

FCC Test Report (Zigbee)

Report No.: RF170526D03

FCC ID: NRIRS350900

Test Model: ON-LRD-509 SERIES

Received Date: May 26, 2017

Test Date: Jun. 1 ~ 7, 2017

Issued Date: Jul. 7, 2017

Applicant: IR-TEC International Ltd.

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

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Release Control Record

Issue No.	Description	Date Issued
RF170526D03	Original release.	Jul. 7, 2017

1 Certificate of Conformity

Product: Line Voltage OS-NET Sensor

Brand: IR-TEC

Test Model: ON-LRD-509 SERIES

Sample Status: Engineering sample

Applicant: IR-TEC International Ltd.

Test Date: Jun. 1 ~ 7, 2017

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)
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 : Annie Chang , **Date:** Jul. 7, 2017
Annie Chang / Senior Specialist

Approved by : Rex Lai , **Date:** Jul. 7, 2017
Rex Lai / Assistant 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 -6.21 dB at 0.15000 MHz
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -2.01dB at 4810.00MHz.
15.247(d)	Antenna Port Emission	PASS	Meet the requirement of limit.
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	Antenna connector is I-PEX not a standard connector.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT:

Measurement	Frequency	Expanded Uncertainty (k=2) (\pm)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.77 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	2.38 dB
	30MHz ~ 1000MHz	5.54 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	4.77 dB
	6GHz ~ 18GHz	5.48 dB

2.2 Modification Record

There were no modifications required for compliance.

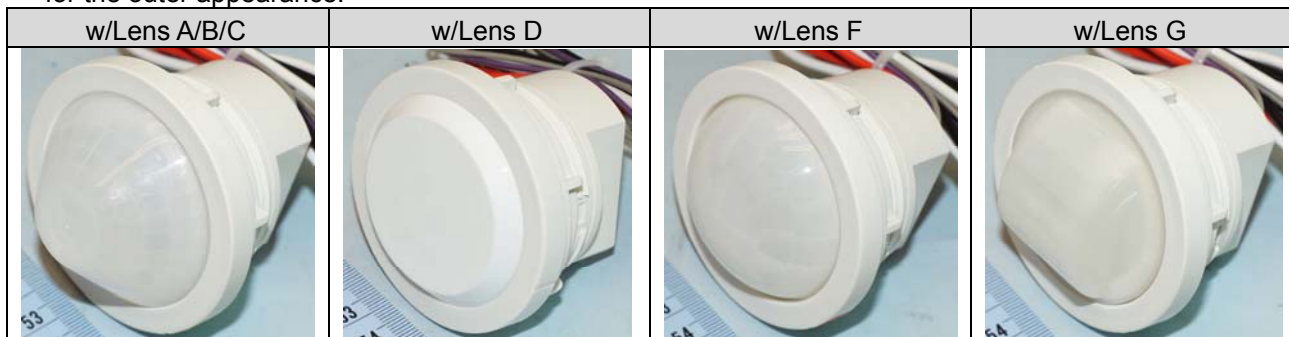
3 General Information

3.1 General Description of EUT

Product	Line Voltage OS-NET Sensor
Brand	IR-TEC
Test Model	ON-LRD-509 SERIES
Status of EUT	Engineering sample
Power Supply Rating	120-277Vac, 50/60Hz
Modulation Type	OQPSK
Transfer Rate	250Kbps
Operating Frequency	2405 ~ 2480MHz
Number of Channel	16
Output Power	4.989mW
Antenna Type	PIFA antenna with 1.53dBi gain
Antenna Connector	N/A
Accessory Device	N/A
Data Cable Supplied	N/A

Note:

1. The EUT is a Line Voltage OS-NET Sensor with Zigbee technology.
2. The following different lens could be chosen and Hardware / RF circuit are identical for each other except for the outer appearance:



The **w/Lens D** was select for the final test.

3. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 Description of Test Modes

16 channels are provided to this EUT:

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
11	2405MHz	19	2445MHz
12	2410MHz	20	2450MHz
13	2415MHz	21	2455MHz
14	2420MHz	22	2460MHz
15	2425MHz	23	2465MHz
16	2430MHz	24	2470MHz
17	2435MHz	25	2475MHz
18	2440MHz	26	2480MHz

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE \geq 1G	RE $<$ 1G	PLC	APCM	
-	√	√	√	√	-

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

NOTE: The EUT had been pre-tested on the positioned of each 2 axis. The worst case was found when positioned on **X-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.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Kbps)
-	11 to 26	11, 18, 26	OQPSK	250

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 (Kbps)
-	11 to 26	26	OQPSK	250

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 (Kbps)
-	11 to 26	26	OQPSK	250

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 CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Kbps)
-	11 to 26	11, 18, 26	OQPSK	250

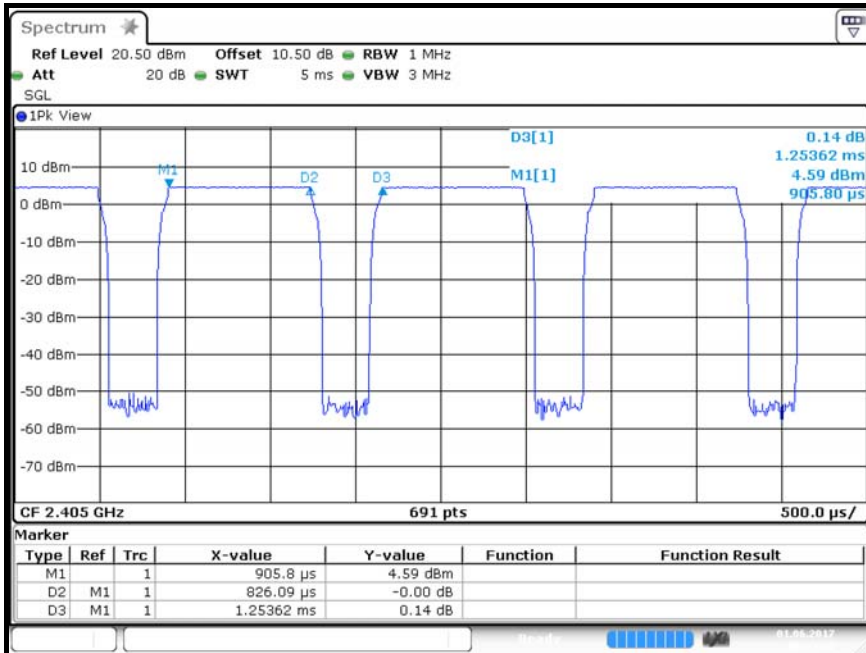
Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE \geq 1G	20deg. C, 71%RH	120Vac, 60Hz	Ian Chang
RE $<$ 1G	20deg. C, 71%RH	120Vac, 60Hz	Ian Chang
PLC	22deg. C, 73%RH	120Vac, 60Hz	Ian Chang
APCM	25deg. C, 76%RH	120Vac, 60Hz	Dalen Dai

3.3 Duty Cycle of Test Signal

Duty cycle of test signal is < 98%

Duty cycle = $0.826 / 1.253 = 0.659$, Duty factor = $10 * \log(1 / 0.659) = 1.81$



3.4 Description of Support Units

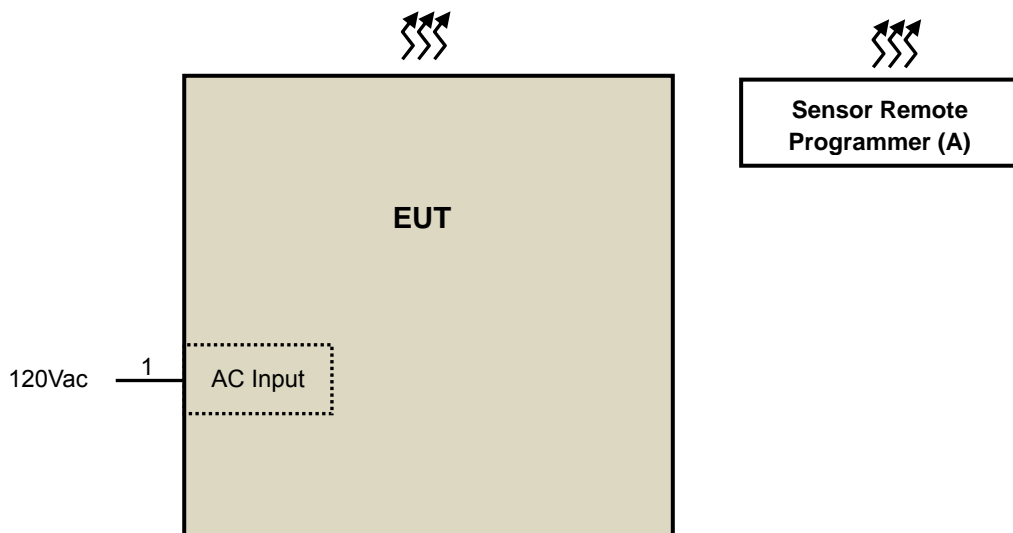
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Sensor Remote Programmer	iR-TEC	SRP-281	N/A	N/A	Supplied by client

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	AC cable	1	1.8	N	0	Supplied by client

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

3.4.1 Configuration of System under Test



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)**
- KDB 558074 D01 DTS Meas Guidance v04**
- 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

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

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
HP Preamplifier	8447D	2432A03504	Feb. 21, 2017	Feb. 20, 2018
HP Preamplifier	8449B	3008A01201	Feb. 22, 2017	Feb. 21, 2018
MITEQ Preamplifier	AMF-6F-260400-33-8P	892164	Feb. 21, 2017	Feb. 20, 2018
Agilent TEST RECEIVER	N9038A	MY51210129	Feb. 08, 2017	Feb. 07, 2018
Schwarzbeck Antenna	VULB 9168	139	Dec. 13, 2016	Dec. 12, 2017
Schwarzbeck Antenna	VHBA 9123	480	May 19, 2017	May 18, 2019
Schwarzbeck Horn Antenna	BBHA-9170	212	Dec. 30, 2016	Dec. 29, 2017
Schwarzbeck Horn Antenna	BBHA 9120-D1	D130	Dec. 27, 2016	Dec. 26, 2017
ADT. Turn Table	TT100	0306	NA	NA
ADT. Tower	AT100	0306	NA	NA
Software	Radiated_V7.6.15.9.5	NA	NA	NA
SUHNER RF cable With 4dB PAD	SF104	CABLE-CH6	Aug. 15, 2016	Aug. 14, 2017
SUHNER RF cable With 3dB PAD	SF102	Cable-CH8-3.6m	Aug. 15, 2016	Aug. 14, 2017
KEYSIGHT Spectrum Analyzer	N9030A	MY54490260	Jul. 26, 2016	Jul. 25, 2017
Loop Antenna EMCI	LPA600	270	Aug. 20, 2015	Aug. 19, 2017
EMCO Horn Antenna	3115	00028257	Dec. 15, 2016	Dec. 14, 2017
Highpass filter Wainwright Instruments	WHK 3.1/18G-10SS	SN 8	NA	NA
ROHDE & SCHWARZ Spectrum Analyzer	FSV40	101042	Sep. 30, 2016	Sep. 29, 2017
Anritsu Power Sensor	MA2411B	0738404	Apr. 24, 2017	Apr. 23, 2018
Anritsu Power Meter	ML2495A	0842014	Apr. 24, 2017	Apr. 23, 2018

- NOTE:**
1. The calibration interval of the above test instruments is 12/24 months. And the calibrations are traceable to NML/ROC and NIST/USA.
 2. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
 3. The test was performed in Chamber No. 6.
 4. The Industry Canada Reference No. IC 7450E-6.
 5. The FCC Site Registration No. is 447212.

4.1.3 Test Procedures

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.
- 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:

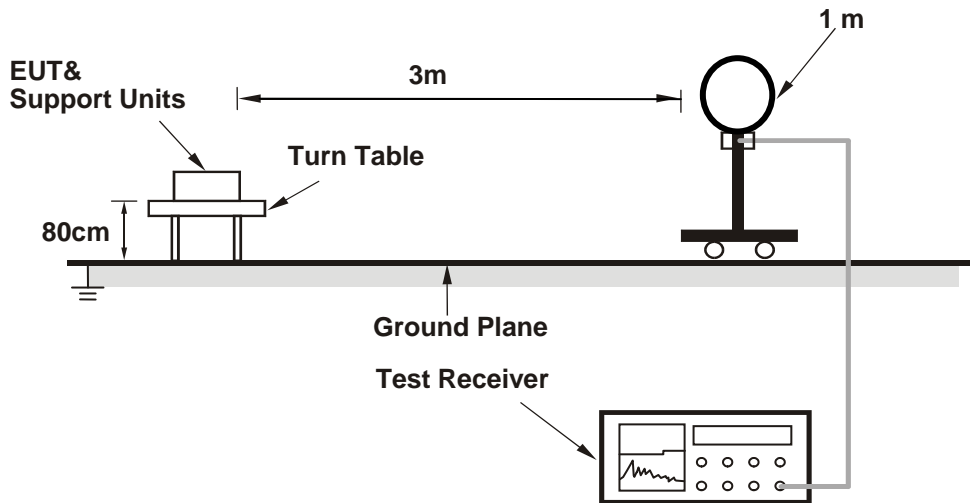
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98%) or 3 x RBW (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

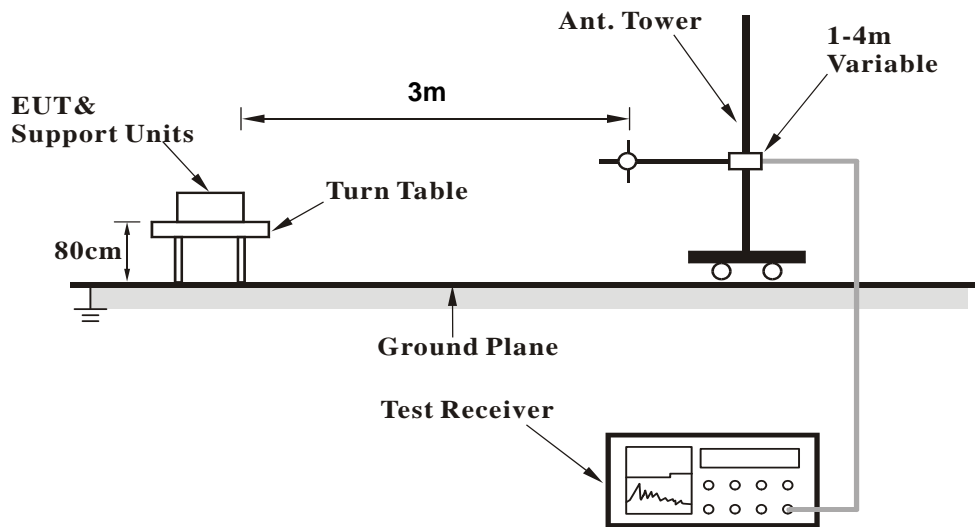
No deviation.

4.1.5 Test Set Up

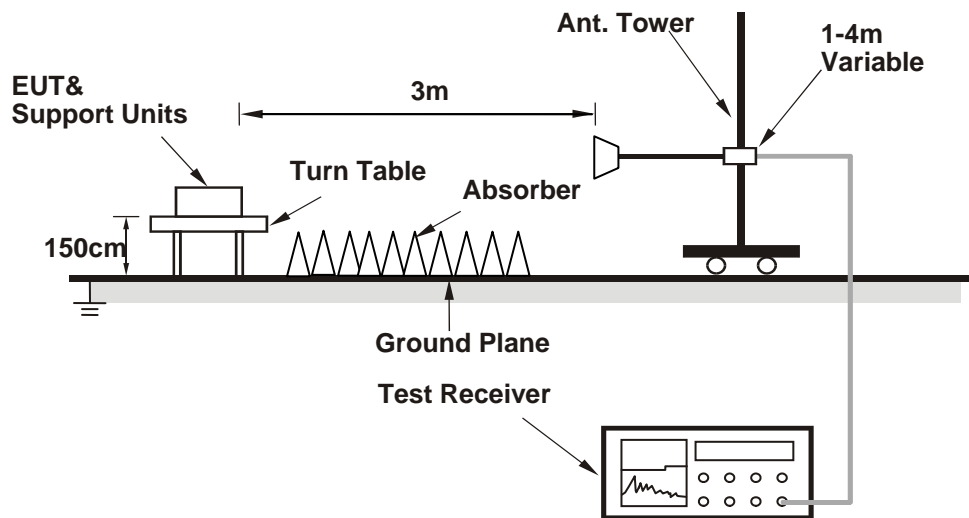
For Radiated emission below 30MHz



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 condition continuously at specific channel frequency.

4.1.7 Test Results

ABOVE 1GHz DATA

CHANNEL	TX Channel 11	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	53.16 PK	74.00	-20.84	3.86 H	10	55.06	-1.90
2	2390.00	38.97 AV	54.00	-15.03	3.86 H	10	40.87	-1.90
3	*2405.00	100.01 PK			3.86 H	10	101.83	-1.82
4	*2405.00	96.91 AV			3.86 H	10	98.73	-1.82
5	4810.00	59.06 PK	74.00	-14.94	3.01 H	20	53.91	5.15
6	4810.00	51.12 AV	54.00	-2.88	3.01 H	20	45.97	5.15

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	52.78 PK	74.00	-21.22	3.36 V	290	54.68	-1.90
2	2390.00	38.45 AV	54.00	-15.55	3.36 V	290	40.35	-1.90
3	*2405.00	98.46 PK			3.36 V	290	100.28	-1.82
4	*2405.00	95.28 AV			3.36 V	290	97.10	-1.82
5	4810.00	60.71 PK	74.00	-13.29	3.17 V	257	55.56	5.15
6	4810.00	51.99 AV	54.00	-2.01	3.17 V	257	46.84	5.15

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 18	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	99.68 PK			3.77 H	13	101.27	-1.59
2	*2440.00	96.76 AV			3.77 H	13	98.35	-1.59
3	4880.00	59.08 PK	74.00	-14.92	2.96 H	28	53.87	5.21
4	4880.00	50.86 AV	54.00	-3.14	2.96 H	28	45.65	5.21

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	98.77 PK			3.29 V	270	100.36	-1.59
2	*2440.00	95.49 AV			3.29 V	270	97.08	-1.59
3	4880.00	59.59 PK	74.00	-14.41	3.58 V	254	54.38	5.21
4	4880.00	51.31 AV	54.00	-2.69	3.58 V	254	46.10	5.21

REMARKS:

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

CHANNEL	TX Channel 26	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	99.34 PK			3.55 H	15	100.68	-1.34
2	*2480.00	96.07 AV			3.55 H	15	97.41	-1.34
3	2483.50	67.39 PK	74.00	-6.61	3.55 H	15	68.72	-1.33
4	2483.50	51.30 AV	54.00	-2.70	3.55 H	15	52.63	-1.33
5	4960.00	57.94 PK	74.00	-16.06	3.32 H	306	52.55	5.39
6	4960.00	49.36 AV	54.00	-4.64	3.32 H	306	43.97	5.39

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	97.54 PK			3.57 V	250	98.88	-1.34
2	*2480.00	94.27 AV			3.57 V	250	95.61	-1.34
3	2483.50	66.86 PK	74.00	-7.14	3.57 V	250	68.19	-1.33
4	2483.50	49.84 AV	54.00	-4.16	3.57 V	250	51.17	-1.33
5	4960.00	58.36 PK	74.00	-15.64	2.97 V	250	52.97	5.39
6	4960.00	50.36 AV	54.00	-3.64	2.97 V	250	44.97	5.39

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

CHANNEL	TX Channel 26	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 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	52.07	18.38 QP	40.00	-21.62	1.00 H	42	27.34	-8.96
2	145.58	18.62 QP	43.50	-24.88	1.58 H	330	27.87	-9.25
3	269.49	19.52 QP	46.00	-26.48	1.99 H	330	27.75	-8.23
4	410.73	23.48 QP	46.00	-22.52	2.39 H	58	28.64	-5.16
5	538.67	27.34 QP	46.00	-18.66	2.05 H	248	29.72	-2.38
6	598.81	28.25 QP	46.00	-17.75	1.87 H	256	29.13	-0.88

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	48.82	15.03 QP	40.00	-24.97	1.64 V	333	24.27	-9.24
2	153.63	16.01 QP	43.50	-27.49	1.06 V	159	25.01	-9.00
3	311.06	17.15 QP	46.00	-28.85	1.42 V	333	24.20	-7.05
4	359.27	19.41 QP	46.00	-26.59	1.55 V	328	25.74	-6.33
5	445.31	20.94 QP	46.00	-25.06	2.08 V	186	25.10	-4.16
6	522.27	23.58 QP	46.00	-22.42	2.38 V	360	26.21	-2.63

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.	Cal. Date	Cal. Due
ROHDE & SCHWARZ TEST RECEIVER	ESCS 30	100276	Apr. 10, 2017	Apr. 09, 2018
ROHDE & SCHWARZ Artificial Mains Network (for EUT)	ENV216	101197	May 22, 2017	May 21, 2018
LISN With Adapter (for EUT)	AD10	C10Ada-002	May 22, 2017	May 21, 2018
ROHDE & SCHWARZ Artificial Mains Network (for peripherals)	ESH3-Z5	100218	Nov. 23, 2016	Nov. 22, 2017
SCHWARZBECK Artificial Mains Network (For EUT)	NNLK8129	8129229	May 09, 2017	May 08, 2018
Software	Cond_V7.3.7.4	NA	NA	NA
RF cable (JYEBAO) With 10dB PAD	5D-FB	Cable-C10.01	Feb. 14, 2017	Feb. 13, 2018
SUHNER Terminator (For ROHDE & SCHWARZ LISN)	65BNC-5001	E1-011484	May 18, 2017	May 17, 2018
ROHDE & SCHWARZ Artificial Mains Network (For TV EUT)	ESH3-Z5	100220	Nov. 08, 2016	Nov. 07, 2017
LISN With Adapter (for TV EUT)	100220	N/A	Nov. 08, 2016	Nov. 07, 2017

Notes: 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. 10.

3. The VCCI Site Registration No. C-1852.

4.2.3 Test Procedures

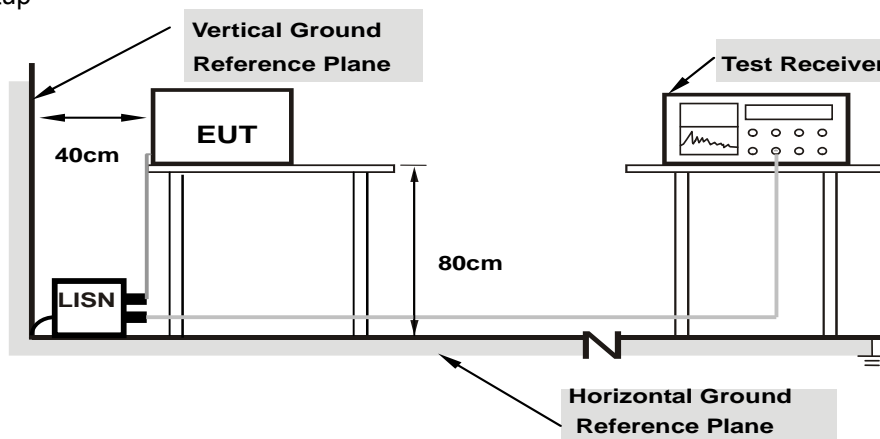
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

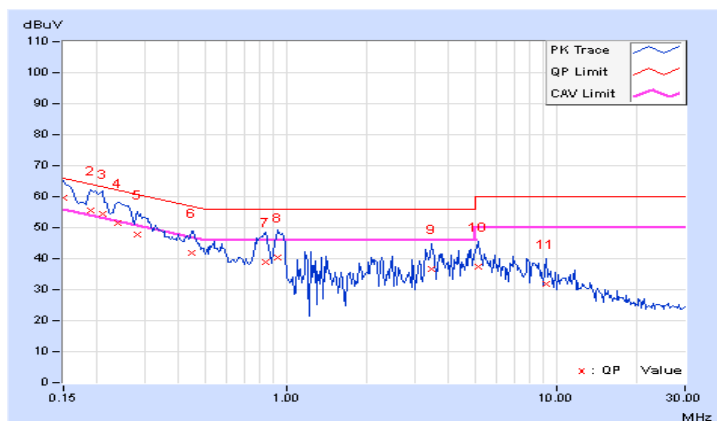
CONDUCTED WORST-CASE DATA

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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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	9.65	50.14	36.45	59.79	46.10	66.00	56.00	-6.21	-9.90
2	0.18906	9.65	46.02	31.06	55.67	40.71	64.08	54.08	-8.41	-13.37
3	0.20859	9.65	44.70	29.44	54.35	39.09	63.26	53.26	-8.91	-14.17
4	0.23984	9.65	42.01	27.13	51.66	36.78	62.10	52.10	-10.44	-15.32
5	0.28281	9.65	38.16	23.17	47.81	32.82	60.73	50.73	-12.92	-17.91
6	0.44688	9.66	32.11	17.49	41.77	27.15	56.93	46.93	-15.16	-19.78
7	0.83750	9.69	29.11	9.39	38.80	19.08	56.00	46.00	-17.20	-26.92
8	0.93516	9.70	30.64	12.22	40.34	21.92	56.00	46.00	-15.66	-24.08
9	3.45313	9.81	26.99	9.40	36.80	19.21	56.00	46.00	-19.20	-26.79
10	5.15234	9.86	27.52	10.42	37.38	20.28	60.00	50.00	-22.62	-29.72
11	9.16406	9.92	21.99	5.58	31.91	15.50	60.00	50.00	-28.09	-34.50

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

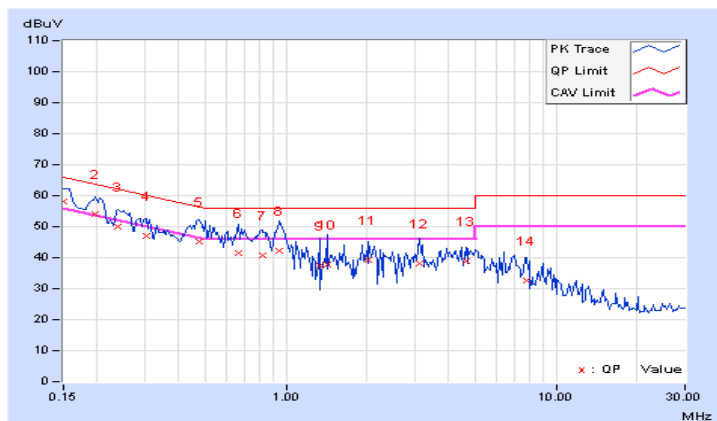


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.68	48.30	35.36	57.98	45.04	66.00	56.00	-8.02	-10.96
2	0.19687	9.67	44.28	31.57	53.95	41.24	63.74	53.74	-9.79	-12.50
3	0.23984	9.67	40.51	27.17	50.18	36.84	62.10	52.10	-11.92	-15.26
4	0.30234	9.68	37.34	27.72	47.02	37.40	60.18	50.18	-13.16	-12.78
5	0.47422	9.68	35.34	27.58	45.02	37.26	56.44	46.44	-11.42	-9.18
6	0.66953	9.69	31.96	24.60	41.65	34.29	56.00	46.00	-14.35	-11.71
7	0.81406	9.70	31.02	18.72	40.72	28.42	56.00	46.00	-15.28	-17.58
8	0.94688	9.71	32.49	21.06	42.20	30.77	56.00	46.00	-13.80	-15.23
9	1.32813	9.72	27.76	15.98	37.48	25.70	56.00	46.00	-18.52	-20.30
10	1.42188	9.73	28.09	20.36	37.82	30.09	56.00	46.00	-18.18	-15.91
11	2.02734	9.75	29.64	22.37	39.39	32.12	56.00	46.00	-16.61	-13.88
12	3.10547	9.81	28.30	17.63	38.11	27.44	56.00	46.00	-17.89	-18.56
13	4.63281	9.87	28.97	21.00	38.84	30.87	56.00	46.00	-17.16	-15.13
14	7.76563	9.92	22.77	11.76	32.69	21.68	60.00	50.00	-27.31	-28.32

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

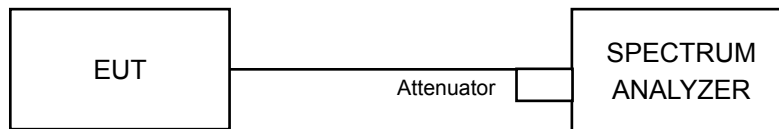


4.3 6dB Bandwidth Measurement

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

Refer to section 4.1.2 to get information of above instrument.

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

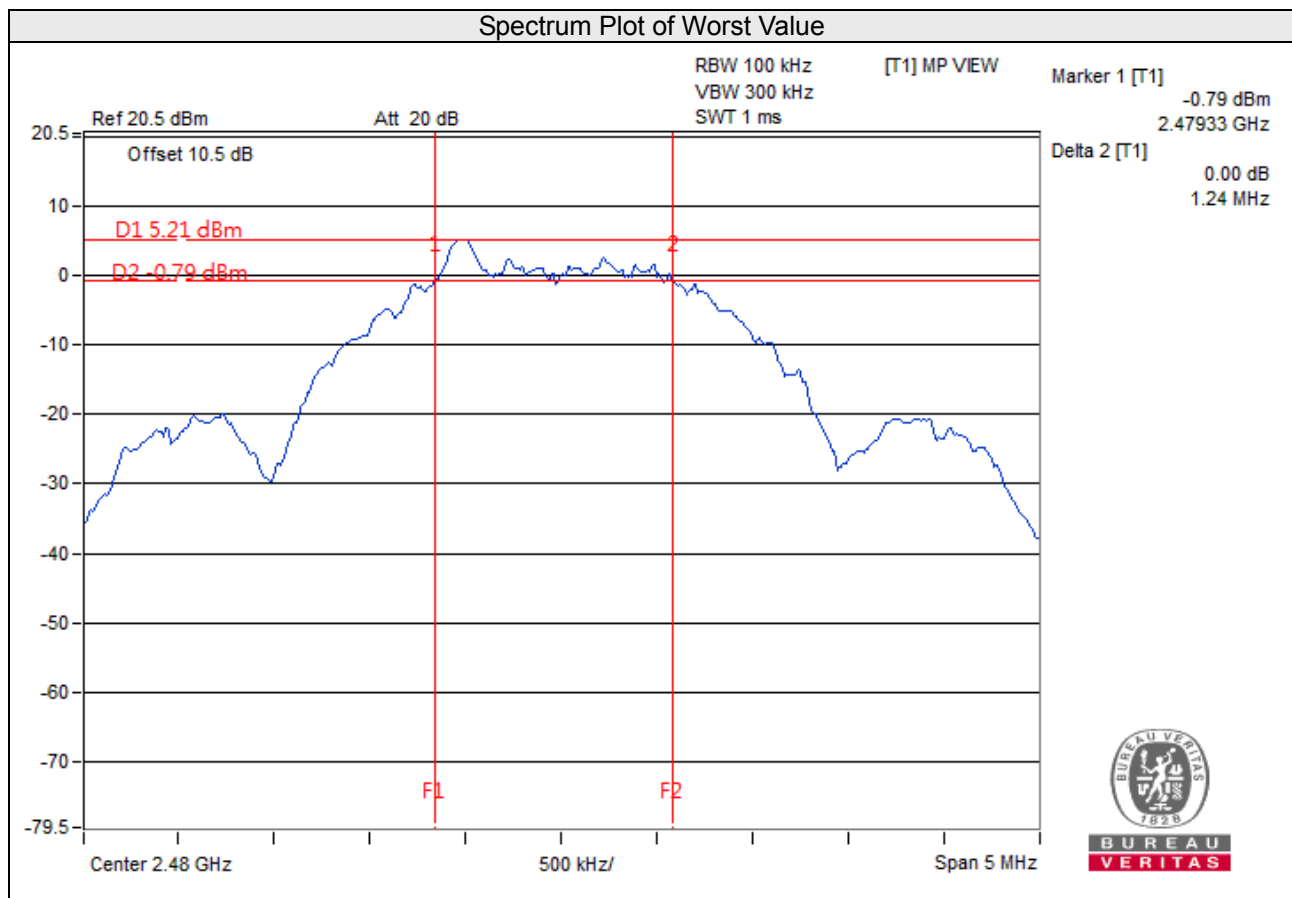
No deviation.

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
11	2405	1.19	0.5	PASS
18	2440	1.17	0.5	PASS
26	2480	1.24	0.5	PASS

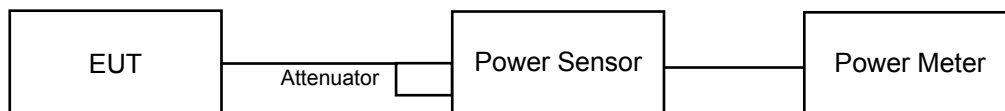


4.4 Conducted Output Power Measurement

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

Refer to section 4.1.2 to get information of above instrument.

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
11	2405	4.764	6.78	30	Pass
18	2440	4.989	6.98	30	Pass
26	2480	4.955	6.95	30	Pass

FOR AVERAGE POWER

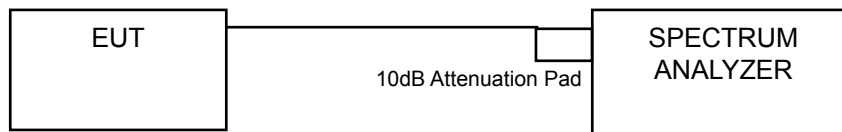
Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
11	2405	4.656	6.68
18	2440	4.875	6.88
26	2480	4.853	6.86

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

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedure

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

4.5.5 Deviation from Test Standard

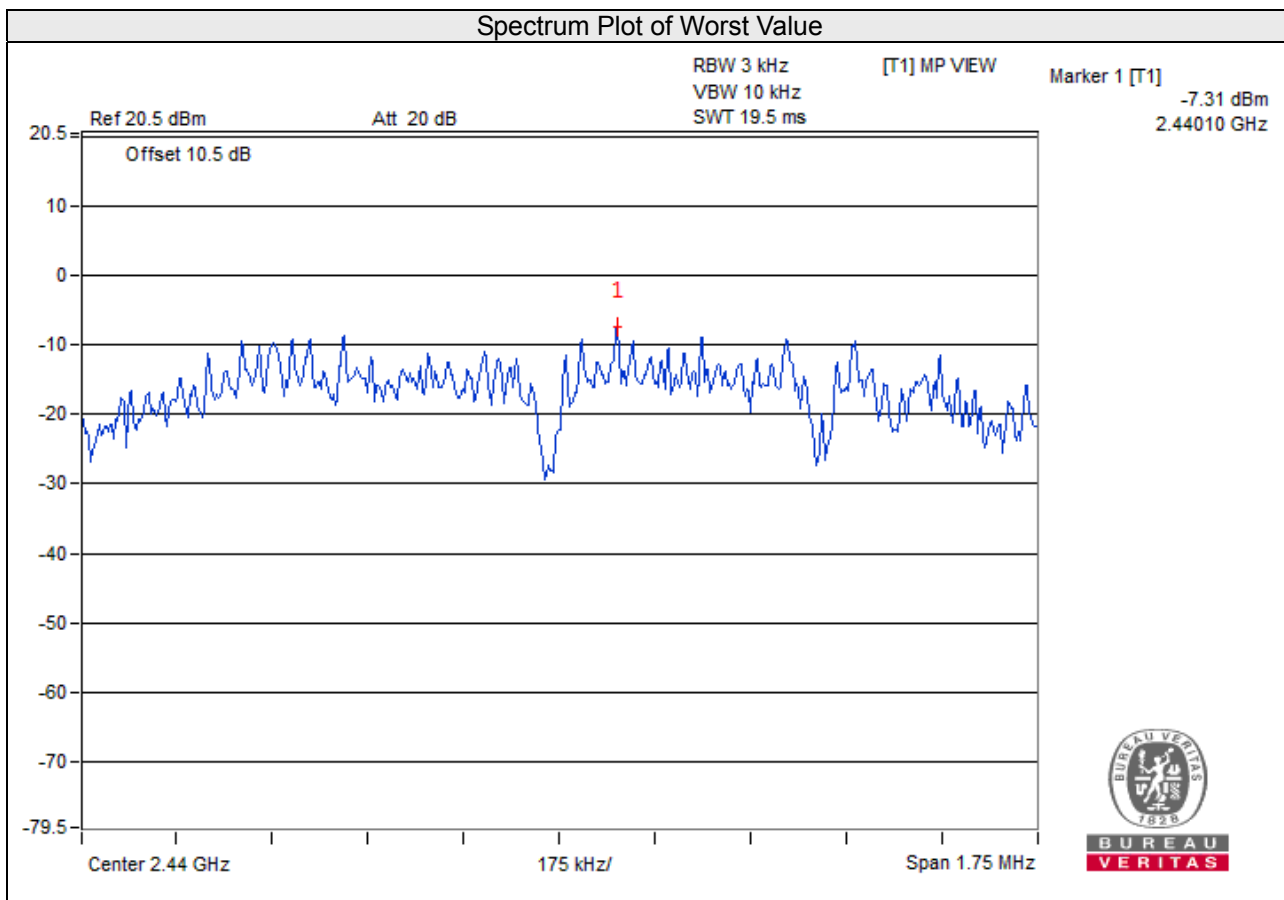
No deviation.

4.5.6 EUT Operating Condition

Same as Item 4.3.6

4.5.7 Test Results

Channel	Freq. (MHz)	PSD (dBm)	Limit (dBm)	Pass /Fail
11	2405	-8.00	8	Pass
18	2440	-7.31	8	Pass
26	2480	-7.95	8	Pass

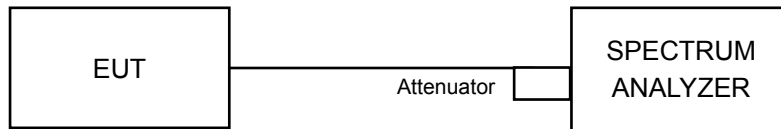


4.6 Conducted Out of Band Emission Measurement

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

Refer to section 4.1.2 to get information of above instrument.

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.

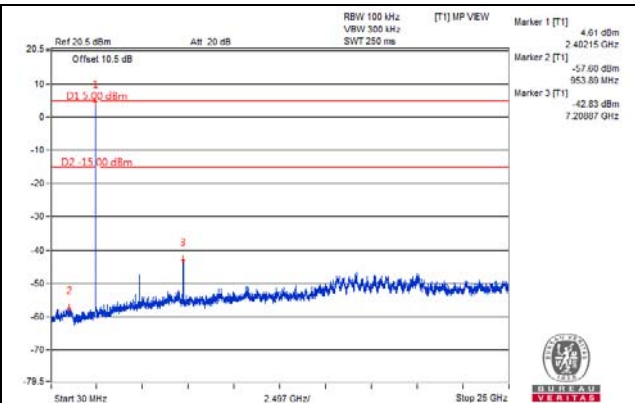
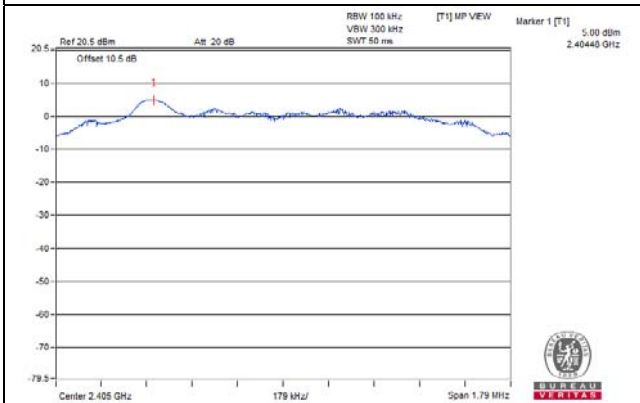
4.6.6 EUT Operating Condition

Same as Item 4.3.6

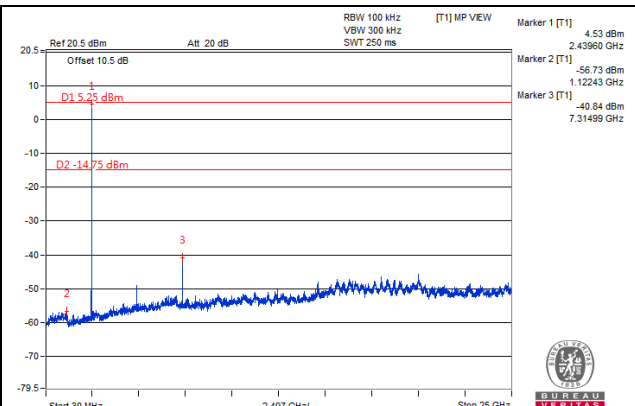
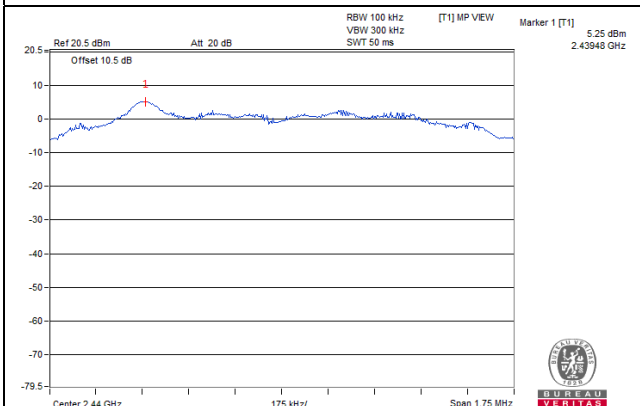
4.6.7 Test Results

The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

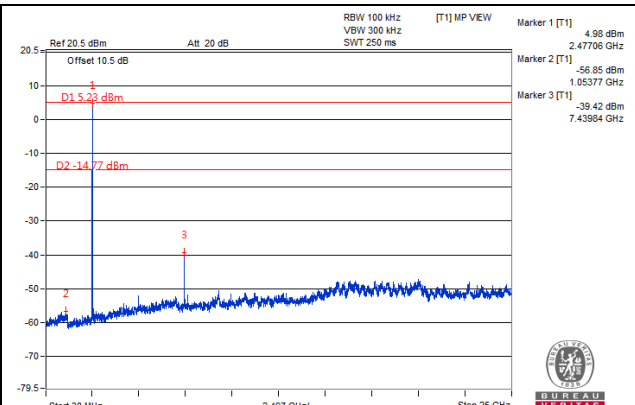
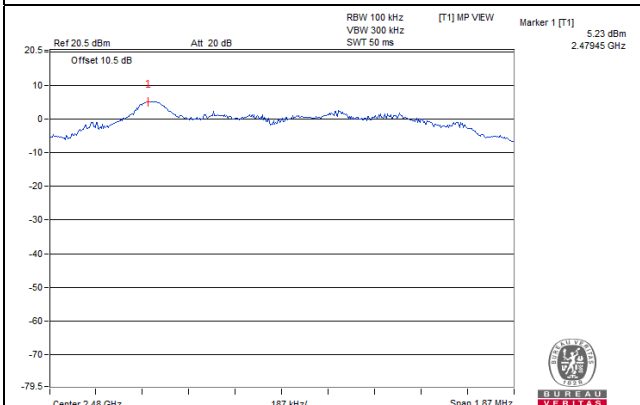
CH 11



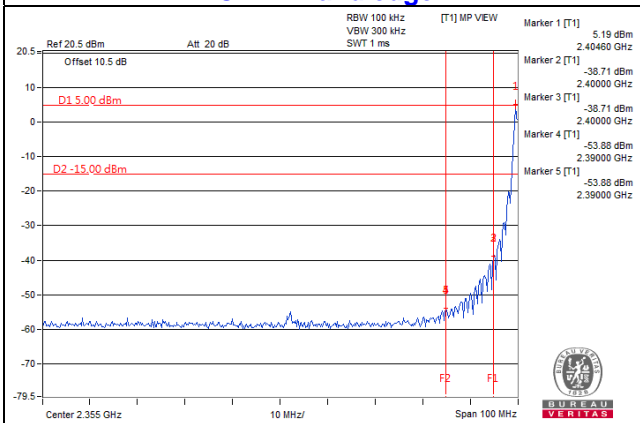
CH 18



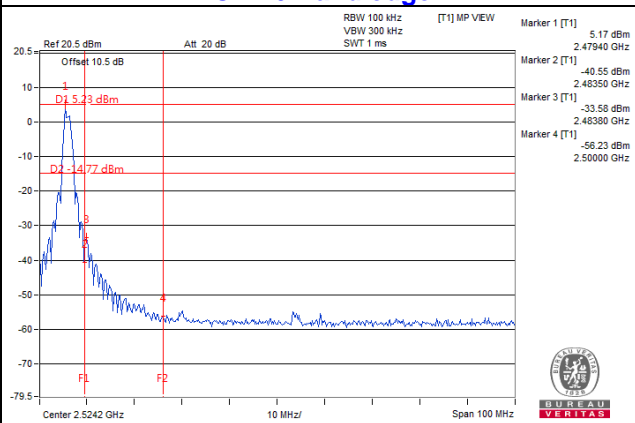
CH 26



CH 11 Band edge



CH 26 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:

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The address and road map of all our labs can be found in our web site also.

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