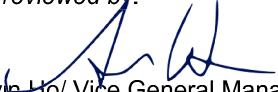


Prüfbericht-Nr.: <i>Test Report No.:</i>	50312818 001	Auftrags-Nr.: <i>Order No.:</i>	238110848	Seite 1 von 29 Page 1 of 29
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	05-Oct-2019	
Auftraggeber: <i>Client:</i>	Sysgration Ltd. 5F-1., No.1, Sec.1, Tiding Blvd., Neihu Dist. Taipei City Taiwan 114			
Prüfgegenstand: <i>Test item:</i>	TPMS			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	RSI-08			
Auftrags-Inhalt: <i>Order content:</i>	FCC Part 15C Test report			
Prüfgrundlage: <i>Test specification:</i>	FCC CFR47 Part 15: Subpart C Section 15.231, 15.231(e)			
Wareneingangsdatum: <i>Date of receipt:</i>	24-Oct-2019			
Prüfmuster-Nr.: <i>Test sample No.:</i>	A001005726-009			
Prüfzeitraum: <i>Testing period:</i>	26-Oct-2019 – 11-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:  14-Nov-2019 Jack H. C. Chang/ Project Manager		kontrolliert von / reviewed by:  14-Nov-2019 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>
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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Produkte
Products

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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: 50312818 001 APPENDIX P)

Appendix D: Test Result of Radiated Emissions

(File Name: 50312818 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)
ANSI C63.10:2013

2. Test Sites

2.1 Test Laboratory

TUV Rheinland Taiwan Ltd.
Taipei Testing Laboratories

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

2.2 Test Facility

TUV Rheinland Taiwan Ltd.

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

FCC Registration No.: 180491
IC Canada Registration No.: 9465A
TAF Accredited NCC Test Lab. No.:3567
TAF ISO17025 Certification effective period: 6th-May-2019 to 05th-May-2022



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	Rohde & Schwarz	ESR 7	101062	2019/10/15	2020/10/15
Spectrum Analyzer	Rohde & Schwarz	FSV-40	100921	2019/04/30	2020/04/30
Pre-Amplifier	Hewlett Packard	8447F	2805A03335	2019/09/11	2020/09/11
Pre-Amplifier	EM Electronics	EM01G18G	060558	2018/11/30	2019/11/30
Pre-Amplifier	EMC Instruments	EMC184045S E	980609(980408)	2019/06/14	2020/06/14
Bilog Antenna	TESEQ	CBL 6111D	29802	2019/09/10	2020/09/10
Horn Antenna	ETS-Lindgren	3117	00138160	2019/06/24	2020/06/24
Horn Antenna	Com-Power	AH-840	101029	2018/12/22	2019/12/22
Loop Antenna	Schwarzbeck	FMZB 1513	1513-076	2019/07/11	2020/07/11
Test Software	Audix	e3	Ver. 9	N/A	N/A

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	$\pm 10 \text{ } \%$

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a UNI Sensor. It contains a 315MHz & 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
Type Designation	RSI-08
FCC ID	HQXRSI08

Table 5: Technical Specification of EUT

Technical Specification	Value
Operating Frequency	315MHz, 434MHz
Channel number	2
Operation Voltage	3V dc
Modulation	ASK

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 emission level. The test modes were adapted accordingly in reference to the instructions for use.

The samples were used as follows:
434MHz & 315MHz ASK: A001005726-009

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.

Full test was applied on all test modes, but only worst case was shown.

4.3 Special Accessories and Auxiliary Equipment

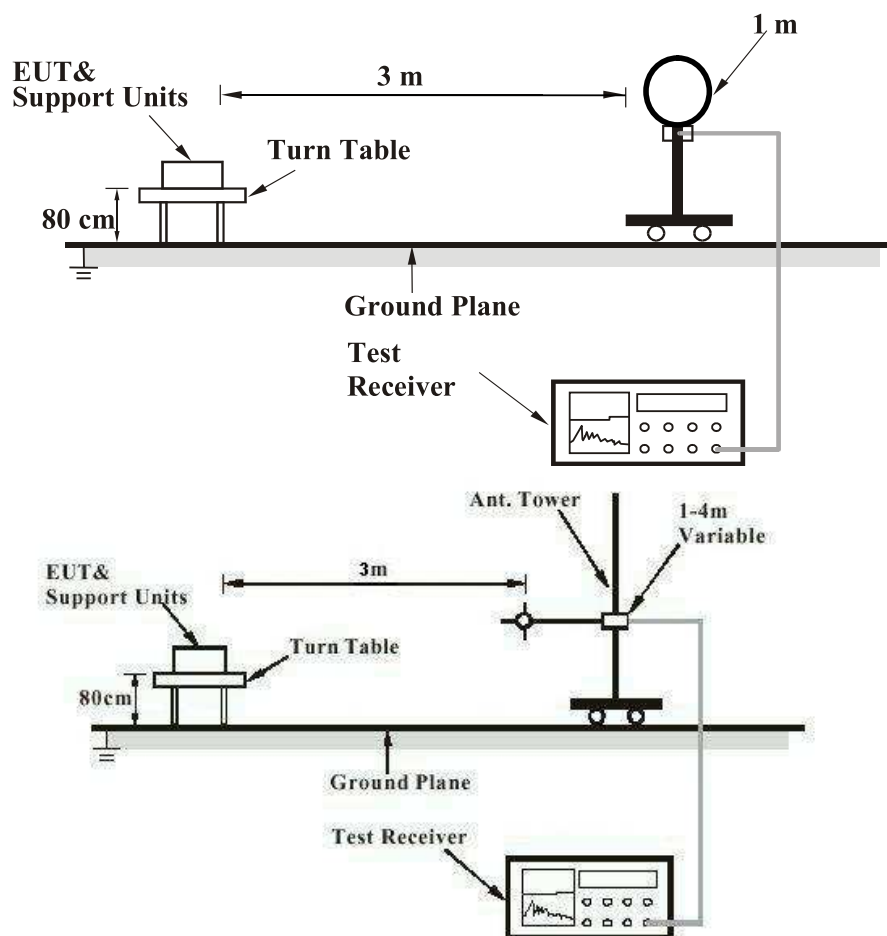
The product has been tested together with the following additional accessories:

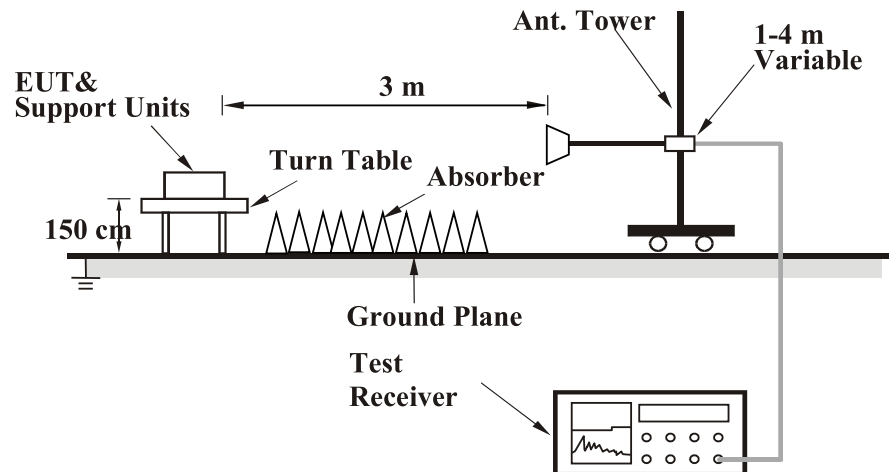
4.4 Countermeasures to achieve EMC Compliance

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





5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:**Passed**

Standard	:	FCC Part 15.203
Requirement	:	Manufacturer must ensure approved antenna is used

The antenna is a Loop 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 Field strength of fundamental**RESULT:****Passed**

Test standard : FCC Part 15. 231(e)

Basic standard : ANSI C63.10:2013

Test setup

Test Channel : 315MHz, 434 MHz

Operation : Pulse Transmission

Mode

Test Lab : Taipei 966A

Atmospheric pressure : 100-103 kPa

The EUT employs pulsed operation.

The pulse width is: 13.043 msec.

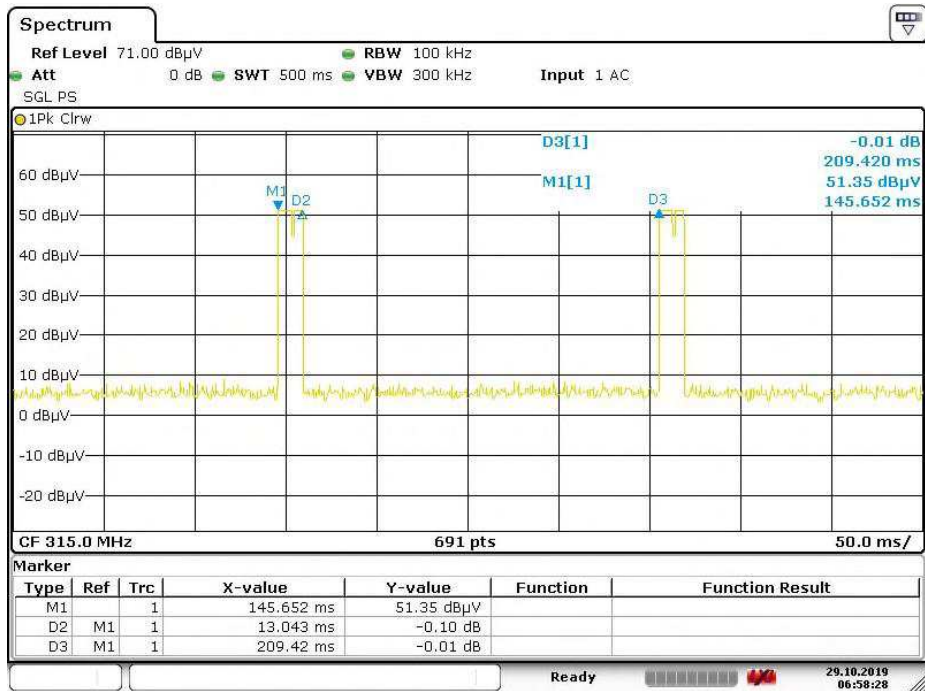
The Tables below show calculated average values from the pulsed emissions measurement dataMHz, corrected with the worst case duty cycle factor over 100 msec.

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

Duty cycle calculation:

$$\text{Duty cycle correction (dB)} = 20 \log (13.043 \text{ msec} / 100 \text{ msec}) = - 17.69 \text{ dB.}$$

Test Plot pulse width



Date: 29.OCT.2019 06:58:28

Table 6: Test result of Field strength of fundamental

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Antenna orientation	Detector or calculated value
434	68.92	92.87	Horizontal	Peak
434	51.23	72.87		Average
434	72.05	92.87	Vertical	Peak
434	54.36	72.87		Average
315	67.02	87.66	Horizontal	Peak
315	49.33	67.66		Average
315	65.14	87.66	Vertical	Peak
315	47.45	67.66		Average

5.1.3 Field strength of harmonics

RESULT:
Passed

Test standard : FCC Part 15. 231(e)

Basic standard : ANSI C63.10:2013

Test setup

Test Channel : 315MHz, 434 MHz

Operation : Pulse Transmission

Mode

Test Lab : Taipei 966A

Atmospheric pressure : 100-103 kPa

Table 7: Test result of Field strength of harmonics, maximum

For 315 MHz

Frequency (MHz)	Test result			
	Level (dBuV/m)	Limit (dBuV/m)	Antenna orientation	Detector
635.086	31.44	67.66	Horizontal	Peak
635.086	<31.44	47.66		Average
863.812	35.39	67.66	Vertical	Peak
863.812	<35.39	47.66		Average
1301	48.17	74	Horizontal	Peak
1301	<48.17	54		Average
1301	58.41	74	Vertical	Peak
1301	<58.41	54		Average

For 434 MHz

Frequency (MHz)	Test result			
	Level (dBuV/m)	Limit (dBuV/m)	Antenna orientation	Detector
868.0800	34.47	72.87	Horizontal	Peak
868.0800	<34.47	52.87		Average
868.0800	36.97	72.87	Vertical	Peak
868.0800	<36.97	52.87		Average
1301	48.17	74	Horizontal	Peak
1301	<48.17	54		Average
1301	58.41	74	Vertical	Peak
1301	<58.41	54		Average

Remark: The maximum results found are reported. 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 15.231(c), A1.3
 Basic standard : ANSI C63.10:2013,
 Kind of test site : Shielded room

Test setup

Test Channel : 315MHz, 434 MHz (20dB BW)
 Operation : A
 Mode
 Test Lab : Taipei

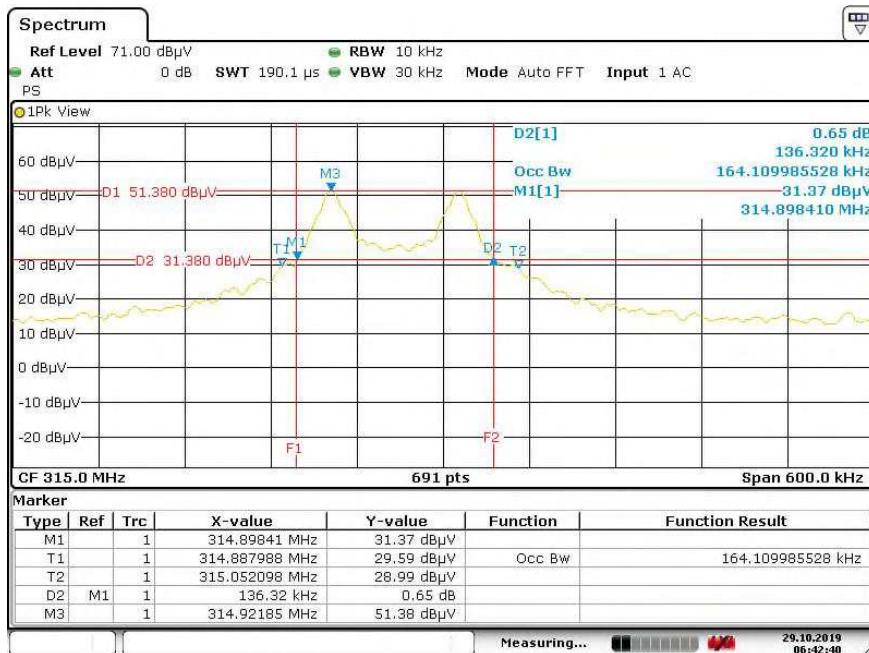
The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated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

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

Table 8: Test result of 20 dB Bandwidth_ASK

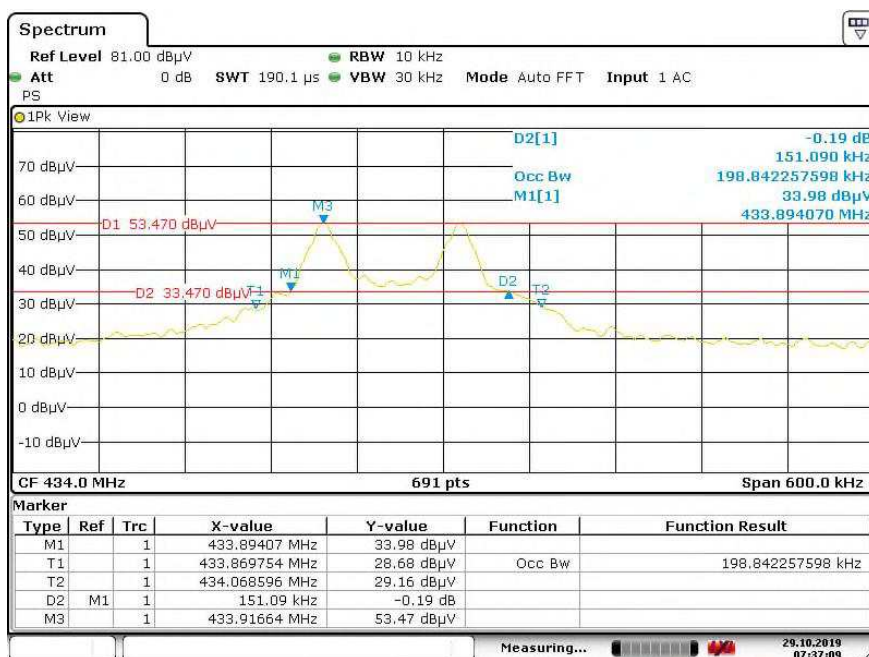
Channel	Channel Frequency (MHz)	-20 dB BW (kHz)	Limit (kHz)	Result
1	315	136.32	787.5	Pass
1	434	151.09	1085	Pass

Test Plot of -20 dB Point 315MHz



Date: 29.OCT.2019 06:42:39

434MHz



Date: 29.OCT.2019 07:37:09

5.1.5 Pulse Width/TX gap

RESULT:
Passed

Test standard : FCC Part 15.231(e)

Kind of test site : Anechoic Chamber

Test setup

Test Channel : 315MHz, 434 MHz

Operation : A

Mode

Test Lab : Taipei

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

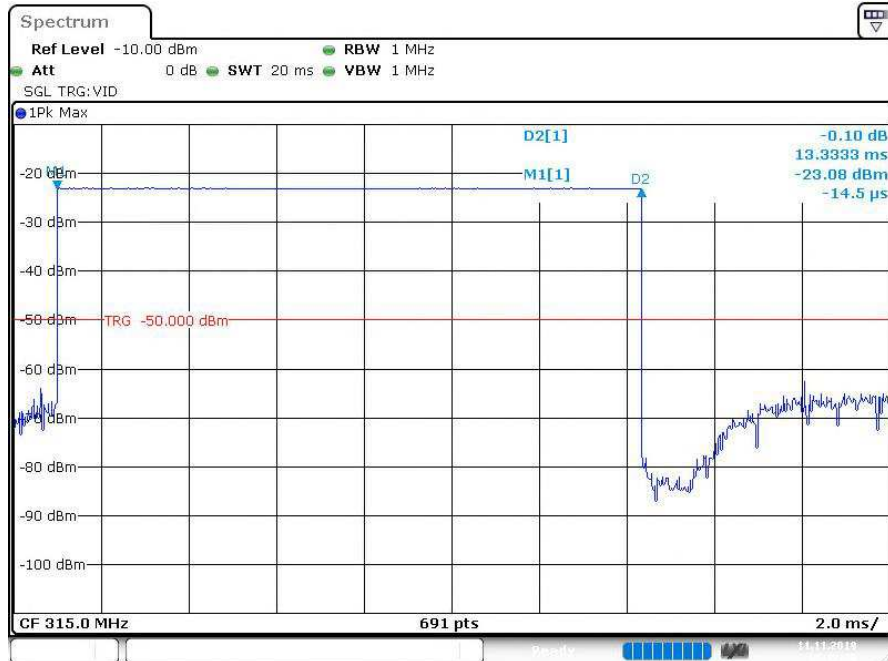
Table 9: Test result of Pulse Width_ASK

Channel	Channel Frequency (MHz)	Pulse Width (ms)	Limit (ms)	Result
1	315	13.333	1000	Pass
1	434	13.333	1000	Pass

Table 10: Test result of TX gap_ASK

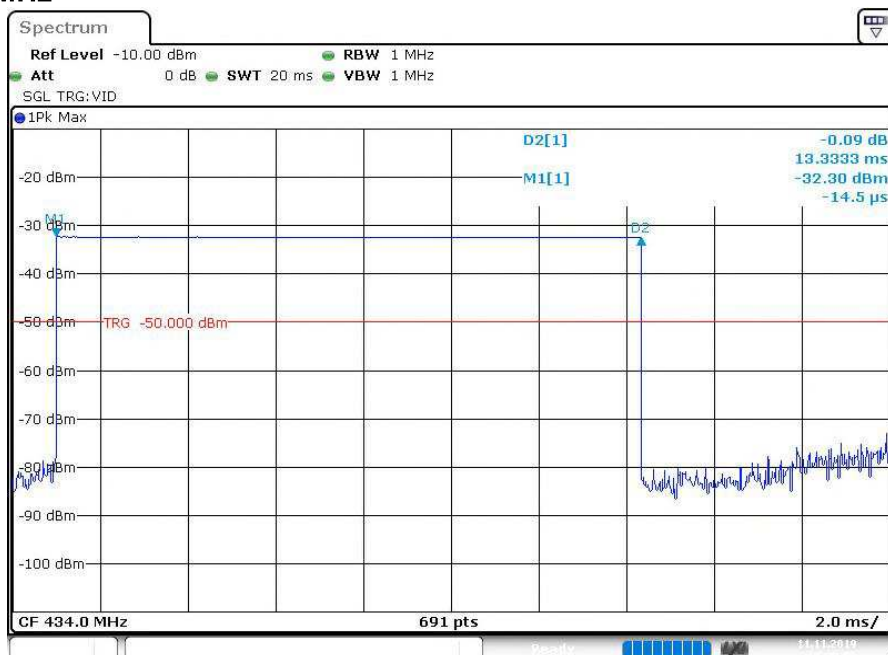
Channel	Channel Frequency (MHz)	TX gap (s)	Limit (s)	Result
1	315	14.014	10	Pass
1	434	14.087	10	Pass

Test Plot of Pulse Width/TX gap, ASK 315MHz



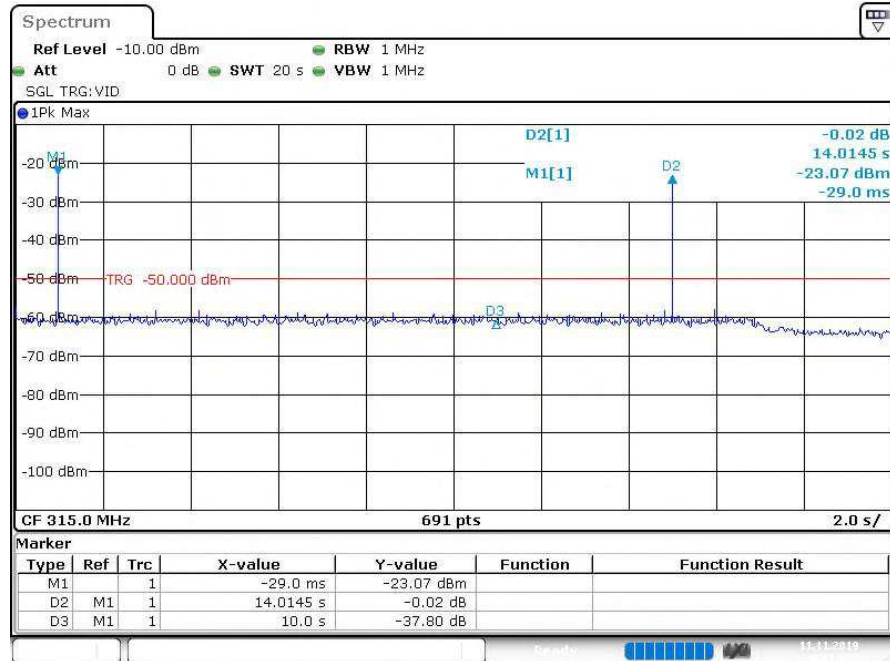
Date: 11.NOV.2019 12:12:19

434MHz



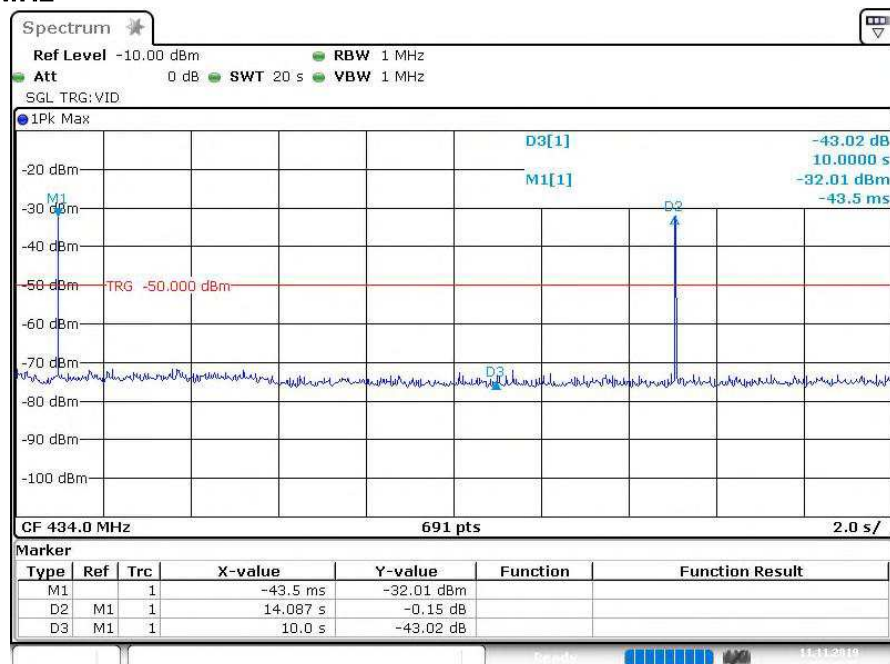
Date: 11.NOV.2019 12:30:06

Test Plot of TX gap, ASK 315MHz



Date: 11.NOV.2019 12:14:22

434MHz



Date: 11.NOV.2019 12:29:16

5.1.6 Spurious Emission**RESULT:****Passed**

Test standard	:	FCC part 15. 231(b), FCC 15.205, FCC 15.209
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	:	315MHz, 434 MHz
Operation mode	:	A
Test Lab	:	Taipei 966A

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

FCC:

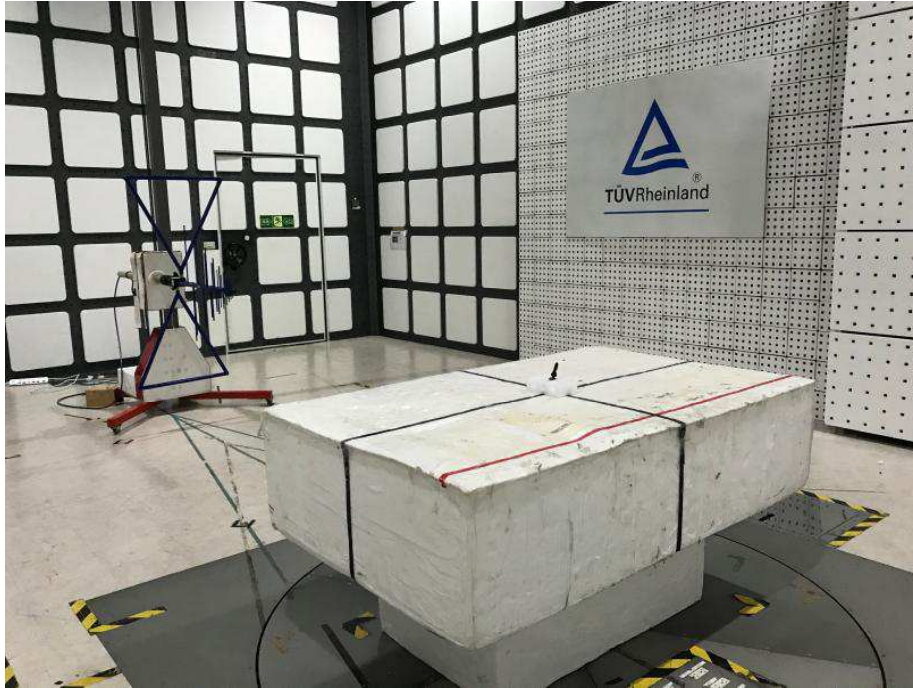
Since maximum peak output power of the transmitter is $0.0048\text{mW} < 10\text{mW}$, hence the EUT is excluded from SAR evaluation according to FCC KDB publication 447498: Mobile Portable RF Exposure

7. Photographs of the Test Set-Up

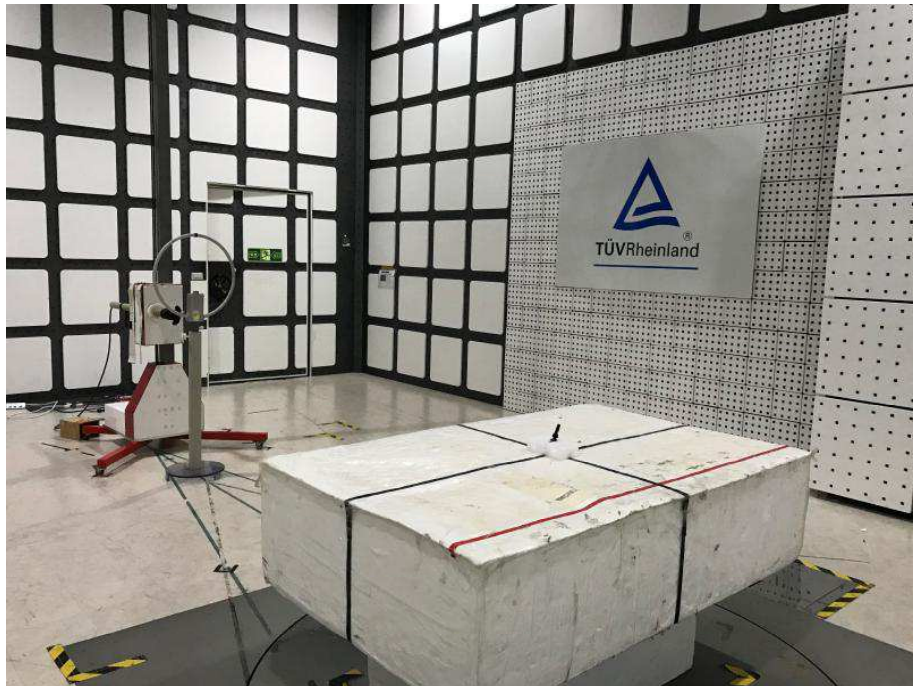
Photograph 1: Set-up for Radiated Emissions (Front View)



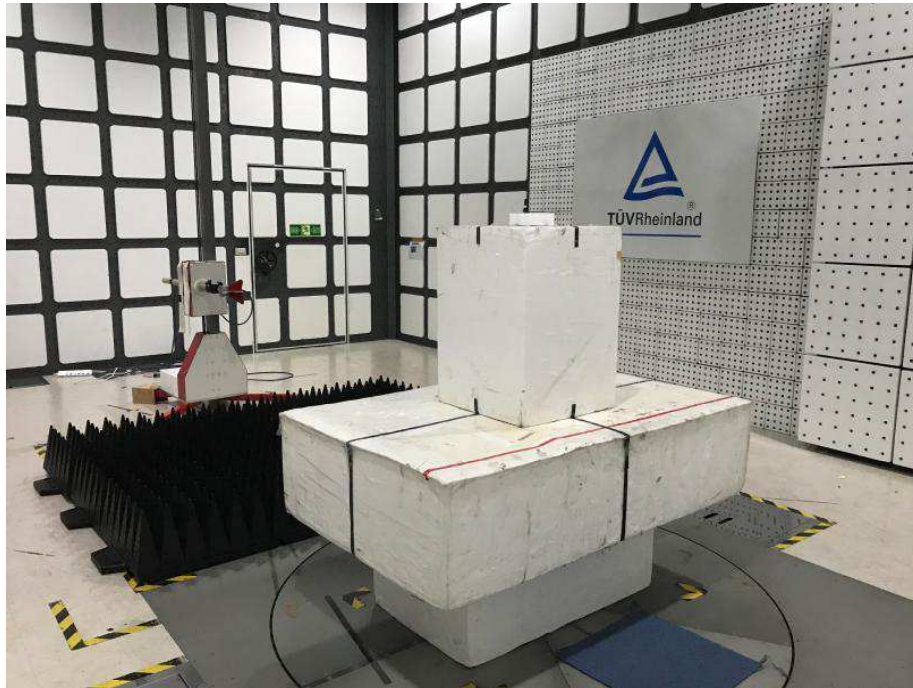
Photograph 2: Set-up for Radiated Emissions (Back View 1)



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



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



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