

FCC TEST REPORT

REPORT NO.: RF131211D22 R1
MODEL NO.: 1632
FCC ID: C3K1632
RECEIVED: Dec. 11, 2013
TESTED: Dec. 18, 2013 ~ Jan. 28, 2014
ISSUED: Feb. 5, 2014

APPLICANT: MICROSOFT CORPORATION

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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.	REASON FOR CHANGE	DATE ISSUED
RF131211D22	Original release	Jan. 9, 2014
RF131211D22 R1	Modify first frequency from 2402MHz to 2403MHz	Feb. 5, 2014

1. CERTIFICATION

PRODUCT: Wireless Keyboard

BRAND NAME: Microsoft®

MODEL NO.: 1632

APPLICANT: MICROSOFT CORPORATION

TESTED: Dec. 18, 2013 ~ Jan. 28, 2014

TEST SAMPLE: ENGINEERING SAMPLE

STANDARDS: FCC Part 15, Subpart C (Section 15.249)

ANSI C63.10-2009

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 : Jessica Cheng , **DATE:** Feb. 5, 2014
(Jessica Cheng / Senior Specialist)

APPROVED BY : Rex Lai , **DATE:** Feb. 5, 2014
(Rex Lai / Assistant Manager)

2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15, Subpart C (Section 15.249)			
STANDARD PARAGRAPH	TEST TYPE	RESULT	REMARK
15.207	Conducted Emission Test	N/A	Power supply is 3.0Vdc from batteries
15.209 15.249 15.249 (d)	Radiated Emission Test Band Edge Measurement Limit: 50dB less than the peak value of fundamental frequency or meet radiated emission limit in section 15.209	PASS	Meet the requirement of limit. Minimum passing margin is -5.4dB at 2390.00MHz.

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:

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Measurement	Frequency	Uncertainty
Radiated emissions	30MHz ~ 1GHz	4.30 dB
	Above 1GHz	3.36 dB

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

EUT	Wireless Keyboard
MODEL NO.	1632
POWER SUPPLY	3.0Vdc
MODULATION TYPE	GFSK
OPERATING FREQUENCY	2403MHz ~ 2480MHz
NUMBER OF CHANNEL	24
ANTENNA TYPE	PCB antenna with -5.96dBi gain
DATA CABLE	N/A
I/O PORT	N/A
ACCESSORY DEVICES	N/A

NOTE:

1. The EUT is a Wireless Keyboard.
2. The EUT has serial samples, which are defined as their serial numbers as follows:

Model No.	Serial no.
1632	EV2-036, EV2-082, EV2-083

3. The above EUT information is declared by the manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

3.2 DESCRIPTION OF TEST MODES

24 channels are provided to this EUT:

Channel Group	Channel	Frequency (MHz)	Channel Group	Channel	Frequency (MHz)
Subset 1	0	2403	Subset 4	12	2408
	1	2422		13	2428
	2	2447		14	2453
	3	2470		15	2476
Subset 2	4	2404	Subset 5	16	2418
	5	2424		17	2430
	6	2449		18	2455
	7	2472		19	2478
Subset 3	8	2406	Subset 6	20	2420
	9	2426		21	2445
	10	2451		22	2457
	11	2474		23	2480

3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

EUT CONFIGURE MODE	APPLICABLE TO					DESCRIPTION
	PLC	RE ³ 1G	RE<1G	BM	FT	
-	Note	√	√	√	√	-

Where **PLC**: Power Line Conducted Emission **RE³1G**: Radiated Emission above 1GHz
RE<1G: Radiated Emission below 1GHz **BM**: Bandedge Measurement
FT: Frequency Tolerance

NOTE: No need to concern of Conducted Emission due to the EUT is powered by batteries.

RADIATED EMISSION TEST (ABOVE 1 GHz):

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

EUT CONFIGURE MODE	SERIAL NO.	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
-	EV2-036, EV2-082, EV2-083	0 to 23	0, 21, 23	GFSK

RADIATED EMISSION TEST (BELOW 1 GHz):

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

EUT CONFIGURE MODE	SERIAL NO.	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
-	EV2-036, EV2-082, EV2-083	0 to 23	0	GFSK

BANDEDGE MEASUREMENT:

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

EUT CONFIGURE MODE	SERIAL NO.	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
-	EV2-083	0 to 23	0, 23	GFSK

FREQUENCY TOLERANCE:

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

EUT CONFIGURE MODE	SERIAL NO.	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
-	EV2-083	0 to 23	0, 21, 23	GFSK

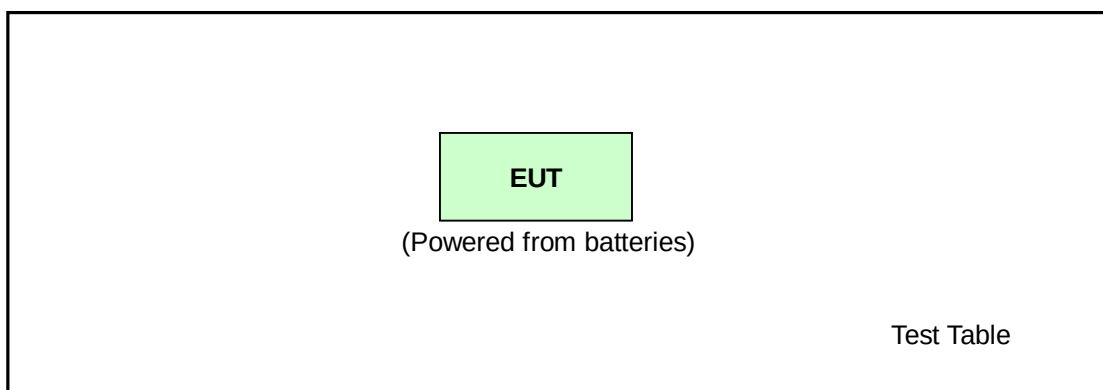
TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE ³ 1G	23deg. C, 74% RH	3Vdc	Joey Liu
RE<1G	23deg. C, 74% RH	3Vdc	Joey Liu
BM	26deg. C, 73% RH	3Vdc	Dalen Dai
FT	26deg. C, 73% RH	3Vdc	Dalen Dai

3.3 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together without any necessary accessory or support 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 (Section 15.249)

ANSI C63.10-2009

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

NOTE: The product 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 CONDUCTED EMISSION MEASUREMENT

N/A

4.2 RADIATED EMISSION AND BAND EDGE MEASUREMENT

4.2.1 LIMITS OF RADIATED EMISSION AND BAND EDGE MEASUREMENT

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following

Fundamental Frequency	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 ~ 24.25 GHz	250	2500

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits as below table, whichever is the lesser attenuation

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 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.

4.2.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
HP Preamplifier	8447D	2432A03504	Feb. 26, 2013	Feb. 25, 2014
HP Preamplifier	8449B	3008A01201	Feb. 26, 2013	Feb. 25, 2014
Agilent TEST RECEIVER	N9038A	MY51210129	Jan. 03, 2014	Jan. 02, 2015
Schwarzbeck Antenna	VULB 9168	137	Mar. 20, 2013	Mar. 19, 2014
Schwarzbeck Antenna	VHBA 9123	480	May 29, 2013	May 28, 2014
ADT. Turn Table	TT100	0306	NA	NA
ADT. Tower	AT100	0306	NA	NA
Software	ADT_Radiated_V 7.6.15.9.2	NA	NA	NA
SUHNER RF cable	SF102	CABLE-CH6	Aug. 16, 2013	Aug. 15, 2014
Schwarzbeck Horn Antenna	BBHA 9120-D1	D130	May 13, 2013	May 12, 2014
Highpass filter Wainwright Instruments	WHK 3.1/18G-10SS	SN 8	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 horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
3. The test was performed in Chamber No. 6.
4. The Industry Canada Reference No. IC 7450E-6.
5. The FCC Site Registration No. is 447212.

4.2.3 TEST PROCEDURES

- a. 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.
- 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 is a broadband antenna, and its 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 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 Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

NOTE:

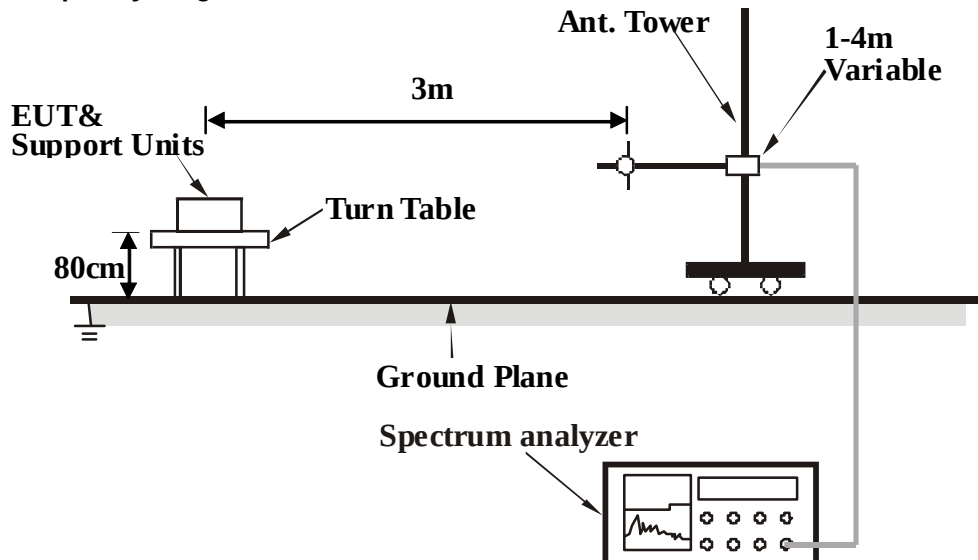
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. All modes of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

4.2.4 DEVIATION FROM TEST STANDARD

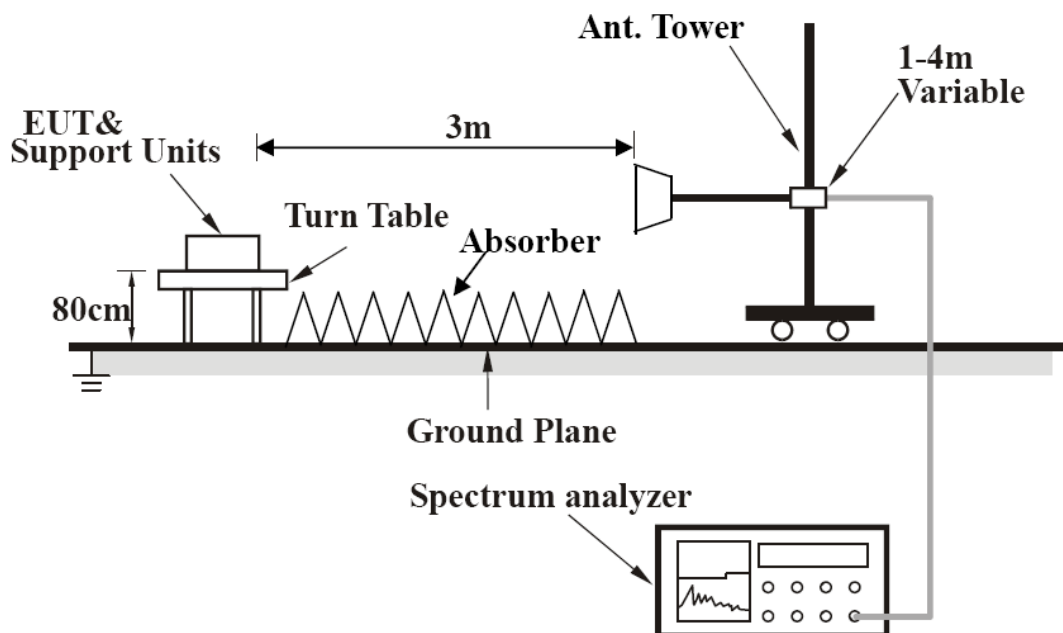
No deviation.

4.2.5 TEST SETUP

Frequency range 30MHz~1GHz



Frequency range above 1GHz



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

4.2.6 EUT OPERATING CONDITIONS

Set the EUT under transmission condition continuously at specific channel frequency.

4.2.7 TEST RESULTS

ABOVE 1GHz DATA (For Fundamental, Harmonics)

EVT2-083

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
SERIAL NO.	EVT2-083		

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	2400.00	64.2 PK	74.0	-9.8	1.00 H	201	67.86	-3.70
2	2400.00	29.2 AV	54.0	-24.8	1.00 H	201	32.86	-3.70
3	*2403.00	103.6 PK	114.0	-10.4	1.00 H	201	107.28	-3.69
4	*2403.00	68.6 AV	94.0	-25.4	1.00 H	201	72.28	-3.69
5	4806.00	47.1 PK	74.0	-26.9	1.00 H	209	43.35	3.71
6	4806.00	12.1 AV	54.0	-41.9	1.00 H	209	8.35	3.71
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	2400.00	48.0 PK	74.0	-26.1	1.00 V	288	51.65	-3.70
2	2400.00	13.0 AV	54.0	-41.1	1.00 V	288	16.65	-3.70
3	*2403.00	87.5 PK	114.0	-26.5	1.00 V	288	91.15	-3.69
4	*2403.00	52.5 AV	94.0	-41.5	1.00 V	288	56.15	-3.69
5	4806.00	43.1 PK	74.0	-31.0	1.00 V	293	39.34	3.71
6	4806.00	8.1 AV	54.0	-46.0	1.00 V	293	4.34	3.71

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 + 20log(Duty cycle) Where the duty factor is calculated from following formula:

$$20 \log (\text{Duty cycle}) = 20 \log (0.14 \text{ ms} / 7.9 \text{ ms}) = -35.0 \text{ dB}$$
Please see page 19 for plotted duty.

CHANNEL	TX Channel 21	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
SERIAL NO.	EVT2-083		

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	*2445.00	102.7 PK	114.0	-11.3	1.00 H	201	102.67	0.00
2	*2445.00	67.7 AV	94.0	-26.3	1.00 H	201	67.67	0.00
3	4890.00	42.3 PK	74.0	-31.7	1.00 H	201	42.27	0.00
4	4890.00	7.3 AV	54.0	-46.7	1.00 H	201	7.27	0.00
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	*2445.00	88.2 PK	114.0	-25.9	1.05 V	280	91.65	-3.50
2	*2445.00	53.2 AV	94.0	-40.9	1.05 V	280	56.65	-3.50
3	4890.00	42.7 PK	74.0	-31.3	1.05 V	282	38.96	3.75
4	4890.00	7.7 AV	54.0	-46.3	1.05 V	282	3.96	3.75

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 + 20log(Duty cycle) Where the duty factor is calculated from following formula:

$$20 \log (\text{Duty cycle}) = 20 \log (0.14 \text{ ms} / 7.9 \text{ ms}) = -35.0 \text{ dB}$$
Please see page 19 for plotted duty.



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CHANNEL	TX Channel 23	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
SERIAL NO.	EVT2-083		

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	*2480.00	99.1 PK	114.0	-14.9	1.00 H	200	102.47	-3.33
2	*2480.00	64.1 AV	94.0	-29.9	1.00 H	200	67.47	-3.33
3	2483.50	61.6 PK	74.0	-12.4	1.00 H	200	64.96	-3.32
4	2483.50	26.6 AV	54.0	-27.4	1.00 H	200	29.96	-3.32
5	4960.00	41.9 PK	74.0	-32.2	1.00 H	204	38.15	3.70
6	4960.00	6.9 AV	54.0	-47.2	1.00 H	204	3.15	3.70
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	*2480.00	84.2 PK	114.0	-29.8	1.00 V	279	87.52	-3.33
2	*2480.00	49.2 AV	94.0	-44.8	1.00 V	279	52.52	-3.33
3	2483.50	46.7 PK	74.0	-27.3	1.00 V	279	50.01	-3.32
4	2483.50	11.7 AV	54.0	-42.3	1.00 V	279	15.01	-3.32
5	4960.00	42.2 PK	74.0	-31.8	1.00 V	280	38.53	3.70
6	4960.00	7.2 AV	54.0	-46.8	1.00 V	280	3.53	3.70

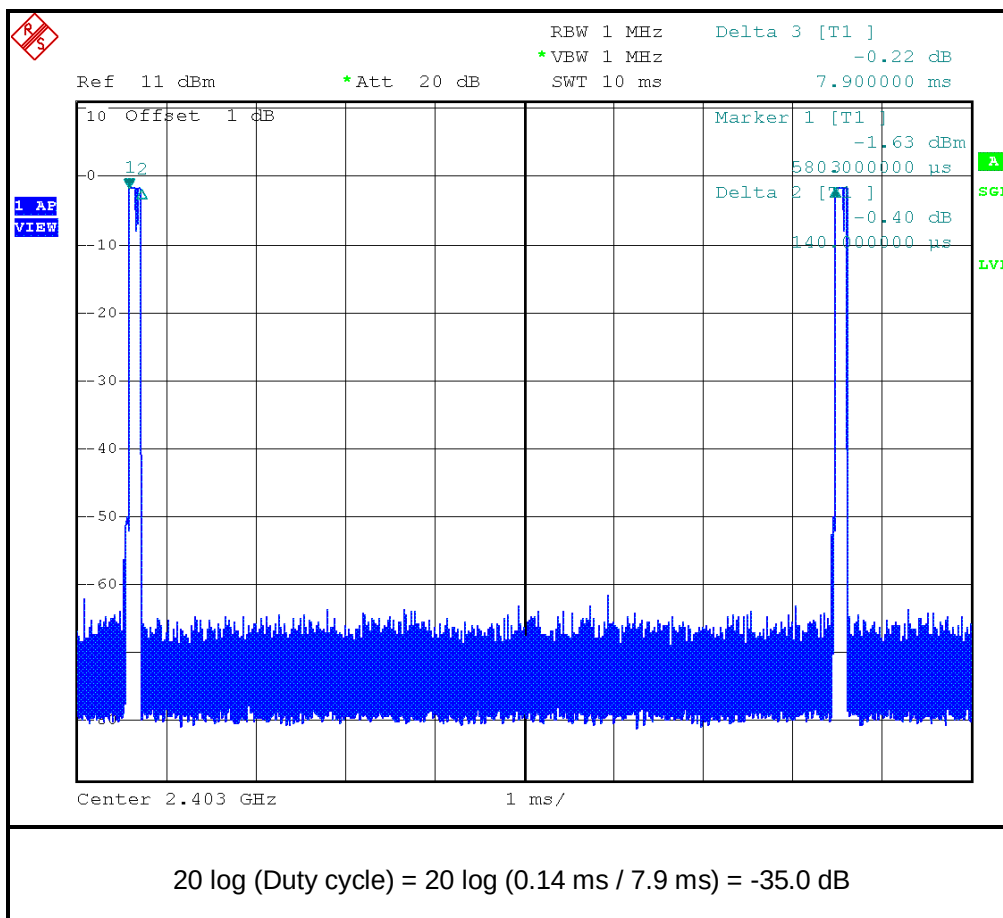
REMARKS:

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.
6. The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:
$$20 \log (\text{Duty cycle}) = 20 \log (0.14 \text{ ms} / 7.9 \text{ ms}) = -35.0 \text{ dB}$$

Please see page 19 for plotted duty.



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ABOVE 1GHz DATA (For Spurious Emission)

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
SERIAL NO.	EVT2-036		

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	2748.00	36.0 PK	74.0	-38.0	1.00 H	11	38.36	-2.32
2	2748.00	24.5 AV	54.0	-29.5	1.00 H	11	26.86	-2.32
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	2748.00	35.0 PK	74.0	-39.0	1.00 V	331	37.36	-2.32
2	2748.00	22.6 AV	54.0	-31.4	1.00 V	331	24.96	-2.32

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

CHANNEL	TX Channel 21	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
SERIAL NO.	EVT2-036		

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	2796.00	36.2 PK	74.0	-37.8	1.00 H	46	38.34	-2.14
2	2796.00	24.6 AV	54.0	-29.4	1.00 H	46	26.74	-2.14
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	2796.00	35.1 PK	74.0	-38.9	1.00 V	278	37.23	-2.14
2	2796.00	23.2 AV	54.0	-30.8	1.00 V	278	25.31	-2.14

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

CHANNEL	TX Channel 23	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
SERIAL NO.	EVT2-036		

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	2836.00	36.6 PK	74.0	-37.4	1.00 H	263	38.65	-2.02
2	2836.00	24.5 AV	54.0	-29.5	1.00 H	263	26.53	-2.02
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	2836.00	35.2 PK	74.0	-38.8	1.00 V	136	37.25	-2.02
2	2836.00	23.3 AV	54.0	-30.7	1.00 V	136	25.31	-2.02

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

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
SERIAL NO.	EVT2-082		

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	2748.00	36.1 PK	74.0	-37.9	1.00 H	58	38.44	-2.32
2	2748.00	24.1 AV	54.0	-29.9	1.00 H	58	26.39	-2.32
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	2748.00	35.2 PK	74.0	-38.8	1.00 V	355	37.56	-2.32
2	2748.00	23.3 AV	54.0	-30.7	1.00 V	355	25.63	-2.32

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

CHANNEL	TX Channel 21	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
SERIAL NO.	EVT2-082		

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	2796.00	36.2 PK	74.0	-37.8	1.00 H	34	38.36	-2.14
2	2796.00	24.2 AV	54.0	-29.8	1.00 H	34	26.37	-2.14
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	2796.00	35.1 PK	74.0	-38.9	1.00 V	254	37.22	-2.14
2	2796.00	22.9 AV	54.0	-31.1	1.00 V	254	25.06	-2.14

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

CHANNEL	TX Channel 23	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
SERIAL NO.	EVT2-082		

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	2836.00	36.3 PK	74.0	-37.7	1.00 H	225	38.32	-2.02
2	2836.00	24.8 AV	54.0	-29.2	1.00 H	225	26.78	-2.02
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	2836.00	35.2 PK	74.0	-38.8	1.00 V	236	37.25	-2.02
2	2836.00	23.1 AV	54.0	-30.9	1.00 V	236	25.13	-2.02

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

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
SERIAL NO.	EVT2-083		

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	2390.00	68.6 PK	74.0	-5.4	1.00 H	201	72.35	-3.75
2	2390.00	38.4 AV	54.0	-15.6	1.00 H	201	42.13	-3.75
3	2748.00	36.4 PK	74.0	-37.6	1.00 H	53	38.68	-2.32
4	2748.00	23.9 AV	54.0	-30.1	1.00 H	53	26.18	-2.32
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	2390.00	50.2 PK	74.0	-23.8	1.00 V	288	53.96	-3.75
2	2390.00	36.4 AV	54.0	-17.6	1.00 V	288	40.14	-3.75
3	2748.00	35.7 PK	74.0	-38.3	1.00 V	35	37.99	-2.32
4	2748.00	22.8 AV	54.0	-31.2	1.00 V	35	25.15	-2.32

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

CHANNEL	TX Channel 21	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
SERIAL NO.	EVT2-083		

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	2796.00	36.5 PK	74.0	-37.5	1.00 H	236	38.65	-2.14
2	2796.00	24.2 AV	54.0	-29.8	1.00 H	236	26.32	-2.14
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	2796.00	35.1 PK	74.0	-38.9	1.00 V	21	37.22	-2.14
2	2796.00	23.0 AV	54.0	-31.0	1.00 V	21	25.17	-2.14

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

CHANNEL	TX Channel 23	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
SERIAL NO.	EVT2-083		

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	2836.00	36.4 PK	74.0	-37.6	1.00 H	247	38.45	-2.02
2	2836.00	24.4 AV	54.0	-29.6	1.00 H	247	26.45	-2.02
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	2836.00	35.2 PK	74.0	-38.8	1.00 V	347	37.22	-2.02
2	2836.00	23.4 AV	54.0	-30.6	1.00 V	347	25.39	-2.02

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

BELOW 1GHz WORST-CASE DATA

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		
SERIAL NO.	EVT2-036		

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	143.97	24.5 QP	43.5	-19.0	1.27 H	294	37.84	-13.30
2	199.94	32.9 QP	43.5	-10.7	1.36 H	274	48.80	-15.95
3	240.00	32.9 QP	46.0	-13.1	1.14 H	254	47.00	-14.06
4	266.58	32.8 QP	46.0	-13.2	1.28 H	269	45.55	-12.76
5	372.26	30.3 QP	46.0	-15.7	1.59 H	340	40.22	-9.93
6	528.00	26.7 QP	46.0	-19.3	1.73 H	93	33.56	-6.90
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	47.99	30.4 QP	40.0	-9.6	1.23 V	3	44.24	-13.88
2	166.58	33.7 QP	43.5	-9.8	1.17 V	85	47.23	-13.53
3	199.07	27.7 QP	43.5	-15.8	1.39 V	327	43.59	-15.89
4	377.99	26.4 QP	46.0	-19.6	1.46 V	235	36.21	-9.84
5	424.21	27.4 QP	46.0	-18.6	1.72 V	185	36.47	-9.04
6	528.00	27.9 QP	46.0	-18.1	1.16 V	271	34.81	-6.90

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

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		
SERIAL NO.	EVT2-082		

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	166.62	27.0 QP	43.5	-16.6	1.07 H	157	40.48	-13.53
2	199.85	33.4 QP	43.5	-10.1	1.34 H	287	49.33	-15.94
3	240.00	32.3 QP	46.0	-13.7	1.16 H	273	46.34	-14.06
4	287.78	29.8 QP	46.0	-16.2	1.27 H	16	41.63	-11.79
5	383.23	30.7 QP	46.0	-15.3	1.53 H	357	40.59	-9.85
6	528.00	26.8 QP	46.0	-19.2	1.17 H	86	33.74	-6.90
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	47.99	30.5 QP	40.0	-9.6	1.37 V	271	44.33	-13.88
2	87.04	28.5 QP	40.0	-11.5	1.24 V	198	47.55	-19.03
3	166.62	33.0 QP	43.5	-10.5	1.74 V	106	46.52	-13.53
4	199.94	29.2 QP	43.5	-14.3	1.33 V	326	45.13	-15.95
5	424.31	25.9 QP	46.0	-20.1	1.16 V	204	34.94	-9.04
6	528.00	28.4 QP	46.0	-17.6	1.25 V	286	35.27	-6.90

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

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		
SERIAL NO.	EVT2-083		

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	166.48	34.0 QP	43.5	-9.5	1.39 H	282	47.54	-13.54
2	199.94	27.8 QP	43.5	-15.7	1.52 H	147	43.71	-15.95
3	256.74	28.6 QP	46.0	-17.4	1.00 H	348	41.87	-13.29
4	281.13	30.3 QP	46.0	-15.7	1.76 H	162	42.17	-11.88
5	388.71	29.2 QP	46.0	-16.9	1.34 H	137	38.84	-9.69
6	528.00	26.4 QP	46.0	-19.6	1.16 H	91	33.29	-6.90
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	47.99	29.6 QP	40.0	-10.4	1.37 V	251	43.50	-13.88
2	116.09	27.9 QP	43.5	-15.6	1.27 V	261	43.88	-15.96
3	166.48	31.1 QP	43.5	-12.4	1.52 V	175	44.61	-13.54
4	199.90	32.9 QP	43.5	-10.6	1.37 V	360	48.81	-15.94
5	376.77	32.0 QP	46.0	-14.0	1.56 V	281	41.90	-9.91
6	528.00	28.3 QP	46.0	-17.7	1.42 V	251	35.19	-6.90

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

4.3 FREQUENCY TOLERANCE MEASUREMENT

4.3.1 LIMITS OF FREQUENCY TOLERANCE MEASUREMENT

Limit : $\pm 0.001\%$

4.3.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
ROHDE & SCHWARZ Spectrum Analyzer	FSP 40	100036	May 17, 2013	May 16, 2014

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.3.3 TEST PROCEDURE

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.001\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

4.3.4 DEVIATION FROM TEST STANDARD

No deviation

4.3.5 EUT OPERATING CONDITION

Same as Item 4.2.6



A D T

4.3.6 TEST RESULTS

SERIAL NO.	EVT2-083		
INPUT POWER	3Vdc	CHANNEL	0, 21, 23

CH 0

TEST CONDITION			Carrier Frequency (MHz)	Frequency Drift (kHz)	Frequency error (%)
Tnom(°C)	20	Vnom(V)	2403.0044	0	0%
Tmin(°C)	-20	Vmin(V)	2403.0072	2.80	0.00012%
		Vmax(V)	2403.0079	3.50	0.00015%
Tmax(°C)	55	Vmin(V)	2402.9920	-12.40	-0.00052%
		Vmax(V)	2402.9925	-11.90	-0.00050%
Limit : ±0.001%					

CH 21

TEST CONDITION			Carrier Frequency (MHz)	Frequency Drift (kHz)	Frequency error (%)
Tnom(°C)	20	Vnom(V)	2445.0048	0	0%
Tmin(°C)	-20	Vmin(V)	2445.0104	5.60	0.00023%
		Vmax(V)	2445.0113	6.50	0.00027%
Tmax(°C)	55	Vmin(V)	2444.9908	-14.00	-0.00057%
		Vmax(V)	2444.9919	-12.90	-0.00053%
Limit : ±0.001%					

CH 23

TEST CONDITION			Carrier Frequency (MHz)	Frequency Drift (kHz)	Frequency error (%)
Tnom(°C)	20	Vnom(V)	2480.0040	0	0%
Tmin(°C)	-20	Vmin(V)	2480.0092	5.20	0.00021%
		Vmax(V)	2480.0101	6.10	0.00025%
Tmax(°C)	55	Vmin(V)	2479.9912	-12.80	-0.00052%
		Vmax(V)	2479.9925	-11.50	-0.00046%
Limit : ±0.001%					

5. PHOTOGRAPHS OF THE TEST CONFIGURATION

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

6. 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:

Linko EMC/RF Lab

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF Lab

Tel: 886-3-5935343

Fax: 886-3-5935342

Hwa Ya EMC/RF/Safety/Telecom Lab

Tel: 886-3-3183232

Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com

Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

7. APPENDIX A – MODIFICATION RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No modifications were made to the EUT by the lab during the test.

---END---