

## FCC IC Test Report

**Report No.:** FCC\_RF\_SL20010601-CHI-001 Rev\_1.0

**FCC ID:** 2ABA2SFM11R2D

**Test Model:** TS300s Koala

**Received Date:** 11/04/2020

**Test Date:** 11/10/2020-11/19/2020

**Issued Date:** 11/19/2020

**Applicant:** SEONG JI INDUSTRIAL CO., LTD

**Address:** 54-33, Dongtanhana 1-gil, Gyeonggi-do Hwaseong-si, South Korea

**Manufacturer:** SEONG JI INDUSTRIAL CO., LTD

**Address:** 54-33, Dongtanhana 1-gil, Gyeonggi-do Hwaseong-si, South Korea

**Issued By:** Bureau Veritas Consumer Products Services, Inc.

**Lab Address:** 775 Montague Expressway, Milpitas, CA 95035

**Test Location (1):** 775 Montague Expressway, Milpitas, CA 95035

**FCC Registration /  
Designation Number:** 540430

**ISED# / CAB identifier:** 4842D



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### Release Control Record

Issue No.	Description	Date Issued
FCC_RF_SL20010601-CHI-001	Original Release	11/19/2020
FCC_RF_SL20010601-CHI-001 Rev_1.0	Update Applicant Information	12/17/2020

## 1 Certificate of Conformity

**Product:** TS300S Koala Fuse Monitoring System

**Brand:** Tecsys

**Test Model:** TS300s Koala

**Sample Status:** Engineering sample

**Applicant:** SEONG JI INDUSTRIAL CO., LTD

**Test Date:** 11/10/2020-11/19/2020

**Standards:** 47 CFR FCC Part 15, Subpart C (Section 15.247)  
ANSI C63.10: 2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services, Inc., Milpitas Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

**Prepared by :**                     *Deon*                    , **Date:**                     11/19/2020                      
Deon Dai / Test Engineer

**Approved by :**                     *Gary Chou*                    , **Date:**                     11/19/2020                      
Gary Chou / Engineer Review

## 2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (SECTION 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	N/A	N/A
15.247(a)(1) (iii)	Number of Hopping Frequency Used	N/A	N/A
15.247(a)(1) (iii)	Dwell Time on Each Channel	N/A	N/A
15.247(a)(1)	1. Hopping Channel Separation 2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	N/A	N/A
15.247(b)	Maximum Peak Output Power	N/A	N/A
15.247(d)	Band Edge Measurement	N/A	N/A
15.205 & 209 & 15.247(d)	Radiated Emissions	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	N/A	N/A

Note: Only Radaited emission test in this report, the other test details please see original report: HCT-R-1707-F019 (FCC ID: 2ABA2SFM11R2D)

### 2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	3.51dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	3.73dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	4.64dB
	6GHz ~ 18GHz	4.82dB
	18GHz ~ 40GHz	4.91dB

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

Product	TS300S Koala Fuse Monitoring System
Brand	TECSYS
Test Model	TS300s Koala
Identification No. of EUT	009233ED0B8
Status of EUT	Engineering sample
Power Supply Rating	3.6Vdc
Modulation Type	DBPSK
Modulation Technology	FHSS
Operating Frequency	Low Band: 902.1375~904.6625 MHz High Band: 920.1375~922.6625 MHz
Number of Channel	Low Band: 54 CH (9 Macro channels x 6 Micro channels) High Band: 54 CH (9 Macro channels x 6 Micro channels)
Max. Output Power	Low Band: 23.123 dBm High Band: 22.734 dBm
Antenna Info	Antenna Type: PCB Trace Antenna Peak Gain: 2 dBi
Antenna Connector	N/A

### 3.2 Description of Test Modes

54 channels are provided to this EUT:

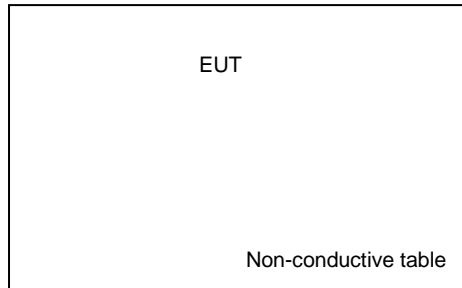
Low Band:

Channel	Frequency (MHz)
Low	902.1375
Mid	903.4125
High	904.6625

High Band:

Channel	Frequency (MHz)
Low	920.1375
Mid	921.3875
High	922.6625

### 3.2.1 Configuration of System under Test



### 3.3 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**47 CFR FCC Part 15, Subpart C (Section 15.247)**  
**ANSI C63.10: 2013**

All test items have been performed and recorded as per the above standards.



## 4 Test Types and Results

### 4.1 Radiated Emission Measurement

#### 4.1.1 Limits of Radiated Emission

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

**NOTE:**

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

## 4.1.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
EMI Test Receiver ROHDE & SCHWARZ	ESIB 40	100179	08/28/2020	08/28/2021
Spectrum Analyzer KEYSIGHT	N9030B	MY57140374	07/22/2020	07/22/2021
Hybrid Antenna SUNAR	JB6	A111717	03/09/2020	03/09/2021
DRG Horn Antenna ETS LINDGREN	3117	214309	11/22/2019	11/22/2020
Preamplifier RF-LAMBDA	RAMP00M50GA	17032300047	10/19/2020	10/19/2021
Preamplifier RF-BAY	LPA-6-30	11170602	05/06/2020	05/06/2021

#### 4.1.3 Test Procedures

##### **For Radiated emission below 30MHz**

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

##### **NOTE:**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz at frequency below 30MHz.

##### **For Radiated emission above 30MHz**

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

##### **Note:**

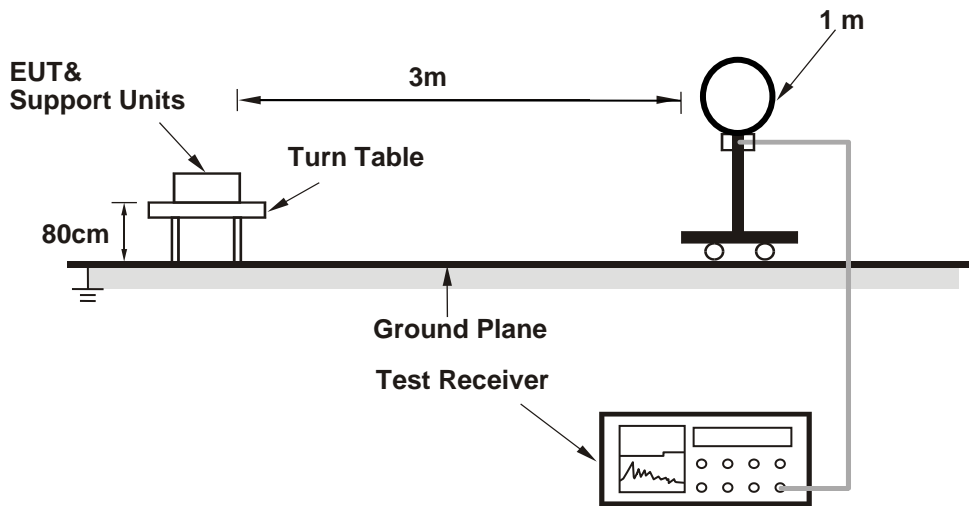
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is  $\geq 1/T$  (Duty cycle  $< 98\%$ ) or 10Hz (Duty cycle  $\geq 98\%$ ) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

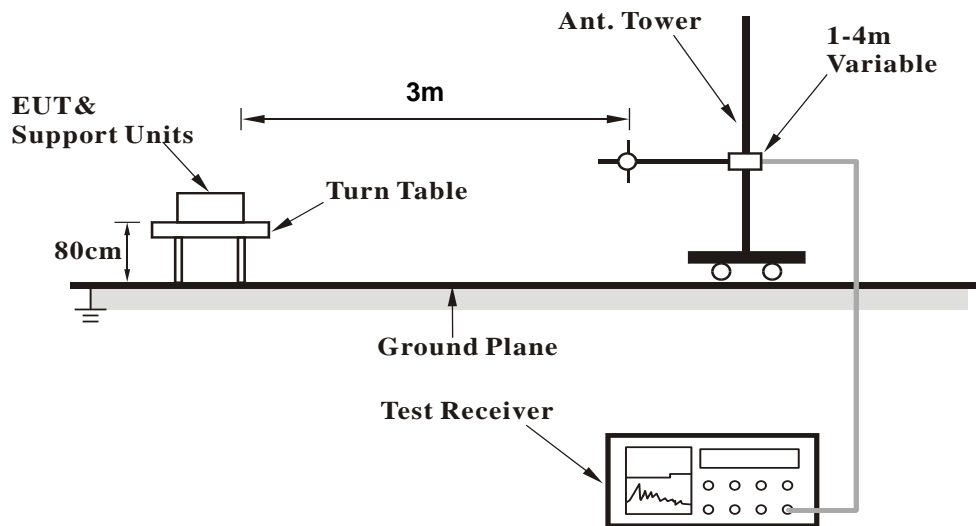
No deviation.

4.1.5 Test Setup

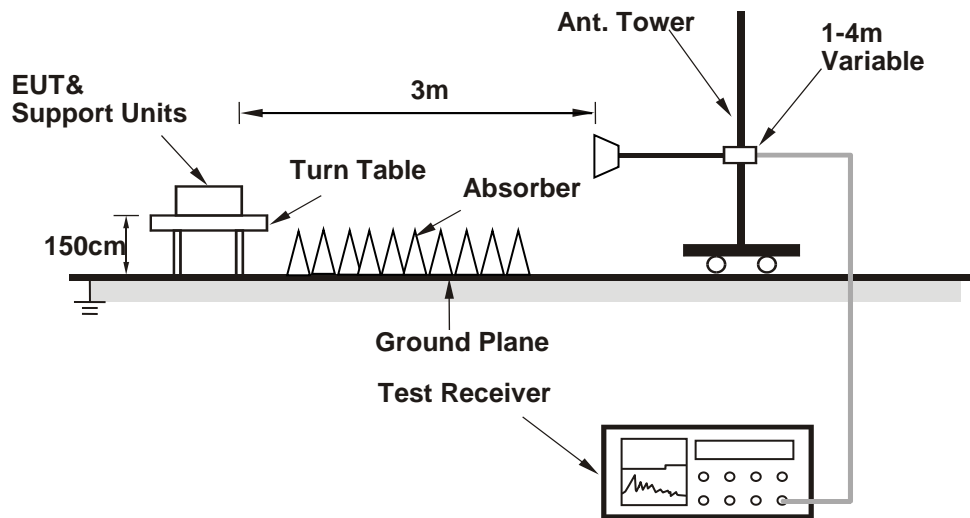
**For Radiated emission below 30MHz**



**For Radiated emission 30MHz to 1GHz**



**For Radiated emission above 1GHz**



For the actual test configuration, please refer to the attached file (Test Setup Photo).

**4.1.6 EUT Operating Conditions**

- a. Set the EUT on continue transmit mode.

4.1.7 Test Results

**BELOW 1GHz WORST-CASE DATA:**

**Low Band**

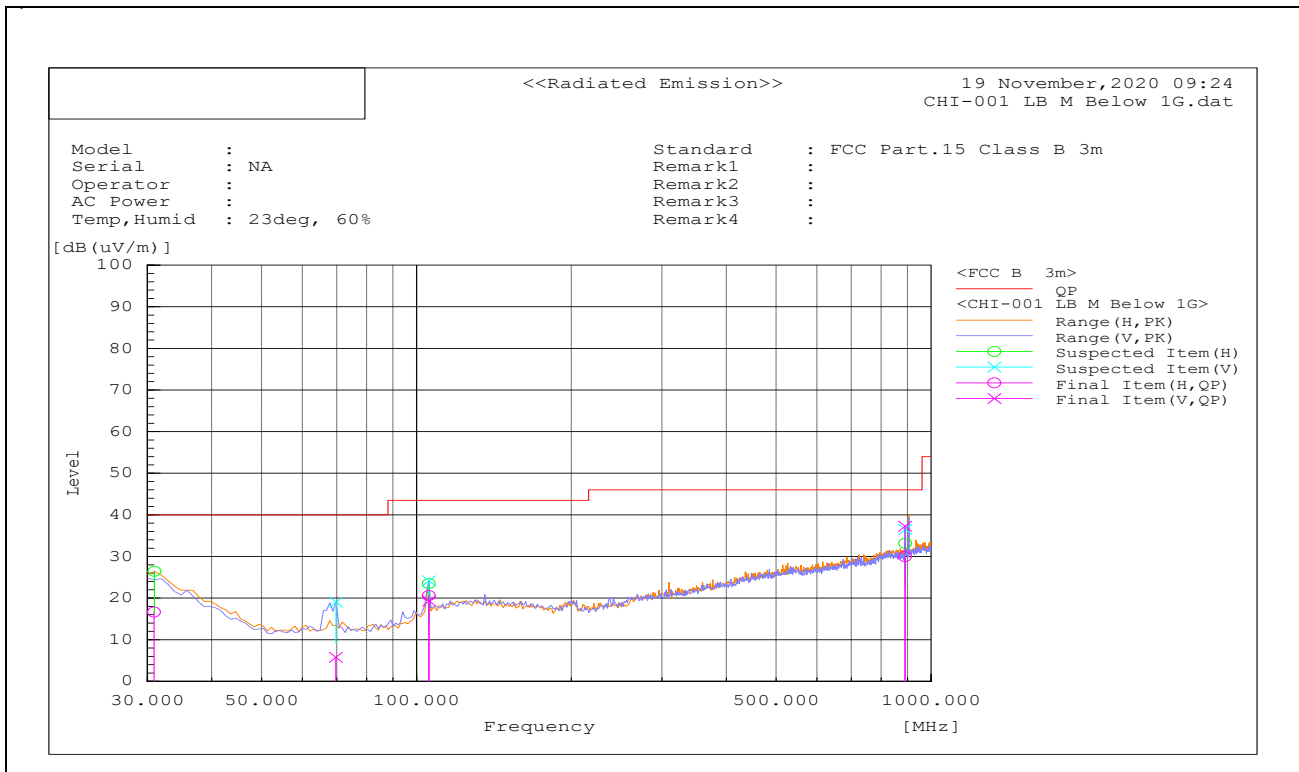
<b>CHANNEL</b>	Middle Channel	<b>DETECTOR FUNCTION</b>	Quasi Peak
<b>FREQUENCY RANGE</b>	30MHz – 1GHz		

**Antenna Polarity & Test Distance: Vertical and Horizontal at 3m**

No.	Frequency (MHz)	Polarization (H/V)	Reading QP [dB(uV)]	Factor [dB(1/m)]	Level QP [dB(uV/m)]	Limit\QP dB(uV/m)	Margin QP [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	30.908	H	-9.6	26.2	16.6	40	-23.4	285	75.5	Pass
2	69.673	V	-7.2	13	5.8	40	-34.2	115	287	Pass
3	105.707	H	3.1	17.5	20.6	43.5	-22.9	237	36.9	Pass
4	105.756	V	1.4	17.9	19.3	43.5	-24.2	134	339	Pass
5	890.006	H	-0.3	30.3	30	46	-16	100	2.2	Pass
6	889.988	V	7.6	29.7	37.3	46	-8.7	134	7.8	Pass

**REMARKS:**

1. Level (dBuV) = Reading (dBuV) + Factor (dB (1/m)).
2. Factor (dB (1/m)) = Antenna Factor (AF) (dB (1/m)) + Cable Loss (dB)
3. Margin = Level (dBuV/m) - Limit value (dBuV/m)



### High Band

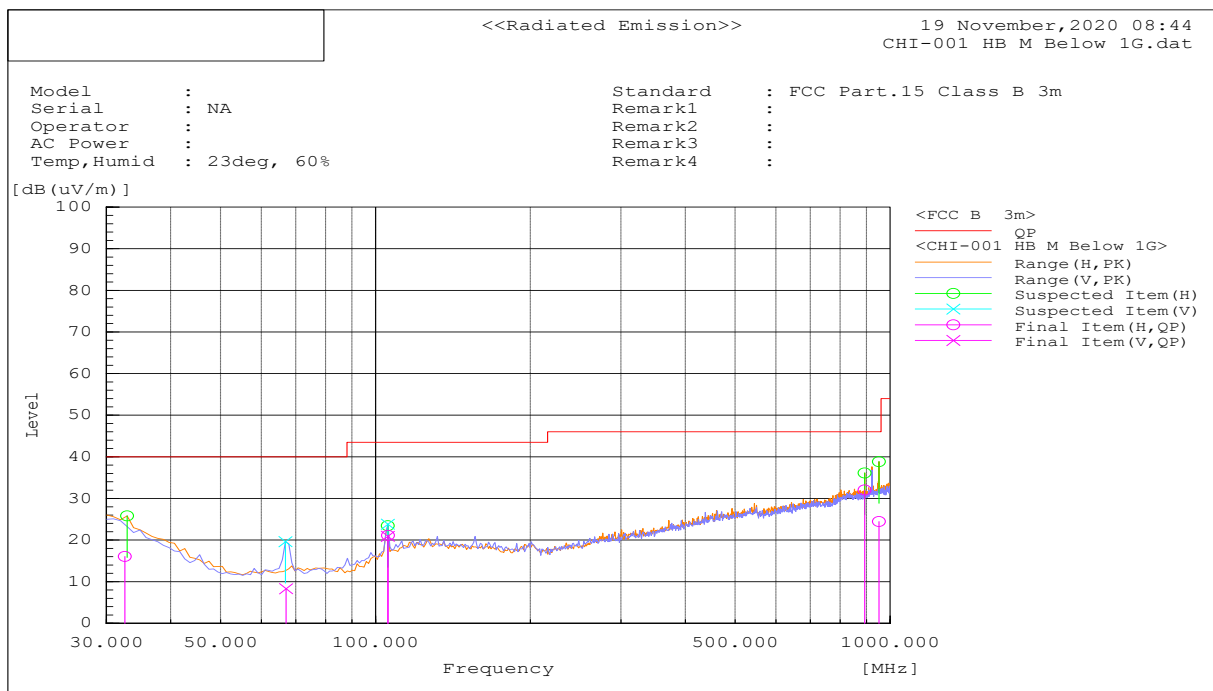
<b>CHANNEL</b>	Middle Channel	<b>DETECTOR FUNCTION</b>	Quasi Peak
<b>FREQUENCY RANGE</b>	30MHz – 1GHz		

#### Antenna Polarity & Test Distance: Vertical and Horizontal at 3m

No.	Frequency (MHz)	Polarization (H/V)	Reading QP [dB(uV)]	Factor [dB(1/m)]	Level QP [dB(uV/m)]	Limit\QP dB(uV/m)	Margin QP [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	32.591	H	-9	25.1	16.1	40	-23.9	322	327	Pass
2	67.04	V	-4.8	13.1	8.3	40	-31.7	106	285	Pass
3	105.672	V	3	17.9	20.9	43.5	-22.6	284	126	Pass
4	105.765	H	3.6	17.5	21.1	43.5	-22.4	100	79.9	Pass
5	892.168	H	1.7	30.3	32	46	-14	115	177	Pass
6	951.128	H	-6.9	31.3	24.4	46	-21.6	100	188	Pass

#### REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB (1/m)).
2. Factor (dB (1/m)) = Antenna Factor (AF) (dB (1/m)) + Cable Loss (dB)
3. Margin = Level (dBuV/m) - Limit value (dBuV/m)



**ABOVE 1GHz TEST DATA:**
**Low Band:**

<b>CHANNEL</b>	Low Channel	<b>DETECTOR FUNCTION</b>	Peak
<b>FREQUENCY RANGE</b>	1GHz ~ 10GHz		Average

**Antenna Polarity & Test Distance: Vertical and Horizontal at 3m**

No	Frequency (MHz)	Polarization (H/V)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	1306.007	V	42.4	55.7	-14.1	28.3	41.6	54	74	-25.7	-32.4	215	0	Pass
2	1899.998	V	44.4	54.7	-11.1	33.3	43.6	54	74	-20.7	-30.4	344	258	Pass
3	2460.727	H	39	52.2	-9.9	29.1	42.3	54	74	-24.9	-31.7	194	107	Pass
4	6321.597	H	34.7	48	-3.5	31.2	44.5	54	74	-22.8	-29.5	119	70.4	Pass
5	8259.327	V	29.4	42.3	0.1	29.5	42.4	54	74	-24.5	-31.6	208	289	Pass
6	15007.33	H	25.5	38.8	8.4	33.9	47.2	54	74	-20.1	-26.8	280	282	Pass

**REMARKS:**

1. Emission level (dBuV/m) = Raw Value (dBuV) + Cable Loss (dB) + AF (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.



<b>CHANNEL</b>	Middle Channel	<b>DETECTOR FUNCTION</b>	Peak Average
<b>FREQUENCY RANGE</b>	1GHz ~ 10GHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No	Frequency (MHz)	Polarization (H/V)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	1900.001	V	45.3	55	-11.1	34.2	43.9	54	74	-19.8	-30.1	301	288.1	Pass
2	1900.002	H	41.3	54	-11.1	30.2	42.9	54	74	-23.8	-31.1	384	285.4	Pass
3	3804.154	H	39.1	52.6	-7.7	31.4	44.9	54	74	-22.6	-29.1	352	354.3	Pass
4	6746.868	V	33.1	46.3	-2.6	30.5	43.7	54	74	-23.5	-30.3	162	50.4	Pass
5	10791.93	H	26.9	40.3	2.5	29.4	42.8	54	74	-24.6	-31.2	198	230.5	Pass
6	15347.70	V	25.5	39.3	9.1	34.6	48.4	54	74	-19.4	-25.6	126	341.9	Pass

**REMARKS:**

1. Emission level (dBuV/m) = Raw Value (dBuV) + Cable Loss (dB) + AF (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.

<b>CHANNEL</b>	High Channel	<b>DETECTOR FUNCTION</b>	Peak Average
<b>FREQUENCY RANGE</b>	1GHz ~ 10GHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No	Frequency (MHz)	Polarization (H/V)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	1814.95	V	40.8	54.4	-12.2	28.6	42.2	54	74	-25.4	-31.8	223	243.8	Pass
2	1934.84	H	40	53.3	-10.8	29.2	42.5	54	74	-24.8	-31.5	100	0	Pass
3	3839.017	H	39.2	52.4	-7.8	31.4	44.6	54	74	-22.6	-29.4	287	64	Pass
4	5724.219	V	36	49.3	-5.1	30.9	44.2	54	74	-23.1	-29.8	244	49.9	Pass
5	13154.64	V	27.8	41	4.8	32.6	45.8	54	74	-21.4	-28.2	180	10.7	Pass
6	14973.19	H	26	39.6	8.4	34.4	48	54	74	-19.6	-26	115	51.8	Pass

**REMARKS:**

1. Emission level (dBuV/m) = Raw Value (dBuV) + Cable Loss (dB) + AF (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.

**ABOVE 1GHz TEST DATA:**
**High Band**

<b>CHANNEL</b>	Low Channel	<b>DETECTOR FUNCTION</b>	Peak
<b>FREQUENCY RANGE</b>	1GHz ~ 10GHz		Average

**Antenna Polarity & Test Distance: Vertical and Horizontal at 3m**

No	Frequency (MHz)	Polarization (H/V)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	1255.315	H	42.1	55.5	-14.1	28	41.4	54	74	-26	-32.6	169	173.4	Pass
2	2020.165	V	40.3	53.6	-10.6	29.7	43	54	74	-24.3	-31	158	9.8	Pass
3	6915.664	V	32.4	46	-2.5	29.9	43.5	54	74	-24.1	-30.5	327	14.3	Pass
4	7954.474	V	30	43.2	-0.1	29.9	43.1	54	74	-24.1	-30.9	102	156.9	Pass
5	12678.95	H	27.3	41.1	4.6	31.9	45.7	54	74	-22.1	-28.3	319	356.8	Pass
6	15110.94	H	25.6	39.5	8.3	33.9	47.8	54	74	-20.1	-26.2	348	353.6	Pass

**REMARKS:**

1. Emission level (dBuV/m) = Raw Value (dBuV) + Cable Loss (dB) + AF (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.

<b>CHANNEL</b>	Middle Channel	<b>DETECTOR FUNCTION</b>	Peak Average
<b>FREQUENCY RANGE</b>	1GHz ~ 10GHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No	Frequency (MHz)	Polarization (H/V)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	1135.21	V	42.3	55.1	-15.3	27	39.8	54	74	-27	-34.2	122	19.9	Pass
2	1951.626	H	38.8	53	-10.7	28.1	42.3	54	74	-25.9	-31.7	198	68.6	Pass
3	2172.915	H	40.1	53.2	-11	29.1	42.2	54	74	-24.9	-31.8	276	56.3	Pass
4	2410.058	H	37.9	51.3	-10.1	27.8	41.2	54	74	-26.2	-32.8	312	275.3	Pass
5	7782.893	V	30.2	43.3	-0.4	29.8	42.9	54	74	-24.2	-31.1	241	356.7	Pass
6	10332.03	V	27.4	41	2.3	29.7	43.4	54	74	-24.3	-30.6	112	52	Pass

**REMARKS:**

1. Emission level (dBuV/m) = Raw Value (dBuV) + Cable Loss (dB) + AF (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.

<b>CHANNEL</b>	High Channel	<b>DETECTOR FUNCTION</b>	Peak Average
<b>FREQUENCY RANGE</b>	1GHz ~ 10GHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No	Frequency (MHz)	Polarization (H/V)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	1885.091	H	41.1	54.4	-11.3	29.8	43.1	54	74	-24.2	-30.9	230	71.6	Pass
2	2614.645	H	39.5	52.6	-9.4	30.1	43.2	54	74	-23.9	-30.8	112	64.5	Pass
3	2615.392	V	39.6	53.6	-9.4	30.2	44.2	54	74	-23.8	-29.8	162	270.2	Pass
4	6320.043	V	34.8	48.1	-3.5	31.3	44.6	54	74	-22.7	-29.4	191	234	Pass
5	13325.87	V	27.7	41.2	4.8	32.5	46	54	74	-21.5	-28	330	65.7	Pass
6	15144.42	H	26.1	39.6	8.5	34.6	48.1	54	74	-19.4	-25.9	287	292.3	Pass

**REMARKS:**

1. Emission level (dBuV/m) = Raw Value (dBuV) + Cable Loss (dB) + AF (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.

## Appendix – Information on the Testing Laboratories

Bureau Veritas is a global leader in testing, inspection and certification (TIC) services. We help businesses improve safety, sustainability and productivity; and our clients include the majority of leading brands in retail, manufacturing and other industries. With a presence in every major country around the world, our quality assurance and compliance solutions are vital in helping our customers enhance product quality and concept-to-consumer journeys. We also assist with increasing speed to market, profitability and brand equity throughout the supply chain. Bureau Veritas is a leading wireless/IoT testing, inspection, audit and certification provider, with a global network of test laboratories to support the IoT industry in areas of connectivity, security, interoperability as well as quality, health & safety, and environmental/chemical requirements.

If you have any comments, please feel free to contact us at the following:

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### **Littleton EMC/RF/Safety/Environmental Lab**

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The address and road map of all our labs can be found in our web site also.

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