



Test Report

Date : 2018-09-13
No. : HM18060018

Page 1 of 27

Applicant: Gatekeeper Systems (HK) Ltd.
36/F, Tower 2, Times Square, 1 Matheson Street, Causeway Bay,
Hong Kong

Manufacturer: Gatekeeper Systems (HK) Ltd.
36/F, Tower 2, Times Square, 1 Matheson Street, Causeway Bay,
Hong Kong

Description of Sample(s): Product: Solar Transmitter
Brand Name: Gatekeeper Systems
Model Number: D-9000
FCC ID: W3Z-D9000

Date Sample(s) Received: 2018-06-26

Date Tested: 2018-08-02 to 2018-08-10

Investigation Requested: Perform ElectroMagnetic Interference measurement in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2017 and ANSI C63.10:2013 for FCC Certification.

Conclusion(s): The submitted product COMPLIED with the requirements of Federal Communications Commission [FCC] Rules and Regulations Part 15. The tests were performed in accordance with the standards described above and on Section 2.2 in this Test Report.

Remark(s): ---


CHEUNG Chi, Kenneth
Authorized Signatory



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Test Report

Date : 2018-09-13
No. : HM18060018

Page 2 of 27

CONTENT:

Cover	Page 1 of 27	
Content	Page 2 of 27	
<u>1.0</u>	<u>General Details</u>	
1.1	Equipment Under Test [EUT] Description of EUT operation	Page 3 of 27
1.2	Description of EUT Operation	
1.3	Date of Order	Page 3 of 27
1.4	Submitted Sample	Page 3 of 27
1.5	Test Duration	Page 3 of 27
1.6	Country of Origin	Page 3 of 27
<u>2.0</u>	<u>Technical Details</u>	
2.1	Investigations Requested	Page 4 of 27
2.2	Test Standards and Results Summary	Page 4 of 27
<u>3.0</u>	<u>Test Results</u>	
3.1	Emission	Page 5-21 of 27
<u>Appendix A</u>		
	List of Measurement Equipment	Page 23 of 27
<u>Appendix B</u>		
	Photographs	Page 24-27 of 27



Test Report

Date : 2018-09-13
No. : HM18060018

Page 3 of 27

1.0 General Details

1.1 Equipment Under Test [EUT] Description of Sample(s)

Product: Solar Transmitter
Manufacturer: Gatekeeper Systems (HK) Ltd.
36/F, Tower 2, Times Square, 1 Matheson Street, Causeway Bay,
Hong Kong
Brand Name: Gatekeeper Systems
Model Number: D-9000
Rating: NiMH rechargeable Battery (AA size x2)=2.4Vd.c
(EUT recharged by solar energy)

1.2 Description of EUT Operation

The Equipment Under Test (EUT) is Solar Transmitter (remote control function) of Gatekeeper Systems (HK) Ltd., which is 2.4GHz transceiver.
The D-9000 Operational mode transmissions are modulated at MSK (Minimum Shift Keying). The EUT was tested under test mode which was set in maximum output power.

1.3 Date of Order

2018-06-26

1.4 Submitted Sample(s):

2 Samples

1.5 Test Duration

2018-08-02 to 2018-08-10

1.6 Country of Origin

China

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Test Report

Date : 2018-09-13
No. : HM18060018

Page 4 of 27

2.0 Technical Details

2.1 Investigations Requested

Perform Electromagnetic Interference measurements in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2017 Regulations and ANSI C63.10:2013 for FCC Certification.

2.2 Test Standards and Results Summary Tables

EMISSION					
Results Summary					
Test Condition	Test Requirement	Test Method	Class / Severity	Test Result	
				Pass	Fail
Field Strength of Fundamental & Harmonics Emissions	FCC 47CFR 15.249	ANSI C63.10:2013	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>
AC power-line conducted emissions	FCC 47CFR 15.207	ANSI C63.10:2013	N/A	N/A	
Radiated Emissions	FCC 47CFR 15.209	ANSI C63.10:2013	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Antenna requirement	FCC 47CFR 15.203	N/A	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Note: N/A - Not Applicable

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Test Report

Date : 2018-09-13
No. : HM18060018

Page 5 of 27

3.0 Test Results

3.1 Emission

3.1.1 Field Strength of Fundamental & Harmonics Emissions

Test Requirement:	FCC 47CFR 15.249
Test Method:	ANSI C63.10:2013
Test Date:	2018-08-02
Mode of Operation:	1. Tx Mode

Test Method:

For emission measurements at or below 1 GHz, the sample was placed 0.8m above the ground plane of semi-anechoic Chamber*. For emission measurements above 1 GHz, the sample was placed 1.5m above the ground plane of semi-anechoic Chamber*. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. In the frequency range of 9kHz to 30MHz, The center of the loop antenna shall be 1 meter above the ground and rotated loop axis for maximum reading. The emissions worst-case are shown in Test Results of the following pages.

Remark: 3 orthogonal axis apply to hand-held device only.

*: Semi-anechoic chamber located on the G/F of The Hong Kong Standards and Testing Centre Ltd.
FCC Test Firm Registration Number 723883
Designation Number HK0001

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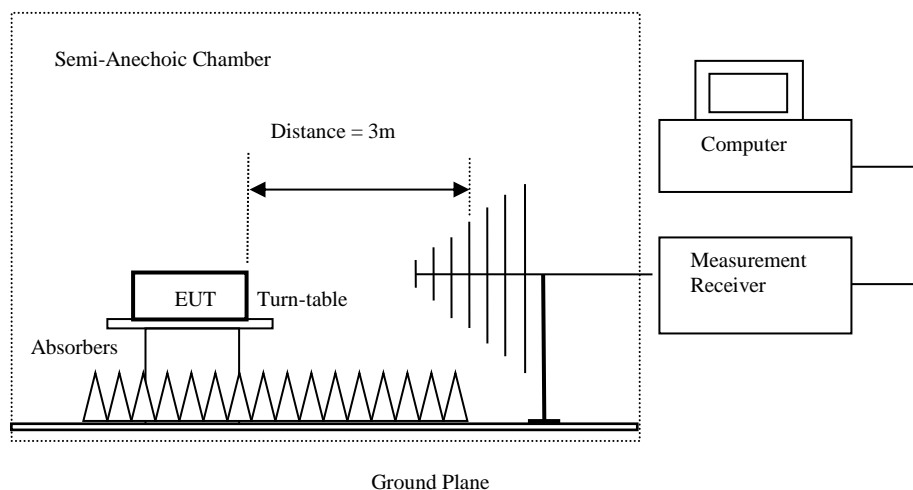
Date : 2018-09-13
No. : HM18060018

Page 6 of 27

Spectrum Analyzer Setting:

9KHz – 30MHz (Pk & Av)	RBW: 10kHz
	VBW: 30kHz
	Sweep: Auto
	Span: Fully capture the emissions being measured
	Trace: Max. hold
30MHz – 1GHz (QP)	RBW: 120kHz
	VBW: 120kHz
	Sweep: Auto
	Span: Fully capture the emissions being measured
	Trace: Max. hold
Above 1GHz (Pk & Av)	RBW: 3MHz
	VBW: 3MHz
	Sweep: Auto
	Span: Fully capture the emissions being measured
	Trace: Max. hold

Test Setup:



Absorbers placed on top of the ground plane are for measurements above 1000MHz only.

Test Report

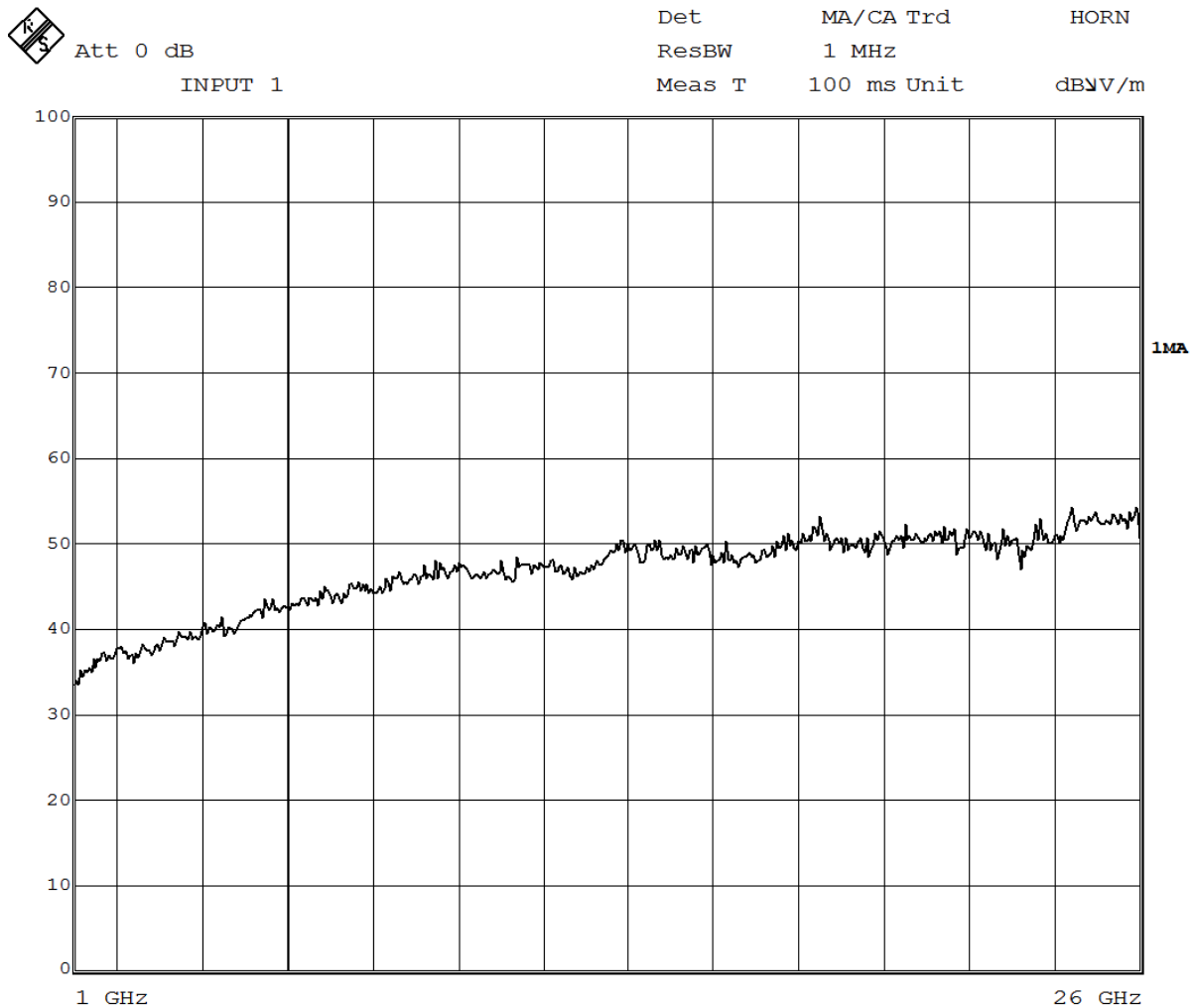
Date : 2018-09-13
 No. : HM18060018

Page 7 of 27

Limits for Field Strength of Fundamental & Harmonics Emissions [FCC 47CFR 15.249]:

Fundamental frequency [MHz]	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

Result of TX mode (Lowest Channel), (Above 1GHz): Pass





Test Report

Date : 2018-09-13
 No. : HM18060018

Page 8 of 27

Result of TX mode (Lowest Channel), (Above 1GHz): Pass

Field Strength of Fundamental and Harmonics Emissions						
Peak Value						
Frequency MHz	Measured Level @3m dB μ V/m	Correction Factor dB μ V/m	Field Strength dB μ V/m	Field Strength μ V/m	Limit @3m μ V/m	E-Field Polarity
2403.5	59.8	27.9	87.7	24,266.1	500,000	Vertical
* 4806.8	8.3	32.1	40.4	104.7	5,000	Vertical
7210.4	0.9	38.6	39.5	94.4	5,000	Vertical
9614.0	Emissions detected are more than 20 dB below the FCC Limits				5,000	Vertical
* 12017.5					5,000	Vertical
14421.0					5,000	Vertical
16824.5					5,000	Vertical
* 19228.0					5,000	Vertical
21631.5					5,000	Vertical
24035.0					5,000	Vertical

Field Strength of Fundamental and Harmonics Emissions						
Average Value						
Frequency MHz	Measured Level @3m dB μ V/m	Correction Factor dB μ V/m	Field Strength dB μ V/m	Field Strength μ V/m	Limit @3m μ V/m	E-Field Polarity
2403.5	48.3	27.9	76.2	6,456.5	50,000	Vertical
* 4806.8	0.8	32.1	32.9	44.2	500	Vertical
7210.4	-1.9	38.6	36.7	68.4	500	Vertical
9614.0	Emissions detected are more than 20 dB below the FCC Limits				500	Vertical
* 12017.5					500	Vertical
14421.0					500	Vertical
16824.5					500	Vertical
* 19228.0					500	Vertical
21631.5					500	Vertical
24035.0					500	Vertical

Remarks: The fundamental frequency was not included in the pre-scan plot, a 2.4G notch filter was added prior to the Receiver, please refer the band-edge plot for the level of fundamental frequency.



Test Report

Date : 2018-09-13
No. : HM18060018

Page 9 of 27

Result of TX mode (Middle Channel), (Above 1GHz): Pass



Att 0 dB

INPUT 1

Det

MA/CA Trd

HORN

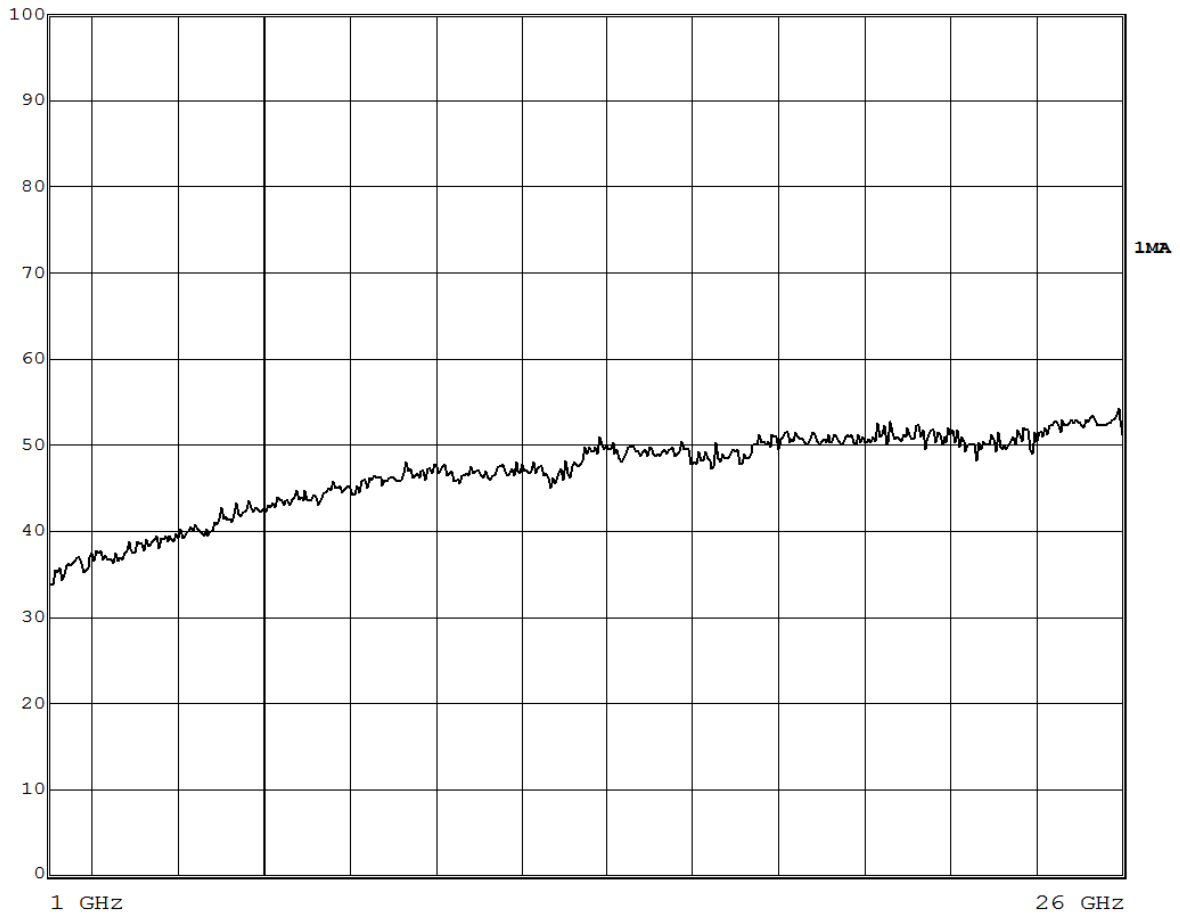
ResBW

1 MHz

Meas T

100 ms Unit

dB μ V/m



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Test Report

Date : 2018-09-13
 No. : HM18060018

Page 10 of 27

Result of TX mode (Middle Channel), (Above 1GHz): Pass

Field Strength of Fundamental and Harmonics Emissions						
Peak Value						
Frequency MHz	Measured Level @3m dB μ V/m	Correction Factor dB μ V/m	Field Strength dB μ V/m	Field Strength μ V/m	Limit @3m μ V/m	E-Field Polarity
2441.2	58.4	27.9	86.3	20,653.8	500,000	Vertical
* 4882.5	9.3	32.1	41.4	117.5	5,000	Vertical
* 7323.5	1.2	38.6	39.8	97.7	5,000	Vertical
9764.8	Emissions detected are more than 20 dB below the FCC Limits				5,000	Vertical
* 12206.0					5,000	Vertical
14647.2					5,000	Vertical
17088.4					5,000	Vertical
* 19529.6					5,000	Vertical
21970.8					5,000	Vertical
24412.0					5,000	Vertical

Field Strength of Fundamental and Harmonics Emissions						
Average Value						
Frequency MHz	Measured Level @3m dB μ V/m	Correction Factor dB μ V/m	Field Strength dB μ V/m	Field Strength μ V/m	Limit @3m μ V/m	E-Field Polarity
2441.2	47.6	27.9	75.5	5,956.6	50,000	Vertical
* 4882.5	1.1	32.1	33.2	45.7	500	Vertical
* 7323.5	-1.3	38.6	37.3	73.3	500	Vertical
9764.8	Emissions detected are more than 20 dB below the FCC Limits				500	Vertical
* 12206.0					500	Vertical
14647.2					500	Vertical
17088.4					500	Vertical
* 19529.6					500	Vertical
21970.8					500	Vertical
24412.0					500	Vertical

Remarks: The fundamental frequency was not included in the pre-scan plot, a 2.4G notch filter was added prior to the Receiver, please refer the band-edge plot for the level of fundamental frequency.

Test Report

Date : 2018-09-13
 No. : HM18060018

Page 11 of 27

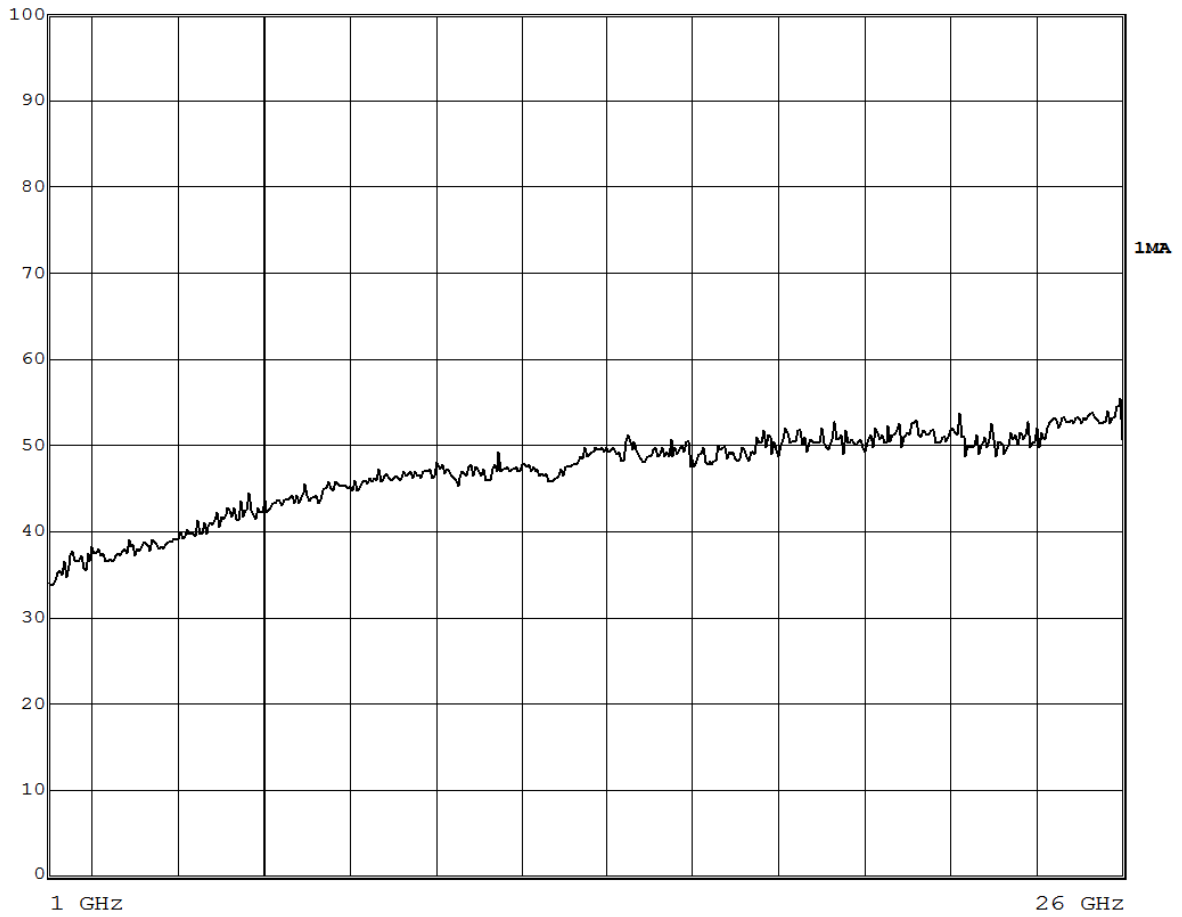
Result of TX mode (Highest Channel), (Above 1GHz): Pass



Att 0 dB

INPUT 1

Det	MA/CA Trd	HORN
ResBW	1 MHz	
Meas T	100 ms Unit	dB μ V/m





Test Report

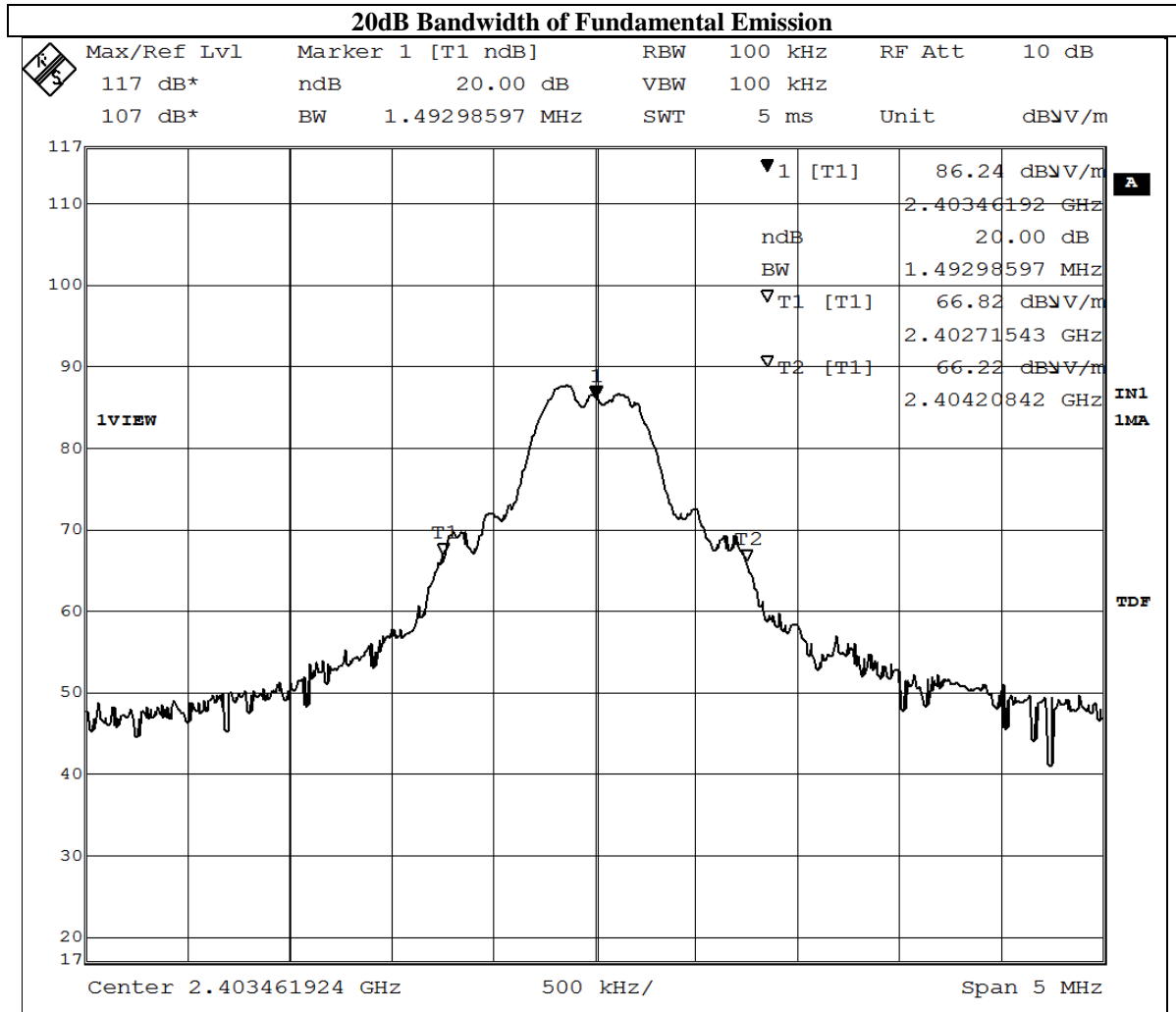
Date : 2018-09-13
 No. : HM18060018

Page 13 of 27

Limits for 20dB Bandwidth of Fundamental Emission:

Frequency Range [MHz]	20dB Bandwidth [MHz]
2403.5	1.49

TX mode Lowest Channel





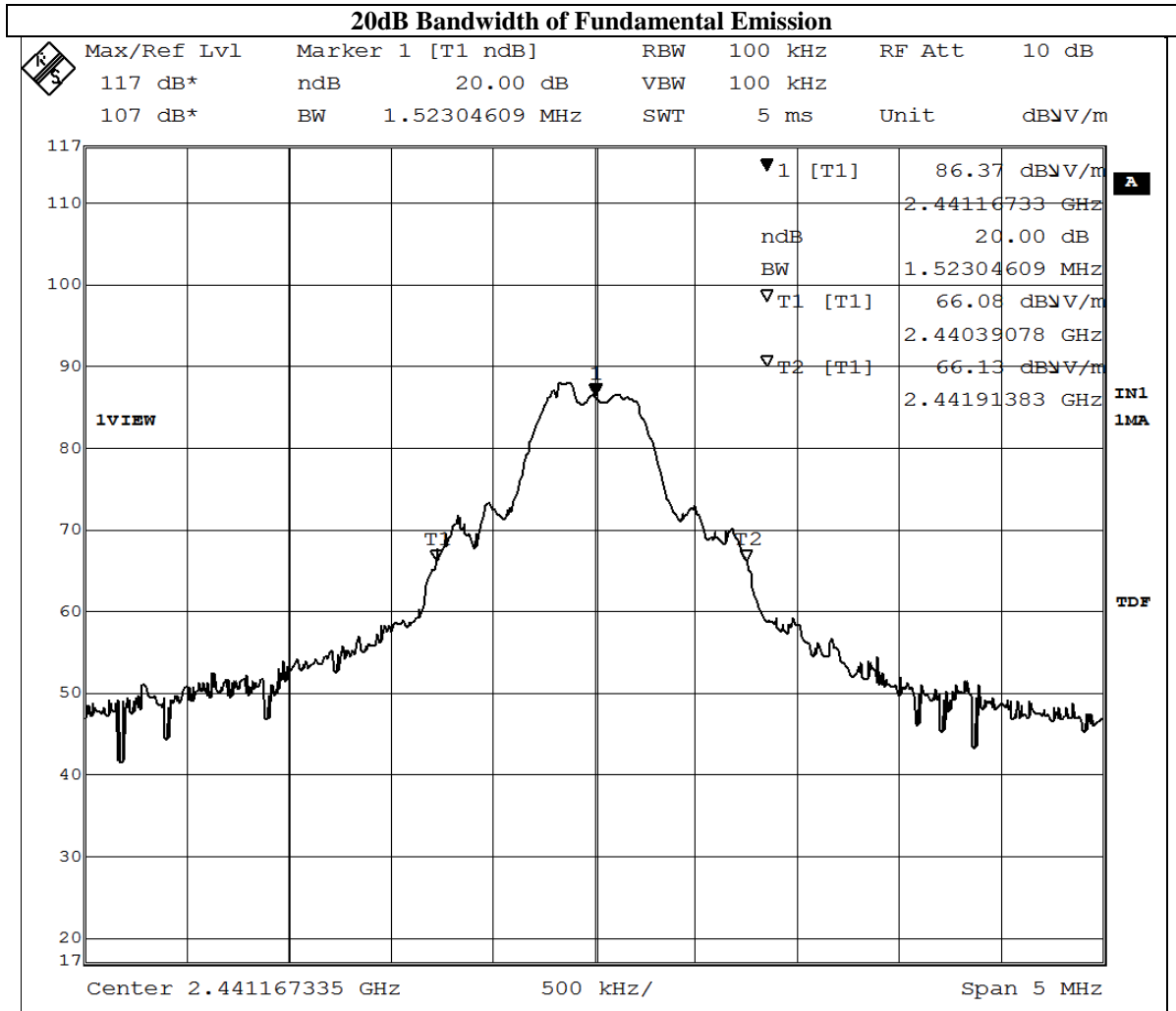
Test Report

Date : 2018-09-13
 No. : HM18060018

Page 14 of 27

Frequency Range [MHz]	20dB Bandwidth [MHz]
2441.2	1.52

TX mode Middle Channel



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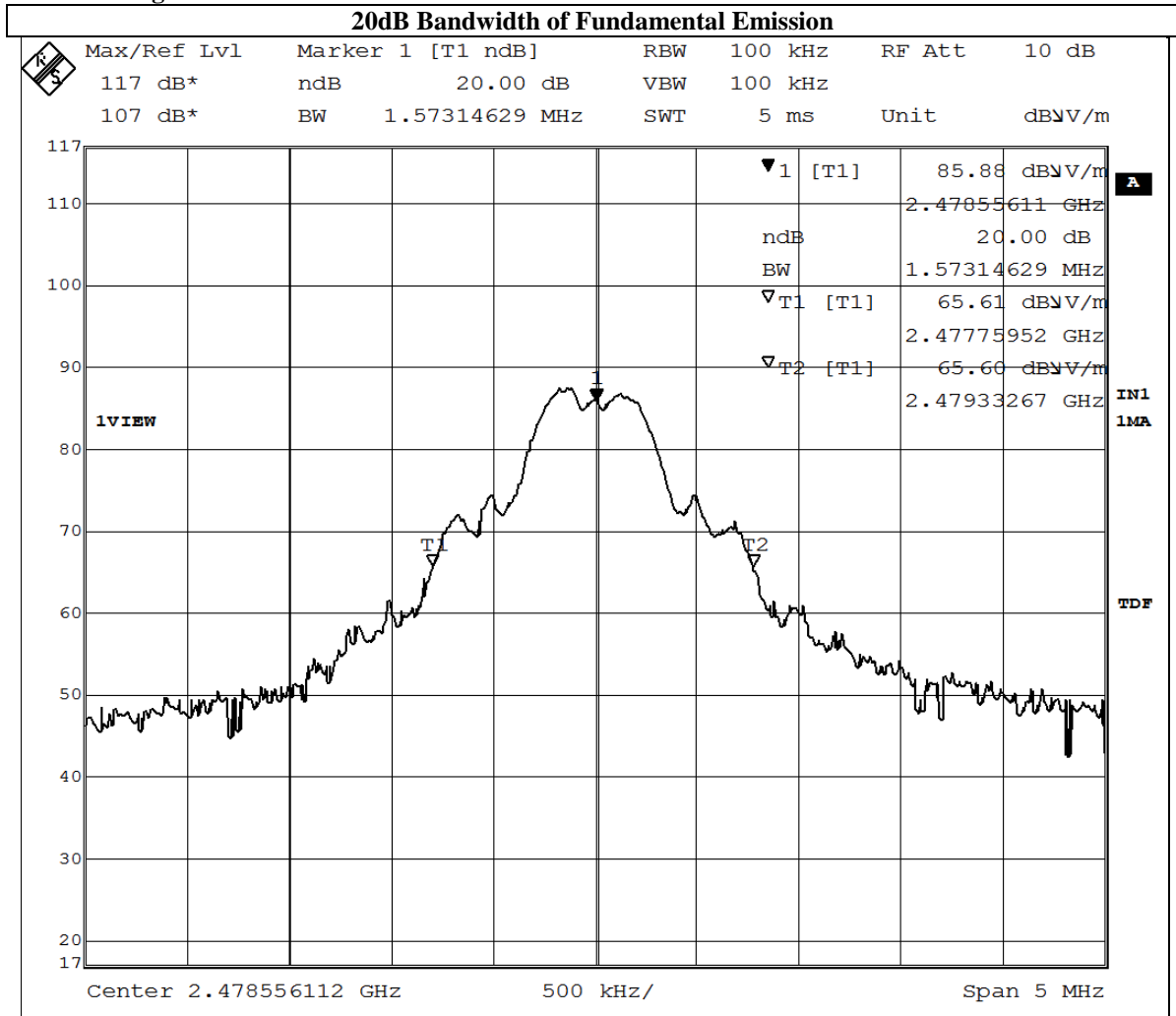
Test Report

Date : 2018-09-13
 No. : HM18060018

Page 15 of 27

Frequency Range [MHz]	20dB Bandwidth [MHz]
2478.6	1.57

TX mode Highest Channel



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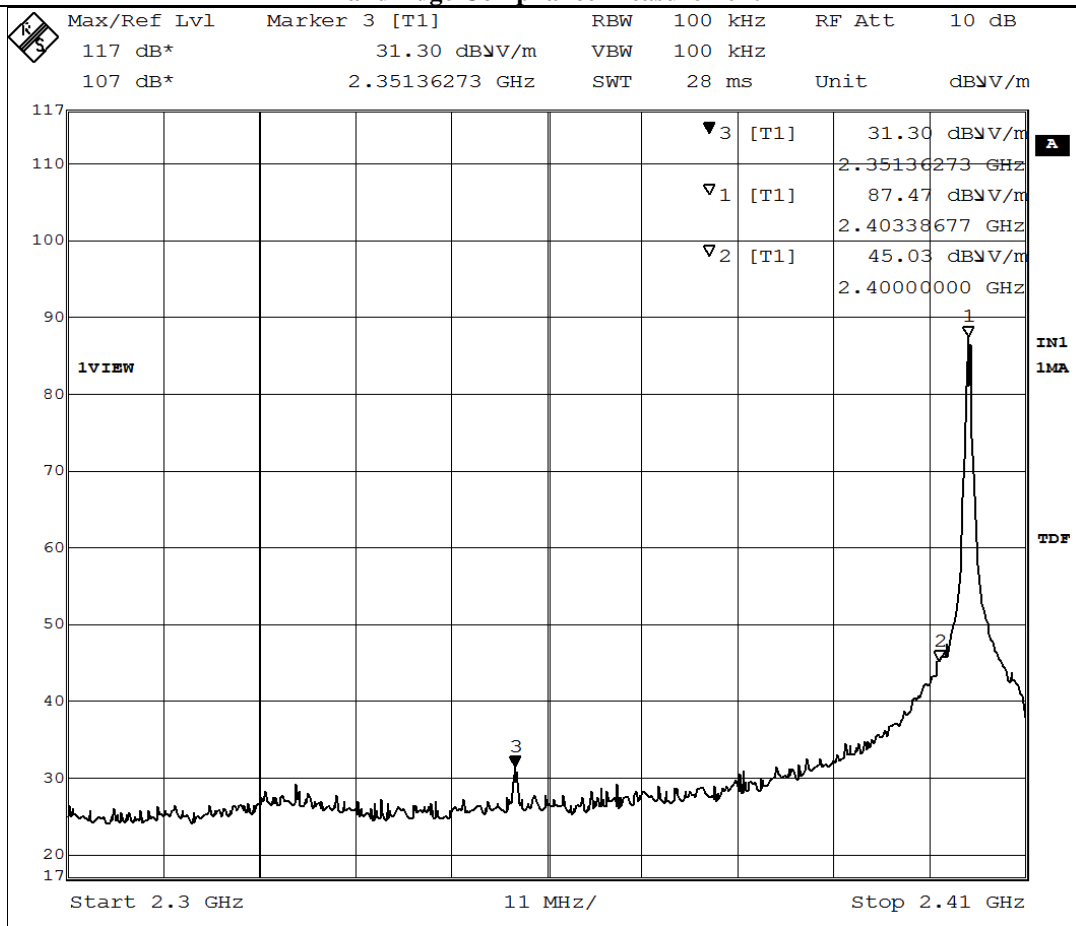
Date : 2018-09-13
 No. : HM18060018

Band Edge Measurement:

TX mode

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400MHz – Lowest Fundamental	42.4

Band Edge Compliance Measurement





Test Report

Date : 2018-09-13
 No. : HM18060018

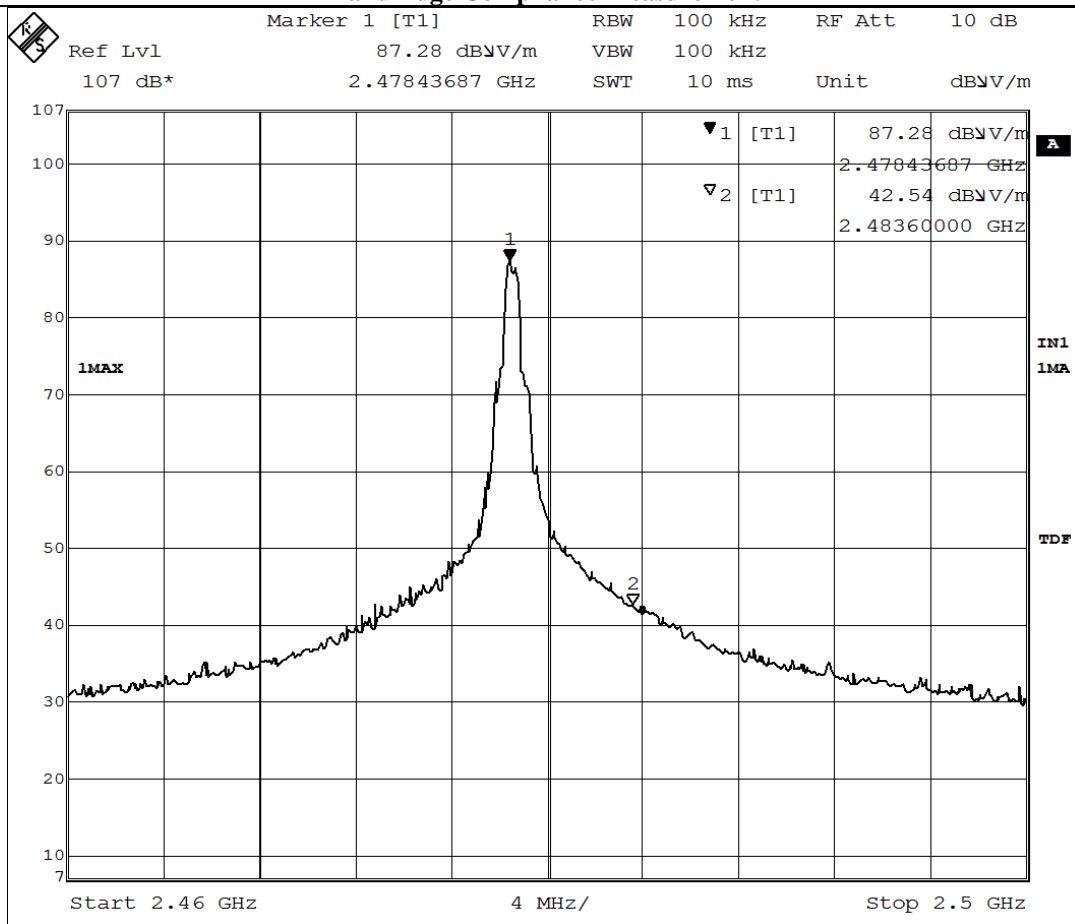
Page 17 of 27

Band Edge Measurement:

TX mode

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
Highest Fundamental – 2483.5MHz	44.7

Band Edge Compliance Measurement



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Test Report

Date : 2018-09-13
No. : HM18060018

Page 18 of 27

Result of TX mode , Band-edge measurement: PASS

Field Strength of Fundamental and Harmonics Emissions						
Peak Value						
Frequency MHz	Measured Level @3m dB μ V/m	Correction Factor dB μ V/m	Field Strength dB μ V/m	Field Strength μ V/m	Limit @3m μ V/m	E-Field Polarity
2351.4	8.7	27.6	36.3	65.3	5,000	Vertical
2484.5	14.6	28.0	42.6	134.9	5,000	Vertical

Field Strength of Fundamental and Harmonics Emissions						
Average Value						
Frequency MHz	Measured Level @3m dB μ V/m	Correction Factor dB μ V/m	Field Strength dB μ V/m	Field Strength μ V/m	Limit @3m μ V/m	E-Field Polarity
2351.4	1.6	27.6	29.2	28.8	500	Vertical
2484.5	3.4	28.0	31.4	37.2	500	Vertical

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Test Report

Date : 2018-09-13
No. : HM18060018

Page 19 of 27

Limits for Radiated Emissions [FCC 47 CFR 15.209]:

Frequency Range [MHz]	Quasi-Peak Limits [μ V/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

Result of Tx mode, (9kHz – 30MHz): PASS

Emissions detected are more than 20 dB below the FCC Limits

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Test Report

Date : 2018-09-13
 No. : HM18060018

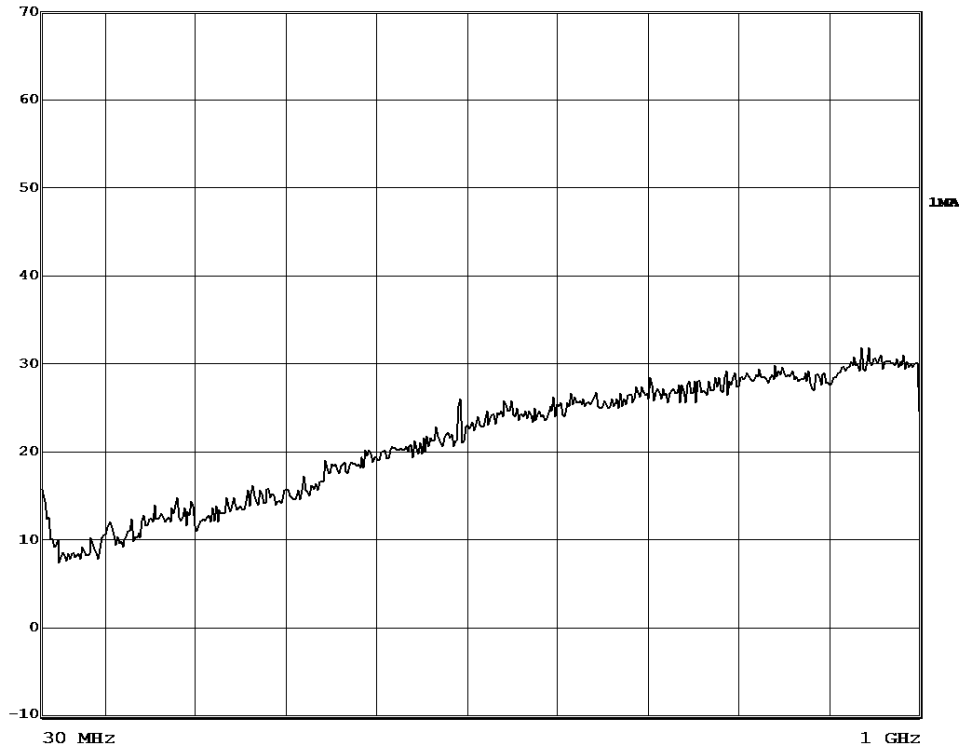
Page 20 of 27

Result of Tx mode, (30MHz – 1GHz): PASS



Att 0 dB AUTO
 Preamp INPUT 2

Det MA/QP Trd 3143B-H
 ResBW 120 kHz
 Meas T 100 ms Unit dBµV/m



Field Strength of Fundamental and Harmonics Emissions						
Quasi-Peak Value						
Frequency MHz	Measured Level @3m dBµV/m	Correction Factor dBµV/m	Field Strength dBµV/m	Field Strength µV/m	Limit @3m µV/m	E-Field Polarity
60.8	2.5	6.8	9.3	2.9	100	Vertical
125.7	3.5	7.6	11.1	3.6	150	Horizontal
203.4	1.6	10.9	12.5	4.2	150	Horizontal
354.2	-0.9	16.0	15.1	5.7	200	Horizontal
413.1	5.9	17.3	23.2	14.5	200	Horizontal
479.3	5.5	18.6	24.1	16.0	200	Horizontal

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Test Report

Date : 2018-09-13
No. : HM18060018

Page 21 of 27

Result of Receiver mode, (9kHz – 30MHz): PASS

Emissions detected are more than 20 dB below the Limits

Result of Receiver mode, (30MHz – 1GHz): PASS

Emissions detected are more than 20 dB below the Limits

Result of Receiver mode, (1GHz – 18GHz): PASS

Field Strength of Fundamental and Harmonics Emissions						
Peak Value						
Frequency MHz	Measured Level @3m dB μ V/m	Correction Factor dB μ V/m	Field Strength dB μ V/m	Field Strength μ V/m	Limit @3m μ V/m	E-Field Polarity
2441.5	3.7	27.9	31.6	38.0	5,000	Vertical

Field Strength of Fundamental and Harmonics Emissions						
Average Value						
Frequency MHz	Measured Level @3m dB μ V/m	Correction Factor dB μ V/m	Field Strength dB μ V/m	Field Strength μ V/m	Limit @3m μ V/m	E-Field Polarity
2441.5	1.1	27.9	29.0	28.2	500	Vertical

Remarks:

No additional spurious emissions found between lowest internal used/generated frequency and 30 MHz
Correction Factor included Antenna Factor and Cable Attenuation.

Calculated measurement uncertainty : (9kHz – 30MHz): 2.4dB
(30MHz – 1GHz): 5.0dB
(1GHz - 18GHz): 5.0dB
(1GHz - 18GHz): 5.24dB



Test Report

Date : 2018-09-13
No. : HM18060018

Page 22 of 27

3.1.12 Antenna Requirement

Ambient temperature 21°C

Relative humidity 51%

Test Requirements: § 15.203

Test Specification:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall 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 manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Test Results:

This is Patch Antenna Array, the antenna gain = 13dBi. The EUT is required installed professionally, the connector is sealed, user is unable to remove or changed the Antenna.



Test Report

Date : 2018-09-13
No. : HM18060018

Page 23 of 27

Appendix A

LIST OF MEASUREMENT EQUIPMENT

Radiated Emission

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EM215	MULTIDEVICE CONTROLLER	EMCO	2090	00024676	N/A	N/A
EM217	ELECTRIC POWERED TURNTABLE	EMCO	2088	00029144	N/A	N/A
EM218	ANECHOIC CHAMBER	ETS-LINDGREN	FACT-3	--	2018/04/24	2019/04/24
EM356	ANTENNA POSITIONING TOWER	ETS-LINDGREN	2171B	00150346	N/A	N/A
EM355	BICONILOG ANTENNA	ETS-LINDGREN	3143B	00201783	2017/03/15	2019/03/15
EM229	EMI TEST RECEIVER	R&S	ESIB40	100248	2018/06/01	2019/06/01
EM299	DOUBLE-RIDGED WAVEGUIDE HORN ANTENNA	ETS-LINDGREN	3115	00114120	2018/04/27	2020/04/27
EM300	PYRAMIDAL STANDARD GAIN HORN ANTENNA	ETS-LINDGREN	3160-09	00130130	2018/05/13	2020/05/13
EM353	LOOP ANTENNA	ETS_LINDGREN	6502	00206533	2018/03/16	2020/03/16

Remarks:

CM Corrective Maintenance
N/A Not Applicable or Not Available
TBD To Be Determined

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Test Report

Date : 2018-09-13
No. : HM18060018

Page 24 of 27

Appendix B

Photographs of EUT

Front View of the product



Rear View of the product



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Test Report

Date : 2018-09-13
No. : HM18060018

Page 25 of 27

Photographs of EUT

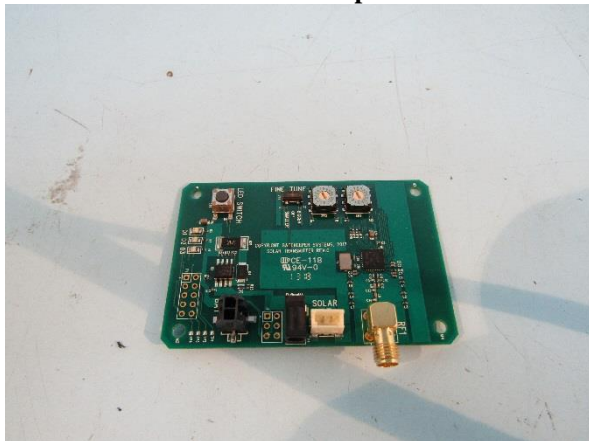
Inner View with Cable-routing



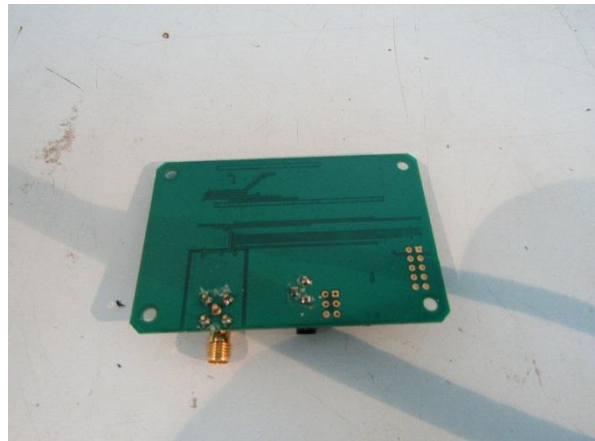
Inner View with Battery Connection



Inner Circuit Top View



Inner Circuit Bottom View



Test Report

Date : 2018-09-13
No. : HM18060018

Page 26 of 27

Photographs of EUT

Measurement of Radiated Emission Test Set Up (9kHz – 30MHz)



Measurement of Radiated Emission Test Set Up (30MHz – 1000MHz)



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Test Report

Date : 2018-09-13
No. : HM18060018

Page 27 of 27

Photographs of EUT

Measurement of Radiated Emission Test Set Up (above 1000MHz)



***** End of Test Report *****

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