REPORT ON

Limited FCC CFR 47: Parts 15 B and C and Industry Canada Radio Standards RSS-Gen and RSS-210 Testing in Support of an Application for Grant of Equipment Authorisation of a Symbol LMX5452 Bluetooth Data Module

FCC ID: H9PLMX5452 and IC: 1549D-LMX5452

Report No OR614743/01 Issue 2 **November 2005**

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FCC ID: H9PLMX5452 IC: 1549D-LMX5452

Report No OR614743/01 Issue 2

November 2005

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DATED

22nd November 2005

This report has been re-issued as Issue 2 to correct the IC number. 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: Parts 15 B and C and Industry Canada Radio Standards RSS-Gen and RSS-210. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineers;

S Hartley A Guy J Holcombe R Small

UKAS TESTING 0141 Group

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SECTION 1

REPORT SUMMARY

Limited FCC CFR 47: Parts 15 B and C and Industry Canada Radio Standards RSS-Gen and RSS-210 Testing in Support of an Application for Grant of Equipment Authorisation of a Symbol LMX5452 Bluetooth Data Module

1.1 STATUS

Equipment Under Test	LMX5452 Bluetooth Data Module
Objective	To undertake measurements to determine the Equipment Under Test's (EUT's) compliance with the specification.
Name and Address of Client	Symbol Technologies Limited Symbol Place Winnersh Triangle Wokingham Berkshire RG41 5TP
Type Number	LMX5452 Bluetooth Data Module
Part Number	LMX5452
Serial Number	9 & 30
Hardware Version	Rev 0 (to be released as Rev A)
Software Version	Rev A
Declared Variants	None
Test Specification/Issue/Date	FCC CFR 47: Part 15, Subparts B and C, October 2003 RSS-Gen, Issue 1, September 2005 and RSS-210 Issue 6, September 2005
Number of Items Tested	Two
Security Classification of EUT	Commercial in Confidence
Incoming Release **Date**	Commercial Invoice 22nd September 2005
Disposal **Reference Number** **Date**	Held pending disposal Not Applicable Not Applicable
Order Number **Date**	4500495480 30th September 2005
Start of Test	30th September 2005
Finish of Test	2nd November 2005

1.1 STATUS

Related Documents	ANSI C63.4: 2001 DA 00-705: 2000 FCC 03-287: 2003 FCC 04-165: 2004 RSS-212: 1999

1.2 INTRODUCTION

The information contained within this report is intended to show limited verification of compliance of the Symbol LMX5452 Bluetooth Data Module to the requirements of FCC Specification Parts 15 B and C and Industry Canada Radio Specifications RSS-Gen and RSS-210.

Testing was carried out in support of an application for Grant of Equipment Authorisation in the name of Symbol.

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

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The units supplied for testing were LMX5452 Bluetooth Data Module, which offers 2.4GHz Bluetooth connectivity.

1.3.2 Modes of Operation

Modes of operation of the EUT during testing were as follows:

Applicable testing was carried out with the EUT transmitting at maximum power or receiving as detailed in Section 1.3.3 “Test Configuration”.

1.3.3 Test Configuration

Bluetooth Transmitting on the following channels and frequencies;
Channel 2: 2402MHz
Channel 41: 2441MHz
Channel 80: 2480MHz
The Output Power level (controlled by application software) was set to maximum.

Bluetooth Receiving on the following channels and frequencies;
Channel 2: 2402MHz
Channel 41: 2441MHz
Channel 80: 2480MHz

1.3 PRODUCT INFORMATION - continued

1.3.4 DECLARATION OF BUILD STATUS

Signature

MAIN EUT			
MANUFACTURING DESCRIPTION	Bluetooth Data Module		
MANUFACTURER	Symbol Technologies Inc		
TYPE	LMX5452		
PART NUMBER	LMX5452		
SERIAL NUMBER	5, 6, 7, 8, 9, 10, 25, 26, 27, 28, 29, 30		
HARDWARE VERSION	Rev 0 (to be released as Rev A)		
SOFTWARE VERSION	Rev A		
TRANSMITTER OPERATING RANGE	2400-2483.5 MHz		
RECEIVER OPERATING RANGE	2400-2483.5 MHz		
INTERMEDIATE FREQUENCIES	N/A - Direct Conversion		
ITU DESIGNATION OF EMISSION	1M00F1D		
HIGHEST INTERNALLY GENERATED FREQUENCY	2480Mhz (Channel 78)		
OUTPUT POWER (W or dBm)	+0dBm: 1mW		
DHSS/FHSS/COMBINED OR OTHER	FHSS		
FCC ID & DATE	H9PLMX5452		
INDUSTRY CANADA ID & DATE	1549D-LMX5452		
TECHNICAL DESCRIPTION (a brief description of the intended use and operation)	The unit supplied for testing is a Symbol LMX5452 Bluetooth Radio Module. The module will be incorporated into SYMBOL only products.		
BATTERY/POWER SUPPLY			
	European	North American	
MANUFACTURING DESCRIPTION	Power Supply	Power Supply	
MANUFACTURER	MPI Neo Co Ltd	Symbol Technologies	
TYPE	230V, 50Hz	100-240V, 50-60Hz	
PART NUMBER	50-14000-009	50-14001-001	
VOLTAGE	5.2V	5.2V	
SERIAL NUMBER	Not Serialised	M020171063	
ANCILLARIES (if applicable)			
MANUFACTURING DESCRIPTION	Data Cable		
MANUFACTURER	Unknown		
TYPE	Data		
PART NUMBER	10D1-03206		
SERIAL NUMBER	Not Serialised		

Date 29 Sept 05
Declaration of Build Status Serial Number OR614743

BABT formally certifies that the manufacturer's declaration as reproduced in this report is a true and accurate record of the original received from the applicant.

1.4 BRIEF SUMMARY OF RESULTS

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

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

Test	Spec Clause		Test Description	Result	Comments
	FCC	Industry Canada			
2.1	15.109(a)	RSS-Gen, 6.0	Spurious Radiated Emissions	Pass	
2.2	15.107	RSS-210, 6.6	Conducted Emissions on AC Power Lines	Pass	
2.3	15.205	RSS-210, A8.5	Measurement at Band Edge /Restricted Bands and Unwanted Emission Frequencies	Pass	
	15.247(c)	RSS-210, A8.5	Spurious Radiated Emissions		
2.4	15.207	RSS-210, 6.6	Conducted Emissions on AC Power Lines/ Transmitter AC Wireline Conducted Emissions	Pass	
2.5	15.247(iii)	RSS-210, A8.1	Channel Dwell Time	Pass	
2.6	15 -15.247(a)(1)	RSS-210, A8.1 (4) or (5)	Channel Occupancy/Separation	Pass	
2.7	15.247(a)(1)	RSS-210, A8.1 (4) or (5)	Number of Channels	Pass	
2.8	15.247(a)(1)	RSS-210, A8.1 (2)	20dB Bandwidth	Pass	
2.9	15.247(b)(2)	RSS-210, A8.4 (2) (3) or (4) RSS-Gen, 4.6	Output Power (Conducted)	Pass	
	15.247(b)(2)	RSS-210, A8.4 RSS-Gen, 4.6	Maximum Peak Output Power (Radiated)		
2.10	15.247(c)	RSS-210, A8.5 and 2.7, Table 2 RSS-Gen, 4.7	Spurious Conducted Emissions on Antenna Port	Pass	
2.11	15.247(c)	RSS-210, A8.5 and 2.7, Table 2 RSS-Gen, 4.7	Spurious Radiated Emissions /Out of Band Emissions	Pass	

1.5 TEST CONDITIONS

The EUT was set-up simulating a typical user installation and was tested in accordance with the applicable specification.

For all tests, the LMX5452 Bluetooth Data Module was powered by a 120V, 60Hz Symbol Power Supply, Part Number 50-14001-001.

1.7 DEVIATIONS FROM THE STANDARD

Limited tests were applied in accordance with Symbol requirements.

1.8 MODIFICATION RECORD

Not Applicable.

SECTION 2

TEST DETAILS

Limited FCC CFR 47: Part 15 B and Industry Canada Radio Standard RSS-Gen
Testing in Support of an Application for Grant of Equipment Authorisation
of a Symbol LMX5452 Bluetooth Data Module

2.1 SPURIOUS RADIATED EMISSIONS

2.1.1 Specification Reference

FCC CFR 47: Part 15 Subpart B, Section 15.109(a) and
Industry Canada Radio Standard RSS-Gen, 6.0

2.1.2 Equipment Under Test

LMX5452 Bluetooth Data Module: Serial Number 30

2.1.3 Date of Test

30th September 2005

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.1” within the Test Equipment Used table shown in Section 3.1.

2.1.5 Test Procedure

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

A preliminary profile of the Spurious Radiated Emissions was obtained by operating the EUT on a remotely controlled turntable within an 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 anechoic chamber (3 metres) 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.

The measurements were performed at a 3m distance unless otherwise stated. And the results extrapolated to 10m.

2.1 SPURIOUS RADIATED EMISSIONS

2.1.6 Test Results

Equipment Designation: Unintentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart B, Section 15.109 (a) and Industry Canada Radio Standard RSS-Gen, 6.0 for Spurious Radiated Emissions (30MHz - 1GHz).

Measurements were made with the EUT in Bluetooth Mode (see Section 1.3.3 for details).

EUT Rx on Middle Channel (2441MHz)

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

Emission Frequency	Polarisation	Height	Azimuth	Field Strength		Limit	
MHz		cm	degree	dBµV/m	µV/m	dBµV/m	µV/m
39.0	Vertical	100	000	15.6	6.0	40.0	100.0
54.9	Vertical	100	062	15.4	5.9	40.0	100.0
65.0	Vertical	100	000	14.8	5.5	40.0	100.0
88.9	Vertical	100	073	20.0	10.0	40.0	100.0
91.2	Vertical	100	091	19.0	8.9	40.0	100.0
93.4	Vertical	100	090	24.6	17.0	40.0	100.0

2.2 CONDUCTED EMISSIONS ON AC POWER LINES

2.2.1 Specification Reference

FCC CFR 47: Part 15 Subpart B, Section 15.107 and
Industry Canada Radio Standard RSS-210, 6.6

2.2.2 Equipment Under Test

LMX5452 Bluetooth Data Module: Serial Number 30

2.2.3 Date of Test

1st October 2005

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 tables below.

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

2.2 CONDUCTED EMISSIONS ON AC POWER LINES

2.2.6 Test Results

The EUT met the Class B requirements of FCC CFR 47: Part 15 Subpart B, Section 15.107 and Industry Canada Radio Standard RSS-210, 6.6 for Conducted Emissions on the Live and Neutral Lines.

Measurements were made with the EUT in Idle Mode (see Section 1.3.3 for details).

EUT Receiving – Live Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.427	36.2	57.3	33.7	47.3
2.030	38.7	56.0	35.1	46.0
2.137	39.6	56.0	35.9	46.0
2.244	39.2	56.0	35.3	46.0
2.351	37.7	56.0	34.0	46.0
2.458	35.8	56.0	32.6	46.0

The margin between the specification requirements and all other emissions were 20.9dB or more below the specified Quasi-Peak limit and 11.9dB or more below the Average limit.

EUT Receiving – Neutral Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.746	32.9	56.0	32.4	46.0
2.024	39.8	56.0	36.2	46.0
2.131	41.3	56.0	37.4	46.0
2.238	41.2	56.0	37.2	46.0
2.344	39.6	56.0	35.9	46.0
2.451	37.7	56.0	34.3	46.0

The margin between the specification requirements and all other emissions were 22.9dB or more below the specified Quasi-peak limit and 13.5dB or more below the specified Average limit.

2.3 MEASUREMENT AT THE BAND EDGE (MARKER DELTA METHOD)

2.3.1 Specification Reference

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

2.3.2 Equipment Under Test

LMX5452 Bluetooth Data Module: Serial Number 30

2.3.3 Date of Test

1st October 2005

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 FCC Public Notice document (DA 00-705 released 30 March 2000) and RSS-212.

2.3 MEASUREMENT AT THE BAND EDGE (MARKER DELTA METHOD)

2.3.6 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 for Band Edge Measurements.

Measurements were made with the EUT in Bluetooth Mode (see Section 1.3.3 for details).

Step 1

Bottom Channel Fundamental Field Strength Measurement.

Peak measurements performed utilising a Resolution Bandwidth and Video Bandwidth of 1MHz. Average measurements performed utilising a Resolution Bandwidth of 1MHz and Video Bandwidth of 10Hz.

Frequency	Antenna Polarisation	Height	Azimuth	Peak Field Strength	Average Field Strength
MHz		cm	deg	dBµV/m	dBµV/m
2402	Horizontal	100	150	99.0	87.4

Step 2

Determine Marker delta amplitude between 2412MHz (the fundamental) and 2390MHz (the Band Edge under investigation).

Using a span of 30MHz with Resolution Bandwidth and Video Bandwidth of 300kHz.

Marker Delta Amplitude = 54.5dB

Step 3

Subtracting the Marker Delta obtained from Step 2 from the 2412MHz Field Strength measurement from Step 1, gives following Result:

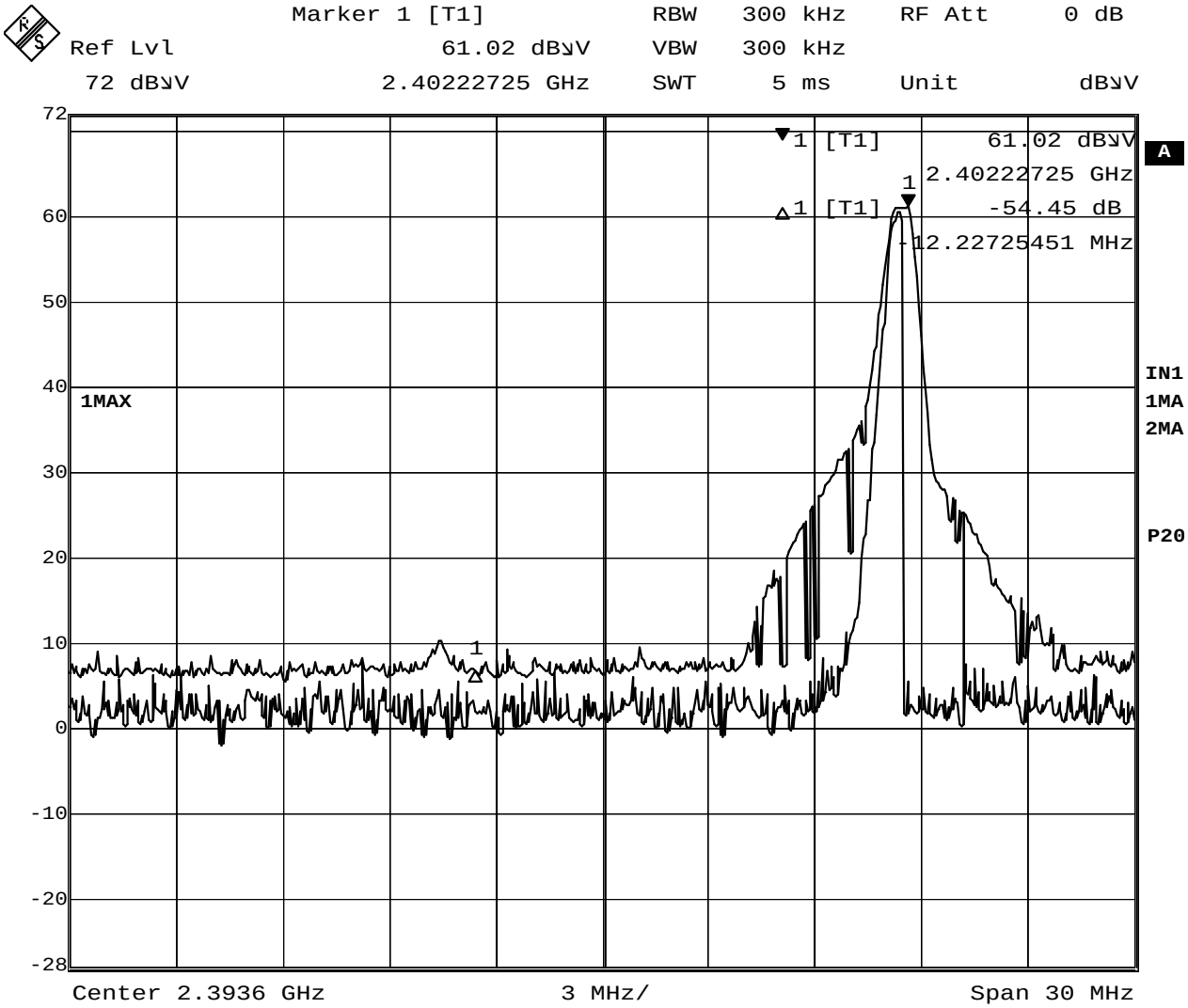
Peak of 44.5dBµV/m (Limit is 74.0dBµV/m)

Average of 32.9dBµV/m (Limit is 54.0dBµV/m)

2.3 MEASUREMENT AT THE BAND EDGE (MARKER DELTA METHOD)

2.3.6 **Test Results** - continued

Plot for Bottom Channel 2402MHz



Date: 1.OCT.2005 04:13:44

2.3 MEASUREMENT AT THE BAND EDGE (MARKER DELTA METHOD)

2.3.6 **Test Results** - continued

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 for Band Edge Measurements.

Measurements were made with the EUT in Bluetooth Mode (see Section 1.3.3 for details).

Peak measurements performed utilising a Resolution Bandwidth and Video Bandwidth of 1MHz. Average measurements performed utilising a Resolution Bandwidth of 1MHz and Video Bandwidth of 10Hz.

Frequency	Antenna Polarisation	Height	Azimuth	Peak Field Strength	Average Field Strength
MHz		cm	deg	dBµV/m	dBµV/m
2480	Horizontal	100	149	100.3	88.7

Step 2

Determine Marker delta amplitude between 2462MHz (the fundamental) and 2483.5MHz (the Band Edge under investigation).

Using a span of 30MHz with Resolution Bandwidth and Video Bandwidth of 300kHz.

Marker Delta Amplitude = 44.9dB

Step 3

Subtracting the Marker Delta obtained from Step 2 from the 2483.5MHz Field Strength measurement from Step 1, gives following Result

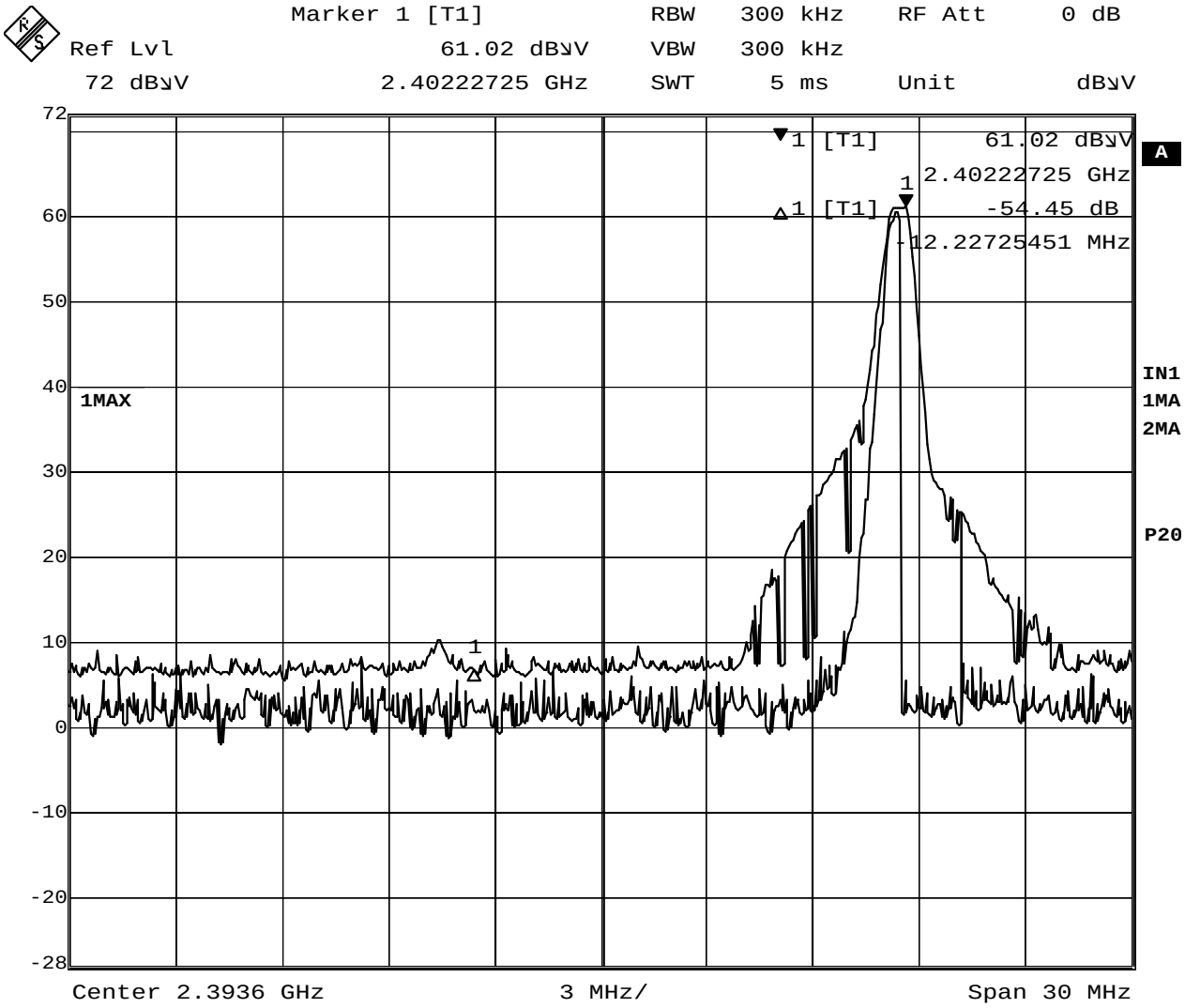
Peak of 55.4dBµV/m (Limit is 74.0dBµV/m)

Average of 43.8dBµV/m (Limit is 54.0dBµV/m)

2.3 MEASUREMENT AT THE BAND EDGE (MARKER DELTA METHOD)

2.3.6 **Test Results** - continued

Plot for Top Channel 2480MHz



Date: 1.OCT.2005 04:13:44

2.4 CONDUCTED EMISSIONS ON AC POWER LINES

2.4.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.207 and
Industry Canada Radio Standard RSS-210, 6.6

2.4.2 Equipment Under Test

LMX5452 Bluetooth Data Module: Serial Number 30

2.4.3 Date of Test

1st October 2005

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

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 tables below.

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

2.4 CONDUCTED EMISSIONS ON AC POWER LINES

2.4.6 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-210, 6.6 for Conducted Emissions on the Live and Neutral Lines.

Measurements were made with the EUT in Bluetooth Mode (see Section 1.3.3 for details).

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

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.426	36.1	57.3	32.0	47.3
0.852	34.9	56.0	29.9	46.0
2.023	39.9	56.0	35.6	46.0
2.129	41.2	56.0	36.9	46.0
2.235	40.5	56.0	36.3	46.0
2.342	38.0	56.0	34.2	46.0

The margin between the specification requirements and all other emissions were 21.0dB or more below the specified Quasi-Peak limit and 11.9dB or more below the Average limit.

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

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.532	34.3	57.3	32.2	47.3
0.852	34.2	56.0	32.3	46.0
2.023	39.9	56.0	36.2	46.0
2.129	41.7	56.0	37.7	46.0
2.235	41.3	56.0	37.0	46.0
2.342	39.4	56.0	35.0	46.0

The margin between the specification requirements and all other emissions were 21.6dB or more below the specified Quasi-peak limit and 12.5dB or more below the specified Average limit.

2.4 CONDUCTED EMISSIONS ON POWER LINES

2.4.6 Test Results - continued

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

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.319	38.5	59.7	37.8	49.7
0.426	36.0	57.3	31.8	47.3
0.639	35.0	56.0	33.8	46.0
2.022	39.5	56.0	35.3	46.0
2.129	41.1	56.0	36.8	46.0
2.235	40.3	56.0	36.2	46.0
2.342	38.2	56.0	34.5	46.0

The margin between the specification requirements and all other emissions were 21.1dB or more below the specified Quasi-Peak limit and 32.0dB or more below the Average limit.

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

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.532	34.3	56.0	34.3	46.0
2.023	39.7	56.0	39.7	46.0
2.129	41.6	56.0	41.6	46.0
2.236	41.3	56.0	41.3	46.0
2.342	39.7	56.0	39.7	46.0
2.449	36.9	56.0	36.9	46.0

The margin between the specification requirements and all other emissions were 21.5dB or more below the specified Quasi-peak limit and 12.3dB or more below the specified Average limit.

2.4 CONDUCTED EMISSIONS ON POWER LINES

2.4.6 Test Results - continued

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

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.639	34.9	56.0	33.8	46.0
1.917	35.6	56.0	31.8	46.0
2.024	39.3	56.0	35.1	46.0
2.130	40.9	56.0	36.8	46.0
2.236	40.3	56.0	36.1	46.0
2.343	38.2	56.0	34.5	46.0

The margin between the specification requirements and all other emissions were 20.9dB or more below the specified Quasi-Peak limit and 11.8dB or more below the Average limit.

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

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
1.917	36.3	56.0	32.5	46.0
2.024	39.7	56.0	35.8	46.0
2.130	41.6	56.0	37.5	46.0
2.237	41.2	56.0	36.9	46.0
2.343	39.7	56.0	35.3	46.0
2.450	36.9	56.0	33.2	46.0

The margin between the specification requirements and all other emissions were 19.5dB or more below the specified Quasi-peak limit and 13.4dB or more below the specified Average limit.

2.5 CHANNEL DWELL TIME

2.5.1 Specification Reference

FCC Part 15.247(a)(i) and Industry Canada Radio Standard RSS-210, A8.1

2.5.2 Equipment Under Test

LMX5452 Bluetooth Radio: Serial Number 9

2.5.3 Date of Test

31st October 2005

2.5.4 Test Equipment Used

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

2.5.5 Test Procedure (DH1)

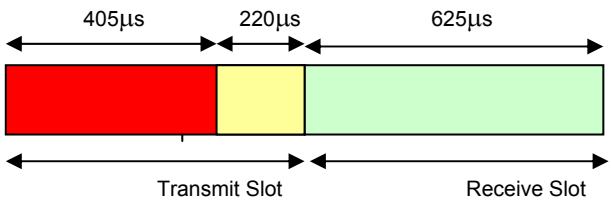
Procedure: Test Performed in accordance with 15.247.

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:

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

In 1 transmit timeslot, the transmit on time is only 405µs. 220µs 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 timelsots, the transmitter is on for 800 x 405µs = 0.324 seconds.

$$\therefore \quad \frac{\text{Total Tx Time On}}{\text{No of Channels}} = \frac{0.324}{79} = 4.10\text{ms}$$

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

$$32 \times 4.10\text{ms} = 0.1312 \text{ seconds}$$

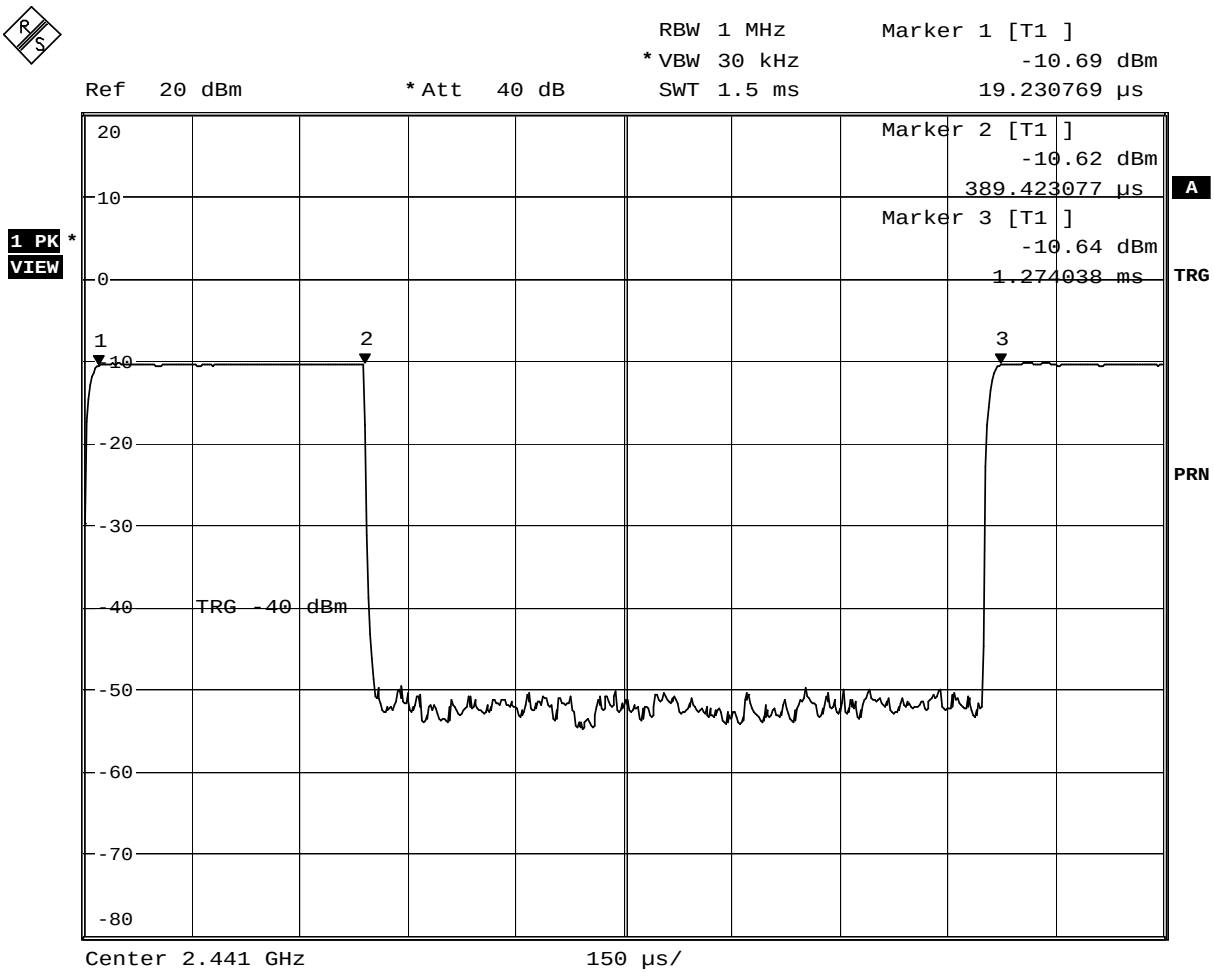
2.5 CHANNEL DWELL TIME

2.5.5 Test Procedure (DH1) - continued

Remarks

Thus, the transmitter dwell time for data rate DH1 is meets the requirements specified in 15.247(a)(iii)

2.5.6 Test Results (DH1)



Date: 31.OCT.2005 16:13:56

Plot Showing DH1 Timeslot

2.5 CHANNEL DWELL TIME

2.5.7 Test Procedure (DH3)

Test Performed in accordance with 15.247.

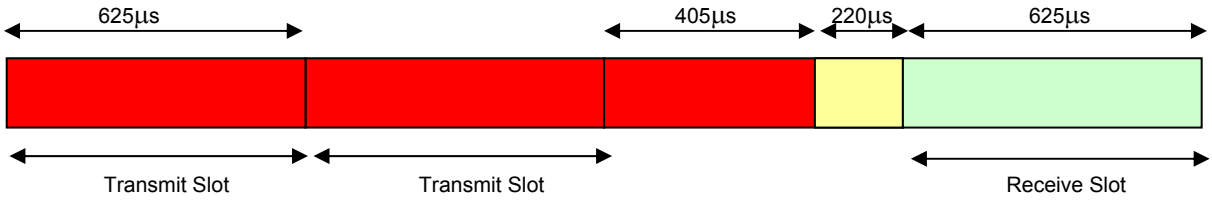
The Bluetooth system hops at a rate of 1600 times per second. Thus, this equates to 1600 timeslots in 1 second. With data rate DH3, the data payload is higher and can use up to 3 timeslots. When more than one timeslot is used, the frequency does not hop and transmission is continuous on all 3 slots,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

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.

Thus:

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

The first 2 Transmit timeslots are transmitting for the complete 625µs. In the third transmit slot, the transmit on time is only 405µs. 220µs 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

2.5.7 Test Procedure (DH3)

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

Tx (2 x 625μs) + (1 x 405μs) = 1.655ms

So:

800 x 625μs = 0.5 seconds
400 x 405μs = 0.162 seconds

Thus: 0.5 + 0.162 = 0.662 seconds

$$\therefore \quad \frac{\text{Total Tx Time On}}{\text{No Of Channels}} = \frac{0.662}{79} = 8.38\text{ms}$$

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

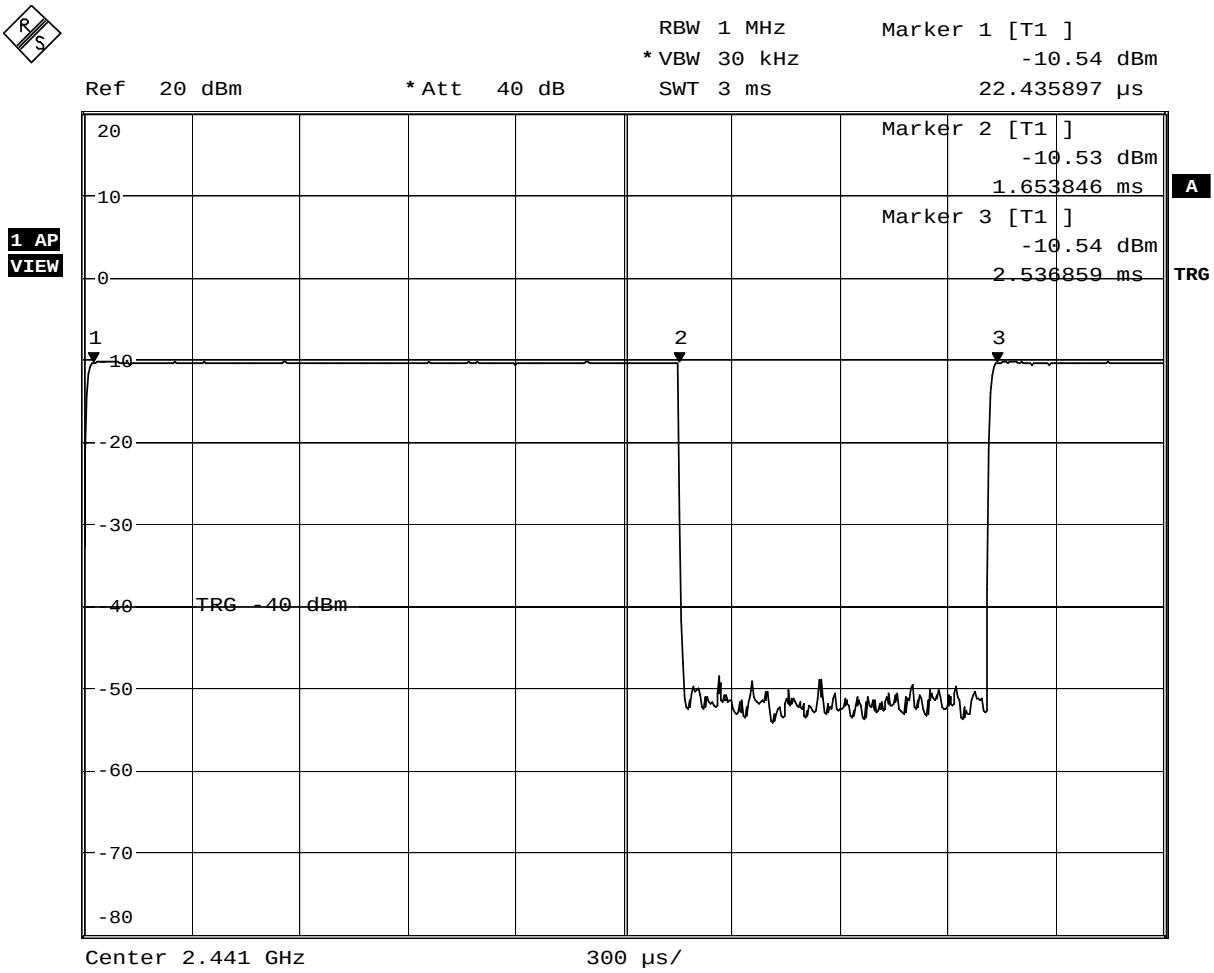
32 x 8.38ms = 0.2682 seconds

Remarks

Thus, the transmitter dwell time for data rate DH3 meets the requirements specified in 15.247(a)(iii)

2.5 CHANNEL DWELL TIME

2.5.8 Test Results (DH3)



Date: 31.OCT.2005 16:20:45

Plot Showing DH3 Timeslot

2.5 CHANNEL DWELL TIME

2.5.9 Test Procedure (DH5)

Test Performed in accordance with 15.247.

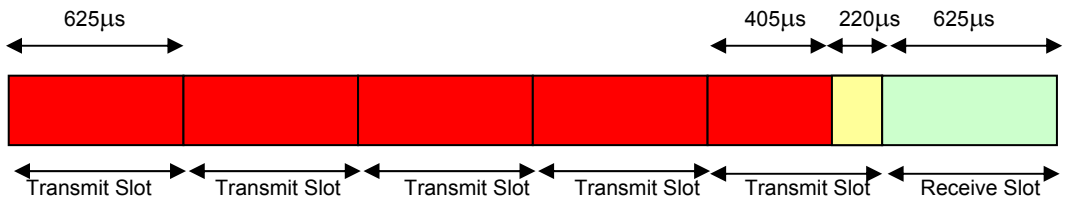
The Bluetooth system hops at a rate of 1600 times per second. Thus, this equates to 1600 timeslots in 1 second. With data rate DH5, the data payload is higher and can use up to 5 timeslots. When more than one timeslot is used, the frequency does not hop and transmission is continuous on all 5 slots,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

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.

Thus:

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

The first 4 Transmit timeslots are transmitting for the complete 625µs. In the fifth transmit slot, the transmit on time is only 405µs. 220µs 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)

2.5 CHANNEL DWELL TIME

2.5.9 Test Procedure (DH5)

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

Tx (4 x 625μs) + (1 x 405μs) = 2.905ms

So:

1066.7 x 625μs = 0.666 seconds
266.7 x 405μs = 0.108 seconds

Thus: 0.666 + 0.108 = 0.774 seconds

$$\therefore \quad \frac{\text{Total Tx Time On}}{\text{No Of Channels}} = \frac{0.774}{79} = 9.80\text{ms}$$

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

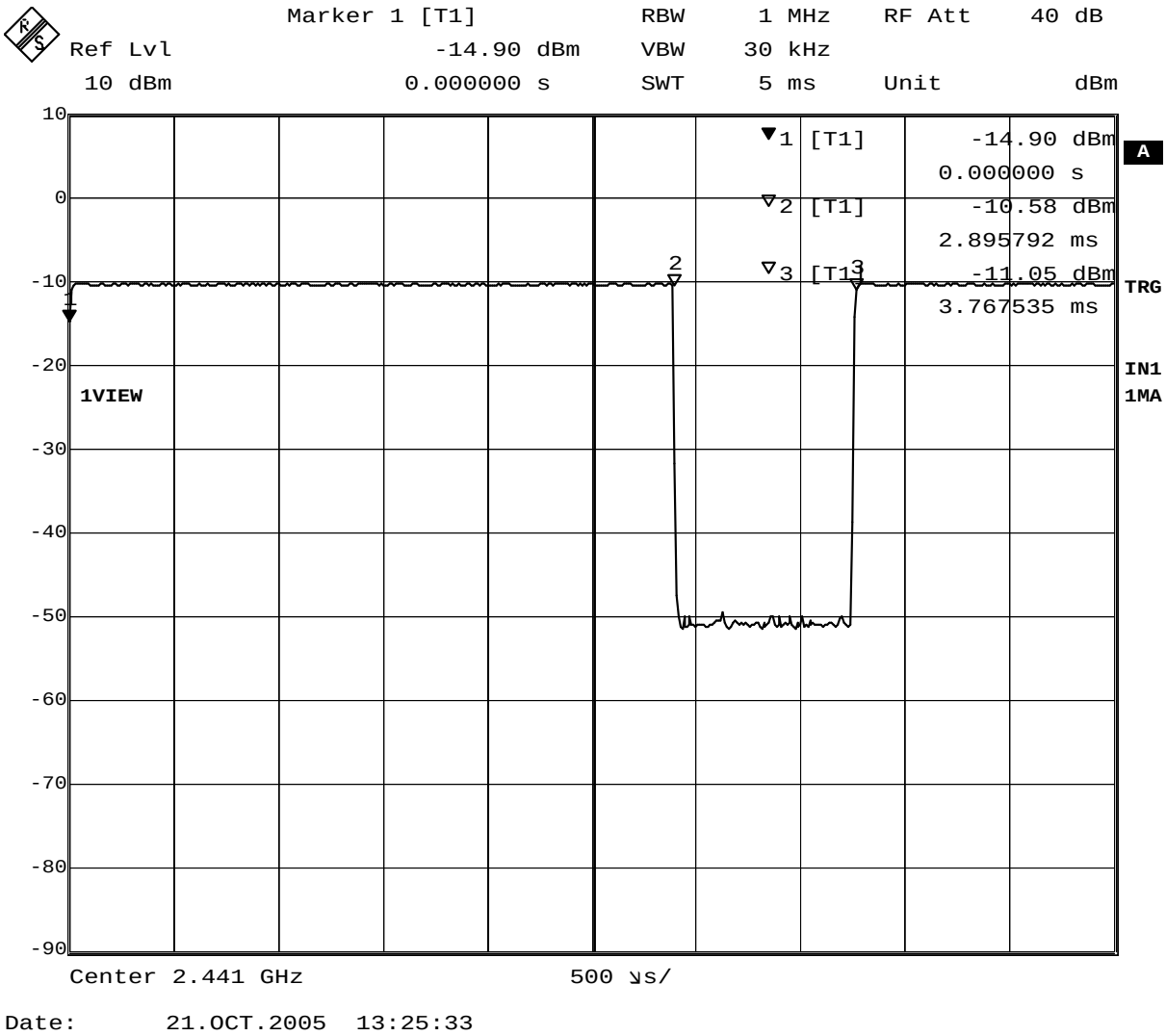
32 x 0.3136ms = 0.3136 seconds

Remarks

The transmitter dwell time for data rate DH5 meets the requirements specified in 15.247(a)(iii)

2.5 CHANNEL DWELL TIME

2.5.10 Test Results (DH5)



Plot Showing DH5 Timeslot

Remarks

Thus, the transmitter dwell time meets the requirements specified in 15.247(a)(i) and Industry Canada Radio Standard RSS-210 A8.1 whilst the EUT is randomly frequency hopping over all 79 channels.

Limit

Occupancy time shall be less than 0.4 seconds in a 10 second period on any channel.

2.6 CHANNEL SEPARATION

2.6.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.247(a) (1) and
Industry Canada Radio Standard RSS-210, A8.1 (4) or (5)

2.6.2 Equipment Under Test

LMX5452 Bluetooth Data Module: Serial Number 9

2.6.3 Date of Test

21st October 2005

2.6.4 Test Equipment Used

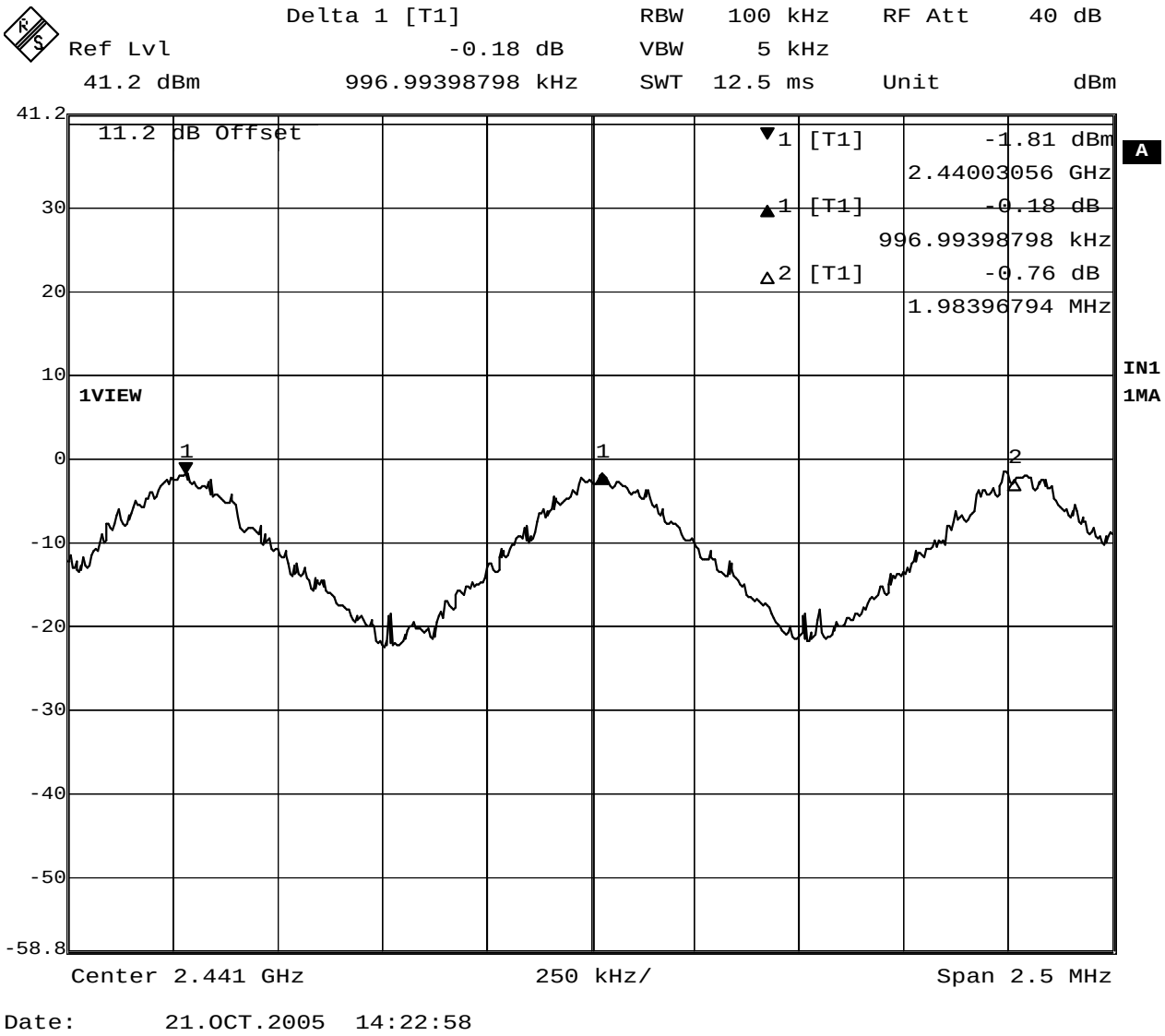
The major items of test equipment used for the above tests are identified in Section 3.1.

2.6.5 Test Procedure

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.

2.6 CHANNEL OCCUPANCY/SEPARATION

2.6.6 Test Results



The system channel separation is specified as being 400kHz. The measured channel separation from the plot above is: 996.994 kHz.

Limit	>25kHz

Remarks

The equipment met the requirements outlined in 15.247(a)(1) and Industry Canada Radio Standard RSS-210, A8.1 (4) or (5)).

2.7 NUMBER OF CHANNELS

2.7.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.247(a) (1) and
Industry Canada Radio Standard RSS-210, A8.1 (4) or (5)

2.7.2 Equipment Under Test

LMX5452 Bluetooth Data Module: Serial Number 9

2.7.3 Date of Test

20th October 2005

2.7.4 Test Equipment Used

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

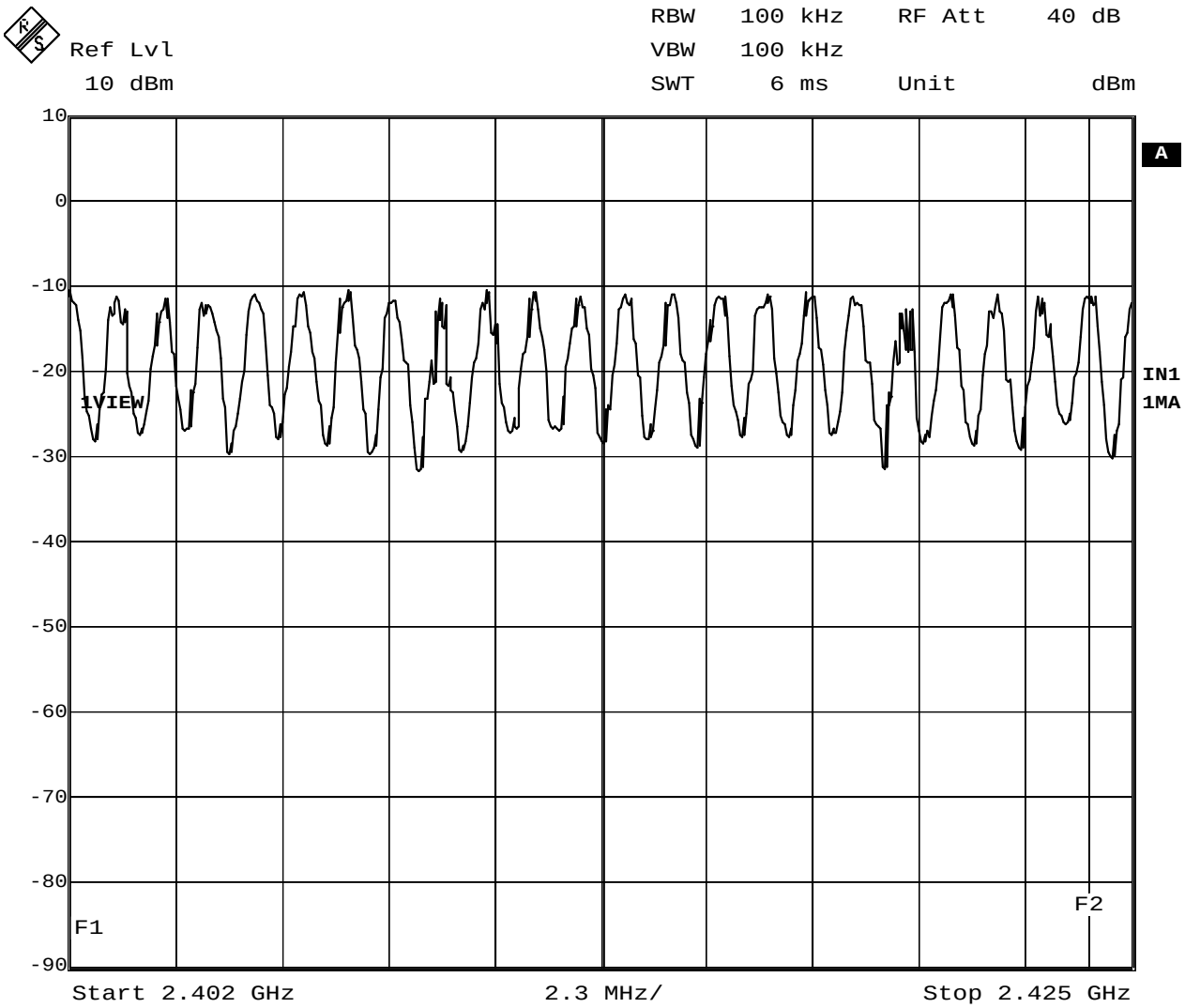
2.7.5 Test Procedure

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 two traces. The display trace was set to Max Hold and the plots recorded.

2.7 NUMBER OF CHANNELS

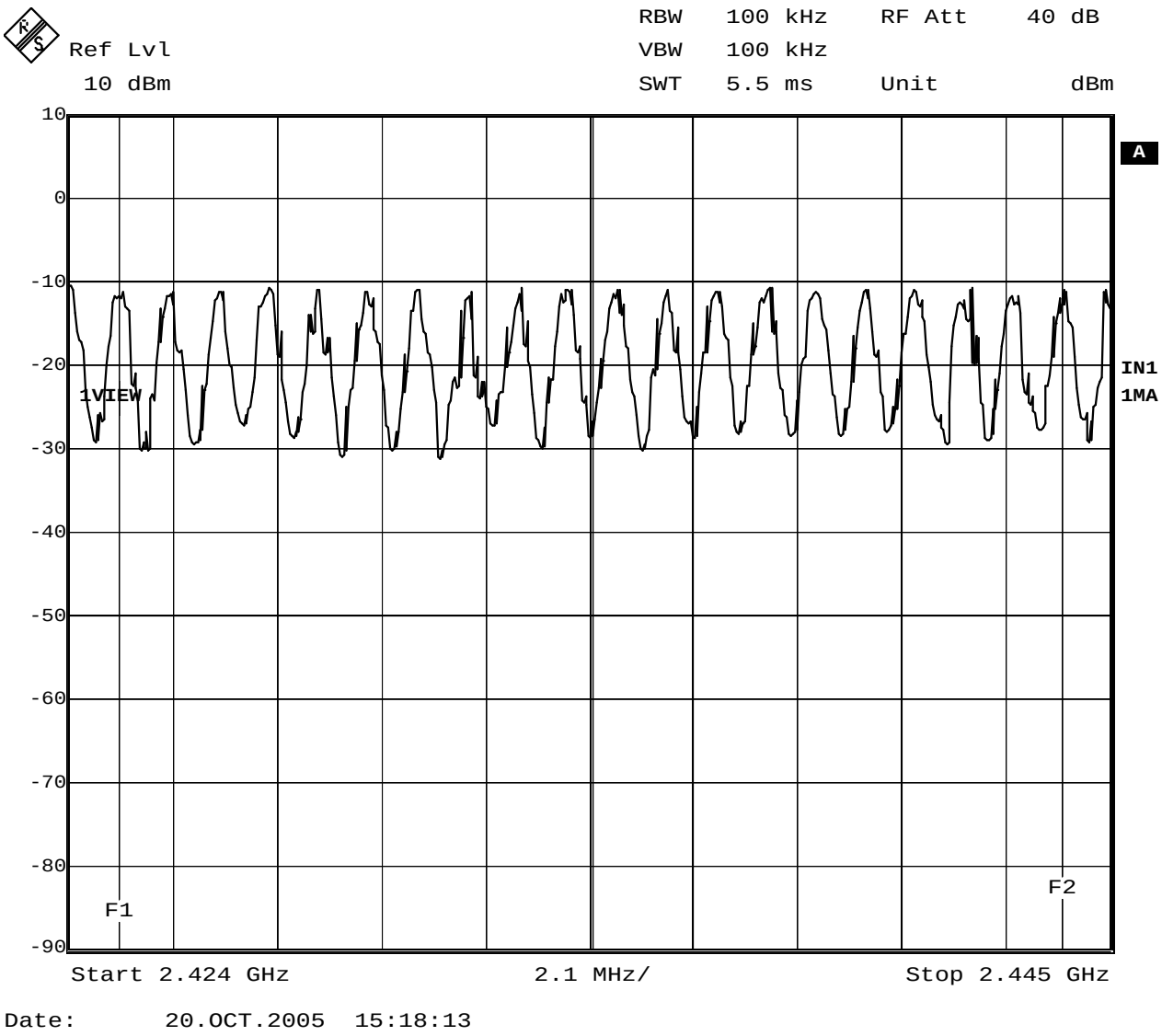
2.7.6 Test Results



Trace Showing Channels 1 – 23

2.7 NUMBER OF CHANNELS

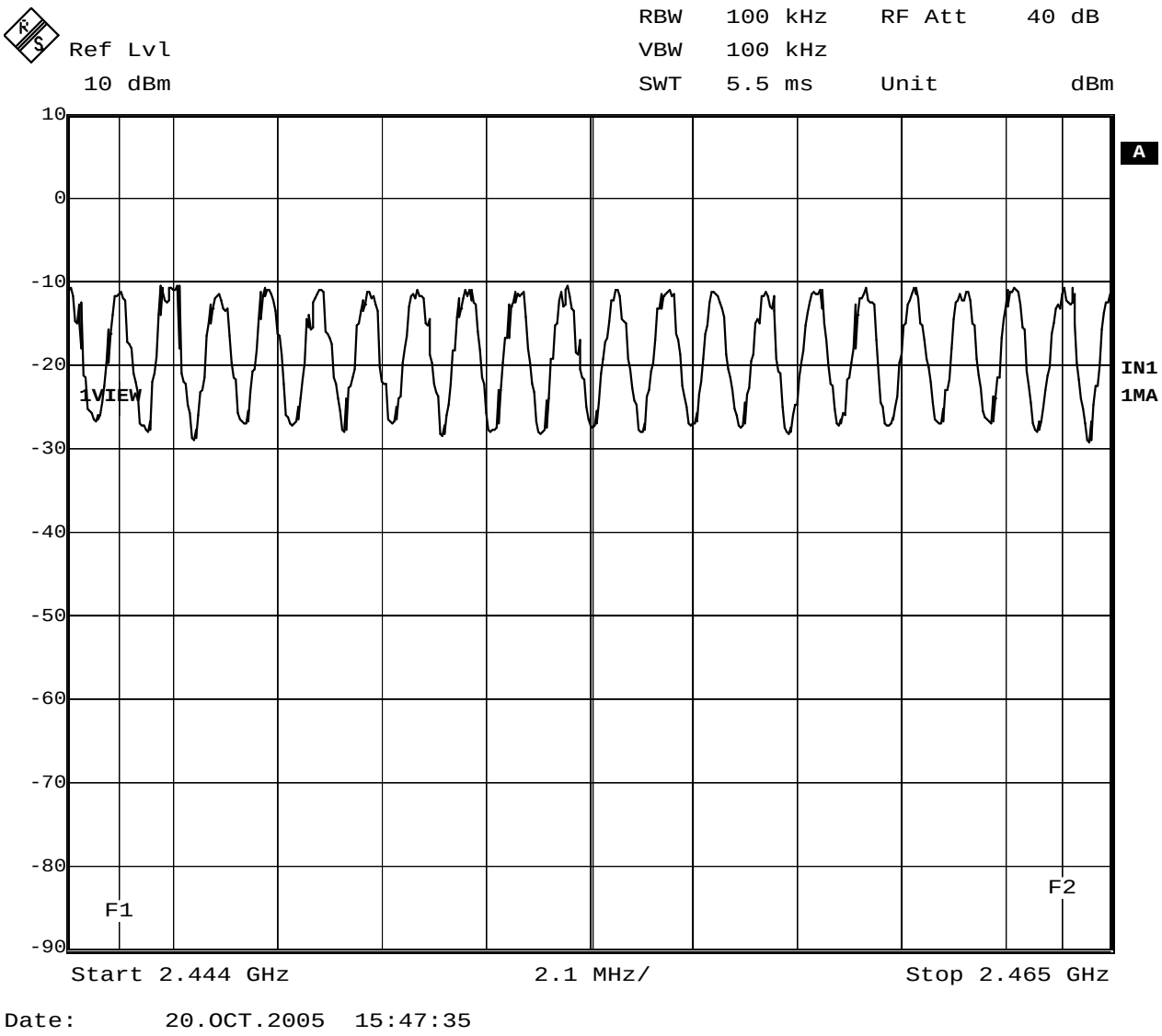
2.7.6 Test Results



Trace Showing Channels 24 - 43

2.7 NUMBER OF CHANNELS

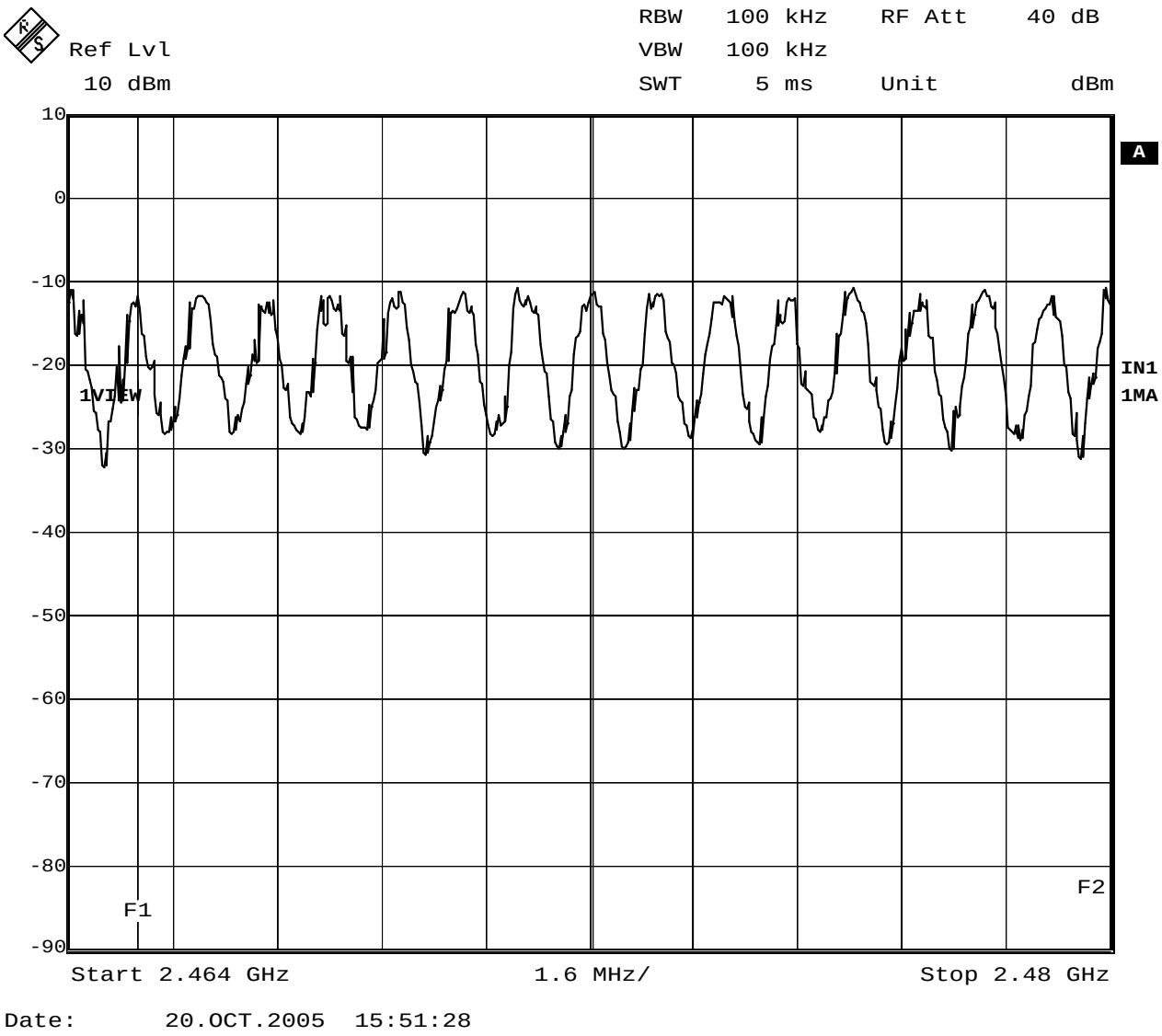
2.7.6 Test Results



Trace Showing Channels 44-63

2.7 NUMBER OF CHANNELS

2.7.6 Test Results



Trace Showing Channels 64 - 79

Limit	≥50 channels

Remarks

EUT complies with CFR 47 15.247(a)(1)(iii) and Industry Canada Radio Standard RSS-210, 6.2.2 (o)(a). The EUT utilises more than 50 channels.

2.8 20dB BANDWIDTH

2.8.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.247(a)(1) and
Industry Canada Radio Standard RSS-210, A8.1 (2)

2.8.2 Equipment Under Test

LMX5452 Bluetooth Data Module: Serial Number 9

2.8.3 Date of Test

21st October 2005 (DH5)
31st October 2005 (DH1 and DH3)

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 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.

2.8 20dB BANDWIDTH

2.8.6 Test Results

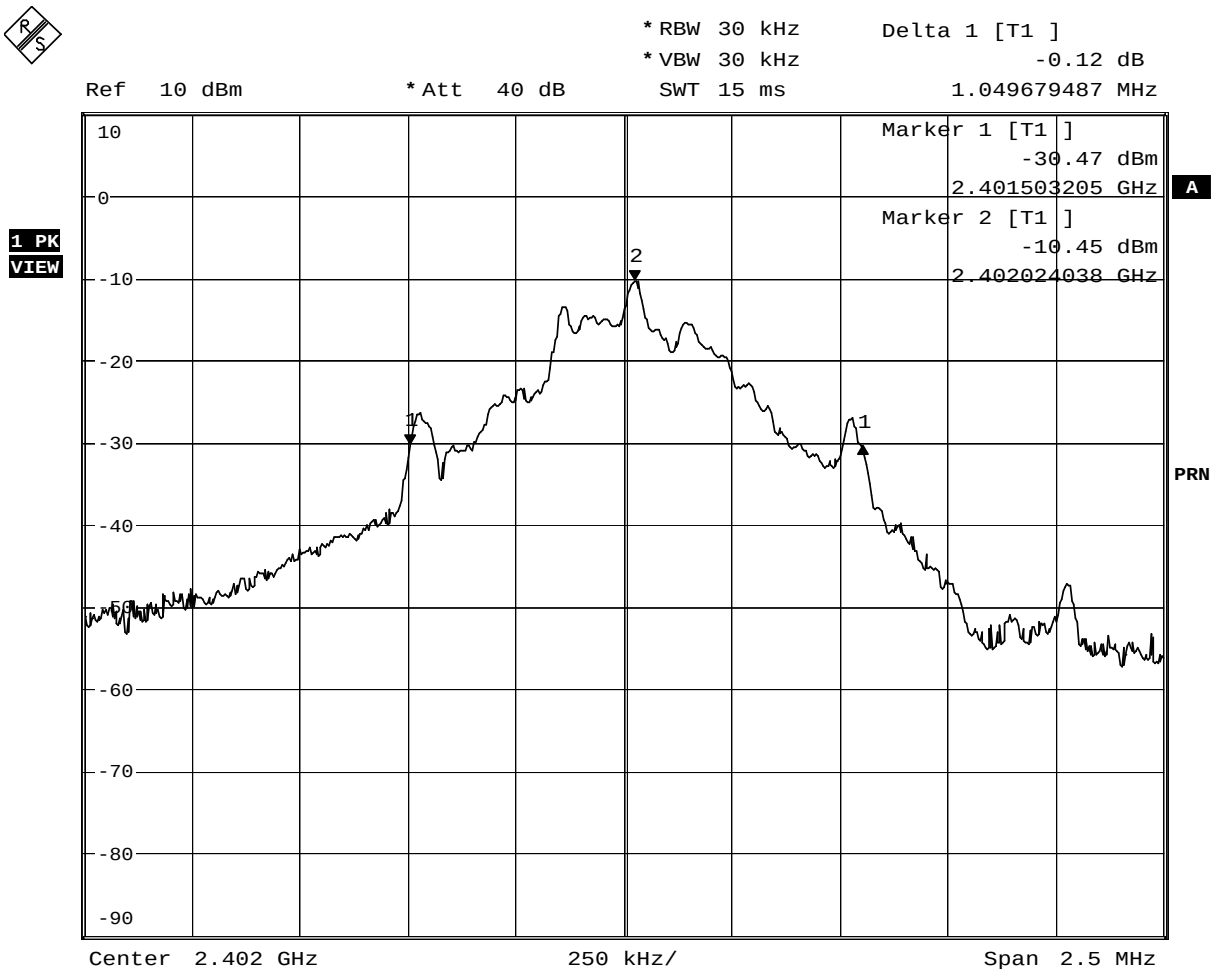
Frequency (MHz)	Data Rate	20dB Bandwidth (kHz)
2402	DH1	1049.679
2441	DH1	1045.673
2480	DH1	1045.673

Frequency (MHz)	Data Rate	20dB Bandwidth (kHz)
2402	DH3	1045.673
2441	DH3	1045.673
2480	DH3	1045.673

Frequency (MHz)	Data Rate	20dB Bandwidth (kHz)
2402	DH5	1052.104
2441	DH5	1047.094
2480	DH5	1047.094

2.8 20dB BANDWIDTH

2.8.6 Test Results

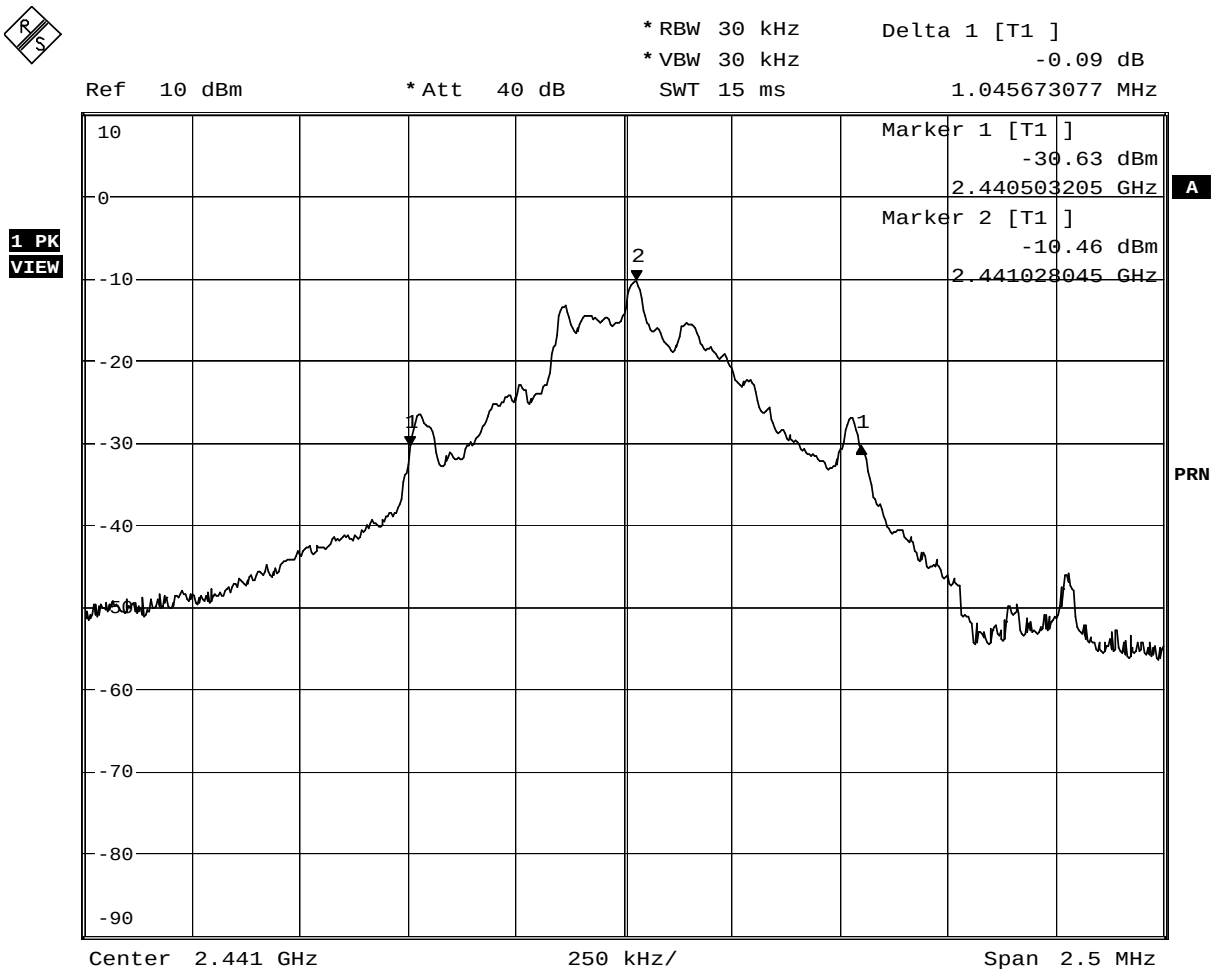


Date: 31.OCT.2005 14:48:19

2402.0MHz – Maximum Power DH1

2.8 20dB BANDWIDTH

2.8.6 Test Results

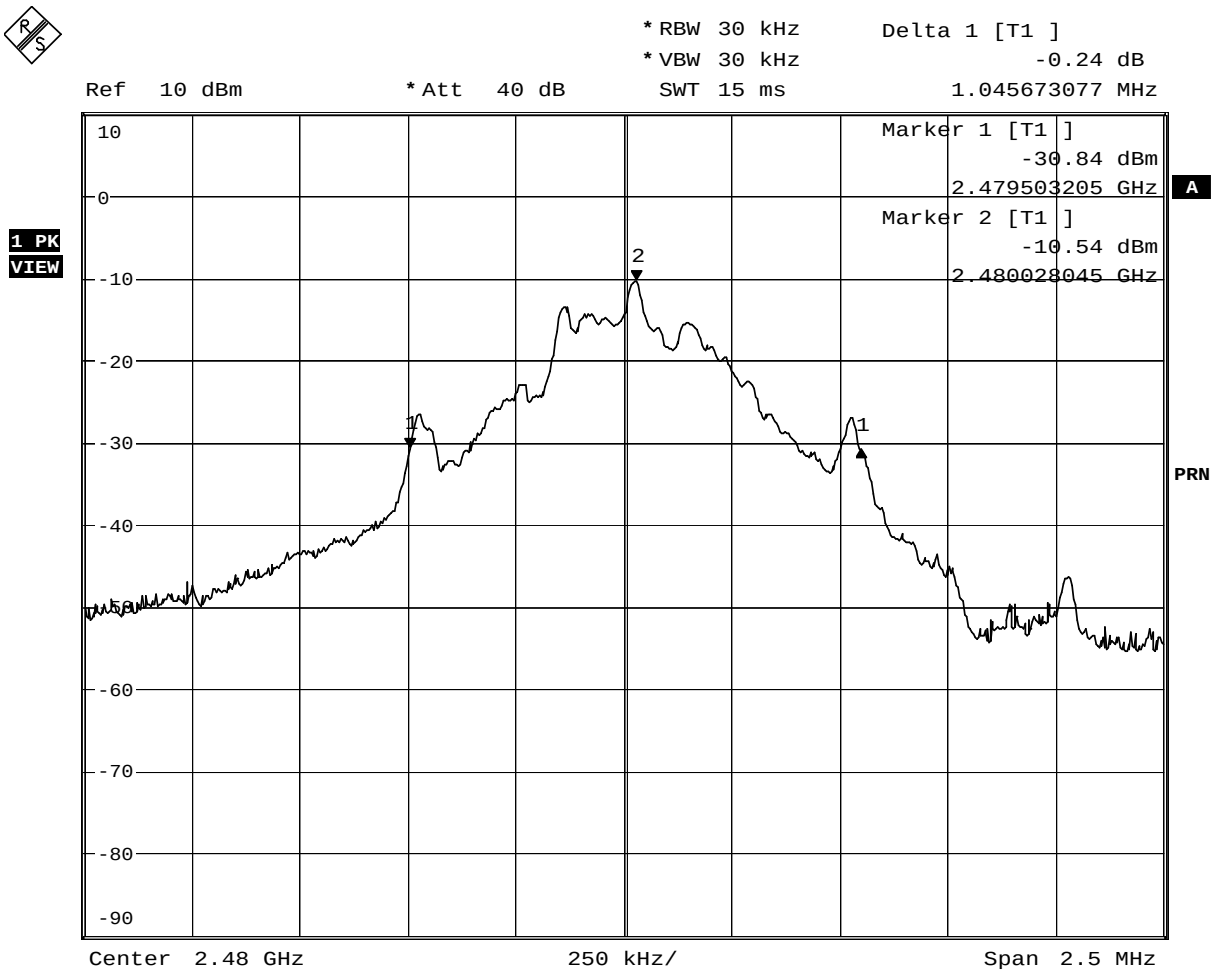


Date: 31.OCT.2005 14:52:10

2441.0MHz – Maximum Power DH1

2.8 20dB BANDWIDTH

2.8.6 Test Results

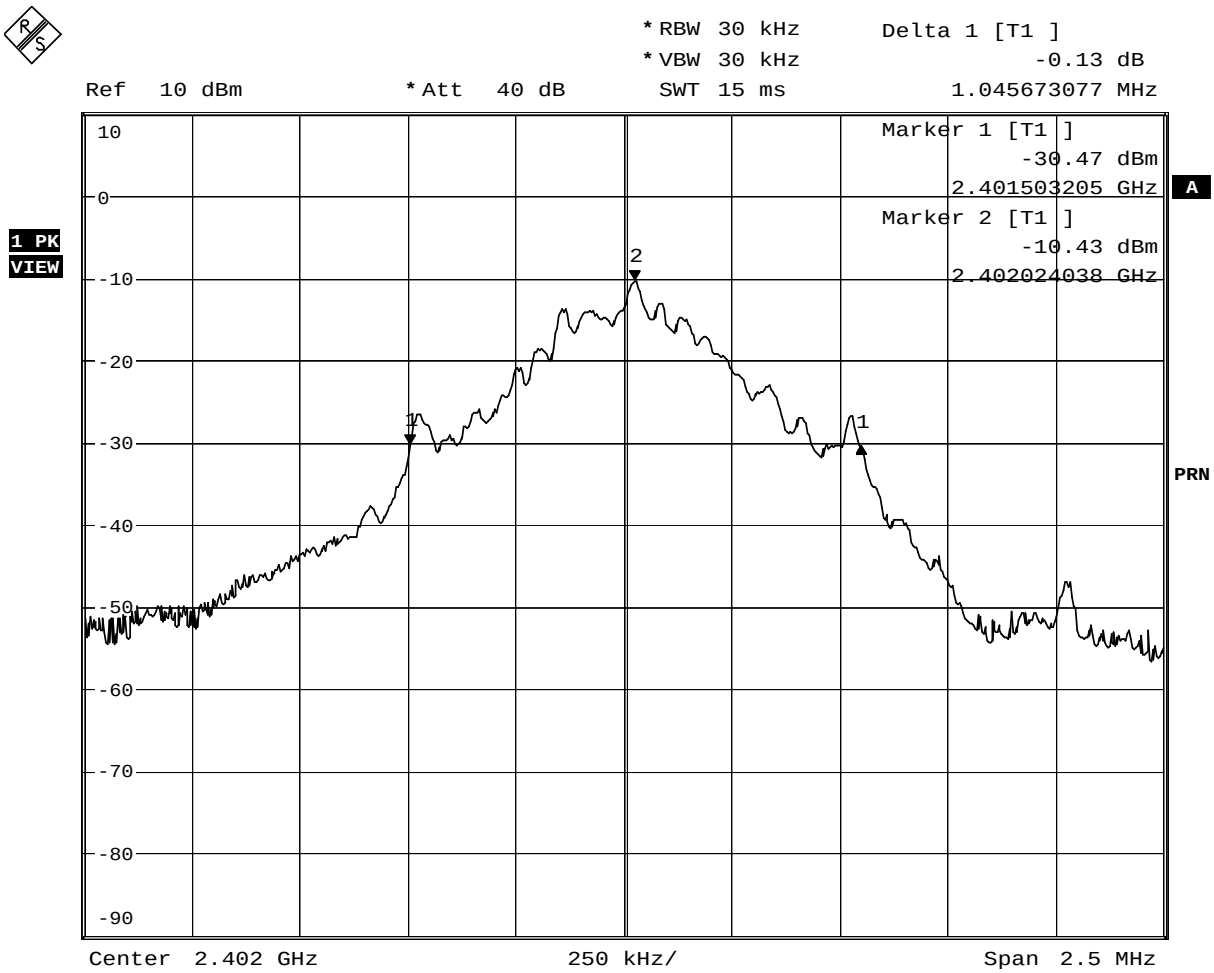


Date: 31.OCT.2005 14:54:32

2441.0MHz – Maximum Power DH1

2.8 20dB BANDWIDTH

2.8.6 Test Results

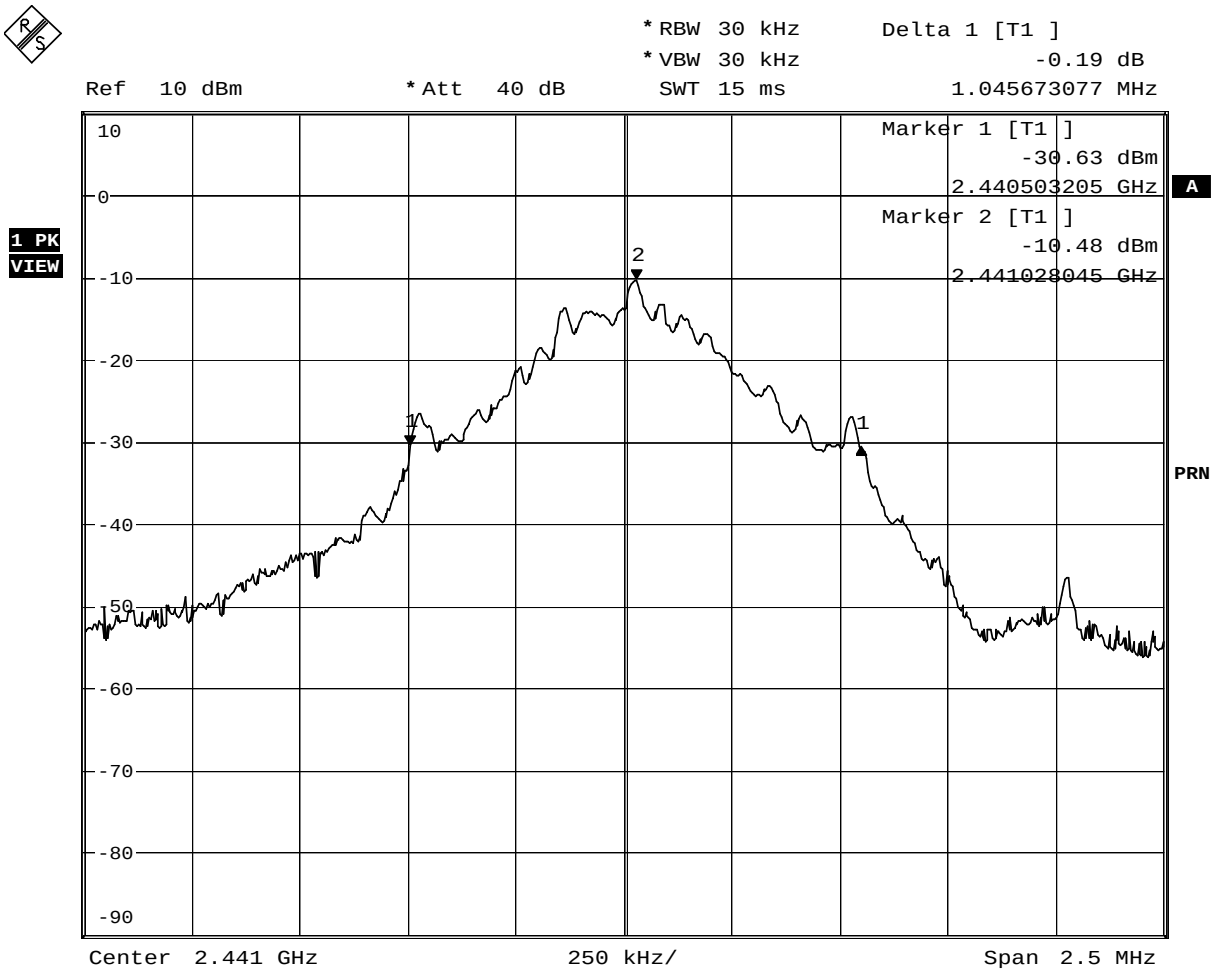


Date: 31.OCT.2005 14:37:20

2402.0MHz – Maximum Power DH3

2.8 20dB BANDWIDTH

2.8.6 Test Results

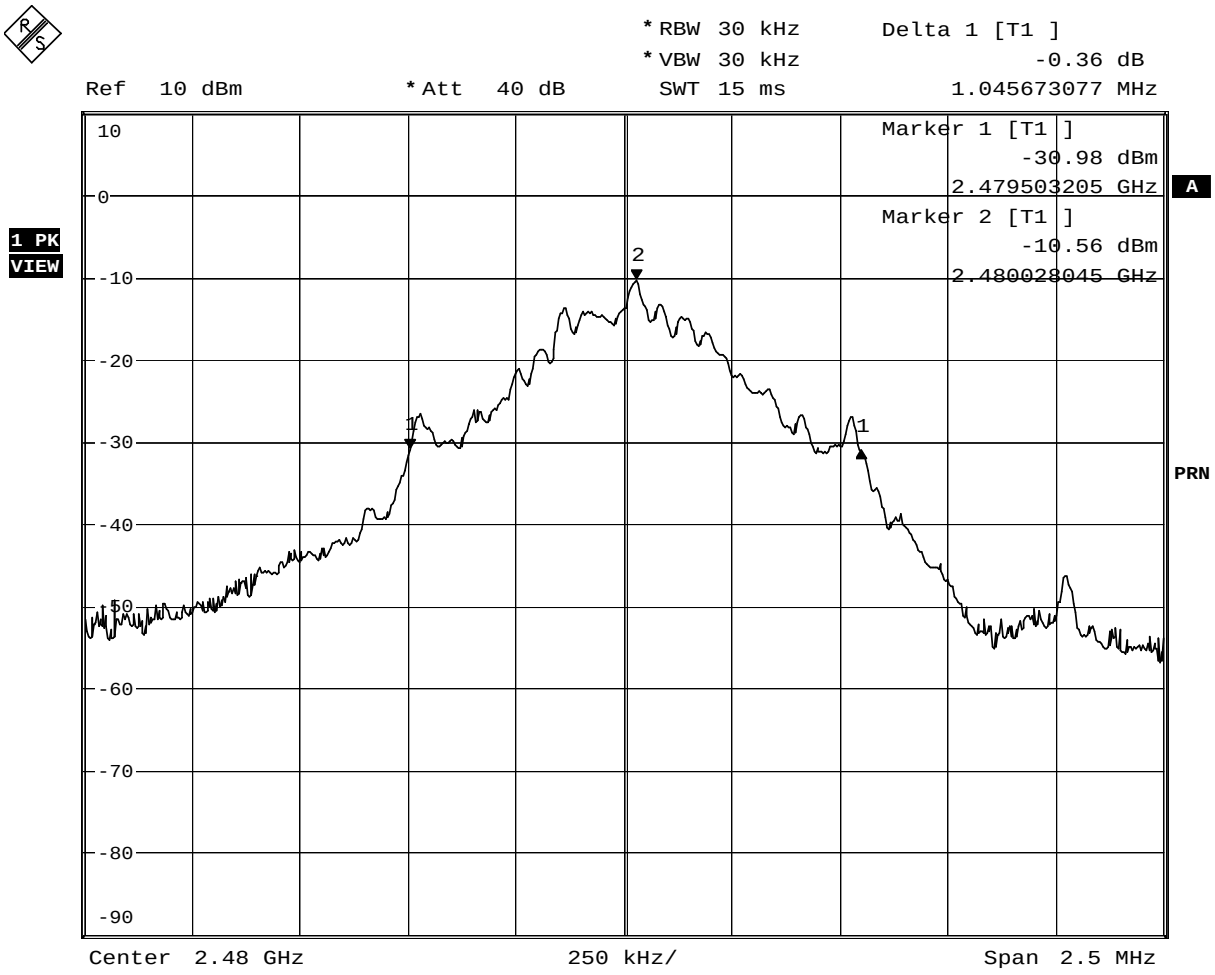


Date: 31.OCT.2005 14:22:35

2441.0MHz – Maximum Power DH3

2.8 20dB BANDWIDTH

2.8.6 Test Results

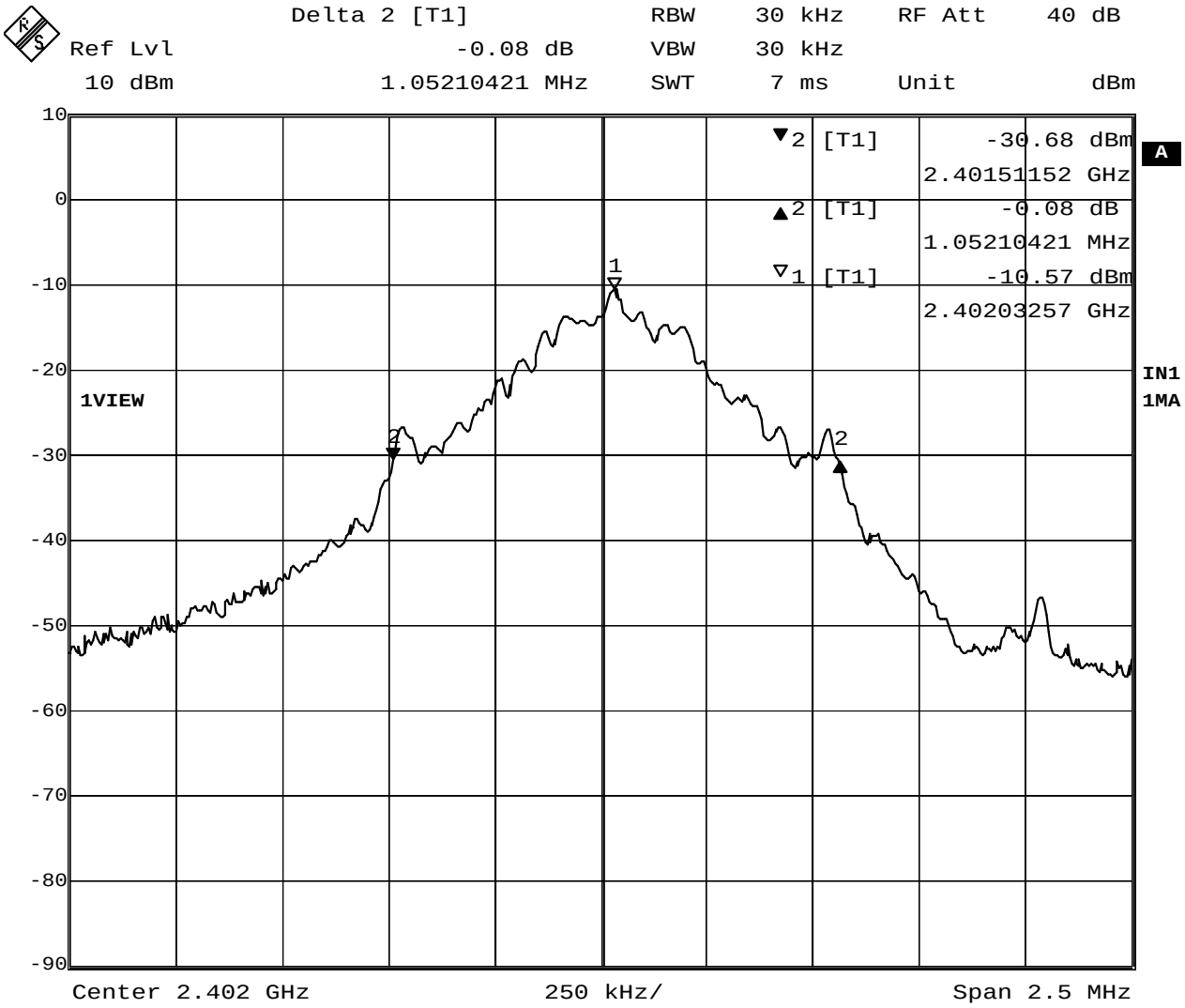


Date: 31.OCT.2005 14:18:08

2480.0MHz – Maximum Power DH3

2.8 20dB BANDWIDTH

2.8.6 Test Results

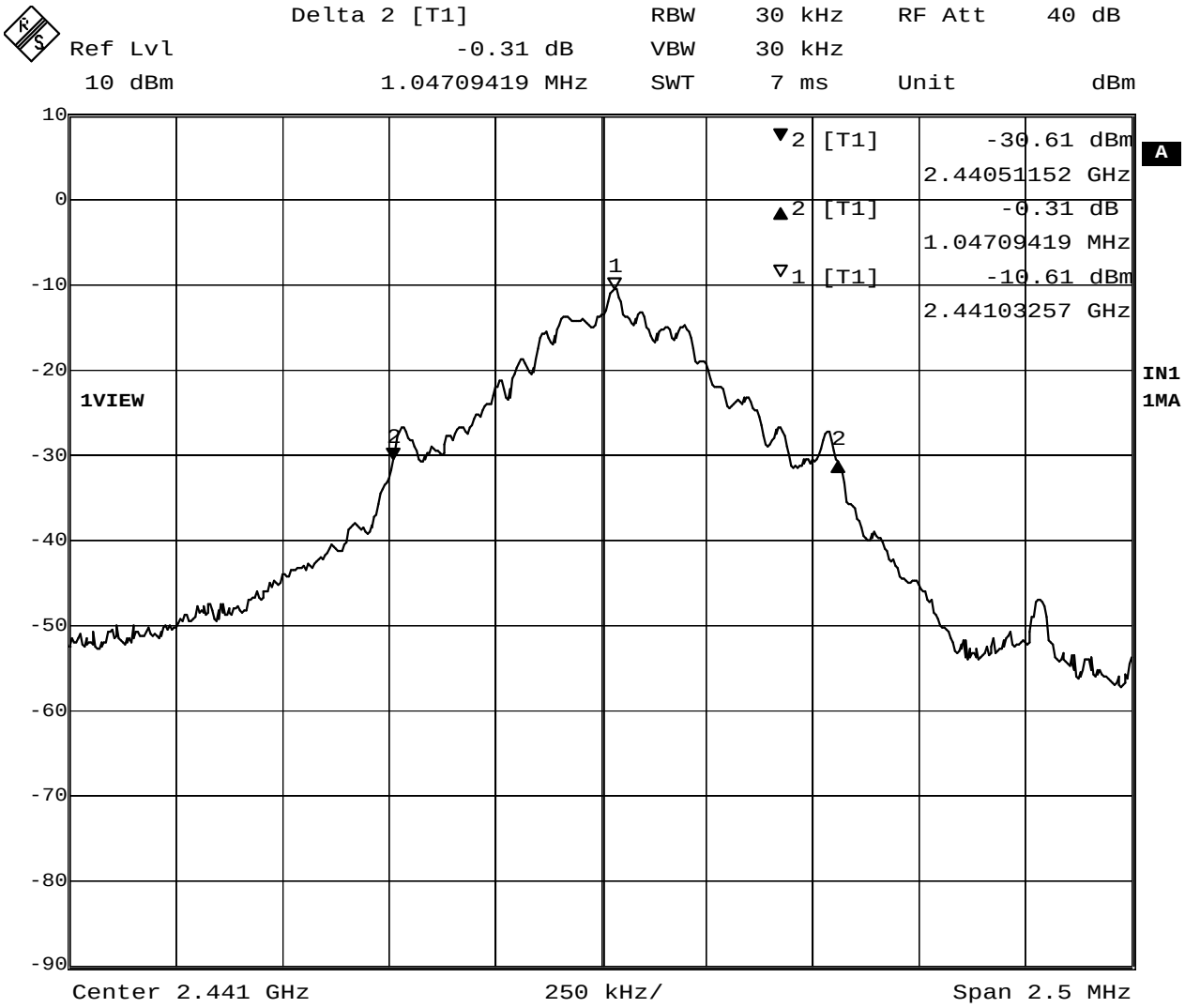


Date: 21.OCT.2005 10:52:45

2402.0MHz – Maximum Power DH5

2.8 20dB BANDWIDTH

2.8.6 Test Results

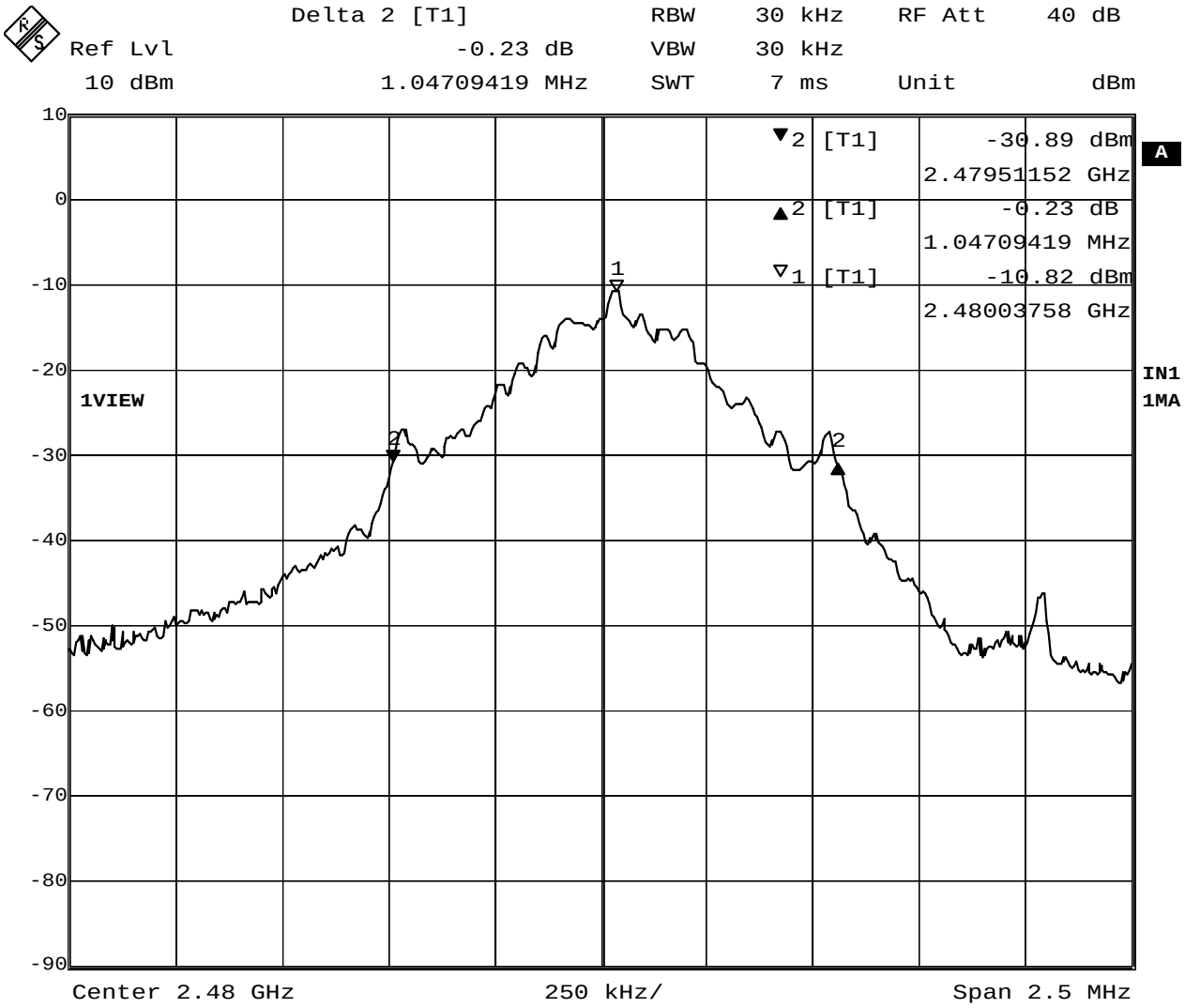


Date: 21.OCT.2005 11:07:05

2441.0MHz – Maximum Power DH5

2.8 20dB BANDWIDTH

2.8.6 Test Results



Date: 21.OCT.2005 11:00:30

2441.0MHz – Maximum Power DH5

2.9 MAXIMUM PEAK OUTPUT POWER (Conducted Method)

2.9.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.247(b) (2) and
Industry Canada Radio Standard RSS-210, A8.4 (2) (3) or (4) and RSS-Gen, 4.6

2.9.2 Equipment Under Test

LMX5452 Bluetooth Data Module: Serial Number 9

2.9.3 Date of Test

1st November 2005

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 FCC CFR 47: Part 15.247(b)(2) and RSS-210.

The EUT contains an antenna port and therefore the Maximum Peak Output Power was made using the conducted method.

The EUT was connected to a Spectrum Analyser via a 10dB attenuator.
The cable loss was measured (with attenuator) and entered as an offset on the Spectrum Analyser.
The EUT was set to transmit at full power on the Top, Middle and Bottom Channels. The output power level was measured at the Spectrum Analyser.

2.9 MAXIMUM PEAK OUTPUT POWER (Conducted Method)

2.9.6 Test Results - continued

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(b) (2) and Industry Canada Radio Standard RSS-210, A8.4 (2) (3) or (4) and RSS-Gen, 4.6 for Maximum Peak Output Power.

Measurements were made with the EUT in Bluetooth Mode (see Section 1.3.3 for details).

Frequency (MHz)	Result EIRP (dBm)	Result EIRP (mW)
2402.0	2.43	1.75
2441.0	2.25	1.68
2480.0	2.19	1.66
Limit	<+30dBm or <1W	

DH1 Results

Frequency (MHz)	Result EIRP (dBm)	Result EIRP (mW)
2402.0	2.12	1.63
2441.0	2.04	1.60
2480.0	2.14	1.64
Limit	<+30dBm or <1W	

DH3 Results

Frequency (MHz)	Result EIRP (dBm)	Result EIRP (mW)
2402.0	2.25	1.68
2441.0	2.22	1.67
2480.0	2.14	1.64
Limit	<+30dBm or <1W	

DH1 Results

2.10 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT

2.10.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.247(c) and
Industry Canada Radio Standard RSS-210, A8.5 and 2.7 Table 2 and RSS-Gen 4.7

2.10.2 Equipment Under Test

LMX5452 Bluetooth Data Module: Serial Number 9

2.10.3 Date of Test

24th October 2005

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

Test Performed in accordance with FCC CFR 47: Part 15 Subpart C, Section 15.247(c) and RSS-210.

In accordance with Part 15.247(c) and RSS-210, Spurious Conducted Emissions from the antenna terminal were measured within 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(c). 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

2.10 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT

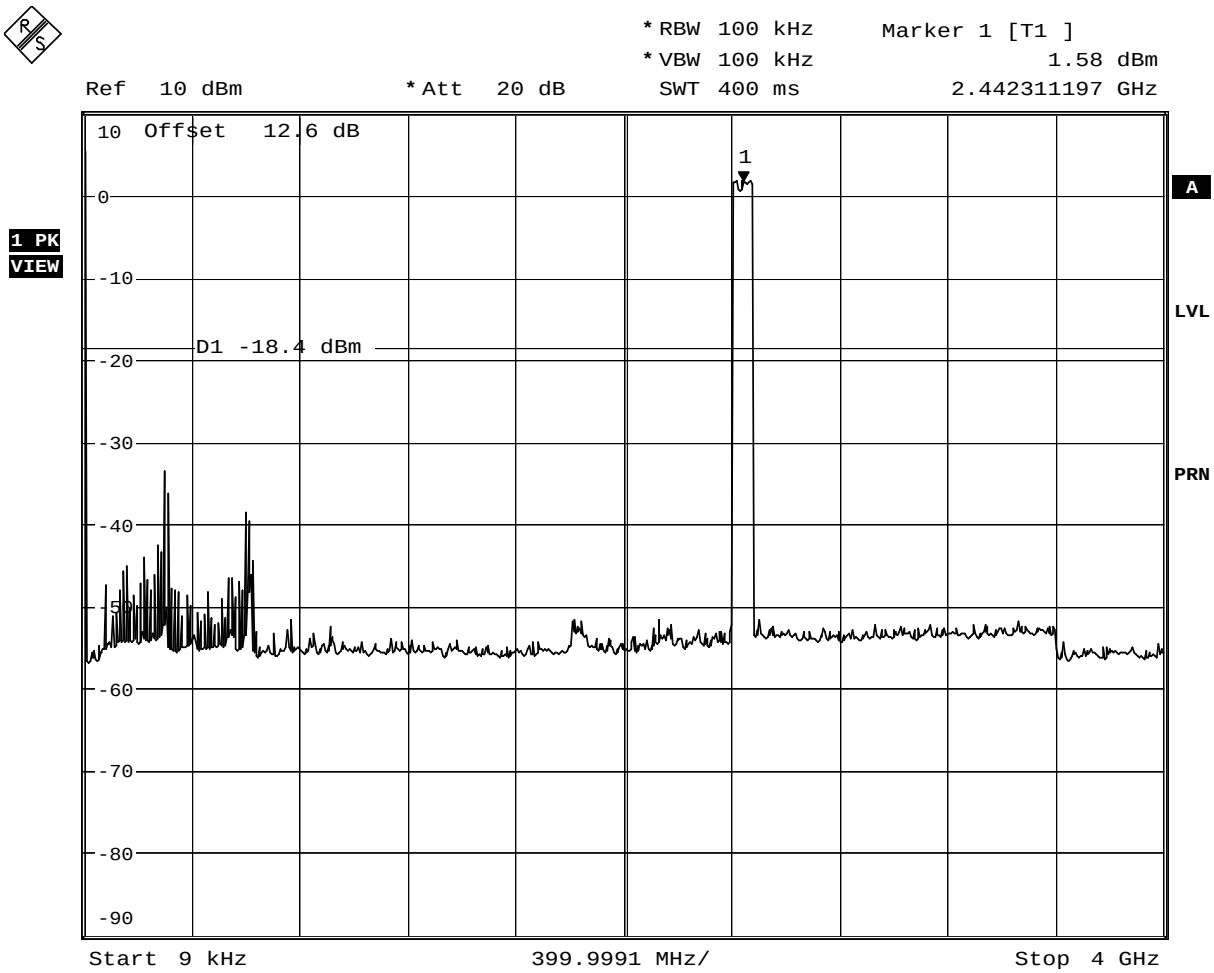
2.10.6 Test Results

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(c) and Industry Canada Radio Standard RSS-210, A8.5 and 2.7 Table 2 and RSS-Gen 4.7 for Spurious Conducted Emissions on the Antenna Port.

The plots on the following pages show the EUT's Antenna Ports Spurious Conducted Emissions over the frequency range 9kHz to 25GHz.

2.10 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT

2.10.6 Test Results - continued



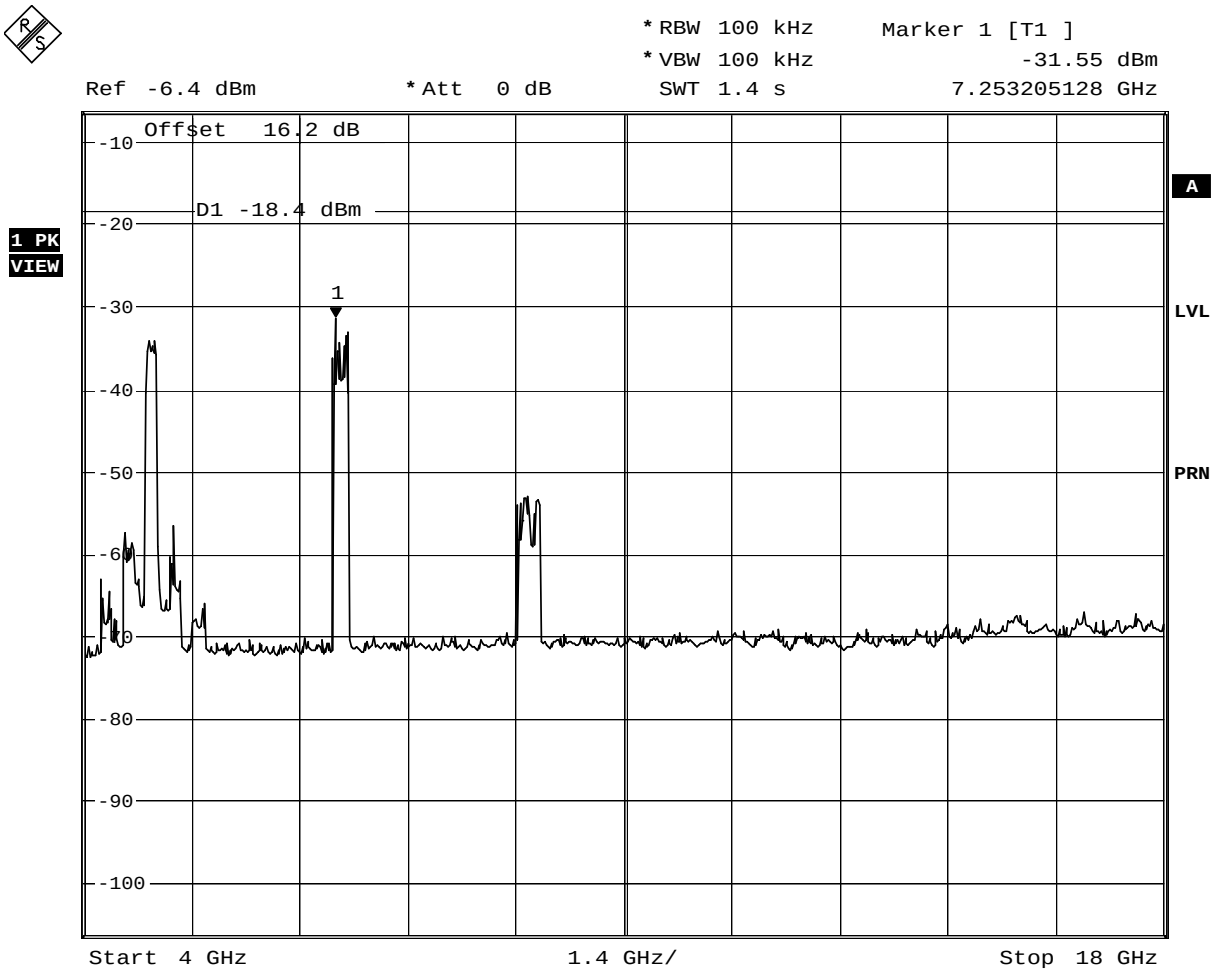
Date: 2.NOV.2005 12:32:33

Spurious Conducted Emissions (9kHz – 4GHz)

EUT Frequency Hopping on all Channels – Maximum Power DH1

2.10 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT

2.10.6 Test Results - continued



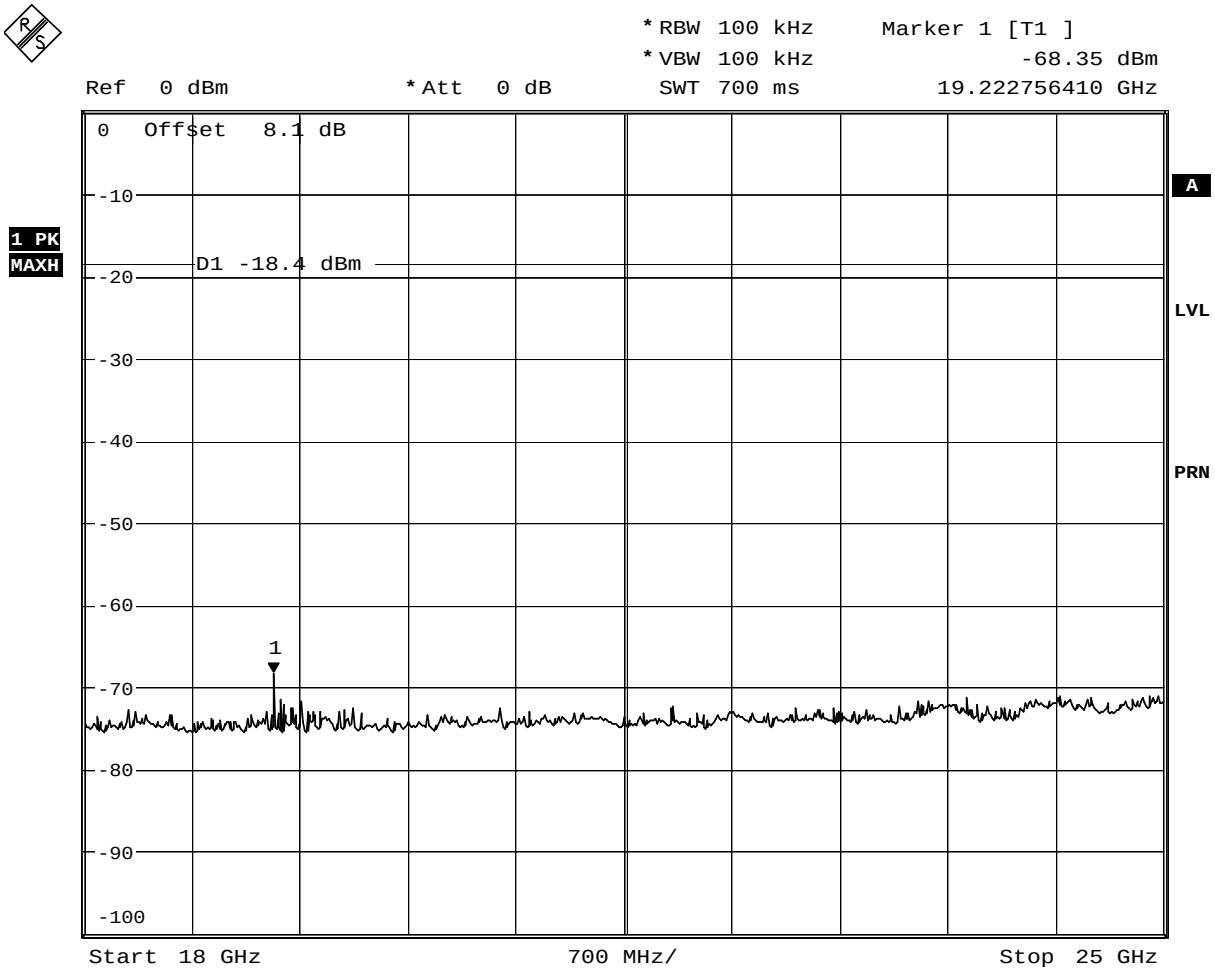
Date: 2.NOV.2005 12:40:42

Spurious Conducted Emissions (4GHz – 18GHz)

EUT Frequency Hopping on all Channels – Maximum Power DH1

2.10 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT

2.10.6 Test Results - continued



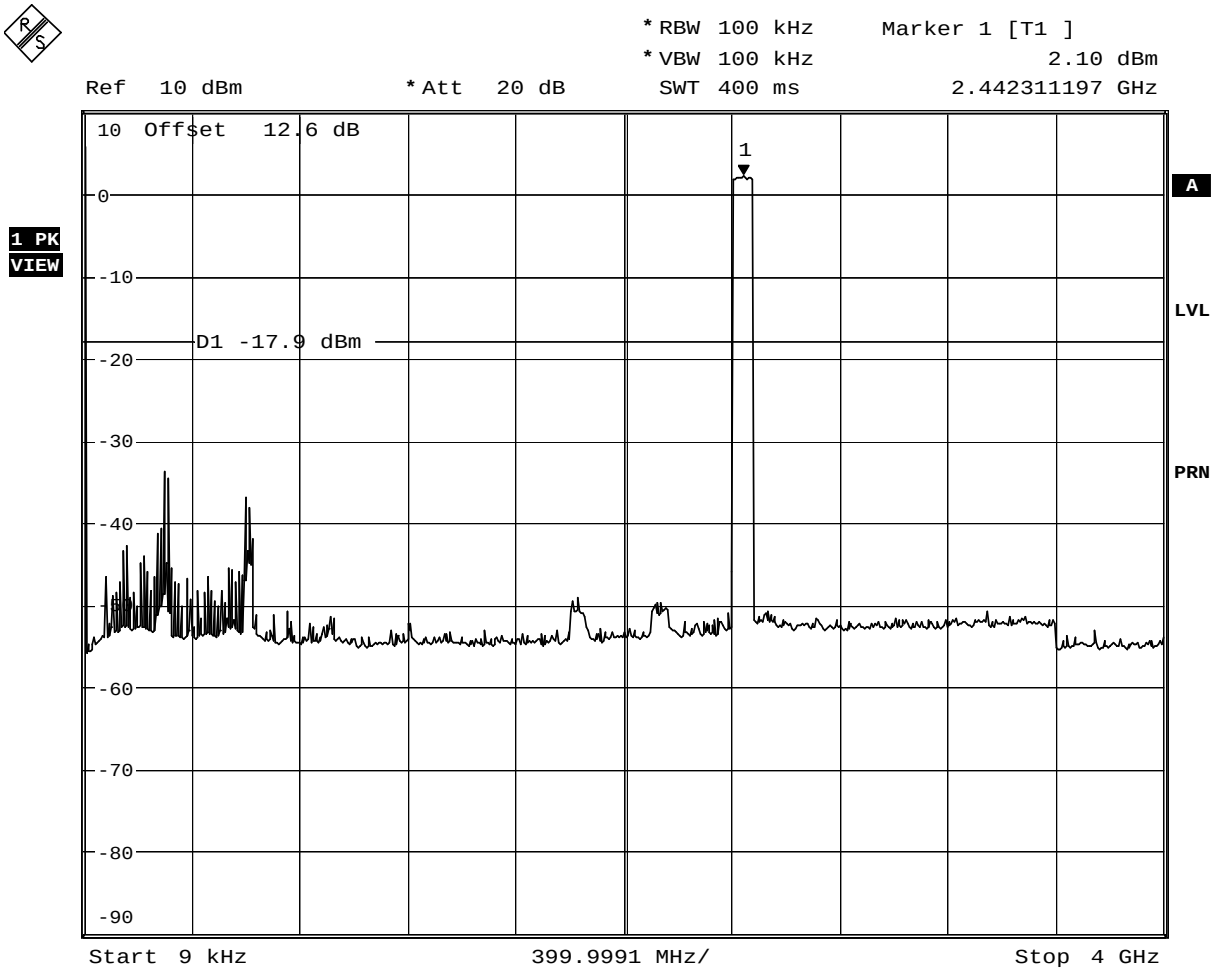
Date: 2.NOV.2005 13:23:14

Spurious Conducted Emissions (18GHz – 25GHz)

EUT Frequency Hopping on all Channels – Maximum Power DH1

2.10 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT

2.10.6 Test Results - continued



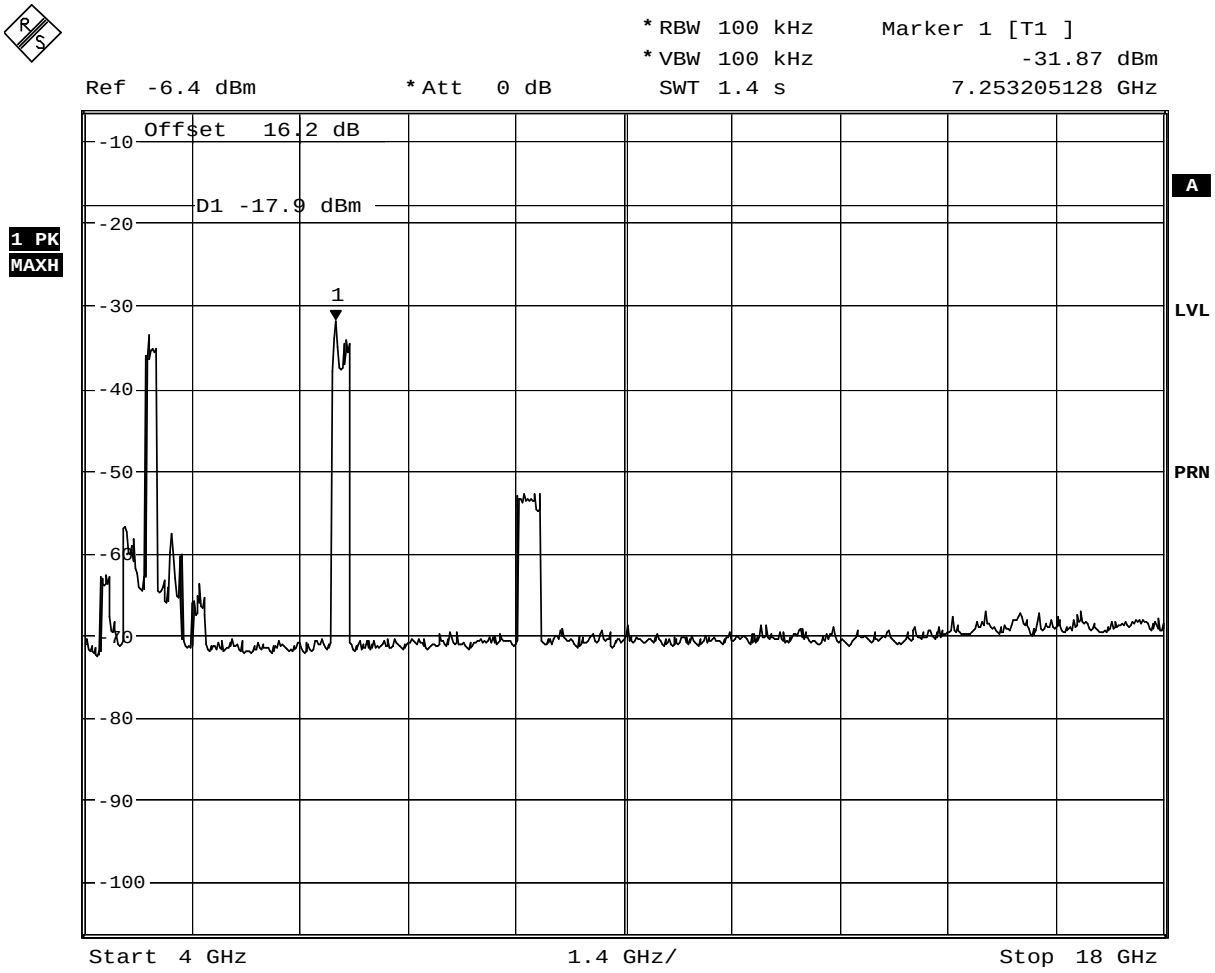
Date: 2.NOV.2005 12:08:01

Spurious Conducted Emissions (9kHz – 4GHz)

EUT Frequency Hopping on all Channels – Maximum Power DH3

2.10 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT

2.10.6 Test Results - continued



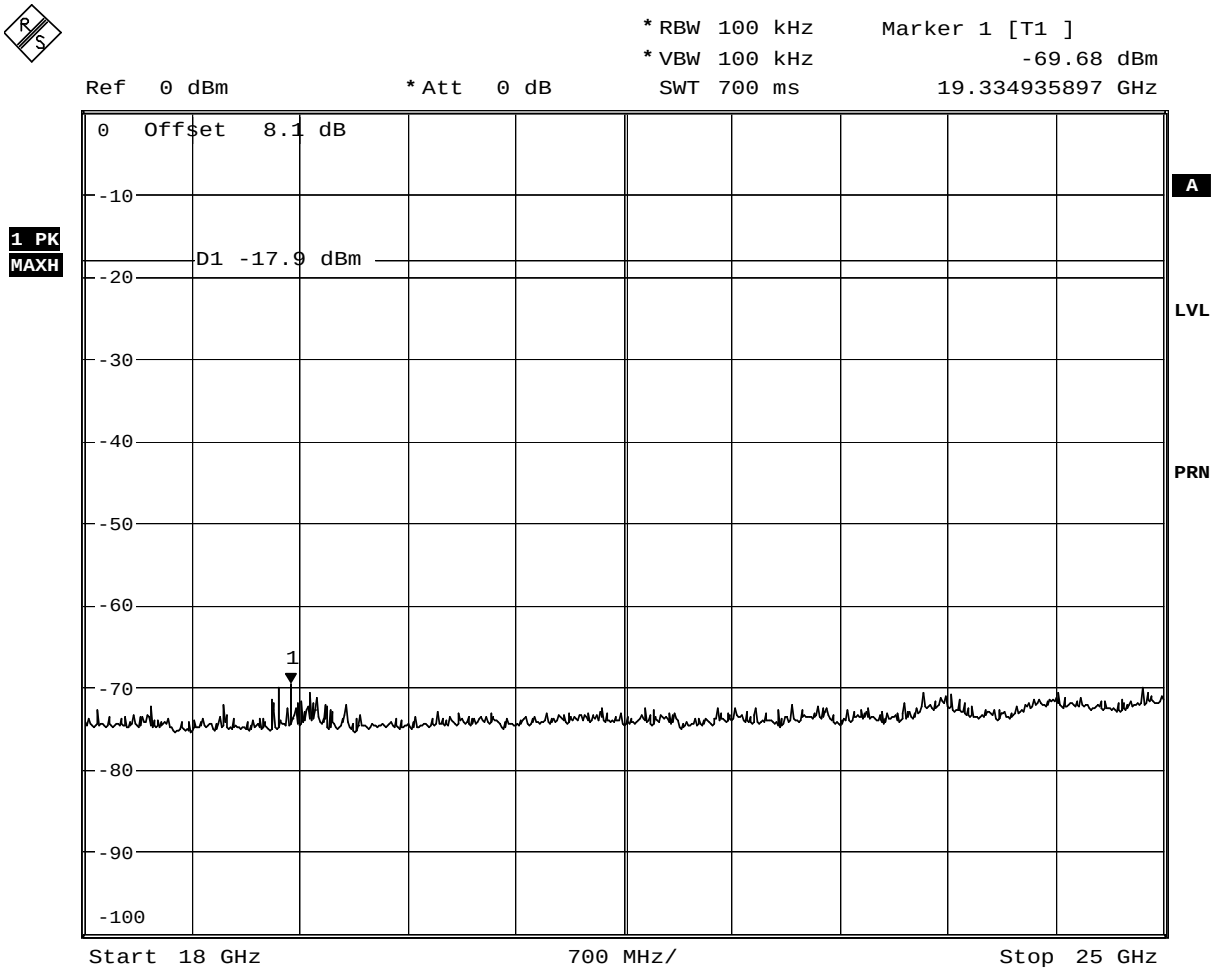
Date: 2.NOV.2005 12:51:37

Spurious Conducted Emissions (4GHz – 18GHz)

EUT Frequency Hopping on all Channels – Maximum Power DH3

2.10 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT

2.10.6 Test Results - continued



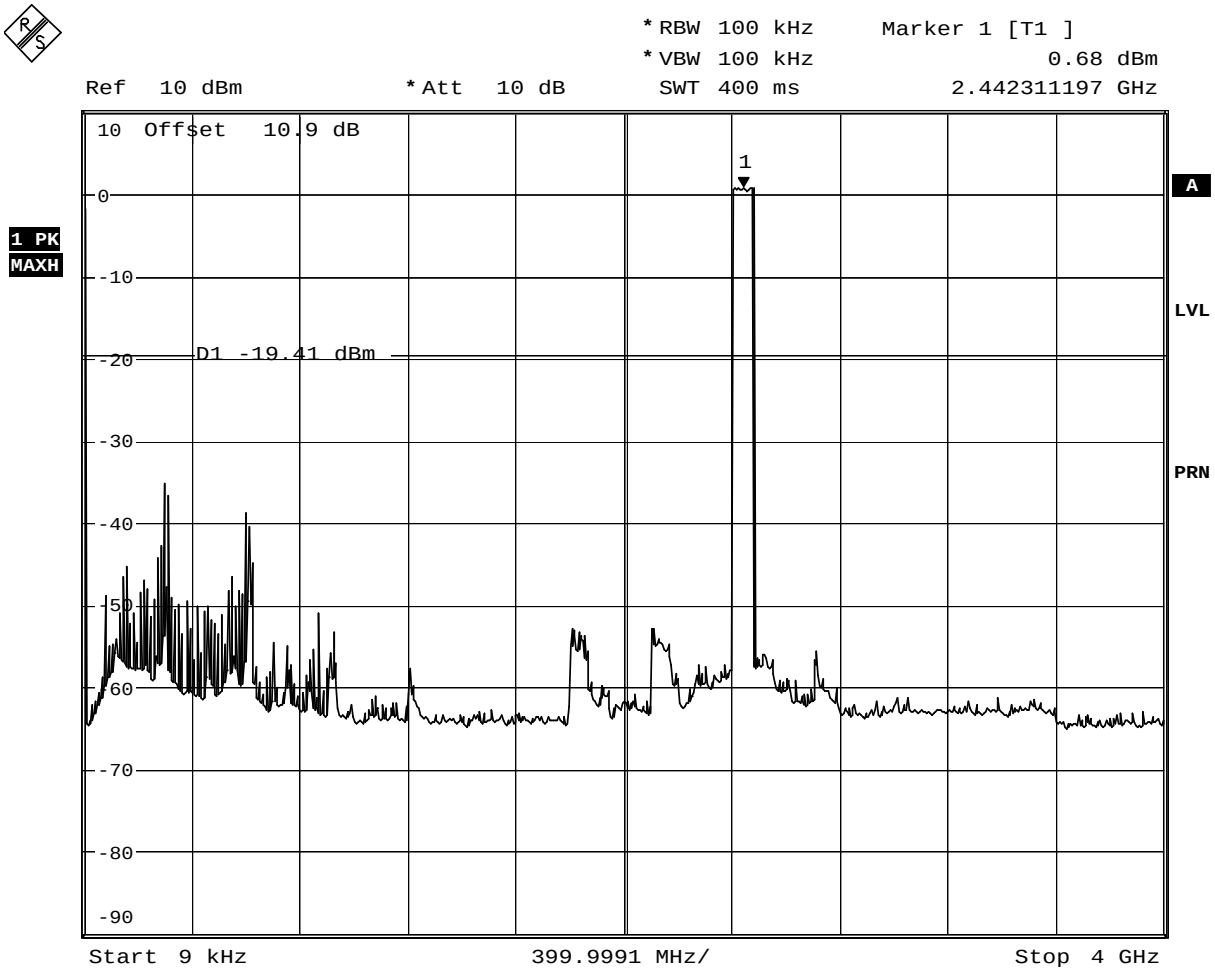
Date: 2.NOV.2005 13:19:08

Spurious Conducted Emissions (18GHz – 25GHz)

EUT Frequency Hopping on all Channels – Maximum Power DH3

2.10 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT

2.10.6 Test Results - continued



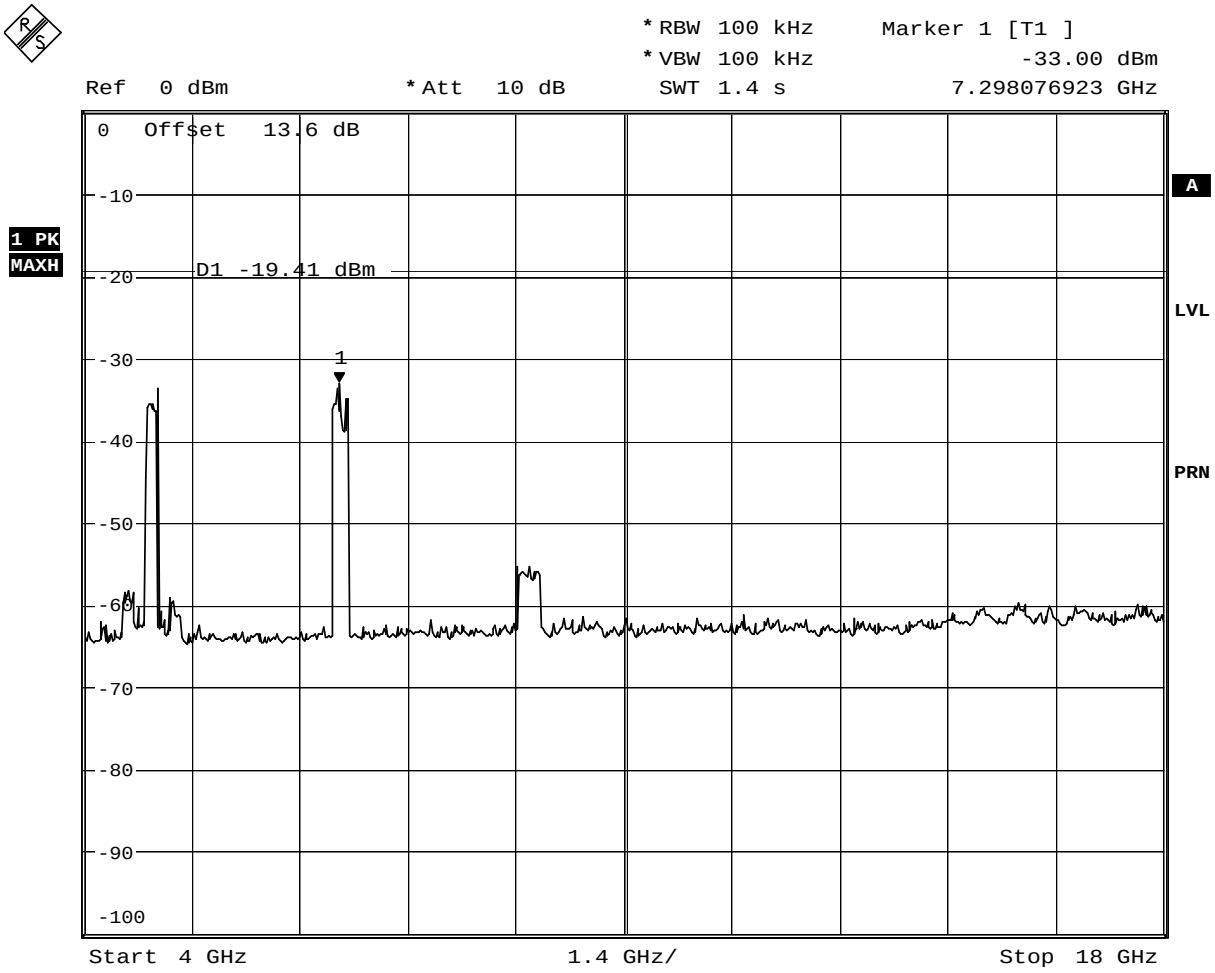
Date: 24.OCT.2005 15:16:24

Spurious Conducted Emissions (9kHz – 4GHz)

EUT Frequency Hopping on all Channels – Maximum Power DH5

2.10 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT

2.10.6 Test Results - continued



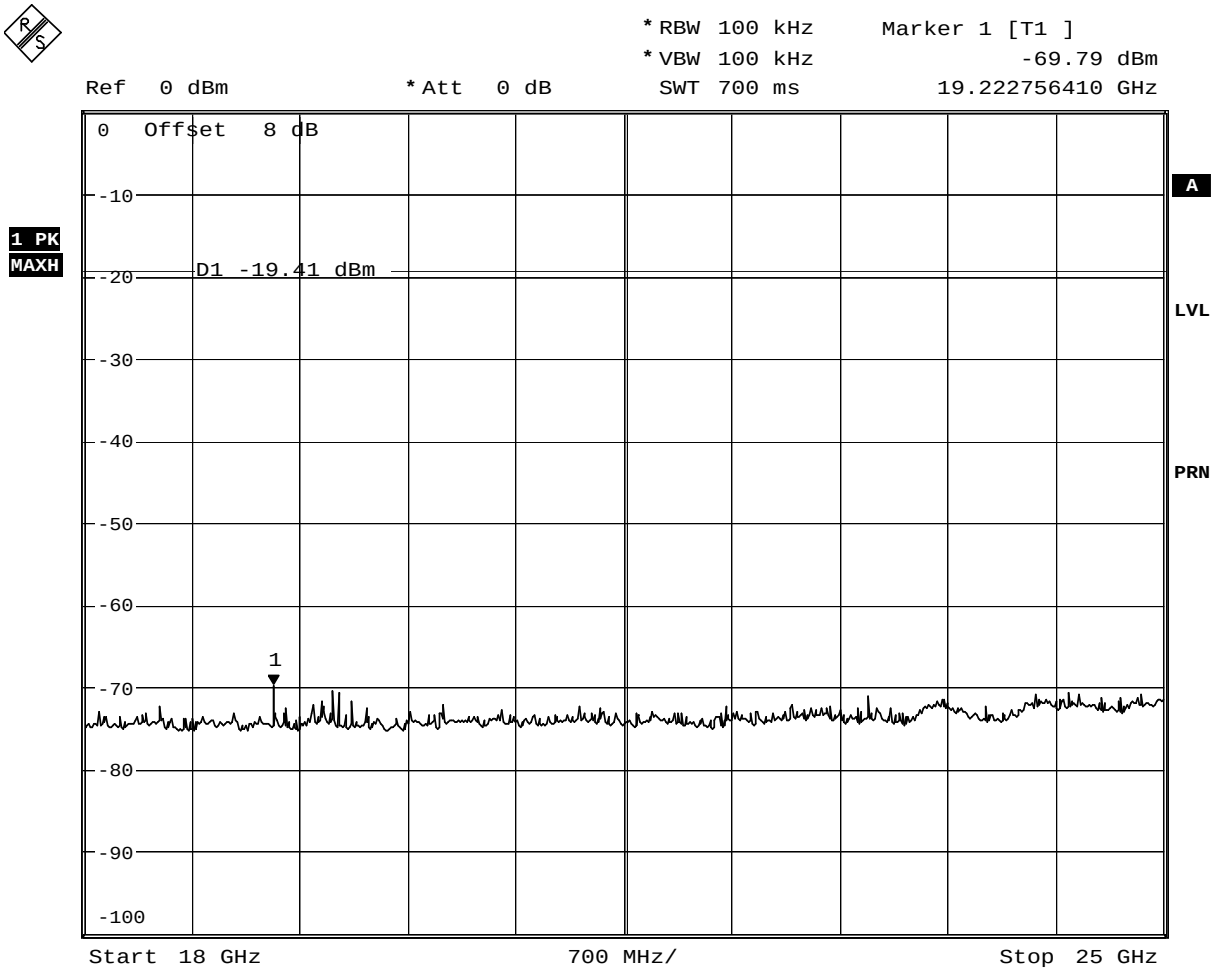
Date: 24.OCT.2005 15:22:45

Spurious Conducted Emissions (4GHz – 18GHz)

EUT Frequency Hopping on all Channels – Maximum Power DH5

2.10 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT

2.10.6 Test Results - continued



Date: 24.OCT.2005 15:09:51

Spurious Conducted Emissions (18GHz – 25GHz)

EUT Frequency Hopping on all Channels – Maximum Power DH5

2.11 SPURIOUS RADIATED EMISSIONS

2.11.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.247(c) and
Industry Canada Radio Standard RSS-210, A8.5 and 2.7, Table 2 and RSS-Gen 4.7

2.11.2 Equipment Under Test

LMX5452 Bluetooth Data Module: Serial Number 30

2.11.3 Date of Test

30th September 2005

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-212.

FCC CFR 47: Part 15 Subpart C, Section 15.247(c) and Industry Canada Radio Standard RSS-210, 6.2.2 (o)(e1), for Radiated Emissions also requires Sections 15.205, 15.209 and RSS-210, 2.7, Table 2 to be applied.

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 Anechoic Chamber (3 metres) 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 – 26GHz 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

2.11.5 Test Procedure - continued

The limits for Spurious Emissions Outside the Restricted Bands have been measured and calculated as shown in the table below:

Test Mode	Carrier Frequency GHz	Carrier Field Strength dBµV/m	Limit for Spurious Outside Restricted Band (Carrier F S –20dB) dBµV/m
(Bluetooth) Bottom	2402	98.5	78.5
(Bluetooth) Middle	2441	99.7	79.7
(Bluetooth) Top	2480	99.9	79.9

The limits for Spurious Emissions Inside the Restricted Bands are in accordance with 15.205(a) & (b) and RSS-210 Annex A Table 2, which call up the limits in 15.209 (a) and RSS-210, 2.7, Table 2.

Frequency Range MHz	Field Strength µV/m	Quasi Peak Field Strength dBµV/m	
30-88	100	40.0	
88-216	150	43.5	
216-960	200	46.0	
960-1000	500	54.0	
Above 1000	500	Average Field Strength dBµV/m	Peak Field Strength dBµV/m
		54.0	74.0

In accordance with FCC Public Notice DA 00-705, Released 30th March 2000, Section 15.247(c) Spurious Radiated Emissions "If the dwell time per channel of the hopping signal is less than 100ms, then the reading obtained with the 10Hz VBW may be further adjusted by a "duty cycle correction factor", derived from 20log(dwell time/100ms), in an effort to demonstrate compliance with the 15.209 limit the following adjustment has been calculated for use with Average Measurements only;

Dwell Time = 5.81ms this is derived from;

Total slot time per time slot for DH5 packet 625µs x 5 = 3.125ms

Actual transmit time during this time slot is 2.905ms and the reply time slot after each DH5 packet is 625µs.

Total time slot length per channel 3.125 + 0.625 = 3.75ms.

Multiply Total time slot length per channel by 32 channels per hop sequence
32 x 3.75 = 120ms

It is therefore possible to have a maximum of two hop sequences in any given 100ms period, a single channel could occur twice within any 100ms time window. 2 x 2.905 = 5.81ms

Therefore; the Bluetooth Duty Cycle Correction Factor for the EUT is
20 log (5.81/100) = -24.7dB

2.11 SPURIOUS RADIATED EMISSIONS

2.11.6 Test Results

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(c), 15.205 and 15.209 and Industry Canada Radio Standard RSS-210, A8.5 and 2.7, Table 2 and RSS-Gen 4.7 for Radiated Emissions (30MHz – 1GHz).

Measurements were made with the EUT in Bluetooth Mode (see Section 1.3.3 for details).

EUT Transmitting on Bottom Channel (2402MHz)

Emission Frequency	Polarisation	Height	Azimuth	Field Strength at 3m		Specification Limit	
MHz		cm	degree	dBµV/m	µV/m	dBµV/m	µV/m
39.0	Vertical	100	000	15.5	6.0	40.0	100.0
88.5	Vertical	108	080	19.5	9.4	43.5	150.0
90.7	Vertical	100	000	18.5	8.4	43.5	150.0
92.9	Vertical	100	067	25.1	18.0	43.5	150.0
95.8	Vertical	100	092	18.6	8.5	43.5	150.0
120.7	Vertical	100	092	18.7	8.6	43.5	150.0

EUT Transmitting on Middle Channel (2441MHz)

Emission Frequency	Polarisation	Height	Azimuth	Field Strength at 3m		Specification Limit	
MHz		cm	degree	dBµV/m	µV/m	dBµV/m	µV/m
39.1	Vertical	100	000	16.0	6.3	40.0	100.0
88.5	Vertical	100	077	20.1	10.0	43.5	150.0
90.7	Vertical	100	000	19.7	9.7	43.5	150.0
92.6	Vertical	100	072	24.8	17.4	43.5	150.0
96.0	Vertical	100	095	18.5	8.4	43.5	150.0
120.0	Vertical	100	095	18.3	8.2	43.5	150.0

* Any emissions which are related to the EUT's transmitter circuitry, that are outside of the Restricted Band of Operation, table (15.205 and Table 2) are compared against the Carrier F S –20dB limit as shown in 12.2.5.

2.11 SPURIOUS RADIATED EMISSIONS

2.11.6 Test Results - continued

30MHz - 1GHz Frequency Range

EUT Transmitting on Top Channel (2462MHz)

Emission Frequency	Polarisation	Height	Azimuth	Field Strength at 3m		Specification Limit	
MHz		cm	degree	dBµV/m	µV/m	dBµV/m	µV/m
38.5	Vertical	100	000	15.8	1.9	40.0	100.0
89.2	Vertical	100	070	19.8	9.8	43.5	150.0
91.0	Vertical	100	000	18.8	8.7	43.5	150.0
93.0	Vertical	100	068	25.3	18.4	43.5	150.0
94.8	Vertical	100	087	19.0	8.9	43.5	150.0
120.1	Vertical	100	087	18.4	8.3	43.5	150.0

* Any emissions which are related to the EUT's transmitter circuitry, that are outside of the Restricted Band of Operation, table (15.205 and Table 2) are compared against the Carrier F S –20dB limit as shown in 12.2.5.

2.11 SPURIOUS RADIATED EMISSIONS

2.11.6 Test Results - continued

1GHz - 26GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(c), 15.205 and 15.209 and Industry Canada Radio Standard RSS-210, A8.5 and 2.7, Table 2 and RSS-Gen 4.7 for Radiated Emissions (1GHz – 26GHz).

Measurements were made with the EUT in Bluetooth Mode (see Section 1.3.3 for details).

EUT Transmitting on Bottom Channel (2402MHz)

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
4.712	Horizontal	100	044	61.4	74.0	6.6*	54.0
4.804	Horizontal	100	044	66.7	74.0	32.1*	54.0
4.823	Vertical	100	000	58.9	74.0	6.3*	54.0

EIRP Results are only taken for frequencies that fall Outside the Restricted Band in accordance 15.247(c.)

Note: The Measurements in the above tables marked N/A are Not Applicable because the frequency does not fall within the Restricted Band (15.205 and Table 2) and hence Average Measurements are not required.

* Note these results have been corrected using the Bluetooth Duty Cycle Correction Factor for the EUT, as calculated on page 21 of this report

2.11 SPURIOUS RADIATED EMISSIONS

2.11.6 Test Results - continued

1GHz – 26GHz Frequency Range - continued

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(c), 15.205 and 15.209 and Industry Canada Radio Standard RSS-210, A8.5 and 2.7, Table 2 and RSS-Gen 4.7 for Radiated Emissions (1GHz – 26GHz).

EUT Transmitting on Middle Channel (2441MHz)

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
4.882	Horizontal	100	076	62.4	74.0	29.9*	54.0
4.890	Horizontal	100	076	54.1	74.0	7.1*	54.0
4.903	Horizontal	100	076	59.0	74.0	6.9*	54.0
7.322	Vertical	100	000	62.6	74.0	23.0*	54.0

EIRP Results are only taken for frequencies that fall Outside the Restricted Band in accordance 15.247(c.)

Note: The Measurements in the above tables marked N/A are Not Applicable because the frequency does not fall within the Restricted Band (15.205 and Table 2) and hence Average Measurements are not required.

* Note these results have been corrected using the Bluetooth Duty Cycle Correction Factor for the EUT, as calculated on page 21 of this report.

2.11 SPURIOUS RADIATED EMISSIONS

2.11.6 Test Results - continued

1GHz – 26GHz Frequency Range - continued

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(c), 15.205 and 15.209 and Industry Canada Radio Standard RSS-210, A8.5 and 2.7, Table 2 and RSS-Gen 4.7 for Radiated Emissions (1GHz – 26GHz).

EUT Transmitting on Top Channel (2480MHz)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz		cm	degree	dBµV/m	dBµV/m	dBµV/m	dBµV/m
4.960	Horizontal	105	106	61.3	74.0	28.7*	54.0
4.981	Horizontal	105	106	58.3	74.0	7.8*	54.0
7.439	Vertical	100	323	62.7	74.0	20.5*	54.0

* Measurement made at 1m, limit increased by 10dB.

EIRP Results are only taken for frequencies that fall Outside the Restricted Band in accordance 15.247(c.)

Note: The Measurements in the above tables marked N/A are Not Applicable because the frequency does not fall within the Restricted Band (15.205 and Table 2) and hence Average Measurements are not required.

* Note these results have been corrected using the Bluetooth Duty Cycle Correction Factor for the EUT, as calculated on page 21 of this report.

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

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

Instrument	Manufacturer	Type No	TE Number	Calibration Due
Section 2.1 Radio - Spurious Emissions				
Turntable Controller	Heinrich Diesel	HD050	22	TU
Bilog Antenna	Schaffner	CBL6143	287	12/11/2005
Screened Room 5	Rainford	Rainford	1545	01/03/2008
Mast Controller	Unknown	CO 1000	1606	TU
Turntable/Mast Controller	EMCO	2090	1607	TU
Emi Test Receiver	Rohde & Schwarz	ESIB26	2085	26/09/2006
Low Noise Amplifier	Miteq Corp	AMF-3d-001080-18-13P	231	TU
High Pass Filter	Sematron	F-100-4000-5-R	564	TU
2m Cable	Reynolds	262-0248-2000	2399	21/07/2006
Amplifier	Avantec	AWT-18036	2821	TU
Wideband Generator	Rohde & Schwarz	SWM 02	62	15/01/2006
Drg Antenna	EMCO	3115	34	14/04/2006
Spectrum Analyser	Rohde & Schwarz	FSEM	37	13/01/2006
Signal Generator	Hewlett Packard	ESG4000A	38	15/02/2006
Drg Antenna	EMCO	3115	795	15/11/2005
Climatic Chamber	Votsch	VT4002	161	21/10/2005
10dB Attenuator	Weinschel	23-10-34	470	11/07/2006
Spectrum Analyser	Hewlett Packard	8562A	14	19/05/2006
10dB Attenuator	Marconi	6534/3	1048	TU
2m Cable	Reynolds	262-0248-2000	2400	21/07/2006
Low Noise Amplifier	Miteq Corp	AMF-3d-001080-18-13P	231	TU
Drg Antenna	EMCO	3115	234	01/07/2006
Drg Antenna	EMCO	3115	235	01/07/2006
Horn Antenna	EMCO	3115	234	01/07/2006
Amplifier	Avantec	AWT-18036	2821	TU
Capacity Coupling Clamp	Omiran	EFTC 105	298	TU
Attenuator	Narda	4772-20	462	25/02/2006
Dual Psu	Thurlby	PL320	288	TU
Spectrum Analyser	Hewlett Packard	8542E	18	08/01/2006
Multimeter	Isotech	Iso Tech IDM101	2424	10/08/2006
Drg Antenna	EMCO	3115	235	01/07/2006
Signal Generator	Hewlett Packard	8673B	1124	25/05/2006
Log Periodic Antenna	EMCO	3146	25	14/10/2006
Biconical Antenna	Rohde & Schwarz	HUF-Z2	36	10/10/2006
Low Noise Amplifier	Miteq Corp	AMF-3d-001080-18-13P	231	TU
DVM	Fluke	75-Mk3	455	14/01/2006
Spectrum Analyser	Agilent	E7405A	1410	06/05/2006
Power Supply Unit	Farnell	LT30-2	160	TU

3.1 TEST EQUIPMENT USED

Instrument	Manufacturer	Type No	TE Number	Calibration Due
Section 2.1 Radio - Spurious Emissions				
Signal Generator	Rohde & Schwarz	SMR40	1589	18/09/2006
1m Cable	Reynolds	262-0248-1000	2407	21/07/2006
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	16/12/2005
DC Power Supply Unit	Farnell	LT30-1	615	TU
Power Supply Unit	Farnell	LT30-2	160	TU
2m Cable	Reynolds	262-0248-2000	2399	21/07/2006
Multimeter	Isotech	Iso Tech IDM101	2424	10/08/2006
Emi Test Receiver	Rohde & Schwarz	ESIB40	1006	07/03/2006
High Pass Filter	RLC Electronics	F-100-4000-5-R	2773	16/05/2006
10dB Attenuator	Weinschel	23-10-34	470	11/07/2006
Spectrum Analyser	Agilent	E7405A	1410	06/05/2006
Climatic Chamber	Votsch	VT4002	161	21/10/2005
Signal Generator	Rohde & Schwarz	SMR 40	1002	25/10/2005
Section 2.11 - Radiated Emission Tests			Emc/Inv Number	
Spectrum Analyser	Hewlett Packard	8542E	2286	08/01/2006
Bilog Antenna	Schaffner	CBL6143	2965	12/11/2005
Emi Receiver	Rohde & Schwarz	ESIB 40	3138	11/08/2006
Low Noise Amplifier	Miteq Corp	AMF-3d-001080-18-13P	2457	TU
Amplifier	Avanteck	AWT-18036	1081	26/06/2005
Signal Amplifier	Avanteck	AMT-26177-33	2072	25/06/2005
Drg Antenna	Emco	3115	2297	01/07/2006
Drg Antenna	Emco	3115	2397	01/07/2006
Drg Horn Antenna	Link Microtek Ltd	AM180HA-K-TU2	2945	24/06/2006
High Pass Filter	Rlc Electronics	F-100-3000-5-R	Inv 4969	10/03/2005
Wideband Generator	Rohde & Schwarz	SWM 02	Inv 2477	15/01/2006
Section 2.10 - Conducted Emission Tests			Emc/Inv Number	
10dB Attenuator	Marconi	6534/3	1494	TU
Spectrum Analyser	Rohde & Schwarz	EZM	1416	TU
LISN	Rohde & Schwarz	ESH2-Z5	1584	12/10/2005
Transient Limiter	Hewlett Packard	11947A	2243	06/06/2006
Section 2.6 Radio (Tx) - Occupied Bandwidth				
Emi Test Receiver	Rohde & Schwarz	ESIB40	1006	07/03/2006
10dB Attenuator	Weinschel	23-10-34	470	11/07/2006
2m Cable	Reynolds	262-0248-2000	2399	21/07/2006
Multimeter	Isotech	Iso Tech IDM101	2424	10/08/2006
Power Supply Unit	Farnell	LT30-2	160	TU

3.2 MEASUREMENT UNCERTAINTY

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

Test Discipline	Frequency / Parameter	MU
Channel Occupancy/Separation	19.1kHz	N/A
Maximum Output Power	Not Applicable	±0.5dB
Number of Channels	Not Applicable	N/A
20dB Bandwidth	19.1kHz	±0.5dB
Radiated Emissions, Bilog Antenna, AOATS	30MHz to 1GHz Amplitude	5.1dB*
Radiated Emissions, Horn Antenna, AOATS	1GHz to 40GHz Amplitude	6.3dB*
Conducted Emissions, LISN	150kHz to 30MHz Amplitude	3.2dB*

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

* In accordance with CISPR 16-4
† In accordance with UKAS Lab 34

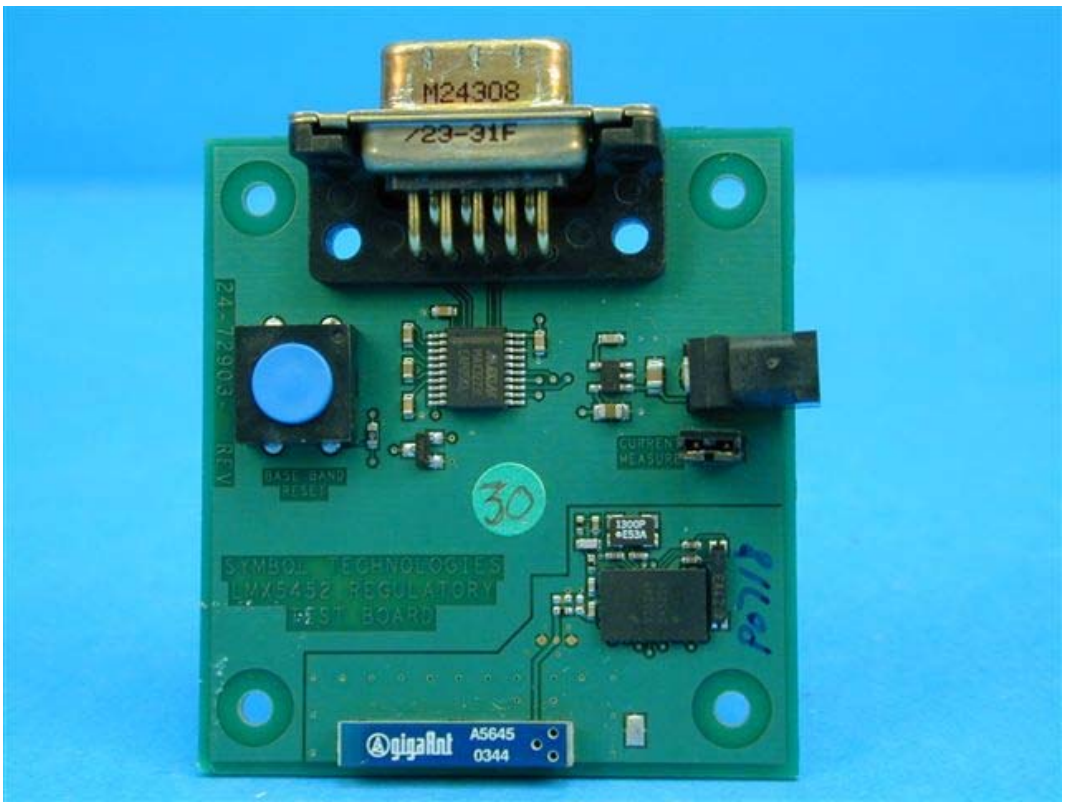
SECTION 4

PHOTOGRAPHS

4.1 PHOTOGRAPH OF EQUIPMENT UNDER TEST (EUT)

Photograph of Front of System

4.1 PHOTOGRAPH OF EQUIPMENT UNDER TEST (EUT)



Photograph of top of EUT

4.1 PHOTOGRAPH OF EQUIPMENT UNDER TEST (EUT)

Photograph of Bottom of EUT

4.1 PHOTOGRAPH OF EQUIPMENT UNDER TEST (EUT)

Photograph of PSU Label

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 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.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).

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