

Prüfbericht-Nr.: Test Report No.:	50130212 001	Auftrags-Nr.: Order No.:	114073037	Seite 1 von 27 Page 1 of 27
Kunden-Referenz-Nr.: Client Reference No.:	N/A	Auftragsdatum: Order date:	15-Dec-2017	
Auftraggeber: Client:	Beijing Noitom Technology Ltd., 502, Tower A, 28 Xijiekouwai Blvd, Beijing, China			
Prüfgegenstand: Test item:	Noitom Hi5 VR Glove			
Bezeichnung / Typ-Nr.: Identification / Type No.:	NTM-Hi5-BE-RG-01; NTM-Hi5-DK-RG-01			
Auftrags-Inhalt: Order content:	FCC Part 15C Test Report			
Prüfgrundlage: Test specification:	FCC 47CFR Part 15: Subpart C Section 15.249			
Wareneingangsdatum: Date of receipt:	5-Jan-2018			
Prüfmuster-Nr.: Test sample No.:	A000678775-001 A000678775-003			
Prüfzeitraum: Testing period:	1-Mar-2018 - 9-Mar-2018			
Ort der Prüfung: Place of testing:	EMC Laboratory Taipei			
Prüflaboratorium: Testing laboratory:	TUV Rheinland Taiwan Ltd.			
Prüfergebnis*: Test result*:	Pass			
geprüft von / tested by:  14-Mar-2018 Brenda Chen/Project Engineer		kontrolliert von / reviewed by:  14-Mar-2018 Arvin Ho/Vice General Manager		
Datum Date	Name / Stellung Name / Position	Unterschrift Signature	Datum Date	Name / Stellung Name / Position
Sonstiges / Other: Note: NTM-Hi5-BE-RG-01 and NTM-Hi5-DK-RG-01 are identical except NTM-Hi5-BE-RG-01 contains a sensor near wrist which does not affect RF performance. All of the testing are executed by NTM-Hi5-BE-RG-01.				
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:		Prüfmuster vollständig und unbeschädigt Test item complete and undamaged		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) 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. This test report only relates to the a. m. test sample. 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 test mark.				

TEST SUMMARY

5.1.1 ANTENNA REQUIREMENT

RESULT: Passed

5.1.2 FIELD STRENGTH OF FUNDAMENTAL

RESULT: Passed

5.1.3 99% BANDWIDTH

RESULT: Passed

5.1.4 SPURIOUS EMISSION

RESULT: Passed

6.1.1 ELECTROMAGNETIC FIELDS

RESULT: Passed

Contents

1.	GENERAL REMARKS	5
1.1	COMPLEMENTARY MATERIALS.....	5
2.	TEST SITES	6
2.1	TEST LABORATORY	6
2.2	TEST FACILITY.....	6
2.3	LIST OF TEST AND MEASUREMENT INSTRUMENTS.....	7
2.4	TRACEABILITY	8
2.5	CALIBRATION	8
2.6	MEASUREMENT UNCERTAINTY	8
3.	GENERAL PRODUCT INFORMATION.....	9
3.1	PRODUCT FUNCTION AND INTENDED USE	9
3.2	RATINGS AND SYSTEM DETAILS.....	9
3.3	INDEPENDENT OPERATION MODES.....	10
3.4	NOISE GENERATING AND NOISE SUPPRESSING PARTS	10
3.5	SUBMITTED DOCUMENTS.....	10
4.	TEST SET-UP AND OPERATION MODES.....	11
4.1	PRINCIPLE OF CONFIGURATION SELECTION	11
4.2	TEST OPERATION AND TEST SOFTWARE.....	11
4.3	SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT	11
4.4	COUNTERMEASURES TO ACHIEVE EMC COMPLIANCE.....	12
4.5	TEST SETUP DIAGRAM	12
5.	TEST RESULTS	14
5.1	TRANSMITTER REQUIREMENT & TEST SUITES.....	14
5.1.1	<i>Antenna Requirement</i>	<i>14</i>
5.1.2	<i>Field strength of fundamental.....</i>	<i>15</i>
5.1.3	<i>99% Bandwidth</i>	<i>18</i>
5.1.4	<i>Spurious Emission</i>	<i>21</i>
6.	SAFETY HUMAN EXPOSURE	22
6.1	RADIO FREQUENCY EXPOSURE COMPLIANCE	22
6.1.1	<i>Electromagnetic Fields.....</i>	<i>22</i>
7.	PHOTOGRAPHS OF THE TEST SET-UP.....	23

Prüfbericht - Nr.: 50130212 001
Test Report No.

Seite 4 von 27
Page 4 of 27

8.	LIST OF TABLES	27
9.	LIST OF PHOTOGRAPHS.....	27

1. General Remarks

1.1 Complementary Materials

These attachments are integral parts of this test report. :

Appendix P: Photo Documentation

(File Name: 50130212APPENDIX P)

Appendix D: Test Result of Radiated Emissions

(File Name: 50130212APPENDIX D)

Test Specifications

The following standards were applied

Table 1: Applied Standard and Test Levels

Radio
FCC 47CFR Part 15: Subpart C Section 15.249 ANSI C63.10:2013

2. Test Sites

2.1 Test Laboratory

TUV Rheinland Taiwan Ltd.
Taichung Branch Office

No.9, Lane 36, Minsheng Rd., Sec. 3, Daya District,
Taichung City 428
Taiwan (R.O.C.)

2.2 Test Facility

TUV Rheinland Taiwan Ltd.
Taipei Office

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

FCC Registration No.: 340738
IC Canada Registration No.: 9465A-1
TAF Accredited NCC Test Lab. No.:0759
TAF ISO17025 Certification effective periods: 2013-Jul-1st to 2016-Jun-30th



Testing Laboratory
0759

2.3 List of Test and Measurement Instruments

Table 2: List of Test and Measurement Equipment

Kind of Equipment	Manu-facturer	Type	S/N	Last Calibration	Next Calibration
Test Software	Farad	EZ EMC	Ver. TUV3A1	N/A	N/A
EMI Test Receiver	R&S	ESR 7	101549	2017/11/10	2018/11/10
Spectrum Analyzer	R&S	FSV 40	100921	2017/05/02	2018/05/01
Spectrum Analyzer	Agilent	N9010A	MY53470241	2017/05/23	2018/05/22
Preamplifier (30MHz -1GHz)	HP	8447F	2805A03335	2017/08/14	2018/08/14
Preamplifier (18 GHz -40 GHz)	COM-POWER	PAM-840	461257	2018/01/18	2019/01/18
Pre-Amplifier (1GHz~18GHz)	EM Electronics	EM01G18G	60558	2017/11/21	2018/11/21
Bilog Antenna	TESEQ	CBL6111D	29804	2017/08/18	2018/08/18
Horn Antenna	ETS-Lindgren	3117	201918	2017/08/18	2018/08/18
Horn Antenna (18GHz~40GHz)	COM-POWER	AH-840	101029	2017/11/28	2018/11/28
Loop Antenna	Schwarzbeck	FMZB 1513	1513-076	2017/06/14	2018/06/14
EMI Test Receiver	R&S	ESR 7	101549	2017/11/10	2018/11/10
Spectrum Analyzer	R&S	FSL3	101943	2015/09/07	2018/09/07
Temp. & Humid. Chamber	Giant Force	GCT-099-40-S	MAF0103-007	2017/03/09	2019/03/09
LISN (1 phase)	R&S	ENV216	101243	2017/06/18	2018/06/18
LISN	R&S	ENV216	101262	2017/06/22	2018/06/21

2.4 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.

2.5 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.

2.6 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
RF power, conducted	$\pm 1.5 \text{ dB}$
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 EUT is a Noitom Hi5 VR Glove Transceiver. It contains a 2.4GHz module enabling the user to communicate data through a Wireless interface.
For details refer to the User Guide, Data Sheet and Circuit Diagram.

3.2 Ratings and System Details

Table 4: Basic Information of EUT

Item	EUT information
Kind of Equipment	Noitom Hi5 VR Glove
Type Designation	NTM-Hi5-BE-RG-01; NTM-Hi5-DK-RG-01
FCC ID	2ABTR-HI5-RG-01

Table 5: Technical Specification of EUT

Technical Specification	Value
Operating Frequencies	2407~2479 MHz
Channel Spacing	2 MHz minimum
Channel number	15
Operation Voltage	1.5Vdc
Modulation	GFSK

3.3 Independent Operation Modes

Basic operation modes are:

- A. Transmitting
 - 1. Low channel
 - 2. Middle channel
 - 3. High channel

3.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.5 Submitted Documents

- Circuit Diagram
- Instruction Manual
- Rating Label
- Technical Description

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

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

4.2 Test Operation and Test Software

Setup for testing: Test samples are provided with a button which makes it possible to control them.

It was used to enable the operation modes listed in section 3.3 as appropriate.

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:

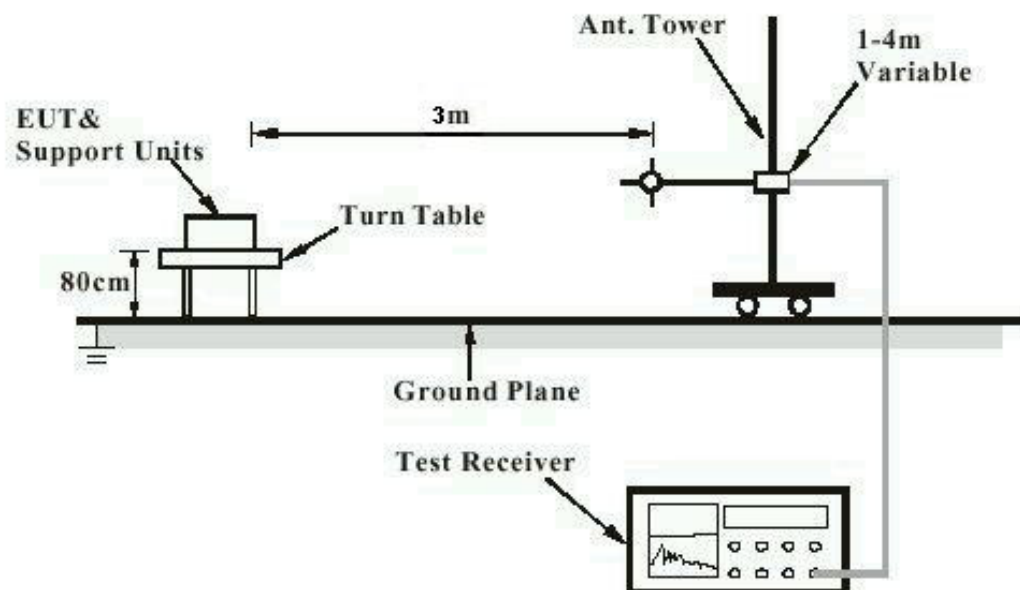
N/A

4.4 Countermeasures to achieve EMC Compliance

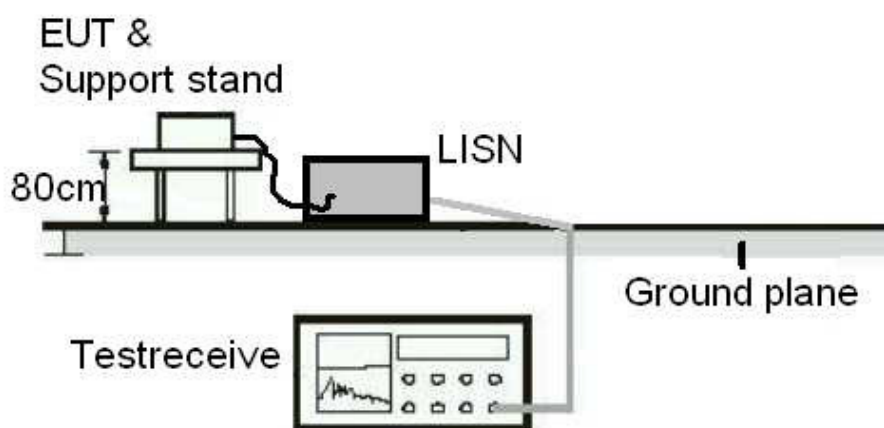
The test sample which has been tested contained the noise suppression parts as described in the Constructional Data Form or the Technical Construction File. No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



Note: Measurements above 1 GHz are done with a table height of 1.5m

Diagram of Measurement Equipment Configuration for Mains Conduction Measurement (if applicable)

5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:**Passed**

Standard : LP0002(2018): 2.2
Part 15.203 and RSS-Gen 7.1.4
Requirement : use of approved antennas only

The antenna is a FPC antenna 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.

5.1.2 Field strength of fundamental

RESULT:

Passed

Test standard	:	FCC Part 15.249(a), RSS-210 B.10 LP0002: 3.10.2(2)
Basic standard	:	ANSI C63.10:2013
Kind of test site	:	Semi-Anechoic Chamber

Test setup

Test Channel	:	Low/ Middle/ High
Operation Mode	:	A
Atmospheric pressure	:	100-103 kPa

In the table below the maximum results found are reported.

For graphics of results of frequencies tested, please refer to Appendix D.

The EUT employs pulsed operation.
The pulse width is: 0.405 msec.
Pulse repetition interval:

The Tables below show calculated average values from the pulsed emissions measurement data, corrected with the worst case duty cycle factor over 9.975 msec.

The average values noted are calculated through the application of a duty cycle correction, according to part 15.35c

Duty cycle calculation:
Duty cycle correction (dB) = $20 \log (0.405 \text{ msec} / 9.975 \text{ msec}) = -27.83 \text{ dB}$.

Test Plot pulse width

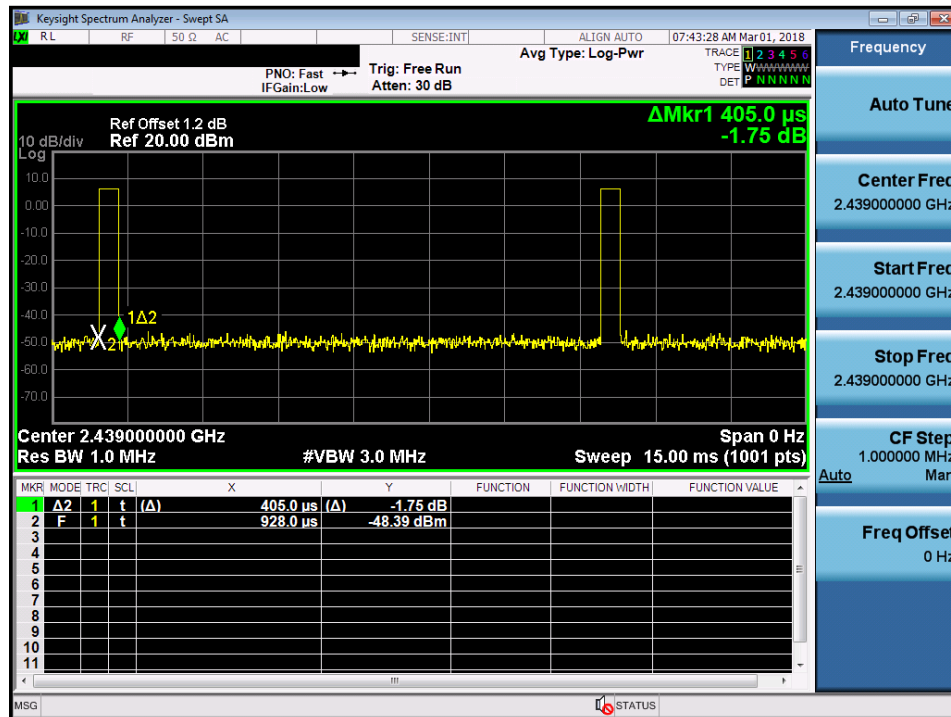
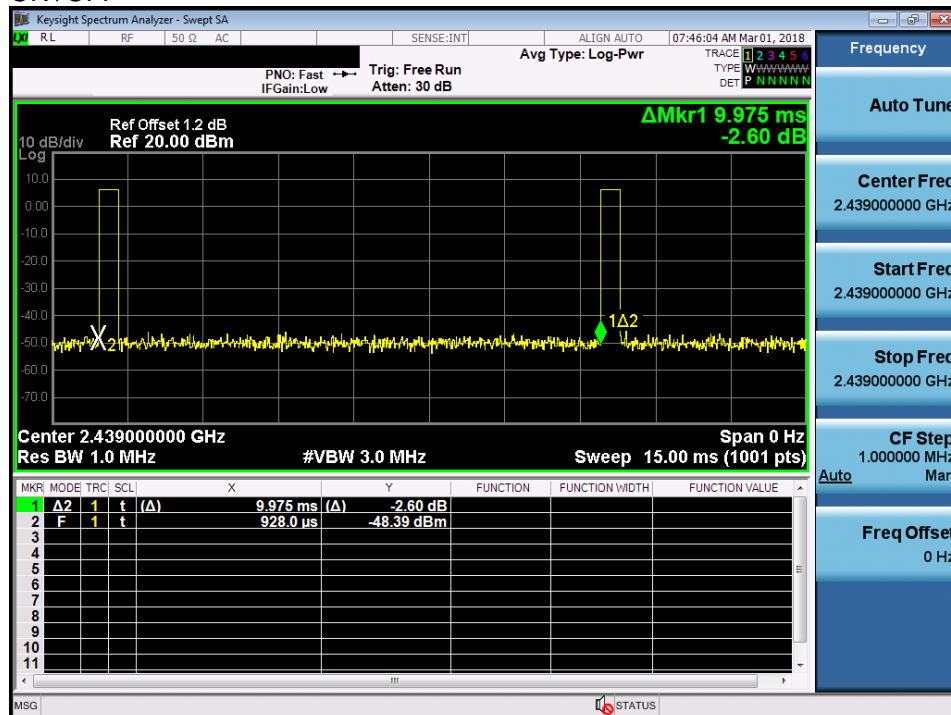
ON

ON+OFF


Table 6: Test result of Field strength of fundamental

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Antenna orientation	Detector or calculated value
2407	100.3	114	Horizontal	Peak
2407	72.46	94		Average
2407	102.41	114	Vertical	Peak
2407	74.57	94		Average
2439	100.08	114	Horizontal	Peak
2439	72.24	94		Average
2439	100.16	114	Vertical	Peak
2439	72.32	94		Average
2479	99.12	114	Horizontal	Peak
2479	71.28	94		Average
2479	98.44	114	Vertical	Peak
2479	70.6	94		Average

5.1.3 99% Bandwidth

RESULT:**Passed**

Test standard : RSS-Gen
Basic standard : ANSI C63.10:2013,
Kind of test site : Semi-Anechoic Chamber

Test setup

Test Channel : Low/ Middle/ High
Operation Mode : A

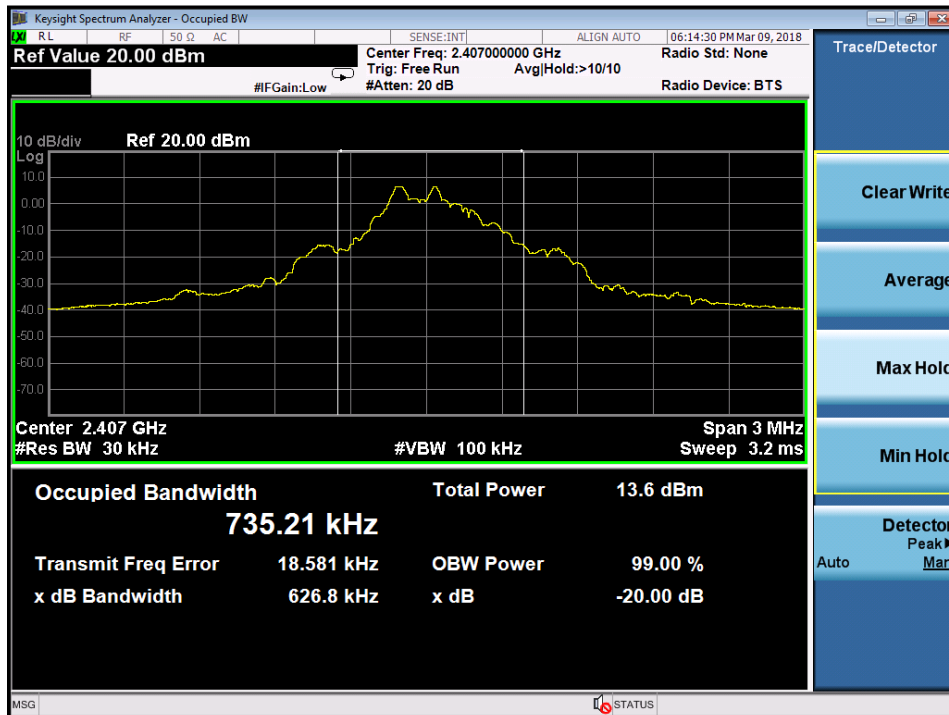
Ambient temperature : 22-26 °C
Relative humidity : 50-65 %
Atmospheric pressure : 100-103 kPa

Table 7: Test result of 99% Bandwidth,

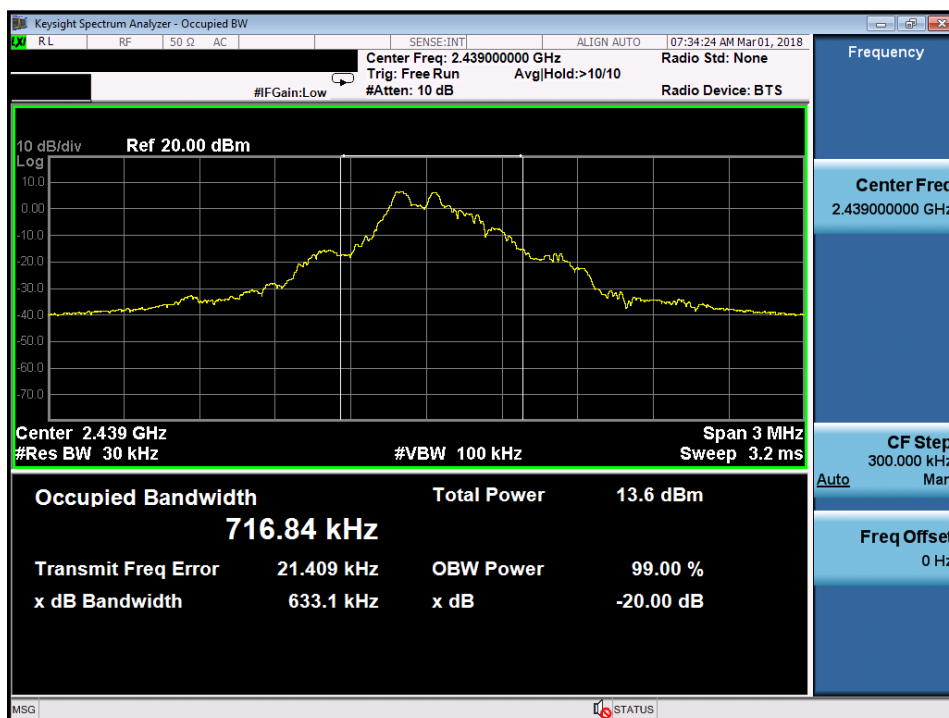
Channel	Channel Frequency (MHz)	99% Bandwidth (kHz)
Low Channel	2407	735.21
Mid Channel	2439	716.84
High Channel	2479	728.77

Test Plot of 99% Bandwidth

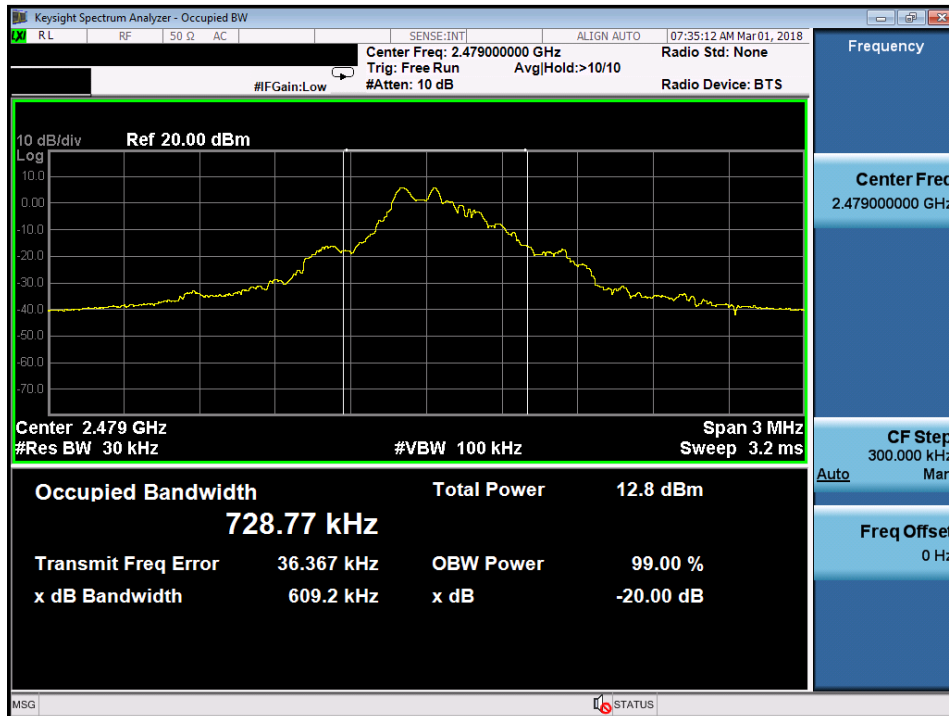
Low Channel



Middle Channel



High Channel



5.1.4 Spurious Emission

RESULT:**Passed**

Test standard	:	FCC part 15.249(d), FCC 15.205, FCC 15.209, RSS-210 2.2, RSS-210 B.10(b), RSS-Gen 7.2.1
Basic standard	:	LP0002: 2.8
Limits	:	ANSI C63.10:2013
	:	Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a), must comply with the radiated emission limits specified in FCC 15.209(a). 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).
Kind of test site	:	3m Semi-Anechoic Chamber

Test setup

Test Channel	:	Low/ Middle/ High
Operation mode	:	A

Remark: Testing was carried out within frequency range 30MHz to the tenth harmonic.

For details refer to Appendix D.

The Radiated Emissions testing was performed in the X, Y and Z axis orientation. The worst-case Axis orientation is 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.

6. Safety Human exposure

6.1 Radio Frequency Exposure Compliance

6.1.1 Electromagnetic Fields

RESULT:**Passed**

Test standard : FCC KDB Publication 447498 D01 v06
RSS-102 issue 5, Table 1

FCC:

Since maximum peak output power of the transmitter is 0.00048 mW < 10mW, hence the EUT is excluded from SAR evaluation according to FCC KDB publication 447498: Mobile Portable RF Exposure

Canada:

Maximum conducted Average power: 0.00057 mW

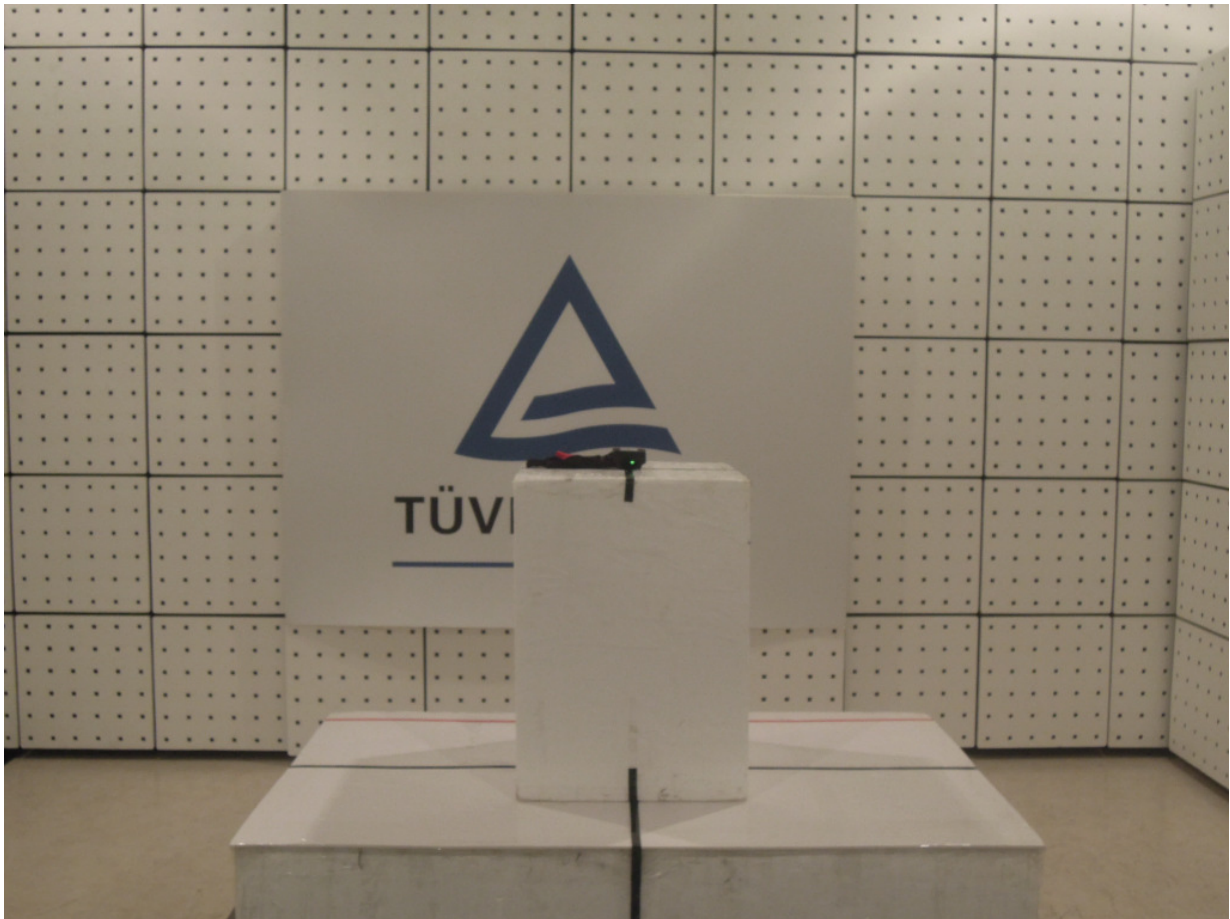
Antenna Gain: x2.5 dBi -> x 1.778

Maximum Power available: 0.001013 mW

Since maximum output power, either EIRP or conducted, of the transmitter < 4mW, hence the EUT is excluded from SAR evaluation according to Table 1 in RSS-102

7. Photographs of the Test Set-Up

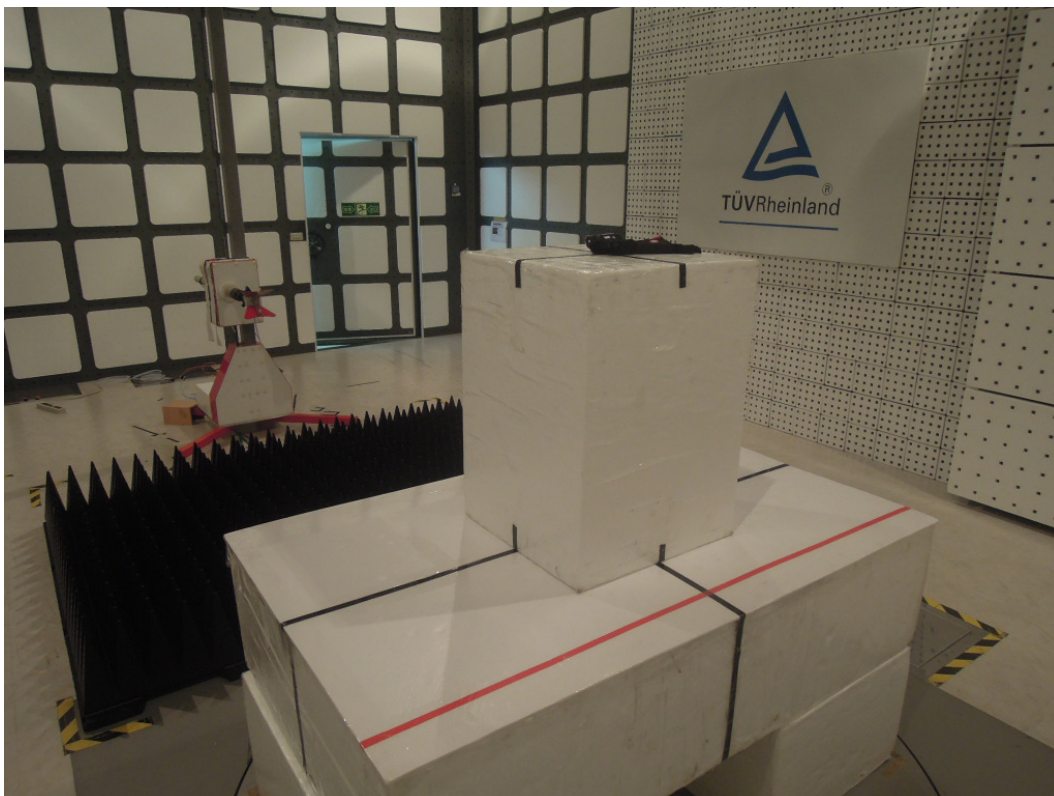
Photograph 1: Set-up for Radiated Emissions (Front View)



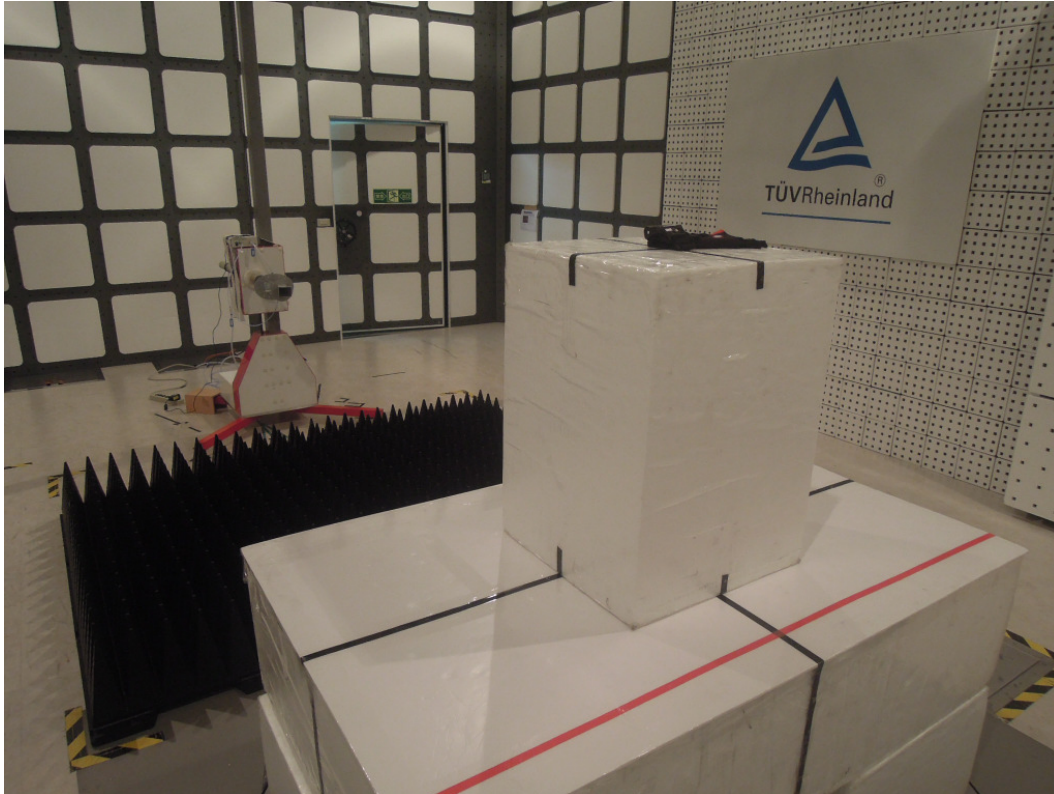
Photograph 2: Set-up for Radiated Emissions (Back View 1)



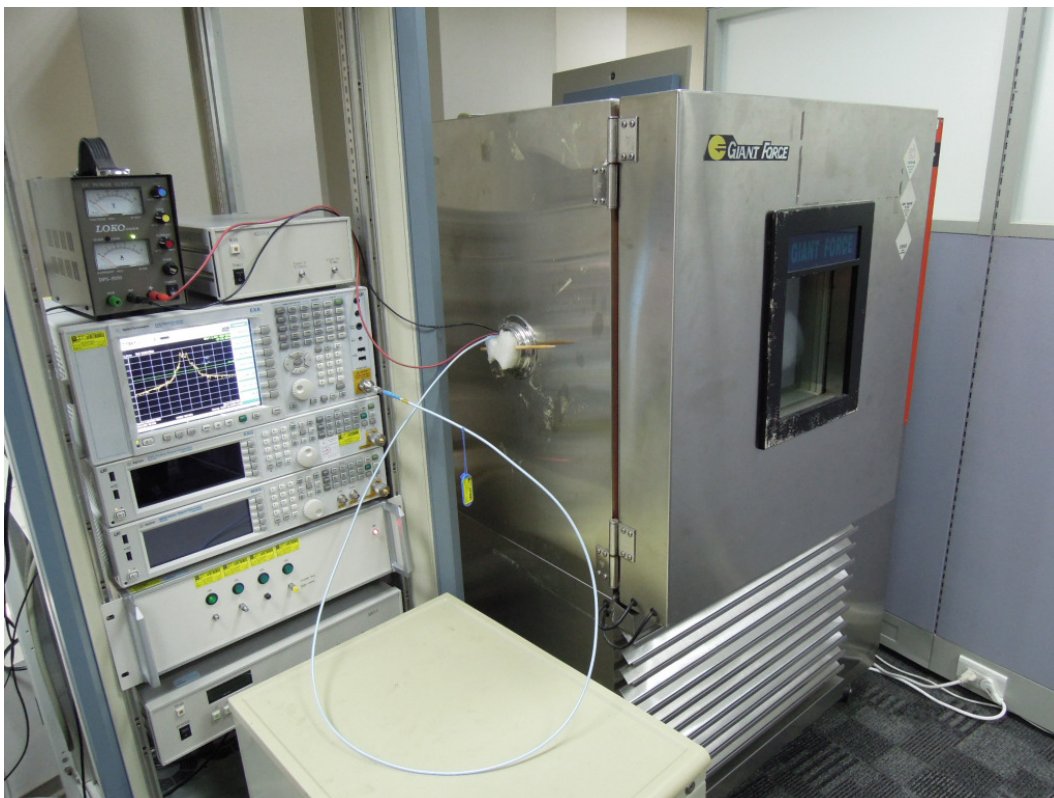
Photograph 3: Set-up for Radiated Emissions (Back View 2)



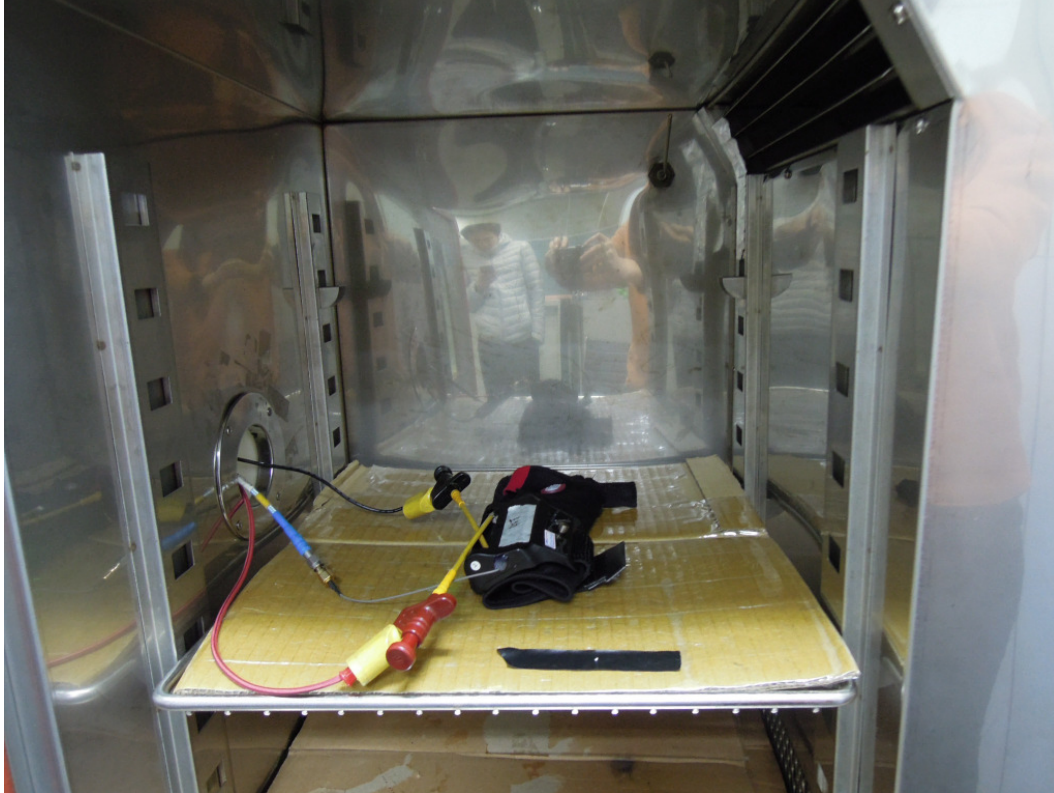
Photograph 4: Set-up for Radiated Emissions (Back View 3)



Photograph 5: Set-up for Conducted testing



Photograph 6: Set-up for Conducted testing



8. List of Tables

Table 1: Applied Standard and Test Levels	5
Table 2: List of Test and Measurement Equipment	7
Table 3: Emission Measurement Uncertainty.....	8
Table 4: Basic Information of EUT	9
Table 5: Technical Specification of EUT	9
Table 6: Test result of Field strength of fundamental	17
Table 7: Test result of 99% Bandwidth,.....	18

9. List of Photographs

Photograph 1: Set-up for Radiated Emissions (Front View)	23
Photograph 2: Set-up for Radiated Emissions (Back View 1)	24
Photograph 3: Set-up for Radiated Emissions (Back View 2)	24
Photograph 4: Set-up for Radiated Emissions (Back View 3)	25
Photograph 5: Set-up for Conducted testing	25
Photograph 6: Set-up for Conducted testing	26