

TEST REPORT

of

FCC Part 15 Subpart C AND CANADA RSS-Gen

☐ New Application; ☐ Class I PC; ☒ Class II PC

Product : Sensor AID DUO TPMS TOOL
Brand: Cub
Model: FCC: Please see page 6
IC:VS-60U029
Model Difference: FCC: Please see page 6
IC: N/A
FCC ID: ZPNVS60U029
IC: 9959A-VS60U029
FCC Rule Part: §15.209
ISED Rule Part: RSS-Gen issue 5; RSS-210 issue 10
Applicant: CUB ELECPARTS INC.
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Test Performed by:

International Standards Laboratory Corp. LT Lab.



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Report No.: ISL-18LR335FC-R2
Issue Date :2021/09/24



Test results given in this report apply only to the specific sample(s) tested and are traceable to national or international standard through calibration of the equipment and evaluating measurement uncertainty herein.

The uncertainty of the measurement does not include in consideration of the test result unless the customer required the determination of uncertainty via the agreement, regulation or standard document specification.

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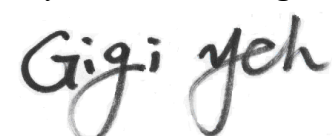
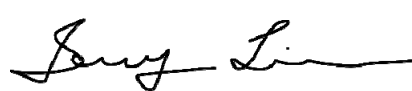
VERIFICATION OF COMPLIANCE

Applicant: CUB ELECPARTS INC.
Product Description: Sensor AID DUO TPMS TOOL
Brand Name: Cub
FCC ID: ZPNVS60U029
IC: 9959A-VS60U029
Model No.: FCC: Please see page 6
IC:VS-60U029
Model Difference: FCC: Please see page 6
IC: N/A
Date of test: 2021/08/12 ~ 2021/09/23
Date of EUT Received: 2021/08/12

We hereby certify that:

All the tests in this report have been performed and recorded in accordance with the standards described above and performed by an independent electromagnetic compatibility consultant, International Standards Laboratory Corp.

The test results contained in this report accurately represent the measurements of the characteristics and the energy generated by sample equipment under test at the time of the test. The sample equipment tested as described in this report is in compliance with the limits of above standards.

Test By:		Date:	2021/09/24
	<i>Barry Lee / Senior Engineer</i>		
Prepared By:		Date:	2021/09/24
	<i>Gigi Yeh / Senior Engineer</i>		
Approved By:		Date:	2021/09/24
	<i>Jerry Liu / Technical Manager</i>		

Version

Version No.	Date	Description
00	2021/09/24	Initial creation of document

Measurement Uncertainty (K=2)

Description Of Test	Uncertainty
Conducted Emission (AC power line)	2.586 dB
Field Strength of Spurious Radiation	<=30MHz: 2.96dB 30-1GHz: 4.22 dB 1-40 GHz: 4.08 dB
Conducted Power	2.412 GHz: 1.30 dB 5.805 GHz: 1.55 dB
Power Density	2.412 GHz: 1.30 dB 5.805 GHz: 1.67 dB
Frequency	0.0032%

Table of Contents

1.	GENERAL INFORMATION	6
1.1	PRODUCT DESCRIPTION	6
1.2	RELATED SUBMITTAL(S) / GRANT (S)	7
1.3	TEST METHODOLOGY.....	7
1.4	TEST FACILITY	7
1.5	SPECIAL ACCESSORIES.....	7
1.6	EQUIPMENT MODIFICATIONS	7
2.	SYSTEM TEST CONFIGURATION	8
2.1	EUT CONFIGURATION.....	8
2.2	EUT EXERCISE	8
2.3	TEST PROCEDURE.....	8
2.4	LIMITATION	9
2.5	CONFIGURATION OF TESTED SYSTEM.....	12
3.	SUMMARY OF TEST RESULTS	13
4.	DESCRIPTION OF TEST MODES	13
5.	EMISSION BANDWIDTH TEST	14
5.1	MEASUREMENT PROCEDURE:	14
5.2	TEST SETUP	14
5.3	MEASUREMENT EQUIPMENT USED:	14
5.4	MEASUREMENT RESULT:	15
6.	RADIATED EMISSION TEST	16
6.1	MEASUREMENT PROCEDURE.....	16
6.2	TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)	16
6.3	MEASUREMENT EQUIPMENT USED:	17
6.4	FIELD STRENGTH CALCULATION	18
6.5	MEASUREMENT RESULT	19

1. General Information

1.1 Product Description

General:

Product Name	Sensor AID DUO TPMS TOOL	
Brand Name	Cub	
FCC: Model Name	VS-60U029; VS-60U029XX; VS-60U029XX-XX; VS-60U029XX-XX-X; VS-60U024; VS-60U024XX; VS-60U024XX-XX; VS-60U024XX-XX-X; VS-60U029XXXXXXXX; VS-60U024XXXXXXXX; CT4; Sensor AID TOOL Gen4; Sensor AID DUO TPMS TOOL; SENSOR AID TOOL GEN4; SENSOR AID DUO TPMS TOOL	
IC: Model Name	VS-60U029	
FCC Model Difference	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	
IC Model Difference	N/A	
Power Supply	5 Vdc from AC/DC adapter or 3.7V from battery	
	Adapter:	Model: SK22G3-0500250U
	Battery:	Model : MLP625094

IC RSS-Gen:

PMN (Product Marketing Name)	VS-60U029
HVIN (Hardware Version Identification Number)	VS-60U029
Product SW version	1.0
Product HW version	1.0
Radio SW version	RS1.0
Radio HW version	1.0

Rule: 15.209 (TX) / RSS-Gen

Frequency Range:	125kHz
Modulation type:	AM
Antenna Designation:	Loop Antenna

1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: ZPNVS60U029 filing to comply with Section 15.209 of the FCC Part 15, Subpart C Rules and IC: 9959A-VS60U029 filing to comply with Industry Canada RSS-Gen issue 5; RSS-210 issue 10.

1.3 Test Methodology

All testing were performed according to the procedures in ANSI C63.10: 2013.

1.4 Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of **International Standards Laboratory Corp.**<LT Lab.> No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist., Tao Yuan City 325, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.10: 2013. FCC Registration Number is: 487532; Designation Number is: TW0997, Canada Registration Number: 4067B-4.

1.5 Special Accessories

Not available for this EUT intended for grant.

1.6 Equipment Modifications

Not available for this EUT intended for grant.

2. System Test Configuration

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The EUT (Transmitter) was tested with a test program to fix the Tx frequency that was for the purpose of the measurements. For more information please see test data and APPENDIX 1 for set-up photographs.

2.3 Test Procedure

2.3.1 Conducted Emissions (Not apply in the report)

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the requirements in Section 7, 13 of ANSI C63.4-2014 and RSS-Gen issue 5. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and Average detector mode.

2.3.2 Radiated Emissions

The EUT is a placed on as turn table which is 0.8/1.5 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” Is still within the 3dB illumination BW of the measurement antenna. According to the requirements in Section 8 and 13 and Sub-clause 8.3.1.2 of ANSI C63.10: 2013.

2.4 Limitation

(1) Emission Bandwidth

FCC 15.215(c) requirement:

Intentional radiators operating under the alternative provisions to the general emission limits must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

RSS-Gen 6.7 requirement:

The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

(2) Conducted Emission

According to FCC 15.207(a) / RSS-Gen 8.8 requirement:

Conducted Emission Limits is as following.

Frequency range MHz	Limits dB (uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Note 1.The lower limit shall apply at the transition frequencies 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

(3) Radiated Emission

FCC 15.209 requirement:

- (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:
- (b) In the emission table above, the tighter limit applies at the band edges.
- (c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other Sections within this Part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

Frequency (MHz)	Field strength $\mu\text{V/m}$	Distance (m)	Field strength at 3m $\text{dB}\mu\text{V/m}$
0.009-0.490	2400/F(kHz)	300	
0.490-1.705	24000/F(kHz)	30	
1.705-30	30	30	69.54
30-88	100	3	40
88-216	150	3	43.5
216-960	200	3	46
Above 960	500	3	54

RSS-Gen requirement:

Except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in following tables. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.

General field strength limits at frequencies above 30 MHz

Frequency (MHz)	Field strength ($\mu\text{V/m}$ at 3 m)
30 – 88	100
88 – 216	150
216 – 960	200
Above 960	500

General field strength limits at frequencies below 30 MHz

Frequency	Magnetic field strength (H-Field) ($\mu\text{A/m}$)	Measurement distance (m)
9 - 490 kHz ¹	6.37/F (F in kHz)	300
490 - 1705 kHz	63.7/F (F in kHz)	30
1.705 - 30 MHz	0.08	30

Note 1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

Limit Table:

Number of Harmonic	Frequency (kHz)	Distance m	Limit at 300m (dBuV/m)	Limit at 30m (dBuV/m)	Distance Factor dB	Limit at 3m (dBuV/m)
1	125	300	25.67	--	80	105.67
2	250	300	19.65	--	80	99.65
3	375	300	16.12	--	80	96.12
4	500	30	--	33.62	40	73.62
5	625	30	--	31.69	40	71.69
6	750	30	--	30.10	40	70.10
7	875	30	--	28.76	40	68.76
8	1000	30	--	27.60	40	67.60
9	1125	30	--	26.58	40	66.58
10	1250	30	--	25.67	40	65.67

Limit Calculation and transfer to 3m test distance:

If the frequency between 9 – 490kHz,
 $\text{Limit} = 20\log(2400/f(\text{kHz})) + 40\log(300/3)$

If the frequency between 490 kHz – 1.705MHz
 $\text{Limit} = 20\log(24000/f(\text{kHz})) + 40\log(30/3)$

2.5 Configuration of Tested System

Fig. 2-1 Configuration of Tested System

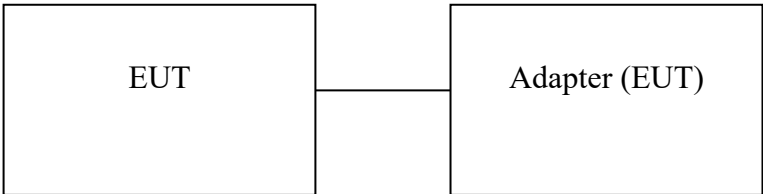


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
1	N/A					

3. Summary of Test Results

FCC Rules	Description Of Test	Result
§15.207	Conducted Emission	N/A
§15.209	Radiated Emission	Compliant

4. Description of test modes

The EUT has been tested under continuous operating condition with a Test Kit. The Frequency 125kHz was chosen for testing.

The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1,E2 mode) three axis modes. Worse case E1 mode.

Note: Test item list below has been re-verify:

1. Emission Bandwidth Test
2. Radiated Emission Test

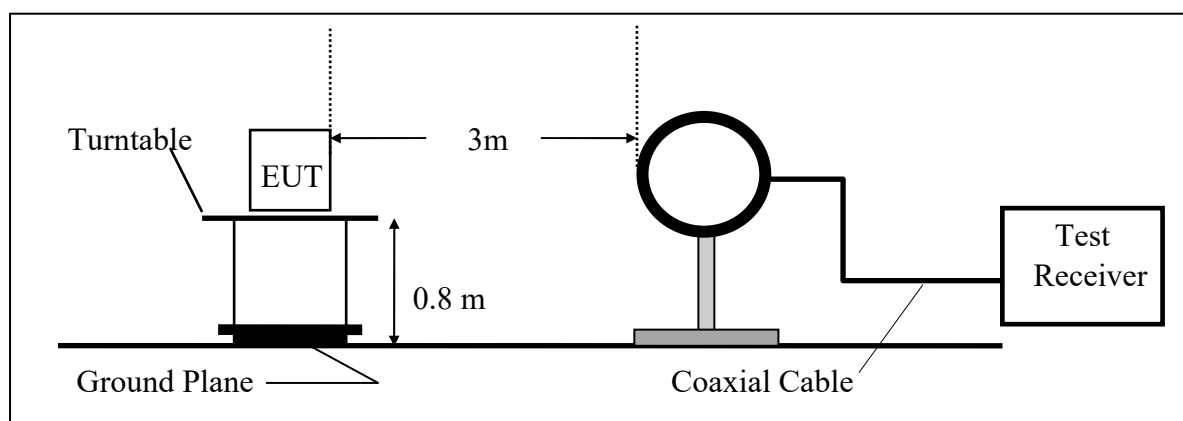
5. Emission Bandwidth Test

5.1 Measurement Procedure:

The spectrum analyzer span was set to 2 to 5 times the estimated bandwidth of the emission. The RBW was set from 1% to 5% of the estimated emission bandwidth. The trace was set to max hold with a peak detector active. The marker-delta function of the analyzer, set at 20 dB below the highest peak, was utilized to determine the 20 dB bandwidth of the emission.

The 99% occupied bandwidth was measured with the spectrum analyzer span set to fully display the emission, including the emissions skirts. The RBW was set from 1% and 5% of the estimated 99% bandwidth. The occupied 99% bandwidth was measured by using the occupied bandwidth function of the spectrum analyzer set to 99% with a peak detector.

5.2 Test Setup

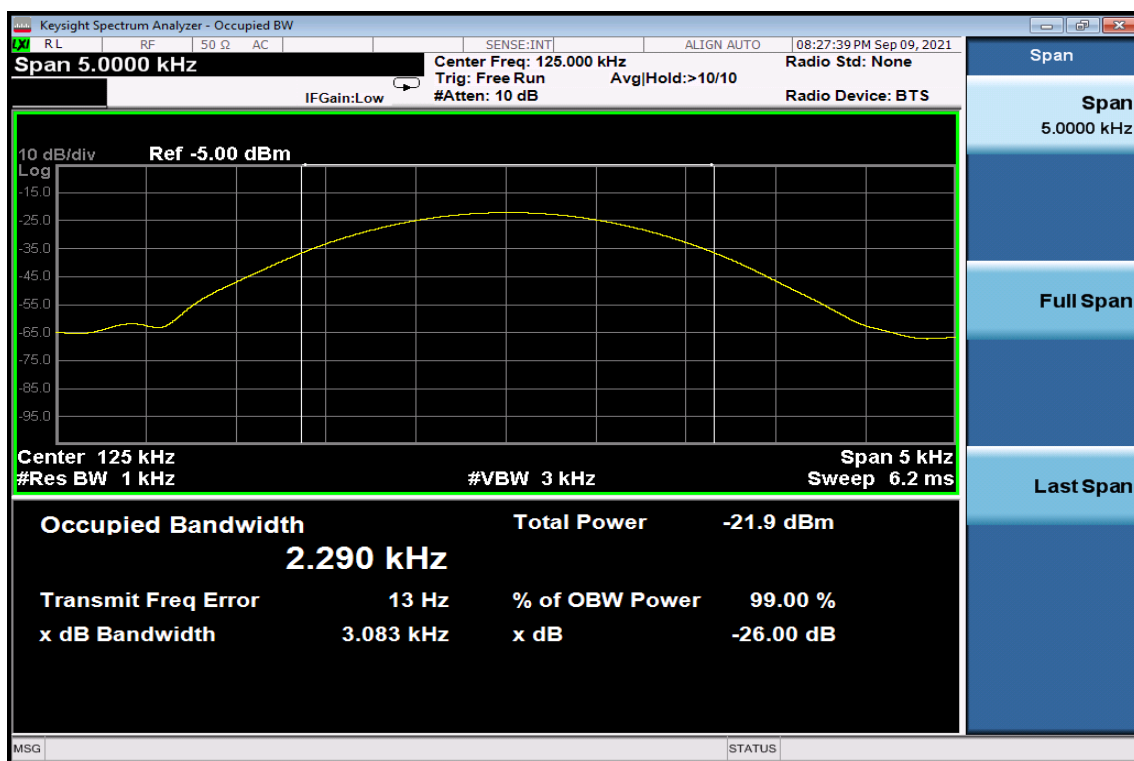


5.3 Measurement Equipment Used:

Chamber 19(966)					
Equipment Type	Manufacturer	Model Number	Serial Number	Last Cal.	Cal Due.
Spectrum analyzer	R&S	FSP40	100116	8/18/2021	8/18/2022
EMI Receiver	R&S	ESR3	102461	5/05/2021	5/05/2022
Loop Antenna(9K-30M)	EM	EM-6879	271	05/21/2020	05/21/2022
Preamplifier (9kHz-1GHz)	HP	8447F	3113A04621	06/22/2021	06/22/2022
Preamplifier (1GHz - 26GHz)	EM	EM01M26G	060681	05/07/2021	05/07/2022

5.4 Measurement Result:

Frequency (kHz)	26dB Bandwidth (kHz)	99% Occupied Bandwidth (kHz)
125	3.083	2.290



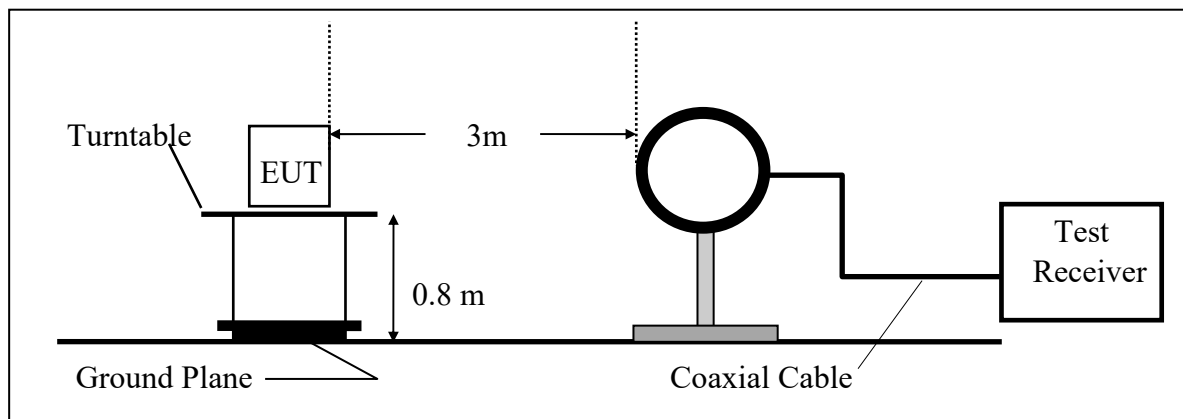
6. Radiated Emission Test

6.1 Measurement Procedure

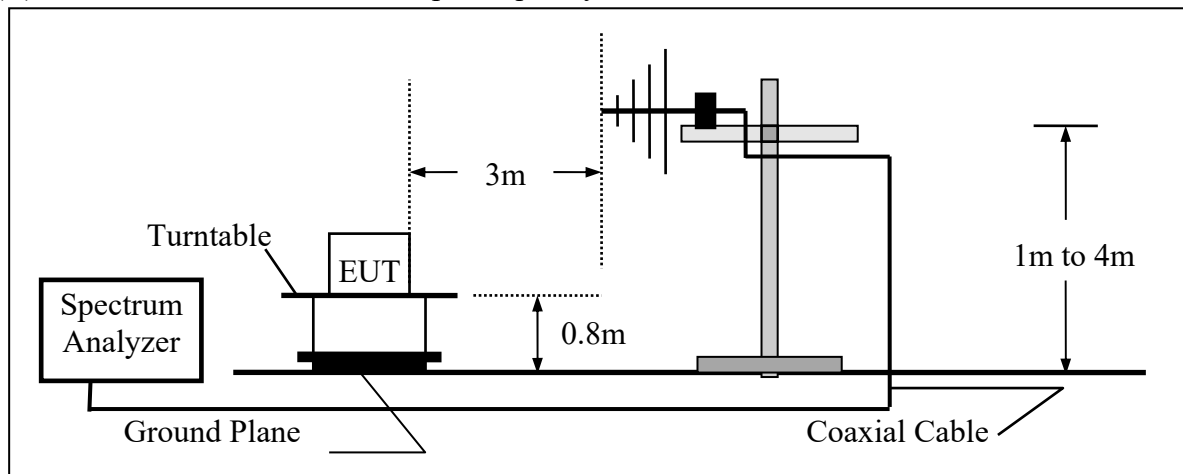
1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measured were complete.

6.2 Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency Below 1000MHz



6.3 Measurement Equipment Used:

Location	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Chamber 19	Signal analyzer	R&S	FSV40	101919	8/18/2021	8/18/2022
Chamber 19	EMI Receiver	R&S	ESR3	102461	5/05/2021	5/05/2022
Chamber 19	Loop Antenna	EM	EM-6879	271	05/21/2020	05/21/2022
Chamber 19	Bilog Antenna (30MHz-1GHz)	Schwarzbeck	VULB9168 w 6dB Att.	9168-736	2/22/2021	2/22/2022
Chamber 19	Horn antenna (1GHz-18GHz)	ETS LINDGREN	3117	00218718	09/25/2021	09/25/2022
Chamber 19	Horn antenna (18GHz-26GHz)	Com-power	AH-826	081001	11/23/2020	11/23/2021
Chamber 19	Horn antenna (26GHz-40GHz)	Com-power	AH-640	100A	03/11/2021	03/11/2022
Chamber 19	Preamplifier (9kHz-1GHz)	HP	8447F	3113A04621	06/22/2021	06/22/2022
Chamber 19	Preamplifier (1GHz - 26GHz)	EM	EM01M26G	060681	05/07/2021	05/07/2022
Chamber 19	Preamplifier (26GHz-40GHz)	MITEQ	JS4-26004000- 27-5A	818471	05/07/2021	05/07/2022
Chamber 19	RF Cable (9kHz-18GHz)	Huber Suhner & Woken	Sucoflex 104A & 18GHz SMA(M)-SM A(M)-10M	MY817/4A & 20200525	12/25/2020	12/25/2021
Chamber 19	RF Cable (18GHz-40GHz)	HUBER SUHNER	Sucoflex 102	27963/2&374 21/2	11/19/2020	11/19/2021
Chamber 19	Signal Generator	Anritsu	MG3692A	20311	01/03/2021	01/03/2022
Chamber 19	Test Software	Audix	E3 Ver:6.12023	N/A	N/A	N/A

6.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Average Value = Peak Value + 20 Log (Ton/Tp) Pulse Modulation

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

6.5 Measurement Result

Fundamental Measurement Result

Operation Mode	: TX CH	Test Date	: 2021/09/09
Fundamental Frequency	: 125kHz	Test By	: Barry
Temp	: 25 °C	Hum.	: 60%

Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
0.12	70.52	30.49	101.01	125.00	-23.99	Peak	VERTICAL
0.12	66.24	30.49	96.73	125.00	-28.27	Peak	HORIZONTAL

Remark:

- 1 Measurement distance is 3 m.
- 2 The IF bandwidth of SPA was 10kHz, VBW=30kHz.

Radiated Spurious Emission Measurement Result (9 kHz~30 MHz)

Operation Mode: Transmitting Mode

Test Date: 2021/09/09

Fundamental Frequency: 125kHz

Test By: Barry

Temperature : 25 °C

Humidity : 65 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	0.19	48.03	26.82	74.85	117.78	-42.93	Peak	VERTICAL
2	0.37	38.15	21.11	59.26	107.12	-47.86	Peak	VERTICAL
3	0.61	32.16	17.52	49.68	72.00	-22.32	Peak	VERTICAL
4	1.78	34.86	12.45	47.31	69.54	-22.23	Peak	VERTICAL
5	3.61	23.27	10.38	33.65	69.54	-35.89	Peak	VERTICAL
6	8.89	17.50	11.26	28.76	69.54	-40.78	Peak	VERTICAL
1	0.22	46.73	25.54	72.27	116.00	-43.73	Peak	HORIZONTAL
2	0.61	33.01	17.52	50.53	72.00	-21.47	Peak	HORIZONTAL
3	1.78	37.69	12.45	50.14	69.54	-19.40	Peak	HORIZONTAL
4	3.58	25.77	10.39	36.16	69.54	-33.38	Peak	HORIZONTAL
5	9.97	18.49	11.45	29.94	69.54	-39.60	Peak	HORIZONTAL
6	20.31	17.86	10.56	28.42	69.54	-41.12	Peak	HORIZONTAL

Remark:

- 1 Measurement distance is 3 m.
- 2 The IF bandwidth of SPA was 10kHz, VBW=30kHz.

Radiated Spurious Emission Measurement Result (30 MHz – 1 GHz)

Operation Mode: Transmitting Mode

Test Date: 2021/09/09

Fundamental Frequency: 125kHz

Test By: Barry

Temperature : 25 °C

Humidity : 65 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	431.58	37.94	-1.78	36.16	46.00	-9.84	Peak	VERTICAL
2	455.83	38.81	-1.38	37.43	46.00	-8.57	Peak	VERTICAL
3	529.55	36.80	-0.38	36.42	46.00	-9.58	Peak	VERTICAL
4	706.09	35.96	2.97	38.93	46.00	-7.07	Peak	VERTICAL
5	740.04	36.29	3.71	40.00	46.00	-6.00	Peak	VERTICAL
6	773.99	36.45	4.44	40.89	46.00	-5.11	Peak	VERTICAL
1	117.30	40.24	-8.09	32.15	43.50	-11.35	Peak	HORIZONTAL
2	522.76	37.08	-0.48	36.60	46.00	-9.40	Peak	HORIZONTAL
3	551.86	35.78	-0.05	35.73	46.00	-10.27	Peak	HORIZONTAL
4	583.87	37.12	0.75	37.87	46.00	-8.13	Peak	HORIZONTAL
5	606.18	35.43	1.44	36.87	46.00	-9.13	Peak	HORIZONTAL
6	627.52	34.71	1.74	36.45	46.00	-9.55	Peak	HORIZONTAL

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 2 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak / QP detector mode.
- 3 The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz, VBW=300kHz.