FCC Test Report

Report No.:	RF170419E08D R1
FCC ID:	QXP-A7310
Test Model:	mevo
Received Date:	Apr. 19, 2017
Test Date:	Apr. 21 to May 05, 2017
Issued Date:	Mar. 06, 2018
Applicant:	FlightScope (Pty) Ltd
Address:	10 Elektron Road, Technopark, Stellenbosch, 7500 South Africa
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
RF170419E08D	Original release.	Feb. 08, 2018
RF170419E08D R1	Revised Antenna gain	Mar. 06, 2018

1 Certificate of Conformity

Product:	FlightScope mevo
Brand:	FlightScope
Test Model:	mevo
Sample Status:	ENGINEERING SAMPLE
Applicant:	FlightScope (Pty) Ltd
Test Date:	Apr. 21 to May 05, 2017
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.245) 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:** Mar. 06, 2018

Wendy Wu / Specialist

Approved by : _____ , **Date:** Mar. 06, 2018

May Chen / Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (SECTION 15.245)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -13.19dB at 0.15391MHz.
15.245	Radiated Emission Test	PASS	Meet the requirement of limit. Minimum passing margin is -8.3dB at 40.02MHz.
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	5.32 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.14 dB
	6GHz ~ 18GHz	5.04 dB
	18GHz ~ 40GHz	5.25 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	FlightScope mevo
Brand	FlightScope
Test Model	mevo
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	5 Vdc from USB interface 3.2~3.4 Vdc from battery
Modulation Type	CW
Operating Frequency	24.075~24.175GHz
Antenna Type	Microstrip antenna with 8.5 dBi gain
Antenna Connector	NA
Accessory Device	NA
Data Cable Supplied	USB Cable x 1(unshielded, 0.1m)

Note:

1. There are 24GHz radar technology and BT-LE technology used for the EUT.
2. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 Description of Test Modes

1 channel is provided in EUT for test:

Channel	Frequency
1	24.088GHz

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO			DESCRIPTION
	RE≥1G	RE<1G	PLC	
1	√	√	√	Power from adapter
2	-	-	√	Power from host equipment

Where **RE≥1G:** Radiated Emission above 1GHz & Bandedge Measurement **RE<1G:** Radiated Emission below 1GHz

PLC: Power Line Conducted Emission

NOTE: 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 (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.

TESTED CHANNEL	MODULATION TYPE
1	CW

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.

TESTED CHANNEL	MODULATION TYPE
1	CW

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.

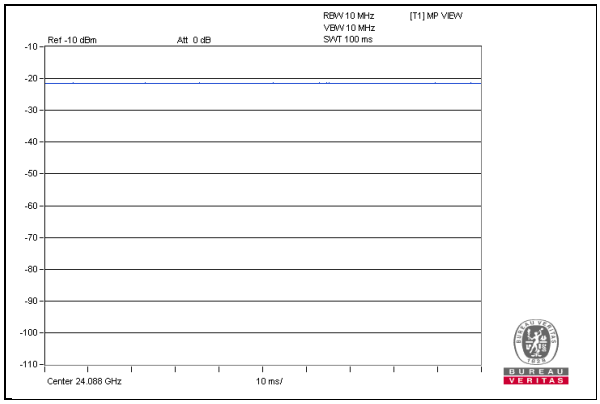
TESTED CHANNEL	MODULATION TYPE
1	CW

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	24deg. C, 61%RH	DC 5V	Jyunchun Lin
RE<1G	24deg. C, 64%RH	DC 5V	Rey Chen
PLC	25deg. C, 75%RH	120Vac, 60Hz (system)	Andy Ho

3.3 Duty Cycle of Test Signal

Duty cycle of test signal is 100 %, duty factor is not required.



3.4 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	Main Switch	NA	NA	NA	NA	Supplied by client(for RF Setup)
B	24GHz RF Switch	NA	NA	NA	NA	Supplied by client(for RF Setup)
C	Bluetooth Switch	NA	NA	NA	NA	Supplied by client(for RF Setup)
D	USB Adapter	ASUS	EXA1205UA	NA	NA	Provided by Lab
E	Laptop	DELL	E6440	F9LYQ32	FCC DoC	Provided by Lab

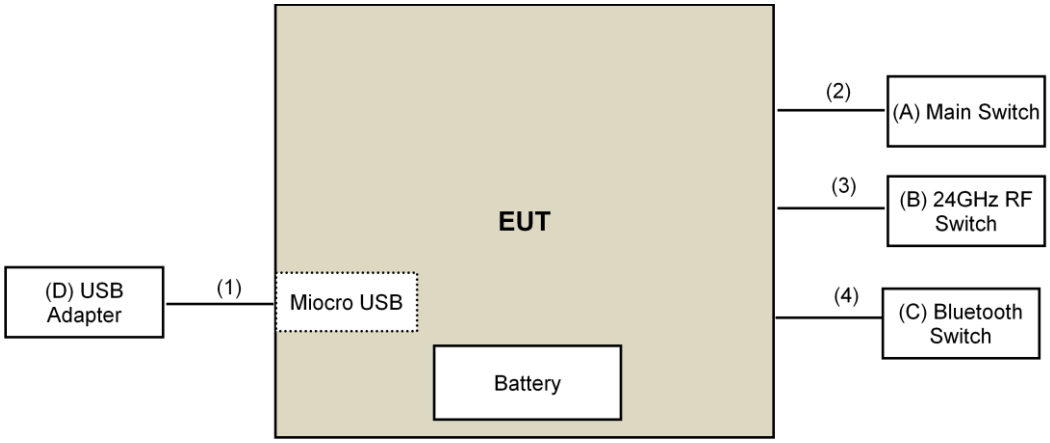
Note:

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

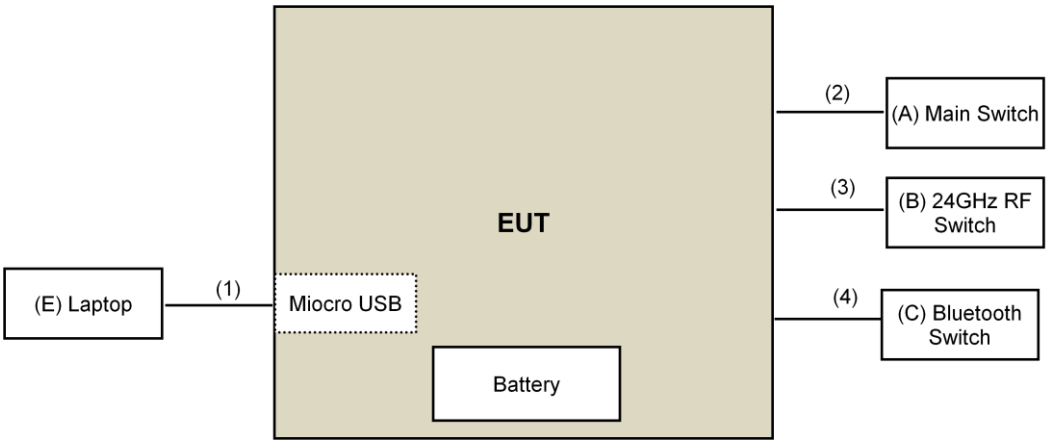
ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	USB Cable	1	0.1	No	0	Supplied by client
2	Console Cable	1	0.05	No	0	Supplied by client(for RF Setup)
3	Console Cable	1	0.05	No	0	Supplied by client(for RF Setup)
4	Console Cable	1	0.05	No	0	Supplied by client(for RF Setup)

3.4.1 Configuration of System under Test

For Mode 1



For Mode 2



3.5 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 (15.245)
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

According to 15.245 the field strength of emissions from intentional radiators operated under these frequencies bands shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (dBuV/m)	
	Peak	Average
24075 ~ 24175	147.9	127.9
	Field Strength of Harmonics (dBuV/m)	
	107.9	87.9

Harmonic emissions in the restricted bands at and above 17.7 GHz shall not exceed the following field strength limits:

Application	Field Strength of Harmonics (dBuV/m)
Field disturbance sensors operating in the 24075-24175 MHz band and for Other field disturbance sensors designed for use only within a building or to open building doors.	87.9
All other field disturbance sensors	77.5

Note: Field disturbance sensors designed to be used in motor vehicles or aircraft must include features to prevent continuous operation unless their emissions in the restricted bands, other than the second and third harmonics from devices operating in the 24075-24175 MHz band, fully comply with the limits given in Section15.209.

(1) Field strength limits are specified at a distance of 3 meters.
(2) 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 in Section 15.209, whichever is the lesser attenuation.

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

Frequencies (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(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

Below 40GHz test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY50010156	Aug. 18, 2016	Aug. 17, 2017
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-05	May 07, 2016	May 06, 2017
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Dec. 29, 2016	Dec. 28, 2017
RF Cable	8D	966-3-1 966-3-2 966-3-3	Apr. 01, 2017	Mar. 31, 2018
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-3-01	Oct. 05, 2016	Oct. 04, 2017
Horn_Antenna SCHWARZBECK	BBHA9120-D	9120D-406	Dec. 28, 2016	Dec. 27, 2017
Pre-Amplifier EMCI	EMC12630SE	980384	Feb. 02, 2017	Feb. 01, 2018
RF Cable	EMC104-SM-SM-1200 EMC104-SM-SM-2000 EMC104-SM-SM-5000	160922 150317 150322	Feb. 02, 2017 Mar. 29, 2017 Mar. 29, 2017	Feb. 01, 2018 Mar. 28, 2018 Mar. 28, 2018
Spectrum Analyzer Keysight	N9030A	MY54490520	July 29, 2016	July 28, 2017
Pre-Amplifier EMCI	EMC184045SE	980386	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	MF780208406	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	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. Loop antenna was used for all emissions below 30 MHz.
4. The test was performed in 966 Chamber No. 3.
5 The CANADA Site Registration No. is 20331-1
6. Tested Date: Apr. 21, 2017

Above 40GHz test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer Agilent	E4446A	MY48250253	Dec. 21, 2016	Dec. 20, 2017
*Harmonic Mixer (33~55GHz) OML	M22HWD	110215-1	Apr. 12, 2017	Apr. 11, 2019
*Horn Antenna (33~55GHz) OML	M22RH	110215-1	Apr. 12, 2017	Apr. 11, 2019
*Harmonic Mixer (50~75GHz) OML	M15RH	110215-1	Apr. 12, 2017	Apr. 11, 2019
*Horn Antenna (50~75GHz) OML	M15HWD	110215-1	Apr. 12, 2017	Apr. 11, 2019
*Harmonic Mixer (75~110GHz) OML	M10HWD	110215-1	Apr. 12, 2017	Apr. 11, 2019
*Horn Antenna (75~110GHz) OML	M10RH	110215-1	Apr. 12, 2017	Apr. 11, 2019
*Diplexer EMCI	DPL26	DPL26_01	Apr. 12, 2017	Apr. 11, 2019
*Diplexer EMCI	DPL26	DPL26_02	Apr. 12, 2017	Apr. 11, 2019
*Precision 30dB Attenuator Keysight	11708A	MY55260015	June 24, 2015	June 23, 2017
*Zero-Bias Detector (50~75GHz) Vdi	WR15ZBD	WR15R5 1-30	July 30, 2015	July 29, 2017
4CH Infiniivision Oscilloscope Keysight	DSOX6004A	MY55190202	Dec. 09, 2016	Dec. 08, 2017
*WR15CH Conical Horn Keysight	WR15CH	WR15CH-01	Sep. 08, 2015	Sep. 07, 2017
*WR10CH Conical Horn Keysight	WR10CH	WR10CH-01	Sep. 08, 2015	Sep. 07, 2017
*Millimeter-Wave Signal Generator Frequency Extension Module (50~75 GHz) Keysight	E8257DV15	US54250106	Dec. 22, 2015	Dec. 21, 2017
*Millimeter-Wave Signal Generator Frequency Extension Module (75~110 GHz) Keysight	E8257DV10	US53250009	Dec. 22, 2015	Dec. 21, 2017
Antenna Tower & Turn Table CT	NA	NA	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. 3
4 The VCCI Site Registration No. is G-137.
5 The CANADA Site Registration No. is IC 7450H-2.
6. Test Date: Apr. 21, 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: 30MHz ~ 18GHz

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.

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 is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Peak detection (PK) at frequency from 1GHz to 40GHz.
3. The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 10Hz for Average detection (AV) at frequency from 1GHz to 40GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

For Radiated emission: Above 18GHz

External harmonic mixers are utilized.

a. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meters chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The distance at which limits are typically specified is 3 meter; however, closer measurement distances may be utilized.

c. Begin handheld measurements with the test antenna (horn) at a distance of 1 meter from the EUT, in a horizontally polarized position. Slowly adjust its position, entirely covering the plane 1 meter from the EUT.

d. Repeat (b) with the horn in a vertically polarized position.

e. If the emission cannot be detected at 1 meter, reduce the RBW in order to increase system sensitivity. Note the value. If the emission still cannot be detected, move the horn closer to the EUT, noting the distance at which a measurement is made.

f. Note the maximum level indicated on the Spectrum Analyzer.

g. Based on the distance at which the measurement was made and the calculated distance to the edge of the far field, determine the appropriate distance attenuation factor. Apply this factor to the calculated field strength in order to determine the equivalent field strength at the distance at which the regulatory limit is specified. Compare to the appropriate limits

h. Repeat (a) - (f) for every emission that must be measured, up through the required frequency range of investigation

NOTE:

1. The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 50MHz for Peak and Average detection at frequency above 40GHz.
2. Shorter measurement distances may be used to improve the measurement system's noise floor. As ANSI C63.10 description is based on the measurement in distance of 3 meters, the data obtained at 0.8-meter distance was extrapolate results to the 3-m distance:

   Test value at 3-meter distance (dBuV)

   = Test value at 0.8 meter distance (dBuV) -20log(3/0.8)(dB)

   = Test value at 0.8 meter distance (dBuV) -11.5(dB).

* Measurements made at 0.8 meter distance. Test value converted to account for 3-meter measurement distance.

FAR FIELD BOUNDARY CALCULATIONS
The far-field boundary is given as:
R far field = (2 * L^2) /λ
where: L = Largest Antenna Dimension, including the reflector, in meters
λ = wavelength in meters

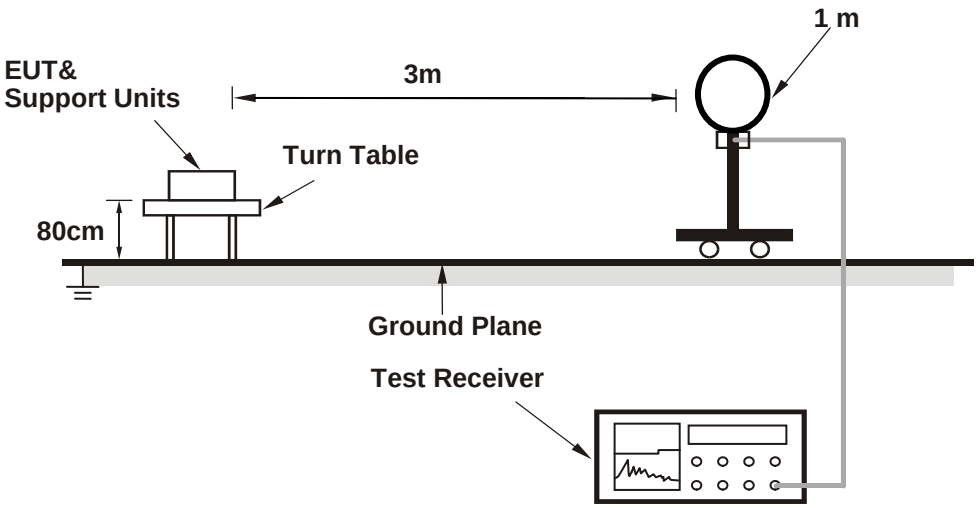
FREQUENCY (GHz)	L (m)	Lambda (m)	R (Far Field) (m)
24.088	0.065	0.0125	0.676

4.1.4 Deviation from Test Standard

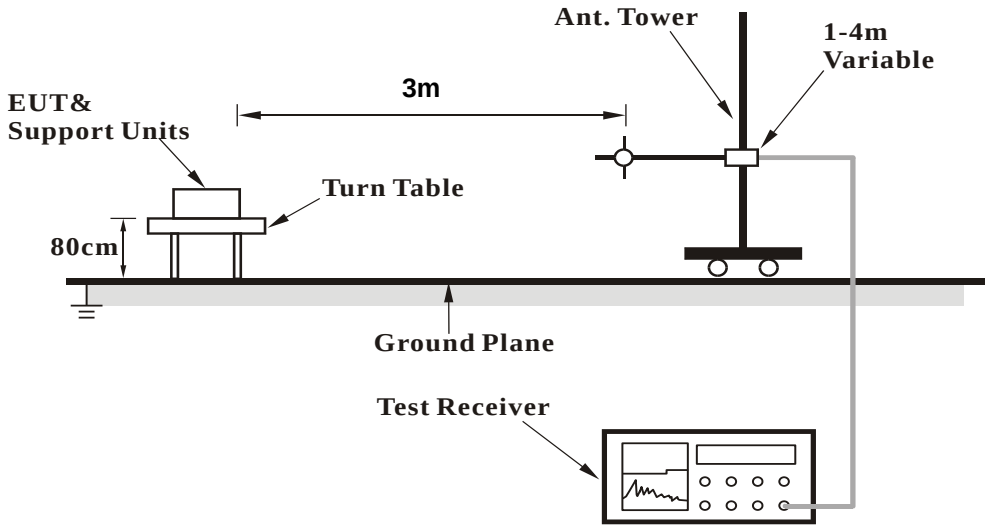
No deviation.

4.1.5 Test Setup

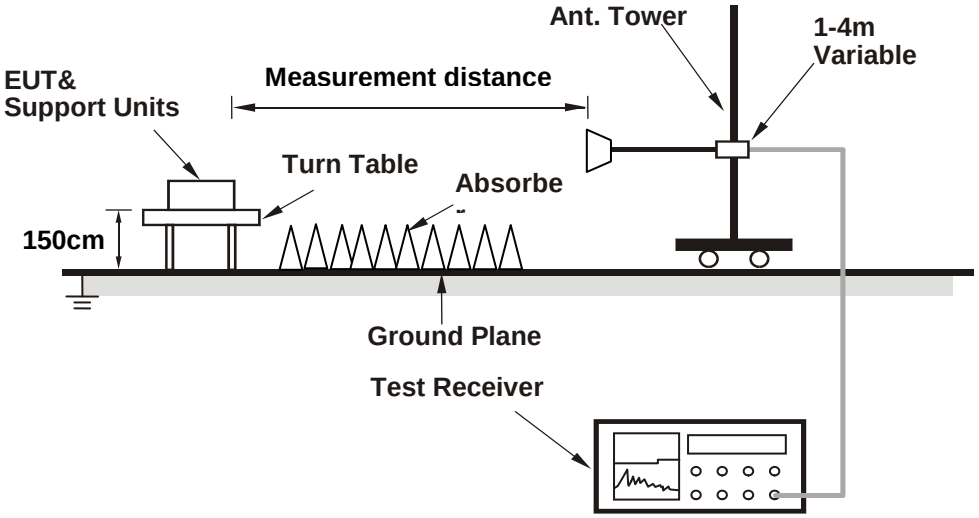
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission 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 / receiver condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1GHz Data

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 18GHz		

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	3569.23	38.4 PK	74.0	-35.6	2.03 H	360	37.7	0.7
2	3569.23	24.9 AV	54.0	-29.1	2.03 H	360	24.2	0.7
3	6821.52	42.1 PK	74.0	-31.9	2.99 H	360	34.3	7.8
4	6821.52	29.9 AV	54.0	-24.1	2.99 H	360	22.1	7.8
5	9233.78	46.9 PK	74.0	-27.1	2.99 H	0	36.2	10.7
6	9233.78	33.7 AV	54.0	-20.3	2.99 H	0	23.0	10.7
7	11170.42	48.5 PK	74.0	-25.5	3.00 H	277	34.8	13.7
8	11170.42	36.1 AV	54.0	-17.9	3.00 H	277	22.4	13.7
9	14358.10	52.3 PK	74.0	-21.7	2.00 H	0	35.4	16.9
10	14358.10	39.0 AV	54.0	-15.0	2.00 H	0	22.1	16.9
11	17969.35	57.4 PK	74.0	-16.6	3.00 H	360	34.5	22.9
12	17969.35	44.9 AV	54.0	-9.1	3.00 H	360	22.0	22.9
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	3297.06	36.6 PK	74.0	-37.4	1.01 V	193	36.3	0.3
2	3297.06	24.9 AV	54.0	-29.1	1.01 V	193	24.6	0.3
3	6847.52	42.9 PK	74.0	-31.1	1.01 V	283	35.1	7.8
4	6847.52	29.6 AV	54.0	-24.4	1.01 V	283	21.8	7.8
5	8125.39	44.7 PK	74.0	-29.3	2.00 V	178	34.4	10.3
6	8125.39	32.5 AV	54.0	-21.5	2.00 V	178	22.2	10.3
7	9705.72	45.9 PK	74.0	-28.1	1.00 V	155	34.3	11.6
8	9705.72	33.4 AV	54.0	-20.6	1.00 V	155	21.8	11.6
9	14358.34	50.7 PK	74.0	-23.3	1.00 V	83	33.8	16.9
10	14358.34	38.9 AV	54.0	-15.1	1.00 V	83	22.0	16.9
11	17987.85	56.8 PK	74.0	-17.2	1.00 V	360	33.7	23.1
12	17987.85	44.8 AV	54.0	-9.2	1.00 V	360	21.7	23.1

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 1	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	18GHz ~ 40GHz		

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	24075.00	44.8 PK	74.0	-29.2	1.50 H	44	59.6	-14.8
2	24075.00	34.8 AV	54.0	-19.2	1.50 H	44	49.6	-14.8
3	*24088.00	86.2 PK		-61.7	1.50 H	44	100.8	-14.6
4	*24088.00	85.7 AV		-42.2	1.50 H	44	100.3	-14.6
5	24175.00	44.4 PK	74.0	-29.6	1.50 H	44	58.8	-14.4
6	24175.00	34.1 AV	54.0	-19.9	1.50 H	44	48.5	-14.4
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	24075.00	45.2 PK	74.0	-28.8	1.50 V	353	60.0	-14.8
2	24075.00	35.4 AV	54.0	-18.6	1.50 V	353	50.2	-14.8
3	*24088.00	107.9 PK		-40.0	1.50 V	353	122.5	-14.6
4	*24088.00	107.1 AV		-20.8	1.50 V	353	121.7	-14.6
5	24175.00	45.4 PK	74.0	-28.6	1.50 V	353	59.8	-14.4
6	24175.00	35.1 AV	54.0	-18.9	1.50 V	353	49.5	-14.4

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. " * ": Fundamental frequency.

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	40GHz ~ 100GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M							
NO.	FREQ. (GHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	EIRP Level (dBm)	Measured Power (dBm)	Receiver Antenna Gain (dBi)
1	48.176	74.3 PK	97.5	-23.2	-20.9	-61.2	23.9
2	48.176	61.9 AV	77.5	-15.6	-33.3	-73.6	23.9
3	72.264	76.4 PK	97.5	-21.1	-18.8	-62.6	23.9
4	72.264	61.9 AV	77.5	-15.6	-33.3	-77.1	23.9
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M							
NO.	FREQ. (GHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	EIRP Level (dBm)	Measured Power (dBm)	Receiver Antenna Gain (dBi)
1	48.176	74.2 PK	97.5	-23.3	-21.0	-61.3	23.9
2	48.176	61.7 AV	77.5	-15.8	-33.5	-73.8	23.9
3	72.264	76.5 PK	97.5	-21.0	-18.7	-62.5	23.9
4	72.264	61.7 AV	77.5	-15.8	-33.5	-77.3	23.9

REMARKS:

1.The measured power level is converted to EIRP using the Friis equation:

EIRP = PT * GT = (PR / GR) * (4 * Pi * D/ λ)^ 2

where:

PR is the power of the receive measurement

GR is the gain of the receive measurement antenna

D is the measurement distance

λ is the wavelength

2. Field strength is then converted to EIRP as follows:

EIRP = ((E*D)^2) / 30

Working in dB units, the above equation is equivalent to:

EIRP[dBm] = E[dBμV/m] + 20 log(D[meters]) - 104.8

E = EIRP – 20 * log(D) + 104.8

3. " - ": The emission levels were too low to be detected.

4. Shorter measurement distances may be used to improve the measurement system's noise floor. As ANSI C63.10 description is based on the measurement in distance of 3 meters, the data obtained at 0.8-meter distance was extrapolate results to the 3-m distance:

Test value at 3-meter distance (dBuV)

= Test value at 0.8 meter distance (dBuV) -20log(3/0.8)(dB)

= Test value at 0.8 meter distance (dBuV) -11.5(dB).

*Measurements made at 0.8 meter distance. Test value converted to account for 3-meter measurement distance.

Below 1GHz Data

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	Below 1GHz		

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	36.79	24.4 QP	40.0	-15.6	3.00 H	335	33.7	-9.3
2	125.88	19.9 QP	43.5	-23.6	3.00 H	308	29.8	-9.9
3	173.75	22.1 QP	43.5	-21.4	1.00 H	74	31.3	-9.2
4	196.16	22.0 QP	43.5	-21.5	4.00 H	238	33.2	-11.2
5	617.34	28.3 QP	46.0	-17.7	3.00 H	360	28.5	-0.2
6	762.11	30.1 QP	46.0	-15.9	4.00 H	168	27.7	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	**40.02**	**31.7 QP**	**40.0**	**-8.3**	**1.00 V**	**37**	**40.8**	**-9.1**
2	54.88	26.4 QP	40.0	-13.6	1.00 V	119	34.9	-8.5
3	196.19	24.3 QP	43.5	-19.2	4.00 V	360	35.5	-11.2
4	229.14	23.4 QP	46.0	-22.6	4.00 V	258	34.0	-10.6
5	644.35	29.6 QP	46.0	-16.4	3.00 V	115	29.2	0.4
6	886.12	30.8 QP	46.0	-15.2	1.00 V	212	27.2	3.6

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.

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 13, 2016	June 12, 2017
50 ohms Terminator	N/A	EMC-02	Sep. 29, 2016	Sep. 28, 2017
RF Cable	5D-FB	COCCAB-001	Sep. 30, 2016	Sep. 29, 2017
10 dB PAD Mini-Circuits	HAT-10+	CONATT-004	June 20, 2016	June 19, 2017
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: Apr. 25, 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.

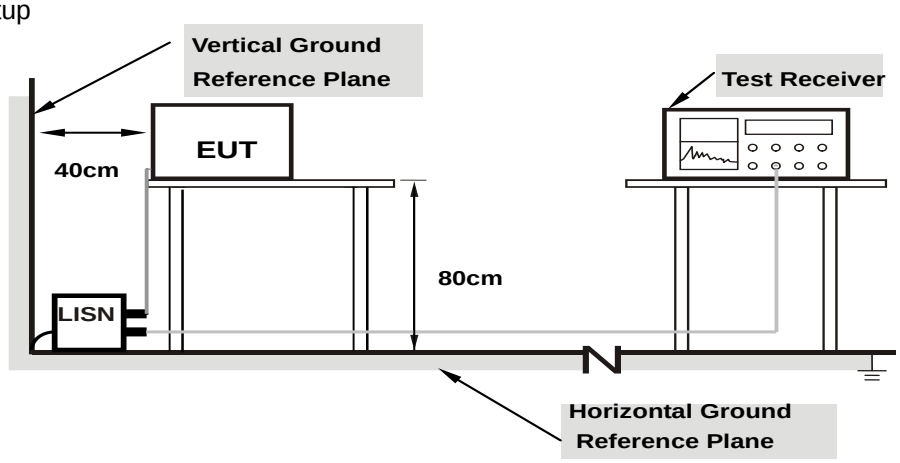
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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.

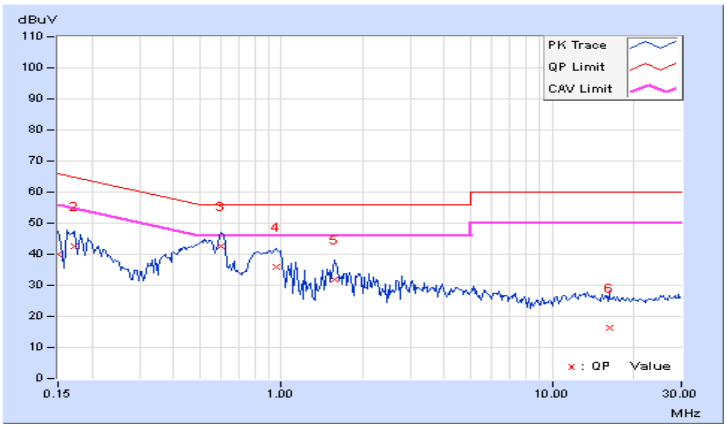
4.2.7 Test Results (Mode 1)

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

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.20	29.92	14.45	40.12	24.65	66.00	56.00	-25.88	-31.35
2	0.17344	10.20	32.50	17.60	42.70	27.80	64.79	54.79	-22.09	-26.99
3	0.59922	10.26	32.26	18.41	42.52	28.67	56.00	46.00	-13.48	-17.33
4	0.95469	10.30	25.54	13.36	35.84	23.66	56.00	46.00	-20.16	-22.34
5	1.57813	10.29	21.41	8.88	31.70	19.17	56.00	46.00	-24.30	-26.83
6	16.30859	11.40	5.08	-2.54	16.48	8.86	60.00	50.00	-43.52	-41.14

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

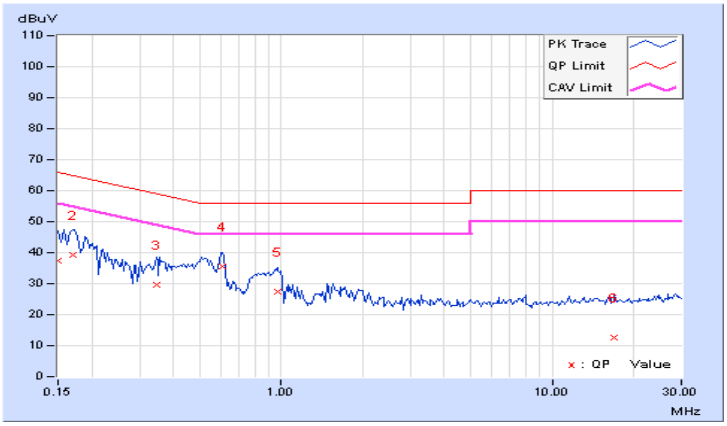


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.19	27.06	6.56	37.25	16.75	66.00	56.00	-28.75	-39.25
2	0.16953	10.18	29.00	10.26	39.18	20.44	64.98	54.98	-25.80	-34.54
3	0.34531	10.22	19.25	5.15	29.47	15.37	59.07	49.07	-29.60	-33.70
4	0.60703	10.25	25.31	11.34	35.56	21.59	56.00	46.00	-20.44	-24.41
5	0.96641	10.26	17.05	4.25	27.31	14.51	56.00	46.00	-28.69	-31.49
6	17.01172	11.21	1.22	-4.82	12.43	6.39	60.00	50.00	-47.57	-43.61

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



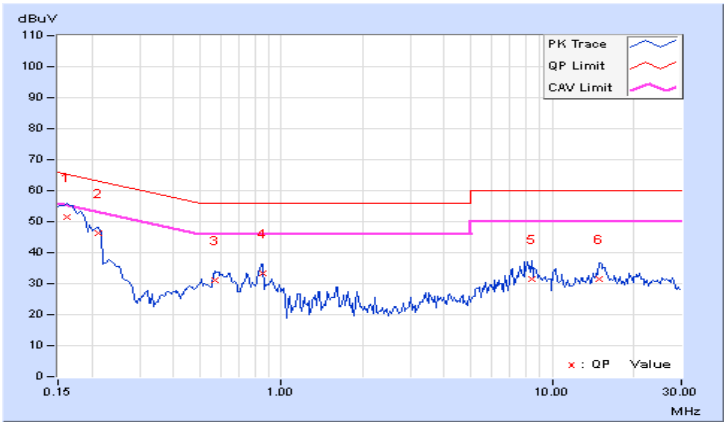
4.2.8 Test Results (Mode 2)

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

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16172	10.19	41.45	23.02	51.64	33.21	65.38	55.38	-13.74	-22.17
2	0.21250	10.19	35.95	24.38	46.14	34.57	63.11	53.11	-16.97	-18.54
3	0.57188	10.23	20.86	11.51	31.09	21.74	56.00	46.00	-24.91	-24.26
4	0.85313	10.25	23.04	11.56	33.29	21.81	56.00	46.00	-22.71	-24.19
5	8.40234	10.47	21.01	12.40	31.48	22.87	60.00	50.00	-28.52	-27.13
6	14.99219	11.05	20.35	13.39	31.40	24.44	60.00	50.00	-28.60	-25.56

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

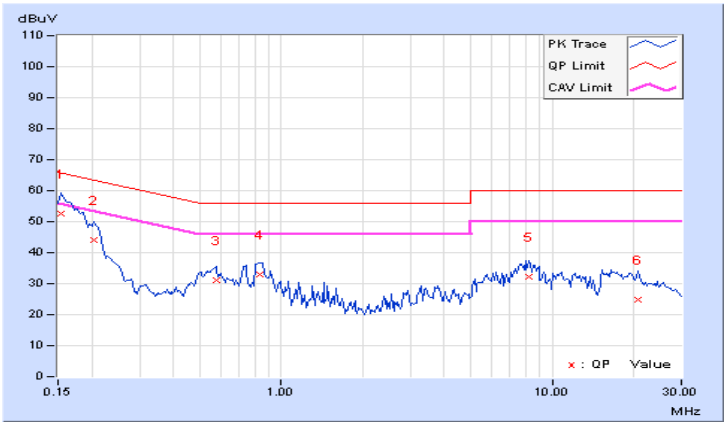


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	**0.15391**	**10.18**	**42.42**	**24.80**	**52.60**	**34.98**	**65.79**	**55.79**	**-13.19**	**-20.81**
2	0.20469	10.16	33.91	14.32	44.07	24.48	63.42	53.42	-19.35	-28.94
3	0.57578	10.22	20.80	12.57	31.02	22.79	56.00	46.00	-24.98	-23.21
4	0.83750	10.22	22.72	9.65	32.94	19.87	56.00	46.00	-23.06	-26.13
5	8.20703	10.39	21.91	12.92	32.30	23.31	60.00	50.00	-27.70	-26.69
6	20.84375	11.10	13.63	7.76	24.73	18.86	60.00	50.00	-35.27	-31.14

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 20dB bandwidth Measurement

4.3.1 Limits of 20dB bandwidth Measurement

According to 15.215(c), the requirement is to ensure the 20dB bandwidth of the emission, or whatever bandwidth may otherwise be specified, is contained within the frequency band designated in the rule section under which the equipment is operated.

4.3.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSV40	100964	June 28, 2016	June 27, 2017

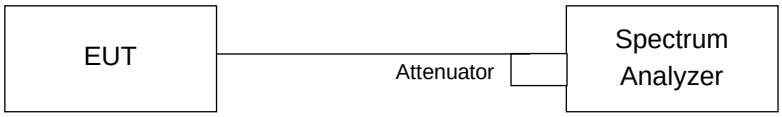
Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. Tested date : May 05, 2017

4.3.3 Test Procedure

The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100 kHz RBW and 300kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.
Set both RBW and VBW of spectrum analyzer to 100 kHz and 300kHz with suitable frequency span from band edge. The bandedge was measured and recorded.

4.3.4 Test Setup



4.3.5 Deviation from Test Standard

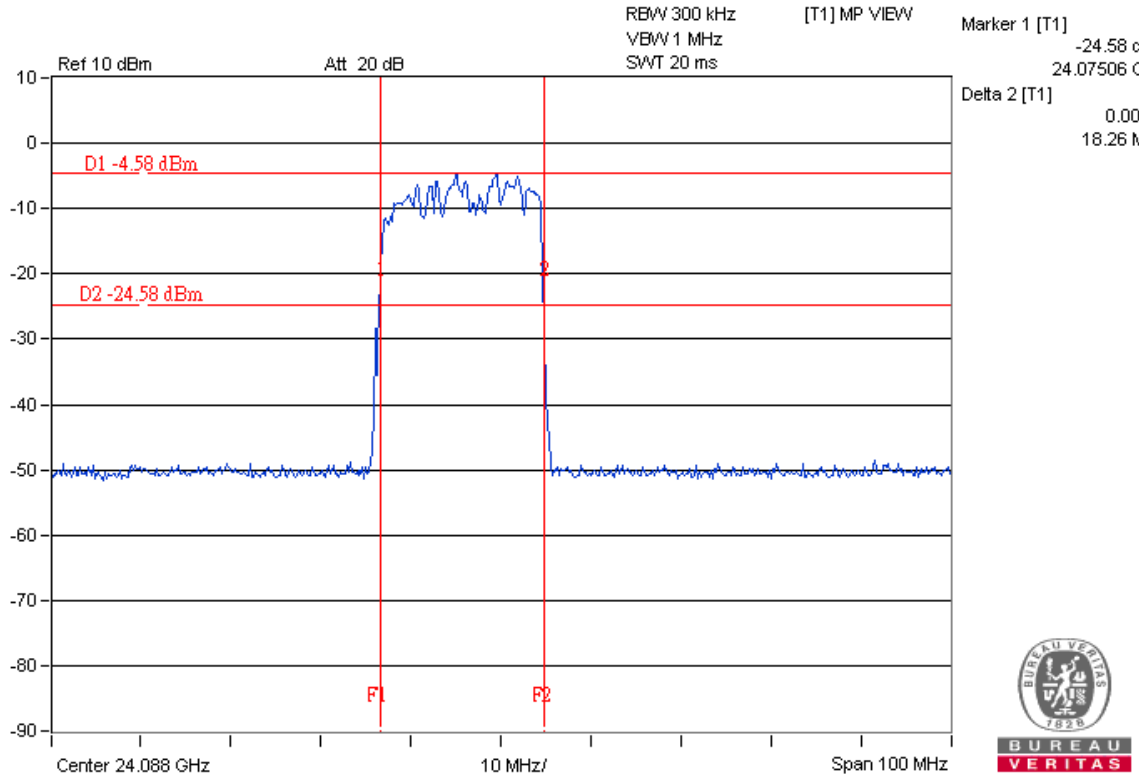
No deviation.

4.3.6 EUT Operating Condition

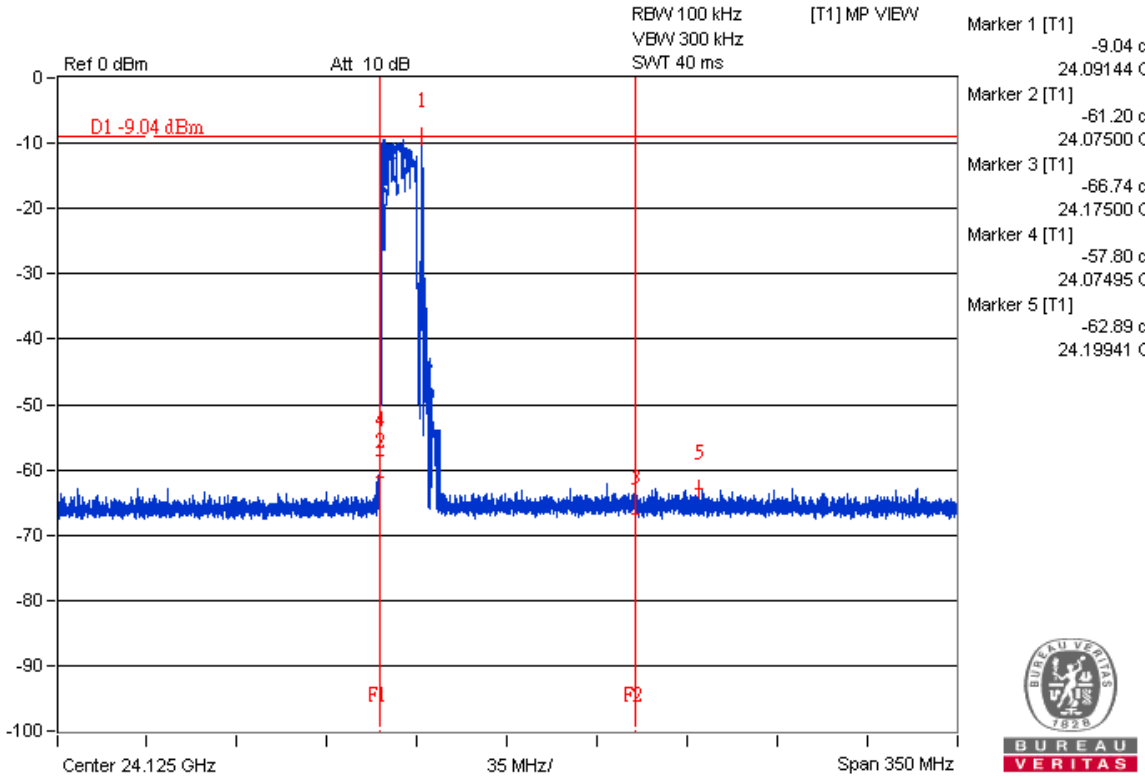
Set the EUT under transmission / receiver condition continuously.

4.3.7 Test Results

For 20dB Bandwidth



For Bandedge



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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