

FCC Test Report (Zigbee)

Report No.: RF200225E06-2

FCC ID: NKR-LS03

Test Model: S40LR0-01

Received Date: Feb. 25, 2020

Test Date: Mar. 09 to 24, 2020

Issued Date: Apr. 15, 2020

Applicant: Wistron NeWeb Corp.

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**FCC Registration /
Designation Number:** 723255 / TW2022



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Release Control Record

Issue No.	Description	Date Issued
RF200225E06-2	Original release.	Apr. 15, 2020

1 Certificate of Conformity

Product: Smart Home Hub

Brand: ADT

Test Model: S40LR0-01

Sample Status: ENGINEERING SAMPLE

Applicant: Wistron NeWeb Corp.

Test Date: Mar. 09 to 24, 2020

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 : Joyce Kuo , **Date:** Apr. 15, 2020
Joyce Kuo / Specialist

Approved by : Clark Lin , **Date:** Apr. 15, 2020
Clark Lin / Technical 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 -8.25dB at 0.40781MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -0.2dB at 2483.50MHz.
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(MHF) not a standard connector.

Note:

- For 2.4GHz band compliance with rule 15.247(d) of the band-edge items, the test plots were recorded in Annex A. Test Procedures refer to report 4.1.3.
- Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

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	1.9 dB
Conducted emissions	-	2.5 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.1 dB
	30MHz ~ 1GHz	5.5 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	5.1 dB
	18GHz ~ 40GHz	5.3 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT (Zigbee)

Product	Smart Home Hub
Brand	ADT
Test Model	S40LR0-01
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	12Vdc from power adapter or 3.65Vdc from battery
Modulation Type	O-QPSK
Modulation Technology	DSSS
Transfer Rate	250kbps
Operating Frequency	2.405 ~ 2.480GHz
Number of Channel	16
Output Power	67.453 mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Adapter x 1, Battery x 1
Data Cable Supplied	NA

Note:

1. The EUT has below radios as following table:

Radio 1	Radio 2	Radio 3
WLAN(2.4GHz)	BT-LE	WWAN(LTE)
Radio 4	Radio 5	Radio 6
Zigbee	Z-wave	DECT

2. The EUT contains certified 3G/LTE modular which FCC ID: NKRIMQ5

3. Simultaneously transmission condition.

Condition	Technology
1	WLAN(2.4G) + BLE + Zigbee+ Z-wave + DECT + LTE

Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.

4. The EUT power needs to be supplied from a battery and power adapter the information is as below table:

Adapter			
No.	Brand	Model No.	Spec.
1	Frecom	F18L10-120150SPAU	Input: 100-240V, 0.6A, 50-60Hz Output: 12V, 1.5A DC Cable: Unshielded, 1.9m
Battery			
No.	Brand	Model No.	Spec.
1	Tenergy	34262 Rev B	Output: 3.65V, 2400mAh

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

Antenna NO.	Antenna Net Gain(dBi)	Frequency range	Antenna Type	Connecter Type
WiFi 2.4GHz	6.07	2.4~2.4835GHz	PCB	i-pex(MHF)
WiFi 2.4GHz	4.67	2.4~2.4835GHz	PCB	i-pex(MHF)
BLE	5.38	2.4~2.4835GHz	PCB	i-pex(MHF)
LTE_ANT1	0.87	698 ~ 716 MHz	Monopole	N/A
	2.38	1710 ~ 1755 MHz		
	2.25	1850 ~ 1910 MHz		
Zigbee	4.11	2.4~2.4835GHz	PCB	i-pex(MHF)
Z-wave	0.91	902 ~ 928 MHz	PIFA	N/A
ANT_DECT1	0.43	1920 ~ 1930MHz	PIFA	N/A
ANT_DECT2	0.59	1920 ~ 1930MHz	PIFA	N/A

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

3.2 Description of Test Modes

16 channels are provided to this EUT:

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

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

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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (kbps)
11 to 26	11, 18, 25, 26	DSSS	O-QPSK	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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (kbps)
11 to 26	25	DSSS	O-QPSK	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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (kbps)
11 to 26	25	DSSS	O-QPSK	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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (kbps)
11 to 26	11, 18, 25, 26	DSSS	O-QPSK	250

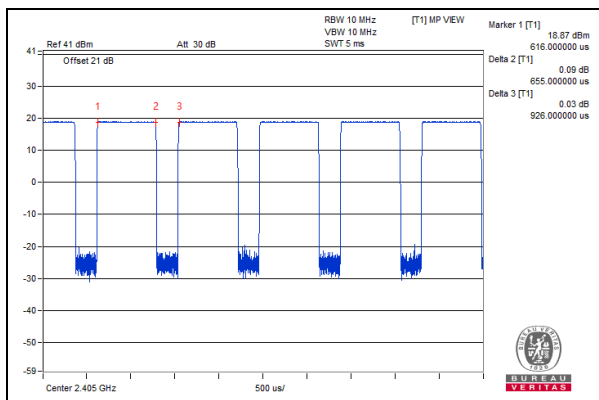
Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE \geq 1G	25deg. C, 75%RH	120Vac, 60Hz	Kevin Ko
RE<1G	22deg. C, 68%RH	120Vac, 60Hz	Kevin Ko
PLC	25deg. C, 75%RH	120Vac, 60Hz	Kevin Ko
APCM	25deg. C, 60%RH	120Vac, 60Hz	Anderson Chen

3.3 Duty Cycle of Test Signal

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

Duty cycle = $0.655/0.926 = 0.707$, Duty factor = $10 * \log(1/\text{Duty cycle}) = 1.50$



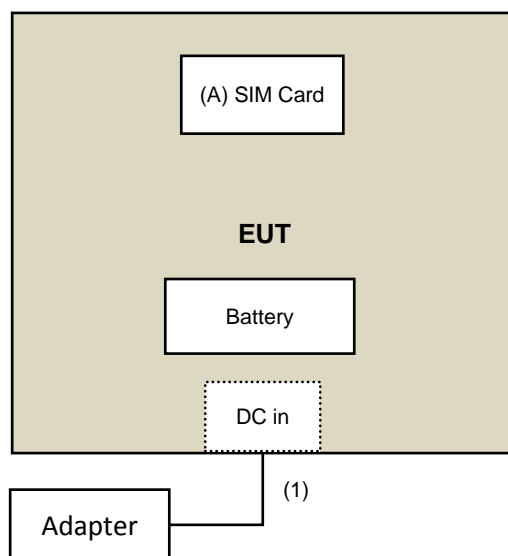
3.4 Description of Support Units

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.	SIM Card	R&S	CRT-Z3	NA	NA	Provided by Lab

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC Cable	1	1.9	No	0	Supplied by client

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards and references

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards and references:

Test standard:

FCC Part 15, Subpart C (15.247)
ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.

References Test Guidance :

KDB 558074 D01 15.247 Meas Guidance v05r02

All test items have been performed as a reference to the above KDB test guidance.

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

For Bandedge test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY51210202	Dec. 13, 2019	Dec. 12, 2020
Horn_Antenna SCHWARZBECK	BBHA 9120D	9120D-783	Nov. 24, 2019	Nov. 23, 2020
Pre-Amplifier EMCI	EMC12630SE	980385	Aug. 15, 2019	Aug. 14, 2020
RF Cable	EMC104-SM-SM-1200	160923	Jan. 15, 2020	Jan. 14, 2021
RF Cable	104 RF cable	131215	Jan. 09, 2020	Jan. 08, 2021
RF Cable	EMC104-SM-SM-6000	180418	May 03, 2019	May 02, 2020
Pre-Amplifier EMCI	EMC184045SE	980387	Jan. 15, 2020	Jan. 14, 2021
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170519	Nov. 24, 2019	Nov. 23, 2020
RF Cable	EMC102-KM-KM-1200	160924	Jan. 15, 2020	Jan. 14, 2021
RF Cable	EMC102-KM-KM-4500	181205	Aug. 26, 2019	Aug. 25, 2020
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	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 966 Chamber No. 4.
3. Tested Date: Mar. 09, 2020

For Radiated Emission (below 1GHz) test

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY51210202	Dec. 13, 2019	Dec. 12, 2020
Pre-Amplifier EMCI	EMC001340	980142	May 30, 2019	May 29, 2020
Loop Antenna Electro-Metrics	EM-6879	264	Feb. 18, 2020	Feb. 17, 2021
RF Cable	NA	LOOPCAB-001	Jan. 08, 2020	Jan. 07, 2021
RF Cable	NA	LOOPCAB-002	Jan. 08, 2020	Jan. 07, 2021
Pre-Amplifier Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-01	Oct. 23, 2019	Oct. 22, 2020
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-406	Nov. 11, 2019	Nov. 10, 2020
RF Cable	8D	966-4-1	Mar. 19, 2019	Mar. 18, 2020
RF Cable	8D	966-4-2	Mar. 19, 2019	Mar. 18, 2020
RF Cable	8D	966-4-3	Mar. 19, 2019	Mar. 18, 2020
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-4-01	Sep. 26, 2019	Sep. 25, 2020
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	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 966 Chamber No. 4.
3. Loop antenna was used for all emissions below 30 MHz.
4. Tested Date: Mar. 11, 2020

For Radiated Emission (above 1GHz) test

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY51210202	Dec. 13, 2019	Dec. 12, 2020
Horn_Antenna SCHWARZBECK	BBHA 9120D	9120D-783	Nov. 24, 2019	Nov. 23, 2020
Pre-Amplifier EMCI	EMC12630SE	980385	Aug. 15, 2019	Aug. 14, 2020
RF Cable	EMC104-SM-SM-1200	160923	Jan. 15, 2020	Jan. 14, 2021
RF Cable	104 RF cable	131215	Jan. 09, 2020	Jan. 08, 2021
RF Cable	EMC104-SM-SM-6000	180418	May 03, 2019	May 02, 2020
Pre-Amplifier EMCI	EMC184045SE	980387	Jan. 15, 2020	Jan. 14, 2021
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170519	Nov. 24, 2019	Nov. 23, 2020
RF Cable	EMC102-KM-KM-1200	160924	Jan. 15, 2020	Jan. 14, 2021
RF Cable	EMC-KM-KM-4000	200214	Mar. 11, 2020	Mar. 10, 2021
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	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 966 Chamber No. 4.
3. Loop antenna was used for all emissions below 30 MHz.
4. Tested Date: Mar. 20, 2020

For other test items:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSV40	100964	June 04, 2019	June 03, 2020
Power meter Anritsu	ML2495A	1014008	May 13, 2019	May 12, 2020
Power sensor Anritsu	MA2411B	0917122	May 13, 2019	May 12, 2020
Fixed Attenuator Mini-Circuits	MDCS18N-10	MDCS18N-10-01	Apr. 15, 2019	Apr. 14, 2020
Software	ADT_RF Test Software V6.6.5.4	NA	NA	NA

- NOTE:**
1. The test was performed in Oven room 2.
 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: Mar. 24, 2020

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. Parallel, perpendicular, and ground-parallel orientations 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 detects 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:

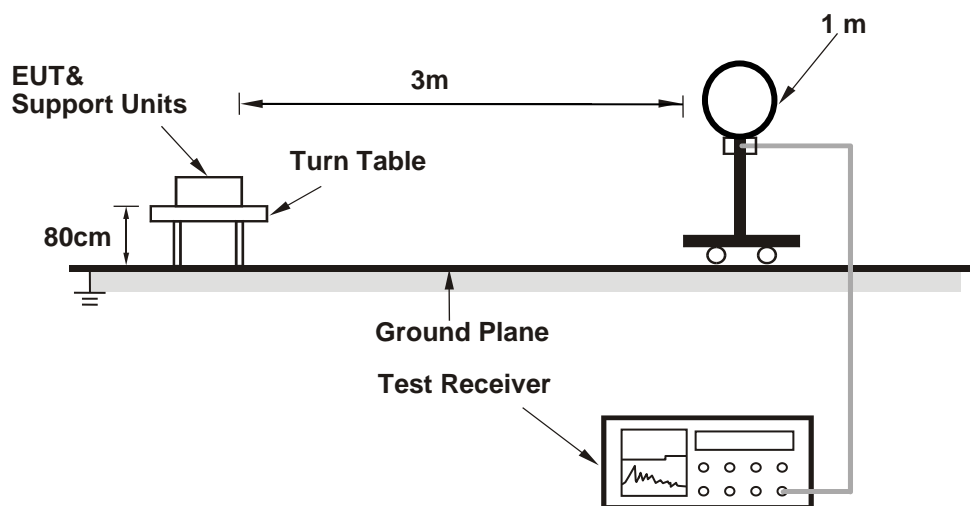
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
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

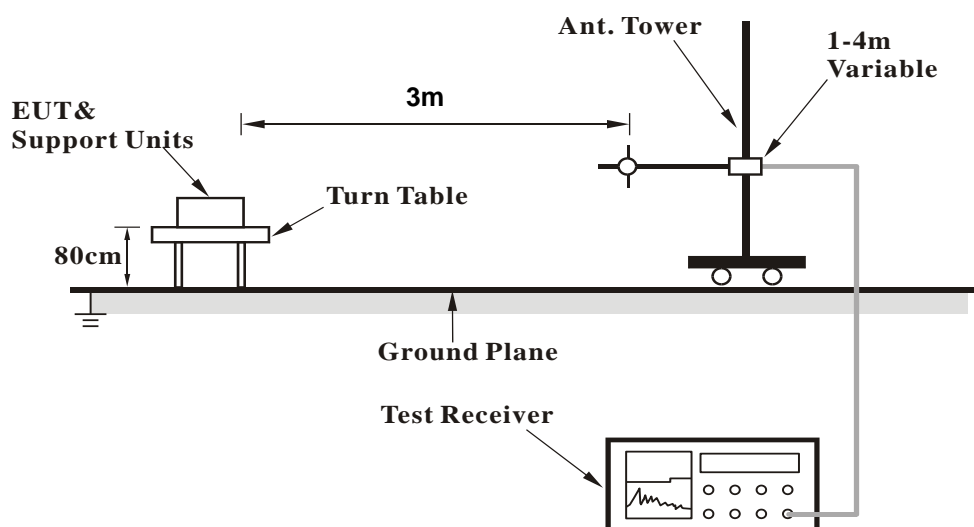
No deviation.

4.1.5 Test Setup

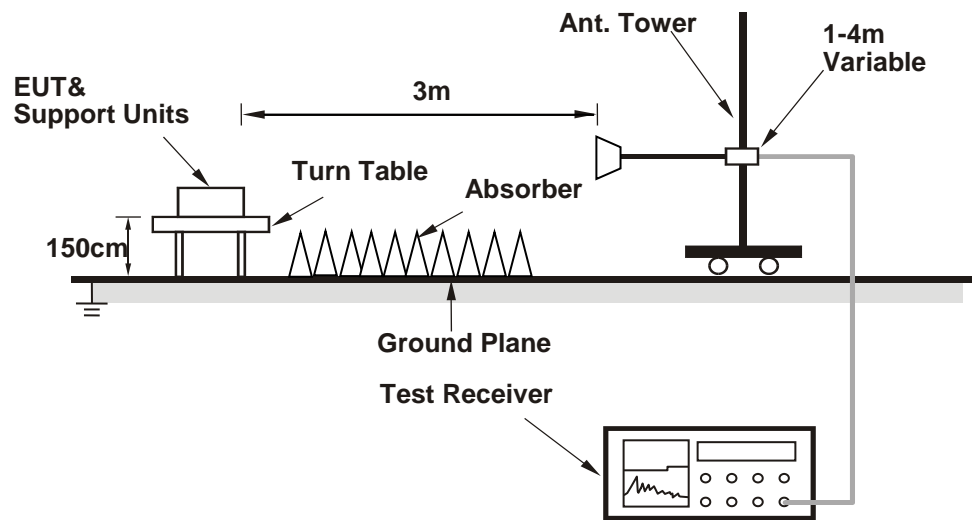
For Radiated emission below 30MHz



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

- Placed the EUT on the testing table.
- Controlling software (Terateem.exe with WNC_LS03-SOP) has been activated to 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	2366.60	52.7 PK	74.0	-21.3	1.80 H	126	54.2	-1.5
2	2366.60	46.8 AV	54.0	-7.2	1.80 H	126	48.3	-1.5
3	2390.00	53.9 PK	74.0	-20.1	1.80 H	126	55.4	-1.5
4	2390.00	42.4 AV	54.0	-11.6	1.80 H	126	43.9	-1.5
5	*2405.00	109.2 PK			1.80 H	126	110.7	-1.5
6	*2405.00	105.5 AV			1.80 H	126	107.0	-1.5
7	4810.00	45.8 PK	74.0	-28.2	2.20 H	234	43.1	2.7
8	4810.00	32.4 AV	54.0	-21.6	2.20 H	234	29.7	2.7
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	2366.60	56.6 PK	74.0	-17.4	2.05 V	353	58.1	-1.5
2	2366.60	49.2 AV	54.0	-4.8	2.05 V	353	50.7	-1.5
3	2390.00	50.5 PK	74.0	-23.5	2.05 V	353	52.0	-1.5
4	2390.00	42.2 AV	54.0	-11.8	2.05 V	353	43.7	-1.5
5	*2405.00	114.1 PK			2.05 V	353	115.6	-1.5
6	*2405.00	110.2 AV			2.05 V	353	111.7	-1.5
7	4810.00	45.8 PK	74.0	-28.2	2.21 V	230	43.1	2.7
8	4810.00	32.4 AV	54.0	-21.6	2.21 V	230	29.7	2.7

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
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	110.7 PK			1.06 H	76	112.1	-1.4
2	*2440.00	107.4 AV			1.06 H	76	108.8	-1.4
3	4880.00	45.2 PK	74.0	-28.8	2.20 H	244	42.7	2.5
4	4880.00	31.6 AV	54.0	-22.4	2.20 H	244	29.1	2.5
5	7320.00	46.8 PK	74.0	-27.2	2.18 H	222	37.3	9.5
6	7320.00	33.4 AV	54.0	-20.6	2.18 H	222	23.9	9.5
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2440.00	115.2 PK			3.31 V	343	116.6	-1.4
2	*2440.00	111.7 AV			3.31 V	343	113.1	-1.4
3	4880.00	45.5 PK	74.0	-28.5	2.16 V	238	43.0	2.5
4	4880.00	32.1 AV	54.0	-21.9	2.16 V	238	29.6	2.5
5	7320.00	46.8 PK	74.0	-27.2	2.16 V	225	37.3	9.5
6	7320.00	33.2 AV	54.0	-20.8	2.16 V	225	23.7	9.5

REMARKS:

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

CHANNEL	TX Channel 25	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	*2475.00	112.4 PK			3.36 H	52	113.9	-1.5
2	*2475.00	108.1 AV			3.36 H	52	109.6	-1.5
3	2483.50	54.9 PK	74.0	-19.1	3.36 H	52	56.4	-1.5
4	2483.50	43.7 AV	54.0	-10.3	3.36 H	52	45.2	-1.5
5	4950.00	46.0 PK	74.0	-28.0	2.11 H	246	43.2	2.8
6	4950.00	32.5 AV	54.0	-21.5	2.11 H	246	29.7	2.8
7	7425.00	47.2 PK	74.0	-26.8	2.16 H	225	37.2	10.0
8	7425.00	33.4 AV	54.0	-20.6	2.16 H	225	23.4	10.0
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	*2475.00	114.8 PK			1.72 V	360	116.3	-1.5
2	*2475.00	111.1 AV			1.72 V	360	112.6	-1.5
3	2483.50	57.7 PK	74.0	-16.3	1.72 V	360	59.2	-1.5
4	2483.50	47.7 AV	54.0	-6.3	1.72 V	360	49.2	-1.5
5	4950.00	45.8 PK	74.0	-28.2	2.20 V	235	43.0	2.8
6	4950.00	32.3 AV	54.0	-21.7	2.20 V	235	29.5	2.8
7	7425.00	46.4 PK	74.0	-27.6	2.12 V	212	36.4	10.0
8	7425.00	32.7 AV	54.0	-21.3	2.12 V	212	22.7	10.0

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
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	108.4 PK			2.22 H	55	109.9	-1.5
2	*2480.00	104.6 AV			2.22 H	55	106.1	-1.5
3	2483.50	69.2 PK	74.0	-4.8	2.22 H	55	70.7	-1.5
4	2483.50	52.4 AV	54.0	-1.6	2.22 H	55	53.9	-1.5
5	4960.00	45.4 PK	74.0	-28.6	2.15 H	240	42.5	2.9
6	4960.00	32.3 AV	54.0	-21.7	2.15 H	240	29.4	2.9
7	7440.00	46.8 PK	74.0	-27.2	2.15 H	240	36.9	9.9
8	7440.00	33.3 AV	54.0	-20.7	2.15 H	240	23.4	9.9
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	*2480.00	110.3 PK			1.80 V	353	111.8	-1.5
2	*2480.00	106.4 AV			1.80 V	353	107.9	-1.5
3	2483.50	69.2 PK	74.0	-4.8	1.80 V	353	70.7	-1.5
4	2483.50	53.8 AV	54.0	-0.2	1.80 V	353	55.3	-1.5
5	4960.00	45.3 PK	74.0	-28.7	2.20 V	223	42.4	2.9
6	4960.00	32.2 AV	54.0	-21.8	2.20 V	223	29.3	2.9
7	7440.00	46.4 PK	74.0	-27.6	2.13 V	235	36.5	9.9
8	7440.00	33.1 AV	54.0	-20.9	2.13 V	235	23.2	9.9

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

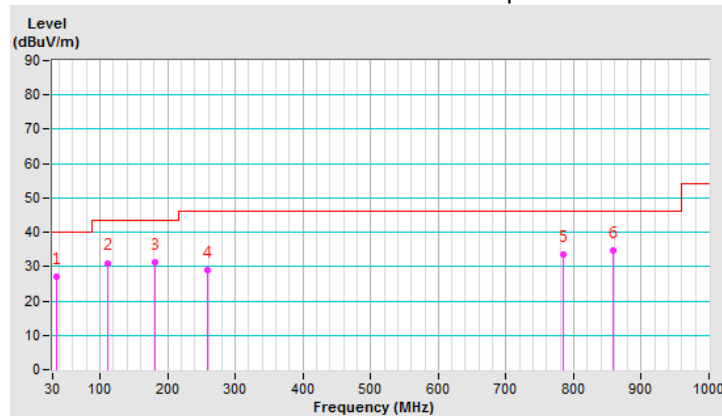
Below 1GHz Data:

CHANNEL	TX Channel 25	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 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	36.62	27.2 QP	40.0	-12.8	1.50 H	270	36.0	-8.8
2	111.33	31.1 QP	43.5	-12.4	1.50 H	213	41.7	-10.6
3	181.13	31.4 QP	43.5	-12.1	1.50 H	342	40.9	-9.5
4	259.87	29.0 QP	46.0	-17.0	1.00 H	238	37.6	-8.6
5	784.39	33.5 QP	46.0	-12.5	1.50 H	173	28.9	4.6
6	858.43	34.8 QP	46.0	-11.2	1.50 H	99	29.5	5.3

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

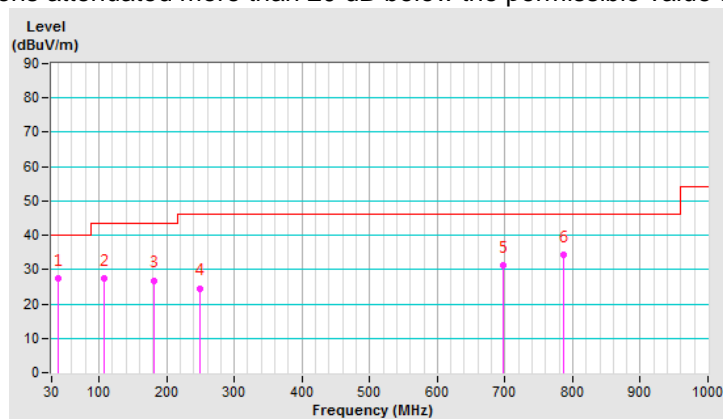


CHANNEL	TX Channel 25	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

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	39.70	27.5 QP	40.0	-12.5	1.00 V	239	35.9	-8.4
2	107.60	27.6 QP	43.5	-15.9	2.00 V	283	38.4	-10.8
3	181.59	26.9 QP	43.5	-16.6	2.00 V	303	36.5	-9.6
4	250.04	24.6 QP	46.0	-21.4	1.00 V	83	33.4	-8.8
5	696.41	31.4 QP	46.0	-14.6	2.00 V	322	29.1	2.3
6	785.68	34.1 QP	46.0	-11.9	1.00 V	114	29.6	4.5

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



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. 23, 2019	Oct. 22, 2020
Line-Impedance Stabilization Network (for EUT) R&S	ESH3-Z5	848773/004	Oct. 23, 2019	Oct. 22, 2020
Line-Impedance Stabilization Network (for Peripheral) R&S	ESH3-Z5	835239/001	Mar. 17, 2019	Mar. 16, 2020
50 ohms Terminator	50	3	Oct. 23, 2019	Oct. 22, 2020
RF Cable	5D-FB	COCCAB-001	Sep. 27, 2019	Sep. 26, 2020
Fixed attenuator EMCI	STI02-2200-10	003	Mar. 14, 2019	Mar. 13, 2020
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 Conduction 1.
- 3 Tested Date: Mar. 11, 2020

4.2.3 Test Procedures

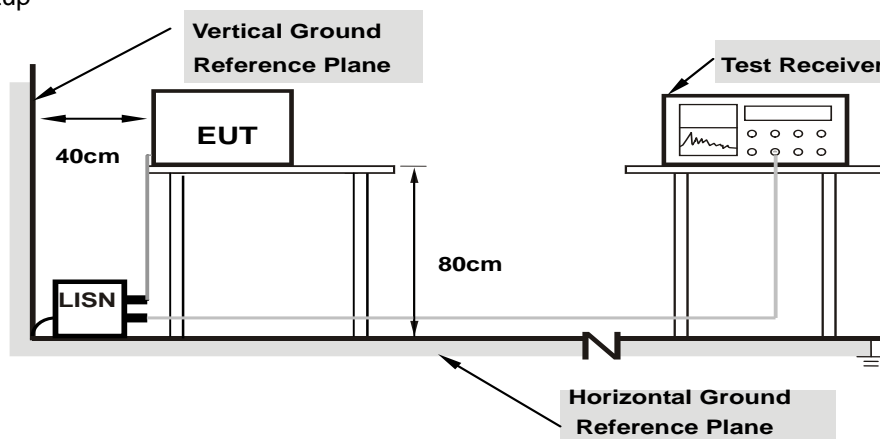
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

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	0.15781	9.99	20.86	4.71	30.85	14.70	65.58	55.58	-34.73	-40.88
2	0.16953	9.99	30.78	21.35	40.77	31.34	64.98	54.98	-24.21	-23.64
3	0.18906	9.99	27.73	18.61	37.72	28.60	64.08	54.08	-26.36	-25.48
4	0.20469	9.99	26.02	17.32	36.01	27.31	63.42	53.42	-27.41	-26.11
5	0.40781	10.00	31.66	27.04	41.66	37.04	57.69	47.69	-16.03	-10.65
6	5.91406	10.38	14.75	5.32	25.13	15.70	60.00	50.00	-34.87	-34.30

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

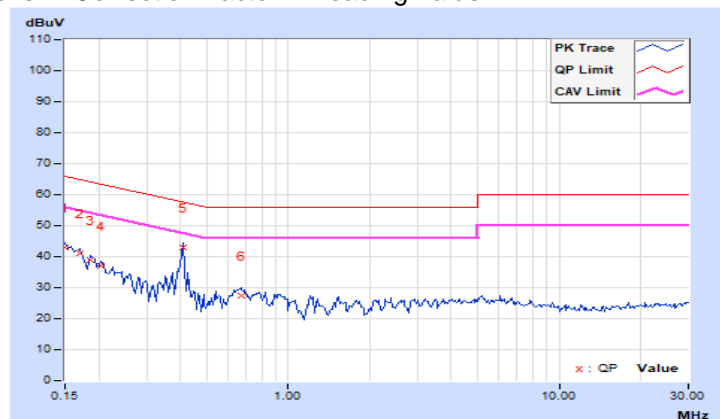


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr.	Reading Value		Emission Level		Limit		Margin	
		Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.99	32.89	19.60	42.88	29.59	66.00	56.00	-23.12	-26.41
2	0.16953	9.99	31.14	17.71	41.13	27.70	64.98	54.98	-23.85	-27.28
3	0.18516	9.99	28.96	15.83	38.95	25.82	64.25	54.25	-25.30	-28.43
4	0.20469	9.99	27.01	14.54	37.00	24.53	63.42	53.42	-26.42	-28.89
5	0.40781	10.01	32.82	29.43	42.83	39.44	57.69	47.69	-14.86	-8.25
6	0.66953	10.03	17.38	12.72	27.41	22.75	56.00	46.00	-28.59	-23.25

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

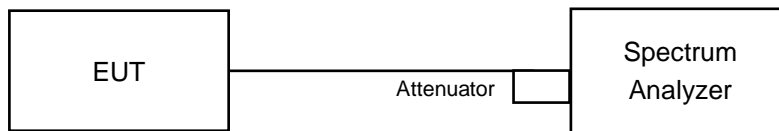


4.3 6dB Bandwidth Measurement

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

- Set resolution bandwidth (RBW) = 100kHz
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- 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

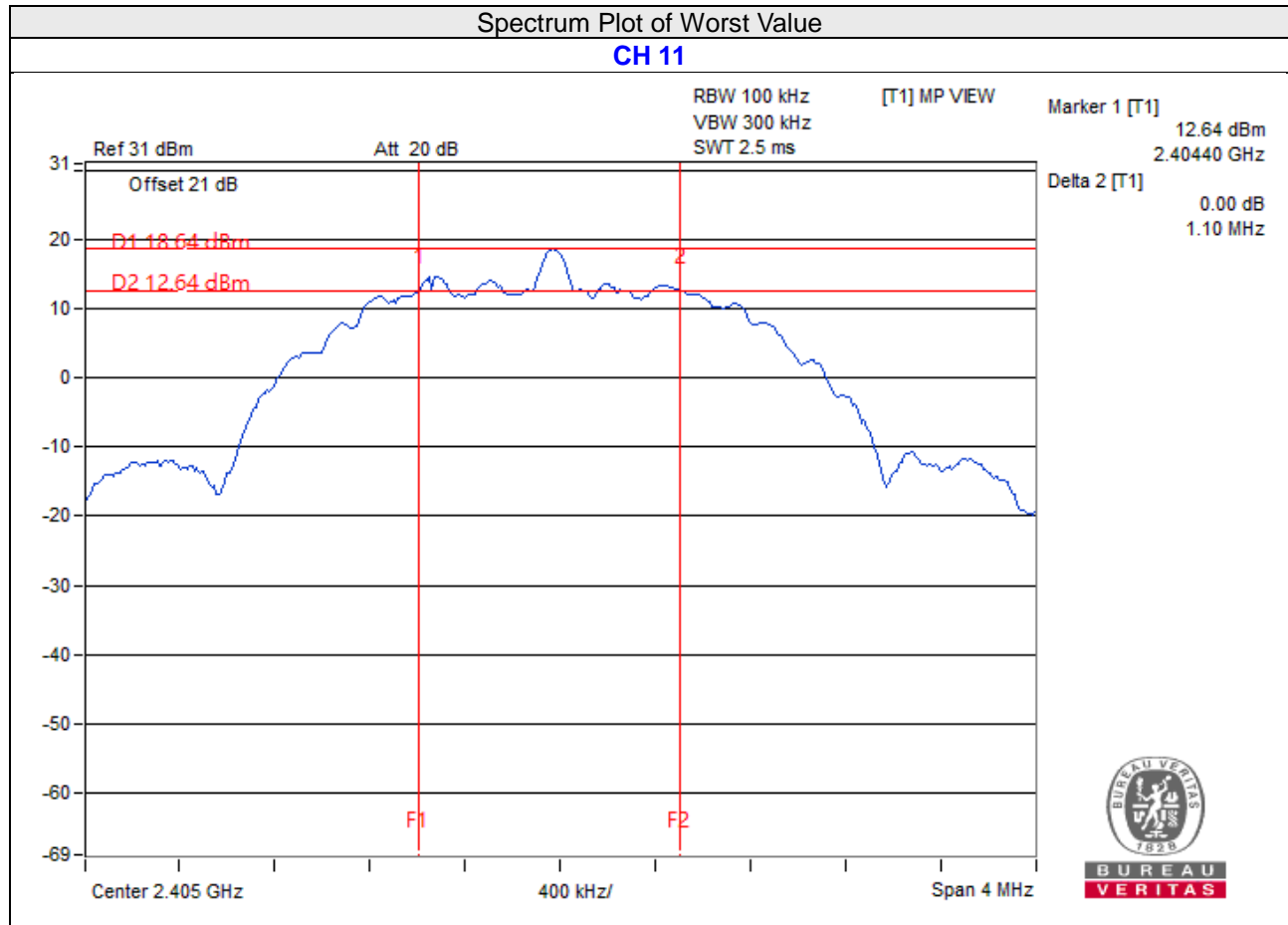
No deviation.

4.3.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.

4.3.7 Test Result

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
11	2405	1.1	0.5	Pass
18	2440	1.1	0.5	Pass
25	2475	1.11	0.5	Pass
26	2480	1.1	0.5	Pass

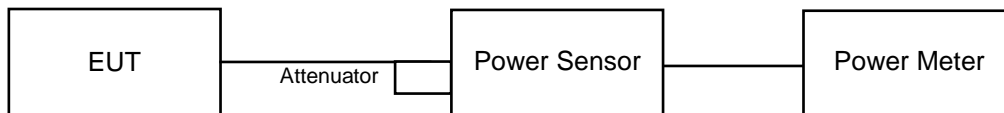


4.4 Conducted Output Power Measurement

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

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

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	66.834	18.25	30	Pass
18	2440	66.527	18.23	30	Pass
25	2475	67.453	18.29	30	Pass
26	2480	19.907	12.99	30	Pass

FOR AVERAGE POWER

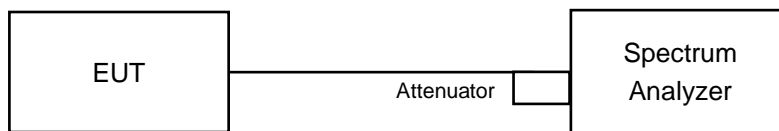
Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
11	2405	65.917	18.19
18	2440	65.615	18.17
25	2475	66.527	18.23
26	2480	19.364	12.87

4.5 Power Spectral Density Measurement

4.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm in any 3 kHz.

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

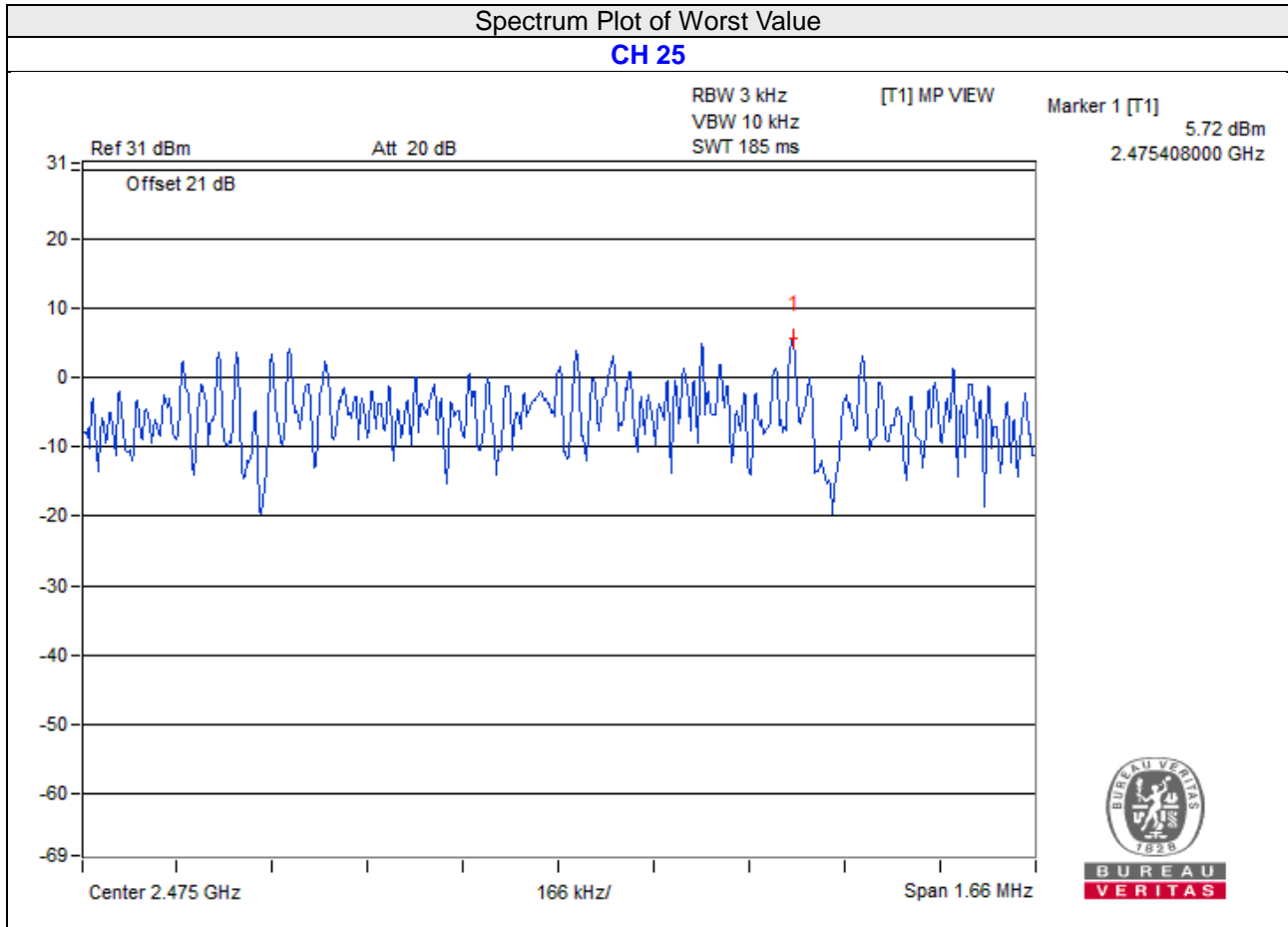
No deviation.

4.5.6 EUT Operating Condition

Same as Item 4.3.6

4.5.7 Test Results

Channel	Freq. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass /Fail
11	2405	5.50	8	Pass
18	2440	5.44	8	Pass
25	2475	5.72	8	Pass
26	2480	0.32	8	Pass

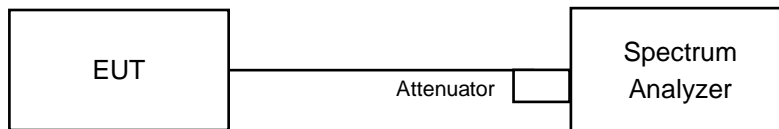


4.6 Conducted Out of Band Emission Measurement

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.

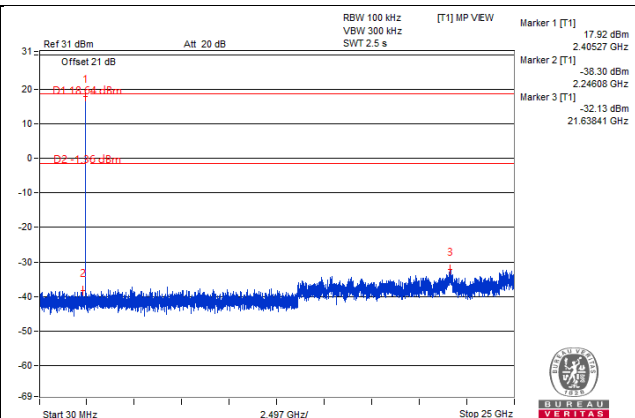
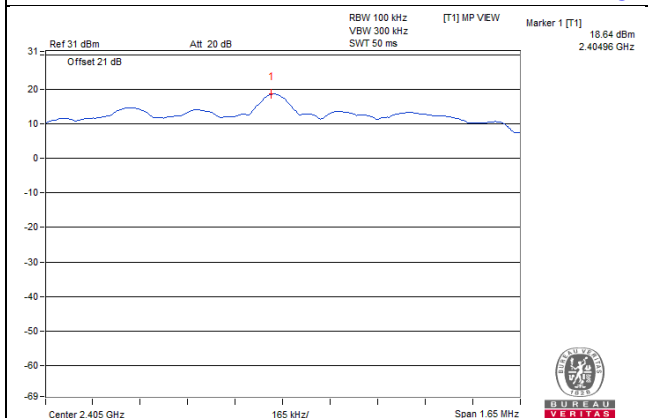
4.6.6 EUT Operating Condition

Same as Item 4.3.6

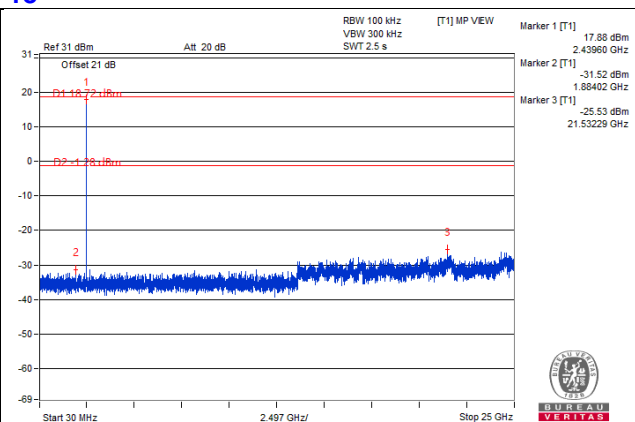
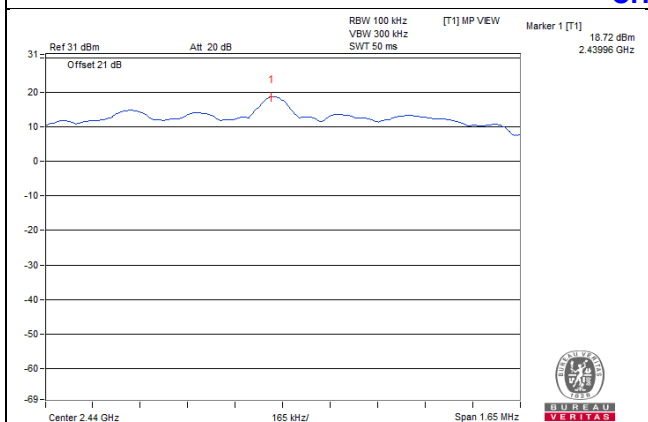
4.6.7 Test Results

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.

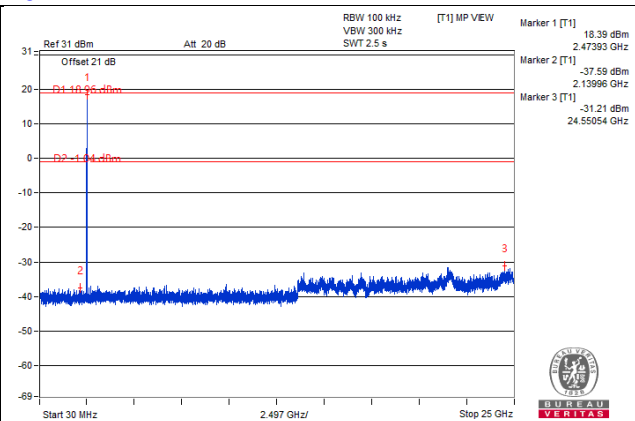
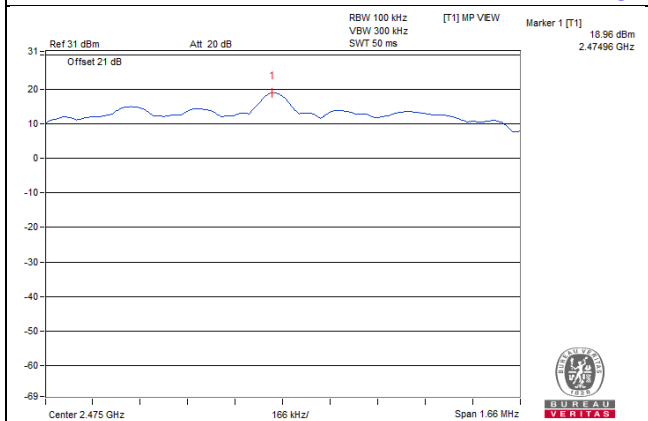
CH 11



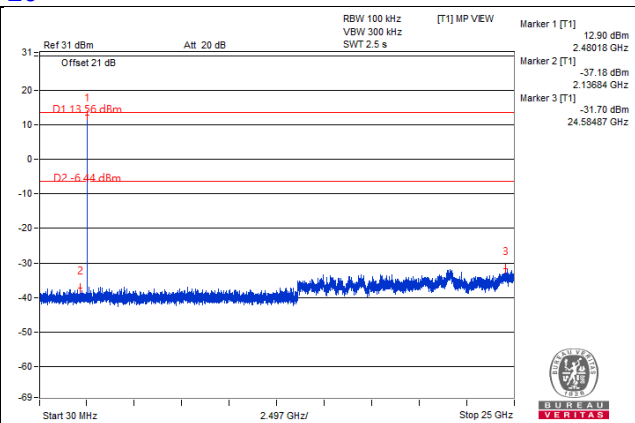
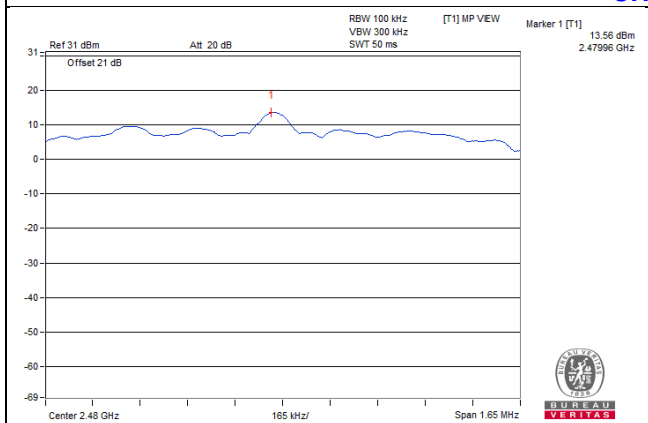
CH 18



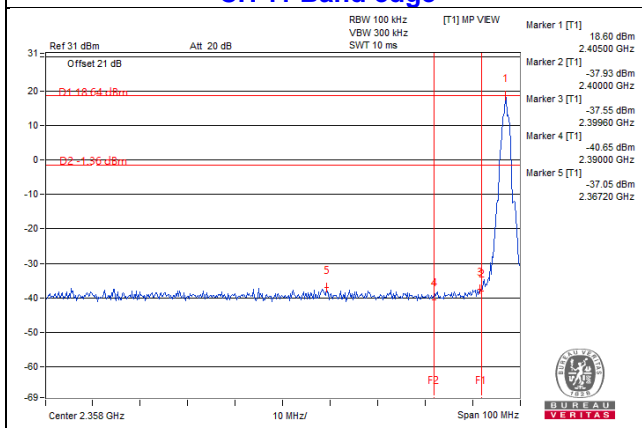
CH 25



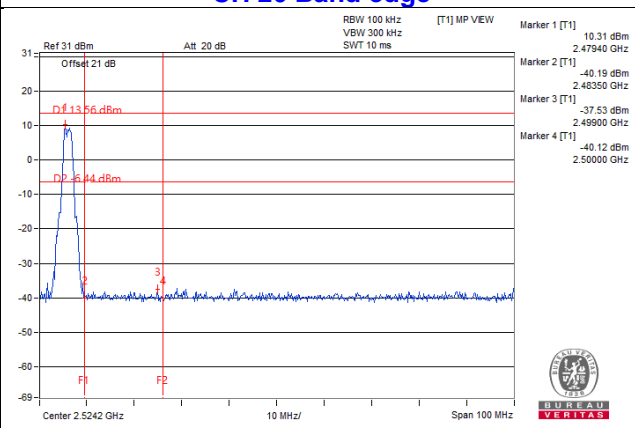
CH 26



CH 11 Band edge



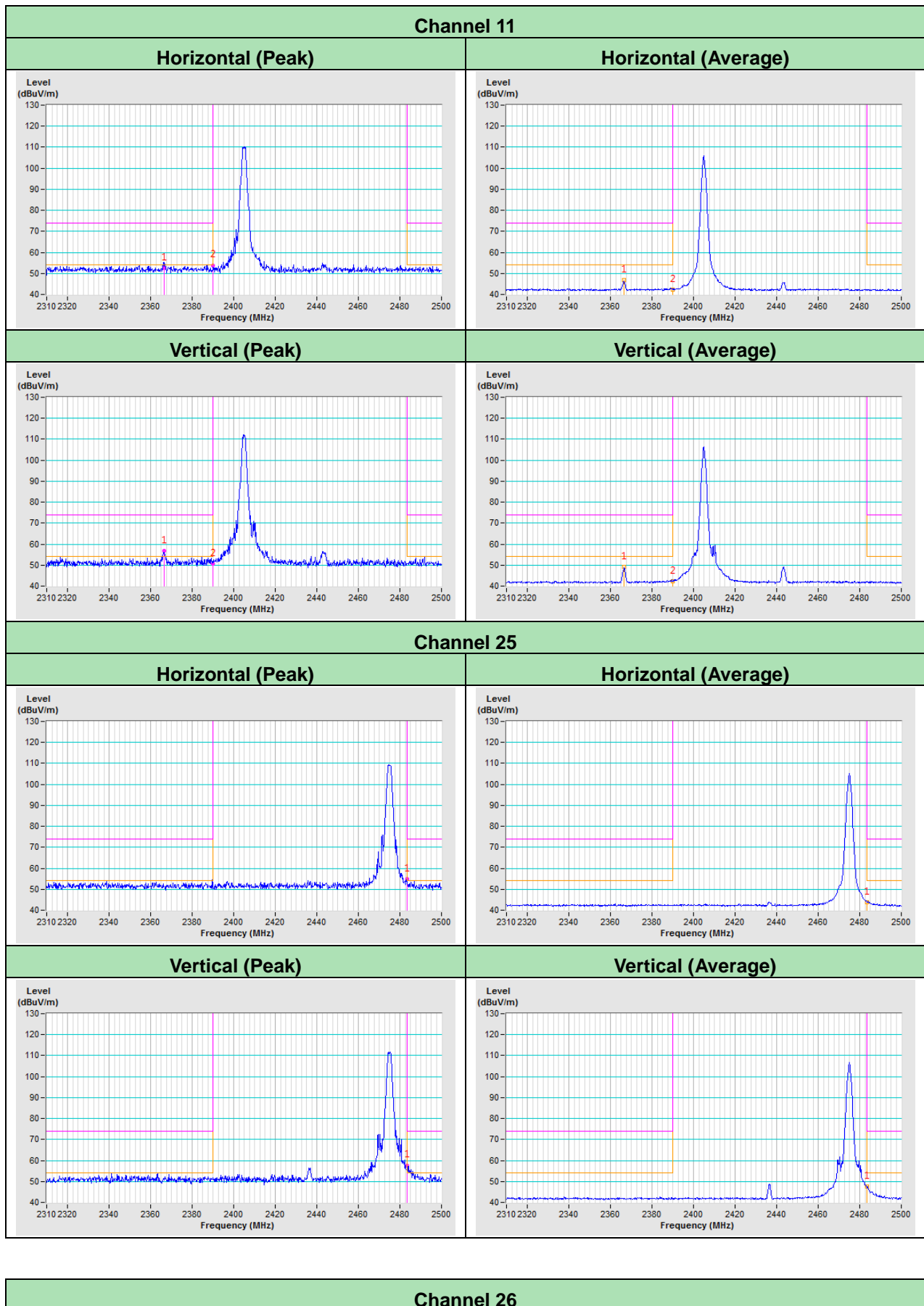
CH 26 Band edge

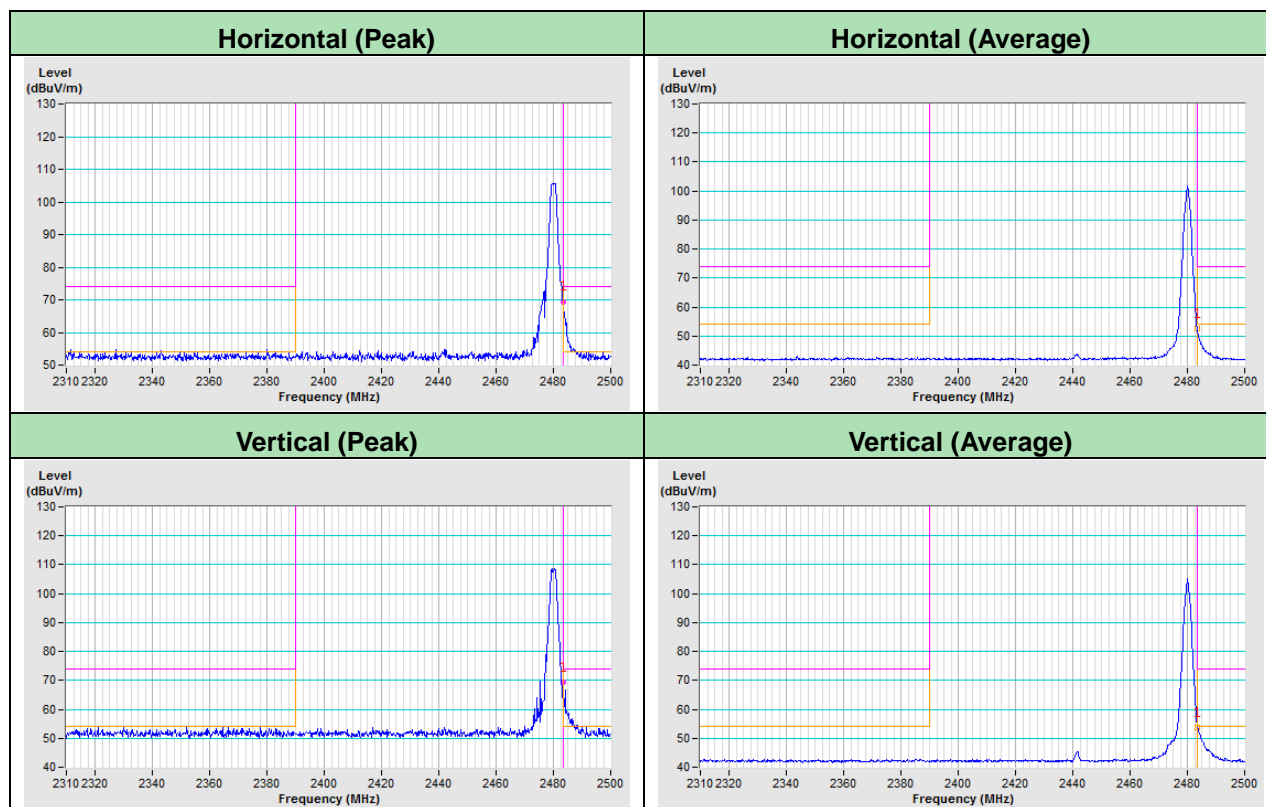


5 Pictures of Test Arrangements

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

Annex A - Band-Edge Measurement





Appendix – Information of 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.

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Web Site: www.bureauveritas-adt.com

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

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