

Prüfbericht-Nr.: Test Report No.:	50096219 001	Auftrags-Nr.: Order No.:	114067578-22	Seite 1 von 42 Page 1 of 42
Kunden-Referenz-Nr.: Client Reference No.:	N/A	Auftragsdatum: Order date:	31-Jul-2017	
Auftraggeber: Client:	N.V. Nederlandsche Apparatenfabriek "Nedap" , Parallelweg 2, 7141 DC Groenlo, The Netherlands			
Prüfgegenstand: Test item:	Lumen iL45			
Bezeichnung / Typ-Nr.: Identification / Type No.:	ASSY AD46R RF+MD+RFID ASSY AD46R RF+RFID			
Auftrags-Inhalt: Order content:	FCC/IC Test report			
Prüfgrundlage: Test specification:	FCC 47CFR Part 15: Subpart C Section 15.247 RSS-247 (02-2017)			
Wareneingangsdatum: Date of receipt:	1-Aug-2017			
Prüfmuster-Nr.: Test sample No.:	A000593200-003, A000593200-004			
Prüfzeitraum: Testing period:	1-Aug-2017 - 15-Aug-2017			
Ort der Prüfung: Place of testing:	EMC Laboratory Taipei			
Prüflaboratorium: Testing laboratory:	TUV Rheinland Taiwan Ltd.			
Prüfergebnis*: Test result*:	Pass			
geprüft von / tested by:		kontrolliert von / reviewed by:		
2017-10-25 Datum Date	Sam Kuo / Project Engineer Name / Stellung Name / Position		2017-10-25 Datum Date	Rene Charton/Senior Project Manager Name / Stellung Name / Position
	Unterschrift Signature			 Unterschrift Signature
Sonstiges / Other:				
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:		Prüfmuster vollständig und unbeschädigt Test item complete and undamaged		
* Legende: Legend:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	4 = ausreichend N/A = nicht anwendbar
	5 = mangelhaft N/T = nicht getestet			
	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory F(ail) = failed a.m. test specification(s)	4 = sufficient N/A = not applicable
				5 = poor 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 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 P: Photo Documentation

(File Name: 50096219APPENDIX P)

Appendix D: Test Result of Radiated Emissions

(File Name: 50096219APPENDIX 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 RSS-247 Issue 2 Feb 2017 RSS-Gen, Issue 4, November 2014 ANSI C63.10:2013 NCC Low-power Radio-frequency Devices Technical Regulations LP0002(2016)(105年6月28日)

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.: 340738
IC Canada Registration No.: 9465A-1
TAF Accredited NCC Test Lab. No.:0759

TAF ISO17025 Certification effective period: 2016-Jul-1st to 2019-Jun-30th



Testing Laboratory
0759

2.2 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	2016/09/12	2017/09/12
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	8447D	2944A06641	2016/12/28	2017/12/28
Preamplifier (18 GHz -40 GHz)	COM- POWER	PAM-840	461257	2016/12/01	2017/12/01
Pre-Amplifier (1GHz~18GHz)	EM Electronics	EM01G18G	060558	2016/11/17	2017/11/17
Bilog Antenna	TESEQ	CBL6111D	29802	2017/07/12	2018/07/12
Horn Antenna	ETS- Lindgren	3117	138160	2017/05/25	2018/05/25
Horn Antenna (18GHz~40GHz)	COM- POWER	AH-840	101031	2016/11/22	2017/11/22
Loop Antenna	Schwarzbeck	FMZB 1513	1513-076	2017/06/14	2018/06/14
EMI Test Receiver	R&S	ESC17	100797	2016/12/30	2017/12/30
Spectrum Analyzer	R&S	FSL3	101943	2015/09/07	2017/09/07
Temp. & Humid. Chamber	WISEWIND	1509	509Q24R	2017/05/24	2018/05/24
LISN (1 phase)	R&S	ENV216	101243	2017/06/18	2018/06/18
LISN	R&S	ENV216	101262	2017/06/22	2018/06/21

2.3 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

requiring calibration is calibrated periodically in a suitably accredited Calibration Lab. 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:

Table 3: Emission Measurement Uncertainty

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

3. General Product Information

3.1 Product Function and Intended Use

The model ASSY AD46R RF+MD+RFID is an Electronic Article Surveillance System. There are 2 versions, with different features implemented. The fully featured version incorporates a Tag detector working in the 7-8 MHz Band, an RFID Tag reader working in the 902-928MHz UHF band and a metal detector that works at a frequency of 125 kHz. The alternative version model ASSY AD46R RF+RFID does not have the 125 kHz current generator and field sensing module for the metal detector installed, but the antenna system is the same for both versions.

This test report relates to the 902-928MHz UHF portion of the device.

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/Test Item	Lumen iL45
Type Identification	ASSY AD46R RF+MD+RFID
FCC ID	CGDADRRFMDRFID (with metal detector) CGDADRRFRFID (without metal detector)
Canada ID	1444A-ADRRFMDRFID (with metal detector) 1444A-ADRRFRFID (without metal detector)
HVIN	ASSY AD46R RF+MD+RFID (with metal detector) ASSY AD46R RF+RFID (without metal detector)

Table 5: Technical Specification of EUT

Technical Specification	Value
Operating Frequency	902.75 MHz ... 927.25 MHz
Channel Spacing	500 kHz
Channel number	50
Operation Voltage	120V (PoE adapter)
Modulation	Hopping
Antenna gain	N/A

3.3 Independent Operation Modes

The basic operation modes are:

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

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

Test operation refers to test setup in chapter 4. All testing were performed according to the procedures in ANSI C63.10: 2013.

The samples were used as follows:

Conducted: N/A

Radiation: A000593200-003, A000593200-004

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:

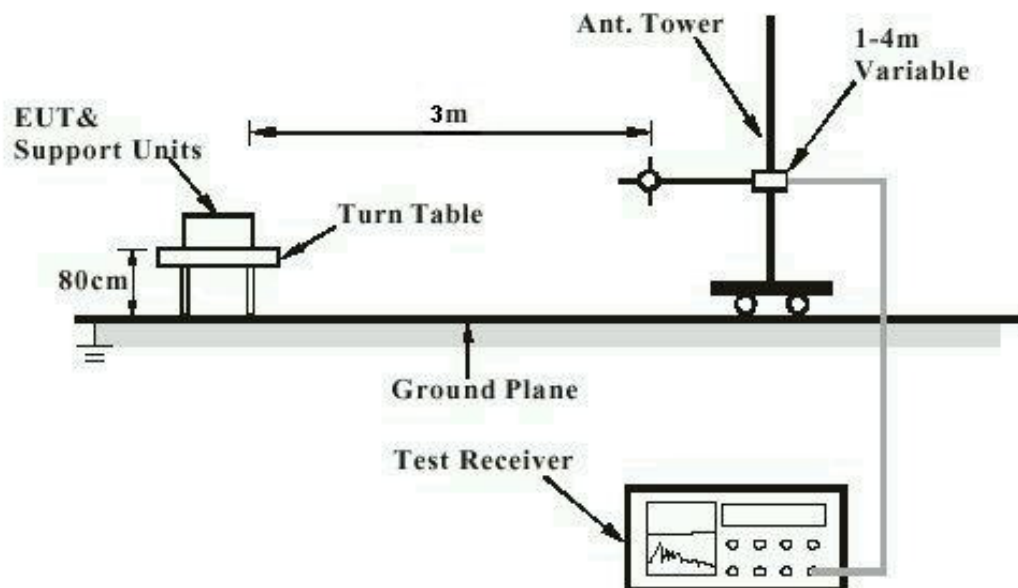
Kind of Equipment	Manufacturer	Model Name	S/N
--	--	--	--

4.4 Countermeasures to achieve EMC Compliance

The test sample which has been tested containing the noise suppression parts as in the Photo Appendix and the Test Setup Photos. 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

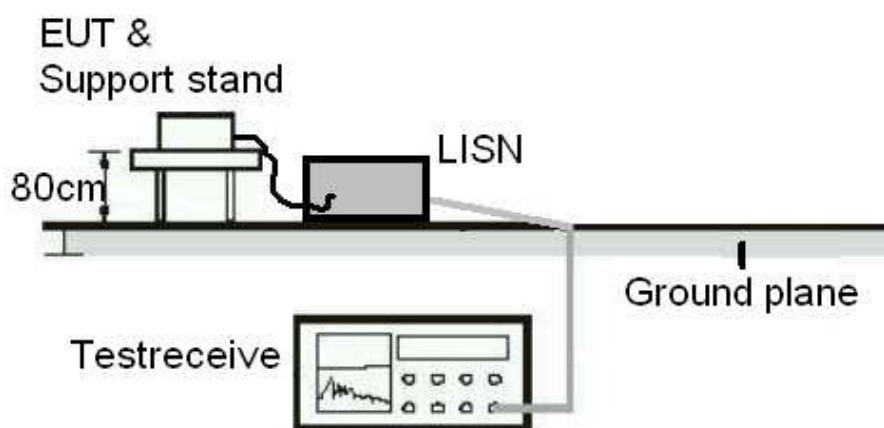
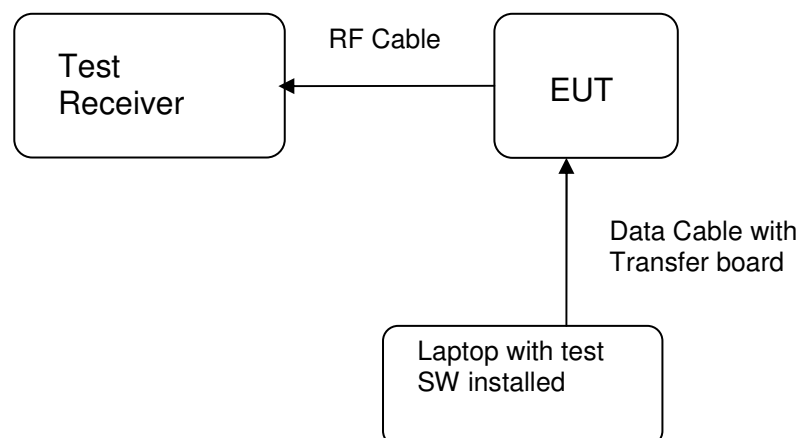


Diagram of Measurement Equipment Configuration for Conducted Transmitter Measurement



5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:**Passed**

Test 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 4.1dBi dBi.

The antenna and the Transmitter Circuit are one unit 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 : FCC Part 15.247(b)(1),
 RSS-247 5.4(2)
 LP0002(2011): 3.10.1, (2)
 Basic standard : ANSI C63.10:2013
 LP0002(2011) Appendix II
 Kind of test site : Shielded room

Test setup

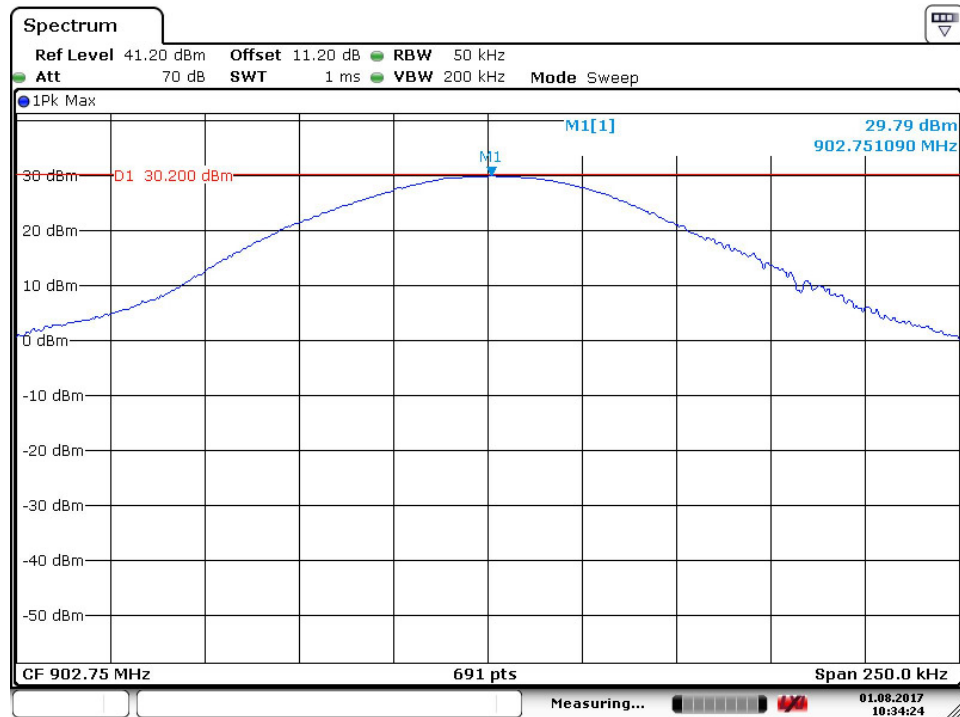
Test Channel : Low/ Middle/ High
 Operation Mode : A

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

Table 6: Test result of Peak Output

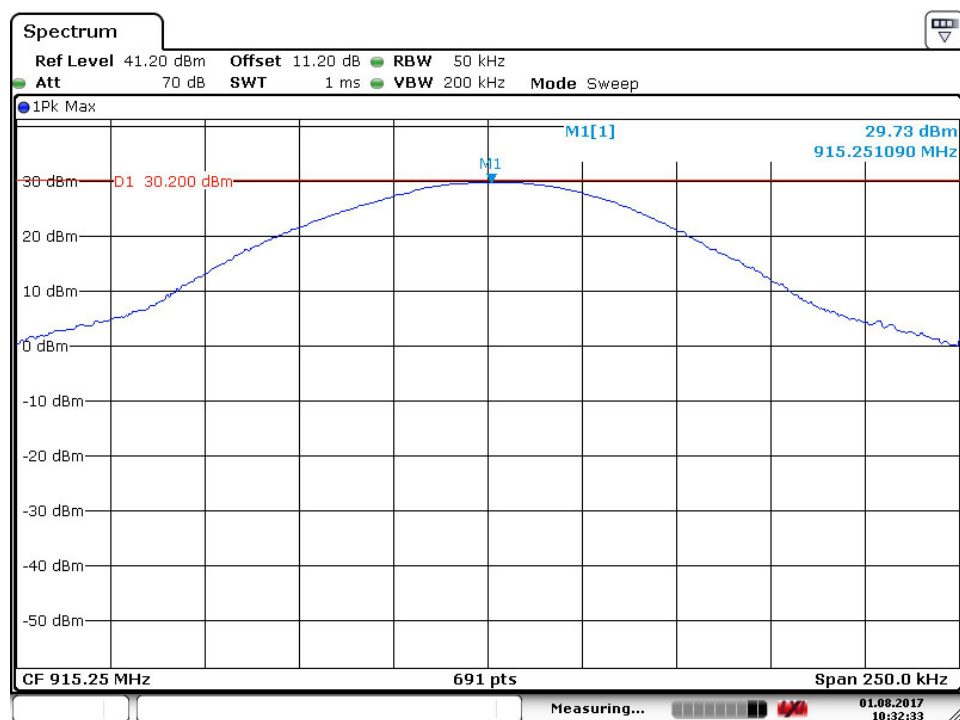
Channel	Channel Frequency	Peak Output Power		Limit
	(MHz)	(dBm)	(W)	(W)
Low Channel	902.75 MHz	29.79	0.9528	1
Middle Channel	915.25 MHz	29.73	0.9397	1
High Channel	927.25 MHz	29.61	0.9141	1

Test Plot of Peak Output Power, Low Channel

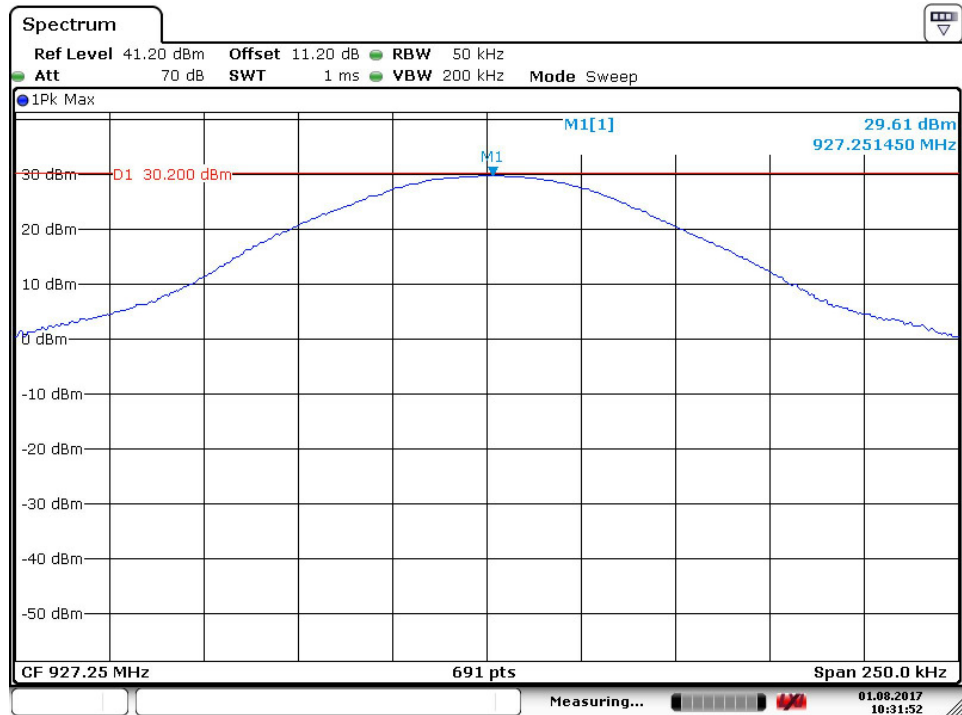


Date: 1.AUG.2017 10:34:25

Middle Channel



Date: 1.AUG.2017 10:32:34

High Channel


Date: 1.AUG.2017 10:31:52

5.1.3 20dB Bandwidth

RESULT:
Passed

Test standard : FCC Part 15.247(a)(1),
 RSS-247 5.1(1)
 LP0002(2011): 3.10.1, (6.1.1)

Basic standard : ANSI C63.10:2013
 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%

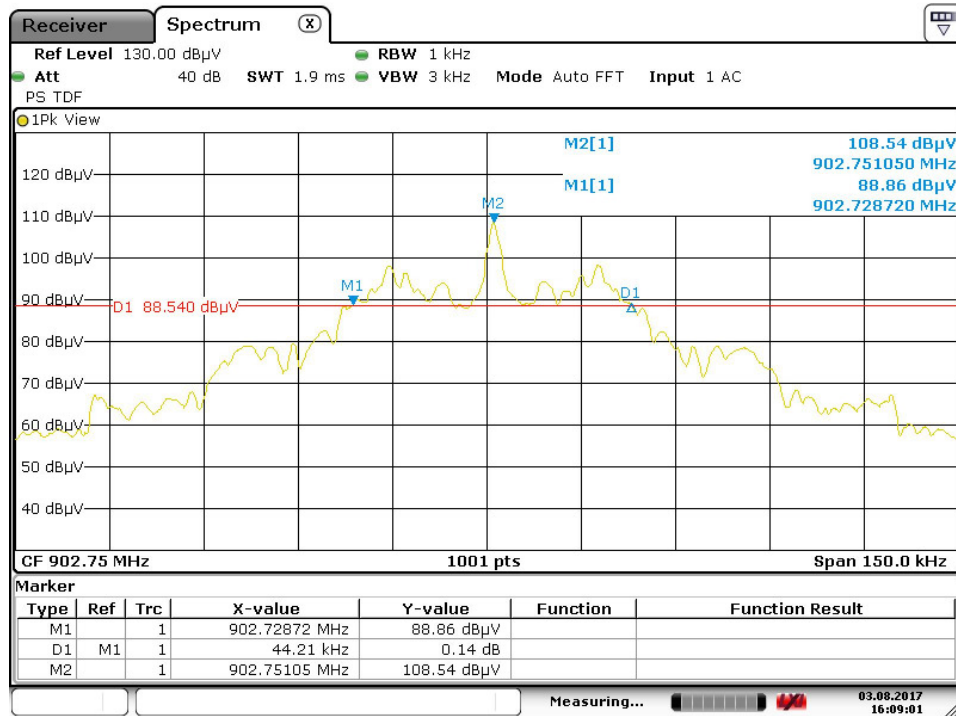
Atmospheric pressure : 100-103kPa

Table 7: Test result of 20dB Bandwidth,

Channel	Channel Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)	Result
Low Channel	902.75 MHz	44.21	< 500	Pass
Mid Channel	915.25 MHz	43.46	< 500	Pass
High Channel	927.25 MHz	42.41	< 500	Pass

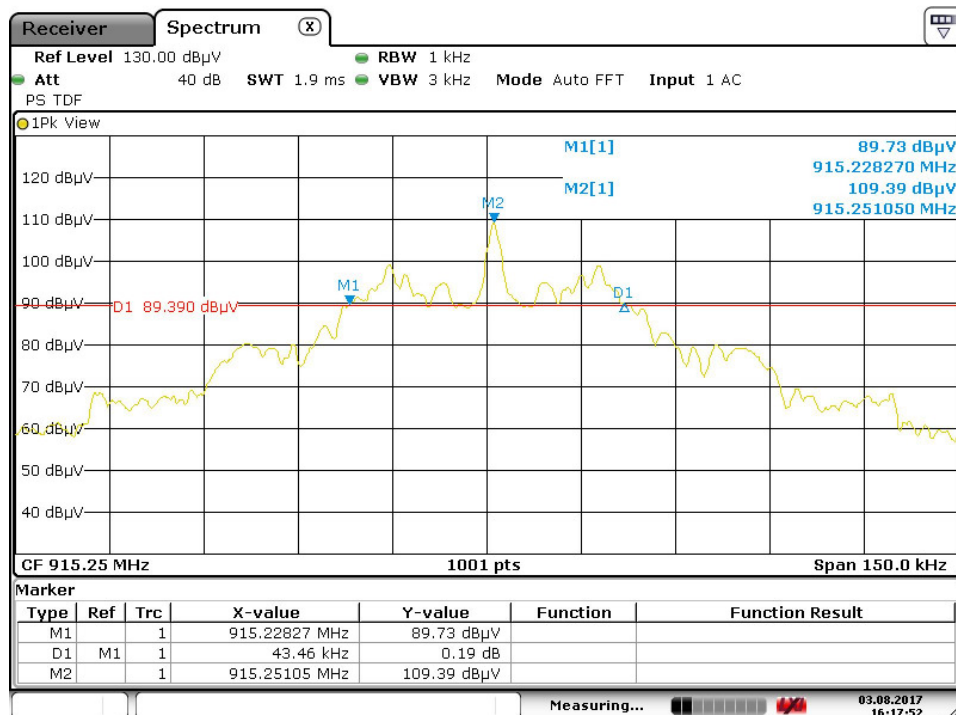
Test Plot of 20dB Bandwidth

Low Channel

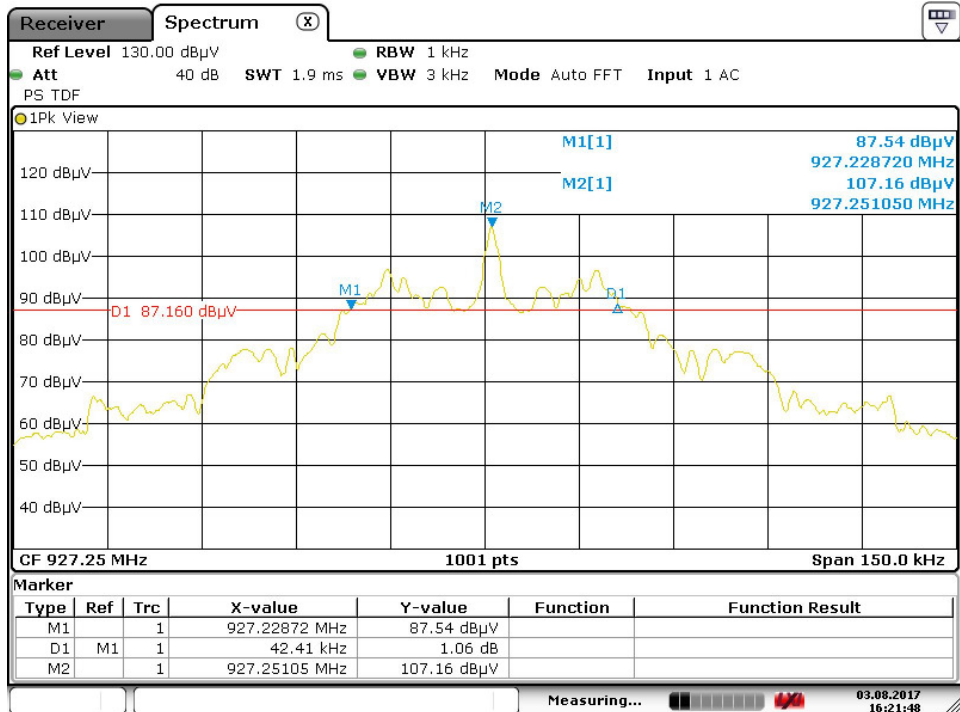


Date: 3.AUG.2017 16:09:00

Middle Channel



Date: 3.AUG.2017 16:17:52

High Channel


Date: 3.AUG.2017 16:21:48

5.1.4 99% Bandwidth

RESULT:**Passed**

Test standard : RSS-Gen, Issue 4, November 2014
Basic standard : ANSI C63.10:2013
Kind of test site : Shielded room

Test setup

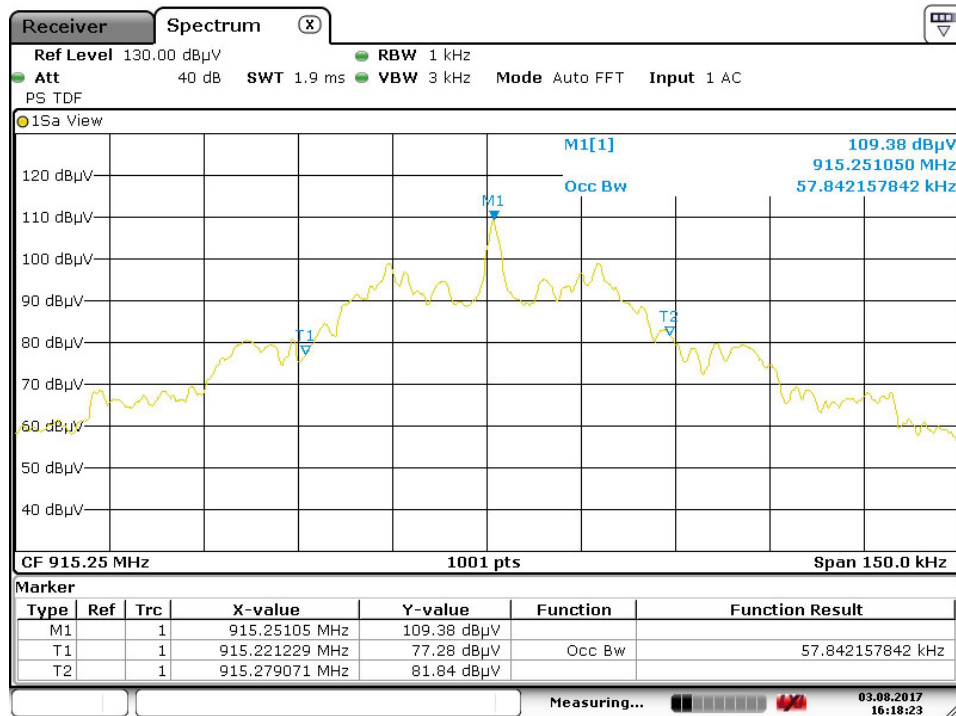
Test Channel : Low/ Middle/ High
Operation Mode : A

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

Table 8: Test result of 99% Bandwidth, GFSK modulation

Channel	Channel Frequency (MHz)	99% Bandwidth (kHz)
Mid Channel	915.25	57.84

Test Plot of 99% Bandwidth, Middle Channel



Date: 3.AUG.2017 16:18:23

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

RESULT:**Passed**

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

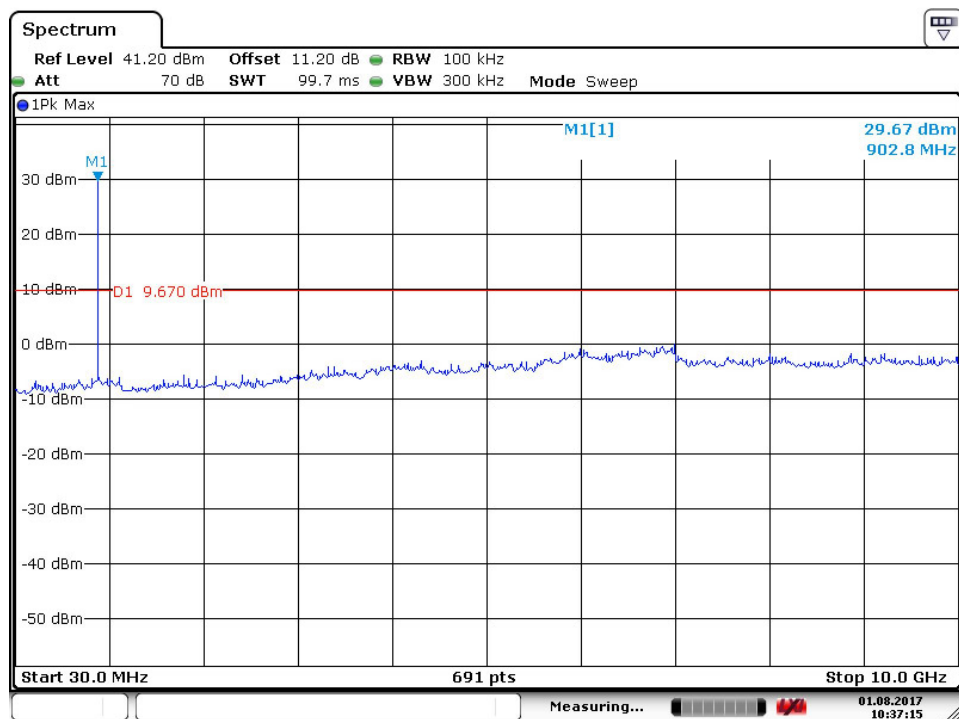
Test setup

Test Channel	:	Low/ Middle/ High
Operation Mode	:	A
Ambient temperature	:	22-26°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.

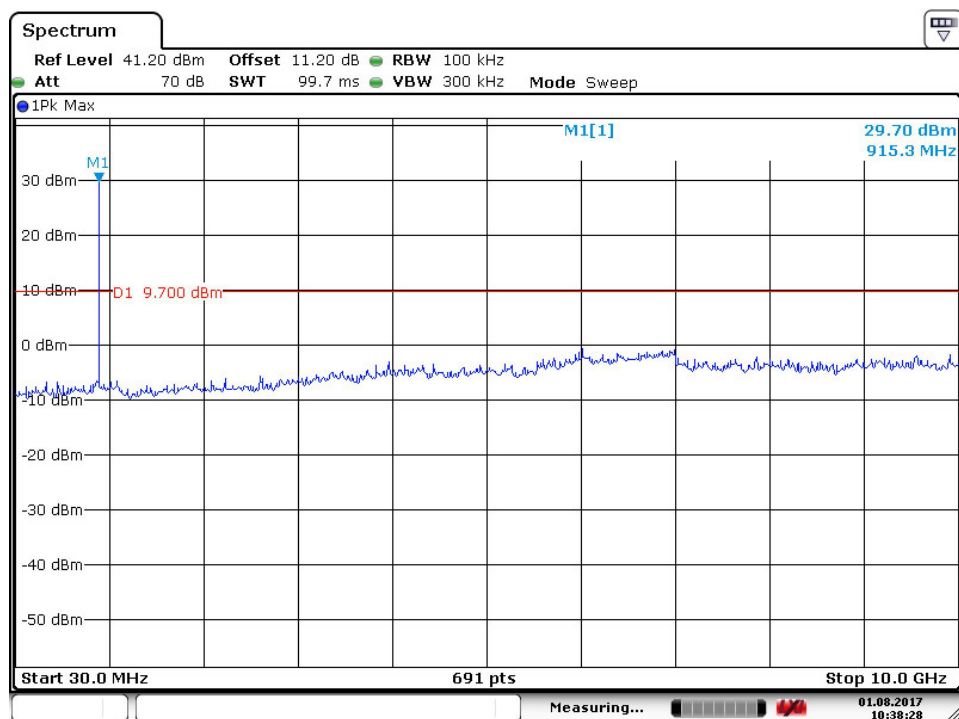
Due to the small size of the product and that there are no inductive components of significant size, 9kHz to 30MHz frequency range is not tested based on technical judgment.

Test Plot of 100kHz Conducted Emissions, Low Channel

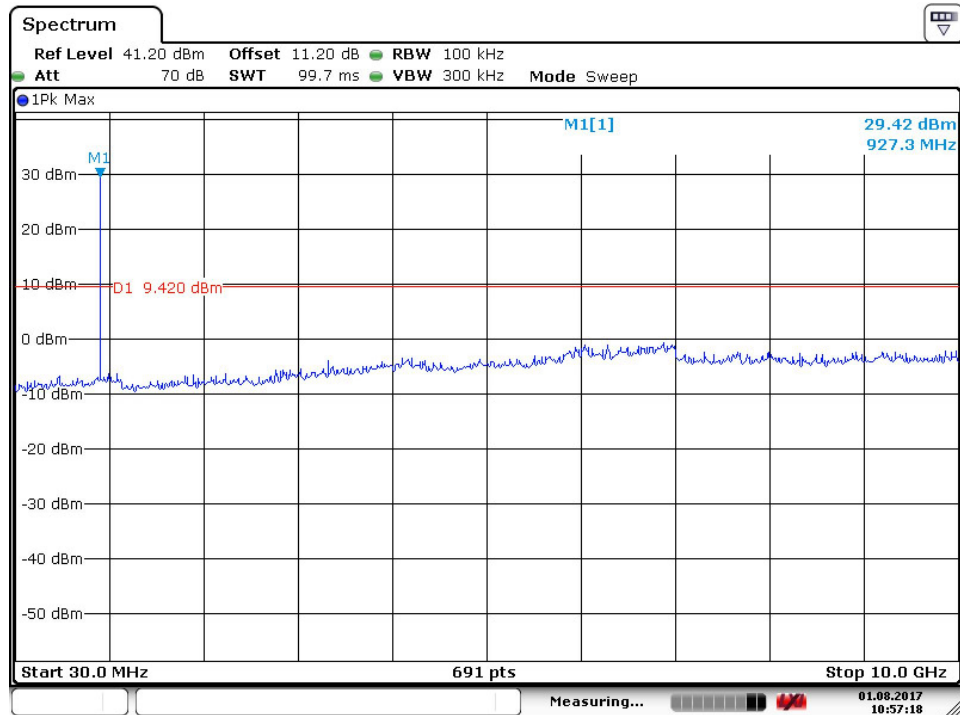


Date: 1.AUG.2017 10:37:16

Middle Channel



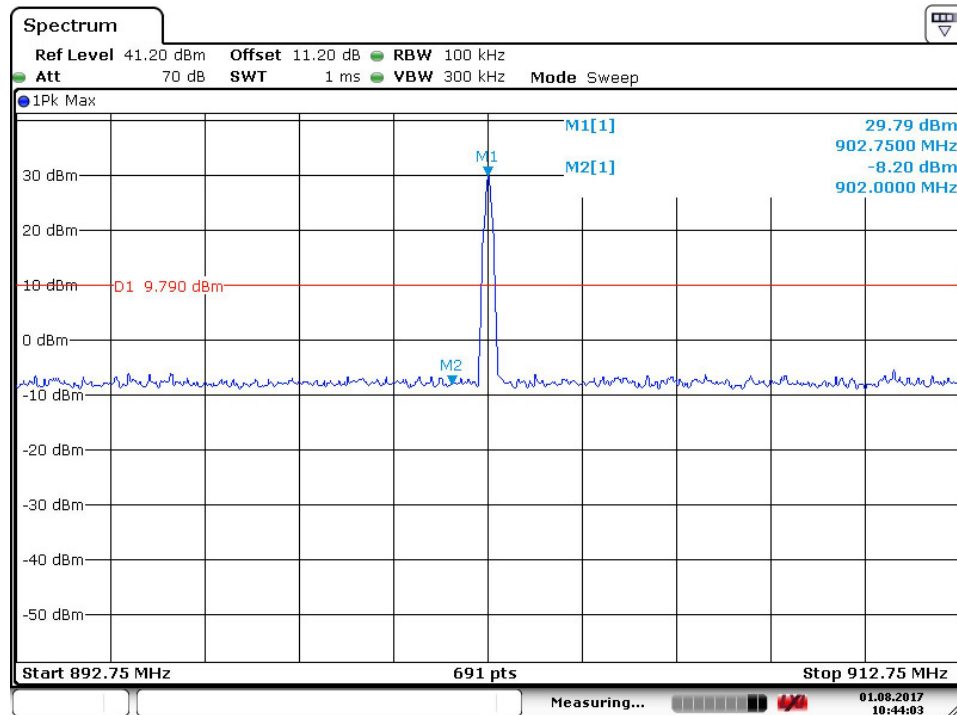
Date: 1.AUG.2017 10:38:29

High Channel


Date: 1.AUG.2017 10:57:18

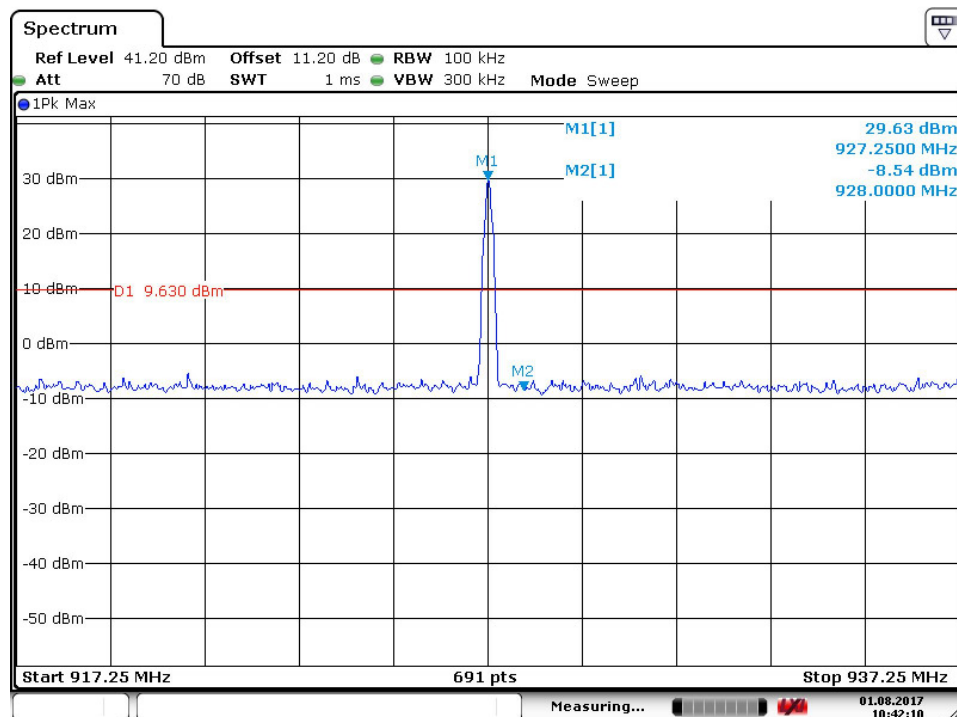
Test Plot of 100kHz Bandwidth of Frequency Band Edge

Low Channel

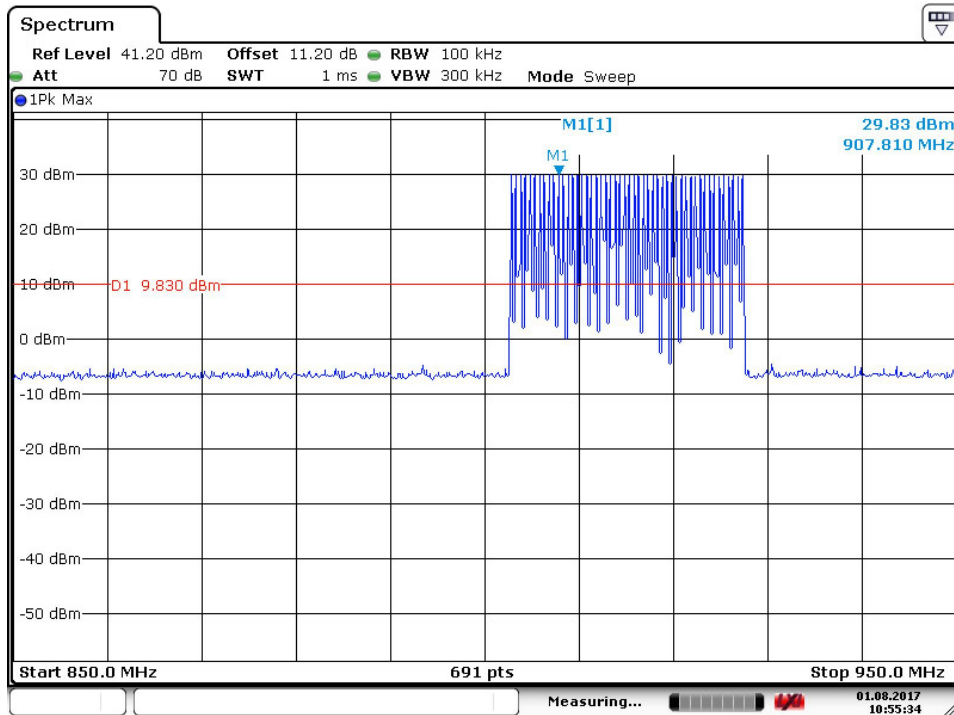


Date: 1.AUG.2017 10:44:03

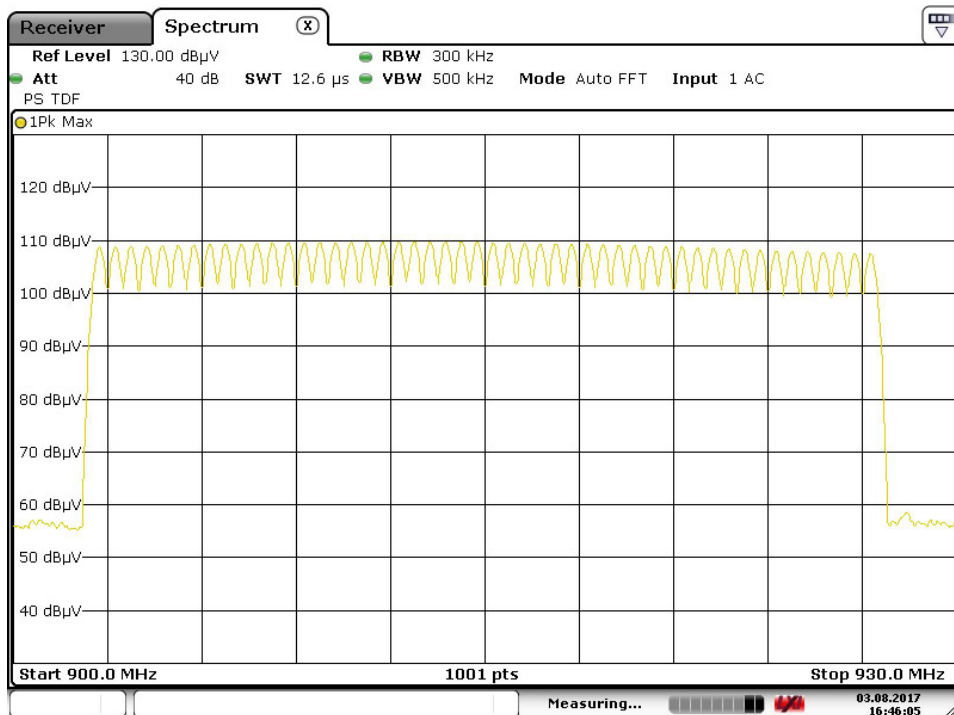
High Channel



Date: 1.AUG.2017 10:42:11

Hopping On


Date: 1.AUG.2017 10:55:34



Date: 3.AUG.2017 16:46:06

5.1.6 Spurious Emission

RESULT:

Passed

Test standard	:	FCC part 15.247(d), FCC 15.205, FCC 15.209, RSS-247 5.5 and RSS-Gen 8.9 LP0002(2011): 3.10.1, (5)
Basic standard	:	ANSI C63.10: 2013
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). Emission radiated outside the specified frequency bands must comply with the -20dBc emission limits specified in FCC 15.247 and RSS-247 5.5
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.

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	:	ANSI C63.10:2013 LP0002(2011) Appendix II
Limit	:	≥ 25kHz or 2/3 of 20dB bandwidth, whichever is greater

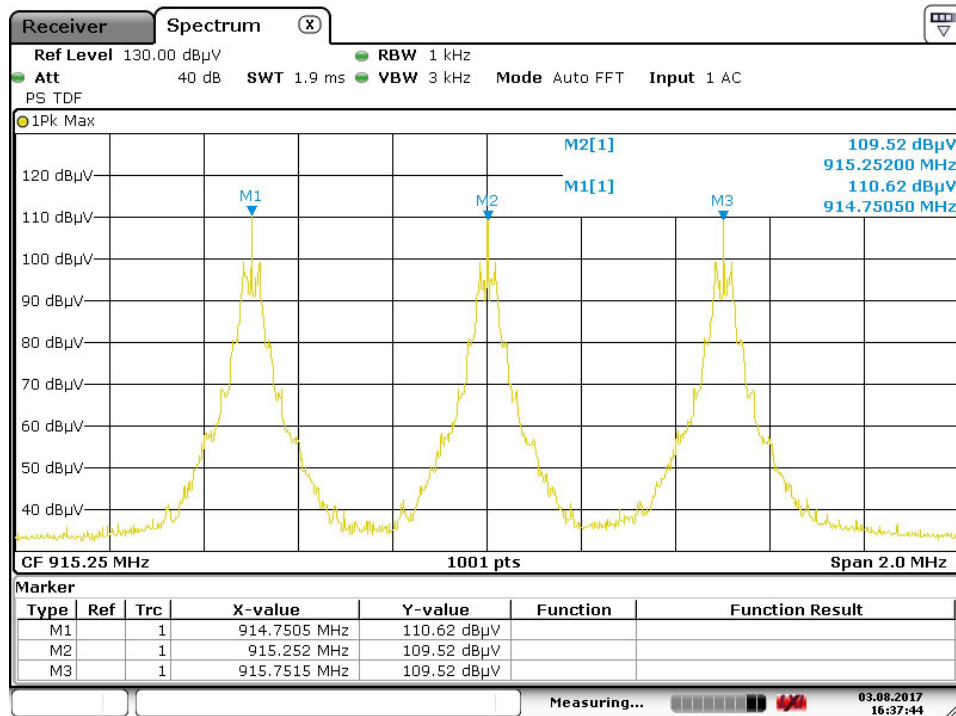
Test setup

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

Table 9: Test result of Frequency Separation

Channel	Channel Frequency (MHz)	Measured Channel Separation (MHz)	Limit (kHz)	Result
Record Channel		0.5	≥115 kHz	Pass
Record Channel adj 1				
Record Channel adj 2	915.25			

Test Plot of Frequency Separation



Date: 3.AUG.2017 16:37:45

5.1.8 Number of Hopping Channels

RESULT:**Passed**

Test standard : FCC part 15.247(a)(1)(iii)
RSS-247 5.1(5)
LP0002(2011): 3.10.1, (6.1.2)
Basic standard : ANSI C63.10:2013
LP0002(2011) Appendix II

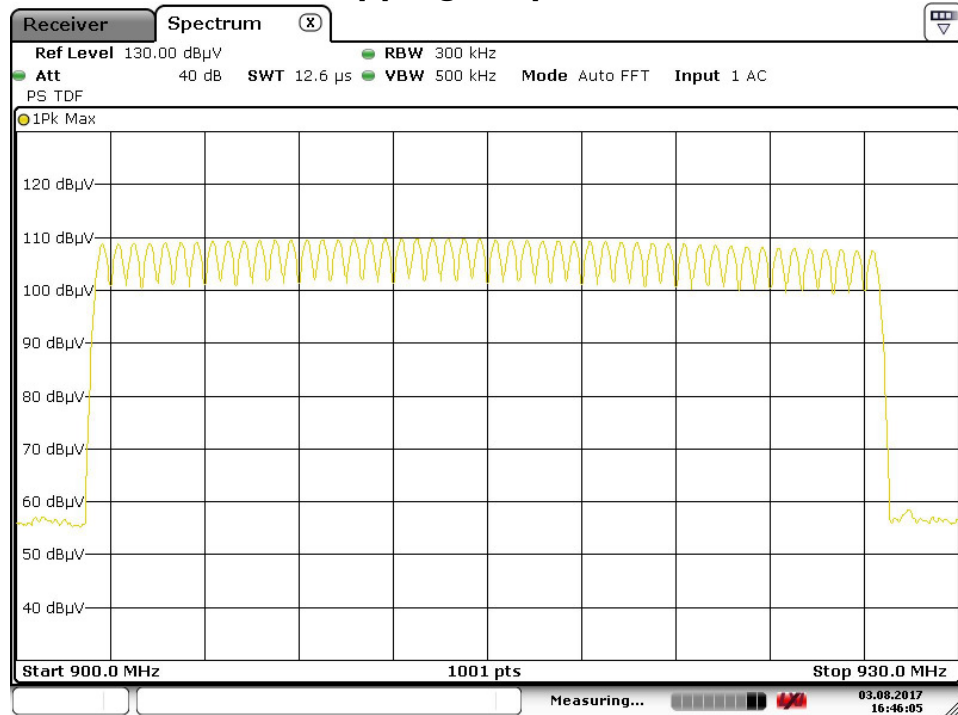
Test setup

Test Channel : Hopping On
Operation Mode : A
Ambient temperature : 22-26°C
Relative humidity : 50-65%
Atmospheric pressure : 100-103 kPa

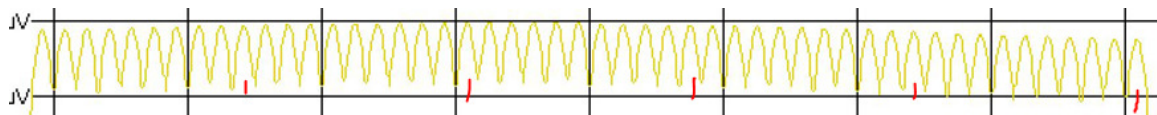
Table 10: Test result of Number of hopping frequency

Frequency Range	Measured Number of Hopping Channel	Limit	Result
902 to 928 MHz	50	≥50	Pass

Test Plot of Number of hopping frequencies



Date: 3.AUG.2017 16:46:06



5.1.9 Time of Occupancy

RESULT:**Passed**

Test standard	:	FCC part 15.247(a)(1)(iii) RSS-247 5.1(5) LP0002(2011): 3.10.1, (6.1.2)
Basic standard	:	ANSI C63.10:2013 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

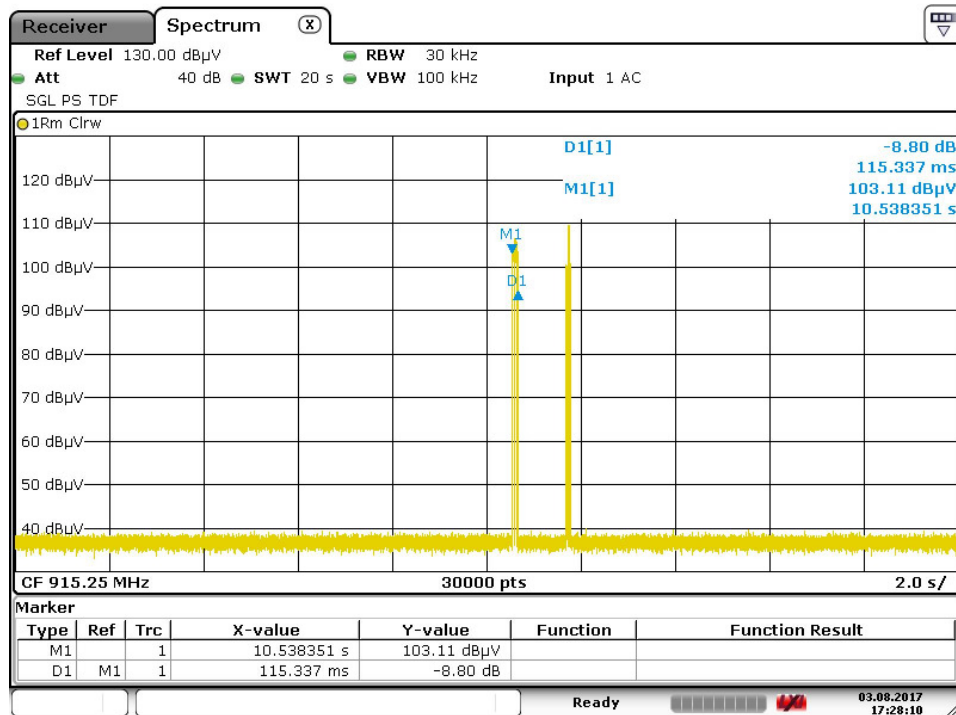
Table 11: Test result of Time of Occupancy

Frequency hopping systems operating in the 902–928 MHz band:
if the 20 dB bandwidth of the hopping channel is less than 250 kHz,
- then the system shall use at least 50 hopping frequencies and
- the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

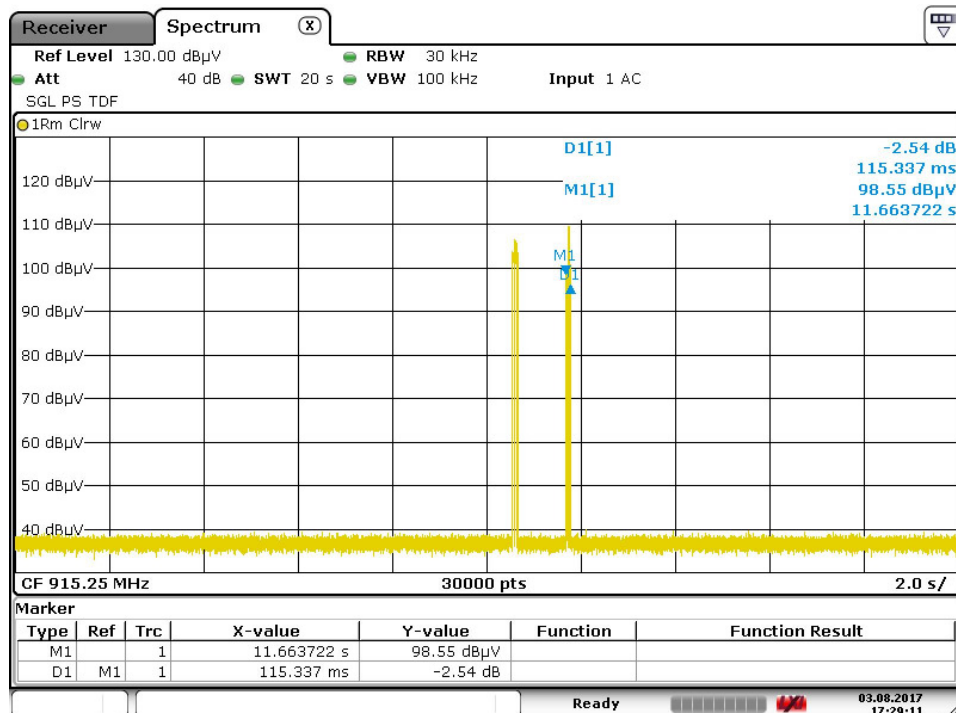
Number of hopping channels: 50

$115.337\text{ms} + 115.337\text{ ms} = 230.674\text{ ms} < 400\text{ ms}$

Test Plot of Time of Occupancy



Date: 3.AUG.2017 17:28:10



Date: 3.AUG.2017 17:29:11

5.2 Mains Emissions

5.2.1 Mains Conducted Emissions

RESULT:**Passed**

Test standard	:	FCC Part 15.207 FCC Part 15.107 RSS-Gen 7.2.4 LP0002: 8.8
Limits	:	Mains Conducted emissions as defined in above test standards must comply with the mains conducted emission limits specified
Kind of test site	:	Shielded Room

Test setup

Test Channel	:	Middle
Operation mode	:	A

Remark: For details refer to Appendix D.

6. Safety Human exposure

6.1 Radio Frequency Exposure Compliance

6.1.1 Electromagnetic Fields

RESULT:**Passed**

Test standard : FCC KDB Publication 447498 D01 v05
RSS-102 issue 5, Table 4

The EUT will maintain a 20 cm distance to all persons.

Maximum Exposure FCC:

Power to Antenna (mW)	953 mW
Power to Antenna (dBm)	29.8 dBm
Antenna Gain	4.1 dBi
Power+Ant Gain	2449.6 mW
Distance	20 cm
S=	0.487 mW/cm ²

Limit FCC: 0.61 mW/cm²

FCC:

0.3-1.34 MHz	(100) mW/cm ²
1.34-30 MHz	(180/f ²) mW/cm ²
30-300 MHz	0.2 mW/cm ²
300-1500 MHz f/1500	mW/cm ²
1500-100,000 MHz	1.0 mW/cm ²

Maximum Exposure Canada:

Power to Antenna (mW)	953 mW
Power to Antenna (dBm)	29.8 dBm
Antenna Gain	4.1 dBi
Power+Ant Gain	2449.6 mW
Distance	28 cm
S=	0.249 mW/cm ²

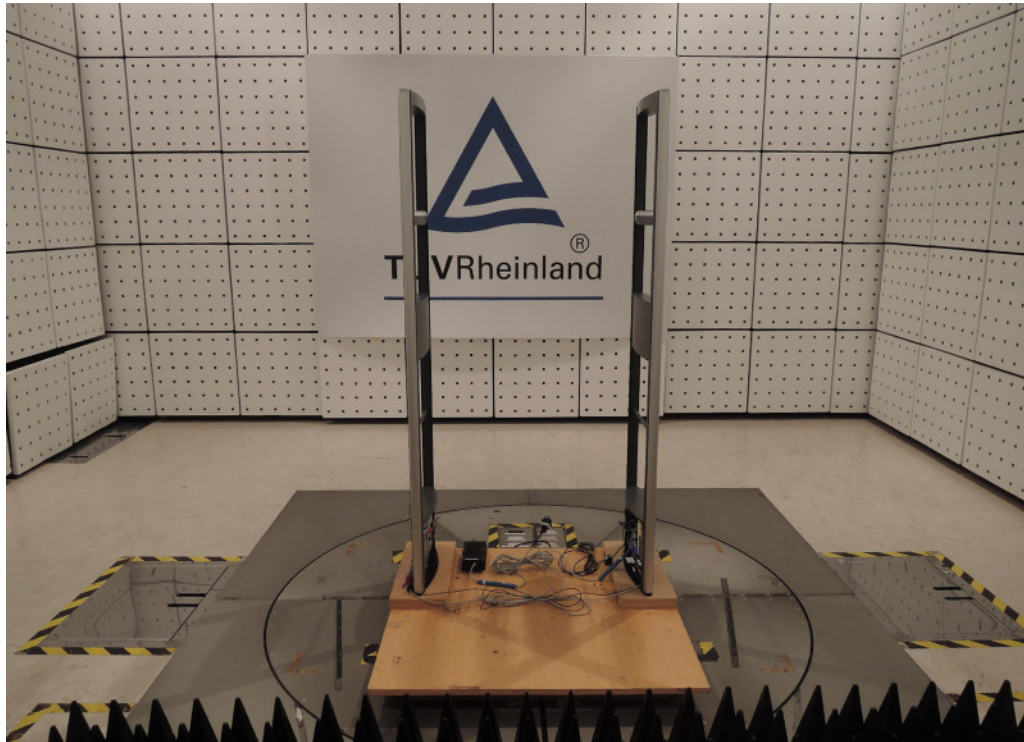
Limit Canada: 0.274 mW/cm²

Canada:

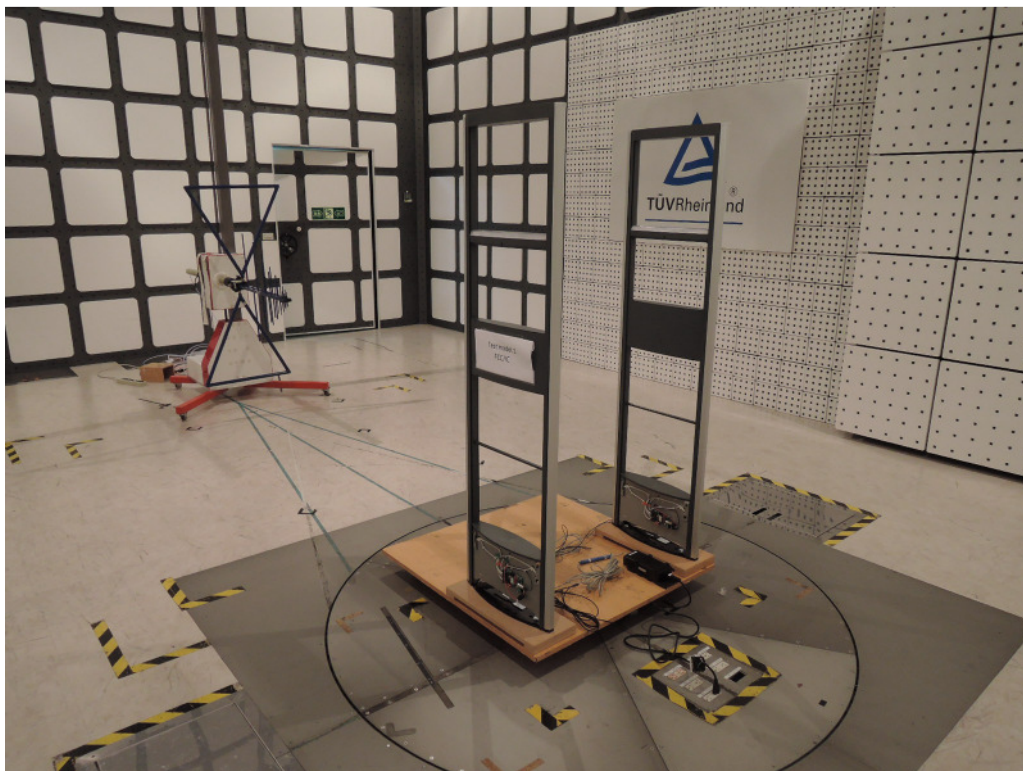
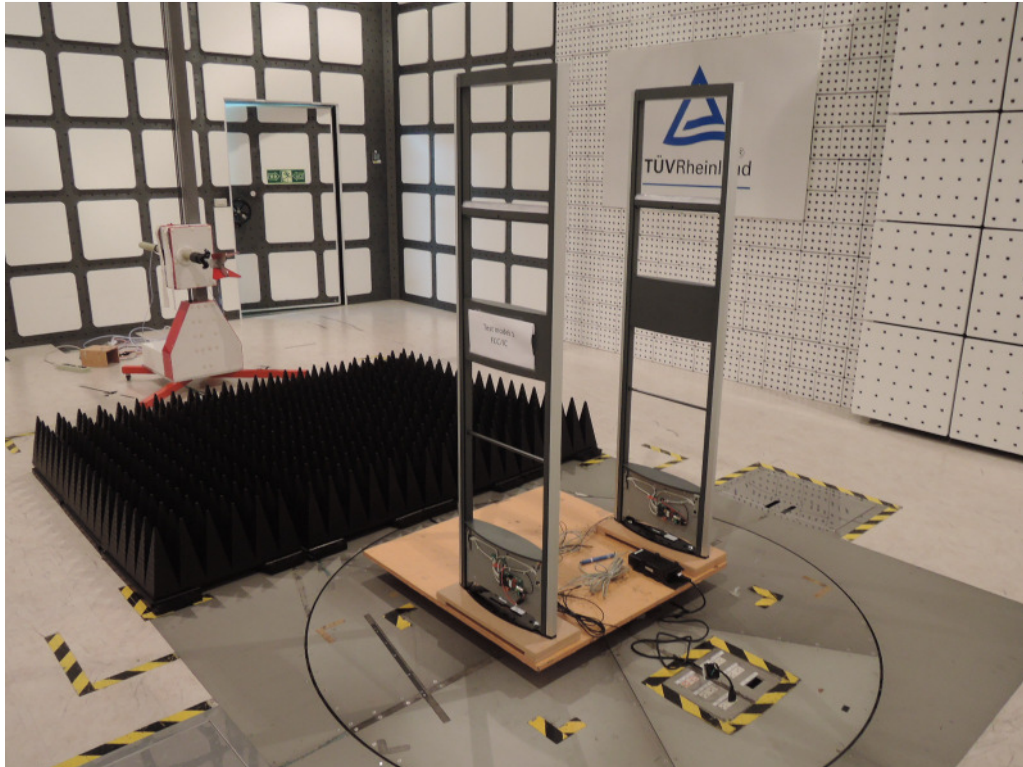
10-20 MHz	0.2 mW/cm ²
20-48 MHz	$(0.8944/f^{0.5})$ mW/cm ²
48-300 MHz	0.129 mW/cm ²
300-6000 MHz	$(0.002619 \cdot f^{0.6834})$ mW/cm ²
6000-15000MHz	1.0 mW/cm ²

7. Photographs of the Test Set-Up

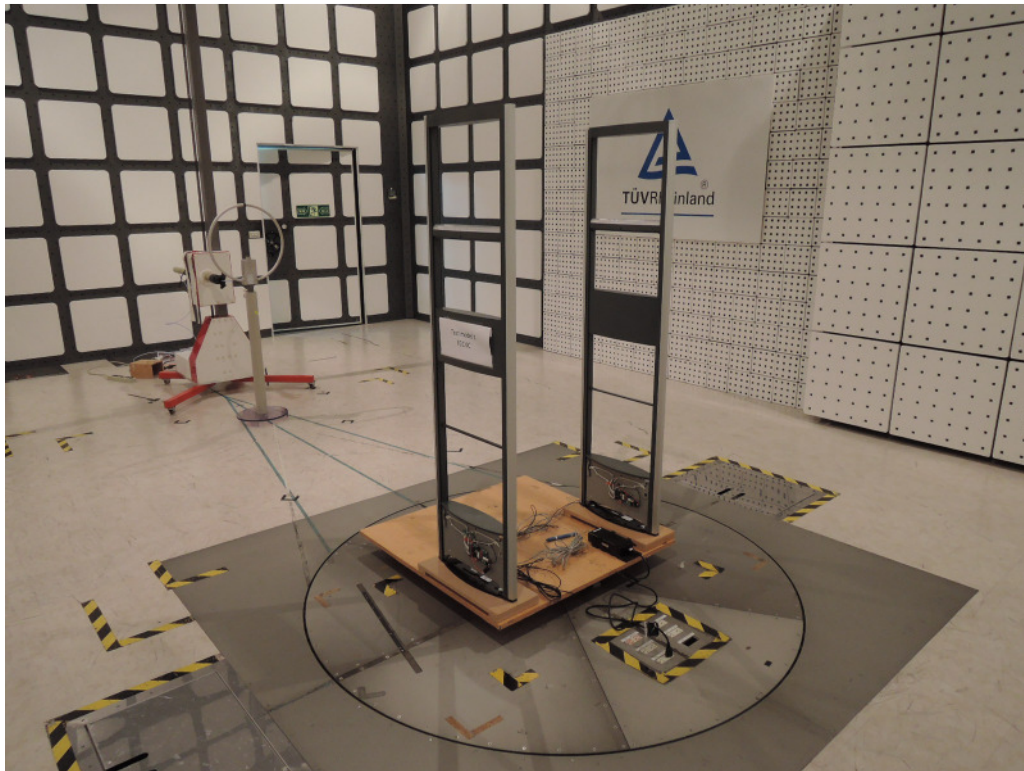
Photograph 1: Set-up for Radiated Emissions (Front View)



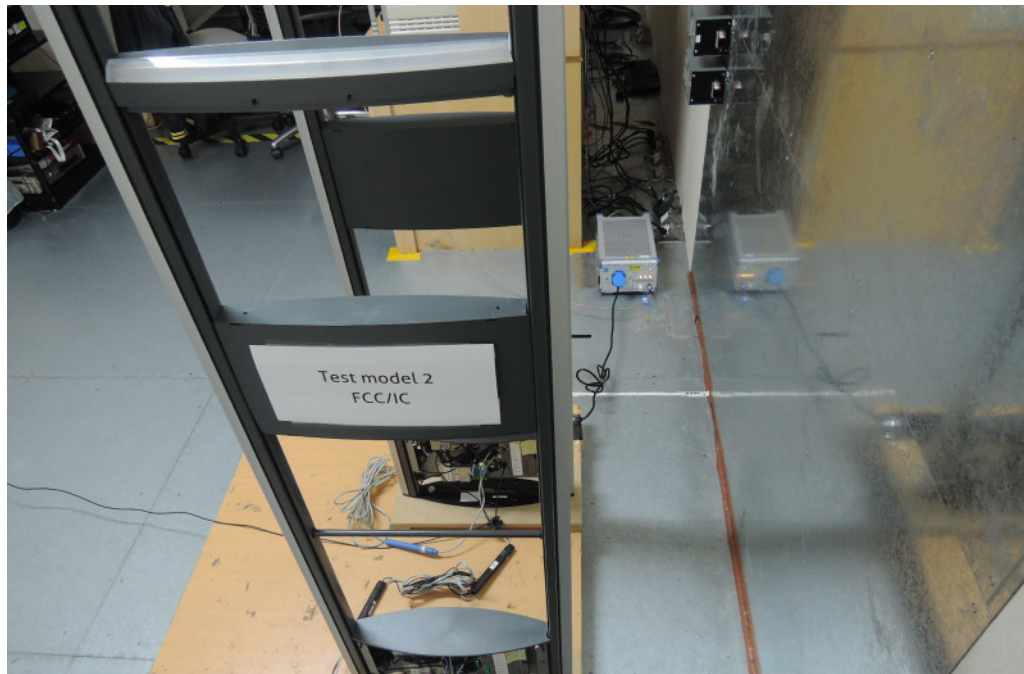
Photograph 2: Set-up for Radiated Emissions (Back View 1)



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



Photograph 4: Set-up for for Mains Conducted testing Back



Photograph 5: Set-up for for Mains Conducted testing Front



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