



IMQ S.p.A. – Società con Socio Unico
Via Quintiliano, 43 I-20138 MILANO
tel 0250731 – info@imq.it – www.imq.it

TEST REPORT

No. ARSO00038

performed in accordance with

FCC Rules: Code of Federal Regulations (CFR) no. 47
Part 15 Subpart C Section 15.231

PRODUCT	WIRELESS MODULE REMOTE CONTROL FOR ENDOGRAPH DC
MODEL(s) TESTED	TLC (portable unit) BRIDGE (fixed unit)
FCC ID	2ABYS76593030
TRADE MARK(s)	VILLA SISTEMI MEDICALI

APPLICANT	VILLA SISTEMI MEDICALI S.p.A. – Via delle Azalee, 3 – I-20090 Buccinasco (MI) - ITALY
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Tested by	Roberto Radice	
Approved by	Roberto Colombo <i>[Area Manager]</i>	

Revision Sheet

Release No.	Date	Revision Description
Rev. 0	2014-03-28	First edition Digital signed - ARSO00038_TR_ FCC Section 15.231_Remote control system TLC+Bridge

The results of tests and checks reported in this Test Report refer exclusively to the samples tested and described in the Report itself.
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1. GENERAL DATA

SAMPLE		
Samples received on	2014-03-12	(item sent and sampling by applicant)
IMQ reference samples	BEM	72204
Samples tested No.	2	
Object under analysis recognition	Not carried out Except where stated, characteristics of products were taken from client description and were not verified by the laboratory	
TEST LOCATION		
Testing dates	2014-03-12 ÷ 2014-03-13	
Testing laboratory.	IMQ S.p.A. con socio unico - Via Quintiliano, 43 – I-20138 Milano	
Testing site	Via Quintiliano, 43 – I-20138 Milano	
ENVIRONMENTAL CONDITIONING		
Parameter	Measured	
Ambient Temperature	25 ÷ 35 °C	
Relative Humidity	50 ÷ 60 %	
Atmospheric Pressure	900 ÷ 1000 mbar	



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2. REFERENCE DOCUMENT

	DOCUMENT	DATE	TITLE
<input checked="" type="checkbox"/>	47 CFR Part 15	2008	Radio Frequency Device
<input checked="" type="checkbox"/>	ANSI C63.4	2009	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
<input checked="" type="checkbox"/>	ANSI C63.10	2009	American National Standard for Testing Unlicensed Wireless Devices



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3. UNIT UNDER TEST (EUT) DETAILS

GENERAL DATA

MODEL (basic)	Description
TLC (portable unit)	WIRELESS MODULE REMOTE CONTROL FOR ENDOGRAPH DC
VARIANTS (derived)	Description
BRIDGE (fixed unit)	WIRELESS MODULE REMOTE CONTROL INSIDE ENDOGRAPH DC
REMARKS	<p>The RF modules are integral part of Endograph DC intra-oral X-ray unit with wireless remote control radiological units composed by two PCB boards:</p> <p>1) Fixed unit (called BRIDGE) linked to the CPU board of the radiological unit;</p> <p>2) Handled unit (called TLC) that works as remote controller for the radiological unit.</p> <p>The modular transmitter has been tested inside the host products and in both the possible configuration PCB boards.</p>

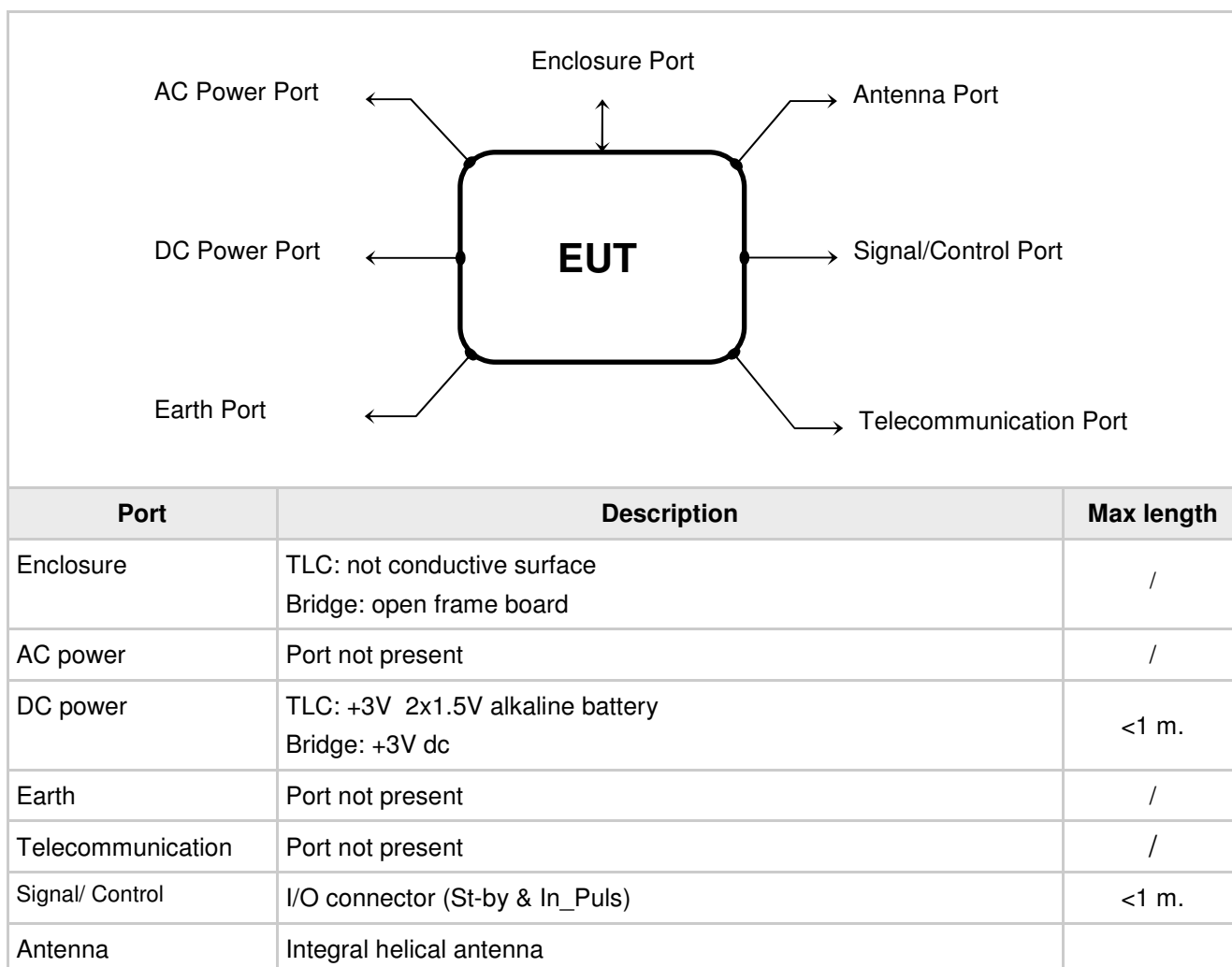
FCC ID	2ABYS76593030
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Manufacturer	VILLA SISTEMI MEDICALI S.p.A. – Via delle Azalee, 3 – I-20090 Buccinasco (MI) - ITALY
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Type of equipment	Remote control
Operating frequency:	433.92MHz
Maximum RF radiated power:	72.01 dBuV/m (TLC unit) 75.80 dBuV/m (Bridge unit)
Modulation:	ASK
Channel Spacing:	Wideband
Antenna:	Integral helical antenna on PCB
RX sensitivity:	Declared -105dBm
Peripherals included (for system application)	/
Interfaces :	/
Integrated interfaces :	/
AC adapter:	/
Data cable	/
Telecom cable	/
Power supply type :	/
AC power input cable :	/
DC power input cable :	/

4. TEST CONFIGURATION OF UNIT UNDER TEST

EUT PORTS



STATE OF THE EUT DURING TESTS

Ref.	Mode	Description
#1	Operating	Continuous transmission



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SUPPORT EQUIPMENT

Defined as equipment needed for correct operation or loading of the EUT, but not considered as tested:

Equipment	Manufacturer	Model
CPU board	Villa Sistemi Medicali	VSM code 5859301000
AC/DC adapter	D-Link	JTA0302E-E input 100-240Vac Output +5Vdc

ELECTROMAGNETICALLY RELEVANT COMPONENTS

Component	No.	Manufacturer	Model
Transceiver module	1	AUR.EL	RTX-MID
8 Bit microcontroller	1	ATMEL	ATMEGA8

RFI SUPPRESSION DEVICES

Component	No.	Manufacturer	Model
None			

EMI PROTECTION DEVICES

Component	No.	Manufacturer	Model
None			

EUT TECHNICAL DOCUMENTATION

Document	Reference
Wiring diagram	Wireless remote Controller – Drawing SE65790100 11/10/2012
Part list	Document number DP65791000 Rev.0.0 11/10/2012
ENDOGRAPH DC – Service manual	Cod. 6959900703 Rev.1



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5. METHODS OF MEASUREMENT

All compliance measurements have been carried out using the procedures described in the standard ANSI C63.4-2009, ANSI C63.10-2009 and Section 15.31 of CFR47 Part 15 – Subpart A (General).

Additional test requirements have been adopted according to the reference Section indicated in the § 6 of this test report.

FREQUENCY RANGE INVESTIGATED

Conducted emission tests : from 150 kHz to 30 MHz.

Radiated emission tests: from 9 kHz to tenth harmonic of fundamental (4.3392 GHz)



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6. SUMMARY OF TEST RESULTS

POSSIBLE TEST CASE VERDICTS:

Test object does meet the requirement	PASS
Test object does not meet the requirement	FAIL
Test case does not apply to the test object	N.A.
Test not performed	N.P.

CFR47 Part 15	TITLE	RESULT
§ 15.203	Antenna Requirements	PASS
§ 15.207 (a)	Conducted Emission	PASS
§ 15.209 (a) (f) § 15.231 (b)	Radiated Emission	PASS
§ 15.231 (a) (1)	Duration of manually activated transmission	PASS
§ 15.231 (a) (2)	Duration of automatically activated transmission	PASS
§ 15.231 (a) (3)	Transmission at predetermined / regular intervals	N.A.
§ 15.231 (a) (4)	Pendency of transmission used during emergencies	N.A.
§ 15.231 (a) (5)	Transmission of set-up information for security systems	N.A.
§ 15.231 (c)	Bandwidth of the emission	PASS
§ 15.231 (d)	Frequency stability in band 40.66÷40.70 MHz	N.A.

PERIODIC OPERATION – PERIODIC RATE EXCEEDING THAT SPECIFIED IN PARAGRAPH 15.231 (A)

CFR47 Part 15	TITLE	RESULT
§ 15.209 (a) (f) § 15.231 (e)	Radiated Emission	N.A.
§ 15.231 (e)	Duration of transmission & periods between transmissions	N.A.



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7. TEST RESULTS

7.1 ANTENNA REQUIREMENTS

TEST REQUIREMENT

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.

Antenna specifications

N° of authorized antenna types	N°1 helical antenna soldering on PCB
Antenna type	Integral antenna
Antenna size	---
Maximum total gain	---
External power amplifiers	Not present

TEST RESULT

The EUT meets the requirements of section 15.203 and 15.204



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7.2 CONDUCTED DISTURBANCES

TEST REQUIREMENT

Test setup	ANSI C63.4
Frequency range	150 kHz ÷ 30 MHz
IF bandwidth	9 kHz
EMC class	B
Limits	sections 15.207 (a)
EUT operating condition	#1
Remark	None

TEST RESULT

The EUT meets the requirements of sections 15.207.

TEST PROCEDURE

- 1) The EUT was placed on a wooden table of size, 80 cm by 80 cm, raised 80 cm in which is located 40 cm away from the vertical wall the shielded room.
- 2) Each EUT power cord input cord was individually connected through a 50Ω/50μH LISN to the input power source.
- 3) Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
- 4) The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
- 5) The measurements were made with the detector set to PEAK and AVERAGE amplitude within a bandwidth of 10 kHz during the measurements.
- 6) The measurements with Quasi-Peak detector are performed only for frequencies for which the Peak values are \geq (Q.P. limit - 6 dB).

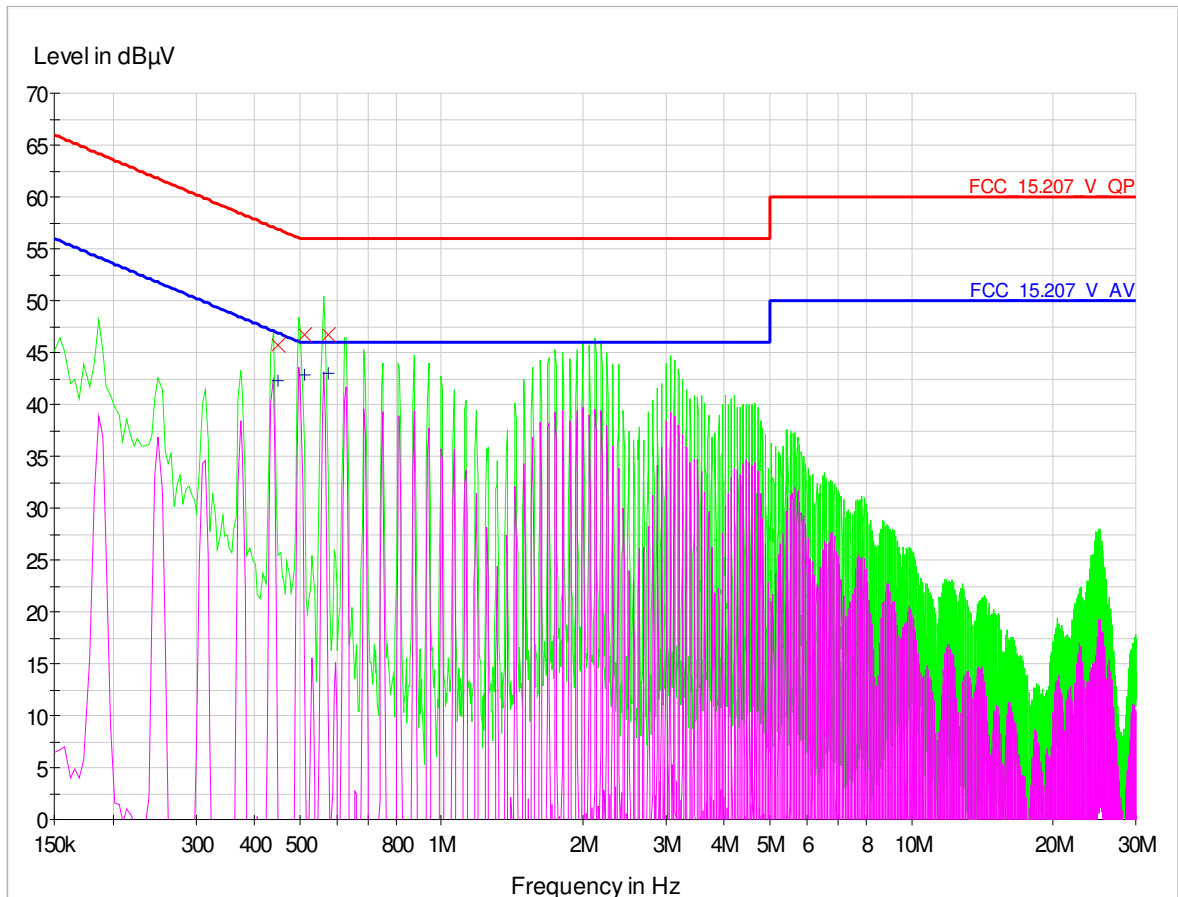


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MEASUREMENTS RESULTS

Port: AC MAINS POWER PORT OF AC/DC ADAPTER of BRIDGE unit

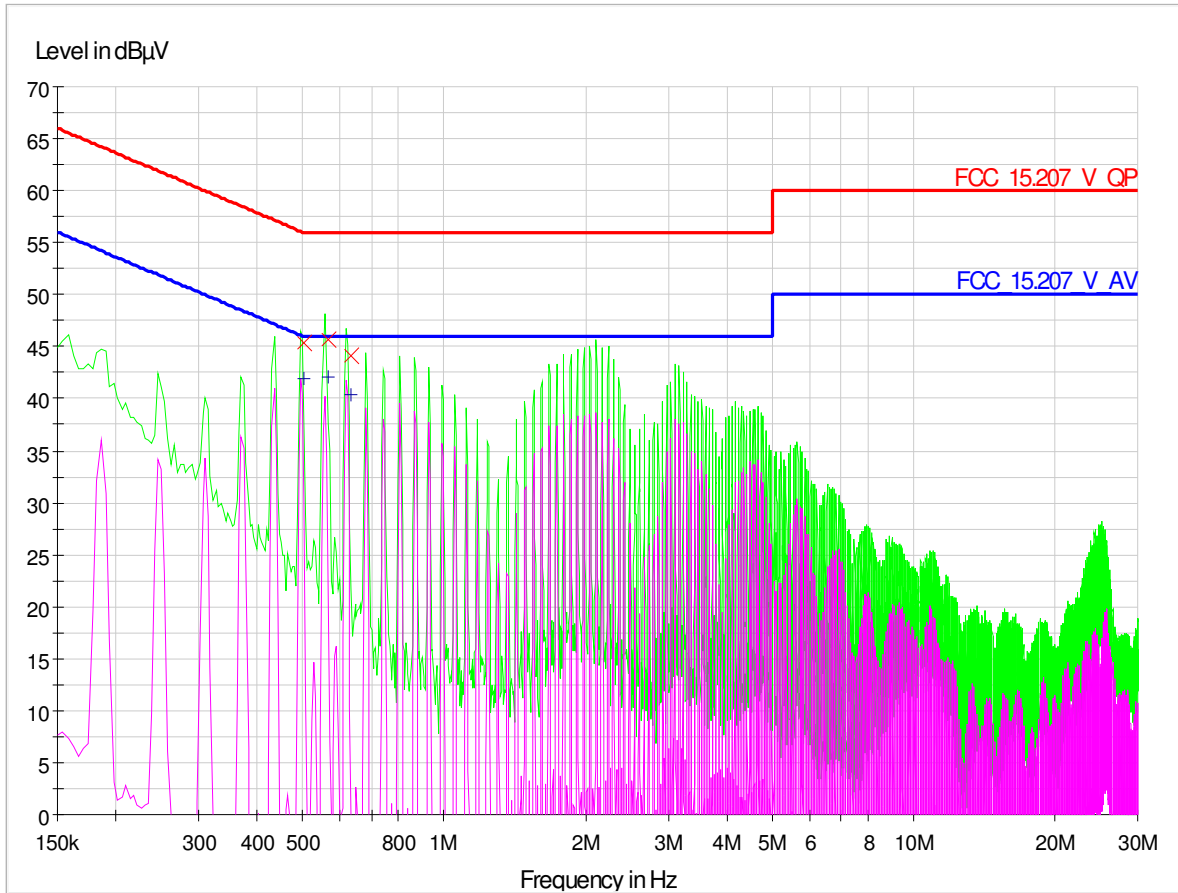
Line: PHASE



Frequency MHz	MaxPeak dBμV	QuasiPeak dBμV	Average dBμV	Meas. Time ms	Bandwidth kHz	Line	Corr. dB
0.448000	---	45,8	42.3	2000.0	9.000	L1	0.1
0.512000	---	46,6	42.9	2000.0	9.000	L1	0.1
0.575000	---	46,7	43.0	2000.0	9.000	L1	0.1

Port: AC MAINS POWER PORT OF AC/DC ADAPTER of BRIDGE unit

Line: NEUTRAL



Frequency MHz	MaxPeak dBμV	QuasiPeak dBμV	Average dBμV	Meas. Time ms	Bandwidth kHz	Line	Corr. dB
0.504000	---	45.4	41.9	2000.0	9.000	N	0.1
0.567000	---	45.7	42.1	2000.0	9.000	N	0.1
0.635000	---	44.1	40.4	2000.0	9.000	N	0.1



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7.3 RADIATED DISTURBANCES

TEST REQUIREMENT	
Test setup	ANSI C63.4
Test facility	Semi-anechoic chamber
Test distance	3 meters
Frequency range	9 kHz to tenth harmonic of fundamental (or 1 GHz)
IF bandwidth (below 30 MHz)	9 kHz
IF bandwidth (below 1,000 MHz)	120 kHz
IF bandwidth (above 1,000 MHz)	1 MHz
Deviation to test procedure	None
Limits	sections 15.209 (a) & 15.231 (b)
EUT operating condition	#1
Remark	(*) In accordance with part 15.31 (f) (2), where the measurement distance was specified to be 30 or 300 meters, a correction factor was applied in order to permit measurement to be performed at a separation distance. The applied formula for limits at 3 meter is: Extrapolation (dB) = $40\log(300\text{meter} / 3\text{meter}) = +80\text{db}$ Extrapolation (dB) = $40\log(30\text{meter} / 3\text{meter}) = +40\text{db}$

TEST RESULT

The EUT meets the requirements of sections 15.209 (a) & 15.231 (b)

LIMITS FOR FUNDAMENTAL & SPURIOUS

Band of operations	Peak (dB μ V/m)	Average Limit (dB μ V/m)
Section 15.231 (b) fundamental	100.82 (@ 433.92MHz)	80,82 (@ 433.92MHz)
Section 15.231 (b) harmonics of fundamental < 1GHz	81.84 (@ 867,80MHz)	61.84 (@ 867.80MHz)
Section 15.231 (b) harmonics of fundamental > 1GHz not in restricted bands (par. 15.205)	81.84	61.84
Restricted bands (par. 15.205)	74	54
Other bands	According to 15.209	According to 15.209



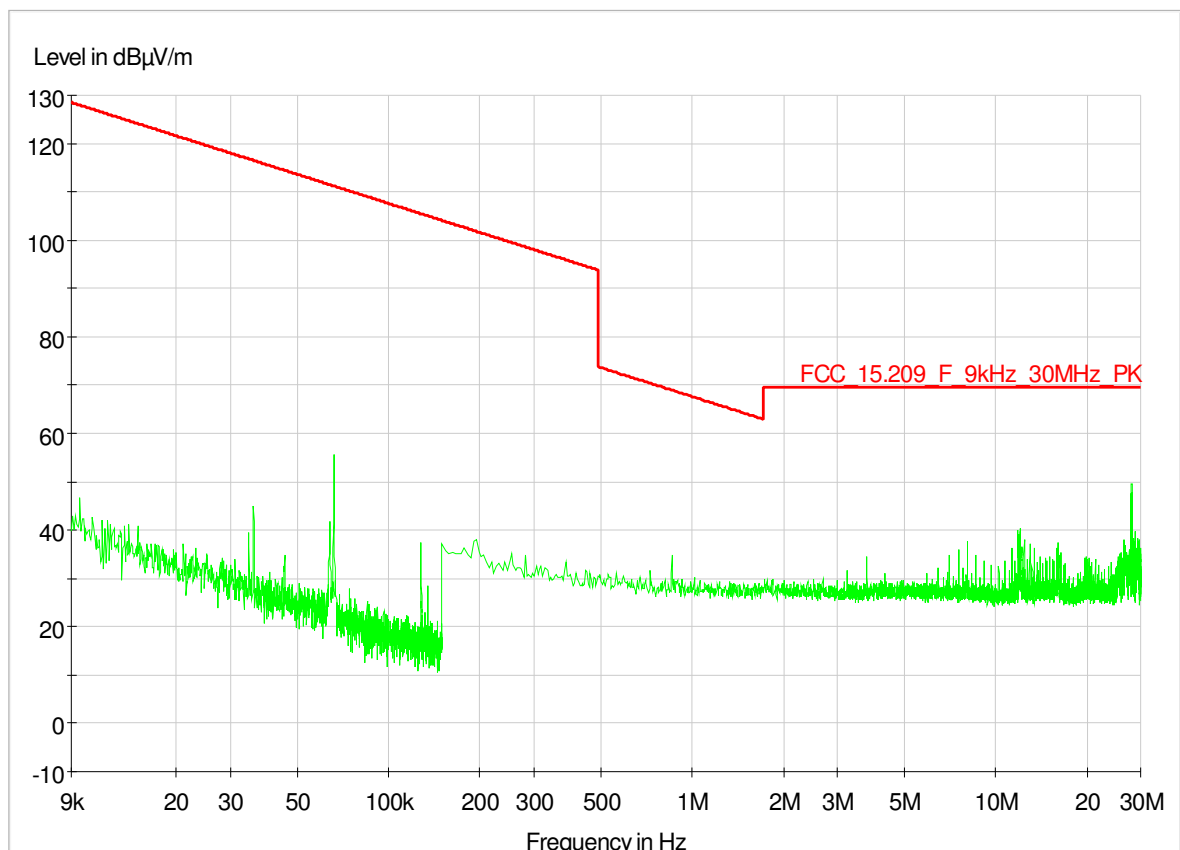
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TEST PROCEDURE

- 1) The EUT was placed on turntable which is 0.8 m above the ground plane
- 2) The turntable shall rotate from 0° to 360° degrees to determine the position of maximum emission level.
- 3) The EUT is positioned 3 m away from the receiving antenna which varied from 1 to 4 m to find the highest emission.
- 4) The measurements were made with the detector set to PEAK and AVERAGE amplitude within a bandwidth of 100 kHz below 1000 MHz and 1 MHz above 1000 MHz.
- 5) The receiving antenna was positioned in both horizontal and vertical polarization.
- 6) The measurements with Quasi-Peak detector, below 1000 MHz are performed only for frequencies for which the Peak values are \geq (Q.P. limit - 6 dB).

MEASUREMENTS RESULTS

Range: 9kHz ÷ 30 MHz (TLC UNIT)

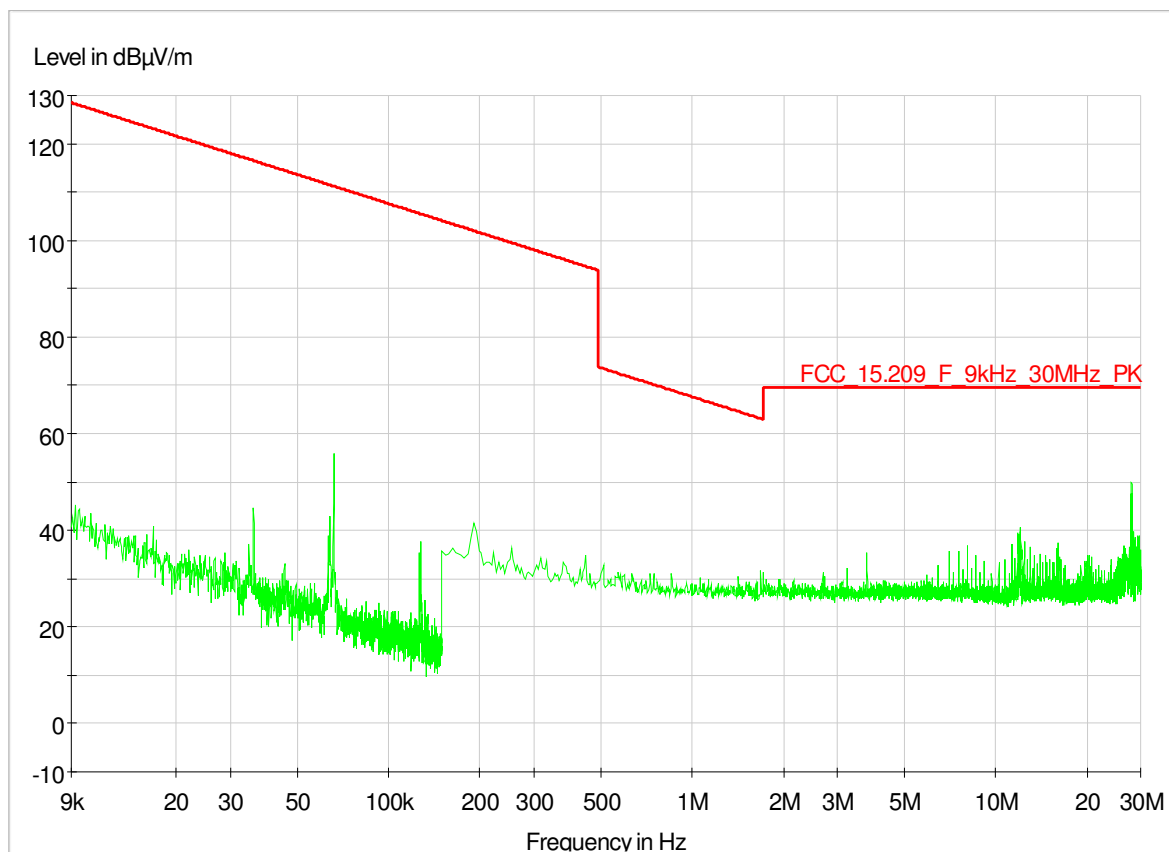


NOTE: The measures above are the worst case on 3 axes X Y and Z



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Range: 9kHz ÷ 30 MHz (BRIDGE UNIT)

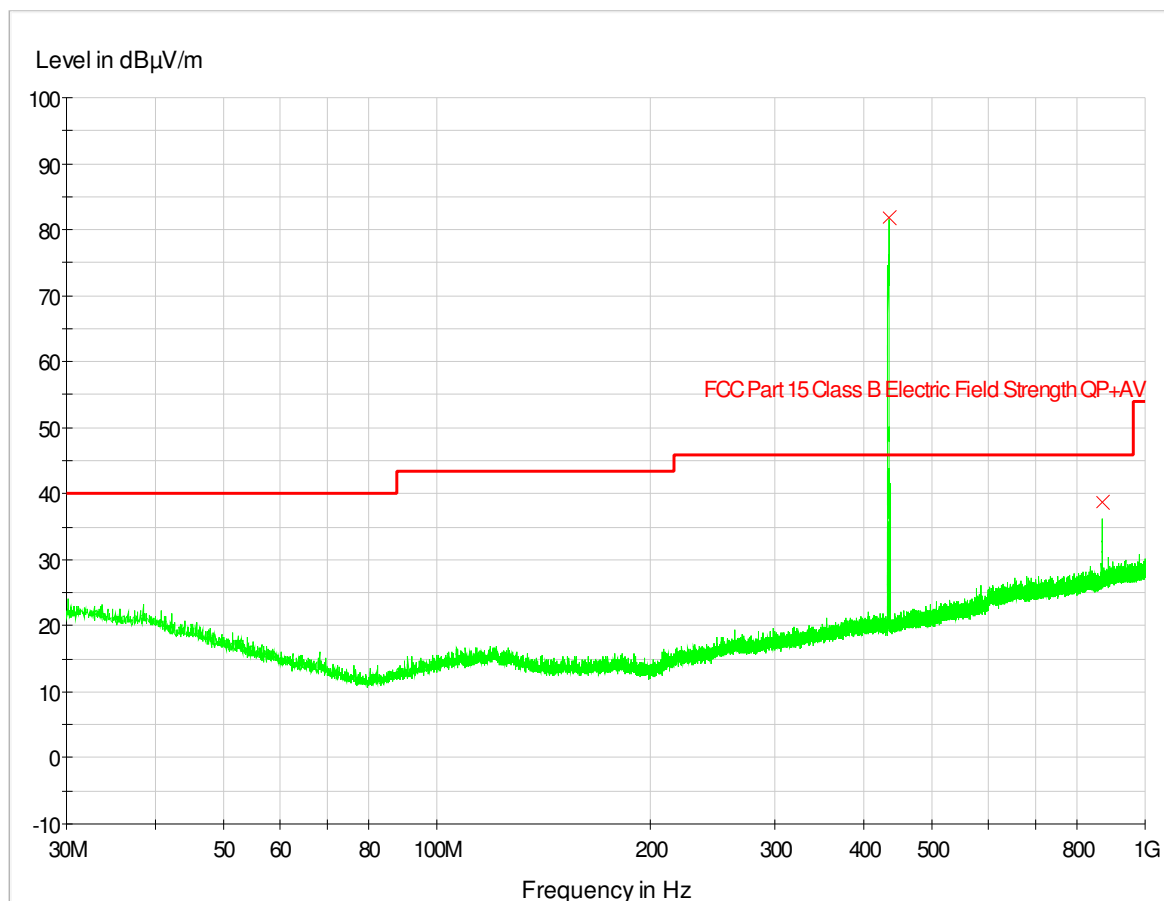


NOTE: The measures above are the worst case on 3 axes X Y and Z



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Range: 30 ÷ 1000 MHz (TLC UNIT)



NOTE: The measures above are the worst case on 3 axes X Y and Z



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PEAK RESULT (RBW=120kHz)

Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Limit	Margin
(MHz)	(dBμV)	(dB3/m)	(dB)	(dB)	(dBμV/m)	(μV/m)	(dBμV/m)	(dB)
433.92	64.70	15.80	1.30	/	81.80	109,960	100.83	>19
867.80	16.44	20.50	1.86	/	38.80	12,500	81.94	>53

AVERAGE FACTOR

T. Pulse (ms)	TX on + TX off (ms)	Duty cycle	Average Factor (dB)
3 x 10.795	100	0.32385	9.79

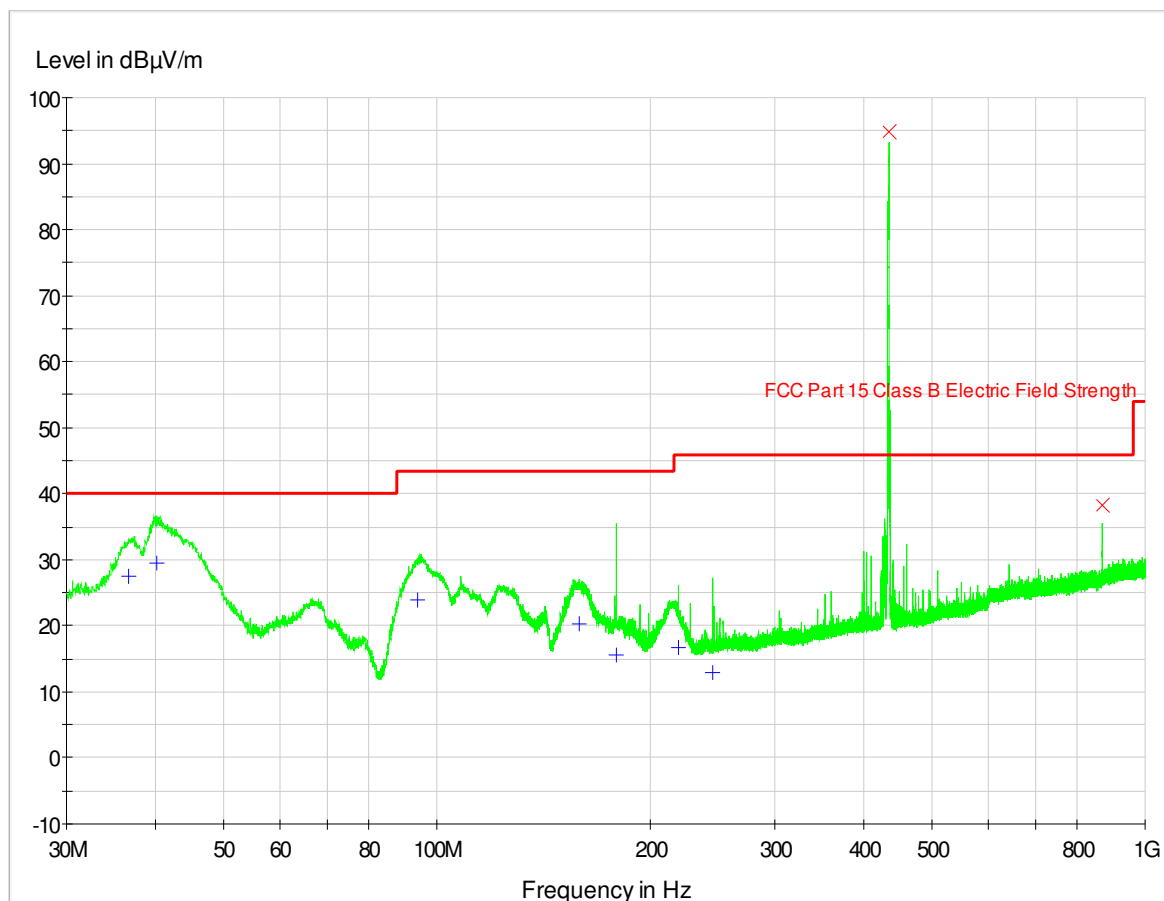
CALCULATE AVERAGE (PEAK – AVERAGE FACTOR)

Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Limit	Margin
(MHz)	(dBμV)	(dB3/m)	(dB)	(dB)	(dBμV/m)	(μV/m)	(dBμV/m)	(dB)
433.92	54.91	15.80	1.30	/	72.01	10,996	80.83	>8
867.80	6.65	20.50	1.86	/	29.01	1,250	61.94	>32



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Range: 30 ÷ 1000 MHz (BRIDGE UNIT)



NOTE: The measures above are the worst case on 3 axes X Y and Z



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PEAK RESULT (RBW=120kHz)

Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Limit	Margin
(MHz)	(dBμV)	(dB3/m)	(dB)	(dB)	(dBμV/m)	(μV/m)	(dBμV/m)	(dB)
433.92	77.70	15.80	1.30	/	94.80	109,960	100.83	>6
867.80	15.84	20.50	1.86	/	38.20	12,500	81.94	>43

AVERAGE FACTOR

T. Pulse (ms)	TX on + TX off (ms)	Duty cycle	Average Factor (dB)
1 x 11.20	100	0.112	19.01

CALCULATE AVERAGE (PEAK – AVERAGE FACTOR)

Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Limit	Margin
(MHz)	(dBμV)	(dB3/m)	(dB)	(dB)	(dBμV/m)	(μV/m)	(dBμV/m)	(dB)
433.92	58.69	15.80	1.30	/	75.79	10,996	80.83	>5
867.80	-3.17	20.50	1.86	/	19.19	1,250	61.94	>41

QUASI-PEAK RESULT (RBW=120kHz)

Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Limit	Margin
(MHz)	(dBμV)	(dB3/m)	(dB)	(dB)	(dBμV/m)	(μV/m)	(dBμV/m)	(dB)
36.80	8.91	17.80	0.29	/	27.60	100	40	>12
40.20	11.89	17.40	0.31	/	29.60	100	40	>10
93.88	13.47	9.80	0.53	/	23.80	150	43.52	>19
159.04	10.46	9.20	0.74	/	20.40	150	43.52	>13
179.40	4.90	9.80	0.80	/	15.50	150	43.52	>28
218.84	4.63	11.20	0.87	/	16.70	200	46.02	>29
244.56	0.23	11.70	0.97	/	12.90	200	46.02	>43



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Range: f>1000 MHz (TLC UNIT)

PEAK RESULT (RBW=1MHz; VBW=1MHz)								
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Limit	Margin
(MHz)	(dBμV)	(dB3/m)	(dB)	(dB)	(dBμV/m)	(μV/m)	(dBμV/m)	(dB)
1301.92*	57.28	25.00	2.63	-38.30	46.61	5000	74.00	>27
1734.91	47.09	25.60	3.01	-37.60	38.10	12,500	81.94	>43
2169.30	48.53	26.50	3.34	-37.30	41.07	12,500	81.94	>40
2604.16	55.68	27.80	3.82	-37.30	50.00	12,500	81.94	>31
3037.77	50.87	28.40	3.96	-37.40	45.83	12,500	81.94	>36
3470.60	58.01	28.80	4.03	-37.10	53.74	12,500	81.94	>28
3905.50*	56.95	29.80	4.44	-36.80	54.39	5000	74.00	>19
4339.20*	50.72	30.50	4.96	-36.70	49.48	5000	74.00	>24

NOTE: The measures above are the worst case on 3 axes X Y and Z
*Frequency in restricted bands

AVERAGE FACTOR			
T. Pulse (ms)	TX on + TX off (ms)	Duty cycle	Average Factor (dB)
3 x 10.795	100	0.32385	9.79

CALCULATE AVERAGE (PEAK – AVERAGE FACTOR)								
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Limit	Margin
(MHz)	(dBμV)	(dB3/m)	(dB)	(dB)	(dBμV/m)	(μV/m)	(dBμV/m)	(dB)
1301.92*	47.49	25.00	2.63	-38.30	36.82	500	54.00	>17
1734.91	37.30	25.60	3.01	-37.60	28.31	1,250	61.94	>33
2169.30	38.74	26.50	3.34	-37.30	31.28	1,250	61.94	>30
2604.16	45.89	27.80	3.82	-37.30	40.21	1,250	61.94	>21
3037.77	41.08	28.40	3.96	-37.40	36.04	1,250	61.94	>25
3470.60	48.22	28.80	4.03	-37.10	43.95	1,250	61.94	>18
3905.50*	47.16	29.80	4.44	-36.80	44.60	500	54.00	>9
4339.20*	40.93	30.50	4.96	-36.70	39.69	500	54.00	>14

*Frequency in restricted bands



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Range: f>1000 MHz (BRIDGE UNIT)

PEAK RESULT (RBW=1MHz; VBW=1MHz)

Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Limit	Margin
(MHz)	(dBμV)	(dB3/m)	(dB)	(dB)	(dBμV/m)	(μV/m)	(dBμV/m)	(dB)
1301.92*	56.92	25.00	2.63	-38.30	46.25	5,000	74.00	>27
1734.91	49.84	25.60	3.01	-37.60	40.85	12,500	81.94	>41
2169.30	46.35	26.50	3.34	-37.30	38.89	12,500	81.94	>43
2604.16	47.85	27.80	3.82	-37.30	42.17	12,500	81.94	>39
3037.77	50.72	28.40	3.96	-37.40	45.68	12,500	81.94	>36
3470.60	45.61	28.80	4.03	-37.10	41.34	12,500	81.94	>40
3905.50*	54.96	29.80	4.44	-36.80	52.40	5,000	74.00	>21
4339.20*	49.94	30.50	4.96	-36.70	48.70	5,000	74.00	>25

NOTE: The measures above are the worst case on 3 axes X Y and Z

*Frequency in restricted bands

AVERAGE FACTOR

T. Pulse (ms)	TX on + TX off (ms)	Duty cycle	Average Factor (dB)
1 x 11.20	100	0.112	19.01

CALCULATE AVERAGE (PEAK – AVERAGE FACTOR)

Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Limit	Margin
(MHz)	(dBμV)	(dB3/m)	(dB)	(dB)	(dBμV/m)	(μV/m)	(dBμV/m)	(dB)
1301.92*	37.91	25.00	2.63	-38.30	27.24	500	54.00	>26
1734.91	30.83	25.60	3.01	-37.60	21.84	1,250	61.94	>40
2169.30	27.34	26.50	3.34	-37.30	19.88	1,250	61.94	>42
2604.16	28.84	27.80	3.82	-37.30	23.16	1,250	61.94	>38
3037.77	31.71	28.40	3.96	-37.40	26.67	1,250	61.94	>35
3470.60	26.60	28.80	4.03	-37.10	22.33	1,250	61.94	>39
3905.50*	35.95	29.80	4.44	-36.80	33.39	500	54.00	>20
4339.20*	30.93	30.50	4.96	-36.70	29.69	500	54.00	>24

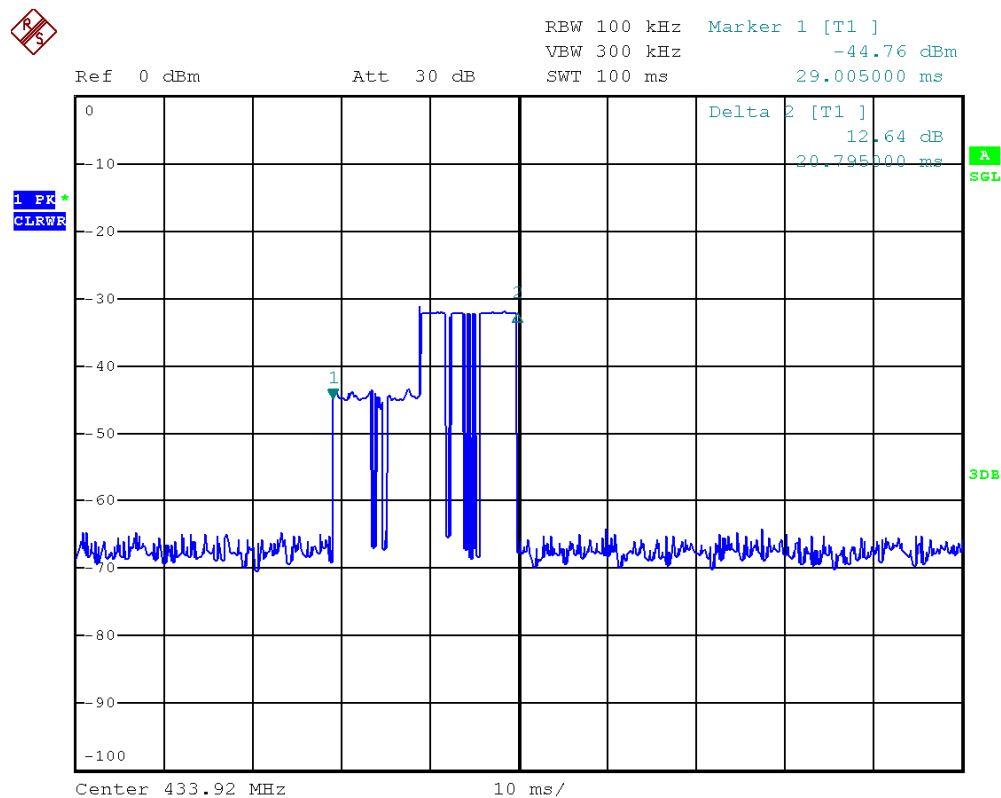
*Frequency in restricted bands



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DUTY CYCLE

TLC + BRIDGE IN NORMAL WORKING CONDITION



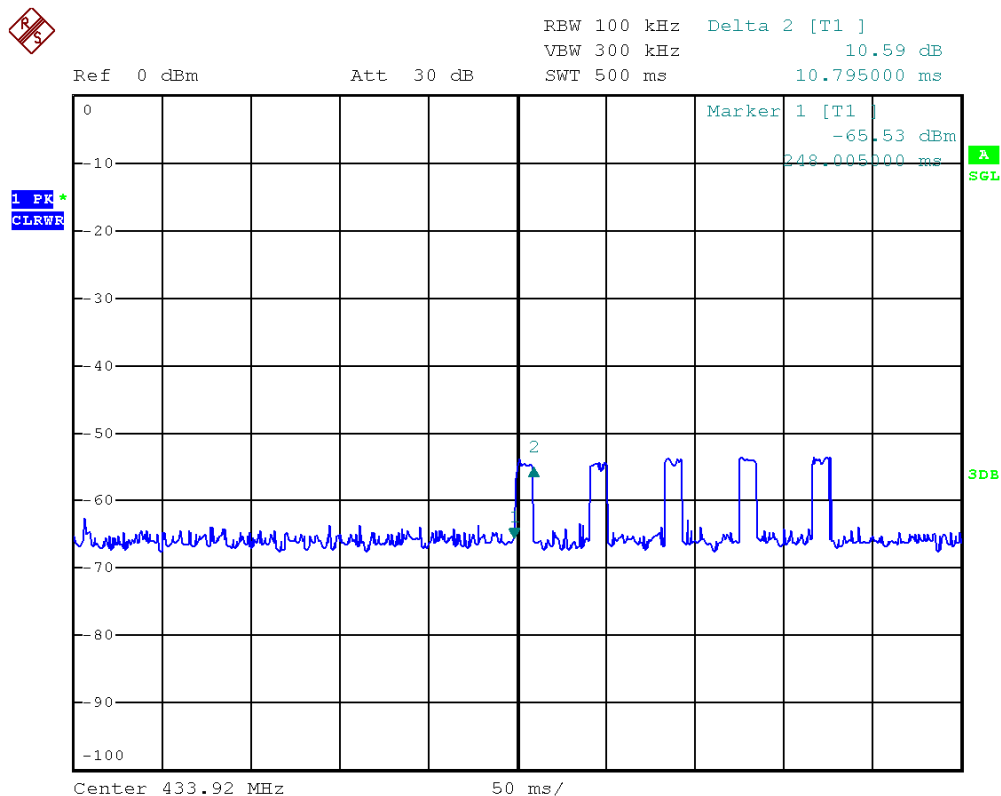
Date: 12.MAR.2014 10:32:09

In normal working condition, in a 100ms period there is a 1 TLC transmission of about 10ms (signed with marker 1 – low level) and immediately a transmission of Bridge of about 10ms (signed with marker 2 – high level)



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DUTY CYCLE OF TLC WHEN BRIDGE NOT RESPONDING



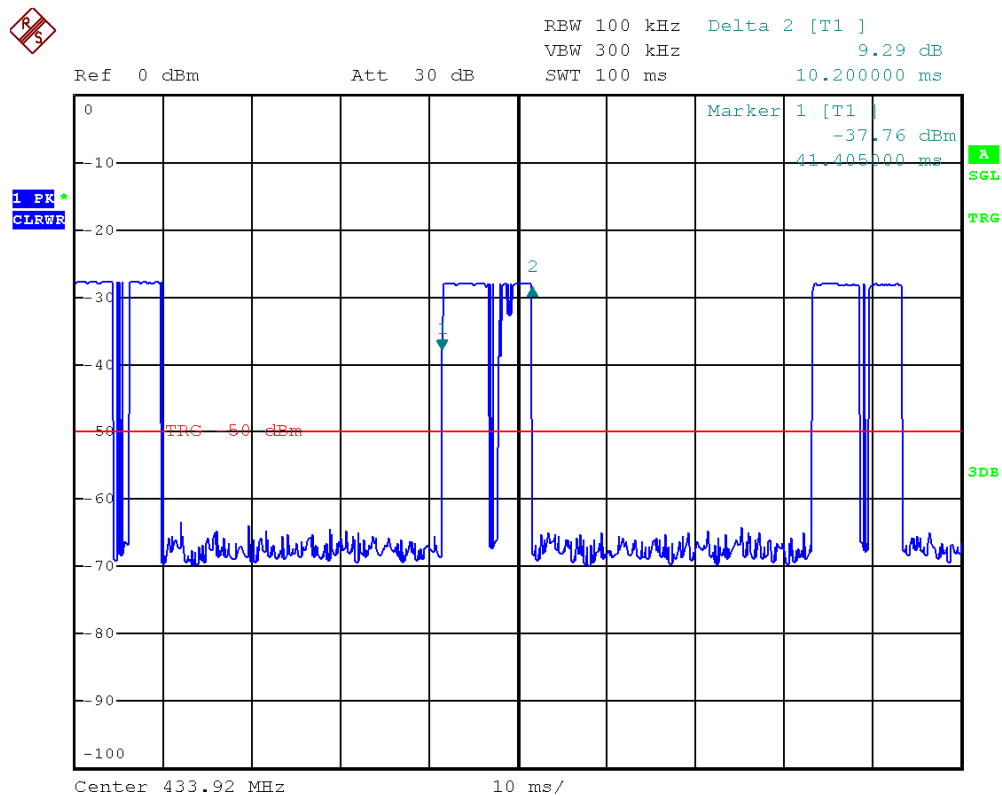
Date: 12.MAR.2014 10:41:43

When Bridge unit not responding, the TLC unit send 5 packet of 10.79ms and then stop the transmission.



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DUTY CYCLE OF TLC IN A 100MS PERIOD WHEN BRIDGE NOT RESPONDING

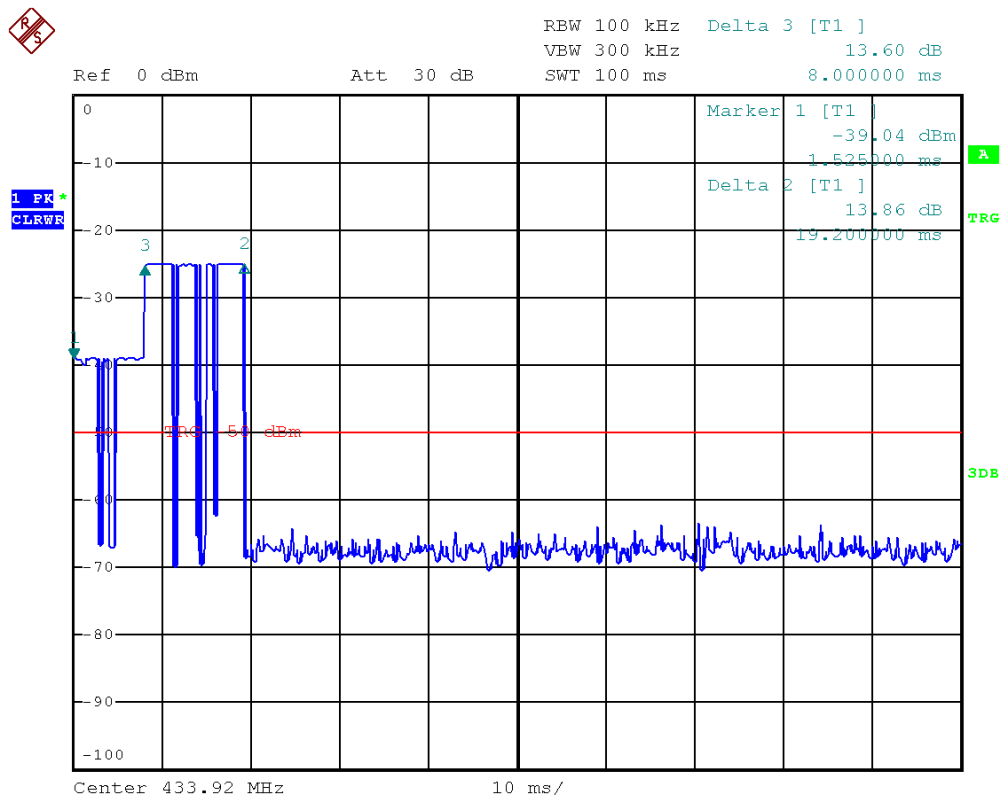


In a 100ms period, when Bridge unit not responding, the TLC unit send 3 packet of 10.79ms.



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DUTY CYCLE OF BRIDGE IN NORMAL WORKING CONDITION



In normal working condition, in a 100ms period there is a 1 Bridge transmission of 11.2ms (signed with marker 2 and 3)



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7.4 CHARACTERISTICS OF TRANSMISSION

TEST REQUIREMENT § 15.231 (A)

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:

- (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
- (2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.
- (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.
- (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.
- (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.

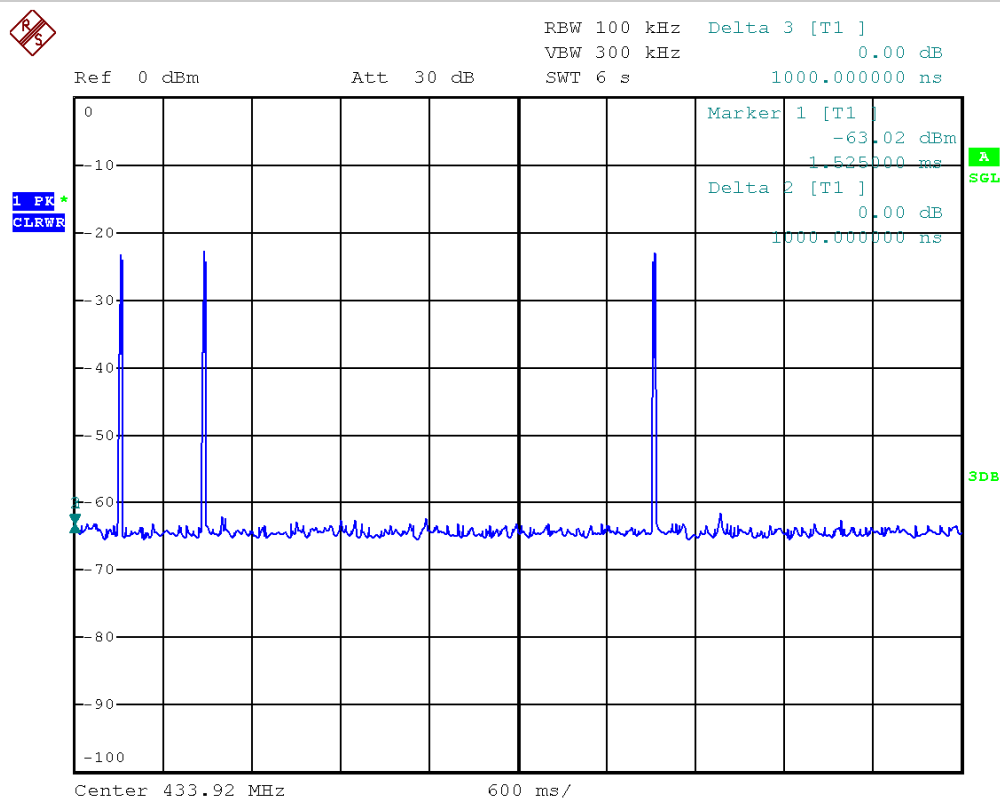
TEST RESULT

The EUT meets the requirements of sections 15.231 (a)



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CHARACTERISTICS OF TRANSMISSION IN NORMAL OPERATION MODE



Date: 12.MAR.2014 10:59:34

In normal working condition, the start of communication begins from the TLC board by pressing the button that sending a PING message to the Bridge board. Only if the Bridge board replies with a return message to the TLC board, the TLC board is able to send "X RAY ON" message to the Bridge board (20ms of total duration) (*First pulse on graphic*)

In case that the Bridge unit does not reply the TLC board attempts to send the PING message for 5 times in a row, all together the attempts last less than 200ms.

When TLC board is engaged, a "X RAY ON" message (10ms) is sent to the Bridge board by pressing and hold pressed the TLC board button. The Bridge board answer with an acknowledgement (10ms) (*Second pulse on graphic*). At this point only two configuration are admitted:

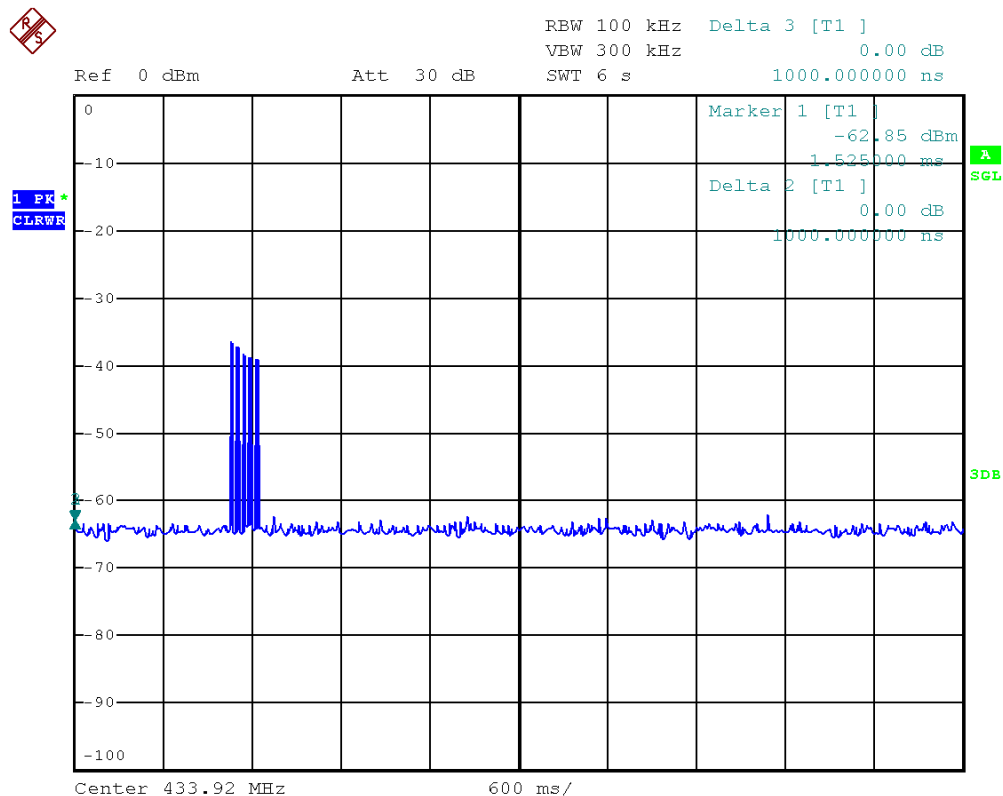
- Release the button during exam: the TLC sent a "X RAY STOP" message (10ms) to the Bridge board, that confirm (10ms) and the exam ends before the normal exam time.
- The button is held pressed till the end of the exam (max. 2,5s): the Bridge board, triggered by the CPU, send an "END EXAM" message (10ms) to the TLC and the communication stops. (*Third pulse on graphic*).

There is no periodic operation. The intentional radiator shall not used for a emergencies.



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CHARACTERISTICS OF TRANSMISSION WHEN BRIDGE NOT RESPONDING



Date: 12.MAR.2014 10:56:40

When the Bridge unit does not reply, the TLC unit send 5 packet (10ms one) and then stop the transmission.



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7.5 BANDWIDTH OF EMISSION IN PERIODIC TRANSMISSION

TEST REQUIREMENT	
Test setup	ANSI C63.4
Test facility	Semi-Anechoic chamber
Frequency range	Over 70MHz
Resolution BW	See next table
Deviation to test procedure	None
Limits	0,25% of the center frequency (in Range 70÷900MHz) 0,5 % of the center frequency (for frequencies above 900MHz)
EUT operating condition	#1
Remark	None

TEST RESULT
The EUT meets the requirements of sections 15.231 (c)

ANSI C63-4 SPECIFICATION

13.1.7 Occupied bandwidth measurements

In order to measure the modulated signal properly, a resolution bandwidth that is small compared with the bandwidth required by the procuring or regulatory agency shall be used on the measuring instrument. However, the resolution bandwidth of the measuring instrument shall be set to a value greater than 5% of the bandwidth requirements. When no bandwidth requirements are specified, the minimum resolution bandwidth of the measuring instrument is given in the following table:

Fundamental frequency	Minimum resolution bandwidth
9 kHz to 30 MHz	1 kHz
30 to 1000 MHz	10 kHz
1000 MHz to 40 GHz	100 kHz

Considering that the limit for 433.92 MHz is 1.084 kHz, 5% of this bandwidth is 54.2 kHz. Automatic setting of Spectrum Analyzer for this bandwidth is 30 kHz.

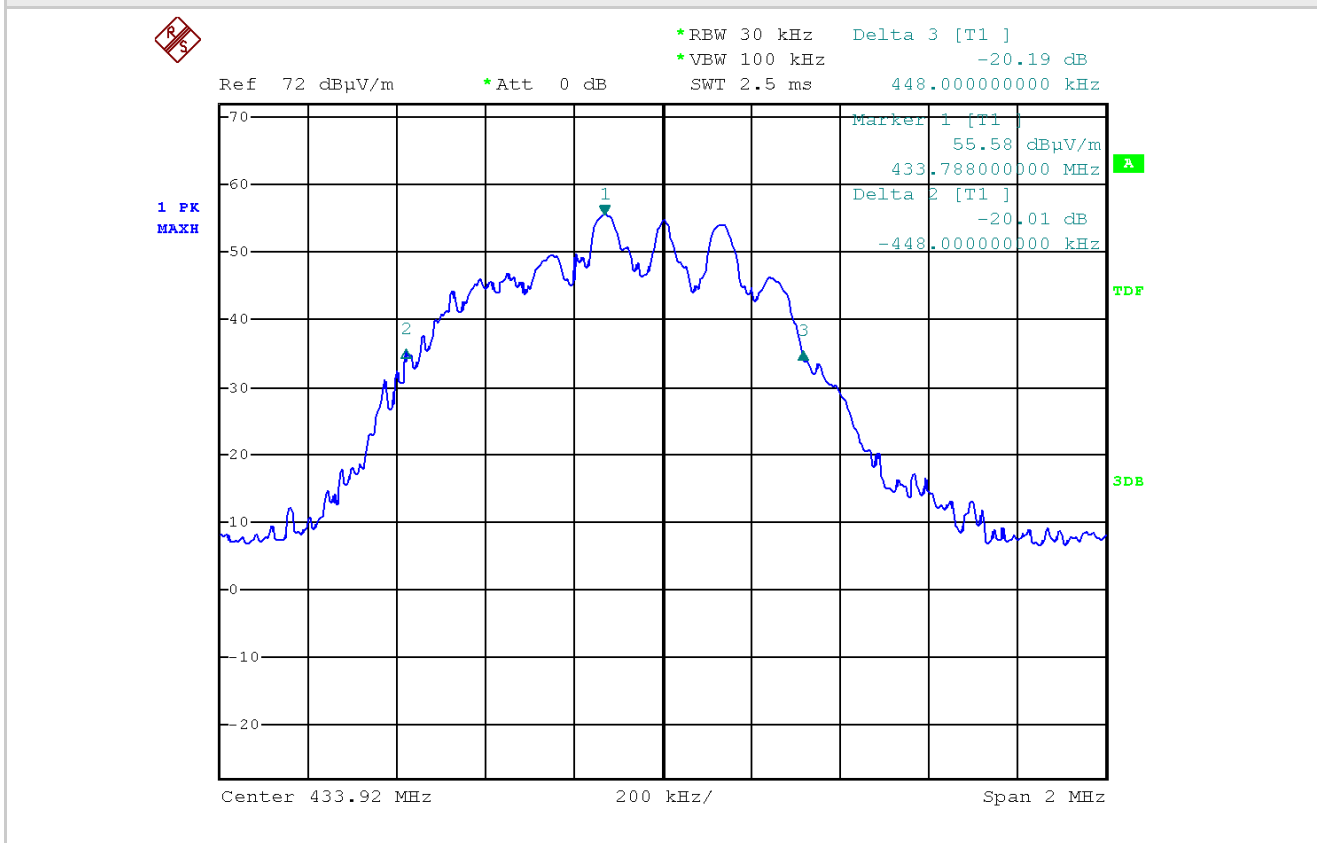
For these consideration, the Laboratory has been used a Resolution Bandwidth of 30kHz and a Video Bandwidth of 100 kHz.



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MEASUREMENTS RESULTS

BANDWIDTH OF EMISSION (AT 20DB POINTS) (TLC UNIT)



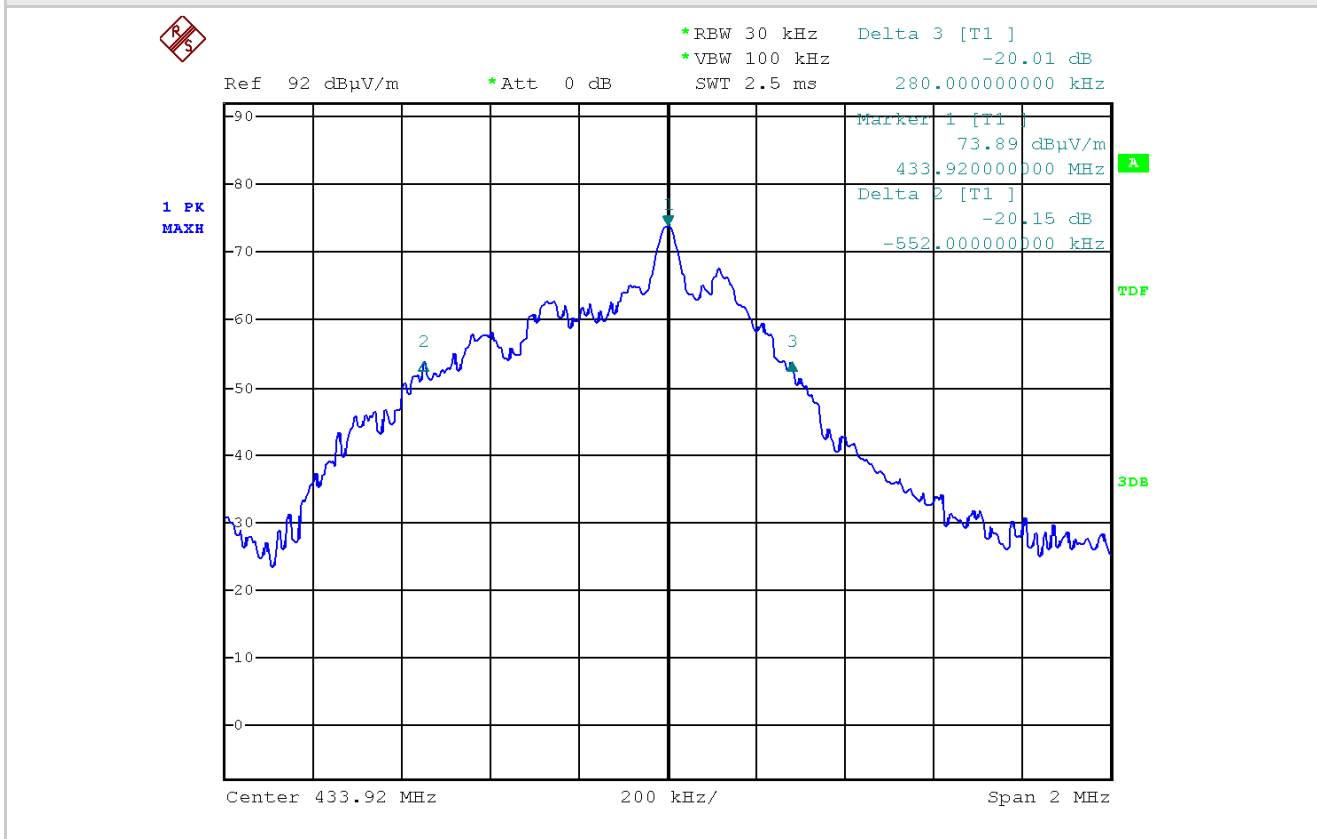
BANDWIDTH OF EMISSION

Frequency	Bandwidth at -20dB points	Limit (0.25% of 433.92 MHz)	Margin
MHz	kHz	kHz	kHz
433.92	896.00	1084.00	188.00



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BANDWIDTH OF EMISSION (AT 20DB POINTS) (BRIDGE UNIT)



BANDWIDTH OF EMISSION

Frequency	Bandwidth at -20dB points	Limit (0,25% of 433.92 MHz)	Margin
MHz	kHz	kHz	kHz
433.92	832.00	1084.00	252.00



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8. MEASUREMENTS AND TESTS UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the IMQ procedure No. IO-DT-U01 and requirement of NIST Technical Note 1297 and NIS 81: 1994 “The Treatment of Uncertainty in EMC Measurements”

Methods	Expanded Uncertainty	Unit	confidence level	Coverage factor	Degree of freedom
Radiated emission (30 ÷ 1000 MHz)	4.77	dB	95 %	2	9
Radiated emission (above 1000 MHz)	3.53	dB	95 %	2	9



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9. LIST OF MEASURING EQUIPMENT AND CALIBRATION INFORMATION

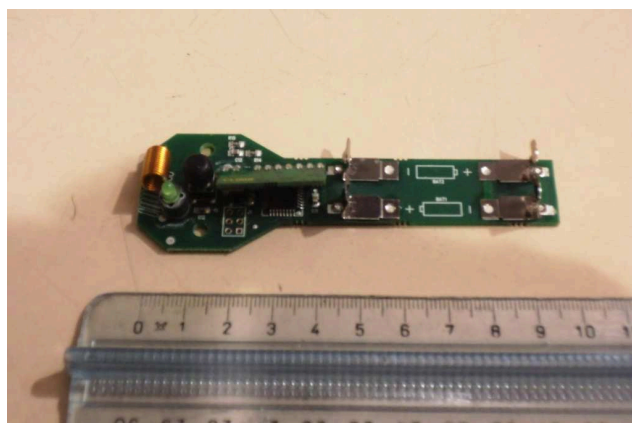
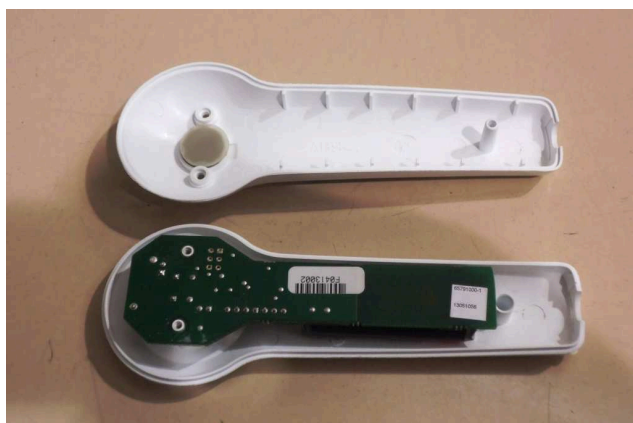
IMQ Serial Number	Instrument	Manufacturer	Type	Last Cal.	Cal. Period.	Calibration Company
P01709	Shielded semi-anechoic chamber	SIDT	/	03-13	12	IMQ
P02486	Turntable controller unit	FRANKONIA	FCTAM01	/	/	/
P02488	Mast antenna	FRANKONIA	FAM4	/	/	/
S05562	EMI Receiver	ROHDE & SCHWARZ	ESU 8	08-13	12	ROHDE & SCHWARZ
S02508	Loop antenna	ROHDE & SCHWARZ	HFH2-Z2	01-12	36	TESEO S.p.A.
S06463	Bi-Log antenna	SCHWARZBECK	VULB9160	03-13	36	SEIBERSDORF
S02385	Log antenna	ARA	LPB-2513	07-11	36	NPL
S03463	Horn Antenna	SCHWARZBECK	BBHA 9120D	09-11	36	NPL
S03668	Horn Antenna	SCHWARZBECK	BBHA 9170	08-13	36	LIBERTY LABS
S03629	Spectrum Analyzer	Rohde & Schwarz	FSP40	12-13	12	ROHDE & SCHWARZ
S03542	Preamplifier	Hewlett Packard	HP 8449B	06-13	24	IMQ
S04322	RF Coax Cable	Rosenberger micro-coax	N 50 Ohm	/	/	/
S05041	Micro-coax cable	Rosenberger micro	UFB311A	10-13	12	IMQ
S05042	Micro-coax cable	Rosenberger micro	UFB311A	10-13	12	IMQ
S05043	Micro-coax cable	Rosenberger micro	UFB311A	10-13	12	IMQ
S05044	Micro-coax cable	Rosenberger micro	UFB311A	10-13	12	IMQ
W-00199/E	Software	Rohde & Schwarz	Emc32 Ver. 6.30	/	/	/
H-00165	PC		/			



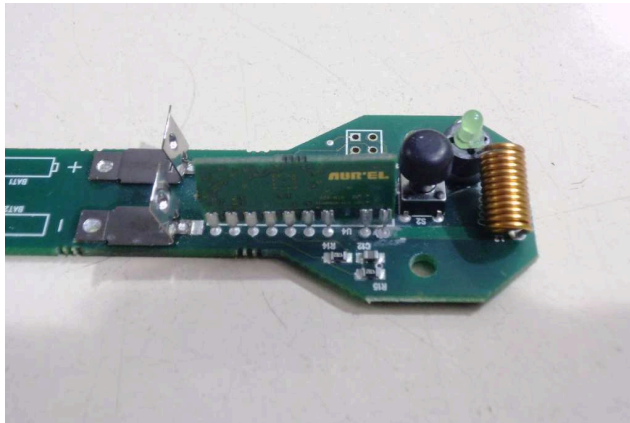
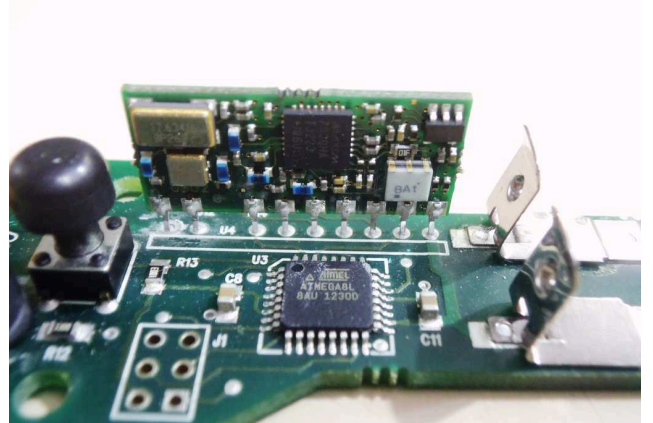
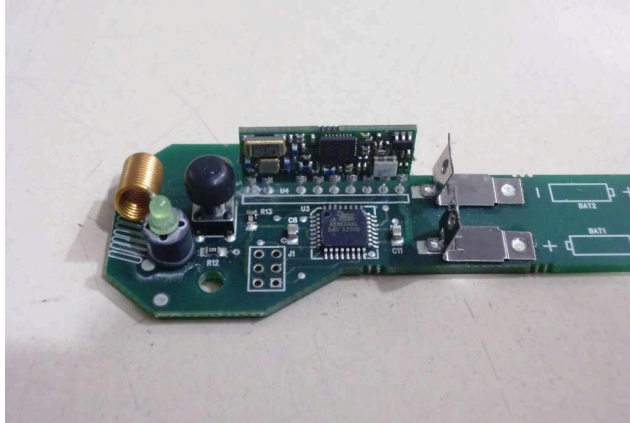
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10. PHOTOGRAPHIC DOCUMENTATION

EUT IDENTIFICATION (TLC UNIT)



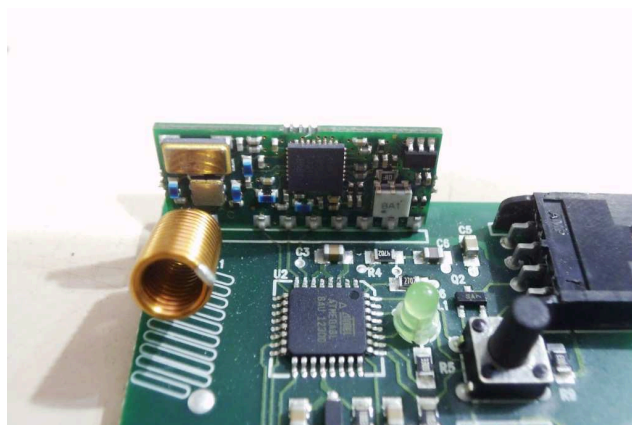
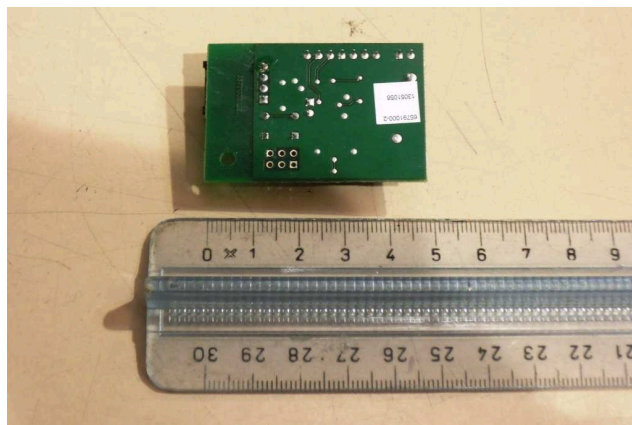
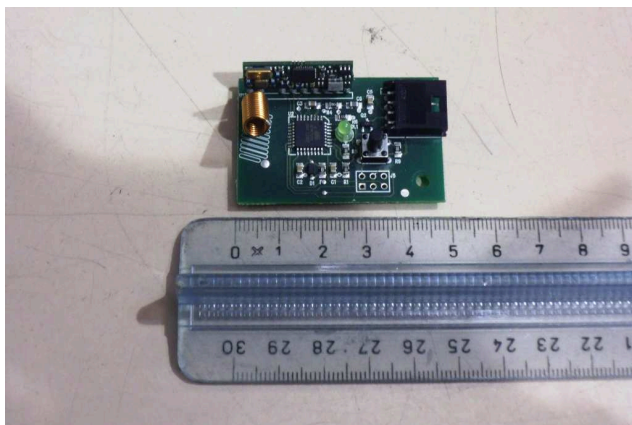
EUT IDENTIFICATION (TLC UNIT)



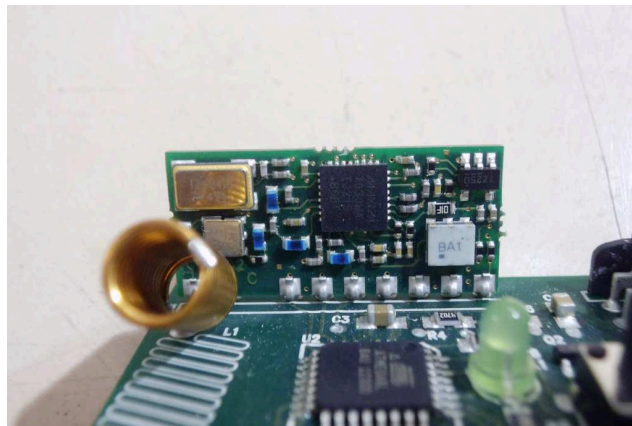
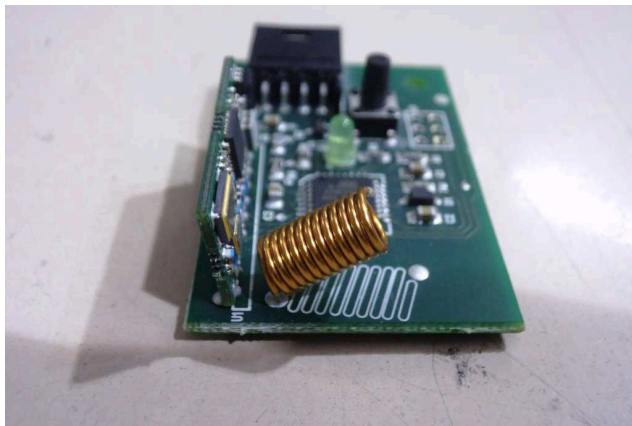


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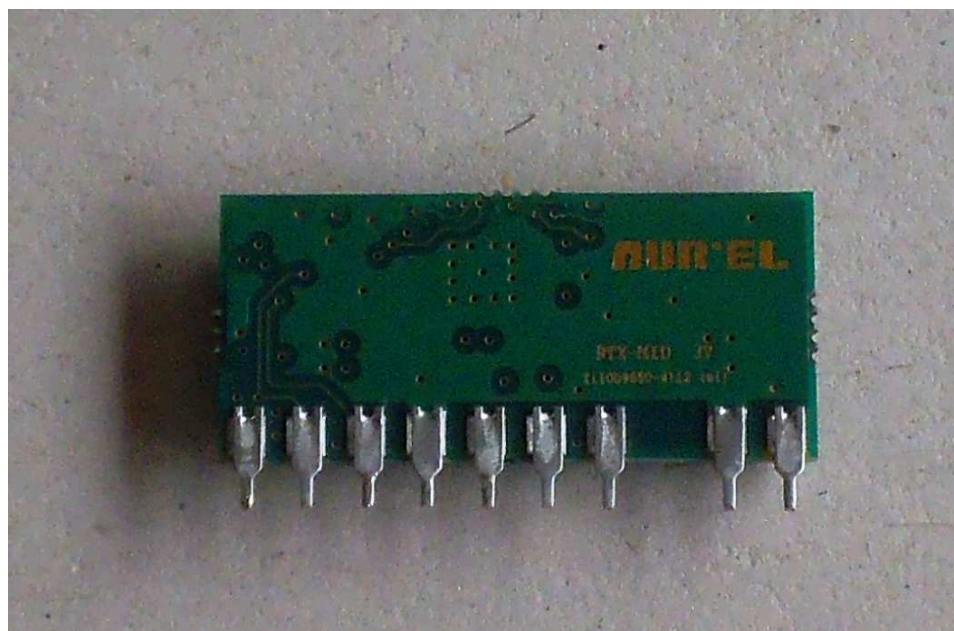
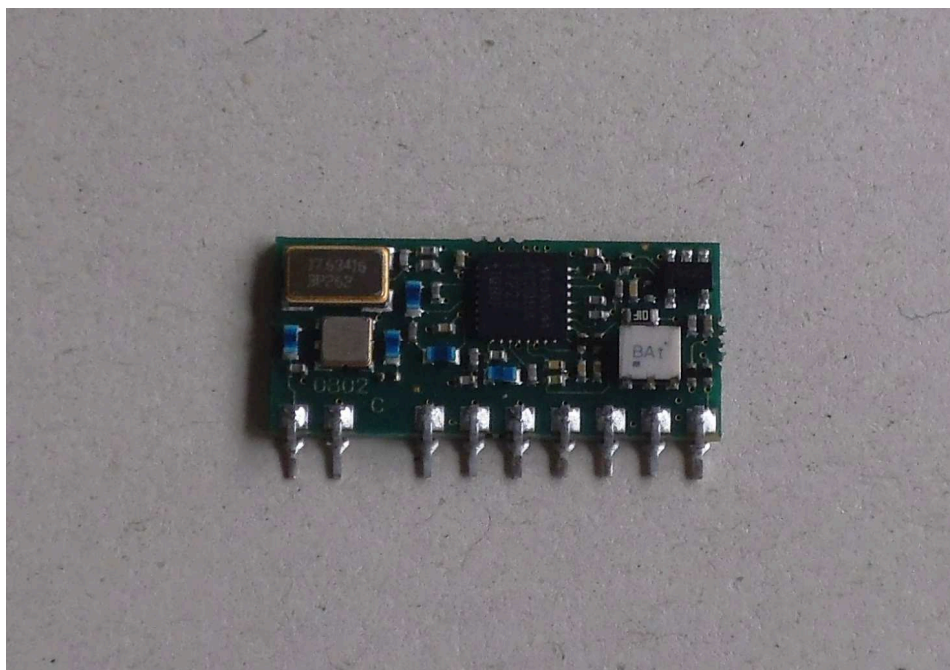
EUT IDENTIFICATION (BRIDGE UNIT)

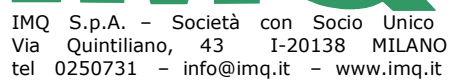


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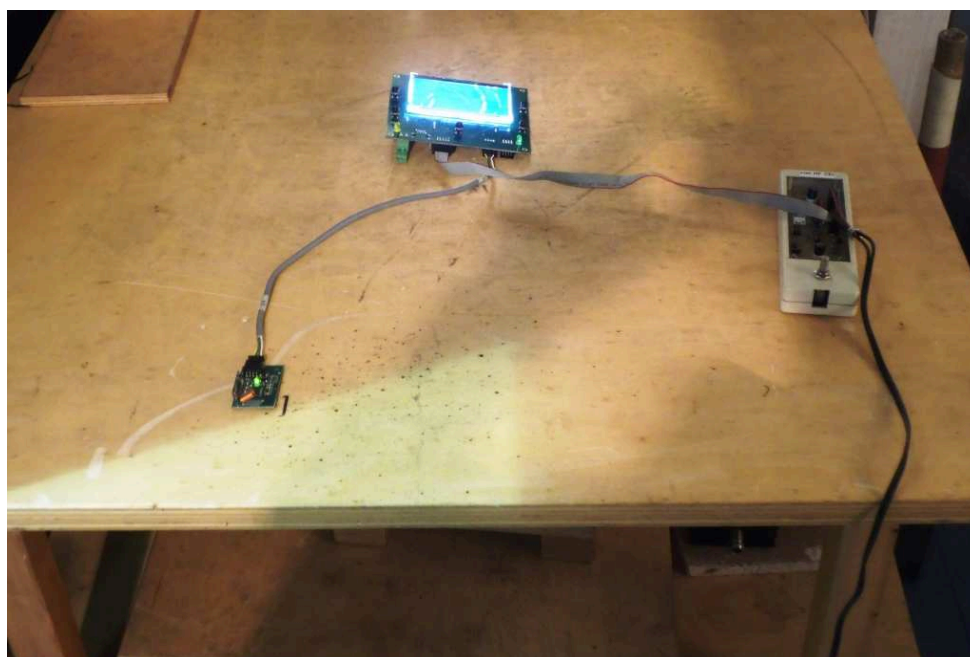
RADIO MODULE AUR.EL





SET-UP

Test set-up conducted emission test

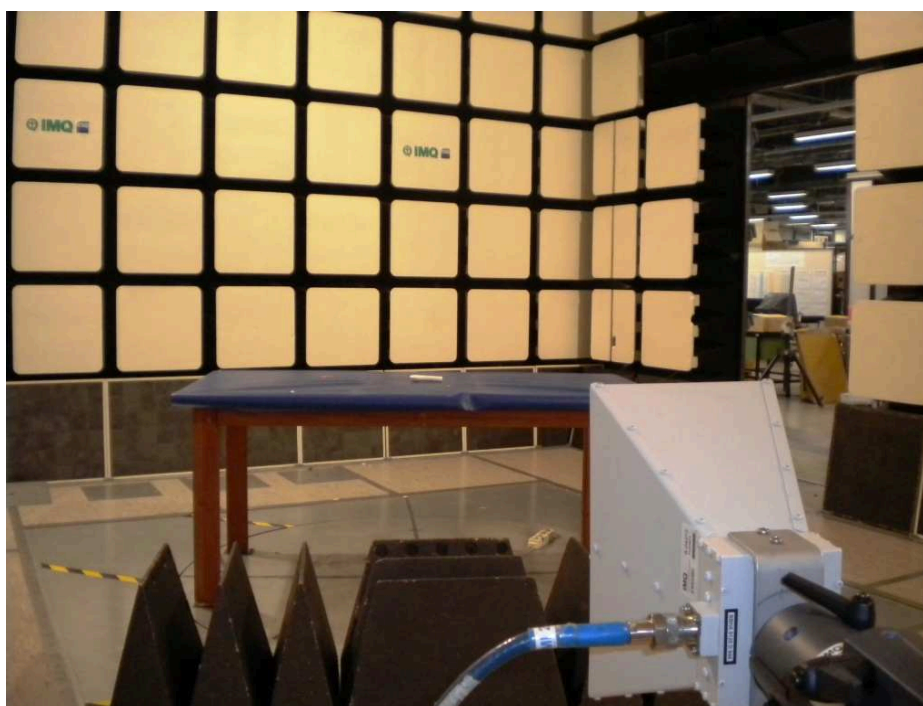
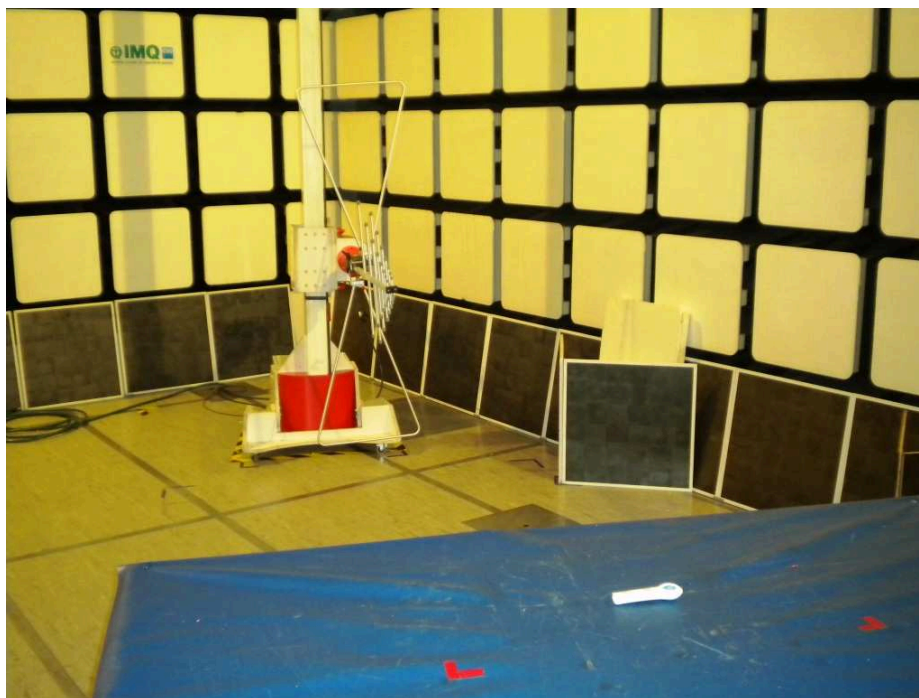


SET-UP

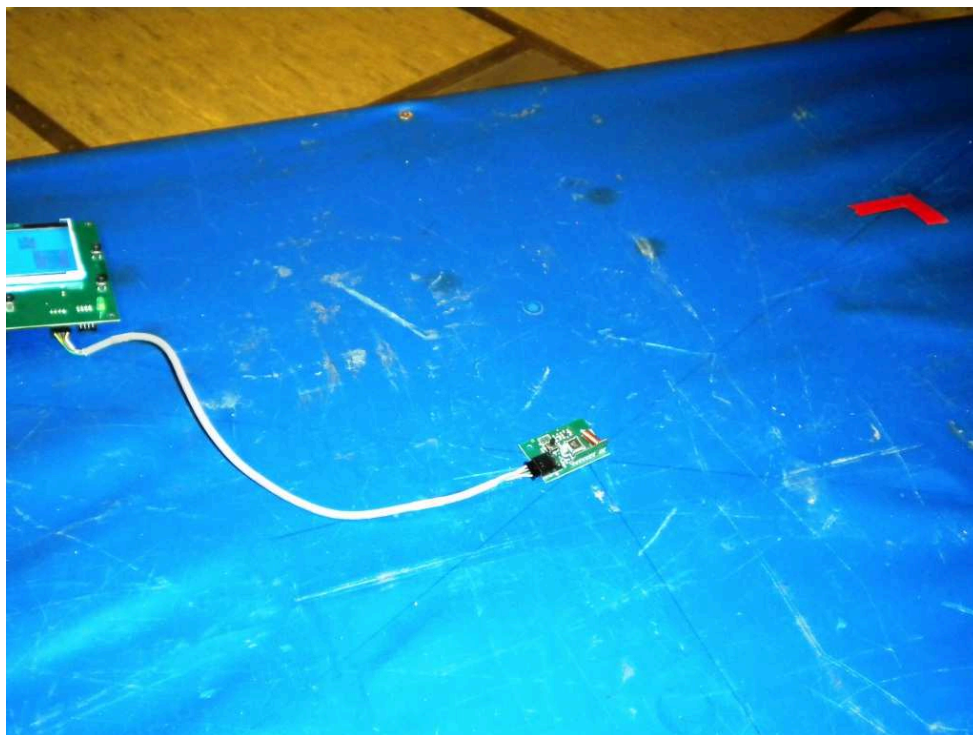
Test set-up radiated emission test (TLC UNIT)



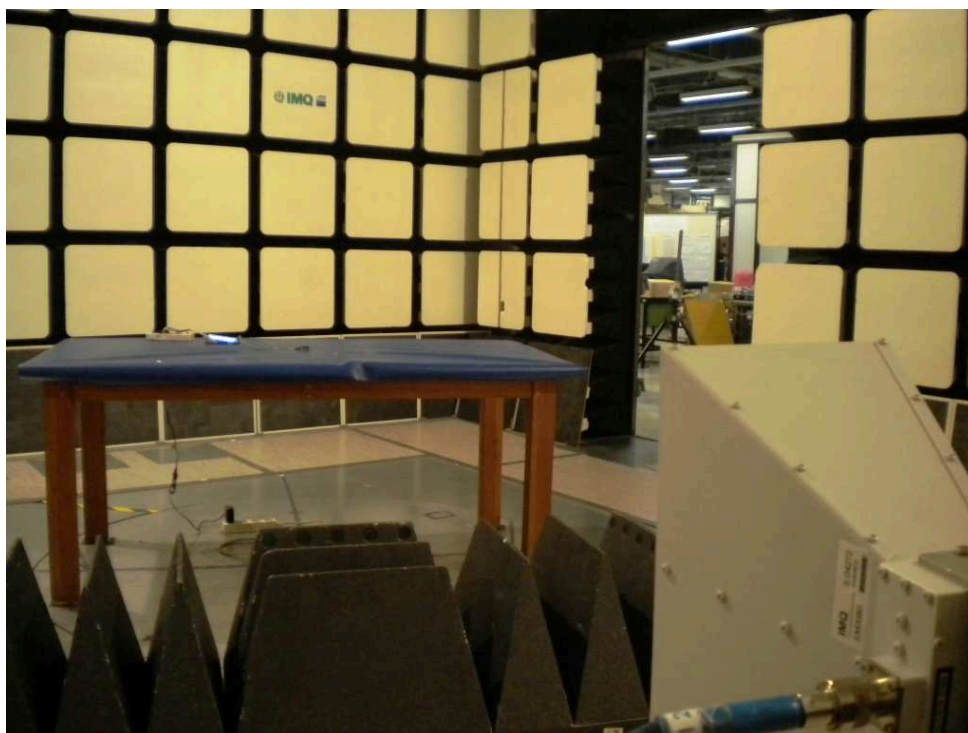
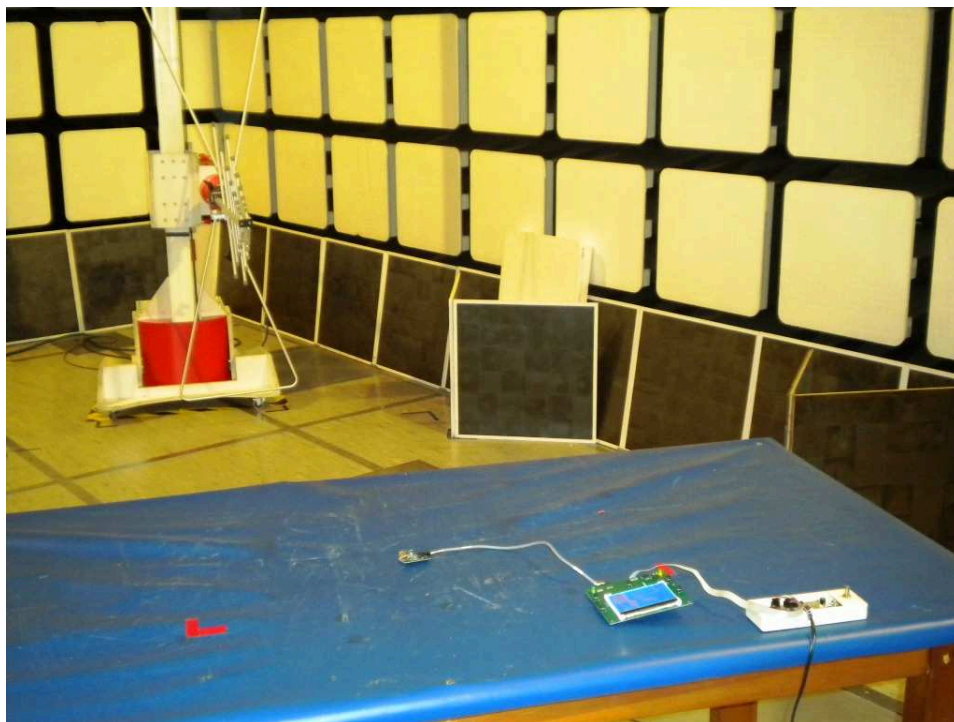
Test set-up radiated emission test (TLC UNIT)



Test set-up radiated emission test (BRIDGE UNIT)



Test set-up radiated emission test (TLC UNIT)



END OF REPORT