

TEST REPORT

Product : Receiver assembly
Trade mark : Kohler
Model/Type reference : 1371930
Serial Number : N/A
Report Number : EED32N80606101
FCC ID : N82-KOHLER041
Date of Issue : Jul. 22, 2021
Test Standards : 47 CFR Part 15 Subpart C
Test result : PASS

Prepared for:

Kohler Co.

444 Highland Drive, Kohler, WI 53044 USA

Prepared by:

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Date:

Jul. 22, 2021

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3 Version

Version No.	Date	Description
00	Jul. 22, 2021	Original

4 Test Summary

Test Item	Test Requirement	Result
Antenna Requirement	47 CFR Part 15 Subpart C Section 15.203/15.247 (c)	Note 1
AC Power Line Conducted Emission	47 CFR Part 15 Subpart C Section 15.207	N/A
DTS Bandwidth	47 CFR Part 15 Subpart C Section 15.247 (a)(2)	Note 1
Maximum Conducted Output Power	47 CFR Part 15 Subpart C Section 15.247 (b)(3)	Note 1
Maximum Power Spectral Density	47 CFR Part 15 Subpart C Section 15.247 (e)	Note 1
Band Edge Measurements	47 CFR Part 15 Subpart C Section 15.247(d)	Note 1
Conducted Spurious Emissions	47 CFR Part 15 Subpart C Section 15.247(d)	Note 1
Radiated Spurious Emission & Restricted bands	47 CFR Part 15 Subpart C Section 15.205/15.209	PASS

Remark:

Company Name and Address shown on Report, the sample(s) and sample Information were provided by the applicant who should be responsible for the authenticity which CTI hasn't verified.

Note 1: This test report (Ref. No.:EED32N80606101) is only valid with the original test report (Ref. No.: EED32L00366301).

Review this report and original report, this report just re-design PCB layout but Bluetooth module keep same as the pervious version.

Therefore in this report the Radiated spurious were retested and shown the data in this report, other tests data please refer to original report No.EED32L00366301.

5 General Information

5.1 Client Information

Applicant:	Kohler Co.
Address of Applicant:	444 Highland Drive, Kohler, WI 53044 USA
Manufacturer:	Kohler Co.
Address of Manufacturer:	444 Highland Drive, Kohler, WI 53044 USA
Factory:	VTech (Dongguan) Communications Ltd.
Address of Factory:	Xia Ling Bei Management Zone, Liaobu Town, Dongguan City ,Guangdong province, China.

5.2 General Description of EUT

Product Name:	Receiver assembly	
Model No.(EUT):	1371930	
Trade mark:	Kohler	
Bluetooth Version:	V4.2	
Operation Frequency:	2402MHz~2480MHz	
Modulation Type:	GFSK	
Transfer Rate:	<input checked="" type="checkbox"/> 1Mbps <input type="checkbox"/> 2Mbps	
Number of Channel:	40	
Antenna Type:	Chip Antenna	
Antenna Gain:	2dBi	
Power Supply:	Battery	DC 1.5V*4 SIZE +AA
Test Voltage:	DC 6V	
Sample Received Date:	May 22, 2020	
Sample tested Date:	May 22, 2020 to Jun. 02, 2020	

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402MHz	10	2422MHz	20	2442MHz	30	2462MHz
1	2404MHz	11	2424MHz	21	2444MHz	31	2464MHz
2	2406MHz	12	2426MHz	22	2446MHz	32	2466MHz
3	2408MHz	13	2428MHz	23	2448MHz	33	2468MHz
4	2410MHz	14	2430MHz	24	2450MHz	34	2470MHz
5	2412MHz	15	2432MHz	25	2452MHz	35	2472MHz
6	2414MHz	16	2434MHz	26	2454MHz	36	2474MHz
7	2416MHz	17	2436MHz	27	2456MHz	37	2476MHz
8	2418MHz	18	2438MHz	28	2458MHz	38	2478MHz
9	2420MHz	19	2440MHz	29	2460MHz	39	2480MHz

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The lowest channel (CH0)	2402MHz
The middle channel (CH19)	2440MHz
The highest channel (CH39)	2480MHz

5.3 Test Configuration

EUT Test Software Settings:				
Software:		BlueNRG GUI (manufacturer declare)		
EUT Power Grade:		Class2 (Power level is built-in set parameters and cannot be changed and selected)		
Use test software to set the lowest frequency, the middle frequency and the highest frequency keep transmitting of the EUT.				
Test Mode	Modulation	Rate	Channel	Frequency(MHz)
Mode a	GFSK	1Mbps	CH0	2402
Mode b	GFSK	1Mbps	CH19	2440
Mode c	GFSK	1Mbps	CH39	2480

5.4 Test Environment

Operating Environment:	
Radiated Spurious Emissions:	
Temperature:	22~25.0 °C
Humidity:	50~55 % RH
Atmospheric Pressure:	1010mbar

5.5 Description of Support Units

The EUT has been tested independently.

5.6 Test Location

All tests were performed at:

Centre Testing International Group Co., Ltd
 Building C, Hongwei Industrial Park Block 70, Bao'an District, Shenzhen, China
 Telephone: +86 (0) 755 33683668 Fax:+86 (0) 755 33683385

No tests were sub-contracted.

FCC Designation No.: CN1164

5.7 Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty
1	Radio Frequency	7.9 x 10 ⁻⁸
2	RF power, conducted	0.46dB (30MHz-1GHz)
		0.55dB (1GHz-18GHz)
3	Radiated Spurious emission test	3.3dB (9kHz-30MHz)
		4.3dB (30MHz-1GHz)
		4.5dB (1GHz-18GHz)
		3.4dB (18GHz-40GHz)
4	Conduction emission	3.5dB (9kHz to 150kHz)
		3.1dB (150kHz to 30MHz)
5	Temperature test	0.64°C
6	Humidity test	3.8%
7	DC power voltages	0.026%

6 Equipment List

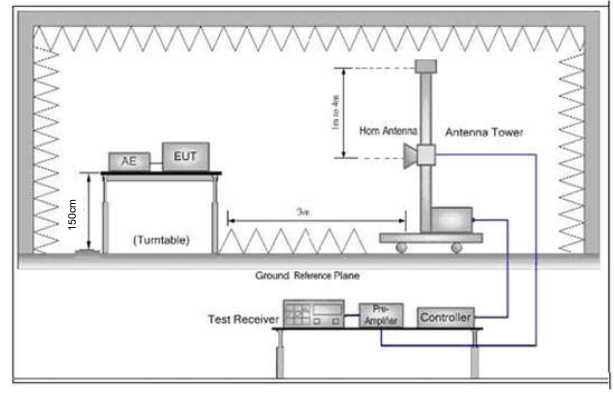
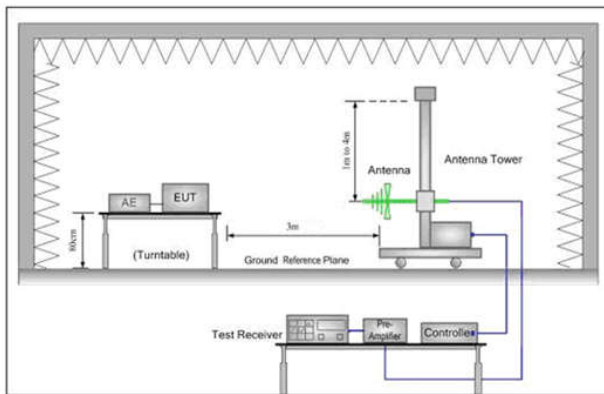
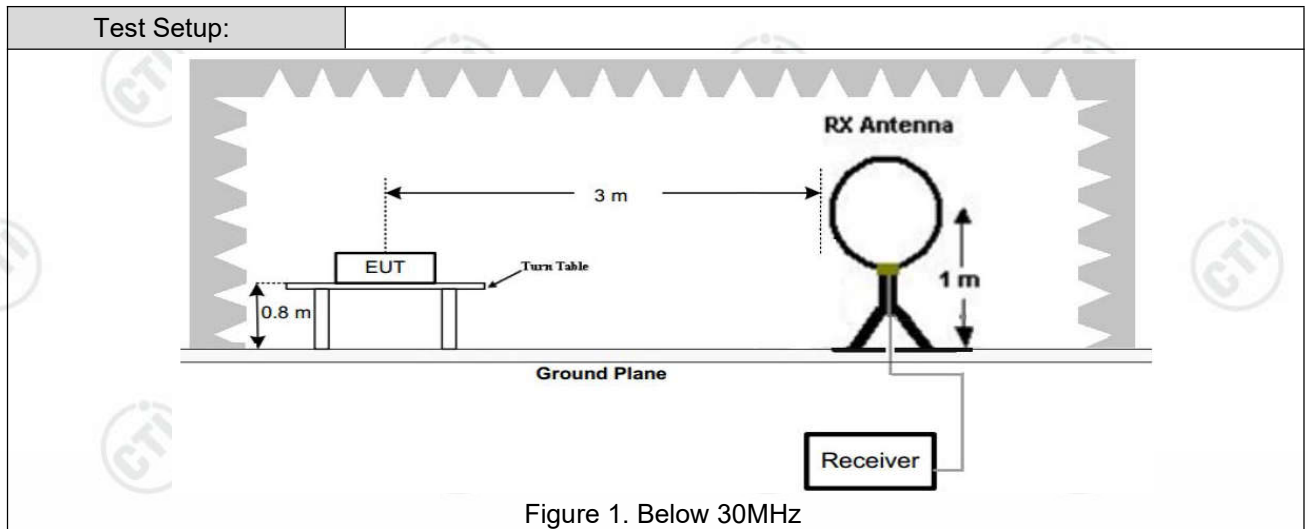
3M Semi/full-anechoic Chamber					
Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm-dd-yyyy)	Cal. Due date (mm-dd-yyyy)
3M Chamber & Accessory Equipment	TDK	SAC-3	---	05-24-2019	05-23-2022
TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-618	07-26-2019	07-25-2020
Loop Antenna	Schwarzbeck	FMZB 1519B	1519B-076	04-25-2018	04-24-2021
Receiver	R&S	ESCI7	100938-003	10-21-2019	10-20-2020
Multi device Controller	matturo	NCD/070/10711112	---	---	---
Temperature/Humidity Indicator	Shanghai qixiang	HM10	1804298	07-26-2019	07-25-2020
Cable line	Fulai(7M)	SF106	5219/6A	---	---
Cable line	Fulai(6M)	SF106	5220/6A	---	---
Cable line	Fulai(3M)	SF106	5216/6A	---	---
Cable line	Fulai(3M)	SF106	5217/6A	---	---

3M full-anechoic Chamber					
Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm-dd-yyyy)	Cal. Due date (mm-dd-yyyy)
RSE Automatic test software	JS Tonscend	JS36-RSE	10166	06-19-2019	06-18-2020
Receiver	Keysight	N9038A	MY57290136	03-05-2020	03-04-2021
Spectrum Analyzer	Keysight	N9020B	MY57111112	03-05-2020	03-04-2021
Spectrum Analyzer	Keysight	N9030B	MY57140871	03-05-2020	03-04-2021
TRIOLOG Broadband Antenna	Schwarzbeck	VULB 9163	9163-1148	04-25-2018	04-24-2021
Horn Antenna	Schwarzbeck	BBHA 9170	9170-832	04-25-2018	04-24-2021
Horn Antenna	ETS-LINDGREN	3117	00057407	07-10-2018	07-09-2021
Preamplifier	EMCI	EMC184055SE	980596	05-20-2020	05-19-2021
Preamplifier	EMCI	EMC001330	980563	04-22-2020	04-21-2021
Preamplifier	JS Tonscend	980380	EMC051845 SE	01-09-2020	01-08-2021
Temperature/Humidity Indicator	biaozhi	GM1360	EE1186631	04-27-2020	04-26-2021
Fully Anechoic Chamber	TDK	FAC-3	---	01-17-2018	01-16-2021
Filter bank	JS Tonscend	JS0806-F	188060094	04-10-2018	04-09-2021
Cable line	Times	SFT205-NMSM-2.50M	394812-0001	---	---
Cable line	Times	SFT205-NMSM-2.50M	394812-0002	---	---
Cable line	Times	SFT205-NMSM-2.50M	394812-0003	---	---
Cable line	Times	SFT205-NMSM-2.50M	393495-0001	---	---
Cable line	Times	EMC104-NMNM-1000	SN160710	---	---
Cable line	Times	SFT205-NMSM-3.00M	394813-0001	---	---
Cable line	Times	SFT205-NMNM-1.50M	381964-0001	---	---
Cable line	Times	SFT205-NMSM-7.00M	394815-0001	---	---
Cable line	Times	HF160-KMKM-3.00M	393493-0001	---	---

7 Test results and Measurement Data

7.1 Radiated Spurious Emission & Restricted bands

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205				
Test Method:	ANSI C63.10 2013				
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
	0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
	0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
	0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
	0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	100 kHz	300kHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
Peak		1MHz	10kHz	Average	
Limit:	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz-88MHz	100	40.0	Quasi-peak	3
	88MHz-216MHz	150	43.5	Quasi-peak	3
	216MHz-960MHz	200	46.0	Quasi-peak	3
	960MHz-1GHz	500	54.0	Quasi-peak	3
	Above 1GHz	500	54.0	Average	3
<p>Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.</p>					



Test Procedure:

- a. 1) Below 1G: The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
 - 2) Above 1G: The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- Note: For the radiated emission test above 1GHz:
Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- 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 antenna height 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

	<p>measurement.</p> <ul style="list-style-type: none"> 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) 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 Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. g. Test the EUT in the lowest channel (2402MHz),the middle channel (2440MHz),the Highest channel (2480MHz) h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case. i. Repeat above procedures until all frequencies measured was complete.
Test Mode:	Refer to clause 5.3
Test Results:	Pass

Radiated Spurious Emission below 1GHz:

During the test, the Radiates Emission from 30MHz to 1GHz was performed in all modes, only the worst case mode b was recorded in the report.

Test Graph

Mode:			BLE GFSK Transmitting				Channel:		2440		
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dB μ V]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Result	Polarity	Remark
1	36.5967	11.21	0.67	-31.38	45.06	25.56	40.00	14.44	Pass	H	PK
2	51.4391	12.97	0.81	-32.07	42.80	24.51	40.00	15.49	Pass	H	PK
3	195.0135	10.43	1.64	-31.94	44.69	24.82	43.50	18.68	Pass	H	PK
4	360.0270	14.52	2.27	-31.84	41.37	26.32	46.00	19.68	Pass	H	PK
5	649.9890	19.40	3.10	-32.07	40.93	31.36	46.00	14.64	Pass	H	PK
6	844.9785	21.44	3.50	-31.82	37.70	30.82	46.00	15.18	Pass	H	PK
7	36.5967	11.21	0.67	-31.38	44.88	25.38	40.00	14.62	Pass	V	PK
8	150.0010	7.55	1.45	-32.01	47.80	24.79	43.50	18.71	Pass	V	PK
9	195.0135	10.43	1.64	-31.94	47.02	27.15	43.50	16.35	Pass	V	PK
10	360.0270	14.52	2.27	-31.84	42.39	27.34	46.00	18.66	Pass	V	PK
11	649.9890	19.40	3.10	-32.07	41.57	32.00	46.00	14.00	Pass	V	PK
12	875.0515	21.80	3.55	-31.70	36.16	29.81	46.00	16.19	Pass	V	PK

Radiated Spurious Emission above 1GHz:

Mode:		BLE GFSK Transmitting					Channel:			2402MHz		
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dB μ V]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Result	Polarity	Remark	
1	1062.8063	27.96	2.52	-43.03	57.43	44.88	74.00	29.12	Pass	H	PK	
2	2131.3131	31.88	3.62	-43.17	59.61	51.94	74.00	22.06	Pass	H	PK	
3	4804.0000	34.50	4.55	-42.80	54.64	50.89	74.00	23.11	Pass	H	PK	
4	7206.2804	36.31	5.81	-42.16	54.03	53.99	74.00	20.01	Pass	H	PK	
5	9608.0000	37.64	6.63	-42.10	46.62	48.79	74.00	25.21	Pass	H	PK	
6	12010.0000	39.31	7.60	-41.90	46.58	51.59	74.00	22.41	Pass	H	AV	
7	2133.5134	31.89	3.63	-43.18	58.89	51.23	74.00	22.77	Pass	V	PK	
8	2660.5661	32.66	4.10	-43.11	57.73	51.38	74.00	22.62	Pass	V	PK	
9	4804.0000	34.50	4.55	-42.80	55.86	52.11	74.00	21.89	Pass	V	PK	
10	7206.2804	36.31	5.81	-42.16	55.06	55.02	74.00	18.98	Pass	V	PK	
11	9608.0000	37.64	6.63	-42.10	48.19	50.36	74.00	23.64	Pass	V	PK	
12	12010.0000	39.31	7.60	-41.90	46.49	51.50	74.00	22.50	Pass	V	PK	
13	7206.2808	36.31	5.81	-42.16	51.53	51.49	54.00	2.51	Pass	V	AV	

Mode:		BLE GFSK Transmitting					Channel:			2440MHz		
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dB μ V]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Result	Polarity	Remark	
1	1332.6333	28.23	2.80	-42.75	53.64	41.92	74.00	32.08	Pass	H	PK	
2	2124.5125	31.87	3.61	-43.17	57.95	50.26	74.00	23.74	Pass	H	PK	
3	4880.0000	34.50	4.80	-42.80	54.88	51.38	74.00	22.62	Pass	H	PK	
4	7320.2880	36.42	5.85	-42.14	55.38	55.51	74.00	18.49	Pass	H	PK	
5	9760.0000	37.70	6.73	-42.10	48.50	50.83	74.00	23.17	Pass	H	PK	
6	12200.0000	39.42	7.67	-41.90	45.87	51.06	74.00	22.94	Pass	H	PK	
7	7320.2870	36.42	5.85	-42.14	52.59	52.72	54.00	1.28	Pass	H	AV	
8	2125.5126	31.88	3.62	-43.18	55.38	47.70	74.00	26.30	Pass	V	PK	
9	2658.7659	32.65	4.10	-43.10	58.20	51.85	74.00	22.15	Pass	V	PK	
10	4880.0000	34.50	4.80	-42.80	56.55	53.05	74.00	20.95	Pass	V	PK	
11	7320.2880	36.42	5.85	-42.14	54.20	54.33	74.00	19.67	Pass	V	PK	
12	9760.0000	37.70	6.73	-42.10	47.02	49.35	74.00	24.65	Pass	V	PK	
13	12200.0000	39.42	7.67	-41.90	46.73	51.92	74.00	22.08	Pass	V	PK	
14	7320.2877	36.42	5.85	-42.14	51.51	51.64	54.00	2.36	Pass	V	AV	

Mode:		BLE GFSK Transmitting					Channel:			2480MHz	
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	1061.6062	27.96	2.52	-43.03	55.86	43.31	74.00	30.69	Pass	H	PK
2	2129.5130	31.88	3.62	-43.17	55.98	48.31	74.00	25.69	Pass	H	PK
3	4960.0000	34.50	4.82	-42.80	56.67	53.19	74.00	20.81	Pass	H	PK
4	7440.2960	36.54	5.85	-42.11	56.56	56.84	74.00	17.16	Pass	H	PK
5	9920.0000	37.77	6.79	-42.10	47.44	49.90	74.00	24.10	Pass	H	PK
6	12400.0000	39.54	7.86	-41.90	48.49	53.99	74.00	20.01	Pass	H	PK
7	7440.2967	36.54	5.85	-42.11	51.38	51.66	54.00	2.34	Pass	H	AV
8	1494.2494	28.39	2.99	-43.08	54.27	42.57	74.00	31.43	Pass	V	PK
9	2127.1127	31.88	3.62	-43.18	60.41	52.73	74.00	21.27	Pass	V	PK
10	4960.1307	34.50	4.82	-42.80	58.69	55.21	74.00	18.79	Pass	V	PK
11	7440.2960	36.54	5.85	-42.11	56.00	56.28	74.00	17.72	Pass	V	PK
12	9920.0000	37.77	6.79	-42.10	46.88	49.34	74.00	24.66	Pass	V	PK
13	11313.5542	38.79	7.33	-42.00	49.19	53.31	74.00	20.69	Pass	V	PK
14	4960.1305	34.50	4.82	-42.80	54.66	51.18	54.00	2.82	Pass	V	AV
15	7440.2970	36.54	5.85	-42.11	51.63	51.91	54.00	2.09	Pass	V	AV

Remark:

1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level = Receiver Reading - Correct Factor

Correct Factor = Preamplifier Factor - Antenna Factor - Cable Factor

2) Scan from 9kHz to 25GHz, the disturbance above 13GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.