

FCC Test Report

(Zigbee)

Report No.: RF190408C21-1

FCC ID: QOQGM210P

Test Model: MGM210P32A, MGM210P22A

Series Model: BGM210P32A, BGM210P22A (Refer to item 3.1 for the more details)

Received Date: Apr. 08, 2019

Test Date: Apr. 13 ~ Jun. 12, 2019

Issued Date: Jun. 21, 2019

Applicant: Silicon Laboratories Finland Oy

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FCC Registration / 788550 / TW0003
Designation Number:



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Release Control Record

Issue No.	Description	Date Issued
RF190408C21-1	Original release	Jun. 21, 2019

1 Certificate of Conformity

Product: Bluetooth Low Energy and ZigBee wireless radio modules

Brand: Silicon Labs

Test Model: MGM210P32A, MGM210P22A

Series Model: BGM210P32A, BGM210P22A (Refer to item 3.1 for the more details)

Sample Status: Engineering sample

Applicant: Silicon Laboratories Finland Oy

Test Date: Apr. 13 ~ Jun. 12, 2019

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 RF characteristics under the conditions specified in this report.

Prepared by : Polly Chien , **Date:** Jun. 21, 2019
Polly Chien / Specialist

Approved by : Bruce Chen , **Date:** Jun. 21, 2019
Bruce Chen / Project Engineer

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 -13.14dB at 0.44123MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -0.8dB 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 1: No antenna connector is used. Antenna 2: Antenna connector is 50-ohm pin not a standard connector.

Note: 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	2.94 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.04 dB
	30MHz ~ 200MHz	3.59 dB
	200MHz ~ 1000MHz	3.60 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Bluetooth Low Energy and ZigBee wireless radio modules
Brand	Silicon Labs
Test Model	MGM210P32A, MGM210P22A
Series Model	BGM210P32A, BGM210P22A
Model Difference	Refer to Note for the more details
Status of EUT	Engineering sample
Power Supply Rating	3.3Vdc from host equipment
Modulation Type	O-QPSK
Operating Frequency	2405 ~ 2480MHz
Number of Channel	16
Output Power	EUT + Dipole antenna Mode A1 (MGM210P32A / High power): 104.232mW Mode A2 (MGM210P22A / Low power): 12.274mW EUT + Chip antenna Mode B1 (MGM210P32A / High power): 102.094mW Mode B2 (MGM210P22A / Low power): 11.722mW
Antenna Type	Refer to Note
Antenna Connector	Chip antenna: NA Dipole antenna: 50-ohm pin
Accessory Device	NA
Data Cable Supplied	NA

Note:

- All models in the family are listed as below. Models MGM210P22A and MGM210P32A are the representatives for the final tests, and this documents applies to these two models in particular, as they are the only modules additionally supporting the Zigbee protocol.

Model	MGM210P22A	MGM210P32A	BGM210P22A	BGM210P32A
Spec.	Low-Power/ Zigbee and/or BLE	High-Power/ Zigbee and/or BLE	Low-Power/ BLE	high-Power/ BLE
Antenna Type	1. On board ceramic chip antenna with 1.86dBi of gain 2. Dipole antenna with the theoretical gain of 2.14dBi			
Hardware	The wireless chipset is the same in all these modules, and it integrates a PA subsystem and a RF switch to route the RF signal to two separate RF ports, one for the integral onboard ceramic chip antenna and one for an optional external antenna			
RF max TX power	10dBm	20dBm	10dBm	20dBm

The MGM210Px modules are for Zigbee + BLE, while the BGM210Px modules are for BLE only. The 22 and 32 in the model names indicate the power variant, that is, the xGM210P22A is the low-power variant which is allowed to transmit at up to 10dBm, whereas the xGM210P32A is the high-power variant for up to 20dBm. Hardware-wise, the two power variants only differ in their 50Ω matching network which is optimized for the related max allowed output power.

- The following samples are provided by client and used for testing.

Sample	Model
A	MGM210P32A
B	MGM210P22A

3. The power setting is list as below.

Test Mode	A1: MGM210P32A / High power / Dipole ant.	Test Mode	A2: MGM210P22A / Low power / Dipole ant.
CH 11	200	CH 11	100
CH 19	200	CH 19	100
CH 25	200	CH 25	100
CH 26	118	CH 26	100
Test Mode	B1: MGM210P32A / High power / Chip ant.	Test Mode	B2: MGM210P22A / Low power / Chip ant.
CH 11	200	CH 11	100
CH 19	200	CH 19	100
CH 25	200	CH 25	100
CH 26	115	CH 26	100

3.2 Description of Test Modes

16 channels are provided to this EUT:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
11	2405	15	2425	19	2445	23	2465
12	2410	16	2430	20	2450	24	2470
13	2415	17	2435	21	2455	25	2475
14	2420	18	2440	22	2460	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	
A1	√	√	√	√	Sample A / High power / Dipole ant.
A2	-	√	√	√	Sample B / Low power / Dipole ant.
B1	√	√	√	√	Sample A / High power / Chip ant.
B2	-	√	√	√	Sample B / Low power / Chip ant.

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:

- 1 The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on Z-plane.
- 2 "-": 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
A1, B1	11 to 26	11, 19, 25, 26	O-QPSK

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
A1, A2, B1, B2	11 to 26	11	O-QPSK

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
A1, A2, B1, B2	11 to 26	11	O-QPSK

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
Conducted output power			
A1, A2, B1, B2	11 to 26	11, 19, 25, 26	O-QPSK
For other tests except conducted output power			
A1, B1	11 to 26	11, 19, 25, 26	O-QPSK

Test Condition:

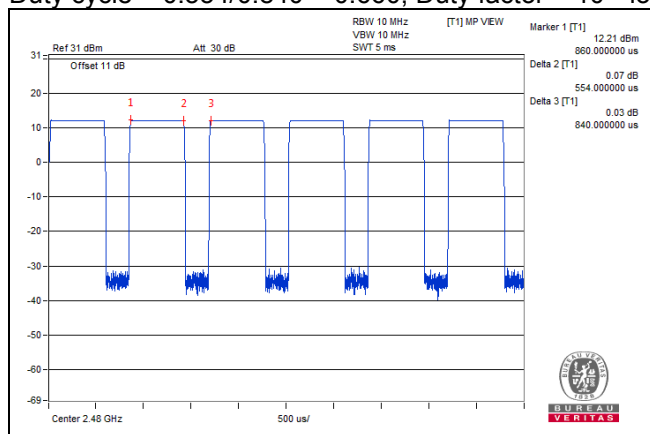
Applicable to	Environmental Conditions	Input Power (System)	Tested by
RE $\geq$ 1G	22 deg. C, 68% RH	120Vac, 60Hz	Greg Lin
RE<1G	22 deg. C, 68% RH	120Vac, 60Hz	Han Wu
PLC	25 deg. C, 75% RH	120Vac, 60Hz	Jones Chang
APCM	25 deg. C, 60% RH	120Vac, 60Hz	Alan Wu

3.1 Duty Cycle of Test Signal

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

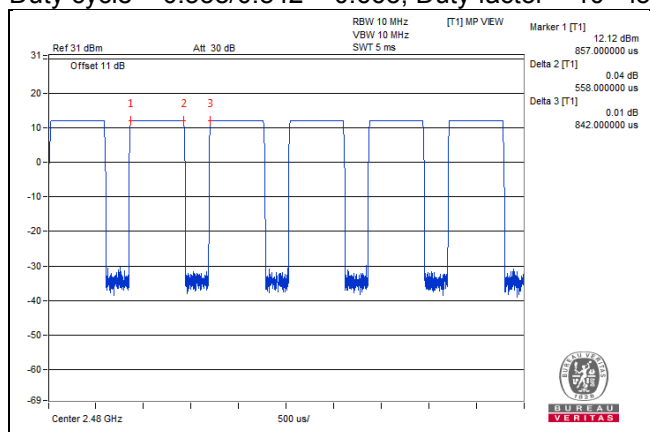
Mode A1, A2

Duty cycle = $0.554/0.840 = 0.660$, Duty factor = $10 * \log(1/0.660) = 1.81$



Mode B1, B2

Duty cycle = $0.558/0.842 = 0.663$, Duty factor = $10 * \log(1/0.663) = 1.79$



3.2 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.

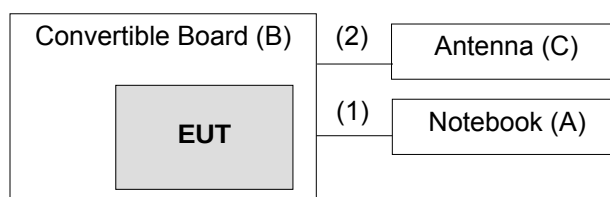
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	Lenovo	81A4	YD02TWF5	FCC DoC Approved	-
B.	Convertible Board	NA	NA	NA	NA	Provided by client
C.	Antenna	NA	NA	NA	NA	Provided by client

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Items A acted as a communication partner to transfer data.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB cable	1	1	Y	0	-
2.	RF cable	1	0.15	-	0	Provided by client

3.2.1 Configuration of System under Test



3.3 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 15.247 Meas Guidance v05r02

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 30dB 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.	Cal. Date	Cal. Due
Test Receiver KEYSIGHT	N9038A	MY51210203	Mar. 18, 2019	Mar. 17, 2020
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100269	May 29, 2018	May 28, 2019
			Jun. 04, 2019	Jun. 03, 2020
BILOG Antenna SCHWARZBECK	VULB9168	9168-160	Nov. 21, 2018	Nov. 20, 2019
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-1169	Nov. 25, 2018	Nov. 24, 2019
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Nov. 25, 2018	Nov. 24, 2019
Loop Antenna EMCI	EM-6879	269	Sep. 07, 2018	Sep. 06, 2019
Preamplifier Agilent (Below 1GHz)	8447D	2944A10638	Aug. 08, 2018	Aug. 07, 2019
Preamplifier Agilent (Above 1GHz)	8449B	3008A02367	Feb. 19, 2019	Feb. 18, 2020
RF signal cable HUBER+SUHNER&EMCI	SUCOFLEX 104 & EMC104-SM-SM80 00	CABLE-CH9-02 (248780+171006)	Jan. 19, 2019	Jan. 18, 2020
RF signal cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9-(250795/4)	Aug. 08, 2018	Aug. 07, 2019
RF signal cable Woken	8D-FB	Cable-CH9-01	Jul. 31, 2018	Jul. 30, 2019
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower EMCO	2070/2080	512.835.4684	NA	NA
Turn Table EMCO	2087-2.03	NA	NA	NA
Antenna Tower & Turn BV ADT	AT100	AT93021705	NA	NA
Turn Table BV ADT	TT100	TT93021705	NA	NA
Turn Table Controller BV ADT	SC100	SC93021705	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY55190 004/MY55190007/MY55 210005	Jul. 17, 2018	Jul. 16, 2019

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 HwaYa Chamber 9.

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 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:

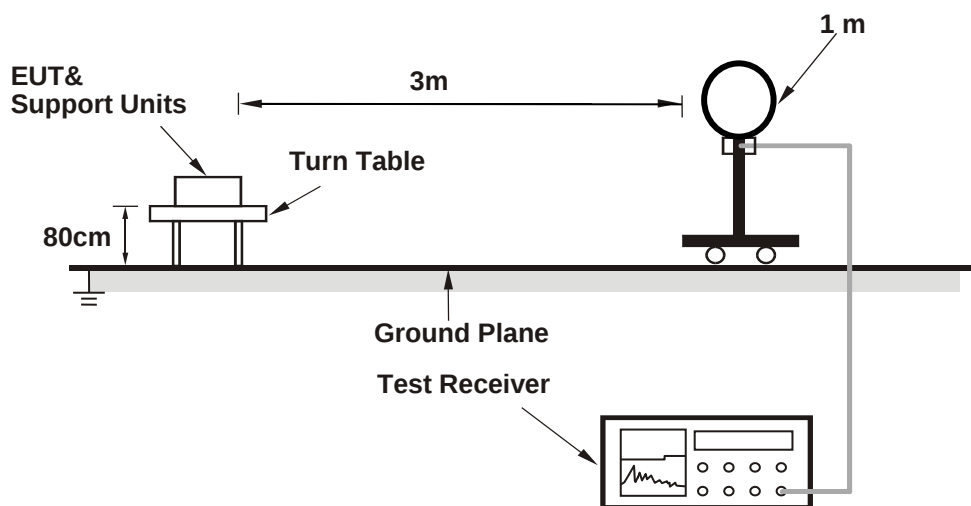
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

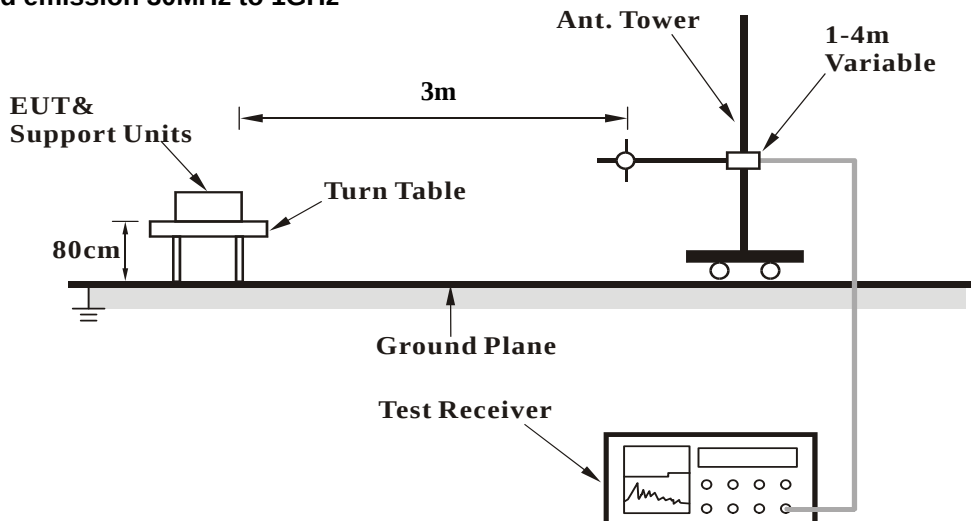
No deviation.

4.1.5 Test Set Up

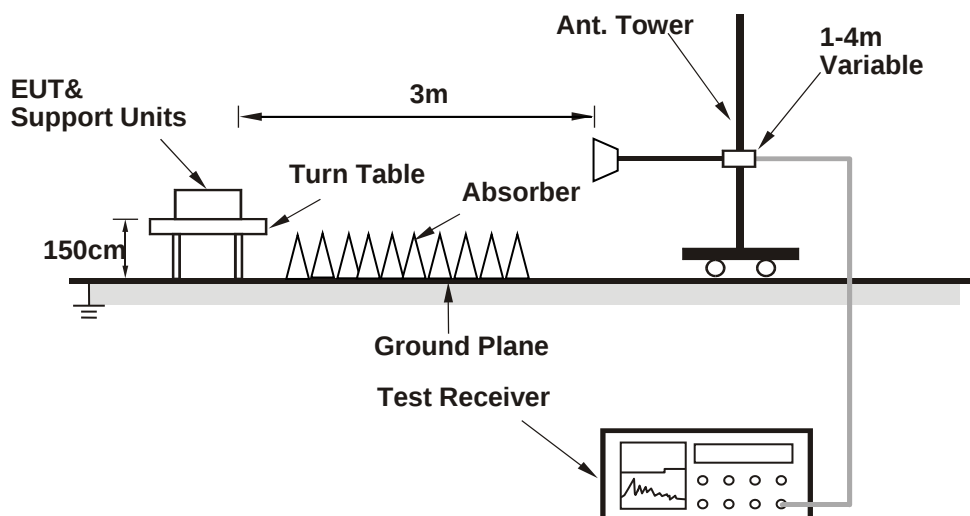
For Radiated emission below 30MHz



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.
- Prepared a notebook to act as a communication partner and placed it outside of testing area.
- The communication partner connected with EUT via a USB cable and ran a test program (BGTOOL) to enable EUT under transmission condition continuously at specific channel frequency.
- The necessary accessories enable the system in full functions.

4.1.7 Test Results

Above 1GHz Data

CHANNEL	TX Channel 11	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz	TEST MODE	A1

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	2366.80	56.8 PK	74.0	-17.2	1.07 H	135	24.9	31.9
2	2366.80	46.5 AV	54.0	-7.5	1.07 H	135	14.6	31.9
3	*2405.00	108.6 PK			1.09 H	148	76.8	31.8
4	*2405.00	102.5 AV			1.09 H	148	70.7	31.8
5	4810.00	46.9 PK	74.0	-27.1	1.08 H	342	43.2	3.7
6	4810.00	34.8 AV	54.0	-19.2	1.08 H	342	31.1	3.7
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	2366.80	60.5 PK	74.0	-13.5	1.46 V	252	28.6	31.9
2	2366.80	52.4 AV	54.0	-1.6	1.46 V	252	20.5	31.9
3	*2405.00	117.7 PK			1.00 V	250	85.9	31.8
4	*2405.00	111.1 AV			1.00 V	250	79.3	31.8
5	4810.00	47.8 PK	74.0	-26.2	1.00 V	170	44.1	3.7
6	4810.00	36.0 AV	54.0	-18.0	1.00 V	170	32.3	3.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
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) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz	TEST MODE	A1

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	*2445.00	109.0 PK			1.12 H	151	77.2	31.8
2	*2445.00	102.6 AV			1.12 H	151	70.8	31.8
3	4890.00	46.9 PK	74.0	-27.1	1.24 H	338	43.4	3.5
4	4890.00	34.8 AV	54.0	-19.2	1.24 H	338	31.3	3.5
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	*2445.00	117.7 PK			1.20 V	249	85.9	31.8
2	*2445.00	111.1 AV			1.20 V	249	79.3	31.8
3	4890.00	48.2 PK	74.0	-25.8	1.02 V	165	44.7	3.5
4	4890.00	36.1 AV	54.0	-17.9	1.02 V	165	32.6	3.5

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

CHANNEL	TX Channel 25	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz	TEST MODE	A1

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	108.5 PK			1.12 H	154	76.7	31.8
2	*2475.00	102.6 AV			1.12 H	154	70.8	31.8
3	2483.50	58.5 PK	74.0	-15.5	1.27 H	166	26.7	31.8
4	2483.50	46.6 AV	54.0	-7.4	1.27 H	166	14.8	31.8
5	4950.00	47.0 PK	74.0	-27.0	1.19 H	335	43.4	3.6
6	4950.00	34.7 AV	54.0	-19.3	1.19 H	335	31.1	3.6
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2475.00	117.6 PK			1.32 V	243	85.8	31.8
2	*2475.00	111.2 AV			1.32 V	243	79.4	31.8
3	2483.50	64.1 PK	74.0	-9.9	1.22 V	248	32.3	31.8
4	2483.50	52.2 AV	54.0	-1.8	1.22 V	248	20.4	31.8
5	4950.00	48.0 PK	74.0	-26.0	1.07 V	158	44.4	3.6
6	4950.00	35.9 AV	54.0	-18.1	1.07 V	158	32.3	3.6

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
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) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz	TEST MODE	A1

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	100.1 PK			1.33 H	166	68.3	31.8
2	*2480.00	94.4 AV			1.33 H	166	62.6	31.8
3	2483.50	51.1 PK	74.0	-22.9	1.34 H	161	19.3	31.8
4	2483.50	44.7 AV	54.0	-9.3	1.34 H	161	12.9	31.8
5	4960.00	45.4 PK	74.0	-28.6	1.22 H	337	41.6	3.8
6	4960.00	31.0 AV	54.0	-23.0	1.22 H	337	27.2	3.8
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	108.1 PK			1.19 V	216	76.3	31.8
2	*2480.00	101.7 AV			1.19 V	216	69.9	31.8
3	2483.50	59.9 PK	74.0	-14.1	1.11 V	213	28.1	31.8
4	2483.50	53.2 AV	54.0	-0.8	1.11 V	213	21.4	31.8
5	4960.00	46.4 PK	74.0	-27.6	1.10 V	159	42.6	3.8
6	4960.00	34.9 AV	54.0	-19.1	1.10 V	159	31.1	3.8

Remarks:

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

CHANNEL	TX Channel 11	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz	TEST MODE	B1

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	57.6 PK	74.0	-16.4	2.34 H	4	25.8	31.8
2	2390.00	44.8 AV	54.0	-9.2	2.34 H	4	13.0	31.8
3	*2405.00	118.5 PK			2.34 H	6	86.7	31.8
4	*2405.00	114.0 AV			2.34 H	6	82.2	31.8
5	4810.00	47.4 PK	74.0	-26.6	1.00 H	49	43.7	3.7
6	4810.00	38.1 AV	54.0	-15.9	1.00 H	49	34.4	3.7
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	2390.00	58.5 PK	74.0	-15.5	1.08 V	266	26.7	31.8
2	2390.00	44.3 AV	54.0	-9.7	1.08 V	266	12.5	31.8
3	*2405.00	111.1 PK			1.13 V	265	79.3	31.8
4	*2405.00	105.6 AV			1.13 V	265	73.8	31.8
5	4810.00	44.5 PK	74.0	-29.5	2.84 V	332	40.8	3.7
6	4810.00	30.6 AV	54.0	-23.4	2.84 V	332	26.9	3.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
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) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz	TEST MODE	B1

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	*2445.00	117.7 PK			1.99 H	9	85.9	31.8
2	*2445.00	111.8 AV			1.99 H	9	80.0	31.8
3	4890.00	47.0 PK	74.0	-27.0	1.00 H	50	43.5	3.5
4	4890.00	37.7 AV	54.0	-16.3	1.00 H	50	34.2	3.5
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	*2445.00	109.2 PK			1.18 V	261	77.4	31.8
2	*2445.00	103.2 AV			1.18 V	261	71.4	31.8
3	4890.00	43.6 PK	74.0	-30.4	2.81 V	330	40.1	3.5
4	4890.00	30.3 AV	54.0	-23.7	2.81 V	330	26.8	3.5

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

CHANNEL	TX Channel 25	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz	TEST MODE	B1

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	117.7 PK			1.64 H	20	85.9	31.8
2	*2475.00	113.2 AV			1.64 H	20	81.4	31.8
3	2483.50	62.8 PK	74.0	-11.2	1.64 H	19	31.0	31.8
4	2483.50	52.4 AV	54.0	-1.6	1.64 H	19	20.6	31.8
5	4950.00	46.9 PK	74.0	-27.1	1.02 H	52	43.3	3.6
6	4950.00	37.9 AV	54.0	-16.1	1.02 H	52	34.3	3.6
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2475.00	109.0 PK			1.06 V	269	77.2	31.8
2	*2475.00	104.4 AV			1.06 V	269	72.6	31.8
3	2483.50	56.9 PK	74.0	-17.1	1.11 V	267	25.1	31.8
4	2483.50	46.0 AV	54.0	-8.0	1.11 V	267	14.2	31.8
5	4950.00	43.7 PK	74.0	-30.3	2.74 V	335	40.1	3.6
6	4950.00	30.7 AV	54.0	-23.3	2.74 V	335	27.1	3.6

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
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) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz	TEST MODE	B1

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	113.3 PK			1.60 H	10	81.5	31.8
2	*2480.00	108.5 AV			1.60 H	10	76.7	31.8
3	2483.50	58.6 PK	74.0	-15.4	1.56 H	8	26.8	31.8
4	2483.50	53.2 AV	54.0	-0.8	1.56 H	8	21.4	31.8
5	4960.00	45.7 PK	74.0	-28.3	1.66 H	12	41.9	3.8
6	4960.00	36.4 AV	54.0	-17.6	1.66 H	12	32.6	3.8
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	104.1 PK			1.04 V	266	72.3	31.8
2	*2480.00	99.3 AV			1.04 V	266	67.5	31.8
3	2483.50	51.2 PK	74.0	-22.8	1.00 V	272	19.4	31.8
4	2483.50	46.4 AV	54.0	-7.6	1.00 V	272	14.6	31.8
5	4960.00	45.0 PK	74.0	-29.0	1.74 V	185	41.2	3.8
6	4960.00	31.4 AV	54.0	-22.6	1.74 V	185	27.6	3.8

Remarks:

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

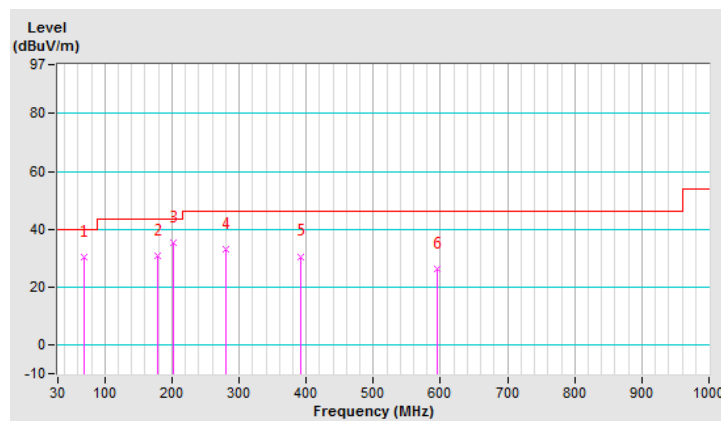
Below 1GHz worst-case data

CHANNEL	TX Channel 11	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz	TEST MODE	A1

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	69.77	30.2 QP	40.0	-9.8	1.00 H	223	41.8	-11.6
2	178.41	30.8 QP	43.5	-12.7	1.00 H	292	41.1	-10.3
3	202.66	35.5 QP	43.5	-8.0	1.00 H	158	47.0	-11.5
4	281.23	32.9 QP	46.0	-13.1	1.00 H	148	41.2	-8.3
5	390.84	30.6 QP	46.0	-15.4	1.00 H	48	37.0	-6.4
6	594.54	26.4 QP	46.0	-19.6	1.00 H	280	28.9	-2.5

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
– Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz.
4. Margin value = Emission Level – Limit value
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz.

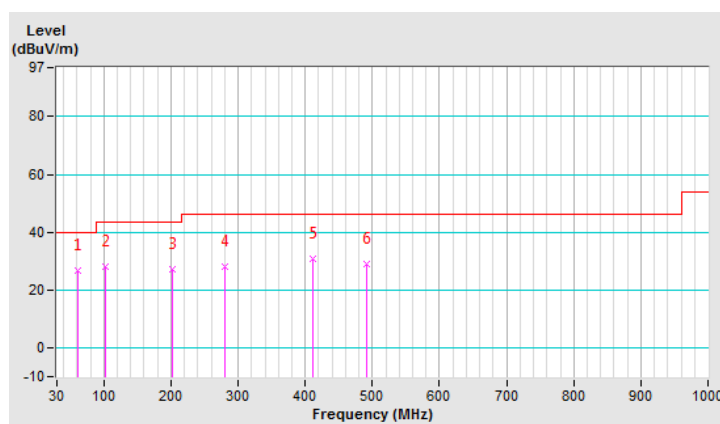


CHANNEL	TX Channel 11	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz	TEST MODE	A1

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	62.01	26.8 QP	40.0	-13.2	1.00 V	308	37.5	-10.7
2	101.78	28.1 QP	43.5	-15.4	1.00 V	236	41.5	-13.4
3	202.66	27.4 QP	43.5	-16.1	1.00 V	213	38.9	-11.5
4	280.26	28.2 QP	46.0	-17.8	1.00 V	179	36.5	-8.3
5	411.21	31.0 QP	46.0	-15.0	1.00 V	160	37.0	-6.0
6	491.72	29.0 QP	46.0	-17.0	1.00 V	188	33.7	-4.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
– Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz.
4. Margin value = Emission Level – Limit value
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz.

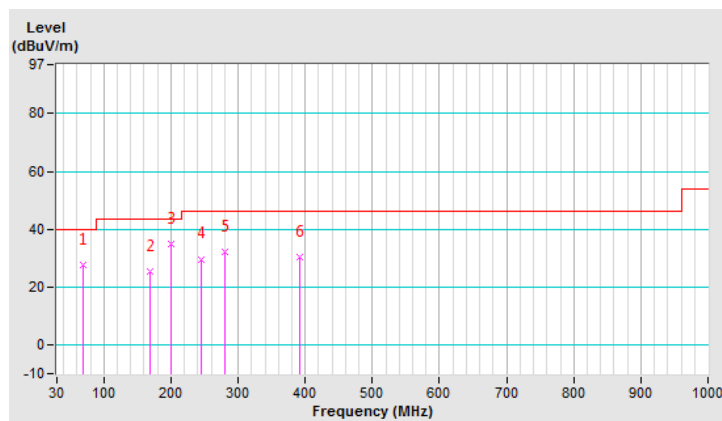


CHANNEL	TX Channel 11	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz	TEST MODE	A2

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	69.77	27.6 QP	40.0	-12.4	1.00 H	217	39.2	-11.6
2	168.71	25.2 QP	43.5	-18.3	1.00 H	295	34.6	-9.4
3	200.72	34.7 QP	43.5	-8.8	1.00 H	149	46.2	-11.5
4	245.34	29.7 QP	46.0	-16.3	1.00 H	118	39.5	-9.8
5	280.26	32.2 QP	46.0	-13.8	1.00 H	153	40.5	-8.3
6	391.81	30.5 QP	46.0	-15.5	1.00 H	44	36.9	-6.4

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
– Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz.
4. Margin value = Emission Level – Limit value
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz.

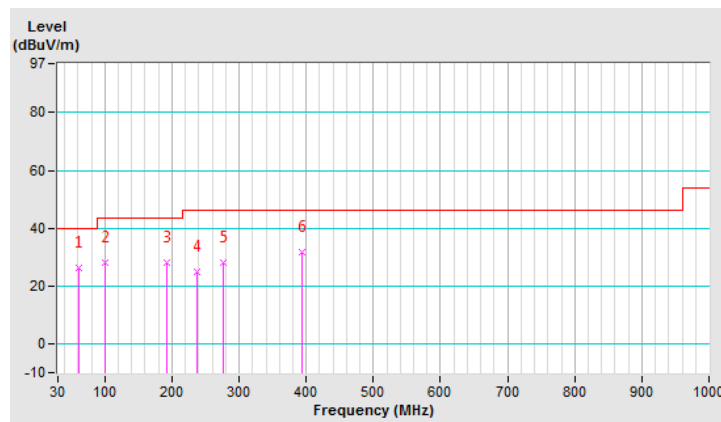


CHANNEL	TX Channel 11	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz	TEST MODE	A2

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	62.01	26.4 QP	40.0	-13.6	1.00 V	331	37.1	-10.7
2	100.81	28.0 QP	43.5	-15.5	1.00 V	239	41.5	-13.5
3	191.99	27.9 QP	43.5	-15.6	1.00 V	195	39.4	-11.5
4	236.61	25.0 QP	46.0	-21.0	1.00 V	184	35.3	-10.3
5	277.35	28.0 QP	46.0	-18.0	1.00 V	174	36.5	-8.5
6	393.75	31.8 QP	46.0	-14.2	1.00 V	151	38.2	-6.4

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
– Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz.
4. Margin value = Emission Level – Limit value
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz.

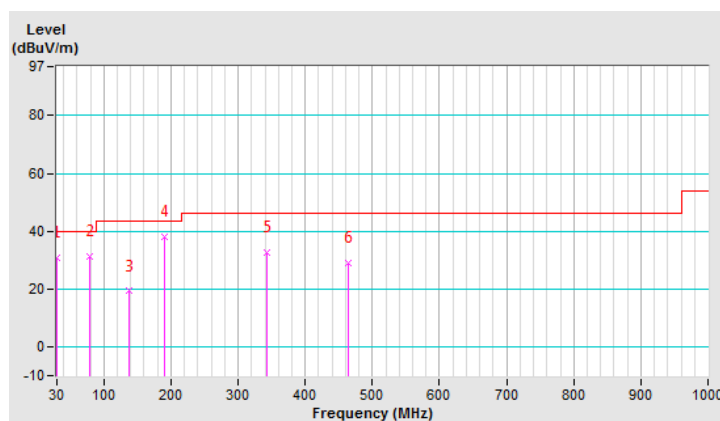


CHANNEL	TX Channel 11	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz	TEST MODE	B1

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	30.97	31.0 QP	40.0	-9.0	1.00 H	226	42.4	-11.4
2	78.50	31.3 QP	40.0	-8.7	1.00 H	208	45.0	-13.7
3	136.70	19.2 QP	43.5	-24.3	1.00 H	114	29.4	-10.2
4	191.02	38.1 QP	43.5	-5.4	1.00 H	124	49.5	-11.4
5	342.34	32.8 QP	46.0	-13.2	1.00 H	311	40.1	-7.3
6	463.59	29.2 QP	46.0	-16.8	1.00 H	317	34.3	-5.1

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
– Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz.
4. Margin value = Emission Level – Limit value
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz.

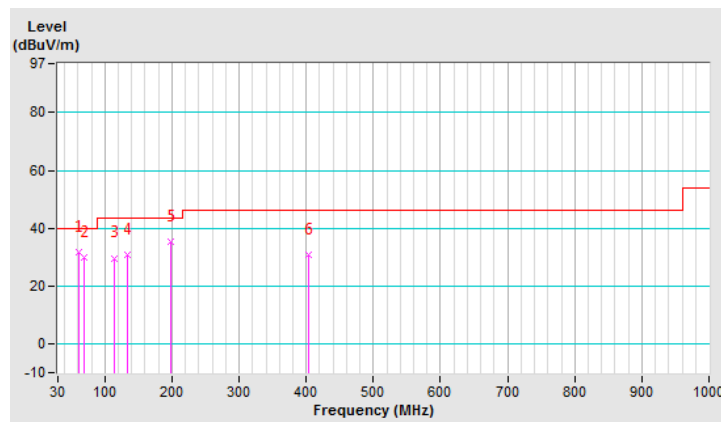


CHANNEL	TX Channel 11	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz	TEST MODE	B1

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	62.01	31.7 QP	40.0	-8.3	1.00 V	239	42.4	-10.7
2	69.77	30.1 QP	40.0	-9.9	1.00 V	353	41.7	-11.6
3	114.39	29.7 QP	43.5	-13.8	1.00 V	125	41.8	-12.1
4	133.79	30.8 QP	43.5	-12.7	1.00 V	133	41.2	-10.4
5	197.81	35.5 QP	43.5	-8.0	1.00 V	201	47.0	-11.5
6	404.42	30.6 QP	46.0	-15.4	1.00 V	220	36.8	-6.2

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 of frequency range 30MHz ~ 1000MHz.
4. Margin value = Emission Level – Limit value
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz.

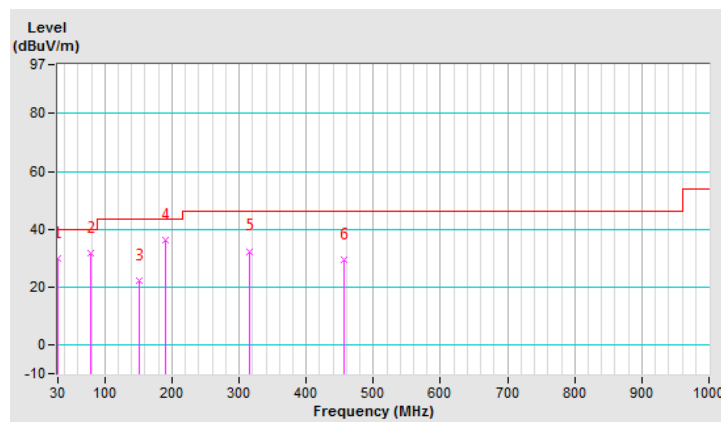


CHANNEL	TX Channel 11	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz	TEST MODE	B2

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	30.97	29.8 QP	40.0	-10.2	1.00 H	59	41.2	-11.4
2	78.50	31.9 QP	40.0	-8.1	1.00 H	204	45.6	-13.7
3	152.22	22.3 QP	43.5	-21.2	1.00 H	112	31.7	-9.4
4	190.05	36.4 QP	43.5	-7.1	1.00 H	286	47.8	-11.4
5	316.15	32.4 QP	46.0	-13.6	1.00 H	166	39.8	-7.4
6	455.83	29.5 QP	46.0	-16.5	1.00 H	316	34.7	-5.2

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 of frequency range 30MHz ~ 1000MHz.
4. Margin value = Emission Level – Limit value
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz.

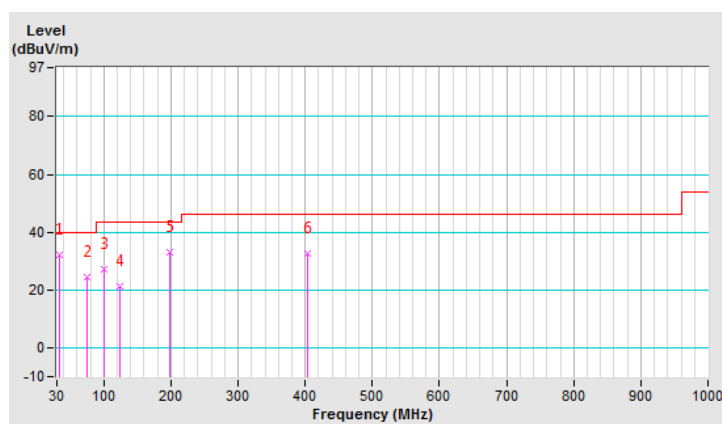


CHANNEL	TX Channel 11	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz	TEST MODE	B2

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	34.85	32.3 QP	40.0	-7.7	1.00 V	195	43.1	-10.8
2	74.62	24.6 QP	40.0	-15.4	1.00 V	312	37.3	-12.7
3	99.84	27.1 QP	43.5	-16.4	1.00 V	229	40.8	-13.7
4	124.09	21.3 QP	43.5	-22.2	1.00 V	150	32.7	-11.4
5	197.81	33.2 QP	43.5	-10.3	1.00 V	192	44.7	-11.5
6	404.42	32.8 QP	46.0	-13.2	1.00 V	213	39.0	-6.2

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 of frequency range 30MHz ~ 1000MHz.
4. Margin value = Emission Level – Limit value
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz.



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
Test Receiver ROHDE & SCHWARZ	ESR3	102412	Feb. 14, 2019	Feb. 13, 2020
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond2-01	Sep. 05, 2018	Sep. 04, 2019
LISN ROHDE & SCHWARZ (EUT)	ESH2-Z5	100100	Jan. 30, 2019	Jan. 29, 2020
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100312	Aug. 13, 2018	Aug. 12, 2019
Software ADT	BV ADT_Cond_ V7.3.7.4	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 HwaYa Shielded Room 2.

3. The VCCI Site Registration No. is C-12047.

4. Test date: Apr. 17, 2019

4.2.3 Test Procedures

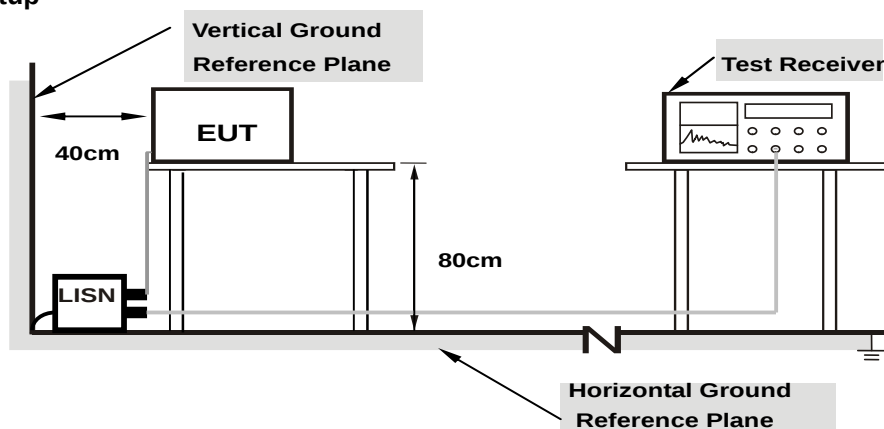
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

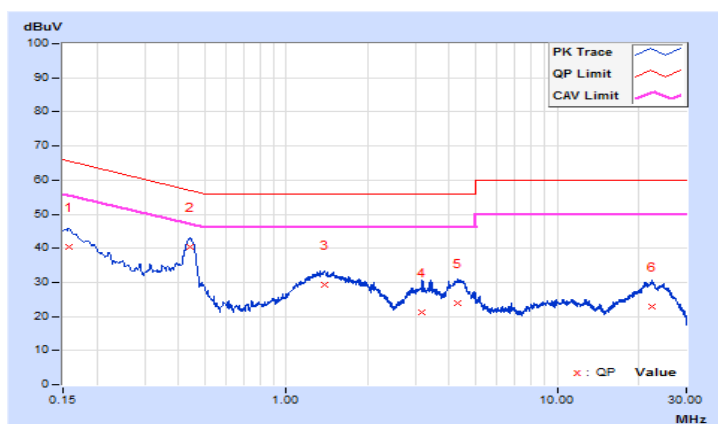
4.2.7 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	A1		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15715	10.20	30.27	16.33	40.47	26.53	65.61	55.61	-25.14	-29.08
2	0.43891	10.28	29.99	22.55	40.27	32.83	57.08	47.08	-16.81	-14.25
3	1.38975	10.32	18.83	12.51	29.15	22.83	56.00	46.00	-26.85	-23.17
4	3.18075	10.38	10.94	4.55	21.32	14.93	56.00	46.00	-34.68	-31.07
5	4.29900	10.42	13.64	5.82	24.06	16.24	56.00	46.00	-31.94	-29.76
6	22.50150	10.78	12.22	7.59	23.00	18.37	60.00	50.00	-37.00	-31.63

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.

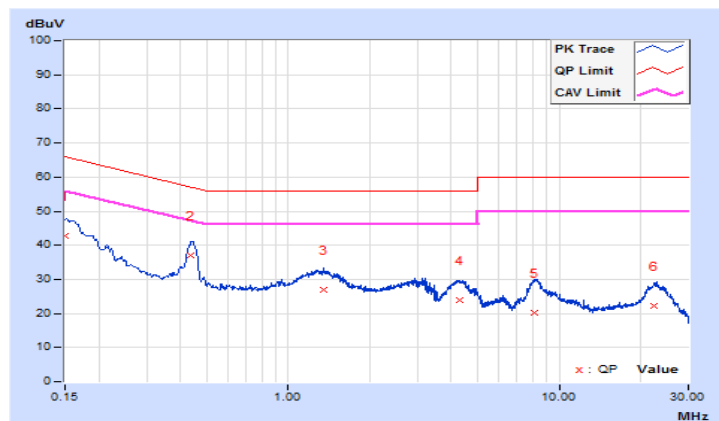


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	A1		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.19	32.63	17.62	42.82	27.81	66.00	56.00	-23.18	-28.19
2	0.43775	10.25	26.95	19.34	37.20	29.59	57.10	47.10	-19.90	-17.51
3	1.35165	10.30	16.73	9.54	27.03	19.84	56.00	46.00	-28.97	-26.16
4	4.28775	10.42	13.46	5.46	23.88	15.88	56.00	46.00	-32.12	-30.12
5	8.13966	10.55	9.81	4.03	20.36	14.58	60.00	50.00	-39.64	-35.42
6	22.44525	10.87	11.22	6.95	22.09	17.82	60.00	50.00	-37.91	-32.18

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.

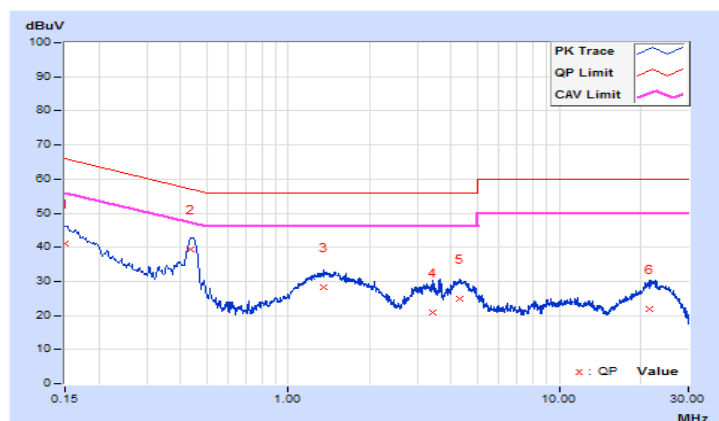


Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	A2		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.19	30.88	15.16	41.07	25.35	66.00	56.00	-24.93	-30.65
2	0.43545	10.28	29.10	21.87	39.38	32.15	57.15	47.15	-17.77	-15.00
3	1.34808	10.32	18.13	11.44	28.45	21.76	56.00	46.00	-27.55	-24.24
4	3.39450	10.39	10.40	3.45	20.79	13.84	56.00	46.00	-35.21	-32.16
5	4.31025	10.42	14.45	5.76	24.87	16.18	56.00	46.00	-31.13	-29.82
6	21.49575	10.80	10.99	5.56	21.79	16.36	60.00	50.00	-38.21	-33.64

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.

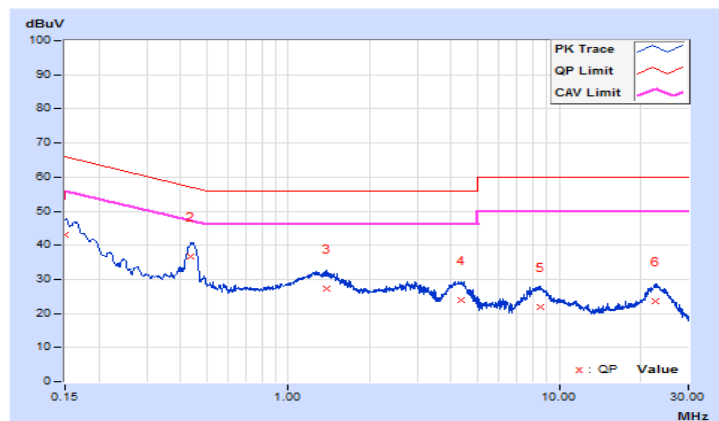


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	A2		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.19	32.93	17.79	43.12	27.98	66.00	56.00	-22.88	-28.02
2	0.43575	10.25	26.58	18.94	36.83	29.19	57.14	47.14	-20.31	-17.95
3	1.38075	10.30	17.06	10.45	27.36	20.75	56.00	46.00	-28.64	-25.25
4	4.36650	10.42	13.51	5.58	23.93	16.00	56.00	46.00	-32.07	-30.00
5	8.50875	10.57	11.35	5.25	21.92	15.82	60.00	50.00	-38.08	-34.18
6	22.80300	10.86	12.74	8.69	23.60	19.55	60.00	50.00	-36.40	-30.45

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.

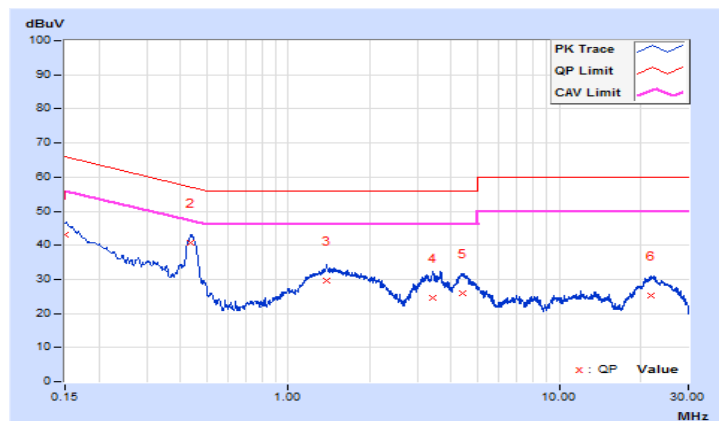


Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	B1		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.19	32.89	14.66	43.08	24.85	66.00	56.00	-22.92	-31.15
2	0.43660	10.28	30.60	23.08	40.88	33.36	57.13	47.13	-16.25	-13.77
3	1.38525	10.32	19.31	13.67	29.63	23.99	56.00	46.00	-26.37	-22.01
4	3.42369	10.39	14.31	6.78	24.70	17.17	56.00	46.00	-31.30	-28.83
5	4.38225	10.42	15.51	5.72	25.93	16.14	56.00	46.00	-30.07	-29.86
6	21.85800	10.79	14.41	10.22	25.20	21.01	60.00	50.00	-34.80	-28.99

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.

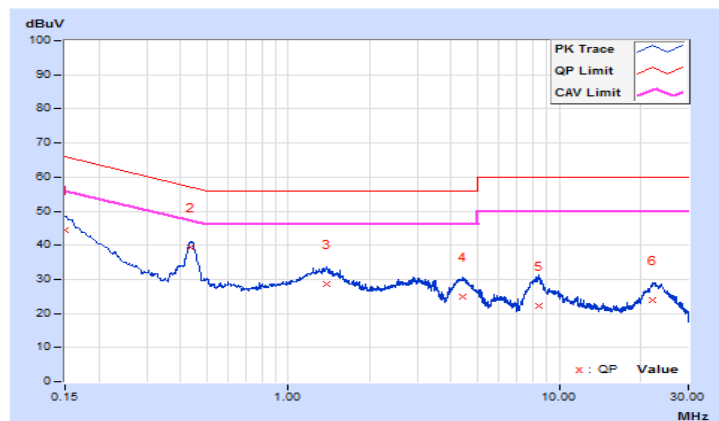


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	B1		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.19	34.09	17.61	44.28	27.80	66.00	56.00	-21.72	-28.20
2	0.43775	10.25	29.22	21.37	39.47	31.62	57.10	47.10	-17.63	-15.48
3	1.37850	10.30	18.34	11.07	28.64	21.37	56.00	46.00	-27.36	-24.63
4	4.38225	10.42	14.36	6.58	24.78	17.00	56.00	46.00	-31.22	-29.00
5	8.46375	10.57	11.73	5.62	22.30	16.19	60.00	50.00	-37.70	-33.81
6	22.18200	10.88	12.96	9.07	23.84	19.95	60.00	50.00	-36.16	-30.05

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.

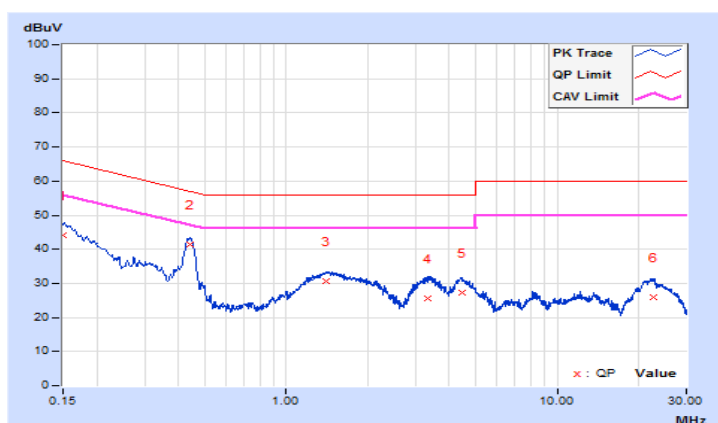


Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	B2		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.19	33.75	15.02	43.94	25.21	66.00	56.00	-22.06	-30.79
2	0.44123	10.28	31.01	23.62	41.29	33.90	57.04	47.04	-15.75	-13.14
3	1.39516	10.32	20.24	12.94	30.56	23.26	56.00	46.00	-25.44	-22.74
4	3.33150	10.38	15.07	8.74	25.45	19.12	56.00	46.00	-30.55	-26.88
5	4.45425	10.42	16.83	6.51	27.25	16.93	56.00	46.00	-28.75	-29.07
6	22.67025	10.77	15.32	11.21	26.09	21.98	60.00	50.00	-33.91	-28.02

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.

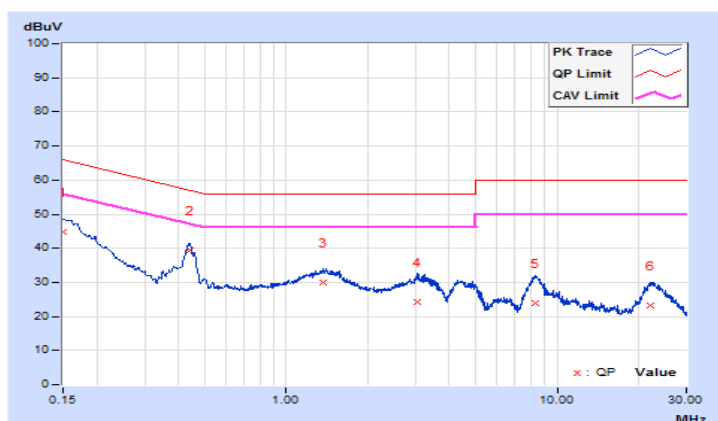


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	B2		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.19	34.61	17.64	44.80	27.83	66.00	56.00	-21.20	-28.17
2	0.43891	10.25	28.98	20.69	39.23	30.94	57.08	47.08	-17.85	-16.14
3	1.36240	10.30	19.55	14.24	29.85	24.54	56.00	46.00	-26.15	-21.46
4	3.05700	10.37	13.82	7.04	24.19	17.41	56.00	46.00	-31.81	-28.59
5	8.33325	10.56	13.28	6.99	23.84	17.55	60.00	50.00	-36.16	-32.45
6	22.10550	10.88	12.48	8.43	23.36	19.31	60.00	50.00	-36.64	-30.69

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.

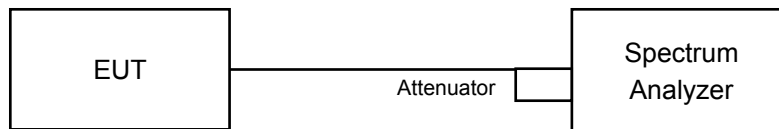


4.3 6dB Bandwidth Measurement

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.

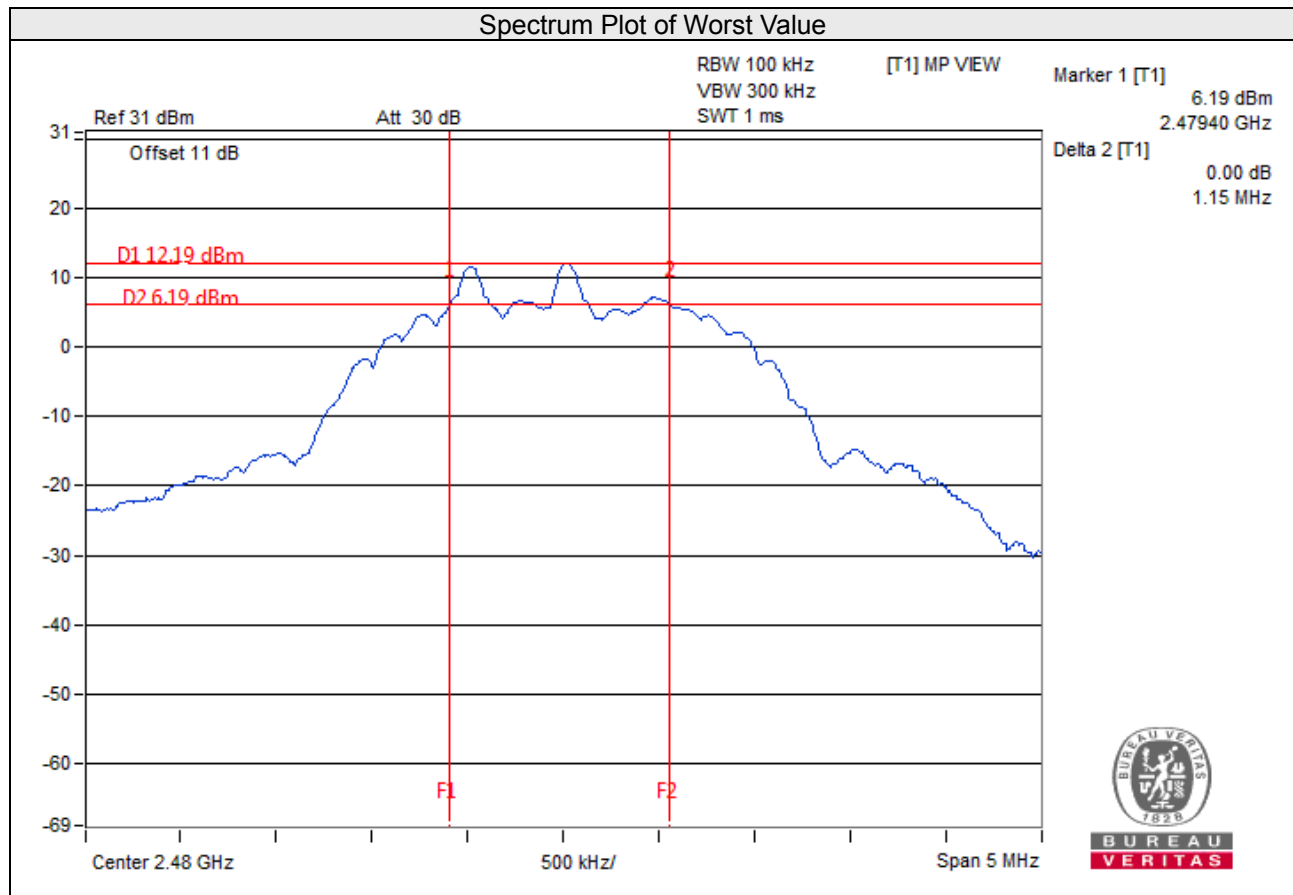
4.3.6 EUT Operating Conditions

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

4.3.7 Test Result

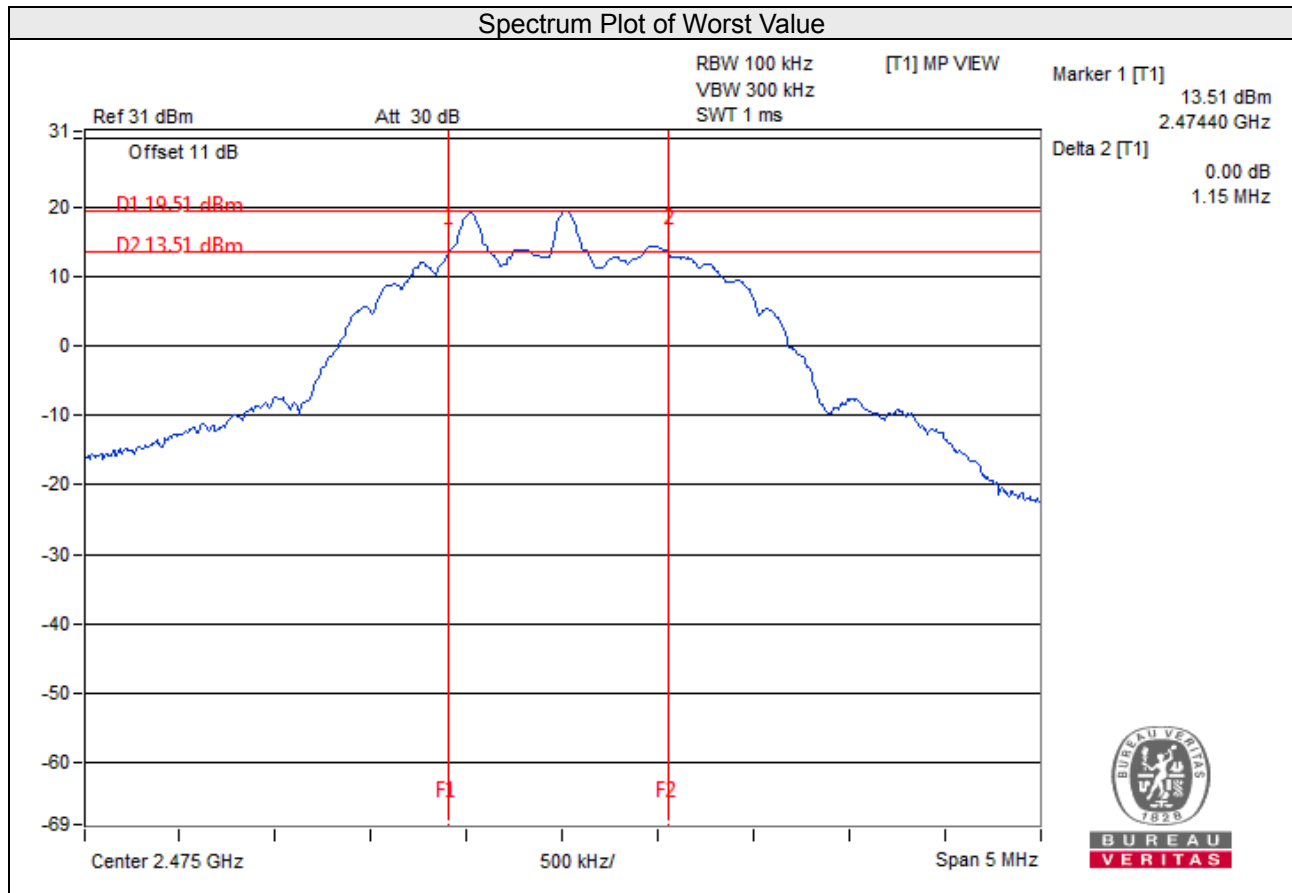
Mode A1

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
11	2405	1.16	0.5	Pass
19	2445	1.16	0.5	Pass
25	2475	1.16	0.5	Pass
26	2480	1.15	0.5	Pass



Mode B1

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
11	2405	1.16	0.5	Pass
19	2445	1.17	0.5	Pass
25	2475	1.15	0.5	Pass
26	2480	1.16	0.5	Pass

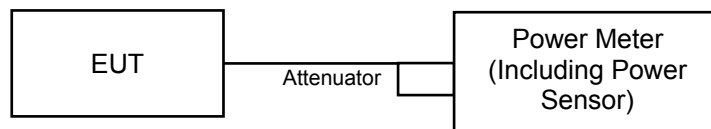


4.4 Conducted Output Power Measurement

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

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

Mode A1

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)	Limit (dBm)	Pass/Fail
11	2405	104.232	20.18	30	Pass
19	2445	103.992	20.17	30	Pass
25	2475	103.753	20.16	30	Pass
26	2480	16.406	12.15	30	Pass

Mode A2

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)	Limit (dBm)	Pass/Fail
11	2405	11.967	10.78	30	Pass
19	2445	12.106	10.83	30	Pass
25	2475	12.274	10.89	30	Pass
26	2480	11.83	10.73	30	Pass

Mode B1

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)	Limit (dBm)	Pass/Fail
11	2405	102.094	20.09	30	Pass
19	2445	102.094	20.09	30	Pass
25	2475	100.231	20.01	30	Pass
26	2480	12.560	10.99	30	Pass

Mode B2

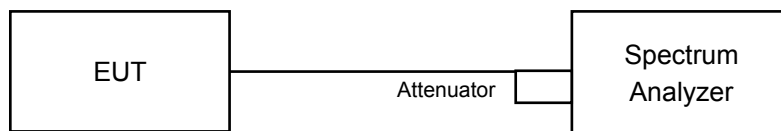
Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)	Limit (dBm)	Pass/Fail
11	2405	10.715	10.30	30	Pass
19	2445	10.765	10.32	30	Pass
25	2475	11.722	10.69	30	Pass
26	2480	11.535	10.62	30	Pass

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.

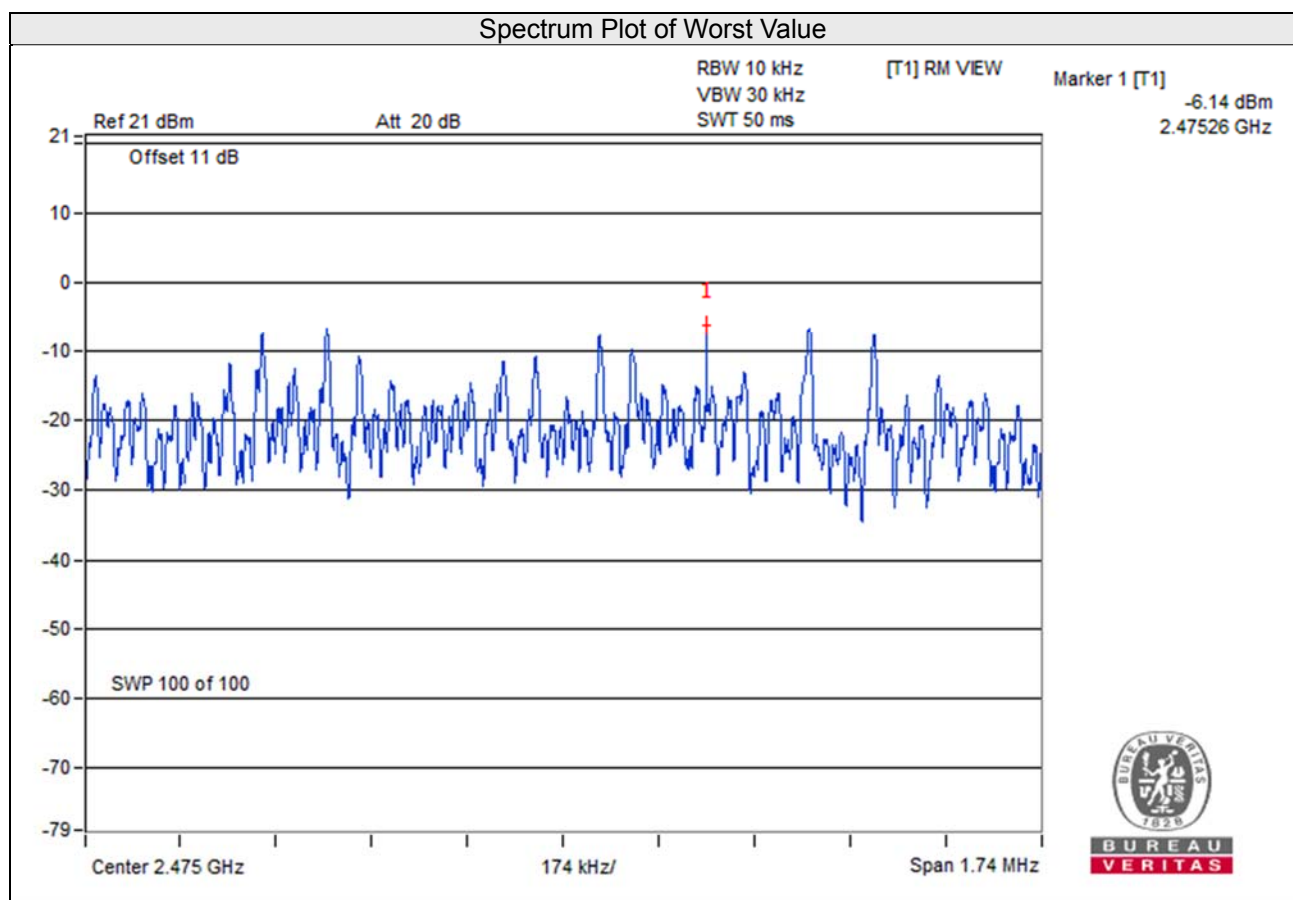
4.5.6 EUT Operating Condition

Same as Item 4.3.6

4.5.7 Test Results

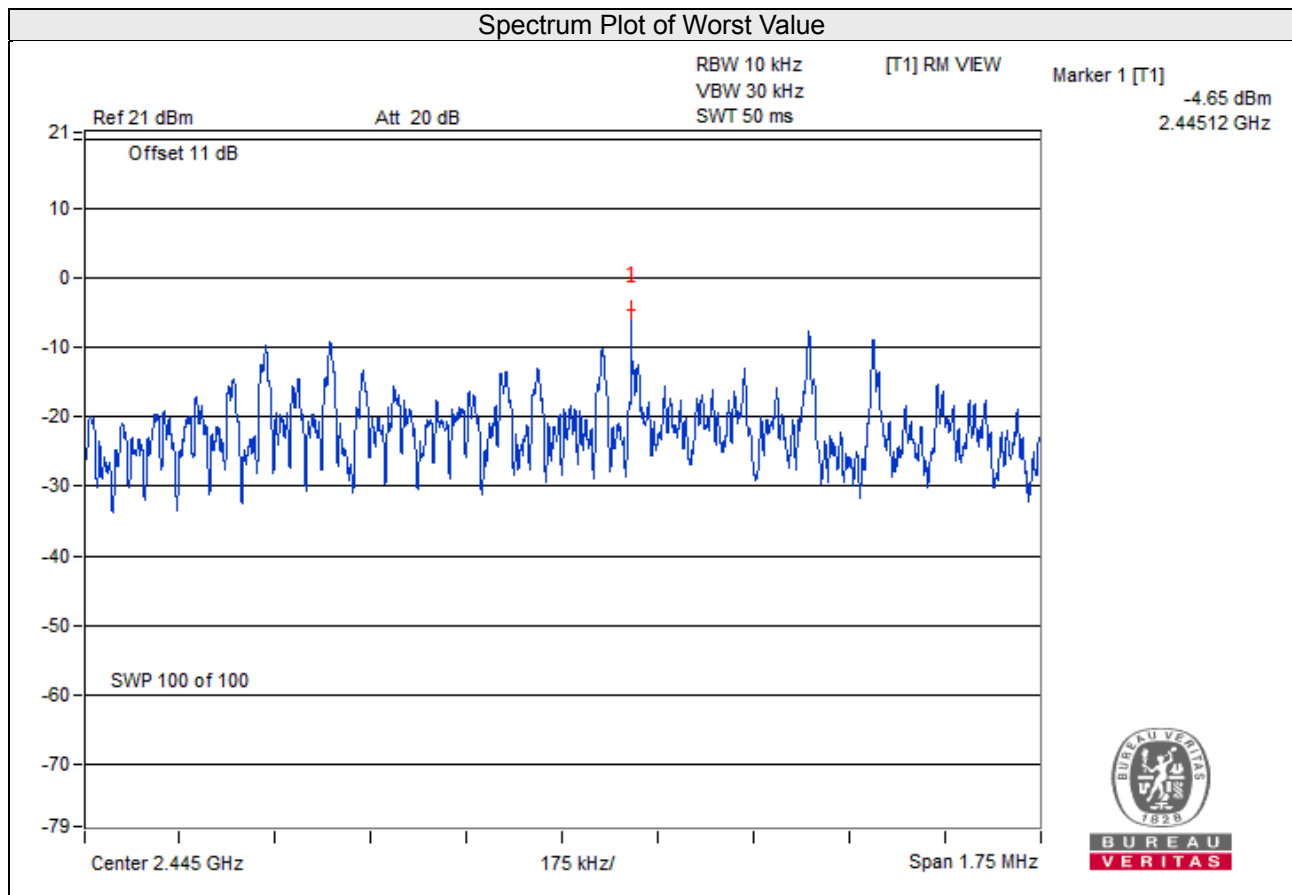
Mode A1

Channel	Frequency (MHz)	PSD w/o Duty Factor (dBm/10kHz)	Duty Factor (dB)	Total PSD With Duty Factor (dBm/10kHz)	Limit (dBm/3kHz)	Pass / Fail
11	2405	-6.60	1.81	-4.79	8.00	Pass
19	2445	-6.51	1.81	-4.70	8.00	Pass
25	2475	-6.14	1.81	-4.33	8.00	Pass
26	2480	-14.90	1.81	-13.09	8.00	Pass



Mode B1

Channel	Frequency (MHz)	PSD w/o Duty Factor (dBm/10kHz)	Duty Factor (dB)	Total PSD With Duty Factor (dBm/10kHz)	Limit (dBm/3kHz)	Pass / Fail
11	2405	-6.06	1.79	-4.27	8.00	Pass
19	2445	-4.65	1.79	-2.86	8.00	Pass
25	2475	-6.83	1.79	-5.04	8.00	Pass
26	2480	-13.64	1.79	-11.85	8.00	Pass

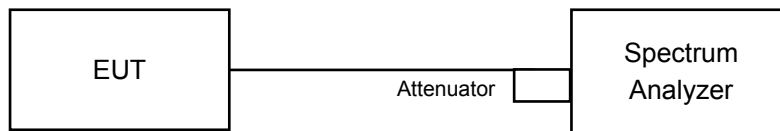


4.6 Conducted Out of Band Emission Measurement

4.6.1 Limits of Conducted Out of Band Emission Measurement

Below -30dB 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

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

MEASUREMENT PROCEDURE OOB

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

4.6.5 Deviation from Test Standard

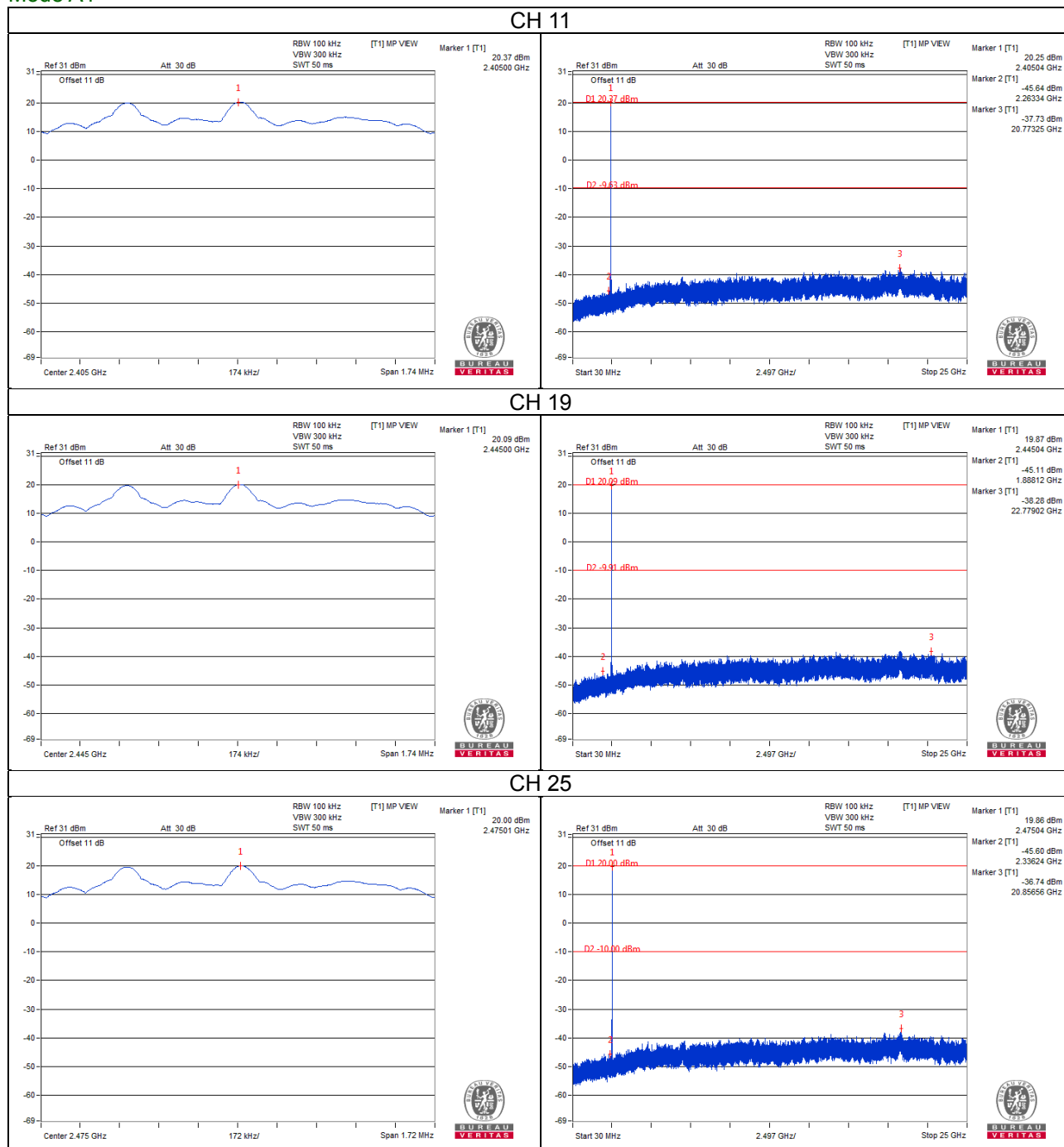
No deviation.

4.6.6 EUT Operating Condition

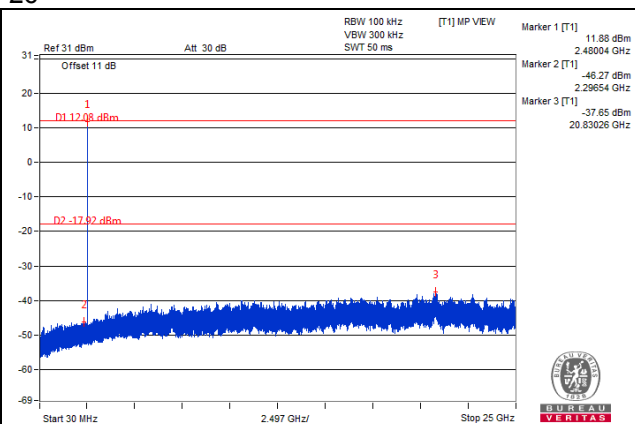
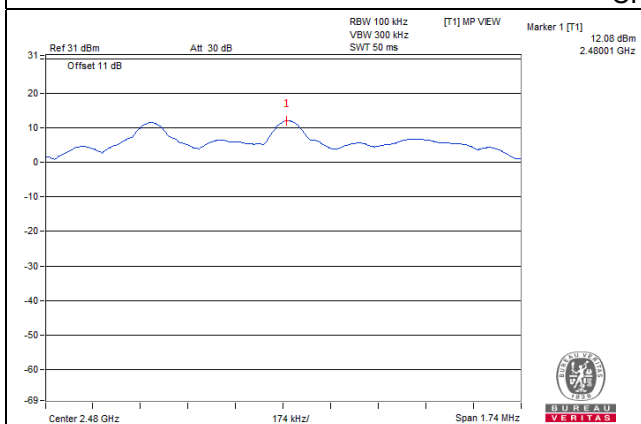
Same as Item 4.3.6

4.6.7 Test Results

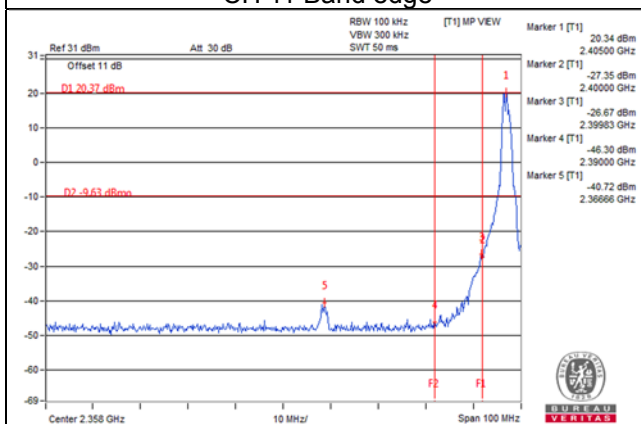
Mode A1



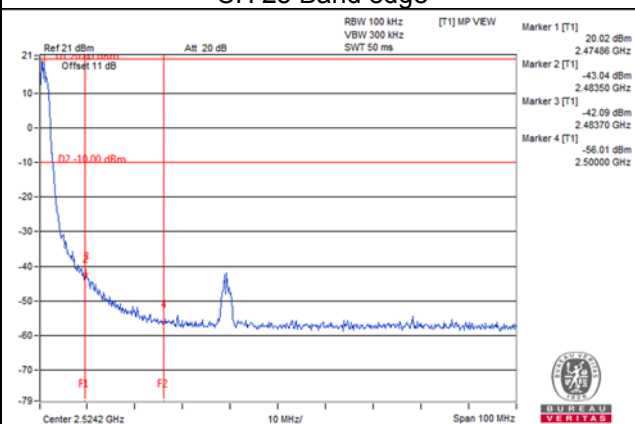
CH 26



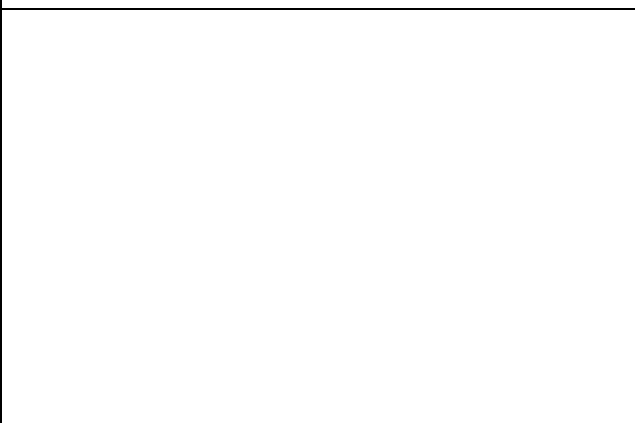
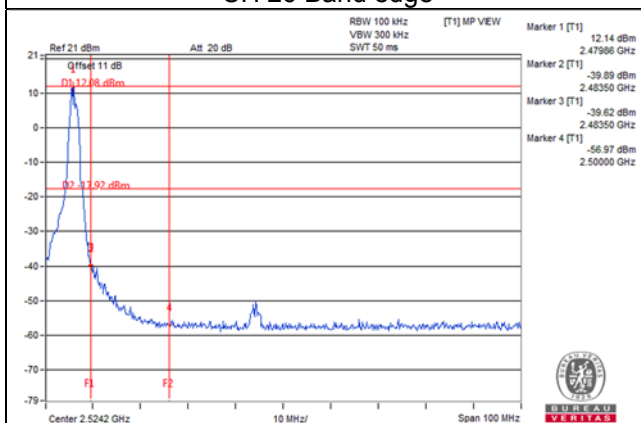
CH 11 Band edge



CH 25 Band edge

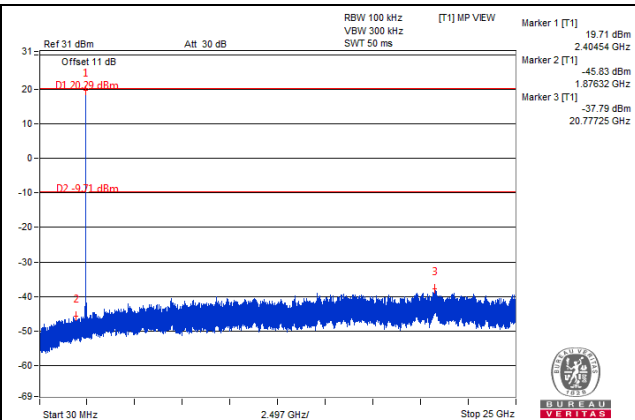
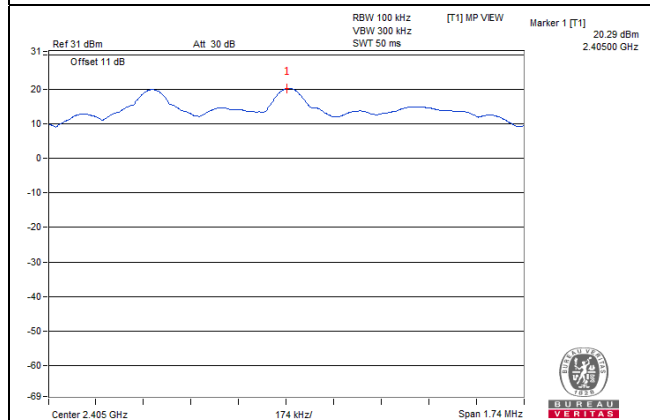


CH 26 Band edge

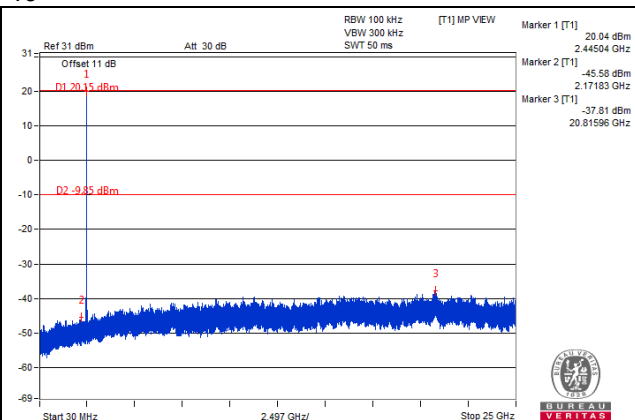
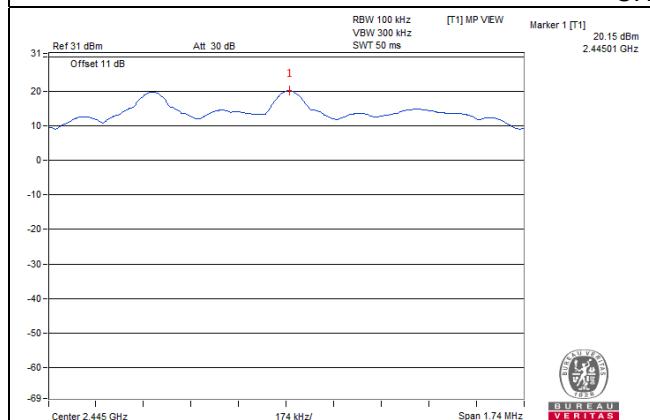


Mode B1

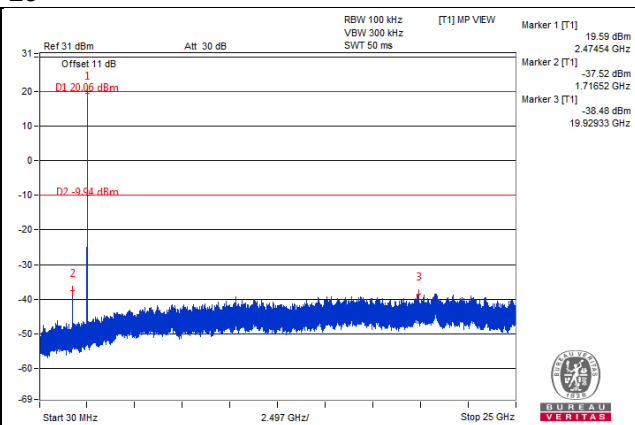
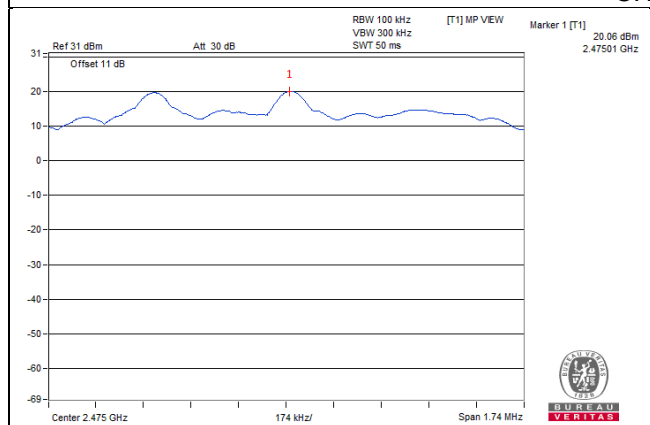
CH 11



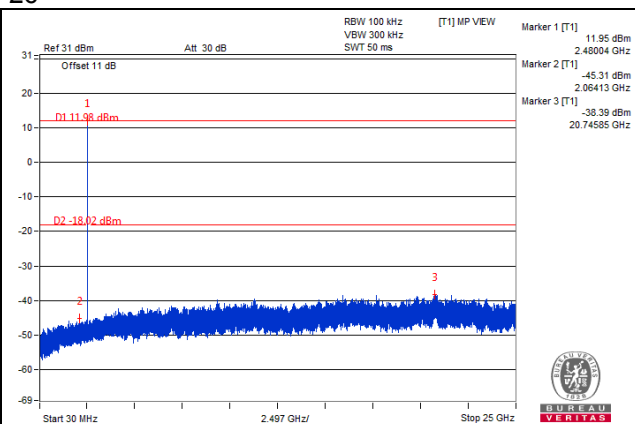
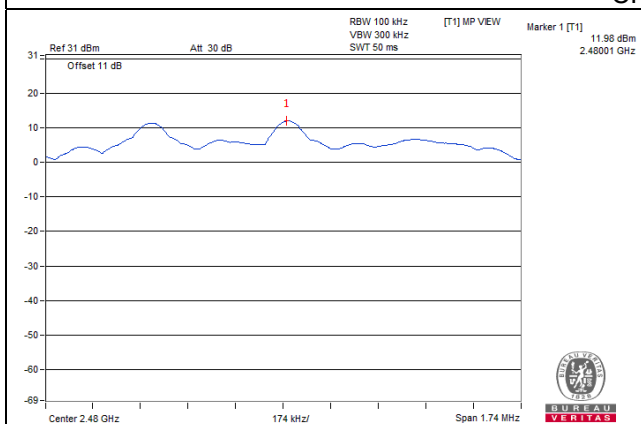
CH 19



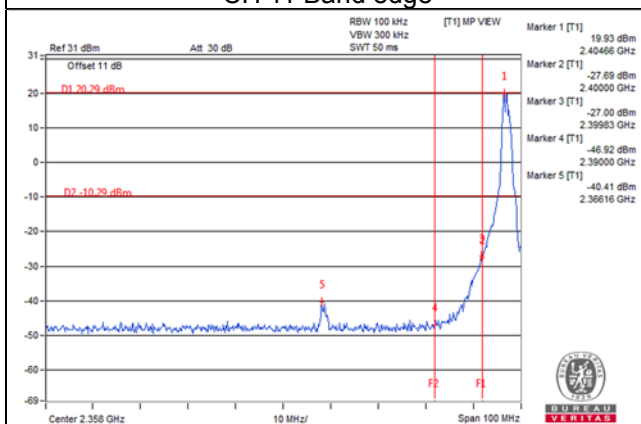
CH 25



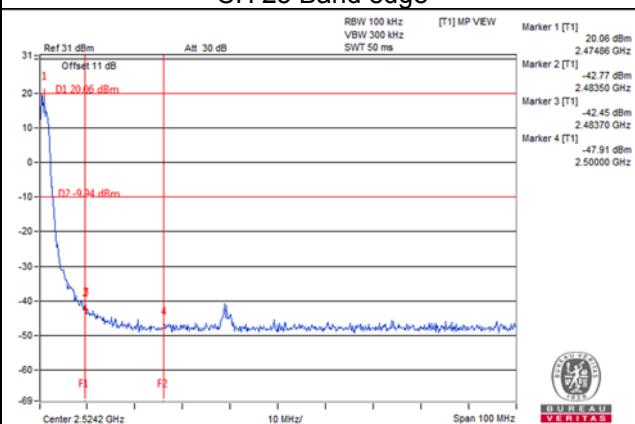
CH 26



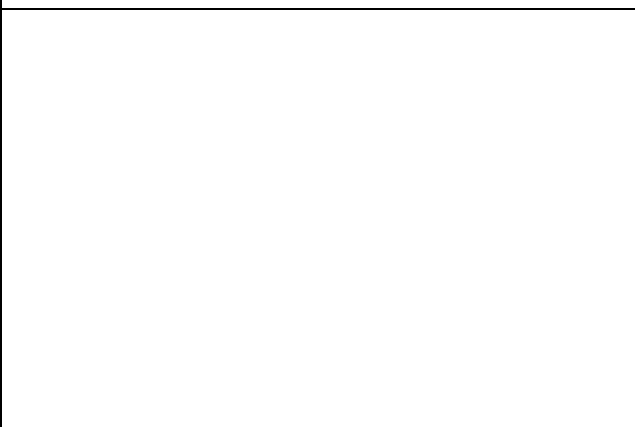
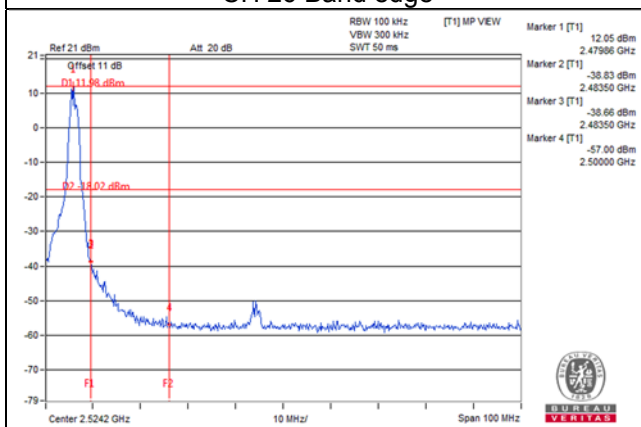
CH 11 Band edge



CH 25 Band edge



CH 26 Band edge



5 Pictures of Test Arrangements

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

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 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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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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