



**Telecommunications & Telematics  
for Transports Lab.**

# TEST REPORT

Ref. No. ARSG00141/b

Date: 2007-06-11

Measurements performed in accordance with:



**FCC Rules: Code of Federal Regulations (CFR) no. 47 -  
PART 15 – RADIO FREQUENCY DEVICES**

PRODUCT : Active dual-layer Transponder  
 APPLICANT : ADVANCED MICROWAVE ENGINEERING S.r.l. – Via del  
 Monasteraccio, 4 - FIRENZE  
 MANUFACTURER : ADVANCED MICROWAVE ENGINEERING S.r.l. – Via del  
 Monasteraccio, 4 - FIRENZE  
 TRADEMARK : ADVANCED MICROWAVE ENGINEERING  
 TESTED MODEL : LX 1004 QDU  
 FCC ID : UKOPLX004QDU  
 RATING : DC 3 V Lithium battery type 2032  
 OTHER INFORMATION : Samples received on : 2006-08-29  
 Testing dates : 2006-08-29 ÷ 2006-09-04  
 Samples tested No. : 1  
 Testing site : IMQ S.p.A – Via Quintiliano, 43 I-20138 MILANO

Tested by : R. Radice Signature: *Roberto Radice* Date : 2007-06-11

Checked by: R. Colombo (EMC and R&TTE Lab. deputy) Signature: *Roberto Colombo* Date : 2007-06-11

## Revision Sheet

Release No.	Date	Revision Description
Rev. 0	2006-09-19	Test Results and Evaluation Report
Rev. 1	2007-02-08	Antenna requirement
Rev. 2	2007-06-11	FCC ID

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**IMQ S.p.A. - Via Quintiliano, 43 – I-20138 MILANO**

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# 1 TEST SPECIFICATIONS, METHODS & PROCEDURES

The following tests and relevant standards have been applied to the Equipment Under Test (EUT):

## 1.1 EMISSION TESTS

Product family standard	Date	Title
FCC Rules	February 1, 2006	Code of Federal Regulations (CFR) no. 47 PART 15 – RADIO FREQUENCY DEVICES

## 1.2 EQUIPMENT CLASSIFICATION

According to the definition 15.3 (o) EUT is a Class B digital device. A digital device that is marketed for use in a residential environment notwithstanding use in commercial, business and industrial environments. Examples of such devices include, but are not limited to, personal computers, calculators, and similar electronic devices that are marketed for use by the general public. Note: The responsible party may also qualify a device intended to be marketed in a commercial, business or industrial environment as a Class B device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B digital device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B digital device, regardless of its intended use so it shall fulfil provisions of **47CFR Part 15 Subpart C – Intentional radiators** – Section 15.231 and 15.209.

## 1.3 ENVIRONMENTAL CONDITIONS

TEST CONDITIONS	MEASURED
Ambient Temperature	20 ÷ 25 °C
Relative Humidity	50 ÷ 60 %
Atmospheric Pressure	900 ÷ 1000 mbar

## 2 EQUIPMENT UNDER TEST DETAILS

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### 2.1 EUT IDENTIFICATION

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<b>The EUT is composed by the following modules/parts:</b>	<ul style="list-style-type: none"><li>▪ Transmitter module 433,92 MHz</li><li>▪ Receiver module 2,45 GHz</li></ul>
<b>EUT classification</b>	<ul style="list-style-type: none"><li>▪ Intentional radiator</li></ul>
<b>EUT use / installation (fixed/vehicular use/portable use) :</b>	Portable
<b>EUT single or system:</b>	<ul style="list-style-type: none"><li>▪ Single</li></ul>
<b>EUT standing (floor-standing/Table-top-wall-mounted) :</b>	<ul style="list-style-type: none"><li>▪ ---</li></ul>
<b>Dimension of EUT (H x W x D):</b>	<ul style="list-style-type: none"><li>▪ 55 x 55 x 12 mm</li></ul>
<b>Weight of EUT:</b>	<ul style="list-style-type: none"><li>▪ ---</li></ul>

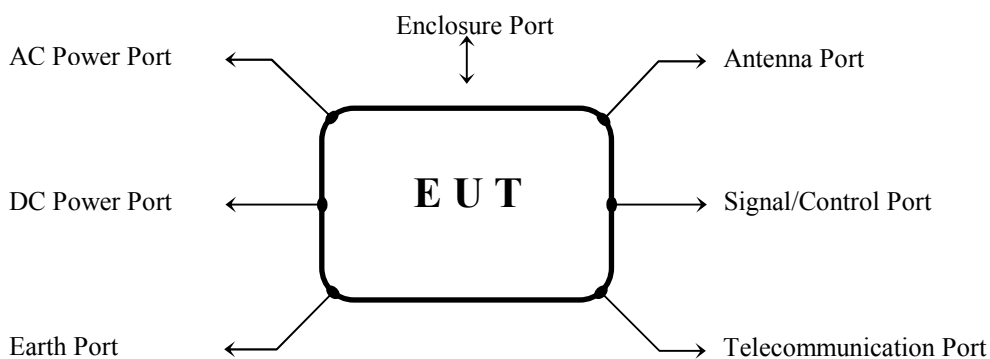
## 2.2 EUT TECHNICAL DATA

Power supply:	▪ DC 3 V lithium battery type 2032
Power specification	▪ Max 25mA (with TX in transmission)
Working frequency	▪ TX: 433.92 MHz ▪ RX: 2.45 GHz
Modulation	▪ OOK / AM
Bitrate	▪ 4800 bps
RX Sensitivity	▪ - 35dBm
Processor	▪ ---
Main Battery	▪ None
Main SW identification	▪ ----
Main HW Board identification	▪ ---
Peripherals included (for system application)	▪ None
Interfaces :	▪ ---
Integrated interfaces :	▪ None
AC adapter:	▪ ---

## 2.3 TESTED SAMPLES

SAMPLE Nr.	S/N
1	---

## 2.4 SYSTEM INTERFACE IDENTIFICATION



#	Interface	Description	Maximum length	Ref. Document
1	Enclosure	Plastic surface	----	----

## 2.5 DESCRIPTION OF SUPPORT EQUIPMENT

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Here following the details concerning equipment needed for correct operation or loading of the EUT, but not considered as part of equipment under test:

EQUIPMENT	MANUFACTURER	MODEL
None	-----	-----

### 3 GENERAL MEASUREMENT CONDITIONS

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Unless special conditions specified in the present test report, EUT configuration and general measurement conditions used are based on requirements of ANSI C63.4-2003 and CISPR Pub. 22:1997.

#### 3.1 OPERATION OF THE EQUIPMENT (EUT)

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The operational condition of the EUT was determined by the manufacturer according to the typical use of the EUT with respect to the expected highest level of emission.

These operational modes are described in the following table:

Ref.	Description
#1	Transmitter in continuous transmission. Receiver active.



### 3.2 EUT PERFORMANCE ASSESSMENT

As declared by manufacturer the following settings have been adopted:

PRIMARY FUNCTIONS	REPRESENTATIVE PARAMETER	TEST INSTRUMENTATION	ACCEPTABLE LEVEL OF PERFORMANCE
Data transmission	Radio data transmission	---	Radio data received by radio receiver

The test instrumentation used for monitoring the parameters has the following identification:

TEST INSTRUMENTS	MANUFACTURER	MODEL	SERIAL NUMBER
---	---	---	---
---	---	---	---

## 4 SUMMARY OF TEST RESULTS

### 4.1 Emission tests

CFR47 Part 15 Subpart C Section:	Title	Port	Operating condition	Result	Test details
15.203 / 15.204	Antenna requirement	Antenna	---	Complies	1
15.207	Conducted emission	AC power supply	---	Not applicable <sup>1</sup>	---
15.209	Radiated emission	Enclosure	#1	Complies	3
15.231a)	Deactivation of transmitter	-----	---	Complies	2
15.231b)	Radiated emission	Enclosure	#1	Complies	3
15.231c)	Bandwidth of emission	Enclosure	#1	Complies	4
15.231d)	Bandwidth of emission in band 40.66÷40.70 MHz	Enclosure	---	Not applicable	---
15.231e)	Radiated emission	Enclosure	---	Not applicable	---

<sup>1</sup> Port not present

## 5 EMC TEST DATA

TEST No. 1	Title "Antenna Requirements"	47CFR Part 15 Ref. Section
<b>TEST REQUIREMENTS</b>	<p>An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.</p>	<b>15.203</b>

Antenna specifications	
N° of authorized antenna types :	<ul style="list-style-type: none"> <li>▪ 1</li> </ul>
Antenna type :	<ul style="list-style-type: none"> <li>▪ Integral antenna</li> </ul>
Total gain :	<ul style="list-style-type: none"> <li>▪ &lt; 6 dBi</li> </ul>
External R.F. power amplifier:	<ul style="list-style-type: none"> <li>▪ Not present</li> </ul>

### Test Result:

The transmitter meets the requirements of section 15.203 and 15.204

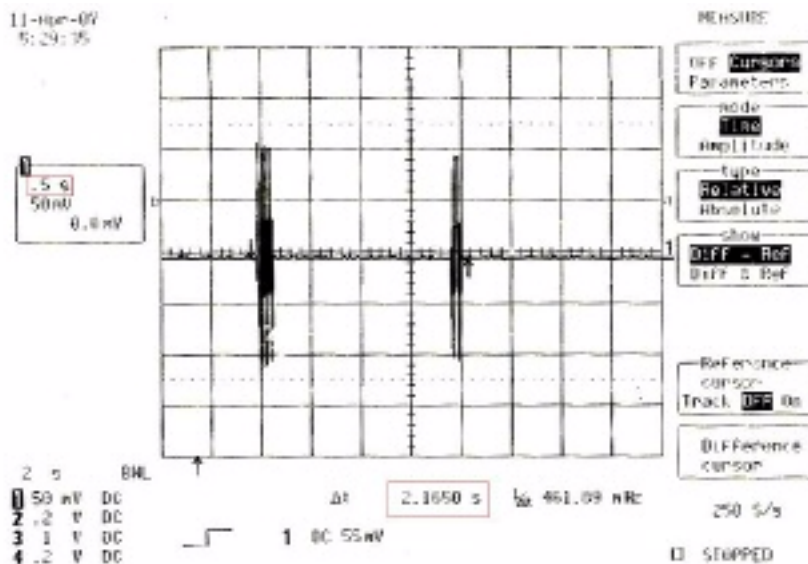
TEST No. 2	Title "Deactivation of transmitter"	47CFR Part 15 Ref. Section <b>15.231 a)</b>
<b>TEST REQUIREMENTS</b>	<p>The provisions of this Section are restricted to periodic operation within the band 40.66 -MHz and above 70 MHz. Except as shown in paragraph (e) of this Section, the intentional radiator restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:</p> <p>(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.</p> <p>(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.</p> <p>(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.</p> <p>(4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.</p> <p>(5) Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmission are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.</p>	

Requirement	Description
15.231 a) 1	No manually transmission
15.231 a) 2	The EUT when receive a code from the activator, automatically active and deactivate the transmitter within not more than 5 seconds (for more detail see section 5.8 of the LNX manual and plot No.1)
15.231 a) 3	No Periodic transmissions
15.231 a) 4	During emergencies the EUT operate during the pendency of the alarm condition
15.231 a) 5	Not applicable

**Test Result:**

The transmitter meets the requirements of section 15.231 a)

**PLOT No. 1: Maximum Transmission Time**



TEST No. 3	Title "Radiated disturbances"		47CFR Part 15 Ref. Section
<b>TEST REQUIREMENTS</b>	TEST SETUP	CISPR Pub. 22 :1997	
	TEST FACILITY	Anechoic chamber	
	TEST DISTANCE	3 m	
	LIMITS FOR RADIATED DISTURBANCES	47CFR Part 15 Ref. Section: 15.231b)	
	FREQUENCY RANGE	30 – 1000 MHz 1000 MHz – tenth harmonics	
	DETECTOR	PEAK/QUASI-PEAK (30 – 1000 MHz) PEAK/AVERAGE (1000 MHz – tenth harmonics)	
	IF BANDWIDTH	120 KHz (30 – 1000 MHz) 1 MHz (1000 MHz – tenth harmonics)	

TEST DATA	PORT UNDER TEST	OPERATING CONDITION	RESULT	NOTES
	Enclosure	#1	Complies	---

**LIMITS FOR FUNDAMENTAL**

Frequency (MHz)	Quasi-Peak Limit (dB $\mu$ V/m)	Quasi-Peak Limit ( $\mu$ V/m)
433,92	80,82	10.996,68

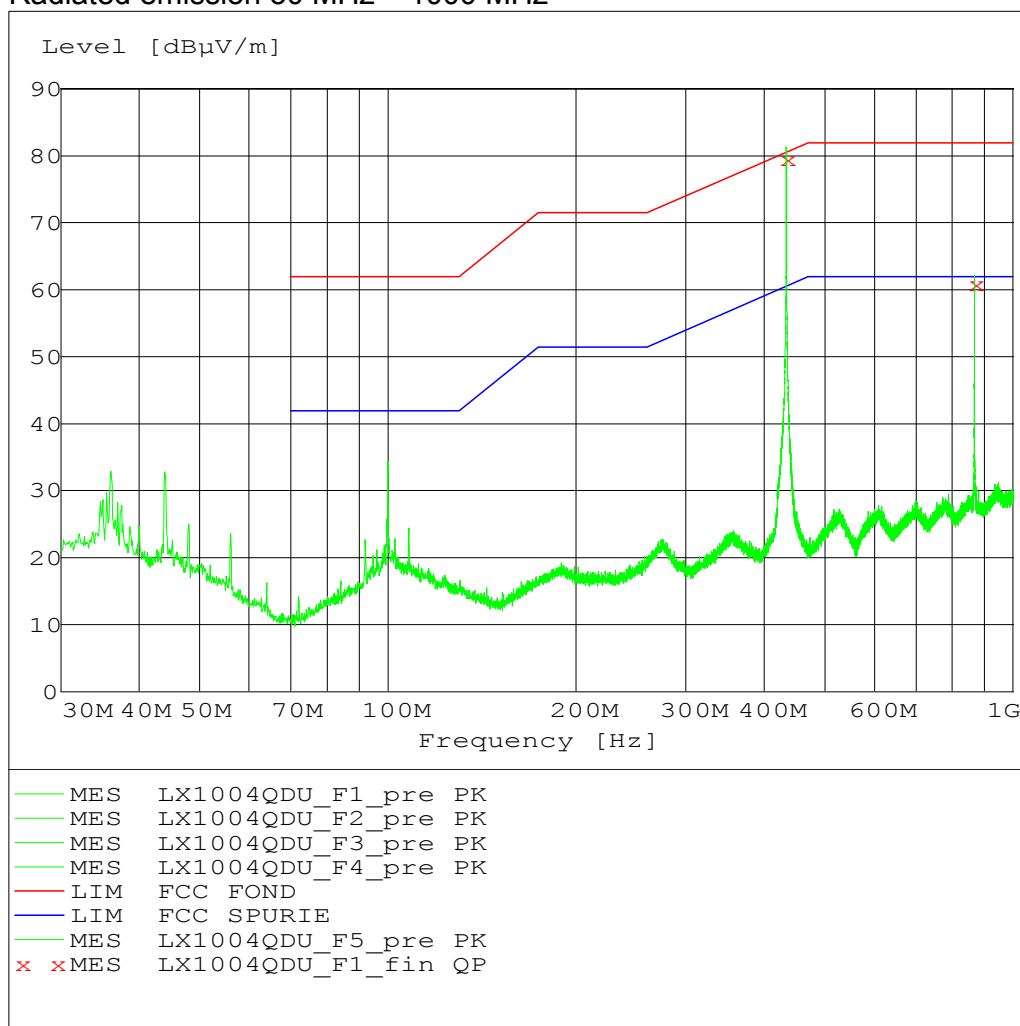
**LIMITS FOR SPURIOUS**

Band of operations	Peak (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)
Restricted bands	74,00	54,00
Other bands	According to 15.231 (b)	According to 15.231 (b)

**MEASUREMENTS RESULTS**

**RADIATED DISTURBANCE AT ENCLOSURE PORT**

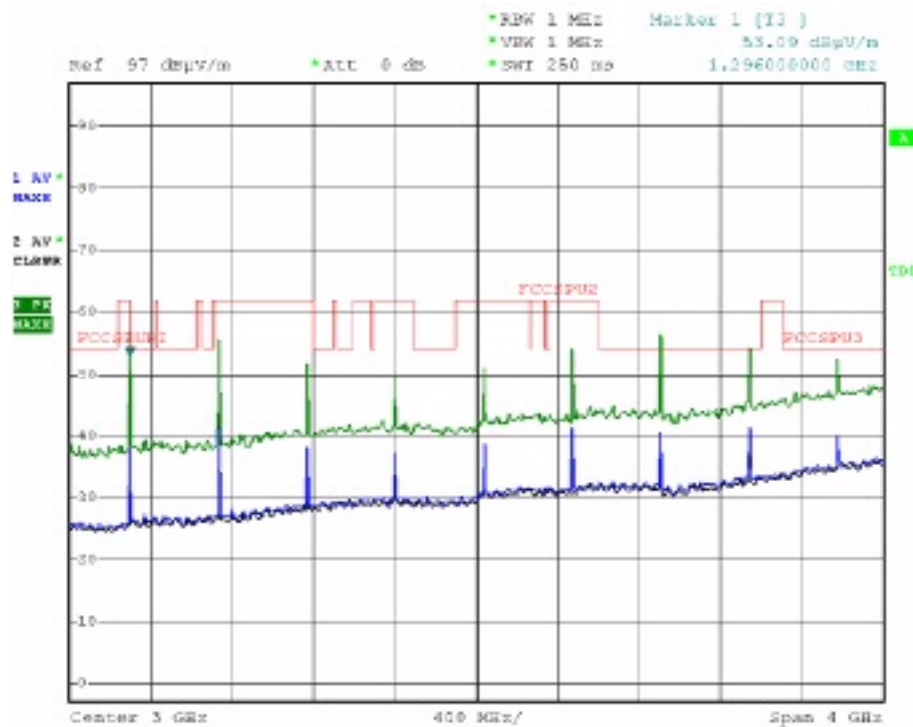
Radiated emission 30 MHz – 1000 MHz



**QUASI-PEAK RESULT**

Frequency (MHz)	Measured Level (dBµV/m)	Limit (µVolt/meter)	Limit (dBµV/m)	Margin (dB)	Pol.
433,98	79,50	10996,68	80,82	1,00	Vertical
867,90	60,80	1250	60,82	1,10	Vertical

Radiated emission 1000 MHz – 5000 MHz (Vertical Polarization)





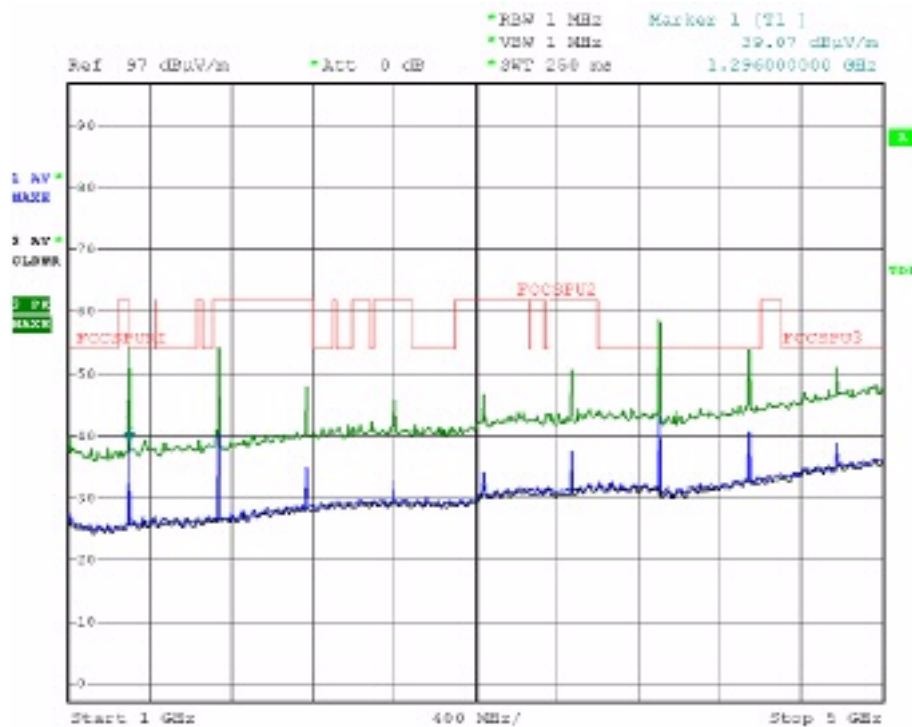
**PEAK RESULT**

Frequency (MHz)	Measured Level (dB $\mu$ V/m)	Limit ( $\mu$ Volt/meter)	Limit (dB $\mu$ V/m)	Margin (dB)
1296,00	53,09	12500	80,82	28,91
1735,60	55,31	12500	80,82	26,69
2169,64	51,76	12500	80,82	30,24
2603,54	50,23	12500	80,82	31,77
3037,57	51,01	12500	80,82	30,99
3471,46	54,18	12500	80,82	27,82
3905,38	56,39	5000	74,00	17,61
4339,47	54,39	5000	74,00	19,61
4776,15	52,45	5000	74,00	21,55

**AVERAGE RESULT**

Frequency (MHz)	Measured Level (dB $\mu$ V/m)	Limit ( $\mu$ Volt/meter)	Limit (dB $\mu$ V/m)	Margin (dB)
1296,00	41,03	1250	60,82	20,97
1735,60	44,41	1250	60,82	17,59
2169,64	41,17	1250	60,82	20,83
2603,54	40,34	1250	60,82	21,66
3037,57	41,57	1250	60,82	20,43
3471,46	44,17	1250	60,82	17,83
3905,38	43,46	500	54,00	10,54
4339,47	44,18	500	54,00	9,82
4776,15	42,91	500	54,00	11,09

Radiated emission 1000 MHz – 5000 MHz (Horizontal Polarization)



**PEAK RESULT**

Frequency (MHz)	Measured Level (dB $\mu$ V/m)	Limit ( $\mu$ Volt/meter)	Limit (dB $\mu$ V/m)	Margin (dB)
1296,00	53,49	5000	80,82	28,51
1735,60	53,69	5000	80,82	28,31
2169,64	47,37	5000	80,82	34,63
2603,54	44,61	5000	80,82	37,39
3037,57	45,95	5000	80,82	36,05
3471,46	50,15	5000	80,82	31,85
3905,38	58,51	5000	74,00	15,49
4339,47	53,15	5000	74,00	20,85
4776,15	50,47	5000	74,00	23,53

**AVERAGE RESULT**

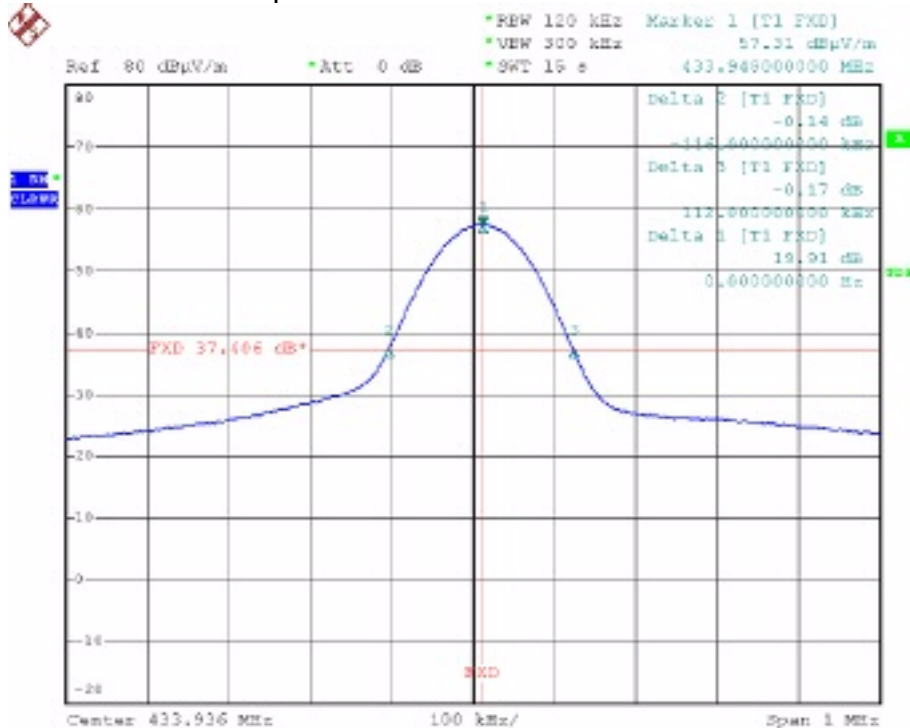
Frequency (MHz)	Measured Level (dB $\mu$ V/m)	Limit ( $\mu$ Volt/meter)	Limit (dB $\mu$ V/m)	Margin (dB)
1296,00	42,06	944	60,82	19,94
1735,60	43,44	944	60,82	18,56
2169,64	37,79	944	60,82	24,21
2603,54	35,90	944	60,82	26,10
3037,57	37,14	944	60,82	24,86
3471,46	40,56	944	60,82	21,44
3905,38	46,37	500	54,00	7,63
4339,47	43,70	500	54,00	10,30
4776,15	41,74	500	54,00	12,26

TEST No. 4	Title		47CFR Part 15 Ref. Section
	"Radiated disturbances and Bandwidth in periodic transmission"		15.231 c)
TEST REQUIREMENTS	TEST SETUP	CISPR Pub. 22 :1997	
	TEST FACILITY	Anechoic chamber	
	TEST DISTANCE	3 m	
	LIMITS FOR BANDWIDTH WIDER	47CFR Part 15 Ref. Section: 15.231 (c)	
	FREQUENCY RANGE	Fundamental frequency	
	DETECTOR FOR BANDWIDTH WIDER	PEAK	
	IF BANDWIDTH	120 KHz	
	NOTES: /		

TEST DATA	PORT UNDER TEST	OPERATING CONDITION	RESULT	NOTES
	Enclosure	#1	Complies	---

**MEASUREMENTS RESULTS**

Bandwidth wider in periodic transmission



Date: 4.SEP.2006 16:55:21

Frequency	Bandwidth at -20dB point	Limit (0,25% of 433,92 MHz)	Margin
MHz	kHz	kHz	kHz
433,92	228	1084	856

## 6 ADDITIONAL TECHNICAL INFORMATION

### 6.1 Electromagnetically relevant components:

Components	N°	Manufacturer	Type – Technical data
Transmitter	1	Advanced Microwave Engineering	LX 1004 QDU

### 6.2 RFI suppression devices:

Components	N°	Manufacturer	Type – Technical data
None			

### 6.3 EMI protection devices:

Components	N°	Manufacturer	Type – Technical data
None			

## 7 TECHNICAL DOCUMENTATION

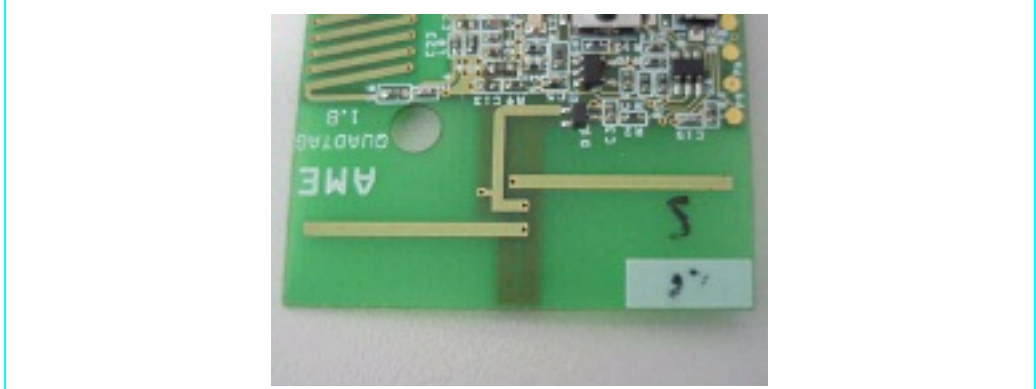
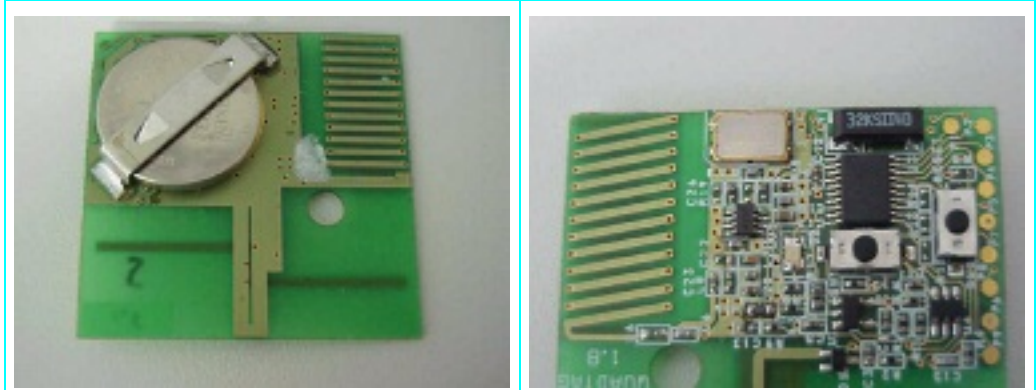
DOCUMENT	REFERENCE
LX 1004 – General technical specifications – Revision 1.2	Date: 30/05/2005

## 8 PHOTOGRAPHIC DOCUMENTATION

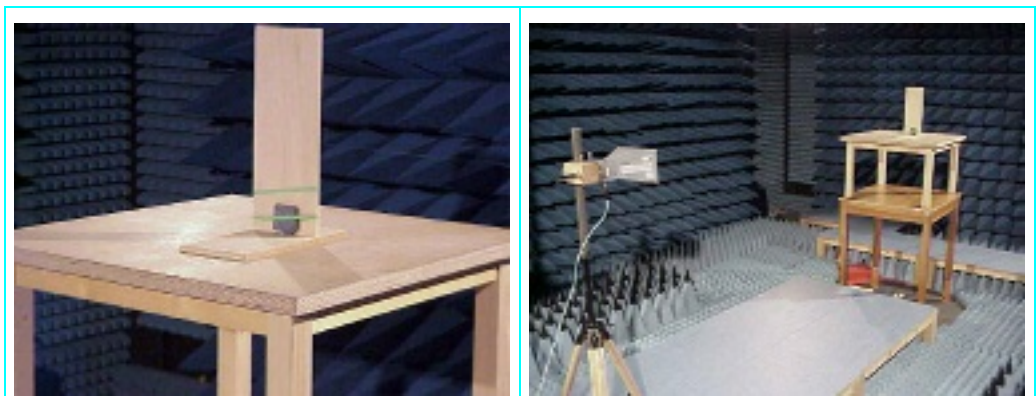
### 8.1 EUT IDENTIFICATION



Equipment under test identification



Internal view



Set up for Radiated emission test



## 9 MEASUREMENT AND TEST EQUIPMENT

INSTRUMENTS	MANUFACTURER	MODEL	IMQ s/n
EMI receiver	Rohde & Schwarz	ESVS10	S-04197
Spectrum analyzer	Rohde & Schwarz	FSP40	S-02350
Pre-amplifier	HP	HP 8439 B	S-03542
Log-periodic antenna	ARA	LPE-2520/1	S-03511
Ridged horn antenna	Schwarzbeck	BBHA9120D	S-03464
Shielded anechoic chamber	SIDT EUROPE	/	P-02386
PC and SW for test automation	/	/	/