FCC Test Report

Report No.:	RF171122C17-4
FCC ID:	HD5-CT60L1N
Test Model:	CT60L1N
Received Date:	Sep. 08, 2017
Test Date:	Oct. 06 to 18, 2017
Issued Date:	Jan. 10, 2018
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.
FCC Registration / Designation Number:	723255 / TW2022

Testing Laboratory
2022

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Release Control Record

Issue No.	Description	Date Issued
RF171122C17-4	Original release.	Jan. 10, 2018

1 Certificate of Conformity

Product:	Dolphin CT60
Brand:	Honeywell
Test Model:	CT60L1N
Sample Status:	ENGINEERING SAMPLE
Applicant:	Honeywell International Inc.
Test Date:	Oct. 06 to 18, 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:** Jan. 10, 2018

Wendy Wu / Specialist

Approved by : _____ , **Date:** Jan. 10, 2018

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
15.207	Conducted emission test	PASS	Meet the requirement of limit. Minimum passing margin is -4.13dB at 0.49519MHz.
15.225 (a)	The field strength of any emissions within the band 13.553-13.567 MHz	PASS	Meet the requirement of limit.
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 -12.5dB at 937.48MHz.
15.225 (e)	The frequency tolerance	PASS	Meet the requirement of limit.
15.215 (c)	20dB Bandwidth	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.84 dB
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	CT60L1N
Status of EUT	ENGINEERING SAMPLE
HW Version	V1.0
HW P/N	DVT3
SW Version	OS.01.001-HON.01.003
SW P/N	329D
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. There are WLAN, Bluetooth, WWAN and NFC technology used for the EUT.
2. Simultaneously transmission condition.

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

3. 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

4. The EUT has four types according to NFC technology as following table:

Mode	Type	Modulation	Data rate
Active	A	100%, ASK	106 kbit/s
	B	10%, ASK	106 kbit/s
	F	8-30%, ASK	212 kbit/s, 424 kbit/s
	V	100%, ASK	26.48 kbit/s

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

WLAN / Bluetooth Antenna Spec.				
Antenna Gain include path loss (dBi)	Frequency range (GHz)	Antenna type	Connector type	Trace loss (dB)
0.62	2.4~2.4835	PIFA	POGO pin	1
1.14	5.15~5.25			1.7
1.14	5.25~5.35			
1.14	5.47~5.725			
1.14	5.725~5.85			

NFC Antenna Spec.		
Frequency range (MHz)	Antenna type	Connector type
13~14	Loop	NA

WWAN Antenna Spec.					
Chain No.	Antenna Gain include path loss (dBi)	Frequency range	Antenna type	Connector type	Trace loss (dB)
Chain 0	0	700~960MHz	PIFA	POGO pin	0.2
	3	1.71~1.9GHz			0.4
	2.4	2.1~2.3GHz			0.5
	0.3	2.7GHz			0.6
Chain 1 (RX only)	-2	700~960MHz	PIFA	POGO pin	NA
	0.5	1.71~1.9GHz			
	0.8	2.1~2.3GHz			
	0.8	2.7GHz			

6. 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.

7. 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	PLC	FS	EB	
1	√	√	√	√	Power from laptop
2	-	√	-	-	Power from adapter

Where **RE:** Radiated Emission **PLC:** Power Line Conducted Emission
FS: Frequency Stability **EB:** 20dB Bandwidth measurement

NOTE: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Z-plane.**
NOTE: "-"means no effect.

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

Power Line Conducted Emission Test:

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

Available Channel	Tested Channel	Modulation Type
1	1	ASK

Frequency Stability:

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

Available Channel	Tested Channel	Modulation Type
1	1	ASK

20dB Bandwidth:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Type
1	1	ASK

TEST CONDITION:

Applicable To	ENVIRONMENTAL CONDITIONS	INPUT POWER (System)	TESTED BY
RE	24deg. C, 64%RH	120Vac, 60Hz	Jyunchun Lin
PLC	24deg. C, 62%RH	120Vac, 60Hz	Andy Ho
FS	26deg. C, 73%RH	120Vac, 60Hz	Robert Cheng
EB	25deg. C, 60%RH	120Vac, 60Hz	Robert Cheng

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
		DELL	E6440	F9LYQ32	FCC DoC	Provided by Lab (For Conducted Emission)
B.	Micro SD Card	Transcend	16GB	NA	NA	Provided by Lab
C.	USB Adapter	ASUS	EXA1205UA	NA	NA	Provided by Lab

Note:

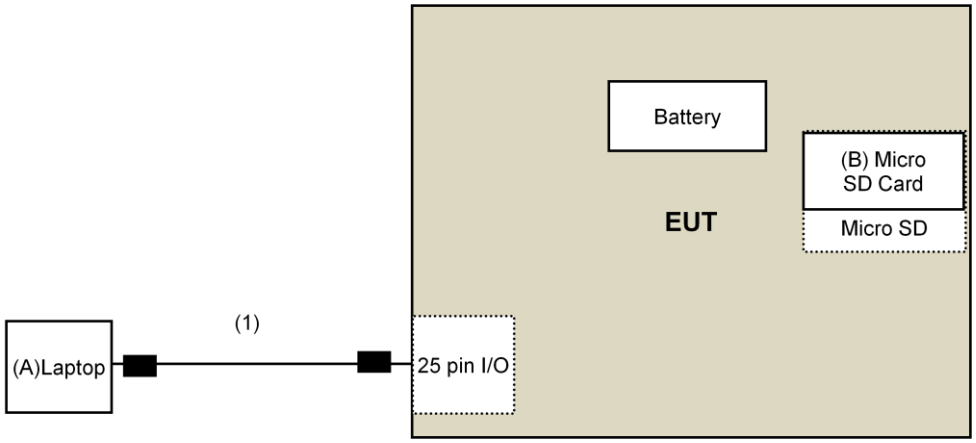
1. All power cords of the above support units are non-shielded (1.8m).

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)

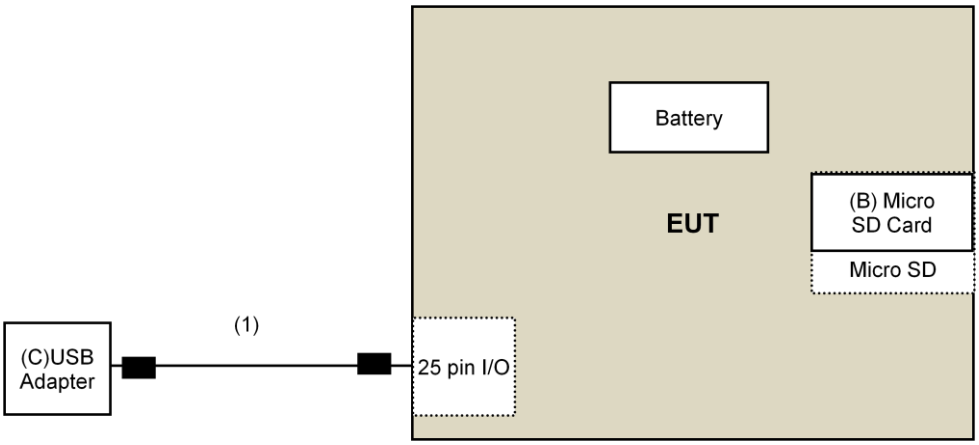
Note: The core(s) is(are) originally attached to the cable(s).

3.3.1 Configuration of System under Test

Mode 1



Mode 2



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
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208410	NA	NA
Spectrum Analyzer R&S	FSv40	100964	July 1, 2017	June 30, 2018
Power meter Anritsu	ML2495A	1014008	May 11, 2017	May 10, 2018
Power sensor Anritsu	MA2411B	0917122	May 11, 2017	May 10, 2018
Temperature & Humidity Chamber Giant Force	GTH-150-40-SP-AR	MAA0812-008	Jan. 11, 2017	Jan. 10, 2018
DC Power Supply Topward	6603D	795558	NA	NA
Digital Multimeter FLUKE	87III	73680266	Nov. 10, 2016	Nov. 09, 2017

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 Loop antenna was used for all emissions below 30 MHz.
5. The CANADA Site Registration No. is 20331-2
6. Tested Date: Oct. 06 to 18, 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:

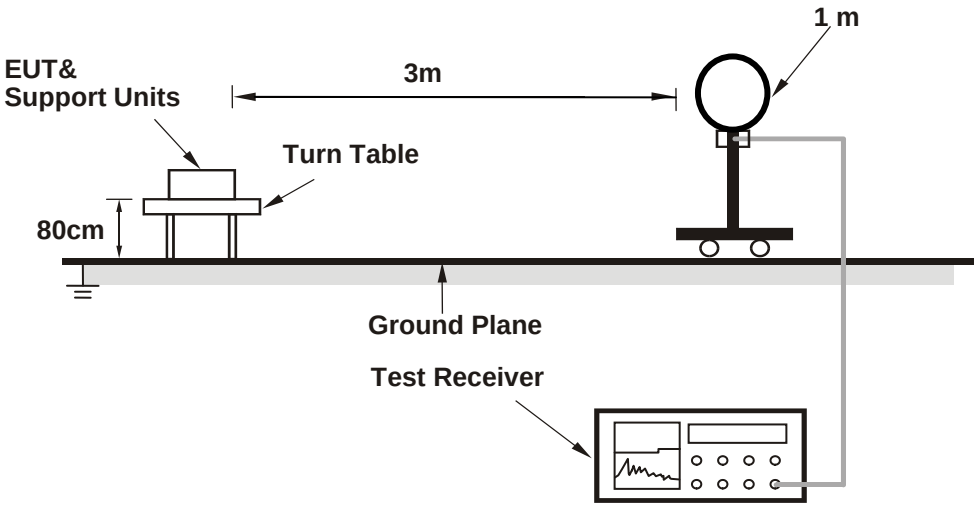
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency above 30MHz.
2. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

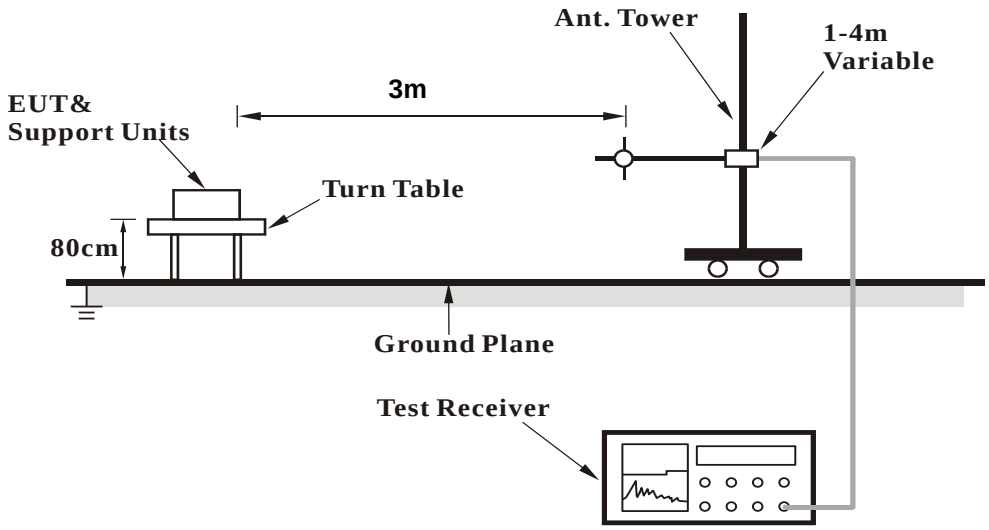
No deviation.

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. Connected the EUT with the Laptop.

b. Controlling software (QRCT_Version3.0.268.0) has been activated to set the EUT on specific status.

4.1.7 Test Results

Type A

Frequency Range	13.110 ~ 14.010MHz	Detector Function	Quasi-Peak

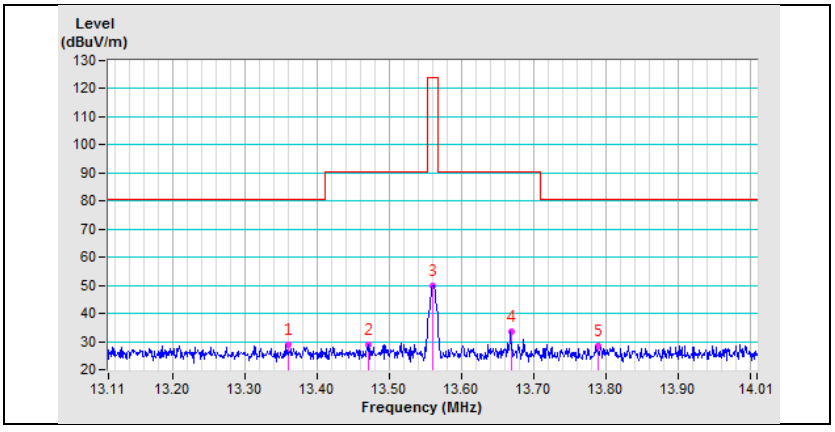
Antenna Polarity & Test Distance: Loop Antenna Open At 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	13.36	28.8 QP	80.5	-51.7	1.00	164	32.1	-3.3
2	13.47	29.0 QP	90.5	-61.5	1.00	164	32.3	-3.3
3	*13.56	49.9 QP	124.0	-74.1	1.00	164	53.2	-3.3
4	13.67	33.5 QP	90.5	-57.0	1.00	164	36.9	-3.4
5	13.79	28.4 QP	80.5	-52.1	1.00	164	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
= 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	29.3 QP	80.5	-51.2	1.00	76	32.6	-3.3
2	13.44	29.6 QP	90.5	-60.9	1.00	76	32.9	-3.3
3	*13.56	45.3 QP	124.0	-78.7	1.00	76	48.6	-3.3
4	13.67	28.8 QP	90.5	-61.7	1.00	76	32.2	-3.4
5	13.76	29.6 QP	80.5	-50.9	1.00	76	33.0	-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
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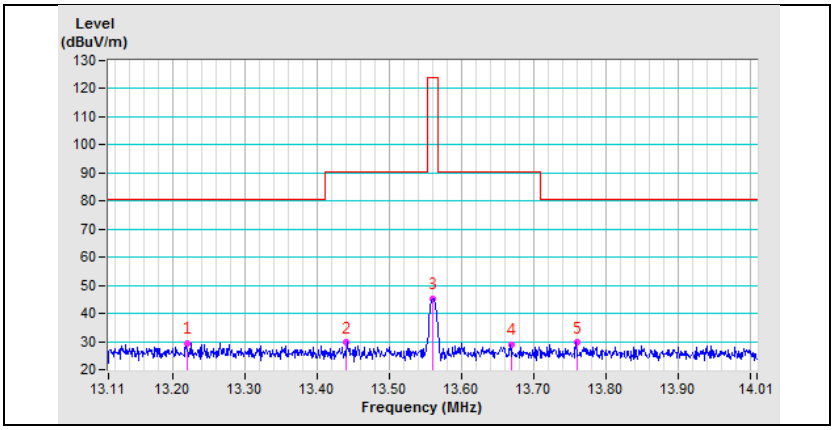
= 124dBuV/m



Frequency Range	Below 30MHz	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	0.34	43.7 QP	97.1	-53.4	1.00	142	35.9	7.8
2	5.42	21.8 QP	69.5	-47.7	1.00	236	24.7	-2.9
3	10.10	33.3 QP	69.5	-36.2	1.00	92	36.1	-2.8
4	11.75	30.6 QP	69.5	-38.9	1.00	318	33.7	-3.1
5	16.23	31.1 QP	69.5	-38.4	1.00	181	34.8	-3.7
6	22.68	38.7 QP	69.5	-30.8	1.00	288	42.4	-3.7
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	0.43	38.1 QP	94.9	-56.8	1.00	319	32.1	6.0
2	2.98	37.0 QP	69.5	-32.5	1.00	82	39.9	-2.9
3	5.00	42.5 QP	69.5	-27.0	1.00	82	45.4	-2.9
4	8.00	43.3 QP	69.5	-26.2	1.00	121	46.2	-2.9
5	16.23	31.7 QP	69.5	-37.8	1.00	134	35.4	-3.7
6	22.54	39.2 QP	69.5	-30.3	1.00	120	43.0	-3.8

REMARKS:

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

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

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	185.35	28.6 QP	43.5	-14.9	2.00 H	303	38.8	-10.2
2	235.49	32.4 QP	46.0	-13.6	2.00 H	0	42.6	-10.2
3	332.81	28.9 QP	46.0	-17.1	1.00 H	5	35.6	-6.7
4	398.38	29.7 QP	46.0	-16.3	2.50 H	67	34.9	-5.2
5	597.69	29.9 QP	46.0	-16.1	1.50 H	342	30.4	-0.5
6	813.61	31.8 QP	46.0	-14.2	1.00 H	119	29.2	2.6
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	30.53	24.7 QP	40.0	-15.3	1.00 V	173	34.2	-9.5
2	161.34	23.2 QP	43.5	-20.3	1.00 V	215	31.1	-7.9
3	295.13	28.3 QP	46.0	-17.7	1.50 V	40	36.1	-7.8
4	399.84	26.6 QP	46.0	-19.4	3.00 V	171	31.8	-5.2
5	703.11	30.9 QP	46.0	-15.1	1.00 V	182	30.0	0.9
6	904.79	32.6 QP	46.0	-13.4	2.00 V	251	28.6	4.0

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

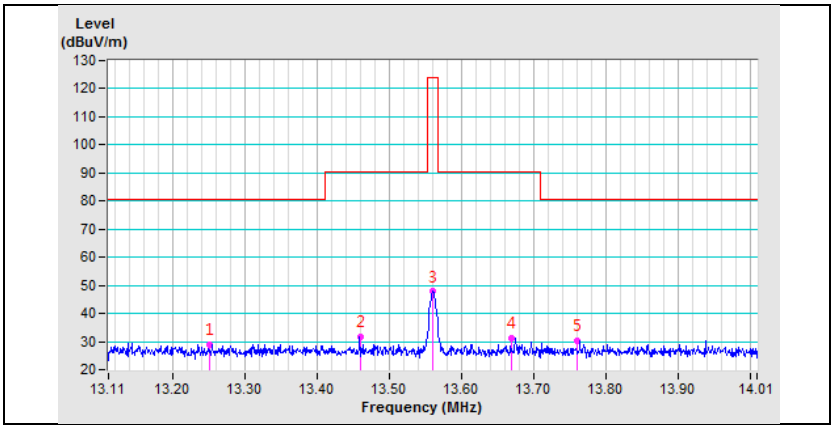
Antenna Polarity & Test Distance: Loop Antenna Open At 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	13.25	29.0 QP	80.5	-51.5	1.00	171	32.3	-3.3
2	13.46	31.7 QP	90.5	-58.8	1.00	171	35.0	-3.3
3	*13.56	47.8 QP	124.0	-76.2	1.00	171	51.1	-3.3
4	13.67	31.1 QP	90.5	-59.4	1.00	171	34.5	-3.4
5	13.76	30.3 QP	80.5	-50.2	1.00	171	33.7	-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

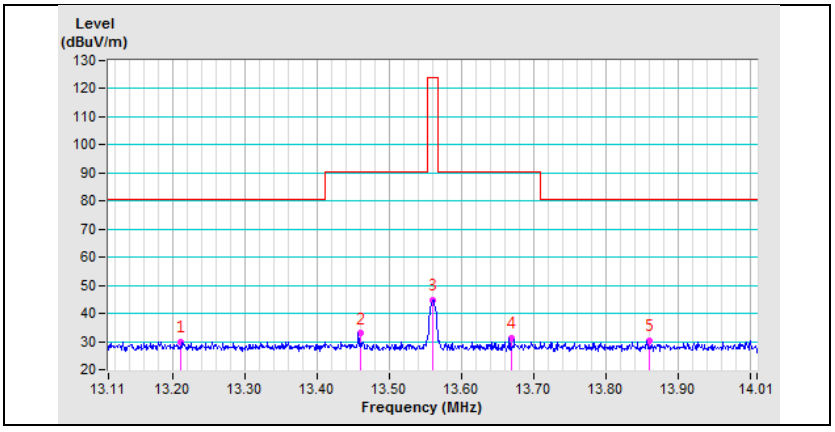
Antenna Polarity & Test Distance: Loop Antenna Close At 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	13.21	30.0 QP	80.5	-50.5	1.00	265	33.3	-3.3
2	13.46	32.9 QP	90.5	-57.6	1.00	265	36.2	-3.3
3	*13.56	44.6 QP	124.0	-79.4	1.00	265	47.9	-3.3
4	13.67	31.2 QP	90.5	-59.3	1.00	265	34.6	-3.4
5	13.86	30.4 QP	80.5	-50.1	1.00	265	33.8	-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
= 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.	**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	0.26	41.2 QP	99.3	-58.1	1.00	126	31.0	10.2
2	5.60	21.8 QP	69.5	-47.7	1.00	5	24.7	-2.9
3	10.04	31.3 QP	69.5	-38.2	1.00	149	34.1	-2.8
4	11.83	29.7 QP	69.5	-39.8	1.00	93	32.8	-3.1
5	16.23	31.6 QP	69.5	-37.9	1.00	34	35.3	-3.7
6	22.89	39.6 QP	69.5	-29.9	1.00	143	43.3	-3.7
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	2.00	41.7 QP	69.5	-27.8	1.00	228	42.9	-1.2
2	6.00	35.7 QP	69.5	-33.8	1.00	269	38.6	-2.9
3	10.04	33.4 QP	69.5	-36.1	1.00	94	36.2	-2.8
4	11.75	29.7 QP	69.5	-39.8	1.00	88	32.8	-3.1
5	16.23	31.6 QP	69.5	-37.9	1.00	88	35.3	-3.7
6	22.54	39.4 QP	69.5	-30.1	1.00	219	43.2	-3.8

REMARKS:

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

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

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	54.06	22.1 QP	40.0	-17.9	2.00 H	347	29.9	-7.8
2	233.55	32.3 QP	46.0	-13.7	1.50 H	360	42.7	-10.4
3	324.47	27.9 QP	46.0	-18.1	1.00 H	0	34.9	-7.0
4	399.86	27.8 QP	46.0	-18.2	2.00 H	70	33.0	-5.2
5	597.28	29.5 QP	46.0	-16.5	1.50 H	331	30.0	-0.5
6	784.81	31.0 QP	46.0	-15.0	1.00 H	61	28.5	2.5
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	30.36	24.8 QP	40.0	-15.2	1.50 V	75	34.3	-9.5
2	165.95	22.6 QP	43.5	-20.9	1.00 V	120	30.9	-8.3
3	233.19	24.0 QP	46.0	-22.0	1.00 V	108	34.4	-10.4
4	317.34	26.0 QP	46.0	-20.0	1.50 V	136	33.2	-7.2
5	399.84	26.2 QP	46.0	-19.8	2.50 V	207	31.4	-5.2
6	655.21	29.4 QP	46.0	-16.6	2.50 V	26	29.0	0.4

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

Type F

Frequency Range	13.110 ~ 14.010MHz	Detector Function	Quasi-Peak

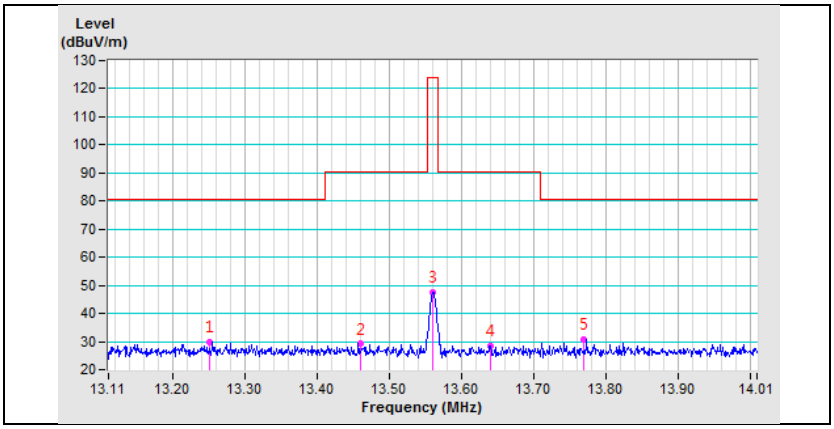
Antenna Polarity & Test Distance: Loop Antenna Open At 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	13.25	29.9 QP	80.5	-50.6	1.00	177	33.2	-3.3
2	13.46	29.2 QP	90.5	-61.3	1.00	177	32.5	-3.3
3	*13.56	47.7 QP	124.0	-76.3	1.00	177	51.0	-3.3
4	13.64	28.6 QP	90.5	-61.9	1.00	177	31.9	-3.3
5	13.77	30.7 QP	80.5	-49.8	1.00	177	34.1	-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

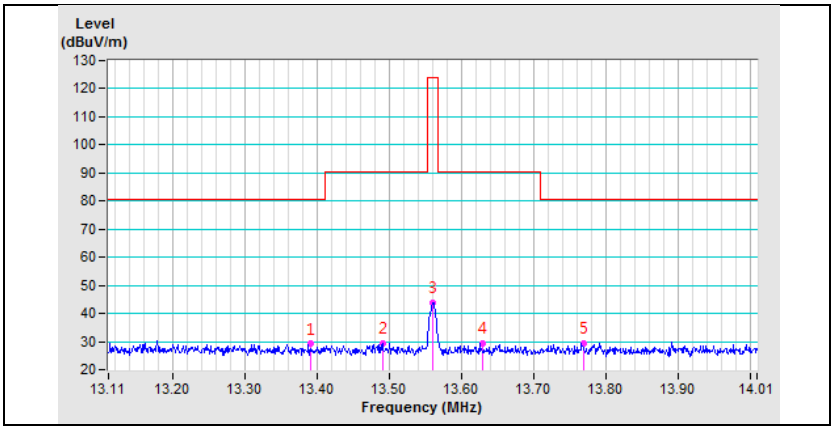
Antenna Polarity & Test Distance: Loop Antenna Close At 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	13.39	29.1 QP	80.5	-51.4	1.00	86	32.4	-3.3
2	13.49	29.4 QP	90.5	-61.1	1.00	86	32.7	-3.3
3	*13.56	43.8 QP	124.0	-80.2	1.00	86	47.1	-3.3
4	13.63	29.4 QP	90.5	-61.1	1.00	86	32.7	-3.3
5	13.77	29.4 QP	80.5	-51.1	1.00	86	32.8	-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
= 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.	**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	1.00	41.7 QP	67.6	-25.9	1.00	87	41.1	0.6
2	3.15	22.8 QP	69.5	-46.7	1.00	322	25.8	-3.0
3	10.04	31.8 QP	69.5	-37.7	1.00	143	34.6	-2.8
4	11.83	30.2 QP	69.5	-39.3	1.00	37	33.3	-3.1
5	16.23	31.6 QP	69.5	-37.9	1.00	290	35.3	-3.7
6	22.53	38.9 QP	69.5	-30.6	1.00	352	42.7	-3.8
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	0.44	37.3 QP	94.8	-57.5	1.00	347	31.3	6.0
2	3.92	24.2 QP	69.5	-45.3	1.00	169	27.2	-3.0
3	10.04	31.4 QP	69.5	-38.1	1.00	30	34.2	-2.8
4	11.80	29.3 QP	69.5	-40.2	1.00	124	32.4	-3.1
5	16.23	32.5 QP	69.5	-37.0	1.00	340	36.2	-3.7
6	22.68	39.9 QP	69.5	-29.6	1.00	227	43.6	-3.7

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.	**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	192.91	30.1 QP	43.5	-13.4	1.50	107	41.2	-11.1
2	240.73	33.0 QP	46.0	-13.0	1.50	360	42.9	-9.9
3	324.54	27.8 QP	46.0	-18.2	1.00	352	34.8	-7.0
4	398.33	29.5 QP	46.0	-16.5	2.50	139	34.7	-5.2
5	597.47	30.4 QP	46.0	-15.6	2.00	0	30.9	-0.5
6	**937.48**	**33.5 QP**	**46.0**	**-12.5**	**3.00**	**77**	**29.0**	**4.5**
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	97.83	22.9 QP	43.5	-20.6	1.00	112	35.9	-13.0
2	221.57	26.1 QP	46.0	-19.9	1.50	360	37.7	-11.6
3	334.94	24.3 QP	46.0	-21.7	1.50	125	31.0	-6.7
4	398.50	26.2 QP	46.0	-19.8	2.50	158	31.4	-5.2
5	731.53	30.3 QP	46.0	-15.7	2.00	180	28.8	1.5
6	939.84	33.3 QP	46.0	-12.7	3.00	251	28.8	4.5

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

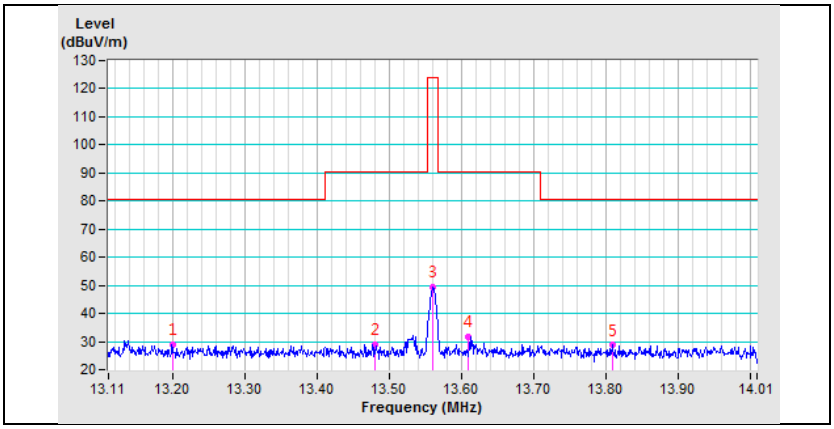
Antenna Polarity & Test Distance: Loop Antenna Open At 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	13.20	28.9 QP	80.5	-51.6	1.00	132	32.2	-3.3
2	13.48	28.9 QP	90.5	-61.6	1.00	132	32.2	-3.3
3	*13.56	49.5 QP	124.0	-74.5	1.00	132	52.8	-3.3
4	13.61	31.8 QP	90.5	-58.7	1.00	132	35.1	-3.3
5	13.81	28.7 QP	80.5	-51.8	1.00	132	32.1	-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	13.32	27.2 QP	80.5	-53.3	1.00	208	30.5	-3.3
2	13.45	28.0 QP	90.5	-62.5	1.00	208	31.3	-3.3
3	*13.56	45.0 QP	124.0	-79.0	1.00	208	48.3	-3.3
4	13.63	28.2 QP	90.5	-62.3	1.00	208	31.5	-3.3
5	13.90	28.8 QP	80.5	-51.7	1.00	208	32.2	-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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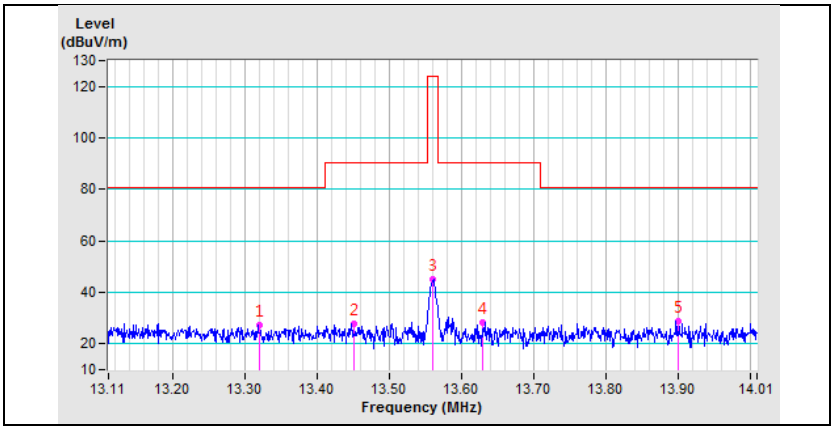


Frequency Range	Below 30MHz	Detector Function	Quasi-Peak

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	0.36	41.8 QP	96.4	-54.6	1.00	20	34.5	7.3
2	10.01	30.9 QP	69.5	-38.6	1.00	154	33.7	-2.8
3	11.75	29.8 QP	69.5	-39.7	1.00	186	32.9	-3.1
4	16.23	30.9 QP	69.5	-38.6	1.00	105	34.6	-3.7
5	18.30	28.7 QP	69.5	-40.8	1.00	186	32.7	-4.0
6	22.54	38.8 QP	69.5	-30.7	1.00	300	42.6	-3.8
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	0.21	41.6 QP	101.2	-59.6	1.00	360	29.1	12.5
2	6.07	27.2 QP	69.5	-42.3	1.00	45	30.1	-2.9
3	10.09	32.0 QP	69.5	-37.5	1.00	212	34.8	-2.8
4	11.00	40.5 QP	69.5	-29.0	1.00	285	43.5	-3.0
5	16.23	32.4 QP	69.5	-37.1	1.00	187	36.1	-3.7
6	22.68	40.8 QP	69.5	-28.7	1.00	105	44.5	-3.7

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.	**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	140.24	29.1 QP	43.5	-14.4	2.00 H	360	37.4	-8.3
2	236.00	31.7 QP	46.0	-14.3	1.50 H	3	41.8	-10.1
3	327.09	27.4 QP	46.0	-18.6	1.00 H	360	34.3	-6.9
4	398.33	28.5 QP	46.0	-17.5	1.00 H	319	33.7	-5.2
5	597.43	29.8 QP	46.0	-16.2	1.50 H	344	30.3	-0.5
6	797.10	32.2 QP	46.0	-13.8	1.50 H	51	29.8	2.4
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	30.58	24.9 QP	40.0	-15.1	1.00 V	188	34.4	-9.5
2	98.09	22.1 QP	43.5	-21.4	1.00 V	30	35.1	-13.0
3	208.09	25.4 QP	43.5	-18.1	2.00 V	66	37.0	-11.6
4	399.81	27.2 QP	46.0	-18.8	3.00 V	157	32.4	-5.2
5	756.21	31.6 QP	46.0	-14.4	2.00 V	0	29.4	2.2
6	882.34	32.8 QP	46.0	-13.2	3.00 V	256	29.1	3.7

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 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

4.2.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver R&S	ESCS 30	847124/029	Oct. 24, 2016	Oct. 23, 2017
Line-Impedance Stabilization Network (for EUT) R&S	ESH3-Z5	848773/004	Oct. 26, 2016	Oct. 25, 2017
Line-Impedance Stabilization Network (for Peripheral) R&S	ENV216	100072	June 03, 2017	June 02, 2018
50 ohms Terminator	N/A	EMC-02	Sep. 22, 2017	Sep. 21, 2018
RF Cable	5D-FB	COCCAB-001	Sep. 29, 2017	Sep. 28, 2018
10 dB PAD Mini-Circuits	HAT-10+	CONATT-004	June 18, 2017	June 17, 2018
Software BVADT	BVADT_Cond_ V7.3.7.4	NA	NA	NA

Note:
1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Shielded Room No. 1.
3 Tested Date: Oct. 17, 2017

4.2.3 Test Procedures

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

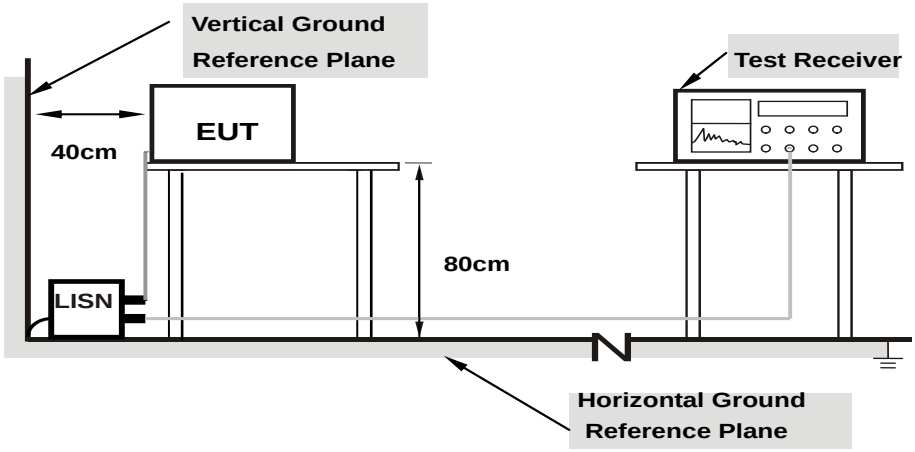
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 TEST SETUP



Note: 1.Support units were connected to second LISN.

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

4.2.6 EUT Operating Conditions

Same as 4.1.6.

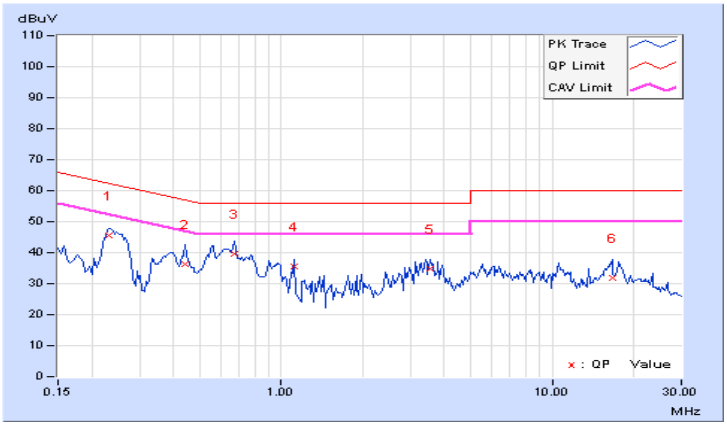
4.2.7 Test Results (Mode 1)

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.23203	10.07	35.50	25.26	45.57	35.33	62.38	52.38	-16.81	-17.05
2	0.44297	10.11	26.11	17.51	36.22	27.62	57.01	47.01	-20.79	-19.39
3	0.67344	10.12	29.51	22.37	39.63	32.49	56.00	46.00	-16.37	-13.51
4	1.12109	10.14	25.47	11.30	35.61	21.44	56.00	46.00	-20.39	-24.56
5	3.53125	10.26	24.64	17.63	34.90	27.89	56.00	46.00	-21.10	-18.11
6	16.61719	11.07	20.91	14.93	31.98	26.00	60.00	50.00	-28.02	-24.00

REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

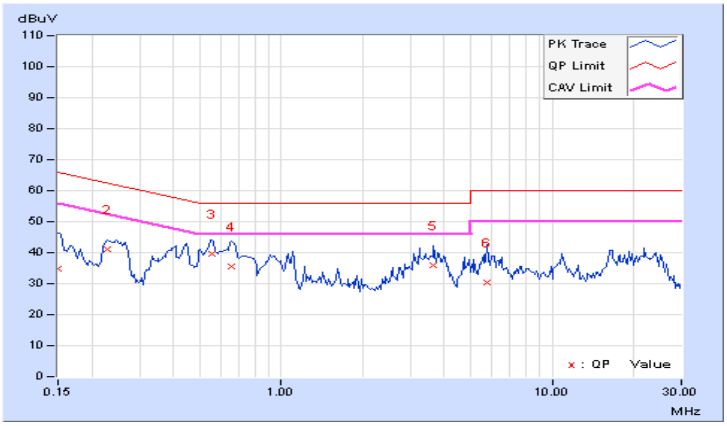


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.06	24.80	19.30	34.86	29.36	66.00	56.00	-31.14	-26.64
2	0.22812	10.04	31.07	20.56	41.11	30.60	62.52	52.52	-21.41	-21.92
3	0.55625	10.10	29.37	20.48	39.47	30.58	56.00	46.00	-16.53	-15.42
4	0.65391	10.10	25.56	10.97	35.66	21.07	56.00	46.00	-20.34	-24.93
5	3.66016	10.21	25.86	19.92	36.07	30.13	56.00	46.00	-19.93	-15.87
6	5.77734	10.32	20.04	14.10	30.36	24.42	60.00	50.00	-29.64	-25.58

REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.



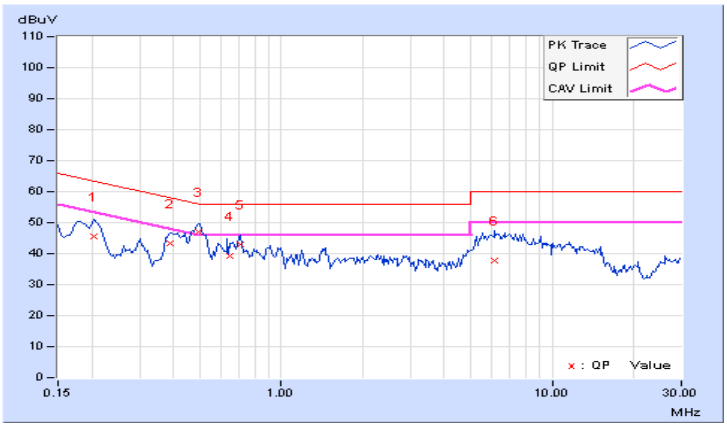
4.2.8 Test Results (Mode 2)

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.20469	10.07	35.48	27.04	45.55	37.11	63.42	53.42	-17.87	-16.31
2	0.38828	10.12	33.34	25.91	43.46	36.03	58.10	48.10	-14.64	-12.07
3	**0.49519**	**10.13**	**36.80**	**31.82**	**46.93**	**41.95**	**56.08**	**46.08**	**-9.15**	**-4.13**
4	0.64272	10.14	28.94	26.08	39.08	36.22	56.00	46.00	-16.92	-9.78
5	0.70469	10.14	32.65	25.28	42.79	35.42	56.00	46.00	-13.21	-10.58
6	6.12500	10.52	27.34	20.69	37.86	31.21	60.00	50.00	-22.14	-18.79

REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

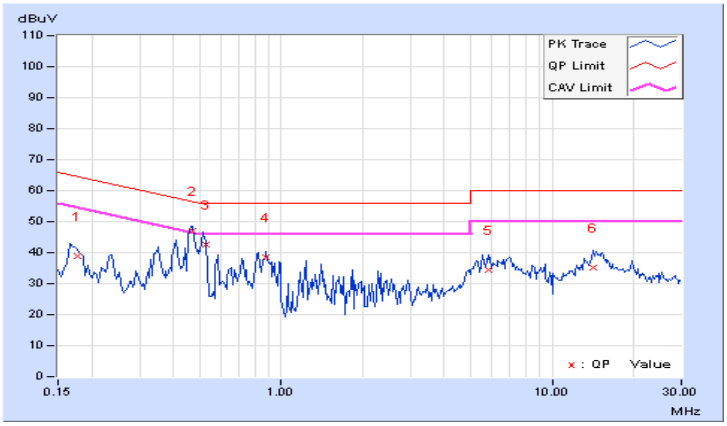


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.17638	10.05	28.93	17.92	38.98	27.97	64.65	54.65	-25.67	-26.68
2	0.46806	10.12	37.01	28.33	47.13	38.45	56.55	46.55	-9.42	-8.10
3	0.52553	10.12	32.49	24.02	42.61	34.14	56.00	46.00	-13.39	-11.86
4	0.88047	10.12	28.33	17.41	38.45	27.53	56.00	46.00	-17.55	-18.47
5	5.79688	10.40	23.94	13.90	34.34	24.30	60.00	50.00	-25.66	-25.70
6	14.17969	10.95	24.13	14.27	35.08	25.22	60.00	50.00	-24.92	-24.78

REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

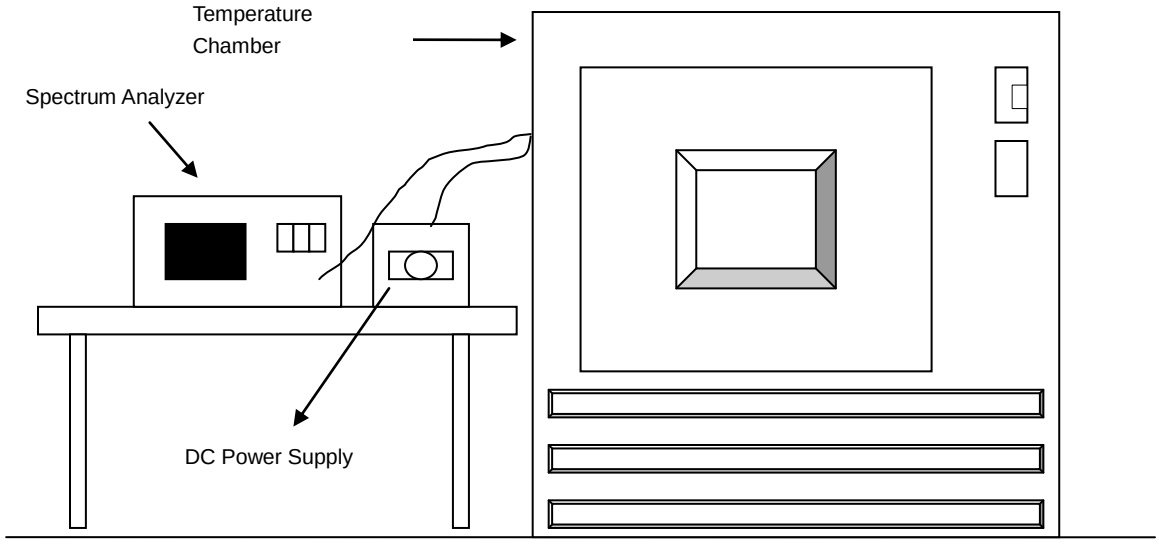


4.3 Frequency Stability

4.3.1 Limits of Frequency Stability Measurement

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% 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.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedure

a. The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.

b. Turned the EUT on and coupled its output to a spectrum analyzer.

c. Turned the EUT off and set the chamber to the highest temperature specified.

d. Allowed sufficient time (approximately 30 min) for the temperature of the chamber to stabilize then turned the EUT on and measured the operating frequency after 2, 5, and 10 minutes.

e. Repeated step 2 and 3 with the temperature chamber set to the lowest temperature.

f. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

Same as Item 4.1.6.

4.3.7 Test Result

Frequemcy Stability Versus Temp.									
TEMP. (℃)	Power Supply (Vdc)	0 Minute		2 Minutes		5 Minutes		10 Minutes	
		Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift
		(MHz)	%	(MHz)	%	(MHz)	%	(MHz)	%
50	3.6	13.56003	0.00022	13.56002	0.00015	13.56002	0.00015	13.56001	0.00007
40	3.6	13.55999	-0.00007	13.56	0.00000	13.55999	-0.00007	13.55999	-0.00007
30	3.6	13.56004	0.00029	13.56004	0.00029	13.56004	0.00029	13.56004	0.00029
20	3.6	13.56003	0.00022	13.56001	0.00007	13.56001	0.00007	13.56002	0.00015
10	3.6	13.56004	0.00029	13.56002	0.00015	13.56003	0.00022	13.56003	0.00022
0	3.6	13.55998	-0.00015	13.55998	-0.00015	13.55999	-0.00007	13.55998	-0.00015
-10	3.6	13.55996	-0.00029	13.55997	-0.00022	13.55997	-0.00022	13.55997	-0.00022
-20	3.6	13.56004	0.00029	13.56004	0.00029	13.56003	0.00022	13.56004	0.00029

Frequemcy Stability Versus Voltage									
TEMP. (℃)	Power Supply (Vdc)	0 Minute		2 Minutes		5 Minutes		10 Minutes	
		Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift
		(MHz)	%	(MHz)	%	(MHz)	%	(MHz)	%
20	4.14	13.56002	0.00015	13.56004	0.00029	13.56007	0.00052	13.56006	0.00044
	3.6	13.56003	0.00022	13.56001	0.00007	13.56001	0.00007	13.56002	0.00015
	3.3	13.56004	0.00029	13.56005	0.00037	13.56008	0.00059	13.56009	0.00066

4.4 20dB bandwidth

4.4.1 Limits of 20dB Bandwidth Measurement

The 20dB bandwidth shall be specified in operating frequency band.

4.4.2 Test Setup

Same as Item 4.1.5.

4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedures

The bandwidth of the fundamental frequency was measured by spectrum analyzer with 10HzRBW and 30Hz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Conditions

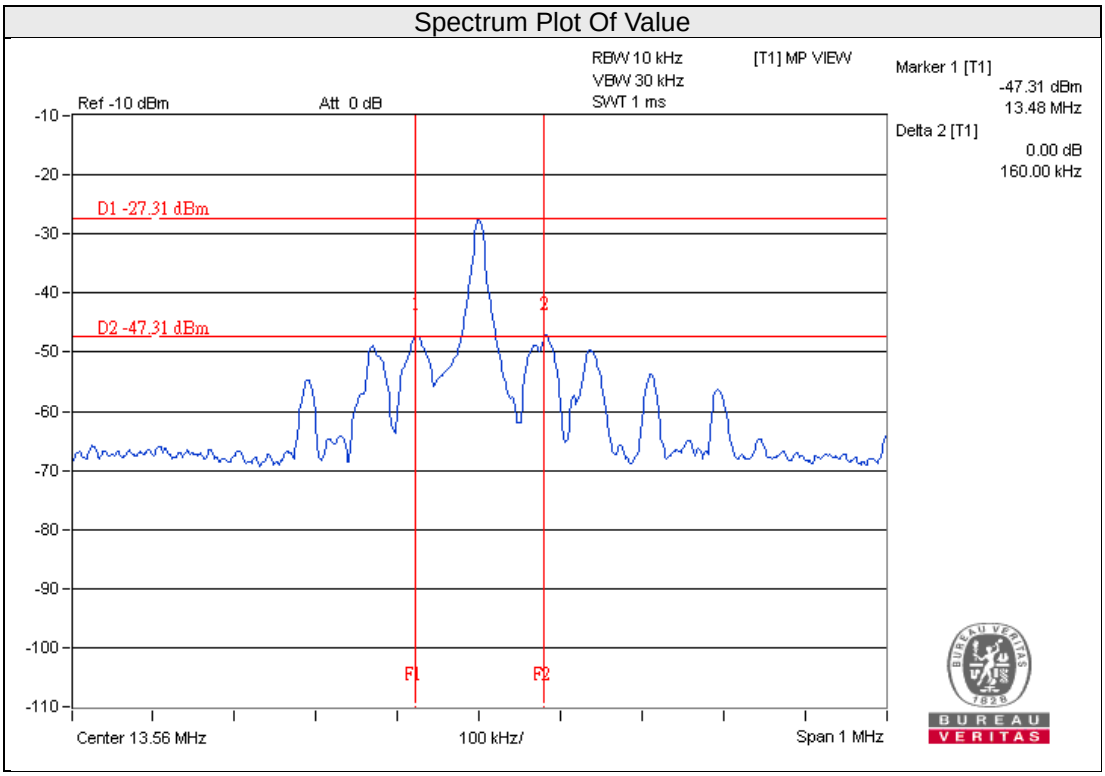
Same as Item 4.1.6.

4.4.7 Test Results

Type A

20dBc point (Low)	20dBc point (High)	Operating frequency band (MHz)	Pass/Fail
13.48	13.64	13.11 – 14.01	PASS

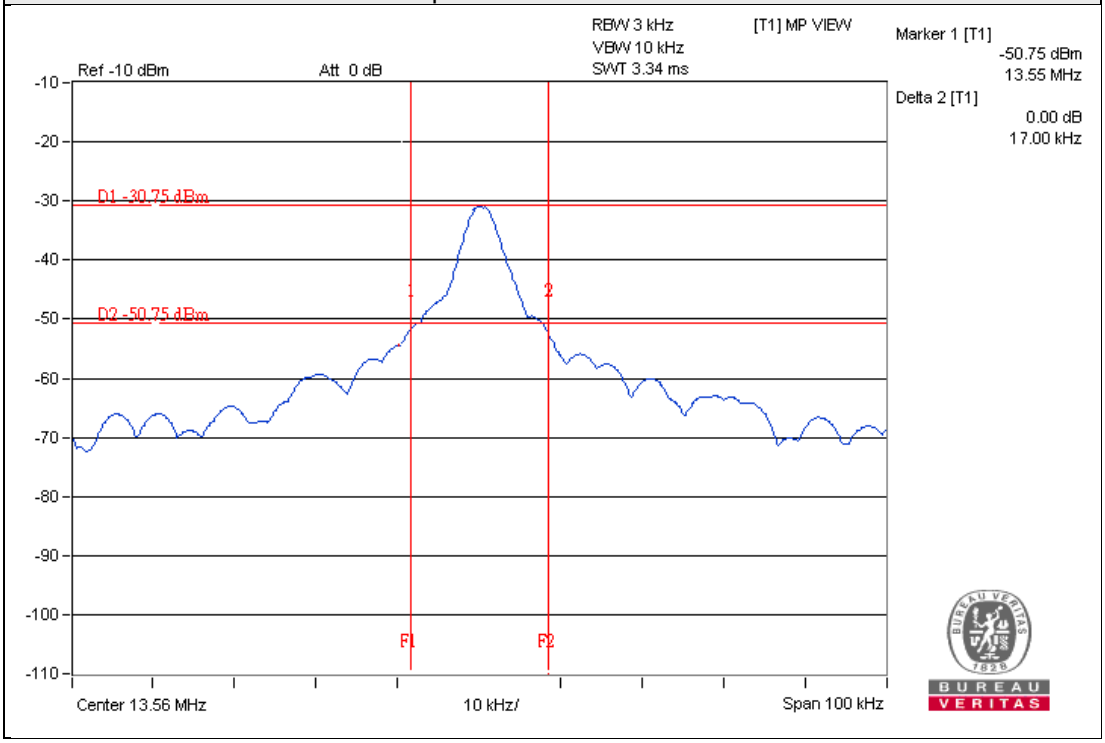
Spectrum Plot Of Value



Type B

20dBc point (Low)	20dBc point (High)	Operating frequency band (MHz)	Pass/Fail
13.55	13.567	13.11 – 14.01	PASS

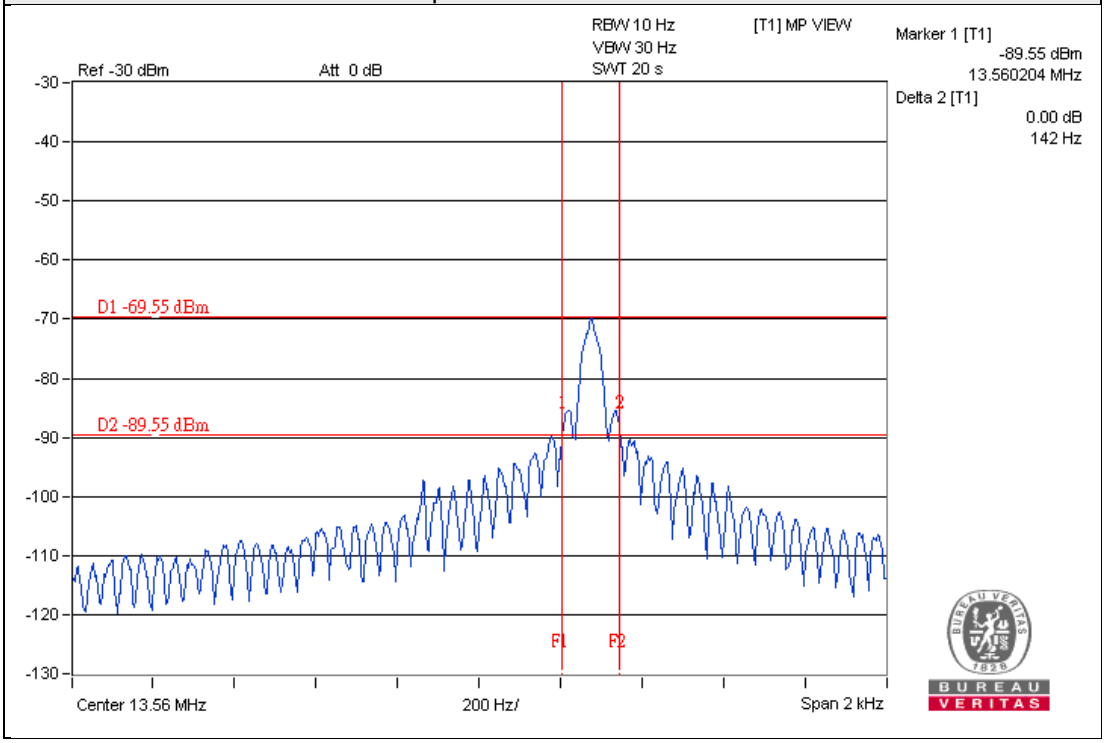
Spectrum Plot Of Value



Type F

20dBc point (Low)	20dBc point (High)	Operating frequency band (MHz)	Pass/Fail
13.560204	13.560346	13.11 – 14.01	PASS

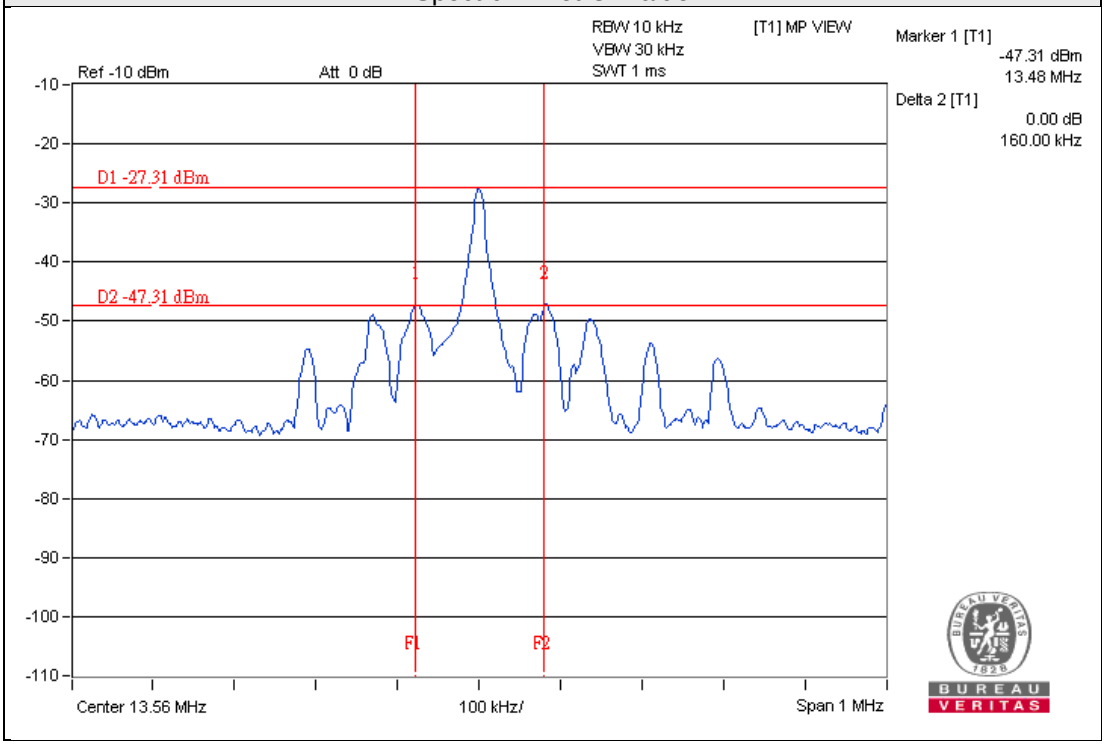
Spectrum Plot Of Value



Type V

20dBc point (Low)	20dBc point (High)	Operating frequency band (MHz)	Pass/Fail
13.48	13.64	13.11 – 14.01	PASS

Spectrum Plot Of 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:

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Hsin Chu EMC/RF/Telecom Lab
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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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