

# DELTA Test Report



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## Radio parameter test to EU requirements of Bluetooth interface of Explorer 700

### Performed for Thrane & Thrane A/S

DANAK-198332 Rev. A

Project no.: A503704-2

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including 4 annexes

04 May 2006

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**Title** Radio parameter test to EU requirements of Bluetooth interface of Explorer 700

**Test object** Explorer 700

**Report no.** DANAK-198332 Rev. A

**Project no.** A503704-2

**Test period** 10 March 2006 to 10 April 2006

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**Specifications** EN 300 328 v1.6.1  
Section 4.2.1.2.1 of EN 301 444 V1.1.1 (2000-05)

**Results** The radio parameters were within the requirements of EN 300 328 and Section 4.2.1.2.1 of ETSI EN 301 444

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**Date** 04 May 2006

**Responsible**



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This report is a revision of the original test report DANAK-198332 dated 19 April 2006. The revision has been made due to the following correction:

On page 6, Section 2.1 Part no. has been changed from TT-3732A and TT-3703A to TT-3720A.

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## 1. Scope and summary of test results

### 1.1 Scope

This report shows the test results from a test performed on a Bluetooth function installed in the Thrane & Thrane Land Mobile Earth Station Explorer 700. According to the manufacturer the Earth station has been tested with respect to the requirements of the product related standard EN 301 444. The Bluetooth unit was active during those tests.

The WLAN module installed in the Thrane & Thrane Land Mobile Earth Station Explorer 700 is excluded from the scope of this test, as it has not been modified by Thrane & Thrane and the manufacturer of the module has performed the relevant tests.

This report covers additional tests of the terminal, where Bluetooth specific use of the spectrum has been tested with respect to the requirements of EN 300 328. Additionally the test specified in Section 4.2.1.2.1 of ETSI EN 301 444 V1.1.1 (2000-05) has been performed to verify compliance.

### 1.2 Summary of test results

The results of the radio parameter tests can be summarized as follows:

Radio parameter tests	Test methods	Results
Equivalent isotropic radiated power	EN 300 328 v1.6.1	Passed
Maximum spectral power density	EN 300 328 v1.6.1	N/A <sup>1</sup>
Frequency range	EN 300 328 v1.6.1	Compliant <sup>2</sup>
Transmitter spurious emissions	EN 300 328 v1.6.1	Passed
Receiver spurious emissions	EN 300 328 v1.6.1	N/A <sup>3</sup>
Unwanted emission	Section 4.2.1.2.1 of EN 301 444 V1.1.1	Passed

#### Abbreviations

Passed	:	The requirements are met.
Compliant	:	The test object is compliant, no test was performed.
Failed	:	The requirements are not met.
Not done	:	No test was performed.
N/A	:	Not applicable.
Not relevant	:	The test was not relevant for the test specimen.

#### Notes

- 1: The test object uses FHSS modulation.
- 2: This test was performed on Explorer 500. According to Thrane & Thrane all electrical components relevant for this test are identical to the Explorer 700.  
Please refer to DELTA Test Report A503514-1, DANAK-198182.
- 3: The test specimen is never in receive-only mode.

## Conclusion

According to Thrane & Thrane A/S the test objects mentioned in this report are in compliance with EN 301 444 v1.1.1. Therefore, only the test requirements of EN 300 328 that are additional with respect to EN 301 444 have been performed.

The test objects mentioned in this report meet the relevant requirements of the standard stated below.

- EN 300 328 v1.6.1 Electromagnetic compatibility and Radio spectrum Matters (ERM); Data transmission equipment operating in the 2.4 GHz ISM band and using wide band modulation techniques; Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive.
- Section 4.2.1.2.1 (unwanted emissions 30-1000 MHz) of EN 301 444 V1.1.1 (2000-05) Satellite Earth Stations and Systems (SES); Harmonized EN for Land Mobile Earth Stations (LMES) operating in the 1.5 and 1.6 GHz bands providing voice and/or data communications covering essential requirements under Article 2.2 of the R&TTE directive.

The results relate only to the objects tested.

## 2. Test objects and auxiliary equipment

### 2.1 Test object - Explorer 700

Category	Mobile Earth Station Equipment
Manufacturer	Thrane & Thrane A/S
Model / type	Explorer 700
Part no.	TT-3720A
Serial no.	EMC-1
FCC ID	ROJEXPLORER-700
Supply voltage	10-32 VDC
Operational mode	Tx, Rx, USB, LAN, 2Wire, ISDN, I/O, Bluetooth, WLAN and DC output active

### 2.2 Test object - AC/DC Adaptor

Category	Information Technology Equipment
Manufacturer	FSP Group Inc.
Model / type	FSP065-AAC
Part no.	NSW19695
Serial no.	-
FCC ID	For home or office use
Supply voltage	100-240 VAC, 47-63 Hz, 3.42 A max
Operational mode	Normal

### 2.3 Auxiliary equipment - Bluetooth Phone

Manufacturer	TENOVIS
Model / type	-
Part no.	-
Serial no.	BH01
FCC ID	-

### 2.4 Auxiliary equipment - Bluetooth Telephone Charger

Manufacturer	TENOVIS
Model / type	Integral Blue Voice L-
Part no.	-
Serial no.	0488B00045
FCC ID	-

### 2.5 Auxiliary equipment - FSQ3 Signal Analyzer

Manufacturer	Rohde & Schwarz
Model / type	FSQ3
Part no.	1155.5001.03
Serial no.	100031
FCC ID	-

## 2.6 Auxiliary equipment - ISDN Telephone

Manufacturer	Ascon
Model / type	Eurit 22
Part no.	-
Serial no.	-
FCC ID	-

## 2.7 Auxiliary equipment - ISDN Telephone

Manufacturer	Ascon
Model / type	Ascon 33
Part no.	-
Serial no.	-
FCC ID	-

## 2.8 Auxiliary equipment - 2Wire Telephone

Manufacturer	Connexion
Model / type	Topper Advance
Part no.	-
Serial no.	-
FCC ID	-

## 2.9 Auxiliary equipment - 2Wire Telephone

Manufacturer	danMark
Model / type	Classic
Part no.	-
Serial no.	-
FCC ID	-

## 2.10 Auxiliary equipment - Laptop PC#1

Manufacturer	Dell
Model / type	Latitude PP01L
Part no.	5D724 A00
Serial no.	TW 09C748-12800-19R-C648
FCC ID	For home or office use

## 2.11 Auxiliary equipment - Laptop PC#4

Manufacturer	Dell
Model / type	Latitude PP01L
Part no.	5D724 A00
Serial no.	TW 09C748-12800-19R-C632
FCC ID	For home or office use

## 2.12 Auxiliary equipment - Laptop PC#6

Manufacturer	Dell
Model / type	Inspiron 500 m
Part no.	7T392 A00
Serial no.	CN-04Y212-48643-349-1937
FCC ID	For home or office use



### 3. General test conditions

#### 3.1 Test setup during test

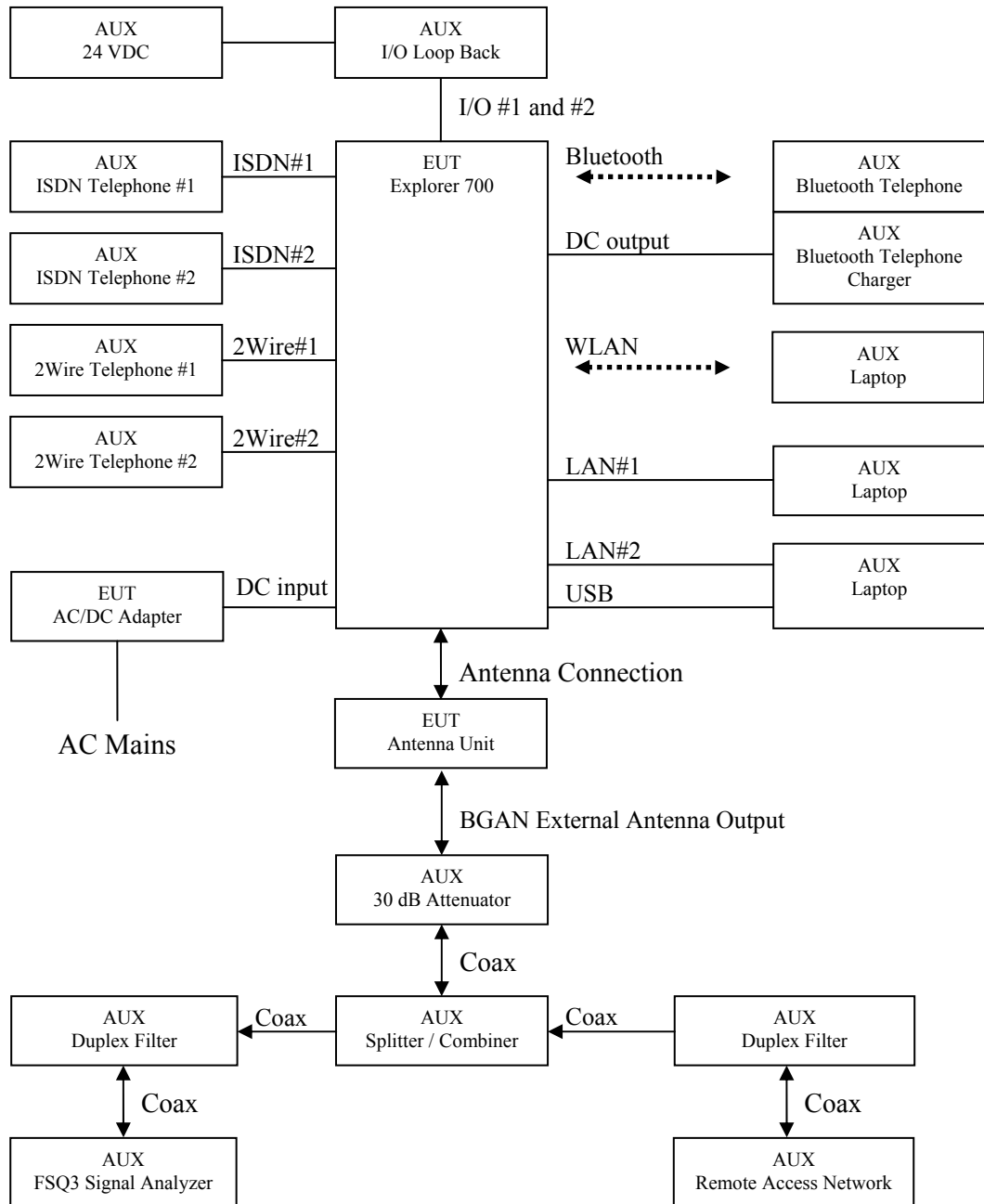


Figure 3.1 Test setup during test.

During test the Explorer 700 is transmitting at maximum Tx level. The Tx signal is monitored on the FSQ3 Signal Analyzer, via a modulation constellation diagram and a MER indication.

The Bluetooth link from the Explorer 700 is active during test. The status is monitored on the Bluetooth telephone.

The WLAN link from the Explorer 700 is active during test. The status is monitored on a laptop.

The two LAN connections are continuously pinged via the laptop. The status is monitored on the laptops.

The USB connection is used to setup the Explorer 700.

A call is placed on the ISDN telephone #1. The Explorer 700 repeats the received audio signal after a delay of approximately 2 seconds. No call is placed on ISDN telephone #2.

A call is placed on the 2Wire telephone #1. The Explorer 700 repeats the received audio signal after a delay of approximately 2 seconds. No call is placed on 2Wire telephone #2.

The two I/O ports are connected to a test box with two LED indicators. The LEDs are blinking continuously.

The DC output is supplying a Bluetooth telephone charger. The charge voltage is monitored via a LED on the telephone charger.

During measurement of unwanted emission according to Section 4.2.1.2.1 of EN 301 444 V1.1.1, the two LAN ports (LAN #1 and LAN #2) were connected to two loop-back connectors instead of the two laptop PCs.

### 3.1.1 Classification of interfaces

Interface	Type	Specified max. length	Std. name of port
AC Mains Power	Unshielded cable	-	AC power port
DC input	Unshielded cable	-	DC power port <sup>1</sup>
LAN#1	Unshielded cable	≤ 100 m	Telecommunication port
ISDN#1	Unshielded cable	≤ 100 m	Signal/control port <sup>2</sup>
ISDN#2	Unshielded cable	≤ 100 m	Signal/control port <sup>2</sup>
2Wire#1	Unshielded cable	≤ 400 m	Signal/control port <sup>2</sup>
2Wire#2	Unshielded cable	≤ 400 m	Signal/control port <sup>2</sup>
LAN#2	Unshielded cable	≤ 100 m	Telecommunication port
USB	Shielded cable	≤ 5 m	Signal/control port
I/O#1	Unshielded cable	Long	Signal/control port
I/O#2	Unshielded cable	Long	Signal/control port
Antenna Connection	Coax cable	≤ 100 m	Antenna port
DC output	Unshielded cable	2 m	DC power port
BGAN	Wireless (external antenna)	-	Enclosure
Bluetooth	Wireless (internal antenna)	-	Enclosure
WLAN	Wireless (internal antenna)	-	Enclosure

Notes:

- 1: The DC input port may be supplied from the AC/DC adapter or from any 10-32 VDC voltage source including a 12 and a 24 VDC vehicular battery.
- 2: The ISDN and 2-Wire ports are considered signal/control ports, as they are not to be connected to the public telephone system.

## 3.2 Radio product information

The following specifications apply to the Bluetooth interface of the Explorer 700.

### Equipment type

The Explorer 700 uses a Bluetooth transceiver followed by a HPA to make it a Class 1 Bluetooth device (100 mW). The transceiver is Bluetooth Specification 1.2 qualified (Certificate B02153).

The Bluetooth interface is considered a secondary radio interface of the combined equipment Explorer 700. The primary radio interface is the BGAN Mobile Earth Station radio.

### Modulation

FHSS modulation (in accordance with Bluetooth Specification 1.2).

### Test modulation

During test continuous RF transmission (CW) was used.

### Channels

79 hopping channels (in accordance with Bluetooth Specification 1.2).

### Frequency range

2400 to 2483.5 MHz.

### Power settings and antenna assemblies

The test object has two power settings: 100 mW (default) and 10 mW. The 10 mW setting is for use in countries with local restrictions (i.e. France where the maximum EIRP is restricted to 10 mW in the frequency range 2454 to 2483.5 MHz).

The test object is only to be used with the build-in antenna.

## 4. Tests and results

### 4.1 Equivalent isotropic radiated power (EIRP)

#### Results

The measured EIRP was within the limits.

#### Test method

Specification: EN 300 328 Section 5.7.2.1

Limit: EN 300 328 Section 4.3.1.2.

The radiated measurements were performed in a semi-anechoic chamber. For each measurement the test specimen was rotated 0-360°. The antenna height above the ground plane was varied to maximize the measurement.

#### Measurement results

Frequency setting	Power setting	Antenna polarization	Measured EIRP [dBm]	EIRP limit [dBm]
2402 MHz	20 dBm	Vertical	18.9	20
	20 dBm	Horizontal	7.2	20
2481 MHz	20 dBm	Vertical	18.4	20
	20 dBm	Horizontal	9.4	20
2481 MHz	0 dBm	Vertical	-4.0	0
	0 dBm	Horizontal	-7.3	0

#### Comments

The test object was transmitting a continuous RF transmission signal.

#### Photos

See Annex 2.

#### Test record sheets

See Annex 3.

## 4.2 Transmitter spurious emissions

### Results

The measured transmitter spurious emissions were within the limits.

### Test method

Specification: EN 300 328 Section 5.7.5  
 Limit: EN 300 328 Section 4.3.4.2 (when operating)  
 (the limit when in standby does not apply).

The radiated measurements were performed in a semi-anechoic chamber. For each measurement the test object was rotated 0-360°. The antenna height above the ground plane was varied to maximize the measurement.

### Measurement results

In order to demonstrate compliance with the additional requirements of EN 300 328 with respect to EN 301 444 (see Section 1) the spurious emissions were measured at the 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> harmonic of the operating frequency.

Frequency setting	Antenna polarization	Second harmonic [dBm]	Third harmonic [dBm]	Fourth harmonic [dBm]	Fifth harmonic [dBm]	Limit (operating) [dBm]
2402 MHz	Horizontal	-56.1	-52.9	-50.9	-49.1	-30
	Vertical	-55.6	-53.2	-51.2	-47.1	-30
2481 MHz	Horizontal	-56.2	-50.5	-49.3	-45.6	-30
	Vertical	-55.6	-50.1	-50.0	-44.2	-30

### Comments

The test object was transmitting a continuous RF transmission signal.  
 The power setting of the test object was 20 dBm.  
 The local oscillator frequency is 2·(operating frequency).

### Photos

See Annex 2.

### 4.3 Unwanted emission

	<b>Requirements</b>
Specification	Section 4.2.1.2.1 of ETSI EN 301 444 V1.1.1 (2000-05)
Test method	Section 5.2.2.2 of ETSI EN 301 444 V1.1.1 (2000-05)
Measuring distance	10 m
Frequency range	30 - 1000 MHz
Limit: (quasi-peak)	30 - 230 MHz: 30 dB $\mu$ V/m 230 - 1000 MHz: 37 dB $\mu$ V/m
Test record sheets	Annex 4

#### Results

The radiated electromagnetic field was within the specified limits.

#### Climatic conditions

23°C and 23% R.H.

#### Supply voltage

230 VAC.

#### Comments

None.

**Annex 1**  
**List of instruments**



<b>NO.</b>	<b>DESCRIPTION</b>	<b>MANUFACTURER</b>	<b>TYPE NO.</b>
29461	ARTIFICIAL MAINS NETWORK	ROHDE & SCHWARZ	ESH2/Z5
29797	BILOG ANTENNA, 30-2000 MHz	CHASE ELECTRICS LTD	CBL 6111A
29861	EMI-SOFTWARE Ver. 1.60	ROHDE & SCHWARZ	ES-K1, PART: 1026.6790.02
29876	RIDGED GUIDE HORN ANTENNA, 1-12.75 (18) GHz	EMCO	3115
29916	AUTOMATIC TEST RECEIVER, 9 kHz - 2.75 GHz	ROHDE & SCHWARZ	ESCS 30 1102.4500.30
49037	BROADBAND MICROWAVE PREAMPLIFIER, 1-12.8 GHz	MITEQ / DELTA	AMF-5D-001128-35- 11P
49086	REMI EMISSION SOFTWARE PACKAGE v. 2.133, ROOM 5	NeWeTec	REMI
49321	SPECTRUM ANALYZER, 50 GHz WITH OPTION 006	HEWLETT-PACKARD	8565E
49421	IMPULSE VOLTAGE LIMITER	ROHDE & SCHWARZ	ESH3/Z2

## **Annex 2**

### **Photos**

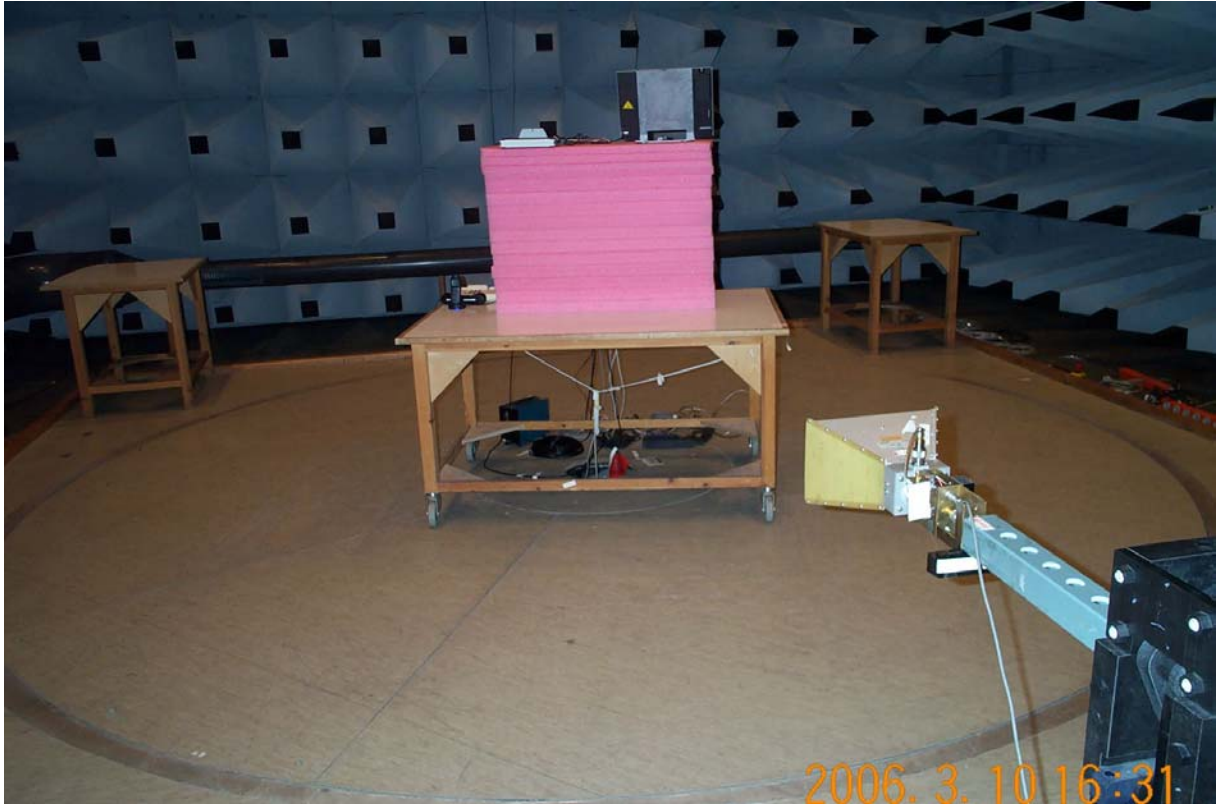


Photo A2.1 EIRP and transmitter spurious emission measurements.



Photo A2.2 EIRP and transmitter spurious emission measurements.



Photo A2.3 EIRP and transmitter spurious emission measurements.



Photo A2.4 Unwanted emission measurements.

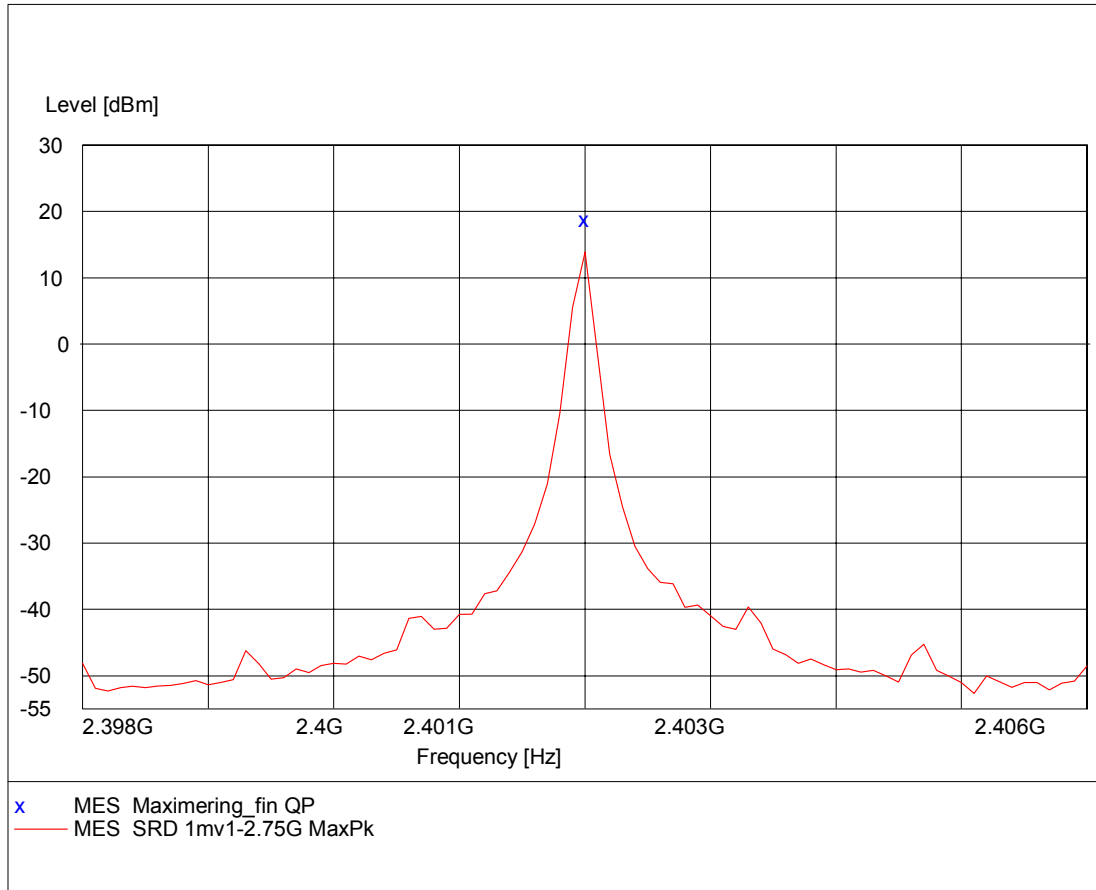


Photo A2.5 Unwanted emission measurements.

### **Annex 3**

#### **Test record sheets regarding EIRP measurements**

EUT: Explorer 700  
 Manufacturer: Thrane & Thrane  
 Operating Condition: Ant. 1,5 m vertical  
 Test Site: EMC-5  
 Operator: HEN - A503704  
 Test Specification: EN 300 328  
 Comment: Sheet 1, Tx: 2402 MHz, 20 dBm  
 Start of Test: 2006-03-10

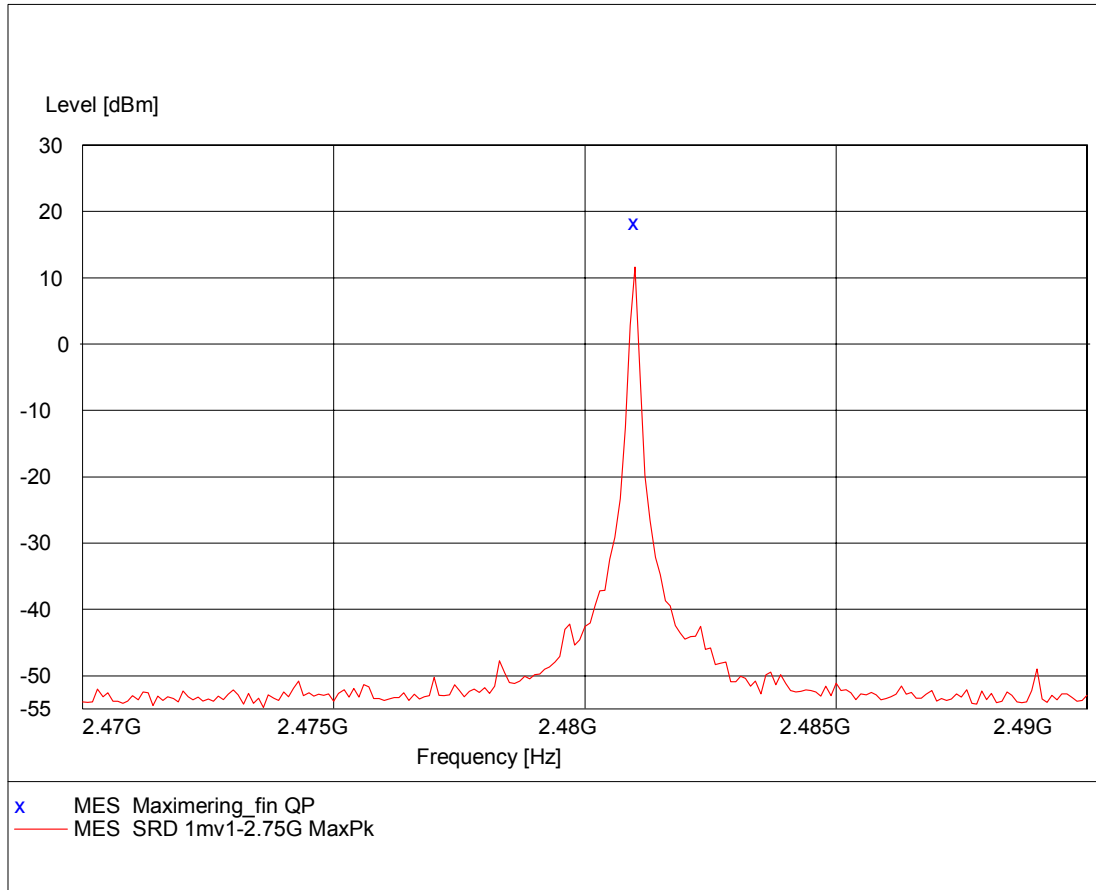


**MEASUREMENT RESULT: "Maximering\_fin QP"**

2006-03-10 10:57

Frequency MHz	Level dBm	Transd dB	Limit dBm	Margin dB	Height cm	Azimuth deg	Polarisation
2402.000000	18.90	-58.9	20.0	1.1	101.0	309.00	VERTICAL

EUT: Explorer 700. Ch 79  
 Manufacturer: Thrane & Thrane  
 Operating Condition: Ant. 1,5 m vertical  
 Test Site: EMC-5  
 Operator: HEN - A503704  
 Test Specification: EN 300 328  
 Comment: Sheet 5, Tx: 2481 MHz, 20 dBm  
 Start of Test: 2006-03-10



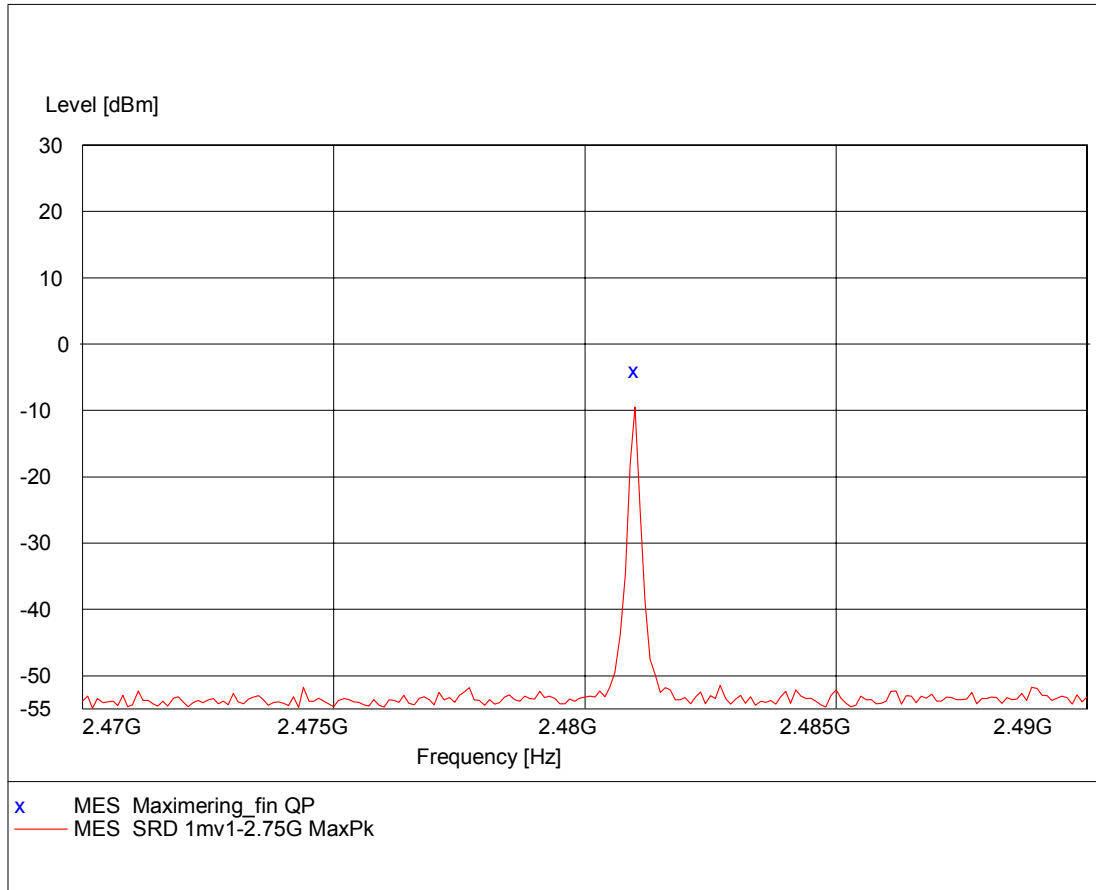
**MEASUREMENT RESULT: "Maximering\_fin QP"**

2006-03-10 11:48

Frequency MHz	Level dBm	Transd dB	Limit dBm	Margin dB	Height cm	Azimuth deg	Polarisation
2481.000000	18.40	-58.5	20.0	1.6	136.0	245.00	VERTICAL



EUT: Explorer 700. Ch 79  
 Manufacturer: Thrane & Thrane  
 Operating Condition: Ant. 1,5 m vertical  
 Test Site: EMC-5  
 Operator: HEN - A503704  
 Test Specification: EN 300 328  
 Comment: Sheet 7, Tx: 2481 MHz, 0 dBm  
 Start of Test: 2006-03-10



**MEASUREMENT RESULT: "Maximering\_fin QP"**

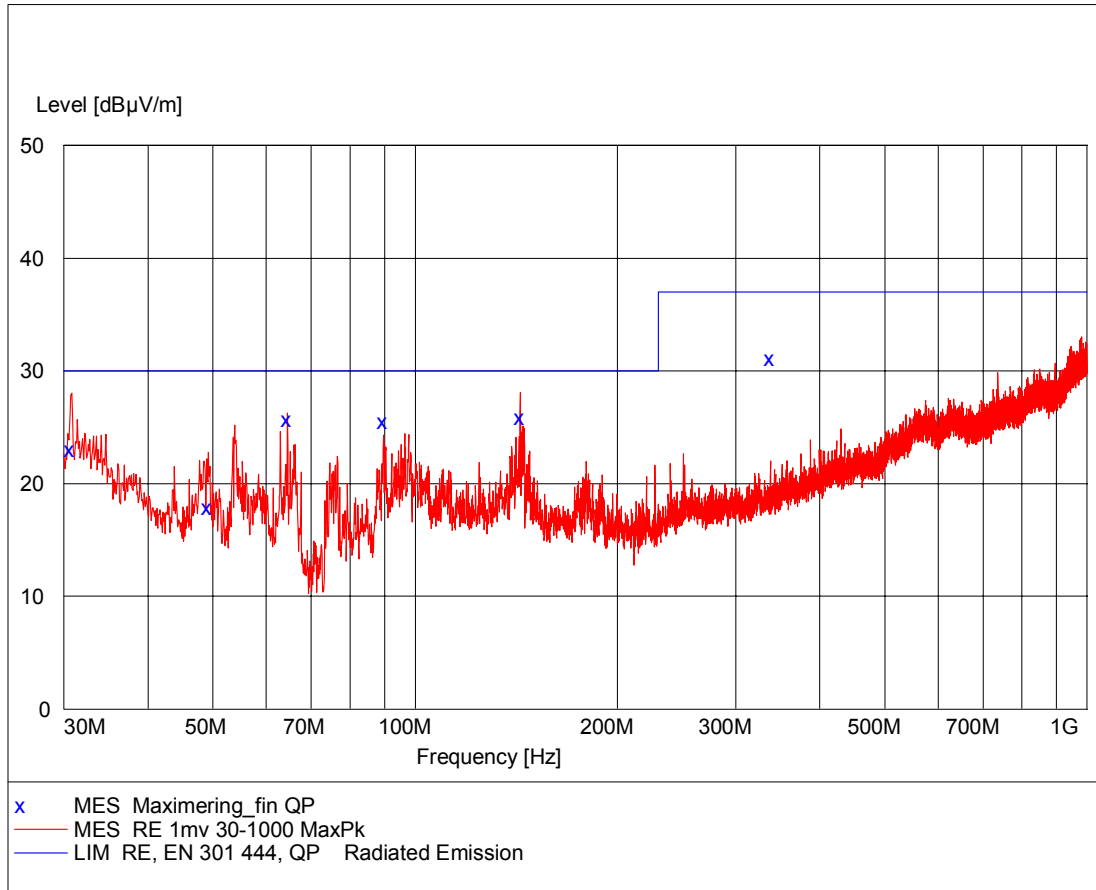
2006-03-10 12:22

Frequency MHz	Level dBm	Transd dB	Limit dBm	Margin dB	Height cm	Azimuth deg	Polarisation
2481.000000	-4.00	-58.5	0.0	4.0	101.0	312.00	VERTICAL

## **Annex 4**

### **Test record sheets regarding unwanted emission measurements**

EUT: Explorer 700.  
 Manufacturer: Thrane & Thrane  
 Operating Condition: Ant 1 m vertical  
 Test Site: EMC-5  
 Operator: CMT - A503704  
 Test Specification: EN 301 444  
 Comment: Sheet 24  
 Start of Test: 2006-04-10



**MEASUREMENT RESULT: "Maximering\_fin QP"**

2006-04-10 11:51

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
30.700000	23.10	19.1	30.0	6.9	151.0	341.00	VERTICAL
49.150000	17.90	8.9	30.0	12.1	111.0	123.00	VERTICAL
64.500000	25.70	6.5	30.0	4.3	247.0	358.00	VERTICAL
89.650000	25.50	10.4	30.0	4.5	155.0	278.00	VERTICAL
143.300000	25.90	12.6	30.0	4.1	156.0	160.00	VERTICAL
337.910000	31.10	15.8	37.0	5.9	225.0	46.00	HORIZONTAL

EUT: Explorer 700.  
Manufacturer: Thrane & Thrane  
Operating Condition: Ant 4 m horizontal  
Test Site: EMC-5  
Operator: CMT - A503704  
Test Specification: EN 301 444  
Comment: Sheet 25  
Start of Test: 2006-04-10

