



**Telecommunications & Telematics
for Transports Lab.**

TEST REPORT

Ref. No. ARSK00125/1

Date: 2011-07-29

Measurements performed in accordance with:



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

PRODUCT : WIRELESS HANDWHEEL SYSTEM

TESTED MODEL : HR 550 FS (HEIDENHAIN brand)
SelBOX-S50 (SELCA brand)

FCC ID : YJKHR550FS



APPLICANT : DR. JOHANNES HEIDENHAIN GmbH
Dr. Johannes Heidenhain Straße 5 – 83301 Traunreut, Germany

MANUFACTURER : DR. JOHANNES HEIDENHAIN GmbH
Dr. Johannes Heidenhain Straße 5 – 83301 Traunreut, Germany

TRADEMARK : HEIDENHAIN - SELCA

SERIAL NUMBER : ID 598 515-02 SN X 27 169 277 (HR 550 FS)

OTHER INFORMATION : Testing dates : 2010-05-26 - 2010-06-25 - IMQ BEM: 54677
Tested samples No. : 1
Testing Laboratory : IMQ S.p.A. Via Quintiliano, 43 I-20138 MILANO

Tested by : R. Torri	Signature: 	Date : 2011-07-29
Checked by: M. De Angelis	Signature: 	Date : 2011-07-29

Revision Sheet

Release No.	Date	Revision Description
Rev. 0	2010-11-26	Test Results and Evaluation Report
Rev. 1	2011-07-29	Adjustment § "RF exposure evaluation"

NOTICE: 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 DESCRIPTION OF EQUIPMENT UNDER TEST

1.1 APPLICANT

NAME	DR. JOHANNES HEIDENHAIN GmbH
ADDRESS	Dr. Johannes Heidenhain Straße 5
COUNTRY	GERMANY

1.2 MANUFACTURER

NAME	DR. JOHANNES HEIDENHAIN GmbH
ADDRESS	Dr. Johannes Heidenhain Straße 5
COUNTRY	GERMANY

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 :	WIRELESS HANDWEEL SYSTEM
Model:	HR 550 FS
FCC ID. :	YJKHR550FS
Trade Name:	HEIDENHAIN
Data cable :	/
Telecom cable :	/
Power supply type :	HR550FS – dedicated NiMh battery pack
AC power input cable :	/
DC power input cable :	/

Model tested	Brand	Description
HR 550 FS	HEIDENHAIN	Handweel - Portable wireless controller
Derivate model	Brand	Description
SelBOX-S50	SELCA	Handweel - Portable wireless controller

1.5 FEATURE OF EQUIPMENT UNDER TEST

Power specification

Operating frequency:	2405 ÷ 2480 MHz
Maximum RF radiated power:	14.71 dBm
Modulation:	DTS
Channel Spacing:	5 MHz
Antenna:	Integral antenna "F" reverse strip on PCB (-3 dBi gain)
RX sensitivity:	/
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)
00	2405
01	2410
02	2415
03	2420
04	2425
05	2430
06	2435
07	2440
08	2445
09	2450
10	2455
11	2460
12	2465
13	2470
14	2475
15	2480

2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST

2.1 ENVIRONMENTAL CONDITIONS

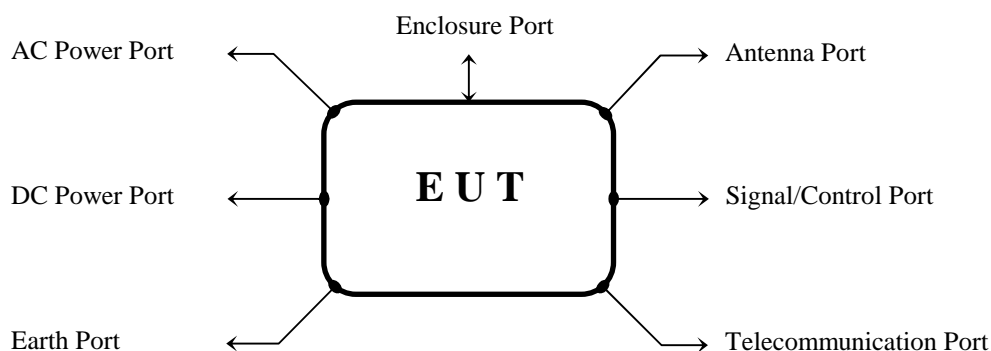
TEST CONDITIONS	MEASURED
Ambient Temperature	20 ÷ 25 °C
Relative Humidity	50 ÷ 60 %
Atmospheric Pressure	900 ÷ 1000 mbar

2.2 DESCRIPTION OF SUPPORT EQUIPMENT

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

EQUIPMENT	MANUFACTURER	MODEL
/	/	/

2.3 INTERFACE IDENTIFICATION AND CONNECTION DIAGRAM OF TEST SYSTEM



#	Port	Description	Max length	Ref. Document
1	Enclosure	Plastic case	/	/
2	AC power input	Non present	/	/
2	AC power output	Non present	/	/
3	DC power input	Equipment power supply by internal dedicated battery pack	/	/
4	Earth	Non present	/	/
5	Telecommunication	Non present	/	/
6	Signal	Serial line (only for fixed interface)	/	/
6	Control	Non present	/	/
7	Antenna	Integrated antenna ("F reverse" on PCB)	/	/

3 OPERATION OF EQUIPMENT UNDER TEST

3.1 OPERATING TEST CONDITIONS

Ref.	Description
#1	Continuous transmission (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	Not applicable		
15.209 (a) (f)	Radiated Emission	#1	PASS	2
15.247 (a)	Frequency Hopping Spread Spectrum Specifications			
15.247(a)	20 dB Bandwidth	Not applicable		
15.247(a)(1)	Carrier frequency (Hopping Channel) Separation	Not applicable		
15.247(a)(1)(iii)	Number of Hopping Channels Used	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	3
15.247(b)	Maximum Peak Output Power			
15.247(b) (1)	Peak Output Power	Not applicable		
15.247(b) (3)	RF power output, radiated (EIRP)	#1	PASS	4
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	5
15.247 (d)	Conducted Emission	#1	PASS	6
15.247 (e)	Power Spectral Density	#1	PASS	7
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	8

The uncertainties for the tests and measurements are those listed in IMQ Operational Instruction IO-80-U01.

4.1 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 Test Table 1.

4.2 FREQUENCY RANGE INVESTIGATED

- a. Radiated emission tests: from 9 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
TEST REQUIREMENTS	<p>An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.</p>	

Antenna specifications	
N° of authorized antenna types	Not Applicable
Antenna type	Integral antenna "F" reverse strip on PCB
Maximum total gain	-3dB
External power amplifiers	Not present

Test Result:

The transmitter meets the requirements of section 15.203 and 15.204

TEST No. 2	Title "Radiated disturbances"	47CFR Part 15 Ref. Section
		15.209
TEST REQUIREMENTS	Test setup	ANSI C63.4
	Test facility	Semi-anechoic chamber
	Test distance	3 m
	Limits for radiated disturbances	15.209 (a)
	Frequency range	9 kHz to tenth harmonic of fundamental
	IF bandwidth (below 30 MHz)	9 kHz
	IF bandwidth (below 1,000 MHz)	120 kHz
	IF bandwidth (above 1,000 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) = $40\log(300\text{meter} / 3\text{meter}) = +80\text{db}$ Extrapolation (dB) = $40\log(30\text{meter} / 3\text{meter}) = +40\text{db}$	

- 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).

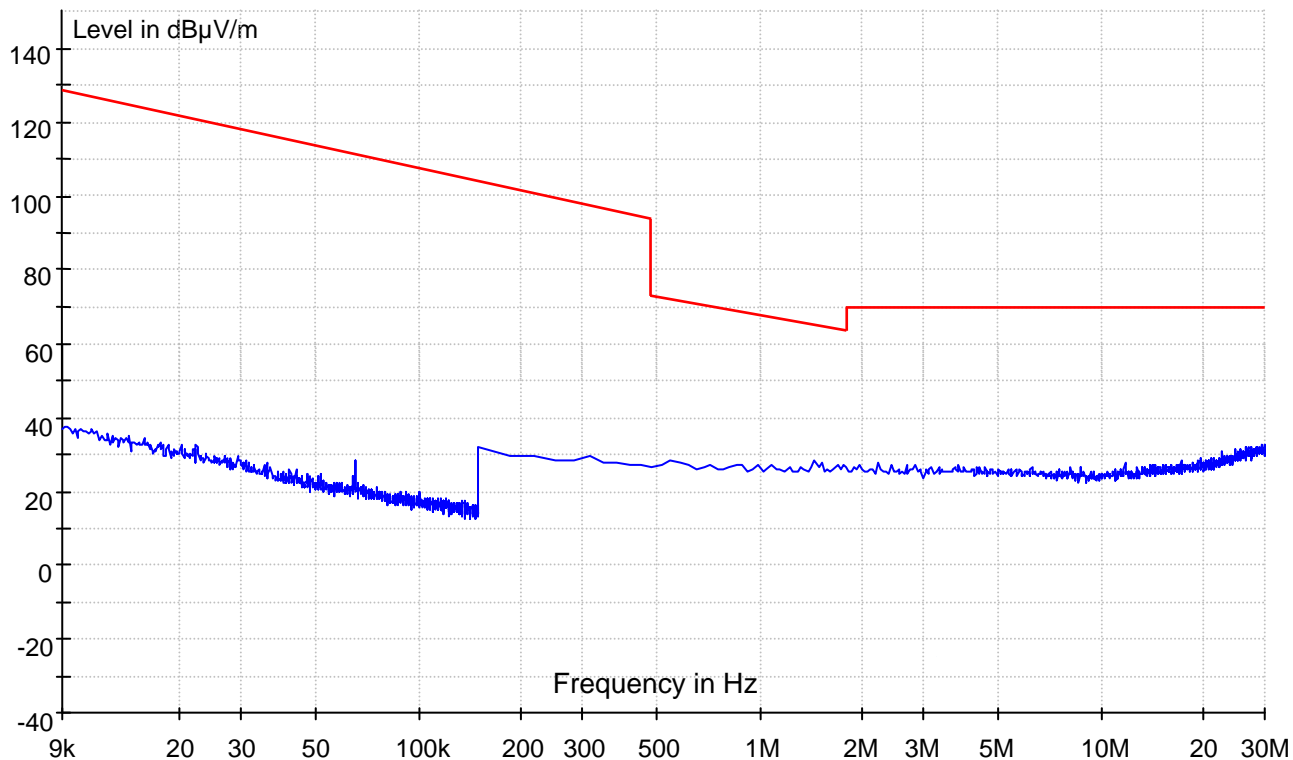
LIMITS FOR SPURIOUS

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

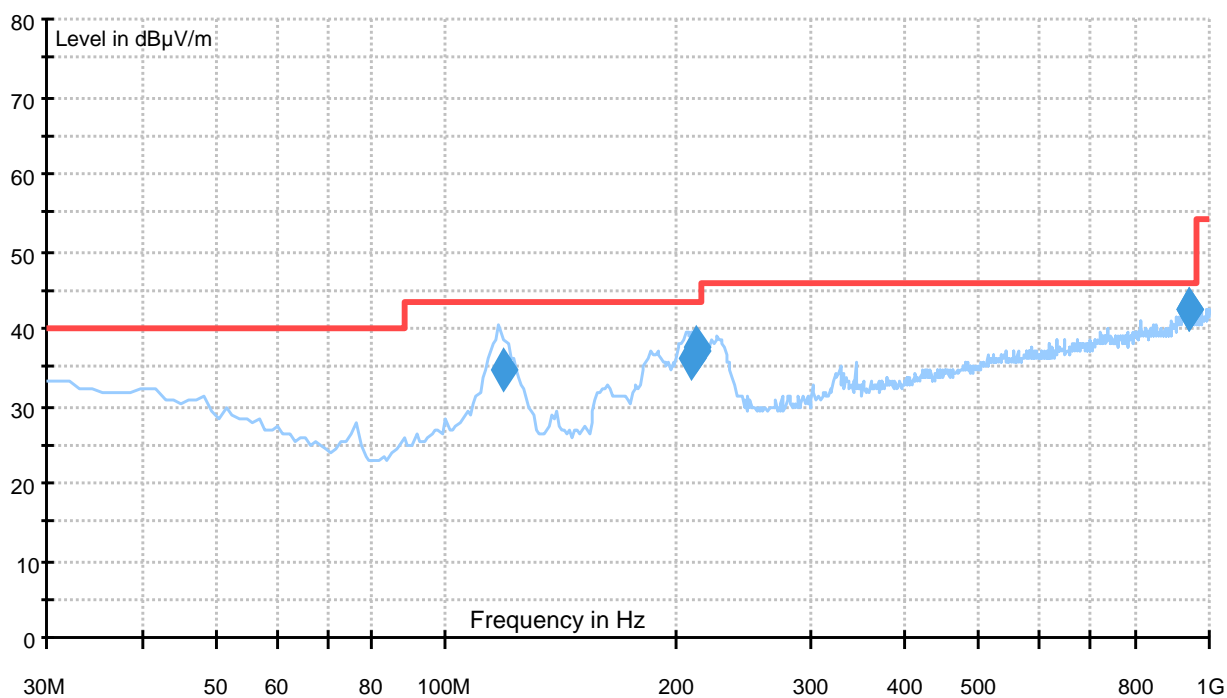
Tested samples

SAMPLE
HR 550 FS

MEASUREMENTS RESULTS (9kHz÷30 MHz)



MEASUREMENTS RESULTS (30÷1,000 MHz)



MEASUREMENTS RESULTS (1000 MHz to 24800 MHz)
Channel n°00 : 2,405 MHz
PEAK RESULT (RBW=1MHz; VBW=1MHz)

Frequency (MHz)	Measured Level (dBμV/m)	Limit (μV/meter)	Limit (dBμV/m)	Margin(dB)
2,405 (fundamental)	109.7288	---	---	---
4,809	59.9988	5000	74.00	14.00
7,213	58.4288	5000	74.00	15.57
9,618	64.3688	5000	74.00	9.63
12,027	57.1688	5000	74.00	16.83
f>12,027	No spurious detected	5000	74.00	---

AVERAGE FACTOR

T. Pulse (ms)	TX on + TX off (ms)	Duty cycle	Average Factor (dB)
4.788	100	0.04788	-26.397

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

Frequency (MHz)	Measured Level (dBμV/m)	Limit (μVolt/meter)	Limit (dBμV/m)	Margin (dB)
2,405 (fundamental)	83.3318	---	---	---
4,809	33.6018	500	54	20.40
7,213	32.0318	500	54	21.97
9,618	37.9718	500	54	16.03
12,027	30.7718	500	54	23.23
f>12,027	No spurious detected	500	54	---

Channel n°8 : 2,445 MHz
PEAK RESULT (RBW=1MHz; VBW=1MHz)

Frequency (MHz)	Measured Level (dBμV/m)	Limit (μV/meter)	Limit (dBμV/m)	Margin(dB)
2,445 (fundamental)	109,9388	---	---	---
4,881	63,2588	5000	74.00	14.00
7,319	54,1288	5000	74.00	15.57
9,752	51,5588	5000	74.00	9.63
12,203	47.1188	5000	74.00	16.83
f>12,203	No spurious detected	5000	74.00	---

AVERAGE FACTOR

T. Pulse (ms)	TX on + TX off (ms)	Duty cycle	Average Factor (dB)
4.788	100	0.04788	-26.397

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

Frequency (MHz)	Measured Level (dBμV/m)	Limit (μVolt/meter)	Limit (dBμV/m)	Margin (dB)
2,445 (fundamental)	83.5418	---	---	---
4,881	36.8618	500	54	20.40
7,319	27.7318	500	54	21.97
9,752	25.1718	500	54	16.03
12,203	20.7218	500	54	23.23
f>12,203	No spurious detected	500	54	---

Channel n°15 : 2,480 MHz
PEAK RESULT (RBW=1MHz; VBW=1MHz)

Frequency (MHz)	Measured Level (dBμV/m)	Limit (μV/meter)	Limit (dBμV/m)	Margin(dB)
2,480 (fundamental)	109.6388	---	---	---
4,959	65.1188	5000	74	8.88
7,426	59.3488	5000	74	14.65
9,918	65.0088	5000	74	8.99
12,377	55.5688	5000	74	18.43
f>12,377	No spurious detected	5000	74	---

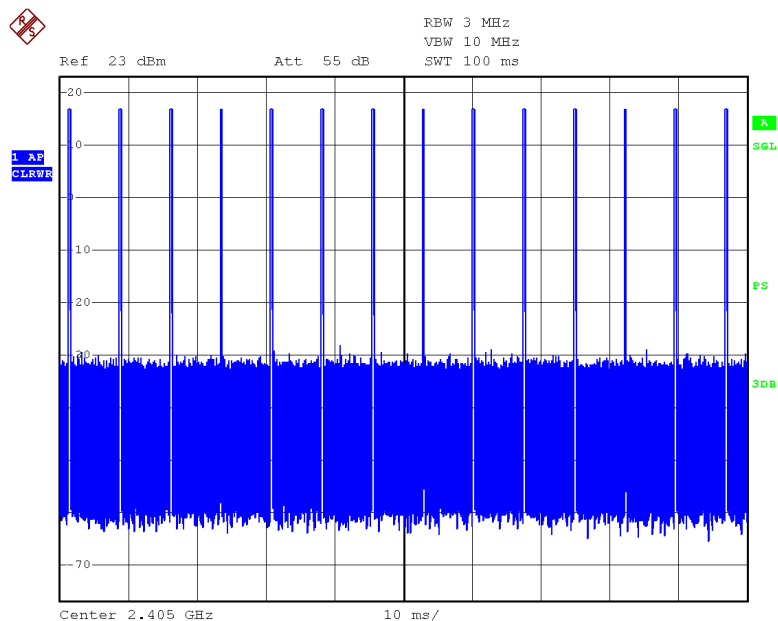
AVERAGE FACTOR

T. Pulse (ms)	TX on + TX off (ms)	Duty cycle	Average Factor (dB)
4.788	100	0.04788	-26.397

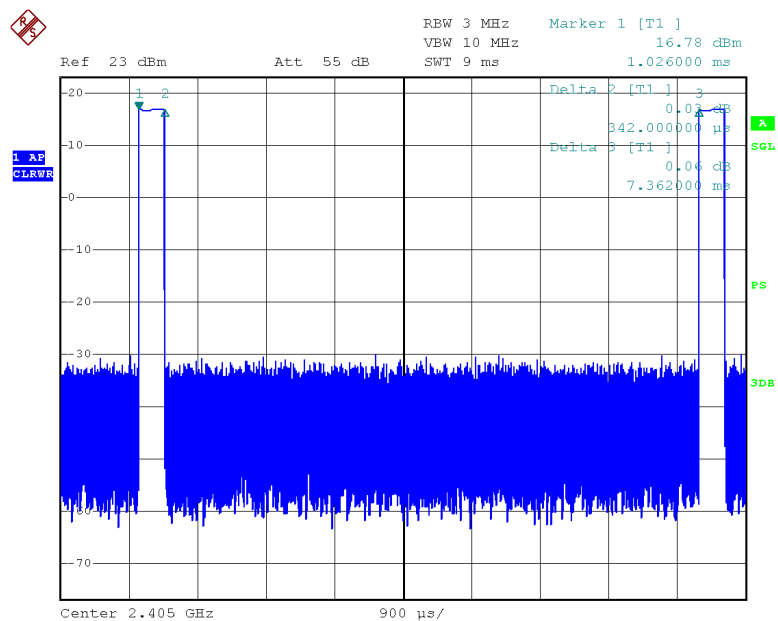
AVERAGE RESULT (RBW=1MHz; VBW=10Hz)

Frequency (MHz)	Measured Level (dBμV/m)	Limit (μVolt/meter)	Limit (dBμV/m)	Margin (dB)
2,480 (fundamental)	83.2418	---	---	---
4,959	38.7218	500	54	15.28
7,426	32.9518	500	54	21.05
9,618	38.6118	500	54	15.39
12,377	29.1718	500	54	24.83
f>12,377	No spurious detected	500	54	---

Number of transmissions in 100ms : 14 transmissions



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Date: 17.JUN.2010 17:15:51

In a 100ms period, there are 14 transmissions, so the TX on is: $0.342\text{ms} \times 14 = 4.788\text{ ms}$

TEST No.3	Title "6 dB Bandwidth"	47CFR Part 15 Ref. Section
		15.247 (a) (2)
TEST SET-UP & REQUIREMENTS	Spectrum analyzer settings	
	Span	2 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 temporary FR 50Ω connector type SMA.

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

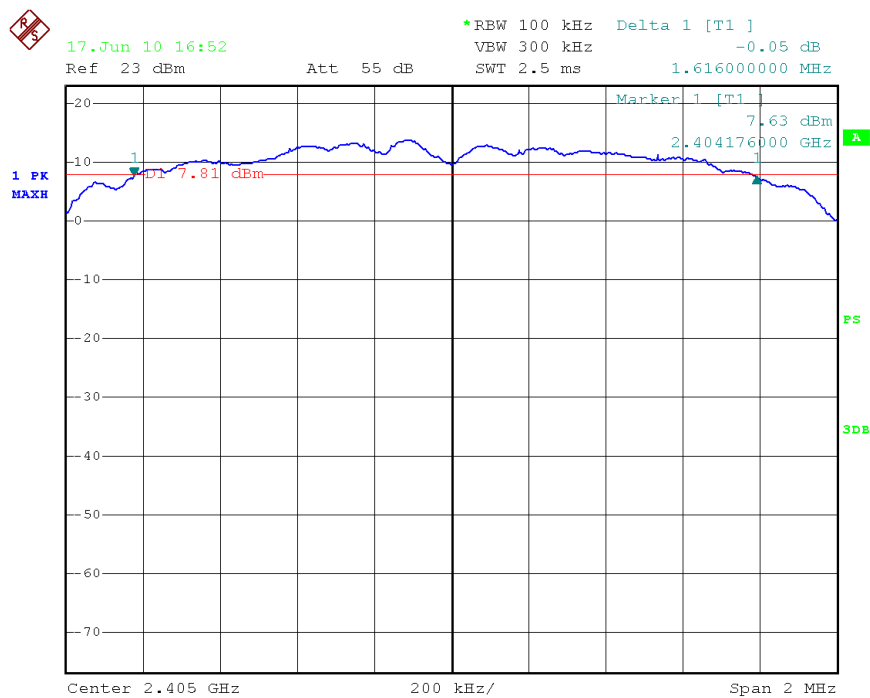
Test Result:

Channel (No.)	Frequency (MHz)	Channel Bandwidth (MHz)	Plot (No.)
00	2,405	1.616	1
08	2,480	1.608	2
15	2,480	1.612	3

Tested samples

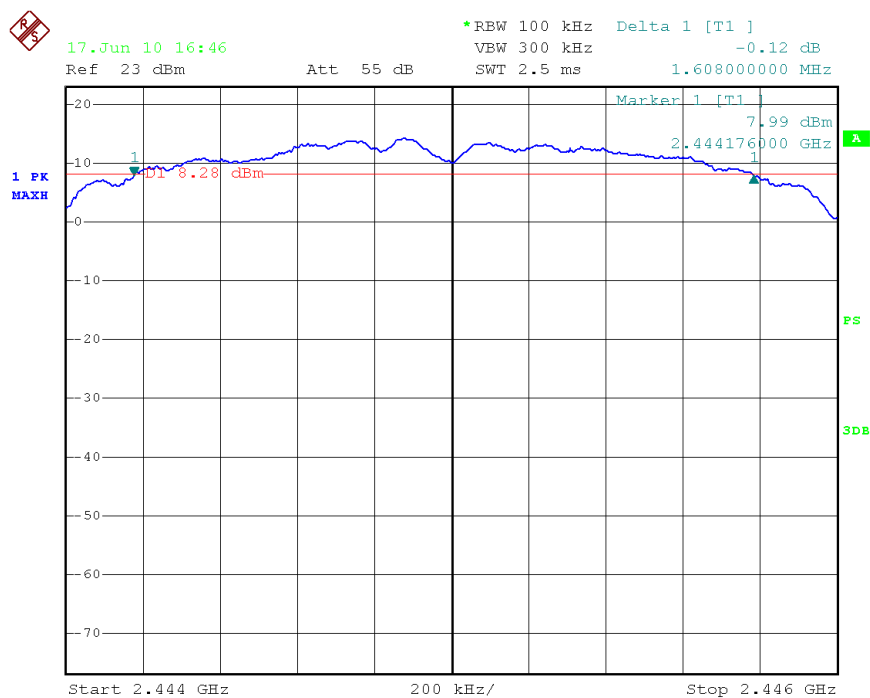
SAMPLE
HR 550 FS

Plot No. 1



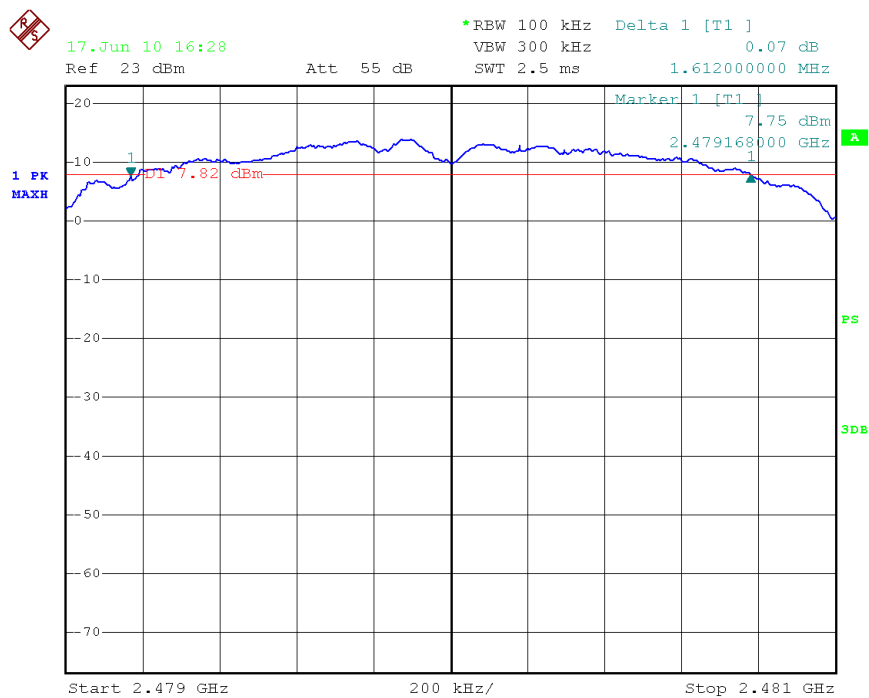
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Plot No. 2



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Plot No. 3



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TEST No.4	Title	47CFR Part 15 Ref. Section
	“ Maximum Peak Output Power with External Antenna (De Facto EIRP) ”	15.247 (b) (3)
TEST SET-UP & REQUIREMENTS	Spectrum analyzer settings	
	Span	/
	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	/
	LIMIT	1 Watt (30dBm)

Conducted measurements:

The transmitter output was connected to the spectrum analyzer through a temporary RF 50Ω connector type SMA.

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.

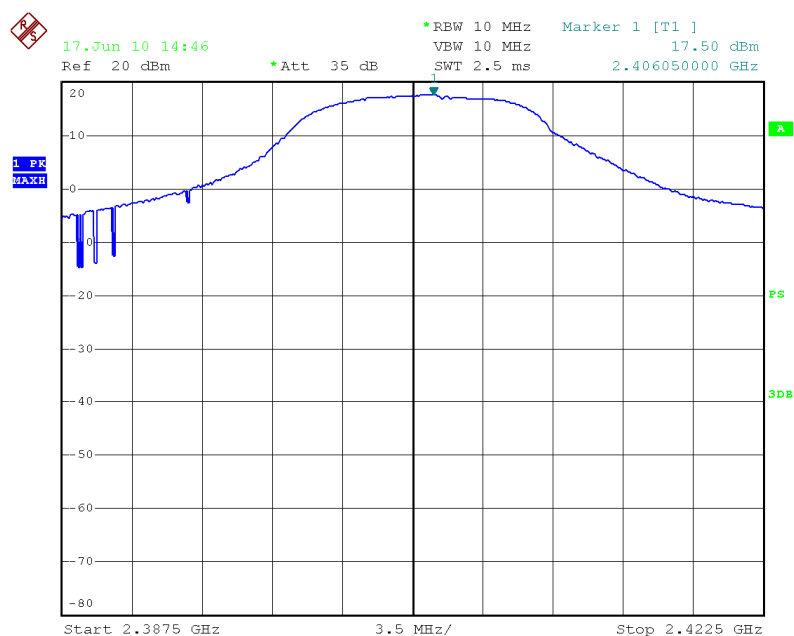
Tested samples

SAMPLE
HR 550 FS

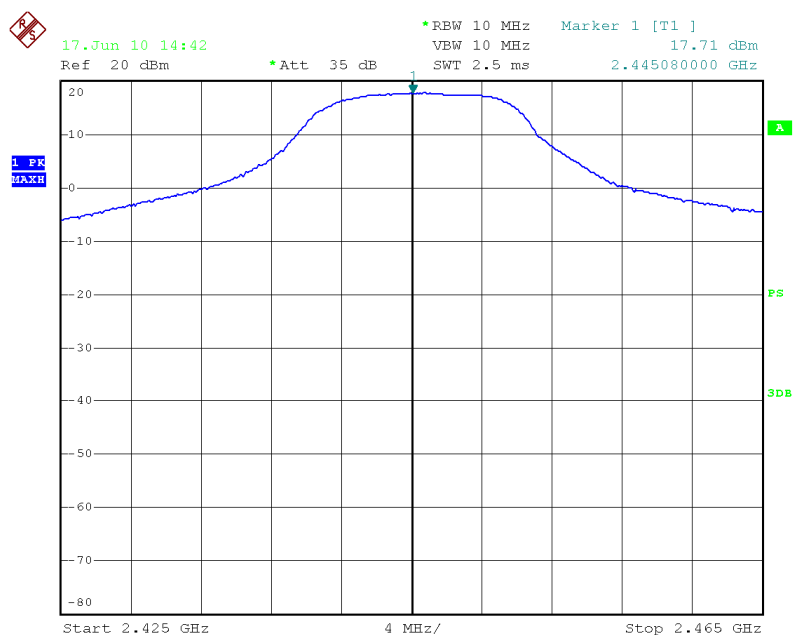
Test Result

Conducted measure (Peak detector)

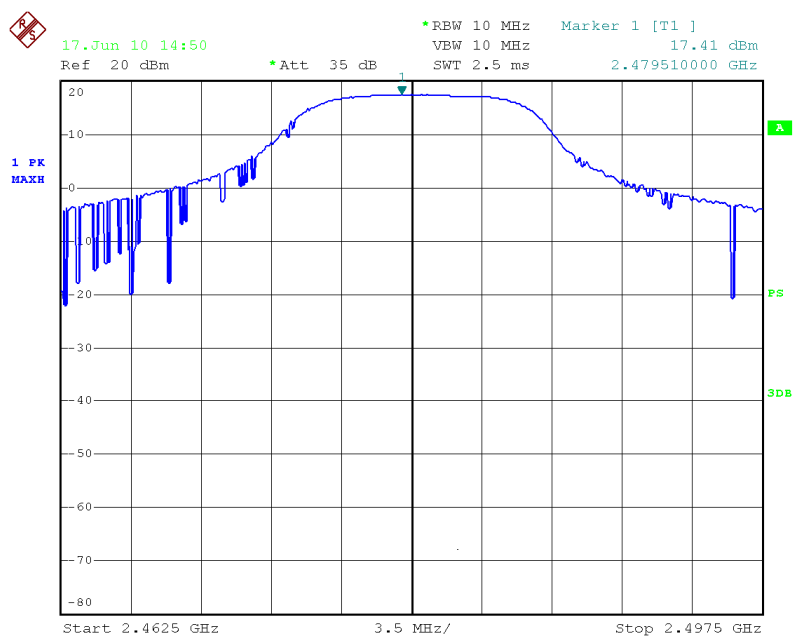
Channel (No.)	Frequency (MHz)	Measured Output Power (dBm)	Max. Antenna Gain (dB)	Calculated Radiated Output Power (dBm)
00	2,405	+17.50	-3	+14.50
08	2,445	+17.71		+14.71
15	2,480	+17.41		+14.41



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TEST No. 5	Title		47CFR Part 15 Ref. Section
	“Band-edge Compliance of RF Radiated Emissions “		15.247 (d)
TEST SET-UP & REQUIREMENTS	Spectrum analyzer settings		
	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	/	
	LIMIT	-20 dB below peak output power	

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

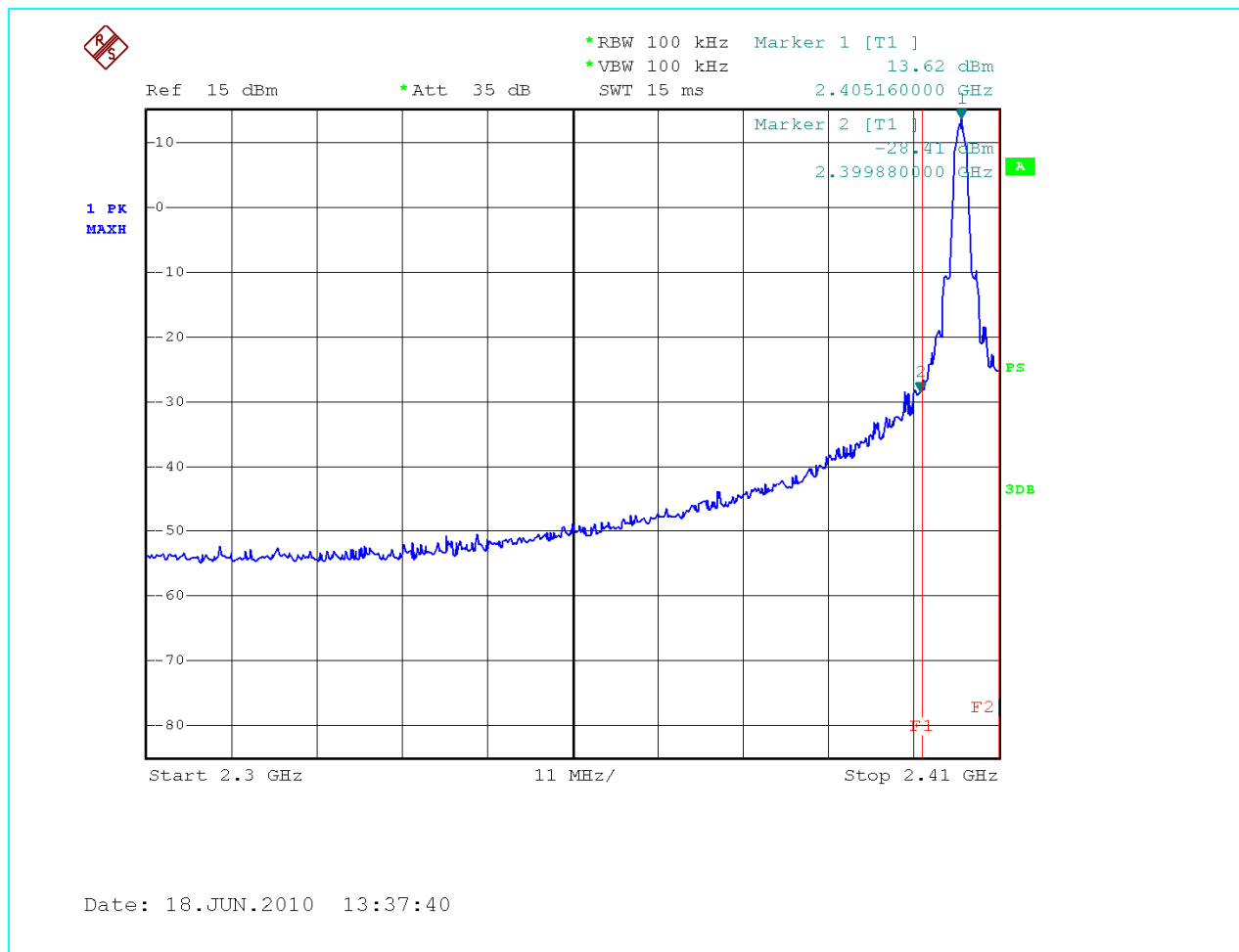
Delta technique: The transmitter output was connected to the spectrum analyzer through a test fixture (radio frequency coupling device associated with the dedicated antenna of the equipment under test) Once the trace is stabilized, by the marker the emission at the band edge (or on the highest modulation 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
HR 550 FS

Test Result:

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

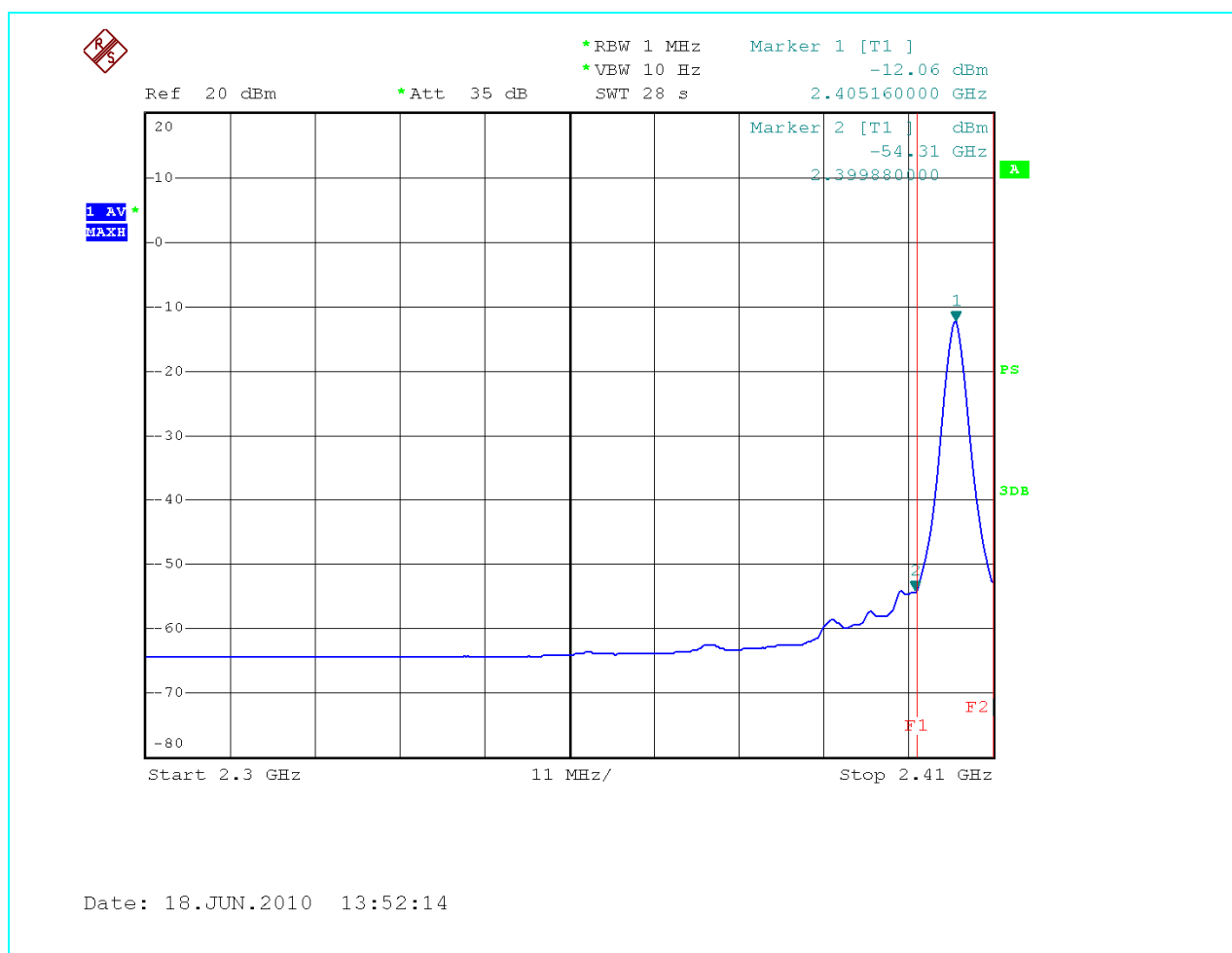


All out of band spurious emissions are more 20 dB below the in band power of the fundamental.

Band-edge compliance to radiated emission test

Band edge Lower (MHz)	Measured power (dBm)	Measured power at the band edge (dBm)	Difference Peak – band edge (dBm)	Peak Limit at PK power –20 dB (dBm)	Margin (dB)
2,405	+13.62	-28.41	-42.03	-6.38	18.43
Within the limit					

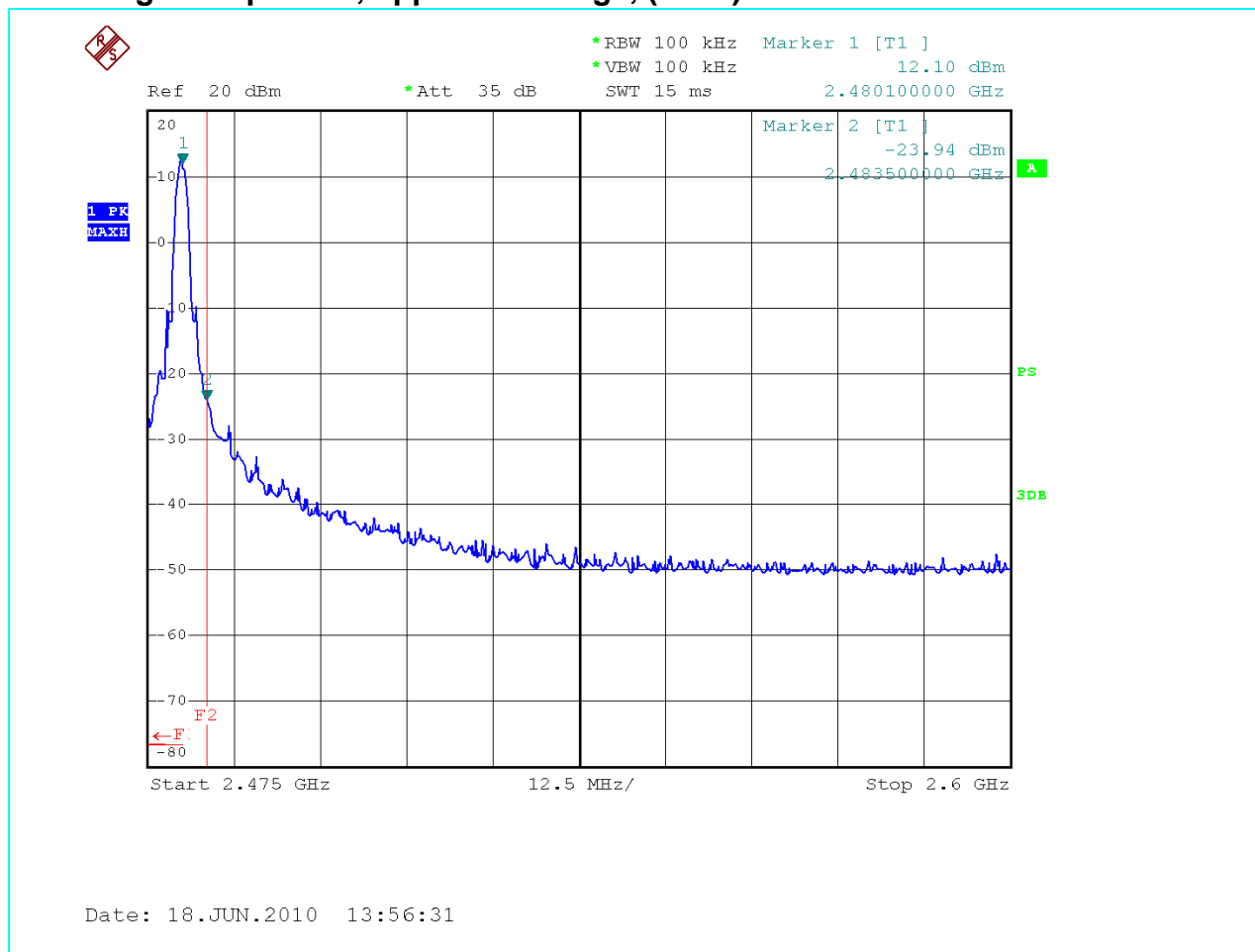
Band-edge compliance, lower band edge, (Average)



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 Lower (MHz)	Measured power (dBm)	Measured power at the band edge (dBm)	Difference Peak – band edge (dBm)	Peak Limit at PK power –20 dB (dBm)	Margin (dB)
2,405 MHz	-12.06	-54.31	-42.25	-32.06	22.25
Within the limit					

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

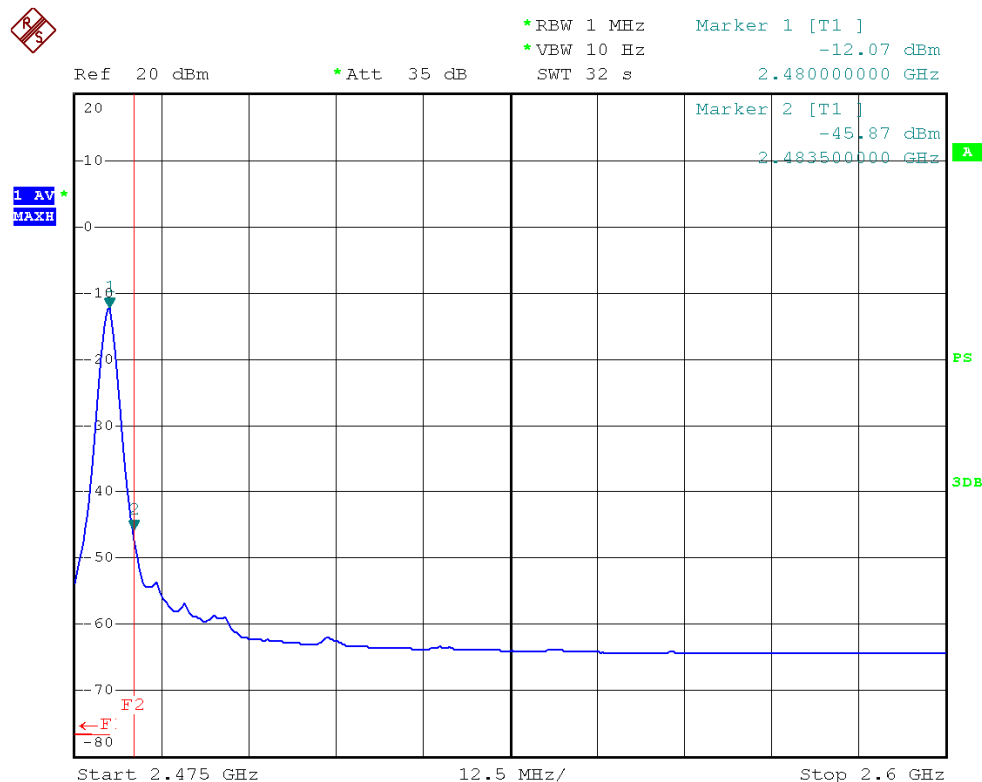


All out of band spurious emissions are more 20 dB below the in band power of the fundamental.

Band-edge compliance to radiated emission test

Band edge Lower (MHz)	Measured power (dBm)	Measured power at the band edge (dBm)	Difference Peak – band edge (dBm)	Peak Limit at PK power –20 dB (dBm)	Margin (dB)
2,480 MHz	+12.10	-23.94	-36.04	-7.9	-16.04
Within the limit					

Band-edge compliance, upper band edge, (Average)



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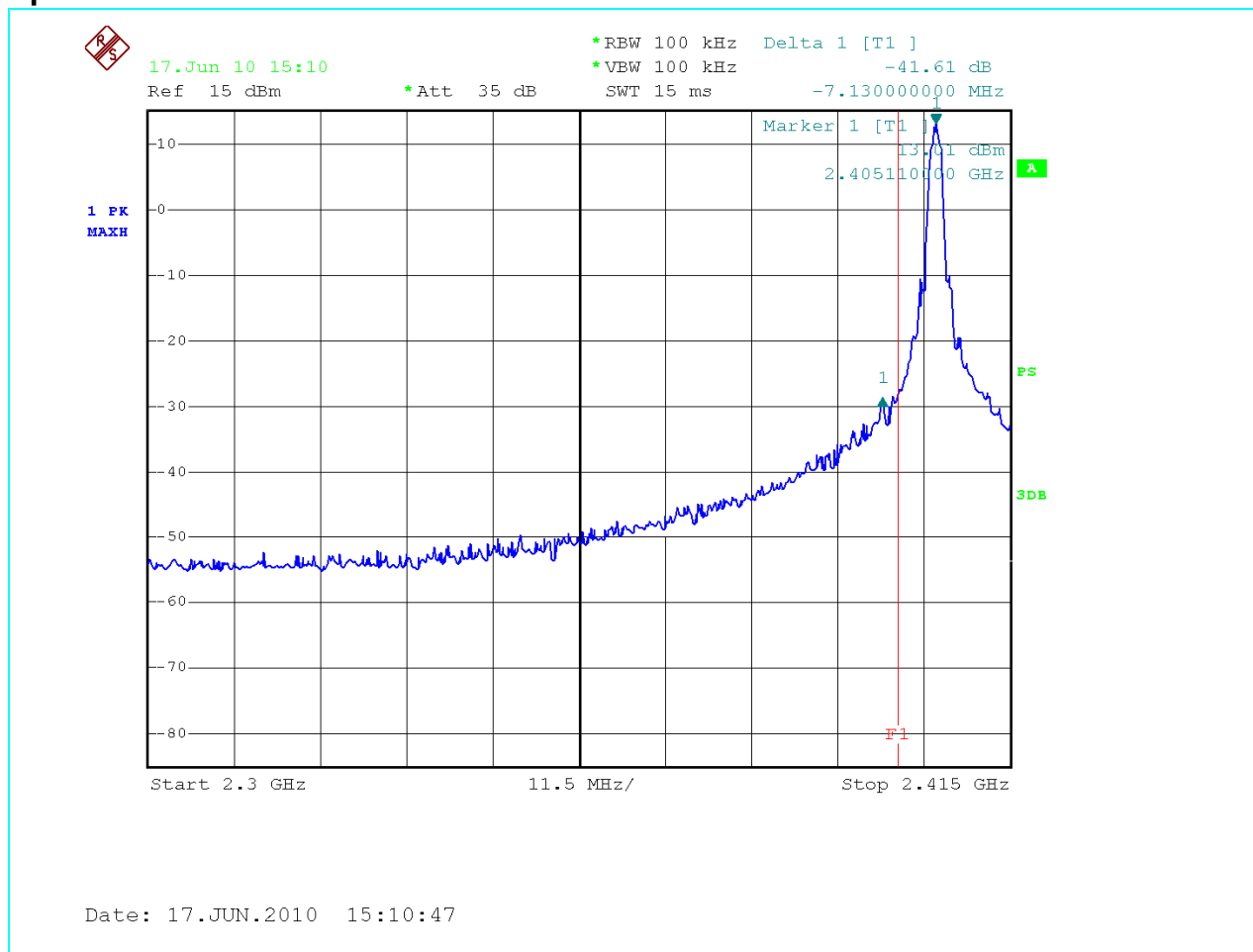
All out of band spurious emissions are more 20 dB below the in band power of the fundamental.

Band-edge compliance to radiated emission test

Band edge Lower (MHz)	Measured power (dBm)	Measured power at the band edge (dBm)	Difference Peak – band edge (dBm)	Peak Limit at PK power –20 dB (dBm)	Margin (dB)
2480 MHz	-12.07	-45.67	-33.6	-32.07	-13.6

Within the limit

Spurious Emission in restricted band near 2400-2483.5 MHz



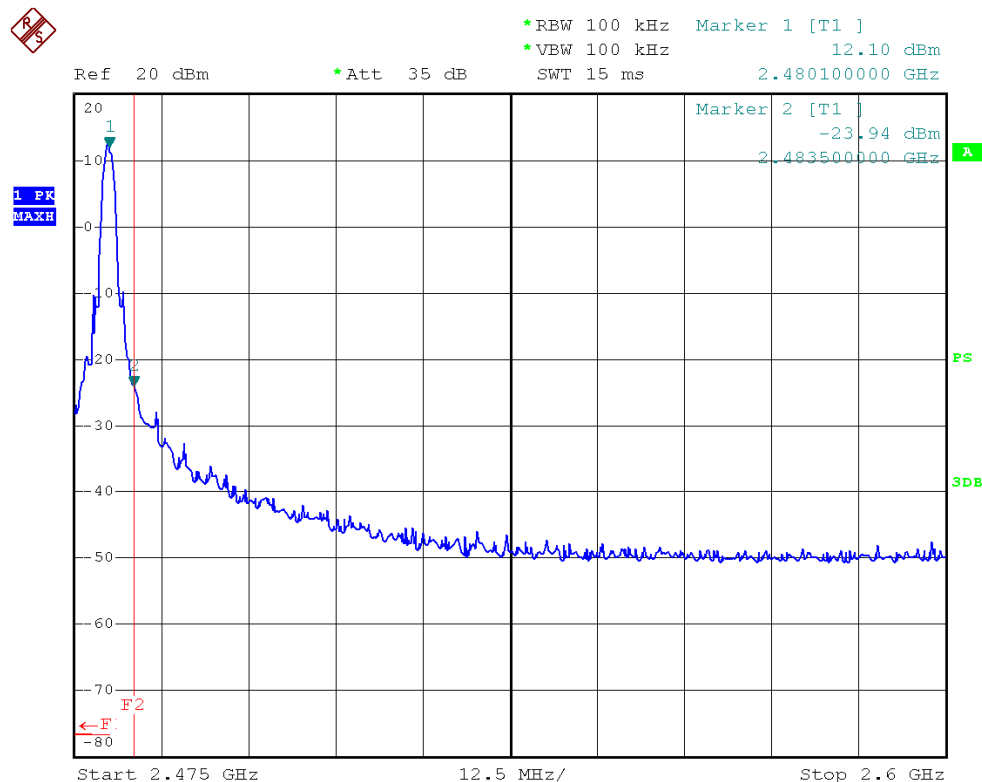
PEAK DETECTOR

Frequency (MHz)	Measured Level (dBμV/m)	Limit (μVolt/meter)	Limit (dBμV/m)	Margin (dB)
2,405.11	66,63	5000	74.00	-7.37

AVERAGE DETECTOR

Frequency (MHz)	PK level -26.397 (dBμV/m)	Limit (μVolt/meter)	Limit (dBμV/m)	Margin (dB)
2,405.11	40.23	500	54.00	-13.77

Spurious Emission in restricted band near 2400-2483.5 MHz



Date: 18.JUN.2010 13:56:31

PEAK DETECTOR

Frequency (MHz)	Measured Level (dBμV/m)	Limit (μVolt/meter)	Limit (dBμV/m)	Margin (dB)
2,480.10	71.29	5000	74.00	-2.71

AVERAGE DETECTOR

Frequency (MHz)	PK level -26.397 (dBμV/m)	Limit (μVolt/meter)	Limit (dBμV/m)	Margin (dB)
2,480.10	40.89	500	54.00	-9.11

TEST No.6	Title “Conducted Emissions outside the band 2,400-2,483.5 MHz”	47CFR Part 15 Ref. Section
		15.247 (d)
TEST SET-UP & REQUIREMENTS	Spectrum analyzer settings	
	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
	Detector function	Peak
	Trace	max hold
	Attenuator	/
	LIMIT	-20 dB below peak output power

The transmitter output was connected to the spectrum analyzer through a temporary FR 50Ω connector type SMA.

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
HR 550 FS

Test Result:

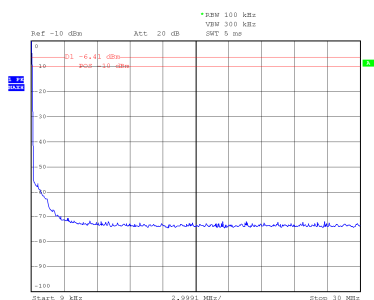
Within the specifications

Channel 00 : Power for determination limit line

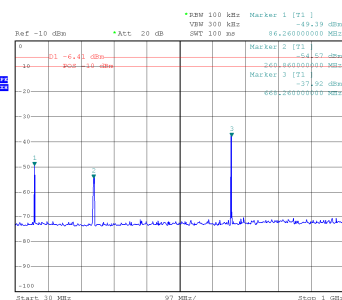


Date: 18.JUN.2010 10:54:38

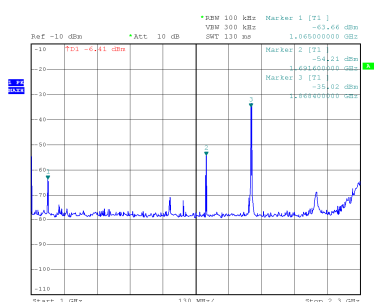
Test Result: Conducted measure (channel 00)



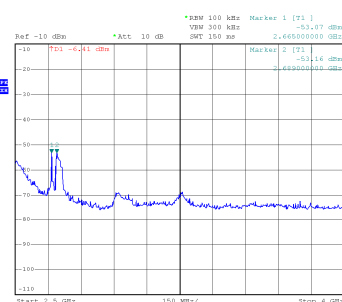
TLP-NT2
Date: 18 JUN 2010 12:43:02



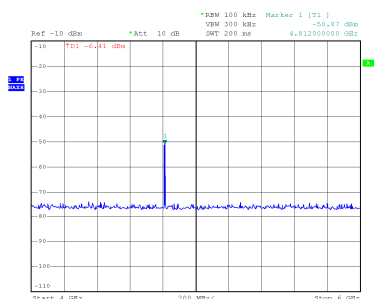
TLP-NT2
Date: 18 JUN 2010 12:53:32



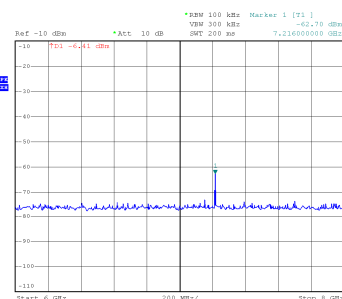
TLP-NT2
Date: 18 JUN 2010 14:01:33



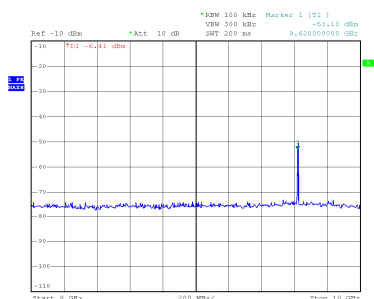
TLP-NT2
Date: 18 JUN 2010 14:03:47



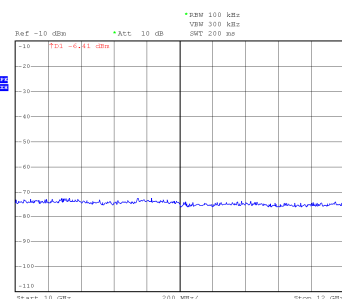
TLP-NT2
Date: 18 JUN 2010 14:05:09



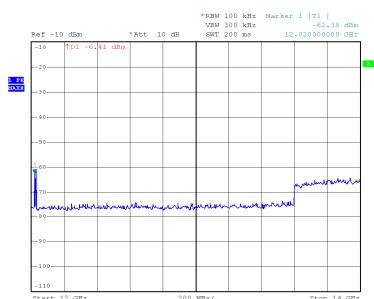
TLP-NT2
Date: 18 JUN 2010 14:06:47



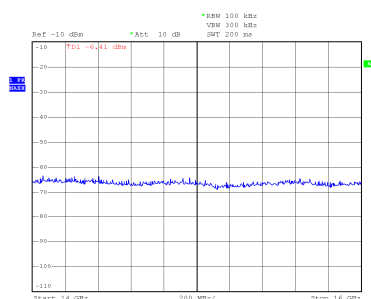
TLP-NT2
Date: 18 JUN 2010 14:08:55



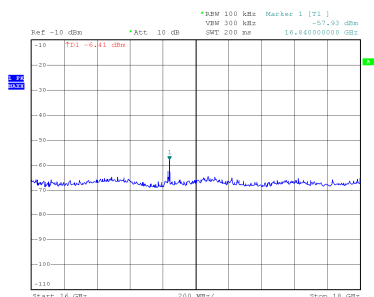
TLP-NT2
Date: 18 JUN 2010 14:15:26



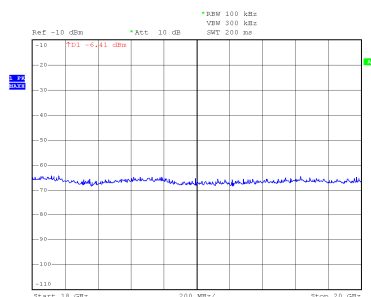
TLP-NT2
Date: 18 JUN 2010 14:16:28



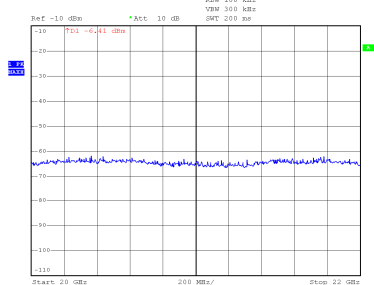
TLP-NT2
Date: 18 JUN 2010 14:16:27



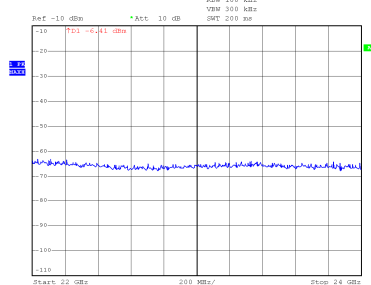
TLP-NT2
Date: 18 JUN 2010 14:18:56



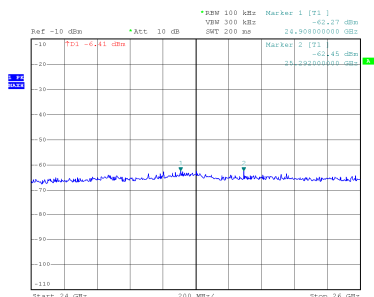
TLP-NT2
Date: 18 JUN 2010 14:21:33



TLP-NT2
Date: 18 JUN 2010 14:21:59



TLP-NT2
Date: 18 JUN 2010 14:22:33



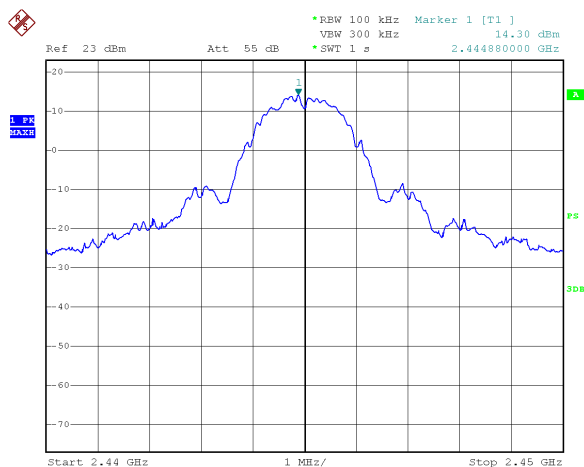
TLP-NT2
Date: 18 JUN 2010 14:23:09

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

PEAK RESULT Channel n°0: 2,405.00 MHz

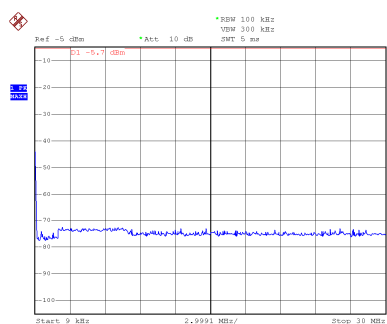
Frequency (MHz)	Measured Level (dBm)	Limit (dBm) Fundamental value – 20dB	Limit (dBm) Restricted band -33dBm	Margin (dB)
86.26	-49.39	-6.41	---	-42.98
260.86	-54.57	---	-33	-21.57
668.26	-37.92	-6.41	---	-31.51
1,065	-63.66	---	-33	-30.66
1,691.6	-54.21	---	-33	-21.21
1,868	-35.02	-6.41	---	-28.61
2,265	-53.07	---	-33	-20.07
2,689	-53.16	-6.41		-46.75
2,405 (fundamental)	+13,59	---	---	---
4,812	-50.87	---	-33	-17.87
7,216	-62.70	-6.41	---	-56.29
9,620	-53.10	-6.41	---	-46.69
12,020	-62.38	---	-33	29.38
16,840	-57.93	-6.41	---	-51.52
24,908	-62.27	-6.41	---	-55.86
25,292	-62.45	-6.41	--	-56.04

Channel 08 : Power for determination limit line

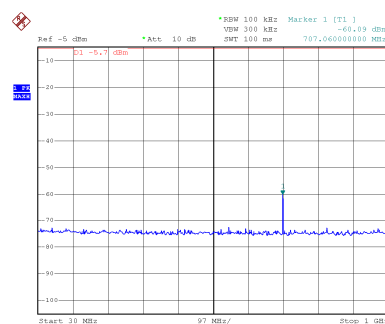


Date: 18.JUN.2010 08:34:55

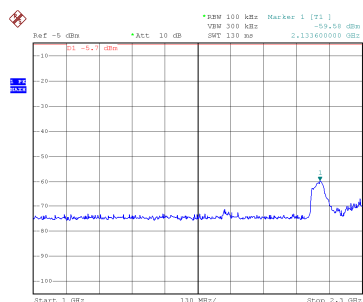
Conducted measure (channel 08)



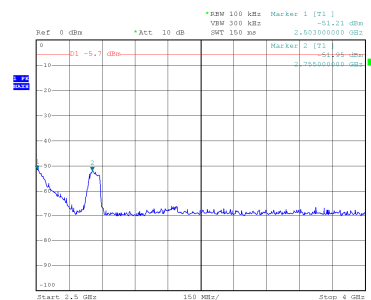
Date: 18.JUN.2010 09:08:00



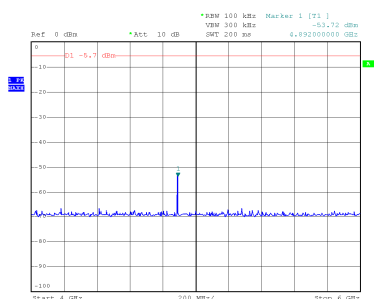
Date: 18.JUN.2010 09:10:49



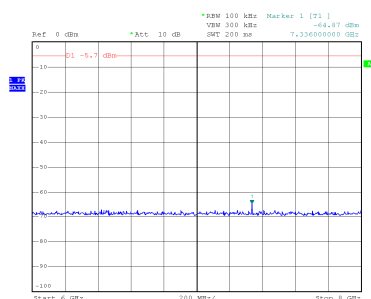
Date: 18.JUN.2010 09:15:52



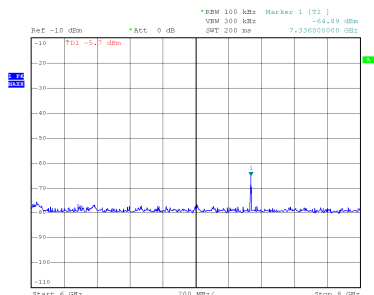
TLP-NT2
Date: 18.JUN.2010 11:30:05



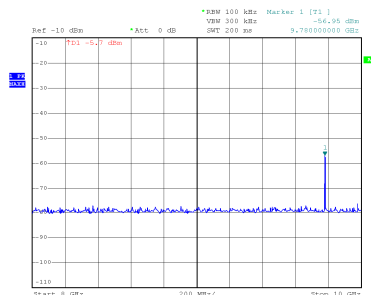
TLP-NT2
Date: 18 JUN 2010 11:32:48



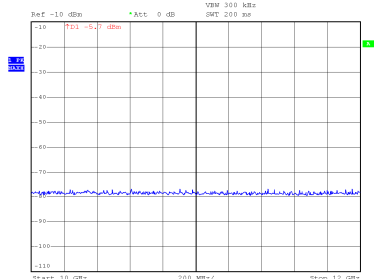
TLP-NT2
Date: 18 JUN 2010 11:35:11



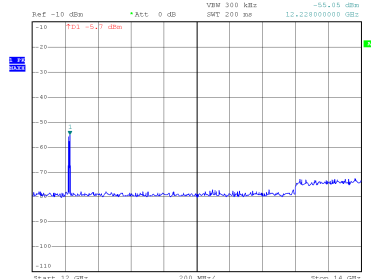
TLP-NT2
Date: 18 JUN 2010 11:45:25



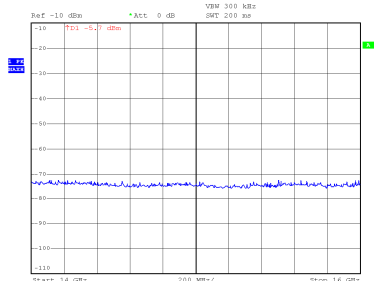
TLP-NT2
Date: 18 JUN 2010 11:46:55



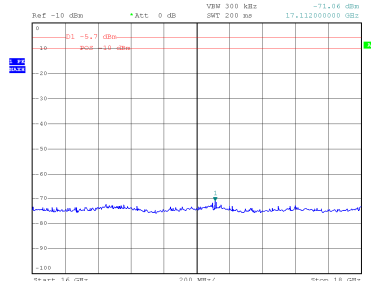
TLP-NT2
Date: 18 JUN 2010 11:50:19



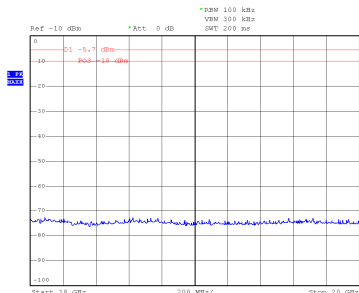
TLP-NT2
Date: 18 JUN 2010 11:51:06



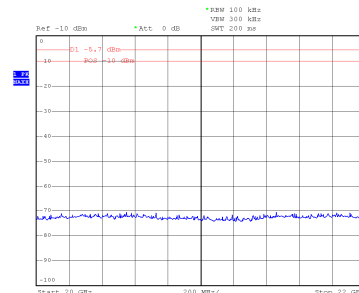
TLP-NT2
Date: 18 JUN 2010 11:53:35



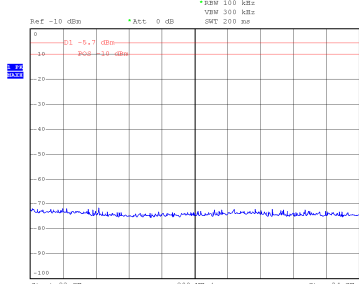
TLP-NT2
Date: 18 JUN 2010 12:01:11



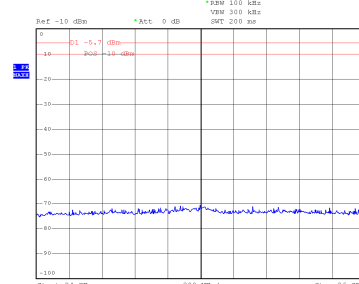
TLP-NT2
Date: 18 JUN 2010 12:02:25



TLP-NT2
Date: 18 JUN 2010 12:03:47



TLP-NT2
Date: 18 JUN 2010 12:04:42



TLP-NT2
Date: 18 JUN 2010 12:06:07

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

PEAK RESULT Channel n°08: 2445.00 MHz

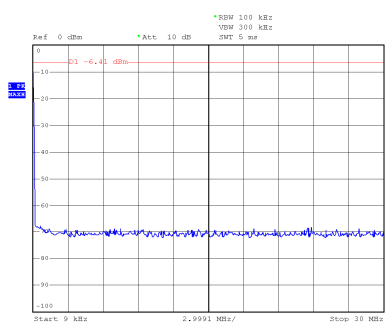
Frequency (MHz)	Measured Level (dBm)	Limit (dBm) Fundamental value – 20dB	Limit (dBm) Restricted band -33dBm	Margin (dB)
707.06	-60.09	-5.7	---	-54.39
2,133.6	-59.58	-5.7	---	-53.88
2,503	-51.21	-5.7	---	-45.51
2,755	-51.95	---	-33	-18.95
2,445 (fundamental)	+14.30	---	---	---
4,892	-53.72	---	-33	-20.72
7,336	-64.89	---	-33	-31.89
9,780	-56.95	-5.7	---	-51.25
12,228	-55.05	---	-33	-22.05
17,112	-71.06	-5.7	---	-65.36

Channel 15 : Power for determination limit line

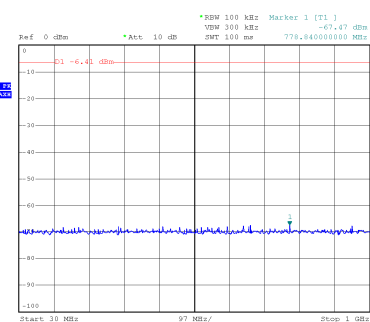


Date: 18.JUN.2010 12:43:07

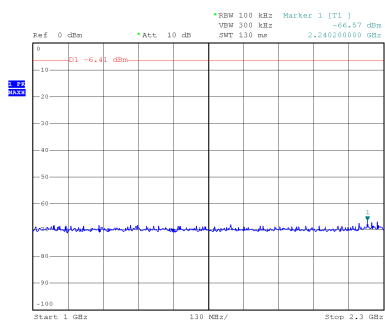
Conducted measure (channel 15)



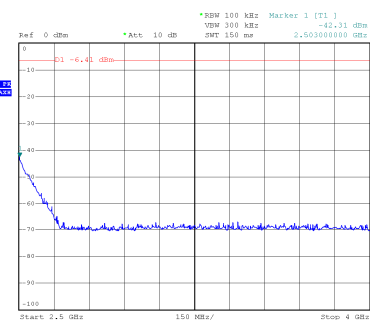
TLP-NT2
Date: 18.JUN.2010 14:31:26



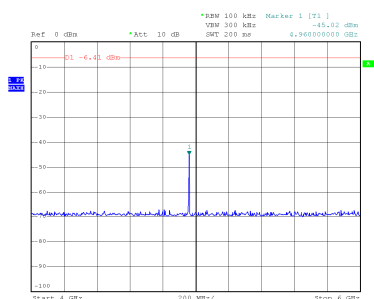
TLP-NT2
Date: 18.JUN.2010 14:32:42



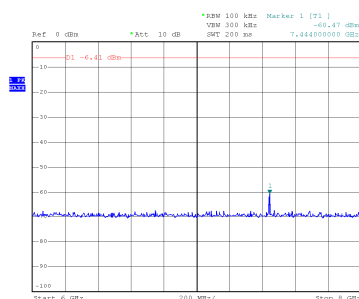
TLP-NT2
Date: 18.JUN.2010 14:33:21



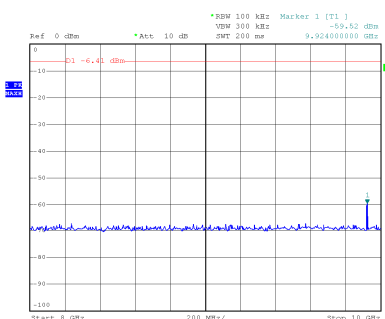
TLP-NT2
Date: 18.JUN.2010 14:34:10



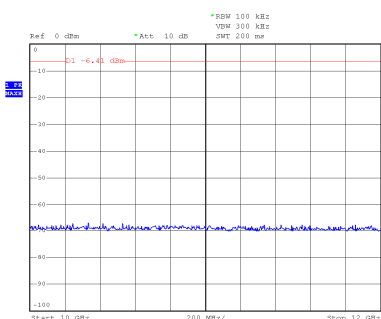
TLP-NT2
Date: 18.JUN.2010 14:35:27



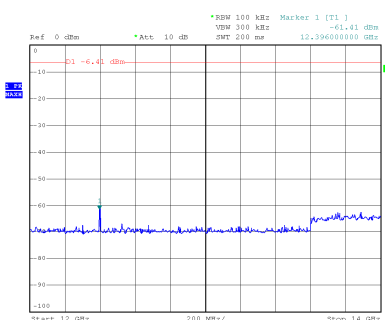
TLP-NT2
Date: 18.JUN.2010 14:37:04



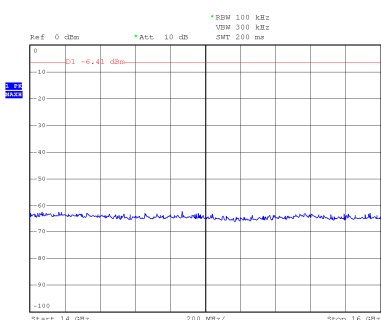
TLP-NT2
Date: 18.JUN.2010 14:40:01



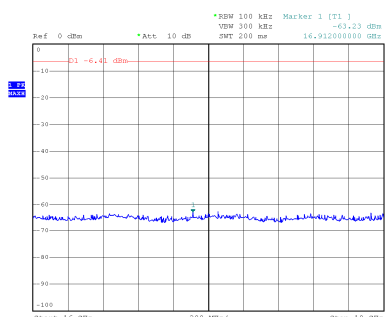
TLP-NT2
Date: 18.JUN.2010 14:42:11



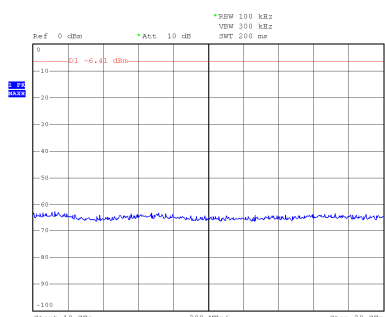
TLP-NT2
Date: 18.JUN.2010 14:42:39



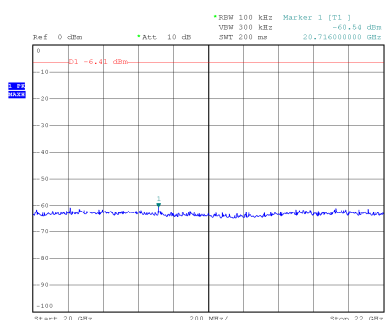
TLP-NT2
Date: 18.JUN.2010 14:45:29



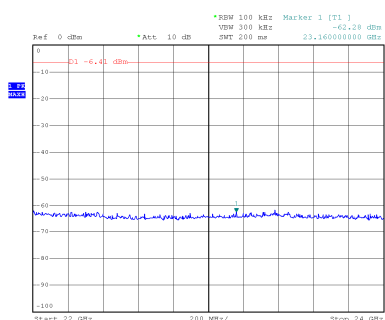
TLP-NT2
Date: 18.JUN.2010 14:46:04



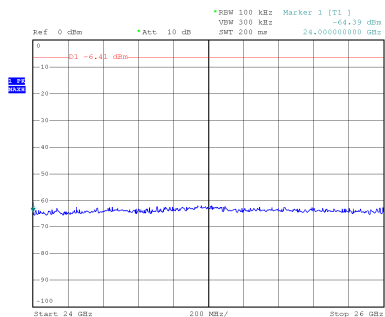
TLP-NT2
Date: 18.JUN.2010 14:47:00



TLP-NT2
Date: 18.JUN.2010 14:47:49



TLP-NT2
Date: 18.JUN.2010 14:48:39



TLP-NT2
Date: 18.JUN.2010 14:49:27

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

PEAK RESULT Channel n°15: 2,480.00 MHz

Frequency (MHz)	Measured Level (dBm)	Limit (dBm) Fundamental value – 20dB	Limit (dBm) Restricted band -33dBm	Margin (dB)
778.84	-67.47	-6.41	---	-61.06
2,240.2	-66.57	---	-33	-33.57
2,480 (fundamental)	+13.59	---	---	---
2,503	-42.31	-6.41	---	-35.90
4,960	-45.02	---	-33	-12.02
7,444	-60.47	---	-33	-27.47
9,924	-59.52	-6.41		-53.11
12,396	-61.41	---	-33	-28.41
16,912	-63.23	-6.41	---	-56.82
20,716	-60.54	---	-33	-27.54
23,160	-62.28	-6.41	---	-55.87

TEST No.7	Title “ Transmitter Power Spectral Density”	47CFR Part 15 Ref. Section
		15.247 (e)
TEST SET-UP & REQUIREMENTS	Spectrum analyzer settings	
	Span	1.5 MHz
	Resolution (or IF) Bandwidth (RBW)	3 kHz
	Video (or Average) Bandwidth (VBW)	10 kHz
	Sweep time	500 s
	Detector function	Peak
	Trace	max hold
	Attenuator	/
	LIMIT	8 dBm

The transmitter output was connected to the spectrum analyzer through a temporary FR 50Ω connector type SMA.

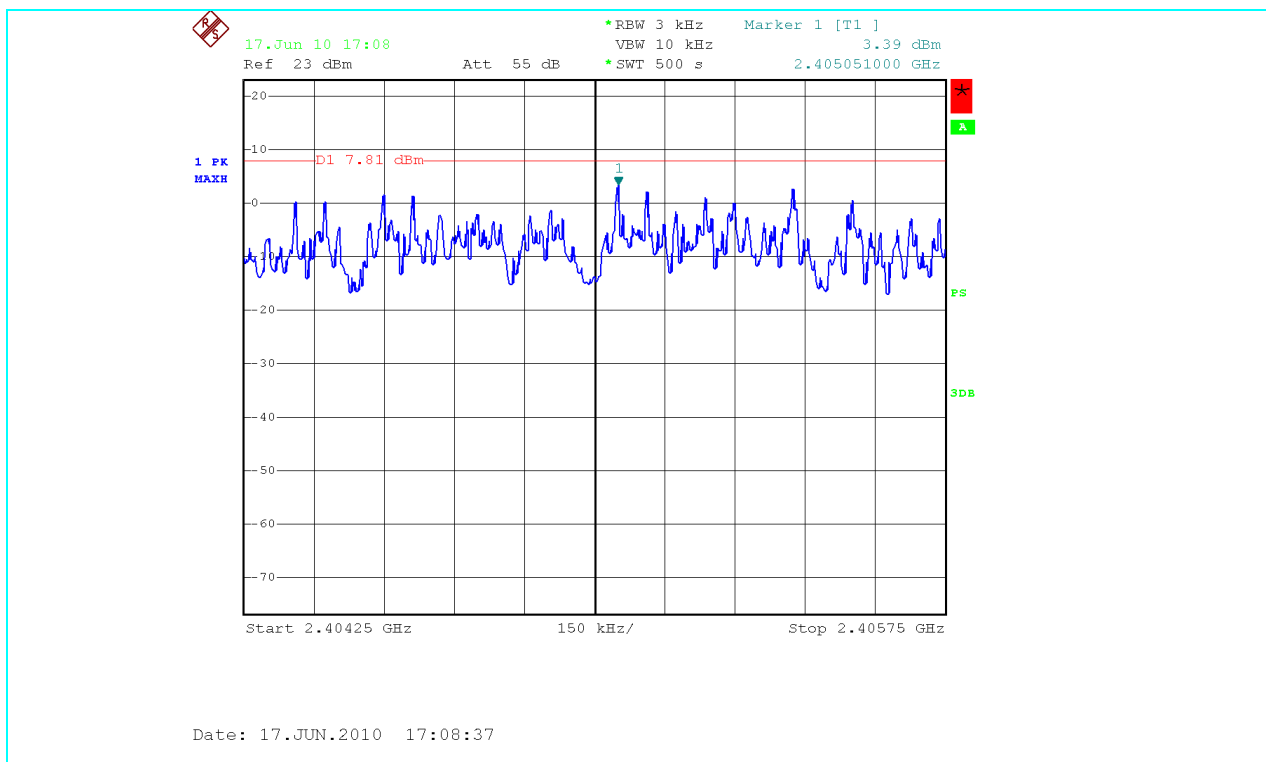
After trace stabilisation the marker shall be set on the signal peak. The indicated level is the power spectral density.

Test Result:

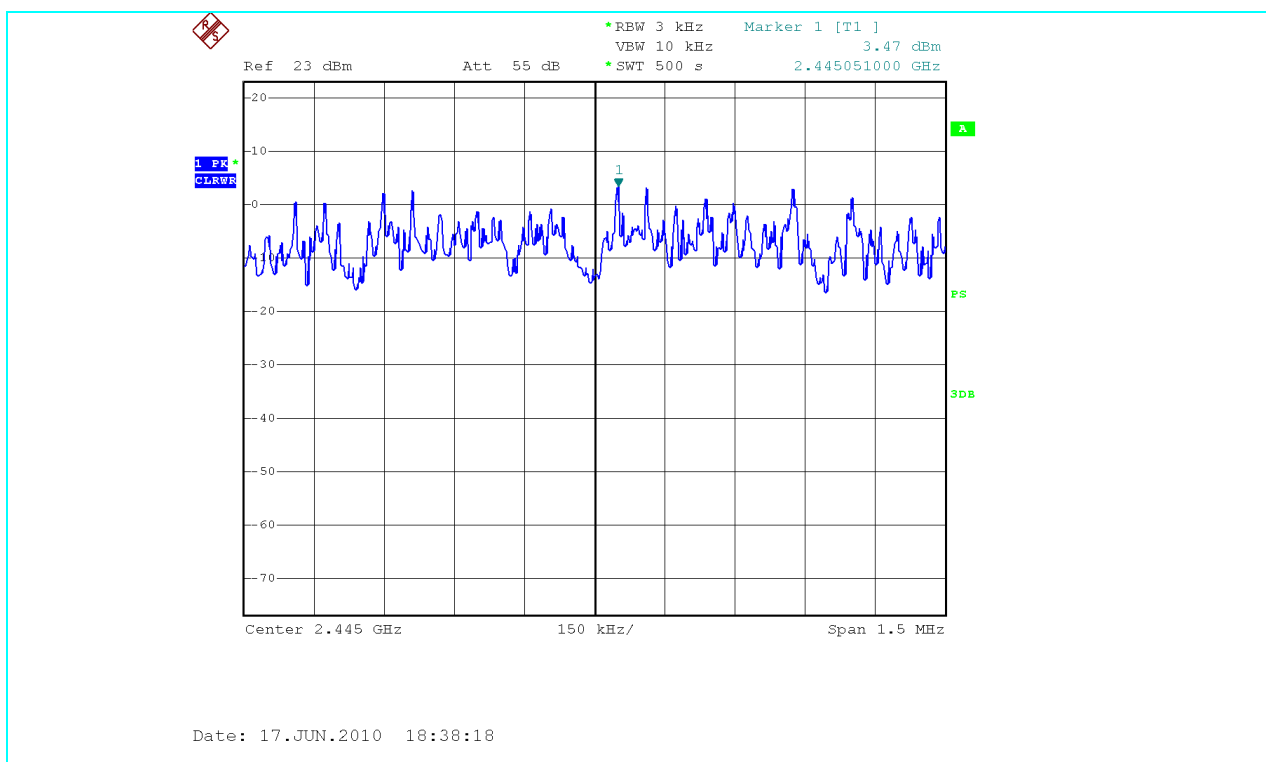
Channel (No.)	Transmitter power on 3 kHz band (dBm)	Plot (No.)
00	+3.39	1
08	+3.47	2
15	+3.44	3

Within the specifications

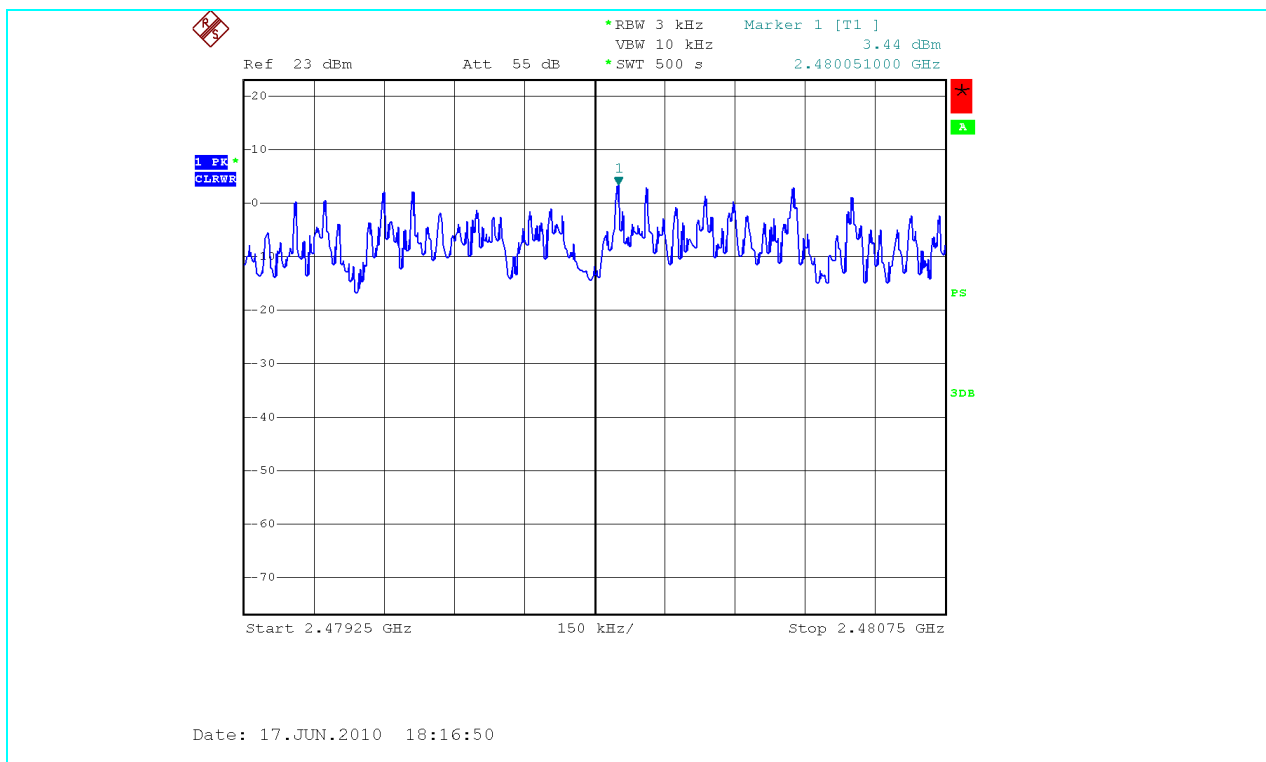
Plot No. 1:



Plot No. 2:



Plot No. 3:



TEST No.8	Title “RF Exposure Evaluation”	47CFR Part 15 Ref. Section
		15.247 (i)
TEST SET-UP & REQUIREMENTS	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)	Portable according to § 2.1093(b) of this Chapter
	LIMITS	According to § 2.1093 of this Chapter, by means of the following guidelines: OET Bulletin 65 and Mobile Portable RF Exposure v.04 (KDB no 447498)

Low threshold limit:

Exposure category	Limit
General population	$60/f_{\text{GHz}} = 24.2 \text{ mW}$

Where f_{GHz} is the highest frequency in the transmission band (2.480 GHz).

Both conducted and radiated (EIRP) output power values must be compared to the threshold limit.

Test Result:

<i>Ton</i> (ms)	<i>Total Period</i> (ms)	Time average factor (dB)	Source-based time averaged output (dBm)
0.342	7.362	-13.33	4.38

The time average factor is calculated as follows:

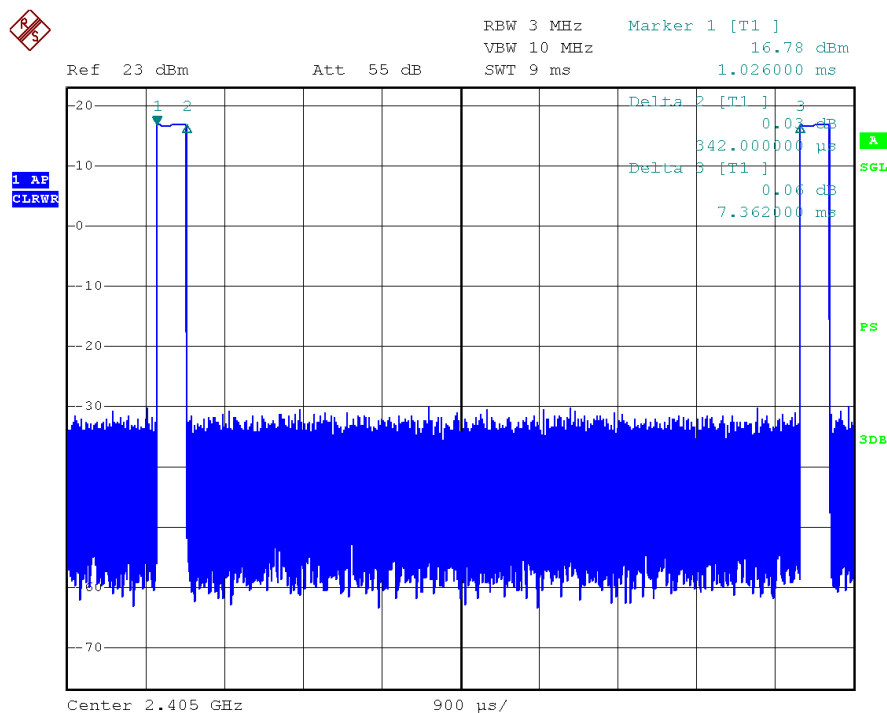
$$10 * \log (Ton / Total Period) \text{ dB}$$

Ton and *Total Period* are expressed in ms; measured values are:

$$Ton = 0.342 \text{ ms}$$

$$Total Period = 7.362 \text{ ms}$$

as shown in the following figure:



Date: 17.JUN.2010 17:15:51

The resulting time average factor is -13.33dB.

The highest output power (conducted) is 17.71dBm . Therefore the averaged output power is calculated as follows:

$$17.71 - 13.33 = 4.38 \text{ dBm (2.741mW)}$$

This value is less than the low threshold limit corresponding to the general population exposure category and therefore no SAR test is required.

6 ADDITIONAL TECHNICAL INFORMATION

6.1 ELECTROMAGNETICALLY RELEVANT COMPONENTS:

Components	N°	Manufacturer	Type – Technical data
Radio Module			
HR 550 FS (handwheel)			
Host Equipment			
---	---	---	/

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. Marking label

A		B	CE
ID	C		
SN	D	E	0051
 HEIDENHAIN www.heidenhain.de			
<p>FCC ID: YJKHR550FS</p> <p>This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.</p>			

Beschriftungstabelle / Labeling table

Feld Field	Beschriftung Labeling	Klischee Printing block
A	Merkmal NAMEA1_TYPA2 aus SML Characteristic NAMEA1_TYPA2 from SML	743422-01
B	Seriennummer 2D-Barcode Data Matrix ECC 200 Serial number 2D-bar code Data Matrix ECC 200	
C	Teilenummer (Klartext) / Part number (plain language)	
D	Prototypenkenner (wenn vergeben)_Seriennummer_Kundenindex (wenn vergeben) im Klartext Prototype code (if assigned)_Serial number_customer index (if assigned) in the plain language	
E	Herstellungsdatum DATECODE01 / Date of manufacture DATECODE01	

Das Zeichen "_" in der Tabelle bedeutet eine Leerstelle im Text.

The "_" character in the table indicates a space in the text.

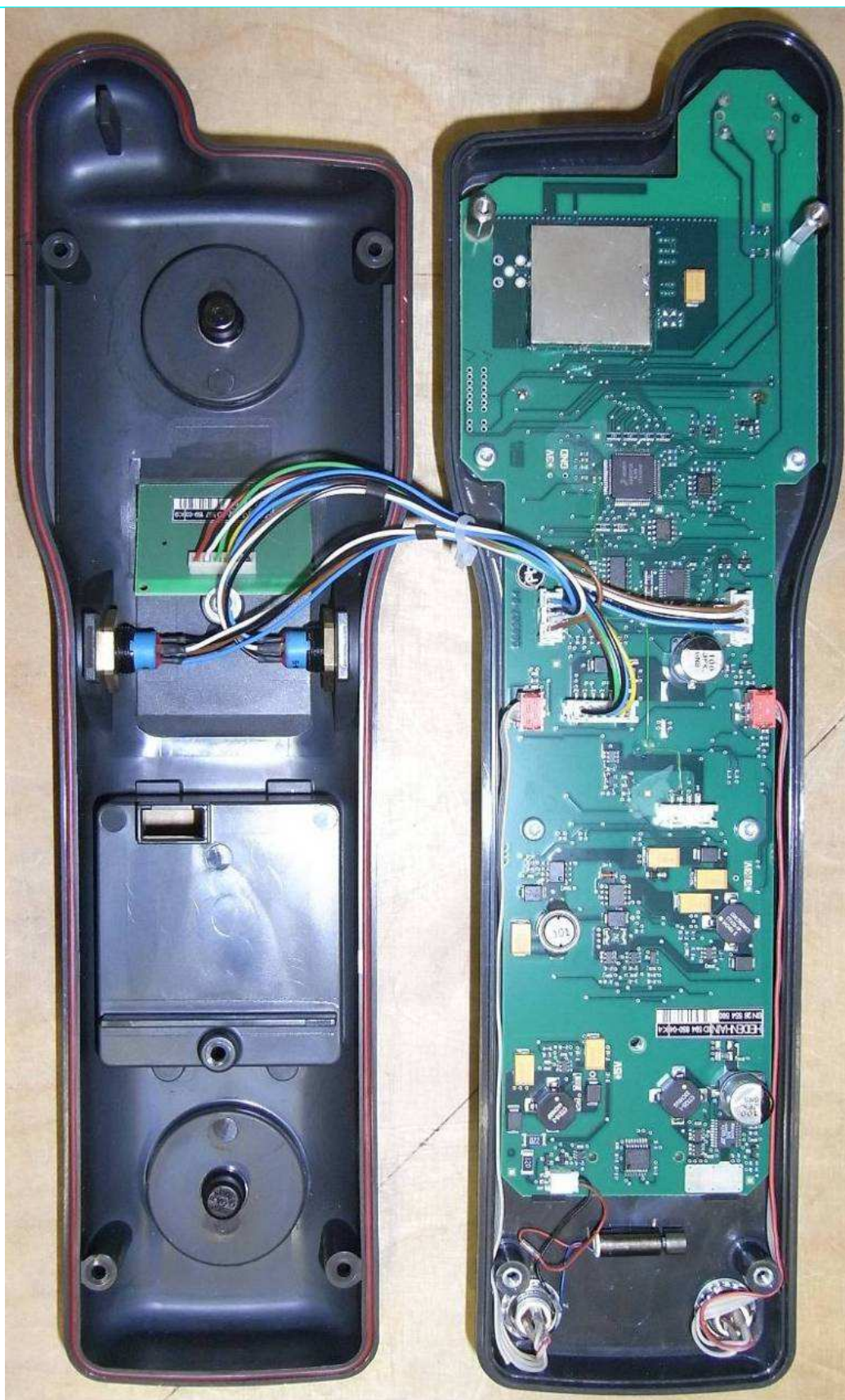
SML = classification list

8 PHOTOGRAPHIC DOCUMENTATION

8.1 EUT IDENTIFICATION



External view of wireless portable controller



Internal view of wireless portable controller

8.2 TEST SET-UP



Set up of Radiated emission test

9 MEASUREMENT AND TEST EQUIPMENT INSTRUMENTATION

Instruments	Manufacturer	Model	IMQ serial number	Calibration data	Calibration interval (Month)
Emi Receiver	Rohde & Schwarz	ESCI	S-04355	12/2009	12
Emi Receiver	Rohde & Schwarz	ESVS	S-04197	12/2008	18
Spectrum Analyzer	Rohde & Schwarz	FSP40	S-03629	11/2009	24
Loop Antenna	Rohde & Schwarz	HFH2-Z2	S-02508	12/2008	24
Antenna Bilog	ARA	LPD-2513	S-02385	07/2009	24
Antenna ridged horn 1÷18 GHz	Schwarzbeck	BBHA9120D	S-03464	02/2009	24
Antenna ridged horn 15÷40 GHz	Schwarzbeck	BBHA9170	S-03668	05/2010	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	05/2010	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	/	/	/