Electromagnetic Compatibility Test Report

Prepared in accordance with

FCC Part 15C, RSS-210 Issue 8, ANSI C63.10:2009

On

ABUS Bluetooth Transceiver

BTA-1

Russound

5 Forbes Road

Newmarket, NH 03857

Prepared by:

TUV Rheinland of North America, Inc.

Manufacturer's statement - attestation

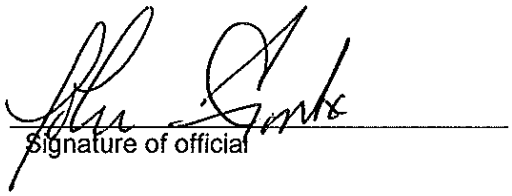
The manufacturer; Russound Inc, as the responsible party for the equipment tested, hereby affirms:

a) That he 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.

John Cronk Printed name of official	 Signature of official
5 Forbes Road **Newmarket NH 03857** Address	12/19/2011 Date
603-659-5170 Telephone number	johncr@russound.com Email address of official

Client:	Russound 5 Forbes Road Newmarket, NH 03857	John Cronk 603-292-0433 / 603-659-5388 johncr@russound.com	
Identification:	ABUS Bluetooth Transceiver	***Serial No.:***	09152430012345
Test item:	BTA-1	***Date tested:***	11/30/2011
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 8: FCC Part 15.207(a) and RSS-210 FCC Parts 15.205, 15.209, 15.215(c), RSS-210 FCC Part 15.247(a)(1) and RSS-210 A1.3, FCC Part 15.247 and RSS-210 Annex 8, FCC Part 15.247(a)(1) and RSS-210, Section A8.1 and Section A1.1.3, FCC Part 15.247(a)(1) and RSS-210 A8.1(c), FCC Part 15.247(b)(2) and RSS-210 A8.4(1), FCC Part 15.247(g) and RSS-210 A8.1, FCC Part 15.247(h) and RSS-210 A8.1, FCC Parts 15.109(a) and ICES-003 and FCC Part 15.107(a) and ICES-003		
Test Result	**The above product was found to be Compliant to the above test standard(s)**		

tested by: Randall Masline	***reviewed by:*** Cecil Gittens
11 January 2012 Randall E Masline ***Signature***	11 January 2012 Cecil Gittens ***Signature***
Other Aspects:	**None**

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

FC	NVLAP	**Industry Canada**	**BSMI**
US5253	NVLAP CODE 200313-0	**3466C-1**	**SL2-IN-E-050R**

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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 FCC Part 15C, RSS-210 Issue 8, ANSI C63.10:2009 based on the results of testing performed on 11/30/2011 on the ABUS Bluetooth Transceiver, Model No. BTA-1, manufactured by Russound. This report only applies to the specific samples tested under the stated test conditions. 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	Russound 5 Forbes Road Newmarket, NH 03857	**Tel**	603-292-0433	**Contact**	John Cronk
		Fax	603-659-5388	**e-mail**	johncr@russound.com

Description	ABUS Bluetooth Transceiver	**Model Number**	BTA-1
Serial Number	09152430012345	**Test Voltage/Freq.**	24 VDC via Ethernet cable
Test Date Completed:	11/30/2011	**Test Engineer**	Randall Masline

Standards	Description	Severity Level or Limit	Criteria	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 8 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)	Below Limit	**Complies**
FCC Part 15.207(a) and RSS-210	Conducted Emissions on Mains EUT in Transmit Mode	Below limit of section 15.207(a)	N/A	**Complies**
FCC Part 15.247 and RSS-210 Annex 8	Operation within the band 2400 -2483.5 MHz	See called out basic standards below	Below Limit	**Complies**
FCC Part 15.247(a)(1) and RSS-210 A1.3	Occupied Bandwidth	Contained within the Frequency Band	Below Limit	**Complies**
FCC Part 15.247(a)(1) and RSS-210, Section A8.1	Channel Seperation		Below Limit	**Complies**
FCC Part 15.247(a)(1) and RSS-210 A8.1(c)	Pseudorandom Hopping Algorithm	75 hopping channels when the BW ≥ 250kHz	Below Limit	**Complies**
FCC Part 15.247(b)(2) and RSS-210 A8.4(1)	Transmitter Output Power	Shall not exceed 1 Watt	Below Limit	**Complies**
FCC Part 15.247(g) and RSS-210 A8.1	Frequency Hopping Spread Spectrum (FHSS) Systems	Description of Hopping System	Below Limit	**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	**Complies**
FCC Parts 15.109(a) and ICES-003	Radiated Emissions while EUT in Receive Mode	Below limit of section 15.109(a) Class B	Below Limit	**Complies**
FCC Part 15.107(a) and ICES-003	Conducteded Emissions EUT in Receive Mode	Below limit of section 15.107(a) Class B	N/A	**Complies**

2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission (Expires 12/7/2013)

TUV Rheinland of North America located at, 336 Initiative Drive, Rochester, NY 14624-6217 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 90575). 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 (Expires 6/30/2013)

This is a 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: 200313-0). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 VCCI

VCCI Accredited test lab. Registration numbers R-1065, C-1120, & C-1121.

2.1.4 Industry Canada (Expires 1/22/2012)

(Registration No.: 3466C-1) The OATS has been accepted by Industry Canada to perform testing to 3 and to 10m, based on the test procedures described in ANSI C63.4-2009.

2.1.5 BSMI

Registration No.: SL2-IN-E-050R. The BSMI accreditation was obtained by NIST MRA with the BSMI.

2.1.6 Korea

Recognized by Radio Research Agency as an accredited Conformity Assessment Body (CAB) under the terms of Phase I of the APEC TEL.

2.1.7 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 #	Ref.	Serial #	Last Cal dd/mm/yy	Next Cal dd/mm/yy	Test
BiLog	Chase	CBL6111	C017	1169	24-Aug-11	24-Aug-12	RE
Horn	EMCO	3115	C025	9512-4630	20-Jul-11	20-Jul-13	RE
Horn	EMCO	3115	C031	9812-5635	16-Mar 10	16-Mar 12	RE
BiLog	Chase	CBL6111	C041	1170	31-Mar-11	31-Mar-12	RE
Power Meter	Gigatronics	8541B	C257	1828546	12-Dec-10	12-Dec-11	RI
Peak Power Sensor	Gigatronics	80350A	C258	1829770	12-Dec-10	12-Dec-11	RI
Analyzer w RF Filter Section 85460A	HP	8546A	C311	3325A00127	9-Aug- 11	9-Aug- 12	RE, CE
Receiver (20Hz-40GHz)	Rohde & Schwarz	ESI 40	C320	839283/005	11-Dec-10	11-Dec-11	RE
EMI Receiver	Rohde & Schwarz	ESVS 30	C322	826006/002	11-Dec-10	11-Dec-11	RE
Multimeter	Fluke	87	C405	49050672	9-Aug- 11	9-Aug- 12	All tests
Multimeter	Fluke	83	C437	48162892	9-Aug- 11	9-Aug- 12	RE
Amplifier (1-26.5 GHz.)	Agilent	8449B	C438	3008A01842	18-Dec-09	18-Dec-11	RE
Amplifier 1 - 18GHz	Rohde & Schwarz	TS-PR18	C439	122002/001	18-Dec-09	18-Dec-11	RE
Amplifier (18-26.5GHz)	Rohde & Schwarz	TS-PR26	C443	100005	10-Aug- 11	10-Aug- 12	RE
Digital Pressure/Temp/RH	Davis	Perception II	C444	40917	23-Mar 11	22-Mar 12	All tests
Multimeter	Fluke	87	C445	59890224	12-Dec-10	12-Dec-11	All tests
Horn	EMCO	3160-09	C447	03-0338-018	17-Nov-10	17-Nov-12	RE
Multimeter	Fluke	8062A	C452	4715199	12-Dec-10	12-Dec-11	All tests
Digital Pressure/Temp/RH	Davis	Perception II	C470	PB00218A16	29-Jun-11	28-Jun-12	RE

Note: CE = Conducted Emissions, CI= Conducted Immunity, DP=Disturbance Power, EFT=Electrical Fast Transients, ESD = Electrostatic Discharge, FLI=Flicker, HAR=Harmonics, MF=Magnetic Field Immunity, RE=Radiated Emissions, RI=Radiated Immunity, SI=Surge Immunity, VDSI=Voltage Dips and Short Interruptions

3 Product Information

3.1 Equipment Modifications

No modifications were needed to bring product into compliance.

3.2 Test Plan

The EUT product information, test configuration, mode of operation, test types, test procedures, test levels, pass/failure criteria, in this report were carried out per the product test plan located in appendix A of this report

3.3 EUT's Technical Specification

FCC Rule Part	15.247
Frequency Range	2400 – 2483.5 MHz
RF Power in Watts	0.001 mWatts
Conducted Power out in dBm	N/A
Field Strength in dBuV/m at 3 Meters	68.47 dBuV/m
6 dB or 20 dB Bandwidth	20 dB Bandwidth = 332 kHz
Type of Modulation	GFSK 79 Channels
EIRP in Watts	N/A
Occupied Bandwidth 99% RSS-210	308 kHz
Emission Designator RSS-210	
Antenna Type	Microstrip
Gain	-2dBi
External Antenna (if applicable)	N/A
Modular Filing, Class II Permissive Change	N/A

4 Spurious Emissions

4.1 Spurious Emissions Outside the band

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.

4.1.1 Over View of Test

Results	**Complies** (as tested per this report)				**Date**	11/14/2011	
Standard	FCC Parts 15.205, 15.209, 15.215 and RSS-210						
Product Model	BTA-1			**Serial#**	09152430012345		
Test Set-up	Tested on 10m O.A.T.S. 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	24 VDC via Ethernet cable	**Temp**	74 ºF	**Humidity**	36%	**Pressure**	1000 mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Randall Masline		

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

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

4.1.4 Final Test

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

The worst–case emissions are shown below

4.1.4.1 Emissions Outside the Frequency Band

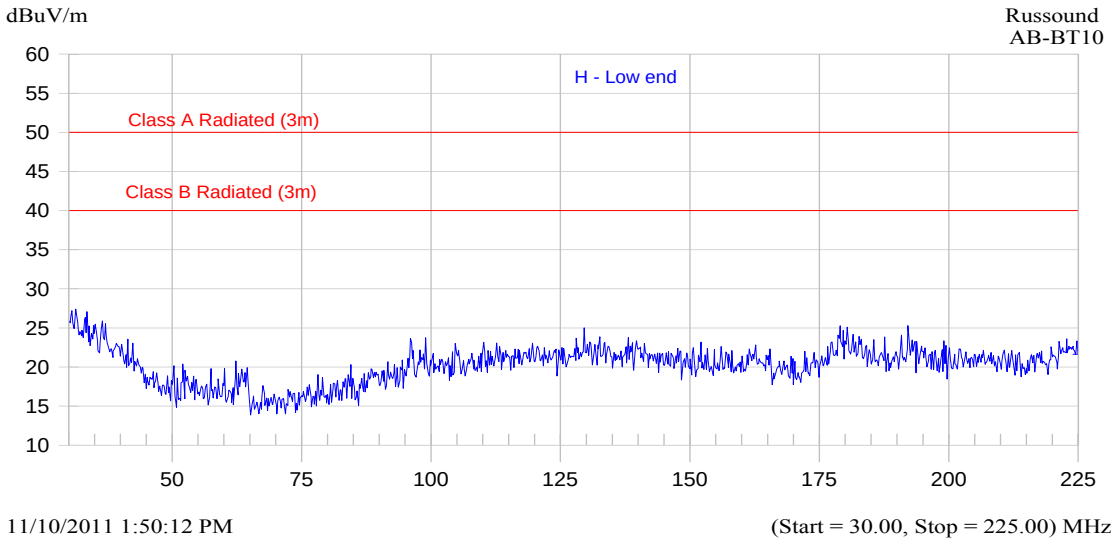
In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

4.1.5 Final Graphs

NOTES:

Radiated Emissions Prescan
Vertical / Horizontal

H - Low end



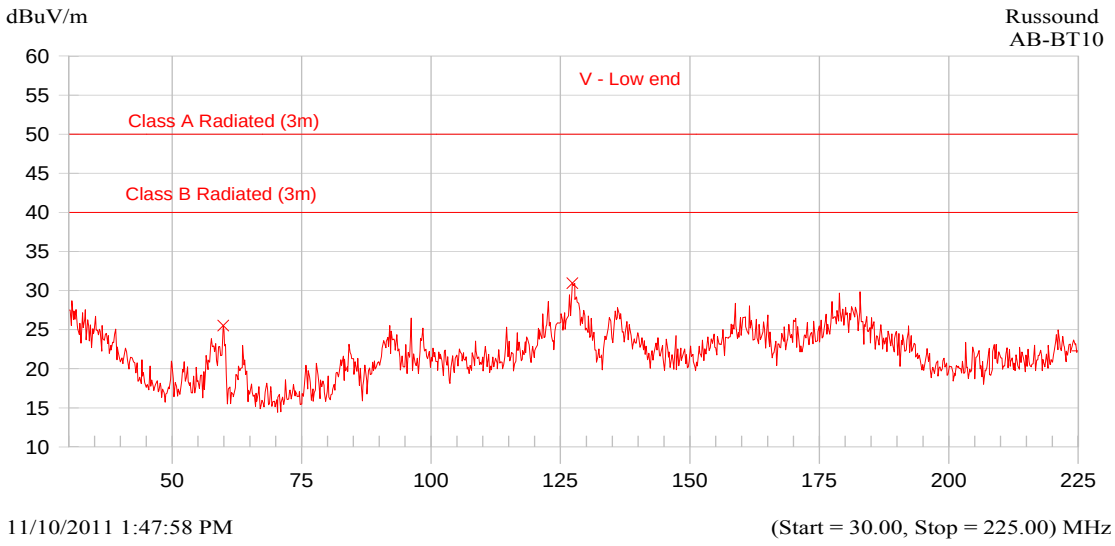
Frequency	Peak	QP	Class B-QP	Class A-QP	Trace Name
MHz	dBuV/m	dBuV/m	dB	dB	

NOTES:

Radiated Emissions Prescan

Vertical / Horizontal

V - Low end

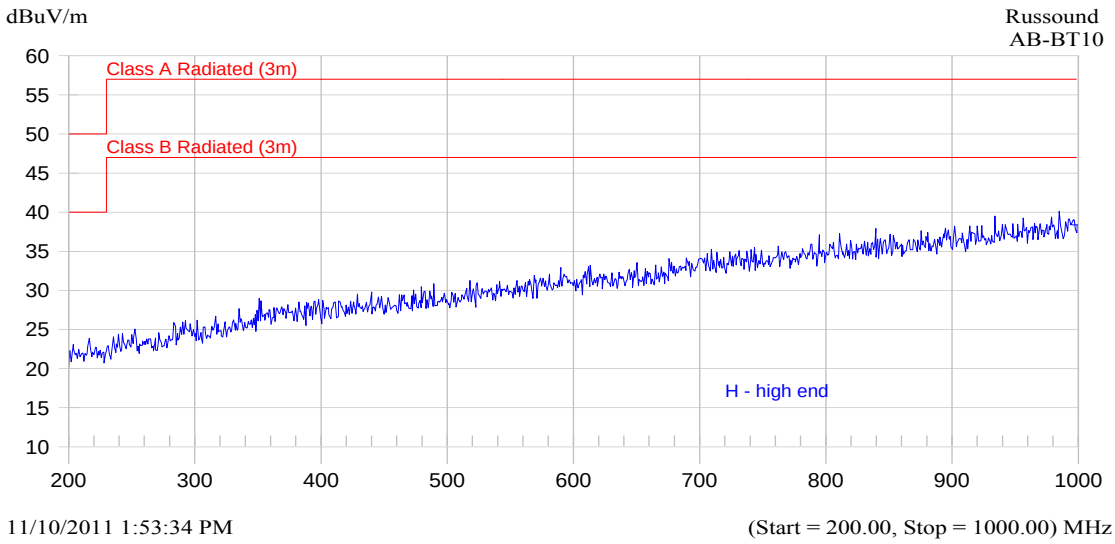


Frequency MHz	Peak dBuV/m	QP dBuV/m	Class B-QP dB	Class A-QP dB	Trace Name
59.856	25.5		23.4		V - Low end
127.320	31.0		28.5		V - Low end

NOTES:

Radiated Emissions Prescan
Vertical / Horizontal

H - high end

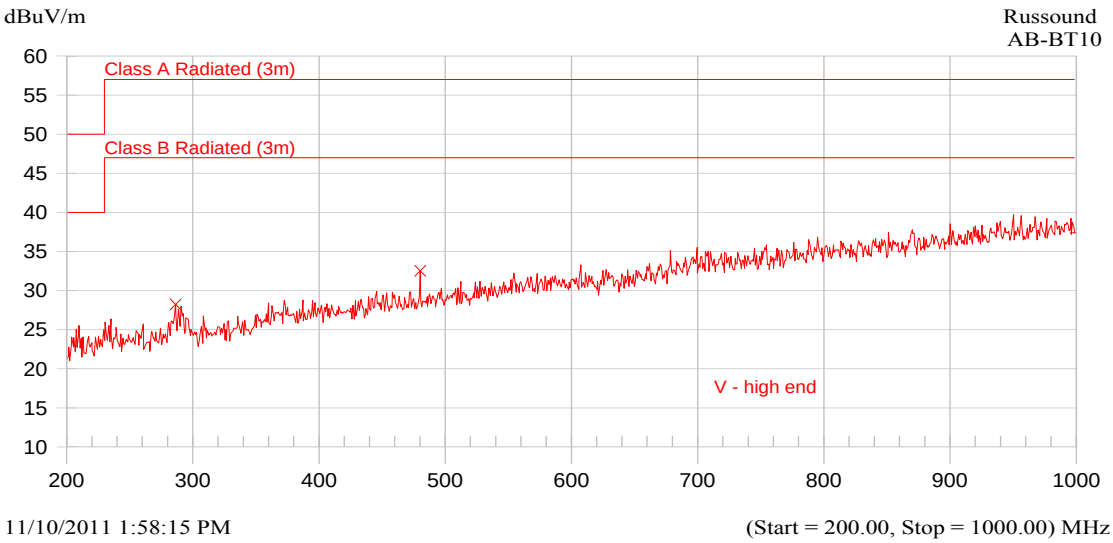


Frequency	Peak	QP	Class B-QP	Class A-QP	Trace Name
MHz	dBuV/m	dBuV/m	dB	dB	

NOTES:

Radiated Emissions Prescan
Vertical / Horizontal

V - high end



Frequency MHz	Peak dBuV/m	QP dBuV/m	Class B-QP dB	Class A-QP dB	Trace Name
286.292	28.2		25.1		V - high end
480.236	32.5		28.2		V - high end

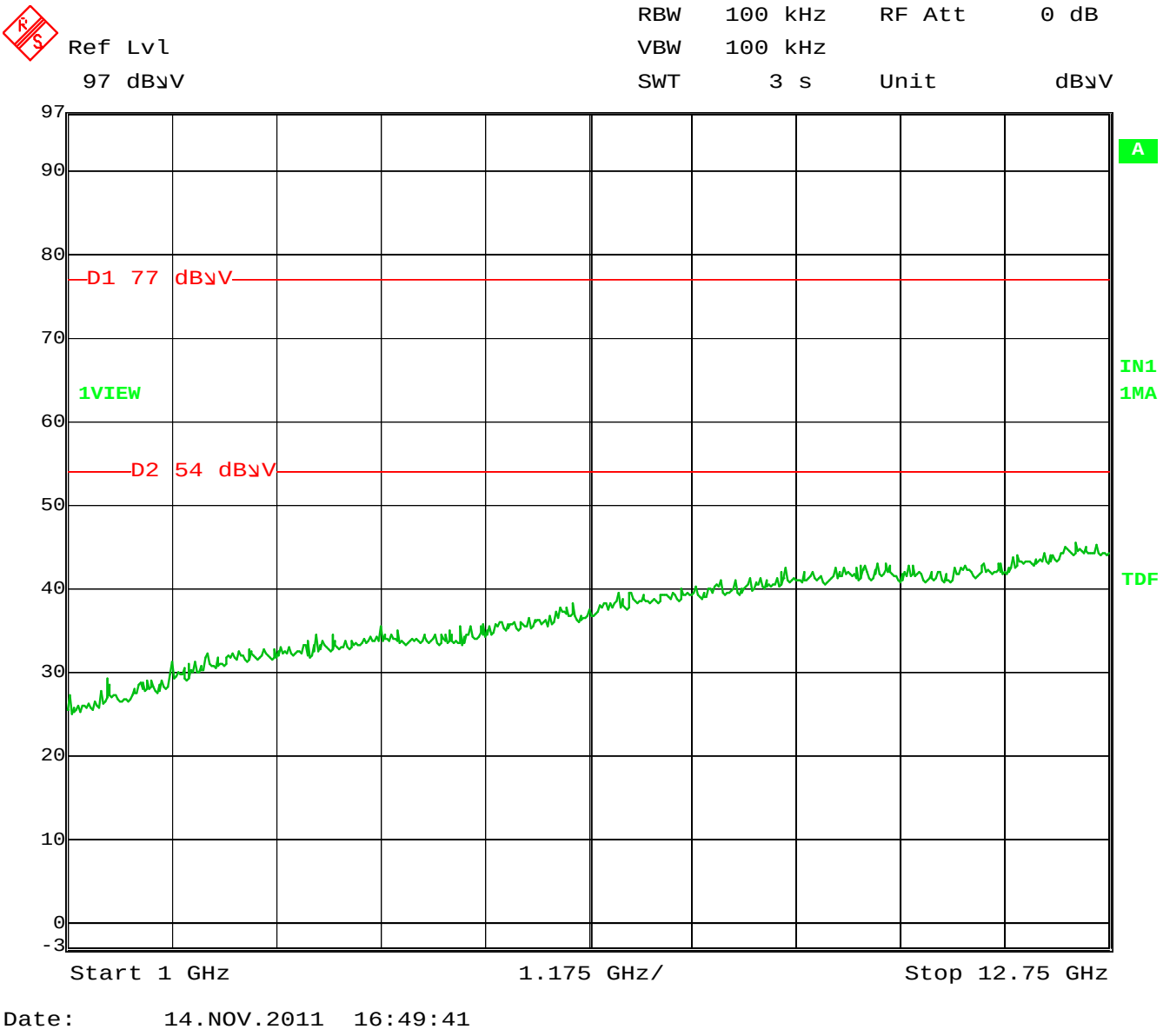


Figure 1: 1 – 12.75 GHz Horizontal

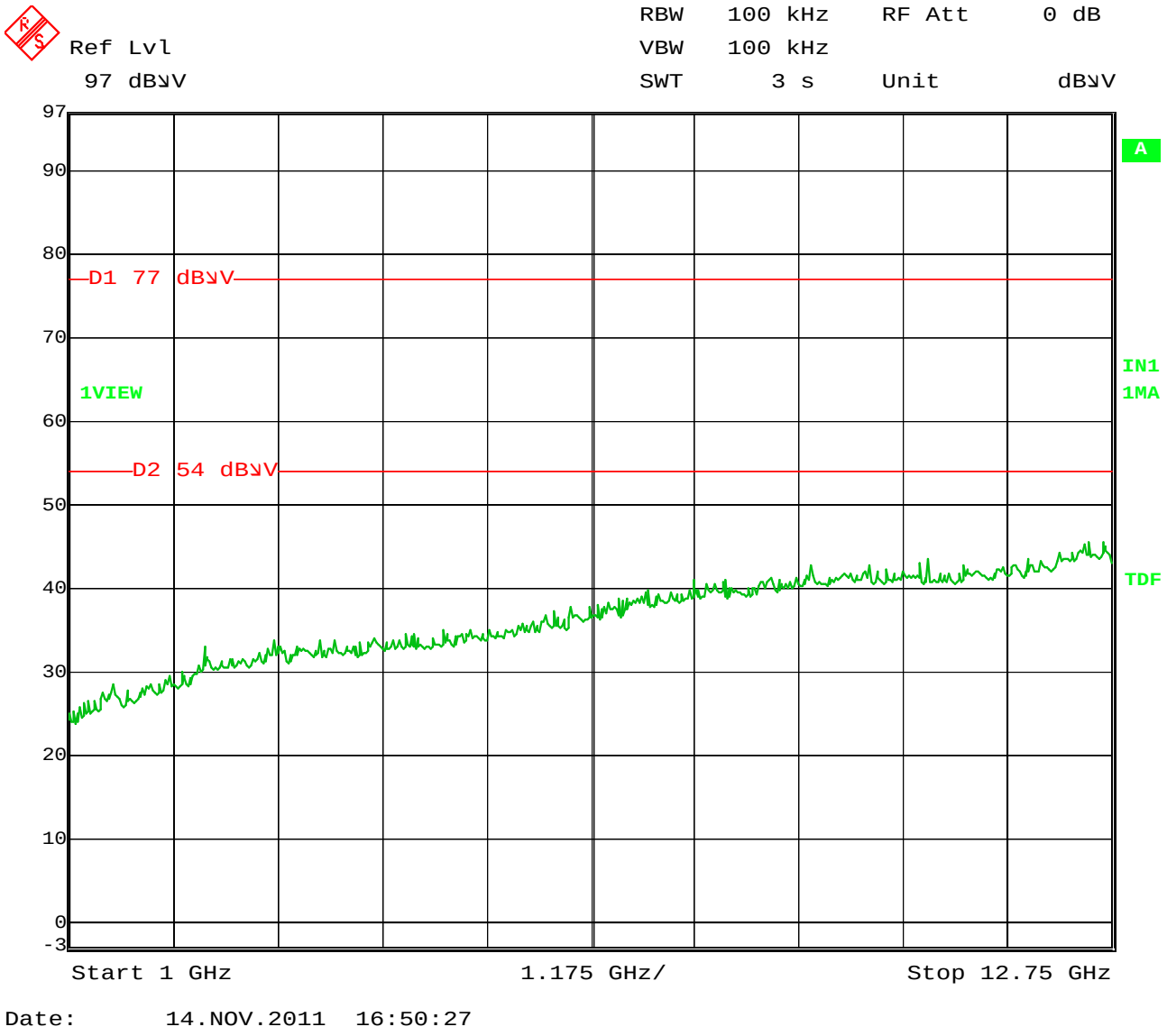


Figure 2: 1 – 12.75 GHz Vertical

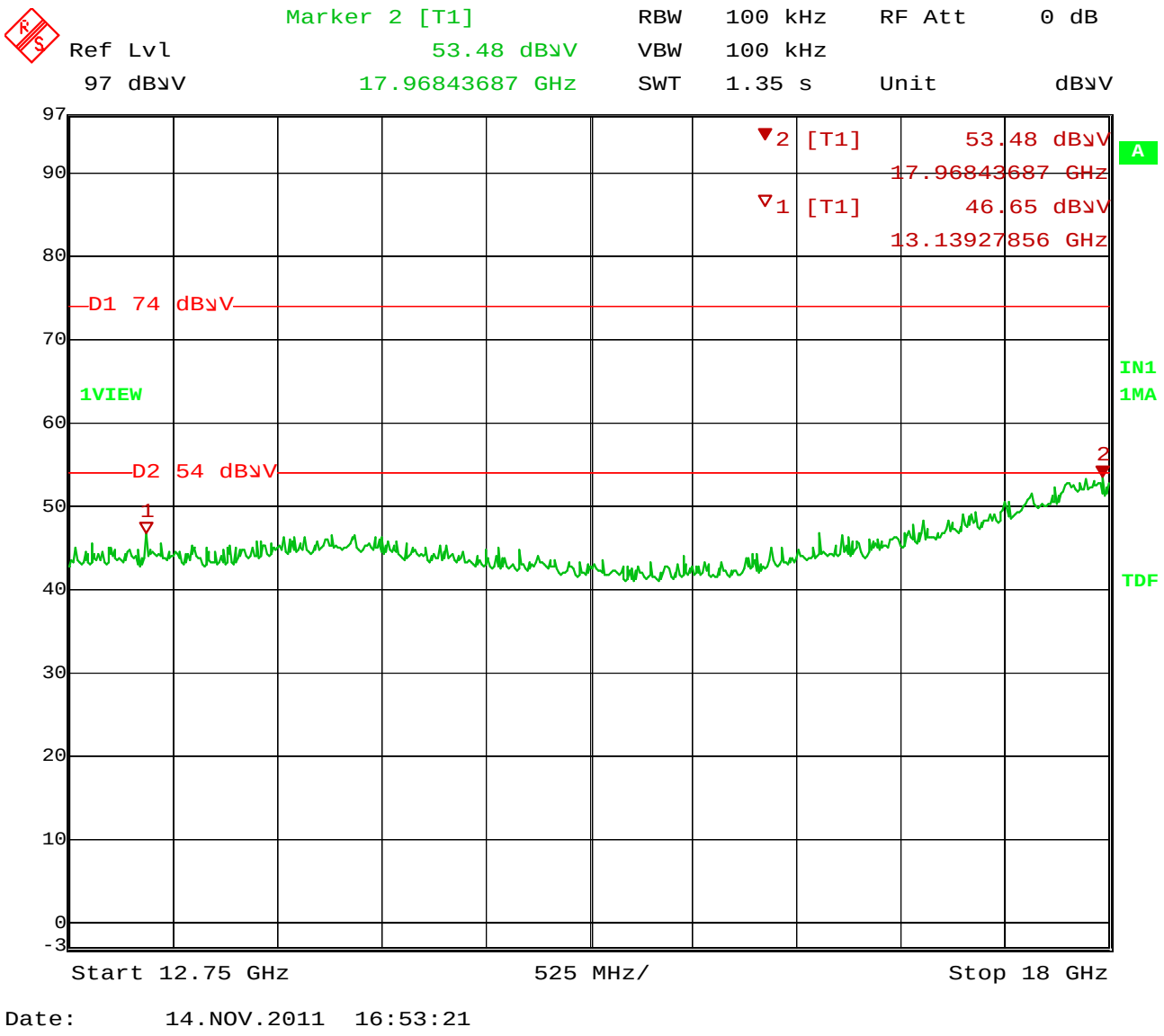


Figure 3: 12.75 – 18 GHz Horizontal

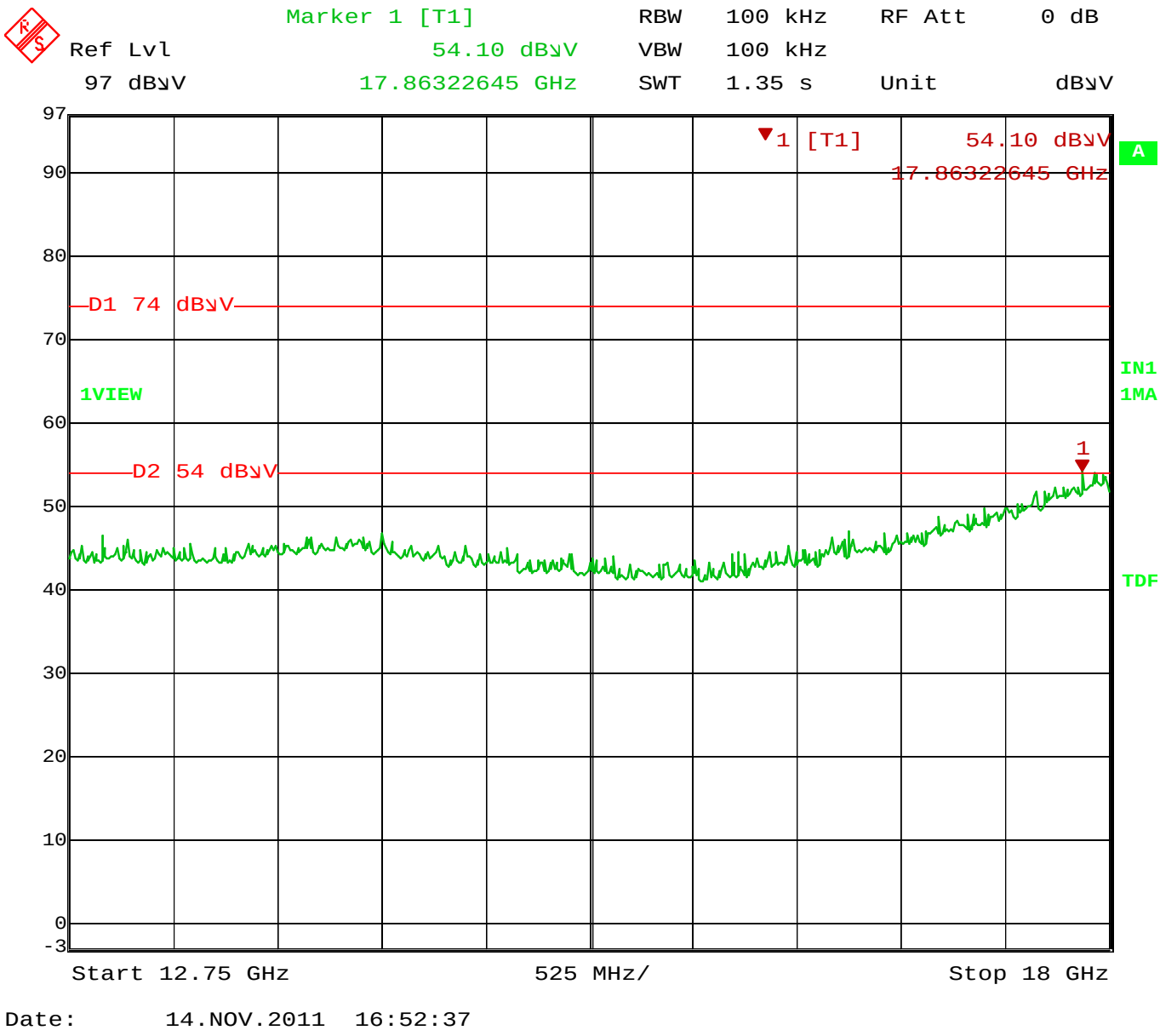


Figure 4: 12.75– 18 GHz Vertical

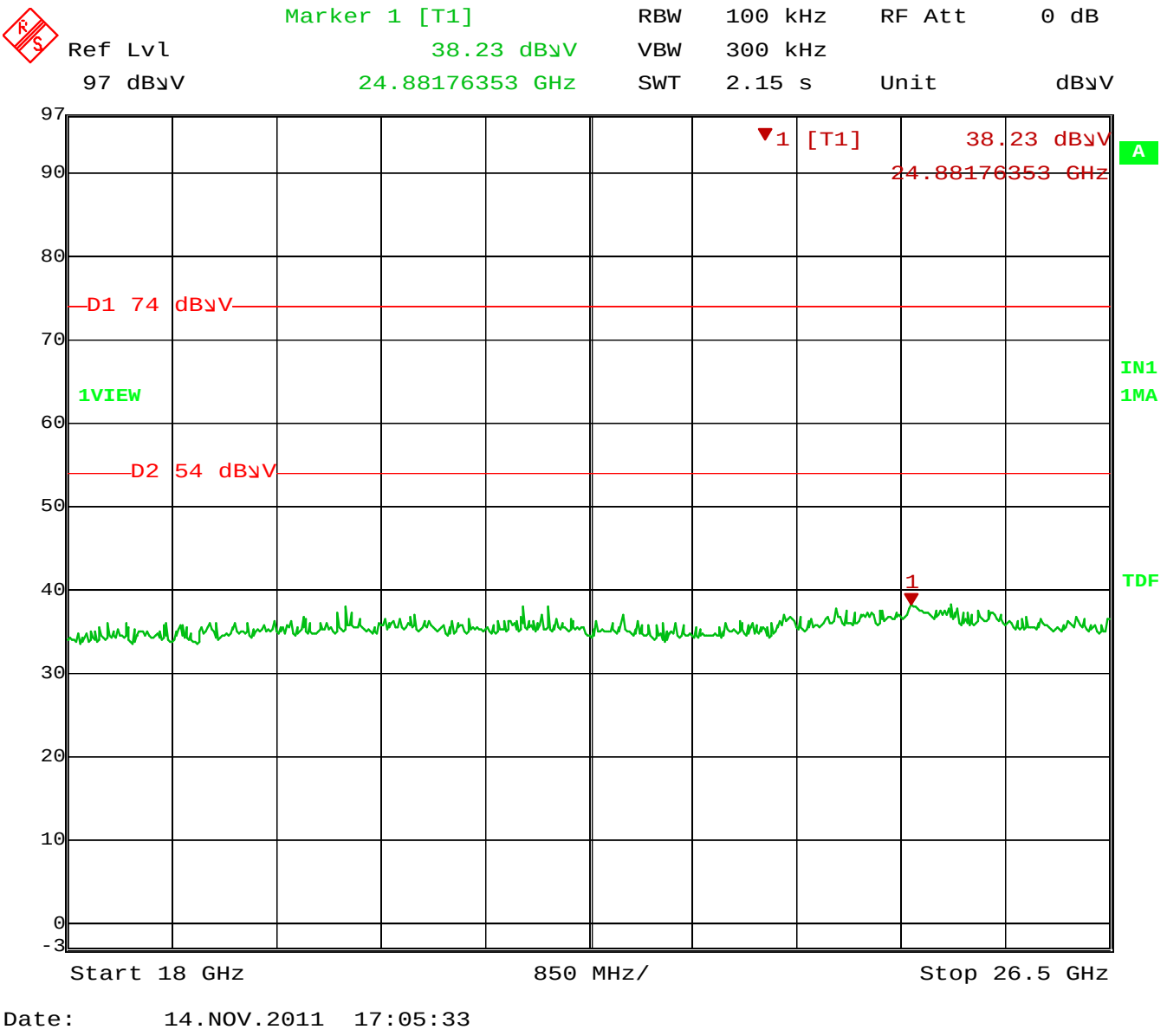


Figure 5: 18 – 26.5 GHz Horizontal

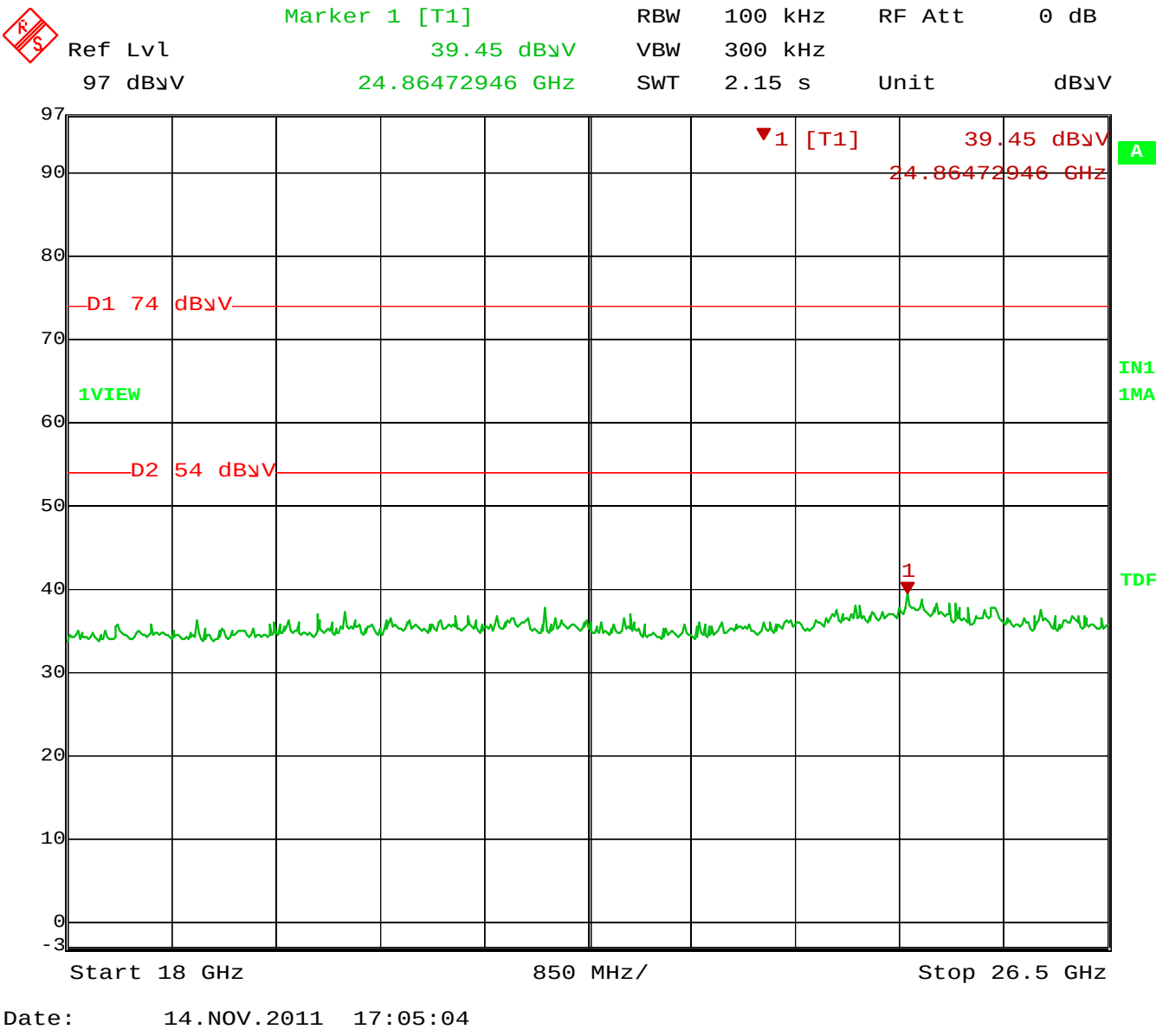


Figure 6: 18 – 26.5 GHz Vertical

4.1 Conducted Emissions in Transmit mode

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 near by electronic equipment.

4.1.1 Over View of Test

Results	**Complies** (as tested per this report)					**Date**	
Standard	FCC Part 15.207(a) and RSS-210						
Product Model	BTA-1			**Serial#**	09152430012345		
Test Set-up	Tested in shielded room. EUT placed on table, see test plans for details						
EUT Powered By	120VAC / 60 Hz	**Temp**	º F	**Humidity**	%	**Pressure**	mbar
Frequency Range	150 kHz – 30 MHz						
Perf. Criteria	(Below Limit)	**Perf. Verification**	Readings Under Limit for L1 & Neutral				
Mod. to EUT	None	**Test Performed By**	Randall Masline				

4.1.2 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 150 kHz – 30 MHz was investigated for conducted emissions.

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

4.1.3 Deviations

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

4.1.4 Final Test

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

4.2 Frequency Hopping Spread Spectrum (FHSS) Systems FCC Part 15.247(g)

Frequency hopping spread spectrum 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.

Each packet is sent on the next channel determined by the pseudo-random hop table. When presented with a continuous data stream, the EUT adheres to the 0.4 second dwell time for each 10 second window requirement. The EUT always distributes its transmissions across all 79 channels, and does not re-use a channel again until a transmission has occurred on each of the other 79 channels.

4.3 Incorporation of Intelligence within a FHSS System FCC Part 15.247(h)

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 hopsets 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 79 channels.

5 Cabinet Radiated Emissions

Testing was performed in accordance with 47 CFR Part 15, ANSI C63.10:2009, RSS-210 Issue 8. 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.

5.1 Band Edge

5.1.1 Test Over View

Results	**Complies** (as tested per this report)					**Date**	11/14/2011
Standard	FCC Part 15.247(a)(1)(i), RSS 210 A8.1						
Product Model	BTA-1			**Serial#**	09152430012345		
Test Set-up	Measured at 3 meters						
EUT Powered By	24 VDC via Ethernet cable	**Temp**	74º F	**Humidity**	32%	**Pressure**	1010mbar
Perf. Criteria	(Below Limit)			**Perf. Verification**	Readings Under Limit		
Mod. to EUT	None			**Test Performed By**	Randall Masline		

5.1.2 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.

5.1.3 Deviations

There were no deviations from the test methodology listed in the test plan for the Radiated Immunity test.

5.1.4 Final Test

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

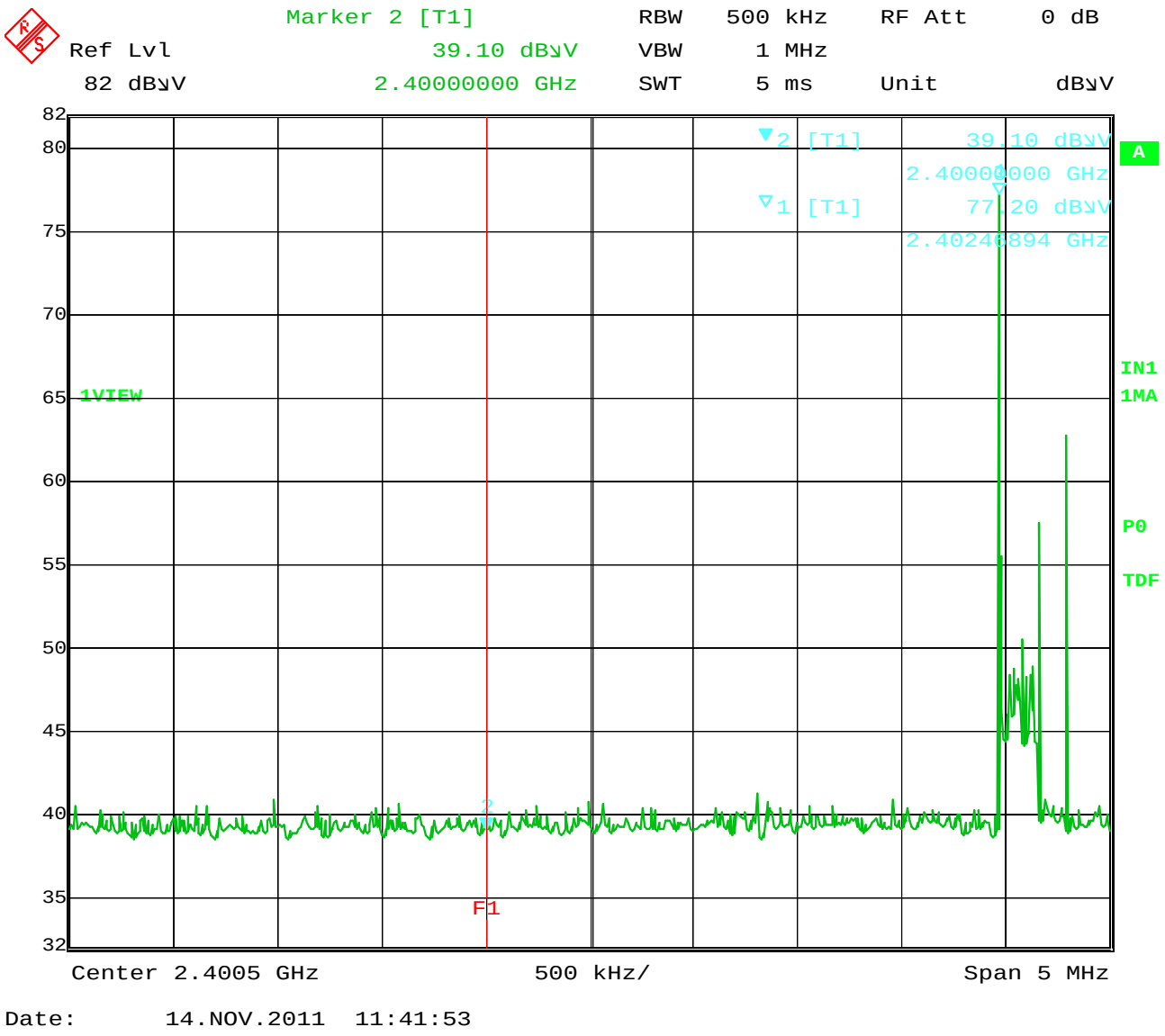


Figure 7: Lower Band Edge Measurement

Note: F1 Vertical marker is at 2400 MHz

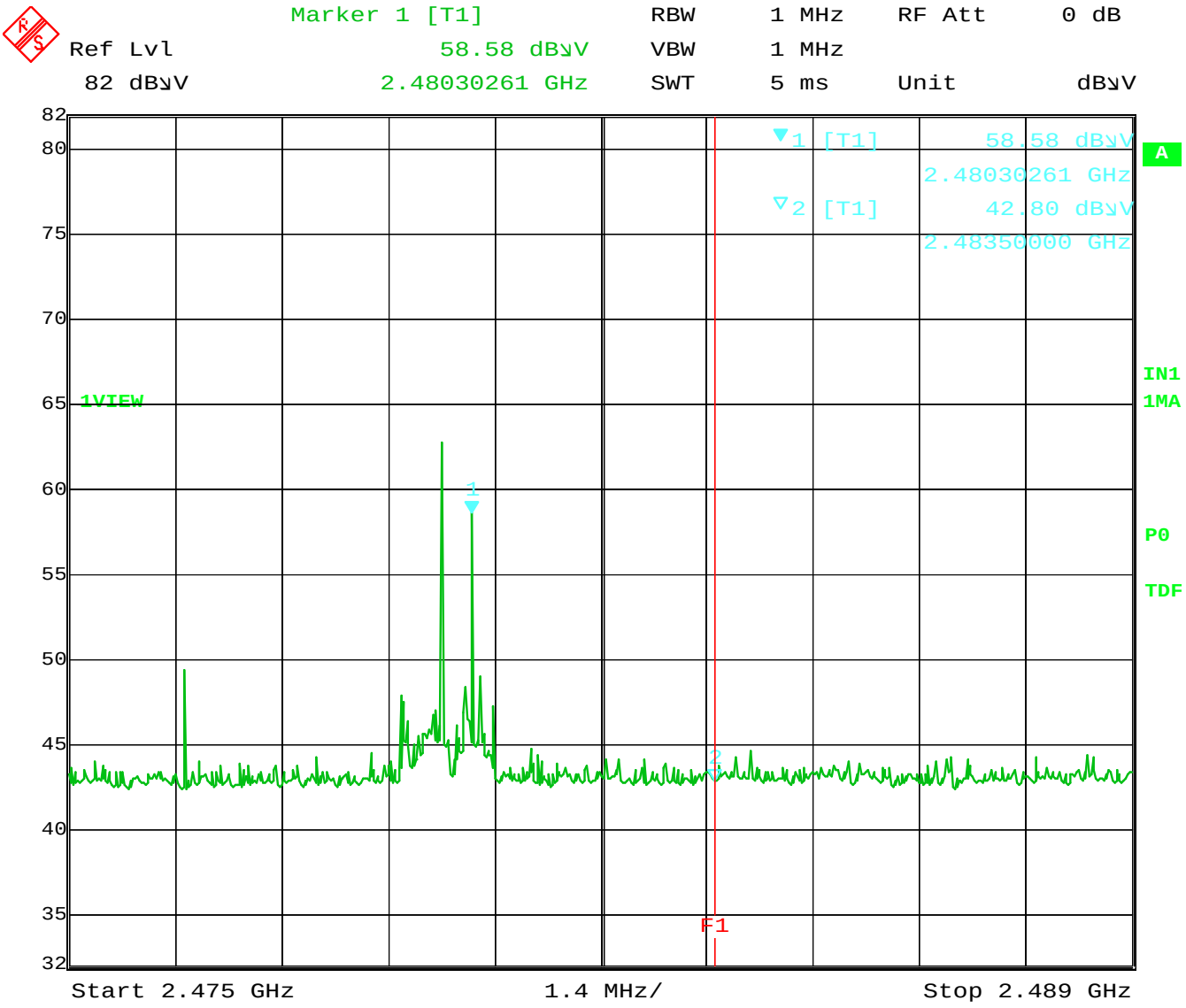


Figure 8: Upper Band Edge Measurement

Note: F1 Vertical marker is at 2400 MHz

5.2 Channel Separation

5.2.1 Test Over View

Results	**Complies** (as tested per this report)					**Date**	11/14/2011
Standard	FCC Part 15.247(a)(1), RSS 210 A8.1						
Product Model	BTA-1			**Serial#**	09152430012345		
Test Set-up	Measured at 3 meters						
EUT Powered By	24 VDC via Ethernet cable	**Temp**	74º F	**Humidity**	32%	**Pressure**	1010mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Randall Masline		

5.2.2 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.

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.

5.2.3 Deviations

There were no deviations from the test methodology listed in the test plan for the Radiated Immunity test.

5.2.4 Final Test

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

5.2.5 Final Data

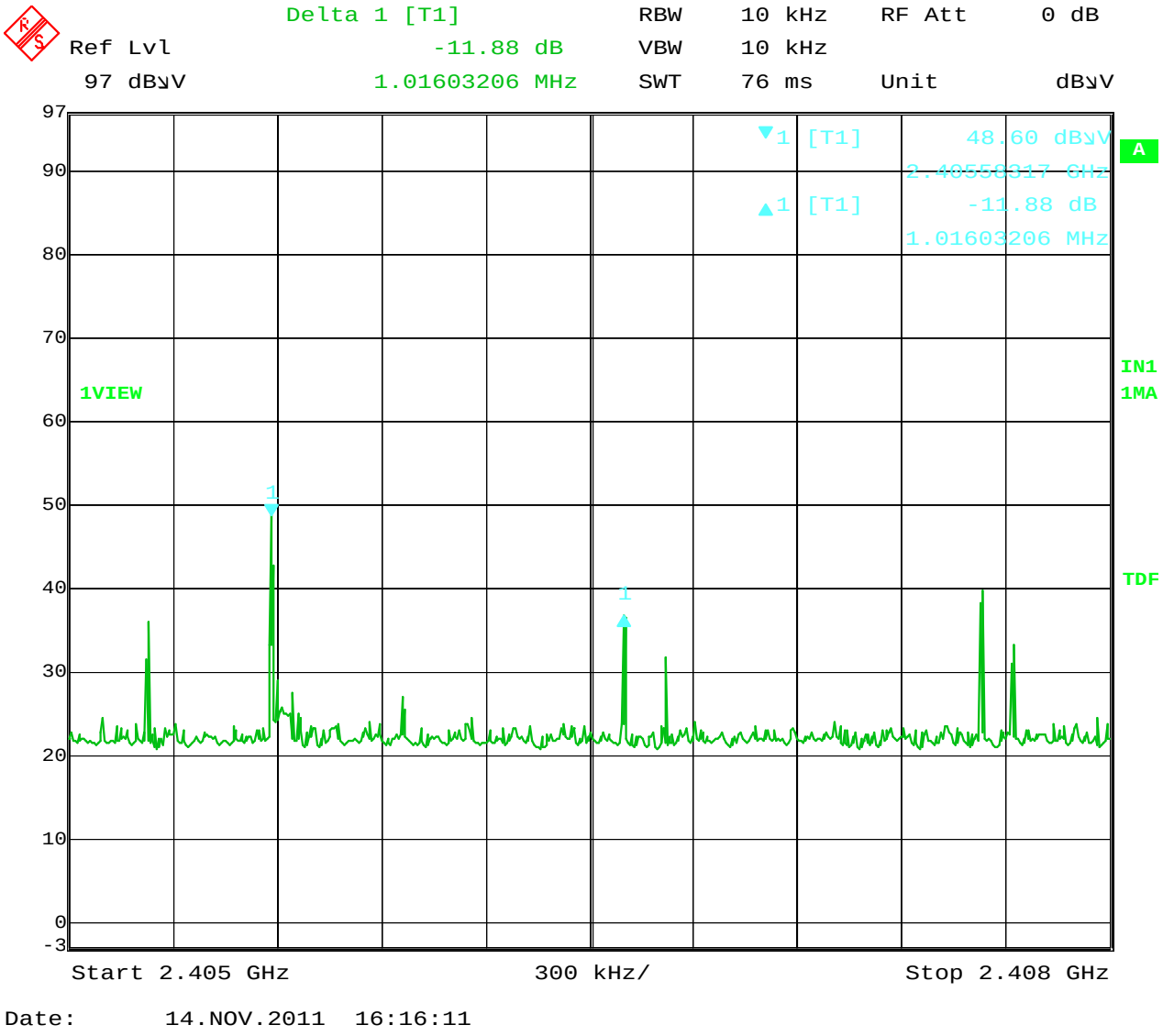


Figure 9: Channel Separation = 1.016 MHz

5.3 Pseudorandom Hopping Algorithm

5.3.1 Test Over View

Results	**Complies** (as tested per this report)					**Date**	11/14/2011
Standard	FCC Part 15.247(a)(1) and RSS-210, A8.1						
Product Model	BTA-1			**Serial#**	09152430012345		
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	24 VDC via Ethernet cable	**Temp**	74º F	**Humidity**	32%	**Pressure**	1010mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Randall Masline		

5.3.2 Test Procedure

The channel bandwidth for this system is greater than 250 kHz. Therefore the system must use at least 75 channels that are selected at the system hopping rate, from a pseudo-randomly ordered list of hopping frequencies. Each frequency must be used equally on average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their transmitters and shall shift frequencies in synchronization with the transmitted signals.

5.3.3 Deviations

There were no deviations from the test methodology listed in the test plan for the Radiated Immunity test.

5.3.4 Final Test

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

5.3.5 Final Data

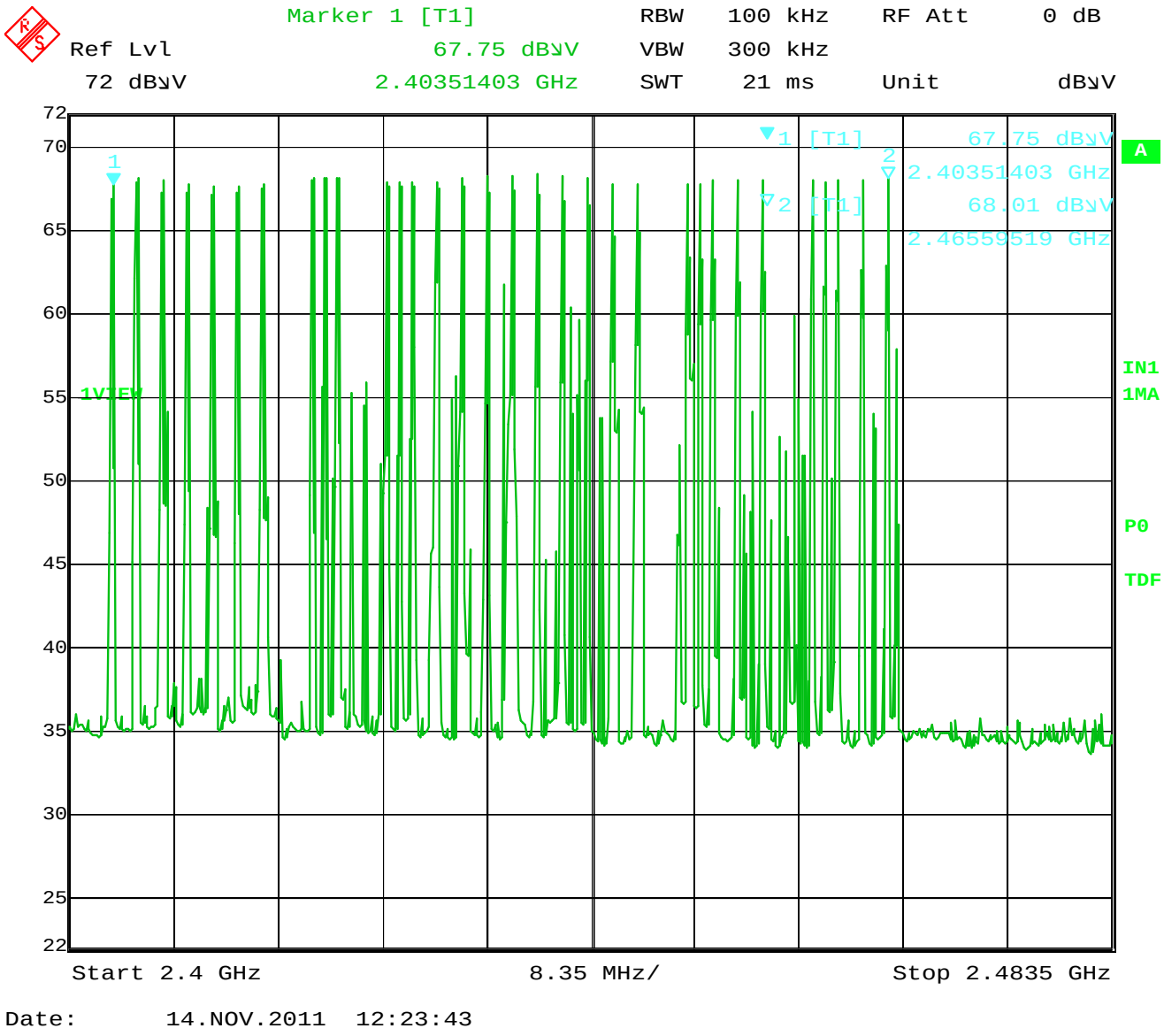


Figure 10: Plot of hopping Channels

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

Frequency Band (MHz)	20 dB Bandwidth	Number of Hopping Channels	Average Time of Occupancy
2400-2483.5	=>250 kHz	79	=<0.4 sec. In 10 sec.

There were 2 hops at 81.48 milliseconds per hop for any 10 sec. Period. Time of occupancy equals number of hops multiplied by the duration of one hop.

Time of Occupancy limit = 0.400 seconds in any 10 second period.
Calculated Time of Occupancy = 0.011 seconds x 2 = 0.022 seconds in any 10 second period

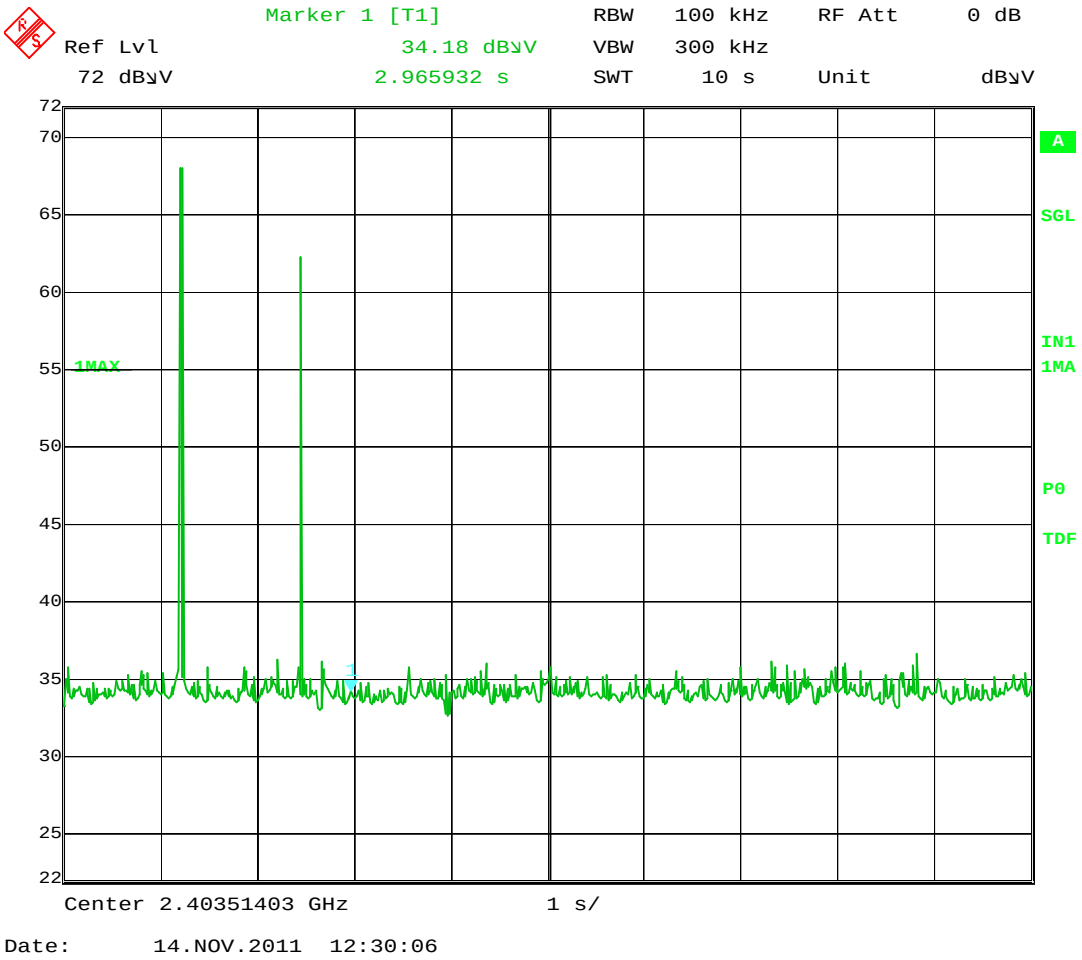


Figure 11: 10 second sweep of 2403.5 MHz

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

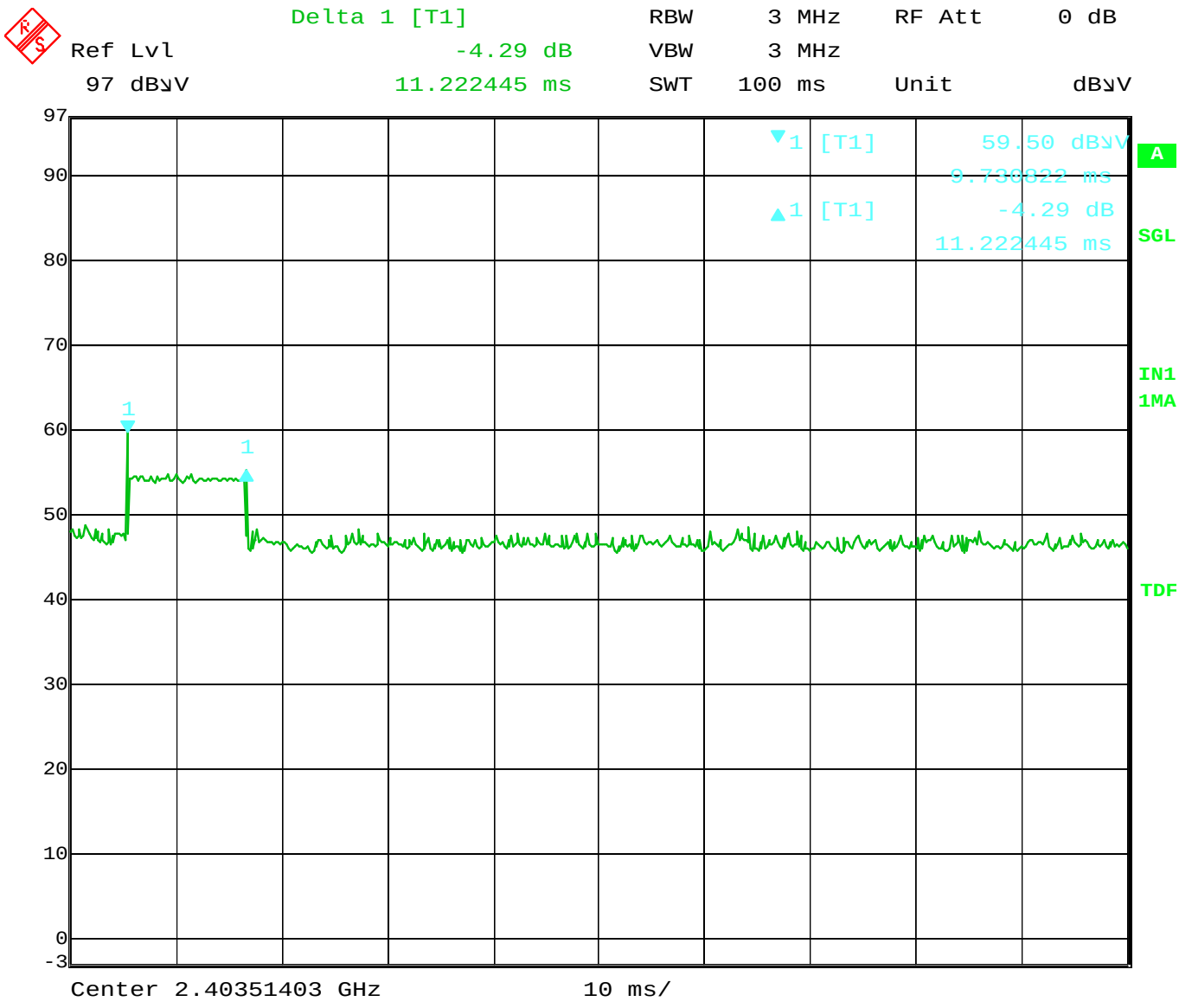


Figure 12: Measurement of 1 hop at 2403.5 MHz

Time on Frequency = 22.44 ms

5.4 Occupied Bandwidth

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

5.4.1 Test Over View

Results	**Complies** (as tested per this report)					**Date**	11/14/2011
Standard	FCC Part 15.247(a)(1)						
Product Model	BTA-1			**Serial#**	09152430012345		
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	24 VDC via Ethernet cable	**Temp**	74º F	**Humidity**	32%	**Pressure**	1010mbar
Perf. Criteria	(Below Limit)			**Perf. Verification**	Readings Under Limit		
Mod. to EUT	None			**Test Performed By**	Randall Masline		

5.4.2 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.

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.

5.4.3 Deviations

There were no deviations from the test methodology listed in the test plan for the Radiated Immunity test.

5.4.4 Final Test

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

5.4.5 Final Data

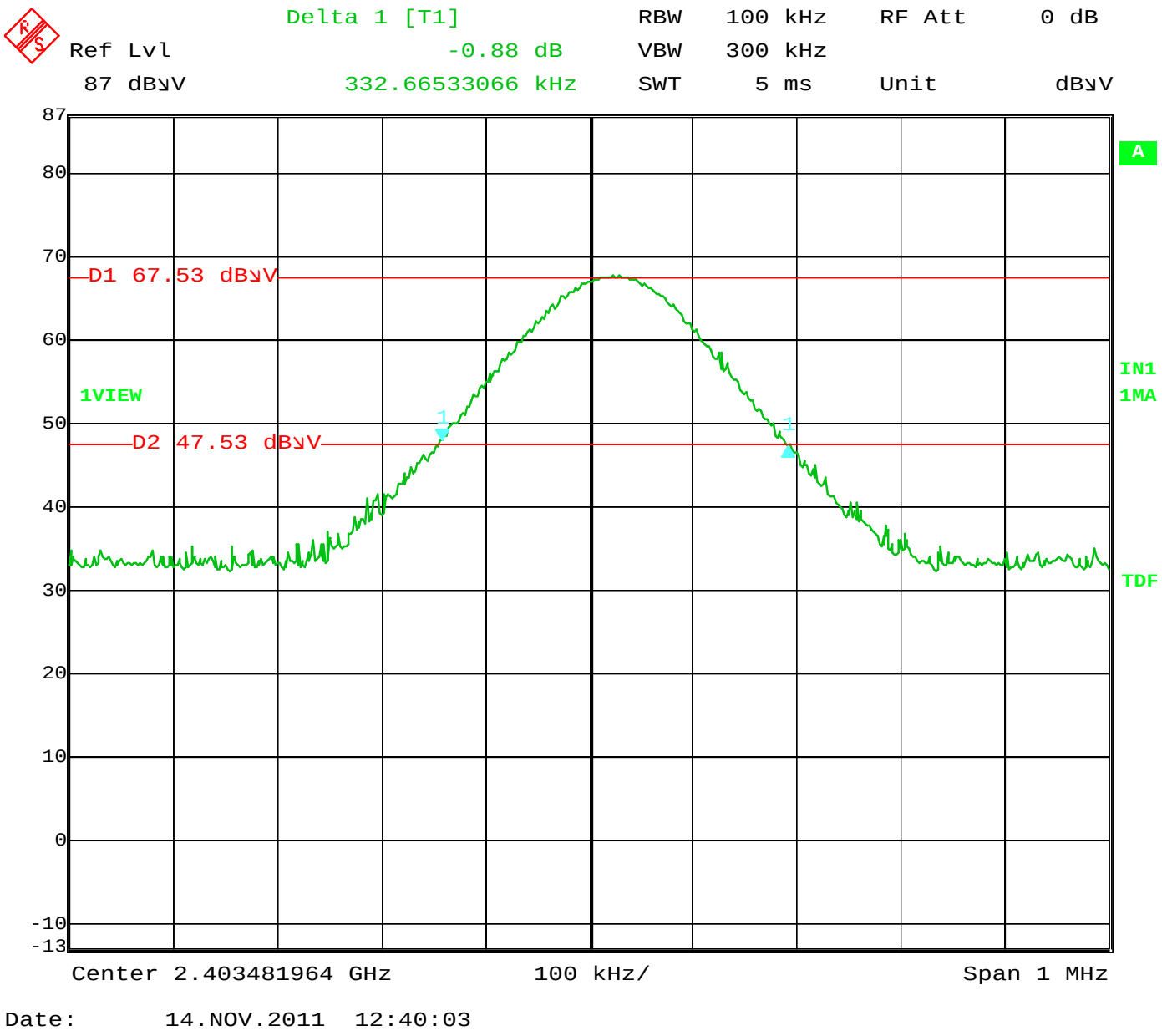


Figure 13: 20 dB Bandwidth

Note: The above plot is the worst case.

***BW = 332.6 KHZ**

5.5 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.

5.5.1 Test Over View

Results	**Complies** (as tested per this report)					**Date**	11/14/2011
Standard	RSS-210 Section A1.1.3						
Product Model	BTA-1			**Serial#**	09152430012345		
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	24 VDC via Ethernet cable	**Temp**	74º F	**Humidity**	32%	**Pressure**	1010mbar
Perf. Criteria	(Below Limit)			**Perf. Verification**	Readings Under Limit		
Mod. to EUT	None			**Test Performed By**	Randall Masline		

5.5.2 Test Procedure

Using the procedures of RSS-GEN section 4.6.1, the 1 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 2400MHz is 12 MHz. The measured 99% bandwidth is 308.6 kHz.

5.5.3 Deviations

There were no deviations from the test methodology listed in the test plan for the 99% Power bandwidth test.

5.5.4 Final Test

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

5.5.5 Final Data

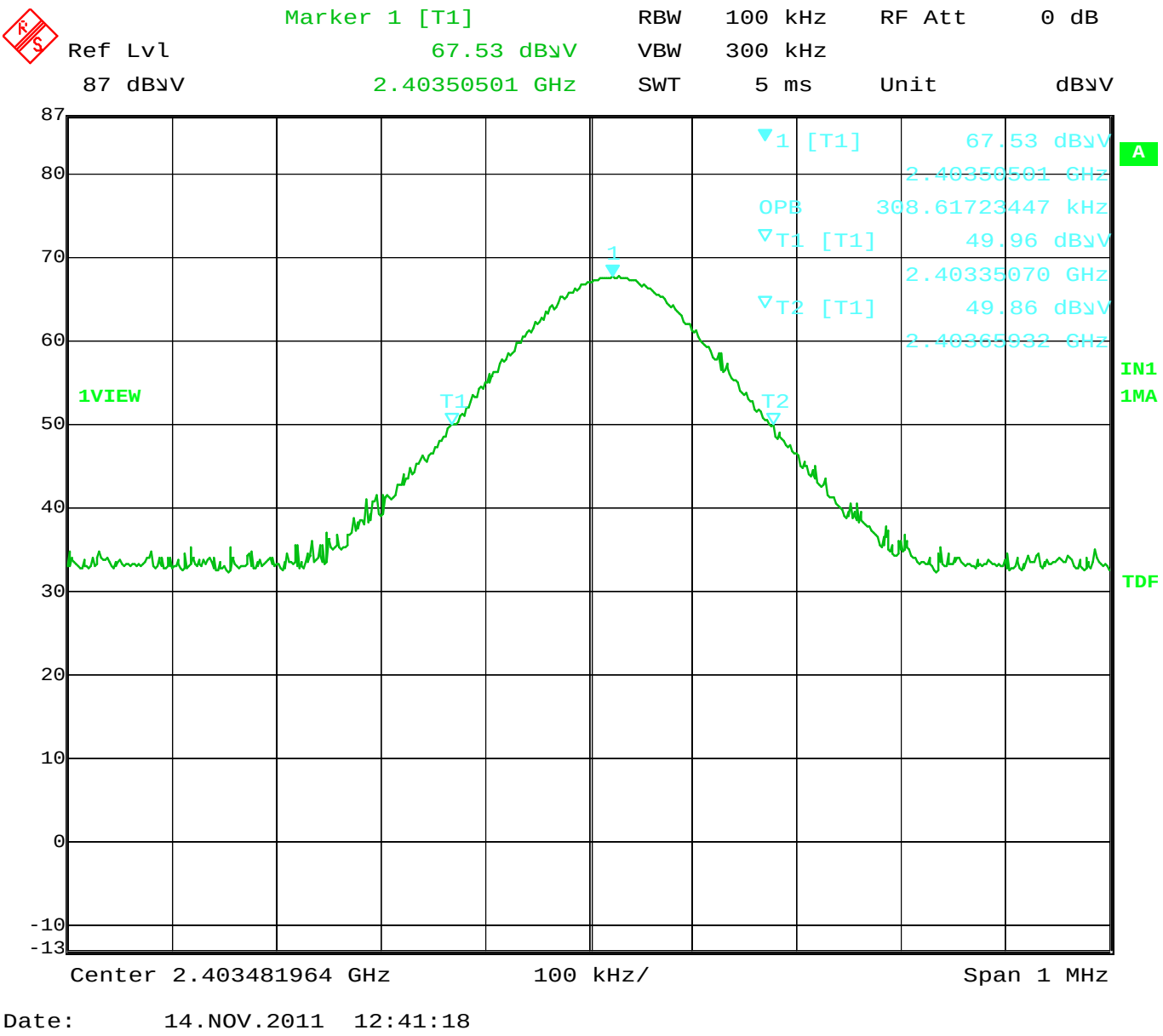


Figure 14 – 99% Power Bandwidth = 308.6 kHz

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

5.6 Peak Output Power

The maximum peak output power of the intentional radiator shall not exceed 1 watt for systems employing at lest 75 non-overlapping channels. (Radiated Measurement)

5.6.1 Test Over View

Results	**Complies** (as tested per this report)				**Date**	11/14/2011	
Standard	FCC Part 15.247(b)(2) and RSS-210 A8.4(1)						
Product Model	BTA-1			**Serial#**	09152430012345		
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	24 VDC via Ethernet cable	**Temp**	74º F	**Humidity**	32%	**Pressure**	1010mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Randall Masline		

5.6.2 Test Procedure

The peak output power was measured at low, mid and highest channels. The measurements were made radiated at 3 meters. 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.

5.6.3 Deviations

There were no deviations from the test methodology listed in the test plan for the Surge Immunity test.

5.6.4 Final Test

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

5.6.5 Final Data - Peak Power Output

Low: = 0.001 mWatts = 67.53 dBµV

Mid: = 0.001 mWatts = 68.47 dBµV

High: = 0.001 mWatts = 67.84 dBµV

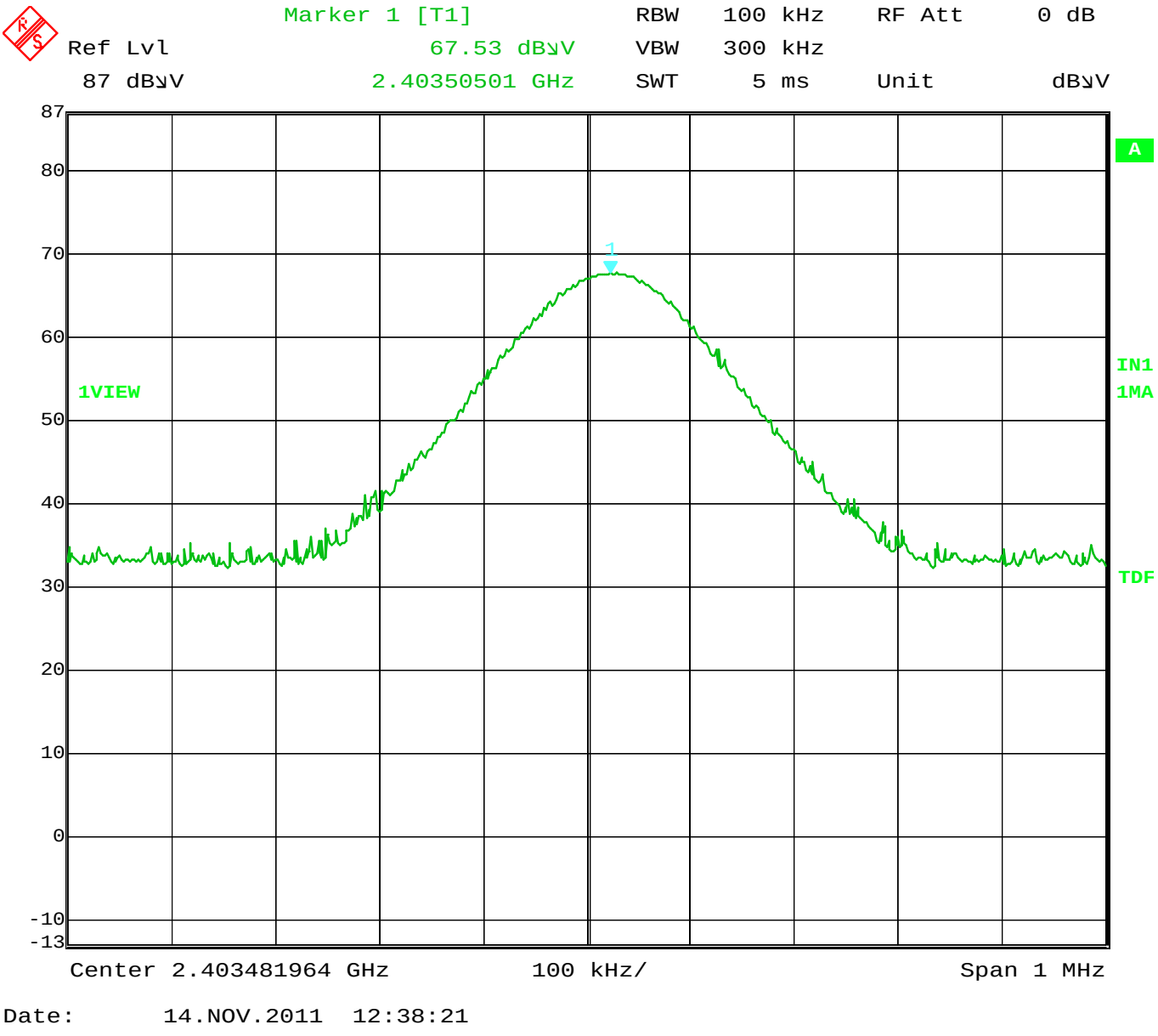


Figure 15: Low channel Peak Output Power

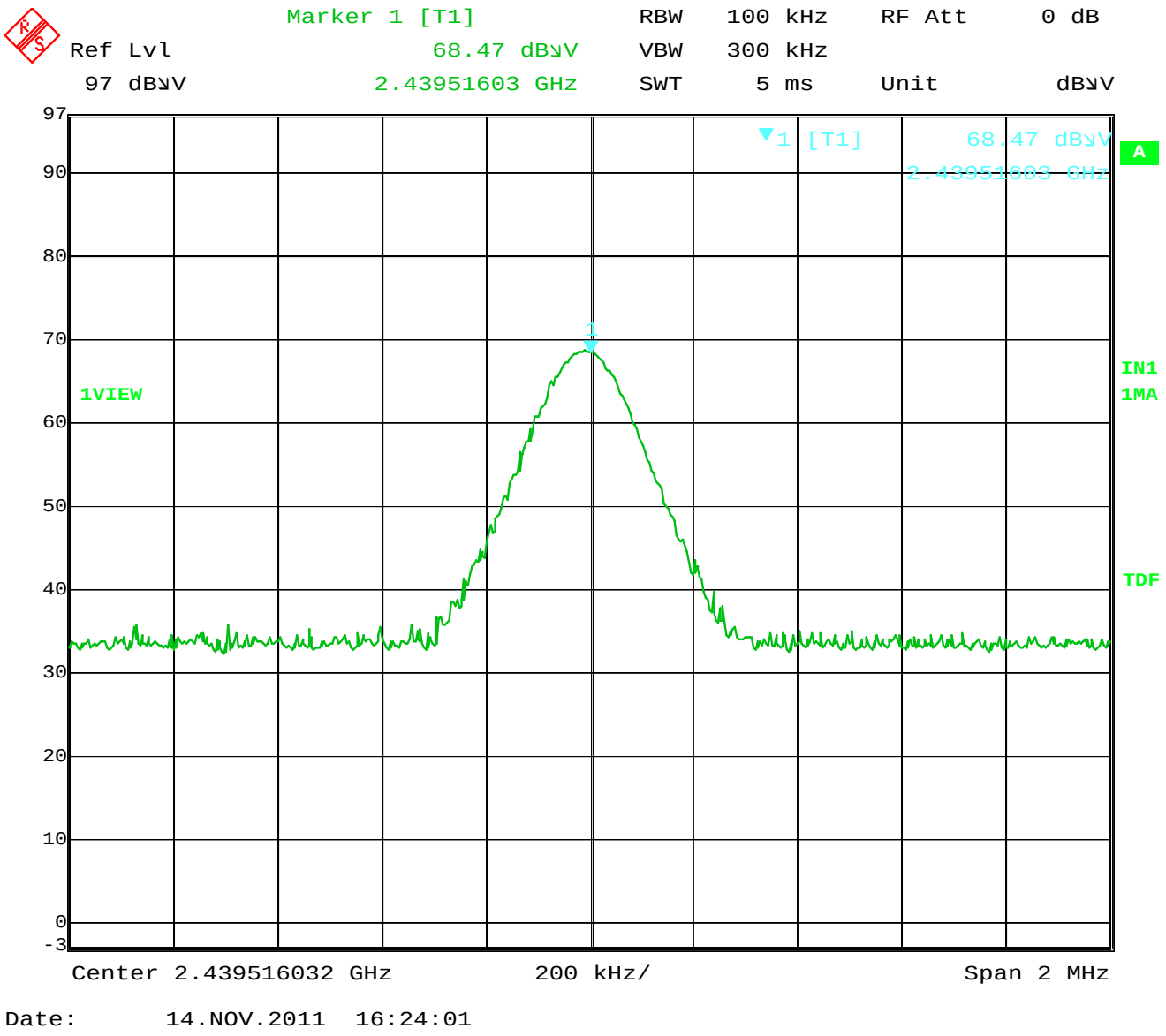


Figure 16: Mid Channel Peak Output Power

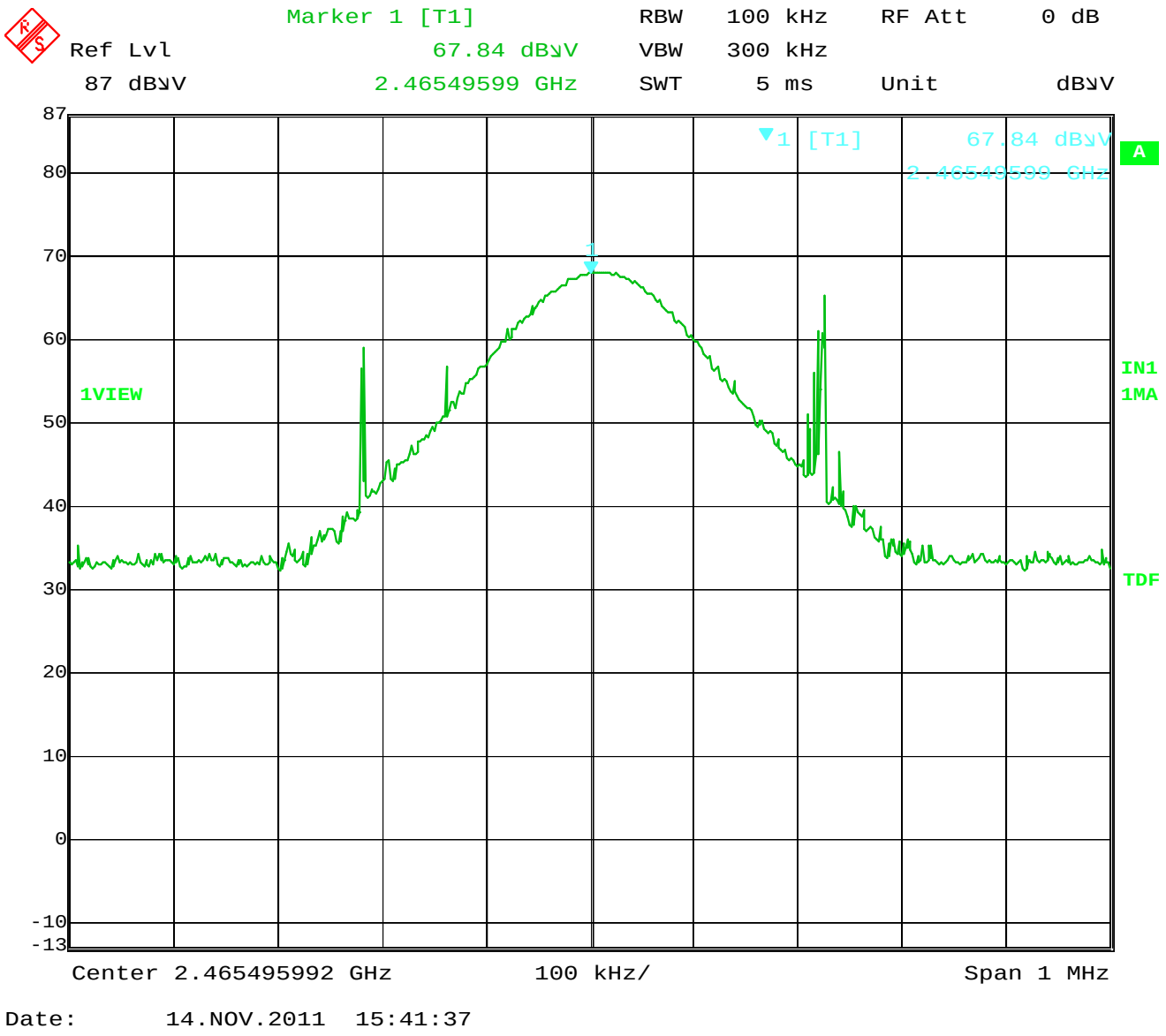


Figure 17: High Channel Peak Output Power

6 Emissions in Receive Mode.

6.1 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.

6.1.1 Over View of Test

Results	**Complies** (as tested per this report)				**Date**	11/14/2011	
Standard	FCC Parts 15.109(a) and ICES-003						
Product Model	BTA-1			**Serial#**	09152430012345		
Configuration	See test plan for details						
Test Set-up	Tested in a 10m OATS, 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	24 VDC via Ethernet cable	**Temp**	74º F	**Humidity**	32%	**Pressure**	1010mbar
Frequency Range	30 MHz to 26.5 GHz @ 3m						
Perf. Criteria	(Below Limit)			**Perf. Verification**	Readings Under Limit		
Mod. to EUT	None			**Test Performed By**	Randall Masline		

6.1.2 Test Procedure

Radiated and FCC emissions tests were performed using the procedures of ANSI C63.4:2003 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 26.5 GHz was investigated for radiated emissions.

6.1.3 Deviations

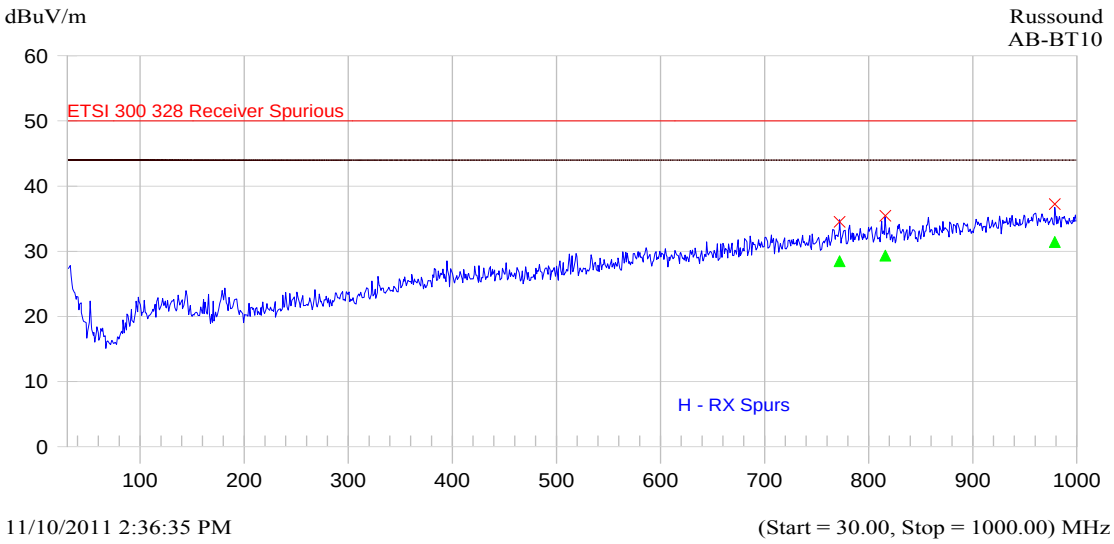
There were no deviations from the test methodology listed in the test plan for the radiated emission test.

6.1.4 Final Test

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

6.1.5 Final Graphs and Tabulated Data

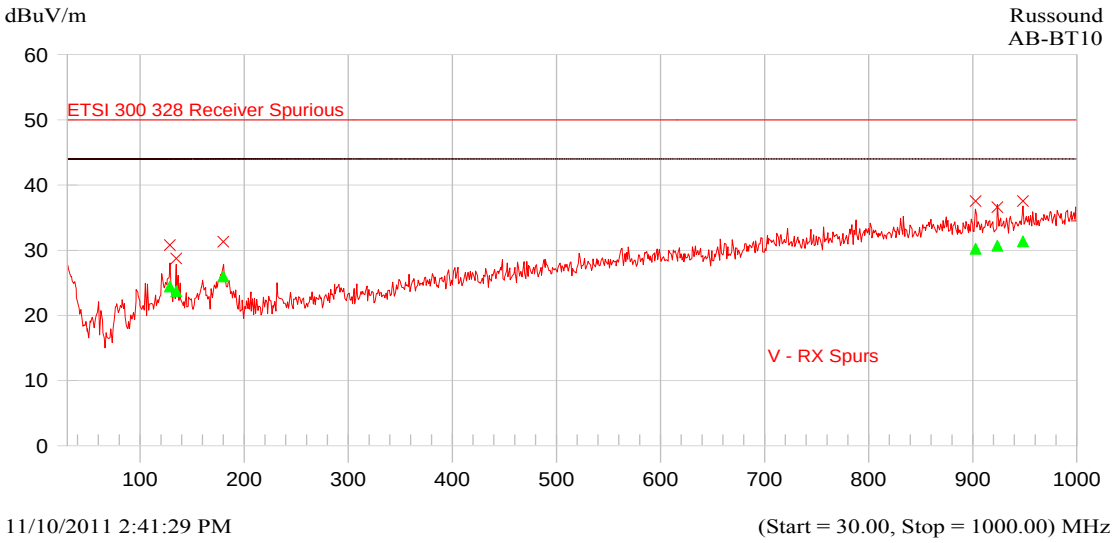
H - RX Spurs



Frequency MHz	Peak dBuV/m	QP dBuV/m	Class B-QP dB	Class A-QP dB	Trace Name
771.915	34.5	28.5	0.0	0.0	H - RX Spurs
815.936	35.4	29.3	0.0	0.0	H - RX Spurs
978.793	37.2	31.4	0.0	0.0	H - RX Spurs

Figure 18: 30 -1000 MHz Horizontal

V - RX Spurs



Frequency MHz	Peak dBuV/m	QP dBuV/m	Class B-QP dB	Class A-QP dB	Trace Name
128.610	30.8	24.4	0.0	0.0	V - RX Spurs
134.598	28.7	23.7	0.0	0.0	V - RX Spurs
180.012	31.3	26.0	0.0	0.0	V - RX Spurs
902.712	37.5	30.2	0.0	0.0	V - RX Spurs
923.662	36.6	30.7	0.0	0.0	V - RX Spurs
948.346	37.5	31.4	0.0	0.0	V - RX Spurs

Figure 19: 30 – 1000 MHz Vertical

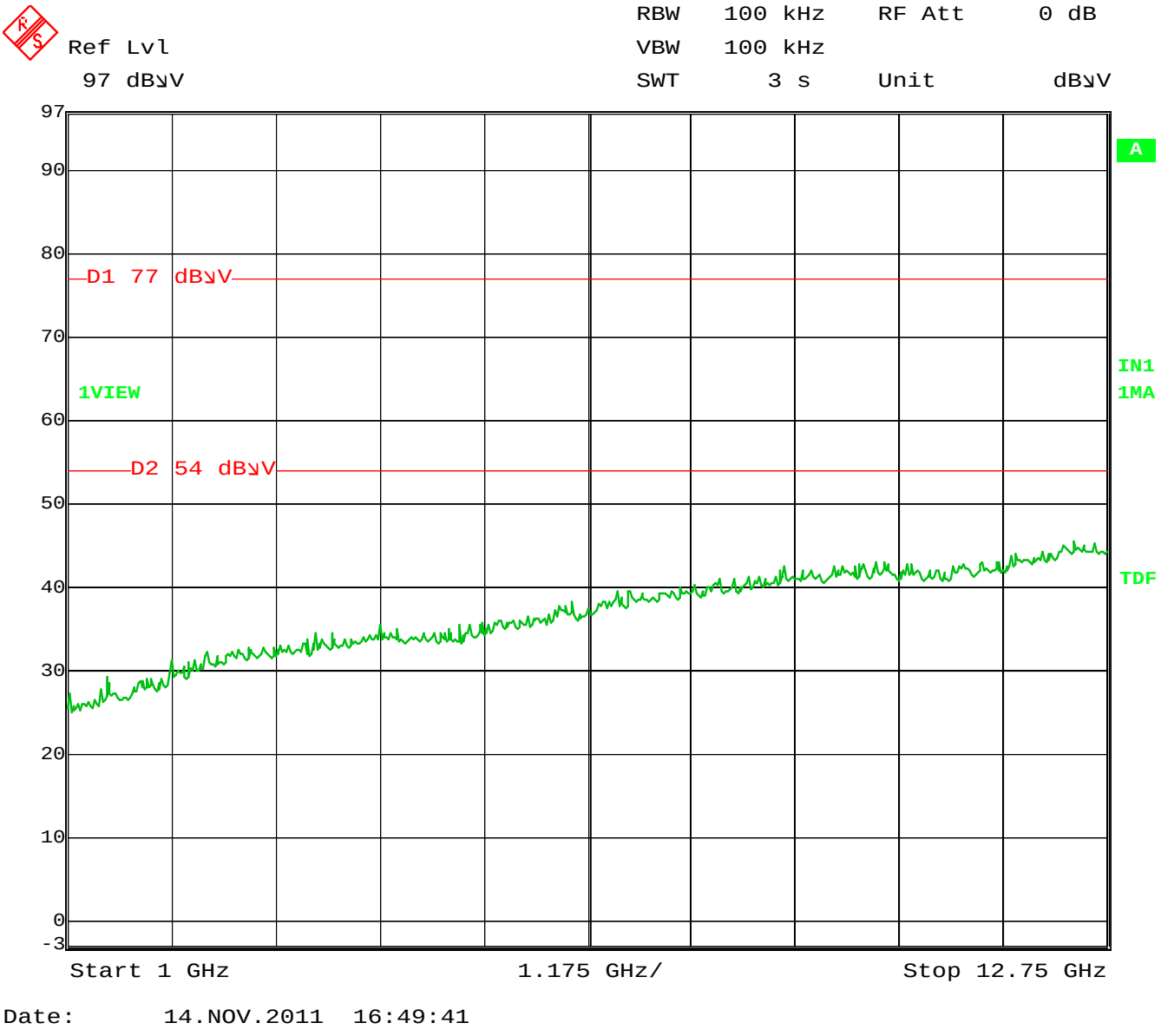


Figure 20: 1 – 12.75 GHz Horizontal

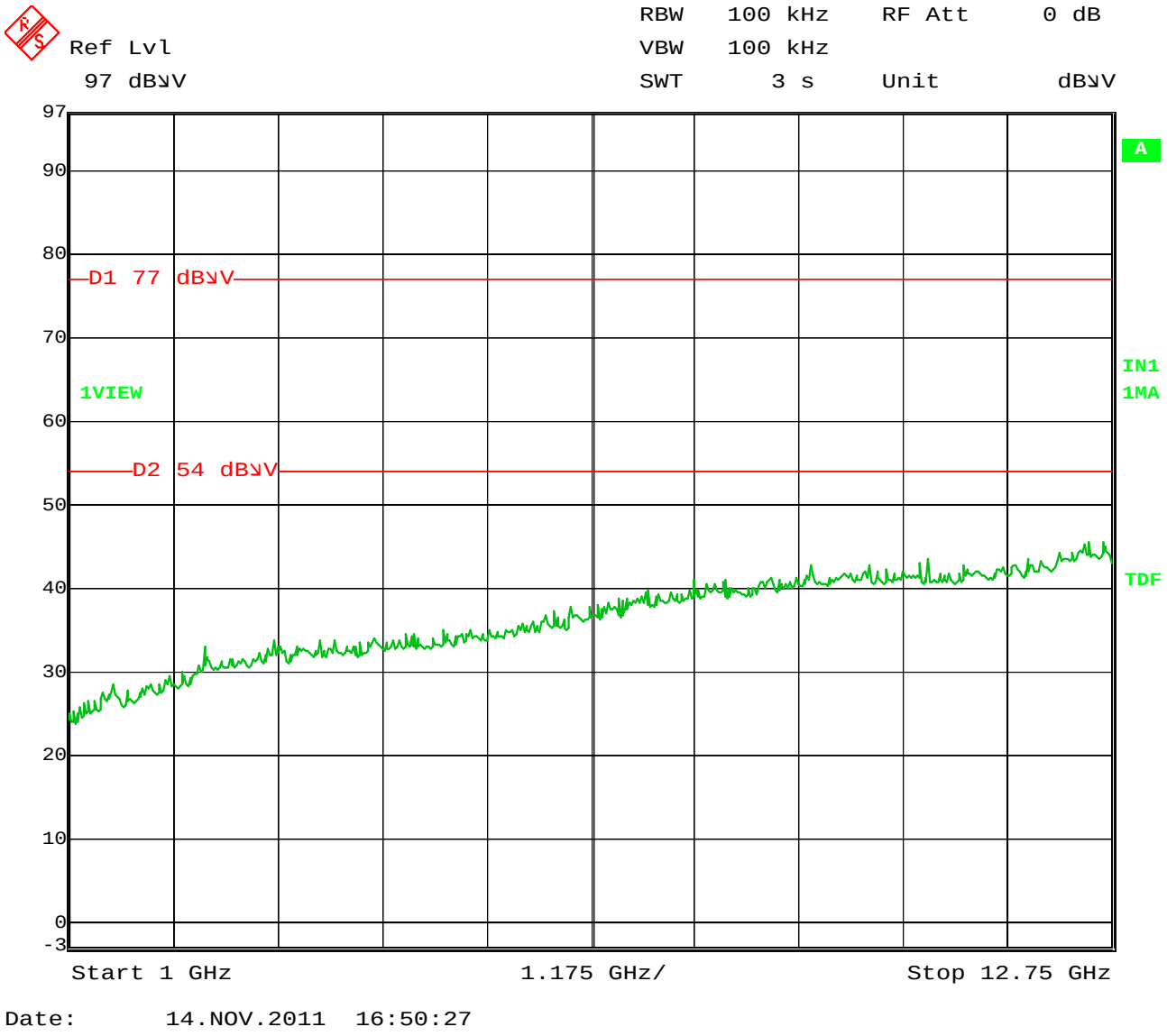


Figure 21: 1 – 12.75 GHz Vertical

6.2 Conducted Emissions

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 near by electronic equipment.

EUT is powered with 1.8 VDC via Ethernet – Testing was not performed

6.2.1 Over View of Test

Results	**Complies** (as tested per this report)				**Date**		
Standard	FCC Part 15.107(a) and ICES-003						
Product Model	BTA-1			**Serial#**	09152430012345		
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	24 VDC via Ethernet cable	**Temp**	º F	**Humidity**	%	**Pressure**	mbar
Frequency Range	150 kHz to 30 MHz						
Perf. Criteria	(Below Limit)	**Perf. Verification**	Readings Under Limit for L1 & Neutral				
Mod. to EUT	None	**Test Performed By**	Randall Masline				

6.2.2 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 150 kHz to 30 MHz was investigated for conducted emissions.

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

6.2.3 Deviations

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

6.2.4 Final Test

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

RF Exposure Measurement (Mobile Device) 15.247(i)

Test Methodology

In this document, we try to prove the safety of radiation harmfulness to the human body for our product. The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. The Gain of the antenna used in this product is measured in a Semi-Anechoic Chamber, and also the maximum total power input to the antenna is measured. Through the Friis transmission formula (see section 4.9.6) and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached.

Although the Friis transmission formula is a far field assumption, the calculated result of that is an over-prediction for near field power density. We will take that as the worst case to specify the safety range.

RF Exposure Limit

According to FCC 1.1310 table 1: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b)

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f^2)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f^2)	30
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30

F = Frequency in MHz

EUT Operating condition

The software provided by Manufacturer enabled the EUT to transmit data at lowest, middle and highest channel individually.

Classification

The antenna of the product, under normal use condition, is at least 20cm away from the body of the user. Warning statement to the user for keeping at least 20cm or more separation distance with the antenna should be included in users manual. Therefore, this device is classified as a **Mobile Device**.

Test Results

Antenna Gain

The maximum Gain measured in Semi-Anechoic Chamber is -2 dBi or 0.631 (numeric).

Output Power into Antenna & RF Exposure value at distance 20cm:

Calculations for this report are based on highest power measurement and the highest gain of the antenna. Limit for MPE (from FCC part 1.1310 table 1) is f(Mhz) / 1500 = 0.6 mW/cm^2

Highest Pout is 0.001mW, highest antenna gain (in linear scale) is 0.631 and R is 20cm.

Pd = (0.001*0.631) / ($4*\pi*20^2$) = **0.0001 mW/cm^2**, which is 4.99 mW/cm^2 below to the limit.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Sample Calculation

The Friis transmission formula: $Pd = (Pout*G) / (4*\pi*R^2)$

Where;

Pd = power density in mW/cm_2
Pout = output power to antenna in mW
G = gain of antenna in linear scale
$\pi \approx 3.1416$
R = distance between observation point and center of the radiator in cm

Ref. : David K. Cheng, *Field and Wave Electromagnetics*, Second Edition, Page 640, Eq. (11-133).