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1. TECHNICAL INFORMATION OF EQUIPMENT UNDER TEST (EUT)

1.1 Identification

Brand name:	AUTEC
Equipment :	MK12 handheld unit (12 keys)
Model name or No. :	Type TC02 Model B04D
Serial number :	prototype
FCC ID :	OQA-TC02B04D
Country of manufacturer:	ITALY

1.2 Technical data

FCC class:	Intentional Radiators
TX module type :	E16STXUS1
Supply voltage:	Custom NiMH Battery pack 7,2 Vdc 750mAh model MBM06MH
Typical usage :	Portable radio remote control used to command Industrial machines
EUT single or system:	Single
EUT dimensions :	270 x 95 x 50 mm

1.3 Transmitter technical data

TRANSMITTER

- Working Frequency : 902,150 – 927,725 MHz
separated in 32 programmable radio channel
- Frequency Range of Operation : 902 – 928 MHz
- Antenna type : Integrated

1.4 Modifications incorporated in E.U.T.

The following items are the modifications introduced in the equipment under test :

- None

1.5 Ports identification

This section contains descriptions of all signal ports and AC/DC power input/output ports, the length and the type of the cable provided by manufacturer needed for the tests.

Moreover it is specified if the ports are ever or optionally connected.

Port		Description	Connection
1	Enclosure	Plastic surface	By screws
2	AC power input/output ports	Line not present	*****
3	DC power input/output ports	Customer battery pack NiMH 7,2V 750mAh	Internal Battery support
4	Signals ports	Line not present	*****

Note: During the tests all cables must be what provided the manufacturer or the same that used in the real employment of the EUT.

1.6 Auxiliary equipment

No auxiliary equipment

2. TEST CONDITIONS

2.1 Operating test modes and test conditions

The equipment has been tested according to the operative conditions described in the user/installation manual provided by the manufacturer and by following reference standards :

Reference Standard:

FCC Part 15, Subpart C, Section 15.231 and 15.249

In the following table there are the operating conditions adopted during tests identified by an indicator (#..) at which has been referred the item “Operating condition of the equipment under test” of all technical sheets of the tests (see Section 4)

Operating condition	Description
#1	Continuous transmission

2.2 Test overview

Sample tested is the main model of a complete set of 915 MHz RF transmitters.

The appliance is classified as “*intentional radiator*” in conformity to FCC Part 15 Sub. A §15.201, and it is subject to “*Certification*” procedure.

The application is mainly used as Industrial machines radio remote control; the RF signal when the apparatus is switch-on is continuously present.

It is possible to declare that the appliance it is subject to additional requirements stated in §15.249

3. REFERENCE STANDARD FOR PERFORMED TESTS

<i>Reference standard :</i>	<i>Title :</i>
FCC Part 15 part A	Code of Regulations Part 15 (Radio Frequency Devices), Subpart A (General) of the Federal Communication Commission (FCC)
FCC Part 15 part C	Code of Regulations Part 15 (Radio Frequency Devices), Subpart C (Intentional Radiators) of the Federal Communication Commission (FCC)
ANSI C63.4	American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz – 40 GHz

4. SUMMARY OF TEST RESULTS

4.1 Tests

Port		Phenomena	Operating condition ¹	Result
1	Enclosure	Radiated emission	#1	Within the limit
		Frequency stability	Not applicable	
2	AC mains Input ports	RF Disturbance voltage: • continuous	Not applicable ²	
		Bandwidth of emission	Not applicable ²	
3	DC Power supply and Battery	Bandwidth of emission	#1	Within the limit

¹ Ref. Tab. of Section 2

² Not applicable: port not present in acc. To §15.207 (d)

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4.2 Emission limits

Acc. to §15.249 for intentional radiator operated within the frequency band 902-928 MHz

Frequency (MHz)	Field Strength of fundamental at a distance of 3m ($\mu\text{V/m}$)	Field Strength of spurious emission at a distance of 3m ($\mu\text{V/m}$)
902 – 928	50	500

According to §15.209 all the other emission of the appliance shall not exceed the following levels:

Frequency (MHz)	Field Strength at a distance of 3m ($\mu\text{V/m}$)
30 - 88	100 **
88 – 216	150 **
216 – 960	200 **
Above 960	500

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 MHz, 76–88 MHz, 174–216 MHz or 470–806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.

5. TEST RESULTS

TX – RADIATED FIELD 30 - 1000 MHZ	11
TX – SPURIOUS EMISSION 1 - 10 GHZ	16

**TEST
1.**

TX – RADIATED FIELD 30 - 1000 MHZ

**REFERENCE
DOCUMENT**

FCC PART 15 subpart C

- **TEST LOCATION:** Semi-anechoic chamber (3 meters)
- **TEST EQUIPMENT USED FOR TEST:** EMI receiver Rohde & Schwarz Mod. ESMI
Chase Antenna Mod. CBL 6111 A
- **TESTED PORT:** Enclosure
- **EMISSION LIMITS:** Acc. to Section 15.209 + 15.249
of reference document
- **UNCERTAINTY OF MEASURE:** Combined uncertainty = ± 1.75 dB
Total uncertainty = $(k=2) \pm 3.5$ dB

TEST CONDITIONS:	MEASURED
Ambient temperature : 15 - 35 °C	24 \pm 3 °C
Ambient humidity : 25 - 75 %rH	40 \pm 5 %rH
Pressure : 85 - 106 kPa (860 mbar - 1060 mbar)	950 \pm 50 mbar
Voltage : customer battery pack	7,2 Vdc

OPERATING CONDITION (Rif. Section. 2) : #1

RESULT: WITHIN THE LIMIT

SCAN TABLE : “Radiated Emission”

Unit: dB μ V/m

Detector : Mode:

Curve1: Max Peak ClearWrite

Curve2: Avg ClearWrite

Subrange:

Start Frequency:	30.0 MHz	Step Size:	80 kHz
Stop Frequency:	1000.0 MHz	IF Bandwidth:	120 kHz
Measure Time:	10 ms		

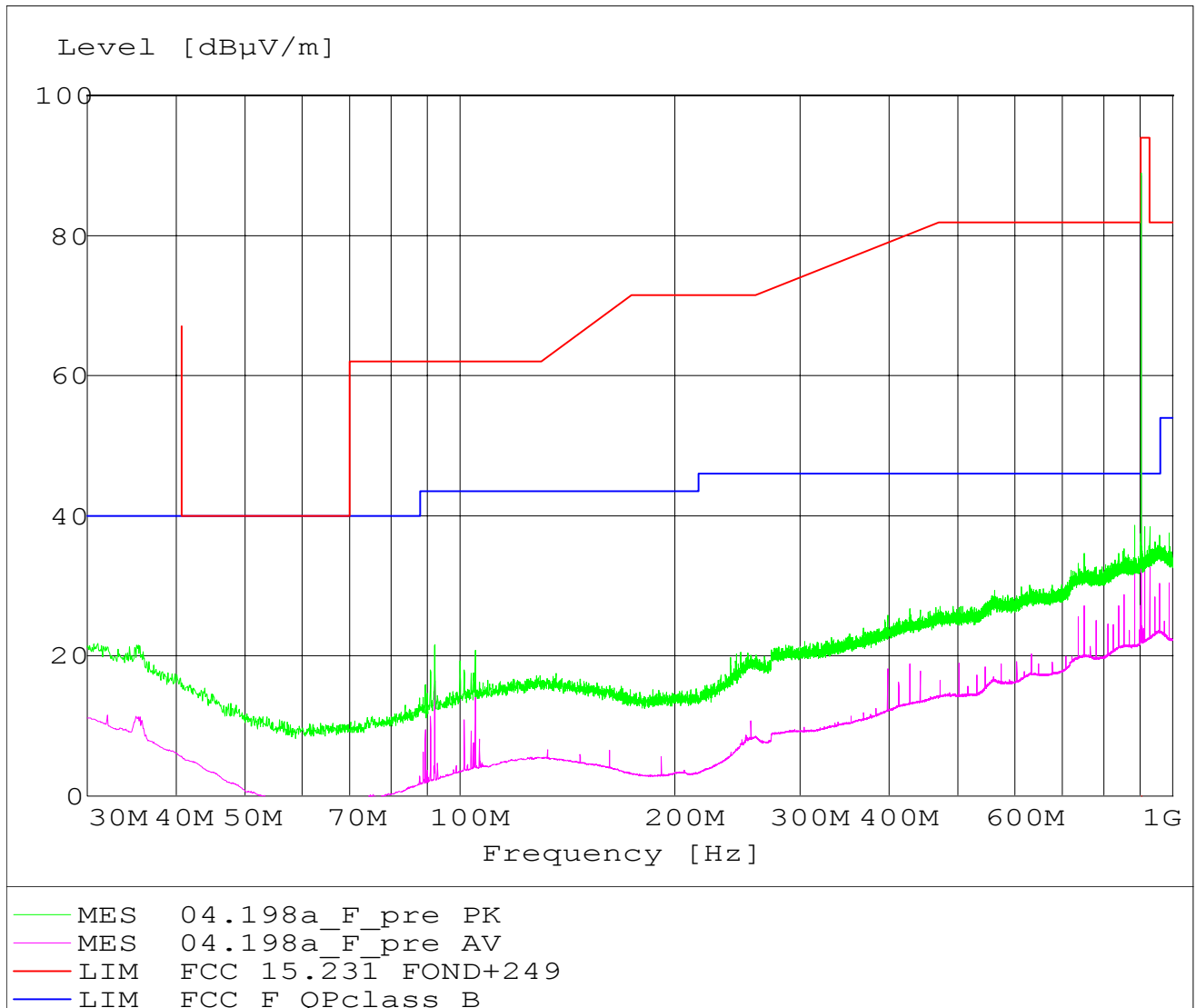
Receiver:	ESXI	Probe Transducer:	CHASE_6111_PRC
Signal Path:	Path 4	System Transducer:	RFin2-CP1/X11
Scan Mode:	Lin	Add. Transducer:	W71.01
Tracking Gen.:	Off		
Input:	2 DC		

Preamplifier:	10 dB	Demodulation:	FM Broad
RF att.:	Coupled	Volume:	0.0%
Ref. Level:	-50 dBm	Squelch:	--
Min. RF att.:	0 dBm	Option:	None
Autorange:	On		

Curve 1:	On	Repetition:	Single
Curve 2:	On	Stop Mark:	On
		Stop Message:	On
		Text:	Connect antenna



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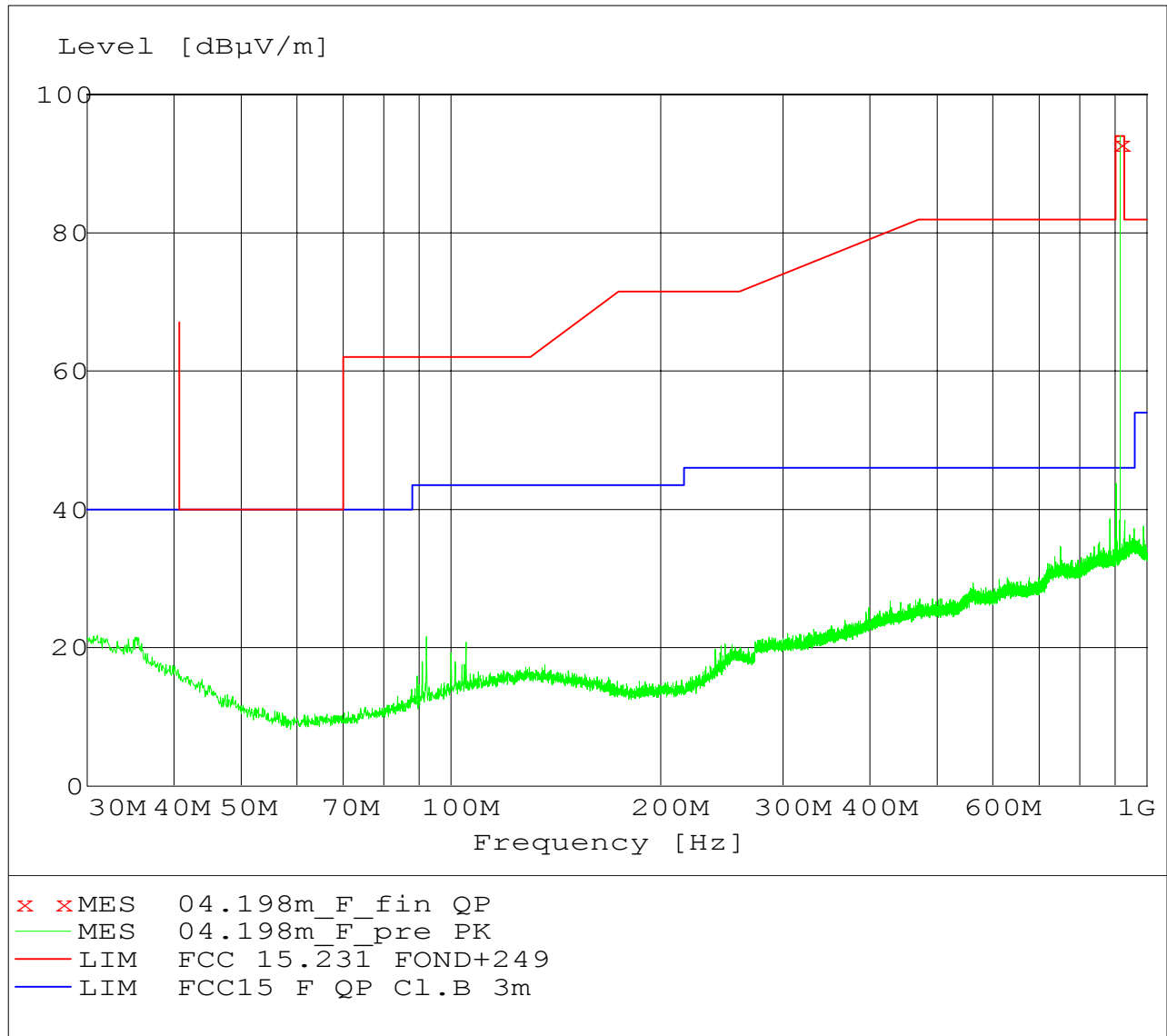


Result of the bottom frequency

Frequency	Remark	Limits	Measured QP level	Measured level - Antenna Polarisation
MHz		dBµV/m	dBµV/m	
902.158	Fundamental	93.98	92.50	HORIZONTAL



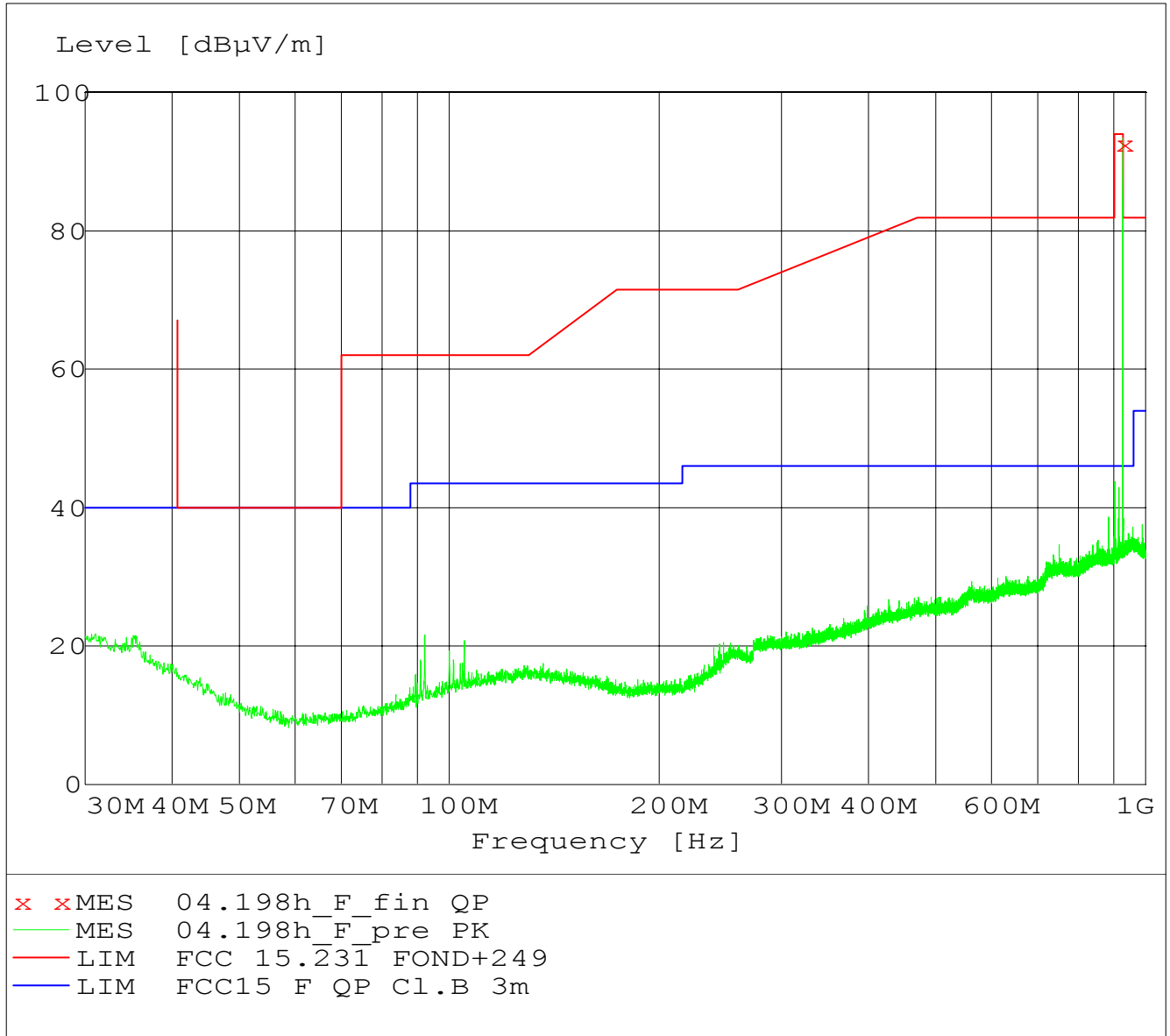
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Result of the center frequency

Frequency	Remark	Limits	Measured QP level	Measured level - Antenna Polarisation
MHz		dBµV/m	dBµV/m	
915.1200	Fundamental	93.98	92.80	HORIZONTAL

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Result of the top frequency

Frequency	Remark	Limits	Measured QP level	Measured level - Antenna Polarisation
MHz		dBµV/m	dBµV/m	
927.1200	Fundamental	93.98	93.43	HORIZONTAL

**TEST
2.**

TX – SPURIOUS EMISSION 1 - 10 GHz

**REFERENCE
DOCUMENT**

FCC PART 15 subpart C

- **TEST LOCATION:** Semi-anechoic chamber (3 meters)
- **TEST EQUIPMENT USED FOR TEST:** Spectrum Analyzer Rohde & Schwarz Mod. FSP (9kHz-40GHz)
Log-periodica Broadband Antenna mod. HL025
- **TESTED PORT:** Enclosure
- **EMISSION LIMITS:** Acc. to Section 15.209 of reference document
- **FREQUENCY BAND :** Fundamental Frequency to 10th harmonics acc. to §15.33 (a)
- **UNCERTAINTY OF MEASURE:** Combined uncertainty = ± 1.75 dB
Total uncertainty = $(k=2) \pm 3.5$ dB

TEST CONDITIONS:	MEASURED
Ambient temperature : 15 - 35 °C	24 \pm 3 °C
Ambient humidity : 25 - 75 %rH	40 \pm 5 %rH
Pressure : 85 - 106 kPa (860 mbar - 1060 mbar)	950 \pm 50 mbar
Voltage : customer battery pack	7,2 Vdc

OPERATING CONDITION (Rif. Section. 2) : #1

RESULT: WITHIN THE LIMIT

SCAN TABLE : “Radiated Emission”

Unit: dB μ V/m

Detector : Mode:

Curve1: Max Peak ClearWrite

Curve2: -- ClearWrite

Subrange:

Start Frequency: 1000.0 MHz

Step Size: 600 kHz

Stop Frequency: 10000.0 MHz

Probe Transducer: HL025

Measure Time: 100 ms

IF Bandwidth: 1 MHz

Receiver: FSP

Signal Path: Path 4

System Transducer: RFin2-CP1/X11

Scan Mode: Lin

Add. Transducer: W71.01

Tracking Gen.: Off

Input: 1

Preamplifier: 0 dB

Demodulation: FM Broad

RF att.: Coupled

Volume: 0.0%

Ref. Level: -50 dBm

Squelch: --

Min. RF att.: 0 dBm

Option: None

Autorange: On

Curve 1: On

Repetition: Single

Curve 2: Off

Stop Mark: On

Stop Message: On

Text: Connect antenna

Limit in acc. to provisions of §15.249 for frequencies between 902-928 MHz related to field strength of spurious emissions.

In addition to the limits over mentioned, in according to Section 15.205 for restricted bands, the limit applied is 54 dB μ V/m

Measurement results

<i>Frequency</i> [MHz]	<i>Remark</i>	<i>AV Level</i> [dB μ V/m]	<i>+PK level</i> [dB μ V/m]	<i>AV Limit</i> [dB μ V/m]
1807,616	Spurious	50,01	52,03	54,00
2711,559	Spurious	37,70	39,71	54,00
3615,304	Spurious	35,98	38,00	54,00
4519,233	Spurious	46,63	48,70	54,00
5422,848	Spurious	more than 20dB below limit	more than 20dB below limit	54,00
6326,656	Spurious	more than 20dB below limit	more than 20dB below limit	61,94
7230,464	Spurious	more than 20dB below limit	more than 20dB below limit	61,94
7400 < f < 10000	Spurious	more than 20dB below limit	more than 20dB below limit	54,00

**TEST
3.**

TX – RANGE OF MODULATION BANDWIDTH

**REFERENCE
DOCUMENT**

FCC PART 15 subpart C

- **TEST LOCATION:** Semi-anechoic chamber (3 meters)
- **TEST EQUIPMENT USED FOR TEST:** Spectrum Analyzer Rohde & Schwarz Mod. FSP (9kHz-40GHz)
Log-periodica Broadband Antenna mod. HL025
- **TESTED PORT:** AC Mains, DC Port and Battery
- **EMISSION LIMITS:** Acc. to Section 15.215 c) of reference document

TEST CONDITIONS:	MEASURED
Ambient temperature : 15 - 35 °C	24 ± 3 °C
Ambient humidity : 25 - 75 %rH	40 ± 5 %rH
Pressure : 85 - 106 kPa (860 mbar - 1060 mbar)	950 ± 50 mbar
Voltage :	2,4 Vdc

OPERATING CONDITION (Rif. Section. 2) : #1

RESULT: WITHIN THE LIMIT

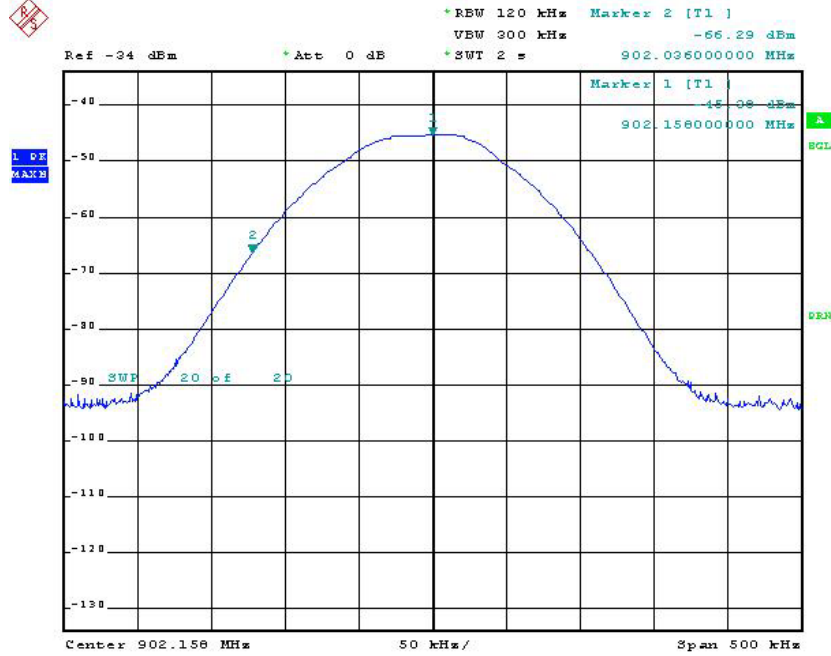
MEASUREMENT RESULTS

TEST CONDITIONS		Occupied frequency range (at 20 dB point)		
		f_L [MHz]	F_C [MHz]	f_H [MHz]
T _{amb} : + 24 °C	V _{nom} : 2,4 Vdc	902.036	----	927.840
Incertezza di misura / Measurement Uncertainty : ± 0.1 kHz				
Legenda / Abbreviations : f_L : Lowest frequency at 20dB point F_C : Central frequency f_H : Highest frequency at 20dB point				

LIMITS
Permitted operating frequency range
902 – 928 MHz

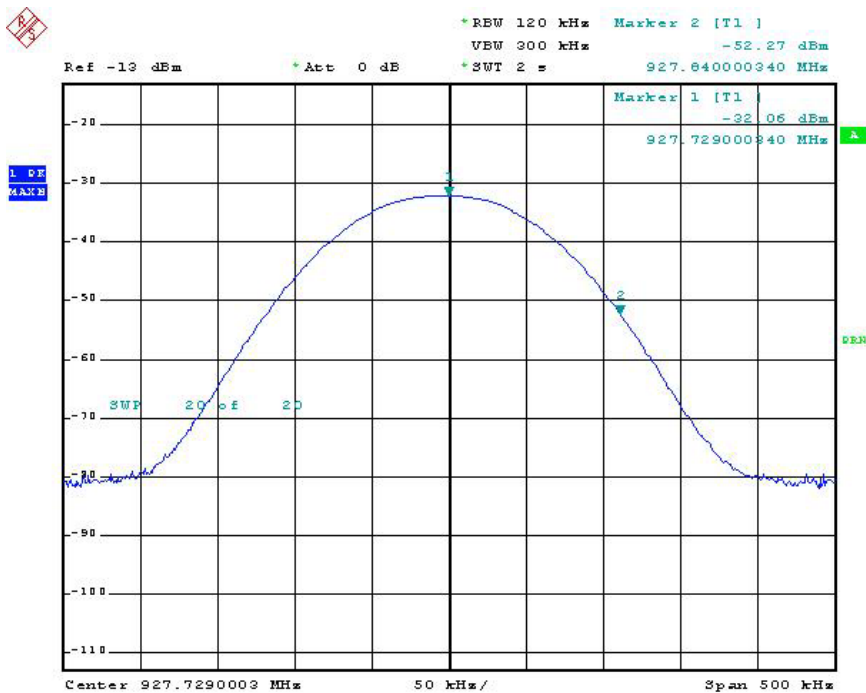
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Diagram for bottom frequency



Date: 28.JUL.2004 18:57:18

Diagram for top frequency



Date: 29.JUL.2004 09:25:43

6. EUT TECHNICAL DOCUMENTATION

6.1 Wiring diagrams

	<i>Document reference (n., edition, date, ...)</i>
WIRING DIAGRAM	<p>Doc. No. SC000237.dsn File name : keyboard MK12 E16STI122-Z.0 Issue date: 2003-06-11 Rev. 0 Sheet no. 1</p> <p>Doc. No. SC000259.dsn File name : E16STXUS1 E16S transmitter module Issue date: 2003-06-22 Rev. 0 Sheet no. 4</p> <p>Doc. No. SC000222.dsn File name : Address key for E16/E16S Issue date: 2004-03-01 Rev. 1 Sheet no. 1</p>
PART LIST	<p>Ref. file : TC02B04D_bill.pdf Issue date: 2004-06-29 Sheet no. 1</p>

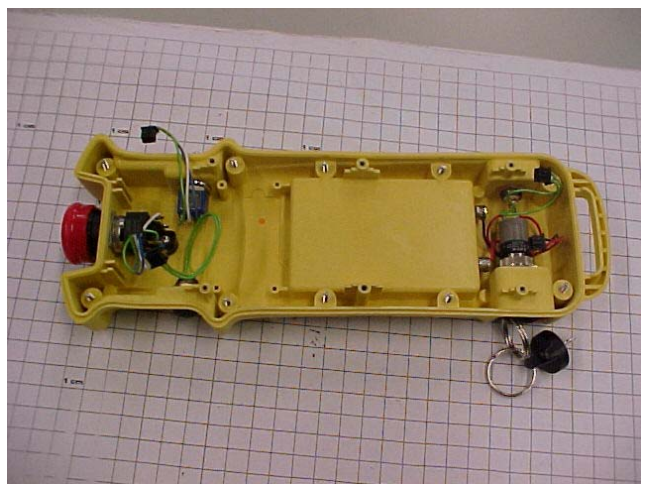
6.2 Technical manual

	<i>Document reference (n., edition, date, ...)</i>
Transmitter system User's Manual	<p>LIMKNPA0.pdf sheet no. 20</p>

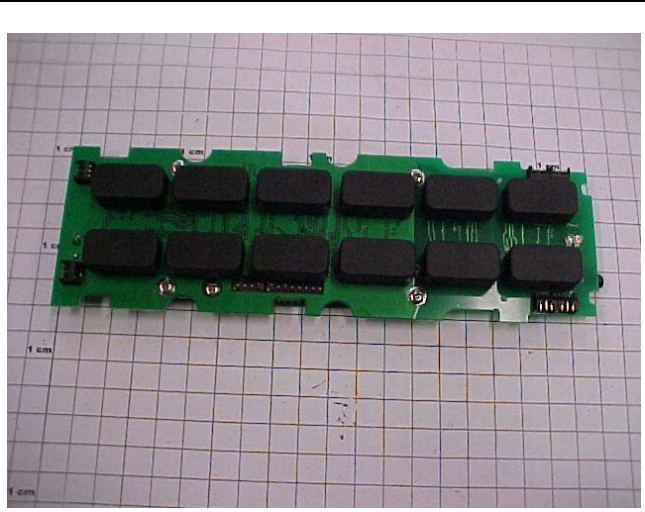
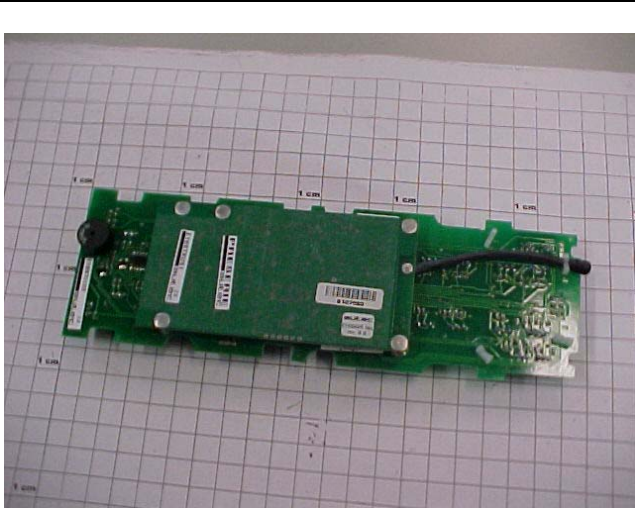
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6.3 Photographic documentation

PHOTO N° 1 – EQUIPMENT UNDER TEST IDENTIFICATION



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PHOTO N° 2 – SET-UP FOR EMISSION RADIATED TEST

