
REPORT ON

Limited FCC CFR 47: Part 15
and Industry Canada RSS-210 and RSS-Gen Testing
of a Promethean Widescreen ACTIVBoard with Bluetooth Radio

FCC ID: QAM007
IC: 5459A-007

COMMERCIAL-IN-CONFIDENCE

Report No OO200364/01 Issue 2

July 2006



Product Service

Competence. Certainty. Quality

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ACTIVBoard with Bluetooth Radio

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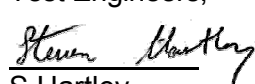
20th July 2006

This report has been re-issued as Issue 2 to correct the specification date.
The Test Results are unaffected.

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47: Part 15. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineers;


S Hartley


A Guy




G Lawler


M Hardy

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SECTION 1

REPORT SUMMARY

Limited FCC CFR 47: Part 15
and Industry Canada RSS-210 and RSS-Gen Testing
of a Promethean Widescreen ACTIVBoard with Bluetooth Radio

1.1 STATUS

Equipment Under Test	Widescreen ACTIVBoard with Bluetooth Radio
Objective	To undertake measurements to determine the Equipment Under Test's (EUT's) compliance with the specification.
Applicant	Promethean Technologies Group Limited Promethean House Lower Philips House Blackburn BB1 5TH
Manufacturers Type Number	PRM-AB295B-06
Manufacturers Part Number	PRM-AB295B-06
Serial Number	N/A Engineering Sample (with Production Electronics)
Hardware Version	1.0
Software Version	ACTIVboard Firmware Version 3.60
Declared Variants	None
Test Specification/Issue/Date	FCC CFR 47: Part 15, Subpart C: 2006 RSS-210: Issue 6: 2005 RSS-Gen: Issue 2: 2005
Number of Items Tested	One
Security Classification of EUT	Commercial-in-Confidence
Incoming Release Date	Declaration of Build Status 19 th June 2006
Disposal	Held pending disposal
Order Number Date	P16457 1 st June 2006
Start of Test	24 th June 2006
Finish of Test	3 rd July 2006
Related Documents	ANSI C63.4: 2001 RSS-212, Issue 2: 1999 SRSP-503, Issue 6: 2003 SRSP-510, Issue 3: 2003



1.2 INTRODUCTION

The information contained within this report is intended to show limited verification of compliance of the Promethean Widescreen ACTIVBoard with Bluetooth Radio to the requirements of FCC Specification Part 15 and Industry Canada Radio Specifications RSS-210 and RSS-Gen.

Testing has been performed under the following site accreditations

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

Industry Canada Accreditation
IC5208 Octagon House, Fareham Test Laboratory



1.2.1 DECLARATION OF BUILD STATUS

MAIN EUT			
MANUFACTURING DESCRIPTION	Bluetooth Wireless Technology enabled Widescreen ACTIVboard		
MANUFACTURER	Promethean Technologies Group Limited		
TYPE	PRM-AB295B-06		
PART NUMBER	PRM-AB295B-06		
SERIAL NUMBER	n/a Engineering Sample (with Production Electronics)		
HARDWARE VERSION	1.0		
SOFTWARE VERSION	ACTIVboard Firmware Version 3.60		
TRANSMITTER OPERATING RANGE	2402 - 2480 MHz FHSS		
RECEIVER OPERATING RANGE	2402 - 2480 MHz FHSS		
COUNTRY OF ORIGIN	UK/China		
INTERMEDIATE FREQUENCIES	Baseband (LO = 2.5GHz)		
ITU DESIGNATION OF EMISSION	80M0FXD - -		
HIGHEST INTERNALLY GENERATED FREQUENCY	2.480 GHz (Crystals 12MHz, 14.7456MHz and 24 MHz)		
OUTPUT POWER (W or dBm)	0.003Watt		
FCC ID	QAM007		
INDUSTRY CANADA ID	5459A-007		
TECHNICAL DESCRIPTION (a brief description of the intended use and operation)	Bluetooth enabled widescreen ACTIVboard connects to a Bluetooth enabled PC removing the requirement for the USB/serial connection cables.		
BATTERY/POWER SUPPLY			
MANUFACTURING DESCRIPTION	External Power Supply		
MANUFACTURER	Friwo		
TYPE	FW7400/06		
PART NUMBER	FW7400/06		
VOLTAGE	Input 100-240 V AC 50/60 Hz 300mA Output 6.0 V DC 1.7A		
COUNTRY OF ORIGIN	Germany/Hong Kong		
MODULES (if applicable)			
MANUFACTURING DESCRIPTION			
MANUFACTURER			
TYPE			
POWER			
FCC ID			
COUNTRY OF ORIGIN			
INDUSTRY CANADA ID			
EMISSION DESIGNATOR			
DHSS/FHSS/COMBINED OR OTHER			
ANCILLARIES (if applicable)			
MANUFACTURING DESCRIPTION			
MANUFACTURER			
TYPE			
PART NUMBER			
SERIAL NUMBER			
COUNTRY OF ORIGIN			

Signature

Date 19 June 2006

Declaration of Build Status Serial Number

1.3 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out is shown below.

FCC CFR 47: Part 15, Subpart C, RSS-210

Section	Spec Clause		Test Description	Result	Comments
	FCC	Industry Canada			
2.1	Part 15.205	RSS-210, A8.5 and 2.7	Measurement at Band Edge	Pass	
2.2	Part 15.207	RSS-Gen 7.22	Conducted Emissions on Power Port	Pass	
2.3	Part 15.247(a)(1)	RSS-210, A8.1(2)	20dB Bandwidth	Pass	
2.4	Part 15.247(a)(iii)	RSS-210, A8.1(4)	Channel Dwell Time (DH1)	Pass	
2.5	Part 15.247(a)(iii)	RSS-210, A8.1(4)	Channel Dwell Time (DH3)	Pass	
2.6	Part 15.247(a)(iii)	RSS-210, A8.1(4)	Channel Dwell Time (DH5)	Pass	
2.7	Part 15.247(a)(1)	RSS-210, A8.1(2)	Channel Separation	Pass	
2.8	Part 15.247(a)(1)	RSS-210, A8.1(4)	Number of Hopping Channels	Pass	
2.9	Part 15.247(b)(1)	RSS-210, A8.1(1)	Maximum Peak Output Power	Pass	
2.10	Part 15.247(d)	RSS-210, A8.5	Spurious Conducted Emissions	Pass	
2.11	Part 15.247(c)	RSS-210, A8.5	Spurious Radiated Emissions	Pass	
2.12	Part 15.247(b)(4)	RSS-210, A8.1(1)	Maximum Peak Output Power – Radiated (EIRP)	Pass	

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Widescreen ActivBoard and BT module Bluetooth Radio, which offers 2.4GHz Wireless connectivity with other Bluetooth devices.

1.4.2 Modes of Operation

The test software in the EUT enabled selection of full power and continuous transmit on the following channels;

2.4GHz RLAN functionality

Bottom Channel 0:	2402MHz
Middle Channel 39:	2441MHz
Top Channel 78:	2480MHz

The EUT was set at the maximum output power during testing.



1.5 TEST CONDITIONS

The EUT was set-up simulating a typical user installation at the Test Laboratory, as listed in Section 1.2 and tested in accordance with the applicable specification.

For all tests, the Promethean Widescreen ACTIVBoard with Bluetooth Radio was powered via an external power supply, with an output of 6.0V DC 1.7A power supply.

1.6 DEVIATIONS FROM THE STANDARD

No deviations from the standard occurred during testing.

1.7 MODIFICATION RECORD

No modifications were made to the test sample.

SECTION 2

TEST RESULTS

Limited FCC CFR 47: Part 15
and Industry Canada RSS-210 and RSS-Gen Testing
of a Promethean Widescreen ACTIVBoard with Bluetooth Radio

2.1 MEASUREMENT AT THE BAND EDGE (MARKER DELTA METHOD)

2.1.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.205 and Industry Canada Radio Standard RSS-210, A8.5 and 2.7, Table 1.

2.1.2 Equipment Under Test

Widescreen ActivBoard and BT module.

2.1.3 Date of Test

25th June 2006.

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.5 Test Procedure

Test Performed in accordance with FCC Public Notice document (DA 00-705 released 30 March 2000) and RSS-212.

2.1.6 Test Results

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.205 and Industry Canada Radio Standard RSS-210, A8.5 and 2.7, Table 1 for Band Edge Measurements.

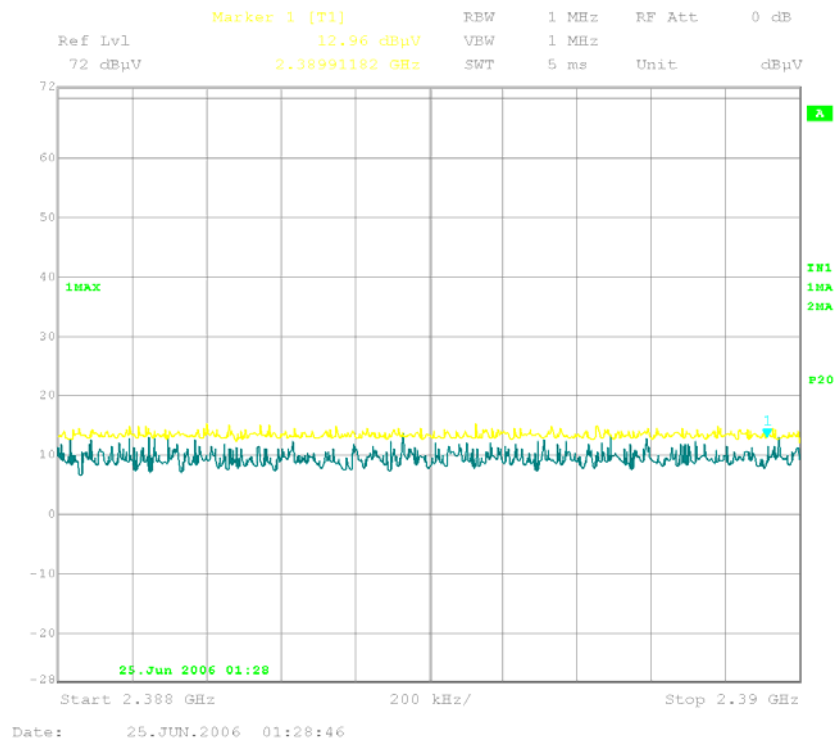
Measurements were made at the Band Edges with the following results;

Channel Frequency	Band Edge Frequency	Antenna Polarisation	Height	Azimuth	Peak Field Strength	Limit Peak Field Strength	Average Field Strength	Limit Average Field Strength
MHz	MHz		cm	degree	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2402.0	2390.0	Horizontal	100	225	50.1	74.0	37.5	54.0
2480.0	2483.5	Horizontal	100	215	50.6	74.0	37.7	54.0

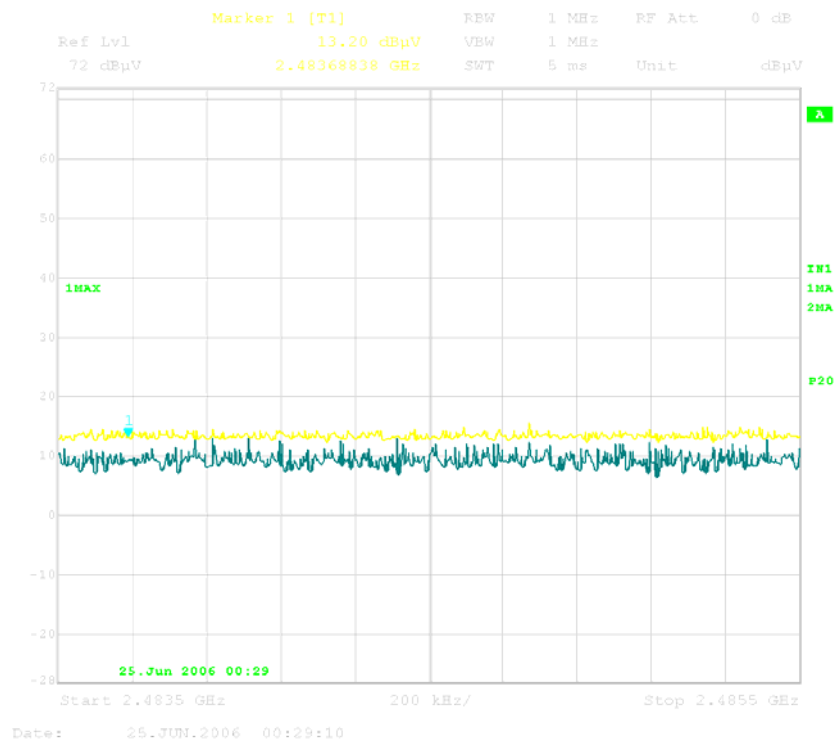
No emissions were detected within 20dB of the limit specified in 15.209 for the restricted bands of operation.

2.1 MEASUREMENT AT THE BAND EDGE (MARKER DELTA METHOD)

2.1.6 Test Results



Bottom Channel Band Edge



Top Channel Band Edge

2.2 CONDUCTED EMISSIONS ON POWER PORT

2.2.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.207 and Industry Canada Radio Standard RSS-Gen, 7.2.2.

2.2.2 Equipment Under Test

Widescreen ActivBoard and BT module.

2.2.3 Date of Test

28th June 2006.

2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.5 Test Procedure

Test performed in accordance with ANSI C63.4 and RSS-212.

Conducted Emission Measurements were undertaken within the semi-anechoic chamber. Emissions were measured on the Live and Neutral Lines in turn.

Emissions were formally measured using a Quasi-Peak and Average Detectors, which meet the CISPR requirements. The details of the worst-case emissions for the Live and Neutral Lines are presented in the following tables.

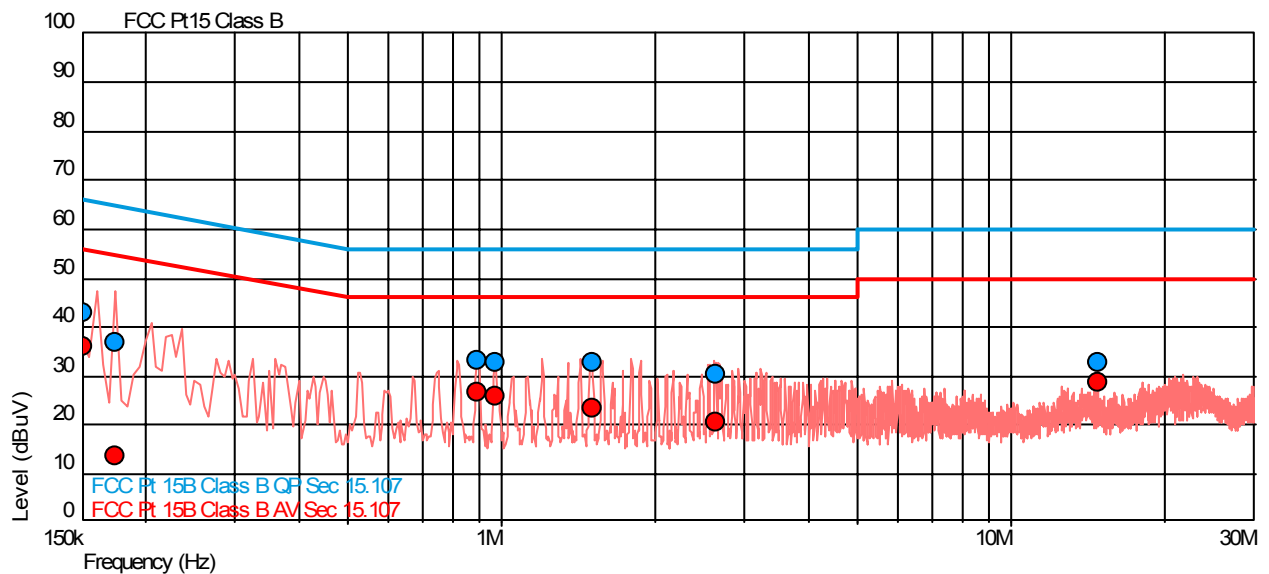
The EUT was supplied from a 120V, 60Hz supply.

2.2 CONDUCTED EMISSIONS ON POWER PORTS

2.2.6 Test Results

The EUT met the Class B requirements of FCC CFR 47: Part 15 Subpart C, Section 15.207 and Industry Canada Radio Standard RSS-Gen, 7.2.2 for Conducted Emissions on the Live and Neutral Lines.

EUT Transmitter on Bottom Channel (2402MHz) – Live Line

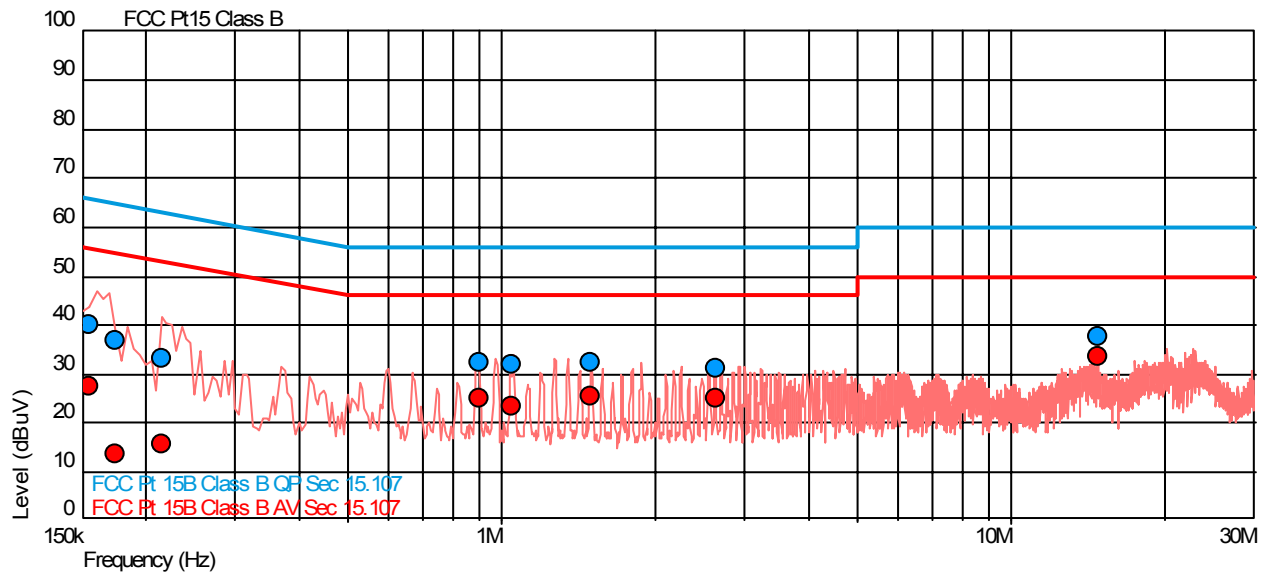


Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Level (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)
0.151	42.9	66.0	-23.0	36.2	56.0	-19.8
0.175	36.8	64.7	-27.9	13.7	54.7	-41.0
0.895	33.1	56.0	-22.9	26.4	46.0	-19.6
0.972	32.8	56.0	-23.2	25.6	46.0	-20.4
1.500	32.8	56.0	-23.2	23.3	46.0	-22.7
2.625	30.3	56.0	-25.7	20.5	46.0	-25.5
14.746	32.6	60.0	-27.4	28.7	50.0	-21.3

2.2 CONDUCTED EMISSIONS ON POWER PORTS

2.2.6 Test Results

EUT Transmitter on Bottom Channel (2402MHz) – Neutral Line

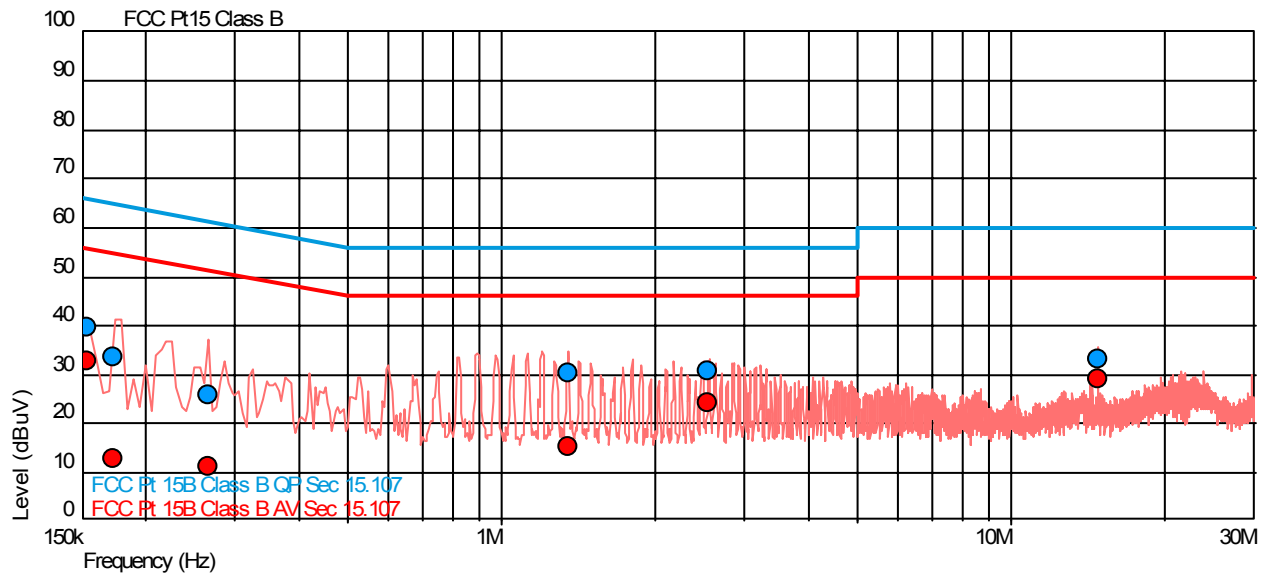


Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Level (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)
0.155	40.0	65.7	-25.7	27.3	55.7	-28.5
0.175	36.9	64.7	-27.8	13.7	54.7	-41.0
0.215	33.1	63.0	-29.9	15.6	53.0	-37.4
0.899	32.5	56.0	-23.5	25.2	46.0	-20.8
1.047	31.8	56.0	-24.2	23.2	46.0	-22.8
1.497	32.3	56.0	-23.7	25.5	46.0	-20.5
2.620	31.1	56.0	-24.9	24.9	46.0	-21.1
14.745	37.6	60.0	-22.4	33.6	50.0	-16.4

2.2 CONDUCTED EMISSIONS ON POWER PORTS

2.2.6 Test Results

EUT Transmitter on Middle Channel (2441MHz) – Live Line

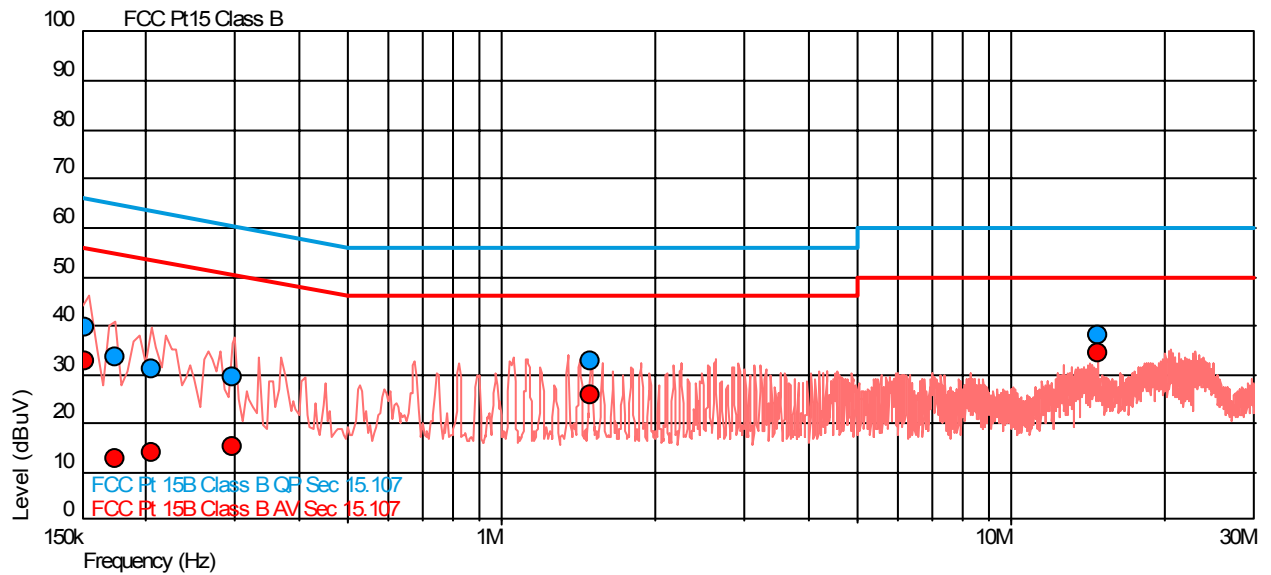


Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Level (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)
0.153	39.8	65.8	-26.0	32.9	55.8	-23.0
0.173	33.7	64.8	-31.1	12.8	54.8	-42.0
0.266	25.7	61.2	-35.5	11.0	51.2	-40.2
1.355	30.5	56.0	-25.5	15.3	46.0	-30.7
2.544	30.8	56.0	-25.2	24.3	46.0	-21.7
14.745	33.0	60.0	-27.0	29.1	50.0	-20.9

2.2 CONDUCTED EMISSIONS ON POWER PORTS

2.2.6 Test Results

EUT Transmitter on Middle Channel (2441MHz) – Neutral Line

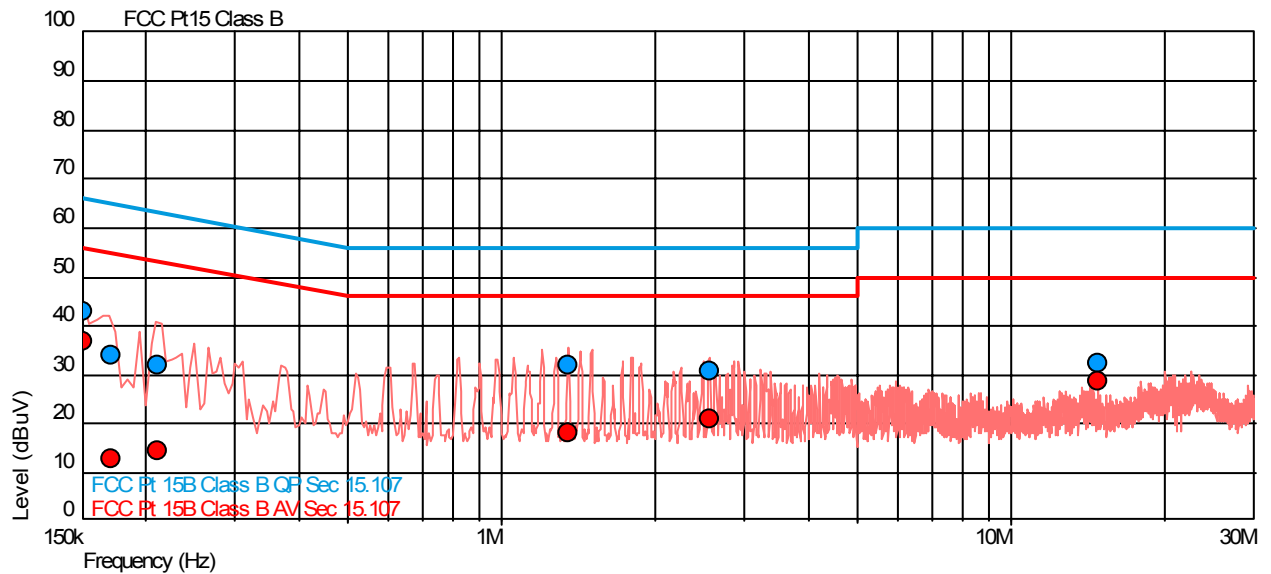


Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Level (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)
0.152	39.8	65.9	-26.1	32.9	55.9	-23.0
0.174	33.3	64.7	-31.4	12.8	54.7	-42.0
0.205	31.2	63.4	-32.2	14.0	53.4	-39.4
0.295	29.4	60.4	-31.0	15.2	50.4	-35.2
1.496	32.6	56.0	-23.4	25.8	46.0	-20.2
14.745	38.1	60.0	-21.9	34.3	50.0	-15.7

2.2 CONDUCTED EMISSIONS ON POWER PORTS

2.2.6 Test Results

EUT Transmitter on Top Channel (2480MHz) – Live Line

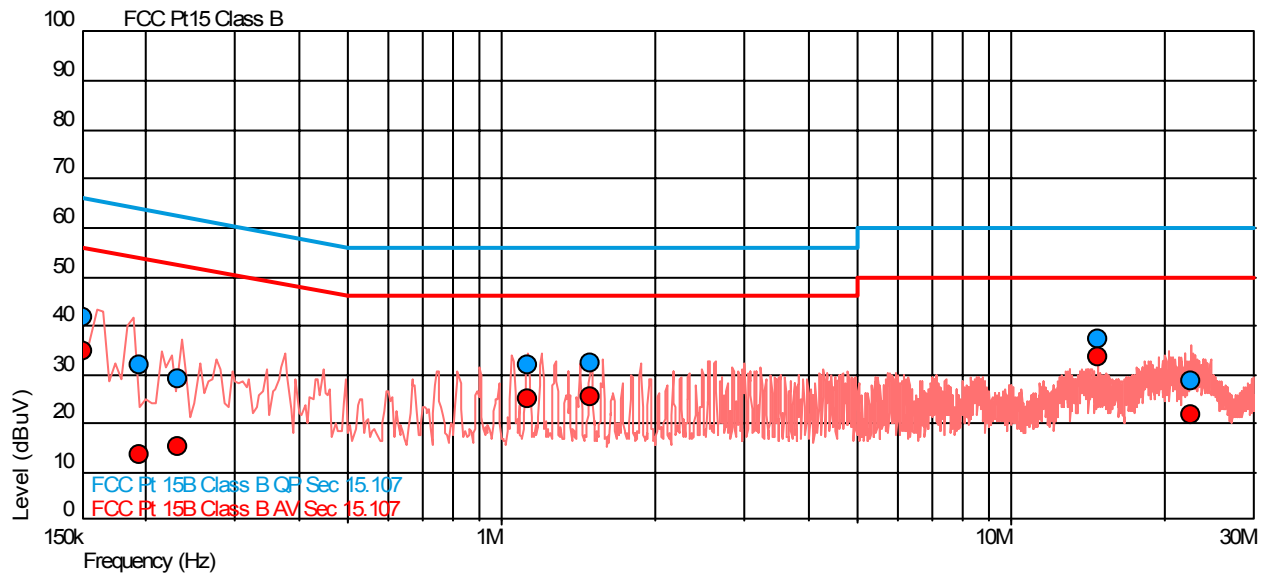


Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Level (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)
0.150	42.8	66.0	-23.2	36.6	56.0	-19.4
0.171	34.0	64.9	-30.9	12.8	54.9	-42.2
0.211	31.8	63.2	-31.3	14.6	53.2	-38.6
1.353	31.9	56.0	-24.1	17.9	46.0	-28.1
2.551	30.6	56.0	-25.4	21.1	46.0	-24.9
14.747	32.5	60.0	-27.5	28.5	50.0	-21.5

2.2 CONDUCTED EMISSIONS ON POWER PORTS

2.2.6 Test Results

EUT Transmitter on Top Channel (2480MHz) – Neutral Line



Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Level (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)
0.151	41.5	66.0	-24.5	34.8	56.0	-21.1
0.194	31.8	63.9	-32.1	13.7	53.9	-40.1
0.232	29.2	62.4	-33.2	15.1	52.4	-37.3
1.122	31.9	56.0	-24.1	25.1	46.0	-20.9
1.497	32.5	56.0	-23.5	25.5	46.0	-20.5
14.744	37.4	60.0	-22.6	33.4	50.0	-16.6
22.411	28.8	60.0	-31.2	21.6	50.0	-28.4

2.3 20dB BANDWIDTH

2.3.1 Specification Reference

FCC Part 15.247(a)(1) and RSS-210, A8.1(2).

2.3.2 Equipment Under Test

Widescreen ActivBoard and BT module.

2.3.3 Date of Test

19th June 2006.

2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.5 Test Procedure

Test Performed in accordance with 15.247 and RSS 210.

The EUT was transmitted at maximum power at all data rates via a cable to the Spectrum Analyser. The Analyser settings were adjusted to display the resultant trace on screen. The peak point of the trace was measured and the markers positioned to give the –20dBc points of the displayed spectrum.

The measurement plots can be seen on the following pages.



Product Service

2.3 20dB BANDWIDTH

2.3.6 Test Results

Frequency (MHz)	Data Rate	20dB Bandwidth (kHz)
		10kHz Bandwidth
2402	DH1	1022
2441	DH1	1018
2480	DH1	1018

Frequency (MHz)	Data Rate	20dB Bandwidth (kHz)
		10kHz Bandwidth
2402	DH3	1018
2441	DH3	1018
2480	DH3	1018

Frequency (MHz)	Data Rate (Mbps)	20dB Bandwidth (kHz)
		10kHz Bandwidth
2402	DH5	1018
2441	DH5	1018
2480	DH5	1018

Test Limit

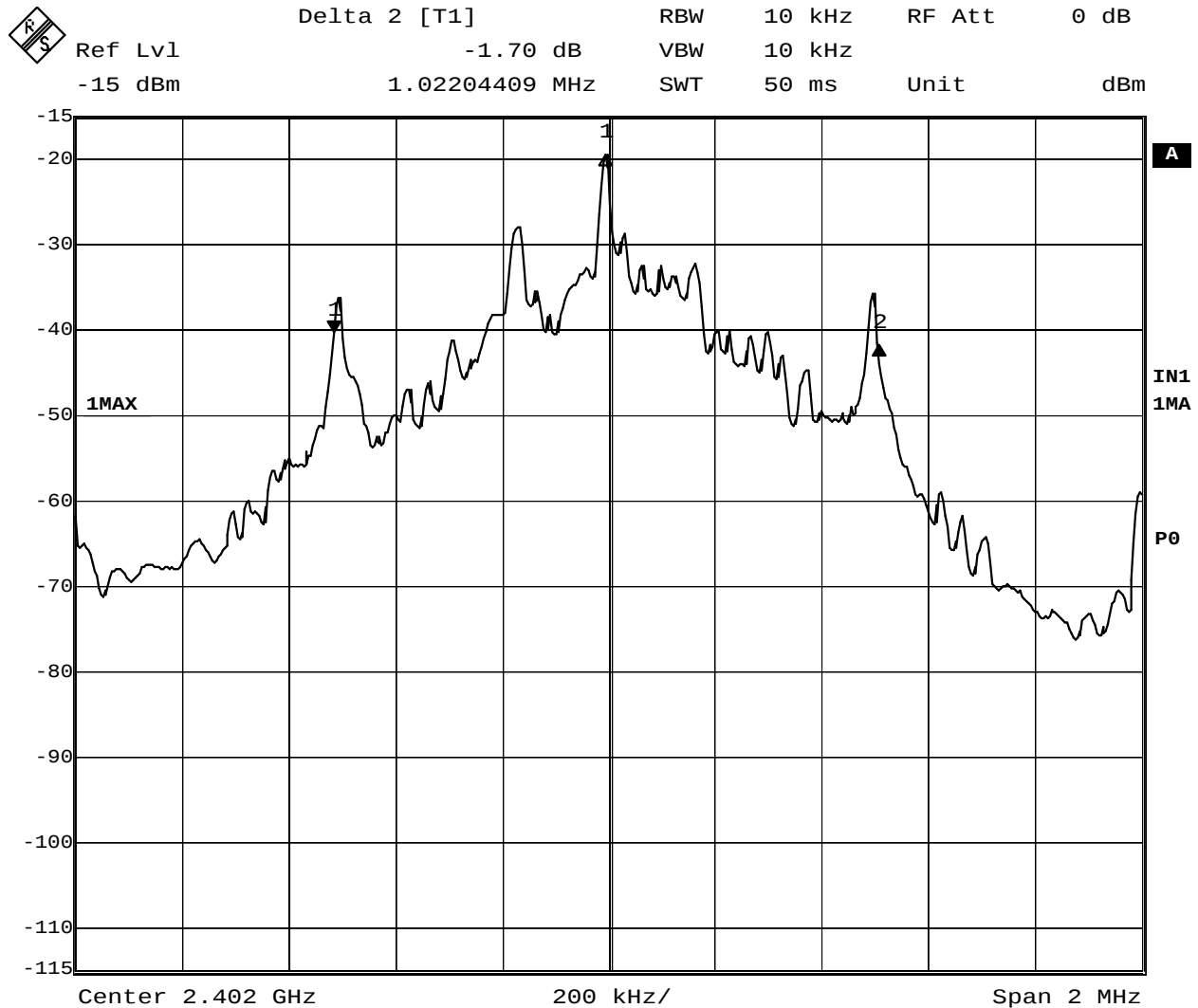
Based on a Bluetooth channel separation of 1MHz :

20dB bandwidth = Channel Separation / (2/3)

Therefore, 20dB limit = $1 / (2/3)$ = 1.5MHz

2.3 20dB BANDWIDTH

2.3.6 Test Results - continued

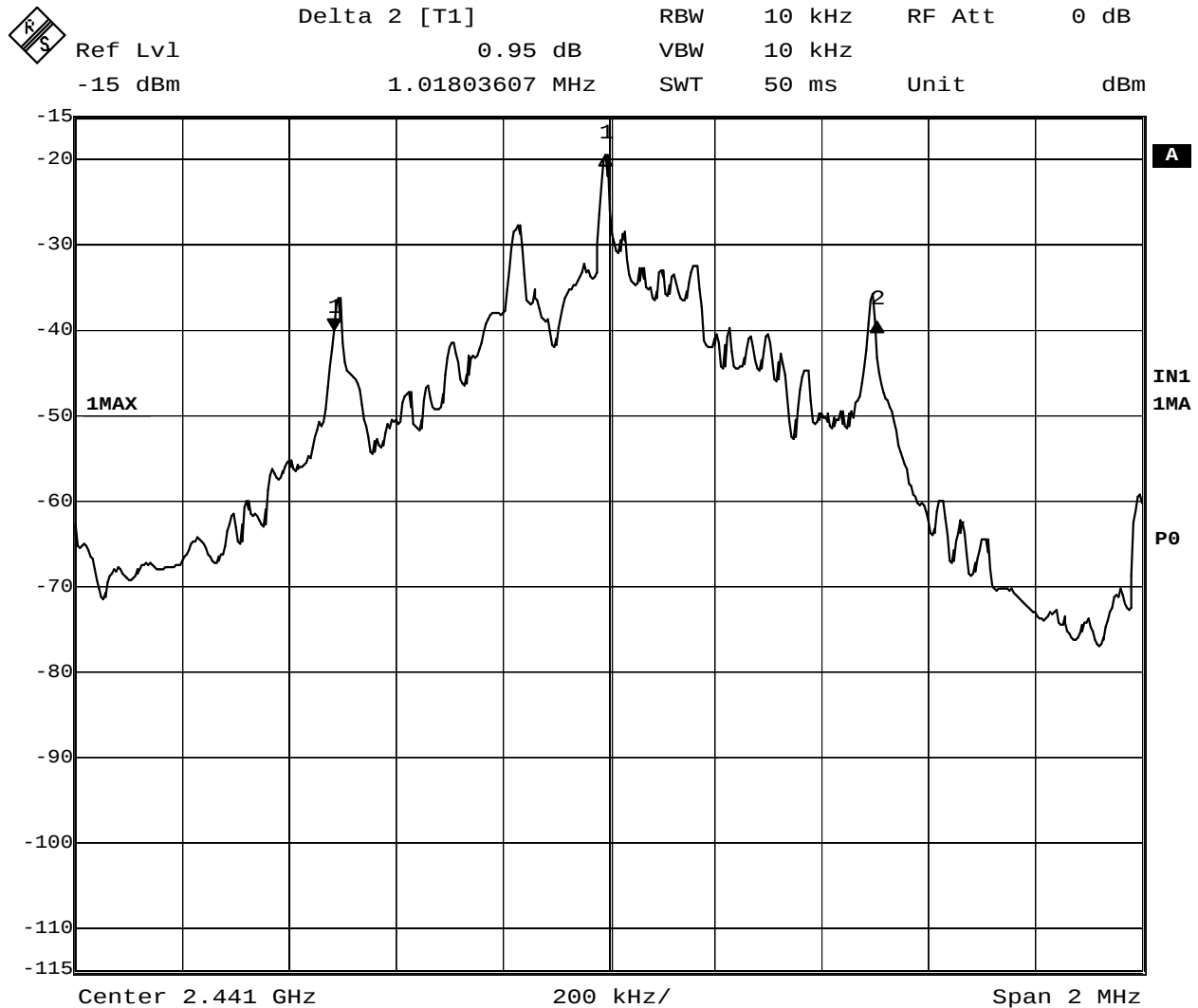


Date: 19.JUN.2006 16:54:22

2402.0MHz – Maximum Power DH1 (10kHz Bandwidth)

2.3 20dB BANDWIDTH

2.3.6 Test Results - continued

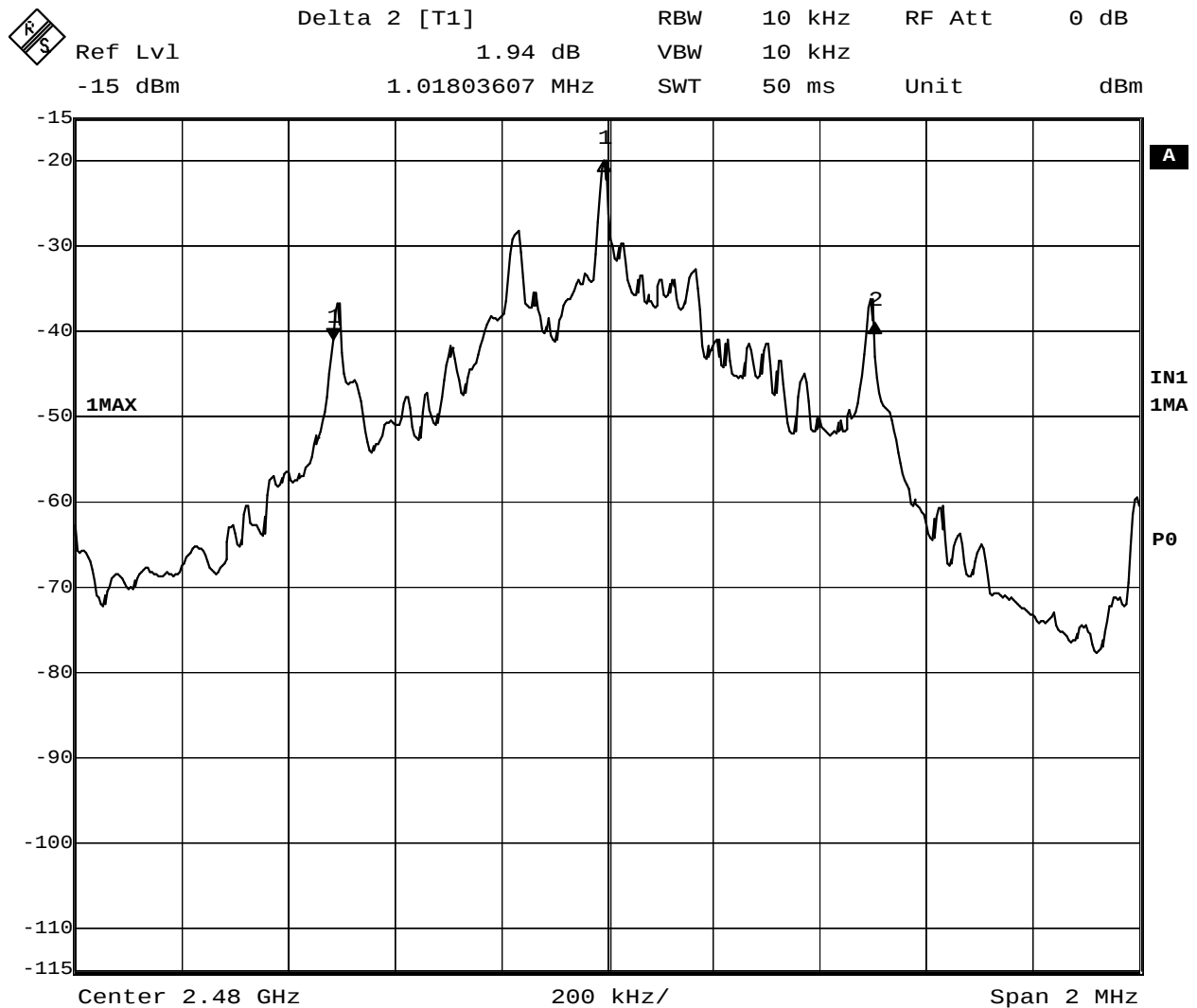


Date: 19.JUN.2006 17:03:11

2441.0MHz – Maximum Power DH1 (10KHz Bandwidth)

2.3 20dB BANDWIDTH

2.3.6 Test Results - continued

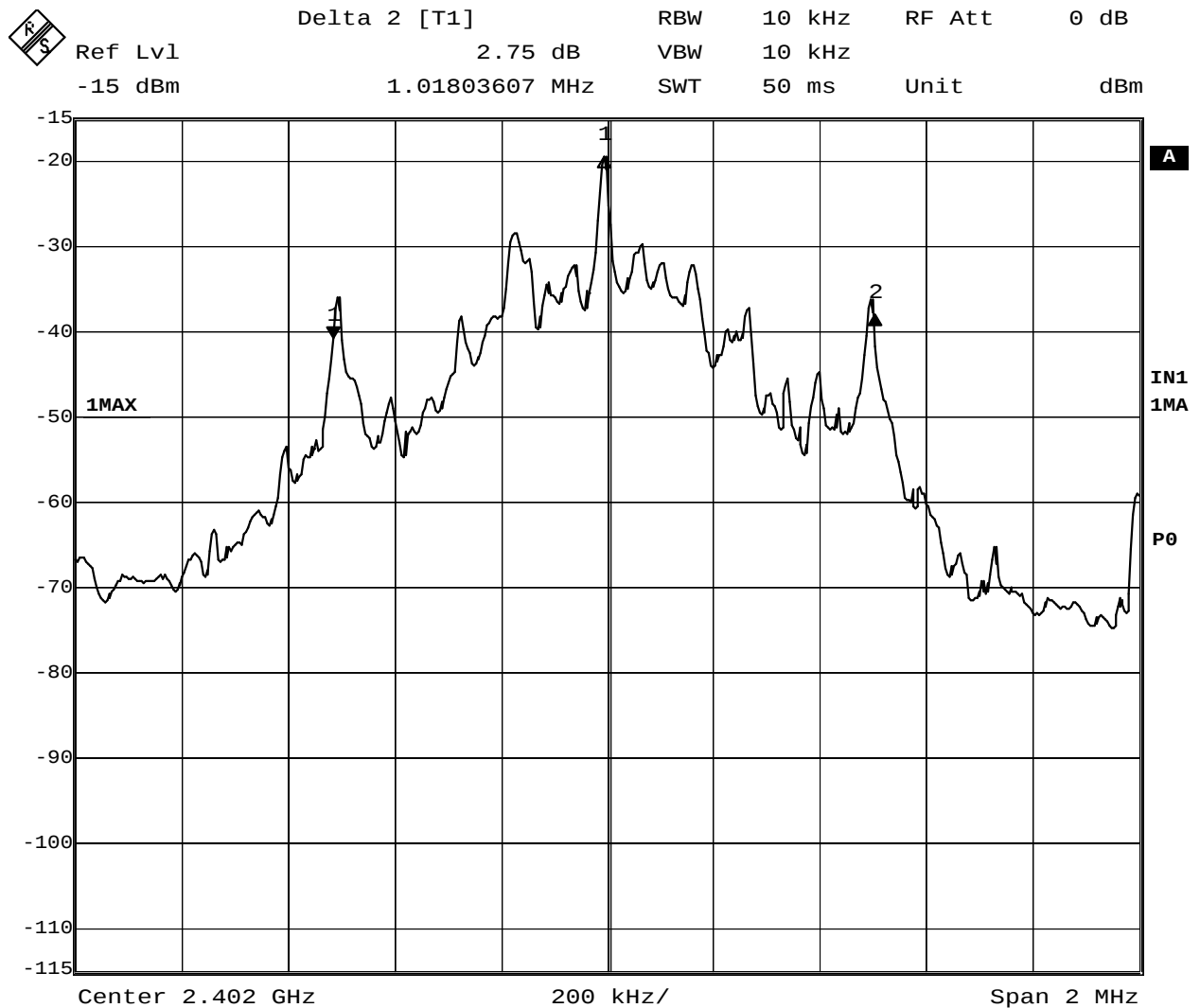


Date: 19.JUN.2006 17:06:07

2480.0MHz – Maximum Power DH1 (10kHz Bandwidth)

2.3 20dB BANDWIDTH

2.3.6 Test Results - continued

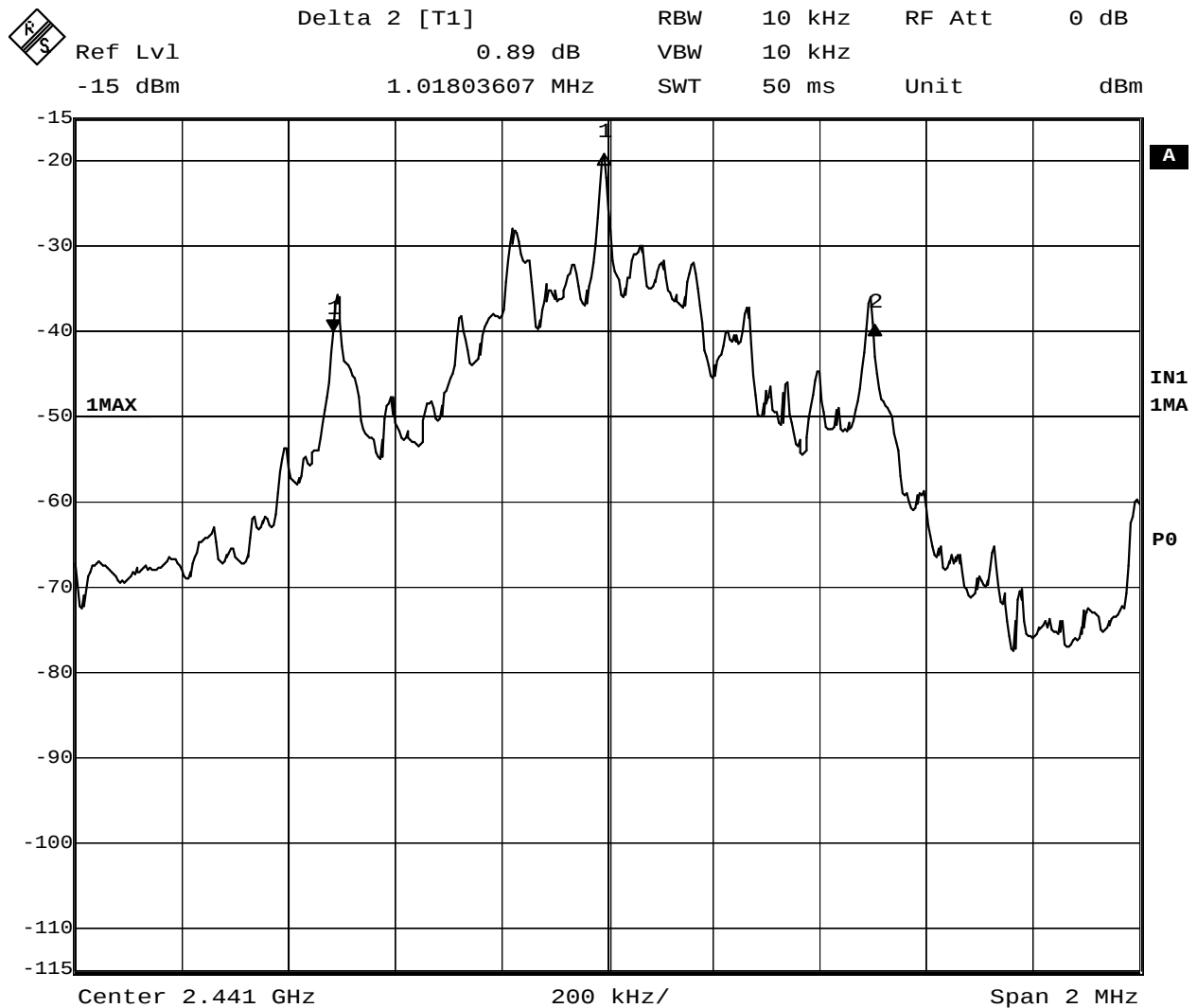


Date: 20.JUN.2006 08:37:34

2402.0MHz – Maximum Power DH3 (10kHz Bandwidth)

2.3 20dB BANDWIDTH

2.3.6 Test Results - continued

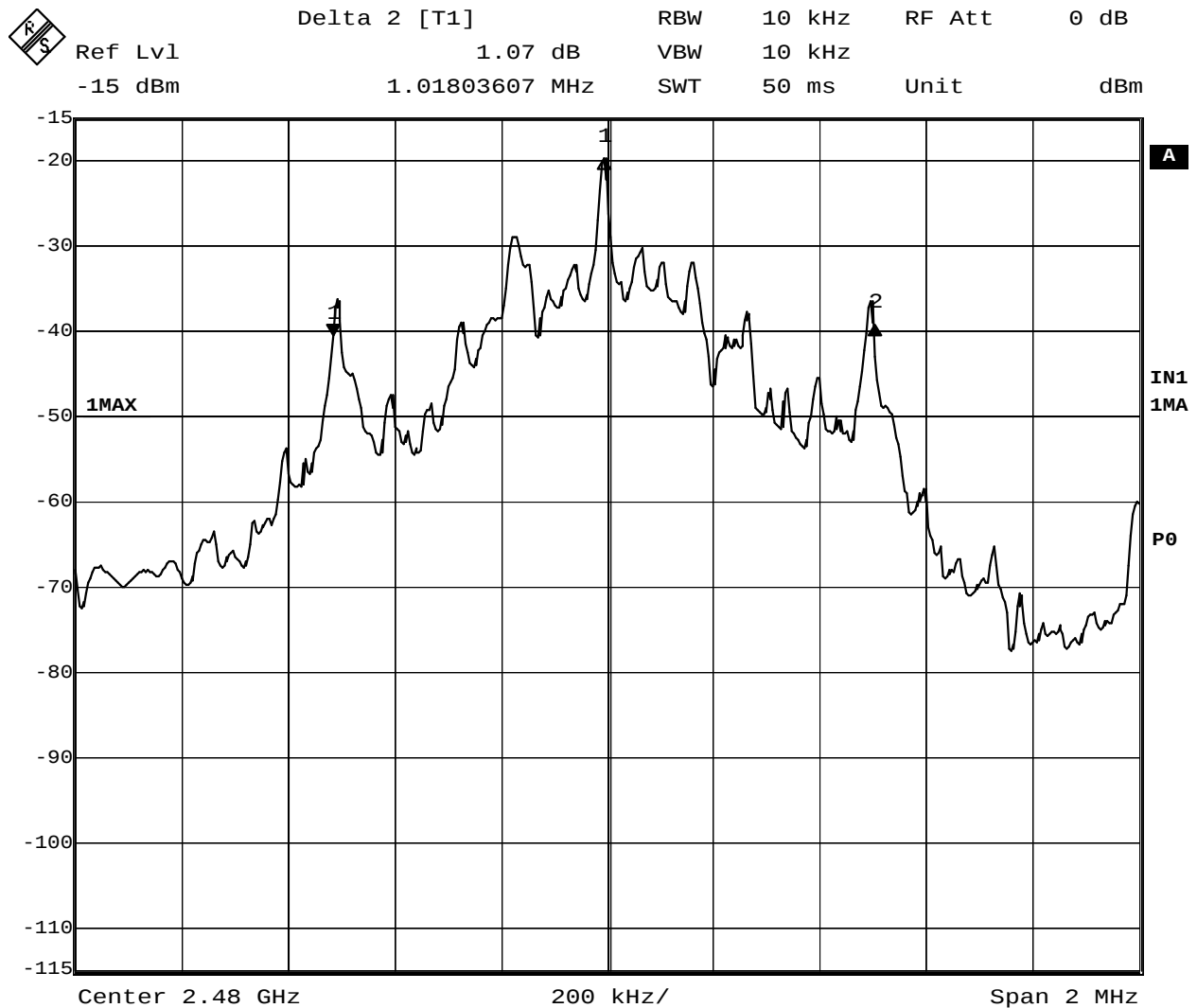


Date: 20.JUN.2006 08:44:36

2441.0MHz – Maximum Power DH3 (10kHz Bandwidth)

2.3 20dB BANDWIDTH

2.3.6 Test Results - continued

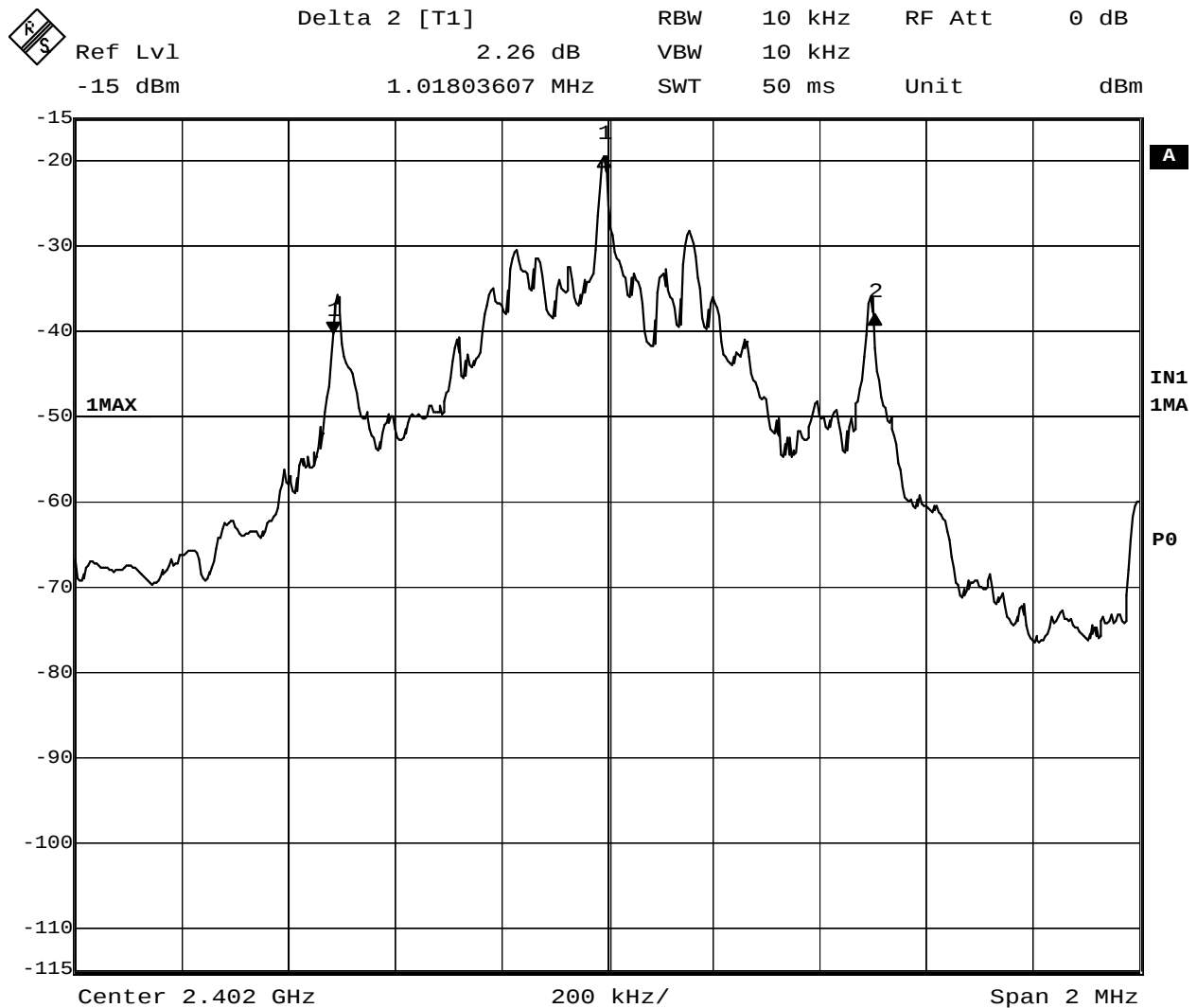


Date: 20.JUN.2006 08:46:56

2480.0MHz – Maximum Power DH3 (10kHz Bandwidth)

2.3 20dB BANDWIDTH

2.3.6 Test Results - continued

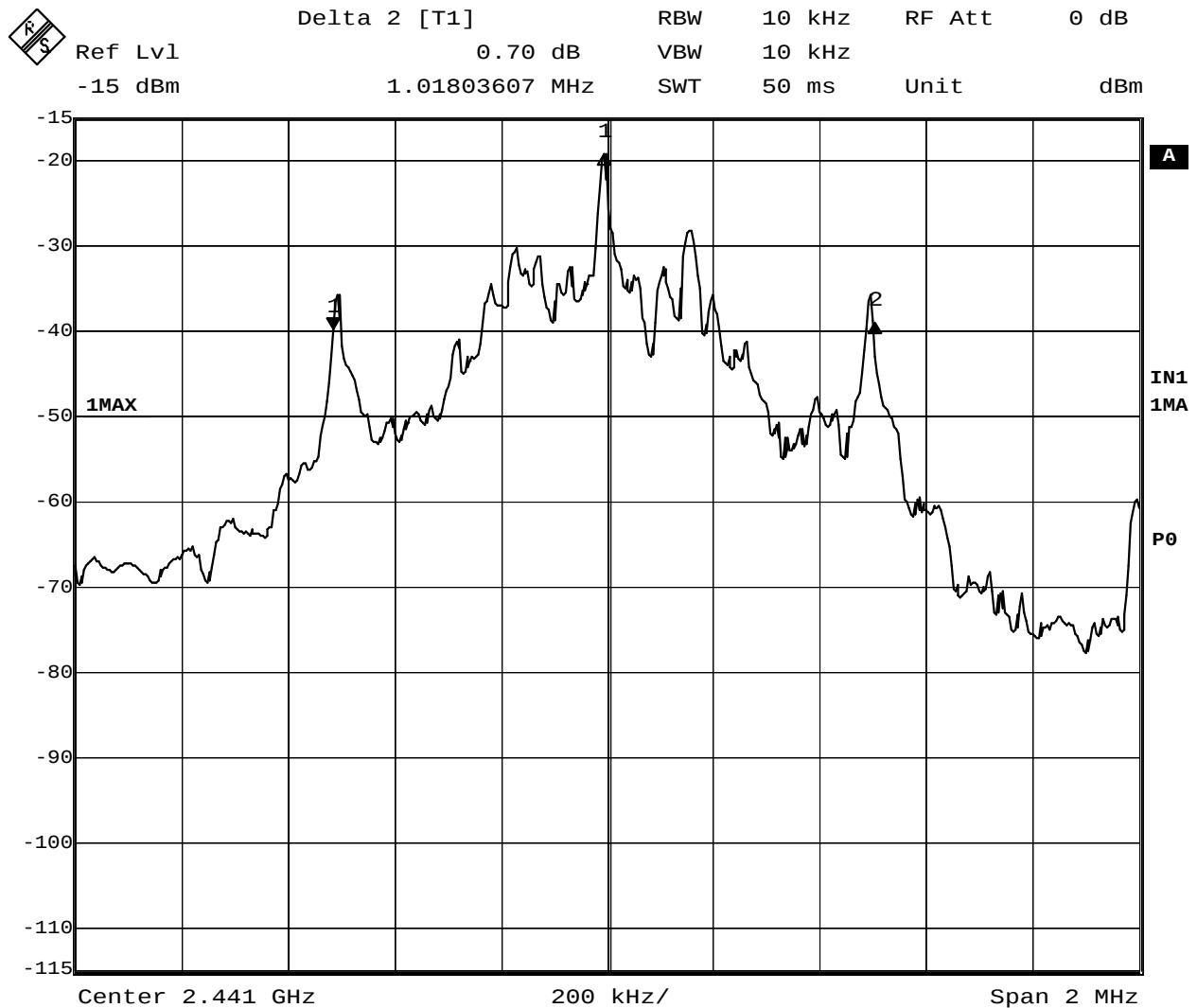


Date: 20.JUN.2006 08:51:36

2402.0MHz – Maximum Power DH5 (10kHz Bandwidth)

2.3 20dB BANDWIDTH

2.3.6 Test Results - continued

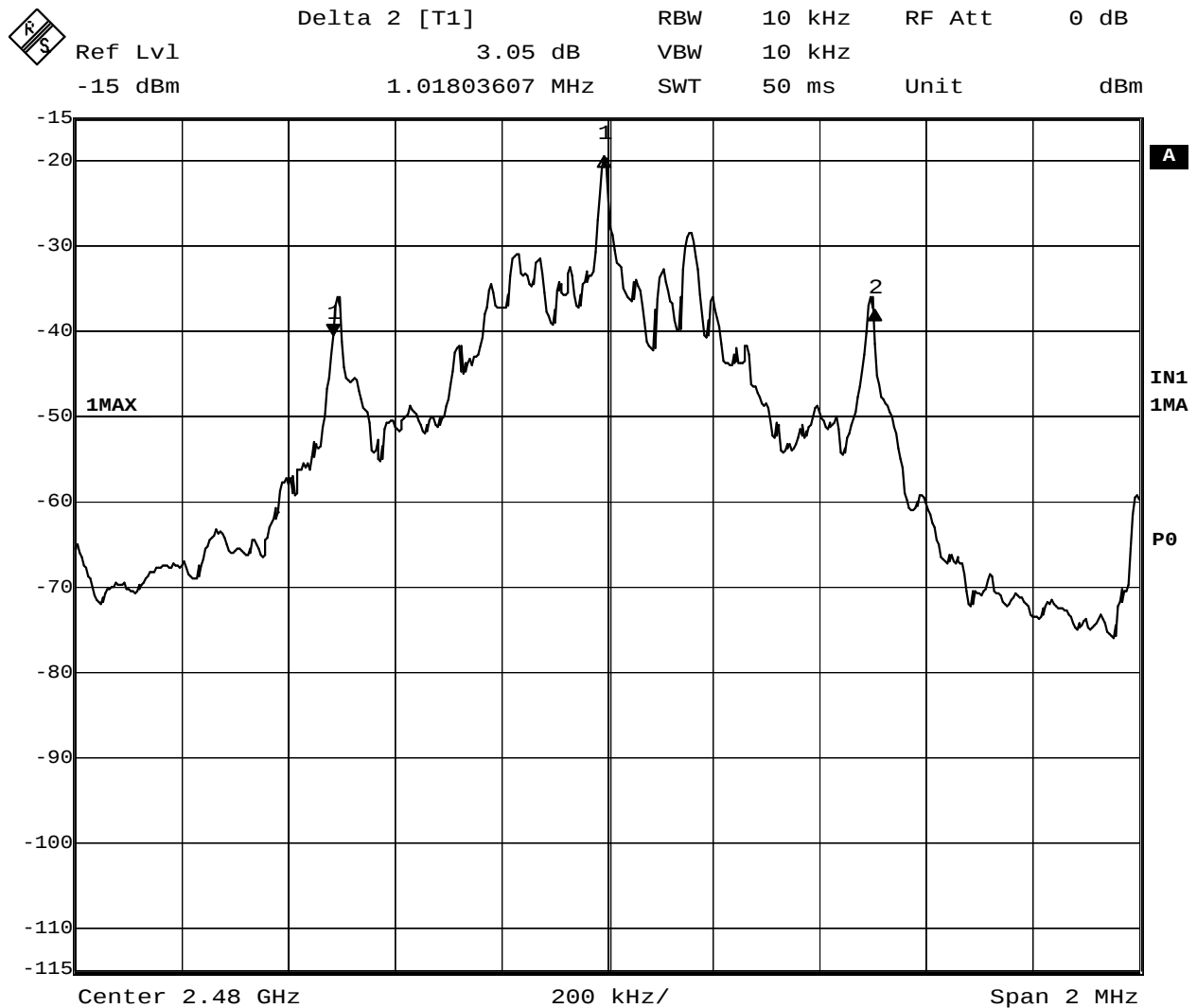


Date: 20.JUN.2006 08:57:49

2441.0MHz – Maximum Power DH5 (10kHz Bandwidth)

2.3 20dB BANDWIDTH

2.3.6 Test Results - continued



Date: 20.JUN.2006 09:02:12

2480.0MHz – Maximum Power DH5 (10kHz Bandwidth)

2.4 CHANNEL DWELL TIME (DH1)

2.4.1 Specification Reference

FCC Part 15.247(a)(iii) and RSS-210, A8.1(4).

2.4.2 Equipment Under Test

Widescreen ActivBoard and BT module.

2.4.3 Date of Test

20th June 2006.

2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.5 Test Procedure

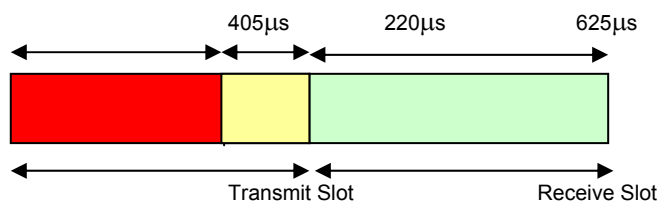
Procedure: Test Performed in accordance with 15.247 and RSS-210.

The Bluetooth system hops at a rate of 1600 times per second. Thus, this equates to 1600 timeslots in 1 second. The DH1 data rate operates on a Transmit on 1 timeslot and Receive on 1 timeslot basis. Thus, in 1 second, there are 800 Transmit timeslots and 800 Receive timeslots.

Thus:

$$1 \text{ Timeslot} = \frac{1}{1600} = 625\mu\text{s}$$

In 1 transmit timeslot, the transmit on time is only 405 μ s. 220 μ s is reserved as off time for the synthesizer to re-tune ready for the next transmit frequency. The following timeslot is a receive slot. This process continues assuming the data rate remains the same.



DH1 Timeslot Arrangement Showing One Complete Transmit and Receive Cycle

So, with 800 Tx and 800 Rx timeslots, the transmitter is on for $800 \times 405\mu\text{s} = 0.324$ seconds.

$$\therefore \frac{\text{Total Tx Time On}}{\text{No Of Channels}} = \frac{0.324}{80} = 4.05\text{ms}$$

So, in 32 seconds, the transmitter dwell time per channel is:

$$32 \times 4.05\text{ms} = 0.1296 \text{ seconds}$$

2.4 CHANNEL DWELL TIME (DH1)

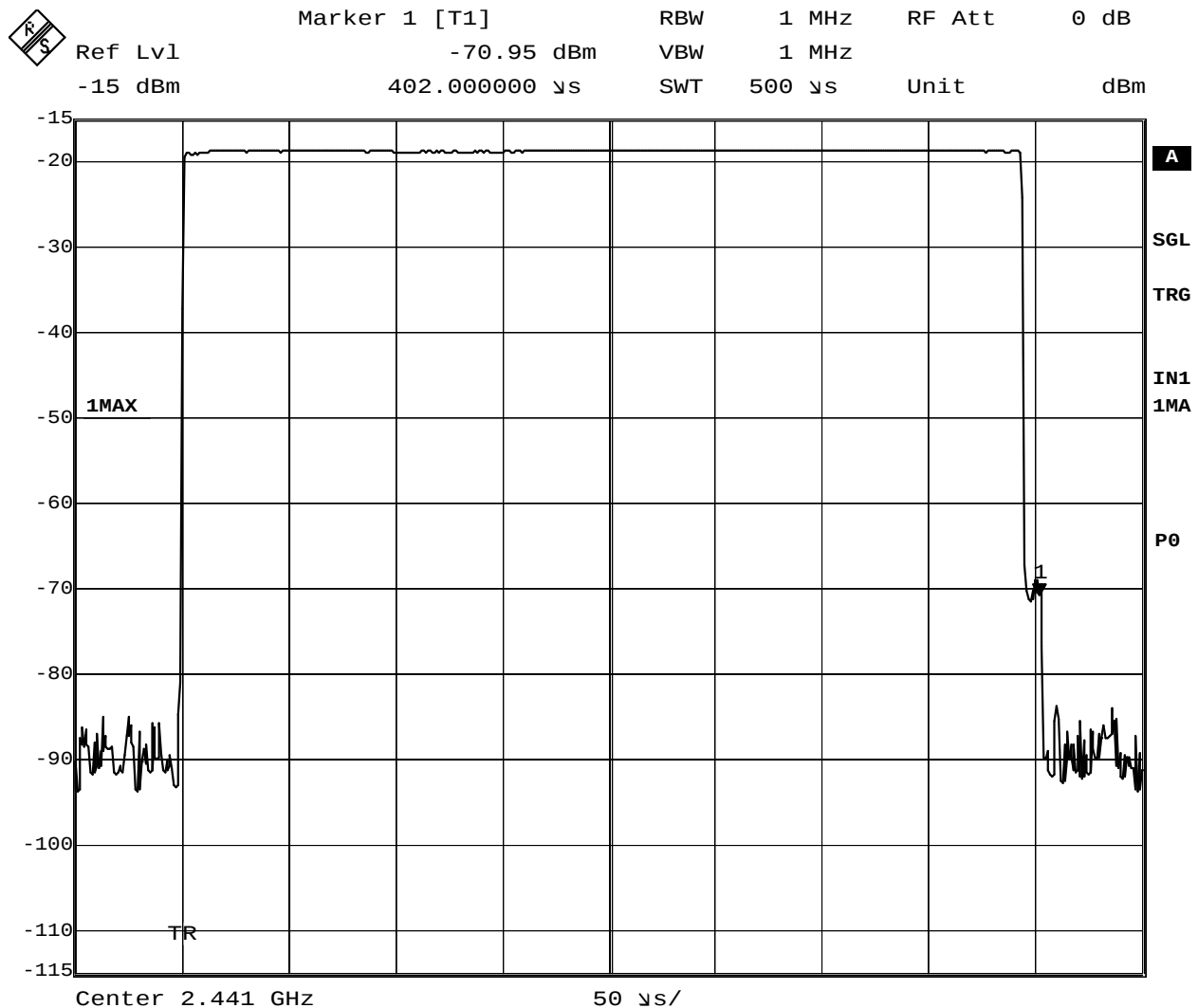
2.4.5 Test Procedure - Continued

Remarks

The transmitter dwell time for data rate DH1 meets the requirements specified in 15.247(a)(iii) and RSS-210, A8.1(4).

2.4.6 Test Results

409µS



Date: 20.JUN.2006 10:36:11

Plot Showing DH1 Timeslot

2.5 CHANNEL DWELL TIME (DH3)

2.5.1 Specification Reference

FCC Part 15.247(a)(iii) and RSS-210, A8.1(4).

2.5.2 Equipment Under Test

Widescreen ActivBoard and BT module.

2.5.3 Date of Test

20th June 2006.

2.5.4 Test Equipment Used

The following major items of test equipment used for the above test are identified in Section 3.1.

2.5.5 Test Procedure

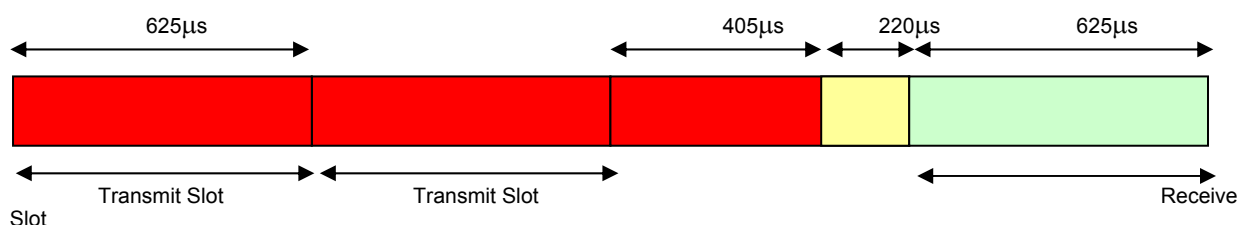
Test Performed in accordance with 15.247 and RSS-210.

The Bluetooth system hops at a rate of 1600 times per second. Thus, this equates to 1600 timeslots in 1 second. With data rate DH3, the data payload is higher and can use up to 3 timeslots. When more than one timeslot is used, the frequency does not hop and transmission is continuous on all 3 slots, (ie. no receive slot in-between the 3 transmit slots). The 220 μ s off time for synthesizer re-tuning at the end of a slot is only used on the final slot. Thus, for one cycle, there are 3 transmit timeslots. 2 are 625 μ s long and the final slot is transmitting for 405 μ s.

The DH3 data rate operates on a Transmit on 3 timeslots and Receives on 1 timeslot basis, (assuming maximum data payload). The frequency-hopping rate is the same. Thus, in 1 second, there are 1200 Transmit timeslots and 400 Receive timeslots.

$$1 \text{ Timeslot} = \frac{1}{1600} = 625\mu\text{s}$$

The first 2 Transmit timeslots are transmitting for the complete 625 μ s. In the third transmit slot, the transmit on time is only 405 μ s. 220 μ s is reserved as off time for the synthesizer to re-tune ready for the next transmit frequency. The following timeslot is a receive slot. This process continues assuming the data rate remains the same.



DH3 Timeslot Arrangement Showing One Complete Transmit and Receive Cycle,
(Maximum Payload)

2.5 CHANNEL DWELL TIME (DH3)

2.5.5 Test Procedure – Continued

Therefore, the transmitter for one complete transmit and receive cycle would be on for:

$$\text{Tx} \quad (2 \times 625\mu\text{s}) + (1 \times 405\mu\text{s}) = 1.655\text{ms}$$

So:

$$\begin{aligned} 800 \times 625\mu\text{s} &= 0.5 \text{ seconds} \\ 400 \times 405\mu\text{s} &= 0.162 \text{ seconds} \end{aligned}$$

$$0.5 + 0.162 = 0.662 \text{ seconds}$$

$$\therefore \frac{\text{Total Tx Time On}}{\text{No Of Channels}} = \frac{0.662}{80} = 8.275\text{ms}$$

So, in 32 seconds, the transmitter dwell time per channel is:

$$32 \times 8.275\text{ms} = 0.2648 \text{ seconds}$$

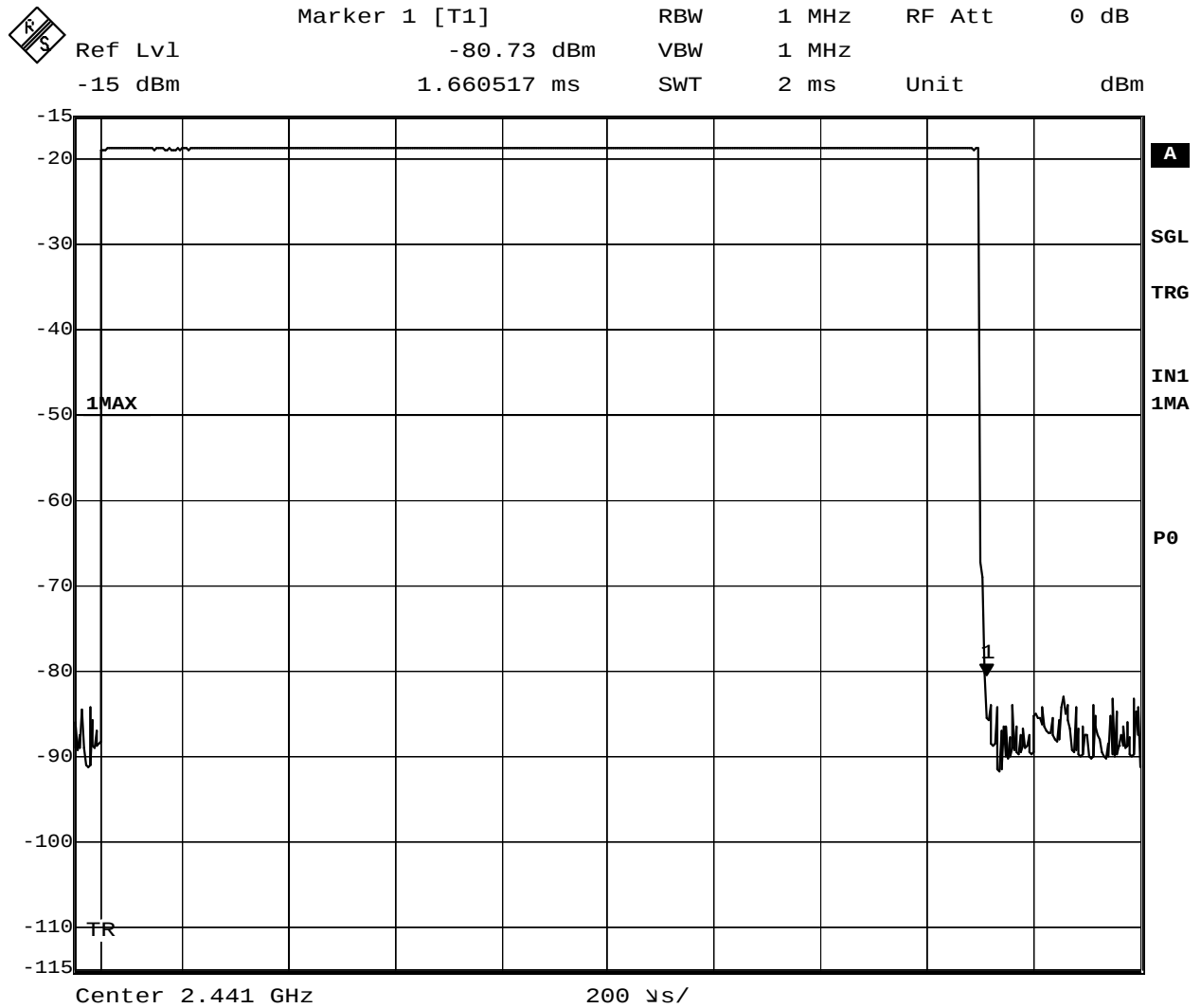
Remarks

The transmitter dwell time for data rate DH3 meets the requirements specified in 15.247(a)(iii) and RSS-210, A8.1(4).

2.5 CHANNEL DWELL TIME (DH3)

2.5.6 Test Results

1.66mS



Date: 20.JUN.2006 10:41:03

Plot Showing DH3 Timeslot

2.6 CHANNEL DWELL TIME (DH5)

2.6.1 Specification Reference

FCC Part 15.247(a)(iii) and RSS-210, A8.1(4).

2.6.2 Equipment Under Test

Widescreen ActivBoard and BT module.

2.6.3 Date of Test

20th June 2006.

2.6.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.6.5 Test Procedure

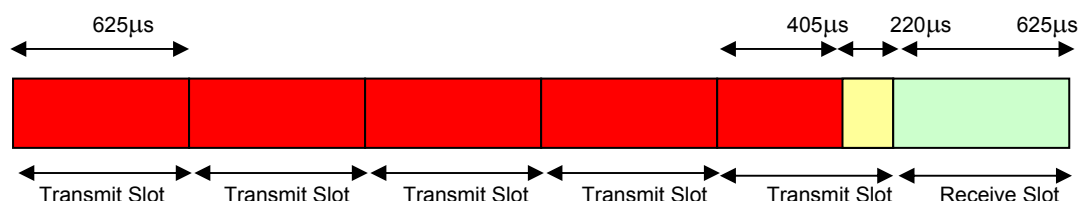
Test Performed in accordance with 15.247 and RSS-210.

The Bluetooth system hops at a rate of 1600 times per second. Thus, this equates to 1600 timeslots in 1 second. With data rate DH5, the data payload is higher and can use up to 5 timeslots. When more than one timeslot is used, the frequency does not hop and transmission is continuous on all 5 slots, (ie. no receive slot in-between the 5 transmit slots). The 220 μ s off time for synthesizer re-tuning at the end of a slot is only used on the final slot. Thus, for one cycle, there are 5 transmit timeslots. 4 are 625 μ s long and the final slot is transmitting for 405 μ s.

The DH5 data rate operates on a Transmit on 5 timeslots and Receives on 1 timeslot basis, (assuming maximum data payload). The frequency-hopping rate is the same. Thus, in 1 second, there are 1333.3 Transmit timeslots and 266.7 Receive timeslots.

$$1 \text{ Timeslot} = \frac{1}{1600} = 625\mu\text{s}$$

The first 4 Transmit timeslots are transmitting for the complete 625 μ s. In the fifth transmit slot, the transmit on time is only 405 μ s. 220 μ s is reserved as off time for the synthesizer to re-tune ready for the next transmit frequency. The following timeslot is a receive slot. This process continues assuming the data rate remains the same.



DH5 Timeslot Arrangement Showing One Complete Transmit and Receive Cycle, (Maximum Payload)

2.6 CHANNEL DWELL TIME (DH5)

2.6.5 Test Procedure - Continued

Thus, the transmitter for one complete transmit and receive cycle would be on for:

$$Tx \quad (2 \times 625\mu s) + (1 \times 405\mu s) = 2.905ms$$

So:

$$1066.7 \times 625\mu s = 0.666 \text{ seconds}$$

$$266.7 \times 405\mu s = 0.108 \text{ seconds}$$

$$0.666 + 0.108 = 0.774 \text{ seconds}$$

$$\therefore \frac{\text{Total Tx Time On}}{\text{No Of Channels}} = \frac{0.774}{80} = 9.675ms$$

So, in 32 seconds, the transmitter dwell time per channel is:

$$32 \times 9.675ms = 0.31 \text{ seconds}$$

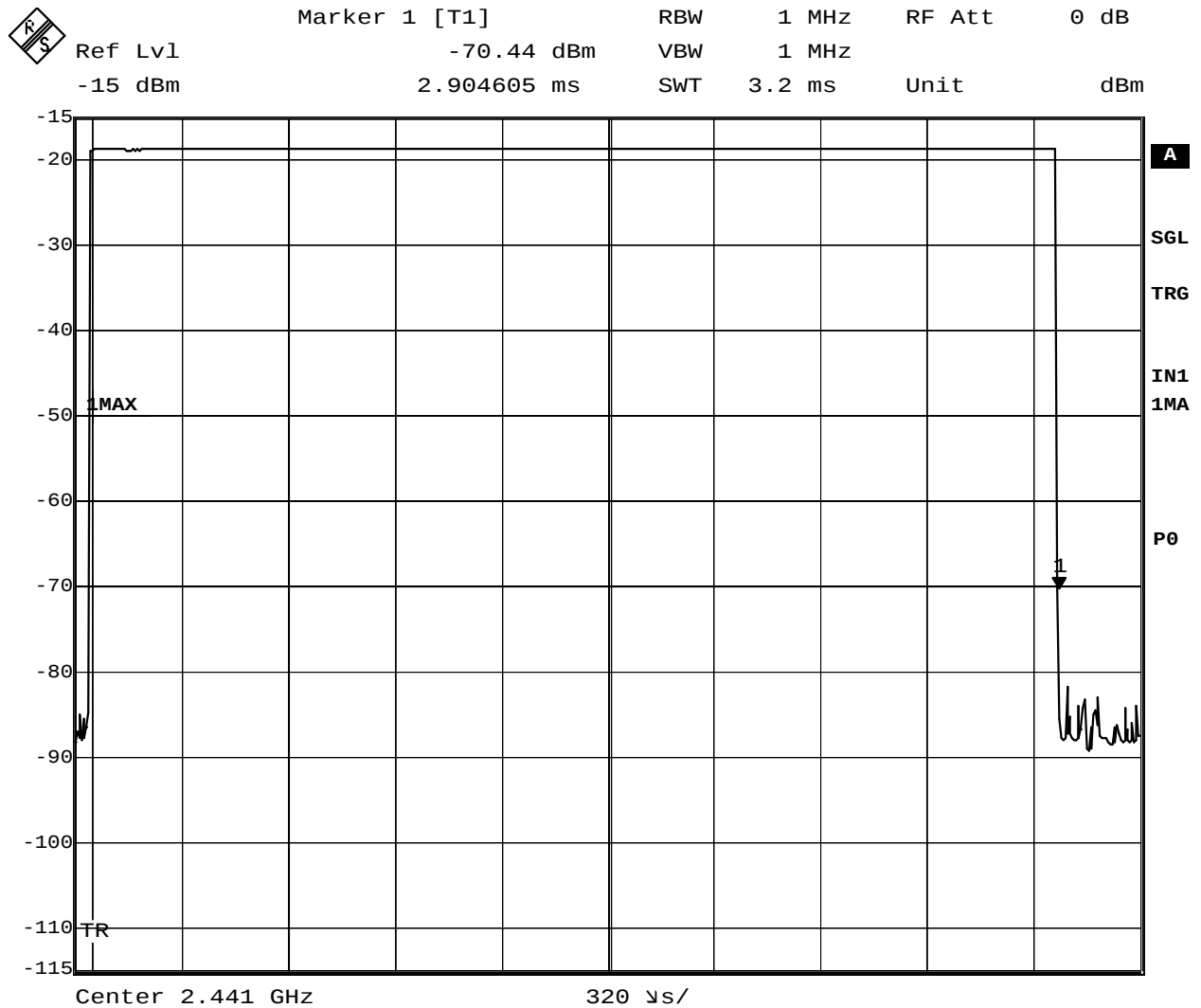
Remarks

Thus, the transmitter dwell time for data rate DH5 meets the requirements specified in 15.247(a)(iii) and RSS-210, A8.1(4).

2.6 CHANNEL DWELL TIME (DH5)

2.6.6 Test Results

2.9mS



Date: 20.JUN.2006 10:43:33

Plot Showing DH5 Timeslot



Product Service

2.7 CHANNEL SEPARATION

2.7.1 Specification Reference

FCC Part 15.247(a)(1) and RSS-210, A8.1(2).

2.7.2 Equipment Under Test

Widescreen ActivBoard and BT module.

2.7.3 Date of Test

20th June 2006.

2.7.4 Test Equipment Used

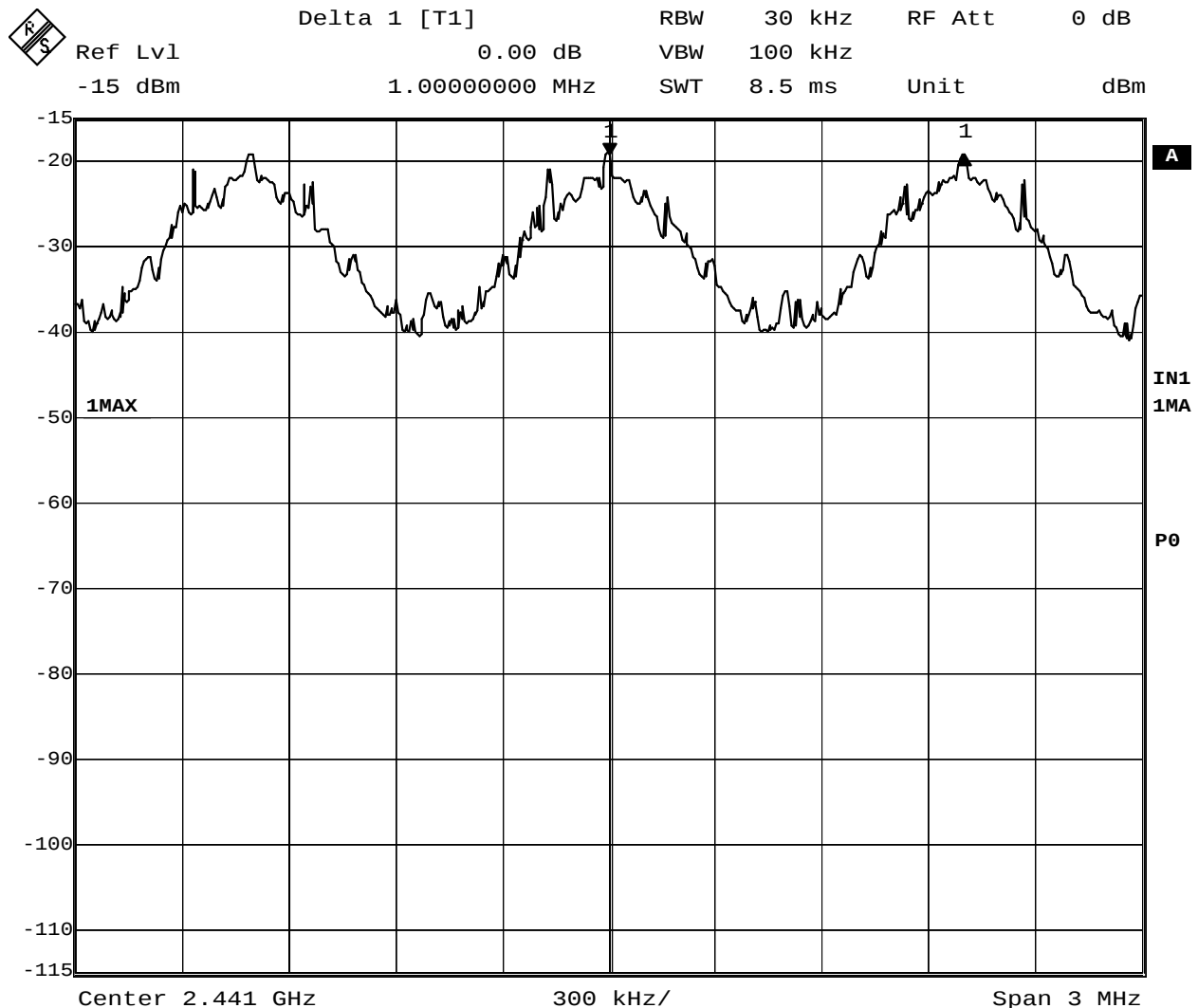
The major items of test equipment used for the above tests are identified in Section 3.1.

2.7.5 Test Procedure

The EUT was transmitted at maximum power into a Spectrum Analyser. The trace was set to Max Hold to store several adjacent channels on screen. Using the marker delta function, the markers were positioned to show the separation between adjacent channels.

2.7 CHANNEL SEPARATION

2.7.6 Test Result



The system channel separation is specified as being 1MHz. The measured channel separation from the plot above is: 1000kHz.

Limit	>25kHz
-------	--------

Remarks

The equipment met the requirements outlined in 15.247(a)(1) and RSS-210, A8.1(2).

2.8 NUMBER OF HOPPING CHANNELS

2.8.1 Specification Reference

FCC Part 15.247(a)(1) and RSS-210, A8.1(4).

2.8.2 Equipment Under Test

Widescreen ActivBoard and BT module.

2.8.3 Date of Test

20th June 2006.

2.8.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

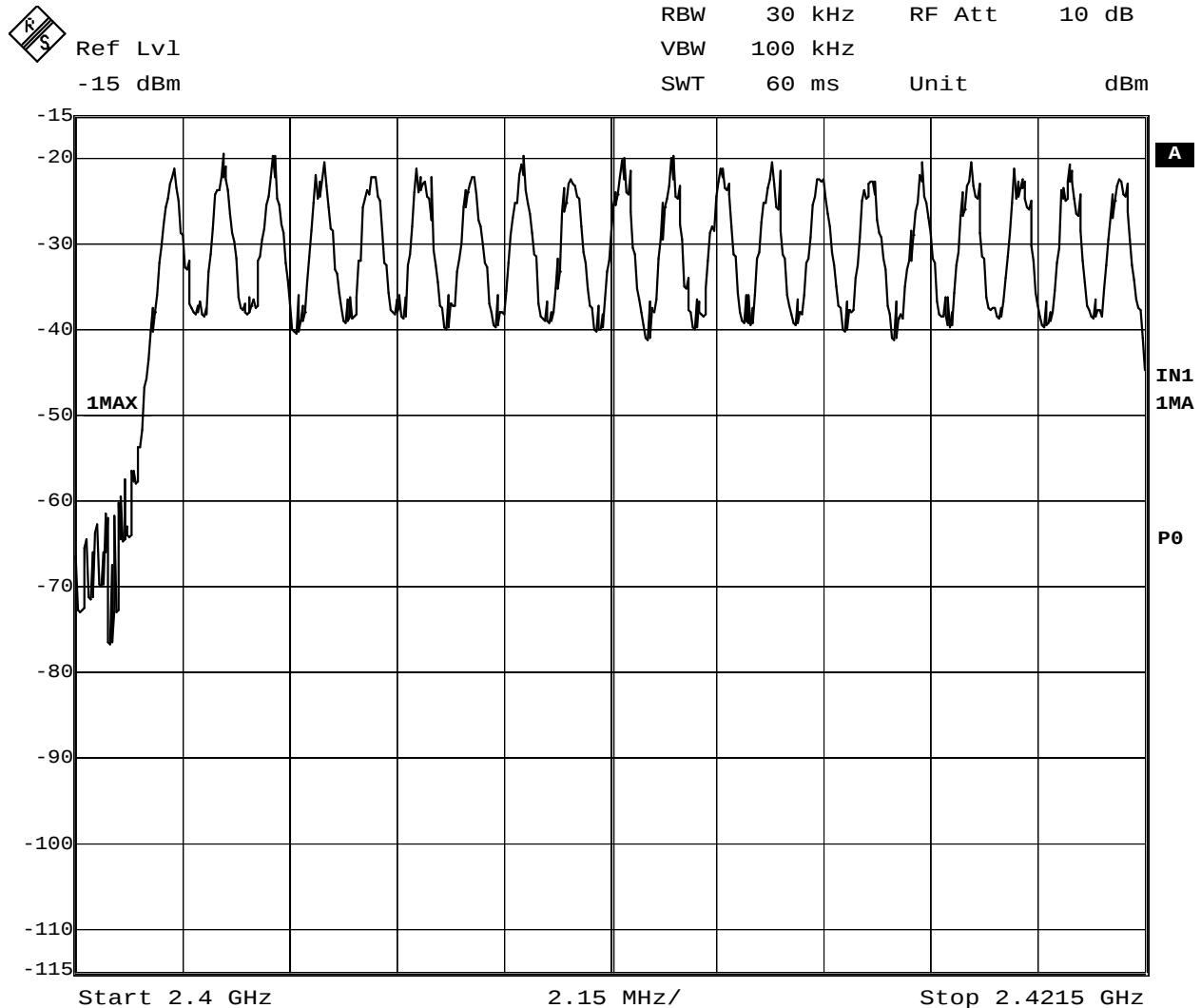
2.8.5 Test Procedure

Test Performed in accordance with 15.247 and RSS-210.

The EUT was connected to a Spectrum Analyser via a cable. The EUT was set to transmit on maximum power and hopping on all channels. The span was adjusted to show the individual channels. To reasonably display the number of channels, the occupied band was split into four traces. The display trace was set to Max Hold and the plots recorded.

2.8 NUMBER OF HOPPING CHANNELS

2.8.6 Test Results

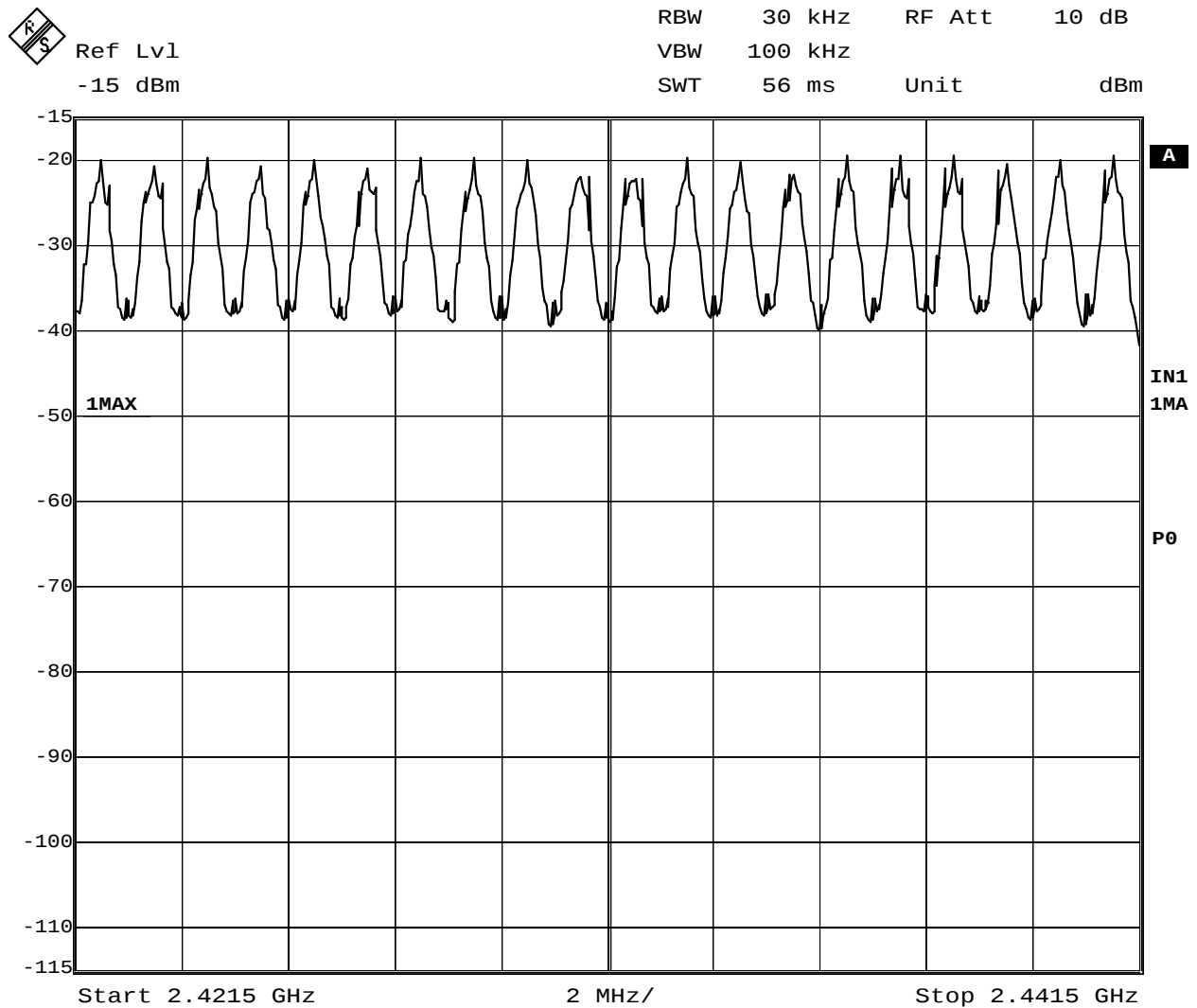


Date: 20.JUN.2006 13:50:05

Trace Showing Channels 1 - 19

2.8 NUMBER OF HOPPING CHANNELS

2.8.6 Test Results - continued

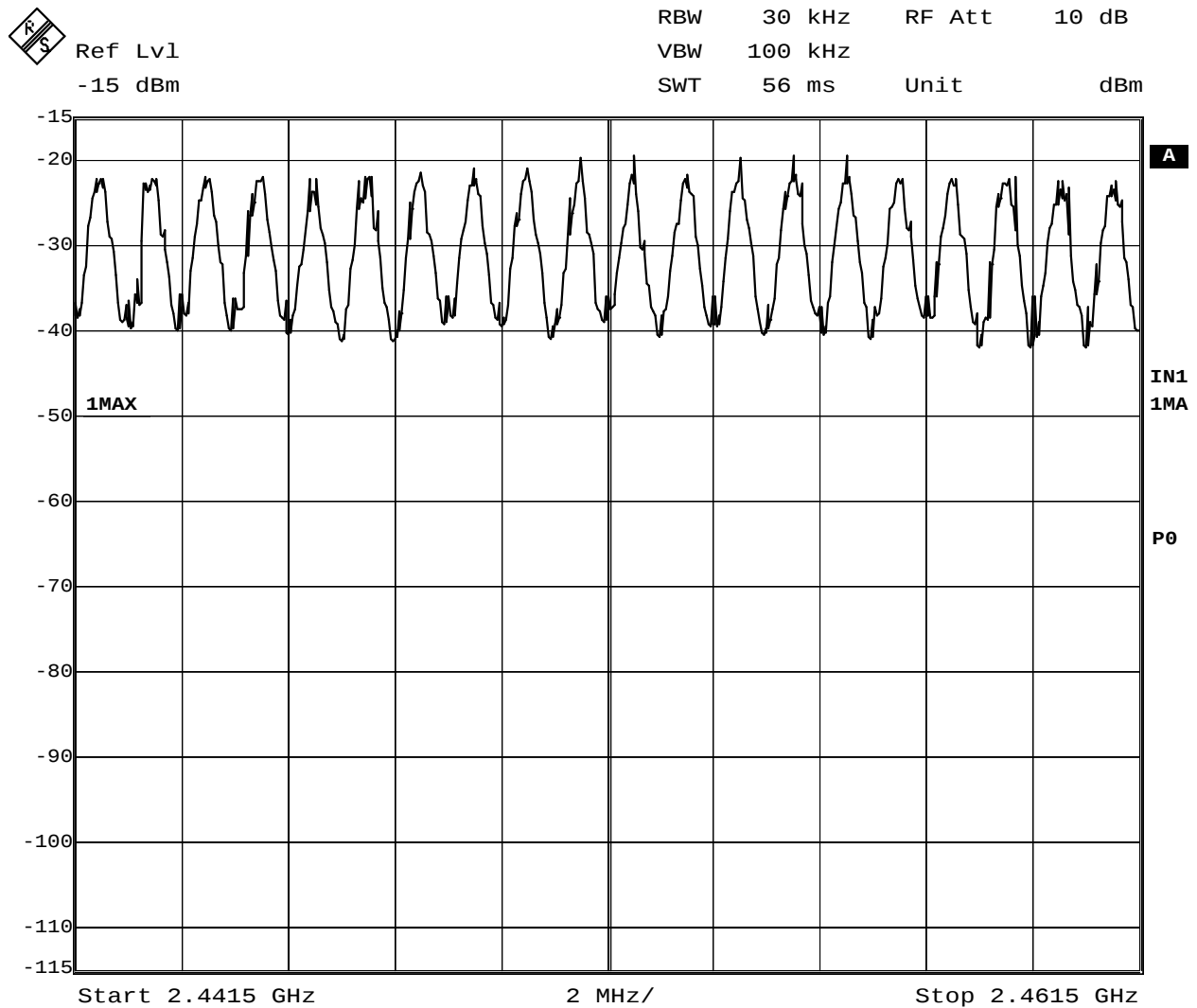


Date: 20.JUN.2006 13:58:32

Trace Showing Channels 20 - 39

2.8 NUMBER OF HOPPING CHANNELS

2.8.6 Test Results - continued

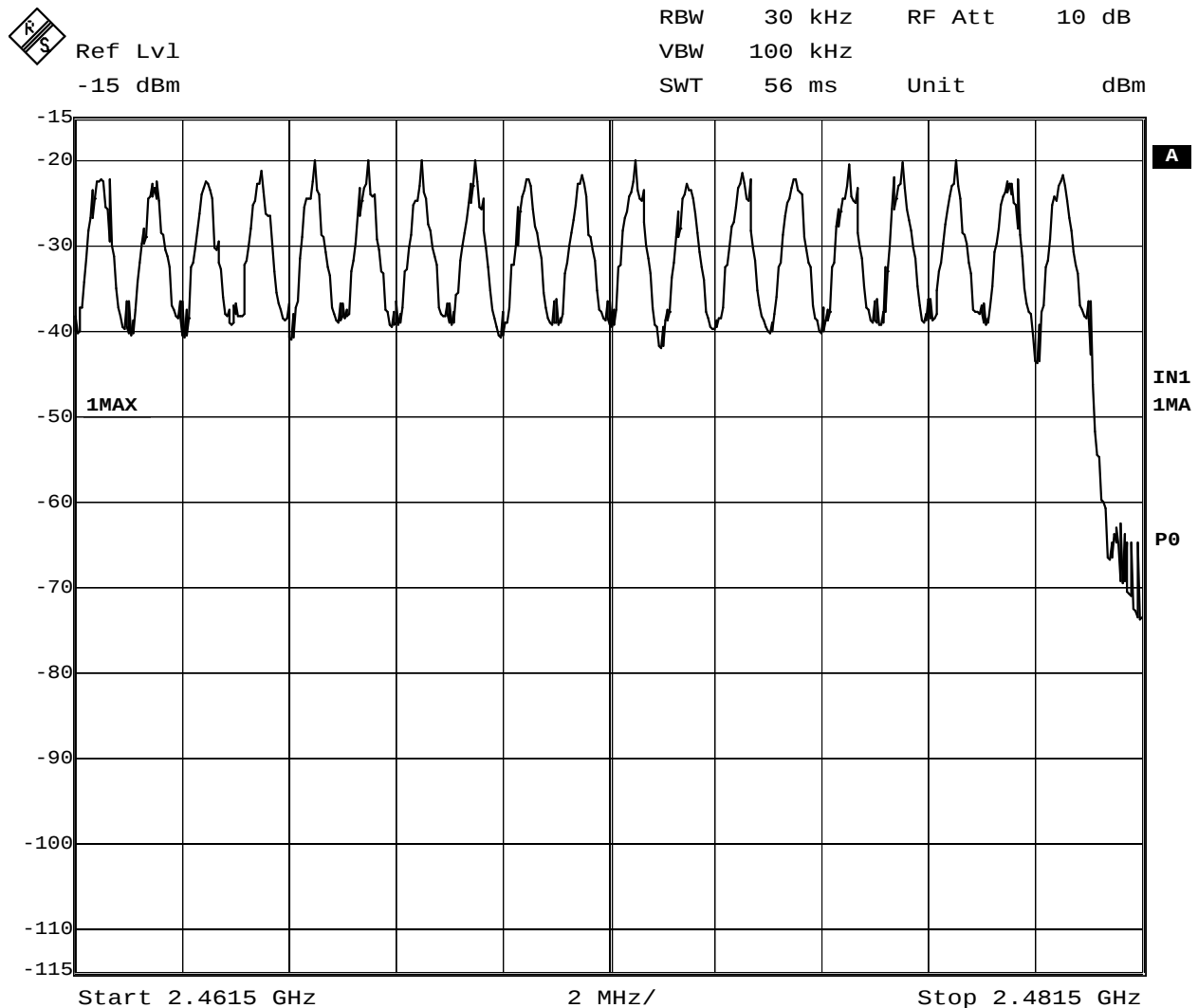


Date: 20.JUN.2006 14:01:56

Trace Showing Channels 40 - 59

2.8 NUMBER OF HOPPING CHANNELS

2.8.6 Test Results - continued



Date: 20.JUN.2006 14:06:40

Trace Showing Channels 60 – 78

Limit	≥75 channels
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Remarks

EUT complies with CFR 47 15.247(a)(1)(iii) and RSS-210, A8.1(4). The EUT utilises more than 75 channels.

2.9 MAXIMUM PEAK OUTPUT POWER

2.9.1 Specification Reference

FCC Part 15.247(b)(1) and RSS-210, A8.1(1).

2.9.2 Equipment Under Test

Widescreen ActivBoard and BT module.

2.9.3 Date of Test

21st June 2006.

2.9.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.9.5 Test Procedure

Test Performed in accordance with 15.247 and RSS-210.

The EUT was connected to a Peak Power Analyser, (8990A), via an RF cable. Using a Signal Generator and the 8990A, the path loss of the cable was measured and entered as an offset adjustment into the 8990A. The peak level was recorded and compared with the test limits.

2.9.6 Test Results

DH1

Frequency (MHz)	Path Loss (dB)	Output Power (dBm)	Result (mW)
2402.0	1.0105	1.339	1.361
2441.0	1.132	1.337	1.361
2480.0	1.163	1.319	1.355

DH3

Frequency (MHz)	Path Loss (dB)	Output Power (dBm)	Result (mW)
2402.0	1.105	1.395	1.379
2441.0	1.132	1.467	1.402
2480.0	1.163	1.385	1.376



2.9 MAXIMUM PEAK OUTPUT POWER

2.9.6 Test Results - continued

DH5

Frequency (MHz)	Path Loss (dB)	Output Power (dBm)	Result (mW)
2402.0	1.105	1.478	1.405
2441.0	1.132	1.500	1.413
2480.0	1.163	1.365	1.369

Limit	$\leq 1\text{W}$ or $\leq +30\text{dBm}$
-------	--

Remarks

EUT complies with CFR 47 15.247(b)(1) and RSS-210, A8.1(1). The EUT does not exceed 1W or +30dBm at the measured frequencies.

2.10 SPURIOUS CONDUCTED EMISSIONS

2.10.1 Specification Reference

FCC Part 15.247(d) and Industry Canada RSS-210, A8.5.

2.10.2 Equipment Under Test

Widescreen ActivBoard and BT module.

2.10.3 Date of Test

20th June 2006.

2.10.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.10.5 Test Procedure

In accordance with Part 15.247(d) and RSS-210, the Spurious Conducted Emissions from the antenna terminal were measured. The transmitter output power was attenuated using a combination of filters and attenuators and the frequency spectrum investigated from 9kHz to 25 GHz. The EUT was set to transmit on full power and frequency hopping on all channels. The resolution and video bandwidths were set to 100kHz in accordance with Part 15.247. The spectrum analyser detector was set to Max Hold.

With the EUT transmitting at maximum power, the Spectrum Analyser was set to Max Hold and the fundamental peak measured in a RBW and VBW of 100kHz. This level was used to determine the limit line as displayed on the plots of -20dBc.

The maximum path loss across each measurement band was used as the reference level offset to ensure worst case results.

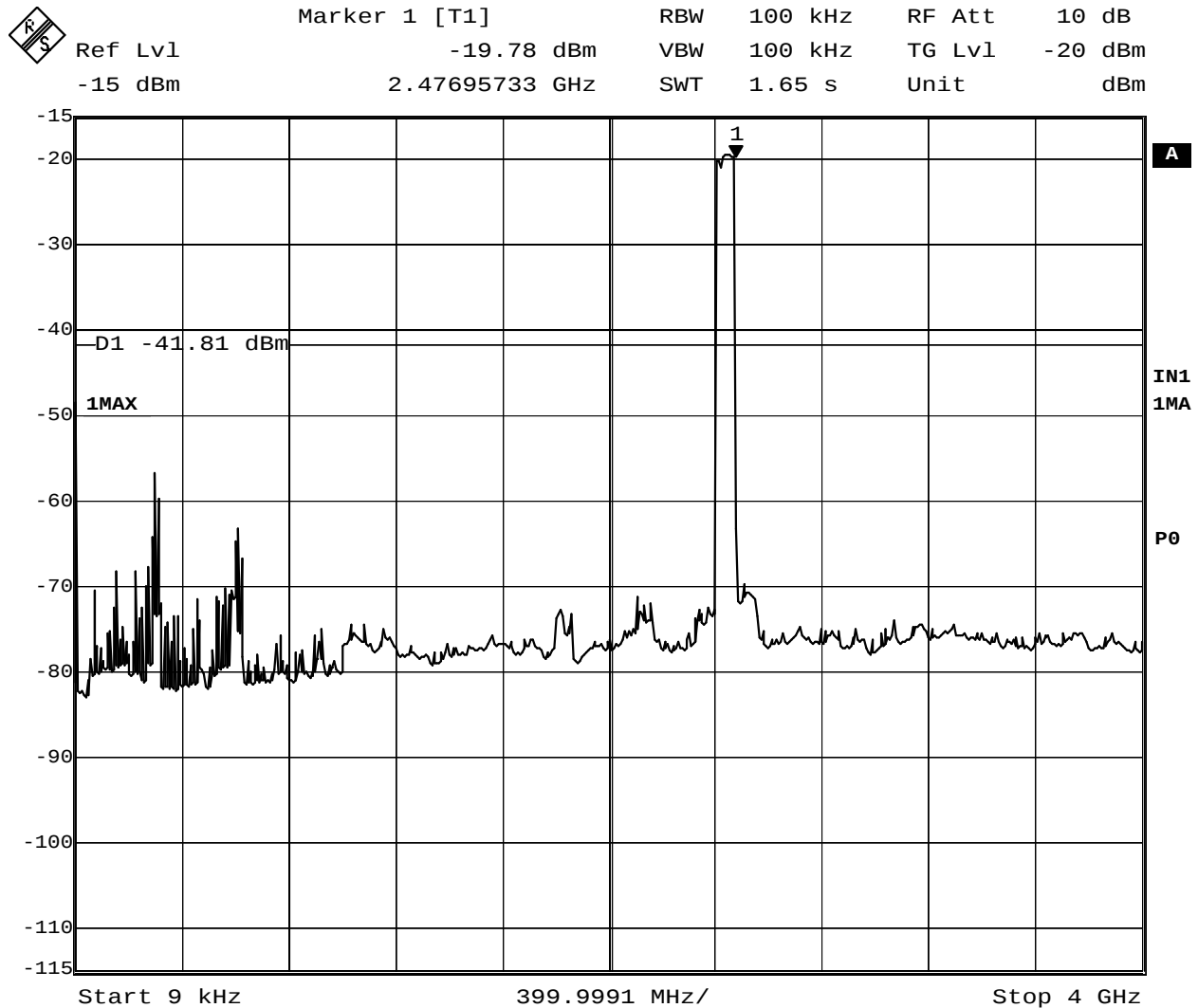
Remarks

The EUT passed the requirements laid out in 15.247(d) and RSS-210, A8.5.

The plots on the following pages show the frequency spectrum from 9kHz to 25GHz of the EUT.

2.10 SPURIOUS CONDUCTED EMISSIONS

2.10.6 Test Results

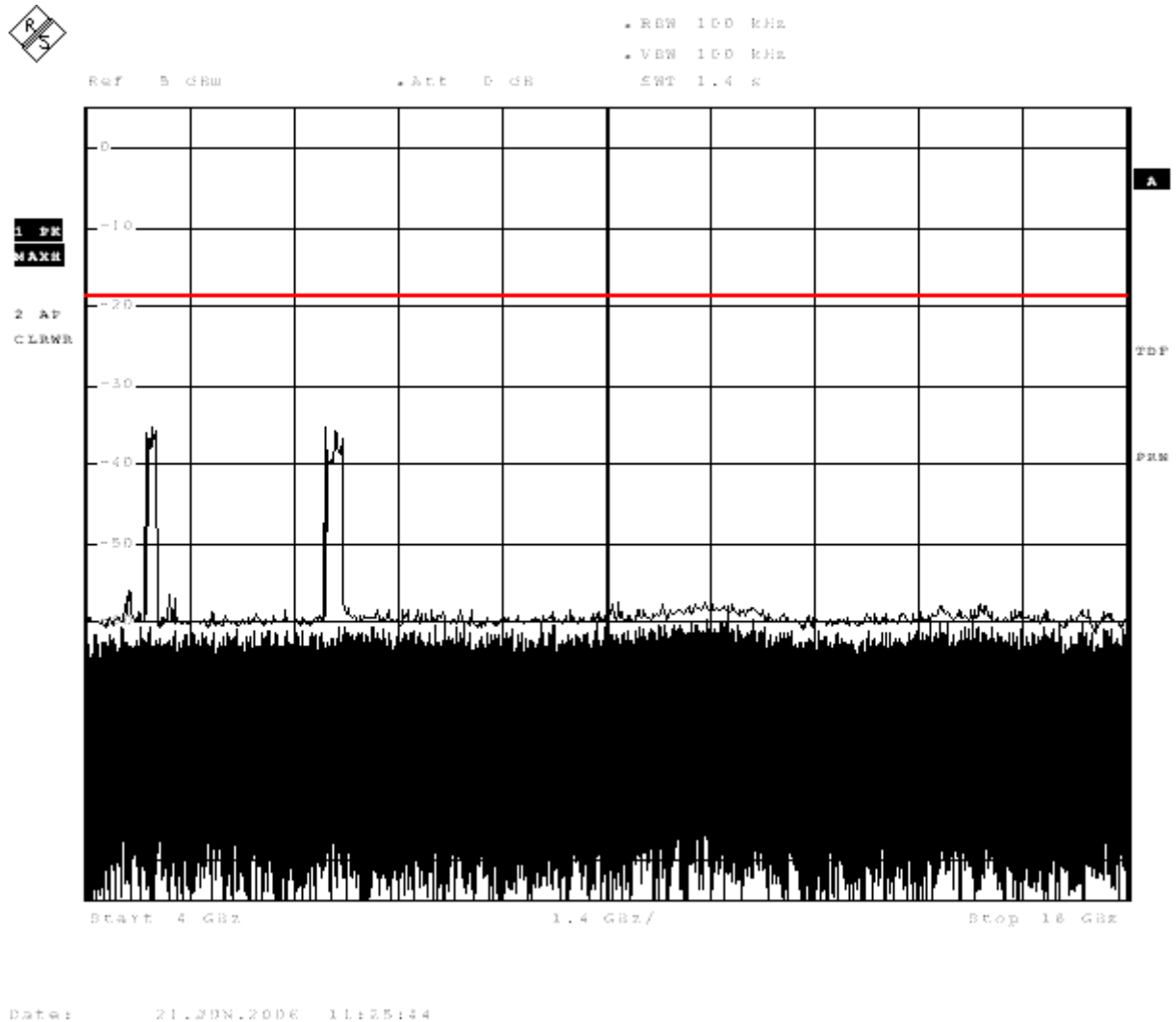


Date: 20.JUN.2006 14:53:53

Spurious Conducted Emissions (9kHz – 4GHz)
Frequency Hopping On All Channels – Maximum Power DH1

2.10 SPURIOUS CONDUCTED EMISSIONS

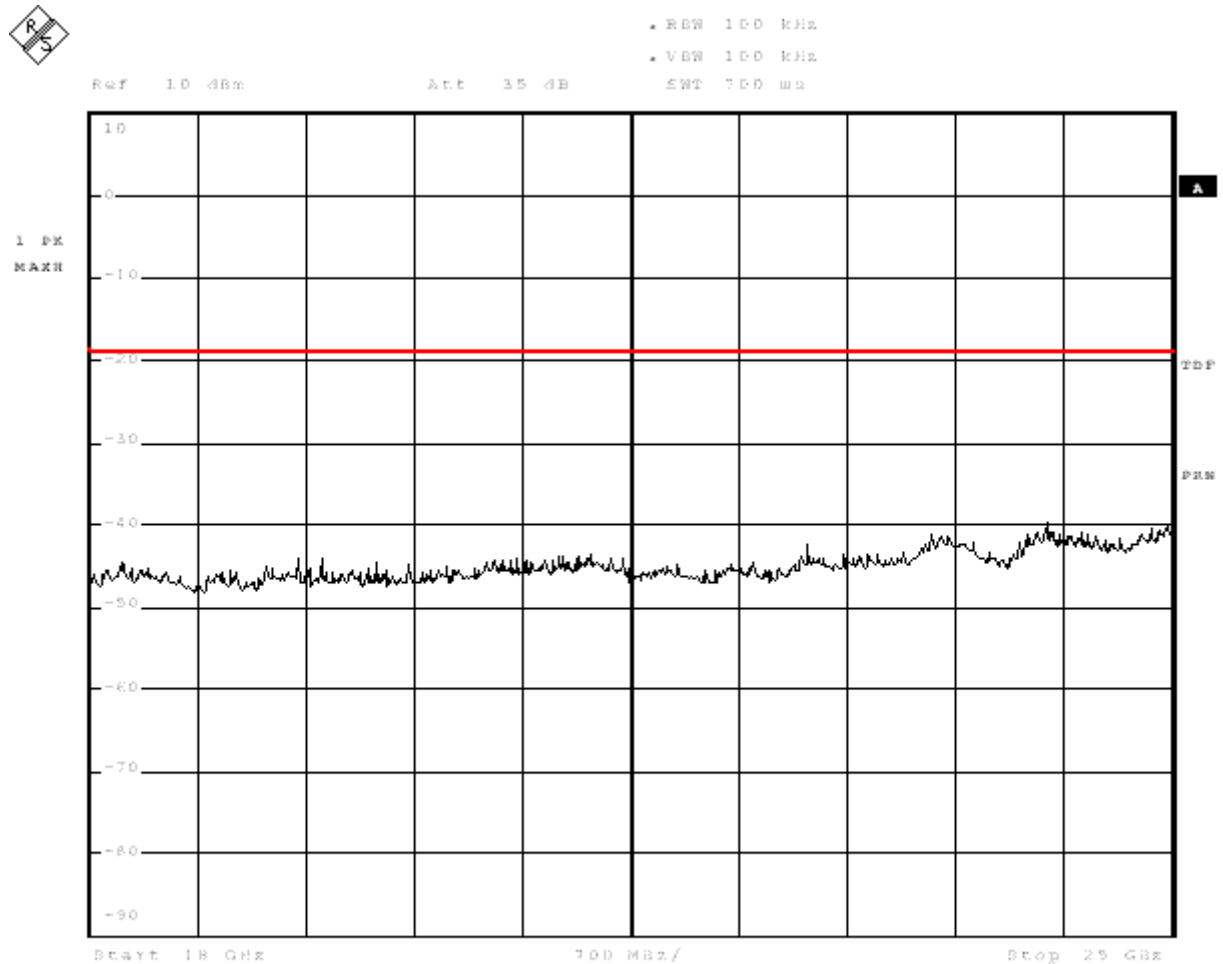
2.10.6 Test Results - continued



Spurious Conducted Emissions (4GHz – 18GHz)
Frequency Hopping On All Channels – Maximum Power DH1

2.10 SPURIOUS CONDUCTED EMISSIONS

2.10.6 Test Results - continued

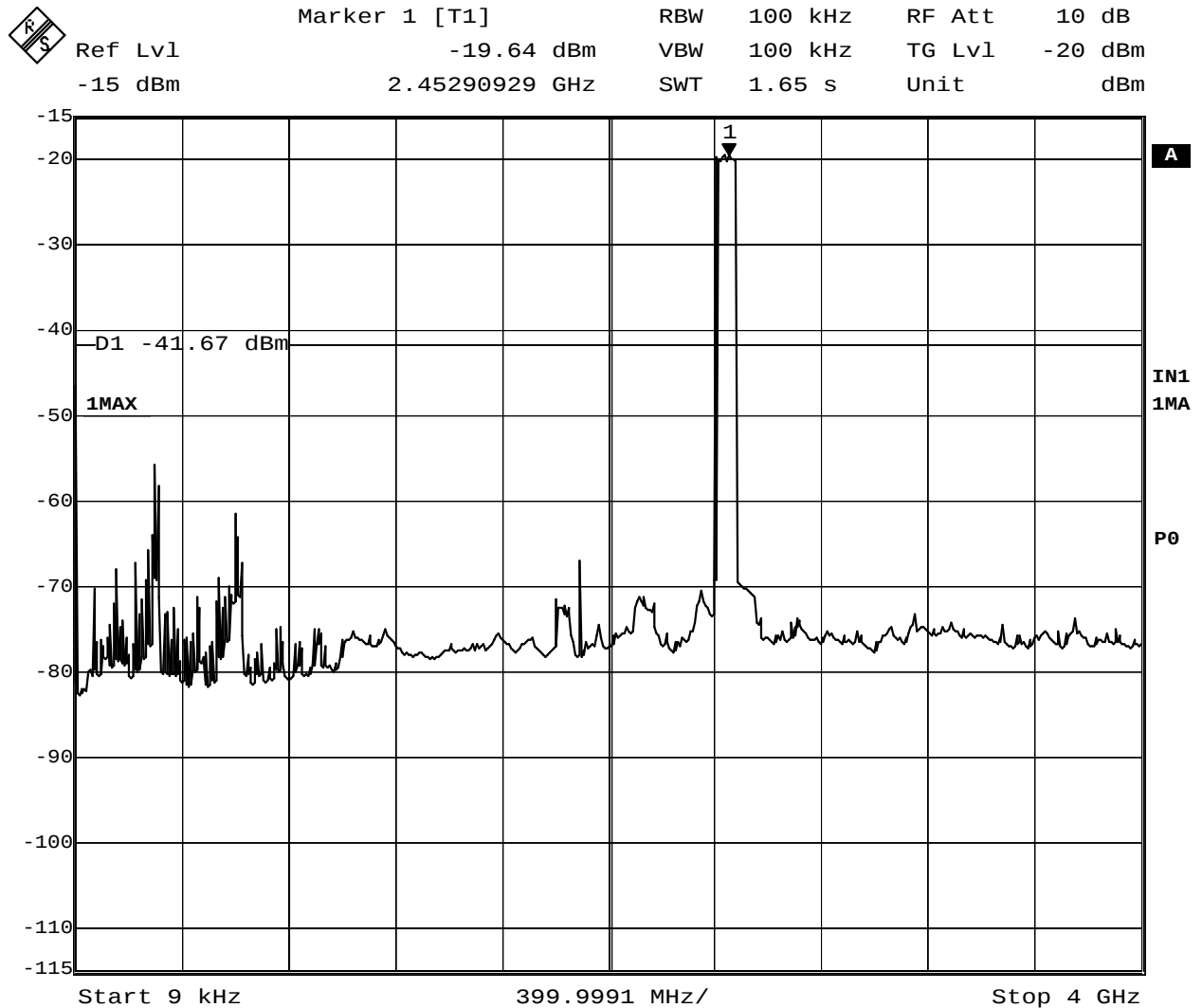


Date: 21.09.2006 11:04:54

Spurious Conducted Emissions (18GHz – 25GHz)
Frequency Hopping On All Channels – Maximum Power DH1

2.10 SPURIOUS CONDUCTED EMISSIONS

2.10.6 Test Results - continued

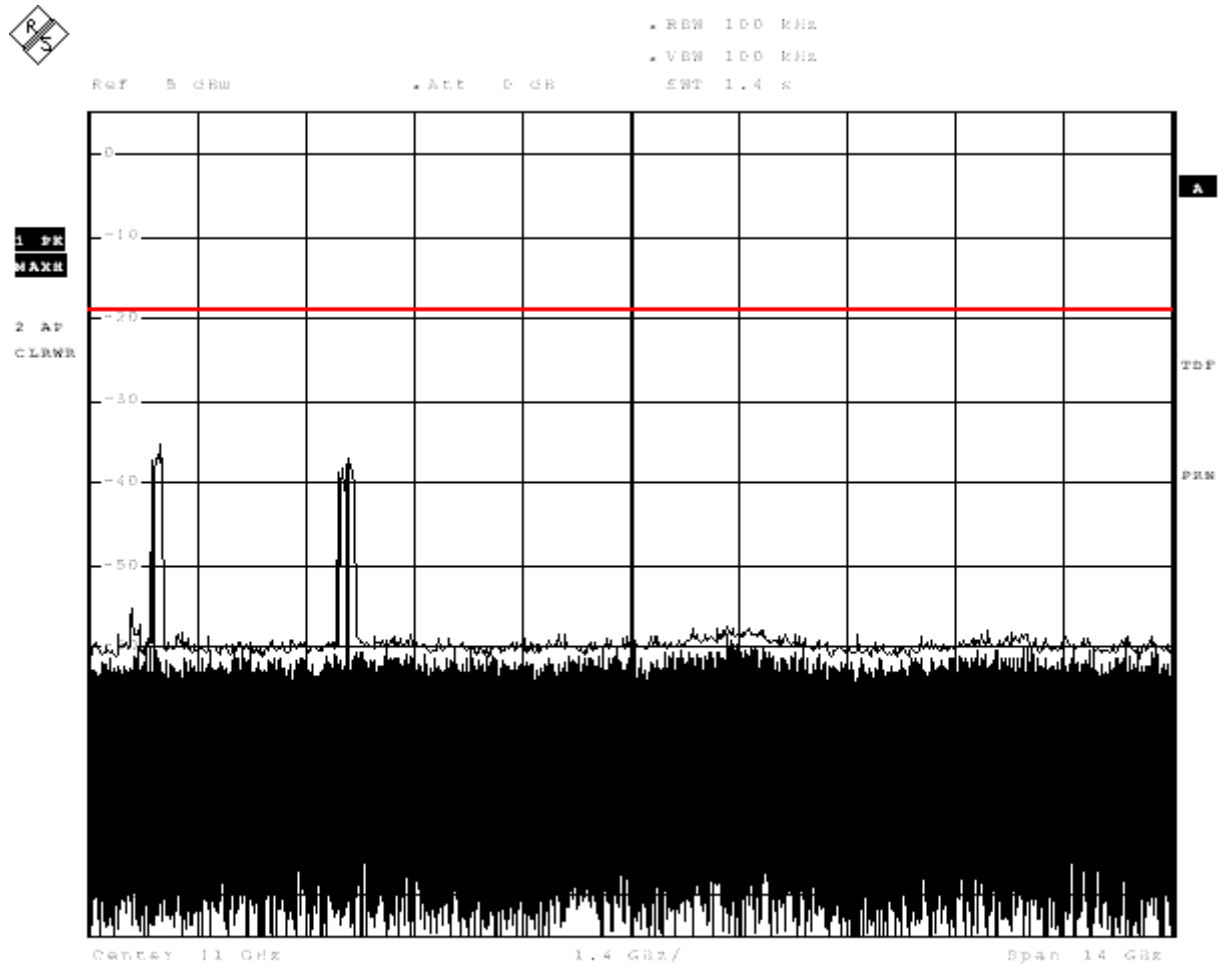


Date: 20.JUN.2006 15:08:52

Spurious Conducted Emissions (9kHz – 4GHz)
Frequency Hopping On All Channels – Maximum Power DH3

2.10 SPURIOUS CONDUCTED EMISSIONS

2.10.6 Test Results - continued

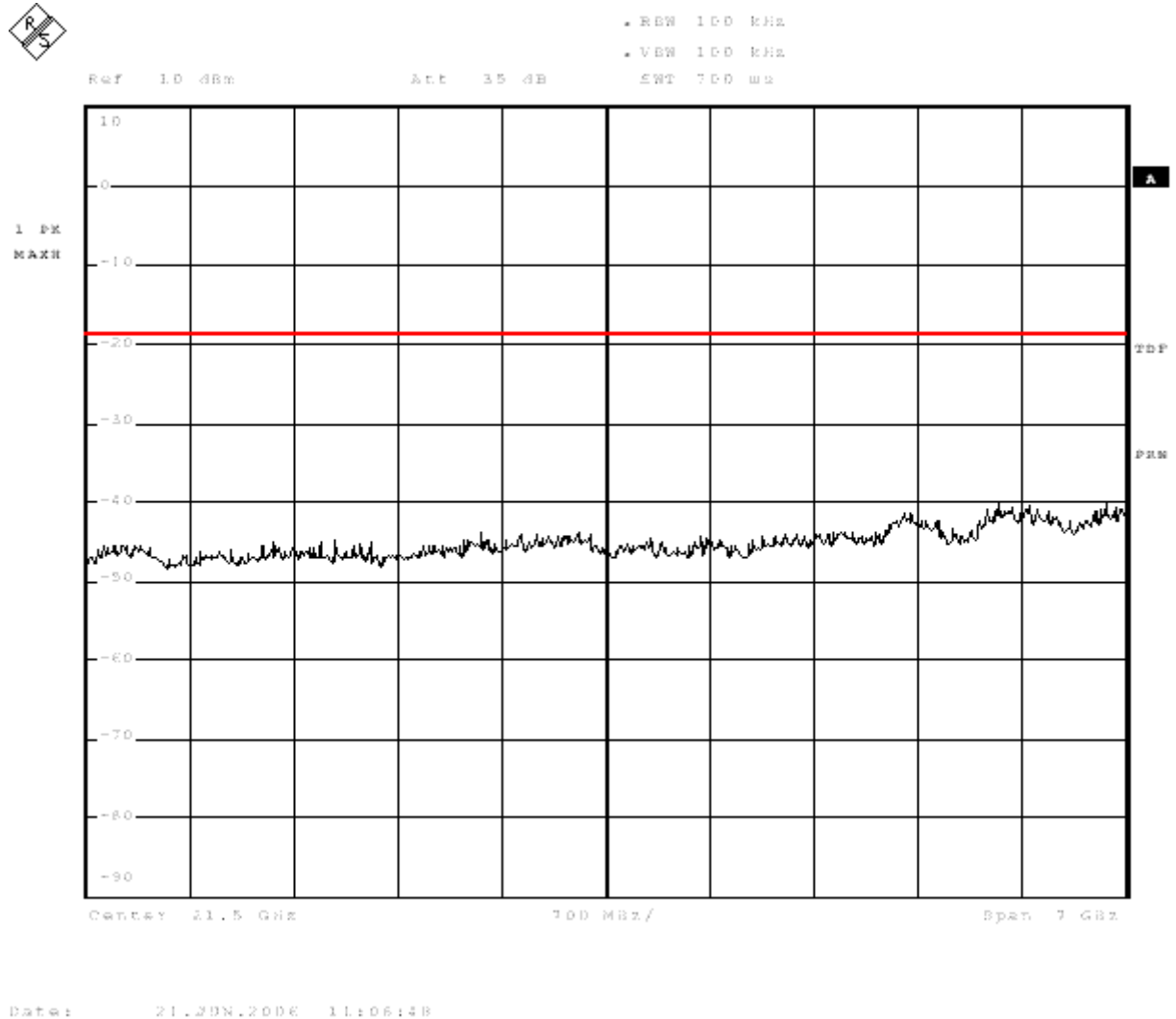


Date: 21 JUN 2006 11:28:31

Spurious Conducted Emissions (4GHz – 18GHz)
Frequency Hopping On All Channels – Maximum Power DH3

2.10 SPURIOUS CONDUCTED EMISSIONS

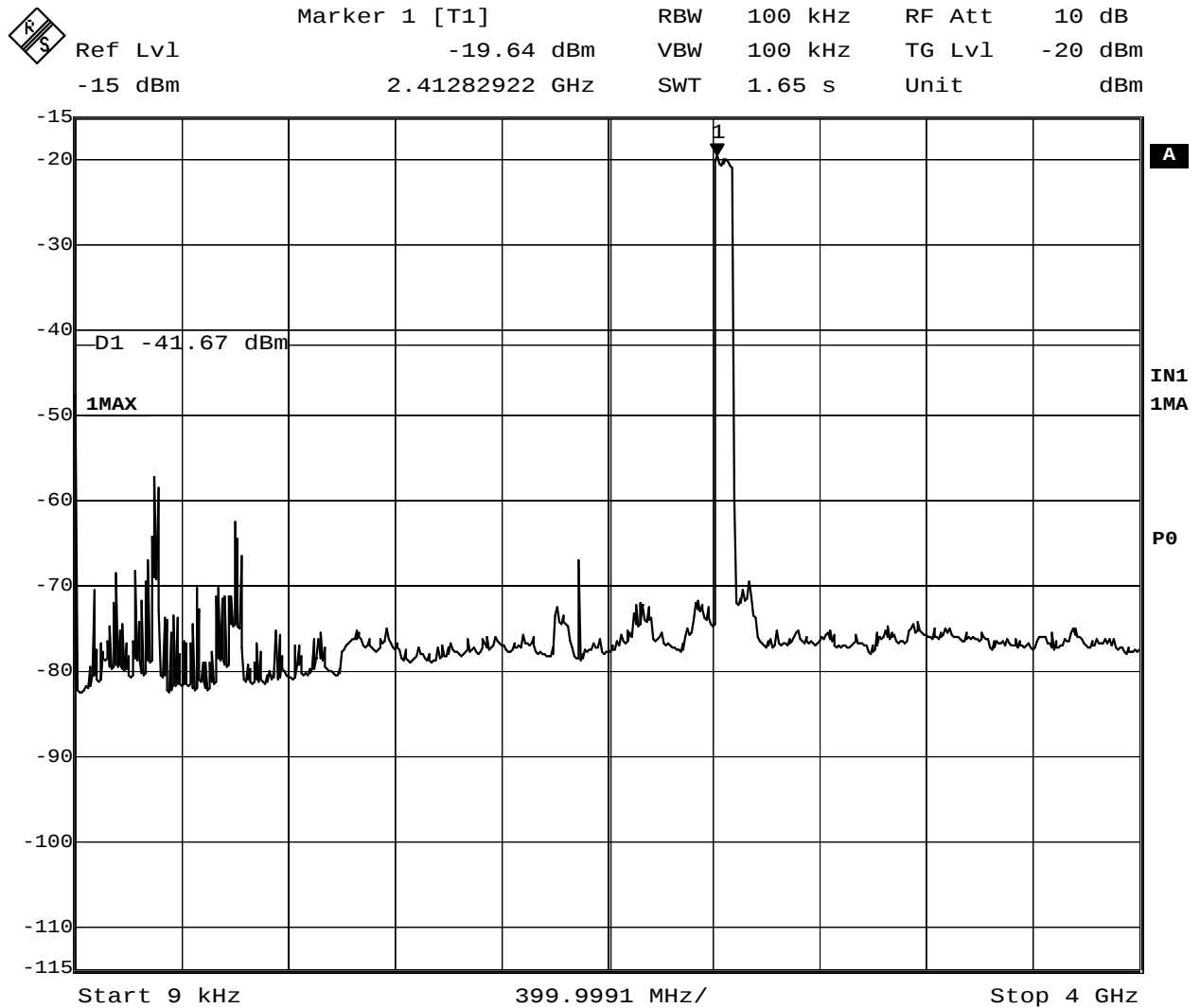
2.10.6 Test Results - continued



Spurious Conducted Emissions (18GHz – 25GHz)
Frequency Hopping On All Channels – Maximum Power DH3

2.10 SPURIOUS CONDUCTED EMISSIONS

2.10.6 Test Results - continued

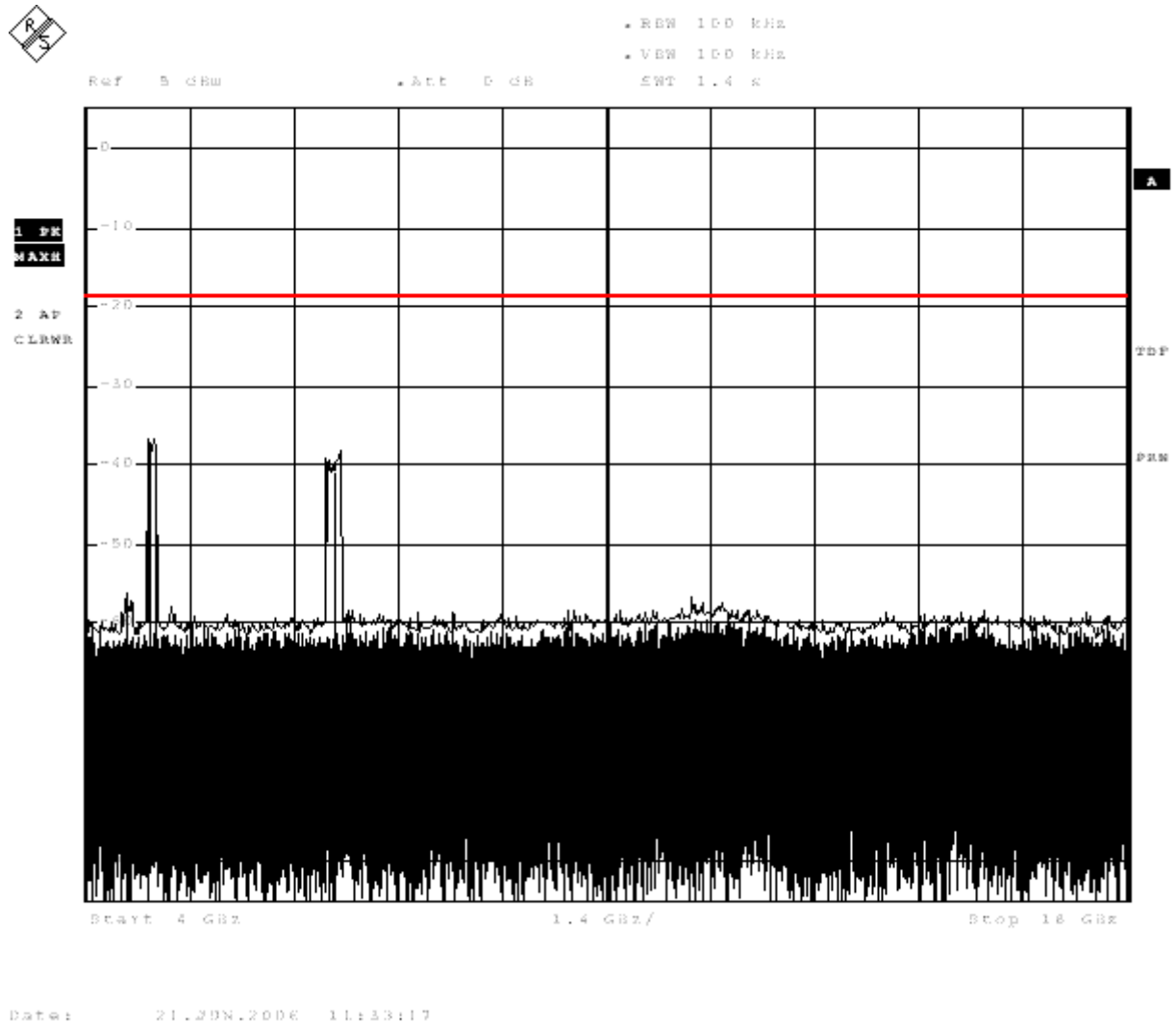


Date: 20.JUN.2006 15:13:57

Spurious Conducted Emissions (9kHz – 4GHz)
Frequency Hopping On All Channels – Maximum Power DH5

2.10 SPURIOUS CONDUCTED EMISSIONS

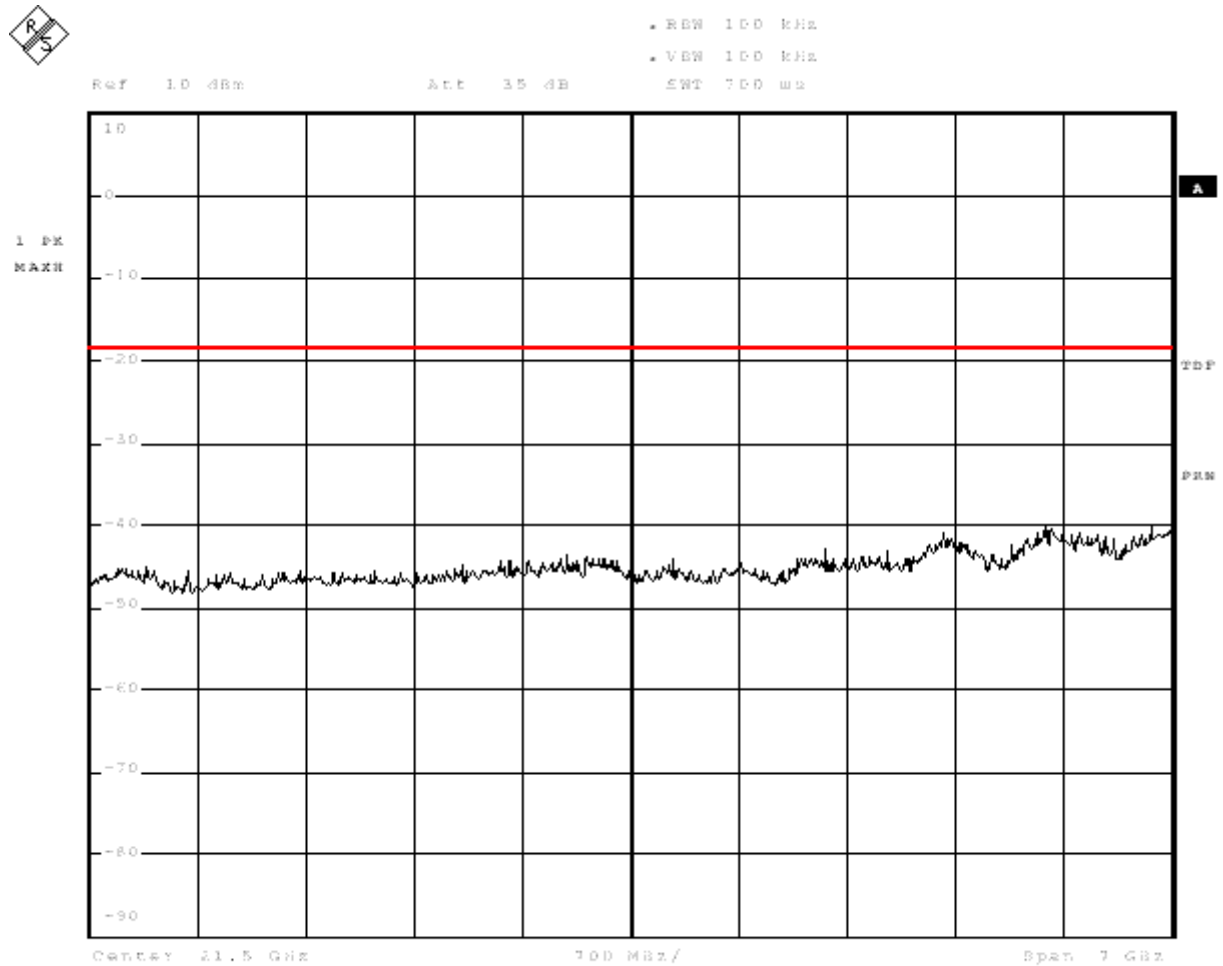
2.10.6 Test Results - continued



Spurious Conducted Emissions (4GHz – 18GHz)
Frequency Hopping On All Channels – Maximum Power DH5

2.10 SPURIOUS CONDUCTED EMISSIONS

2.10.6 Test Results - continued



Date: 21.09.2006 11:05:40

Spurious Conducted Emissions (18GHz – 25GHz)
Frequency Hopping On All Channels – Maximum Power DH5

2.11 SPURIOUS RADIATED EMISSIONS

2.11.1 Specification Reference

FCC CFR 47: Part 15 Subpart B, Section 15.247 (c), Industry Canada RSS-210, A8.5.

2.11.2 Equipment Under Test

Widescreen ACTIVBoard with Bluetooth Radio.

2.11.3 Date of Test

24th June 2006.

2.11.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.11.5 Test Procedure

Test Performed in accordance with ANSI C63.4 and RSS-210.

A preliminary profile of the Spurious Radiated Emissions was obtained by operating the EUT on a remotely controlled turntable within a semi-anechoic chamber. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst-case emissions together with the EUT azimuth and antenna polarisation.

Using the information from the preliminary profiling of the EUT. The list of emissions was then confirmed or updated under Alternative Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

Emissions identified within the range 30MHz – 1GHz were then formally measured using a CISPR Quasi-Peak detector.

Emissions identified within the range 1GHz – 9GHz were then formally measured using Peak and Average Detectors, as appropriate.

The measurements were performed at a 3m distance unless otherwise stated.

2.11 SPURIOUS RADIATED EMISSIONS

2.11.6 Test Results (below 1GHz)

The limits for Spurious Emissions have been measured, as shown in the table below:

Carrier Frequency MHz	Limit for Spurious Emissions dBµV/m
2402.0	76.5
2441.0	77.3
2480.0	80.3

Equipment Designation: Unintentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart B, Section 15.247(c) and Industry Canada RSS-210, A8.5 for Spurious Radiated Emissions (30MHz – 1GHz).

EUT Receiving on Bottom Channel (2402.0MHz)

Frequency MHz	Polarisation	Height cm	Azimuth degree	Field Strength		Limit	
				dBµV/m	µV/m	dBµV/m	µV/m
58.98	Vertical	101	256	29.4	29.5	40.0	100.0
589.80	Horizontal	100	109	37.6	75.9	46.0	200.0
648.80	Vertical	100	186	36.4	66.1	46.0	200.0
796.30	Horizontal	145	146	34.4	52.5	46.0	200.0
825.80	Horizontal	157	116	36.9	70.0	46.0	200.0

EUT Receiving on Middle Channel (2441.0MHz)

The levels of the six highest emissions measured in accordance with the specification are presented below: -

Frequency MHz	Polarisation	Height cm	Azimuth degree	Field Strength		Limit	
				dBµV/m	µV/m	dBµV/m	µV/m
58.99	Vertical	100	075	39.6	70.0	40.0	100.0
339.20	Horizontal	100	146	38.3	82.2	43.5	150.0
589.80	Horizontal	100	110	37.7	76.7	46.0	200.0
737.30	Horizontal	100	122	39.6	95.5	46.0	200.0
766.80	Horizontal	100	121	38.6	85.1	46.0	200.0
796.30	Horizontal	100	119	41.2	114.8	46.0	200.0



Product Service

2.11 SPURIOUS RADIATED EMISSIONS

2.11.6 Test Results (below 1GHz)- continued

EUT Receiving on Top Channel (2480.0MHz)

The levels of the six highest emissions measured in accordance with the specification are presented below: -

Frequency	Polarisation	Height	Azimuth	Field Strength		Limit	
MHz		cm	degree	dBμV/m	μV/m	dBμV/m	μV/m
58.98	Vertical	100	070	36.8	69.2	40.0	100.0
339.20	Horizontal	100	145	38.2	82.3	46.0	200.0
589.80	Horizontal	100	112	37.5	75.0	46.0	200.0
737.30	Horizontal	100	122	39.4	93.3	46.0	200.0
752.00	Horizontal	108	099	37.5	75.0	46.0	200.0
766.80	Horizontal	100	120	38.4	83.2	46.0	200.0
796.30	Horizontal	100	118	40.7	108.4	46.0	200.0

2.11 SPURIOUS RADIATED EMISSIONS

2.11.7 Test Results (above 1GHz)

Equipment Designation: Unintentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart B, Section 15.247(c) and Industry Canada RSS-210, A8.5 for Spurious Radiated Emissions (1GHz - 20GHz).

EUT Receiving on Bottom Channel (2402.0MHz)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Polarisation	Height	Azimuth				
MHz		cm	degree	dBµV/m	dBµV/m	dBµV/m	dBµV/m
4804	Horizontal	313	233	59.7	74.0	34.4	54.0
7206	Horizontal	267	208	60.8	76.5	N/A	N/A

No other EUT attributable emissions were detected.

EUT Receiving on Middle Channel (2441.0MHz)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Polarisation	Height	Azimuth				
GHz		cm	degree	dBµV/m	dBµV/m	dBµV/m	dBµV/m
4882	Horizontal	295	254	60.5	74.0	34.9	54.0
7322	Horizontal	244	222	67.3	74.0	38.5	54.0

No other EUT attributable emissions were detected.

EUT Receiving on Top Channel (2480.0MHz)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Polarisation	Height	Azimuth				
GHz		cm	degree	dBµV/m	dBµV/m	dBµV/m	dBµV/m
4960.0	Vertical	123	189	61.4	74.0	35.2	54.0
7440.0	Horizontal	264	228	64.7	74.0	38.4	54.0

No other EUT attributable emissions were detected.

2.12 MAXIMUM PEAK OUTPUT POWER (RADIATED) EIRP

2.12.1 Specification Reference

FCC CFR 47: Part, Section 15.247(b)(4) and Industry Canada RSS-210, A8.4(1).

2.12.2 Equipment Under Test

Widescreen ACTIVBoard with Bluetooth Radio.

2.12.3 Date of Test

3rd July 2006.

2.12.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.12.5 Test Procedure

Test Performed in accordance with ANSI C63.4.

The EUT has an Integral Antenna, therefore the Maximum Peak Output Power (EIRP) was made using the Radiated method.

The Spectrum Analyser was tuned to the test frequency. The device Output Power setting was controlled as specified in the Product Information, Section 1.5 of this document. The device was then rotated through 360 degrees, and the measuring antenna height searched (1m – 4m) until the highest power level was observed in both horizontal and vertical polarisation. The device was then replaced with a substitution antenna, whose input signal to the antenna was adjusted until the received level matched that of the previously detected emission.



Product Service

2.12 MAXIMUM PEAK OUTPUT POWER (RADIATED) EIRP

2.12.6 Test Results

The EUT met the requirements of FCC Part 15, Section 15.247(b)(4), and Industry Canada RSS-210, A8.4(1).

Frequency MHz	Result EIRP dBm	EIRP Limit dBm	Result EIRP mW	EIRP Limit W
2402.0	0.4	33.0	1.0	2.0
2441.0	-0.6	33.0	0.9	2.0
2480.0	2.5	33.0	1.8	2.0

SECTION 3

TEST EQUIPMENT

3.1 TEST EQUIPMENT

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No	TE Number	Calibration Due
Section 2.2 EMC - Conducted Emissions				
Transient Limiter	Hewlett Packard	11947A	15	22/09/2006
LISN	Rohde & Schwarz	ESH2-Z5	16	17/08/2006
LISN (1 Phase)	Chase	MN 2050	336	23/02/2007
50ohm/15W Load	Diamond Antenna	DL-30N	788	05/09/2006
Test Receiver	Rohde & Schwarz	ESIB40	1006	07/04/2007
Sections 2.2, 2.11 and 2.12 EMC - Radiated Emissions				
Spectrum Analyser	Hewlett Packard	8542E	18	09/02/2007
Signal Generator	Rohde & Schwarz	SWM 02	62	O/P Mon
Amplifier	Miteq Corp	AMF-3d-001080-18-13P	231	O/P Mon
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	01/07/2006
Amplifier (Low Noise, 18GHz-40GHz)	Narda	NARDA DB02-0447	240	15/06/2007
Dual Power Supply Unit	Thurlby	PL320	288	TU
Filter (High Pass, 4GHz)	Sematron	F-100-4000-5-R	564	TU
Test Receiver	Rohde & Schwarz	ESIB40	1006	07/04/2007
DRG Antenna	Q-Par Angus Ltd	QSH 180K	1511	O/P Mon
Screened Room (5)	Rainford	Rainford	1545	01/03/2008
Mast Controller	Inn-Co GmbH	CO 1000	1606	TU
Turntable/Mast Controller	EMCO	2090	1607	TU
Test Receiver	Rohde & Schwarz	ESIB40	1934	02/05/2007
Amplifier (8GHz-18GHz)	Avantec	AWT-18036	2821	TU
Bilog Antenna	Chase	CBL6143	2904	10/11/2007

3.1 TEST EQUIPMENT

Instrument	Manufacturer	Type No	TE Number	Calibration Due
Section 2.10 Radio (Tx) - Conducted Spurious Emissions				
1m sma(m) - sma(m) Cable	Reynolds	262-0248-1000	2408	21/07/2006
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	03/02/2007
High Pass Filter (4GHz)	RLC Electronics	F-100-4000-5-R	2773	18/05/2007
Hygrometer	Rotronic	I-1000	2891	20/12/2006
20dB/2W Attenuator: dc - 12.4GHz	Weinschel	1	3032	21/12/2006
Signal Generator: 10MHz to 40GHz	Rohde & Schwarz	SMR40	3171	29/06/2007
Sections 2.3, 2.4, 2.5, 2.6, 2.7, 2.8 and 2.9 Radio (Tx) - Power Characteristics				
EMI Test Receiver	Rohde & Schwarz	ESIB26	2028	13/06/2007

O/P MON Output Monitored
TU Traceability Unscheduled



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3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:-

Test Discipline	Frequency / Parameter	MU
Radiated Emissions, Bilog Antenna, AOATS	30MHz to 1GHz Amplitude	5.1dB*
Radiated Emissions, Horn Antenna, AOATS	1GHz to 40GHz Amplitude	6.3dB*

Worst case error for both Time and Frequency measurement 12 parts in 10^6 .

* In accordance with CISPR 16-4



Product Service

SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

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