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## TEST REPORT

### **Nexus6 SmartKey Bluetooth USB Transceiver**

*tested to the*

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

**Part 15 – Radio Frequency Devices,  
Subpart C – Intentional Radiators**

**Section 15.249 – Operation in the band  
2400.0 – 2483.5 MHz**

*for*

**Nexus6 Ltd**

This Test Report is issued with the authority of:

A handwritten signature in blue ink that reads "Andrew Cutler". The signature is written in a cursive style and is positioned above a horizontal line.

**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 **Nexus6 SmartKey Bluetooth USB Transceiver** complies with 47 CFR Part 15 and in particular Sections, 15.205, 15.207, 15.209, 15.215 and 15.249 as detailed below when tested in accordance with ANSI C63.4 – 2003.

## 2. RESULTS SUMMARY

The results of testing, carried out in September / October 2012, are listed below

Clause	Description	Result
15.201	Equipment authorisation requirement	Applied
15.203	Antenna requirement	Complies
15.204	External power amplifiers	Not applicable
15.205	Operation in restricted bands	Complies
15.207	Conducted emissions	Complies
15.209	Radiated emissions	Complies
15.215	Additional provisions	Complies
15.249 (a)	Field strength of fundamental	Complies
15.249 (a)	Field strength of harmonics	Complies
15.249 (b)	Fixed, point to point operations	Not applicable
15.249 (c)	3 metre measurement distance	Noted
15.249 (d)	Spurious emission levels except harmonics	Complies
15.249 (e)	Detectors above 1000 MHz	Noted
15.249 (f)	Reference to section 15.37(d)	Noted

## 3. CLIENT INFORMATION

**Company Name** Nexus6 Ltd

**Address** Suite 205  
8 Commerce Street

**City** Auckland 1010

**Country** New Zealand

**Contact** Mr Michael Cormack

## 4. DESCRIPTION OF TEST SAMPLE

<b>Brand Name</b>	Nexus6
<b>Model Number</b>	SmartKey
<b>Product</b>	Bluetooth USB Transceiver
<b>Manufacturer</b>	Nexus6
<b>Country of Origin</b>	New Zealand
<b>Serial Number</b>	15566
<b>FCC ID</b>	PN2-SKEY1
<b>FCC Band:</b>	2400.0 – 2483.5 MHz
<b>Band of operation:</b>	2402 – 2480 MHz using 40 channels that are 2 MHz spaced
<b>Test Frequencies:</b>	2402, 2440 and 2480 MHz
<b>Rated Conducted Power:</b>	0.001 W (0 dBm) approximately
<b>Antenna Type:</b>	Integral antenna
<b>Power Supply:</b>	USB from host computer
<b>Ports:</b>	USB port to host computer. No other ports.

The device tested is described as a short range USB Bluetooth transceiver that is used for data collection purposes relating to the use of Asthma Inhalers.

The Asthma Inhaler will be placed in a holder that will record various data relating to its use.

Periodically this holder will interact with the USB Bluetooth transceiver which will download the recorded data and then carryout the appropriate data processing.

## 5. 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.**

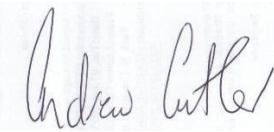
This report replaces report number 120922.1a to include the FCC ID of the product and to include additional below 30 MHz measurements.

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.

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

## **6. TEST RESULTS**

### **Section 15.201: Equipment authorisation requirement**

Certification as detailed in Subpart J of Part 2 is required for this device as it contains a short range transmitter.

### **Section 15.203 – Antenna requirement**

The antenna for this device is integral to the device as can be seen from the photographs

**Result:** Complies

### **Section 15.204: External radio frequency power amplifiers and antenna modifications**

An external power amplifier is not supplied with this device and it is not possible to attach an external power amplifier.

**Result:** Complies.

### **Section 15.205 – Restricted bands of operation**

Refer to measurements made with reference to Section 15.249 (a).

This device operates in the 2400.0 – 2483.5 MHz which is not a restricted band.

**Result:** Complies

## **Section 15.207 – Conducted emissions**

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

Testing was carried out while the device was in transmit and receive modes which required the device to be activated every 4 minutes approximately.

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  $\mu$ H / 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

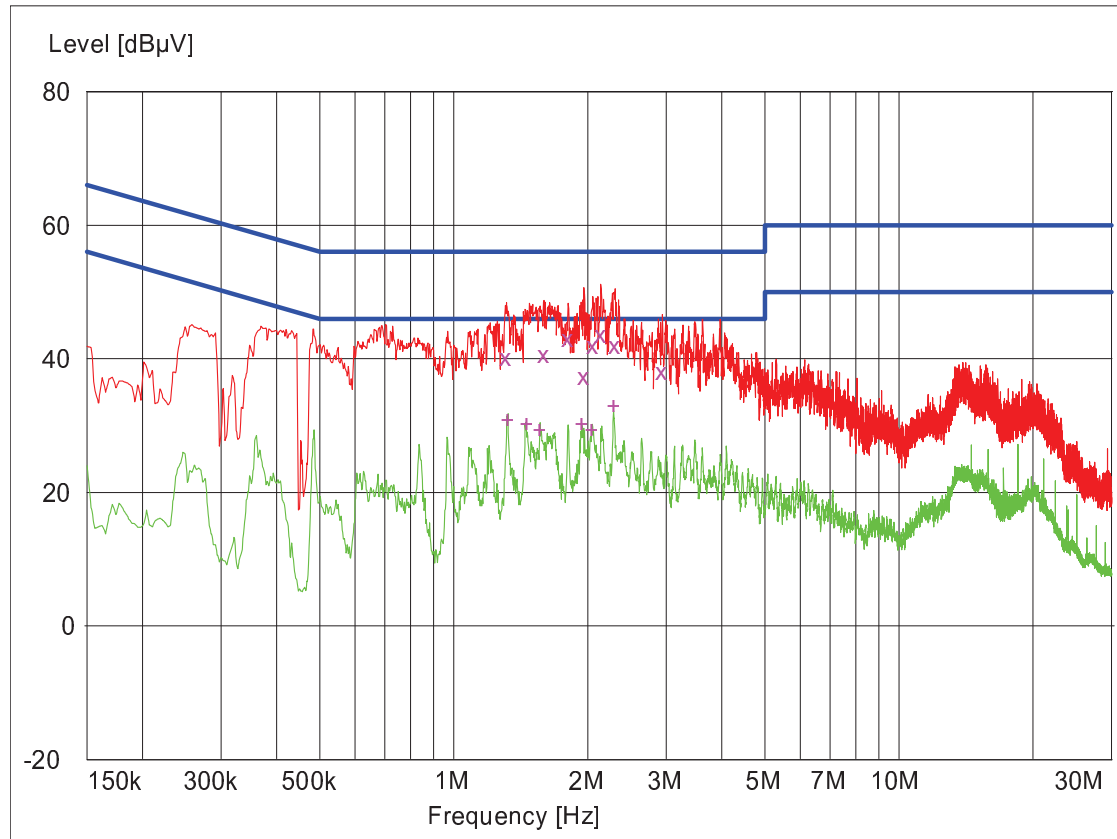
Measurement uncertainty with a confidence interval of 95% is:

Conducted emissions tests (0.15 - 30 MHz)  $\pm$  2.2 dB

## Conducted Emissions – AC Input Power Port

**Setup:** Device tested when powered at 110 Vac using a representative laptop computer while frequency hopping continuously.

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



### Final Quasi-Peak Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
1.311000	40.20	56.0	15.8	N	
1.596000	40.60	56.0	15.4	L1	
1.806000	43.10	56.0	12.9	L1	
1.959000	37.40	56.0	18.6	N	
2.054000	42.10	56.0	13.9	L1	
2.139500	43.60	56.0	12.4	L1	
2.306000	42.00	56.0	14.0	L1	
2.940500	38.20	56.0	17.8	N	

### Final Average Measurements

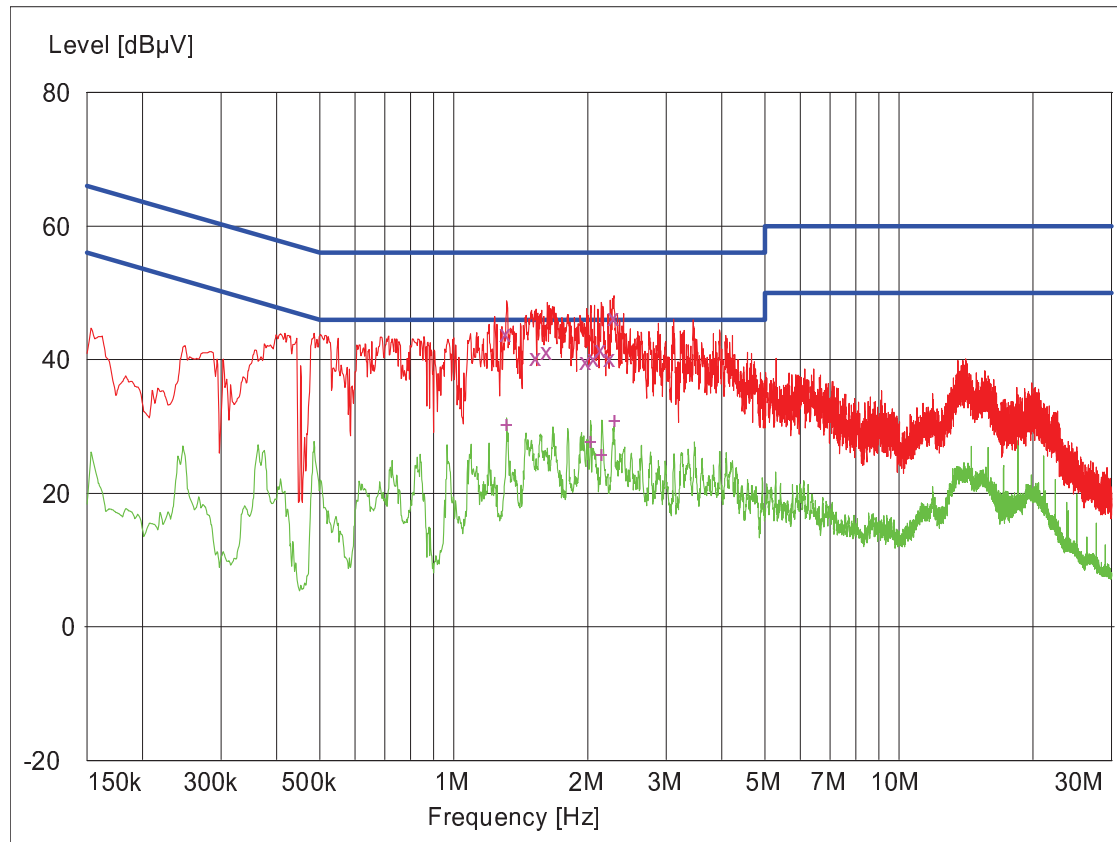
Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
1.323000	30.80	46.0	15.2	L1	
1.455000	30.20	46.0	15.8	L1	
1.560000	29.30	46.0	16.7	L1	
1.938000	30.20	46.0	15.8	L1	
2.045000	29.40	46.0	16.6	L1	
2.283500	33.00	46.0	13.0	L1	



## Conducted Emissions – AC Input Power Port

**Setup:** Device tested when powered at 110 Vac using a representative laptop computer while operating in receive mode continuously.

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



Final Quasi-Peak Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
1.314000	44.00	56.0	12.0	N	
1.530000	40.40	56.0	15.6	N	
1.623000	41.30	56.0	14.7	N	
1.989000	39.80	56.0	16.2	N	
2.067500	40.30	56.0	15.7	N	
2.144000	41.60	56.0	14.4	N	
2.247500	40.30	56.0	15.7	N	
2.288000	46.30	56.0	9.7	N	

Final Average Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
1.314000	30.30	46.0	15.7	N	
2.027000	27.70	46.0	18.3	N	
2.148500	25.70	46.0	20.3	N	
2.288000	30.80	46.0	15.2	N	

## Section 15.209 – Radiated emissions

In accordance with section 15.249 (d) the general emission limits specified in Section 15.209 (a) have been applied to all emissions.

For emissions above 30 MHz see Section 15.249 (a) for further details.

As the device contains devices that operate using frequencies of 32 kHz and 16 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.

Details of the general test set up are provided in the photograph section of this report.

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.

Frequency (kHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna
32.000	< 66.0	97.5	> 29.5	Average	Loop
	< 92.0	117.5	> 15.5	Peak	Loop

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna
16.000	< 20.0	49.5	> 29.5	Quasi Peak	Loop

No emissions were detected on these frequencies of interest and no other 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 (9 kHz – 30 MHz)  $\pm$  4.8 dB

**Section 15.215 (c) – Additional provisions to the general radiated emission limitations**

The device operates in the 2400.0 – 2483.5 MHz band and in particular between 2402 - 2480 MHz using 40 channels with a 2 MHz channel spacing

-20 dB band edge measurements have been made at 2402 and 2480 MHz.

The 20 dB bandwidth of the modulated signal on the two test frequencies was measured to ensure that they were contained within the assigned frequency band.

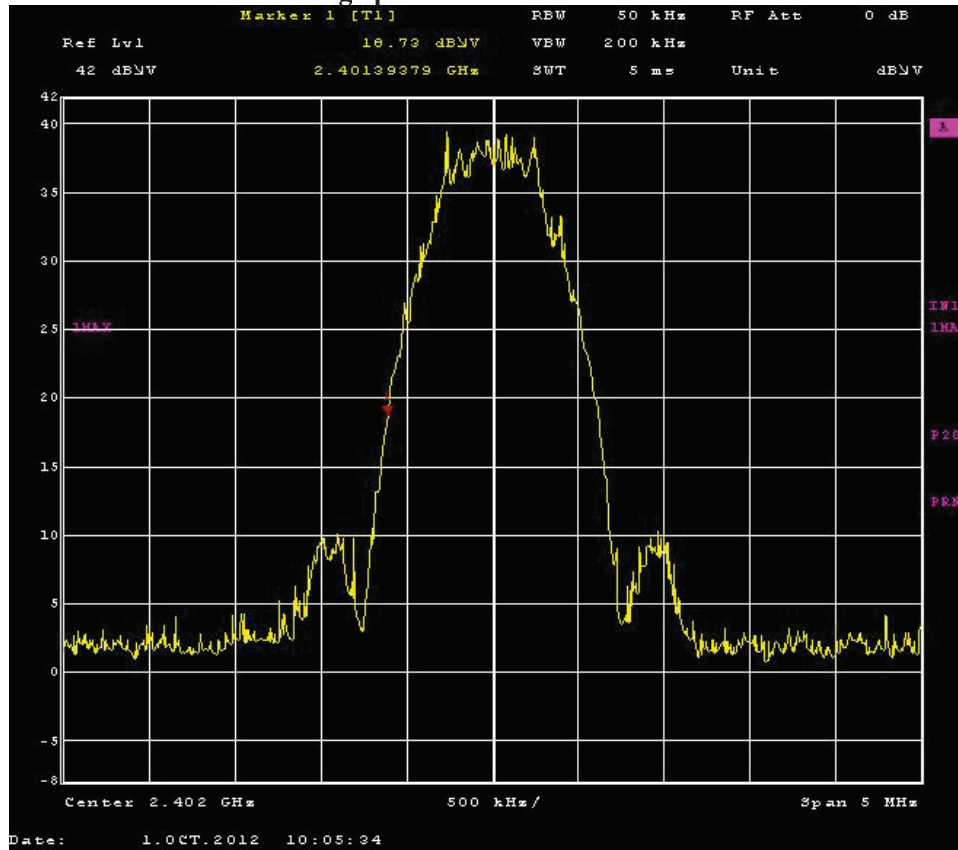
<b>Frequency (MHz)</b>	<b>F low (MHz)</b>	<b>F high (MHz)</b>	<b>Occupied BW (MHz)</b>
2402.000	2401.393	Not applicable	1.293
2480.000	Not applicable	2480.636	1.333

Measurements show compliance with the -20 dB requirements

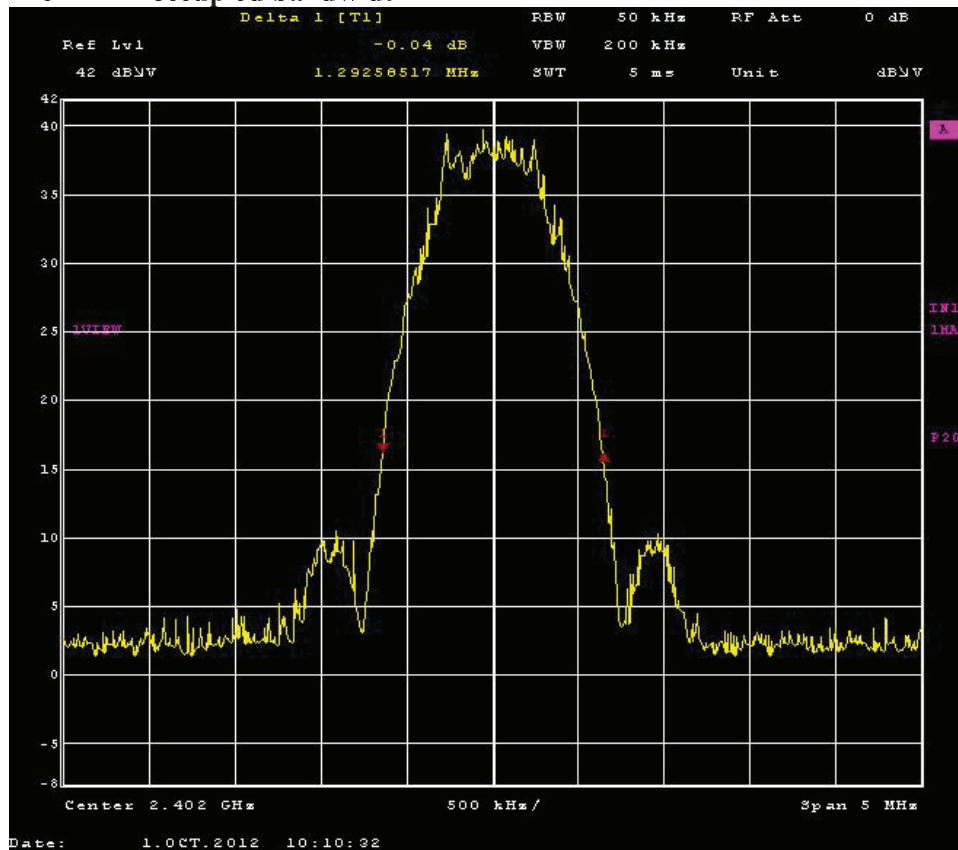
The actual measurement plots are detailed below

**Results:** Complies

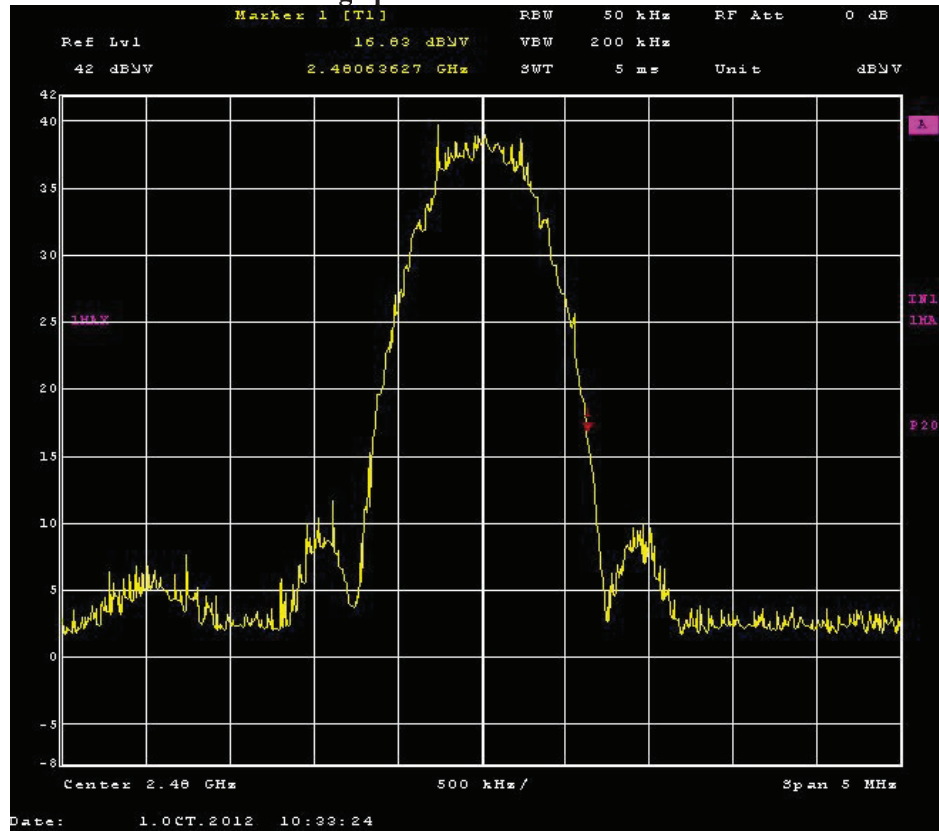
### 2402 MHz -20 dB bandedge point



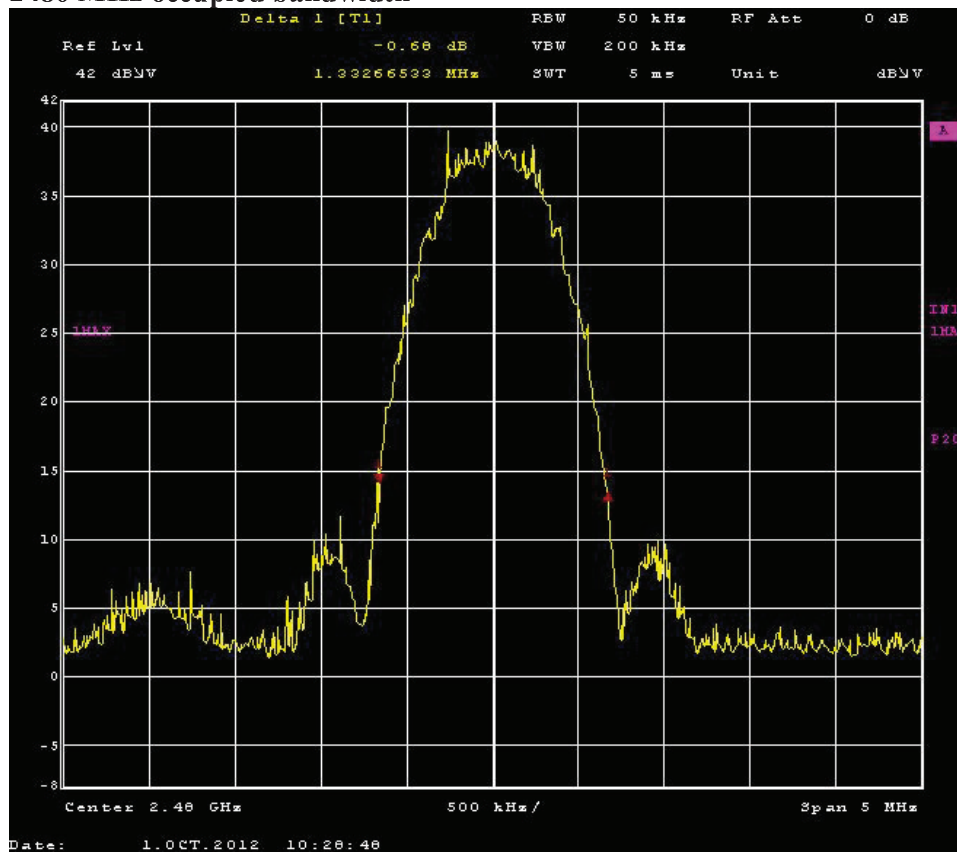
### 2402 MHz occupied bandwidth



### 2480 MHz -20 dB bandedge point



### 2480 MHz occupied bandwidth



## Section 15.249 (a) – Field strength of the Fundamental and Harmonics

Radiated emission measurements were carried out with the limits as per section 15.249 (a) being applied to the Fundamental and Harmonics of the transmitter over the range of 30 MHz to approximately 25 GHz.

Testing was carried out at EMC Technologies NZ Ltd Open Area Test Site, which is located at 670 Kawakawa Orere Rd, RD5, Papakura, New Zealand

The transmitter 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 3 metres from the transmitting antenna.

Measurements below 1000 MHz were made using a 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.

The limit as specified section 15.249 was applied to the average detector levels with a factor of 20 dB being applied to these levels when they were then measured using a peak detector.

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 is measured in both vertical and horizontal antenna polarisations with no measurements being made above the 10<sup>th</sup> harmonic

The device was tested transmitting in a test mode for periods of 255 seconds (4.5 seconds) with 10 ms burst being sent every one second.

Testing was carried out when the device was attached to a laptop computer that was loaded with the Smartinhaler Engineering Application V1.2 test software.

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) + Coax Loss (dB) – Amplifier Gain (dB)

**Fundamental**

Frequency (MHz)	Vertical (dBuV/m)	Horizontal (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
2480.000	89.4	85.9	114.0	24.6	Peak
	74.3	71.7	94.0	19.7	Average
2440.000	90.7	85.2	114.0	23.3	Peak
	75.1	72.5	94.0	18.9	Average
2402.000	91.6	90.5	114.0	22.4	Peak
	75.1	74.5	94.0	18.9	Average

Section 15.249 specifies a limit of 50 mV/m when an average detector is used for devices operating the band 2400.0 – 2483.5 MHz.

A resolution bandwidth of 1 MHz has been used.

The average limit has been increased by 20 dB in order to determine the peak limit.

This limit has been converted to dBuV/m using the formula  $20 * (\log 0.050 / 0.000001)$

**Result:** Complies

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (30 – 25,000 MHz)  $\pm 4.1$  dB

## Spurious emissions - Harmonics

### Transmitting on 2402 MHz

Frequency (MHz)	Vertical (dBuV/m)	Horizontal (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
4804.000	60.0	57.7	74.0	14.0	Peak
	47.6	45.4	54.0	6.4	Average
7206.000	< 50.0	< 50.0	74.0	> 24.0	Peak
	< 40.0	< 40.0	54.0	> 14.0	Average
9608.000	< 52.0	< 52.0	74.0	> 22.0	Peak
	< 41.0	< 41.0	54.0	> 13.0	Average
12010.000	< 55.5	< 58.1	74.0	> 15.9	Peak
	< 43.8	< 46.4	54.0	> 7.6	Average
14412.000	< 59.1	< 58.9	74.0	> 14.9	Peak
	< 45.4	< 45.8	54.0	> 8.2	Average
16814.000	< 61.0	< 61.0	74.0	> 13.0	Peak
	< 48.1	< 48.1	54.0	> 5.9	Average
19216.000	< 57.0	< 56.7	74.0	> 17.0	Peak
	< 43.2	< 44.8	54.0	> 9.2	Average
21618.000	< 57.5	< 58.2	74.0	> 15.8	Peak
	< 44.5	< 45.2	54.0	> 8.8	Average
24020.000	< 58.3	< 58.3	74.0	> 15.7	Peak
	< 45.4	< 45.4	54.0	> 8.6	Average

No emissions were detected above 2Fc



**Transmitting on 2440 MHz**

Frequency (MHz)	Vertical (dBuV/m)	Horizontal (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
4880.000	58.1	57.6	74.0	15.9	Peak
	44.5	43.3	54.0	9.5	Average
7320.000	< 50.0	< 50.0	74.0	> 24.0	Peak
	< 40.0	< 40.0	54.0	> 14.0	Average
9760.000	< 52.0	< 52.0	74.0	> 22.0	Peak
	< 41.0	< 41.0	54.0	> 13.0	Average
12200.000	< 55.5	< 58.1	74.0	> 15.9	Peak
	< 43.8	< 46.4	54.0	> 7.6	Average
14640.000	< 59.1	< 58.9	74.0	> 14.9	Peak
	< 45.4	< 45.8	54.0	> 8.2	Average
17080.000	< 61.0	< 61.0	74.0	> 13.0	Peak
	< 48.1	< 48.1	54.0	> 5.9	Average
19520.000	< 57.0	< 56.7	74.0	> 17.0	Peak
	< 43.2	< 44.8	54.0	> 9.2	Average
21960.000	< 57.5	< 58.2	74.0	> 15.8	Peak
	< 44.5	< 45.2	54.0	> 8.8	Average
24400.000	< 58.3	< 58.3	74.0	> 15.7	Peak
	< 45.4	< 45.4	54.0	> 8.6	Average

No emissions were detected above 2Fc

**Transmitting on 2480 MHz**

<b>Frequency (MHz)</b>	<b>Vertical (dBuV/m)</b>	<b>Horizontal (dBuV/m)</b>	<b>Limit (dBuV/m)</b>	<b>Margin (dB)</b>	<b>Detector</b>
4960.000	58.1	57.8	74.0	15.9	Peak
	44.5	43.3	54.0	9.5	Average
7440.000	< 50.0	< 50.0	74.0	> 24.0	Peak
	< 40.0	< 40.0	54.0	> 14.0	Average
9920.000	< 52.0	< 52.0	74.0	> 22.0	Peak
	< 41.0	< 41.0	54.0	> 13.0	Average
12400.000	< 55.5	< 58.1	74.0	> 15.9	Peak
	< 43.8	< 46.4	54.0	> 7.6	Average
14880.000	< 59.1	< 58.9	74.0	> 14.9	Peak
	< 45.4	< 45.8	54.0	> 8.2	Average
17360.000	< 61.0	< 61.0	74.0	> 13.0	Peak
	< 48.1	< 48.1	54.0	> 5.9	Average
19840.000	< 57.0	< 56.7	74.0	> 17.0	Peak
	< 43.2	< 44.8	54.0	> 9.2	Average
22320.000	< 57.5	< 58.2	74.0	> 15.8	Peak
	< 44.5	< 45.2	54.0	> 8.8	Average
24800.000	< 58.3	< 58.3	74.0	> 15.7	Peak
	< 45.4	< 45.4	54.0	> 8.6	Average

No emissions were detected above 2Fc

## Spurious emissions - Other emissions detected

Testing was carried out when operating in transmit and also receive mode.

A number of these emissions are from the host computer which remained compliant while the USB transceiver was attached

Frequency (MHz)	Vertical (dBuV/m)	Horizontal (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna	Source
78.933		25.5	40.0	14.5	Horizontal	
88.000		25.8	40.0	14.2	Horizontal	
160.000		29.4	43.5	14.1	Horizontal	
166.100	31.3		43.5	12.2	Vertical	
254.747		32.2	46.0	13.8	Horizontal	
257.068	29.8	34.5	46.0	11.5	Horizontal	
374.960		32.7	46.0	13.3	Horizontal	Host
433.090	35.2		46.0	10.8	Vertical	Host

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) + Coax Loss (dB)

**Result:** Complies

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (30 – 25,000 MHz)  $\pm$  4.1 dB

## 7. TEST EQUIPMENT USED

Instrument	Manufacturer	Model	Serial No	Asset Ref	Cal Due
Aerial Controller	EMCO	1090	9112-1062	RFS 3710	Not applic
Aerial Mast	EMCO	1070-1	9203-1661	RFS 3708	Not applic
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709	Not applic
Receiver	R & S	ESIB 40	100171	R-27-1	10 Oct 2013
Receiver	R & S	ESHS 10	828404/005	RFS 3728	2 Dec 2012
Mains Network	R & S	ESH2-Z5	881362/034	3628	29 Jul 2013
VHF Balun	Schwarzbeck	VHA 9103	-	RFS 3603	30 Jan 2013
Biconical Antenna	Schwarzbeck	BBA 9106	-	RFS 3612	30 Jan 2013
Log Periodic	Schwarzbeck	VUSLP 9111	9111-228	3785	30 Jan 2013
Horn Antenna	EMCO	3115	9511-4629	E1526	3 May 2013
Horn Antenna	EMCO	3116	92035	-	16 Jun 2013
Loop Antenna	EMCO	6502	9003-2485	3798	9 May 2014

## 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 updated in February 2011.

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

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

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