

EMC TEST REPORT

**RADIO PERFORMANCE MEASUREMENTS ON
THE SAITEK PS30 WIRELESS TRANSCEIVER**

D Legge

Test Report 04013938C-4

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Report approved by:

K Newman
Manager
EMC Testing

March, 2005

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REPORT SUMMARY

Customer: Saitek Plc
 Units 3 & 4 West Point Row
 Great park Road
 Almondsbury
 Bristol
 BS32 4QG
 United Kingdom

Customer's Representative: Martin Mannix

Customer's Purchase Order: Proforma Invoice

Description of Equipment Under Test: Wireless Transceiver

Type Number(s): PS30

Serial Number(s): None

Test Specification(s): DA 00 -705,CFR47 Part 15

Equipment Received: 7 January 2005

Test Date(s): 10 – 4th February 2005

The results of the tests are summarised as follows:

Transmitter Parameters	CFR47 -15 Clause Number	EN300 440-1 Clause Number	Compliance
Field Strength	15.247	7.1	Pass
Permitted range of operation frequencies	15.249	7.2	Pass
Spurious Emissions	15.249	7.3	Pass
Receiver parameters			
Spurious Emissions(Conducted)	15.207	8.4	Pass
Spurious Emissions(Radiated)	15.209	-	Pass

Test Engineer(s):	D A Legge	
Report Written by:	D A Legge	
Checked by:	R Orchard	

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RADIO PERFORMANCE MEASUREMENTS ON THE SAITEK PS30 JOYSTICK AND DONGLE WIRELESS TRANSCEIVER

1 INTRODUCTION

Intertek Testing & Certification Ltd on behalf of Saitek Plc tested the Saitek PS30-1 Joystick and PS30-2 Dongle with a standard laptop PC as the host computer. The samples used operated in the frequency sub-band of 2400- 2483.5 which contains 78 channels. The lower frequency centre point is 2402.0 MHz and the upper frequency centre point is 2479.0 MHz. The samples were set to a discrete frequency of lower, middle and upper frequency limits, and were tested to the relevant performance specifications published by the Federal Communications Commission and the European Telecommunications Standards Institute. This report contains the results of these tests and is submitted to Saitek Plc as the final test results.

2 TEST PROCEDURE

2.1 Relevant Performance Specification

The relevant performance specification for the Saitek Plc PS30 is FCC CFR47 Part 15. The tests performed are those required to demonstrate compliance with the essential requirements of CFR47 Part 15 for regulatory purposes.

2.2 Test Environment

The tests were performed in the EMC Test Department Test Facility at Intertek Testing & Certification Ltd laboratories in Leatherhead. The samples were subjected to the ambient conditions in the laboratory and indoor test site except during tests at extremes of temperatures, when the EUT was placed in an environmental chamber. The temperature and relative humidity recorded during the period of each test are given in the results.

2.3 Configuration of Test Sample

The test sample consisted of three PS30 Joysticks and a PS30 Dongle using a host laptop computer.

2.4 Test Frequency

The samples supplied operated at the discrete frequencies of 2402.0, 2442.0 and 2478.0

Test Power Sources

The Joystick is intended to operate from an internal battery 1.50vdc, whilst the Dongle derives 5.0vdc from the host PC.

2.5 Measurement Uncertainty

All measurement uncertainties stated in this report are estimated to a 95% confidence level.

3 RESULTS OF TRANSMITTER TESTS

3.1 RADIATED FIELD STRENGTH

The tests were carried out under normal test conditions in a fully lined anechoic chamber using a test range of 1.0 m.

The EUT (S) were set to transmit and rotated through 360° in a vertical axis to find the maximum radiated power. The field strength was then calculated and extrapolated for a 3m test distance.

Laboratory Conditions: Temperature 22.0 °C Humidity 58%

3.1.1 Joystick

Fundamental MHz	Field mV/m	Limit mV/m
2402.0	6.6	50.0
1st Harmonic MHz	Field µV/m	Limit µV/m
4803.97	< 81.0	500.0

Fundamental MHz	Field mV/m	Limit mV/m
2442.0	4.6	50.0
1st Harmonic MHz	Field µV/m	Limit µV/m
4884.11	160	500.0

Fundamental MHz	Field mV/m	Limit mV/m
2470.0	5.0	50.0
1st Harmonic MHz	Field µV/m	Limit µV/m
4956.0	255	500.0

3.1.2 Laptop + Dongle

Fundamental MHz	Field mV/m	Limit mV/m
2402.0	6.0	50.0
Ist Harmonic MHz	Field μ V/m	Limit μ V/m
4804.02	<81.0	500.0

Fundamental MHz	Field mV/m	Limit mV/m
2442.0	4.1	50.0
Ist Harmonic MHz	Field μ V/m	Limit μ V/m
4884.11	<81.0	500.0

Fundamental MHz	Field mV/m	Limit mV/m
2478.0	5.6	50.0
Ist Harmonic MHz	Field μ V/m	Limit μ V/m
4956.0	255	500.0

3.1.3 Sub-band 2483.0 to 2500.0 MHz

To demonstrate compliance within the restricted sub-band 2483.0 to 2500.0 MHz measurements were made for all three samples. A pre-amplifier of 26dB nominal gain was used when the measurements were carried out. The plots showing the results are shown in Annex 1.

Note: Emissions above 1GHz are manual measurements made using a spectrum analyser with RBW 1MHz, VBW 3MHz, Peak Detector including a pre -amplifier of 26dB average gain. As all peak detected levels are lower than the average limits, no average measurements were made.

3.2 Permitted Range of Operating Frequencies

Laboratory Conditions: Temperature 22°C; Humidity 58 %

3.2.1 Joystick - nominal frequency 2402.0 MHz

Occupied Operating Frequencies (- 6dBpk)

Measured frequency MHz - fL	Measured frequency MHz - fH	Limit 2400.0 – 2483.5 MHz
2400.71	2403.03	Pass
Measurement Uncertainty: ± 500 Hz		

3.2.2 Occupied Operating Frequencies (- 30dBpk)

Measured frequency MHz - fL	Measured frequency MHz - fH	Limit 2400.0 – 2483.5 MHz
2397.4	2406.34	Pass
Measurement Uncertainty: ± 500 Hz		

Note 1: All peak amplitudes are below the average limit.

Note 2: Plots showing the occupied operating frequencies are shown in Annex 2

3.2.2 Joystick - nominal frequency 2442.0 MHz

Occupied Operating Frequencies (- 6dBpk)

Measured frequency MHz - fL	Measured frequency MHz - fH	Limit 2400.0 – 2483.5 MHz
2440.4	2443.3	Pass
Measurement Uncertainty: ± 500 Hz		

3.2.2 Occupied Operating Frequencies (- 30dBpk)

Measured frequency MHz - fL	Measured frequency MHz - fH	Limit 2400.0 – 2483.5 MHz
2436.6	2447.2	Pass
Measurement Uncertainty: ± 500 Hz		

Note: Plots showing the occupied operating frequencies are shown in Annex 2

3.2.3 Joystick - nominal frequency 2478.0 MHz**Occupied Operating Frequencies (- 6dBpk)**

Measured frequency MHz - fL	Measured frequency MHz - fH	Limit 2400.0 – 2483.5 MHz
2477.6	2478.4	Pass
Measurement Uncertainty: ± 500 Hz		

3.2.2 Occupied Operating Frequencies (- 30dBpk)

Measured frequency MHz - fL	Measured frequency MHz - fH	Limit 2400.0 – 2483.5 MHz
2476.1	2479.8	Pass
Measurement Uncertainty: ± 500 Hz		

Note: Plots showing the occupied operating frequencies are shown in Annex 2

3.3 Permitted Range of Operating Frequencies

Laboratory Conditions: Temperature 22°C; Humidity 58 %

3.3.1 Laptop and Dongle - nominal frequency 2402.0 MHz

Occupied Operating Frequencies (- 6dBpk)

Measured frequency MHz - fL	Measured frequency MHz - fH	Limit 2400.0 – 2483.5 MHz
2400.6	2403.0	Pass
Measurement Uncertainty: ± 500 Hz		

3.2.2 Occupied Operating Frequencies (- 30dBpk)

Measured frequency MHz - fL	Measured frequency MHz - fH	Limit 2400.0 – 2483.5 MHz
2397.4	2406.0	Pass
Measurement Uncertainty: ± 500 Hz		

Note 1: All amplitudes are peak measurements which are below the average limits.

Note 2: Plots showing the occupied operating frequencies are shown in Annex 2

3.3.2 Laptop and Dongle- nominal frequency 2442.0 MHz

Occupied Operating Frequencies (- 6dBpk)

Measured frequency MHz - fL	Measured frequency MHz - fH	Limit 2400.0 – 2483.5 MHz
2440.2	2443.3	Pass
Measurement Uncertainty: ± 500 Hz		

3.2.2 Occupied Operating Frequencies (- 30dBpk)

Measured frequency MHz - fL	Measured frequency MHz - fH	Limit 2400.0 – 2483.5 MHz
2436.6	2447.2	Pass
Measurement Uncertainty: ± 500 Hz		

Note: Plots showing the occupied operating frequencies are shown in Annex 2

3.3.3 Laptop and Dongle - nominal frequency 2478.0 MHz**Occupied Operating Frequencies (- 6dBpk)**

Measured frequency MHz - fL	Measured frequency MHz - fH	Limit 2400.0 – 2483.5 MHz
2477.6	2478.4	Pass
Measurement Uncertainty: ± 500 Hz		

3.2.2 Occupied Operating Frequencies (- 30dBpk)

Measured frequency MHz - fL	Measured frequency MHz - fH	Limit 2400.0 – 2483.5 MHz
2472.5	2481.0	Pass
Measurement Uncertainty: ± 500 Hz		

Note: Plots showing the occupied operating frequencies are shown in Annex 2

3.4 Spurious Emissions

3.4.1 Conducted – Line/Neutral/Ground – Transmit Mode

Operating Frequency (MHz)	Measured Frequency (MHz)	Emission (dB μ V)	Limits (dB μ V)	Comment
2402.0	-	-	60.0	Pass
2442.0	-	-	60.0	Pass
2478.0	-	-	60.0	Pass
All other emissions were at least 10 dB within specification Measurement uncertainty : ± 4.4 dB				

There were no emissions within 10dB of the limit

Note: Plots of the conducted emissions are shown in Annex 3.

3.4.2 Radiated - Transmitter Operating – 2402.0MHz

Laptop and Dongle - Vertical Polarisation

Laboratory Conditions: Temperature 21.0°C; Humidity 32%

Frequency (MHz)	Emission (µV/m)	Limits (µV/m)	Comment
195.48	19.0	150	Pass
586.44	68.0	200	Pass
651.54	71.0	200	Pass
1114.0	115.0	500	Pass
All other emissions were at least 20 dB within specification			
Measurement uncertainty based on substitution method ±5.1dB			

Joystick - Vertical Polarisation

Laboratory Conditions: Temperature 21.0°C; Humidity 32%

Frequency (MHz)	Emission (µV/m)	Limits (µV/m)	Comment
521.22	64.0	200	Pass
586.38	45.0	200	Pass
651.54	50.0	200	Pass
1857.0	200.0	200	Pass
All other emissions were at least 20 dB within specification			
Measurement uncertainty based on substitution method ±5.1dB			

3.4.3 Radiated - Transmitter Standby

There were no emissions found above system measuring level (at least 10 dB below limit).

3.4.4 Radiated - Transmitter Operating – 2442.0**Laptop and Dongle - Vertical Polarisation**

Laboratory Conditions: Temperature 21.0°C; Humidity 32%

Frequency (MHz)	Emission (µV/m)	Limits (µV/m)	Comment
195.48	19.0	150	Pass
521.28	95.0	200	Pass
586.44	62.0	200	Pass
651.54	71.0	200	Pass
All other emissions were at least 20 dB within specification			
Measurement uncertainty based on substitution method ±5.1dB			

Joystick - Vertical Polarisation

Laboratory Conditions: Temperature 21.0°C; Humidity 32%

Frequency (MHz)	Emission (µV/m)	Limits (µV/m)	Comment
521.22	52.0	200	Pass
All other emissions were at least 20 dB within specification			
Measurement uncertainty based on substitution method ±5.1dB			

3.4.5 Radiated - Transmitter Standby

There were no emissions found above system measuring level (at least 10 dB below limit).

3.4.6 Radiated - Transmitter Operating – 2478.0MHz**Laptop and Dongle - Vertical Polarisation**

Laboratory Conditions: Temperature 21.0°C; Humidity 32%

Frequency (MHz)	Emission (µV/m)	Limits (µV/m)	Comment
195.48	24.0	150	Pass
325.8	37.0	200	Pass
586.38	< 81.0	200	Pass
651.54	< 81.0	200	Pass
All other emissions were at least 20 dB within specification			
Measurement uncertainty based on substitution method ±5.1dB			

Joystick - Vertical Polarisation

Laboratory Conditions: Temperature 24.0°C; Humidity 31%

Frequency (MHz)	Emission (µV/m)	Limits (µV/m)	Comment
521.2	85.0	150	Pass
586.4	53.0	200	Pass
651.54	64.0	200	Pass
All other emissions were at least 20 dB within specification			
Measurement uncertainty based on substitution method ±5.1dB			

3.4.7 Radiated - Transmitter Standby

There were no emissions found above system measuring level (at least 10 dB below limit).

4 RESULTS OF RECEIVER TESTS

4.1 Spurious Emissions

4.1.1 Conducted – Line/Neutral/Ground

Laboratory Conditions: Temperature 19.5 °C; Humidity 24%

There were no emissions above measuring system noise, minimum 19µV.

Note: Plots of the conducted results are shown in annex 3.

4.1.2 Radiated Emissions – Receive mode

There were no emissions above measuring system noise, minimum 19µV.

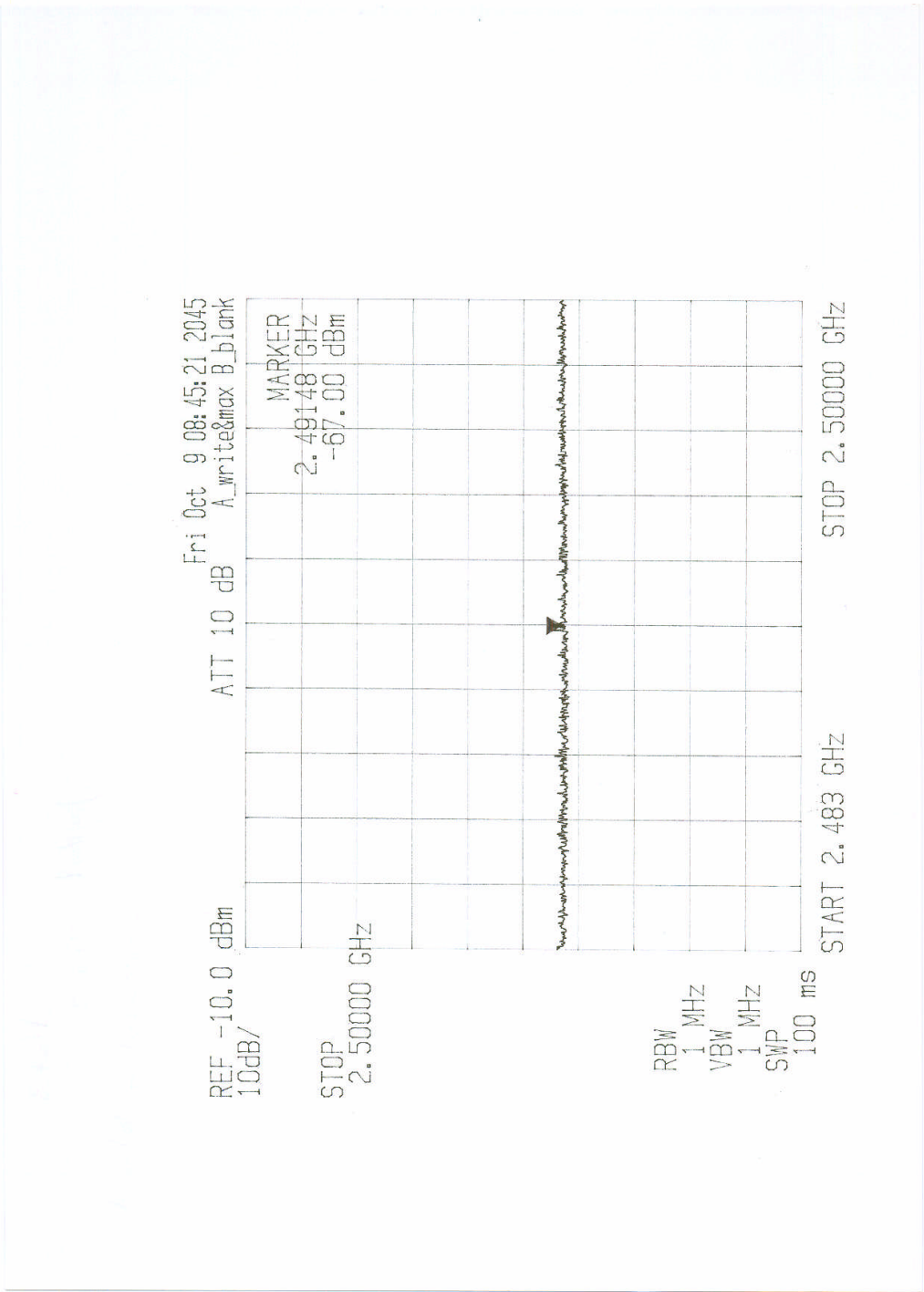
4.1.3 Sample Calculation

Freq	Analyser	ACF	Cables	Pre -Amp	Total	Field @ 3m
MHz	dBµV	dB	dB	dB	dBµV/m	µV/m
208.0	44.3	+9.6	+0.7	-26	28.6	27.0

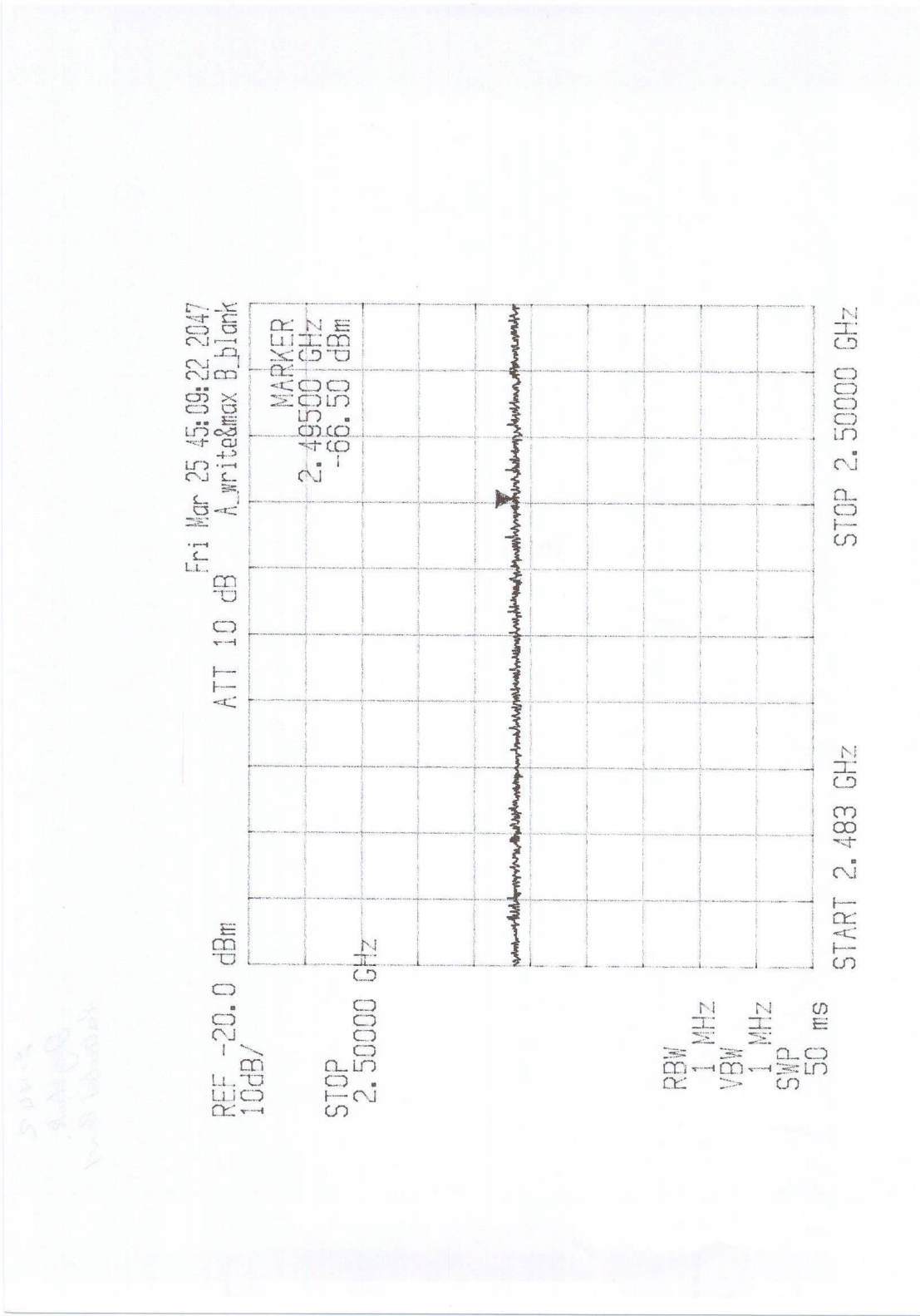
5 ANNEX 1

5.1 Plots showing the restricted sub band 2483.0 to 2500MHz

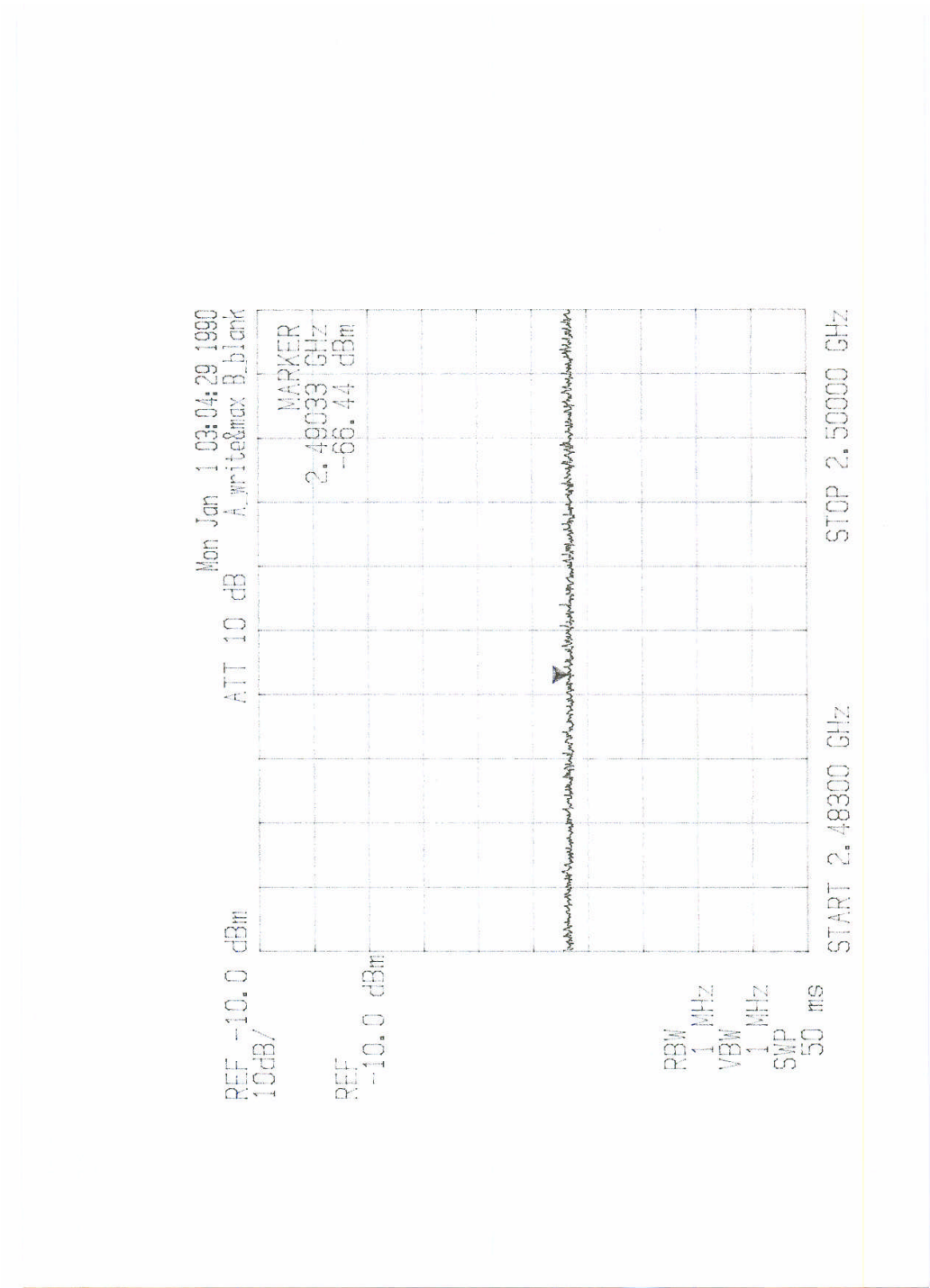
Joystick & Laptop and Dongle Transmitting 2402.0MHz



Joystick & Laptop and Dongle Transmitting 2442.0MHz



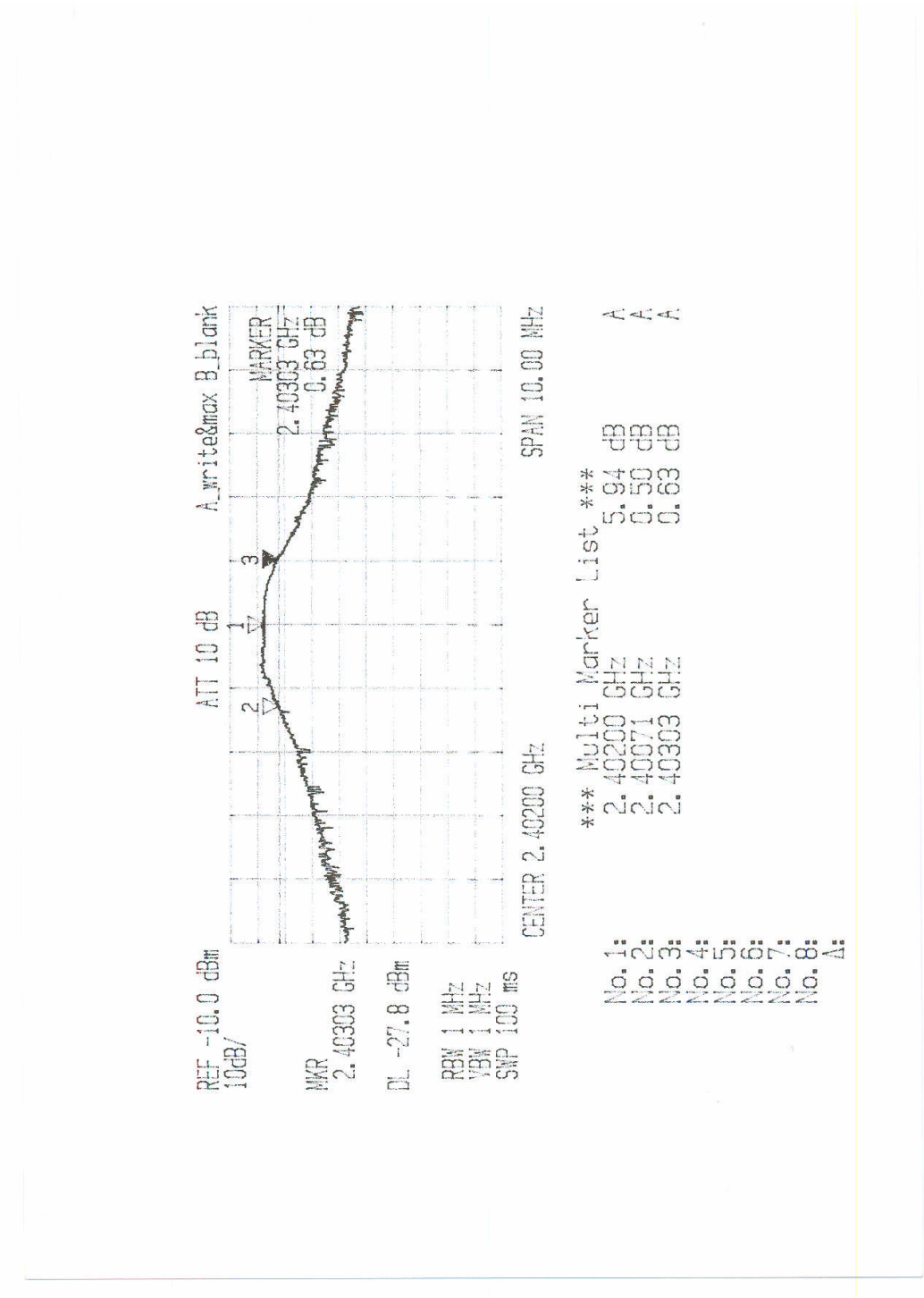
Joystick & Laptop and Dongle Transmitting 2478.0MHz



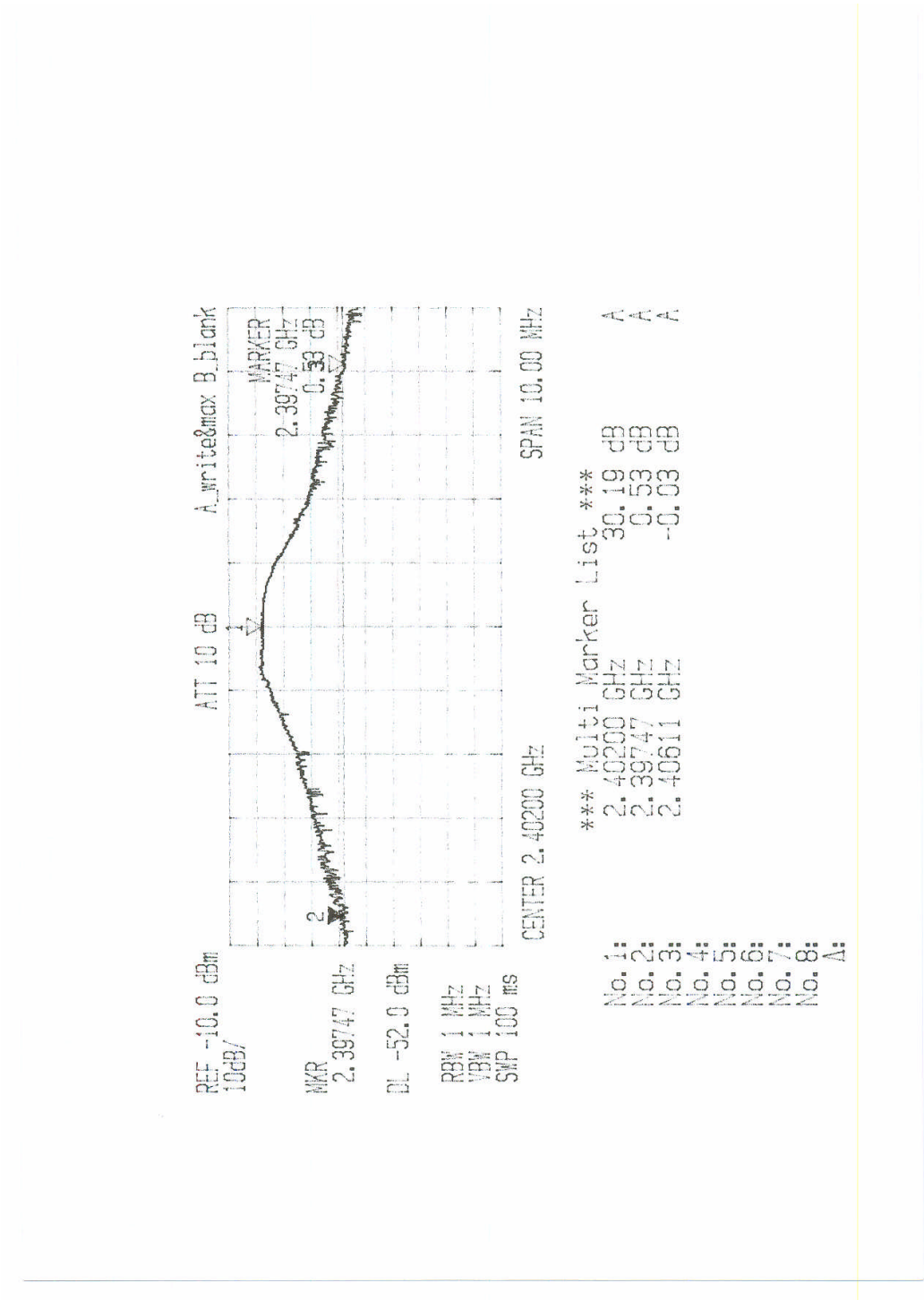
6 ANNEX 2

6.1 Plots of Permitted Operating Frequencies

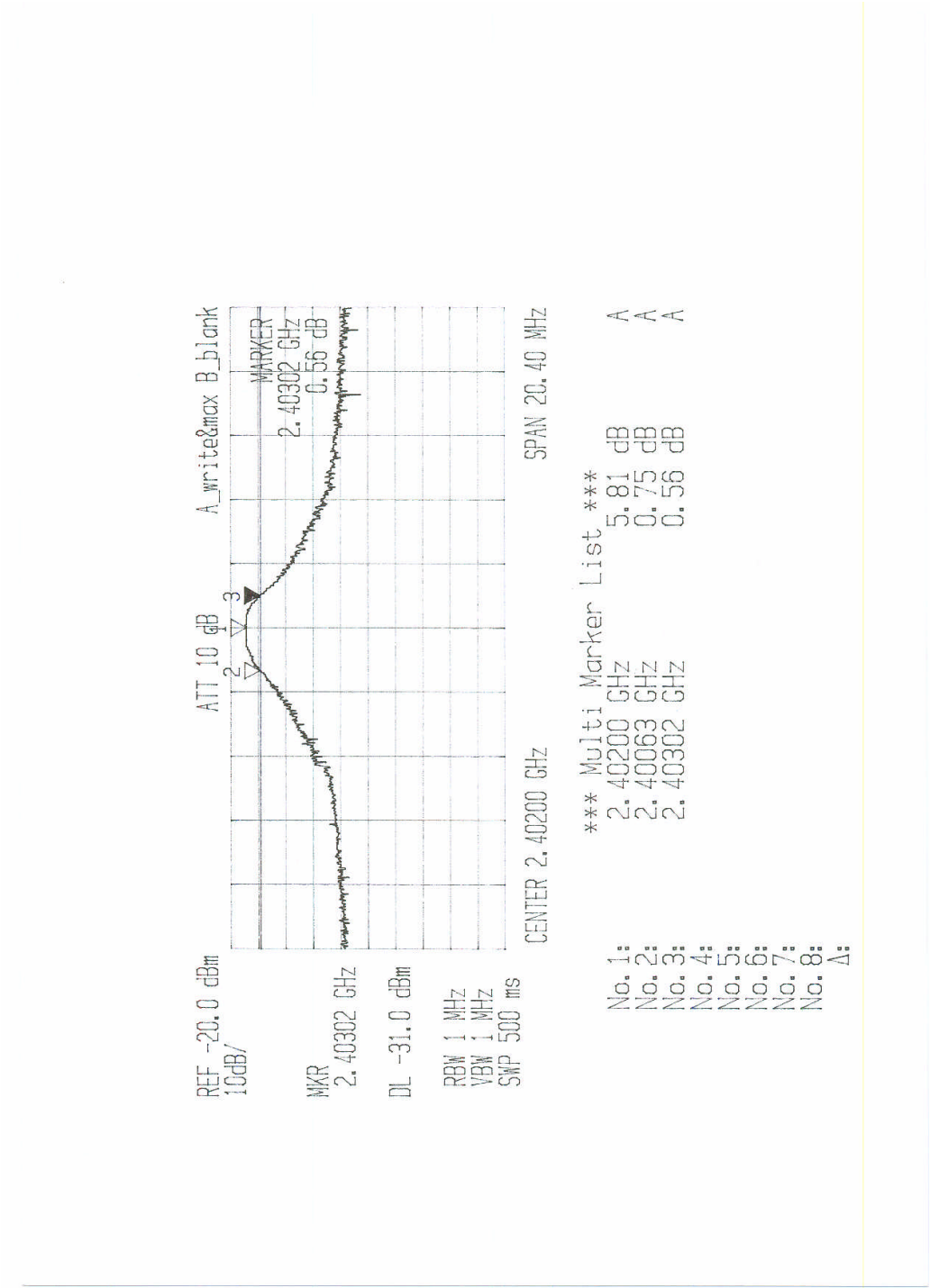
Joystick-6dB



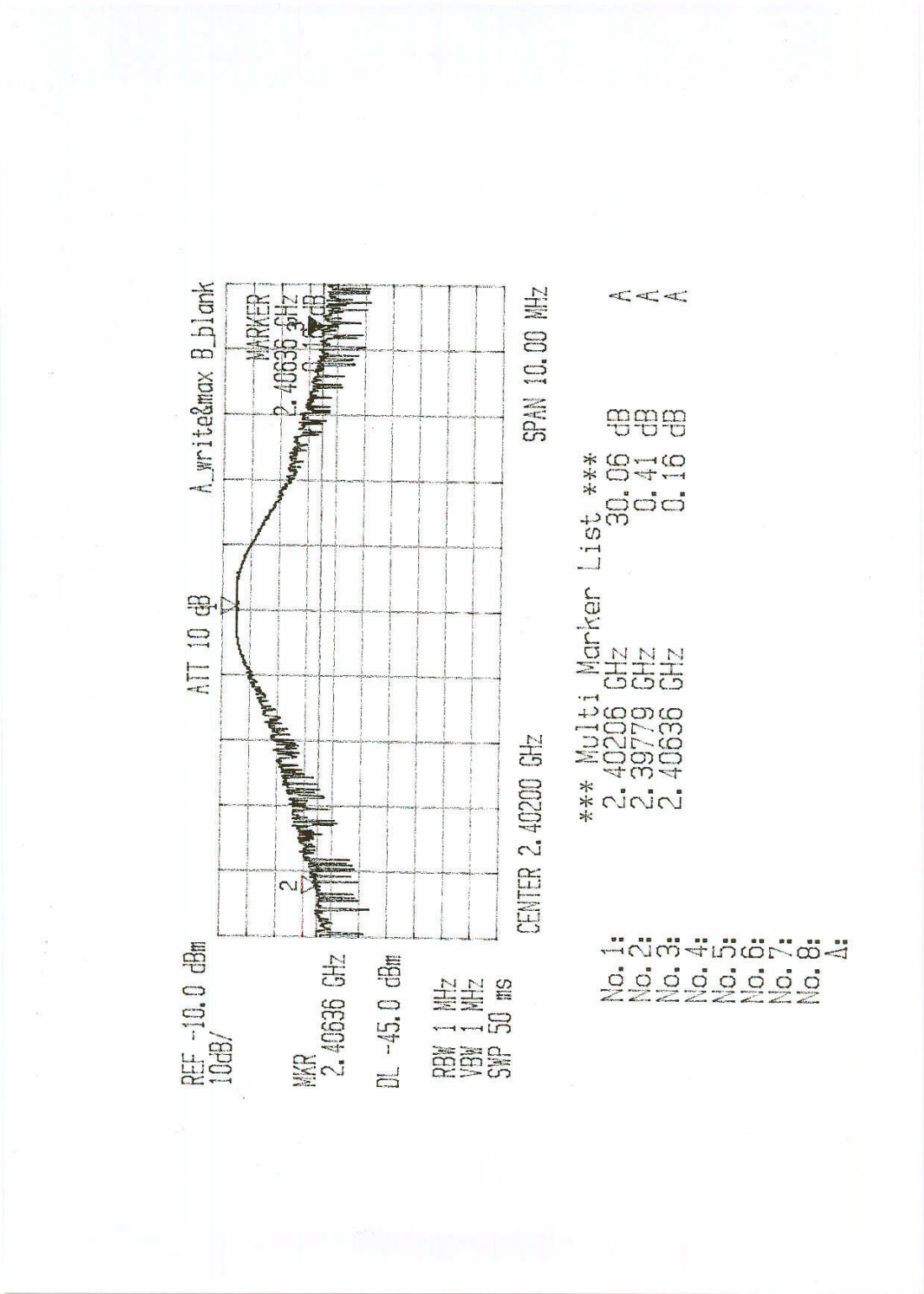
Laptop and Dongle -30dB



Laptop and Dongle -6dB



Joystick -30dB



Joystick -6dB

