

Prüfbericht-Nr.: <i>Test Report No.:</i>	50296856 001	Auftrags-Nr.: <i>Order No.:</i>	238109624	Seite 1 von 32 Page 1 of 32	
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	05-Sep-2019		
Auftraggeber: <i>Client:</i>	CUB ELECPARTS INC No.6, Lane 546, Sec. 6, Changlu Road, Fuhsin Township, Changhua County, Taiwan				
Prüfgegenstand: <i>Test item:</i>	TPMS SENSOR				
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	UNISENSOR1 (For serial model refer to table 5)				
Auftrags-Inhalt: <i>Order content:</i>	FCC Part 15C Test report ISED RSS-210 Test report				
Prüfgrundlage: <i>Test specification:</i>	FCC CFR47 Part 15: Subpart C Section 15.231(e) ISED RSS-210 A1.4				
Wareneingangsdatum: <i>Date of receipt:</i>	16-Sep-2019				
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000990161-17 ~ A000990161-20				
Prüfzeitraum: <i>Testing period:</i>	17-Sep-2019 – 18-Nov-2019				
Ort der Prüfung: <i>Place of testing:</i>	EMC/RF Laboratory Taipei				
Prüflaboratorium: <i>Testing laboratory:</i>	TUV Rheinland Taiwan Ltd.				
Prüfergebnis*: <i>Test result*:</i>	Pass				
geprüft von / tested by:			kontrolliert von / reviewed by:		
2019-11-18 Mars Y.J. Lin/ Project Engineer			2019-11-18 Arvin Ho/ Vice General Manager		
Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>
Sonstiges / Other:					
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>			Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* 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. <i>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.</i>					

TEST SUMMARY

5.1.1 ANTENNA REQUIREMENT

RESULT: *Passed*

5.1.2 FIELD STRENGTH OF FUNDAMENTAL

RESULT: *Passed*

5.1.3 FIELD STRENGTH OF HARMONICS

RESULT: *Passed*

5.1.4 20dB BANDWIDTH AND 99% BANDWIDTH

RESULT: *Passed*

5.1.5 PULSE WIDTH/TX GAP

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

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix P: Photo Documentation

(File Name: 50296856 001 APPENDIX P)

Appendix D: Test Result of Radiated Emissions

(File Name: 50296856 001 APPENDIX 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. 231(e)
FCC CFR47 Part 2: Subpart J Section 2.1091
FCC KDB Publication 447498 D01 General RF Exposure Guidance v06
ISED RSS-210 Issue 9, August 2016
ISED RSS-Gen, Issue 4, November 2014
ISED RSS-102, Issue 5, March 2015
ANSI C63.10:2013

2. Test Sites

2.1 Test Laboratory

TUV Rheinland Taiwan Ltd.

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

2.2 Test Facility

TUV Rheinland Taiwan Ltd.

No. 458-18, Sec 2, Fenliao., Linkou Dist.
New Taipei City 244
Taiwan (R.O.C.)

FCC Registration No.: 226631
IC Canada Registration No.: 25563
TAF Accredited NCC Test Lab. No.:3567
TAF ISO17025 Certification effective period: 6th-May-2019 to 05th-May-2022



Testing Laboratory
3567

2.3 List of Test and Measurement Instruments

Table 2: List of Test and Measurement Equipment

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due Date
EMI Test Receiver	R&S	ESR7	102108	2019/02/06	2020/02/05
Spectrum Analyzer	R&S	FSV40	101508	2019/02/05	2020/02/04
Pre-Amplifier	Agilent	8447D	2944A10772	2019/02/22	2020/2/21
Pre-Amplifier	EMCI	EMC051845SE	980633	2019/2/25	2020/2/24
Pre-Amplifier	EMCI	EMC184045SE	980657	2019/2/23	2020/2/22
Bilog Antenna	SCHWARZBECK	VULB-9168	00951	2019/1/14	2020/1/13
Horn Antenna	ETS-Lindgren	3117	00218930	2019/12/27	2020/12/26
Horn Antenna	SCHWARZBECK	BBHA 9170	00887	2019/4/12	2020/4/11
Loop Antenna	EMCI	LPA600	287	2019/12/20	2020/12/19
Test Software	Audix	e3	Ver. 9	N/A	N/A
Test Cable	HUBER+SUHNER	SUCOFLEX 104EA_9k~18G	800056/4EA	2019/4/18	2020/4/17
Test Cable	HUBER+SUHNER	SUCOFLEX 104_9k~18G	804680/4	2019/4/18	2020/4/17
Test Cable	HUBER+SUHNER	SUCOFLEX 104_9k~18G	MY37202/4	2019/4/18	2020/4/17
Test Cable	HUBER+SUHNER	SUCOFLEX 102EA_1G~40G	800898/2EA	2019/4/18	2020/4/17
Test Cable	HUBER+SUHNER	SUCOFLEX 102EA_1G~40G	800901/2EA	2019/4/18	2020/4/17
Test Cable	HUBER+SUHNER	SUCOFLEX 102EA_1G~40G	801027/2EA	2019/4/18	2020/4/17

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
Radio Frequency	$\pm 1 \times 10^{-7}$
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	$\pm 10 \%$

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a UNI Sensor. It contains a 315 & 434 MHz 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	TPMS SENSOR
Type Designation	UNISENSOR1
FCC ID	ZPNUNISENSOR1
Canada ID	9959A-UNISENSOR1
HVIN	UNISENSOR1

Table 5: UNISENSOR1 Series model

VS-62U031	VS-62U031XXXXXXXX	VS-62U031XX-XX-X	VS-62U031XXXXXX
VS-6XXXXXXXXXX	VS-6XXXXXXXXXXXXXX	VS-6XXXXXXXX-XX-X	VS-6XXXXXXXXXXXXXX
UNISENSOR1	UNISENSORM	UNISENSOR 1	

1. For the marketing purpose.
2. Where X may be any alpha character "a"-“z”, “A”-“Z”, or numeric character “0”-“9”, or -, (,), or blank or combination of alpha and numeric characters.
3. The representative sample with model “UNISENSOR1” was tested and recorded in this report.

Table 6: Technical Specification of EUT

Technical Specification	Value
Operating Frequency	315, 434MHz
Channel number	315MHz:1 434MHz:1
Operation Voltage	3Vdc
Modulation	ASK, FSK

3.3 Independent Operation Modes

Basic operation modes are:

- A. Transmitting
- 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 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 test software SPI 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 samples were used as follows:

434MHz ASK :A000990161-20
434MHz FSK : A000990161-19
315MHz ASK : A000990161-18
315MHz FSK : A000990161-17

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:

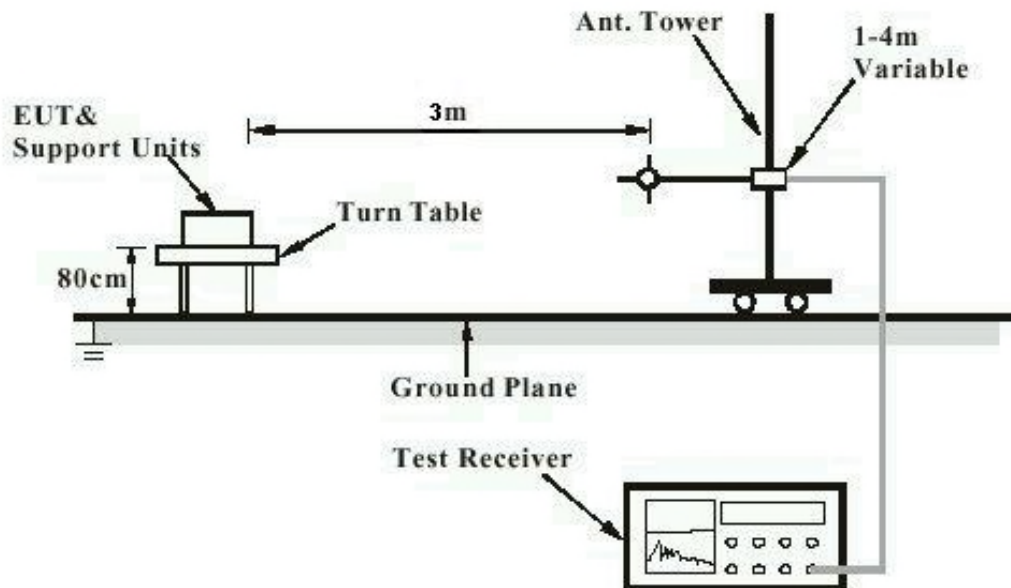
None.

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

5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT: **Passed**

Standard : FCC Part 15.203 and ISED RSS-Gen 6.8
Requirement : Manufacturer must ensure approved antenna is used

The antenna is a loop 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. 231(e)
ISED RSS-210 A1.4, Table A2

Basic standard : ANSI C63.10:2013

Test setup

Test Channel : 315, 434 MHz
Operation Mode : A
Test Lab : Linkou

Atmospheric pressure : 100-103 kPa

The EUT employs pulsed operation.
The pulse width is: ASK: 28.7 msec. FSK:10.435ms

The Tables below show calculated average values from the pulsed emissions measurement dataMHz, corrected with the worst case duty cycle factor over 100 msec.

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

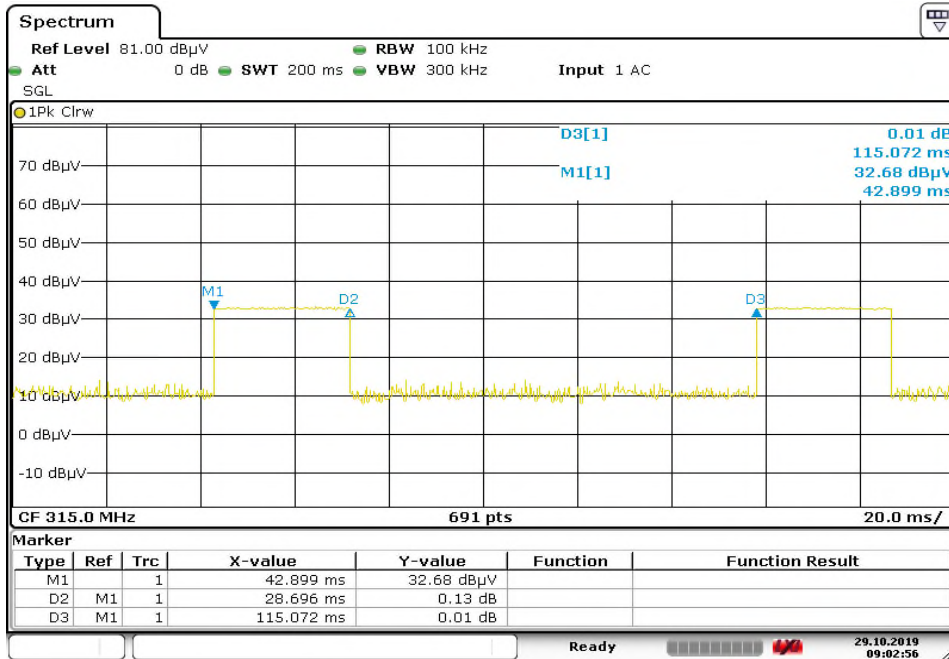
Duty cycle calculation:

ASK: Duty cycle correction (dB) = $20 \log (28.7 \text{ msec} / 100 \text{ msec}) = -10.84 \text{ dB}$.

FSK: Duty cycle correction (dB) = $20 \log (10.435 \text{ msec} / 100 \text{ msec}) = -19.63 \text{ dB}$.

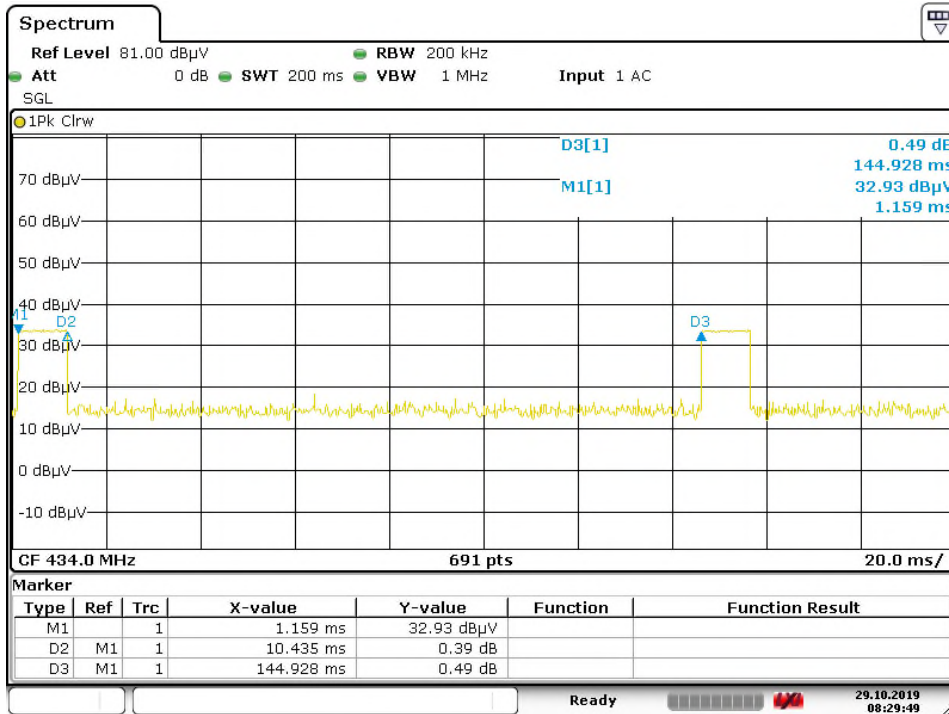
Test Plot pulse width

ASK:



Date: 29.OCT.2019 09:02:56

FSK:



Date: 29.OCT.2019 08:29:48

Table 7: Test result of Field strength of fundamental
ASK:

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Antenna orientation	Detector or calculated value
315	67.46	87.66	Horizontal	Peak
315	56.62	67.66		Average
315	60.13	87.66	Vertical	Peak
315	49.29	67.66		Average
434	72.35	92.87	Horizontal	Peak
434	61.51	72.87		Average
434	69.32	92.87	Vertical	Peak
434	58.48	72.87		Average

FSK:

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Antenna orientation	Detector or calculated value
315	66.71	87.66	Horizontal	Peak
315	47.08	67.66		Average
315	59.31	87.66	Vertical	Peak
315	39.68	67.66		Average
434	71.09	92.87	Horizontal	Peak
434	51.46	72.87		Average
434	68.88	92.87	Vertical	Peak
434	49.25	72.87		Average

5.1.3 Field strength of harmonics

RESULT:**Passed**

Test standard : FCC Part 15. 231(e)
ISED RSS-210 A1.4, Table A2

Basic standard : ANSI C63.10:2013

Test setup

Test Channel : 315, 434 MHz
Operation Mode : A
Test Lab : Linkou

Atmospheric pressure : 100-103 kPa

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

5.1.4 20dB Bandwidth and 99% Bandwidth

RESULT:
Passed

Test standard : FCC Part 15.231x(c), A1.3, ISSED RSS Gen
 Basic standard : ANSI C63.10:2013,
 Kind of test site : Shielded room

Test setup

Test Channel : 315, 434 MHz (20dB BW)
 315, 434 MHz (99% OBW)
 Operation Mode : A
 Test Lab : Linkou

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier..

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

Table 8: Test result of 20 dB Bandwidth, ASK

Channel	Channel Frequency (MHz)	-20 dB BW (kHz)	Limit (kHz)	Result
ASK	315	55.14	787	Pass
	434	64.4	1085	Pass

Table 9: Test result of 20 dB Bandwidth, FSK

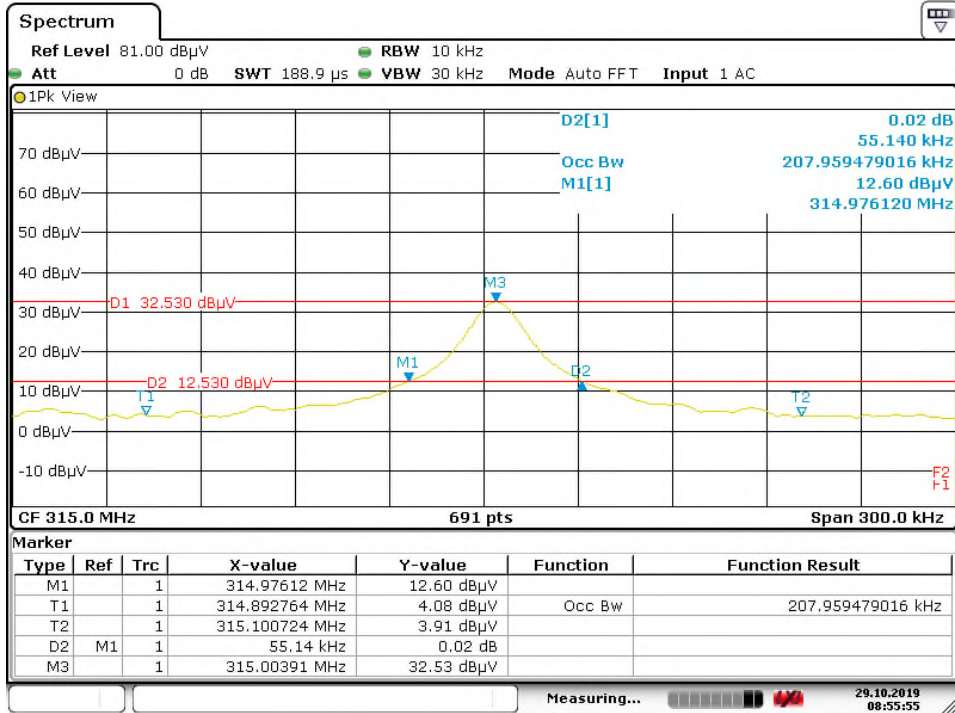
Channel	Channel Frequency (MHz)	-20 dB BW (kHz)	Limit (kHz)	Result
FSK	315	115.92	787	Pass
	434	136.76	1085	Pass

Table 10: Test result of 99% Bandwidth, ASK

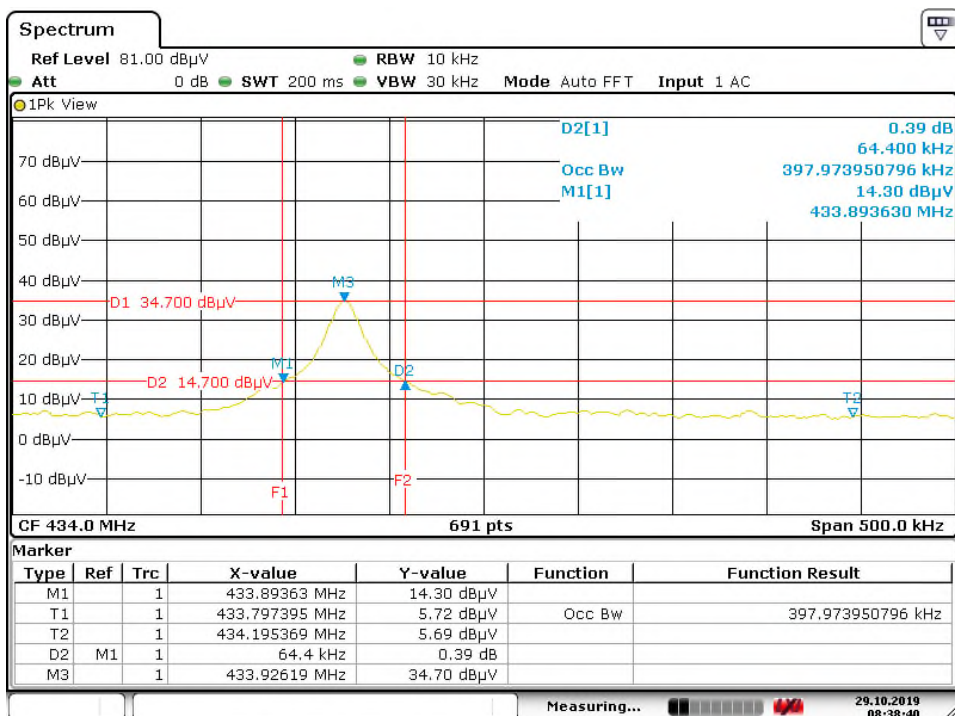
Channel	Channel Frequency (MHz)	99% Bandwidth (kHz)	Result
ASK	315	207.96	Pass
	434	397.97	Pass

Table 11: Test result of 99% Bandwidth, FSK

Channel	Channel Frequency (MHz)	99% Bandwidth (kHz)	Result
FSK	315	141.10	Pass
	434	348.77	Pass

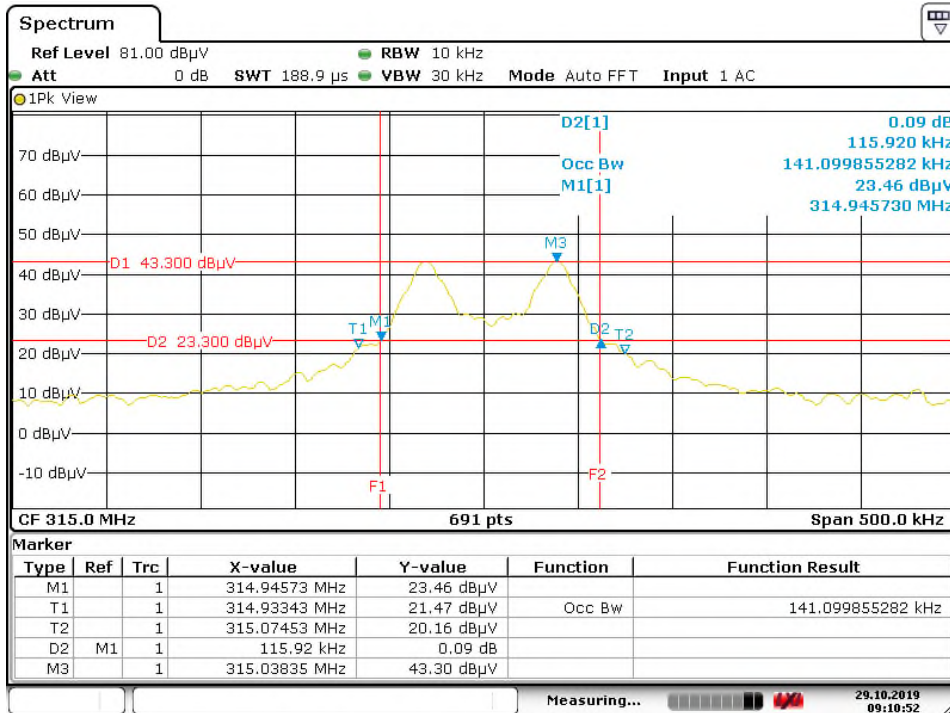
Test Plot of -20 dB Point, ASK
315MHz


Date: 29.OCT.2019 08:55:55

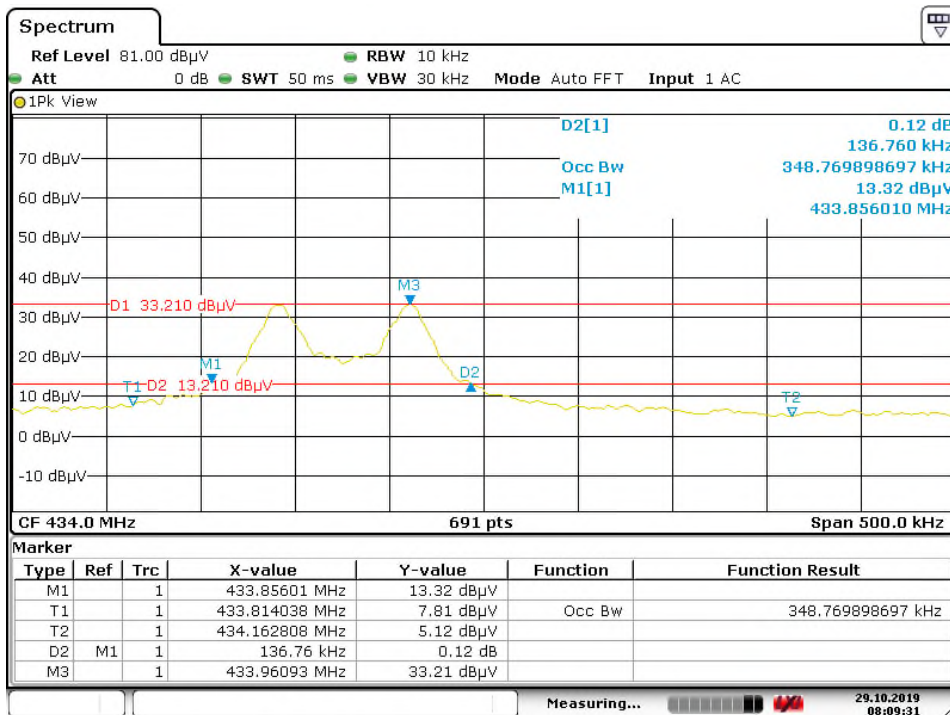
434MHz


Date: 29.OCT.2019 08:38:40

Test Plot of -20 dB Point, FSK

315MHz


Date: 29.OCT.2019 09:10:52

434MHz


Date: 29.OCT.2019 08:09:31

5.1.5 Pulse Width/TX gap

RESULT:**Passed**

Test standard : FCC Part 15.231x(e), ISED RSS-210 (Annex A1.4(b))

Kind of test site : Anechoic Chamber

Test setupTest Channel : 315, 434 MHz
Operation Mode : A

The device has automatic control mechanism such that each transmission time(Pulse width) is shorter than 1 second, and stop duration of a transmission period(TX gap) is longer than 10 seconds and is not shorter than transmission time multiplied by 30.

Atmospheric pressure : 100-103 kPa

Table 12: Test result of Pulse Width, ASK

Channel	Channel Frequency (MHz)	Pulse Width (ms)	Limit (ms)	Result
ASK	315	747.83	1000	Pass
	434	721.74	1000	Pass

Table 13: Test result of Pulse Width, FSK

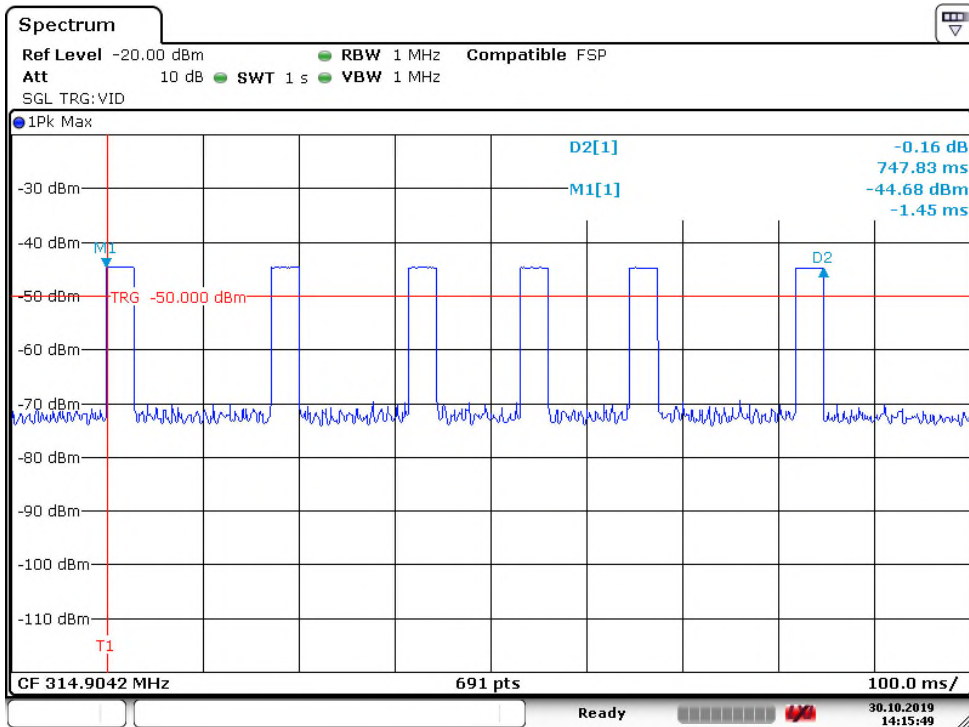
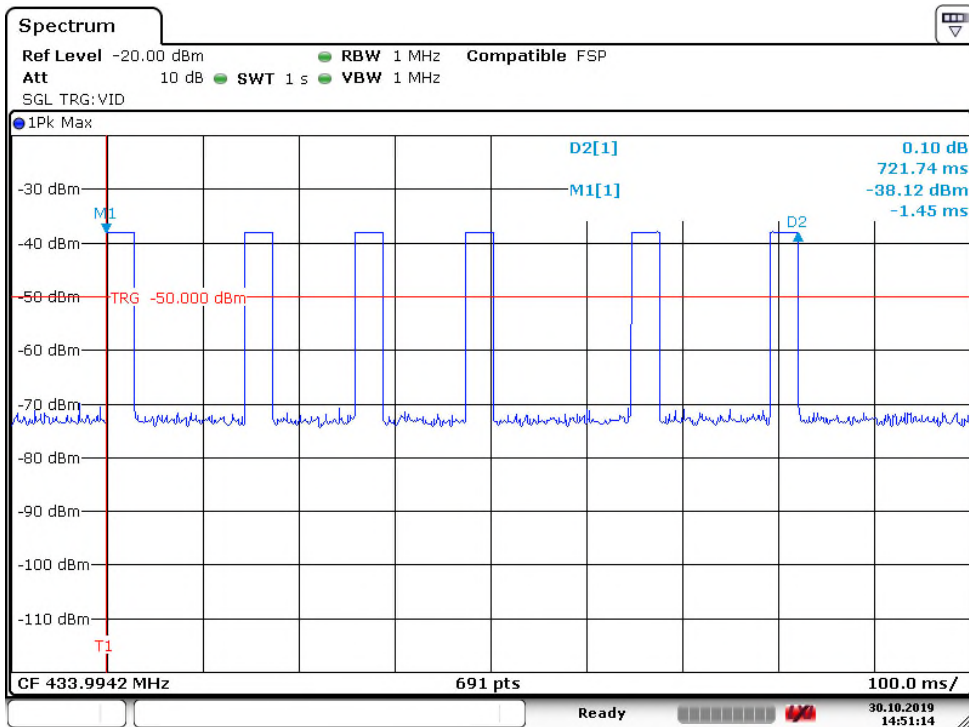
Channel	Channel Frequency (MHz)	Pulse Width (ms)	Limit (ms)	Result
FSK	315	450.72	1000	Pass
	434	476.81	1000	Pass

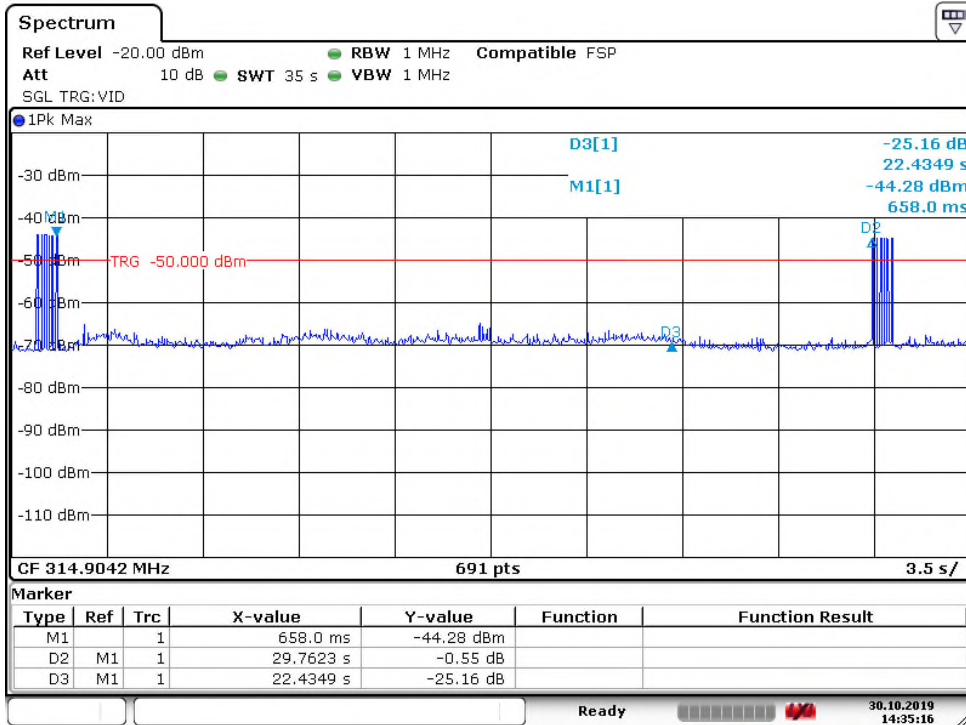
Table 14: Test result of TX gap, ASK

Channel	Channel Frequency (MHz)	TX gap (s)	Limit (s)	Result
ASK	315	22.4349	10	Pass
	434	29.6246	10	Pass

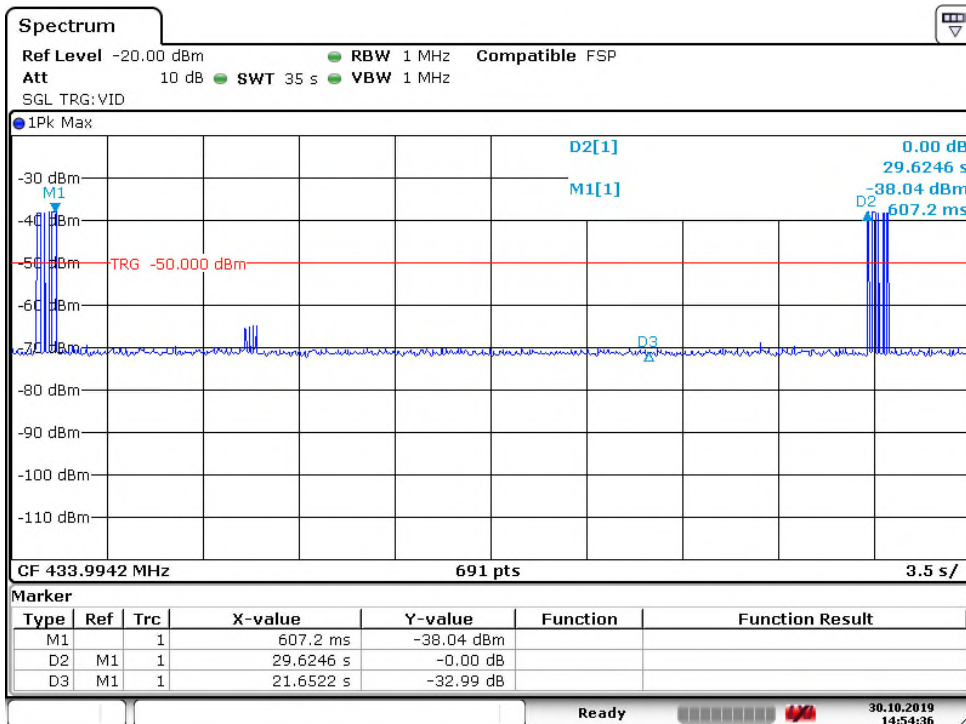
Table 15: Test result of TX gap, FSK

Channel	Channel Frequency (MHz)	TX gap (s)	Limit (s)	Result
FSK	315	29.9217	10	Pass
	434	30.4551	10	Pass

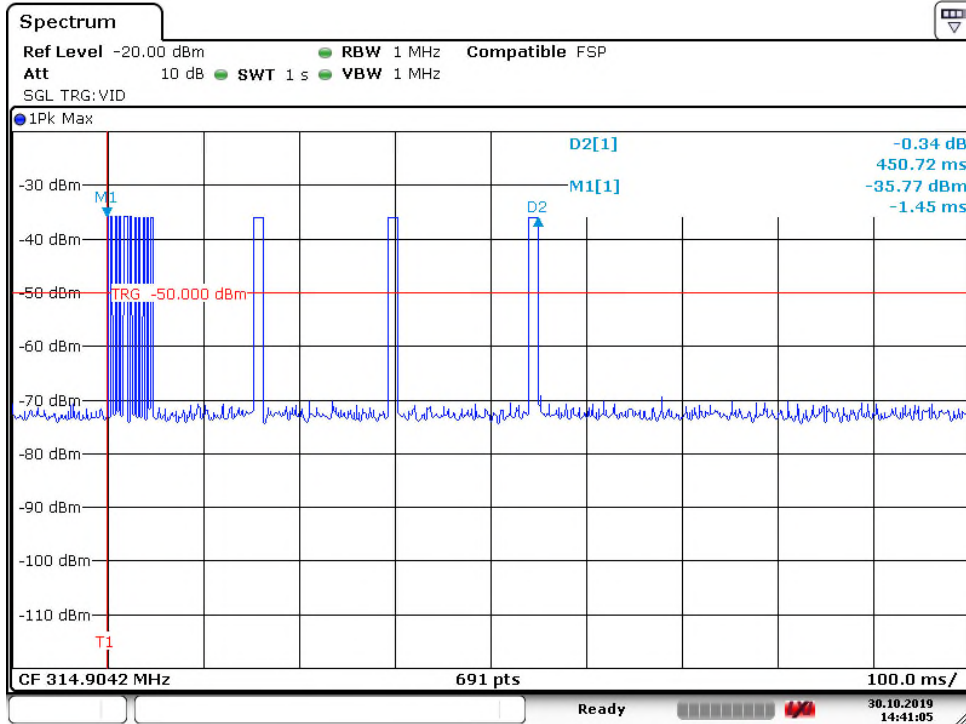
Test Plot of Pulse Width for ASK
315MHz

434MHz


Test Plot of TX gap for ASK
315MHz


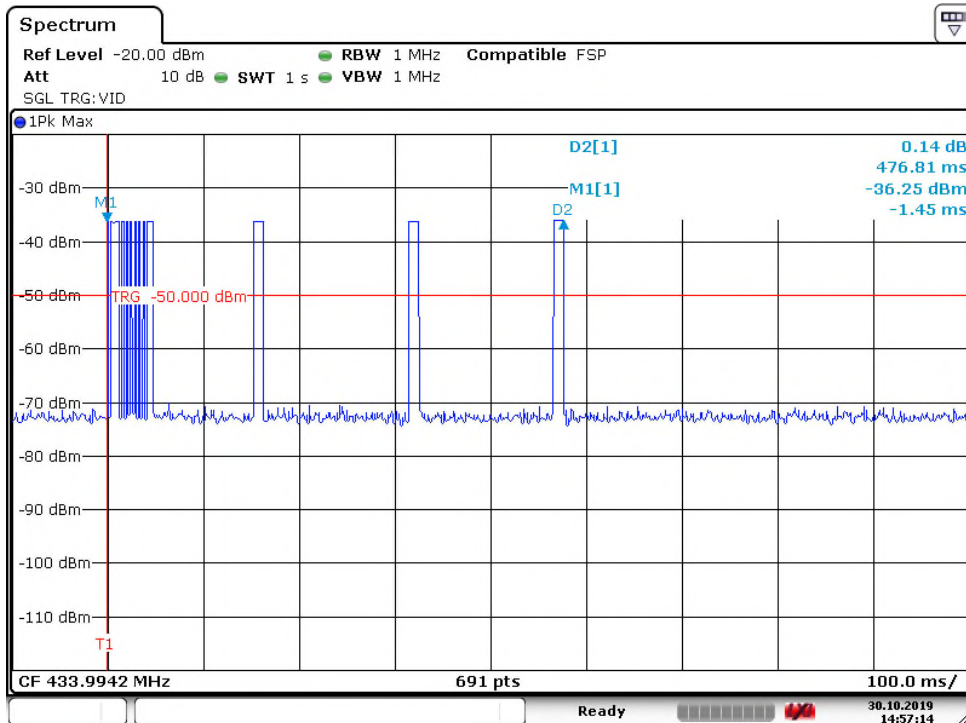
Date: 30.OCT.2019 14:35:16

434MHz


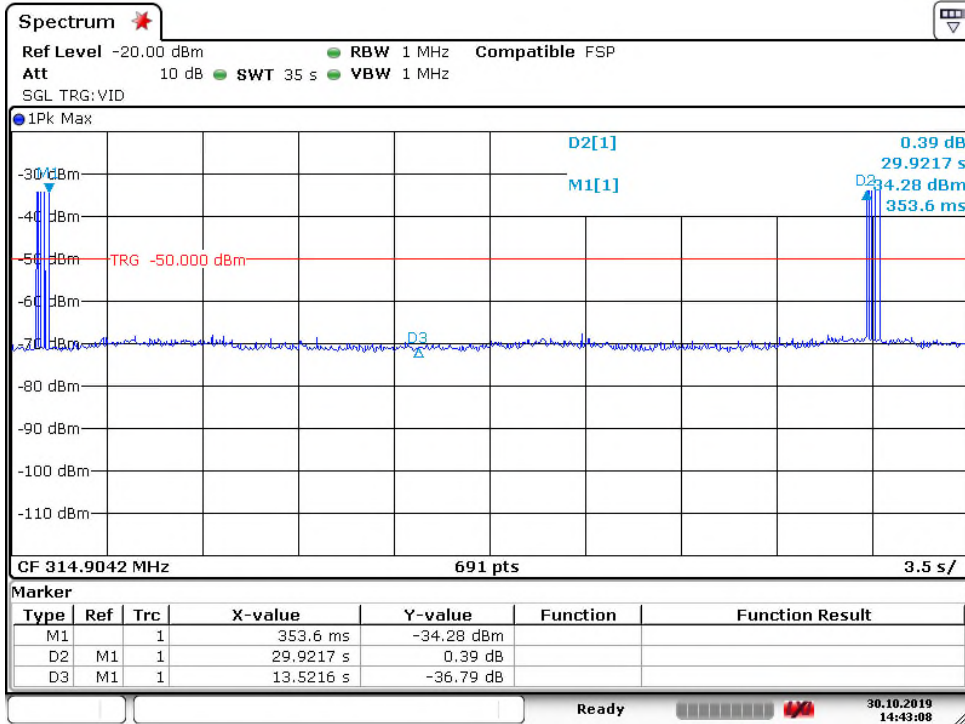
Date: 30.OCT.2019 14:54:37

Test Plot of Pulse Width for FSK
315MHz


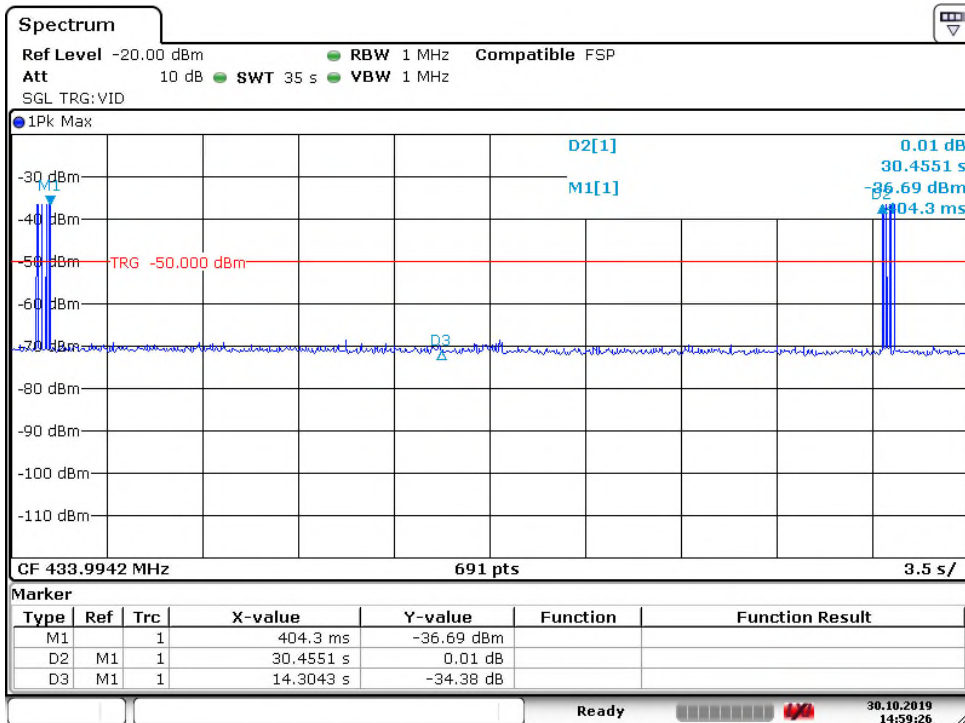
Date: 30.OCT.2019 14:41:06

434MHz


Date: 30.OCT.2019 14:57:15

Test Plot of TX gap for FSK
315MHz


Date: 30.OCT.2019 14:43:08

434MHz


Date: 30.OCT.2019 14:59:27

5.1.6 Spurious Emission

RESULT:**Passed**

Test standard	:	FCC part 15. 231(b) AND FCC 15.205, FCC 15.209, RSS-210 A1.4(d) AND RSS-Gen
Basic standard	:	ANSI C63.10: 2013
Limits	:	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) or FCC 15. 231(b).
Kind of test site	:	3m Semi-Anechoic Chamber

Test setup

Test Channel	:	315, 434 MHz
Operation mode	:	A
Test Lab	:	Linkou

Remark:

Testing was carried out within frequency range 9kHz 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.

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
ISED RSS-102 issue 5, Table 1

FCC:

Since maximum peak output power of the transmitter is 0.000343 mW < 10mW, hence the EUT is excluded from SAR evaluation according to FCC KDB publication 447498: Mobile Portable RF Exposure

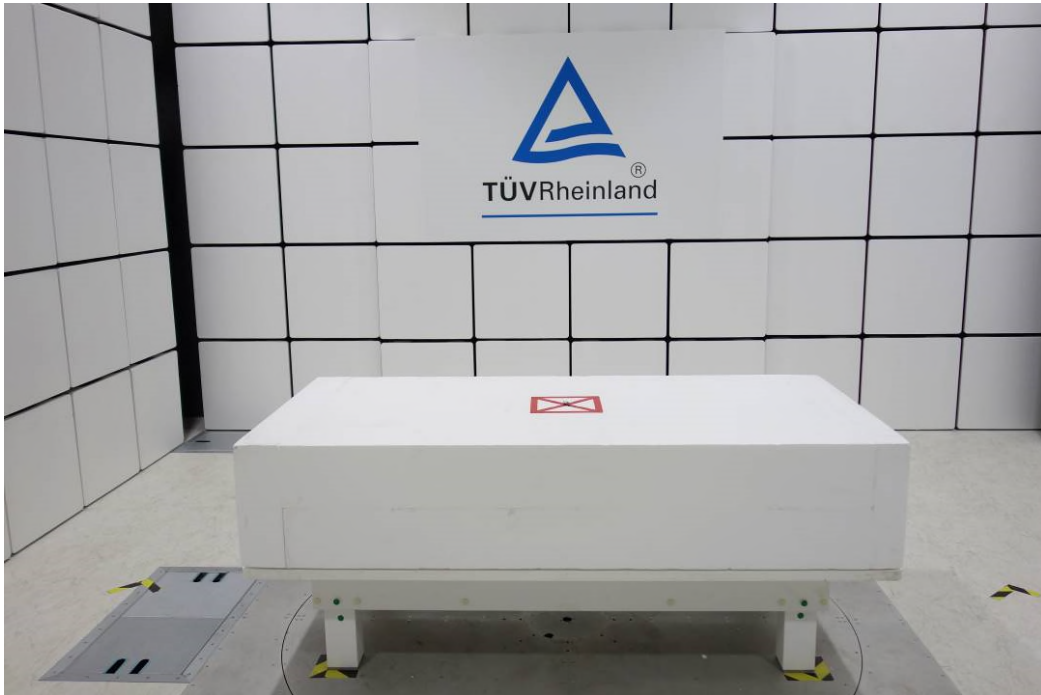
Canada:

Maxmium ERP = 72.35dBu/m +2.15 = 74.5dBuV/m (EIRP) = 0.000562mW

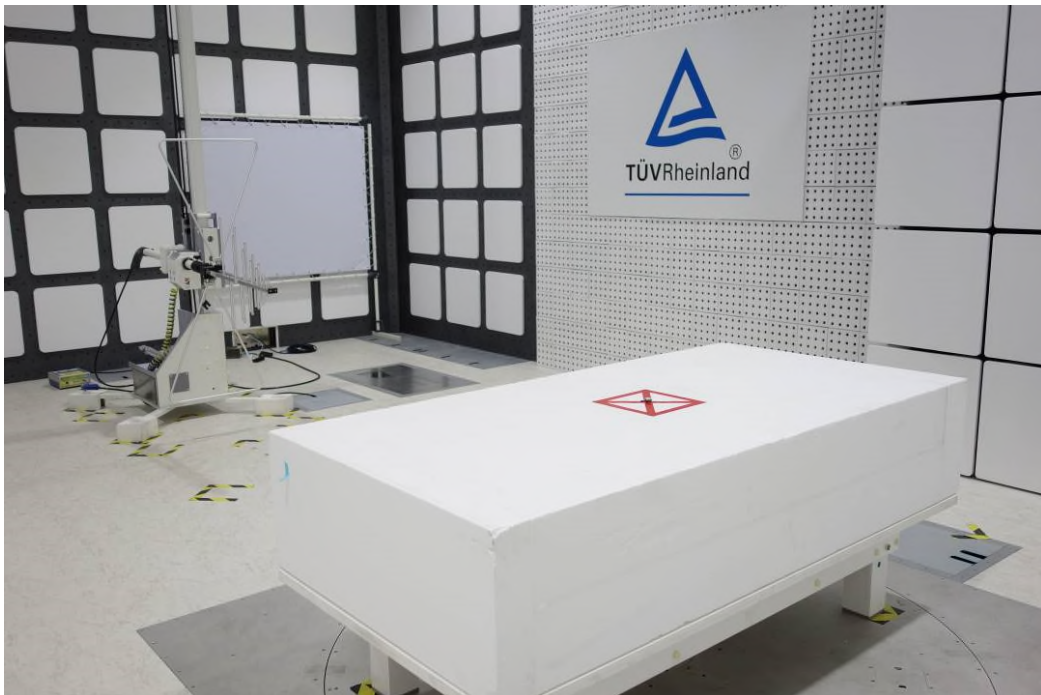
Since maximum output power, either EIRP or conducted, of the transmitter 0.000567mW < 4mW, hence the EUT is excluded from SAR evaluation according to Table 1 in RSS-102

7. Photographs of the Test Set-Up

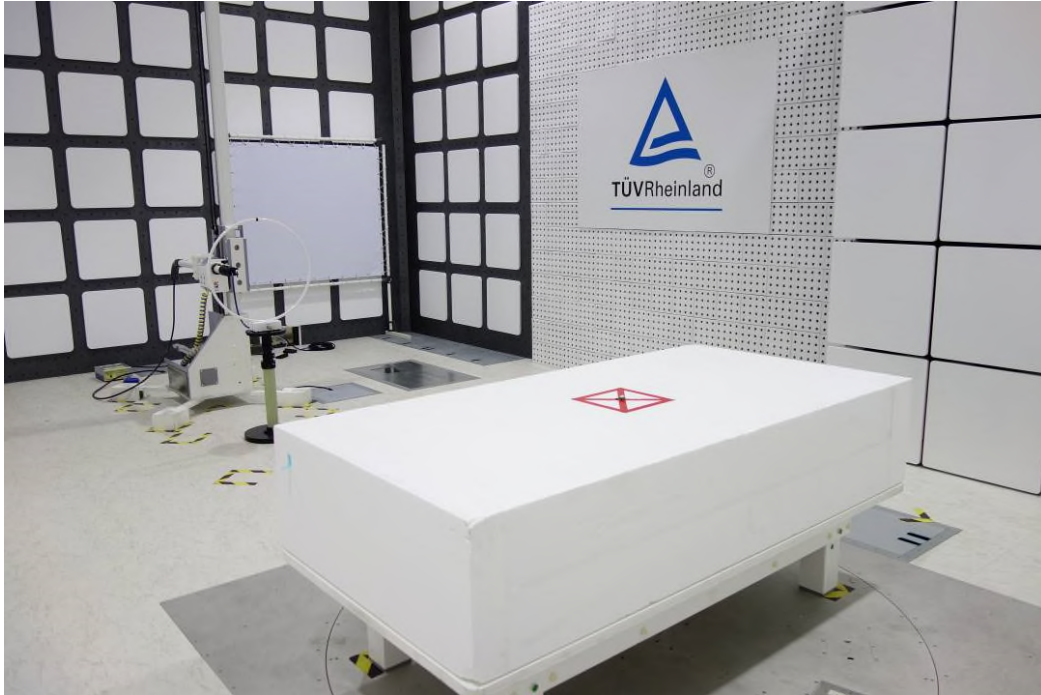
Photograph 1: Set-up for Radiated Emissions (Front View)



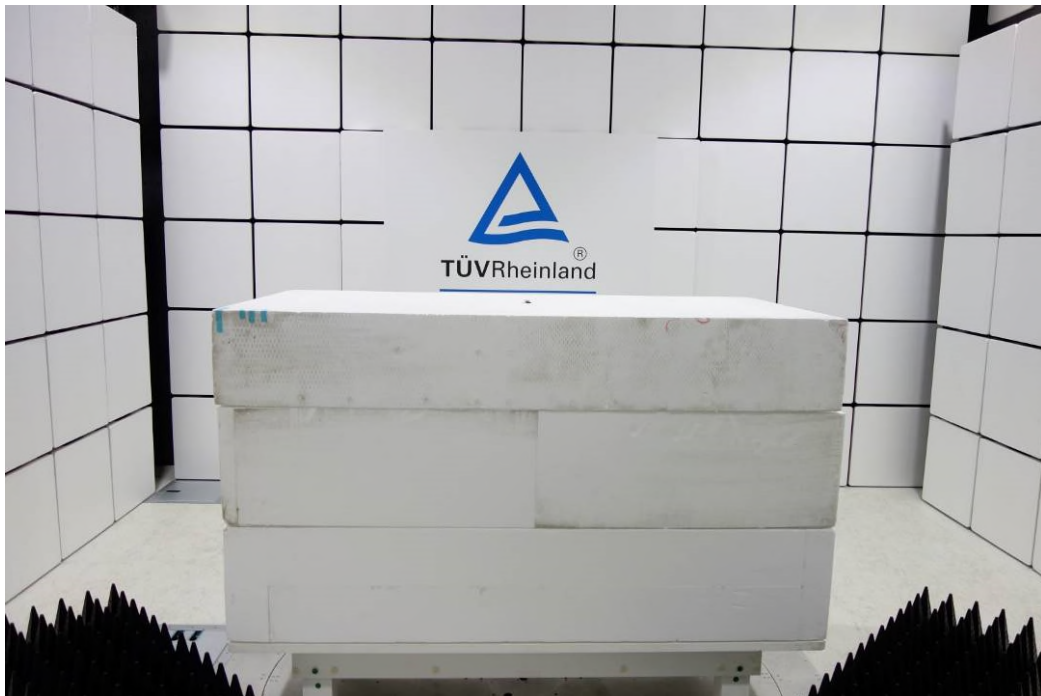
Photograph 2: Set-up for Radiated Emissions (Back View)



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



Photograph 4: Set-up for Radiated Emissions (Back View 1)



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