

MEASUREMENT REPORT

FCC PART 15.209 / RSS 210

FCC ID: VZ4-360SLT2

IC: 12007A-360SLT2

Applicant: Doran Manufacturing, LLC

Application Type: Certification

Product: SmartLink TPMS Tablet

Model No.: 360SLT2

FCC Classification: Part 15 Low Power Transmitter Below 1705 kHz (DCD)

FCC Rule Part(s): Part15 Subpart C (Section 15.209)

IC Rule(s) RSS 210 Issue 9, RSS-Gen Issue 5

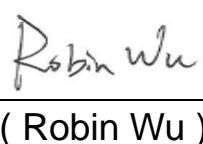
Test Procedure(s): ANSI C63.10-2013

Test Date: August 18 ~ September 24, 2019

Reviewed By:


(Sunny Sun)

Approved By:


(Robin Wu)



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
1908RSU022-U4	Rev. 01	Initial Report	10-11-2019	Valid

CONTENTS

Description	Page
1. INTRODUCTION	6
1.1. Scope	6
1.2. MRT Test Location	6
2. PRODUCT INFORMATION	7
2.1. Feature of Equipment under Test.....	7
2.2. Test Mode	7
2.3. Test Configuration	7
2.4. EMI Suppression Device(s)/Modifications.....	7
2.5. Labeling Requirements	7
3. DESCRIPTION OF TEST	9
3.1. Evaluation Procedure	9
3.2. AC Line Conducted Emissions.....	9
3.3. Radiated Emissions.....	10
4. ANTENNA REQUIREMENTS	11
5. TEST EQUIPMENT CALIBRATION DATE	12
6. MEASUREMENT UNCERTAINTY	14
7. TEST RESULT	15
7.1. Summary	15
7.2. Conducted Emission	16
7.2.1. Test Limit	16
7.2.2. Test Setup	16
7.2.3. Test Result.....	17
7.3. General Radiated Emission.....	19
7.3.1. Test Limit	19
7.3.2. Test Procedure Used.....	19
7.3.3. Test Setup	19
7.3.4. Test Result.....	21
7.4. 99% & 20dB Bandwidth Measurement.....	22
7.4.1. Test Limit	22
7.4.2. Test Procedure Used.....	22
7.4.3. Test Setting.....	22
7.4.4. Test Setup	22
7.4.5. Test Result.....	23

8. CONCLUSION.....	24
Appendix A - Test Setup Photograph.....	25
Appendix B - EUT Photograph	26

General Information

Applicant:	Doran Manufacturing, LLC
Applicant Address:	2851 Massachusetts Avenue, Cincinnati, OH 45225, USA
Manufacturer:	Zhangzhou Lilliput Electronic Technology Co., Ltd
Manufacturer Address:	No.26 Fu Qi North Road, Lan Tian Economic Development Zone, Zhangzhou, Fujian, China
Test Site:	MRT Technology (Suzhou) Co., Ltd
Test Site Address:	D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China

Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Tian'edang Rd., Suzhou, China.

- MRT facility is a FCC registered (MRT Reg. No. 893164) test facility with the site description report on file and has met all the requirements specified in ANSI C63.4-2014.
- MRT facility is an IC registered (MRT Reg. No. 11384A-1) test laboratory with the site description on file at Industry Canada.
- MRT facility is a VCCI registered (R-20025, G-20034, C-20020, T-20020) test laboratory with the site description on file at VCCI Council.
- MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA) under the American Association for Laboratory Accreditation Program (A2LA Cert. No. 3628.01) in EMC, Telecommunications, Radio and SAR testing.



1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada and Certification and Engineering Bureau.

1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taihu Lake. These measurement tests were conducted at the MRT Technology (Suzhou) Co., Ltd. Facility located at D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The measurement facility compliant with the test site requirements specified in ANSI C63.4-2014.



2. PRODUCT INFORMATION

2.1. Feature of Equipment under Test

Product Name:	SmartLink TPMS Tablet
Model No.:	360SLT2
Wi-Fi Specification:	802.11b/g/n
Bluetooth Version:	V4.0 (BLE only)
LF Transmitter:	125kHz (FSK)
RF Frequency:	434.1MHz (FSK)
Accessories	
Adapter:	Model No.: FJ-SW266B50502000E Input: 100 ~ 240V ~ 50/60Hz 0.4A Max Output: 5VDC, 2.0A

2.2. Test Mode

Test Mode	Transmit at 125kHz
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2.3. Test Configuration

The EUT was tested per the guidance of ANSI C63.10-2013, which is used as the reference of appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

2.4. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

2.5. Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase.

However, when the device is so small wherein placement of the label with specified statement is not practical, only the FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.

RSS-Gen Issue 5 Section 4

In addition to complying with the applicable RSSs and RSP-100, each unit of a product model (i.e. of a radio apparatus) shall meet the labelling requirements set out in this section prior to being

marketed in Canada or imported into Canada.

For information regarding the labelling option, see Section 4.1, 4.2, 4.3 4.4. The label for the certified product represents the manufacturer's or importer's compliance with Innovation, Science and Economic Development Canada's (ISED) regulatory requirements.

Please see attachment for IC label and label location.

3. DESCRIPTION OF TEST

3.1. Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) was used in the measurement.

Deviation from measurement procedure.....None

3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 8'x4'x4' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150kHz to 30MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or data exchange speed, or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions were used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

An extension cord was used to connect to a single LISN which powered by EUT. The extension cord was calibrated with LISN, the impedance and insertion loss are compliance with the requirements as stated in ANSI C63.10-2013.

3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the Antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. A MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable. For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive Antenna height using a broadband Antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn Antennas were used. For frequencies below 30MHz, a calibrated loop Antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband Antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-40GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive Antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn Antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive Antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive Antenna, whichever produced the worst-case emissions. According to 3dB Beam-Width of horn Antenna, the horn Antenna should be always directed to the EUT when rising height.

4. ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.”

- The antenna of the unit is **permanently attached**.
- There are no provisions for connection to an external antenna.

Conclusion:

The unit complies with the requirement of §15.203.

5. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions - SR2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR3	MRTSUE06185	1 year	2020/04/15
Two-Line V-Network	R&S	ENV 216	MRTSUE06002	1 year	2020/06/13
Two-Line V-Network	R&S	ENV 216	MRTSUE06003	1 year	2020/06/13
Thermohygrometer	Testo	608-H1	MRTSUE06404	1 year	2020/08/08
Shielding Room	MIX-BEP	Chamber-SR2	MRTSUE06215	N/A	N/A

Radiated Emissions - AC1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2020/08/01
PXA Signal Analyzer	Keysight	9030B	MRTSUE06395	1 year	2020/09/03
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2020/11/10
Bilog Period Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2020/03/31
Broad Band Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06023	1 year	2020/10/13
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06024	1 year	2019/12/17
Microwave System Amplifier	Agilent	83017A	MRTSUE06076	1 year	2020/11/15
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2020/06/11
Thermohygrometer	Testo	608-H1	MRTSUE06403	1 year	2020/08/08
Anechoic Chamber	TDK	Chamber-AC1	MRTSUE06212	1 year	2020/04/30

Radiated Emission - AC2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Keysight	N9038A	MRTSUE06125	1 year	2020/08/01
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2020/11/10
Bilog Period Antenna	Schwarzbeck	VULB 9162	MRTSUE06022	1 year	2020/10/13
Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06171	1 year	2020/10/27
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06024	1 year	2019/12/17
Broadband Coaxial Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2020/11/15
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2020/06/11
Temperature/Humidity Meter	Minggao	ETH529	MRTSUE06170	1 year	2019/12/13
Anechoic Chamber	RIKEN	Chamber-AC2	MRTSUE06213	1 year	2020/04/30

Conducted Test Equipment - TR3

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EXA Signal Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2020/04/15
EXA Signal Analyzer	Keysight	N9010B	MRTSUE06452	1 year	2020/07/11
Signal Analyzer	R&S	FSV40	MRTSUE06218	1 year	2020/04/15
Power Meter	Agilent	U2021XA	MRTSUE06030	1 year	2020/11/18
USB wideband power sensor	Keysight	U2021XA	MRTSUE06446	1 year	2020/06/30
USB wideband power sensor	Keysight	U2021XA	MRTSUE06447	1 year	2020/06/30
Bluetooth Test Set	Anritsu	MT8852B-042	MRTSUE06389	1 year	2020/06/13
Audio Analyzer	Agilent	U8903B	MRTSUE06143	1 year	2020/06/13
Modulation Analyzer	HP	8901A	MRTSUE06098	1 year	2020/10/10
Wideband Radio Communication Tester	R&S	CMW 500	MRTSUE06243	1 year	2020/11/07
DC Power Supply	GWINSTEK	DPS-3303C	MRTSUE06064	N/A	N/A
Temperature & Humidity Chamber	BAOYT	BYH-150CL	MRTSUE06051	1 year	2020/11/07
Thermohygrometer	testo	608-H1	MRTSUE06401	1 year	2020/08/08

Software	Version	Function
EMI Software	V3	EMI Test Software

6. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.

AC Conducted Emission Measurement - SR2
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_{c(y)}$): 9kHz~150kHz: 3.84dB 150kHz~30MHz: 3.46dB
Radiated Emission Measurement - AC1
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_{c(y)}$): Horizontal: 30MHz~300MHz: 4.07dB 300MHz~1GHz: 3.63dB 1GHz~18GHz: 4.16dB Vertical: 30MHz~300MHz: 4.18dB 300MHz~1GHz: 3.60dB 1GHz~18GHz: 4.76dB
Radiated Emission Measurement - AC2
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_{c(y)}$): Horizontal: 30MHz~300MHz: 3.75dB 300MHz~1GHz: 3.53dB 1GHz~18GHz: 4.28dB Vertical: 30MHz~300MHz: 3.86dB 300MHz~1GHz: 3.53dB 1GHz~18GHz: 4.33dB

7. TEST RESULT

7.1. Summary

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.207	RSS-Gen [8.8]	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits	Line Conducted	Pass	Section 7.2
15.209	RSS-Gen [8.9]	General Field Strength Limits	FCC Part 15.209 limits	Radiated	Pass	Section 7.3
15.215(c)	RSS-Gen [6.7]	99% & 20dB Bandwidth	20 dB bandwidth of the emission in the specific band		Pass	Section 7.4

Notes: All modes of operation and data rates were investigated. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst-case emissions.

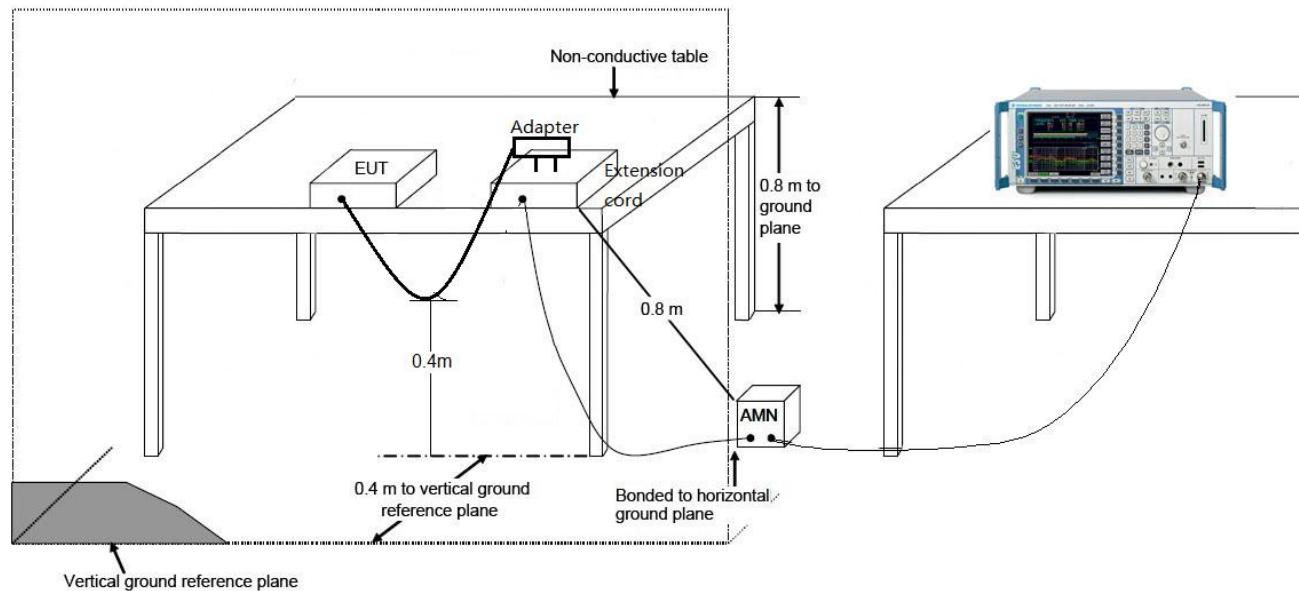
7.2. Conducted Emission

7.2.1. Test Limit

FCC 15.207 Limits		
Frequency (MHz)	QP (dBuV)	AV (dBuV)
0.15 ~ 0.50	66 ~ 56	56 ~ 46
0.50 ~ 5.0	56	46
5.0 ~ 30	60	50

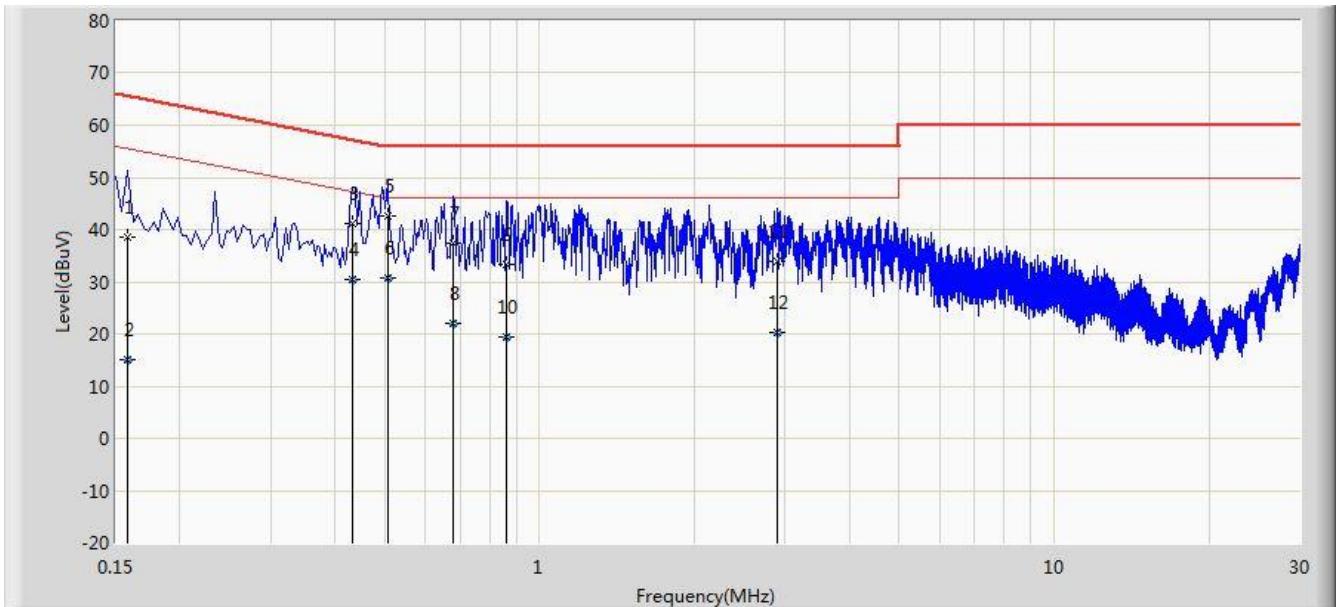
Note 1: The lower limit shall apply at the transition frequencies.
Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

7.2.2. Test Setup



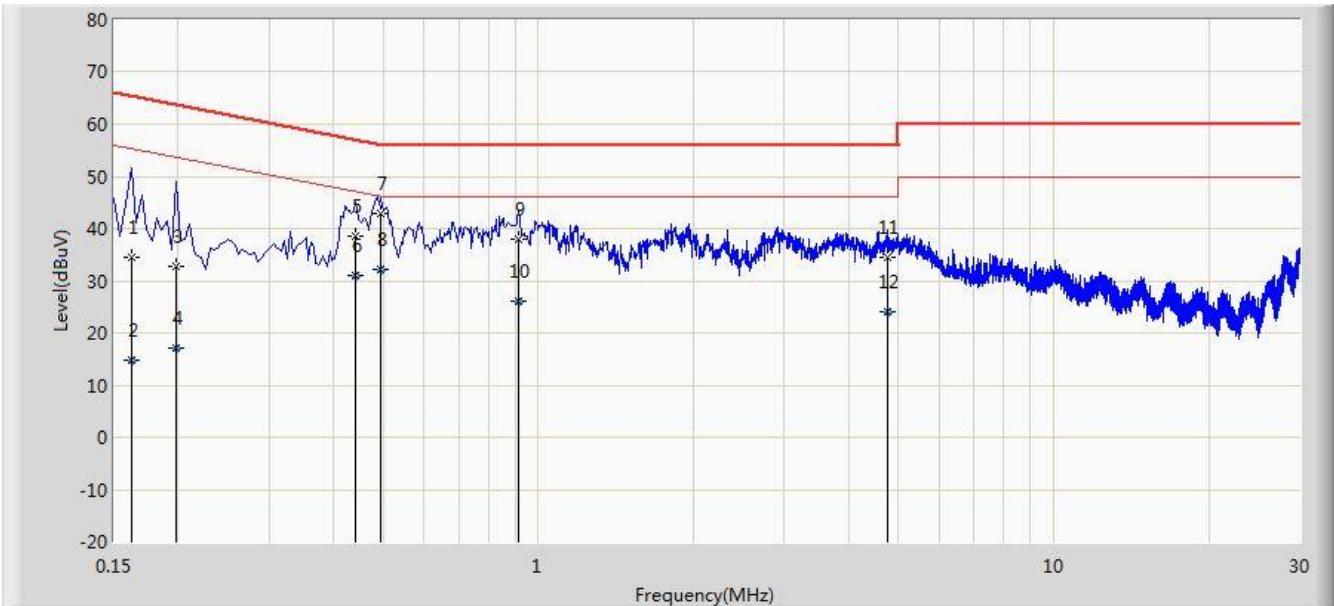
7.2.3. Test Result

Site: SR2	Time: 2019/10/12 - 15:45
Limit: FCC_Part15.207_CE_AC Power	Engineer: Liz Yuan
Probe: ENV216_101683_Filter On	Polarity: Line
EUT: SmartLink TPMS Tablet	Power: AC 120V/60Hz
Test Mode: Transmit at 125kHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV)	Factor (dB)	Type
1			0.158	38.595	28.284	-26.974	65.568	10.311	QP
2			0.158	14.985	4.674	-40.583	55.568	10.311	AV
3			0.434	41.163	31.050	-16.012	57.176	10.113	QP
4			0.434	30.328	20.215	-16.848	47.176	10.113	AV
5		*	0.506	42.483	32.326	-13.517	56.000	10.157	QP
6			0.506	30.841	20.684	-15.159	46.000	10.157	AV
7			0.678	37.280	27.205	-18.720	56.000	10.075	QP
8			0.678	21.936	11.861	-24.064	46.000	10.075	AV
9			0.862	33.372	23.392	-22.628	56.000	9.980	QP
10			0.862	19.422	9.442	-26.578	46.000	9.980	AV
11			2.902	33.895	24.044	-22.105	56.000	9.850	QP
12			2.902	20.153	10.303	-25.847	46.000	9.850	AV

Site: SR2	Time: 2019/10/12 - 15:50
Limit: FCC_Part15.207_CE_AC Power	Engineer: Liz Yuan
Probe: ENV216_101683_Filter On	Polarity: Neutral
EUT: SmartLink TPMS Tablet	Power: AC 120V/60Hz
Test Mode: Transmit at 125kHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dB μ V)	Reading Level (dB μ V)	Margin (dB)	Limit (dBuV)	Factor (dB)	Type
1			0.162	34.483	24.404	-30.878	65.361	10.078	QP
2			0.162	14.836	4.758	-40.525	55.361	10.078	AV
3			0.198	32.873	22.859	-30.821	63.694	10.015	QP
4			0.198	17.053	7.038	-36.641	53.694	10.015	AV
5			0.442	38.586	28.442	-18.438	57.024	10.144	QP
6			0.442	31.041	20.897	-15.983	47.024	10.144	AV
7	*	*	0.495	42.778	32.600	-13.305	56.083	10.178	QP
8			0.495	32.178	22.000	-13.905	46.083	10.178	AV
9			0.914	37.853	27.897	-18.147	56.000	9.957	QP
10			0.914	26.137	16.181	-19.863	46.000	9.957	AV
11			4.762	34.494	24.466	-21.506	56.000	10.029	QP
12			4.762	23.933	13.905	-22.067	46.000	10.029	AV

Note: Measure Level (dB μ V) = Reading Level (dB μ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB)

7.3. General Radiated Emission

7.3.1. Test Limit

FCC Part 15.209 Limit		
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 80	100	3
80 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

Note 1: The lower limit shall apply at the transition frequency.
Note 2: Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
Note 3: E field strength (dBuV/m) = 20 log E field strength (uV/m).

7.3.2. Test Procedure Used

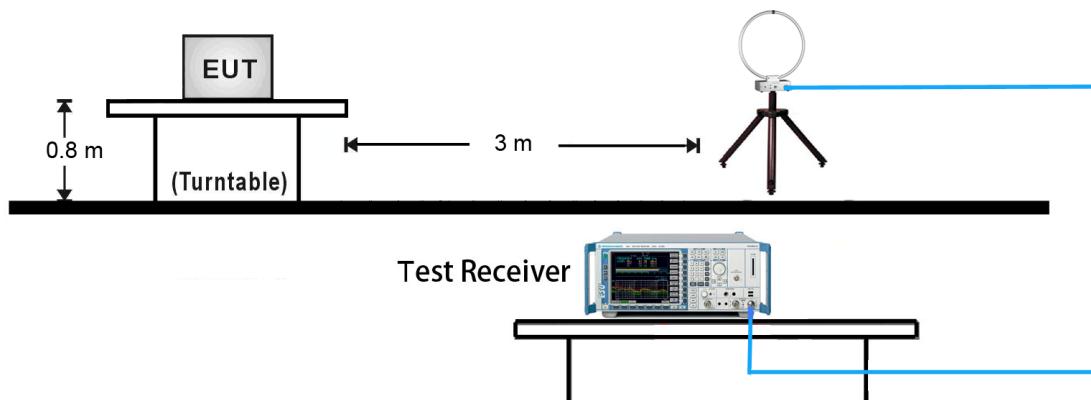
ANSI C63.10 - Section 6.3 (General Requirements)

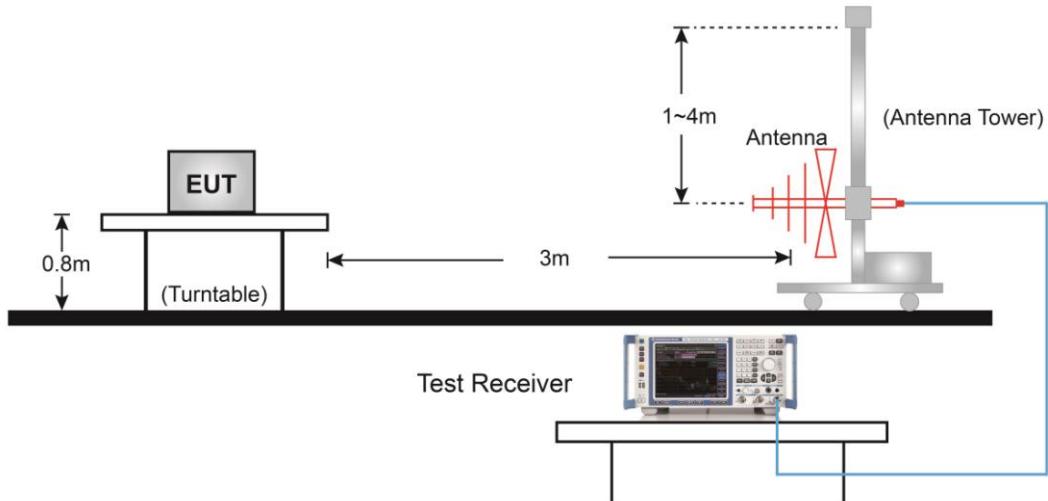
ANSI C63.10 - Section 6.4 (Standard test method below 30MHz)

ANSI C63.10 - Section 6.5 (Standard test method above 30MHz to 1GHz)

7.3.3. Test Setup

Below 30MHz Test Setup:



30MHz ~ 1GHz Test Setup:

7.3.4. Test Result

Product	SmartLink TPMS Tablet	Temperature	25°C
Test Engineer	Messiah Li	Relative Humidity	52%
Test Site	AC1	Test Date	2019/08/27

Frequency (MHz)	Reading Level (dB μ V)	Factor (dB)	Measure Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Detector	Polarization
Fundamental Radiated Emission							
0.127	49.574	20.188	69.762	105.528	-35.766	Peak	Face On
Radiated Spurious Emission							
0.019	27.128	21.294	48.422	122.029	-73.607	Peak	Face On
0.024	23.325	21.171	44.496	120.000	-75.504	Peak	Face On
0.063	23.25	20.306	43.556	111.617	-68.061	Peak	Face On
51.340	0.866	14.155	15.021	40.000	-24.979	QP	Horizontal
122.150	1.215	13.472	14.687	43.500	-28.813	QP	Horizontal
154.645	-0.545	15.400	14.855	43.500	-28.645	QP	Horizontal
167.255	-0.035	14.741	14.706	43.500	-28.794	QP	Horizontal
436.430	-0.077	17.737	17.660	46.000	-28.340	QP	Horizontal
712.880	1.338	22.618	23.956	46.000	-22.044	QP	Horizontal
38.245	7.619	14.472	22.091	40.000	-17.909	QP	Vertical
50.360	12.650	14.224	26.874	40.000	-13.126	QP	Vertical
73.650	7.626	11.132	18.758	40.000	-21.242	QP	Vertical
123.605	2.347	13.556	15.903	43.500	-27.597	QP	Vertical
434.005	2.800	17.674	20.474	46.000	-25.526	QP	Vertical
729.370	1.751	22.853	24.604	46.000	-21.396	QP	Vertical
Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB)							

7.4. 99% & 20dB Bandwidth Measurement

7.4.1. Test Limit

N/A

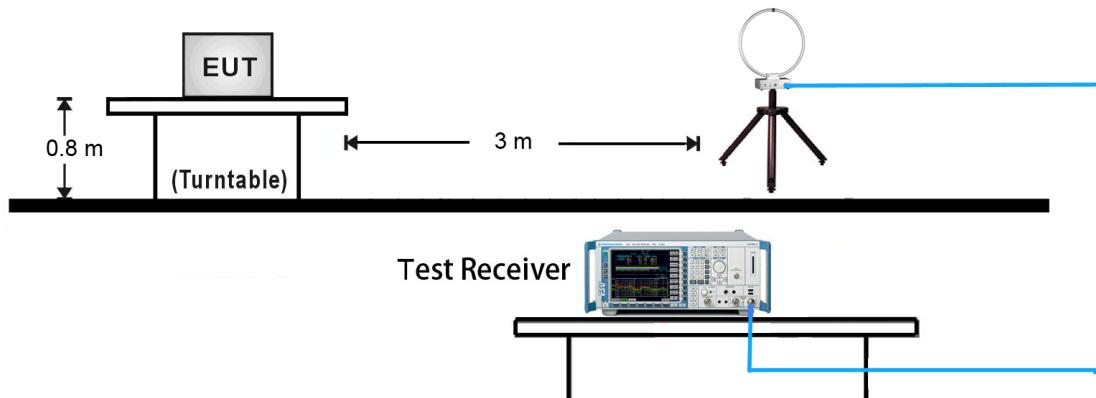
7.4.2. Test Procedure Used

ANSI C63.10 Clause 6.9.2

7.4.3. Test Setting

1. Set the spectrum span shall be between two times and five times the OBW
2. Set RBW = 1% ~ 5% of the OBW
3. VBW $\geq 3 \times$ RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. Allow the trace was allowed to stabilize and marker the highest level.
8. Determine the display level (the highest level - 20dB) and place two markers, one at the lowest frequency and the other at the highest frequency.

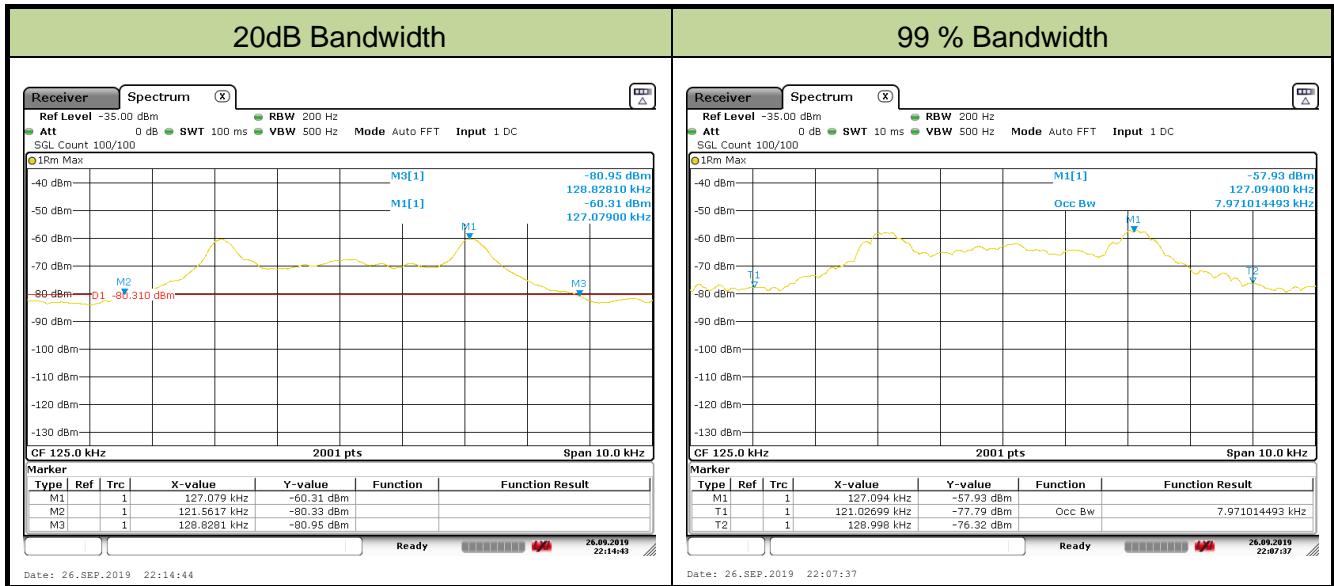
7.4.4. Test Setup



7.4.5. Test Result

Product	SmartLink TPMS Tablet	Temperature	25°C
Test Engineer	David Li	Relative Humidity	52%
Test Site	AC1	Test Date	2019/09/26

Item	Bandwidth		Result
20dB Bandwidth	Low Frequency	121.562 kHz	Pass
	High Frequency	128.828 kHz	
99% Bandwidth	7.971 kHz		Pass



8. CONCLUSION

The data collected relate only the item(s) tested and show that the unit is compliance with Part 15C of the FCC rules and ISED rules.

The End

Appendix A - Test Setup Photograph

Refer to "1908RSU022-UT" file.

Appendix B - EUT Photograph

Refer to "1908RSU022-UE" file.