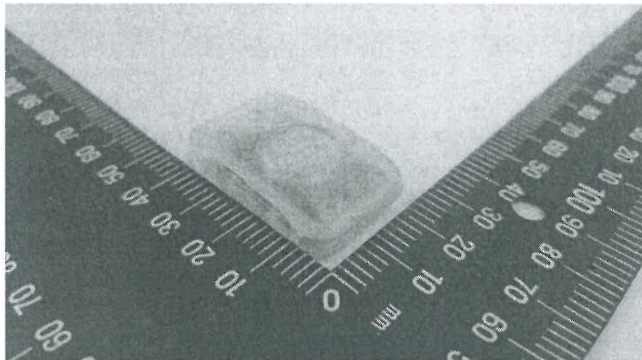


<b>Prüfbericht-Nr.:</b> Test Report No.:	<b>50048435 001</b>	<b>Auftrags-Nr.:</b> Order No.:	<b>114052370</b>	<b>Seite 1 von 31</b> Page 1 of 31
<b>Kunden-Referenz-Nr.:</b> Client Reference No.:	<b>N/A</b>	<b>Auftragsdatum:</b> Order date:	<b>17-Jun-2016</b>	
<b>Auftraggeber:</b> Client:	<b>Indagem Tech LLC</b> 20142 Ocean Key Drive, Boca Raton FL 33498 U.S.A			
<b>Prüfgegenstand:</b> Test item:	<b>UMS</b>			
<b>Bezeichnung / Typ-Nr.:</b> Identification / Type No.:	<b>CS01</b>			
<b>Auftrags-Inhalt:</b> Order content:	<b>FCC Part15C Test report (BLE)</b>			
<b>Prüfgrundlage:</b> Test specification:	<b>FCC 47CFR Part 15: Subpart C Section 15.247</b>			
<b>Wareneingangsdatum:</b> Date of receipt:	<b>23-Jun-2016</b>			
<b>Prüfmuster-Nr.:</b> Test sample No.:	<b>A000383619-001</b> <b>A000383619-002</b>			
<b>Prüfzeitraum:</b> Testing period:	<b>27-Jun-2016 - 30-Jun-2016</b>			
<b>Ort der Prüfung:</b> Place of testing:	<b>EMC/RF Laboratory Taipei</b>			
<b>Prüflaboratorium:</b> Testing laboratory:	<b>TUV Rheinland Taiwan Ltd.</b>			
<b>Prüfergebnis*:</b> Test result*:	<b>Pass</b>			
<b>Report date / tested by:</b>		<b>kontrolliert von / reviewed by:</b>		
2016-08-05 Amy S.R.Hsu /Engineer		2016-08-05 Rene Charton/Senior Project Manager		
Datum	Name / Stellung	Unterschrift	Datum	Name / Stellung
Date	Name / Position	Signature	Date	Name / Position
<b>Sonstiges / Other:</b>				
<b>Zustand des Prüfgegenstandes bei Anlieferung:</b> Condition of the test item at delivery:		<b>Prüfmuster vollständig und unbeschädigt</b> Test item complete and undamaged		
<p>* 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</p> <p>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</p>				
<p><b>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.</b>  <b>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.</b></p>				

## TEST SUMMARY

### **5.1.1 ANTENNA REQUIREMENT**

*RESULT: Passed*

### **5.1.2 PEAK OUTPUT POWER**

*RESULT: Passed*

### **5.1.3 6dB BANDWIDTH**

*RESULT: Passed*

### **5.1.4 POWER DENSITY**

*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*

### **6.1.1 ELECTROMAGNETIC FIELDS**

*RESULT: Passed*

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## 1. General Remarks

### 1.1 Complementary Materials

These attachments are integral parts of this test report:

**Appendix P: Photo Documentation internal view**  
(File Name: 50048435APPENDIX P)

**Appendix D: Test Result of Radiated Emissions**  
(File Name: 50048435APPENDIX D)

Test Specifications

The following standards were applied.

**Table 1: Applied Standard and Test Levels**

Radio
FCC CFR47 Part 15: Subpart C Section 15.247 ANSI C63.10:2013 KDB558074 D01 DTS Meas Guidance v02

## 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.: 365730  
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	ESR7	101062	2015/09/10	2016/09/10
Spectrum Analyzer	R&S	FSV 40	100921	2016/04/21	2017/04/21
Spectrum Analyzer	Agilent	N9010A	MY53470241	2016/04/25	2017/04/24
Preamplifier (30MHz -1GHz)	HP	8447F	2805A03335	2015/08/31	2016/08/31
Preamplifier (18 GHz -40 GHz)	COM-POWER	PAM-840	461257	2015/11/19	2016/11/19
Pre-Amplifier (1GHz~18GHz)	EM Electronics	EM01G18G	060558	2015/11/19	2016/11/19
Bilog Antenna	TESEQ	CBL6111D	29802	2014/07/04	2016/07/04
Horn Antenna	ETS-Lindgren	3117	138160	2016/05/03	2017/05/03
Horn Antenna (18GHz~40GHz)	COM-POWER	AH840	101031	2015/11/02	2016/11/02
Loop Antenna	Schwarzbeck	FMZB 1513	1513-076	2016/05/11	2017/05/11
EMI Test Receiver	R&S	ESCI7	100797	2015/12/28	2016/12/27
Spectrum Analyzer	R&S	FSL3	101943	2015/09/07	2016/09/07
Temp. & Humid. Chamber	Giant Force	GCT-099-40-S	MAF0103-007	2015/07/13	2016/07/12
LISN	R&S	ENV216	101262	2016/06/16	2017/06/16
Test Software	Audix	e3	Ver. 9	N/A	N/A
Test Software	Agilent	300328 testsystem	V1.9.1	N/A	N/A
Power sensor	Agilent	U2021XA	MY53480013	2016/03/11	2017/03/10
Signal Generator	R&S	SMU200	104260	2015/09/06	2016/09/05

## 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 in a suitably accredited Calibration Lab. Additionally all equipment is verified for proper performance on a regular schedule using in house standards or comparisons.

## 2.6 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements .

**Table 3: Emission Measurement Uncertainty**

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-7}$
RF power, conducted	$\pm 1.5$ dB
RF power density, conducted	$\pm 3$ dB
spurious emissions, conducted	$\pm 3$ dB
all emissions, radiated	$\pm 6$ dB
Temperature	$\pm 1$ °C
Humidity	$\pm 5$ %
DC and low frequency voltages	$\pm 3$ %



## 3. General Product Information

### 3.1 Product Function and Intended Use

The EUT is a Bluetooth SensorTag. It contains a Bluetooth BLE compatible 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 System Details and Ratings

**Table 4: Basic Information of EUT**

Item	EUT information
Kind of Equipment	UMS
Type Designation	CS01
FCC ID	2AI3JUMS-CS01

**Table 5: Technical Specification of EUT**

Technical Specification	Value
Operating Frequencies	2402~2480 MHz
Channel Spacing	2 MHz
Channel number	40
Operation Voltage	3.3 Vdc
Modulation	GFSK
Antenna gain	3.19 dBi

### **3.3 Independent Operation Modes**

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**

- 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 power 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 contain a button which makes it possible to control the EUT through the button to set it to transmitting on set frequencies

This software was running on the laptop computer connected to the EUT. It was used to enable the operation modes listed in section 3.3 as appropriate.

The samples were used as follows:

Conducted: A000383619-001

Radiation: A000383619-002

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:

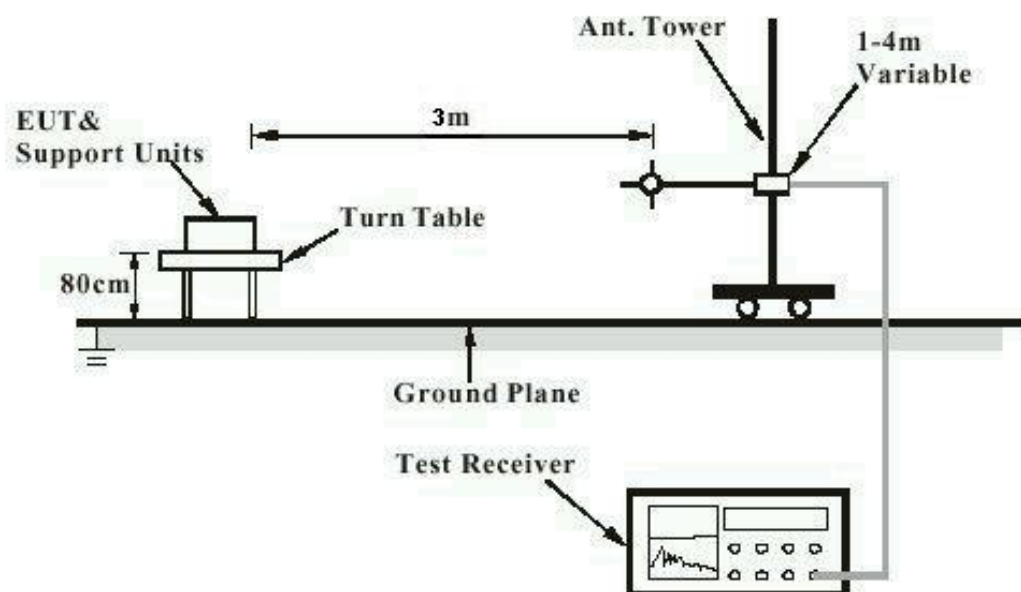
N/A

## 4.4 Countermeasures to achieve EMC Compliance

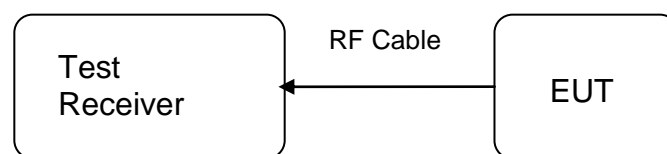
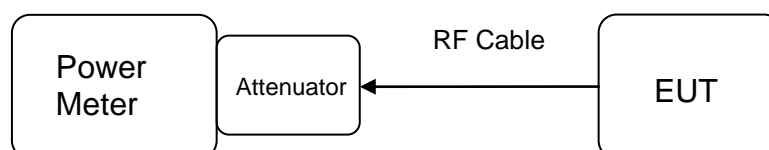
The test sample which has been tested contained the noise suppression parts as described in the Constructional Data Form or the Technical Construction File. No additional measures were employed to achieve compliance.

## 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 Conducted Transmitter Measurement****Diagram of Measurement Equipment Configuration for Conducted Transmitter Measurement (Power meter)**

## 5. Test Results

### 5.1 Transmitter Requirement & Test Suites

#### 5.1.1 Antenna Requirement

**RESULT:****Passed**

Test standard	:	LP0002(2011): 2.2, 3.10.1, (3) FCC Part 15.247(b)(4), Part 15.203 and RSS- Gen 8.3
Requirement	:	use of approved antennas only with directional gains that do not exceed 6 dBi

According to the manufacturer declaration, the EUT has an antenna with a directional gain of 3.19 dBi. The antenna is a Chip Antenna soldered to the PCB 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 Peak Output Power

**RESULT:****Passed**

Test standard : LP0002(2011): 3.10.1, (2)  
FCC Part 15.247(b)(3), RSS-247 5.4(4)  
Basic standard : ANSI C63.10:2013, KDB558074  
Limit : 1 Watt  
Kind of test site : Shielded room

**Test setup**

Test Channel : Low/ Middle/ High  
Operation Mode : A  
  
Ambient temperature : 20-24 °C  
Relative humidity : 50-65 %  
Atmospheric pressure : 100-103 kPa

**Table 6: Test result of Peak Output Power**

Channel	Channel Frequency (MHz)	Output Power		Limit
		(dBm)	(W)	(W)
Low Channel	2402	-5.627	0.0003	1
Middle Channel	2440	-6.779	0.0002	1
High Channel	2480	-7.442	0.0002	1

Pmax: 0.3 mW

### 5.1.3 6dB Bandwidth

**RESULT:****Passed**

Test standard : LP0002(2011): 3.10.1, (5)  
FCC Part 15.247(a)(2), RSS-247 5.2(1)  
Basic standard : ANSI C63.10:2013, KDB558074  
Kind of test site : Shielded room

**Test setup**

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

Ambient temperature : 20-24°C  
Relative humidity : 50-65%  
Atmospheric pressure : 100-103 kPa

**Table 7: Test result of 6dB Bandwidth**

Channel	Channel Frequency (MHz)	6dB Bandwidth (kHz)	Limit (kHz)	Result
Low Channel	2402	701.2	>500	Pass
Mid Channel	2440	688.3	>500	Pass
High Channel	2480	672.6	>500	Pass

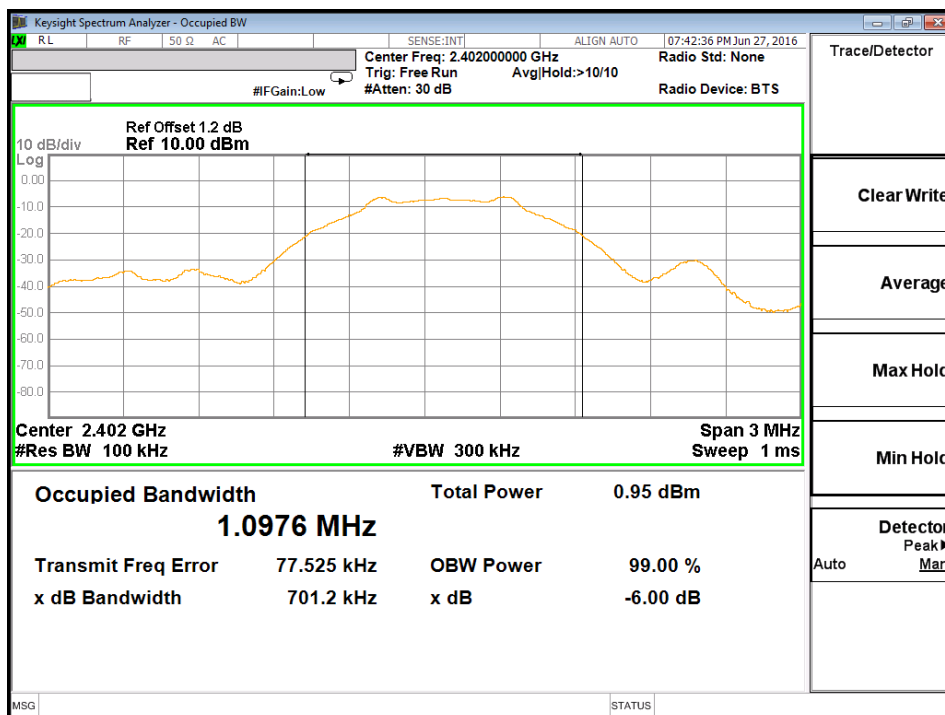
**Table 8: Test result of 99% Bandwidth,**

Channel	Channel Frequency (MHz)	99% Bandwidth (MHz)
Mid Channel	2440	1.0660

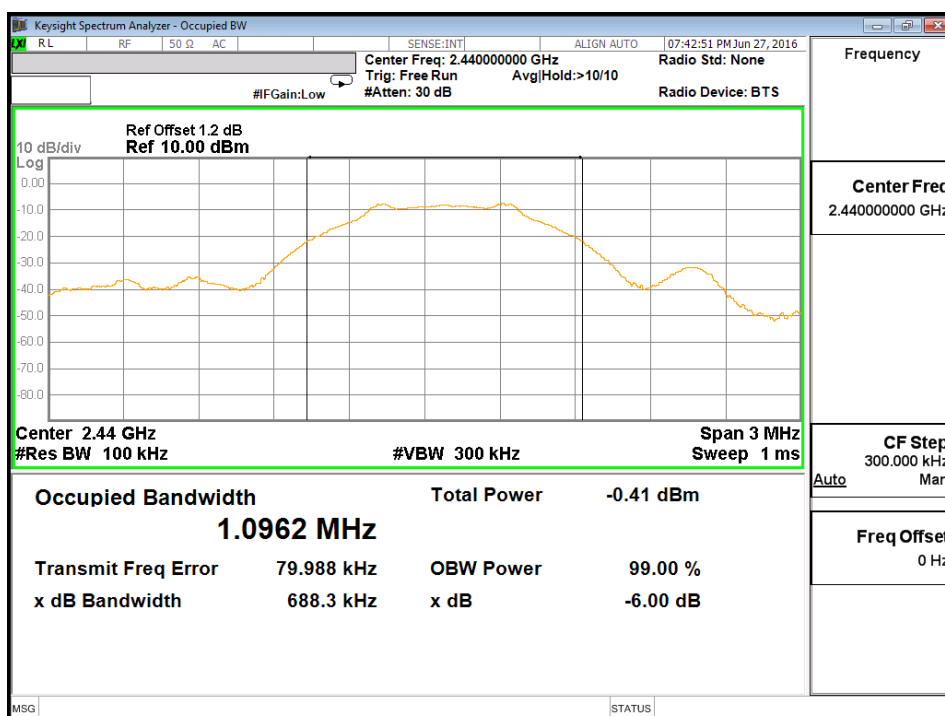


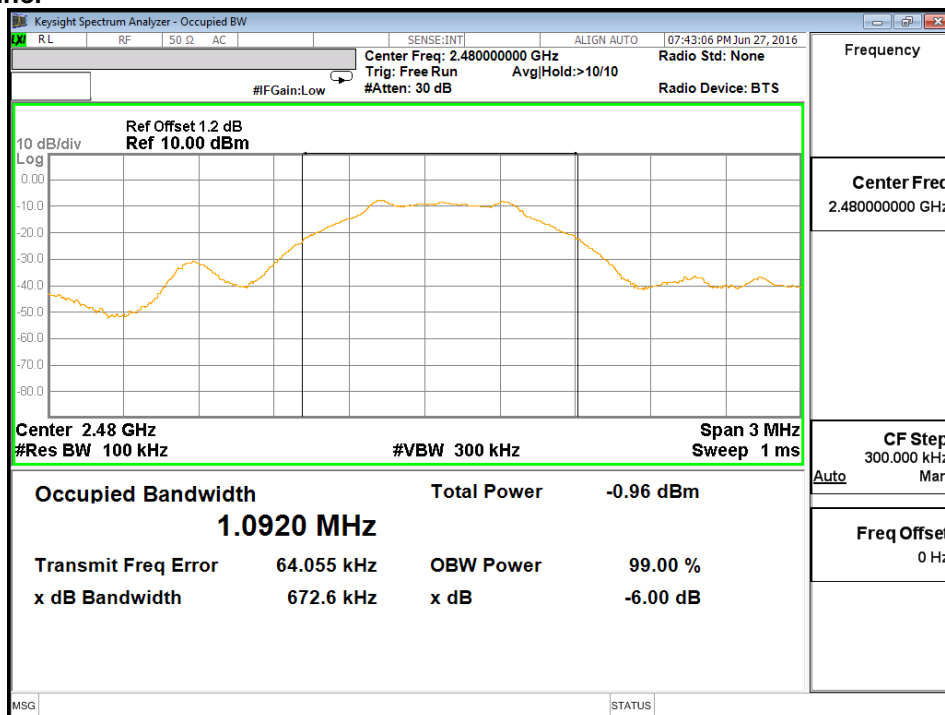
## Test Plot of 6dB Bandwidth

### Low Channel



### Middle Channel



**High Channel**


### 5.1.4 Power Density

**RESULT:****Passed**

Test standard : LP0002(2011): 3.10.1, (6.2.2)  
FCC Part 15.247(e) , RSS-247 5.2(2)  
Basic standard : ANSI C63.10:2013, KDB558074  
Kind of test site : Shielded room

**Test setup**

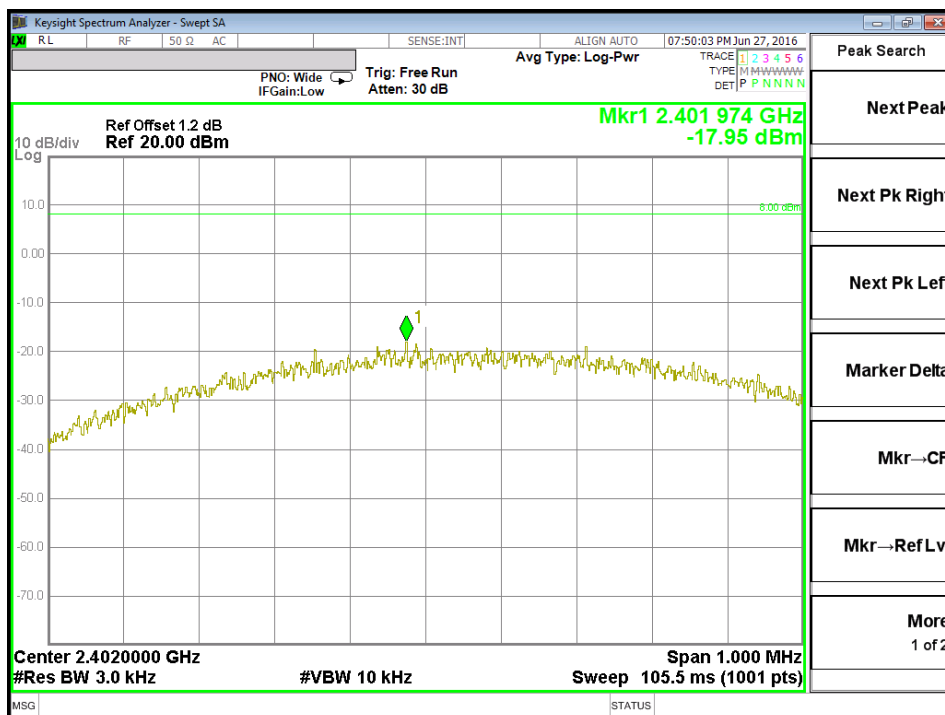
Test Channel : Low/ Middle/ High  
Operation Mode : A  
Ambient temperature : 20-24°C  
Relative humidity : 50-65%  
Atmospheric pressure : 100-103 kPa

**Table 9: Test result of Power Density**

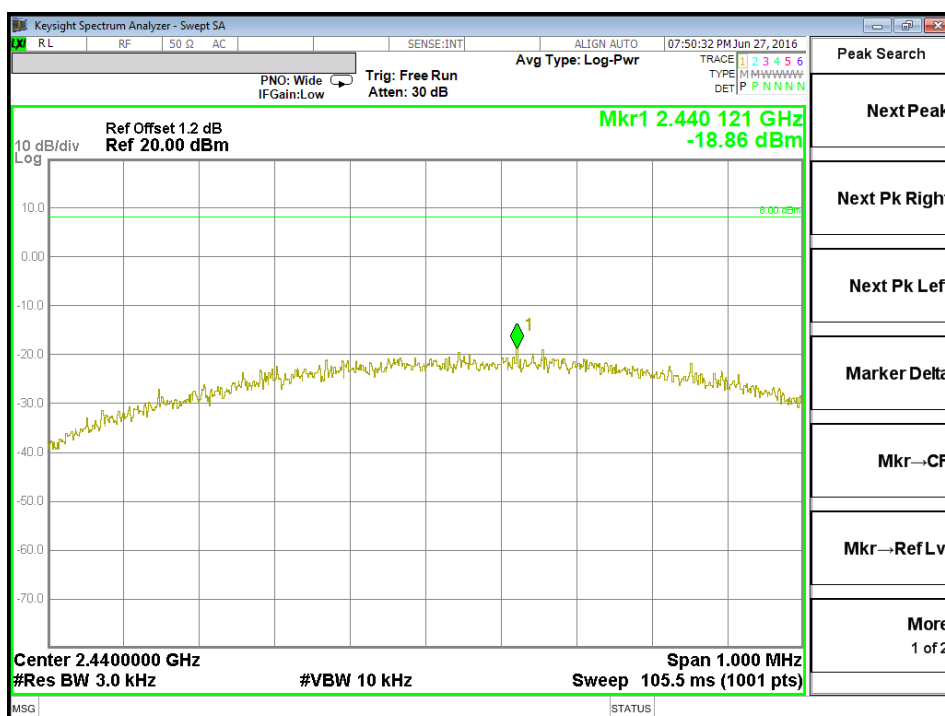
Channel	Channel Frequency (MHz)	Power Density	Limit
		(dBm)	(dBm)
Low Channel	2402	-17.95	8
Middle Channel	2440	-18.86	8
High Channel	2480	-20.39	8

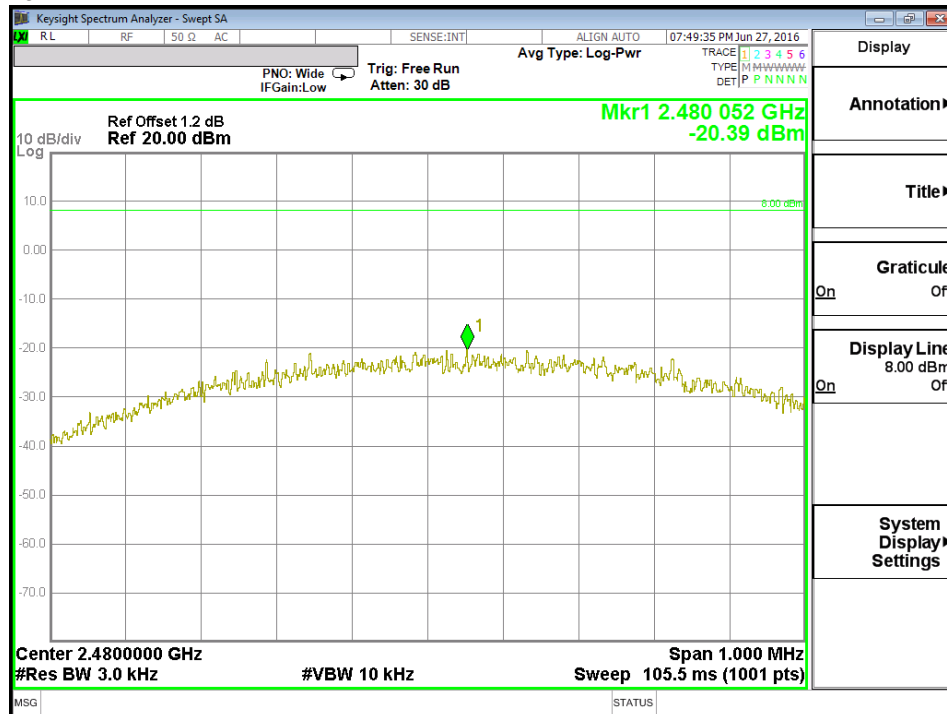
## Test Plot of Power Density

### Low Channel



### Middle Channel





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

**RESULT:****Passed**

Test standard	:	LP0002(2011): 3.10.1, (5) FCC part 15.247(d), RSS-247 5.5
Basic standard	:	ANSI C63.10:2013, KDB558074
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**

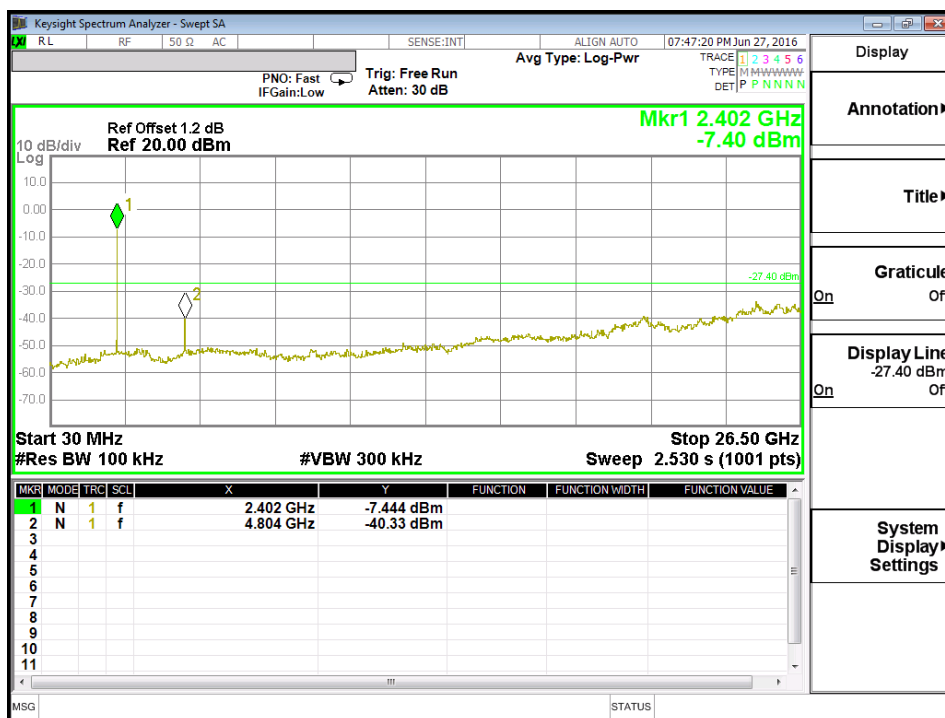
Test Channel	:	Low/ High
Operation mode	:	A
Ambient temperature	:	20-24°C
Relative humidity	:	50-65%
Atmospheric pressure	:	100-103 kPa

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

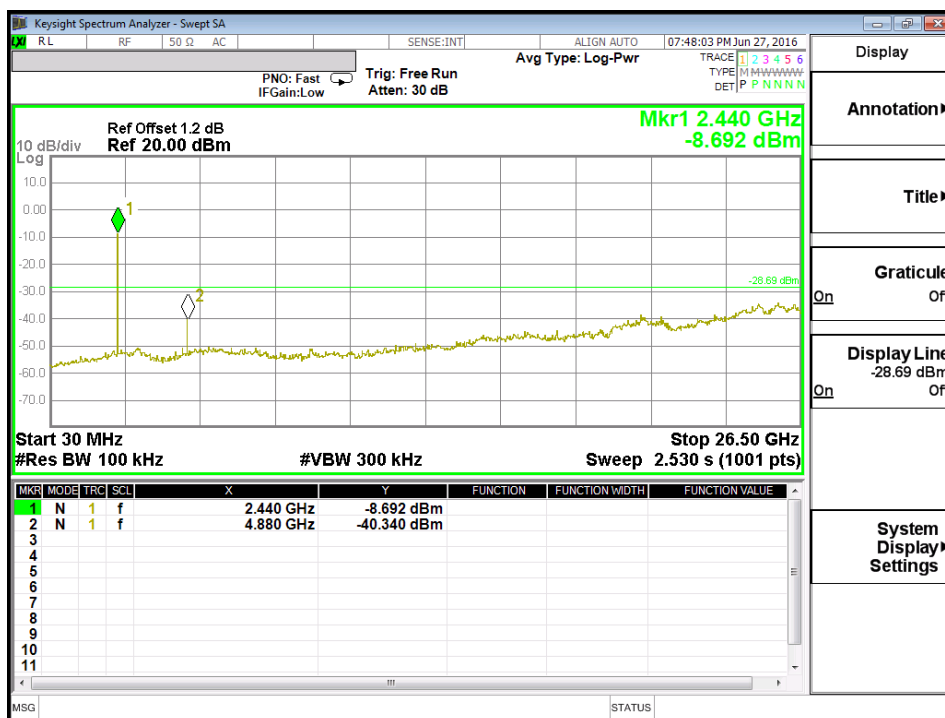
Due to the small size of the product and that there are no inductive components of significant size, 9kHz to 30MHz frequency range is not tested based on technical judgment.

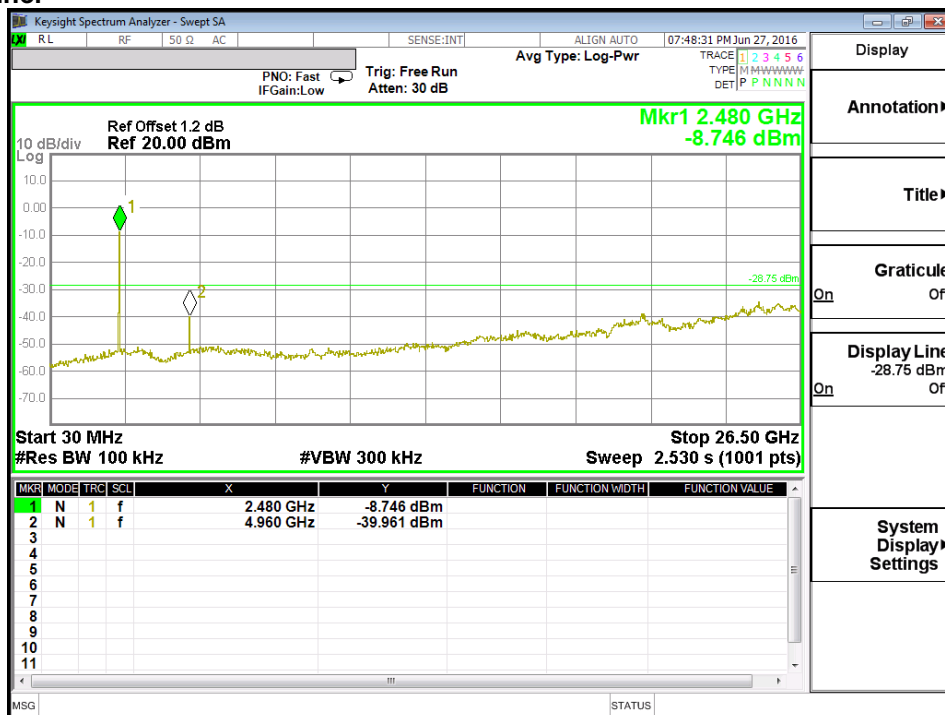
## Test Plot 100kHz Conducted Emissions

### Low Channel



### Middle Channel

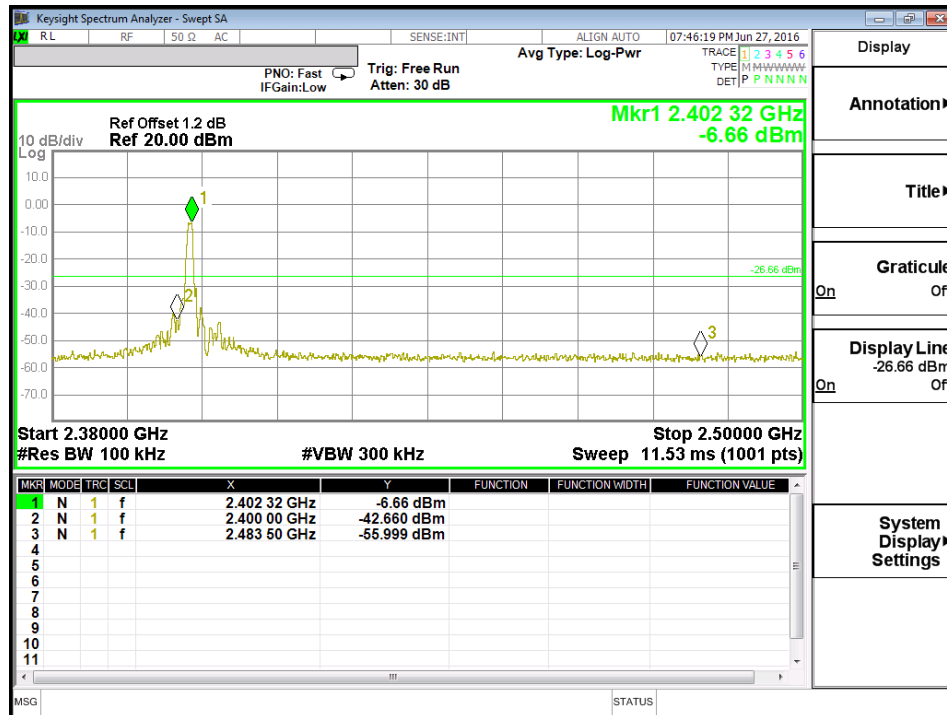


**High Channel**


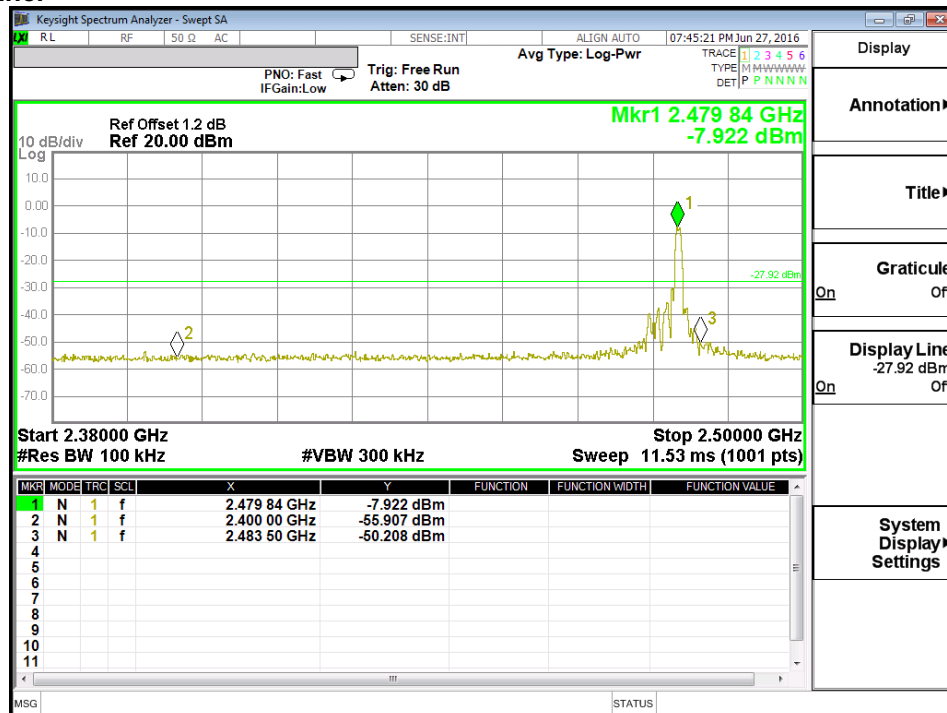


## Test Plot 100kHz RBW of Band Edge

### Low Channel



### High Channel



### 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-247 5.5 and RSS-Gen 8.9 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-Gen i4, 8.9 (Table 6), must comply with the radiated emission limits specified in FCC 15.209(a) and RSS-Gen i4, 8.9 (Table 4 and 5). 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-Gen i4, 8.9 (Table 4 and 5) 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

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

For details refer to Appendix D.

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

FCC:

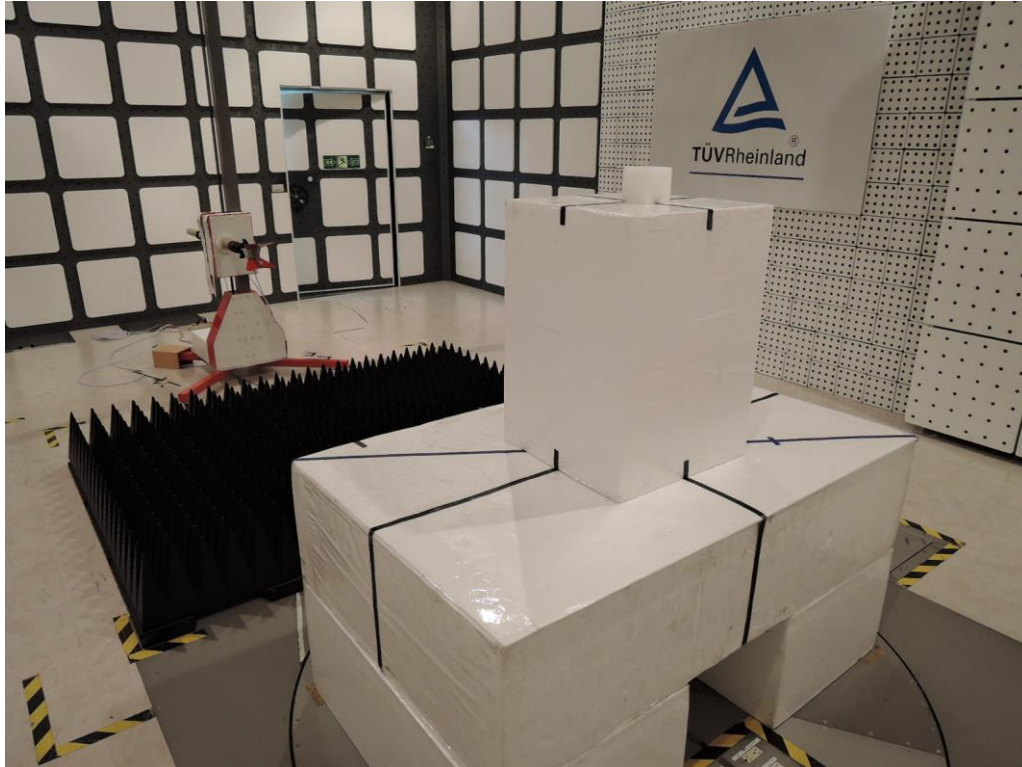
Since maximum peak output power of the transmitter is  $0.3 \text{ mW} < 10 \text{ mW}$ , hence the EUT is excluded from SAR evaluation according to FCC KDB publication 447498 D01 v05: Mobile Portable RF Exposure

## 7. Photographs of the Test Set-Up

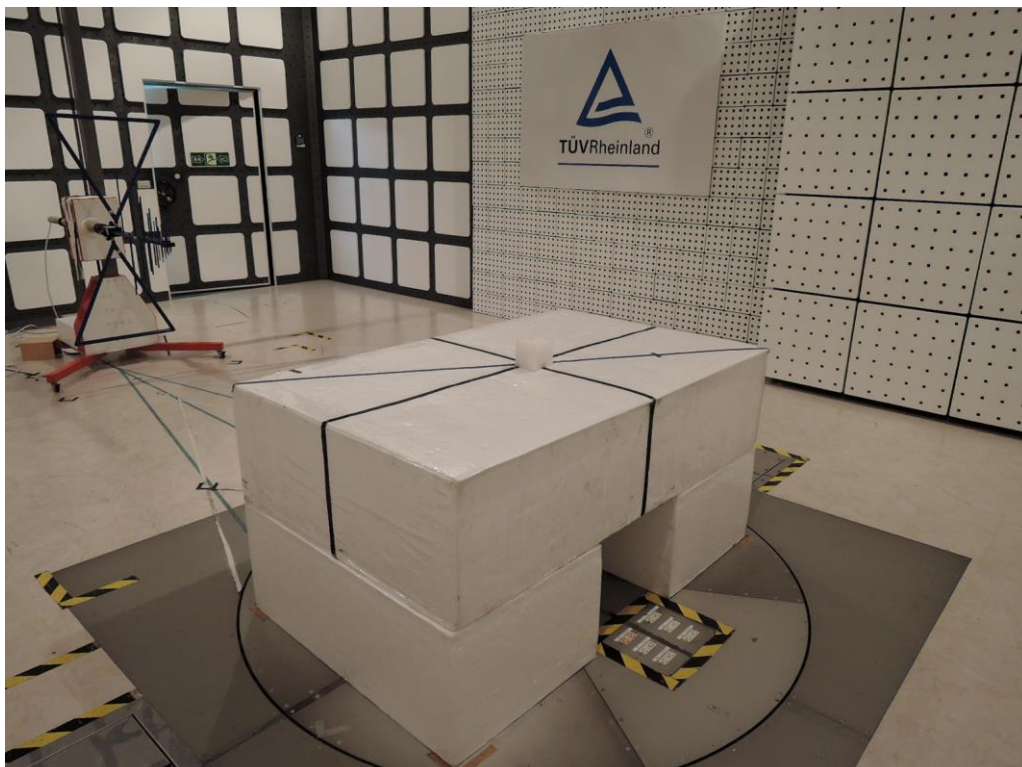
**Photograph 1: Set-up for Spurious Emissions (Front View)**



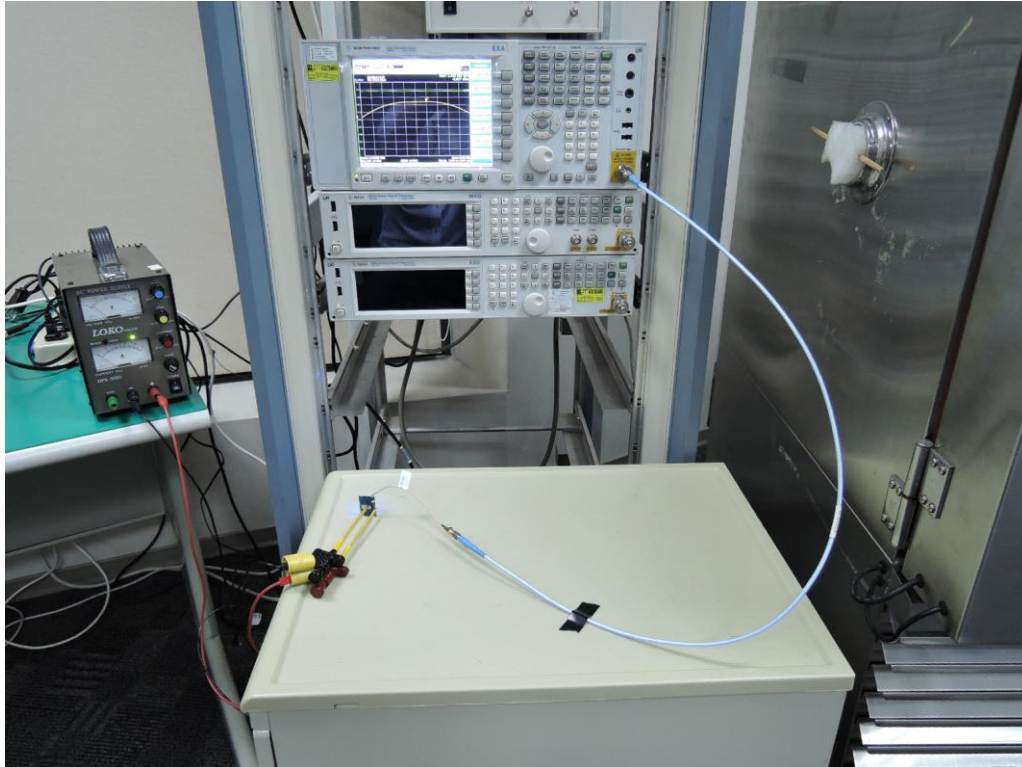
**Photograph 2: Set-up for Spurious Emissions (Back View 1)**



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



**Photograph 4: Set-up for Conducted testing**





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