

FCC Test Report

Report No.: RF150623E05

FCC ID: 2ABC8-5898

Test Model: 5898

Received Date: June 23, 2015

Test Date: Aug. 14 to 19, 2015

Issued Date: Oct. 02, 2015

Applicant: Honeywell Security Sensor CoE

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory

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Test Location (2): No. 49, Ln. 206, Wende Rd., Shangshan Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan R.O.C.

Test Location (3): E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.



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A D T

Release Control Record

Issue No.	Description	Date Issued
RF150623E05	Original release.	Oct. 02, 2015



1 Certificate of Conformity

Product: Wireless DUAL TEC Motion Sensor
Brand: Honeywell
Test Model: 5898
Sample Status: ENGINEERING SAMPLE
Applicant: Honeywell Security Sensor CoE
Test Date: Aug. 14 to 19, 2015
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 : Phoenix Huang , **Date:** Oct. 02, 2015
Phoenix Huang / Specialist

Approved by : May Chen , **Date:** Oct. 02, 2015
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	Power supply is 3Vdc from batteries
15.209 15.231(b)	Radiated Emission Test	PASS	Meet the requirement of limit. Minimum passing margin is -3.0dB at 344.00MHz.
15.231(c)	Emission Bandwidth Measurement	PASS	Meet the requirement of limit.
15.231(a)(2)	De-activation	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used.

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 above 1 GHz	30MHz ~ 1GHz	5.37 dB
	1GHz ~ 6GHz	3.65 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Wireless DUAL TEC Motion Sensor
Brand	Honeywell
Test Model	5898
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	3Vdc from batteries
Modulation Type	ASK
Transfer Rate	3.7kbps
Number of Channel	1
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	NA
Data Cable Supplied	NA

Note:

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

Antenna Gain (dBi) <Include cable loss>	Antenna Type	Connector Type (External only)	Frequency range
7	patch array antenna	NA	10.522GHz~10.528GHz
0	Monopole antenna (individual antenna soldered on PCB board)	NA	345MHz

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	Frequency (MHz)
1	345

3.2.1 Test Mode Applicability and Tested Channel Detail

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

Where **RE≥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. No need to concern of Conducted Emission due to the EUT is powered by batteries.
 2. "-" means no effect.

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	DATA RATE (kbps)
1	1	ASK	3.7

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	DATA RATE (kbps)
1	1	ASK	3.7

Power Line Conducted Emission Test:

- 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	DATA RATE (kbps)
1	1	ASK	3.7

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	DATA RATE (kbps)
1	1	ASK	3.7

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	DATA RATE (kbps)
1	1	ASK	3.7

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested By
RE≥1G	24deg. C, 67%RH	3Vdc	Tim Ho
RE<1G	23deg. C, 65%RH	3Vdc	Tim Ho
EB	25deg. C, 60%RH	3Vdc	Anderson Chen
DT	25deg. C, 60%RH	3Vdc	Anderson Chen

3.3 Description of Support Units

The EUT has been tested as an independent unit.

3.3.1 Configuration of System under Test



3.4 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.

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	75	37.50
260 ~ 470	3750 ~ 12500	71.48 ~ 81.94	375 ~ 1250	51.48 ~ 61.94
Above 470	12500	81.94	1250	61.94

NOTE:

- 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, $\mu\text{V/m}$ at 3 meters = $56.81818(F)-6136.3636$; for the band 260-470 MHz, $\mu\text{V/m}$ at 3 meters = $41.6667(F)-7083.3333$. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.
- 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:

- The lower limit shall apply at the transition frequencies.
- Emission level (dBuV/m) = $20 \log$ Emission level ($\mu\text{V/m}$).
- 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	MY51210105	July 24, 2015	July 23, 2016
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-03	Nov. 12, 2014	Nov. 11, 2015
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-360	Feb. 06, 2015	Feb. 05, 2016
RF Cable	8D-FB	CHGCAB-001 -1 CHGCAB-001 -2	Oct. 04, 2014	Oct. 03, 2015
	RF-141	CHGCAB-004	Oct. 04, 2014	Oct. 03, 2015
Horn_Antenna AISI	AIH.8018	000032009111 0	Feb. 09, 2015	Feb. 08, 2016
Pre-Amplifier Agilent	8449B	3008A02578	June 23, 2015	June 22, 2016
RF Cable	NA	131205 131216 131217 SNMY23684/ 4	Jan. 16, 2015	Jan. 15, 2016
Software	ADT_Radiated _V8.7.07	NA	NA	NA
Antenna Tower & Turn Table CT	NA	NA	NA	NA
SPECTRUM ANALYZER R&S	FSP 40	100060	May 08, 2015	May 07, 2016

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 test was performed in 966 Chamber No. G.
3. The FCC Site Registration No. is 966073.
4. The VCCI Site Registration No. is G-137.
5. The CANADA Site Registration No. is IC 7450H-2.
6. Tested Date: Aug. 14 to 19, 2015

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 detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.

Note:

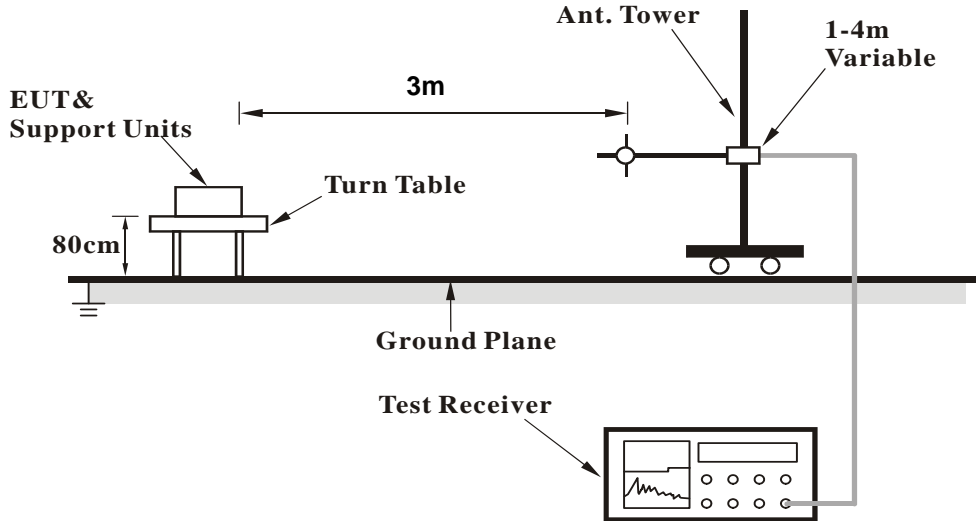
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

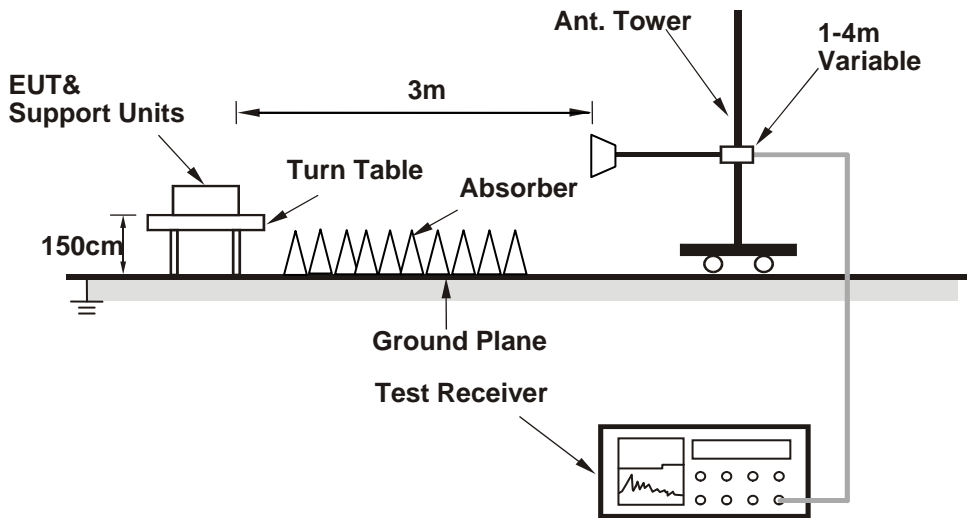
No deviation.

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 ~ 4GHz		

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	1035.00	60.7 PK	74.0	-13.3	1.29 H	210	68.66	-7.96
2	1035.00	39.3 AV	54.0	-14.7	1.29 H	210	47.26	-7.96
3	1380.00	58.5 PK	74.0	-15.5	1.50 H	191	65.00	-6.50
4	1380.00	37.1 AV	54.0	-16.9	1.50 H	191	43.60	-6.50
5	1725.00	60.8 PK	74.0	-13.2	1.50 H	210	65.46	-4.66
6	1725.00	39.4 AV	54.0	-14.6	1.50 H	210	44.06	-4.66
7	2070.00	54.5 PK	74.0	-19.5	1.70 H	181	57.30	-2.80
8	2070.00	33.1 AV	54.0	-20.9	1.70 H	181	35.90	-2.80
9	2415.00	57.2 PK	74.0	-16.8	1.50 H	144	58.57	-1.37
10	2415.00	35.8 AV	54.0	-18.2	1.50 H	144	37.17	-1.37
11	2760.00	58.6 PK	74.0	-15.4	1.50 H	41	59.53	-0.93
12	2760.00	37.2 AV	54.0	-16.8	1.50 H	41	38.13	-0.93
13	3105.00	59.5 PK	74.0	-14.5	1.10 H	269	59.88	-0.38
14	3105.00	38.1 AV	54.0	-15.9	1.10 H	269	38.48	-0.38
15	3450.00	56.0 PK	74.0	-18.0	1.10 H	106	55.10	0.91
16	3450.00	34.6 AV	54.0	-19.4	1.10 H	106	33.70	0.91

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:
 $20 \log (\text{Duty cycle}) = 20 \log (8.536 \text{ ms} / 100 \text{ ms}) = -21.4 \text{ dB}$
 Please see page 19 for plotted duty.

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 4GHz		

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	1035.00	59.1 PK	74.0	-14.9	1.14 V	360	67.06	-7.96
2	1035.00	37.7 AV	54.0	-16.3	1.14 V	360	45.66	-7.96
3	1380.00	56.3 PK	74.0	-17.7	1.19 V	138	62.80	-6.50
4	1380.00	34.9 AV	54.0	-19.1	1.19 V	138	41.40	-6.50
5	1725.00	57.3 PK	74.0	-16.7	1.33 V	299	61.96	-4.66
6	1725.00	35.9 AV	54.0	-18.1	1.33 V	299	40.56	-4.66
7	2070.00	55.9 PK	74.0	-18.1	1.38 V	160	58.70	-2.80
8	2070.00	34.5 AV	54.0	-19.5	1.38 V	160	37.30	-2.80
9	2415.00	55.8 PK	74.0	-18.2	1.00 V	150	57.17	-1.37
10	2415.00	34.4 AV	54.0	-19.6	1.00 V	150	35.77	-1.37
11	2760.00	58.1 PK	74.0	-15.9	1.00 V	105	59.03	-0.93
12	2760.00	36.7 AV	54.0	-17.3	1.00 V	105	37.63	-0.93
13	3105.00	58.6 PK	74.0	-15.4	1.00 V	111	58.98	-0.38
14	3105.00	37.2 AV	54.0	-16.8	1.00 V	111	37.58	-0.38
15	3450.00	57.2 PK	74.0	-16.8	1.49 V	63	56.29	0.91
16	3450.00	35.8 AV	54.0	-18.2	1.49 V	63	34.89	0.91

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:
 $20 \log (\text{Duty cycle}) = 20 \log (8.536 \text{ ms} / 100 \text{ ms}) = -21.4 \text{ dB}$
 Please see page 19 for plotted duty.

Below 1GHz Data

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		Peak (PK)
			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	#41.98	23.8 QP	57.3	-33.5	1.00 H	354	37.42	-13.64
2	#65.21	23.5 QP	57.3	-33.7	1.00 H	339	37.91	-14.37
3	#193.93	22.0 QP	57.3	-35.3	1.00 H	291	38.23	-16.24
4	#344.00	54.2 QP	57.3	-3.0	1.00 H	268	65.73	-11.51
5	*345.00	83.7 PK	97.3	-13.6	1.00 H	110	95.20	-11.50
6	*345.00	62.3 AV	77.3	-15.0	1.00 H	110	73.80	-11.50
7	#346.00	46.8 QP	57.3	-10.5	1.00 H	301	58.24	-11.48
8	#690.00	51.5 QP	57.3	-5.7	1.00 H	50	55.32	-3.81

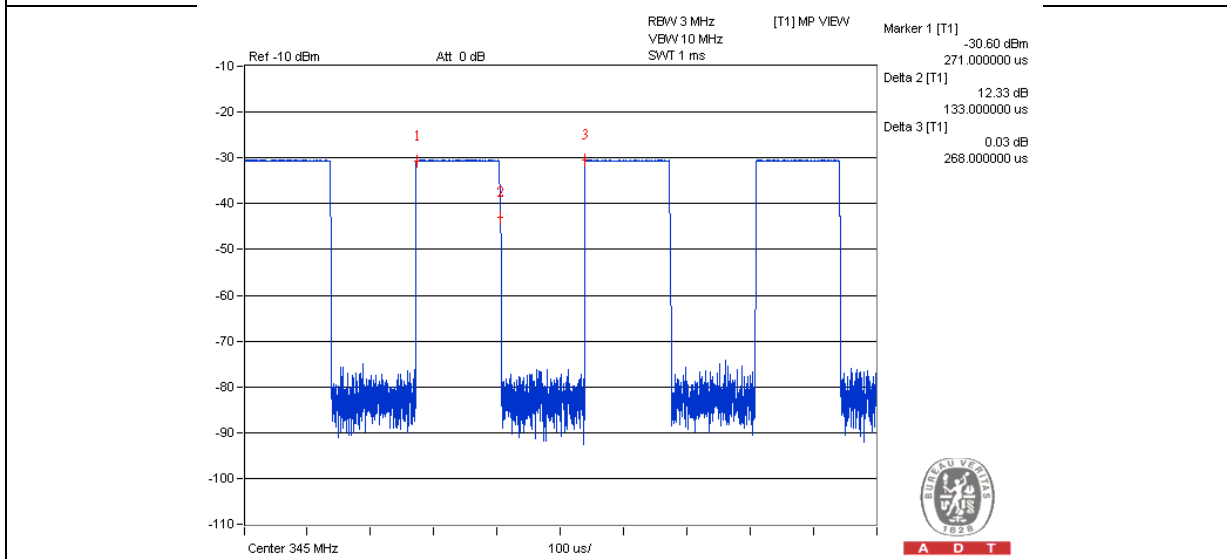
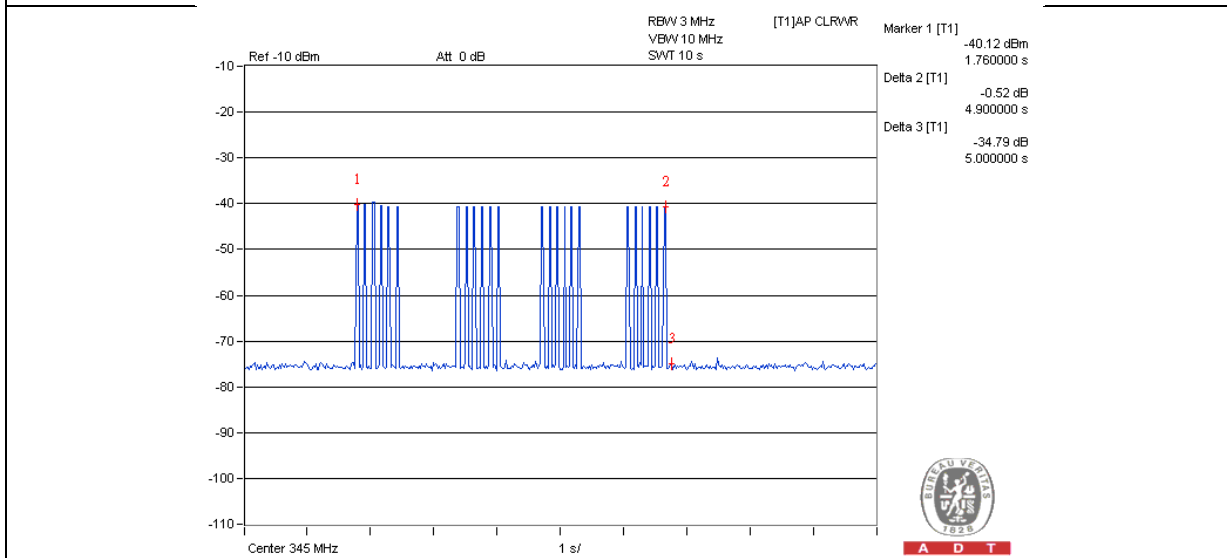
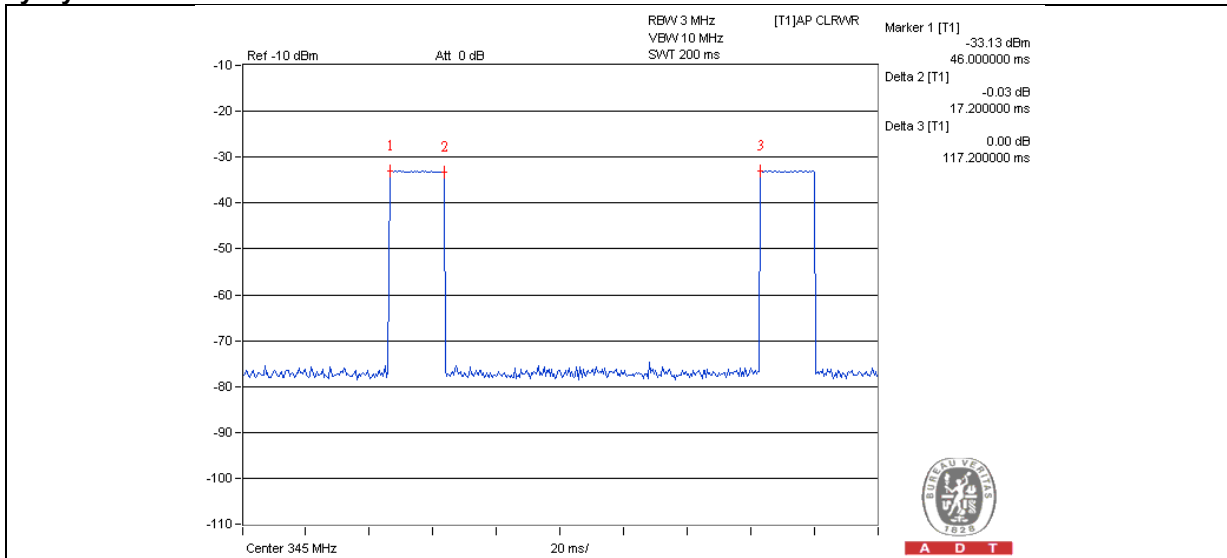
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

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	#42.22	27.9 QP	57.3	-29.4	1.00 V	324	41.49	-13.61
2	#91.26	25.6 QP	57.3	-31.6	1.00 V	249	44.56	-18.92
3	165.22	23.3 QP	43.5	-20.2	1.00 V	8	36.25	-12.97
4	#344.00	51.7 QP	57.3	-5.5	1.53 V	92	63.22	-11.51
5	*345.00	88.6 PK	97.3	-8.7	1.45 V	104	100.10	-11.50
6	*345.00	67.2 AV	77.3	-10.1	1.45 V	104	78.70	-11.50
7	#346.00	47.0 QP	57.3	-10.2	1.53 V	92	58.51	-11.48
8	#690.00	51.4 QP	57.3	-5.8	1.55 V	46	55.24	-3.81

REMARKS:

- Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
- The other emission levels were very low against the limit.
- Margin value = Emission Level – Limit value
- " * ": Fundamental frequency.
- The average value of fundamental frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty factor is calculated from following formula:
 $20 \log (\text{Duty cycle}) = 20 \log (8.536 \text{ ms} / 100 \text{ ms}) = -21.4 \text{ dB}$
 Please see page 19 for plotted duty.
- " # ": The radiated frequency is out of the restricted band.

Duty Cycle Plots:



TX on = $17.2 \times (0.133 / 0.268) = 8.536\text{ms}$
 $20 \log (\text{Duty cycle}) = 20 \log (8.536 \text{ ms} / 100 \text{ ms}) = -21.4 \text{ dB}$

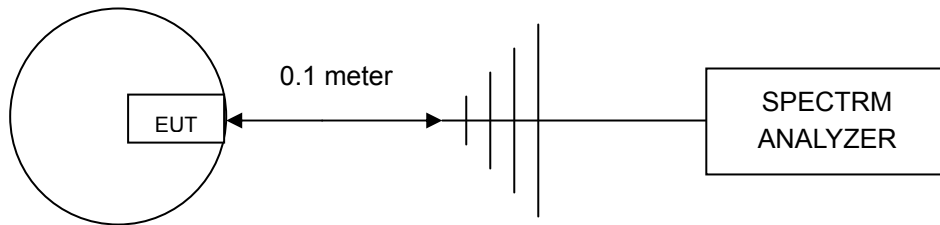
4.2 20dB Bandwidth Measurement

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)
345	862.5

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 Procedures

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

4.2.5 Deviation from Test Standard

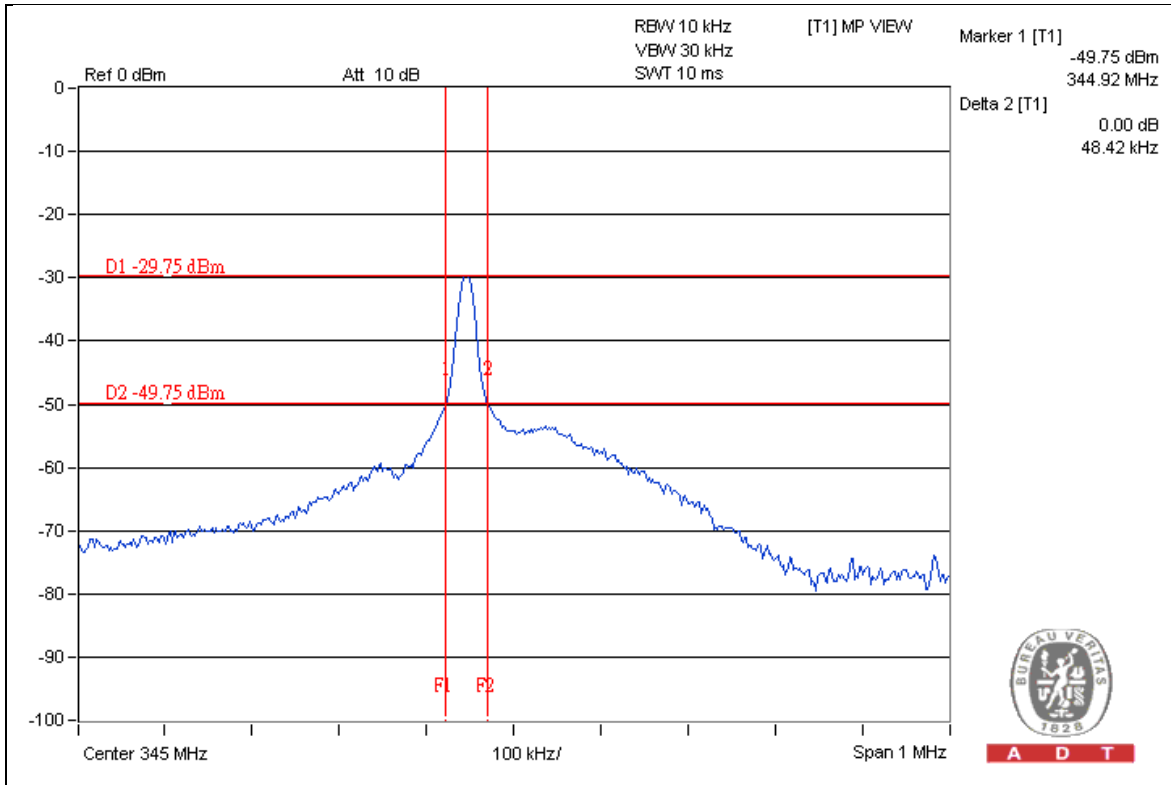
No deviation.

4.2.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at below channel frequencies individually.

4.2.7 Test Results

Channel	Frequency (MHz)	20dB Bandwidth (kHz)	Maximum Limit (kHz)	Pass / Fail
1	345	48.42	862.5	Pass

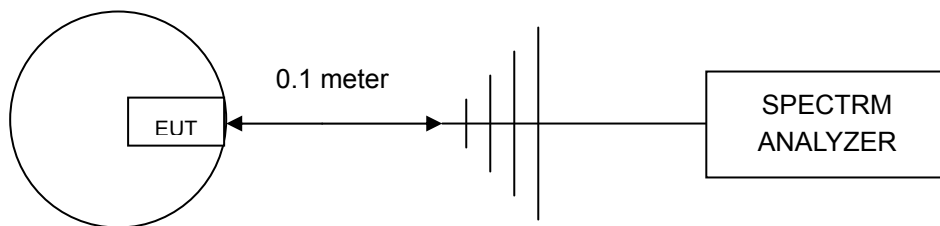


4.3 Deactivation Time Measurement

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 3MHz and video bandwidth to 10MHz. 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

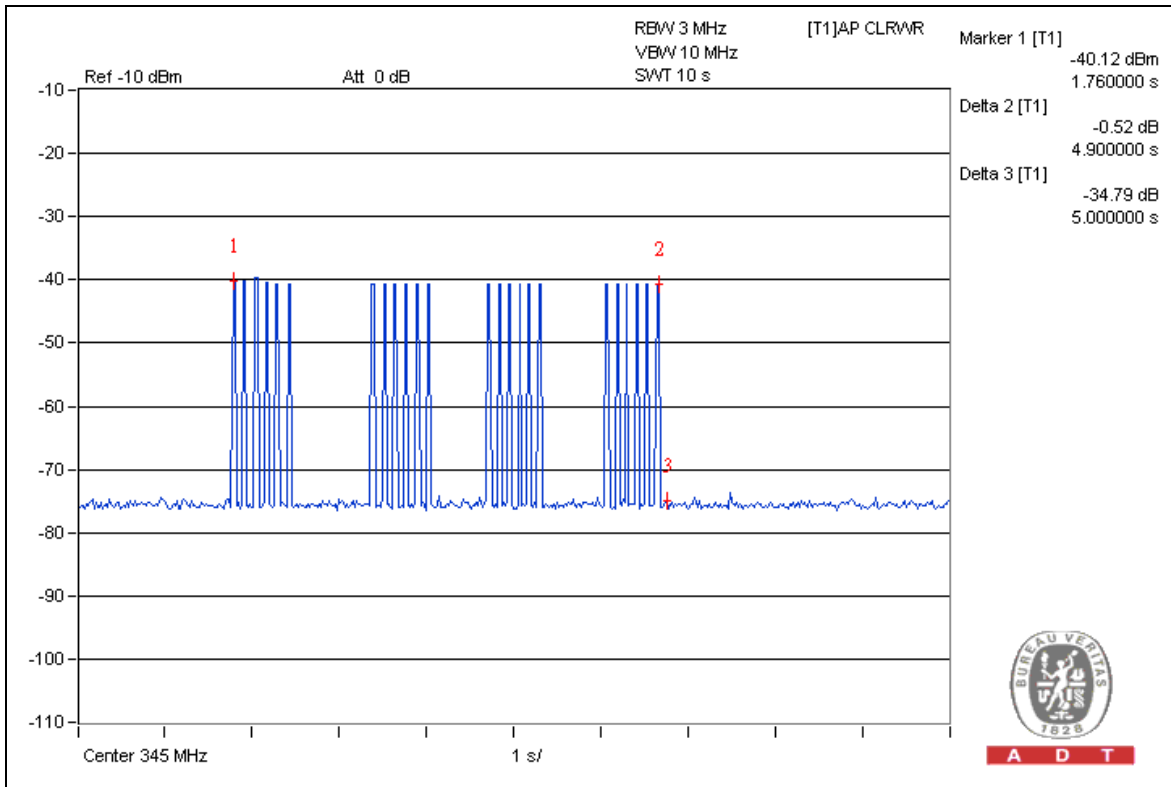
Same as Item 4.2.6.



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4.3.7 Test Results

Channel	Frequency (MHz)	Transmission Time (Sec)	Maximum Limit (Sec)	Pass/Fail
1	345	4.9	5	Pass



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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