FCC Test Report

Report No.:	RF170908C01A-4
FCC ID:	HD5-CT60L0N
Test Model:	CT60L0N
Received Date:	Oct. 30, 2017
Test Date:	Nov. 03, 2017
Issued Date:	Nov. 15, 2017
Applicant:	Honeywell International Inc.
Address:	9680 Old Bailes Road, Fort Mill, SC 29707 USA
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
Lab Address:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.
Test Location :	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.

Testing Laboratory
2022

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Release Control Record

Issue No.	Description	Date Issued
RF170908C01A-4	Original release.	Nov. 15, 2017

1 Certificate of Conformity

Product:	Dolphin CT60
Brand:	Honeywell
Test Model:	CT60L0N
Sample Status:	ENGINEERING SAMPLE
Applicant:	Honeywell International Inc.
Test Date:	Nov. 03, 2017
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.225) 47 CFR FCC Part 15, Subpart C (Section 15.215) 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:** Nov. 15, 2017

Claire Kuan / Specialist

Approved by : _____ , **Date:** Nov. 15, 2017

May Chen / Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (SECTION 15.225, 15.215)			
FCC Clause	Test Item	Result	Remarks
15.225 (a)	The field strength of any emissions within the band 13.553-13.567 MHz	PASS	Meet the requirement of limit. Minimum passing margin is –49.8dB at 13.77MHz.
15.225 (b)	The field strength of any emissions within the bands 13.410-13.553 MHz and 13.567-13.710 MHz	PASS	Meet the requirement of limit.
15.225 (c)	The field strength of any emissions within the bands 13.110-13.410 MHz and 13.710-14.010 MHz	PASS	Meet the requirement of limit.
15.225 (d)	The field strength of any emissions appearing outside of the 13.110-14.010 MHz band	PASS	Meet the requirement of limit. Minimum passing margin is -5.80dB at 40.69MHz.

Note: This report is supplementary report.

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	Expanded Uncertainty (k=2) (±)
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.30 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.16 dB
	6GHz ~ 18GHz	4.91 dB
	18GHz ~ 40GHz	5.30 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Dolphin CT60
Brand	Honeywell
Test Model	CT60L0N
Status of EUT	ENGINEERING SAMPLE
HW Version	V1.0
SW Version	249D
HW P/N	DVT2.2
Power Supply Rating	3.6Vdc from battery 5Vdc from USB interface
Modulation Type	ASK
Operating Frequency	13.56MHz
Number of Channel	1
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Battery x 1
Data Cable Supplied	USB snap-on adapter x 1 (1.25m, Shielded with two cores)

Note:

1. This report is prepared for FCC Class II change. The difference compared with the Report No.: RF170908C01-4 design is as the following:
   - ◆ The change list as below table:

No.	Change Item	BOM Change	Layout Change
1	1.U2101 SIM_SWIO_1 connect to SIM1 J1301 2.U2101 SIM_SWIO_2 connect to SIM1 J1303 3. SIM powers path change	Yes	Yes
2	Add a pull-up 100K resistor to VREG_L11A_1P8 at J1202 pin-34 and connect J1202 pin-35 to GPIO_56	Yes	Yes
3	1. Pull-down WIPWR_CHG_OK. 2. There is divided voltage 1.8V from VDC_IN by 180K and 100K resistors to QI_PMA_ON	Yes	Yes
4	Add more vias to mic pads to make the pads hold.	No	Yes
5	They need to be shifted base on MD's drawing.	No	Yes
6	Add more vias to the solder pads to make them hold better. (SW1401~SW1406)	No	Yes
7	Circuit change between J2003 and U2001	Yes	Yes
8	Remove U1901 circuit, just keep J1901,L1906(DNI),R1910(0R), E1911(DNI),EMI1901 from original for RF.	Yes	Yes
9	1.Remove U1801 circuit,just keep EMI1801,EMI1802,R1813,R1812,L1806,J1801,R1809,R1810,R1811 for RF.	Yes	Yes
10	AIN1 pin needs to be pulled down	No	Yes

No.	Change Item	BOM Change	Layout Change
11	CT50 pad size is 2.0x3.0mm but MD team suggests pad size is 1.5x3.0mm because receiver spec suggested having 0.5mm gape requirement.	No	Yes
12	Moving camera's test points x 7 pcs to left	No	Yes
13	Moving U1107 circuit to right for 0.5mm	No	Yes
14	Add additional vias on the battery connector pads	No	Yes
15	RF team needs to have NFC circuit changes and matching components value changes.	Yes	Yes
16	Open a ground pad to contact receiver's back side metal	No	Yes
17	R401 needs to be changed to 33 Ohm	Yes	No
18	Put R1219 and R1220	Yes	No
19	Change Tool1716 to PTH.	No	Yes
20	Add 0.5pF to USIM2_DATA_CONN, USIM1_DATA_CONN between system GND,instead to SIM GND	Yes	Yes
21	Add Ferried Bead and capacitor on Vibrator driving line.	Yes	Yes
22	Remove R505,C512,C513	Yes	Yes

2. According to above conditions, only radiated emissions test item needs to be performed. And all data was verified to meet the requirements.
3. There are WLAN, Bluetooth and NFC technology used for the EUT.
4. Simultaneously transmission condition.

Condition	Technology	
1	WLAN 2.4GHz	NFC
2	WLAN 5GHz	NFC
3	Bluetooth	NFC
Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.		

5. The EUT needs to be supplied from battery, the information is as below table:

Brand	Model No.	Spec.
Inventus	CT50-BTSC	3.6Vdc, 4040mAh, 14.6Wh

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

WLAN / Bluetooth Antenna Spec.				
Antenna No.	Antenna Gain include path loss (dBi)	Frequency rang (GHz)	Antenna type	Connector type
1	0.62	2.4~2.4835	PIFA	UFL
	1.14	5.15~5.25		
	1.14	5.25~5.35		
	1.14	5.47~5.725		
	1.14	5.725~5.85		

NFC Antenna Spec.			
Antenna No.	Frequency rang (MHz)	Antenna type	Connector type
1	13~14	Loop	NA
Note: 1. The antenna has path loss. 2.4GHz: 1dB; 5GHz: 1.7dB			

7. In the original test report, for the radiated emissions, the EUT was pre-tested under the following modes:

Test Mode	Description
Mode A	**Power from laptop**
Mode B	Power from adapter

From the above modes, the worst case was found in **Mode A**. Therefore only the test data of the mode was recorded in this report.

8. 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	13.56

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to	Description
	RE	
1	√	Power from laptop

Where **RE:** Radiated Emission

NOTE: In the oritinal test repot, the EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Z-plane.**

Radiated 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
1	1	ASK

TEST CONDITION:

Applicable To	ENVIRONMENTAL CONDITIONS	INPUT POWER (System)	TESTED BY
RE	23deg. C, 64%RH	120Vac, 60Hz	Rey Chen

3.3 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.	Laptop	HP	Pavilion 14-ab023TU	5CD5340WXZ	FCC DoC	Provided by Lab
B.	Micro SD Card	Transcend	16GB	NA	NA	Provided by Lab

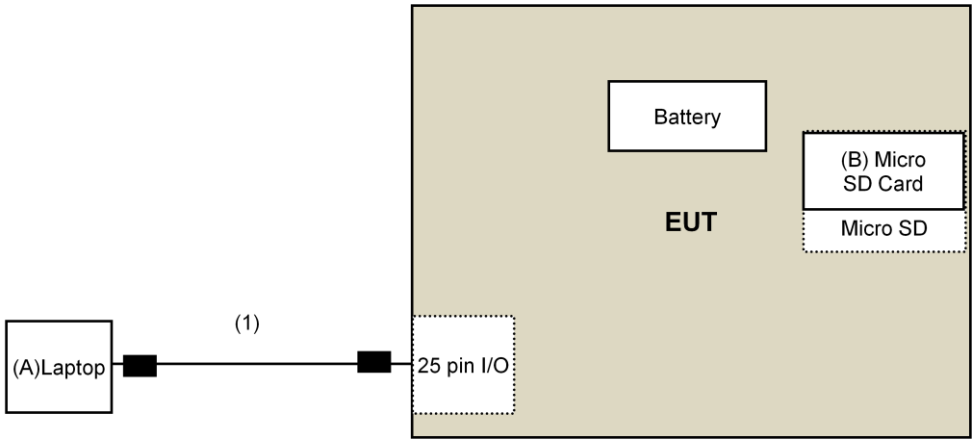
Note:

1. All power cords of the above support units are non-shielded (1.8m).

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB Charging Cable	1	1.25	Yes	2	Supplied by client(for RF Setup)

Note: The core(s) is(are) originally attached to the cable(s).

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 (15.225)

FCC Part 15, Subpart C (15.215)

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

(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209 as below table:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(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.

4.1.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Keysight	N9038A	MY54450088	July 08, 2017	July 07, 2018
Pre-Amplifier(*) EMCI	EMC001340	980142	Jan. 20, 2016	Jan. 19, 2018
Loop Antenna(*) Electro-Metrics	EM-6879	264	Dec. 16, 2016	Dec. 15, 2018
RF Cable	NA	LOOPCAB-001 LOOPCAB-002	Jan. 17, 2017	Jan. 16, 2018
Pre-Amplifier Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-01	Nov. 10, 2016	Nov. 09, 2017
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-406	Dec. 13, 2016	Dec. 12, 2017
RF Cable	8D	966-4-1 966-4-2 966-4-3	Apr. 01, 2017	Mar. 31, 2018
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-4-01	Oct. 03, 2017	Oct. 02, 2018
Horn_Antenna SCHWARZBECK	BBHA 9120D	9120D-783	Dec. 27, 2016	Dec. 26, 2017
Pre-Amplifier EMCI	EMC12630SE	980385	Feb. 02, 2017	Feb. 01, 2018
RF Cable	EMC104-SM-SM-1200 EMC104-SM-SM-2000 EMC104-SM-SM-5000	160923 150318 150321	Feb. 02, 2017 Mar. 29, 2017 Mar. 29, 2017	Feb. 01, 2018 Mar. 28, 2018 Mar. 28, 2018
Pre-Amplifier EMCI	EMC184045SE	980387	Feb. 02, 2017	Feb. 01, 2018
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170608	Dec. 15, 2016	Dec. 14, 2017
RF Cable	SUCOFLEX 102	36432/2 36433/2	Jan. 15, 2017	Jan. 14, 2018
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208410	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP02	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. 4.
4. The FCC Designation Number is TW2022.
5. The CANADA Site Registration No. is 20331-2
6. Tested Date: Nov. 03, 2017

4.1.3 Test Procedures

For Radiated emission below 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. 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. Both X and Y axes of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case 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.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 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.

Note:

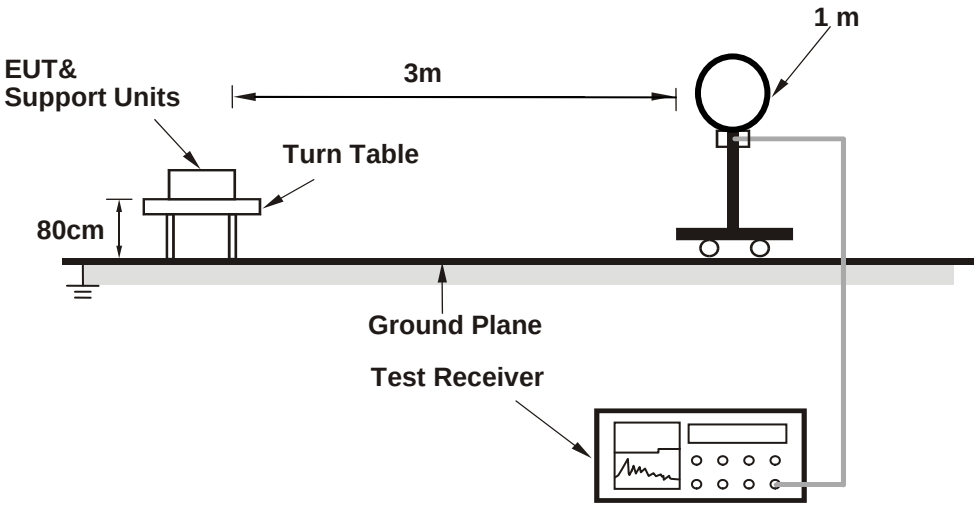
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency above 30MHz.
2. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

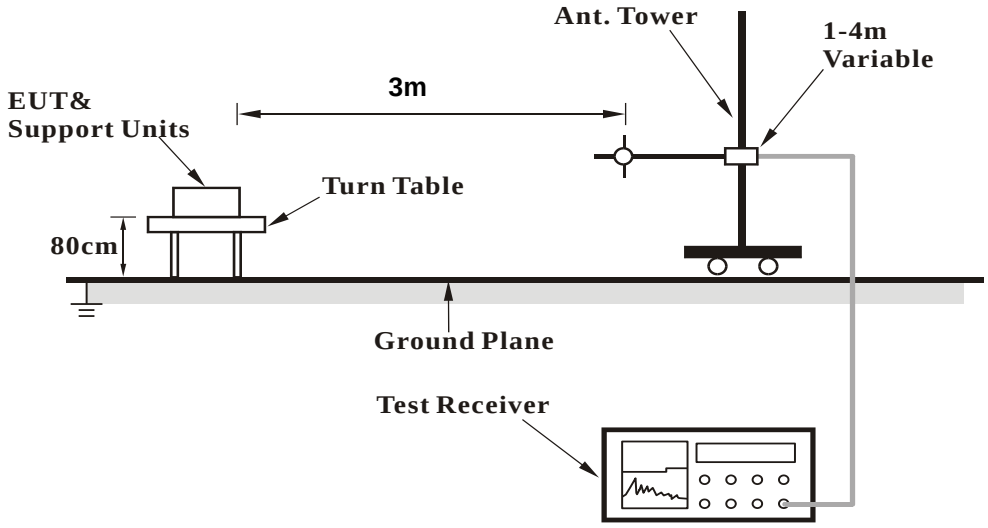
No deviation.

4.1.5 Test Setup

For Radiated emission below 30MHz



For Radiated emission 30MHz to 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

Type A

Frequency Range	13.110 ~ 14.010MHz	Detector Function	Quasi-Peak

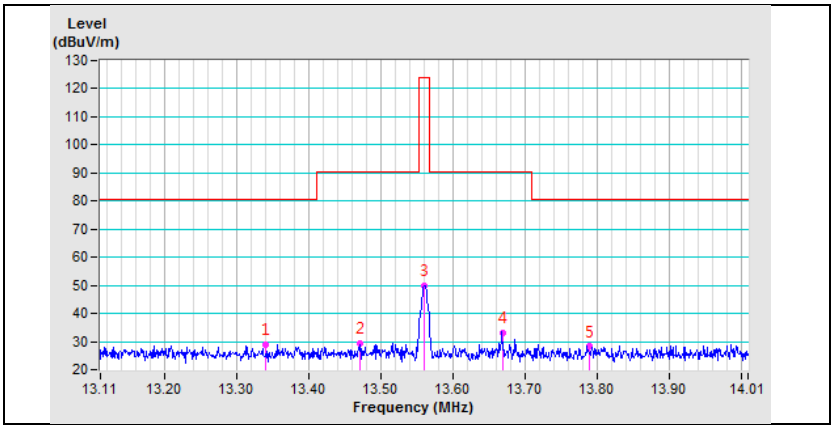
Antenna Polarity & Test Distance: Loop Antenna Open At 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	13.34	29.0 QP	80.5	-51.5	1.00 H	144	32.3	-3.3
2	13.47	29.5 QP	90.5	-61.0	1.00 H	144	32.8	-3.3
3	*13.56	49.8 QP	124.0	-74.2	1.00 H	144	53.1	-3.3
4	13.67	33.2 QP	90.5	-57.3	1.00 H	144	36.6	-3.4
5	13.79	28.2 QP	80.5	-52.3	1.00 H	144	31.6	-3.4

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. Above limits have been translated by the formula
6. " * ": Fundamental frequency.

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

13.56MHz = 15848uV/m 30m
= 84dBuV/m 30m
= $84+20\log(30/3)^2$ 3m
= 124dBuV/m



Frequency Range	13.110 ~ 14.010MHz	Detector Function	Quasi-Peak

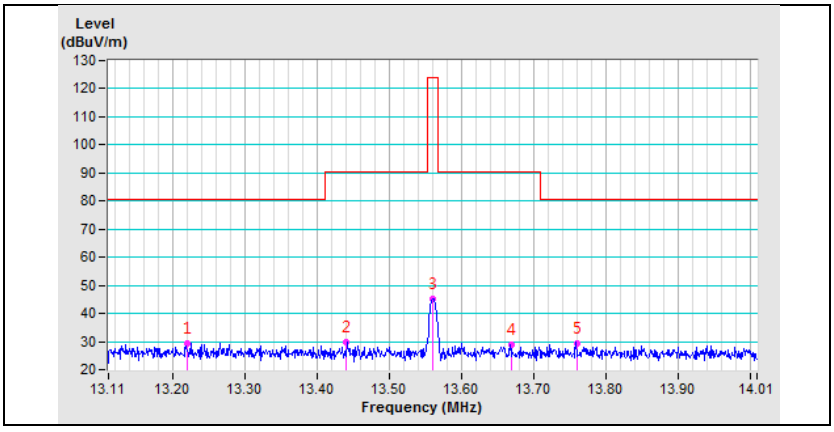
Antenna Polarity & Test Distance: Loop Antenna Close At 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	13.22	29.5 QP	80.5	-51.0	1.00 V	140	32.8	-3.3
2	13.44	29.8 QP	90.5	-60.7	1.00 V	140	33.1	-3.3
3	*13.56	45.1 QP	124.0	-78.9	1.00 V	140	48.4	-3.3
4	13.67	29.0 QP	90.5	-61.5	1.00 V	140	32.4	-3.4
5	13.76	29.5 QP	80.5	-51.0	1.00 V	140	32.9	-3.4

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. Above limits have been translated by the formula
6. " * ": Fundamental frequency.

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

13.56MHz = 15848uV/m 30m
= 84dBuV/m 30m
= $84+20\log(30/3)^2$ 3m
= 124dBuV/m



Frequency Range	Below 30MHz	Detector Function	Quasi-Peak

Antenna Polarity & Test Distance : Loop Antenna Open At 3m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	4.22	26.00 QP	69.50	-43.50	1.00	309	28.80	-2.80
2	8.72	24.50 QP	69.50	-45.00	1.00	101	27.40	-2.90
3	11.96	28.20 QP	69.50	-41.30	1.00	95	31.30	-3.10
4	18.24	33.00 QP	69.50	-36.50	1.00	276	37.00	-4.00
5	23.13	42.40 QP	69.50	-27.10	1.00	135	46.00	-3.60
6	26.49	34.40 QP	69.50	-35.10	1.00	184	37.20	-2.80
Antenna Polarity & Test Distance : Loop Antenna Close At 3m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2.36	23.10 QP	69.50	-46.40	1.00	301	24.90	-1.80
2	4.19	25.70 QP	69.50	-43.80	1.00	84	28.50	-2.80
3	12.75	29.10 QP	69.50	-40.40	1.00	0	32.30	-3.20
4	14.21	33.00 QP	69.50	-36.50	1.00	49	36.40	-3.40
5	18.24	29.60 QP	69.50	-39.90	1.00	328	33.60	-4.00
6	23.13	40.40 QP	69.50	-29.10	1.00	135	44.00	-3.60

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

Frequency Range	30MHz ~ 1000MHz	Detector Function	Quasi-Peak

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	40.69	25.70 QP	40.00	-14.30	2.00 H	128	34.20	-8.50
2	67.81	25.20 QP	40.00	-14.80	1.00 H	150	34.80	-9.60
3	122.05	21.10 QP	43.50	-22.40	2.00 H	355	30.70	-9.60
4	176.28	26.10 QP	43.50	-17.40	1.00 H	157	35.10	-9.00
5	558.55	26.20 QP	46.00	-19.80	2.50 H	191	27.90	-1.70
6	774.09	30.00 QP	46.00	-16.00	1.00 H	0	27.70	2.30
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	40.69	34.10 QP	40.00	-5.90	1.00 V	270	42.60	-8.50
2	67.81	30.20 QP	40.00	-9.80	2.00 V	98	39.80	-9.60
3	149.16	23.20 QP	43.50	-20.30	1.00 V	268	31.30	-8.10
4	176.28	31.20 QP	43.50	-12.30	3.00 V	80	40.20	-9.00
5	311.93	23.00 QP	46.00	-23.00	2.00 V	351	30.20	-7.20
6	801.22	30.20 QP	46.00	-15.80	2.00 V	358	27.70	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

Type B

Frequency Range	13.110 ~ 14.010MHz	Detector Function	Quasi-Peak

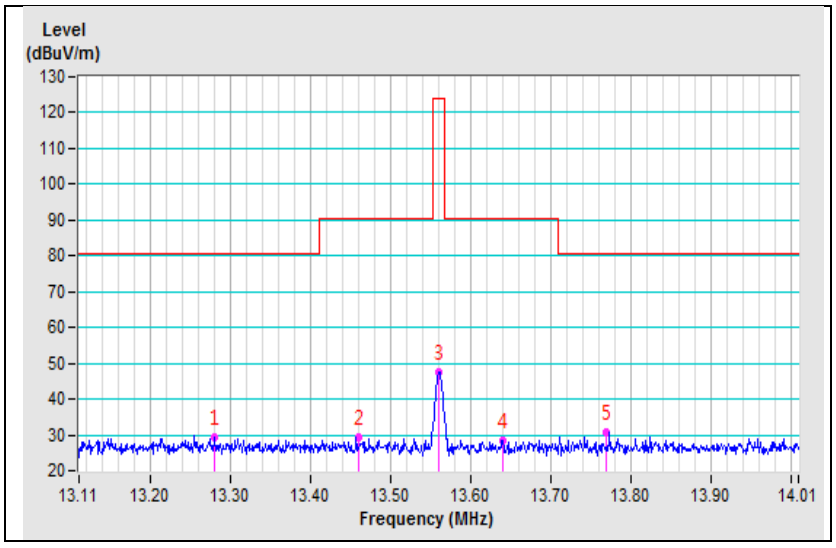
Antenna Polarity & Test Distance: Loop Antenna Open At 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	13.28	29.30 QP	80.50	-51.20	1.00	166	32.60	-3.30
2	13.46	29.40 QP	90.50	-61.10	1.00	166	32.70	-3.30
3	*13.56	47.60 QP	124.00	-76.40	1.00	166	50.90	-3.30
4	13.64	28.40 QP	90.50	-62.10	1.00	166	31.70	-3.30
5	**13.77**	**30.70 QP**	**80.50**	**-49.80**	**1.00**	**166**	**34.10**	**-3.40**

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. Above limits have been translated by the formula
6. " * ": Fundamental frequency.

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

13.56MHz = 15848uV/m 30m
= 84dBuV/m 30m
= $84+20\log(30/3)^2$ 3m
= 124dBuV/m



Frequency Range	13.110 ~ 14.010MHz	Detector Function	Quasi-Peak

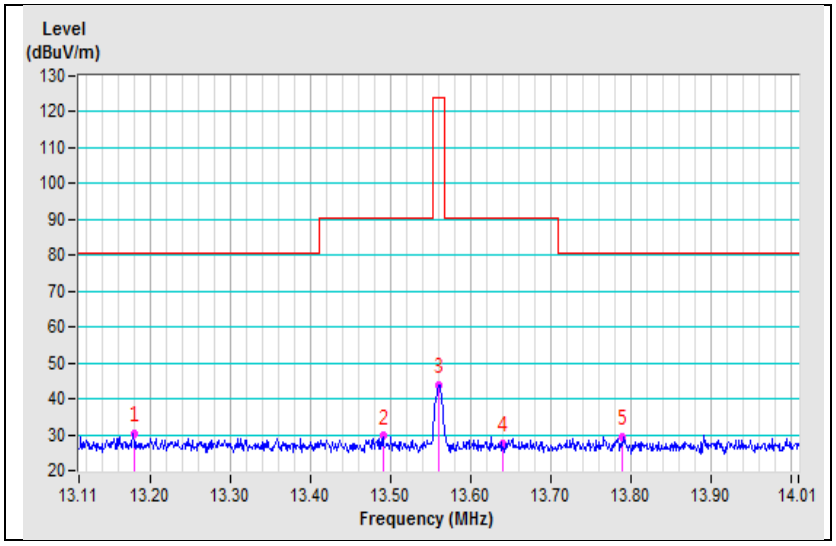
Antenna Polarity & Test Distance: Loop Antenna Close At 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	13.18	30.30 QP	80.50	-50.20	1.00	257	33.60	-3.30
2	13.49	29.60 QP	90.50	-60.90	1.00	257	32.90	-3.30
3	*13.56	43.90 QP	124.00	-80.10	1.00	257	47.20	-3.30
4	13.64	27.60 QP	90.50	-62.90	1.00	257	30.90	-3.30
5	13.79	29.40 QP	80.50	-51.10	1.00	257	32.80	-3.40

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. Above limits have been translated by the formula
6. " * ": Fundamental frequency.

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

13.56MHz = 15848uV/m 30m
= 84dBuV/m 30m
= $84+20\log(30/3)^2$ 3m
= 124dBuV/m



Frequency Range	Below 30MHz	Detector Function	Quasi-Peak

Antenna Polarity & Test Distance : Loop Antenna Open At 3m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	4.16	26.40 QP	69.50	-43.10	1.00	277	29.20	-2.80
2	14.21	36.00 QP	69.50	-33.50	1.00	302	39.40	-3.40
3	16.23	29.80 QP	69.50	-39.70	1.00	158	33.50	-3.70
4	18.92	30.80 QP	69.50	-38.70	1.00	165	35.00	-4.20
5	23.13	41.90 QP	69.50	-27.60	1.00	197	45.50	-3.60
6	29.41	32.60 QP	69.50	-36.90	1.00	80	34.90	-2.30
Antenna Polarity & Test Distance : Loop Antenna Close At 3m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	0.53	37.50 QP	73.10	-35.60	1.00	72	33.00	4.50
2	4.18	28.50 QP	69.50	-41.00	1.00	312	31.30	-2.80
3	12.50	27.30 QP	69.50	-42.20	1.00	234	30.50	-3.20
4	14.15	33.60 QP	69.50	-35.90	1.00	140	37.00	-3.40
5	18.24	29.70 QP	69.50	-39.80	1.00	360	33.70	-4.00
6	23.13	39.60 QP	69.50	-29.90	1.00	138	43.20	-3.60

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

Frequency Range	30MHz ~ 1000MHz	Detector Function	Quasi-Peak

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	67.81	25.40 QP	40.00	-14.60	1.00	153	35.00	-9.60
2	94.94	19.50 QP	43.50	-24.00	1.00	193	33.10	-13.60
3	176.30	24.90 QP	43.50	-18.60	2.00	192	33.90	-9.00
4	257.68	19.90 QP	46.00	-26.10	1.00	293	29.10	-9.20
5	598.08	28.00 QP	46.00	-18.00	1.50	205	28.50	-0.50
6	787.74	30.90 QP	46.00	-15.10	2.50	192	28.50	2.40
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	**40.69**	**34.20 QP**	**40.00**	**-5.80**	**1.00**	**79**	**42.70**	**-8.50**
2	67.81	29.60 QP	40.00	-10.40	2.00	72	39.20	-9.60
3	94.92	24.90 QP	43.50	-18.60	2.00	244	38.50	-13.60
4	122.05	27.70 QP	43.50	-15.80	1.00	247	37.30	-9.60
5	176.30	31.20 QP	43.50	-12.30	1.00	275	40.20	-9.00
6	767.10	30.50 QP	46.00	-15.50	1.50	154	28.30	2.20

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

Type F

Frequency Range	13.110 ~ 14.010MHz	Detector Function	Quasi-Peak

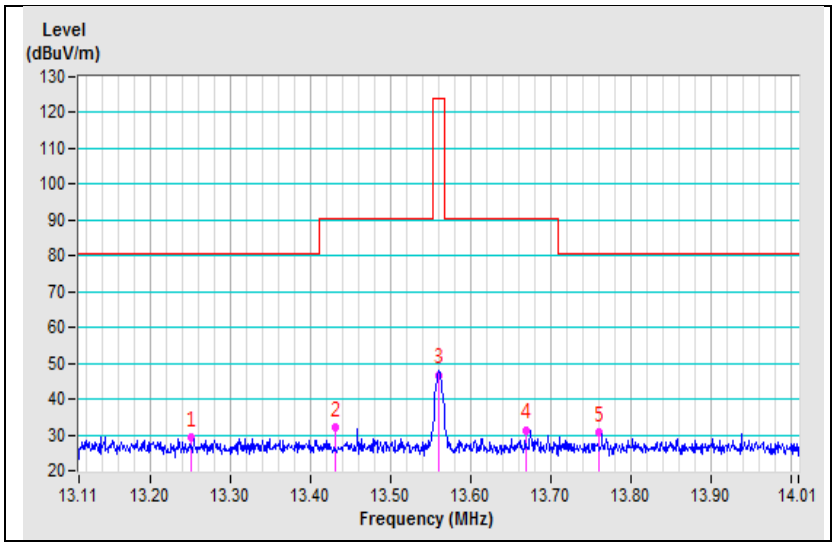
Antenna Polarity & Test Distance: Loop Antenna Open At 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	13.25	29.20 QP	80.50	-51.30	1.00	112	32.50	-3.30
2	13.43	31.90 QP	90.50	-58.60	1.00	112	35.20	-3.30
3	*13.56	46.50 QP	124.00	-77.50	1.00	112	49.80	-3.30
4	13.67	31.30 QP	90.50	-59.20	1.00	112	34.70	-3.40
5	13.76	30.60 QP	80.50	-49.90	1.00	112	34.00	-3.40

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. Above limits have been translated by the formula
6. " * ": Fundamental frequency.

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

13.56MHz = 15848uV/m 30m
= 84dBuV/m 30m
= $84+20\log(30/3)^2$ 3m
= 124dBuV/m



Frequency Range	13.110 ~ 14.010MHz	Detector Function	Quasi-Peak

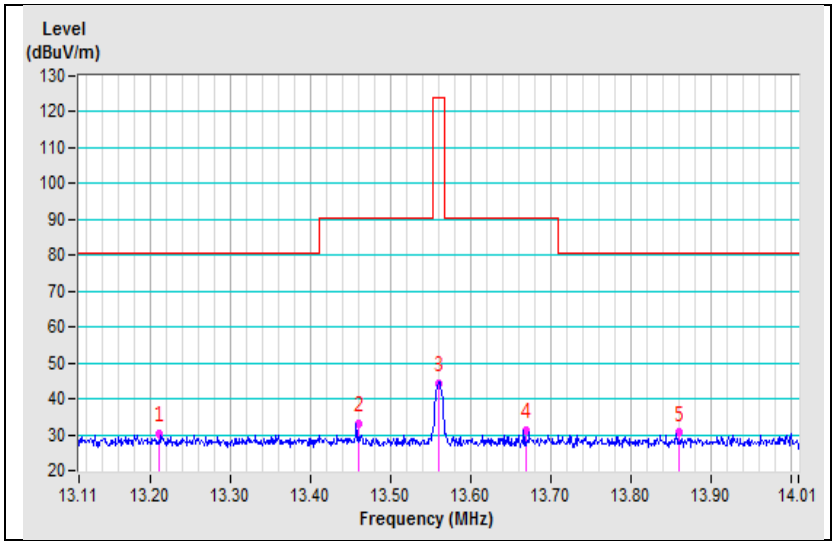
Antenna Polarity & Test Distance: Loop Antenna Close At 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	13.21	30.20 QP	80.50	-50.30	1.00	311	33.50	-3.30
2	13.46	33.00 QP	90.50	-57.50	1.00	311	36.30	-3.30
3	*13.56	44.30 QP	124.00	-79.70	1.00	311	47.60	-3.30
4	13.67	31.40 QP	90.50	-59.10	1.00	311	34.80	-3.40
5	13.86	30.60 QP	80.50	-49.90	1.00	311	34.00	-3.40

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. Above limits have been translated by the formula
6. " * ": Fundamental frequency.

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

13.56MHz = 15848uV/m 30m
= 84dBuV/m 30m
= $84+20\log(30/3)^2$ 3m
= 124dBuV/m



Frequency Range	Below 30MHz	Detector Function	Quasi-Peak

Antenna Polarity & Test Distance : Loop Antenna Open At 3m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	4.24	25.60 QP	69.50	-43.90	1.00	217	28.40	-2.80
2	7.37	24.00 QP	69.50	-45.50	1.00	166	26.90	-2.90
3	12.14	27.70 QP	69.50	-41.80	1.00	179	30.80	-3.10
4	14.21	35.40 QP	69.50	-34.10	1.00	136	38.80	-3.40
5	18.24	32.70 QP	69.50	-36.80	1.00	270	36.70	-4.00
6	23.13	42.20 QP	69.50	-27.30	1.00	173	45.80	-3.60
Antenna Polarity & Test Distance : Loop Antenna Close At 3m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2.61	25.30 QP	69.50	-44.20	1.00	320	27.50	-2.20
2	4.15	26.80 QP	69.50	-42.70	1.00	36	29.60	-2.80
3	14.15	33.50 QP	69.50	-36.00	1.00	360	36.90	-3.40
4	18.24	30.00 QP	69.50	-39.50	1.00	34	34.00	-4.00
5	23.13	39.60 QP	69.50	-29.90	1.00	268	43.20	-3.60
6	26.49	33.00 QP	69.50	-36.50	1.00	350	35.80	-2.80

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

Frequency Range	30MHz ~ 1000MHz	Detector Function	Quasi-Peak

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	40.69	20.60 QP	40.00	-19.40	1.00 H	212	29.10	-8.50
2	67.81	22.30 QP	40.00	-17.70	2.00 H	181	31.90	-9.60
3	122.05	20.30 QP	43.50	-23.20	2.50 H	354	29.90	-9.60
4	176.30	26.00 QP	43.50	-17.50	1.00 H	162	35.00	-9.00
5	401.56	22.60 QP	46.00	-23.40	2.00 H	200	27.80	-5.20
6	725.88	30.50 QP	46.00	-15.50	1.50 H	290	29.30	1.20
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	40.69	32.80 QP	40.00	-7.20	1.00 V	59	41.30	-8.50
2	67.81	28.30 QP	40.00	-11.70	1.00 V	284	37.90	-9.60
3	122.08	29.20 QP	43.50	-14.30	2.00 V	321	38.80	-9.60
4	176.30	32.60 QP	43.50	-10.90	1.50 V	69	41.60	-9.00
5	559.67	26.20 QP	46.00	-19.80	1.50 V	222	27.90	-1.70
6	788.44	30.70 QP	46.00	-15.30	1.00 V	227	28.30	2.40

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

Type V

Frequency Range	13.110 ~ 14.010MHz	Detector Function	Quasi-Peak

Antenna Polarity & Test Distance: Loop Antenna Open At 3m								
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	13.13	30.3 QP	80.5	-50.2	1.00 H	214	33.6	-3.3
2	13.53	32.4 QP	90.5	-58.1	1.00 H	214	35.7	-3.3
3	*13.56	49.4 QP	124.0	-74.6	1.00 H	214	52.7	-3.3
4	13.61	31.6 QP	90.5	-58.9	1.00 H	214	34.9	-3.3
5	13.96	28.4 QP	80.5	-52.1	1.00 H	214	31.8	-3.4

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. Above limits have been translated by the formula
6. " * ": Fundamental frequency.

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

13.56MHz = 15848uV/m 30m
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= $84+20\log(30/3)^2$ 3m
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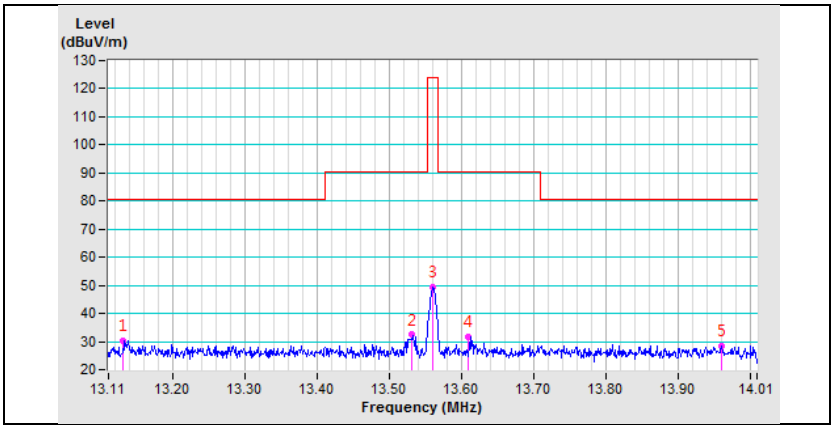

Frequency Range	13.110 ~ 14.010MHz	Detector Function	Quasi-Peak

Antenna Polarity & Test Distance: Loop Antenna Close At 3m								
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	13.13	28.2 QP	80.5	-52.3	1.00 V	197	31.5	-3.3
2	13.45	28.0 QP	90.5	-62.5	1.00 V	197	31.3	-3.3
3	*13.56	45.2 QP	124.0	-78.8	1.00 V	197	48.5	-3.3
4	13.59	29.9 QP	90.5	-60.6	1.00 V	197	33.2	-3.3
5	13.94	28.2 QP	80.5	-52.3	1.00 V	197	31.6	-3.4

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. Above limits have been translated by the formula
6. " * ": Fundamental frequency.

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

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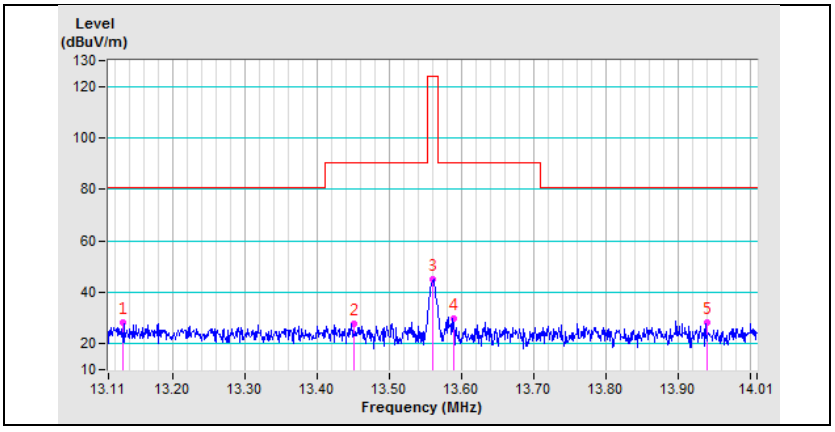

Frequency Range	Below 30MHz	Detector Function	Quasi-Peak

Antenna Polarity & Test Distance : Loop Antenna Open At 3m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	4.22	25.50 QP	69.50	-44.00	1.00	93	28.30	-2.80
2	10.79	26.20 QP	69.50	-43.30	1.00	322	29.10	-2.90
3	12.75	30.10 QP	69.50	-39.40	1.00	32	33.30	-3.20
4	14.21	35.60 QP	69.50	-33.90	1.00	201	39.00	-3.40
5	21.66	37.80 QP	69.50	-31.70	1.00	36	41.90	-4.10
6	23.13	42.20 QP	69.50	-27.30	1.00	258	45.80	-3.60
Antenna Polarity & Test Distance : Loop Antenna Close At 3m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	4.15	25.50 QP	69.50	-44.00	1.00	216	28.30	-2.80
2	12.81	28.50 QP	69.50	-41.00	1.00	360	31.70	-3.20
3	14.21	33.40 QP	69.50	-36.10	1.00	293	36.80	-3.40
4	18.92	29.50 QP	69.50	-40.00	1.00	158	33.70	-4.20
5	23.13	40.40 QP	69.50	-29.10	1.00	54	44.00	-3.60
6	26.49	32.30 QP	69.50	-37.20	1.00	132	35.10	-2.80

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

Frequency Range	30MHz ~ 1000MHz	Detector Function	Quasi-Peak

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	40.67	23.40 QP	40.00	-16.60	1.00 H	122	31.90	-8.50
2	67.78	23.60 QP	40.00	-16.40	1.50 H	140	33.20	-9.60
3	142.69	19.90 QP	43.50	-23.60	2.00 H	327	28.00	-8.10
4	176.30	24.80 QP	43.50	-18.70	1.50 H	187	33.80	-9.00
5	490.92	24.80 QP	46.00	-21.20	1.00 H	345	27.80	-3.00
6	823.24	31.60 QP	46.00	-14.40	1.00 H	259	28.60	3.00
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	40.69	33.20 QP	40.00	-6.80	1.50 V	102	41.70	-8.50
2	67.81	29.70 QP	40.00	-10.30	1.00 V	276	39.30	-9.60
3	94.92	25.60 QP	43.50	-17.90	2.00 V	280	39.20	-13.60
4	122.05	31.00 QP	43.50	-12.50	1.50 V	108	40.60	-9.60
5	176.30	32.40 QP	43.50	-11.10	1.00 V	74	41.40	-9.00
6	643.14	28.40 QP	46.00	-17.60	1.00 V	357	28.30	0.10

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 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 FCC recognized accredited test firms and accredited 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: 886-3-6668565
Fax: 886-3-6668323

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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