

FCC Test Report

Report No.: RF150630D07

FCC ID: C3K1728

Test Model: 1728

Received Date: Jun. 23, 2015

Test Date: Jun. 23 ~ Jul. 1, 2015

Issued Date: Jul. 7, 2015

Applicant: MICROSOFT CORPORATION

Address: ONE MICROSOFT WAY REDMOND, WA 98052-6399, U.S.A

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

Lab Address: No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan (R.O.C.)



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A D T

Release Control Record

Issue No.	Description	Date Issued
RF150630D07	Original release.	Jul. 7, 2015

1 Certificate of Conformity

Product: Wireless keyboard

Brand: Microsoft®

Test Model: 1728

Sample Status: Engineering sample

Applicant: MICROSOFT CORPORATION

Test Date: Jun. 23 ~ Jul. 1, 2015

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.249)
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 :



(Celia Chen / Senior Specialist)

Date: Jul. 7, 2015

Approved by :



(Rex Lai / Assistant Manager)

Date: Jul. 7, 2015

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (SECTION 15.249)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	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 -7.0dB at 2483.50MHz.

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) ($\pm$)
Radiated Emissions up to 1 GHz	30MHz ~ 1000MHz	4.00 dB
Radiated Emissions above 1 GHz	Above 1GHz	3.36 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Wireless keyboard
Brand	Microsoft®
Test Model	1728
Status of EUT	Engineering sample
Power Supply Rating	3Vdc from batteries
Modulation Type	GFSK
Operating Frequency	2403MHz ~ 2480MHz
Number of Channel	24
Antenna Type	PCB antenna with 1.47dBi gain
Antenna Connector	N/A
Accessory Device	N/A
Data Cable Supplied	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.
1728	0200801987604, 0200801987606, 0200801987608, 0200801987609

3. 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

24 channels are provided to this EUT:

Channel Group	Channel	Frequency (MHz)	Channel Group	Channel	Frequency (MHz)
Subset A	0	2403	Subset D	12	2405
	1	2419		13	2425
	2	2478		14	2444
	3	2468		15	2452
Subset B	4	2429	Subset E	16	2423
	5	2450		17	2446
	6	2470		18	2456
	7	2480		19	2474
Subset C	8	2421	Subset F	20	2417
	9	2431		21	2427
	10	2472		22	2448
	11	2454		23	2476

3.2.1 Test Mode Applicability and Tested Channel Detail

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

Where **RE³1G**: Radiated Emission above 1GHz & Bandedge Measurement

RE<1G: Radiated Emission below 1GHz

PLC: Power Line Conducted Emission

APCM: Antenna Port Conducted Measurement

FT: Frequency Tolerance

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

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.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	SERIAL NO.
-	0 to 23	0, 14, 7	GFSK	0200801987604
-	0 to 23	0, 14, 7	GFSK	0200801987608
-	0 to 23	0, 14, 7	GFSK	0200801987609

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.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	SERIAL NO.
-	0 to 23	0	GFSK	0200801987604
-	0 to 23	0	GFSK	0200801987608
-	0 to 23	0	GFSK	0200801987609

Frequency Tolerance:

- ☒ 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.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	SERIAL NO.
-	0 to 23	0, 14, 7	GFSK	0200801987606

**Test Condition:**

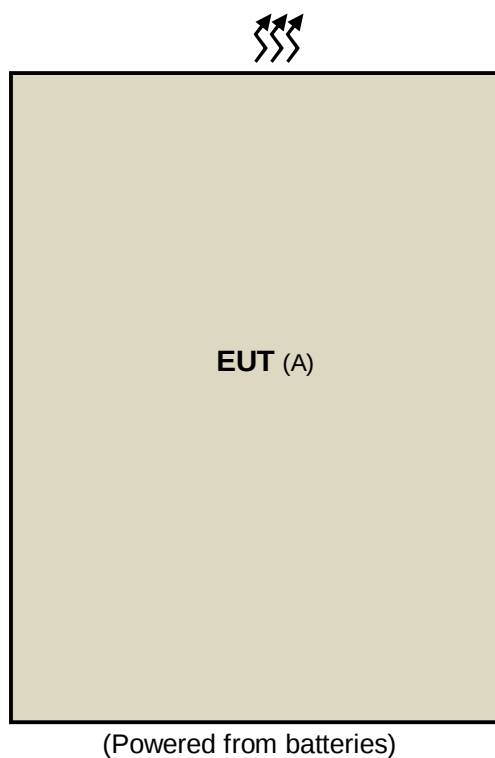
APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE ³ 1G	28deg. C, 61%RH	3Vdc	Aaron You
RE<1G	28deg. C, 61%RH	3Vdc	Aaron You
FT	24deg. C, 75%RH	3Vdc	Saxon Lee

3.3 Description of Support Units

The EUT has been tested as an independent unit together without any necessary accessory or support unit.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	EUT	Microsoft®	1728	0200801987604, 0200801987606, 0200801987608, 0200801987609	-	-

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 (15.249)

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 and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge 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:

- The lower limit shall apply at the transition frequencies.
- Emission level (dBuV/m) = $20 \log$ Emission level (uV/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
HP Preamplifier	8447D	2432A03504	Feb. 26, 2015	Feb. 25, 2016
HP Preamplifier	8449B	3008A01201	Feb. 26, 2015	Feb. 25, 2016
MITEQ Preamplifier	AMF-6F-260400-33-8P	892164	Mar. 01, 2015	Feb. 28, 2016
Agilent Spectrum	E4446A	MY51100050	Oct. 24, 2014	Oct. 23, 2015
Agilent TEST RECEIVER	N9038A	MY51210129	Jan. 20, 2015	Jan. 19, 2016
Schwarzbeck Antenna	VULB 9168	139	Feb. 04, 2015	Feb. 03, 2016
Schwarzbeck Antenna	VHBA 9123	480	May 29, 2015	May 28, 2017
Schwarzbeck Horn Antenna	BBHA-9170	212	Feb. 09, 2015	Feb. 08, 2016
Schwarzbeck Horn Antenna	BBHA 9120-D1	D130	Feb. 10, 2015	Feb. 09, 2016
ADT. Turn Table	TT100	0306	NA	NA
ADT. Tower	AT100	0306	NA	NA
Software	ADT_Radiated_V7.6.15.9.4	NA	NA	NA
SUHNER RF cable	SF104	CABLE-CH6	Aug. 15, 2014	Aug. 14, 2015
SUHNER RF cable	SF102	Cable-CH8-3.6m	Aug. 15, 2014	Aug. 14, 2015
EMCO Horn Antenna	3115	00028257	Feb. 05, 2015	Feb. 04, 2016
Highpass filter Wainwright Instruments	WHK 3.1/18G-10SS	SN 8	NA	NA
ROHDE & SCHWARZ Spectrum Analyzer	FSV40	101042	Sep. 29, 2014	Sep. 28, 2015
Anritsu Power Sensor	MA2411B	0738404	Apr. 21, 2015	Apr. 20, 2016
Anritsu Power Meter	ML2495A	0842014	Apr. 21, 2015	Apr. 20, 2016

- NOTE:**
1. The calibration interval of the above test instruments is 12/24 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.

4.1.3 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:

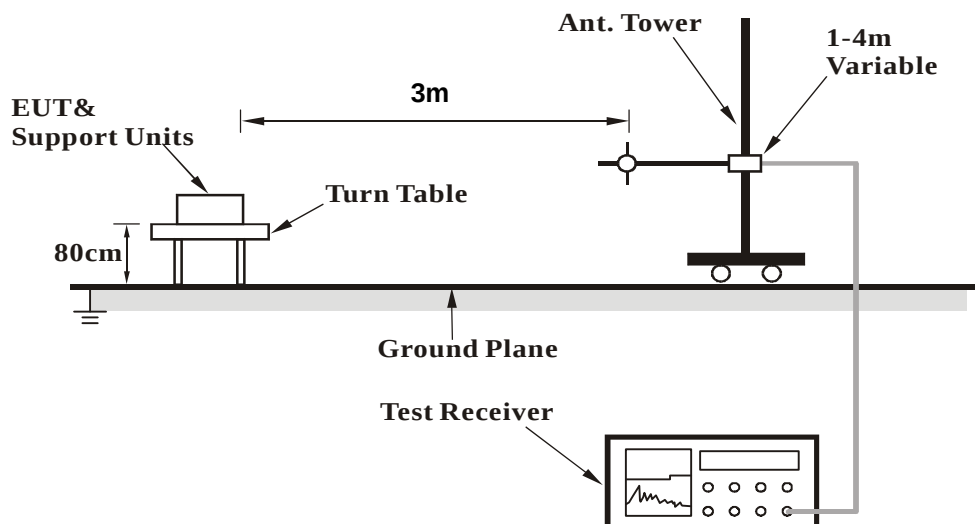
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average (Duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor ($10 \log(1/\text{duty cycle})$).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

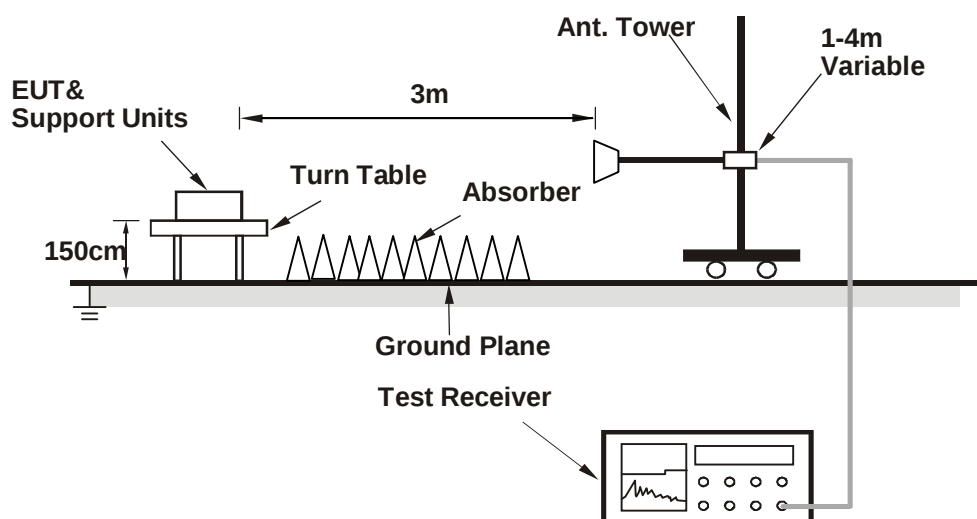
No deviation.

4.1.5 Test Set Up

<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

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

4.1.7 Test Results

Above 1GHz Data (For Fundamental, Harmonics) :

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
SERIAL NO.	0200801987609		

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	*2403.00	90.4 PK	114.0	-23.6	1.84 H	62	94.66	-4.25
2	*2403.00	57.2 AV	94.0	-36.8	1.84 H	62	61.46	-4.25
3	4806.00	45.0 PK	74.0	-29.0	1.32 H	90	42.11	2.90
4	4806.00	11.8 AV	54.0	-42.2	1.32 H	90	8.91	2.90
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	*2403.00	83.4 PK	114.0	-30.6	2.21 V	177	87.62	-4.25
2	*2403.00	50.2 AV	94.0	-43.8	2.21 V	177	54.42	-4.25
3	4806.00	44.2 PK	74.0	-29.8	1.00 V	239	41.29	2.90
4	4806.00	11.0 AV	54.0	-43.0	1.00 V	239	8.09	2.90

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:

$$20 \log (\text{Duty cycle}) = 20 \log (0.173 \text{ ms} / 7.942 \text{ ms}) = -33.2 \text{ dB}$$
Please see page 19 for plotted duty.

CHANNEL	TX Channel 14	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
SERIAL NO.	0200801987609		

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	*2444.00	91.6 PK	114.0	-22.4	1.61 H	46	95.69	-4.05
2	*2444.00	58.4 AV	94.0	-35.6	1.61 H	46	62.49	-4.05
3	4888.00	45.3 PK	74.0	-28.8	2.04 H	87	42.16	3.09
4	4888.00	12.1 AV	54.0	-42.0	2.04 H	87	8.96	3.09
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	*2444.00	82.0 PK	114.0	-32.0	2.56 V	78	86.05	-4.05
2	*2444.00	48.8 AV	94.0	-45.2	2.56 V	78	52.85	-4.05
3	4888.00	44.0 PK	74.0	-30.0	1.00 V	244	40.89	3.09
4	4888.00	10.8 AV	54.0	-43.2	1.00 V	244	7.69	3.09

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:

$$20 \log (\text{Duty cycle}) = 20 \log (0.173 \text{ ms} / 7.942 \text{ ms}) = -33.2 \text{ dB}$$
Please see page 19 for plotted duty.

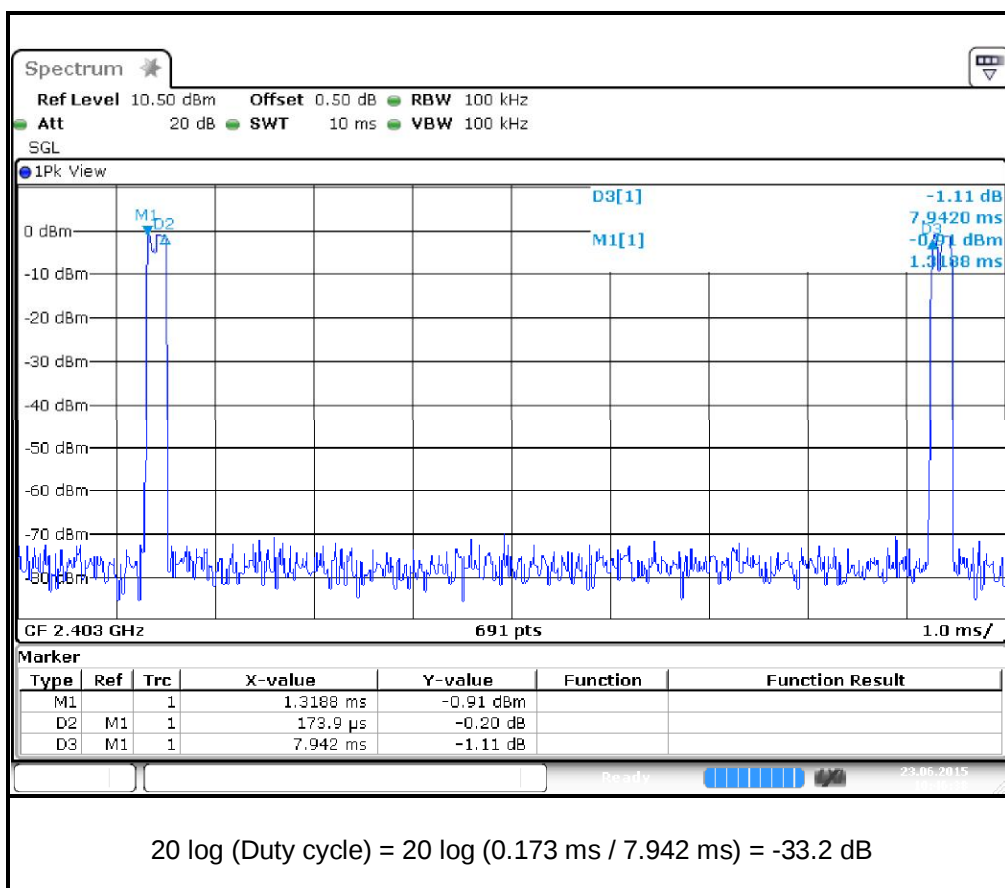
CHANNEL	TX Channel 7	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
SERIAL NO.	0200801987609		

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	92.6 PK	114.0	-21.4	1.77 H	48	96.51	-3.88
2	*2480.00	59.4 AV	94.0	-34.6	1.77 H	48	63.31	-3.88
3	4960.00	47.6 PK	74.0	-26.4	1.55 H	86	44.28	3.33
4	4960.00	14.4 AV	54.0	-39.6	1.55 H	86	11.08	3.33
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	81.5 PK	114.0	-32.5	2.66 V	286	85.36	-3.88
2	*2480.00	48.3 AV	94.0	-45.7	2.66 V	286	52.16	-3.88
3	4960.00	46.4 PK	74.0	-27.6	1.05 V	239	43.10	3.33
4	4960.00	13.2 AV	54.0	-40.8	1.05 V	239	9.90	3.33

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:

$$20 \log (\text{Duty cycle}) = 20 \log (0.173 \text{ ms} / 7.942 \text{ ms}) = -33.2 \text{ dB}$$
Please see page 19 for plotted duty.



ABOVE 1GHz DATA (For Spurious Emission) :

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
SERIAL NO.	0200801987604		

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	41.0 PK	74.0	-33.0	1.02 H	68	43.58	-2.59
2	2748.00	28.4 AV	54.0	-25.6	1.02 H	68	30.99	-2.59
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	39.5 PK	74.0	-34.5	1.00 V	163	42.05	-2.59
2	2748.00	27.5 AV	54.0	-26.5	1.00 V	163	30.11	-2.59

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 14	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
SERIAL NO.	0200801987604		

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	2795.00	41.4 PK	74.0	-32.6	1.23 H	88	43.87	-2.50
2	2795.00	28.5 AV	54.0	-25.5	1.23 H	88	31.04	-2.50
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	2795.00	39.9 PK	74.0	-34.2	2.03 V	177	42.35	-2.50
2	2795.00	27.8 AV	54.0	-26.2	2.03 V	177	30.26	-2.50

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 7	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
SERIAL NO.	0200801987604		

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	41.8 PK	74.0	-32.2	1.42 H	80	44.18	-2.37
2	2836.00	29.7 AV	54.0	-24.3	1.42 H	80	32.05	-2.37
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	39.8 PK	74.0	-34.2	1.35 V	102	42.20	-2.37
2	2836.00	28.2 AV	54.0	-25.8	1.35 V	102	30.57	-2.37

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.	0200801987608		

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	40.4 PK	74.0	-33.6	1.18 H	69	43.01	-2.59
2	2748.00	28.0 AV	54.0	-26.0	1.18 H	69	30.55	-2.59
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	40.0 PK	74.0	-34.0	1.00 V	154	42.62	-2.59
2	2748.00	27.6 AV	54.0	-26.4	1.00 V	154	30.15	-2.59

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 14	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
SERIAL NO.	0200801987608		

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	2795.00	41.4 PK	74.0	-32.6	1.21 H	76	43.87	-2.50
2	2795.00	28.7 AV	54.0	-25.3	1.21 H	76	31.22	-2.50
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	2795.00	39.9 PK	74.0	-34.1	1.89 V	168	42.38	-2.50
2	2795.00	28.2 AV	54.0	-25.8	1.89 V	168	30.66	-2.50

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 7	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
SERIAL NO.	0200801987608		

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	41.5 PK	74.0	-32.5	1.60 H	70	43.89	-2.37
2	2836.00	29.4 AV	54.0	-24.6	1.60 H	70	31.77	-2.37
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	39.9 PK	74.0	-34.1	1.39 V	103	42.31	-2.37
2	2836.00	28.2 AV	54.0	-25.8	1.39 V	103	30.58	-2.37

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.	0200801987609		

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	51.4 PK	74.0	-22.6	1.84 H	62	55.70	-4.34
2	2390.00	37.2 AV	54.0	-16.8	1.84 H	62	41.50	-4.34
3	2400.00	46.8 PK	74.0	-27.2	1.84 H	62	51.03	-4.27
4	2400.00	13.6 AV	54.0	-40.4	1.84 H	62	17.83	-4.27
5	2748.00	41.0 PK	74.0	-33.0	1.10 H	73	43.62	-2.59
6	2748.00	28.4 AV	54.0	-25.6	1.10 H	73	30.98	-2.59
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	49.1 PK	74.0	-24.9	2.21 V	177	53.45	-4.34
2	2390.00	35.9 AV	54.0	-18.1	2.21 V	177	40.25	-4.34
3	2400.00	46.2 PK	74.0	-27.8	2.21 V	177	50.44	-4.27
4	2400.00	13.0 AV	54.0	-41.0	2.21 V	177	17.24	-4.27
5	2748.00	39.5 PK	74.0	-34.5	1.02 V	150	42.11	-2.59
6	2748.00	27.5 AV	54.0	-26.5	1.02 V	150	30.05	-2.59

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 14	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
SERIAL NO.	0200801987609		

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	2795.00	41.5 PK	74.0	-32.5	1.26 H	82	43.99	-2.50
2	2795.00	28.7 AV	54.0	-25.3	1.26 H	82	31.21	-2.50
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	2795.00	39.6 PK	74.0	-34.4	2.40 V	176	42.11	-2.50
2	2795.00	28.3 AV	54.0	-25.7	2.40 V	176	30.78	-2.50

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 7	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)
SERIAL NO.	0200801987609		

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	2483.50	67.0 PK	74.0	-7.0	1.77 H	49	70.85	-3.85
2	2483.50	33.8 AV	54.0	-20.2	1.77 H	49	37.65	-3.85
3	2836.00	41.8 PK	74.0	-32.2	1.59 H	73	44.21	-2.37
4	2836.00	29.2 AV	54.0	-24.8	1.59 H	73	31.60	-2.37
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	2483.50	55.2 PK	74.0	-18.8	2.66 V	286	59.09	-3.85
2	2483.50	22.0 AV	54.0	-32.0	2.66 V	286	25.89	-3.85
3	2836.00	39.8 PK	74.0	-34.2	1.44 V	90	42.17	-2.37
4	2836.00	28.3 AV	54.0	-25.7	1.44 V	90	30.69	-2.37

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.	0200801987604		

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	41.27	20.4 QP	40.0	-19.6	1.30 H	141	34.76	-14.32
2	131.75	21.3 QP	43.5	-22.2	1.46 H	40	36.35	-15.07
3	191.99	25.0 QP	43.5	-18.5	1.27 H	3	41.26	-16.26
4	256.01	26.6 QP	46.0	-19.4	1.78 H	160	40.54	-13.96
5	448.02	23.2 QP	46.0	-22.9	1.63 H	124	32.49	-9.34
6	875.64	27.1 QP	46.0	-18.9	1.91 H	19	29.15	-2.06
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	56.14	22.7 QP	40.0	-17.3	1.72 V	0	36.75	-14.07
2	117.98	18.7 QP	43.5	-24.9	1.27 V	104	35.09	-16.44
3	303.15	20.4 QP	46.0	-25.6	1.65 V	67	32.58	-12.15
4	697.79	24.3 QP	46.0	-21.7	1.39 V	350	29.27	-4.97
5	793.63	26.8 QP	46.0	-19.2	1.48 V	274	30.00	-3.16
6	919.11	28.0 QP	46.0	-18.0	1.66 V	360	29.19	-1.21

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.	0200801987608		

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	42.32	20.6 QP	40.0	-19.4	1.64 H	179	34.75	-14.19
2	192.04	24.8 QP	43.5	-18.7	1.37 H	7	41.05	-16.26
3	256.01	26.6 QP	46.0	-19.4	1.18 H	165	40.54	-13.96
4	448.02	23.0 QP	46.0	-23.0	1.52 H	132	32.31	-9.34
5	725.39	23.9 QP	46.0	-22.1	1.57 H	341	28.32	-4.43
6	919.68	27.9 QP	46.0	-18.1	1.89 H	0	29.09	-1.20
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	55.61	22.8 QP	40.0	-17.3	1.54 V	224	36.72	-13.97
2	117.93	18.2 QP	43.5	-25.3	1.69 V	259	34.62	-16.45
3	470.48	19.9 QP	46.0	-26.1	1.35 V	296	28.98	-9.08
4	584.16	22.4 QP	46.0	-23.6	1.89 V	123	29.28	-6.84
5	786.72	26.0 QP	46.0	-20.0	1.08 V	320	29.26	-3.24
6	861.97	26.9 QP	46.0	-19.1	1.33 V	144	29.11	-2.19

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.	0200801987609		

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	175.99	24.2 QP	43.5	-19.4	1.73 H	360	38.63	-14.48
2	256.01	25.9 QP	46.0	-20.1	1.62 H	165	39.87	-13.96
3	320.03	22.4 QP	46.0	-23.6	1.88 H	200	34.16	-11.75
4	448.05	24.0 QP	46.0	-22.0	1.51 H	110	33.34	-9.34
5	751.04	25.8 QP	46.0	-20.3	1.09 H	84	29.65	-3.90
6	928.36	27.4 QP	46.0	-18.6	1.39 H	312	28.53	-1.15
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	56.05	23.6 QP	40.0	-16.5	1.35 V	9	37.62	-14.07
2	117.93	23.2 QP	43.5	-20.3	1.76 V	215	39.62	-16.45
3	432.06	19.0 QP	46.0	-27.0	1.53 V	102	28.51	-9.54
4	612.68	23.0 QP	46.0	-23.0	1.81 V	120	29.31	-6.27
5	749.97	25.6 QP	46.0	-20.4	1.16 V	210	29.52	-3.94
6	848.24	27.7 QP	46.0	-18.4	1.47 V	360	30.08	-2.43

REMARKS:

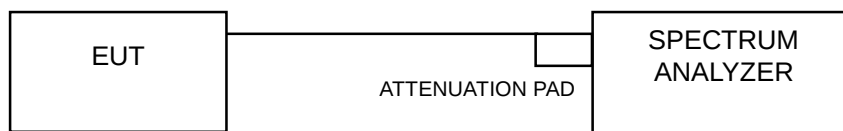
1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

4.2 Frequency Tolerance Measurement

4.2.1 Limits of Frequency Tolerance Measurement

Limit : $\pm 0.001\%$

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 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.

4.2.5 Deviation from Test Standard

No deviation

4.2.6 EUT Operating Condition

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 Results

SERIAL NO.: 0200801987606

CH 0

TEST CONDITION			Carrier Frequency (MHz)	Frequency Drift (kHz)	Frequency error (%)
Tnom(°C)	+20	Vnom(V)	2403.0267	0.00	0.00000%
Tmin(°C)	-20	Vmin(V)	2403.0347	8.00	0.00033%
		Vmax(V)	2403.0347	8.00	0.00033%
Tmax(°C)	+55	Vmin(V)	2403.0271	0.40	0.00002%
		Vmax(V)	2403.0267	0.00	0.00000%
Limit : ±0.001%					

CH 14

TEST CONDITION			Carrier Frequency (MHz)	Frequency Drift (kHz)	Frequency error (%)
Tnom(°C)	+20	Vnom(V)	2444.0271	0.00	0.00000%
Tmin(°C)	-20	Vmin(V)	2444.0351	8.00	0.00033%
		Vmax(V)	2444.0351	8.00	0.00033%
Tmax(°C)	+55	Vmin(V)	2444.0267	-0.40	-0.00002%
		Vmax(V)	2444.0271	0.00	0.00000%
Limit : ±0.001%					

CH 7

TEST CONDITION			Carrier Frequency (MHz)	Frequency Drift (kHz)	Frequency error (%)
Tnom(℃)	+20	Vnom(V)	2480.0275	0.00	0.00000%
Tmin(℃)	-20	Vmin(V)	2480.0355	8.00	0.00032%
		Vmax(V)	2480.0359	8.40	0.00034%
Tmax(℃)	+55	Vmin(V)	2480.0271	-0.40	-0.00002%
		Vmax(V)	2480.0271	-0.40	-0.00002%
Limit : ±0.001%					

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:

Linko EMC/RF Lab

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab

Tel: 886-3-5935343

Fax: 886-3-5935342

Hwa Ya EMC/RF/Safety 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.

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