Electromagnetic Compatibility Test Report

Prepared in accordance with

CFR 47 Part 15C, RSS-210 Issue 7

On

Hand Held Terminal Bluetooth transmitter

MX7 TECTON

LXE, Inc.
125 Technology Parkway
Norcross, GA 30092

Prepared by:

TUV Rheinland of North America, Inc.

Manufacturer's statement / attestation

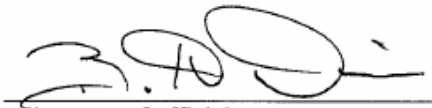
The manufacturer; LXE, A Division of EMS Technologies, as the responsible party for the equipment tested; hereby affirms:

a) That he/she has reviewed and concurs that the test shown in this report are reflective of the operational characteristics of the device for which certification is sought;

b) That the device in this test report will be representative of production units;

c) That all changes (in hardware and software/firmware) to the subject device will be reviewed.

d) That any changes impacting the attributes, functionality or operational characteristics documented in this report will be communicated to the body responsible for approving (certifying) the subject equipment.

Bruce Douglas	
Printed name of official	Signature of official
LXE, Inc. 125 Technology Parkway Norcross, GA 30092	02 December 2010
Address	Date
770-447-4224	Davis.b@lxe.com
Telephone number	Email address of official

Client:	LXE, Inc. 125 Technology Parkway Norcross, GA 30092	Bruce Douglas 770-447-4224 X3456 / 770-447-6928 davis.b@lxe.com	
Identification:	Hand Held Terminal	***Serial No.:***	MX710167801 and MX710167802
Test item:	MX7 TECTON	***Date tested:***	12 November 2010
Testing location:	TUV Rheinland of North America 762 Park Avenue Youngsville, NC 27596-9470 U.S.A.	Tel: (919) 554-3668 Fax: (919) 554-3542	
Test specification:	**Emissions:** FCC Part 15, Subpart C, RSS-210 Issue 7: FCC Part 15.207(a) and RSS-GEN, 7.2.2 FCC Parts 15.205, 15.209, 15.215(c), RSS-210 FCC Part 15.247(a)(1), RSS-210 A8.1(a), and RSS-GEN 4.6.1, FCC Part 15.247 and RSS-210 Annex 8, FCC Part 15.247(a)(1)(iii), RSS-210, Section A8.1 FCC Part 15.247(b)(1) and RSS-210 A8.1(b), FCC Part 15.247(b)(1) and RSS-210 A8.4(2), FCC Part 15.247(g) and RSS-210 A8.1, FCC Part 15.247(h) and RSS-210 A8.1, FCC Part 15.31(e) FCC Parts 15.109(a) and RSS-210 2.2, 2.6,A8.5, RSS-GEN 7.2.3.2, FCC Part 2.1093 and RSS-102, Issue 4		
Test Result	**The above product was found to be Compliant to the above test standard(s)**		
tested by: Mark Ryan		***reviewed by:*** Robert Richards	
15 December 2010 ***Signature***		Digitally signed by Bob Richards Date: 2010.12.15 14:23:52 -05'00' 15 December 2010 ***Signature***	
Other Aspects:	**None**		

Abbreviations: OK, Pass, Compliant, Complies = passed Fail, Not Compliant, Does Not Comply = failed N/A = not applicable

90552 and 100881	**NVLAP Lab Code (200094-0)**	**Industry Canada** **IC-2932H**

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1 General Information

1.1 Scope

This report is intended to document the status of conformance with the requirements of the CFR 47 Part 15C, RSS-210 Issue 7 based on the results of testing performed on 12 November 2010 on the Hand Held Terminal, Model No. MX7 TECTON, manufactured by LXE, Inc.. This report only applies to the specific samples tested under the stated test conditions for the Bluetooth transmitter only. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT (Equipment Under Test) in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

1.3 *Summary of Test Results*

Applicant	LXE, Inc. 125 Technology Parkway Norcross, GA 30092	**Tel**	770-447-4224 X3456	**Contact**	Bruce Douglas
		Fax	770-447-6928	**e-mail**	davis.b@lxe.com

Description	Hand Held Terminal	**Model Number**	MX7 TECTON
Serial Number	MX710167801 and MX710167802	**Test Voltage/Freq.**	100-240VAC 50/60Hz
Test Date Completed:	12 November 2010	**Test Engineer**	Mark Ryan

Standards	Description	Severity Level or Limit	Results	Test Result
FCC Part 15, Subpart C Standard	Radio Frequency Devices-Subpart C: Intentional Radiators	See called out basic standards below	See Below	**Complies**
RSS-210 Issue 7 Standard	Low-Power Licence-exempt Radiocommunication Devices Category I Equipment	See called out basic standards below	See Below	**Complies**
FCC Parts 15.205, 15.209, 15.215(c), RSS-210	Radiated Emissions EUT in Transmit Mode	Below limit of sections 15.205, 15.209(a) and 15.215(c)	49.8 dBµV	Complies
FCC Part 15.207(a) and RSS-GEN, 7.2.2	Conducted Emissions on Mains EUT in Transmit Mode	15.207(a) limits, 150kHz - 30MHz	53.19 dBµV	Complies
FCC Part 15.247 and RSS-210 Annex 8	Operation within the band 2400-2483.5 MHz	See called out basic standards below	--	Complies
FCC Part 15.247(a)(1)(iii), RSS-210, Section A8.1	Channel Seperation	Minimum 15 channels	1.0 MHz (79 channels)	Complies
FCC Part 15.247(b)(1) and RSS-210 A8.1(b)	Pseudorandom Hoppong Algorithm	≥ 75 hopping channels	Bluetooth v2.1 protocol	Complies
FCC Part 15.247(a)(1), RSS-210 A8.1(a), and RSS-GEN 4.6.1	Occupied Bandwidth	6dB ≥ 500 kHz 20dB (ref. for channel separation) 99% BW ≤ 500 kHz	501 kHz 1.14 MHz 1.05 MHz	Complies
FCC Part 15.247(d) and RSS-210 A8.5	Band Edge	Ensure 20dB bandwidth is Contained within the Frequency Band	>20dB BW is contained	Complies
FCC Part 15.247(b)(1) and RSS-210 A8.4(2)	Transmitter Output Power	Shall not exceed 1.0 Watts	0.001 W	Complies
FCC Part 15.247(g) and RSS-210 A8.1	Frequency Hopping Spread Spectrum (FHSS) Systems	Description of Hopping System	Bluetooth v2.1 protocol	Complies
FCC Part 15.247(h) and RSS-210 A8.1	Incorporation of Intelligence within a FHSS System	Not Applicable: EUT does not incorporate hopping intelligence	NA	NA
FCC Part 15.31(e) and RSS-210, 2.1	Voltage Requirements	Output at 0.85% and 1.15% of Rated Voltage	5 kHz	Complies
FCC Parts 15.109(a) and RSS-210 2.2, 2.6,A8.5, RSS-GEN 7.2.3.2	Radiated Emissions while EUT in Receive Mode	Below limit of section 15.109(a) Class B	39.77 dBµV	Complies
FCC Part 2.1093 and RSS-102, Issue 4	RF Exposure	SAR or MPE Requirements	Below Limit	Complies

2 Laboratory Information

2.1 Accreditations and Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America located at 762 Park Avenue, Youngsville, NC 27596-9470 is accredited by the commission for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (Registration No 90552 and 100881). The laboratory scope of accreditation includes: Title 47 CFR Part 15, and 18. The accreditation is updated every 3 years.

2.1.2 NIST / NVLAP

Program, which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Standard 17025:2005 (Lab code: 200094-0). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 Industry Canada

Registration No.: IC-2932H The OATS has been accepted by Industry Canada to perform testing to 3 and to 10m, based on the test procedures described in ANSI C63.10-2009.

2.1.4 Japan – VCCI

The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland at the 762 Park Ave. Youngsville, N.C 27596 address has been assessed and approved in accordance with the Regulations for Voluntary Control Measures. (Registration No. R-1174, R-1679, C-1790 and C-1791).

2.1.5 Sample Calculation – radiated & conducted emissions

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength (dBμV/m) = RAW - AMP + CBL + ACF

Where: RAW = Measured level before correction (dBμV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

25 dBuV/m + 17.5 dB – 20 dB + 1.0 dB = 23.5 dBuV/m

2.2 Measurement Uncertainty Emissions

	U_{lab}	U_{cispr}
Radiated Disturbance @ 10m		
30 MHz – 1,000 MHz	3.3 dB	5.2 dB
Conducted Disturbance @ Mains Terminals		
150 kHz – 30 MHz	1.18 dB	3.6 dB
Disturbance Power		
30 MHz – 300 MHz	3.88 dB	4.5 dB

2.3 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Standard 17025:2005. Equipment calibration records are kept on file at the test facility.

2.4 Measurement Equipment Used

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal dd/mm/yy	Next Cal dd/mm/yy
Radiated RF Emissions (5 Meter Chamber)					
Amplifier, preamp	Agilent Technologies	8449B	3008A01480	24-Feb-10	24-Feb-11
Antenna Horn 1-18GHz	EMCO	3115	2236	12-Mar-09	12-Mar-11
Antenna Horn 18 - 26.5 GHz					
Receiver, EMI	Rohde & Schwarz	ESIB40	100043	11-Jul-10	11-Jul-11
Spectrum Analyzer	Agilent Tec.	E7405A	US39440157	04-Dec-09	04-Dec-10
Cable, Coax	MicroCaox	MKR300C-0-0-1200-500500	002	07-Sept-10	07-Sept-11
Cable, Coax	Andrew	FSJ1-50A	003	14-Dec-09	14-Dec-10
Cable, Coax	Andrew	FSJ1-50A	030	14-Dec-09	14-Dec-10
1.5 GHz High Pass Filter	Bonn Electronik	BHF 1500	025155	16-Feb-10	16-Feb-11
Conducted Emissions (AC/DC and Signal I/O)					
LISN 15-18 (NSLK 8126)	Schwarzbeck Mess-Electronik	NSLK 8126	003885	12-Jan-10	12-Jan-11
Transient Limiter	Schaffner	CFL-9206	1649	09-Dec-09	09-Dec-10
Spectrum Analyzer	Agilent Tec.	E7405A	US39440157	04-Dec-09	04-Dec-10
Cable, Coax	Pasternack	RG-223	051	09-Dec-09	09-Dec-10
General Laboratory Equipment					
Meter, Digital Multi	Fluke	179	90580752	01-Dec-10	01-Dec-11
Meter, Temp/Humid/Barometer	Fisher	02-400	01	28--Dec-09	28--Dec-10

3 Product Information

3.1 Product Description

The MX7 TECTON is a rugged handheld computer intended for Industrial data-collection and tracking applications. The MX7 TECTON includes optional:

1. Keypad
   a. 55-key
   b. 32-key
2. Cold Storage Option
   a. Scanner/Imager Window & Touch screen defrosters
3. Battery
   a. 2400mAh 7.2V Li-Ion Battery
   b. 1400mAh Li-Ion Battery (Cold Storage Option)
4. Barcode Laser scanners
   a. Standard Range
   b. All Range
5. Barcode Imager
   a. 1D
   b. 2D
6. Radio
   a. Bluetooth v2.1
   b. Wi-Fi with 2.4 GHz / 5.0GHz 802.11 a/b/g
7. Handle
8. Rubber boot
9. Zip-on Carrying case with or without shoulder strap
10. Holster

The Equipment Under Test (EUT); the MX7 series of Hand Held Terminals utilize a Concord Electonic model CM-1BC04-003 Bluetooth transceiver module designed for use in OEM products, where the designers desire a pre-manufactured Bluetooth wireless solution.

The Wi-Fi radio is a pre-approved module that contains its own voltage regulation, and buffered I/O. Therefore, this report will concentrate only on the Bluetooth module.

The transmitters' RF power levels are set to a fixed leveling a calibration step during manufacturing, and cannot be changed by the user.

3.2 Equipment Modifications

No modifications were needed to bring product into compliance.

4 Transmitter Emission Measurements

4.1 Spurious Emissions Outside the band - FCC 15.247(d), RSS-210 A8.5

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power, based on either RF conducted or radiated measurements.

4.1.1 Over View of Test

Results	**Complies** (as tested per this report)					**Date**	15 October 2010
Standard	FCC Parts 15.205, 15.209, 15.215(c), 15.247(d), RSS-210 A8.5, and RSS-GEN 7.2.3.2						
Product Model	MX7 TECTON			**Serial#**	MX710167801 and MX710167802		
Test Set-up	Tested in a 5m Semi Anechoic chamber, placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane on a turn-table. See test plans for details						
EUT Powered By	100-240VAC 50/60Hz	**Temp**	74 ºF	**Humidity**	36%	**Pressure**	1000 mbar
Perf. Criteria	(Below Limit)			**Perf. Verification**	Readings Under Limit		
Mod. to EUT	None			**Test Performed By**	Mark Ryan		

4.1.2 Test Procedure

Testing was performed in accordance with 47 CFR Part 15, ANSI C63.10:2009, RSS-GEN Issue 2. These test methods are listed under the laboratory's NVLAP Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

4.1.3 Deviations

The test samples received were not modified with a direct measurement port. Therefore 3m radiated emissions were made for this measurement.

4.1.4 Final Test

All final radiated spurious emissions measurements were below (in compliance) the limits.

The worst –case emissions are shown below. All other emissions are on file at TUV Rheinland.

4.1.4.1 Emissions Outside the Frequency Band

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power, based on either RF conducted or radiated measurements. Radiated antenna emission measurements are provided below to show that the EUT meets these requirements at the band edges.

Three orientations of the EUT investigated for highest emissions:

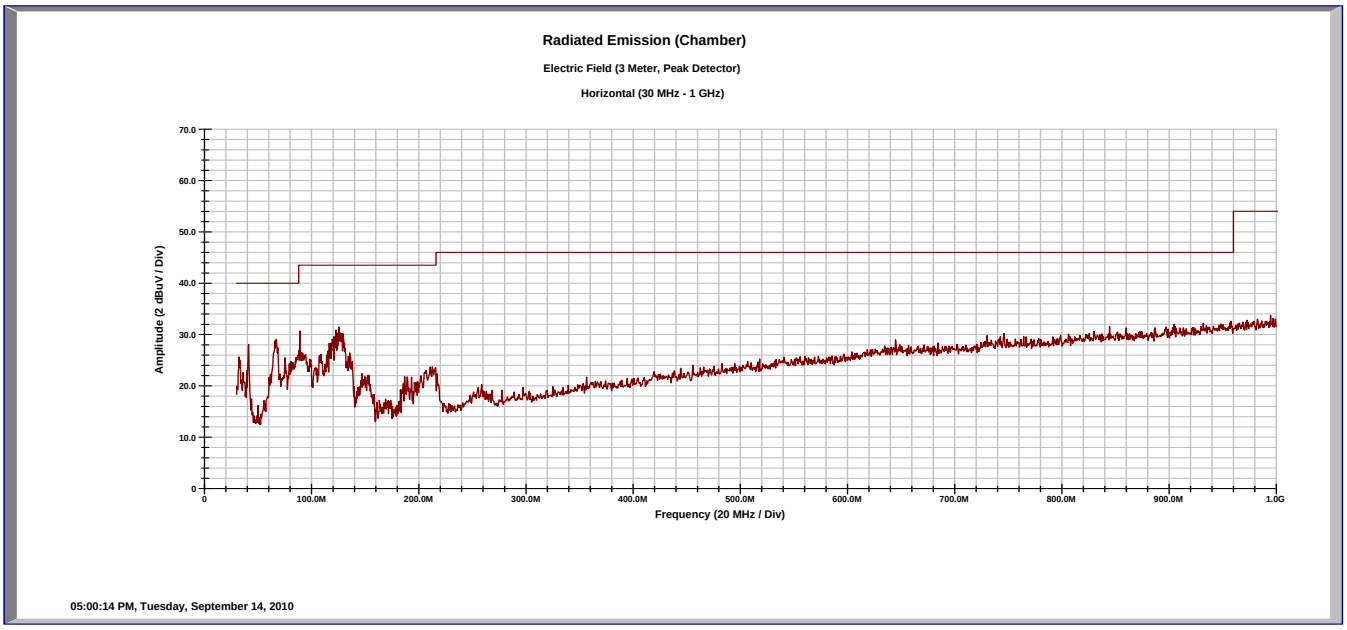
Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	QP FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Orientation
CH 0:									
2402.00	H	1.3	117	61.24	0.00	5.81	28.32	95.36	1
2402.00	V	1.1	167	59.60	0.00	5.81	28.21	93.62	1
2402.00	H	1.1	154	57.23	0.00	5.81	28.32	91.35	2
2402.00	V	1.0	344	60.45	0.00	5.81	28.21	94.47	2
2402.00	H	1.4	157	60.54	0.00	5.81	28.32	94.66	3
2402.00	V	1.0	149	56.96	0.00	5.81	28.21	90.98	3
CH 36:									
2441.00	H	1.2	147	61.70	0.00	5.85	28.39	95.94	1
2441.00	V	1.4	136	58.12	0.00	5.85	28.24	92.22	1
2441.00	H	1.4	151	56.48	0.00	5.85	28.39	90.72	2
2441.00	V	1.0	11	59.95	0.00	5.85	28.24	94.05	2
2441.00	H	1.3	157	61.24	0.00	5.85	28.39	95.48	3
2441.00	V	1.0	65	57.99	0.00	5.85	28.24	92.09	3
CH 78:									
2480.00	H	1.5	145	63.86	0.00	5.89	28.46	98.21	1
2480.00	V	1.1	168	61.06	0.00	5.89	28.28	95.23	1
2480.00	H	1.0	155	56.79	0.00	5.89	28.46	91.14	2
2480.00	V	1.0	337	60.47	0.00	5.89	28.28	94.64	2
2480.00	H	1.4	51	59.92	0.00	5.89	28.46	94.27	3
2480.00	V	1.0	66	58.60	0.00	5.89	28.28	92.77	3

NOTE: Orientation 1 of CH 78 produced the highest emission at the fundamental frequency (see highlighted). Red Emissions are Orientation 1, Green Emissions are Orientation 2, and Blue Emissions are Orientation 3 Refer to the test setup photos for views of the three orientations.

All four models of the LXE were investigated. All four models produced very similar emissions. This model produced slightly higher emissions, so this model will be used for all intentional radiator tests.

Worst-Case Radiated Emissions 30MHz to 1000MHz

Horizontal

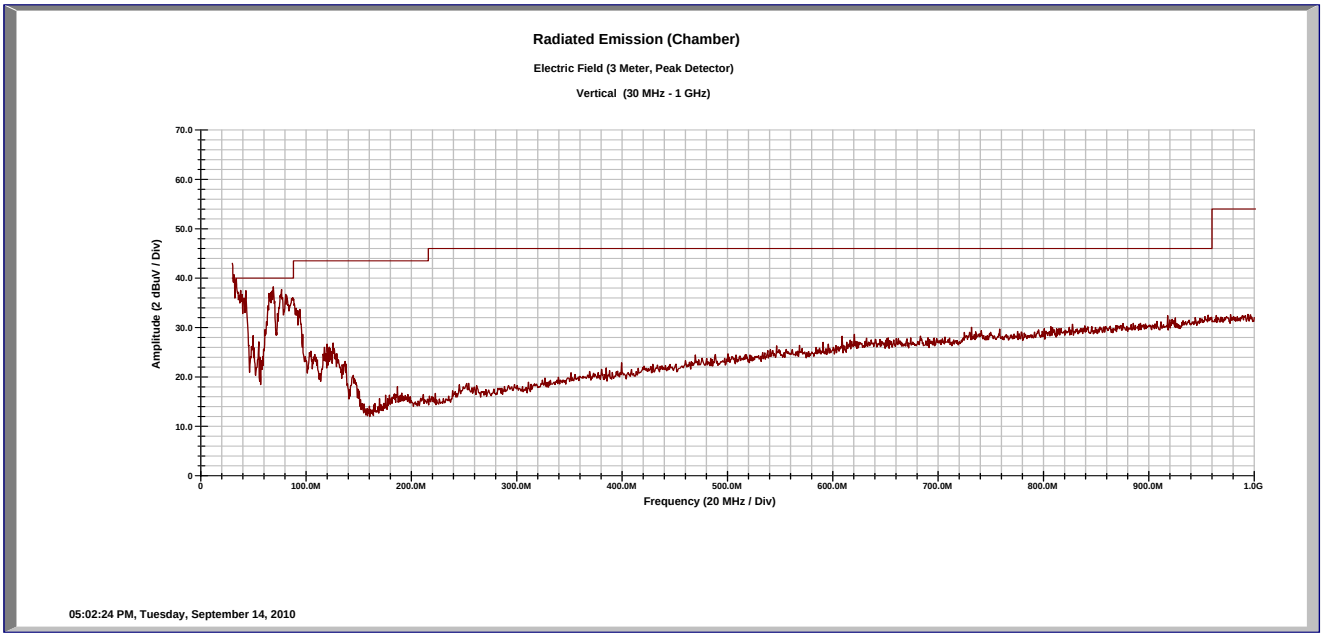


Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
32.40	H	4	112	12.28	0.00	0.64	6.09	19.01	40.00	-20.99
40.90	H	1	98	18.46	0.00	0.72	9.31	28.49	40.00	-11.51
89.61	H	2.5	257	25.27	0.00	1.01	6.67	32.95	43.50	-10.55
125.73	H	1.7	274	20.49	0.00	1.19	7.41	29.10	43.50	-14.40
208.20	H	1	260	9.75	0.00	1.55	10.49	21.79	43.50	-21.71

Notes: The Emissions shown are virtually identical to the emissions when both Bluetooth and Wi-Fi transmitters are all off. No effect of the transmitter can be discerned. The emissions from the low mid and high channel evaluated have very similar results.

Worst-Case Radiated Emissions 30MHz to 1000MHz

Vertical

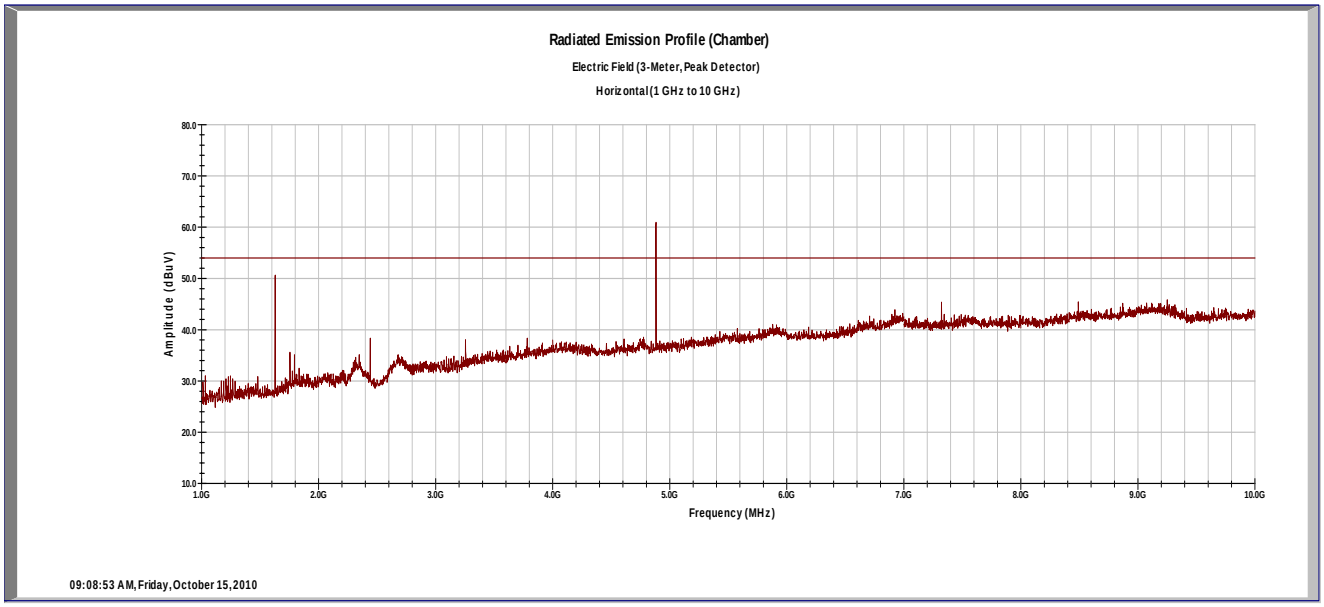


Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
30.12	V	1.3	112	33.55	0.00	0.61	4.18	38.34	40.00	-1.66
67.50	V	1	215	20.76	0.00	0.92	7.85	26.53	40.00	-13.47
89.10	V	1	317	19.07	0.00	1.06	6.71	26.84	43.50	-16.66

Notes: The Emissions shown are virtually identical to the emissions when both Bluetooth and Wi-Fi transmitters are all off. No effect of the transmitter can be discerned. The emissions from the low mid and high channel evaluated have very similar results.

Worst-Case Radiated Emissions 1GHz to 10GHz

Horizontal



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
1628.00	H	1.2	153	57.61	35.83	6.04	25.74	51.56	54.00	-1.44
4882.00	H	1	133	38.40	35.49	11.22	32.96	47.10	54.00	-6.90
1628.00	H	1.2	153	59.97	35.83	6.04	25.74	55.92	74.00	-18.08
4882.00	H	1	133	52.99	35.49	11.22	32.96	61.69	74.00	-12.31

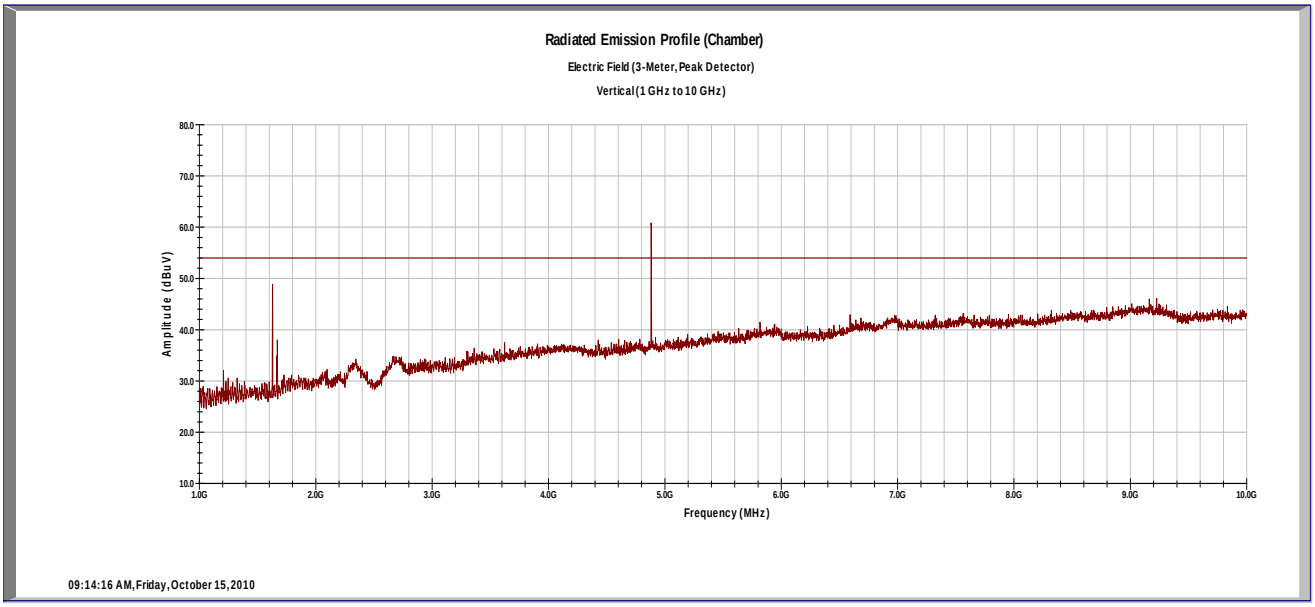
Notes: The low, medium, and high band channels were investigated. The mid band produced the worst-case spurious and harmonic emissions, as shown here. The other two scans are on file at TUV Rheinland.

Emissions shown in **Green** were measured using the Average detector, per FCC part 15.35(b).
The Emissions shown in **Blue** were measured using the Peak detector, per FCC part 15.35(b).

ALL EMISSIONS including those outside Restricted Bands are below the limits of Part FCC 15.209.
The Fundamental Emissions at 2441MHz is attenuated by use of a notch filter.

Worst-Case Radiated Emissions 1GHz to 10GHz

Vertical



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
1628.00	V	1	346	53.48	35.83	6.04	25.70	49.39	54.00	-4.61
4882.00	V	1.1	189	40.08	35.49	11.22	32.96	48.78	54.00	-5.22
1628.00	V	1	346	55.50	35.83	6.04	25.70	51.41	74.00	-22.59
4882.00	V	1.1	189	54.85	35.49	11.22	32.96	63.55	74.00	-8.45

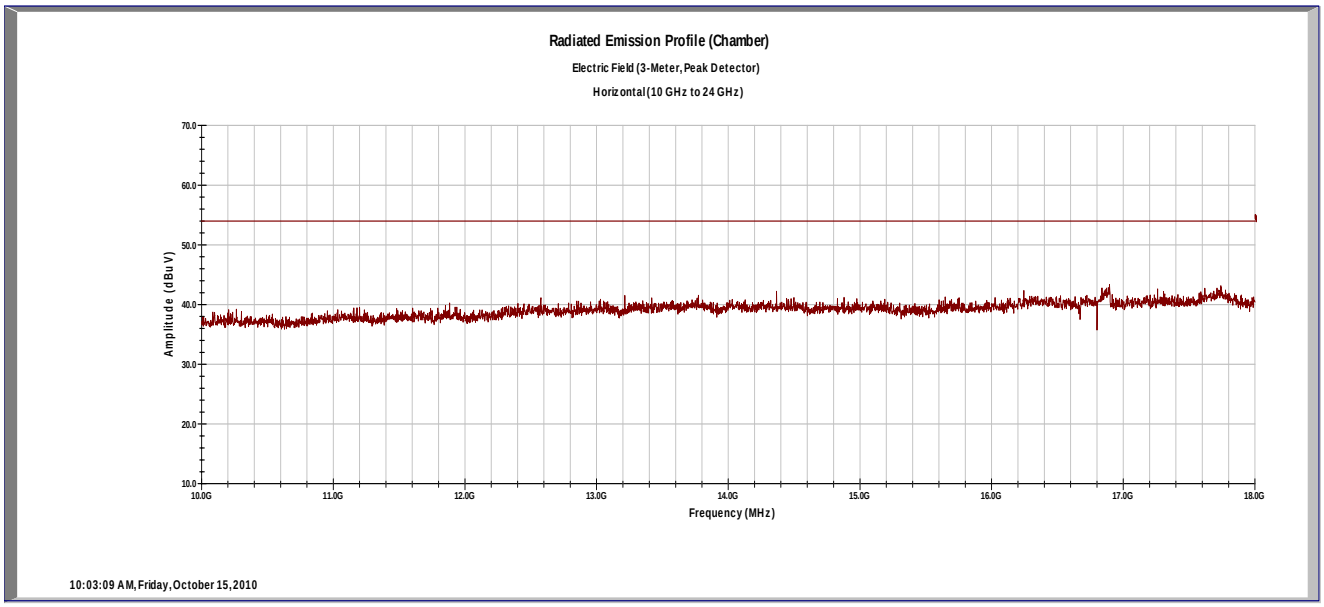
Notes: The low, medium, and high band channels were investigated. The mid band produced the worst-case spurious and harmonic emissions, as shown here. The other two scans are on file at TUV Rheinland.

Emissions shown in **Green** were measured using the Average detector, per FCC part 15.35(b).
The Emissions shown in **Blue** were measured using the Peak detector, per FCC part 15.35(b).

ALL EMISSIONS including those outside Restricted Bands are below the limits of Part FCC 15.209.
The Fundamental Emissions at 2441MHz is attenuated by use of a notch filter.

Worst-Case Radiated Emissions 10GHz to 18GHz

Horizontal

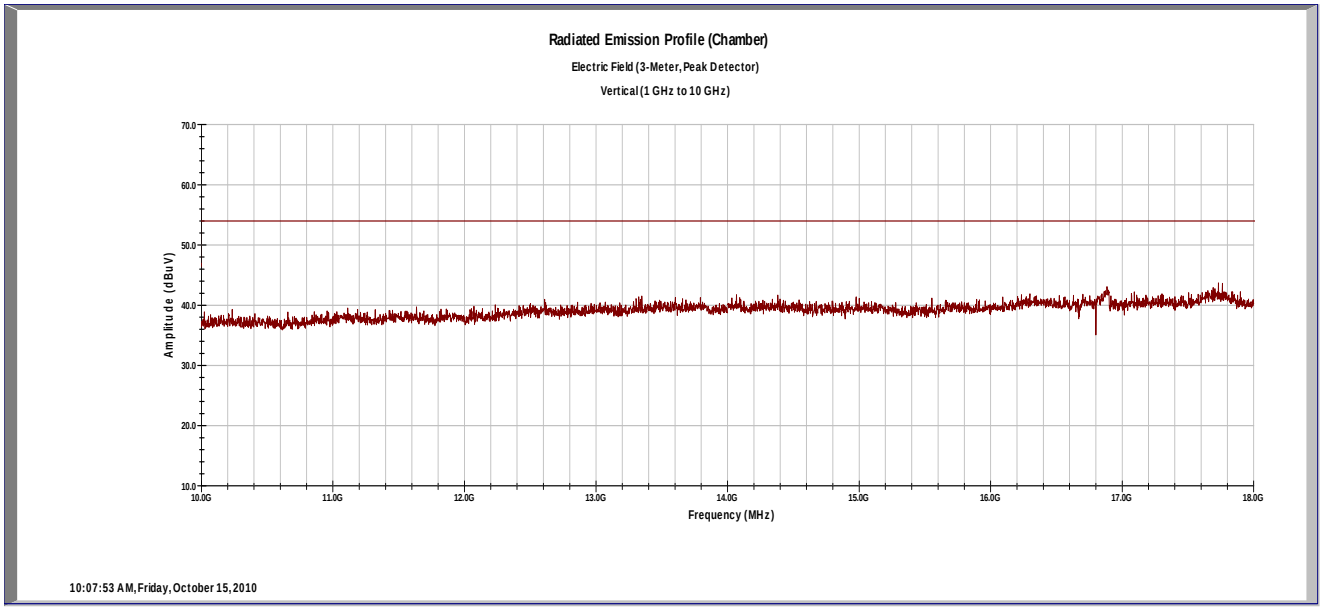


Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Notes: ALL EMISSIONS in this scan are below the noise floor of the test receiver.
The Fundamental Emissions at 2441 MHz is attenuated by use of a notch filter.

Worst-Case Radiated Emissions 10GHz to 18GHz

Vertical

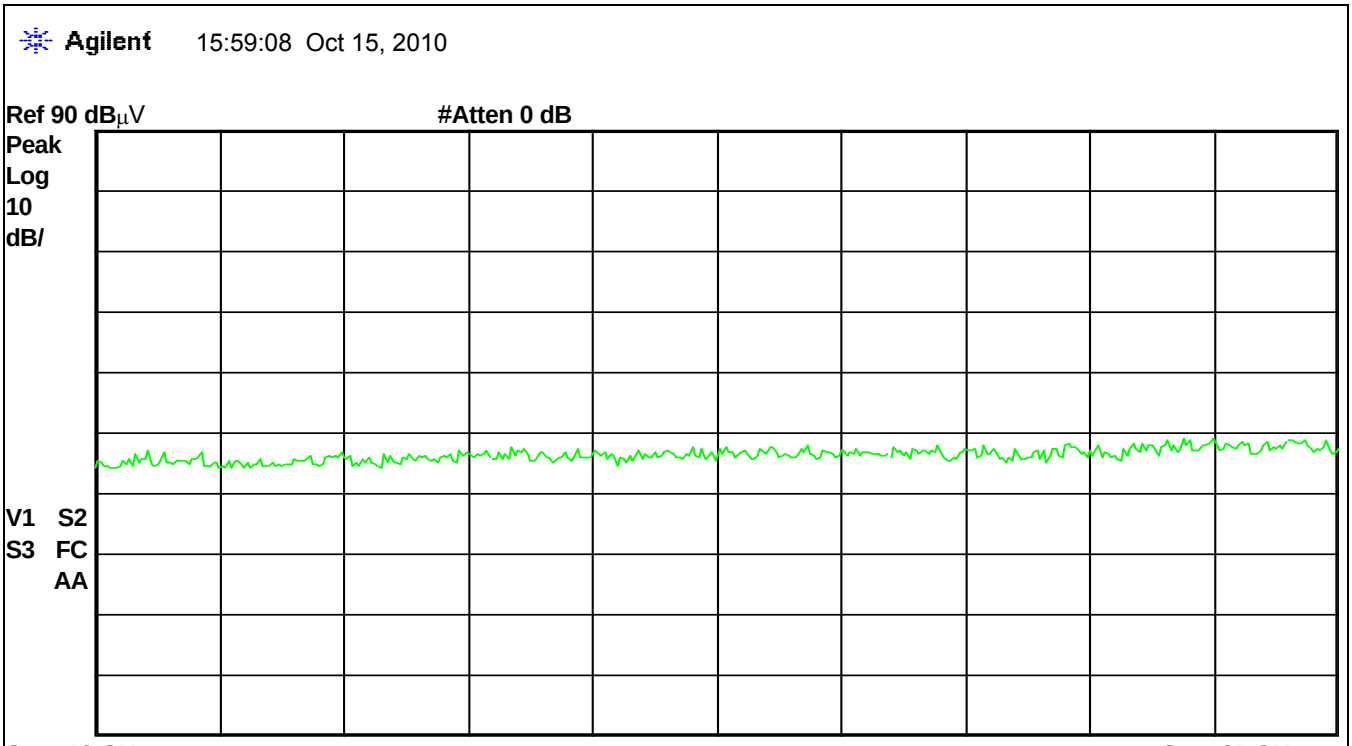


Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Notes: ALL EMISSIONS in this scan are below the noise floor of the test receiver.
The Fundamental Emissions at 2441 MHz is attenuated by use of a notch filter.

Worst-Case Radiated Emissions 18GHz to 25GHz

Horizontal

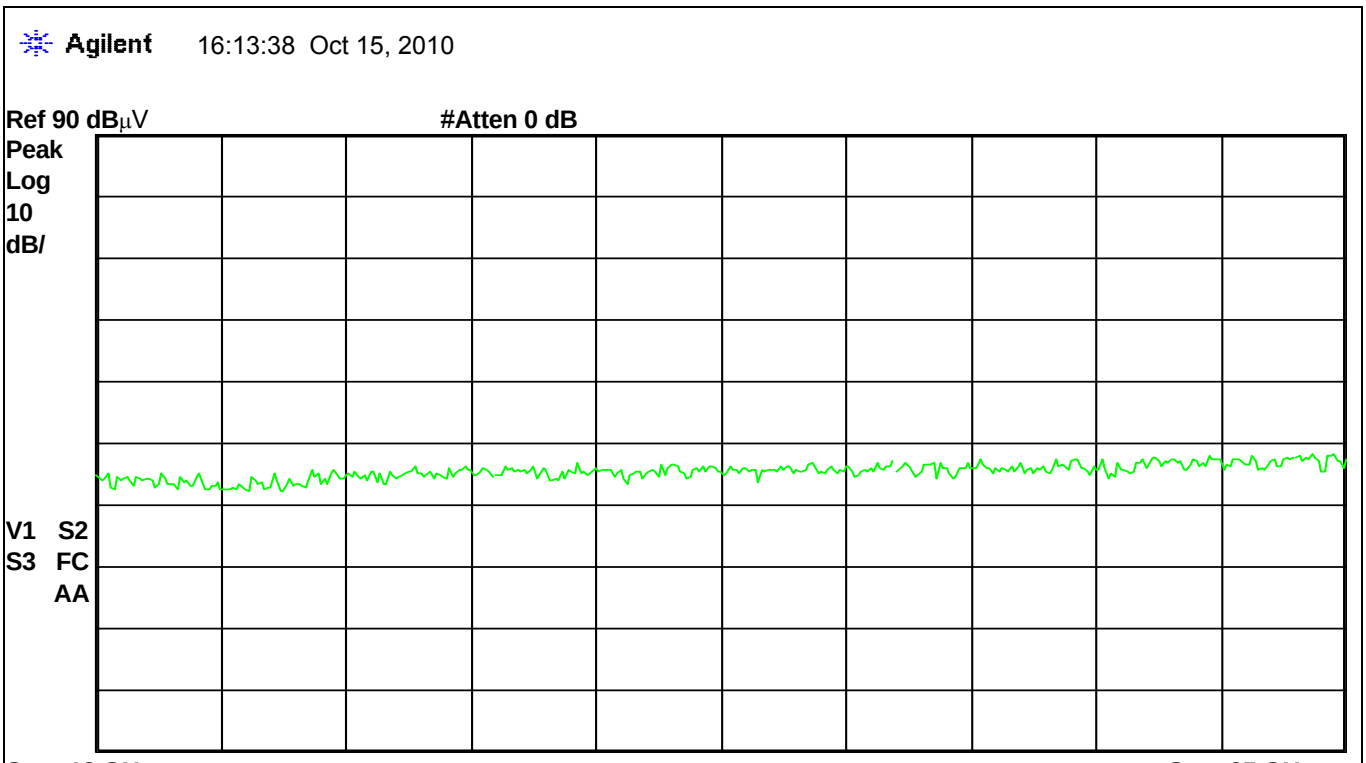


Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Notes: All emissions were below the noise floor of the EMC Receiver.
The Trace shown above is raw data, without the application of correction factors.

Worst-Case Radiated Emissions 18GHz to 25GHz

Vertical



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Notes: All emissions were below the noise floor of the EMC Receiver.
The Trace shown above is raw data, without the application of correction factors.

4.2 Conducted Emissions FCC 15.207(a) and RSS-210

This test measures the electromagnet levels of spurious signals generated by the EUT on the AC power line that may affect the performance of other nearby electronic equipment.

4.2.1 Over View of Test

Results	**Complies** (as tested per this report)				**Date**	15 September 2010	
Standard	FCC Part 15.207(a) and RSS-GEN, 7.2.2						
Product Model	MX7 TECTON			**Serial#**	MX710167802		
Configuration	See test plan for details						
Test Set-up	Tested in shielded room. EUT placed on table, see test plans for details						
EUT Powered By	100-240VAC 50/60Hz	**Temp**	76º F	**Humidity**	41%	**Pressure**	1009 mbar
Frequency Range	**150kHz - 30MHz**						
Perf. Criteria	15.207(a) limits	**Perf. Verification**	Readings Under Limit for L1 & Neutral				
Mod. to EUT	None	**Test Performed By**	Mark Ryan				

4.2.2 Test Procedure

Conducted and FCC emissions tests were performed using the procedures of ANSI C63.4 including methods for signal maximizations and EUT configuration. The photos included with the report show the EUT in its maximized configuration.

The frequency range from 150kHz - 30MHz was investigated for conducted emissions.

Conducted Emissions measurements were performed in the shielded room using procedures specified in the test plan and standard.

4.2.3 Deviations

There were no deviations from the test methodology listed in the test plan for the conducted emission test.

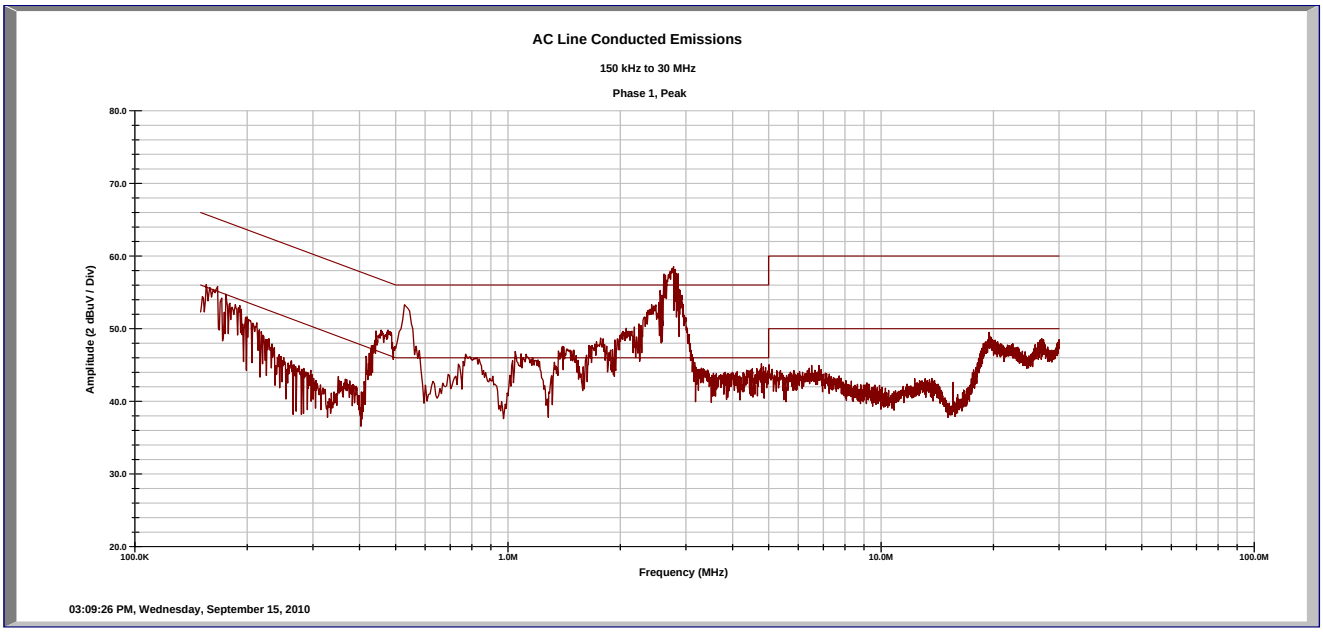
4.2.4 Final Test

All final conducted emissions measurements were below (in compliance) the limits.

4.2.5 Final Graphs and Tabulated Data

Conducted Emissions – Transmitters off @ 120V/60Hz

Line 1



Freq (MHz)	ID (1,2,3,N)	Quasi (dBuV)	Ave (dBuV)	Loss (dB)	T Limiter (dB)	Limit (dBuV)	Limit (dBuV)	Margin (dB)	Margin (dB)
0.15	1	42.25	27.28	0.02	9.93	66.00	56.00	-13.80	-18.77
0.54	1	39.38	28.92	0.04	9.91	56.00	46.00	-6.67	-7.13
1.48	1	34.09	24.68	0.07	9.92	56.00	46.00	-11.92	-11.33
2.77	1	43.14	29.06	0.11	9.95	56.00	46.00	-2.81	-6.89
4.66	1	29.12	19.22	0.14	10.02	56.00	46.00	-16.72	-16.62
19.48	1	33.12	27.74	0.31	10.28	60.00	50.00	-16.30	-11.68
27.26	1	32.67	26.44	0.37	10.48	60.00	50.00	-16.48	-12.71

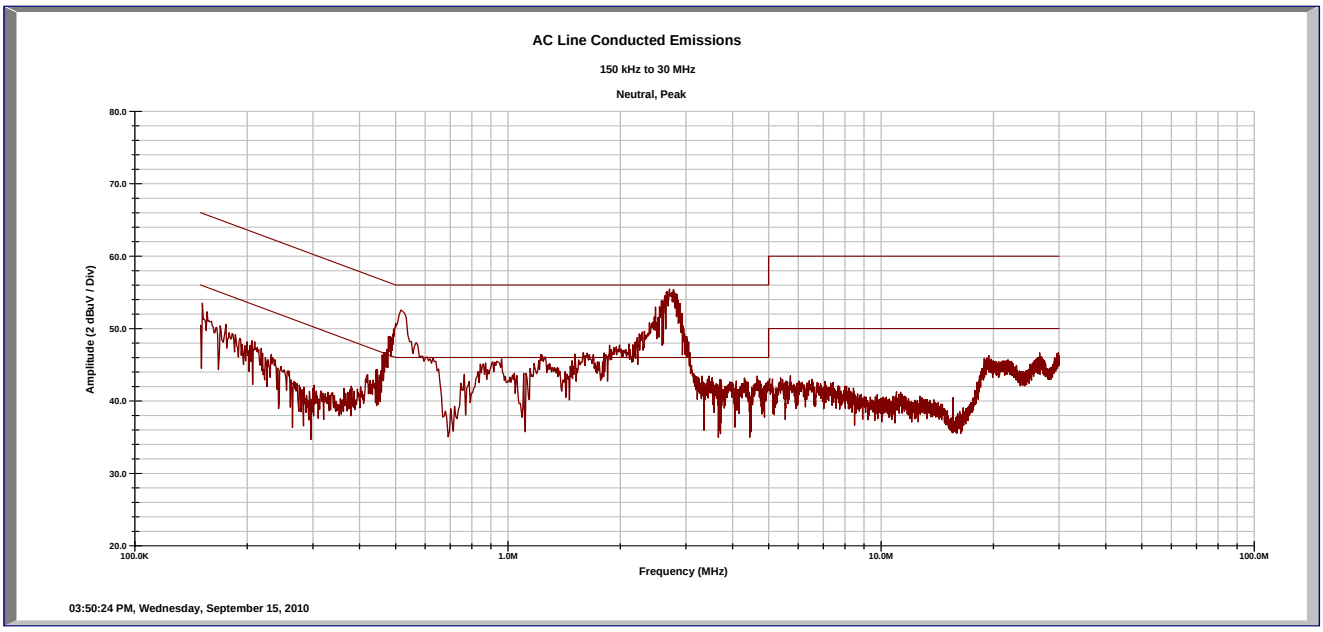
Quasi Spec Margin = Quasi FIM + Cable Loss + LISN CF - Quasi Limit ± Uncertainty
Ave Spec Margin = Ave FIM + Cable Loss + LISN CF - Ave Limit ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.2dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes:

Conducted Emissions – Transmitters off @ 120V/60Hz

Neutral



Freq (MHz)	ID (1,2,3,N)	Quasi (dBuV)	Ave (dBuV)	Loss (dB)	T Limiter (dB)	Limit (dBuV)	Limit (dBuV)	Margin (dB)	Margin (dB)
0.15	N	42.41	26.94	0.02	10.10	66.00	56.00	-13.47	-18.94
0.54	N	37.47	25.52	0.04	9.95	56.00	46.00	-8.54	-10.49
1.49	N	32.02	22.45	0.07	9.94	56.00	46.00	-13.97	-13.54
2.77	N	42.63	30.38	0.11	9.96	56.00	46.00	-3.30	-5.55
4.65	N	28.23	17.21	0.14	10.02	56.00	46.00	-17.61	-18.63
19.53	N	31.75	26.12	0.31	10.21	60.00	50.00	-17.73	-13.36
26.38	N	31.05	24.60	0.36	10.35	60.00	50.00	-18.24	-14.69

Quasi Spec Margin = Quasi FIM + Cable Loss + LISN CF - Quasi Limit ± Uncertainty
Ave Spec Margin = Ave FIM + Cable Loss + LISN CF - Ave Limit ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.2dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes:

4.3 *FHSS Systems FCC 15.247(g) and RSS-210, A8.1*

Frequency Hopping Spread Spectrum (FHSS) systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

The MX7 TECTON utilizes the standard Bluetooth v2.1 transmitter protocols and pseudo-random hopping table.

4.4 Incorporation of Intelligence within a FHSS System FCC 15.247(h) and RSS-210, A8.1

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hop sets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

The EUT does not incorporate intelligence relating to the hopping pattern as described above. Rather, the EUT always distributes its transmissions across the same 79 channels. A channel is not re-used until a transmission has occurred on each of the other 24 channels.

4.5 Channel Separation

4.5.1 Test Over View

Results	**Complies** (as tested per this report)					**Date**	14 October 2010
Standard	FCC Part 15.247(a)(1)(iii), RSS 210 A8.1						
Product Model	MX7 TECTON			**Serial#**	MX710167801 and MX710167802		
Test Set-up	Radiated emissions at 3m						
EUT Powered By	100-240VAC 50/60Hz	**Temp**	74º F	**Humidity**	32%	**Pressure**	1010mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Mark Ryan		

4.5.2 Test Procedure

Frequency hopping Systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Maximum allowed 20dB Bandwidth = 500 kHz

Min. Channel Separation = 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater

The channel separation is greater than the measured maximum 20 dB bandwidth. Therefore the EUT is compliant with this section.

4.5.3 Deviations

The test samples received were not modified with a direct measurement port. Therefore 3m radiated emissions were made for this measurement.

4.5.4 Final Test

The EUT met the performance criteria requirement as specified in the test plan of this report and in the standards.

4.5.5 Final Data

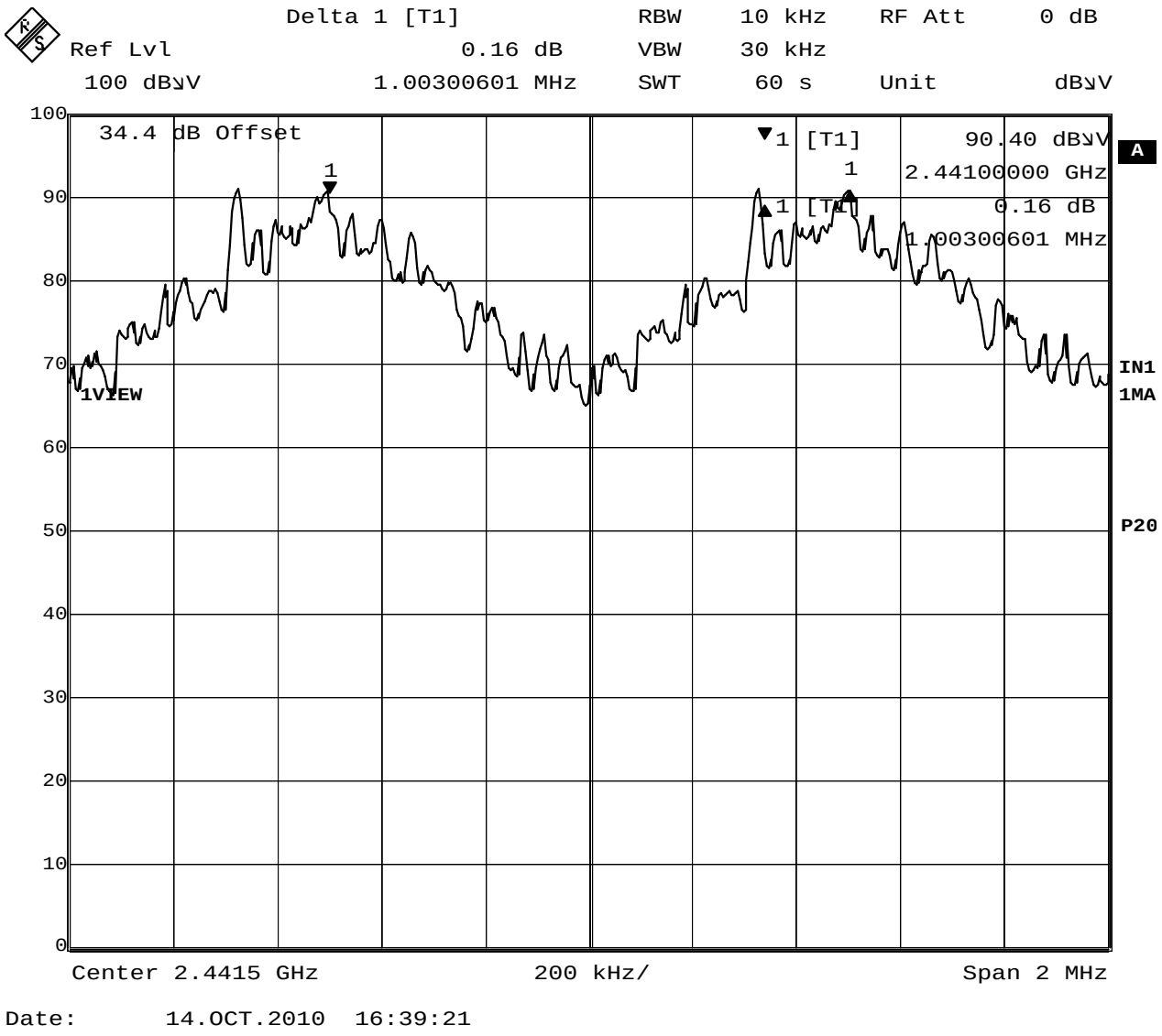


Figure 1: Channel Separation = 1.00 MHz

Spectrum Analyzer Parameters:
RBW=10kHz
Span=2 MHz
VBW= 30kHz
LOG dB/div.= 10dB
Sweep = 60s
Detector = sample detector, max hold

4.6 Pseudorandom Hopping Algorithm

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

4.6.1 Test Over View

Results	**Complies** (as tested per this report)				**Date**	14 October 2010	
Standard	FCC Part 15.247(b)(1) and RSS-210, A8.1(b)						
Product Model	MX7 TECTON			**Serial#**	MX710167801 and MX710167802		
Test Set-up	Radiated Measurement from 3m						
EUT Powered By	100-240VAC 50/60Hz	**Temp**	77º F	**Humidity**	35%	**Pressure**	1004 mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Mark Ryan		

4.6.2 Test Procedure

The MX7 TECTON Transmitter would send a packet every 97.3 ms with a delay of 8 to 16 ms between packets. Each packet is sent on the next channel as determined by the Bluetooth v2.1 pseudo-random hop protocol.

4.6.3 Deviations

The test samples received were not modified with a direct measurement port. Therefore 3m radiated emissions were made for this measurement.

4.6.4 Final Test

The EUT met the performance criteria requirement as specified in the test plan of this report and in the standards.

4.6.5 Final Data

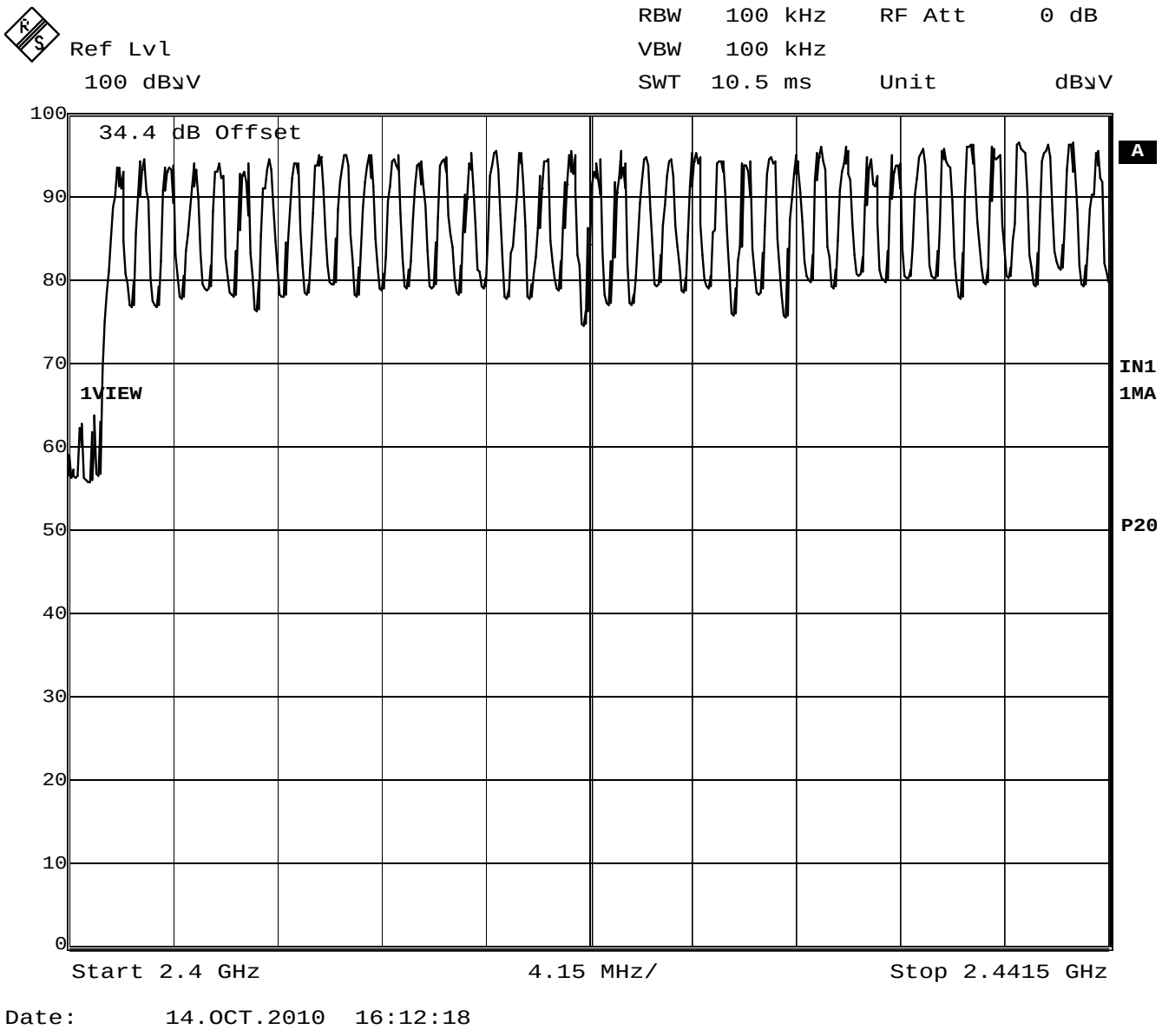


Figure 2: Plot of hopping Channels - 2402 MHz to mid-band

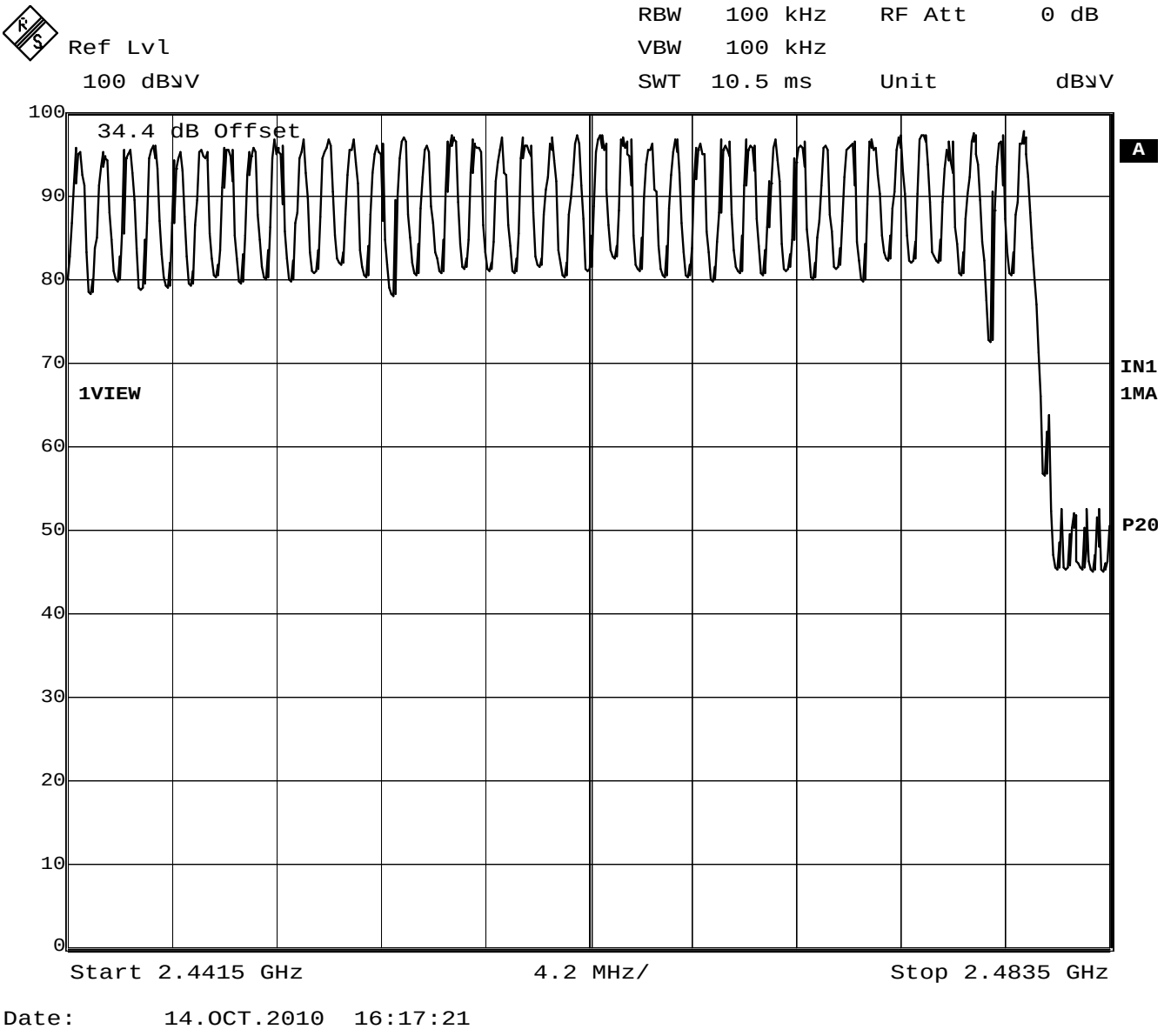


Figure 3: Plot of hopping Channels from Mid-band to 2480 MHz (79 hopping channels total)

Spectrum Analyzer Parameters:
RBW=100kHz
Span=14MHz
VBW= 100kHz
LOG dB/div.= 10dB
Sweep = Auto
Detector = sample detector, max hold

Time of Occupancy FCC Part 15.247(a)(1)(iii)

Frequency Band (MHz)	20 dB Bandwidth	Number of Hopping Channels	Average Time of Occupancy
2400 - 2483.5	=>250 kHz	79	*≤ 0.4 sec. In (0.4*79) sec.*

There were 10 hops at 10.20 milliseconds per hop for any 10 second period. Time of occupancy equals number of hops multiplied by the duration of one hop.

Time of Occupancy limit = 0.40 seconds in any (0.4*79) = 31.6 second period.
Calculated Time of Occupancy = 475µs / hop x (31.6s * 10 hops/s) = 0.15 seconds in any 31.6 second period

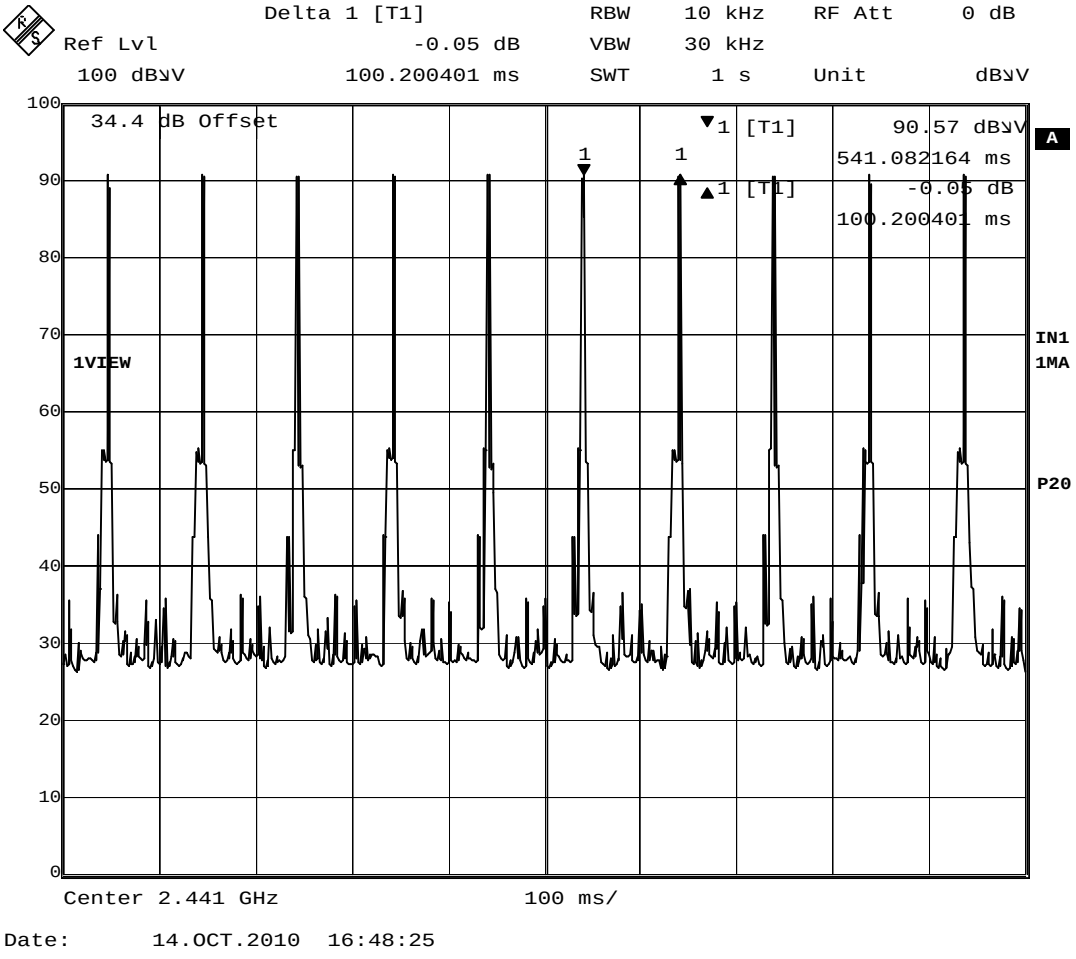


Figure 4: 1 second sweep of 2441 MHz showes 10 hops

Note: The on-channel traces are the two highest peaks.

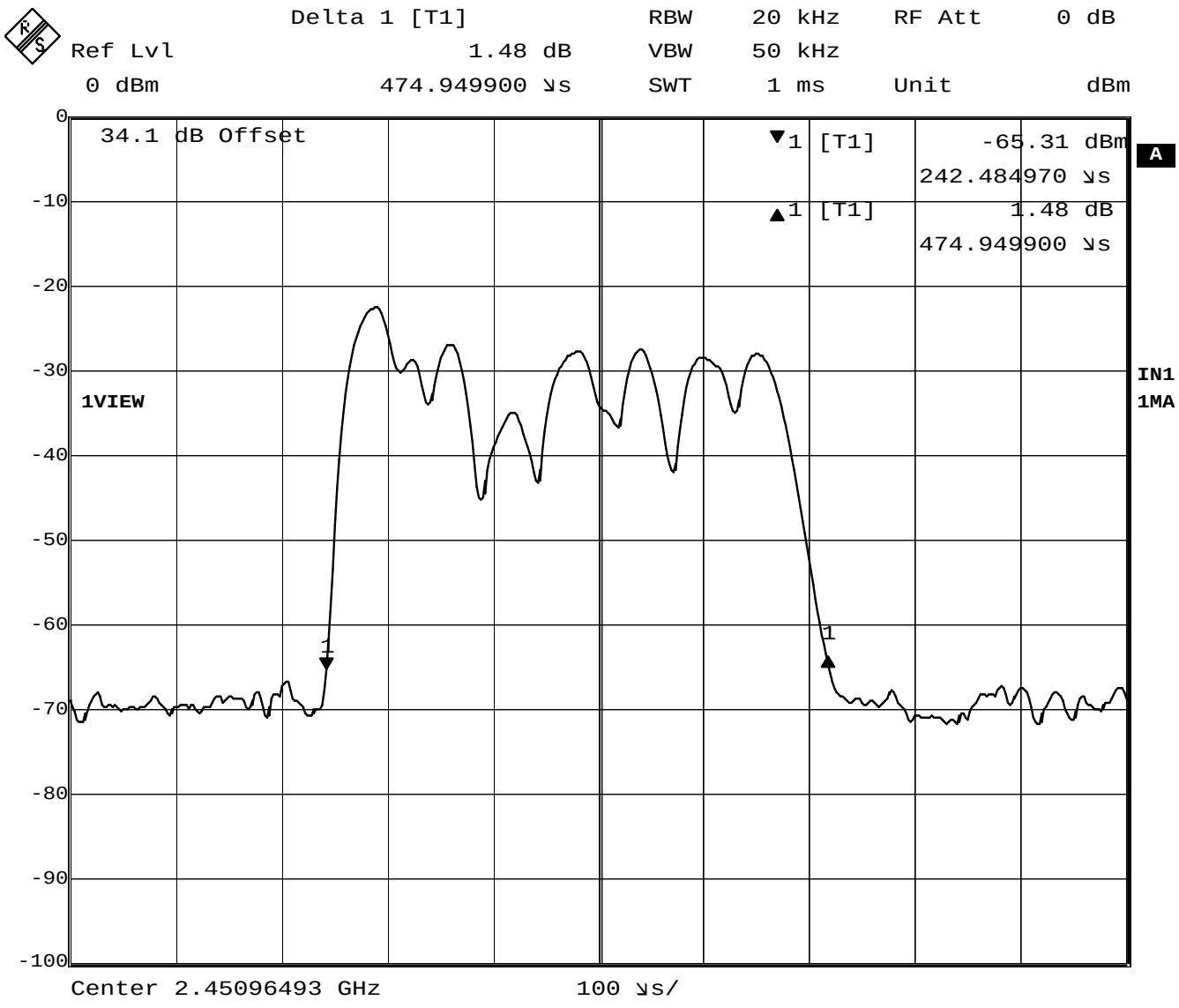


Figure 5: Measurement of 1 hop at 2450.9 MHz

Time on Frequency = 475µs

Spectrum Analyzer Parameters:
RBW=100kHz
Span=zero
VBW= 100kHz
LOG dB/div.= 10dB
Sweep = 200 ms
Detector = sample detector, max hold

4.7 Occupied Bandwidth

The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

4.7.1 Test Over View

Results	**Complies** (as tested per this report)					**Date**	14 October 2010
Standard	FCC Part 15.247(a)(1)(i) and RSS-210, A8.1(a)						
Product Model	MX7 TECTON			**Serial#**		MX710167801 and MX710167802	
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	100-240VAC 50/60Hz	**Temp**	74º F	**Humidity**	32%	**Pressure**	1010mbar
Perf. Criteria	(Below Limit)			**Perf. Verification**		Readings Under Limit	
Mod. to EUT	None			**Test Performed By**		Mark Ryan	

4.7.2 Test Procedure

Frequency hopping Systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Maximum allowed 20dB Bandwidth = 500 kHz

Channel Separation = 25 kHz Min. or the 20 dB bandwidth of the hopping channel, whichever is greater

The channel separation is greater than the measured maximum 20 dB bandwidth. Therefore the EUT is compliant with this section.

4.7.3 Deviations

The test samples received were not modified with a direct measurement port. Therefore 3m radiated emissions were made for this measurement.

4.7.4 Final Test

The EUT met the performance criteria requirement as specified in the test plan of this report and in the standards.

4.7.5 Final Data

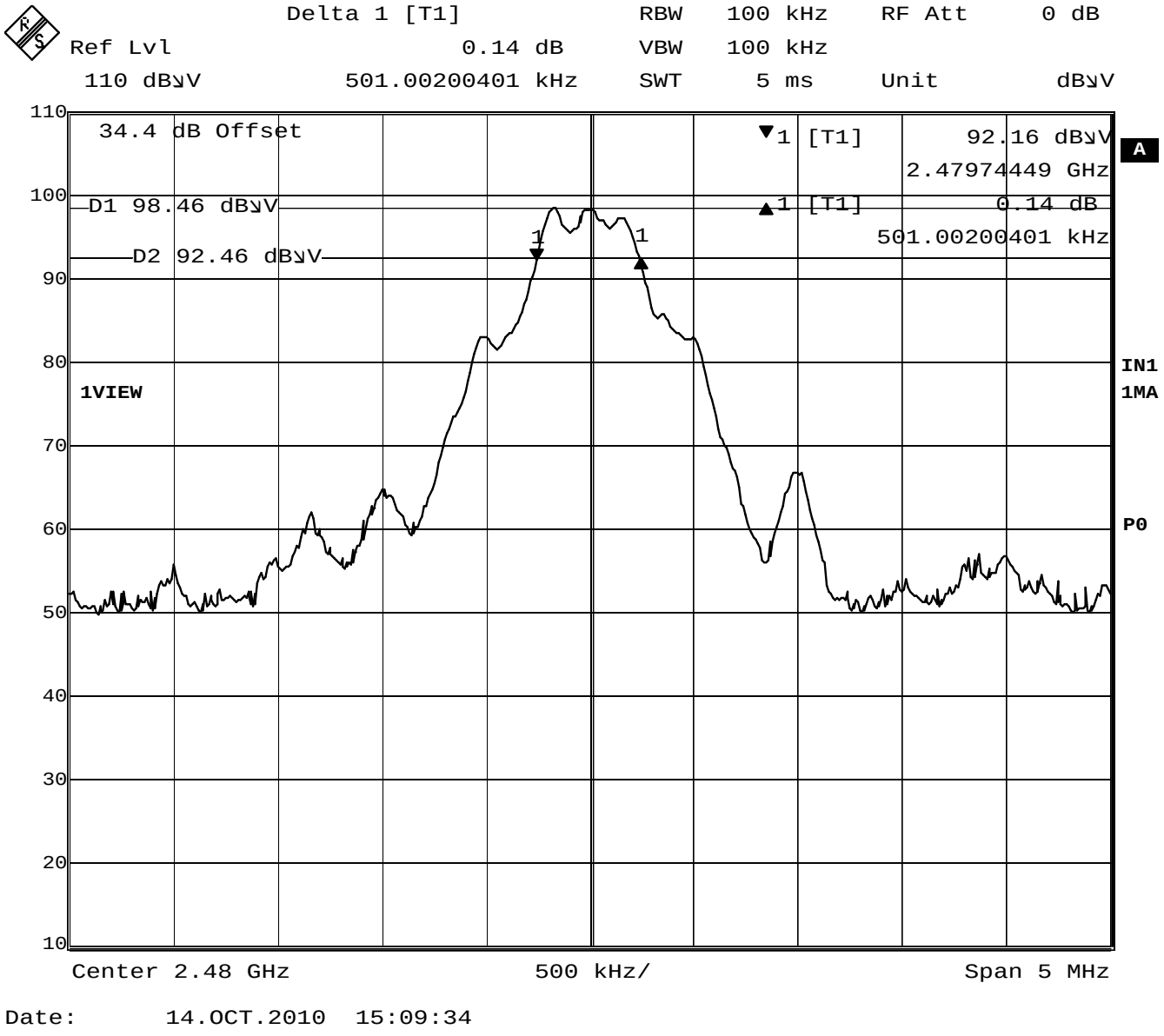


Figure 6: Occupied Bandwidth

Note: The low-band, mid-band and high-band all had the same 6dB bandwidth.

***BW = 501 KHZ**

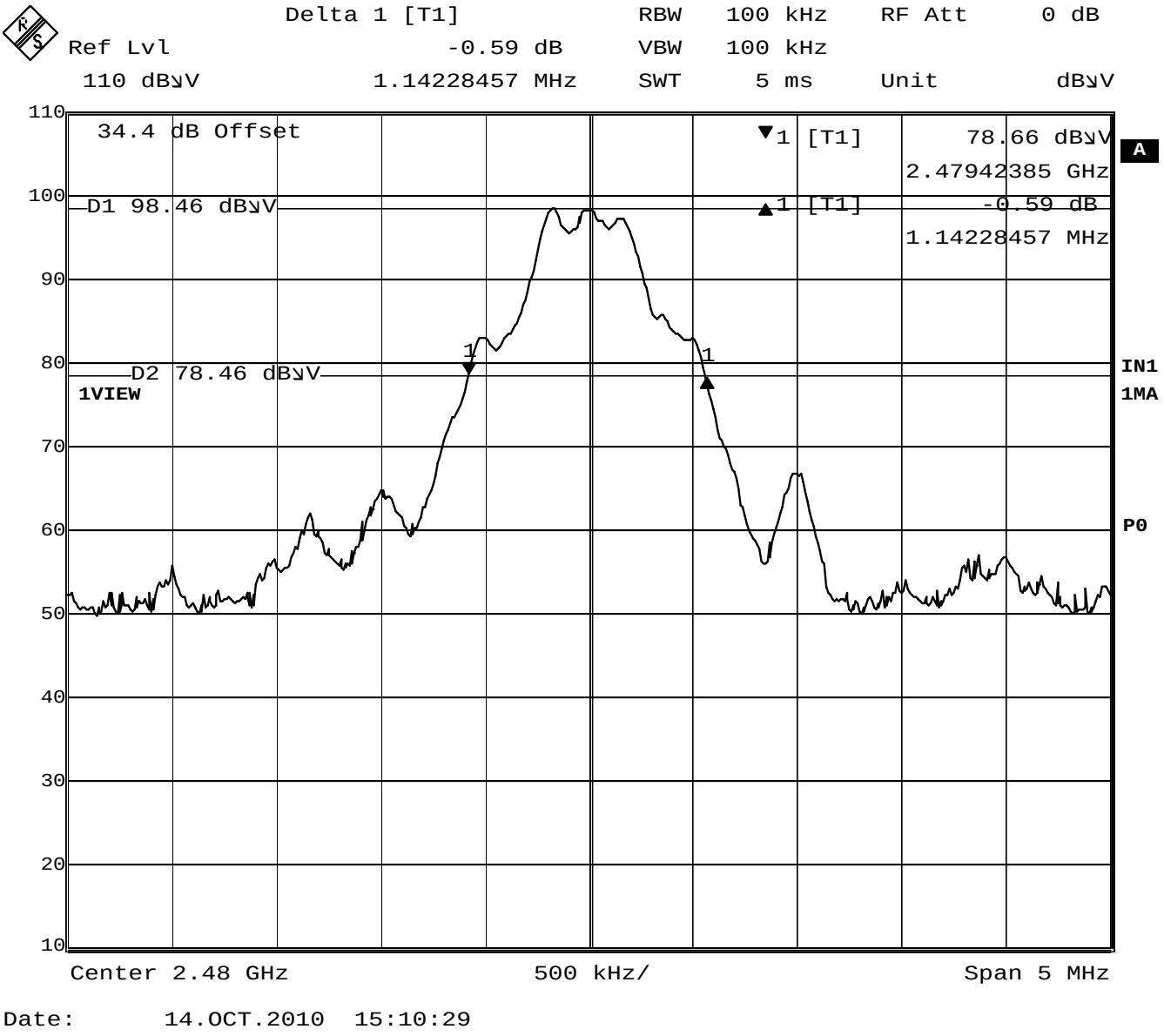


Figure 7: 20 dB Occupied Bandwidth

Note: The low-band, mid-band and high-band all had the same 20dB bandwidth

.

***BW = 1.14 MHZ**

4.8 99% Power Bandwidth

For the purpose of Section A1.1, the 99% bandwidth shall be no wider than .25% of the center frequency for devices operating between 70-900MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency.

4.8.1 Test Over View

Results	**Complies** (as tested per this report)				**Date**	14 October 2010	
Standard	RSS-210, A8.1(a) and RSS-GEN.4.6.1						
Product Model	MX7 TECTON			**Serial#**	MX710167801 and MX710167802		
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	100-240VAC 50/60Hz	**Temp**	74º F	**Humidity**	32%	**Pressure**	1010mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Mark Ryan		

4.8.2 Test Procedure

Using the procedures of RSS-GEN section 4.6.1, the 10 kHz resolution bandwidth is 1% of the 1 MHz span. The Video bandwidth is 3 times that of the resolution bandwidth.

The limit of the bandwidth would be 0.5% of 916 MHz is 4.58 MHz. The measured 99% bandwidth is 326.7 kHz.

4.8.3 Deviations

The test samples received were not modified with a direct measurement port. Therefore 3m radiated emissions were made for this measurement.

4.8.4 Final Test

The EUT met the performance criteria requirement as specified in the test plan of this report and in the standards.

4.8.5 Final Data

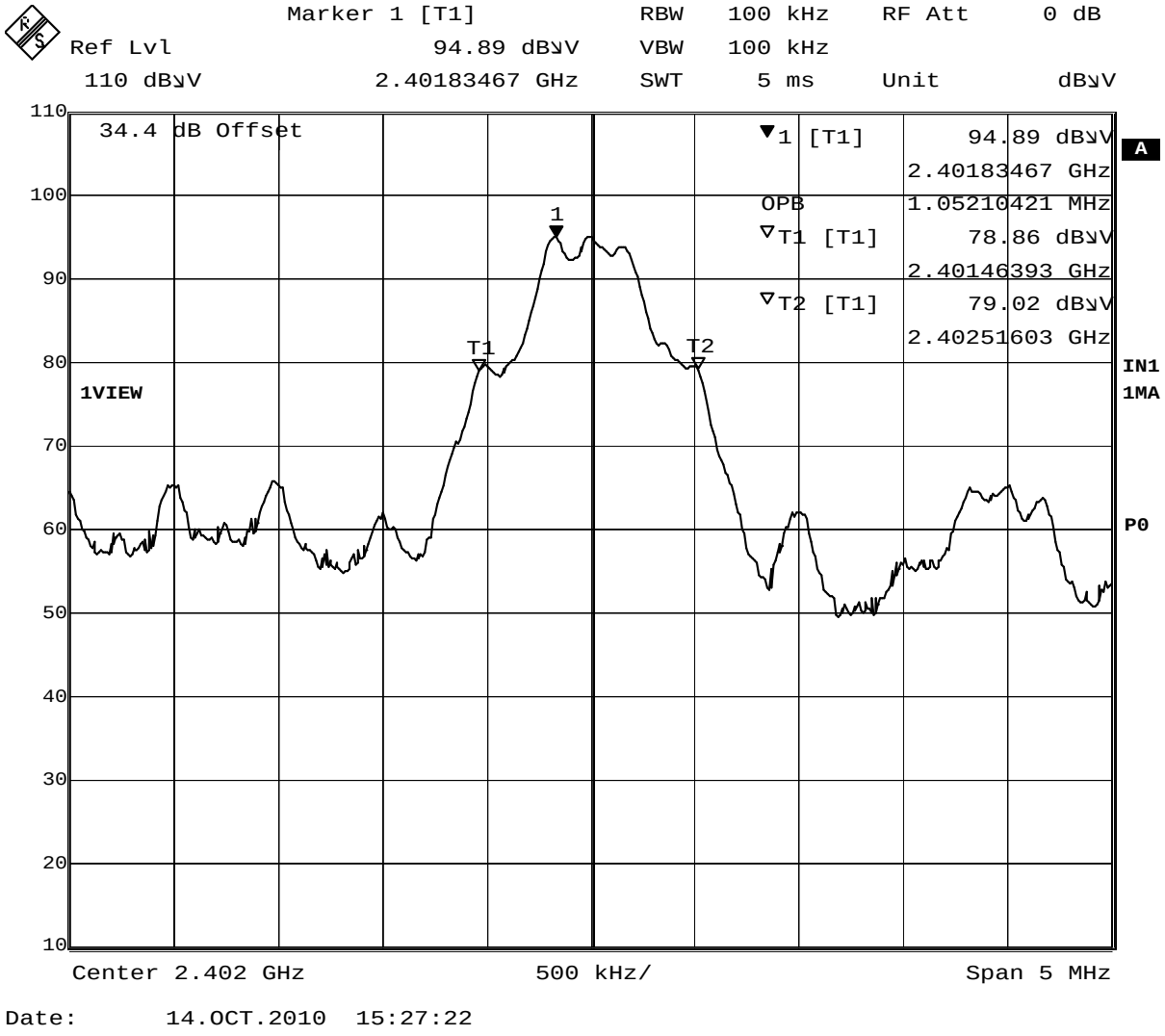


Figure 8 – Worst case 99% Power Bandwidth = 1.05 MHz

Spectrum Analyzer Parameters:
RBW=100kHz
Span=5MHz
VBW= 100kHz
LOG dB/div.= 10dB
Sweep = Auto
Detector = sample detector, max hold

The EUT is compliant to the requirements of RSS-210 A1.1.3

4.9 Band Edge

4.9.1 Test Over View

Results	**Complies** (as tested per this report)					**Date**	14 October 2010
Standard	FCC Part 15.247(d), RSS 210 A8.5						
Product Model	MX7 TECTON			**Serial#**	MX710167801 and MX710167802		
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	100-240VAC 50/60Hz	**Temp**	74º F	**Humidity**	32%	**Pressure**	1010mbar
Perf. Criteria	(Below Limit)			**Perf. Verification**	Readings Under Limit		
Mod. to EUT	None			**Test Performed By**	Mark Ryan		

4.9.2 Test Procedure

Intentional radiators operating under the alternative provisions to the general emission limits must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

4.9.3 Deviations

The test samples received were not modified with a direct measurement port. Therefore 3m radiated emissions were made for this measurement.

4.9.4 Final Test

The EUT met the performance criteria requirement as specified in the test plan of this report and in the standards.

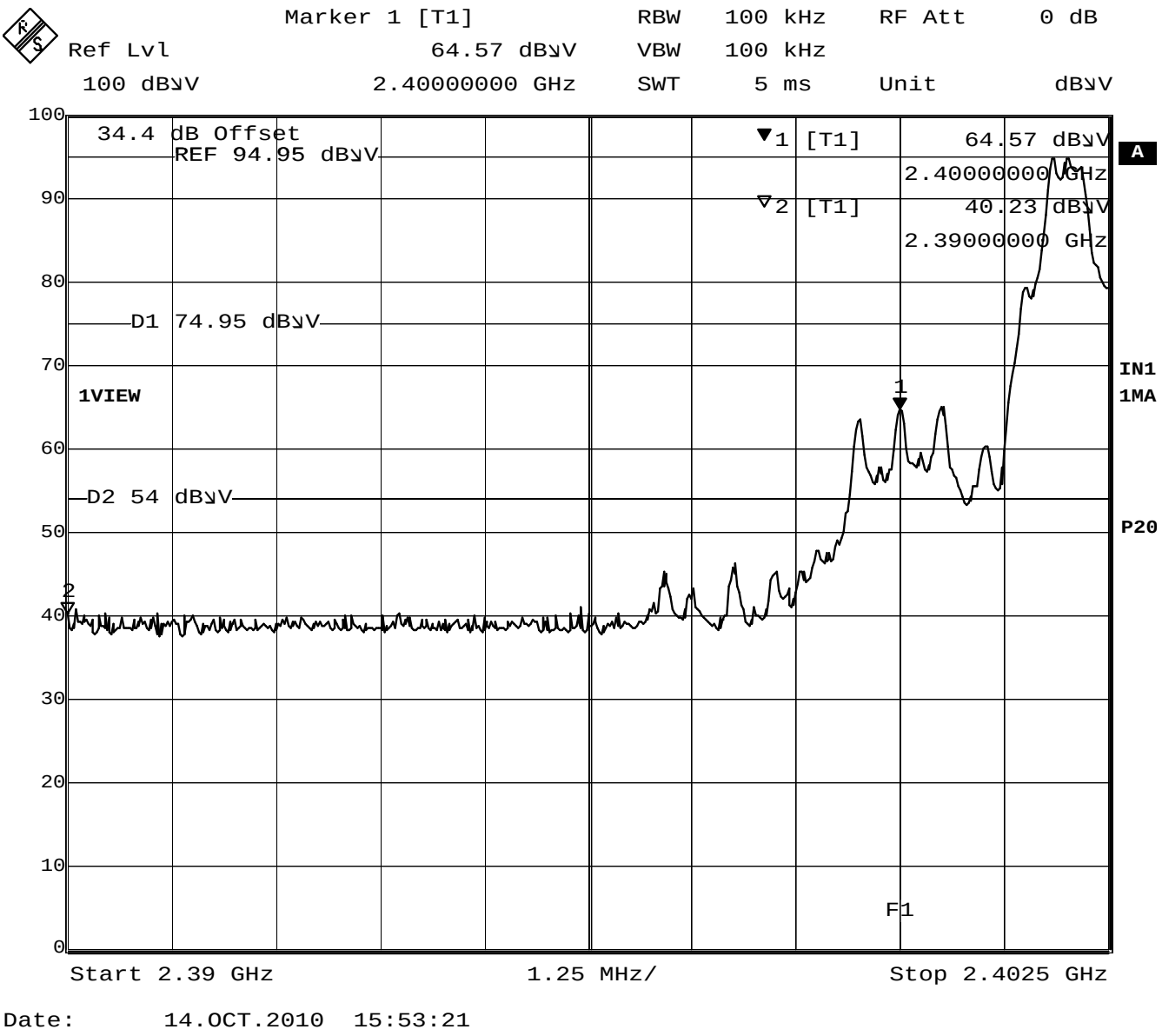


Figure 9: Lower Band Edge Measurement

Note: Band Edge is at 2400 MHz

Channel Frequency is 2402 MHz,

The level at the 2400MHz band edge is 64.57 dBµV which is -30.38 dBc

The level at the 2390 MHz restricted is below the receiver's noise floor which is at least 13.77 dB below the restricted band limit.

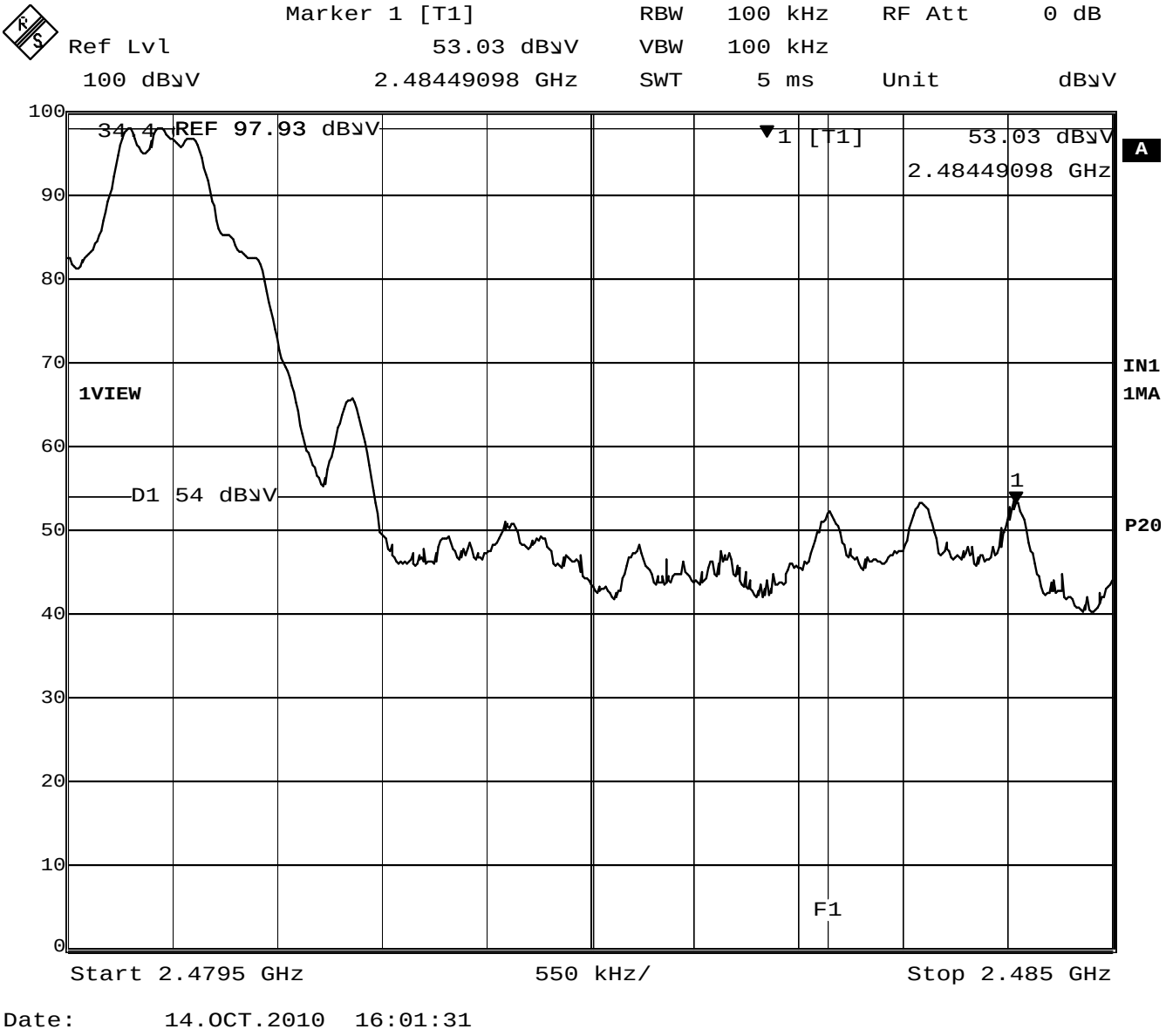


Figure 10: Upper Band Edge Measurement

Note: Band edge is at 2483.5 MHz

Channel 63 Frequency is 2480 MHz.

The band edge at 2483.5 MHz is also the beginning of a restricted band. The highest emission, using the peak detector, is 20.97 dB below the peak level limit of 74 dBµV

The EUT is compliant with the rules.

4.10 Transmitter Output Power FCC part 15.247(b)(1) and RSS-210

For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels: 1 watt.

4.10.1 Test Over View

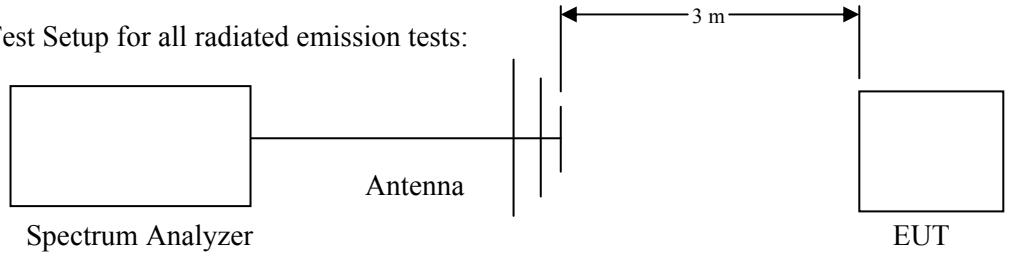
Results	**Complies** (as tested per this report)					**Date**	14 October 2010
Standard	FCC Part 15.247(b)(1) and RSS-210 A8.4(2)						
Product Model	MX7 TECTON			**Serial#**	MX710167801 and MX710167802		
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	100-240VAC 50/60Hz	**Temp**	74º F	**Humidity**	32%	**Pressure**	1010mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Mark Ryan		

4.10.2 Test Procedure

The peak output power was measured at the low, mid and high band frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The cable loss and the attenuator was measured and added in the reference level offset in the spectrum analyzer. The spectrum analyzer's resolution bandwidth was greater than the 20dB bandwidth of the modulated carrier and the video bandwidth was equal to the resolution bandwidth.

Note: The EUT also utilizes a pre-approved module for the Wi-Fi section of this device. The Wi-Fi and Bluetooth transmitters do not share a common antenna. Therefore per KDB Tracking Number 917484, answer IV) B) 1); the EUT is not required to be tested with all transmitters operating.

Test Setup for all radiated emission tests:



4.10.3 Deviations

The test samples received were not modified with a direct measurement port. Therefore 3m radiated emissions were made for this measurement.

4.10.4 Final Test

The EUT met the performance criteria requirement as specified in the test plan of this report and in the standards.

4.10.5 Peak Power Output

Peak Output Calculated Power Measurements

Emission Freq (MHz)	Corrected Value (dBµV/m)	Corrected Value (V/m)	Antenna Gain (numeric)	Calculated output power (dBm)	Spec Limit (dBm)	Spec Margin (dB)
2402.00 (f_H)	95.36	0.059	2.00	-2.87	30	-32.78
2441.00 (f_M)	95.44	0.063	2.00	-2.79	30	-32.79
2480.00 (f_H)	**98.21**	**0.081**	**2.00**	**0.00**	**30**	**-30.00**

Note: the spec limit Per FCC 15.247(b)(1) is 0.1 Watt = 20 dBm

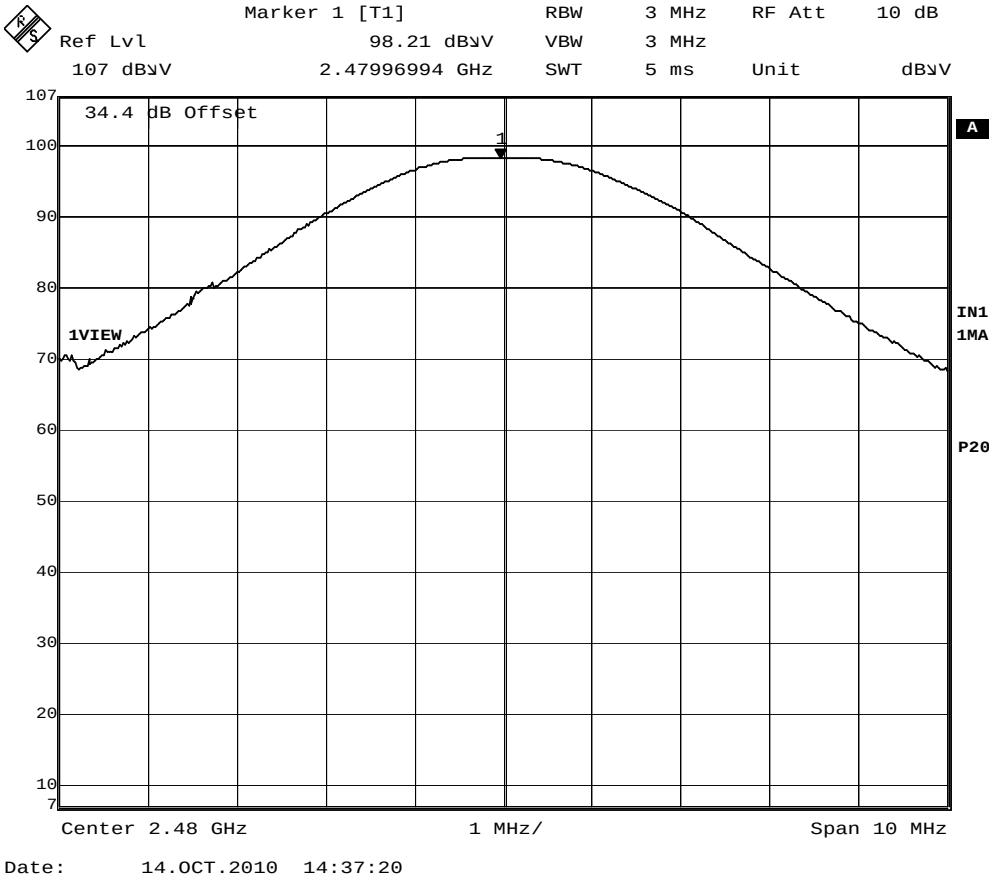


Figure 11 – Highest Peak Radiated Power Output at 3m, for EUT highest frequency.

Graphs of the other frequencies are on file at the manufacturer and at TUV.

4.10.1 Output Power Calculation

The Antenna Gain data was supplied separately with the following results provided:

Maximum Internal Antenna gain:

Freq. (MHz)	Max Peak (dBi)	Gain (Numeric)
2400.0 - 2483.5	3.00	2.0

Note: The gain of the antenna does not exceed 6dBi, therefore the EUT is also compliant to FCC Part 15.247(b)(4)

The maximum emissions is 98.21 dBµV/m at 3m, which is equivalent to 0.08 V/m

Using the formula: $(PG / 4\pi D^2) = (E^2 / 120\pi)$.

P = Power output
G = numeric Gain of transmitting antenna
D = Distance of measuring antenna
E = field strength of emission in V/m.

Solving for P = 1.00 mW or 0 dBm

This calculation is consistent with the published specification of the Bluetooth module that states the typical output to be 1 mW.

Results

As tested, the EUT was found to be compliant to the requirements of the test standard.

4.11 Voltage Requirements FCC Part 15.31(e)

FCC Part 15.31 states that for intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

4.11.1 Over View of Test

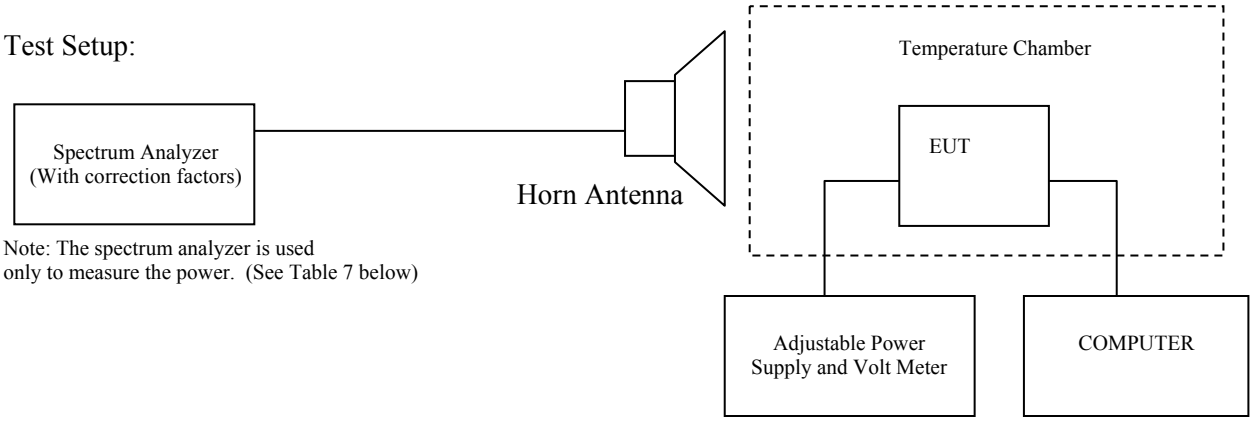
Results	**Complies** (as tested per this report)	**Date**	12 November 2010
Standard	FCC Part 15.31(e) and RSS-210, 2.1		
Product Model	MX7 TECTON	**Serial#**	MX710167801
Test Set-up	Tested in Temperature chamber at 20ºC.		
Mod. to EUT	None	**Test Performed By**	Mark Ryan

4.11.2 Test Procedure

Since this module could be used in many different applications, including battery operation, the manufacturer selected that worst-case testing suite to be performed. The power source test was performed using the ±15% of rated voltage

Manufacturer Rated voltage: 100-240VAC 50/60Hz, the test will be performed at ±15% of rated voltage.

Test Setup:



Note: The spectrum analyzer is used only to measure the power. (See Table 7 below)

Reference at nominal temperature; +20º C

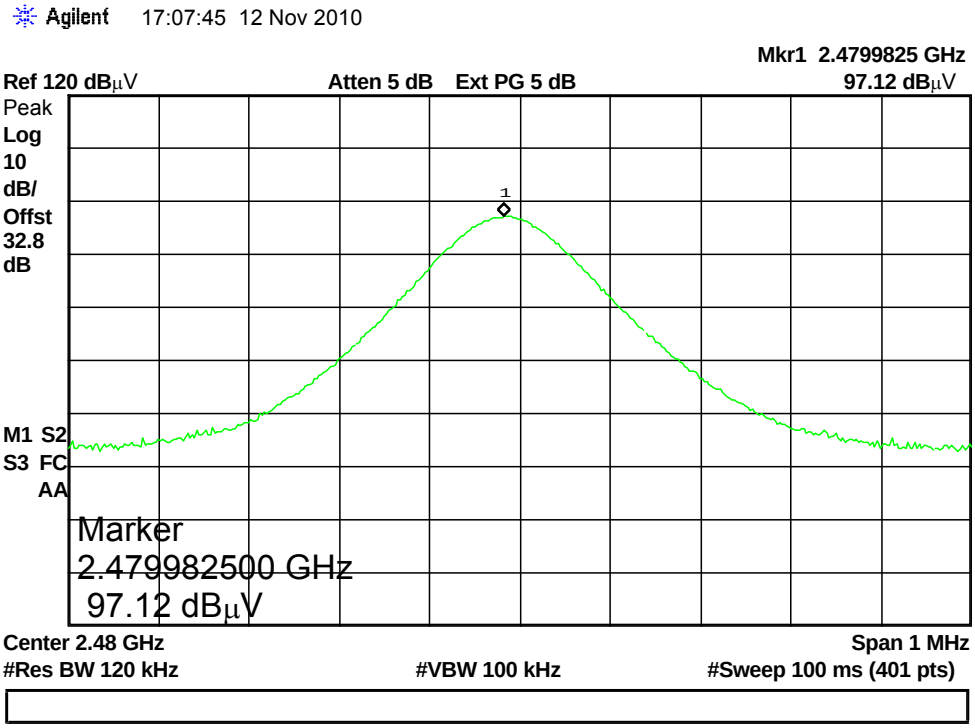
Volts	P(dBµV)	Frequency in Hz	Δ to nominal Power (dB)	Δ to nominal Frequency (kHz)
120	96.94	2,479,987,500	0.00	0
276	97.08	2,479,982,500	0.14	-5.0
85	97.12	2,479,982,500	0.18	-5.0

Note: Reading highlighted in Yellow is the reference frequency and power.

Nominal Rated Voltage (V_{Nom}): 120 Volts
+15% Max Voltage (V_{max}): 276 Volts
-15% Minimum Voltage (V_{min}): 85 Volts

4.11.3 Final Test

As tested, the EUT was found to be compliant to the requirements of the test standard.



Worst Case power shift at +5.175VDC from -8.371 dBm to -8.363 dBm.

Note: All other plots of the extreme voltage tests are on file at TUV Rheinland.

5 Emissions in Receive Mode.

5.1 Radiated Emissions

This test measures the electromagnetic levels of spurious signals generated by the EUT that radiated from the EUT and may affect the performance of other nearby electronic equipment.

5.1.1 Over View of Test

Results	**Complies** (as tested per this report)				**Date**	14 September 2010	
Standard	FCC Parts 15.109(a) and RSS-210 2.2, 2.6,A8.5, RSS-GEN 7.2.3.2						
Product Model	MX7 TECTON			**Serial#**	MX710167801 and MX710167802		
Configuration	See test plan for details						
Test Set-up	Tested in a 5m Semi Anechoic chamber, placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane on a turn-table. See test plans for details						
EUT Powered By	100-240VAC 50/60Hz	**Temp**	75 ºF	**Humidity**	33%	**Pressure**	1001 mbar
Frequency Range	30 MHz to 5 GHz @ 3m						
Perf. Criteria	(Below Limit)			**Perf. Verification**	Readings Under Limit		
Mod. to EUT	None			**Test Performed By**	Mark Ryan		

5.1.2 Test Procedure

Radiated and FCC emissions tests were performed using the procedures of ANSI C63.10:2009 including methods for signal maximizations and EUT configuration. The photos included with the report show the EUT in its maximized configuration.

The frequency range from 30 MHz to 14 GHz was investigated for radiated emissions.

Radiated emission testing was performed at a distance of 3 meters in a 5 meter semi-anechoic chamber.

5.1.3 Deviations

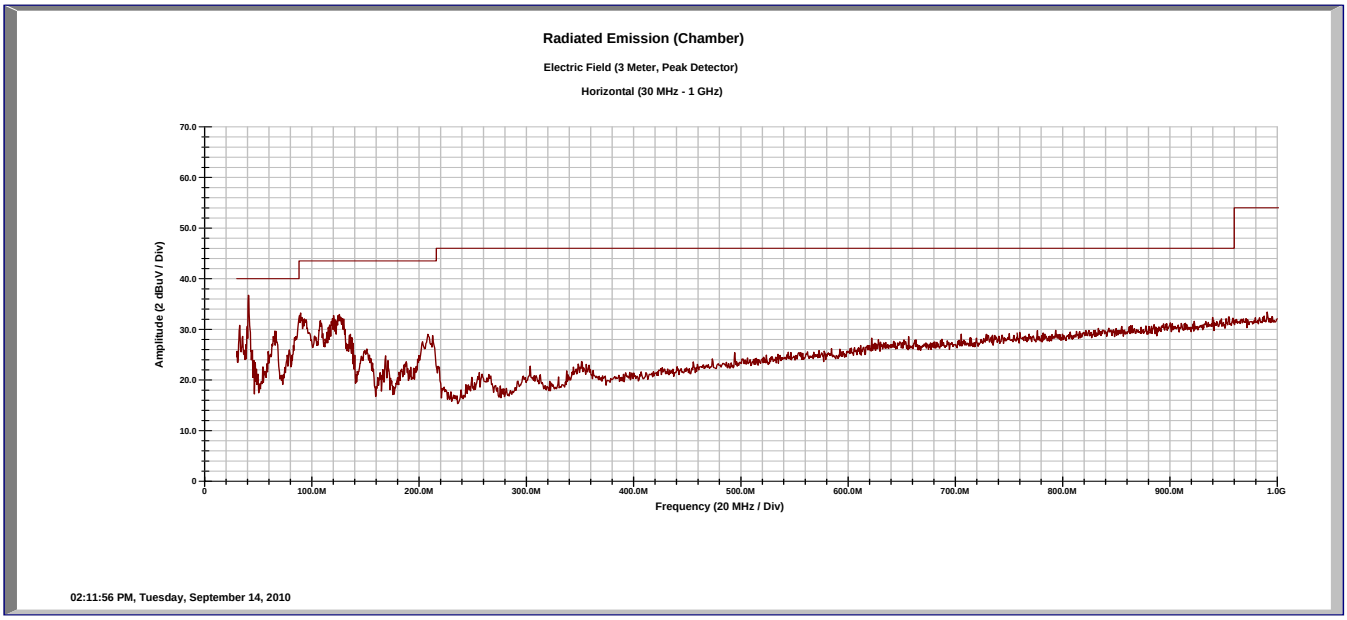
There were no deviations from the test methodology listed in the test plan for the radiated emission test.

5.1.4 Final Test

All final radiated emissions measurements were below (in compliance) the limits.

5.1.5 Final Graphs and Tabulated Data

Radiated Emissions - 30 to 1000 MHz
Horizontal



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	QP FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
32.40	H	4	112	18.91	0.00	0.60	6.09	25.61	40.00	-14.39
40.90	H	1	98	20.64	0.00	0.68	9.31	30.63	40.00	-9.37
89.61	H	2.5	257	25.27	0.00	1.01	6.67	32.95	43.50	-10.55
125.73	H	1.7	274	20.49	0.00	1.19	7.41	29.10	43.50	-14.40
208.20	H	1	260	9.75	0.00	1.55	10.49	21.79	43.50	-21.71

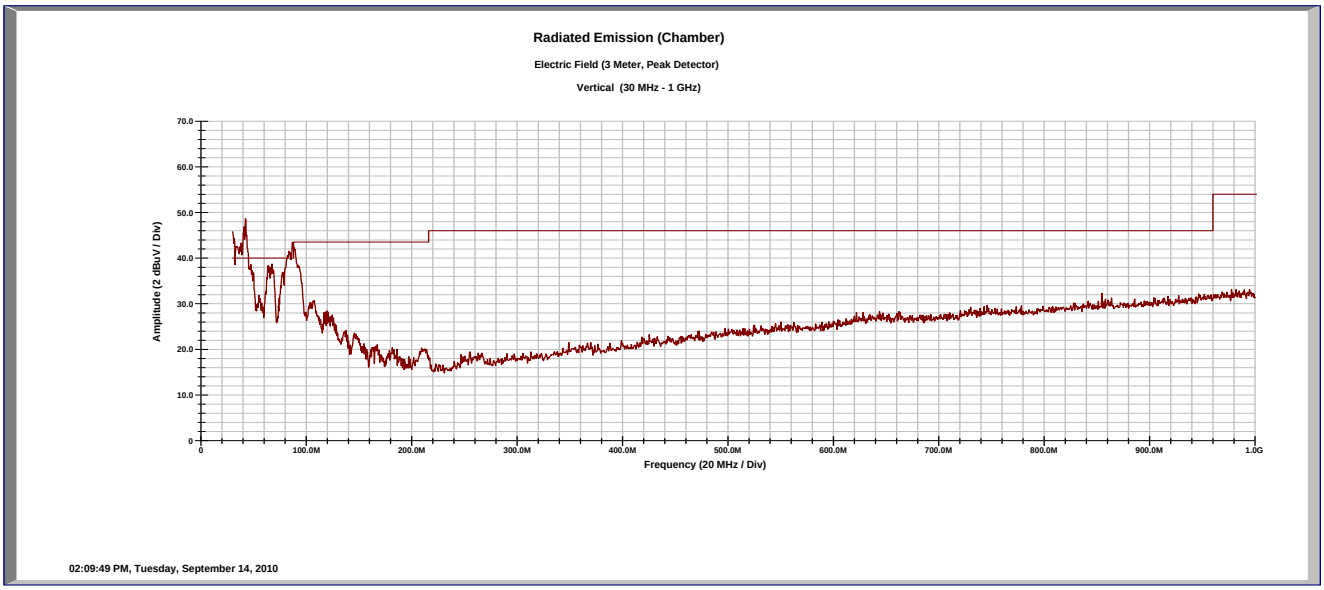
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Orientation 1 – Worst Case Emissions dBµV
Trace shown using peak detector.

Radiated Emissions - 30 to 1000 MHz

Vertical



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	QP FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
30.10	V	1.3	112	33.75	0.00	0.58	4.16	38.49	40.00	-1.51
42.26	V	1	187	30.20	0.00	0.69	8.88	39.77	40.00	-0.23
67.47	V	1	215	16.81	0.00	0.87	7.86	25.54	40.00	-14.46
86.89	V	1	317	29.81	0.00	0.99	6.97	37.77	40.00	-2.23
213.88	V	1	0	1.11	0.00	1.58	10.48	13.16	43.50	-30.34

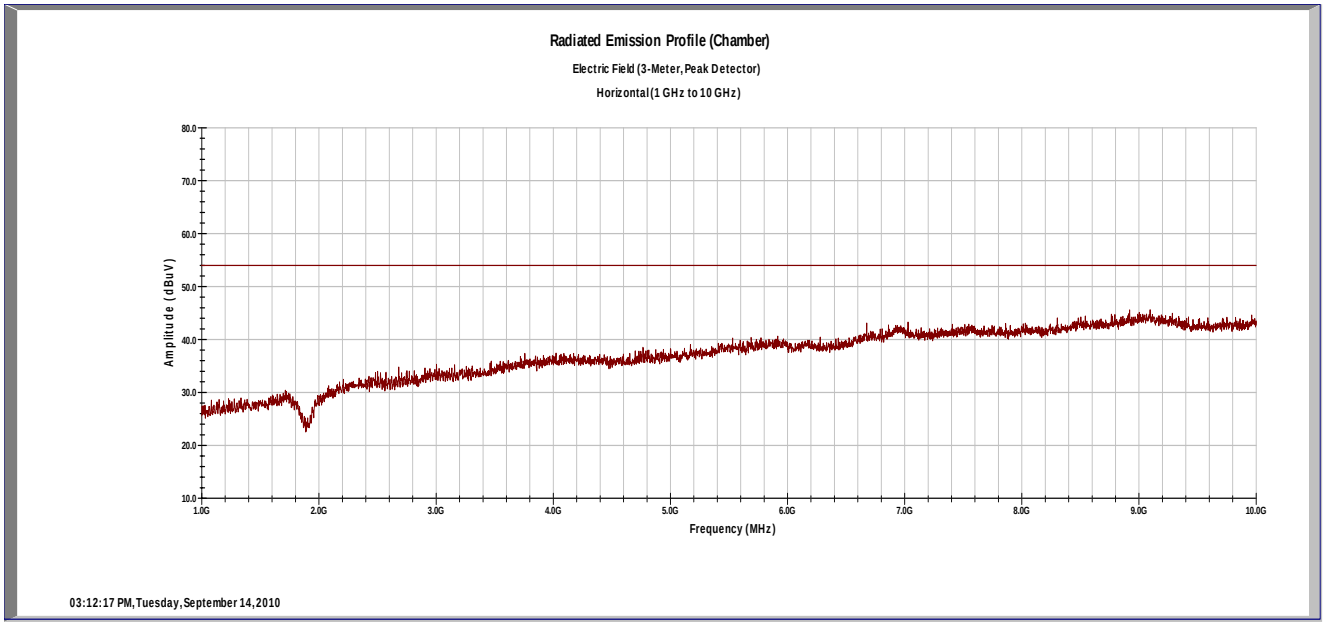
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Orientation 1 – Worst Case Emissions
Trace shown using peak detector.

Radiated Emissions – 1 to10 GHz

Horizontal



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

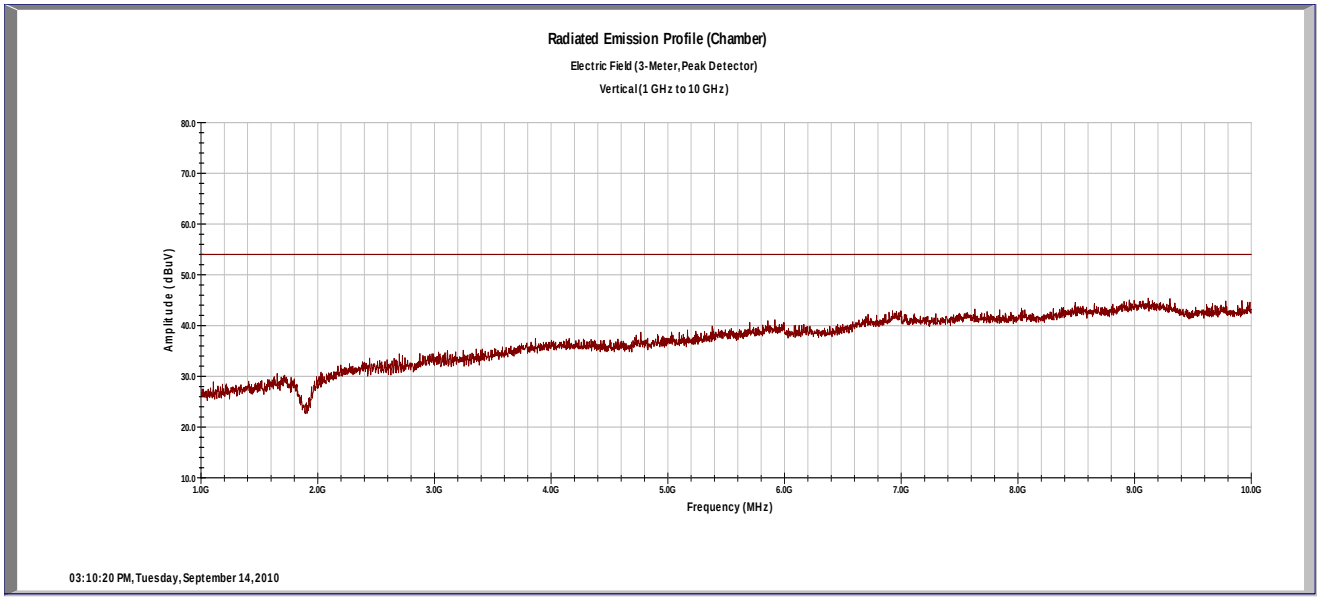
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: No emissions detected.
Trace shown using peak detector.

Radiated Emissions – 1 to10 GHz

Vertical



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

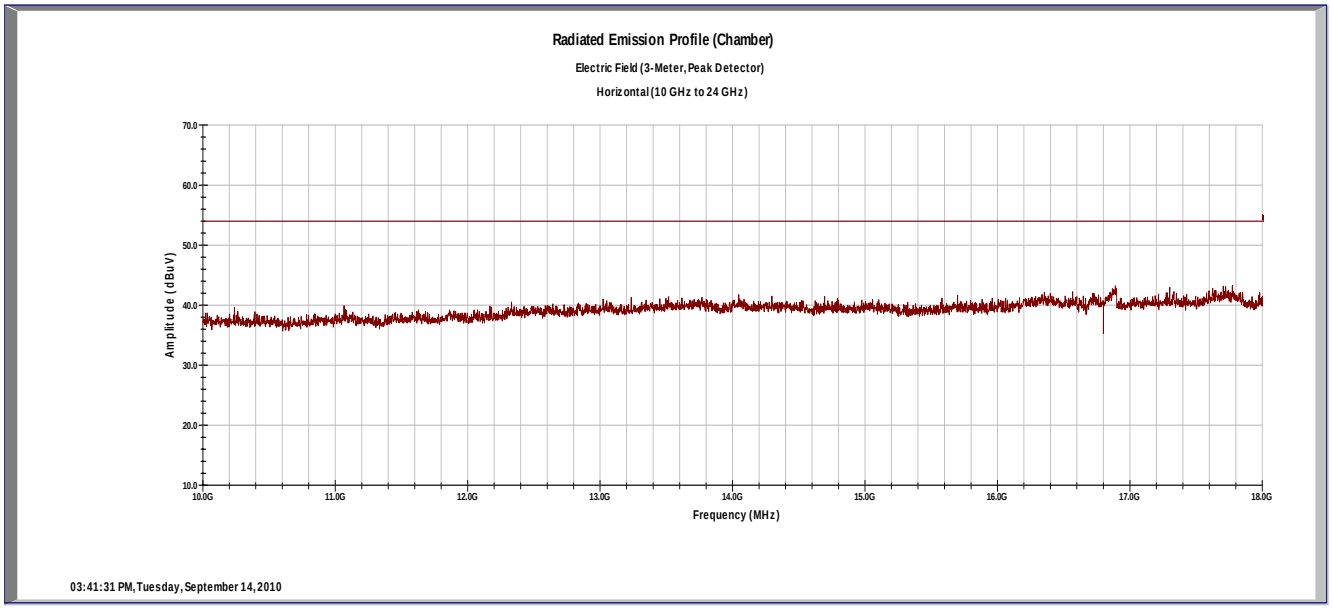
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: No emissions detected.
Trace shown using peak detector.

Radiated Emissions – 10 to14 GHz

Horizontal



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

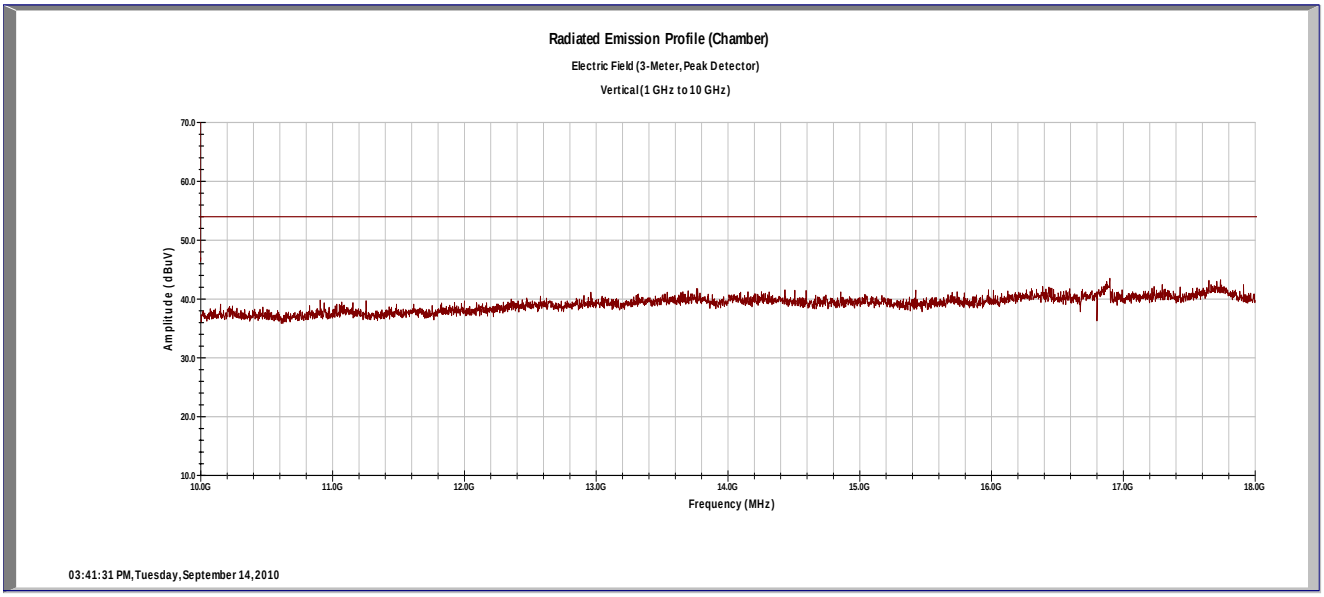
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: No emissions detected.
Trace shown using peak detector.

Radiated Emissions – 10 to14 GHz

Vertical



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: No emissions detected.
Trace shown using peak detector.

6 RF Exposure

6.1 Exposure Requirements – FCC Part 2.1093 and RSS-102 Issue 4

FCC Part 15.247(d) states that SAR evaluation in not required if "Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. *See* §1.1307(b)(1) of CFR 47."

RSS-102 section 2.5.1 states that a device is exempt from SAR evaluation if the frequency is "above 2.2 GHz and up to 3 GHz inclusively, and with output power (i.e. the higher of the conducted or radiated (e.i.r.p.) source-based, time-averaged output power) that is less than or equal to 20 mW for general public use…".

6.1.1 Test Procedure

If the antenna is located > 20cm from the user, then an MPE calculation is acceptable.

If the antenna is located < 20cm (portable / mobile / hand-held device) from the user, then SAR evaluation is required.

6.1.2 Evaluation

The EUT is indented to be a hand held device. Therefore the Bluetooth antenna is located in close proximity (< 20cm) to humans. A SAR evaluation is required.

6.2 Evaluation for FCC

FCC Part 15.247(d) states that SAR evaluation in not required if "Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. *See* §1.1307(b)(1) of CFR 47."

FCC 447498 D01 Mobile Portable RF Exposure v04, Paragraph 2) section a) i) states:
"A device may be used in portable exposure conditions with no restrictions on host platforms when either the source-based time-averaged output power is ≤ $60/f_{(GHz)}$ mW or all measured 1-g SAR are < 0.4 W/kg.[11] ".

The minimum power that requires SAR is 60 / 2.4 or 25 mW.

The maximum power output plus maximum antenna gain of the EUT is: 2 mW

The EUT is well below the 25mW power limit.

6.2.1 Conclusion

EiRP output of 2 mW is well below the 25 mW.

The Bluetooth transmitter is exempt from SAR Testing.

6.3 Evaluation for Industry Canada

RSS-102, Issue 4, section 2.5.1 states that a device is exempt from SAR evaluation if the frequency is "above 2.2 GHz and up to 3 GHz inclusively, and with output power (i.e. the higher of the conducted or radiated (e.i.r.p.) source-based, time-averaged output power) that is less than or equal to 20 mW for general public use…".

1 mW output with a 3dBi gain (numeric gain of 2) antenna. = a maximum EiRP output of 2 mW.

6.3.1 Conclusion

EiRP output of 2 mW is well below the 20 mW limit of RSS-102 section 2.5.1.

The Bluetooth transmitter is exempt from SAR Testing.

6.4 SAR Evaluation for pre-approved Wi-Fi Module

The EUT utilizes a pre-approved Wi-Fi module, but was not tested for SAR.
Refer to RF Exposure Lab's SAR test report Number; SAR 20101003 for SARs testing on the Wi-Fi portion of this device.

6.4.1 Conclusion

The SAR levels are compliant with both the FCC and Industry Canada rules for the Wi-Fi transmitter.