

FCC Test Report

Report No.: RF160530E06

FCC ID: YLIGT-RGBTX2

Test Model: GT-RGBTX2

Received Date: May 30, 2016

Test Date: June 20 to 23, 2016

Issued Date: July 06, 2016

Applicant: H.S. CRAFT MANUFACTURING CO.

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
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Release Control Record

Issue No.	Description	Date Issued
RF160530E06	Original release.	July 06, 2016

1 Certificate of Conformity

Product: Remote control

Brand: GE

Test Model: GT-RGBTX2

Sample Status: ENGINEERING SAMPLE

Applicant: H.S. CRAFT MANUFACTURING CO.

Test Date: June 20 to 23, 2016

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.231)

ANSI C63.10: 2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan 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:** July 06, 2016

Claire Kuan / Specialist

Approved by :  _____, **Date:** July 06, 2016

May Chen / Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (SECTION 15.231)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	NA	Without AC power port of the EUT.
15.209 15.231(b)	Radiated Emission Test	PASS	Meet the requirement of limit. Minimum passing margin is -1.2dB at 433.92MHz.
15.231(c)	Emission Bandwidth Measurement	PASS	Meet the requirement of limit.
15.231(a)	De-activation	PASS	Meet the requirement of limit.

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	Expended Uncertainty (k=2) (±)
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.31 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	3.40 dB
	6GHz ~ 18GHz	3.73 dB
	18GHz ~ 40GHz	4.11 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Remote control
Brand	GE
Test Model	GT-RGBTX2
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	6Vdc from batteries
Modulation Type	ASK
Transfer Rate	2.4kbps
Operating Frequency	433.92MHz
Number of Channel	1
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Battery (LR44) x 4
Data Cable Supplied	NA

Note:

1. The antenna provided to the EUT, please refer to the following table:

Antenna Gain (dBi)	Antenna	Connector Type	Frequency range
0	PCB	NA	433.92MHz

2. 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.

3.2 Description of Test Modes

One channel was provided to this EUT:

Channel	FREQ. (MHz)
1	433.92

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO					DESCRIPTION
	RE \geq 1G	RE $<$ 1G	PLC	EB	DT	
-	✓	✓	-	✓	✓	-

Where

RE \geq 1G: Radiated Emission above 1GHz

RE $<$ 1G: Radiated Emission below 1GHz

PLC: Power Line Conducted Emission

EB: 20dB Bandwidth measurement

DT: Deactivation Time measurement

NOTE: 1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.

Radiated Emission Test (Above 1GHz):

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1	1	ASK

Radiated Emission Test (Below 1GHz):

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1	1	ASK

Emission Bandwidth Measurement:

- This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1	1	ASK

Deactivation Time Measurement:

- This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1	1	ASK

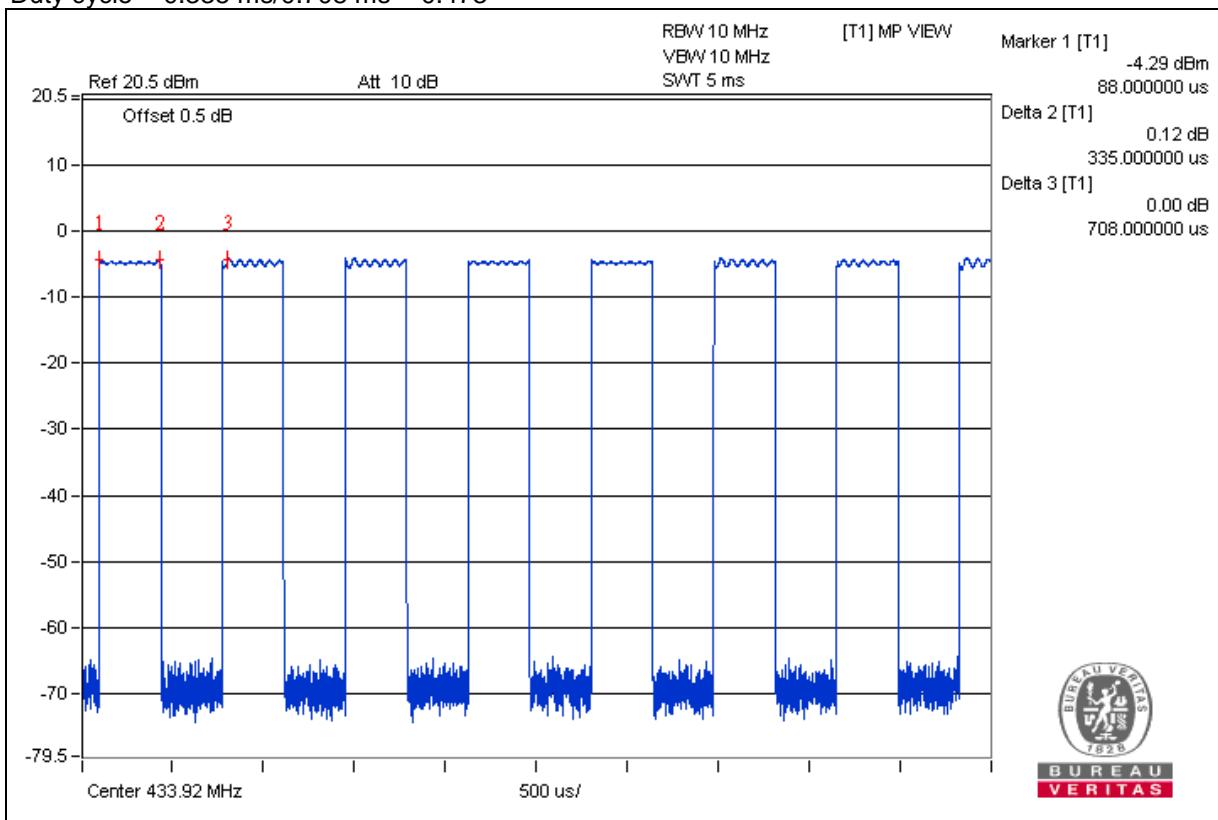
TEST CONDITION:

Applicable To	Environmental Conditions	Input Power	Tested By
RE≥1G	25deg. C, 65%RH	6Vdc	Tim Ho
RE<1G	25deg. C, 65%RH	6Vdc	Tim Ho
EB	25deg. C, 60%RH	6Vdc	Anderson Chen
DT	25deg. C, 60%RH	6Vdc	Anderson Chen

3.3 Duty Cycle of Test Signal

Duty cycle of test signal is < 98 %

Duty cycle = $0.335 \text{ ms} / 0.708 \text{ ms} = 0.473$

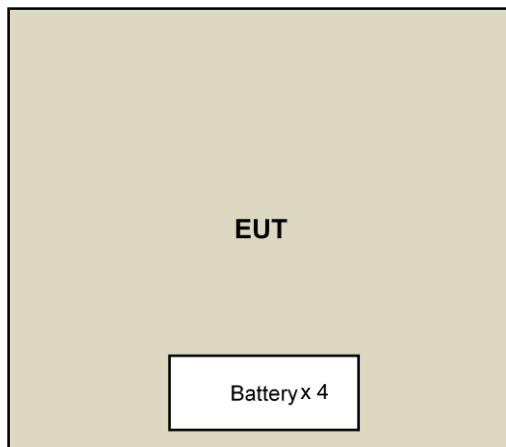


3.4 Description of Support Units

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.	Battery	Maxell	LR44	NA	NA	Provided by Lab

3.4.1 Configuration of System under Test



3.5 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:

FCC Part 15, Subpart C (15.231)

ANSI C63.10-2013

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

Note: The EUT has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC).
The test report has been issued separately.

4 Test Types and Results

4.1 Radiated Emission Measurement

4.1.1 Limits of Radiated Emission Measurement

Fundamental Frequency (MHz)	Field Strength of Fundamental		Field Strength of Spurious	
	uV/meter	dBuV/meter	uV/meter	dBuV/meter
40.66 ~ 40.70	2250	67.04	225	48.04
70 ~ 130	1250	61.94	125	41.94
130 ~ 174	1250 ~ 3750	61.94 ~ 71.48	125 ~ 375	41.94 ~ 51.48
174 ~ 260	3750	71.48	375	51.48
260 ~ 470	3750 ~ 12500	71.48 ~ 81.94	375 ~ 1250	51.48 ~ 61.94
Above 470	12500	81.94	1250	61.94

NOTE:

1. Where F is the frequency in MHz, the formula for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, $\text{uV/m at 3 meters} = 56.81818(F) - 6136.3636$; for the band 260-470 MHz, $\text{uV/m at 3 meters} = 41.6667(F) - 7083.3333$. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.
2. The above field strength limits are specified at a distance of 3meters. The tighter limits apply at the band edges.

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	$2400/F(\text{kHz})$	300
0.490 ~ 1.705	$24000/F(\text{kHz})$	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) = $20 \log \text{Emission level (uV/m)}$.
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.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY50010156	Aug. 12, 2015	Aug. 11, 2016
Pre-Amplifier ^(*) EMCI	EMC001340	980142	Jan. 20, 2016	Jan. 19, 2018
Loop Antenna ^(*) Electro-Metrics	EM-6879	264	Dec. 16, 2014	Dec. 15, 2016
RF Cable	NA	LOOPCAB-001 LOOPCAB-002	Jan. 18, 2016	Jan. 17, 2017
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-05	May 07, 2016	May 06, 2017
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-156	Jan. 04, 2016	Jan. 03, 2017
RF Cable	8D	966-3-1 966-3-2 966-3-3	Apr. 02, 2016	Apr. 01, 2017
Horn_Antenna SCHWARZBECK	BBHA9120-D	9120D-406	Jan. 20, 2016	Jan. 19, 2017
Pre-Amplifier Agilent	8449B	3008A02465	Apr. 05, 2016	Apr. 04, 2017
RF Cable	EMC104-SM-SM-2000 EMC104-SM-SM-5000 EMC104-SM-SM-5000	150317 150321 150322	Mar. 30, 2016	Mar. 29, 2017
Spectrum Analyzer Keysight	N9030A	MY54490520	July 26, 2015	July 25, 2016
Pre-Amplifier EMCI	EMC184045	980143	Jan. 15, 2016	Jan. 14, 2017
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170608	Jan. 08, 2016	Jan. 07, 2017
RF Cable	SUCOFLEX 102	36432/2 36441/2	Jan. 16, 2016	Jan. 15, 2017
Software	ADT_Radiated _V8.7.07	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. *The calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. The test was performed in 966 Chamber No. 3.
4. The FCC Site Registration No. is 147459
5. The CANADA Site Registration No. is 20331-1
6. Tested Date: June 20 to 21, 2016

4.1.3 Test Procedures

- a. The EUT was placed on the top of a rotating table 0.8 meters (for below 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 detect 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:

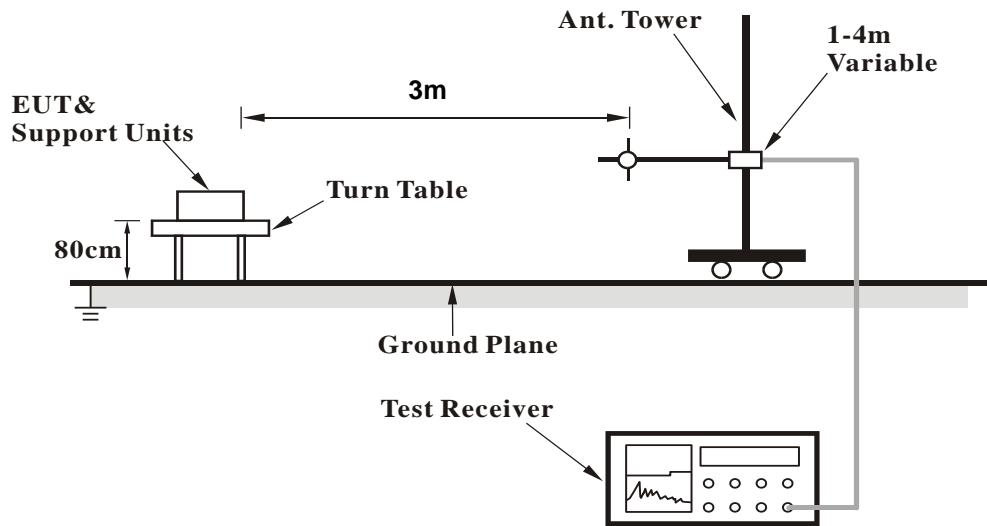
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is $\geq 1/T$ (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

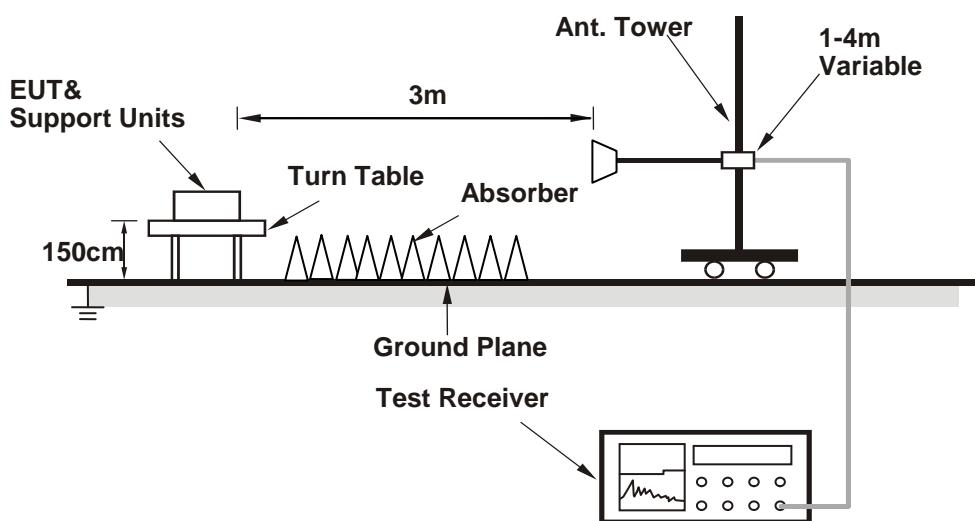
No deviation.

4.1.5 Test Setup

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



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

4.1.6 EUT Operating Conditions

- a. Placed the EUT on the testing table.
- b. Set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

ABOVE 1GHz DATA :

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	1301.76	53.8 PK	74.0	-20.2	2.27 H	318	60.9	-7.1
2	1301.76	47.3 AV	54.0	-6.7	2.27 H	318	54.4	-7.1
3	1735.68	50.0 PK	80.8	-30.8	1.60 H	316	56.4	-6.4
4	1735.68	43.5 AV	60.8	-17.3	1.60 H	316	49.9	-6.4
5	2169.60	50.6 PK	80.8	-30.2	1.62 H	228	55.7	-5.1
6	2169.60	44.1 AV	60.8	-16.7	1.62 H	228	49.2	-5.1
7	2603.52	51.7 PK	80.8	-29.1	2.38 H	9	55.2	-3.5
8	2603.52	45.2 AV	60.8	-15.6	2.38 H	9	48.7	-3.5
9	3037.44	53.5 PK	80.8	-27.3	1.00 H	338	55.9	-2.4
10	3037.44	47.0 AV	60.8	-13.8	1.00 H	338	49.4	-2.4
11	3471.36	52.0 PK	80.8	-28.8	1.05 H	323	53.6	-1.6
12	3471.36	45.5 AV	60.8	-15.3	1.05 H	323	47.1	-1.6
13	3905.28	49.9 PK	74.0	-24.1	1.05 H	167	50.2	-0.3
14	3905.28	43.4 AV	54.0	-10.6	1.05 H	167	43.7	-0.3
15	4339.20	49.4 PK	74.0	-24.6	1.05 H	360	48.2	1.2
16	4339.20	42.9 AV	54.0	-11.1	1.05 H	360	41.7	1.2

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. The average value of fundamental frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty factor is calculated from following formula:

$$20 \log (\text{Duty cycle}) = 20 \log (0.335 \text{ ms} / 0.708 \text{ ms}) = -6.5 \text{ dB}$$

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	1301.76	48.0 PK	74.0	-26.0	1.64 V	221	55.1	-7.1
2	1301.76	41.5 AV	54.0	-12.5	1.64 V	221	48.6	-7.1
3	1735.68	47.7 PK	80.8	-33.1	2.74 V	200	54.1	-6.4
4	1735.68	41.2 AV	60.8	-19.6	2.74 V	200	47.6	-6.4
5	2169.60	47.9 PK	80.8	-32.9	2.79 V	179	53.0	-5.1
6	2169.60	41.4 AV	60.8	-19.4	2.79 V	179	46.5	-5.1
7	2603.52	51.6 PK	80.8	-29.2	3.54 V	28	55.1	-3.5
8	2603.52	45.1 AV	60.8	-15.7	3.54 V	28	48.6	-3.5
9	3037.44	52.6 PK	80.8	-28.2	3.46 V	34	55.0	-2.4
10	3037.44	46.1 AV	60.8	-14.7	3.46 V	34	48.5	-2.4
11	3471.36	50.1 PK	80.8	-30.7	2.34 V	360	51.7	-1.6
12	3471.36	43.6 AV	60.8	-17.2	2.34 V	360	45.2	-1.6
13	3905.28	48.8 PK	74.0	-25.2	1.67 V	71	49.1	-0.3
14	3905.28	42.3 AV	54.0	-11.7	1.67 V	71	42.6	-0.3
15	4339.20	50.2 PK	74.0	-23.8	1.67 V	308	49.0	1.2
16	4339.20	43.7 AV	54.0	-10.3	1.67 V	308	42.5	1.2

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. The average value of fundamental frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty factor is calculated from following formula:

$$20 \log (\text{Duty cycle}) = 20 \log (0.335 \text{ ms} / 0.708 \text{ ms}) = -6.5 \text{ dB}$$

BELOW 1GHz DATA

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	Below 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	33.88	31.6 QP	60.8	-29.2	2.31 H	216	41.2	-9.6
2	66.86	25.9 QP	60.8	-34.9	2.31 H	216	35.8	-9.9
3	217.21	35.8 QP	60.8	-25.0	2.31 H	216	47.1	-11.3
4	*433.92	79.6 QP	80.8	-1.2	2.31 H	216	83.3	-3.7
5	650.80	41.7 QP	60.8	-19.1	2.31 H	216	41.0	0.7
6	868.08	31.5 QP	60.8	-29.3	2.31 H	216	27.7	3.8

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	33.88	34.9 QP	60.8	-25.9	2.33 V	267	44.5	-9.6
2	66.86	29.3 QP	60.8	-31.5	2.33 V	267	39.2	-9.9
3	97.90	21.1 QP	60.8	-39.7	2.33 V	267	34.4	-13.3
4	*433.92	72.3 QP	80.8	-8.5	2.33 V	267	76.0	-3.7
5	650.80	33.1 QP	60.8	-27.7	2.33 V	267	32.4	0.7
6	868.08	29.8 QP	60.8	-31.0	2.33 V	267	26.0	3.8

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

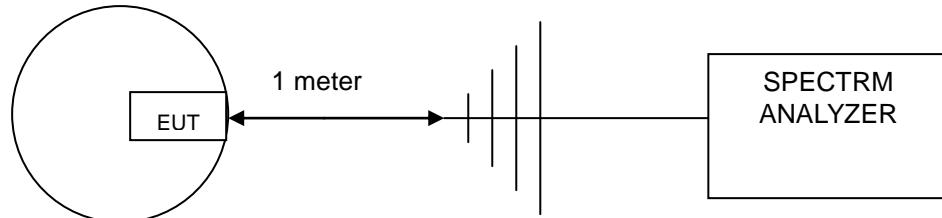
4.2 20dB Bandwidth Measurement

4.2.1 Limits of 20dB Bandwidth Measurement

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for device operating above 70 MHz and below 900 MHz.

Fundamental Frequency (MHz)	Limit of Emission Bandwidth (kHz)
433.92	1084.8

4.2.2 Test Setup



4.2.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.2.4 Test Procedure

- The EUT was placed on the turn table.
- The signal was coupled to the spectrum analyzer through an antenna.
- Set the resolution bandwidth to 10 kHz and video bandwidth to 30 kHz then select Peak function to scan the channel frequency.
- The emission bandwidth was measured and recorded.

4.2.5 Deviation from Test Standard

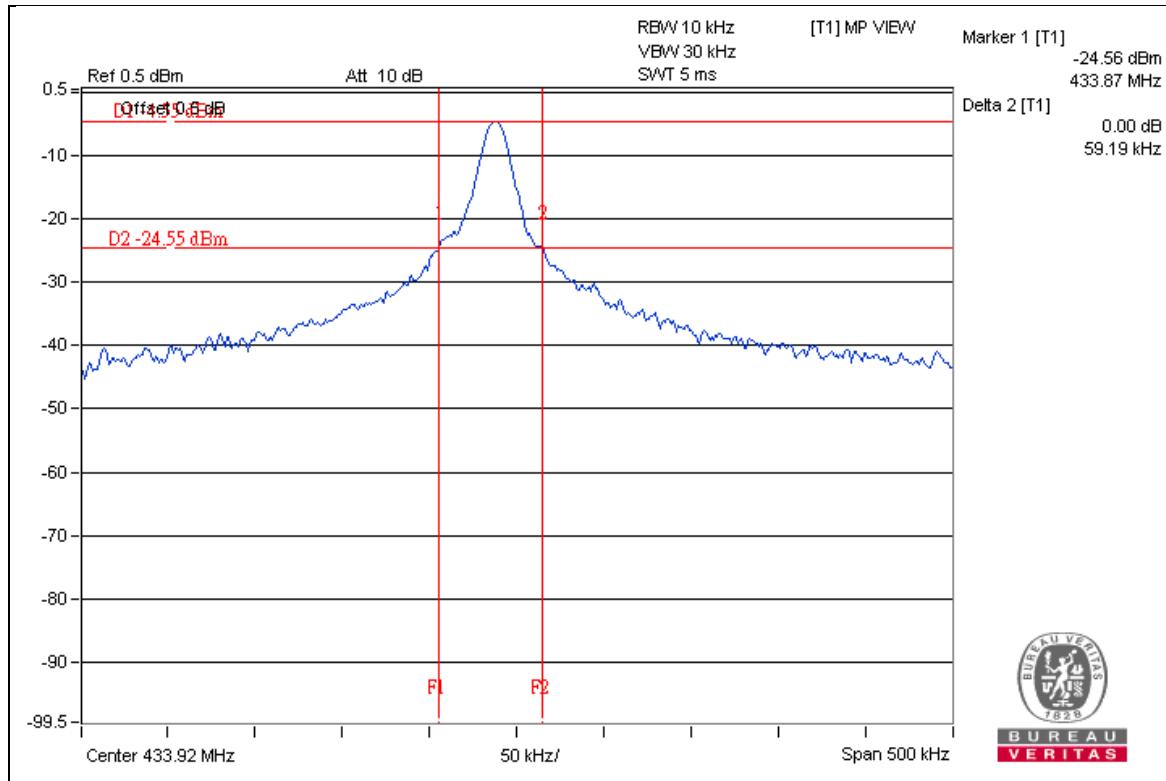
No deviation.

4.2.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.2.7 Test Result

Channel	Frequency (MHz)	20dB Bandwidth (kHz)	Maximum Limit (kHz)	Pass / Fail
1	433.92	59.19	1084.8	Pass

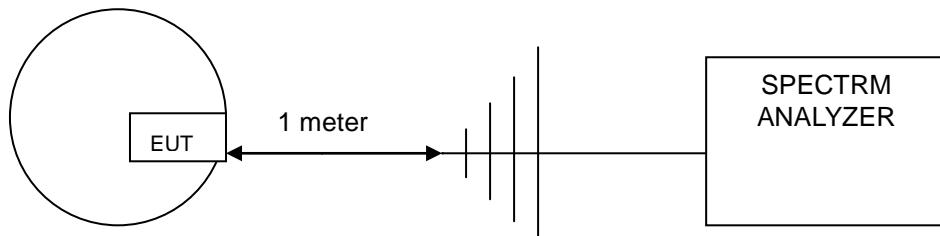


4.3 Deactivation Time Measurement

4.3.1 Limits of Deactivation Time Measurement

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedures

- a. The EUT was placed on the turning table.
- b. The signal was coupled to the spectrum analyzer through an antenna.
- c. Set the resolution bandwidth to 100kHz and video bandwidth to 300kHz. The spectrum analyser was turned to the centre frequency of the transmitter's and the analyser's marker function was used to determine the duration of transmission.
- d. The transmission duration was measured and recorded.

4.3.5 Deviation from Test Standard

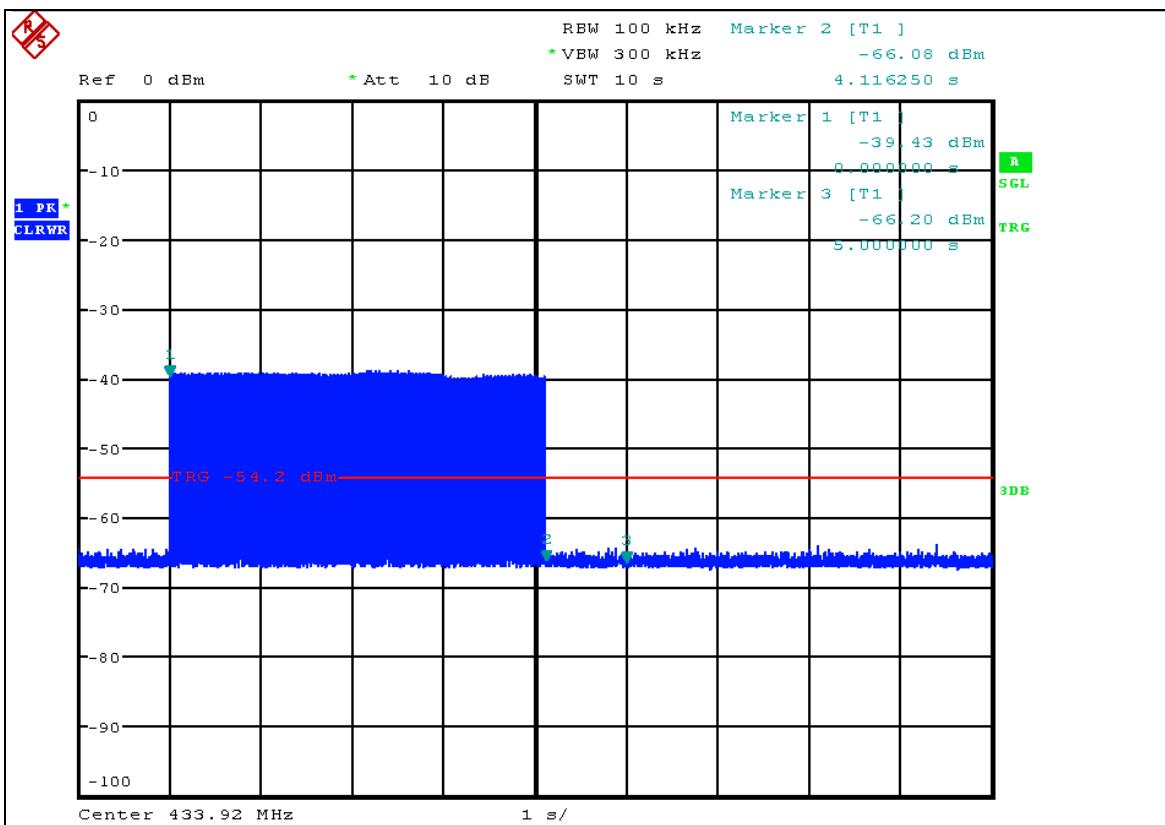
No deviation.

4.3.6 EUT Operating Conditions

Same as Item 4.2.6.

4.3.7 Test Results

Channel	Frequency (MHz)	Transmission Time (Sec)	Maximum Limit (Sec)	Pass/Fail
1	433.92	4.116250	5	Pass



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5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

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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