REPORT ON

FCC CFR 47: Parts 15 B, C and E Testing in support of an Application for Grant of Equipment Authorisation of a Symbol 802.11a/b/g RLAN Module
(2400-2483.5MHz, 5150-5250MHz, 5250-5350MHz and 5725-5830MHz)

FCC ID: H9P2121160

Report No OR611511/02 Issue 4 September 2004

TÜV PRODUCT SERVICE

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REPORT ON Limited FCC CFR 47: Parts 15 B, C and E Testing in support of an Application for Grant of Equipment Authorisation of a Symbol 802.11a/b/g RLAN Module (2400-2483.5MHz, 5150-5250MHz, 5250-5350MHz and 5725-5830MHz)

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September 2004

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DATED 24-09-04 24-09-04

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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, C & E. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineers;

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0141 Group

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SECTION 1

REPORT SUMMARY

Limited FCC CFR 47: Parts 15 B, C and E Testing in support of an
Application for Grant of Equipment Authorisation
of a Symbol 802.11a/b/g RLAN Module
(2400-2483.5MHz, 5150-5250MHz, 5250-5350MHz and 5725-5830MHz)

1.1 STATUS

EQUIPMENT UNDER TEST	802.11a/b/g RLAN 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 Inc One Symbol Plaza Holtsville 11742-1300, New York United States of America
TYPE NUMBER	21-21160
PART NUMBER	21-21160-01
SERIAL NUMBERS	TH4290335, TH4290281, TH4290339, and TH4290078
HARDWARE VERSION	Rev 3.5
DECLARED VARIANTS	21-1160-02
TEST SPECIFICATION ISSUE/DATE	FCC CFR 47: Part 15, Subparts B, C and E October 2003
NUMBER OF ITEMS TESTED	Three
SECURITY CLASSIFICATION OF EUT	Commercial In Confidence
INCOMING RELEASE DATE	Declaration of Build Status
DISPOSAL REFERENCE NUMBER DATE	Held pending disposal Not Applicable Not Applicable
ORDER NUMBER DATE	USI 2000282857 18th March 2004
START OF TEST	19th July 2004
FINISH OF TEST	23rd August 2004
RELATED DOCUMENTS	ANSI C63.4 2001. Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz. FCC Public Notice document (DA 00-705 released 30 March 2000)

1.2 INTRODUCTION

This report is Issue 4 and has been produced to include clarification of the limited tests performed on the 5.15-5.25GHz and 5.25-5.35GHz Frequency Bands that was not included in the original test report; this report supersedes the previous report OR611511/02 Issue 3.

The information contained within this report is intended to show verification of compliance of the Symbol Technologies Inc 802.11a/b/g RLAN Module to the requirements of FCC Specification Parts 15 B, C and E for frequency bands 2400-2483.5MHz, 5150-5250MHz, 5250-5350MHz and 5725-5830MHz.

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

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The device supplied for testing was a 21-21160-01 RF Module, which offers 2.4GHz and 5GHz wireless local area network connectivity employing IEEE 802.11a/b/g technologies.

Variant 21-21160-02
The device is identical to that above, employing the same circuitry and same RF design. The only difference being, the PCB has cutouts and the antenna connection point is on the reverse side of the PCB.

BABT Chief Engineer Mr. Chris Gould examined both the 21-21160-01 and 21-21160-02 Radio Cards. It was determined that both cards are identical in respect of component placement and tracking and that the cards differ only in respect of the physical mounting arrangements.

The 21-21160-01 variant utilises a circuit board, which incorporates retained “snap off” mounting ears. For the 21-21160-02 variant the mounting ears are “snapped off”.

It is considered that the 21-21160-02 variant would not emit any more interference, nor be any more susceptible to interference than the 21-21160-01 variant.

It is therefore concluded that if the EMC/RF performance of the 21-21160-01 variant is satisfactory that the 21-21160-02 can be deemed to be satisfactory on the grounds of similarity.

1.3.2 Modes of Operation

Prior to testing it was agreed with the TCB that to expedite testing it was acceptable to reduce the amount of frequencies to be tested.
It was agreed with the TCB that as the EUT operates from 5.15-5.35GHz, it was acceptable to reduce testing by performing near top & bottom of each individual band e.g. 5.15-5.25GHz (test at 5.18 & 5.24GHz) and 5.25-5.35GHz (test at 5.26 & 5.32GHz). Further, the TCB took into account that the total frequency range of the two bands combined is only 200kHz wide.

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 PRODUCT INFORMATION - continued

1.3.3 Test Configuration

1.3.3.1 802.11 RLAN Mode

The EUT is capable of using either 802.11b (11Mbps) or 802.11g (54Mbps), all emissions testing was performed using 802.11b modulation (11Mbps), as this was considered to be the worst case by Symbol Technologies. All other tests were carried out using both 802.11b (11Mbps) and 802.11g (6Mbps), as these were considered to be the worst case by Symbol Technologies

802.11b/g RLAN Transmitting on the following channels and frequencies;
Channel 1: 2412MHz
Channel 6: 2437MHz
Channel 11: 2462MHz
The Output Power level (controlled by application software) was set to +17.5dBm

802.11b/g RLAN Receiving on the following channels and frequencies;
Channel 1: 2412MHz
Channel 6: 2437MHz
Channel 11: 2462MHz

1.3.3.2 U-NII Bands I & II Mode
The EUT is capable of using 802.11a modulation (54Mbps); all testing was performed using 802.11a modulation (6Mbps), as this was considered to be the worst case by Symbol Technologies.

802.11a RLAN Transmitting on the following channels and frequencies;
Channel 36: 5180MHz
Channel 48: 5240MHz
Channel 52: 5260MHz
Channel 64: 5320MHz
The Output Power level (controlled by application software) was set to +16dBm

802.11a RLAN Receiving on the following channels and frequencies;
Channel 36: 5180MHz
Channel 48: 5240MHz
Channel 52: 5260MHz
Channel 64: 5320MHz

1.3.3.3 U-NII Band III & ISM Band Mode
The EUT is capable of using 802.11a modulation (54Mbps); all testing was performed using 802.11a modulation (6Mbps), as this was considered to be the worst case by Symbol Technologies.

802.11a RLAN Transmitting on the following channels and frequencies;
Channel 149 5745MHz
Channel 161: 5805MHz
Channel 166: 5830MHz
The Output Power level (controlled by application software) was set to +16dBm

802.11a RLAN Receiving on the following channels and frequencies;
Channel 149 5745MHz
Channel 161: 5805MHz
Channel 166: 5830MHz

1.3.4 DECLARATION OF BUILD STATUS

EUT	
MANUFACTURERS DESCRIPTION	802.11a/b/g RLAN Module
MANUFACTURER	Symbol Technologies
TYPE NUMBER	21-21160
VARIANT	21-21160-01
SERIAL NUMBER	TH4290335, TH4290281, TH4290339, TH4290073, TH4290282 and TH4290078
HARDWARE VERSION	Rev 3.5
TRANSMITTER OPERATING RANGE	2.4-2.4835 & 5.150-5.350, 5.470-5.725, 5.725-5.875GHz
COUNTRY OF ORIGIN	Taiwan
RECEIVER OPERATING RANGE	2.4-2.4835 & 5.150-5.350, 5.470-5.725, 5.725-5.875GHz
RX INTERMEDIATE FREQUENCIES	Not Applicable (Zero IF)
ITU DESIGNATION OF EMISSION	11M0F1D for DSSS & 20M0D2D for OFDM
MODULATION	DSSS & OFDM
RF POWER	100mW MAX EIRP for 2.4 and 5GHz.
FCC ID	H9P2121160
INDUSTRY CANADA ID	1549D-2121160
TECHNICAL DESCRIPTION	The device supplied for testing was a RF Module, which offers 2.4GHz and 5GHz wireless local area network connectivity employing IEEE 802.11a/b/g technologies.
DECLARED VARIANTS	
MANUFACTURERS DESCRIPTION	802.11a/b/g RLAN Module
MANUFACTURER	Symbol Technologies
TYPE NUMBER	21-21160
VARIANT	21-21160-02
TECHNICAL DESCRIPTION	The device is identical to that above, employing the same circuitry and same RF design. The only difference being, the PCB has cutouts and the antenna connection point is on the reverse side of the PCB.
POWER SUPPLY	
VOLTAGE	RLAN Module Powered by Host. Supply Voltage 3.1-3.6V

Signature 

Date 24th August 2004

D of B S Serial No OS611511_ Issue 4

The unit used for the internal photographs in this report was not the EUT, but was supplied as an identical unit for photographs only. It is declared as being the same build status as the EUT.

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.

2.4GHz RLAN Band

Test	Spec Clause	Test Description	Result	Levels/ Comments
2.1	15.109	Spurious Radiated Emissions	Pass	
2.4	15.205	Measurement at Band Edge	Pass	
2.5	15.207	Spurious Conducted Emissions on Power Lines	Pass	
2.6	15.247(a)(2)	6dB Bandwidth	Pass	
2.7	15.247(b)(3)	Maximum Peak Output Power (Conducted)	Pass	
2.8	15.247(c)	Spurious Conducted Emissions on Antenna Port	Pass	
2.9	15.247(c)	Spurious Radiated Emissions	Pass	
2.10	15.247(d)	Peak Power Spectral Density	Pass	

1.4 BRIEF SUMMARY OF RESULTS - continued

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

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

5.15GHz – 5.25GHz and 5.25GHz-5.35GHz – U-NII Bands I & II

Test	Spec Clause	Test Description	Result	Levels/ Comments
2.2	15.109	Spurious Radiated Emissions	Pass	
2.11	15.407(a)(1)	Peak Power Spectral Density	Pass	
2.12	15.407(a)(1)(2)(3)	Peak Output Power	Pass	
2.13	15.407(a)(1)(2)(3)	Emission Bandwidth	Pass	
2.14	15.407(a)(6)	Peak Excursion	Pass	
2.15	15.407(b)(1)(2)(3)(5)(6)	Spurious Radiated Emissions	Pass	
2.16	15.407(b)(5)	Spurious Conducted Emissions on Power Lines	Pass	
2.17	15.407(b)(6) & 15.205	Measurement at the Band Edge	Pass	
2.18	15.407(b)(1)(2)(3)	Conducted Emission	Pass	
2.19	2.1055, 15.407(g)	Frequency Stability Under Temperature Variations	Pass	

1.4 BRIEF SUMMARY OF RESULTS - continued

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

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

5725MHz – 5825MHz – U-NII Band III

Test	Spec Clause	Test Description	Result	Levels/ Comments
2.3	15.109	Spurious Radiated Emissions	Pass	
2.20	15.407(a)(1)	Peak Power Spectral Density	Pass	
2.21	15.407(a)(1)(2)(3)	Peak Output Power	Pass	
2.22	15.407(a)(1)(2)(3)	Emission Bandwidth	Pass	
2.23	15.407(a)(6)	Peak Excursion	Pass	
2.24	15.407(b)(1)(2)(3)(5)(6)	Spurious Radiated Emissions	Pass	
2.25	15.407(b)(5)	Spurious Conducted Emissions on Power Lines	Pass	
2.26	15.407(b)(1)(2)(3)	Conducted Emission	Pass	
2.27	2.1055, 15.407(g)	Frequency Stability Under Temperature Variations	Pass	

1.5 OPINIONS AND INTERPRETATIONS

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

1.6 TEST CONDITIONS

The EUT was set-up simulating a typical user installation on the Alternative Open Field Test Site identified in Appendix A and tested in accordance with the applicable specification.

For all tests, the Symbol 802.11a/b/g RLAN Module was powered by the Host Terminal.

1.7 DEVIATIONS FROM THE STANDARD

Limited tests were applied see Section 1.3.2 Modes of Operation and Section 1.4 Brief Summary of Results.

1.8 MODIFICATION RECORD

Not Applicable.

1.9 ALTERNATIVE TEST SITE

No alternative test site was used.

SECTION 2

TEST DETAILS

2.4GHz RLAN BAND

Limited FCC CFR 47: Part 15 B Testing in support of an
Application for Grant of Equipment Authorisation
of a Symbol 802.11a/b/g RLAN Module

2.1 SPURIOUS RADIATED EMISSIONS

2.1.1 Specification Reference

FCC CFR 47: Part 15 Subpart B, Section 15.109

2.1.2 Equipment Under Test

802.11 a/b/g RLAN Module

2.1.3 Date of Test

21st July 2004

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.

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 – 40GHz were then formally measured using Peak and Average Detectors, as appropriate.

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

Symbol declared that the highest frequency generated within the EUT was 10GHz and therefore testing to 15.109 was carried out to 40GHz.

2.1 SPURIOUS RADIATED EMISSIONS - continued

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 for Spurious Radiated Emissions (30MHz – 1GHz).

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

EUT Rx on Middle Channel (2437MHz)

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	Horizontal/ Vertical	cm	degree	dBµV/m	µV/m	dBµV/m	µV/m
99.4	V	163	263	27.1	22.6	43.5	150.0
99.5	H	230	189	29.5	29.9	43.5	150.0
147.5	H	193	193	27.2	23.0	43.5	150.0
425.2	H	206	182	33.5	47.3	46.0	200.0
440.0	H	221	158	31.6	38.8	46.0	200.0
480.0	H	204	156	31.8	38.9	46.0	200.0

The EUT met the requirements of FCC CFR 47: Part 15 Subpart B, Section 15.109 for Spurious Radiated Emissions (1GHz – 40GHz).

Measurements were made with the EUT in 2.4GHz RLAN Mode (see Section 1.3.3 for details).

EUT Rx on Middle Channel (2437MHz)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
1.040	H	100	295	47.3	74.0	40.9	54.0
19.496*	V	106	153	62.1	84.0	57.0	64.0

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

SECTION 2

TEST DETAILS

5.15GHz-5.25GHz and 5.25GHz-5.35GHz – U-NII Bands I & II

Limited FCC CFR 47: Parts 15 B Testing in support of an
Application for Grant of Equipment Authorisation
of a Symbol 802.11a/b/g RLAN Module

2.2 SPURIOUS RADIATED EMISSIONS

2.2.1 Specification Reference

FCC CFR 47: Part 15 Subpart B, Section 15.109

2.2.2 Equipment Under Test

802.21 a/b/g RLAN Module

2.2.3 Date of Test

21st July 2004

2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.2” within the Test Equipment Used table shown in Section 3.1.

2.2.5 Test Procedure

Test Performed in accordance with ANSI C63.4.

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 – 40GHz were then formally measured using Peak and Average Detectors, as appropriate.

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

Symbol declared that the highest frequency generated within the EUT was 10GHz and therefore testing to 15.109 was carried out to 40GHz.

2.2 SPURIOUS RADIATED EMISSIONS - continued

2.2.6 Test Results

Equipment Designation: Unintentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart B, Section 15.109 for Spurious Radiated Emissions (30MHz – 1GHz).

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

EUT Rx on Middle Channel (5240MHz)

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	Horizontal/ Vertical	cm	degree	dBµV/m	µV/m	dBµV/m	µV/m
99.8	h	184	200	28.9	27.9	43.5	150.0
147.5	H	200	200	26.3	20.7	43.5	150.0
160.0	H	129	191	26.1	20.2	43.5	150.0
440.0	H	201	163	30.9	35.1	46.0	200.0
480.0	H	199	160	32.0	39.8	46.0	200.0
800.0	H	163	222	30.1	32.0	46.0	200.0

The EUT met the requirements of FCC CFR 47: Part 15 Subpart B, Section 15.109 for Spurious Radiated Emissions (1GHz –40GHz).

Measurements were made with the EUT in 2.4GHz RLAN Mode (see Section 1.3.3 for details).

EUT Rx on Middle Channel (5240MHz)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
1.040	H	100	294	48.2	74.0	41.7	54.0
20.960*	V	100	300	61.9	84.0	54.7	64.0

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

SECTION 2

TEST DETAILS

5.15GHz-5.25GHz and 5.25GHz-5.35GHz – U-NII Bands I & II

Limited FCC CFR 47: Parts 15 B Testing in support of an
Application for Grant of Equipment Authorisation
of a Symbol 802.11a/b/g RLAN Module

2.3 SPURIOUS RADIATED EMISSIONS

2.3.1 Specification Reference

FCC CFR 47: Part 15 Subpart B, Section 15.109

2.3.2 Equipment Under Test

802.11 a/b/g RLAN Module

2.3.3 Date of Test

21st July 2004

2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.3” within the Test Equipment Used table shown in Section 3.1.

2.3.5 Test Procedure

Test Performed in accordance with ANSI C63.4.

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 – 40GHz were then formally measured using Peak and Average Detectors, as appropriate.

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

Symbol declared that the highest frequency generated within the EUT was 10GHz and therefore testing to 15.109 was carried out to 40GHz.

2.3 SPURIOUS RADIATED EMISSIONS - continued

2.3.6 Test Results

Equipment Designation: Unintentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart B, Section 15.109 for Spurious Radiated Emissions (30MHz – 1GHz).

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

EUT Rx on Middle Channel (5600MHz)

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	Horizontal/ Vertical	cm	degree	dBµV/m	µV/m	dBµV/m	µV/m
99.8	H	179	198	29.3	29.2	43.5	150.0
147.4	H	183	179	26.8	21.9	43.5	150.0
160.0	H	130	198	25.9	19.7	43.5	150.0
186.9	H	170	204	25.3	18.4	43.5	150.0
440.0	H	212	172	30.0	31.6	46.0	200.0
480.0	H	184	160	30.5	33.5	46.0	200.0

The EUT met the requirements of FCC CFR 47: Part 15 Subpart B, Section 15.109 for Spurious Radiated Emissions (1GHz –40GHz).

Measurements were made with the EUT in 2.4GHz RLAN Mode (see Section 1.3.3 for details).

EUT Rx on Middle Channel (5600MHz)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
1.040	V	101	071	47.0	74.0	40.1	54.0
22.400*	V	101	267	63.4	84.0	57.6	64.0

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

SECTION 2

TEST DETAILS
2.4GHz RLAN BAND

Limited FCC CFR 47: Parts 15 C Testing in support of an
Application for Grant of Equipment Authorisation
of a Symbol 802.11a/b/g RLAN Module

2.4 MEASUREMENT AT THE BAND EDGE (MARKER DELTA METHOD)

2.4.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.205

2.4.2 Equipment Under Test

802.41a/b/g RLAN Module

2.4.3 Date of Test

23rd July 2004

2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.4” within the Test Equipment Used table shown in Section 3.1.

2.4.5 Test Procedure

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

2.4 MEASUREMENT AT THE BAND EDGE (MARKER DELTA METHOD) - continued

2.4.6 Test Results

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.205 for Band Edge Measurements.

Measurements were made with the EUT in RLAN 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	H/V	cm	deg	dBµV/m	dBµV/m
2412	V	100	264	111.6	103.4

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 = 55.99dB

Step 3

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

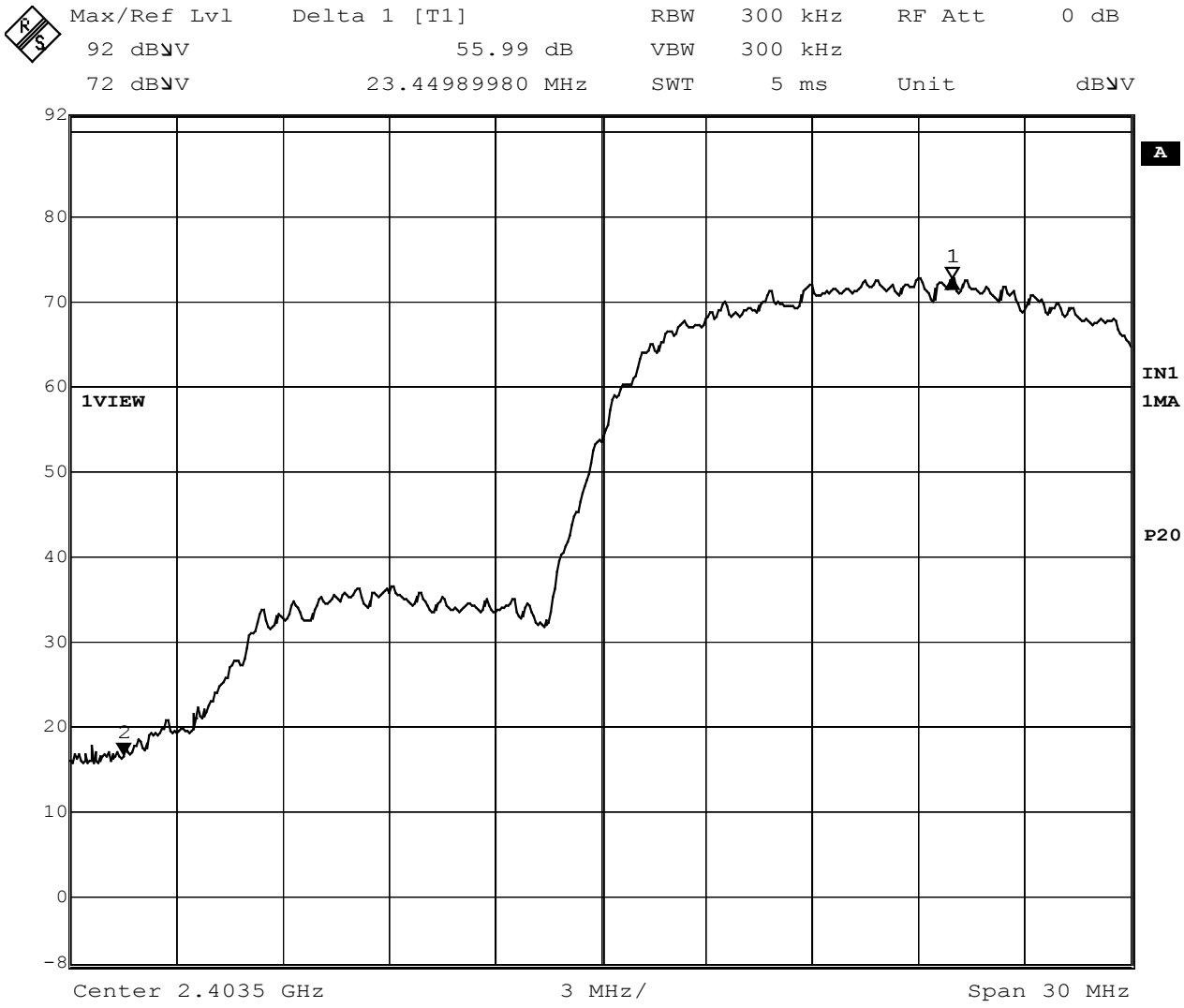
Peak of 55.6dBµV/m (Limit is 74.0dBµV/m)

Average of 47.4dBµV/m (Limit is 54.0dBµV/m)

2.4 MEASUREMENT AT THE BAND EDGE (MARKER DELTA METHOD) - continued

2.4.6 Test Results - continued

Plot for Bottom Channel 2412MHz



2.4 MEASUREMENT AT THE BAND EDGE (MARKER DELTA METHOD) - continued

2.4.6 Test Results - continued

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.205 for Band Edge Measurements.

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

Step 1

Top Channel 2462MHz

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	H/V	cm	deg	dBµV/m	dBµV/m
2462	V	263	77.49	112.2	104.3

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 = 53.38dB

Step 3

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

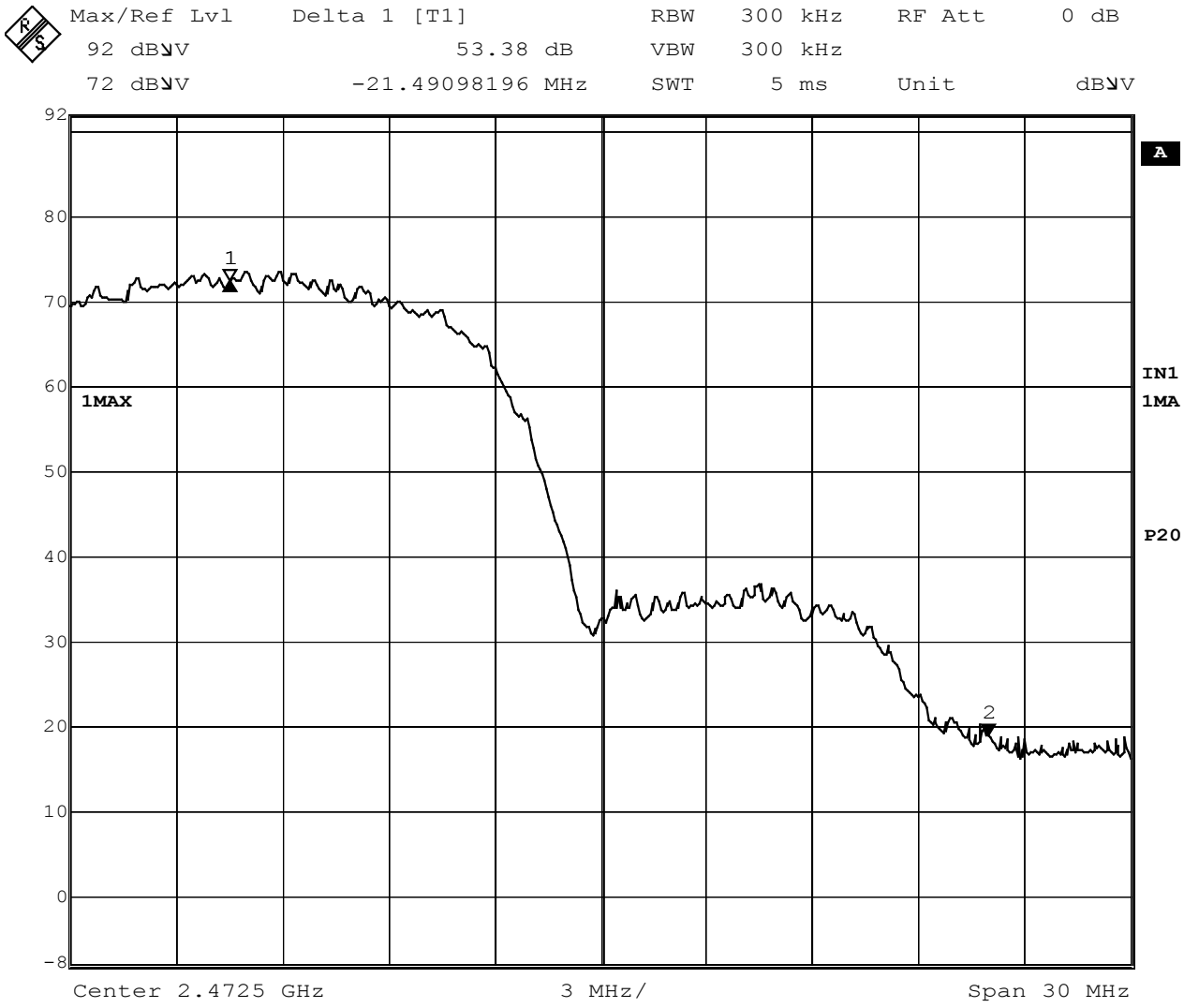
Peak of 58.8dBµV/m (Limit is 74.0dBµV/m)

Average of 50.9dBµV/m (Limit is 54.0dBµV/m)

2.4 MEASUREMENT AT THE BAND EDGE (MARKER DELTA METHOD) - continued

2.4.6 Test Results - continued

Plot for Top Channel 2462MHz



2.5 CONDUCTED EMISSIONS ON POWER LINES

2.5.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.207

2.5.2 Equipment Under Test

802.11a/b/g RLAN Module

2.5.3 Date of Test

3rd August 2004

2.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.5” within the Test Equipment Used table shown in Section 3.1.

2.5.5 Test Procedure

Test performed in accordance with ANSI C63.4.

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 on the following pages.

The Conducted Emissions Measurements were made on the Host Laptop.

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

2.5 CONDUCTED EMISSIONS ON POWER LINES - continued

2.5.6 Test Results

The EUT met the Class B requirements of FCC CFR 47: Part 15 Subpart C, Section 15.207 for Conducted Emissions on the Live and Neutral Lines.

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

EUT Tx on Bottom Channel (2412MHz) – Live Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.194	46.3	63.9	40.8	53.9
0.259	38.2	61.5	33.9	51.9
0.390	33.0	58.1	27.5	48.1
0.453	36.3	56.8	32.6	46.8
0.519	33.0	56.0	29.9	46.0
0.582	32.1	56.0	29.5	46.0

The margin between the specification requirements and all other emissions were 28.3dB or more below the specified Quasi-Peak limit and 21.0dB or more below the Average limit.

EUT Tx on Bottom Channel (2412MHz) – Neutral Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.194	44.0	63.9	38.4	53.9
0.259	37.0	61.5	31.7	51.5
0.388	32.8	58.1	28.0	48.1
0.454	36.0	56.8	32.3	46.8
0.520	32.9	56.0	29.0	46.0
0.582	31.7	56.0	29.4	46.0

The margin between the specification requirements and all other emissions were 27.9dB or more below the specified Quasi-peak limit and 29.1dB or more below the specified Average limit.

2.5 CONDUCTED EMISSIONS ON POWER LINES - continued

2.5.6 Test Results - continued

EUT Tx on Middle Channel (2437MHz) – Live Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.195	46.0	63.8	40.9	53.8
0.259	38.2	61.5	33.9	51.5
0.388	32.3	58.1	27.9	48.1
0.454	35.0	56.8	32.2	46.8
0.519	32.8	56.0	30.2	46.0
0.582	31.9	56.0	29.5	46.0

The margin between the specification requirements and all other emissions were 26.6dB or more below the specified Quasi-Peak limit and 37.6dB or more below the Average limit.

EUT Tx on Middle Channel (2437MHz) – Neutral Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.194	44.3	63.9	38.5	53.9
0.259	37.1	61.5	31.7	51.5
0.388	32.6	58.1	28.3	48.1
0.454	35.2	56.8	32.2	46.8
0.519	32.6	56.0	29.8	46.0
0.583	31.6	56.0	29.3	46.0

The margin between the specification requirements and all other emissions were 27.8dB or more below the specified Quasi-peak limit and 20.4dB or more below the specified Average limit.

2.5 CONDUCTED EMISSIONS ON POWER LINES - continued

2.5.6 Test Results - continued

EUT Tx on Top Channel (2462MHz) – Live Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.194	46.3	63.9	40.9	53.9
0.324	38.2	59.6	28.8	49.6
0.389	33.0	58.1	27.9	48.1
0.454	35.6	56.8	32.6	46.8
0.519	33.0	56.0	30.1	46.0
0.583	31.9	56.0	29.5	46.0

The margin between the specification requirements and all other emissions were 28.3dB or more below the specified Quasi-Peak limit and 20.7dB or more below the Average limit.

EUT Tx on Top Channel (2462MHz) – Neutral Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.194	44.0	63.9	38.4	53.9
0.259	37.1	61.5	31.7	51.5
0.389	33.3	58.1	27.9	48.1
0.453	36.1	56.8	32.6	46.8
0.519	32.7	56.0	30.0	46.0
0.582	32.1	56.0	30.2	46.0

The margin between the specification requirements and all other emissions were 27.2dB or more below the specified Quasi-peak limit and 38.3dB or more below the specified Average limit.

2.6 6dB BANDWIDTH

2.6.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.247(b)(2)

2.6.2 Equipment Under Test

802.11a/b/g RLAN Module

2.6.3 Date of Test

26th July 2004

2.6.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as Section 2.10 within the Test Equipment Used table shown in Section 3.1.

2.6.5 Test Procedure

Test Performed in accordance with 15.247.

The EUT was transmitted at maximum power at the data rates specified by the manufacturer, via a 20dB Attenuator 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 –6dBc points of the displayed spectrum.

The measurement plots can be seen on the following pages.

2.6.6 Test Results

802.11b

Frequency (MHz)	Data Rate (Mbps)	6dB Bandwidth (MHz)
2412	11	11.52
2437	11	11.52
2462	11	11.52

802.11g

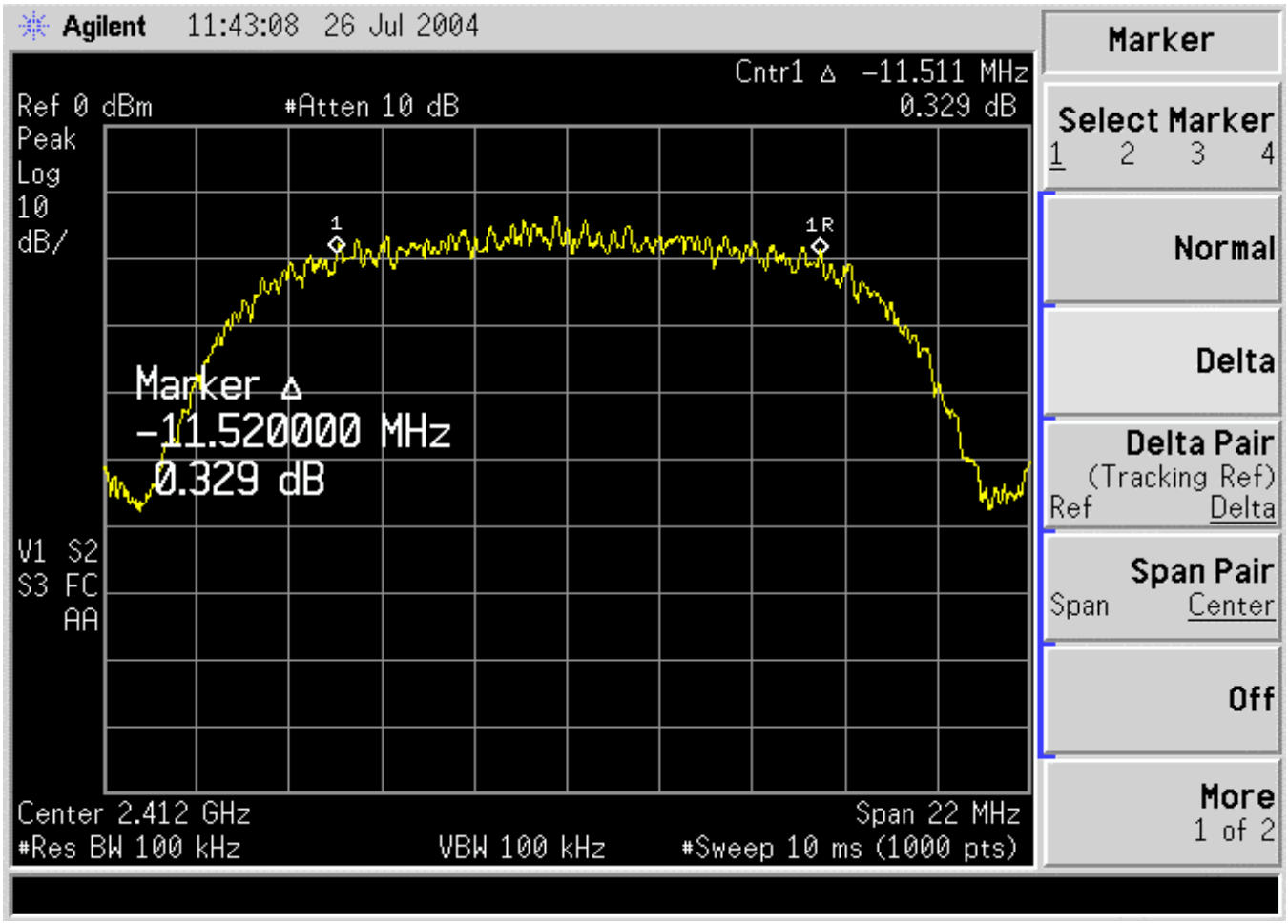
Frequency (MHz)	Data Rate (Mbps)	6dB Bandwidth (MHz)
2412	6	16.36
2417	6	16.38
2437	6	16.36
2457	6	16.36
2462	6	16.36

2.6 6dB BANDWIDTH - continued

2.6.6 Test Results - continued

2412MHz – Maximum Power

802.11b

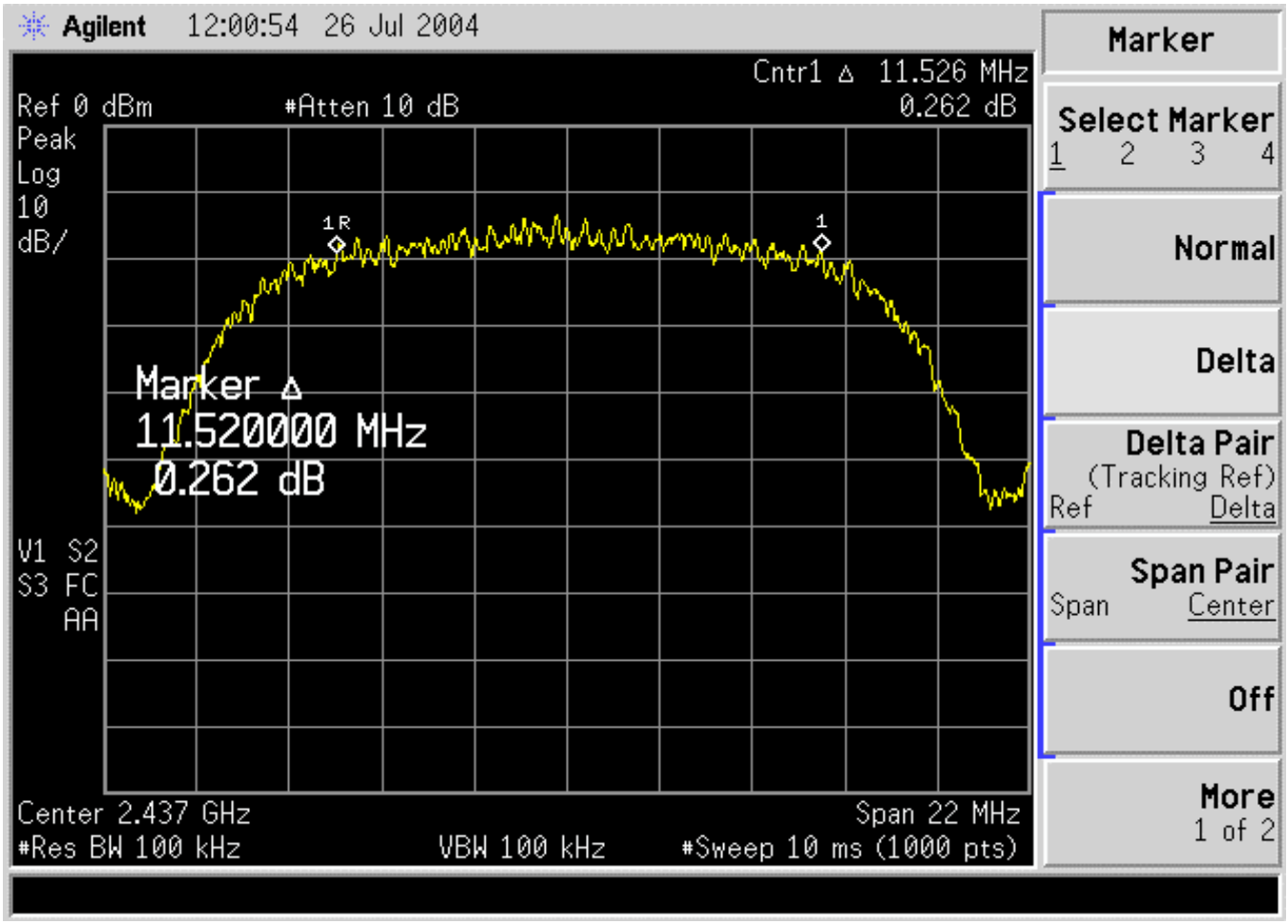


2.6 **6dB BANDWIDTH** - continued

2.6.6 **Test Results** - continued

2437MHz – Maximum Power

802.11b

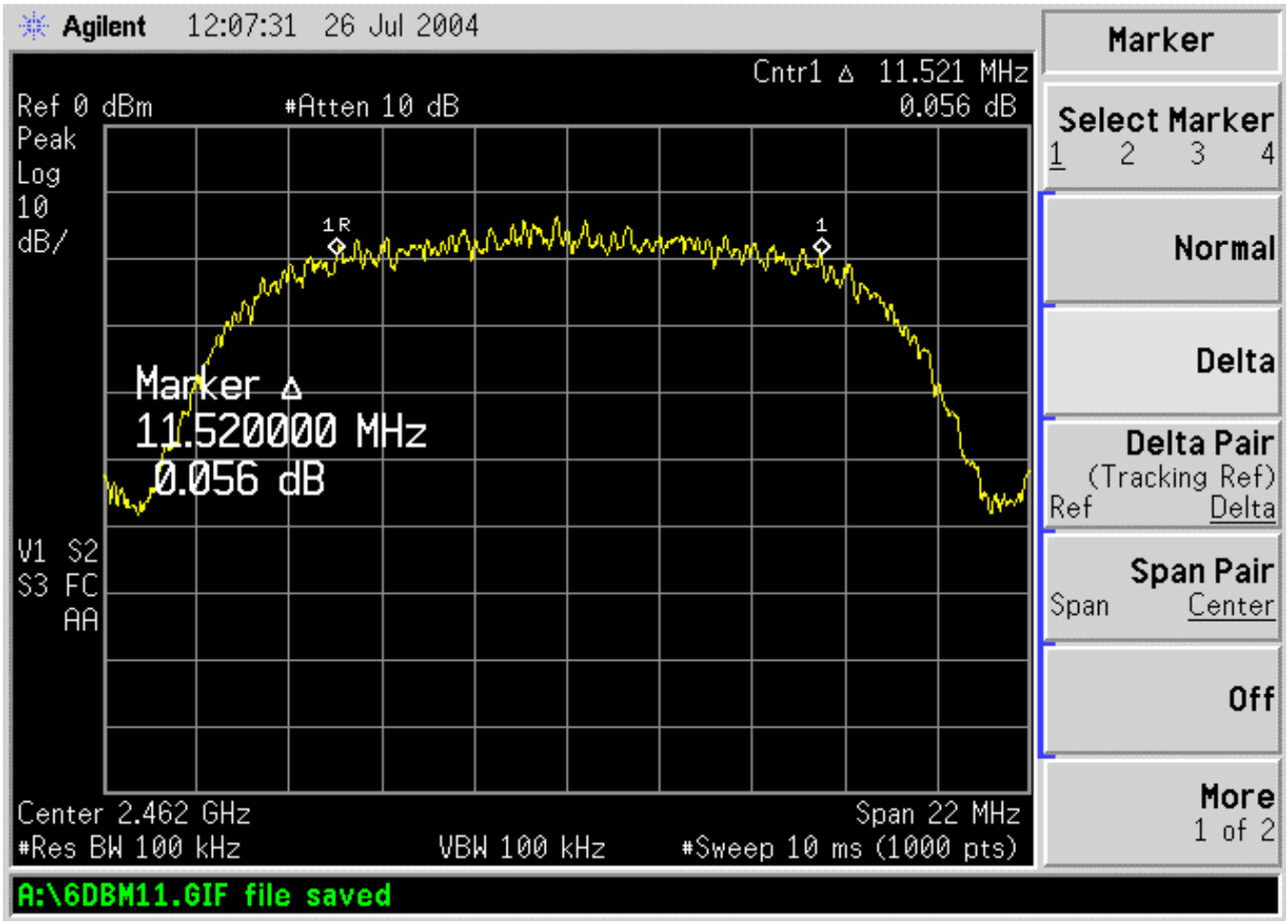


2.6 6dB BANDWIDTH - continued

2.6.6 Test Results - continued

2462MHz – Maximum Power

802.11b

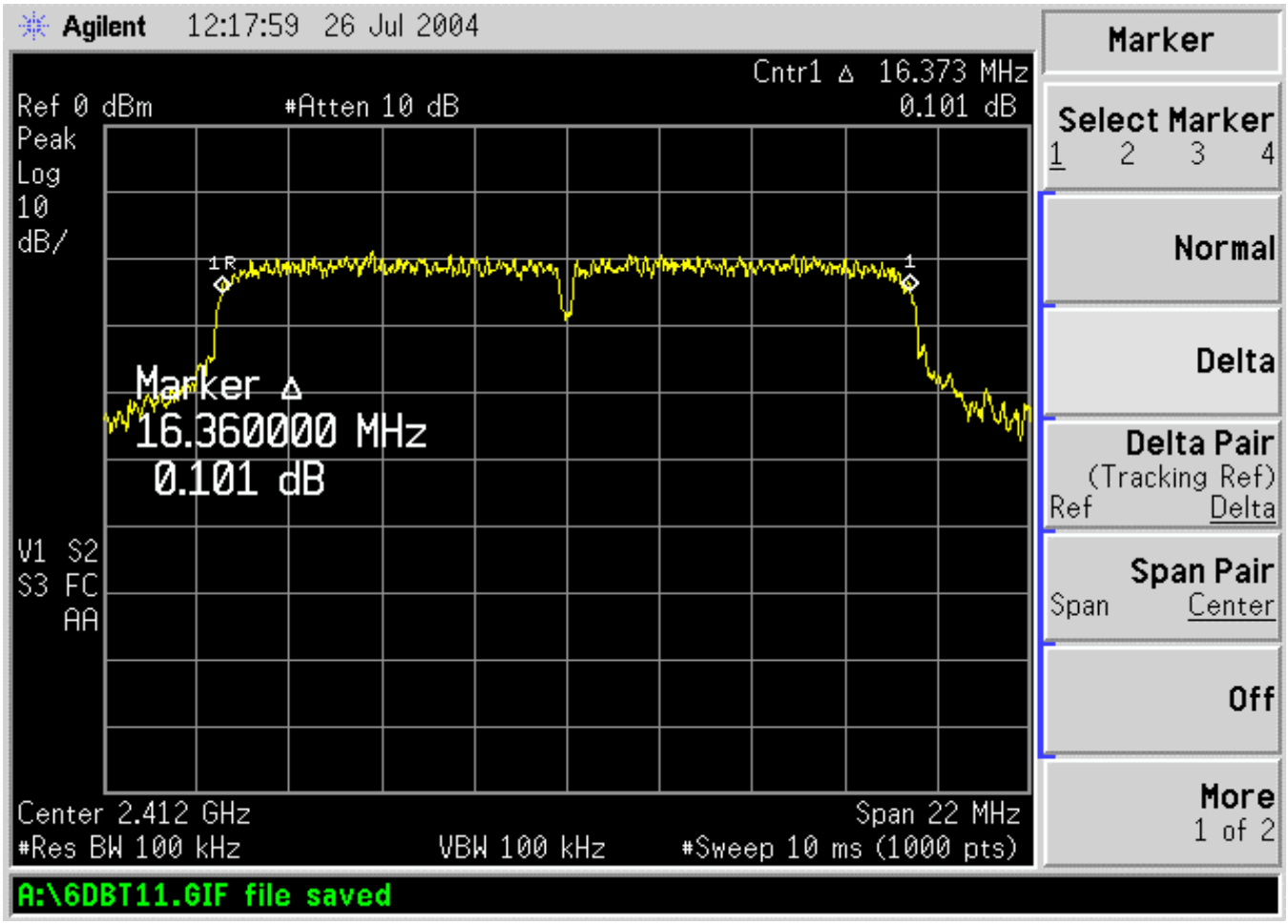


2.6 6dB BANDWIDTH - continued

2.6.6 Test Results - continued

2412MHz – Maximum Power

802.11g

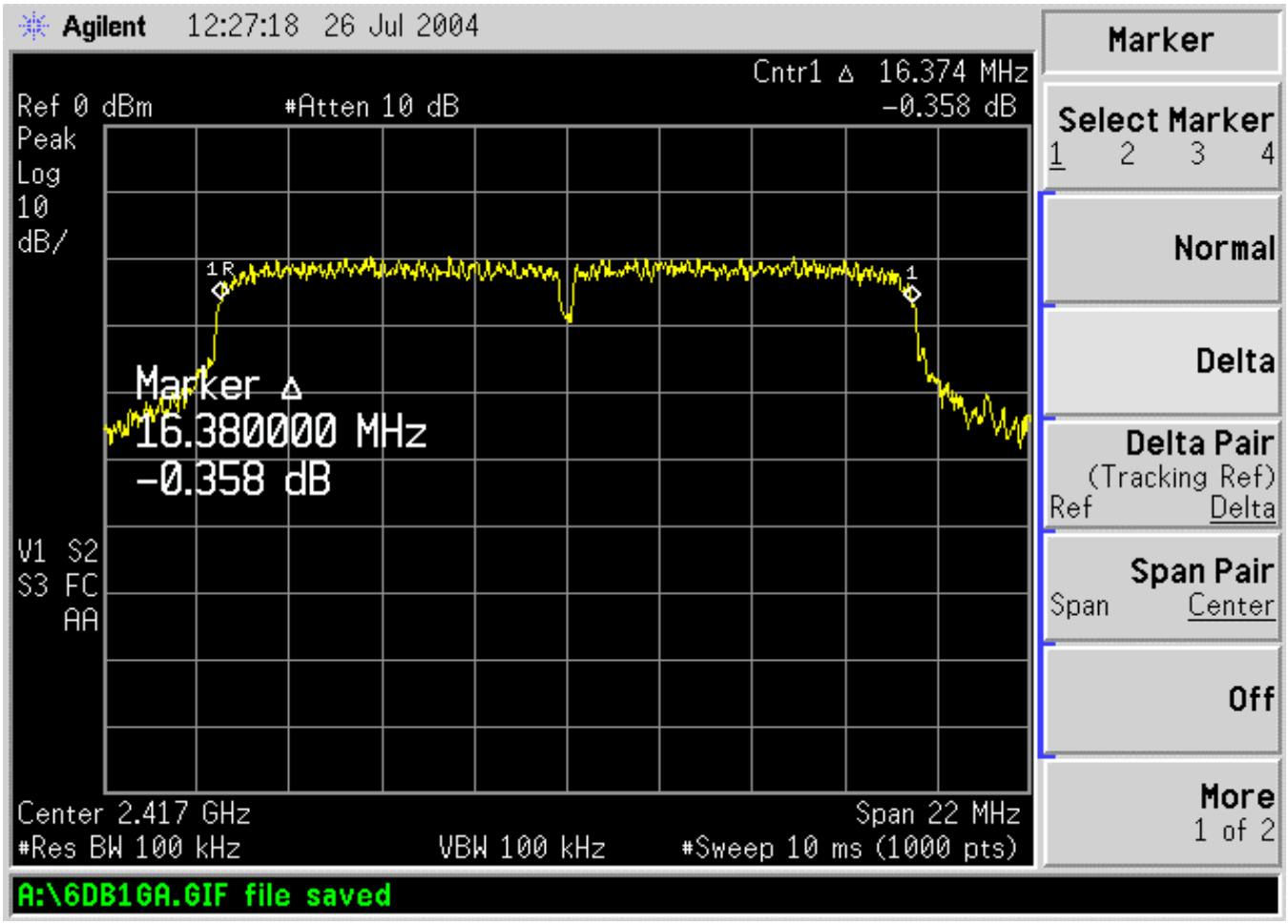


2.6 6dB BANDWIDTH - continued

2.6.6 Test Results - continued

2417MHz – Maximum Power

802.11g

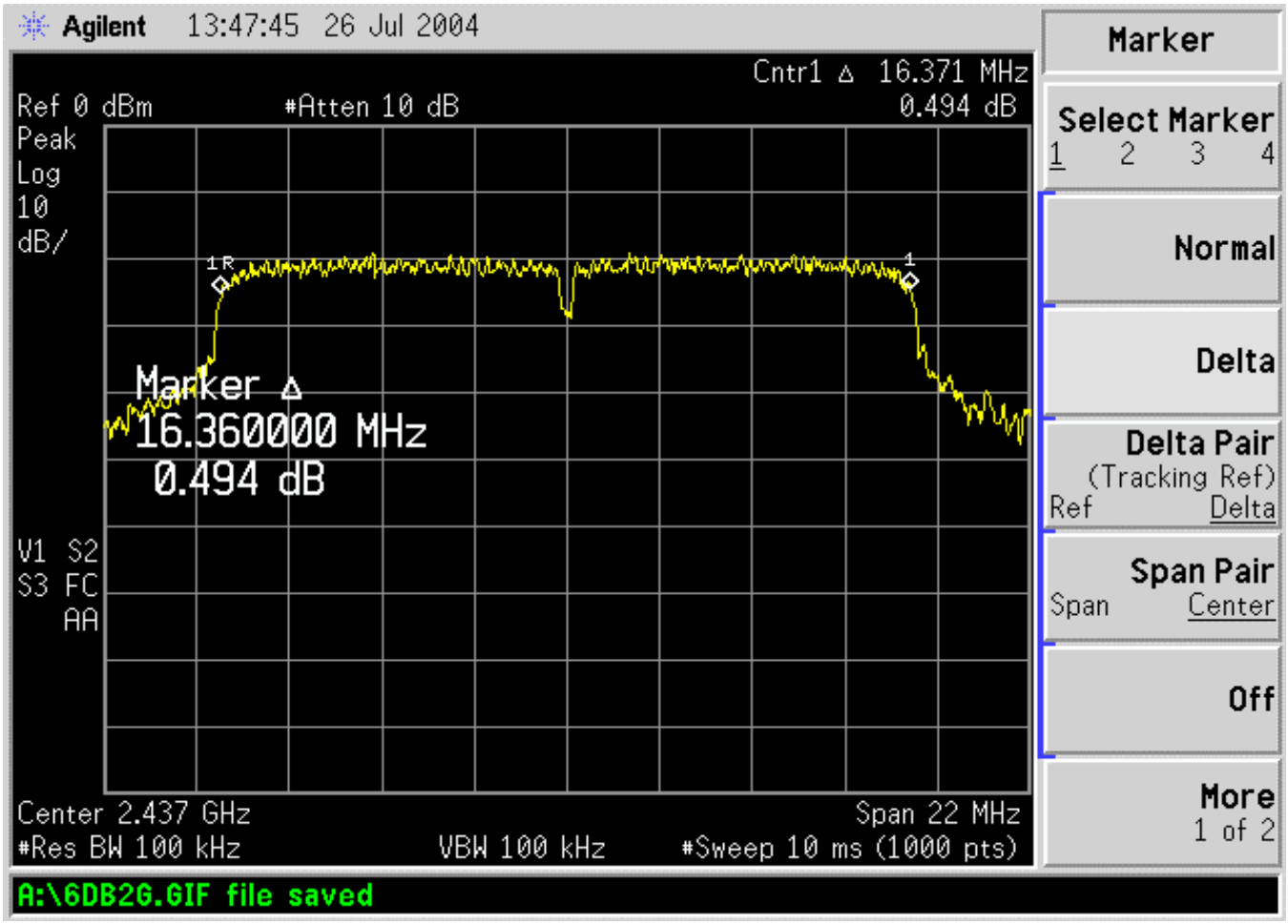


2.6 6dB BANDWIDTH - continued

2.6.6 Test Results - continued

2437MHz – Maximum Power

802.11g

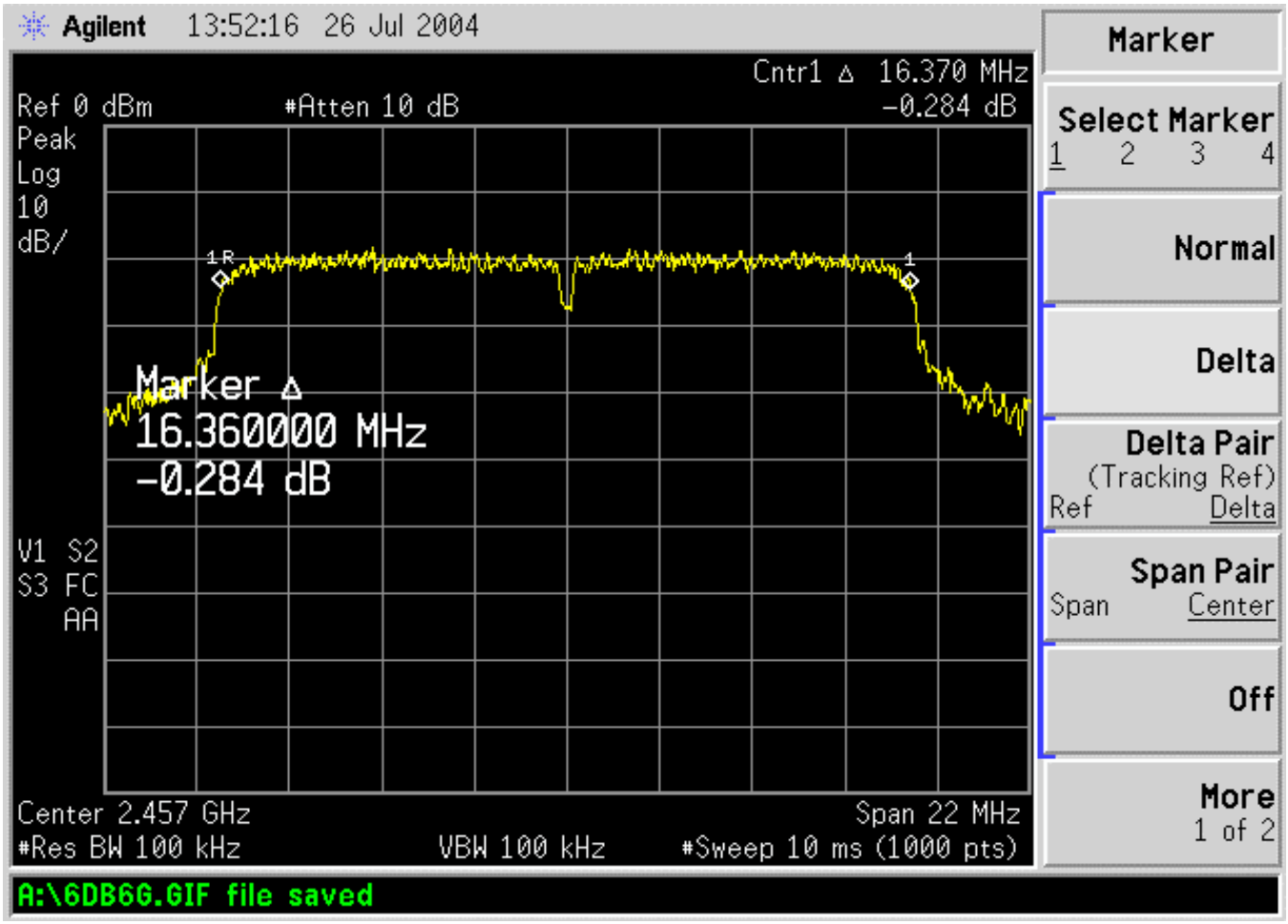


2.6 6dB BANDWIDTH - continued

2.6.6 Test Results - continued

2457MHz – Maximum Power

802.11g

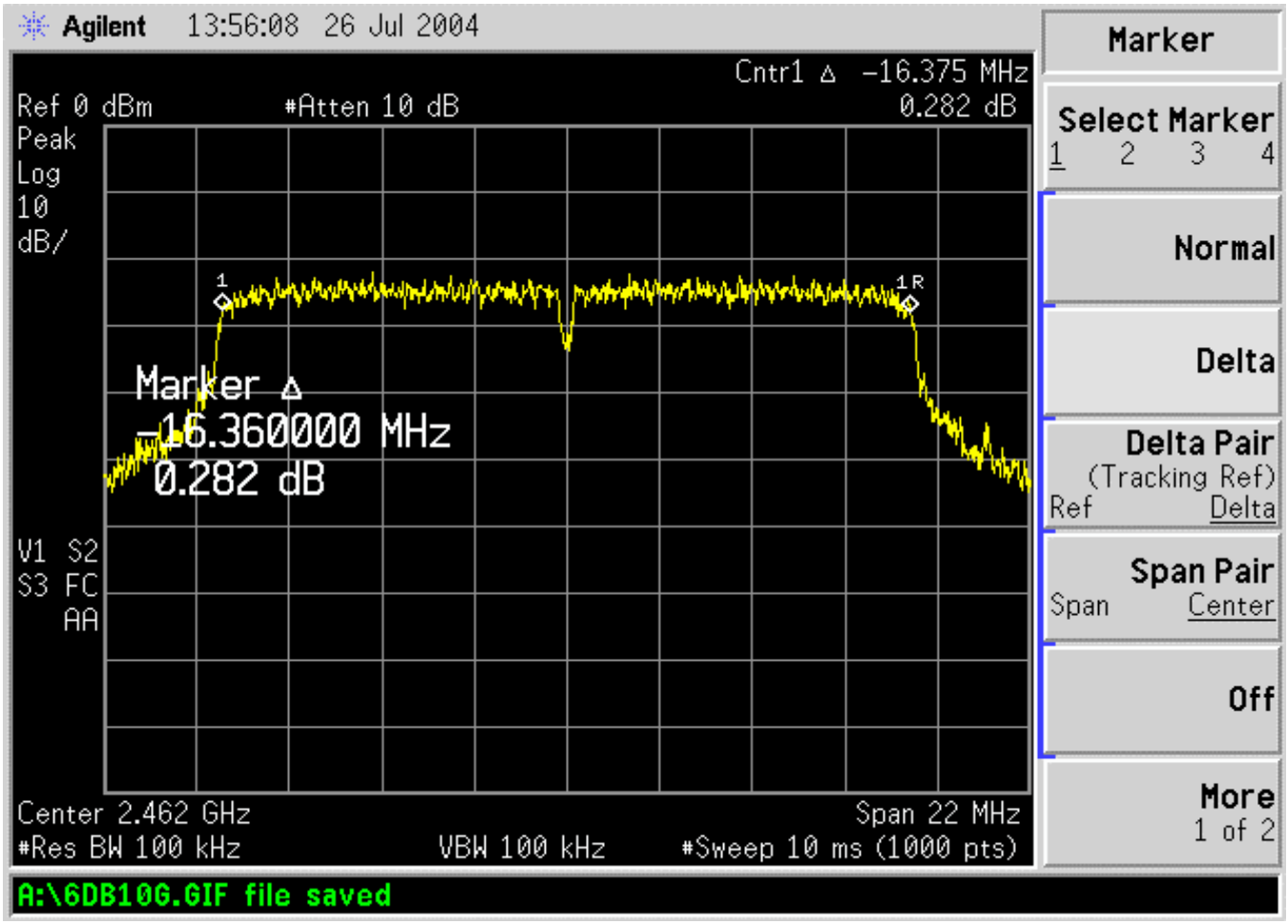


2.6 6dB BANDWIDTH - continued

2.6.6 Test Results - continued

2462MHz – Maximum Power

802.11g



2.7 MAXIMUM PEAK OUTPUT POWER (Conducted Method)

2.7.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.247(b)(3)

2.7.2 Equipment Under Test

802.11a/b/g RLAN Module

2.7.3 Date of Test

26th July 2004

2.7.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.11” within the Test Equipment Used table shown in Section 3.1.

2.7.5 Test Procedure

Test Performed in accordance with FCC CFR 47: Part 15.247(b)(3).

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 Peak Power Analyser via a 20dB attenuator.
The path loss was measured and entered as an offset on the Peak Power Analyser.
The peak power was then measured on the channels listed below.

2.7.6 Test Results

11Mbps
802.11b

Frequency (MHz)	Output Power (dBm)	Results (mW)
2412	19.02	79.80
2437	19.39	86.90
2462	18.91	77.80

2.7 MAXIMUM PEAK OUTPUT POWER (Conducted Method) - continued

2.7.6 Test Results - continued

6Mbps
802.11g

Frequency (MHz)	Output Power (dBm)	Results (mW)
2412	16.61	45.81
2417	19.38	86.70
2437	19.38	86.70
2457	19.99	99.77
2462	17.25	53.09

Limit	<+30dBm or <4W

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(b)(3) for Maximum Peak Output Power.

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

2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT

2.8.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.247(c)

2.8.2 Equipment Under Test

802.11a/b/g RLAN Module

2.8.3 Date of Test

28th July 2004

2.8.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.12” within the Test Equipment Used table shown in Section 3.1.

2.8.5 Test Procedure

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

In accordance with Part 15.247(c), Spurious Conducted Emissions from the antenna terminal were measured. The transmitter output power was attenuated using a combination of of filters and attenuators and the frequency spectrum investigated from 9kHz to 25GHz. The EUT was set to transmit on full power, at the data rates specified by the manufacturer. 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.

For measuring the range 9kHz to 4GHz, a 20dB attenuator was used. From 4GHz to 18GHz, a 10dB attenuator and a high pass filter were used. From 18GHz to 25GHz a piece of waveguide was used as a high pass filter.

The Maximum “fundamental peak” level measured was used to determine the limit line as displayed on the following plots.

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

2.8.6 Test Results

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(c) 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.

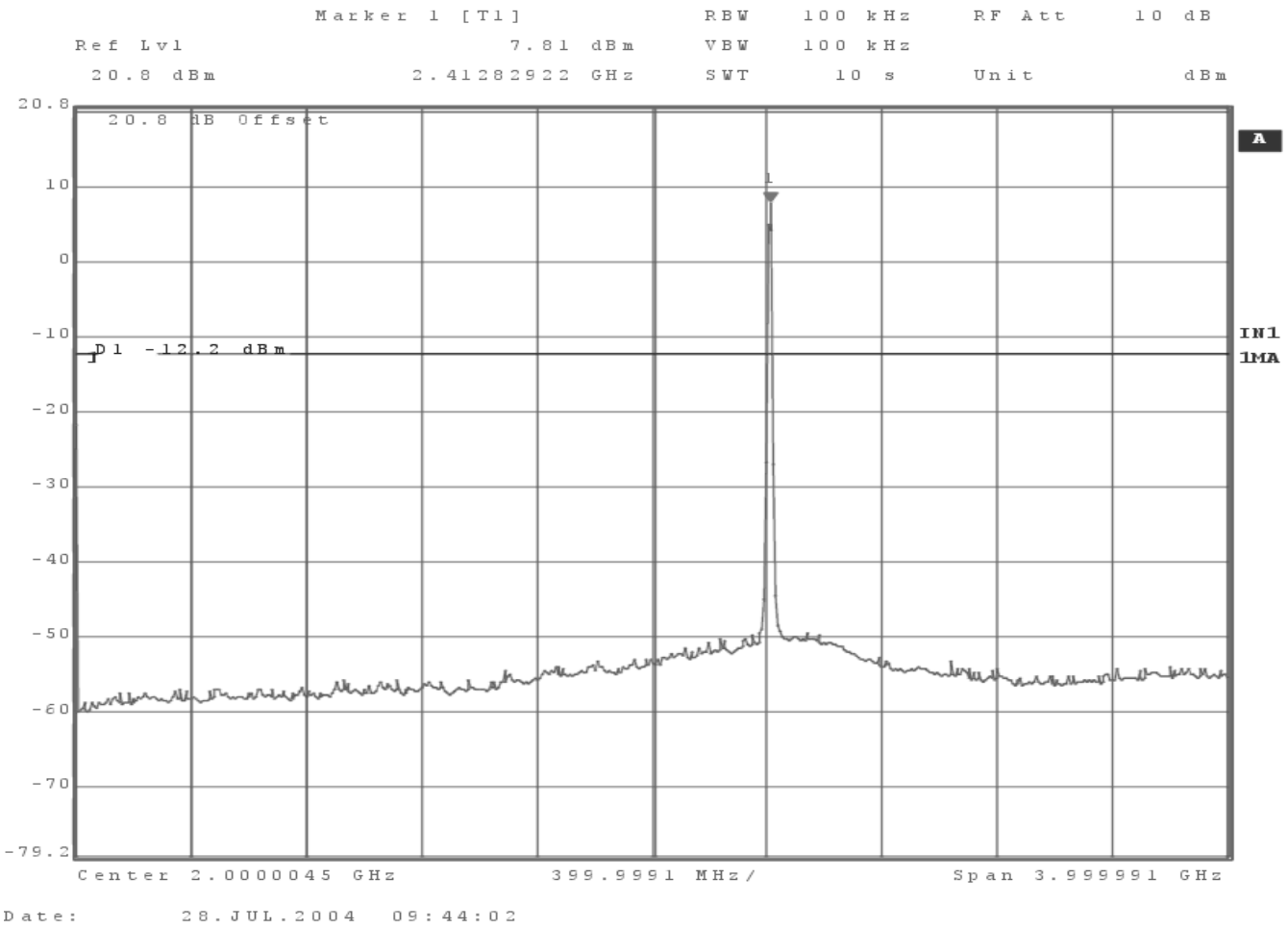
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.6 Test Results – continued

Spurious Conducted Emissions (9kHz – 4GHz)

EUT Tx on Bottom Channel, (2412.0MHz) – Maximum Power 11Mbps

802.11b



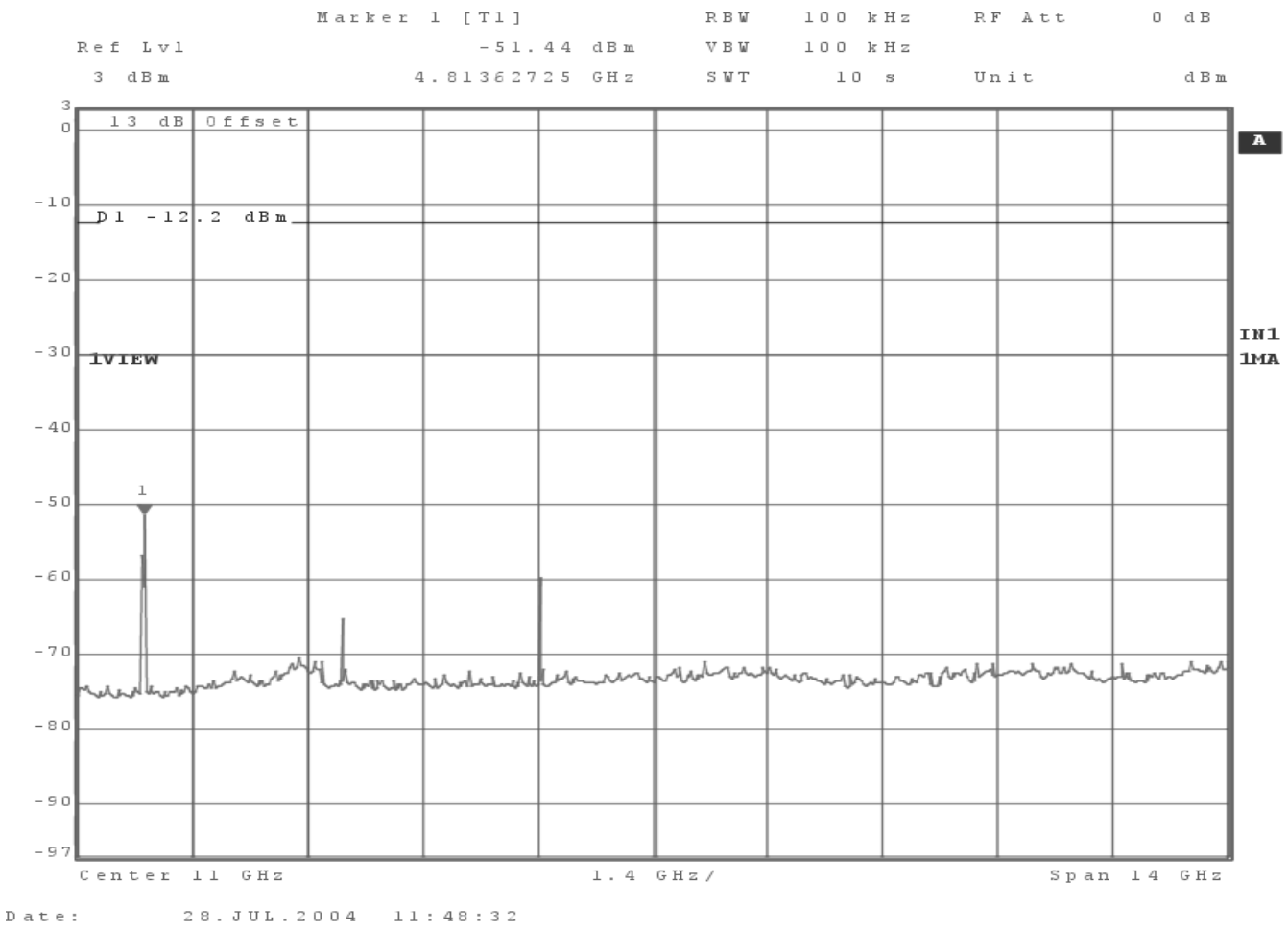
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.6 Test Results – continued

Spurious Conducted Emissions (4GHz – 18GHz)

EUT Tx on Bottom Channel, (2412.0MHz) – Maximum Power 11Mbps

802.11b



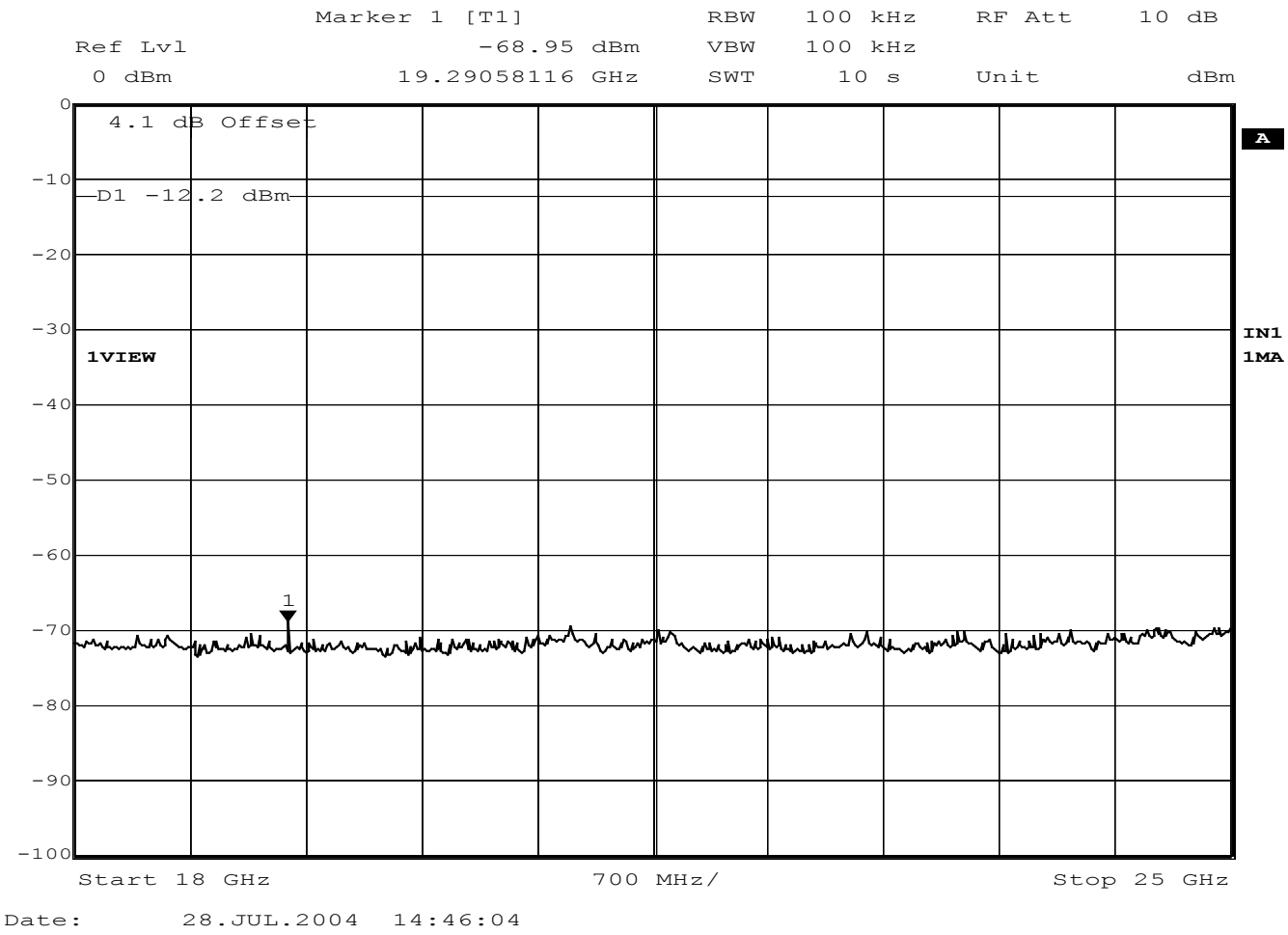
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.6 Test Results – continued

Spurious Conducted Emissions (18GHz – 25GHz)

EUT Tx on Bottom Channel, (2412.0MHz) – Maximum Power 11Mbps

802.11b



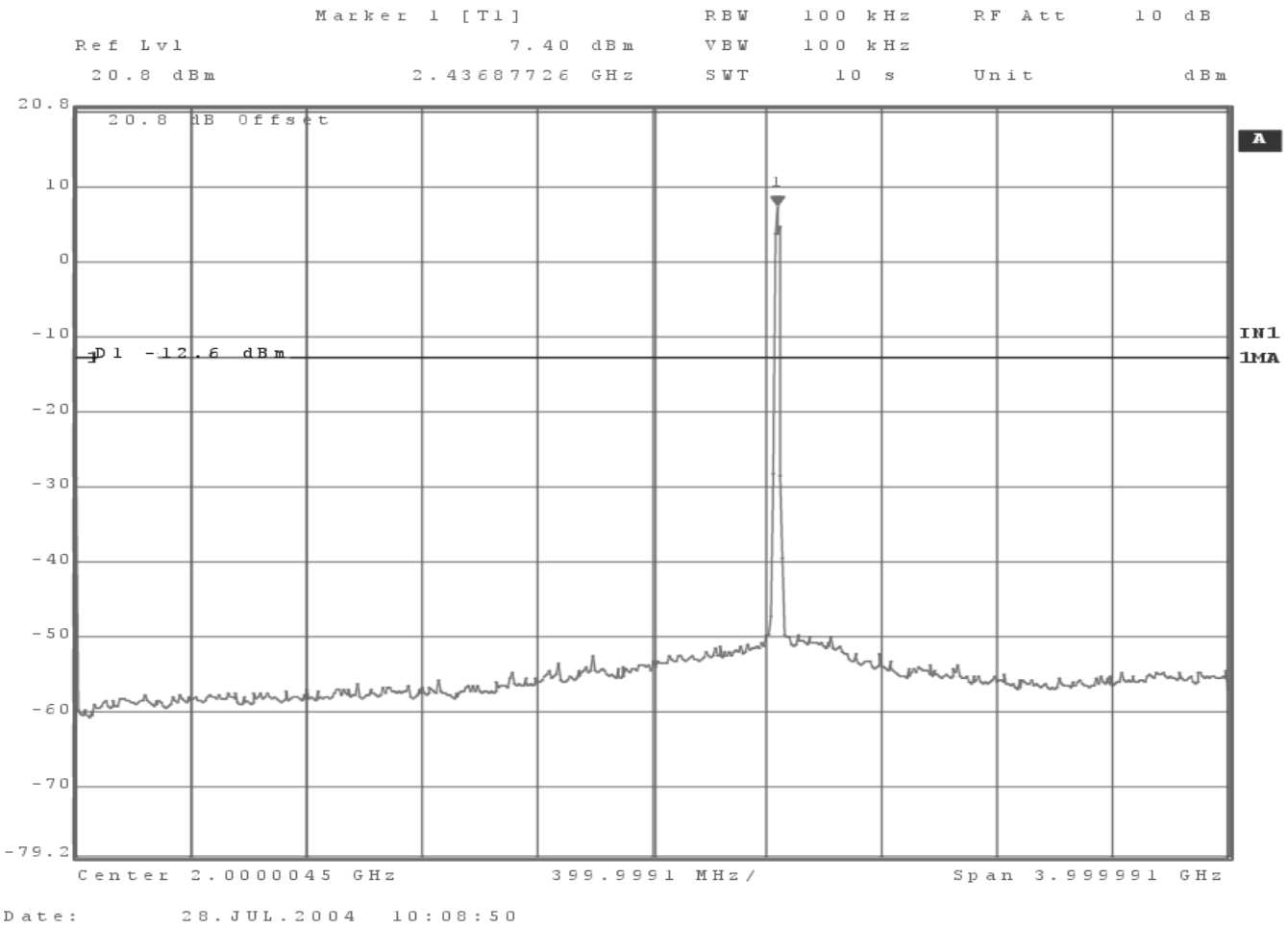
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.7 Test Results – continued

Spurious Conducted Emissions (9kHz – 4GHz)

EUT Tx on Middle Channel, (2437.0MHz) – Maximum Power 11Mbps

802.11b



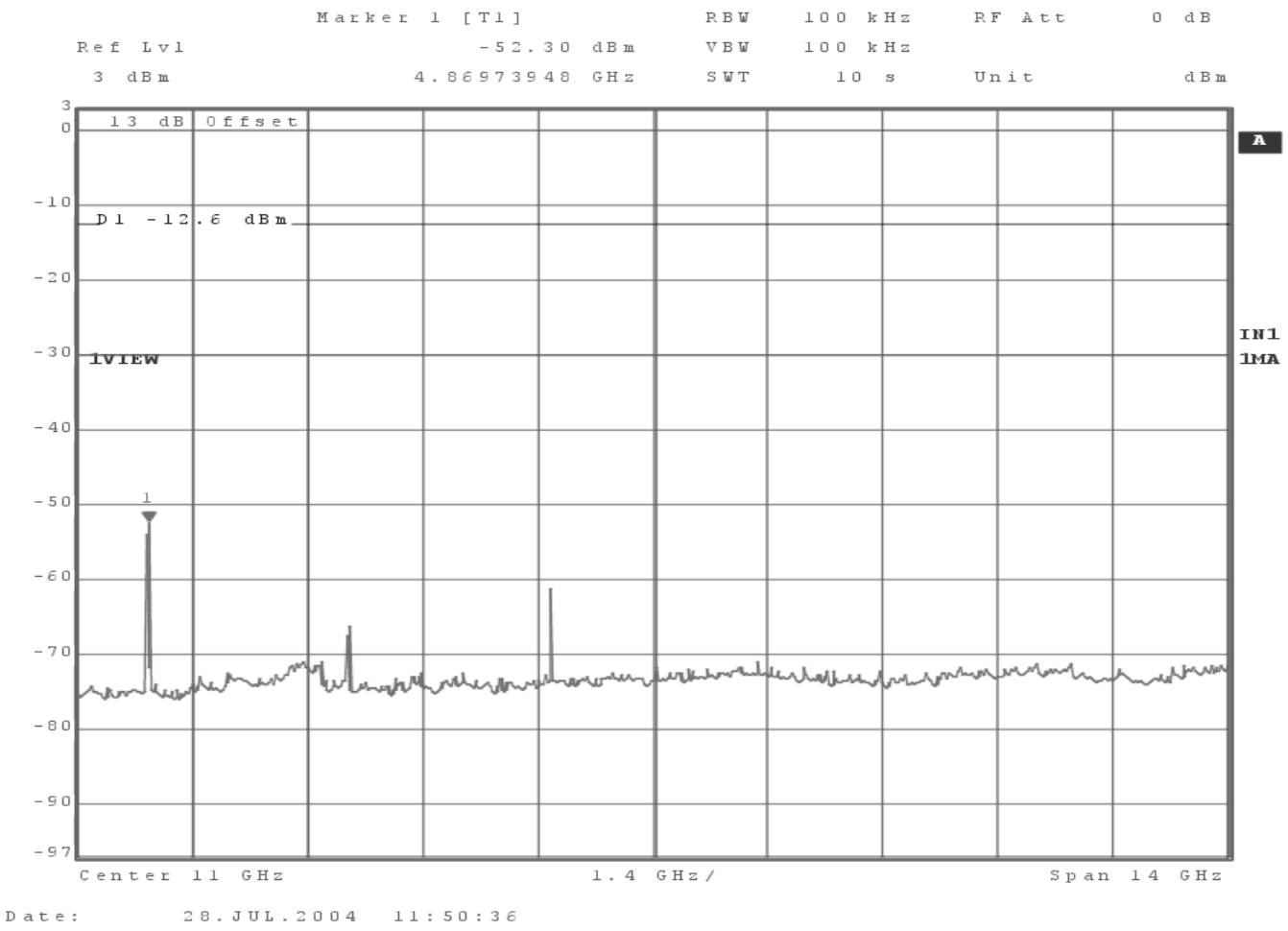
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.6 Test Results – continued

Spurious Conducted Emissions (4GHz – 18GHz)

EUT Tx on Middle Channel, (2437.0MHz) – Maximum Power 11Mbps

802.11b



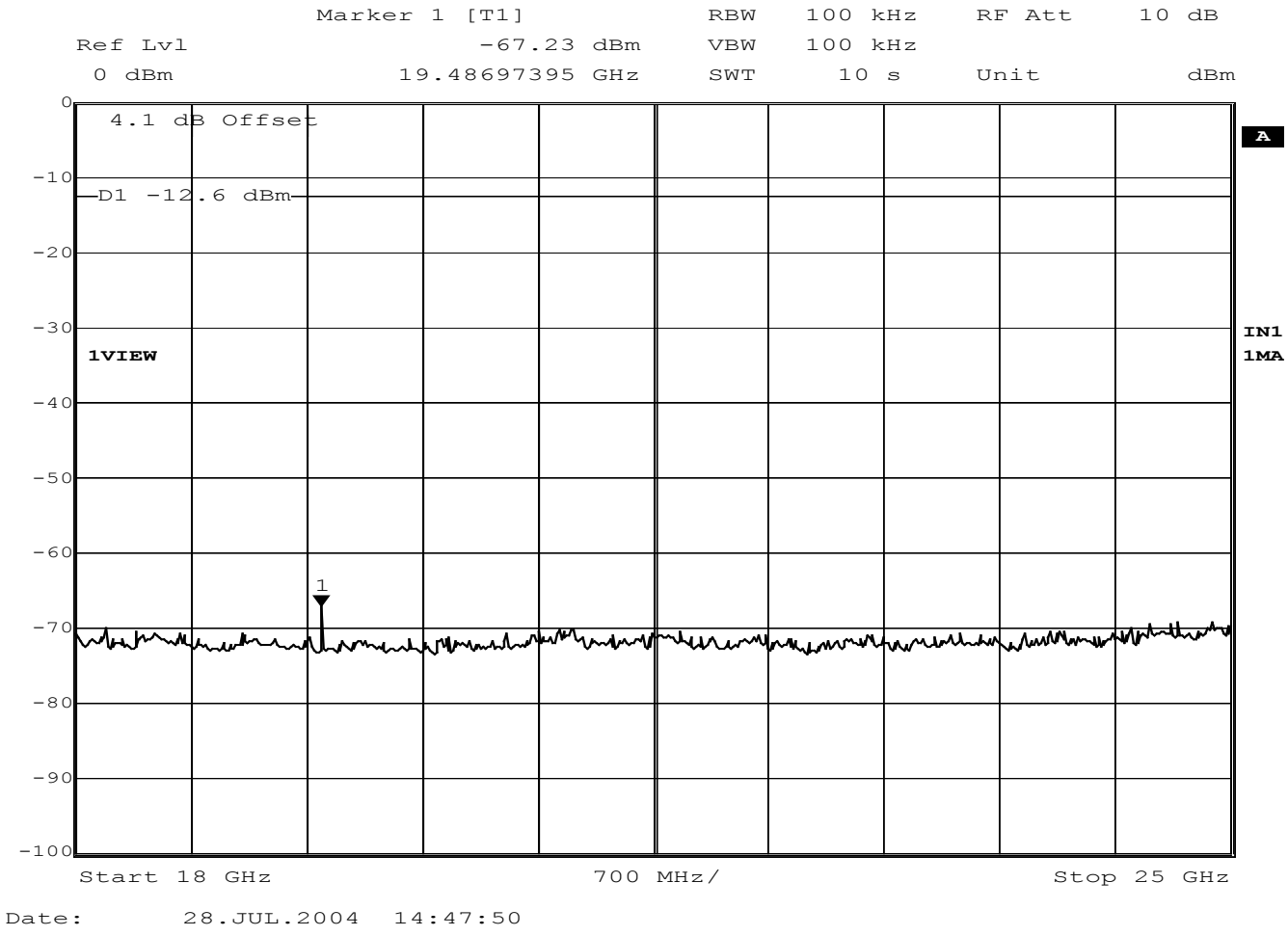
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.6 Test Results – continued

Spurious Conducted Emissions (18GHz – 25GHz)

EUT Tx on Middle Channel, (2437.0MHz) – Maximum Power 11Mbps

802.11b



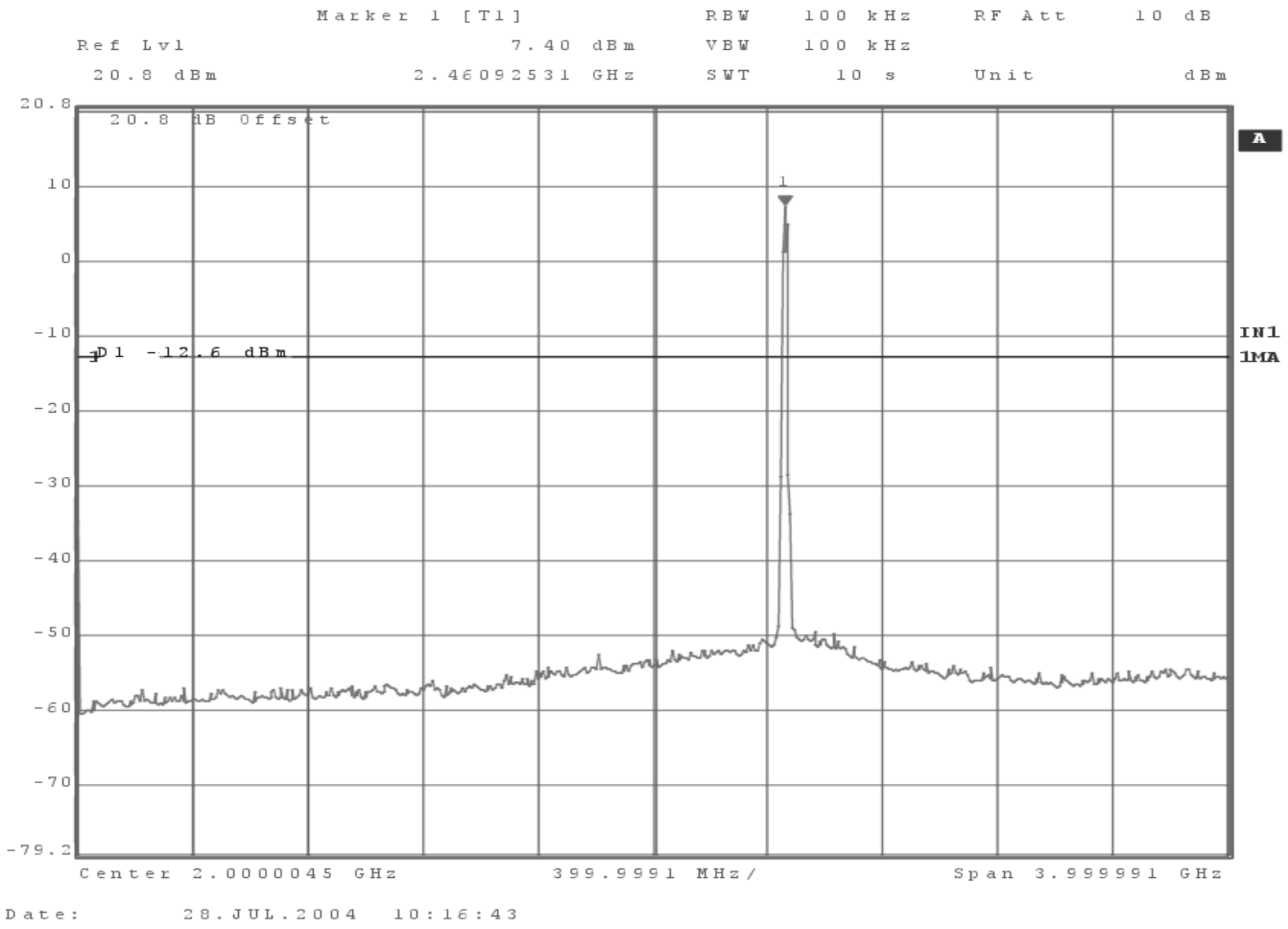
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.8 Test Results – continued

Spurious Conducted Emissions (9kHz – 4GHz)

EUT Tx on Top Channel, (2462.0MHz) – Maximum Power 11Mbps

802.11b



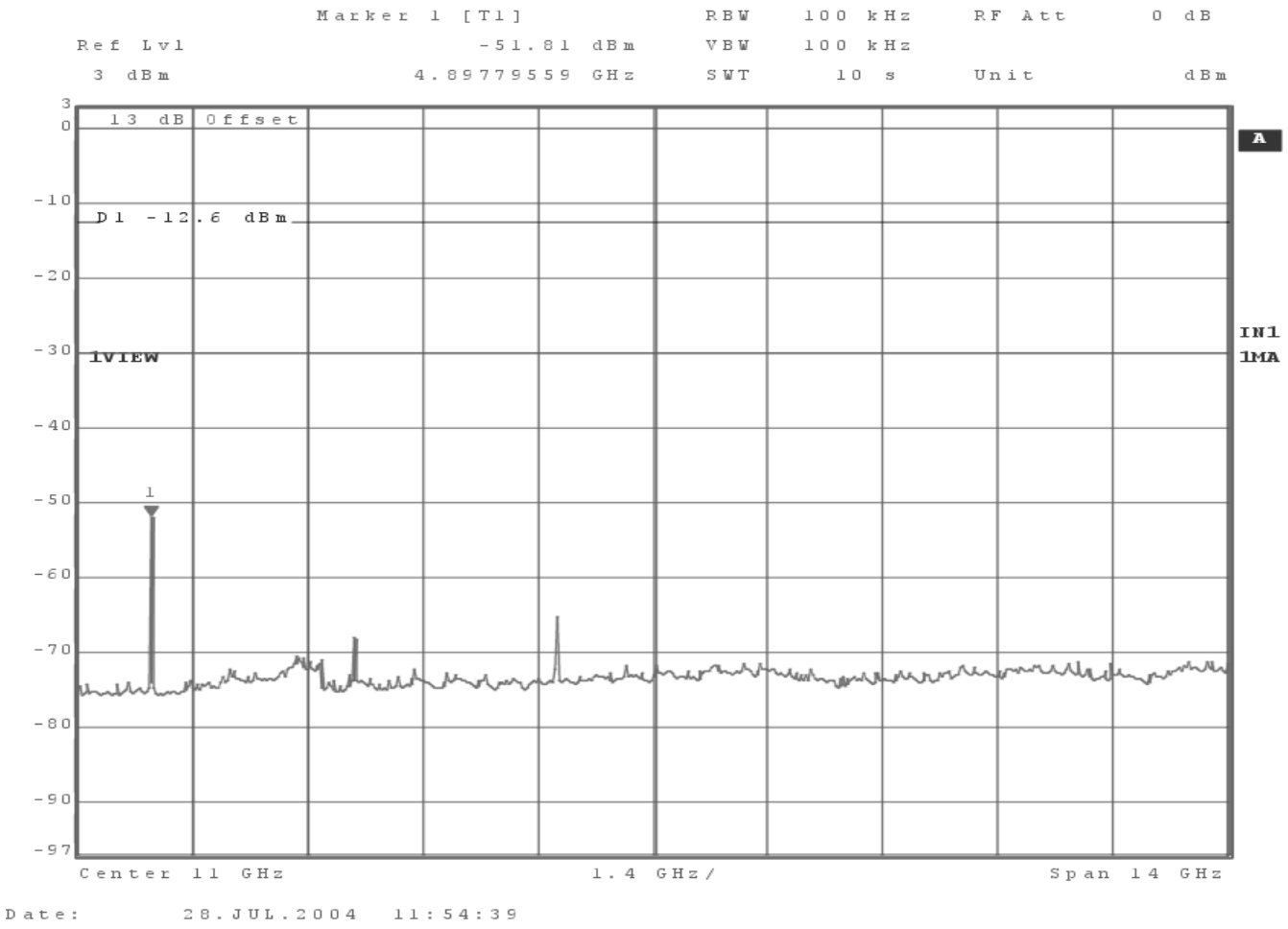
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.6 Test Results – continued

Spurious Conducted Emissions (4GHz – 18GHz)

EUT Tx on Top Channel, (2462.0MHz) – Maximum Power 11Mbps

802.11b



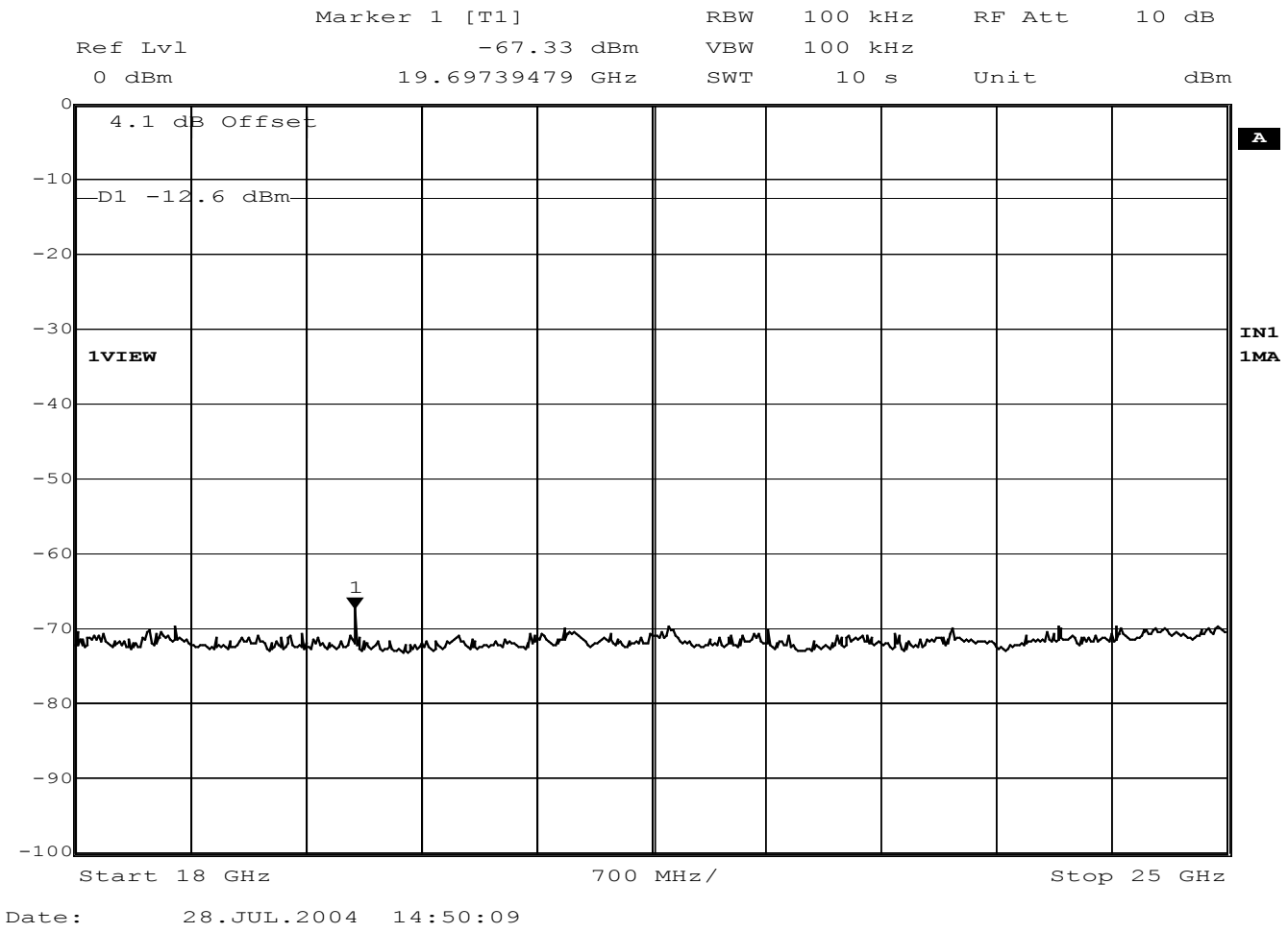
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.6 Test Results – continued

Spurious Conducted Emissions (18GHz – 25GHz)

EUT Tx on Top Channel, (2462.0MHz) – Maximum Power 11Mbps

802.11b



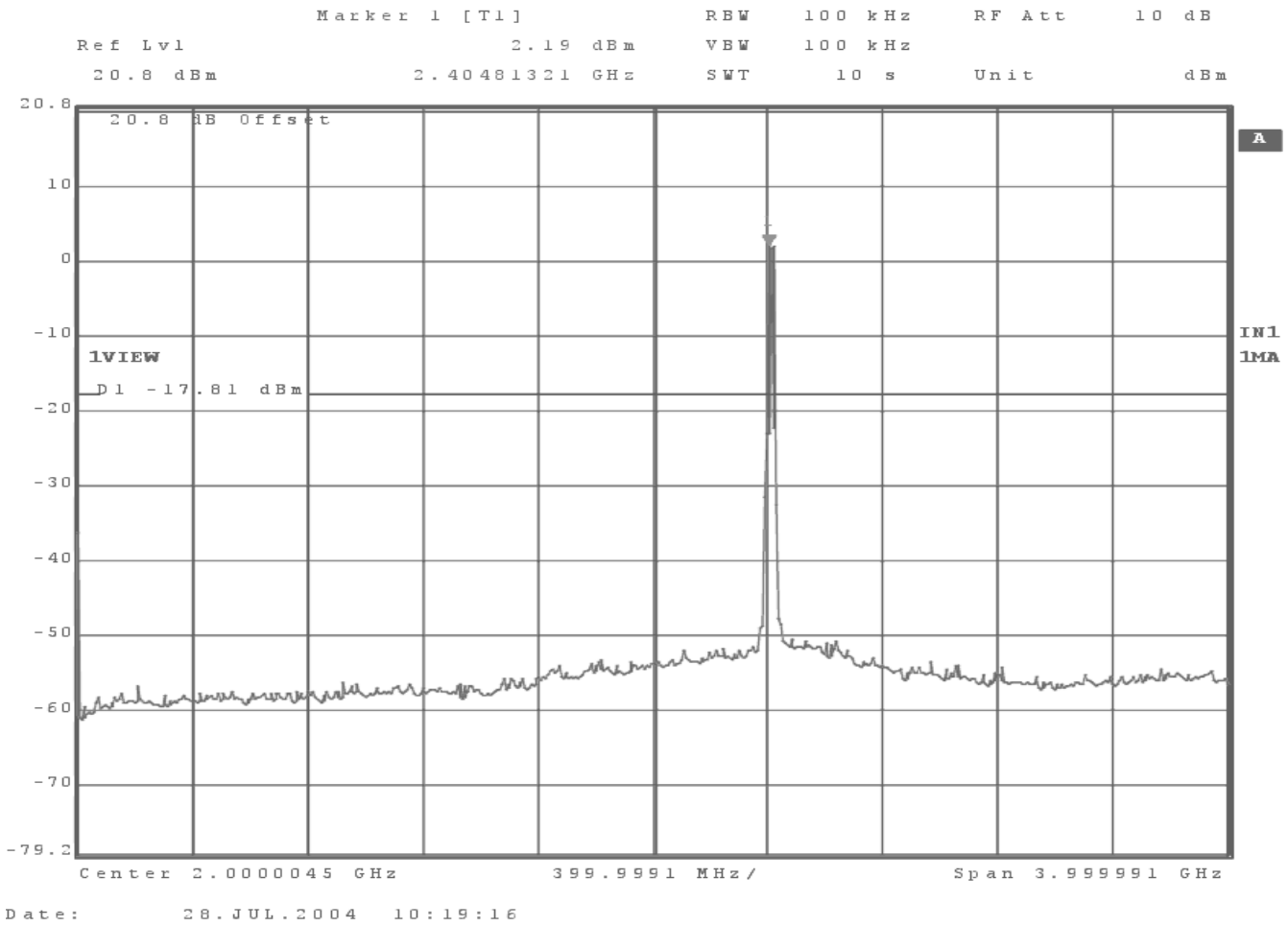
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.9 Test Results – continued

Spurious Conducted Emissions (9kHz – 4GHz)

EUT Tx on Bottom Channel, (2412.0MHz) – Maximum Power 6Mbps

802.11g



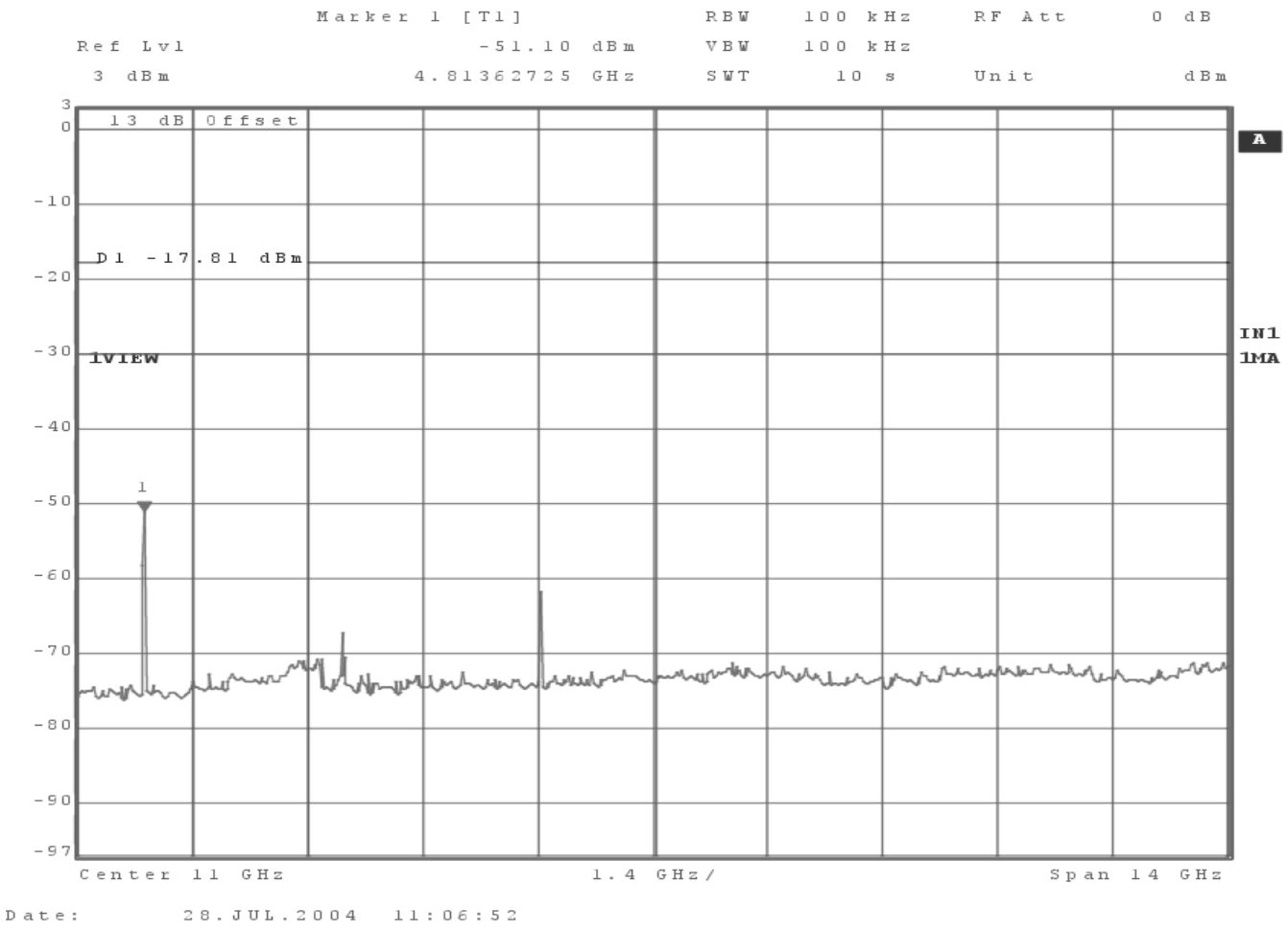
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.6 Test Results – continued

Spurious Conducted Emissions (4GHz – 18GHz)

EUT Tx on Bottom Channel, (2412.0MHz) – Maximum Power 6Mbps

802.11g



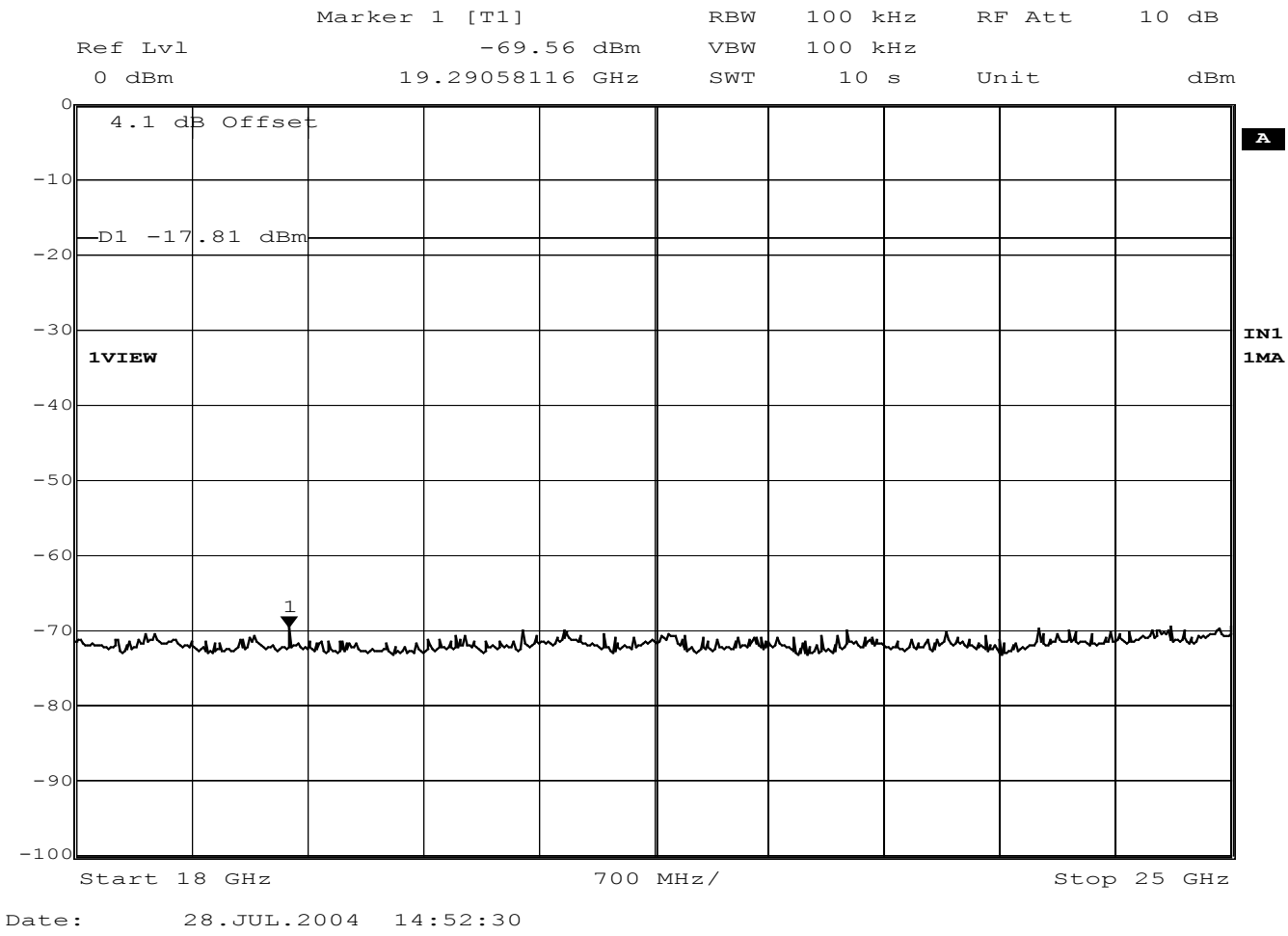
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.6 Test Results – continued

Spurious Conducted Emissions (18GHz – 25GHz)

EUT Tx on Bottom Channel, (2412.0MHz) – Maximum Power 6Mbps

802.11g



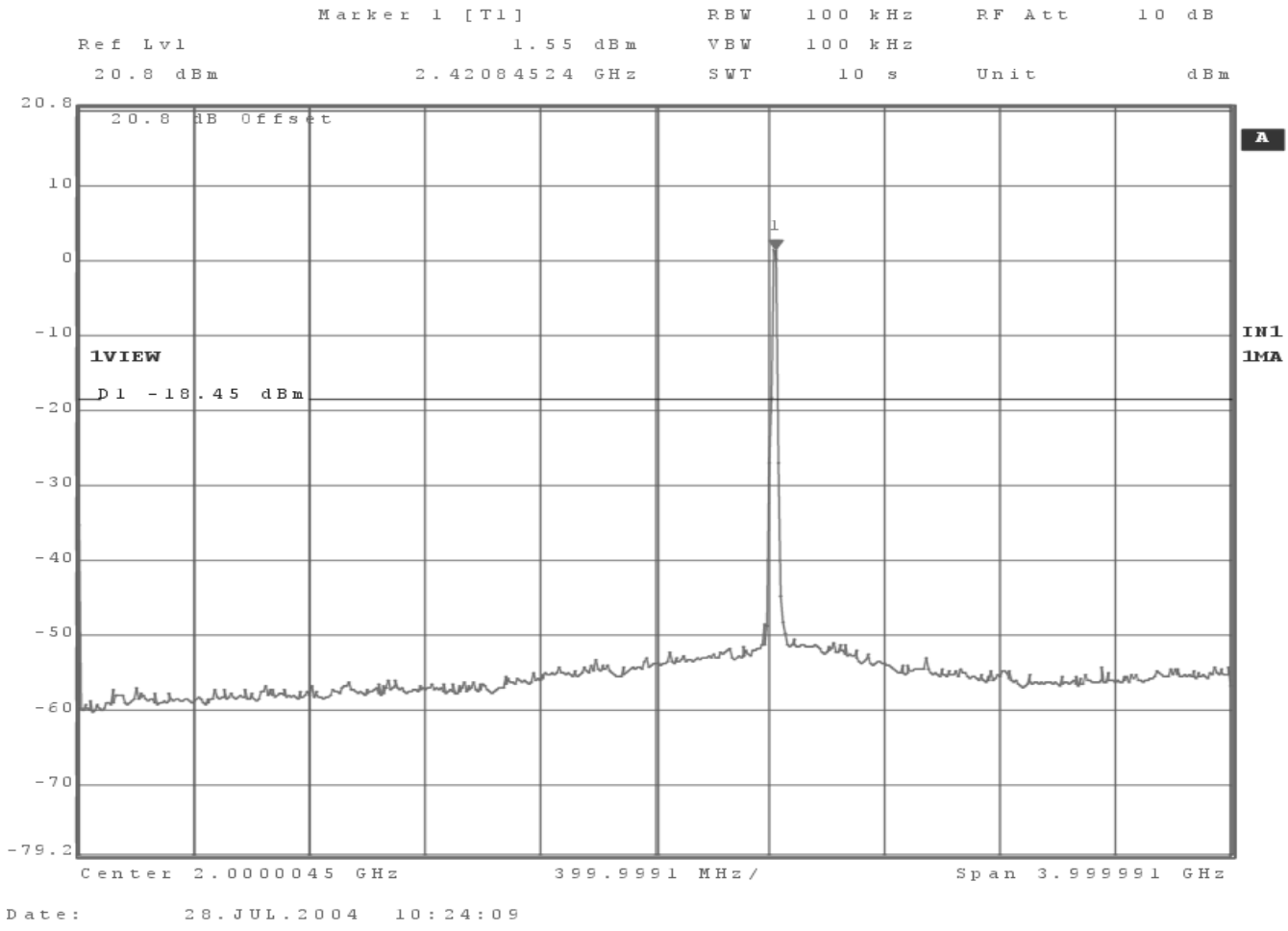
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.10 Test Results – continued

Spurious Conducted Emissions (9kHz – 4GHz)

EUT Tx on Channel 2, (2417.0MHz) – Maximum Power 6Mbps

802.11g



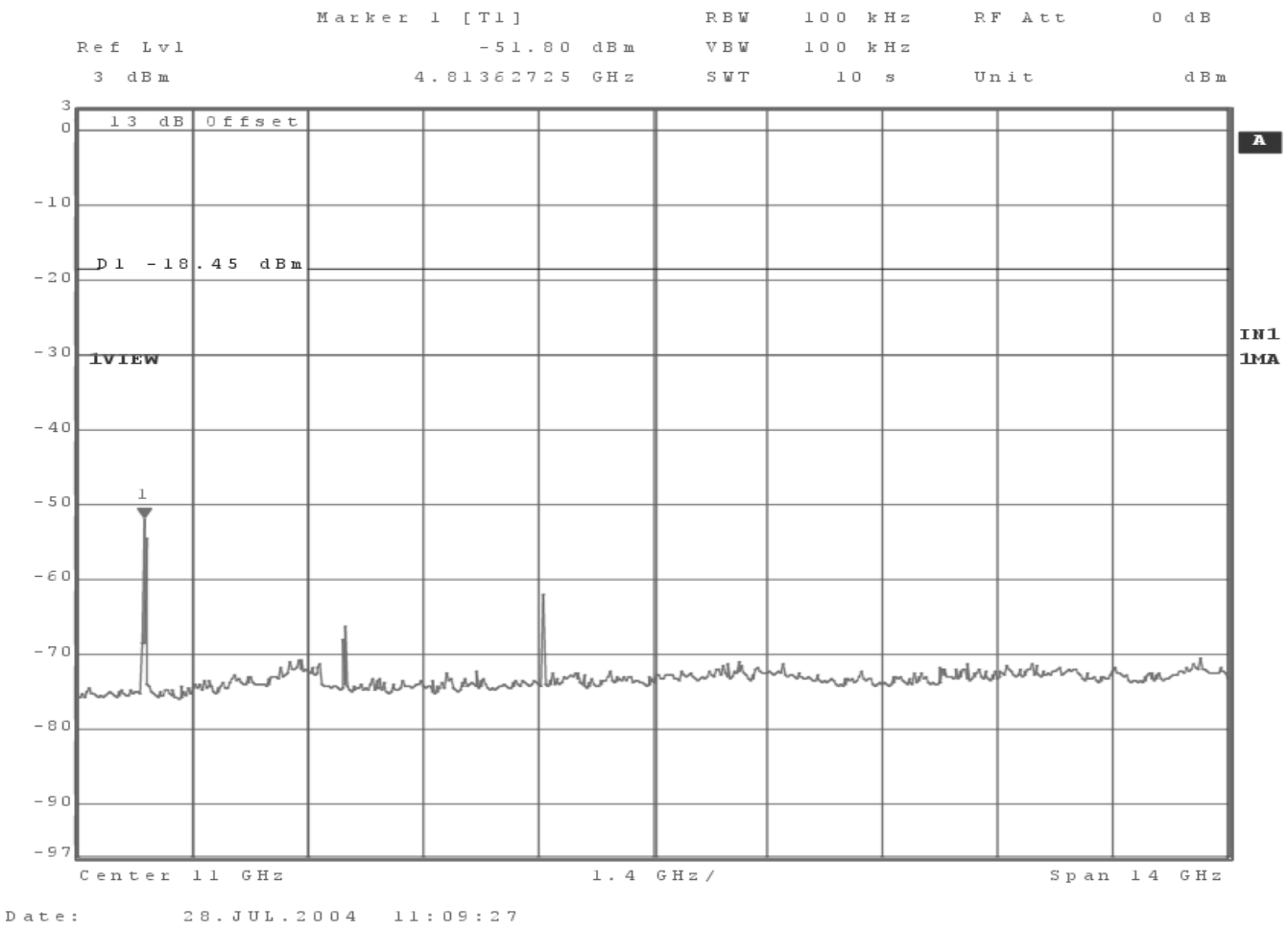
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.6 Test Results – continued

Spurious Conducted Emissions (4GHz – 18GHz)

EUT Tx on Channel 2, (2417.0MHz) – Maximum Power 6Mbps

802.11g



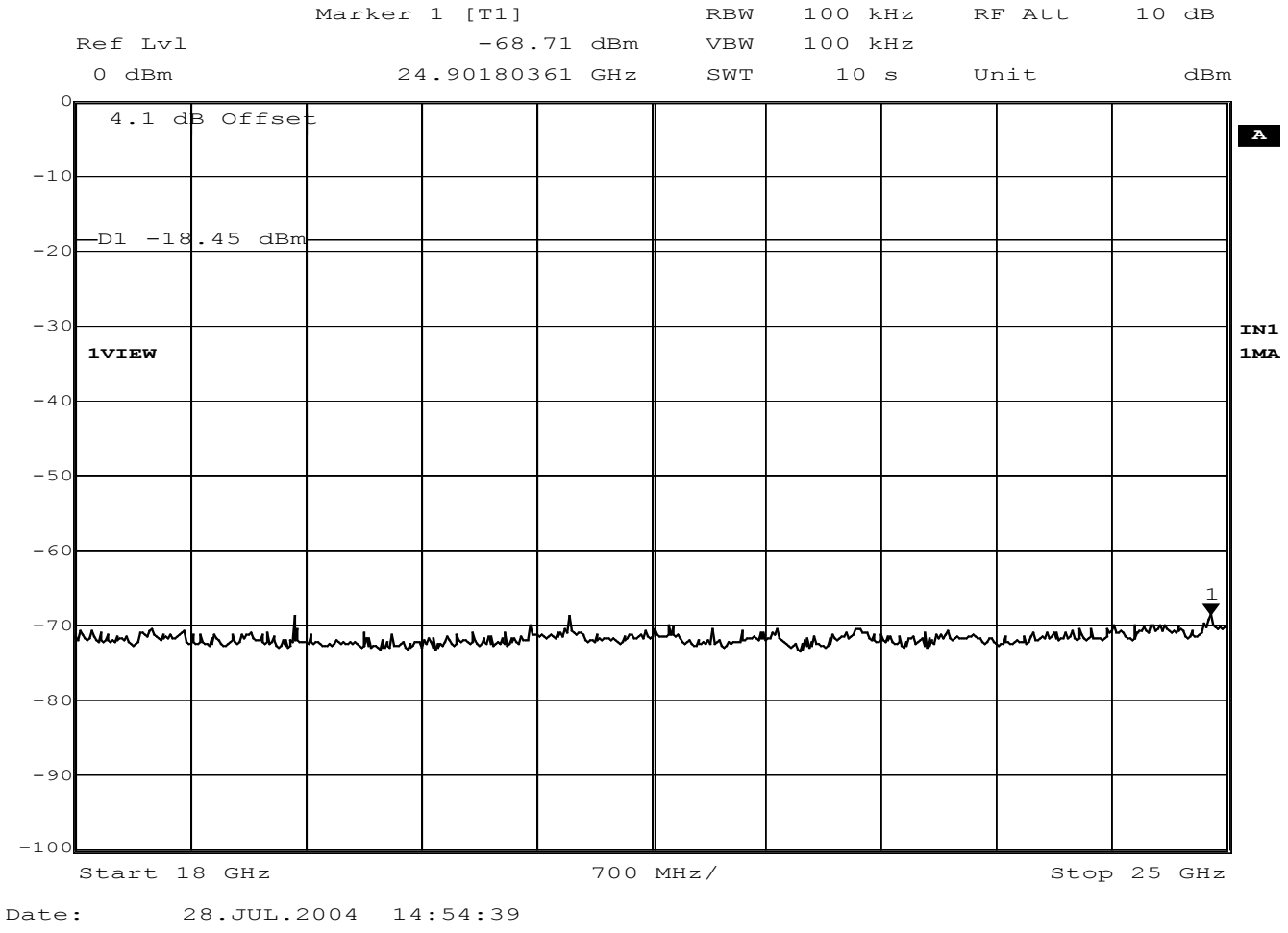
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.6 Test Results – continued

Spurious Conducted Emissions (18GHz – 25GHz)

EUT Tx on Channel 2, (2417.0MHz) – Maximum Power 6Mbps

802.11g



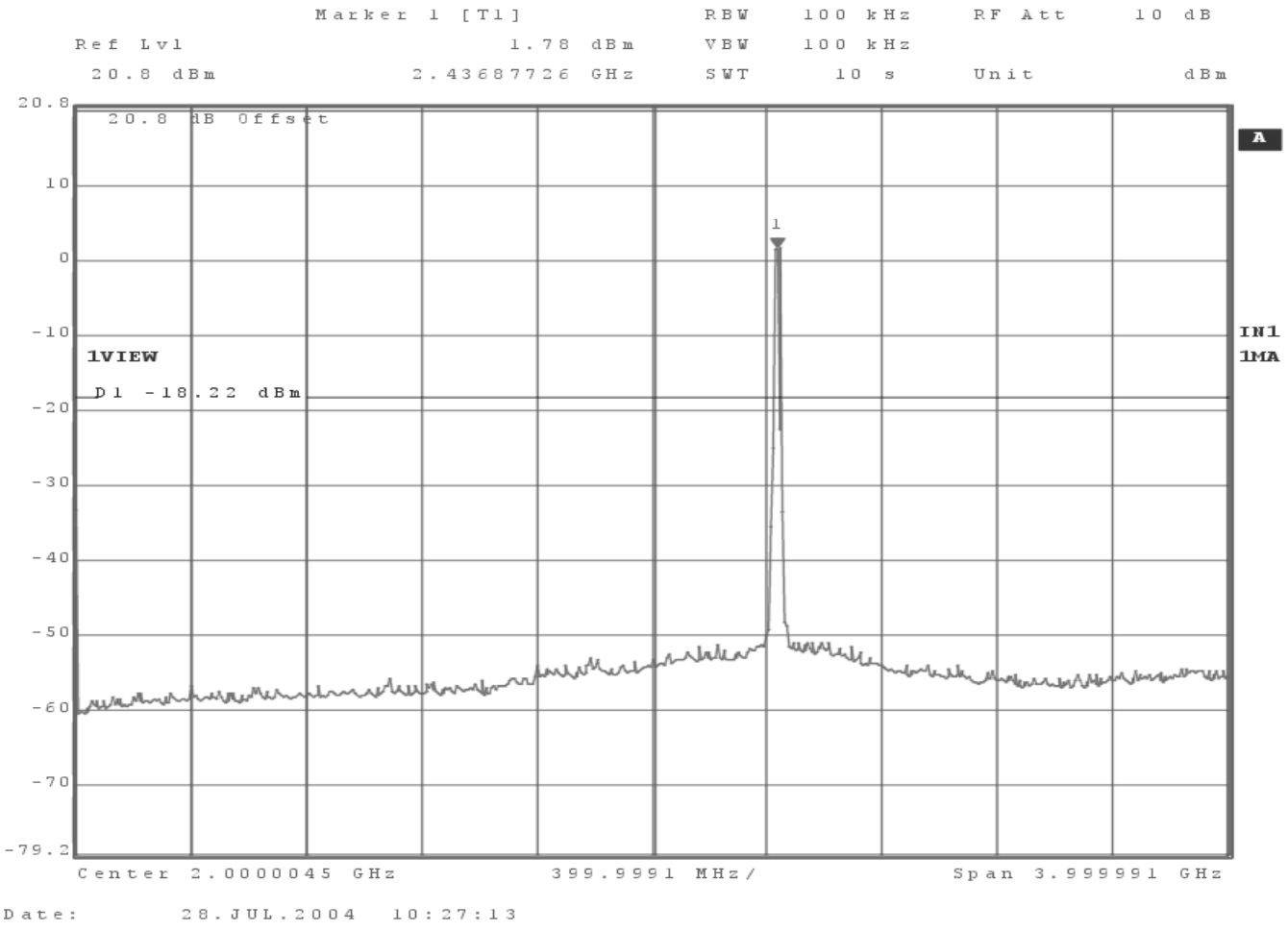
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.11 Test Results – continued

Spurious Conducted Emissions (9kHz – 4GHz)

EUT Tx on Middle Channel, (2437.0MHz) – Maximum Power 6Mbps

802.11g



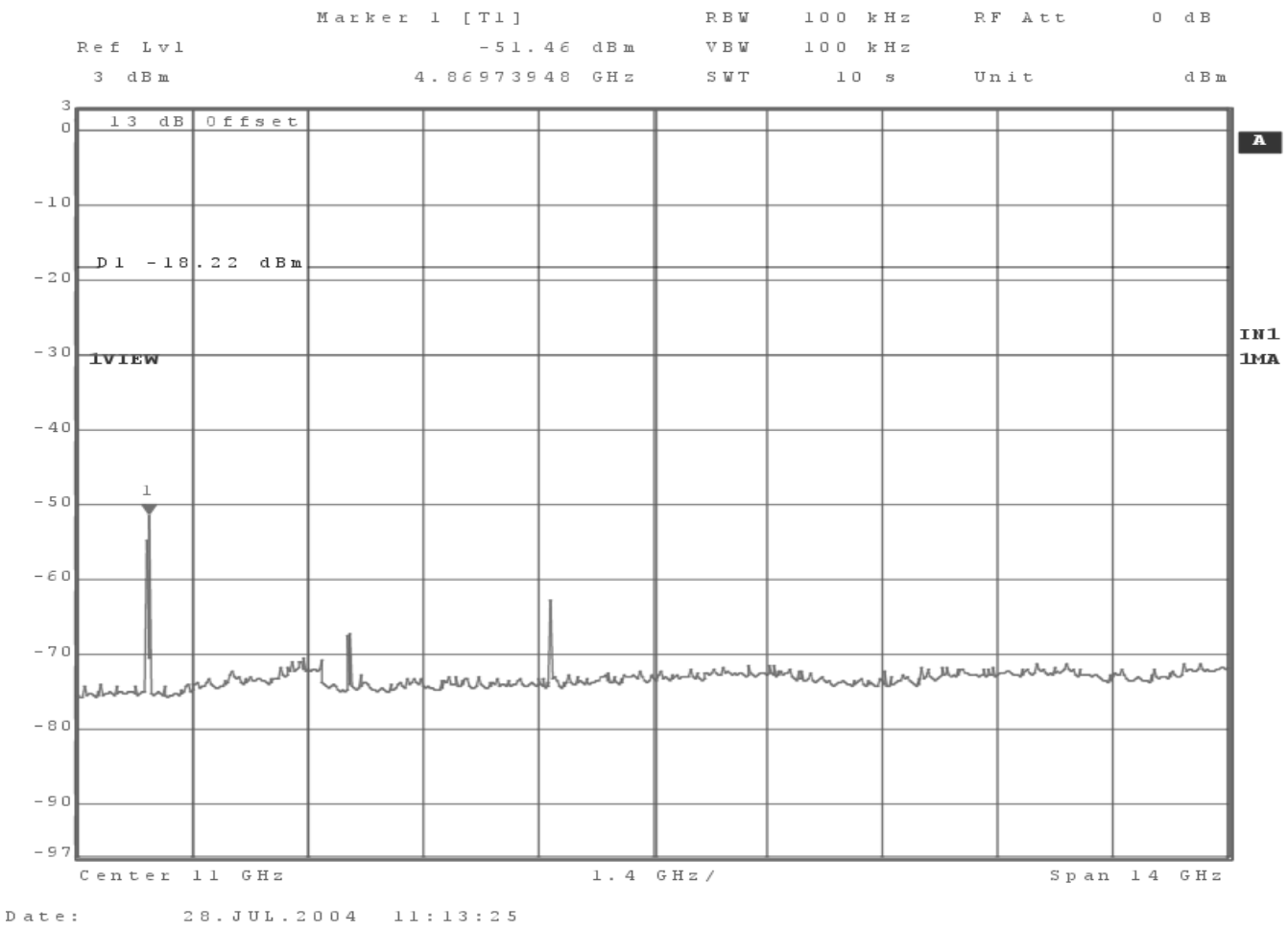
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.6 Test Results – continued

Spurious Conducted Emissions (4GHz – 18GHz)

EUT Tx on Middle Channel, (2437.0MHz) – Maximum Power 6Mbps

802.11g



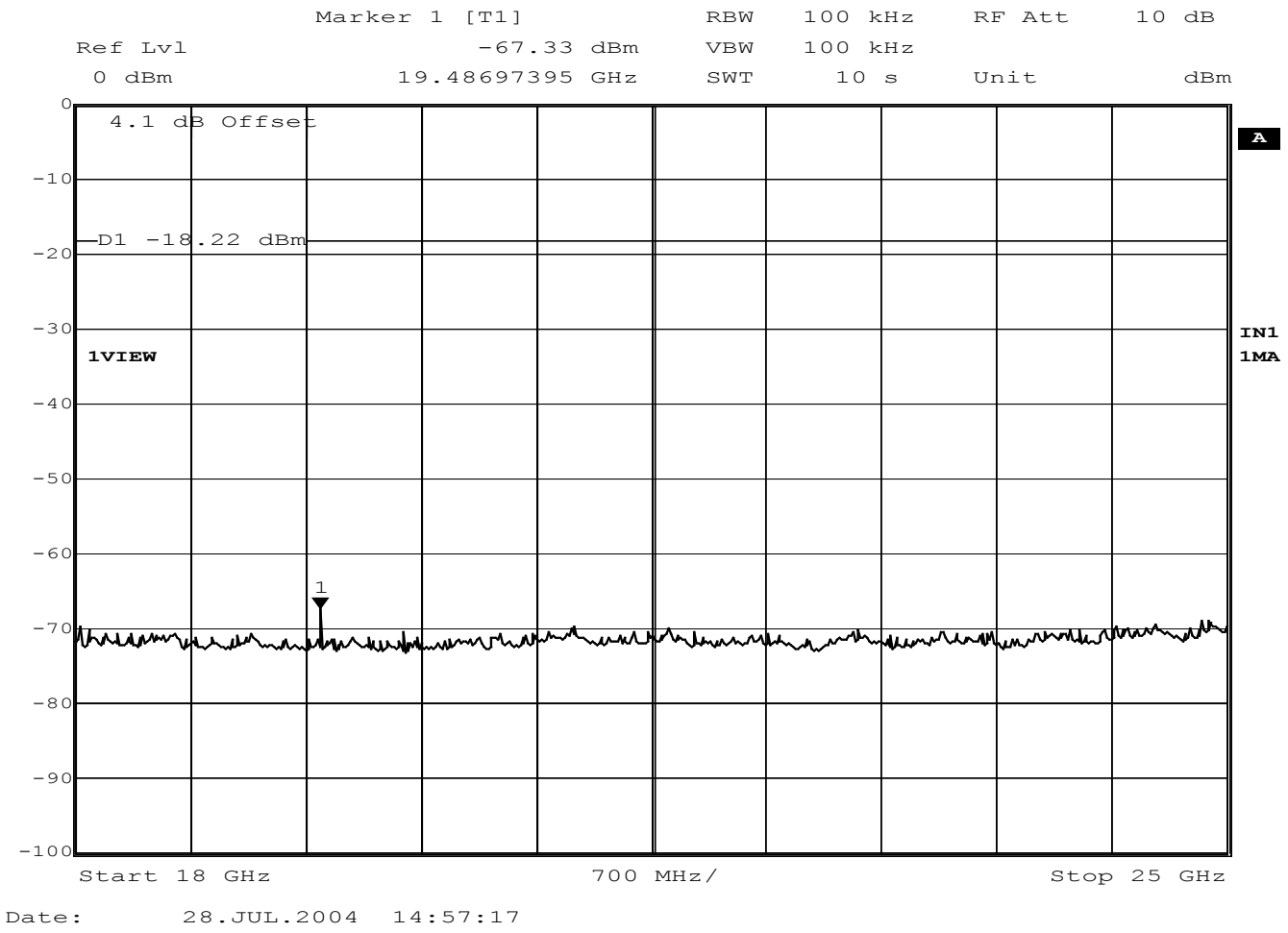
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.6 Test Results – continued

Spurious Conducted Emissions (18GHz – 25GHz)

EUT Tx on Middle Channel, (2437.0MHz) – Maximum Power 6Mbps

802.11g



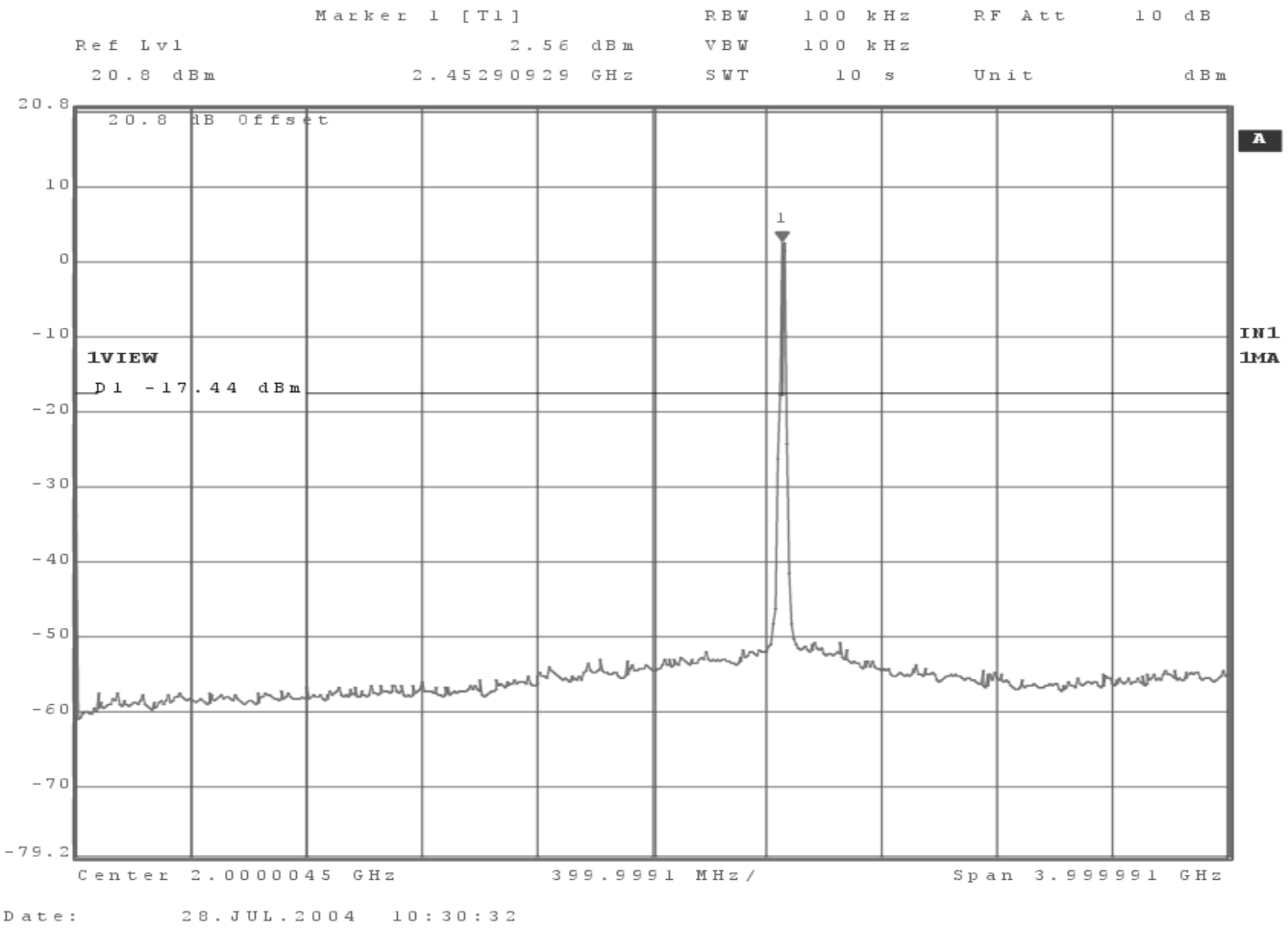
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.12 Test Results – continued

Spurious Conducted Emissions (9kHz – 4GHz)

EUT Tx on Channel 10, (2457.0MHz) – Maximum Power 6Mbps

802.11g



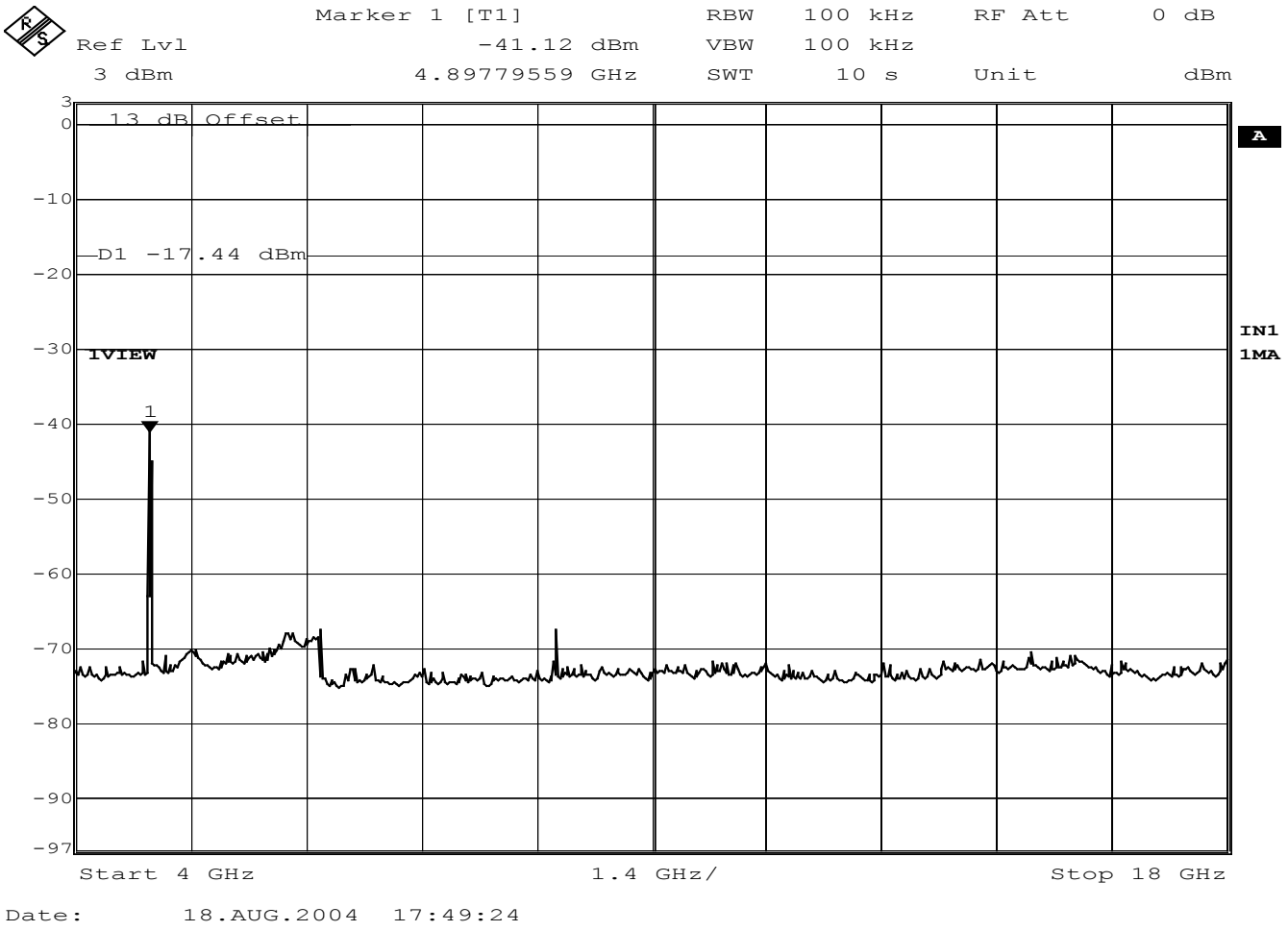
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.6 Test Results – continued

Spurious Conducted Emissions (4GHz – 18GHz)

EUT Tx on Channel 10, (2457.0MHz) – Maximum Power 6Mbps

802.11g



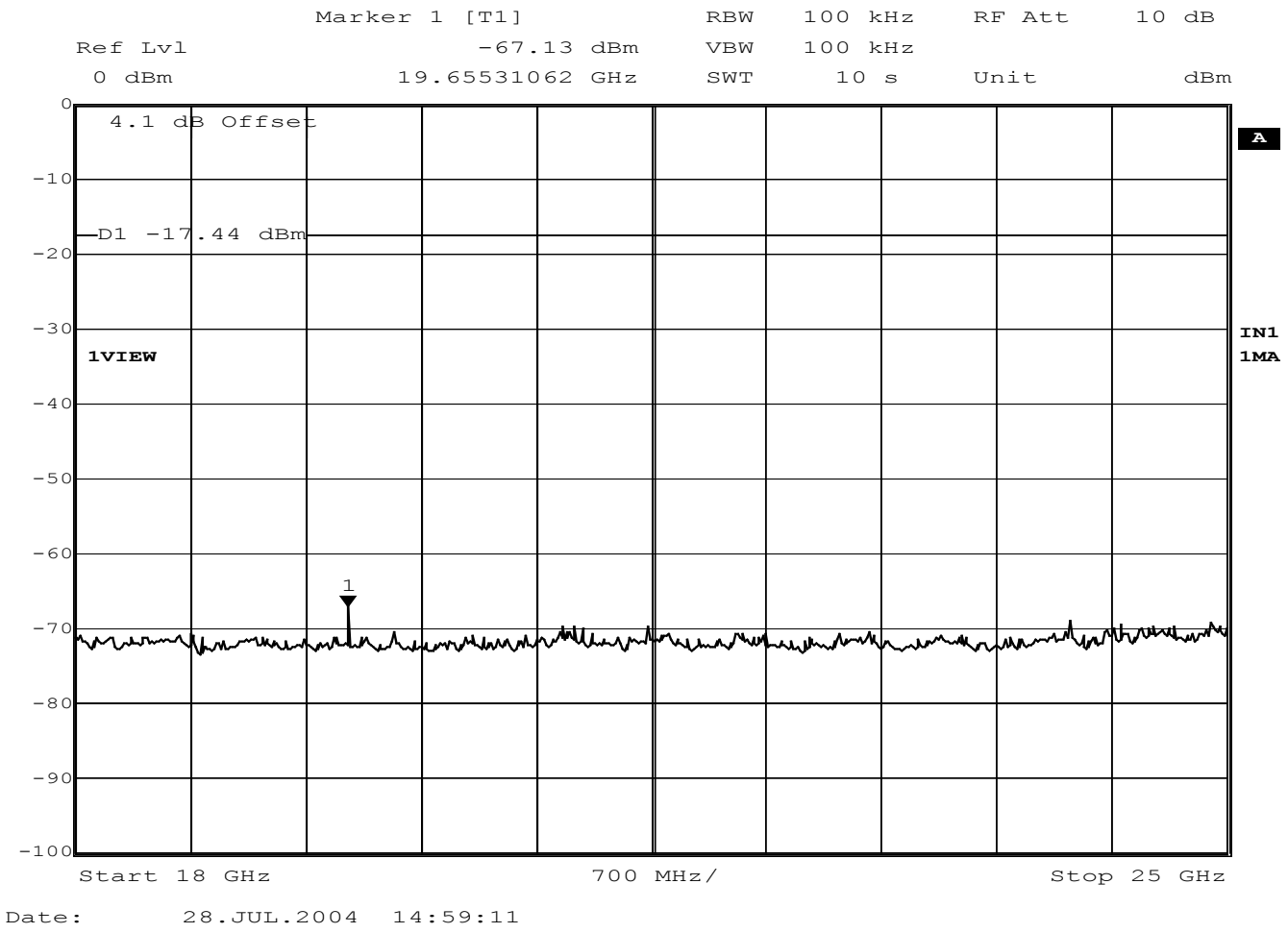
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.6 Test Results – continued

Spurious Conducted Emissions (18GHz – 25GHz)

EUT Tx on Channel 10, (2457.0MHz) – Maximum Power 6Mbps

802.11g



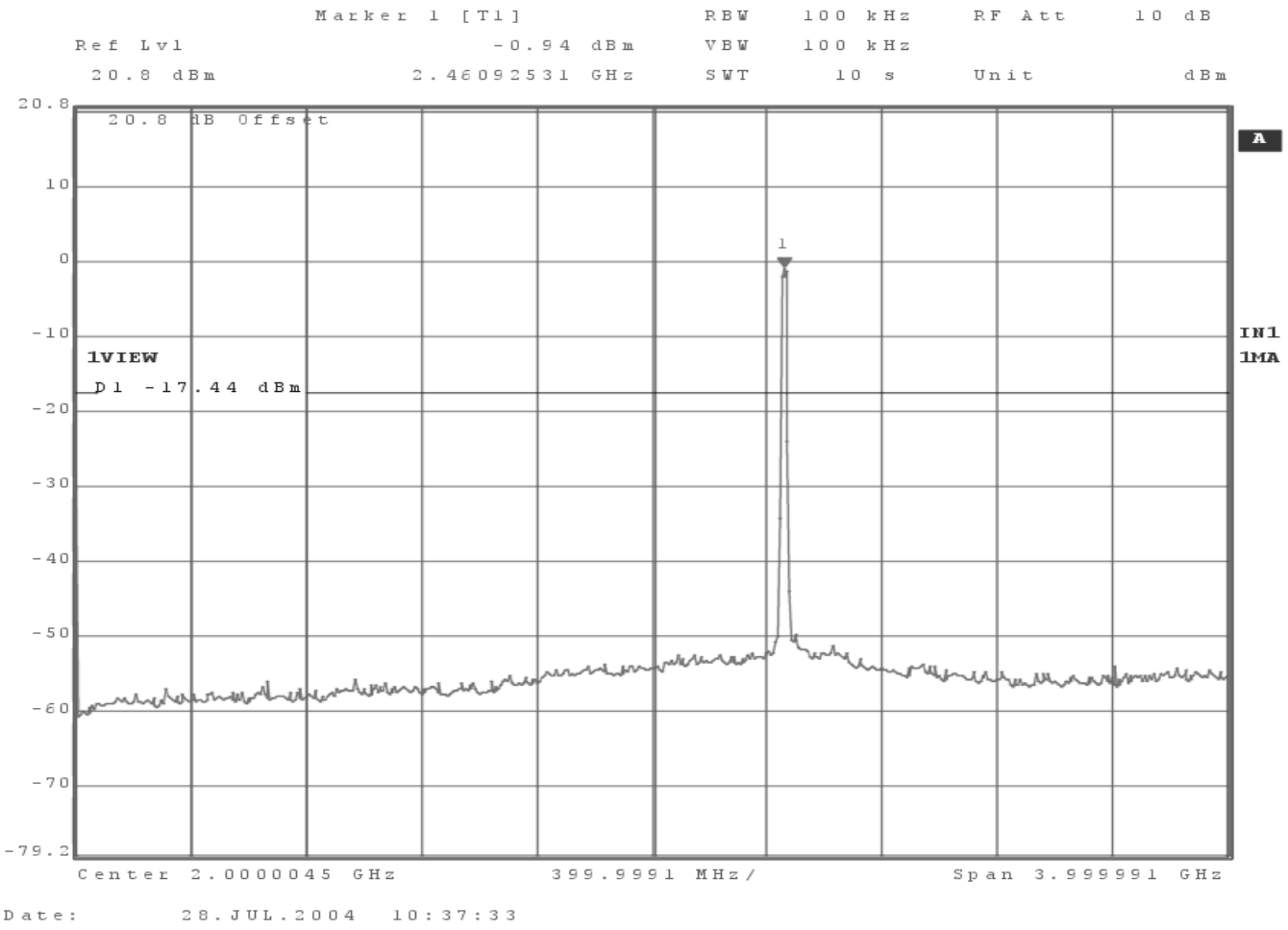
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.13 Test Results – continued

Spurious Conducted Emissions (9kHz – 4GHz)

EUT Tx on Top Channel, (2462.0MHz) – Maximum Power 6Mbps

802.11g



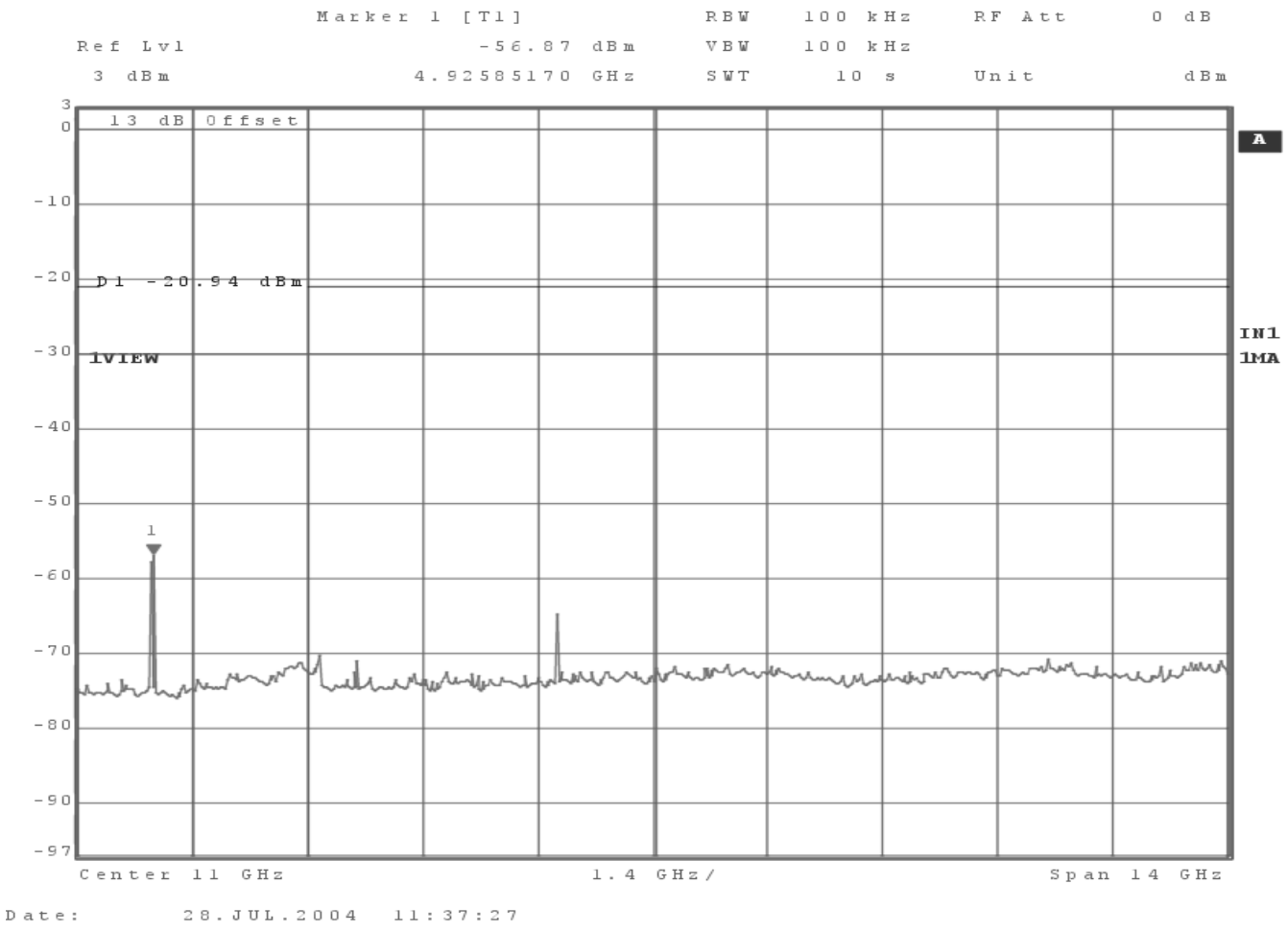
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.6 Test Results – continued

Spurious Conducted Emissions (4GHz – 18GHz)

EUT Tx on Top Channel, (2462.0MHz) – Maximum Power 6Mbps

802.11g



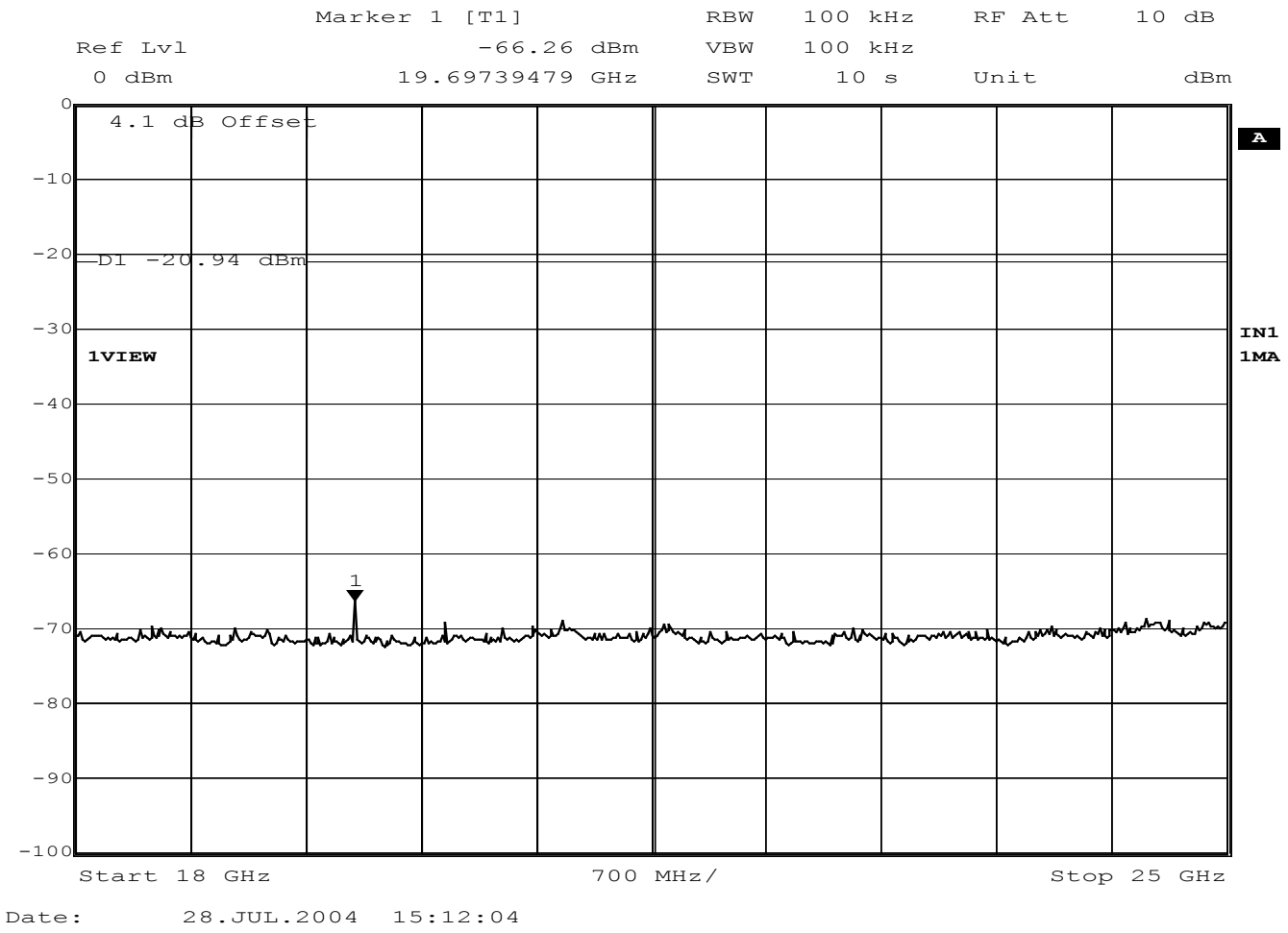
2.8 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.8.6 Test Results – continued

Spurious Conducted Emissions (18GHz – 25GHz)

EUT Tx on Top Channel, (2462.0MHz) – Maximum Power 6Mbps

802.11g



2.9 SPURIOUS RADIATED EMISSIONS

2.9.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.247(c)

2.9.2 Equipment Under Test

802.11a/b/g RLAN Module

2.9.3 Date of Test

21st July 2004

2.9.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as Section 2.9 within the Test Equipment Used table shown in Section 3.1.

2.9.5 Test Procedure

Testing to the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(c), for Spurious Radiated Emissions was carried out on the Measurement Test Facility detailed in Annex A. Section 15.247(c) also requires Rule parts 15.205 and 15.209 to be applied.

A preliminary profile of the Spurious Radiated Emissions was obtained by operating the Equipment Under Test (EUT) on a remotely controlled turntable within a semi-anechoic chamber; measurements were taken at a 3m distance unless otherwise stated. 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, a search was made in the frequency range 30MHz to 25GHz. The list of worst-case emissions was then confirmed or updated under Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

30MHz – 1GHz emissions levels were then formally measured using a CISPR Quasi-Peak detector. 1GHz – 40GHz emissions levels were then formally measured using Peak and Average detectors.

(Note: Peak measurements performed using a Resolution and Video Bandwidth of 1MHz, Average measurements performed using a Resolution Bandwidth of 1MHz and a Video Bandwidth of 10Hz)

The Host Laptop was connected to a 120V 60Hz supply.

2.9 SPURIOUS RADIATED EMISSIONS - continued

2.9.5 Test Procedure - continued

Spurious Radiated Emissions from 30MHz to 1GHz were made using a HP 8542E Test Receiver.

Spurious Radiated Emissions from 1GHz to 40GHz were made using a Rhode and Schwarz ESIB 40 Test Receiver.

The test was performed in accordance with ANSI C63.4.

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

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
2.4GHz RLAN	2412	105.1	85.1
2.4GHz RLAN	2437	107.3	87.3
2.4GHz RLAN	2462	106.0	86.0

The limits for Spurious Emissions Inside the Restricted Bands are in accordance with 15.205(a) & (b), which call up the limits in 15.209 (a)

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

2.9 SPURIOUS RADIATED EMISSIONS - continued

2.9.6 Test Results

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Spurious Radiated Emissions (30MHz – 1GHz).

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

EUT Tx on Bottom Channel (2412MHz)

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
99.4	V	164	242	28.9	27.9	43.5	150.0
99.9	H	176	33.6	30.5	31.6	43.5	150.0
159.9	H	152	34.2	26.1	20.2	43.5	150.0
440.0	H	213	35.0	31.5	37.6	43.5	150.0
480.0	H	194	35.0	30.8	34.7	46.0	200.0
520.0	V	104	34.5	28.4	26.3	46.0	200.0

EUT Tx on Middle Channel (2437MHz)

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
99.6	V	170	226	29.0	28.2	43.5	150.0
99.7	H	179	204	31.2	36.3	43.5	150.0
160.0	H	167	184	26.5	21.1	43.5	150.0
440.1	H	199	175	30.7	34.3	46.0	200.0
480.0	H	200	169	31.0	35.5	46.0	200.0
520.1	V	100	97	29.0	28.2	46.0	200.0

2.9 SPURIOUS RADIATED EMISSIONS - continued

2.9.6 Test Results – continued

30MHz - 1GHz Frequency Range

EUT Tx on Top Channel (2462MHz)

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
99.4	H	173	198	30.9	35.1	43.5	150.0
160.1	H	169	180	26.0	20.0	43.5	150.0
187.2	H	202	190	25.3	18.4	43.5	150.0
440.0	H	204	179	31.0	35.5	46.0	200.0
480.0	H	204	170	31.3	36.7	46.0	200.0
520.0	V	105	101	27.9	24.8	46.0	200.0

ABBREVIATIONS FOR ABOVE TABLES

H	Horizontal Polarisation	V	Vertical Polarisation
Pol	Polarisation	Hgt	Height
deg	degree	Azm	Azimuth

2.9 SPURIOUS RADIATED EMISSIONS - continued

2.9.6 Test Results - continued

1GHz - 40GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC Part 15.247(c)), 15.205 and 15.209 for SPURIOUS RADIATED Emissions (30MHz – 25GHz).

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

EUT Tx on Bottom Channel (2412MHz)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
1.040	V	100	66	48.4	74.0	40.9	54.0
4.822	V	100	101	58.7	74.0	46.9	54.0
7.116	V	100	99	52.9	85.1	N/A	N/A
19.295*	V	100	180	60.5	84.0	60.5	64.0

EUT Tx on Middle Channel (2437MHz)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
1.040	V	100	65	48.1	74.0	40.9	54.0
4.874	V	146	311	60.6	74.0	48.0	54.0
19.496*	V	100	178	63.2	84.0	59.8	64.0

* 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 hence Average Measurements are not required.

2.9 SPURIOUS RADIATED EMISSIONS - continued

2.9.6 Test Results – continued

1GHz - 40GHz Frequency Range

EUT Tx on Top Channel (2462MHz)

The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Spurious Radiated Emissions (30MHz – 40GHz).

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
1.040	V	100	67	48.7	74.0	40.8	54.0
4.923	V	103	24	56.3	74.0	43.6	54.0
19.695*	V	100	179	62.3	84.0	59.0	64.0

* 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.)

ABBREVIATIONS FOR ABOVE TABLES

H	Horizontal Polarisation	V	Vertical Polarisation
Pol	Polarisation	Hgt	Height
deg	degree	Azm	Azimuth

2.10 PEAK POWER SPECTRAL DENSITY

2.10.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.247(d)

2.10.2 Equipment Under Test

802.11a/b/g RLAN Module

2.10.3 Date of Test

26th July 2004

2.10.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.14” within the Test Equipment Used table shown in Section 3.1.

2.10.5 Test Procedure

The EUT was connected to the Spectrum Analyser via a 10dB Attenuator. The EUT was set to transmit at maximum power on the required test frequencies and at the data rates specified by the manufacturer.

With the EUT transmitting, the trace was adjusted to display the whole of the fundamental. The RBW and VBW were initially set to 100kHz Using the max hold function on the Spectrum Analyser, the peak response of the fundamental were established. This point was then centered on the display screen and the span adjusted to 600kHz and the RBW and VBW changed to 3kHz. The sweep time was set at 200 seconds, ($600x10^3$ / 3 x 10^3), and Max Hold selected. The peak response was then measured and recorded.

Test Performed In Accordance With 15.247(d).

2.10 PEAK POWER SPECTRAL DENSITY– continued

2.10.6 Test Results

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, 15.247(d) for Peak Power Spectral Density).

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

The results are recorded in the table below.

802.11b

Frequency (MHz)	Data Rate (Mbps)	Measurement Bandwidth (kHz)	Result (dBm)
2412	11	3	-6.612
2437	11	3	-6.834
2462	11	3	-6.502

802.11g

Frequency (MHz)	Data Rate (Mbps)	Measurement Bandwidth (kHz)	Result (dBm)
2412	6	3	-16.61
2417	6	3	-13.82
2437	6	3	-13.96
2457	6	3	-13.46
2462	6	3	-17.15

Limit	≤ +8dBm/3kHz

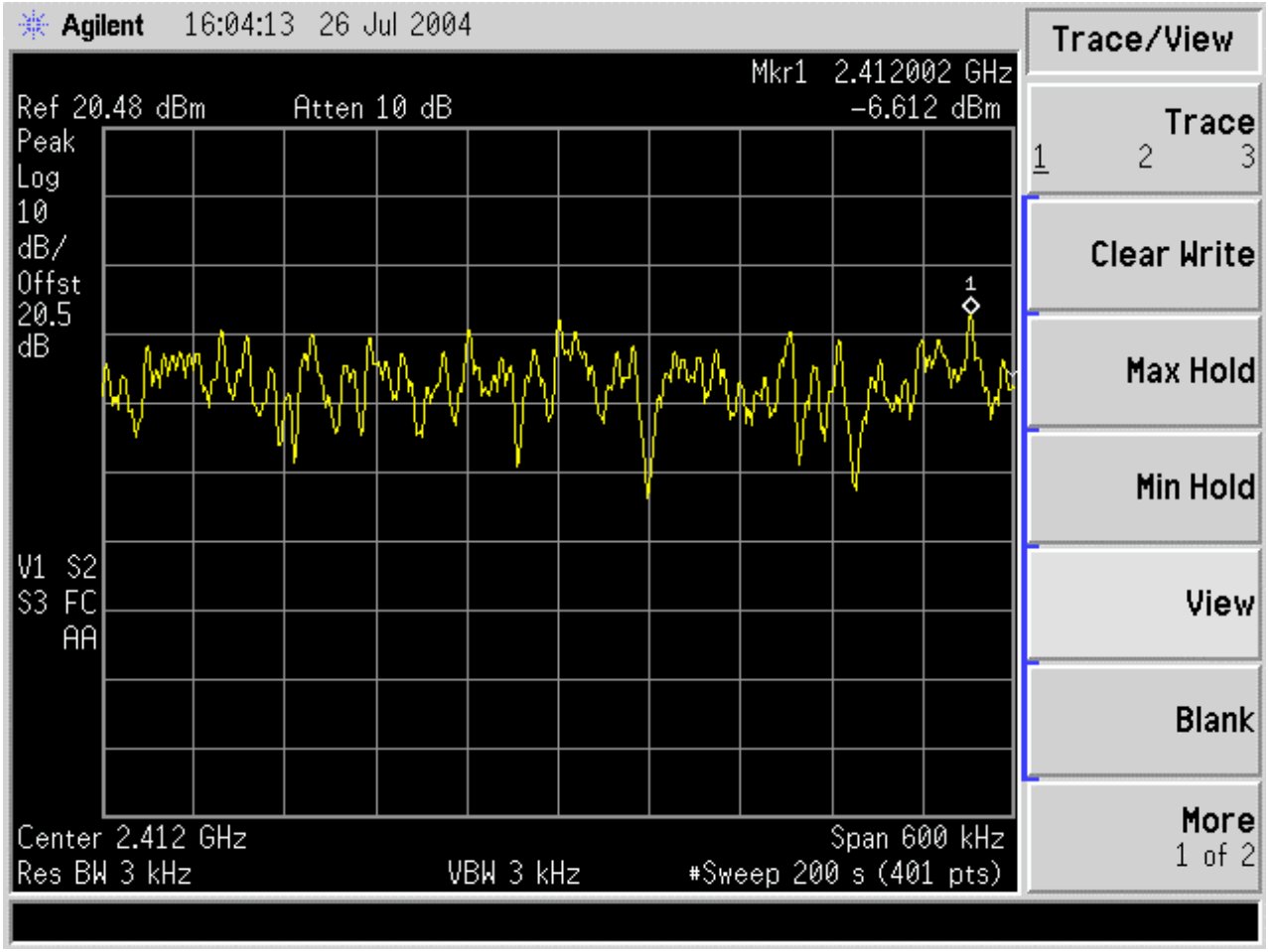
Remarks

The EUT met the requirements specified in Clause 15.247(d). The Peak Power Spectral Density was below the +8dBm/3kHz limit.

2.10 PEAK POWER SPECTRAL DENSITY– continued

2.10.6 Test Results - continued

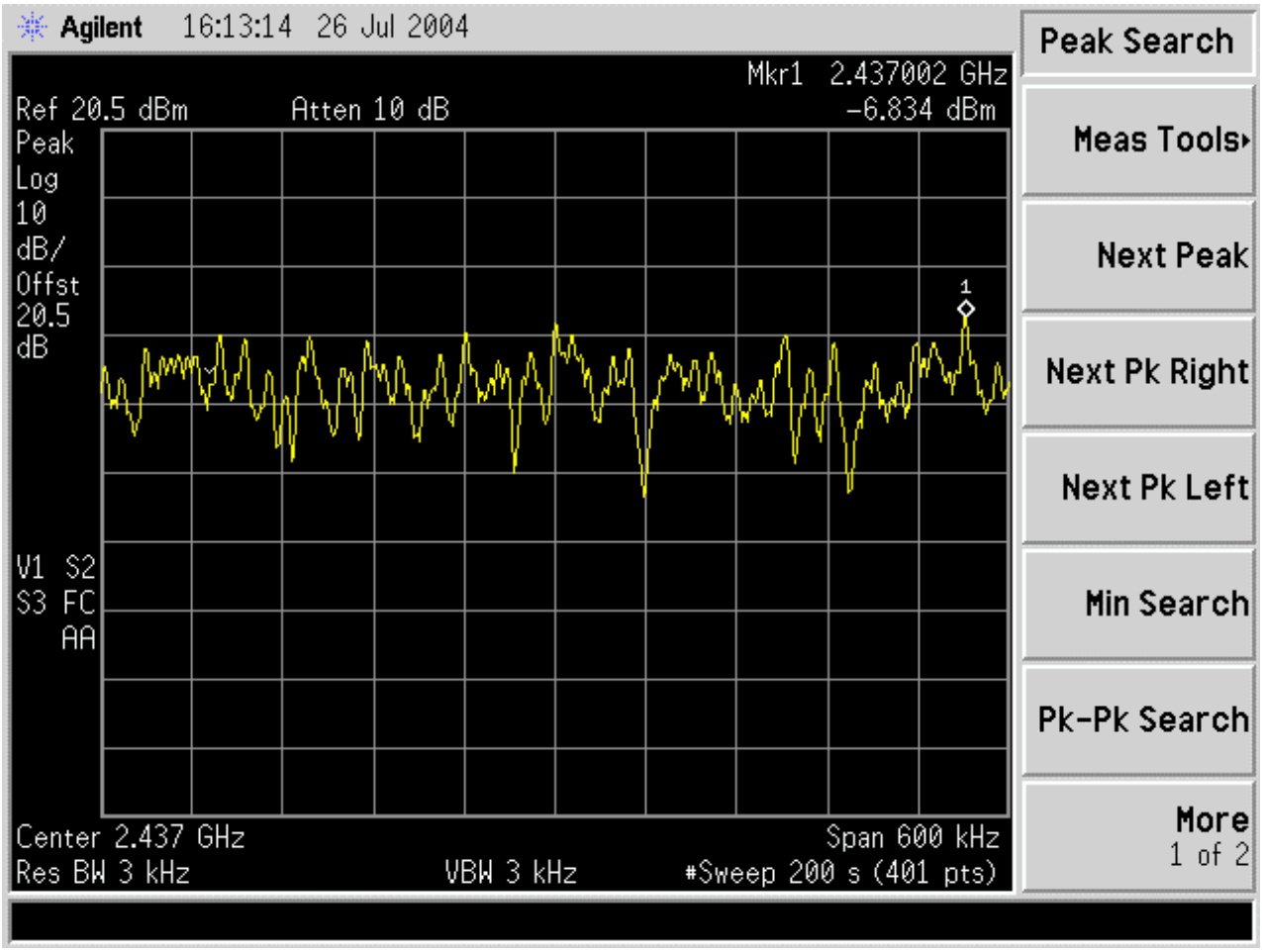
2412MHz – Maximum Power 11Mbps



2.10 PEAK POWER SPECTRAL DENSITY– continued

2.10.6 Test Results - continued

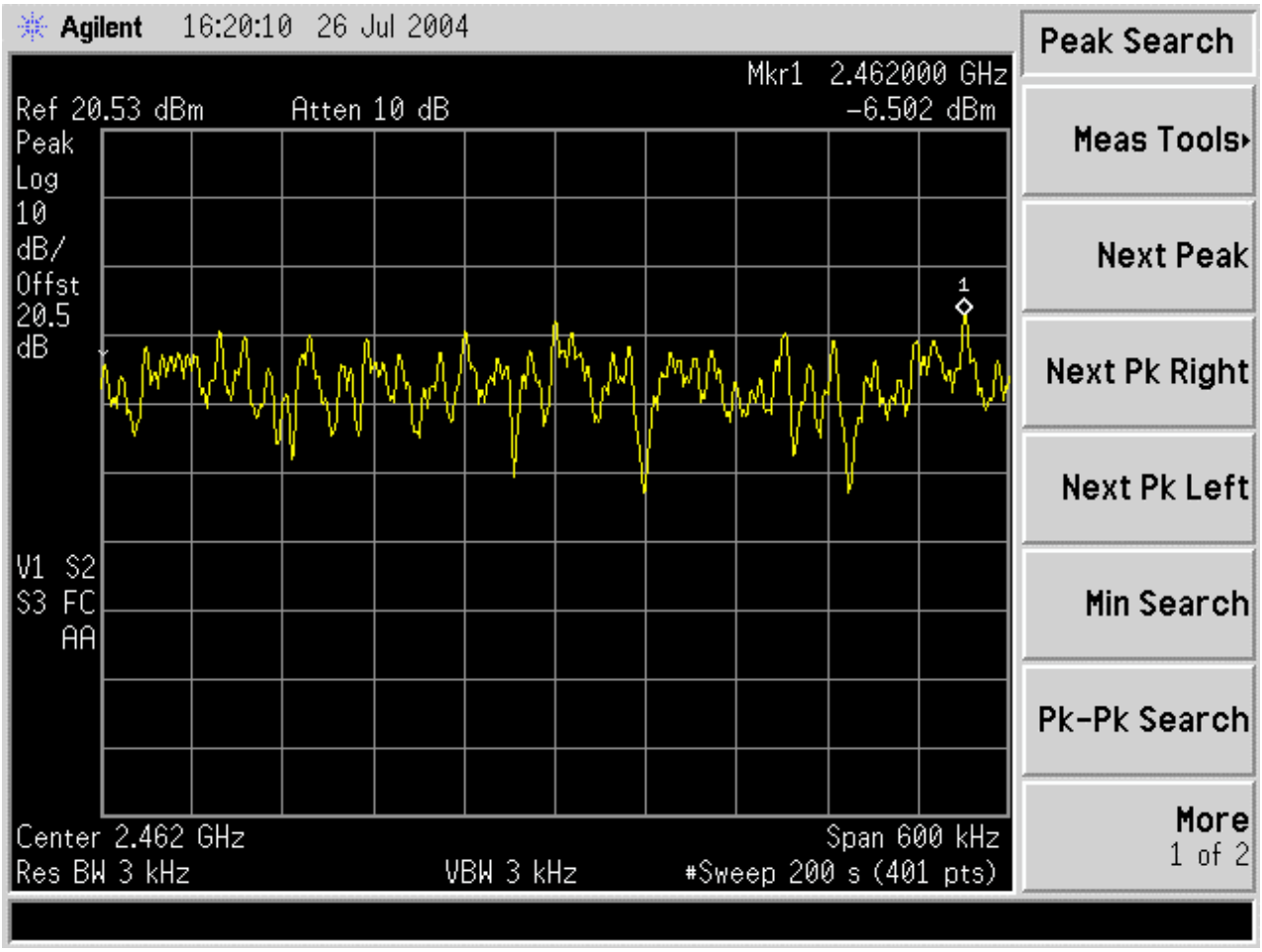
2437MHz – Maximum Power 11Mbps



2.10 PEAK POWER SPECTRAL DENSITY– continued

2.10.6 Test Results - continued

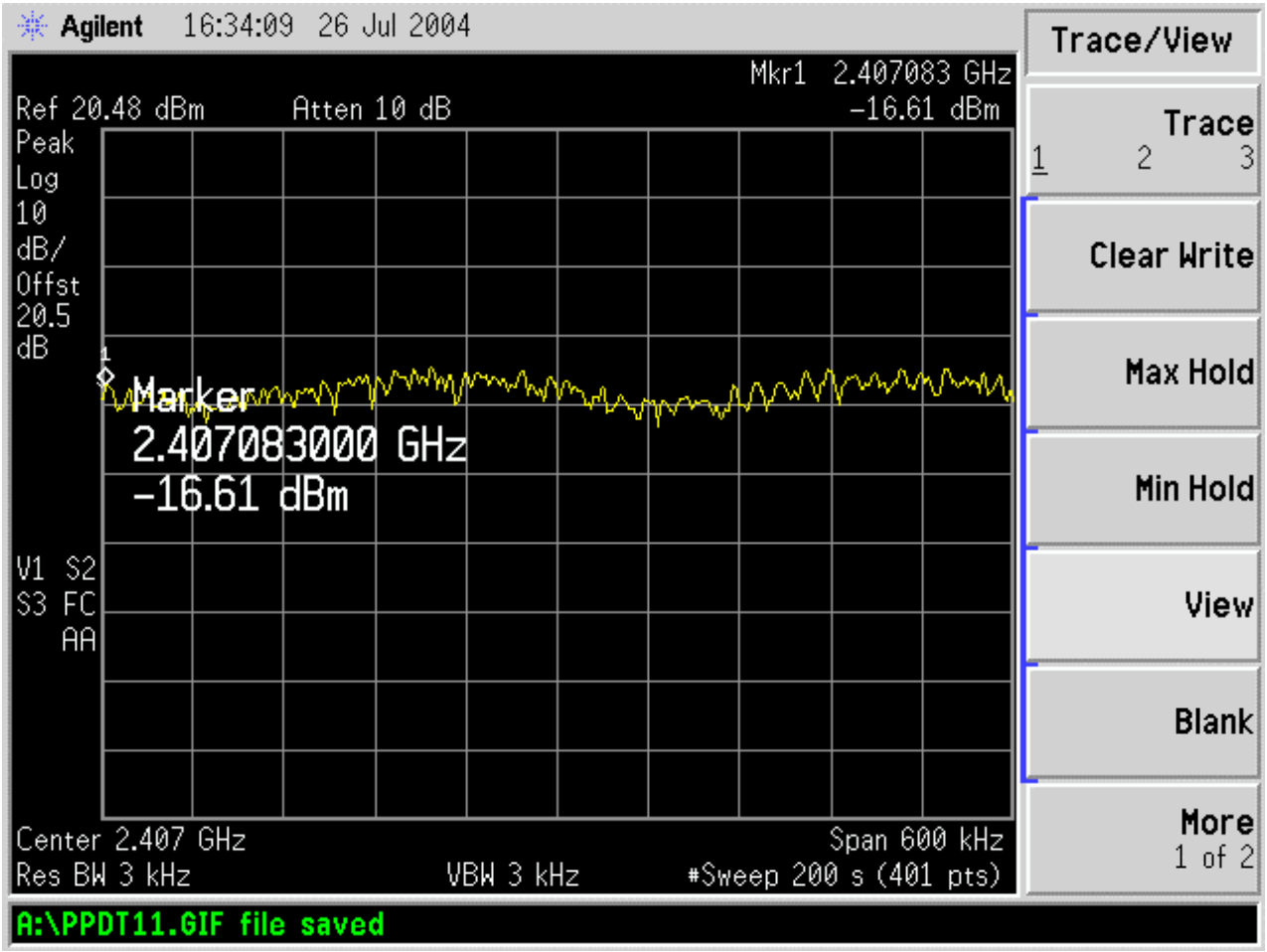
2462MHz – Maximum Power 11Mbps



2.10 PEAK POWER SPECTRAL DENSITY– continued

2.10.6 Test Results - continued

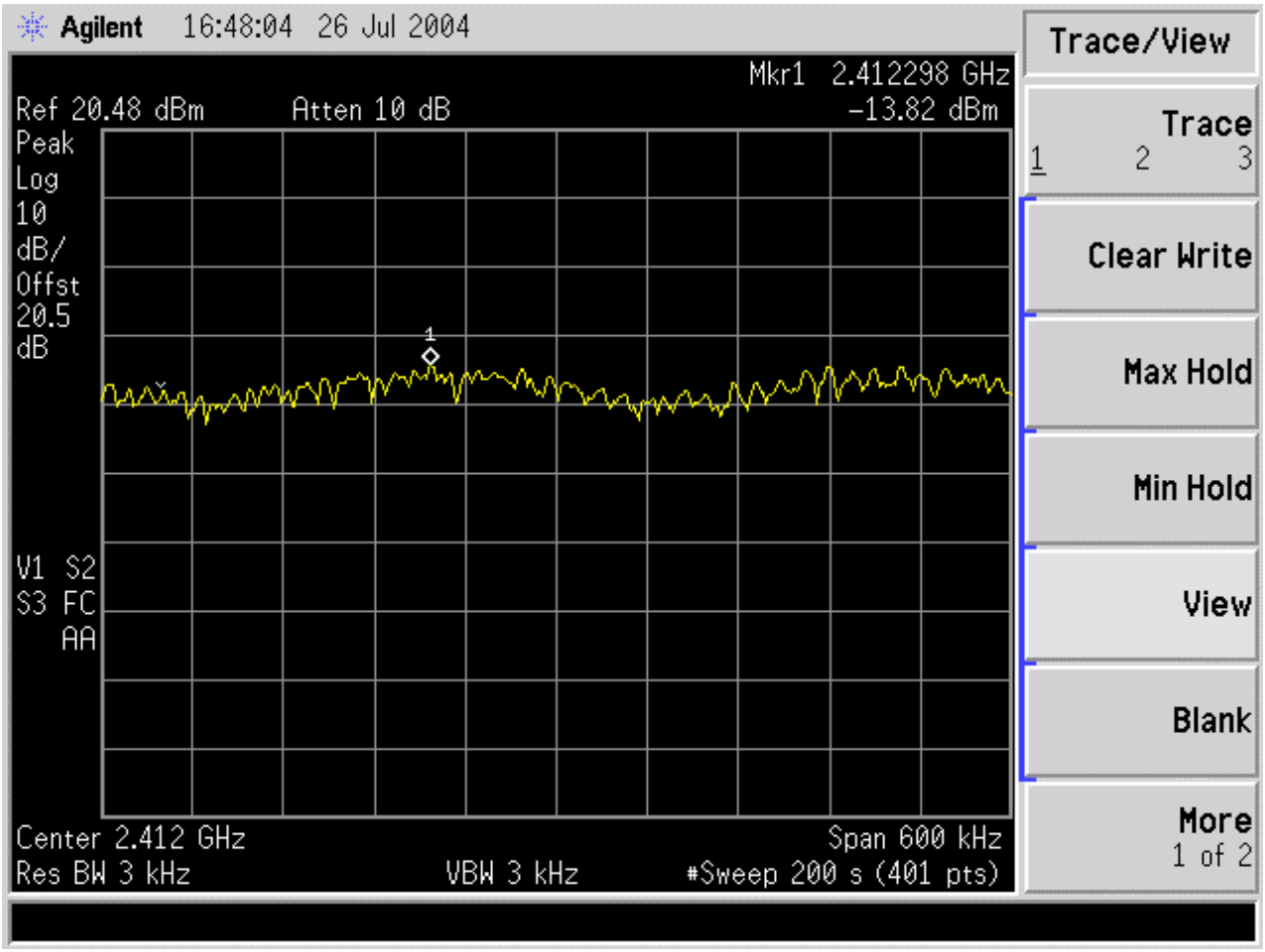
2412MHz – Maximum Power 6Mbps



2.10 PEAK POWER SPECTRAL DENSITY– continued

2.10.6 Test Results - continued

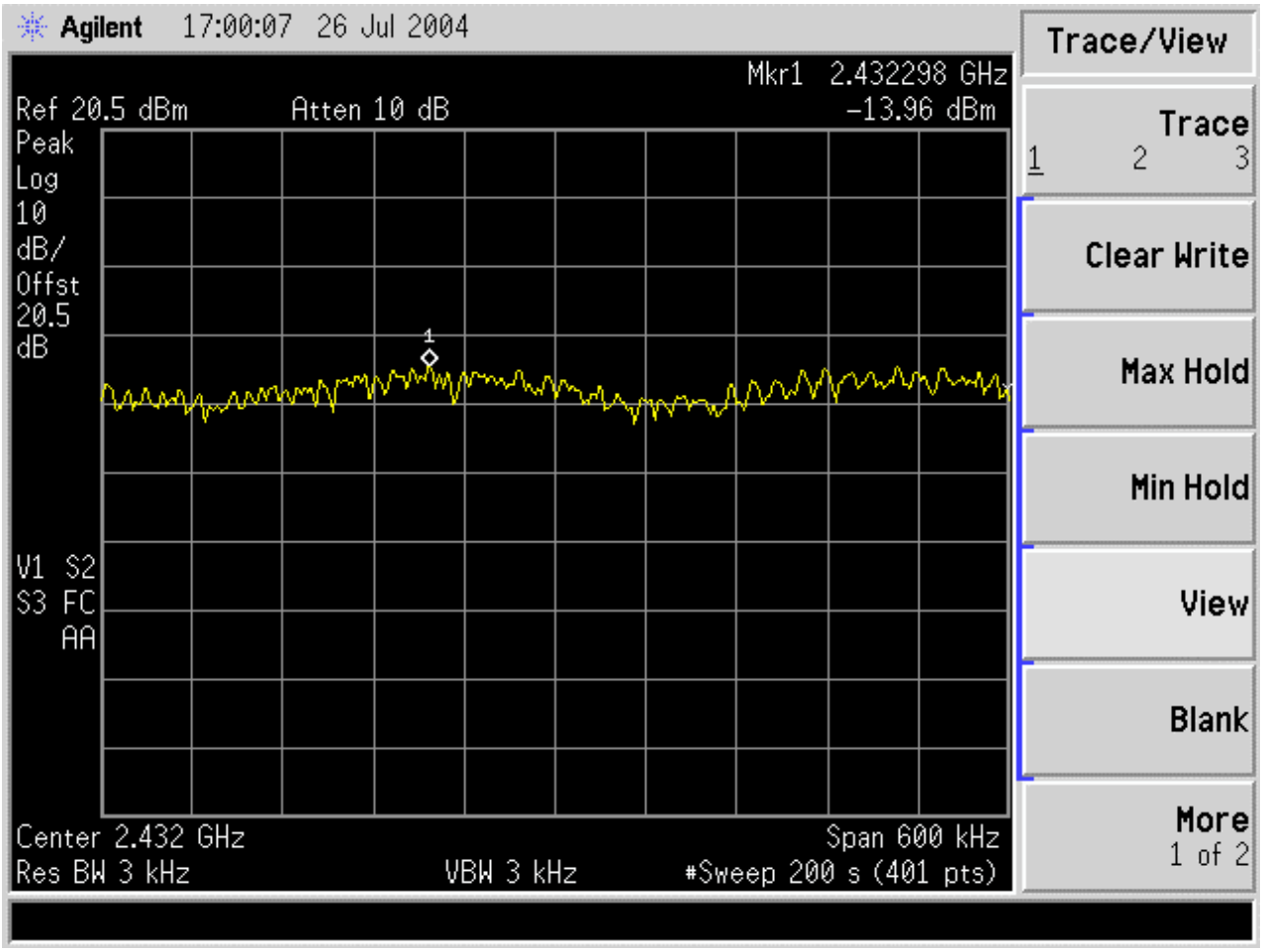
2417MHz – Maximum Power 6Mbps



2.10 PEAK POWER SPECTRAL DENSITY– continued

2.10.6 Test Results - continued

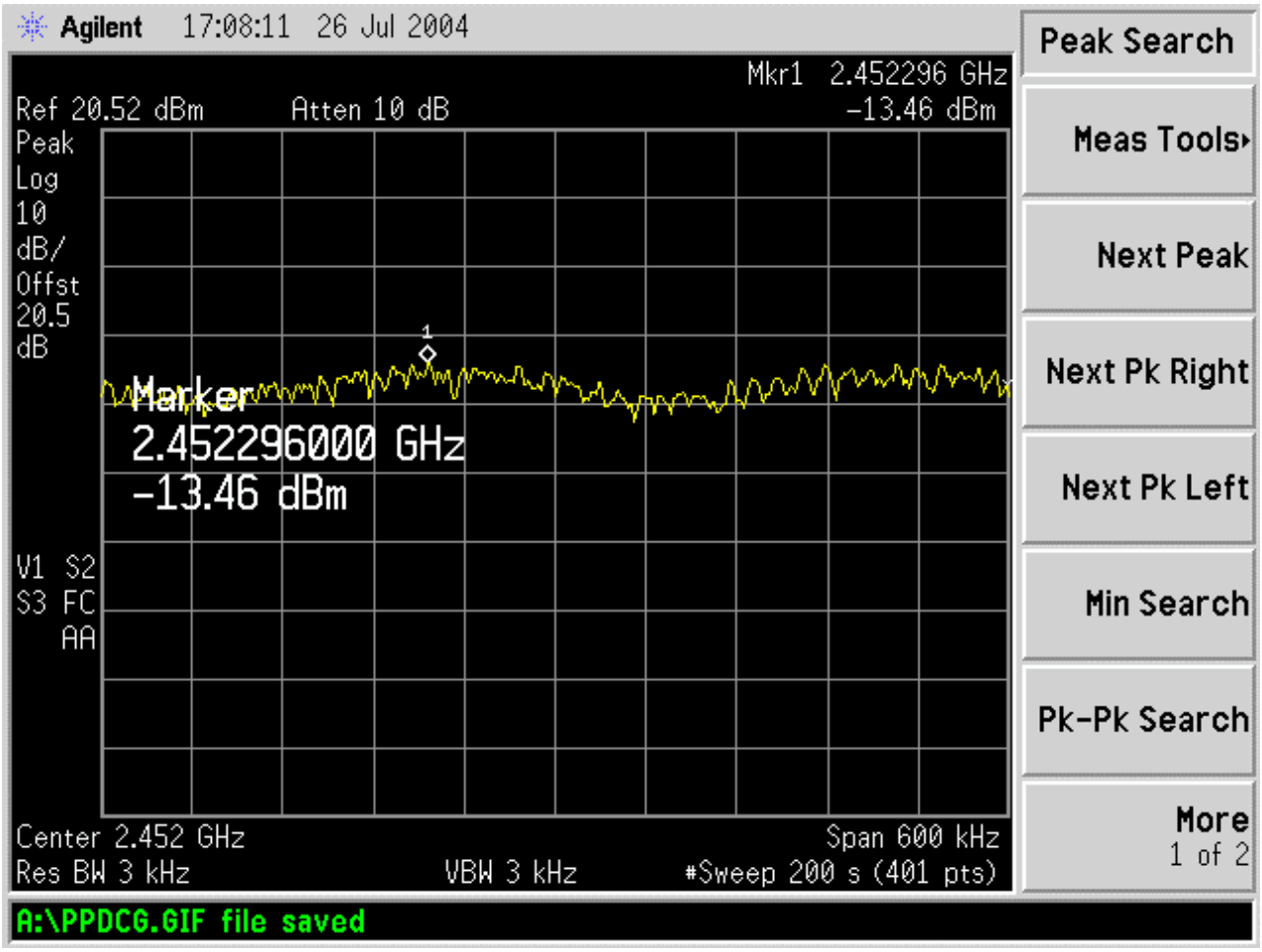
2437MHz – Maximum Power 6Mbps



2.10 PEAK POWER SPECTRAL DENSITY– continued

2.10.6 Test Results - continued

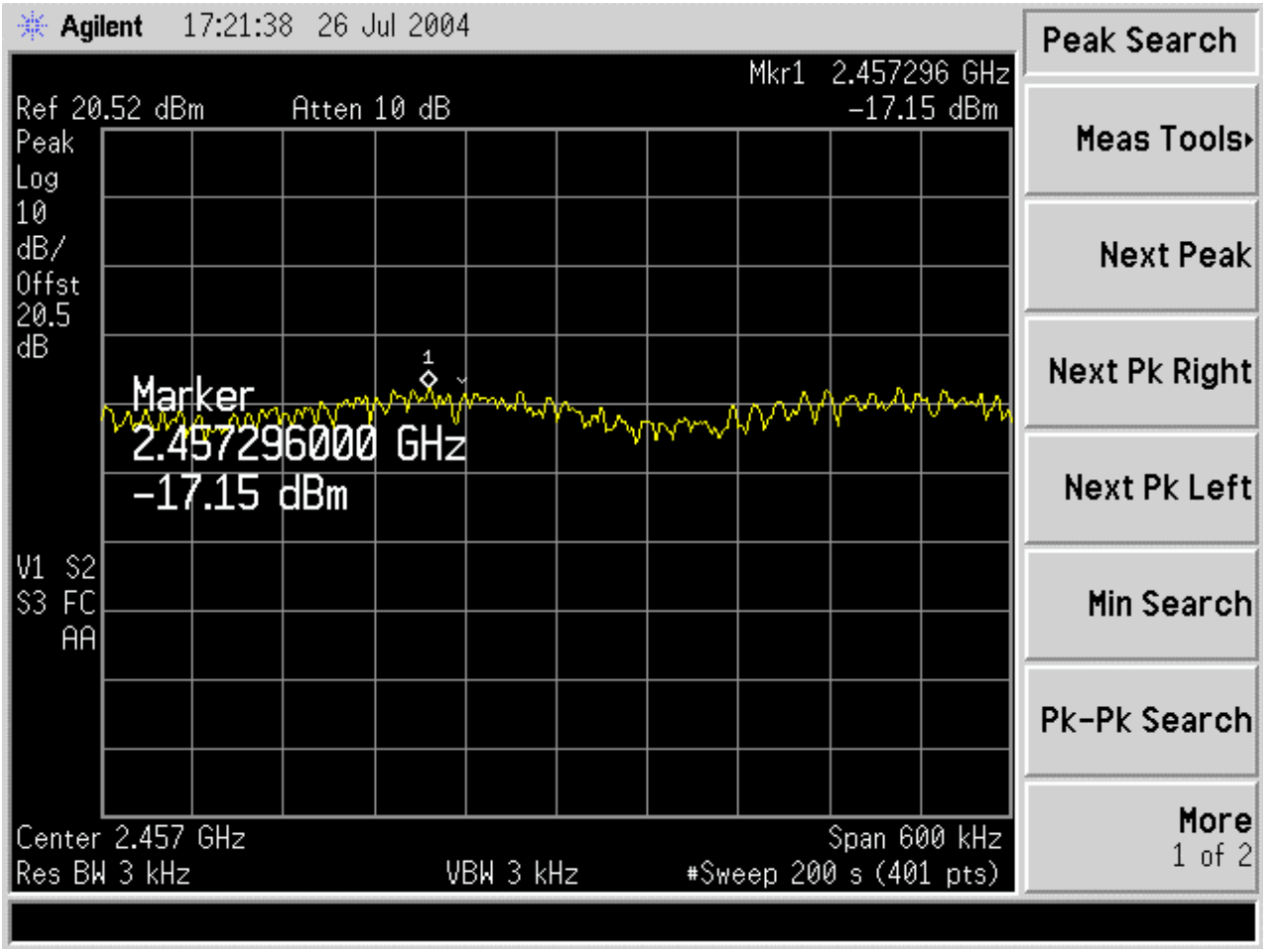
2457MHz – Maximum Power 6Mbps



2.10 PEAK POWER SPECTRAL DENSITY– continued

2.10.6 Test Results - continued

2462MHz – Maximum Power 6Mbps



SECTION 2

TEST DETAILS for 5.15GHz TO 5.35GHz

Limited FCC CFR 47: Parts 15 C and E Testing in support of an
Application for Grant of Equipment Authorisation
Of a Symbol 802.11a/b/g RLAN Module

2.11 PEAK POWER SPECTRAL DENSITY

2.11.1 Specification Reference

FCC CFR 47: Part 15 Subpart E, Sections 15.407(a)(1) and 15.407(a)(2)

2.11.2 Equipment Under Test

802.11a/b/g RLAN Module

2.11.3 Date of Test

29th July 2004

2.11.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.15” within the Test Equipment Used table shown in Section 3.1.

2.11.5 Test Procedure

The EUT was connected to a Spectrum Analyser via a 20dB attenuator. The EUT was set to transmit on maximum power an all required channels and at 6Mbps.

With the EUT transmitting, the trace was adjusted to display the 20dB bandwidth of the fundamental. The RBW was adjusted to 1MHz with the VBW set to 3MHz. The spectrum analyser detector was set to RMS AVE. The trace was then averaged over 200 samples. The peak response was then measured and recorded.

Test Performed In Accordance With 15.407(a)(1) and 15.407(a)(2).

2.11 PEAK POWER SPECTRAL DENSITY– continued

2.11.6 Test Results

The EUT met the requirements of FCC CFR 47: Part 15 Subpart E, 15.407(a)(1) and 15.407(a)(2) for Peak Power Spectral Density.

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

The results are recorded in the table below.

Frequency Band: 5150 – 5250MHz & 5250-5350MHz

Frequency (MHz)	Data Rate (Mbps)	Measurement Bandwidth (MHz)	Result (dBm)
5180	6	1	+2.50
5240	6	1	+2.88
5260	6	1	+4.03
5320	6	1	+5.29

Frequency Range	Limit
5150 – 5250MHz	4dBm/1MHz
5250-5350MHz	11dBm/1MHz

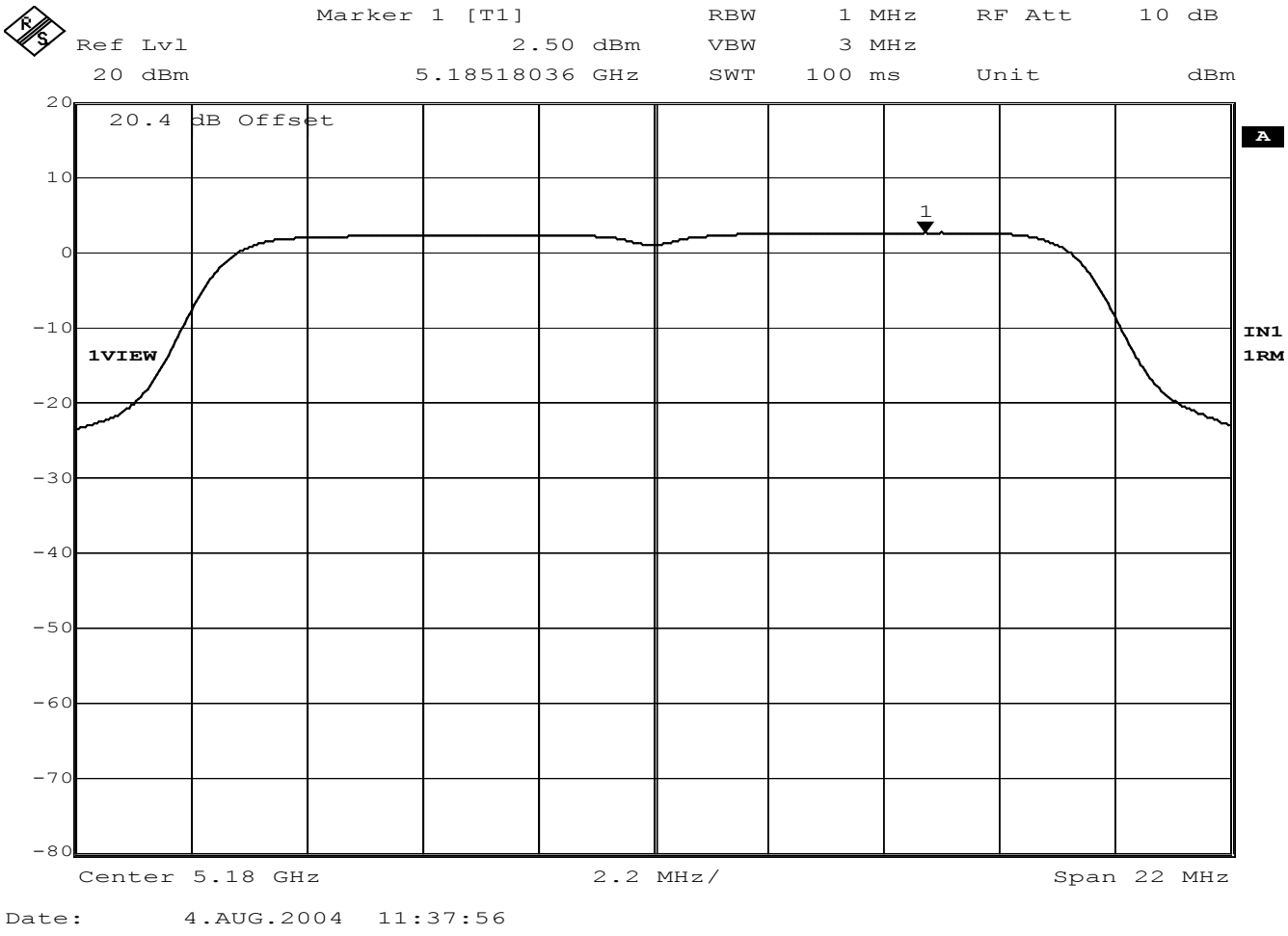
Remarks

The EUT met the requirements specified in sections 15.407(a)(1) and 15.407(a)(2). The Peak Power Spectral Density was below the 4dBm/1MHz limit in the 5150 – 5250MHz range and 11dBm/1MHz in the 5250-5350MHz range.

2.11 PEAK POWER SPECTRAL DENSITY– continued

2.11.6 Test Results - continued

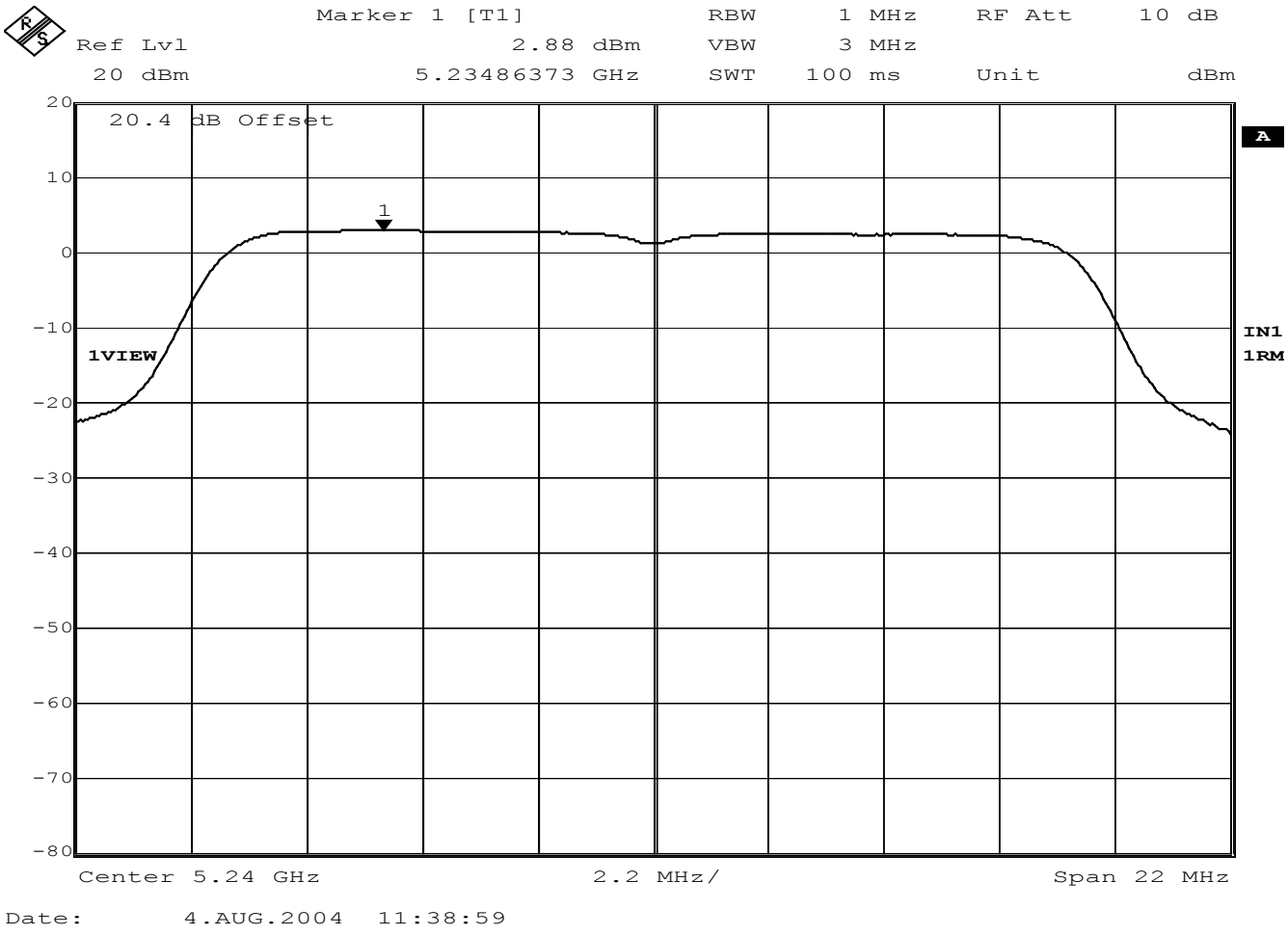
5180.0MHz – Maximum Power 6Mbps



2.11 PEAK POWER SPECTRAL DENSITY– continued

2.11.6 Test Results - continued

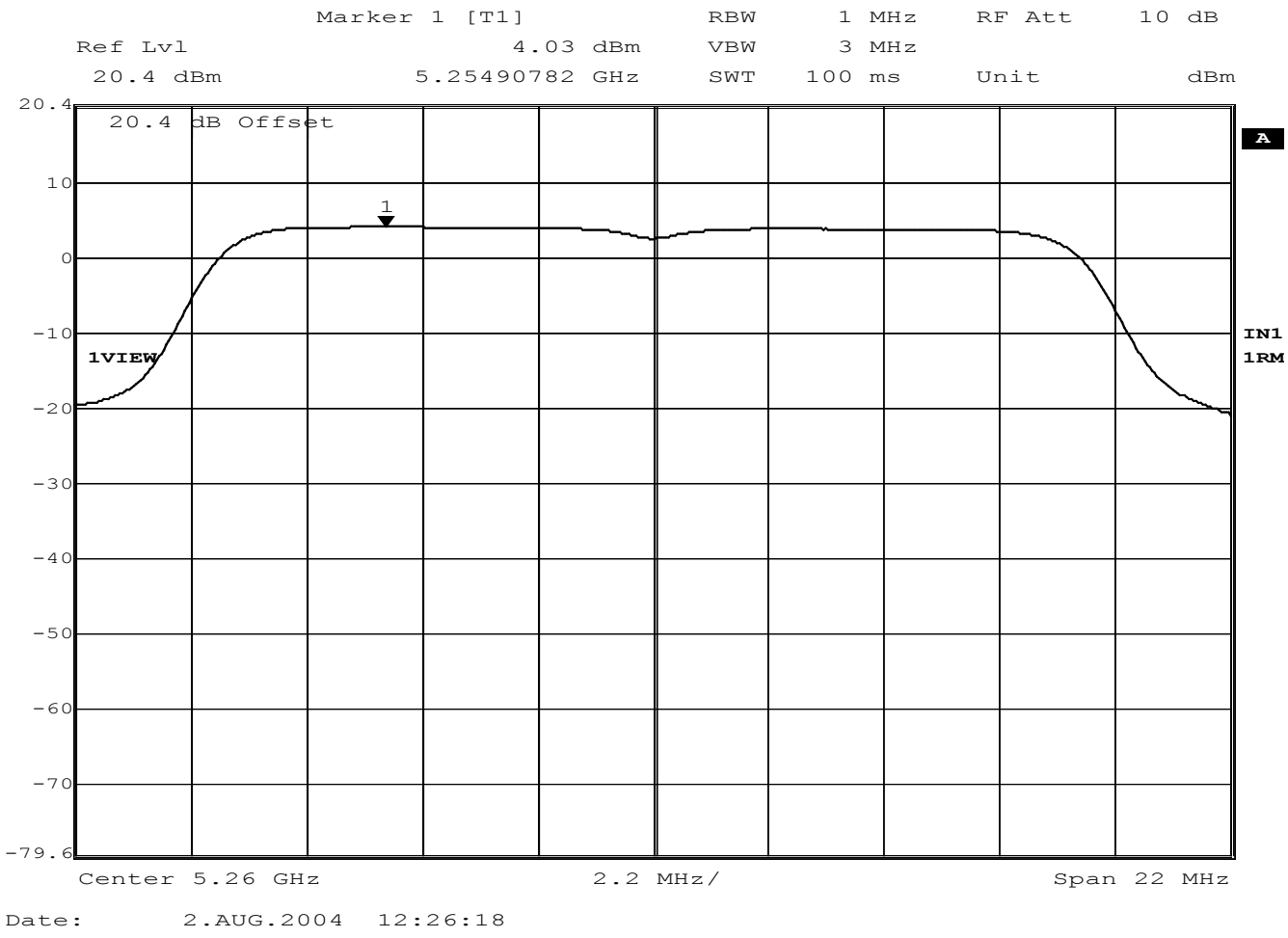
5240.0MHz – Maximum Power 6Mbps



2.11 PEAK POWER SPECTRAL DENSITY– continued

2.11.6 Test Results - continued

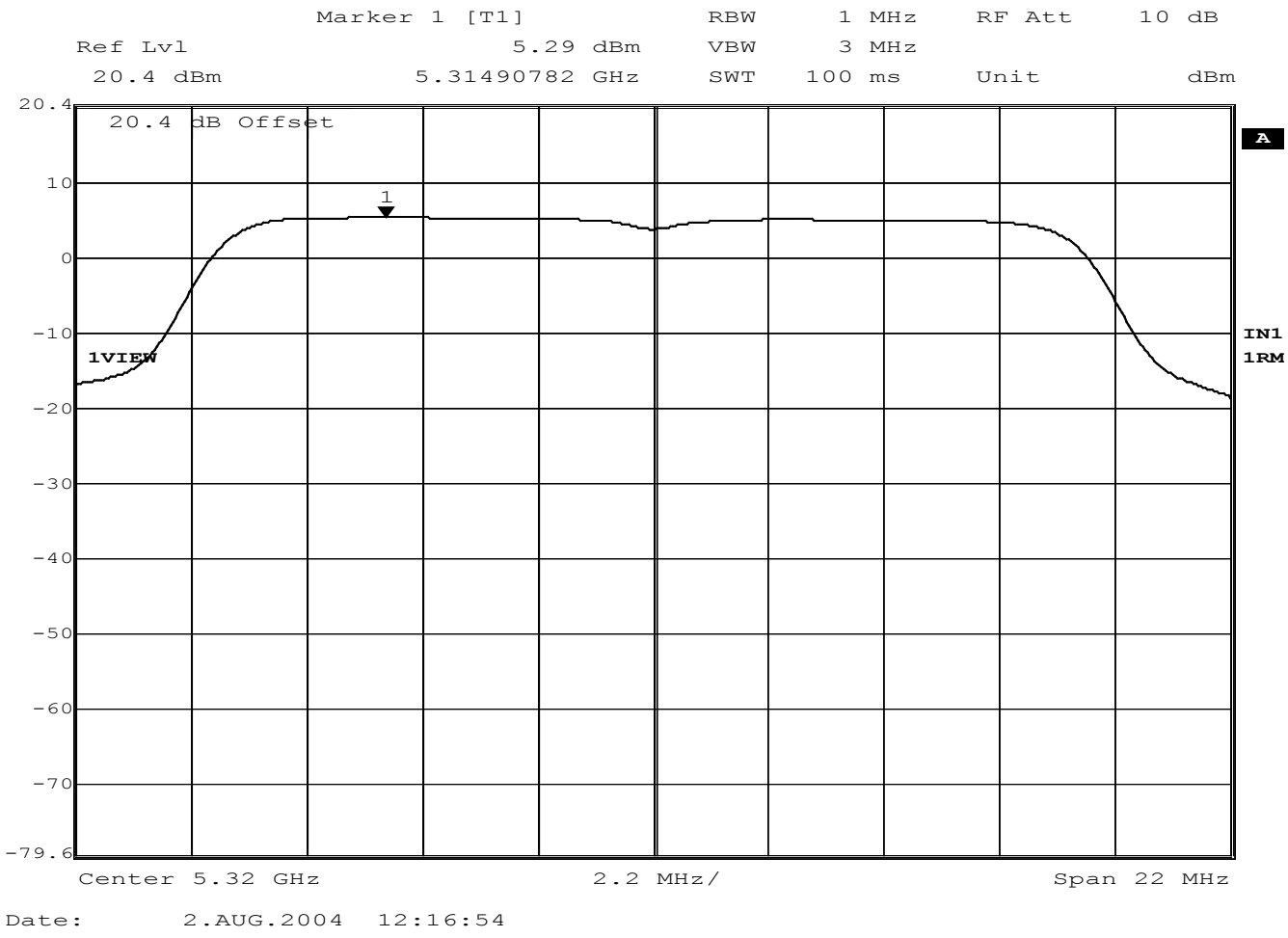
5260.0MHz – Maximum Power 6Mbps



2.11 PEAK POWER SPECTRAL DENSITY– continued

2.11.6 Test Results - continued

5320.0MHz – Maximum Power 6Mbps



2.12 PEAK OUTPUT POWER

2.12.1 Specification Reference

FCC CFR 47: Part 15 Subpart E, Section 15.407(a)(1)(2)

2.12.2 Equipment Under Test

802.11a/b/g RLAN Module

2.12.3 Date of Test

29th July 2004

2.12.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.16” within the Test Equipment Used table shown in Section 3.1.

2.12.5 Test Procedure

The EUT was connected to a Peak Power Analyser via a 10dB Attenuator. The path loss previously measured was used as an offset in the Peak Power Analyser and the Peak Power was measured.

Test Performed In Accordance With 15.407(a)(1) and 15.407(a)(2).

2.12 PEAK OUTPUT POWER – continued

2.12.6 Test Results

The EUT met the requirements of FCC CFR 47: Part 15 Subpart E, 15.407(a)(1)(2) for Peak Output Power).

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

Frequency (MHz)	Data Rate (Mbps)	Output Power (dBm)	Result (mW)
5180	6	16.92	49.20
5240	6	16.95	49.55
5260	6	19.23	83.75
5320	6	18.78	75.51

Limit

Frequency (MHz)	Limit (mW)
5180	50
5240	50
5260	100.23
5320	250

2.13 EMISSION BANDWIDTH

2.13.1 Specification Reference

FCC CFR 47: Part 15 Subpart E, Section 15.407(a)(1)(2)(3)

2.13.2 Equipment Under Test

802.11a/b/g RLAN Module

2.13.3 Date of Test

23rd August 2004

2.13.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.17” within the Test Equipment Used table shown in Section 3.1.

2.13.5 Test Procedure

The EUT was connected to the Spectrum Analyser using a 20dB Attenuator and cables. The RBW was set to 300kHz and the VBW to 1MHz. The Span was adjusted to encompass the whole of the fundamental. The Peak detector was selected and the trace was set to View. The peak of the fundamental was searched using a –26dB display line. The Marker Delta function was used where the signal crosses the display line. The resultant difference in the markers was recorded as the Emission Bandwidth.

Test Performed In Accordance With 15.407(a)(1)(2)(3).

2.13 EMISSION BANDWIDTH– continued

2.13.6 Test Results

The EUT met the requirements of FCC CFR 47: Part 15 Subpart E, 15.407(a)(1)(2)(3) for Emission Bandwidth).

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

The results are recorded in the table below.

Frequency Band: 5150 – 5250MHz and 5250 –5350MHz

Frequency, (MHz)	Data Rate, (Mbps)	Emission Bandwidth, (MHz)
5180	6	40.381
5240	6	38.076
5260	6	39.880
5320	6	35.571

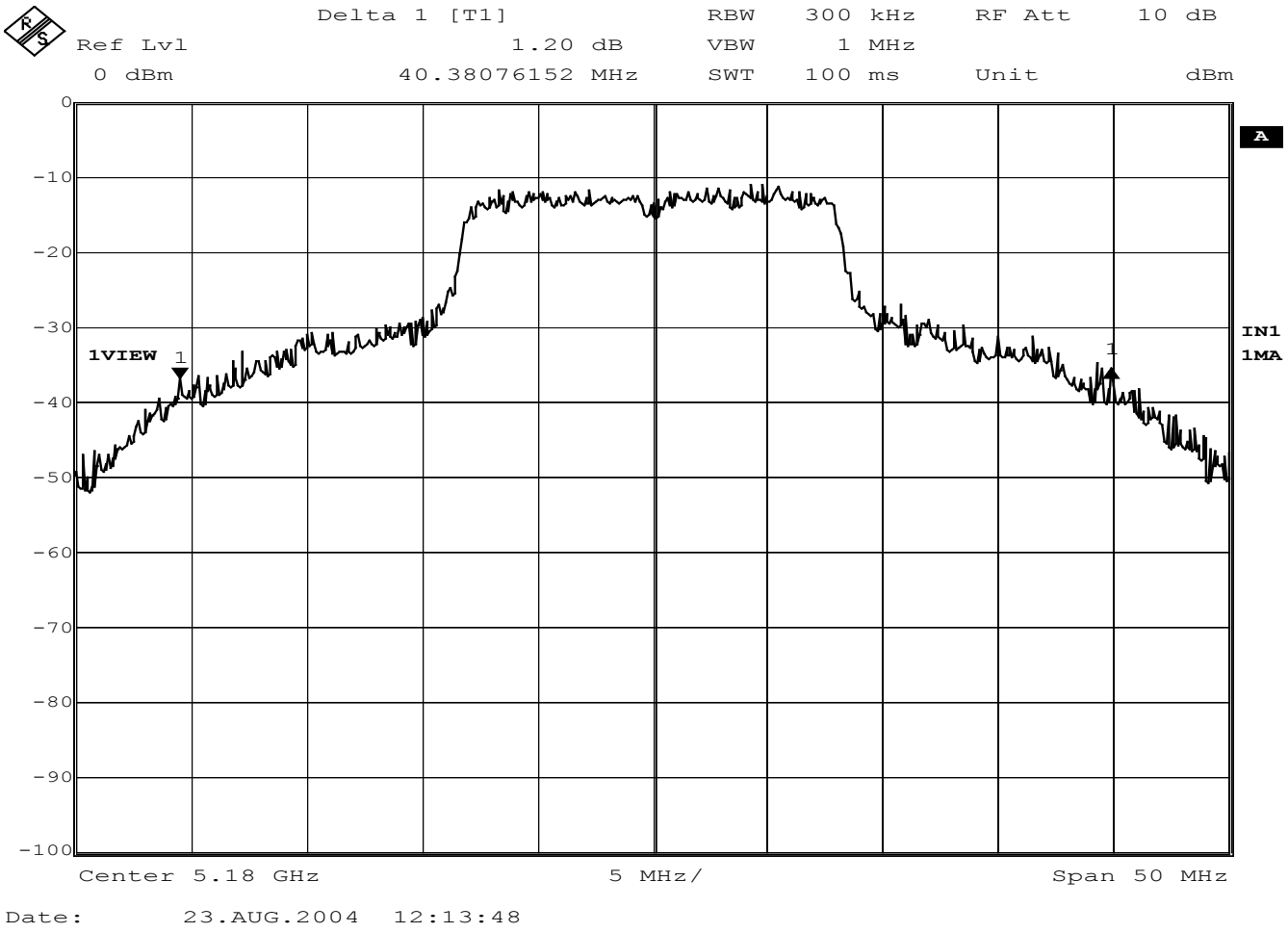
Remarks

The EUT met the requirements specified in Clause 15.407(a)(1)(2)(3)

2.13 EMISSION BANDWIDTH – continued

2.13.6 Test Results - continued

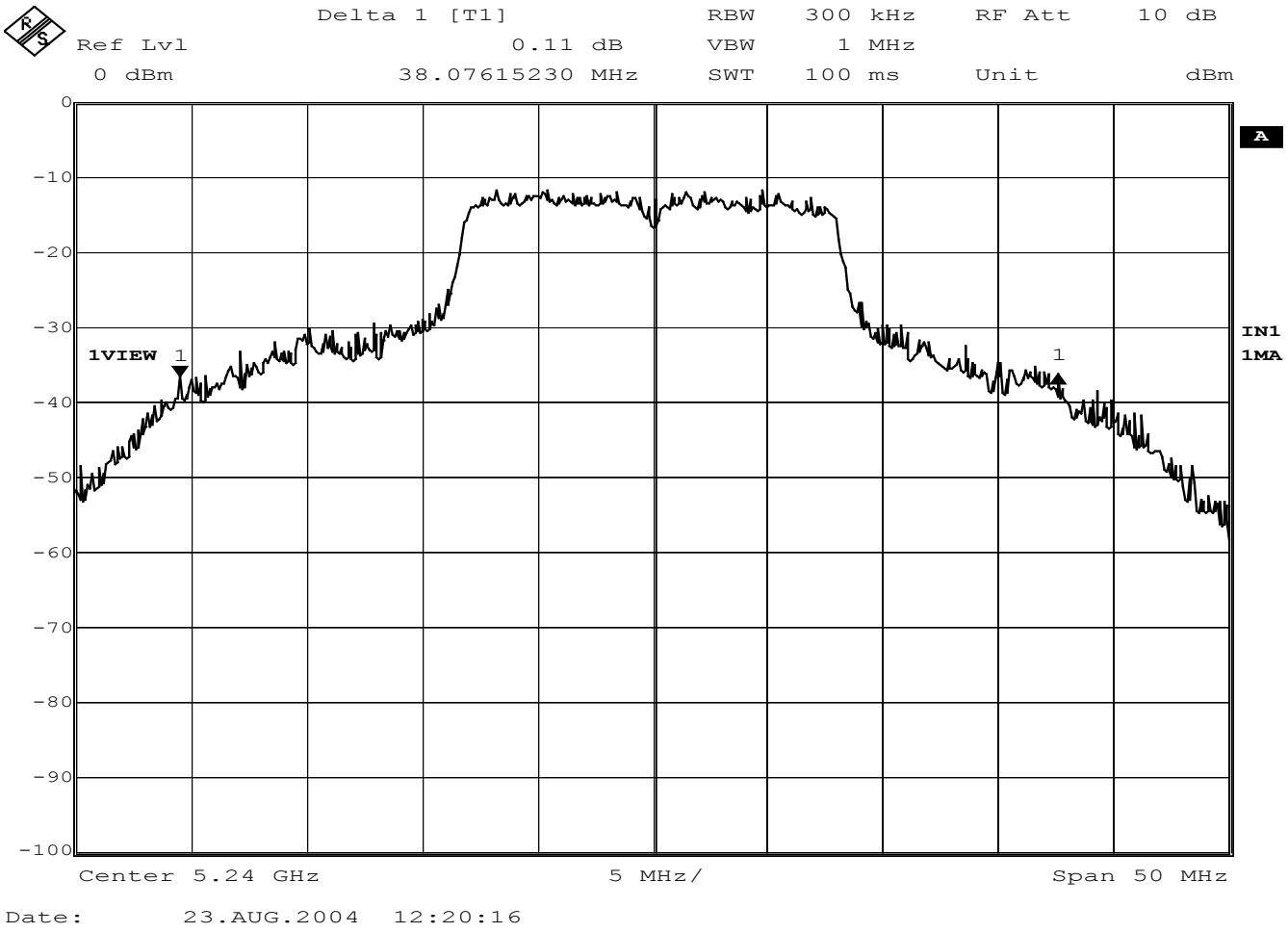
5180.0MHz – Maximum Power 6Mbps



2.13 EMISSION BANDWIDTH – continued

2.13.6 Test Results - continued

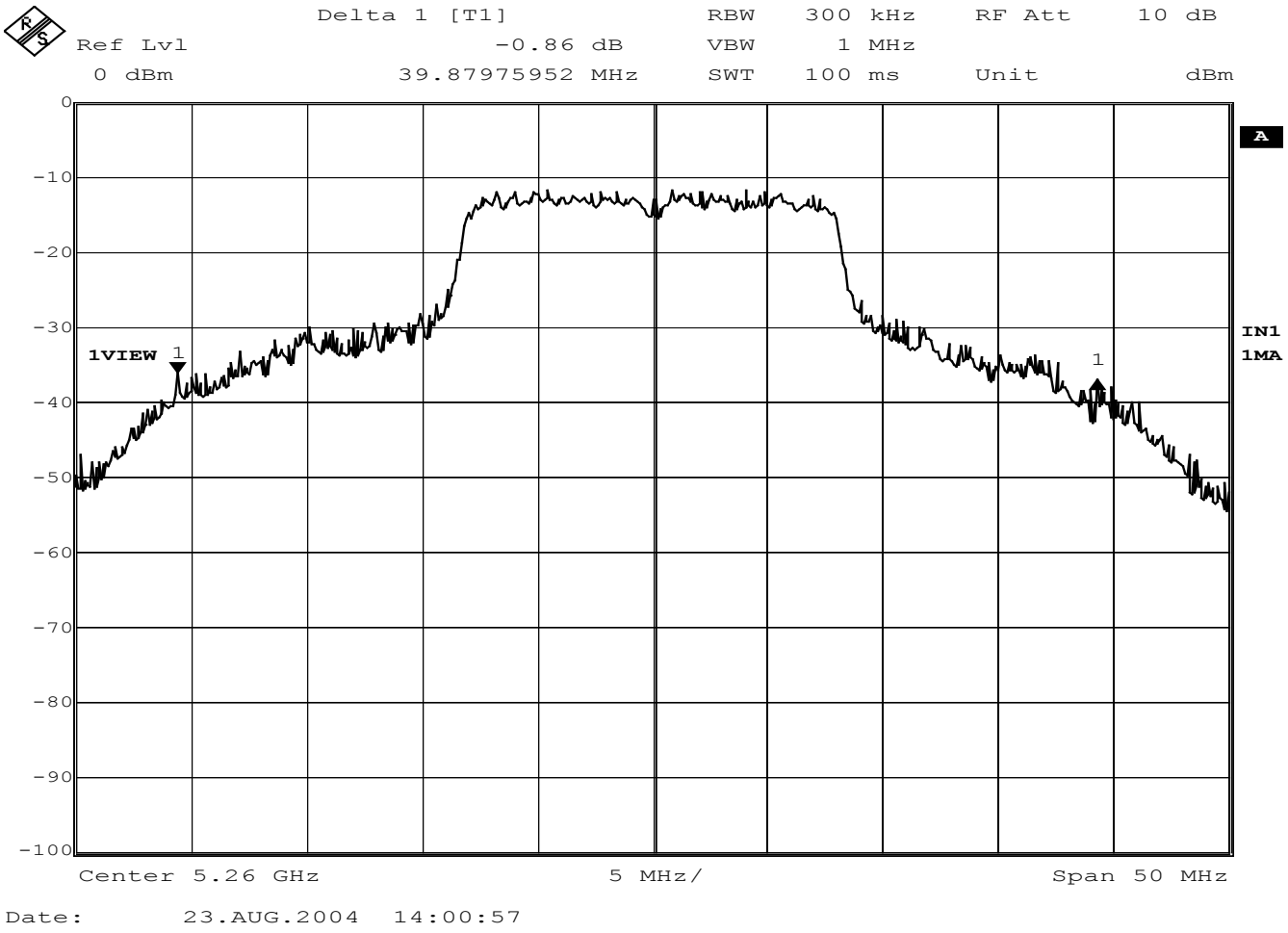
5240.0MHz – Maximum Power 6Mbps



2.13 EMISSION BANDWIDTH – continued

2.13.6 Test Results - continued

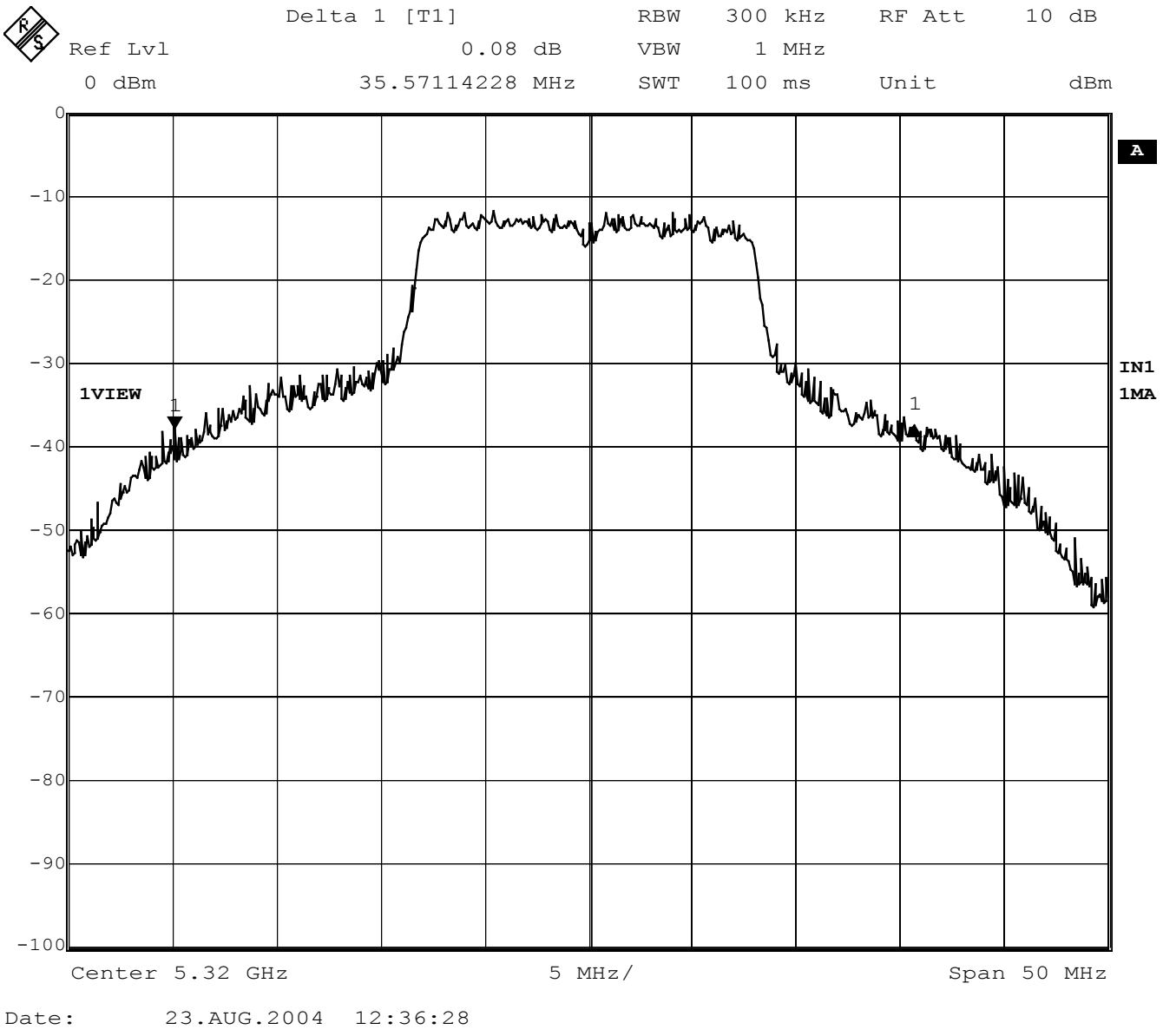
5260.0MHz – Maximum Power 6Mbps



2.13 EMISSION BANDWIDTH – continued

2.13.6 Test Results - continued

5320.0MHz – Maximum Power 6Mbps



2.14 PEAK EXCURSION

2.14.1 Specification Reference

FCC CFR 47: Part 15 Subpart E, 15.407(a)(6)

2.14.2 Equipment Under Test

802.11a/b/g RLAN Module

2.14.3 Date of Test

3rd August 2004

2.14.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.18” within the Test Equipment Used table shown in Section 3.1.

2.14.5 Test Procedure

The EUT was connected to the Spectrum Analyser via a 20dB Attenuator. The EUT was set to transmit at maximum power on required channels and with a data rate of 6Mbps.

With the EUT transmitting, the trace was adjusted to display the entire emission bandwidth of the fundamental. The RBW was adjusted to 1MHz with the VBW set to 3MHz. Trace 1 was set to Max Hold with a peak detector. Trace 2 was then selected with a sample detector. The VBW on trace 2 was reduced to 30kHz and the trace set to max hold. Using the marker delta function, the difference between the two traces was measured.

2.14 PEAK EXCURSION – continued

2.14.6 Test Results

The EUT met the requirements of 47 CFR 15, Subpart E, Section 15.407(b)(6) for Peak Excursion.

The measurement plots are shown on the following pages.

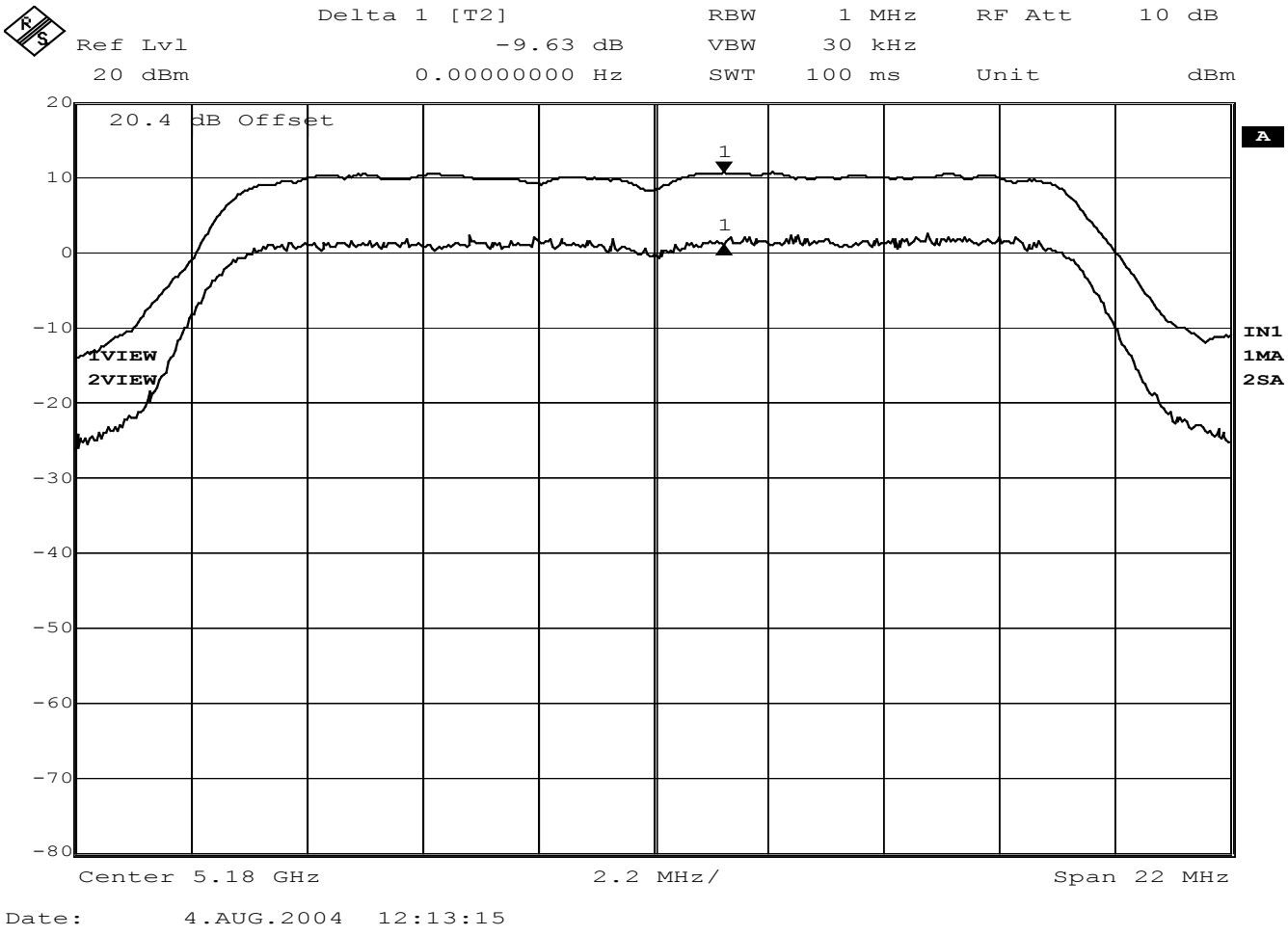
Remarks

The equipment met the requirements outlined in Clause 15.407(a)(6) where the peak excursion was less than 13dB.

2.14 PEAK EXCURSION – continued

2.14.6 Test Results - continued

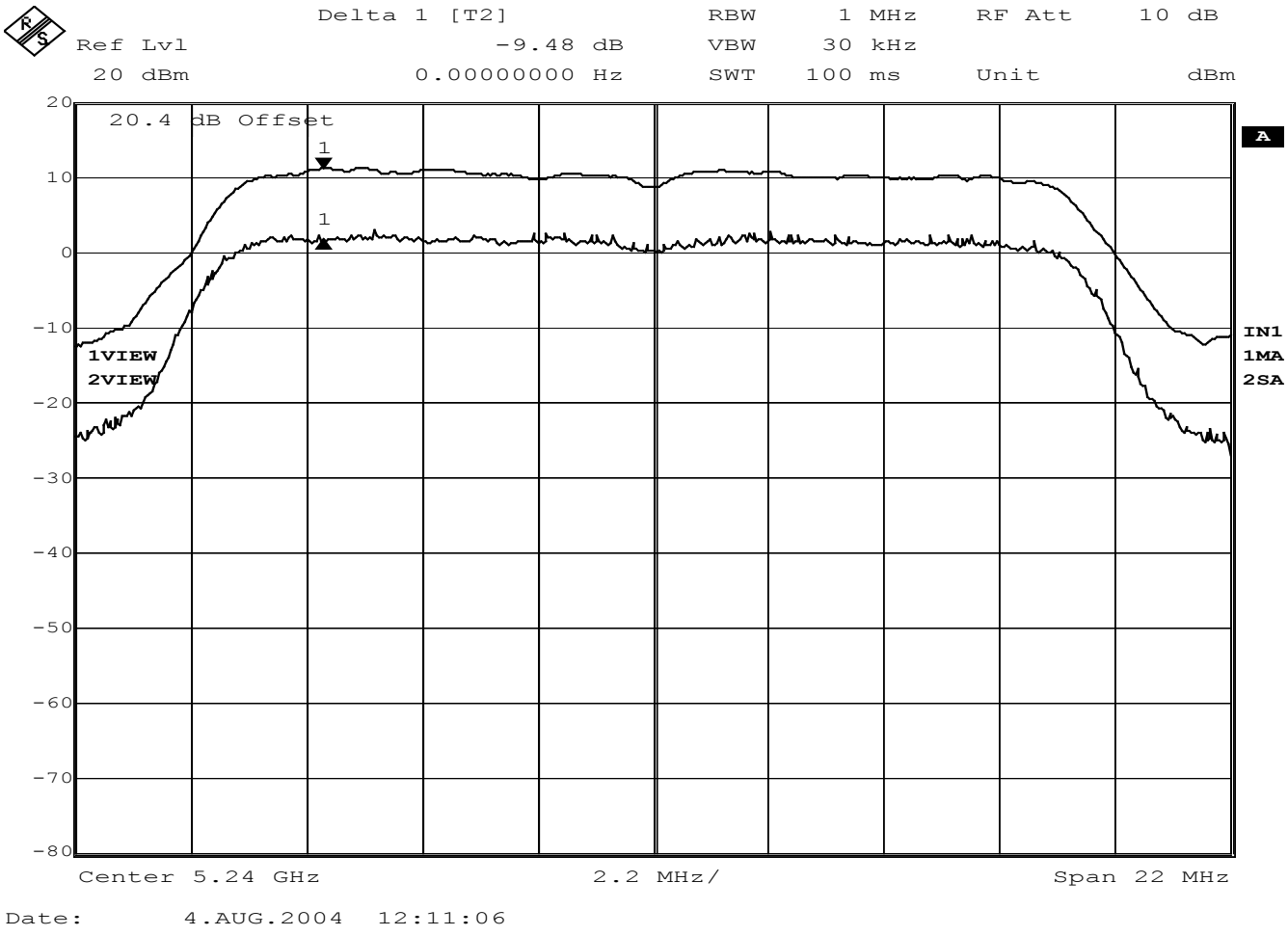
5180.0MHz – Maximum Power 6Mbps



2.14 PEAK EXCURSION – continued

2.14.6 Test Results - continued

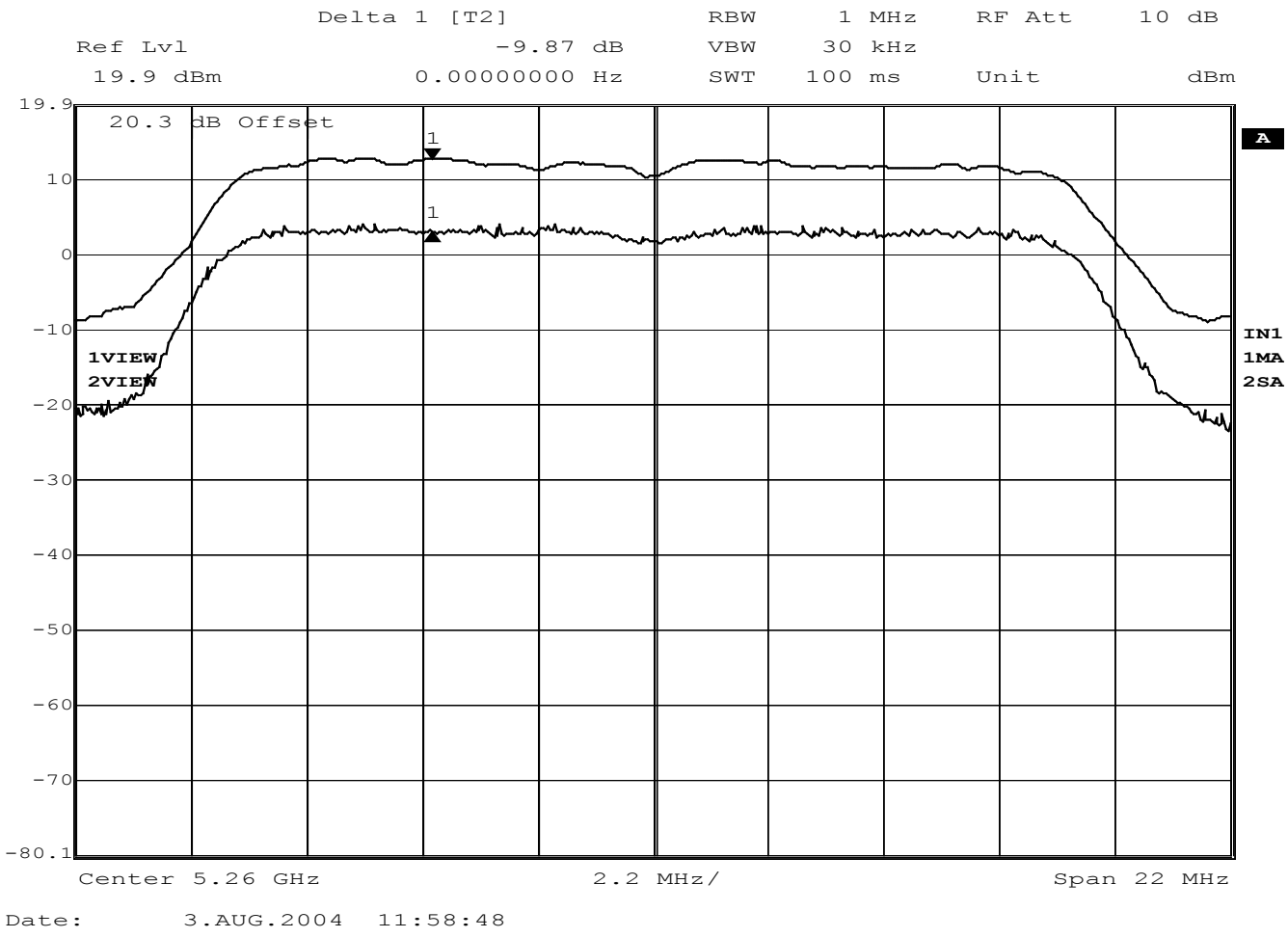
5240.0MHz – Maximum Power 6Mbps



2.14 PEAK EXCURSION – continued

2.14.6 Test Results - continued

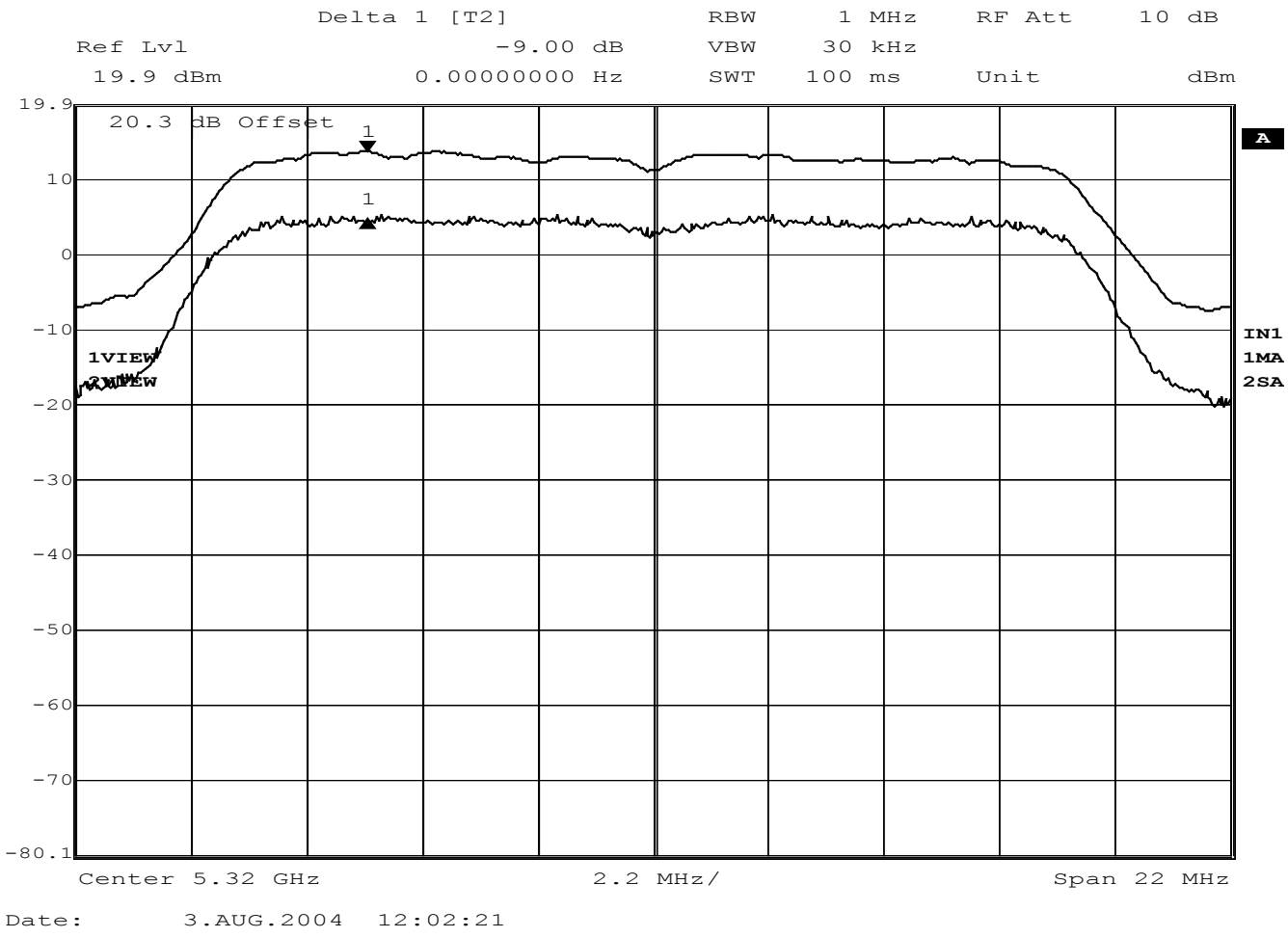
5260.0MHz – Maximum Power 6Mbps



2.14 PEAK EXCURSION – continued

2.14.6 Test Results - continued

5320.0MHz – Maximum Power 6Mbps



2.15 SPURIOUS RADIATED EMISSIONS

2.15.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.407 (b)(1)(2)(3)(5)(6)

2.15.2 Equipment Under Test

802.11a/b/g RLAN Module

2.15.3 Date of Test

25th July 2004

2.15.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as Section 2.15 within the Test Equipment Used table shown in Section 3.1.

2.15.5 Test Procedure

Testing to the requirements of FCC CFR 47: Part 15 Subpart E, 15.407(b)(1)(2)(3)(5)(6), for Spurious Radiated Emissions was carried out on the Measurement Test Facility detailed in Annex A. Section 15.407(b)(1)(2)(3)(5)(6) also requires Rule parts 15.205 and 15.209 to be applied.

A preliminary profile of the Spurious Radiated Emissions was obtained by operating the Equipment Under Test (EUT) on a remotely controlled turntable within a semi-anechoic chamber; measurements were taken at a 3m distance unless otherwise stated. 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, a search was made in the frequency range 30MHz to 25GHz. The list of worst-case emissions was then confirmed or updated under Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

30MHz – 1GHz emissions levels were then formally measured using a CISPR Quasi-Peak detector. 1GHz – 40GHz emissions levels were then formally measured using Peak and Average detectors.

(Note: Peak measurements performed using a Resolution and Video Bandwidth of 1MHz, Average measurements performed using a Resolution Bandwidth of 1MHz and a Video Bandwidth of 10Hz)

The Host Laptop was connected to a 120V 60Hz supply.

2.15 SPURIOUS RADIATED EMISSIONS - continued

2.15.5 Test Procedure - continued

Spurious Radiated Emissions from 30MHz to 1GHz were made using a HP 8542E Test Receiver.

Spurious Radiated Emissions from 1GHz to 40GHz were made using a Rhode and Schwarz ESIB 40 Test Receiver.

The test was performed in accordance with ANSI C63.4.

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

The limits for Spurious Emissions Inside the Restricted Bands are in accordance with 15.205(a) & (b), which call up the limits in 15.209 (a)

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

The limits for Spurious Emissions outside the Restricted Bands are in accordance with 15.407(b) paragraphs (1) (2) & (3) which call up the EIRP limit of -27dBm (or -17dBm if within ±10MHz of the 5.725 – 5.825GHz Band Edge.

The EIRP result is derived from the Field Strength result, and converted to EIRP via the following formula:-

$$\text{EIRP (W)} = \frac{(\text{V/m} \times \text{Distance\{metres\}})^2}{30}$$

2.15 SPURIOUS RADIATED EMISSIONS - continued

2.15.6 Test Results

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC Part 15.407(b)(5)(6), 15.205 and 15.209 for Spurious Radiated Emissions (30MHz –1GHz).

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

EUT Tx on Bottom Channel (5.180MHz)

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
50.0	V	100	0	22.7	13.6	40.0	100.0
99.4	H	197	187	28.2	25.7	43.5	150.0
432.0	H	100	180	28.1	25.4	46.0	200.0
440.0	H	227	148	32.0	39.8	46.0	200.0
480.0	H	189	153	33.0	44.7	46.0	200.0
520.0	V	100	242	27.1	22.6	46.0	200.0

EUT Tx on Middle Lower Channel (5240MHz)

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
50.0	V	100	0	22.4	13.2	40.0	100.0
99.9	H	186	203	27.8	24.5	43.5	150.0
213.8	H	183	190	25.0	17.8	43.5	150.0
432.1	H	100	160	29.1	28.5	46.0	200.0
440.0	H	233	164	32.2	40.7	46.0	200.0
480.0	H	201	159	32.1	40.3	46.0	200.0

2.15 SPURIOUS RADIATED EMISSIONS - continued

2.15.6 Test Results – continued

30MHz - 1GHz Frequency Range

EUT Tx on Middle Upper Channel (5260MHz)

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
50.0	V	100	7	22.7	13.6	40.0	100.0
99.8	H	182	200	28.4	26.3	43.5	150.0
212.7	H	180	186	25.9	19.7	43.5	150.0
432.0	H	100	175	28.9	27.9	46.0	200.0
440.0	H	217	156	31.9	39.4	46.0	200.0
480.0	H	232	157	33.3	46.2	46.0	200.0

EUT Tx on Top Channel (5320MHz)

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
50.0	V	100	0	22.9	14.0	40.0	100.0
99.8	V	100	229	28.1	25.4	43.5	150.0
211.7	H	178	195	26.4	20.9	43.5	150.0
440.0	H	247	159	32.1	40.3	46.0	200.0
480.0	H	193	164	30.1	32.0	46.0	200.0
520.1	V	112	96	32.4	41.7	46.0	200.0

ABBREVIATIONS FOR ABOVE TABLES

H	Horizontal Polarisation	V	Vertical Polarisation
Pol	Polarisation	Hgt	Height
deg	degree	Azm	Azimuth

2.15 SPURIOUS RADIATED EMISSIONS - continued

2.15.6 Test Results - continued

1GHz - 40GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC Part 15.407(b)(1)(2)(3)(5)(6), 15.205 and 15.209 for Spurious Radiated Emissions (1GHz – 40GHz).

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

EUT Tx on Bottom Channel (5180MHz)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
1.040	V	100	65	49.2	74.0	41.1	54.0
1.332	V	100	6	58.2	74.0	43.0	54.0
5.144*	V	100	61	69.6	84.0	57.9	64.0
20.720*	V	100	179	59.0	84.0	52.6	64.0

EUT Tx on Middle Lower Channel (5240MHz)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
1.040	V	100	62	48.7	74.0	41.3	54.0
5.148*	V	100	62	68.7	84.0	56.0	64.0
20.960*	V	100	168	60.8	84.0	53.7	64.0

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

2.15 SPURIOUS RADIATED EMISSIONS - continued

2.15.6 Test Results – continued

1GHz - 40GHz Frequency Range

EUT Tx on Middle Upper Channel (5260MHz)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
1.040	V	100	65	48.6	74.0	41.3	54.0
5.132*	V	100	57	69.4	84.0	55.1	64.0
21.040*	V	100	163	60.2	84.0	54.9	64.0

EUT Tx on Top Channel (5320MHz)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
5.122*	V	100	60	69.6	84.0	55.3	64.0
21.279*	V	116	182	58.8	84.0	49.4	64.0

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

ABBREVIATIONS FOR ABOVE TABLES

H	Horizontal Polarisation	V	Vertical Polarisation
Pol	Polarisation	Hgt	Height
deg	degree	Azm	Azimuth

2.16 CONDUCTED EMISSIONS ON POWER LINES

2.16.1 Specification Reference

FCC CFR 47: Part 15 Subpart E, Section 15.407(b)(5)

2.16.2 Equipment Under Test

802.11a/b/g RLAN Module

2.16.3 Date of Test

7th August 2004

2.16.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as Section 2.16 within the Test Equipment Used table shown in Section 3.1.

2.16.5 Test Procedure

Test performed in accordance with ANSI C63.4.

Testing to the requirements of FCC CFR 47: Part 15 Subpart E, Section 15.407(b)(5) which also requires Rule parts 15.207 to be applied. for Conducted Emissions was carried out on the Measurement Test Facility detailed in Annex A.

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 Conducted Emissions Measurements were made on the Host Laptop.

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

2.16 CONDUCTED EMISSIONS ON POWER LINES - continued

2.16.6 Test Results

The EUT met the Class B requirements of 47 CFR 15, Subpart E, Section 15.407(b)(5) and Subpart C, Section 15.207 for Conducted Emissions on the Live and Neutral Lines.

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

EUT Tx on Bottom Channel (5180MHz) – Live Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.195	46.0	63.8	40.7	53.8
0.259	38.2	61.5	33.7	51.5
0.389	33.2	58.1	28.8	48.1
0.454	35.7	56.8	32.7	46.8
0.520	33.1	56.0	33.8	46.0
0.523	31.8	56.0	32.0	46.0

The margin between the specification requirements and all other emissions were 29.7dB or more below the specified Quasi-Peak limit and 37.6dB or more below the Average limit.

EUT Tx on Bottom Channel (5180MHz) – Neutral Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.195	44.1	63.8	38.6	53.8
0.259	37.3	61.5	31.8	51.5
0.390	33.8	58.1	28.9	48.1
0.453	36.7	56.8	33.4	46.8
0.520	33.3	56.0	31.7	46.0
0.583	32.3	56.0	29.3	46.0

The margin between the specification requirements and all other emissions were 29.9dB or more below the specified Quasi-peak limit and 39.5dB or more below the specified Average limit.

2.16 CONDUCTED EMISSIONS ON POWER LINES - continued

2.16.6 Test Results - continued

EUT Tx on Middle Channel (5240MHz) – Live Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.195	46.3	63.8	41.0	53.8
0.259	38.5	61.5	33.8	51.5
0.388	33.1	58.1	31.2	48.1
0.454	36.1	56.8	32.9	46.8
0.519	33.3	56.0	30.6	46.0
0.583	32.6	56.0	29.6	46.0

The margin between the specification requirements and all other emissions were 28.2dB or more below the specified Quasi-Peak limit and 35.5dB or more below the Average limit.

EUT Tx on Middle Channel (5240MHz) – Neutral Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.195	44.0	63.9	38.4	53.9
0.259	37.2	61.5	31.9	51.5
0.388	33.2	58.1	28.6	48.1
0.454	36.4	56.8	32.9	46.8
0.519	32.8	56.0	30.7	46.0
0.583	31.8	56.0	29.2	46.0

The margin between the specification requirements and all other emissions were 28.9dB or more below the specified Quasi-peak limit and 37.2dB or more below the specified Average limit.

2.16 CONDUCTED EMISSIONS ON POWER LINES - continued

2.16.6 Test Results - continued

EUT Tx on Top Channel (5260MHz) – Live Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.150	43.2	66.0	23.4	56.0
0.195	46.9	63.8	41.8	53.8
0.391	36.6	58.0	36.4	48.0
0.456	35.0	56.8	32.3	46.8
0.521	34.9	56.0	33.2	46.0
0.586	32.6	56.0	29.7	46.0

The margin between the specification requirements and all other emissions were 17.1dB or more below the specified Quasi-Peak limit and 24.0dB or more below the Average limit.

EUT Tx on Top Channel (5260MHz) – Neutral Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.151	43.0	65.9	23.4	55.9
0.196	45.8	63.8	40.3	53.8
0.197	45.8	63.7	40.2	53.7
0.328	36.7	59.5	30.4	49.5
0.524	34.8	56.0	32.6	46.0
0.590	33.9	56.0	28.7	46.0

The margin between the specification requirements and all other emissions were 17.8dB or more below the specified Quasi-Peak limit and 23.4dB or more below the Average limit.

2.16 CONDUCTED EMISSIONS ON POWER LINES - continued

2.16.6 Test Results - continued

EUT Tx on Top Channel (5320MHz) – Live Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.194	46.0	63.9	40.9	53.9
0.259	38.3	61.5	33.7	51.5
0.389	33.3	58.1	28.7	48.1
0.454	35.7	56.8	34.0	46.8
0.519	33.3	56.0	30.7	46.0
0.582	32.3	56.0	31.3	46.0

The margin between the specification requirements and all other emissions were 29.0dB or more below the specified Quasi-Peak limit and 35.6dB or more below the Average limit.

EUT Tx on Top Channel (5320MHz) – Neutral Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.194	44.1	63.9	38.6	53.9
0.259	37.6	61.5	31.8	51.5
0.389	33.4	58.1	28.9	48.1
0.453	36.7	56.8	32.8	46.8
0.519	33.0	56.0	30.5	46.0
0.583	32.5	56.0	29.6	46.0

The margin between the specification requirements and all other emissions were 29.5dB or more below the specified Quasi-peak limit and 37.3dB or more below the specified Average limit.

2.17 MEASUREMENT AT THE BAND EDGE

2.17.1 Specification Reference

FCC CFR 47: Part 15 Subpart E, Section 15.407(b)(6) & 15.205

2.17.2 Equipment Under Test

802.11a/b/g RLAN Module

2.17.3 Date of Test

26th July 2004

2.17.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as Section 2.17 within the Test Equipment Used table shown in Section 3.1.

2.17.5 Test Procedure

The EUT was set to operate at a carrier frequency of 5.180MHz (lowest channel). The measuring antenna height/polarisation and turntable azimuth were then adjusted to maximise the received 5.180MHz signal. The receiver was then tuned to 5.150MHz band edge and the received signal level measured. The test was then repeated with the EUT operating on its top channel (5.320MHz) and the band edge measurement made at 5.350MHz.

2.17 MEASUREMENT AT THE BAND EDGE - continued

2.17.6 Test Results

The EUT met the requirements of FCC CFR 47: Part 15 Subpart E, Section 15.407(b)(6) & 15.205 for Band Edge Measurements.

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

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	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
5180	5150	V	100	233	63.8	74.0	52.2	54.0
5320	5350	V	110	233	64.5	74.0	51.3	54.0

2.18 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT

2.18.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.407(b)(1)(2)

2.18.2 Equipment Under Test

802.11a/b/g RLAN Module

2.18.3 Date of Test

4th & 5th August 2004

2.18.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as Section 2.18 within the Test Equipment Used table shown in Section 3.1.

2.18.5 Test Procedure

Test Performed in accordance with FCC CFR 47: Part 15 Subpart C, Section 15.407(b)(1)(2).

Spurious Conducted Emissions from the antenna terminal were measured. The transmitter output power was attenuated using a combination of of filters and attenuators and the frequency spectrum investigated from 9kHz to 40GHz. The EUT was set to transmit on full power, with a data rate of 6Mbps. The resolution and video bandwidths were set to 1MHz and 3MHz respectively in accordance with Part 15.407(b)(4). The spectrum analyser detector was set to Max Hold.

For measuring the range 9kHz to 7GHz, a 20dB attenuator was used. From 7GHz to 18GHz, a high pass filter was used. From 18GHz to 26GHz and 26GHz to 40GHz, pieces of waveguide were used as a high pass filter.

The display line function on the spectrum analyser was used to show the appropriate limits for the band.

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

2.18.6 Test Results

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, 15.407(b)(1)(2) for Spurious Conducted Emissions on the Antenna Port.

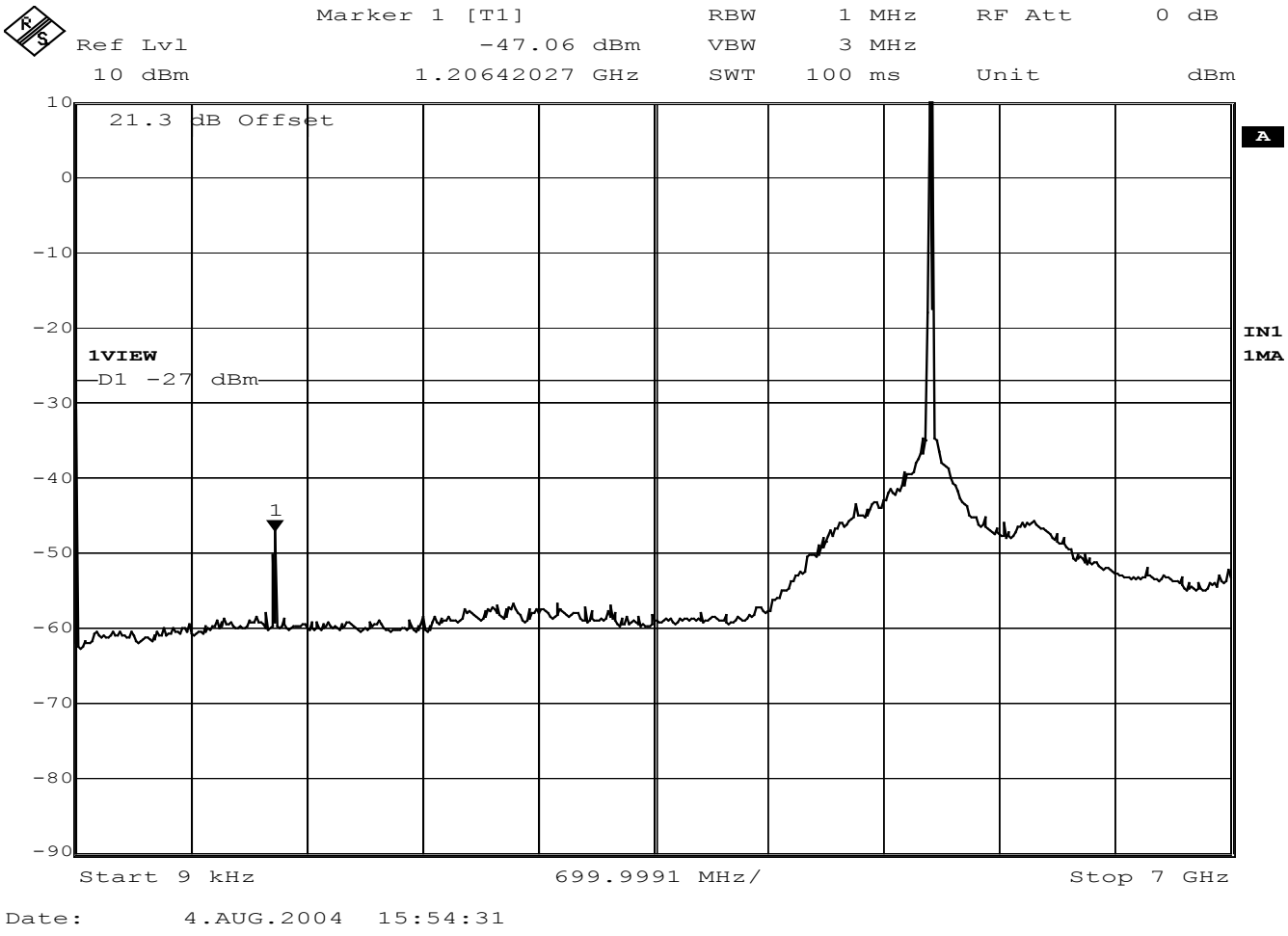
The plots on the following pages show the EUT's Antenna Ports Spurious Conducted Emissions over the frequency range 9kHz to 40GHz.

2.18 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.18.6 Test Results – continued

Spurious Conducted Emissions (9kHz – 7GHz)

EUT Tx on 5180MHz – Maximum Power 6Mbps

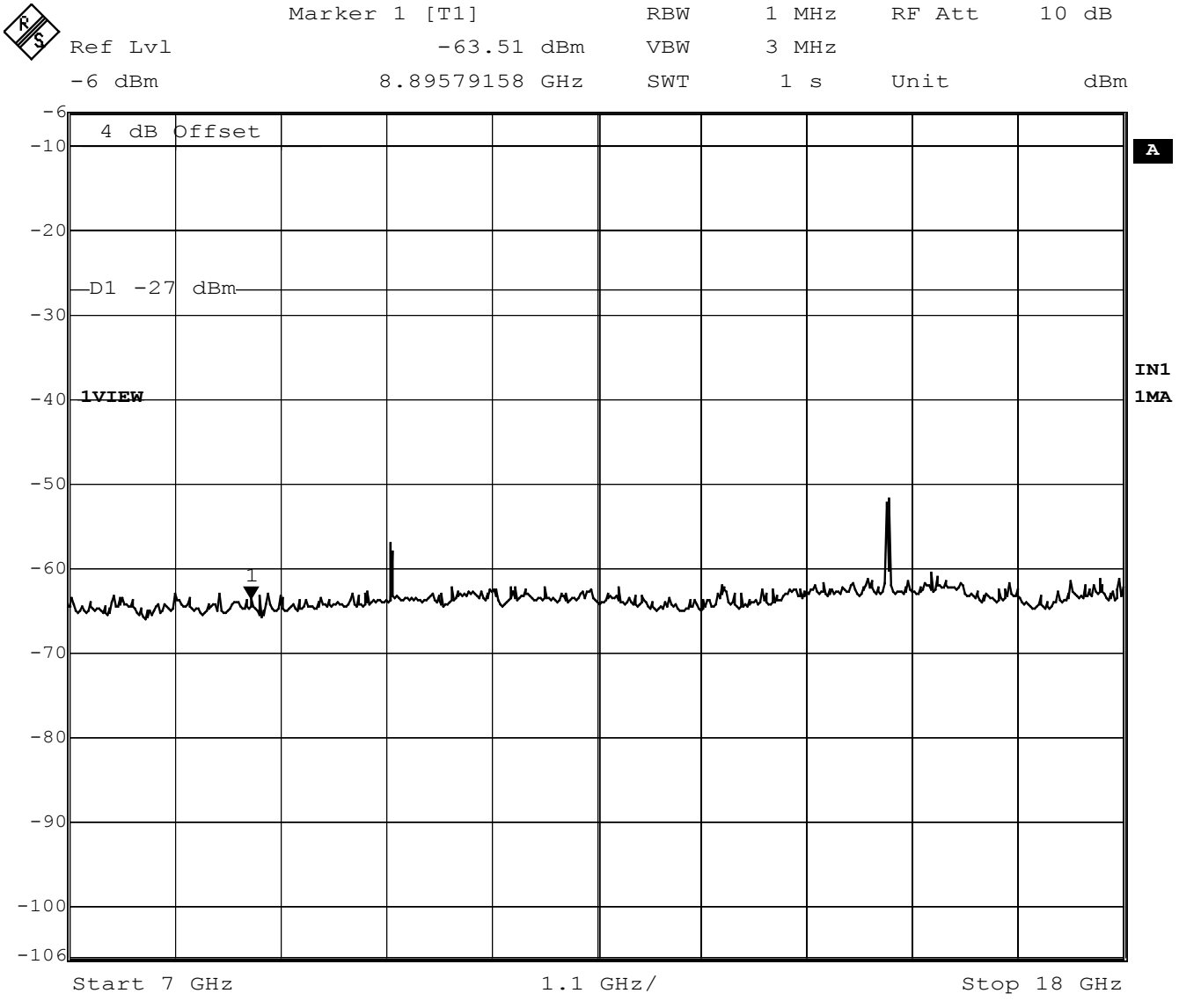


2.18 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.18.6 Test Results – continued

Spurious Conducted Emissions (7GHz – 18GHz)

EUT Tx on 5180MHz – Maximum Power 6Mbps

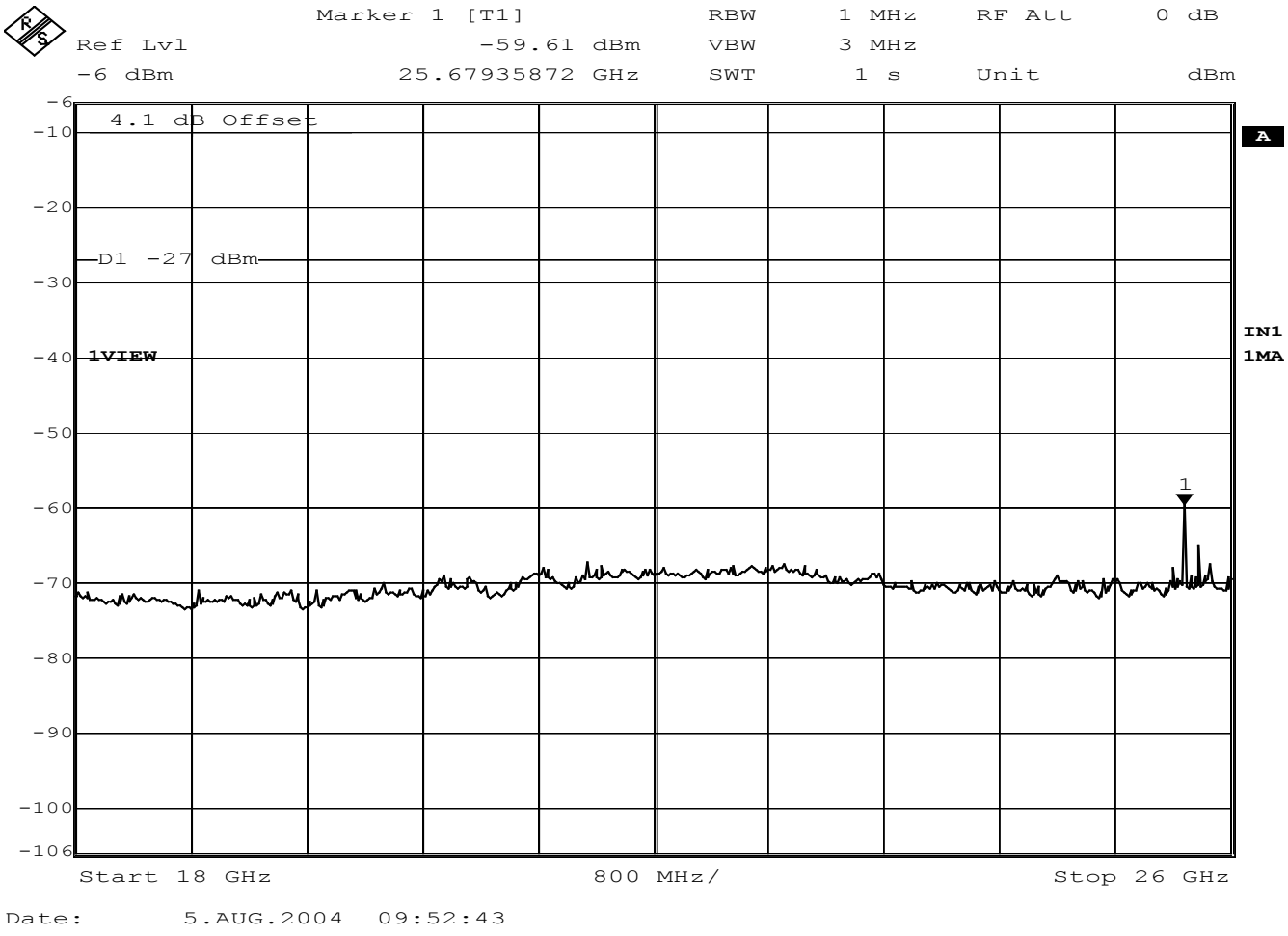


2.18 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.18.6 Test Results – continued

Spurious Conducted Emissions (18GHz – 26GHz)

EUT Tx on 5180MHz – Maximum Power 6Mbps

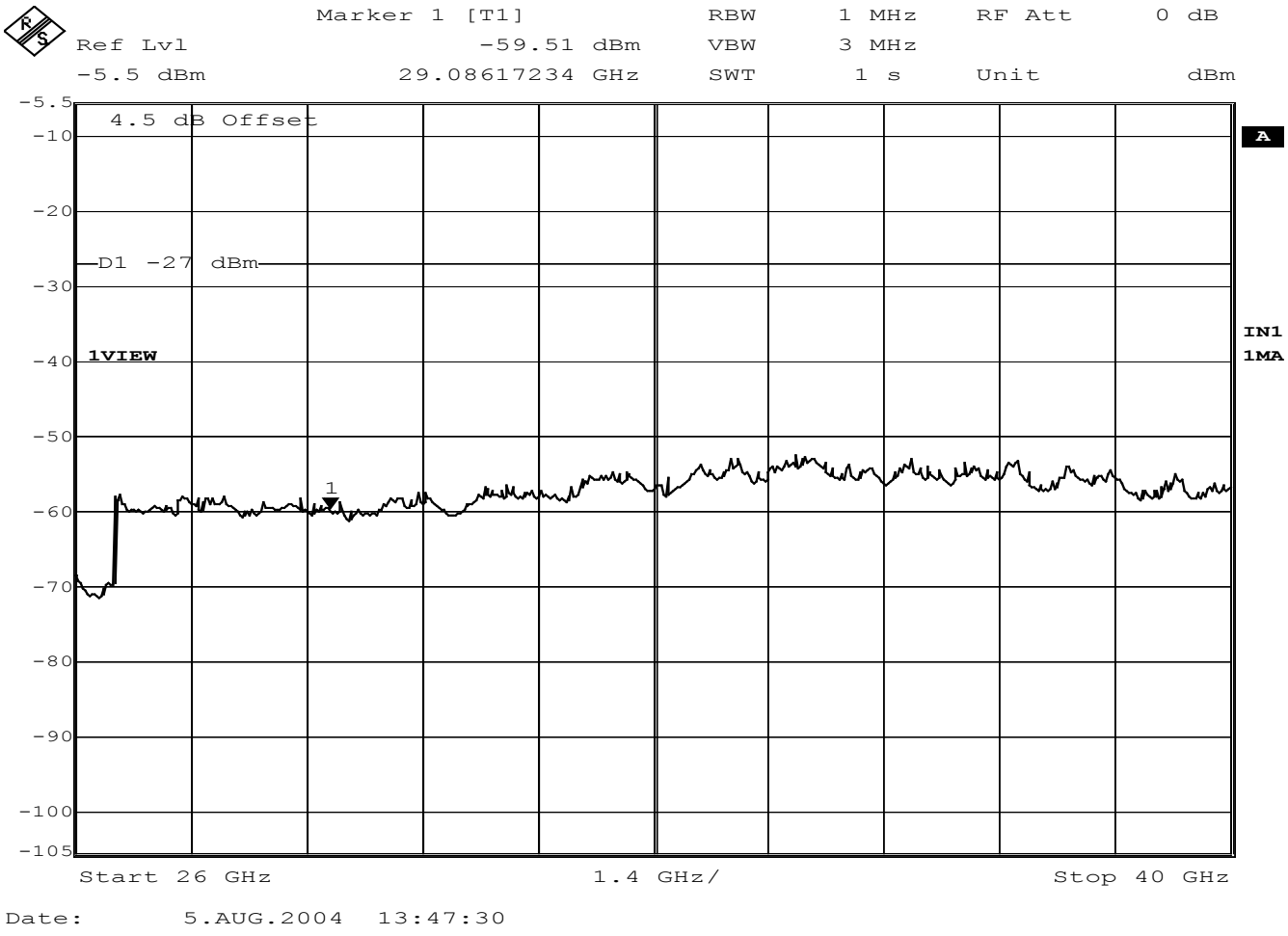


2.18 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.18.6 Test Results – continued

Spurious Conducted Emissions (26GHz – 40GHz)

EUT Tx on 5180MHz – Maximum Power 6Mbps

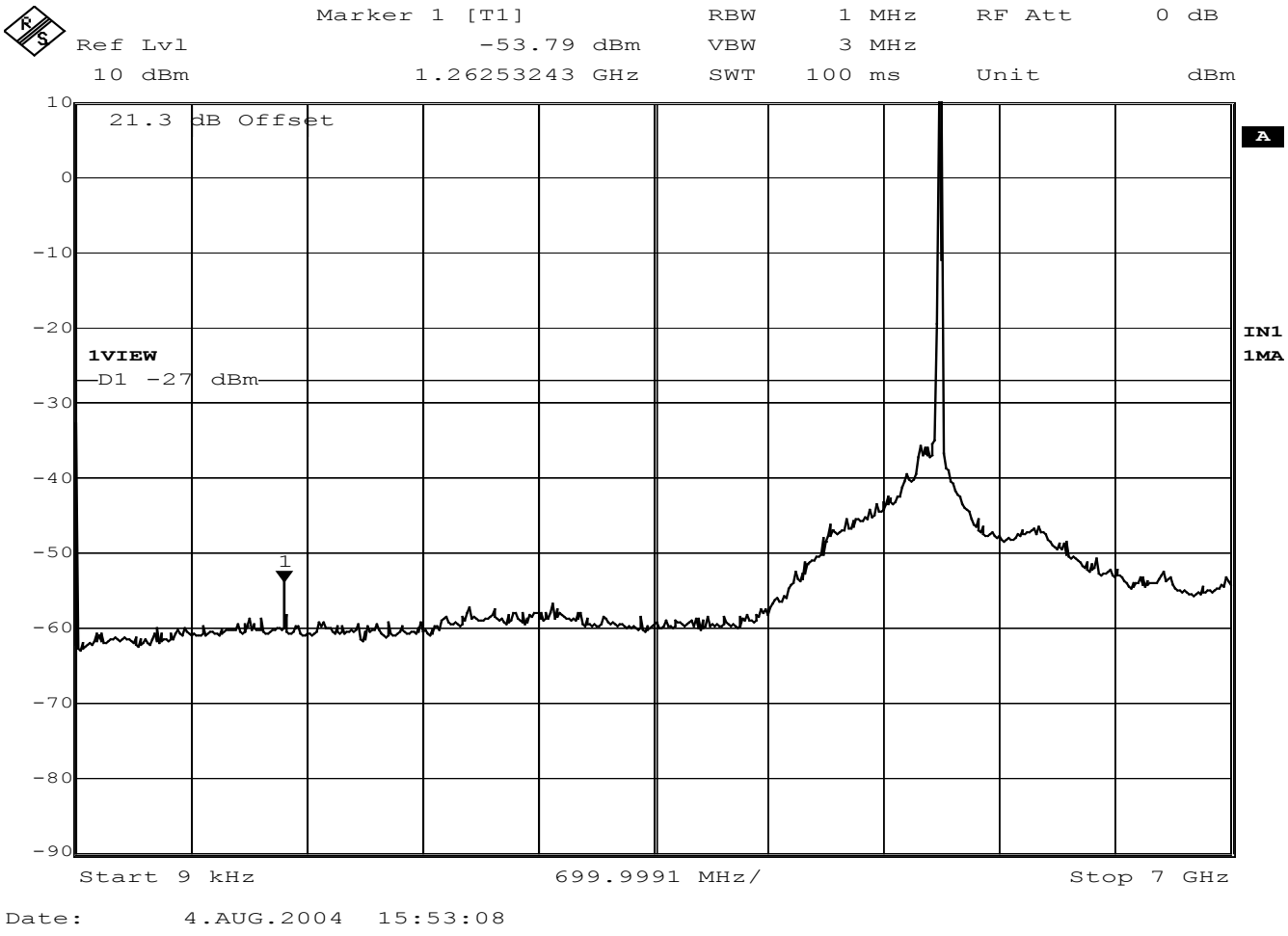


2.18 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.18.6 Test Results – continued

Spurious Conducted Emissions (9kHz – 7GHz)

EUT Tx on 5240MHz – Maximum Power 6Mbps

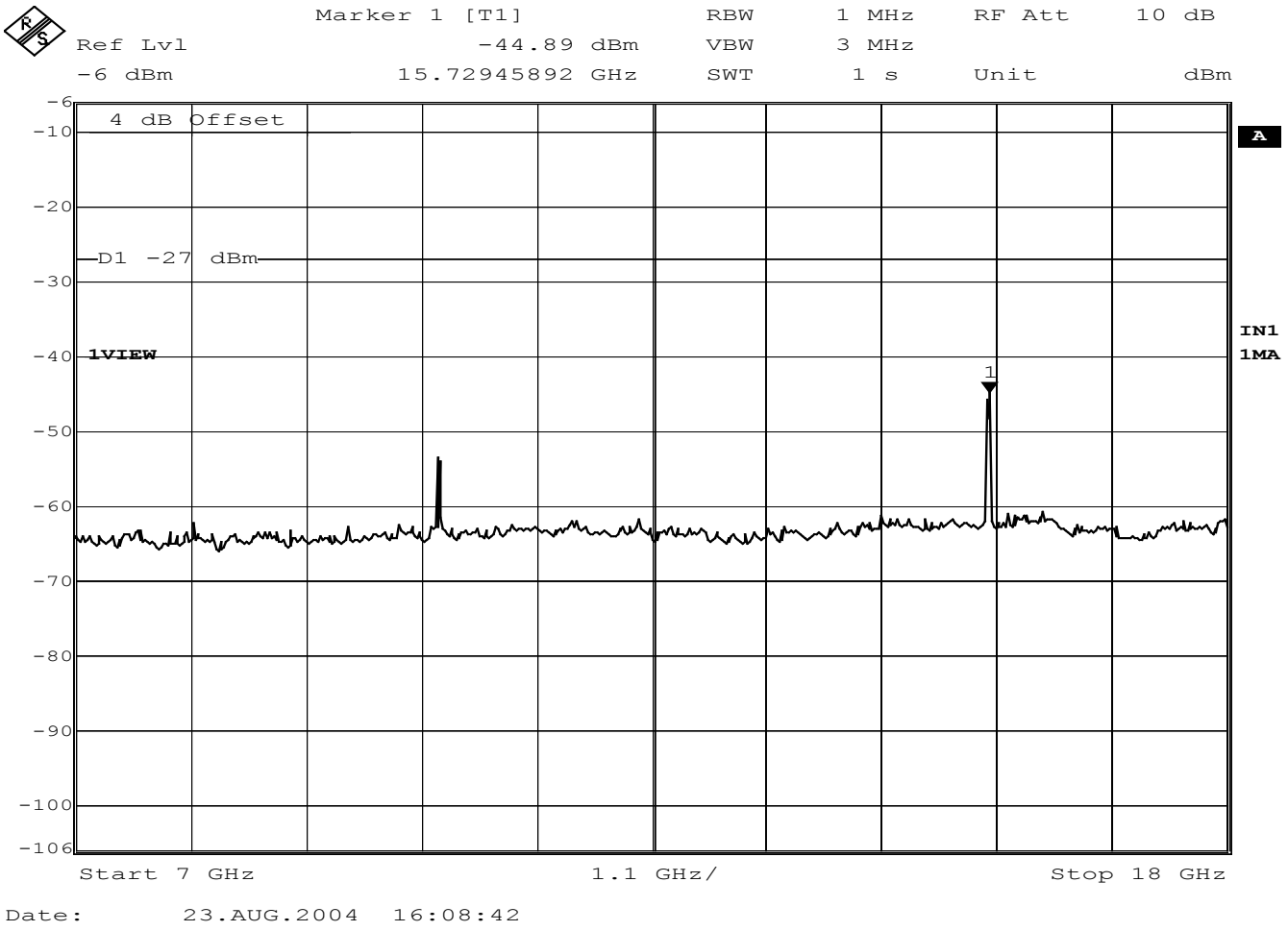


2.18 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.18.6 Test Results – continued

Spurious Conducted Emissions (7GHz – 18GHz)

EUT Tx on 5240MHz – Maximum Power 6Mbps

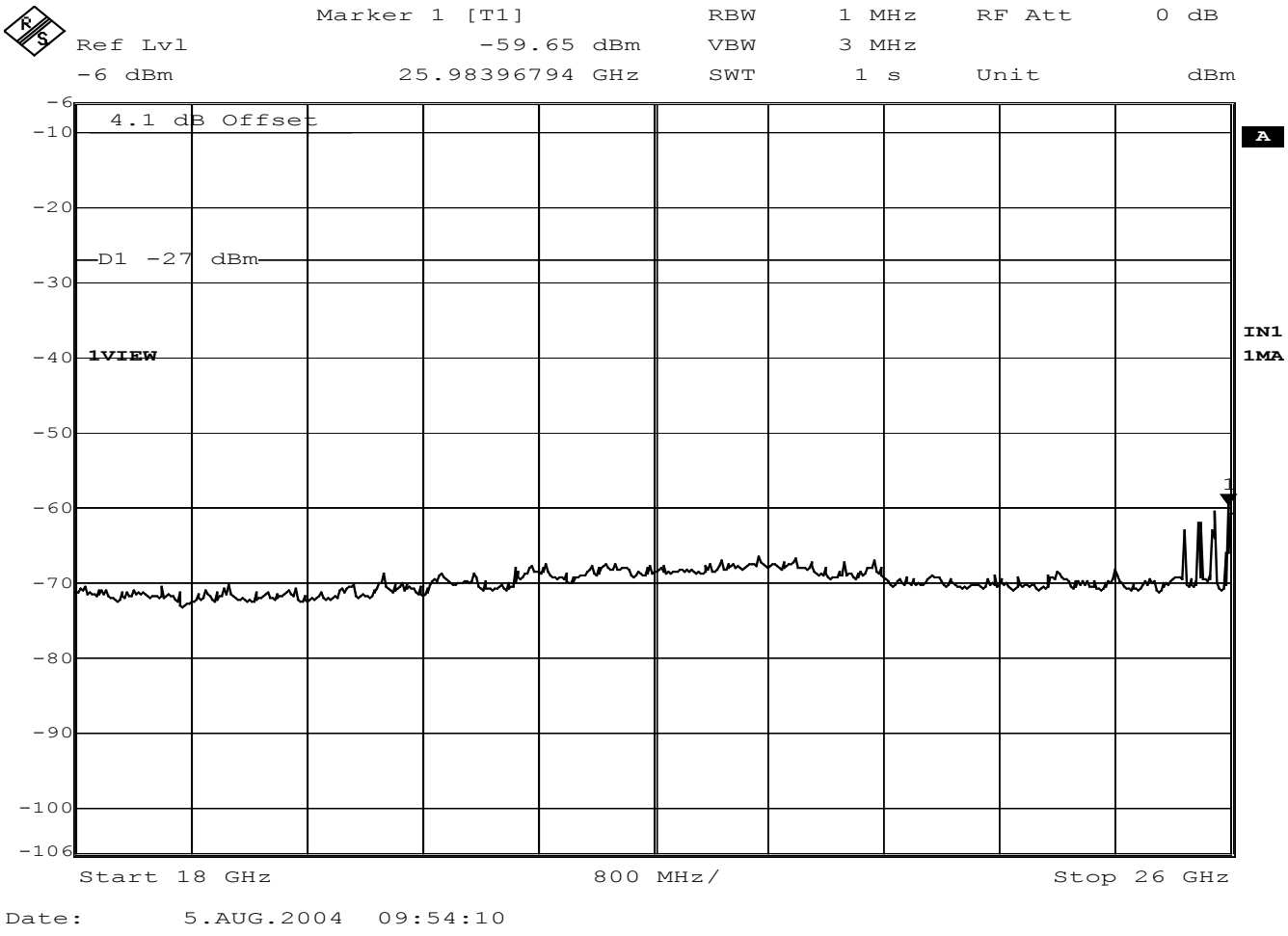


2.18 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.18.6 Test Results – continued

Spurious Conducted Emissions (18GHz – 26GHz)

EUT Tx on 5240MHz – Maximum Power 6Mbps

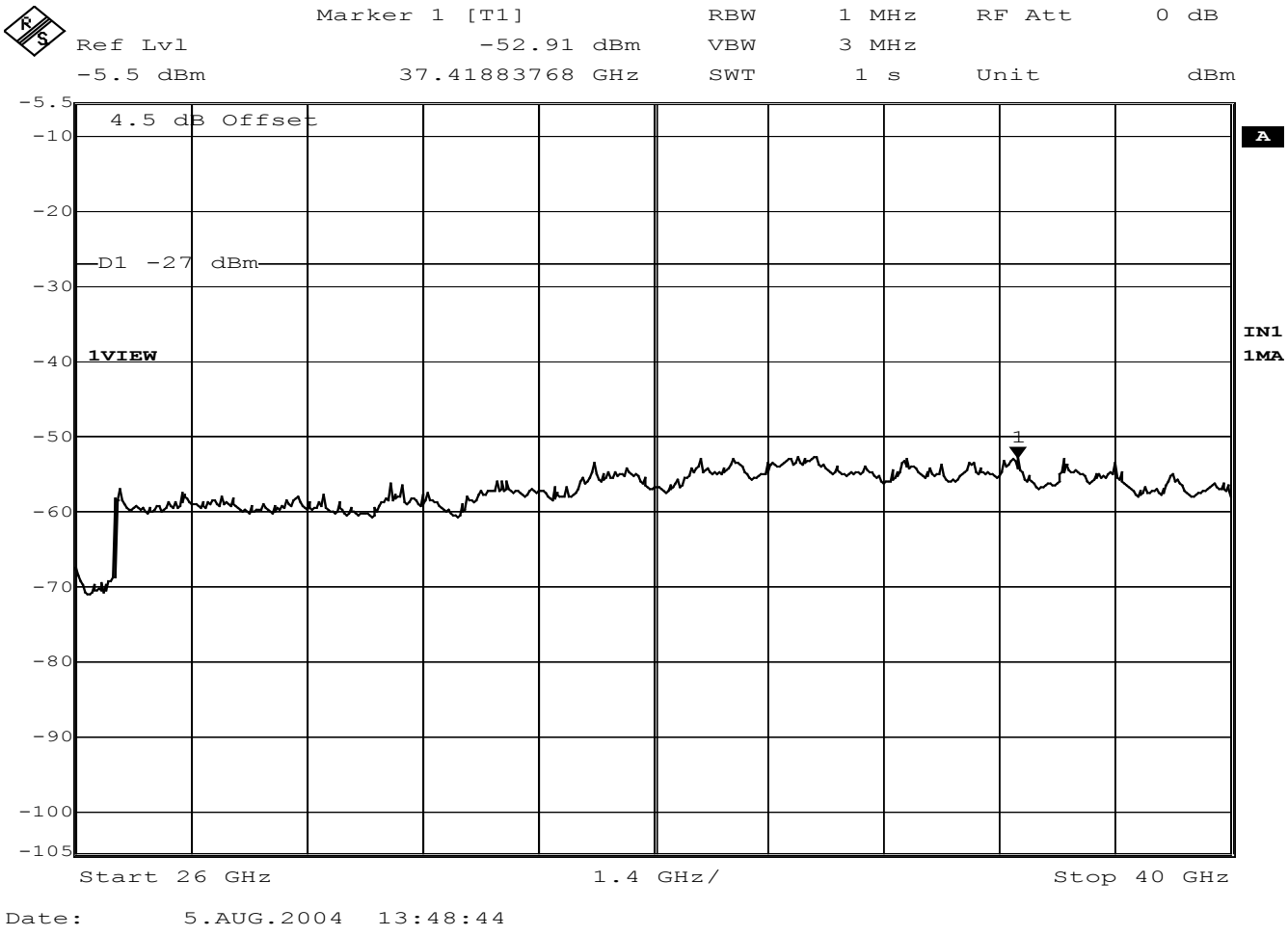


2.18 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.18.6 Test Results – continued

Spurious Conducted Emissions (26GHz – 40GHz)

EUT Tx on 5240MHz – Maximum Power 6Mbps

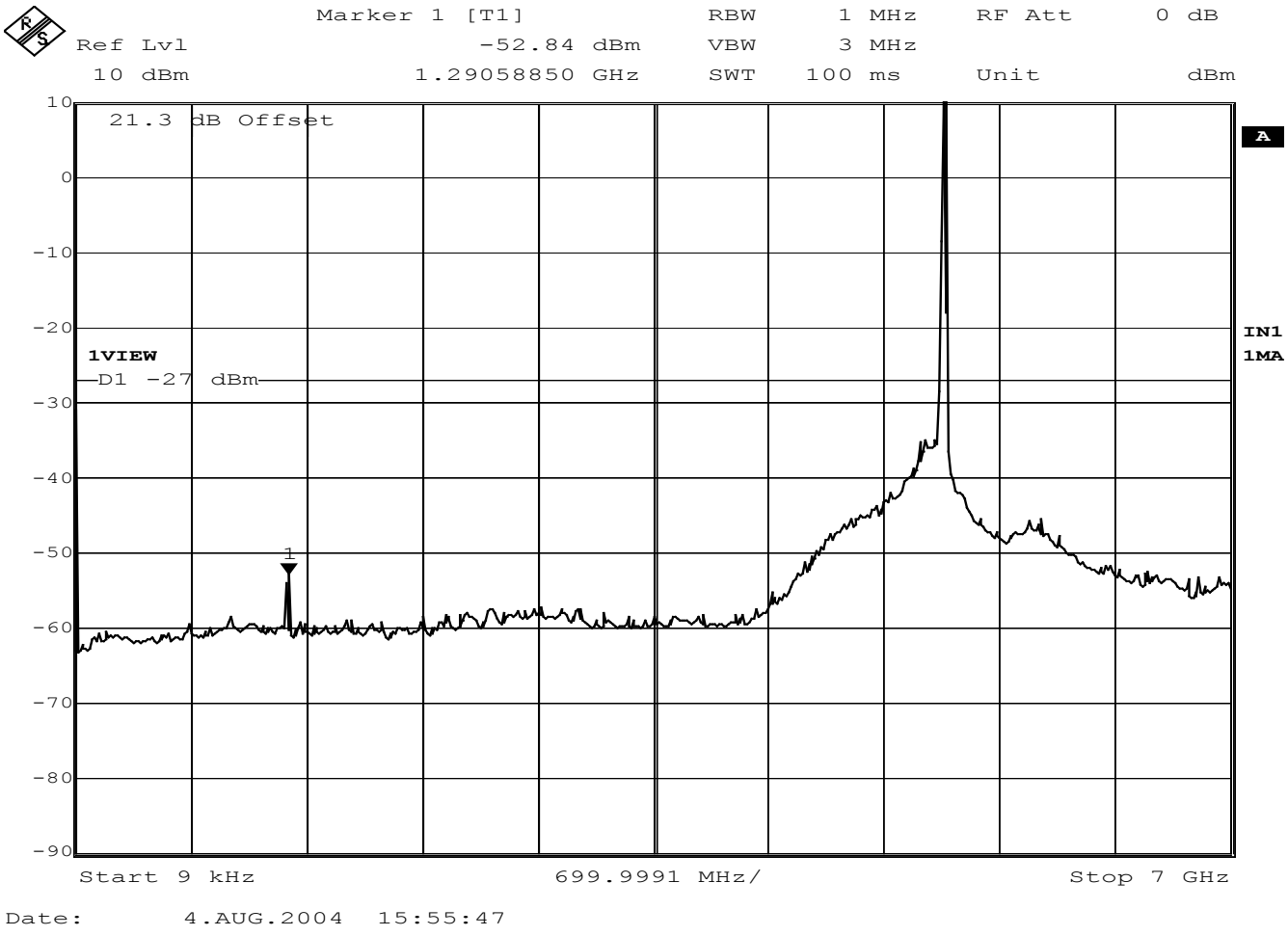


2.18 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.18.6 Test Results – continued

Spurious Conducted Emissions (9kHz – 7GHz)

EUT Tx on 5260MHz – Maximum Power 6Mbps

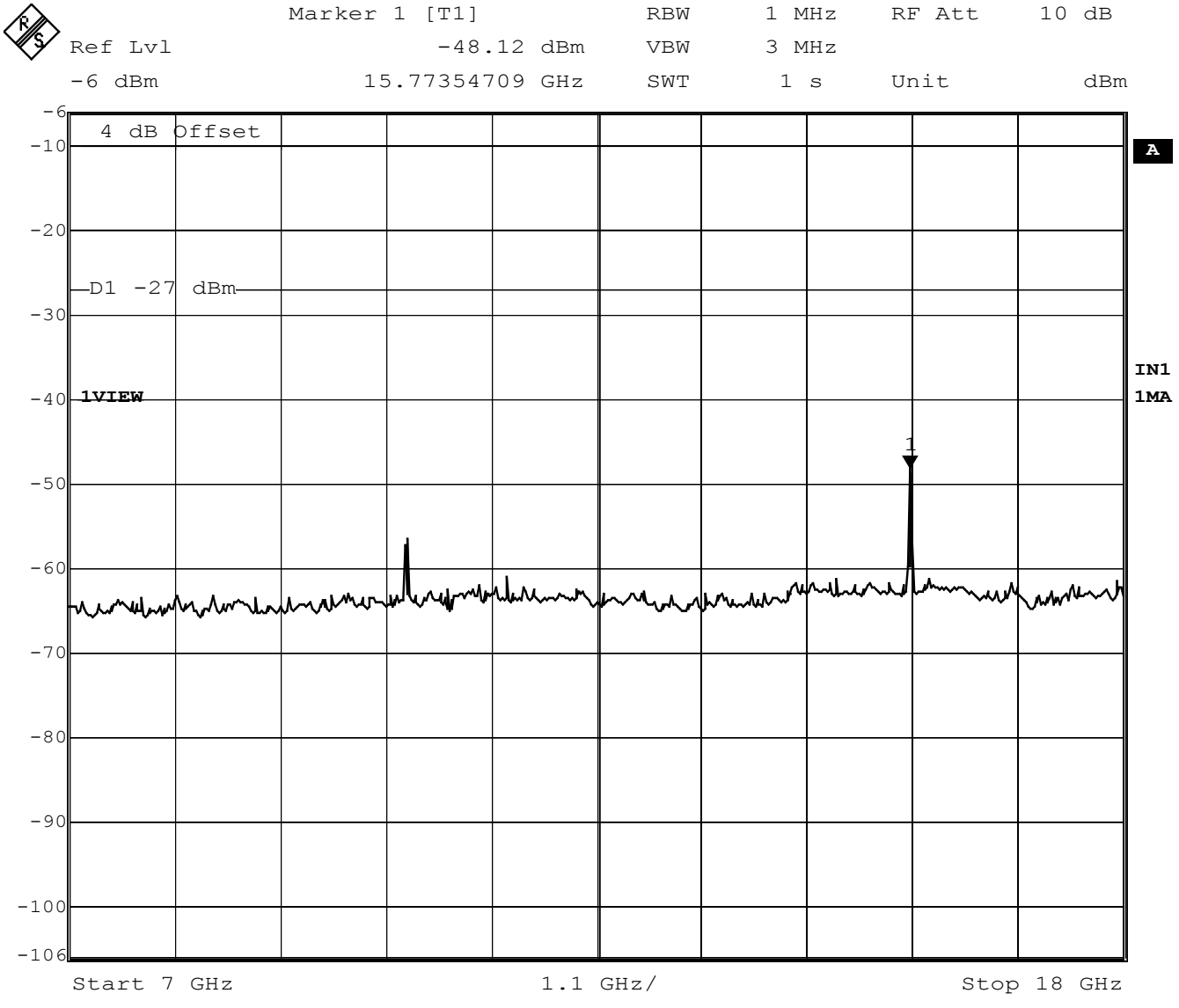


2.18 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.18.6 Test Results – continued

Spurious Conducted Emissions (7GHz – 18GHz)

EUT Tx on 5260MHz – Maximum Power 6Mbps

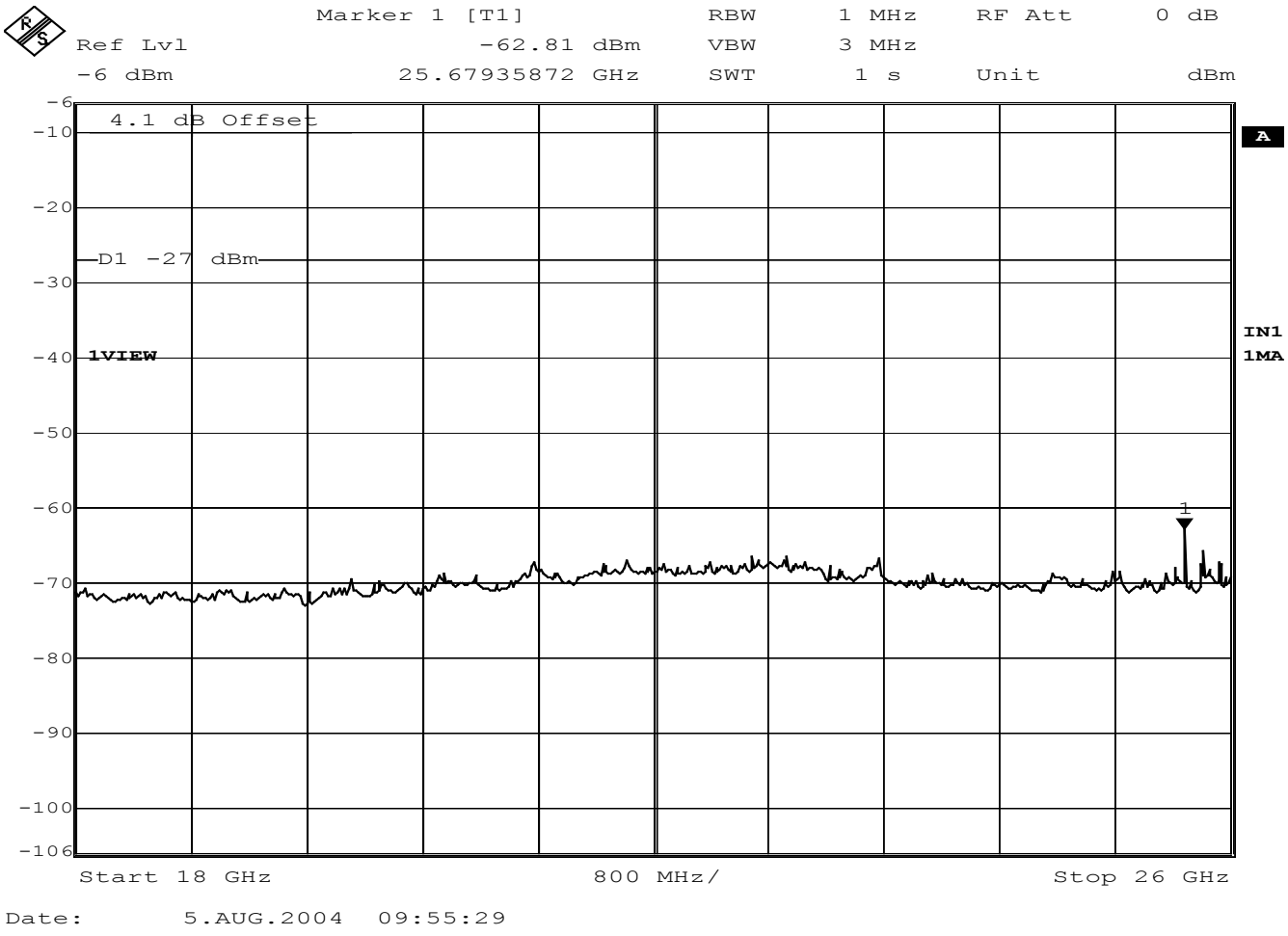


2.18 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.18.6 Test Results – continued

Spurious Conducted Emissions (18GHz – 26GHz)

EUT Tx on 5260MHz – Maximum Power 6Mbps

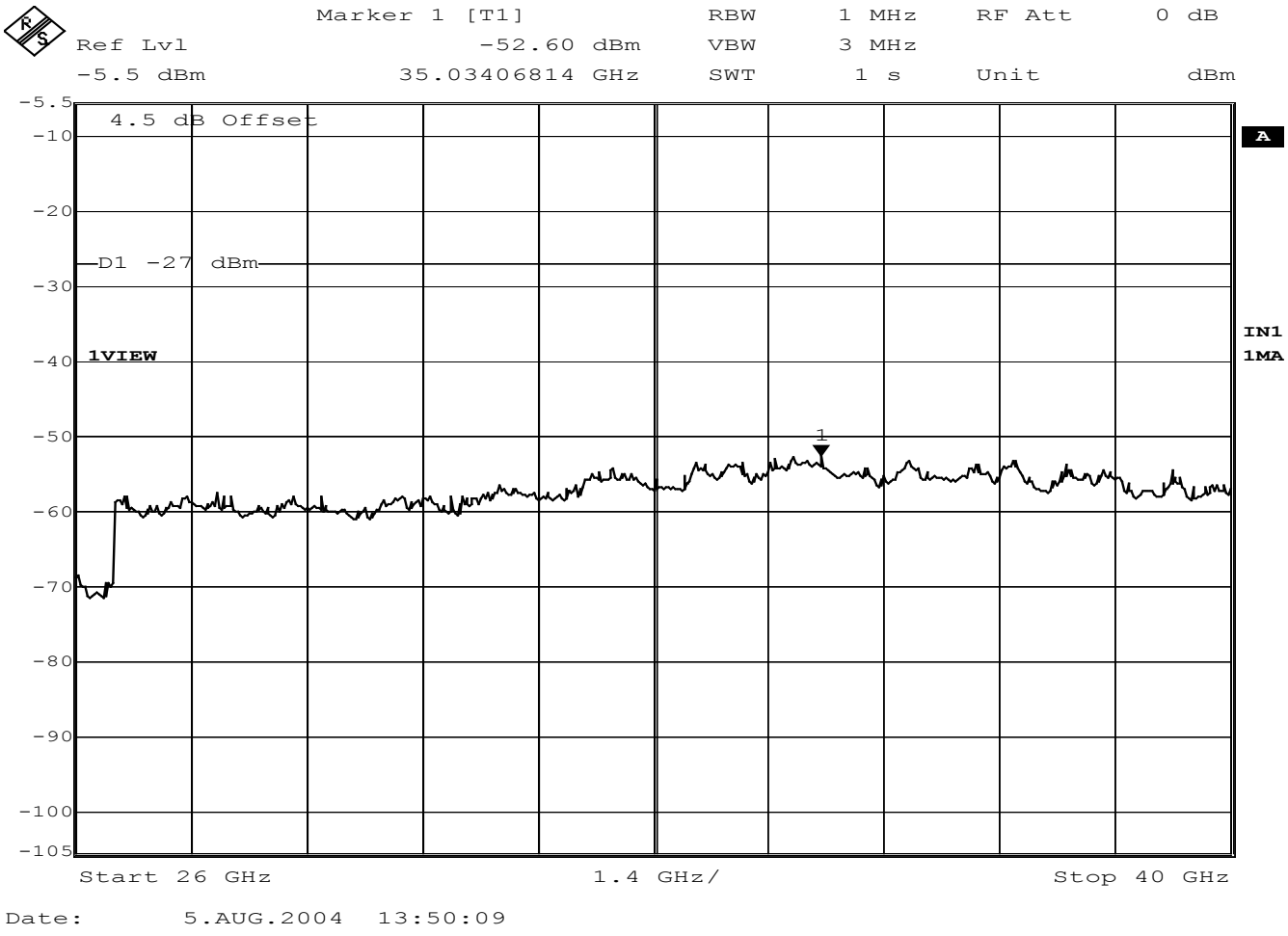


2.18 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.18.6 Test Results – continued

Spurious Conducted Emissions (26GHz – 40GHz)

EUT Tx on 5260MHz – Maximum Power 6Mbps

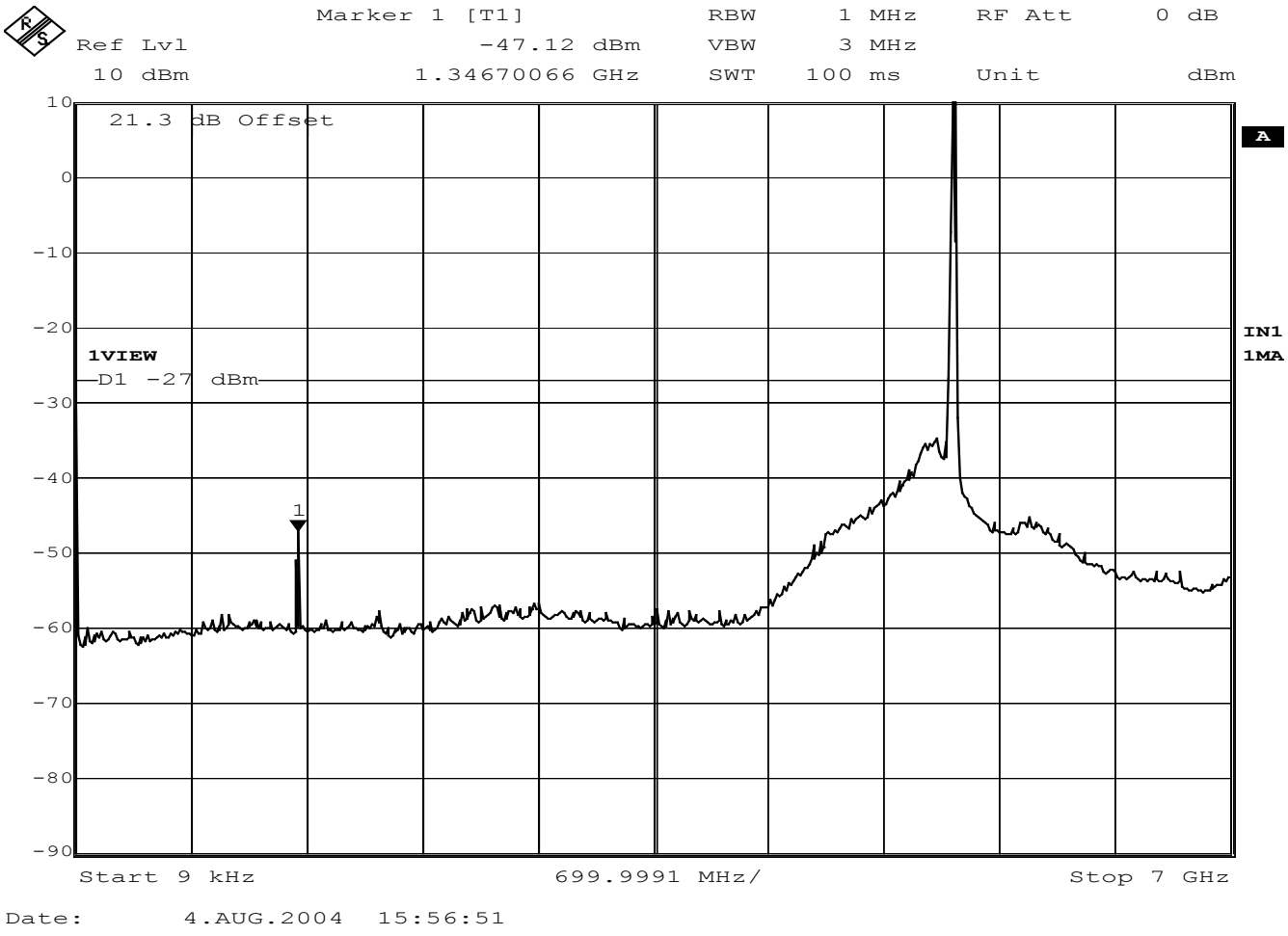


2.18 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.18.6 Test Results – continued

Spurious Conducted Emissions (9kHz – 7GHz)

EUT Tx on 5320MHz – Maximum Power 6Mbps

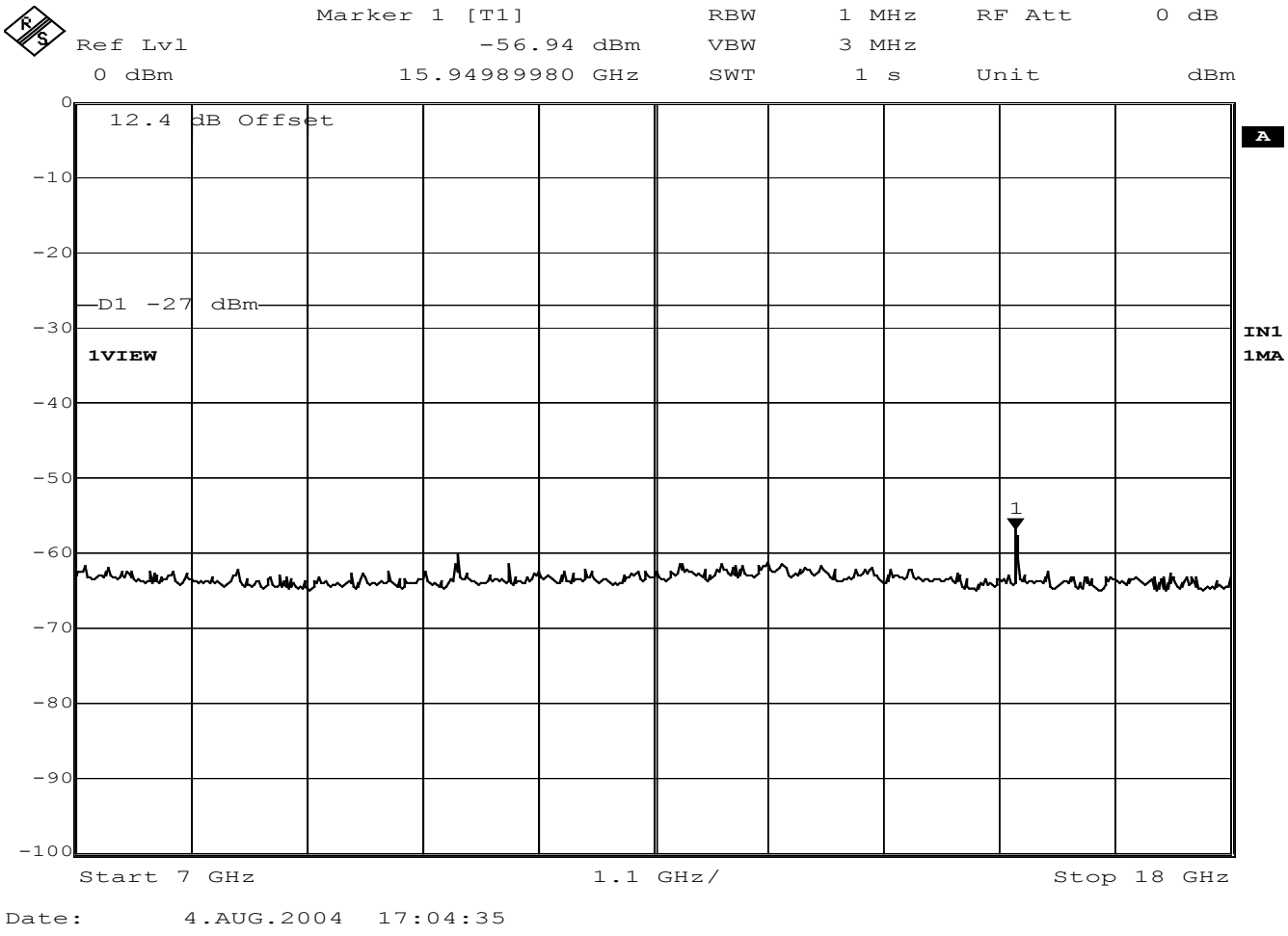


2.18 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.18.6 Test Results – continued

Spurious Conducted Emissions (7GHz – 18GHz)

EUT Tx on 5320MHz – Maximum Power 6Mbps

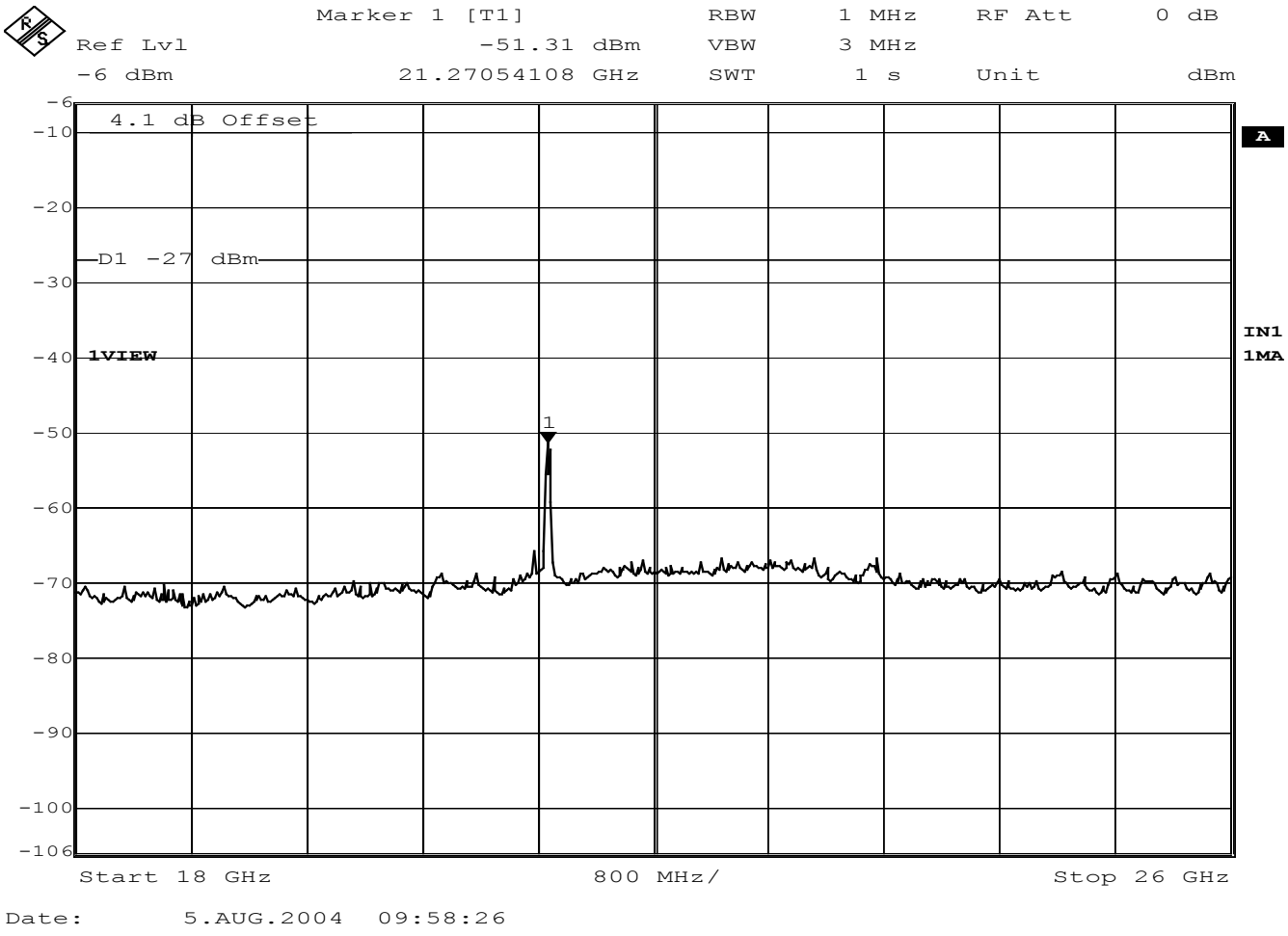


2.18 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.18.6 Test Results – continued

Spurious Conducted Emissions (18GHz – 26GHz)

EUT Tx on 5320MHz – Maximum Power 6Mbps

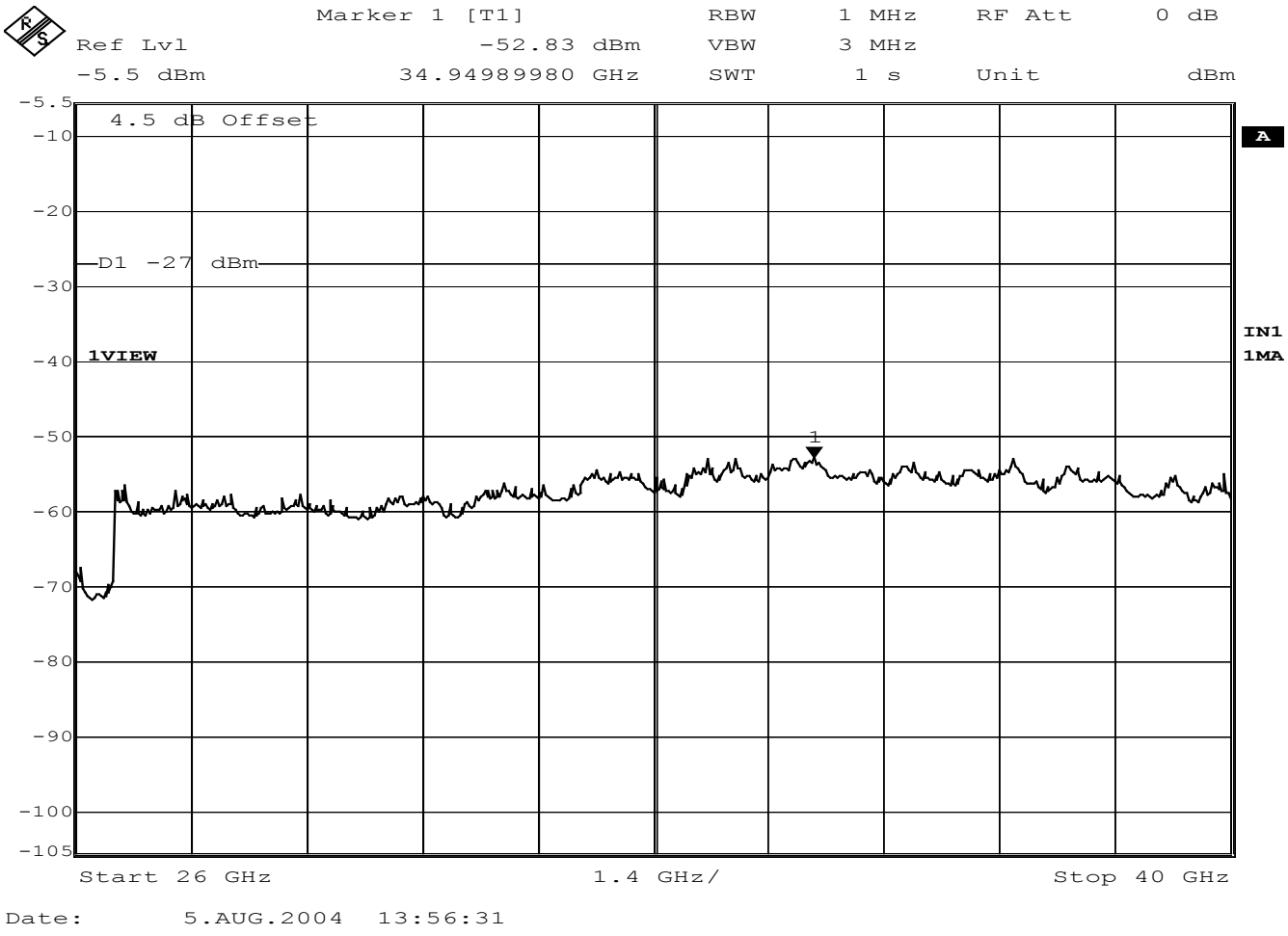


2.18 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.18.6 Test Results – continued

Spurious Conducted Emissions (26GHz – 40GHz)

EUT Tx on 5320MHz – Maximum Power 6Mbps



2.19 FREQUENCY STABILITY UNDER TEMPERATURE VARIATIONS

2.19.1 Specification Reference

FCC CFR 47: Part 15 Subpart E, Section 2.1055, 15.407(g)

2.19.2 Equipment Under Test

802.11a/b/g RLAN Module

2.19.3 Date of Test

11th August 2004

2.19.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.22” within the Test Equipment Used table shown in Section 3.1.

2.19.5 Test Procedure

The EUT was set to transmit on maximum power with no modulation. A Frequency Counter was used to measure the frequency. The maximum frequency error was recorded. The temperature was adjusted between –30ºC and +50ºC in 10º steps as per 2.1055.

Test Performed In Accordance With 2.1055, 15.407(g).

2.19 FREQUENCY STABILITY UNDER TEMPERATURE VARIATIONS – continued

2.19.6 Test Results

The EUT met the requirements of FCC CFR 47: 2.1055, Part 15 Subpart E, 15.407(g) for Frequency Stability Under Temperature Variations).

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

The results are recorded in the table below.

Frequency Band: 5150 – 5250MHz & 5250-5350MHz

Temperature Interval (ºC)	Deviation (kHz)			
	5180 MHz	5240 MHz	5260 MHz	5230 MHz
-30	-46.394	-46.263	-46.423	-47.595
-20	-23.392	-22.985	-23.233	-23.660
-10	-12.239	-12.349	-12.390	-12.438
0	-10.238	-10.017	-10.038	-10.030
+10	-12.844	-12.902	-12.924	-12.982
+20	-25.286	-26.084	-26.287	-26.717
+30	-28.326	-28.785	-28.891	-29.140
+40	-29.945	-30.401	-30.790	-31.085
+50	-28.450	-28.872	-28.949	-29.271

Remarks

The frequency stability of the EUT is sufficient to keep it within the allocated frequency bands at any temperature interval across the measured range.

SECTION 2

TEST DETAILS for 5725MHz to 5825MHz
Including 5830MHz

Limited FCC CFR 47: Parts 15 B, C and E Testing in support of an
Application for Grant of Equipment Authorisation
Of a Symbol 802.11a/b/g RLAN Module

2.20 PEAK POWER SPECTRAL DENSITY

2.20.1 Specification Reference

FCC CFR 47: Part 15 Subpart E, Section 15.407(a)(3)

2.20.2 Equipment Under Test

802.11a/b/g RLAN Module

2.20.3 Date of Test

4th August 2004

2.20.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.23” within the Test Equipment Used table shown in Section 3.1.

2.20.5 Test Procedure

The EUT was connected to a Spectrum Analyse via a 20dB attenuator. The EUT was set to transmit on maximum power an all required channels and at 6Mbps.

With the EUT transmitting, the trace was adjusted to display the 20dB bandwidth of the fundamental. The RBW was adjusted to 1MHz with the VBW set to 3MHz. The spectrum analyser detector was set to RMS AVE. The trace was then averaged over 200 samples. The peak response was then measured and recorded.

Test Performed In Accordance With 15.407(a)(3).

2.20 PEAK POWER SPECTRAL DENSITY– continued

2.20.6 Test Results

The EUT met the requirements of FCC CFR 47: Part 15 Subpart E, 15.407(a)(3) for Peak Power Spectral Density).

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

The results are recorded in the table below.

Frequency Band: 5725 – 5825MHz and 5830MHz

Frequency (MHz)	Data Rate (Mbps)	Measurement Bandwidth (MHz)	Result (dBm)
5745	6	1	+3.91
5805	6	1	+4.53
5830	6	1	+4.34

Limit	≤ +17dBm/1MHz

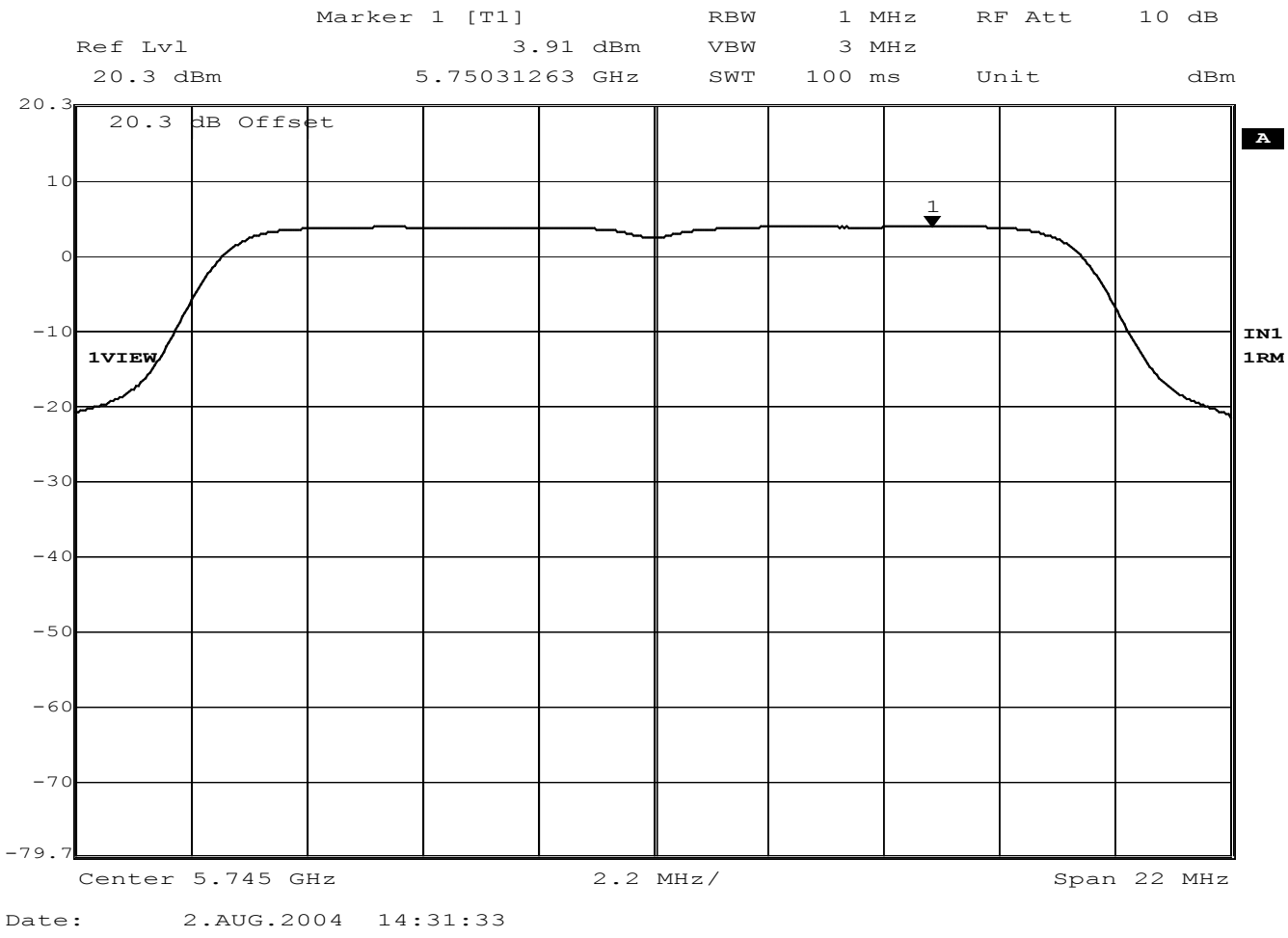
Remarks

The EUT met the requirements specified in Clause 15.407(a)(3). The Peak Power Spectral Density was below the +17dBm/MHz limit.

2.20 PEAK POWER SPECTRAL DENSITY– continued

2.20.6 Test Results - continued

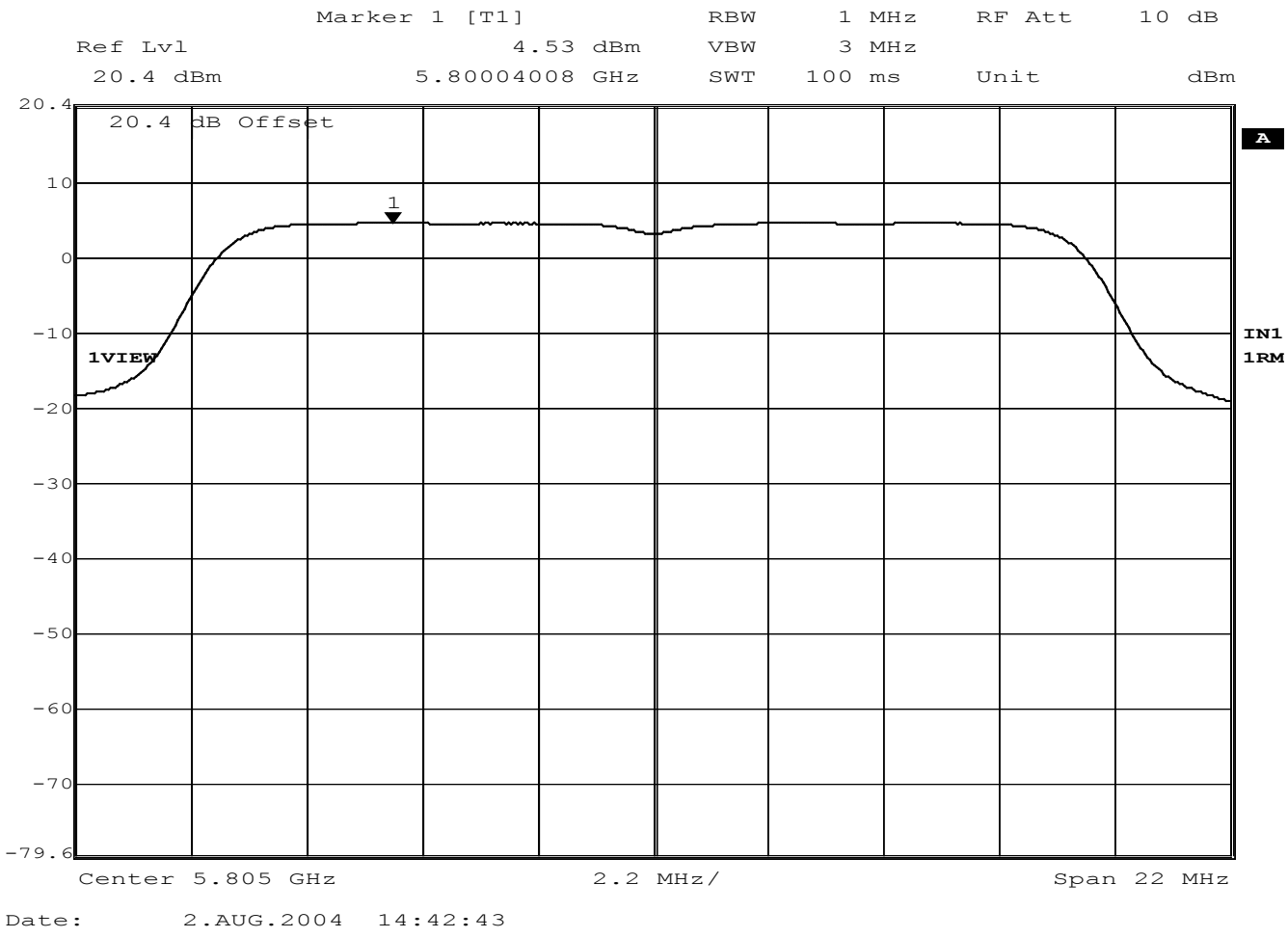
5745.0MHz – Maximum Power 6Mbps



2.20 PEAK POWER SPECTRAL DENSITY– continued

2.20.6 Test Results - continued

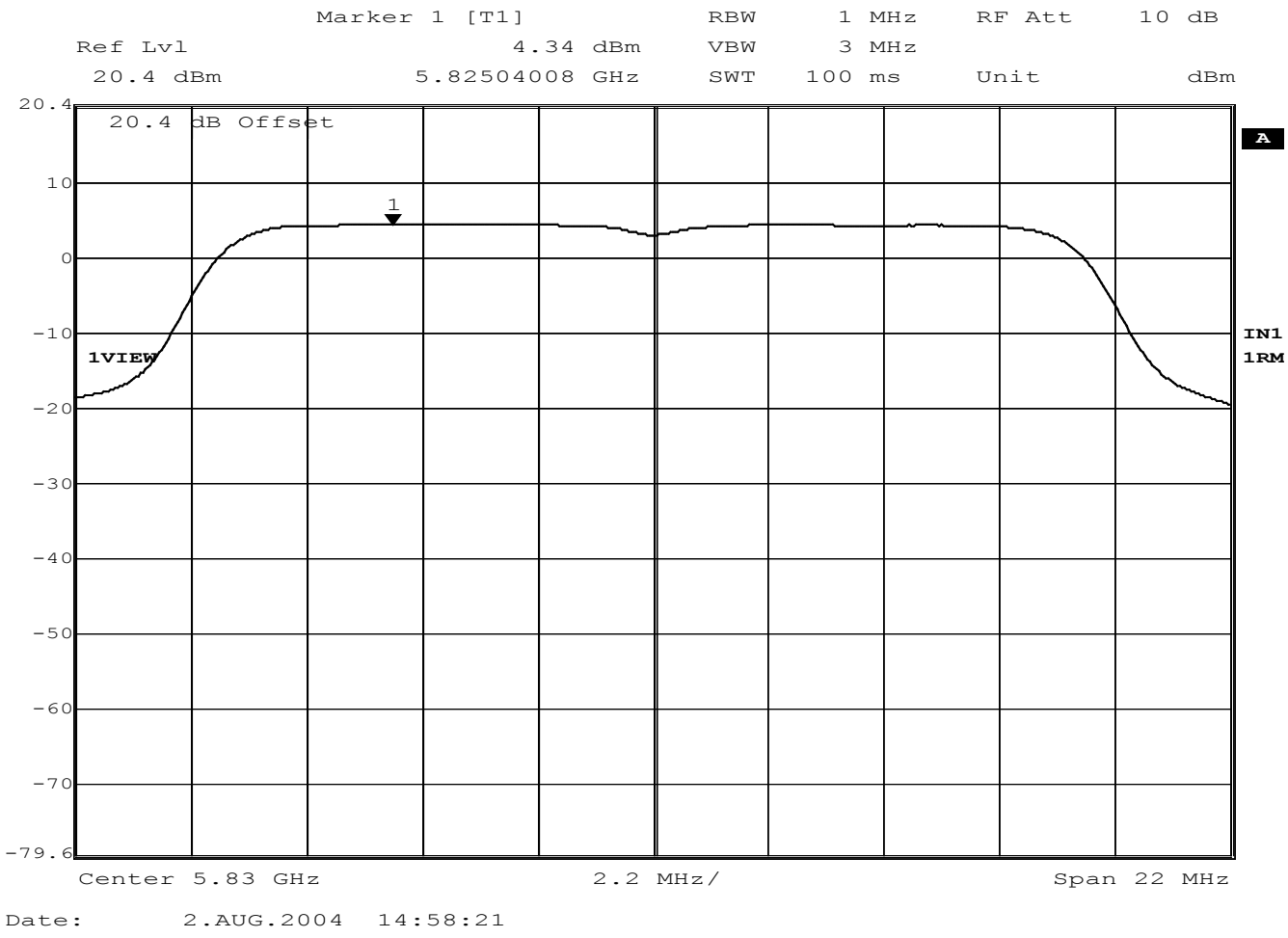
5805.0MHz – Maximum Power 6Mbps



2.20 PEAK POWER SPECTRAL DENSITY– continued

2.20.6 Test Results - continued

5830.0MHz – Maximum Power 6Mbps



2.21 PEAK OUTPUT POWER

2.21.1 Specification Reference

FCC CFR 47: Part 15 Subpart E, Section 15.407(a)(3)

2.21.2 Equipment Under Test

802.11a/b/g RLAN Module

2.21.3 Date of Test

29th July 2004

2.21.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.24” within the Test Equipment Used table shown in Section 3.1.

2.21.5 Test Procedure

The EUT was connected to a Peak Power Analyser via a 10dB Attenuator. The path loss previously measured was used as an offset in the Peak Power Analyser and the Peak Power was measured.

Test Performed In Accordance With 15.407(a)(3).

2.21 PEAK OUTPUT POWER – continued

2.21.6 Test Results

The EUT met the requirements of FCC CFR 47: Part 15 Subpart E, 15.407(a)(3) for Peak Output Power).

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

Frequency (MHz)	Data Rate (Mbps)	Output Power (dBm)	Result (mW)
5745	6	18.60	72.44
5805	6	18.39	69.02
5830	6	18.76	75.16

Limits

Frequency (MHz)	Limit (W)
5745	1.0
5805	1.0
5830	1.0

2.22 EMISSION BANDWIDTH

2.22.1 Specification Reference

FCC CFR 47: Part 15 Subpart E, Section 15.407(a)(3)

2.22.2 Equipment Under Test

802.11a/b/g RLAN Module

2.22.3 Date of Test

2nd August 2004

2.22.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.25” within the Test Equipment Used table shown in Section 3.1.

2.22.5 Test Procedure

The EUT was connected to the Spectrum Analyser using a 20dB Attenuator and cables. The RBW was set to 300kHz and the VBW to 1MHz. The Span was adjusted to encompass the whole of the fundamental. The Peak detector was selected and the trace was set to View. The peak of the fundamental was searched using a –26dB display line. The Marker Delta function was used where the signal crosses the display line. The resultant difference in the markers was recorded as the Emission Bandwidth.

Test Performed In Accordance With 15.407(a)(3).

2.22 EMISSION BANDWIDTH– continued

2.22.6 Test Results

The EUT met the requirements of FCC CFR 47: Part 15 Subpart E, 15.407(a)(3) for Emission Bandwidth).

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

The results are recorded in the table below.

Frequency Band: 5725 – 5825MHz and 5830MHz

Frequency, (MHz)	Data Rate, (Mbps)	Emission Bandwidth, (MHz)
5745	6	35.471
5805	6	35.471
5830	6	35.471

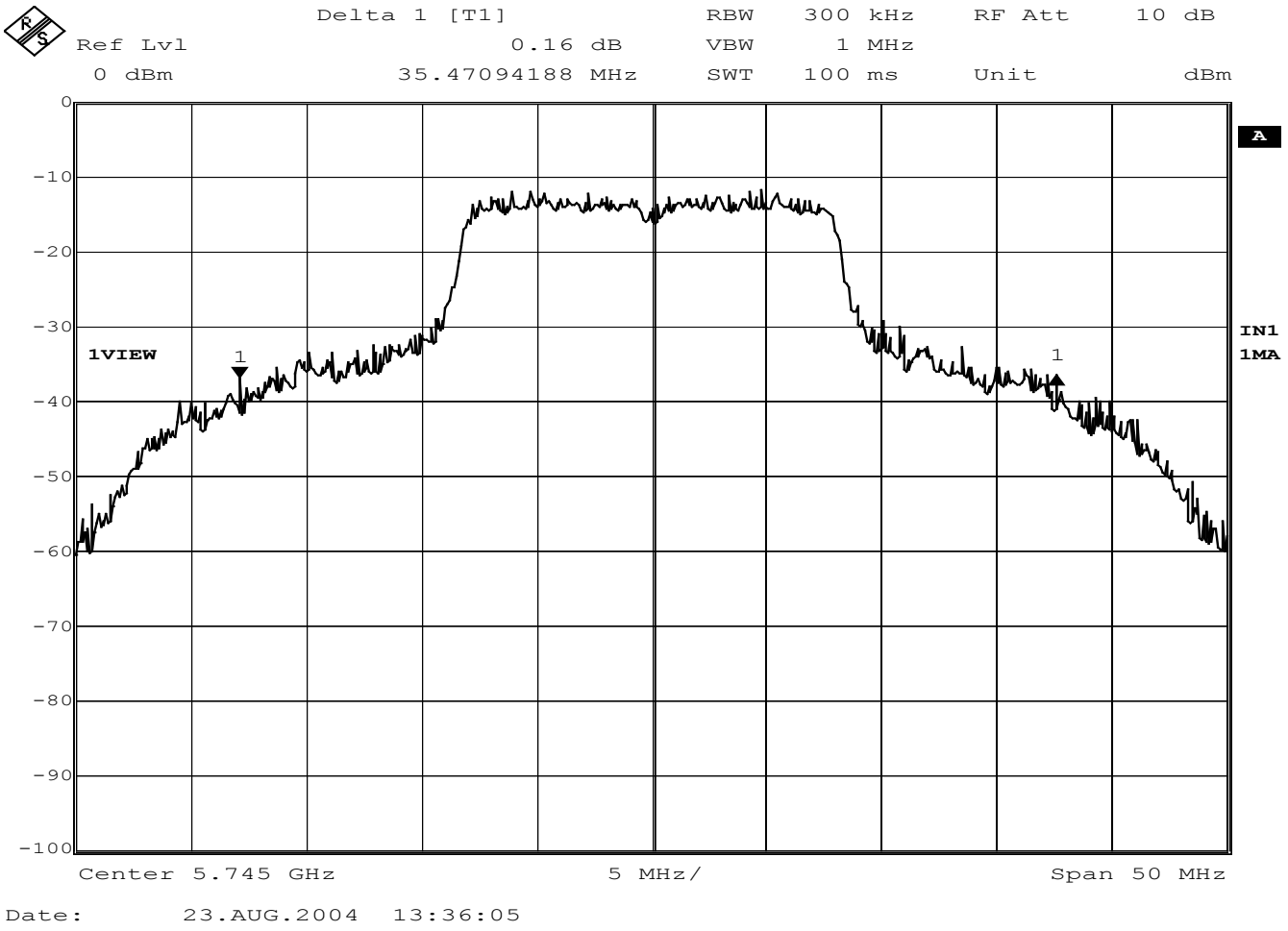
Remarks

The EUT met the requirements specified in Clause 15.407(a)(3)

2.22 EMISSION BANDWIDTH – continued

2.22.6 Test Results - continued

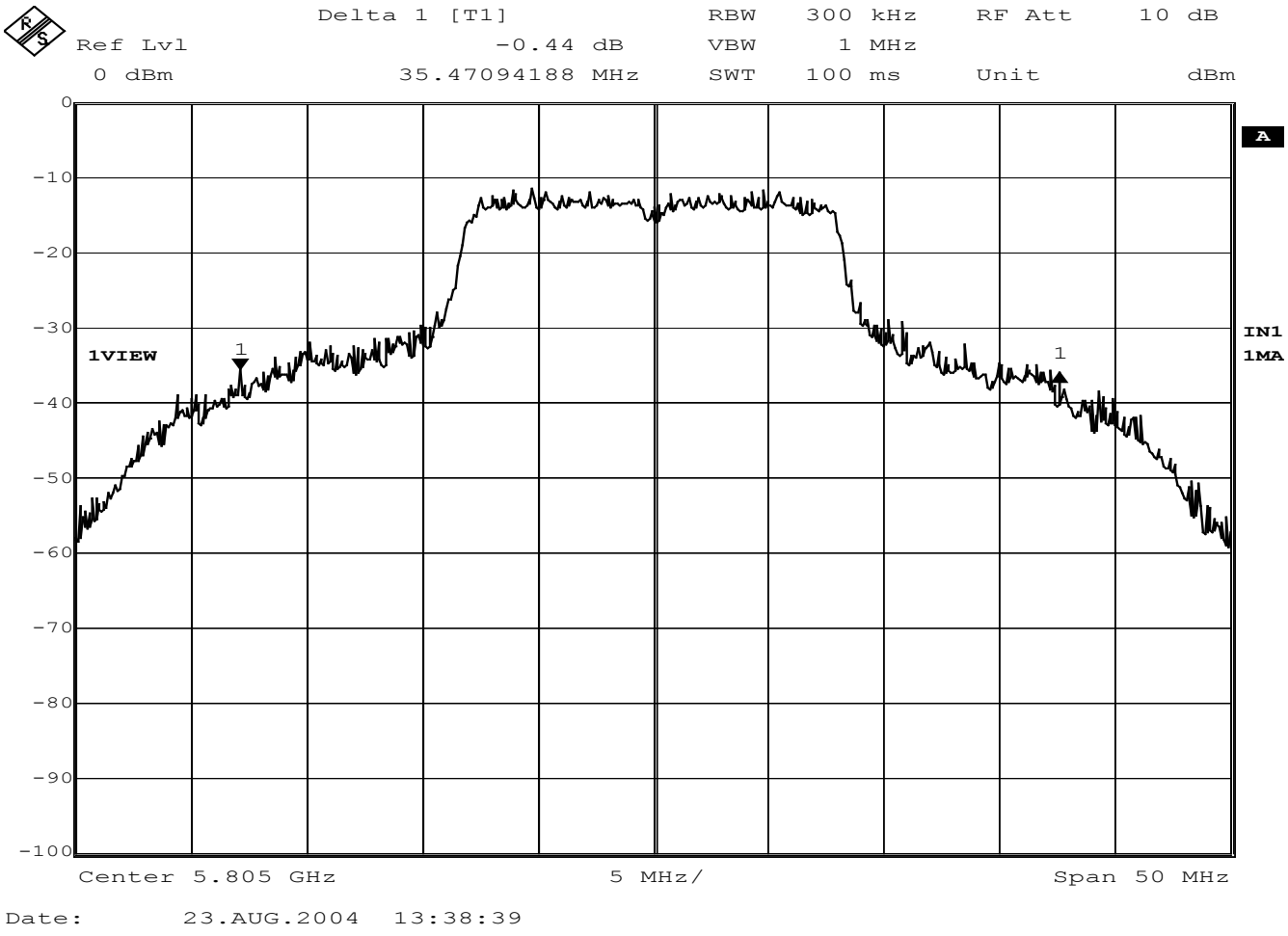
5745.0MHz – Maximum Power 6Mbps



2.22 EMISSION BANDWIDTH – continued

2.22.6 Test Results - continued

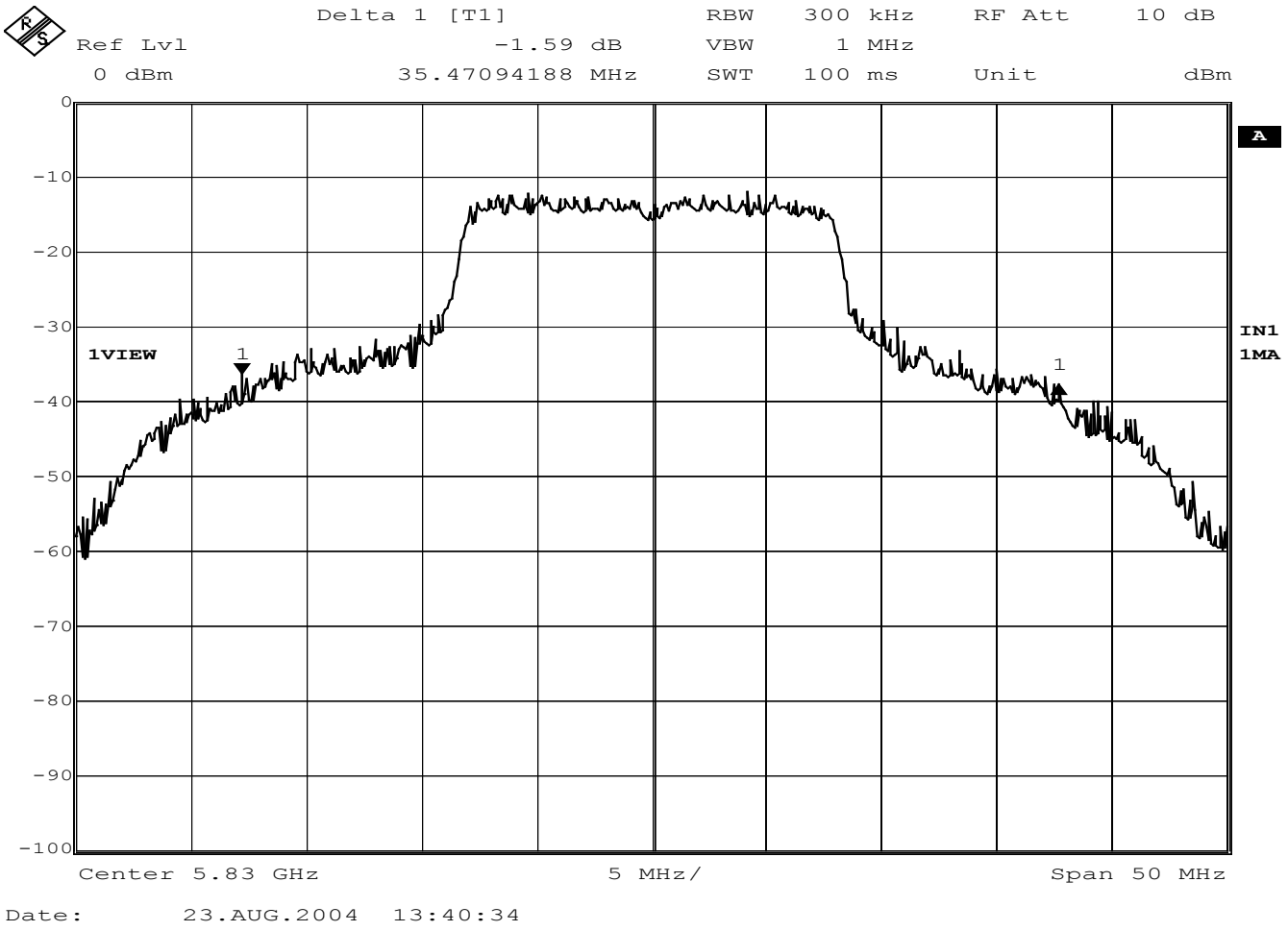
5805.0MHz – Maximum Power 6Mbps



2.22 EMISSION BANDWIDTH – continued

2.22.6 Test Results - continued

5830.0MHz – Maximum Power 6Mbps



2.23 PEAK EXCURSION

2.23.1 Specification Reference

FCC CFR 47: Part 15 Subpart E, 15.407(a)(6)

2.23.2 Equipment Under Test

802.11a/b/g RLAN Module

2.23.3 Date of Test

3rd August 2004

2.23.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.26” within the Test Equipment Used table shown in Section 3.1.

2.23.5 Test Procedure

The EUT was connected to the Spectrum Analyser via a 20dB Attenuator. The EUT was set to transmit at maximum power on all three channels and at the highest and lowest data rates.

With the EUT transmitting, the trace was adjusted to display the entire emission bandwidth of the fundamental. The RBW was adjusted to 1MHz with the VBW set to 3MHz. Trace 1 was set to Max Hold with a peak detector. Trace 2 was then selected with a sample detector. The VBW on trace 2 was reduced to 30kHz and the trace set to max hold. Using the marker delta function, the difference between the two traces was measured.

2.23 PEAK EXCURSION – continued

2.23.6 Test Results

The EUT met the requirements of 47 CFR 15, Subpart E, Section 15.407(a)(6) for Peak Excursion.

The measurement plots are shown on the following pages.

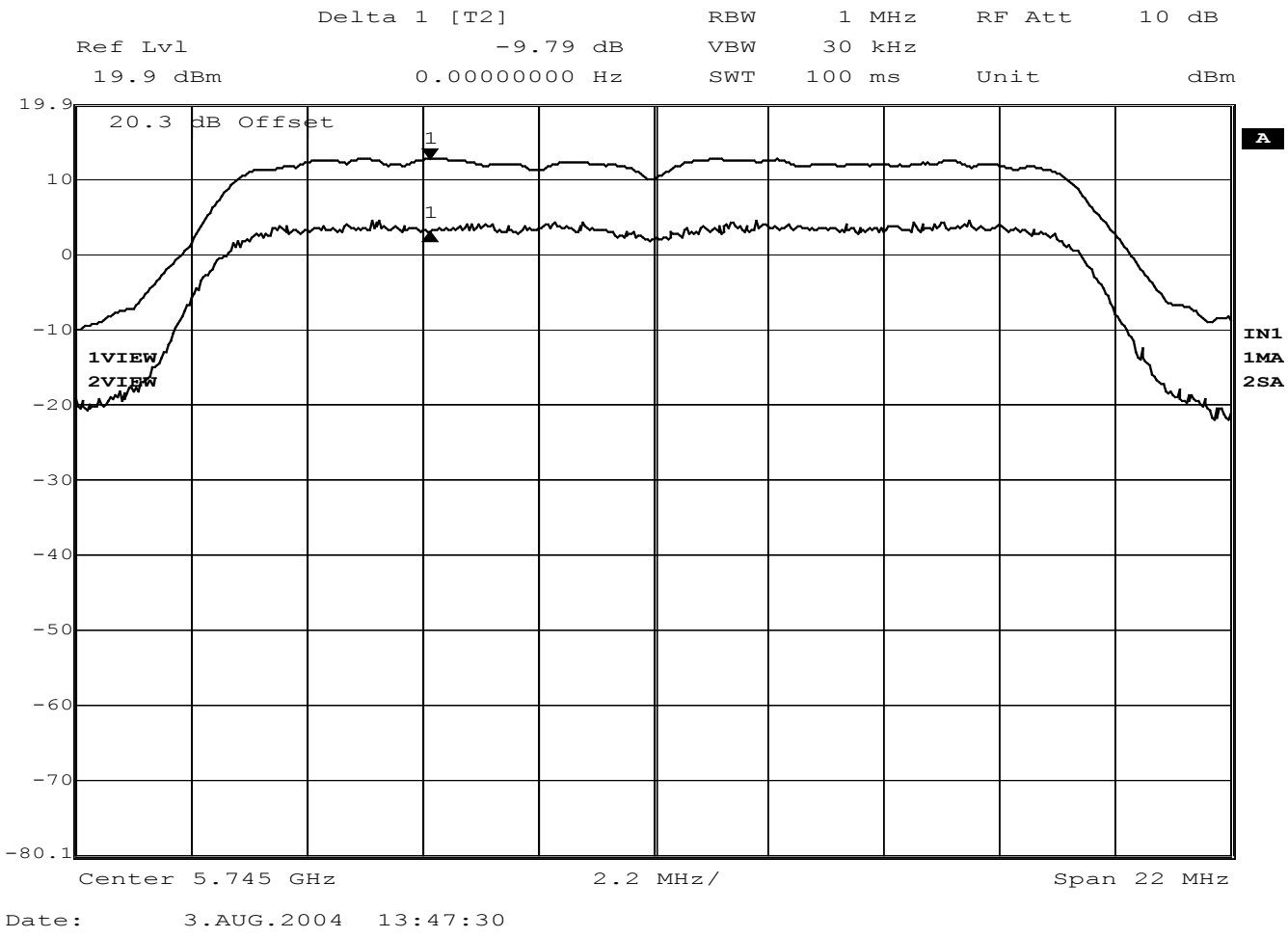
Remarks

The equipment met the requirements outlined in Clause 15.407(a)(6) where the peak excursion was less than 13dB.

2.23 PEAK EXCURSION – continued

2.23.6 Test Results - continued

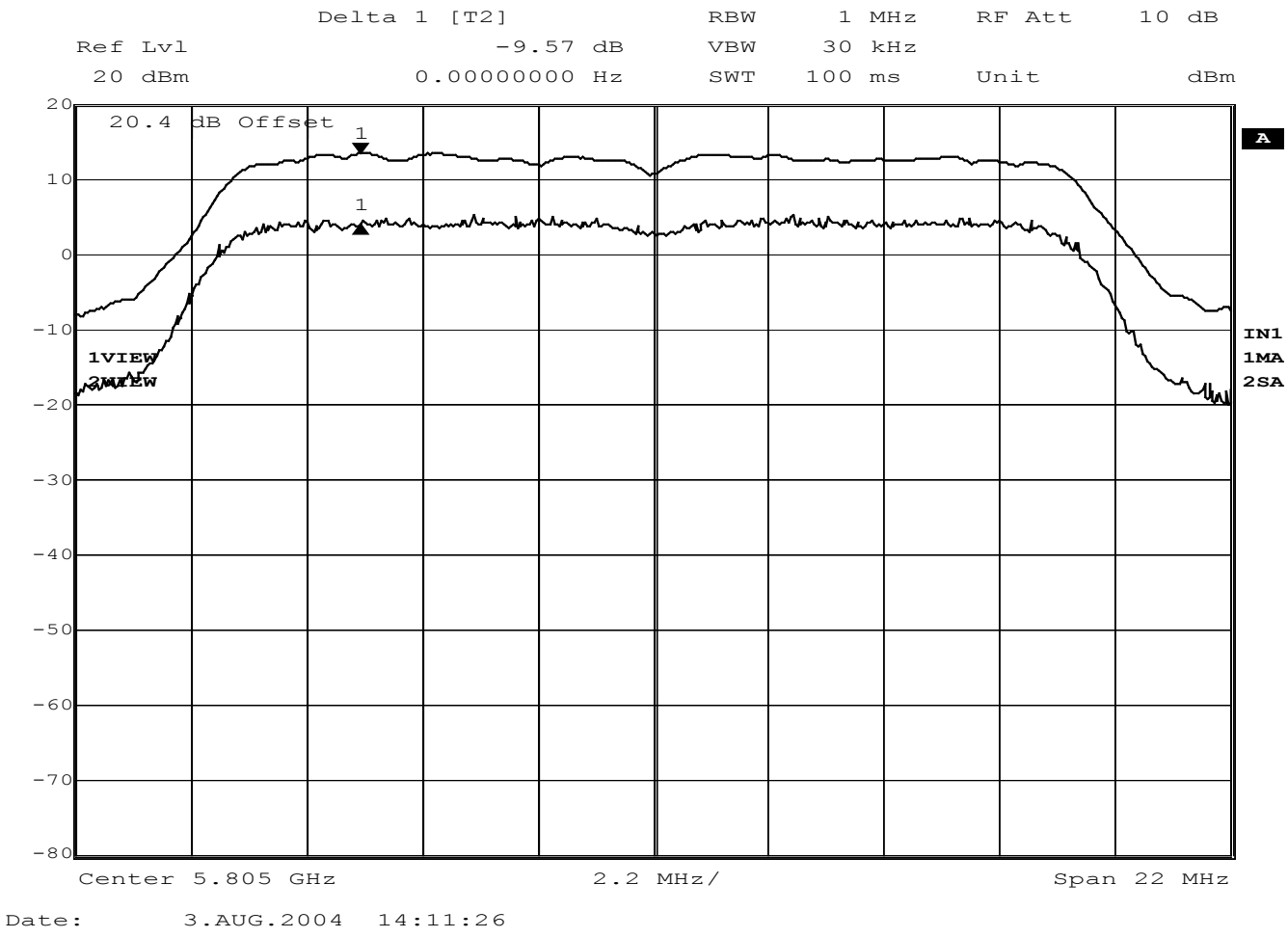
5745.0MHz – Maximum Power 6Mbps



2.23 PEAK EXCURSION – continued

2.23.6 Test Results - continued

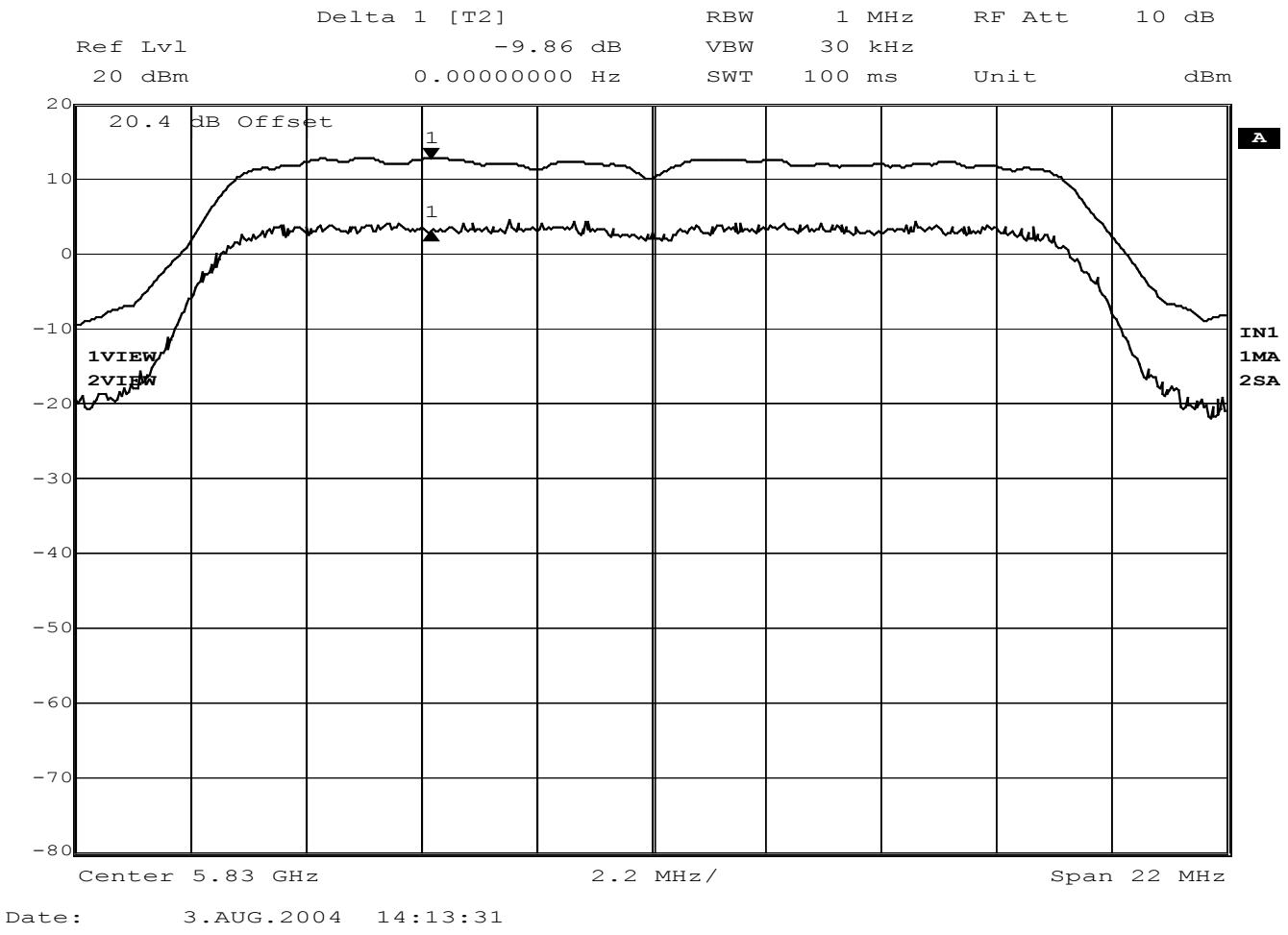
5805.0MHz – Maximum Power 6Mbps



2.23 PEAK EXCURSION – continued

2.23.6 Test Results - continued

5830.0MHz – Maximum Power 6Mbps



2.24 SPURIOUS RADIATED EMISSIONS

2.24.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.407(b)(1)(2)(3)(5)(6)

2.24.2 Equipment Under Test

802.11a/b/g RLAN Module

2.24.3 Date of Test

26th July 2004

2.24.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as Section 2.24 within the Test Equipment Used table shown in Section 3.1.

2.24.5 Test Procedure

Testing to the requirements of FCC CFR 47: Part 15 Subpart E, 15.407(b)(1)(2)(3)(5)(6), for Spurious Radiated Emissions was carried out on the Measurement Test Facility detailed in Annex A. Section 15.407(b)(1)(2)(3)(5)(6) also requires Rule parts 15.205 and 15.209 to be applied.

A preliminary profile of the Spurious Radiated Emissions was obtained by operating the Equipment Under Test (EUT) on a remotely controlled turntable within a semi-anechoic chamber; measurements were taken at a 3m distance unless otherwise stated. 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, a search was made in the frequency range 30MHz to 25GHz. The list of worst-case emissions was then confirmed or updated under Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

30MHz – 1GHz emissions levels were then formally measured using a CISPR Quasi-Peak detector. 1GHz – 40GHz emissions levels were then formally measured using Peak and Average detectors.

(Note: Peak measurements performed using a Resolution and Video Bandwidth of 1MHz, Average measurements performed using a Resolution Bandwidth of 1MHz and a Video Bandwidth of 10Hz)

The Host Laptop was connected to a 120V 60Hz supply.

2.24 SPURIOUS RADIATED EMISSIONS - continued

2.24.5 Test Procedures

Spurious Radiated Emissions from 30MHz to 1GHz were made using a HP 8542E Test Receiver.

Spurious Radiated Emissions from 1GHz to 40GHz were made using a Rhode and Schwarz ESIB 40 Test Receiver.

The test was performed in accordance with ANSI C63.4.

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

The limits for Spurious Emissions Inside the Restricted Bands are in accordance with 15.205(a) & (b), which call up the limits in 15.209 (a)

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

The limits for Spurious Emissions outside the Restricted Bands are in accordance with 15.407(b) paragraphs (1) (2) & (3) which call up the EIRP limit of -27dBm (or -17dBm if within ±10MHz of the 5.725 – 5.825GHz Band Edge.

The EIRP result is derived from the Field Strength result, and converted to EIRP via the following formula:-

$$\text{EIRP (W)} = \frac{(\text{V/m} \times \text{Distance\{metres\}})^2}{30}$$

2.24 SPURIOUS RADIATED EMISSIONS - continued

2.24.6 Test Results

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC Part 15.407(b)(5)(6), 15.205 and 15.209 for Spurious Radiated Emissions (30MHz –1GHz).

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

EUT Tx on Bottom Channel (5745MHz)

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
99.43	V	100	087	24.0	15.8	43.5	150.0
99.43	H	260	195	29.3	29.2	43.5	150.0
147.00	H	178	173	26.4	20.9	46.0	200.0
440.00	H	204	185	29.6	30.2	46.0	200.0
480.00	H	210	170	32.2	40.7	46.0	200.0
524.00	H	199	211	31.5	37.6	46.0	200.0

EUT Tx on Middle Lower Channel (5805MHz)

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
99.70	H	179	200	28.7	27.2	43.5	150.0
147.50	H	179	191	26.3	20.7	43.5	150.0
440.00	H	225	174	29.1	28.5	46.0	200.0
480.00	H	176	162	31.7	28.5	46.0	200.0
520.20	V	100	127	28.4	26.3	46.0	200.0
524.90	H	170	199	30.8	34.7	46.0	200.0

2.24 SPURIOUS RADIATED EMISSIONS - continued

2.24.6 Test Results – continued

30MHz - 1GHz Frequency Range

EUT Tx on Top Channel (5830MHz)

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
99.70	H	169	195	28.3	26.0	43.5	150.0
147.40	H	172	198	25.8	19.5	43.5	150.0
440.00	H	221	176	29.0	28.2	46.0	200.0
480.00	H	184	170	32.0	39.8	46.0	200.0
520.20	V	100	134	29.0	28.2	46.0	200.0
524.70	H	179	197	31.1	35.9	46.0	200.0

ABBREVIATIONS FOR ABOVE TABLES

H	Horizontal Polarisation	V	Vertical Polarisation
Pol	Polarisation	Hgt	Height
deg	degree	Azm	Azimuth

2.24 SPURIOUS RADIATED EMISSIONS - continued

2.24.6 Test Results - continued

1GHz - 40GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC Part 15.407(b)(1)(2)(3)(5)(6), 15.205 and 15.209 for Spurious Radiated Emissions (1GHz – 40GHz).

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

EUT Tx on Bottom Channel (5745MHz)

Frequency	Antenna		Azm	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit	EIRP Result	EIRP Limit
	Pol	Hgt							
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m	dB(m)	dB(m)
1.040	V	100	062	48.5	74.0	41.3	54.0	N/A	N/A
5.147	V	100	229	63.6	74.0	49.7	54.0	N/A	N/A
5.725	V	146	140	-22.0	N/A	N/A	N/A	-19.1	-17.0
11.491	V	100	000	56.4	74.0	42.3	54.0	N/A	N/A
22.980*	V	100	181	61.4	84.0	52.3	64.0	N/A	N/A

EUT Tx on Middle Channel (5805MHz)

Frequency	Antenna		Azm	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit	EIRP Result	EIRP Limit
	Pol	Hgt							
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m	dB(m)	dB(m)
1.040	V	100	062	48.7	74.0	41.4	54.0	N/A	N/A
5.147	V	100	225	63.0	74.0	49.5	54.0	N/A	N/A
5.825	V	135	120	-24.9	N/A	N/A	N/A	-21.7	-17.0
23.220*	V	100	317	60.3	N/A	N/A	N/A	-44.5	-27.0

* Measurement made at 1m.

2.24 SPURIOUS RADIATED EMISSIONS - continued

2.24.6 Test Results – continued

1GHz - 40GHz Frequency Range

EUT Tx on Top Channel (5830MHz)

Frequency	Antenna		Azm	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit	EIRP Result	EIRP Limit
	Pol	Hgt							
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m	dB(m)	dB(m)
1.040	V	100	065	48.4	74.0	41.1	54.0	N/A	N/A
5.098	V	100	229	64.0	74.0	49.8	54.0	N/A	N/A
23.320*	V	115	168	60.0	N/A	N/A	N/A	-44.7	-27.0

* Measurement made at 1m.

ABBREVIATIONS FOR ABOVE TABLES

H	Horizontal Polarisation	V	Vertical Polarisation
Pol	Polarisation	Hgt	Height
deg	degree	Azm	Azimuth

2.25 CONDUCTED EMISSIONS ON POWER LINES

2.25.1 Specification Reference

FCC CFR 47: Part 15 Subpart E, Section 15.407(b)(5)

2.25.2 Equipment Under Test

802.11a/b/g RLAN Module

2.25.3 Date of Test

21st August 2004

2.25.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as Section 2.25 within the Test Equipment Used table shown in Section 3.1.

2.25.5 Test Procedure

Test performed in accordance with ANSI C63.4.

Testing to the requirements of FCC CFR 47: Part 15 Subpart E, Section 15.407(b)(5) which also requires Rule parts 15.207 to be applied. for Conducted Emissions was carried out on the Measurement Test Facility detailed in Annex A.

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 Conducted Emissions Measurements were made on the Host Laptop.

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

2.25 CONDUCTED EMISSIONS ON POWER LINES - continued

2.25.6 Test Results

The EUT met the Class B requirements of 47 CFR 15, Subpart E, Section 15.407(b)(5) and Subpart C, Section 15.207 for Conducted Emissions on the Live and Neutral Lines.

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

EUT Tx on Bottom Channel (5745MHz) – Live Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.156	41.6	65.7	23.3	55.7
0.198	43.3	63.7	35.4	53.7
0.262	36.7	61.4	29.4	51.4
0.454	37.0	56.8	33.7	46.8
0.519	34.5	56.0	31.4	46.0
0.584	31.6	56.0	29.2	46.0

The margin between the specification requirements and all other emissions were 19.3dB or more below the specified Quasi-Peak limit and 24.7dB or more below the Average limit.

EUT Tx on Bottom Channel (5745MHz) – Neutral Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.152	41.5	65.9	22.9	55.9
0.194	44.6	63.9	38.9	53.9
0.261	37.5	61.4	31.5	51.4
0.453	37.1	56.8	33.6	46.8
0.519	34.1	56.0	31.2	46.0
0.584	32.5	56.0	29.7	46.0

The margin between the specification requirements and all other emissions were 21.2dB or more below the specified Quasi-peak limit and 27.4dB or more below the specified Average limit.

2.25 CONDUCTED EMISSIONS ON POWER LINES - continued

2.25.6 Test Results - continued

EUT Tx on Middle Channel (5805MHz) – Live Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.165	40.0	65.2	17.2	55.2
0.197	46.2	63.7	40.2	53.7
0.391	33.7	58.0	26.3	48.0
0.456	33.1	56.8	29.0	46.8
0.523	33.0	56.0	27.7	46.0
0.581	33.4	56.0	30.5	46.0

The margin between the specification requirements and all other emissions were 22.6dB or more below the specified Quasi-Peak limit and 24.8dB or more below the Average limit.

EUT Tx on Middle Channel (5805MHz) – Neutral Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.197	44.0	63.7	37.5	53.7
0.262	35.6	61.4	27.2	51.4
0.390	34.9	58.1	32.6	48.1
0.456	33.3	56.8	33.7	46.8
0.523	33.0	56.0	27.9	46.0
0.584	31.5	56.0	29.5	46.0

The margin between the specification requirements and all other emissions were 33.2dB or more below the specified Quasi-peak limit and 25.2dB or more below the specified Average limit.

2.25 CONDUCTED EMISSIONS ON POWER LINES - continued

2.25.6 Test Results - continued

EUT Tx on Top Channel (5830MHz) – Live Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.155	41.6	65.7	22.8	55.7
0.198	44.9	63.7	39.3	53.7
0.262	37.2	61.4	31.6	51.4
0.456	33.0	56.8	28.9	46.8
0.519	34.4	56.0	30.9	46.0
0.584	31.6	56.0	29.4	46.0

The margin between the specification requirements and all other emissions were 19.4dB or more below the specified Quasi-Peak limit and 24.6dB or more below the Average limit.

EUT Tx on Top Channel (5830MHz) – Neutral Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.164	39.8	65.3	16.9	55.3
0.194	44.9	63.9	39.1	53.9
0.259	37.9	61.5	32.3	51.5
0.454	37.1	56.8	33.5	46.8
0.519	34.1	56.0	30.7	46.0
0.584	31.8	56.0	29.2	46.0

The margin between the specification requirements and all other emissions were 32.6dB or more below the specified Quasi-peak limit and 31.1dB or more below the specified Average limit.

2.26 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT

2.26.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.407(b)(3)

2.26.2 Equipment Under Test

802.11a/b/g RLAN Module

2.26.3 Date of Test

4th & 5th August 2004

2.26.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.12” within the Test Equipment Used table shown in Section 3.1.

2.26.5 Test Procedure

Test Performed in accordance with FCC CFR 47: Part 15 Subpart C, Section 15.407(b)(3).

Spurious Conducted Emissions from the antenna terminal were measured. The transmitter output power was attenuated using a combination of of filters and attenuators and the frequency spectrum investigated from 9kHz to 40GHz. The EUT was set to transmit on full power, with a data rate of 6Mbps. The resolution and video bandwidths were set to 1MHz and 3MHz respectively in accordance with Part 15.407(b)(4). The spectrum analyser detector was set to Max Hold.

For measuring the range 9kHz to 7GHz, a 20dB attenuator was used. From 7GHz to 18GHz, a high pass filter was used. From 18GHz to 26GHz and 26GHz to 40GHz, pieces of waveguide were used as a high pass filter.

Spurious Emissions within ±10MHz of the 5.725 – 5.825GHz Band Edge were also measured in accordance with 15.407(b)(3).

The display line function on the spectrum analyser was used to show the appropriate limits for the band.

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

2.26.6 Test Results

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, 15.407(b)(3) for Spurious Conducted Emissions on the Antenna Port.

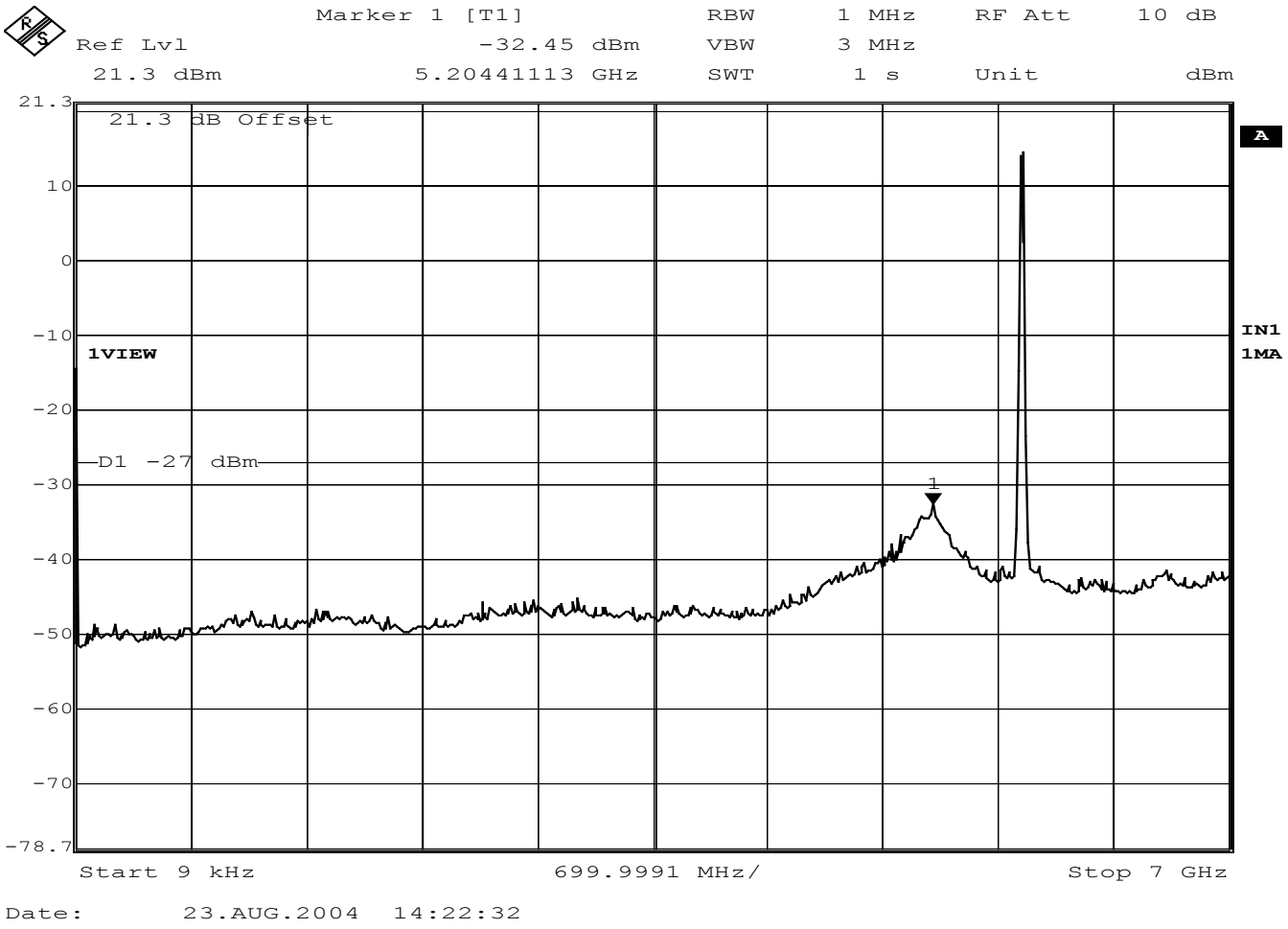
The plots on the following pages show the EUT’s Antenna Ports Spurious Conducted Emissions over the frequency range 9kHz to 40GHz.

2.26 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.26.6 Test Results – continued

Spurious Conducted Emissions (9kHz – 7GHz)

EUT Tx on 5745MHz – Maximum Power 6Mbps

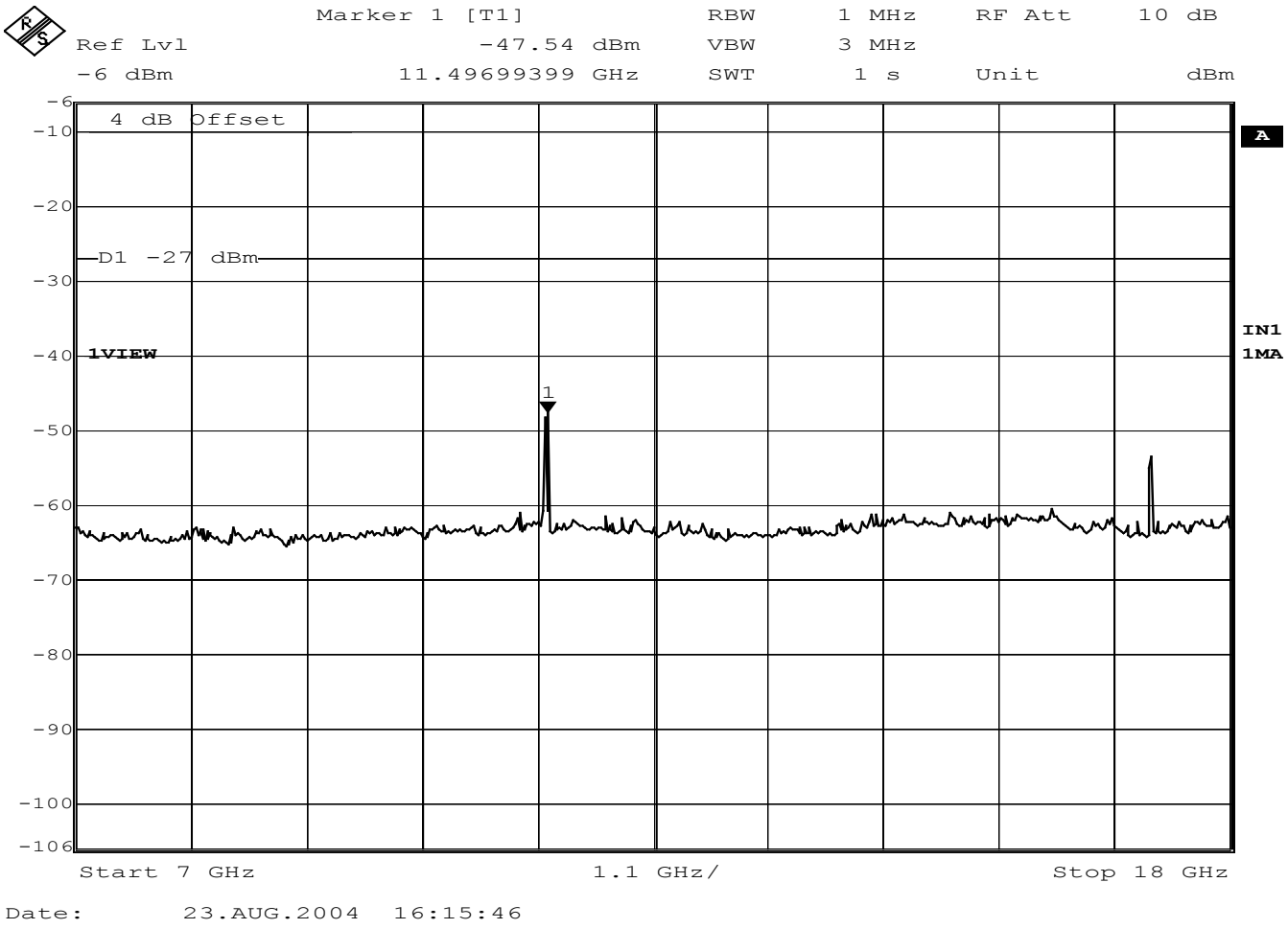


2.26 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.26.6 Test Results – continued

Spurious Conducted Emissions (7GHz – 18GHz)

EUT Tx on 5745MHz – Maximum Power 6Mbps

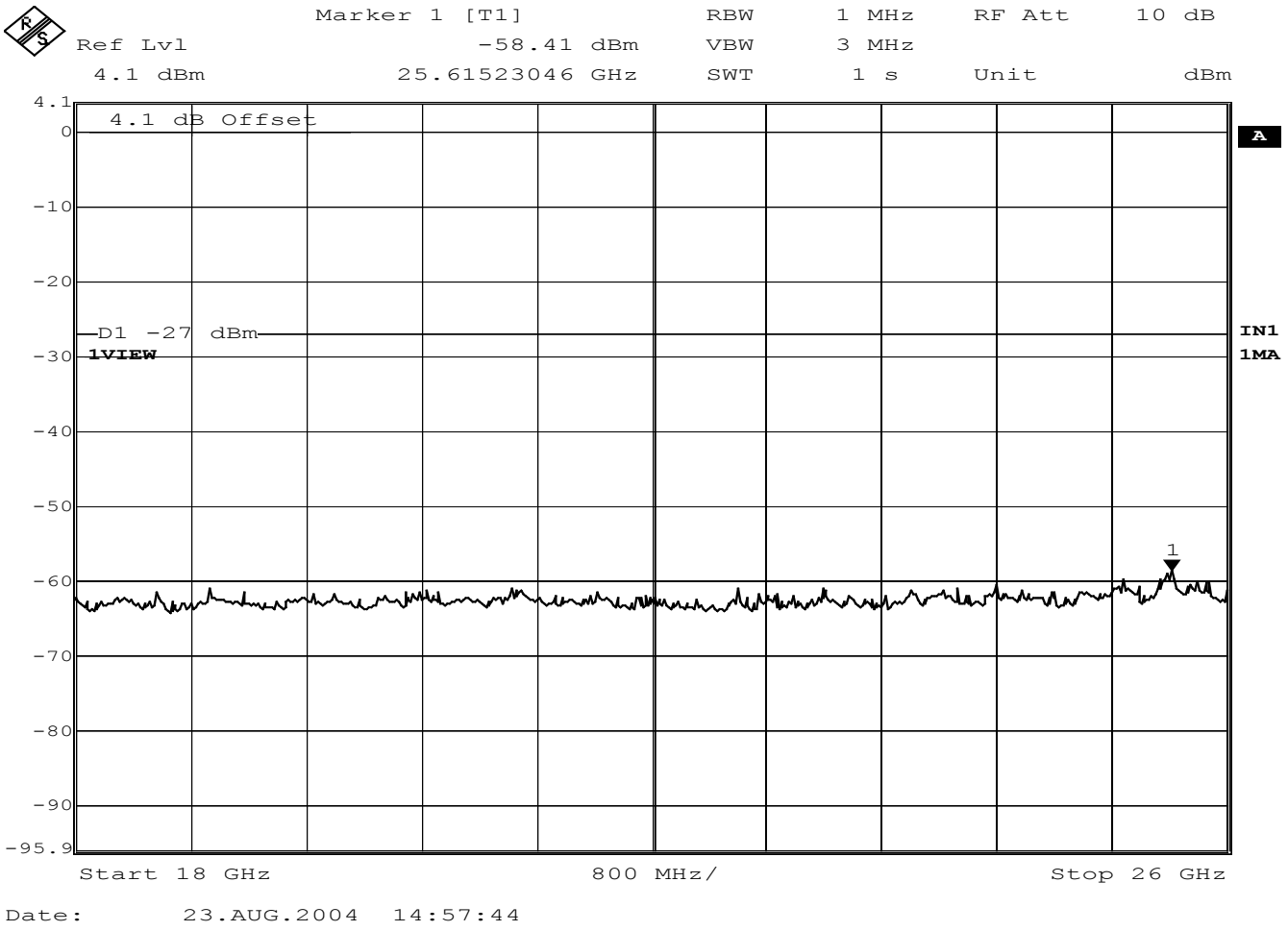


2.26 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.26.6 Test Results – continued

Spurious Conducted Emissions (18GHz – 26GHz)

EUT Tx on 5745MHz – Maximum Power 6Mbps

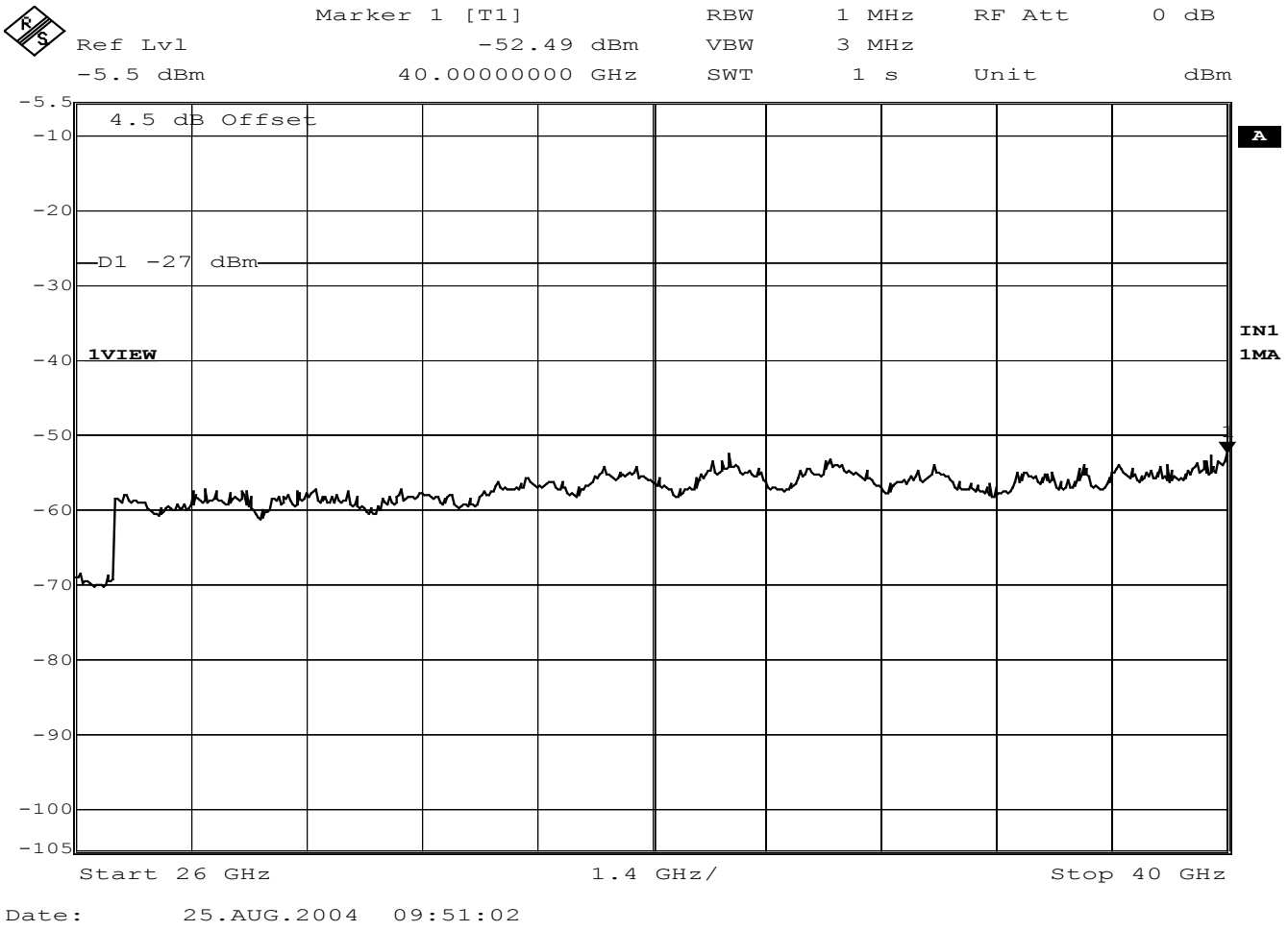


2.26 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.26.6 Test Results – continued

Spurious Conducted Emissions (26GHz – 40GHz)

EUT Tx on 5745MHz – Maximum Power 6Mbps

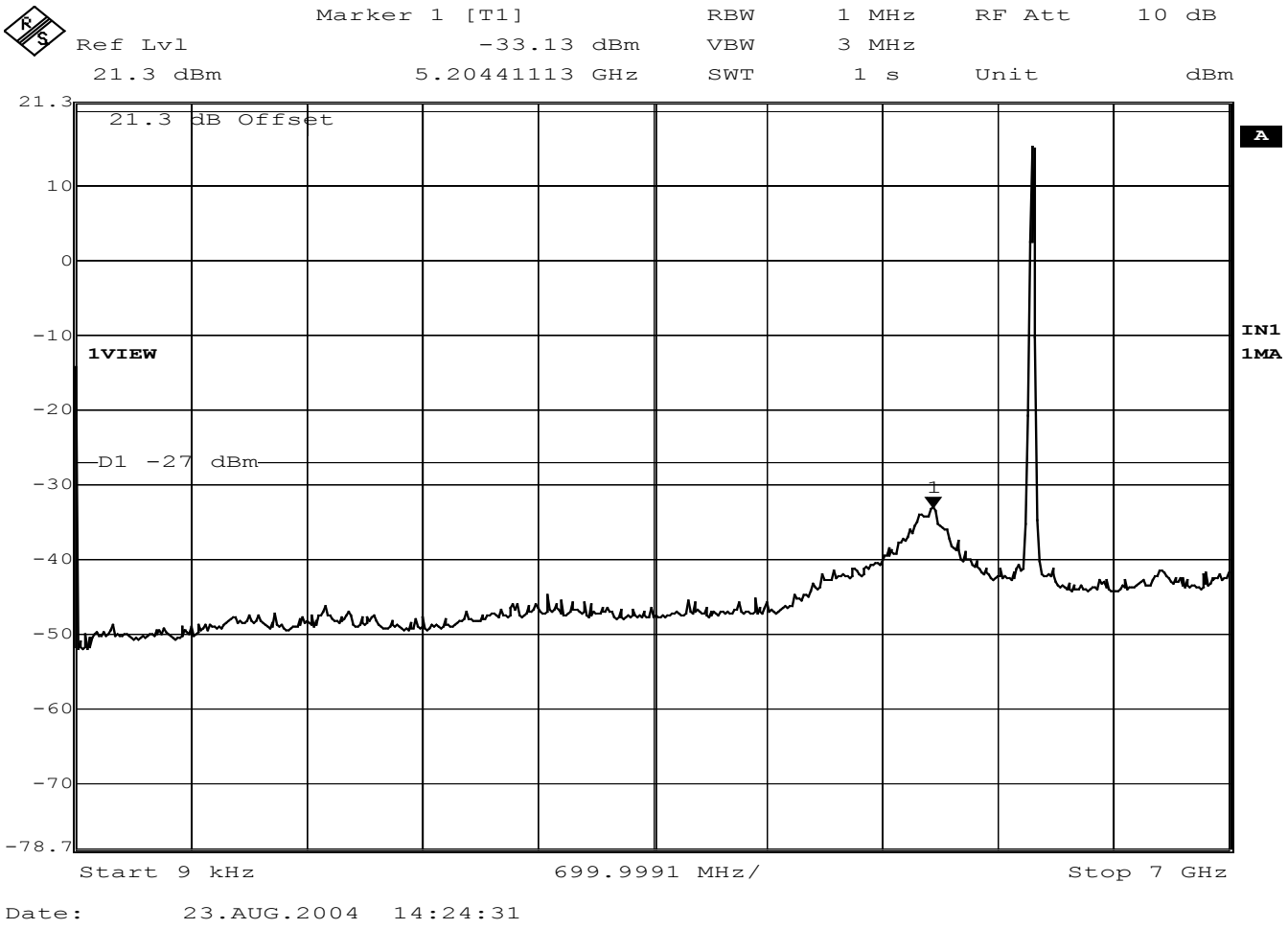


2.26 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.26.6 Test Results – continued

Spurious Conducted Emissions (9kHz – 7GHz)

EUT Tx on 5805MHz – Maximum Power 6Mbps

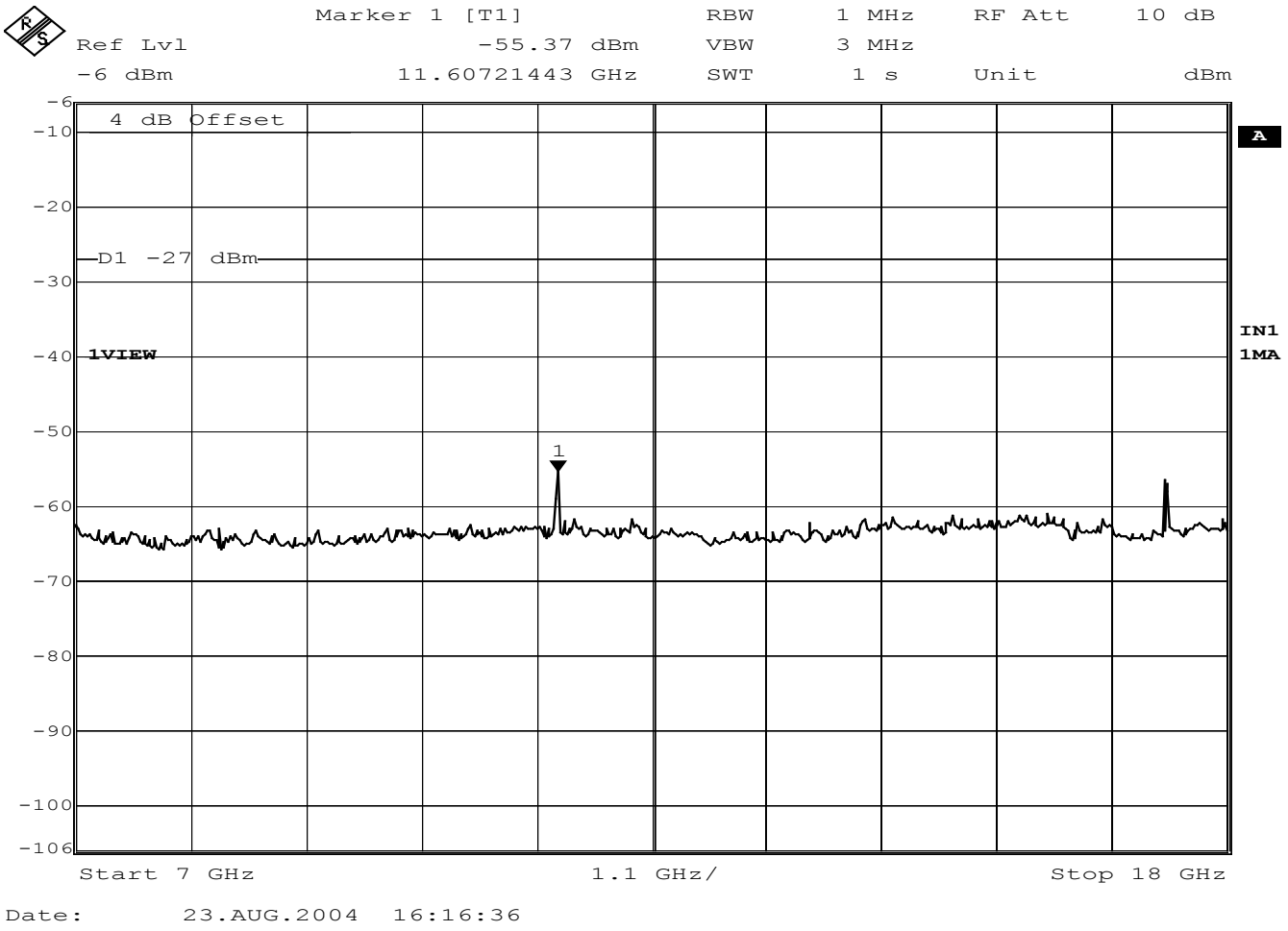


2.26 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.26.6 Test Results – continued

Spurious Conducted Emissions (7GHz – 18GHz)

EUT Tx on 5805MHz – Maximum Power 6Mbps

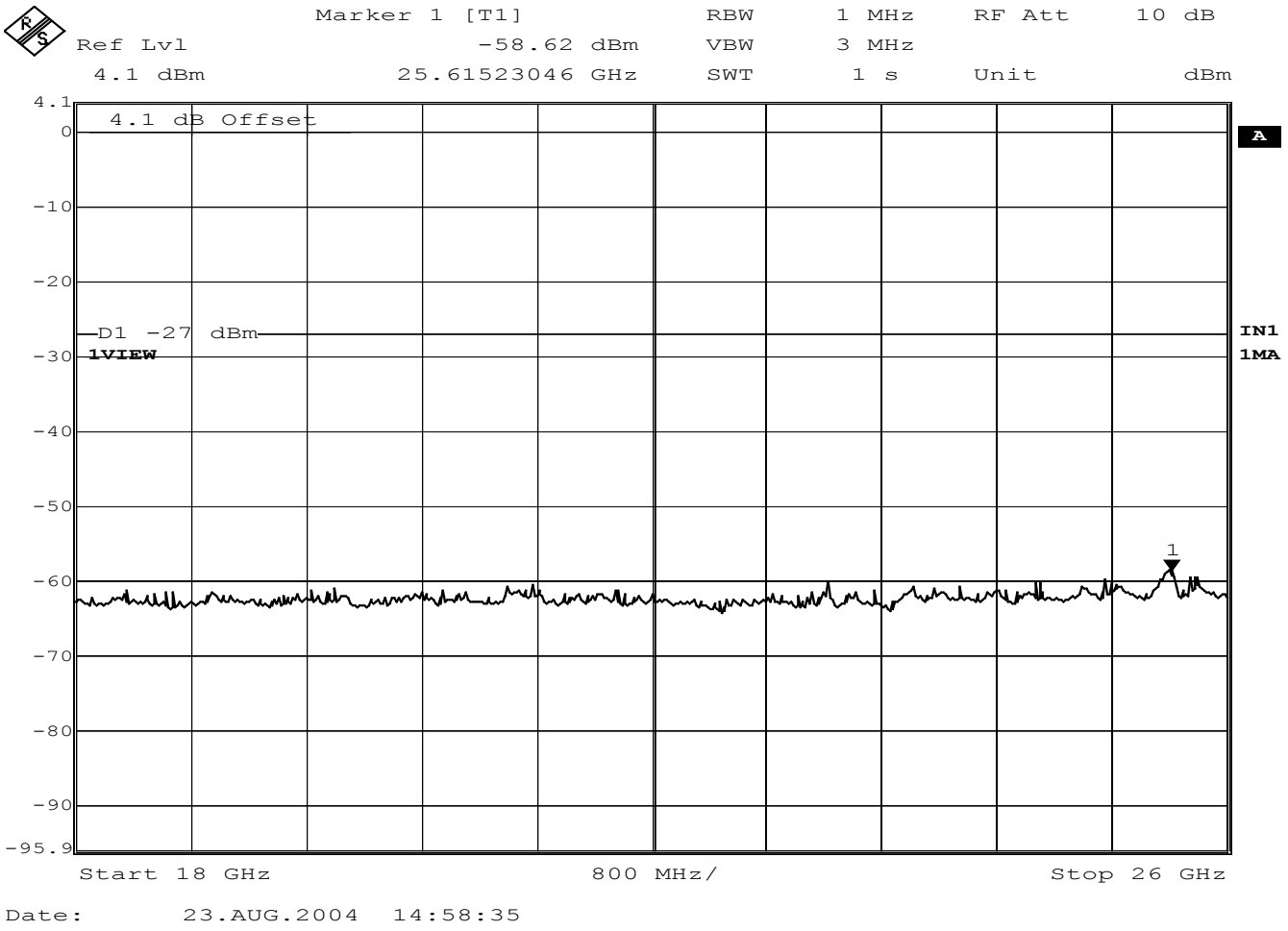


2.26 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.26.6 Test Results – continued

Spurious Conducted Emissions (18GHz – 26GHz)

EUT Tx on 5805MHz – Maximum Power 6Mbps

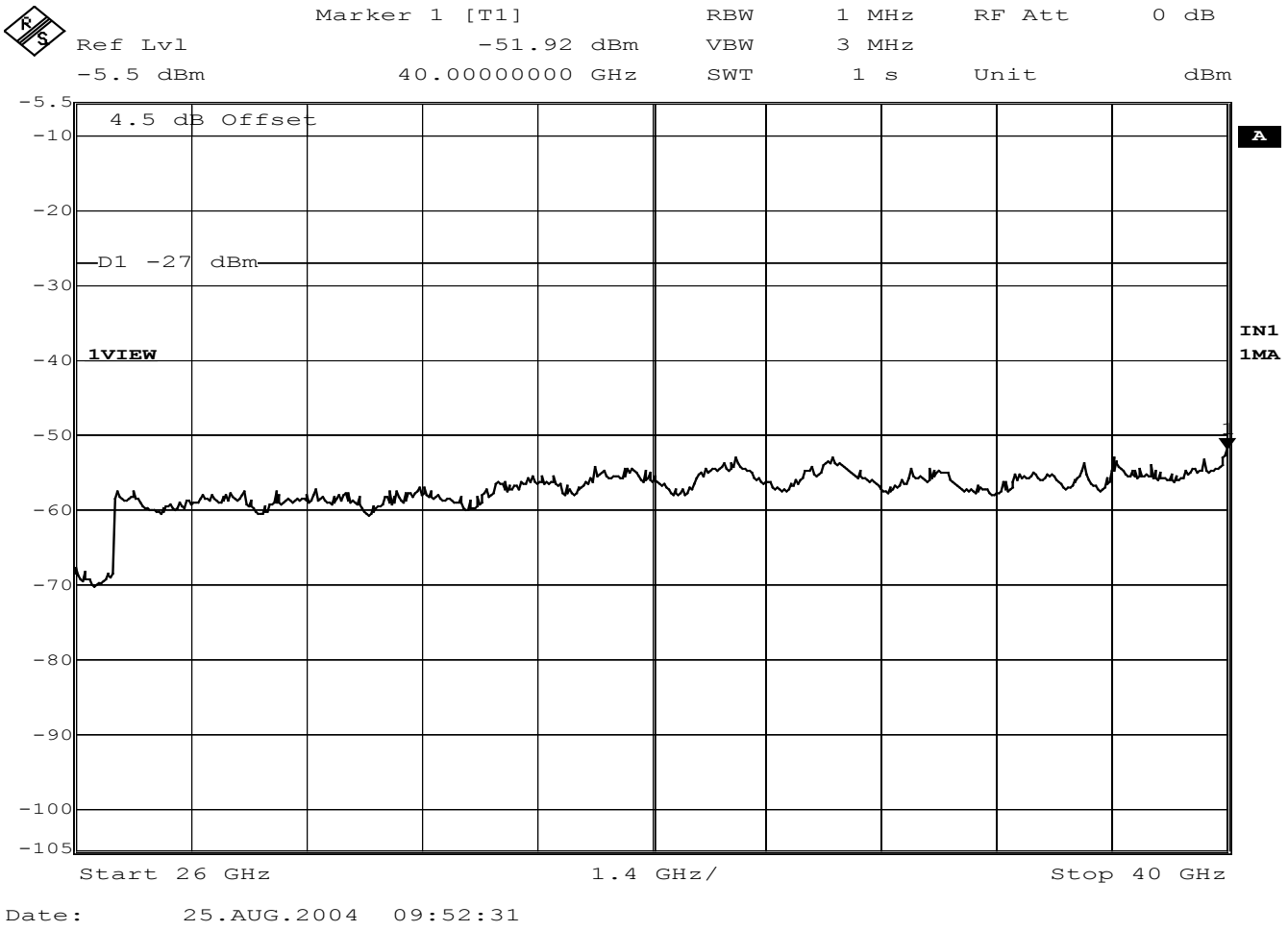


2.26 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.26.6 Test Results – continued

Spurious Conducted Emissions (26GHz – 40GHz)

EUT Tx on 5805MHz – Maximum Power 6Mbps

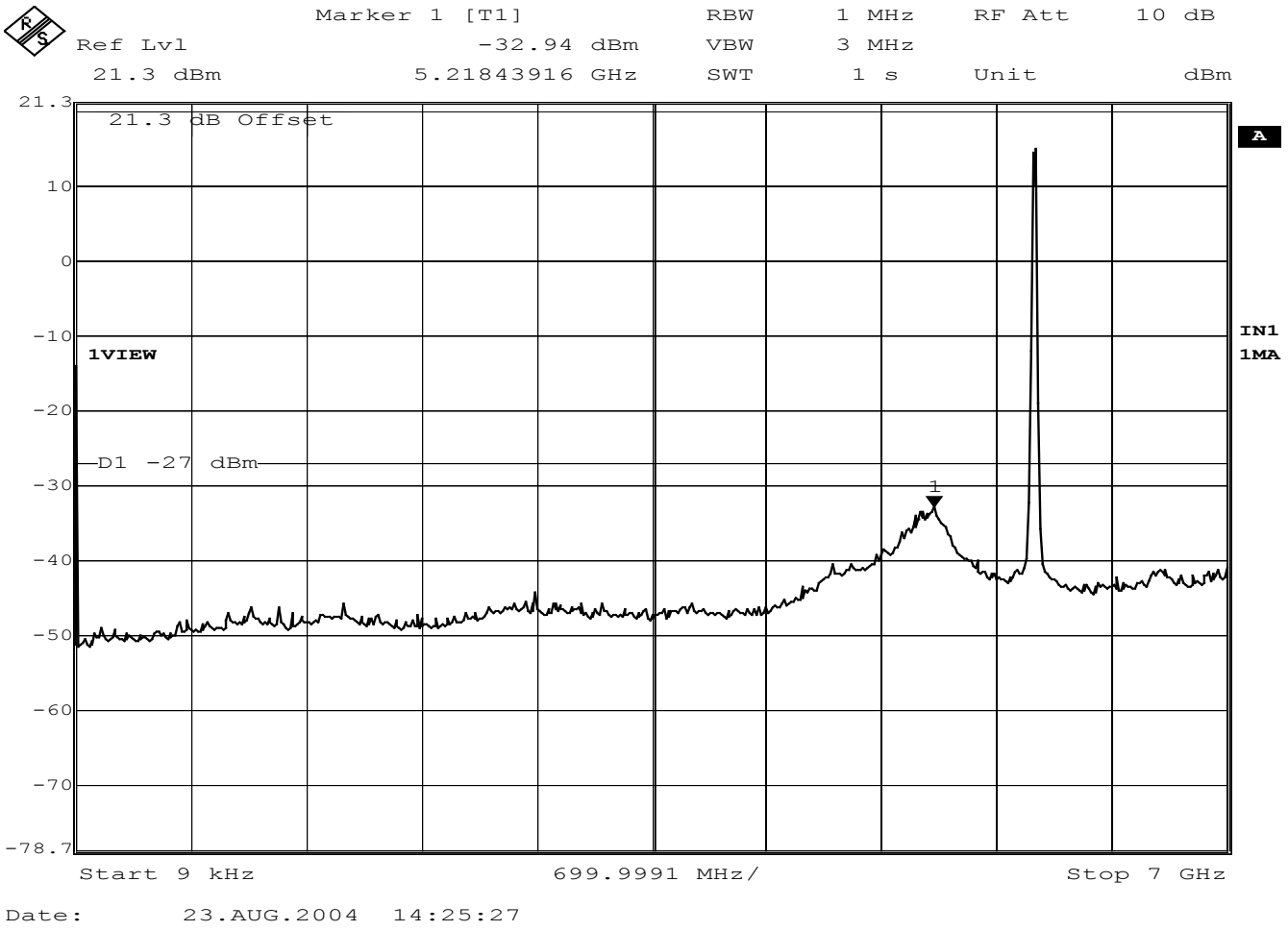


2.26 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.26.6 Test Results – continued

Spurious Conducted Emissions (9kHz – 7GHz)

EUT Tx on 5830MHz – Maximum Power 6Mbps

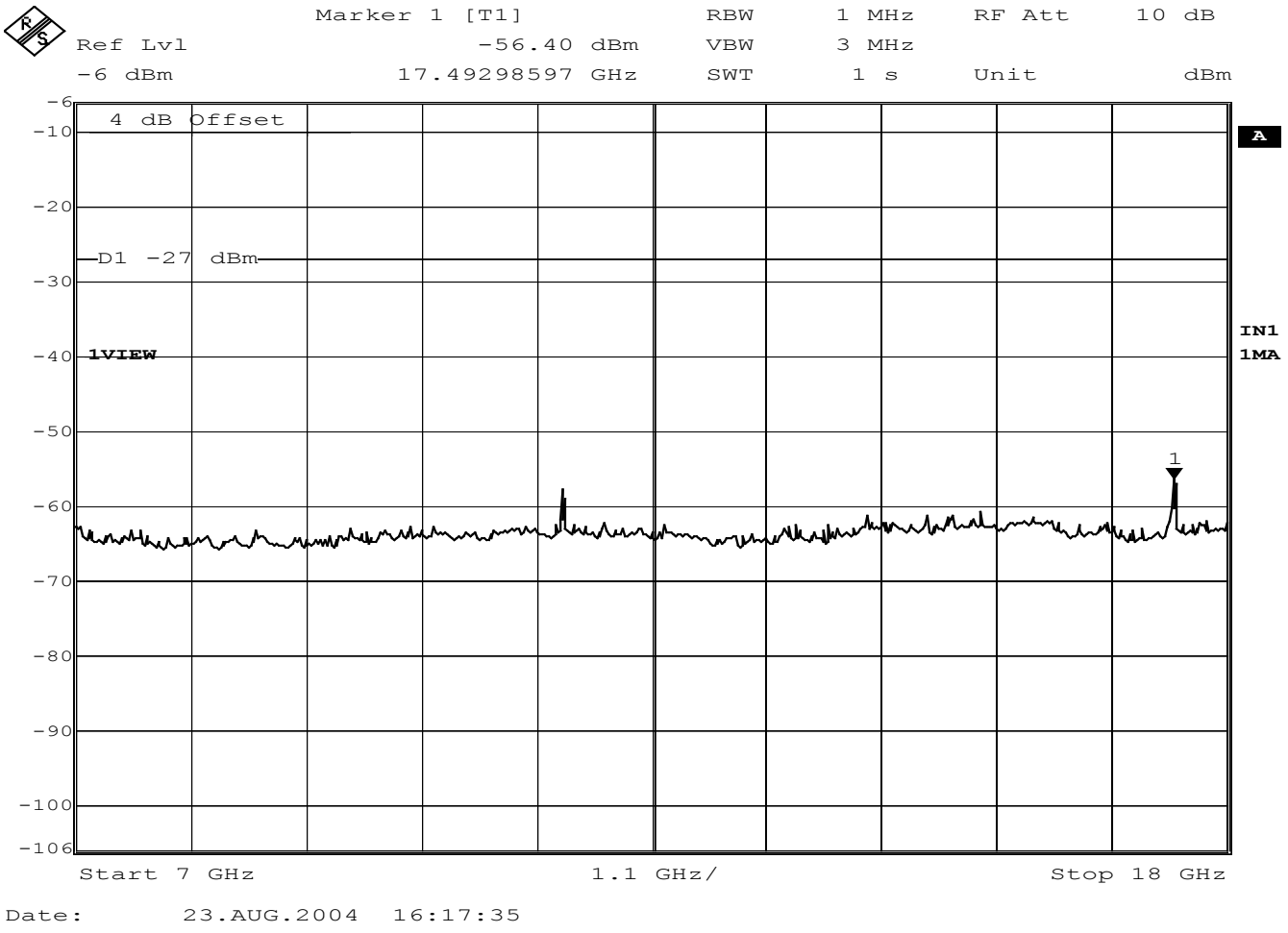


2.26 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.26.6 Test Results – continued

Spurious Conducted Emissions (7GHz – 18GHz)

EUT Tx on 5830MHz – Maximum Power 6Mbps

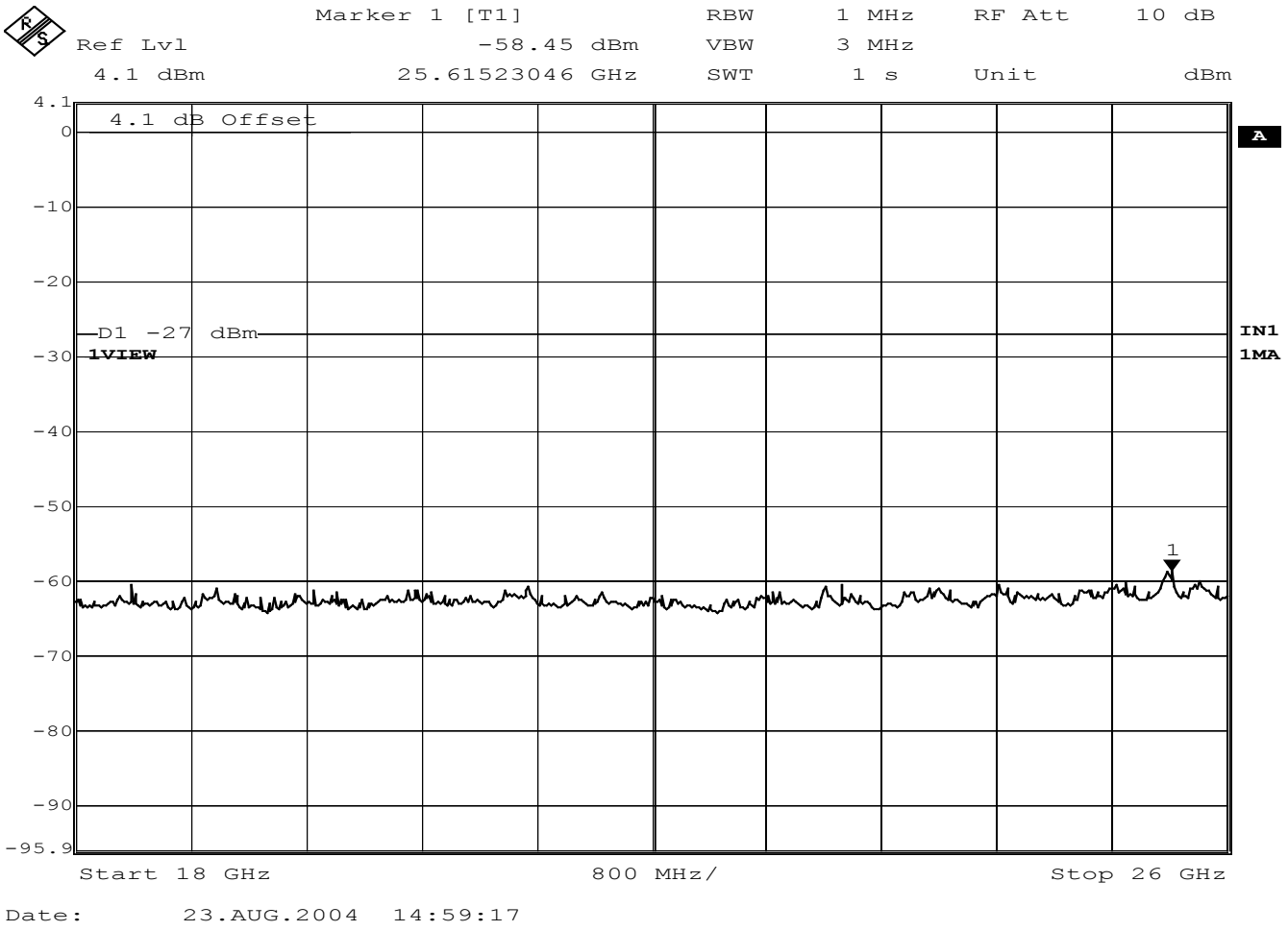


2.26 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.26.6 Test Results – continued

Spurious Conducted Emissions (18GHz – 26GHz)

EUT Tx on 5830MHz – Maximum Power 6Mbps

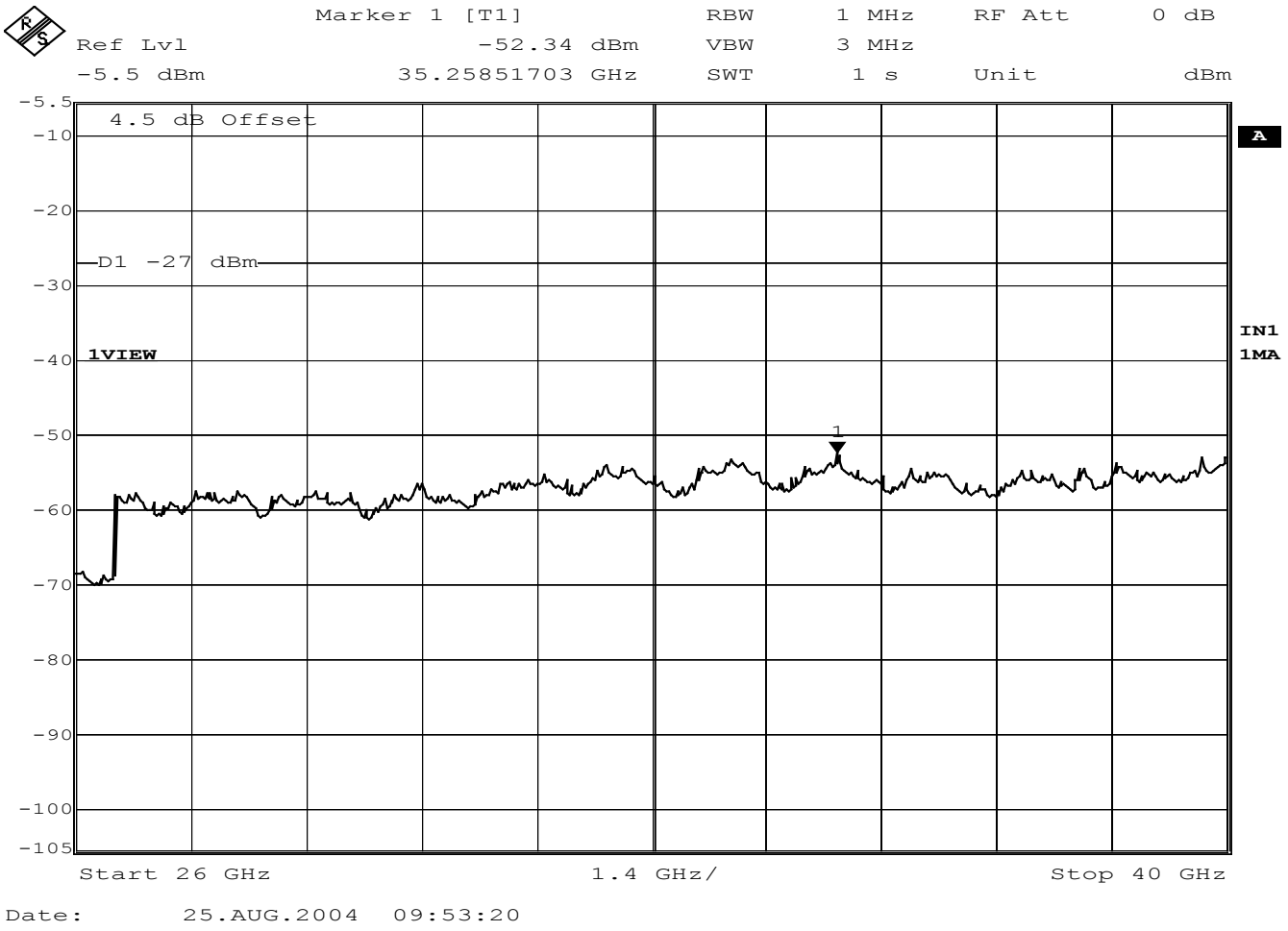


2.26 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.26.6 Test Results – continued

Spurious Conducted Emissions (26GHz – 40GHz)

EUT Tx on 5830MHz – Maximum Power 6Mbps

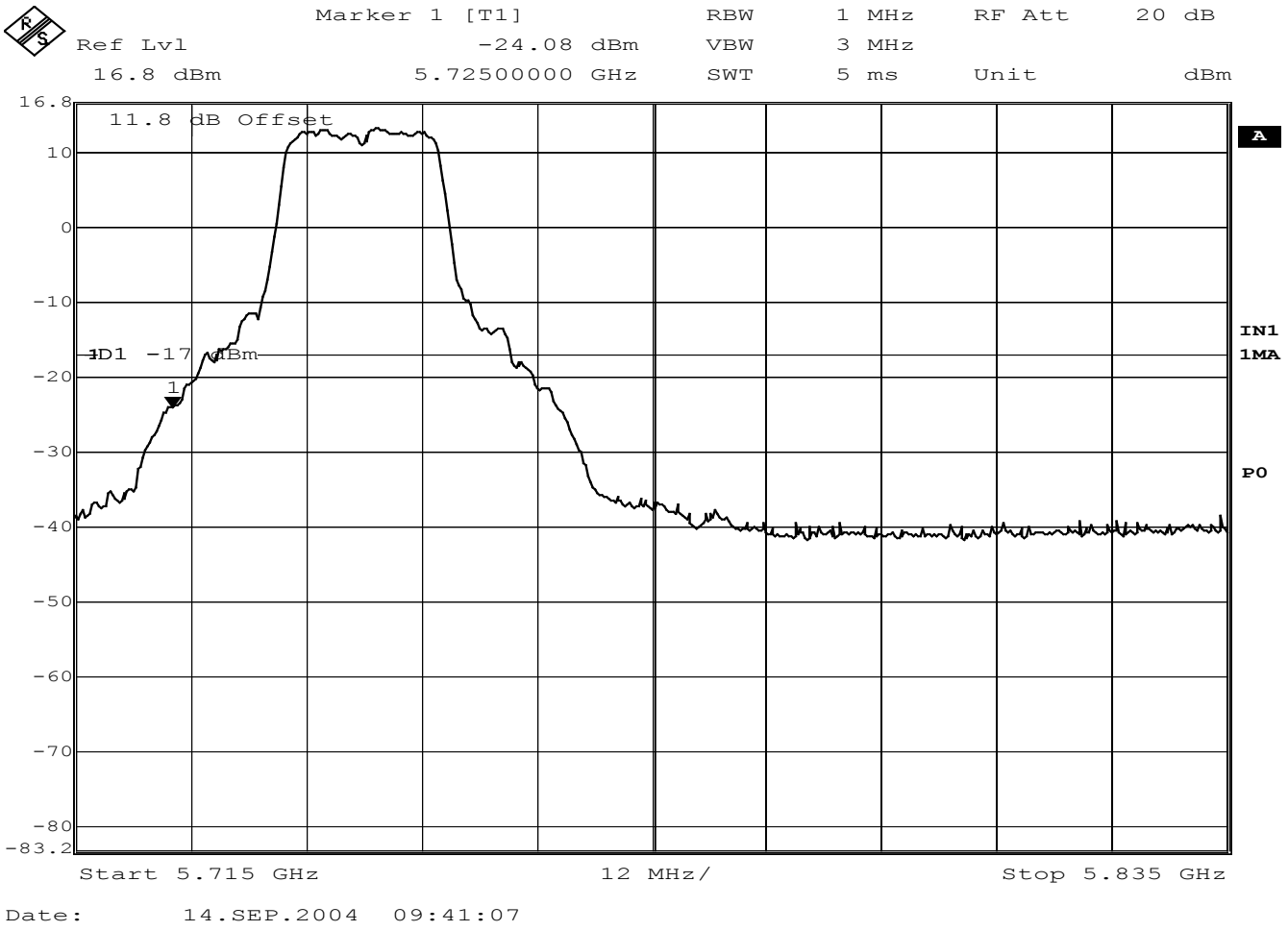


2.26 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.26.6 Test Results – continued

Spurious Conducted Emissions

EUT Tx on 5745MHz – Maximum Power 6Mbps

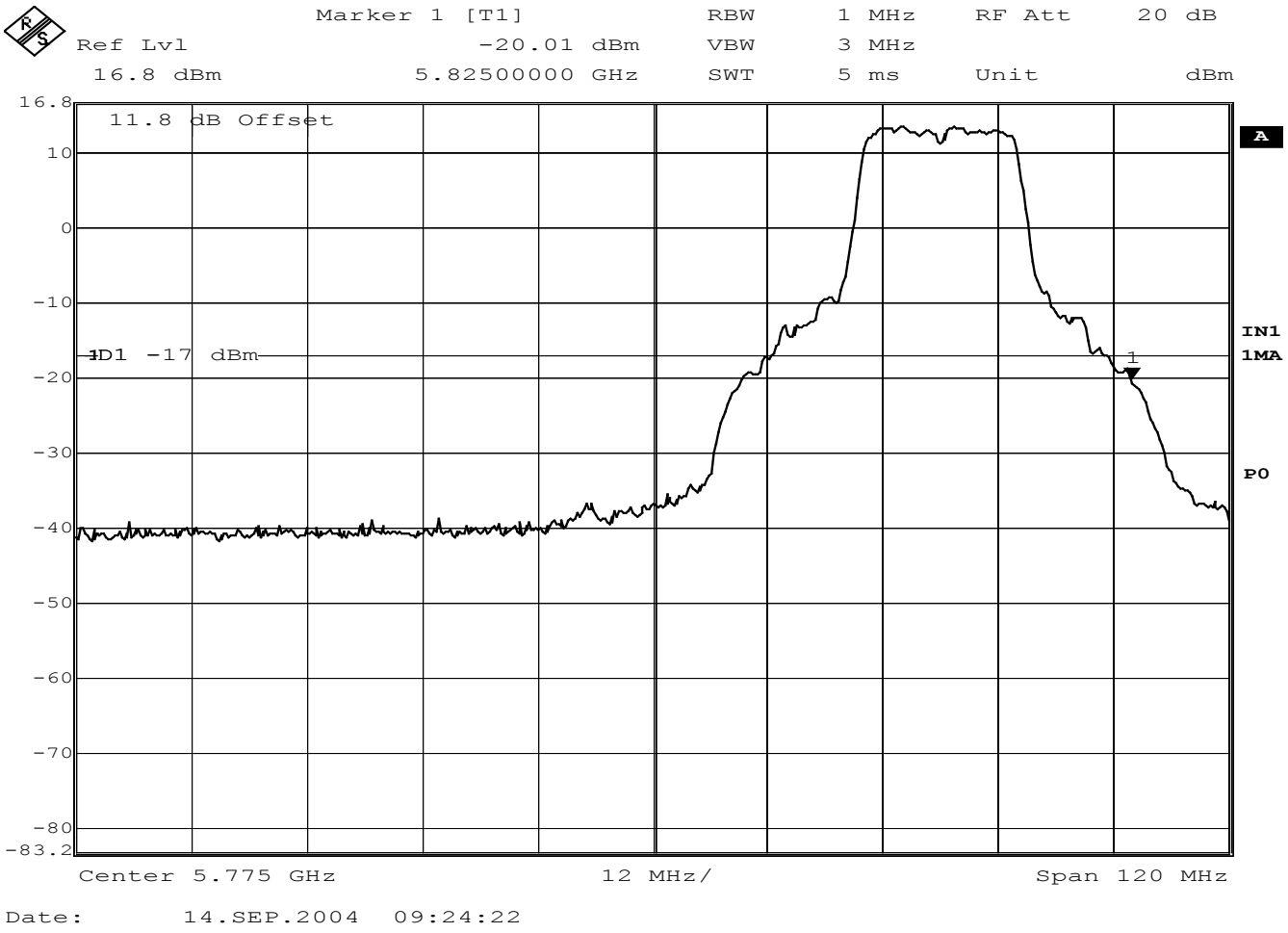


2.26 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT - continued

2.26.6 Test Results – continued

Spurious Conducted Emissions

EUT Tx on 5805MHz – Maximum Power 6Mbps



2.27 FREQUENCY STABILITY UNDER TEMPERATURE VARIATIONS

2.27.1 Specification Reference

FCC CFR 47: Part 15 Subpart E, Section 2.1055, 15.407(g)

2.27.2 Equipment Under Test

802.11a/b/g RLAN Module

2.27.3 Date of Test

11th August 2004

2.27.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.29” within the Test Equipment Used table shown in Section 3.1.

2.27.5 Test Procedure

The EUT was set to transmit on maximum power with no modulation. A Frequency Counter was used to measure the frequency. The maximum frequency error was recorded. The temperature was adjusted between –30ºC and +50ºC in 10º steps as per 2.1055.

Test Performed In Accordance With 2.1055, 15.407(g).

2.27 FREQUENCY STABILITY UNDER TEMPERATURE VARIATIONS – continued

2.27.6 Test Results

The EUT met the requirements of FCC CFR 47: 2.1055, Part 15 Subpart E, 15.407(g) for Frequency Stability Under Temperature Variations).

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

The results are recorded in the table below.

Frequency Band: 5725 – 5825MHz and 5830MHz

Temperature Interval (ºC)	Deviation (kHz)		
	5745 MHz	5805 MHz	5830 MHz
-30	-49.891	-49.651	-50.844
-20	-24.710	-24.665	-24.935
-10	-13.256	-13.624	-13.756
0	-10.583	-10.788	-10.825
+10	-14.805	-14.258	-14.652
+20	-28.954	-29.478	-29.486
+30	-29.970	-29.904	-30.212
+40	-33.425	-33.625	-33.959
+50	-31.908	-32.078	-32.121

Remarks

The frequency stability of the EUT is sufficient to keep it within the allocated frequency bands at any temperature interval across the measured range.

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

Instrument	Manufacturer	Type No	EMC / INV No	Cal. Due
Section 2.1, 2.2 & 2.3				
Turntable Controller	H-D	HD 050	2528	TU
Antenna Mast 6m	EMC	1051-2	2182	TU
Screened Room 5	SIE	EAC54300	2533	TU
EMI Receiver	HEW	8542E	2286	09/12/2004
Bilog Antenna	SCH	CBL6143	2965	19/09/2005
EMI Test Receiver	ROH	ESIB40	2917	11/02/2005
EMI Test Receiver	ROH	ESIB40	2989	08/04/2005
Low Noise Amplifier	MIQ	AMF-3d-001080-18-13P	2457	TU
Solid State Amplifier	AVA	AWT-18036	1081	26/06/2005
LNA 18-40GHz	NAR	NARDA DB02-0447	2936	28/04/2005
1-18GHz DRG Horn Ant	EMC	3115	2297	07/07/2005
1-18GHz DRG Horn Ant	EMC	3115	2397	07/07/2005
Signal Generator	ROH	SWM02	2477	10/11/2005
Signal Generator	MAR	2031	2199	29/09/2004
Signal Generator	HEW	8673B	2551	19/06/2005
Attenuator Fixed	NAR	4768-3	2961	TU
Digital Barometer	ORE	BAA913HG	Room 5	TU
Drg Horn Antenna	LML	AM180-HA-K-TU2	2945	24/06/2005
Section 2.4 & 2.17				
Turntable Controller	H-D	HD 050	2528	TU
Antenna Mast 6m	EMC	1051-2	2182	TU
Screened Room 5	SIE	EAC54300	2533	TU
EMI Test Receiver	ROH	ESIB40	2917	11/02/2005
Drg Horn Ant	EMC	3115	2297	07/07/2005
Attenuator 10dB	MAR	6534/3	1494	TU
Signal Generator	HEW	8672A	411	02/03/2005
Digital Barometer	ORE	BAA913HG	Room 5	TU
Attenuator Fixed	NAR	4768-3	2961	TU
Section 2.5, 2.16 & 2.25				
Screened Room 5	SIE	EAC54300	2533	TU
Test Receiver	ROH	ESH3	1020	16/09/2004
Spectrum Analyser	ROH	EZM	1416	TU
LISN	ROH	ESH2-Z5	1584	02/10/2004
Transient Limiter	HEW	11947A	2243	24/01/2005
Digital Barometer	ORE	BAA913HG	Room 5	TU
Section 2.6				
Power Supply	HEW	6253A	992	-
Meter	FLU	70	INV 3550	18/02/2005
Hygrometer	ROT	I-1000	INV 3232	07/04/2005
Attenuator	WEI	1	INV 2651	08/10/2004
Analyser	HEW	EE4407B	EMC 2783	22/03/2005
Section 2.7				
Power Supply	HEW	6253A	992	-
Meter	FLU	70	INV 3550	18/02/2005
Hygrometer	ROT	I-1000	INV 3232	07/04/2005
Attenuator	WEI	1	INV 2651	08/10/2004
Analyser	HEW	8990A	1670	14/08/2004
Sensor	HEW	8482A	777	21/06/2005
Meter	HEW	436A	757	10/06/2005
Signal Source	HEW	ESG4000A	INV 3710	03/02/2005
Section 2.8				
Power Supply	HEW	6253A	992	-
Meter	FLU	70	INV 3550	18/02/2005
Hygrometer	ROT	I-1000	INV 3232	07/04/2005
Attenuator	WEI	1	INV 2651	08/10/2004
Signal Source	HEW	ESG4000A	INV 3710	03/02/2005
Signal Generator	HEW	8673B	953	10/06/2005
Receiver	ROH	ESIB26	2958	05/09/2004
Attenuator	PAS	PE7004	1970	21/08/2004
Filter	RLC	F-100-3000-5-R	INV 4968	10/03/2005
HPF Waveguide		206935		TU

3.1 TEST EQUIPMENT USED – continued

Instrument	Manufacturer	Type No	EMC / INV No	Cal. Due
Section 2.9				
Turntable Controller	H-D	HD 050	2528	TU
Antenna Mast 6m	EMC	1051-2	2182	TU
Screened Room 5	SIE	EAC54300	2533	TU
EMI Test Receiver	ROH	ESIB40	2917	11/02/2005
EMI Receiver	HEW	8542E	2286	09/12/2004
Bilog Antenna	SCH	CBL6143	2965	19/09/2005
Low Noise Amplifier	MIQ	AMF-3d-001080-18-13P	2457	TU
Solid State Amplifier	AVA	AWT-18036	1081	26/06/2005
LNA 18-40GHz	NAR	NARDA DB02-0447	2936	28/04/2005
Drg Horn Ant	EMC	3115	2297	07/07/2005
Signal Generator	HEW	8672A	411	02/03/2005
Thermo Stirrer	GAL	WATER 85	1494	TU
Digital Barometer	ORE	BAA913HG	Room 5	TU
Dual PSU	THU	PL320	1582	TU
Attenuator Fixed	NAR	4768-3	2961	TU
Signal Generator	MAR	2031	2199	29/09/2004
Section 2.10, 2.11 & 2.20				
Power Supply	HEW	6253A	992	-
Meter	FLU	70	INV 3550	18/02/2005
Hygrometer	ROT	I-1000	INV 3232	07/04/2005
Attenuator	WEI	1	INV 2651	08/10/2004
Sensor	HEW	8482A	777	21/06/2005
Analyser	HEW	8990A	1670	14/08/2004
Meter	HEW	436A	757	10/06/2005
Signal Source	HEW	ESG4000A	INV 3710	03/02/2005
Signal Generator	HEW	8673B	953	10/06/2005
Receiver	ROH	ESIB26	2958	05/09/2004
Section 2.12 & 2.21				
Power Supply	HEW	6253A	992	-
Meter	FLU	70	INV 3550	18/02/2005
Hygrometer	ROT	I-1000	INV 3232	07/04/2005
Attenuator	WEI	1	INV 2651	08/10/2004
Analyser	HEW	8990A	1670	14/08/2004
Signal Generator	HEW	8673B	953	10/06/2005
Section 2.13 & 2.22				
Power Supply	HEW	6253A	992	-
Meter	FLU	70	INV 3550	18/02/2005
Hygrometer	ROT	I-1000	INV 3232	07/04/2005
Attenuator	WEI	1	INV 2651	08/10/2004
Analyser	HEW	EE4407B	2783	22/03/2005
Section 2.14 & 2.23				
Power Supply	HEW	6253A	992	-
Meter	FLU	70	INV 3550	18/02/2005
Hygrometer	ROT	I-1000	INV 3232	07/04/2005
Attenuator	WEI	1	INV 2651	08/10/2004
Receiver	ROH	ESIB26	2958	05/09/2004
Section 2.18 & 2.26				
Power Supply	HEW	6253A	992	-
Meter	FLU	70	INV 3550	18/02/2005
Hygrometer	ROT	I-1000	INV 3232	07/04/2005
Attenuator	WEI	1	INV 2651	08/10/2004
Signal Source	HEW	ESG4000A	INV 3710	03/02/2005
Attenuator	PAS	PE7004-10	1970	21/08/2004
Filter	RLC	F-100-3000-5-R	INV 4968	10/03/2005
HPF Waveguide		206935		TU
Test Equipment	ROH	ESIB40	2972	08/11/2004
Signal Source	ROH	SMR 40	2768	18/09/2004
HPF Waveguide		22093KF		TU
26-40GHZ Cable		FB142A0010M2020		TU

3.1 TEST EQUIPMENT USED - continued

Instrument	Manufacturer	Type No	EMC / INV No	Cal. Due
Section 2.19 & 2.27				
Power Supply	HEW	6253A	992	-
Meter	FLU	70	INV 3550	18/02/2005
Hygrometer	ROT	I-1000	INV 3232	07/04/2005
Attenuator	WEI	23-10-34	INV 4063	08/07/2005
Frequency Counter	HEW	5343A	665	12/08/2004
Chamber	HERS	VM 04/100	INV 1755	14/11/2004

Key To Manufacturers

AVA Avantek
EMC Emco
GAL Gallenkamp
H-D No Data
HEW Hewlett Packard
LML Link Microtek Ltd
MAR Marconi
MIQ Miteq Corp
NAR Narda
ORE Oregan Scientific
ROH Rohde & Schwarz
SIE Siemens
THU Thurlby

3.2 MEASUREMENT UNCERTAINTY

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

Test Discipline	Frequency / Parameter	MU
For 6dB Bandwidth	±210.894kHz	±0.5dB
For Maximum Output Power	Not Applicable	±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*
Substitution Antenna, Radiated Field	30MHz to 18GHz Amplitude	2.6dB
For Peak Power Spectral Density	Not Applicable	±1.8dB
For Effective Radiated Power (ERP) measurements	Not Applicable	±1.45dBm

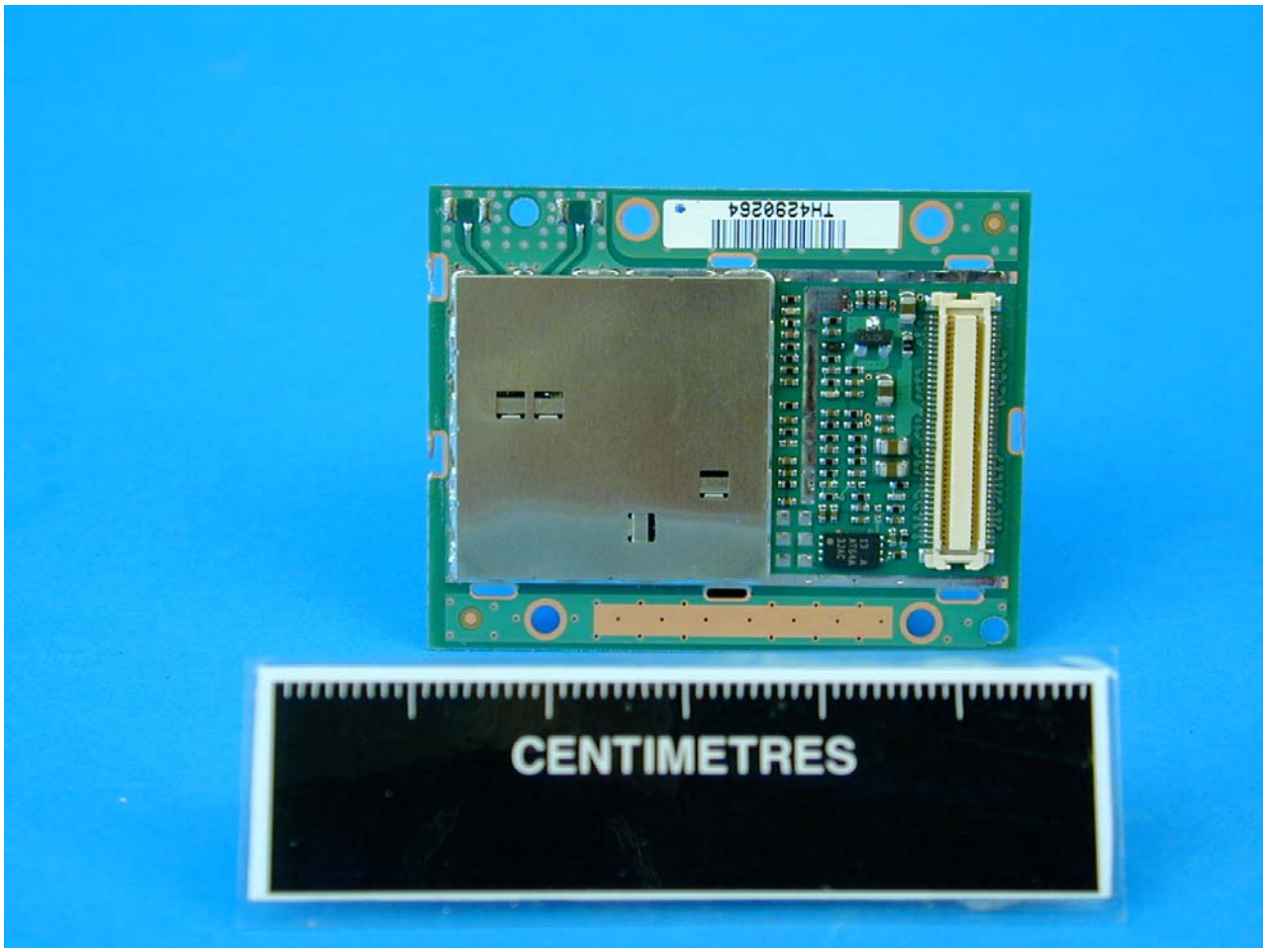
Worst case error for both Time and Frequency measurement 12 parts in 10^6.

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

SECTION 4

EUT PHOTOGRAPH

4.1 EUT PHOTOGRAPH



Front View

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

Group

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).

APPENDIX A

TITCHFIELD FCC SITE COMPLIANCE LETTER

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

October 18, 2002

Registration Number: 90987

TUV Product Service Ltd
Segensworth Road
Titchfield
Fareham, Hampshire, PO15 5RH
United Kingdom
Attention: Kevan Adsetts

Re: Measurement facility located at Titchfield
Anechoic chamber (3 meters) and 3 & 10 meter OATS
Date of Listing: October 18, 2002

Gentlemen:

Your request for registration of the subject measurement facility has been reviewed and found to be in compliance with the requirements of Section 2.948 of the FCC rules. The information has, therefore, been placed on file and the name of your organization added to the list of facilities whose measurement data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Please note that the file must be updated for any changes made to the facility and the registration must be renewed at least every three years.

Measurement facilities that have indicated that they are available to the public to perform measurement services on a fee basis may be found on the FCC website www.fcc.gov under E-Filing, OET Equipment Authorization Electronic Filing, Test Firms.

Sincerely,

Thomas W Phillips
Electronics Engineer