

FCC Test Report (BT-LE)

Report No.: RF141203E08A-3

FCC ID: JNZVR0004

Test Model: V-R0004

Received Date: Dec. 03, 2014

Test Date: Jan. 20 to 22, 2015

Issued Date: Jan. 30, 2015

Applicant: LOGITECH FAR EAST LTD.

Address: #2 Creation Rd. 4, Science-Based Ind. Park Hsinchu Taiwan, R.O.C.

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

Lab Address: No. 81-1, Lu Liao Keng, 9th Ling, Wu Lung Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan R.O.C.

Test Location (1): No. 81-1, Lu Liao Keng, 9th Ling, Wu Lung Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan R.O.C.

Test Location (2): No. 49, Ln. 206, Wende Rd., Shangshan Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan R.O.C.



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A D T

Release Control Record

Issue No.	Description	Date Issued
RF141203E08A-3	Original release.	Jan. 30, 2015



A D T

1 Certificate of Conformity

Product: ConferenceCam Connect

Brand: Logitech

Test Model: V-R0004

Sample Status: ENGINEERING SAMPLE

Applicant: LOGITECH FAR EAST LTD.

Test Date: Jan. 20 to 22, 2015

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)
ANSI C63.10:2009

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Midoli Peng, **Date:** Jan. 30, 2015
Midoli Peng / Specialist

Approved by : May Chen, **Date:** Jan. 30, 2015
May Chen / Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (SECTION 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -6.31dB at 0.30234MHz.
15.205 15.209 15.247(d)	Radiated Emissions & Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -4.1dB at 185.73MHz.
15.247(a)(2)	6dB bandwidth	PASS	Meet the requirement of limit.
15.247(b)	Conducted power	PASS	Meet the requirement of limit.
15.247(e)	Power Spectral Density	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	Expended Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.86 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.37 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	3.72 dB
	6GHz ~ 18GHz	4.00 dB
	18GHz ~ 40GHz	4.11 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT (BT-LE)

Product	ConferenceCam Connect
Brand	Logitech
Test Model	V-R0004
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	DC 5V from USB interface or DC 3.6V from battery or DC 12V from power adapter
Modulation Type	GFSK
Modulation Technology	DTS
Transfer Rate	Up to 1Mbps
Operating Frequency	2402MHz ~ 2480MHz
Number of Channel	40
Output Power	2.075mW
Antenna Type	Refer to NOTE
Antenna Connector	Refer to NOTE
Accessory Device	Remote control (Model : R-R0007) x1 Adapter x1
Data Cable Supplied	USB charging cable (shielded, 2m with oue core) x 1

Note:

1. There are Bluetooth 4.0, WLAN and NFC (Passive) technology used for the EUT.
2. For WLAN, 2.4GHz and 5GHz technology can not transmit at same time.
3. WLAN and Bluetooth technology can transmit at same time.
4. The emission of the simultaneous operation (WLAN & Bluetooth) has been evaluated and no non-compliance was found.
5. The EUT must be supplied with a battery or a adapter, please refer to the following table:

Battery		
Brand	Model No.	Spec.
SANYO	533-000104	3.6Vdc, 3200 mAh, 11.52 Wh
Adapter		
Brand	Model No.	Spec.
Logitech	DSA-12CA-12 120100	AC Input: 100-240V, 0.3A, 50/60Hz DC Output: 12V, 1A DC output cable(shielded, 3m with oue core)

6. The EUT was pre-tested under following test modes :

Test Mode	Description
Mode A	Power from Battery
Mode B	Power from Adapter
Mode C	Power from USB interface

For the above modes, the worst radiated test was found in **Mode C**. Therefore only the test data of the modes were recorded in this report.

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

BT					
Brand	Model	Gain (dBi)	Antenna Type	Connector Type	Frequency range (GHz to GHz)
NA	NA	-1.29	PCB printed	NA	2.402 ~ 2.48
WLAN					
Brand	Model	Gain (dBi)	Antenna Type	Connector Type	Frequency range (GHz to GHz)
NA	NA	1.64	PCB printed	NA	2.4 ~ 2.4835
		1.57			5.15 ~ 5.85

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

40 channels are provided to this EUT:

CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE $\geq$ 1G	RE<1G	PLC	APCM	
1	√	√	√	√	Power from USB interface
2	-	-	√	-	Power from Adapter

Where **RE $\geq$ 1G**: Radiated Emission above 1GHz **RE<1G**: Radiated Emission below 1GHz
PLC: Power Line Conducted Emission **APCM**: Antenna Port Conducted Measurement

NOTE: "-" means no effect.

RADIATED EMISSION TEST (ABOVE 1GHz):

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

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
1	0 to 39	0, 19, 39	GFSK	1

RADIATED EMISSION TEST (BELOW 1GHz):

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

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
1	0 to 39	19	GFSK	1

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.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
1	0 to 39	0	GFSK	1
2	0 to 39	0	GFSK	1

ANTENNA PORT CONDUCTED MEASUREMENT:

- ☒ 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.

EUT CONFIGUURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
1	0 to 39	0, 19, 39	GFSK	1

TEST CONDITION:

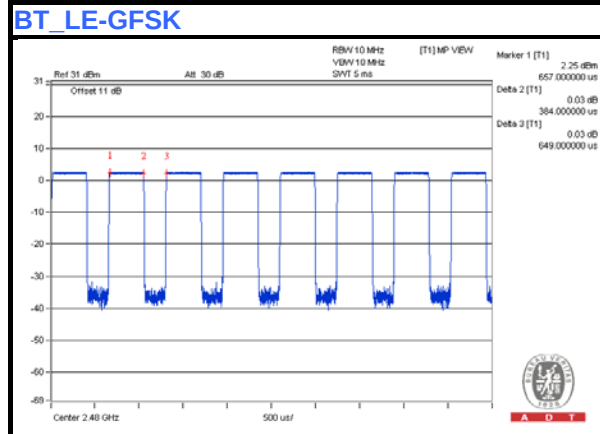
APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
RE $\geq$ 1G	22deg. C, 71%RH	120Vac, 60Hz	Gary Cheng
RE<1G	23deg. C, 69%RH	120Vac, 60Hz	Tim Ho
PLC	20deg. C, 60%RH	120Vac, 60Hz	Mike Hsieh
APCM	25deg. C, 60%RH	120Vac, 60Hz	Andy Ho

3.3 Duty Cycle of Test Signal

Duty cycle of test signal is < 98 %, duty factor shall be considered.

For BT_LE-GFSK:

Duty cycle = 0.384 ms/0.649 ms = 0.592, Duty factor = $10 * \log(1/0.592) = 2.3$



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.

No.	Product	Brand	Model No.	Serial No.	FCC ID	Remark
A	NOTEBOOK COMPUTER	DELL	E5430	HYV4VY1	FCC DoC	Provided by Lab
B	MONITOR	DELL	U2410F	CNOJ257M728729AG159L	FCC DoC	Provided by Lab
C	RJ45 to USB connector	Logitech	NA	NA	NA	Supplied by Client
D	USB test tool	Logitech	NA	NA	NA	Supplied by Client
E	Test tool	Logitech	NA	NA	NA	Supplied by Client

NOTE:

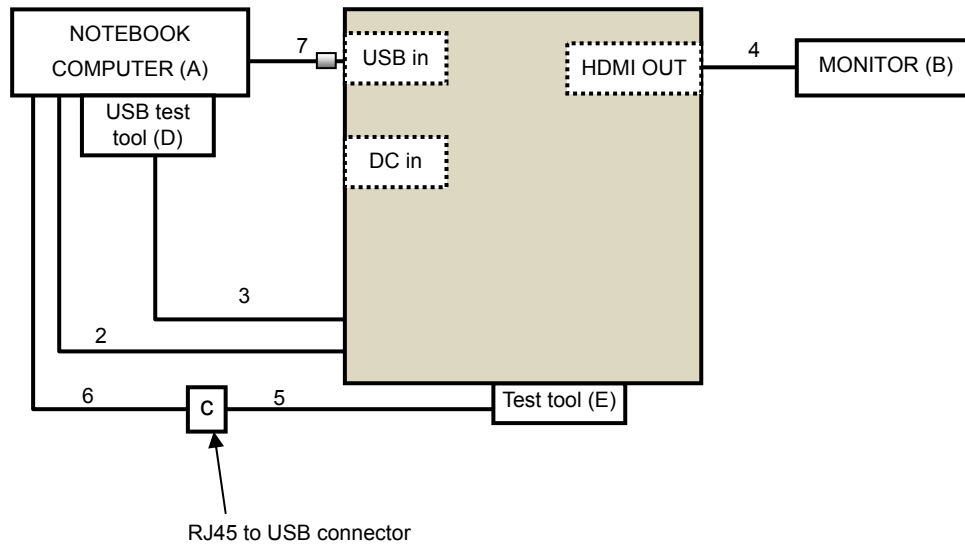
- All power cords of the above support units are non-shielded (1.8 m).

No.	Cable	Qty.	Length (m)	Shielded (Yes/ No)	Cores (Number)	Remark
1	DC	1	3	Yes	1	Supplied by Client
2	USB	1	1	Yes	0	Supplied by Client(Set up only)
3	Cable	1	0.5	No	0	Supplied by Client(Set up only)
4	HDMI	1	1.5	No	0	Provided by Lab
5	RJ45	1	1.5	No	0	Supplied by Client(Set up only)
6	USB	1	1	No	0	Supplied by Client(Set up only)
7	USB	1	2	Yes	1	Supplied by Client

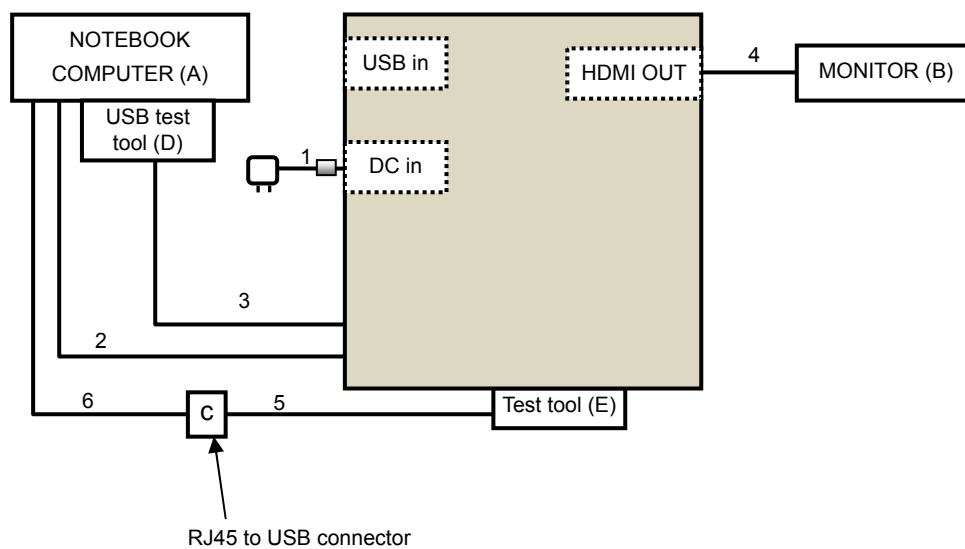
Note: The core(s) is(are) originally attached to the cable(s).

3.4.1 Configuration of System under Test

USB mode:



Adapter mode:



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 (15.247)

558074 D01 DTS Meas Guidance v03r02

ANSI C63.10-2009

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 and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

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 1GHz test

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
MXE EMI Receiver Agilent	N9038A	MY51210105	July 21, 2014	July 20, 2015
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-03	Nov. 12, 2014	Nov. 11, 2015
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-360	Feb. 26, 2014	Feb. 25, 2015
RF Cable	NA	CHGCAB_001	Oct. 04, 2014	Oct. 03, 2015
Horn_Antenna AISI	AIH.8018	0000320091110	Aug. 27, 2014	Aug. 26, 2015
Pre-Amplifier Agilent	8449B	3008A02578	June 24, 2014	June 23, 2015
RF Cable	NA	131205 131214 SNMY23684/4	Jan. 16, 2015	Jan. 15, 2016
Spectrum Analyzer R&S	FSV40	100964	July 05, 2014	July 04, 2015
Pre-Amplifier EMCI	EMC184045	980143	Jan. 16, 2015	Jan. 15, 2016
Horn_Antenna SCHWARZBECK	BBHA 9170	9170-424	Aug. 26, 2014	Aug. 25, 2015
RF Cable	NA	RF104-121 RF104-204	Dec. 11, 2014	Dec. 10, 2015
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 horn antenna, preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
- 3 The test was performed in 966 Chamber No. G.
4. The FCC Site Registration No. is 966073.
- 5 The VCCI Site Registration No. is G-137.
- 6 The CANADA Site Registration No. is IC 7450H-2.
- 7 Tested Date: Jan. 20, 2015

Above 1GHz test

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
MXE EMI Receiver Agilent	N9038A	MY50010156	Aug. 11, 2014	Aug. 10, 2015
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-04	Nov. 12, 2014	Nov. 11, 2015
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Feb. 27, 2014	Feb. 26, 2015
RF Cable	NA	CHHCAB_001	Oct. 05, 2014	Oct. 04, 2015
Horn_Antenna AISI	AIH.8018	0000220091110	Aug. 26, 2014	Aug. 25, 2015
Pre-Amplifier Agilent	8449B	300801923	Oct. 28, 2014	Oct. 27, 2015
RF Cable	NA	131206 131215 SNMY23685/4	Jan. 16, 2015	Jan. 15, 2016
Spectrum Analyzer R&S	FSV40	100964	July 05, 2014	July 04, 2015
Pre-Amplifier EMCI	EMC184045	980143	Jan. 16, 2015	Jan. 15, 2016
Horn_Antenna SCHWARZBECK	BBHA 9170	9170-424	Aug. 26, 2014	Aug. 25, 2015
RF Cable	NA	RF104-121 RF104-204	Dec. 11, 2014	Dec. 10, 2015
Software	ADT_Radiated _V8.7.07	NA	NA	NA
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 horn antenna, preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
- 3 The test was performed in 966 Chamber No. H.
4. The FCC Site Registration No. is 797305.
- 5 The CANADA Site Registration No. is IC 7450H-3.
- 6 Tested Date: Jan. 22, 2015

4.1.3 Test Procedures

- a. The EUT was placed on the top of a rotating table 0.8 meters (for below 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

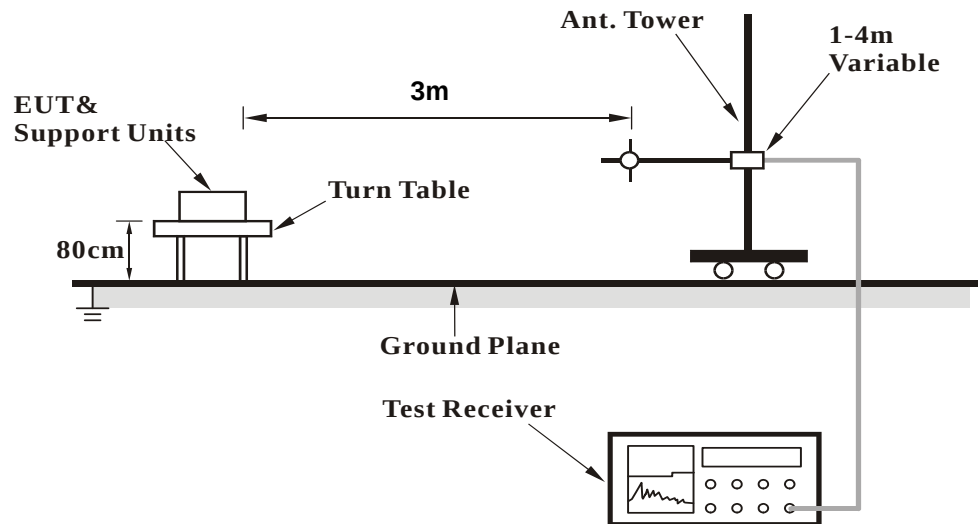
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is $\geq 1/T$ (Duty cycle $< 98\%$) or 10Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

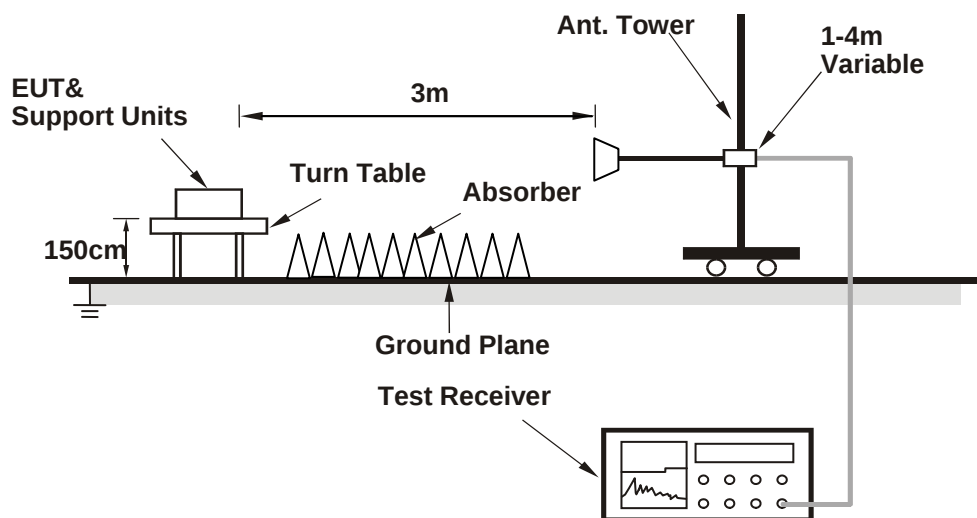
No deviation.

4.1.5 Test Set Up

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



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

4.1.6 EUT Operating Conditions

1. Placed the EUT on testing table.
2. Controlling software (Blue Test 3.0_Version:2.5.0.93) has been activated to set the EUT under transmission/receiving condition continuously.

4.1.7 Test Results

ABOVE 1GHz DATA :

BT_LE-GFSK

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	52.8 PK	74.0	-21.2	1.07 H	217	58.40	-5.60
2	2390.00	32.7 AV	54.0	-21.3	1.07 H	217	38.30	-5.60
3	*2402.00	94.1 PK			1.07 H	217	99.69	-5.59
4	*2402.00	92.3 AV			1.07 H	217	97.89	-5.59
5	4804.00	53.1 PK	74.0	-20.9	1.00 H	111	49.21	3.89
6	4804.00	46.4 AV	54.0	-7.6	1.00 H	111	42.51	3.89
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	53.2 PK	74.0	-20.8	1.00 V	208	58.80	-5.60
2	2390.00	33.1 AV	54.0	-20.9	1.00 V	208	38.70	-5.60
3	*2402.00	97.2 PK			1.00 V	208	102.79	-5.59
4	*2402.00	95.4 AV			1.00 V	208	100.99	-5.59
5	4804.00	54.7 PK	74.0	-19.3	1.00 V	294	50.81	3.89
6	4804.00	48.1 AV	54.0	-5.9	1.00 V	294	44.21	3.89

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 19	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

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	*2440.00	92.3 PK			1.19 H	176	97.71	-5.41
2	*2440.00	90.1 AV			1.19 H	176	95.51	-5.41
3	4880.00	54.1 PK	74.0	-19.9	1.04 H	137	50.30	3.80
4	4880.00	46.7 AV	54.0	-7.3	1.04 H	137	42.90	3.80
5	7320.00	54.5 PK	74.0	-19.5	1.00 H	95	46.23	8.27
6	7320.00	42.3 AV	54.0	-11.7	1.00 H	95	34.03	8.27

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	*2440.00	95.2 PK			1.00 V	194	100.61	-5.41
2	*2440.00	93.5 AV			1.00 V	194	98.91	-5.41
3	4880.00	54.3 PK	74.0	-19.7	1.08 V	315	50.50	3.80
4	4880.00	47.3 AV	54.0	-6.7	1.08 V	315	43.50	3.80
5	7320.00	52.7 PK	74.0	-21.3	1.01 V	82	44.43	8.27
6	7320.00	42.9 AV	54.0	-11.1	1.01 V	82	34.63	8.27

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 39	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2480.00	91.1 PK			1.16 H	196	96.33	-5.23
2	*2480.00	89.0 AV			1.16 H	196	94.23	-5.23
3	2483.50	52.6 PK	74.0	-21.4	1.16 H	196	57.80	-5.20
4	2483.50	32.6 AV	54.0	-21.4	1.16 H	196	37.80	-5.20
5	4960.00	54.2 PK	74.0	-19.8	1.00 H	137	50.37	3.83
6	4960.00	46.8 AV	54.0	-7.2	1.00 H	137	42.97	3.83
7	7440.00	55.4 PK	74.0	-18.6	1.00 H	80	46.72	8.68
8	7440.00	43.0 AV	54.0	-11.0	1.00 H	80	34.32	8.68

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2480.00	93.2 PK			1.00 V	192	98.43	-5.23
2	*2480.00	91.2 AV			1.00 V	192	96.43	-5.23
3	2483.50	52.8 PK	74.0	-21.2	1.00 V	192	58.00	-5.20
4	2483.50	32.8 AV	54.0	-21.2	1.00 V	192	38.00	-5.20
5	4960.00	54.8 PK	74.0	-19.2	1.04 V	320	50.97	3.83
6	4960.00	47.9 AV	54.0	-6.1	1.04 V	320	44.07	3.83
7	7440.00	52.9 PK	74.0	-21.1	1.04 V	98	44.22	8.68
8	7440.00	43.0 AV	54.0	-11.0	1.04 V	98	34.32	8.68

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.

BELOW 1GHz WORST-CASE DATA

BT_LE-GFSK

CHANNEL	TX Channel 0	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	98.34	33.0 QP	43.5	-10.5	1.00 H	215	50.89	-17.87
2	185.24	37.0 QP	43.5	-6.5	1.00 H	222	51.90	-14.94
3	233.46	32.5 QP	46.0	-13.6	1.00 H	332	47.49	-15.04
4	489.86	33.7 QP	46.0	-12.3	1.50 H	241	40.63	-6.96
5	489.88	34.1 QP	46.0	-12.0	1.50 H	222	41.01	-6.96
6	949.88	35.1 QP	46.0	-10.9	1.00 H	100	33.35	1.71
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	109.33	30.7 QP	43.5	-12.9	2.00 V	310	46.73	-16.08
2	185.73	39.4 QP	43.5	-4.1	1.00 V	160	54.39	-15.01
3	225.46	34.2 QP	46.0	-11.8	1.00 V	73	49.91	-15.69
4	382.66	35.5 QP	46.0	-10.5	1.50 V	103	45.09	-9.59
5	414.58	36.3 QP	46.0	-9.8	1.50 V	294	45.09	-8.84
6	988.69	34.9 QP	54.0	-19.1	2.00 V	259	32.88	2.04

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 ROHDE & SCHWARZ	ESCS 30	100375	Apr. 29, 2014	Apr. 28, 2015
Line-Impedance Stabilization Network (for EUT) SCHWARZBECK	NSLK-8127	8127-522	Sep. 15, 2014	Sep. 14, 2015
Line-Impedance Stabilization Network (for Peripheral) ROHDE & SCHWARZ	ENV216	100071	Nov. 10, 2014	Nov. 09, 2015
RF Cable (JYEBAO)	5DFB	COCCAB-001	Mar. 10, 2014	Mar. 09, 2015
50 ohms Terminator	N/A	EMC-03	Sep. 22, 2014	Sep. 21, 2015
50 ohms Terminator	N/A	EMC-02	Sep. 30, 2014	Sep. 29, 2015
Software ADT	BV ADT_Cond_V7.3.7. 3	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 test was performed in Shielded Room No. C.
3. The VCCI Con C Registration No. is C-3611.
4. Tested Date: Jan. 22, 2015

4.2.3 Test Procedures

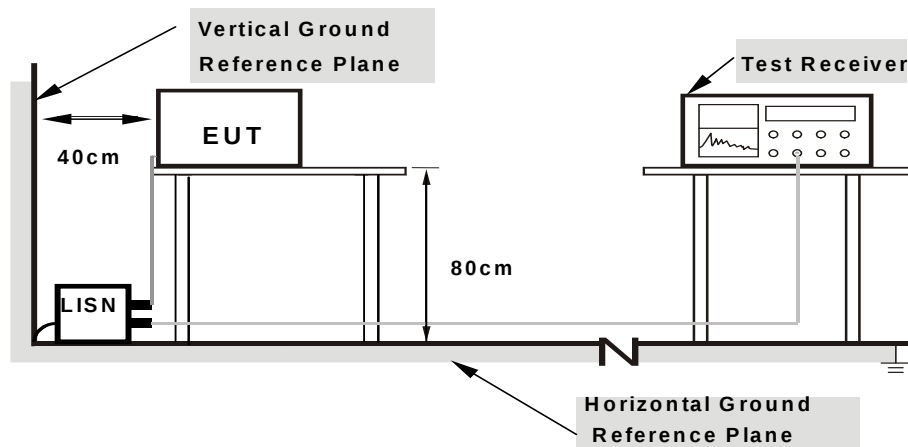
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

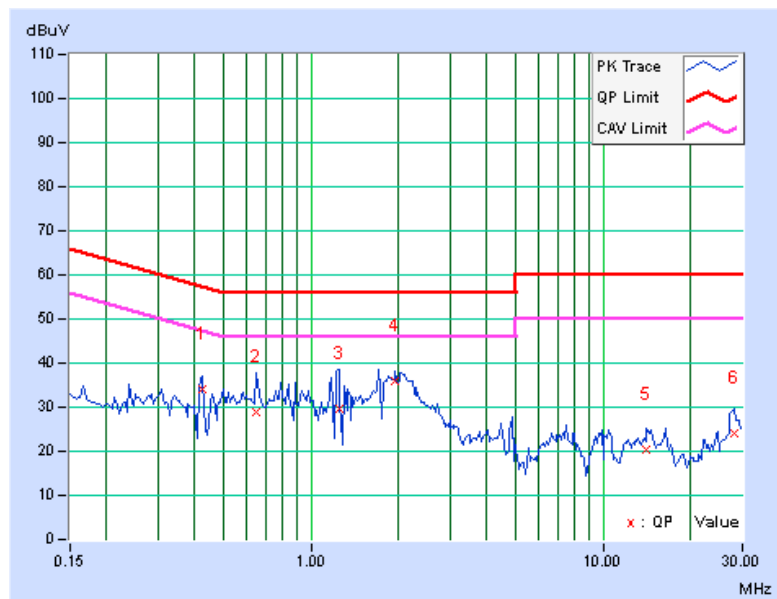
4.2.7 Test Results (Mode 1)

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.42344	0.09	34.12	33.00	34.21	33.09	57.38	47.38	-23.17	-14.29
2	0.65391	0.11	28.95	25.94	29.06	26.05	56.00	46.00	-26.94	-19.95
3	1.24609	0.14	29.32	24.89	29.46	25.03	56.00	46.00	-26.54	-20.97
4	1.93359	0.18	35.77	32.09	35.95	32.27	56.00	46.00	-20.05	-13.73
5	14.10938	0.56	19.86	14.72	20.42	15.28	60.00	50.00	-39.58	-34.72
6	28.16406	0.87	23.09	18.48	23.96	19.35	60.00	50.00	-36.04	-30.65

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.

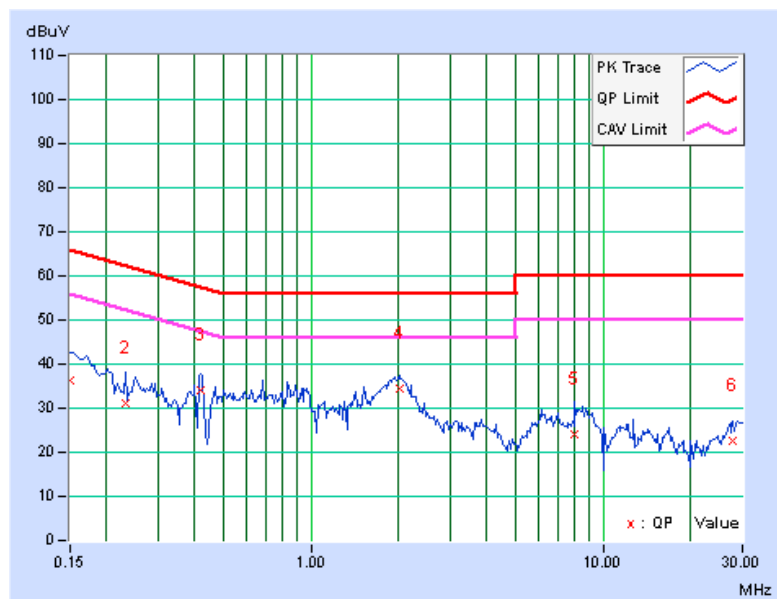


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr.	Reading Value		Emission Level		Limit		Margin	
		Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	0.07	36.38	26.91	36.45	26.98	66.00	56.00	-29.55	-29.02
2	0.23203	0.06	31.10	28.53	31.16	28.59	62.38	52.38	-31.21	-23.78
3	0.41953	0.09	34.04	27.42	34.13	27.51	57.46	47.46	-23.33	-19.95
4	2.00781	0.18	34.36	29.91	34.54	30.09	56.00	46.00	-21.46	-15.91
5	7.99219	0.39	23.65	18.16	24.04	18.55	60.00	50.00	-35.96	-31.45
6	27.73828	0.92	21.58	16.61	22.50	17.53	60.00	50.00	-37.50	-32.47

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.



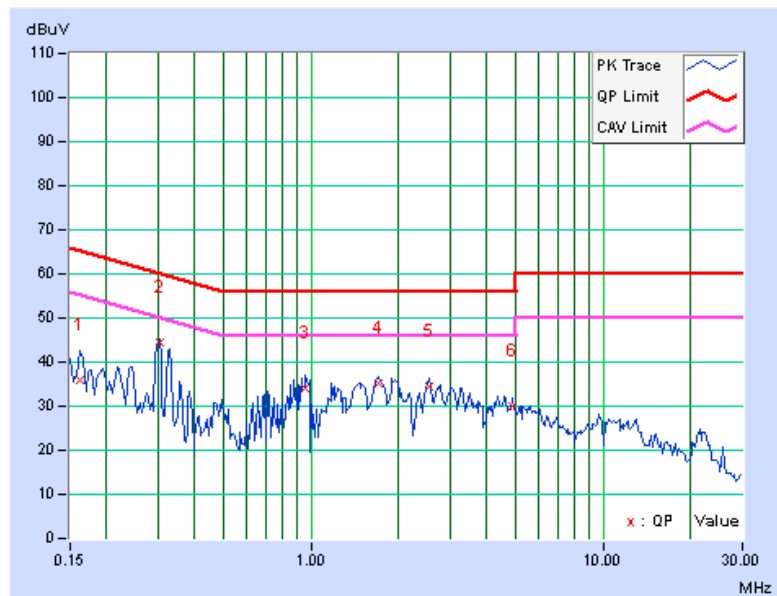
4.2.8 Test Results (Mode 2)

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16172	0.07	35.76	26.83	35.83	26.90	65.38	55.38	-29.55	-28.48
2	0.30234	0.08	44.33	43.79	44.41	43.87	60.18	50.18	-15.77	-6.31
3	0.95859	0.13	34.07	32.44	34.20	32.57	56.00	46.00	-21.80	-13.43
4	1.69922	0.16	34.89	34.51	35.05	34.67	56.00	46.00	-20.95	-11.33
5	2.54688	0.20	34.27	31.98	34.47	32.18	56.00	46.00	-21.53	-13.82
6	4.87500	0.28	29.56	24.59	29.84	24.87	56.00	46.00	-26.16	-21.13

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.

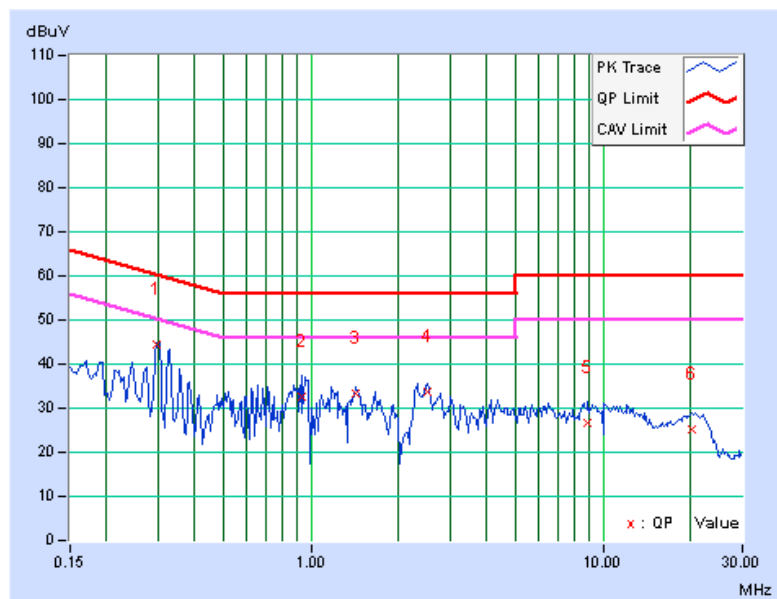


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr.	Reading Value		Emission Level		Limit		Margin	
		Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.29844	0.07	44.27	43.75	44.34	43.82	60.29	50.29	-15.94	-6.46
2	0.93125	0.13	32.37	29.96	32.50	30.09	56.00	46.00	-23.50	-15.91
3	1.42188	0.15	33.01	32.23	33.16	32.38	56.00	46.00	-22.84	-13.62
4	2.51563	0.20	33.67	30.80	33.87	31.00	56.00	46.00	-22.13	-15.00
5	8.88672	0.42	26.30	21.96	26.72	22.38	60.00	50.00	-33.28	-27.62
6	20.14453	0.74	24.50	20.11	25.24	20.85	60.00	50.00	-34.76	-29.15

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.

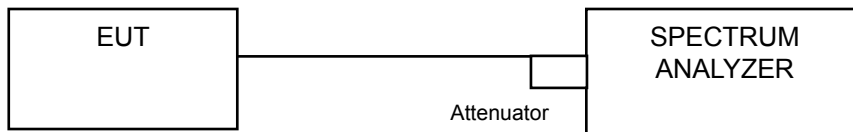


4.3 6dB Bandwidth Measurement

4.3.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

4.3.2 Test Setup



4.3.3 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSP 40	100060	May 08, 2014	May 07, 2015

- NOTE:**
1. The test was performed in Oven room B.
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 3. Tested Date: Jan. 22, 2015

4.3.4 Test Procedure

- a. Set resolution bandwidth (RBW) = 100kHz
- b. Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
- c. Trace mode = max hold.
- d. Sweep = auto couple.
- e. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

4.3.5 Deviation from Test Standard

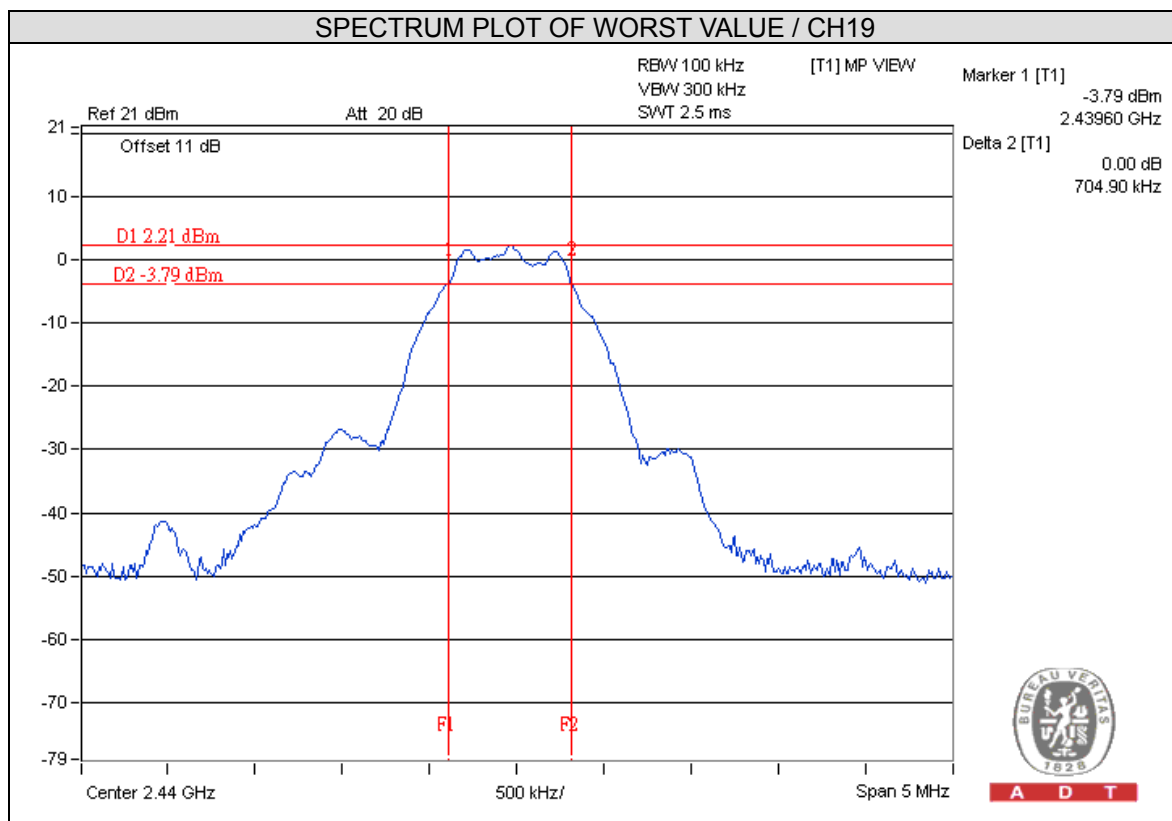
No deviation.

4.3.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.3.7 Test Result

CHANNEL	FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
0	2402	0.72	0.5	PASS
19	2440	0.70	0.5	PASS
39	2480	0.71	0.5	PASS

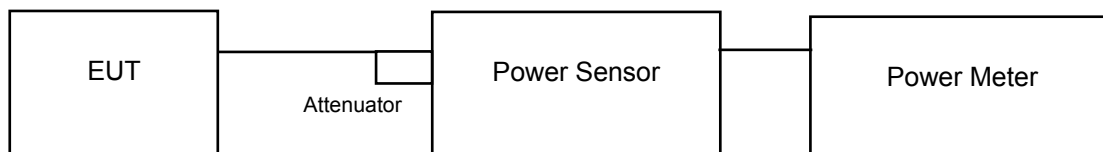


4.4 Conducted Output Power

4.4.1 Limits of Conducted Output Power Measurement

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30dBm)

4.4.2 Test Setup



4.4.3 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Power Meter Anritsu	ML2495A	1014008	Apr. 30, 2014	Apr. 29, 2015
Power Sensor Anritsu	MA2411B	0917122	Apr. 30, 2014	Apr. 29, 2015

- NOTE:**
1. The test was performed in Oven room B.
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 3. Tested Date: Jan. 22, 2015

4.4.4 Test Procedures

A peak / average power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak / average power sensor. Record the power level.

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Conditions

Same as Item 4.3.6.

4.4.7 Test Results

FOR PEAK POWER

CHANNEL	FREQUENCY (MHz)	PEAK POWER (mW)	PEAK POWER (dBm)	LIMIT (dBm)	PASS/FAIL
0	2402	2.075	3.17	30	PASS
19	2440	1.905	2.80	30	PASS
39	2480	2	3.01	30	PASS

FOR AVERAGE POWER

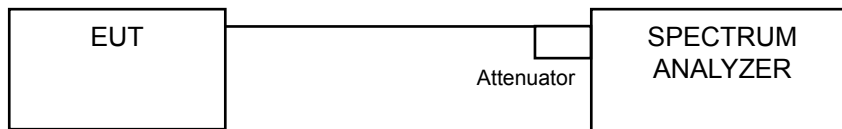
CHANNEL	FREQUENCY (MHz)	AVERAGE POWER (mW)	AVERAGE POWER (dBm)
0	2402	1.849	2.67
19	2440	1.698	2.30
39	2480	1.774	2.49

4.5 Power Spectral Density Measurement

4.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm.

4.5.2 Test Setup



4.5.3 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSP 40	100060	May 08, 2014	May 07, 2015

- NOTE:**
1. The test was performed in Oven room B.
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 3. Tested Date: Jan. 22, 2015

4.5.4 Test Procedure

- a. Set analyzer center frequency to DTS channel center frequency.
- b. Set the span to 1.5 times the DTS bandwidth.
- c. Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- d. Set the VBW $\geq 3 \times \text{RBW}$.
- e. Detector = peak.
- f. Sweep time = auto couple.
- g. Trace mode = max hold.
- h. Allow trace to fully stabilize.
- i. Use the peak marker function to determine the maximum amplitude level within the RBW.

4.5.5 Deviation from Test Standard

No deviation.

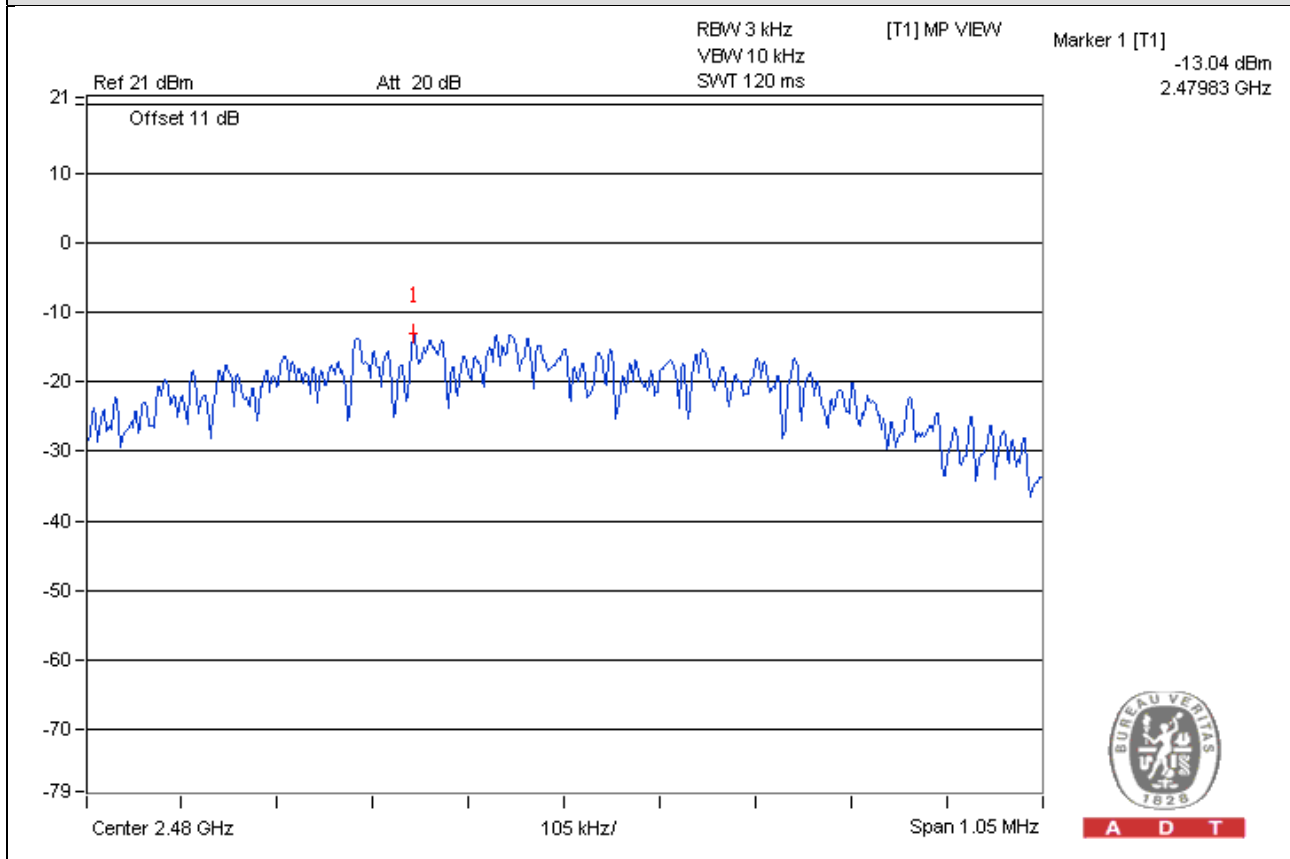
4.5.6 EUT Operating Condition

Same as Item 4.3.6

4.5.7 Test Results

Channel	Freq. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
0	2402	-13.28	8	PASS
19	2440	-13.38	8	PASS
39	2480	-13.04	8	PASS

SPECTRUM PLOT OF WORST VALUE / CH39

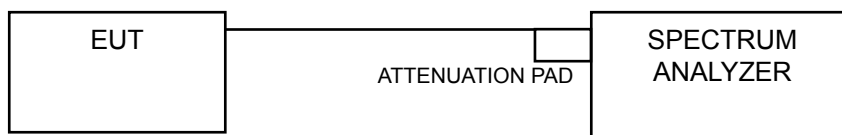


4.6 Conducted Out of Band Emission Measurement

4.6.1 Limits of Conducted Out of Band Emission Measurement

Below –20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

4.6.2 Test Setup



4.6.3 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSP 40	100060	May 08, 2014	May 07, 2015

- NOTE:**
1. The test was performed in Oven room B.
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 3. Tested Date: Jan. 22, 2015

4.6.4 Test Procedure

MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW $\geq$ 300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOB

1. Set RBW = 100 kHz.
2. Set VBW $\geq$ 300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

4.6.5 Deviation from Test Standard

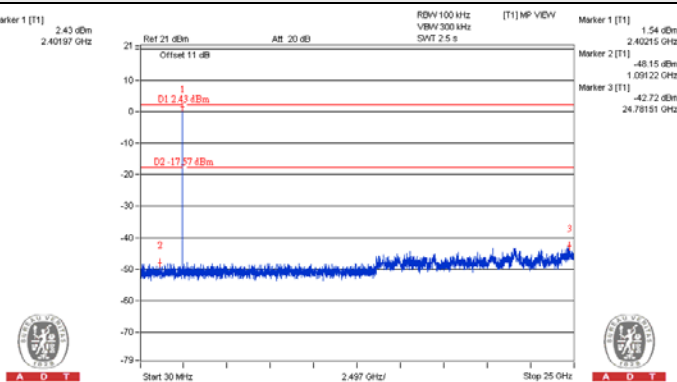
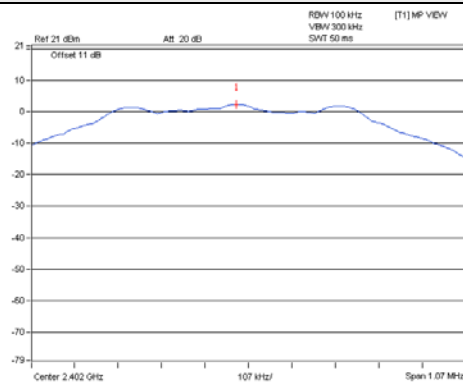
No deviation.

4.6.6 EUT Operating Condition

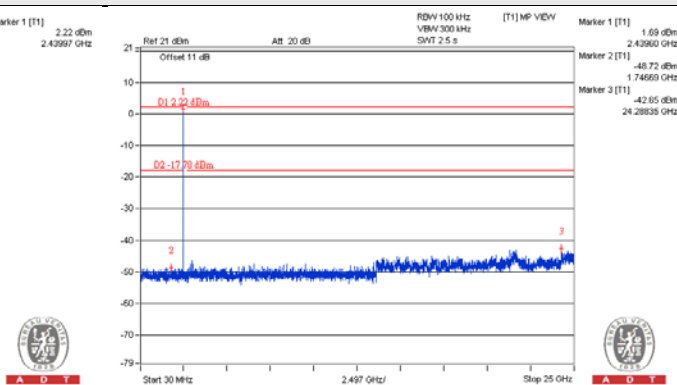
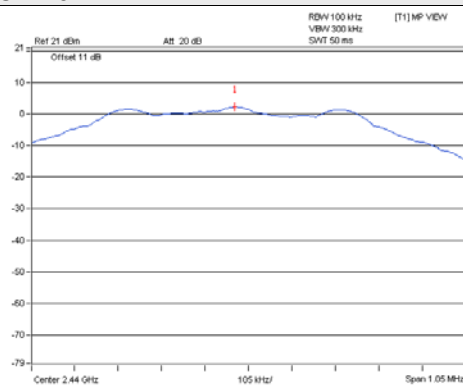
Same as Item 4.3.6

4.6.7 Test Results

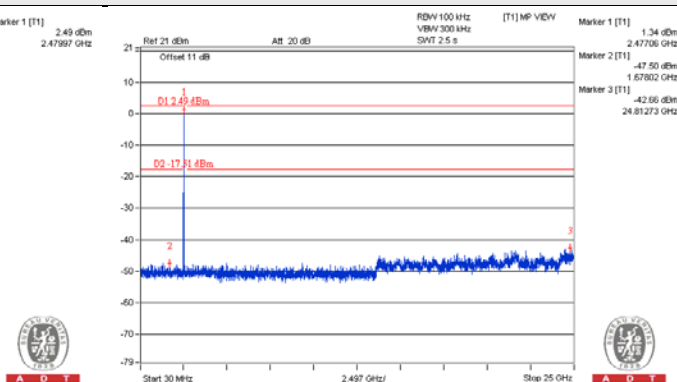
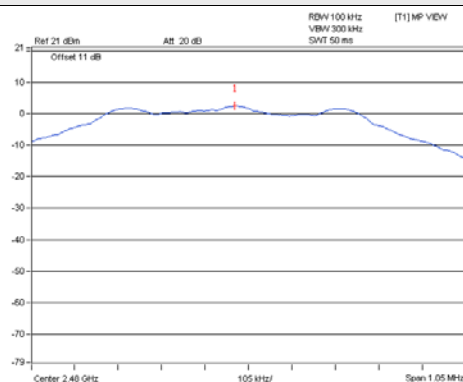
CH 0



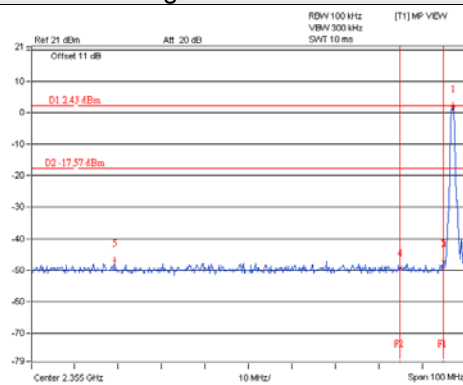
CH 19



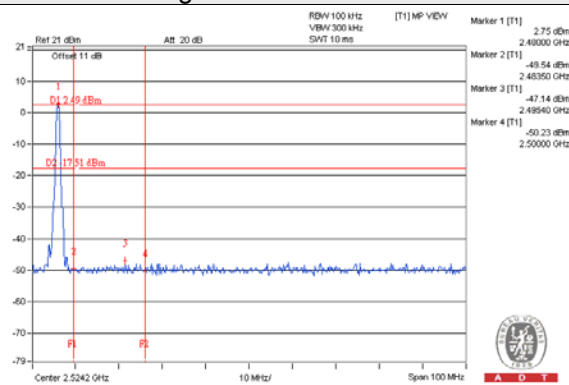
CH 39



CH 0 Band edge



CH 39 Band edge



5 Pictures of Test Arrangements

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

Appendix – Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

Linko EMC/RF Lab

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF Lab/Telecom Lab

Tel: 886-3-5935343

Fax: 886-3-5935342

Hwa Ya EMC/RF/Safety

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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