
TEST REPORT

FCC Part 15C Testing in support of an Application for Grant of Equipment Authorisation of
a Symbol WSM-5030 RLAN Radio Module
FCC ID: H9PWSM5030

Report Number: OR610776/02/Issue 2

October 2003

REPORT ON

FCC Part 15C Testing in support of an Application for Grant of
Equipment Authorisation of a Symbol WSM-5030 RLAN Radio
Module

FCC ID: H9PWSM5030

Report No OR610776/02/Issue 2

October 2003

EQUIPMENT:

WSM-5030 RLAN Radio Module

FCC ID:

H9PWSM5030

SPECIFICATION:

47 CFR 15.247

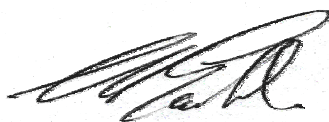
PREPARED FOR:

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DATED:

10-10-03

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STATUS

OBJECTIVE	To undertake measurements to determine the Equipment Under Test's (EUT's) compliance with the specification.
MANUFACTURING DESCRIPTION	RLAN Module for use with host unit WSAP-5030
APPLICANT	Symbol Technologies Symbol Place Winnersh Triangle Berkshire RG41 5TP
MANUFACTURERS TYPE NUMBER	WSM-5030
MANUFACTURERS PART NUMBER	WSM-5030-100-WW
SERIAL NUMBER	No 2 and No 5
HARDWARE REVISION	DVT3.1
TEST SPECIFICATION NUMBER	FCC Part 15 Subpart C
REGISTRATION NUMBER	OR610776
QUANTITY OF ITEMS TESTED	One
SECURITY CLASSIFICATION OF EUT	Unclassified
INCOMING RELEASE SERIAL NUMBER DATE	Declaration of Build Status OR610776 29 th June 2003
DISPOSAL REFERENCE NUMBER DATE	Held pending disposal N/A N/A
START OF TEST FINISH OF TEST	7 th July 2003 8 th August 2003
TEST ENGINEERS	B Airs A Guy P Harrison R Small B Bennett M Terry
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)



TEST RATIONALE

This report has been re-issued as Issue 2 to cover some minor typographical errors and also include some test clause references that were omitted from the original report. This report is intended to replace the original report OR610776/2 Issued in September 2003.

The information contained within this report is intended to show verification of compliance of the Symbol Technologies Inc WSM-5030 RLAN Radio Module to the requirements of FCC Specification Part 15.

FCC ID H9PWSM5030

The unit supplied for testing was a WSM-5030 RLAN Radio Module, which offers 2.4GHz 802.11b Wireless LAN connectivity.

This Module is intended for use in a WSAP-5030 Access Port, which is being submitted under a separate report and FCC ID H9PWSAP5030.

For all measurements made radiated Unit No 5 was configured in a WSAP-5030 Access Port using rubber duck antennas and a 120V, 60Hz Power Supply Unit Symbol Part No SNP-PA5T.

For all measurements made conducted through the antenna port Unit No 2 was configured in a WSAP-5030 Access Port using a DC Power Supply Unit.

This report details testing carried out in accordance with:

- FCC: Part 15.205, 15.209, Measurement at Band Edge (Marker Delta Method)
- FCC: Part 15.247(a)(2), 6dB Bandwidth
- FCC: Part 15.247(b)(1), Maximum Peak Output Power
- FCC: Part 15.247(c), Spurious Conducted Emissions
- FCC: Part 15.207, Spurious Conducted Emissions Power Line
- FCC: Part 15.247(c), Spurious Radiated Emissions
- FCC: Part 15.247(d), Peak Power Spectral Density

Location Of Testing

BABT Engineers, Brian Airs, R Small, Phil Harrison and Tony Guy, conducted all testing (except Spurious Radiated Emissions from 30MHz to 1GHz, which were performed at our Bearley Site) at the premises BABT, Segensworth Road, Fareham, Hampshire, PO15 5RH. Spurious Radiated Emissions measurements were performed in a 3 metre Anechoic Chamber. A complete site description is on file with the FCC Laboratory Division, Registration Number: 90987. See Annex A.

BABT Engineers, Bob Bennett and Malcolm Terry, conducted all Spurious Radiated Emissions (from 30MHz to 1GHz) testing at the premises BABT, Snitterfield Road, Bearley, Stratford upon Avon, Warwickshire, CV37 0EX. A complete site description is on file with the FCC Laboratory Division, Registration Number: 90986. See Annex A.

SYSTEM CONFIGURATION DURING EMC TESTING

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

The test software in the EUT enabled the Test Engineer to select full power and continuous transmit on the following channels;

2.4GHz RLAN functionality

Channel 1: 2412MHz
Channel 6: 2437MHz
Channel 11: 2462MHz

The output power values were set as below: -

Channel 1: 2412MHz = +19dBm
Channel 6: 2437MHz = +16dBm
Channel 11: 2462MHz = +14dBm

TEST SETUP PHOTOGRAPH

The photograph below shows the EUT configuration during Radiated Emission testing.



Photograph 1



EQUIPMENT INFORMATION

Equipment under Test (EUT):

Manufacturing Description	WSM-5030 RLAN Module for use with host unit WSAP-5030	Power Supply Unit	Dipole Antenna (Rubber Duck)
Manufacturer:	Symbol Technologies Inc	Skynet	Cushcraft
Model No:	WSM-5030	SNP-PA5T	ML 2499-APA1
Serial No:	No 2 and No 5	S/N03 1119327	Not Applicable
Drawing Revision:	DVT3.1	Not Applicable	Not Applicable



EQUIPMENT INFORMATION-continued

INSTRUMENTATION USED FOR TESTING THE EUT

Instrument/Ancillary	Type	Manufacturer	EMC No	Cal Due
Signal Generator	SMP22	Rohde & Schwarz	2474	16 May 04
Crystal Detector	8407B	Hewlett Packard	INV 4209	T/U
Digital Storage Oscilloscope	LC554L	LeCroy	INV4005	18 Dec 03
Attenuator	HFP-50N	Texscan	1604	10 July 04
Spectrum Analyser	FSE M	Rohde & Schwarz	INV4034	16 Dec 03
Signal Generator	ESG4000A	Hewlett Packard	INV 3709	21 Jan 04
Signal Generator	8673B	Hewlett Packard	2551	14 Jun 04
Waveguide	N/A	Flann Microwave	N/A	T/U
EMI Receiver	8542E	Hewlett Packard	2286	12 Nov 03
Screened Enclosure	EAC 54300	Siemens	2533	TU
Turntable & Controller	HD 050	HD GmbH	2528	TU
Antenna Mast	1051	Emco	2182	TU
Antenna Mast Controller	1050	Emco	2090	TU
Test Receiver	8542E	Hewlett Packard	2286	13 Dec 03
Bilog Antenna	CBL 6143	Chase	2860	11 Apr 04
Test Receiver	ESIB 40	Rhode and Schwarz	2917	04 Feb 04
Horn (1 - 18GHz)	AMF-3D-001080-18-13P	Miteq	2457	29 Jun 04
Horn (18GHz - 40GHz)	AM180HA-K-TU2	Advanced Microtek	2945	20 May 04
Signal Generator	8672A	Hewlett Packard	411	26 Feb 04
Low Noise Amplifier (8 - 18GHz)	AWT 18036	Avantek	1081	TU
Low Noise Amplifier (18 - 26GHz)	AMT-26177-33	Avantek	2072	TU
Low Noise Amplifier (18 – 40GHz)	DB02-0447	Narda	2936	23 Apr 04
3GHz High Pass Filter	F-100-3000-5-R	RLC Electronics	INV 04467	TU
4GHz High Pass Filter	F-100-4000-5-R	RLC Electronics	INV 04468	TU
Barometer	-	Diplex	1938	TU
Hygrometer	A1	Rotronic	INV4066	TU
Horn Antenna	3115	EMCO	2397	4 July 04
Signal Generator	8673B	Hewlett Packard	953	8 June 04
YIG Filter (4-40GHz)	FD3103	Filtronic	-	TU
Computer	PCD-4H	Siemens Nixdorf	FN1	TU
Test Receiver	ESH3	Rohde & Schwarz	2840	21 Nov 03
Test Receiver	ESH3	Rohde & Schwarz	1805	17 July 04
Test Receiver	ESVP	Rohde & Schwarz	1806	21 June 04
Test Receiver	ESVP	Rohde & Schwarz	1807	24 July 04
Spectrum Monitor	EZM	Rohde & Schwarz	1811	TU
Bicon Antenna	3104	EMCO	1846	TU
Log Periodic Antenna	3146	EMCO	1850	TU
Bilog Antenna	CBL6111B	Chase Limited	2451	8 Oct 04
LISN	ESH 3-Z5	Rohde & Schwarz	1814	12 Feb 04



EQUIPMENT INFORMATION-continued

INSTRUMENTATION USED FOR TESTING THE EUT

Instrument/Ancillary	Type	Manufacturer	EMC No	Cal Due
Turn Table & Controller	RH253	British Turntables	1858	TU
Automatic Antenna Mast & Controller	1050	EMCO	1844/5	TU
Antenna Mast	AMU74A	Electrometrics	1853	TU
Plotter	7550A	Hewlett Packard	-	TU
Printer	Colour 850	Epson	BIRPR2	TU
Anechoic Screened Enclosure	6277	Ray Proof	1804	TU
Open Area Test Site	OATS2	Assessment Services	2280	28 Nov 05
Thermohydrograph	A1	Rotronic	INV3162	15 Nov 03
HPA Monitor	-	Diplex	1932	TU

Note(s)

- 1) All items are calibrated annually, except where labelled TU (Traceability Unscheduled). These items are calibrated within the test configurations using calibrated equipment.

INSTRUMENTATION USED FOR EXERCISING THE EUT

Instrument	Manufacturer	Type No	INV No
Laptop Computer	Dell	Latitude CPI	N/A
Laptop Computer	Dell	Latitude C400	N/A



Test Case : Band Edge Measurements
Test Date : 18th July 2003
Rule Parts : 15.205

Testing to the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.205, for Restricted Bands of Operation was carried out on the Measurement Test Facility detailed in Annex A.
The following Test Results were obtained using the FCC Public Notice document (DA 00-705 released 30 March 2000) for making measurements at the Band Edge, incorporating the 'Marker Delta Method'.

EUT was operating at maximum power at 11Mbps.

Step 1

Bottom Channel Fundamental Field Strength Measurement.

Performed in accordance with ANSI C63.4

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.

Freq	Ant Pol	Hgt	Azi	Peak Field Strength	Average Field Strength
GHz	H/V	cm	deg	dBμV/m	dBμV/m
2.412	V	102	274	83.8	75.8

Step 2

Determine Marker delta amplitude between 2.412GHz fundamental and 2.390GHz the Band Edge under investigation.

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

The Marker Delta = 36.6dB

Step 3

By subtracting the Marker Delta obtained from Step 2 from the 2.412GHz Field Strength measurement from Step 1, gives following Result

Peak of 83.8dBμV/m – 36.6dB (Delta) = 47.2dBμV/m (Limit is 74.0dBμV/m = Pass)

Average of 75.8dBμV/m – 36.6dB (Delta) = 39.2dBμV/m (Limit is 54.0dBμV/m = Pass)



Test Case : Band Edge Measurements- Continued
Test Date : 18th July 2003
Rule Parts : 15.205

Step 1

Top Channel Fundamental Field Strength Measurement.

Performed in accordance with ANSI C63.4

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.

Freq	Ant Pol	Hgt	Azi	Peak FS	Average FS
GHz	H/V	cm	deg	dBµV/m	dBµV/m
2.462	V	137	335	84.5	76.2

Step 2

Determine Marker delta amplitude between 2.462GHz fundamental and 2.4835GHz the Band Edge under investigation.

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

The Marker Delta = 34.2dB

Step 3

By subtracting the Marker Delta obtained from Step 2 from the 2.412GHz Field Strength measurement from Step 1, gives following Result

Peak of 84.5dBµV/m – 34.2dB (Delta) = 50.3dBµV/m (Limit is 74.0dBµV/m = Pass)

Average of 76.2dBµV/m – 34.2dB (Delta) = 42.0dBµV/m (Limit is 54.0dBµV/m = Pass)

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

Performed by: P Harrison & A Guy, EMC Engineer's.



Test Case : 6dB Bandwidth
Test Date : 5th August 2003
Rule Parts : 15.247(a)(2)

Measurement Method

The EUT was transmitted at maximum power at all data rates via a 10dB 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.

Results

Frequency (MHz)	Data Rate (Mbps)	6dB Bandwidth (MHz)
2412	1	11.10
2437	1	11.06
2462	1	10.19

Frequency (MHz)	Data Rate (Mbps)	6dB Bandwidth (MHz)
2412	2	9.82
2437	2	10.05
2462	2	10.10

Frequency (MHz)	Data Rate (Mbps)	6dB Bandwidth (MHz)
2412	5.5	10.88
2437	5.5	10.69
2462	5.5	11.33

Frequency (MHz)	Data Rate (Mbps)	6dB Bandwidth (MHz)
2412	11	11.24
2437	11	10.42
2462	11	10.72

Limit	≥500kHz
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Remarks

EUT complies with CFR 47 15.247(a)(2). The EUT exceeds the 500kHz requirement at the measured frequencies and data rates.

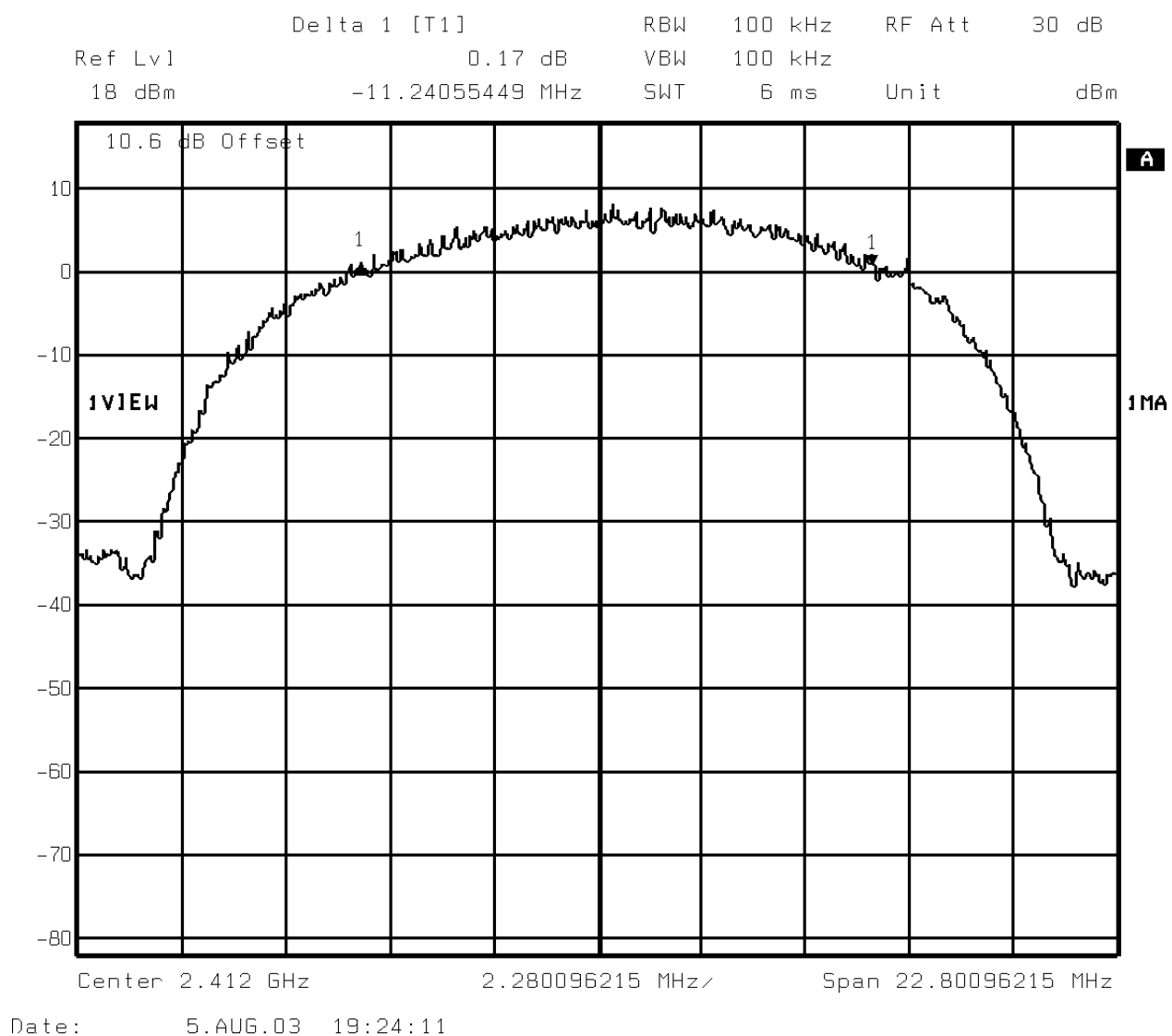
Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: R Small, Radio Engineer.



Test Case 6dB Bandwidth
Test Date 5th August 2003
Rule Parts 15.247(a)(2)

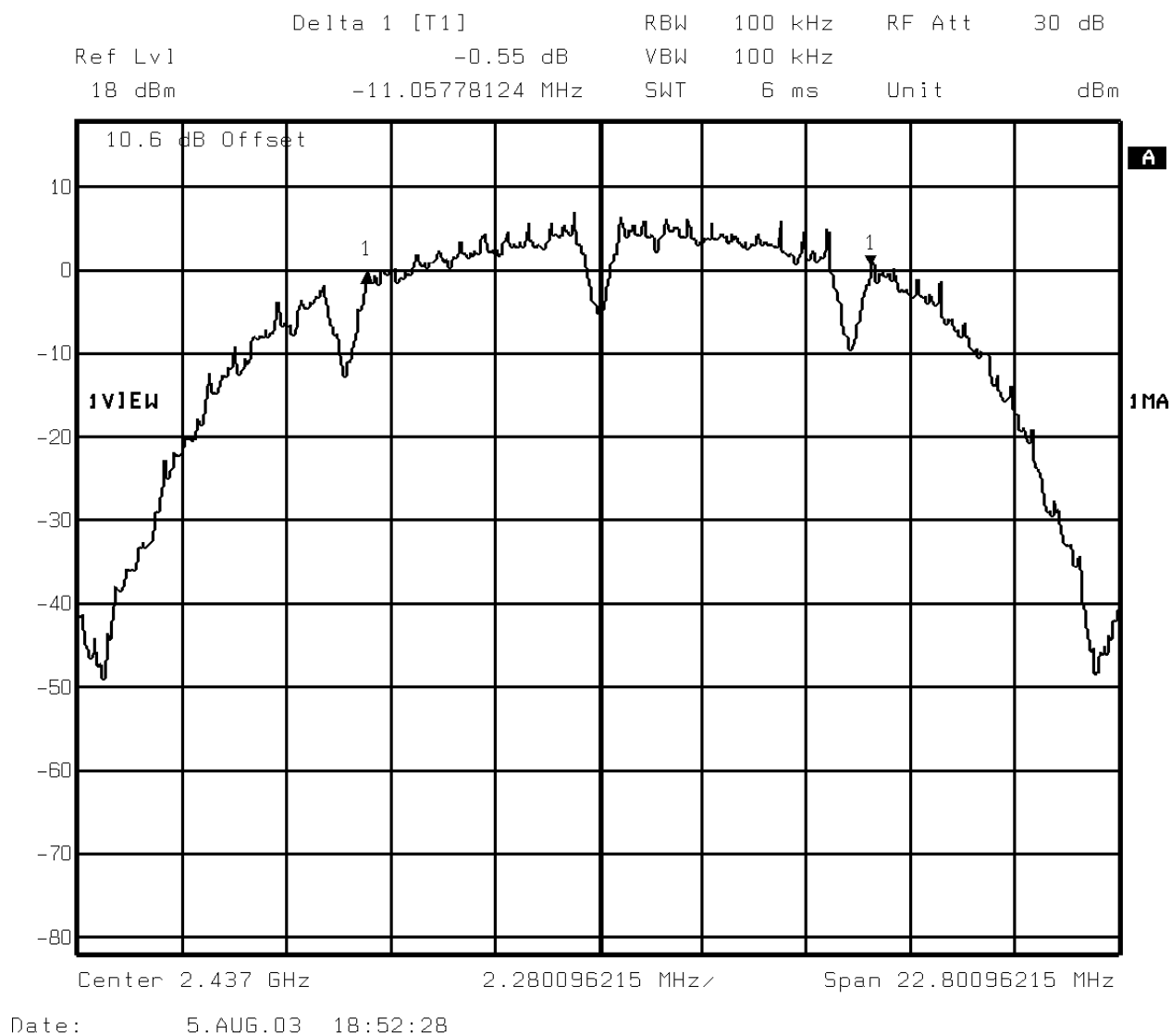
Channel 1, (2412.0MHz) – Maximum Power 1Mbps





Test Case : 6dB Bandwidth
Test Date : 5th August 2003
Rule Parts : 15.247(a)(2)

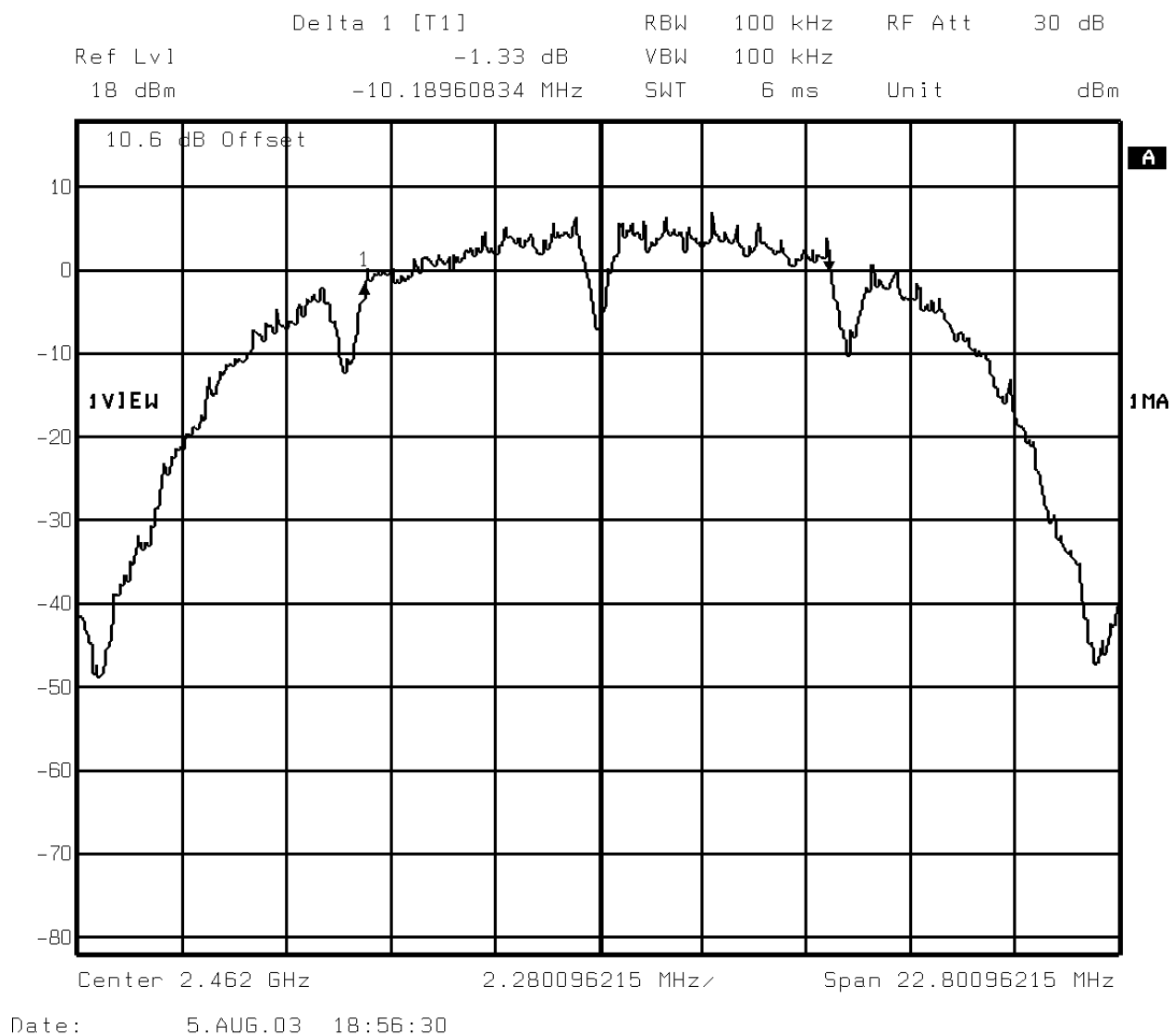
Channel 6, (2437.0MHz) – Maximum Power 1Mbps





Test Case : 6dB Bandwidth
Test Date : 5th August 2003
Rule Parts : 15.247(a)(2)

Channel 11, (2462.0MHz) – Maximum Power 1Mbps

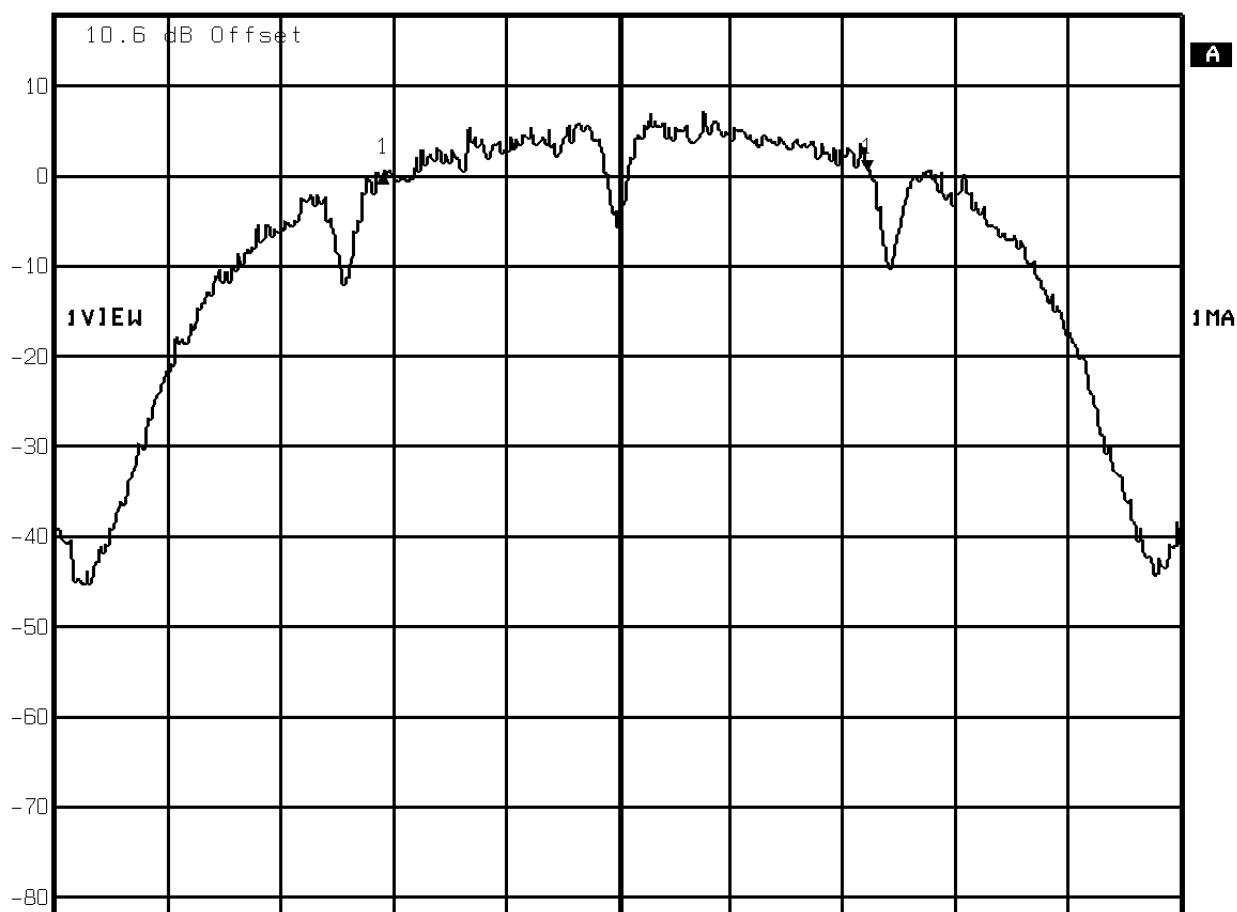




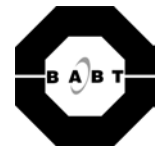
Test Case : 6dB Bandwidth
Test Date : 5th August 2003
Rule Parts : 15.247(a)(2)

Channel 1, (2412.0MHz) – Maximum Power 2Mbps

Delta 1 [T1]	RBW	100 kHz	RF Att	30 dB
Ref Lvl	-0.01 dB	VBW	100 kHz	
18 dBm	-9.82406185 MHz	SWT	6 ms	Unit dBm

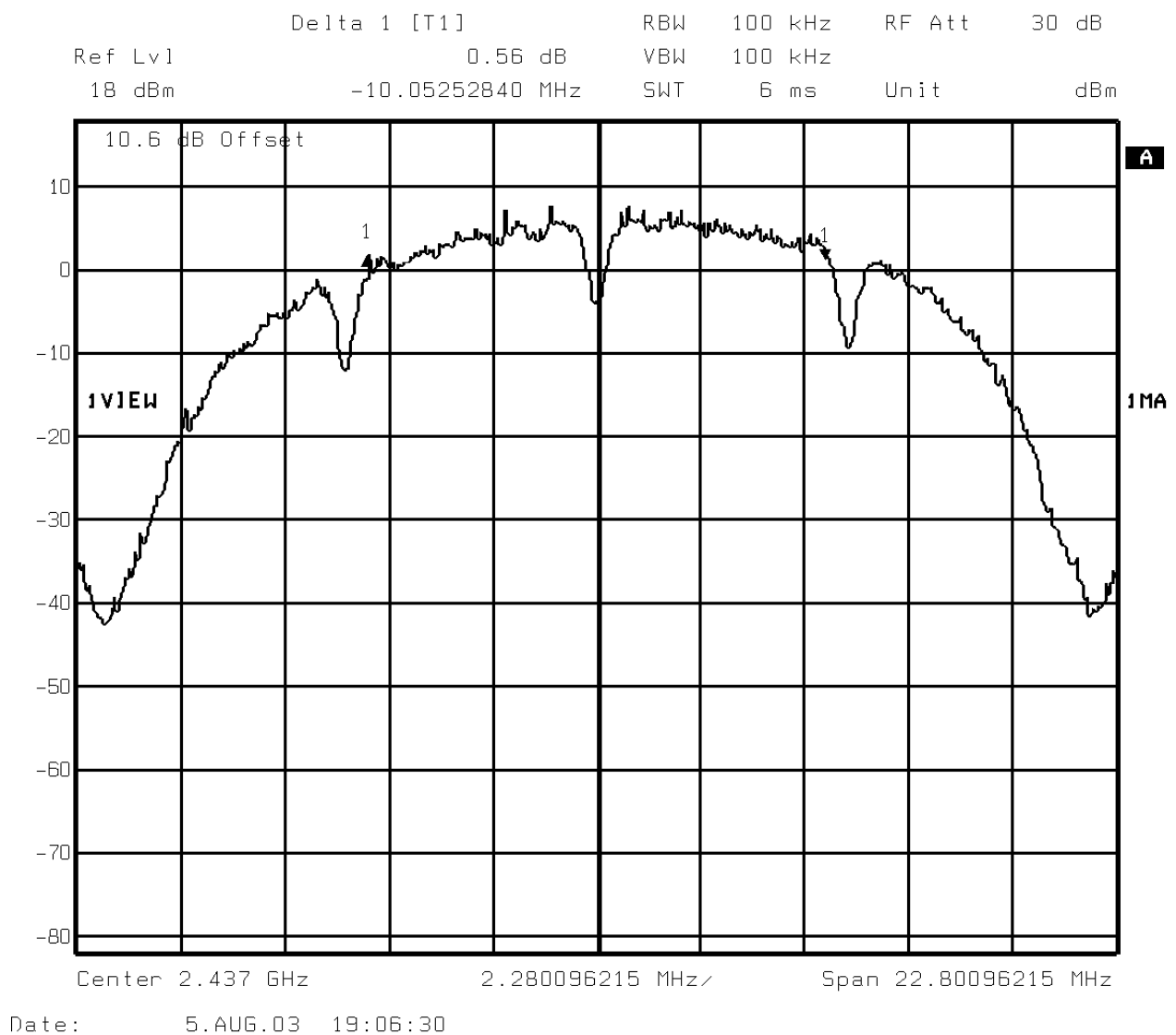


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Test Case : 6dB Bandwidth
Test Date : 5th August 2003
Rule Parts : 15.247(a)(2)

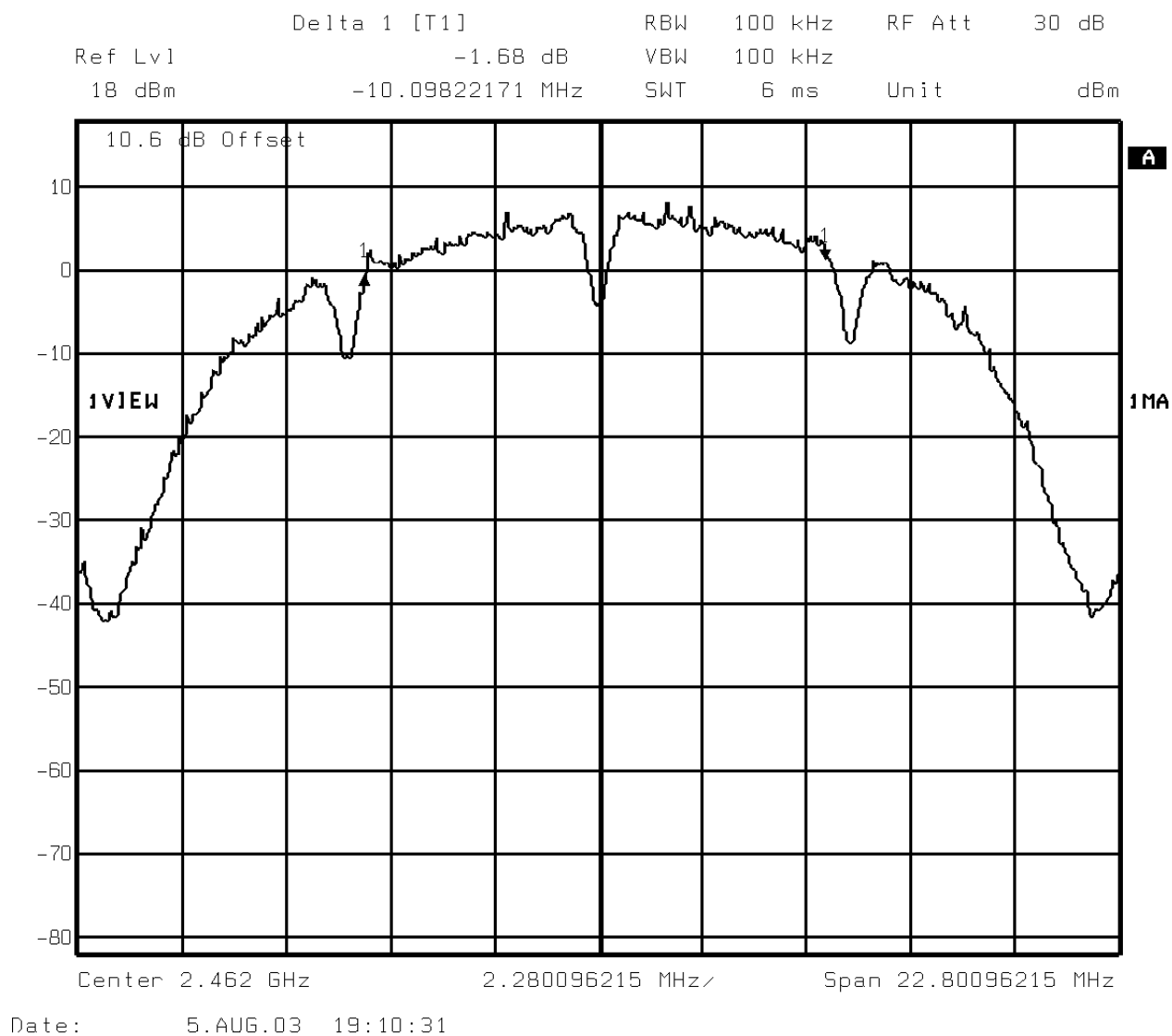
Channel 6, (2437.0MHz) – Maximum Power 2Mbps





Test Case : 6dB Bandwidth
Test Date : 5th August 2003
Rule Parts : 15.247(a)(2)

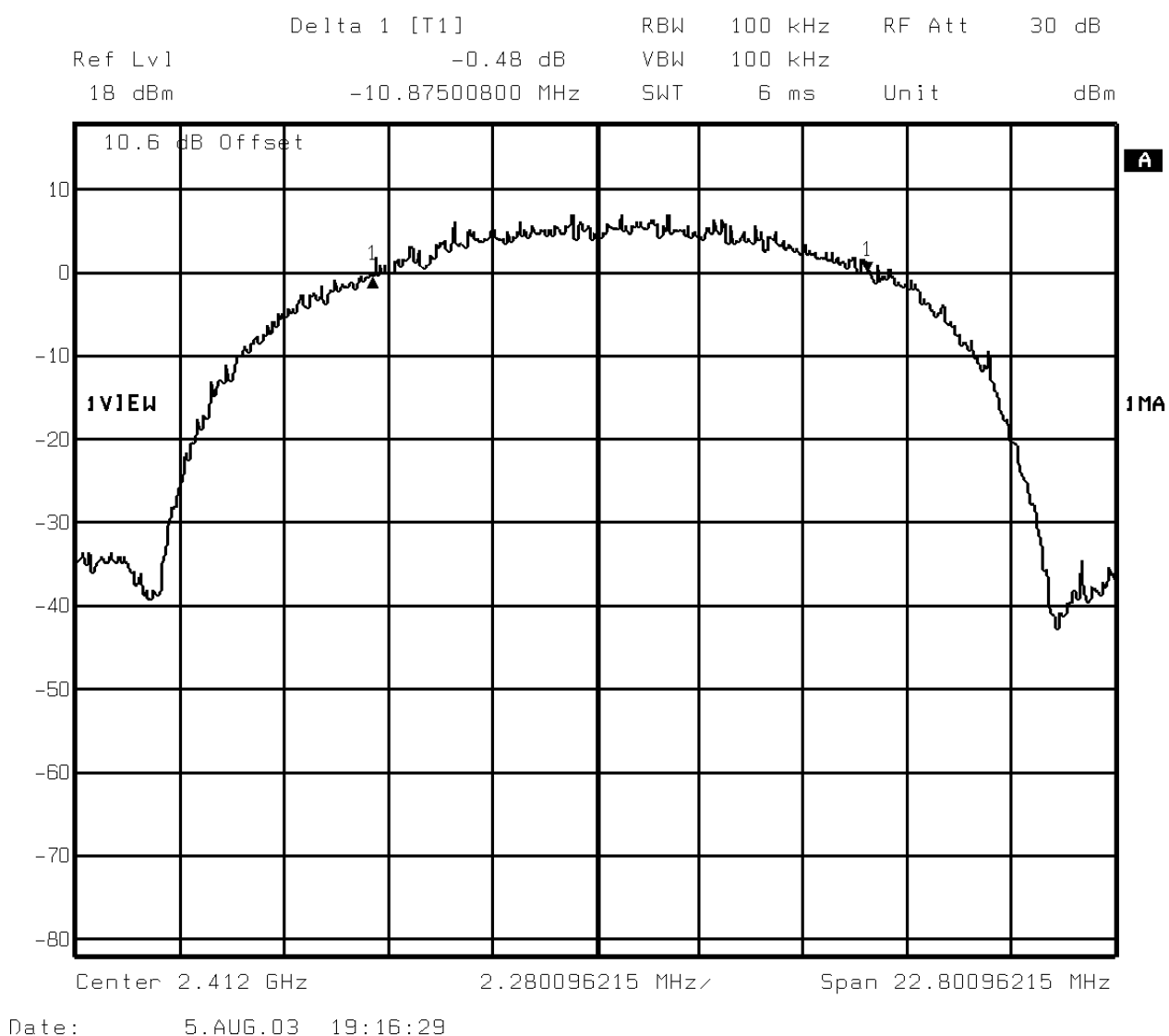
Channel 11, (2462.0MHz) – Maximum Power 2Mbps





Test Case : 6dB Bandwidth
Test Date : 5th August 2003
Rule Parts : 15.247(a)(2)

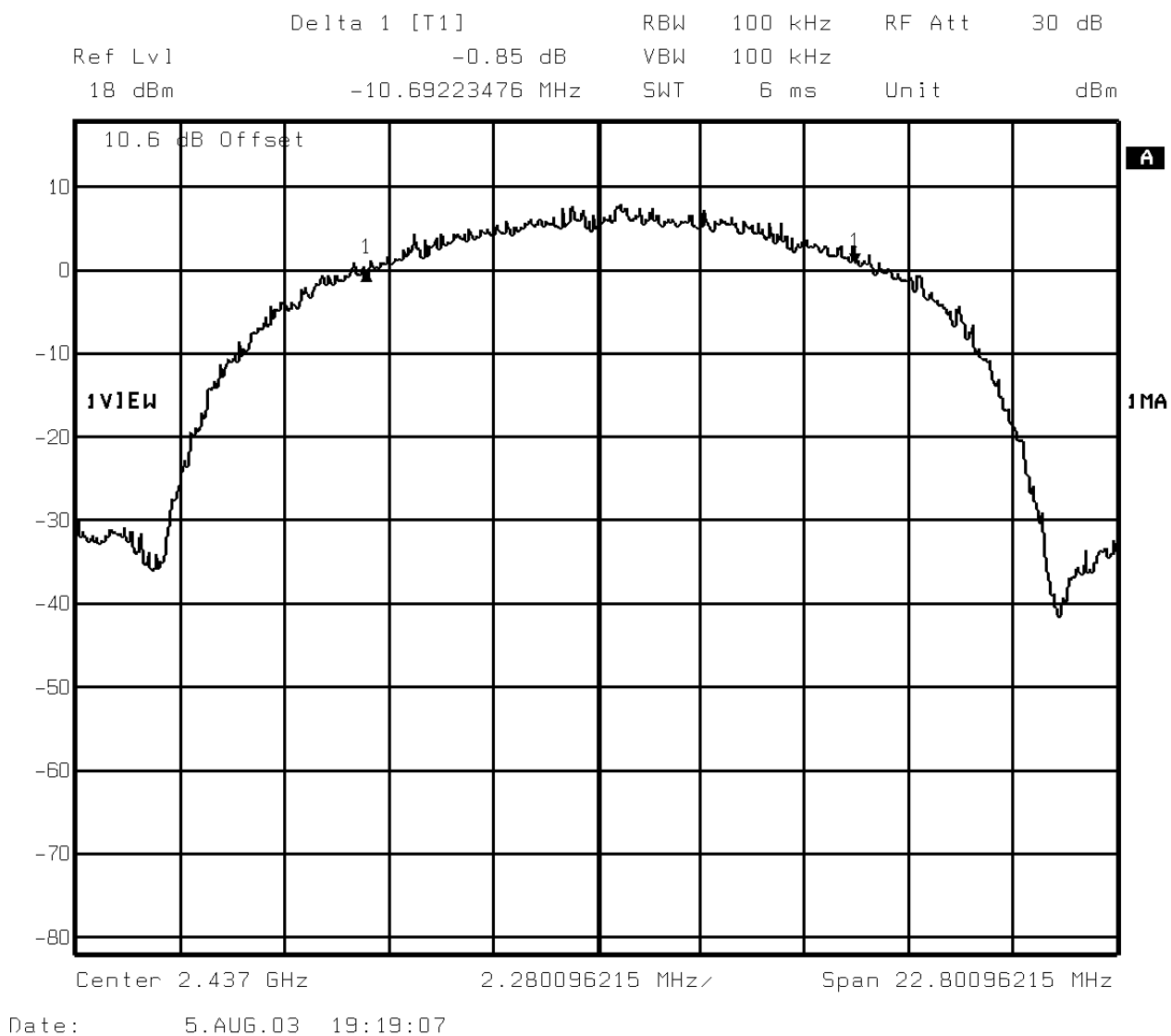
Channel 1, (2412.0MHz) – Maximum Power 5.5Mbps

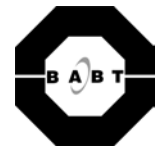




Test Case : 6dB Bandwidth
Test Date : 5th August 2003
Rule Parts : 15.247(a)(2)

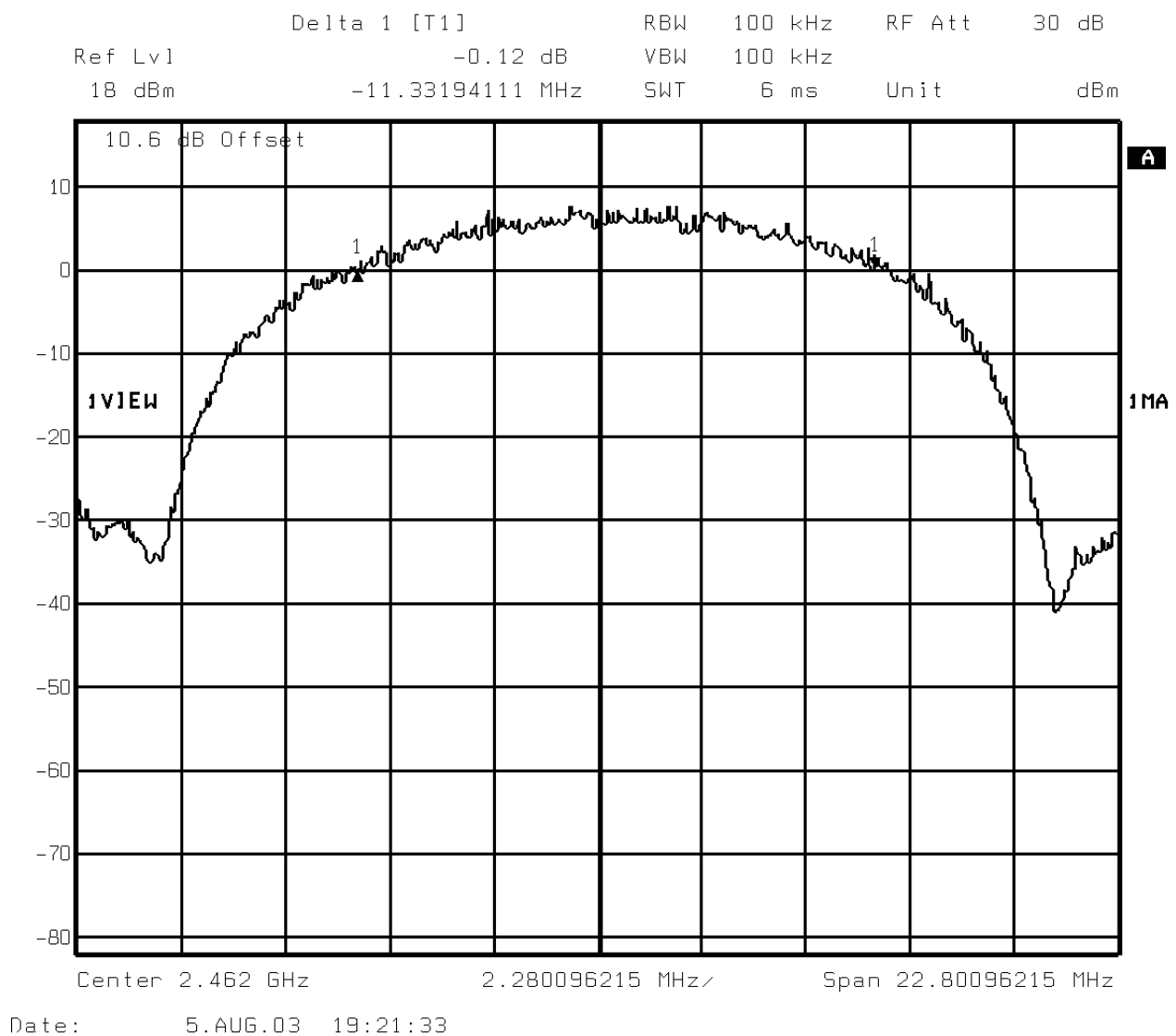
Channel 6, (2437.0MHz) – Maximum Power 5.5Mbps

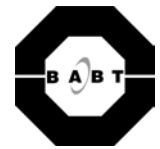




Test Case : 6dB Bandwidth
Test Date : 5th August 2003
Rule Parts : 15.247(a)(2)

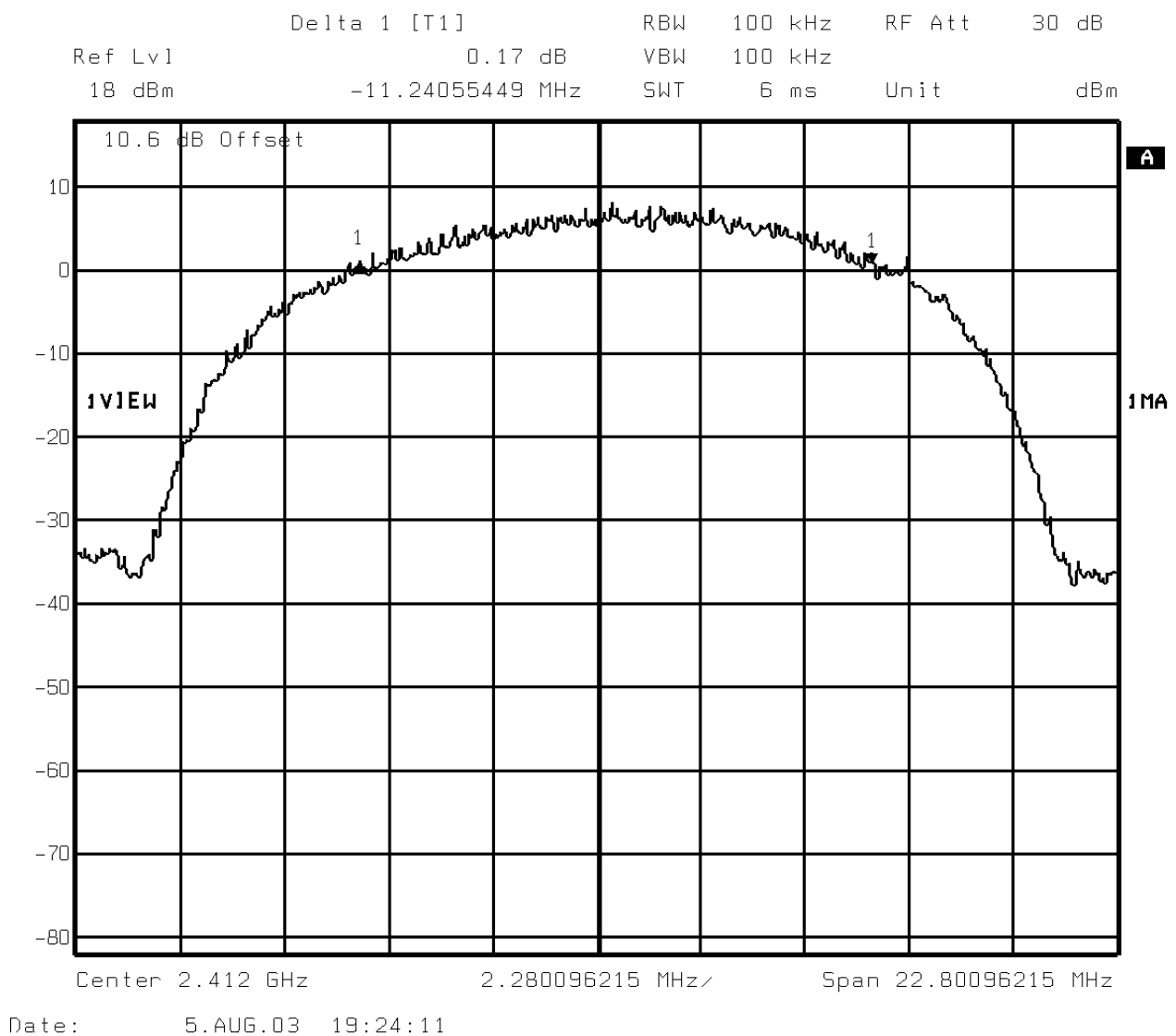
Channel 11, (2462.0MHz) – Maximum Power 5.5Mbps





Test Case : 6dB Bandwidth
Test Date : 5th August 2003
Rule Parts : 15.247(a)(2)

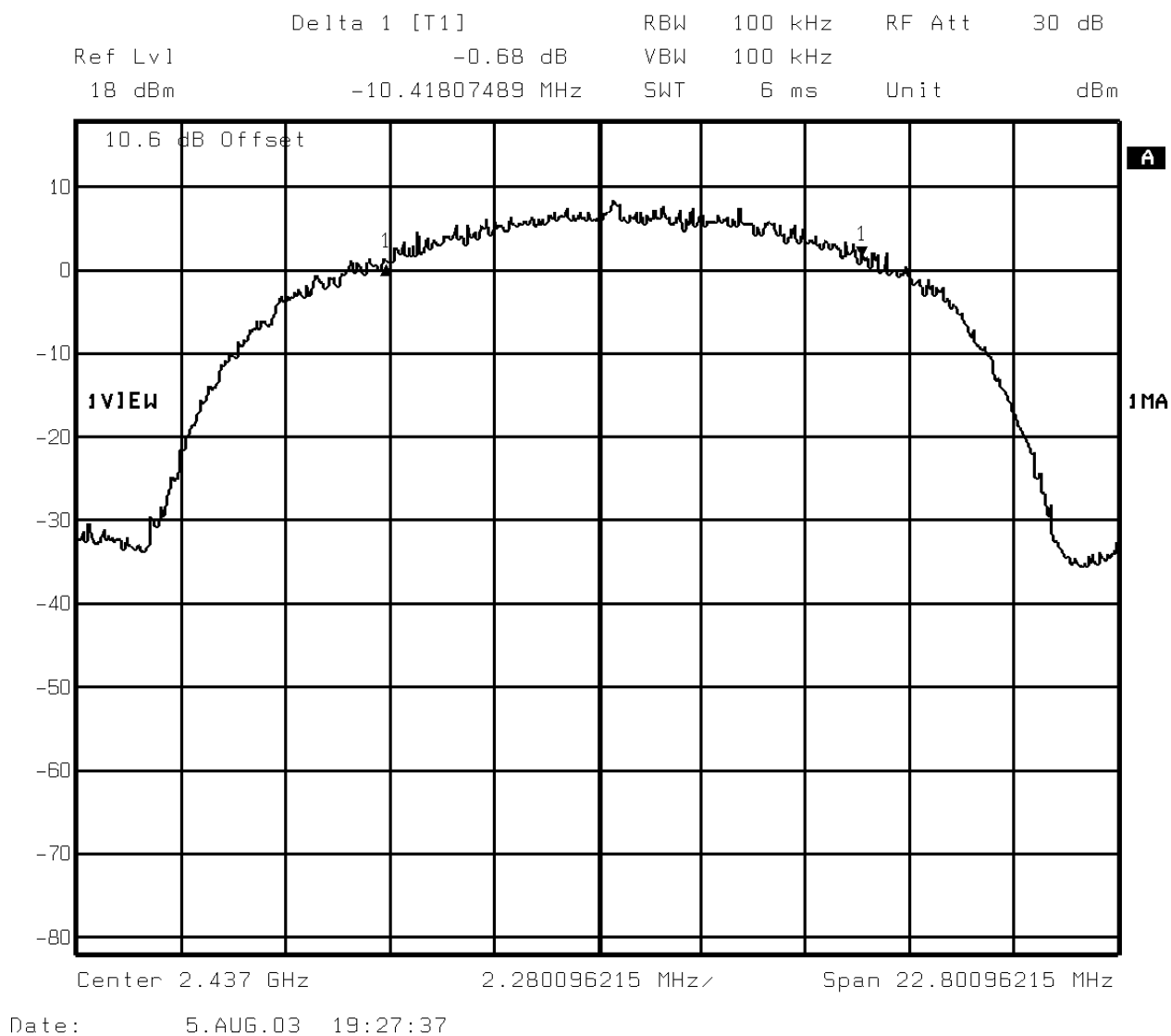
Channel 1, (2412.0MHz) – Maximum Power 11Mbps





Test Case : 6dB Bandwidth
Test Date : 5th August 2003
Rule Parts : 15.247(a)(2)

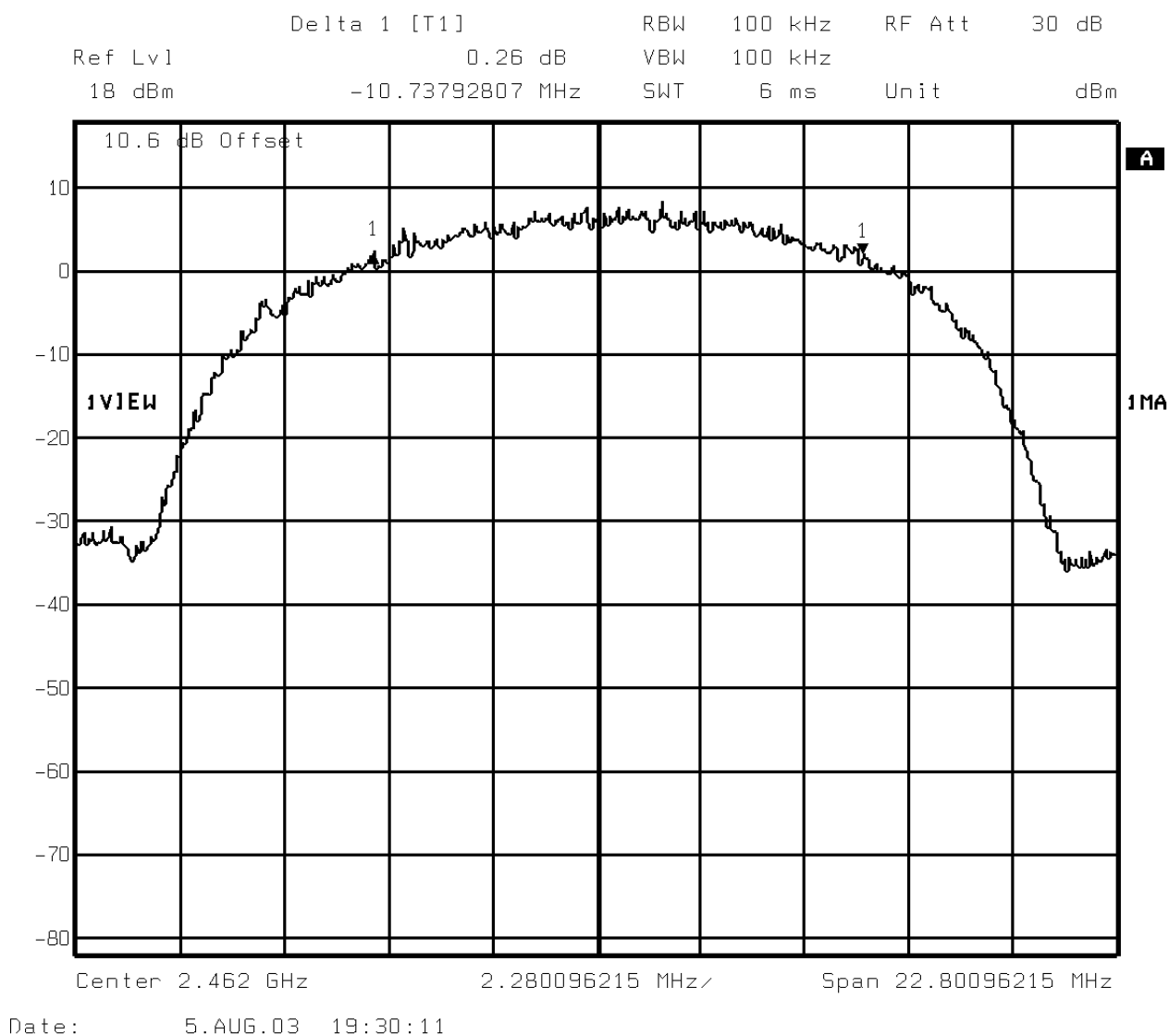
Channel 6, (2437.0MHz) – Maximum Power 11Mbps





Test Case : 6dB Bandwidth
Test Date : 5th August 2003
Rule Parts : 15.247(a)(2)

Channel 11, (2462.0MHz) – Maximum Power 11Mbps



Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: R Small, Radio Engineer.



Test Case : Maximum Peak Output Power
Test Date : 5th August 2003
Rule Parts : 15.247(b)(1)

Measurement Method

The EUT was connected to a Digital Storage Oscilloscope via an attenuator and Crystal Detector. The DC output from the Crystal Detector was measured on the Oscilloscope. The EUT was then substituted for a Signal Generator. The generators frequency was adjusted to that of the EUT and the amplitude increased to give the same DC level as measured from the EUT. The level was read from the Signal Generator and gave the maximum output power.

Results

1Mbps

Frequency (MHz)	Output Power (dBm)	Result (mW)
2412.0	16.70	46.77
2437.0	16.75	47.32
2462.0	17.05	50.70

2Mbps

Frequency (MHz)	Output Power (dBm)	Result (mW)
2412.0	16.65	46.24
2437.0	16.75	47.32
2462.0	17.05	50.70

5.5Mbps

Frequency (MHz)	Output Power (dBm)	Result (mW)
2412.0	16.70	46.77
2437.0	16.65	46.24
2462.0	16.85	48.42



Test Case : Maximum Peak Output Power -continued
Test Date : 5th August 2003
Rule Parts : 15.247(b)(1)

11Mbps

Frequency (MHz)	Output Power (dBm)	Result (mW)
2412.0	16.65	46.24
2437.0	16.75	47.32
2462.0	16.95	49.55

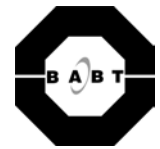
Limit	<1W or <+30dBm
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Remarks

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

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: R Small, Radio Engineer.



Test Case : Spurious Conducted Emissions
Test Date : 7th August 2003
Rule Parts : 15.247(c)

Measurement Method

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

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

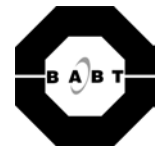
With the EUT transmitting at maximum power, the Spectrum Analyser was set to Max Hold and the fundamental peak measured in a RBW and VBW of 100kHz. This level was used to determine the limit line as displayed on the plots of -20dBc.

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

Remarks

The EUT passed the requirements laid out in 15.247(c).

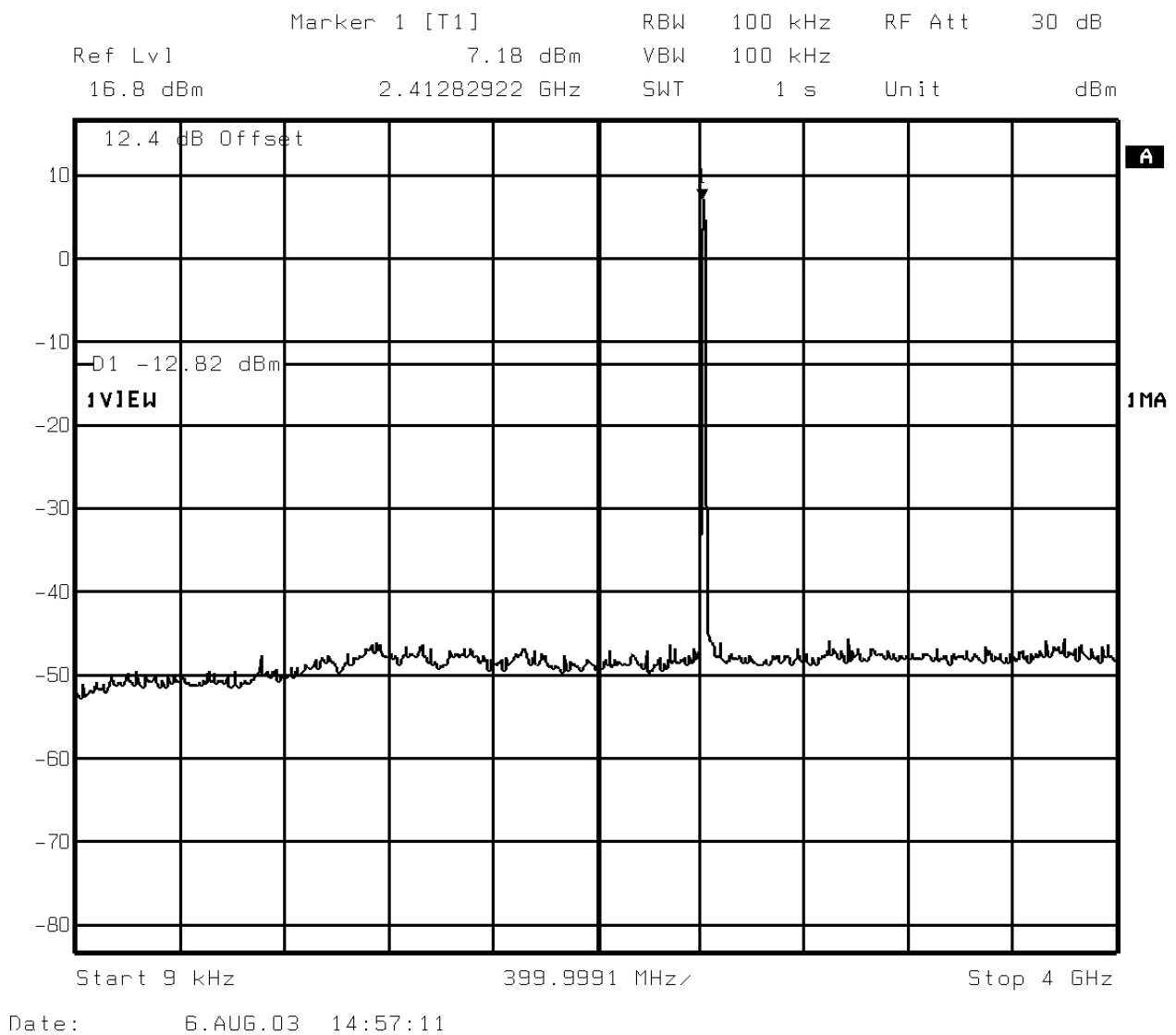
The plots on the following pages show the frequency spectrum from 9kHz to 25GHz of the EUT.



Test Case : Spurious Conducted Emissions
Test Date : 7th August 2003
Rule Parts : 15.247(c)

Spurious Conducted Emissions (9kHz – 4GHz)

Channel 1, (2412.0MHz) – Maximum Power 1Mbps





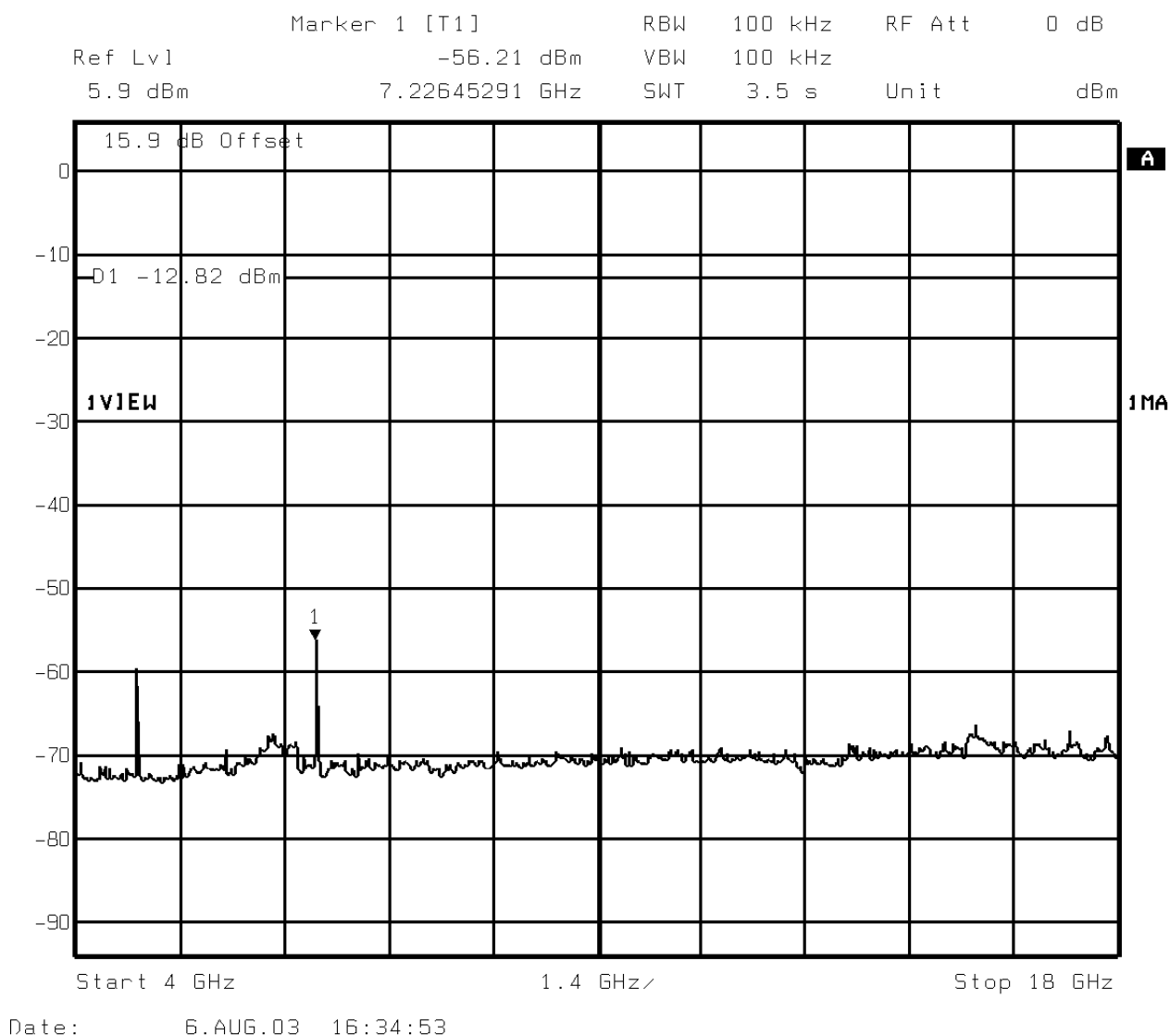
Test Case : Spurious Conducted Emissions

Test Date : 17th August 2003

Rule Parts : 15.247(c)

Spurious Conducted Emissions (4GHz – 18GHz)

Channel 1, (2412.0MHz) – Maximum Power 1Mbps



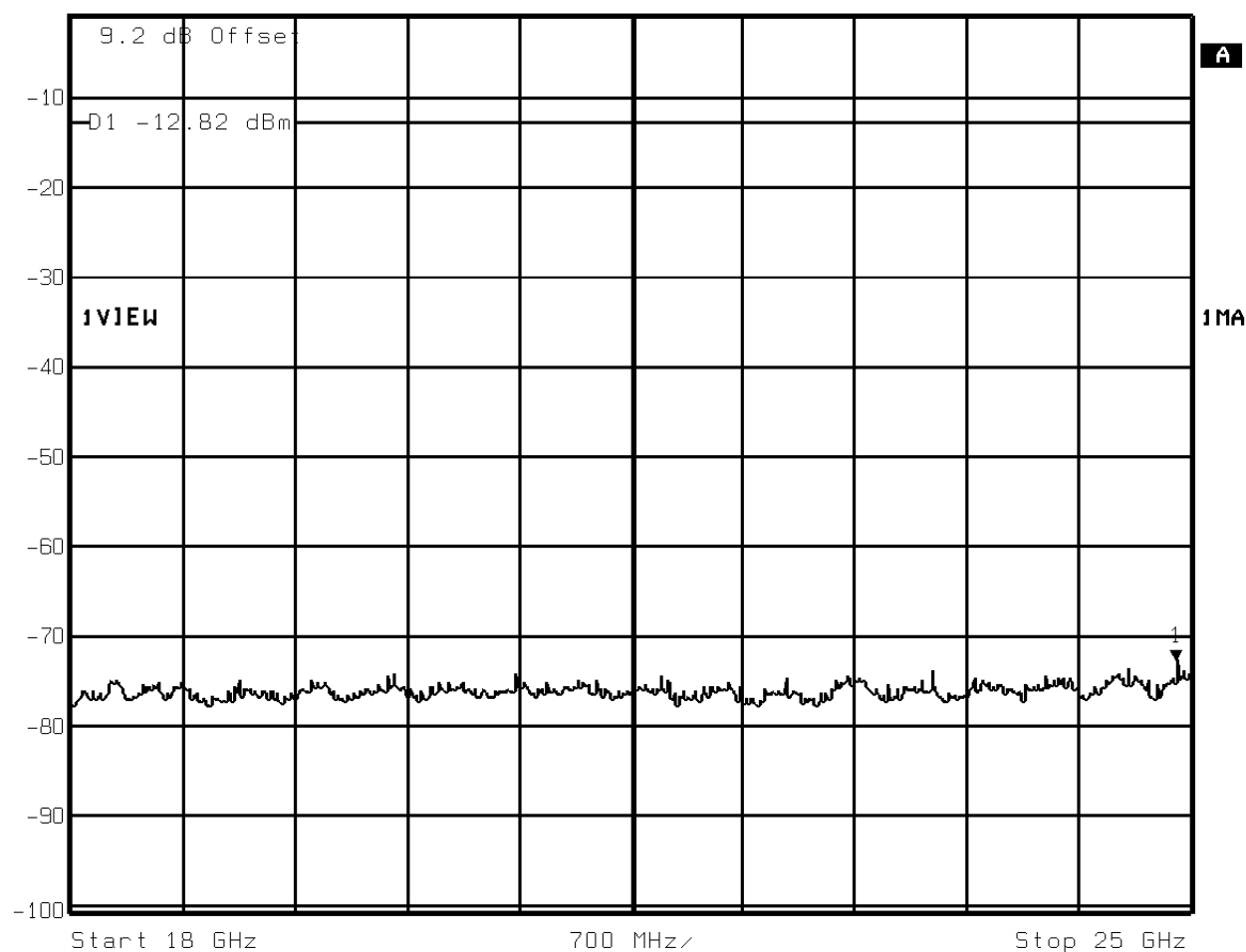


Test Case : Spurious Conducted Emissions
Test Date : 7th August 2003
Rule Parts : 15.247(c)

Spurious Conducted Emissions (18GHz – 25GHz)

Channel 1, (2412.0MHz) – Maximum Power 1Mbps

Marker 1 [T1] RBW 100 kHz RF Att 0 dB
Ref Lvl -72.59 dBm VBW 100 kHz
-0.8 dBm 24.91583166 GHz SWT 1.75 s Unit dBm



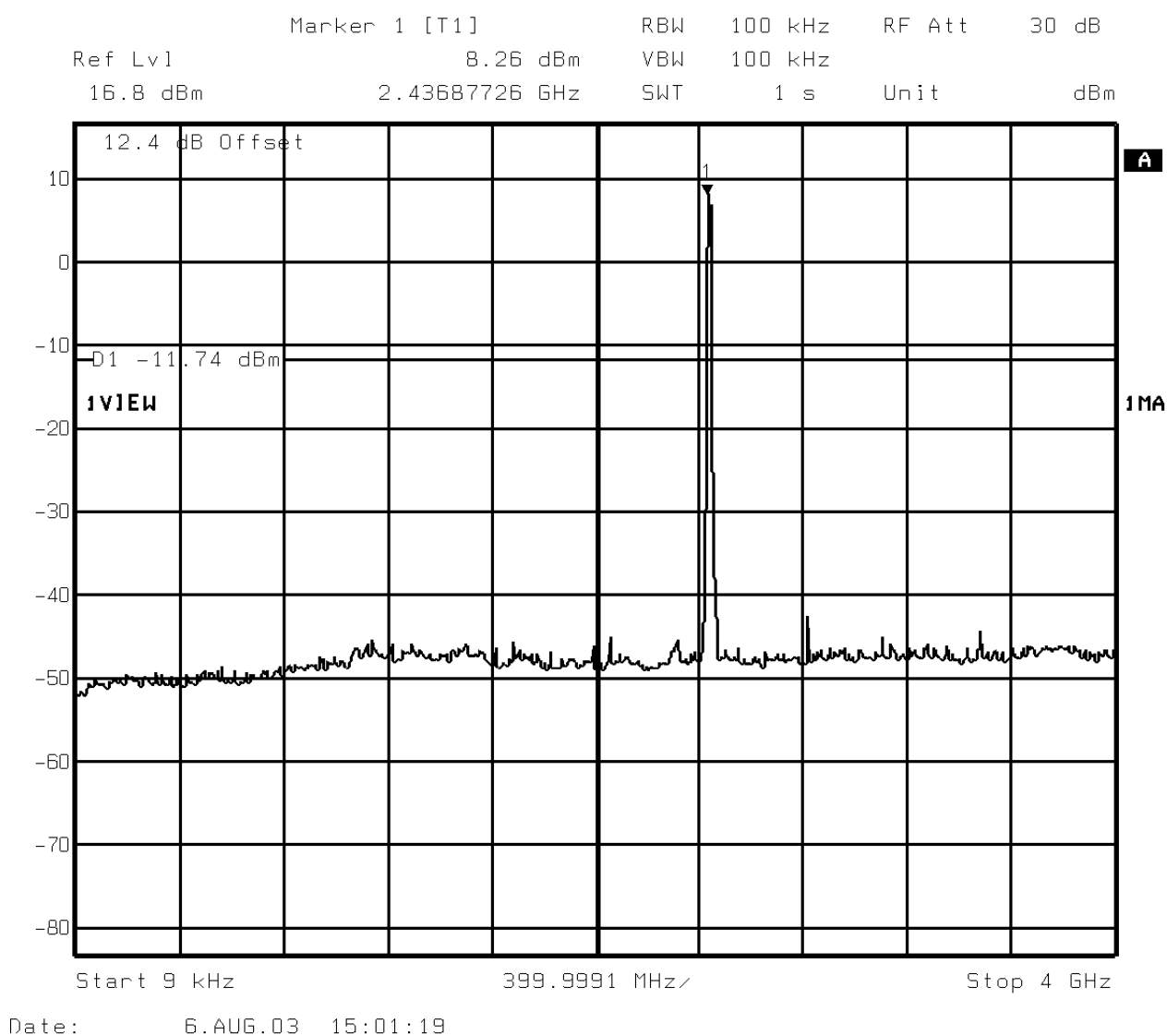
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Test Case : Spurious Conducted Emissions
Test Date : 7th August 2003
Rule Parts : 15.247(c)

Spurious Conducted Emissions (9kHz – 4GHz)

Channel 6, (2437.0MHz) – Maximum Power 1Mbps





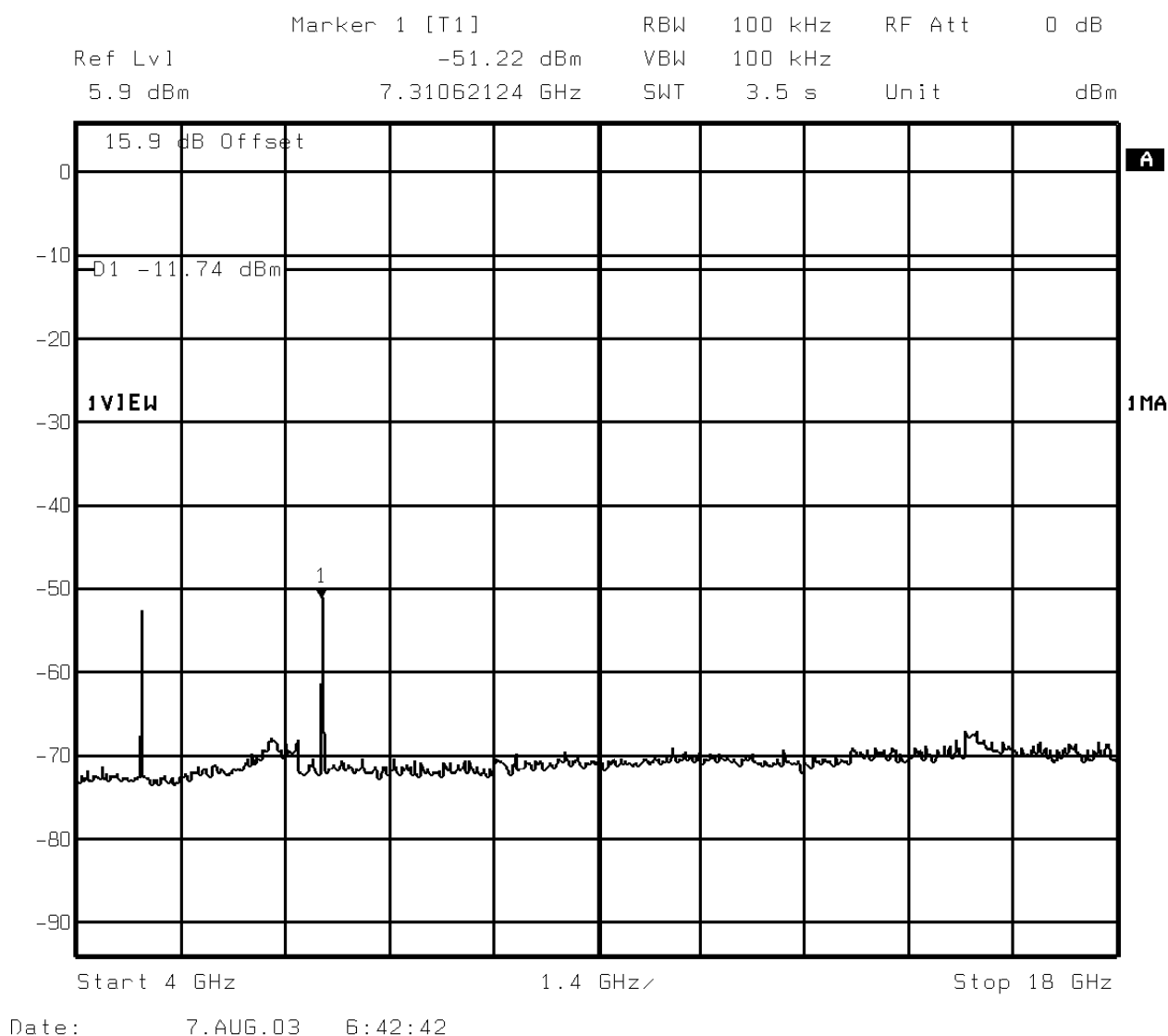
Test Case : Spurious Conducted Emissions

Test Date : 7th August 2003

Rule Parts : 15.247(c)

Spurious Conducted Emissions (4GHz – 18GHz)

Channel 6, (2437.0MHz) – Maximum Power 1Mbps





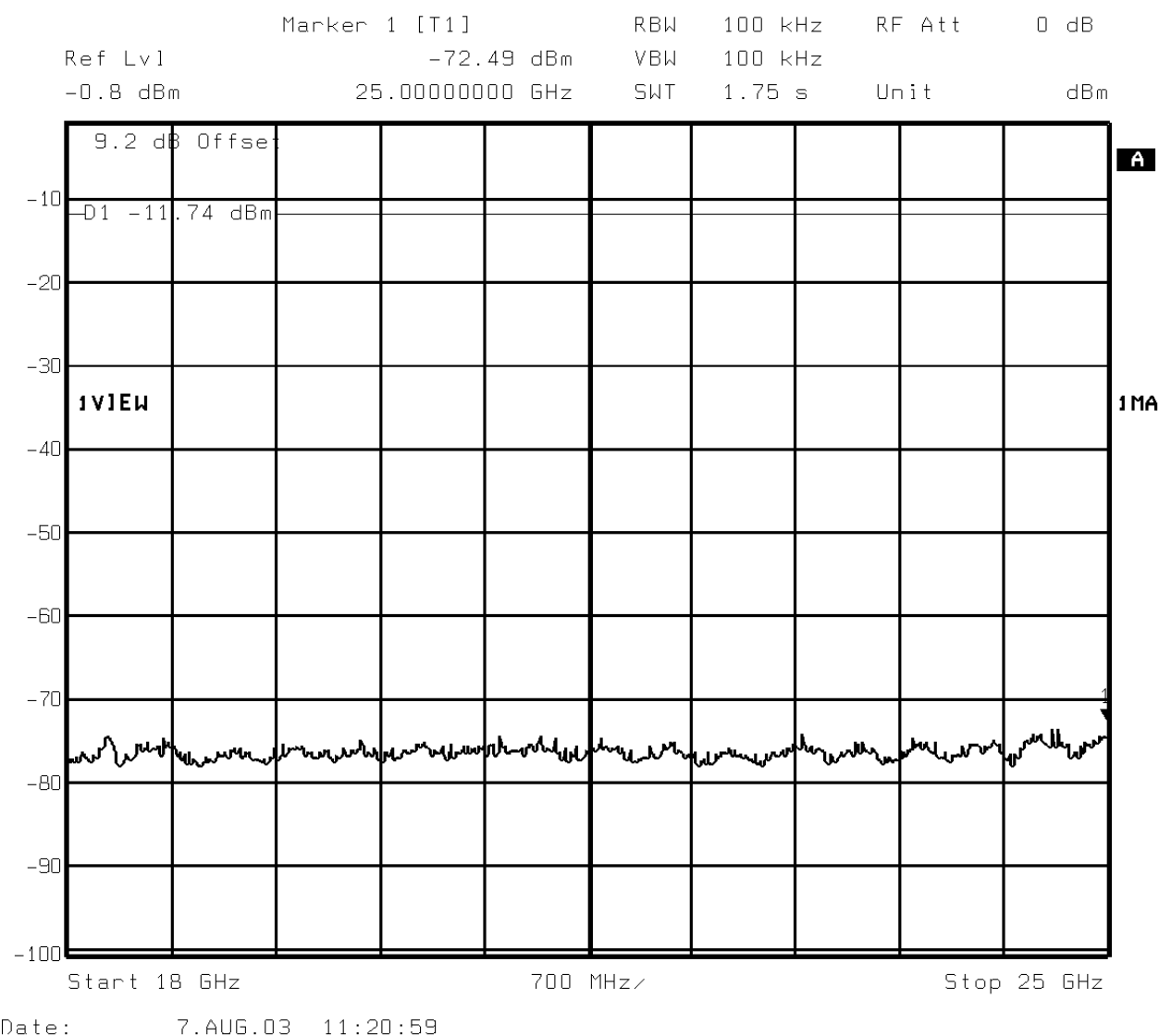
Test Case : Spurious Conducted Emissions

Test Date : 7th August 2003

Rule Parts : 15.247(c)

Spurious Conducted Emissions (18GHz – 25GHz)

Channel 6, (2437.0MHz) – Maximum Power 1Mbps





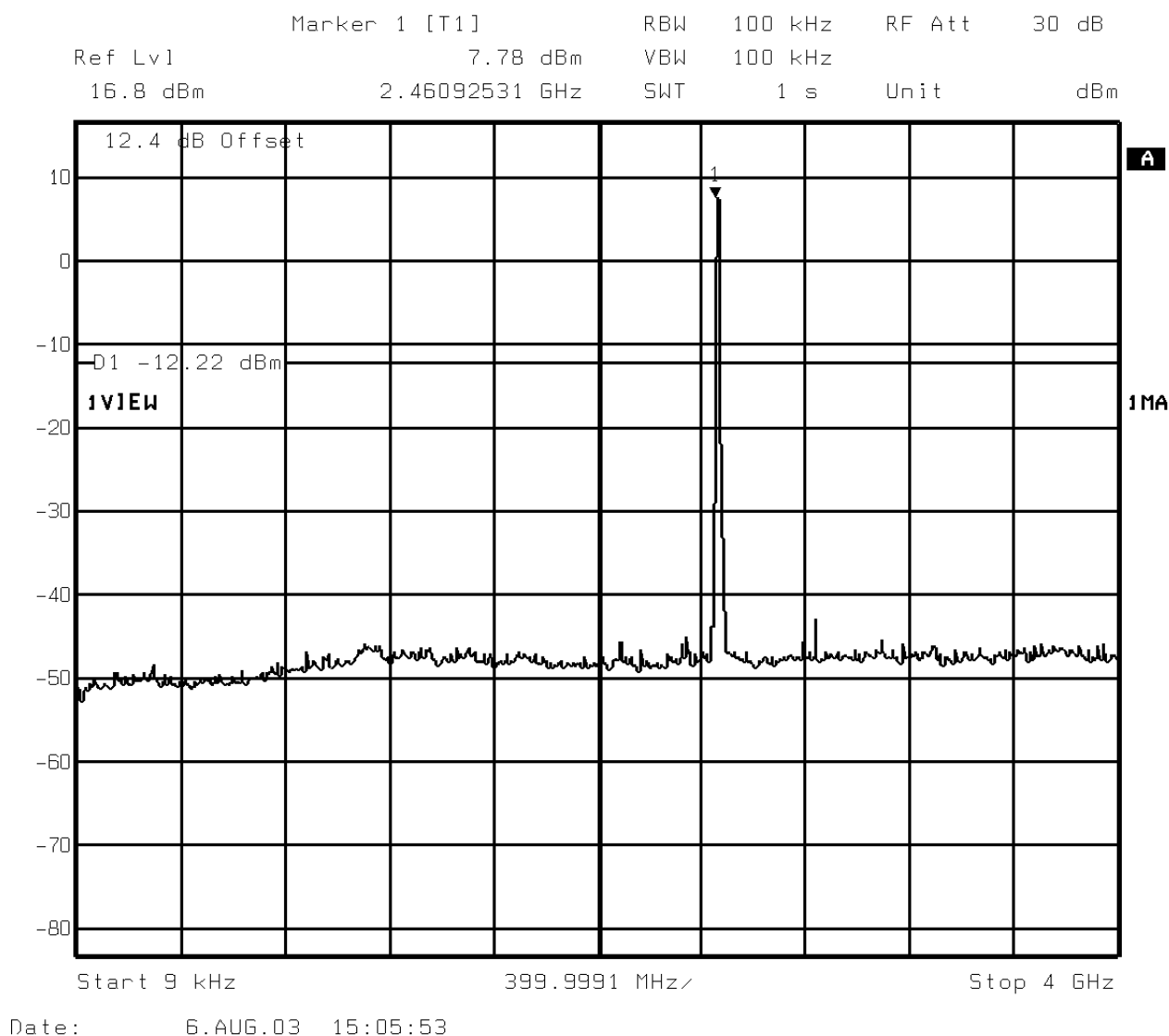
Test Case : Spurious Conducted Emissions

Test Date : 7th August 2003

Rule Parts : 15.247(c)

Spurious Conducted Emissions (9kHz – 4GHz)

Channel 11, (2462.0MHz) – Maximum Power 1Mbps





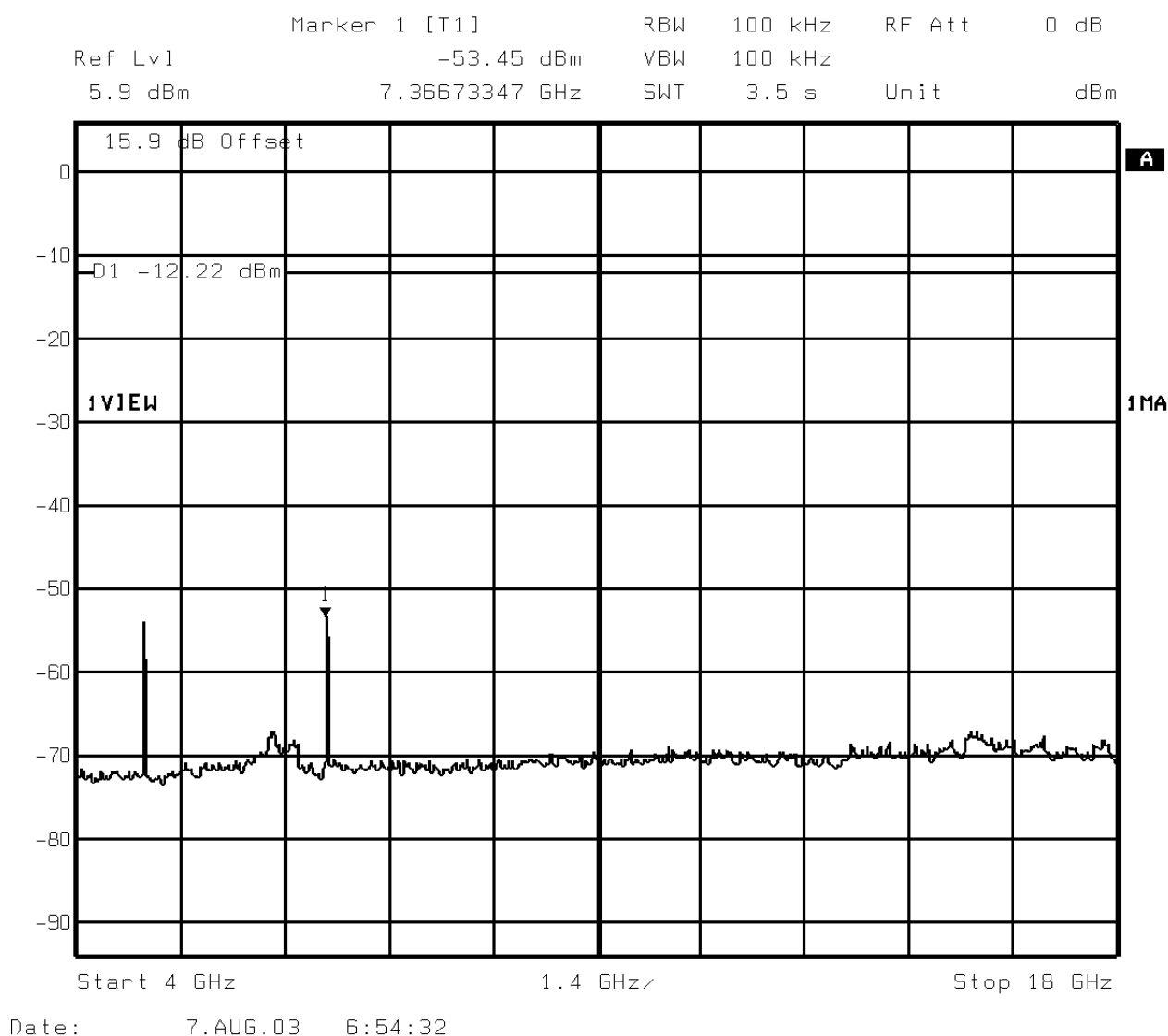
Test Case : Spurious Conducted Emissions

Test Date : 7th August 2003

Rule Parts : 15.247(c)

Spurious Conducted Emissions (4GHz – 18GHz)

Channel 11, (2462.0MHz) – Maximum Power 1Mbps





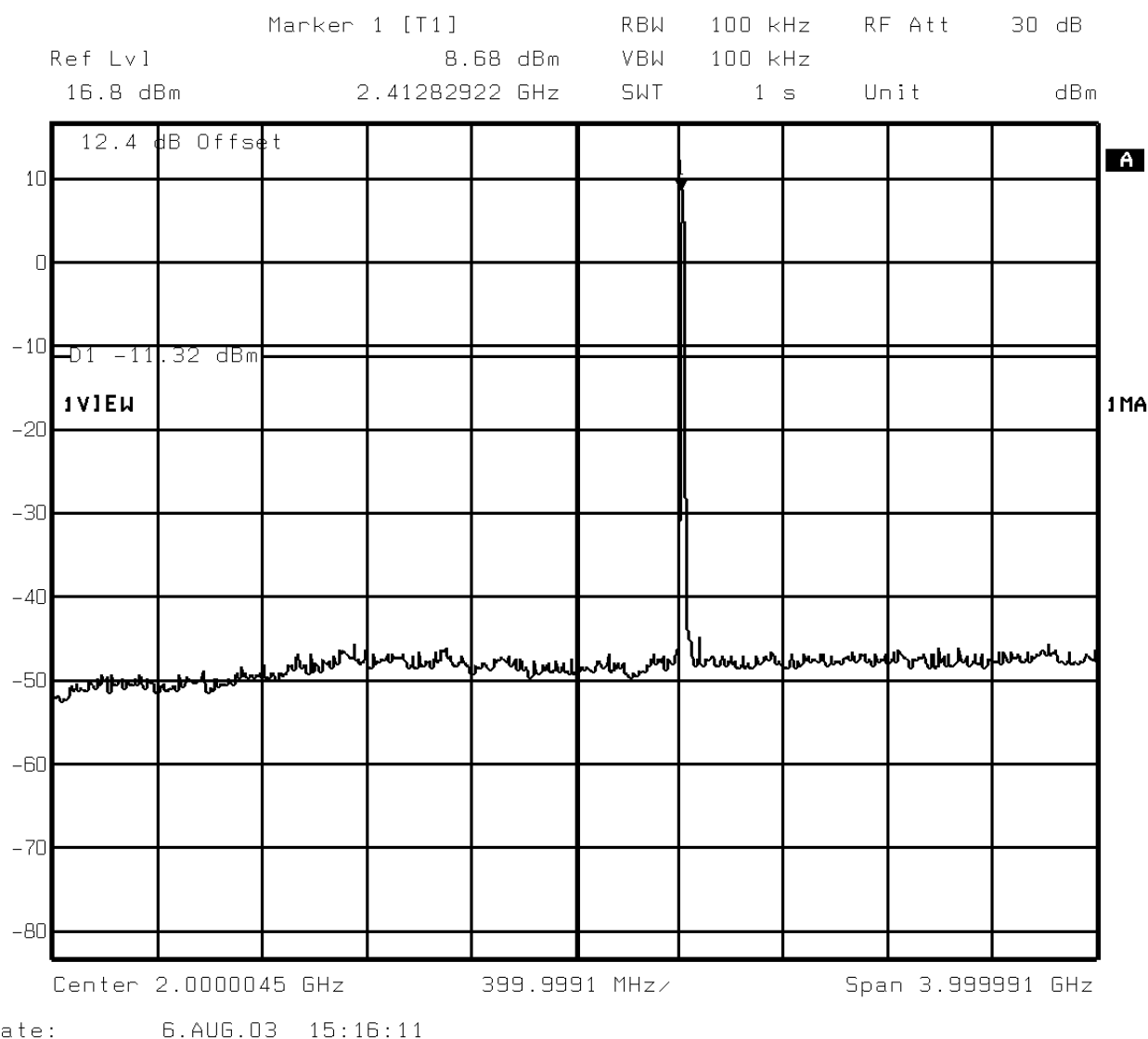
Test Case : Spurious Conducted Emissions

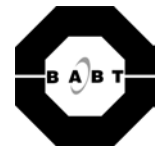
Test Date : 7th August 2003

Rule Parts : 15.247(c)

Spurious Conducted Emissions (9kHz – 4GHz)

Channel 1, (2412.0MHz) – Maximum Power 2Mbps

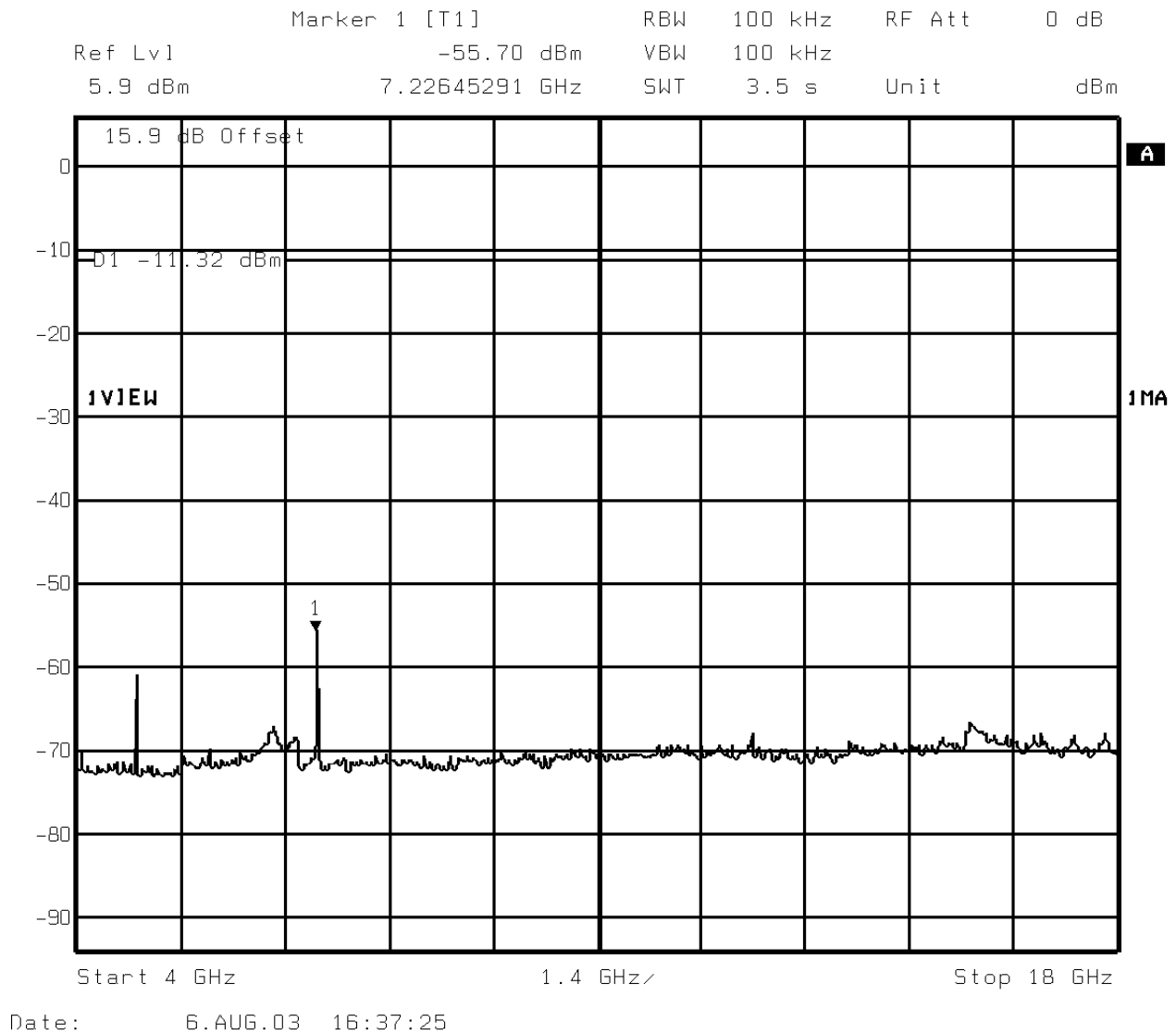




Test Case : Spurious Conducted Emissions
Test Date : 7th August 2003
Rule Parts : 15.247(c)

Spurious Conducted Emissions (8GHz – 18GHz)

Channel 1, (2412.0MHz) – Maximum Power 2Mbps

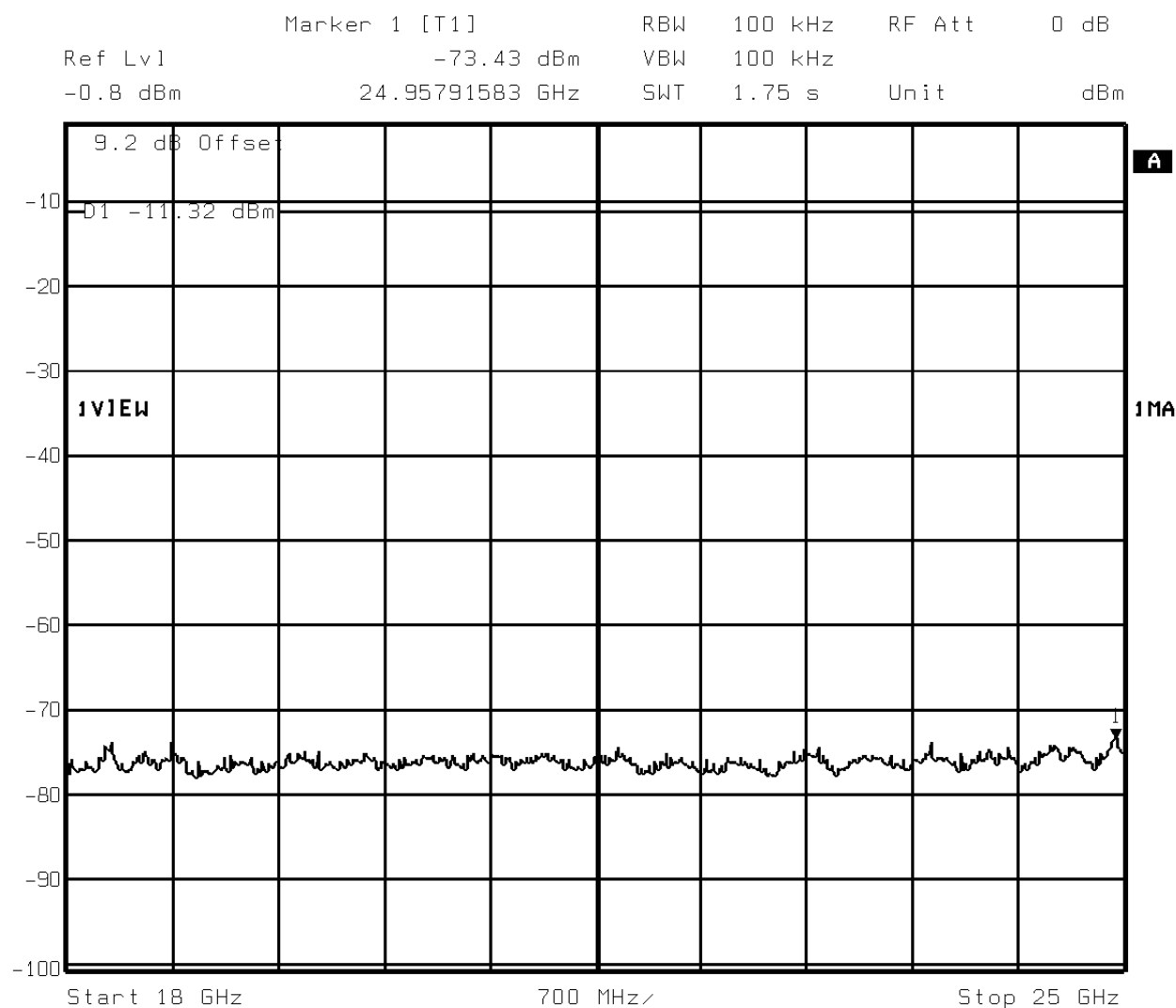




Test Case : Spurious Conducted Emissions
Test Date : 7th August 2003
Rule Parts : 15.247(c)

Spurious Conducted Emissions (18GHz – 25GHz)

Channel 1, (2412.0MHz) – Maximum Power 2Mbps



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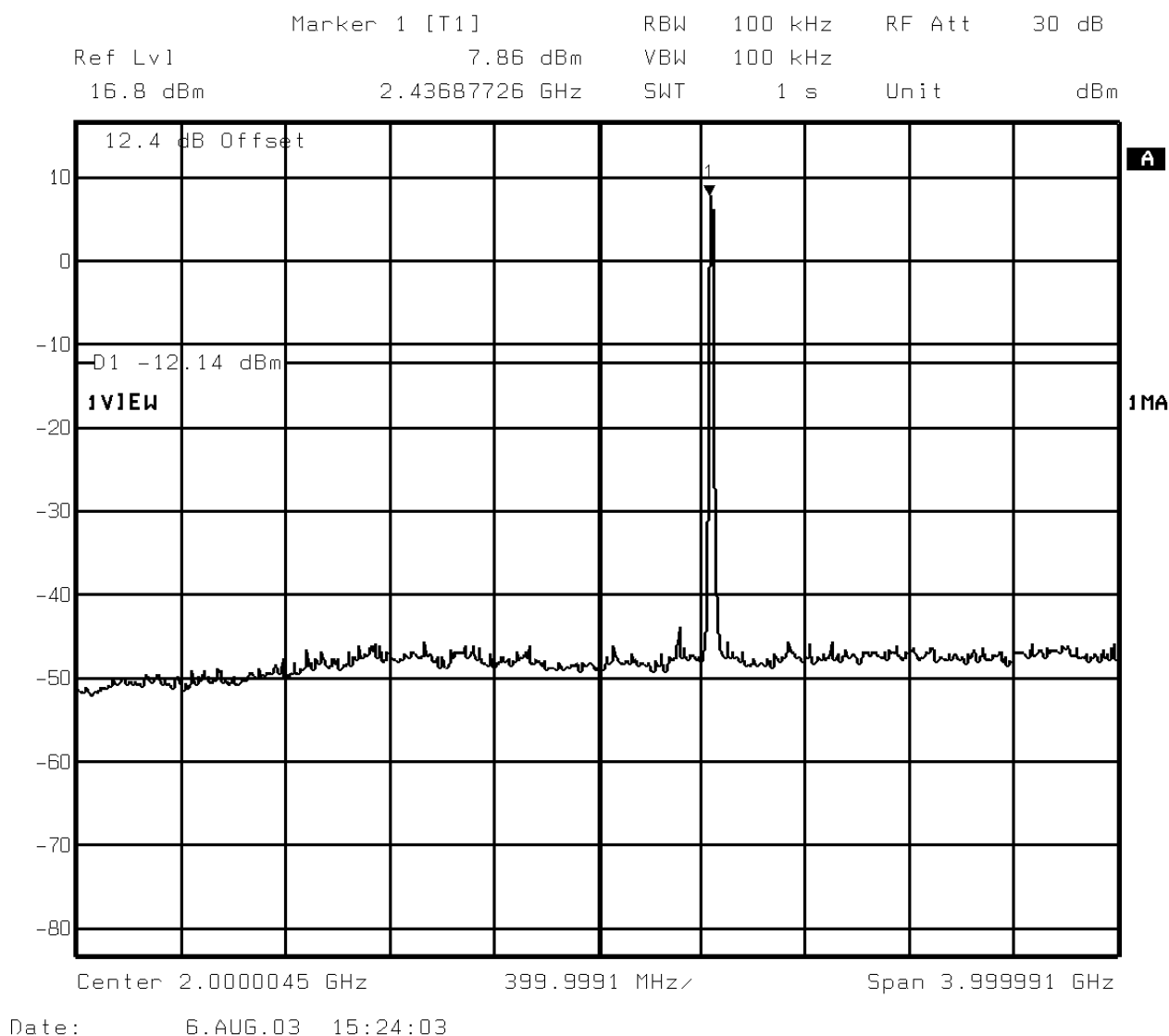
Test Case : Spurious Conducted Emissions

Test Date : 7th August 2003

Rule Parts : 15.247(c)

Spurious Conducted Emissions (9kHz – 4GHz)

Channel 6, (2437.0MHz) – Maximum Power 2Mbps





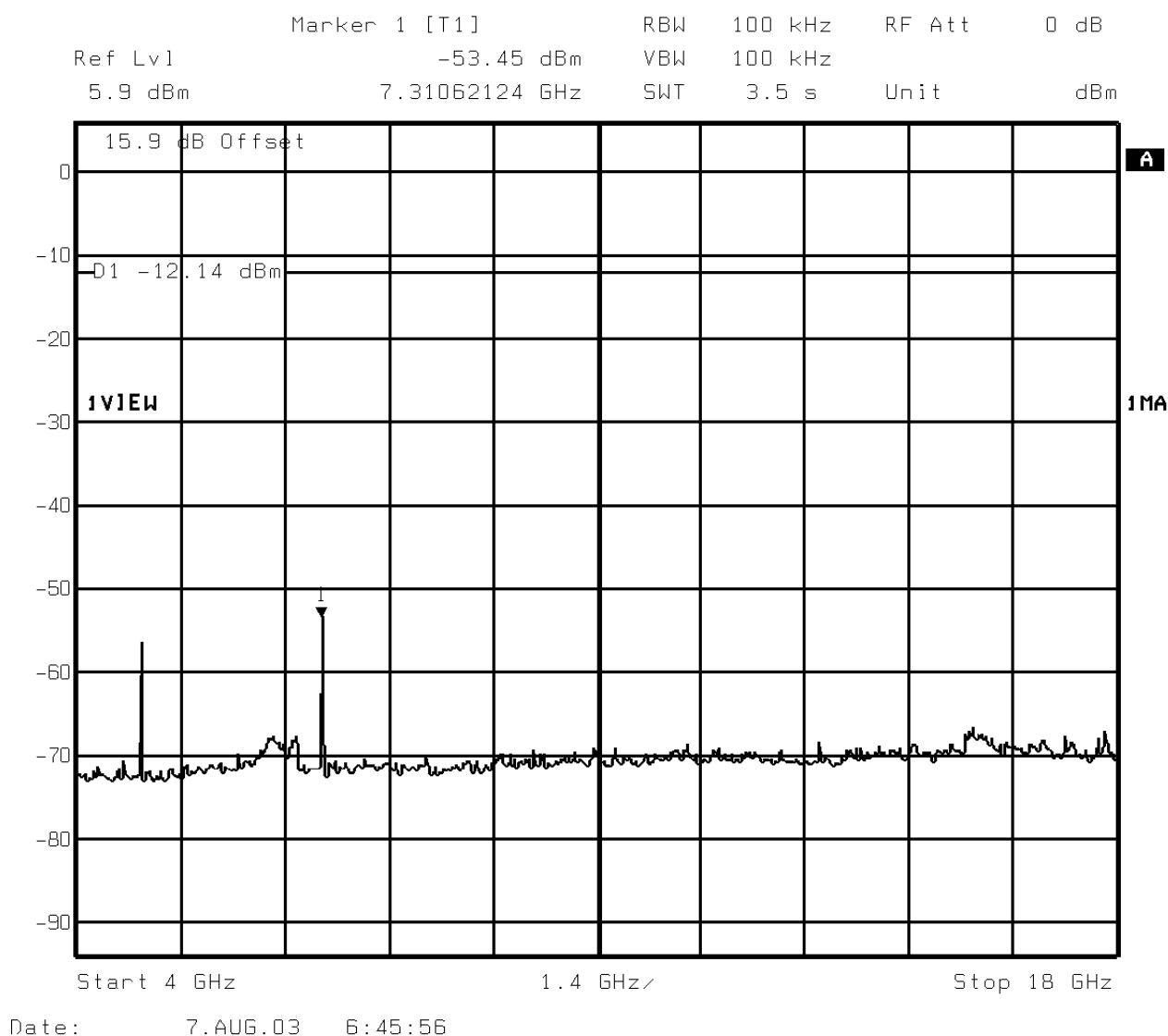
Test Case : Spurious Conducted Emissions

Test Date : 7th August 2003

Rule Parts : 15.247(c)

Spurious Conducted Emissions (4GHz – 18GHz)

Channel 6, (2437.0MHz) – Maximum Power 2Mbps





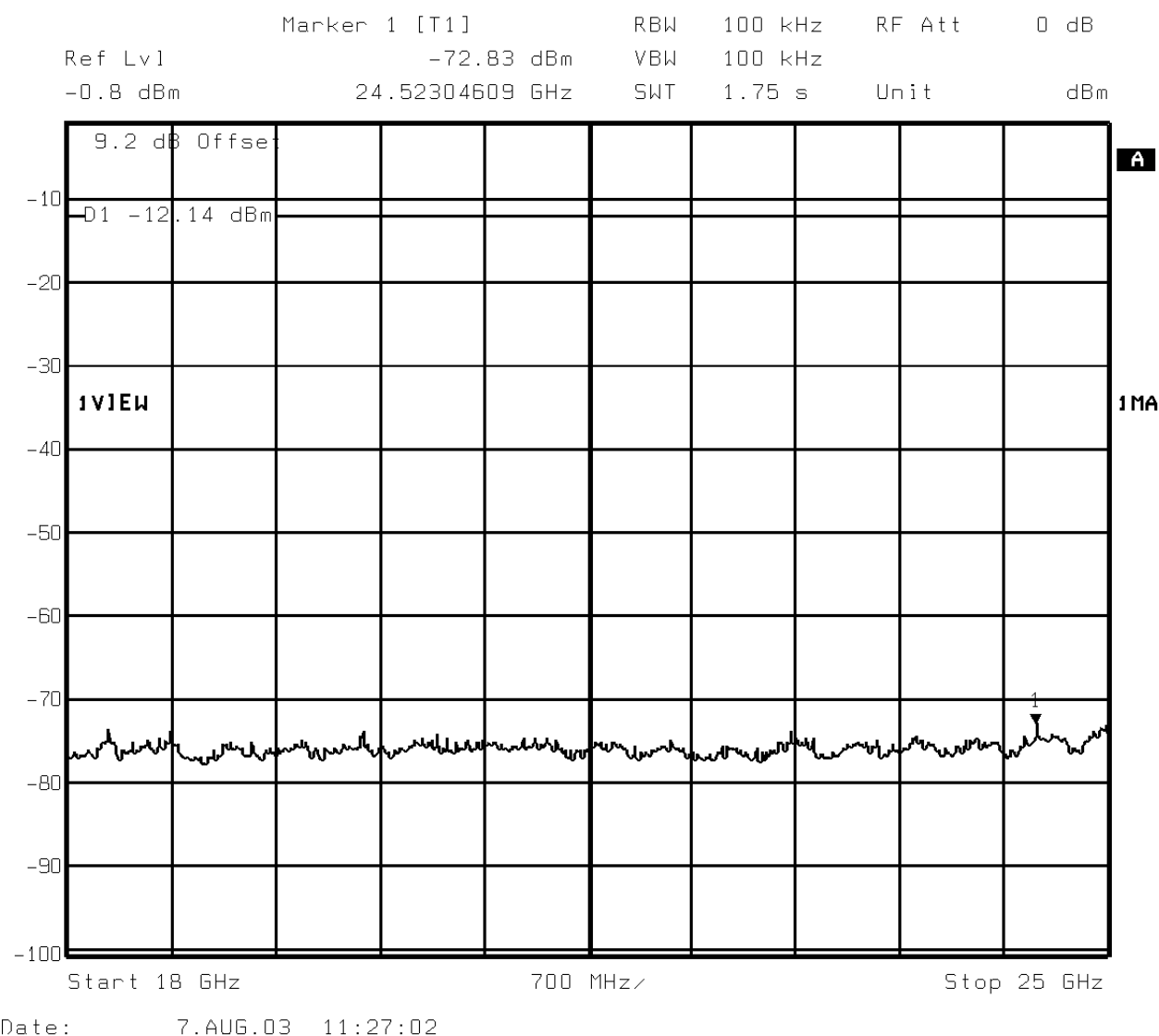
Test Case : Spurious Conducted Emissions

Test Date : 7th August 2003

Rule Parts : 15.247(c)

Spurious Conducted Emissions (18GHz – 25GHz)

Channel 6, (2437.0MHz) – Maximum Power 2Mbps





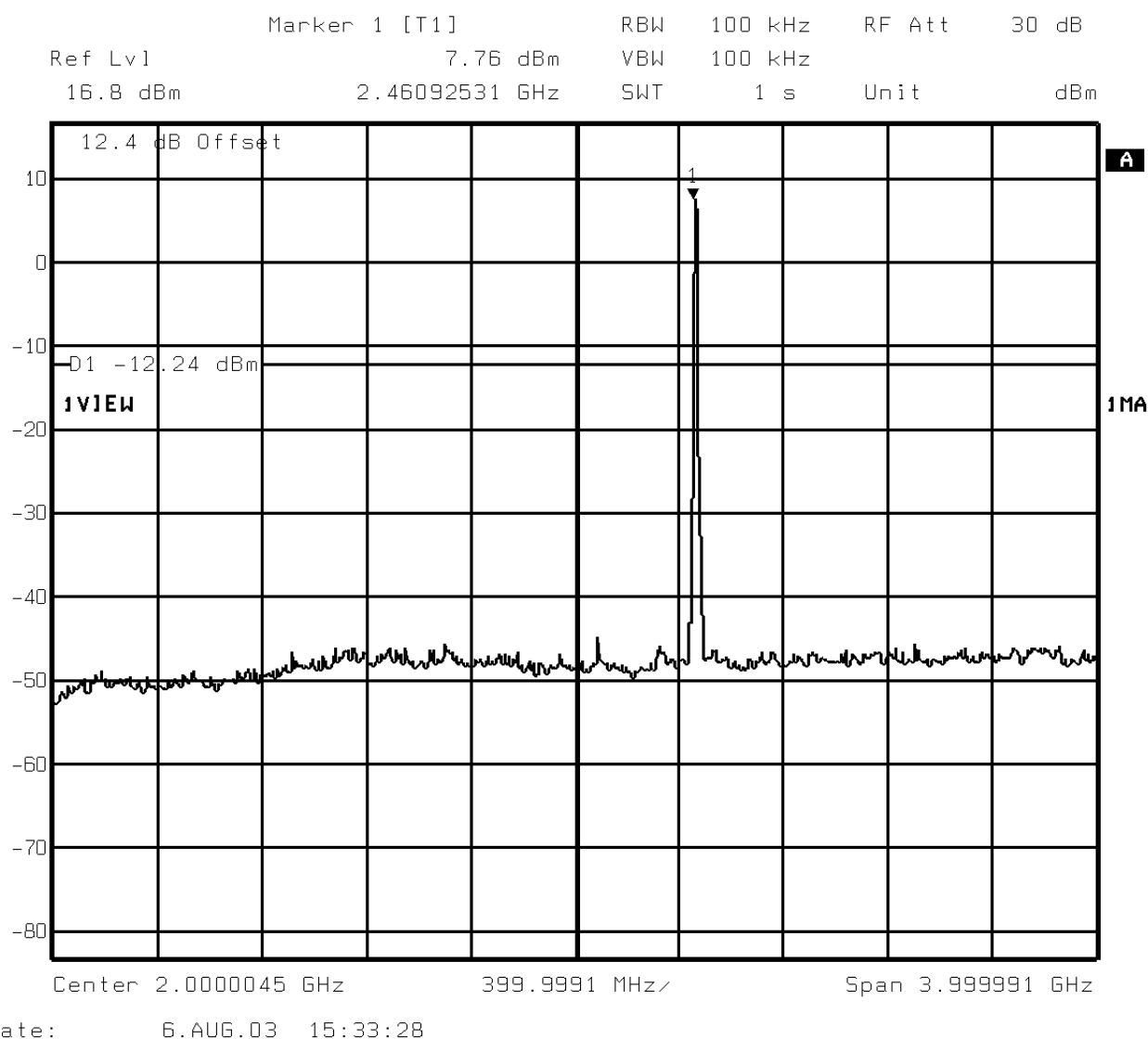
Test Case : Spurious Conducted Emissions

Test Date : 7th August 2003

Rule Parts : 15.247(c)

Spurious Conducted Emissions (9kHz – 4GHz)

Channel 11, (2462.0MHz) – Maximum Power 2Mbps





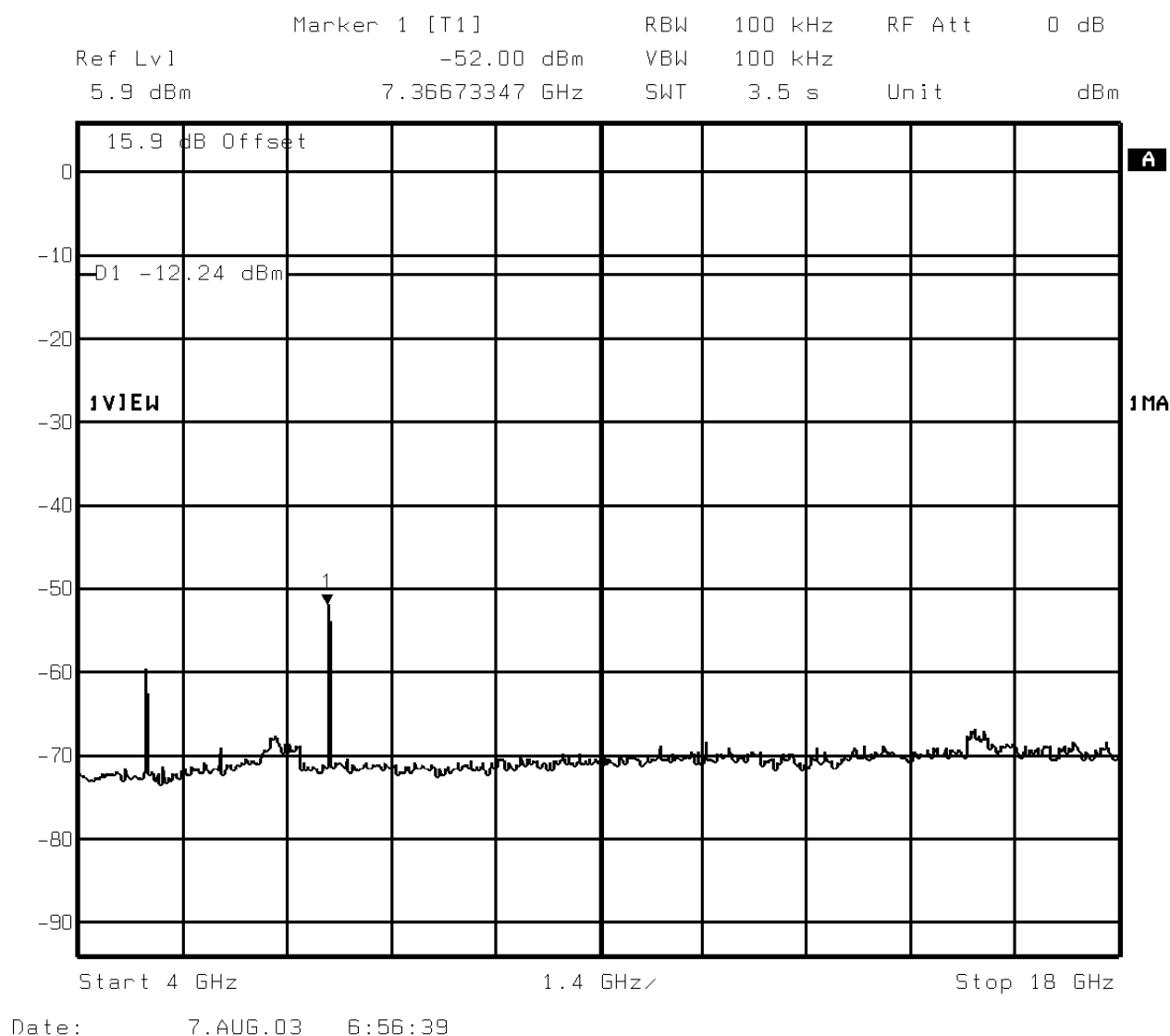
Test Case : Spurious Conducted Emissions

Test Date : 7th August 2003

Rule Parts : 15.247(c)

Spurious Conducted Emissions (4GHz – 18GHz)

Channel 11, (2462.0MHz) – Maximum Power 2Mbps





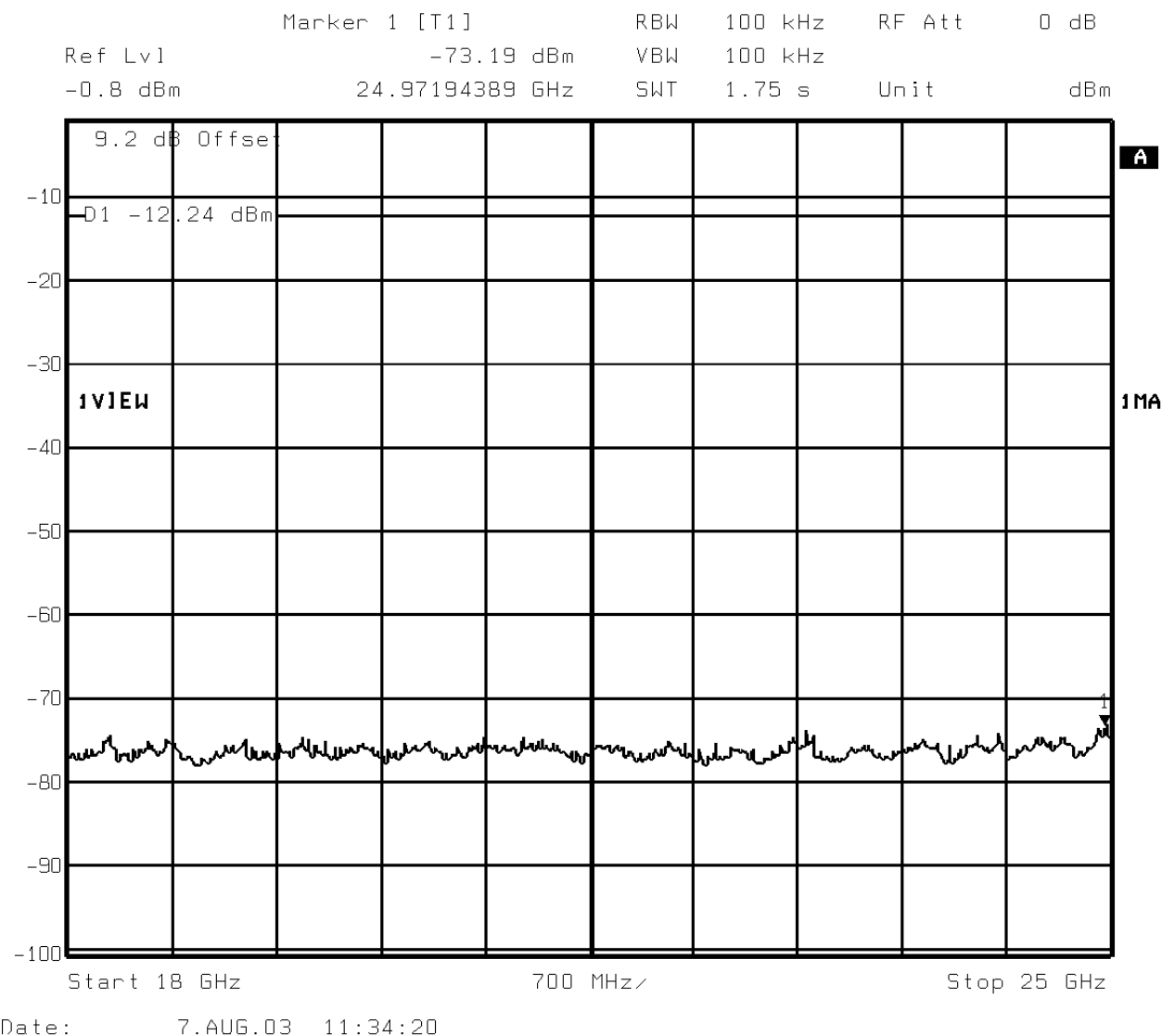
Test Case : Spurious Conducted Emissions

Test Date : 7th August 2003

Rule Parts : 15.247(c)

Spurious Conducted Emissions (18GHz – 25GHz)

Channel 11, (2462.0MHz) – Maximum Power 2Mbps





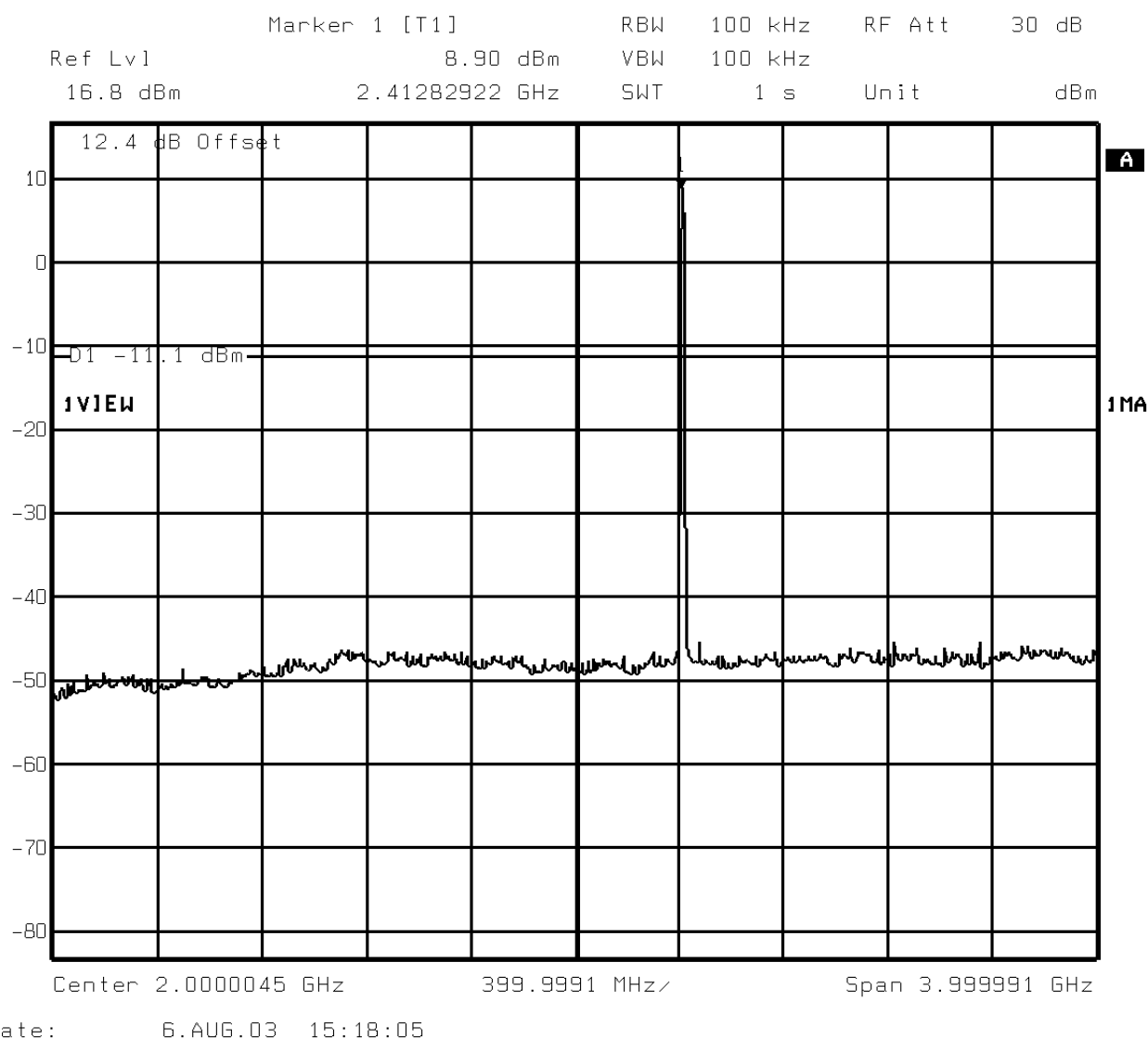
Test Case : Spurious Conducted Emissions

Test Date : 7th August 2003

Rule Parts : 15.247(c)

Spurious Conducted Emissions (9kHz – 4GHz)

Channel 1, (2412.0MHz) – Maximum Power 5.5Mbps

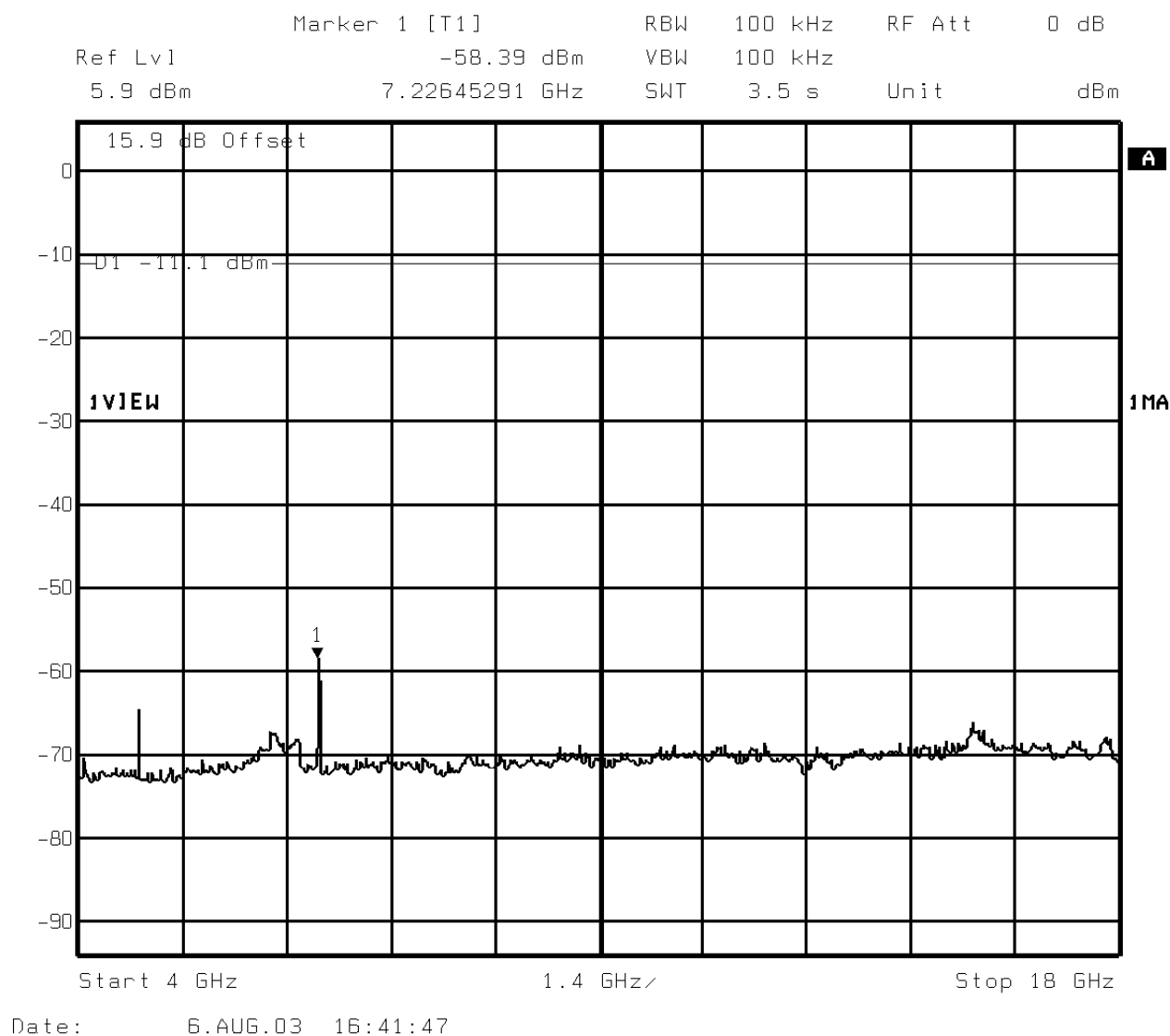




Test Case : Spurious Conducted Emissions
Test Date : 7th August 2003
Rule Parts : 15.247(c)

Spurious Conducted Emissions (4GHz – 18GHz)

Channel 1, (2412.0MHz) – Maximum Power 5.5Mbps



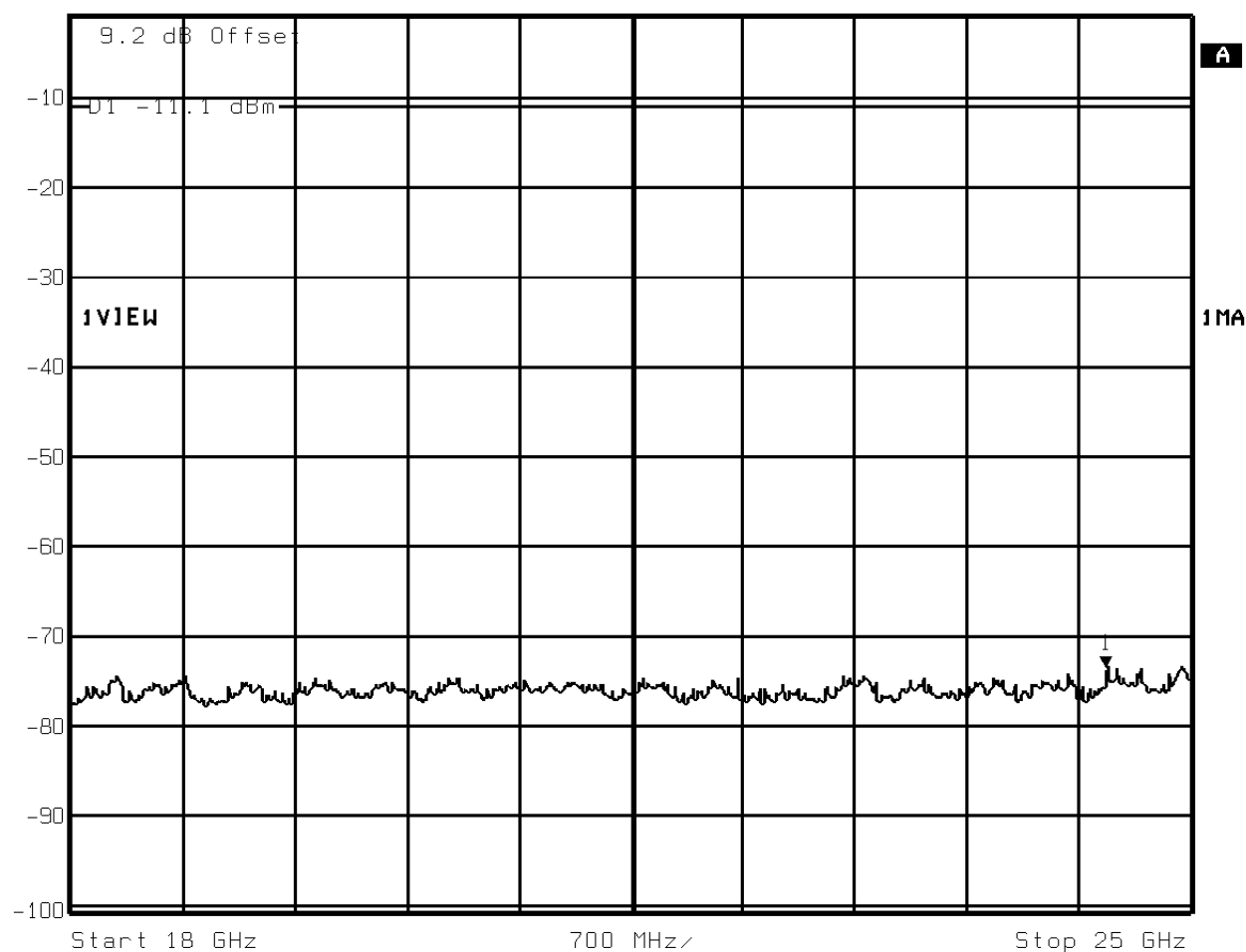


Test Case : Spurious Conducted Emissions
Test Date : 7th August 2003
Rule Parts : 15.247(c)

Spurious Conducted Emissions (18GHz – 25GHz)

Channel 1, (2412.0MHz) – Maximum Power 5.5Mbps

Marker 1 [T1] RBW 100 kHz RF Att 0 dB
Ref Lvl -73.48 dBm VBW 100 kHz
-0.8 dBm 24.48096192 GHz SWT 1.75 s Unit dBm



Date: 7.AUG.03 11:14:49



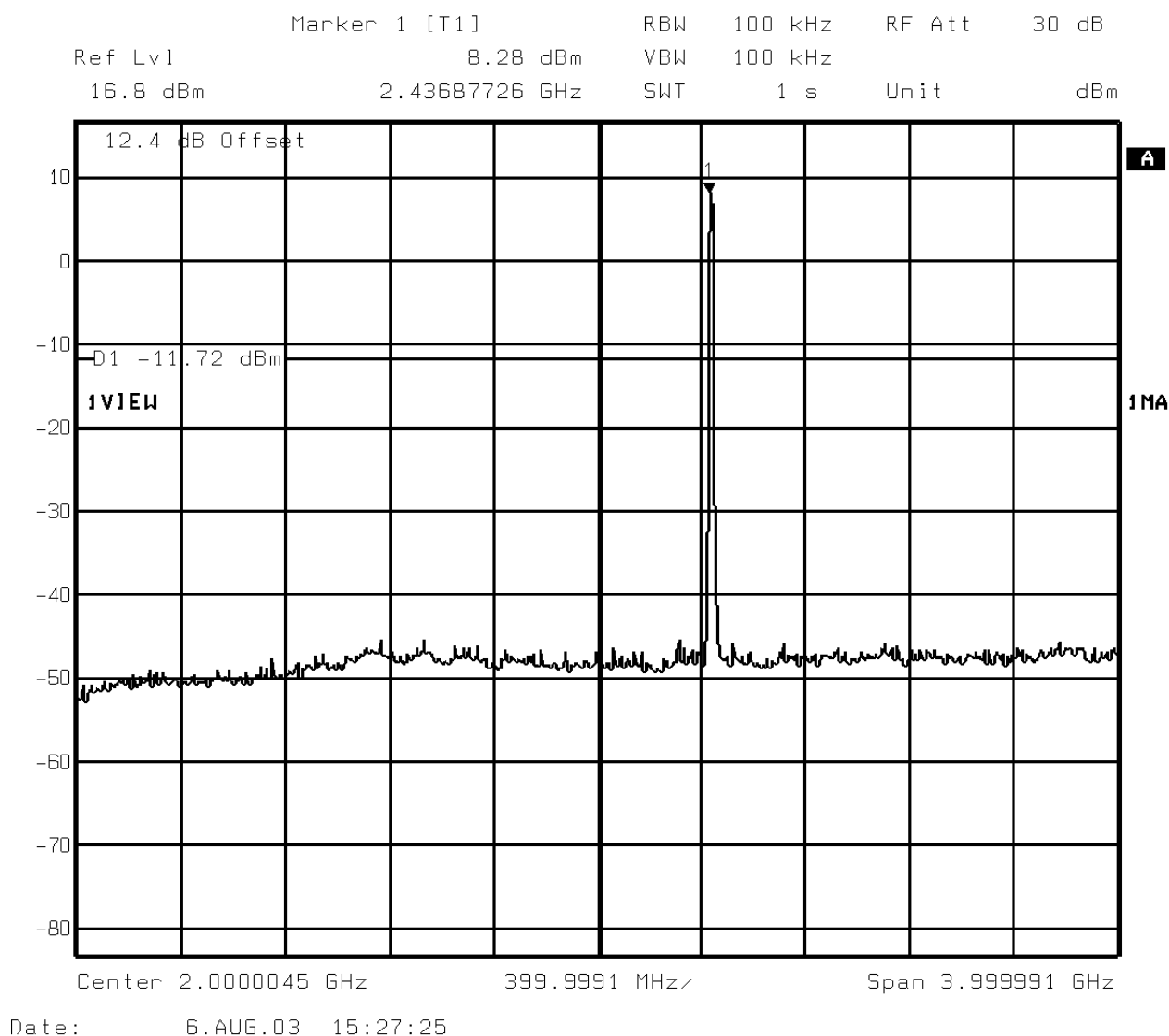
Test Case : Spurious Conducted Emissions

Test Date : 7th August 2003

Rule Parts : 15.247(c)

Spurious Conducted Emissions (9kHz – 4GHz)

Channel 6, (2437.0MHz) – Maximum Power 5.5Mbps





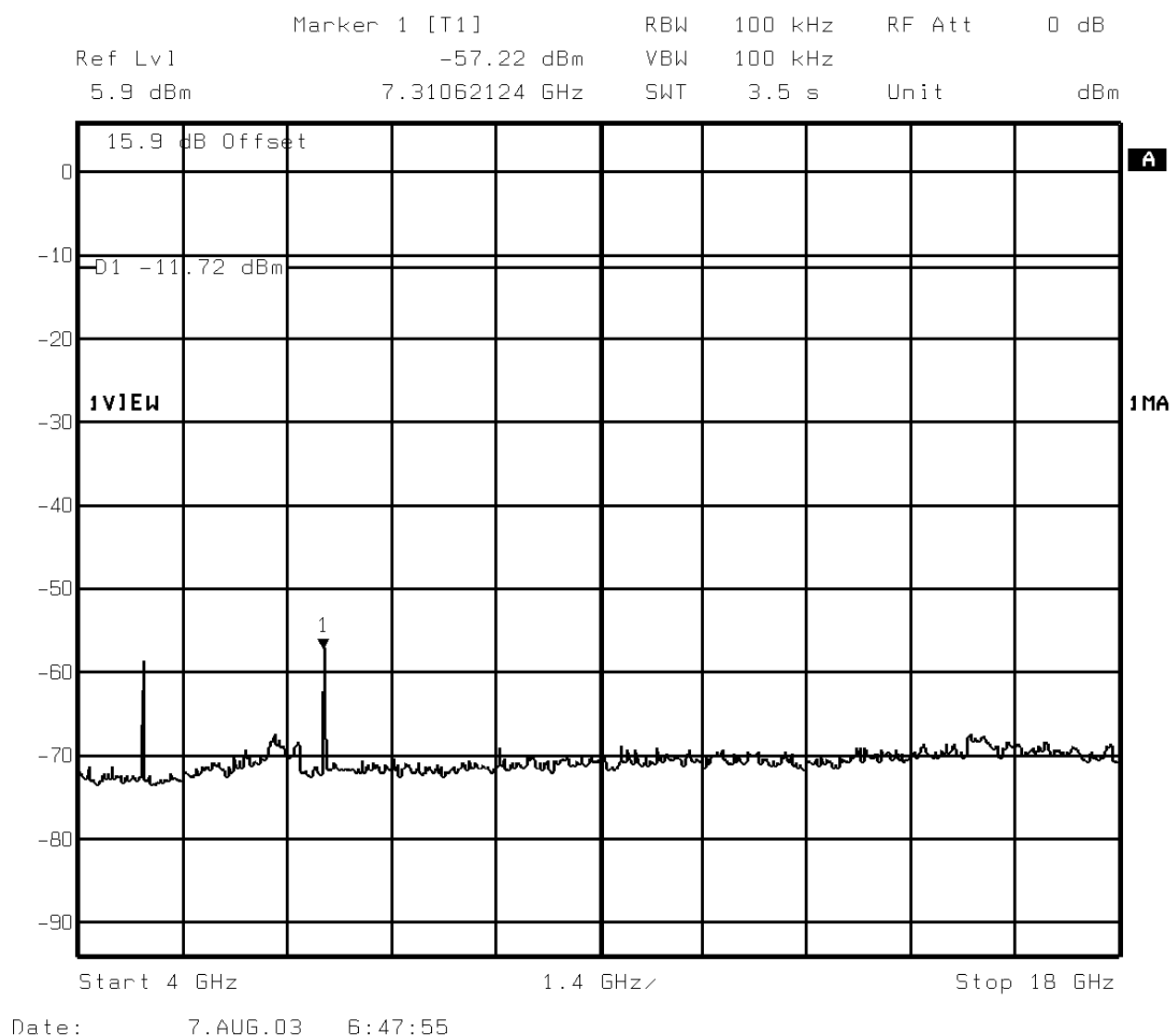
Test Case : Spurious Conducted Emissions

Test Date : 7th August 2003

Rule Parts : 15.247(c)

Spurious Conducted Emissions (4GHz – 18GHz)

Channel 6, (2437.0MHz) – Maximum Power 5.5Mbps





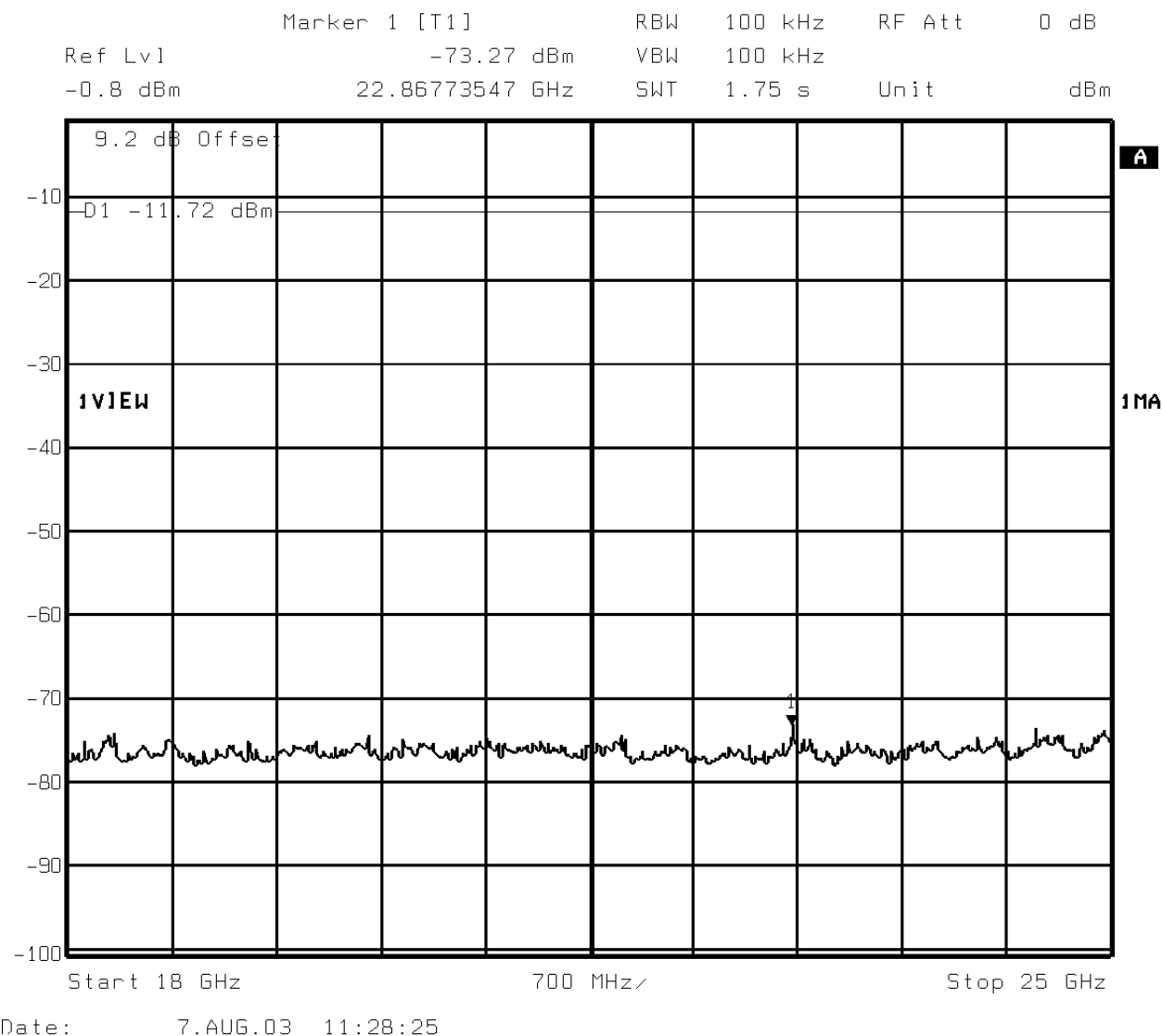
Test Case : Spurious Conducted Emissions

Test Date : 7th August 2003

Rule Parts : 15.247(c)

Spurious Conducted Emissions (18GHz – 25GHz)

Channel 6, (2437.0MHz) – Maximum Power 5.5Mbps





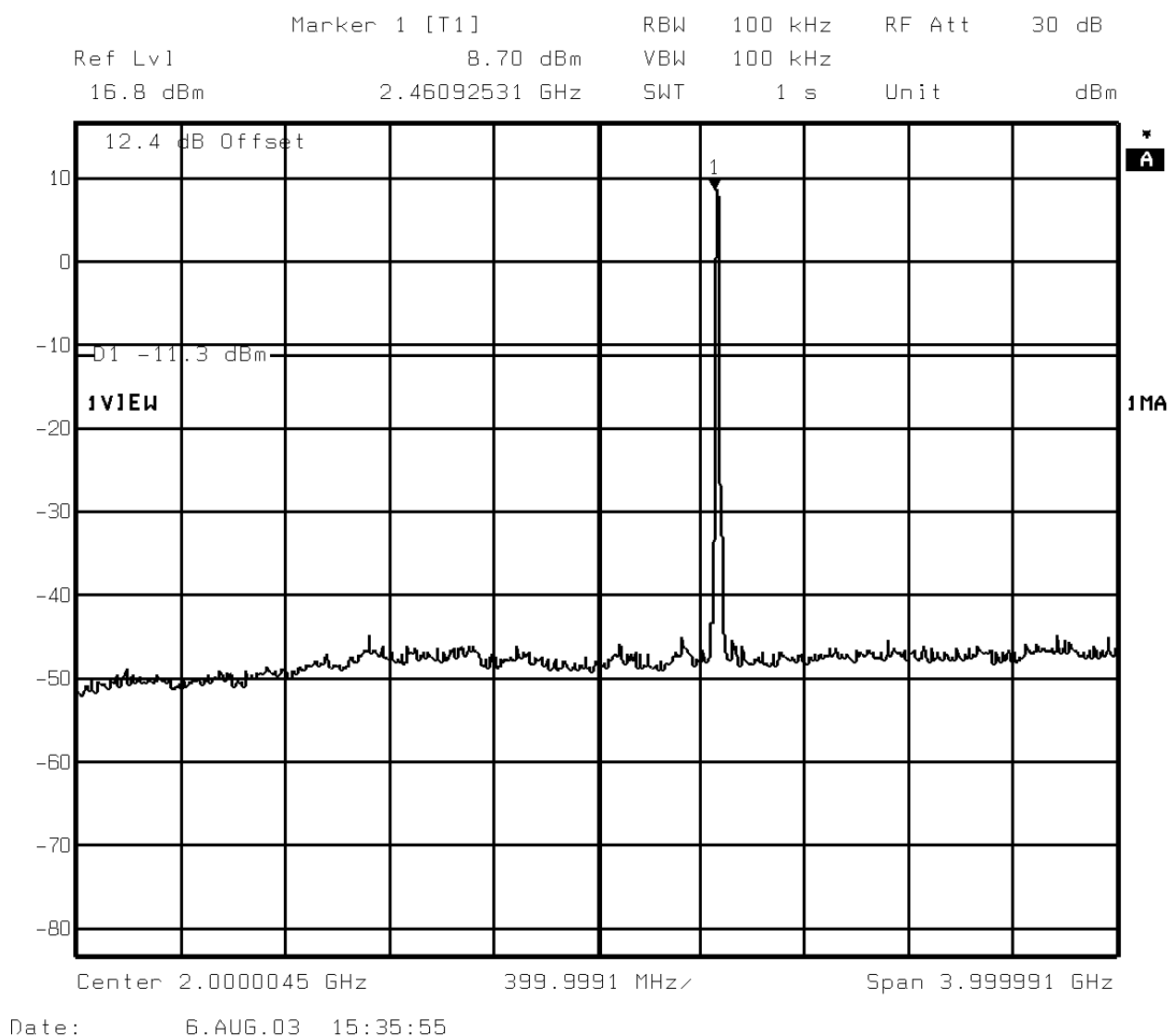
Test Case : Spurious Conducted Emissions

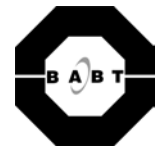
Test Date : 7th August 2003

Rule Parts : 15.247(c)

Spurious Conducted Emissions (9kHz – 4GHz)

Channel 11, (2462.0MHz) – Maximum Power 5.5Mbps

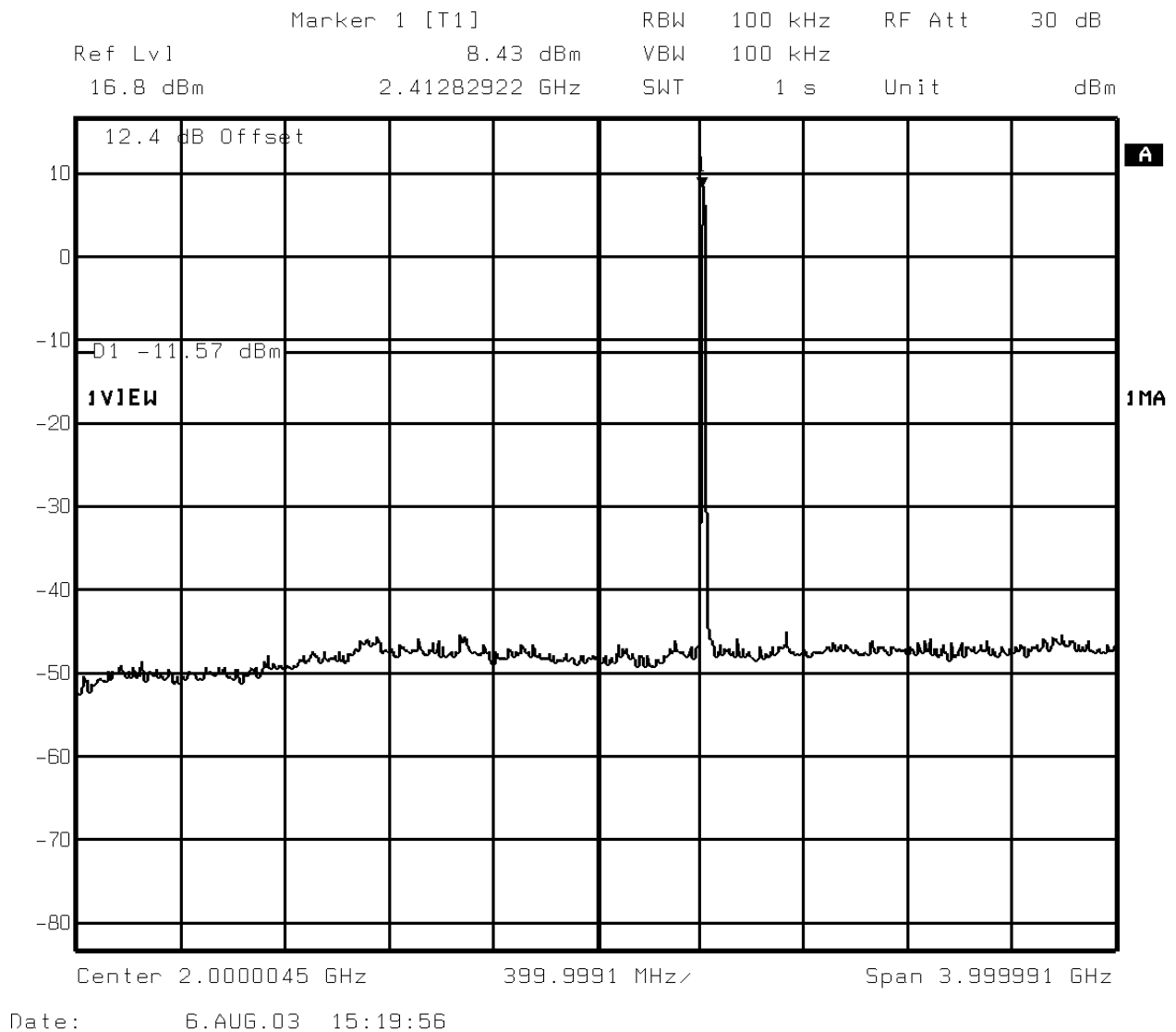


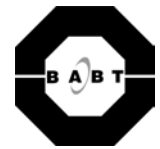


Test Case : Spurious Conducted Emissions
Test Date : 7th August 2003
Rule Parts : 15.247(c)

Spurious Conducted Emissions (9kHz – 4GHz)

Channel 1, (2412.0MHz) – Maximum Power 11Mbps

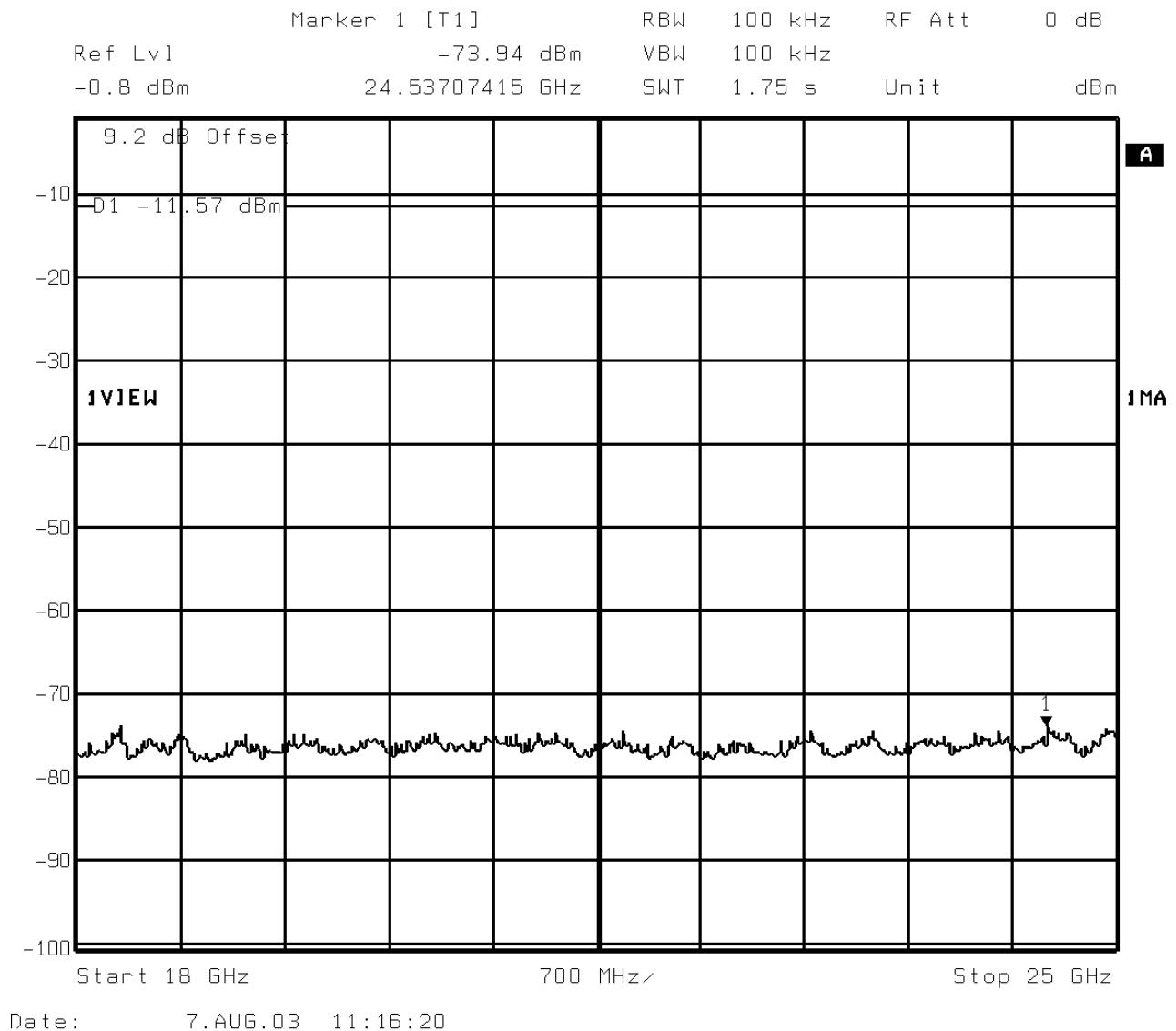




Test Case : Spurious Conducted Emissions
Test Date : 7th August 2003
Rule Parts : 15.247(c)

Spurious Conducted Emissions (18GHz – 25GHz)

Channel 1, (2412.0MHz) – Maximum Power 11Mbps





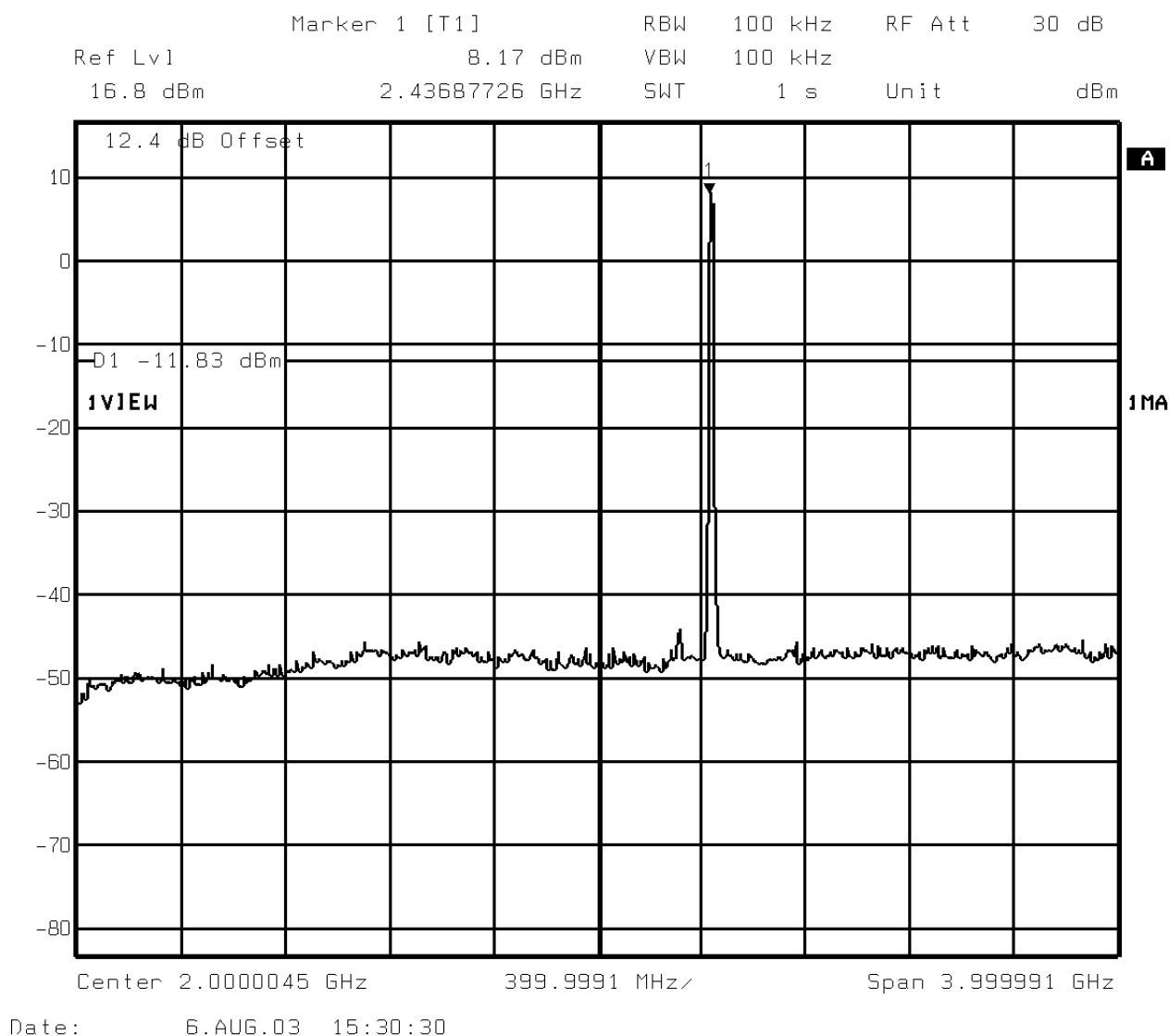
Test Case : Spurious Conducted Emissions

Test Date : 7th August 2003

Rule Parts : 15.247(c)

Spurious Conducted Emissions (9kHz – 4GHz)

Channel 6, (2437.0MHz) – Maximum Power 11Mbps

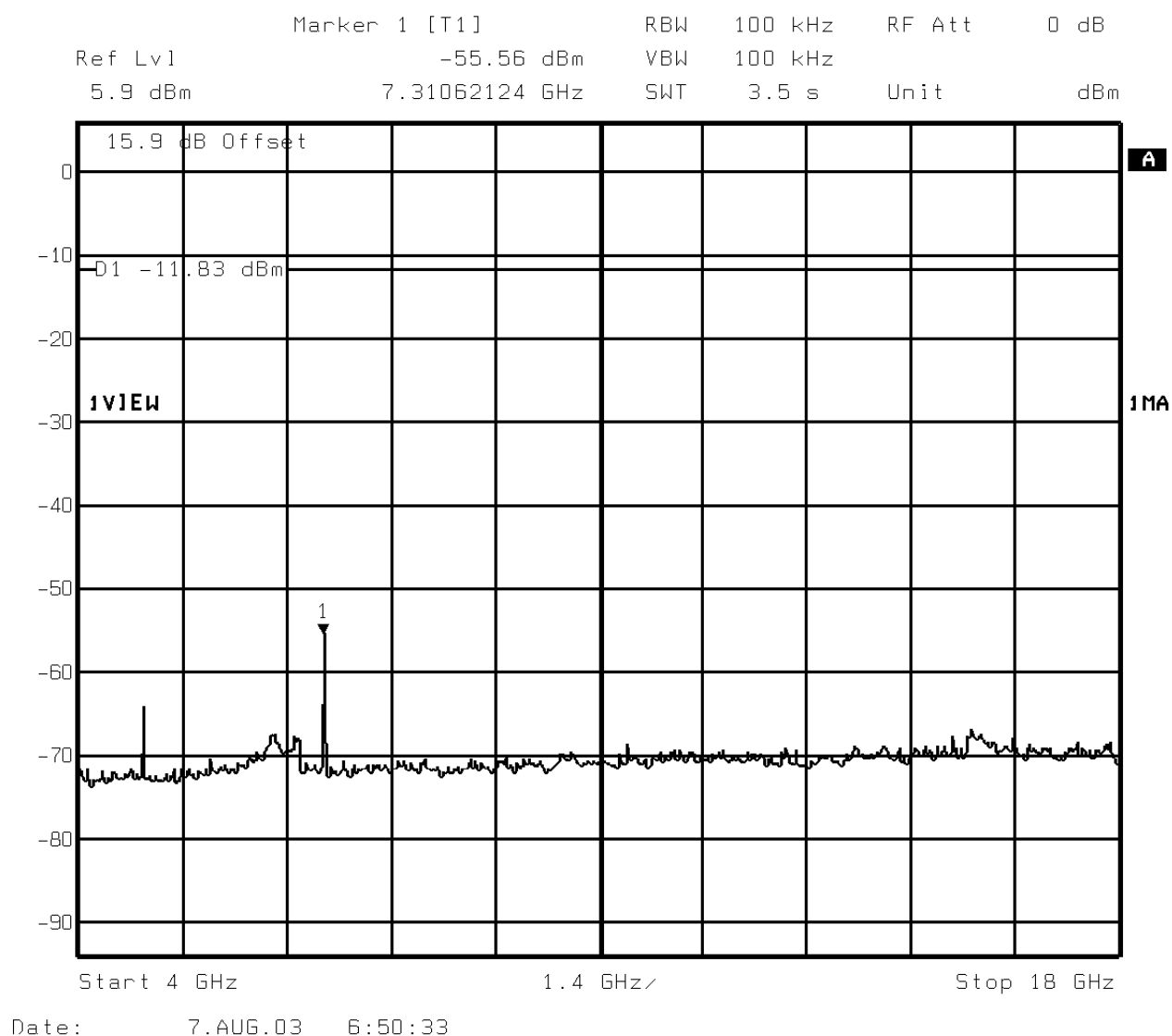




Test Case : Spurious Conducted Emissions
Test Date : 7th August 2003
Rule Parts : 15.247(c)

Spurious Conducted Emissions (4GHz – 18GHz)

Channel 6, (2437.0MHz) – Maximum Power 11Mbps

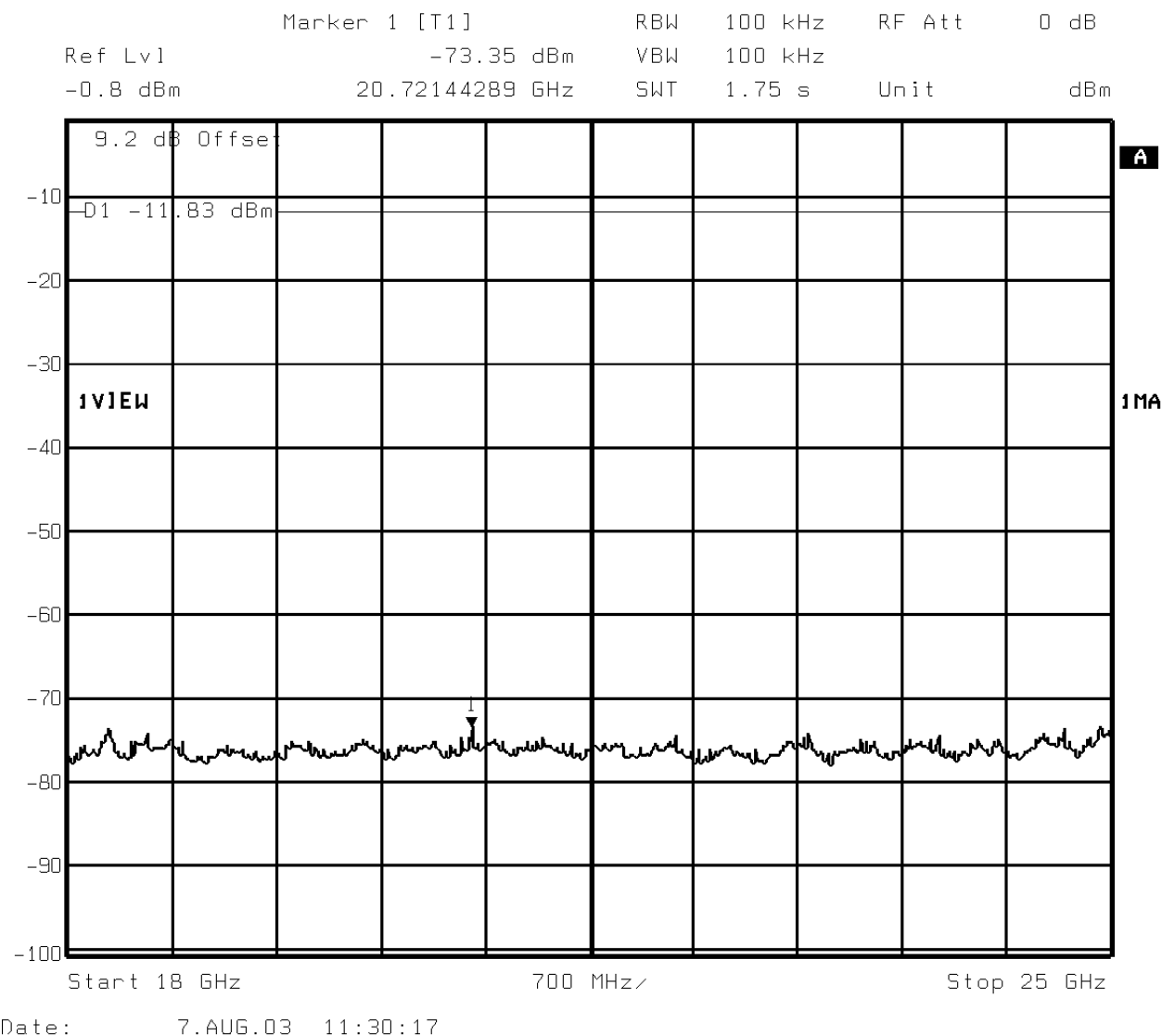




Test Case : Spurious Conducted Emissions
Test Date : 7th August 2003
Rule Parts : 15.247(c)

Spurious Conducted Emissions (18GHz – 25GHz)

Channel 6, (2437.0MHz) – Maximum Power 11Mbps





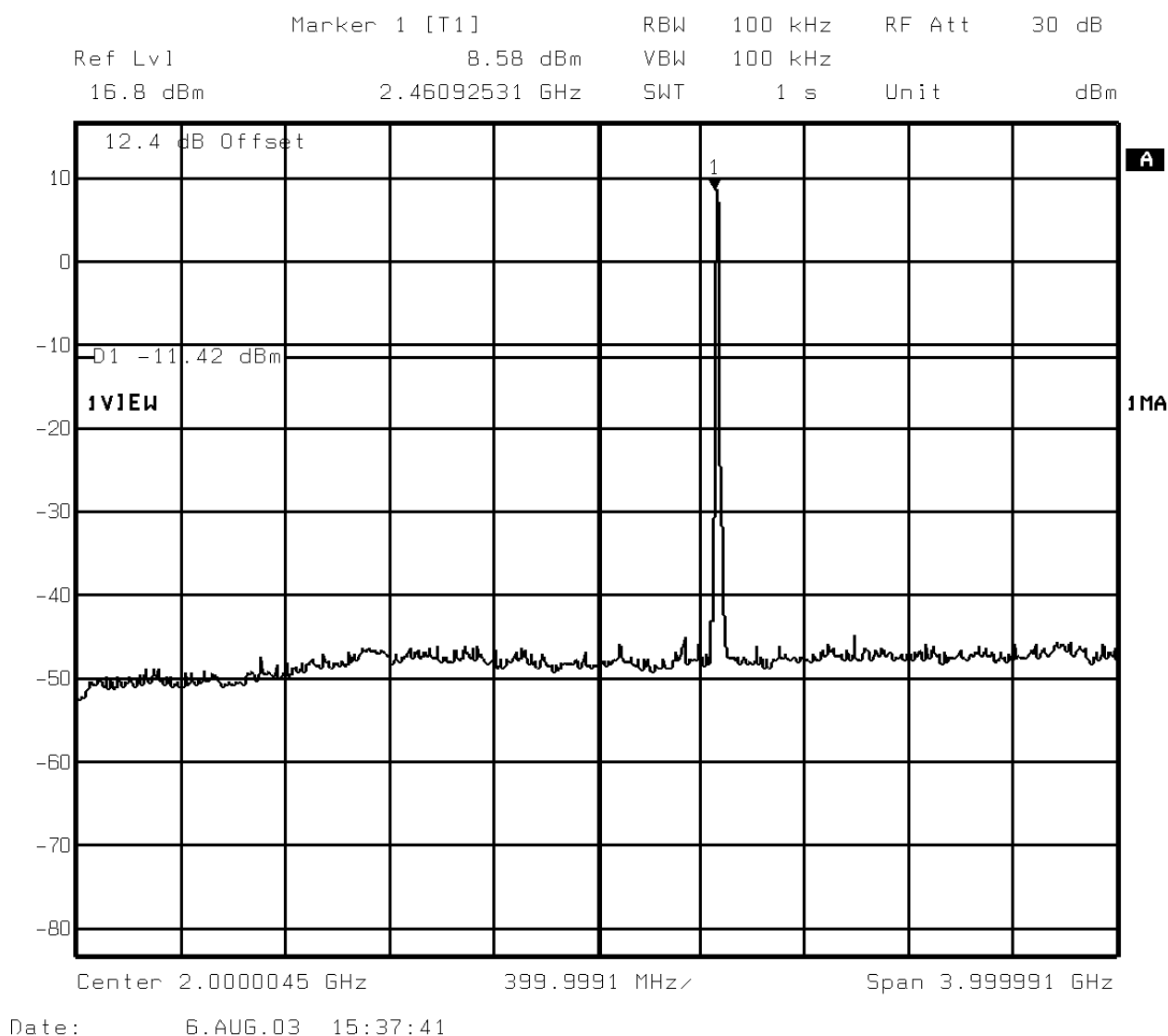
Test Case : Spurious Conducted Emissions

Test Date : 7th August 2003

Rule Parts : 15.247(c)

Spurious Conducted Emissions (9kHz – 4GHz)

Channel 11, (2462.0MHz) – Maximum Power 11Mbps





Test Case : Spurious Conducted Emissions on Power Lines
Test Date : 31st July 2003
Rule Parts : 15.207

Test Procedure

Testing to the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.207, 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.

Emissions were formally measured using a Quasi-Peak Detector, which meets the CISPR requirements. The details of the worst-case emissions for the Live and Neutral Lines are presented in Tables below respectively.

The EUT was connected to a 120V 60Hz supply.

The Conducted Emission measurements were made using a Hewlett Packard 8542E EMI Receiver.

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



Test Case : Spurious Conducted Emissions on Power Lines-continued
Test Date : 31st July 2003
Rule Parts : 15.207

Test Results

The EUT met the Class B requirements of 47 CFR 15.207 for Conducted Emissions on the Live and Neutral Lines.

EUT Tx on Bottom Channel (2.412GHz)

Conducted Emissions - Live Line

Emission Frequency (MHz)	Quasi-Peak Level (dBμV)	Quasi-Peak Limit (dBμV)	Average Level (dBμV)	Average Limit (dBμV)
0.1774	42.6	64.6	37.3	54.6
0.2838	43.6	60.7	39.4	50.7
0.3179	38.9	59.8	35.7	49.8
0.6208	37.6	56.0	37.2	46.0
0.9333	32.7	56.0	31.5	46.0
2.8670	36.5	56.0	31.3	46.0

The margin between the specification requirements and all other emissions were 18.9dB or more below the specified Quasi-Peak limit and 15.1dB or more below the Average limit.

Conducted Emissions Neutral Line :

Emission Frequency (MHz)	Quasi-Peak Level (dBμV)	Quasi-Peak Limit (dBμV)	Average Level (dBμV)	Average Limit (dBμV)
0.2828	44.4	60.8	39.6	50.8
0.3186	39.6	59.8	35.5	49.8
0.4958	38.9	56.1	32.5	46.1
0.5661	38.4	56.0	31.0	46.0
0.6203	37.4	56.0	37.0	46.0
2.584	36.7	56.0	30.7	46.0

The margin between the specification requirements and all other emissions were 18.6dB or more below the specified Quasi-peak limit and 16.3dB or more below the specified Average limit.

Procedure: Test performed in accordance with ANSI C63.4.

Performed by: A Guy, EMC Engineer.



Test Case : Spurious Conducted Emissions on Power Lines-continued
Test Date : 31st July 2003
Rule Parts : 15.207

Test Results

The EUT met the Class B requirements of 47 CFR 15.207 for Conducted Emissions on the Live and Neutral Lines.

EUT Tx on Middle Channel (2.437GHz)

Conducted Emissions - Live Line

Emission Frequency (MHz)	Quasi-Peak Level (dBμV)	Quasi-Peak Limit (dBμV)	Average Level (dBμV)	Average Limit (dBμV)
0.2832	43.8	60.8	39.6	50.8
0.3179	39.0	59.8	35.8	49.8
0.4955	40.2	56.1	29.9	46.1
0.5760	39.8	56.0	31.6	46.0
0.6214	37.5	56.0	37.1	46.0
0.9314	33.5	56.0	32.8	46.0

The margin between the specification requirements and all other emissions were 21.8dB or more below the specified Quasi-Peak limit and 12.3dB or more below the Average limit.

Conducted Emissions Neutral Line :

Emission Frequency (MHz)	Quasi-Peak Level (dBμV)	Quasi-Peak Limit (dBμV)	Average Level (dBμV)	Average Limit (dBμV)
0.2826	45.5	60.8	39.6	50.8
0.3174	41.7	59.8	35.7	49.8
0.4946	41.2	56.1	33.0	46.1
0.5667	40.3	56.0	30.9	46.0
0.6206	38.6	56.0	37.0	46.0
2.5840	37.6	56.0	31.7	46.0

The margin between the specification requirements and all other emissions was 19.7dB or more below the specified Quasi-peak limit and 17.0dB or more below the specified Average limit.

Procedure: Test performed in accordance with ANSI C63.4.

Performed by: A Guy, EMC Engineer.



Test Case : Spurious Conducted Emissions on Power Lines-continued
Test Date : 31st July 2003
Rule Parts : 15.207

Test Results

The EUT met the Class B requirements of 47 CFR 15.207 for Conducted Emissions on the Live and Neutral Lines.

EUT Tx on Top Channel (2.462GHz)

Conducted Emissions - Live Line

Emission Frequency (MHz)	Quasi-Peak Level (dBμV)	Quasi-Peak Limit (dBμV)	Average Level (dBμV)	Average Limit (dBμV)
0.2827	43.9	60.8	39.7	50.8
0.3183	39.0	59.8	35.8	49.8
0.4956	40.2	56.1	29.8	46.1
0.5657	40.0	56.0	31.7	46.0
0.6203	37.7	60.0	37.2	50.0
2.5840	37.3	60.0	31.7	50.0

The margin between the specification requirements and all other emissions was 20.8dB or more below the specified Quasi-Peak limit and 16.3dB or more below the Average limit.

Conducted Emissions Neutral Line :

Emission Frequency (MHz)	Quasi-Peak Level (dBμV)	Quasi-Peak Limit (dBμV)	Average Level (dBμV)	Average Limit (dBμV)
0.2823	44.2	60.8	39.8	50.8
0.3171	39.1	59.8	34.9	49.8
0.4945	38.6	56.1	32.3	46.1
0.5654	38.3	56.0	30.9	46.0
0.6217	37.5	60.0	37.0	50.0
2.5830	36.4	60.0	30.5	50.0

The margin between the specification requirements and all other emissions was 19.9dB or more below the specified Quasi-peak limit and 16.6dB or more below the specified Average limit.

Procedure: Test performed in accordance with ANSI C63.4.

Performed by: A Guy, EMC Engineer.



Test Case : Spurious Radiated Emissions
Test Date : 6th August 2003
Rule Parts : 15.247(c)

Measurement Method

Testing to the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(c), for Radiated Electric Field Emissions was carried out on the Measurement Test Facility detailed in Annex A. Section 15.247(c) which 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 – 25GHz 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 EUT was operating via the internal power supply of the Host.

Measurements were made with the EUT transmitting on the following channels.

Channel 1: 2412MHz
Channel 6: 2437MHz
Channel 11: 2462MHz

Spurious Radiated Emissions from 30MHz to 1GHz were made using a Rhode & Schwarz ESVP Receiver and performed on an Open Area Test Site.

Spurious Radiated Emissions from 1GHz to 25GHz were made using a Rhode and Schwarz ESIB 40 Test Receiver and performed on an Alternative Open Area Test Site.

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

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



Test Case : Spurious Radiated Emissions (cont'd)
Test Date : 6th August 2003
Rule Parts : 15.247(c)

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (30MHz – 1GHz).

EUT Tx on Bottom Channel (2.412GHz)

30MHz – 25GHz Test Site Results: The levels of the six highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBμV/m	μV/m	dBμV/m	μV/m
37.315	V	100	75	34.2	51.3	40.0	100.0
40.338	V	100	78	33.7	48.4	40.0	100.0
59.325	V	100	199	33.3	46.2	40.0	100.0
60.197	V	100	206	36.5	66.8	40.0	100.0
60.803	V	100	219	33.5	47.3	40.0	100.0
60.809	V	100	228	34.0	50.1	40.0	100.0

EUT Tx on Middle Channel (2.437GHz)

30MHz – 25GHz Test Site Results: The levels of the six highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBμV/m	μV/m	dBμV/m	μV/m
39.523	V	100	160	33.0	44.7	40.0	100.0
40.350	V	100	86	33.8	49.0	40.0	100.0
56.734	V	100	336	34.2	51.3	40.0	100.0
58.700	V	100	172	35.7	61.0	40.0	100.0
59.259	V	100	197	33.9	49.5	40.0	100.0
60.229	V	100	197	36.3	65.3	40.0	100.0



Test Case : Spurious Radiated Emissions (cont'd)
Test Date : 6th August 2003
Rule Parts : 15.247(c)

30MHz - 25GHz Frequency Range

EUT Tx on Top Channel (2.462GHz)

30MHz – 25GHz Test Site Results: The levels of the six highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
37.5430	V	100	98	34.4	52.5	40.0	100.0
56.7531	V	100	339	35.6	60.3	40.0	100.0
58.7427	V	100	182	36.9	70.0	40.0	100.0
60.2375	V	101	195	37.0	70.8	40.0	100.0
60.8291	V	100	214	34.9	55.6	40.0	100.0
60.8200	V	101	215	34.8	55.0	40.0	100.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation
deg degree

V Vertical Polarisation
Hgt Height
Azm Azimuth

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: B Bennett, EMC Engineer.



Test Case : Peak Power Spectral Density
Test Date : 5th August 2003
Rule Parts : 15.247(d)

Measurement Method

The EUT was connected to the Spectrum Analyser via a 10dB Attenuator. The EUT was set to transmit at maximum power on all three channels and at all data rates.

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 was established. This point was then centred 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, $(600 \times 10^3 / 3 \times 10^3)$, and Max Hold selected. The peak response was then measured and recorded.

The results are recorded in the table below.

Results

Frequency (MHz)	Data Rate (Mbps)	Measurement Bandwidth (kHz)	Result (dBm)
2412	1	3	-4.43
2437	1	3	-5.07
2462	1	3	-3.84
2412	2	3	-5.41
2437	2	3	-5.13
2462	2	3	-4.71
2412	5.5	3	-5.96
2437	5.5	3	-5.75
2462	5.5	3	-5.97
2412	11	3	-5.76
2437	11	3	-5.64
2462	11	3	-5.59

Limit	$\leq +8\text{dBm}/3\text{kHz}$
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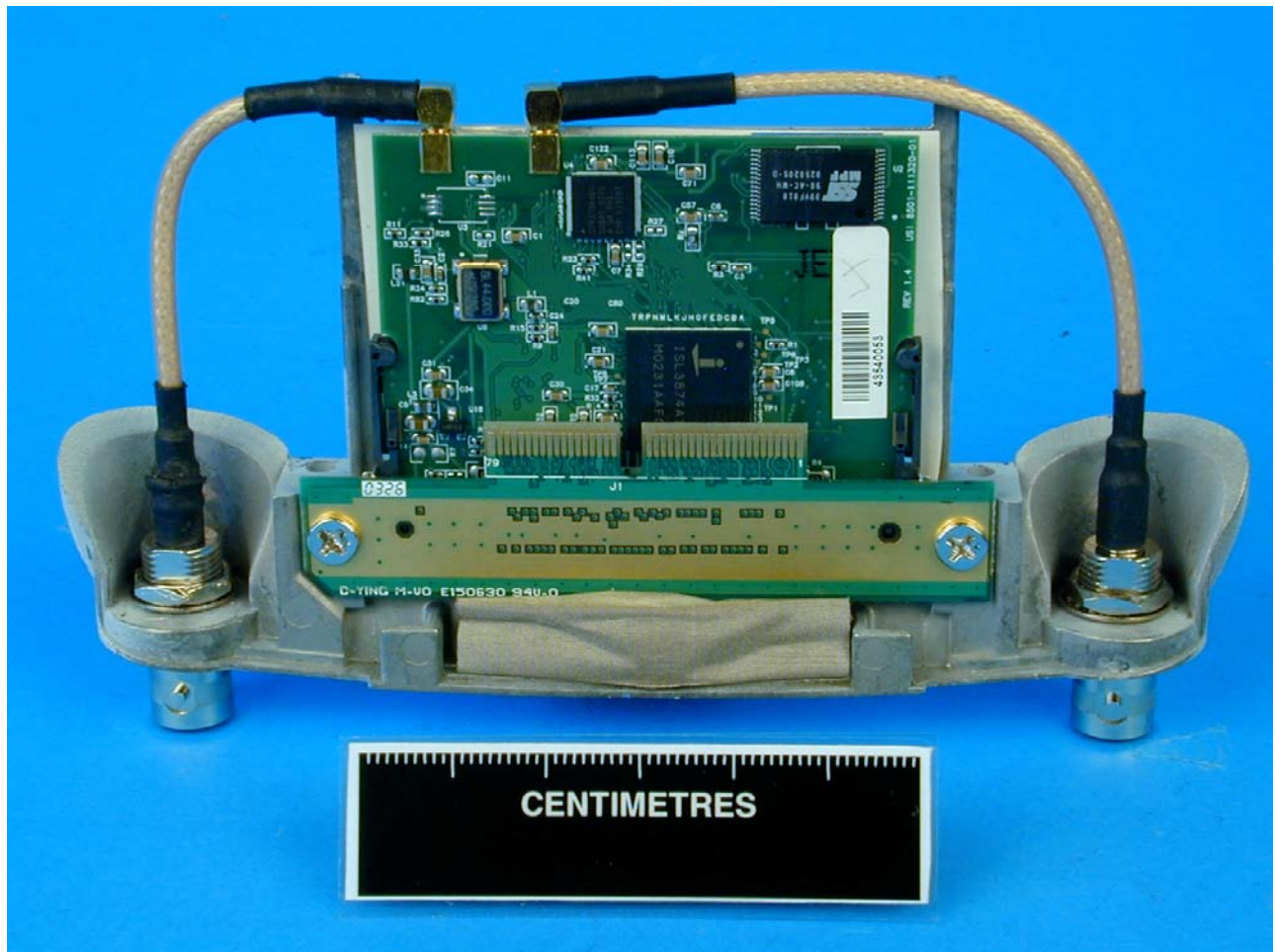
Remarks

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

Procedure: Test Performed in accordance with ANSI C63.4.

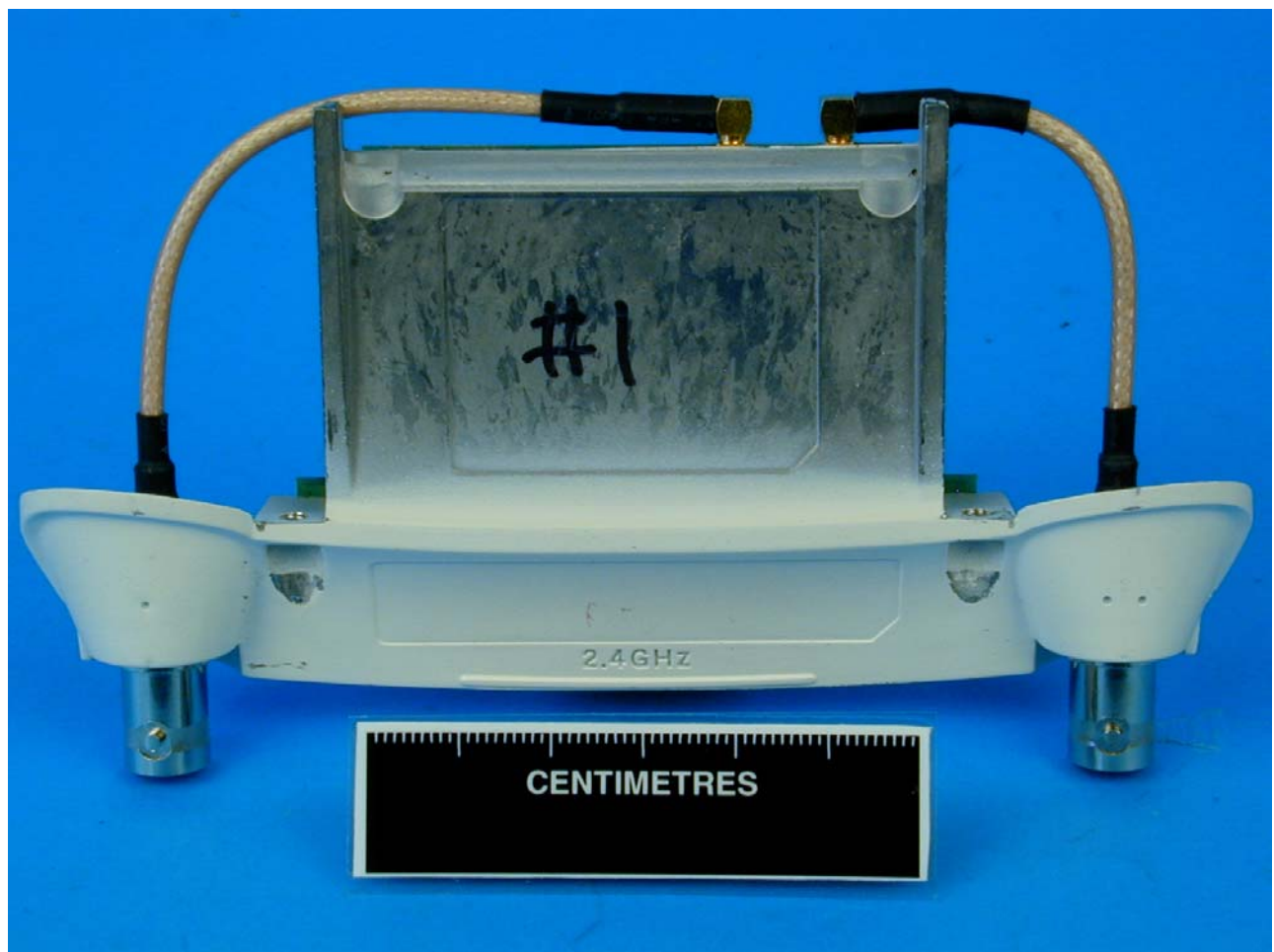
Performed by: B Airs, Radio Engineer.

PHOTOGRAPHS OF EQUIPMENT

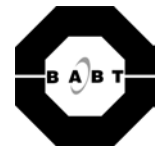


Photograph 2
Front View Symbol WSM-5030 RLAN Radio Module

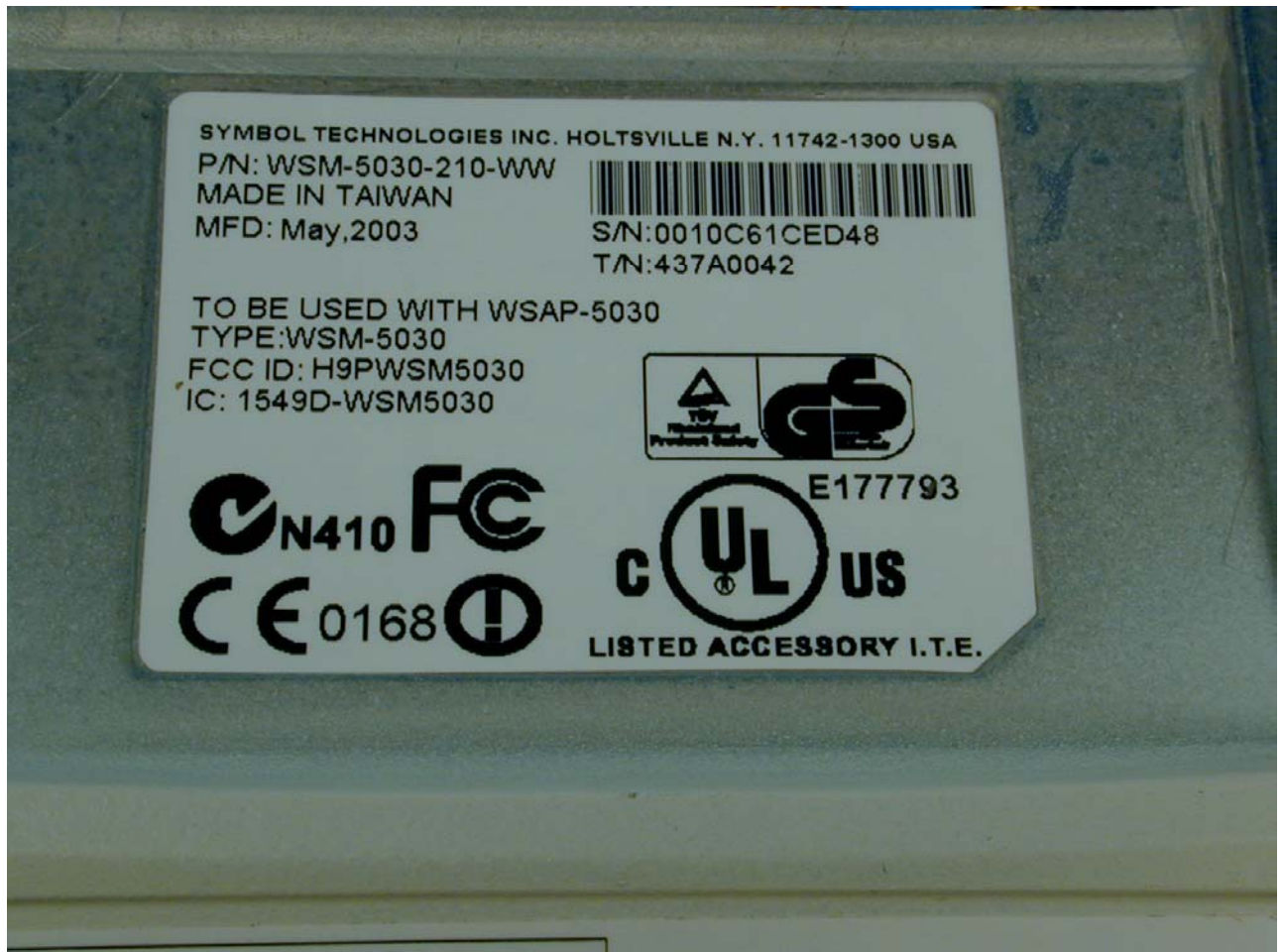
PHOTOGRAPHS OF EQUIPMENT



Photograph 3
Rear View Symbol WSM-5030 RLAN Radio Module



PHOTOGRAPHS OF EQUIPMENT



Photograph 4
Label 2 View Symbol WSM-5030 RLAN Radio Module



MEASUREMENT UNCERTAINTY

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

In the frequency range 30MHz to 1000MHz

For 6dB Bandwidth

Frequency	$\pm 210.894\text{kHz}$
Amplitude	$\pm 0.5\text{dB}$

For Maximum Output Power

Amplitude	$\pm 0.5\text{dB}$
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For Spurious Conducted Emissions

Amplitude	$\pm 3.0\text{dB}$
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For Spurious Radiated Emissions, Quasi-Peak Measurements using the ESVP Test Receiver and Bilog Antenna: - Frequency $\pm 5\text{ppm} + 500\text{Hz}$ Amplitude $\pm 4.1\text{dB}$

In the frequency range 1GHz to 25GHz

For Spurious Radiated Emissions measurements: -

Frequency	$\pm 2 \times 10^{-7} \times \text{Centre Frequency}$
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Amplitude	$\pm 3.4\text{dB}$
-----------	--------------------

For Peak Power Spectral Density

Amplitude	$\pm 1.8\text{dB}$
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0141
Group

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

UKAS Accreditation's do not cover opinions and interpretations and any expressed herein are outside the scope of any UKAS Accreditation.

Results of tests not yet included in our UKAS Accreditation Schedule are marked NUA
(Not UKAS Accredited).

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ANNEX A
FCC SITE COMPLIANCE LETTERS



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**



FEDERAL COMMUNICATIONS COMMISSION
Laboratory Division
7435 Oakland Mills Road
Columbia, MD. 21046

September 08, 2000

Registration Number: 90986

BABT Product Service
Snitterfield Road
Bearley, Stratford-upon-Avon
Warwickshire CV37 0EX
United Kingdom
Attention: Jensen Adams

Re: Measurement facility located at Bearley
3 & 10 meter site
Date of Listing: September 08, 2000

Gentlemen:

Your submission of the description 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 description has, therefore, been placed on file and the name of your organization added to the Commission's 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 this filing must be updated for any changes made to the facility, and at least every three years from the date of listing the data on file must be certified as current.

If requested, the above mentioned facility has been added to our list of those who perform these measurement services for the public on a fee basis. An up-to-date list of such public test facilities is available on the Internet on the FCC Website at WWW.FCC.GOV, E-Filing, OET Equipment Authorization Electronic Filing.

Sincerely,

Thomas W Phillips
Electronics Engineer