



**Telecommunications & Telematics  
for Transports Lab.**

## TEST REPORT

Ref. No. ARSI00227

Date: 2009-07-03

Measurements performed in accordance with:



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

PRODUCT : ZigBee module general purpose

TESTED MODEL : SPZB260C-PRO  
SPZB260A-PRO

FCC ID : S9NZB260B

APPLICANT : STMicroelectronics – Via C. Olivetti, 2 – I-20041 Agrate Brianza (MI)

MANUFACTURER : STMicroelectronics – Via C. Olivetti, 2 – I-20041 Agrate Brianza (MI)

TRADEMARK : STMicroelectronics

OTHER INFORMATION : Testing dates : 2008-12-02 - 2009-07-02  
Tested samples No. : 2  
Testing Laboratory : IMQ S.p.A. Via Quintiliano, 43 I-20138 MILANO

Tested by : R. Radice Signature: *Roberto Radice* Date: 2009-07-03  
R. Colombo

Checked by: (EMC and R&TTE Lab. Deputy) Signature: *Roberto Colombo* Date: 2009-07-03

### Revision Sheet

Release No.	Date	Revision Description
Rev. 0	2009-07-03	Test Results and Evaluation Report

NOTICE: The results of tests and checks reported in this Test Report refer exclusively to the samples tested and described in the Report itself. This report shall not be reproduced partially or in its entirety without the written approval of IMQ S.p.A.

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

# CONTENTS

<b>1</b>	<b>General Description of Equipment under Test.....</b>	<b>1-3</b>
1.1	APPLICANT.....	1-3
1.2	MANUFACTURER.....	1-3
1.3	EQUIPMENT CLASSIFICATION.....	1-3
1.4	BASIC DESCRIPTION OF EQUIPMENT UNDER TEST .....	1-4
1.5	FEATURE OF EQUIPMENT UNDER TEST.....	1-5
<b>2</b>	<b>Test Configuration of Equipment under Test .....</b>	<b>2-7</b>
2.1	ENVIRONMENTAL CONDITIONS .....	2-7
2.2	DESCRIPTION OF SUPPORT EQUIPMENT.....	2-7
2.3	INTERFACE IDENTIFICATION AND CONNECTION DIAGRAM OF TEST SYSTEM.....	2-8
<b>3</b>	<b>Operation of Equipment under Test .....</b>	<b>3-9</b>
3.1	OPERATING TEST CONDITIONS.....	3-9
<b>4</b>	<b>Tests Identification and Results .....</b>	<b>4-10</b>
4.1	METHODS OF MEASUREMENT .....	4-12
4.2	FREQUENCY RANGE INVESTIGATED .....	4-12
<b>5</b>	<b>Measurements and Tests Data.....</b>	<b>5-13</b>
<b>6</b>	<b>Additional Technical Information.....</b>	<b>6-59</b>
6.1	ELECTROMAGNETICALLY RELEVANT COMPONENTS: ....	6-59
6.2	RFI SUPPRESSION DEVICES: .....	6-59
6.3	EMI PROTECTION DEVICES: .....	6-59
<b>7</b>	<b>Technical Documentation.....</b>	<b>7-60</b>
<b>8</b>	<b>Photographic Documentation .....</b>	<b>8-61</b>
8.1	EUT IDENTIFICATION .....	8-61
8.2	TEST SET-UP .....	8-64
<b>9</b>	<b>Measurement and Test Equipment Instrumentation.....</b>	<b>9-66</b>

# 1 GENERAL DESCRIPTION OF EQUIPMENT UNDER TEST

---

## 1.1 APPLICANT

---

<b>NAME</b>	STMicroelectronics
<b>ADDRESS</b>	Via C. Olivetti, 2 – I-20041 Agrate Brianza (MI)
<b>COUNTRY</b>	ITALY

## 1.2 MANUFACTURER

---

<b>NAME</b>	STMicroelectronics
<b>ADDRESS</b>	Via C. Olivetti, 2 – I-20041 Agrate Brianza (MI)
<b>COUNTRY</b>	ITALY

## 1.3 EQUIPMENT CLASSIFICATION

---

According to the definition 15.3 (o) EUT is a **Intentional Radiator operating within the bands 2400-2483,5 MHz** so it shall fulfil provisions of 47CFR Part 15 Subpart C – Intentional radiators – and Section 15.247.

## 1.4 BASIC DESCRIPTION OF EQUIPMENT UNDER TEST

Parameters	Value
Type of equipment :	<ul style="list-style-type: none"> <li>▪ ZigBee module general purpose</li> </ul>
Model:	<ul style="list-style-type: none"> <li>▪ SPZB260C-PRO</li> <li>▪ SPZB260A-PRO</li> </ul>
FCC ID. :	<ul style="list-style-type: none"> <li>▪ S9NZB260B</li> </ul>
Trade Name:	<ul style="list-style-type: none"> <li>▪ STMicroelectronics</li> </ul>
Data cable :	<ul style="list-style-type: none"> <li>▪ /</li> </ul>
Telecom cable :	<ul style="list-style-type: none"> <li>▪ /</li> </ul>
Power supply type :	<ul style="list-style-type: none"> <li>▪ DC 3.3V, 41,5mA max.</li> </ul>
AC power input cable :	<ul style="list-style-type: none"> <li>▪ /</li> </ul>
DC power input cable :	<ul style="list-style-type: none"> <li>▪ /</li> </ul>

Model	Description
SPZB260C-PRO	Provided with external ANTENOVA Antenna connected with RF reverse SMA connector
SPZB260A-PRO	provided with integrated MURATA Antenna
Remark: Between the two models no changes to the basic frequency determining and stabilizing circuitry (including clock and data rates), frequency multiplication stages, basic modulator circuit or maximum conducted output power.  No simultaneous transmission is possible.	

## 1.5 FEATURE OF EQUIPMENT UNDER TEST

Power specification	▪ 3.3 V dc
Operating frequency:	▪ 2405 ÷ 2480 MHz (16 Channels)
Maximum RF output power:	▪ 5.39 dBm
Modulation:	▪ O-QPSK
Channel Spacing:	▪ >1 MHz
Antenna:	▪ Dedicated antenna (0,4 dBi gain) Murata mod. ANCV12G44SAA127 ▪ Dedicated antenna (2,2 dBi gain) Antenova mod. Titanic 2.4GHz Part No. 2010B6090-01
RX sensitivity:	▪ -92 dBm
Main SW identification	▪ /
Main HW Board identification	▪ /
Peripherals included (for system application)	▪ None
Interfaces :	▪ None
Integrated interfaces :	▪ None
AC adapter:	▪ None

### CHANNEL CONFIGURATION

Channel (No.)	Frequency (MHz)
11	2405.00
12	2410.00
13	2415.00
14	2420.00
15	2425.00
16	2430.00
17	2435.00
18	2440.00
19	2445.00
20	2450.00
21	2455.00
22	2460.00
23	2465.00
24	2470.00
25	2475.00
26	2480.00

## 2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST

---

### 2.1 ENVIRONMENTAL CONDITIONS

---

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

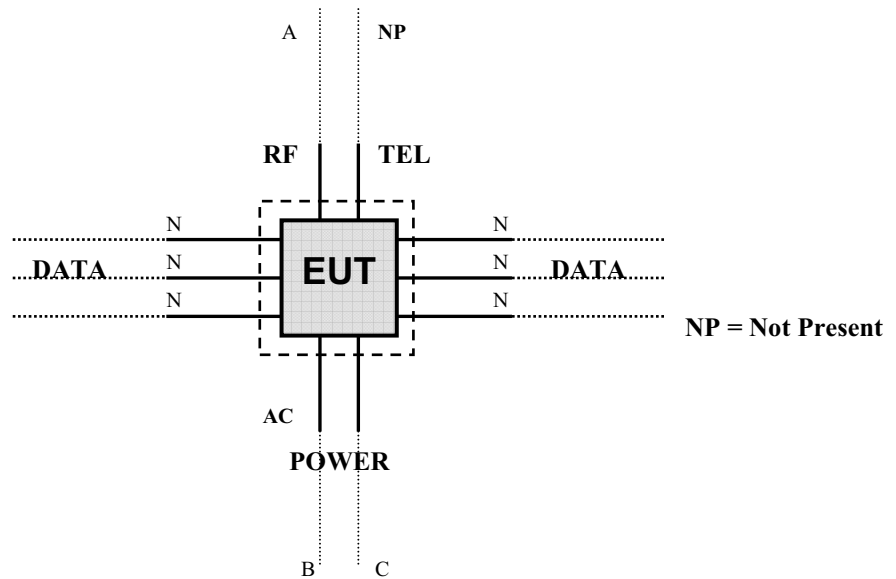
### 2.2 DESCRIPTION OF SUPPORT EQUIPMENT

---

Here following the details concerning equipment needed for correct operation or loading of the EUT:

EQUIPMENT	MANUFACTURER	MODEL
Personal Computer	IBM	-----
Test Jig	STMicroelectronics	-----
AC/DC Adapter	STMicroelectronics	GSPPJ-5215STM/1

## 2.3 INTERFACE IDENTIFICATION AND CONNECTION DIAGRAM OF TEST SYSTEM



#	Interface	Description	Maximum length	Ref. Document
1	Enclosure	Open frame board	/	/
2	AC mains power input/output port	Port not present	/	/
3	DC power port	3,3V dc furnished on test jig board; ZigBee module: 3.3 V dc	/	/
4	Signal / control port	Port not present	/	/
5	Antenna port (RF)	Dedicated SMD antenna integrated on ZigBee module & external dedicated Antenna	/	antenna description



### 3 OPERATION OF EQUIPMENT UNDER TEST

---

#### 3.1 OPERATING TEST CONDITIONS

---

Ref.	Description
#1	Continuous transmission with Boost mode activated (single channel transmission)

## 4 TESTS IDENTIFICATION AND RESULTS

**TABLE 1 : SUMMARY OF TESTS**

CFR47 Part 15 Section	Title	Operating condition	Result	Test No.
15.203 15.247 (b)(4)(i)	Antenna Requirements	/	PASS	1
15.207 (a)	Conducted Emission	#1	PASS	2
15.209 (a) (f)	Radiated Emission	#1	PASS	3
15.247 (a)	Frequency Hopping Spread Spectrum Specifications			
15.247(a)(1)(iii)	Number of Hopping Channels Used	Not applicable		
15.247(a)	20 dB Bandwidth	Not applicable		
15.247(a)(1)	Carrier frequency (Hopping Channel) Separation	Not applicable		
15.247(a)(1)(iii)	Time occupancy (Dwell Time) of Each Channel (ch) within a $0,4 \times N_{ch}$ (sec) Period	Not applicable		
15.247(a)(2)	6dB Minimum Bandwidth	#1	PASS	4
15.247(b)	Maximum Peak Output Power			
15.247(b) (1)	Peak Output Power	#1	PASS	5
15.247(b) (4)	Antenna gain	Not applicable		
15.247(c)	Operation with directional antenna gains greater than 6 dBi	Not applicable		
15.247 (d)	100 kHz Bandwidth of Frequency Band Edges	#1	PASS	6

CFR47 Part 15 Section	Title	Operating condition	Result	Test No.
15.247 (d)	Conducted Emission	#1	PASS	7
15.247 (e)	Power Spectral Density	#1	PASS	8
15.247 (f)	Hybrid systems	Not applicable		
15.247 (g)	FHSS Transmission characteristics	Not applicable		
15.247 (h)	Recognition of occupied channel and multiple transmission system	Not applicable		
15.247(i) (§ 47CFR 1.1307(b)(1))	RF humane exposure	#1	PASS	9

## 4.1 METHODS OF MEASUREMENT

---

All compliance measurements have been carried out using the procedures described in the standard ANSI C63.4-2003 (excluding sub-par. 4.1.5.2, 5.7.9 and 14) 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 Test Table

## 4.2 FREQUENCY RANGE INVESTIGATED

---

- a. Conducted emission tests : from 150 kHz to 30 MHz.
- b. Radiated emission tests : from 150 kHz to tenth harmonic of fundamental

## 5 MEASUREMENTS AND TESTS DATA

TEST No. 1	Title "Antenna Requirements"	47CFR Part 15 Ref. Section
		15.203 / 15.204
<b>TEST REQUIREMENTS</b>	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	▪ 2	
Antenna type	<ul style="list-style-type: none"> <li>▪ Dedicated SMD antenna integrated on ZigBee MODULE</li> <li>▪ External dedicated antenna fitted with a reverse SMA connector and a blade made of flexible material that can be rotated 360 degree</li> </ul>	
Maximum total gain	▪ 2,2 dBi	
External power amplifiers	▪ Not present	
Antenna Description		
No.	Manufacturer	Model Type
1	ANTENOVA	Titanic 2.4GHz Part No. 2010B6090-01
2	MURATA	ANCV12G44SAA127

### Test Result:

The transmitter meets the requirements of section 15.203 and 15.204

TEST No. 2	Title "Conducted emission"	47CFR Part 15 Ref. Section
		15.207
TEST REQUIREMENTS	Test setup	ANSI C63.4
	Limits of mains terminal disturbance voltage	15.207 (a)
	Frequency range	150 kHz – 30 MHz
	IF bandwidth	9 kHz
	EMC class	B

TEST DATA	PORT UNDER TEST	OPERATING CONDITION	RESULT
	AC mains power input port	#1	Complies
	Note: In search of max noise (phase(s) and neutral) for both the models type SPZB260C-PRO and SPZB260A-PRO		

- 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 AVAREGE 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).

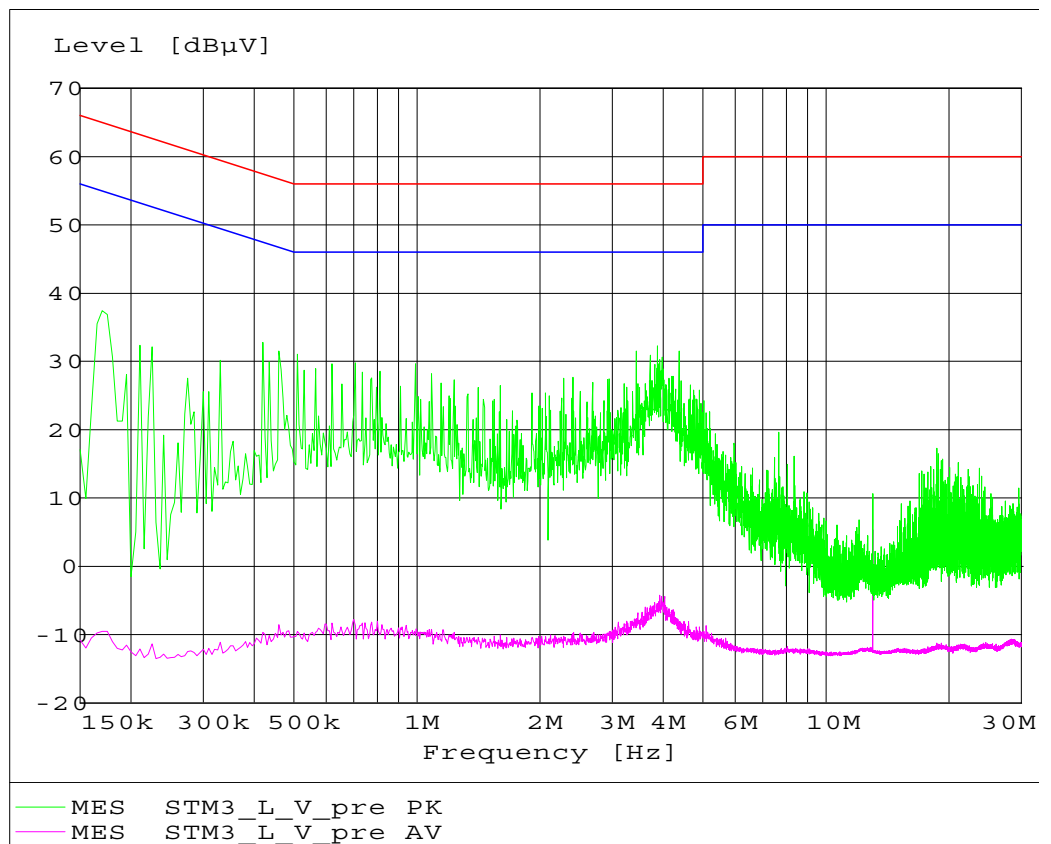
**Test Result:**

Within the specifications

### MEASUREMENTS RESULTS

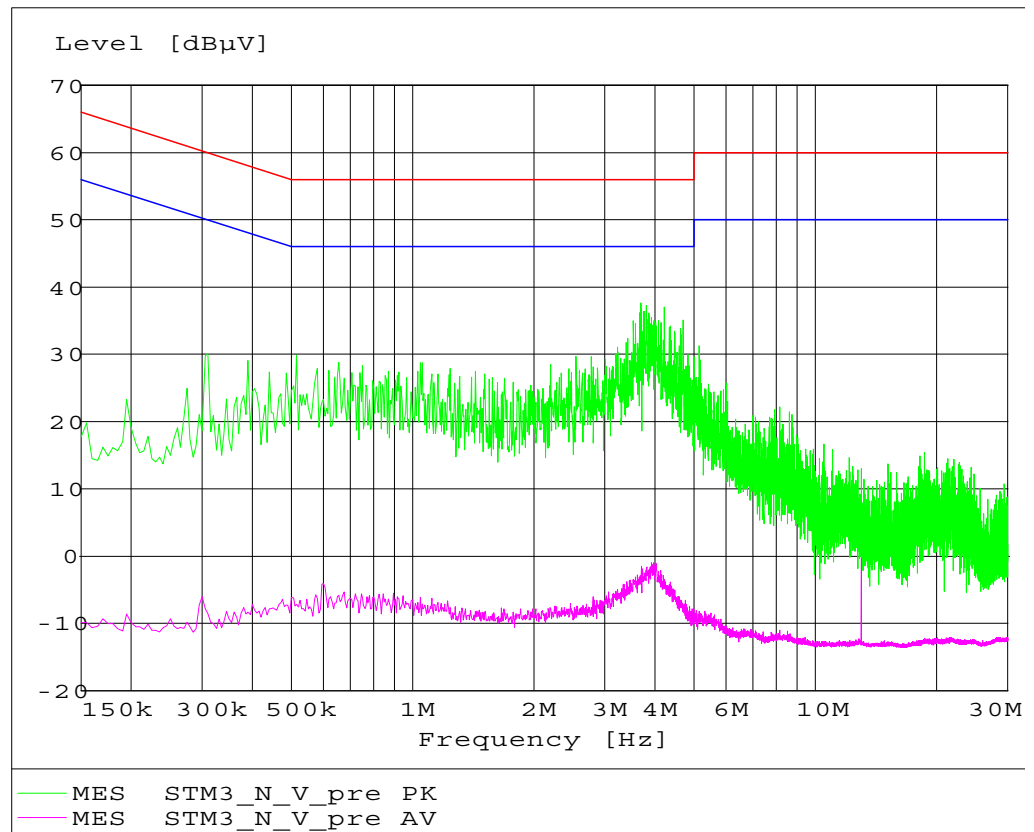
#### CONDUCTED DISTURBANCE ON AC MAINS POWER PORT OF AC/DC ADAPTER

##### MEASURE LINE: PHASE



### CONDUCTED DISTURBANCE ON AC MAINS POWER PORT OF AC/DC ADAPTER

MEASURE LINE: NEUTRAL





TEST No. 3	Title "Radiated disturbances"	47CFR Part 15 Ref. Section
		15.209
<b>TEST REQUIREMENTS</b>	Test setup	ANSI C63.4
	Test facility	Anechoic chamber
	Test distance	3 m
	Limits for radiated disturbances	15.209 (a)
	Frequency range	150 kHz to 1 GHz
	IF bandwidth (below 30 MHz)	9 kHz
	IF bandwidth (below 1000 MHz)	120 kHz
	IF bandwidth (above 1000 MHz)	1 MHz
	EMC class	B
	(*) 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) = 40log (300meter / 3meter) = +80db Extrapolation (dB) = 40log (30meter / 3meter) = +40db	

- 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).

**LIMITS FOR SPURIOUS**

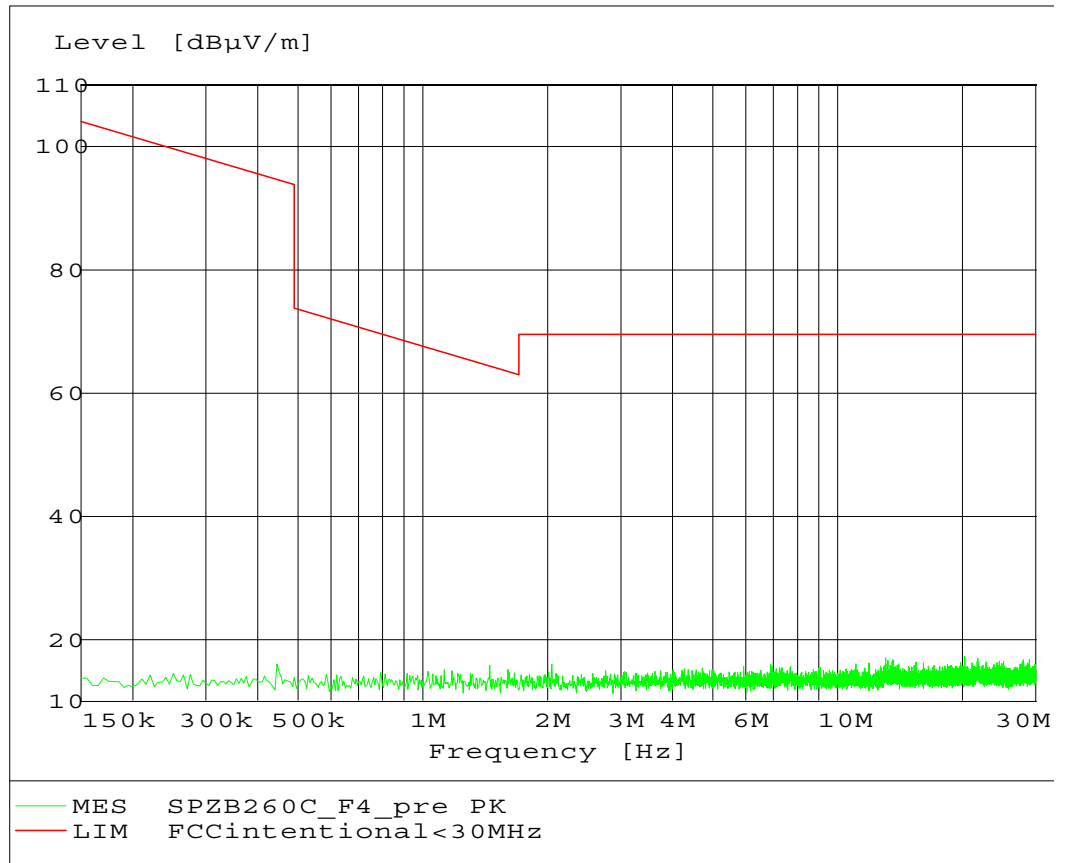
Band of operations	Peak (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)
Restricted bands (par. 15.205)	74,00	54,00
Other bands	According to 15.209 or fundamental -20dB (which is greater)	According to 15.209 or fundamental -20dB (which is greater)

**Tested samples**

SAMPLE	
1)	Model SPZB260C-PRO provided with ANTENOVA Antenna
2)	Model SPZB260A-PRO provided with MURATA Antenna

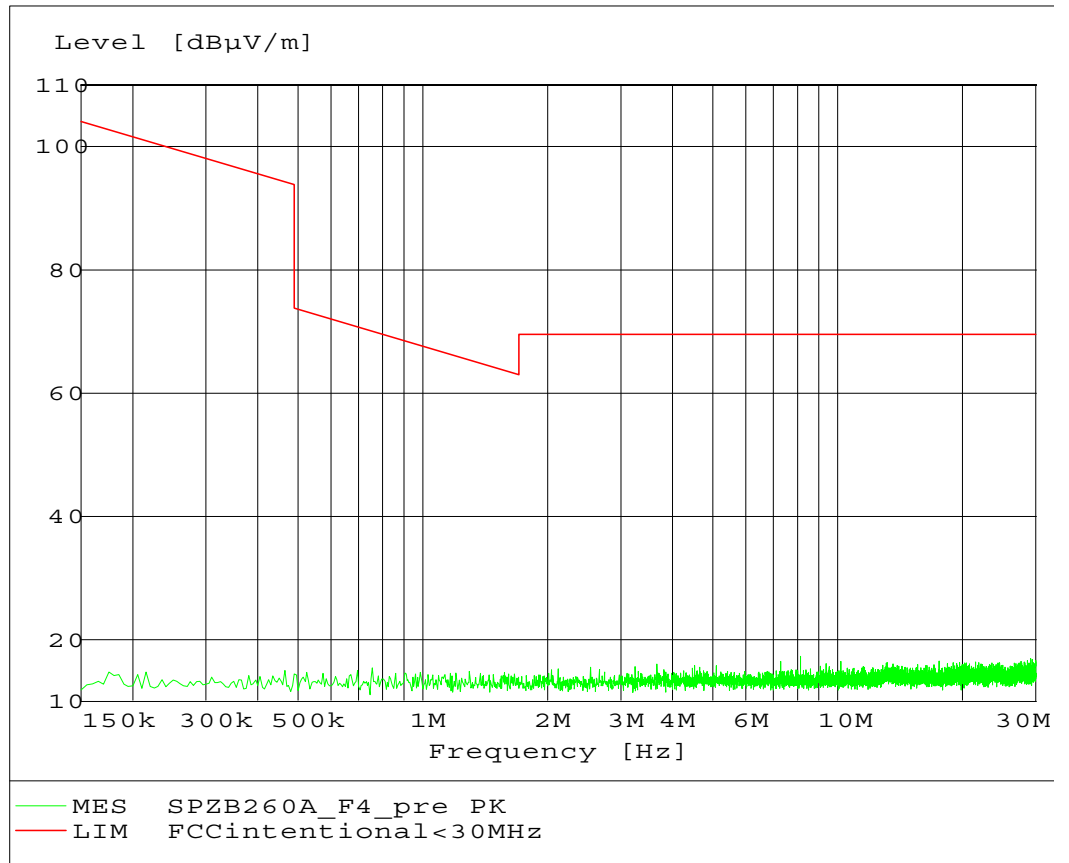
**MEASUREMENTS RESULTS (below 30 MHz)**

**Model SPZB260C-PRO**



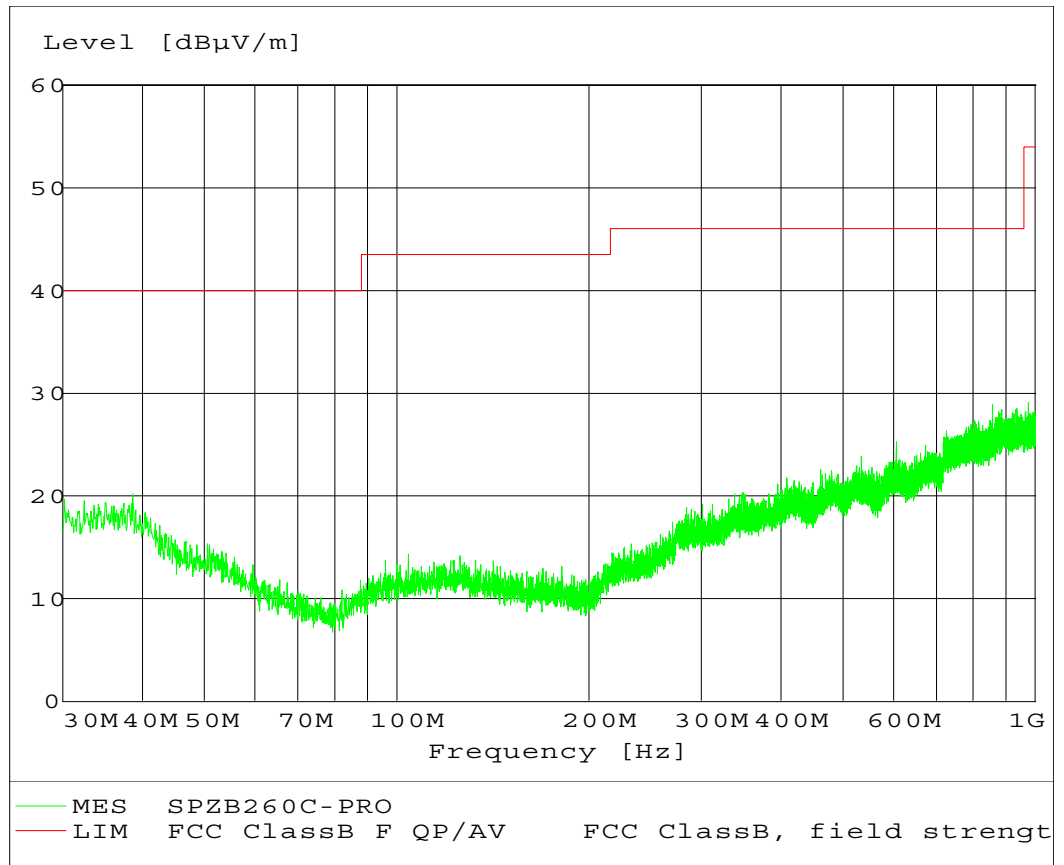
### MEASUREMENTS RESULTS (below 30 MHz)

#### Model SPZB260A-PRO



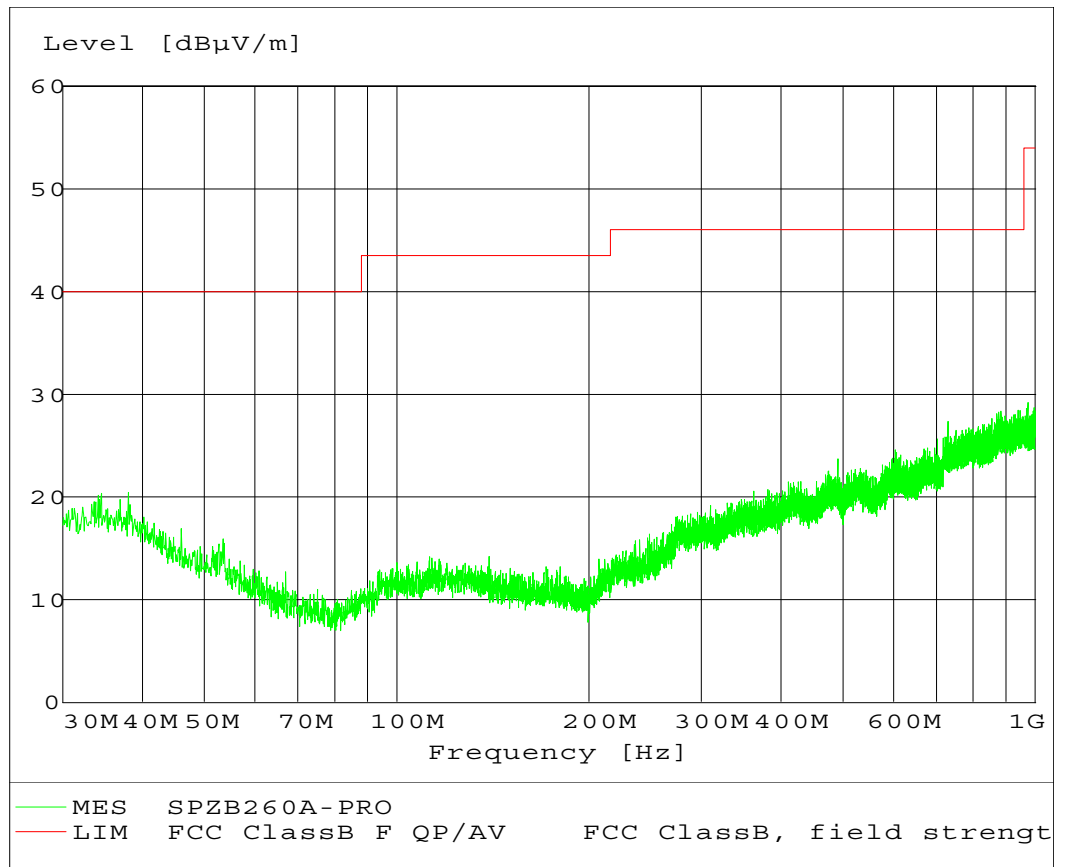
**MEASUREMENTS RESULTS (below 1000 MHz)**

**Model SPZB260C-PRO**



**MEASUREMENTS RESULTS (below 1000 MHz)**

**Model SPZB260A-PRO**



**MEASUREMENTS RESULTS (1000 MHz to 24800 MHz)**
**Module type SPZB260A-PRO:**

Channel n°11: 2405,00 MHz) (with Dedicated SMD antenna MURATA)

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

Frequency (MHz)	Measured Level (dB $\mu$ V/m)	Limit ( $\mu$ Volt/meter)	Limit (dB $\mu$ V/m)	Margin (dB)	Pol.
2405 (fundamental)	96,67	-----	-----	-----	Horizontal
4810	50,23	5000	74,00	23,77	Horizontal
7215	54,00	5000	74,00	20,00	Horizontal
9620	< 40,00	5000	74,00	> 34,00	Horizontal
12025	< 40,00	5000	74,00	> 34,00	Horizontal
f>12030	No spurious				

**AVERAGE FACTOR**

T. Pulse (ms)	TX on + TX off (ms)	Duty cycle	Average Factor (dB)
3,12	100	0,0312	-30,11

**AVERAGE RESULT (RBW=1MHz; VBW=10Hz)**

Frequency (MHz)	Measured Level (dB $\mu$ V/m)	Limit ( $\mu$ Volt/meter)	Limit (dB $\mu$ V/m)	Margin (dB)	Pol.
2405 (fundamental)	66,56	-----	-----	-----	Horizontal
4810	20,12	500	54,00	33,88	Horizontal
7215	23,89	500	54,00	30,11	Horizontal

Channel n°20: 2450,00 MHz (with Dedicated SMD anten na MURATA)

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

Frequency (MHz)	Measured Level (dB $\mu$ V/m)	Limit ( $\mu$ Volt/meter)	Limit (dB $\mu$ V/m)	Margin (dB)	Pol.
2450 (fundamental)	96,54	-----	-----	-----	Horizontal
4900	49,95	5000	74,00	24,05	Horizontal
7350	52,66	5000	74,00	21,34	Horizontal
9800	< 40,00	5000	74,00	> 34,00	Horizontal
12250	< 40,00	5000	74,00	> 34,00	Horizontal
f>12260	No spurious				

**AVERAGE FACTOR**

T. Pulse (ms)	TX on + TX off (ms)	Duty cycle	Average Factor (dB)
3,12	100	0,0312	-30,11

**AVERAGE RESULT (RBW=1MHz; VBW=10Hz)**

Frequency (MHz)	Measured Level (dB $\mu$ V/m)	Limit ( $\mu$ Volt/meter)	Limit (dB $\mu$ V/m)	Margin (dB)	Pol.
2450 (fundamental)	66,43	-----	-----	-----	Horizontal
4900	19,84	500	54,00	34,16	Horizontal
7351	22,55	500	54,00	31,45	Horizontal



Channel n°26: 2480,00 MHz (with Dedicated SMD anten na MURATA)

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

Frequency (MHz)	Measure Level (dB $\mu$ V/m)	Limit ( $\mu$ Volt/meter)	Limit (dB $\mu$ V/m)	Margin (dB)	Pol.
2480 (fundamental)	94,74	-----	-----	-----	Horizontal
4960	50,06	5000	74,00	23,94	Horizontal
7440	51,40	5000	74,00	22,66	Horizontal
9920	< 40,00	5000	74,00	> 34,00	Horizontal
12400	< 40,00	5000	74,00	> 34,00	Horizontal
f>12400	No spurious				

**AVERAGE FACTOR**

T. Pulse (ms)	TX on + TX off (ms)	Duty cycle	Average Factor (dB)
3,12	100	0,0312	-30,11

**AVERAGE RESULT (RBW=1MHz; VBW=10Hz)**

Frequency (MHz)	Measured Level (dB $\mu$ V/m)	Limit ( $\mu$ Volt/meter)	Limit (dB $\mu$ V/m)	Margin (dB)	Pol.
2480 (fundamental)	64,63	-----	-----	-----	Horizontal
4960	19,95	500	54,00	34,05	Horizontal
7440	21,29	500	54,00	32,71	Horizontal

**MEASUREMENTS RESULTS (1000 MHz to 24800 MHz)**
**Module type SPZB260C-PRO:**

Channel n°11: 2405,00 MHz (with Dedicated antenna A NTENOVA)

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

Frequency (MHz)	Measured Level (dB $\mu$ V/m)	Limit ( $\mu$ Volt/meter)	Limit (dB $\mu$ V/m)	Margin (dB)	Pol.
2405 (fundamental)	97,96	-----	-----	-----	Vertical
4810	49,94	5000	74,00	24,06	Vertical
7215	61,10	5000	74,00	12,90	Horizontal
9620	< 40,00	5000	74,00	> 34,00	Vertical
12025	< 40,00	5000	74,00	> 34,00	Vertical
f>12030	No spurious				

**AVERAGE FACTOR**

T. Pulse (ms)	TX on + TX off (ms)	Duty cycle	Average Factor (dB)
3,12	100	0,0312	-30,11

**AVERAGE RESULT (RBW=1MHz; VBW=10Hz)**

Frequency (MHz)	Measured Level (dB $\mu$ V/m)	Limit ( $\mu$ Volt/meter)	Limit (dB $\mu$ V/m)	Margin (dB)	Pol.
2405 (fundamental)	67,87	-----	-----	-----	Vertical
4810	19,83	500	54,00	34,17	Vertical
7215	30,99	500	54,00	23,01	Horizontal

Channel n°20: 2450,00 MHz (with Dedicated antenna A NTENOVA)

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

Frequency (MHz)	Measured Level (dB $\mu$ V/m)	Limit ( $\mu$ Volt/meter)	Limit (dB $\mu$ V/m)	Margin (dB)	Pol.
2450 (fundamental)	98,55	-----	-----	-----	Vertical
4900	49,89	5000	74,00	24,05	Vertical
7350	59,47	5000	74,00	21,34	Horizontal
9800	< 40,00	5000	74,00	> 34,00	Vertical
12250	< 40,00	5000	74,00	> 34,00	Vertical
f>12260	No spurious				

**AVERAGE FACTOR**

T. Pulse (ms)	TX on + TX off (ms)	Duty cycle	Average Factor (dB)
3,12	100	0,0312	-30,11

**AVERAGE RESULT (RBW=1MHz; VBW=10Hz)**

Frequency (MHz)	Measured Level (dB $\mu$ V/m)	Limit ( $\mu$ Volt/meter)	Limit (dB $\mu$ V/m)	Margin (dB)	Pol.
2450 (fundamental)	68,44	-----	-----	-----	Vertical
4900	19,78	500	54,00	34,22	Vertical
7351	29,36	500	54,00	24,64	Horizontal

Channel n°26: 2480,00 MHz (with Dedicated antenna A NTENOVA)

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

Frequency (MHz)	Measure Level (dB $\mu$ V/m)	Limit ( $\mu$ Volt/meter)	Limit (dB $\mu$ V/m)	Margin (dB)	Pol.
2480 (fundamental)	98,69	-----	-----	-----	Vertical
4960	52,58	5000	74,00	21,42	Vertical
7440	56,43	5000	74,00	17,57	Vertical
9920	< 40,00	5000	74,00	> 34,00	Vertical
12400	< 40,00	5000	74,00	> 34,00	Vertical
f>12400	No spurious				

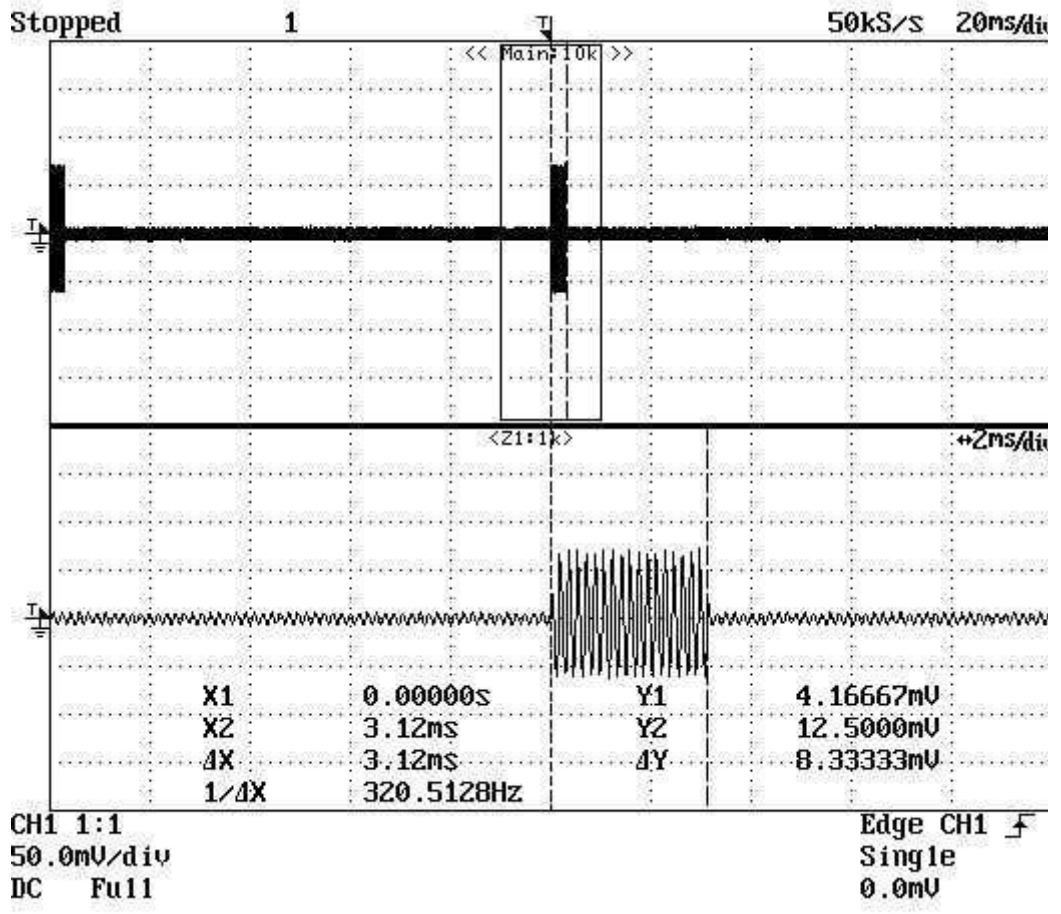
**AVERAGE FACTOR**

T. Pulse (ms)	TX on + TX off (ms)	Duty cycle	Average Factor (dB)
3,12	100	0,0312	-30,11

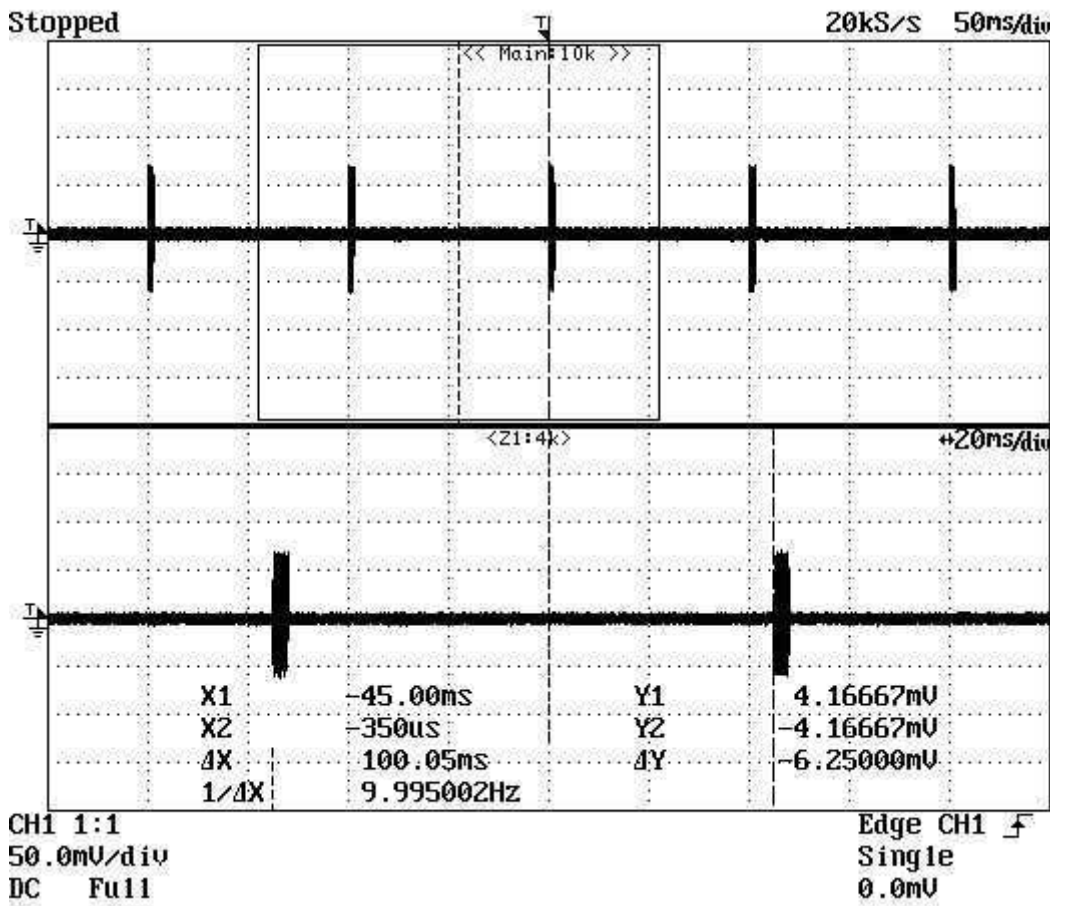
**AVERAGE RESULT (RBW=1MHz; VBW=10Hz)**

Frequency (MHz)	Measured Level (dB $\mu$ V/m)	Limit ( $\mu$ Volt/meter)	Limit (dB $\mu$ V/m)	Margin (dB)	Pol.
2480 (fundamental)	68,58	-----	-----	-----	Vertical
4960	22,47	500	54,00	31,53	Vertical
7440	26,32	500	54,00	27,68	Vertical

**T. PULSE ON: 3,12ms**



**TX ON + TX OFF : 100ms**



TEST No.4	Title	47CFR Part 15 Ref. Section
		"6 dB Bandwidth"
TEST SET-UP & REQUIREMENTS	Spectrum analyzer settings	
	Span	4 MHz
	Resolution (or IF) Bandwidth (RBW)	100 kHz
	Video (or Average) Bandwidth (VBW)	300 kHz
	Sweep time	2,5 ms
	Detector function	Peak
	Trace	max hold
	Attenuator	/
	LIMIT	-----

The EUT is set to transmit has its maximum data rate.

The transmitter output was connected to the spectrum analyzer through a test fixture (radio frequency coupling device associated with the dedicated antenna of the equipment under test)

The Channel bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6 dB.

#### Test Result:

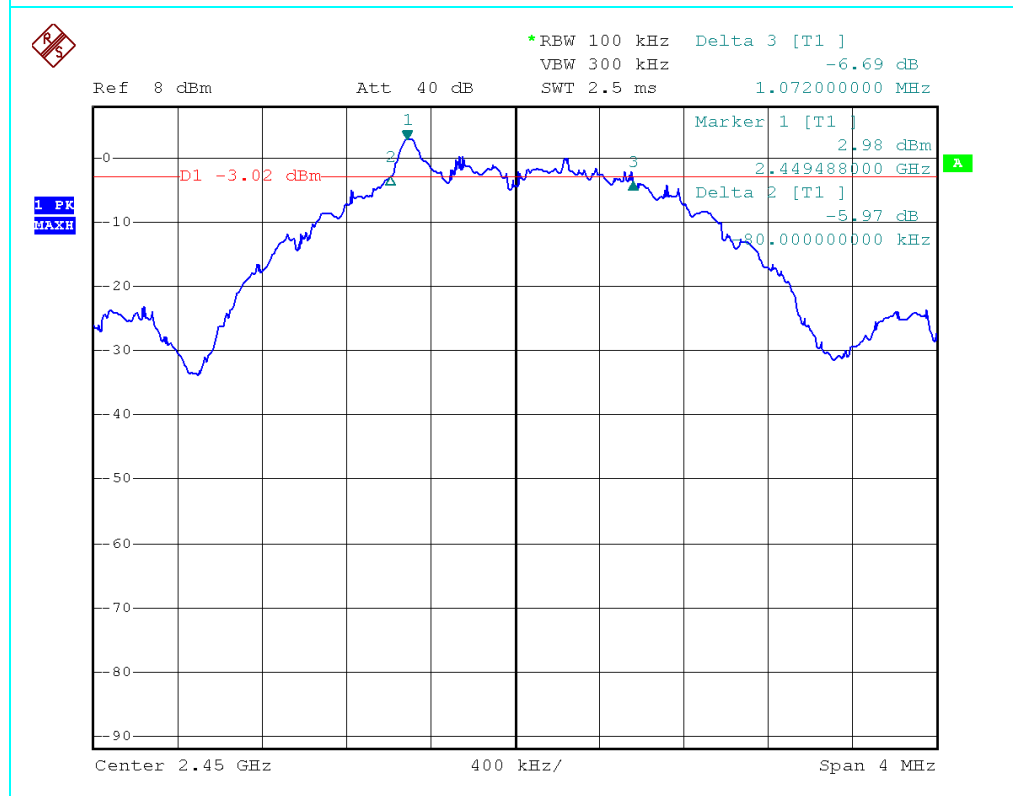
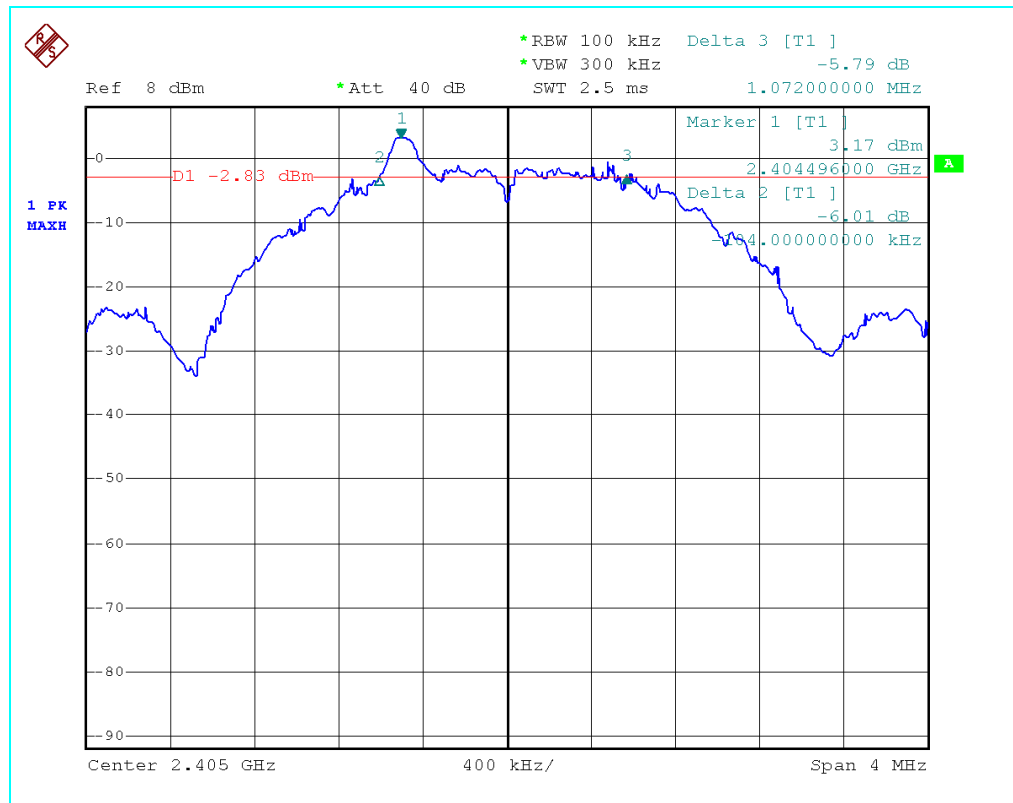
The Test results is identical for both the models type SPZB260C-PRO and SPZB260A-PRO

Channel (No.)	Frequency (MHz)	Channel Bandwidth (kHz)	Plot (No.)
11	2405,00	1176	1
20	2450,00	1152	2
26	2480,00	1192	3

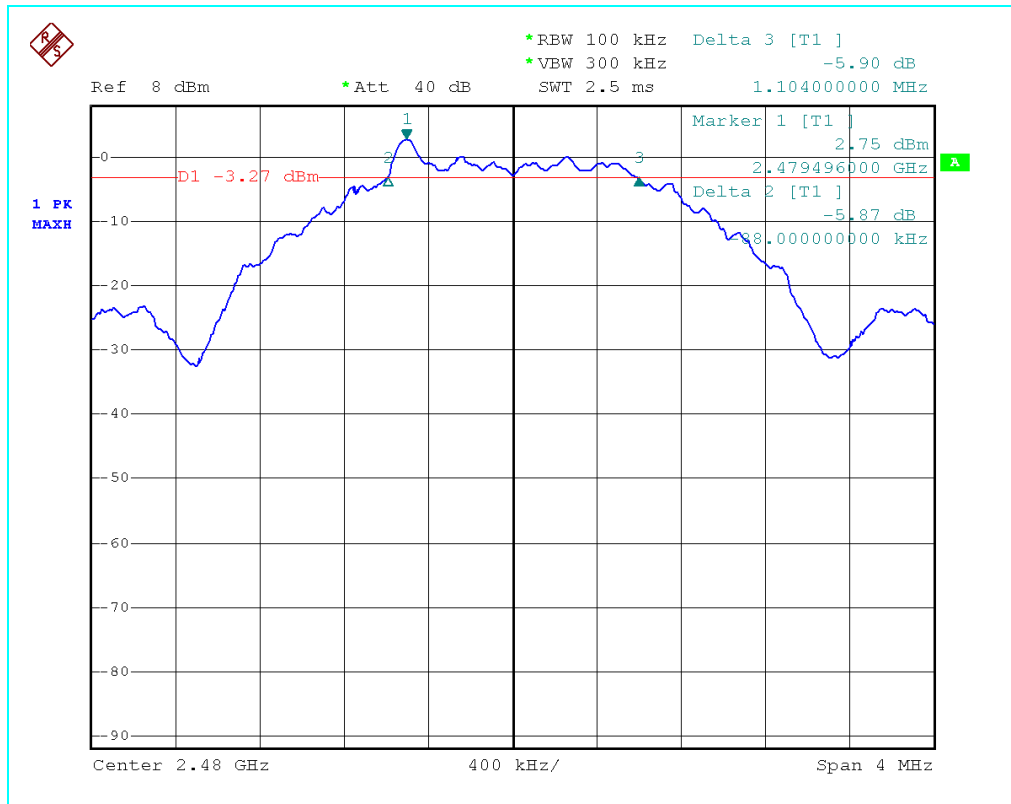
#### Tested samples

SAMPLE
1) Model SPZB260C-PRO provided with ANTENOVA Antenna
2) Model SPZB260A-PRO provided with MURATA Antenna

Plot No. 1÷3:







TEST No.5	Title	47CFR Part 15 Ref. Section
		“ Maximum Peak Output Power with External Antenna (De Facto EIRP)”
<b>TEST SET-UP &amp; REQUIREMENTS</b>	<b>Spectrum analyzer settings</b>	
	Span	40 MHz
	Resolution (or IF) Bandwidth (RBW)	10 MHz
	Video (or Average) Bandwidth (VBW)	10 MHz
	Sweep time	2,5 ms
	Detector function	Peak
	Trace	max hold
	Attenuator	/
	<b>LIMIT</b>	<b>1 Watt (30dBm)</b>

**Conducted measurements:**

The transmitter output was connected to the spectrum analyzer via a low loss cable.

**Radiated measurements:**

As the EUT is supplied with a dedicated antenna, the effective radiated power is measured in a 3 m anechoic chamber with the substitution antenna method.

**Tested samples**

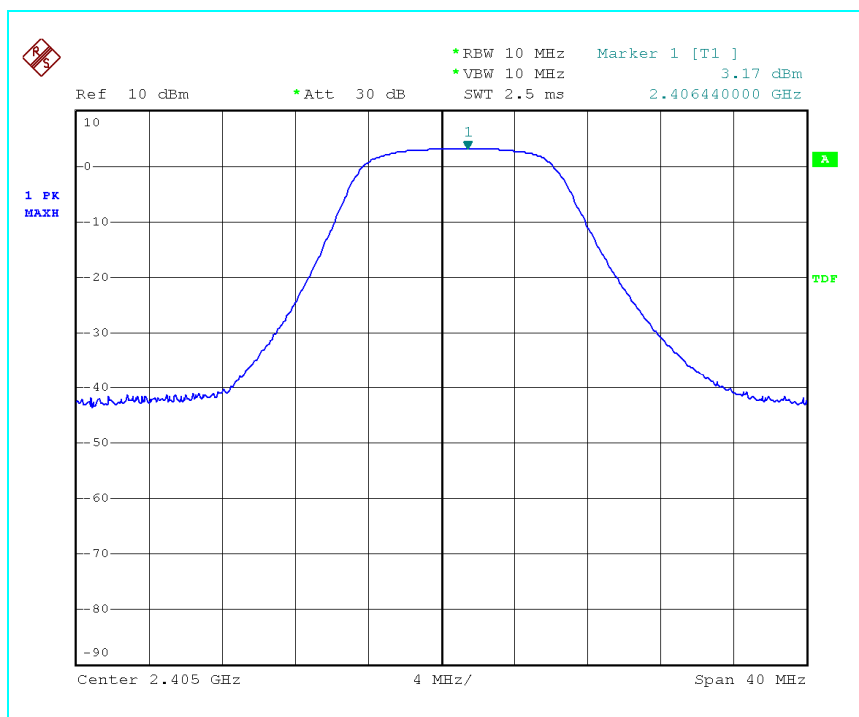
SAMPLE
1) Model SPZB260C-PRO provided with ANTENOVA Antenna
2) Model SPZB260A-PRO provided with MURATA Antenna

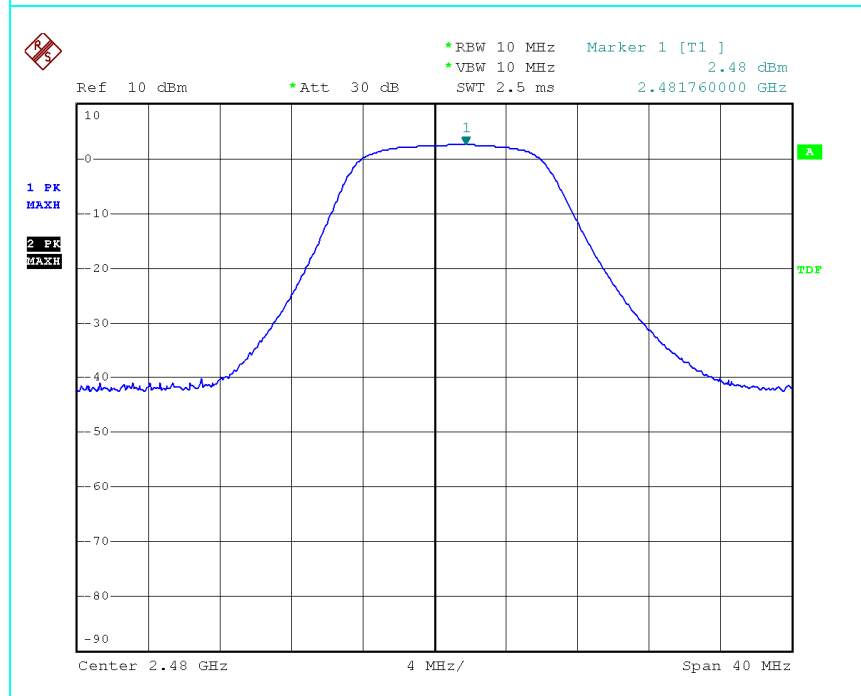
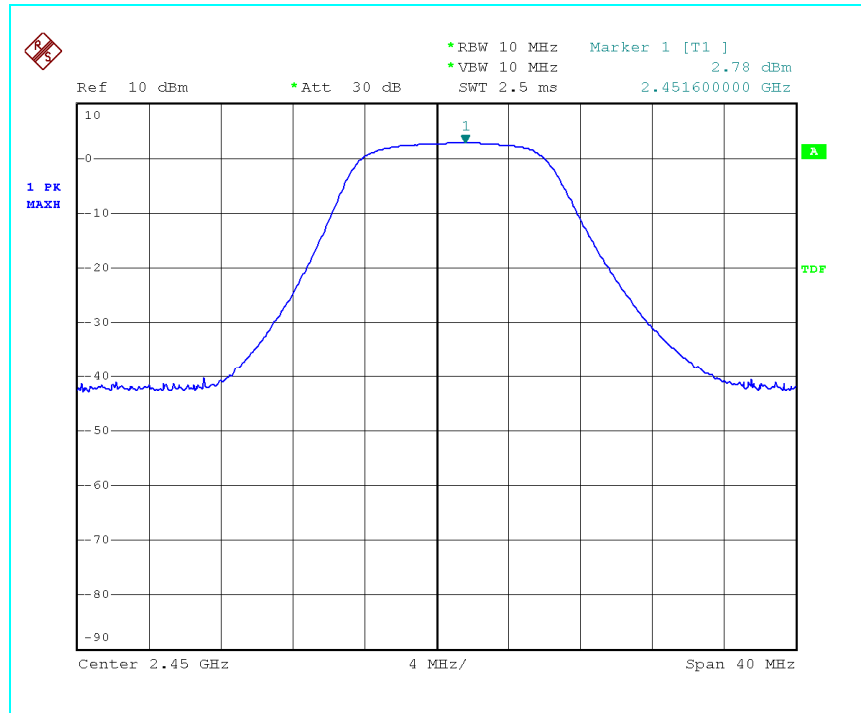
### Test Result

The Test results is identical for both the models type SPZB260C-PRO and SPZB260A-PRO

#### Conducted measure (Peak detector)

Channel (No.)	Frequency (MHz)	Measured Output Power (dBm)	Max. Antenna Gain (dB)	Calculated Radiated Output Power (dBm)
11	2405,00	3,17	2,2	5,39
20	2450,00	2,78		5,00
26	2480,00	2,48		4,70





TEST No. 6	Title “Band-edge Compliance of RF Conducted Emissions “		47CFR Part 15 Ref. Section
			15.247 (d)
<b>TEST SET-UP &amp; REQUIREMENTS</b>	<b>Spectrum analyzer settings</b>		
	Span	Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation	
	Resolution (or IF) Bandwidth (RBW)	1 MHz (100 kHz band-edge)	
	Video (or Average) Bandwidth (VBW)	1 MHz (100 kHz band-edge)	
	Sweep time	Auto	
	Detector function	Peak	
	Trace	Max hold	
	Attenuator	/	
	<b>LIMIT</b>	<b>&gt; 20 dB below that in the 100 kHz bandwidth within the assigned band</b>	

Only for measuring emissions up to 2 MHz removed from the band-edge the "delta" technique for Radiated emissions was used.

Delta technique: The transmitter output was connected to the spectrum analyzer through a test fixture (radio frequency coupling device associated with the dedicated antenna of the equipment under test)

Once the trace is stabilized, by the marker the emission at the band edge (or on the highest modulation product outside of the band, if this level is greater than that at the band edge) was set.

The “n” by the marker-delta function and the marker-to-peak function the peak of the in-band emission was selected. The marker-delta value displayed was compared with the limit specified in this Section.

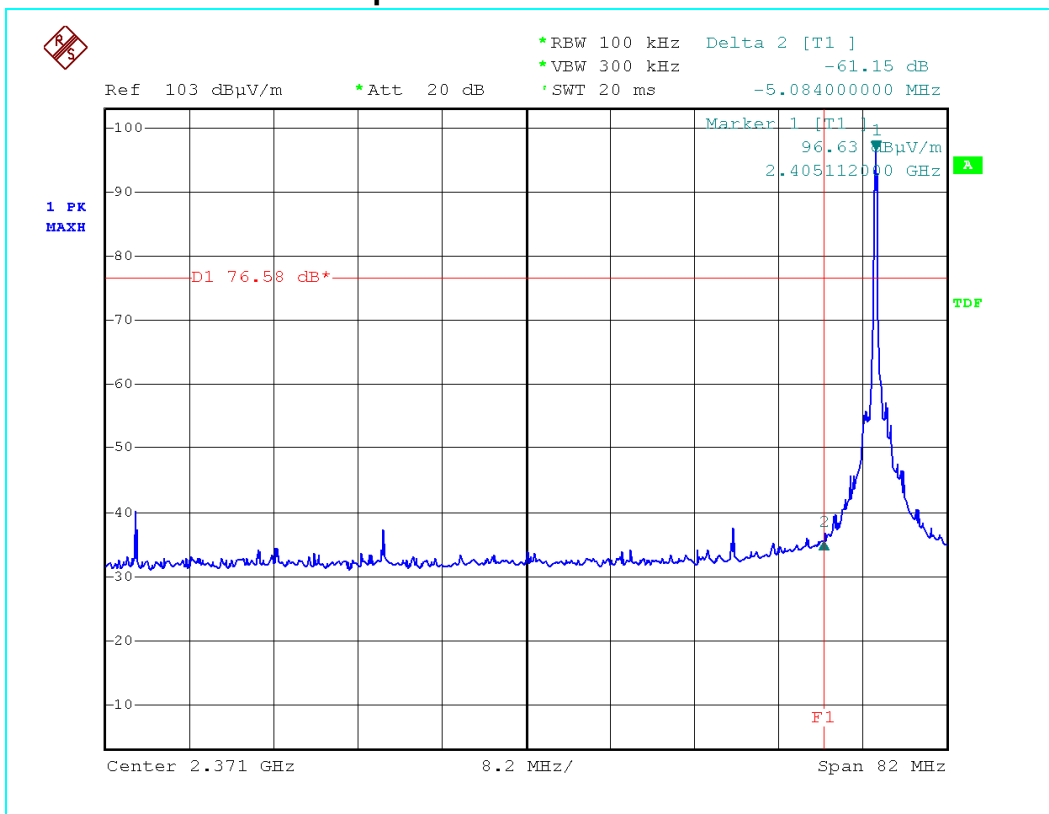
**Tested samples**

SAMPLE
1) Model SPZB260C-PRO provided with ANTENOVA Antenna
2) Model SPZB260A-PRO provided with MURATA Antenna

**Test Result:**

**Band-edge compliance, lower band edge, (Peak)**

**Model SPZB260A-PRO provided with MURATA Antenna**

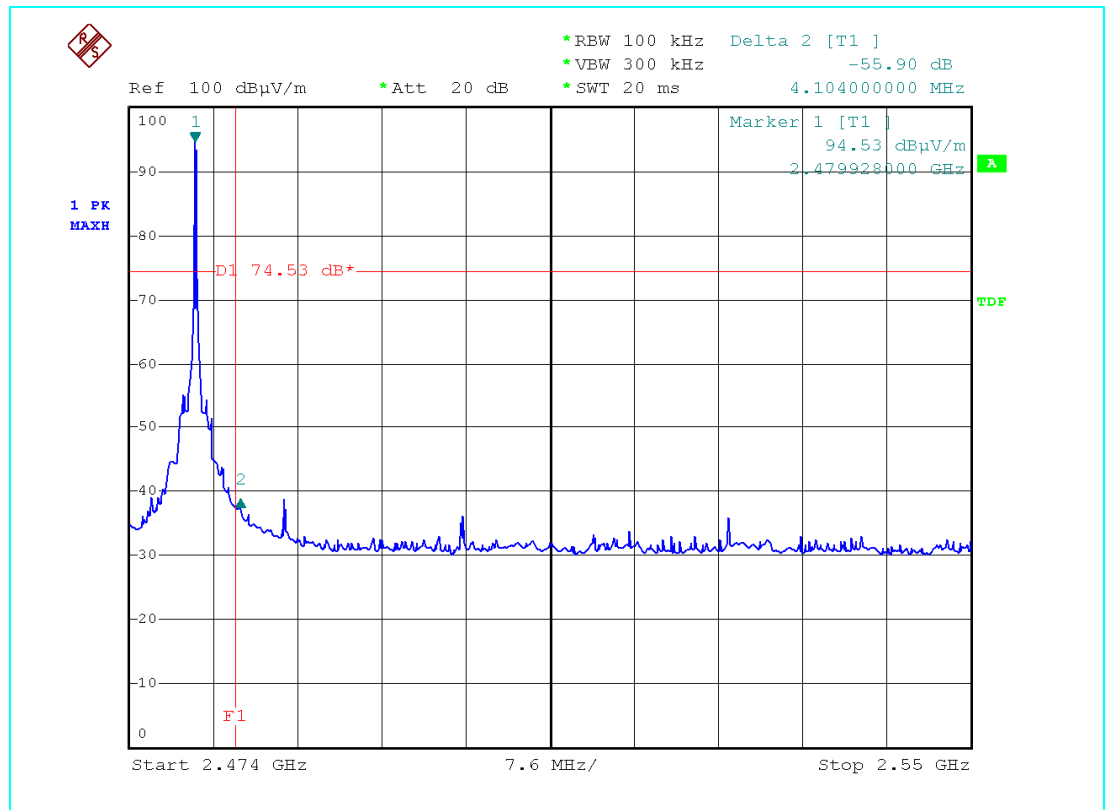


All out of band spurious emissions are more 20 dB below the in band power of the fundamental.

Band-edge compliance to radiated emission test				
Band edge	Different to the signal peak (dB)	Field strength measured (dBμV/m)	Field strength at the band-edge (dBμV/m) (peak detector)	Average Limit at the band-edge (dBμV/m)
Lower (2400 MHz)	61,15	96,63	35,48	54,00
<b>Within the limit</b>				

**Band-edge compliance, upper band edge, (Peak)**

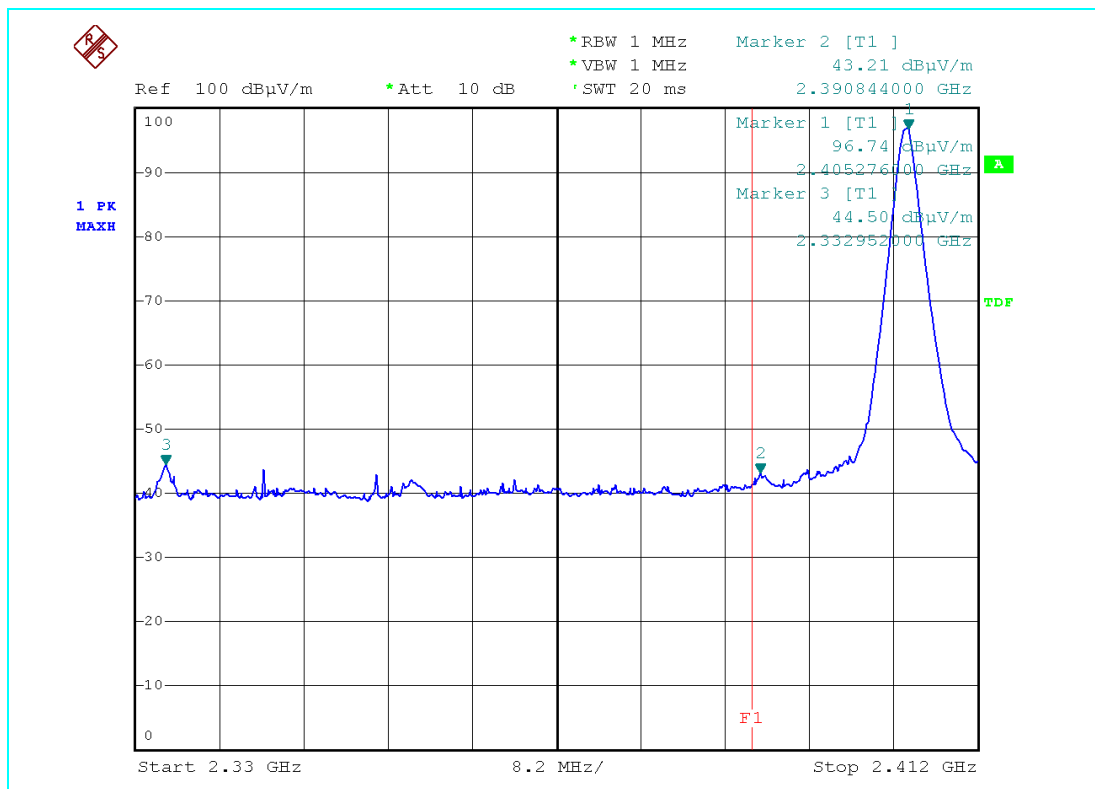
**Model SPZB260A-PRO provided with MURATA Antenna**



All out of band spurious emissions are more 20 dB below the in band power of the fundamental.

Band-edge compliance to radiated emission test				
Band edge	Different to the signal peak (dB)	Field strength measured (dBμV/m)	Field strength at the band-edge (dBμV/m) (peak detector)	Average Limit at the band-edge (dBμV/m)
Upper (2484,032 MHz)	55,90	94,53	38,63	54,00
<b>Within the limit</b>				

**Spurious Emission in restricted band near 2400-2483.5 MHz**  
**Model SPZB260A-PRO provided with MURATA Antenna**

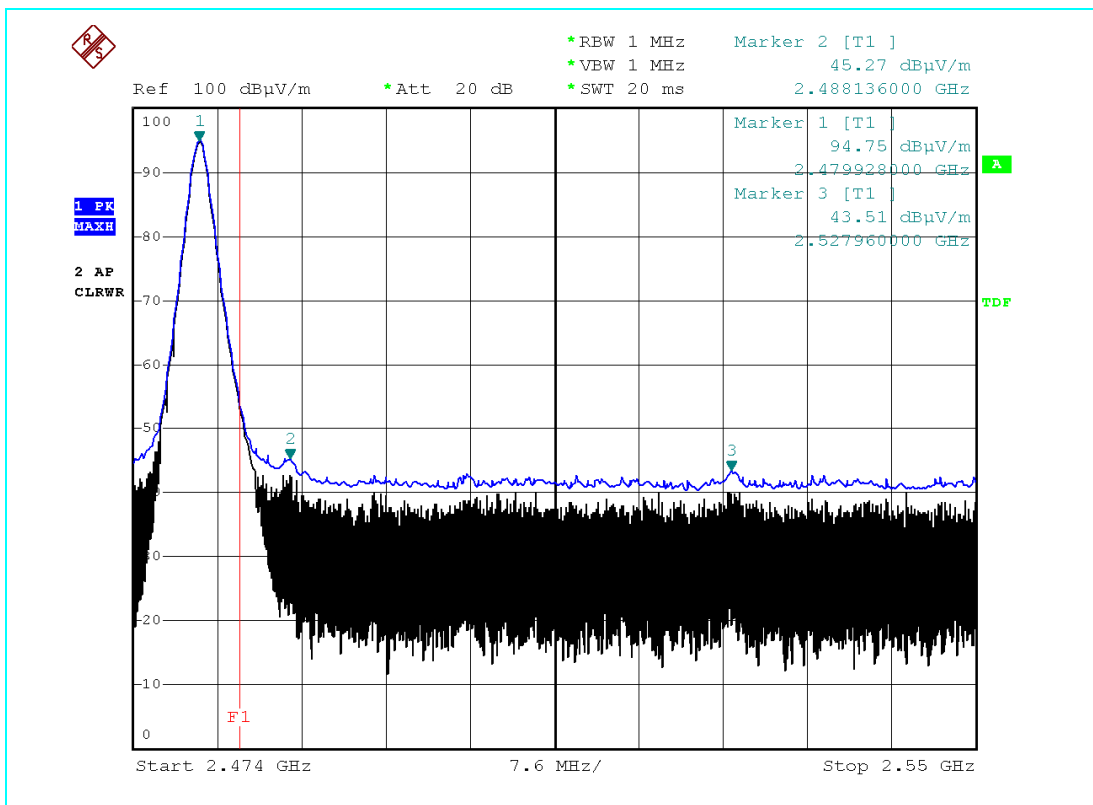


**PEAK DETECTOR**

Frequency (MHz)	Measured Level (dBµV/m)	Limit (µVolt/meter)	Limit (dBµV/m)	Margin (dB)
2332,95	44,50	5011,87	74,00	29,50
2390,84	43,21	5011,87	74,00	30,79



**Spurious Emission in restricted band near 2400-2483.5 MHz**  
**Model SPZB260A-PRO provided with MURATA Antenna**

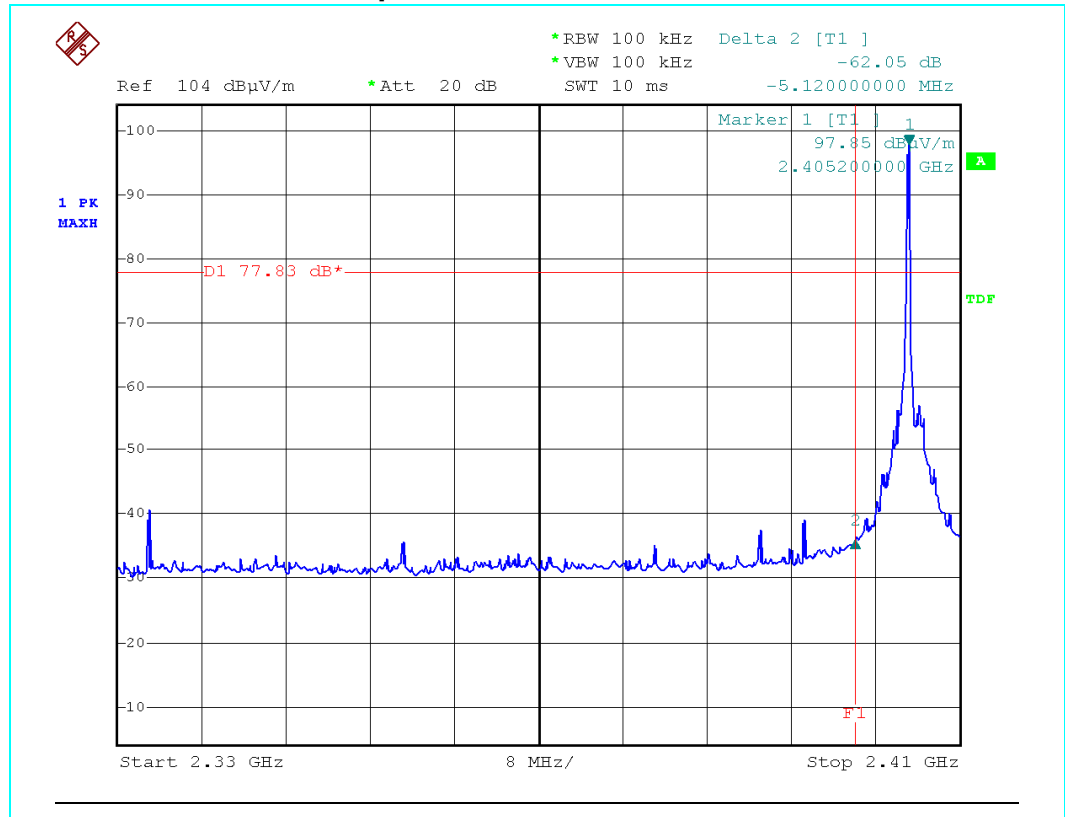


**PEAK DETECTOR**

Frequency (MHz)	Measured Level (dBµV/m)	Limit (µVolt/meter)	Limit (dBµV/m)	Margin (dB)
2488,13	45,27	5011,87	74,00	28,73
2527,96	43,51	5011,87	74,00	30,49

**Band-edge compliance, lower band edge, (Peak)**

**Model SPZB260C-PRO provided with ANTENOVA**

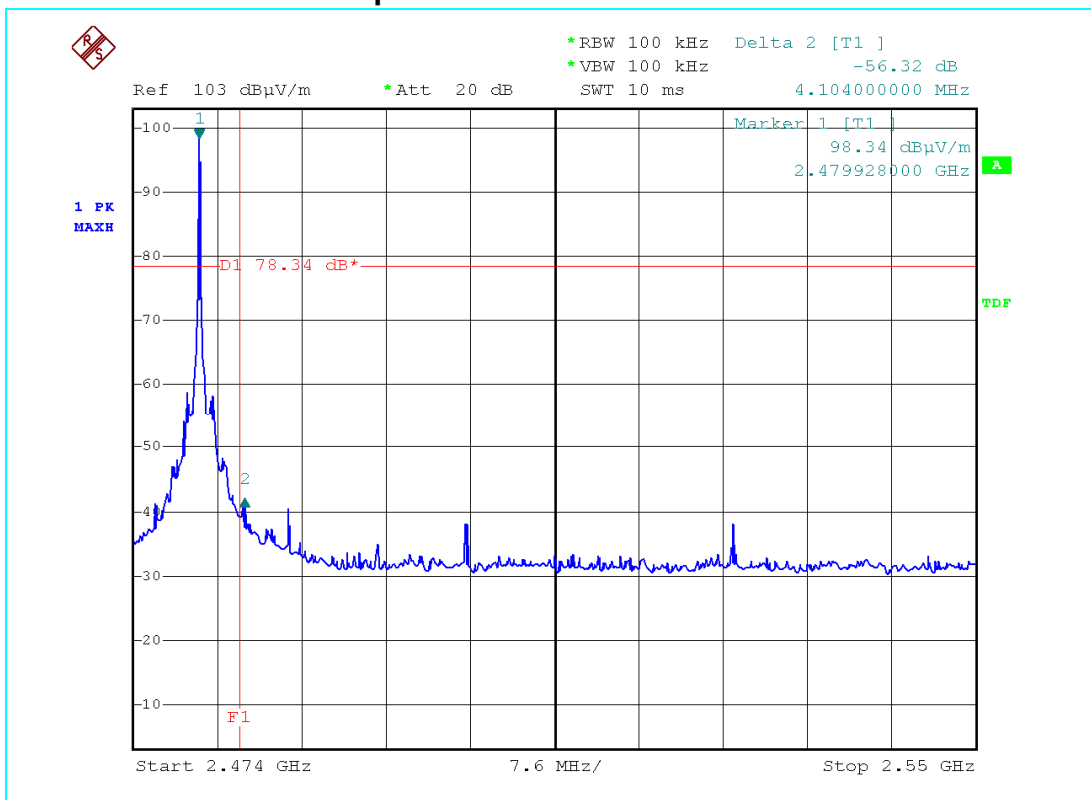


All out of band spurious emissions are more 20 dB below the in band power of the fundamental.

Band-edge compliance to radiated emission test				
Band edge	Different to the signal peak (dB)	Field strength measured (dBμV/m)	Field strength at the band-edge (dBμV/m) (peak detector)	Average Limit at the band-edge (dBμV/m)
Lower (2400 MHz)	62,05	97,85	35,80	54,00
<b>Within the limit</b>				

**Band-edge compliance, upper band edge, (Peak)**

**Model SPZB260C-PRO provided with ANTENOVA**

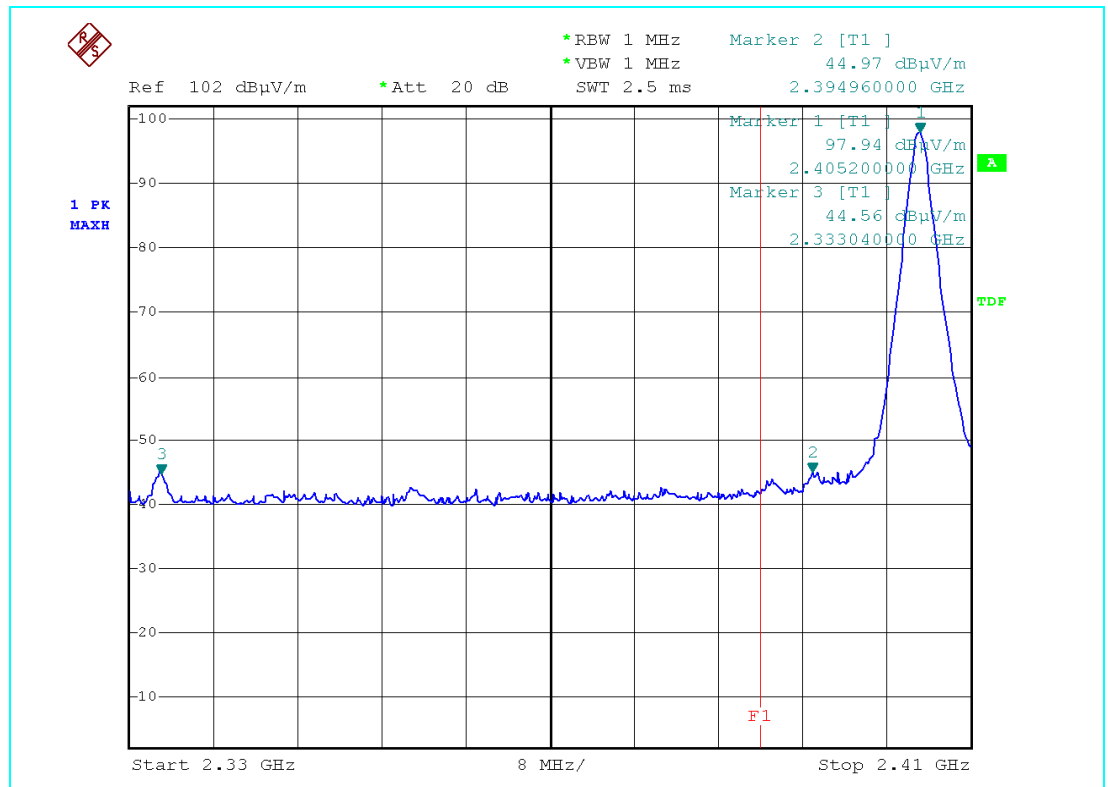


All out of band spurious emissions are more 20 dB below the in band power of the fundamental.

Band-edge compliance to radiated emission test				
Band edge	Different to the signal peak (dB)	Field strength measured (dBµV/m)	Field strength at the band-edge (dBµV/m) (peak detector)	Average Limit at the band-edge (dBµV/m)
Upper (2484,132 MHz)	56,32	98,34	42,02	54,00
<b>Within the limit</b>				

### Spurious Emission in restricted band near 2400-2483.5 MHz

#### Model SPZB260C-PRO provided with ANTENOVA

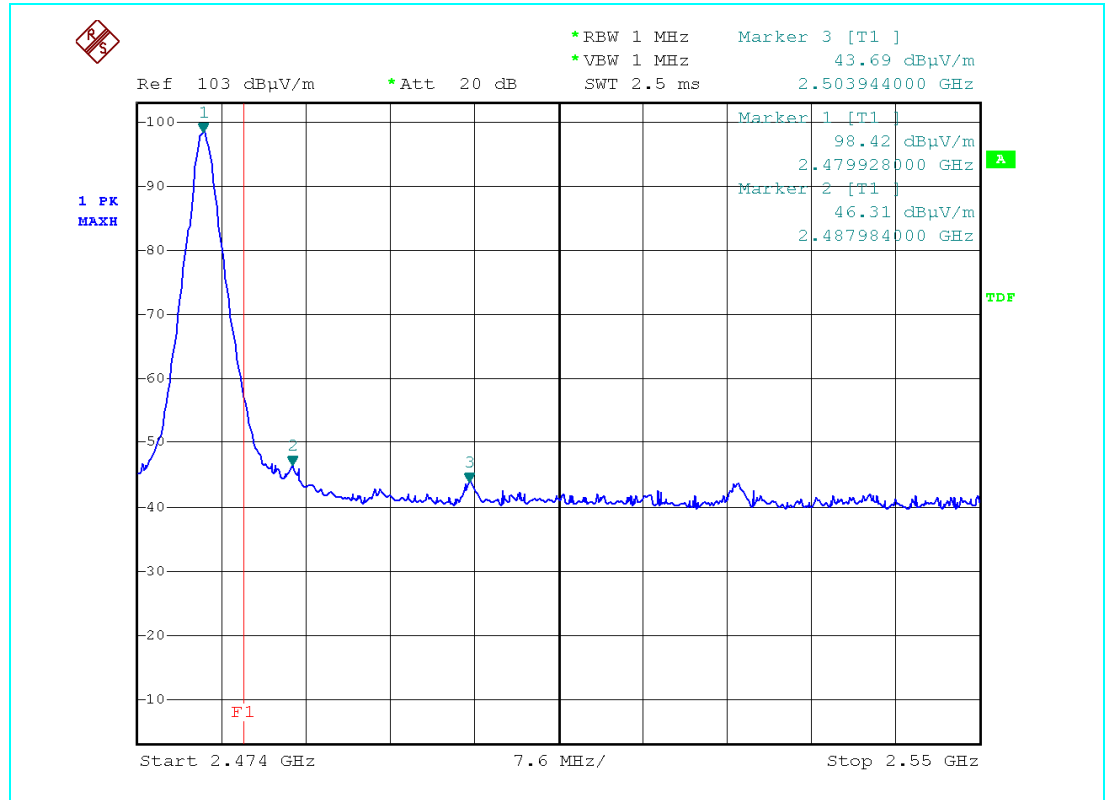


#### PEAK DETECTOR

Frequency (MHz)	Measured Level (dBμV/m)	Limit (μVolt/meter)	Limit (dBμV/m)	Margin (dB)
2333,04	44,56	5011,87	74,00	29,44
2394,96	44,97	5011,87	74,00	29,03

### Spurious Emission in restricted band near 2400-2483.5 MHz

#### Model SPZB260C-PRO provided with ANTENOVA



#### PEAK DETECTOR

Frequency (MHz)	Measured Level (dBµV/m)	Limit (µVolt/meter)	Limit (dBµV/m)	Margin (dB)
2487,98	46,31	5011,87	74,00	27,69
2503,94	43,69	5011,87	74,00	30,31

TEST No.7	Title		47CFR Part 15 Ref. Section
	“Conducted Emissions outside the band 2400-2483.5 MHz“		15.247 (d)
<b>TEST SET-UP &amp; REQUIREMENTS</b>	<b>Spectrum analyzer settings</b>		
	Span	/	
	Resolution (or IF) Bandwidth (RBW)	100 kHz	
	Video (or Average) Bandwidth (VBW)	300 kHz	
	Sweep time	as necessary to capture the entire dwell time per hopping channel	
	Detector function	Peak	
	Trace	max hold	
	Attenuator	/	
	<b>LIMIT</b>	<b>20 dB below from Conducted peak of RF or limit specified in section 15.209 for Restricted Band.</b>	

The transmitter output was connected to the spectrum analyzer through an opportune RF attenuator.

The measure has been executed with the lowest transmit channel, the highest transmit channel and one located somewhere in the middle of the band.

**Tested samples**

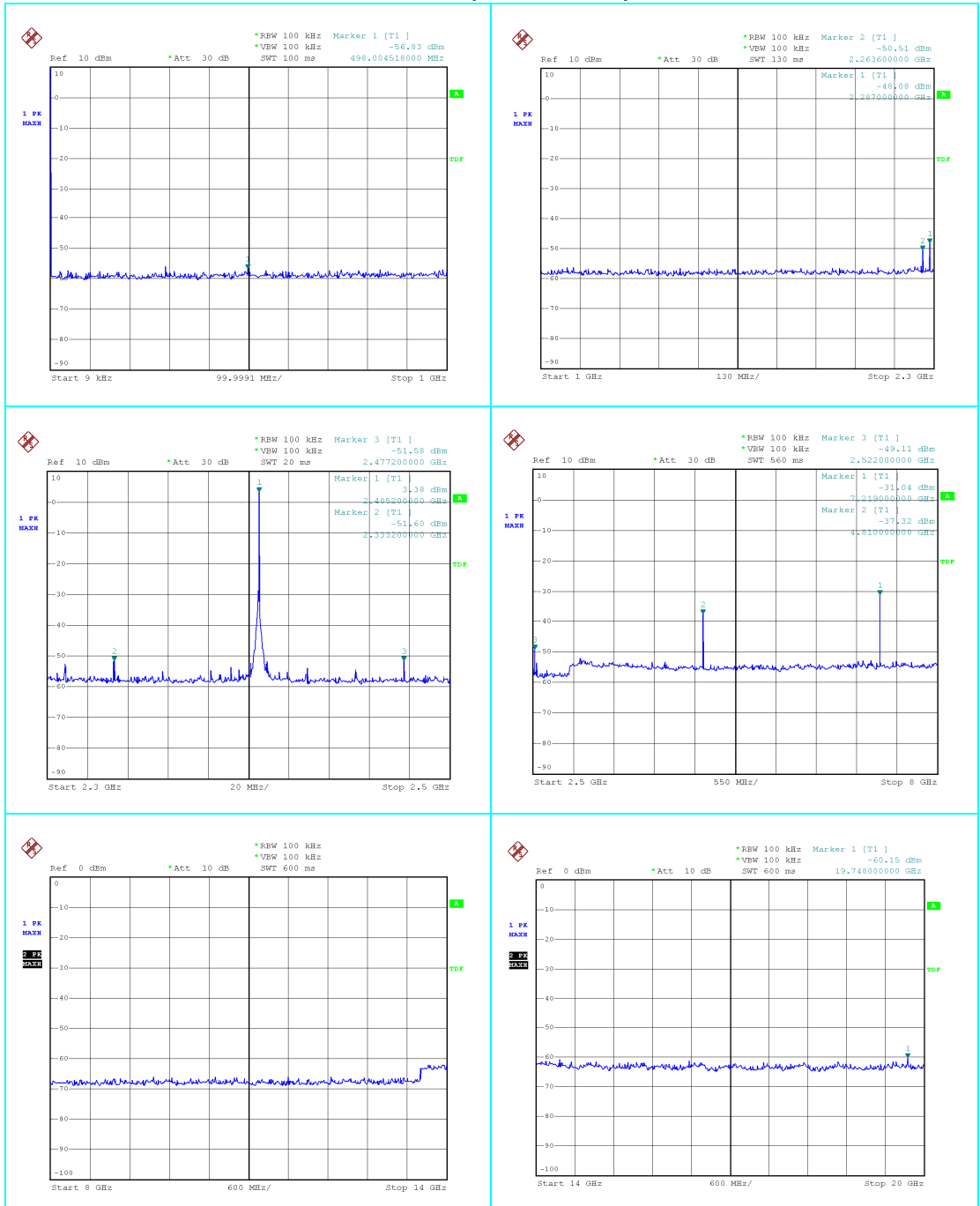
SAMPLE
1) Model SPZB260C-PRO provided with ANTENOVA Antenna
2) Model SPZB260A-PRO provided with MURATA Antenna

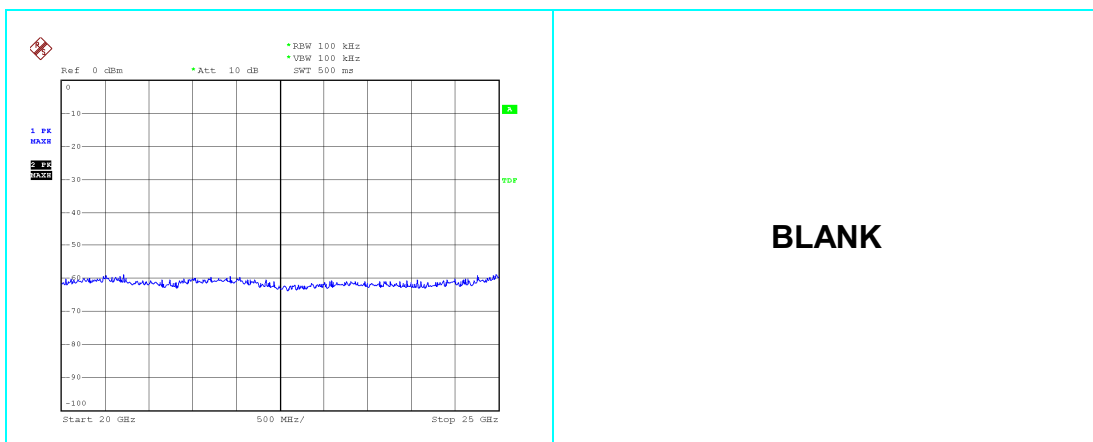
**Test Result:**

Within the specifications

**The Test results is identical for both the models type SPZB260C-PRO and SPZB260A-PRO**

### Test Result: Conducted measure (channel 11)





All out of band spurious emissions are more 20dB below the in band power of the fundamental.

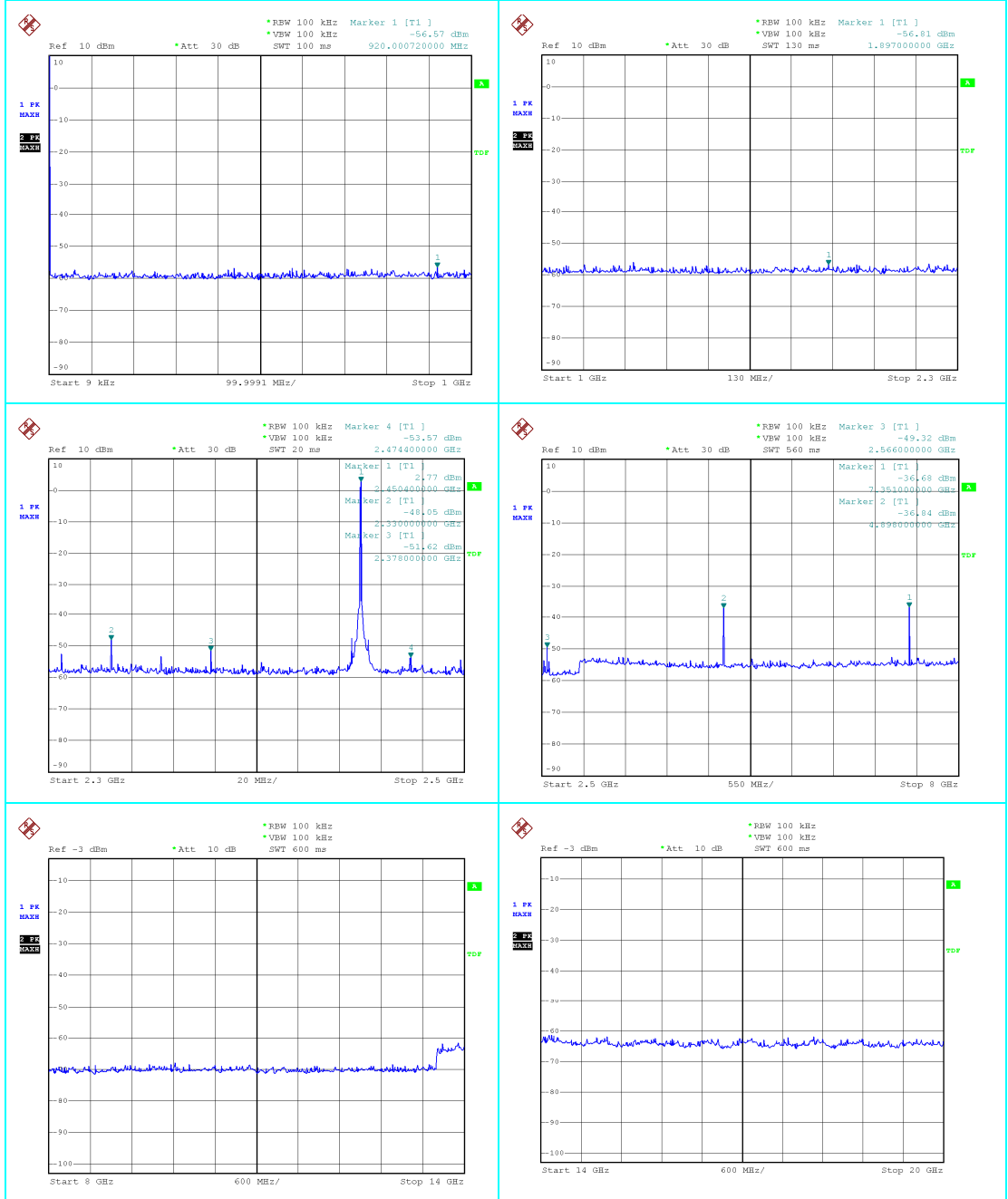
Channel n°11: 2405,00 MHz

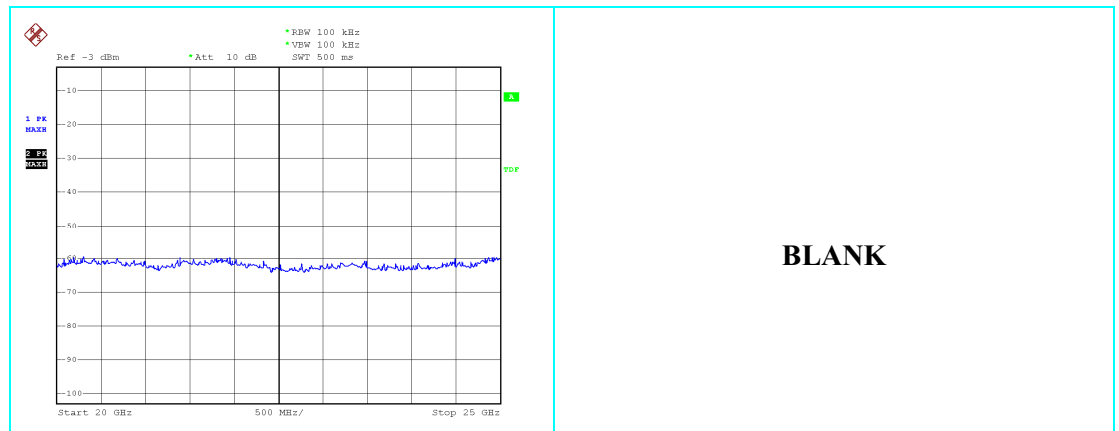
**PEAK RESULT**

Frequency (MHz)	Measured Level (dBm)	Limit (dBm) Fundamental value – 20dB	Margin (dB)
2263,60	-50,51	-16,62	33,89
2287,00	-48,08	-16,62	31,46
2333,20	-51,60	-16,62	34,98
2405,20 (fundamental)	+3,38	-----	-----
2477,20	-51,58	-16,62	34,96
2522,00	-49,11	-16,62	32,49
4810,00	-37,32	-16,62	20,70
7219,00	-31,04	-16,62	14,42



### Conducted measure (channel 20)





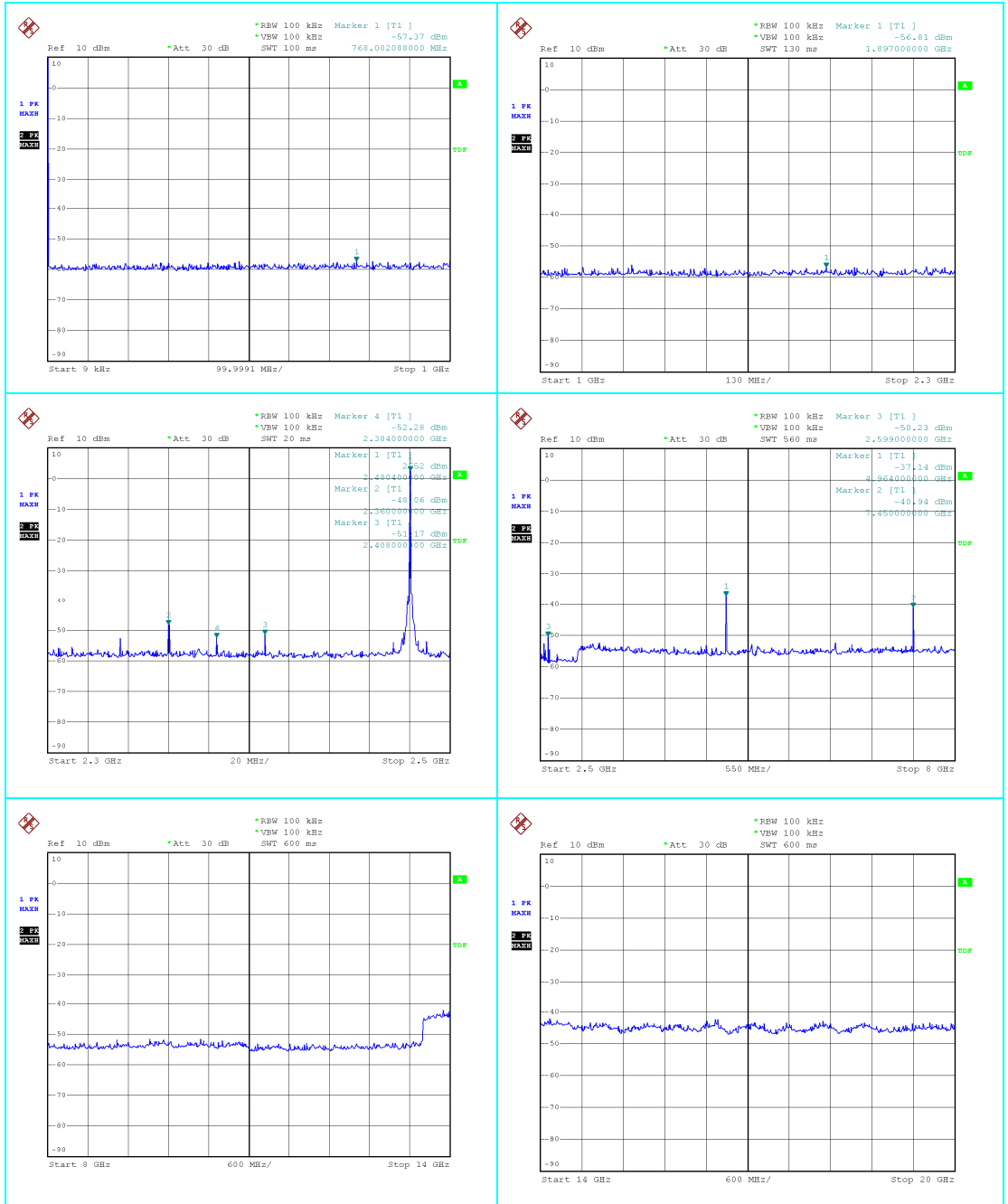
All out of band spurious emissions are more 20dB below the in band power of the fundamental.

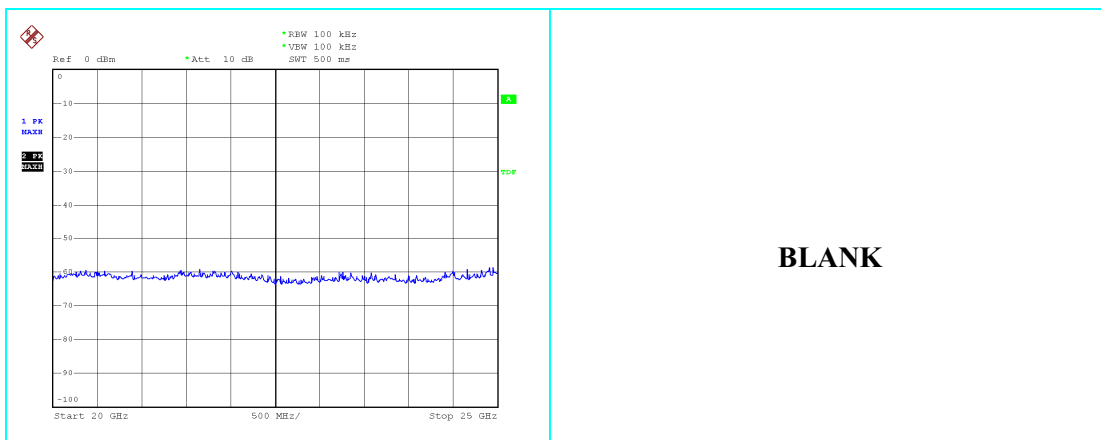
Channel n°20: 2450,00 MHz

**PEAK RESULT**

Frequency (MHz)	Measured Level (dBm)	Limit (dBm) Fundamental value – 20dB	Margin (dB)
2330,00	-48,05	-17,23	30,82
2378,00	-51,62	-17,23	34,39
2450,04 (fundamental)	+2,77	-----	-----
2474,40	-53,57	-17,23	36,34
2566,00	-49,32	-17,23	32,09
4898,00	-36,84	-17,23	19,61
7351,00	-36,68	-17,23	19,45

### Conducted measure (channel 26)





All out of band spurious emissions are more 20dB below the in band power of the fundamental.

Channel n°26: 2480,00 MHz

**PEAK RESULT**

Frequency (MHz)	Measured Level (dBm)	Limit (dBm) Fundamental value – 20dB	Margin (dB)
2360,00	-48,06	-17,48	30,58
2384,00	-52,28	-17,48	34,80
2408,00	-51,17	-17,48	33,69
2480,04 (fundamental)	+2,52	-----	-----
2599,00	-50,23	-17,48	32,75
4964,00	-37,14	-17,48	19,66
7450,00	-40,94	-17,48	23,46

TEST No.8	Title	47CFR Part 15 Ref. Section
		“ Transmitter Power Spectral Density”
<b>TEST SET-UP &amp; REQUIREMENTS</b>	<b>Spectrum analyzer settings</b>	
	Span	3 MHz
	Resolution (or IF) Bandwidth (RBW)	3 kHz
	Video (or Average) Bandwidth (VBW)	30 kHz
	Sweep time	340 ms
	Detector function	Peak
	Trace	max hold
	Attenuator	/
	LIMIT	8 dBm

The transmitter output was connected to the spectrum analyzer through a test fixture (radio frequency coupling device associated with the dedicated antenna of the equipment under test)

After trace stabilisation the marker shall be set on the signal peak. The indicated level is the power spectral density.

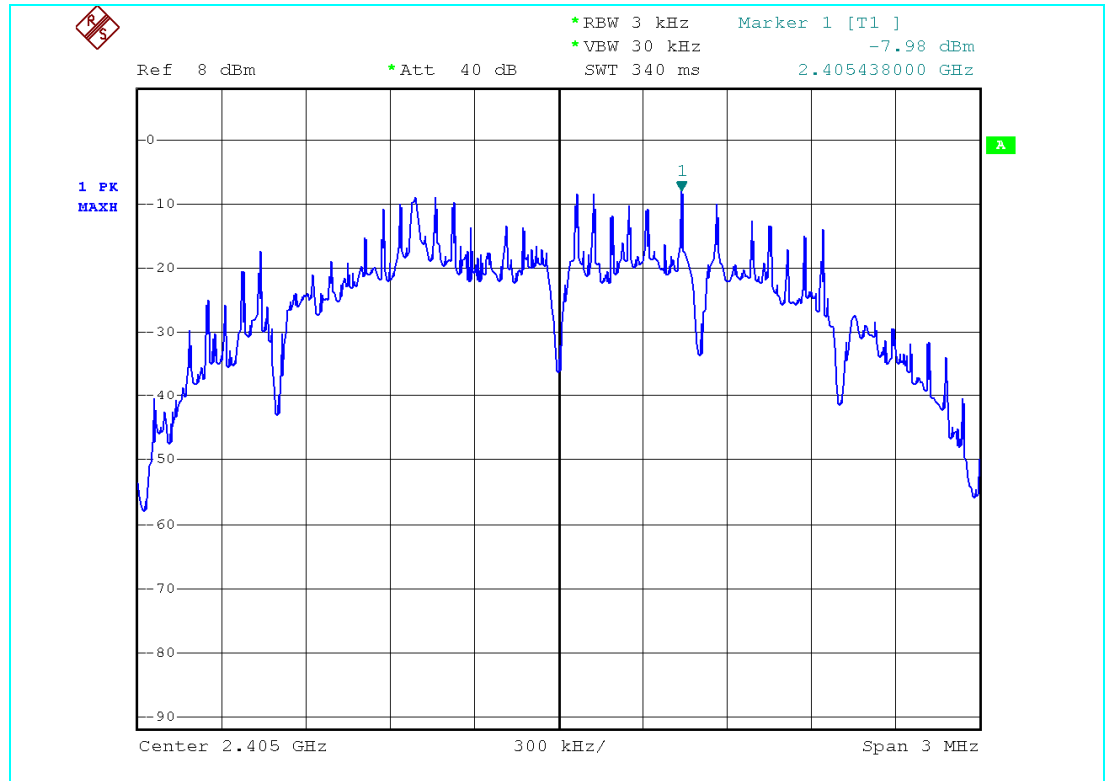
**Test Result:**

Channel (No.)	Power spectral density (dBm)	Plot (No.)
11	-7,98	1
20	-7,06	2
26	-7,63	3

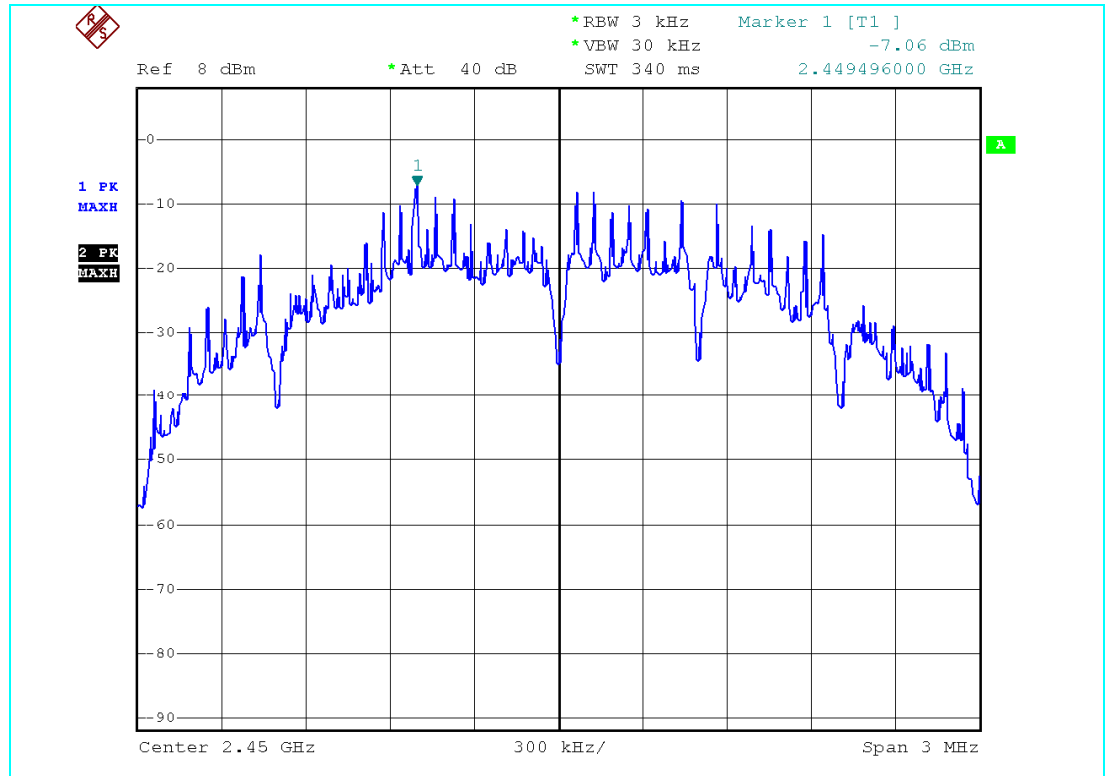
Within the specifications

**The Test results is identical for both the models type SPZB260C-PRO and SPZB260A-PRO**

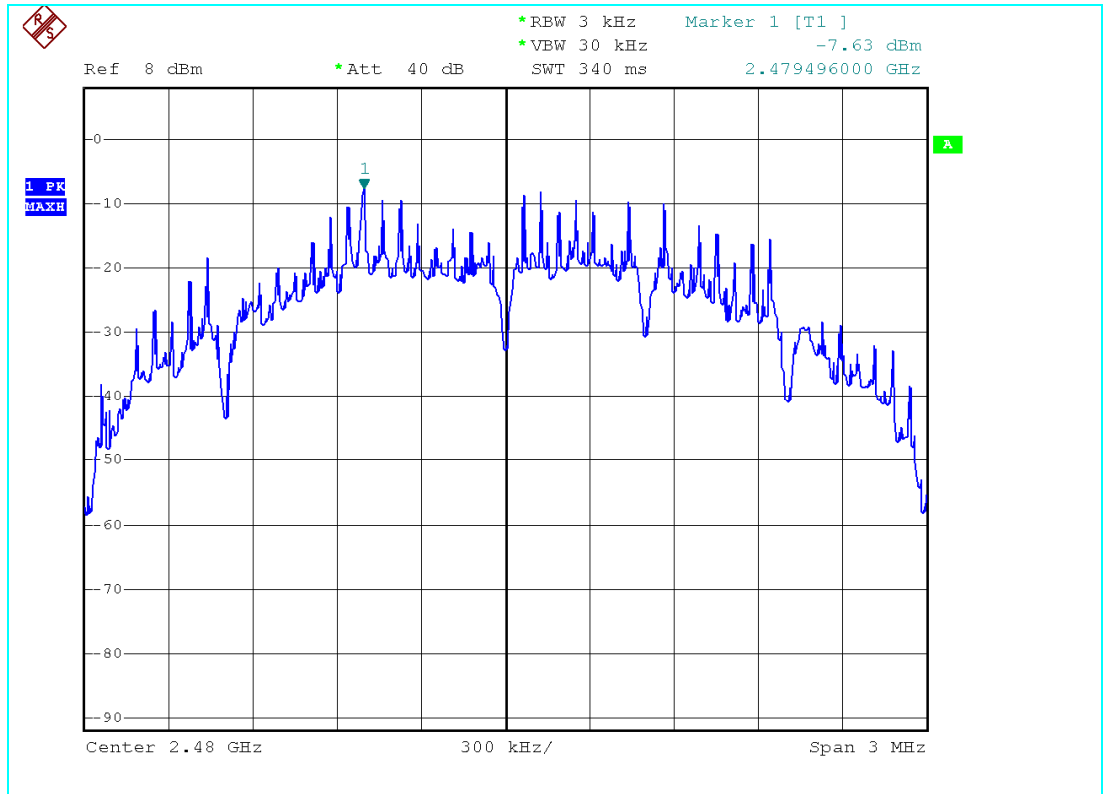
**Plot No. 1:**



**Plot No. 2:**



**Plot No. 3:**





TEST No.9	Title "RF Exposure Evaluation"	47CFR Part 15 Ref. Section
		<b>15.247 (i)</b>
<b>TEST SET-UP &amp; REQUIREMENTS</b>	Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See § 1.1307(b)(1) of this Chapter.	
	EUT classification (fixed, mobile or portable devices)	Fixed, mobile or portable
	LIMITS	See table below

**Limit for maximum permissible Exposure (MPE)**

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm <sup>2</sup> )	Average Time (minutes)
<b>(A) Limits for Occupational/Controlled Exposure</b>				
0.3÷3.0	614	1.63	(100)*	6
3.0÷30	1842/f	4.89/f	(900/f <sup>2</sup> )*	6
30÷300	61.4	0.163	1.0	6
300÷1500	--	--	f/300	6
1500÷100,000	--	--	5	6
<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
0.3÷3.0	614	1.63	(100)*	30
3.0÷30	824/f	2.19/f	(180/f <sup>2</sup> )*	30
30÷300	27.5	0.073	0.2	30
300÷1500	--	--	f/1500	30
1500÷100,000	--	--	1.0	30
F = Frequency in MHz      *Plane-wave equivalent power density				

The distance from the device's transmitting antenna where the exposure level reaches the maximum permitted limit is calculated using the general equation:

$$S = P \cdot G / 4\pi R^2$$

Where:

S = Power Density (mW/cm<sup>2</sup>)

P = Conducted power (mW)

G = Linear power gain relative to isotropic radiator (numeric gain)

R = Distance (cm)

**RF Exposure evaluation Distance:**

Channel  (No.)	Frequency  (MHz)	Output power to antenna  (dBm)	Power density @ 20 cm  (mW/cm <sup>2</sup> )	Distance where the exposure level reaches the limit  (cm)	Limits  (mW/cm <sup>2</sup> )
11	2405,00	3,17	0,001	0,835	1
20	2450,00	2,78	0,001	0,782	1
26	2480,00	2,48	0,001	0,739	1

**Test Result:**

The EUT operates at low power level so it does not exceed the Commission's RF exposure guidelines limits; furthermore, Spread spectrum transmitters operate according to the Section 15.247 are categorically excluded from routine environmental evaluation.  
RF exposure limit warning or SAR test are not required.

**The Test results is identical for both the models type SPZB260C-PRO and SPZB260A-PRO**

## 6 ADDITIONAL TECHNICAL INFORMATION

### 6.1 ELECTROMAGNETICALLY RELEVANT COMPONENTS:

Components	N°	Manufacturer	Type – Technical data
<b>Radio Module</b>			
See Technical document			
<b>Host Equipment</b>			
Test Jig		STM	/

### 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
Bill of materials	SPZB260C_A_pro_BOM
Electronic diagram	EI_DWG_SPZB260C_A
Manual	SPZB260C-PRO_SPZB260A-PRO_1

## 8 PHOTOGRAPHIC DOCUMENTATION

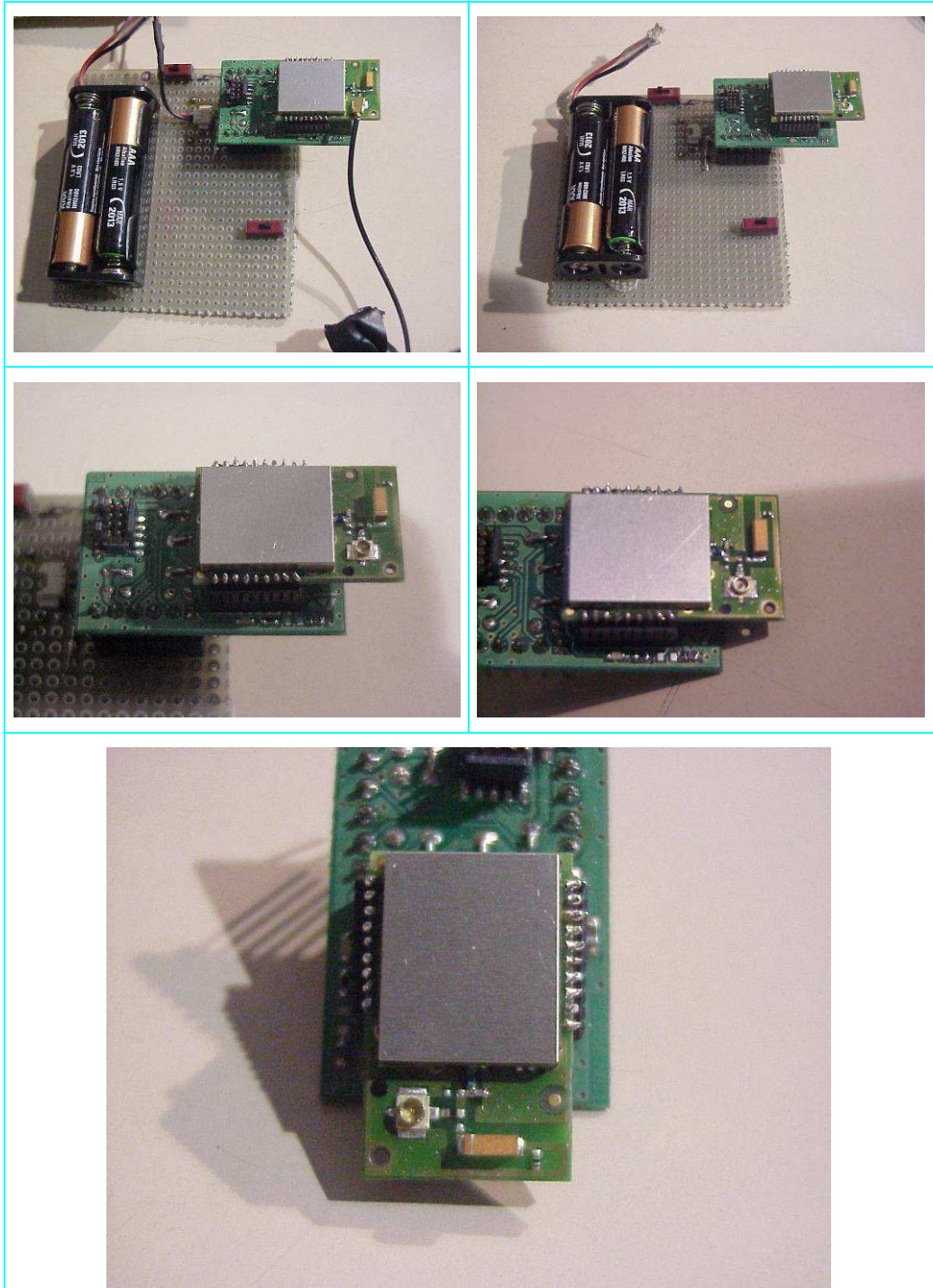
### 8.1 EUT IDENTIFICATION



Model SPZB260C-PRO provided with ANTENOVA Antenna

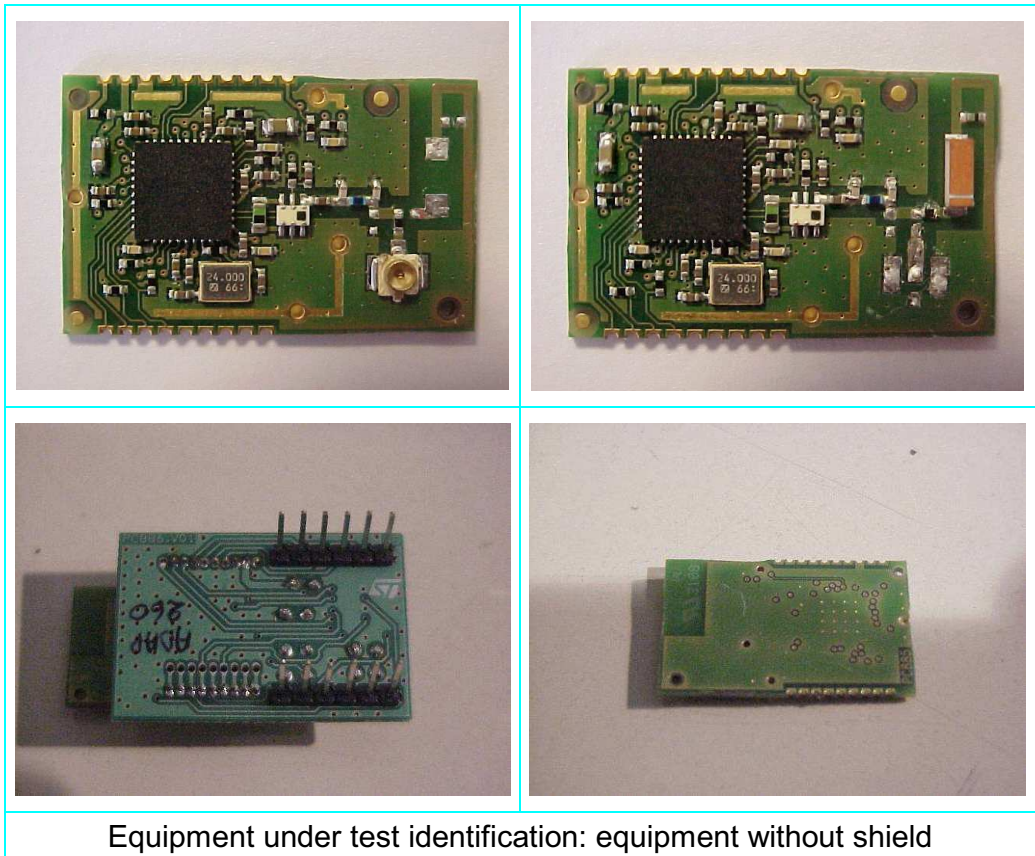


Model SPZB260A-PRO provided with MURATA Antenna



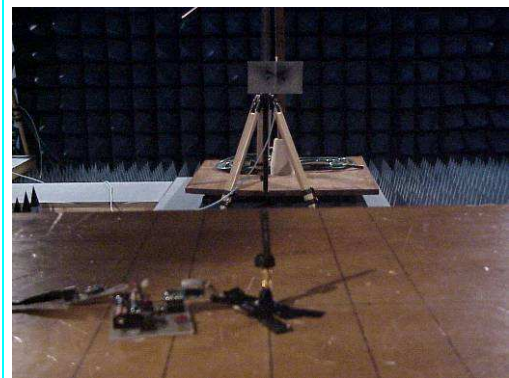
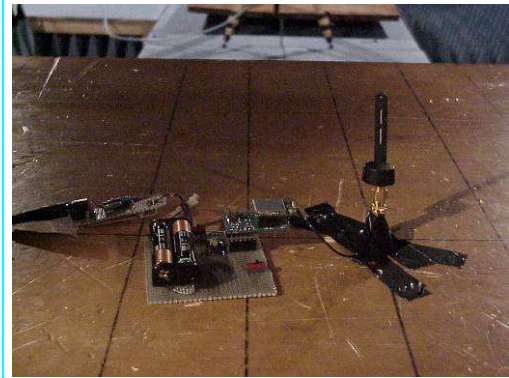
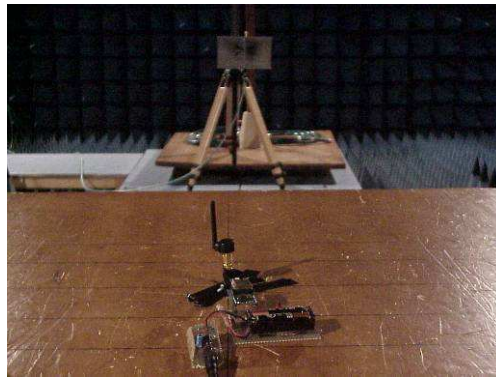
Equipment under test identification: Test jig + Radio module





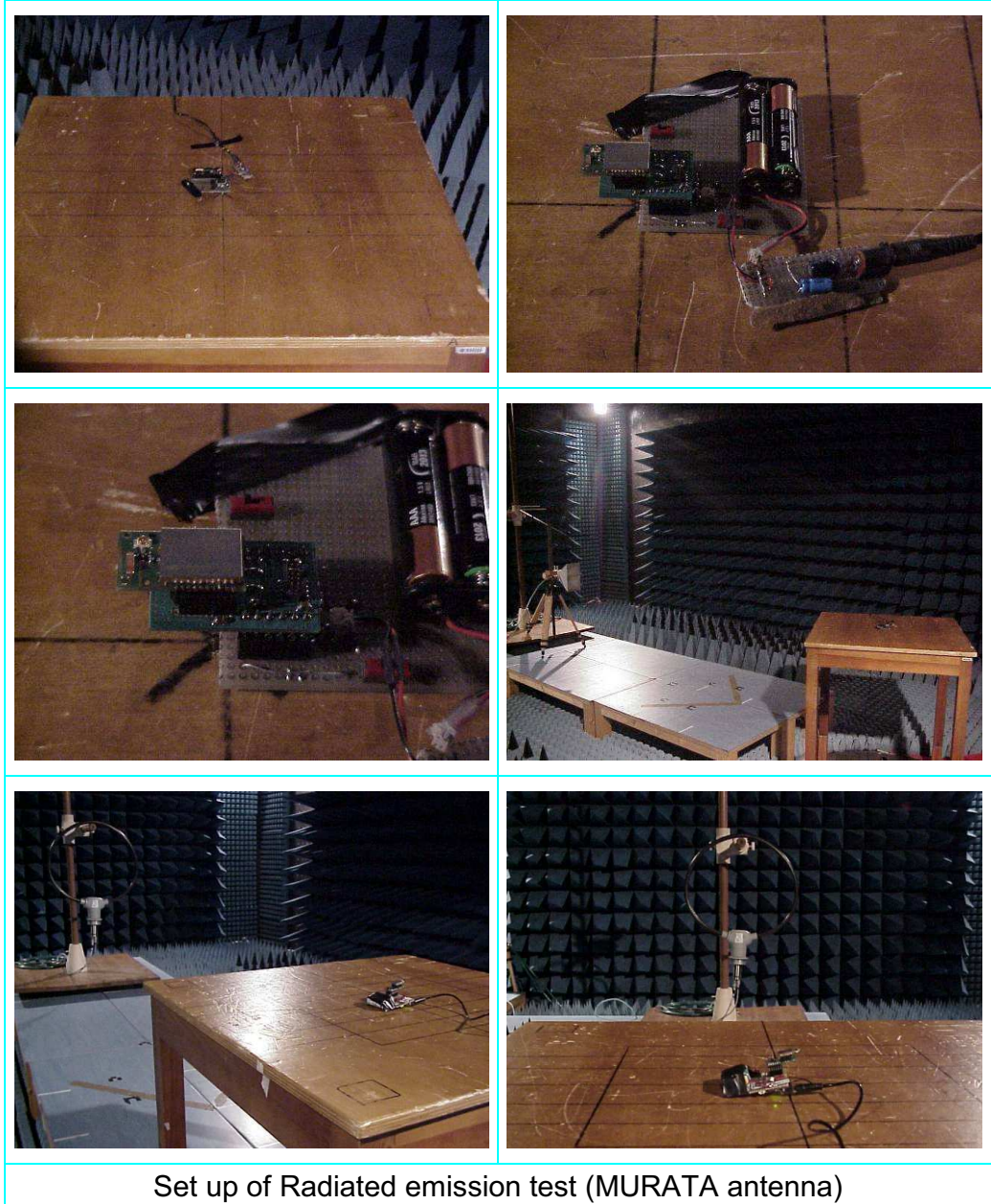
Equipment under test identification: equipment without shield

## 8.2 TEST SET-UP



Set up of Radiated emission test (ANTENOVA antenna)





## 9 MEASUREMENT AND TEST EQUIPMENT INSTRUMENTATION

Instruments	Manufacturer	Model	IMQ serial number	Calibration data	Calibration interval (Month)
Emi Receiver	Rohde & Schwarz	ESHS 10	S-03494	02/2008	18
Emi Receiver	Rohde & Schwarz	ESVS	S-04197	12/2008	18
Artificial Mains V-network	COMTEST	/	S-02405	09/2007	24
Spectrum Analyzer	Rohde & Schwarz	FSP40	S-03629	07/2007	24
Loop Antenna	Rohde & Schwarz	HFH2-Z2	S-02508	12/2008	24
Antenna Bilog	ARA	LPD-2513	S-02385	05/2007	24
Antenna ridged horn 1÷18 GHz	Schwarzbeck	BBHA9120D	S-03464	02/2009	24
Antenna ridged horn 15÷40 GHz	Schwarzbeck	BBHA9170	S-03668	02/2008	24
Pre-amplifier 1-26.5 GHz	HP	HP 8449 B	S-03542	07/2008	24
Pre-amplifier 30-1000 MHz	BONN ELEKTRONIK	BLNA	S-04193	12/2008	24
Digital Oscilloscope	Yokogawa	DL7200	S-03745	04/2008	12
Band Reject Filter 2400÷2483 MHz	Wainwright	WRCG2400 / 2483	S-04308	/	/
Highpass Filter 3.4÷18 GHz	Wainwright	WHK3.4/18	S-04309	/	/
Crystal Detector	Agilent	8472B	S-04467	/	/
Software for test automation	Rohde & Schwarz	ES-K1 V.1.60	/	/	/

The IMQ instruments are tested and calibrated according to UNI EN 45001, the IMQ procedure IP-037 "Calibration test equipment and measurement" and according to plans set on IMQ operating instruction IO-FT-034 "Criteria for the calibration of test equipment and measurement" which are an integral part of the Quality Manual of IMQ.