

TEST REPORT

Report Number		RAPA13-O-625
Type of Equipment		Singing Machine Home
Model Name		SMC HOME
FCC ID		2AAXO-SMCHOME
IC Number		11387A-SMCHOME
Applicant	Name	The Singing Machine Company, Inc.
	Logo	
	Address	6301 NW 5 th Way, Suite 2900, Fort Lauderdale FL 33309
Manufacturer	Name	VisionScape
	Address	404, 60-19, Gasan-dong, Geumcheon-gu, Seoul, Korea
Test period		August 20, 2013 to September 10, 2013
Issuing date of report		September 16, 2013
Total page		64 pages (including this page)

SUMMARY

The equipment complies with FCC Part 15.247: Operation within the bands 902 MHz to 928 MHz, 2 400 MHz to 2 483.5 MHz, and 5 725 MHz to 5 850 MHz and IC RSS-210 Issue8 Annex 1-2010.

This test report contains only the results of a single test of the sample supplied for the examination. It is not a general valid assessment of the features of the respective products of the mass-production.

Date : September 16, 2013

Date : September 16, 2013




Prepared and tested by Tae Yang Yoon
Manager / TCL of RAPA

Reviewed by Sukil Park
Executive Managing Director / TCL of RAPA

CONTENTS

1. GENERAL DESCRIPTION	3
1.1 Applicant	3
1.2 Manufacturer	3
1.3 Basic description of EUT	3
1.4 Electrical specification	4
2. General information of test.....	5
2.1 Standard for measurement methods	5
2.2 Description of EUT modification	5
2.3 Description of test system configuration	5
3. Measurement data.....	7
3.1 Number of Channel Measurement	7
3.2 Frequency separation	9
3.3 Average time of occupancy	15
3.4 20 dB and 99 % bandwidth	26
3.5 Peak output power	37
3.6 Conducted emission and band edge	43
3.7 Radiated emission in restricted band	52
3.8 AC Conducted Emission	60
3.9 Antenna Requirments	63
4. Test equipment list	64

1. GENERAL DESCRIPTION

1.1 Applicant

- Company name : The Singing Machine Company, Inc.
- Address : 6301 NW 5th Way, Suite 2900, Fort Lauderdale FL 33309
- Contact person : Gary Atkinson / CEO
- Phone/Fax : +1-954-596-1000 / +1-954-596-2000

1.2 Manufacturer

- Company name : VisionScape
- Address : 404, 60-19, Gasan-dong, Geumcheon-gu, Seoul, Korea
- Contact person : Hun Pil Lim / CEO
- Phone/Fax : 82-2-856-8150 / 82-2-856-2828

1.3 Basic description of EUT

- Product name : Singing Machine Home
- Model name : SMC HOME
- Serial number : N/A
- Frequency : 2 402 MHz to 2 480 MHz
- Number of channel(s) : 79 Channels
- Modulation method : FHSS
- FCC Rule Part(s) : FCC CFR47 Part 15 Subpart C Section 15.247
- IC Rule Part(s) : IC RSS-210 Issue8 Annex 8-2010
- FCC classification : DSS / Part 15 Spread Spectrum Transmitter (FHSS)
- IC classification : Annex 8 / Frequency Hopping and Digital Modulation Systems Operating in the bands 902 - 928 MHz, 2 400 - 2 483.5 MHz and 5 725 - 5 850 MHz
- Test period : August 26, 2013 to September 10, 2013
- Issuing date of report : September 16, 2013
- Place of test : Head office
824 & B104, Anyang Megavalley, 799, Gwanyang-dong,
Dongan-gu, Anyang-si, Gyeonggi-do 431-767, Korea

Open area test site

80, Jeil-ri, Yangji-myun, Cheoin-gu, Yongin-si, Gyeonggi-do
449-825, Korea

(FCC Registration Number : 337229)

(IC Submission Number : 143881)

(KCC Designation Number : KR0027)

1.4 Electrical specification

Item	Specifications
Input power	DC15V/3A(Adapter : 100~240V, 50~60Hz, 1.2A)
Internal clock	CPU Main OSC : 24MHz CPU RTC : 32.768KHz 2.4G Wireless Audio : 48MHz
RF frequency	WiFi : 2.4GHz Bluetooth : 2.4GHz Wireless Audio : 2.4GHz
Transmitter frequency	WiFi : 2.4GHz Bluetooth : 2.4GHz Wireless Audio : 2.4GHz
Number of layer	8 layer PCB
External connector	DC Jack x 1, HDMI x 1
Working temperature	0 ~ 50
Storage temperature	-20 ~ 60
Battery	x
Relative humidity	60%
Dimensions (W x H x D)	293.6 x 293.6 x 140.4
Sound	Internal Speaker
RF method	WLAN Bluetooth 2.1 EDR Wireless Audio

2. General information of test

2.1 Standard for measurement methods

Applied Standard : FCC CFR47 Part 15 Subpart C, IC RSS-210 Issue8 Annex 8-2010				
FCC	IC	Description of Test	Limit	Result
15.247(a)(1)	RSS-210 A8.4(2)	Number of Channels	≥ 15 Chs	Pass
15.247(a)(1)	RSS-210 A8.1(b)	Hopping Channel Separation	≥ 2/3 of 20 dB BW	Pass
15.247(a)(1)	RSS-210 A8.1(d)	Dwell Time of Each Channel	≤ 0.4 sec in 31.6 sec period	Pass
15.247(a)(1)	RSS-210 A8.1(a)	20 dB Bandwidth	NA	Pass
-	RSS-GEN 4.6.1	99% Bandwidth	-	Pass
15.247(b)(1)	RSS-210 A8.1(b)	Peak Output Power	≤ 1 W for 1 Mbps ≤ 125 mW of 2.3 Mbps	Pass
15.247(d)	RSS-210 A8.5	Cunducted Band Edgens	≤ 20 dBc	Pass
15.247(d)	RSS-210 A8.5	Cunducted Spurious Emission	≤ 20 dBc	Pass
15.247(d)	RSS-GEN 7.2.4	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass
15.207	RSS-210 A8.4	AC Conducted Emission	15.207(a)	Pass
15.203 &15.247(b)	RSS-210 A8.4	Antenna Requirement	NA	Pass

2.2 Description of EUT modification

During the test, there was no mechanical or circuitry modification to improve any RF specification including spurious characteristic, and any RF and spurious suppression device(s) were not added against the device tested.

2.3 Description of test system configuration

- Peripheral equipment used;

Description	Model name	Serial No.	Manufacturer	FCC ID
EUT	SMC HOME	Proto Type	VisionScape	2AAXO-SMCHOME
Test fixer (JIG)	CC Debugger	Proto Type	TEXAS INSTRUMENTS	-
Control PC	E655X-8FA	JT0802G100530031	JOOYONTECH	-

• Cables used

Device from	Device to	Type of cable	Type of connector	Length
EUT	Test fixer (JIG)	Non-shielded	Wire	0.30 m
Test fixer (JIG)	Control PC	Non-shielded	USB to USB	2.00 m
Control PC	Test fixer (JIG)	Non-shielded	USB to USB	2.00 m
EUT	Spectrum analyzer	Shielded	SMA to SMA	1.00 m

3. Measurement data

3.1 Number of Channel Measurement

3.1.1 Definitions

Frequency hopping systems in the 2 400 MHz – 2 483.5 MHz band shall use at least 15 channels.

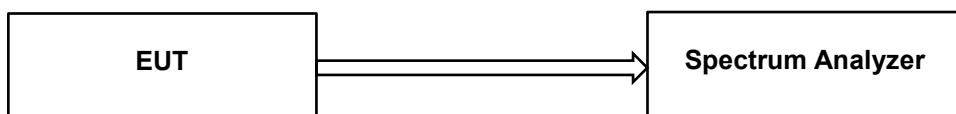
3.1.2 Specification

- FCC Rules Part 15 Subpart C Section 15.247(a)(1)
- IC Rules RSS-210 Issue8 Annex 8-2010 A8.4(2)

3.1.3 Measurement method

- Public Notice “DA 00-705”

3.1.4 Set-up



3.1.5 Test equipment list

Equipment	Model name	Manufacturer
EUT	SMC HOME	VisionScape
Spectrum analyzer	FSV	Rohde & Schwarz

3.1.6 Test procedure

- The output of EUT was connected to the spectrum analyzer.
- Measure the hopping channels of EUT using spectrum analyzer.
- With the analyzer set to max hold readings were taken for 1 ~ 2 minutes in each band.

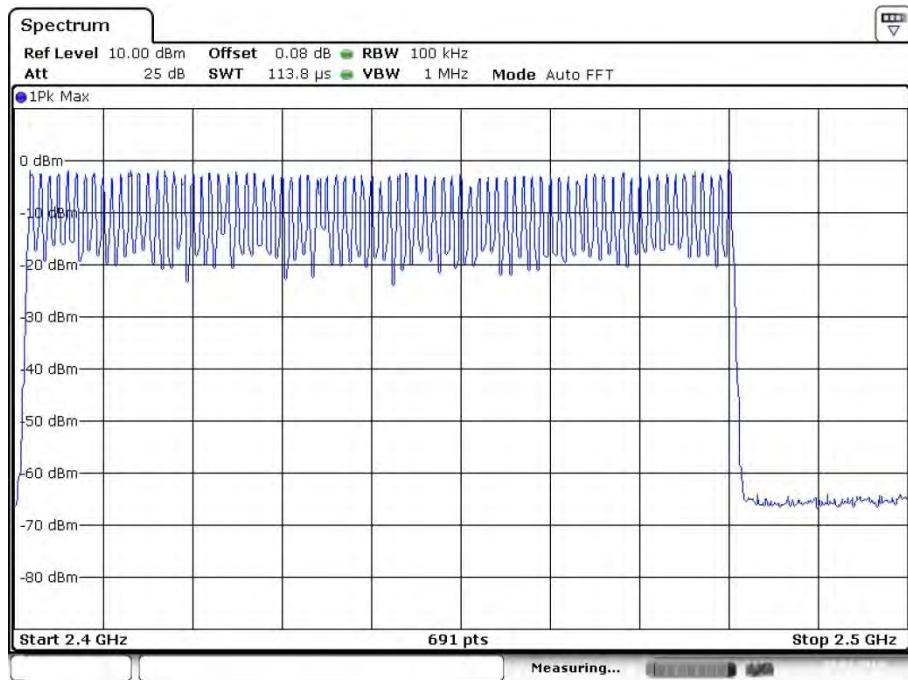
3.1.7 Test condition

- Test place : Test room
- Test environment : 25 °C, 56 % R.H.
- Test mode : Operation at full hopping

3.3.8 Test result

Channel	Number of hopping channels	Limit
Full hopping	79	≥ 15 Channels

3.1.9 Plots of number of hopping channels



3.2 Frequency separation

3.2.1 Definitions

Frequency hopping systems operating in the 2400 ~ 2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

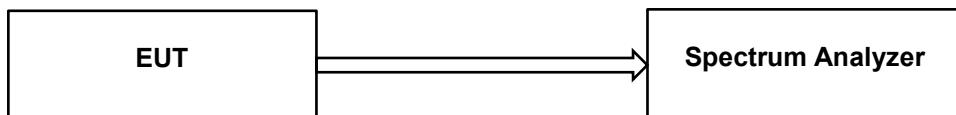
3.2.2 Specification

- FCC Rules Part 15 Subpart C Section 15.247(a)(1)
- IC Rules RSS-210 Issue8 Annex 8-2010 A8.1 B

3.2.3 Measurement method

- Public Notice “DA 00-705”

3.2.4 Set-up



3.2.5 Test equipment list

Equipment	Model name	Serial No.
EUT	SMC HOME	VisionScape
Test fixer (JIG)	CC Debugger	TEXAS INSTRUMENTS
Spectrum analyzer	FSV30	Rohde & Schwarz
Control PC	E655X-8FA	JT0802G100530031

3.2.6 Test procedure

- The output of EUT was connected to the spectrum analyzer.
- The Hopping channel separation is defined as the channel is separated with next channel.

3.2.7 Test condition

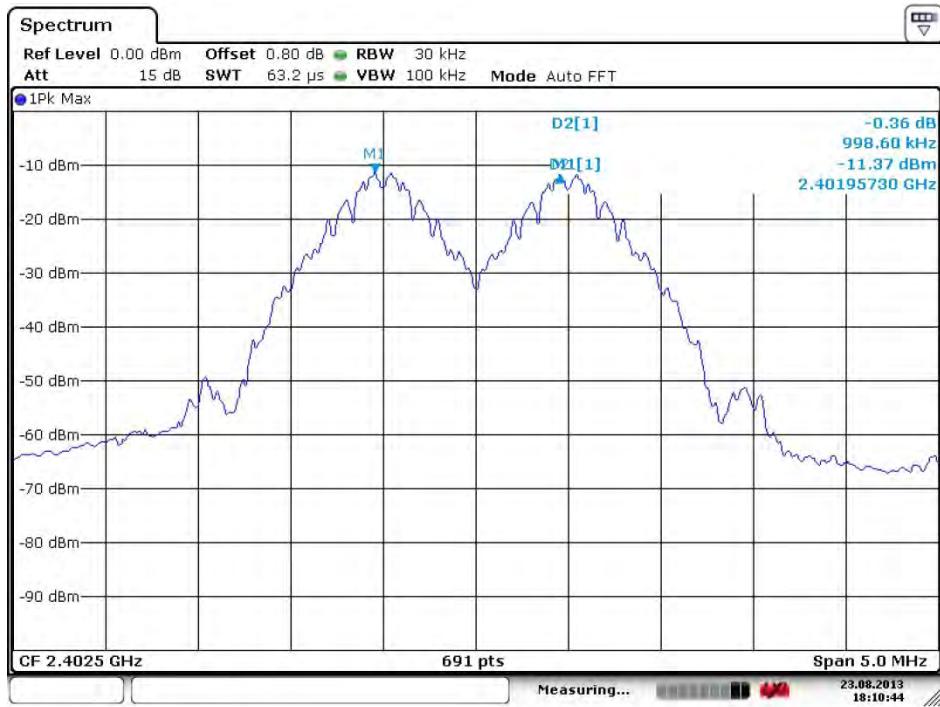
- Test place : Test room
- Test environment : 25 °C, 56 % R.H.
- Test mode : Operation at full hopping

3.2.8 Test result

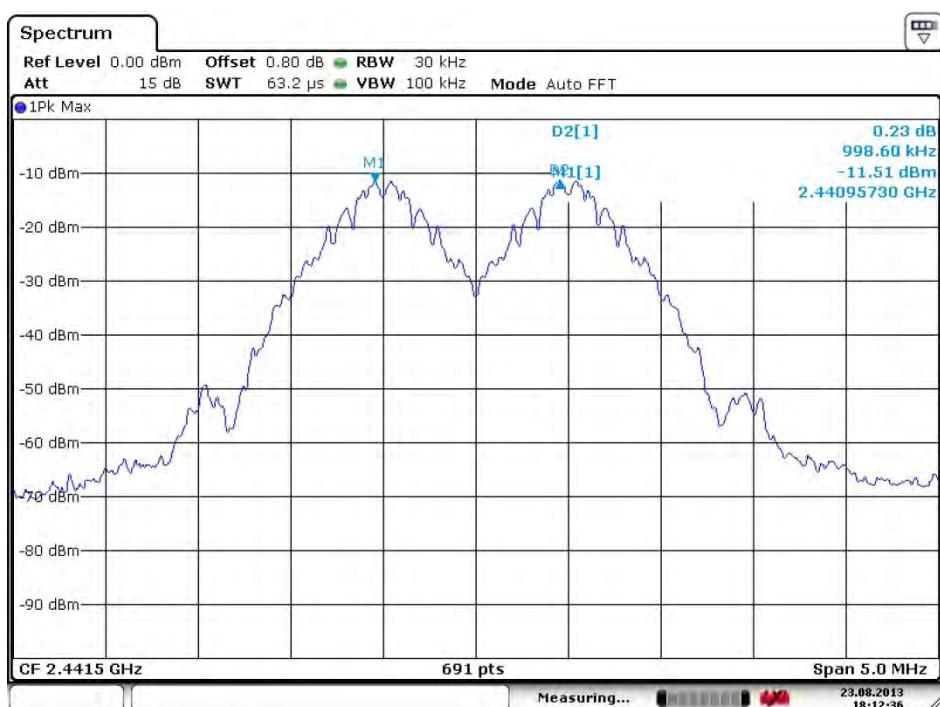
Test Mode	Channel	Frequency [MHz]	Frequency separation [kHz]	(2/3 of 20 dB BW) Limits [kHz]
1 Mbps	00	2 402	998.60	630.27
	40	2 442	998.60	630.27
	78	2 480	998.60	631.61
2 Mbps	00	2 402	998.60	879.25
	40	2 442	998.60	878.91
	78	2 480	998.60	879.91
3 Mbps	00	2 402	998.60	908.57
	40	2 442	998.60	908.57
	78	2 480	998.60	908.24

3.2.9 Plots of frequency separation

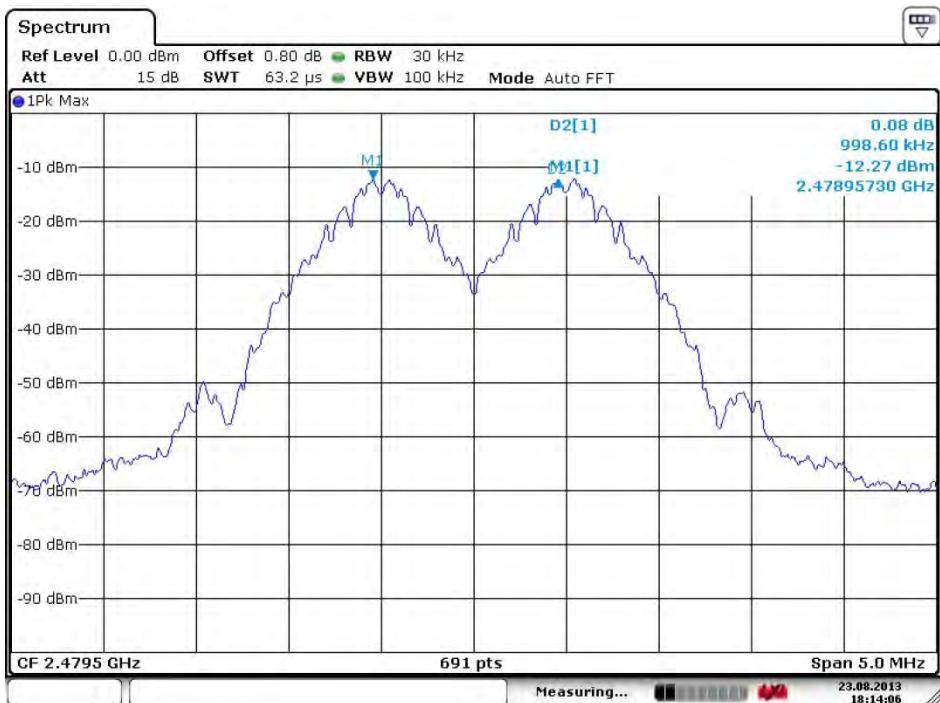
- **Channel 00-01(1 Mbps)**



- **Channel 39-40(1 Mbps)**

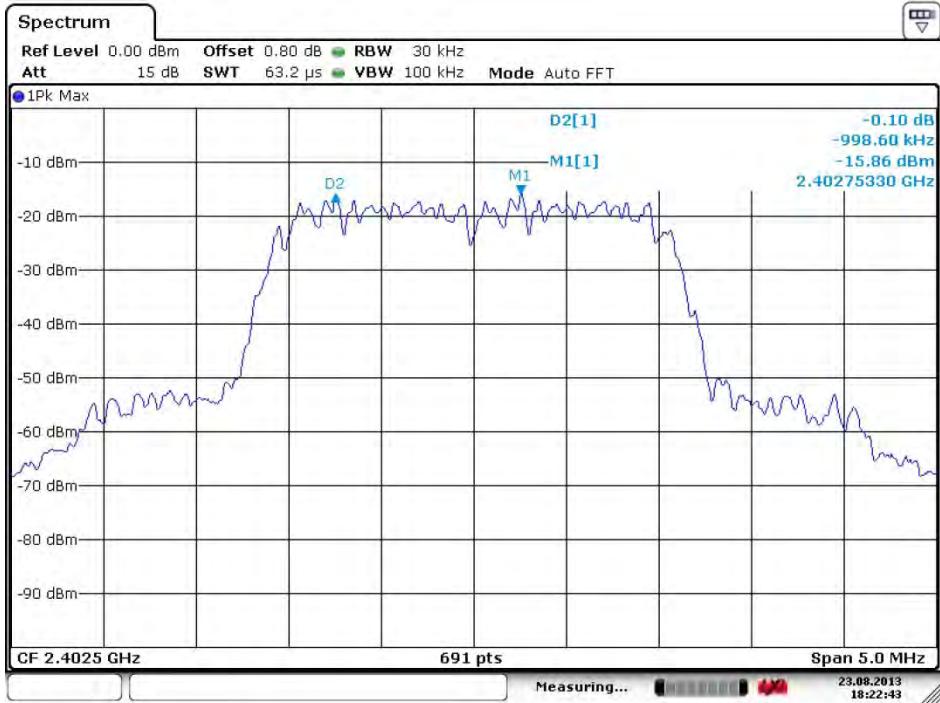


- **Channel 77-78(1 Mbps)**

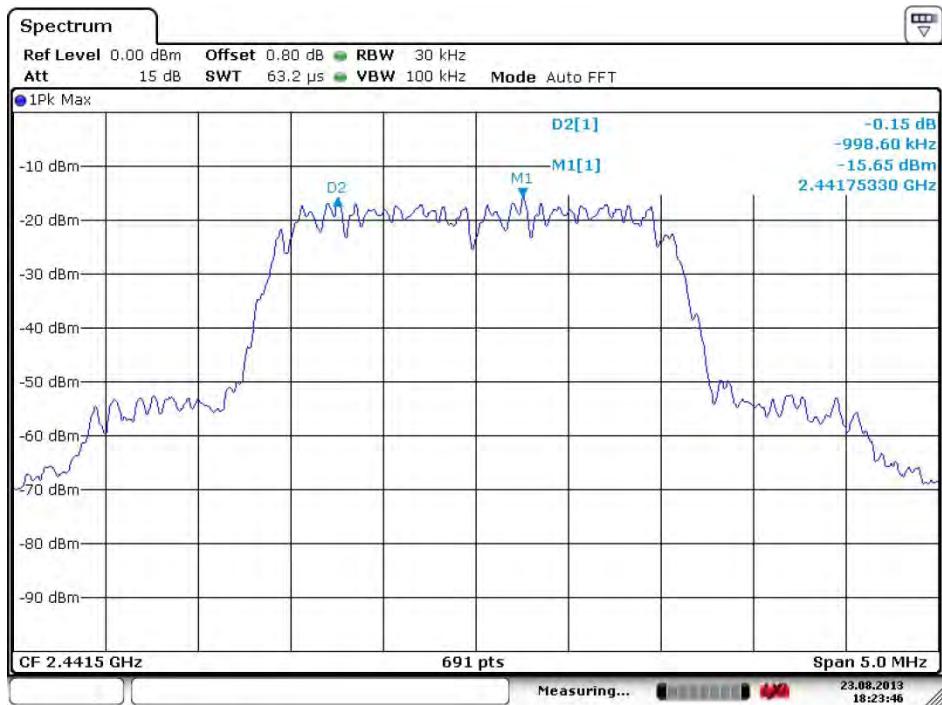


Date: 23.AUG.2013 18:14:06

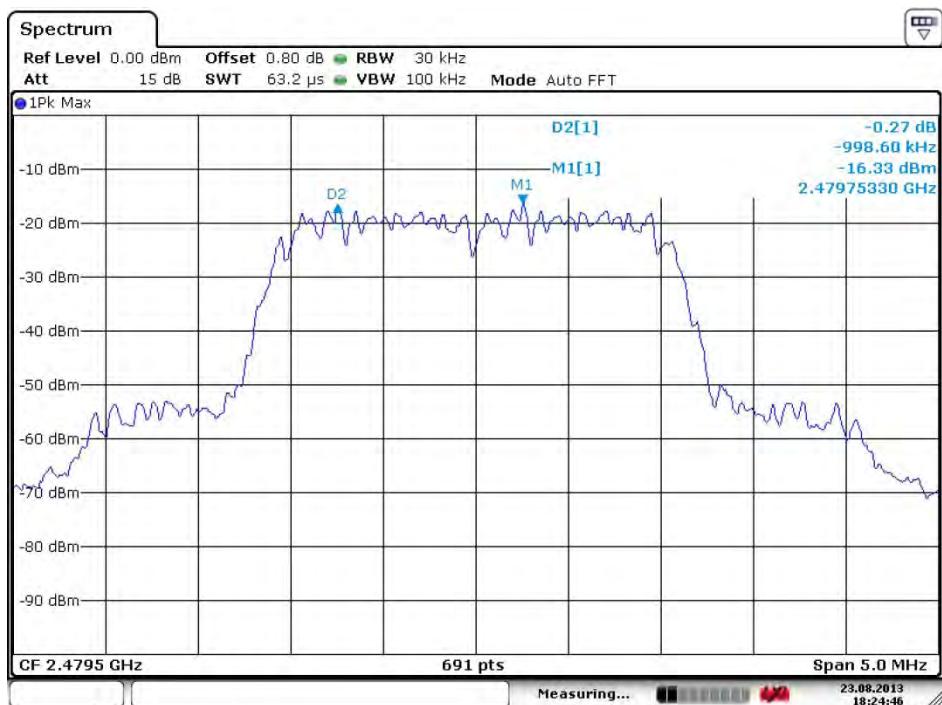
- **Channel 00-01(2 Mbps)**



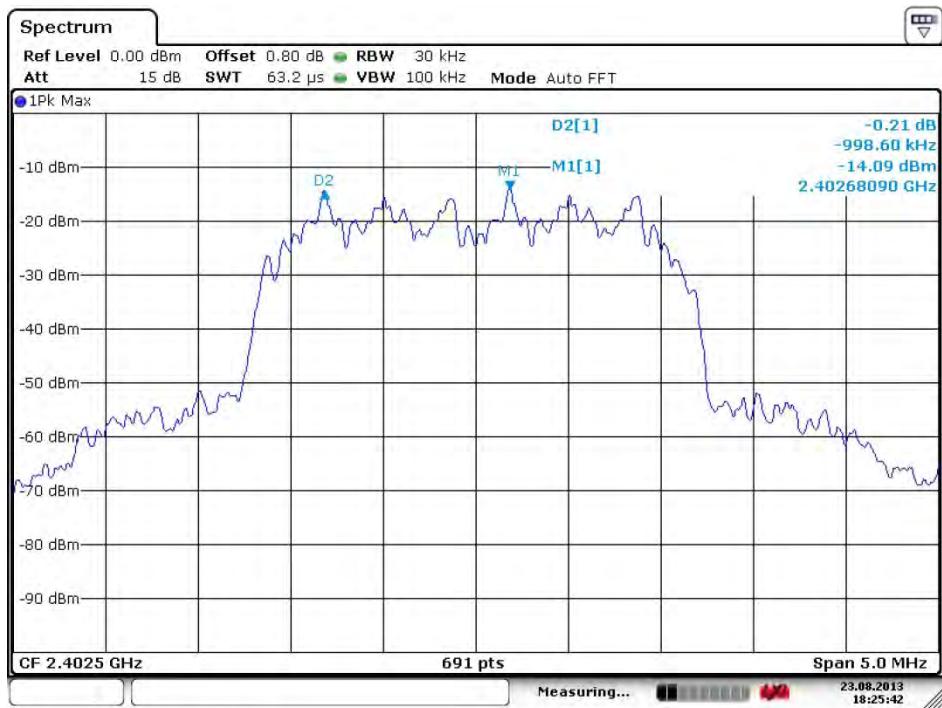
Date: 23.AUG.2013 18:22:43

- Channel 39-40(2 Mbps)


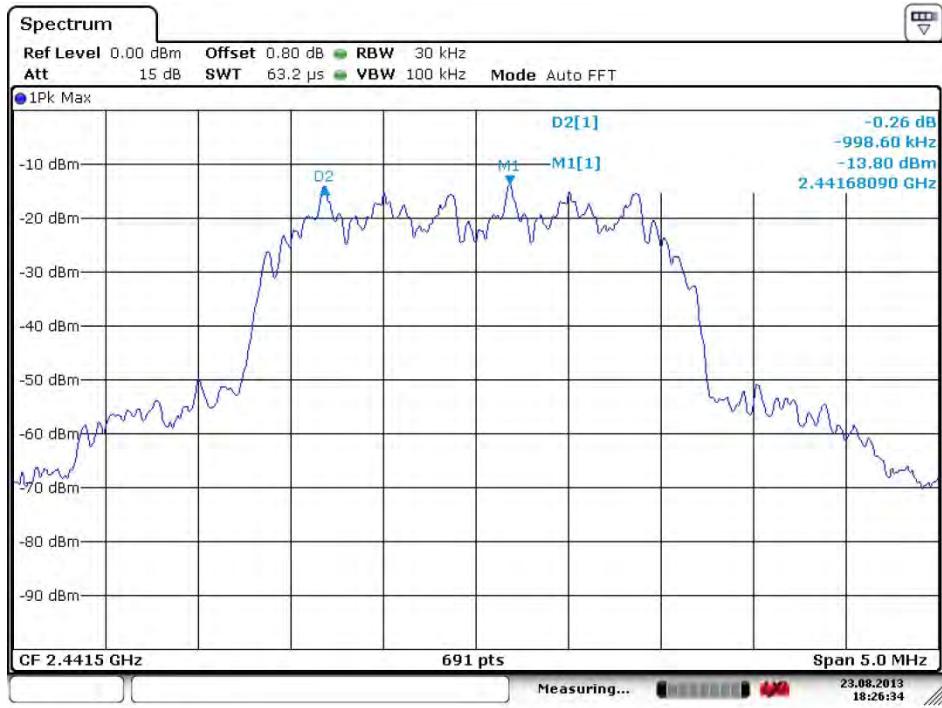
Date: 23.AUG.2013 18:23:46

- Channel 77-78(2 Mbps)


Date: 23.AUG.2013 18:24:46

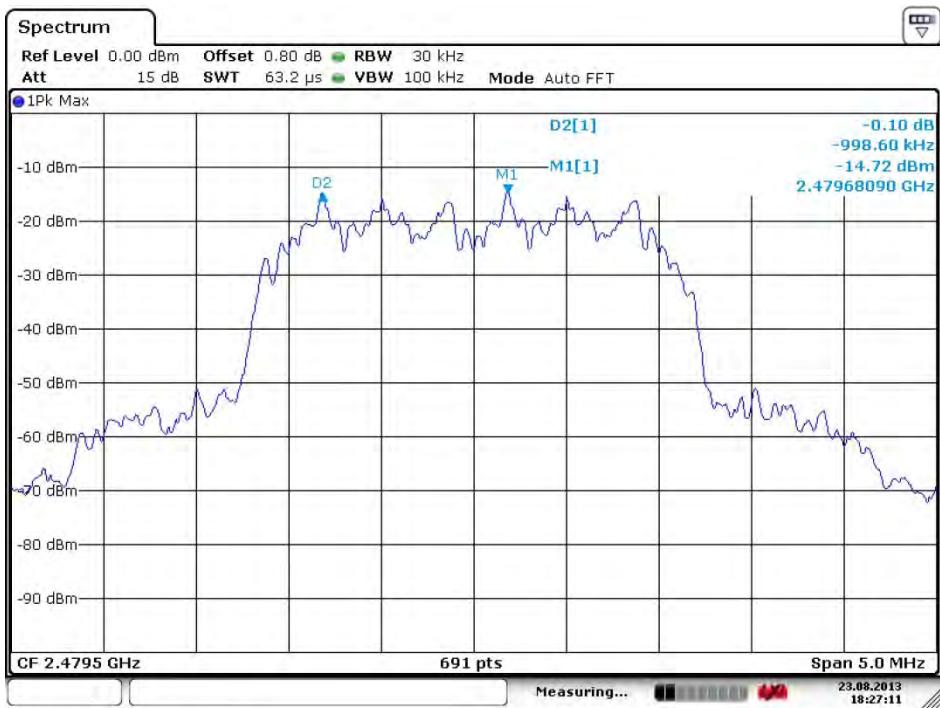
- Channel 00-01(3 Mbps)


Date: 23.AUG.2013 18:25:42

- Channel 39-40(3 Mbps)


Date: 23.AUG.2013 18:26:34

- **Channel 77-78(3 Mbps)**



Date: 23.AUG.2013 18:27:11

3.3 Average time of occupancy

3.3.1 Definition

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

3.3.2 Specification

FCC Rules Part 15, Section 15.247(a)(a)(iii)

3.3.3 Method of measurement

Public Notice "DA 00-705"

3.3.4 Measurement set-up



3.3.5 Test equipment list

Equipment	Model name	Manufacture
EUT	SMC HOME	VisionScape
Test fixer (JIG)	CC Debugger	TEXAS INSTRUMENTS
Spectrum analyzer	ESPI7	Rohde & Schwarz
Control PC	E655X-8FA	JT0802G100530031

3.3.6 Test procedure

- ① According to Section 15.247(a)(1)(iii) the average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.
- ② The time period to be observed is "0.4 s x 79 = 31.6 seconds".
- ③ According to the Bluetooth specification the system transmits at a rate of 1 600 hops per second. For DH5 packet five time slot is used for TX and one time slot for RX.
- ④ That means a total of $(1600 / 6)$ transmissions occurs in one second. The average time of occupancy is calculated as following: $[(1600 / 6) \times 2.920 \text{ ms}] \times (0.4 \times 79) / 79 = 311.47 \text{ ms}$
- ⑤ Dwell time = [hop/s] X [observed time] X [transmission time]

3.3.7 Test condition

- Test place : Shield room
- Test mode : Normal operation
- Test environment : 25 °C, 56 %R.H.

3.3.8 Test result

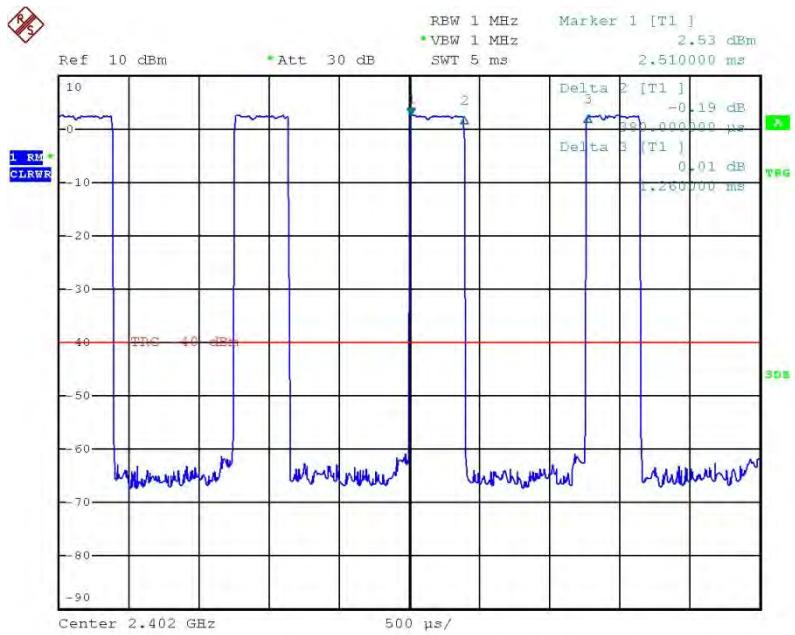
Channel	Frequency (MHz)	Packet type	Transmission time (ms)	Hop per second (Hop/s)	Dwell time (ms)	Limit (ms)
Low	2 402	DH1	0.380	10.44	125.36	≤ 400
		DH3	1.620	5.38	275.41	
		DH5	2.920	3.48	321.10	
Middle	2 441	DH1	0.380	10.44	125.36	≤ 400
		DH3	1.620	5.38	275.41	
		DH5	2.920	3.48	321.10	
High	2 480	DH1	0.380	10.44	125.36	≤ 400
		DH3	1.620	5.38	275.41	
		DH5	2.920	3.48	321.10	

3.3.9 Limit

The average time of occupancy on any channel shall not be greater than 0.4 seconds multiplied by the number of hopping channels employed.

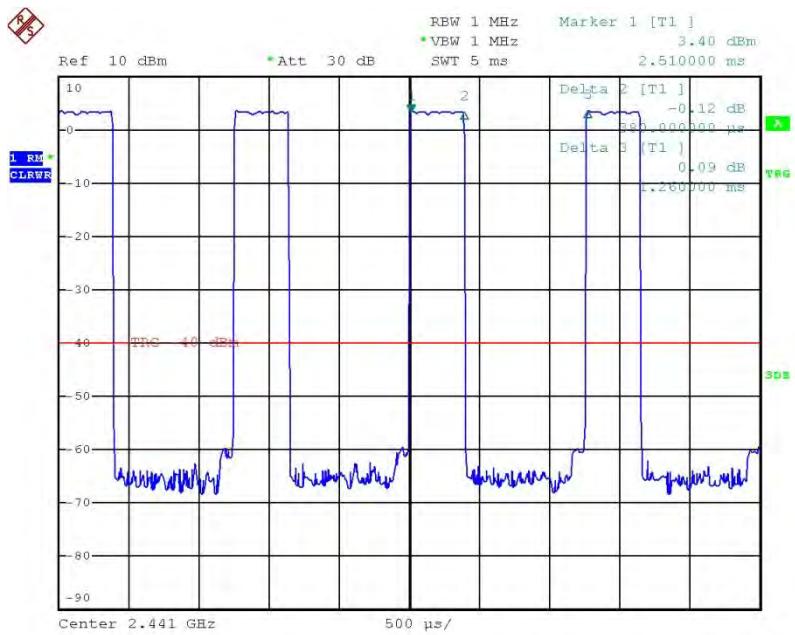
3.3.10 Plot of average time of occupancy

① DH1 of 2 402 MHz



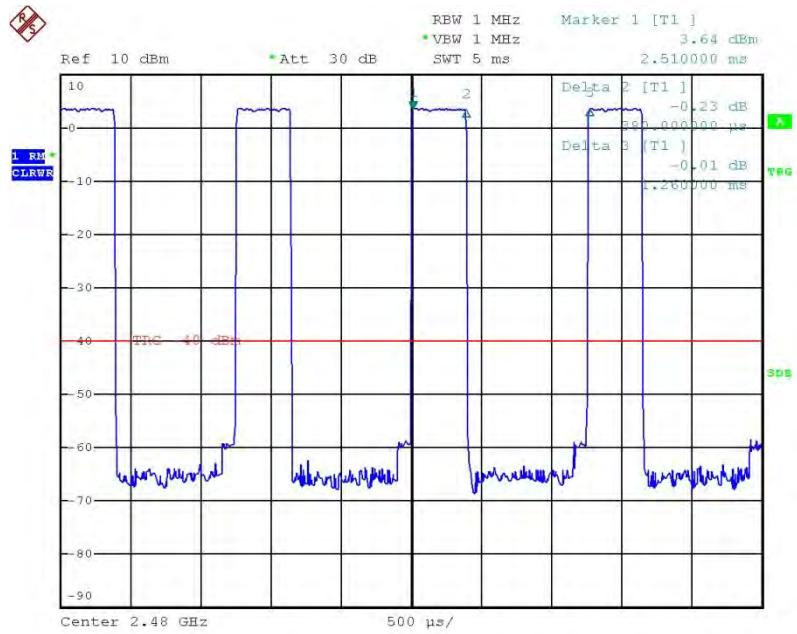
Transmission Time → 0.380 ms

② DH1 of 2 441 MHz



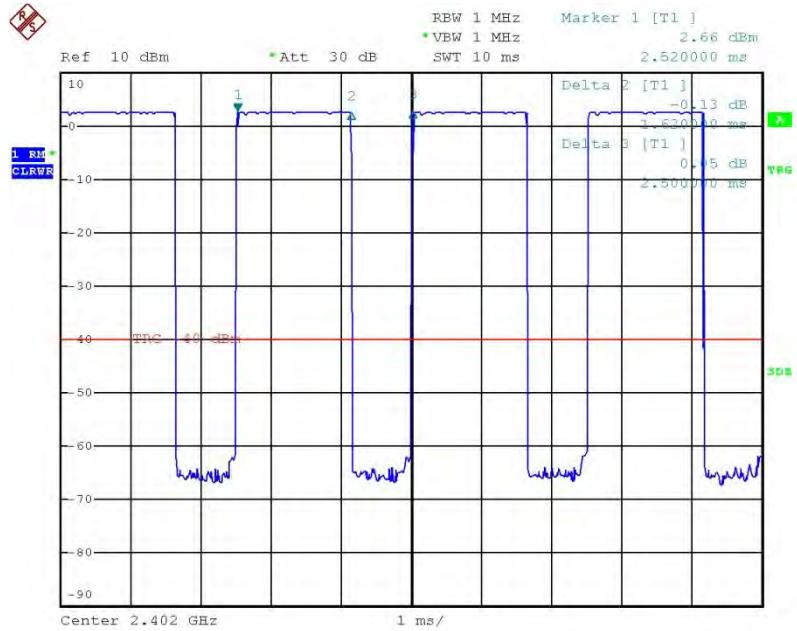
Transmission Time → 0.380 ms

③ DH1 of 2 480 MHz



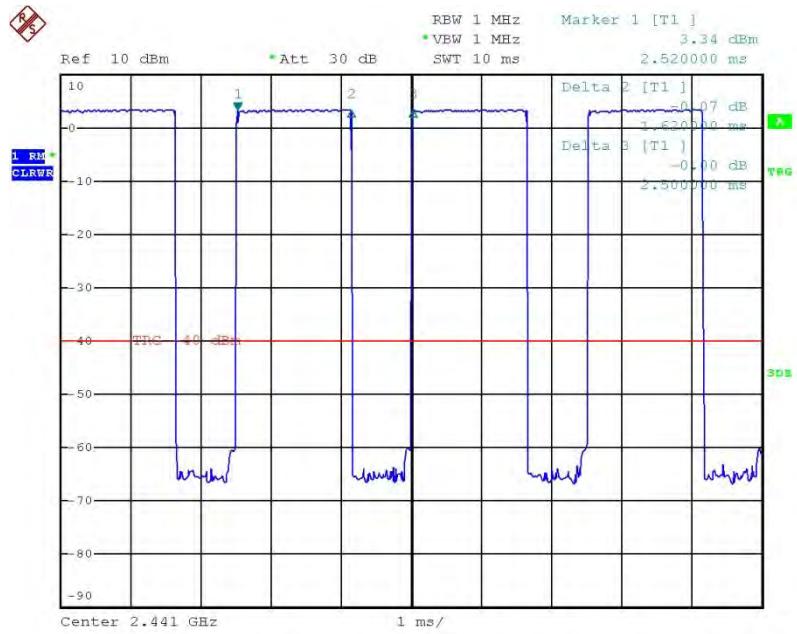
Transmission Time → 0.380 ms

④ DH3 of 2 402 MHz



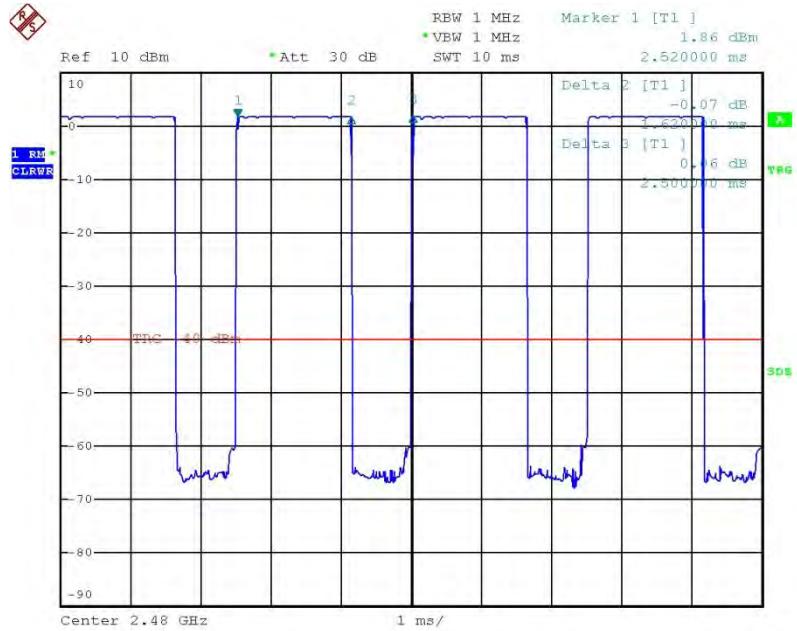
Transmission Time → 1.620 ms

⑤ DH3 of 2 441 MHz



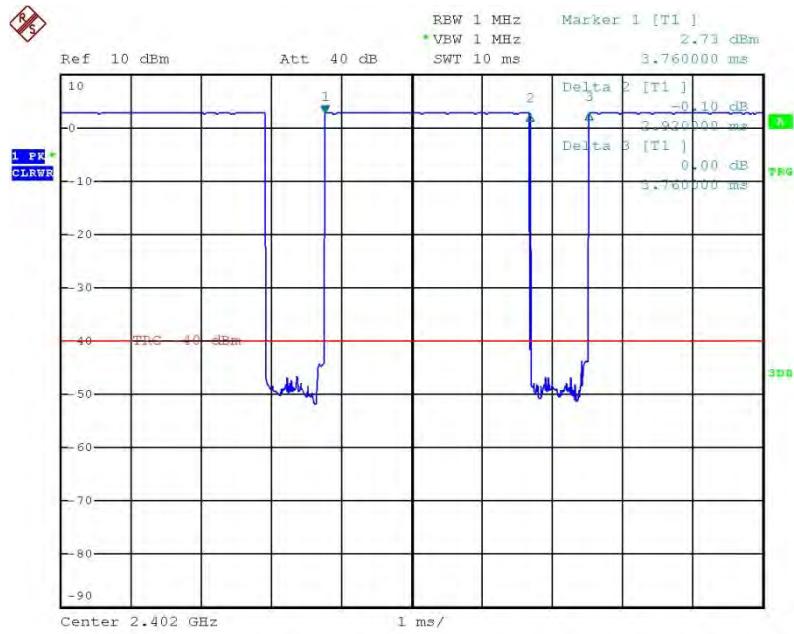
Transmission Time → 1.620 ms

⑥ DH5 of 2 480 MHz



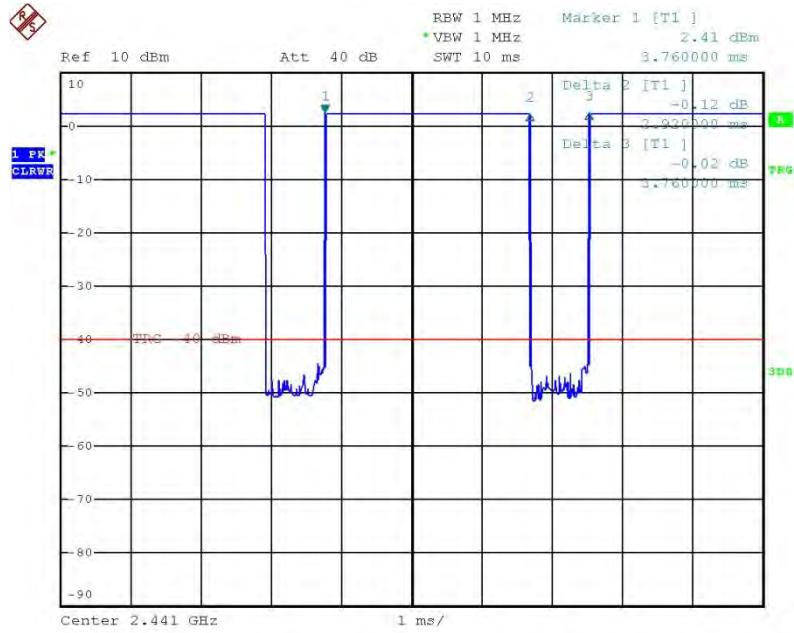
Transmission Time → 1.620 ms

⑦ DH5 of 2 402 MHz



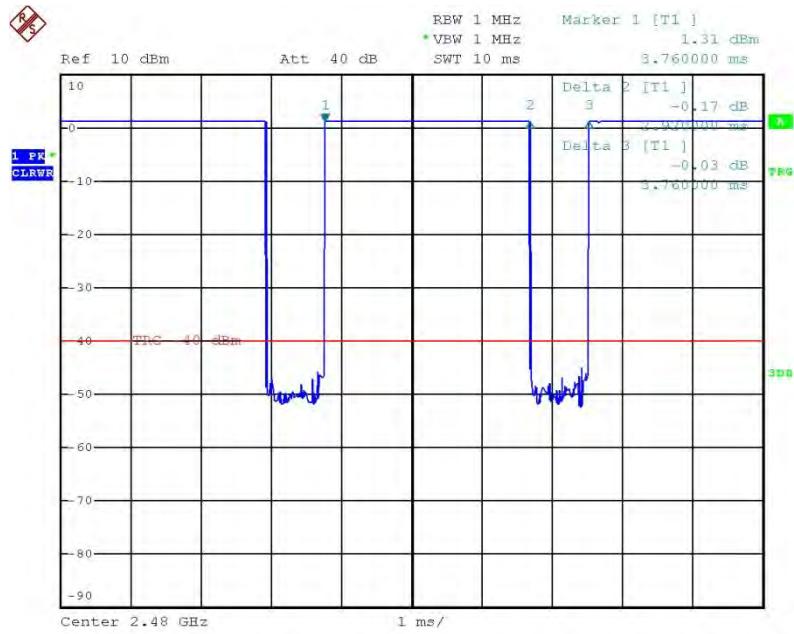
Transmission Time → 2.920 ms

⑧ DH5 of 2 441 MHz



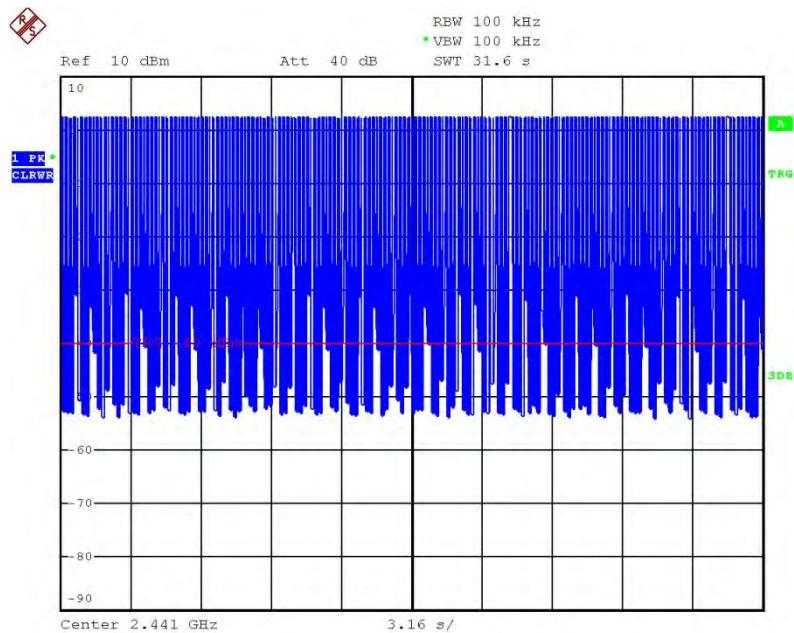
Transmission Time → 2.920 ms

⑨ DH5 of 2 480 MHz

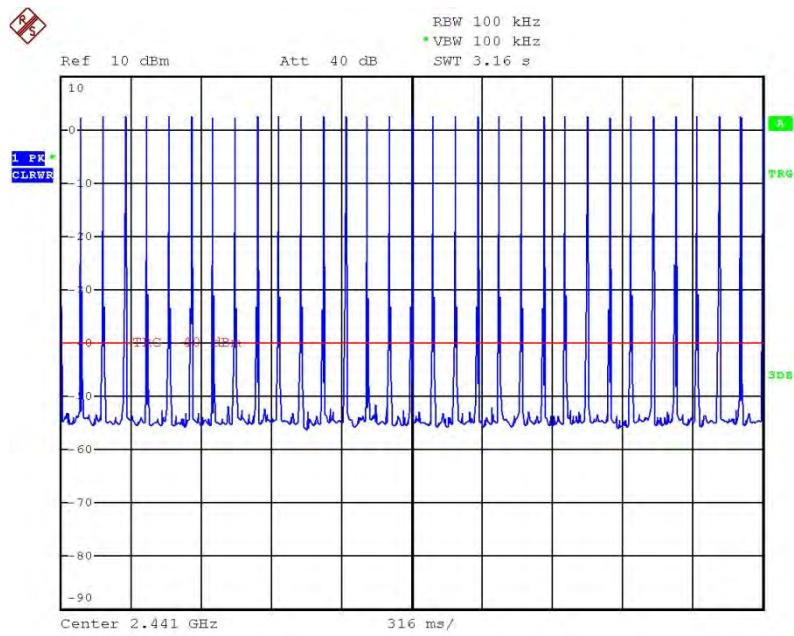


Transmission Time → 2.920 ms

⑩ Hoppings of DH1 in 31.6 s



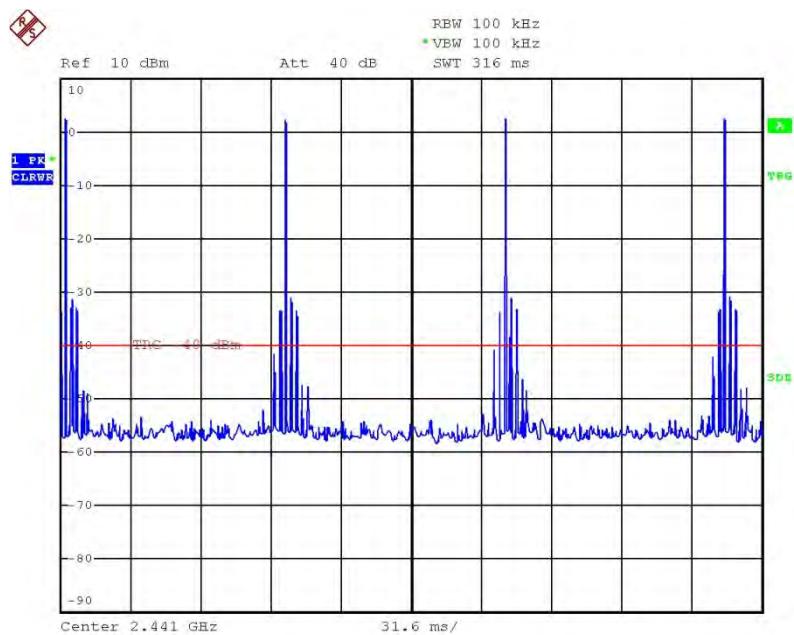
⑪ Hoppings of DH1 in 3.16 s



Number of hops in 3.16 s → 33 times

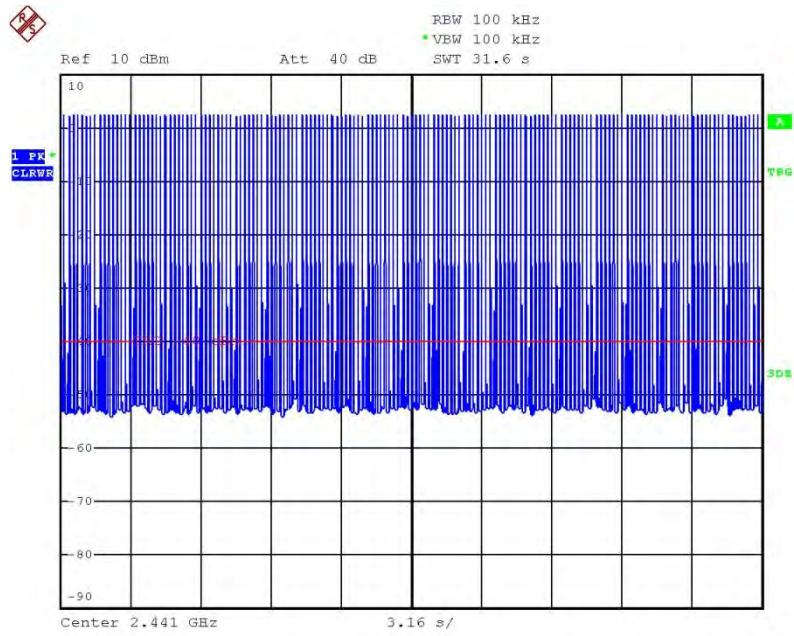
Hop per second → 10.44 times

⑫ Hopping of DH1 in 0.316 s

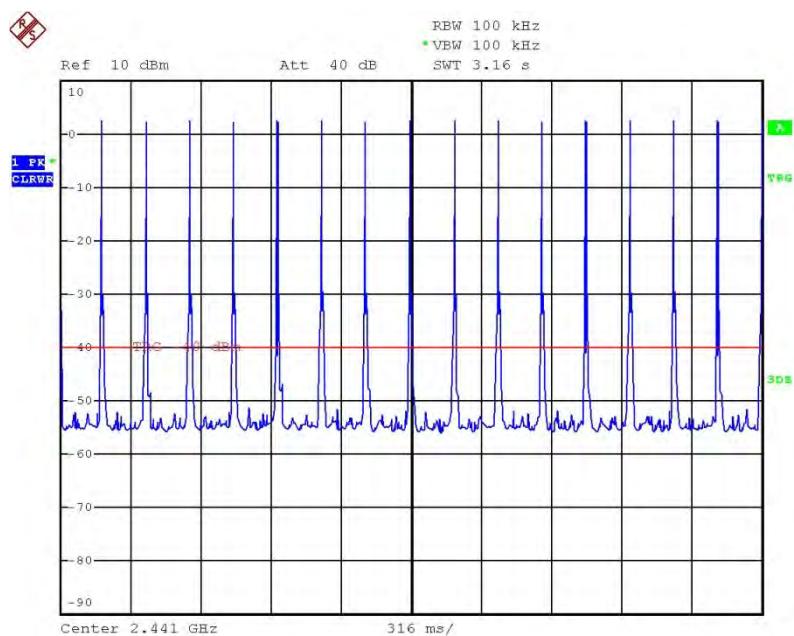


Number of hops in 0.316 s → 4 times

⑬ Hopping of DH3 in 31.6 s



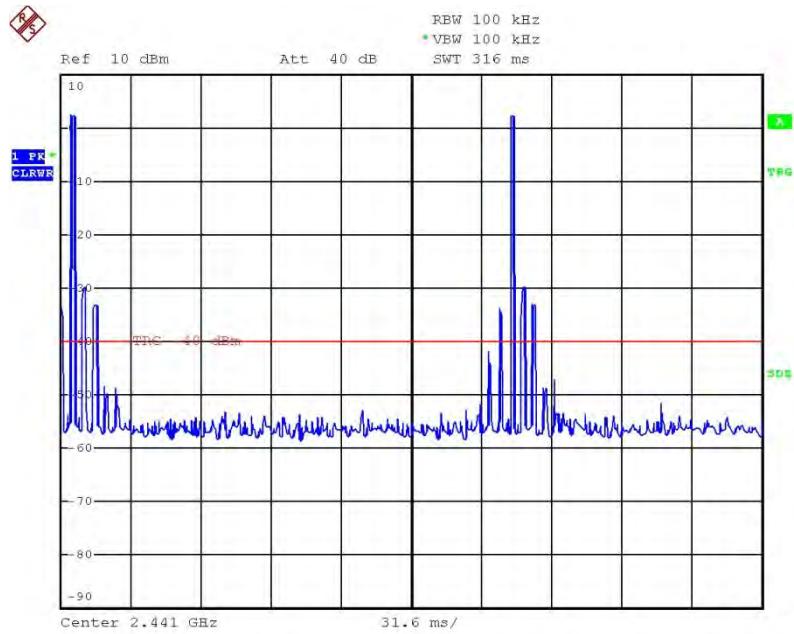
⑭ Hopping of DH3 in 3.16 s



Number of hops in 3.16 s → 17 times

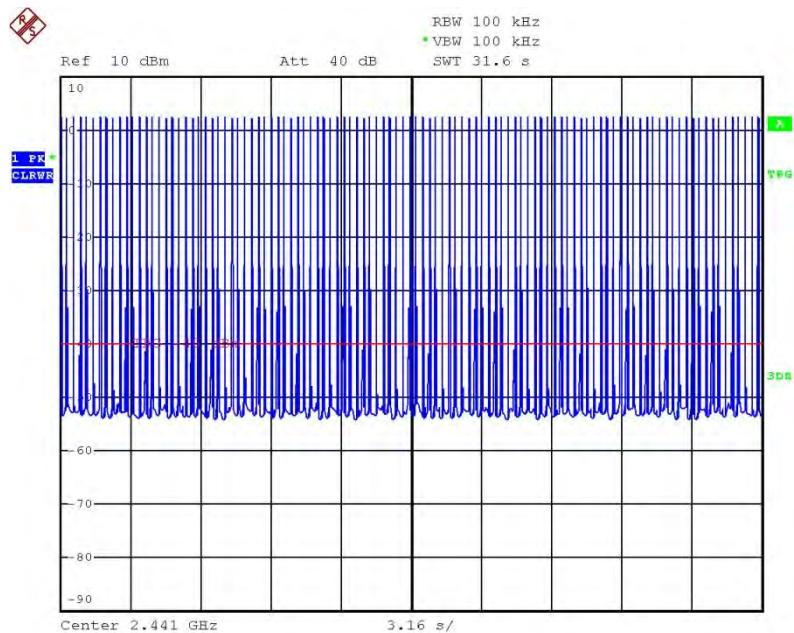
Hop per second → 5.38 times

⑯ Hopping of DH3 in 0.316 s

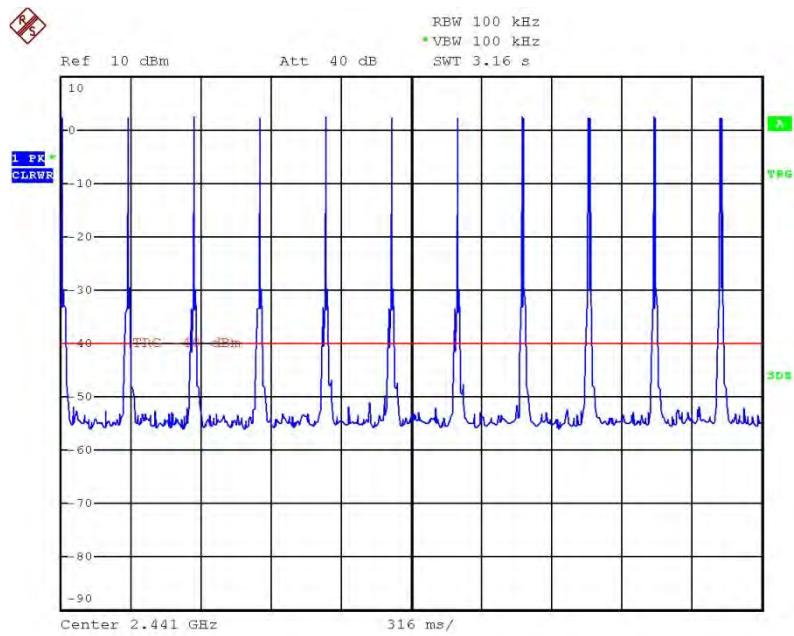


Number of hops in 0.316 s → 2 times

⑯ Hopping of DH5 in 31.6 s



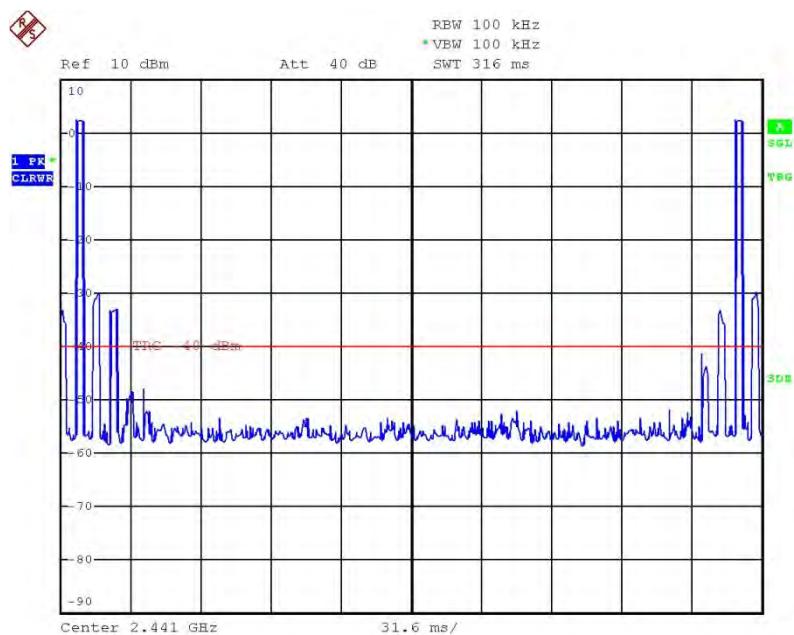
⑯ Hopping of DH5 in 3.16 s



Number of hops in 3.16 s → 11 times

Hop per second → 3.48 times

⑯ Hopping of DH5 in 0.316 s



Number of hops in 0.316 s → 2 times

3.4 20 dB and 99 % bandwidth

3.4.1 Definitions

A occupied bandwidth is width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each lower 20 dB of the total mean power of a given emission.

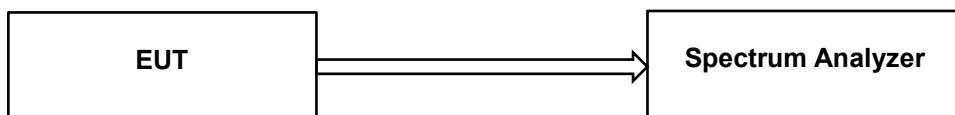
3.4.2 Specification

- FCC Rules Part 15 Subpart C Section 15.247(a)(1)
- IC Rules RSS-210 Issue8 Annex 8-2010 A8.1(a), RSS-GEN 4.6.1

3.4.3 Measurement method

- Public Notice “DA 00-705”

3.4.4 Set-up



3.4.5 Test equipment list

Equipment	Model name	Serial No.
EUT	SMC HOME	VisionScape
Test fixer (JIG)	CC Debugger	TEXAS INSTRUMENTS
Spectrum analyzer	FSV30	Rohde & Schwarz
Control PC	E655X-8FA	JT0802G100530031

3.4.6 Test procedure

- The output of EUT was connected to the spectrum analyzer.
- Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level.

3.4.7 Test condition

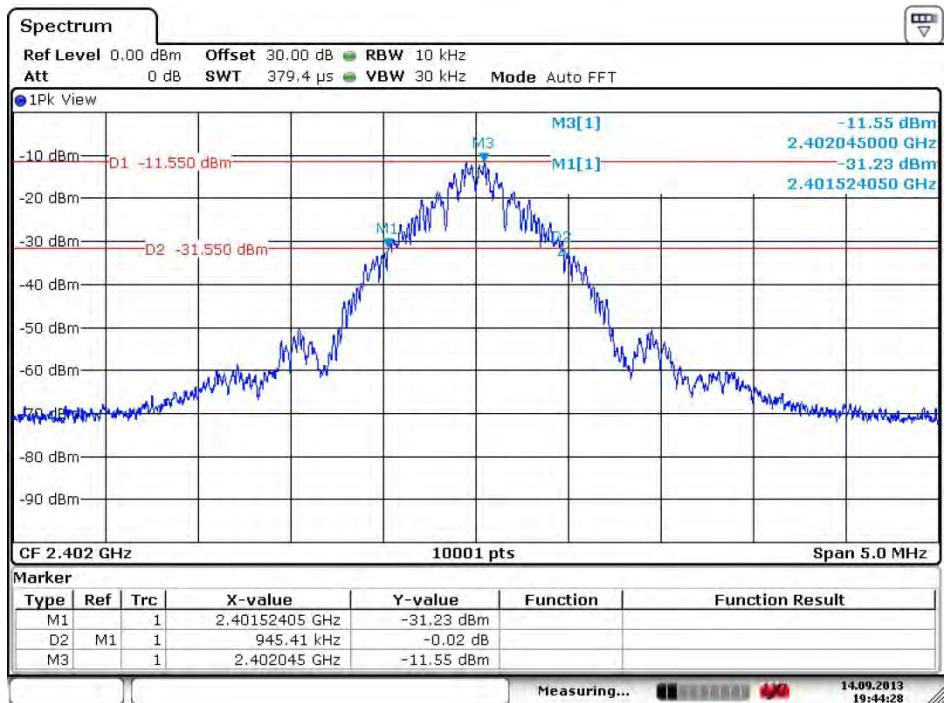
- Test place : Test room
- Test environment : 25 °C, 56 % R.H.
- Test mode : Operation at single channel

3.4.8 Test result

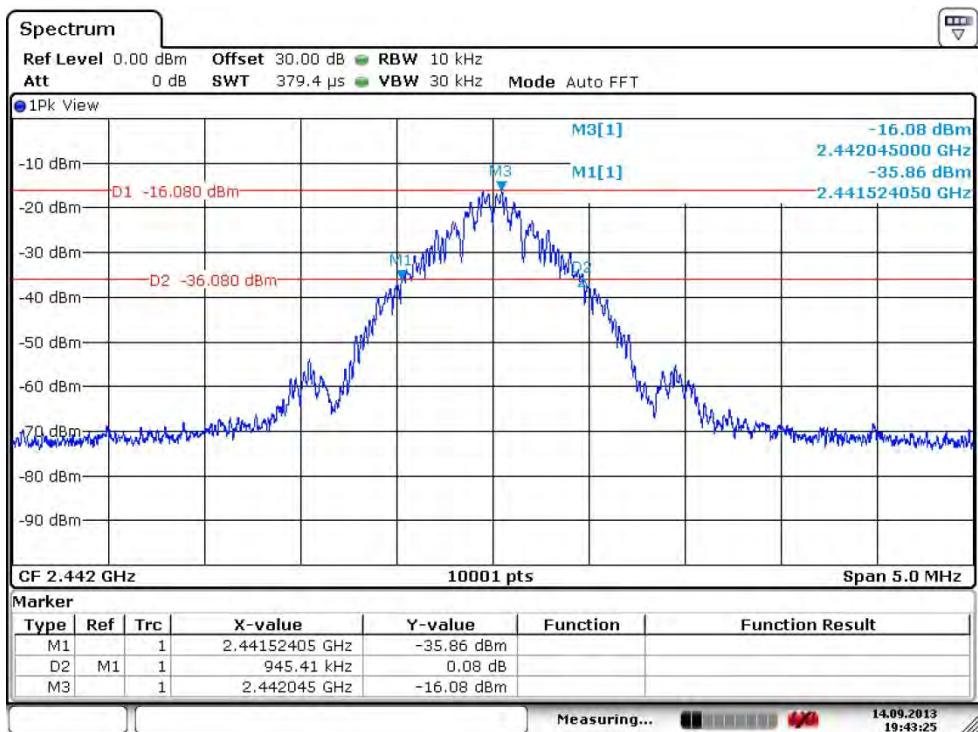
Mode	Frequency [MHz]	20 dB Bandwidth [kHz]	99 % Bandwidth [kHz]
1 Mbps	2 402	945.41	894.35
	2 442	945.41	898.69
	2 480	947.41	881.33
2 Mbps	2 402	1 318.87	1 120.11
	2 442	1 318.37	1 094.06
	2 480	1 319.87	1 111.43
3 Mbps	2 402	1 362.86	1 241.67
	2 442	1 362.86	1 237.33
	2 480	1 362.36	1 241.67

3.4.9 Plots of 20 dB bandwidth

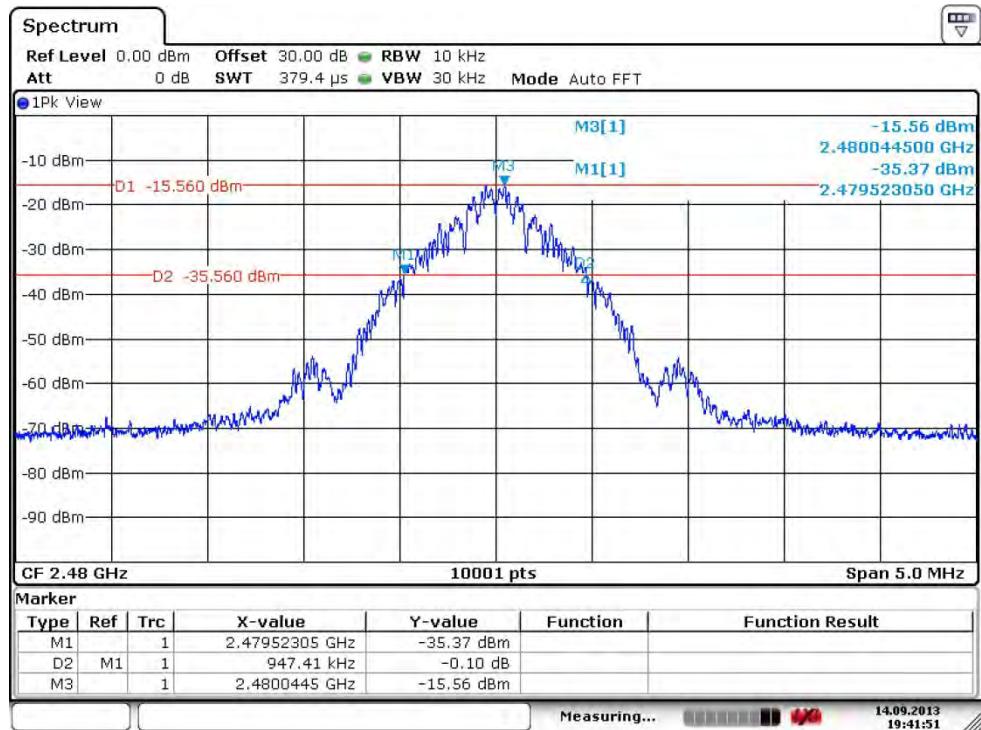
3.4.9.1 Channel 0 – 1 Mbps



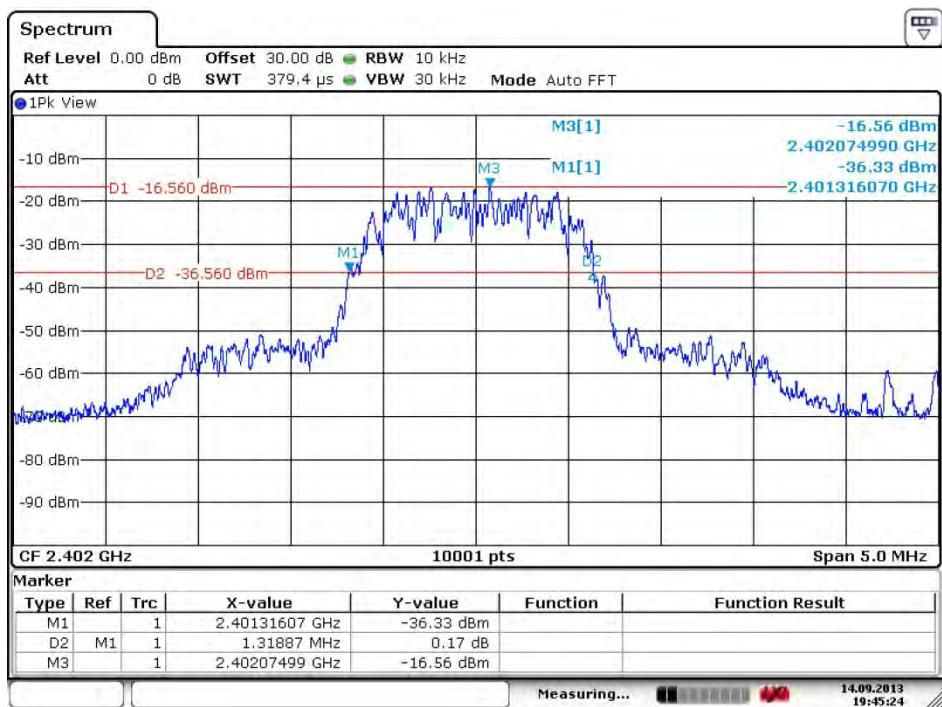
3.4.9.2 Channel 40 – 1 Mbps



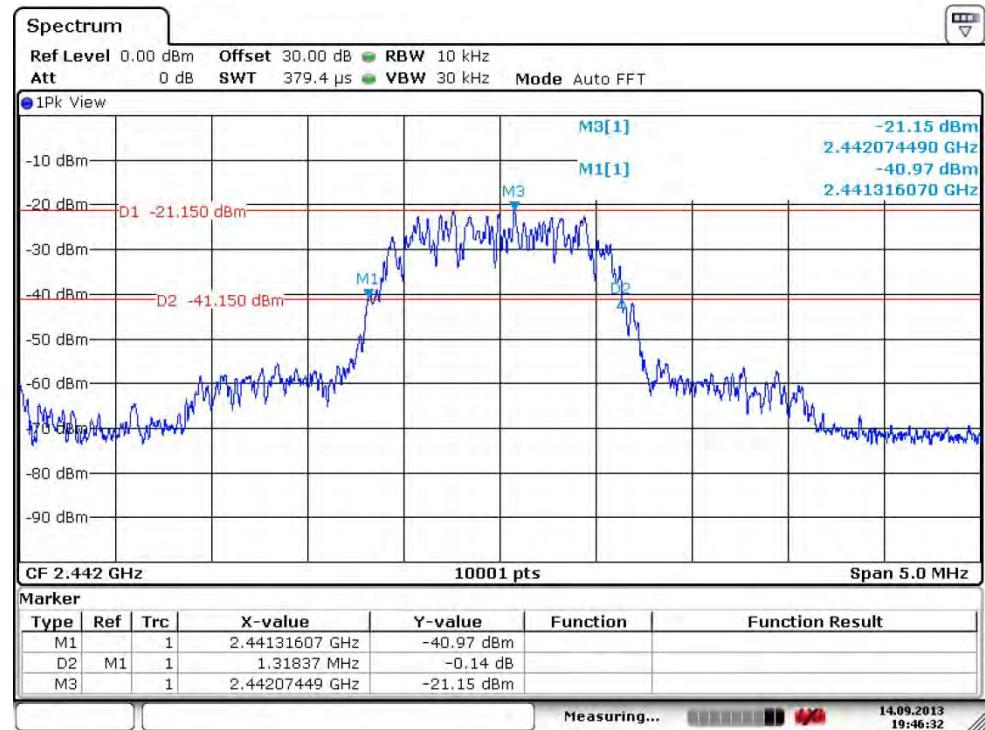
3.4.9.3 Channel 78 – 1Mbps



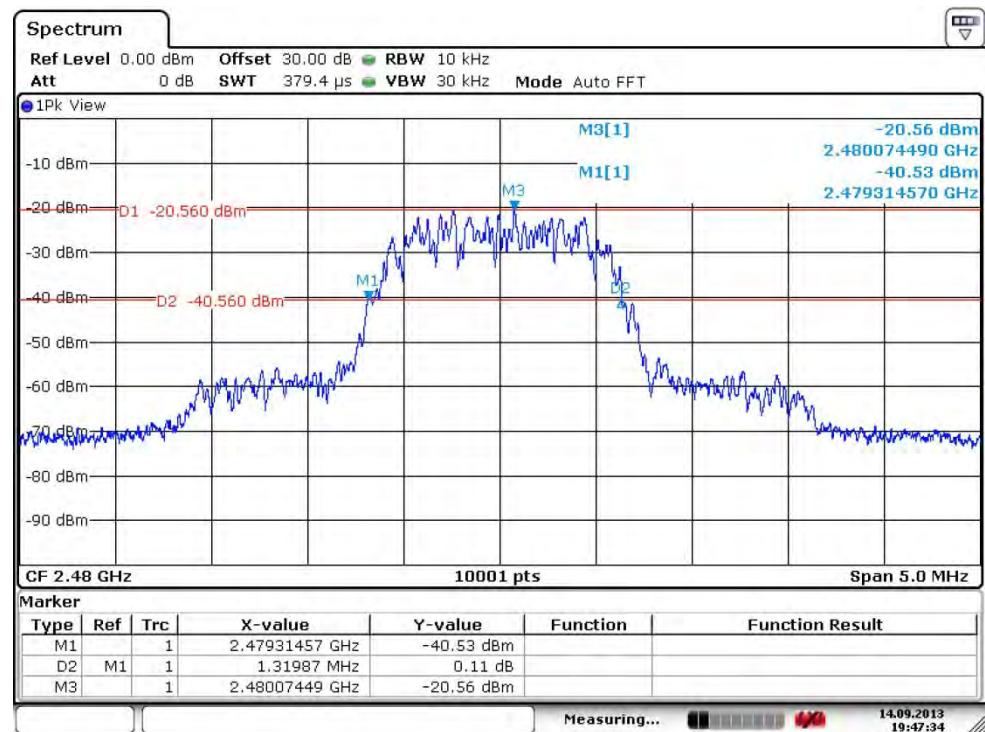
3.4.9.4 Channel 0 – 2 Mbps



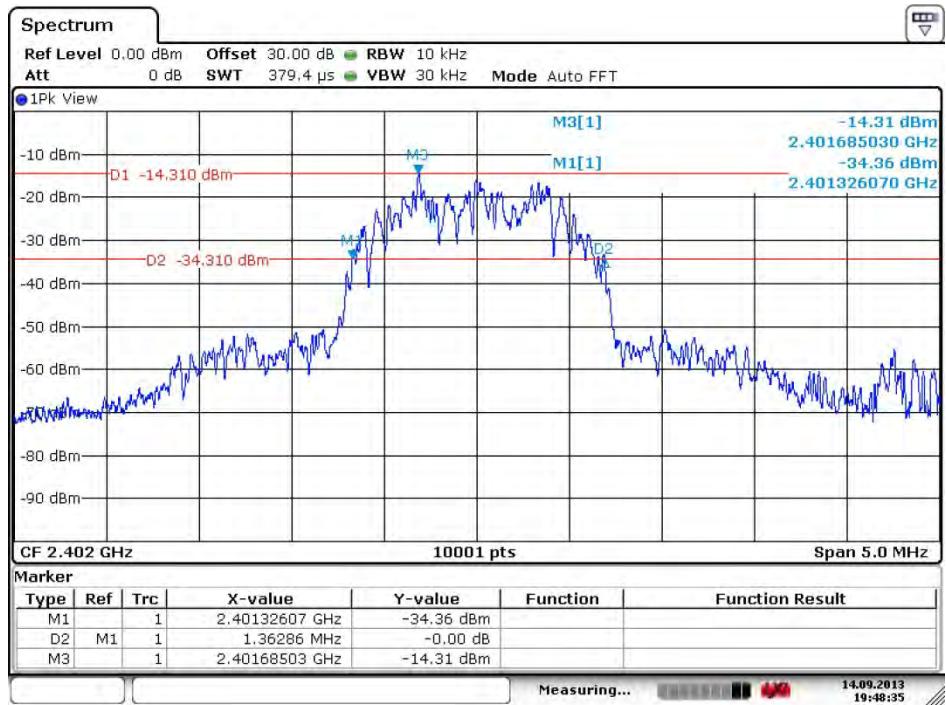
3.4.9.5 Channel 40 – 2 Mbps



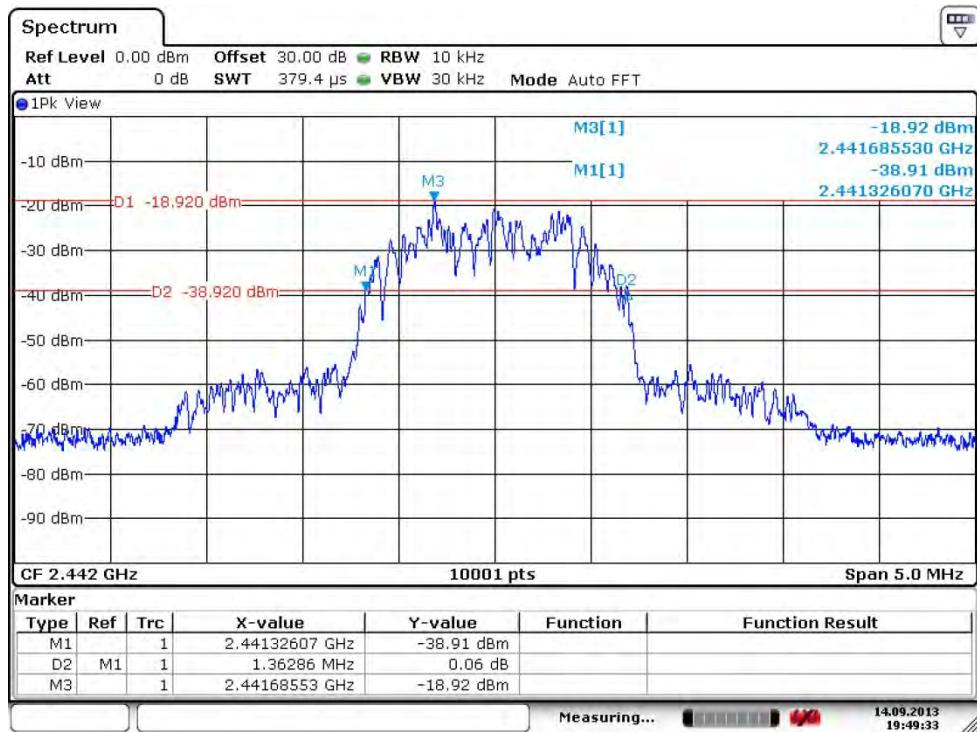
3.4.9.6 Channel 78 – 2 Mbps



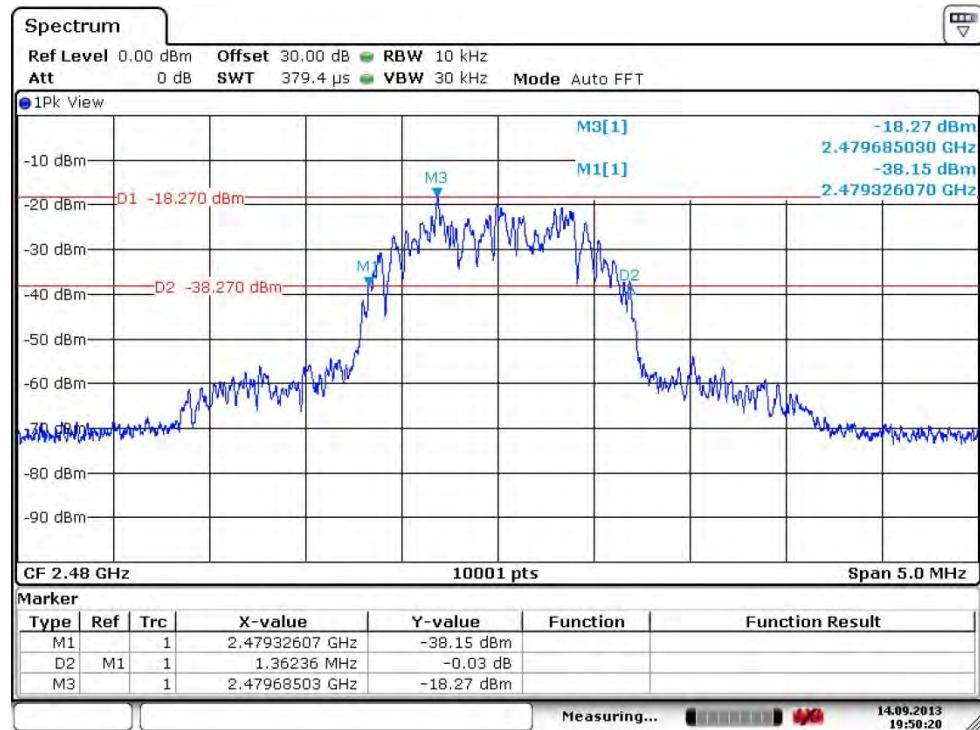
3.4.9.7 Channel 0 – 3 Mbps



3.4.9.8 Channel 40 – 3 Mbps



3.4.9.9 Channel 78 – 3 Mbps

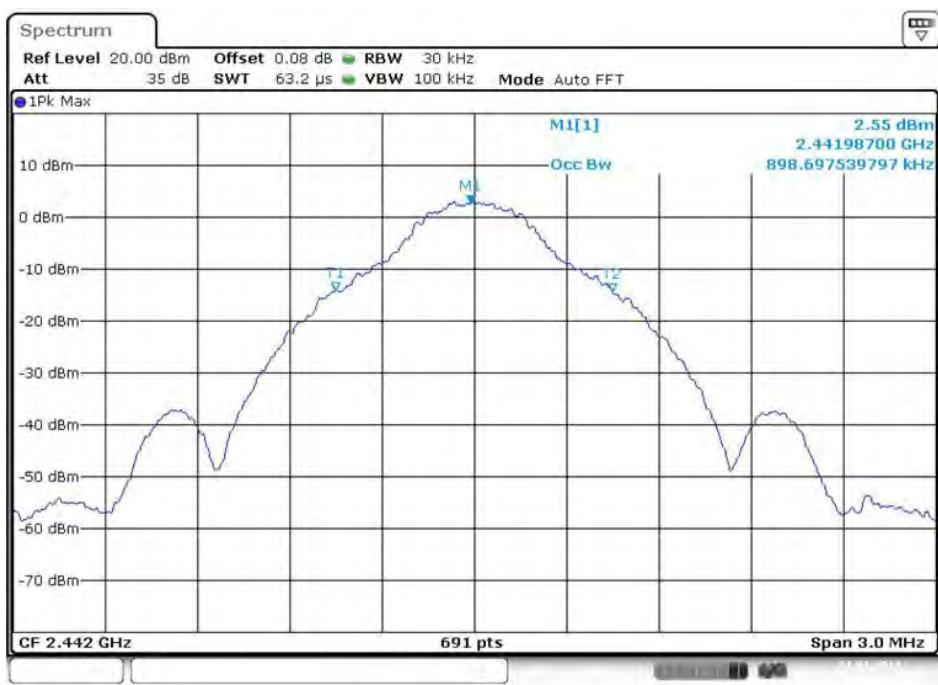


3.4.10 Plots of 99 % bandwidth

3.4.10.1 Channel 0 – 1 Mbps



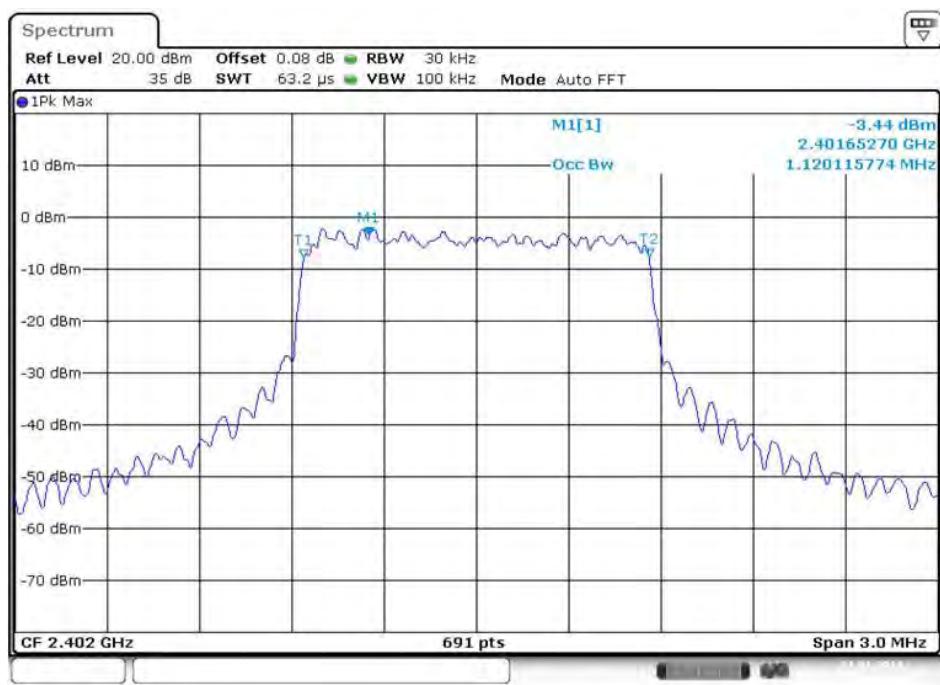
3.4.10.2 Channel 40 – 1 Mbps



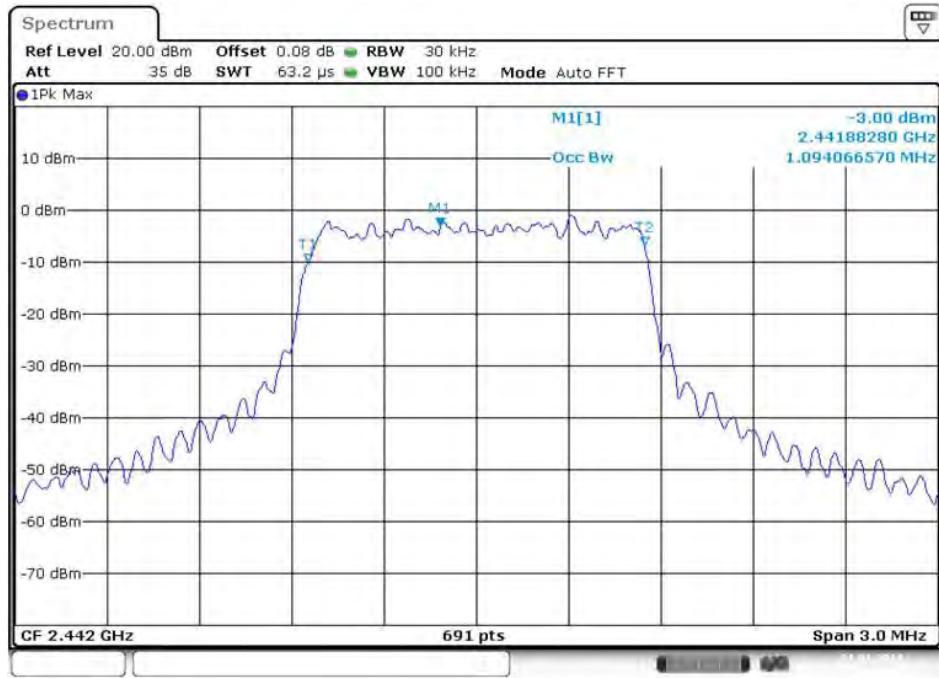
3.4.10.3 Channel 78 – 1 Mbps



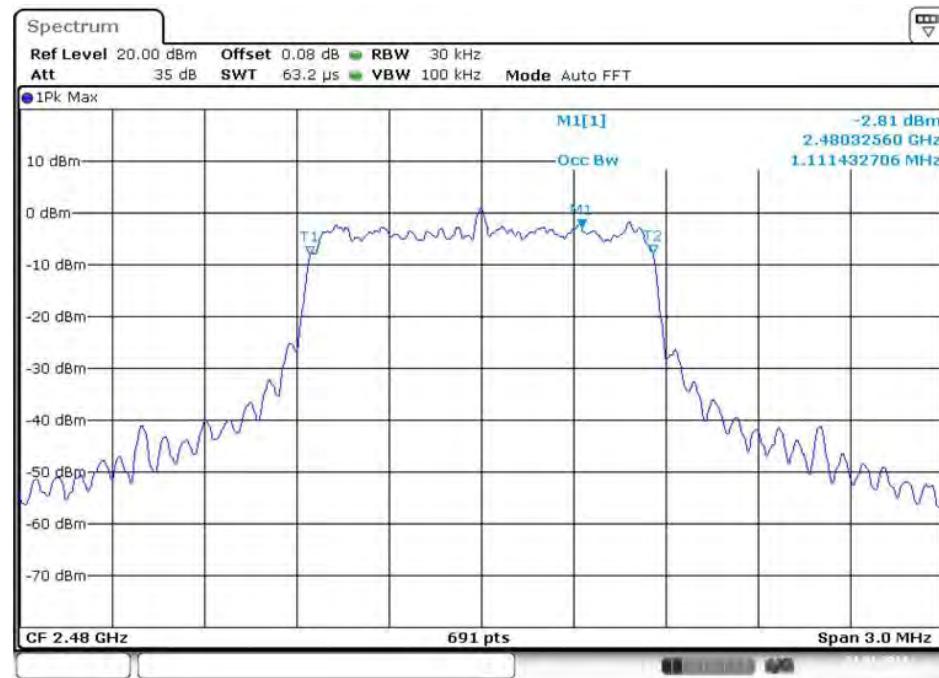
3.4.10.4 Channel 0 – 2 Mbps



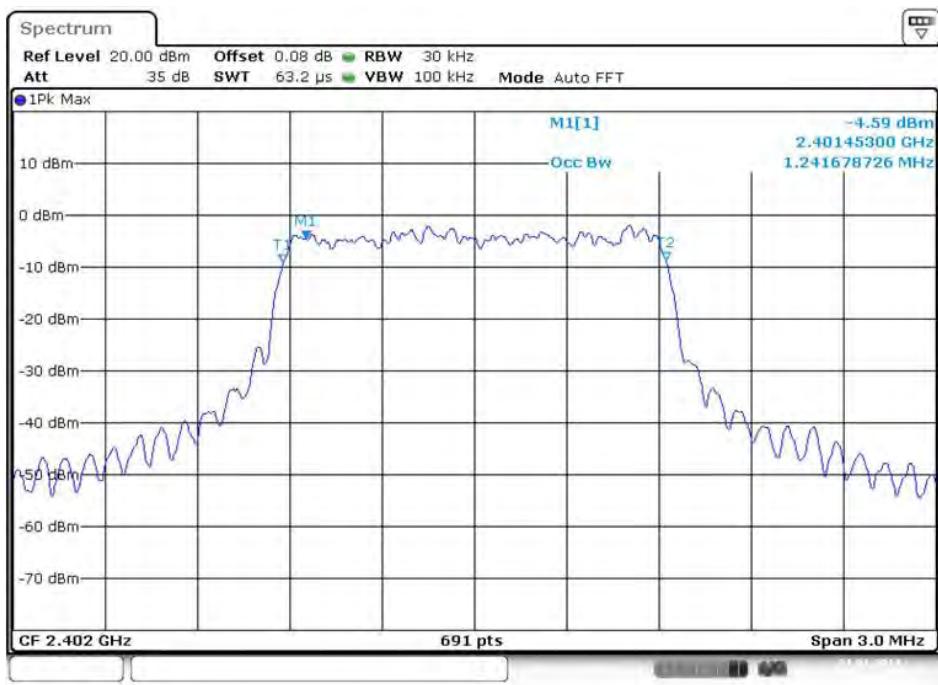
3.4.10.5 Channel 40 – 2 Mbps



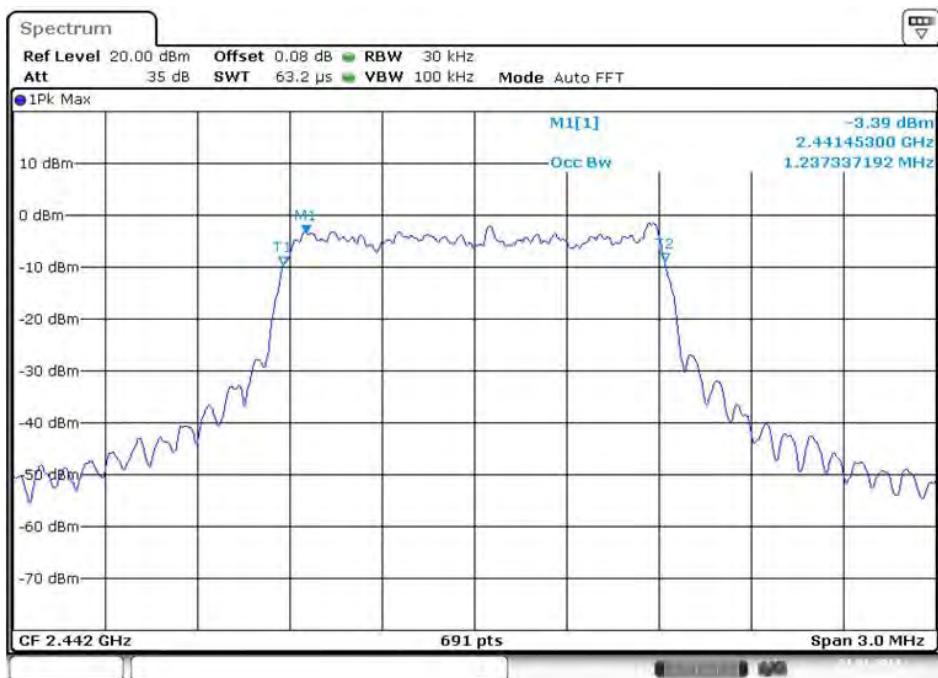
3.4.10.6 Channel 78 – 2 Mbps



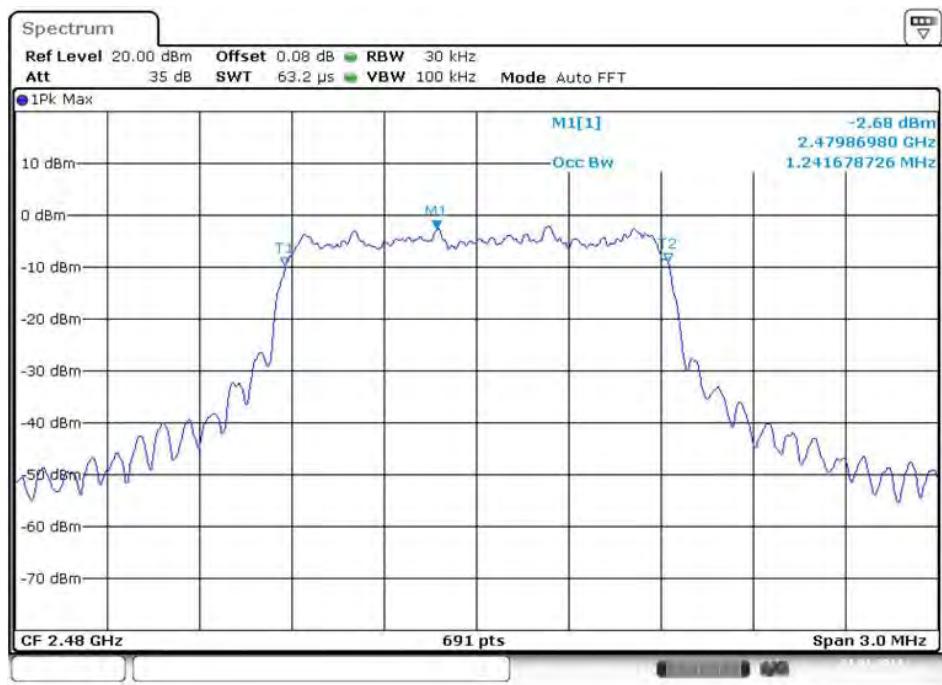
3.4.10.7 Channel 0 – 3 Mbps



3.4.10.8 Channel 40 – 3 Mbps



3.4.10.9 Channel 78 – 3 Mbps



3.5 Peak output power

3.5.1 Definitions

Maximum conducted output power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level.

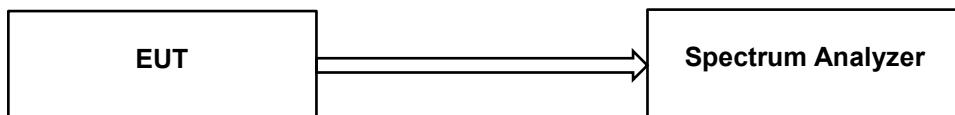
3.5.2 Specification

- FCC Rules Part 15 Subpart C Section 15.247(b)(1)
- IC Rules RSS-210 Issue8 Annex 8-2010 A8.1(b)

3.5.3 Measurement method

- Public Notice “DA 00-705”

3.5.4 Set-up



3.5.5 Test equipment list

Equipment	Model name	Serial No.
EUT	SMC HOME	VisionScape
Test fixer (JIG)	CC Debugger	TEXAS INSTRUMENTS
Spectrum analyzer	FSV30	Rohde & Schwarz
Control PC	E655X-8FA	JT0802G100530031

3.5.6 Test procedure

- The output of EUT was connected to the spectrum analyzer.
- Sets RBW 1 MHz, VBW 3 MHz, Max hold

3.5.7 Test condition

- Test place : Test room
- Test environment : 25 °C, 56 % R.H.
- Test mode : Operation at single channel

3.5.8 Test result

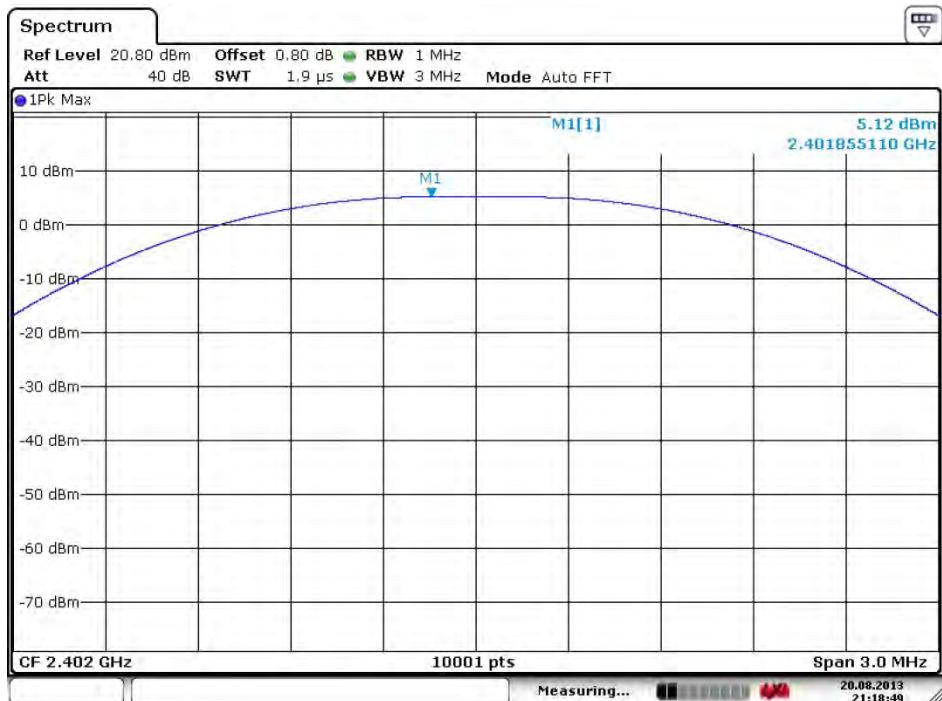
Channel	Frequency [MHz]	Peak Output Power						Limit [mW]	
		1 Mbps		2 Mbps		3 Mbps			
		dBm	mW	dBm	mW	dBm	mW		
00	2 402	5.12	3.25	5.68	3.69	5.38	3.45	125	
40	2 442	5.15	3.27	5.50	3.54	5.26	3.35	125	
78	2 480	4.44	2.78	4.92	3.10	4.92	3.10	125	

3.5.9 Limit

Less than 125 mW.

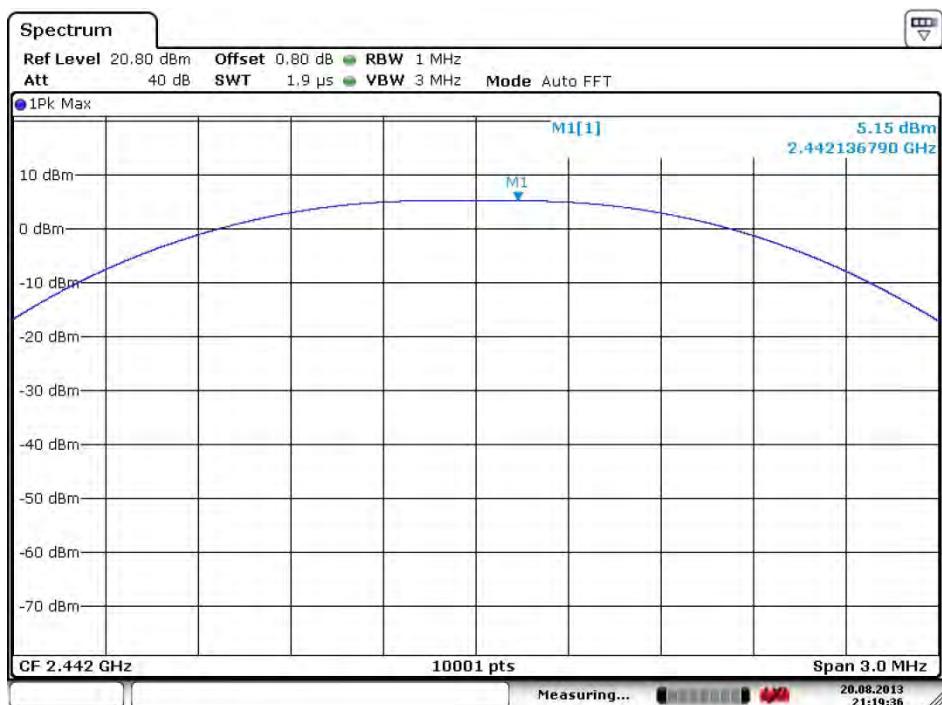
3.5.10 Plots of peak output power at high power

3.5.10.1 Channel 0 – 1 Mbps



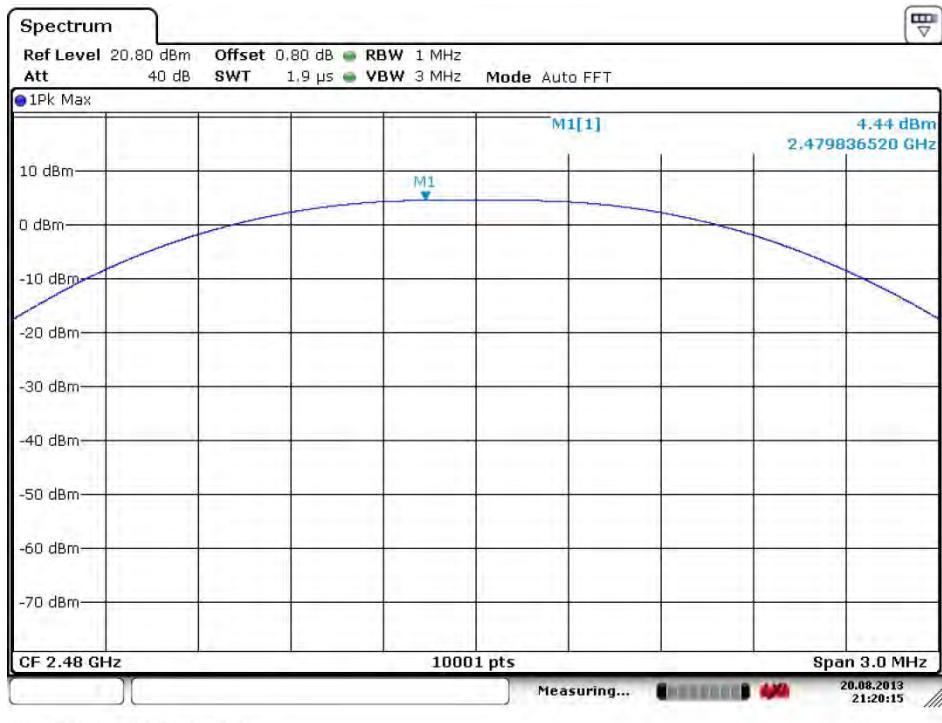
Date: 20.AUG.2013 21:18:49

3.5.10.2 Channel 40 – 1 Mbps

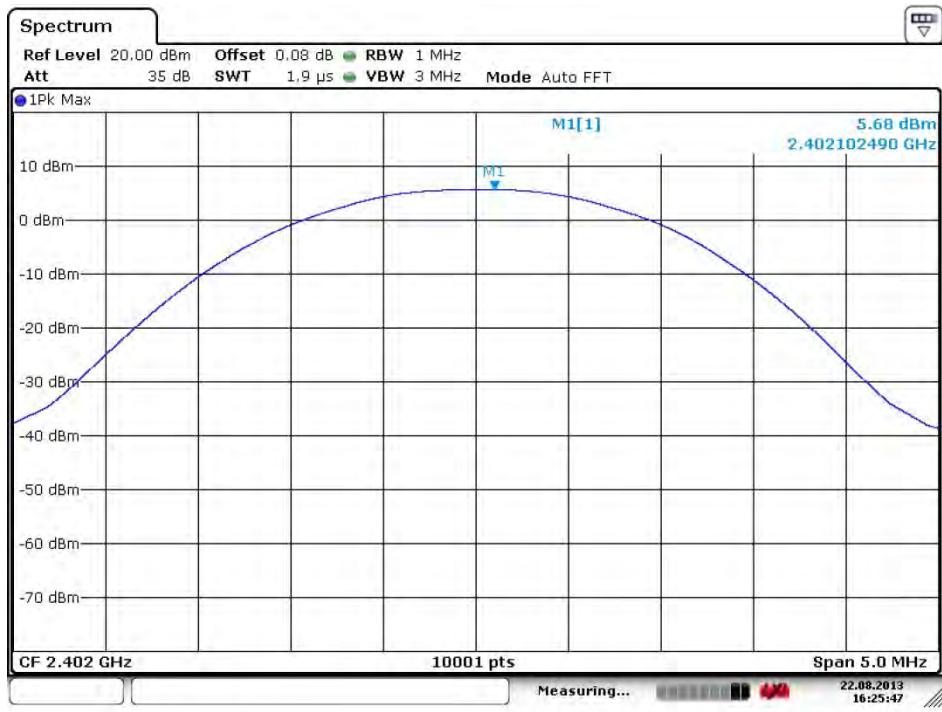


Date: 20.AUG.2013 21:19:37

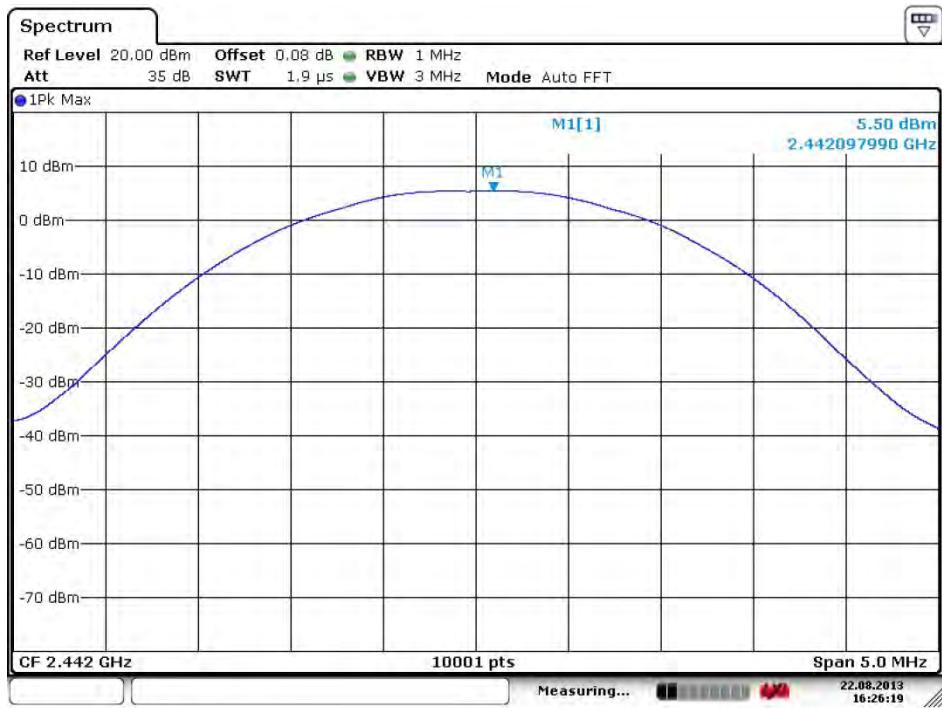
3.5.10.3 Channel 78 – 1 Mbps



3.5.10.4 Channel 0 – 2 Mbps

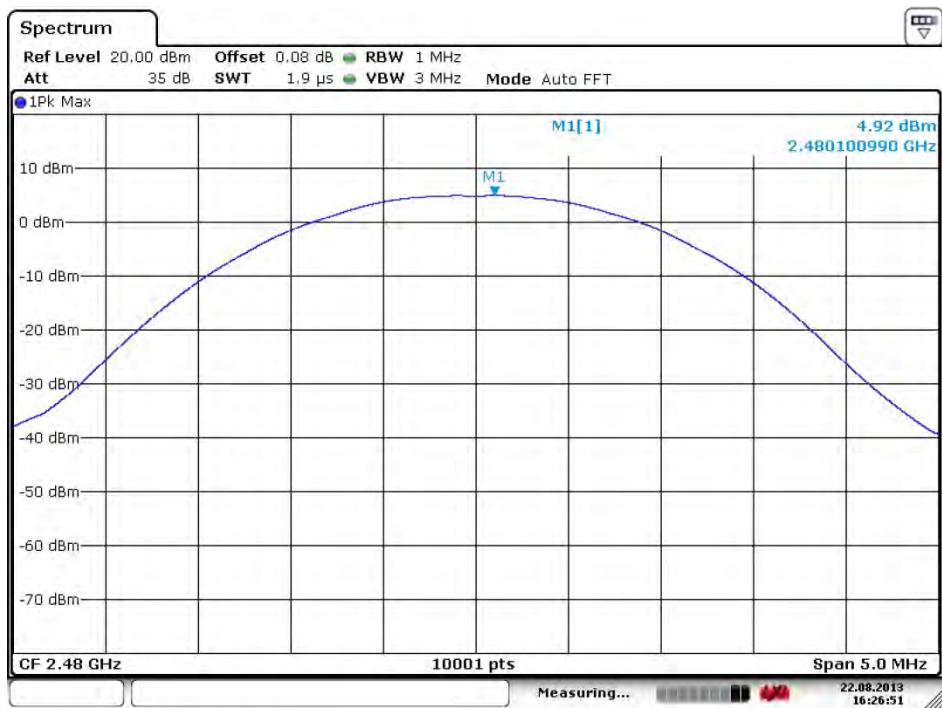


3.5.10.5 Channel 40 – 2 Mbps



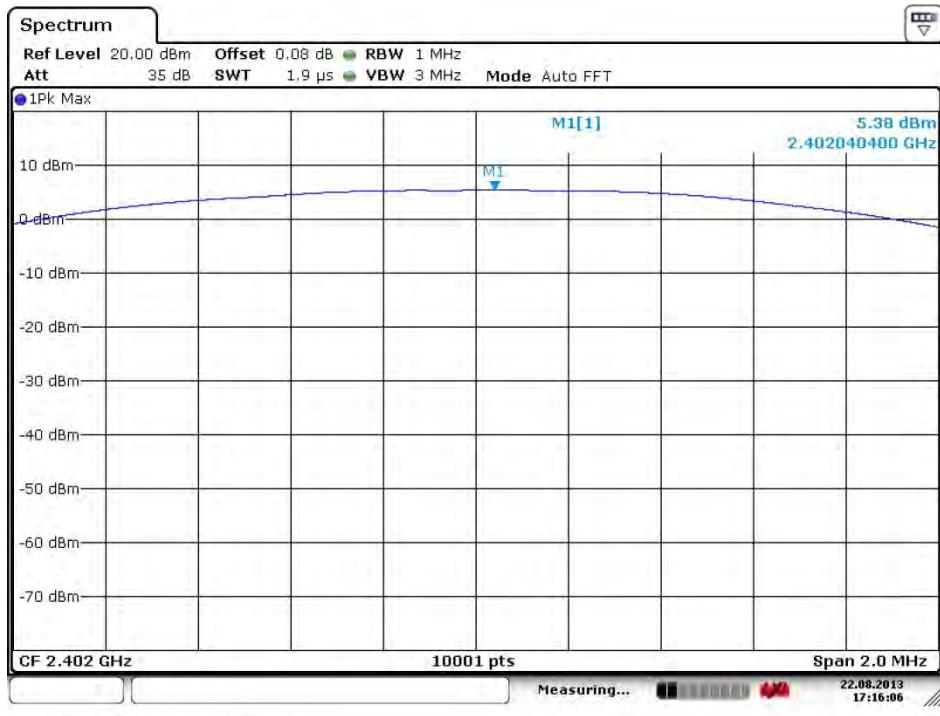
Date: 22.AUG.2013 16:26:19

3.5.10.6 Channel 78 – 2 Mbps



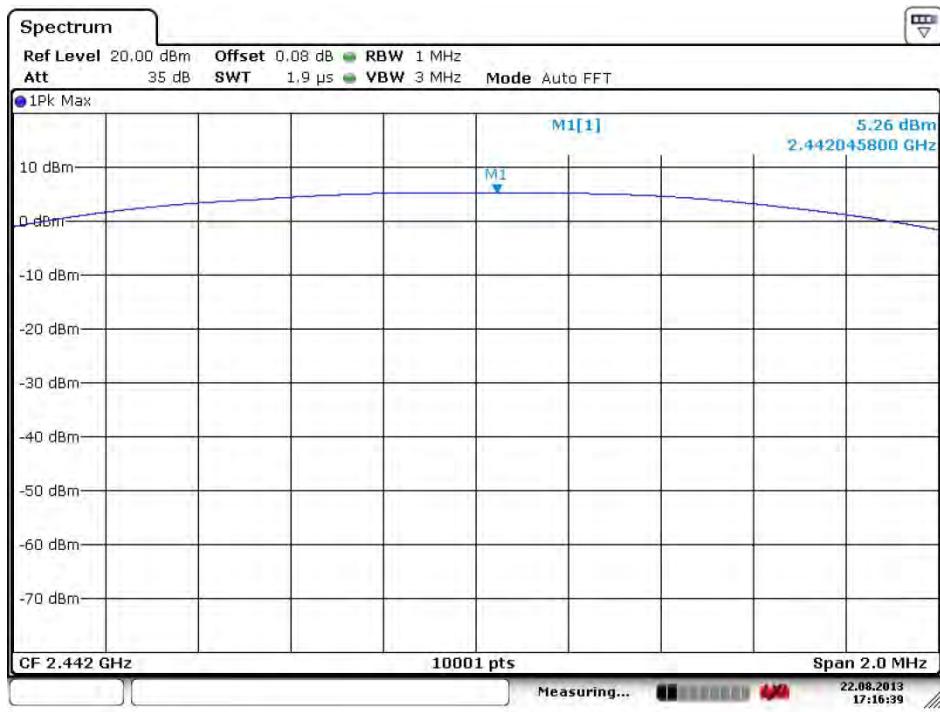
Date: 22.AUG.2013 16:26:51

3.5.10.7 Channel 0 – 3 Mbps



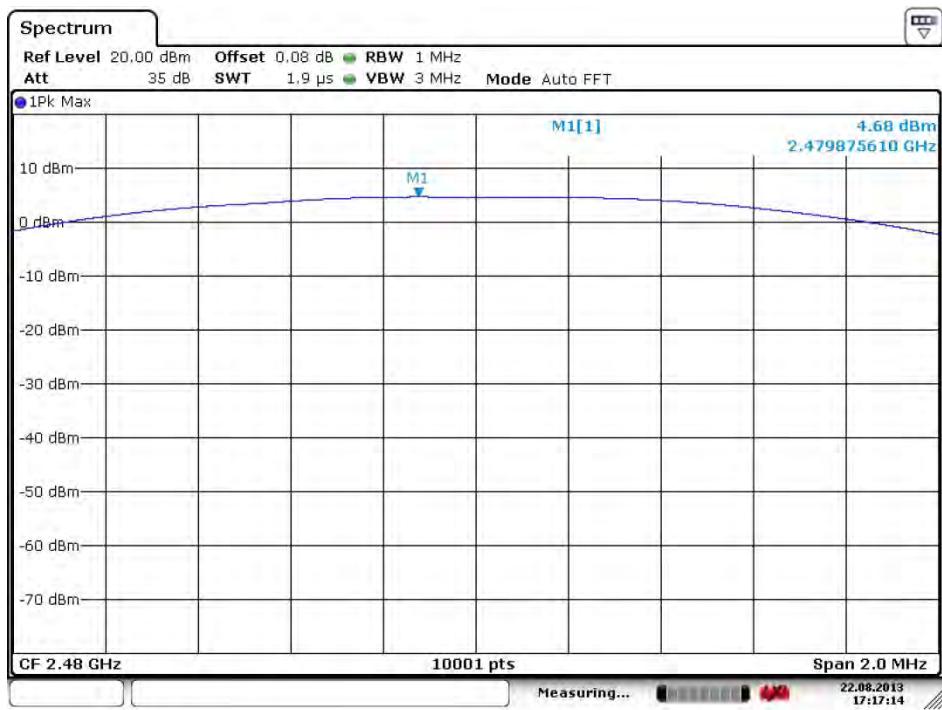
Date: 22,AUG,2013 17:16:06

3.5.10.8 Channel 40 – 3 Mbps



Date: 22,AUG,2013 17:16:39

3.5.10.9 Channel 78 – 3 Mbps



Date: 22,AUG,2013 17:17:15

3.6 Conducted emission and band edge

3.6.1 Definitions

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 RF conducted measurement.

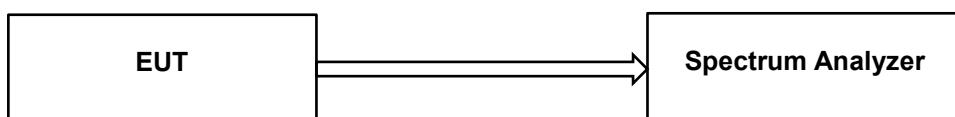
3.6.2 Specification

- FCC Rules Part 15 Subpart C Section 15.247(d)
- IC Rules RSS-210 Issue8 Annex 8-2010 A8.5

3.6.3 Measurement method

- Public Notice “DA 00-705”

3.6.4 Set-up



3.6.5 Test equipment list

Equipment	Model name	Serial No.
EUT	SMC HOME	VisionScape
Test fixer (JIG)	CC Debugger	TEXAS INSTRUMENTS
Spectrum analyzer	FSV30	Rohde & Schwarz
Control PC	E655X-8FA	JT0802G100530031

3.6.6 Test procedure

- The output of EUT was connected to the spectrum analyzer.
- Sets RBW 100 kHz, VBW 300 KHz, Max hold

3.6.7 Test condition

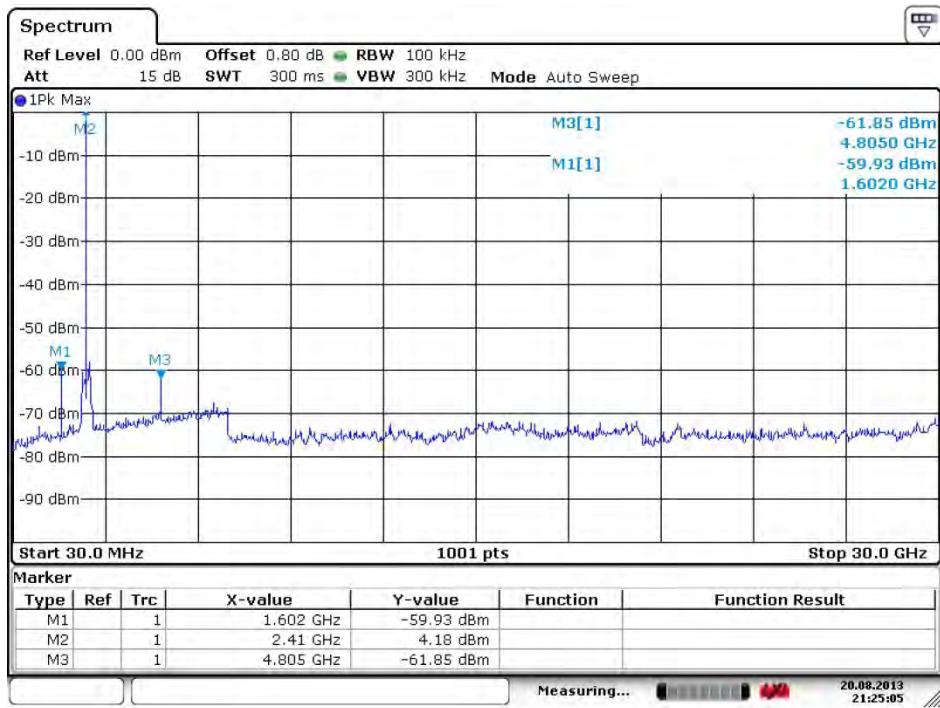
- Test place : Test room
- Test environment : 25 °C, 56 % R.H.
- Test mode : Operation at single channel

3.6.8 Limit

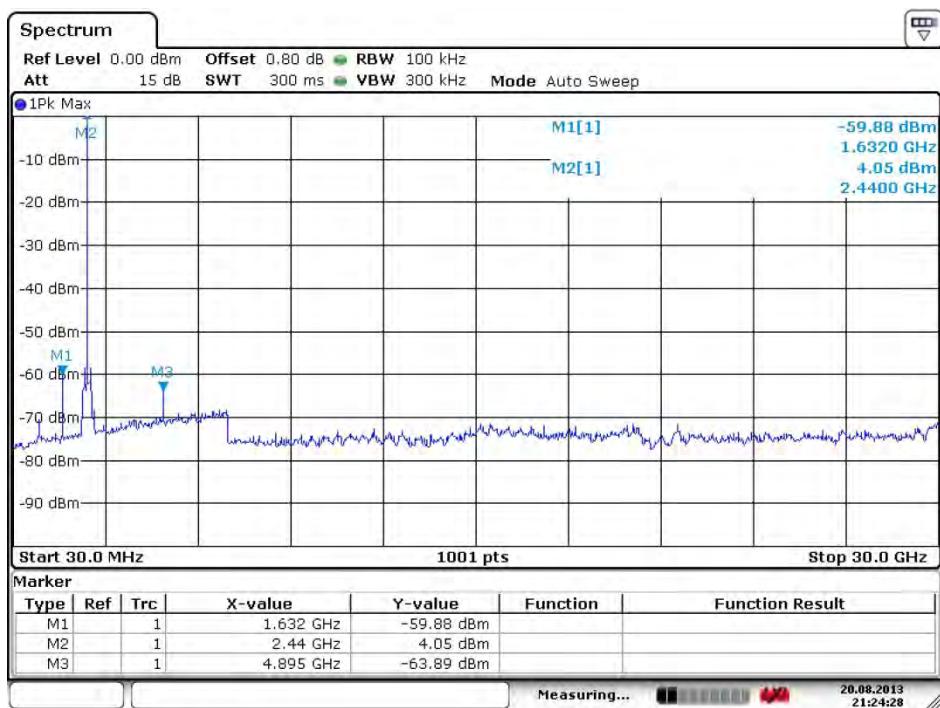
Less than 20 dBc.

3.6.9 Plots of conducted emission & band edge

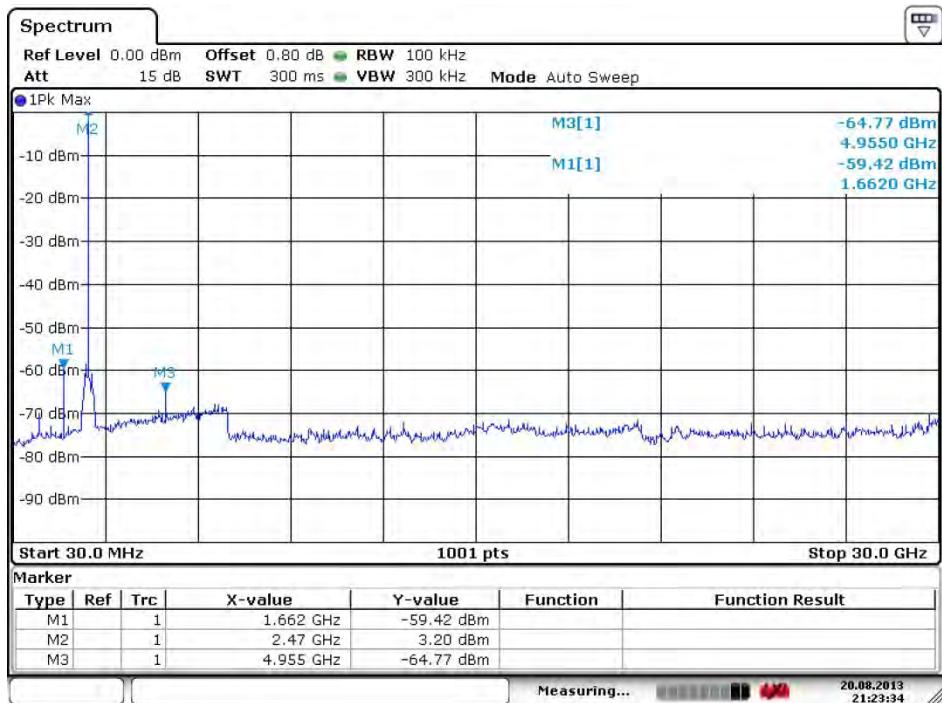
3.6.9.1 Channel 0 – 1 Mbps



3.6.9.2 Channel 42 – 1 Mbps

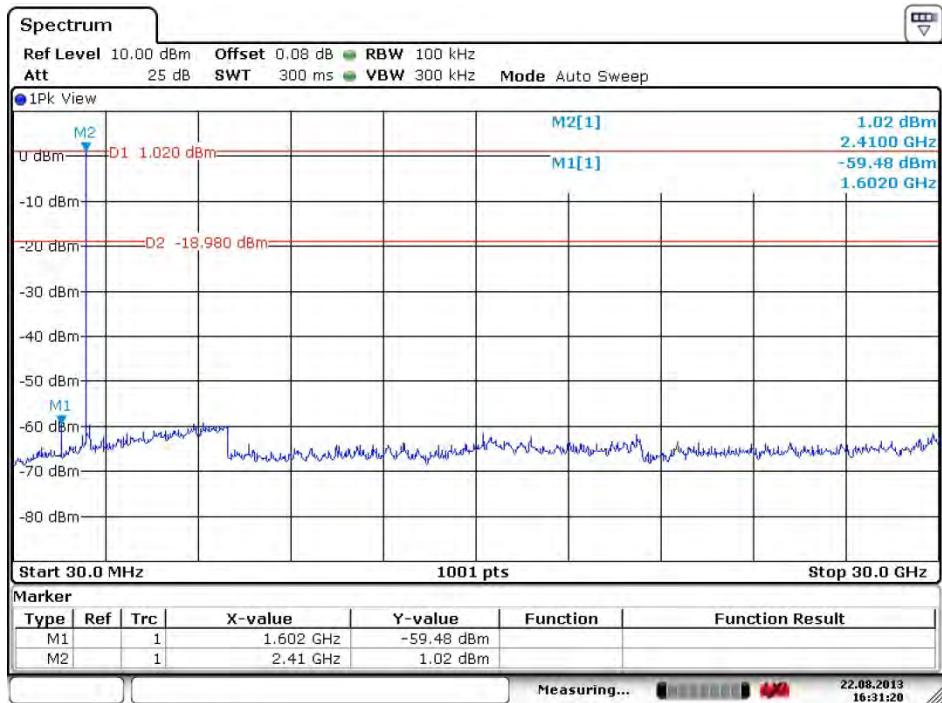


3.6.9.3 Channel 78 – 1 Mbps



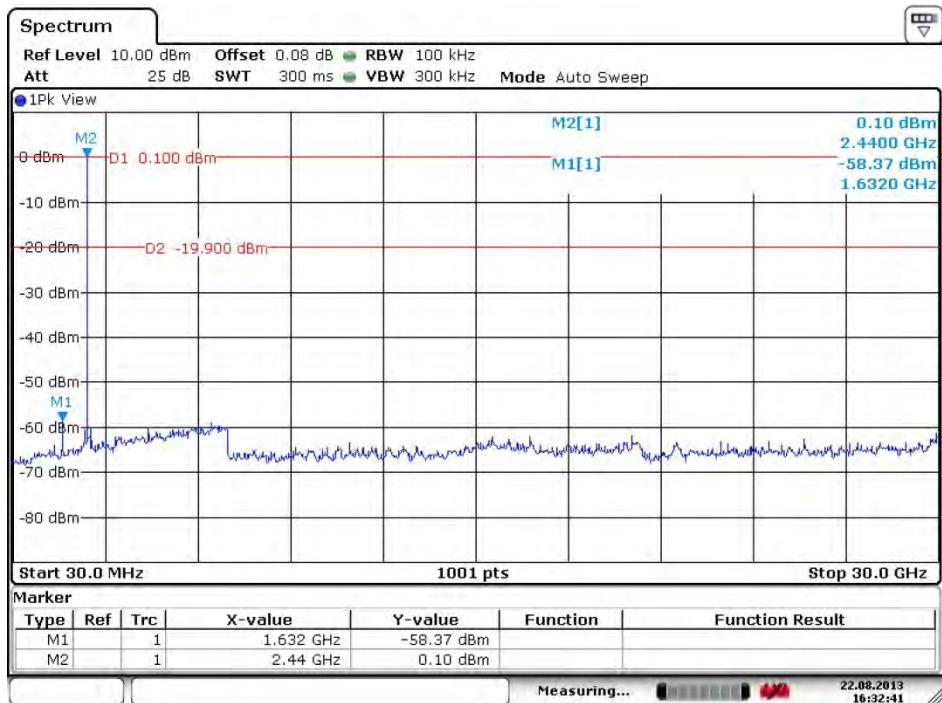
Date: 20.AUG.2013 21:23:34

3.6.9.4 Channel 0 – 2 Mbps



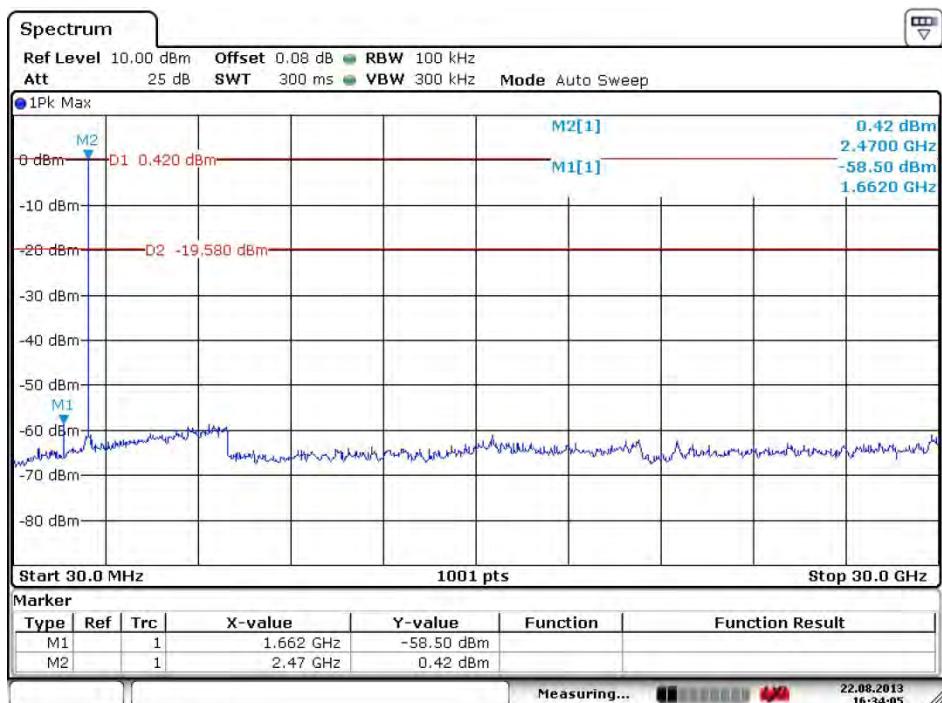
Date: 22.AUG.2013 16:31:20

3.6.9.5 Channel 42 – 2 Mbps



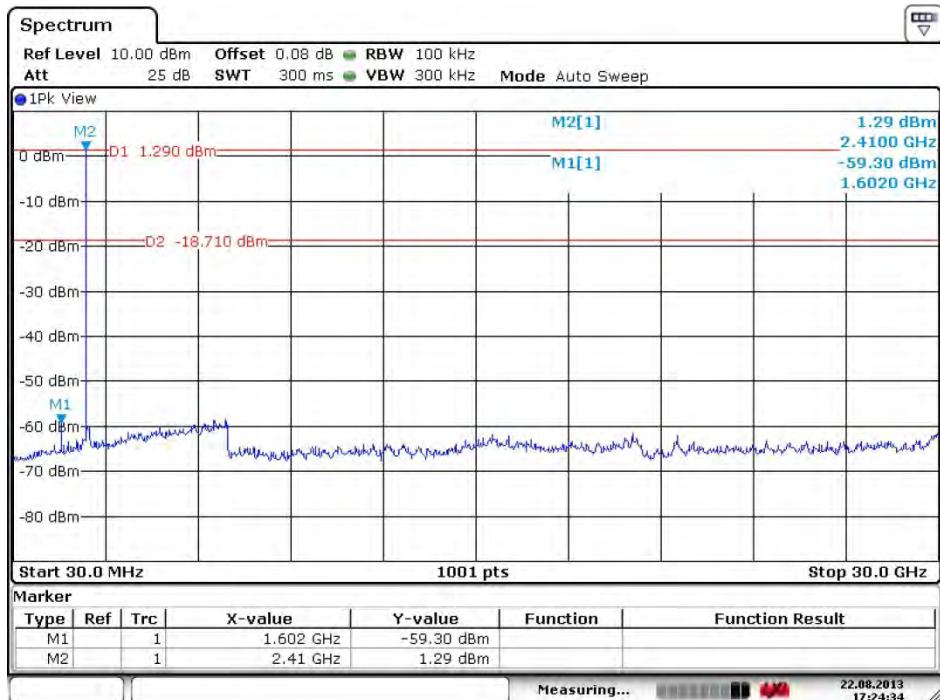
Date: 22.AUG.2013 16:32:41

3.6.9.6 Channel 78 – 2 Mbps



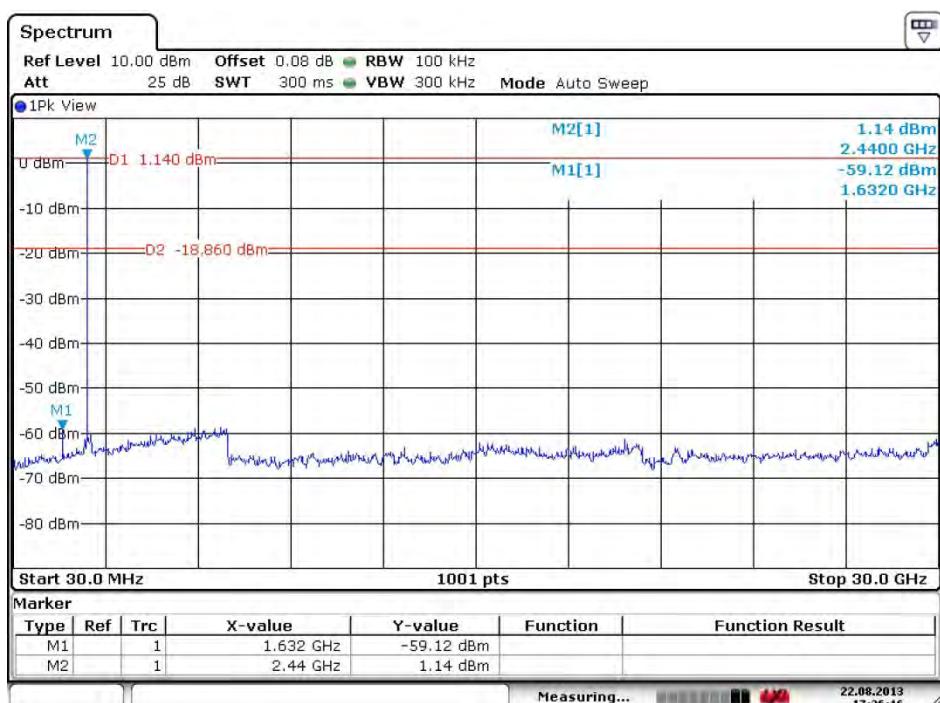
Date: 22.AUG.2013 16:34:05

3.6.9.7 Channel 0 – 3 Mbps



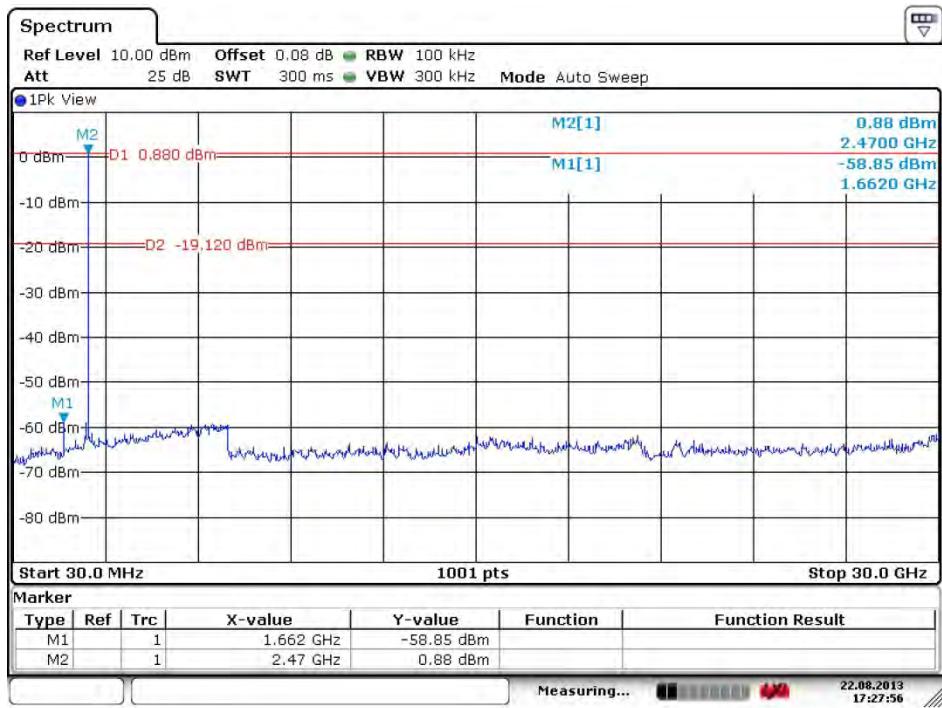
Date: 22.AUG.2013 17:24:34

3.6.9.8 Channel 42 – 3 Mbps

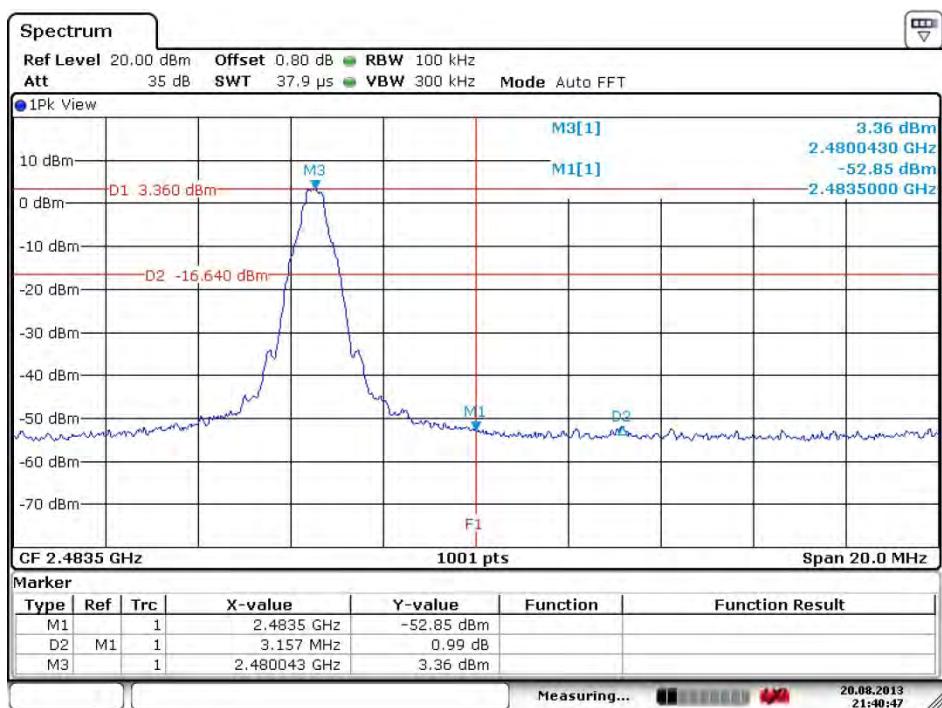
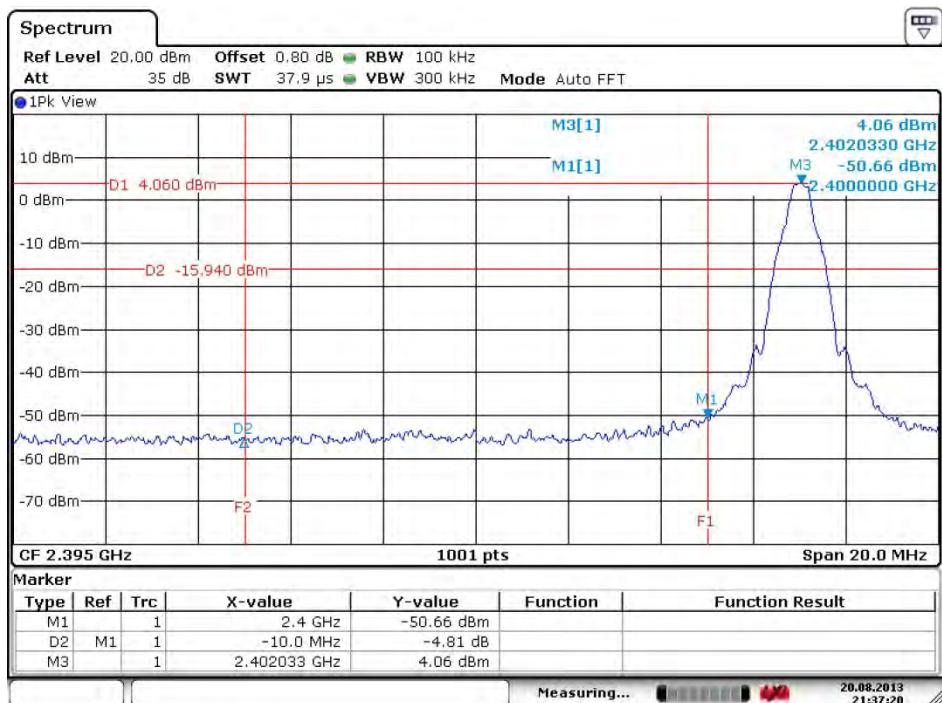


Date: 22.AUG.2013 17:26:16

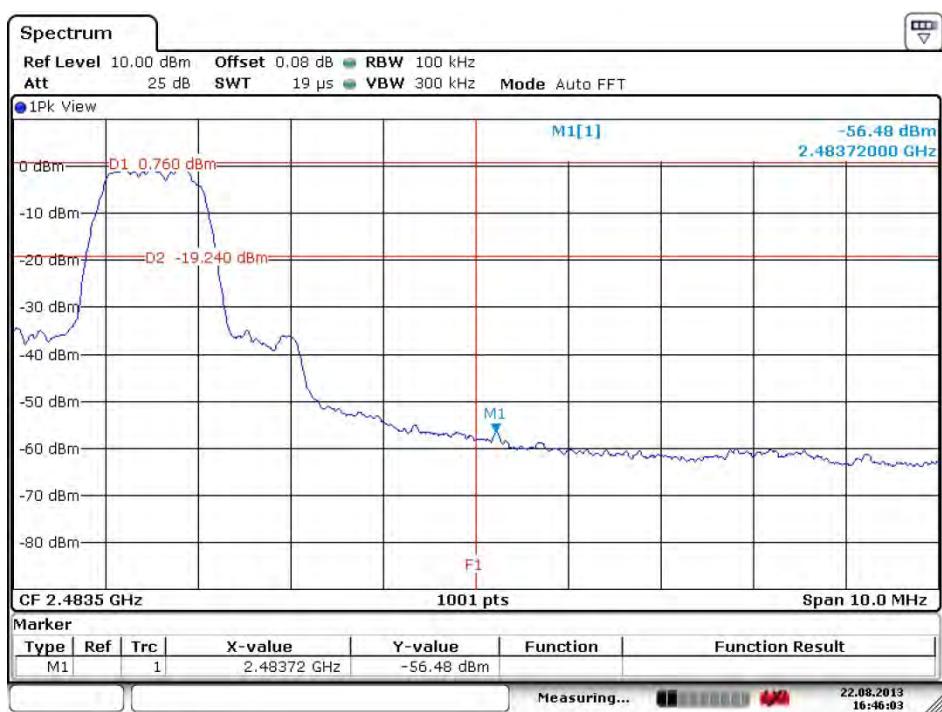
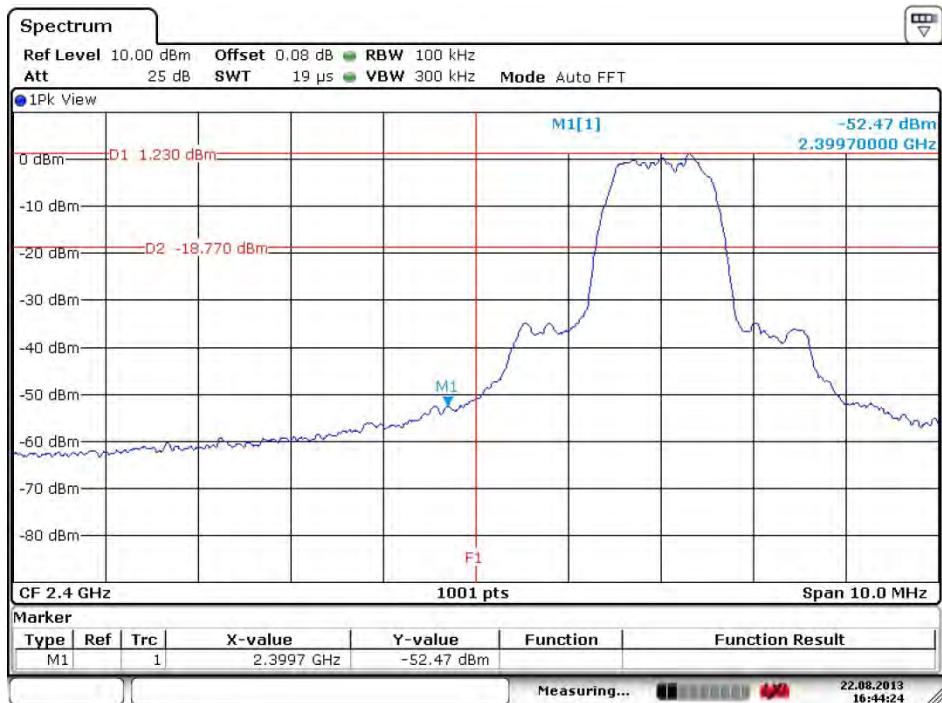
3.6.9.9 Channel 78 – 3 Mbps



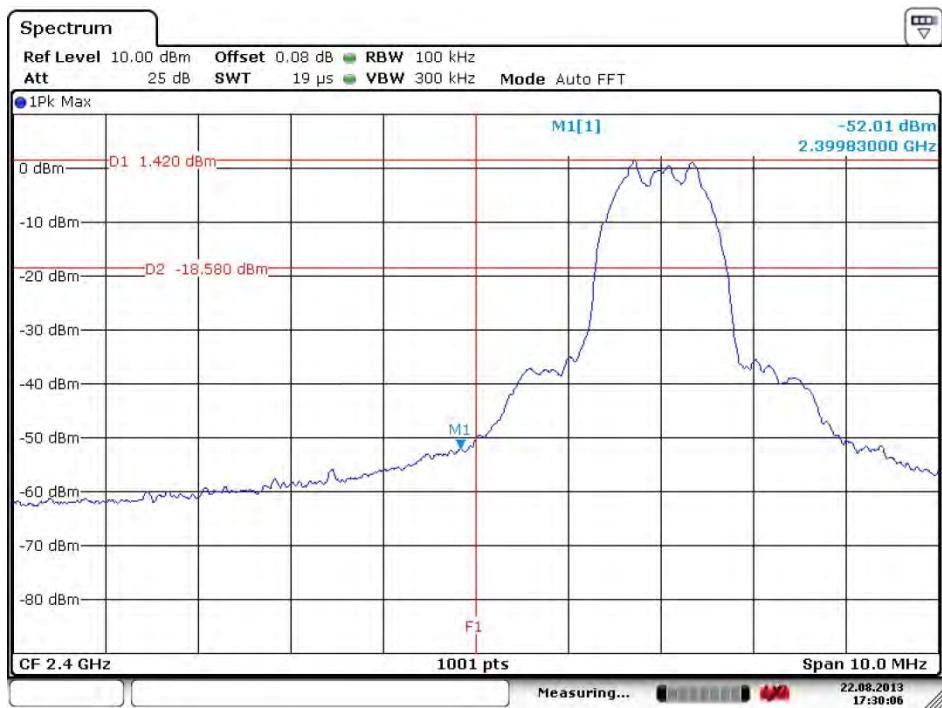
3.6.9.10 Band edge – 1 Mbps



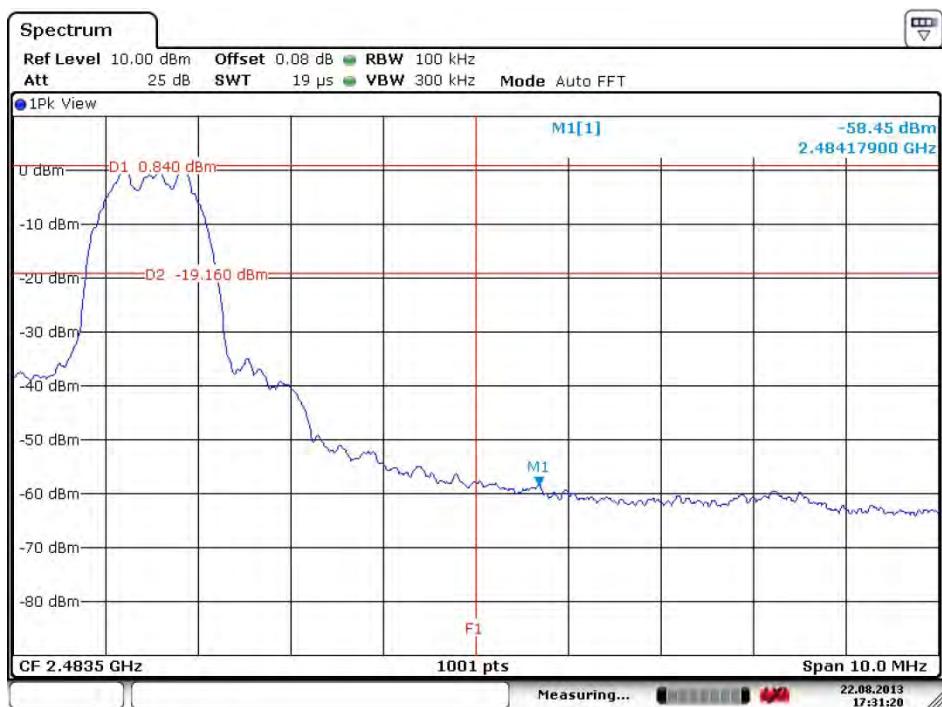
3.6.9.11 Band edge – 2 Mbps



3.6.9.12 Band edge – 3 Mbps

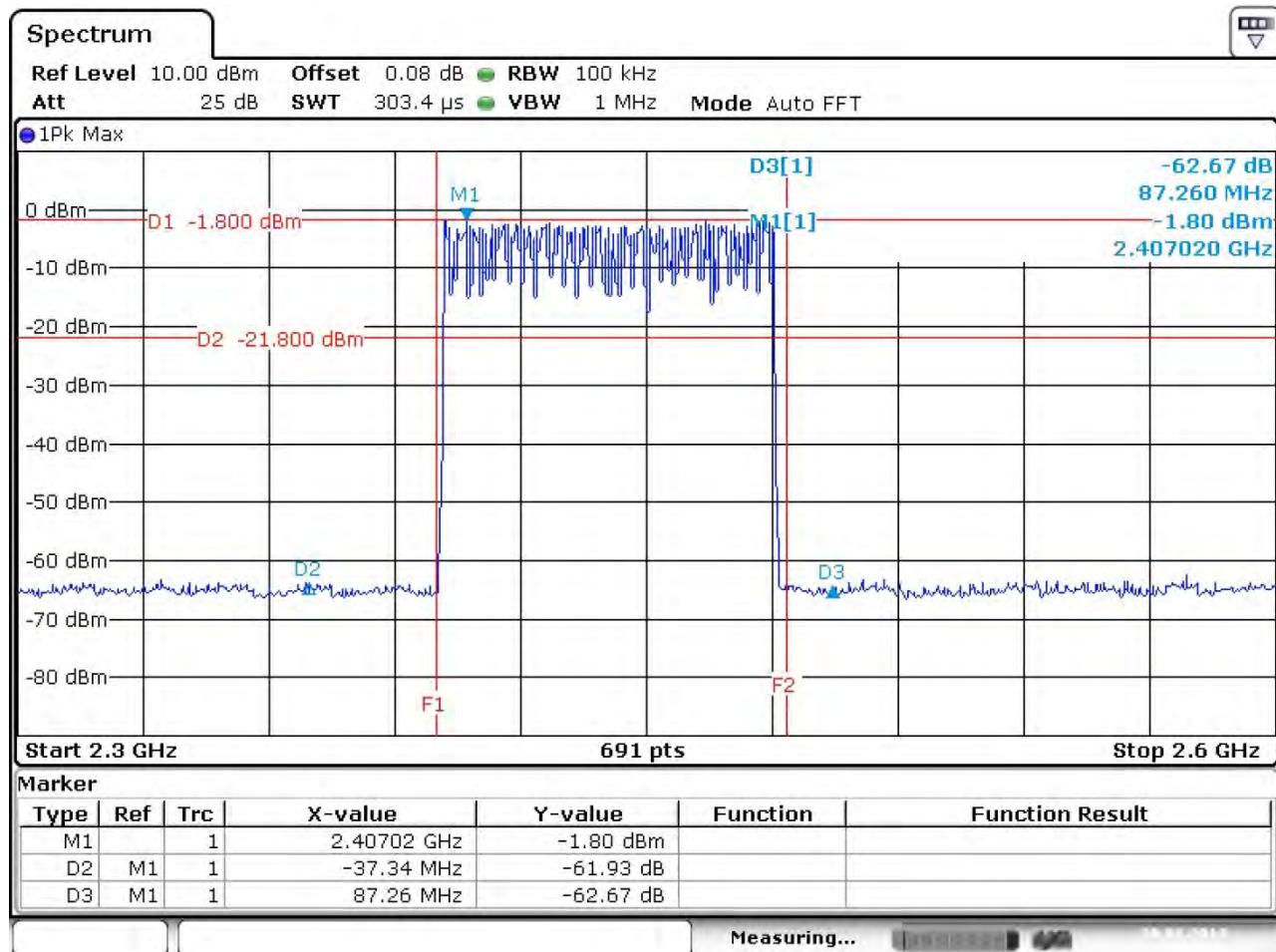


Date: 22.AUG.2013 17:30:06



Date: 22.AUG.2013 17:31:20

3.7.9.4 Band edge at full hopping mode – 1 Mbps



Operating frequency : Full hopping

RBW : 100 kHz

VBW : 1 MHz

Detector mode : Peak

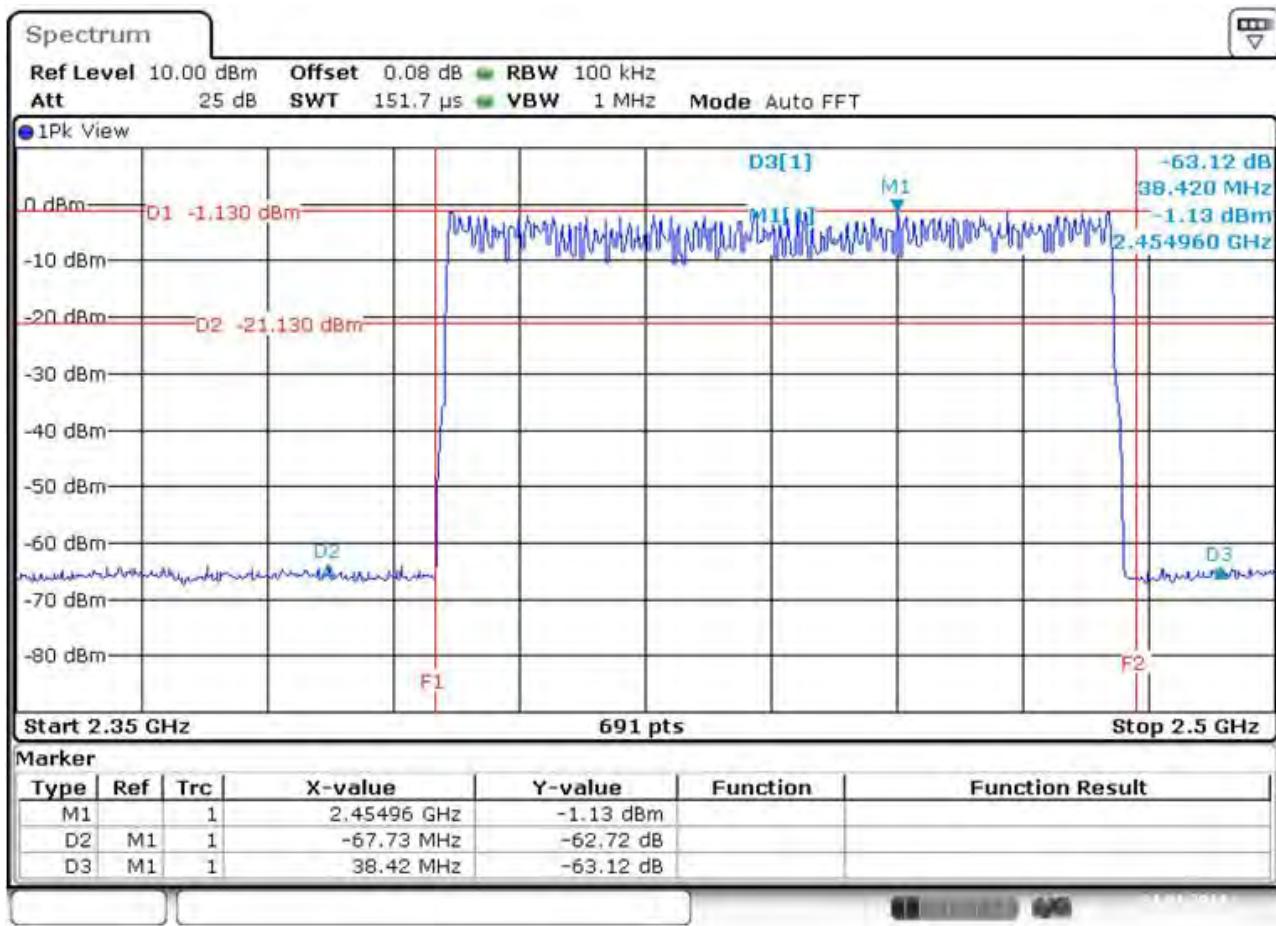
Trace mode : Max hold

Sweep time : Auto

Lower band edge : 61.93 dBc

Upper band edge : 62.67 dBc

3.7.9.5 Band edge at full hopping mode – 2 Mbps



Operating frequency : Full hopping

RBW : 100 kHz

VBW : 1 MHz

Detector mode : Peak

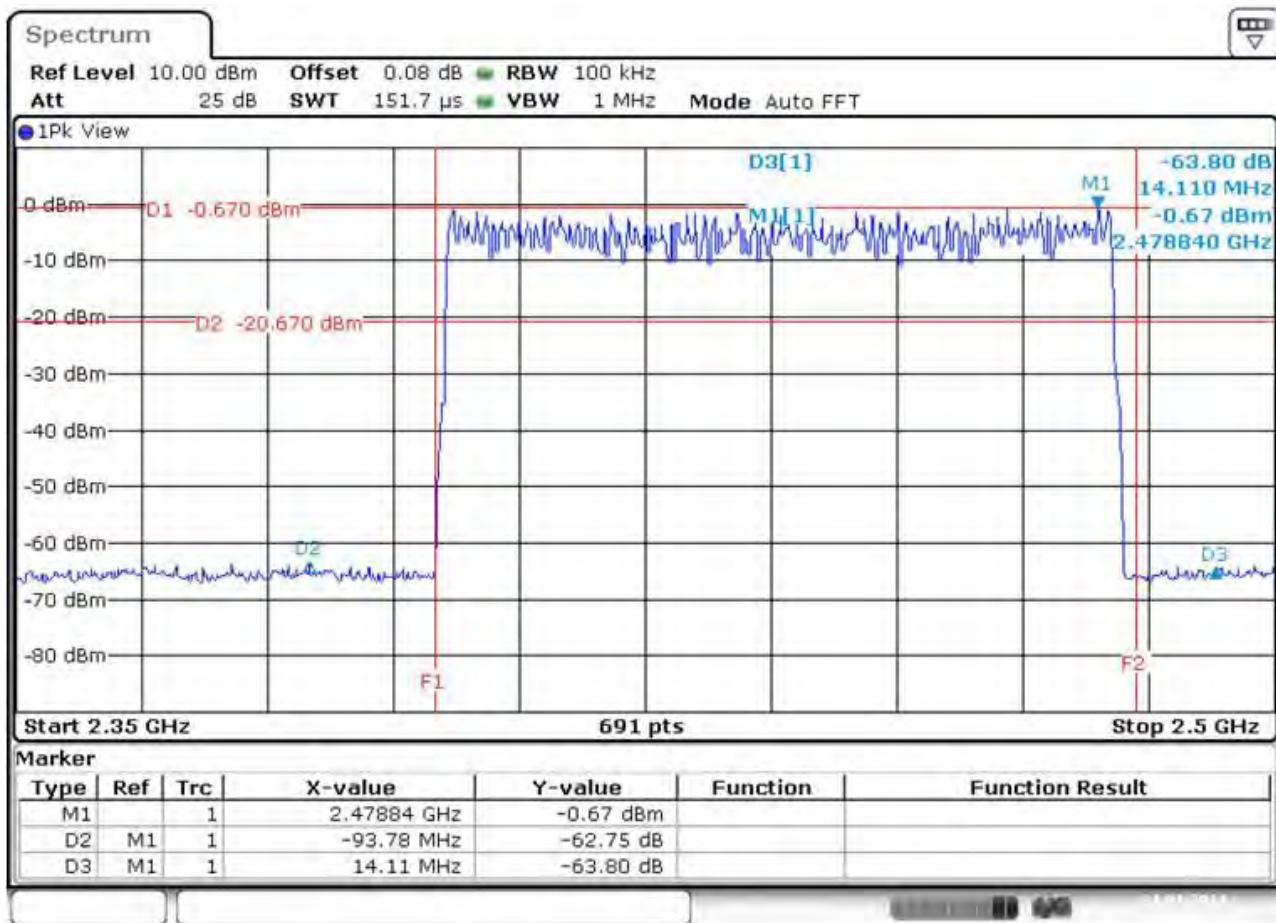
Trace mode : Max hold

Sweep time : Auto

Lower band edge : 62.72 dBc

Upper band edge : 63.12 dBc

3.7.9.6 Band edge at full hopping mode – 3 Mbps



Operating frequency : Full hopping

RBW : 100 kHz

VBW : 1 MHz

Detector mode : Peak

Trace mode : Max hold

Sweep time : Auto

Lower band edge : 62.75 dBc

Upper band edge : 63.80 dBc

3.7 Radiated emission in restricted band

3.7.1 Definitions

A radiated emission is a emission from the equipment when transmitting into a non-radiating load on frequencies that are restricted band sufficient to ensure transmission of information of required quality for the class of communications desired.

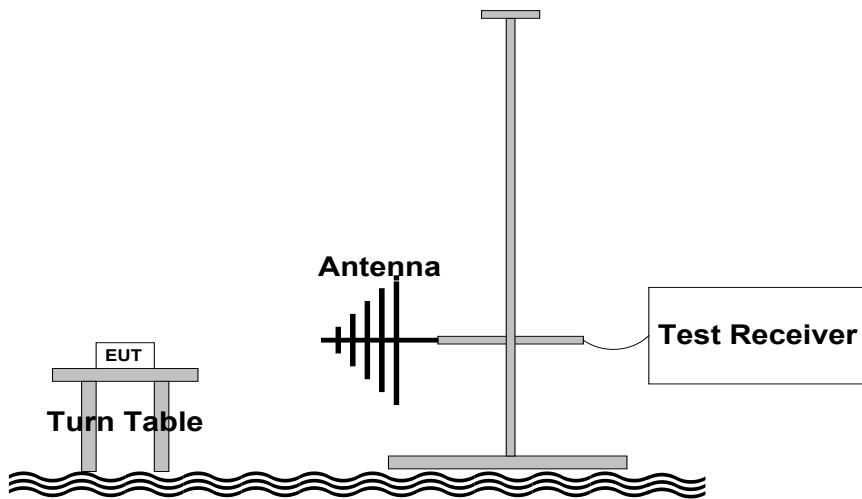
3.7.2 Specification

- FCC Rules Part 15 Subpart C Section 15.247
- IC Rules RSS-210 A8.5

3.7.3 Measurement method

- ANSI Standard C63.4-2003 8.3

3.7.4 Set-up



3.7.5 Test equipment list

Equipment	Model name	Manufacturer
EUT	SMC HOME	VisionScape
Test Receiver	ESCI 7	Rohde & Schwarz
Test fixer (JIG)	CC Debugger	TEXAS INSTRUMENTS
Control PC	E655X-8FA	JT0802G100530031
Loop antenna	EMCO 6502	EMCO
Bi-conical antenna	VHA9103	Schwarzbeck
Log periodic antenna	VULP9118A	Schwarzbeck
Horn Antenna	BBHA-9120D	Schwarzbeck
Horn Antenna	FR6517	ORBIT

3.7.6 Test procedure

The EUT is placed on a turntable, which is 0.8 meter high above ground.

The turntable rotates 360 degrees to determine the position of the maximum emission level.

EUT is set 3.0 meters away from the receiving antenna, broadband antenna, which is mounted on an antenna mast. The antenna moved up and down between 1 meter and 4 meters to find out the maximum emission level from the EUT. Both horizontal and vertical polarizations of the antenna are set on measurement.

In order to find out the maximum emission levels, all of the EUT location were manipulated according to ANSI 63.4 during the radiated emission measurement. The EUT was tested to 3 orthogonal planes.

The RBW of test receiver is 120 kHz between 30 to 1 000 MHz, and 1 MHz above 1 GHz.

3.7.7 Test condition

- Test place : Open area test site
- Test environment : 26.0 °C, 56 % R.H.
- Test mode : Operation at single channel

3.7.8 Limit

Frequency [MHz]	Field Strength [μ V/m]	Field Strength [dB μ V/m]	Measurement Distance [m]
0.009 – 0.490	2 400 / F(kHz)	48.52 to 13.80	300
0.490 – 1.705	2 4000 / F(kHz)	33.80 to 22.97	30
1.705 – 30.0	30	29.54	30
30 – 88	100	40.00	3
88 – 216	150	43.52	3
216 – 960	200	46.02	3
Above 960	500	53.98	3

§15.205 and RSS-210(2.7 Table 1) : Restrict Band of Operation : Only spurious emissions are permitted in any of the frequency bands listed below ;

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
1) 0.495 - 0.505**	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	Above 38.6

1) Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.

3.7.9 Test result

3.7.9.1 Mode – 1 Mbps

- Operation frequency: 2 402 MHz

Frequency [MHz]	Pol. [H/V]	Plane [X/Y/Z]	Detect mode [Peak/AVG]	Reading [dB μ V]	Antenna factor [dB/m]	Cable loss [dB]	Pre-amp gain [dB]	Emission level [dB μ V]	Limit [dB μ V]	Margin [dB]
*2 312	V	Y	Peak	26.32	28.05	2.68	0	57.05	74.00	16.95
			Average	15.46	28.05	2.68	0	46.19	54.00	7.81
2 402	V	Y	Peak	64.51	28.74	2.72	0	95.97	-	-
			Average	54.86	28.74	2.72	0	86.32	-	-
*4 815	V	Y	Peak	19.37	32.75	4.78	0	56.90	74.00	17.10
			Average	1.23	32.75	4.78	0	38.76	54.00	15.24

- Operation frequency: 2 442 MHz

Frequency [MHz]	Pol. [H/V]	Plane [X/Y/Z]	Detect mode [Peak/AVG]	Reading [dB μ V]	Antenna factor [dB/m]	Cable loss [dB]	Pre-amp gain [dB]	Emission level [dB μ V]	Limit [dB μ V]	Margin [dB]
2 442	V	Y	Peak	66.00	28.83	2.76	0	97.59	-	-
			Average	54.45	28.83	2.76	0	86.04	-	-
*4 905	V	Y	Peak	20.22	32.91	4.89	0	58.02	74.00	15.98
			Average	2.17	32.91	4.89	0	39.97	54.00	14.03

- Operation frequency: 2 480 MHz

Frequency [MHz]	Pol. [H/V]	Plane [X/Y/Z]	Detect mode [Peak/AVG]	Reading [dB μ V]	Antenna factor [dB/m]	Cable loss [dB]	Pre-amp gain [dB]	Emission level [dB μ V]	Limit [dB μ V]	Margin [dB]
2 480	V	Y	Peak	66.30	28.87	2.78	0	97.95	-	-
			Average	54.49	28.87	2.78	0	86.14	-	-
*2 491	V	Y	Peak	26.29	29.51	2.96	0	58.76	74.00	15.24
			Average	11.72	29.51	2.96	0	44.19	54.00	9.81
*4 940	V	Y	Peak	19.16	32.97	4.93	0	57.06	74.00	16.94
			Average	1.23	32.97	4.93	0	39.13	54.00	14.87

Remark: The other emissions were not detected.

Here. * is restricted frequency.

3.7.9.2 Mode – 2 Mbps

- Operation frequency: 2 402 MHz

Frequency [MHz]	Pol. [H/V]	Plane [X/Y/Z]	Detect mode [Peak/AVG]	Reading [dB μ V]	Antenna factor [dB/m]	Cable loss [dB]	Pre-amp gain [dB]	Emission level [dB μ V]	Limit [dB μ V]	Margin [dB]
*2 338	V	Y	Peak	26.66	28.05	2.68	0	57.39	74.00	16.61
			Average	15.41	28.05	2.68	0	46.14	54.00	7.86
2 402	V	Y	Peak	64.55	28.74	2.72	0	96.01	-	-
			Average	54.53	28.74	2.72	0	85.99	-	-
*4 815	V	Y	Peak	17.75	32.75	4.78	0	55.28	74.00	18.72
			Average	1.51	32.75	4.78	0	39.04	54.00	14.96

- Operation frequency: 2 442 MHz

Frequency [MHz]	Pol. [H/V]	Plane [X/Y/Z]	Detect mode [Peak/AVG]	Reading [dB μ V]	Antenna factor [dB/m]	Cable loss [dB]	Pre-amp gain [dB]	Emission level [dB μ V]	Limit [dB μ V]	Margin [dB]
2 442	V	Y	Peak	65.43	28.83	2.76	0	97.02	-	-
			Average	54.38	28.83	2.76	0	85.97	-	-
*4 905	V	Y	Peak	19.84	32.91	4.89	0	57.64	74.00	16.36
			Average	1.44	32.91	4.89	0	39.24	54.00	14.76

- Operation frequency: 2 480 MHz

Frequency [MHz]	Pol. [H/V]	Plane [X/Y/Z]	Detect mode [Peak/AVG]	Reading [dB μ V]	Antenna factor [dB/m]	Cable loss [dB]	Pre-amp gain [dB]	Emission level [dB μ V]	Limit [dB μ V]	Margin [dB]
2 480	V	Y	Peak	65.10	28.87	2.78	0	96.75	-	-
			Average	55.39	28.87	2.78	0	87.04	-	-
*2 492	V	Y	Peak	26.07	29.51	2.96	0	58.54	74.00	15.46
			Average	11.42	29.51	2.96	0	43.89	54.00	10.11
*4 940	V	Y	Peak	18.67	32.97	4.93	0	56.57	74.00	17.43
			Average	2.11	32.97	4.93	0	40.01	54.00	13.99

Remark: The other emissions were not detected.

Here. * is restricted frequency.

3.7.9.3 Mode – 3 Mbps

- Operation frequency: 2 402 MHz

Frequency [MHz]	Pol. [H/V]	Plane [X/Y/Z]	Detect mode [Peak/AVG]	Reading [dB μ V]	Antenna factor [dB/m]	Cable loss [dB]	Pre-amp gain [dB]	Emission level [dB μ V]	Limit [dB μ V]	Margin [dB]
*2 336	V	Y	Peak	27.97	28.05	2.68	0	58.70	74.00	15.30
			Average	14.62	28.05	2.68	0	45.35	54.00	8.65
2 402	V	Y	Peak	62.79	28.74	2.72	0	94.25	-	-
			Average	54.28	28.74	2.72	0	85.74	-	-
*4 815	V	Y	Peak	17.81	32.75	4.78	0	55.34	74.00	18.66
			Average	1.11	32.75	4.78	0	38.64	54.00	15.36

- Operation frequency: 2 442 MHz

Frequency [MHz]	Pol. [H/V]	Plane [X/Y/Z]	Detect mode [Peak/AVG]	Reading [dB μ V]	Antenna factor [dB/m]	Cable loss [dB]	Pre-amp gain [dB]	Emission level [dB μ V]	Limit [dB μ V]	Margin [dB]
2 442	V	Y	Peak	64.45	28.83	2.76	0	96.04	-	-
			Average	54.43	28.83	2.76	0	86.02	-	-
*4 905	V	Y	Peak	19.38	32.91	4.89	0	57.18	74.00	16.82
			Average	0.67	32.91	4.89	0	38.47	54.00	15.53

- Operation frequency: 2 480 MHz

Frequency [MHz]	Pol. [H/V]	Plane [X/Y/Z]	Detect mode [Peak/AVG]	Reading [dB μ V]	Antenna factor [dB/m]	Cable loss [dB]	Pre-amp gain [dB]	Emission level [dB μ V]	Limit [dB μ V]	Margin [dB]
2 480	V	Y	Peak	64.31	28.87	2.78	0	95.96	-	-
			Average	54.29	28.87	2.78	0	85.94	-	-
*2 490	V	Y	Peak	27.33	29.51	2.96	0	59.80	74.00	14.20
			Average	13.92	29.51	2.96	0	46.39	54.00	7.61
*4 940	V	Y	Peak	18.41	32.97	4.93	0	56.31	74.00	17.69
			Average	1.06	32.97	4.93	0	38.96	54.00	15.04

Remark: The other emissions were not detected.

Here. * is restricted frequency.

3.7.9.4 Receiver

Frequency [MHz]	Pol. [H/V]	Plane [X/Y/Z]	Detect mode [Peak/AVG]	Reading [dB μ V]	Antenna factor [dB/m]	Cable loss [dB]	Pre-amp gain [dB]	Emission level [dB μ V]	Limit [dB μ V]	Margin [dB]
No Receiver Emissions within 6 dB of limit										

3.8 AC Conducted Emission

3.8.1 Specification

- FCC Rules Part 15 Section 15.207
- RSS-GEN 7.2.4

3.8.2 Measurement method

- ANSI C63.4-2003

3.8.3 Test equipment list

Equipment	Model name	Manufacturer
EUT	SMCHome	VisionScape
Test Receiver	ESS	Rohde & Schwarz
Power supply	E3633A	Agilent
Control PC	E655X-8FA	JOOYONTECH
Test fixer	CC Debugger	TEXAS INSTRUMENTS
LISN	ENV216	Rohde & Schwarz
LISN	NNBM 8125	Schwarzbeck
LISN	NNBM 8125	Schwarzbeck

3.8.4 Test procedure

The EUT was placed on a wooden table with 0.8 m height above the floor. The EUT was connected to AC power supply and the input power was supplied through a $50 \Omega / 50 \mu\text{H} \pm 5 \Omega$ Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

3.8.5 Test condition

- Test place : Shield room
- Test environment : 19 °C, 34 % R.H.
- Test mode : Operation at full Hopping.

3.8.6 Limit

Frequency of emission [MHz]	Conducted limit [dB μ V]	
	Quasi-peak	Average
0.15 – 0.5	66 to 56	56 to 46
0.5 – 5	56	46
5 – 30	60	50

3.8.7 Test result

- Test mode : Bluetooth 2.1 + EDR

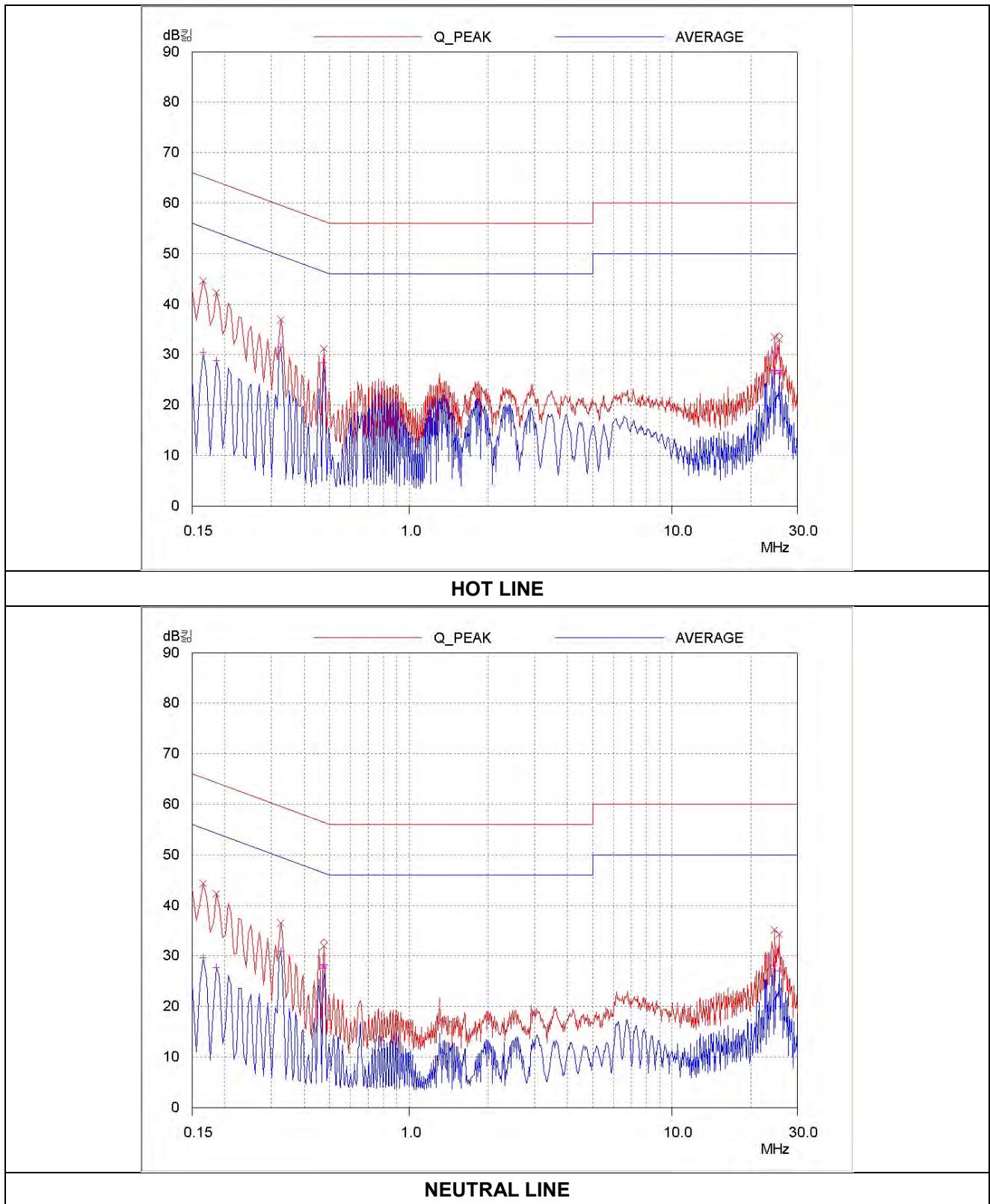
Frequency (MHz)	Line	Quasi Peak (dB μ V)			Average (dB μ V)		
		Emission Level	Limits	Margin (dB)	Emission Level	Q.P Limits	Margin (dB)
0.16	H	44.59	65.21	20.62	30.52	55.21	24.69
0.18	N	42.32	64.26	21.94	27.74	54.26	26.52
0.32	H	36.87	59.58	22.71	31.47	49.58	18.11
0.47	N	31.98	56.43	24.45	27.61	46.43	18.82
24.46	N	35.10	60.00	24.90	28.09	50.00	21.91
25.48	N	34.24	60.00	25.76	27.06	50.00	22.94

Tabulated test data for Mains Terminal Continuous Disturbance Voltage

Here, H: Hot Line, N: Neutral line

See next page for an overview sweep performed with quasi peak and average detector.

- Test mode : BT mode



3.9 Antenna Requirements

3.9.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to intentional radiator shall be considered sufficient to comply with the FCC rule.

3.9.2 Antenna Connected Construction

The use of a permanently attached antenna.

3.9.3 Antenna Gain

The Antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak out power limit.

4. Test equipment list

The listing below denotes the test equipment for the test(s).

No.	Equipment	Model	Manufacturer	Serial Number	Calibration Due date
1	Spectrum analyzer	FSV	Rohde & Schwarz	101673	02/04/14
2	Test receiver	ESCI 7	Rohde & Schwarz	1166.5950.07	01/30/14
3	Power supply	E3633A	Agilent	SG40002272	01/28/14
4	Loop antenna	6502	EMCO	9609-9087	03/03/14
5	Biconical antenna	VHA9103	Schwarzbeck	2217	11/23/13
6	Log-Periodic antenna	VULP9118A	Schwarzbeck	382	11/23/13
7	Horn antenna	BBHA 9120 D	Schwarzbeck	395	08/07/14
8	Horn antenna	FR6517	ORBIT	0511106	08/07/14
9	Turn table	N/A	Daeil EMC	N/A	N/A
10	Antenna mast	EAM4.5	Daeil EMC	N/A	N/A
11	Controller	DE200	Daeil EMC	AAA69813111	N/A