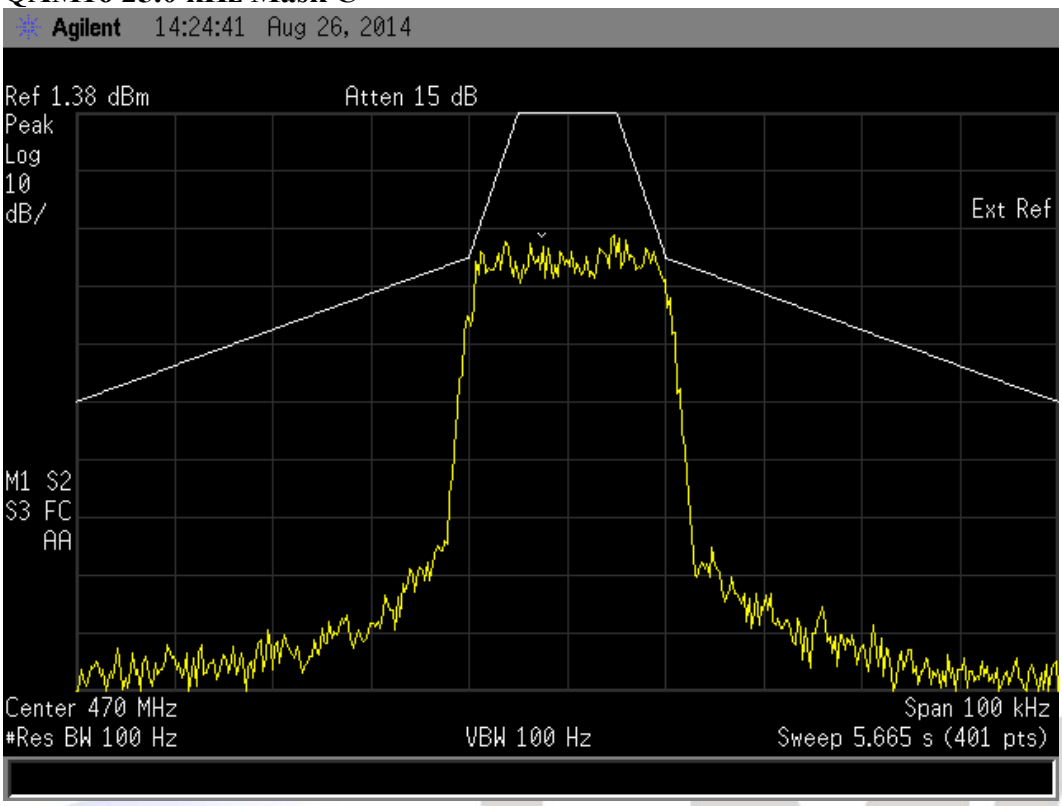
QAM256 12.5 kHz Mask D



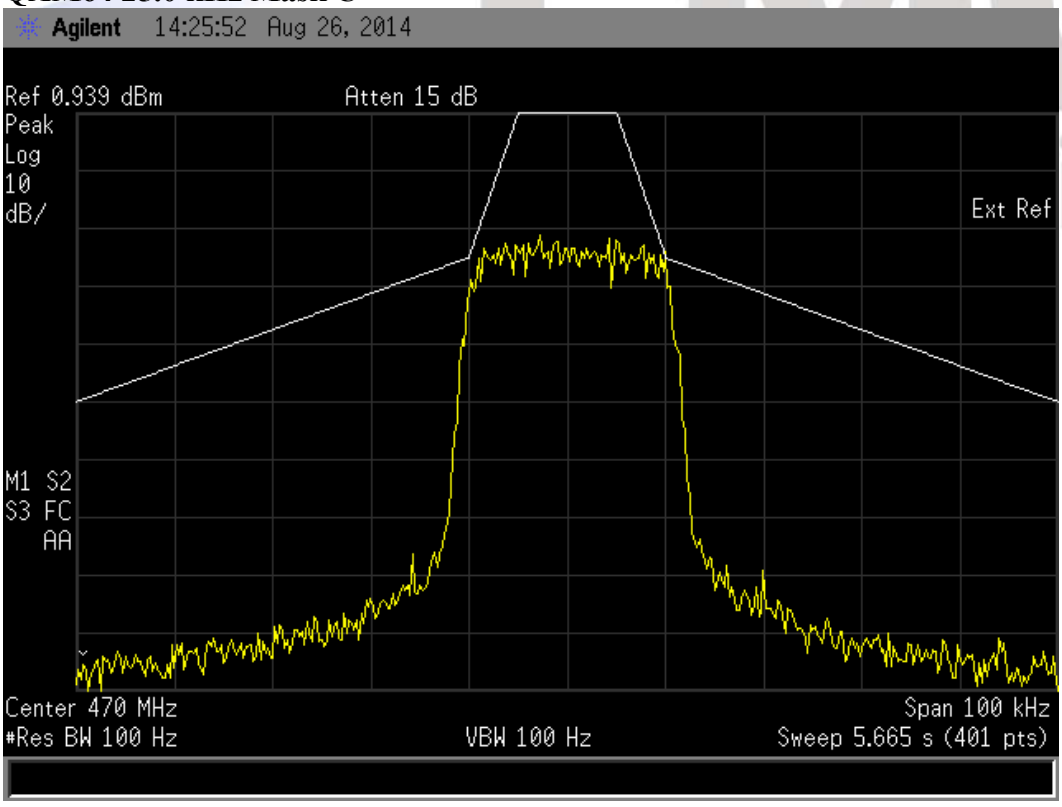
QPSK 25.0 kHz Mask C



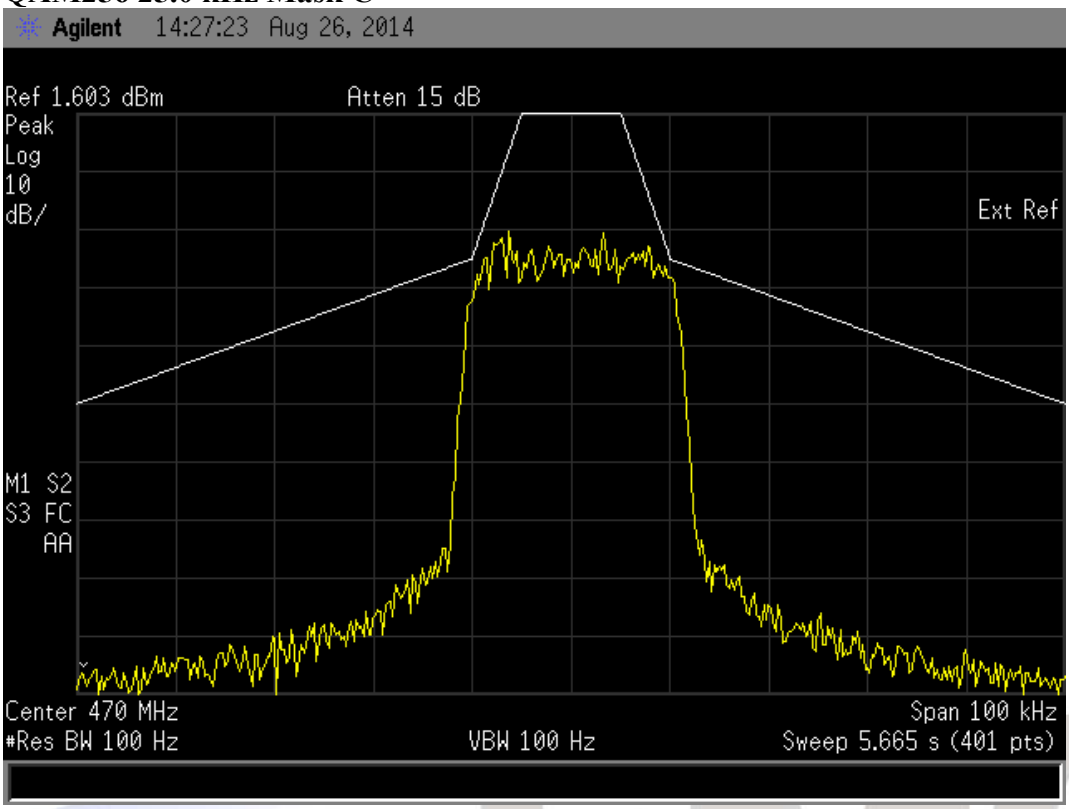
QAM16 25.0 kHz Mask C



QAM64 25.0 kHz Mask C



QAM256 25.0 kHz Mask C



Transmitter spurious emissions at the antenna terminals

Frequency: 469.975 MHz

Spurious emission (MHz)	Emission level (dBm)	Limit (dBm)
939.950	< -80.0	-20.0
1409.925	< -80.0	-20.0
1879.900	< -80.0	-20.0
2349.875	< -80.0	-20.0
2819.850	< -80.0	-20.0
3289.825	< -80.0	-20.0
3759.800	< -80.0	-20.0
4229.775	< -80.0	-20.0
4699.750	< -80.0	-20.0

No emissions observed greater than -80 dBm

Testing was carried out using both 12.5 kHz and 25.0 kHz channel spacing with identical results being obtained.

Limit:
Applied mask D, on any frequency removed from the centre of the authorised bandwidth by a displacement frequency of more than 12.5 kHz shall be attenuated by at least 50 + 10 log (P) or 70.0 dB whichever is the lesser attenuation.

The spectrum has been investigated up to the 10^{th} harmonic of the transmitter.

A rated power of 0.25 watts (+24.0 dBm) gives a limit of –20 dBm which has been applied as a worst case indication.

The spurious emission limit defined by Mask D has been applied as this transmitter can operate using channel spacing of 12.5 kHz.

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^{th} harmonic if the transmitter operates below 10 GHz.

Result: Complies.
Measurement Uncertainty: ± 3.3 dB

Field strength of the transmitter spurious emissions

Frequency: 469.975 MHz

Frequency (MHz)	Level (dBµV/m)	Level (dBm)	Limit (dBm)	Polarity	Margin (dB)
939.950	39.1	-58.3	-20.0	Vertical	22.3
939.950	38.1	-59.3	-20.0	Horizontal	23.3
1409.925	37.6	-59.8	-20.0	Vertical	29.8
1409.925	37.8	-59.6	-20.0	Horizontal	29.6
1879.900	43.8	-53.6	-20.0	Vertical	23.6
1879.900	42.8	-54.6	-20.0	Horizontal	24.6
2349.875	46.3	-51.1	-20.0	Vertical	21.1
2349.875	45.7	-51.7	-20.0	Horizontal	21.7
2819.850	46.3	-51.1	-20.0	Vertical	21.1
2819.850	46.1	-51.3	-20.0	Horizontal	21.3
3289.825	< 48.0	<-49.0	-20.0	Vertical	> 20.0
3289.825	< 48.0	<-49.0	-20.0	Horizontal	> 20.0
3759.800	< 48.0	<-49.0	-20.0	Vertical	> 20.0
3759.800	< 48.0	<-49.0	-20.0	Horizontal	> 20.0
4229.775	< 48.0	<-49.0	-20.0	Vertical	> 20.0
4229.775	< 48.0	<-49.0	-20.0	Horizontal	> 20.0
4699.750	< 48.0	<-49.0	-20.0	Vertical	> 20.0
4699.750	< 48.0	<-49.0	-20.0	Horizontal	> 20.0

Testing was carried out using both 12.5 kHz and 25.0 kHz channel spacing with identical results being obtained.

In transmit mode the transmitter was tested while transmitting continuously while attached to a dummy load. The power level of each emission was determined by replacing the transmitter with a dipole antenna that was connected to a signal generator. The signal generator output level was increased until the same field strength level was observed at each emission frequency. The level recorded is the signal generator output level in dBm less any gains / losses due to the coax cable and the dipole antenna.

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. Details of this site have been filed with the Commission, Registration Number: 90838, which was last updated in July 2013

Limit:

All spurious emissions are to be attenuated by at least 50 + 10 log (P). The rated power of 0.25 Watts (+24.0 dBm) gives a limit of –20 dBm.

No measurements were made above the 10th harmonic.

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 measured after a period of 1 minute.

Frequency: 469.975 MHz

Port 1

Temperature (°C)	Voltage (10.0 Vdc)	Voltage (24.0 Vdc)	Voltage (60.0 Vdc)
+50	-59.0	-59.0	-58.0
+40	-52.0	-52.0	-54.0
+30	-51.0	-58.0	-58.0
+20	-59.0	-66.0	-60.0
+10	-98.0	-95.0	-96.0
0	-115.0	-114.0	-113.0
-10	-109.0	-106.0	-106.0
-20	-84.0	-82.0	-81.0
-30	-50.0	-43.0	-41.0

Port 2

Temperature (°C)	Voltage (10.0 Vdc)	Voltage (24.0 Vdc)	Voltage (60.0 Vdc)
+50	-57.0	-59.0	-59.0
+40	-48.0	-51.0	-51.0
+30	-52.0	-52.0	-59.0
+20	-57.0	-60.0	-60.0
+10	-91.0	-93.0	-93.0
0	-107.0	-107.0	-110.0
-10	-104.0	-102.0	-102.0
-20	-86.0	-85.0	-85.0
-30	-49.0	-48.0	-46.0

Limit:
Part 90.213 states that mobile station transmitters operating between 421 – 512 MHz with 12.5 kHz channelling are required to have a frequency tolerance of 1.5 ppm.

The Part 90 frequency stability requirement of 1.5 ppm has been applied to this transmitter.

1.5 ppm = 1.5 x 470 = 705 Hz.

A worst case frequency error of -115.0 Hz which equate to an error of 0.24 ppm

Result: Complies.
Measurement Uncertainty: ± 30 Hz.

Transient frequency behaviour

Transient frequency behaviour measurements are applicable to wide band and narrow band transmitters operating in the frequency band 421 - 512 MHz.

Measurements were carried out using the method described in TIA-603 and EN 300-086.

In summary this method calls for the use of an external signal generator tuned to transmitter transmit frequency of 440.075 MHz with an output level 0.1 % (-30 dB) of the level from the transmitter with a 1 kHz tone with a frequency deviation of 12.5 kHz being applied to the input of a modulation analyser along with the output from the transmitter.

The modulation analyser produces an amplitude difference signal and a frequency difference signal, which are applied to the input of a storage oscilloscope.

The unmodulated transmitter is then keyed which produces a trigger pulse that is AC coupled to the oscilloscope that produces a display on the screen.

The result of the change in the ratio of power between the test signal from the signal generator and the transmitter output will produce 2 separate sides on the oscilloscope picture. One will show the 1000 Hz test modulation and the other will be the frequency difference of the transmitter versus time.

Channel Spacing (kHz)	Transient Period t_1	Frequency Period t_2	Deviation (kHz) Period t_3
12.5	Nil	Nil	Nil
25.0	Nil	Nil	Nil

Limits:

Time Interval	Period (mS)	12.5 kHz Deviation (kHz)	25 kHz Deviation (kHz)
t_1	10	± 12.5	± 25.0
t_2	25	± 6.25	± 12.5
t_3	10	± 12.5	± 25.0

Result: Complies.
Measurement Uncertainty: Frequency difference ± 1.6 kHz, Time period ±1 ms.

12.5 kHz transmitter turn on

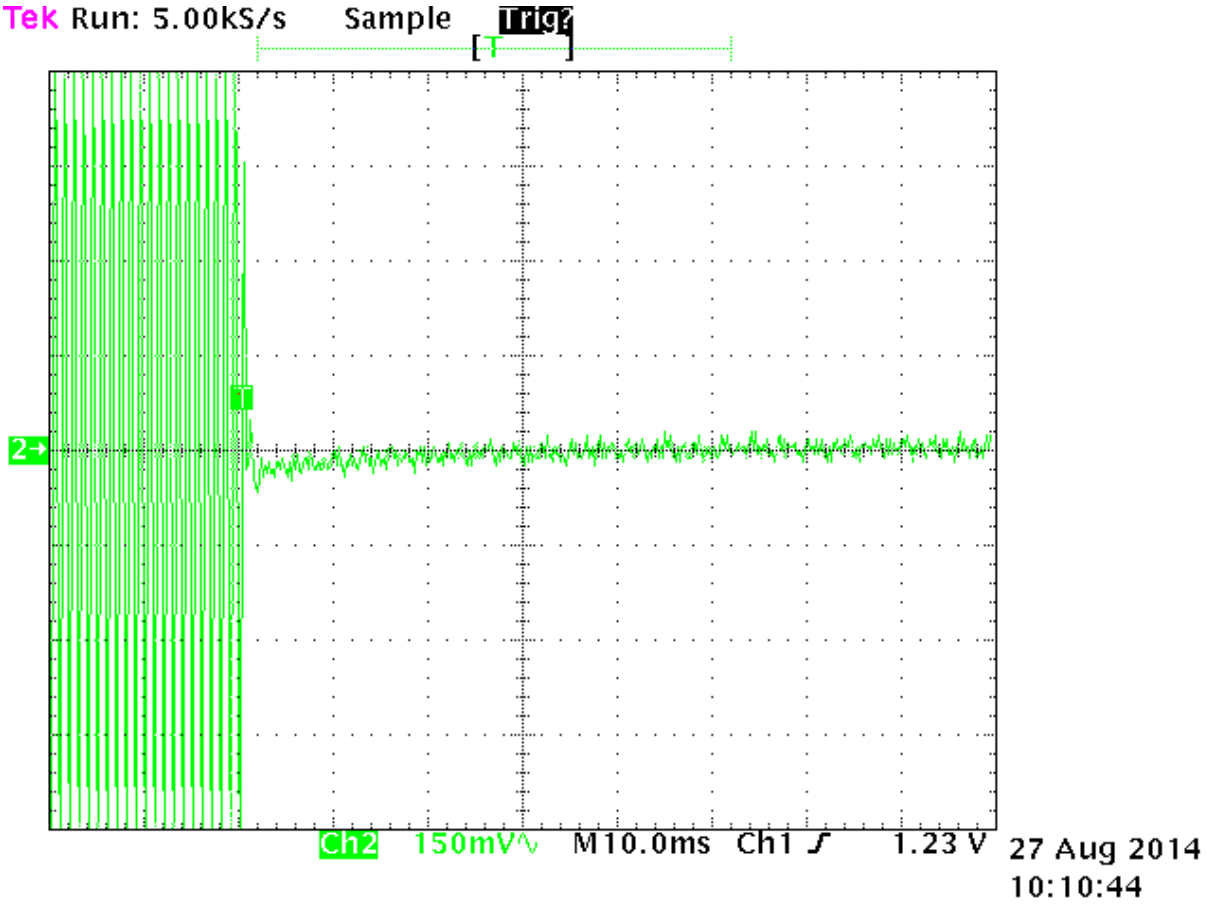
Green Trace = 1 kHz tone with FM deviation of 12.5 kHz and any transient.

Green trace has been maximised to give full screen indication of a ±12.5 kHz.
Therefore each Y axis division = 3.125 kHz per division.
The X axis has been set to a sweep rate of 10 ms/division.

Triggering has been set to occur 2 divisions from the left hand edge (20 ms). This is position *t*on.

*t*1 occurs between 2.0 and 3.0 divisions from the left-hand edge.
*t*2 occurs between 3.0 and 5.5 divisions from the left-hand edge.

A very small transient response can be observed during *t*1.



12.5 kHz transmitter turn off

Green Trace = 1 kHz tone with FM deviation of 12.5 kHz and any transient.

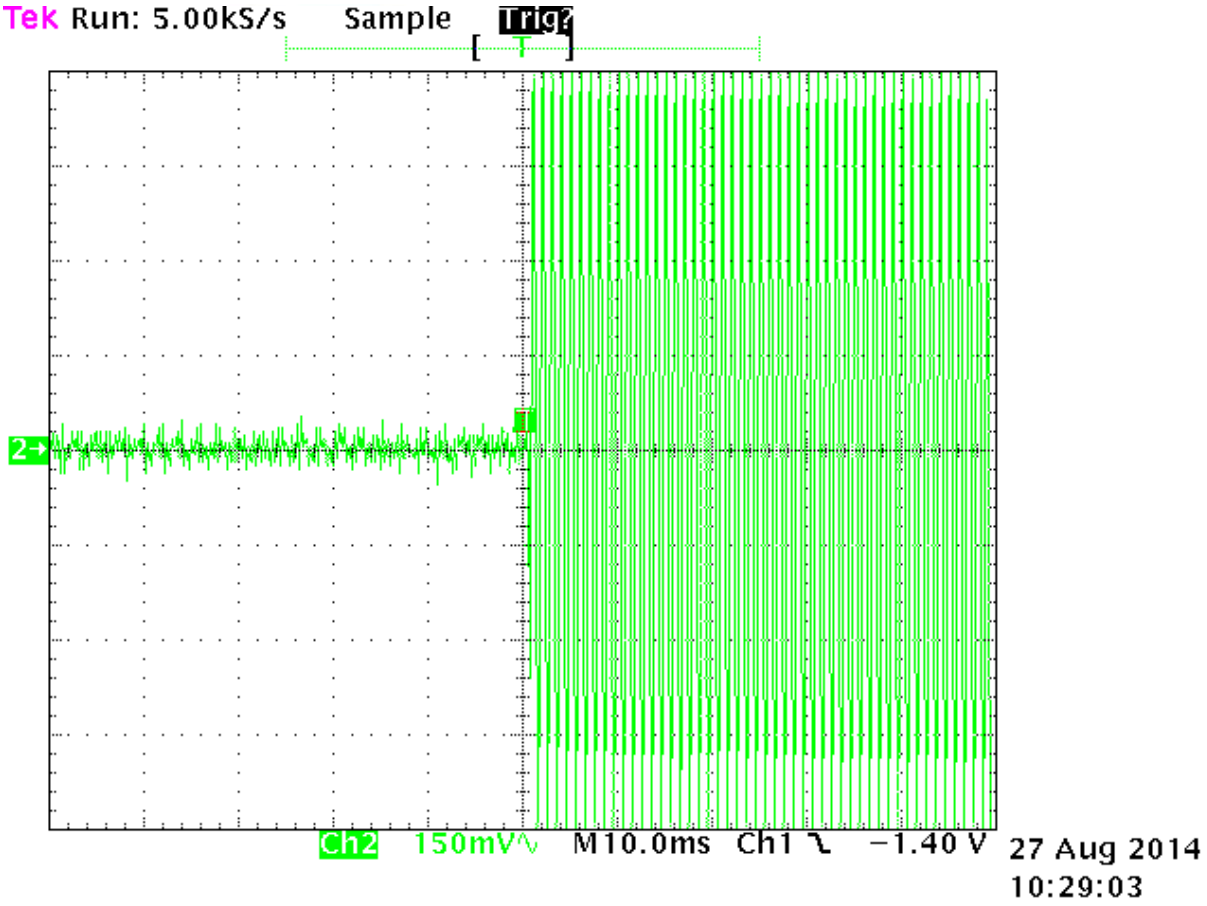
Green trace has been maximised to give full screen indication of a ± 12.5 kHz.
Therefore each Y axis division = 3.125 kHz per division.
The X axis has been set to a sweep rate of 10 ms/division.

The display of the 1 kHz signal rising has been positioned 5 divisions from the left hand edge (50 ms).

This is position *t*off.

*t*3 occurs between 4.0 and 5.0 divisions from the left hand edge.

No transient response can be observed before *t*off.



25.0 kHz transmitter turn on

Green Trace = 1 kHz tone with FM deviation of 25.0 kHz.

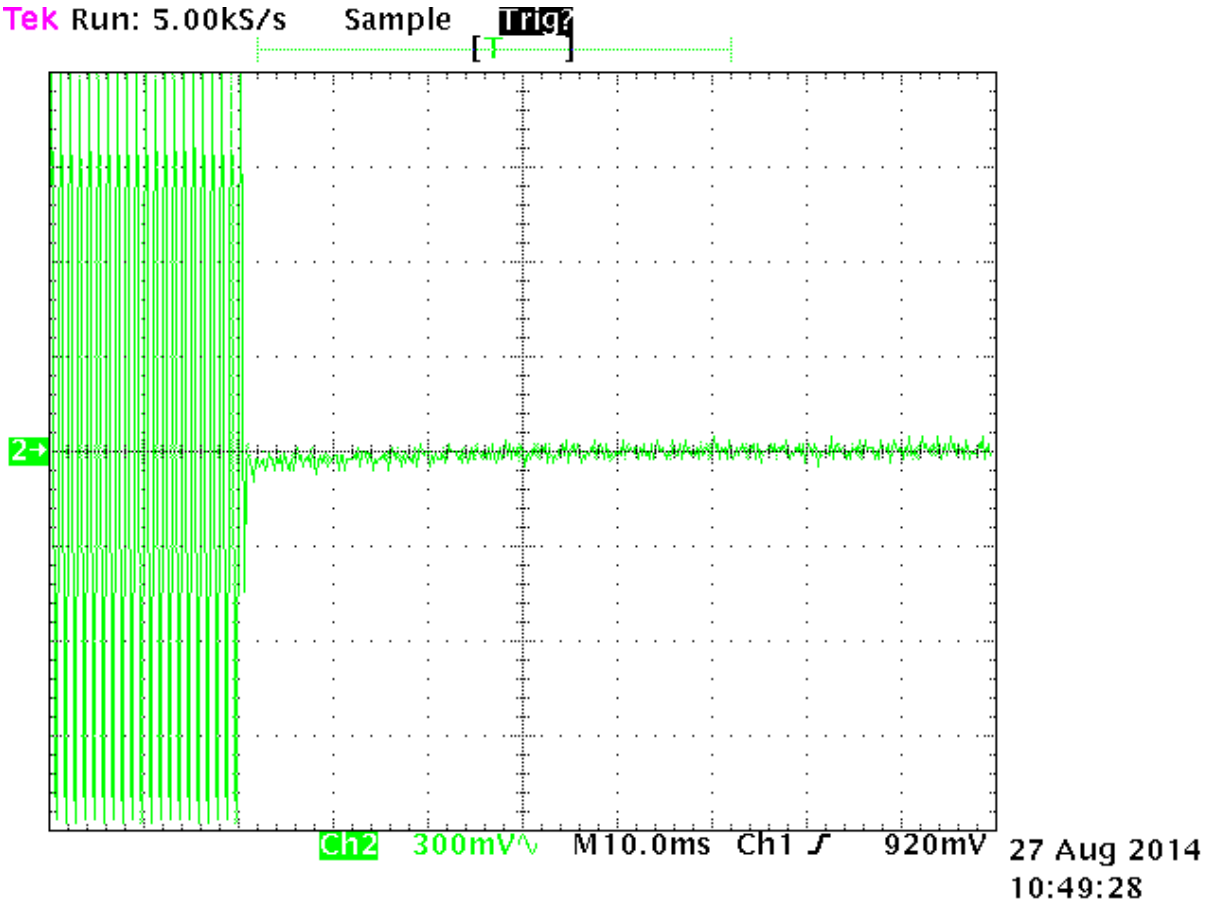
Green trace has been maximised to give full screen indication of +/- 25.0 kHz.
Therefore each Y axis division = 6.25 kHz per division.
The X axis has been set to a sweep rate of 10 mS/division.

Triggering has been set to occur 2 divisions from the left hand edge (20 mS).

*t*on occurs at 20 mS.

*t*1 occurs between 2.0 and 3.0 divisions from the left hand edge.
t2 occurs between 3.0 and 5.5 divisions from the left hand edge.

No transient response can be observed during *t*1 and *t*2.



25.0 kHz transmitter turn off

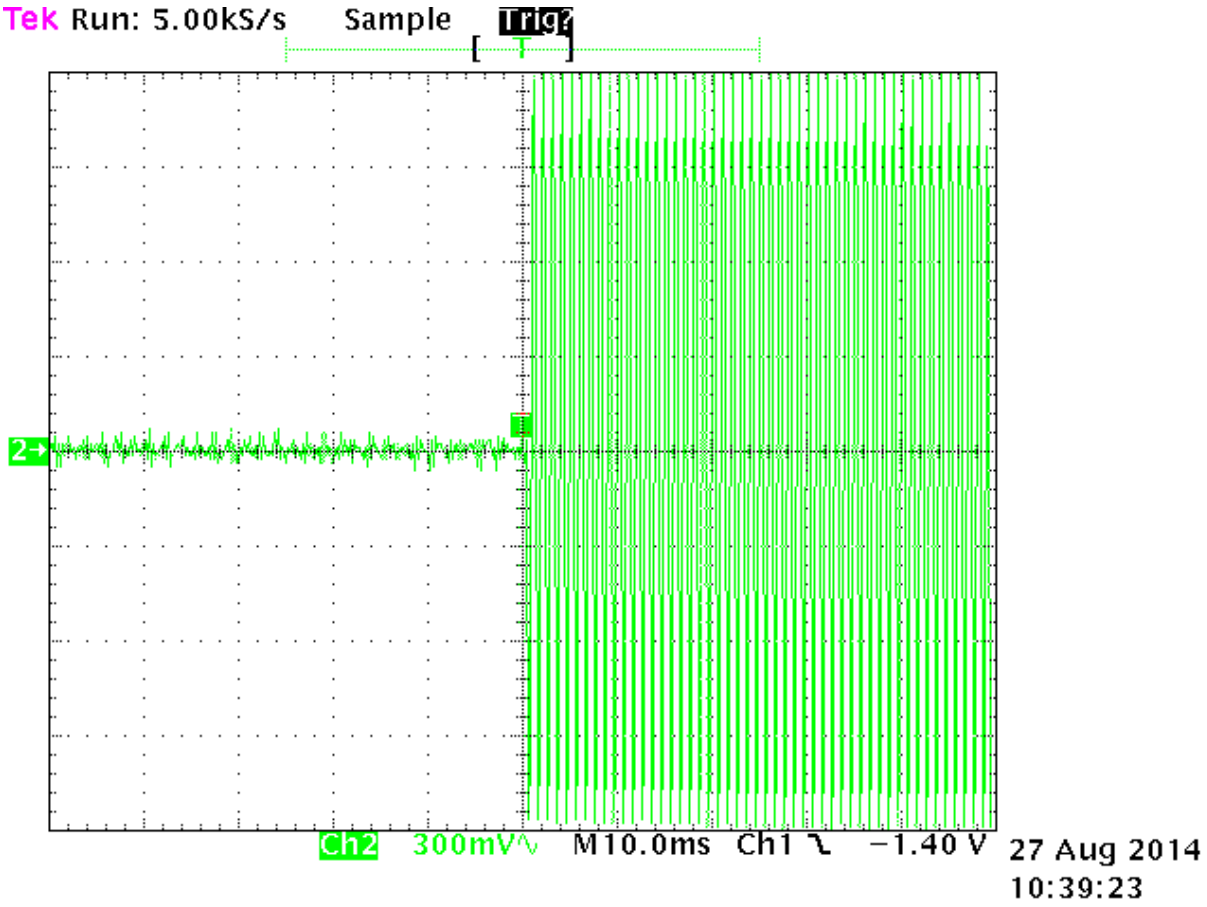
Green Trace = 1 kHz tone with FM deviation of 25.0 kHz.

Green trace has been maximised to give full screen indication of +/- 25.0 kHz.
Therefore each Y axis division = 6.25 kHz per division.
The X axis has been set to a sweep rate of 10 mS/division

The display of the 1 kHz signal rising has been positioned 5 divisions from the left hand edge (50 mS). This is position *t*off.

*t*3 occurs between 4.0 and 5.0 divisions from the left hand edge..

No transient response can be observed before *t*off.



Exposure of humans to RF fields

As per FCC KDB 447498 D01 and Section 2.1091 radio frequency transmitters are required to be operated in a manner that ensures the public is not exposed to RF energy levels.

Calculations have been made using the General Public/Uncontrolled Exposure limits that are defined in Section 1.1310.

Minimum safe distances have been calculated using 406.100 MHz which gives a worst case calculation.

Power density, $mW/m^2 = E^2/3770$

- General Population / Uncontrolled exposure limit will be 0.27 mW/cm^2
(f/1500 = 406.1 MHz/1500)

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, V/m = (√ (30 * P * G)) / d

Uncontrolled
Power Density = 0.27 $mW/m^2 = E^2/3770$
E= √ 0.27*3770
E = 31.9 V/m

The rated maximum transmitter power = 0.25 watts.

Transmitter is operated using various antennas with the highest gain declared to be 17 dBi (G=50).

The client has declared a duty cycle of 100% (DC=1)

Uncontrolled
d = √ (30 * P * G*DC) / E
d = √ (30 * 0.25 * 50 * 1) / 31.9
d = 0.61 metres or 61.0 cm

Result: Complies if the safe distance calculated is applied.

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	3 years
Biconical Antenna	Schwarzbeck	BBA 9106	-	3612	12/01/2015	3 years
Log Periodic Antenna	Schwarzbeck	VUSLP 91111	9111-228	3785	12/01/2015	3 years
Horn Antenna	EMCO	3115	9511-4629	E1526	04/06/2017	3 years
Receiver	Rohde & Schwarz	ESIB-40	100171	EMC4003	29/01/2015	1 year
Level generator	Anritsu	MG443B	M61689	E1143	15/01/2015	2 years
Modulation Analyzer	Rohde & Schwarz	FMA	837807/020	E1552	15/01/2015	2 years
Modulation Analyzer	Hewlett Packard	8901B	2608A00782	E1090	15/01/2015	2 years
Oscilloscope	Tektronics	745A	B010643	E1569	15/01/2015	2 years
Power Attenuator	JFW	50FH-030-100	-	-	N/a	N/a
Power Supply	Hewlett Packard	6032A	2743A-02859	E1069	N/a	N/a
Selective Level Meter	Anritsu	ML422C	M35386	E1140	03/07/2015	2 years
Signal Generator	Rohde & Schwarz	SMHU	838923/028	E1493	22/01/2015	2 years
Spectrum Analyzer	Hewlett Packard	E7405A	US39150142	RFS 3776	26/02/2015	1 year
Thermal chamber	Contherm	M180F	86025	E1129	01/06/2015	N/a
Thermometer	DSIR	RT200	035	E1049	01/06/2015	N/a

At the time of testing all equipment was within calibration

8. ACCREDITATIONS

Testing was carried out in accordance with EMC Technologies NZ Ltd registration with the Federal Communications Commission as a listed facility, Registration Number: 90838, which was last updated in June 2014.

All testing has been carried out in accordance with the terms of EMC Technologies (NZ) Ltd's International Accreditation New Zealand (IANZ) Accreditation to ISO/IEC 17025.

All measurement equipment has been calibrated in accordance with the terms of EMC Technologies (NZ) Ltd's International Accreditation New Zealand (IANZ) Accreditation to 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