APPENDIX E

DATA SHEETS

RADIATED EMISSIONS

DATA SHEETS

FCC 15.247
Thales Navigation Date: 04/21/05
GPS Receiver Lab: B
Model: MobileMapper CE Tested By: Benigno Chavez
Configuration: With Internal Antenna
X-Axis
Low Channel - 2402 MHz Fundamental
Transmit Mode

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4804		V	74	-74	Peak			No Emissions
4804		V	54	-54	Avg			Detected
7206		V	74	-74	Peak			No Emissions
7206		V	54	-54	Avg			Detected
9608		V	--	--	Peak			No Emissions
9608		V	--	--	Avg			Detected
12010		V	74	-74	Peak			No Emissions
12010		V	54	-54	Avg			Detected
14412		V	74	-74	Peak			No Emissions
14412		V	54	-54	Avg			Detected
16814		V	--	--	Peak			No Emissions
16814		V	--	--	Avg			Detected
19216		V	74	-74	Peak			No Emissions
19216		V	54	-54	Avg			Detected
21618		V	--	--	Peak			No Emissions
21618		V	--	--	Avg			Detected
24020		V	--	--	Peak			No Emissions
24020		V	--	--	Avg			Detected

FCC 15.247
Thales Navigation Date: 04/21/05
GPS Receiver Lab: B
Model: MobileMapper CE Tested By: Benigno Chavez
Configuration: With Internal Antenna
X-Axis
Low Channel - 2402 MHz Fundamental
Transmit Mode

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4804		H	74	-74	Peak			No Emissions
4804		H	54	-54	Avg			Detected
7206		H	74	-74	Peak			No Emissions
7206		H	54	-54	Avg			Detected
9608		H	--	--	Peak			No Emissions
9608		H	--	--	Avg			Detected
12010		H	74	-74	Peak			No Emissions
12010		H	54	-54	Avg			Detected
14412		H	74	-74	Peak			No Emissions
14412		H	54	-54	Avg			Detected
16814		H	--	--	Peak			No Emissions
16814		H	--	--	Avg			Detected
19216		H	74	-74	Peak			No Emissions
19216		H	54	-54	Avg			Detected
21618		H	--	--	Peak			No Emissions
21618		H	--	--	Avg			Detected
24020		H	--	--	Peak			No Emissions
24020		H	--	--	Avg			Detected

FCC 15.247
Thales Navigation Date: 04/21/05
GPS Receiver Lab: B
Model: MobileMapper CE Tested By: Benigno Chavez
Configuration: With Internal Antenna
Y-Axis
Low Channel - 2402 MHz Fundamental
Transmit Mode

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4804		V	74	-74	Peak			No Emissions
4804		V	54	-54	Avg			Detected
7206		V	74	-74	Peak			No Emissions
7206		V	54	-54	Avg			Detected
9608		V	--	--	Peak			No Emissions
9608		V	--	--	Avg			Detected
12010		V	74	-74	Peak			No Emissions
12010		V	54	-54	Avg			Detected
14412		V	74	-74	Peak			No Emissions
14412		V	54	-54	Avg			Detected
16814		V	--	--	Peak			No Emissions
16814		V	--	--	Avg			Detected
19216		V	74	-74	Peak			No Emissions
19216		V	54	-54	Avg			Detected
21618		V	--	--	Peak			No Emissions
21618		V	--	--	Avg			Detected
24020		V	--	--	Peak			No Emissions
24020		V	--	--	Avg			Detected

FCC 15.247
Thales Navigation Date: 04/21/05
GPS Receiver Lab: B
Model: MobileMapper CE Tested By: Benigno Chavez
Configuration: With Internal Antenna
Y-Axis
Low Channel - 2402 MHz Fundamental
Transmit Mode

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4804		H	74	-74	Peak			No Emissions
4804		H	54	-54	Avg			Detected
7206		H	74	-74	Peak			No Emissions
7206		H	54	-54	Avg			Detected
9608		H	--	--	Peak			No Emissions
9608		H	--	--	Avg			Detected
12010		H	74	-74	Peak			No Emissions
12010		H	54	-54	Avg			Detected
14412		H	74	-74	Peak			No Emissions
14412		H	54	-54	Avg			Detected
16814		H	--	--	Peak			No Emissions
16814		H	--	--	Avg			Detected
19216		H	74	-74	Peak			No Emissions
19216		H	54	-54	Avg			Detected
21618		H	--	--	Peak			No Emissions
21618		H	--	--	Avg			Detected
24020		H	--	--	Peak			No Emissions
24020		H	--	--	Avg			Detected

FCC 15.247
Thales Navigation Date: 04/21/05
GPS Receiver Lab: B
Model: MobileMapper CE Tested By: Benigno Chavez
Configuration: With Internal Antenna
Z-Axis
Low Channel - 2402 MHz Fundamental
Transmit Mode

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4804		V	74	-74	Peak			No Emissions
4804		V	54	-54	Avg			Detected
7206		V	74	-74	Peak			No Emissions
7206		V	54	-54	Avg			Detected
9608		V	--	--	Peak			No Emissions
9608		V	--	--	Avg			Detected
12010		V	74	-74	Peak			No Emissions
12010		V	54	-54	Avg			Detected
14412		V	74	-74	Peak			No Emissions
14412		V	54	-54	Avg			Detected
16814		V	--	--	Peak			No Emissions
16814		V	--	--	Avg			Detected
19216		V	74	-74	Peak			No Emissions
19216		V	54	-54	Avg			Detected
21618		V	--	--	Peak			No Emissions
21618		V	--	--	Avg			Detected
24020		V	--	--	Peak			No Emissions
24020		V	--	--	Avg			Detected

FCC 15.247
Thales Navigation Date: 04/21/05
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Model: MobileMapper CE Tested By: Benigno Chavez
Configuration: With Internal Antenna
Z-Axis
Low Channel - 2402 MHz Fundamental
Transmit Mode

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4804		H	74	-74	Peak			No Emissions
4804		H	54	-54	Avg			Detected
7206		H	74	-74	Peak			No Emissions
7206		H	54	-54	Avg			Detected
9608		H	--	--	Peak			No Emissions
9608		H	--	--	Avg			Detected
12010		H	74	-74	Peak			No Emissions
12010		H	54	-54	Avg			Detected
14412		H	--	--	Peak			No Emissions
14412		H	--	--	Avg			Detected
16814		H	--	--	Peak			No Emissions
16814		H	--	--	Avg			Detected
19216		H	74	-74	Peak			No Emissions
19216		H	54	-54	Avg			Detected
21618		H	74	-74	Peak			No Emissions
21618		H	54	-54	Avg			Detected
24020		H	--	--	Peak			No Emissions
24020		H	--	--	Avg			Detected

FCC 15.247
Thales Navigation Date: 04/21/05
GPS Receiver Lab: B
Model: MobileMapper CE Tested By: Benigno Chavez
Configuration: With Internal Antenna
X-Axis
Middle Channel - 2441 MHz Fundamental
Transmit Mode

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4882		V	74	-74	Peak			No Emissions
4882		V	54	-54	Avg			Detected
7323		V	74	-74	Peak			No Emissions
7323		V	54	-54	Avg			Detected
9764		V	--	--	Peak			No Emissions
9764		V	--	--	Avg			Detected
12205		V	74	-74	Peak			No Emissions
12205		V	54	-54	Avg			Detected
14646		V	--	--	Peak			No Emissions
14646		V	--	--	Avg			Detected
17087		V	--	--	Peak			No Emissions
17087		V	--	--	Avg			Detected
19528		V	74	-74	Peak			No Emissions
19528		V	54	-54	Avg			Detected
21969		V	--	--	Peak			No Emissions
21969		V	--	--	Avg			Detected
24410		V	--	--	Peak			No Emissions
24410		V	--	--	Avg			Detected

FCC 15.247
Thales Navigation Date: 04/21/05
GPS Receiver Lab: B
Model: MobileMapper CE Tested By: Benigno Chavez
Configuration: With Internal Antenna
Y-Axis
Middle Channel - 2441 MHz Fundamental
Transmit Mode

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4882		V	74	-74	Peak			No Emissions
4882		V	54	-54	Avg			Detected
7323		V	74	-74	Peak			No Emissions
7323		V	54	-54	Avg			Detected
9764		V	--	--	Peak			No Emissions
9764		V	--	--	Avg			Detected
12205		V	74	-74	Peak			No Emissions
12205		V	54	-54	Avg			Detected
14646		V	--	--	Peak			No Emissions
14646		V	--	--	Avg			Detected
17087		V	--	--	Peak			No Emissions
17087		V	--	--	Avg			Detected
19528		V	74	-74	Peak			No Emissions
19528		V	54	-54	Avg			Detected
21969		V	--	--	Peak			No Emissions
21969		V	--	--	Avg			Detected
24410		V	--	--	Peak			No Emissions
24410		V	--	--	Avg			Detected

FCC 15.247
Thales Navigation Date: 04/21/05
GPS Receiver Lab: B
Model: MobileMapper CE Tested By: Benigno Chavez
Configuration: With Internal Antenna
X-Axis
Middle Channel - 2441 MHz Fundamental
Transmit Mode

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4882		H	74	-74	Peak			No Emissions
4882		H	54	-54	Avg			Detected
7323		H	74	-74	Peak			No Emissions
7323		H	54	-54	Avg			Detected
9764		H	--	--	Peak			No Emissions
9764		H	--	--	Avg			Detected
12205		H	74	-74	Peak			No Emissions
12205		H	54	-54	Avg			Detected
14646		H	--	--	Peak			No Emissions
14646		H	--	--	Avg			Detected
17087		H	--	--	Peak			No Emissions
17087		H	--	--	Avg			Detected
19528		H	74	-74	Peak			No Emissions
19528		H	54	-54	Avg			Detected
21969		H	--	--	Peak			No Emissions
21969		H	--	--	Avg			Detected
24410		H	--	--	Peak			No Emissions
24410		H	--	--	Avg			Detected

FCC 15.247
Thales Navigation Date: 04/21/05
GPS Receiver Lab: B
Model: MobileMapper CE Tested By: Benigno Chavez
Configuration: With Internal Antenna
Y-Axis
Middle Channel - 2441 MHz Fundamental
Transmit Mode

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4882		H	74	-74	Peak			No Emissions
4882		H	54	-54	Avg			Detected
7323		H	74	-74	Peak			No Emissions
7323		H	54	-54	Avg			Detected
9764		H	--	--	Peak			No Emissions
9764		H	--	--	Avg			Detected
12205		H	74	-74	Peak			No Emissions
12205		H	54	-54	Avg			Detected
14646		H	--	--	Peak			No Emissions
14646		H	--	--	Avg			Detected
17087		H	--	--	Peak			No Emissions
17087		H	--	--	Avg			Detected
19528		H	74	-74	Peak			No Emissions
19528		H	54	-54	Avg			Detected
21969		H	--	--	Peak			No Emissions
21969		H	--	--	Avg			Detected
24410		H	--	--	Peak			No Emissions
24410		H	--	--	Avg			Detected

FCC 15.247
Thales Navigation Date: 04/21/05
GPS Receiver Lab: B
Model: MobileMapper CE Tested By: Benigno Chavez
Configuration: With Internal Antenna
Z-Axis
Middle Channel - 2441 MHz Fundamental
Transmit Mode

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4882		V	74	-74	Peak			No Emissions
4882		V	54	-54	Avg			Detected
7323		V	74	-74	Peak			No Emissions
7323		V	54	-54	Avg			Detected
9764		V	--	--	Peak			No Emissions
9764		V	--	--	Avg			Detected
12205		V	74	-74	Peak			No Emissions
12205		V	54	-54	Avg			Detected
14646		V	--	--	Peak			No Emissions
14646		V	--	--	Avg			Detected
17087		V	--	--	Peak			No Emissions
17087		V	--	--	Avg			Detected
19528		V	74	-74	Peak			No Emissions
19528		V	54	-54	Avg			Detected
21969		V	--	--	Peak			No Emissions
21969		V	--	--	Avg			Detected
24410		V	--	--	Peak			No Emissions
24410		V	--	--	Avg			Detected

FCC 15.247
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Z-Axis
Middle Channel - 2441 MHz Fundamental
Transmit Mode

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4882		H	74	-74	Peak			No Emissions
4882		H	54	-54	Avg			Detected
7323		H	74	-74	Peak			No Emissions
7323		H	54	-54	Avg			Detected
9764		H	--	--	Peak			No Emissions
9764		H	--	--	Avg			Detected
12205		H	74	-74	Peak			No Emissions
12205		H	54	-54	Avg			Detected
14646		H	--	--	Peak			No Emissions
14646		H	--	--	Avg			Detected
17087		H	--	--	Peak			No Emissions
17087		H	--	--	Avg			Detected
19528		H	74	-74	Peak			No Emissions
19528		H	54	-54	Avg			Detected
21969		H	--	--	Peak			No Emissions
21969		H	--	--	Avg			Detected
24410		H	--	--	Peak			No Emissions
24410		H	--	--	Avg			Detected

FCC 15.247
Thales Navigation Date: 04/21/05
GPS Receiver Lab: B
Model: MobileMapper CE Tested By: Benigno Chavez
Configuration: With Internal Antenna
X-Axis
High Channel - 2480 MHz Fundamental
Transmit Mode

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4960		V	74	-74	Peak			No Emissions
4960		V	54	-54	Avg			Detected
7440		V	74	-74	Peak			No Emissions
7440		V	54	-54	Avg			Detected
9920		V	--	--	Peak			No Emissions
9920		V	--	--	Avg			Detected
12400		V	74	-74	Peak			No Emissions
12400		V	54	-54	Avg			Detected
14880		V	--	--	Peak			No Emissions
14880		V	--	--	Avg			Detected
17360		V	--	--	Peak			No Emissions
17360		V	--	--	Avg			Detected
19840		V	74	-74	Peak			No Emissions
19840		V	54	-54	Avg			Detected
22320		V	74	-74	Peak			No Emissions
22320		V	54	-54	Avg			Detected
24410		H	--	--	Peak			No Emissions
24410		H	--	--	Avg			Detected

FCC 15.247

Thales Navigation — Date: 04/21/05
GPS Receiver — Lab: B
Model: MobileMapper CE — Tested By: Benigno Chavez
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X-Axis
High Channel - 2480 MHz Fundamental
Transmit Mode

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4960		H	74	-74	Peak			No Emissions
4960		H	54	-54	Avg			Detected
7440		H	74	-74	Peak			No Emissions
7440		H	54	-54	Avg			Detected
9920		H	--	--	Peak			No Emissions
9920		H	--	--	Avg			Detected
12400		H	74	-74	Peak			No Emissions
12400		H	54	-54	Avg			Detected
14880		H	--	--	Peak			No Emissions
14880		H	--	--	Avg			Detected
17360		H	--	--	Peak			No Emissions
17360		H	--	--	Avg			Detected
19840		H	74	-74	Peak			No Emissions
19840		H	54	-54	Avg			Detected
22320		H	74	-74	Peak			No Emissions
22320		H	54	-54	Avg			Detected
24410		H	--	--	Peak			No Emissions
24410		H	--	--	Avg			Detected

FCC 15.247
Thales Navigation Date: 04/21/05
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Y-Axis
High Channel - 2480 MHz Fundamental
Transmit Mode

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4960		V	74	-74	Peak			No Emissions
4960		V	54	-54	Avg			Detected
7440		V	74	-74	Peak			No Emissions
7440		V	54	-54	Avg			Detected
9920		V	--	--	Peak			No Emissions
9920		V	--	--	Avg			Detected
12400		V	74	-74	Peak			No Emissions
12400		V	54	-54	Avg			Detected
14880		V	--	--	Peak			No Emissions
14880		V	--	--	Avg			Detected
17360		V	--	--	Peak			No Emissions
17360		V	--	--	Avg			Detected
19840		V	74	-74	Peak			No Emissions
19840		V	54	-54	Avg			Detected
22320		V	74	-74	Peak			No Emissions
22320		V	54	-54	Avg			Detected
24410		H	--	--	Peak			No Emissions
24410		H	--	--	Avg			Detected

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Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4960		H	74	-74	Peak			No Emissions
4960		H	54	-54	Avg			Detected
7440		H	74	-74	Peak			No Emissions
7440		H	54	-54	Avg			Detected
9920		H	--	--	Peak			No Emissions
9920		H	--	--	Avg			Detected
12400		H	74	-74	Peak			No Emissions
12400		H	54	-54	Avg			Detected
14880		H	--	--	Peak			No Emissions
14880		H	--	--	Avg			Detected
17360		H	--	--	Peak			No Emissions
17360		H	--	--	Avg			Detected
19840		H	74	-74	Peak			No Emissions
19840		H	54	-54	Avg			Detected
22320		H	74	-74	Peak			No Emissions
22320		H	54	-54	Avg			Detected
24410		H	--	--	Peak			No Emissions
24410		H	--	--	Avg			Detected

FCC 15.247
Thales Navigation Date: 04/21/05
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Configuration: With Internal Antenna
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Transmit Mode

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
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4960		V	54	-54	Avg			Detected
7440		V	74	-74	Peak			No Emissions
7440		V	54	-54	Avg			Detected
9920		V	--	--	Peak			No Emissions
9920		V	--	--	Avg			Detected
12400		V	74	-74	Peak			No Emissions
12400		V	54	-54	Avg			Detected
14880		V	--	--	Peak			No Emissions
14880		V	--	--	Avg			Detected
17360		V	--	--	Peak			No Emissions
17360		V	--	--	Avg			Detected
19840		V	74	-74	Peak			No Emissions
19840		V	54	-54	Avg			Detected
22320		V	74	-74	Peak			No Emissions
22320		V	54	-54	Avg			Detected
24410		H	--	--	Peak			No Emissions
24410		H	--	--	Avg			Detected

FCC 15.247
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GPS Receiver Lab: B
Model: MobileMapper CE Tested By: Benigno Chavez
Configuration: With Internal Antenna
Z-Axis
High Channel - 2480 MHz Fundamental
Transmit Mode

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
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4960		H	54	-54	Avg			Detected
7440		H	74	-74	Peak			No Emissions
7440		H	54	-54	Avg			Detected
9920		H	--	--	Peak			No Emissions
9920		H	--	--	Avg			Detected
12400		H	74	-74	Peak			No Emissions
12400		H	54	-54	Avg			Detected
14880		H	--	--	Peak			No Emissions
14880		H	--	--	Avg			Detected
17360		H	--	--	Peak			No Emissions
17360		H	--	--	Avg			Detected
19840		H	74	-74	Peak			No Emissions
19840		H	54	-54	Avg			Detected
22320		H	74	-74	Peak			No Emissions
22320		H	54	-54	Avg			Detected
24410		H	--	--	Peak			No Emissions
24410		H	--	--	Avg			Detected

FCC 15.247

Thales Navigation — Date: 04/21/05
GPS Receiver — Lab: B
Model: MobileMapper CE — Tested By: Benigno Chavez
Configuration: With Internal Antenna

Receive Mode for the GPS Portion
Note: The EUT had no emissions from the Receiver of the Bluetooth Portion

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1404.8	34.13	H	80	-45.87	Peak	1.62	180	
1404.8	22.75	H	60	-37.25	Avg	1.62	180	
2809.8	37.65	H	80	-42.35	Peak	2.28	225	
2809.8	24.54	H	60	-35.46	Avg	2.28	225	
4214.6	41.13	H	80	-38.87	Peak	1.39	225	
4214.6	29.14	H	60	-30.86	Avg	1.39	225	
5619.5	45.13	H	80	-34.87	Peak	1.9	315	
5619.5	32.25	H	60	-27.75	Avg	1.9	315	
1404.8	33.92	V	80	-46.08	Peak	1.47	225	
1404.8	24.31	V	60	-35.69	Avg	1.47	225	
2809.8	38.61	V	80	-41.39	Peak	1.39	225	
2809.8	26.6	V	60	-33.4	Avg	1.39	225	
4214.6	41.44	V	80	-38.56	Peak	1.34	180	
4214.6	29.22	V	60	-30.78	Avg	1.34	180	
5619.5	56.34	V	80	-23.66	Peak	1.47	315	
5619.5	37.6	V	60	-22.4	Avg	1.47	315	

FCC Subpart B

Thales Navigation — Date: 04/21/05
GPS Receiver — Lab: B
Model: MobileMapper CE — Tested By: Benigno Chavez
Configuration: With Internal Antenna

Vertical and Horizontal Polarizations
Digital Portion From 1 GHz to 25 GHz

All Readings Below from the Digital Portion only

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1000		V	74	-74	Peak			No emissions were detected
1000		V	54	-54	Avg			from the Digital Portion
								of the EUT
1601		V	74	-74	Peak			from 1 GHz to 25 GHz
1601		V	54	-54	Avg			
1000		H	74	-74	Peak			
1000		H	54	-54	Avg			
1601		H	74	-74	Peak			
1601		H	54	-54	Avg			

COMPATIBLE ELECTRONICS

Test Location : Compatible Electronics — Page : 1/1
Customer : Thales Navigation — Date : 4/19/2005
Manufacturer : Thales Navigation — Time : 20:34:51
Eut name : GPS Receiver — Lab : A
Model : Mobille Mapper — Test Distance : 3.0 Meters
Serial # :
Specification : FCC B
Distance correction factor (20 * log(test/spec) : 0.00
Test Mode : Vertical and Horizontal Polarizations
MobileMapper CE - Qualification Scan
Test Range: 10 kHz to 300 MHz
Tested By: Benigno Chavez

Pol	Freq	Rdng	Cable loss	Ant factor	Amp gain	Cor'd rdg = R	Limit = L	Delta R-L
	MHz	dBuV	dB	dB	dB	dBuV	dBuV/m	dB
1V	39.534	57.30	1.79	10.90	33.01	36.98	40.00	-3.02
2V	41.666	58.90	1.84	10.69	33.02	38.41	40.00	-1.59
3V	41.668Qp	56.05	1.84	10.69	33.02	35.56	40.00	-4.44
4V	45.403	59.30	1.91	10.39	33.06	38.55	40.00	-1.45
5V	45.409Qp	55.24	1.91	10.39	33.06	34.49	40.00	-5.51
6V	46.332	57.30	1.93	10.60	33.07	36.77	40.00	-3.23
7V	79.544	52.20	2.50	6.25	33.20	27.75	40.00	-12.25
8V	87.022	49.90	2.57	7.63	33.13	26.97	40.00	-13.03
9V	104.034	61.00	2.77	10.75	33.18	41.34	43.50	-2.16
10V	104.044Qp	58.13	2.77	10.75	33.18	38.47	43.50	-5.03
11V	106.111	58.20	2.81	11.08	33.17	38.91	43.50	-4.59
12V	108.140	54.60	2.84	11.39	33.16	35.66	43.50	-7.84
13H	108.153	48.00	2.84	11.39	33.16	29.07	43.50	-14.43
14V	109.200	54.60	2.86	11.55	33.16	35.85	43.50	-7.65
15H	110.217	47.20	2.87	11.70	33.16	28.62	43.50	-14.88
16V	110.619	53.90	2.88	11.76	33.15	35.39	43.50	-8.11
17H	118.039	44.00	3.00	12.83	33.13	26.70	43.50	-16.80
18V	127.594	54.80	3.11	12.31	33.09	37.13	43.50	-6.37
19H	128.258	51.40	3.11	12.29	33.09	33.71	43.50	-9.79
20V	131.343	55.50	3.13	12.18	33.07	37.74	43.50	-5.76
21V	133.720	55.30	3.14	12.10	33.06	37.48	43.50	-6.02
22H	134.060	52.20	3.14	12.09	33.06	34.37	43.50	-9.13
23V	138.521	54.50	3.16	11.95	33.04	36.56	43.50	-6.94
24H	140.564	45.50	3.16	11.89	33.04	27.52	43.50	-15.98
25V	144.323	50.80	3.18	11.86	33.02	32.81	43.50	-10.69
26V	150.433	48.40	3.20	11.87	33.00	30.47	43.50	-13.03

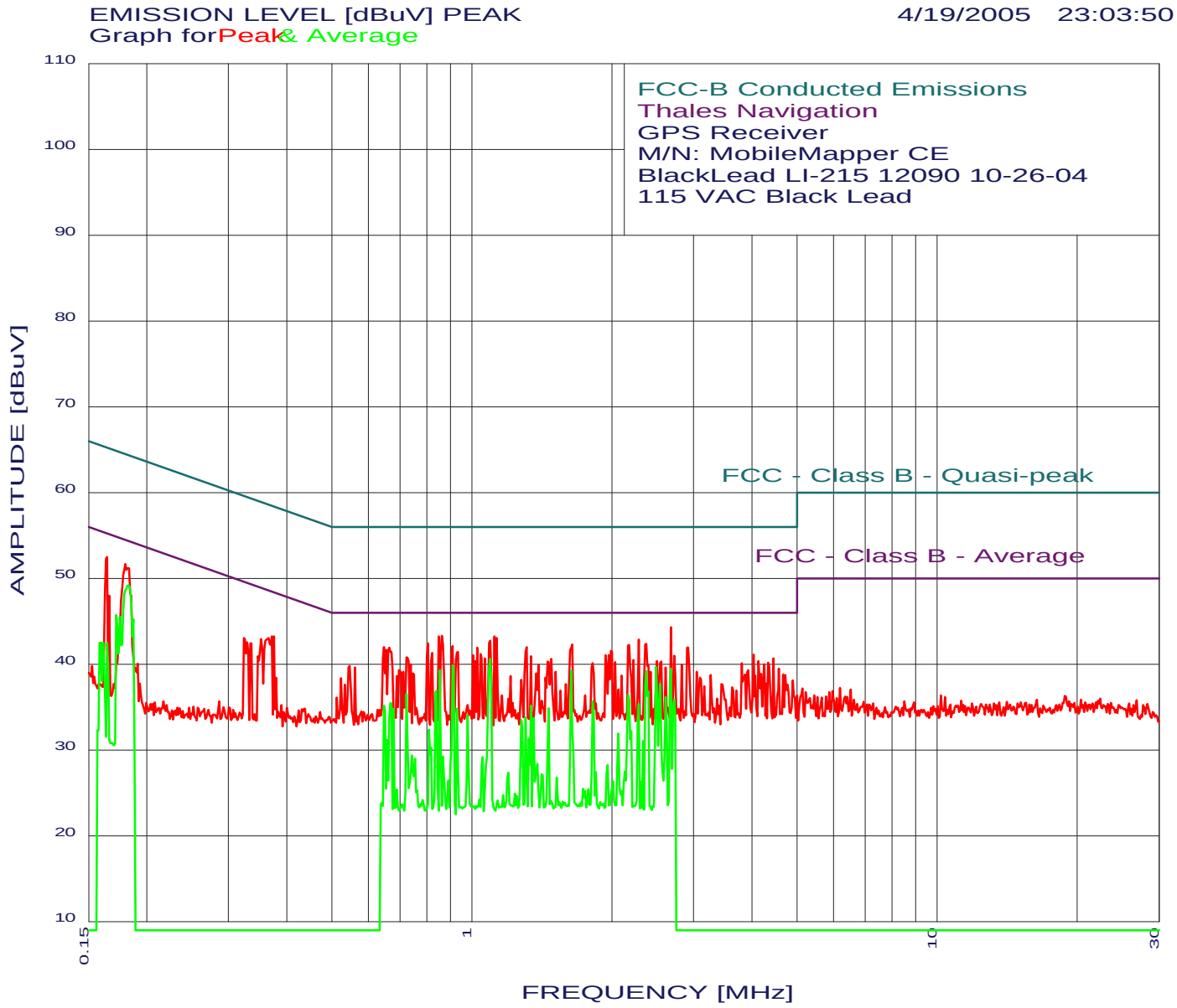
COMPATIBLE ELECTRONICS

Test Location : Compatible Electronics Page : 1/1
Customer : Thales Navigation Date : 4/19/2005
Manufacturer : Thales Navigation Time : 21:49:54
Eut name : GPS Receiver Lab : A
Model : Mobille Mapper Test Distance : 3.0 Meters
Serial # :
Specification : FCC B
Distance correction factor (20 * log(test/spec) : 0.00
Test Mode : Vertical and Horizontal Polarizations
MobileMapper CE - Qualification Scan
Test Range: 300 MHz to 1 GHz
Tested By: Benigno Chavez

Pol	Freq	Rdng	Cable loss	Ant factor	Amp gain	Cor'd rdg = R	Limit = L	Delta R-L
	MHz	dBuV	dB	dB	dB	dBuV	dBuV/m	dB
1H	314.727	52.50	4.42	12.87	32.94	36.85	46.00	-9.15
2V	324.257	45.80	4.55	12.97	32.90	30.42	46.00	-15.58
3V	343.309	47.40	4.81	13.17	32.83	32.56	46.00	-13.44

CONDUCTED EMISSIONS

DATA SHEETS



COMPATIBLE ELECTRONICS

COMPATIBLE ELECTRONICS

4/19/2005 23:03:50

Thales Navigation
GPS Receiver
M/N: MobileMapper CE
115 VAC Black Lead
TEST ENGINEER : Benigno Chavez

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39 highest peaks above -50.00 dB of FCC - Class B - Average limit line
Peak criteria : 1.00 dB, Curve : Peak

Peak#	Freq(MHz)	Amp(dBuV)	Limit(dB)	Delta(dB)
1	2.679	44.29	46.00	-1.71*
2	0.862	43.31	46.00	-2.69*
3	1.118	43.24	46.00	-2.76*
4	0.164	52.46	55.25	-2.79*
5	0.849	43.21	46.00	-2.79*
6	0.180	51.65	54.50	-2.85*
7	1.130	43.05	46.00	-2.95*
8	2.286	42.85	46.00	-3.15
9	1.094	42.74	46.00	-3.26
10	0.805	42.40	46.00	-3.60
11	2.371	42.36	46.00	-3.64
12	1.646	42.25	46.00	-3.75
13	2.179	42.24	46.00	-3.76
14	0.909	42.11	46.00	-3.89
15	0.648	41.99	46.00	-4.01
16	1.311	41.98	46.00	-4.02
17	1.027	41.93	46.00	-4.07
18	2.916	41.91	46.00	-4.09
19	0.665	41.89	46.00	-4.11
20	0.655	41.69	46.00	-4.31
21	1.992	41.52	46.00	-4.48
22	0.934	41.41	46.00	-4.59
23	0.822	41.30	46.00	-4.70
24	1.043	41.13	46.00	-4.87
25	4.029	41.12	46.00	-4.88
26	1.006	41.02	46.00	-4.98
27	1.971	41.01	46.00	-4.99
28	1.939	41.01	46.00	-4.99
29	2.722	40.99	46.00	-5.01
30	1.338	40.89	46.00	-5.11
31	0.375	43.21	48.38	-5.18
32	0.724	40.79	46.00	-5.21
33	0.371	43.21	48.47	-5.26
34	4.456	40.67	46.00	-5.33
35	1.066	40.63	46.00	-5.37
36	1.480	40.62	46.00	-5.38
37	2.226	40.44	46.00	-5.56
38	2.501	40.37	46.00	-5.63
39	4.137	40.33	46.00	-5.67

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* Please See the Average Readings on the Next Page and on the Plot

COMPATIBLE ELECTRONICS

4/19/2005 23:03:50

Thales Navigation
GPS Receiver
M/N: MobileMapper CE
115 VAC Black Lead
TEST ENGINEER : Benigno Chavez

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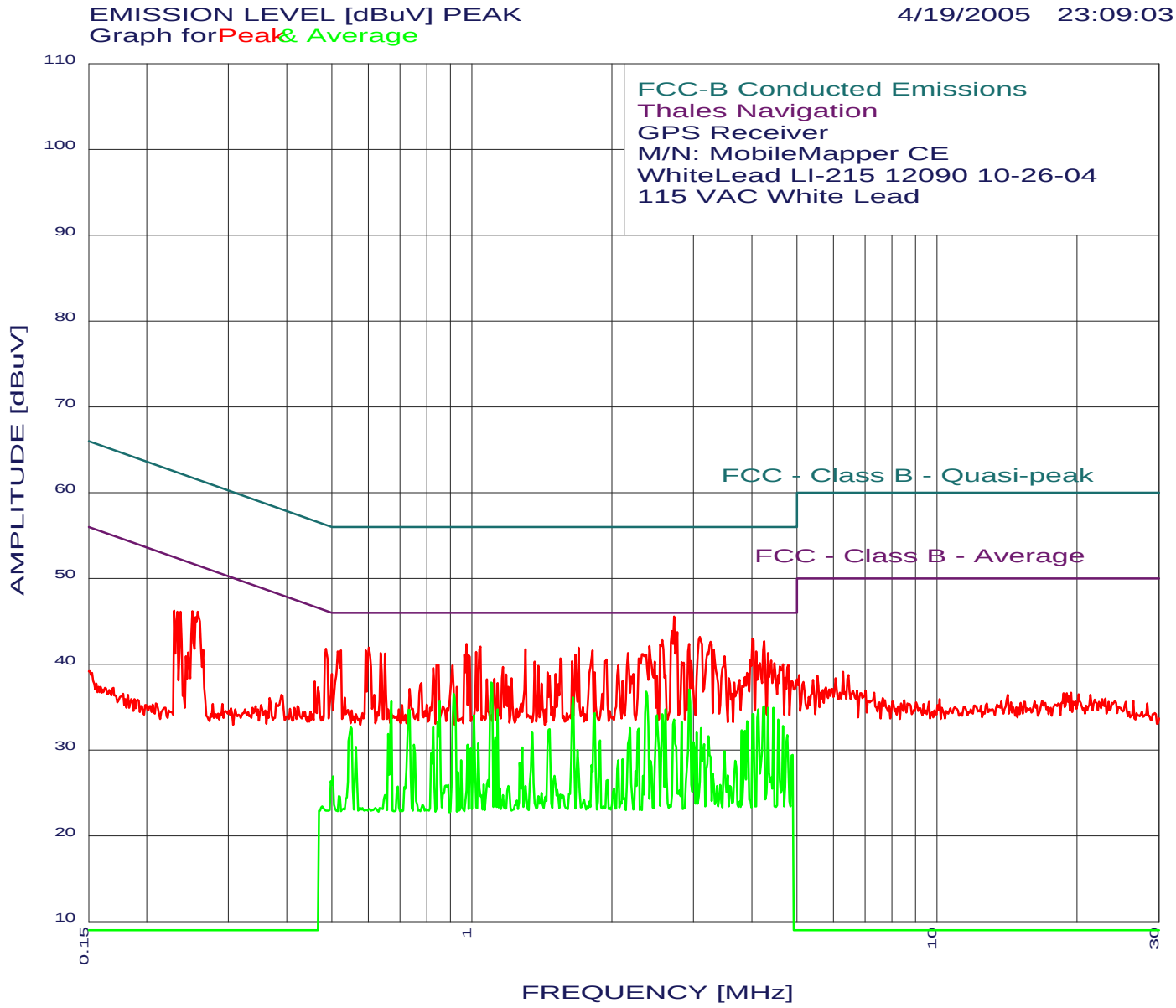
40 highest peaks above -50.00 dB of FCC - Class B - Average limit line
Peak criteria : 0.10 dB, Curve : Average

Peak#	Freq(MHz)	Amp(dBuV)	Limit(dB)	Delta(dB)
1	0.183	49.15	54.37	-5.22
2	1.094	40.61	46.00	-5.39
3	0.909	39.86	46.00	-6.14
4	2.488	39.63	46.00	-6.37
5	2.679	39.44	46.00	-6.56
6	0.853	39.26	46.00	-6.74
7	1.637	39.21	46.00	-6.79
8	2.371	39.16	46.00	-6.84
9	2.540	37.66	46.00	-8.34
10	0.187	45.21	54.15	-8.94
11	0.839	36.88	46.00	-9.12
12	0.172	45.70	54.86	-9.15
13	0.175	45.56	54.72	-9.16
14	2.397	36.75	46.00	-9.25
15	0.724	36.53	46.00	-9.47
16	2.168	36.39	46.00	-9.61
17	2.610	36.17	46.00	-9.83
18	2.722	35.83	46.00	-10.17
19	1.820	35.63	46.00	-10.37
20	0.669	35.44	46.00	-10.56
21	2.286	35.33	46.00	-10.67
22	0.648	35.19	46.00	-10.81
23	1.338	35.14	46.00	-10.86
24	1.464	34.84	46.00	-11.16
25	0.679	34.78	46.00	-11.22
26	0.929	34.77	46.00	-11.23
27	0.979	34.01	46.00	-11.99
28	1.304	33.80	46.00	-12.20
29	1.359	33.69	46.00	-12.31
30	1.276	33.50	46.00	-12.50
31	0.164	42.46	55.25	-12.79
32	0.161	42.46	55.43	-12.97
33	0.158	42.46	55.56	-13.10
34	0.809	32.36	46.00	-13.64
35	2.201	32.17	46.00	-13.83
36	2.066	31.90	46.00	-14.10
37	1.325	31.29	46.00	-14.71
38	0.658	31.16	46.00	-14.84
39	2.334	31.02	46.00	-14.98
40	0.818	30.26	46.00	-15.74



COMPATIBLE ELECTRONICS

COMPATIBLE ELECTRONICS

4/19/2005 23:09:03

Thales Navigation
GPS Receiver
M/N: MobileMapper CE
115 VAC White Lead
TEST ENGINEER : Benigno Chavez

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39 highest peaks above -50.00 dB of FCC - Class B - Average limit line
Peak criteria : 1.00 dB, Curve : Peak

Peak#	Freq(MHz)	Amp(dBuV)	Limit(dB)	Delta(dB)
1	2.722	45.52	46.00	-0.48*
2	2.693	43.82	46.00	-2.18*
3	2.766	43.73	46.00	-2.27*
4	3.091	43.16	46.00	-2.84*
5	4.008	42.96	46.00	-3.04
6	2.568	42.80	46.00	-3.20
7	4.249	42.68	46.00	-3.32
8	3.260	42.58	46.00	-3.42
9	2.932	42.34	46.00	-3.66
10	0.974	42.32	46.00	-3.68
11	2.410	42.09	46.00	-3.91
12	1.043	42.04	46.00	-3.96
13	0.601	41.88	46.00	-4.12
14	1.699	41.88	46.00	-4.12
15	1.304	41.69	46.00	-4.31
16	3.311	41.69	46.00	-4.31
17	1.820	41.60	46.00	-4.40
18	0.592	41.58	46.00	-4.42
19	0.524	41.57	46.00	-4.43
20	0.486	41.77	46.23	-4.45
21	4.092	41.47	46.00	-4.53
22	0.516	41.47	46.00	-4.53
23	1.021	41.43	46.00	-4.57
24	0.637	41.29	46.00	-4.71
25	4.339	41.29	46.00	-4.71
26	2.168	41.26	46.00	-4.74
27	0.651	41.19	46.00	-4.81
28	2.334	41.18	46.00	-4.82
29	0.963	41.12	46.00	-4.88
30	1.671	41.07	46.00	-4.93
31	0.984	41.03	46.00	-4.97
32	3.492	40.91	46.00	-5.09
33	1.552	40.64	46.00	-5.36
34	0.258	46.06	51.51	-5.45
35	1.950	40.53	46.00	-5.47
36	0.251	46.17	51.73	-5.56
37	4.408	40.39	46.00	-5.61
38	1.646	40.36	46.00	-5.64
39	2.963	40.35	46.00	-5.65

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* Please See the Average Readings on the Next Page and on the Plot

COMPATIBLE ELECTRONICS

4/19/2005 23:09:03

Thales Navigation
GPS Receiver
M/N: MobileMapper CE
115 VAC White Lead
TEST ENGINEER : Benigno Chavez

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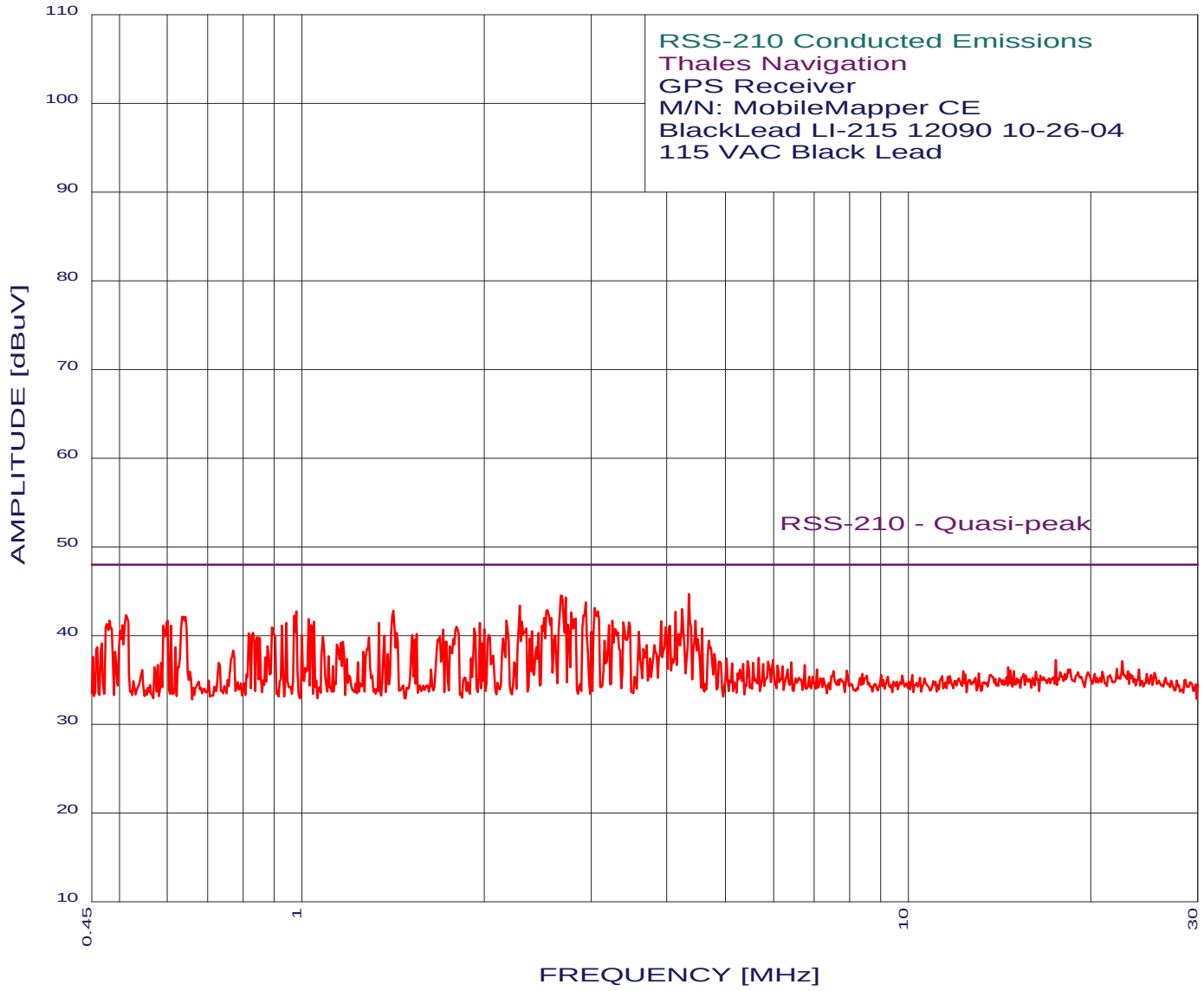
40 highest peaks above -50.00 dB of FCC - Class B - Average limit line
Peak criteria : 0.10 dB, Curve : Average

Peak#	Freq(MHz)	Amp(dBuV)	Limit(dB)	Delta(dB)
1	1.100	37.86	46.00	-8.14
2	2.932	37.03	46.00	-8.97
3	2.371	36.77	46.00	-9.23
4	0.914	36.51	46.00	-9.49
5	1.654	36.09	46.00	-9.91
6	0.853	35.68	46.00	-10.32
7	0.672	35.64	46.00	-10.36
8	4.249	35.11	46.00	-10.89
9	4.456	34.93	46.00	-11.07
10	4.339	34.91	46.00	-11.09
11	4.137	34.71	46.00	-11.29
12	2.610	34.71	46.00	-11.29
13	1.136	34.71	46.00	-11.29
14	0.735	34.63	46.00	-11.37
15	1.840	34.31	46.00	-11.69
16	4.029	34.19	46.00	-11.81
17	2.568	34.13	46.00	-11.87
18	1.011	34.04	46.00	-11.96
19	2.501	34.02	46.00	-11.98
20	2.722	33.55	46.00	-12.45
21	4.552	33.52	46.00	-12.48
22	3.903	33.36	46.00	-12.64
23	0.844	33.31	46.00	-12.69
24	2.826	33.30	46.00	-12.70
25	4.672	32.81	46.00	-13.19
26	0.826	32.66	46.00	-13.34
27	0.550	32.63	46.00	-13.37
28	3.107	32.54	46.00	-13.46
29	2.190	32.54	46.00	-13.46
30	2.286	32.47	46.00	-13.53
31	1.472	32.39	46.00	-13.61
32	3.800	32.28	46.00	-13.72
33	3.862	32.24	46.00	-13.76
34	3.043	32.03	46.00	-13.97
35	1.345	32.00	46.00	-14.00
36	0.662	31.86	46.00	-14.14
37	4.774	31.73	46.00	-14.27
38	3.226	31.61	46.00	-14.39
39	1.124	31.46	46.00	-14.54
40	1.889	31.07	46.00	-14.93

EMISSION LEVEL [dBuV] PEAK
Graph forPeak

4/19/2005 22:47:07



COMPATIBLE ELECTRONICS

COMPATIBLE ELECTRONICS

4/19/2005 22:47:07

Thales Navigation
GPS Receiver
M/N: MobileMapper CE
115 VAC Black Lead
TEST ENGINEER : Benigno Chavez

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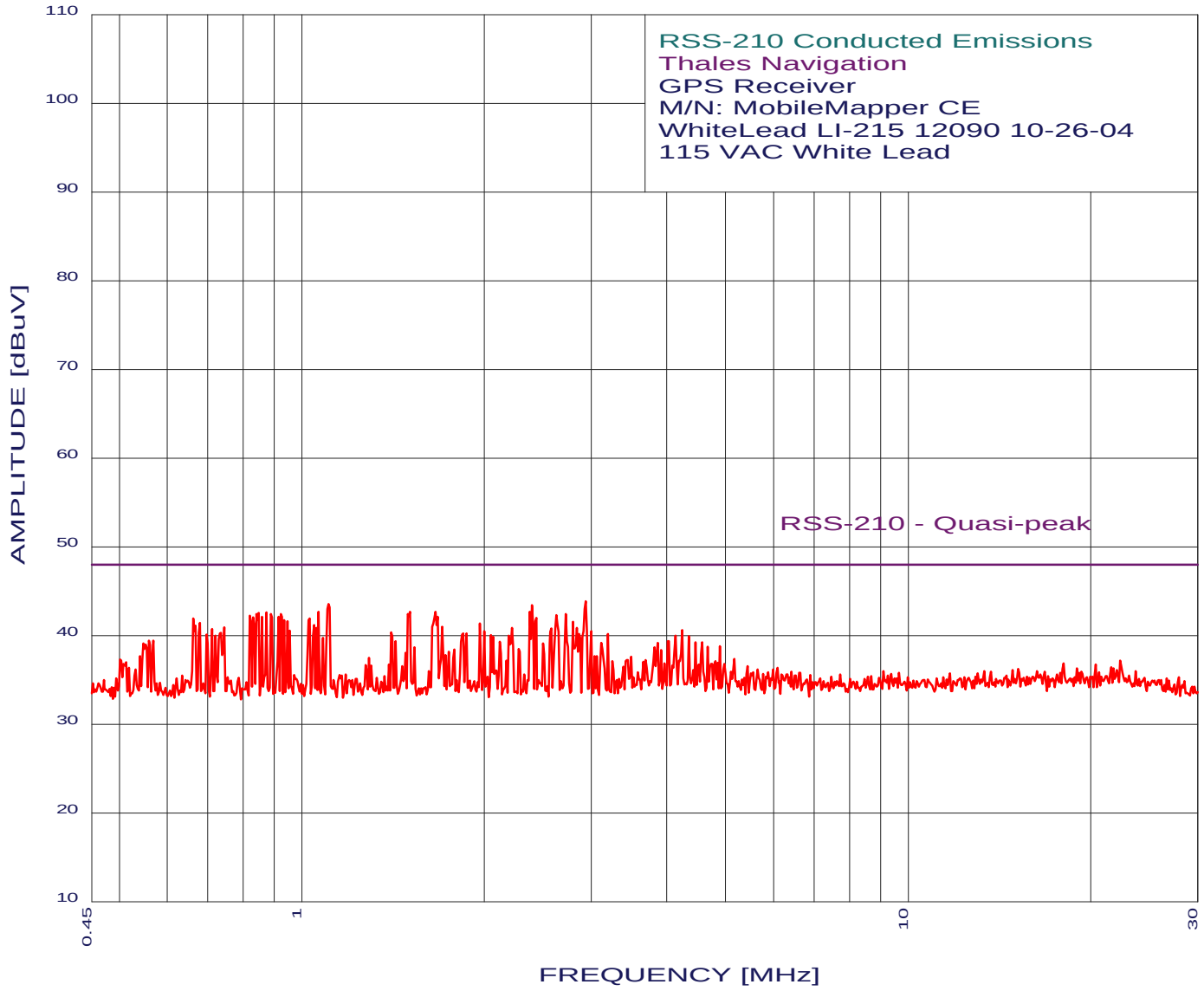
40 highest peaks above -50.00 dB of RSS-210 - Quasi-peak limit line
Peak criteria : 0.10 dB, Curve : Peak

Peak#	Freq(MHz)	Amp(dBuV)	Limit(dB)	Delta(dB)
1	4.348	44.65	48.00	-3.35
2	2.682	44.49	48.00	-3.51
3	2.727	44.29	48.00	-3.71
4	2.942	43.71	48.00	-4.29
5	2.287	43.35	48.00	-4.65
6	3.042	43.12	48.00	-4.88
7	4.239	42.94	48.00	-5.06
8	2.540	42.87	48.00	-5.13
9	1.416	42.80	48.00	-5.20
10	3.081	42.73	48.00	-5.27
11	0.979	42.72	48.00	-5.28
12	4.134	42.63	48.00	-5.37
13	2.786	42.60	48.00	-5.40
14	0.513	42.27	48.00	-5.73
15	0.971	42.22	48.00	-5.78
16	0.643	42.09	48.00	-5.91
17	0.638	42.09	48.00	-5.91
18	2.582	41.98	48.00	-6.02
19	2.508	41.97	48.00	-6.03
20	2.833	41.90	48.00	-6.10
21	1.025	41.83	48.00	-6.17
22	2.809	41.80	48.00	-6.20
23	0.601	41.68	48.00	-6.32
24	0.481	41.68	48.00	-6.32
25	4.457	41.67	48.00	-6.33
26	3.254	41.65	48.00	-6.35
27	2.174	41.64	48.00	-6.36
28	3.915	41.61	48.00	-6.39
29	2.305	41.55	48.00	-6.45
30	1.047	41.53	48.00	-6.47
31	3.466	41.47	48.00	-6.53
32	3.392	41.46	48.00	-6.54
33	0.943	41.42	48.00	-6.58
34	1.965	41.41	48.00	-6.59
35	1.341	41.39	48.00	-6.61
36	0.477	41.28	48.00	-6.72
37	2.750	41.20	48.00	-6.80
38	0.506	41.17	48.00	-6.83
39	3.212	41.14	48.00	-6.86
40	1.034	41.13	48.00	-6.87

EMISSION LEVEL [dBuV] PEAK
Graph forPeak

4/19/2005 23:12:34



COMPATIBLE ELECTRONICS

COMPATIBLE ELECTRONICS

4/19/2005 23:12:34

Thales Navigation
GPS Receiver
M/N: Mobile Mapper CE
115 VAC White Lead
TEST ENGINEER : Benigno Chavez

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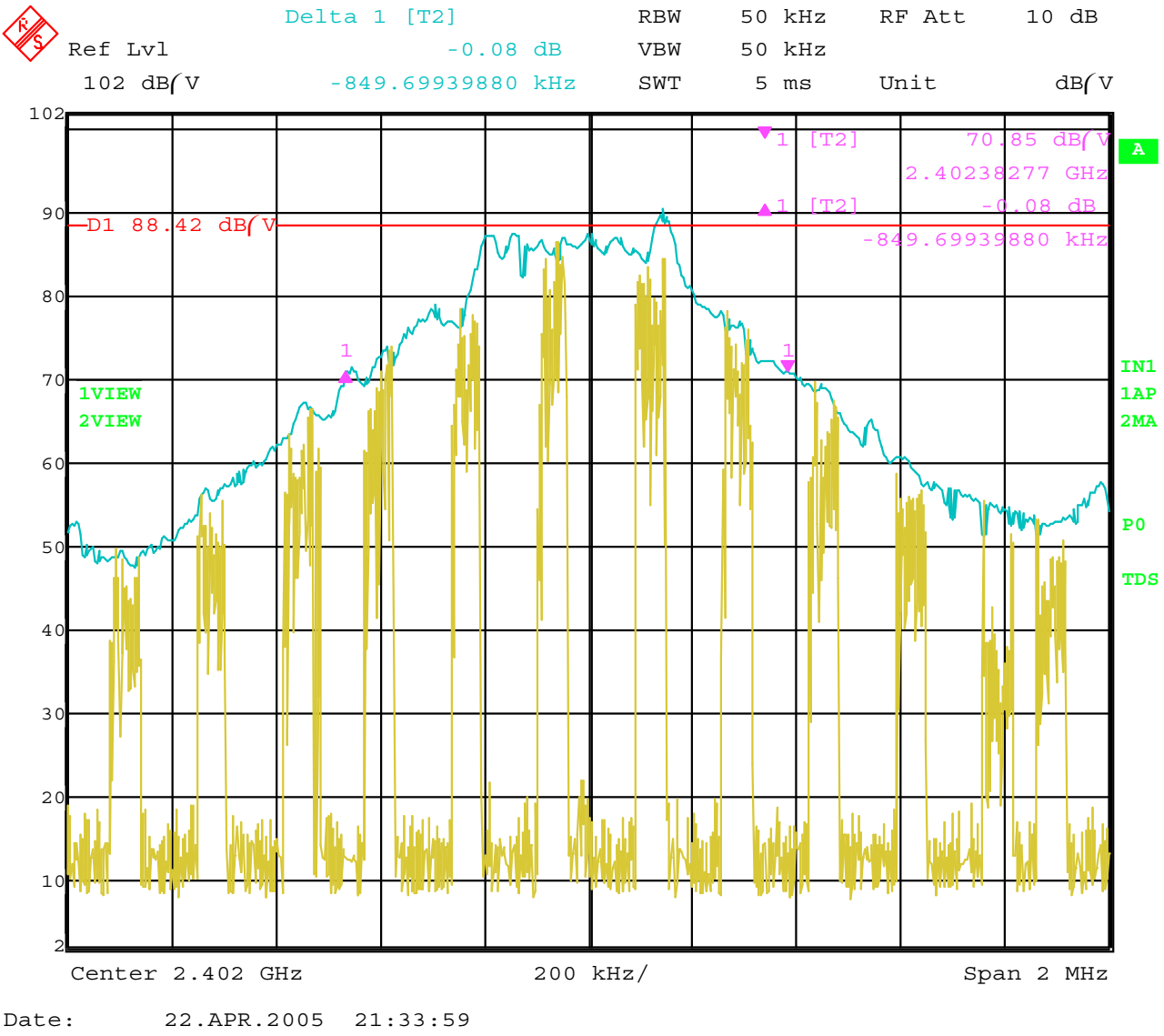
40 highest peaks above -50.00 dB of RSS-210 - Quasi-peak limit line
Peak criteria : 0.10 dB, Curve : Peak

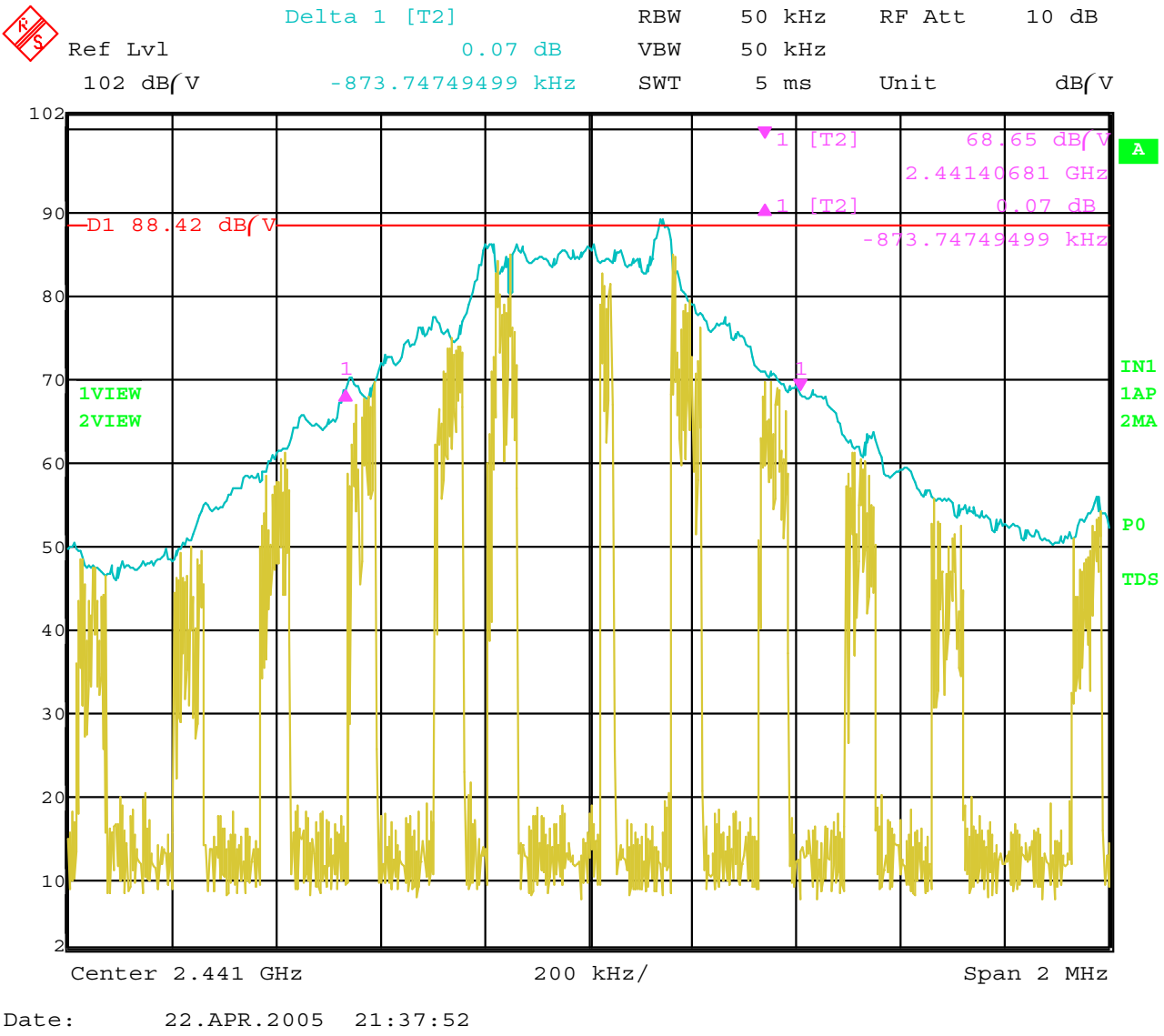
Peak#	Freq(MHz)	Amp(dBuV)	Limit(dB)	Delta(dB)
1	2.942	43.84	48.00	-4.16
2	1.106	43.55	48.00	-4.45
3	2.395	43.38	48.00	-4.62
4	2.375	42.68	48.00	-5.32
5	1.661	42.67	48.00	-5.33
6	1.065	42.64	48.00	-5.36
7	1.509	42.64	48.00	-5.36
8	0.874	42.61	48.00	-5.39
9	0.849	42.51	48.00	-5.49
10	1.496	42.43	48.00	-5.57
11	2.727	42.42	48.00	-5.58
12	0.923	42.42	48.00	-5.58
13	0.889	42.41	48.00	-5.59
14	0.842	42.41	48.00	-5.59
15	2.627	42.31	48.00	-5.69
16	0.820	42.21	48.00	-5.79
17	0.915	42.12	48.00	-5.88
18	0.859	42.11	48.00	-5.89
19	1.675	42.07	48.00	-5.93
20	0.831	42.01	48.00	-5.99
21	2.435	41.99	48.00	-6.01
22	1.029	41.93	48.00	-6.07
23	0.662	41.89	48.00	-6.11
24	0.935	41.72	48.00	-6.28
25	0.947	41.62	48.00	-6.38
26	2.798	41.53	48.00	-6.47
27	0.679	41.39	48.00	-6.61
28	1.965	41.33	48.00	-6.67
29	1.047	41.14	48.00	-6.86
30	0.668	41.09	48.00	-6.91
31	1.704	40.98	48.00	-7.02
32	0.745	40.90	48.00	-7.10
33	2.220	40.86	48.00	-7.14
34	1.056	40.84	48.00	-7.16
35	2.845	40.83	48.00	-7.17
36	2.582	40.80	48.00	-7.20
37	0.711	40.69	48.00	-7.31
38	4.239	40.58	48.00	-7.42
39	0.955	40.52	48.00	-7.48
40	3.004	40.45	48.00	-7.55

-20 dB BANDWIDTH

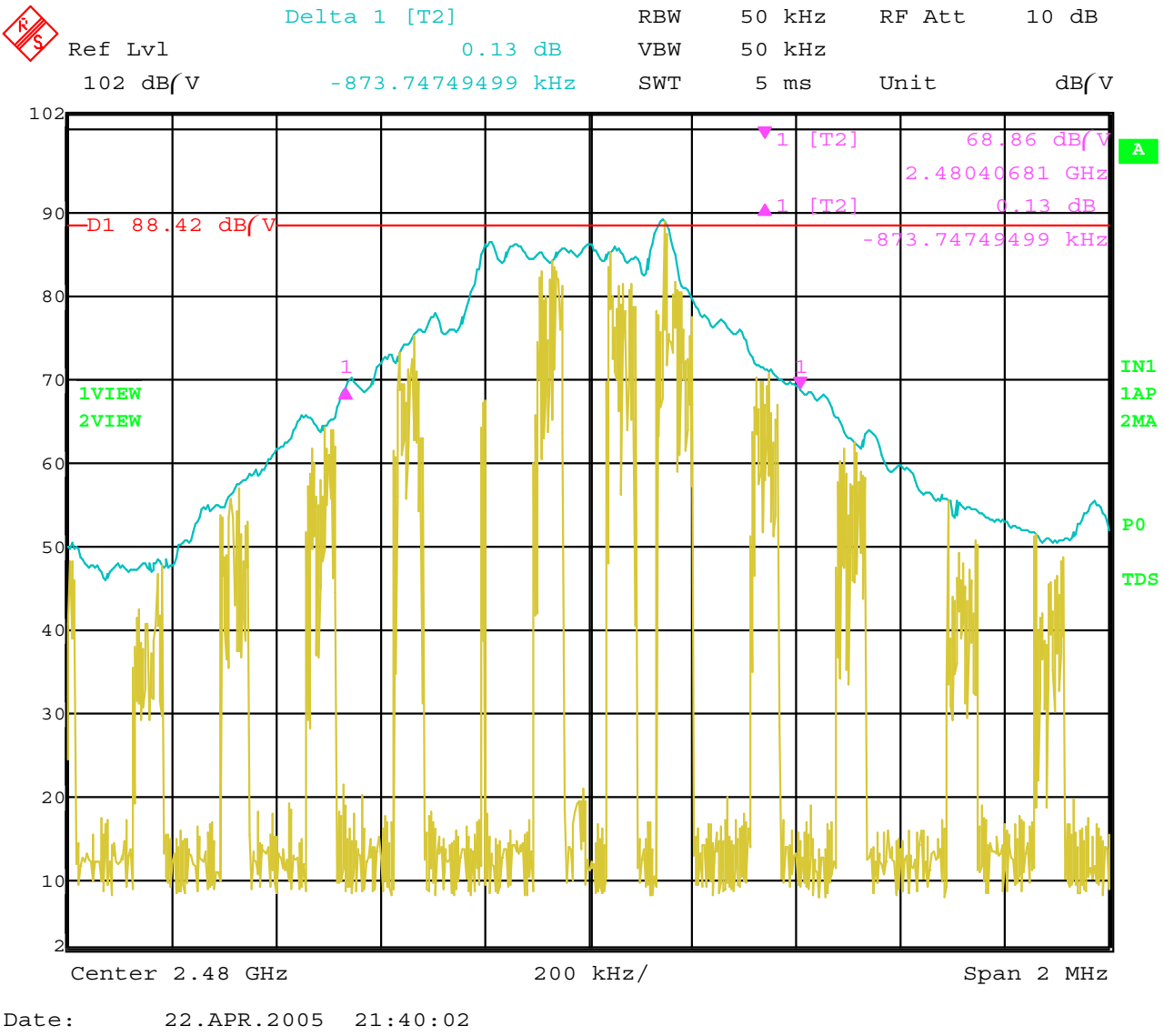
DATA SHEETS



-20 dB Bandwidth – Low Channel



-20 dB Bandwidth – Middle Channel



-20 dB Bandwidth – High Channel

PEAK POWER OUTPUT

DATA SHEETS

FCC 15.247

Thales Navigation
GPS Receiver
Model: MobileMapper CE
Configuration: With Internal Antenna

Date: 04/19/05
Lab: B
Tested By: Benigno Chavez

Peak Output Power
Worst Case Axis for Vertical Polarization = X-Axis
Worst Case Axis for Horizontal Polarization = X-Axis

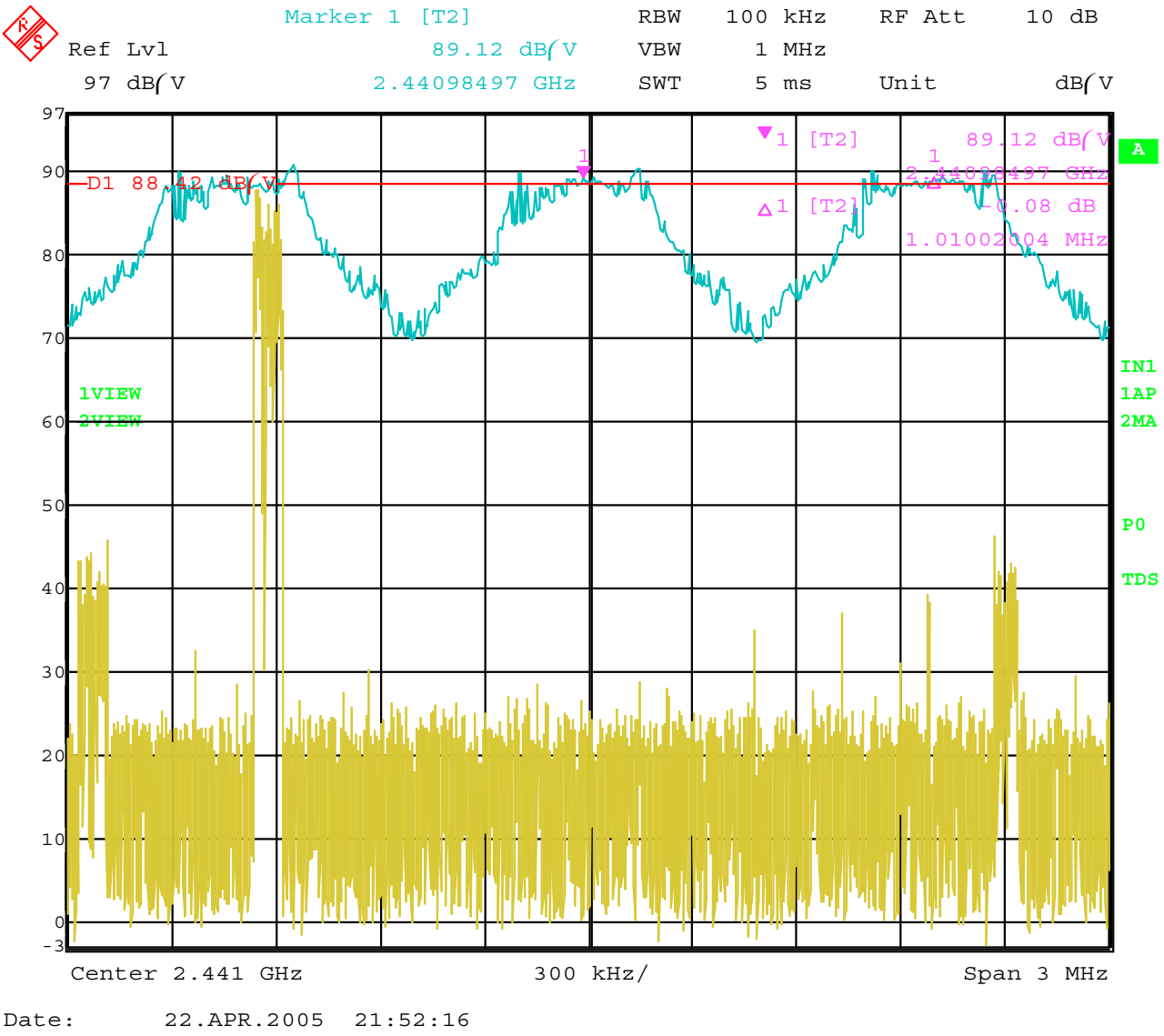
Freq. (MHz)	Level (dBuV)	Level (V/m)	Antenna Gain (dBi)	Numeric Gain	Power Output (Watts)	Power Output (mW)	Power Output (dBm)	Comments
2402	86.86	0.0220293	2	1.584893	9.186E-05	0.09186	-10.369	Vertical
2441	85.84	0.0195884	2	1.584893	7.263E-05	0.07263	-11.389	Vertical
2480	86.58	0.0213304	2	1.584893	8.612E-05	0.08612	-10.649	Vertical
2402	88.42	0.0263633	2	1.584893	0.0001316	0.13156	-8.8088	Horizontal
2441	86.61	0.0214042	2	1.584893	8.672E-05	0.08672	-10.619	Horizontal
2480	86	0.0199526	2	1.584893	7.536E-05	0.07536	-11.229	Horizontal

The Power in Watts is obtained by the following Formula Below:

P=[(E*D)^2]/(30*G)
P = Power in Watts
E = The Measured Maximum Field Strength in V/m
G = The Numberic Gain of the Transmitting Antenna over an Isotropic Radiator

CHANNEL HOPPING SEPARATION

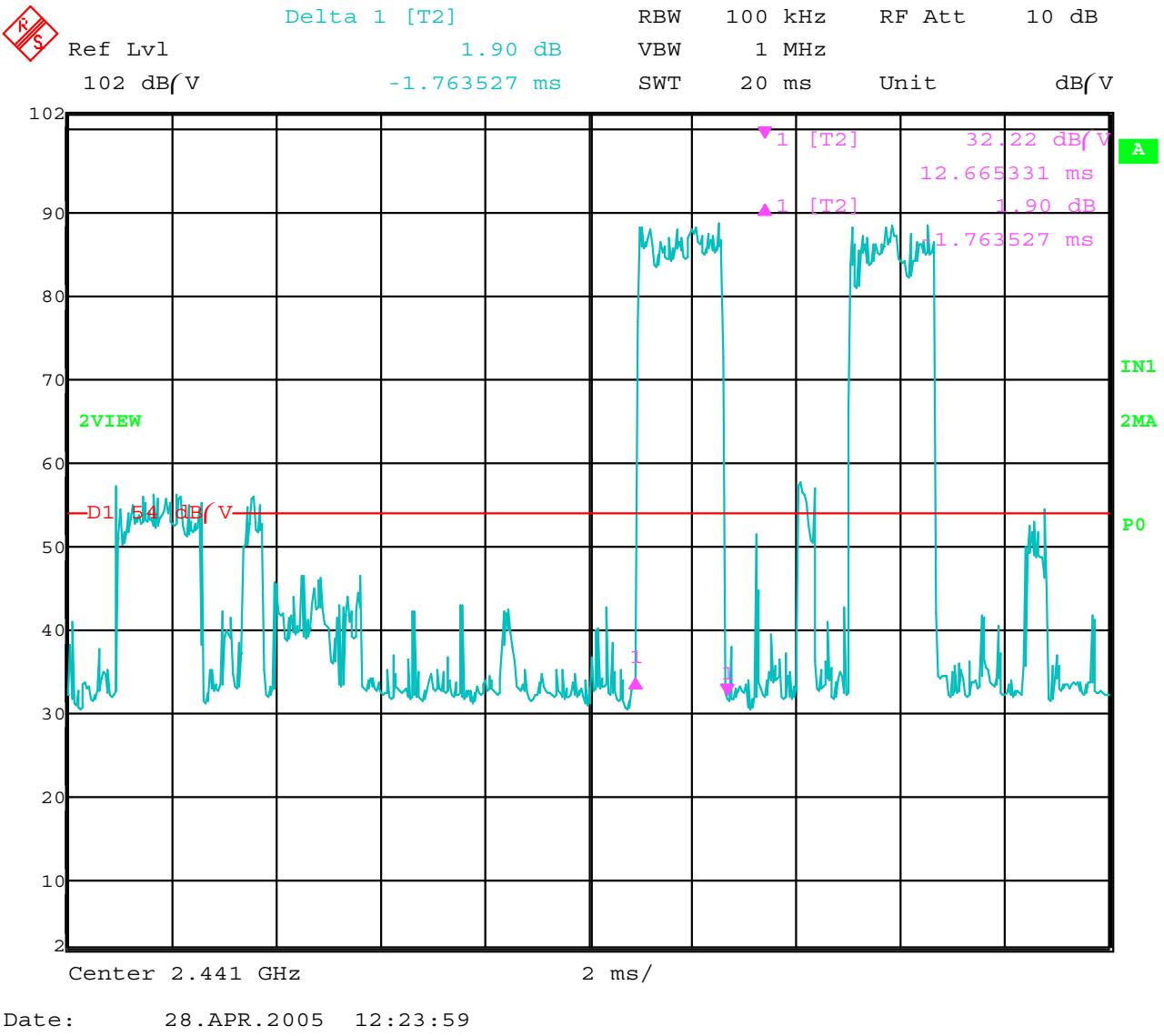
DATA SHEET



Channel Frequency Separation Test

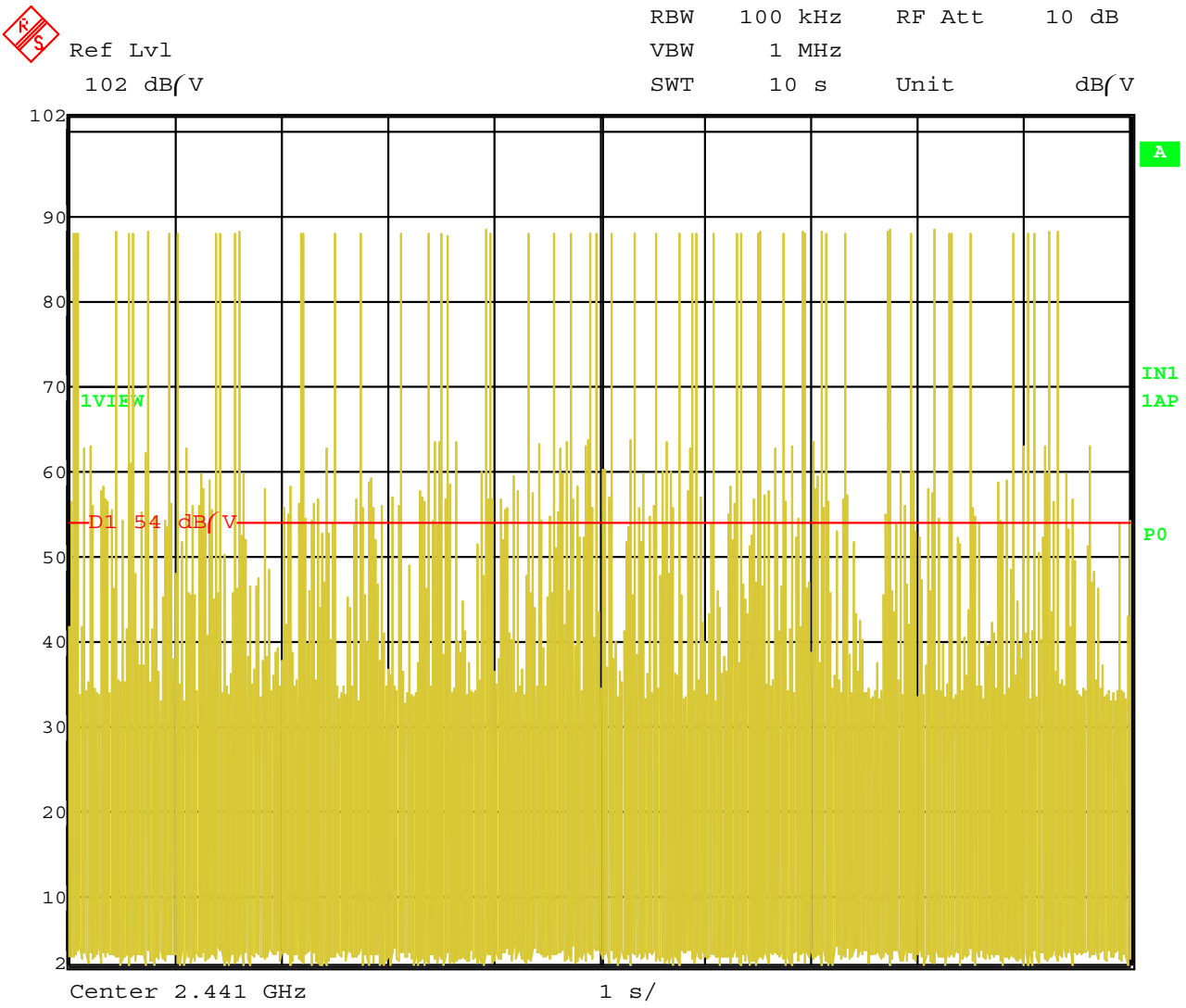
AVERAGE TIME OF OCCUPANCY

DATA SHEETS



Date: 28.APR.2005 12:23:59

Time of one Pulse = 1.763527 mS



58 Pulses in a 10 Second Period = 183.28 Pulses in a 31.6 second period
Total On time per 31.6 seconds = 1.763527 mS *183.28 = 323.21922856 mS

SPECTRAL DENSITY OUTPUT

DATA SHEETS

FCC 15.247

Thales Navigation
GPS Receiver
Model: MobileMapper CE
Configuration: With Internal Antenna

Date: 04/19/05
Lab: B
Tested By: Benigno Chavez

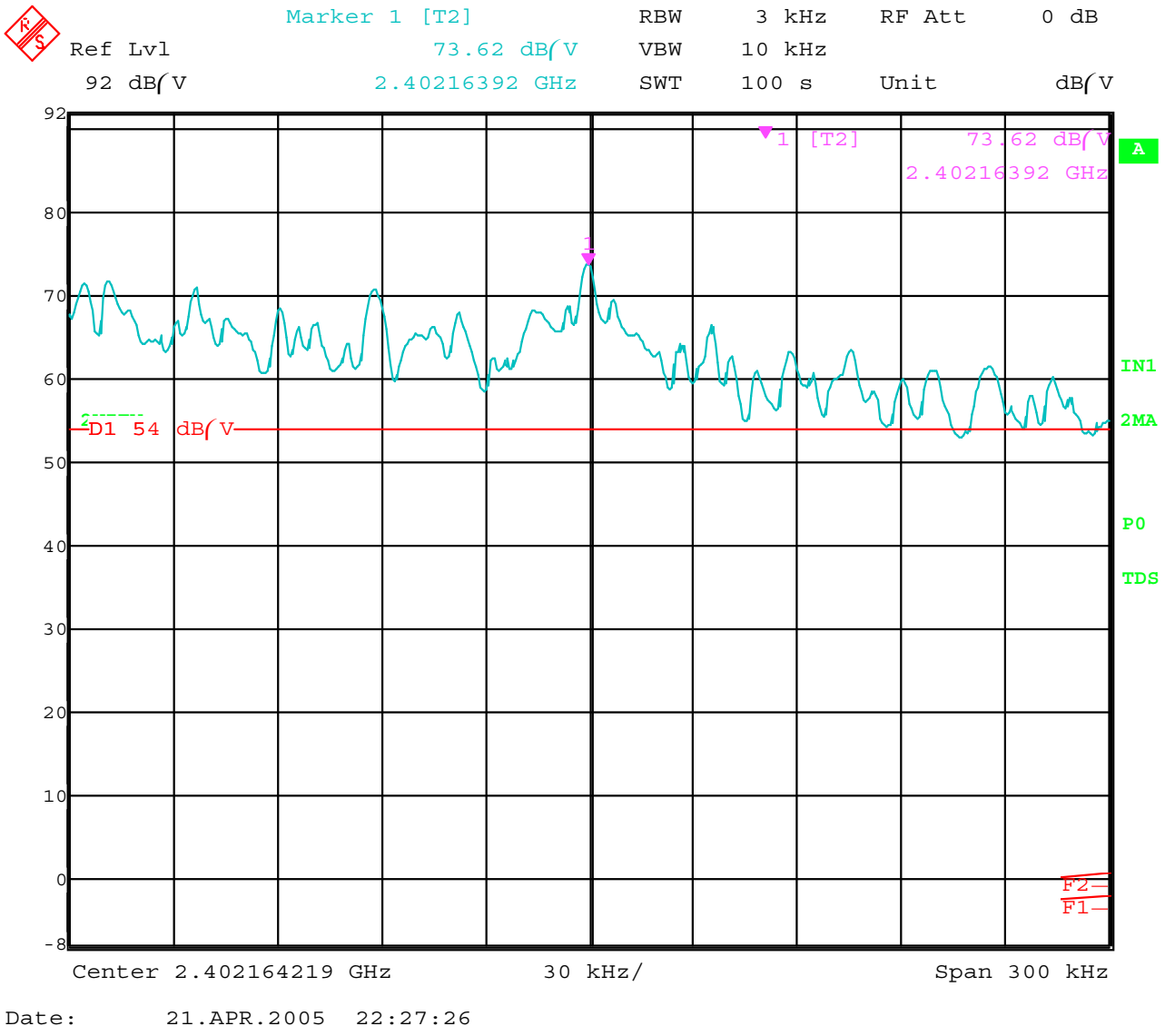
Spectral Density Test
Worst Case Axis for Vertical Polarization = X-Axis
Worst Case Axis for Horizontal Polarization = X-Axis

Freq. (MHz)	Level (dBuV)	Level (V/m)	Antenna Gain (dBi)	Numeric Gain	Power Output (Watts)	Power Output (mW)	Power Output (dBm)	Comments
2402	73.62	0.0048	2	1.584893	4.3563E-06	0.00436	-23.609	(Vert) Limit = +8 dBm
2441	70.41	0.00332	2	1.584893	2.0803E-06	0.00208	-26.819	(Vert) Limit = +8 dBm
2480	73.44	0.0047	2	1.584893	4.1795E-06	0.00418	-23.789	(Vert) Limit = +8 dBm
2402	75.34	0.00585	2	1.584893	6.4732E-06	0.00647	-21.889	(Horiz) Limit = +8 dBm
2441	71.28	0.00366	2	1.584893	2.5417E-06	0.00254	-25.949	(Horiz) Limit = +8 dBm
2480	72.83	0.00438	2	1.584893	3.6318E-06	0.00363	-24.399	(Horiz) Limit = +8 dBm

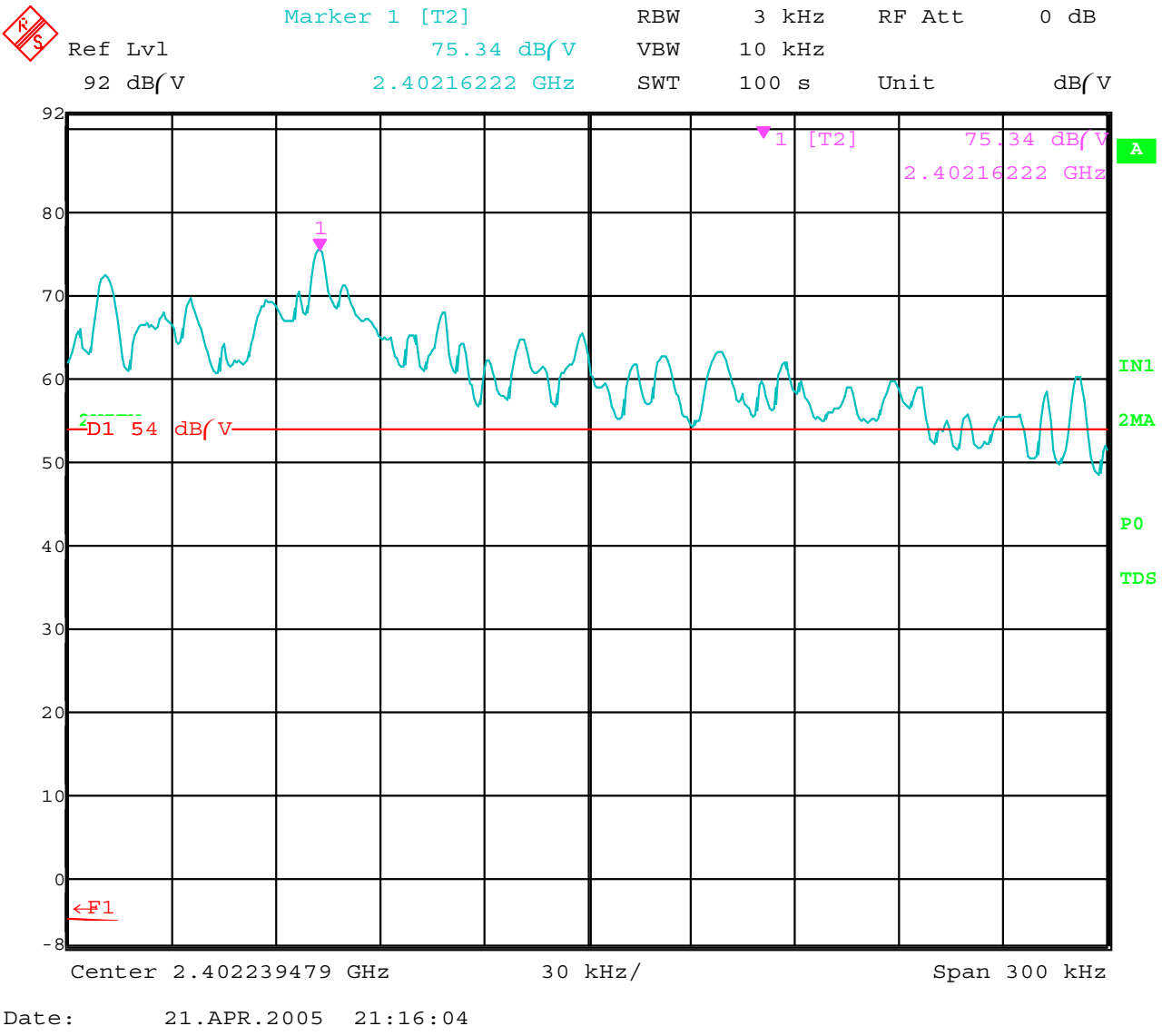
Level in dBuV obtained by maximizing fundamental emission then setting the EMI Receiver to
RBW = 3 kHz, VBW = 10 kHz, Span = 300 kHz, Sweep Time = 100 Seconds

The Power in Watts is obtained by the following Formula Below:

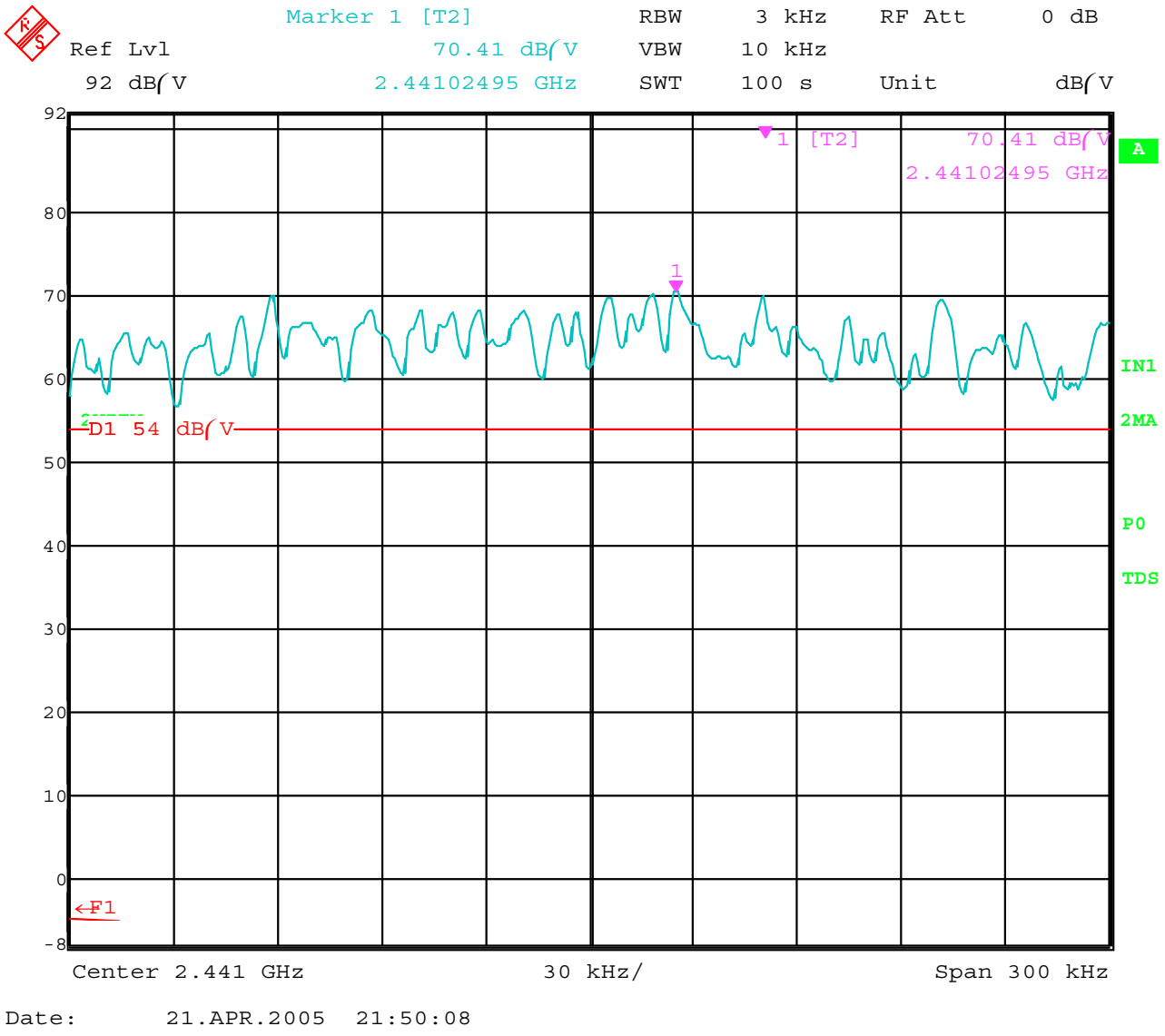
P=[(E*D)^2]/(30*G)
P = Power in Watts
E = The Measured Maximum Field Strength in V/m
G = The Numberic Gain of the Transmitting Antenna over an Isotropic Radiator



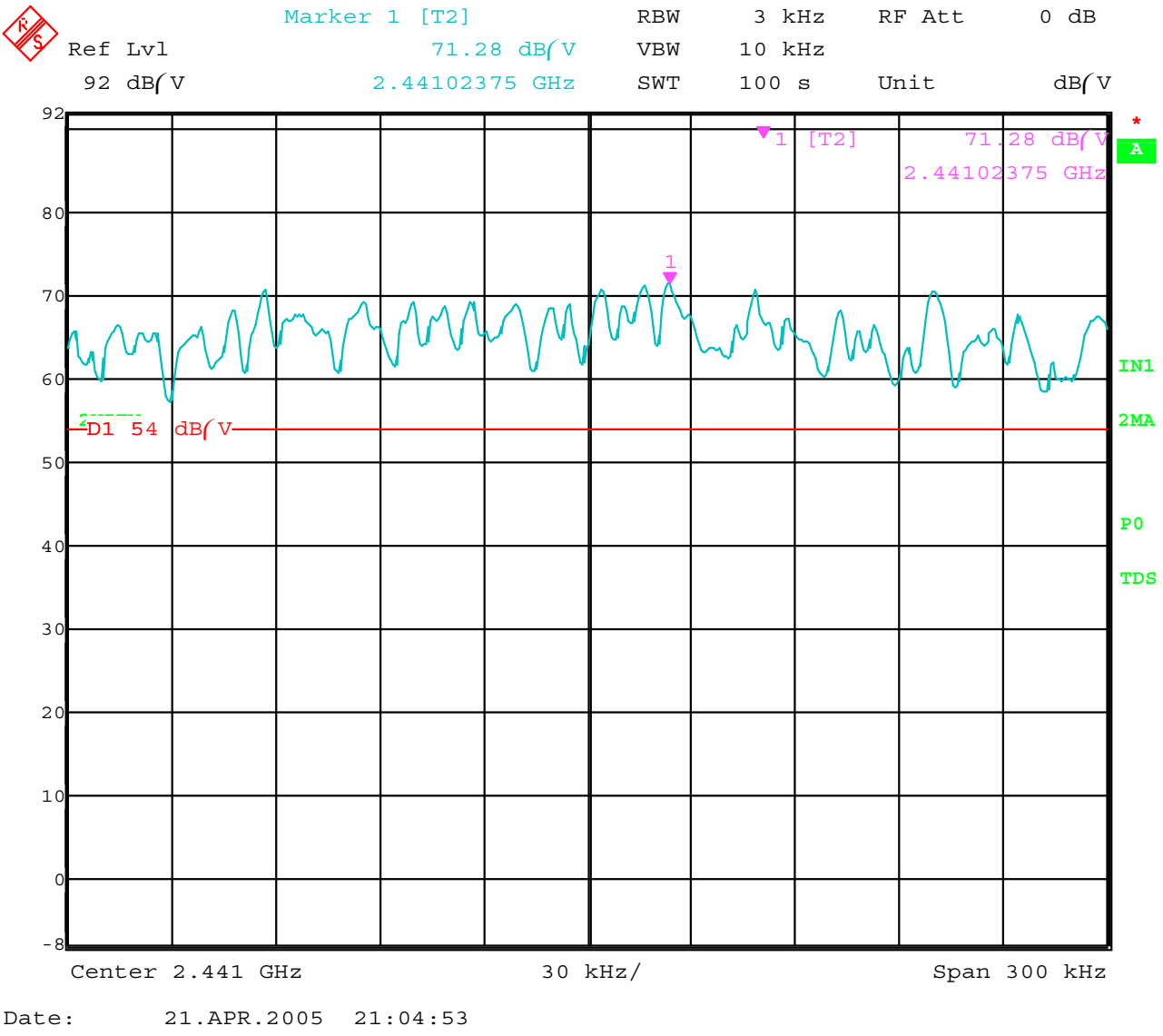
PPSD – Low Channel – Vertical Polarization



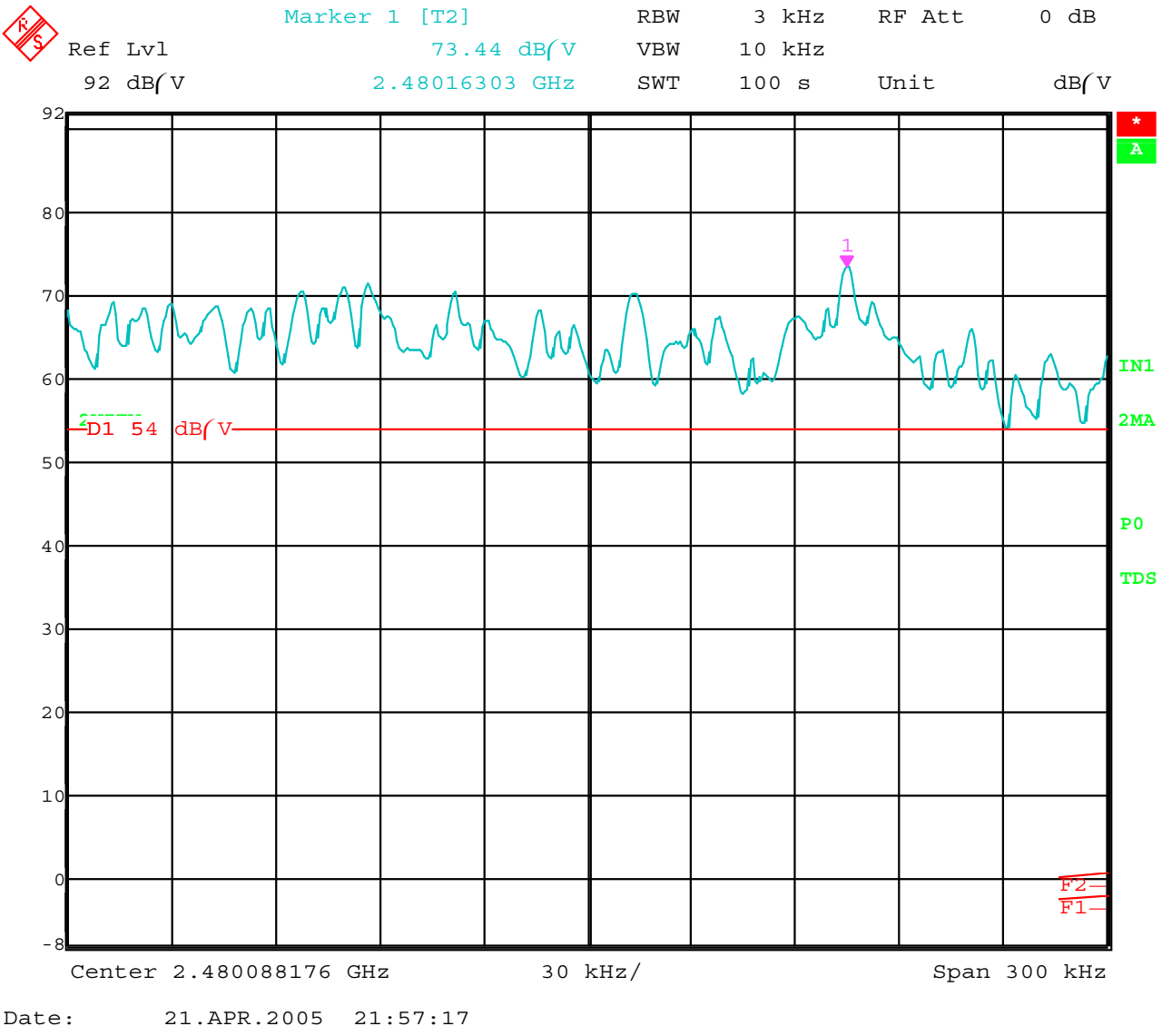
PP PPSD – Low Channel – Horizontal Polarization



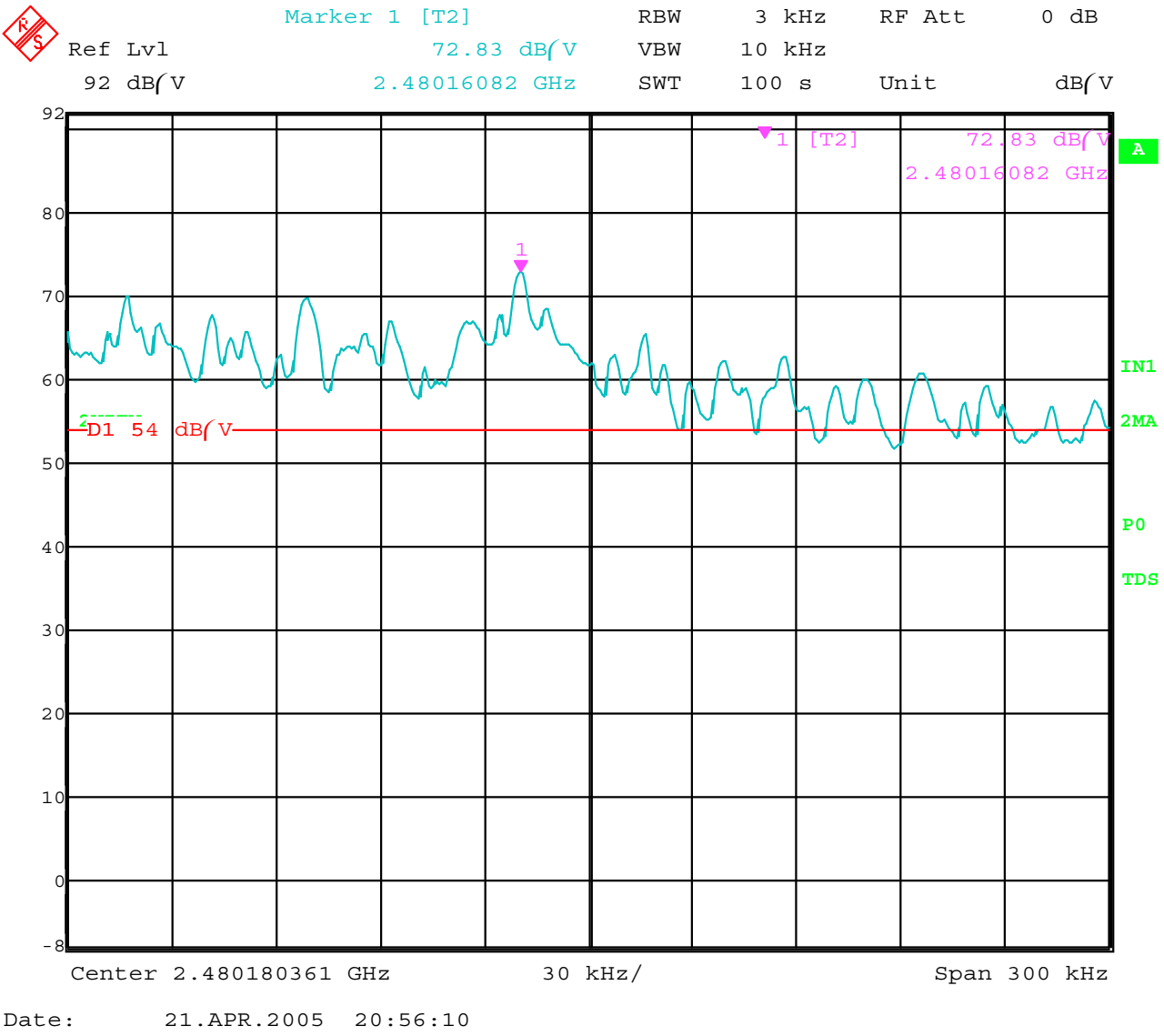
P PPSD – Middle Channel – Vertical Polarization



PPSD – Middle Channel – Horizontal Polarization



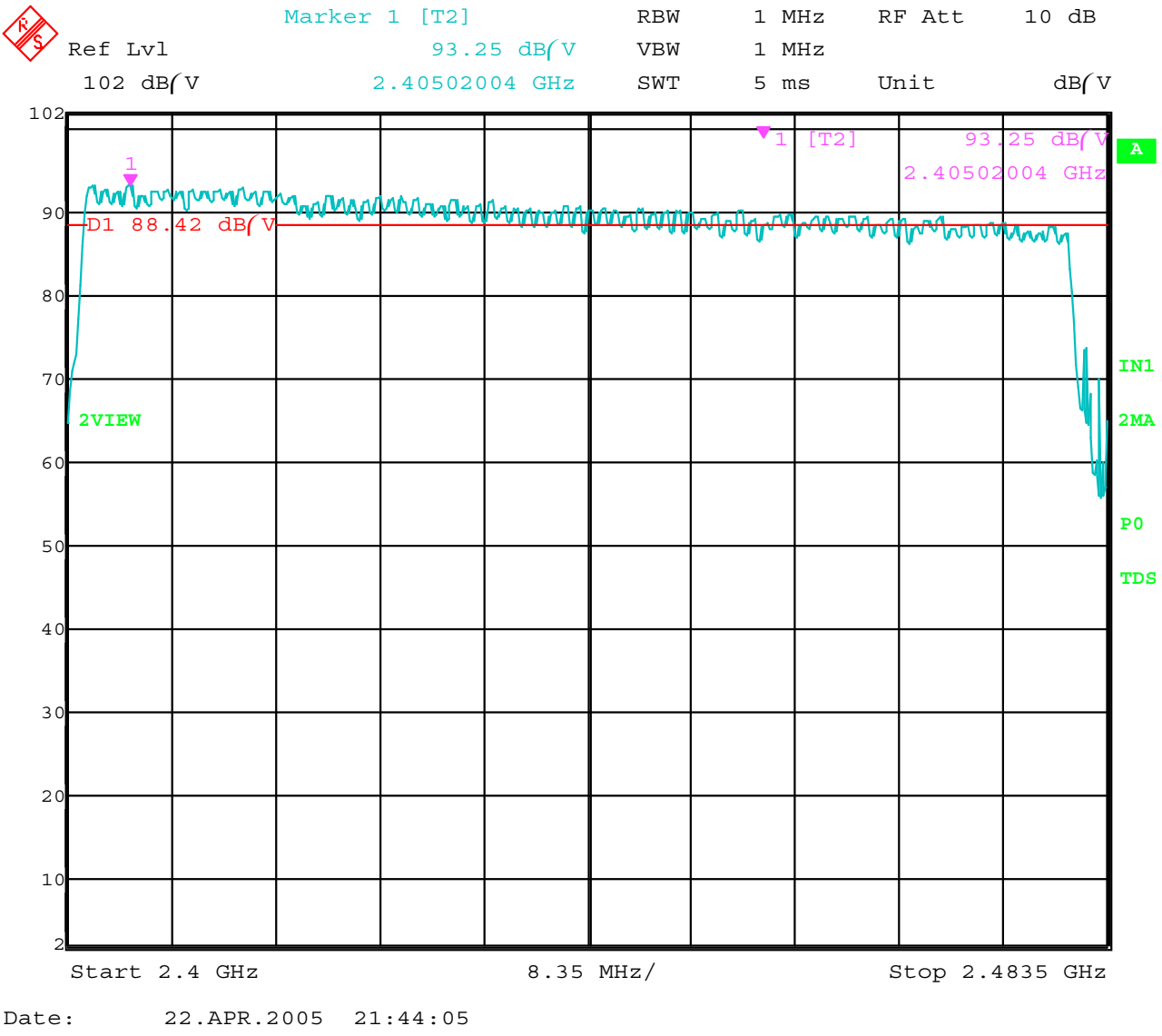
PPSD – Hi Channel – Vertical Polarization



PPSD – Hi Channel – Horizontal Polarization

NUMBER OF HOPPING FREQUENCIES

DATA SHEET



Number of Frequencies – 79 Total

BAND EDGES

DATA SHEETS

FCC 15.247

Thales Navigation — Date: 04/21/05
GPS Receiver — Lab: B
Model: MobileMapper CE — Tested By: Benigno Chavez
Configuration: With Internal Antenna

Worst Case - X-axis for EUT itself
Low Channel - 2402 MHz Fundamental
Mid Channel - 2441 MHz Fundamental
High Channel - 2480 MHz Fundamental

Transmit Mode

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
2402	86.86	V	--	--	Peak	1.92	315	Fundamental of Low Channel
2402	43.7	V	--	--	Avg	1.92	315	@ 3 meters
2389.8	48.35	V	74	-25.65	Peak	1.92	315	**No** Marker Delta Method
2333.4	27.98	V	54	-26.02	Avg	1.92	315	Method Used
2441	85.84	V	--	--	Peak	1.95	315	Fundamental of Middle Channel
2441	42.99	V	--	--	Avg	1.95	315	@ 3 meters
2480	86.58	V	--	--	Peak	1.94	315	Fundamental of High Channel
2480	43.82	V	--	--	Avg	1.94	315	@ 3 meters
2483.5	63.89	V	74	-10.11	Peak	1.94	315	**No** Marker Delta Method
2483.5	25.57	V	54	-28.43	Avg	1.94	315	Method Used

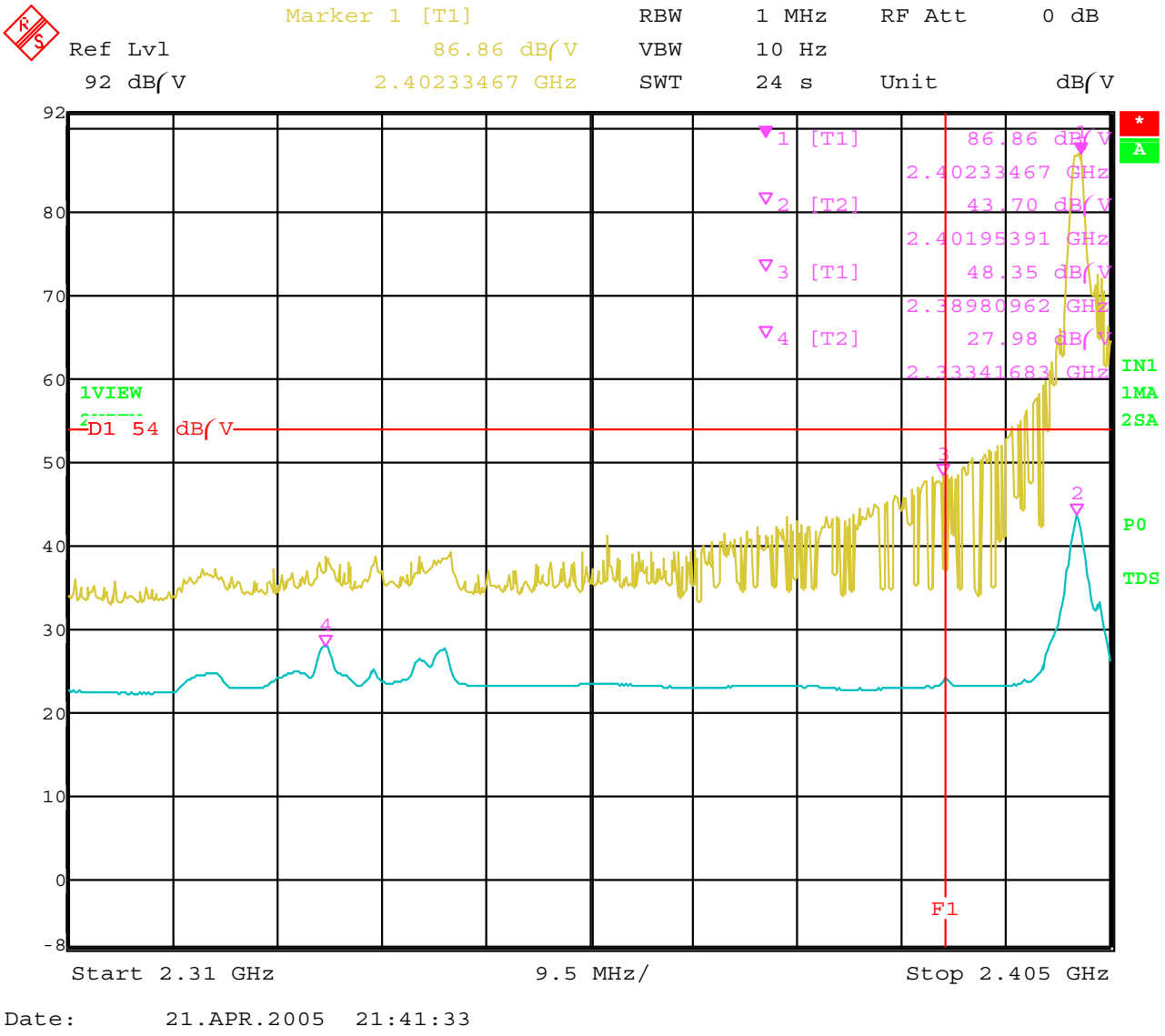
FCC 15.247

Thales Navigation — Date: 04/21/05
GPS Receiver — Lab: B
Model: MobileMapper CE — Tested By: Benigno Chavez
Configuration: With Internal Antenna

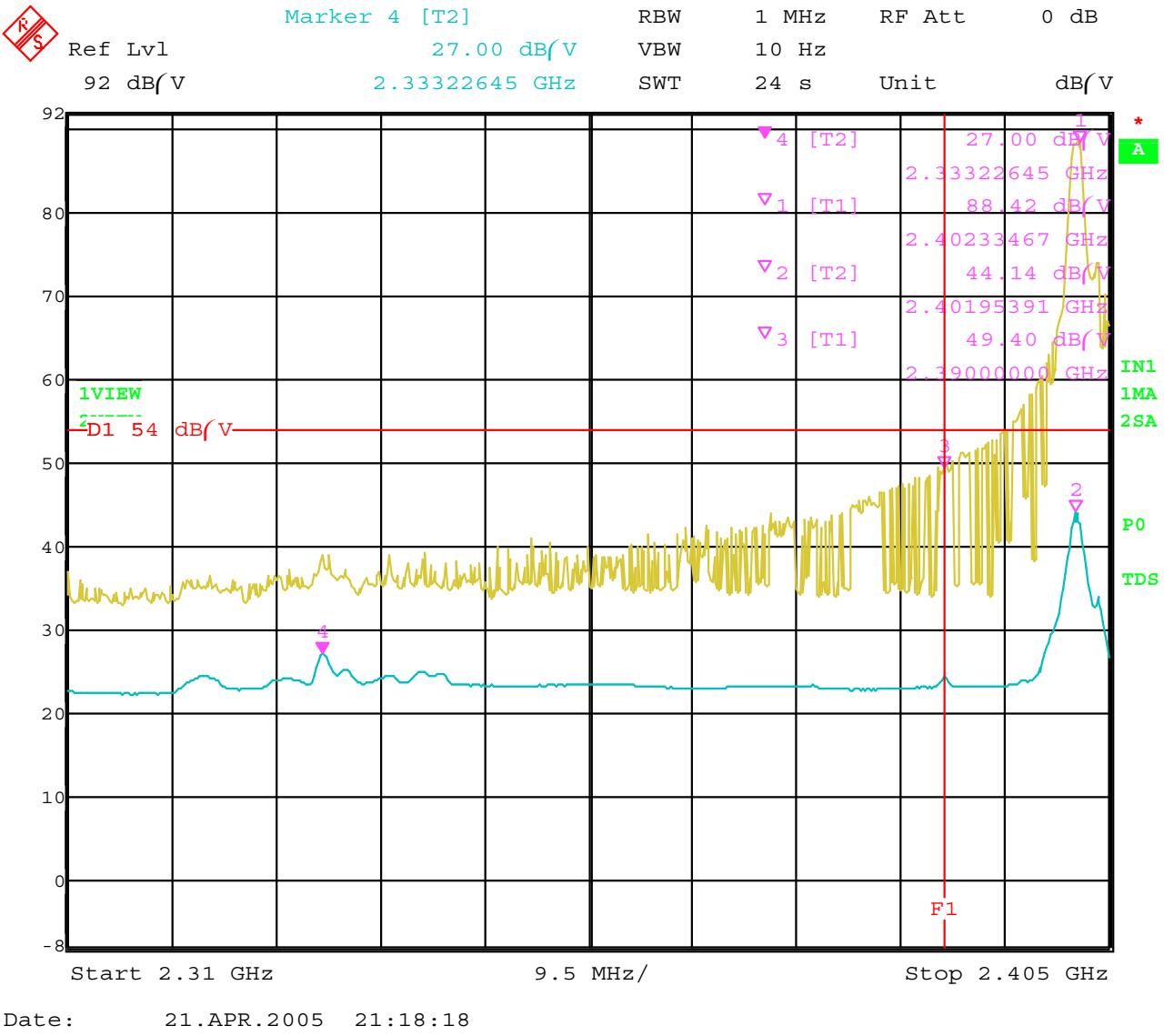
Worst Case - X-axis for EUT itself
Low Channel - 2402 MHz Fundamental
Mid Channel - 2441 MHz Fundamental
High Channel - 2480 MHz Fundamental

Transmit Mode

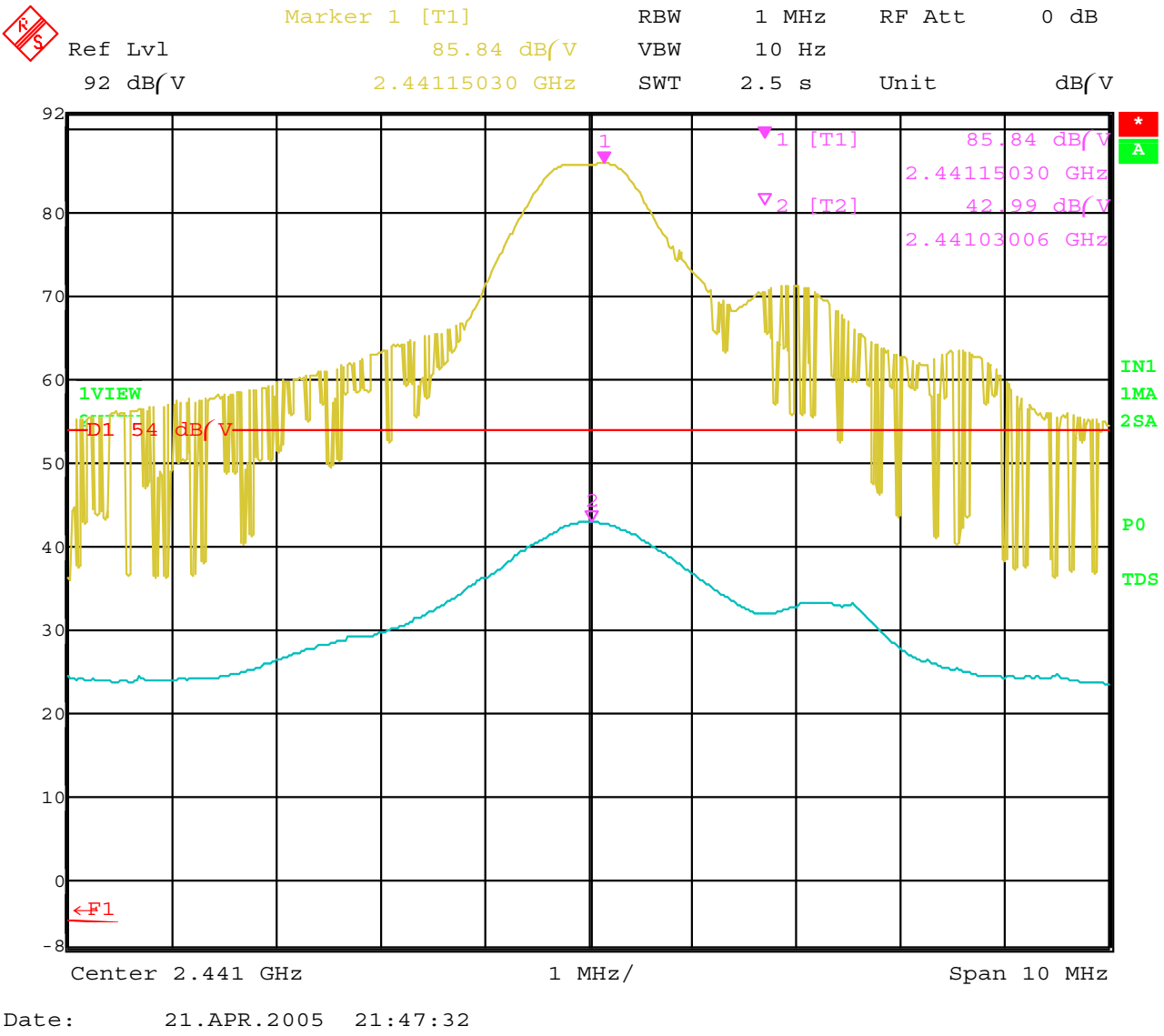
Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
2402	88.42	H	--	--	Peak	1.34	180	Fundamental of Low Channel
2402	44.14	H	--	--	Avg	1.34	180	@ 3 meters
2390	49.4	H	74	-24.6	Peak	1.34	180	**No** Marker Delta Method
2333.2	27	H	54	-27	Avg	1.34	180	Method Used
2441	86.61	H	--	--	Peak	1.34	180	Fundamental of Middle Channel
2441	44.66	H	--	--	Avg	1.34	180	@ 3 meters
2480	86.08	H	--	--	Peak	1.72	180	Fundamental of High Channel
2480	43.64	H	--	--	Avg	1.72	180	@ 3 meters
2483.5	63.29	H	74	-10.71	Peak	1.72	180	**No** Marker Delta Method
2483.5	25.73	H	54	-28.27	Avg	1.72	180	Method Used



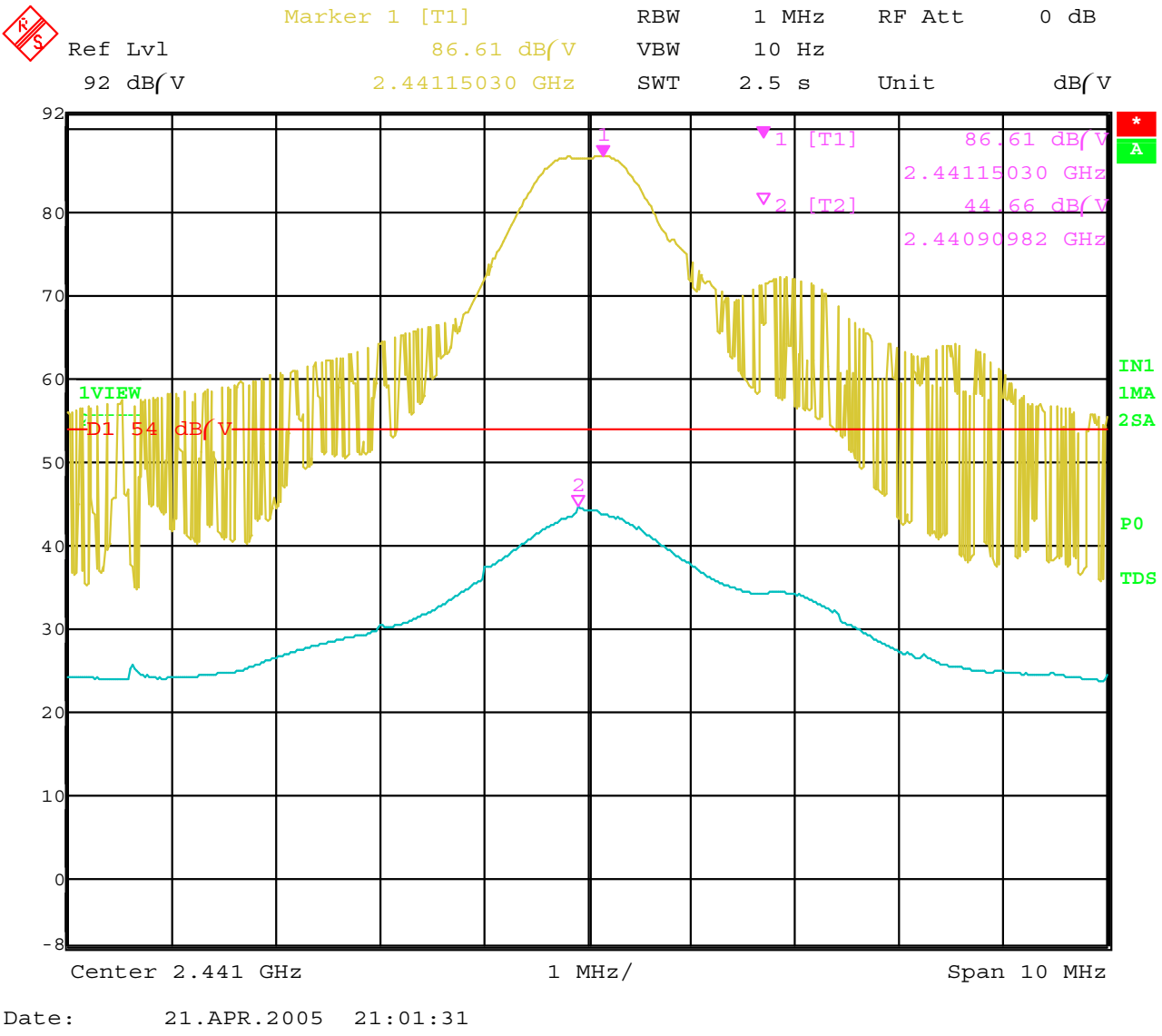
Band Edge – Low – Vertical Polarization



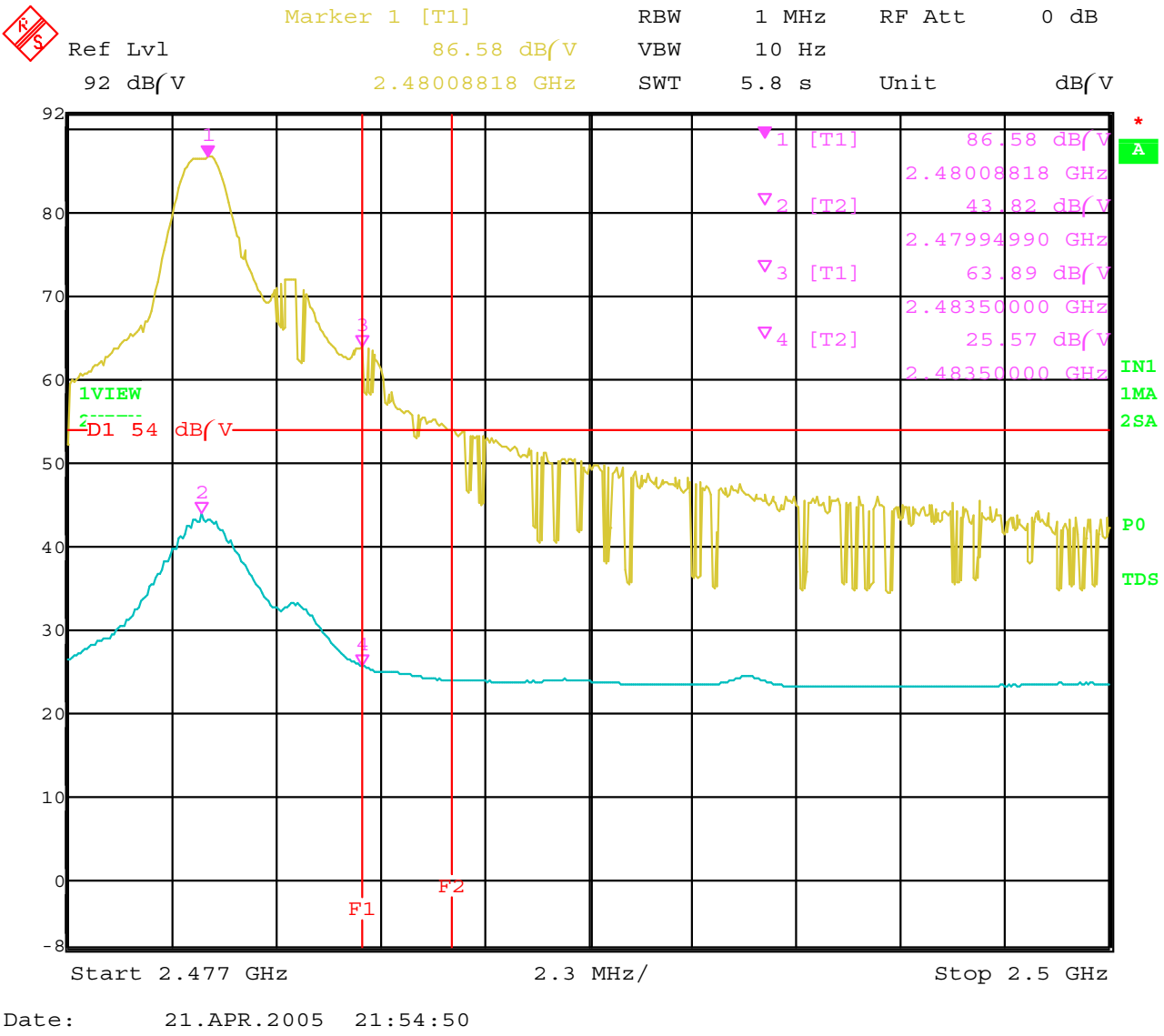
Band Edge – Low – Horizontal Polarization



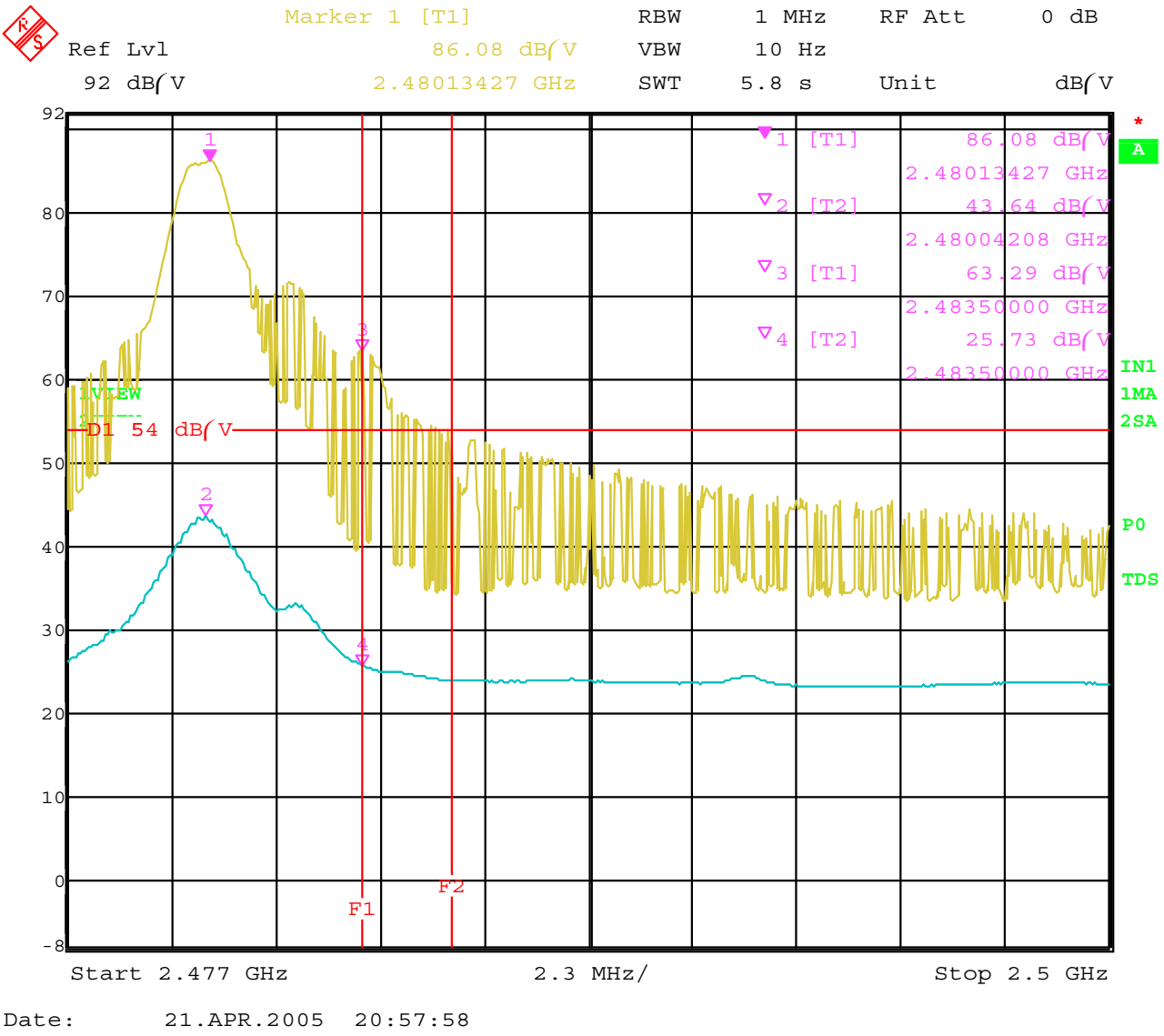
Band Edge – Middle – Vertical Polarization



Band Edge – Middle – Horizontal Polarization



Band Edge – Hi – Vertical Polarization



Band Edge – Hi – Horizontal Polarization

DUTY CYCLE

INFORMATION

Company: 15.247 Interpretation	**Subject:** Spurious emission		1227
Remarks:		**Keyword:**	
Rule Parts: 15.247	**City:**	**State:**	**Country:**

INQUIRY: I'm writing the regulatory sections for a new wireless standard, the IEEE 802.15.4 Personal Area Network standard. This is the IEEE's answer to a need for something a bit lower cost than Bluetooth. Since these standards have in the past not done a particularly good job of documenting and interpreting FCC and other applicable regs, I'm really making a special effort to get it right for these guys. However, I've run into a problem on interpretation of Part 15.247 that no one knows the answer to, though it is quite fundamental and should have probably been spelled out in the rules. 15.247 allows harmonics at -20 dBc (easy) for ISM band spread spectrum equipment, but where the harmonics fall in the restricted bands of FCC 15.205 the general level of FCC 15.209 must be met. This is 500 uV/m at 3 meters, or -41.2 dBm ERP. The 2nd, 3rd, and 5th harmonics of 2400 MHz band gear falls into restricted, as does the 3rd and 5th of 902-928 MHz. At a transmit power level of 100 mW steady state, the equipment must attain -61 dBc harmonic rejection, or with higher antenna gain (say on the third where a quarterwave whip resonates) it must get even more. This is a real bear for cheap gear to meet. Now it is common practice to use the provisions of FCC 15.35 to average the transmission over 100 mS and allow the electric field strength to go up inversely with the average from 0 to 100% duty cycle. This may be done to a maximum of 20 dB allowed higher spurious emissions. For example, at 10% duty cycle over 100 mS, the electric field of harmonics may go up 10X, and since power is the square of electric field the peak power of spurs landing in restricted bands may go up 100X, or 20 dB. This is the max allowed, and in this case it makes a hell of a difference. Now the key question is: Do the averaging provisions of FCC 15.35 apply to hoppers? This is true if the standard practice when measuring frequency hopping systems for harmonics is to let the transmitter hop while the test system takes its data in a fixed 1 MHz channel that the system hops through. Or, has the standard practice been to FORCE the transmitter to transmit on a fixed non-hopping frequency and measure harmonics on a fixed channel using the averaging detector? I have pinged the Part 15 author, John Reed, and he is apparently not sure how he intended this to be interpreted when he wrote the rules. Both he and Ray Laforge have referred me to you on this key question. If a policy on this has not been previously spelled out, then whatever is standard practice on Bluetooth would seem to be the standard for all ISM band hopping systems. On the Bluetooth standard with 79 channels, 1600 hops per second, and an average of two hits on a test channel per 100 mS test period, the full 20 dB relaxation on spurious emissions would be attained. This basically allows about 40 dB harmonic suppression (not so hard to get) vs. 60 if the relaxation via averaging does not apply RESPONSE: The spurious emissions that fall in the restricted bands above 1 GHz would be subject to a peak field strength level at 3 meters of 74 dBuV/m (5000uV/m) and an average field strength level of 54 dBuV/m(500uV/m) . The following procedure should be used when measuring the peak level. During these tests the hopping function is disabled. I understand that the hopping channels may overlap in a 1 MHz band in this new proposal. Therefore, the duty factor should take this into account. This was not an issue in the current bluetooth specification as the channel separation is 1 MHz and the 20 db bandwidths do not overlap. Spurious Radiated Emissions This test is required for any spurious emission or modulation product that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings: Span = wide enough to fully capture the emission being measured RBW = 1 MHz for f > 1 GHz, 100 kHz for f < 1 GHz VBW > RBW Sweep = auto Detector function = peak Trace = max hold Follow the guidelines in ANSI C63.4-1992 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc. A pre-amp and a high pass filter are required for this test, in order to provide the measuring system with sufficient sensitivity. Allow the trace to stabilize. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, which must comply with the limit specified in Section 15.35(b). Submit this data. Now set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from 20log(dwell time/100 ms), in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

Supporting Images:

ID	Description	File Type