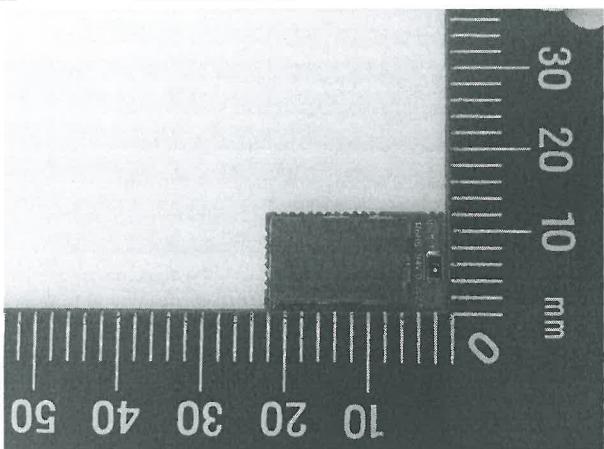


Prüfbericht-Nr.: Test Report No.:	10052797 001	Auftrags-Nr.: Order No.:	114039665	Seite 1 von 34 Page 1 of 34
Kunden-Referenz-Nr.: Client Reference No.:	N/A	Auftragsdatum: Order date:	20-Aug-2015	
Auftraggeber: Client:	Microchip Technology Inc., 2355 West Chandler Blvd. Chandler, Arizona 85224-6199, United States			
Prüfgegenstand: Test item:	Bluetooth module			
Bezeichnung / Typ-Nr.: Identification / Type No.:	BM78abcdefg, RN4678			
Auftrags-Inhalt: Order content:	Test Report for CE compliance, R&TTE Directive (BR/EDR)			
Prüfgrundlage: Test specification:	EN 300 328 V 1.9.1 EN 62479:2010 Refer to section 1.1 Test Specifications for more details.			
Wareneingangsdatum: Date of receipt:	23-Aug-2015			
Prüfmuster-Nr.: Test sample No.:	A000244783-005 A000244783-006			
Prüfzeitraum: Testing period:	2-Sep-2015 - 8-Sep-2015			
Ort der Prüfung: Place of testing:	EMC/RF Laboratory Taipei			
Prüflaboratorium: Testing laboratory:	TUV Rheinland Taiwan Ltd.			
Prüfergebnis*: Test result*:	Pass			
geprüft von / tested by:  2015-12-21 Ryan W. T. Chen / Project Manager Datum Name / Stellung Unterschrift Date Name / Position Signature	 kontrolliert von / reviewed by:  2015-12-21 Arvin Ho / Department Manager Datum Name / Stellung Unterschrift Date Name / Position Signature			
Sonstiges / Other: Model name: BM78abcdefg (a,b,c,d,e,f,g,h=0~9,A~Z) The spurious emission test results found in the test report are more than 6 dB below the limits, therefore it can be assumed that this device also fulfills the requirements of the version EN 300 328 V 1.9.1. All other test items in v1.8.1 are equivalent to the version v1.9.1.				
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(pass) = entspricht o.g. Prüfgrundlage(n) F(fail) = 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(pass) = passed a.m. test specification(s) F(fail) = 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.				

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## TEST SUMMARY

### 4.1.1 RF OUTPUT POWER

RESULT: PASS

### 4.1.2 DUTY CYCLE, TX-SEQUENCE, TX-GAP

RESULT: N/A

### 4.1.3 DWELL TIME

RESULT: PASS

### 4.1.4 MINIMUM FREQUENCY OCCUPATION

RESULT: PASS

### 4.1.5 HOPPING FREQUENCY SEPARATION

RESULT: PASS

### 4.1.6 MEDIUM UTILISATION FACTOR

RESULT: PASS

### 4.1.7 ADAPTIVITY (ADAPTIVE FREQUENCY HOPPING)

RESULT: N/A

### 4.1.8 OCCUPIED CHANNEL BANDWIDTH

RESULT: PASS

### 4.1.9 TRANSMITTER UNWANTED EMISSIONS IN THE OOB DOMAIN

RESULT: PASS

### 4.1.10 TRANSMITTER UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN

RESULT: PASS

### 4.2.1 RECEIVER RADIATED SPURIOUS EMISSIONS

RESULT: PASS

### 4.2.2 RECEIVER BLOCKING

RESULT: N/A

### 5.1.1 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: IUT Photos**

(File Name: 10052797AppendixP)

**Appendix 2: Test Result of Radiated Emissions**

(File Name: 10052797AppendixD)

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

<b>Radio</b>
EN 300 328 V 1.9.1

## 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.)

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## 2.2 List of Test and Measurement Instruments

**Table 2: List of Test and Measurement Equipment**

Kind of Equipment	Manufacturer	Type	S/N	Last Calibration	Next Calibration
EMI Test Receiver	R&S	ESR7	101062	31-Aug-14	15-Sep-15
Bilog Antenna	TESEQ	CBL6111D	29802	4-Jul-14	3-Jul-16
Spectrum Analyzer	R&S	FSV 40	100921	17-Dec-14	16-Dec-15
Spectrum Analyzer	Agilent	N9010A	MY53470241	1-Apr-15	30-Mar-16
Horn Antenna	ETS-Lindgren	3117	138160	12-Jan-15	11-Jan-17
Horn Antenna (18GHz~40GHz)	COM-POWER	AH840	101031	30-Oct-13	29-Oct-15
Preamplifier (30MHz -1GHz)	HP	8447F	2805A03335	24-Dec-14	24-Dec-15
Preamplifier (18 GHz -40 GHz)	COM-POWER	PAM-840	461257	26-Aug-14	26-Aug-16
Pre-Amplifier (1GHz~18GHz)	EM Electronics	EM30180	60558	4-Nov-14	3-Nov-15
Loop Antenna	Schwarzbeck	FMZB 1513	1513-076	22-Oct-14	21-Oct-15
EMI Test Receiver	R&S	ESCI7	100797	28-Dec-14	27-Dec-15
Spectrum Analyzer	R&S	FSL3	101943	7-Sep-15	7-Sep-16
Temp. & Humid. Chamber	Giant Force	GCT-099-40-S	MAF0103-007	13-Jul-15	12-Jul-16
LISN (1 phase)	R&S	ENV216	101243	1-Jun-15	31-May-16
LISN	R&S	ENV216	101262	16-Jun-15	15-Jun-16
Power sensor	Agilent	U2021XA	MY53480013	11-Mar-15	9-Mar-16
Signal Generator	R&S	SMU200	104260	6-Sep-15	5-Sep-16
EXG-B RF Analog Signal Generator	Agilent	N5171B	MY53050377	15-Mar-15	13-Mar-16
MXG-B RF Vector Signal Generator	Agilent	N5182B	MY53050524	18-Mar-15	16-Mar-16

## 2.3 Measurement Uncertainty

**Table 3: Emission Measurement Uncertainty**

Parameter	Uncertainty
Occupied Channel Bandwidth	±5 %
RF power, conducted	± 1.5 dB
RF power density, conducted	± 3 dB
unwanted emissions, conducted	± 3 dB
all emissions, radiated	± 6 dB
Temperature	± 1 °C
Humidity	± 5 %
DC and low frequency voltages	±3 %
Time	± 5 %
Duty Cycle	± 5 %

## General Product Information

## 2.4 Product Function and Intended Use

The EUT is a Bluetooth module. It contains a Bluetooth 4.2 BLE/BR/EDR compatible module enabling the user to communicate data through a Wireless interface.  
For details refer to the User Guide, Data Sheet and Circuit Diagram.

## 2.5 System Details

**Table 4: Technical Specification of EUT**

Technical Specification	Value
Kind of Equipment	Bluetooth module
Operating Frequency	2402~2480 MHz
Channel Spacing	1 MHz
Channel number	79
Extreme Temperature Range	-20~70 °C
Operation Voltage	3.3Vdc
Modulation	GFSK, π/4 DQPSK, 8 DPSK
Antenna gain	1.63 dBi

## 2.6 Independent Operation Modes

Testing was performed at the lowest operating frequency (2402MHz), at the operating frequency in the middle of the specified frequency band (2441MHz) and at the highest operating frequency (2480MHz).

The basic operation modes are:

- A. EUT transmits (TX mode), with full power, at lowest channel (2402MHz), a continuous modulated signal streaming with 100% duty cycle.
- B. EUT transmits (TX mode), with full power, at lowest channel (2441MHz), a continuous modulated signal streaming with 100% duty cycle.
- C. EUT transmits (TX mode), with full power, at highest channel (2480MHz), a continuous modulated signal streaming with 100% duty cycle.
- D. EUT receives (RX mode), at lowest channel (2402MHz), continuously.
- E. EUT receives (RX mode), at highest channel (2480MHz), continuously.
- F. Transmitter is in stand-by.
- G. EUT transmits on pseudo-random sequence on all channels (hopping mode).

## 2.7 Noise Suppressing Parts

Nothing mentioned explicitly. Please refer to photo documentation for details.

## 3 Test Set-up and Operation Modes

### 3.1 Principle of Configuration Selection

**Radio:** The equipment under test (EUT) was configured at its highest power output in order to measure its highest possible radiation and conducted level. The test modes were adapted accordingly in reference to the instructions for use.

### 3.2 Test Operation and Test Software

Software used for testing: Test samples are provided with a USB interface which makes it possible to control them through a test software installed on a notebook computer.

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 connection laptop was removed when performing the testing.

Test operation please refer to test setup in chapter 6.

### 3.3 Special Accessories and Auxiliary Equipment

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

Kind of Equipment	Manufacturer	Model Name	S/N
Notebook	HP	HSTNN-Q78C-3	CNF0339QBM

## 4 Test Results RADIO

### 4.1 Transmitter Parameters

#### 4.1.1 RF output power

**RESULT:** PASS

Date of testing: 2-Sep-2015

Atmospheric pressure: 100-103 kPa

Test requirement: EN 300 328 V 1.8.1, clause 4.3.1.1

Test procedure: EN 300 328 V 1.8.1, clause 5.3.2

Test modes applied: A, B, C

Note:

The output power of this device is below 10 dBm.. Tx-Gap measurement is not required. Therefore the timing information of a Burst is not required and the testing can be done with the EUT set to a continuous signal, with a non-sampling power sensor.

The output power (conducted) was measured at the antenna port with a Power Meter. The final measurement takes into account the loss generated by all the involved cables.

EIRP was then determined at normal and extreme conditions at the above mentioned data rate.

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**Table 5: Equivalent Isotropically Radiated Power**

Antenna Assembly Gain:		1.63		
Cable Loss=		1.6		
TEST CONDITIONS		TRANSMITTER POWER (dBm)		
		-20 °C	25 °C	70 °C
Data rate				3.3 V
	Read Power	-0.23	-0.20	-1.25
1DH5	e.i.r.p.	3.00	3.03	1.98
	Read Power	-4.26	-3.80	-2.78
2DH5	e.i.r.p.	-1.03	-0.57	0.45
	Read Power	-4.25	-3.82	-2.77
3DH5	e.i.r.p.	-1.02	-0.59	0.46
Limit = 20 dBm				

**AVG Conducted Power**

25	3.3 V	Max Power	1.40	(dBm)
----	-------	-----------	------	-------

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#### 4.1.2 Duty Cycle, Tx-sequence, Tx-gap

**RESULT:**

**N/A**

Test requirement: EN 300 328 V 1.8.1, clause 4.3.1.2

Note:

The output power of this device is below 10 dBm. Tx-Gap measurement is not required.

#### 4.1.3 Dwell Time

**RESULT:**

**PASS**

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

Test requirement: EN 300 328 V 1.8.1, clause 4.3.1.3

Test procedure: EN 300 328 V 1.8.1, clause 5.3.4.2.1

Test mode applied: G

Measurement procedure:

A spectrum analyzer was connected to the antenna port of the EUT. The analyzer resolution bandwidth and were set to ~ 50 % of the Occupied Channel Bandwidth, with video bandwidth set to  $\geq 2 \cdot RBW$ . The dwell time of a single packet was then measured using the Delta Marker function using a zero span centered on a hopping channel.

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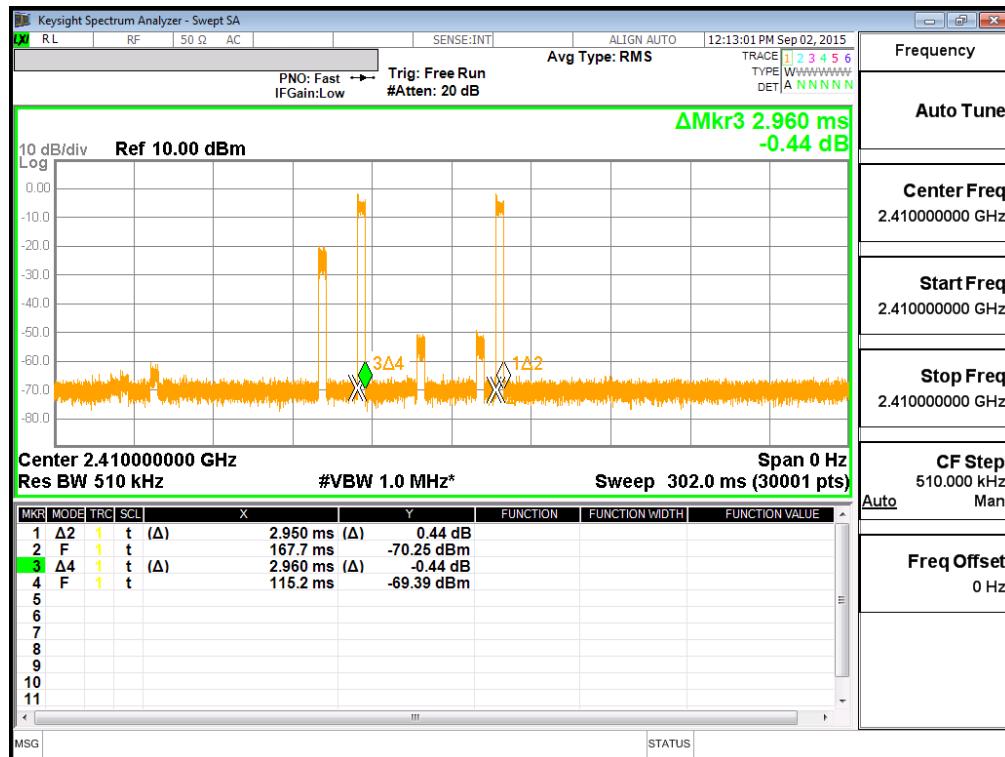
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**Table 6: Dwell Time**

Packet Type	Frequency [MHz]	Packet Duration [ms]	Maximum Dwell Time in one period	Limit [ms]
3-DH5	2410	2.96	5.92	15
3-DH5	2470	2.97	5.94	15

**Figure 1: Accumulated Dwell Time, 2410 MHz**



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**Figure 2: Accumulated Dwell Time, 2470 MHz**



**Prüfbericht - Nr.: 10052797 001**  
*Test Report No.*Seite 16 von 34  
Page 16 of 34**4.1.4 Minimum Frequency Occupation****RESULT:****PASS**

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

Test requirement: EN 300 328 V 1.8.1, clause 4.3.1.3  
Test procedure: EN 300 328 V 1.8.1, clause 5.3.4.2.1

Test mode applied: G

**Measurement procedure:**

A spectrum analyzer was connected to the antenna port of the EUT. The analyzer resolution bandwidth and were set to ~ 50 % of the Occupied Channel Bandwidth, with video bandwidth set to  $\geq 2 \times \text{RBW}$ . All the dwell times of packets within ( $4 \times \text{dwell time per hop} \times \text{number of hopping frequencies in use}$ ) was then measured using the Time Delta Marker function using a zero span centered on a hopping channel and then summed up

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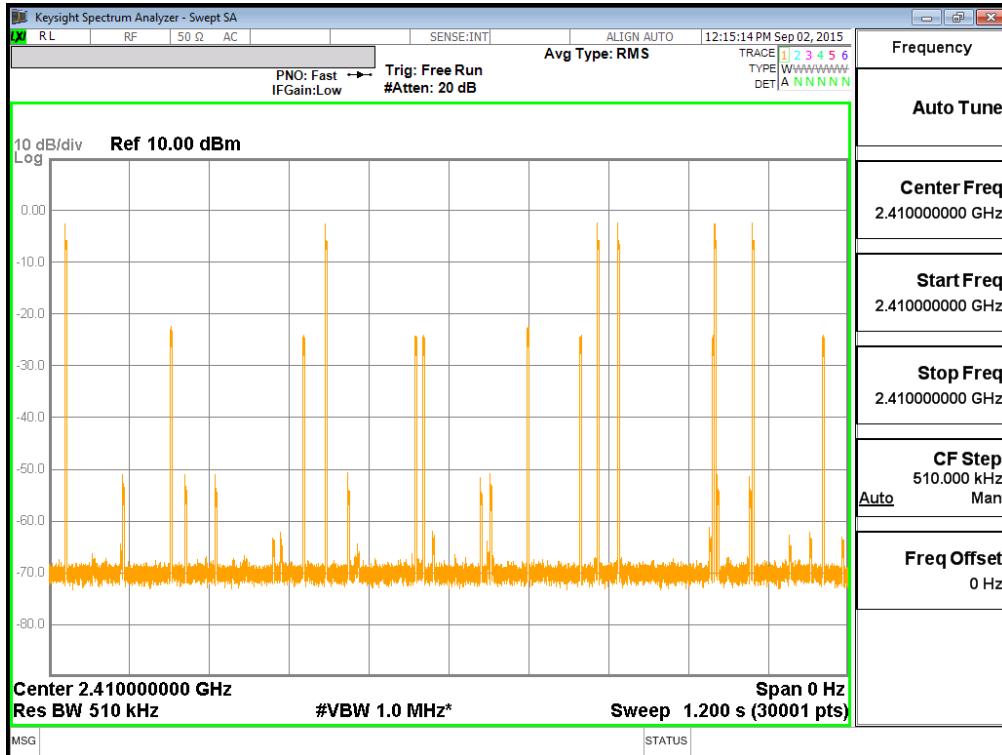
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**Table 7: Minimum Frequency Occupation**

Packet Type	Frequency [MHz]	Number of Packets in four periods	Sum of all Packet Duration [ms]	Minimum Dwell Time in four periods [ms]
3-DH5	2410	6	17.76	>2.96
3-DH5	2470	3	8.91	>2.97

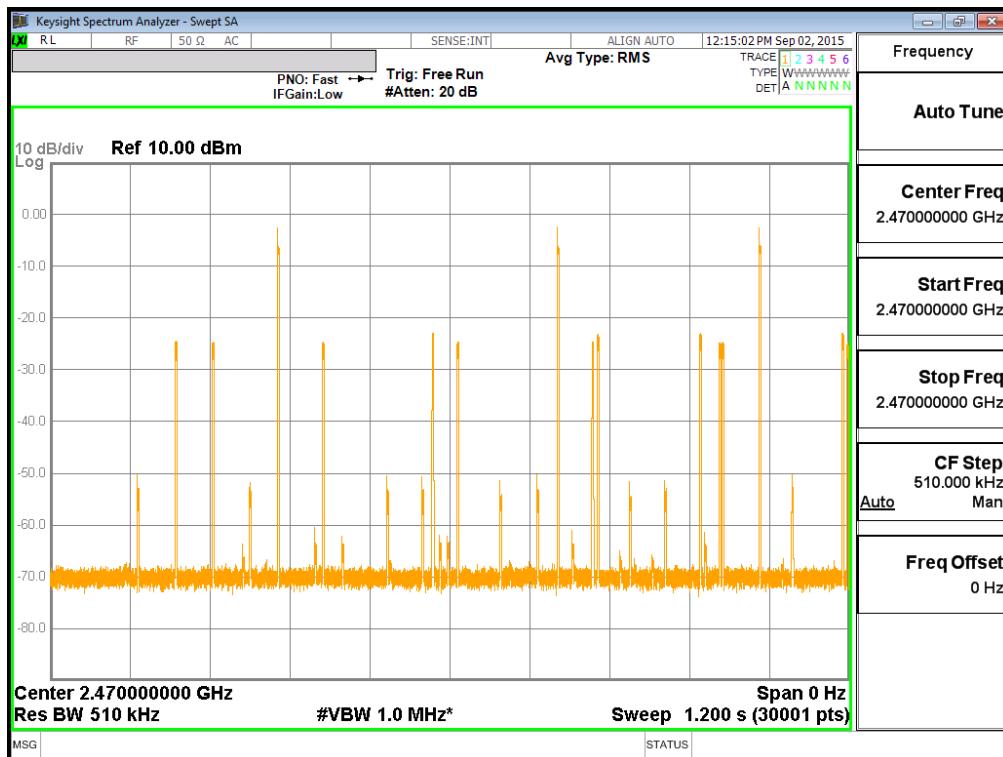
**Figure 3: Dwell Time in four periods, 2410 MHz**



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**Figure 4: Dwell Time in four periods, 2470 MHz**



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*Test Report No.*Seite 19 von 34  
*Page 19 of 34***4.1.5 Hopping Frequency Separation****RESULT:****PASS**

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

Test requirement: EN 300 328 V 1.8.1, clause 4.3.1.3  
Test procedure: EN 300 328 V 1.8.1, clause 5.3.4.2.1

Test mode applied: G

**Measurement procedure:**

A spectrum analyzer was connected to the antenna port of the EUT. The was set as prescribed in item 5.3.4.2. of EN 300 328. The Delta Marker function was used to determine the separation between the peaks of two adjacent channels.

**Prüfbericht - Nr.: 10052797 001**  
*Test Report No.*Seite 20 von 34  
Page 20 of 34**Table 8: Hopping Channel Separation**

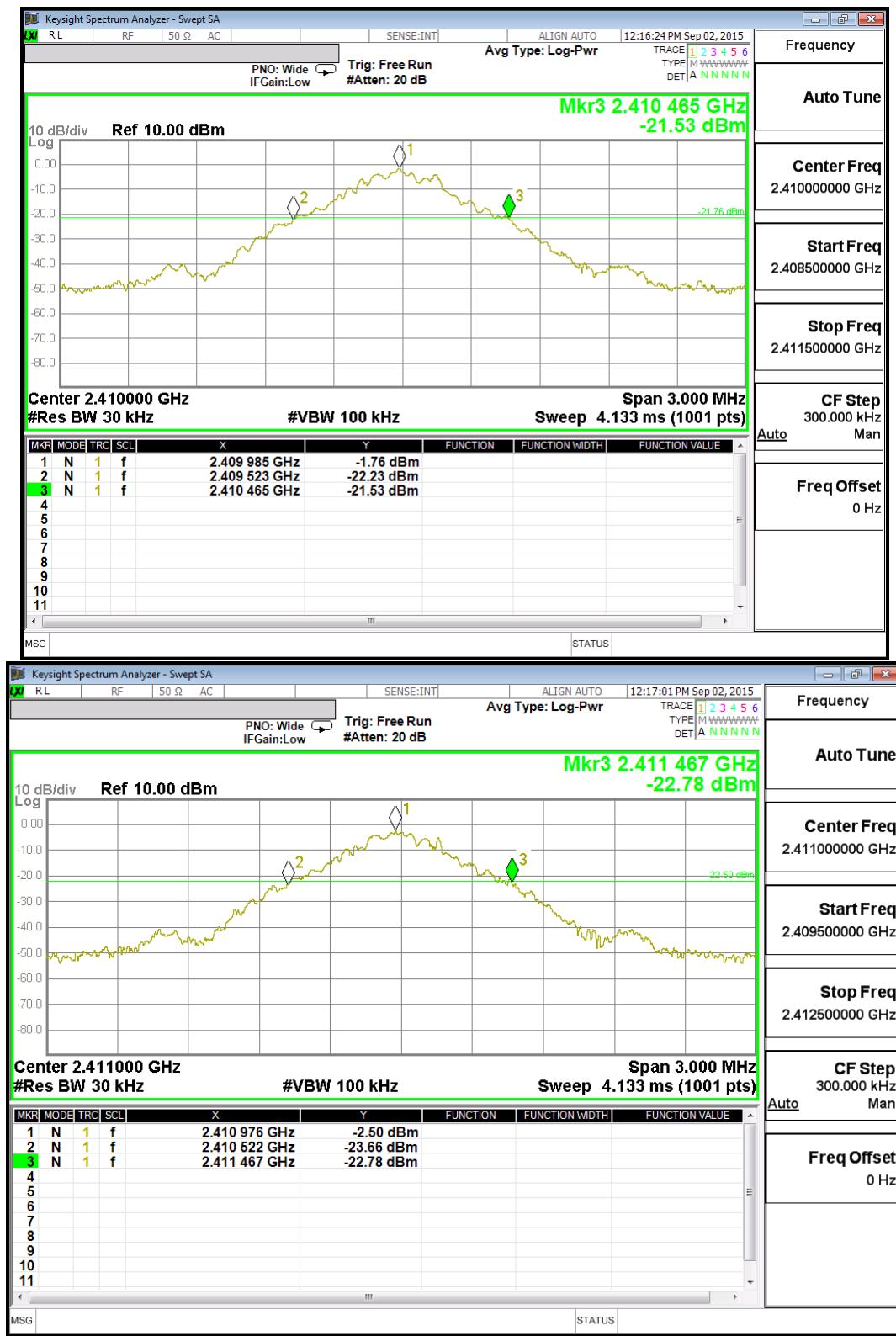
Frequency [MHz]	F <sub>L</sub> [MHz]	F <sub>H</sub> [MHz]	F <sub>C</sub> =(F <sub>L</sub> +F <sub>H</sub> )/2 [MHz]	Channel Separation [MHz]	Limit [MHz]
2410	2409.523	2410.465	2409.9940	1.0005	≥ 0.1
2411	2410.522	2411.467	2410.9945		

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**Figure 5: Hopping Channel Separation**



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*Page 22 of 34***4.1.6 Medium Utilisation Factor****RESULT:** PASS

Test requirement: EN 300 328 V1.8.1, clause 4.3.1.5

The output power is less than 10 dBm. Therefore, assessment of the Medium Utilisation Factor is not required. This device may transmit continuously.

**4.1.7 Adaptivity (Adaptive Frequency Hopping)****RESULT:** N/A

Requirement: EN 300 328 V1.8.1, clause 4.3.1.6

The output power is less than 10 dBm. Therefore, a testing of the adaptive hopping implementation is not required. May use the full available band.

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Page 23 of 34**4.1.8 Occupied Channel Bandwidth****RESULT:****PASS**

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

Test requirement: EN 300 328 V 1.8.1, clause 4.3.1.7  
Test procedure: EN 300 328 V 1.8.1, clause 5.3.8

Test modes applied: A, C

**Table 9: Test result of 99% Bandwidth, GFSK modulation**

Channel	Channel Frequency (MHz)	99% Bandwidth (MHz)	Limit
Low Channel	2402	0.884	4 MHz (Ch2402)
High Channel	2480	0.882	5 MHz

**Table 10: Test result of 99% Bandwidth, 8DPSK modulation**

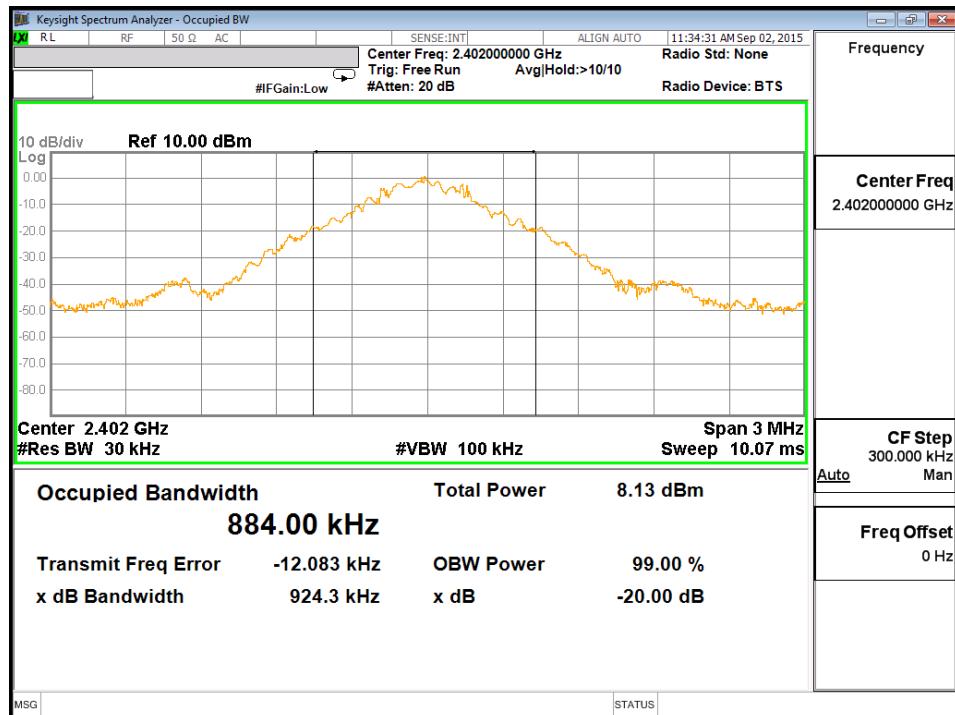
Channel	Channel Frequency (MHz)	99% Bandwidth (MHz)	Limit
Low Channel	2402	1.1646	4 MHz (Ch2402)
High Channel	2480	1.1598	5 MHz

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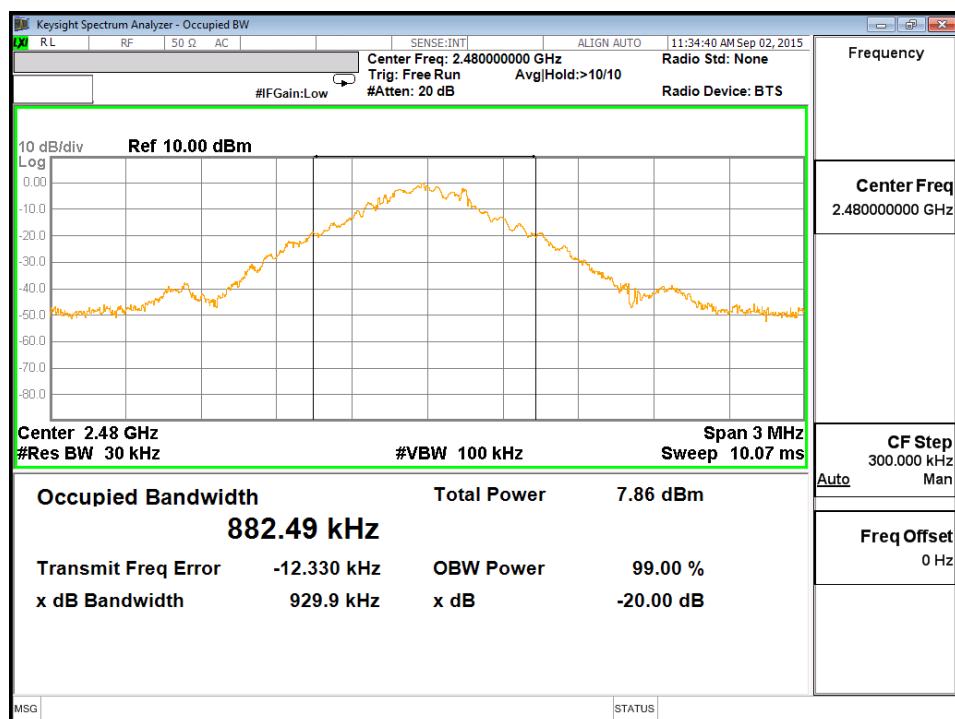
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**Figure 6: 99% Bandwidth Low Channel GFSK**



**Figure 7: 99% Bandwidth High Channel GFSK**



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Figure 8: 99% Bandwidth Low Channel 8DPSK

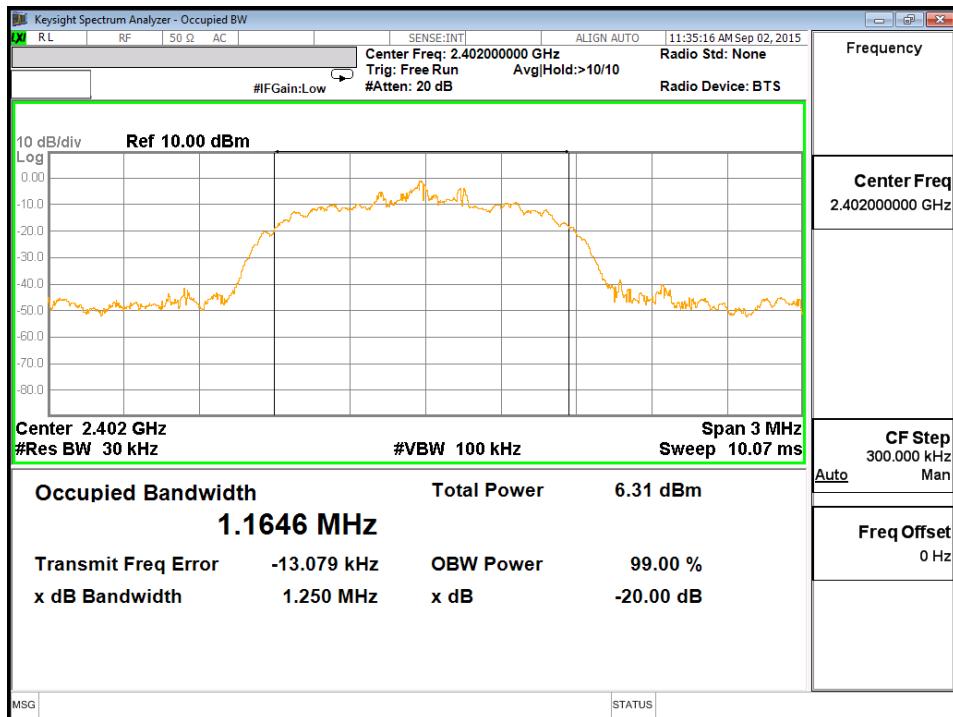
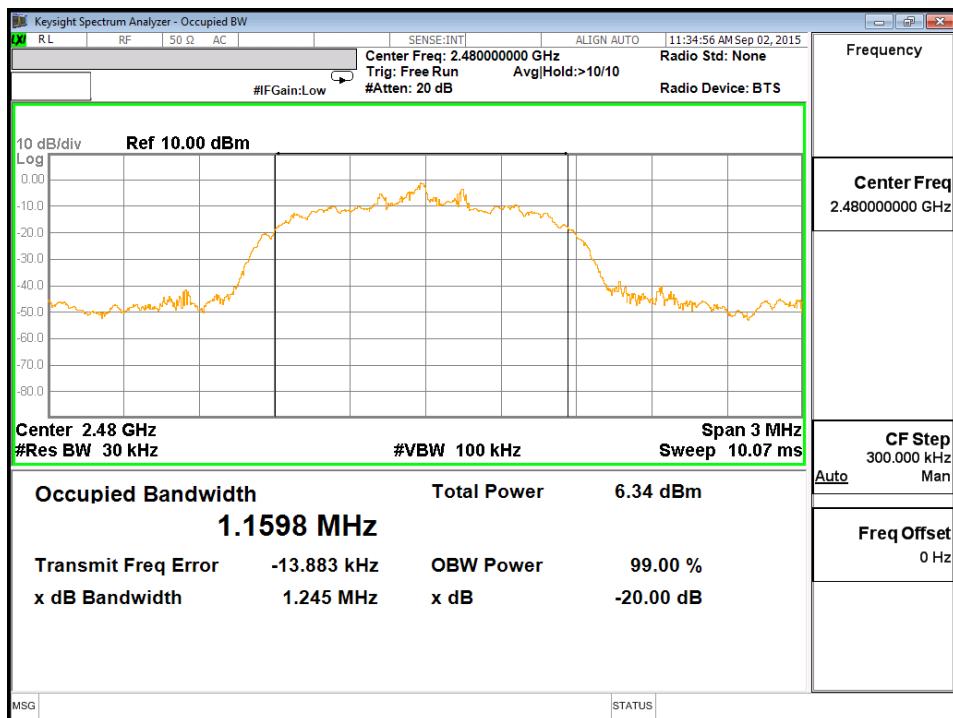


Figure 9: 99% Bandwidth High Channel 8DPSK



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*Test Report No.***Seite 26 von 34**  
*Page 26 of 34***4.1.9 Transmitter unwanted emissions in the OOB domain****RESULT:****PASS**

Test requirement: EN 300 328 V 1.8.1, clause 4.3.1.8

Test procedure: EN 300 328 V 1.8.1, clause 5.3.9

Frequency range: 30MHz - 12.75GHz

Measurement distance: 3m

Kind of test site: Semi Anechoic Chamber

Test mode applied: A, C, F

**Note:**

Outside the 2400 – 2483.5 MHz band all unwanted emissions are below -30 dBm

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Temperature Low:	-20	°C
Temperature Normal:	25	°C
Temperature High:	70	°C

### 1DH5

Ton of Duty Cycle:	2.94
Tall of Duty Cycle:	3.76
Duty factor: (dB)	1.07

### Temperature Low

Freq.(MHz)	Read(dBm)	e.i.r.p.(dBm)	Limit(dBm)
2398.5	-60.50	-56.20	-20
2399.5	-51.13	-46.83	-10
2484	-64.85	-60.55	-10
2485	-69.95	-65.65	-20

Antenna Assembly Gain: (dBi)	1.63
Cable Loss: (dB)	1.6

### 3DH5

Ton of Duty Cycle:	2.94
Tall of Duty Cycle:	3.75
Duty factor: (dB)	1.06

Freq.(MHz)	Read(dBm)	e.i.r.p.(dBm)	Limit(dBm)
2398.14	-68.06	-63.77	-20
2398.32	-67.10	-62.81	-20
2399.32	-57.33	-53.04	-10
2399.5	-55.43	-51.14	-10
2484	-69.60	-65.31	-10
2484.18	-70.47	-66.18	-10
2485.18	-74.43	-70.14	-20
2485.36	-74.61	-70.32	-20

### Temperature Normal

Freq.(MHz)	Read(dBm)	e.i.r.p.(dBm)	Limit(dBm)
2398.5	-61.82	-57.52	-20
2399.5	-52.38	-48.08	-10
2484	-66.13	-61.83	-10
2485	-71.25	-66.95	-20

Freq.(MHz)	Read(dBm)	e.i.r.p.(dBm)	Limit(dBm)
2398.14	-67.88	-63.59	-20
2398.32	-66.96	-62.67	-20
2399.32	-58.66	-54.37	-10
2399.5	-56.91	-52.62	-10
2484	-69.65	-65.36	-10
2484.18	-70.11	-65.82	-10
2485.18	-72.13	-67.84	-20
2485.36	-73.63	-69.34	-20

### Temperature High

Freq.(MHz)	Read(dBm)	e.i.r.p.(dBm)	Limit(dBm)
2398.5	-59.45	-55.15	-20
2399.5	-50.45	-46.15	-10
2484	-66.73	-62.43	-10
2485	-71.31	-67.01	-20

Freq.(MHz)	Read(dBm)	e.i.r.p.(dBm)	Limit(dBm)
2398.14	-64.72	-60.43	-20
2398.32	-63.83	-59.54	-20
2399.32	-55.53	-51.24	-10
2399.5	-53.88	-49.59	-10
2484	-67.34	-63.05	-10
2484.18	-67.98	-63.69	-10
2485.18	-70.09	-65.80	-20
2485.36	-71.13	-66.84	-20

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#### **4.1.10 Transmitter unwanted emissions in the spurious domain**

**RESULT:**

**PASS**

Test requirement: EN 300 328 V 1.8.1, clause 4.3.1.9  
Test procedure: EN 300 328 V 1.8.1, clause 5.3.10

Frequency range: 30MHz - 12.75GHz  
Measurement distance: 3m  
Kind of test site: Semi Anechoic Chamber

Test mode applied: A, C, F

**Please refer to Appendix D: Test result of Radiated Emissions**

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## 4.2 Receiver Parameters

### 4.2.1 Receiver Radiated Spurious Emissions

**RESULT:** PASS

Test requirement:	EN 300 328 V 1.8.1, clause 4.3.1.10
Test procedure:	EN 300 328 V 1.8.1, clause 5.3.11
Frequency range:	30MHz - 12.75GHz
Measurement distance:	3m
Kind of test site:	Semi Anechoic Chamber
Test mode applied:	D, E

**Please refer to Appendix D: Test result of Radiated Emissions**

### 4.2.2 Receiver Blocking

**RESULT:** N/A

Test requirement:	EN 300 328 V 1.8.1, clause 4.3.1.11
Test procedure:	EN 300 328 V 1.8.1, clause 5.3.7

The output power is less than 10 dBm. Therefore, test items related to adaptivity are not required for this device.

## 5 Safety Human exposure

### 5.1 Radio Frequency Exposure Compliance

#### 5.1.1 Electromagnetic Fields

**RESULT:** Passed

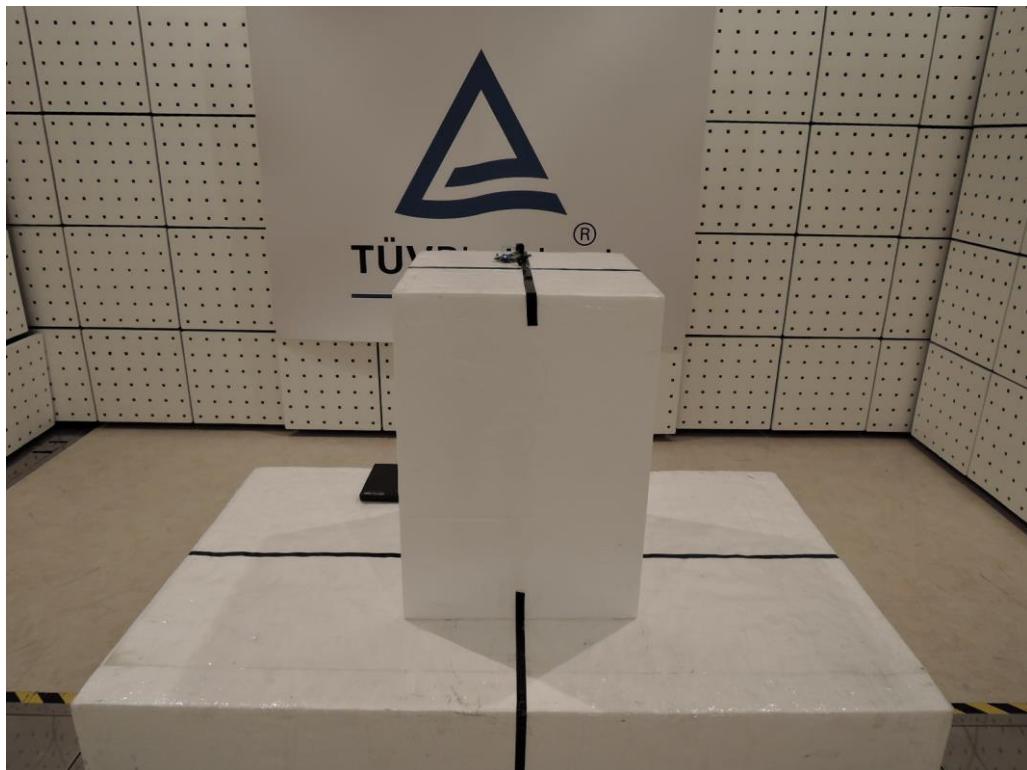
Test standard : EN 62479:2010, A.3.

Maximum available Power:

Max Power (dBm)	Power (mW)	Head and Body Power Limit in (mW)	Pass/Fail
1.4	1.38	20	PASS

## 6 Photographs of the Test Setup

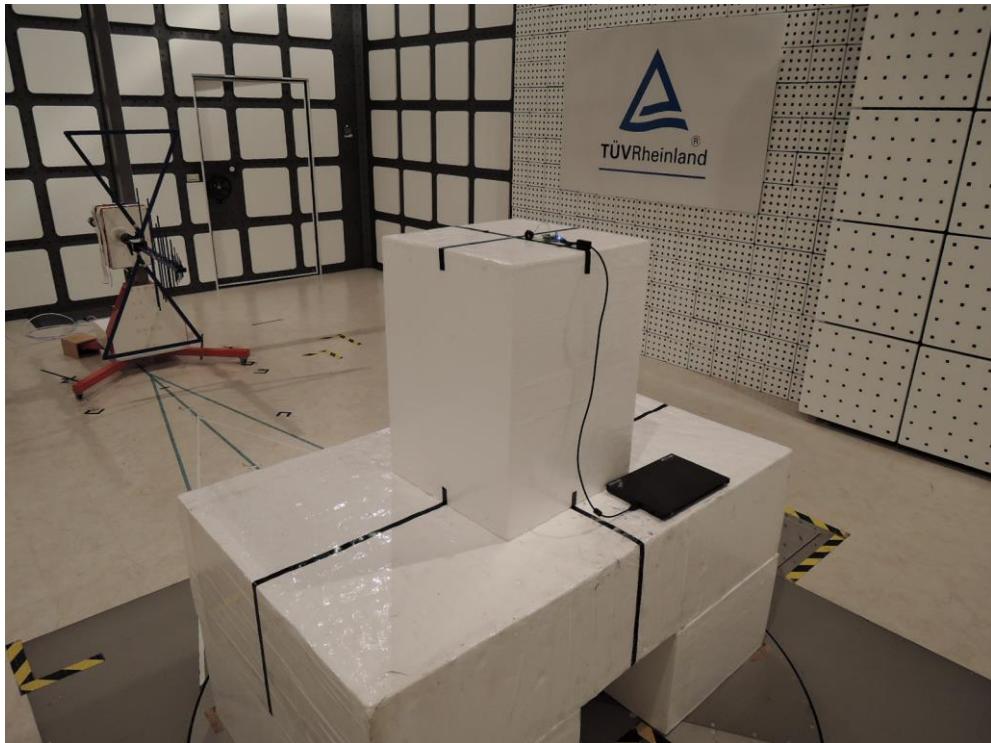
**Photograph 1: Set-up for Radiated Emission (front)**



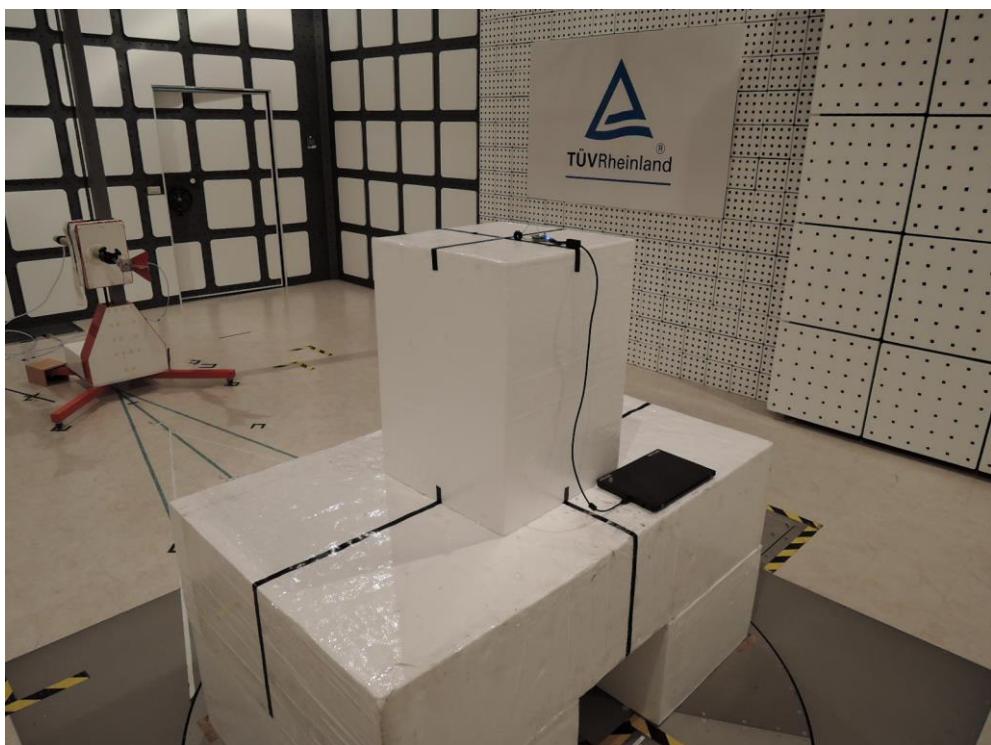
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**Photograph 2: Set-up for Radiated Emission (30 MHz-1GHz)**



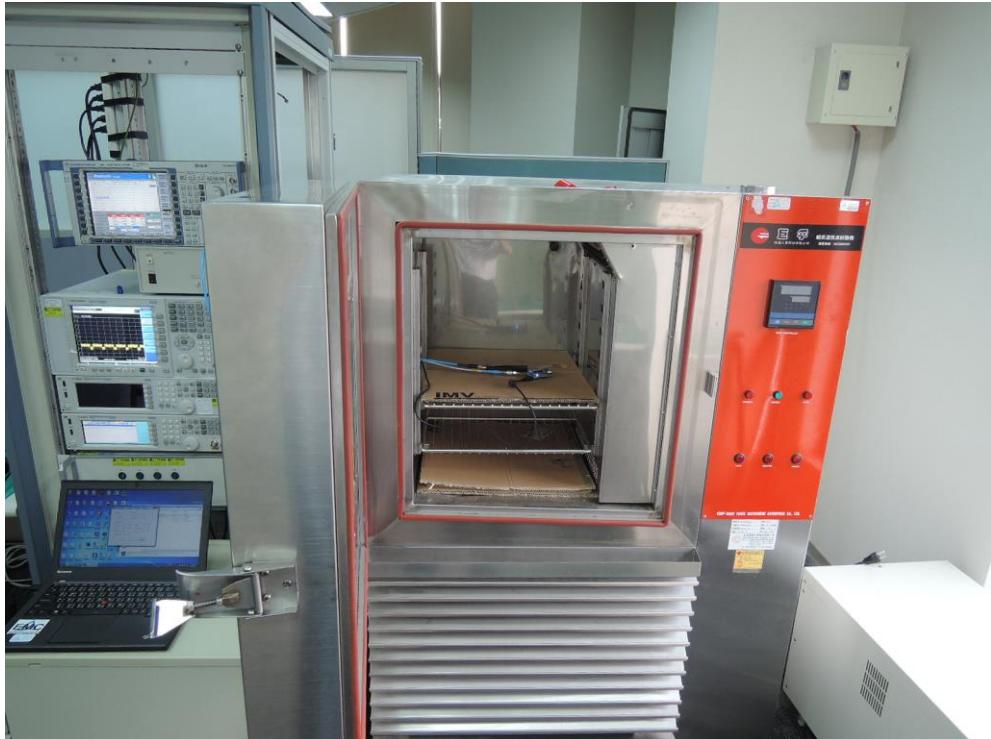
**Photograph 3: Set-up for Radiated Emission (Rear View 2)**



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**Photograph 4: Setup for Radio Frequency Conducted Tests**



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