

Prüfbericht-Nr.: Test Report No.:	10043715 001		Auftrags-Nr.: Order No.:	114013947	Seite 1 von 48 Page 1 of 48
Kunden-Referenz-Nr.: Client Reference No.:	N/A		Auftragsdatum Order date:	: September 11,	2013
Auftraggeber: Client:	Skullcandy, Ind	c., Suite 250, 14	41 W. Ute Blvd, P	ark City, UT 8409	8, USA
Prüfgegenstand: Test item:	Bluetooth spe	aker			
Bezeichnung / Typ-Nr.: Identification / Type No.:	Air Raid				
Auftrags-Inhalt: Order content:	FCC Part 15C	Test report			- 1147
Prüfgrundlage: Test specification:	RSS-210 (12-	2010) A8	C Section 15.247 ency Devices Tecl	nnical Regulations	LP0002(2011)
Wareneingangsdatum: Date of receipt:	9/12/2013				
Prüfmuster-Nr.: Test sample No.:	A000023273-0 A000023273-0				
Prüfzeitraum: Testing period:	30-Sep-2013 -	1-Oct-2013			
Ort der Prüfung: Place of testing:	EMC Laborate	ory Taipei			
Prüflaboratorium: Testing laboratory:	TUV Rheinlan	nd Taiwan Ltd.			
Prüfergebnis*: Test result*:	Pass				
geprüft von / tested by: 2013-10-14 Danny S.	Dan C. Sung/Project	t Manager		Rene Charton/Sen	ior Project Manager
Datum Name / Stell Date Name / Position		Unterschrift Signature		ame / Stellung ame / Position	Unterschrift Signature
Sonstiges / Other:			0.50		
Zustand des Prüfgeger Condition of the test iten		nlieferung:		ständig und unbeso lete and undamage	
* Legende: 1 = sehr gut	2 = gut	3 = befriedigend	cht o.g. Prüfgrundlage(n)	4 = ausreichend N/A = nicht anwendbar	5 = mangelhaft N/T = nicht getestet
P(ass) = entspricht o Legend: 1 = very good P(ass) = passed a.m.	2 = good	3 = satisfactory F(ail) = failed a.m. te		4 = sufficient N/A = not applicable	5 = poor N/T = not tested
Dieser Prüfbericht be	zieht sich nur au	ıf das o.g. Prüfm	uster und darf ohr	e Genehmigung de	er Prüfstelle nicht
auszugsweise vervi This test report only relates	to the a. m. test s	ample. Without pe	perechtigt nicht zu ermission of the test does not entitle to d	center this test repo	ort is not permitted to be



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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 99% BANDWIDTH

RESULT: Passed

5.1.5 CONDUCTED SPURIOUS EMISSIONS AND FREQUENCY BAND EDGE MEASURED IN 100kHz BANDWIDTH

RESULT: Passed

5.1.6 Spurious Emission

RESULT: Passed

5.1.7 FREQUENCY SEPARATION

RESULT: Passed

5.1.8 Number of hopping frequency

RESULT: Passed

5.1.9 TIME OF OCCUPANCY

RESULT: Passed

5.2.1 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 PI: Photo Documentation internal view

(File Name: 10043715APPENDIX PI)

Appendix PE: Photo Documentation external view

(File Name: 10043715APPENDIX PE)

Appendix D: Test Result of Radiated Emissions

(File Name: 10043715APPENDIX D)

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 ANSI C63.4:2009, Public Notice DA 00-705

NCC Low-power Radio-frequency Devices Technical Regulations LP0002(2011)(100年6月28日)



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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 Accredition effective period: 2013-Jul-1st to 2016-Jun-30th



Testing Laboratory 0759



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2.2 List of Test and Measurement Instruments

Table 2: List of Test and Measurement Equipment

Kind of Equipment	Manufacturer	Туре	S/N	Calibrated until
EMI Test Receiver	R&S	ESCI 7	100797	20-Dec-13
Bilog Antenna	TESEQ	CBL6111D	29802	29-Jun-14
Spectrum Analyzer	R&S	FSV 40	100921	13-Dec-13
Horn Antenna	ETS-Lindgren	3117	138160	10-Jan-14
Horn Antenna (18GHz~40GHz)	COM- POWER	AH840	101031	2-Nov-13
Preamplifier (30MHz -1GHz)	HP	8447F	2805A03335	2-Sep-14
Preamplifier (18 GHz -40 GHz)	COM- POWER	PAM-840	461257	2-Sep-14
Pre-Amplifier (1GHz~18GHz)	EM Electronics	EM30180	60558	12-Nov-13
Loop Antenna	Schwarzbeck	FMZB 1513	1513-076	28-Sep-14
EMI Test Receiver	R&S	ESCI	101094	29-Aug-14
LISN (1 phase)	R&S	ENV216	101243	5-Jun-14
LISN	Rolf Heine	NNB-2/16Z	99080	30-Aug-14

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 basics using in house standards or comparisons.



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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	± 1 x 10 ⁻⁷
RF power, conducted	± 1 dB
Adjacent channel power	±3 dB
Radiated emission of transmitter, valid up to 26 GHz	± 6 dB
Radiated emission of receiver, valid up to 26 GHz	± 6 dB
Temperature	± 2 ºC
Humidity	± 10 %



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3. General Product Information

3.1 Product Function and Intended Use

The EUT is a a wireless Bluetooth audio speaker solution to work with Bluetooth enabled Mobile Devices

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

3.2 System Details and Ratings

Table 4: Basic Information of EUT

Item	EUT information
Kind of Equipment	Bluetooth speaker
Type Designation	Air Raid
Brand Name	
FCC ID	Y22-SK20130006 Canada ID : 10486A-SK20130006

Table 5: Technical Specification of EUT

Technical Specification	Value
Operating Frequency	2402 MHz ~ 2480 MHz
Channel Spacing	1 MHz
Channel number	79
Operation Voltage	3.7 V
Modulation	FHSS with GFSK, π /4 QPSK, 8 DPSK
Antenna gain	0 dBi

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Table 6: 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



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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



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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.

The samples were used as follows: Conducted: A000023273-002

Radiation: A000023273-004

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
		(07(1201017()	100000000



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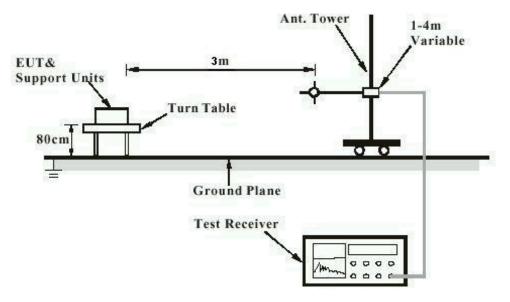
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4.4 Countermeasures to achieve EMC Compliance

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



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Diagram of Measurement Equipment Configuration for Mains Conduction Measurement

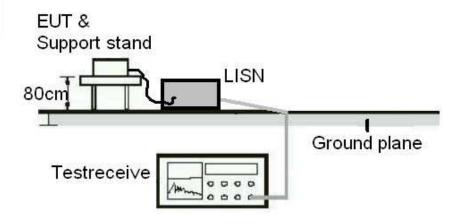
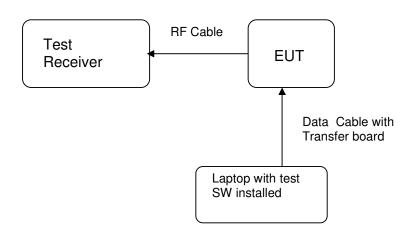


Diagram of Measurement Equipment Configuration for Conducted Transmitter Measurement





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5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT: Passed

Test standard : FCC Part 15.247(b)(4), Part 15.203

RSS-Gen 7.1.4

LP0002(2011): 3.10.1, (3)

Limit : the use of antennas with directional gains that do not

exceed 6 dBi

According to the manufacturer declaration, the EUT has an antenna with a directional gain of 0 dBi dBi. The antenna is a printed PCB trace with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision.

Refer to EUT photo for details.



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5.1.2 Peak Output Power

RESULT: Passed

Test standard FCC Part 15.247(b)(1),

RSS-210 A8.4(2)

LP0002(2011): 3.10.1, (2)

Basic standard DA 00-705 of March 30, 2000

LP0002(2011) Appendix II

Kind of test site Shielded room

Test setup

Low/ Middle/ High Test Channel

Operation Mode

22-26 °C 50-65 % Ambient temperature : Relative humidity : Atmospheric pressure : 100-103 kPa

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

Channel	Channel Frequency	Peak Output Power		Limit
	(MHz)	(dBm)	(W)	(W)
Low Channel	2402	0.13	0.0010	0.125
Middle Channel	2441	3.28	0.0021	0.125
High Channel	2480	3.47	0.0022	0.125

Table 8: Test result of Peak Output Power, 8DPSK modulation

Channel	Channel Frequency	Peak Output Power (dBm) (W)		Limit
	(MHz)			(W)
Low Channel	2402	2.09	0.0016	0.125
Middle Channel	2441	4.71	0.0030	0.125
High Channel	2480	5.04	0.0032	0.125

Pmax: 3.2 mW

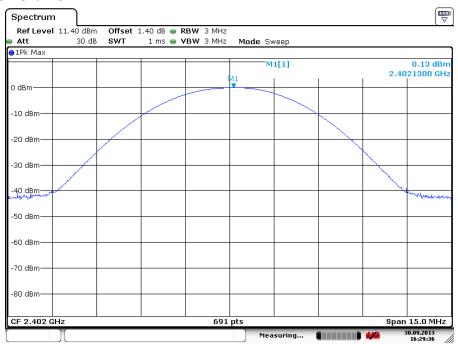


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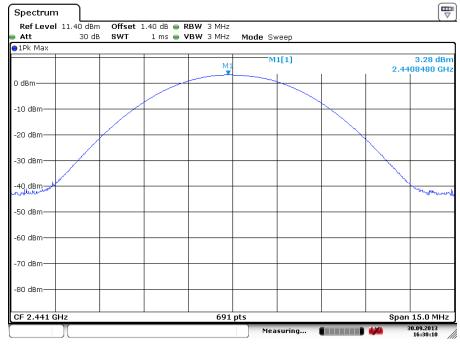
Test Plot of Peak Output Power, GFSK modulation

Low Channel



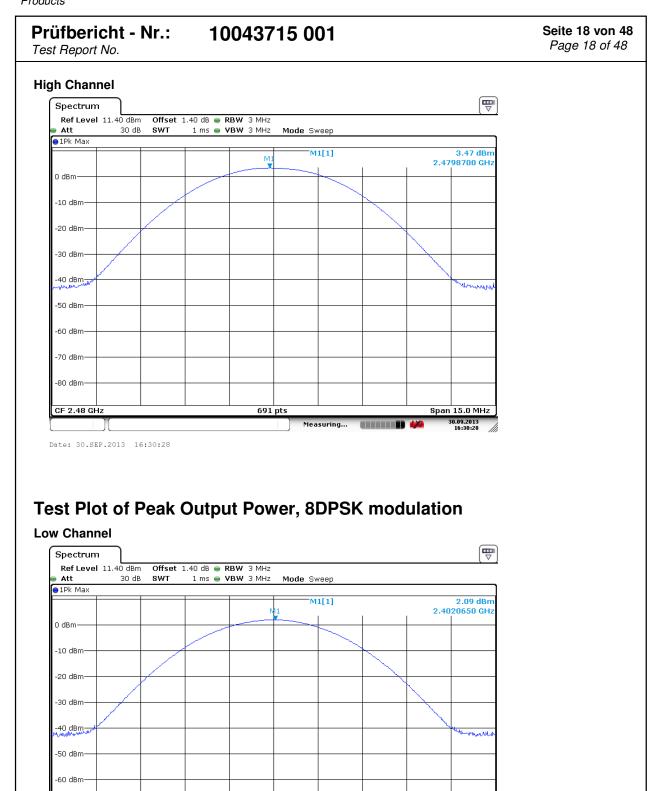
Date: 30.SEP.2013 16:29:36

Middle Channel



Date: 30.SEP.2013 16:30:10





691 pts

Measuring...

Span 15.0 MHz

Date: 30.SEP.2013 16:32:52

-70 dBm· -80 dBm·

CF 2.402 GHz



Produkte

Date: 30.SEP.2013 16:32:19





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5.1.3 20dB Bandwidth

RESULT: Passed

Test standard : FCC Part 15.247(a)(1),

RSS-210 A8.1(a)

LP0002(2011): 3.10.1, (6.1.1)

Basic standard : DA 00-705 of March 30, 2000

LP0002(2011) Appendix II

Kind of test site : Shielded room

Test setup

Test Channel : Low/ Middle/ High

Operation Mode : A

Ambient temperature : 22-26°C
Relative humidity : 50-65%
Atmospheric pressure : 100-103kPa

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

Channel	Channel Frequency (MHz)	20dB Bandwidth (kHz)	Limit (MHz)	Result
Low Channel	2402	946.5	1.5	Pass
Mid Channel	2441	955.1	1.5	Pass
High Channel	2480	955.1	1.5	Pass

Note: Limit is for Channel Separation of 1 MHz and a power limit of 125 mW.

Table 10: Test result of 20dB Bandwidth, 8DPSK modulation

Channel	Channel Frequency (MHz)	20dB Bandwidth (kHz)	Limit (MHz)	Result
Low Channel	2402	1272.1	1.5	Pass
Mid Channel	2441	1263.4	1.5	Pass
High Channel	2480	1263.4	1.5	Pass

Note: Limit is for Channel Separation of 1 MHz and a power limit of 125 mW.

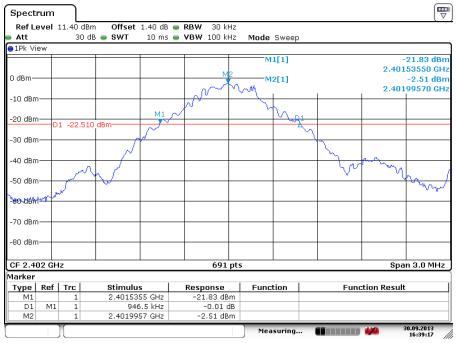


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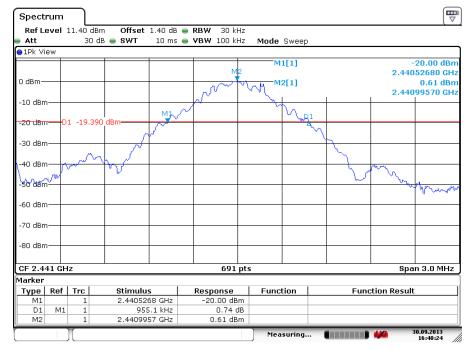
Test Plot of 20dB Bandwidth, GFSK modulation

Low Channel



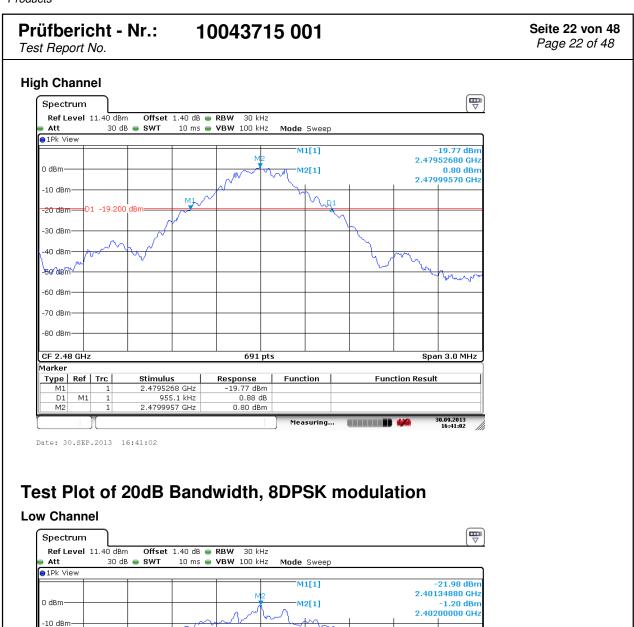
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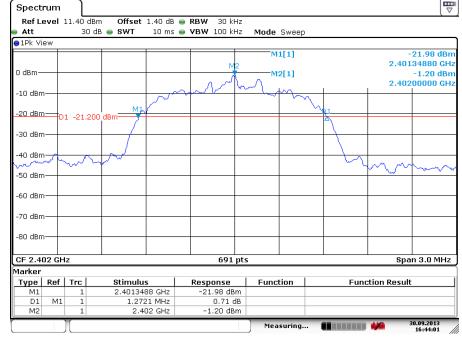
Middle Channel



Date: 30.SEP.2013 16:40:24







Date: 30.SEP.2013 16:44:01



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5.1.4 99% Bandwidth

RESULT: Passed

Test standard : RSS-Gen (Issue 3) Dec. 2010 Basic standard : RSS-Gen (Issue 3) Dec. 2010

Kind of test site : Shielded room

Test setup

Test Channel : Low/ Middle/ High

Operation Mode : A

Ambient temperature : 22-26°C
Relative humidity : 50-65%
Atmospheric pressure : 100-103kPa

Table 11: Test result of 99% Bandwidth, GFSK modulation

Channel	Channel Frequency (MHz)	99% Bandwidth (kHz)	Limit (MHz)	Result
Low Channel	2402	876.9	/	Pass
Mid Channel	2441	876.9	876.9 /	
High Channel	2480	876.9	/	Pass

Table 12: Test result of 99% Bandwidth, PSK modulation

Channel	Channel Frequency (MHz)	99% Bandwidth (kHz)	Limit (MHz)	Result	
Low Channel	2402	1180.8	/	Pass	
Mid Channel	2441	1180.8	/	Pass	
High Channel	2480	1172.2	/	Pass	

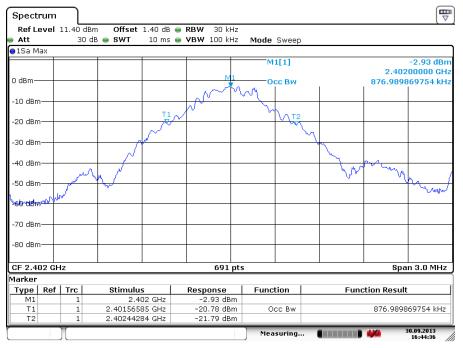


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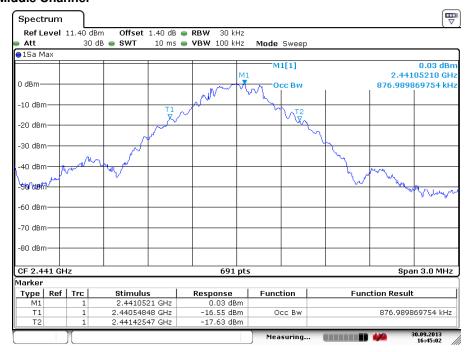
Test Plot of 99% Bandwidth, GFSK modulation

Low Channel



Date: 30.SEP.2013 16:44:36

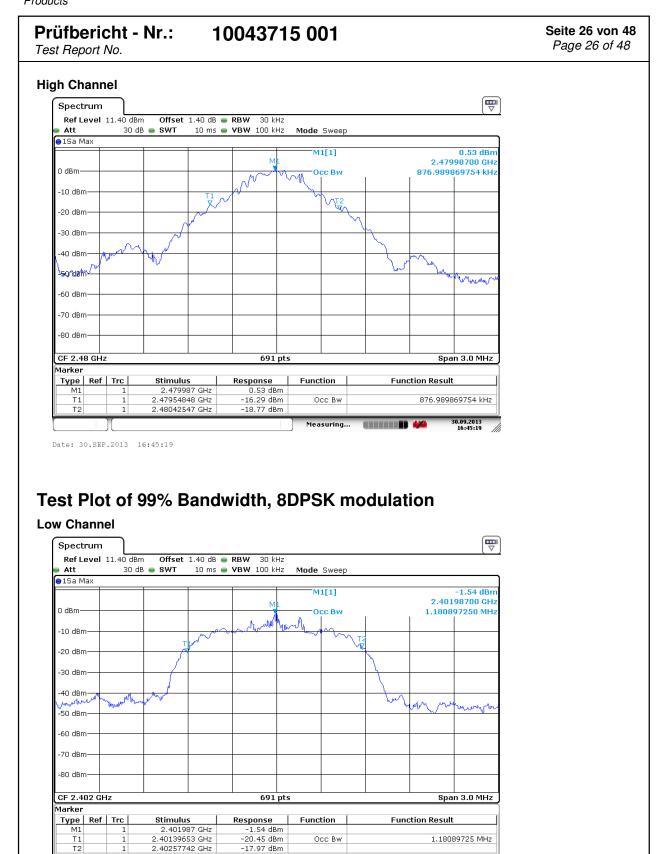
Middle Channel



Date: 30.SEP.2013 16:45:02



Date: 30.SEP.2013 16:46:17

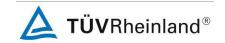


Measuring...



Produkte





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

RESULT: Passed

FCC part 15.247(d), Test standard

RSS-210 A8.5

LP0002(2011): 3.10.1, (5)

Basic standard DA 00-705 of March 30, 2000

LP0002(2011) Appendix II

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/ Middle/ High

Operation Mode

Ambient temperature 22-26°C 50-65% Atmospheric pressure 100-103 kPa

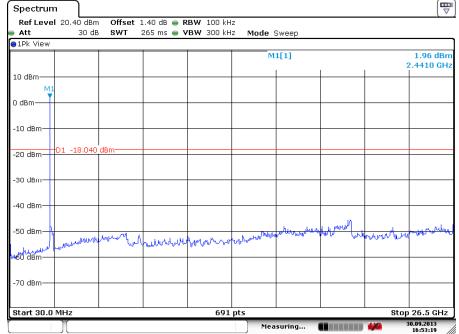
All emissions are more than 20dB below fundamental, details refer to following test plot, and compliance is achived as well.

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.



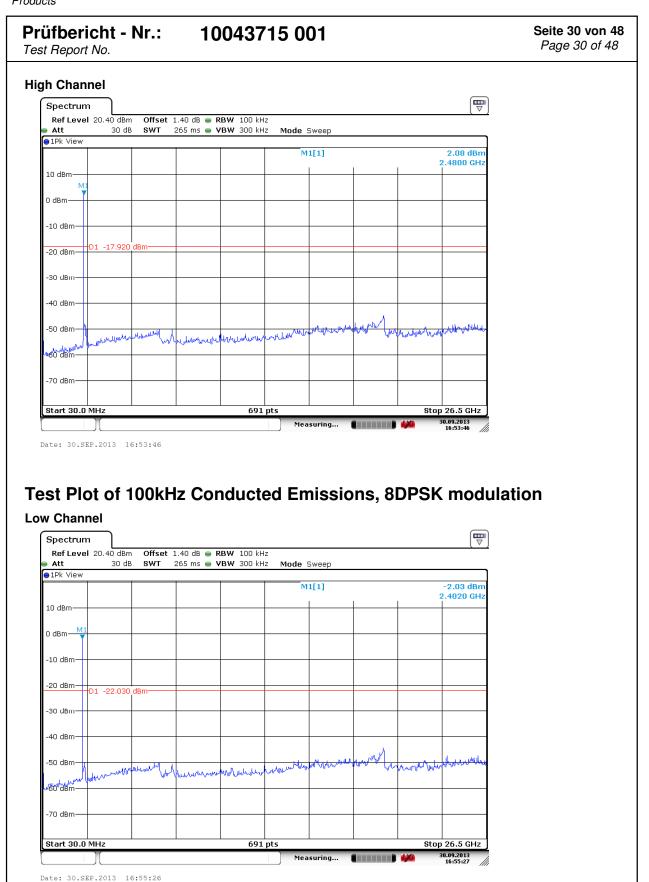
Produkte Products 10043715 001 Seite 29 von 48 Prüfbericht - Nr.: Page 29 of 48 Test Report No. Test Plot of 100kHz Conducted Emissions, GFSK modulation **Low Channel** Spectrum Ref Level 20.40 dBm Offset 1.40 dB 🖷 RBW 100 kHz 30 dB SWT 265 ms 🁄 **VBW** 300 kHz Mode Sweep ●1Pk View M1[1] -1.03 dBn 10 dBm 0 dBm--10 dBm -20 dBm-D1 -21.030 dBm -30 dBm 40 dBm -50 dBm *المتاليليليا* -460 dBm -70 dBm Start 30.0 MHz 691 pts Stop 26.5 GHz Measuring... • Date: 30.SEP.2013 16:52:42 **Middle Channel** Spectrum Ref Level 20.40 dBm Offset 1.40 dB @ RBW 100 kHz **SWT** 265 ms

VBW 300 kHz Mode Sweep ●1Pk View M1[1] 1.96 dBn 2.4410 GHz 10 dBm 0 dBm-

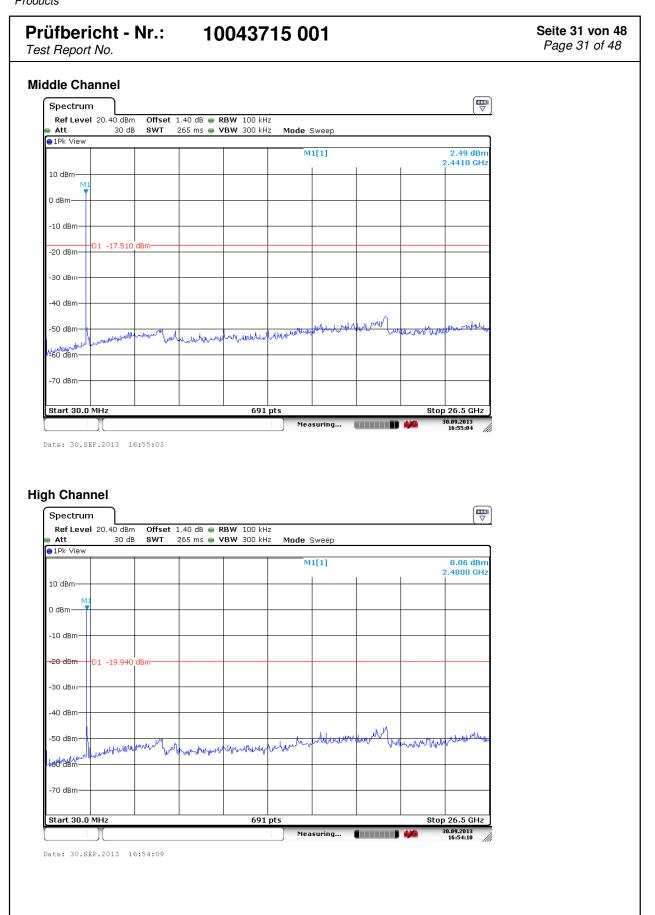


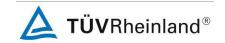
Date: 30.SEP.2013 16:53:19











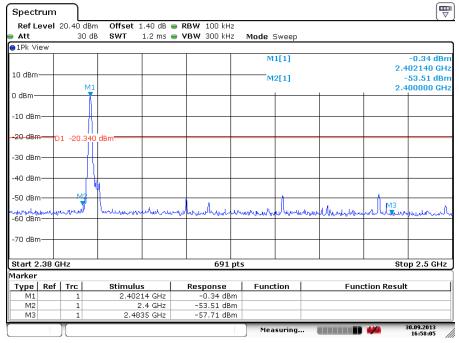
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Test Plot of 100kHz Bandwidth of Frequency Band Edge, GFSK modulation

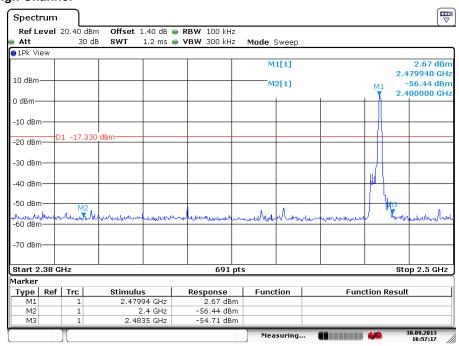
Low Channel

Test Report No.



Date: 30.SEP.2013 16:58:05

High Channel



Date: 30.SEP.2013 16:57:17



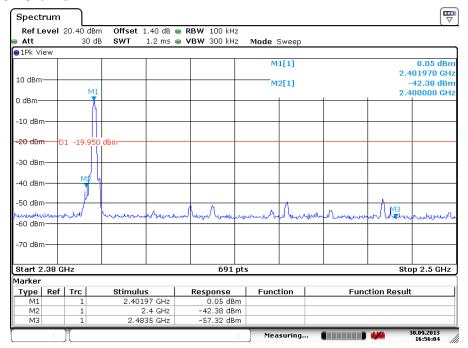
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Test Plot of 100kHz Bandwidth of Frequency Band Edge, 8DPSK modulation

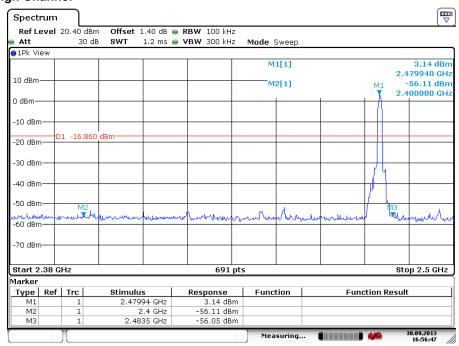
Low Channel

Test Report No.



Date: 30.SEP.2013 16:56:04

High Channel



Date: 30.SEP.2013 16:56:47



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5.1.6 Spurious Emission

RESULT: Passed

Test standard : FCC part 15.247(d), FCC 15.205, FCC 15.209, RSS-

210 2.2, RSS-210 A8.5 and RSS-Gen 7.2.1

LP0002(2011): 3.10.1, (5)

Basic standard : ANSI C63.10: 2009

Limits : Radiated emissions which fall in the restricted bands,

as defined in FCC 15.205(a) and RSS-210 2.7 (Table 1), must comply with the radiated emission limits specified in FCC 15.209(a) and RSS-210 2.7 (Table

2 and 3).

Radiated emissions which fall in the restricted bands, as defined in LP0002(2011): 2.7, must comply with

the radiated emission limits specified in

LP0002(2011): 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), RSS-210 2.7 (Table 2 and 3) and RSS-210 A2.9(a). Emission radiated outside the specified frequency bands must comply with the radiated emission limits

specified in LP0002(2011): 2.8

Kind of test site : 3m Semi-Anechoic Chamber

Test setup

Test Channel : Low/ Middle/ High

Operation Mode : A, B

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.



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5.1.7 Frequency Separation

RESULT: Passed

Test standard FCC part 15.247(a)(1)

RSS-210 A8.1(b)

LP0002(2011): 3.10.1, (6.1.1)

Basic standard DA 00-705 of March 30, 2000

LP0002(2011) Appendix II

≥ 25kHz or 2/3 of 20dB bandwidth, whichever is greater Limit

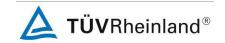
Test setup

Test Channel Low/ Middle/ High

Operation Mode Ambient temperature **24**℃ 53% Relative humidity

Table 13: Test result of Frequency Separation

Channel	Channel Frequency (MHz)	Measured Channel Separation (MHz)	Limit (kHz)	Result
Record Channel	2441		> 05111 0/0 (
Record Channel adj 1	2440	1	≥ 25kHz or 2/3 of 20dB bandwidth	Pass
Record Channel adj 2	2442		200B bandwidth	



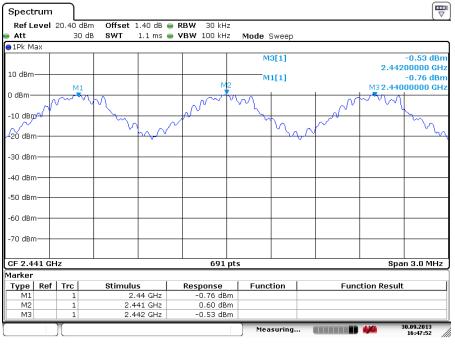
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Test Plot of Frequency Separation

GFSK



Date: 30.SEP.2013 16:47:52



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5.1.8 Number of hopping frequency

RESULT: Passed

Test standard FCC part 15.247(a)(1)(iii)

RSS-210 A8.1(d)

LP0002(2011): 3.10.1, (6.1.2)

Basic standard DA 00-705 of March 30, 2000 :

LP0002(2011) Appendix II

Limits ≥ 15 non-overlapping channels

Kind of test site Shield room

Test setup

Test Channel Low/ Middle/ High

Operation Mode Α

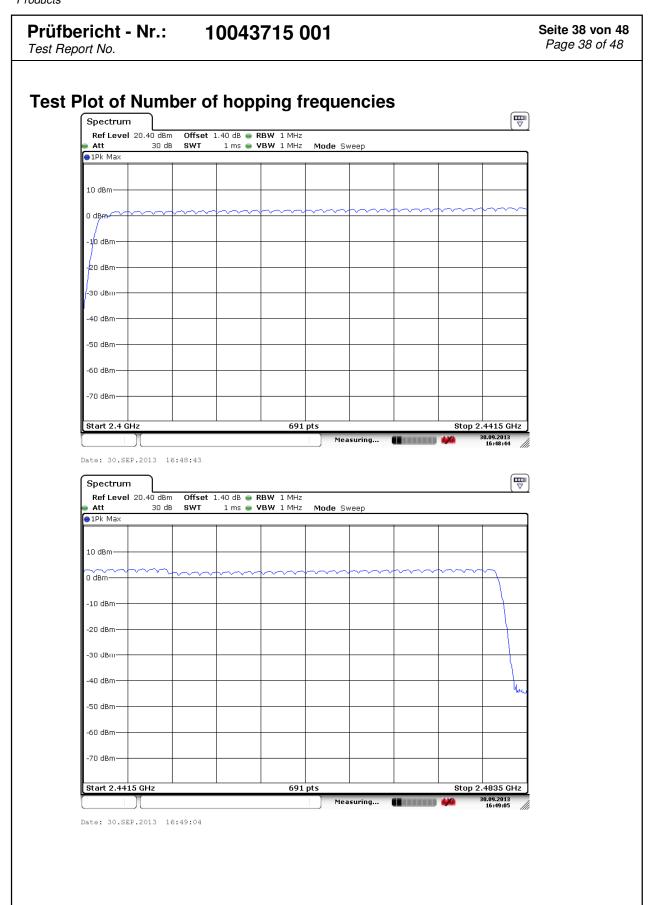
Ambient temperature : 22-26°C 50-65% Relative humidity Atmospheric pressure : 100-103 kPa

Table 14: Test result of Number of hopping frequency

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



Products





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5.1.9 Time of Occupancy

RESULT: Passed

Test standard : FCC part 15.247(a)(1)(iii)

RSS-210 A8.1(d)

LP0002(2011): 3.10.1, (6.1.2)

Basic standard : DA 00-705 of March 30, 2000

LP0002(2011) Appendix II

Limits : 0.4s

Kind of test site : Shield room

Test setup

Test Channel : Low/ Middle/ High

Operation Mode : A

Ambient temperature : 22-26°C
Relative humidity : 50-65%
Atmospheric pressure : 100-103 kPa

Table 15: Test result of Time of Occupancy

Data Mode	Captured Burst (s)	Dwell time (s)	On+Off time (s)	Limit (s)	Result
DH5	0.0030	0.3151	0.003754	0.4	Pass
3DH5	0.0025	0.2626	0.003754	0.4	Pass

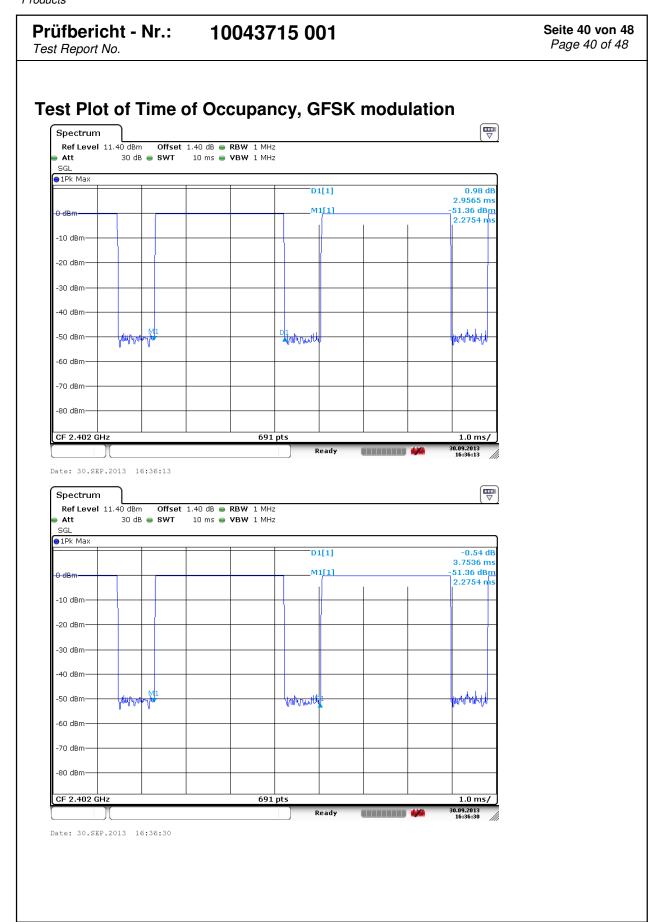
Note:

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

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

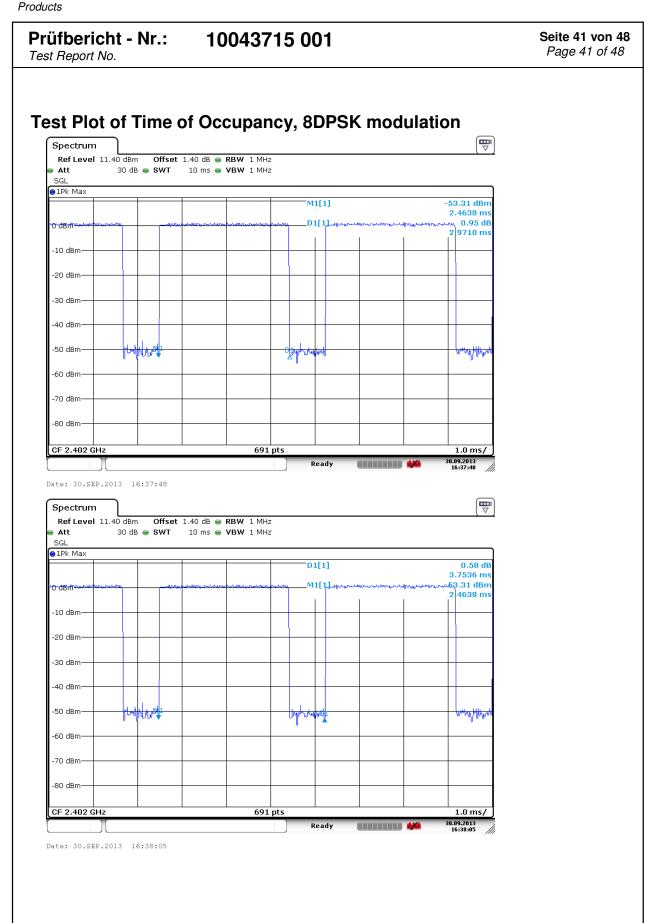


Products





Produkte





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5.2 Mains Emissions

5.2.1 Mains Conducted Emissions

RESULT: Passed

Test standard FCC Part 15.207

FCC Part 15.107 LP0002(2011): 2.3

Limits Mains Conducted emissions as defined in

above standards

Kind of test site Shielded Room

Test setup

Test Channel Middle Operation mode

Remark: For details refer to Appendix D.



Products

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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 <10mW, hence the EUT is exclueded from SAR evaluation according to FCC KDB publication 447498 D01: Mobile Portable RF Exposure.

The enclosure provides a separation distance of > 5 mm to the antenna system.



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7. Photographs of the Test Set-Up

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

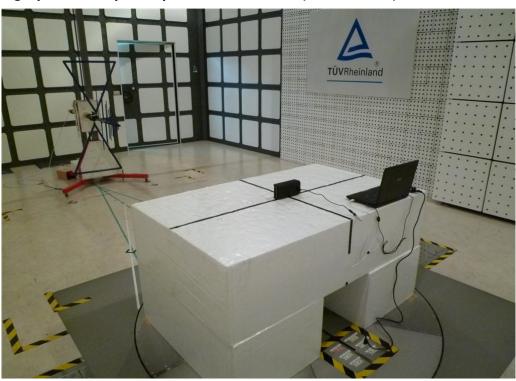




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Photograph 2: Set-up for Spurious Emissions (Back View 1)



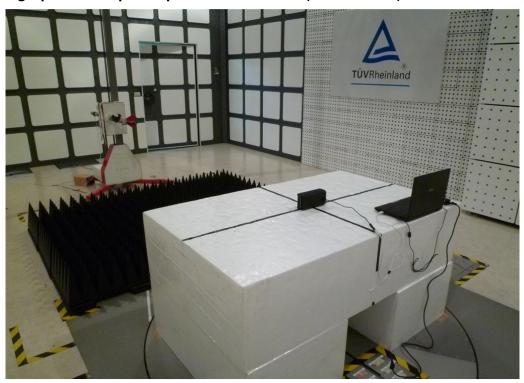


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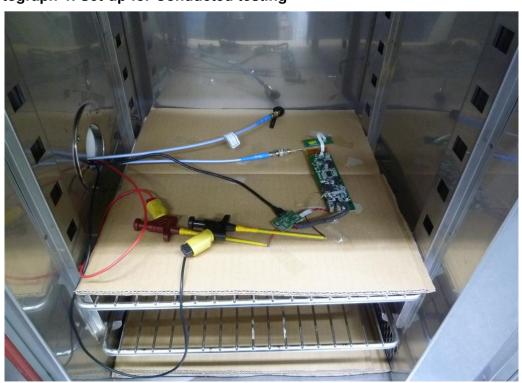
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Photograph 3: Set-up for Spurious Emissions (Back View 2)



Photograph 4: Set-up for Conducted testing

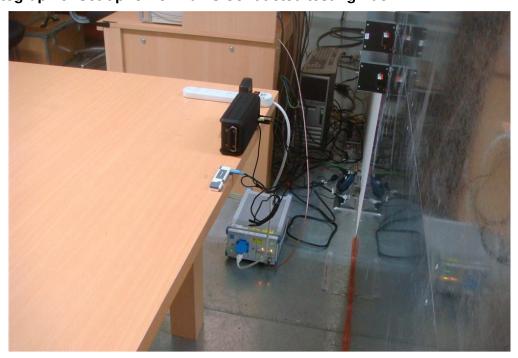




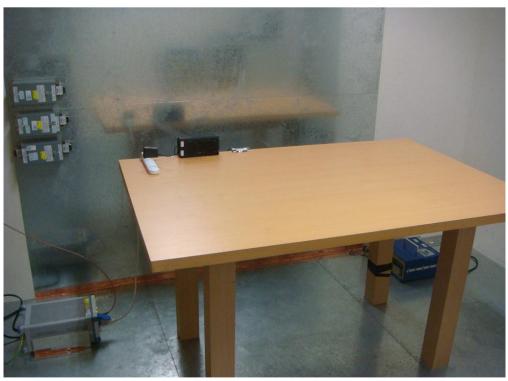
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Photograph 5: Set-up for Mains Conducted testing Back



Photograph 6: Set-up for Mains Conducted testing Front





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