

**ELECTROMAGNETIC INTERFERENCE TEST REPORT**

**Doc. 20060310R1 / Project No. 1299**

**TEST STANDARD: USA 47 CFR PART 15**

**JETT.XL Handheld Computer  
FCC ID: RYJJETTXL**

**TWO TECHNOLOGIES, INC.  
HORSHAM, PA**

**TEST DATE: February 9 - 28, 2006**

**ISSUE: April 10, 2006**

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**AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION**

Certificate No: 1028.01

## **ERRATA**

This document is revision 1 to PCTC document 20060310R and is marked “Doc. 20050205R1”, dated 4/10/2006. This revision is issued to make the following additions/clarifications: (1) Added plots for the Nos. of Hopping Channels, Channel separation, Antenna Port conducted emissions and Spectral Density. (2) Revised 20 db Occupied bandwidth/bandedge measurements with proper modulations, and (3) Clarified about the setting of bandwidth used during the emission measurements (Section 4.1.1).

## PREFACE

This report documents product testing conducted to verify compliance of the specified EUT with applicable standards and requirements as identified herein. EUT, test instrument configurations, test procedures and recorded data are generally described in this report. The reader is referred to the applicable test standards for detailed procedures. The following table summarizes the test results obtained during this evaluation.

## SUMMARY

The Two Technologies, model JETT.XL Handheld Computer (FCC ID: RYJJETTXL) was tested to the standards listed below, and found to have the following characteristics:

TEST	STANDARD	REQUIREMENT	RESULT
Radiated Emissions - Intentional Radiation	FCC Part 15C, Section 15.247 and Section 15.205	Emissions up to 10 Harmonics in the Restricted Bands	Below Max. Permissible limit
Radiated Emissions - Spurious and Unintentional Radiation	FCC Part 15C, Section 15.209 FCC Part 15B, Class A	30 MHz – 25 GHz	Below Max. Permissible limit
Conducted Emissions - AC Power lines	FCC Part 15C, Section 15.207 FCC Part 15B, Class B	150 KHz - 30 MHz	Below Max. Permissible limit
Antenna Port	FCC Part 15C, Section 15.247	Operating Band 2.4000 MHz – 2.4835 MHz	Below Max. Permissible limit

## EUT Modifications

No modifications were made on the JETT.XL handheld computer during the EMI testing.

<b>MEASUREMENT UNCERTAINTY</b>				
Measurement Type	Measurement Dist	Frequency Range	Measurement Limit	Expanded Combined Uncertainty
Radio Disturbance	10 meters	30 MHz to 1 GHz	Class A	4.3 dB
Radio Disturbance	10 meters	30 MHz to 1 GHz	Class B	5.0 dB
Radio Disturbance	3 meters	30 MHz to 1 GHz	Class B	4.3 dB
Conducted Disturbance	N/A	150 kHz to 30 MHz	Class A or B	3.6 dB

As all values of uncertainty are less than the CISPR 16-4:2002 recommendations, no adjustments to measured data presented in this report are required.

### **LAB CERTIFICATIONS/ACCREDITATIONS**

The testing presented in this report is covered under one or a combination of all of the following Certifications or Accreditations.

<b>AGENCY</b>	<b>CERT/REG. NUMBER</b>
American Association of Laboratory Accreditation	1028.01
FCC	91047
Canada	IC3442
Taiwan - BSMI	SL2-IN-E-1037
Japan – VCCI (OATS Site – Radiated Emissions)	R-1191
Japan – VCCI (OATS Site – Conducted Emissions)	C-1241
Japan – VCCI (Shielded Enclosure Site – Conducted Emissions)	C-1242

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**1.0 Description of the Equipment Under Test (EUT)**

Equipment Identification	Handheld Computer
Model Number	JETT.XL
ID Number	Unit 1: HH301490 (No modification) Unit 2: None (with SMA connector at the antenna port)
Manufacturer	Two Technologies, Inc. 419 Sargon Way Horsham, PA 19044
Technical Contact	Philip Lanese
Condition Received	Acceptable for Test
Date Received	February 9, 2006
Sample Type	Preproduction Unit
Equipment Classification	Intentional Radiator, Unlicensed Low power Transmitter
Unisys Test Personnel	Itamar Gonen Dipak Patel

Unless otherwise noted in the individual test results sections, testing was performed on the EUT configured as follows.

**1.1 General Description**

The model JETT.XL is a handheld computer for commercial use. It is a transceiver incorporating Bluetooth and a serial interface. The JETT.XL uses Windows CE 5.0 as its operating system. The front face of the JETT.XL has color display and a keypad. It has an Intel PXA270 XScale microprocessor that operates at 624 MHz.

The JETT.XL handheld computer operates with a 7.2 VDC Nickel Metal Hydride (NiMH) rechargeable battery pack. The JETT.XL incorporates Maxim MAX1755 integrated Circuit voltage regulator. The battery pack can provide up to twelve hours of operating time on a full charge (depending on power management and use). The JETT.XL is supplied with 120 volts AC adaptor (Stancor model STA-5712) primarily for charging the battery pack. However in the emergency, if there is no battery installed, then the AC adaptor will supply the voltage regulator (Maxim MAX1775) on the CPU PCB with power, otherwise the battery will.

The JETT.XL integral Bluetooth operates with 79 channels with operating frequency range 2.402 - 2.480 GHz. It incorporates frequency hopping with GFSK modulation techniques.



**Photo 1: JETT.XL – Front/Side View**



**Photo 2: JETT.XL – Rear/Side View**





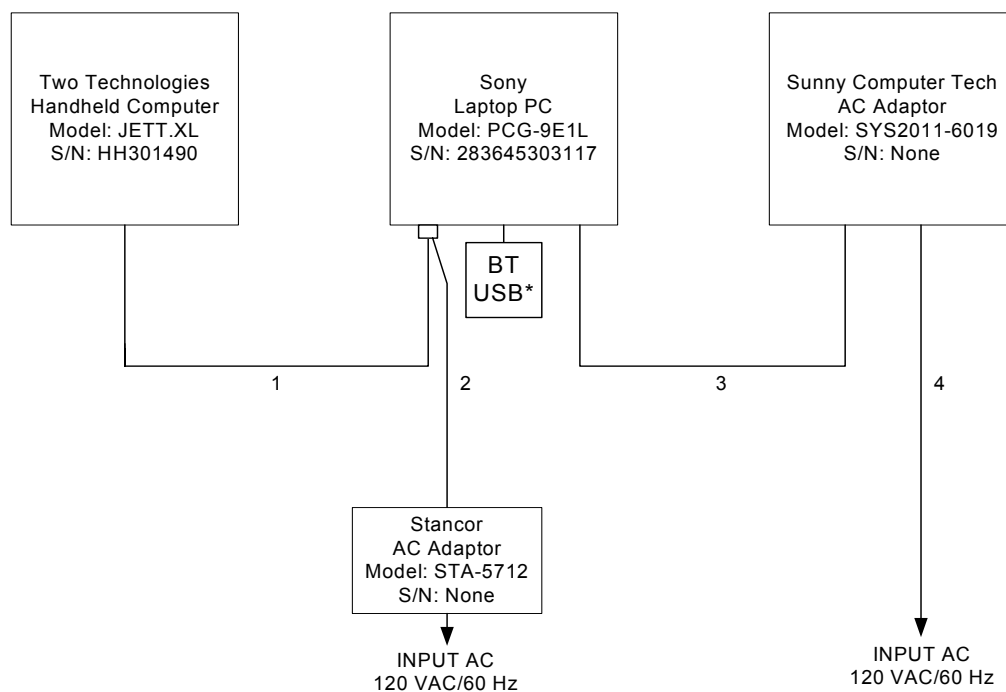
**Photo 3: Stancor model STA-5712AC Adaptor**

## **1.2 Test Configurations**

Testing was carried out on a single EUT configuration. The EUT, mounted a wooden stand, was placed on a wooden table of 80 cm height. Since the EUT is a handheld device, it was tested with placing it in each of the three orthogonal axes for radiated emission evaluation.

### **Block Diagram and Cable listing**

A block diagram of the EUT configuration showing interconnection cables is shown on the next page for reference. The drawings show the physical hardware layout used for the tests along with I/O cables connection and AC power distribution. A description of any external interface cable present during the test is attached to this drawing for reference.



\*: Belkin Model F8T001  
Bluetooth USB Adaptor

**Note:**  
Details of interconnecting cables  
are provided on the next page

**Figure 1 – Block Diagram, EUT Test Configuration**

**List of Cable Interconnections**

<b>Reference Designation</b>	<b>Cable Function</b>	<b>Cable Type</b>	<b>Cable Length (feet)</b>	<b>Remark</b>
1	Serial Data/Power cable	Shielded	15	-
2	12 VDC Cable	Unshielded	6.3	Part of Stancor AC Adaptor
3	19 VDC Cable	Unshielded	6.3	Part of Sunny AC Adaptor
4	Input AC Cable	Unshielded	6.5	Part of Sunny AC Adaptor

**Detailed EUT Hardware Listing**

The JETT.XL has a permanently attached antenna. The detail of hardware tested is listed below:

<b>Description</b>	<b>Manufacturer</b>	<b>Manufacturer Part Number</b>
CPU PCB	Two Technologies	14644
Sharp Display PCB	Two Technologies	13966
Power Distribution Flex Circuit FFC	Two Technologies	13967
Interface PCB	Two Technologies	14744
Compact Flash PCB	Two Technologies	14751
Charger PCB	Two Technologies	13964
Bluetooth TX/RX Module	Phillip Electronics	BGW203
Voltage Regulator	Maxim	MAX1775
Microprocessor	Intel	CY8C24223A-24SXI
AC Adaptor	Stancor	STA-5712

**Test Support Items**

The following device was used to verify the EUT operation.

<b>Description</b>	<b>Manufacturer</b>	<b>Model Number</b>	<b>S/N or ID Number</b>
Laptop PC	Sony	PCG-9E1L	
AC Adaptor	Sunny Computer Tech	SYS2011-6019	None
Bluetooth USB Adaptor	Belkin	F8T001, Ver. 2	None

### **1.3 Rationale for the Chosen Configuration**

The tested configuration of the JETT.XL represents actual deliverable hardware. During the testing, the EUT was configured with serial interface connection and AC adaptor. This represents the maximum configuration of the EUT

### **1.4 EUT Modifications**

No modifications were made on the JETT.XL handheld computer during the EMI testing.

## **2.0 Operation of the EUT During Testing**

Unless otherwise noted in the individual test results sections, testing was performed on the EUT as follows.

### **2.1 General**

#### **Climatic Environment**

The following were the ambient conditions in the laboratory during testing:

Temperature:  $22^{\circ}\text{C} \pm 5^{\circ}\text{C}$

Relative Humidity  $50\% \pm 10\% \text{ RH}$

#### **Input Power**

The JETT.XL Computer was powered from its integral battery pack. The battery was also being recharged from the Stancor model STA-5712 AC adaptor. The AC adaptor was supplied with input AC power at 120 VAC/60 Hz.

### **2.2 Operating Mode**

During the emissions testing, the JETT.XL Computer was operated for two modes of operation

**Mode 1:** Continuous transmit/receive mode of operation. The EUT was communicating continuously with wireless Bluetooth interface as well as RS-232 interface.

**Mode 2:** As per the FCC rules, the intentional radiation/conduction testing was performed with operating the JETT.XL Computer at three selected transmission frequencies (Low, Medium and High) as identified below:

Channel 0 – 2.402 GHz (Low TX)

Channel 47 – 2.449 GHz (Medium TX)

Channel 78 – 2.480 GHz (High TX)

### **2.3 Rationale for the Chosen Mode of Operation**

The continuous transmit/receive mode of operation simulates the actual transmit/receive application of the EUT for both the Bluetooth as well as serial interface communication. Further, as per the FCC rules, intentional radiated testing was performed at the selected three frequencies, therefore it was considered as appropriate operating modes for the EMI evaluation.

### **3.0 Applicable Requirements, Methods and Procedures**

#### **3.1 Applicable Requirements**

The results of the measurement of the radio disturbance characteristics of the EUT described herein may be applied and, where appropriate, provide a presumption of compliance to one or more of the following requirements or to other requirement at the discretion of the client, regulatory agencies, or other entities.

##### **USA**

47 CFR, Part 15, Radio Frequency Devices,

- Subpart B, "Unintentional Radiators".
- Subpart C, "Intentional Radiators".

##### **Canada**

Industry Canada (IC) Spectrum Management and Telecommunication, Radio Standards Specifications:

- RSS-Gen, "General Requirements and Information for the Certification of Radiocommunication Equipment". Issue 1, September 2005.
- RSS-210, "Low Power License – Exempt Radiocommunication Devices (All Frequency Bands): Category I equipment", Issue 6, September 2005.

#### **3.2 Basic Test Methods and Procedures**

The applicable regulatory product family or generic standards require that radio disturbance/interference tests be performed in accordance with the following:

- C63.4, 2003 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in The Range of 9 kHz to 40 GHz".

#### **3.3 Deviations Or Exclusions From The Requirements And Standards**

There were no deviations or exclusions from the requirements and standards.

## 4.0 Test Results

### 4.1 Radiated Emissions

#### 4.1.1 Radiated Emissions Test Procedure

##### Radiated Emissions 30 MHz – 1000 MHz

Initial measurements, for the purpose of identifying suspect emissions from the equipment under test, were performed by dividing the test frequency range into the following twenty bands:

Band	Frequency Range	Band	Frequency Range	Band	Frequency Range
1)	30 - 40 MHz	8)	108 - 148 MHz	15)	570 - 670 MHz
2)	40 - 50 MHz	9)	148 - 165 MHz	16)	670 - 770 MHz
3)	50 - 88 MHz	10)	165 - 200 MHz	17)	770 - 855 MHz
4)	88 - 93 MHz	11)	200 - 300 MHz	18)	855 - 875 MHz
5)	93 - 98 MHz	12)	300 - 450 MHz	19)	875 - 892 MHz
6)	98 - 103 MHz	13)	450 - 470 MHz	20)	892 - 1000 MHz
7)	103 - 108 MHz	14)	470 - 570 MHz		

Each of these bands was monitored on a spectrum analyzer display while the turntable was initially positioned at the reference 0 degree point. A mast mounted broadband antenna was located at a distance of 3/10 meters (as applicable) from the periphery of the EUT(s). The antenna was set to a height of 1 meter, for the vertical polarity and a height of 2.5 meters, for horizontal polarity for these suspect emission scans. All emissions with amplitudes 8 dB or less below the appropriate regulatory limit were identified and saved for later source identification and investigation. This initial suspect identification procedure was repeated for turntable positions of 90, 180 and 270 degrees. The resolution bandwidth was set to 120 KHz.

The source of questionable emissions was verified by powering off the EUT(s). Those emissions remaining were removed from the suspect list. Valid suspect emissions were then maximized through cable manipulation. The highest six signals or all within 4 dB of the limit, identified during this initial investigation, were then maximized by rotating the turntable through a complete 360 degrees of azimuth and then raising the antenna from 1 to 4 meters of elevation with the turntable positioned at the angle of maximum signal level. When the EUT(s) azimuth, antenna height and polarization that produced the maximum indication were found, the emission amplitude and frequency were remeasured to obtain maximum peak and quasi-peak field strength. The frequencies and amplitudes of RFI emissions are recorded in this report in units derived as follows:

$$\text{Field Strength (dBuV/m)} = \text{meter reading (dBuV)} + \text{antenna factor (dB/m)} + \text{Cable Loss (dB)}$$



**Radiated Emissions above 1 GHz**

The required test frequency range above 1 GHz, was scanned manually by placing a Double Ridged Guide antenna at a distance of 3 meters from the perimeter of the equipment under test. Emissions were monitored using EMI Test Receiver ESIB 40 set for a 1 MHz resolution bandwidth with rotating the turntable through a complete 360 degrees of azimuth. Both horizontal and vertical antenna polarities were investigated for suspect emissions. The support equipment and test item(s) were powered off in turn to determine the source of the emissions. The test procedure described above for 30 –1000 MHz was observed to maximize the emissions. The measurements were made with both peak and average detectors. The field strengths were recorded as follows:

$$\text{Field Strength (dBuV/m)} = \text{Meter reading (dBuV)} + \text{Correction Factor}^*$$

\* Correction Factor includes Antenna Factor (dB/m) + Cable Loss (dB) – Amplifier Gain (dB)

**4.1.2 Radiated Emissions Test Results (2/9/06 – 2/24/06)****Restricted Bands Radiated Emissions Test - FCC Part 15.205**

Radiated emission scan for the harmonics and spurs emissions in the restricted bands (FCC 15.205) up to the 10<sup>th</sup> Harmonics of the fundamental transmission frequency were made. Testing was performed with the JETT.XL operating at the following transmission frequencies:

Channel 0 – 2.402 GHz (Low TX)  
Channel 47 – 2.449 GHz (Medium TX)  
Channel 78 – 2.480 GHz (High TX)

For each of the fundamental transmitting frequency, testing was carried out with EUT mounting in three orthogonal axes.

No emission with significant level with respect to with the limit specified by FCC Part 15.209 was detected.

**Radiated Emissions Test - FCC Part 15.109 and 15.209**

Emission scan for detection of spurious and unintentional radiation was performed. The recorded levels are compared with the applicable limit specified in FCC Part 15, Section 15.209 which is the same limit as FCC Part 15 specified for Class B digital devices for the test measurement frequency spectrum. Measurement scan was performed for the frequency range of 30 MHz to 25 GHz, at the test distance of 3 meters.

Testing was performed with the JETT.XL in continuous transmit/receive mode of operation. The EUT was communicating continuously with wireless Bluetooth interface as well as RS-232 interface. Emission scan was carried out with EUT mounting in all three orthogonal axes. Out of three orthogonal axes, the EUT in side orientation was determined to be worst case emission orientation. The results of the measurements with EUT in side orientation are presented on the next page. It may be noted that initially, all the detected levels were compared with the limit specified in FCC Part 15, Section 15.209. Those emission levels found to be within -1db or above the Section 15.209 limit were identified for determination RF source. If the identified emission was found to be generated by the digital circuit activity and not the TX/RX RF circuit activity then it was considered as unintentional radiated emission. In that case, the FCC Part 15.109 Class A limit for digital devices was applied. In the following table, those levels are compared with the Class A limit as identified with Note 1 in the remark column.

### EUT in Side Orientation

Freq [MHz]	Q-Pk [dBuV/m]	Ant Pol	Angle [deg]	Ht [cm]	CF [dB]	Limit* [dBuV/m]	Delta [dB]	Remark
47.987	41.44	V	264	102	16.13	49.5	-8.06	Note 1
47.987	31.08	H	99	340	16.13	49.5	-18.42	Note 1
80.372	30.77	V	307	137	8.36	40	-9.23	
80.372	25.42	H	46	299	8.36	40	-14.58	
174.343	26.63	V	94	100	11.57	43.5	-16.87	
174.343	29.81	H	158	144	11.57	43.5	-13.69	
175.246	37.52	V	275	400	11.55	43.5	-5.98	
175.246	34.4	H	121	225	11.55	43.5	-9.1	
184.612	44.08	V	86	361	11.71	54.0	-9.92	Note 1
184.612	38.04	H	308	224	11.71	54.0	-15.96	Note 1
221.147	29.93	V	225	184	13.74	46	-16.07	
221.147	38.41	H	180	114	13.74	46	-7.59	
225.343	31.71	V	226	183	14.03	46	-14.29	
225.343	38	H	150	118	14.03	46	-8	
235.124	34.13	V	233	196	14.32	46	-11.87	
235.124	41.99	H	183	114	14.32	46	-4.01	
241.681	35.1	V	243	163	14.51	46	-10.9	
241.681	42.74	H	186	107	14.51	46	-3.26	
248.303	42.4	H	197	102	14.7	46	-3.6	
248.303	34.68	V	234	175	14.7	46	-11.32	
254.86	33.38	V	223	153	14.92	46	-12.62	
254.86	39.83	H	293	102	14.92	46	-6.17	
278.321	28.65	V	225	164	15.68	46	-17.35	
278.321	35.36	H	296	100	15.68	46	-10.64	
312.011	41.42	V	227	136	16.52	56.9	-15.48	Note 1
312.011	47.31	H	207	100	16.52	56.9	-9.59	Note 1
345.687	25.47	V	230	117	17.33	46	-20.53	
345.687	29.05	H	290	247	17.33	46	-16.95	
373.344	41	V	317	101	18.22	56.9	-15.9	Note 1
373.344	45.13	H	89	103	18.22	56.9	-11.77	Note 1
555.247	38.98	V	247	109	21.76	46	-7.02	
555.247	42.21	H	321	262	21.76	46	-3.79	

\*: FCC Part 15, Section 15.209, except as noted in Note 1 below:

**Note 1:** Emission at this frequency was identified as unintentional emission generated by the digital circuit activity and not the TX/RX RF circuit activity. Therefore this emission level shall meet the, FCC Part 15.109 Class A limit for digital devices. This emission level is compared with the Class A limit, extrapolated to 3 meter test distance.

**Overall Results:** All the detected EUT signals are under the FCC Part 15, Section 15.209 limit at 3 meters or FCC Part 15, Section 15.209, Class A digital devices limit extrapolated at 3 meters, as applicable.

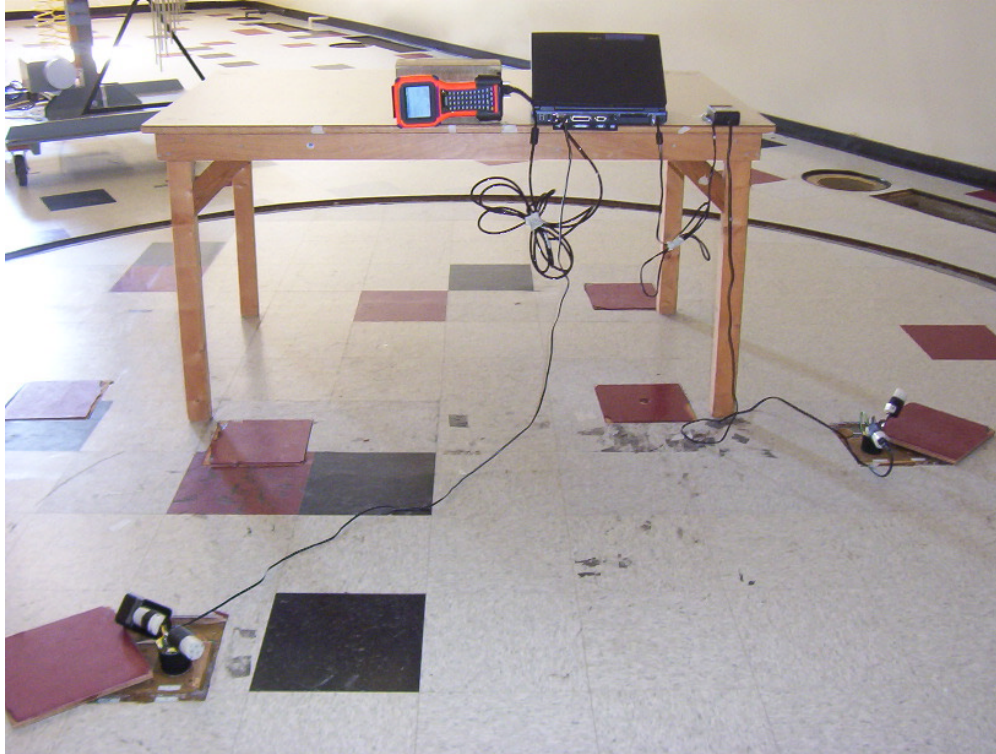
**Test Setups**



**Photo 4: Radiated Emission Test Setup – Vertical Orientation, Front View**



**Photo 5: Radiated Emission Test Setup – Vertical Orientation, Rear View**



**Photo 6: Radiated Emission Test Setup – Side Orientation, Front View**





**Photo 7: Radiated Emission Test Setup – Side Orientation, Rear View**



**Photo 8: Radiated Emission Test Setup – Flat Orientation, Front View**





**Photo 9: Radiated Emission Test Setup – Flat Orientation, Rear View**

## **4.2 AC Power Lines Conducted Emissions**

### **4.2.1 Conducted Emission Test Procedure**

Peak amplitude terminal voltage emissions at the AC power input port of the Stancor model STA-5712 AC Adaptor, were measured with a receiver, using a peak detector and the appropriate CISPR bandwidth, connected to the RF output of a 50 Ohm, 50 microhenry Line Impedance Stabilization Network (LISN) installed in each power line. Peak detector emission data measurements were made over the frequency range from 150 kHz to 30 MHz while the EUT(s) was operating as described in paragraph 2.2.

Note: For speed and convenience, a receiver employing a peak detector was used to sweep through and record the spectrum. As a tool to judge compliance of the emissions, the peak detector sweep is displayed and graphed against the appropriate average limit. This type of measurement is valid given that the peak reading will always be greater than or equal to the average or quasi-peak reading. From the Peak detector emission data plot, the top six (6) emissions or any other peak emissions that exceed the average limit, or are found to be within 1 dB of the average limit, are re-measured using receiver with the detector function first set to quasi-peak and then to average. These measurements are recorded and presented in the table format below the peak emission graph.

The amplitudes of emissions measured on the AC power lines of the EUT(s) are recorded in this report in units derived as follows:

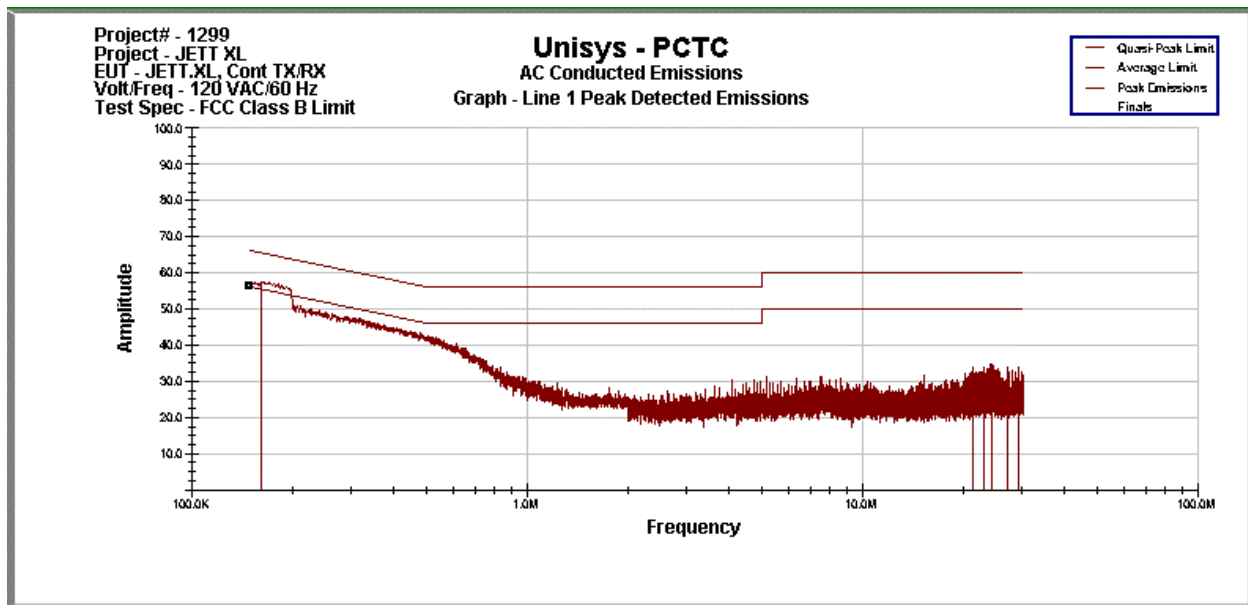
***Conducted Emission (dBuV) = Meter reading (dBuV) + Correction Factor\****

\* Correction Factor = Cable Loss (dB) + LISN factor (dB) + Limiter Loss (dB).

#### 4.2.2 Conducted Emissions Test Results (2/27/2006)

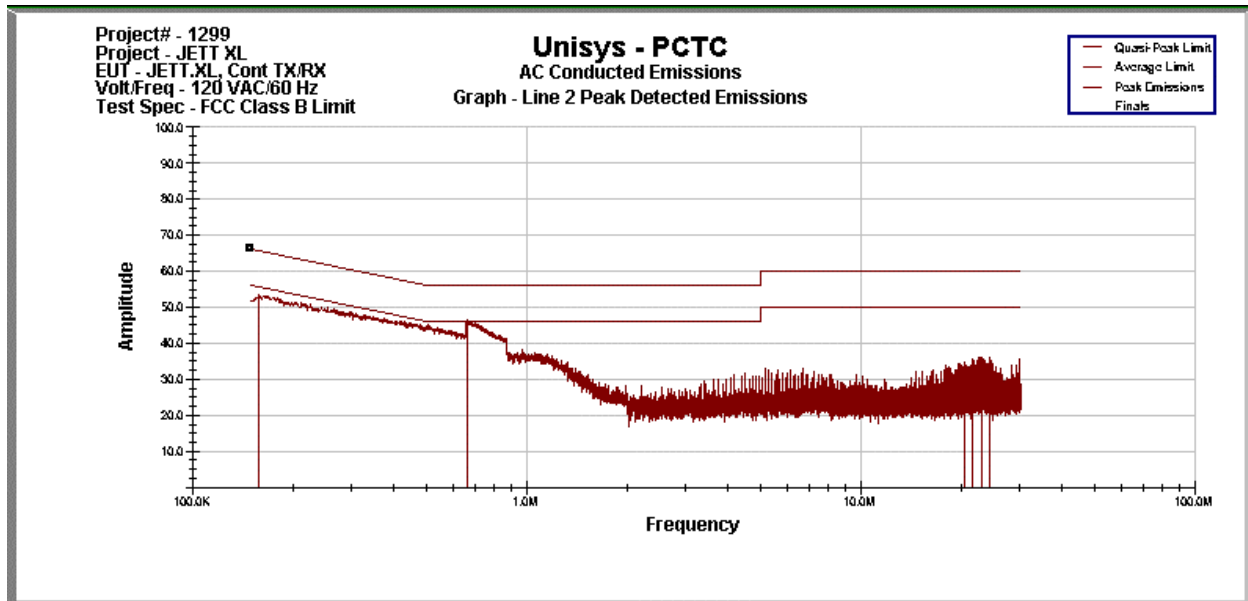
The conducted emissions recorded at the AC power input port of the Stancor model STA-5712 AC Adaptor for the JETT.XL, displayed against the limits for FCC 15.207 (same as FCC Class B Conducted Emission limit) are presented below:

#### JETT.XL Handheld Computer, Continuous TX/RX – Line 1



Unisys - PCTC							
Line 1 Conducted Emissions							
02:36:47 PM, Monday, February 27, 2006							
	1	2	3	4	5	6	7
Frequency	AVG	AVG	AVG	QP	QP	QP	Corr
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor
162.000 KHz	28.67	55.66	-26.98	45.63	65.66	-20.02	13.067
21.427 MHz	16.76	50.00	-33.24	21.92	60.00	-38.08	10.640
22.961 MHz	16.87	50.00	-33.13	21.60	60.00	-38.40	10.726
24.174 MHz	17.21	50.00	-32.79	22.08	60.00	-37.92	10.794
26.922 MHz	16.27	50.00	-33.73	20.54	60.00	-39.46	11.003
29.114 MHz	18.56	50.00	-31.44	21.66	60.00	-38.34	11.200
Project# - 1299							
Project - JETT XL							
EUT - JETT.XL, Cont TX/RX							
Volt/Freq - 120 VAC/60 Hz							
Test Spec - FCC Class B Limit							

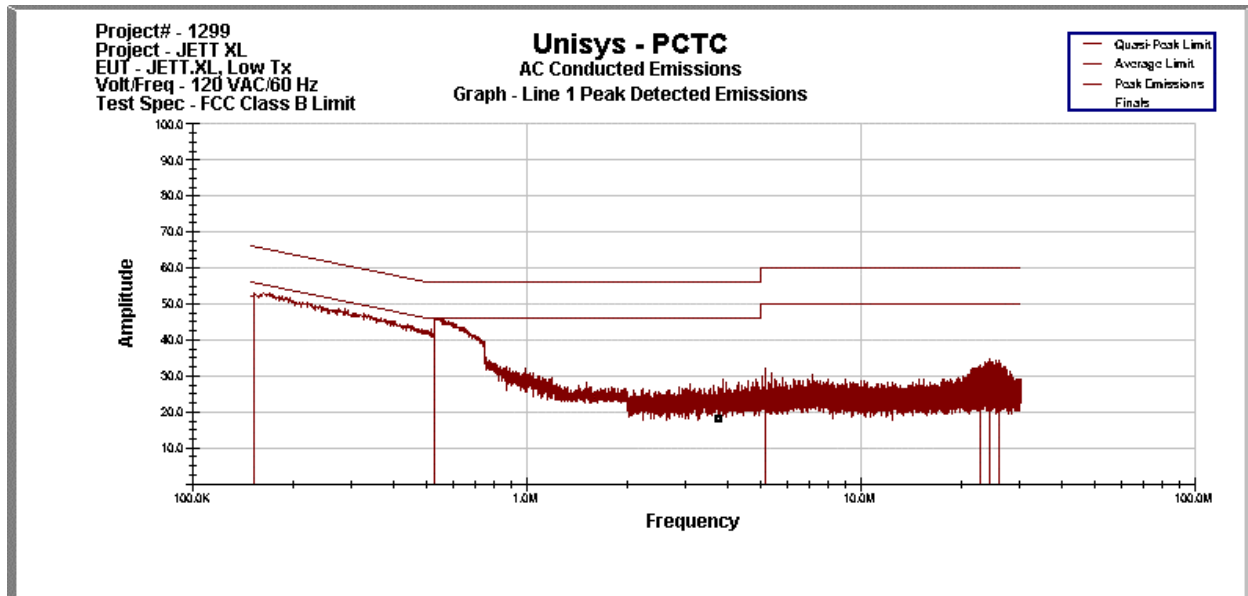
**JETT.XL Handheld Computer, Continuous TX/RX – Line 2**



Unisys - PCTC  
 Line 2 Conducted Emissions  
 02:41:52 PM, Monday, February 27, 2006

	1	2	3	4	5	6	7	
Frequency	AVG	AVG	AVG	QP	QP	QP	Corr	
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor	
158.000 KHz	30.987	55.771	-24.785	45.545	65.771	-20.227	13.221	
665.000 KHz	16.971	46.000	-29.029	33.546	56.000	-22.454	10.321	
20.374 MHz	17.200	50.000	-32.800	23.315	60.000	-36.685	10.581	
21.584 MHz	16.690	50.000	-33.310	21.528	60.000	-38.472	10.649	
23.018 MHz	17.188	50.000	-32.812	22.398	60.000	-37.602	10.729	
24.333 MHz	17.330	50.000	-32.670	22.086	60.000	-37.914	10.803	
Project# - 1299								
Project - JETT XL								
EUT - JETT.XL, Cont TX/RX								
Volt/Freq - 120 VAC/60 Hz								
Test Spec - FCC Class B Limit								

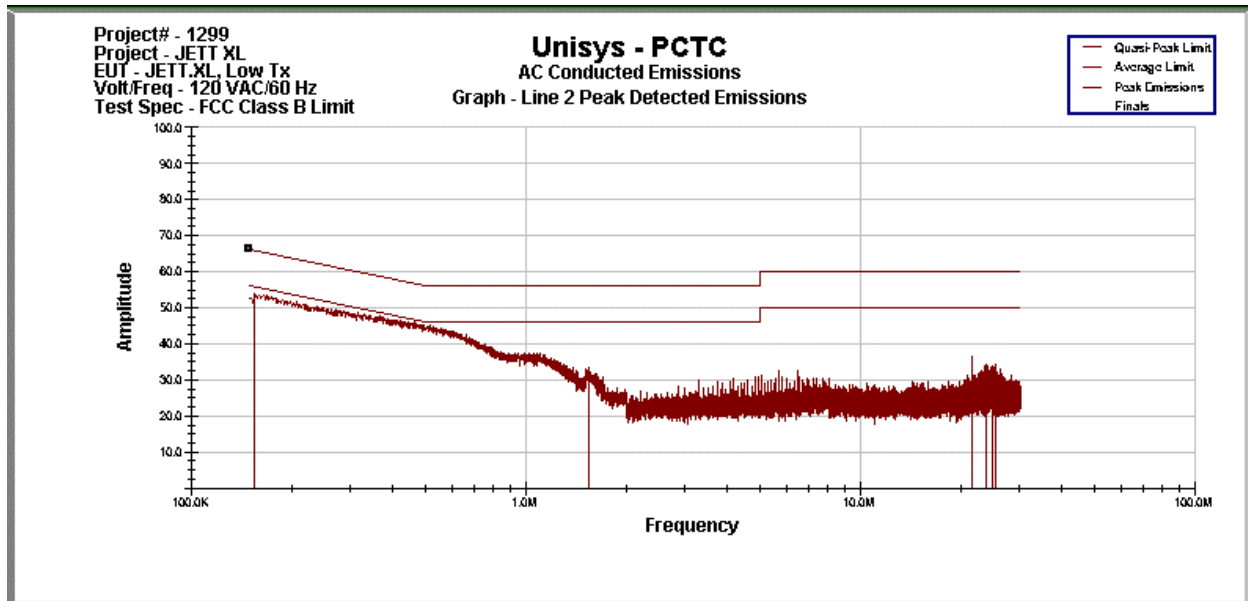
**JETT.XL Handheld Computer, Low TX – Line 1**



Unisys - PCTC  
 Line 1 Conducted Emissions  
 03:50:01 PM, Monday, February 27, 2006

	1	2	3	4	5	6	7	
Frequency	AVG	AVG	AVG	QP	QP	QP	Corr	
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor	
153.000 KHz	27.34	55.91	-28.58	45.23	65.91	-20.68	13.414	
532.000 KHz	16.44	46.00	-29.56	33.84	56.00	-22.16	10.414	
5.166 MHz	20.36	50.00	-29.64	25.49	60.00	-34.51	10.173	
22.746 MHz	17.60	50.00	-32.40	23.78	60.00	-36.22	10.714	
24.180 MHz	22.33	50.00	-27.67	28.10	60.00	-31.90	10.794	
25.933 MHz	22.58	50.00	-27.42	25.98	60.00	-34.02	10.915	
Project# - 1299								
Project - JETT XL								
EUT - JETT.XL, Low Tx								
Volt/Freq - 120 VAC/60 Hz								
Test Spec - FCC Class B Limit								

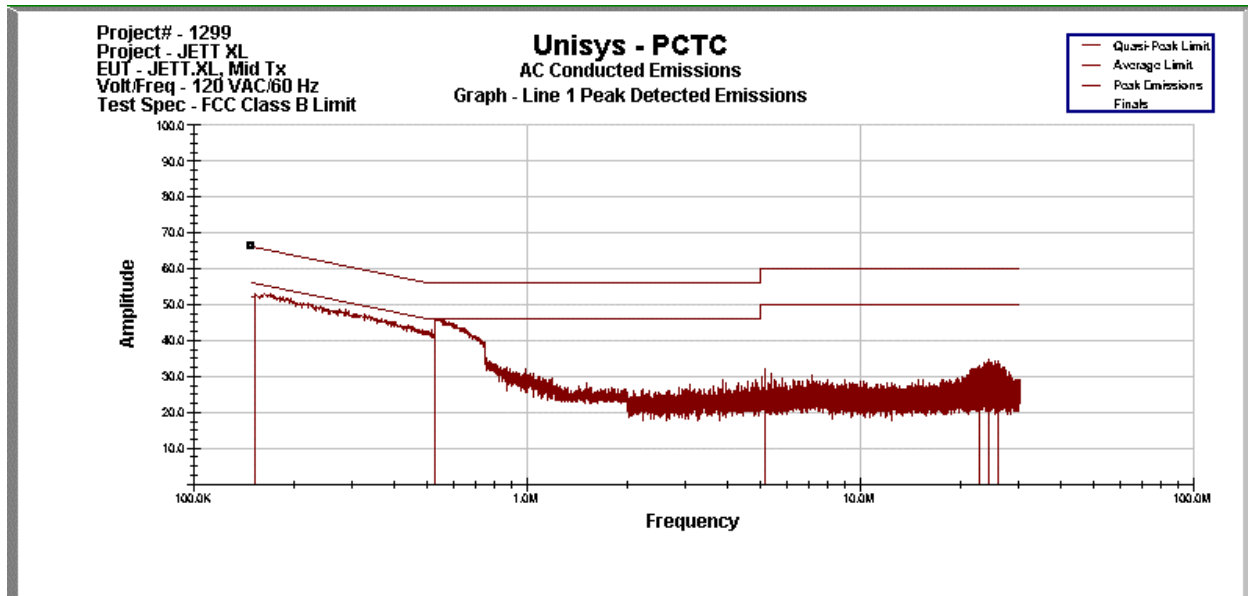
**JETT.XL Handheld Computer, Low TX – Line 2**



Unisys - PCTC  
 Line 2 Conducted Emissions  
 03:55:01 PM, Monday, February 27, 2006

	1	2	3	4	5	6	7	
Frequency	AVG	AVG	AVG	QP	QP	QP	Corr	
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor	
155.000 KHz	27.839	55.857	-28.018	45.800	65.857	-20.057	13.337	
1.536 MHz	14.709	46.000	-31.291	20.602	56.000	-35.398	10.147	
21.640 MHz	16.682	50.000	-33.318	23.386	60.000	-36.614	10.652	
23.845 MHz	17.604	50.000	-32.396	22.814	60.000	-37.186	10.775	
24.724 MHz	17.406	50.000	-32.594	22.108	60.000	-37.892	10.825	
25.271 MHz	16.581	50.000	-33.419	21.317	60.000	-38.683	10.862	
Project# - 1299								
Project - JETT XL								
EUT - JETT.XL, Low Tx								
Volt/Freq - 120 VAC/60 Hz								
Test Spec - FCC Class B Limit								

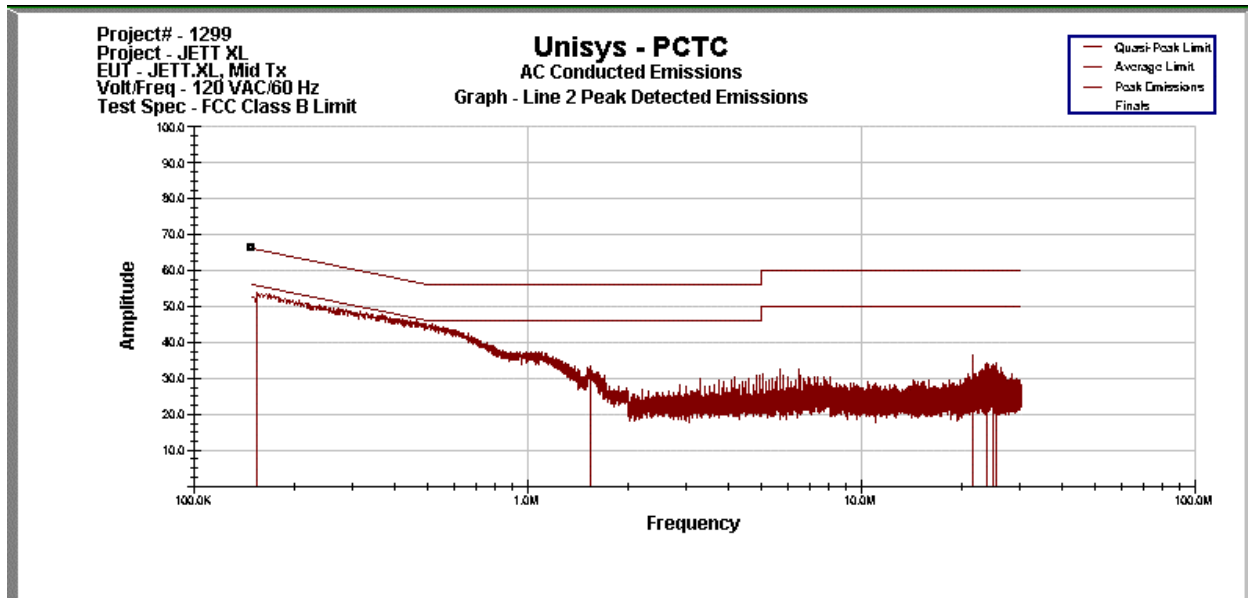
**JETT.XL Handheld Computer, Medium TX – Line 1**



Unisys - PCTC  
 Line 1 Conducted Emissions  
 03:50:01 PM, Monday, February 27, 2006

	1	2	3	4	5	6	7	
Frequency	AVG	AVG	AVG	QP	QP	QP	Corr	
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor	
153.000 KHz	27.34	55.91	-28.58	45.23	65.91	-20.68	13.414	
532.000 KHz	16.44	46.00	-29.56	33.84	56.00	-22.16	10.414	
5.166 MHz	20.36	50.00	-29.64	25.49	60.00	-34.51	10.173	
22.746 MHz	17.60	50.00	-32.40	23.78	60.00	-36.22	10.714	
24.180 MHz	22.33	50.00	-27.67	28.10	60.00	-31.90	10.794	
25.933 MHz	22.58	50.00	-27.42	25.98	60.00	-34.02	10.915	
Project# - 1299								
Project - JETT XL								
EUT - JETT.XL, Mid Tx								
Volt/Freq - 120 VAC/60 Hz								
Test Spec - FCC Class B Limit								

**JETT.XL Handheld Computer, Medium TX – Line 2**

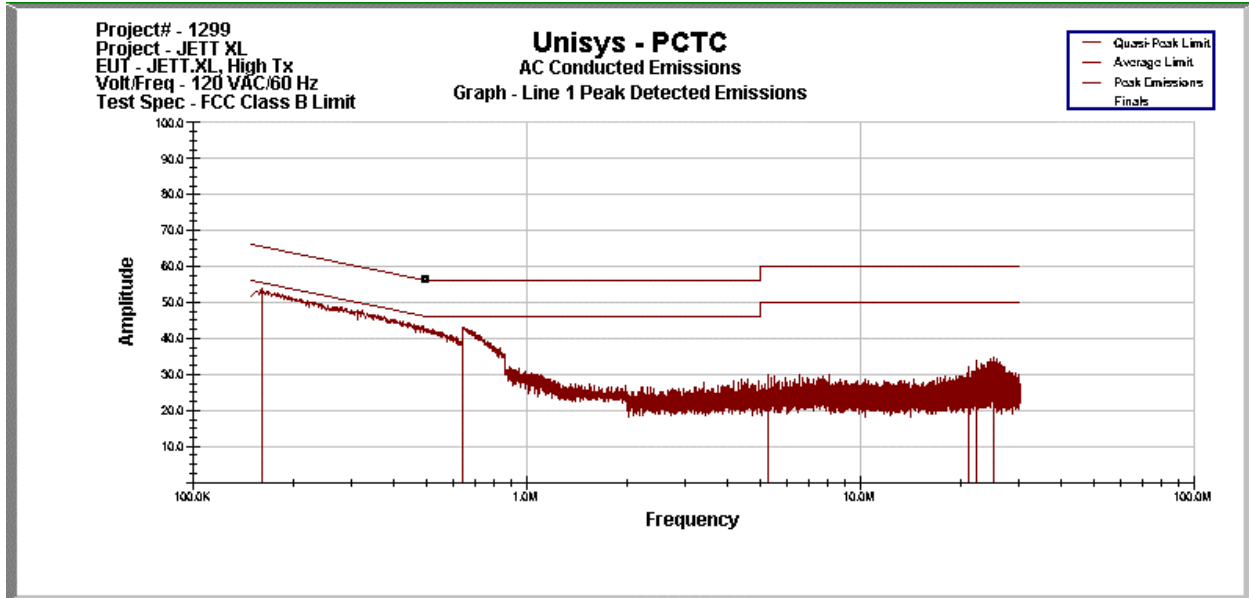


Unisys - PCTC  
 Line 2 Conducted Emissions  
 03:55:01 PM, Monday, February 27, 2006

	1	2	3	4	5	6	7	
Frequency	AVG	AVG	AVG	QP	QP	QP	Corr	
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor	
155.000 KHz	27.839	55.857	-28.018	45.800	65.857	-20.057	13.337	
1.536 MHz	14.709	46.000	-31.291	20.602	56.000	-35.398	10.147	
21.640 MHz	16.682	50.000	-33.318	23.386	60.000	-36.614	10.652	
23.845 MHz	17.604	50.000	-32.396	22.814	60.000	-37.186	10.775	
24.724 MHz	17.406	50.000	-32.594	22.108	60.000	-37.892	10.825	
25.271 MHz	16.581	50.000	-33.419	21.317	60.000	-38.683	10.862	
Project# - 1299								
Project - JETT XL								
EUT - JETT.XL, Mid Tx								
Volt/Freq - 120 VAC/60 Hz								
Test Spec - FCC Class B Limit								



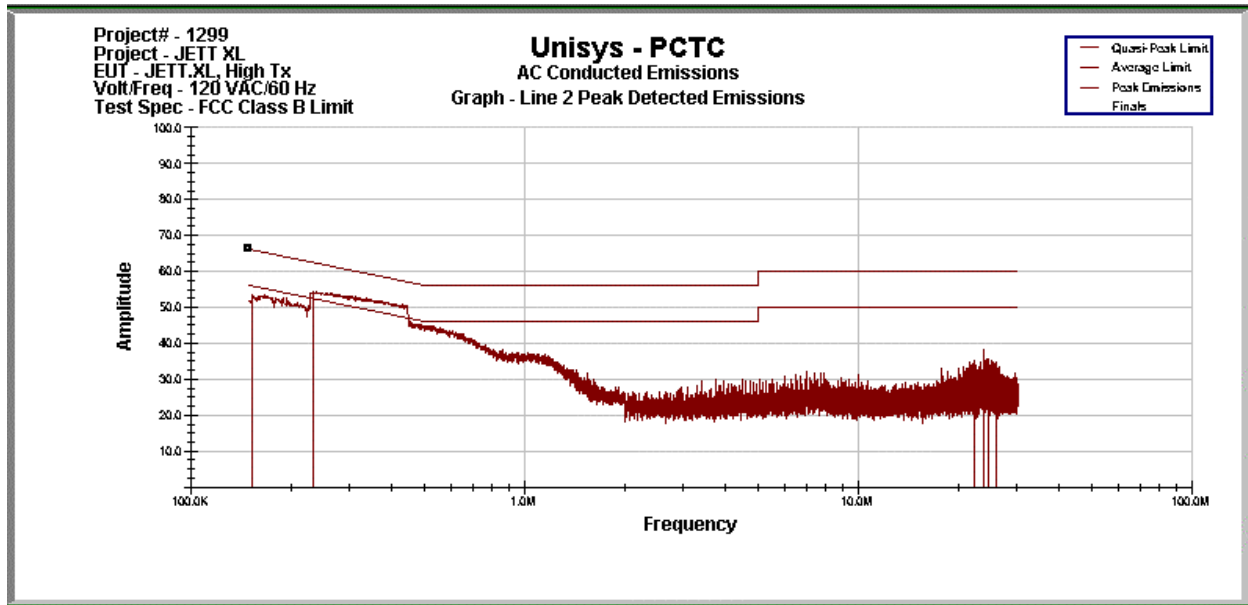
**JETT.XL Handheld Computer, High TX – Line 1**



Unisys - PCTC  
 Line 1 Conducted Emissions  
 04:05:23 PM, Monday, February 27, 2006

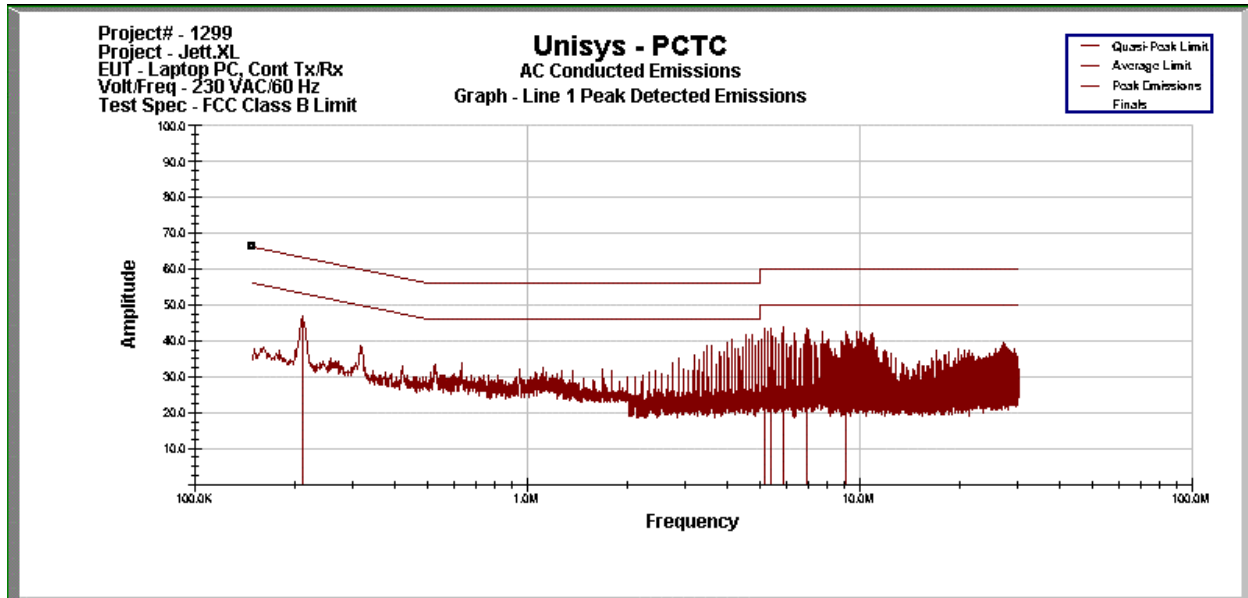
	1	2	3	4	5	6	7	
Frequency	AVG	AVG	AVG	QP	QP	QP	Corr	
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor	
161.000 KHz	28.01	55.69	-27.68	45.67	65.69	-20.01	13.105	
642.000 KHz	15.10	46.00	-30.90	30.62	56.00	-25.38	10.335	
5.276 MHz	18.13	50.00	-31.87	23.55	60.00	-36.45	10.175	
20.996 MHz	16.56	50.00	-33.44	21.07	60.00	-38.93	10.616	
22.312 MHz	17.28	50.00	-32.72	22.73	60.00	-37.27	10.689	
24.943 MHz	26.31	50.00	-23.69	29.59	60.00	-30.41	10.837	
Project# - 1299								
Project - JETT XL								
EUT - JETT.XL, High Tx								
Volt/Freq - 120 VAC/60 Hz								
Test Spec - FCC Class B Limit								

**JETT.XL Handheld Computer, High TX – Line 2**



Unisys - PCTC							
Line 2 Conducted Emissions							
04:10:15 PM, Monday, February 27, 2006							
	1	2	3	4	5	6	7
Frequency	AVG	AVG	AVG	QP	QP	QP	Corr
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor
153.000 KHz	27.251	55.914	-28.663	45.489	65.914	-20.425	13.414
232.000 KHz	25.669	53.657	-27.988	42.399	63.657	-21.259	11.037
22.187 MHz	26.091	50.000	-23.909	30.965	60.000	-29.035	10.682
23.827 MHz	20.375	50.000	-29.625	28.464	60.000	-31.536	10.774
24.497 MHz	23.988	50.000	-26.012	29.732	60.000	-30.268	10.812
25.921 MHz	23.976	50.000	-26.024	29.834	60.000	-30.166	10.914
Project# - 1299							
Project - JETT XL							
EUT - JETT.XL, High Tx							
Volt/Freq - 120 VAC/60 Hz							
Test Spec - FCC Class B Limit							

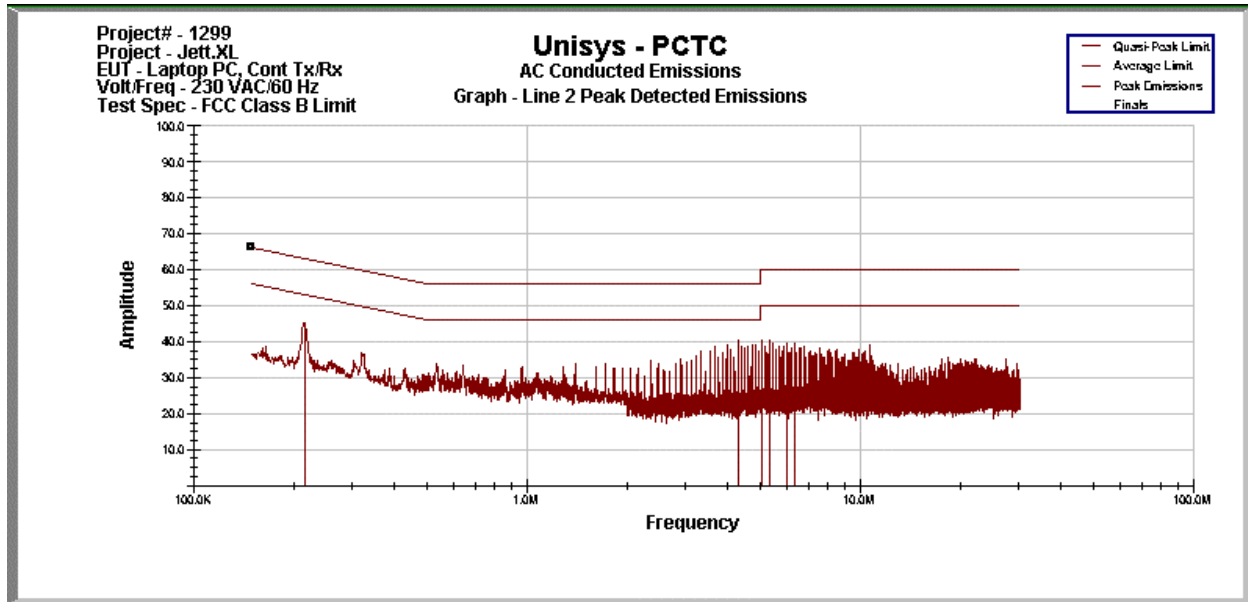
**Laptop Computer, Continuous TX/RX – Line 1**



Unisys - PCTC  
 Line 1 Conducted Emissions  
 02:05:02 PM, Monday, February 27, 2006

	1	2	3	4	5	6	7	
Frequency	AVG	AVG	AVG	QP	QP	QP	Corr	
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor	
211.000 KHz	36.73	54.26	-17.53	47.21	64.26	-17.05	11.406	
5.171 MHz	15.35	50.00	-34.65	19.71	60.00	-40.29	10.173	
5.380 MHz	15.38	50.00	-34.62	19.72	60.00	-40.28	10.177	
5.908 MHz	15.83	50.00	-34.17	20.20	60.00	-39.80	10.186	
6.965 MHz	16.42	50.00	-33.58	21.08	60.00	-38.92	10.205	
9.078 MHz	15.50	50.00	-34.50	20.25	60.00	-39.75	10.243	
Project# - 1299								
Project - Jett.XL								
EUT - Laptop PC, Cont Tx/Rx								
Volt/Freq - 230 VAC/60 Hz								
Test Spec - FCC Class B Limit								

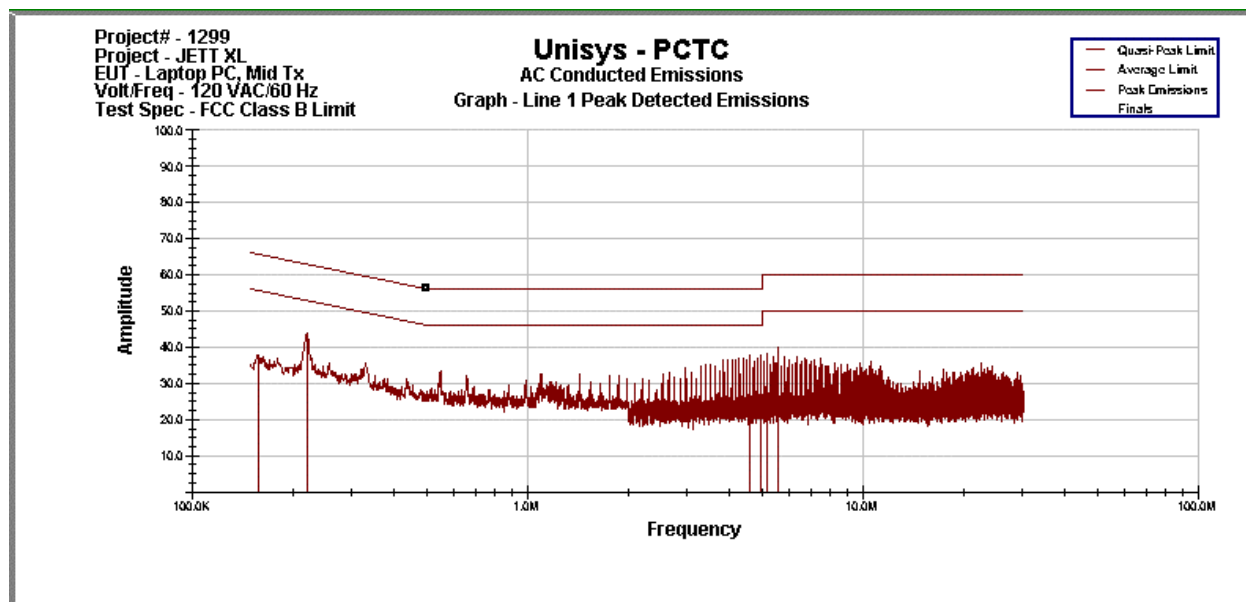
**Laptop Computer, Continuous TX/RX – Line 2**



Unisys - PCTC  
 Line 2 Conducted Emissions  
 02:11:37 PM, Monday, February 27, 2006

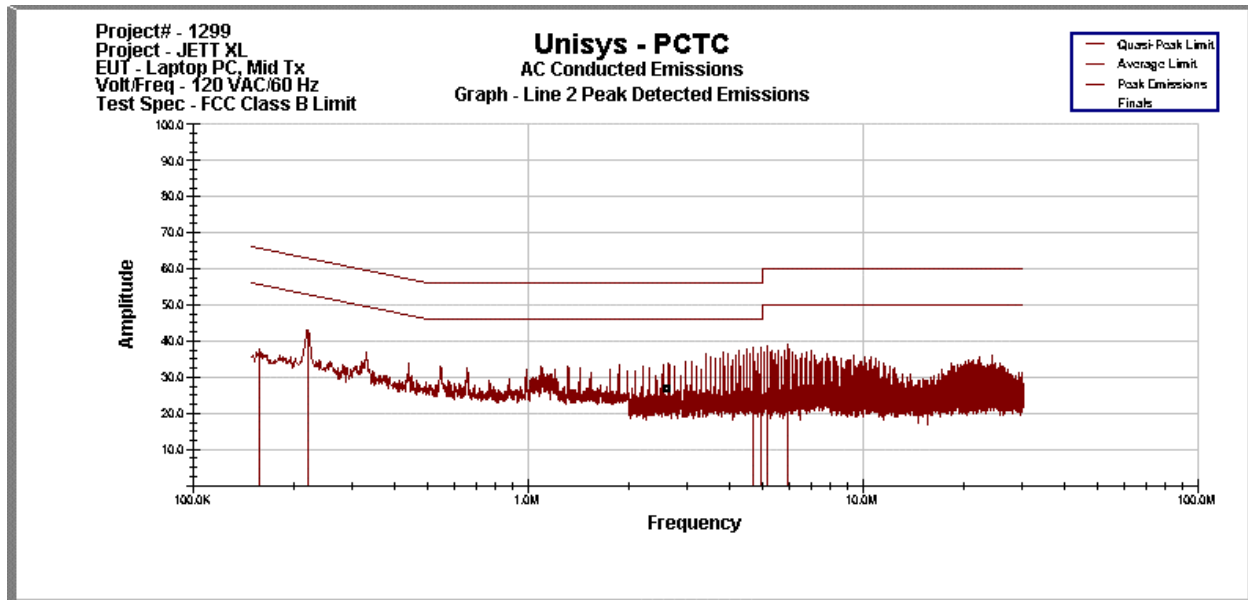
	1	2	3	4	5	6	7	
Frequency	AVG	AVG	AVG	QP	QP	QP	Corr	
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor	
215.000 KHz	35.903	54.143	-18.239	42.814	64.143	-21.329	11.336	
4.296 MHz	17.042	46.000	-28.958	21.432	56.000	-34.568	10.149	
5.045 MHz	15.408	50.000	-34.592	19.711	60.000	-40.289	10.171	
5.368 MHz	15.409	50.000	-34.591	20.186	60.000	-39.814	10.177	
6.015 MHz	15.680	50.000	-34.320	20.198	60.000	-39.802	10.188	
6.337 MHz	15.930	50.000	-34.070	20.649	60.000	-39.351	10.194	
Project# - 1299								
Project - Jett.XL								
EUT - Laptop PC, Cont Tx/Rx								
Volt/Freq - 230 VAC/60 Hz								
Test Spec - FCC Class B Limit								

**Laptop Computer, Medium TX – Line 1**



Unisys - PCTC							
Line 1 Conducted Emissions							
04:17:38 PM, Monday, February 27, 2006							
	1	2	3	4	5	6	7
Frequency	AVG	AVG	AVG	QP	QP	QP	Corr
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor
158.000 KHz	26.44	55.77	-29.33	31.81	65.77	-33.96	13.221
220.000 KHz	36.10	54.00	-17.90	41.48	64.00	-22.52	11.248
4.611 MHz	33.24	46.00	-12.76	36.18	56.00	-19.82	10.158
4.939 MHz	33.01	46.00	-12.99	36.40	56.00	-19.60	10.168
5.160 MHz	32.20	50.00	-17.80	35.59	60.00	-24.41	10.173
5.597 MHz	30.54	50.00	-19.46	35.04	60.00	-24.96	10.181
Project# - 1299							
Project - JETT XL							
EUT - Laptop PC, Mid Tx							
Volt/Freq - 120 VAC/60 Hz							
Test Spec - FCC Class B Limit							

**Laptop Computer, Medium TX – Line 2**



Unisys - PCTC							
Line 2 Conducted Emissions							
04:23:00 PM, Monday, February 27, 2006							
	1	2	3	4	5	6	7
Frequency	AVG	AVG	AVG	QP	QP	QP	Corr
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor
157.000 KHz	27.178	55.800	-28.622	32.502	65.800	-33.298	13.260
221.000 KHz	34.766	53.971	-19.206	40.171	63.971	-23.800	11.230
4.719 MHz	32.294	46.000	-13.706	35.885	56.000	-20.115	10.162
4.937 MHz	33.368	46.000	-12.632	36.815	56.000	-19.185	10.168
5.158 MHz	28.851	50.000	-21.149	36.191	60.000	-23.809	10.173
5.924 MHz	30.842	50.000	-19.158	33.897	60.000	-26.103	10.187
Project# - 1299							
Project - JETT XL							
EUT - Laptop PC, Mid Tx							
Volt/Freq - 120 VAC/60 Hz							
Test Spec - FCC Class B Limit							

**Overall Results:** All conducted emissions measured at the AC power input port of the Stancor model STA-5712 AC Adaptor for the JETT.XL, are below the FCC 15.207 limit.

**Test Setup**



**Photo 10: Conducted Emission Test Setup, JETT.XL – Front View**



**Photo 11: Conducted Emission Test Setup, JETT.XL – Side View**



### **4.3        Antenna Port (2/24/06 – 2/28/06)**

#### **4.3.1        Antenna Requirements**

The antenna used for transmitting is an integral part of the JETT.XL. It is permanently attached and considered as consumer non-replacement part. The antenna has directional gain of 0 dBi.

**Overall Results:** The JETT.XL met the antenna requirements of FCC Part 15, Section 15.203.

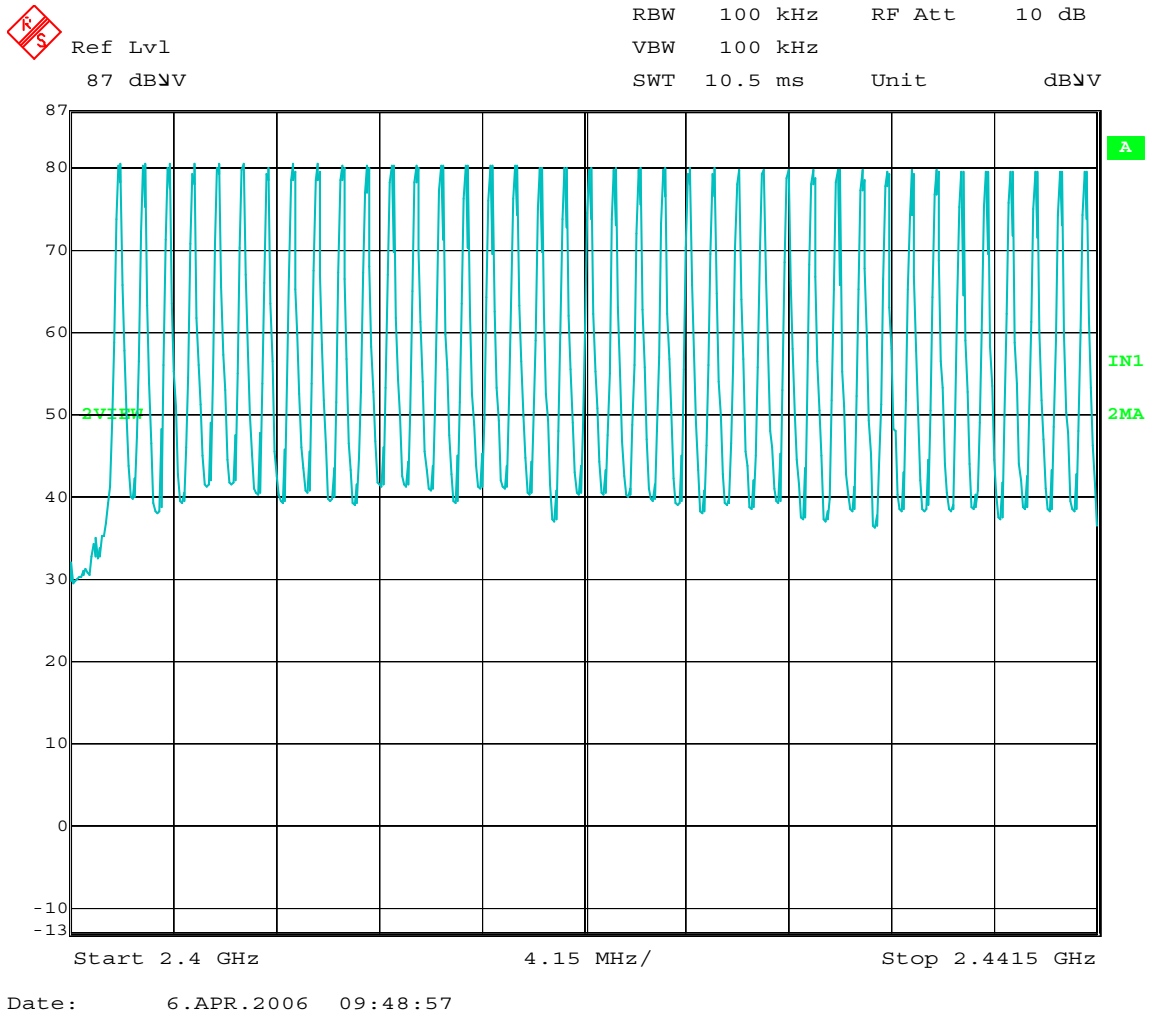
#### **4.3.2        Numbers of Hopping Channel**

The JETT.XL transmits in the frequency band of 2400 MHz – 2483.5 MHz, with a total of 79 frequency hopping channels. According to the FCC Section 15.247 (a) (1) (iii), for the frequency band of 2400 MHz – 2483.5 MHz, the requirements, it shall have at least 15 channels.

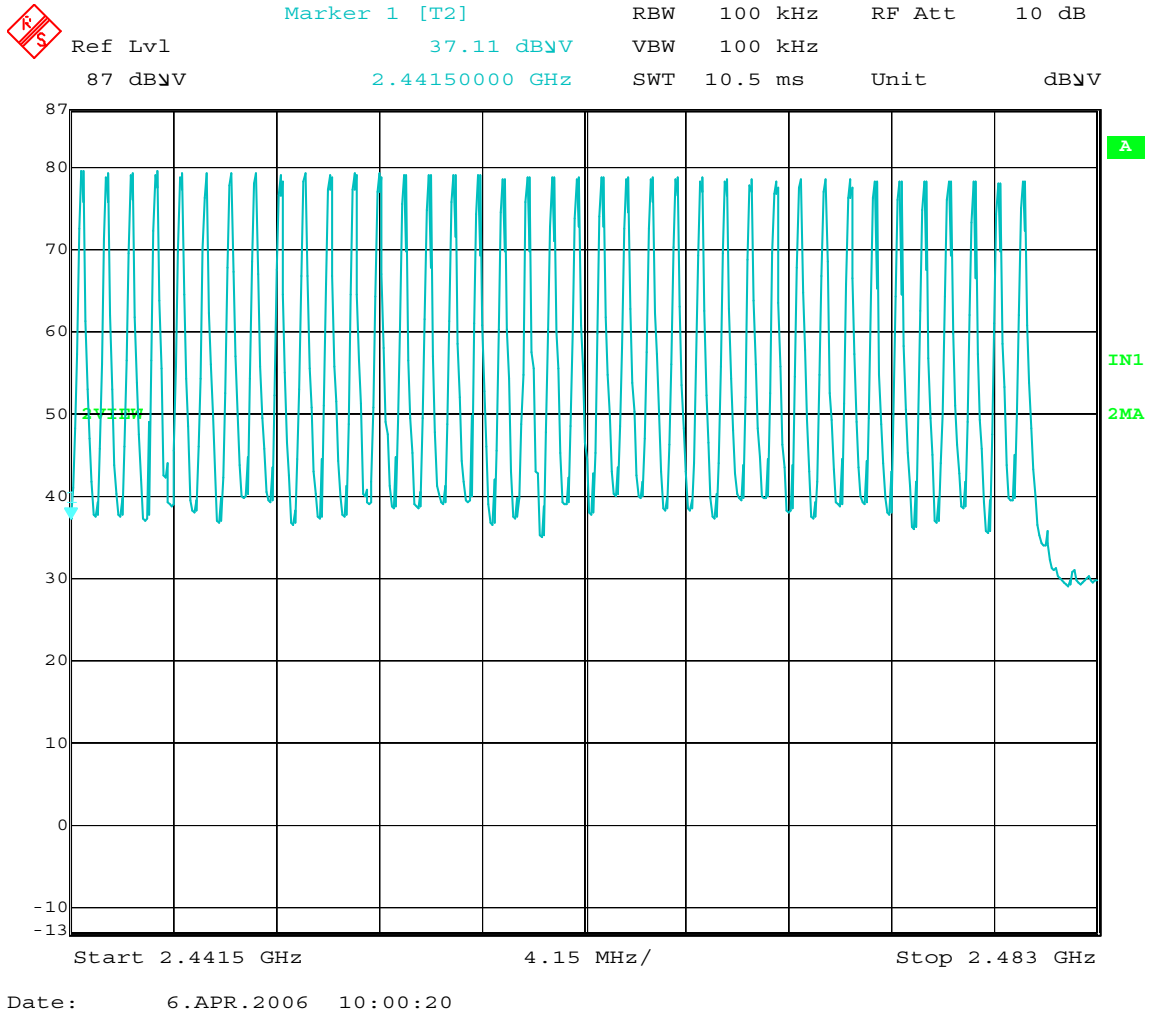
The graphical plots showing each individual channels are presented on the next pages.

**Overall Results:** The JETT.XL met the minimum numbers hopping channel requirements of FCC Part 15, Section 15.247.

**Graphical Plots for Nos. of Channels**



**Plot 1: Channels 0-39**



**Plot 2: Channels 40-78**

### 4.3.3 Maximum Peak Output Power

According to FCC Part 15, Section 15.247 (b) (1) for the frequency hopping systems operating in the 2400 MHz – 2483.5 MHz band and employing at least 75 hopping channels, the peak output power limit is 1 Watt (30 dBm). The JETT.XL antenna port was connected directly to the spectrum analyzer through a suitable attenuator. The following table shows the result peak power measurements at the selected fundamental transmit frequencies:

Transmit Frequency	Receiver Measured Voltage Level (dBuV)	Correction Factor (dB)	Corrected Voltage Level (dBuV)	Corrected Power Output (dBm)	FCC Power Output Limit (dBm)
2.402 GHz (Low TX)	80.45	30.2	110.65	3.65	30
2.449 GHz (Medium TX)	79.00	30.2	109.2	2.20	30
2.480 GHz (High TX)	77.92	30.2	108.12	1.12	30

**Overall Results:** The JETT.XL conducted peak power output was below the limit specified in FCC Part 15, Section 15.247 (b) (1).

#### **4.3.4 Frequency Separation**

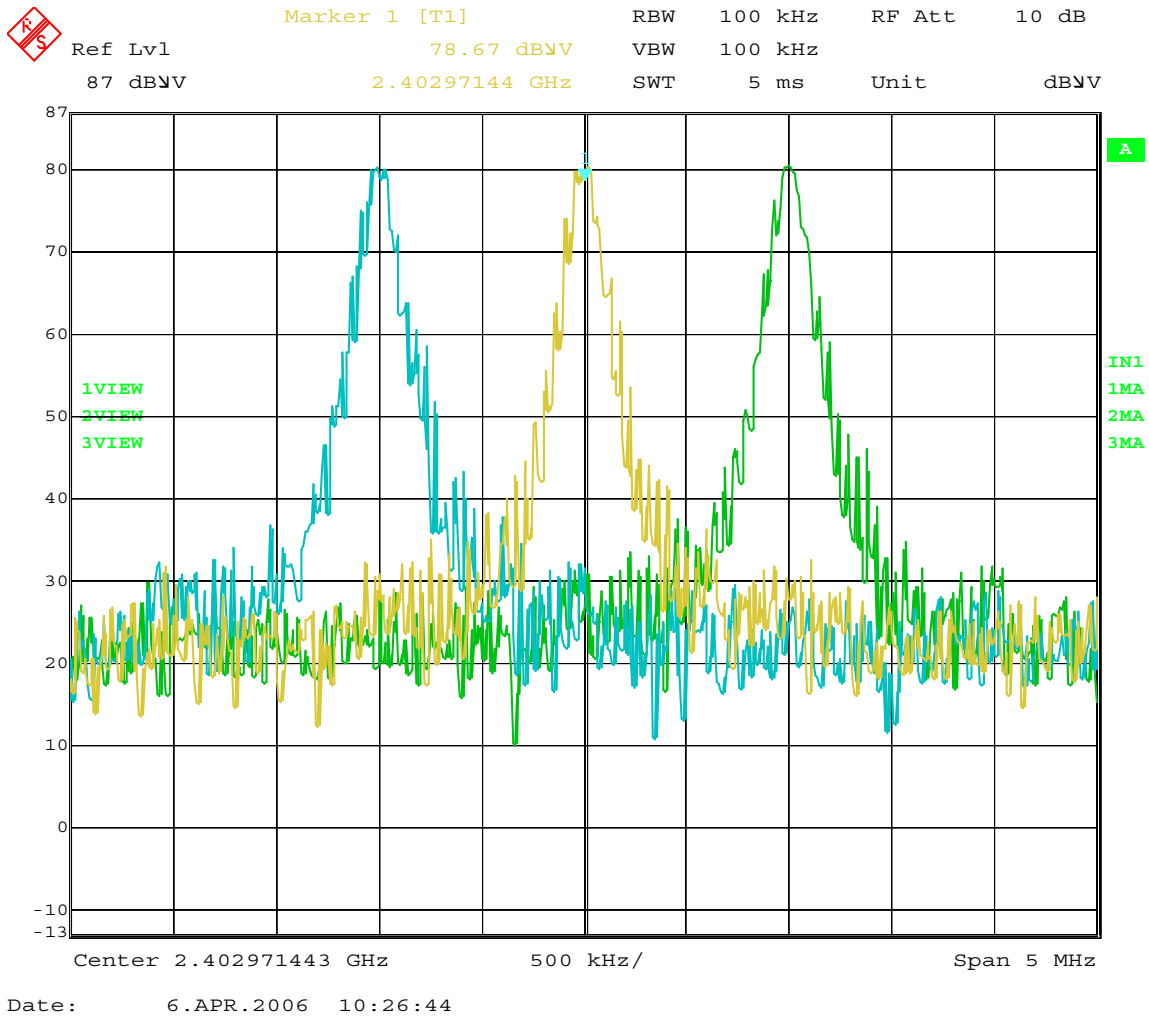
The JETT.XL operates with an output power no greater than 125 mw. Therefore according to the FCC Part 15, Section 15.247, the applicable hopping channel minimum separation requirement is 25 KHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater. 20 dB bandwidth measurements were performed at the Low TX, MID TX and High TX channel frequencies. The 20 dB bandwidth measurement was recorded as 638.27 kHz.

The frequency separation of hopping channel was measured as 1 MHz.

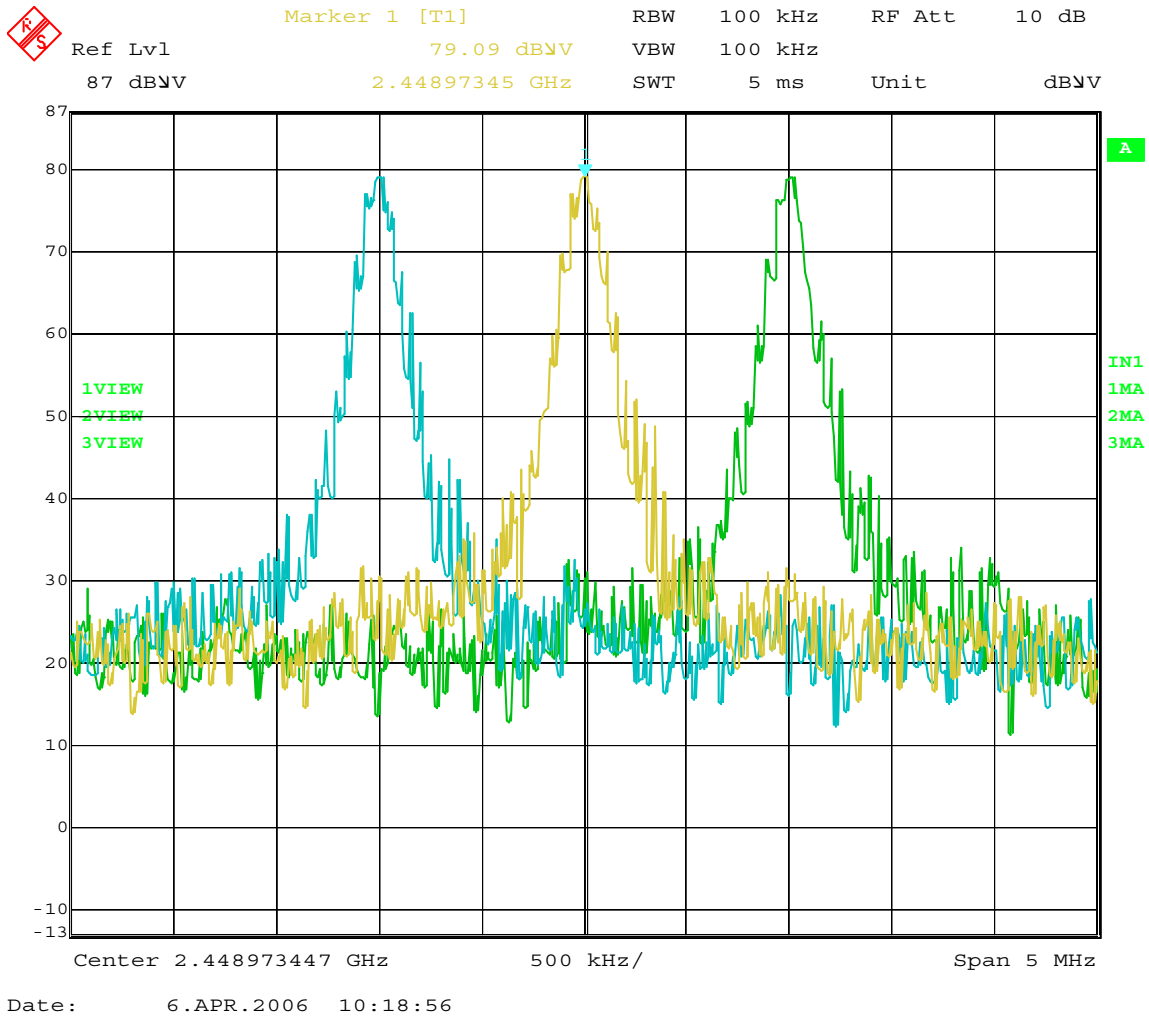
The graphical plots showing channel separation at the Low TX, MID TX and High TX channel frequencies. are presented on the next pages.

**Overall Results:** The JETT.XL met the minimum hopping channel frequency separation requirements of the FCC Part 15, Section 15.247 (a) (1).

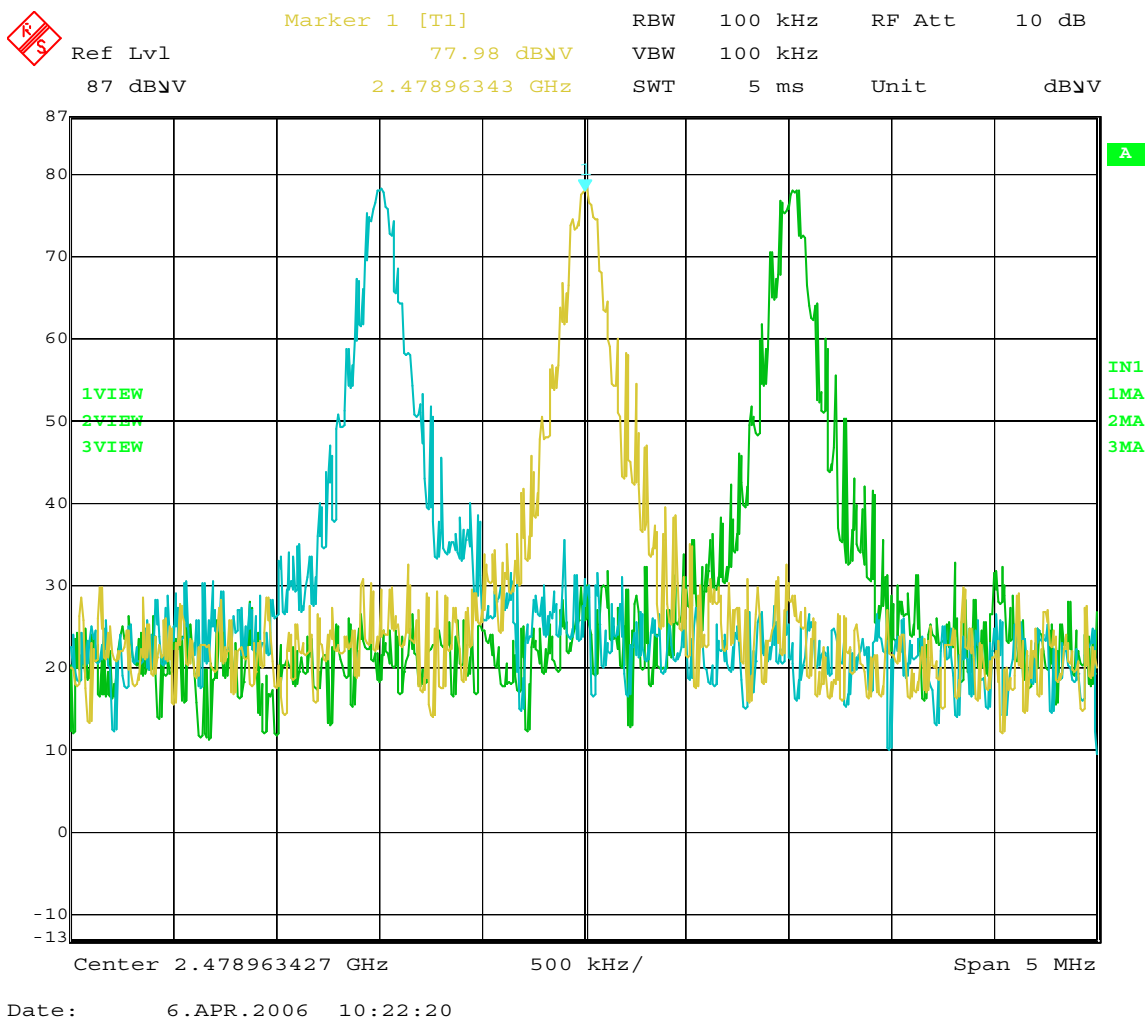
### Frequency Separation Plots



Plot 3 – Low Frequency Separation (Channels 0, 1, and 2)



Plot 4 - Mid Frequency Separation (Channels 46, 47, and 48)



**Plot 5 - High Frequency Separation (Channels 76, 77, and 78)**



#### 4.3.5 Time of Occupancy on Channel

Following table shows results of time of occupancy measurements at the selected fundamental transmit frequencies:

Transmit Frequency	Measured Time of Single Pulse	Specified Test Duration	Total Occupancy Time	FCC Limit for Time of Occupancy FCC 15.247 (a) (iii)
	Micosec	Seconds	Seconds	Seconds
2.402 GHz (Low TX)	372	31.6	0.238	0.4
2.449 GHz (Medium TX)	204	31.6	0.130	0.4
2.480 GHz (High TX)	308	31.6	0.197	0.4

**Overall Results:** The JETT.XL met the time of occupancy limit specified in FCC Part 15, Section 15.247 (a) (1) (iii).

#### **4.3.6 Antenna Port Conducted Emissions Requirements**

This test was performed with the JETT.XL antenna port connected directly to the spectrum analyzer through a suitable attenuator (30 db). Measurements made with a peak detector and a 100 kHz RBW. Measurement scan was performed for the frequency range of 30 MHz to 25 GHz. The purpose of this test is to demonstrate that all harmonics of the fundamental frequency and spurious Emissions from the EUT are 20 dB below from the highest emission level within the authorized band.

Measurements were performed with operating the JETT.XL Handheld Computer at three selected transmission frequencies (Low, Medium and High) as identified below:

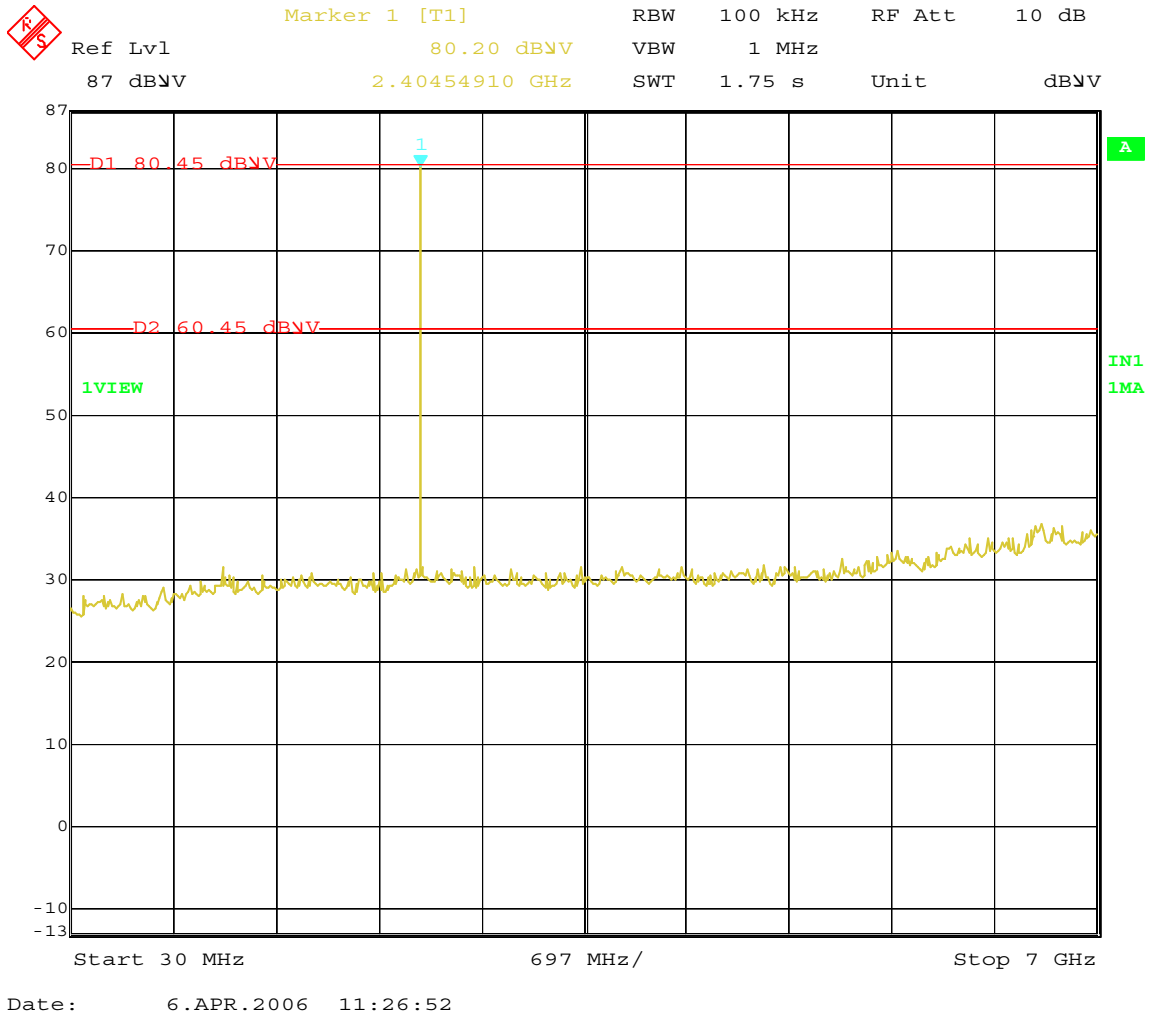
Channel 0 – 2.402 GHz (Low TX)  
Channel 47 – 2.449 GHz (Medium TX)  
Channel 78 – 2.480 GHz (High TX)

Emission scan did not find any significant level with respect to the applicable limit, all the levels were considerably below the applicable limit per FCC Part 15.247 (d).

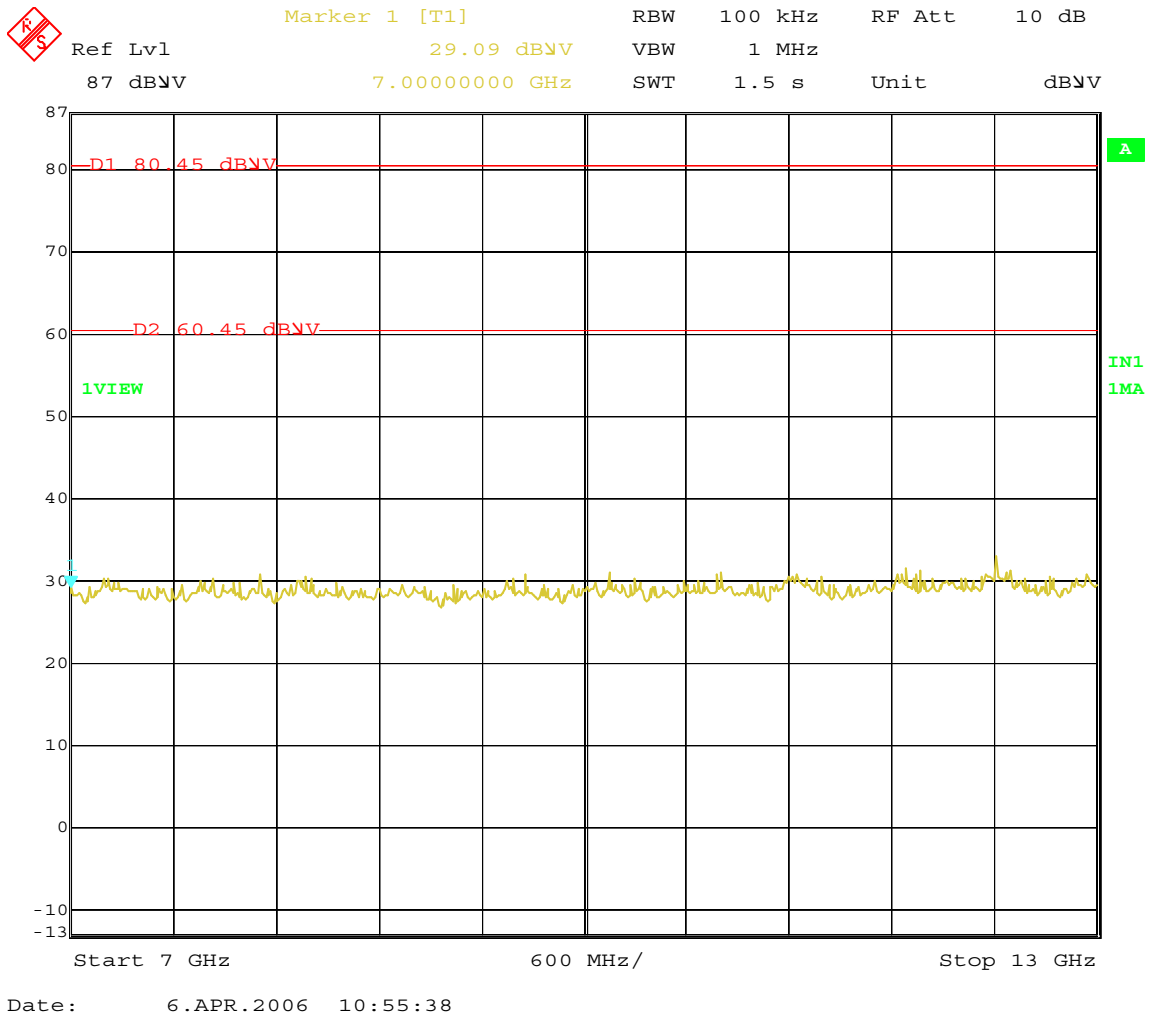
The graphical plots showing conducted emissions measurements are presented on the next pages.

**Overall Results:** All harmonics and spurious emissions are more than 20 dB down from the highest emissions level (80.45 dBuV + Attenuator loss) within the authorized band.

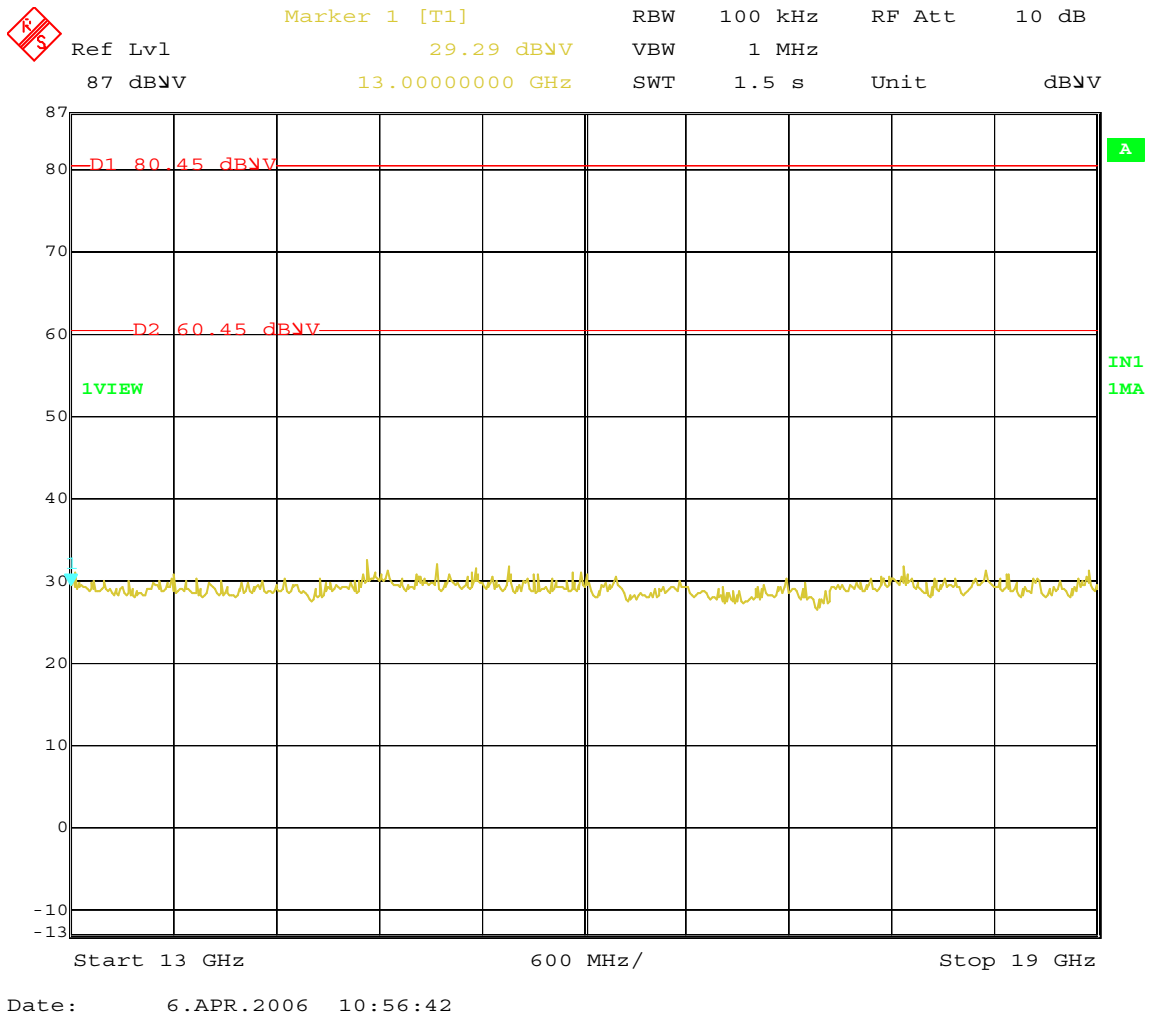
**Antenna Port Conducted Emission Plots**



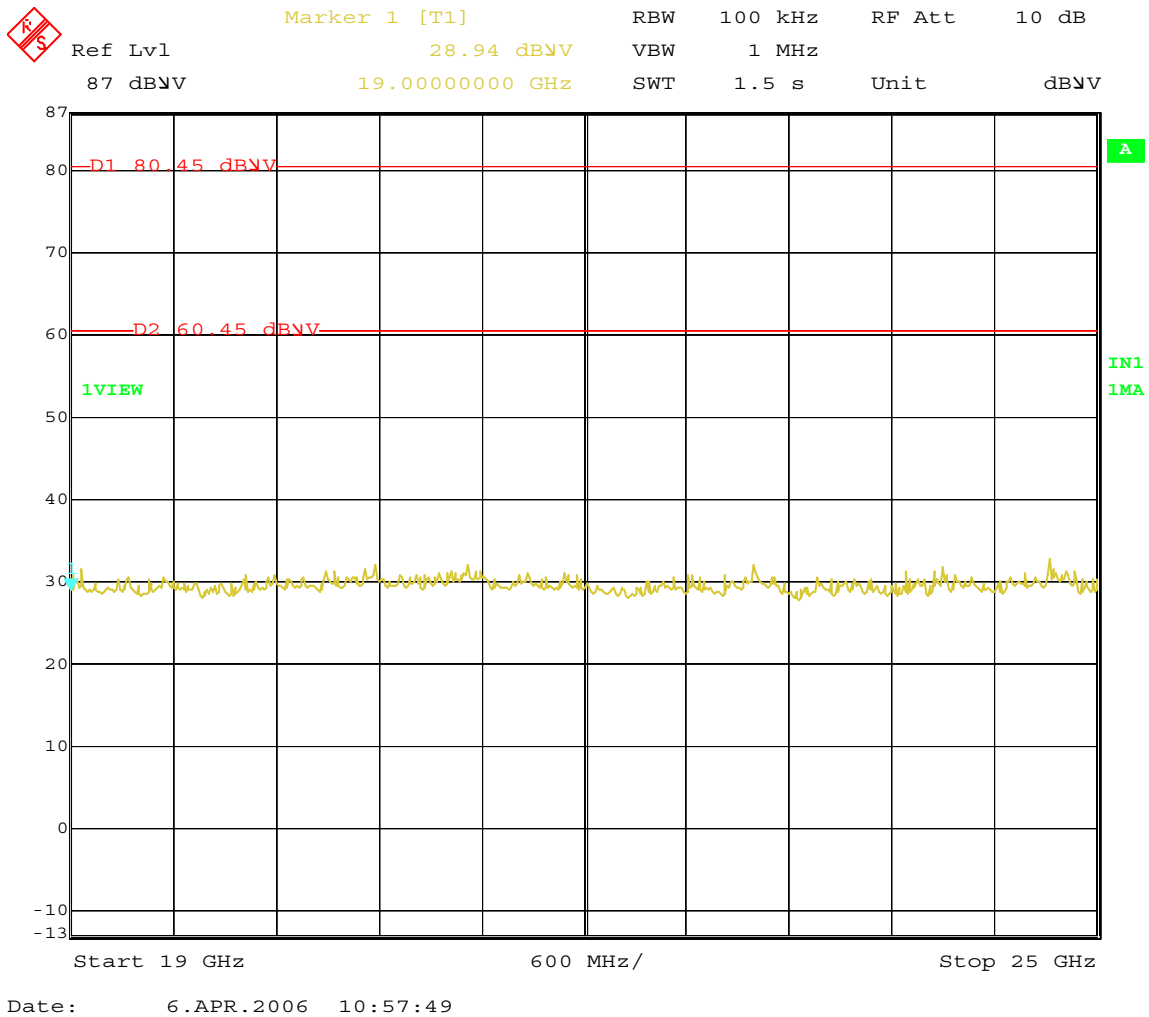
**Plot 6 – Low Tx (Channel 0), Antenna Conducted Emissions, 30 MHz-7 GHz**



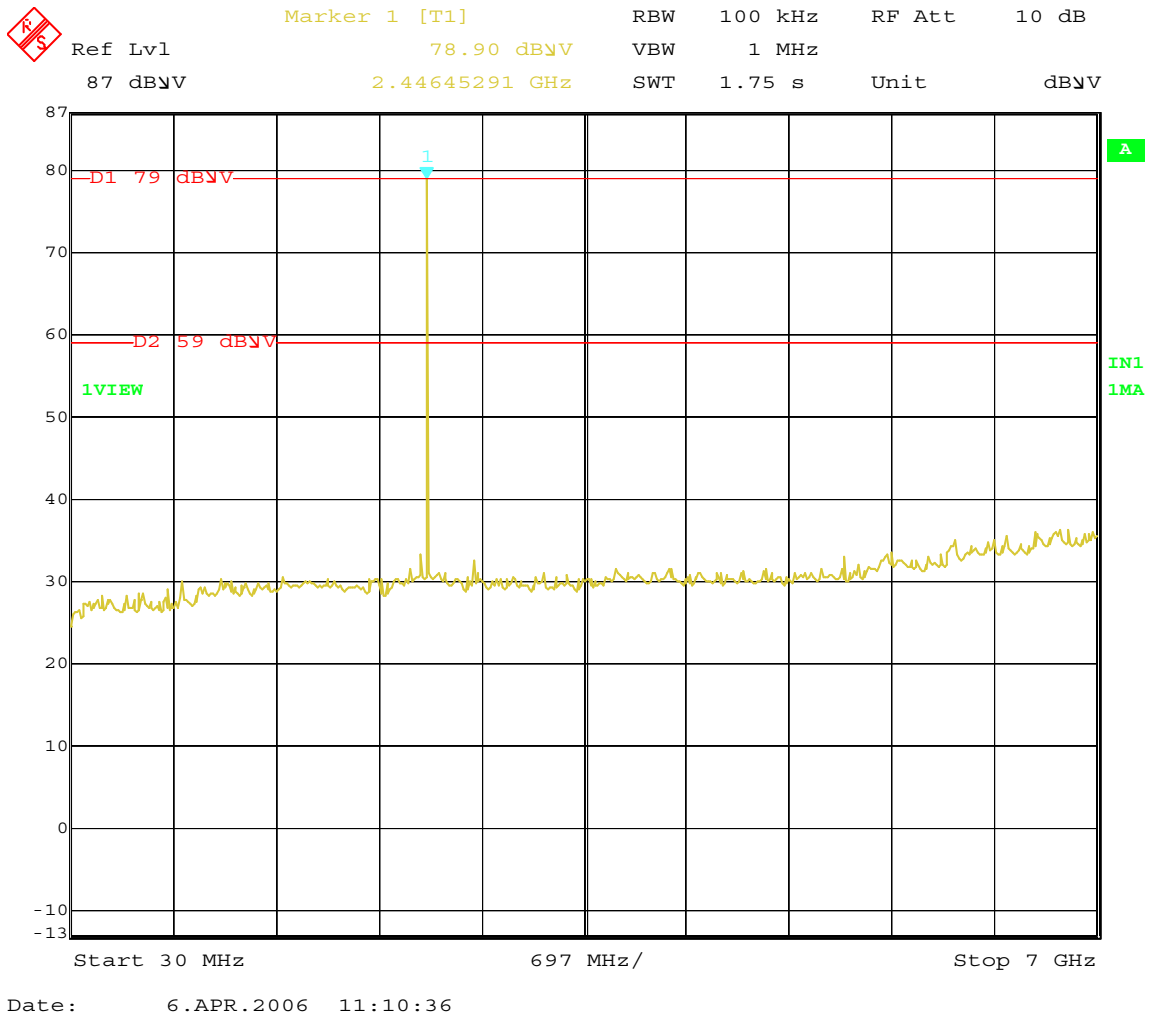
Plot 7 - Low Tx (Channel 0), Antenna Conducted Emissions, 7 GHz-13 GHz



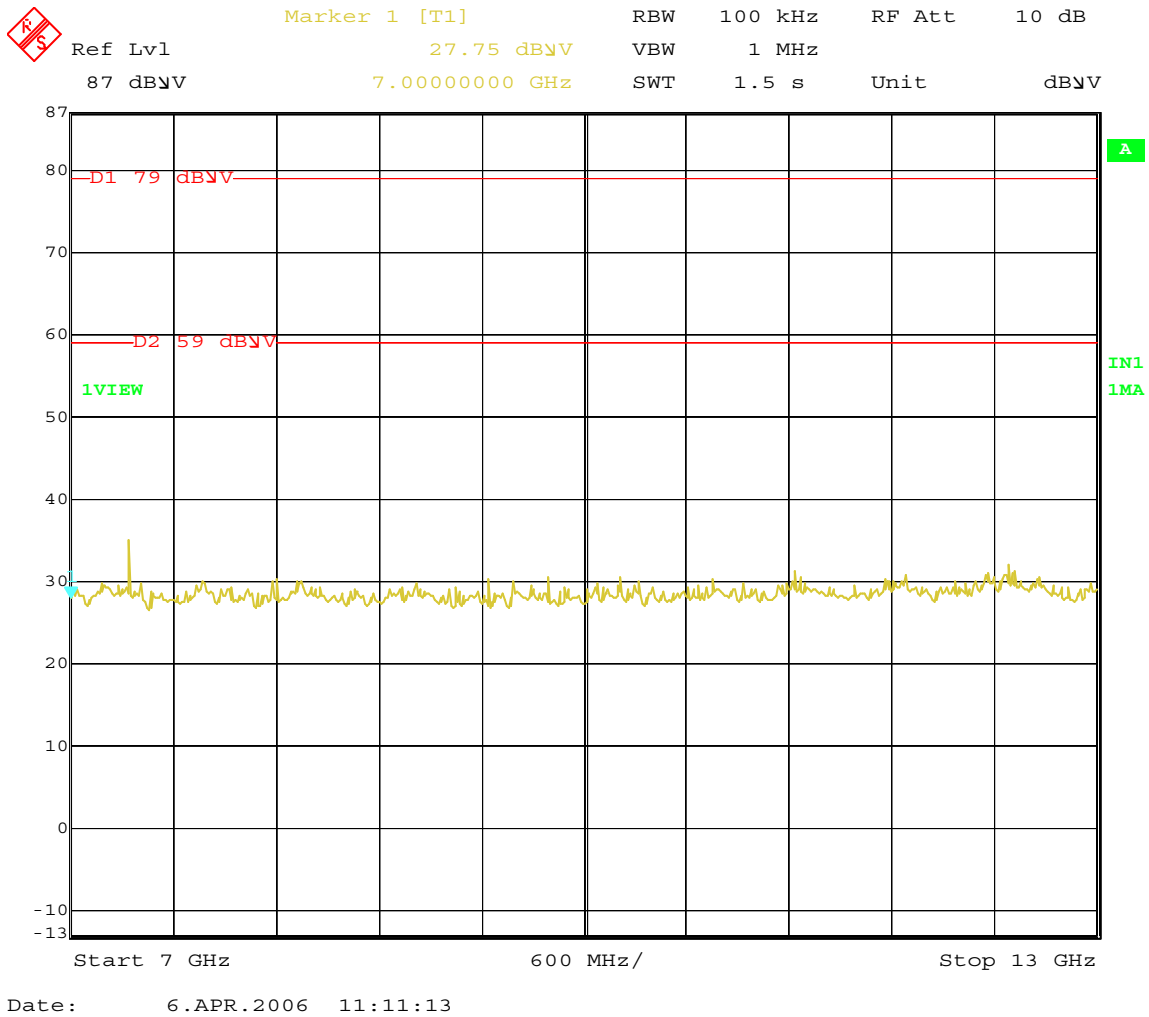
Plot 8 - Low Tx (Channel 0), Antenna Conducted Emissions, 13 GHz-19 GHz



Plot 9 - Low Tx (Channel 0), Antenna Conducted Emissions, 19GHz-25GHz

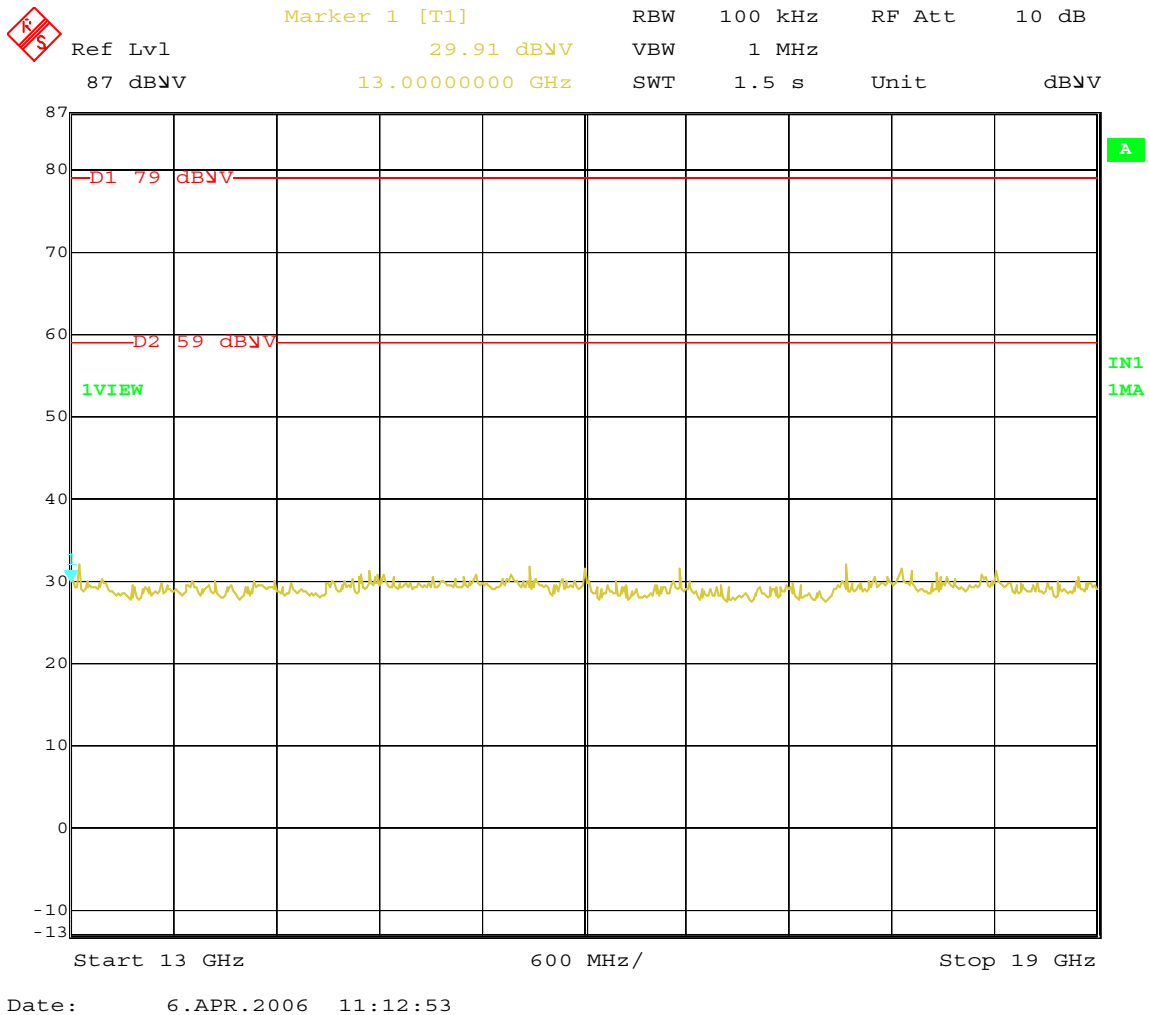


**Plot 10 - Mid Tx (Channel 47), Antenna Conducted Emissions, 30 MHz-7 GHz**

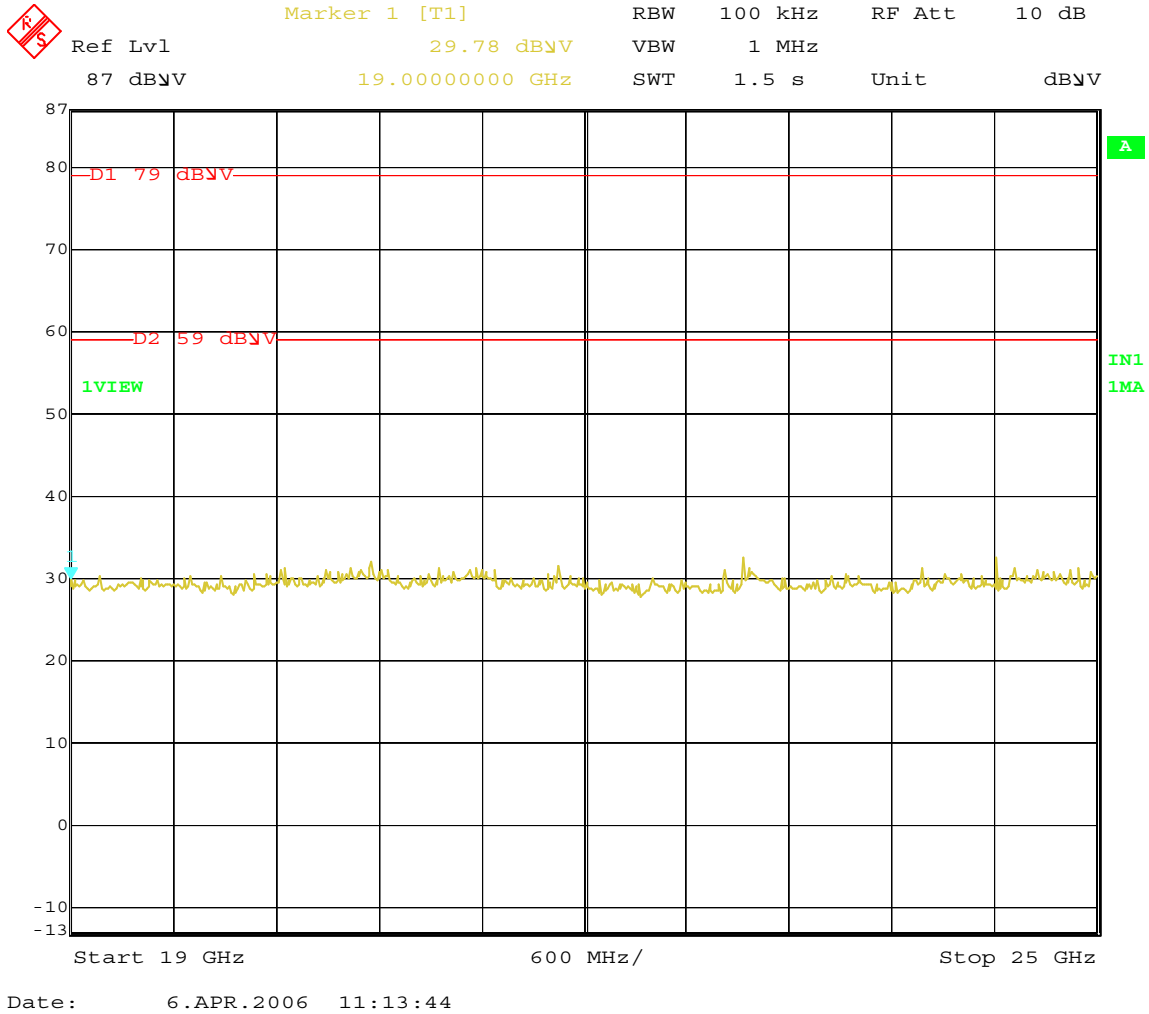


**Plot 11 - Mid Tx (Channel 47), Antenna Conducted Emissions, 7 GHz-13 GHz**

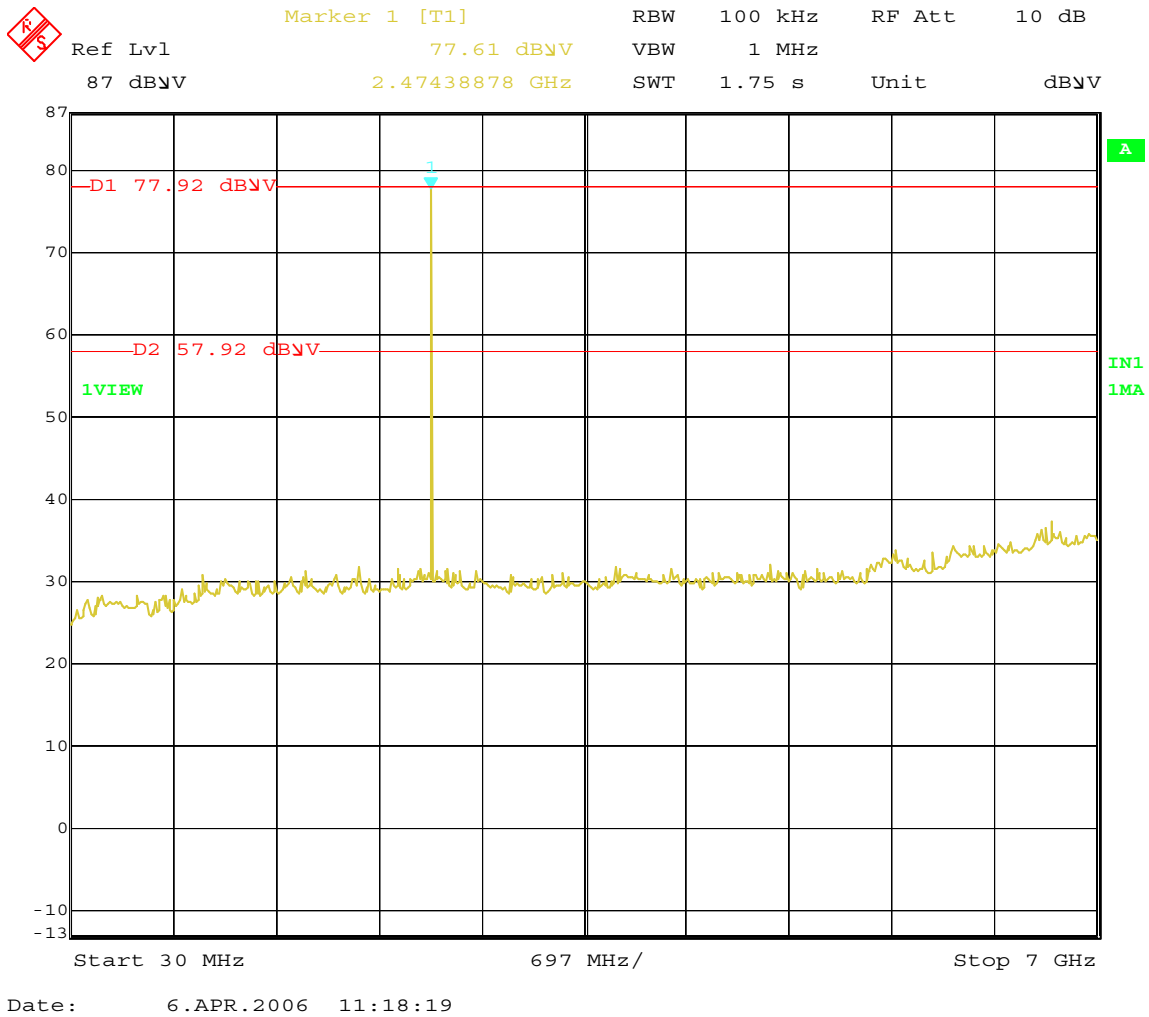




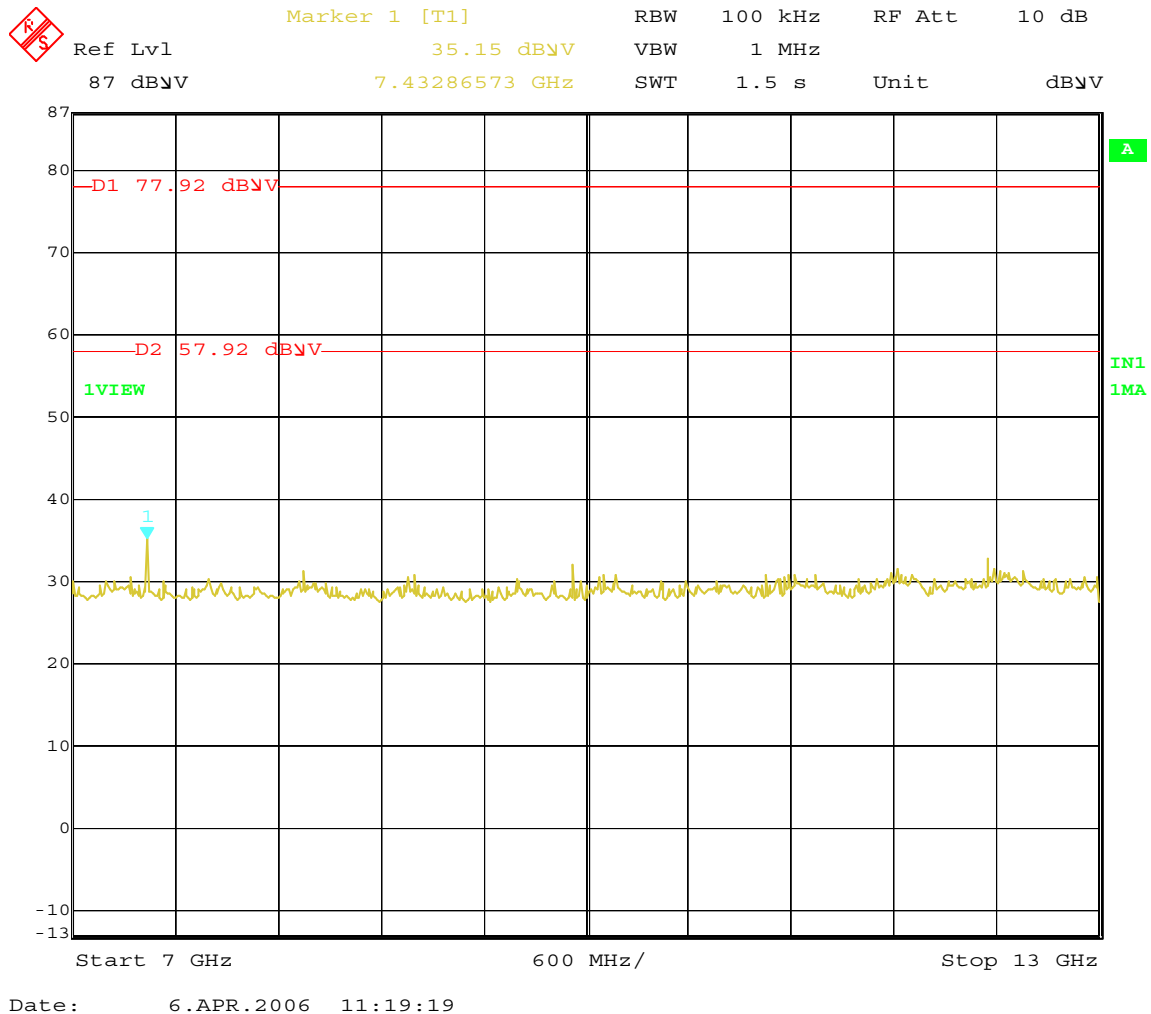
Plot 12 - Mid Tx (Channel 47), Antenna Conducted Emissions, 13 GHz-19 GHz



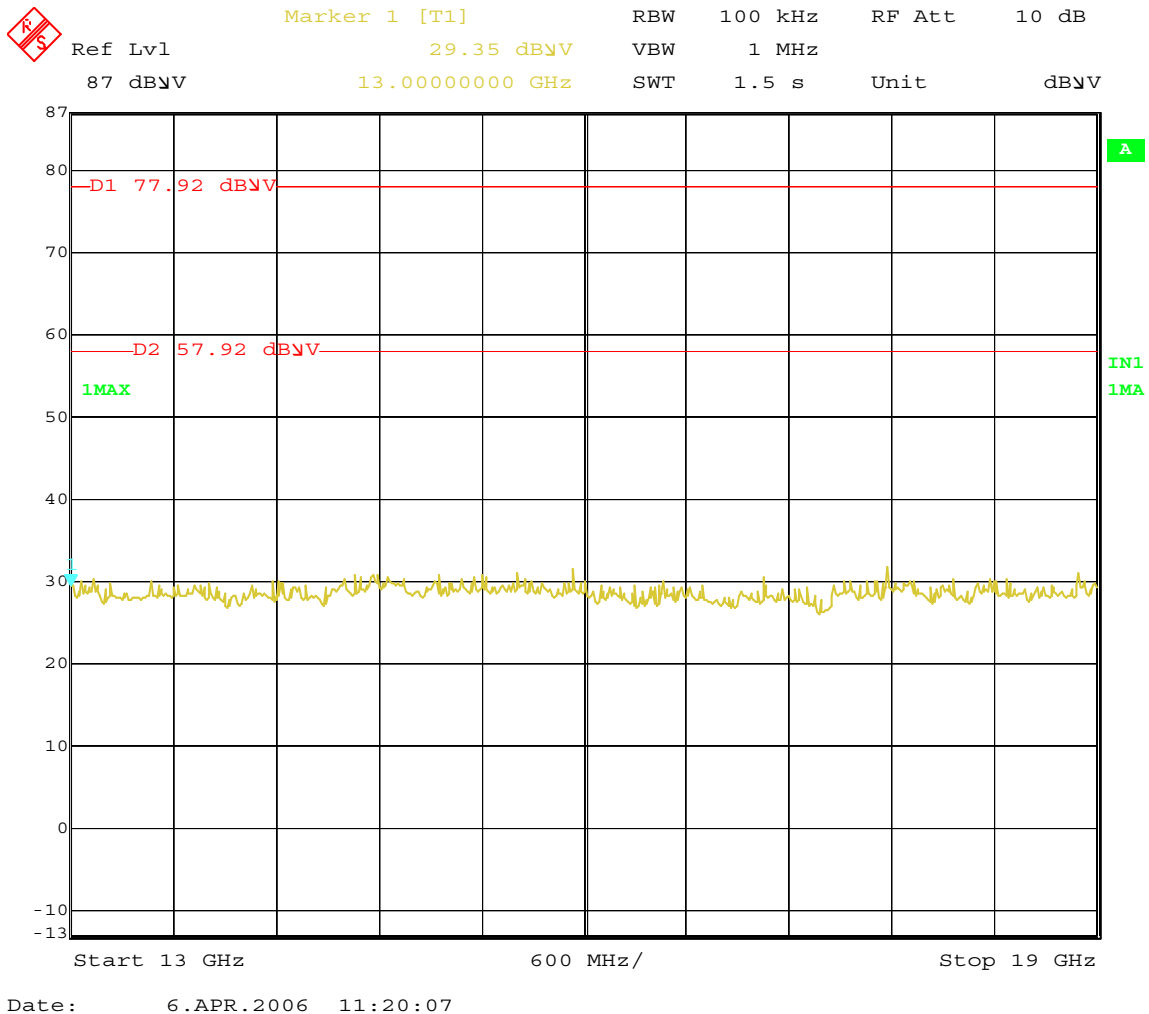
**Plot 13 - Mid Tx (Channel 47), Antenna Conducted Emissions, 19 GHz-25 GHz**



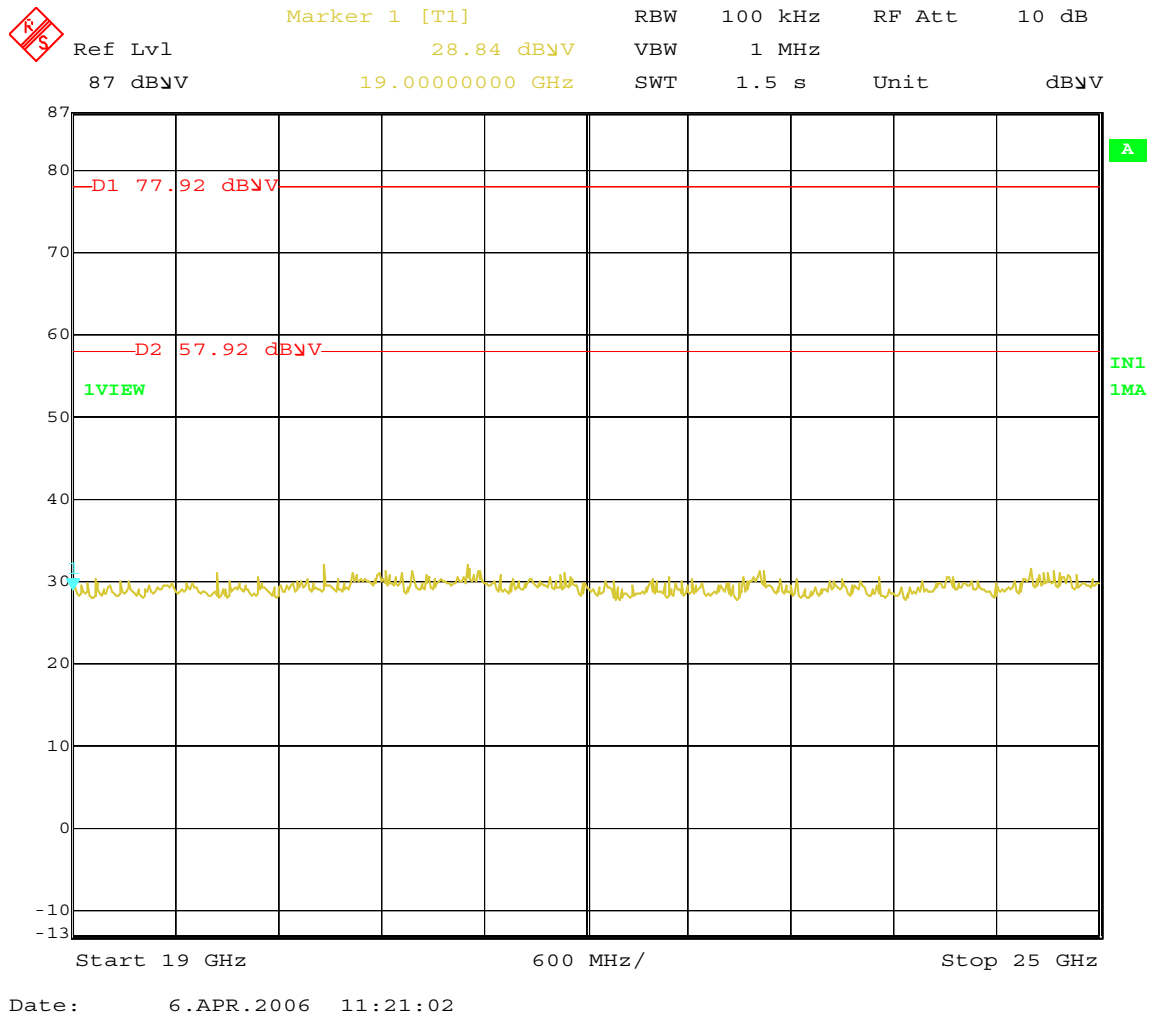
**Plot 14 - High Tx (Channel 78), Antenna Conducted Emissions, 30 MHz-7 GHz**



Plot 15 - High Tx (Channel 78), Antenna Conducted Emissions, 7 GHz-13 GHz



Plot 16 - High Tx (Channel 78), Antenna Conducted Emissions, 13 GHz-19 GHz



Plot 17 - High Tx (Channel 78), Antenna Conducted Emissions, 19 GHz-25GHz

#### 4.3.7 RF Safety - Maximum Permitted Exposure

The JETT.XL has the antenna with 0 dBi nominal Antenna Gain. Therefore the numeric antenna gain is 1 (0 dBi=10 log (numeric gain))

Based on the FCC OET Bulletin 65, Edition 97-01, power density at a distance of 20 cm was calculated as below:

$$S = \frac{P \cdot G}{4\pi R^2}$$

Where:

S=Power Density (mW/cm<sup>2</sup>)

P=Power input to Antenna (mW)

G=Antenna Numeric Gain

R=Distance from center of Radiation Antenna (cm)

Tx Freq	Ant Gain (dBi)	Antenna Gain (Numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (mW/cm <sup>2</sup> )	*Limit of Power Density (mW/cm <sup>2</sup> )
2.402 GHz (Low TX)	0	1	3.65	2.317	0.00046	1
2.449 GHz (Medium TX)	0	1	2.20	1.650	0.00033	1
2.480 GHz (High TX)	0	1	1.12	1.294	0.00026	1

\*Limit for General Population/Uncontrolled Exposure is applied as per FCC Part 15, Section 1.1310.

**Overall Results:** The JETT.XL met the Maximum Permitted Exposure (MPE) requirements specified in FCC Part 15, Section 15.247 (i).

#### 4.3.8 Power Spectral Density Requirements

This test was performed with the JETT.XL antenna port connected directly to the spectrum analyzer through a suitable attenuator.

Measurements were made for all the three selected operating test frequencies – Low TX, Mid TX and High TX.

The limit for power spectral density as specified in FCC 15.247 is 8 dBm.

The test results are presented below:

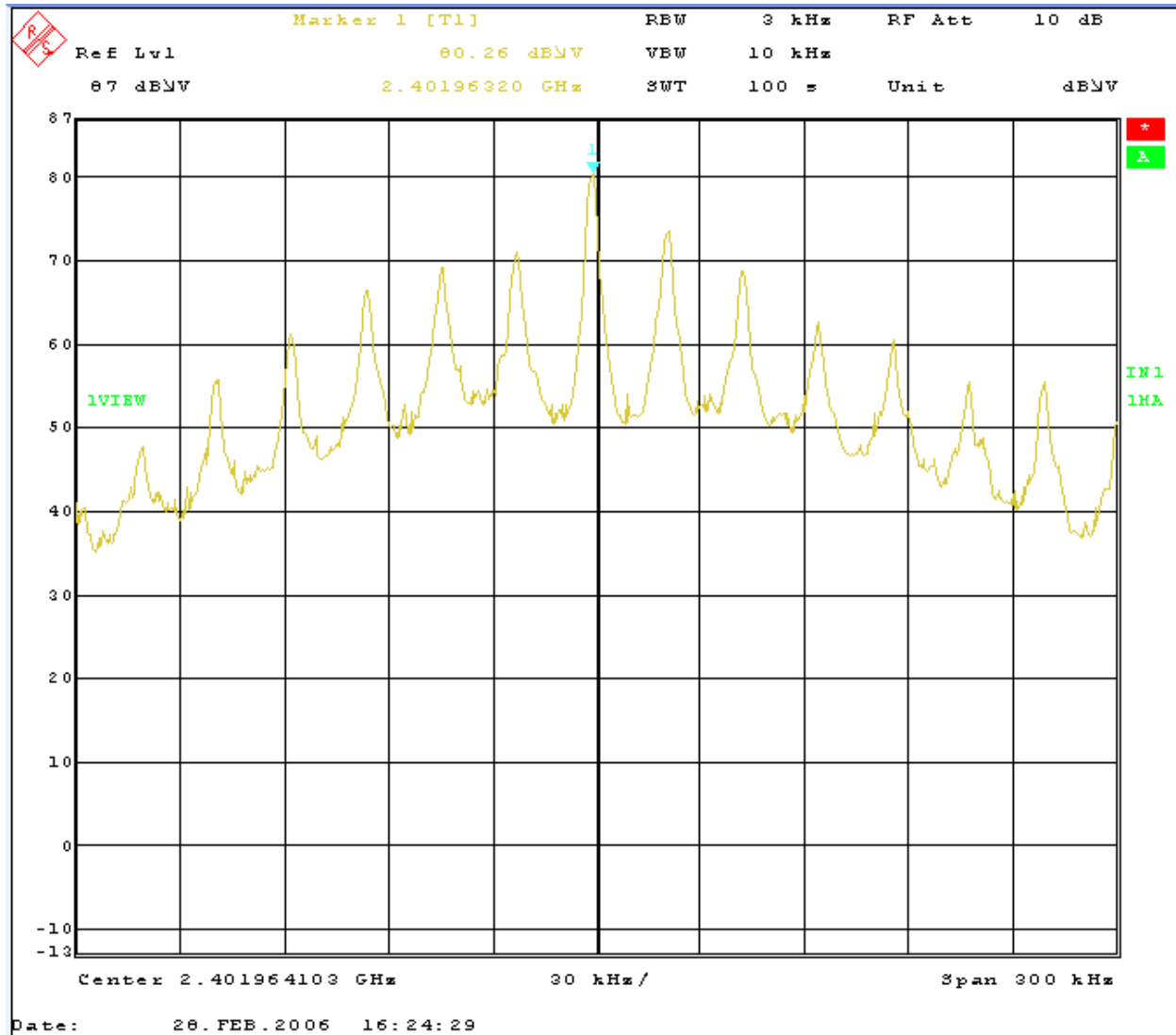
Transmit Frequency	Peak Receiver Level	Correction Factor	Corrected Voltage Level	Corrected Power Level	FCC Power Density Limit
	(dBuV)	(dB)	(dBuV)	(dBm)	(dBm)
2.402 GHz (Low TX)	80.26	30.2	110.46	3.46	8
2.449 GHz (Medium TX)	78.73	30.2	108.93	1.93	8
2.480 GHz (High TX)	77.58	30.2	107.78	0.78	8

The graphical plots showing power spectral density measurements are presented on the next pages.

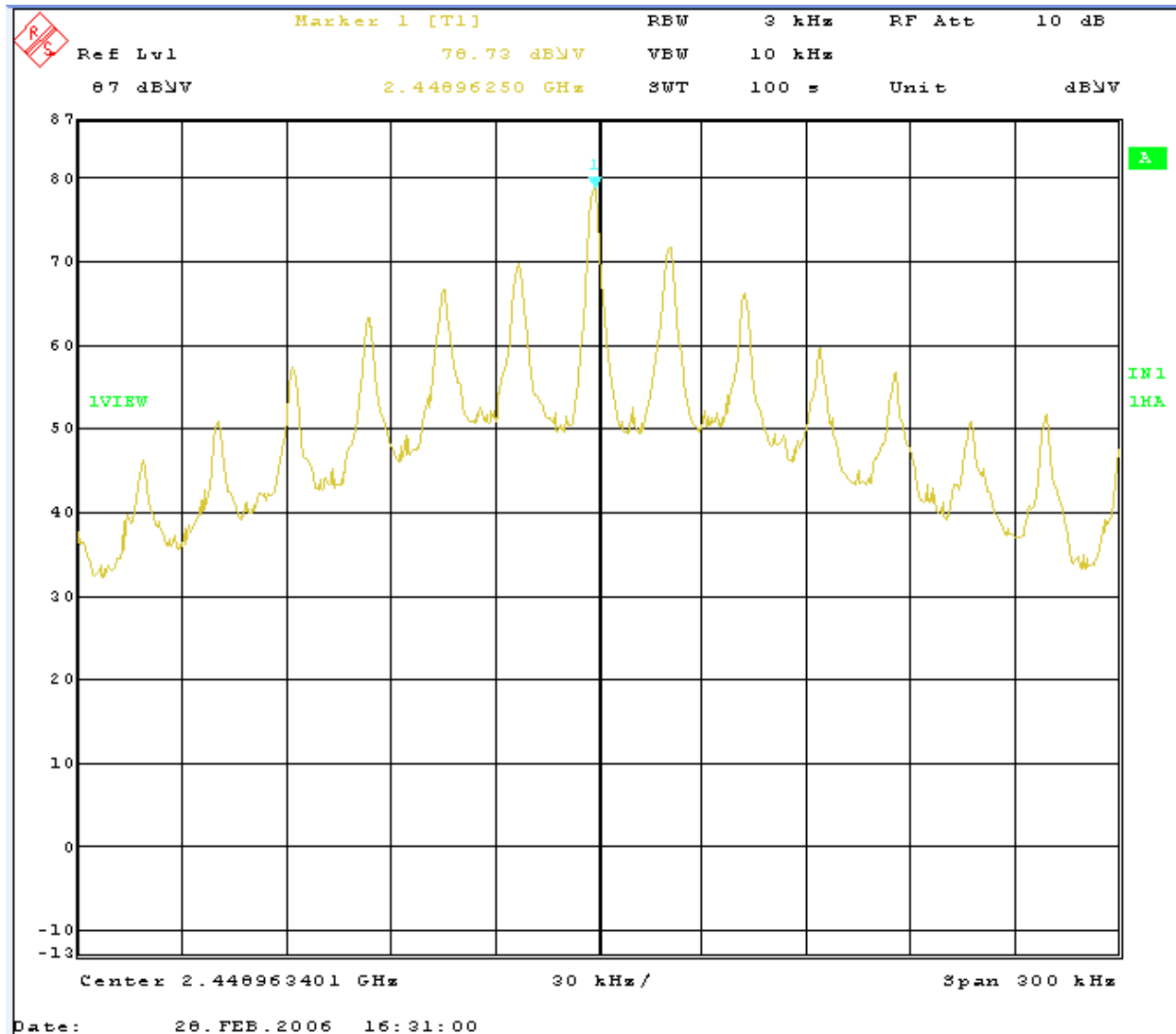
**Overall Results:** The JETT.XL met the power spectral density requirements specified in FCC Part 15, Section 15.247 (e).



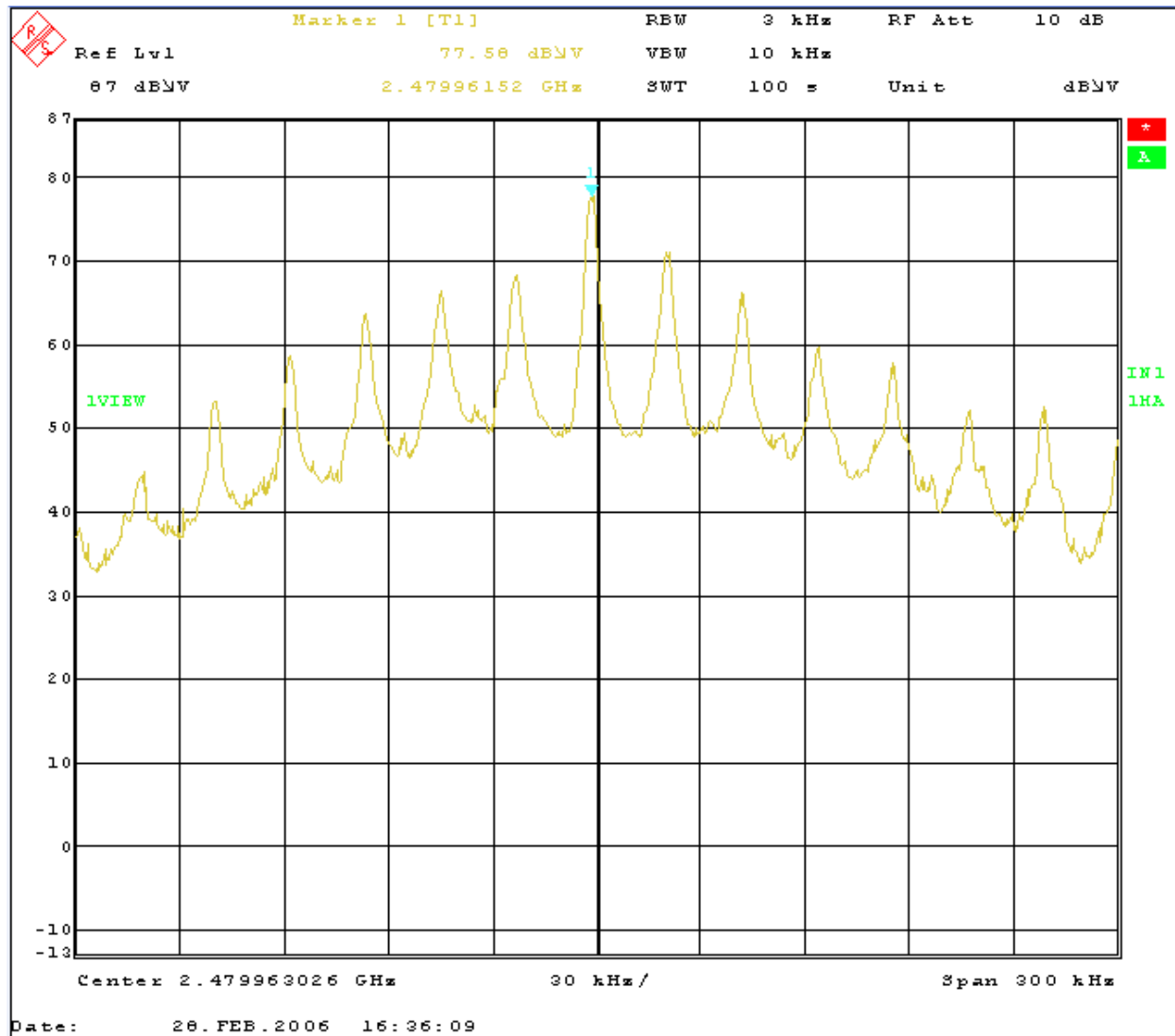
**Power Spectral Density Plots**



**Plot 18 - Low Tx (Channel 0), Power Spectral Density**



**Plot 19 - Mid Tx (Channel 47), Power Spectral Density**



Plot 20 - High Tx (Channel 78), Power Spectral Density

#### **4.3.9 Bandedge Requirements**

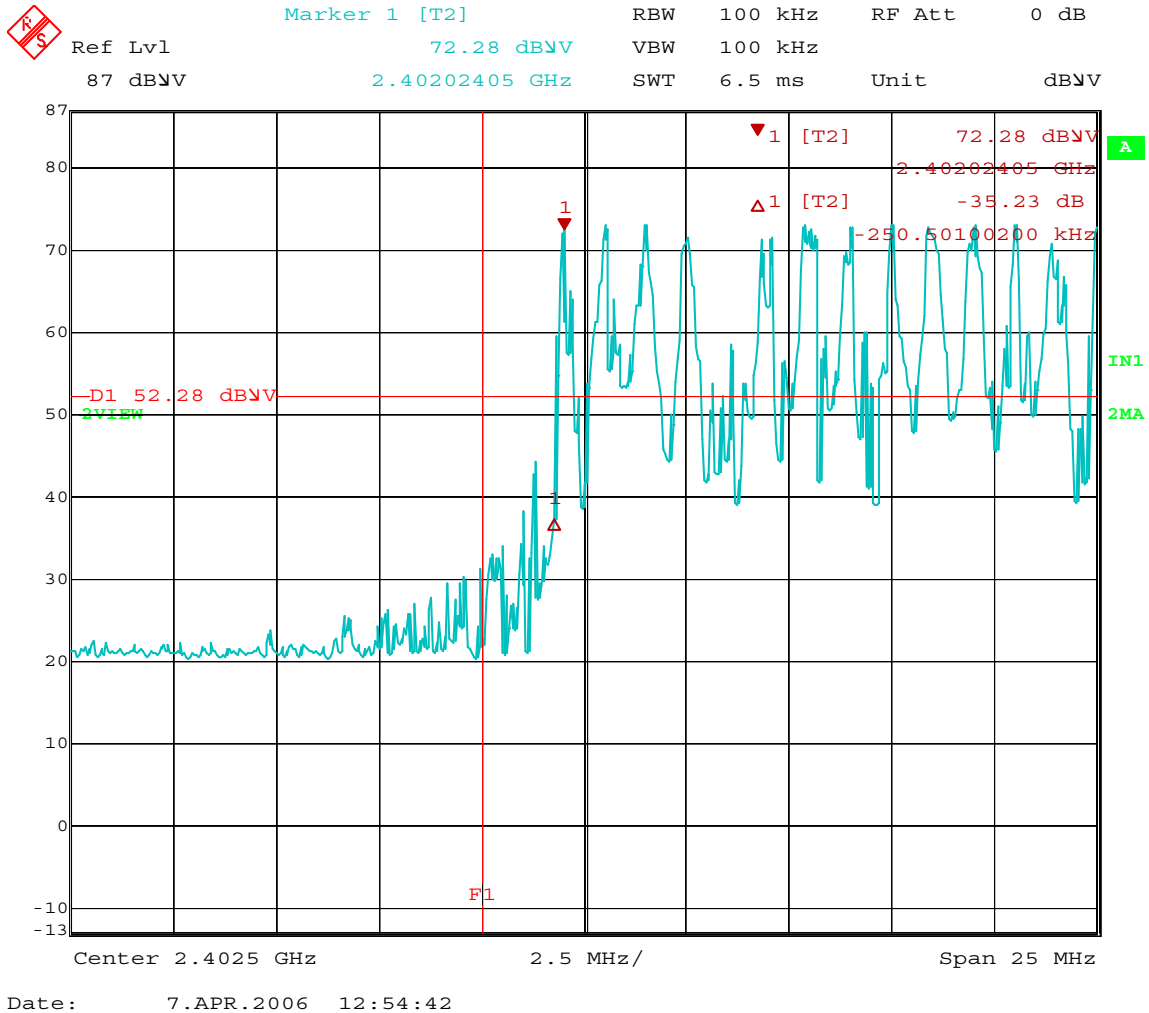
Measurements were made at the edge of the lowest and highest test frequencies.

The requirement is that the transmission signal frequency measured at 20 dB down from its peak amplitude at the lowest and highest channels shall remain within the permissible band.

The graphical plots showing bandedge measurements made at the lowest and highest channels are presented on the next pages.

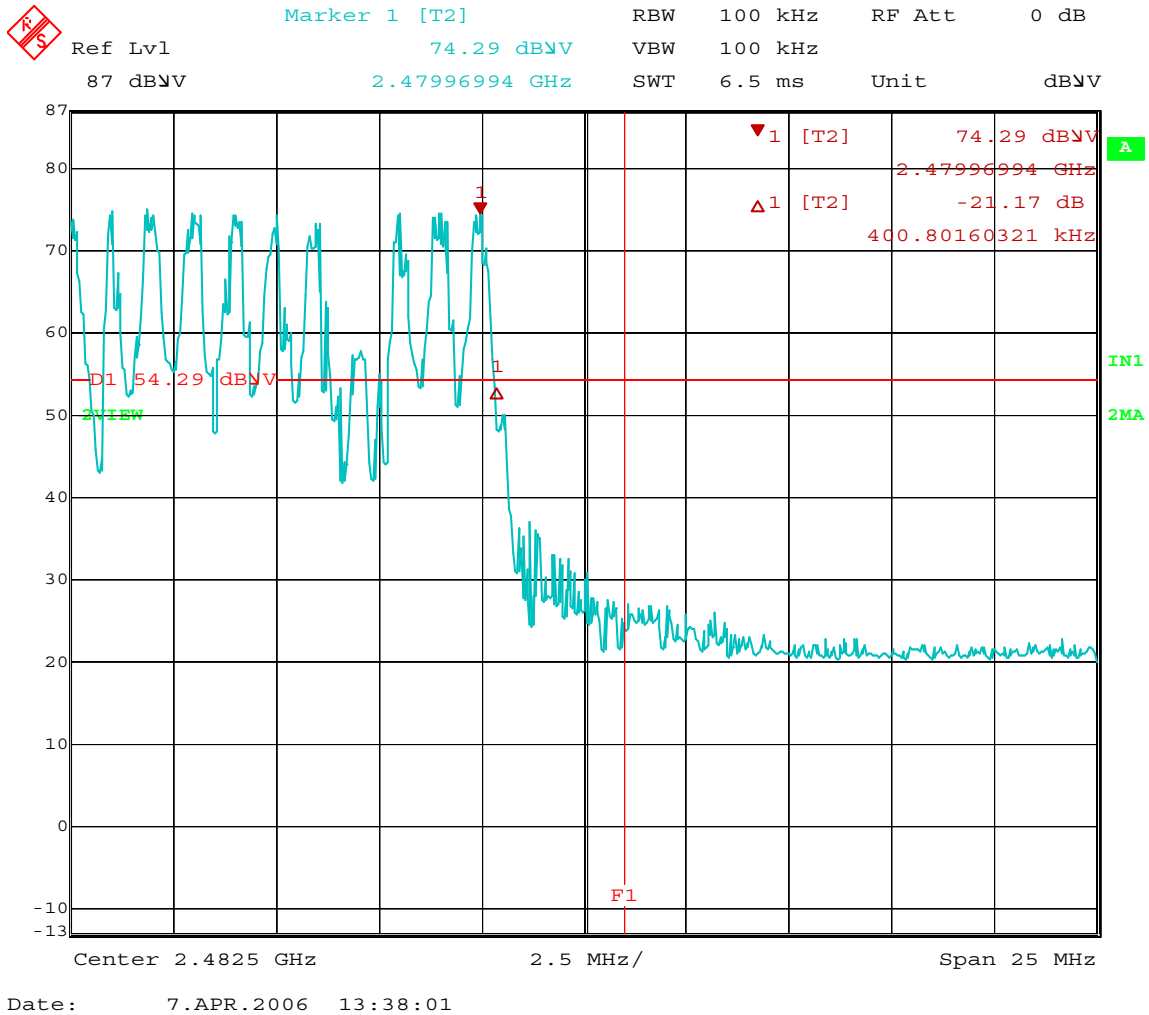
**Overall Results:** The JETT.XL met the bandedge requirements specified by the FCC Part 15.

**Bandedge Measurements Plots**



**Note:** Marker 1 is at Lowest Tx Channel, Frequency Line F1 is at 2.4 GHz

**Plot 21 - Bandedge at the Lowest Tx Frequency**



**Note:** Marker 1 is at Highest Tx Channel, Frequency Line F1 is at 2.4835GHz

**Plot 22 - Bandedge at the Highest Tx Frequency**

**4.3.10 20 dB Occupied Bandwidth Measurements**

Measurements were made for all the three selected operating test frequencies – Low TX, Mid TX and High TX.

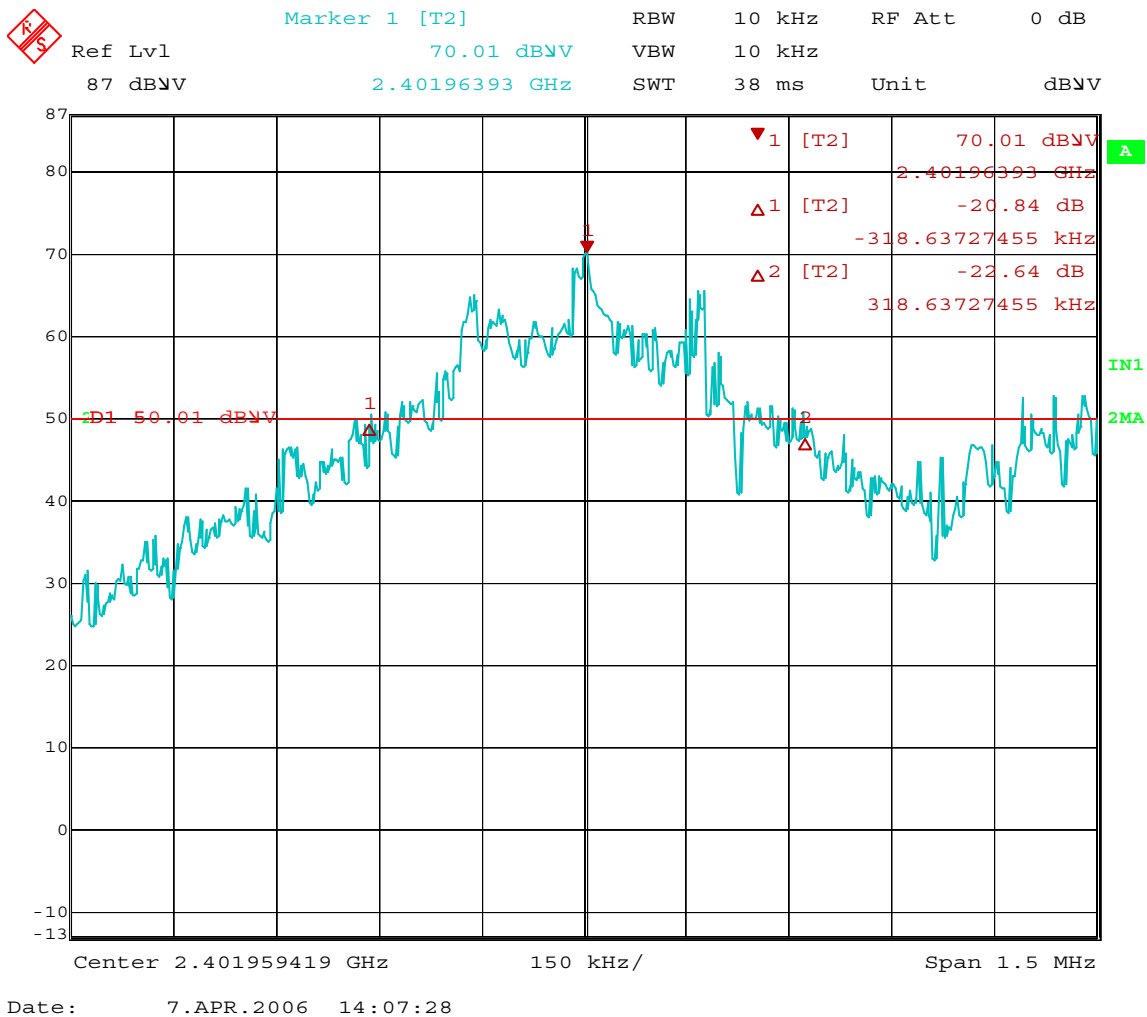
The test results are presented below:

<b>Transmit Frequency</b>	<b>Occupied Bandwidth</b>
	<b>(kHz)</b>
2.402 GHz (Low TX)	637.27
2.449 GHz (Medium TX)	655.31
2.480 GHz (High TX)	622.24

The graphical plots showing occupied bandwidth measurements are presented on the next pages.

**Overall Results:** Average overall occupied bandwidth of the JETT.XL was determined as 638.27 kHz.

### Occupied Bandwidth Plots

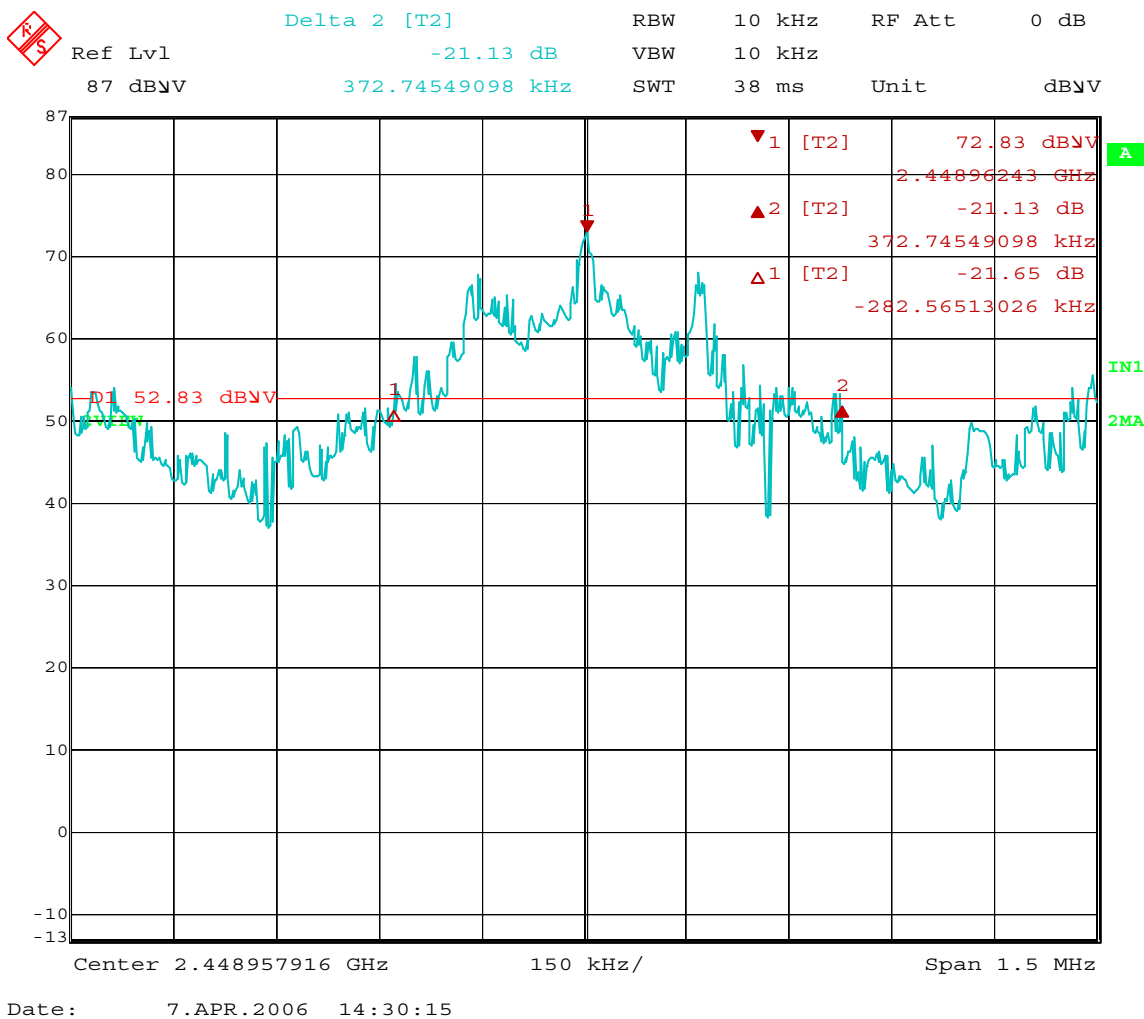


**Note:** Trace on Max hold for 20 minutes. Signal on the left is Channel 1

20 dB Bandwidth = 637.27 kHz

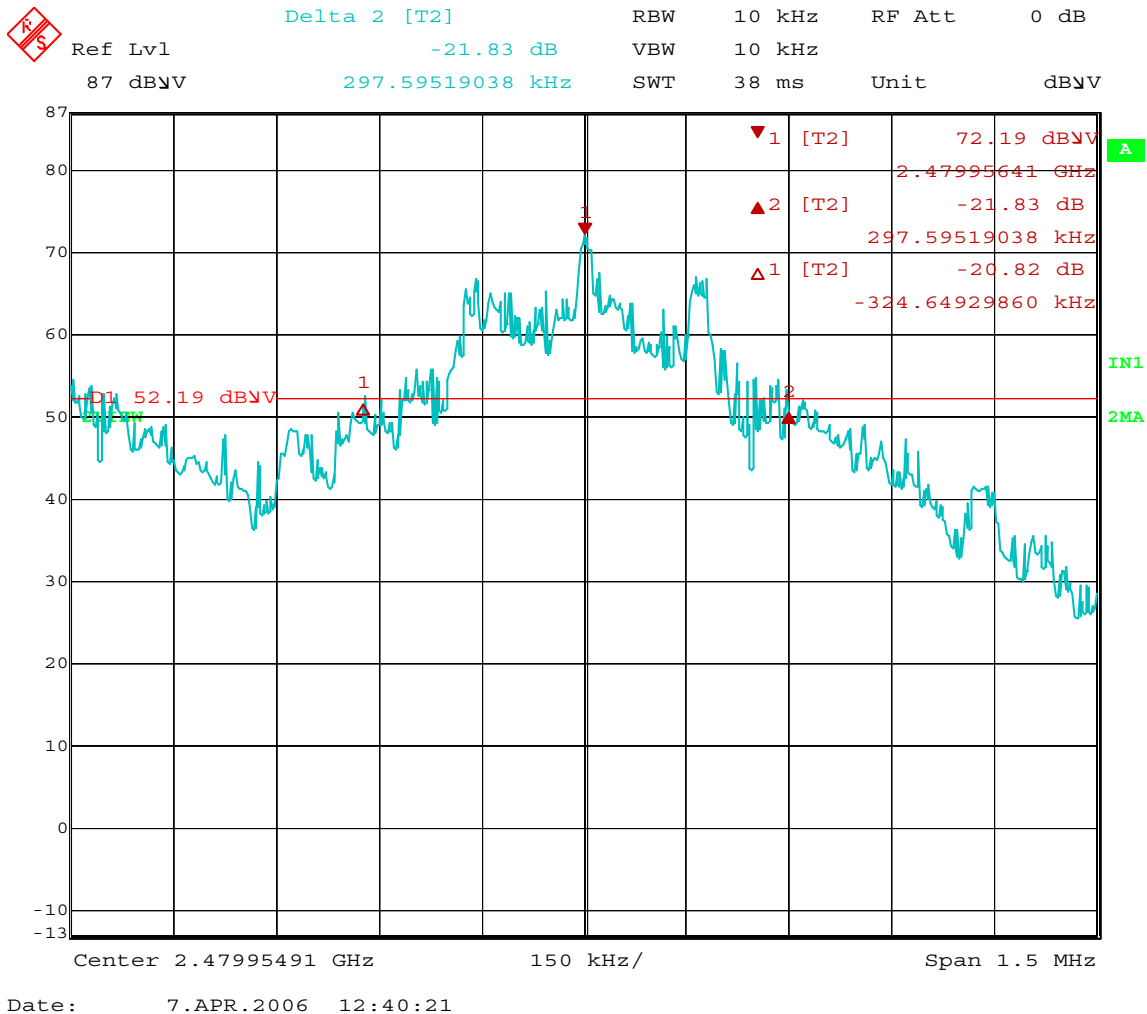
**Plot 23 – Occupied Bandwidth at Low Tx Frequency**





**Note:** Trace on Max hold for 20 minutes. Signal on the left is Channel 1  
20 dB Bandwidth = 655.31 kHz

**Plot 24 – Occupied Bandwidth at Mid Tx Frequency**



**Note:** Trace on Max hold for 20 minutes. Signal on the left is Channel 78  
20 dB Bandwidth = 622.24 kHz

**Plot 25 – Occupied Bandwidth at High Tx Frequency**

**Appendix A – Test Equipment**

<b>Description</b>	<b>Freq Range (Hz)</b>	<b>Model Number</b>	<b>Manufacturer</b>	<b>ID / SN</b>	<b>Last Cal Date</b>
EMI Test Receiver/Analyzer	20 Hz – 40 GHz	ESIB 40	Rohde & Schwarz	C-062	12/19/2005
Antenna	25M - 2G	LPB-2520/A	ARA	B965	9/26/2005
Antenna	1G – 18G	96001	EATON	U926	5/12/2005
Antenna	18G – 26.5G	DBE-520	DEMORNAY	D485	9/9/2005
Controller, Tower and Turntable	NA	2090	EMCO	B812	NA
Amplifier	1G – 40G	NSP4000-44	Miteq	B827	9/14/2005
EMI Test Receiver/Analyzer	20 Hz – 26.5 GHz	ESIB 26	Rohde & Schwarz	C232	3/18/2005
Filter, Bandpass	0.15M - 30M	NA	Unisys	NA	NA
Limiter, Pulse	DC - 30M	ESH3-Z2	Polarad	NA	NA
LISN	9k - 30M	MN 2053	Chase	U775	10/17/2005