

Variant FCC Test Report

Product Name : TracKing V5
Brand Name : Thermo King
Model No. : TKV5
FCC ID : Q37TKV5

Applicant : Thermo King Corporation
Address : 314 West 90th Street, Minneapolis, MN USA 55420

Date of Receipt : Nov. 26, 2021
Issued Date : Feb. 15, 2022
Report No. : 21B0999R-RFNAOTHV02-B
Report Version : V1.0



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration of the equipment and evaluated measurement uncertainty herein.

This report must not be used to claim product endorsement by TAF or any agency of the government.

Measurement uncertainties evaluated for each testing system and associated connections are given here to provide the system information for reference. Compliance determinations do not take into account measurement uncertainties for each testing system, but are based on the results of the compliance measurement.

The test report shall not be reproduced except in full without the written approval of DEKRA Testing and Certification Co., Ltd.


Variant Test Report Certification



Product Name : TrackKing V5
Applicant : Thermo King Corporation
Address : 314 West 90th Street, Minneapolis, MN USA 55420
Manufacturer : Thermo King Corporation
Address : 314 West 90th Street, Minneapolis, MN USA 55420
Brand Name : Thermo King
Model No. : TKV5
FCC ID : Q37TKV5
EUT Voltage : DC 14.2V
Testing Voltage : DC 14.2V
Applicable Standard : FCC CFR Title 47 Part 22 Subpart H
FCC CFR Title 47 Part 24 Subpart E
FCC CFR Title 47 Part 27 Subpart M
ANSI/TIA-603-E
Test Lab : Hsin Chu Laboratory
Address : No.372-2, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu
County 310, Taiwan, R.O.C.
TEL: +886-3-582-8001 / FAX: +886-3-582-8958
Test Result : Complied

Documented By : 

(Hailey Peng / Senior Engineer)

Approved By : 

(Louis Hsu / Deputy Manager)

The test results relate only to the samples tested.
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Revision History

Version	Description	Issued Date
V1.0	Initial issue of report	Feb. 15, 2022

Class II Permissive Change (C2PC)

Report No.	Version	Description	Issued Date
2181021R-E3042110007	V1.0	Original application.	Nov. 12, 2021
21B0999R-RFNAOTHV02-B	V1.0	<p>1. Changing of crystal that generates the RF frequencies for the BT module, U13 (EFR32BG21A010F512IM32-B).</p> <p>(1) Original: 38.4MHz Crystal 1.2 x 1.0 mm size (Manufacturer part number: Murata XRCED38M400FXQ50R0).</p> <p>(2) Current: same frequency (38.4 MHz), bigger 2.0 x 1.6mm size (TaiSaw, Geyer, Murata).</p> <p>2. The PCB pads will be modified to accommodate the bigger 2.0 x 1.6 mm crystals.</p> <p>3. A metal shield can will be added to the top layer and to the bottom layer of the PCB.</p> <p>4. RS485 transceiver (U26) is depopulated.</p> <p>5. Package of power controller IC (U34) will be changed from 10-pin DFN to 10-pin MSOP.</p> <p>After evaluating, the worst result of original report is selected to verify radiated spurious emission test and record in the report.</p>	Feb. 15, 2022

TABLE OF CONTENTS

Description	Page
1. General Information	6
1.1. EUT Description	6
1.2. Mode of Operation	7
1.3. Comments and Remarks	7
1.4. Tested System Details	8
1.5. Configuration of Tested System	8
1.6. EUT Operation of during Test	8
2. Technical Test	9
2.1. Summary of Test Result	9
2.2. Test Facility	11
2.3. List of Test Equipment	12
2.4. Measurement Uncertainty	12
3. Spurious Emission	13
3.1. Test Setup	13
3.2. Test Procedure	14
3.3. Test Methodology and Reference Procedures	14
3.4. Test Result of Radiated Spurious Emission	15
Appendix A	21
Test Setup Photograph	21

1. General Information

1.1. EUT Description

Product Name	TrackKing V5
Brand Name	Thermo King
Model No.	TKV5
Tx Frequency Range (MHz)	WCDMA Band 2: 1852.4-1907.6 WCDMA Band 4: 1712.4-1752.6 WCDMA Band 5: 826.4-846.6
Rx Frequency Range (MHz)	WCDMA Band 2: 1932.4-1987.6 WCDMA Band 4: 2112.4-2152.6 WCDMA Band 5: 871.4-891.6
Function	WCDMA / HSDPA / DC-HSDPA / HSUPA / HSPA+
Type of Modulation	BPSK / QPSK / 16QAM / 64QAM
Hardware Version	1.1
Software Version	T-0102-000028
IMEI No.	864049050138744

Antenna Information						
Ant. No.	Manufacturer	Model No.	Ant. Type	Ant. Gain (dBi)		
				WCDMA Band 2	WCDMA Band 4	WCDMA Band 5
0	N/A	N/A	PCB	2.33	3.39	-0.27

Note:

1. The above EUT information is declared by the manufacturer.
2. Regards to the frequency band operation; the lowest, middle and highest frequency of channel were selected to perform the test, and then shown on this report.
3. This device was tested under all bandwidths, RB configurations and modulations.
The worst case was found in RMC mode and show the worst case in the test report.
4. The 64QAM modulation for downlink only.

1.2. Mode of Operation

DEKRA has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Test Mode	Mode 1: WCDMA Band 2 Mode 2: WCDMA Band 4 Mode 3: WCDMA Band 5
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Note: The EUT was performed at X axis and Z axis position for radiated spurious emission test.

The worst case was found at Z axis for original report, so the measurement will follow this same test configuration.

1.3. Comments and Remarks

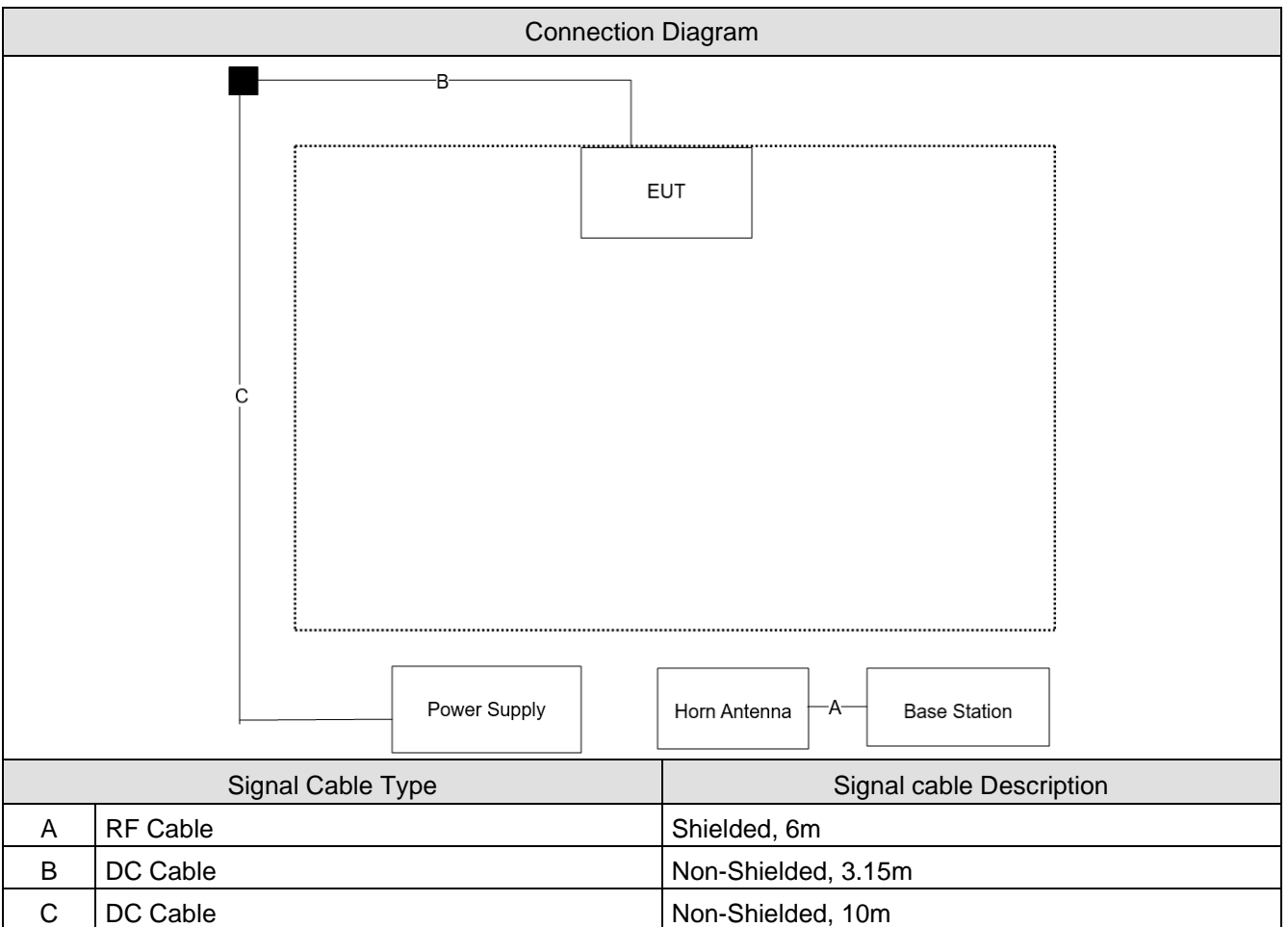
The product specification and testing instructions for the EUT declared in the report are provided by the manufacturer who will take all responsibilities for the accuracy.

1.4. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system.

Product	Manufacturer	Model No.	Serial No.	FCC ID	Power Cord
1 Horn Antenna	Schwarzbeck	BBHA 9120D	1640	N/A	--
2 Base Station	R&S	CMW500	157118	N/A	Non-Shielded, 1.8m
3 Power Supply	Topward	6303D	8095908	N/A	Non-Shielded, 1.8m

1.5. Configuration of Tested System



1.6. EUT Operation of during Test

1	Setup the EUT and simulators as shown on.
2	Turn on the power of all equipment.
3	The EUT will continue receive the signal from WCDMA function.
4	Repeat the above procedure (3)

2. Technical Test

2.1. Summary of Test Result

No deviations from the test standards

Deviations from the test standards as below description:

WCDMA Band 2			
FCC Part 24 Subpart E			
Performed Item	FCC Rule	Limit	Result
RF Output Power	§2.1033	< 2 Watts EIRP	Pass
	§2.1046		
	§24.232		
Occupied Bandwidth	§2.1049	N/A	Pass
Peak to Average Ratio	§24.232(d)	≤ 13dB	Pass
Conducted Band Edge	§27.238	< -13dBm	Pass
Spurious Emission	§2.1053	< -13dBm	Pass
	§24.238		
Frequency Stability	§2.1055	< 2.5 ppm	Pass
	§24.235		

WCDMA Band 4			
FCC Part 27 Subpart M			
Performed Item	FCC Rule	Limit	Result
RF Output Power	§2.1046	< 1 Watts EIRP	Pass
	§ 27.50(h)(2)		
Occupied Bandwidth	§ 2.1049	N/A	Pass
	§ 27.53(l)(6)		
Peak to Average Ratio	§27.50(b)	≤ 13dB	Pass
Conducted Band Edge	§ 2.1051	< -13 dBm	Pass
	§27.53(l)(4)(6)		
Spurious Emission	§ 2.1051	< -25 dBm	Pass
	§27.53(l)(4)(6)		
Frequency Stability	§2.1055(a)(l)	< 2.5 ppm	Pass
	§ 27.54		

WCDMA Band 5			
FCC Part 22 Subpart H			
Performed Item	FCC Rule	Limit	Result
RF Output Power	§2.1033	< 7 Watts ERP	Pass
	§2.1046		
	§22.913		
Occupied Bandwidth	§2.1049	N/A	Pass
Peak to Average Ratio	§22.913(d)	\leq 13dB	Pass
Conducted Band Edge	§22.917	< -13dBm	Pass
Spurious Emission	§2.1053	< -13dBm	Pass
	§22.917		
Frequency Stability	§2.1055	< 2.5 ppm	Pass
	§22.335		

Note: Determining compliance shall be based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.2. Test Facility

Ambient conditions in the laboratory:

Items	Test Item	Actually	Tested by	Test Date	Test Site
Temperature (°C)	Spurious Emission	20.2	Ling Chen	2021/12/3	CB2-H
Humidity (%RH)		48			

Note: Test site information refers to Laboratory Information.

Laboratory Information

USA : **FCC Registration Number: TW3024**
Canada **CAB identifier : TW3024**

The address and introduction of DEKRA Testing and Certification Co., Ltd. laboratories can be founded in our

Web site: <http://www.dekra.com.tw>

If you have any comments, please don't hesitate to contact us. Our test sites as below:

Test Laboratory	DEKRA Testing and Certification Co., Ltd.
Address	1. No.372-2, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County 31061, Taiwan, R.O.C. 2. No.372, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County 31061, Taiwan, R.O.C.
Phone number	1. +886-3-582-8001 2. +886-3-582-8001
Fax number	1. +886-3-582-8958 2. +886-3-582-8958
E mail address	info.tw@dekra.com
Website	http://www.dekra.com.tw
Note: Test site number for address 1 includes SR2-H. Test site number for address 2 includes CB2-H, CB3-H, CB4-H, SR10-H and SR12-H.	

2.3. List of Test Equipment

CB2-H

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Signal Analyzer	R&S	FSVA40	101455	2021/10/22	2022/10/21
Signal & Spectrum Analyzer	R&S	FSV40	101049	2021/03/31	2022/03/30
Signal Analyzer	R&S	FSVA40	101435	2021/06/04	2022/06/03
EXA Signal Analyzer	Keysight	N9010A	MY51440132	2021/01/25	2022/01/24
Trilog Broadband Antenna	Schwarzbeck	VULB 9168	1272	2021/08/20	2022/08/19
Bilog Antenna	Teseq	CBL6112D	23191	2021/02/26	2022/02/25
Horn Antenna	Schwarzbeck	BBHA 9120D	639	2021/05/17	2022/05/16
Horn Antenna	Schwarzbeck	BBHA 9170	202	2021/12/01	2022/11/30
Pre-Amplifier	EMCI	EMC01820I	980365	2021/05/28	2022/05/27
Pre-Amplifier	E MEC	EM01G18GA	060741	2021/07/02	2022/07/01
Pre-Amplifier	DEKRA	AP-400C	201801231	2021/11/12	2022/11/11
Coaxial Cable(13m)	Huber+Suhner	SF104	CB2-H	2021/08/17	2022/08/16
Coaxial Cable(3m)	Suhnerr,Rosnol	SF102_Rosnol	CB2-H	2021/08/17	2022/08/18
Radiated Software	AUDIX	e3 V9	CB2-H	N/A	N/A

Note: All equipment upon which need to calibrated are with calibration period of 1 year.

2.4. Measurement Uncertainty

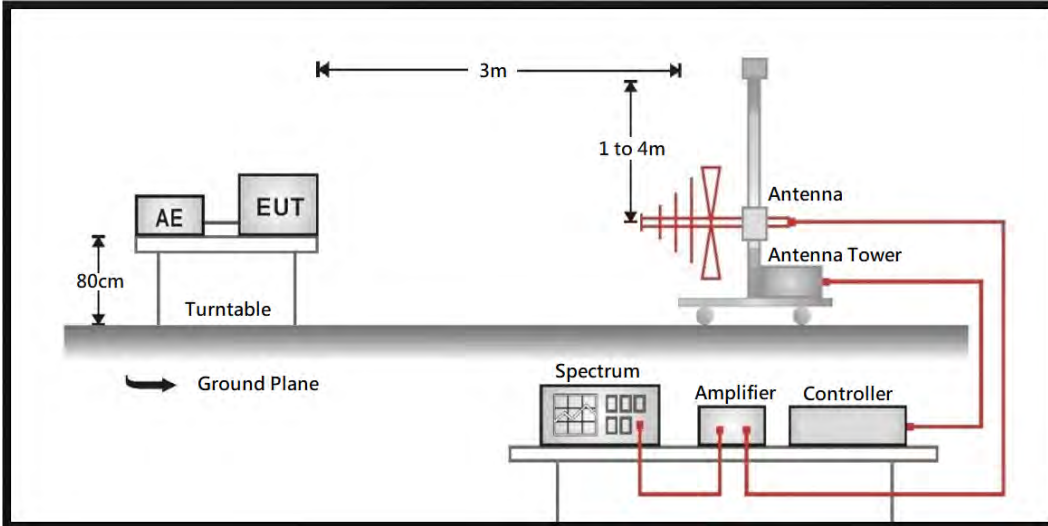
Uncertainties have been calculated according to the DEKRA internal document with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)).

Test Item	Uncertainty
Spurious Emissions	± 3.25 dB below 1 GHz ± 3.32 dB above 1 GHz

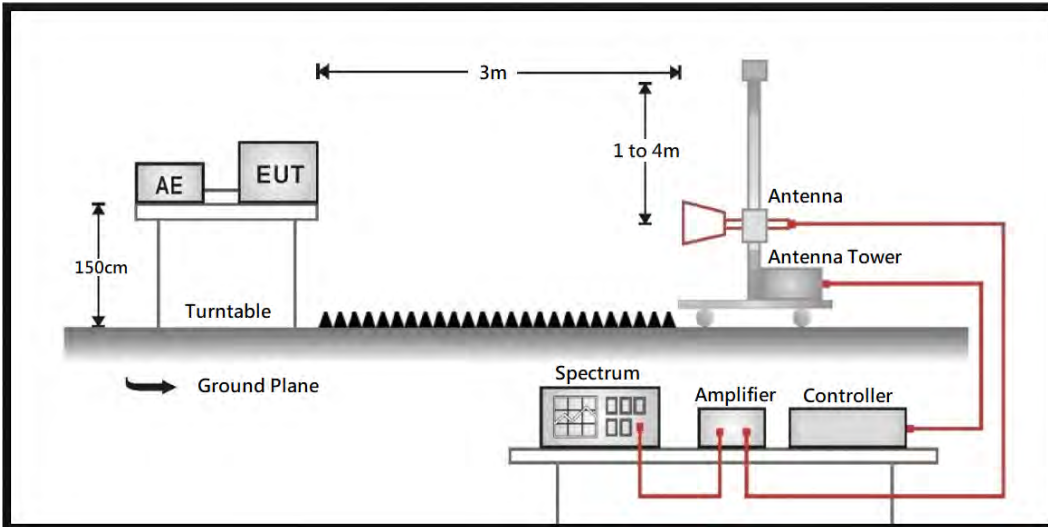
3. Spurious Emission

3.1. Test Setup

Radiated Spurious Measurement (below 1 GHz)



Radiated Spurious Measurement (above 1 GHz)



3.2. Test Procedure

Radiated Spurious Measurement:

The EUT and its simulators are placed on a turn table which is 0.8 or 1.5 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The height of the receiving antenna is varied between one meter and four meters to search the maximum spurious emission for both horizontal and vertical polarizations. The resolution bandwidth of the spectrum analyzer was set at 1 MHz, sufficient scans were taken to show the out of band Emission if any up to 10th harmonic. Taking the record of maximum spurious emission.

3.3. Test Methodology and Reference Procedures

KDB 971168 D01 Power Meas License Digital Systems v03r01

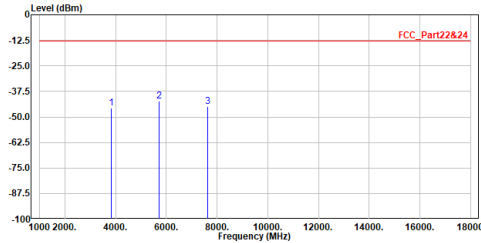
ANSI C63.26-2015

3.4. Test Result of Radiated Spurious Emission

Mode 1: WCDMA Band 2

<p>Site :CB2-H Condition :3m Horizontal Mode :WCDMA_B2_Ch9262 Test By :Cyril</p> <table border="1"> <thead> <tr> <th>No.</th> <th>Frequency MHz</th> <th>Level dBm</th> <th>Limit Line dBm</th> <th>Over Limit dB</th> <th>Read Level dBm</th> <th>Factor dB</th> <th>Remark</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>3704.800</td> <td>-43.74</td> <td>-13.00</td> <td>-30.74</td> <td>-37.97</td> <td>-5.77</td> <td>Peak</td> </tr> <tr> <td>2</td> <td>5557.200</td> <td>-43.11</td> <td>-13.00</td> <td>-30.11</td> <td>-43.66</td> <td>0.55</td> <td>Peak</td> </tr> <tr> <td>3</td> <td>7409.600</td> <td>-44.20</td> <td>-13.00</td> <td>-31.20</td> <td>-51.52</td> <td>7.32</td> <td>Peak</td> </tr> </tbody> </table> <p>Note: 1. Level = Read Level + Factor 2. Factor = Antenna Factor + Cable Loss - Preamp Factor + Aux Factor 3. Over Limit = Level - Limit Line 4. Aux Factor = Convert E (dBuV/m) to EIRP (dBm) = 107 + 20log(3) - 104.8 = 11.8 dB 5. The other emission levels were very low against the limit. 6. The emission under 1GHz was not included since the emission levels are very low against the limit.</p>	No.	Frequency MHz	Level dBm	Limit Line dBm	Over Limit dB	Read Level dBm	Factor dB	Remark	1	3704.800	-43.74	-13.00	-30.74	-37.97	-5.77	Peak	2	5557.200	-43.11	-13.00	-30.11	-43.66	0.55	Peak	3	7409.600	-44.20	-13.00	-31.20	-51.52	7.32	Peak	<p>Site :CB2-H Condition :3m Vertical Mode :WCDMA_B2_Ch9262 Test By :Cyril</p> <table border="1"> <thead> <tr> <th>No.</th> <th>Frequency MHz</th> <th>Level dBm</th> <th>Limit Line dBm</th> <th>Over Limit dB</th> <th>Read Level dBm</th> <th>Factor dB</th> <th>Remark</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>3704.800</td> <td>-45.47</td> <td>-13.00</td> <td>-32.47</td> <td>-39.70</td> <td>-5.77</td> <td>Peak</td> </tr> <tr> <td>2</td> <td>5557.200</td> <td>-44.04</td> <td>-13.00</td> <td>-31.04</td> <td>-44.59</td> <td>0.55</td> <td>Peak</td> </tr> <tr> <td>3</td> <td>7409.600</td> <td>-43.28</td> <td>-13.00</td> <td>-30.28</td> <td>-50.60</td> <td>7.32</td> <td>Peak</td> </tr> </tbody> </table> <p>Note: 1. Level = Read Level + Factor 2. Factor = Antenna Factor + Cable Loss - Preamp Factor + Aux Factor 3. Over Limit = Level - Limit Line 4. Aux Factor = Convert E (dBuV/m) to EIRP (dBm) = 107 + 20log(3) - 104.8 = 11.8 dB 5. The other emission levels were very low against the limit. 6. The emission under 1GHz was not included since the emission levels are very low against the limit.</p>	No.	Frequency MHz	Level dBm	Limit Line dBm	Over Limit dB	Read Level dBm	Factor dB	Remark	1	3704.800	-45.47	-13.00	-32.47	-39.70	-5.77	Peak	2	5557.200	-44.04	-13.00	-31.04	-44.59	0.55	Peak	3	7409.600	-43.28	-13.00	-30.28	-50.60	7.32	Peak
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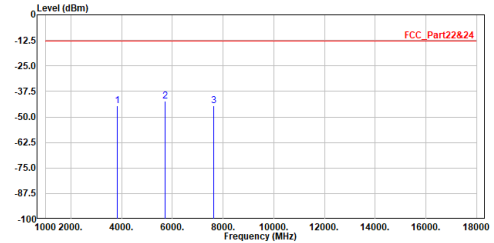
Site :CB2-H
 Condition :3m Horizontal
 Mode :WCDMA_B2_Ch9538
 Test By :Cyril



No.	Frequency MHz	Level dBm	Limit Line dBm	Over Limit dB	Read Level dBm	Factor dB	Remark
1	3815.200	-45.72	-13.00	-32.72	-40.38	-5.34	Peak
2	5722.800	-42.43	-13.00	-29.43	-43.83	1.40	Peak
3	7630.400	-44.85	-13.00	-31.85	-52.07	7.22	Peak

Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor + Aux Factor
 3. Over Limit = Level - Limit Line
 4. Aux Factor = Convert E (dBuV/m) to EIRP (dBm)
 $= 107 + 20\log(3) - 104.8 = 11.8 \text{ dB}$
 5. The other emission levels were very low against the limit.
 6. The emission under 1GHz was not included since the emission levels are very low against the limit.

Site :CB2-H
 Condition :3m Vertical
 Mode :WCDMA_B2_Ch9538
 Test By :Cyril

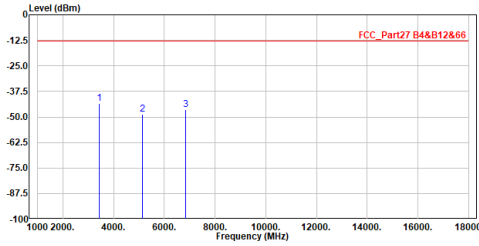


No.	Frequency MHz	Level dBm	Limit Line dBm	Over Limit dB	Read Level dBm	Factor dB	Remark
1	3815.200	-44.41	-13.00	-31.41	-39.07	-5.34	Peak
2	5722.800	-42.16	-13.00	-29.16	-43.56	1.40	Peak
3	7630.400	-44.45	-13.00	-31.45	-51.67	7.22	Peak

Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor + Aux Factor
 3. Over Limit = Level - Limit Line
 4. Aux Factor = Convert E (dBuV/m) to EIRP (dBm)
 $= 107 + 20\log(3) - 104.8 = 11.8 \text{ dB}$
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 6. The emission under 1GHz was not included since the emission levels are very low against the limit.

Mode 2: WCDMA Band 4

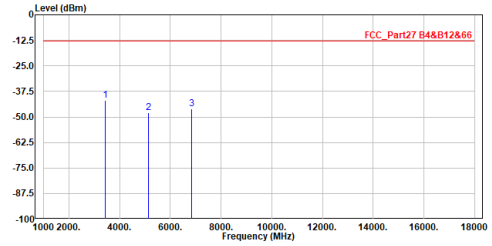
Site :CB2-H
 Condition :3m Horizontal
 Mode :WCDMA_B4_Ch1312
 Test by :Cyril



No.	Frequency MHz	Level dBm	Limit Line dBm	Over Limit dB	Read Level dBm	Factor dB	Remark
1	3424.800	-43.25	-13.00	-30.25	-36.60	-6.65	Peak
2	5137.200	-48.74	-13.00	-35.74	-47.89	-0.85	Peak
3	6849.600	-46.31	-13.00	-33.31	-52.35	6.04	Peak

Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor + Aux Factor
 3. Over Limit = Level - Limit Line
 4. Aux Factor = Convert E (dBuVm) to EIRP (dBm)
 = 107 + 20log(3) - 104.8 = 11.8 dB
 5. The other emission levels were very low against the limit.
 6. The emission under 1GHz was not included since the emission levels are very low against the limit.

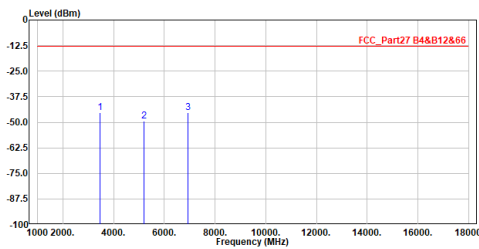
Site :CB2-H
 Condition :3m Vertical
 Mode :WCDMA_B4_Ch1312
 Test by :Cyril



No.	Frequency MHz	Level dBm	Limit Line dBm	Over Limit dB	Read Level dBm	Factor dB	Remark
1	3424.800	-42.04	-13.00	-29.04	-35.39	-6.65	Peak
2	5137.200	-47.83	-13.00	-34.83	-46.98	-0.85	Peak
3	6849.600	-46.11	-13.00	-33.11	-52.15	6.04	Peak

Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor + Aux Factor
 3. Over Limit = Level - Limit Line
 4. Aux Factor = Convert E (dBuVm) to EIRP (dBm)
 = 107 + 20log(3) - 104.8 = 11.8 dB
 5. The other emission levels were very low against the limit.
 6. The emission under 1GHz was not included since the emission levels are very low against the limit.

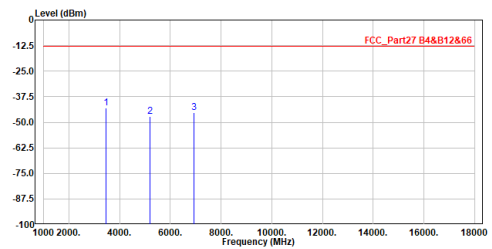
Site :CB2-H
 Condition :3m Horizontal
 Mode :WCDMA_B4_Ch1413
 Test by :Cyril



No.	Frequency MHz	Level dBm	Limit Line dBm	Over Limit dB	Read Level dBm	Factor dB	Remark
1	3465.200	-45.31	-13.00	-32.31	-38.71	-6.60	Peak
2	5197.800	-49.62	-13.00	-36.62	-48.95	-0.67	Peak
3	6930.400	-45.12	-13.00	-32.12	-51.57	6.45	Peak

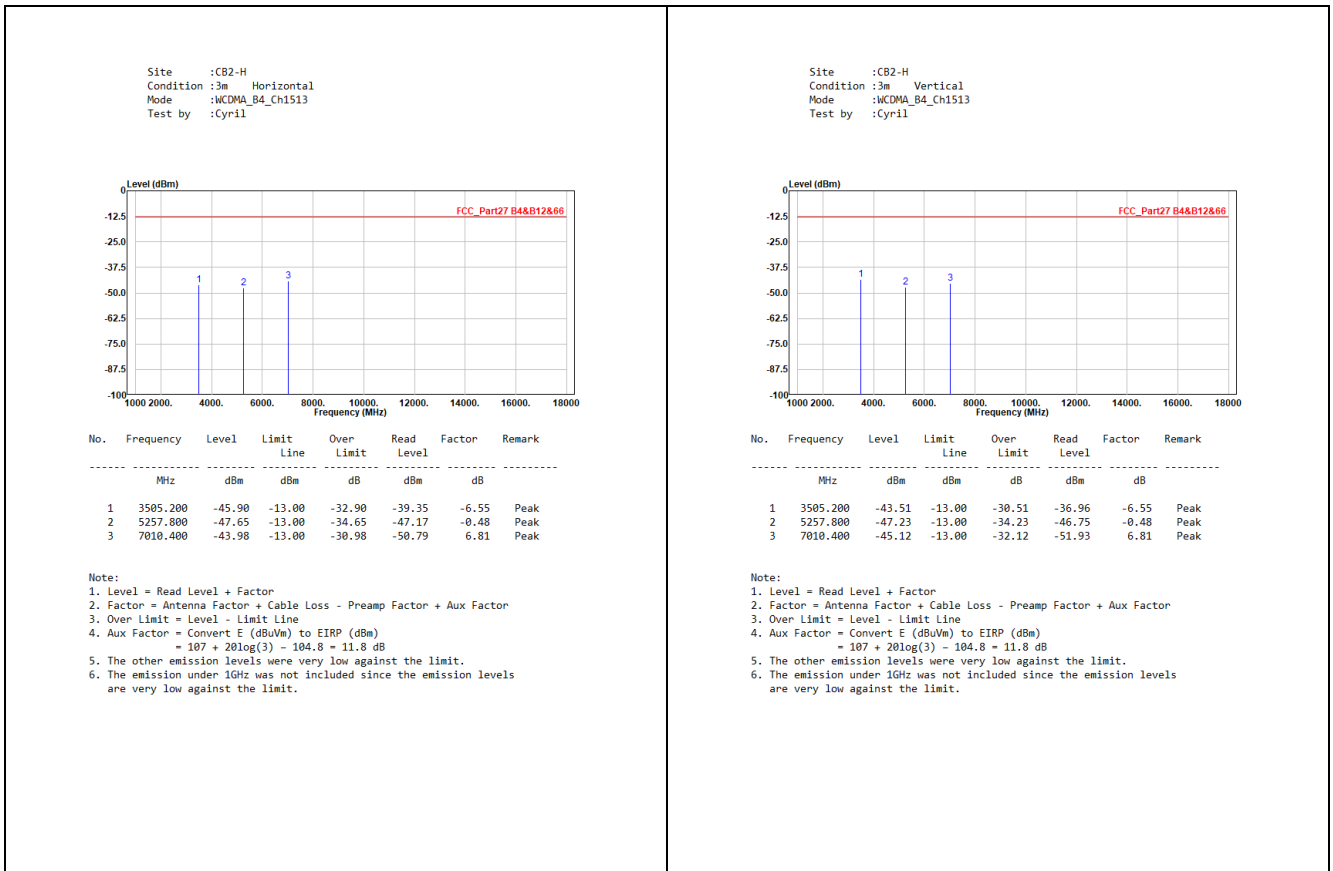
Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor + Aux Factor
 3. Over Limit = Level - Limit Line
 4. Aux Factor = Convert E (dBuVm) to EIRP (dBm)
 = 107 + 20log(3) - 104.8 = 11.8 dB
 5. The other emission levels were very low against the limit.
 6. The emission under 1GHz was not included since the emission levels are very low against the limit.

Site :CB2-H
 Condition :3m Vertical
 Mode :WCDMA_B4_Ch1413
 Test by :Cyril

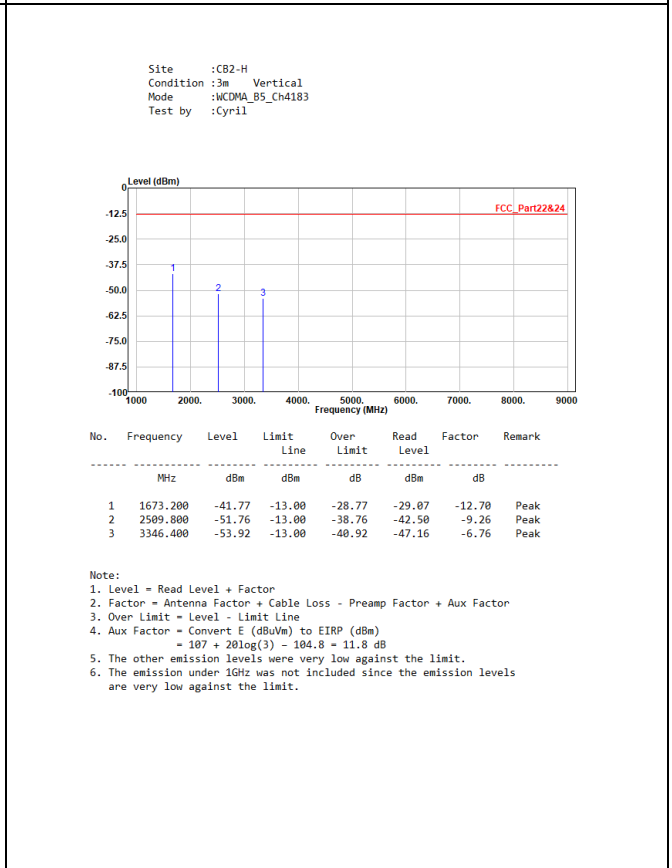
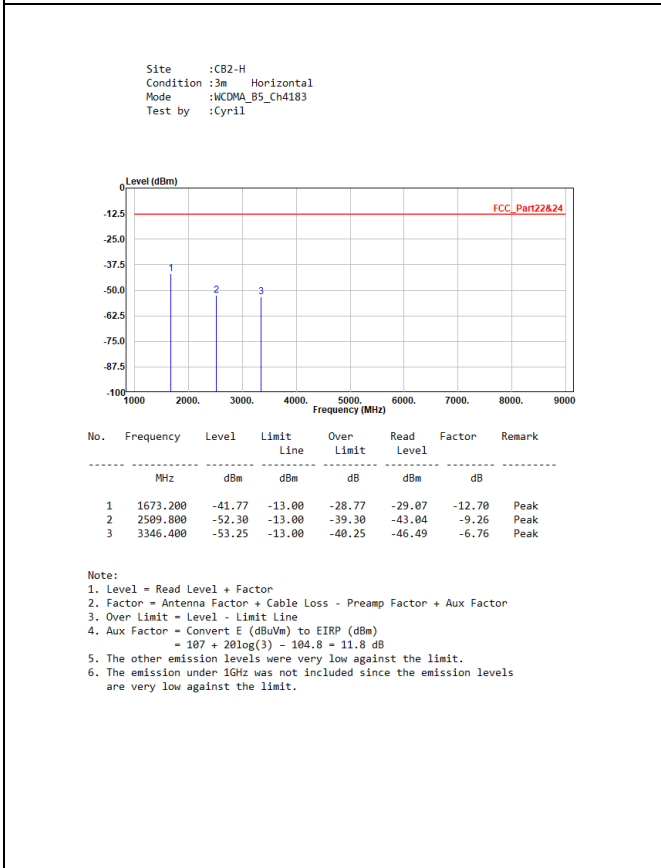
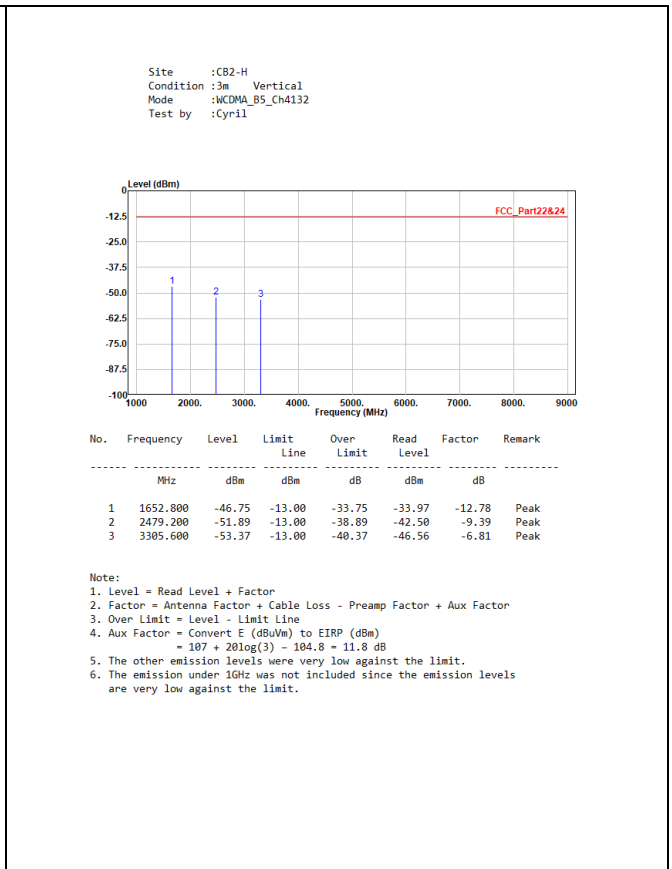
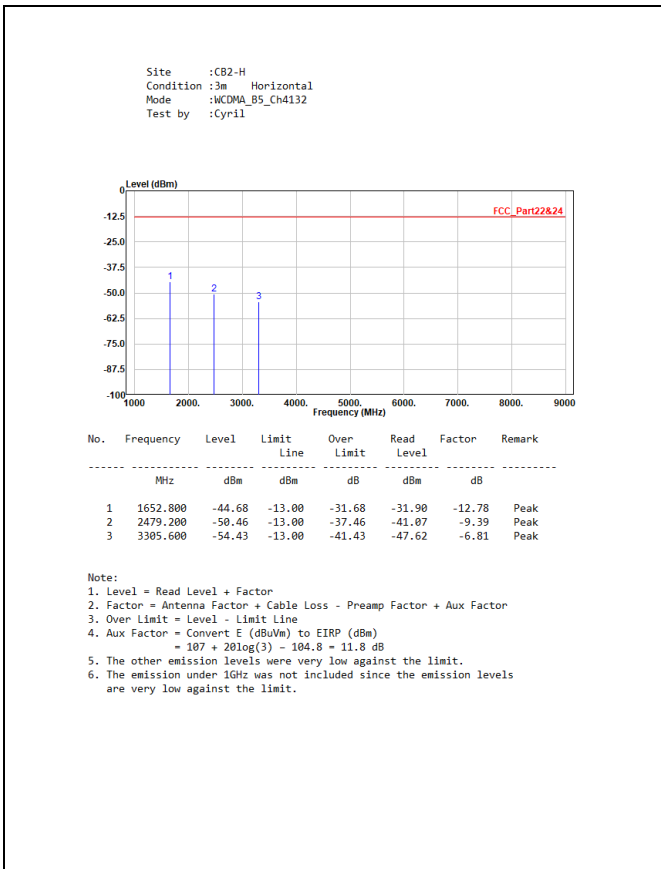


No.	Frequency MHz	Level dBm	Limit Line dBm	Over Limit dB	Read Level dBm	Factor dB	Remark
1	3465.200	-43.01	-13.00	-30.01	-36.41	-6.60	Peak
2	5197.800	-47.31	-13.00	-34.31	-46.64	-0.67	Peak
3	6930.400	-45.47	-13.00	-32.47	-51.92	6.45	Peak

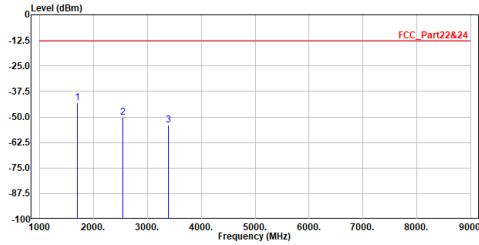
Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor + Aux Factor
 3. Over Limit = Level - Limit Line
 4. Aux Factor = Convert E (dBuVm) to EIRP (dBm)
 = 107 + 20log(3) - 104.8 = 11.8 dB
 5. The other emission levels were very low against the limit.
 6. The emission under 1GHz was not included since the emission levels are very low against the limit.



Mode 3: WCDMA Band 5



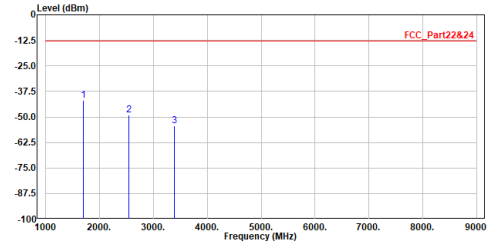
Site :CB2-H
 Condition :3m Horizontal
 Mode :WCDMA_B5_Ch4233
 Test by :Cyril



No.	Frequency MHz	Level dBm	Limit Line dBm	Over Limit dB	Read Level dBm	Factor dB	Remark
1	1693.200	-43.17	-13.00	-30.17	-30.53	-12.64	Peak
2	2539.800	-50.23	-13.00	-37.23	-41.10	-9.13	Peak
3	3386.400	-53.80	-13.00	-40.80	-47.09	-6.71	Peak

Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor + Aux Factor
 3. Over Limit = Level - Limit Line
 4. Aux Factor = Convert E (dBuVm) to EIRP (dBm)
 $= 107 + 20\log(3) - 104.8 = 11.8$ dB
 5. The other emission levels were very low against the limit.
 6. The emission under 1GHz was not included since the emission levels are very low against the limit.

Site :CB2-H
 Condition :3m Vertical
 Mode :WCDMA_B5_Ch4233
 Test by :Cyril



No.	Frequency MHz	Level dBm	Limit Line dBm	Over Limit dB	Read Level dBm	Factor dB	Remark
1	1693.200	-41.93	-13.00	-28.93	-29.29	-12.64	Peak
2	2539.800	-49.06	-13.00	-36.06	-39.93	-9.13	Peak
3	3386.400	-54.15	-13.00	-41.15	-47.44	-6.71	Peak

Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor + Aux Factor
 3. Over Limit = Level - Limit Line
 4. Aux Factor = Convert E (dBuVm) to EIRP (dBm)
 $= 107 + 20\log(3) - 104.8 = 11.8$ dB
 5. The other emission levels were very low against the limit.
 6. The emission under 1GHz was not included since the emission levels are very low against the limit.