

**Electromagnetic Compatibility
 TEST REPORT
 Radiated Spurious Emissions Per
 FCC Part 2.1053 & Part 90.219(e)(3)**

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Testing Laboratory.....: Quality Auditing Institute
Address.....: 16 – 211 Schoolhouse Street, Coquitlam, BC, V3K 4X9, Canada

Accreditations (ISO 17025):



Standard Council of Canada: Accredited Laboratory No. 743

International Accreditation Service Inc: Accredited Laboratory: No. TL-239

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Applicant's name: Dali Wireless (Canada), Inc.
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Phone.....: (604)420-7760 Fax: (604) 420-7730

Test Standard.....: FCC Part 2.1053 & Part 90.219(e)(3)

Test item description.....: t37 (Public Safety 150/450 MHz)

Model.....: t37-DVU-S4N

Trade Mark.....:



Manufacturer.....: Dali Wireless (Canada), Inc.

Registrations.....: FCC ID: HCOT37DVUS4A



t37 (Public Safety 150/450MHz)



Revision History

Date	Report Number	Rev #	Details	Authors Initials
August 1, 2014	E10454-1402B	0.0	Draft Test Report	PS
August 3, 2014	E10454-1402B	1.0	Final Report Issued	AJ
August 5, 2014	E10454-1402B	2.0	Final Report Issued-Corrected FCC ID	AJ
August 12, 2014	E10454-1401A	3.0	Revised Report number, 150MHz frequency bands and measurement tables	DJ

Note: All previous versions of this report have been superseded by the latest dated revision as listed in the above table. Please dispose of all previous electronic and paper printed revisions accordingly.



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Statement of Compliance

The following tests demonstrate the testimony to “FCC” Mark Electromagnetic compatibility testing for “t37 (Public Safety 150M/450M)” manufactured by Dali Wireless (Canada), Inc.

EMISSIONS
United States: Intentional Transmitter (Radiated Spurious Only)
FCC CFR 47, Part 2.1053
FCC CFR 47, Part 90.219(e)(3)

Tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with the above list of standards. Additional standards may apply to this product. The manufacturer listed in this report is responsible for the tested product configuration, continued product compliance with these standards listed, additional testing as required by other standards not listed and for the appropriate auditing of subsequent products as required.

This is to certify that the following report is true and correct to the best of our knowledge.

X 

Tested and Report Written By:
Parm Singh, EMC Division Manager

X 

Reviewed By:
Aman Jathaul, EMC Project Manager



Testing Location and Procedures

Testing Laboratory:	Quality Auditing Institute
Testing location/ address	16 – 211 Schoolhouse Street, Coquitlam, BC, 3K 4X9, Canada
Associated Laboratory:	Quality Auditing Institute (Remote location)
Testing location/ address	19473 Fraser Way, Pitt Meadows, BC, V3Y 2V4, Canada
FCC Test Site Registration Number (OATS 10m and SAC-3m):	226383
Industry Canada Site Registration Number (SAC-3m).....	9543B-1
Industry Canada Test Site Registration Number (OATS-10m)..:	9543C-1
Tested by	Parm Singh and Rajinder Atwal
Reviewed by.....	Aman Jathaul
Sample Information:	
Product Name.....	t37 (Public Safety 150M/450M)
Part Number.....	t37 DUV-S4N
Company:.....	Dali Wireless (Canada) Inc.
Received Date:.....	21Jul2014
Received By.....	David Johanson
Sample Log.....	QAI Product Control Log (QM 1301 - Sample Inventory)
Environmental Conditions:	
Indoor – 28 July to 11 August 2014:	Temperature: 23°C R.H.: 40.0%

Measurement Uncertainty

Radio Frequency: $\pm 1,5 \times 10^{-5}$ MHz
 Total RF power, conducted.....: ± 1 dB
 RF power density, conducted.....: ± 2.75 dB
 Spurious emissions, conducted.....: ± 3 dB
 All emissions, radiated.....: ± 3.5 dB
 Temperature.....: $\pm 1^{\circ}\text{C}$
 Humidity.....: ± 5 %
 DC and low frequency voltages.....: ± 3 %

Test Equipment List

Semi-Anechoic Chamber Equipment List

Manufacturer	Model	Description	Serial No.	Last Cal	Cal Due Date
ETS Lindgren	2165	Turntable	00043677	N/A	N/A
ETS Lindgren	2125	Mast	00077487	N/A	N/A
Sunol Sciences	JB3	Biconilog Antenna 30MHz – 3GHz	A042004	31-Oct-2012	31-Oct-2015
Rohde & Schwarz	ESU40	EMI Receiver	100011	26-June-2012	26-Jun-2015
EMCO	3825/2	AC/DC MAINS LISN	9002-1601	19-Nov-2012	19-Nov-2015
COM-POWER	AHA-118	Dual Ridge Horn Antenna	711040	11-Mar-2012	11-Mar-2015
ETS Lindgren	S201	3 meter Semi-Anechoic Chamber	1030	N/A	N/A

Product Description

Introduction:

Dali's **t37-ps**, (37 dBm, 5 W) is an all-digital, medium power, dual-radio remote. It bi-directionally transfers two public safety bands over a single optical fiber (SFP –Single Mode Fiber) to/from the RF Router, **tHost®** at 6 Gb/s up to 40 km. It also accommodates 100Mb/s Ethernet backhaul as well. This smart radio remote enables multiple network topologies that cater to different deployments scenarios including star, chain, hybrid and loop topologies.

EUT Test Configuration:

The t37 (EUT) was provided with the auxiliary equipment, tHost, Laptop and RF Generator, for the operation and control of the EUT using a computer interface. The EUT was mounted in a stand to simulate the vertical orientation that is it's normal mounting position.

The typical configuration of the EUT with an external AC-DC adaptor was set up. All of the 6 SFP slots were populated. The COM port was a craftsman port and was terminated. The two RF input ports and the two RF output ports were terminated with perfect 50dB attenuators with 1 meter long RF cables.

Equipment Under Test Information

Manufacturer	Dali Wireless (Canada), Inc.
Product Name	t37-ps (Public Safety 150M/450M)
Model Name	T37-DVU-S4N
Serial No.	15327414E01B47001
Firmware Version	R1.8.0

tHost

Manufacturer	Dali Wireless (Canada), Inc.
Product Name	(Public Safety VHF/UHF/700M/800M
Model Name	tHost-QVUQD-SS8S
Serial No.	15477513E01B 47001
Firmware Version	R1.8.0

RF Frequency generator

Manufacturer	Agilent
Product Name	Vector Signal Generator 100kHz-6GHz MXG
Model Name	N5182B
Serial No.	MY53050168

Computer

Manufacturer	Lenovo Thinkpad
Product Name	PC Laptop
Model Name	2808-CZU
Serial No.	R8-WVK70 09/08
Windows Version	Windows 7
Software used	Internet Explorer

Cabling Configuration

Description	Number of Lines	Connection Type	Load or Termination	Shielded	Ferrites
AC Power Adapter	3	Custom 4 pin threaded plastic circular connector	No	No	No
Ethernet Cable (beige)	8	RJ-45	No	No	Yes
Single SMF Optical Fiber cable (yellow)	1	SMF	No	No	No
ss-402 Coax Cable (blue)	4	N	Yes	Yes	No
Low Impedance braided Ground Strap	1	screw	No	No	No

Requirements for the US Market (FCC)

General

Tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC requirements for an Intentional Transmitter. The Transmitters were set to transmit on the Low, middle and high channels for each of the 2 transmitters and the spurious emissions were measured.

Test	Standard	Description	Performance Criteria
Radiated Emissions	FCC CFR47 Part 2.1053	The Radiated Spurious Emissions are measured in the 0.10 - 10000.0 MHz range.	Complies

Out Of Band Spurious Emissions Radiated from Cabinet and Circuits

DATE: August 11, 2014

TEST STANDARD: FCC Part 2.1053;
Part 90.219(e)(3)

TEST VOLTAGE: 120Vac 60Hz

MINIMUM STANDARD: **Part 2.1053 - Measurements required: Field strength of spurious radiation.**
 (a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission.

Part 90.219 – Use of signal boosters

(e) Device Specifications. In addition to the general rules for equipment certification in §90.203(a)(2) and part 2, subpart J of this chapter, a signal booster must also meet the rules in this paragraph.

(3) Spurious emissions from a signal booster must not exceed -13 dBm within any 100 kHz measurement bandwidth.

TEST SETUP: The EUT was tested in 3 m SAC and was positioned on the center of the turntable and powered up. RF outputs of the equipment under test were terminated with 50 ohm terminations. The transmitter was set for continuous transmission using appropriate signal generators for 150-174MHz band and 450-512MHz bands. The radiated spurious emissions measurements from 10kHz to 10GHz were performed at lowest, middle and highest transmitting channels. The EUT was tested in its normal vertical orientation on the table top as indicated in the test photos.

MEASUREMENT METHOD: The measurements were made using spectrum analyser and receiver using the appropriate antennas, amplifiers, attenuators and filters. All measurements were done as per ANSI c63.4, TIA-603-C-2004, FCC KDB 971168 D01 Power Meas License Digital Systems V02r01 and 935210 D02 Signal Boosters Certification v02r01

The EUT can provide up to 5Watts (36.9dBm) on the transmitter output. The attenuation levels to show the limit lines are:
 $43 + 10\log(5) = 49.9\text{dB attenuation} = -13\text{dBm}$

Since this is a radiated measurement performed at 3meters, the limit line is converted to dBuV/m using the formulas as outlined in KDB 971168:

$$\text{EIRP (dBm)} = -104.8 + E_0 \text{ (dBmV/m)} + 20 \log D_0 \text{ (m)}$$

$$-20\text{dBm} = E_0 \text{ (dBmV/m)} + (20 \log (3)) -104.8 = E_0 \text{ (dBmV/m)} + 95.3$$

$$\text{ERP} = \text{EIRP} - 2.15 \text{ dB.}$$

$$E(\text{dBuV/m}) = P(\text{dBmEIRP}) - 2.15 + 95.3 = -20 - 2.15 + 95.3 = 73.15\text{dBuV}$$

For the purpose of verifying the products Out of Band Spurious Emissions in relation to the lowest limit line of -20dBm ERP, all emissions will be measured to verify that they are below 75dBuV when measured at 3meters.

For all emissions that are 20dB or greater below the limit line, (55dBuV), the radiated measurement is used to demonstrate that the emission complies with the limit.

For all emissions that are less than 20dB below the limit line, (55dBuV), the emission is measured using the substitution method in TIA-603-C as required by KDB 971168

DEVICE DESCRIPTIONS: As described in the above EUT description and setup section.

EMISSIONS DATA: No transmitter Radiated Spurious Emissions were detected 9kHz to 30MHz..

All Spurious Emissions 30MHz to 10GHz are 20dB or greater below the limit line.

150MHz Transmitter – Channels: 150.81; 157.19, 161.96, 173.39 Harmonic Emissions

Spurious emissions Below 1 GHz								
Freq.	Corrected Value	Antenna height	Polarity	Turn table	Correction factor	ERP	Limit	Margin
(MHz)	(dBuV)	(cm)	(V/H)	(deg)	(dB)	(dBm)	(dbm)	(dB)
301.612	42.37	100	H	203.8	21.2	-55.08	-20	30.78
452.41875	26.15	180	V	44.0	24.7	-71.30	-20	47.00
314.3875	33.14	233	V	250.4	21.7	-64.31	-20	40.01
471.58125	32.04	182	V	83.9	25.3	-65.41	-20	41.11
323.9125	29.47	169	H	236.7	21.8	-67.98	-20	43.68
485.86875	30.27	192	V	12.0	25.9	-67.18	-20	42.88
346.7875	29.77	133	H	67.5	22.5	-67.68	-20	43.38

Spurious emissions above 1 GHz								
Frequency	Avg Peak	Antenna height	Polarity	Turntable position	Correction factor	ERP	Limit	Margin
(MHz)	(dBμV/m)	(cm)		(deg)	(dB)	(dBm)	(dbm)	(dB)
1055.64	14.64	100	V	180	-13.6	-82.81	-20	58.51
1100.36	14.96	100	V	360	-13.3	-82.49	-20	58.19
1133.69	16.82	100	V	244	-13.2	-80.63	-20	56.33
1040.36	14.77	100	H	355	-13.6	-82.68	-20	58.38

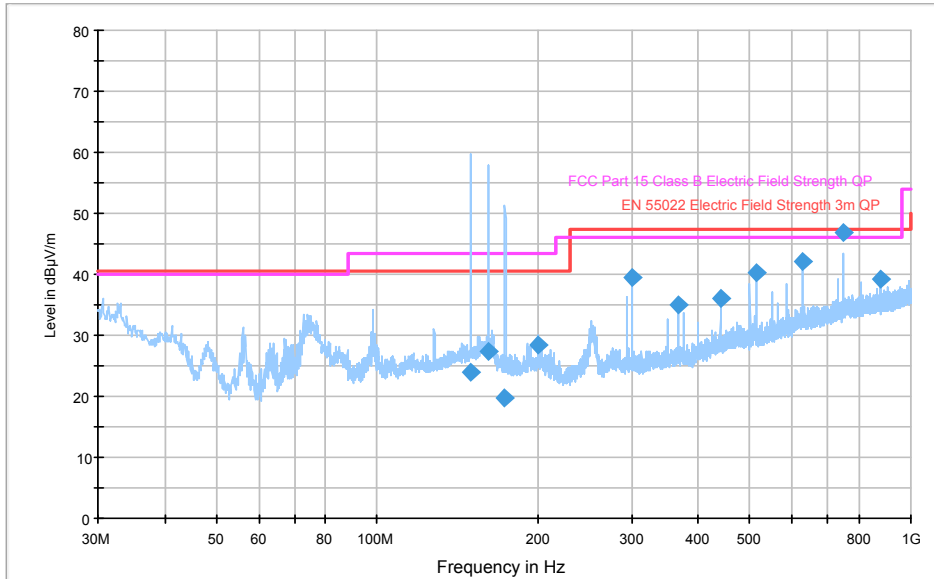
450 MHz transmitter – channels: 450, 481 and 512 MHz Harmonic Emissions

Spurious emissions Below 1 GHz								
Freq.	Corrected Value	Antenna height	Polarity	Turn table	Correction factor	ERP	Limit	Margin
(MHz)	(dBuV)	(cm)	(V/H)	(deg)	(db)	(dBm)	(dbm)	(dB)
900	64.8	100	H	104.6	29.7	-32.61	-20	12.61
962	59.14	100	H	11.4	30.64	-38.31	-20	18.27
200.0146	32.8	133	H	290.0	20.1	-64.61	-20	44.61
625.00404	42.8	149	V	325.0	26.5	-54.61	-20	34.61
732.00464	41.8	137	V	326.0	27.7	-55.61	-20	35.61
834.16764	31.5	184	H	0.0	29.3	-65.91	-20	45.91

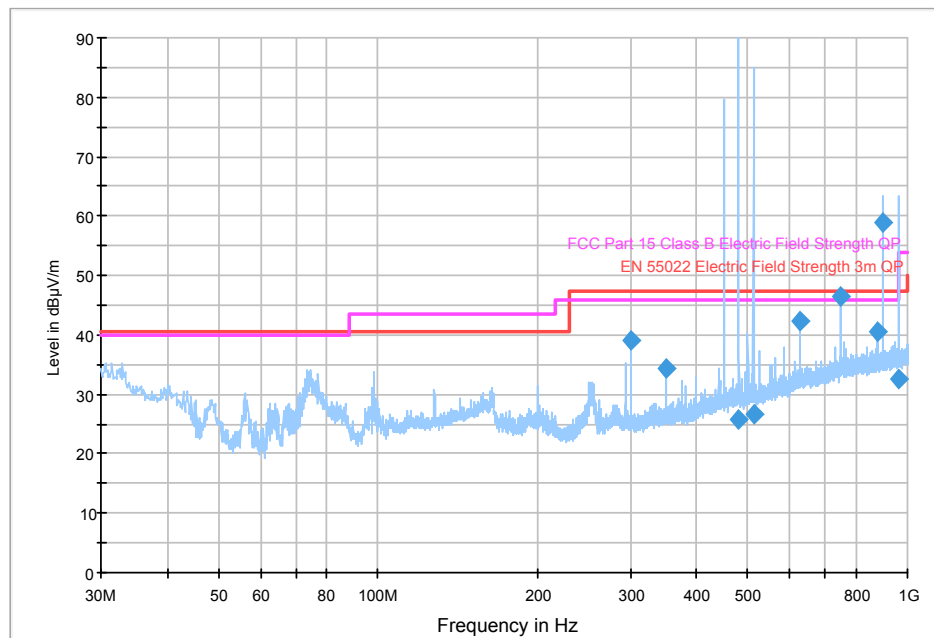
Spurious emissions above 1 GHz								
Freq.	Corrected Value	Antenna height	Polarity	Turn table	Correction factor	ERP	Limit	Margin
(MHz)	(dBuV)	(cm)	(V/H)	(deg)	(db)	(dBm)	(dbm)	(dB)
1024.4	58.4	100	H	186.4	-14.9	-39.01	-20	19.01
1171.18	43.9	100	V	143	-14	-53.51	-20	33.51
1350	48	100	H	124.5	-13.1	-49.41	-20	29.41
1443	58.1	100	H	228.3	-11.7	-39.31	-20	19.31
1536	31.7	100	H	143	-11.2	-65.71	-20	45.71
1610.35	36.9	183.3	H	174.1	-10.8	-60.51	-20	40.51
1756.51	21.1	100	H	280.9	-11.2	-76.31	-20	56.31
1800	36.1	100	V	274.8	-9.9	-61.31	-20	41.31
1924	44.3	113.7	V	322.4	-9.3	-53.11	-20	33.11
2048	24.5	100	H	193.6	-9.3	-72.91	-20	52.91
2250	24.4	153.4	V	188.5	-9.5	-73.01	-20	53.01
2342.4	40.6	100	V	214.6	-9.5	-56.81	-20	36.81
2405	23.3	100	V	162.2	-9.5	-74.11	-20	54.11
4684.8	40.7	120.4	V	199.3	-7.3	-56.71	-20	36.71

Appendix A

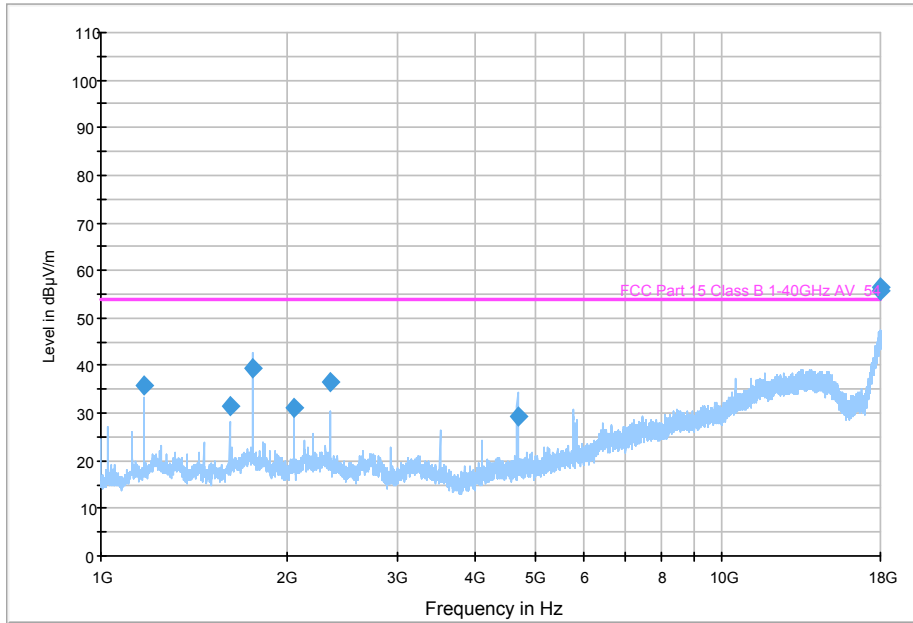
EUT Reference Plots



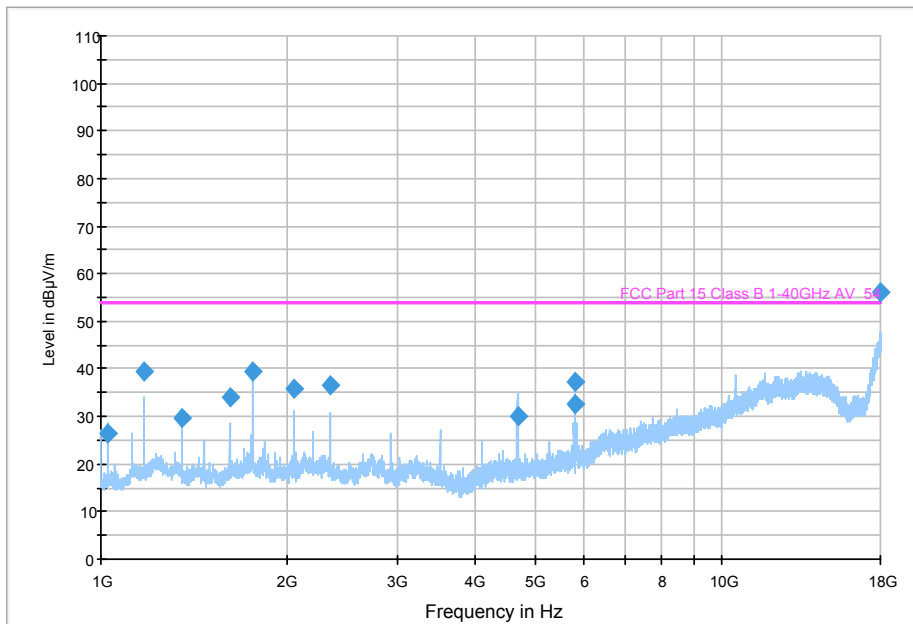
Plot 1: Radiated Emission plots with 150 MHz TX on from 30 to 1000 MHz (for reference only)



Plot 2: Radiated Emission plots with 450 MHz TX on from 30 to 1000 MHz (for reference only)



Plot 3: Radiated Emission plots with 150 MHz TX on from 1 to 18 GHz (for reference only)



Plot 4: Radiated Emission plots with 450 MHz TX on from 1 to 18 GHz (for reference only)

Appendix B

EUT photos during the testing



Picture 1: Radiated Emission test setup in Semi Anechoic Chamber



Picture 2: Radiated Emission test setup in Semi Anechoic Chamber