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Electromagnetic Compatibility
TEST REPORT
Radiated Spurious Emissions Per
FCC Part 2.1053, 90.543(c), 90.691(a), 90.219(e)(1),(3), 20.21(e)(9)(f), 90.210(c),(g),(h)

Report Reference No. .....: E10454-1402A Rev 5.0
Date of issue.....: Oct.08, 2014
Total number of pages.....: 17

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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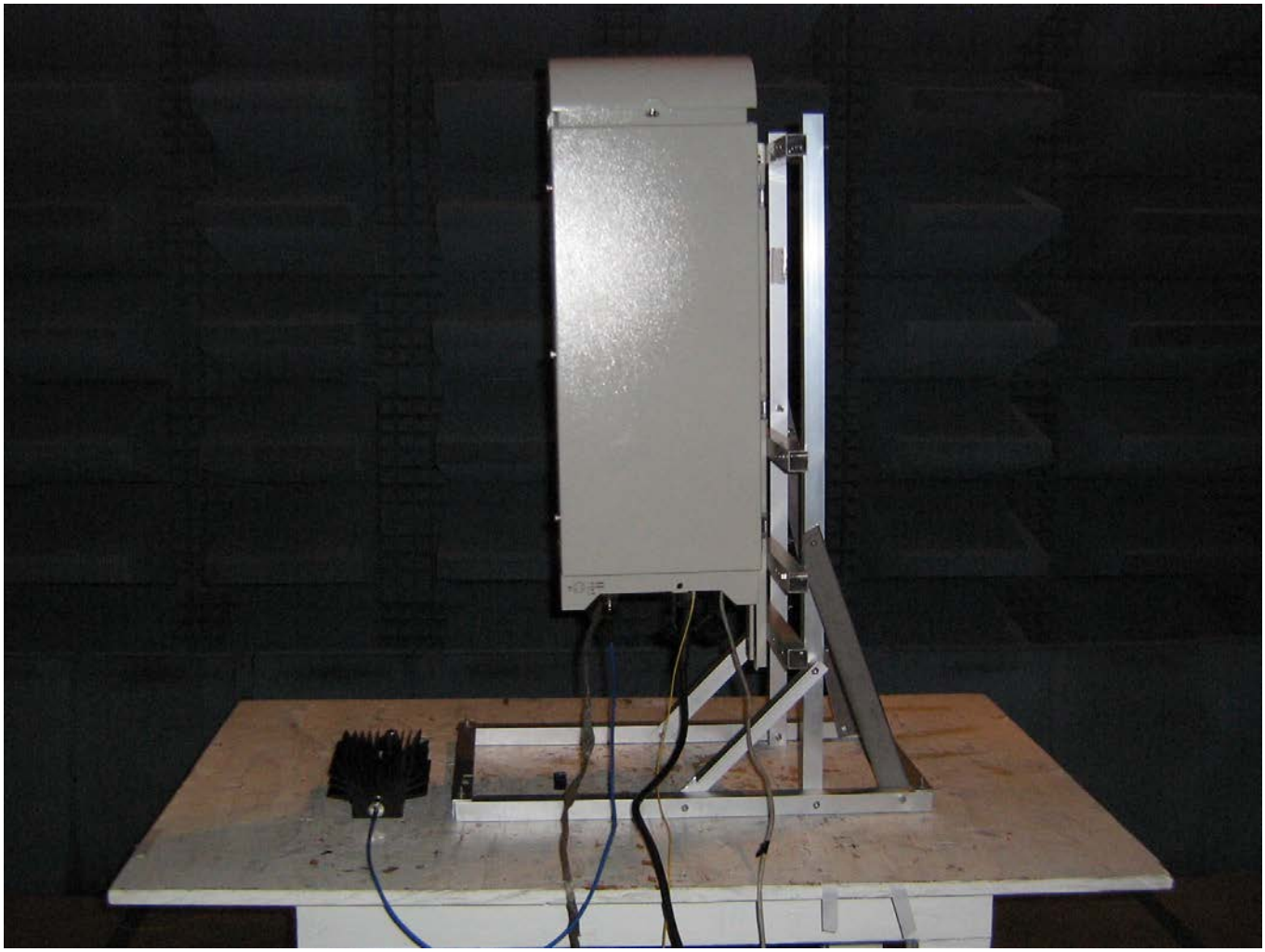
Applicant's name .....: Dali Wireless (Canada), Inc.
Address.....: 8618 Commerce Court Burnaby BC Canada V5A 4N6
Contact.....: Daryl Meerkerk, dmeerkerk@daliwireless.com
Phone.....: (604)420-7760 Fax: (604) 420-7730

Test Standard.....: FCC Part 2.1053, 90.543(c), 90.691(a), 90.219(e)(1),(3), 20.21(e)(9)(f), 90.210(c),(g),(h)

Test item description.....: t43 (Public Safety 700M/800M)
Model.....: t43-DQD-D1D
Trade Mark .....:

Manufacturer.....: Dali Wireless (Canada), Inc.
Registrations: : FCC ID: HCOT43DQDD1A



t43 (Public Safety 700M/800M)

Revision History

Date	Report Number	Rev #	Details	Authors Initials
July 29, 2014	E10454-1402	0.0	Draft Test Report	DJ
July 29, 2014	E10454-1402	1.0	Release Version of Test Report	DJ
July 30, 2014	E10454-1402	2.0	Release Version of Test Report	AJ
Aug 5, 2014	E10454-1402	3.0	Release Version of Test Report with updates as per client's feedback.	AJ
Aug 11, 2014	E10454-1402	4.0	Report released with two FCC IDs as per TCB review.	AJ
Note: All previous versions of this report have been superseded by the latest dated revision as listed in the above table.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.				

Index

Statement of Compliance

The following tests demonstrate the testimony to “FCC” Mark Electromagnetic compatibility testing for “t43 (Public Safety 700M/800M)” manufactured by Dali Wireless (Canada), Inc.

EMISSIONS
United States: Intentional Transmitter (Radiated Spurious Only) CFR 47, FCC Part 2.1053, CFR 47, FCC 90.543(c), CFR 47, FCC 90.691(a), CFR 47, FCC 90.219(e)(1),(3), CFR 47, FCC 20.21(e)(9)(f), CFR 47, FCC 90.210(c),(g),(h)

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 

Updated By Rajinder S. Atwal
RF/EMC Test Engineer

X 

Reviewed By Amandeep Jathaul
RF/EMC Test Engineer

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	
CAB Designation Number: CA9543	
Test Firm Registration #: 388697	
Industry Canada Site Registration Number (SAC-3m)…….: 9543B-1	
Industry Canada Test Site Registration Number (OATS-10m)..: 9543C-1	
Tested by ……..:	David Johanson
Reviewed by……..:	Aman Jathaul
Sample Information:	
Product Name…….....:	t43 (Public Safety 700M/800M)
Part Number……..:	t43-DQD-D1D
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 – 21-22July 2014:	Temperature: 23ºC R.H.: 40.0%
Outdoor – 23 July 2014:	Temperature: 17ºC R.H.: 60.0%

Measurement Uncertainty

Radio Frequency .....: ±1,5 x 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.....: ±1ºC

Humidity.....: ±5 %

DC and low frequency voltages.....: ±3 %

Test Equipment List

OATS Equipment List

Manufacturer	Model	Description	Serial No.	Last Cal	Cal Due Date
Sunol Sciences	SM46C	Turntable	051204-2	N/A	N/A
QAI	custom	Mast	custom	N/A	N/A
Sunol Sciences	JB3	Biconilog Antenna 30MHz – 3GHz	A042004	31-Oct-2012	31-Oct-2015
AILTECH/Eaton	94455-1	Biconical Antenna 20-200MHz	0931	10-Mar-2012	10-Mar-2015
EMCO	93146	Log Periodical Antenna 200-1000MHz	9811-5136	10-Mar-2012	10-Mar-2015
Rohde & Schwarz	ESCI	EMI Receiver	1000123	29-Mar-2012	29-Mar-2015

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 all-digital, high power, dual-band radio remote, t43ps, (43 dBm, 20 W) is designed for distributed antenna systems applications. 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 can be easily combined with a second unit to create a compact, integrated quad-band transceiver. It also accommodates 1Gb/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 t43 (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 EUT has both an AC power option as well as a battery option. The Battery is used as a power back up in the event of an AC power failure. For this testing, the DC mode was tested using a DC power supply.
There was an extra multiple pin connector that was available but it was not used since it is designed for factory setup only.
All radiated emissions were done with the EUT in the vertical orientation connected to a 50dB attenuator with a 50Ohm termination.

Equipment Under Test Information

Manufacturer	Dali Wireless (Canada), Inc.
Product Name	t43 (Public Safety 700M/800M)
Model Name	t43-DQD-D1D
Serial No.	15737338E01B 47001
Firmware Version	R1.8.0
FCC ID	HCOT43DQDD1A

tHost

Manufacturer	Dali Wireless (Canada), Inc.
Product Name	(Public Safety VHF/UHF/700M/800M
Model Name	tHost-QVUQD-SS8S
Serial No.	15477513E01B47001
Firmware Version	R1.8.0

RF Frequency generator

Manufacturer	Agilent
Product Name	Vector Signal Generator 100kHz-6GHz MXG
Model Name	N5182A
Serial No.	MY50140960

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 Cord (black connector to black cable)	3	Custom 4 pin threaded plastic circular connector to NEMA-15 AC Plug	No	No	No
DC Power Cord (green connector to black cable)	2	Custom 4 pin Metal (MIL-STD) threaded Circular connector to bare wire	No	No	No
Ethernet Cable (beige)	8	RJ-45	No	No	No
Single SMF Optical Fiber cable (yellow)	1	SMF	No	No	No
RG-256 Coax Cable (blue)	1	N	No	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: July 23, 2014

TEST STANDARD: FCC Part 2.1053, 90.543(c), 90.691(a), 90.219(e)(1),(3), 20.21(e)(9)(f), 90.210(c),(g),(h)

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.

for the 700MHz and the 800MHz transmitters, the following Intentional Transmitter emissions limitations apply:

Part 90.219– Emission Limits

(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.

(1) The output power capability of a signal booster must be designed for deployments providing a radiated power not exceeding 5 Watts ERP for each retransmitted channel.

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

Part 90.210 – Emission Masks

c) *Emission Mask C.* For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:

(3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

(g) *Emission Mask G.* For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

(2) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

(h) *Emission Mask H.* For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

(5) On any frequency removed from the center of the authorized bandwidth by more than 25 kHz: At least 43 + log (P) dB.

Part 90.543 – Emission Limitations

Transmitters designed to operate in 769-775 MHz and 799-805 MHz frequency bands must meet the emission limitations in paragraphs (a) through (d) of this section. Transmitters operating in 758-768 MHz and 788-798 MHz bands must meet the emission limitations in (e) of this section.

(c) Out-of-band emission limit. On any frequency outside of the frequency ranges covered by the ACP tables in this section, the power of any emission must be reduced below the mean output power (P) by at least 43 + 10log (P) dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

(e) For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least 43 + 10 log (P) dB

Part 90.691- Emission Mask.

(a) Out-of-band emission requirement shall apply only to the "outer" channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log_{10}(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.Part 20.21- Emission Limitations.

(e) *Consumer Signal Booster Network Protection Standard.* (1) All Consumer Signal Boosters must incorporate features to prevent harmful interference to wireless networks including but not limited to those enumerated in this section.

(9) *Provider-Specific Consumer Signal Boosters.* A Provider-Specific Consumer Signal Booster will meet the Consumer Signal Booster Network Protection Standard if it complies with paragraphs (e)(1) through (e)(7) of this section and the following:

(F) *Out of Band Emission Limits.* Booster out of band emissions (OOBE) shall meet the FCC's mobile emission limits for the supported bands of operation. Compliance to OOBE limits will utilize high peak-to-average CMRS signal types

TEST SETUP: The EUT was tested in our 3 m SAC and was positioned on the center of the turntable and powered up. The Transmitter Output was connected to its on-board fixed antenna. The transmitter was set for continuous transmission. The lowest, middle and highest channels were measured for all radiated emissions 10kHz to 10 GHz. The EUT was tested in its normal vertical orientation on the table top as indicated in the test photos.

During testing, it was identified that the radiated emissions from the transmitter are higher when in DC battery mode of operation. Measurements were taken in both modes of operation, but only the DC mode is reported.

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 20 Watts (43dBm) on the transmitter output. The attenuation levels to show the limit lines are:
43 + 10log(20) = 56dB attenuation = -13dBm

The lowest limit line is -13dBm ERP.

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:

EIRP (dBm) = -104.8 + E_0 (dBuV/m) + 20 log D_0 (m)

EIRP (dBm) = E_0 (dBmV/m) + (20 log (3)) -104.8 = E_0 (dBmV/m) - 95.3

ERP = EIRP – 2.15 dB.

E(dBuV/m) = P(dBmEIRP) +2.15 + 95.3 = -13 +2.15 + 95.3 = 84dBuV

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.

700MHz Transmitter – Channels: 758.01; 766.5; 774.96 Harmonic Emissions

Freq.	Raw Measured	Antenna height	Polarity	Turn table	Antenna Factor	Amp/cable Corrections (+Loss) (-Gain)	Signal Strength at 3m	ERP	Limit	Margin
(MHz)	(dBuV)	(cm)	(V/H)	(deg)	(dB)	(db)	(dBuV)	(dBm)	(dbm)	(dB)
1516.20	29.9	**124**	**V**	0	24.6	-30.4	**24.1**	-73.35	-13	-60.35
2274.30	33	**160.5**	**V**	0	25.2	-30	**28.2**	-69.25	-13	-56.25
3032.40	32.6	**134.2**	**V**	330.5	26	-29.8	**28.8**	-68.65	-13	-55..65
3790.50	24.3	**100**	**V**	360	27.9	-28.4	**23.8**	-73.65	-13	-60.65
1533.00	31.3	**124**	**H**	20.5	24.6	-30.4	**25.5**	-71.95	-13	-58.95
2299.50	35.8	**133.2**	**V**	0	25.2	-30	**31**	-66.45	-13	-53.45
3066.00	39.4	**131.2**	**V**	348.3	26	-29.8	**35.6**	-61.85	-13	-48.85
3832.50	26.3	**100**	**V**	0	27.9	-28.4	**25.8**	-71.65	-13	-58.65
4599.00	28.5	**125.3**	**V**	330	29.5	-27.5	**30.5**	-66.95	-13	-53.95

1549.92	30	**100**	**V**	298.4	24.6	-30.4	**24.2**	-73.25	-20	-60.25
2324.70	37	**105**	**V**	0	25.2	-30	**32.2**	-65.25	-20	-52.25
3099.60	39.6	**100**	**V**	332	26	-30	**35.6**	-61.85	-20	-48.85
3874.80	26.2	**100**	**V**	5	27.9	-28.3	**25.8**	-71.65	-20	-58.65

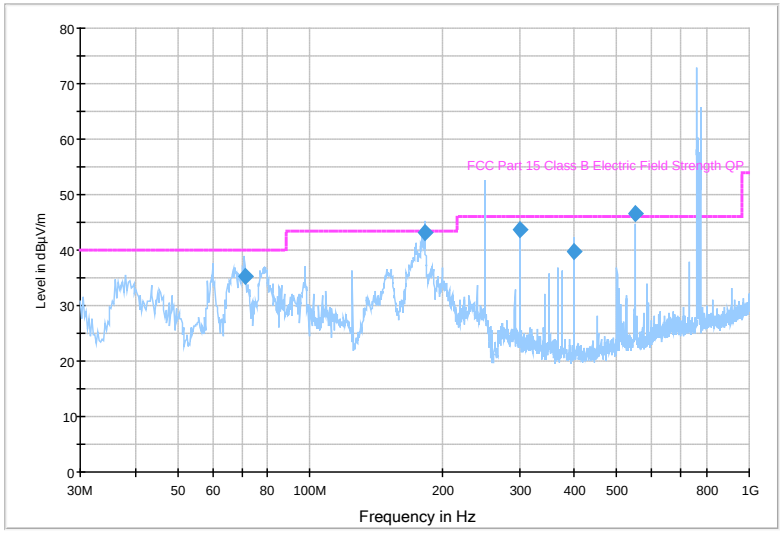
800 MHz transmitter – channels: 851.100; 860.000; 868.900MHz Harmonic Emissions

Freq.	**Raw Measured**	**Antenna height**	**Polarity**	**Turn table**	**Antenna Factor**	**Amp/cable Corrections (+Loss) (-Gain)**	**Signal Strength at 3m**	**ERP**	**Limit**	**Margin**
(MHz)	**(dBuV)**	**(cm)**	**(V/H)**	**(deg)**	**(dB)**	**(db)**	**(dBuV)**	**(dBm)**	**(dbm)**	**(dB)**
1702.20	31.9	**141.5**	**V**	328	24.6	-30.4	**26.1**	-71.35	-13	-58.35
2553.30	32.5	**115.4**	**V**	325	25.2	-30	**27.7**	-69.75	-13	-56.75
3404.40	31.3	**100**	**V**	215.6	26	-30	**27.3**	-70.15	-13	-57.15
4255.50	28.7	**100**	**V**	350	27.9	-28.3	**28.3**	-69.15	-13	-56.15

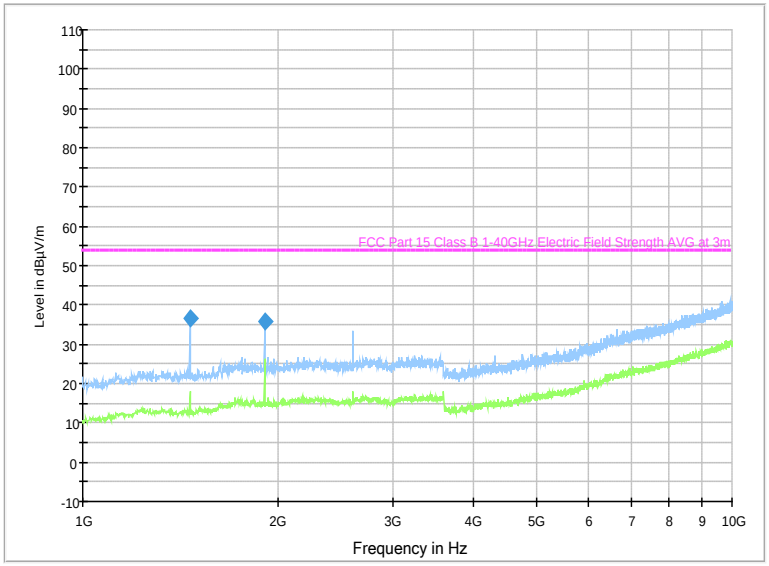
1720.00	31.6	**105**	**V**	295	24.6	-30	**26.2**	-71.25	-13	-58.25
2580.00	32.3	**104**	**V**	311.4	25.2	-29.9	**27.6**	-69.85	-13	-56.85
3440.00	29.8	**100**	**V**	330	26	-28.5	**27.3**	-70.15	-13	-57.15
1737.80	31.7	**100**	**V**	330	24.6	-30	**26.3**	-71.15	-13	-51.15
2606.71	39	**100**	**V**	310	25.2	-29.9	**34.3**	-63.15	-13	-43.15
3475.60	29.2	**100**	**v**	192	26	-28.5	**26.7**	-70.75	-13	-57.75

Appendix A

EUT Reference Plots



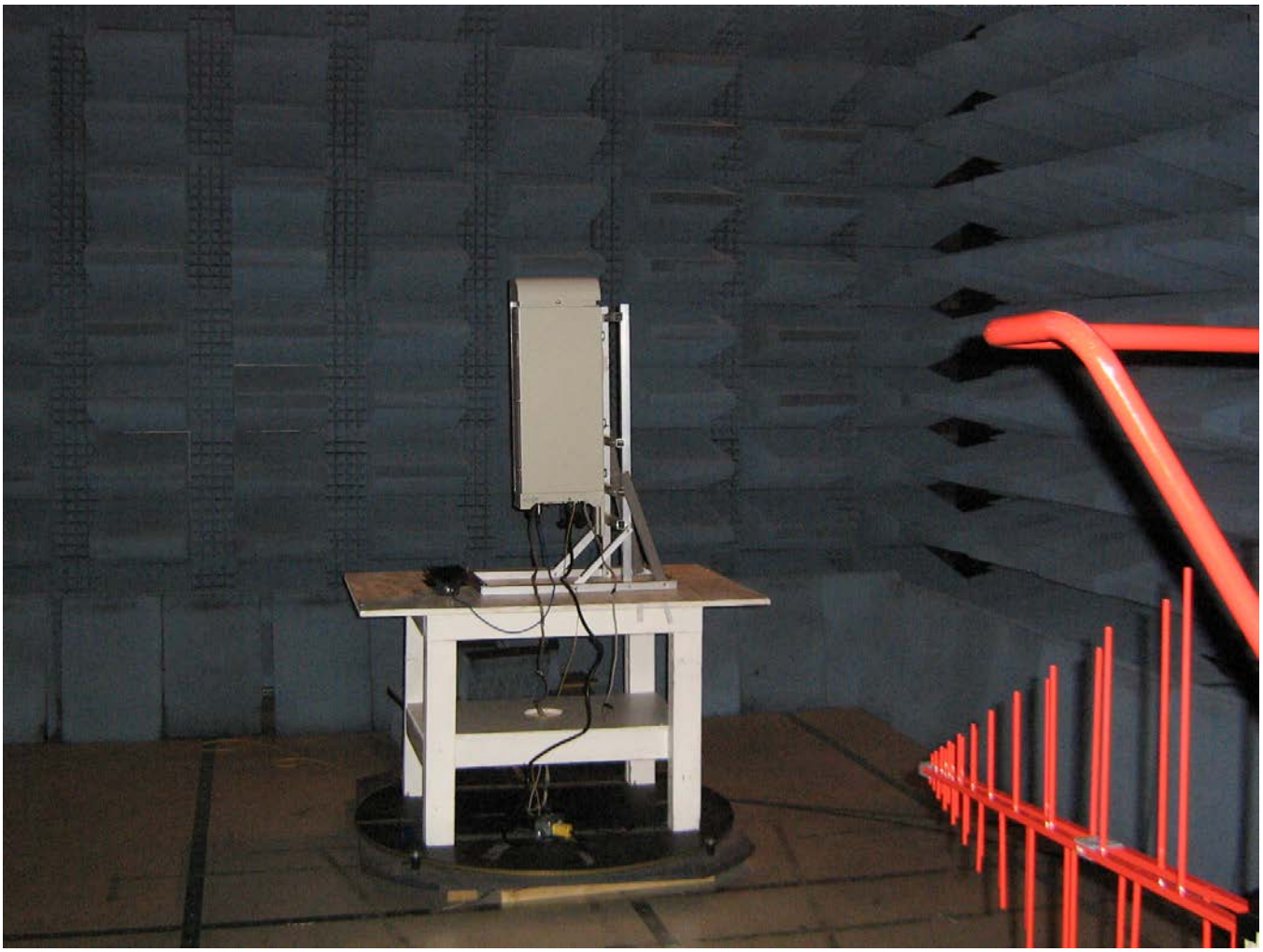
Plot 1: Radiated Emission plots with 700 MHz TX on from 30 to 1000 MHz (for reference only)



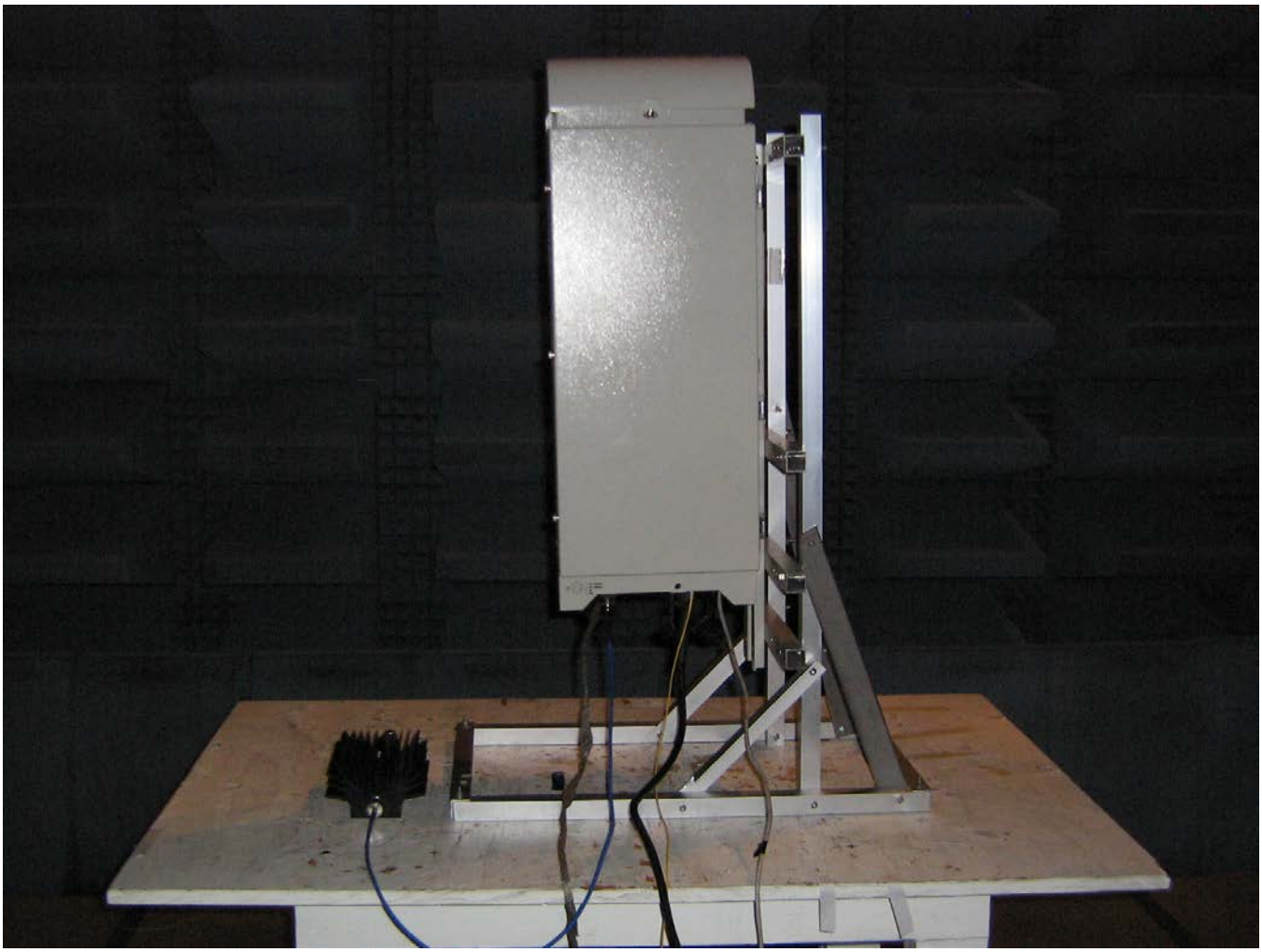
Plot 2: Radiated Emission plots with 800 MHz TX on from 1 to 10 GHz (for reference only)

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