FCC IC Test Report

Report No.:	FCC_IC_RF_SL20012301-XIR-002_Co-location Rev_1.0
FCC ID:	GKM-XT2500 XMR201707BG96
IC:	10281A-XT2500 10224A-201709BG96
Test Model:	XT2500
Series Model:	N/A
Test Date:	05/12/2020
Issued Date:	06/22/2020
Applicant:	Xirgo Technologies
Address:	188 Camino Ruiz, Camarillo, CA 93012
Manufacturer:	BCM Corporation
Address:	Plot 21, Jalan Hi-Tech 4, Kulim Hi-Tech Park, Phase 1, 09090 Kulim, Kedah, MALAYSIA
Issued By:	Bureau Veritas Consumer Products Services, Inc.
Lab Address:	775 Montague Expressway, Milpitas, CA 95035, USA
Test Location (1):	775 Montague Expressway, Milpitas, CA 95035, USA
FCC Registration / Designation Number:	540430
ISED# / CAB identifier:	4842D

ACCREDITED
TESTING CERT # 2742-01

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Release Control Record

Issue No.	Description	Date Issued
FCC_IC_RF_SL20012301-XIR-002_Co-location	Initial release	05/13/2020
FCC_IC_RF_SL20012301-XIR-002_Co-location Rev_1.0	Update Product Name	06/22/2020

1 Certificate of Conformity

Product:	XT2500
Brand:	Xirgo Technologies
Test Model:	XT2500
Sample Status:	Engineering sample
Applicant:	XT2500
Test Date:	05/12/2020
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247) 47 CFR FCC Part 2/22/24/27 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 : _____ , **Date:** 06/22/2020

Deon Dai / Test Engineer

Approved by : _____ , **Date:** 06/22/2020

Chen Ge / Engineer Reviewer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)/RSS247 Issue 2, February 2017 47 CFR FCC Part 2/22/24/27 / RSS130 /RSS139 / RSS 132			
Item	Test Item	Result	Remarks
1	Radiated Emissions Measurement	PASS	Meet the requirement of limit.

Note: For all other test details please see original FCC ID No.: XMR201707BG96 and GKM-XT2500 test report.

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	XT2500
Brand	Xirgo Technologies
Test Model	XT2500
Series Model	N/A
Status of EUT	Engineering Sample
Power Supply Rating	6-32VDC
Modulation Type	BLE: GFSK LTE: QPSK, 16QAM, 64QAM
Modulation Technology	DTS,OFDM
Operating Frequency	BLE: 2402 ~ 2480 MHz LTE Band 2: 1850-1910 MHz LTE Band 4: 1710-1755 MHz LTE Band 5: 824-849 MHz LTE Band 12: 699-716 MHz LTE Band 13: 777-787 MHz
Antenna Type	BLE: Chip antenna LTE: Rigid FR4 PCB Antenna
Antenna Gain	BLE: 1.5 dBi LTE Band 2: 2.5 dBi LTE Band 4: 3.0 dBi LTE Band 5: 4.0 dBi LTE Band 12: 0.0 dBi LTE Band 13: 4.0 dBi
Antenna Connector	BLE: Surface Mount LTE: Connect with pogo-pins to main PCB

Note:

1. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.1.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	
-	√	√	-	-	-

Where RE≥1G: Radiated Emission above 1GHz & Bandedge Measurement **RE<1G:** Radiated Emission below 1GHz

PLC: Power Line Conducted Emission **APCM:** Antenna Port Conducted Measurement

NOTE: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Y-plane**.
NOTE: "-"means no effect.

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	25deg. C, 65%RH	DC 5V	Deon Dai
RE<1G	25deg. C, 65%RH	DC 5V	Deon Dai
PLC	-	-	-
APCM	-	-	-

3.2 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Wideband Radio Communicator	Rohde & Schwarz	CMW500	108852	N/A	Provided by Lab For LTE Connection
B.	Wideband Radio Communicator	Rohde & Schwarz	CMW500	163332	N/A	Provided by Lab For BLE connection
C.	Wide-band Antenna	Speag	SE UMS 176 CA	1116	N/A	Provided by Lab
D.	Dipole Antenna	N/A	N/A	N/A	N/A	Provided by Lab
E.						
F.						
G.						

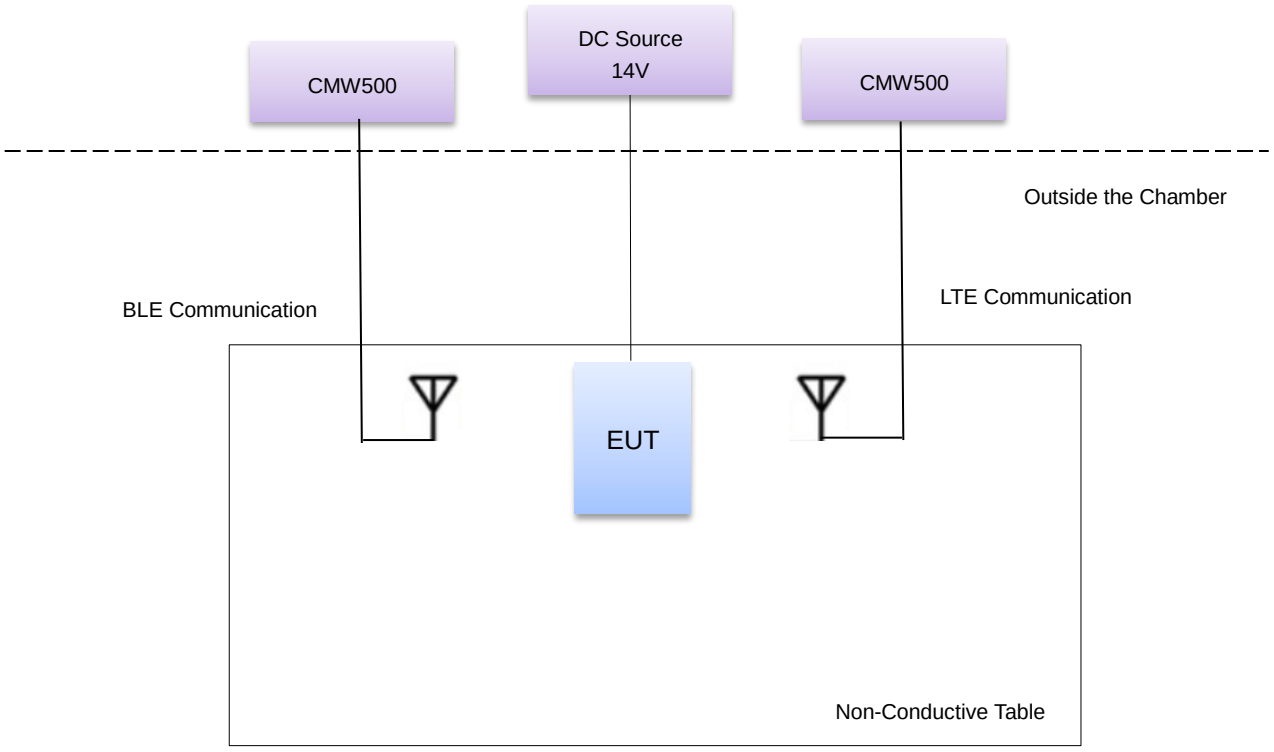
Note:

1. All power cords of the above support units are non-shielded (1.8m).

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.						
2.						
3.						

Note: The core(s) is(are) originally attached to the cable(s).

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)
47 CFR FCC Part 22/24/27
RSS247
RSS130 /RSS139 / RSS 132
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 Measurement

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 (power peak measurement) or 30dB (power Ave.measurement) 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 Receiver Rohde & Schwarz	ESW 44	1328.4100K-101662-MH	08/30/2019	08/30/2020
Biconilog Antenna Sunol	JB1	A030702	03/09/2020	03/09/2021
Horn Antenna ETS-Lindgren	3117	218554	12/20/2019	12/20/2020
Pre-Amplifier RF-Lambda	RAMP00M50GA	17032300048	06/18/2019	06/18/2020

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 9kHz 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:

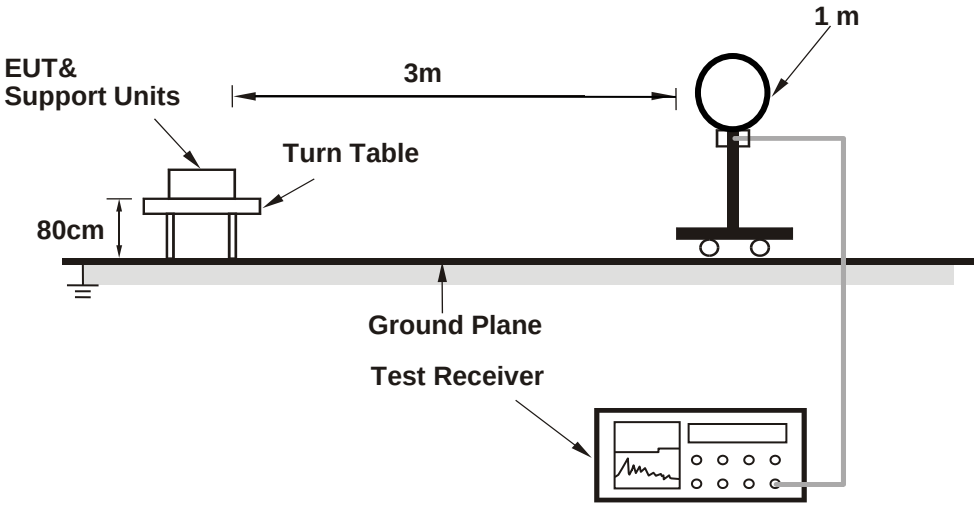
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 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

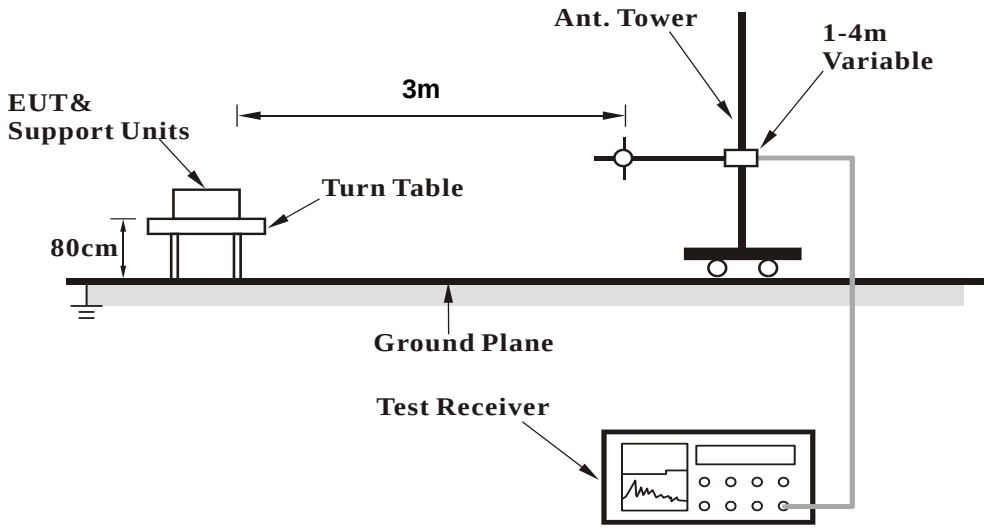
No deviation.

4.1.5 Test Setup

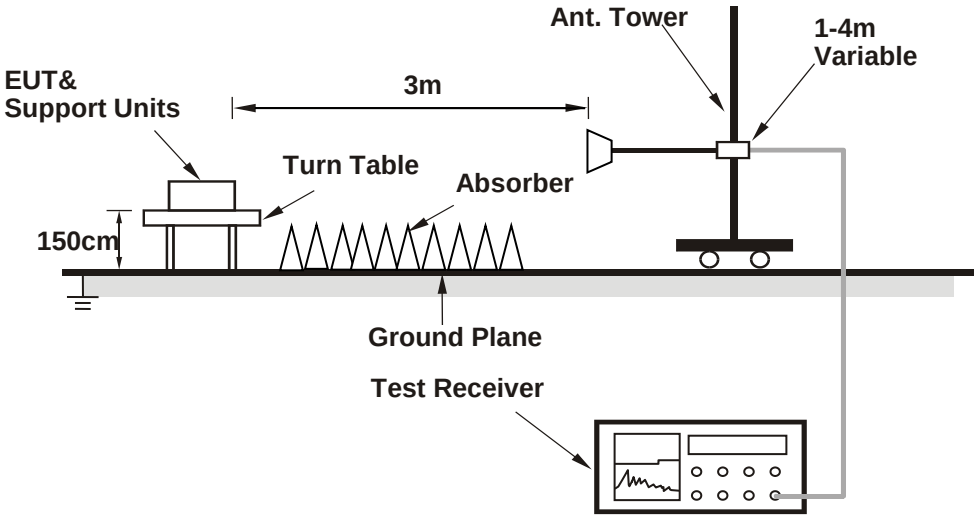
For Radiated emission below 30MHz



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).

EUT OPERATING CONDITIONS

a. Placed the EUT on the testing table.
b. Prepared notebooks to act as communication partner and placed it outside of testing area.
c. The communication partner connected with EUT and ran a test program (provided by manufacturer) to enable EUT under transmission condition continuously at specific channel frequency.
d. The necessary accessories enable the system in full functions.

4.1.6 Test Results

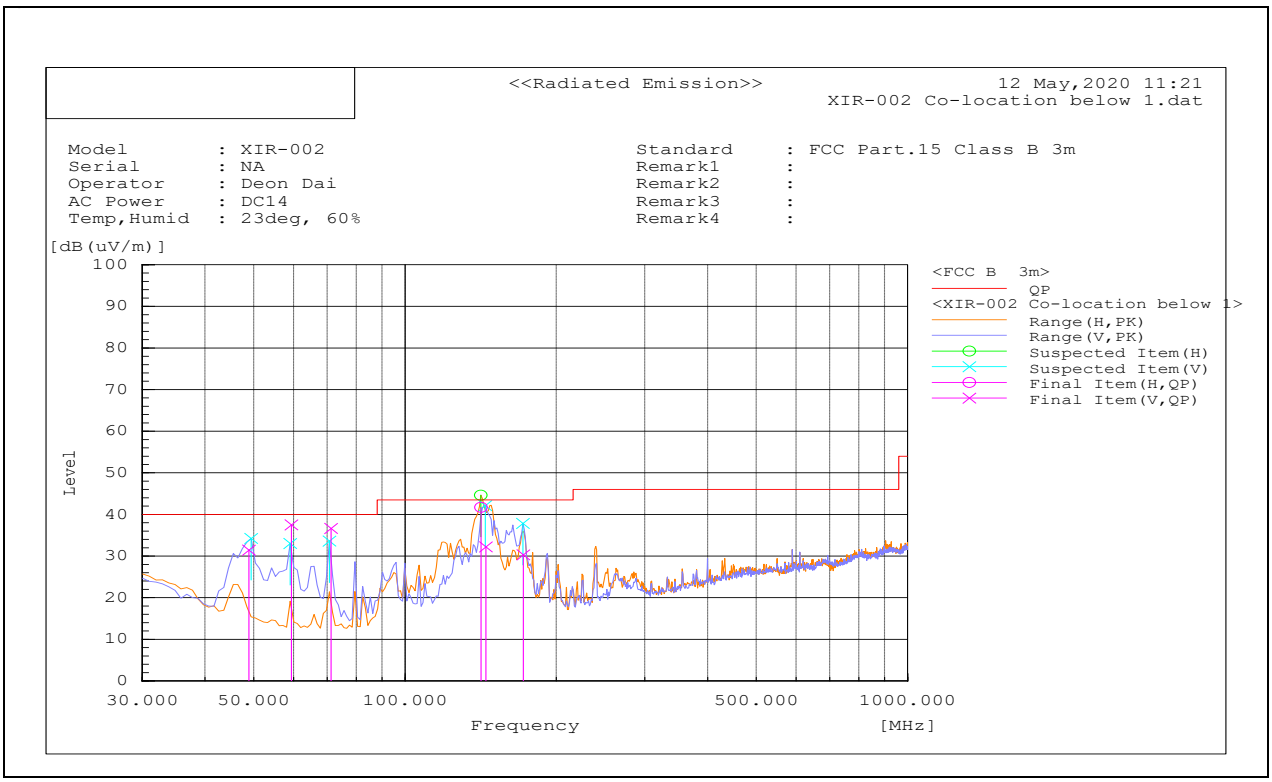
BELOW 1GHz WORST-CASE DATA:

CHANNEL	BLE/LTE B5 transmit simultaneous mode	**DETECTOR FUNCTION**	Quasi Peak
FREQUENCY RANGE	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	48.923	V	17.4	14	31.4	40	-8.6	262	165.6	Pass
2	59.402	V	24.8	12.7	37.5	40	-2.5	100	236.7	Pass
3	71.24	V	23.5	13.1	36.6	40	-3.4	100	256.7	Pass
4	141.64	H	22.6	19.1	41.7	43.5	-1.8	100	0.4	Pass
5	144.775	V	13	19.2	32.2	43.5	-11.3	271	285.3	Pass
6	172.001	V	11.5	18.8	30.3	43.5	-13.2	233	359.9	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.



Above 1GHz Test Data:

Above 1GHz-40GHz – Co-location

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	1682.04	H	44.1	63.7	-13	31.1	50.7	54	74	-22.9	-23.3	374	352.3	Pass
2	2522.71	H	43.4	55.4	-9.3	34.1	46.1	54	74	-19.9	-27.9	399	16.1	Pass
3	3362.36	H	42.3	53.6	-7.9	34.4	45.7	54	74	-19.6	-28.3	162	295.6	Pass
4	4204.69	H	43.2	54.2	-7.8	35.4	46.4	54	74	-18.6	-27.6	283	99	Pass
5	5043.94	V	40.1	52.6	-5.9	34.2	46.7	54	74	-19.8	-27.3	374	43.4	Pass
6	5885.99	H	39.6	50.4	-3.4	36.2	47	54	74	-17.8	-27	147	277.6	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.

5 Pictures of Test Arrangements

Please see setup photo file.

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

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