

Test Report



INTENTIONAL RADIATOR TESTS ACCORDING TO FCC PART 15 C and INDUSTRY CANADA REQUIREMENTS

Equipment Under Test: Bluetooth 2.1 + EDR -module

Type/ Model: WT12

Manufacturer: BlueGiga Technologies Oy
PO. BOX 120
FI-02631 ESPOO
FINLAND

Customer: BlueGiga Technologies Oy
PO. BOX 120
FI-02631 ESPOO
FINLAND

FCC Rule Part: 15.247: 2012
IC Rule Part: RSS-210, Issue 8, 2010
RSS-GEN Issue 3, 2010

KDB: Filing and Measurement Guidelines for
Frequency Hopping Spread Spectrum Systems
DA 00-705 (March 30, 2000)

Date: June 17th, 2013

Issued by:

Niklas Karpatskij
Testing Engineer

Date: June 17th, 2013

Checked by:

Jari Merikari
Technical Manager

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Equipment Under Test (EUT)

Bluetooth 2.1 + EDR -module
Type/ Model: WT12
Serial Number: -

The purpose of the tests was to verify that changing a balun on the module to an electrically identical balun with different pin layout does not change the maximum peak conducted power of the module. The conducted spurious emissions were also measured to verify that the EUT still complies with the limits.

The maximum peak conducted output power was measured with two different samples, one with the original balun and the other with the new balun. Both modules were connected to an evaluation board. Measurements were made from the antenna connector (SMA).

Classification of the device

Fixed device	<input type="checkbox"/>
Mobile Device (Human body distance > 20cm)	<input checked="" type="checkbox"/>
Portable Device (Human body distance < 20cm)	<input type="checkbox"/>

Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing

Ratings and declarations

Bluetooth:

Operating Frequency Range (OFR): 2402 – 2480 MHz
Channels: 79
Channel separation: 1 MHz
Conducted power: +5.13 dBm
Transmission technique: FHSS
Modulation: GFSK, $\pi/4$ DQPSK, 8DPSK
Integrated antenna gain: 0.5 dBi max

Power Supply

The evaluation board was powered by a laboratory power supply with 3.6 V DC.

Disclaimer

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SUMMARY OF TESTING

Test Specification	Description of Test	Result
§15.247(b)(1) / RSS-210 8.4	Maximum Peak Conducted Output Power	PASS
§15.247(d) / RSS-210 A8.5	Conducted Spurious Emissions	PASS

EUT Test Conditions during Testing

The EUT was configured into the wanted channel and was in continuous transmit mode during the tests.

Following channels were used during the tests:

Channel	Frequency/ MHz
LOW (CH 1)	2402
MID (CH 40)	2441
HIGH (CH 79)	2480

Test Facility

<input type="checkbox"/> Testing Location / address: FCC registration number: 90598	SGS Fimko Ltd Särkiniementie 3 FI-00210, HELSINKI FINLAND
<input checked="" type="checkbox"/> Testing Location / address: FCC registration number: 178986 Industry Canada registration number: 8708A-2	SGS Fimko Ltd Karakaarenkuja 4 FI-02610, ESPOO FINLAND

Maximum Peak Conducted Output Power

Standard: ANSI C63.10 (2009)
Tested by: NKA
Date: 7.6.2013
Humidity: 45 % RH
Temperature: 23.2 °C
Measurement uncertainty ± 2.87dB Level of confidence 95 % (k = 2)

FCC Rule: 15.247(b) (1)

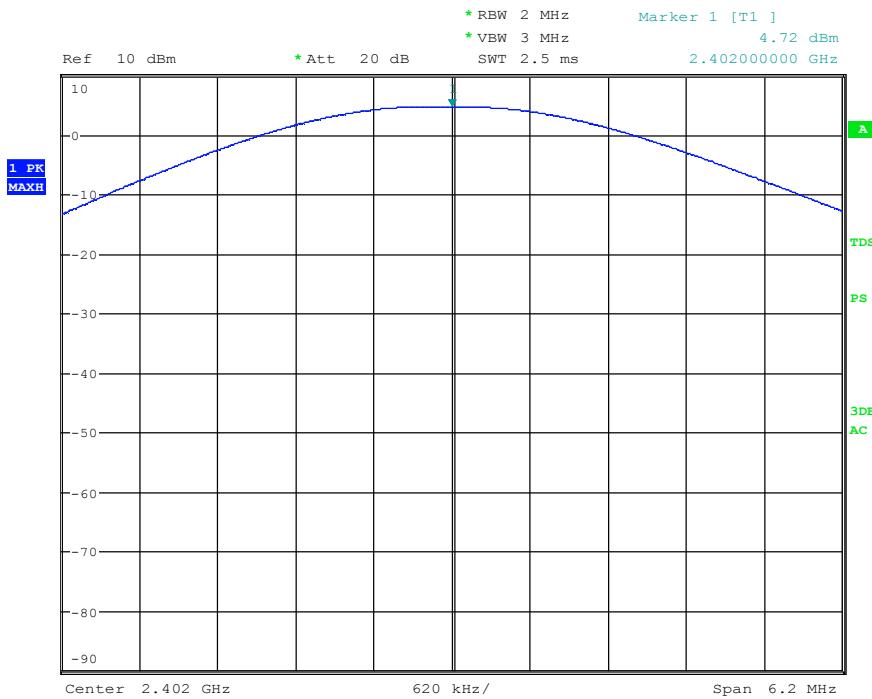
For frequency hopping systems operating in the 2400-2483.5 MHz, employing at least 75 channels limit is 1.0 Watt. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

The measurements were only performed with the data rate of 1 Mbps as it was deemed to cause the highest output power.

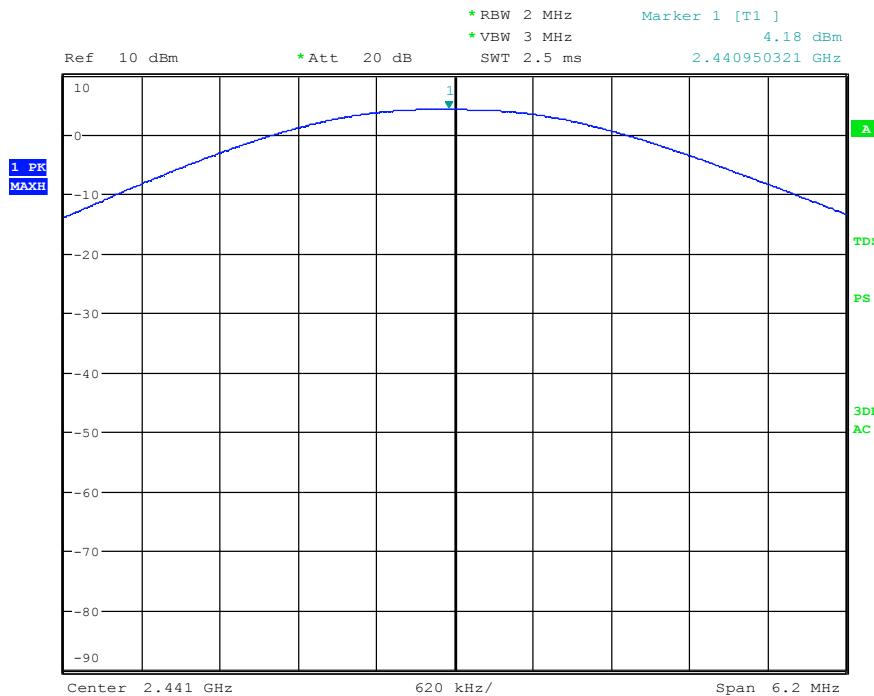
Results:**1 Mbps**

Channel	Conducted Power [dBm]		Difference [dB]
	Original balun	New balun	
Low	4.72	5.13	0.41
Mid	4.18	4.66	0.48
High	3.98	4.23	0.25

Conducted Spurious Emission 30 MHz to 26.5 GHz and Band Edge



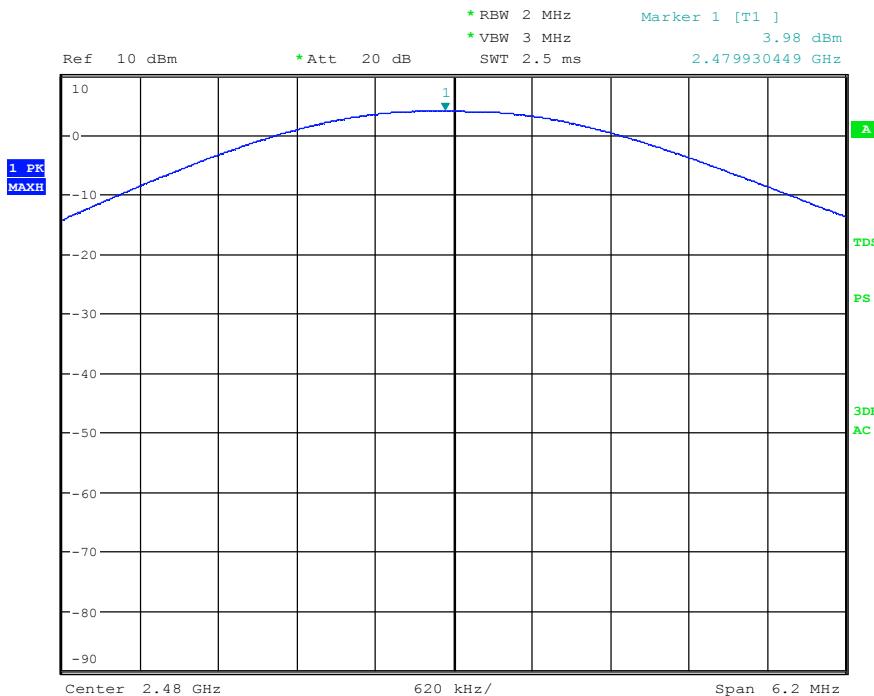
Date: 7.JUN.2013 12:27:01

Figure 1. Original Balun Channel LOW.

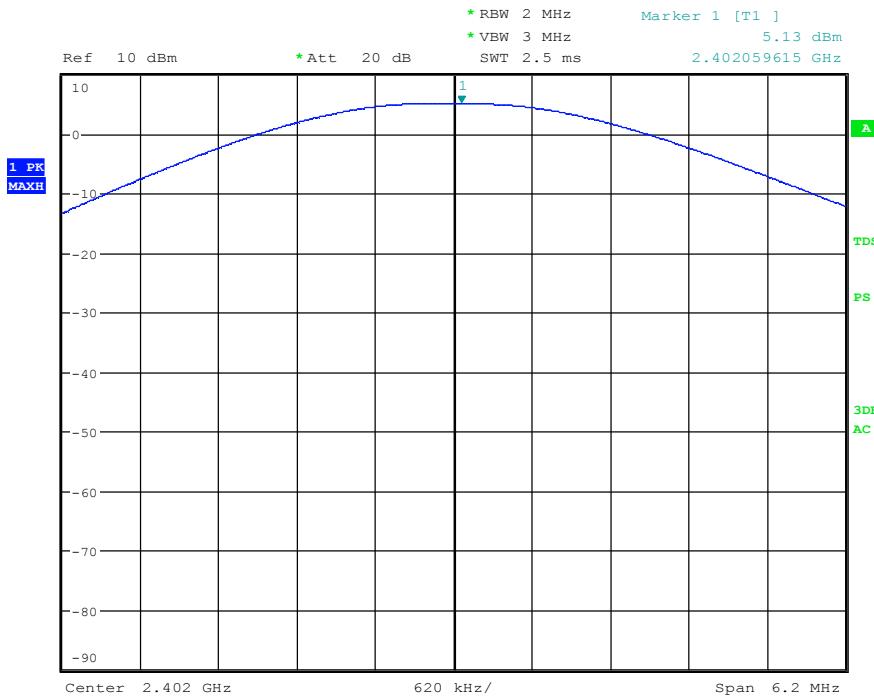
Date: 7.JUN.2013 12:28:37

Figure 2. Original Balun Channel MID.

Conducted Spurious Emission 30 MHz to 26.5 GHz and Band Edge



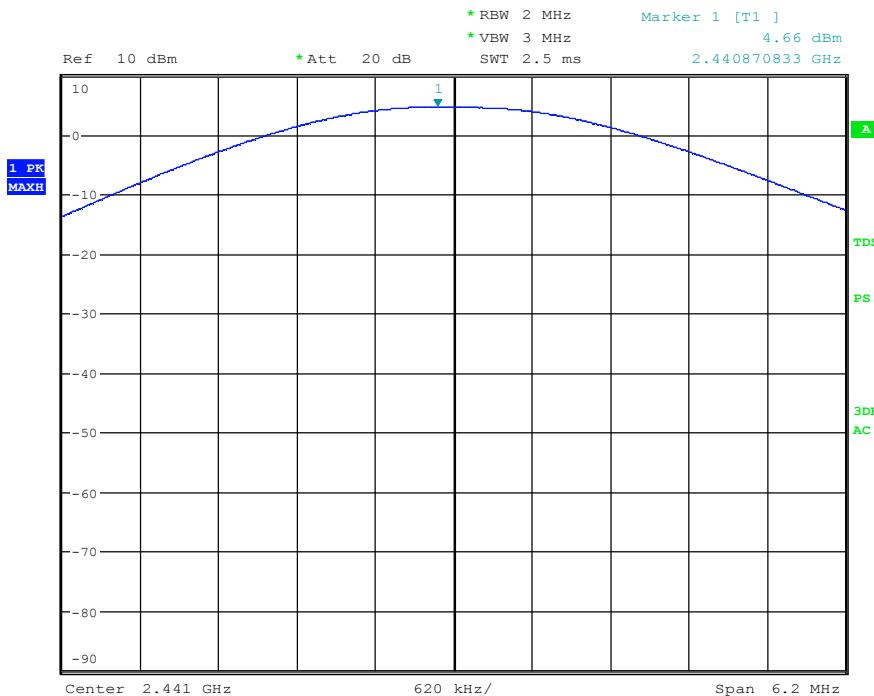
Date: 7.JUN.2013 12:29:45

Figure 3. Original Balun Channel HIGH.

Date: 7.JUN.2013 12:36:32

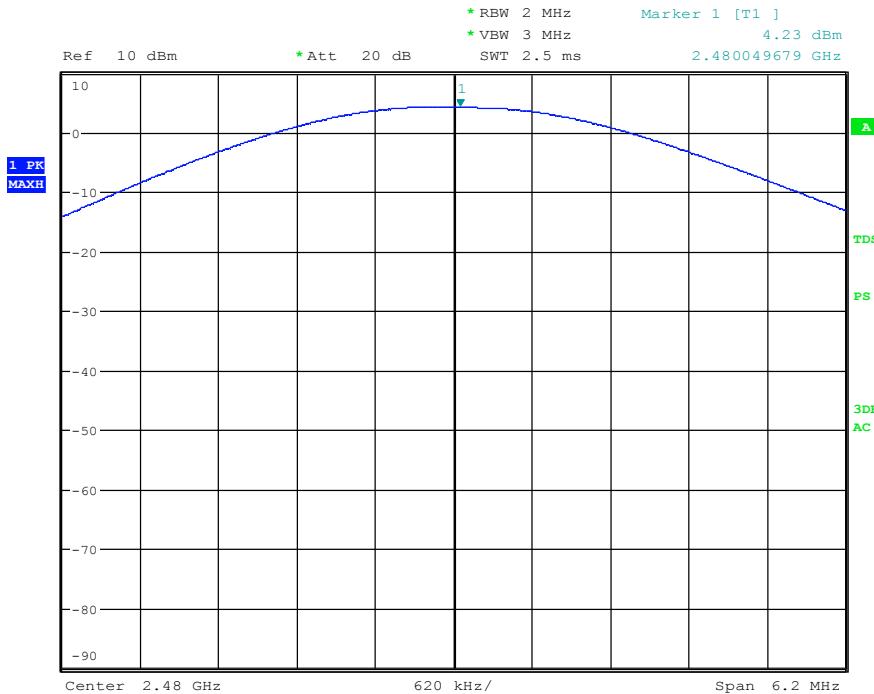
Figure 4. New Balun Channel LOW.

Conducted Spurious Emission 30 MHz to 26.5 GHz and Band Edge



Date: 7.JUN.2013 12:37:41

Figure 5. New Balun Channel MID.



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Figure 6. New Balun Channel HIGH.

Conducted Spurious Emission 30 MHz to 26.5 GHz and Band Edge

Conducted Spurious Emissions 30 MHz to 26.5 GHz and Band Edge

Standard: ANSI C63.10 (2009)
Tested by: NKA
Date: 17.6.2013
Temperature: 23.1 °C
Humidity: 45 % RH

FCC Rule: 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

The EUT was deemed to have the maximum spurious emissions with the data rate of 1 Mbps

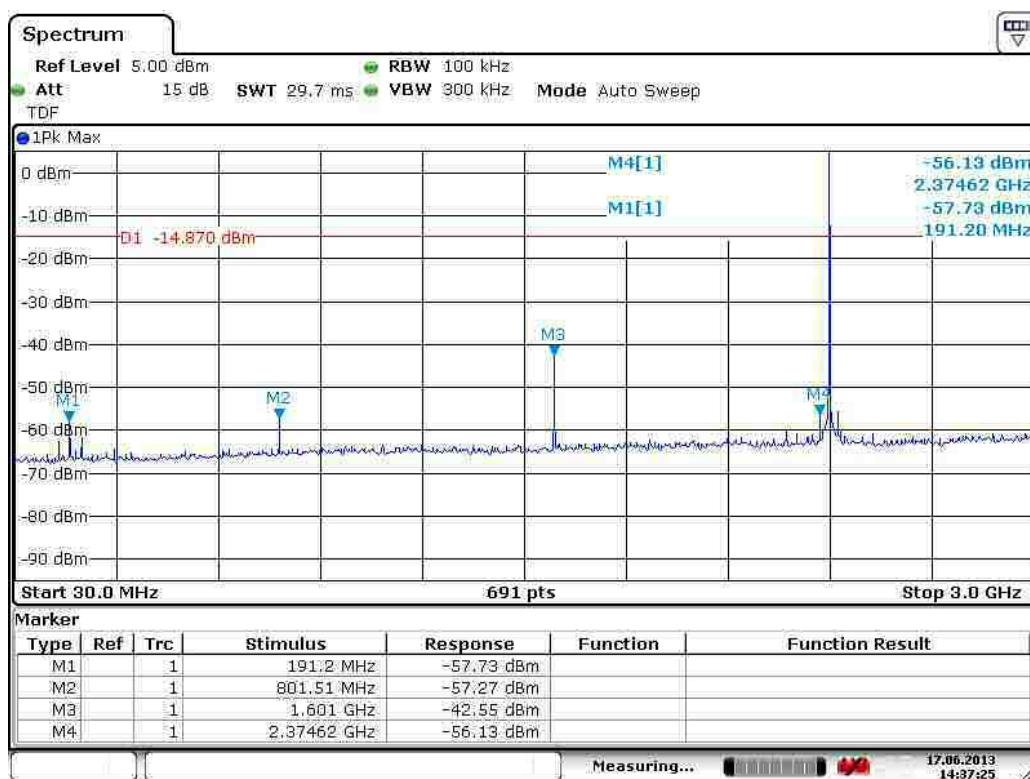
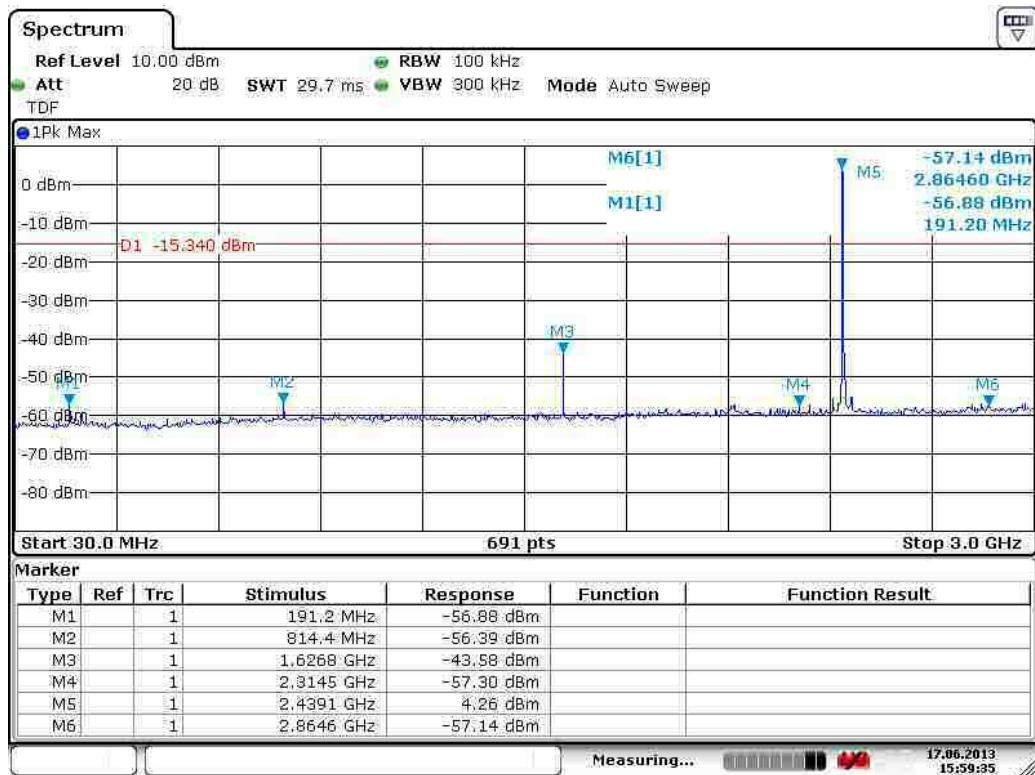


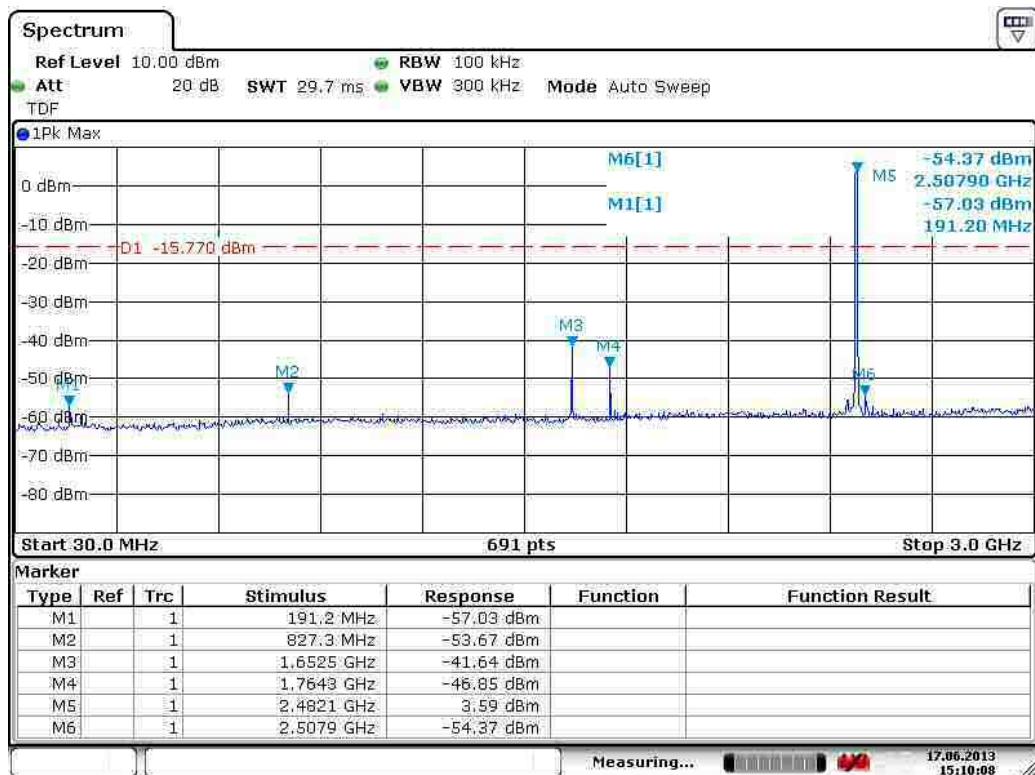
Figure 7. Low channel conducted emission 30 MHz to 3000 MHz.

Conducted Spurious Emission 30 MHz to 26.5 GHz and Band Edge



Date: 17.JUN.2013 15:59:35

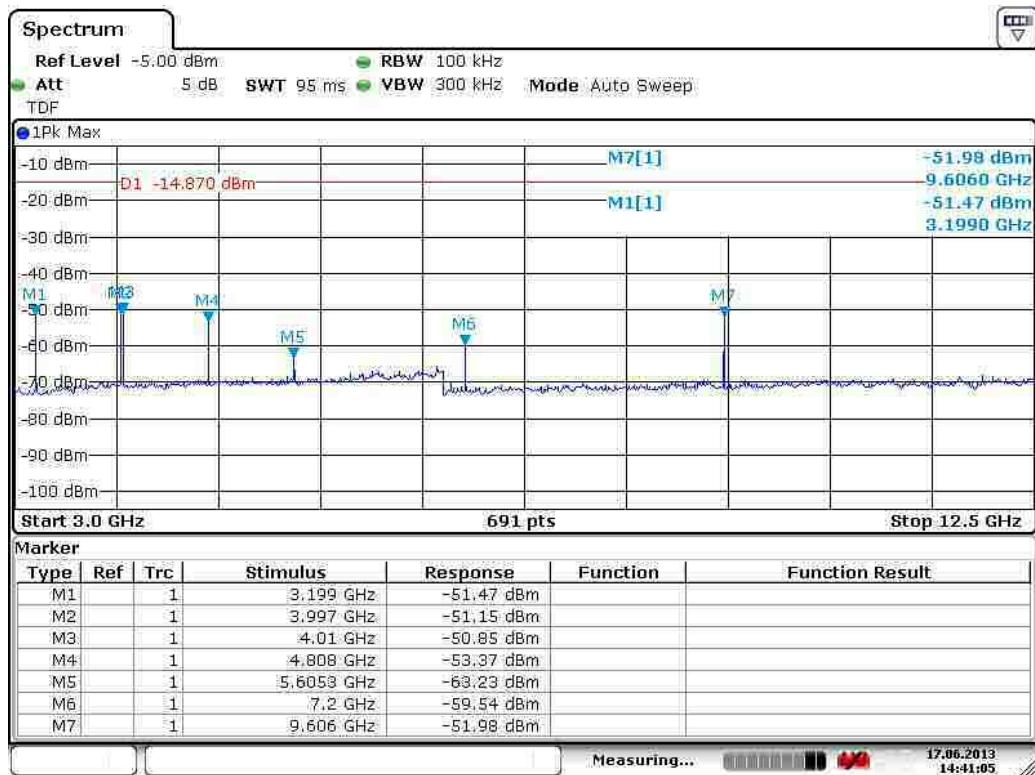
Figure 8. Mid channel conducted emission 30 MHz to 3000 MHz.



Date: 17.JUN.2013 15:10:07

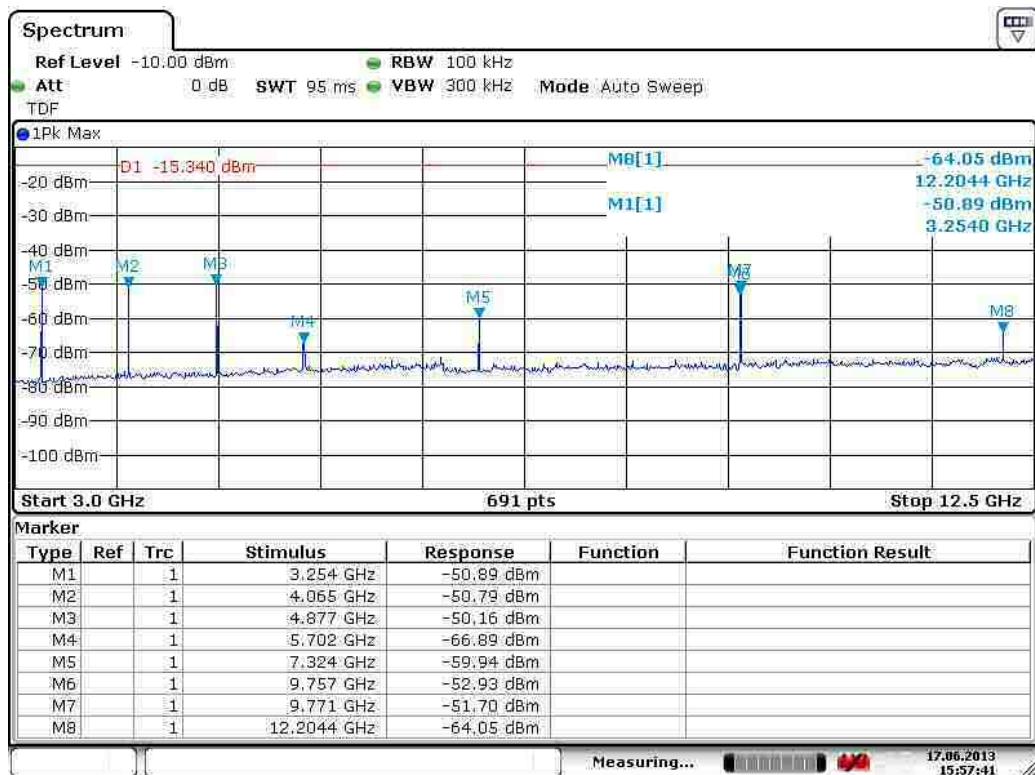
Figure 9. High channel conducted emission 30 MHz to 3000 MHz (1 Mbps).

Conducted Spurious Emission 30 MHz to 26.5 GHz and Band Edge



Date: 17.JUN.2013 14:41:04

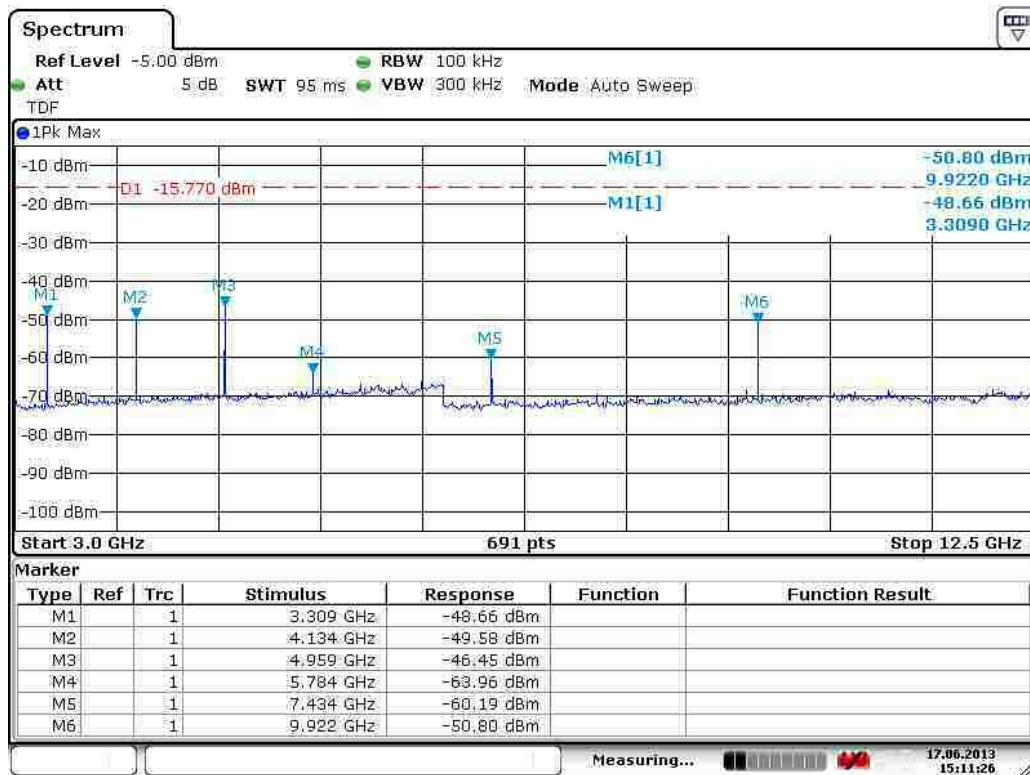
Figure 10. Low channel conducted emission 3 GHz to 12.5 GHz (1 Mbps).



Date: 17.JUN.2013 15:57:41

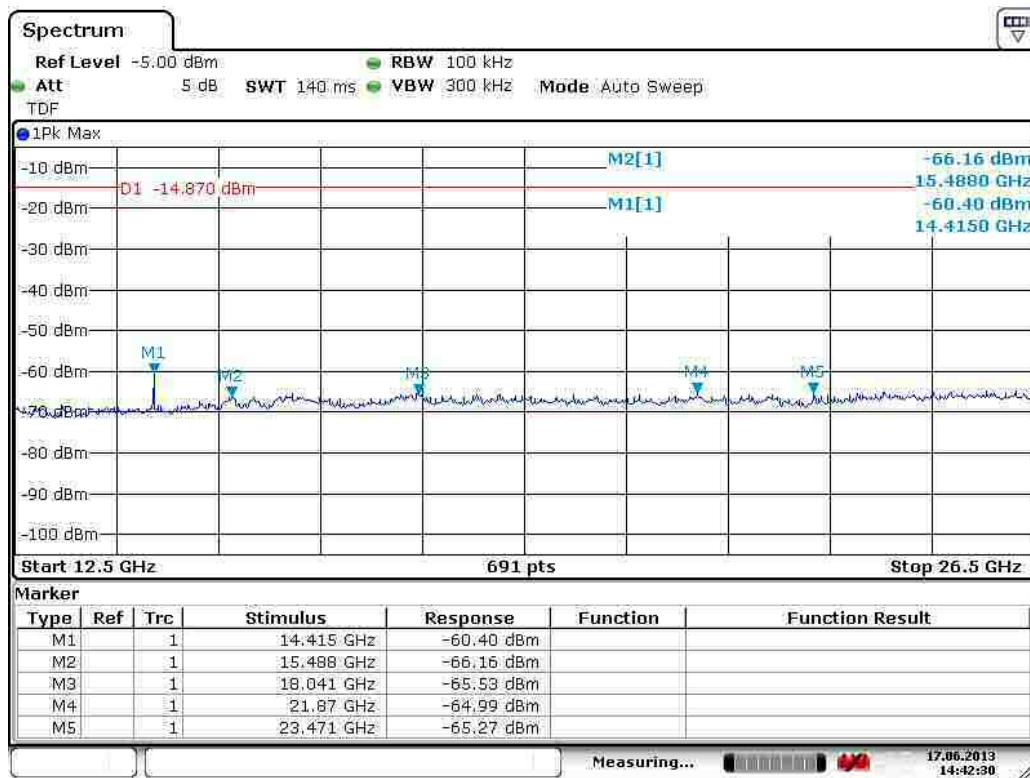
Figure 11. Mid channel conducted emission 3 GHz to 12.5 GHz (1 Mbps).

Conducted Spurious Emission 30 MHz to 26.5 GHz and Band Edge



Date: 17.JUN.2013 15:11:26

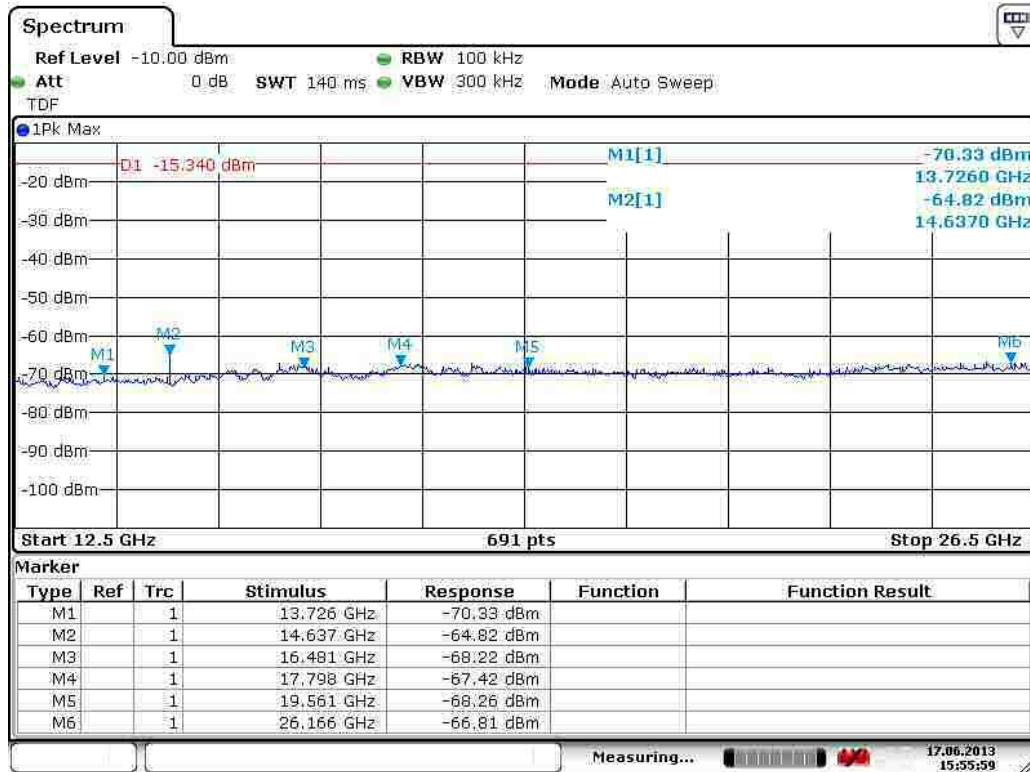
Figure 12. High channel conducted emission 3 GHz to 12.5 GHz (1 Mbps).



Date: 17.JUN.2013 14:42:30

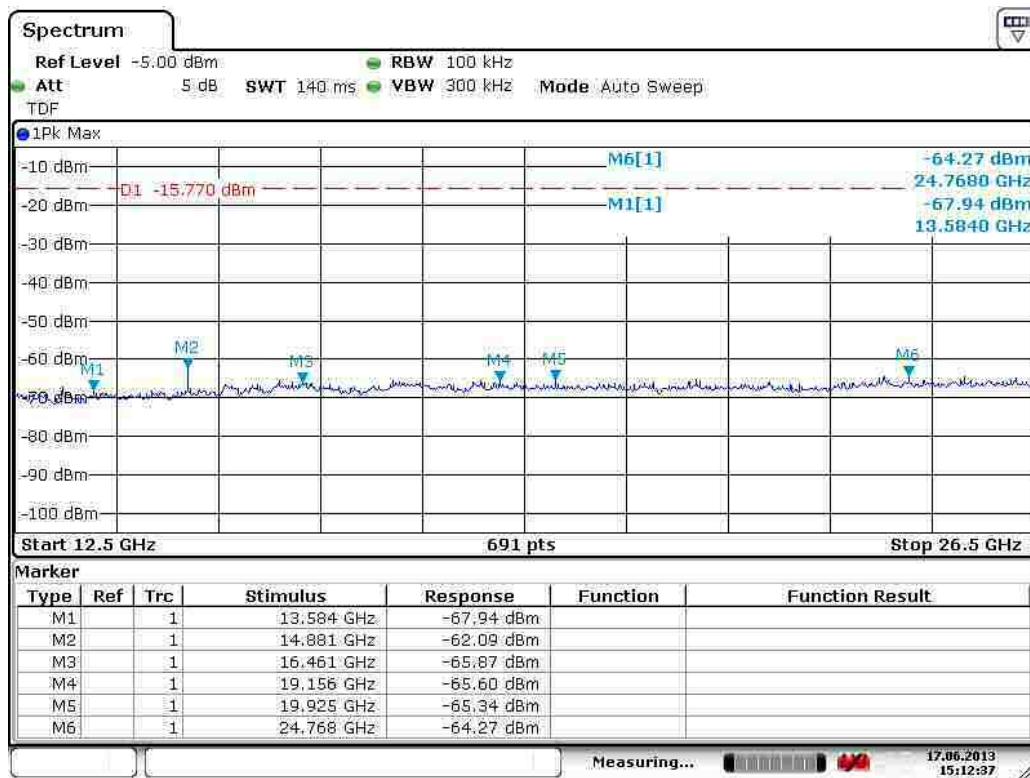
Figure 13. Low channel conducted emission 12.5 GHz to 26.5 GHz (1 Mbps).

Conducted Spurious Emission 30 MHz to 26.5 GHz and Band Edge



Date: 17.JUN.2013 15:55:59

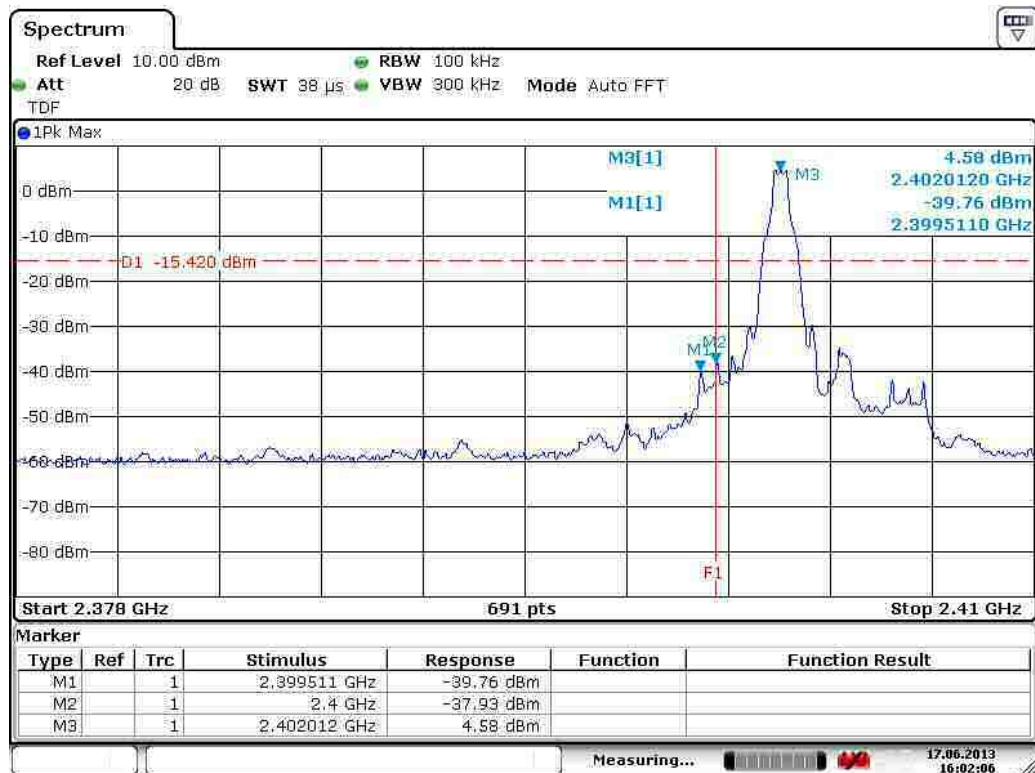
Figure 14. Mid channel conducted emission 12.5 GHz to 26.5 GHz (1 Mbps).



Date: 17.JUN.2013 15:12:36

Figure 15. High channel conducted emission 12.5 GHz to 26.5 GHz (1 Mbps).

Conducted Spurious Emission 30 MHz to 26.5 GHz and Band Edge



Date: 17.JUN.2013 16:02:06

Figure 16. Conducted emission at low band edge.



Date: 17.JUN.2013 16:05:06

Figure 17. Conducted emission at high band edge.

LIST OF TEST EQUIPMENT

Manufacturer	Type	Serial no	Inv. no
ROHDE & SCHWARZ			
Signal Analyzer	FSV40	101068	9093
EMI Test receiver	ESU 26	100185	8453
Test software	EMC32	-	-
DAVIS			
Weather station	Vantage Pro	-	5297
HUBER-SUHNER			
Attenuator 10dB	6810.17B	-	-

All used measurement equipment was calibrated (if required).