

Produkte
Products

Prüfbericht - Nr.: 10039980 001			Seite 1 von 40		
<i>Test Report No.:</i>			<i>Page 1 of 40</i>		
Auftraggeber: <i>Client:</i>		Lite-On Technology Corporation 90, Chien I Road, Chung Ho, Taipei Hsien 203, Taiwan, R.O.C. 光寶科技股份有限公司, 臺北市內湖區瑞光路 392 號 22 樓			
Gegenstand der Prüfung: <i>Test item:</i>		802.11 a/b/g/n, 2.4G/5G 1T1R Wireless+BT Module			
Bezeichnung: <i>Identification:</i>	WCBN603MH	Serien-Nr.: <i>Serial No.:</i>	N/A		
Wareneingangs-Nr.: <i>Receipt No.:</i>	TPE81101	Eingangsdatum: <i>Date of receipt:</i>	2012-12-20		
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of test item at delivery:</i>		The sample is ok for testing and not damaged			
Prüfort: <i>Testing location:</i>	TÜV Rheinland Taiwan Ltd. 11F., No.758, Sec. 4, Bade Rd., Songshan Dist., Taipei City 105 Taiwan FCC Registration No.: 365730				
Prüfgrundlage: <i>Test specification:</i>	FCC CFR47 Part 15: Subpart C Section 15.247 NCC LP0002: 2011-Jun				
Prüfergebnis: <i>Test Result:</i>	Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n). <i>The test item passed the test specification(s).</i>				
Prüflaboratorium: <i>Testing Laboratory:</i>	TÜV Rheinland Taiwan Ltd. 11F., No.758, Sec. 4, Bade Rd., Songshan Dist., Taipei City 105, Taiwan, R.O.C.				
geprüft/ tested by:		kontrolliert/ reviewed by:			
 2013-01-23 Arvin Ho/Department Manager		 2013-01-28 Rene Charton/Senior Project Manager			
<i>Datum</i> <i>Date</i>	<i>Name/Stellung</i> <i>Name/Position</i>	<i>Unterschrift</i> <i>Signature</i>	<i>Datum</i> <i>Date</i>	<i>Name/Stellung</i> <i>Name/Position</i>	<i>Unterschrift</i> <i>Signature</i>
Sonstiges/ Other Aspects:					
Abkürzungen: P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet			Abbreviations: P(ass) = passed F(ail) = failed N/A = not applicable N/T = not tested		
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report relates to the a. m. test item. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products.</i>					

TEST SUMMARY

5.1.1 ANTENNA REQUIREMENT

RESULT: Passed

5.1.2 PEAK OUTPUT POWER

RESULT: Passed

5.1.3 20dB BANDWIDTH

RESULT: Passed

5.1.4 CONDUCTED SPURIOUS EMISSIONS AND FREQUENCY BAND EDGE MEASURED IN 100KHz BANDWIDTH

RESULT: Passed

5.1.5 SPURIOUS EMISSION

RESULT: Passed

5.1.6 FREQUENCY SEPARATION

RESULT: Passed

5.1.7 NUMBER OF HOPPING FREQUENCY

RESULT: Passed

5.1.8 TIME OF OCCUPANCY

RESULT: Passed

5.1.9 MAINS CONDUCTED EMISSIONS

RESULT: Passed

6.1.1 ELECTROMAGNETIC FIELDS

RESULT: Passed

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1. General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix 1: Photo

(File:10039980APPENDIX1)

Appendix 2: Test Result of Radiated Emissions

(File:10039980APPENDIX2)

Appendix 3: Test Result of Mains Conducted Emissions

(File:10039980APPENDIX3)

Test Specifications

The following standards were applied (in bold: product standards, otherwise: basic standards).

Table 1: Applied Standard and Test Levels

Radio
FCC CFR47 Part 15: Subpart C Section 15.247 DA 00-705 of March 30, 2000 NCC LP0002

2. Test Sites

2.1 Test Facilities

TUV Rheinland Taiwan Ltd.

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

FCC Registration No.: 365730

TAF Accredited NCC Test Lab. No.:0759

TAF ISO 17025 Certification effective periods: 2010-Jul-1st to 2013-Jun-30th



Testing Laboratory
0759

2.2 List of Test and Measurement Instruments

Table 2: List of Test and Measurement Equipment

Kind of Equipment	Manufacturer	Type	S/N	Calibrated until
EMI Test Receiver	R&S	ESCI 7	1166.5950K07-100797-Pt	20-Dec-13
Bilog Antenna	TESEQ	CBL6111D	29802	29-Jun-13
Pre-Amplifier	HP	8447F	2805A03335	14-Sep-13
Spectrum Analyzer	R&S	FSV 40	100921	13-Dec-13
Horn Antenna (1GHz~18GHz)	COM-POWER	AHA118	701251	28-Sep-13
Horn Antenna (18GHz~40GHz)	COM-POWER	AH840	101031	2-Nov-13
Preamplifier (30MHz -1GHz)	HP	8447F	2805A03335	14-Sep-13
Preamplifier (18 GHz -40 GHz)	COMPOWER	PAM-840	461257	17-Sep-13
Power meter	R&S	NRVD	100439	27-Mar-13
Power sensor	R&S	NRV-Z1	100013	27-Mar-13
Temp. & Humid. Chamber	Giant Force	GCT-099-40-S	MAF0103-007	13-May-13
Signal Generator	R&S	SMU200	104260	13-Aug-13
Loop Antenna	Schwarzbeck	FMZB 1513	1513-076	28-Sep-13

2.3 Traceability

All measurement equipment calibrations are traceable to NML(Taiwan)/NIST(USA) or where calibration is performed outside Taiwan, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements are $\pm 3\text{dB}$.

Table 3: Emission Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-7}$
RF power, conducted	$\pm 1 \text{ dB}$
Adjacent channel power	$\pm 3 \text{ dB}$
Radiated emission of transmitter, valid up to 26 GHz	$\pm 6 \text{ dB}$
Radiated emission of receiver, valid up to 26 GHz	$\pm 6 \text{ dB}$
Temperature	$\pm 2 \text{ }^{\circ}\text{C}$
Humidity	$\pm 10 \text{ \%}$

3. General Product Information

3.1 Product Function and Intended Use

"The tested sample is a Combo module, which is designed to work mount on other device. The module has two antenna ports, and it is has two work functions (Bluetooth and Wireless function)."

For details refer to the User Guide, Data Sheet and Circuit Diagram.

3.2 Ratings and System Details

Table 4: Technical Specification of EUT

Technical Specification	Value
Kind of Equipment	Combo module
Brand Name	Lite-On Technology Corporation
FCC ID	PPQ-WCBN603MH
Type Designation	WCBN603MH
Operating Frequency	2402 MHz ~ 2480 MHz
Channel Spacing	1 MHz
Channel number	79
Operation Voltage	3.3Vdc (Via Mini PCI-E port)
Modulation	GFSK, $\pi/4$ QPSK, 8 DPSK
Antenna gain	1.63 dBi
Antenna Type	Monopole (Chant Sincere: 341AWAE21311004)

Table 5: Frequency hopping information

Technical Specification	Description
Hopping Range	Hereby we declare that the maximum frequency of this device is: 2402-2480MHz. This is according the Bluetooth Core Specification V2.1+EDR for devices which will be operated in the USA. This was checked during the Bluetooth Qualification tests (Test Case: TRM/CA/04).
Hopping Sequence	Example of a 79 hopping sequence in data mode: 33,04,21,44,23,42,53,46,55,48,40,59,72,29,76,31,08,73,07,75,09,45,60,39,58,13,47,11,77,52,35,50,65,54,67,56,69,62,71,64, 7,25,27,66,57,70,74,61,78,63,10,41,05,43,15,44,64,68,02,70,06,01,51,03,55,05,03,66,53,49,36,47,
Receiver input bandwidth	The input bandwidth of the receiver is 1MHz. In every connection one Bluetooth device is the master and the other one is the slave. The master determines the hopping sequence. The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master. Additionally the type of connection is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing according to the packet type of the connection. Also the slave of the connection will use these settings. Repeating of a packer has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence.

3.3 Independent Operation Modes

The basic operation modes are:

- A. Transmitting
 - 1. Low channel
 - 2. Middle channel
 - 3. High channel
- B. Receiving
- C. Standby
- D. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.5 Submitted Documents

- Bill of Material
- PCB Layout
- Photo Document
- Technical Description
- Circuit Diagram
- Instruction Manual
- Rating Label

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its maximum power level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 4. All testing were performed according to the procedures in ANSI C63.10: 2009 and DA 00-705 of March 30, 2000.

Full test was applied on all test modes, but only worst case was shown.

4.3 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

Kind of Equipment	Manufacturer	Model Name	S/N
Laptop	MSI	MSI4532 (CX420MX)	CX420 MX-233TWK 1008000096

4.4 Countermeasures to achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Constructional Data Form or the Technical Construction File. No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test

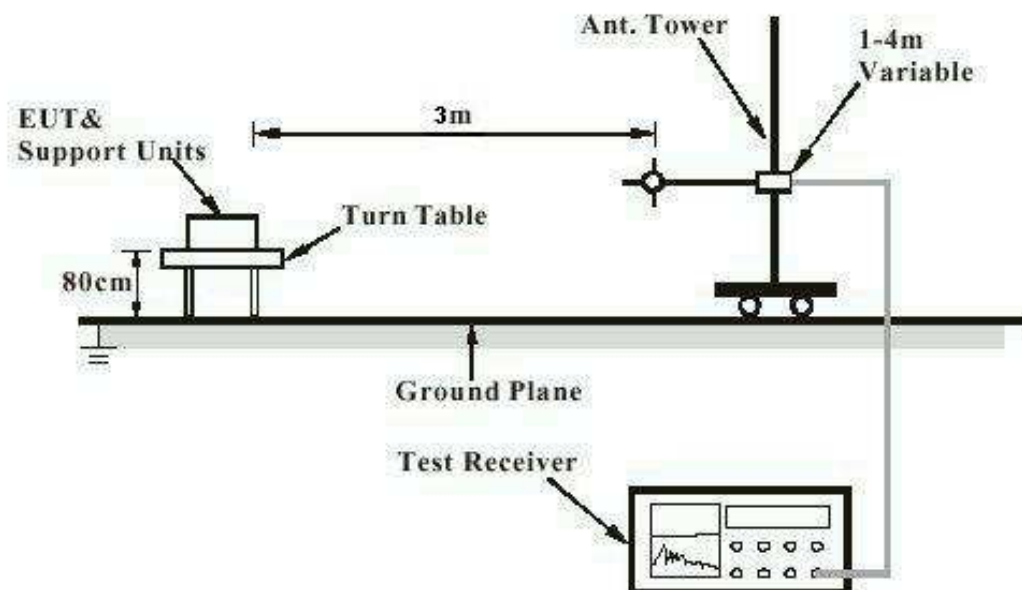


Diagram of Measurement Equipment Configuration for Mains Conduction Measurement

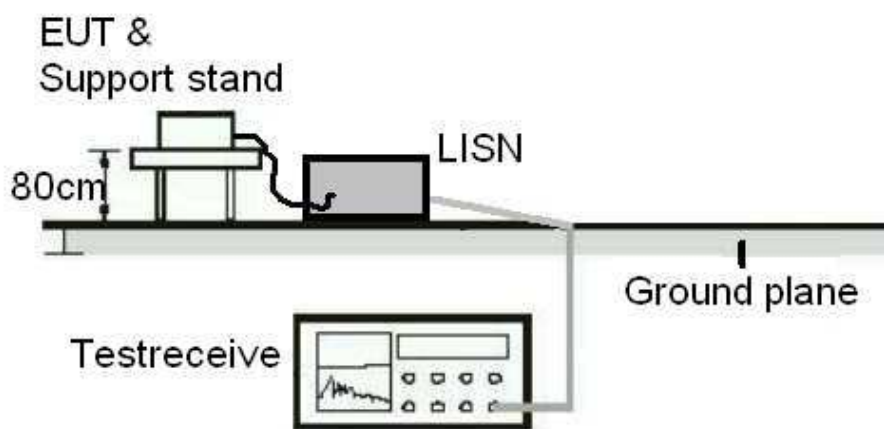
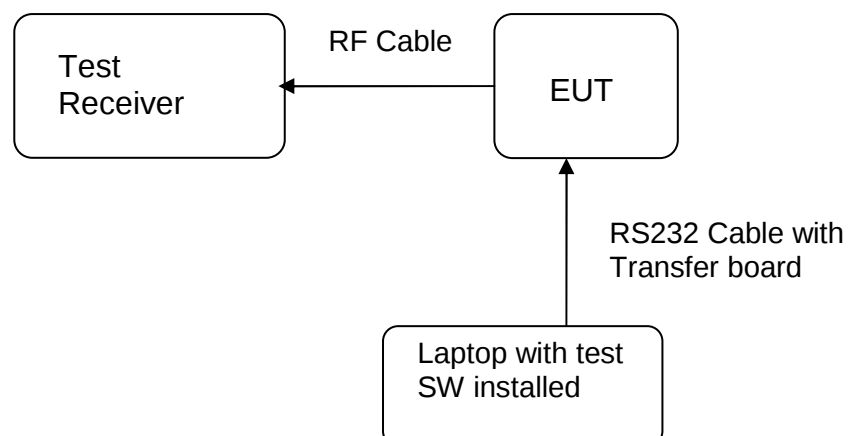


Diagram of Measurement Equipment Configuration for Conducted Transmitter Measurement



5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:**Passed**

Test date	:	December 28, 2012
Test standard	:	FCC Part 15.247(b)(4), Part 15.203 and LP0002 3.10.1
Limit	:	the use of antennas with directional gains that do not exceed 6 dBi

According to the manufacturer declaration, the EUT has an internal antenna with an directional gain of 1.63 dBi, and the antenna is a printed PCB trace with no possibility of replacement. Therefore, the EUT is considered to comply the provision.

Refer to EUT photo for details.

5.1.2 Peak Output Power

RESULT:
Passed

Test date : December 28, 2012
 Test standard : FCC Part 15.247(b)(1), LP0002 3.10.1
 Basic standard : DA 00-705 of March 30, 2000
 Limit : 1 Watt (EBW<1MHz) 0.125W (EBW>1MHz)
 Kind of test site : Shielded room

Test setup

Test Channel : Low/ Middle/ High
 Operation Mode : A
 Ambient temperature : 22°C
 Relative humidity : 52%
 Atmospheric pressure : 102 kPa

Table 6: Test result of Peak Output Power, FSK modulation

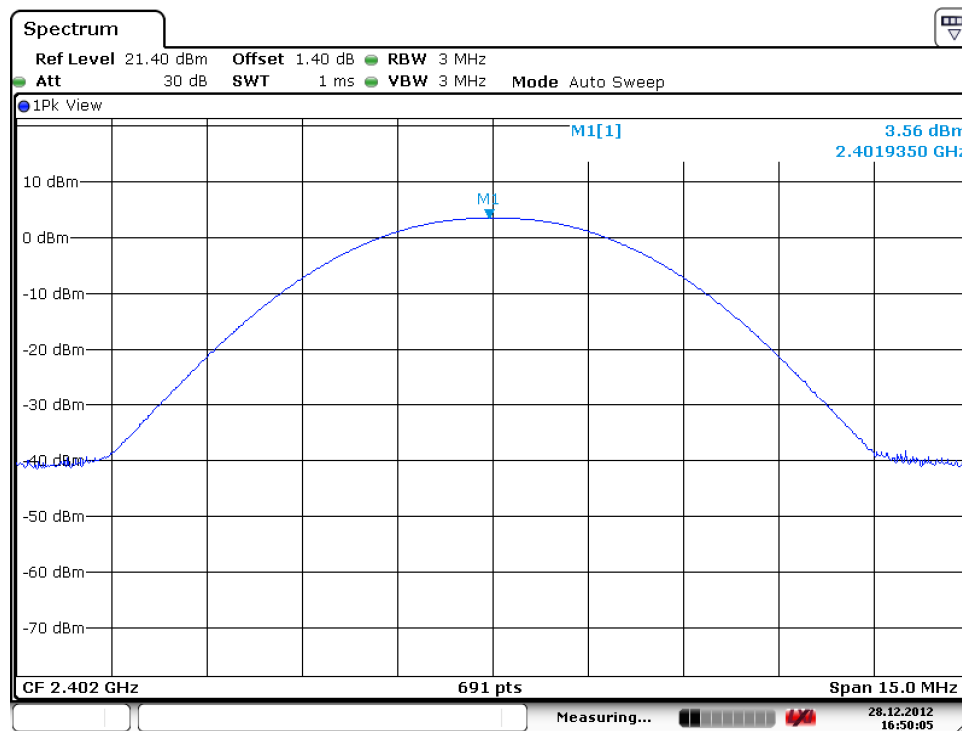
Channel	Channel Frequency	Peak Output Power		Limit
	(MHz)	(dBm)	(W)	(W)
Low Channel	2402	3.56	0.0023	1
Middle Channel	2441	3.15	0.0021	1
High Channel	2480	2.74	0.0019	1

Table 7: Test result of Peak Output Power, PSK modulation

Channel	Channel Frequency	Peak Output Power		Limit
	(MHz)	(dBm)	(W)	(W)
Low Channel	2402	2.4	0.0017	0.125
Middle Channel	2441	1.87	0.0015	0.125
High Channel	2480	1.52	0.0014	0.125

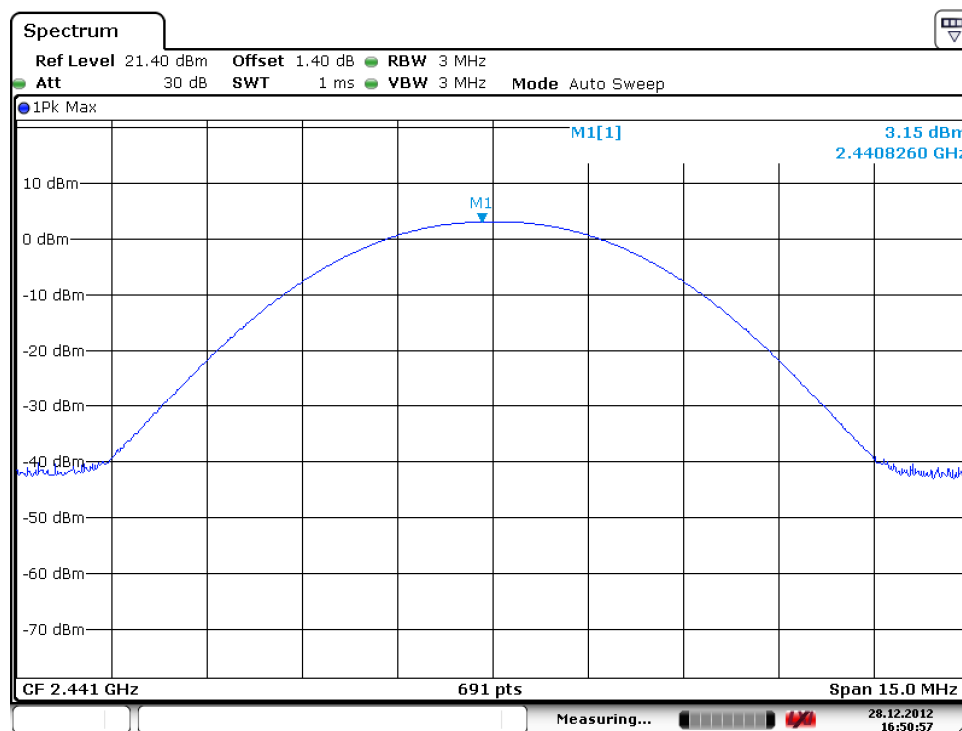
Test Plot of Peak Output Power, GFSK modulation

Low Channel



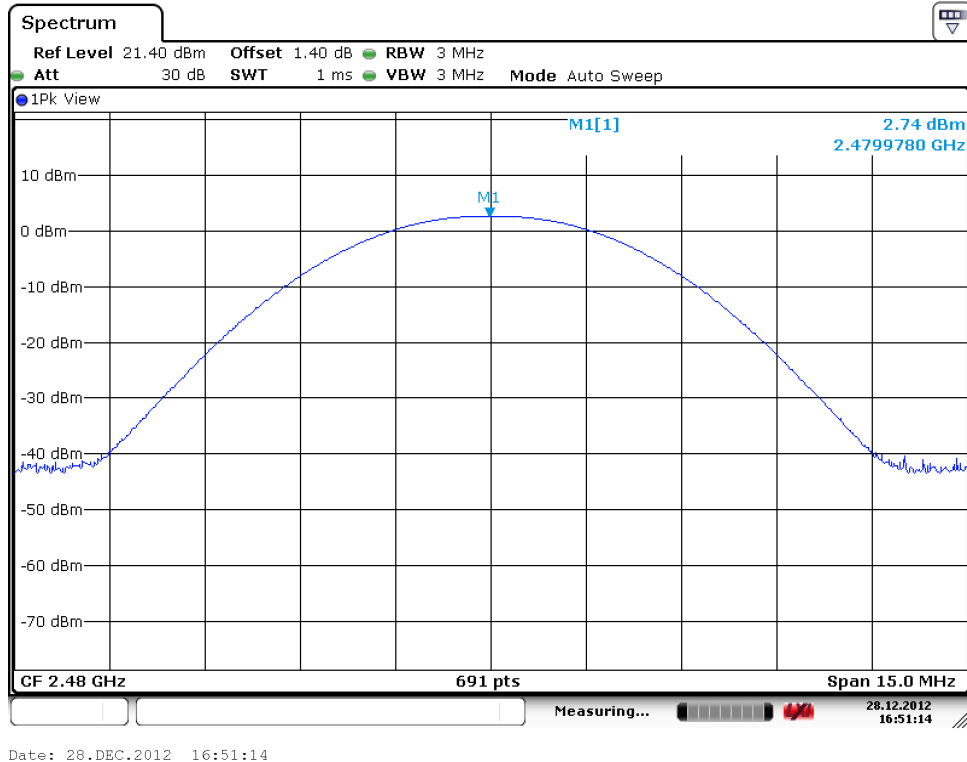
Date: 28.DEC.2012 16:50:05

Middle Channel



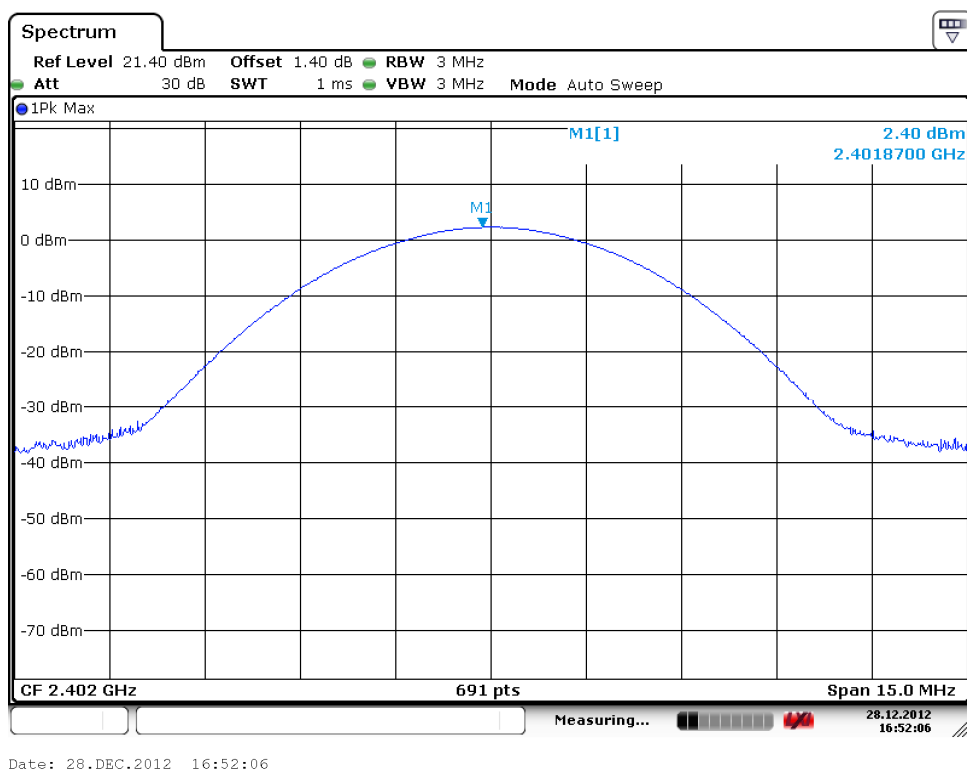
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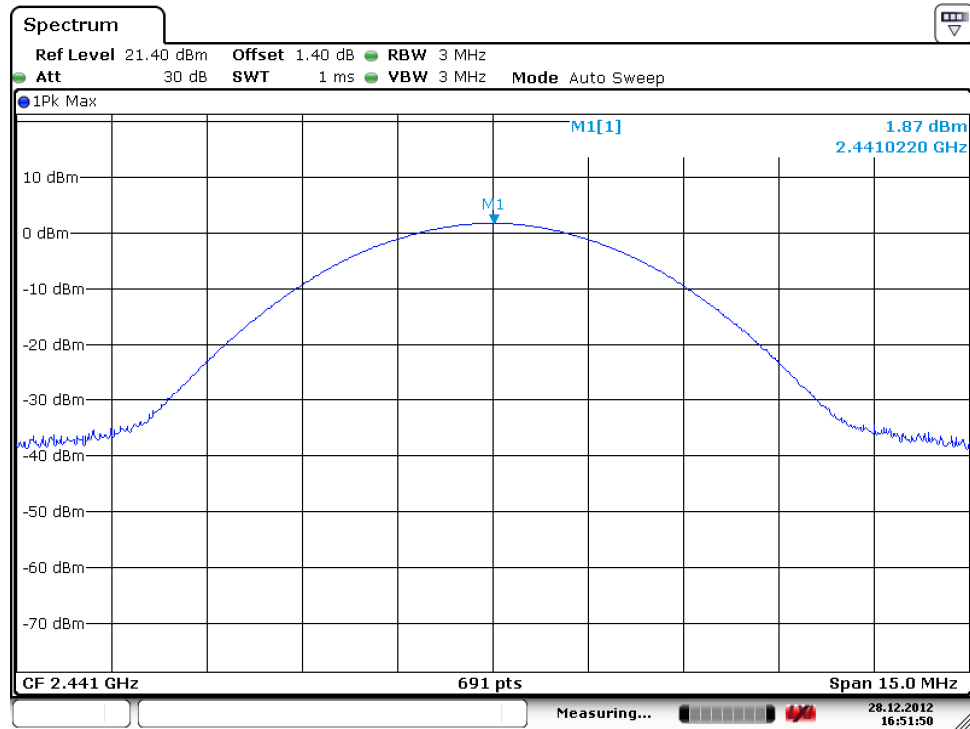
High Channel



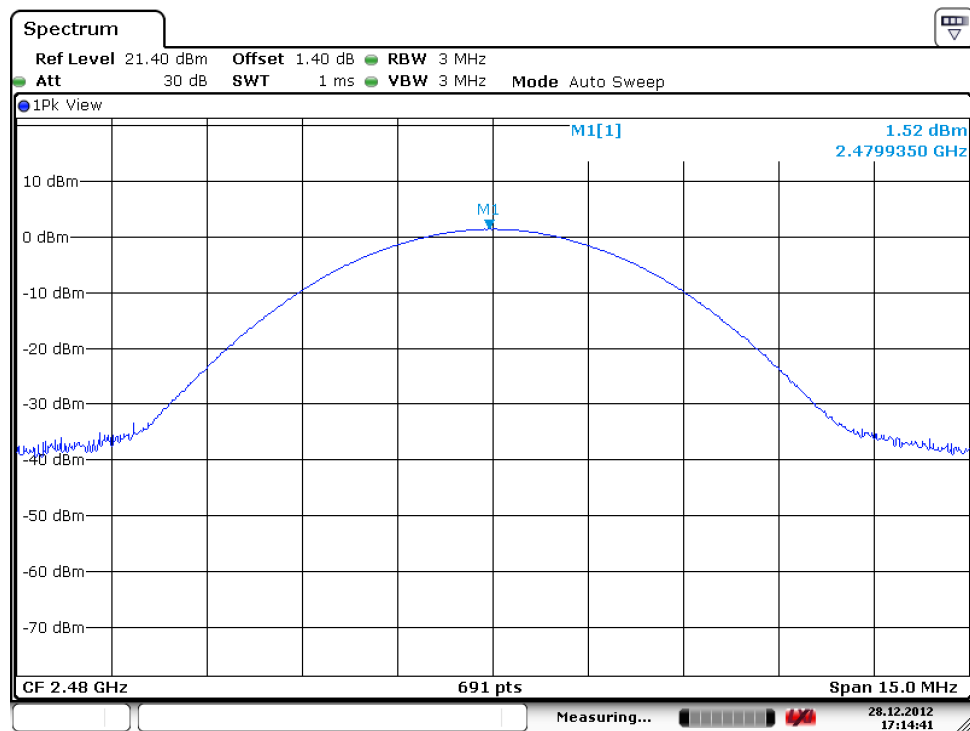
Test Plot of Peak Output Power, PSK modulation

Low Channel



Middle Channel


Date: 28.DEC.2012 16:51:49

High Channel


Date: 28.DEC.2012 17:14:41

5.1.3 20dB Bandwidth

RESULT:
Passed

Date of testing : December 28, 2012
 Test standard : FCC Part 15.247(a)(1), LP0002 3.10.1
 Basic standard : DA 00-705 of March 30, 2000
 Kind of test site : Shielded room

Test setup

Test Channel : Low/ Middle/ High
 Operation Mode : A
 Ambient temperature : 24°C
 Relative humidity : 53%
 Atmospheric pressure : 102 kPa

Table 8: Test result of 20dB Bandwidth, GFSK modulation

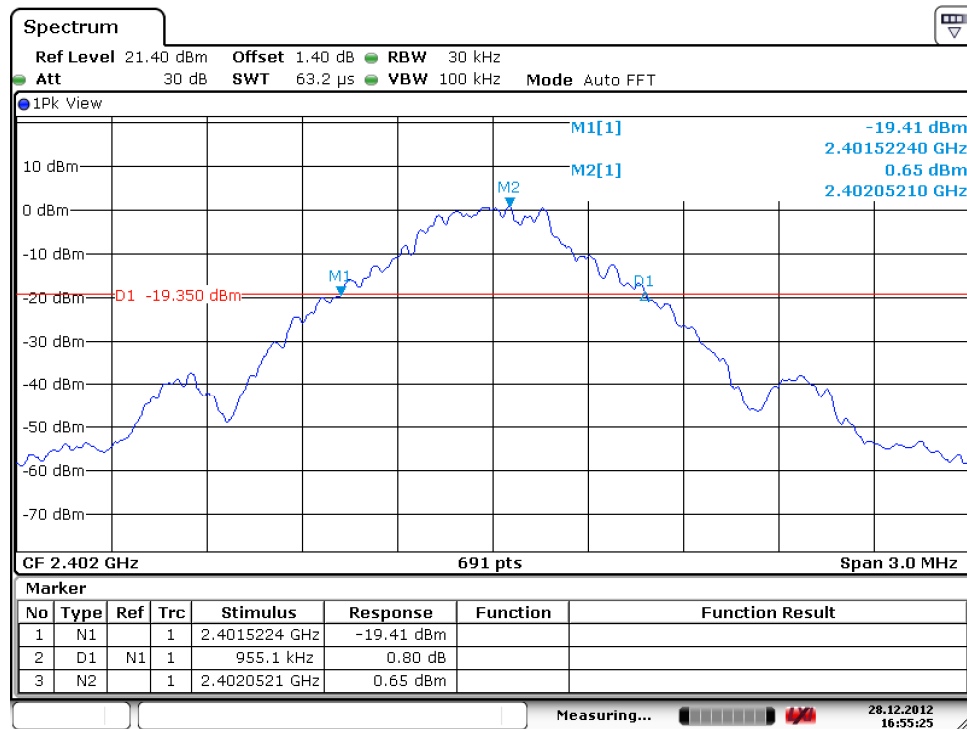
Channel	Channel Frequency (MHz)	20dB Bandwidth (kHz)	Limit (MHz)	Result
Low Channel	2402	955.1	/	Pass
Mid Channel	2441	959.5	/	Pass
High Channel	2480	959.5	/	Pass

Table 9: Test result of 20dB Bandwidth, PSK modulation

Channel	Channel Frequency (MHz)	20dB Bandwidth (kHz)	Limit (MHz)	Result
Low Channel	2402	1302.5	/	Pass
Mid Channel	2441	1302.5	/	Pass
High Channel	2480	1280.8	/	Pass

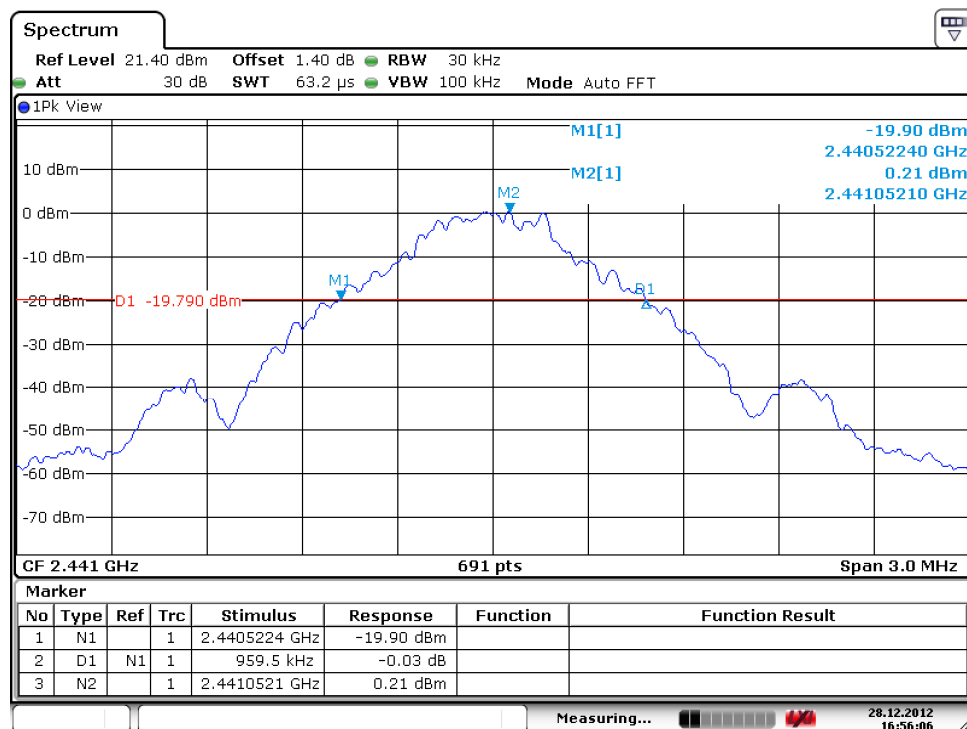
Test Plot of 20dB Bandwidth, GFSK modulation

Low Channel



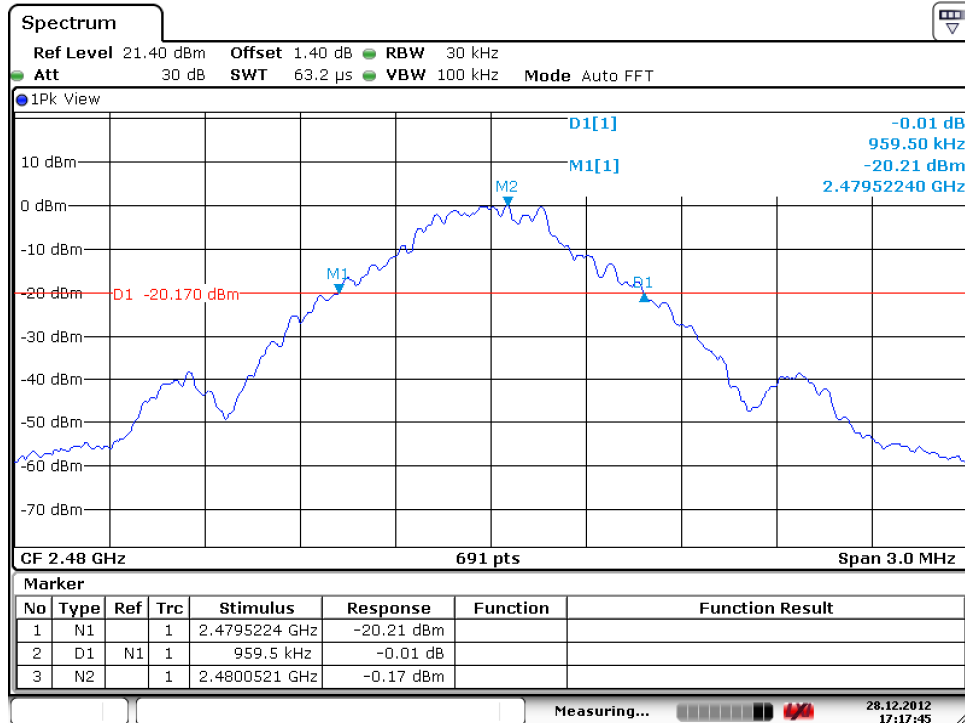
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Middle Channel



Date: 28.DEC.2012 16:56:06

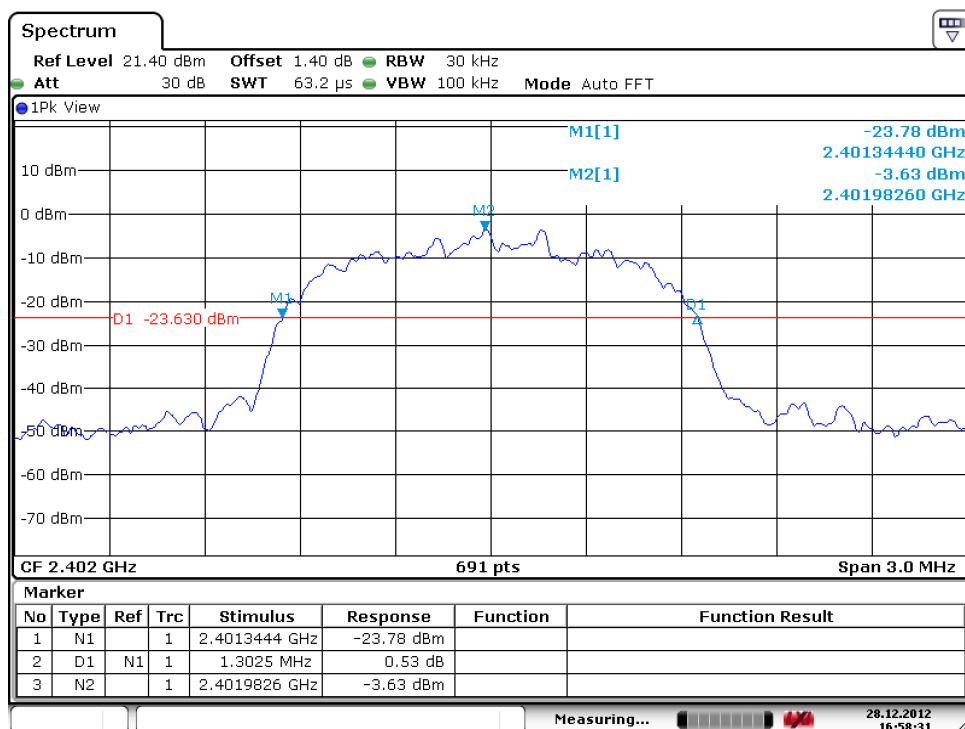
High Channel



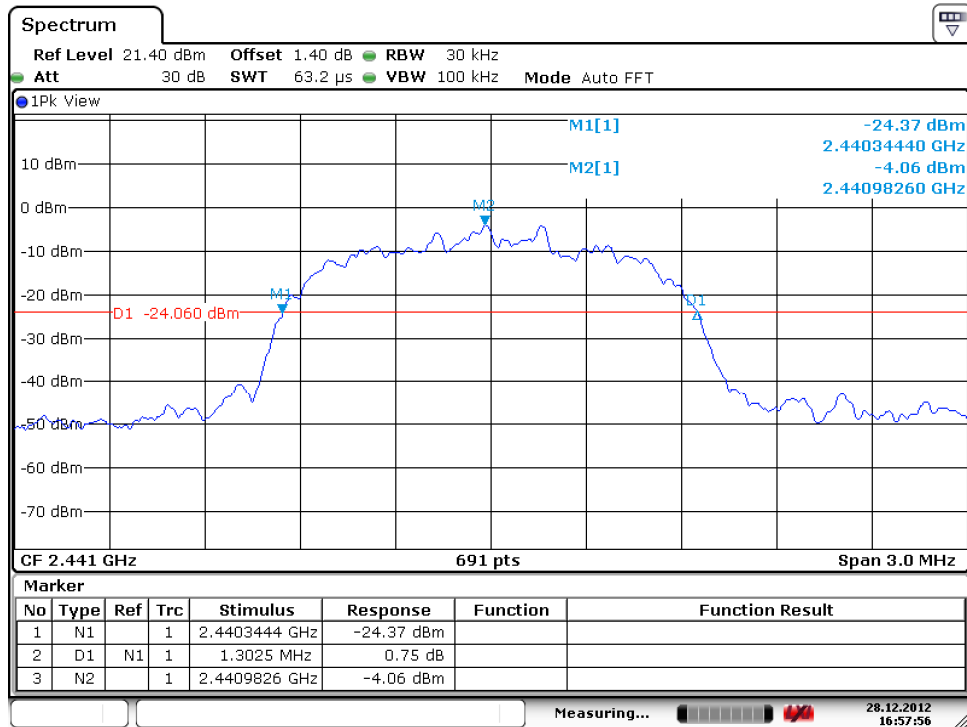
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Test Plot of 20dB Bandwidth, PSK modulation

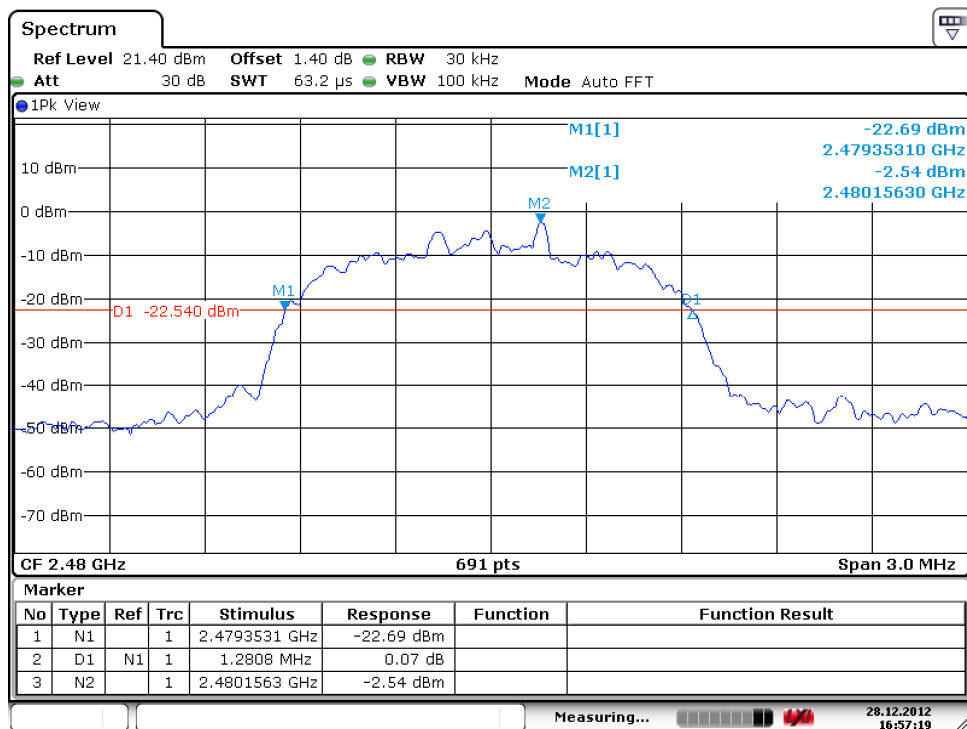
Low Channel



Date: 28.DEC.2012 16:58:31

Middle Channel


Date: 28.DEC.2012 16:57:56

High Channel


Date: 28.DEC.2012 16:57:19

5.1.4 Conducted spurious emissions and Frequency Band Edge measured in 100kHz Bandwidth

RESULT:**Passed**

Date of testing	:	December 28, 2012
Test standard	:	FCC part 15.247(d), LP0002 3.10.1
Basic standard	:	DA 00-705 of March 30, 2000
Limit	:	20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power)
Kind of test site	:	Shielded room

Test setup

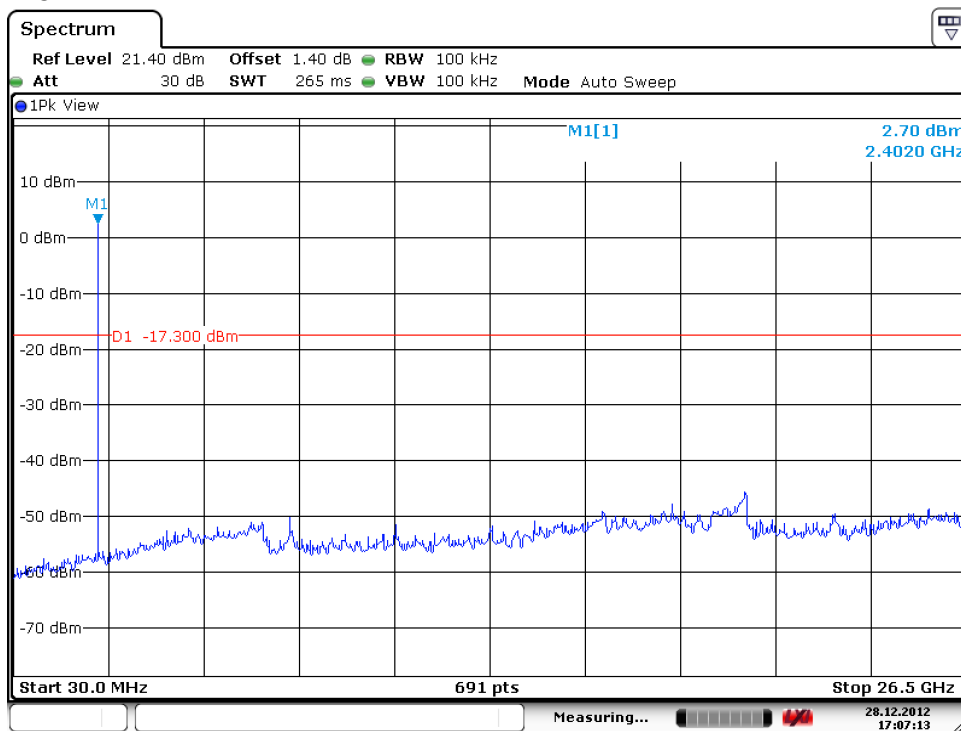
Test Channel	:	Low/ High
Operation mode	:	A
Ambient temperature	:	22°C
Relative humidity	:	52%
Atmospheric pressure	:	102 kPa

All emissions are more than 20dB below fundamental, details refer to following test plot, and compliance is achieved as well.

Due to the small size of the product and that there are no inductive components of significant size, 9kHz to 30MHz frequency range is not tested based on technical judgment.

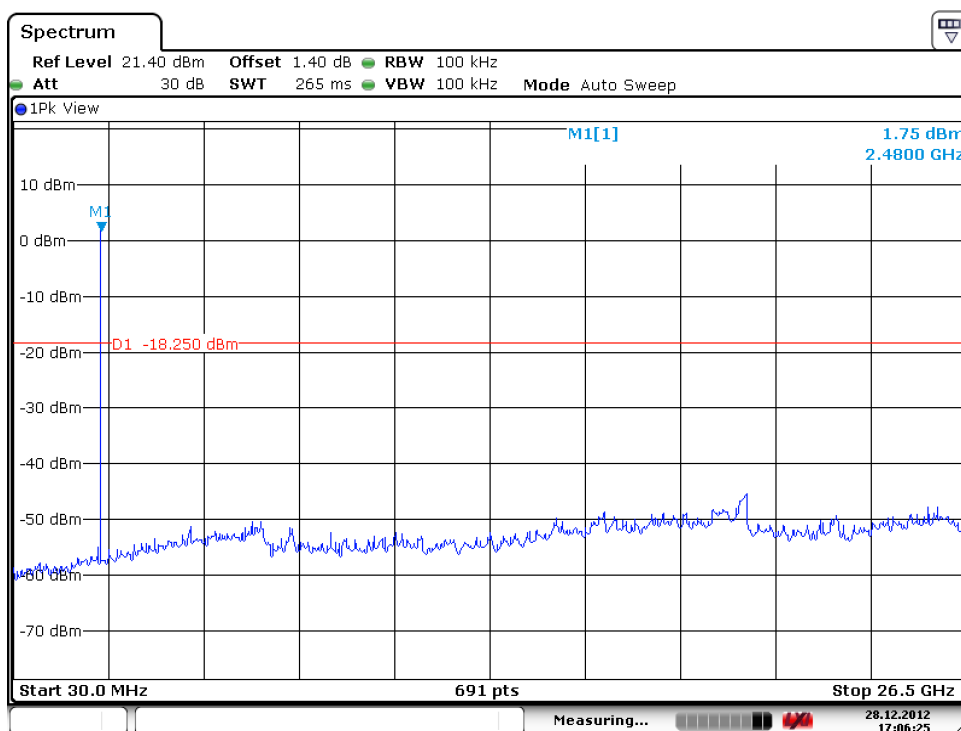
Test Plot of 100kHz Conducted Emissions, GFSK modulation

Low Channel



Date: 28.DEC.2012 17:07:13

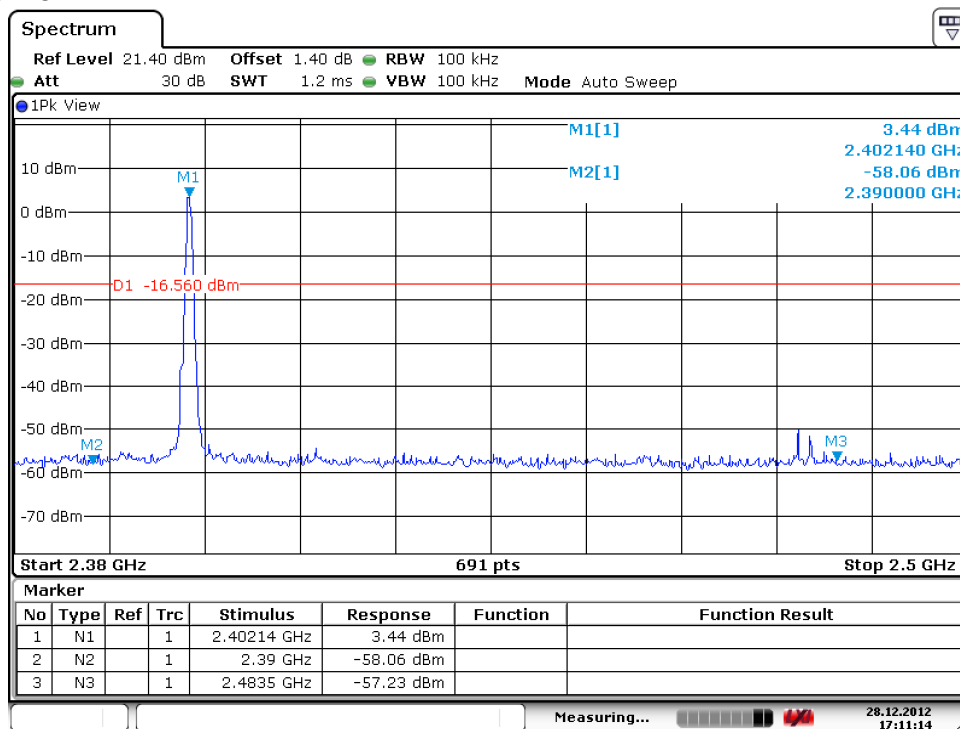
High Channel



Date: 28.DEC.2012 17:06:25

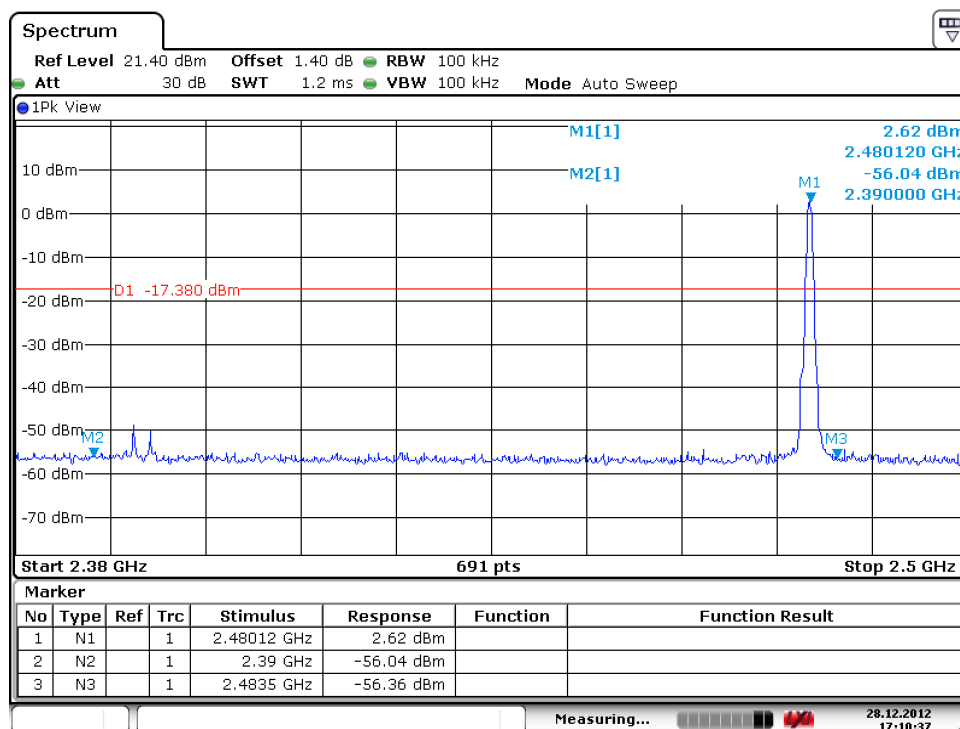
Test Plot of 100kHz Bandwidth of Frequency Band Edge, GFSK modulation

Low Channel



Date: 28.DEC.2012 17:11:14

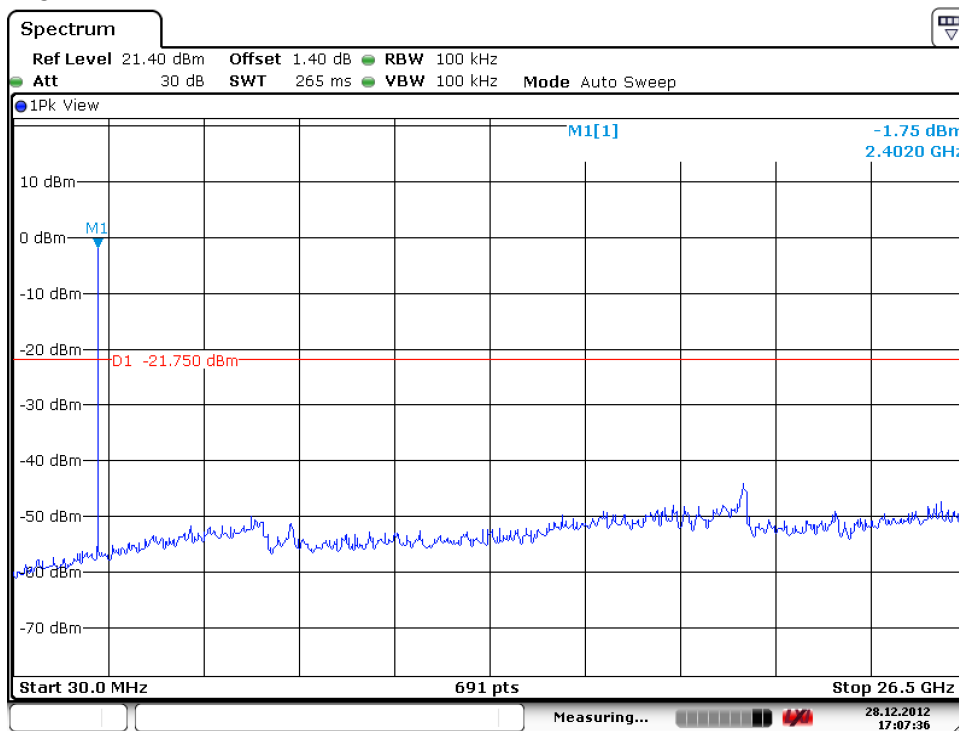
High Channel



Date: 28.DEC.2012 17:10:37

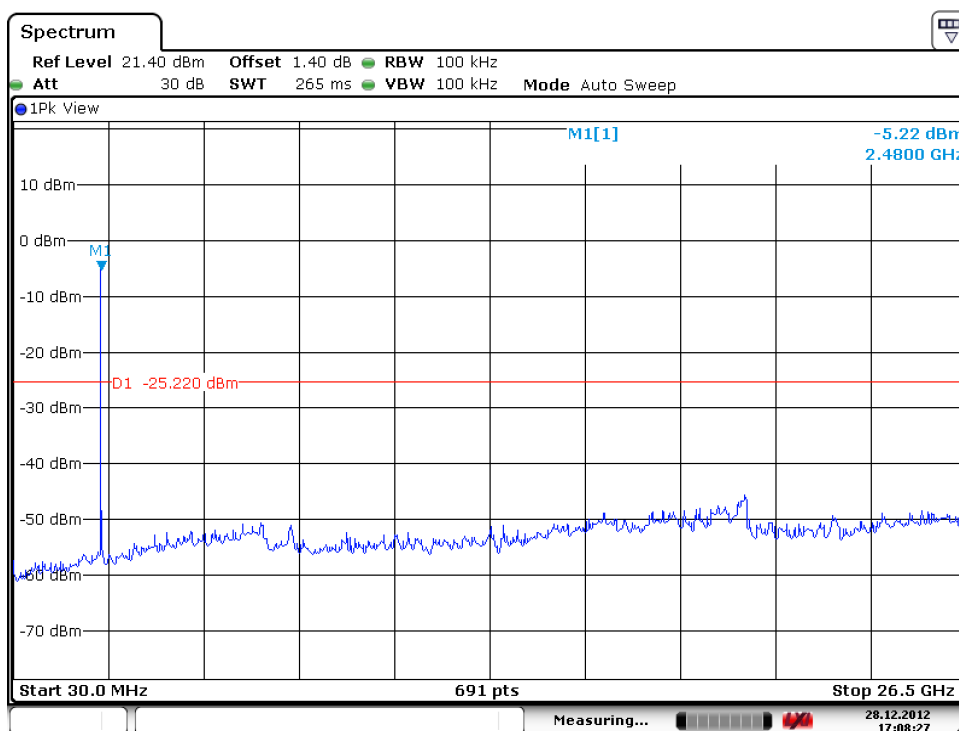
Test Plot of 100kHz Conducted Emissions, PSK modulation

Low Channel



Date: 28.DEC.2012 17:07:36

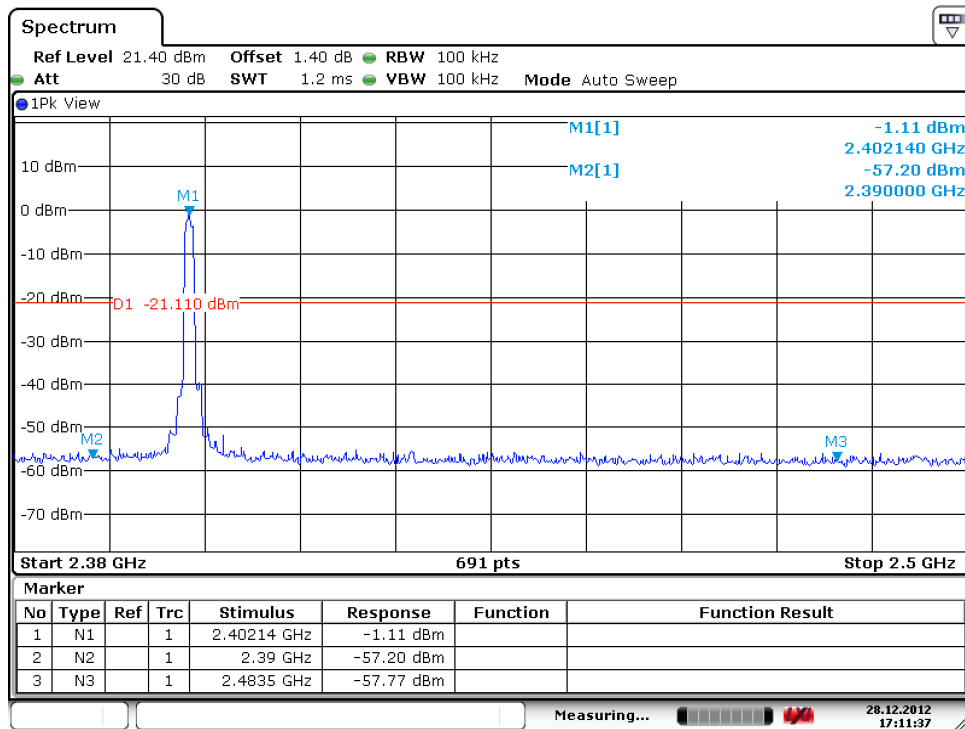
High Channel



Date: 28.DEC.2012 17:08:27

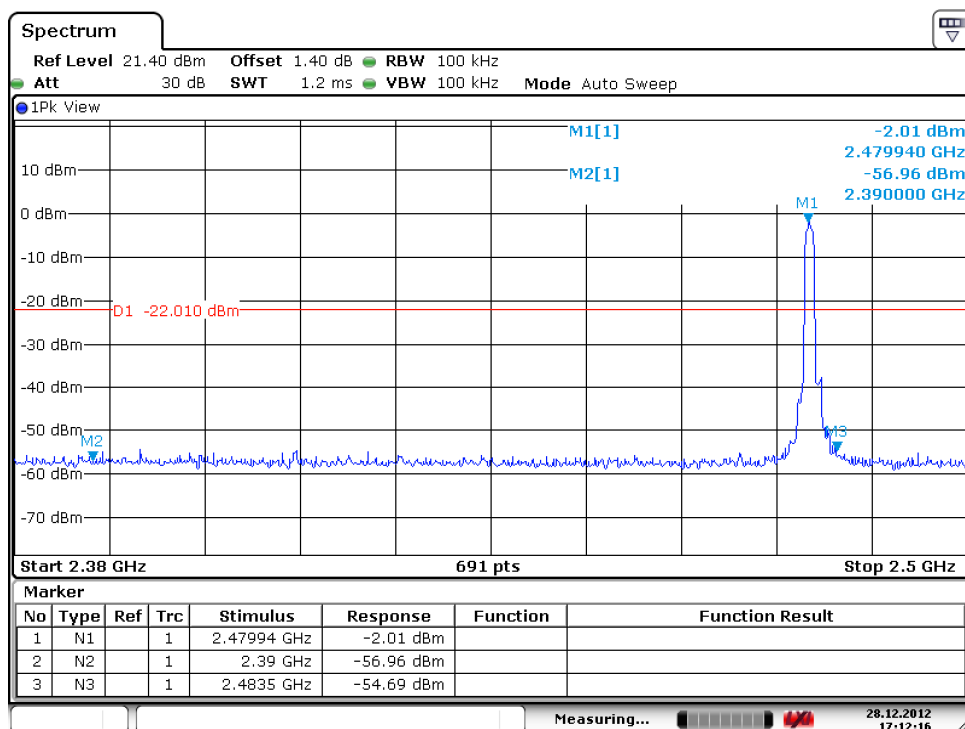
Test Plot of 100kHz Bandwidth of Frequency Band Edge, PSK modulation

Low Channel



Date: 28.DEC.2012 17:11:37

High Channel



Date: 28.DEC.2012 17:12:16

5.1.5 Spurious Emission

RESULT:**Passed**

Date of testing	:	December 28, 2012
Test standard	:	FCC part 15.247(d), FCC 15.205, FCC 15.209, LP0002 2.7, 2.8
Basic standard	:	ANSI C63.10: 2009
Limits	:	Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a) and LP0002 2.7, 2.8, must comply with the radiated emission limits specified in FCC 15.209(a) and LP0002 2.7, 2.8. Emission radiated outside the specified frequency bands must comply with the radiated emission limits specified in FCC 15.209(a) and FCC 15.249(a), LP0002 2.7.
Kind of test site	:	3m Semi-Anechoic Chamber

Test setup

Test Channel	:	Low/ Middle/ High
Operation mode	:	A, C
Ambient temperature	:	24°C
Relative humidity	:	56%
Atmospheric pressure	:	102 kPa

Remark: Testing was carried out within frequency range 30MHz to the tenth harmonic. For details refer to Appendix 2. The Radiated Emissions testing was performed in the X, Y and Z axis orientation. The X Axis orientation is the worst-case and recorded in this test report. Due to the small size of the product and that there are no inductive components of significant size, 9kHz to 30MHz frequency range is not tested based on technical judgment.

5.1.6 Frequency Separation

RESULT:**Passed**

Date of testing : December 28, 2012
Test standard : FCC part 15.247(a)(1), LP0002 3.10.1
Basic standard : DA 00-705 of March 30, 2000
Limit : $\geq 25\text{kHz}$ or $2/3$ of 20dB bandwidth, whichever is greater

Test setup

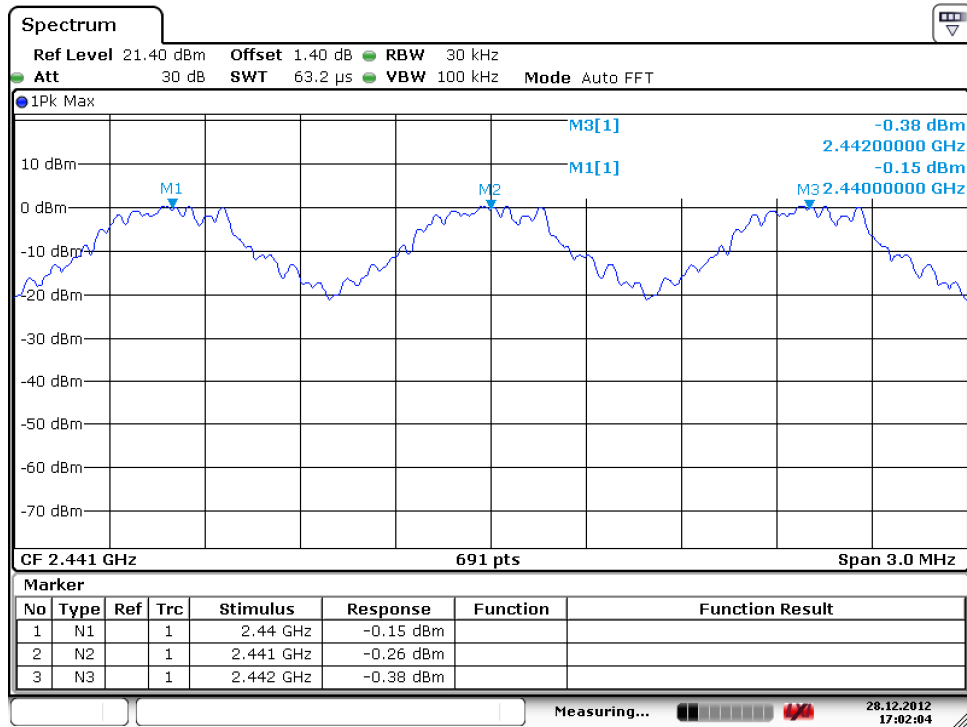
Test Channel : Low/ Middle/ High
Operation Mode : A
Ambient temperature : 24°C
Relative humidity : 53%
Atmospheric pressure : 102 kPa

Table 10: Test result of Frequency Separation

Channel	Channel Frequency (MHz)	Measured Channel Separation (MHz)	Limit (kHz)	Result
Record Channel	2441	1	$\geq 25\text{kHz}$ or $2/3$ of 20dB bandwidth	Pass
Record Channel adj 1	2440			
Record Channel adj 2	2442			

Test Plot of Frequency Separation

GFSK



Date: 28.DEC.2012 17:02:04

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5.1.7 Number of hopping frequency

RESULT:**Passed**

Date of testing : December 28, 2012
Test standard : FCC part 15.247(a)(1)(iii), LP0002 3.10.1
Basic standard : DA 00-705 of March 30, 2000
Limits : ≥ 15 non-overlapping channels
Kind of test site : Shield room

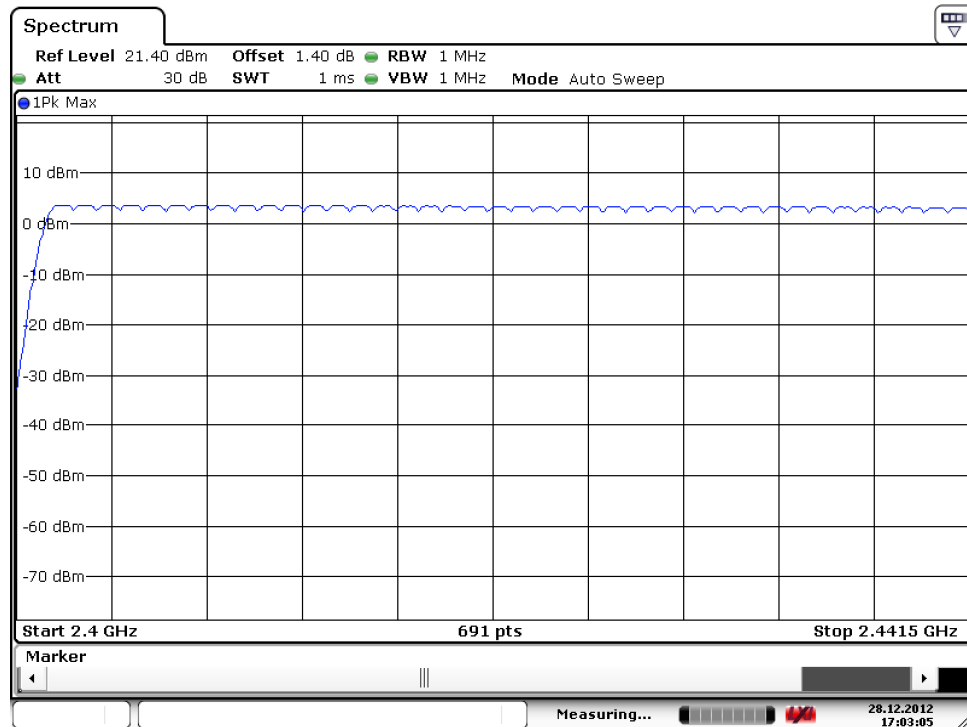
Test setup

Test Channel : Low/ Middle/ High
Operation Mode : A
Ambient temperature : 24°C
Relative humidity : 53%
Atmospheric pressure : 102 kPa

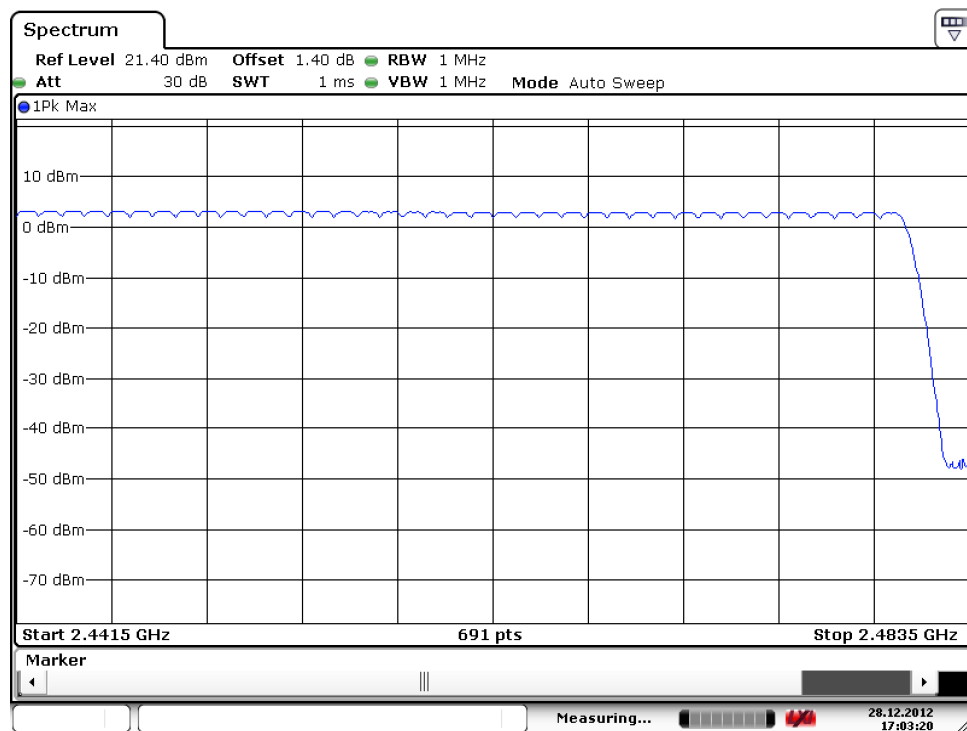
Table 11: Test result of Number of hopping frequency

Frequency Range	Measured Quantity of Hopping Channel	Limit	Result
<u>2400</u> to <u>2483.5</u> MHz	79	≥ 15	Pass

Test Plot of Number of hopping frequencies



Date: 28.DEC.2012 17:03:05



Date: 28.DEC.2012 17:03:20

5.1.8 Time of Occupancy

RESULT:
Passed

Date of testing : December 28, 2012
 Test standard : FCC part 15.247(a)(1)(iii), LP0002 3.10.1
 Basic standard : DA 00-705 of March 30, 2000
 Limits : 0.4s
 Kind of test site : Shield room

Test setup

Test Channel : Low/ Middle/ High
 Operation Mode : A
 Ambient temperature : 24°C
 Relative humidity : 53%
 Atmospheric pressure : 102 kPa

Table 12: Test result of Time of Occupancy

Data Mode	Captured Burst (s)	On+Off time (s)	Hopping Rate	Dwell time (s)	Limit (s)	Result
DH5	0.0029275	0.0037536	266.411	0.3120	0.4	Pass
3DH5	0.0029275	0.0037536	266.411	0.3120	0.4	Pass

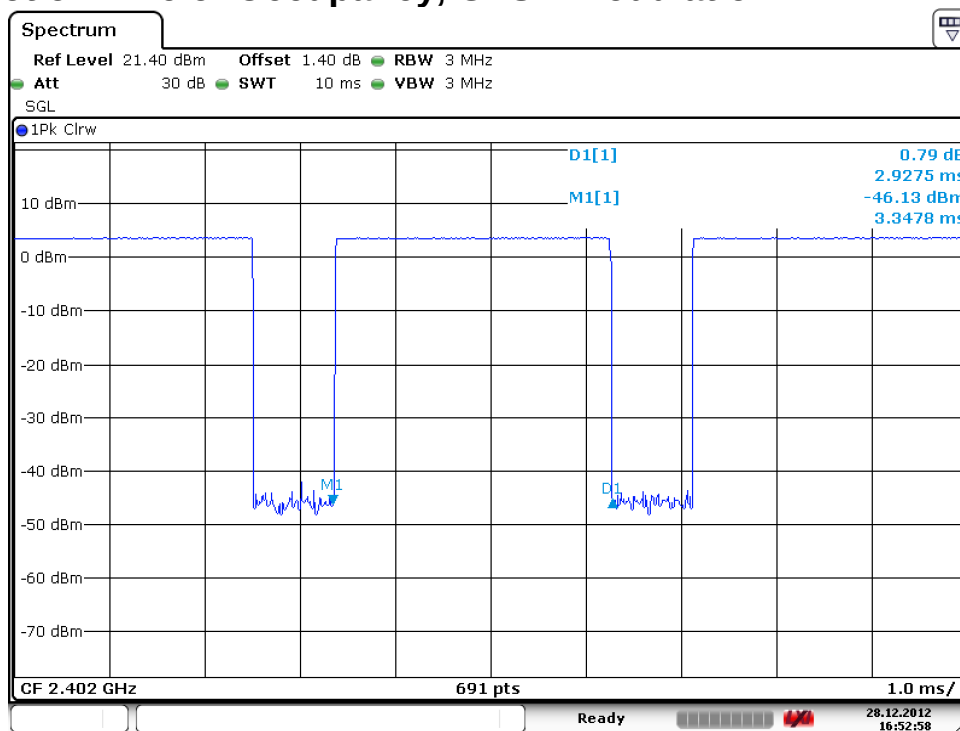
Note:

Dwell time = Pulse width x (Hopping rate / Number of channels) x Period

Period = 0.4 (seconds/ channel) x 79 (channel) = 31.6 seconds

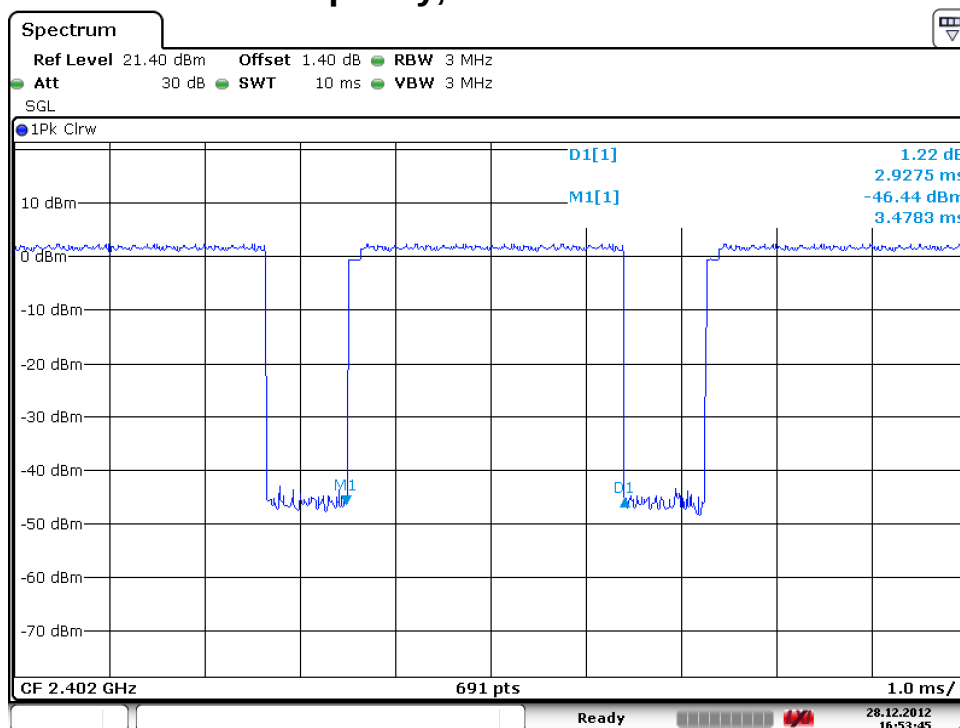
Hopping rate = 1/(On+Off time)

Test Plot of Time of Occupancy, GFSK modulation



Date: 28.DEC.2012 16:52:58

Test Plot of Time of Occupancy, PSK modulation



Date: 28.DEC.2012 16:53:45

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5.1.9 Mains Conducted Emissions

RESULT:**Passed**

Date of testing : 2013-01-16
Test standard : LP0002: 2.3
Limits : Mains Conducted emissions as defined in
LP0002: 2.3 , must comply with the mains
conducted emission limits specified in
LP0002: 2.3
Kind of test site : Shielding Chamber

Test setup

Test Channel : Low/ Middle/ High
Operation mode : A, C
Ambient temperature : 24°C
Relative humidity : 56%
Atmospheric pressure : 102 kPa

Remark: For details refer to Appendix 3.

6. Safety Human exposure

6.1 Radio Frequency Exposure Compliance

6.1.1 Electromagnetic Fields

RESULT:**Passed**

Test standard : FCC KDB Publication 447498

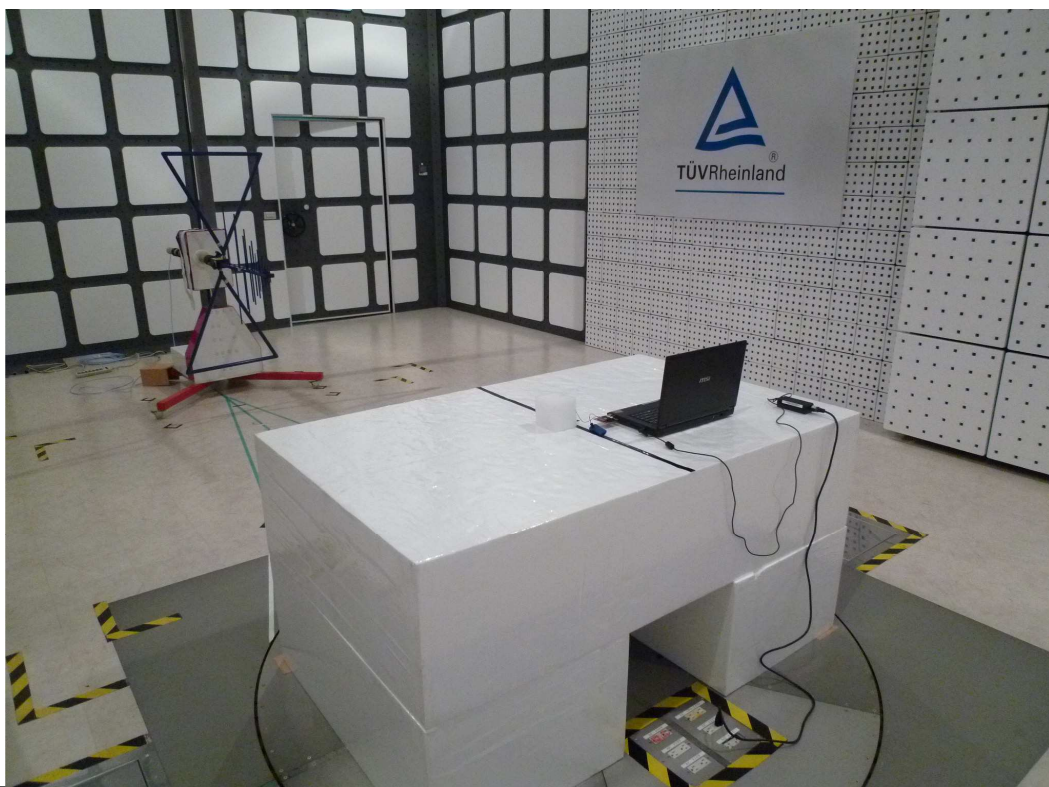
Since maximum peak output power of the transmitter is $<60/f(\text{GHz})\text{mW}$, i.e.
 $2.3\text{mW} < 25(=60/2.4)\text{mW}$, hence the EUT is excluded from SAR evaluation according to FCC
KDB publication 447498 D01: Mobile Portable RF Exposure.

7. Photographs of the Test Set-Up

Photograph 1: Set-up for Spurious Emissions (Front View)



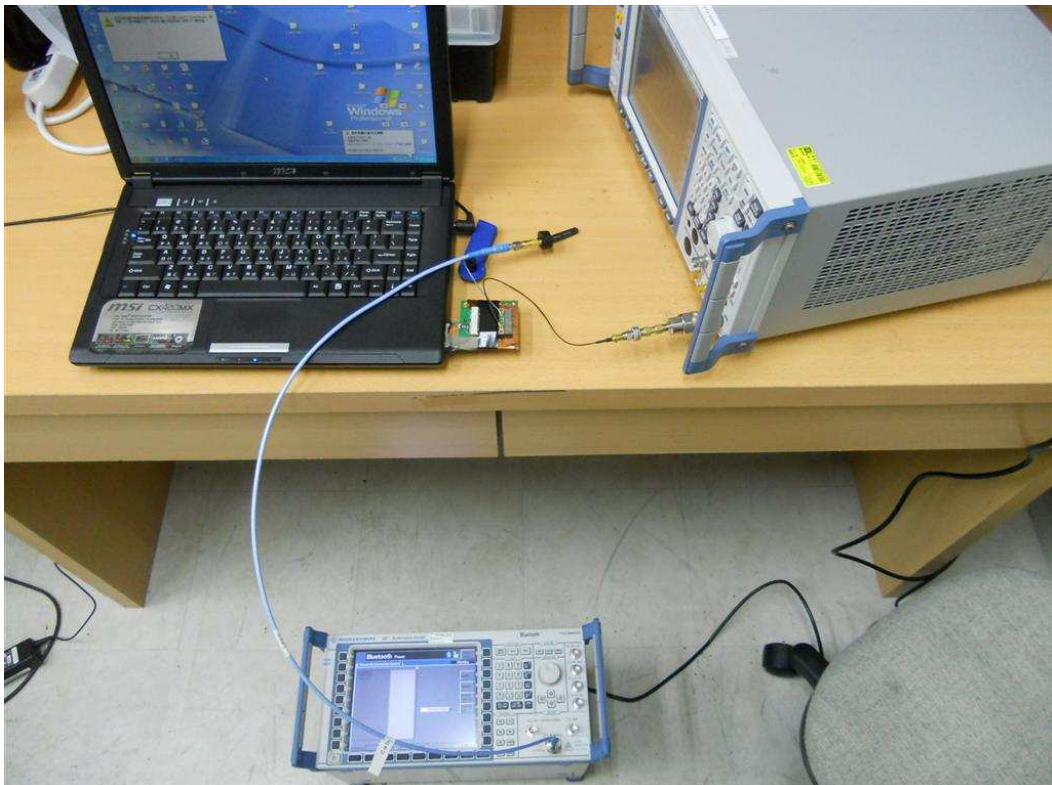
Photograph 2: Set-up for Spurious Emissions (Back View 1)



Photograph 3: Set-up for Spurious Emissions (Back View 2)



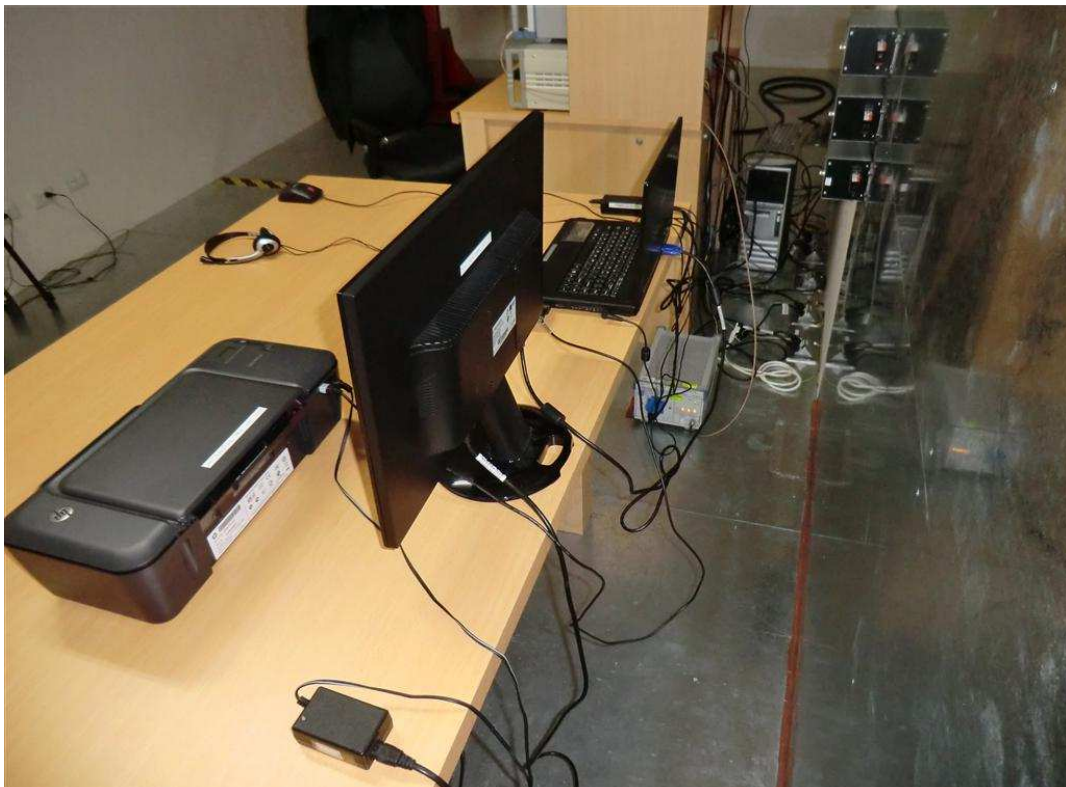
Photograph 4: Set-up for Conducted testing



Photograph 5: Set-up for Mains Conducted Emissions (Front View)



Photograph 6: Set-up for Mains Conducted Emissions (Back View)



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