

FCC & IC TEST REPORT for Intentional Radiator No. 160402733SHA-001

Applicant : OSIM International Ltd
65 Ubi Avenue 1, OSIM Headquarters, Singapore 408939
Manufacturer : DT-OSIM Healthcare Appliances (Suzhou) Co., Ltd.
China-Singapore Suzhou Industrial Park,
No. 69 Longpu Road, Xinglong Street, Suzhou, China
Product Name : BT Module for Data Transfer
Type/Model : OS-868

SUMMARY

The equipment complies with the requirements according to the following standard(s):

47CFR Part 15 (2015): Radio Frequency Devices

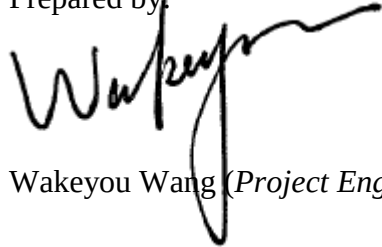
RSS-247 (Issue 1, 2015): Digital Transmission Systems (DTs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

RSS-Gen Issue 4 (November 2014): General Requirements and Information for the Certification of Radiocommunication Equipment

ANSI C63.10 (2013): American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

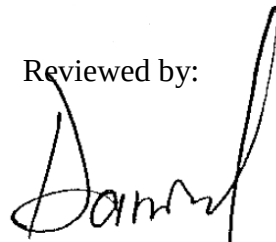
Date of issue: July 25, 2016

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1. Test Summary

This report applies to tested sample only. This report shall not be reproduced in part without written approval of Intertek Testing Service Shanghai Limited.

Test Items	FCC Reference	IC Reference	Result
Minimum 6dB Bandwidth & Occupied Bandwidth	15.247(a)(2)	RSS-247 Issue 1 Clause 5 RSS-Gen Issue 4 Clause 6.6	Pass
Output power	15.247(b)	RSS-247 Issue 1 Clause 5	Pass
Power spectrum density	15.247(e)	RSS-247 Issue 1 Clause 5	Pass
Emissions in non-restricted frequency bands	15.247(d)	RSS-247 Issue 1 Clause 5	Pass
Emissions in restricted frequency bands	15.205 & 15.209	RSS-247 Issue 1 Clause 5	Pass
Power line conducted emission	15.207	RSS-Gen Issue 4 Clause 8.8	Pass

2. General Information

2.1 Applicant Information

Applicant : OSIM International Ltd
65 Ubi Avenue 1, OSIM Headquarters, Singapore 408939
Name of contact : Kenneth Lin
Tel : +65 6318 -2704
Fax : +65 6846-8115
Manufacturer : DT-OSIM Healthcare Appliances (Suzhou) Co., Ltd.
China-Singapore Suzhou Industrial Park,
No. 69 Longpu Road, Xinglong Street, Suzhou, China

2.2 Identification of the EUT and Technical specification

Equipment : BT Module for Data Transfer
Type/model : OS-868
FCC ID : ARG-OS-868
IC : 10142A-OS868
Operation Frequency : 2402-2480MHz
EUT Modes of : BT4.0 LE
Modulation
Type of Modulation : GFSK
Transfer Rate : 1Mbps
Power Class : Class II
Channel Number : 40 (0-39)
Antenna : 0dBi PCB antenna
Description of EUT : There is one model only. The EUT is tested together with the
host device massage chair.
Rating : DC 3.3V powered by the massage chair indirectly (220-240V
input for massage chair OS-868)
Category of EUT : Class B
EUT type : ☐ Table top ☒ Floor standing
Sample received date : 2015.05.02
Sample Identification : /
No
Date of test : 2015.05.02 ~ 2016.5.20

2.3 Channel List

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

2.4 Test software and Power Setting

The test setting software is offered by the manufactory. The pre-scan for the conducted power with all rates in each modulation and bands was used, and the worst case was found and used in all test cases.

Test software and Power Setting parameter			
Test Software	Direct Test Mode Win Form		
Working Mode	BLE		
Test Channel	2402MHz	2442MHz	2480MHz
Power Setting	Default setting	Default setting	Default setting

3. Test Specification

3.1 Instrument list

Equipment	Type	Manu.	Internal no.	Cal. Date	Due date
Shielded room	-	Zhongyu	EC 2838	1/9/2016	1/8/2017
Test Receiver	ESCS 30	R&S	EC 2107	10/20/2015	10/19/2016
A.M.N.	ESH2-Z5	R&S	EC 3119	12/17/2015	12/16/2016
A.M.N.	ENV 216	R&S	EC 3394	8/2/2016	8/1/2016
A.M.N.	ENV4200	R&S	EC3558	8/2/2015	8/1/2016
Bilog Antenna	CBL 6112D	TESEQ	EC 4206	4/28/2016	4/27/2017
Horn antenna	HF 906	R&S	EC 3049	4/28/2016	4/27/2017
Horn antenna	3117	ETS	EC 4792-1	4/22/2016	4/21/2017
Horn antenna	HAP18-26W	TOYO	EC 4792-3	6/12/2015	6/11/2016
Pre-amplifier	Pre-amp 18	R&S	EC 5262	5/26/2015	5/25/2016
Pre-amplifier	Tpa0118-40	TOYO	EC 4792-2	4/12/2016	4/11/2017
Fully-anechoic chamber	-	Albatross project	EC 3047	5/12/2016	5/11/2017
Signal generator	SMR 20	R&S	EC 3044-1	8/18/2015	8/17/2016
Power amplifier	150W1000	AR	EC 3044-2	8/15/2015	8/14/2016
Power amplifier	25S1G4	AR	EC 3044-4	8/15/2015	8/14/2016
Power sensor / Power meter	N1911A/N1921A	Agilent	EC4318	4/9/2016	4/8/2017
PXA Signal Analyzer	N9030A	Agilent	EC5338	5/15/2016	5/14/2017
Power sensor	U2021XA	Agilent	EC5338-1	3/6/2016	3/5/2017
Vector Signal Generator	N5182B	Agilent	EC5175	1/9/2016	1/8/2017
MXG Analog Signal Generator	N5181A	Agilent	EC5338-2	3/6/2016	3/5/2017
Mobile Test System	Iqxel	Litepoint	EC 5176	1/9/2016	1/8/2017
Spectrum analyzer	E7402A	Agilent	EC2254	8/15/2015	8/14/2016

3.2 Test Standard

47CFR Part 15 (2015)

RSS-247 (Issue 1, 2015)

RSS-Gen Issue 4 (November 2014)

ANSI C63.10 (2013)

3.3 Mode of operation during the test / Test peripherals used

While testing transmitting mode of EUT, the internal modulation and continuously transmission was applied. The EUT is tested together with the host (massage chair OS-868).

Test peripherals used:

Item No	Description	Band and Model	S/No
1	Laptop computer	HP ProBook 6470b	NA
2	RS-232 cable	1.8m Unshielded	NA
Note: The accessories are used for configuration only and not used during test.			

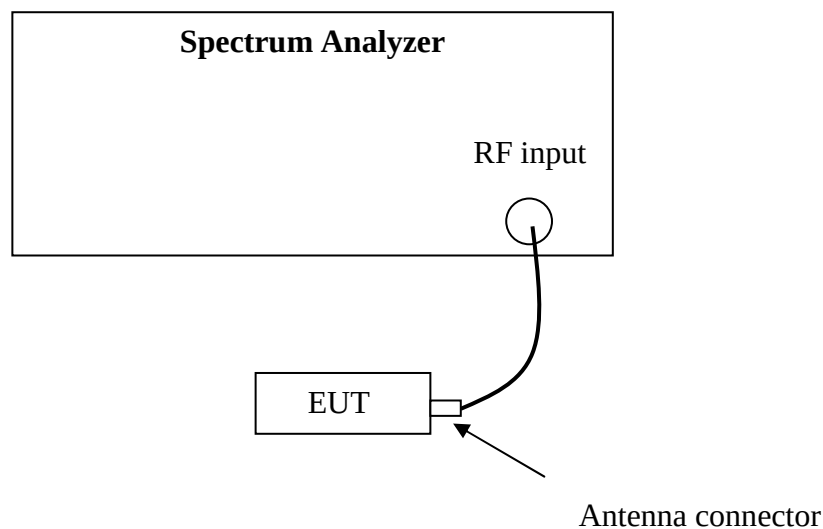
4. Minimum 6dB Bandwidth

Test result: PASS

4.1 Limit

For systems using digital modulation techniques that may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz bands, the minimum 6 dB bandwidth shall be at least 500 kHz.

4.2 Test Configuration



4.3 Test Procedure and test setup

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

4.4 Test Protocol

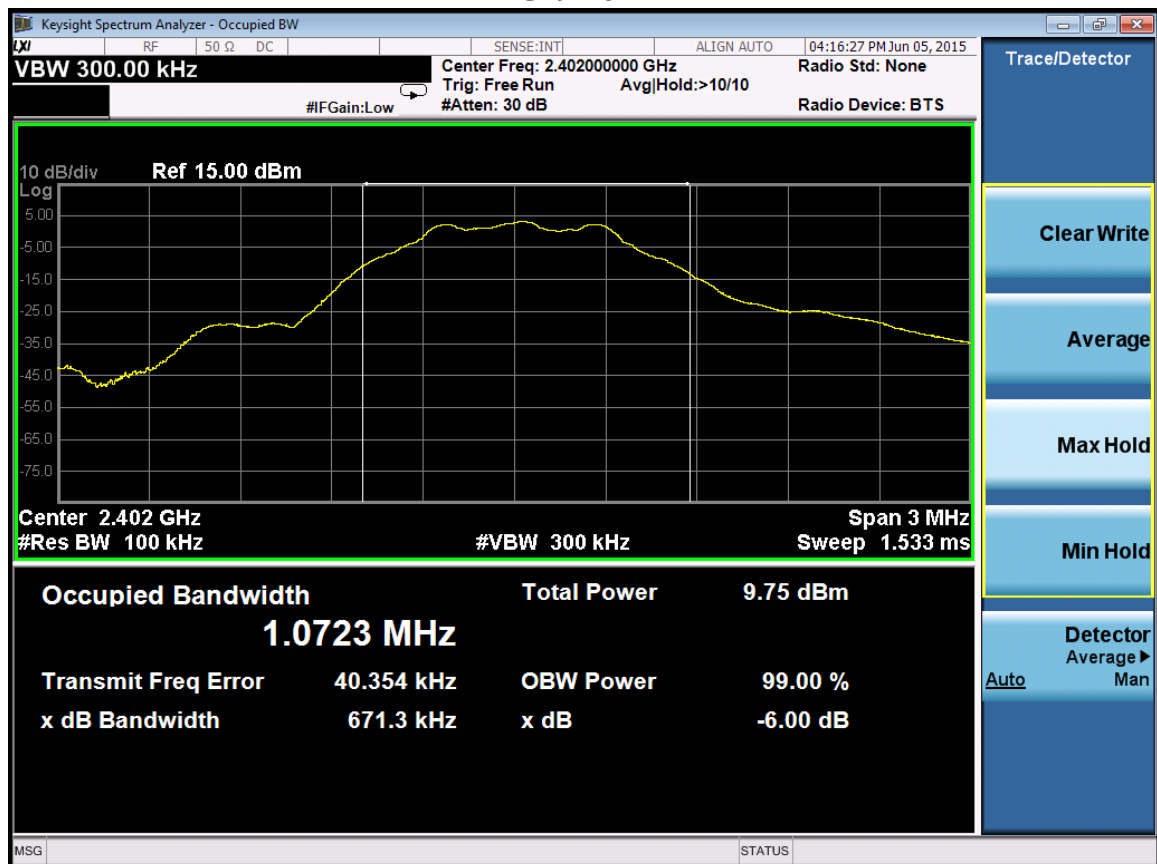
Temperature: 22°C

Relative Humidity: 53%

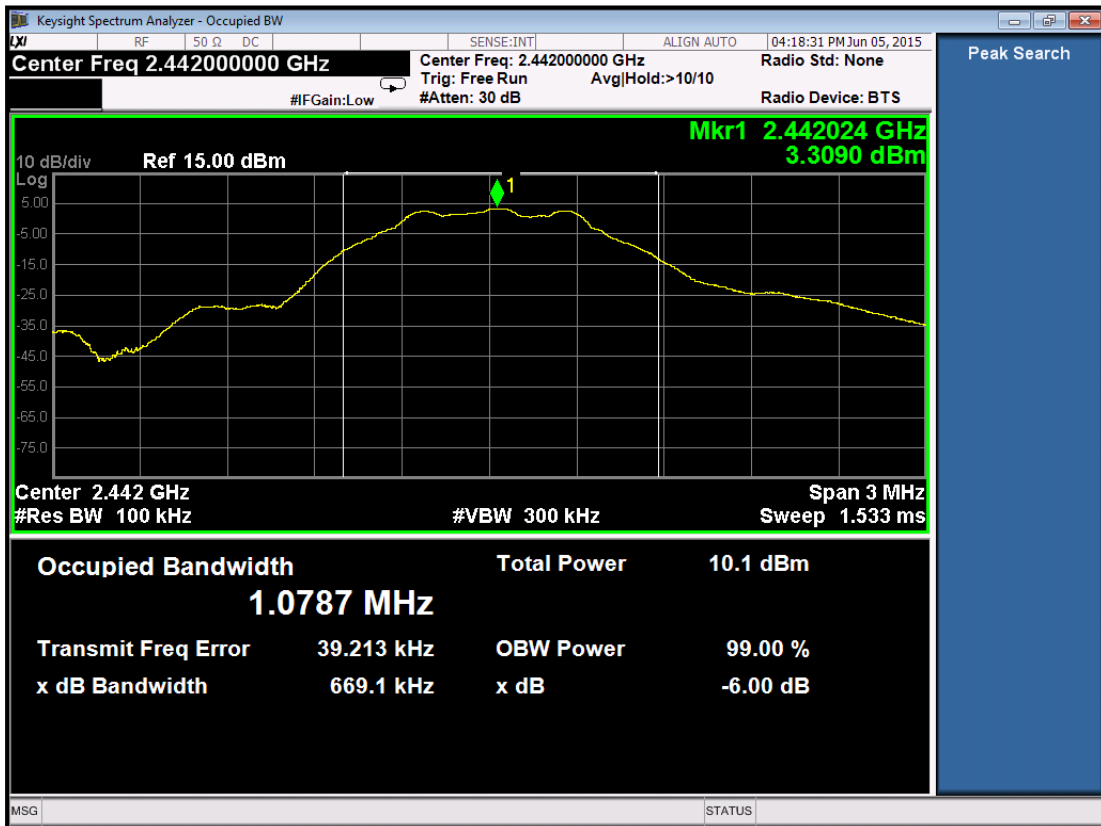
Modulation	Frequency (MHz)	Minimum 6dB Bandwidth (kHz)	Limits (KHz)
BLE	2402	671	> 500
	2442	669	> 500
	2480	675	> 500

Modulation	Frequency (MHz)	99% Occupied Bandwidth (MHz)
BLE	2402	1.07
	2442	1.08
	2480	1.13

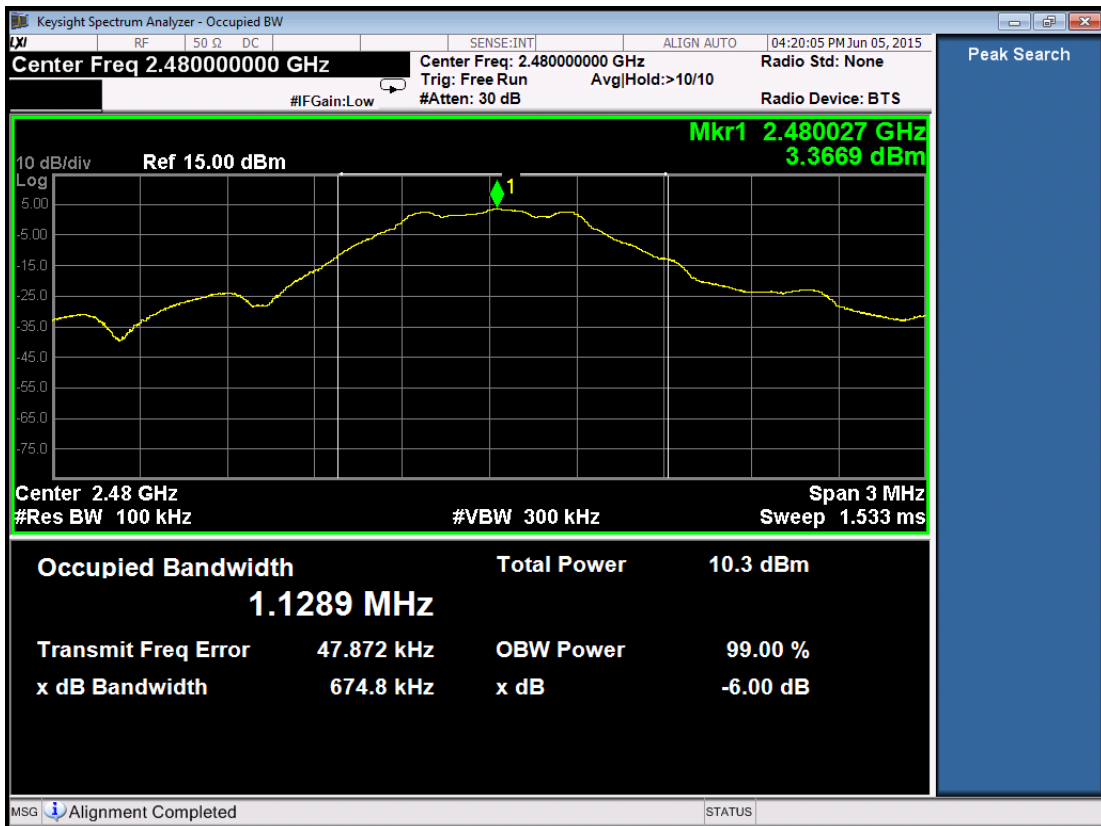
Channel L



Channel M



Channel H



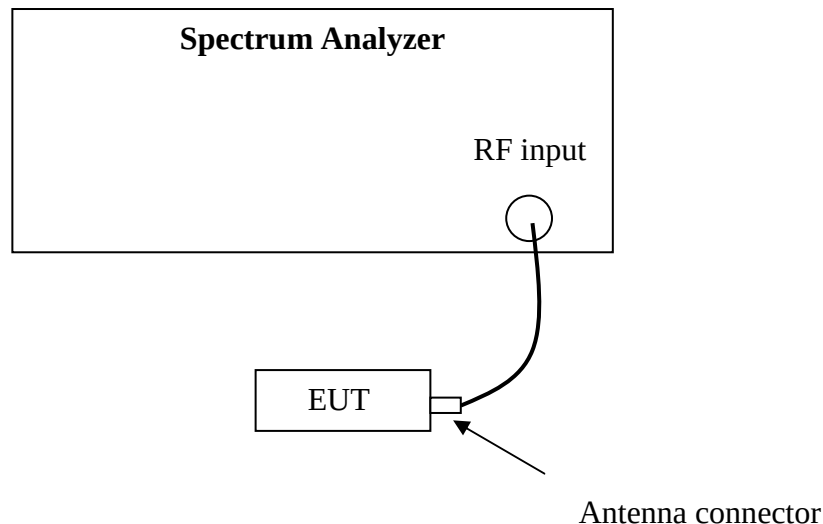
5. Maximum Conducted Output power

Test result: Pass

5.1 Test limit

- ☐ For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt
- ☐ For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts
- ☒ For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

5.2 Test Configuration



5.3 Test procedure and test setup

- a) Set the RBW $\geq$ DTS bandwidth.
- b) Set VBW $\geq 3 \times$ RBW.
- c) Set span $\geq 3 \times$ RBW
- d) Sweep time = auto couple.
- e) Detector = peak.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use peak marker function to determine the peak amplitude level.

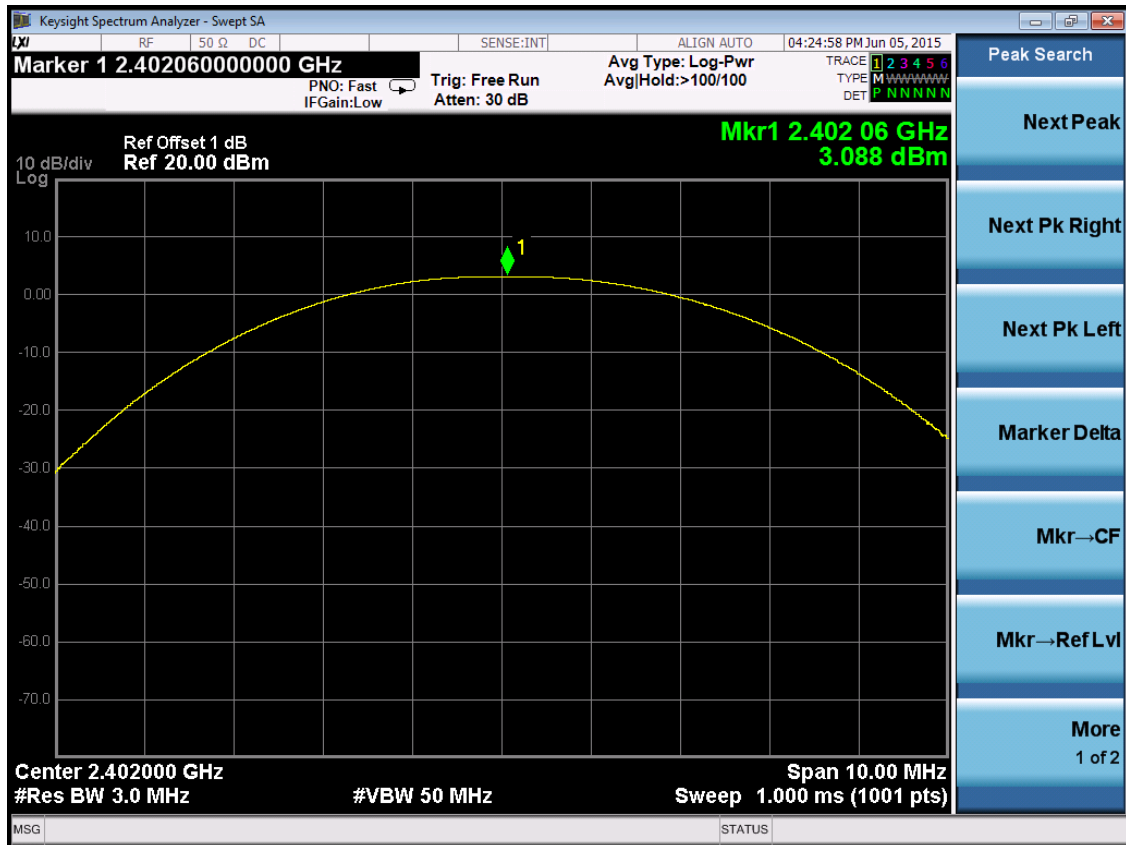
5.4 Test protocol

Temperature: 22 °C

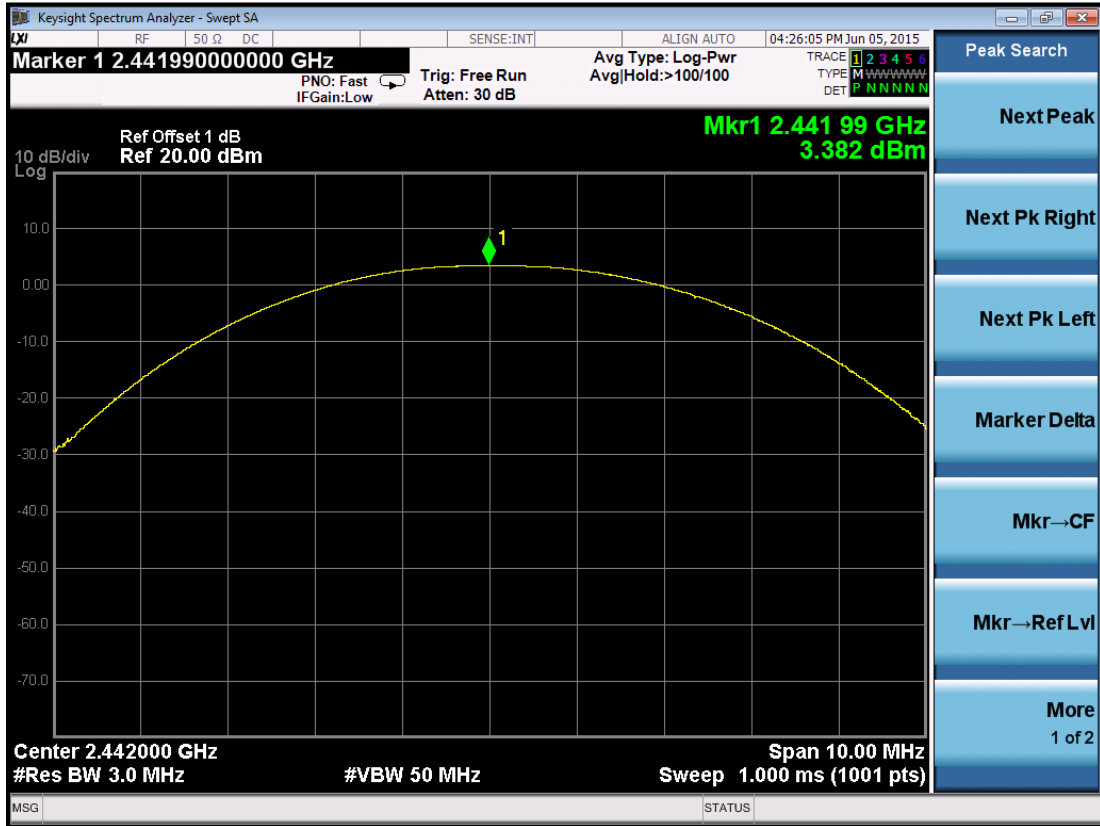
Relative Humidity: 53 %

Modulation	Frequency (MHz)	MaxConducted Power (dBm)	Limit (dBm)
BLE	2402	3.09	30
	2442	3.38	30
	2480	3.44	30

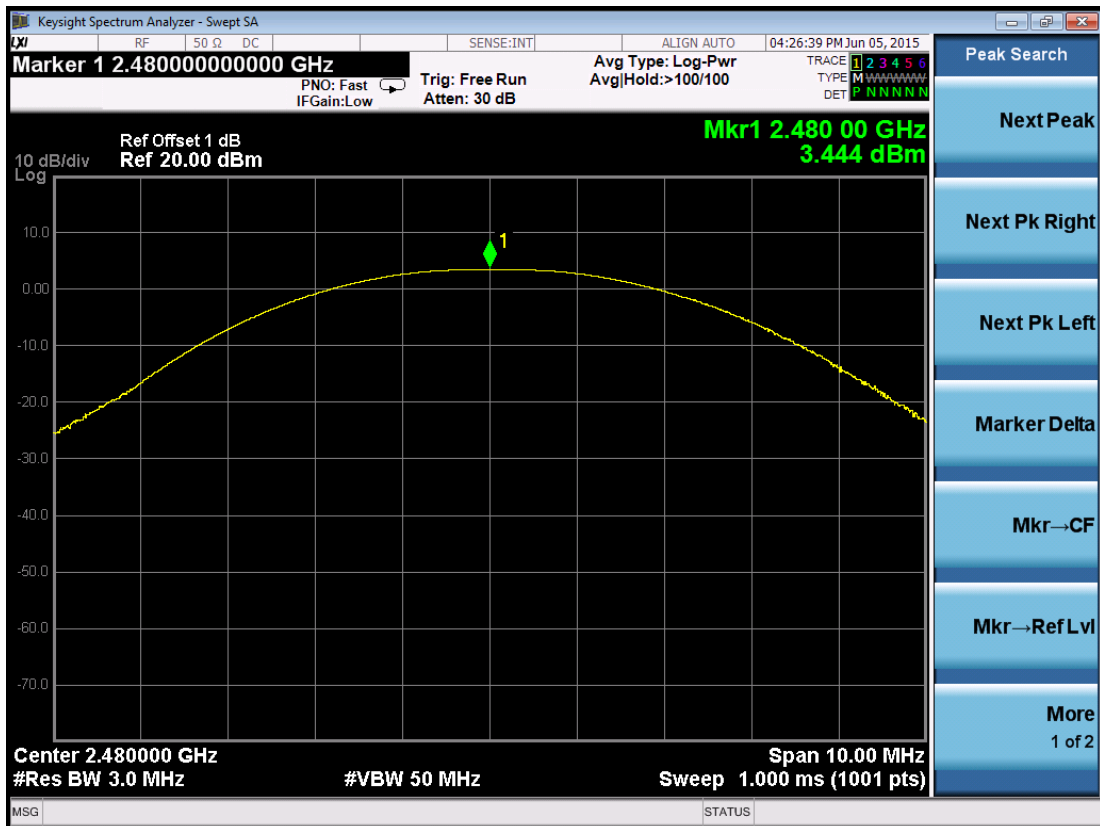
Channel L



Channel M



Channel H



6. Maximum Power spectrum density

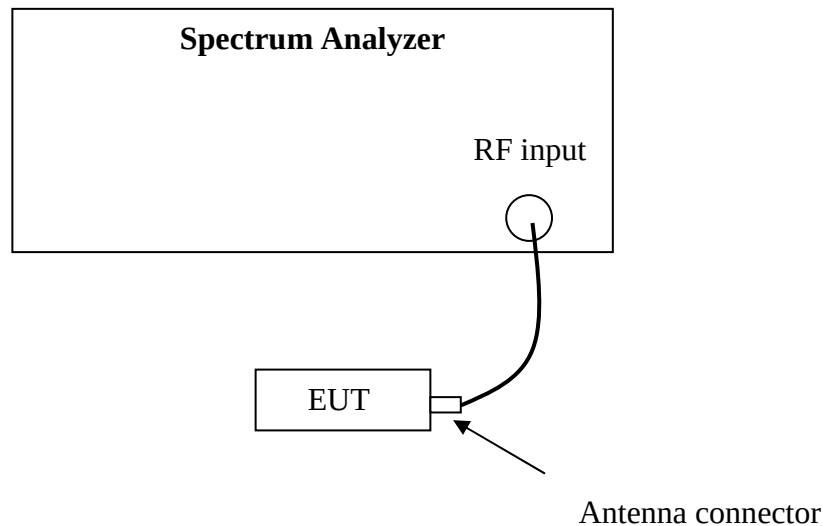
Test result: Pass

6.1 Test limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. If there have a beam forming type, the limit should be the minimum of 8dBm/MHz and $8 + (6 - \text{antenna gain} - \text{beam forming gain})$.

6.2 Test Configuration



6.3 Test procedure and test setup

- 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.
- If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

6.4 Test Protocol

Temperature: 22 °C
Relative Humidity: 53 %

Modulation	Frequency (MHz)	Maximum Power spectrum density (dBm/3KHz)	Limit (dBm/3KHz)
BLE	2402	-10.76	8
	2442	-9.86	8
	2480	-10.48	8

Channel L



Channel M



Channel H



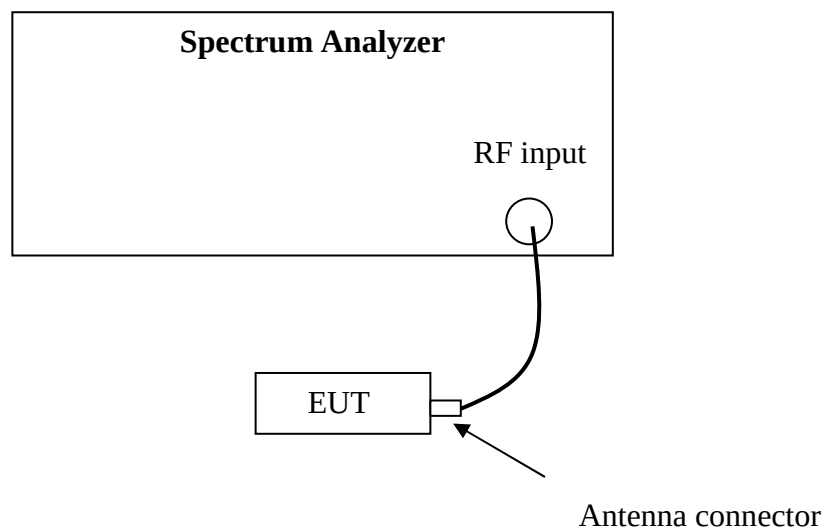
7. Emissions in non-restricted frequency bands

Test result: Pass

7.1 Test limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

7.2 Test Configuration



7.3 Test procedure and test setup

Reference level measurement

Establish a reference level by using the following procedure:

- a) Set instrument center frequency to DTS channel center frequency.
- b) Set the span to ≥ 1.5 times the *DTS bandwidth*.
- c) Set the RBW = 100 kHz.
- d) Set the VBW $\geq 3 \times$ RBW.
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum PSD level.

Emission level measurement

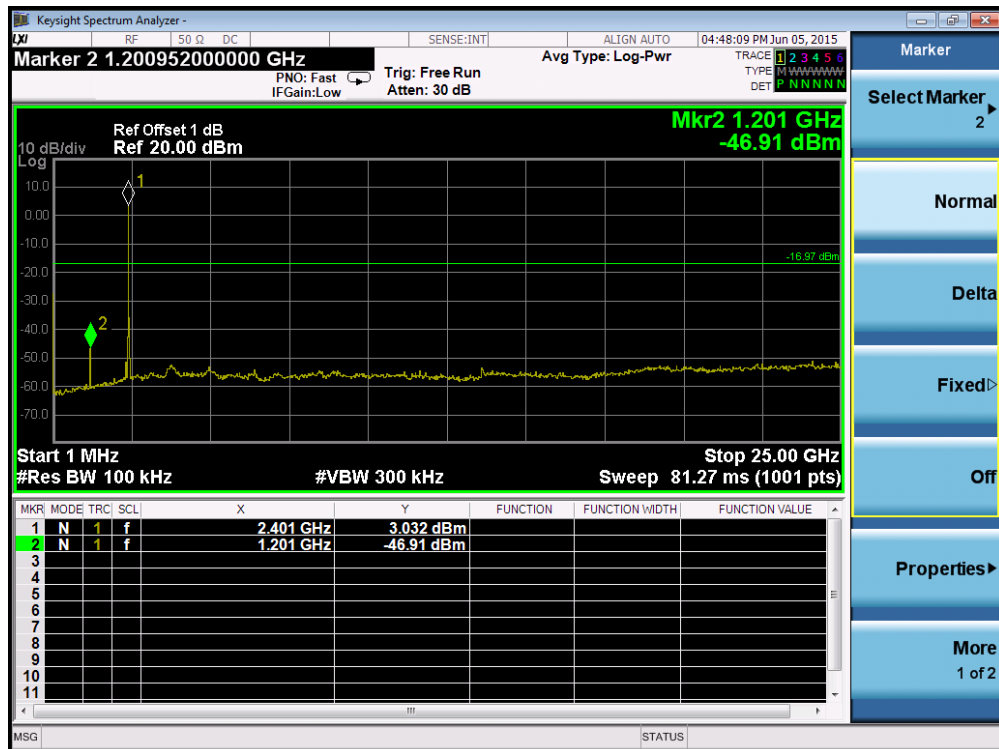
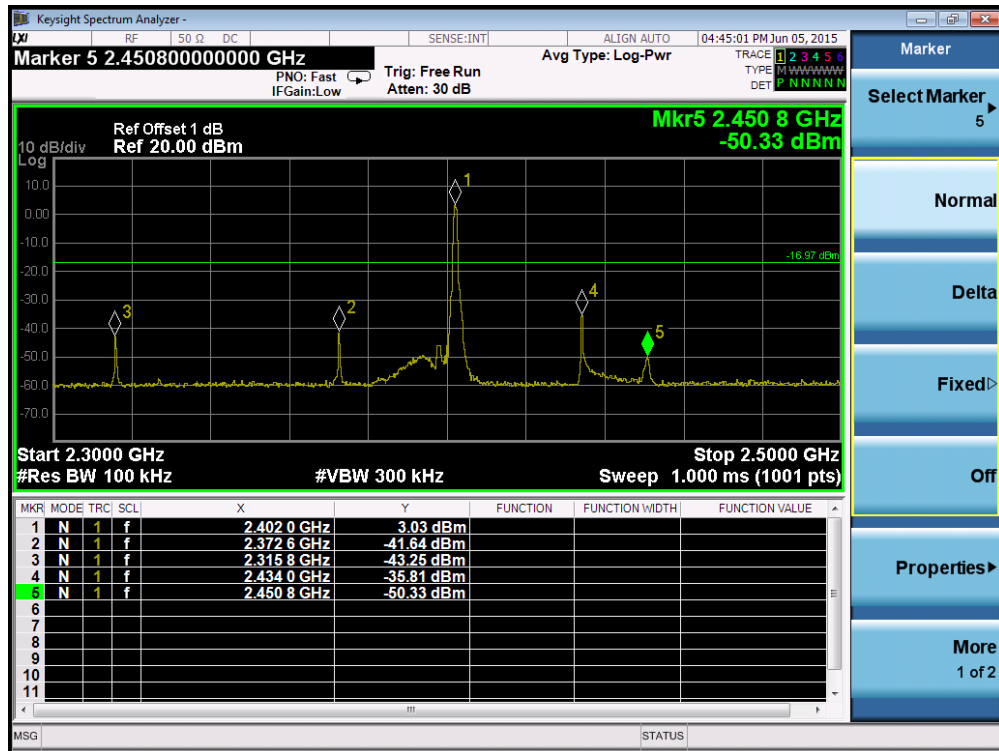
- a) Set the center frequency and span to encompass frequency range to be measured.
- b) Set the RBW = 100 kHz.
- c) Set the VBW $\geq 3 \times$ RBW.
- d) Detector = peak.
- e) Ensure that the number of measurement points $\geq \text{span/RBW}$
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level.

7.4 Test Protocol

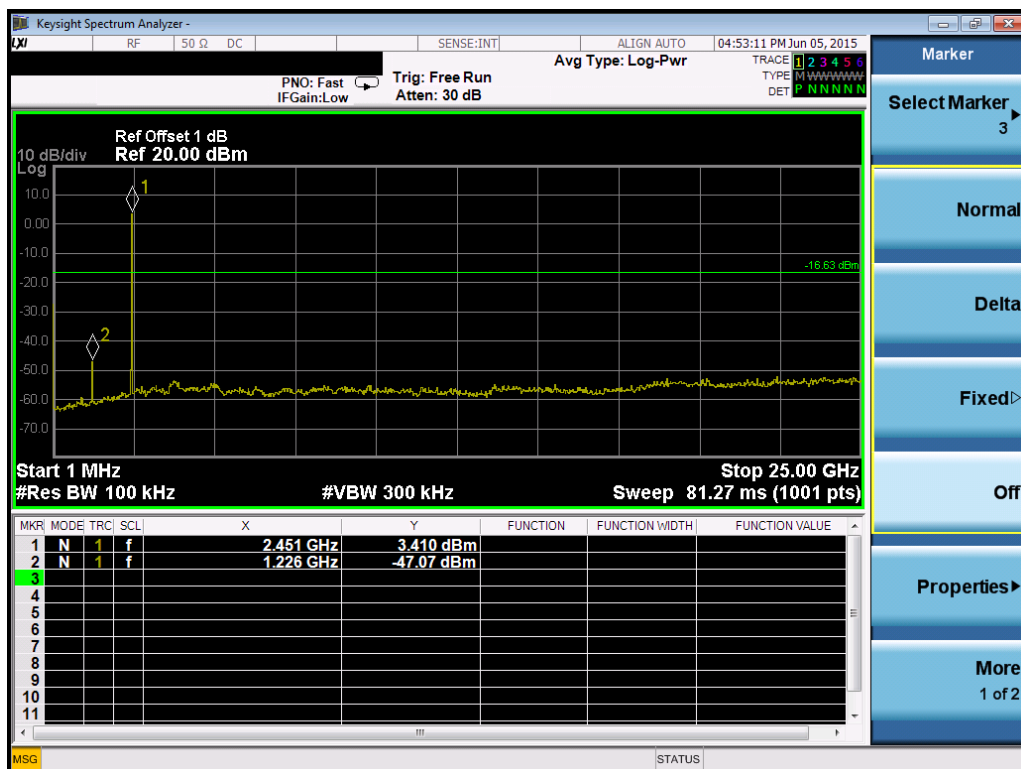
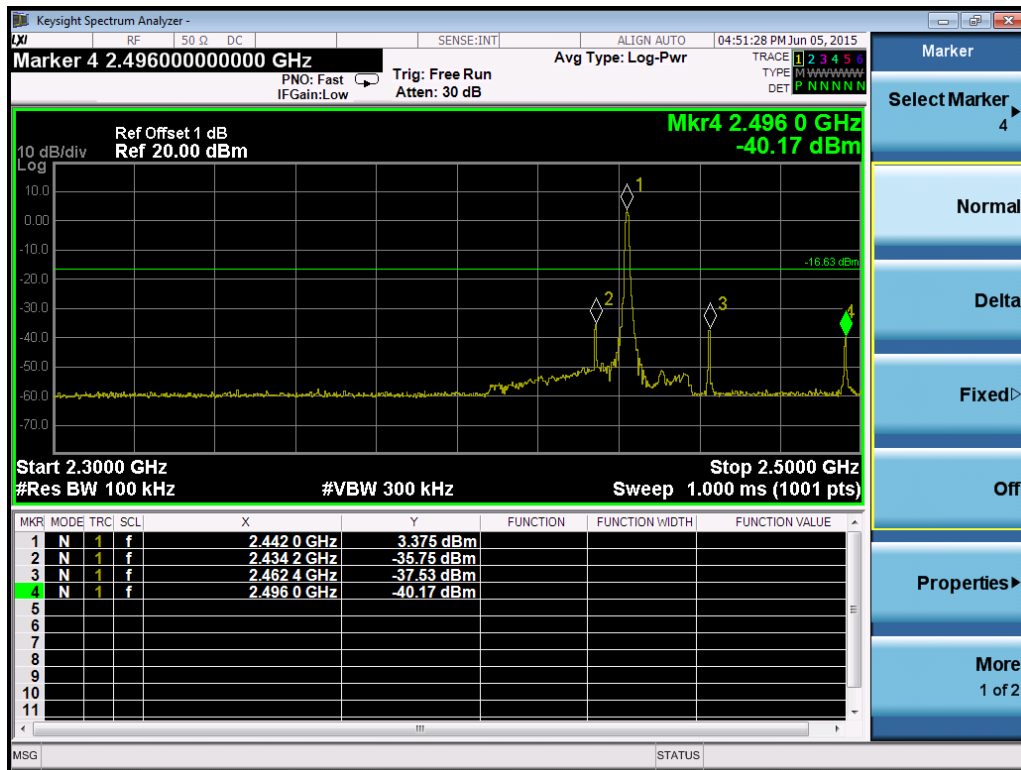
Temperature: 22 °C

Relative Humidity: 53 %

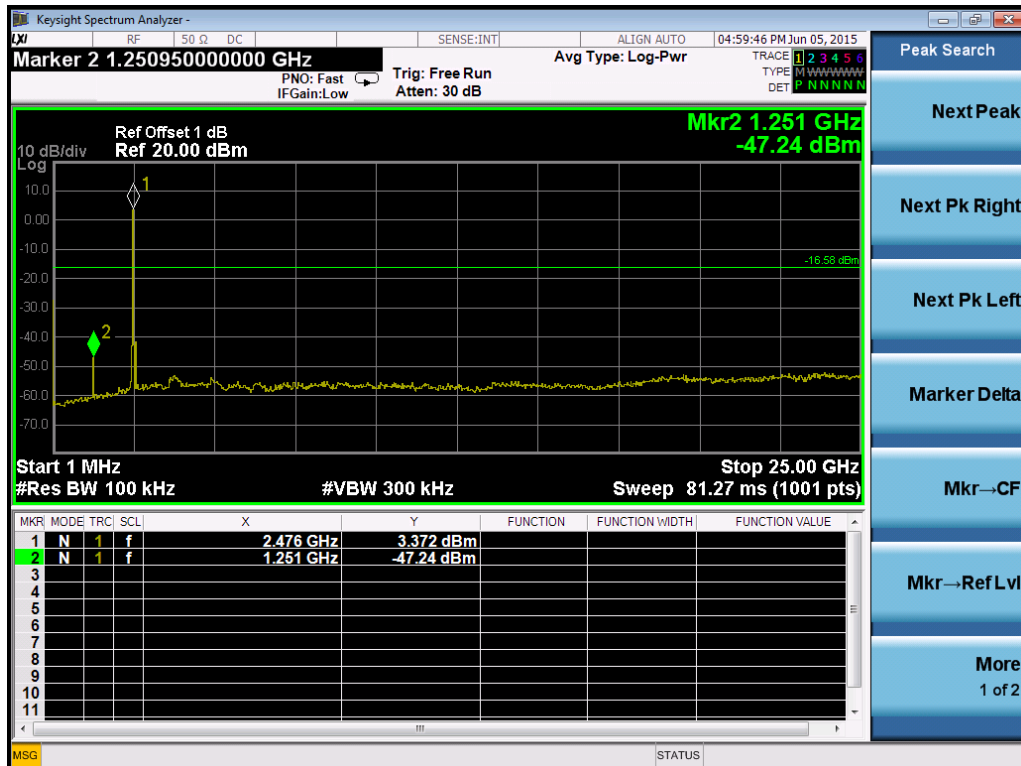
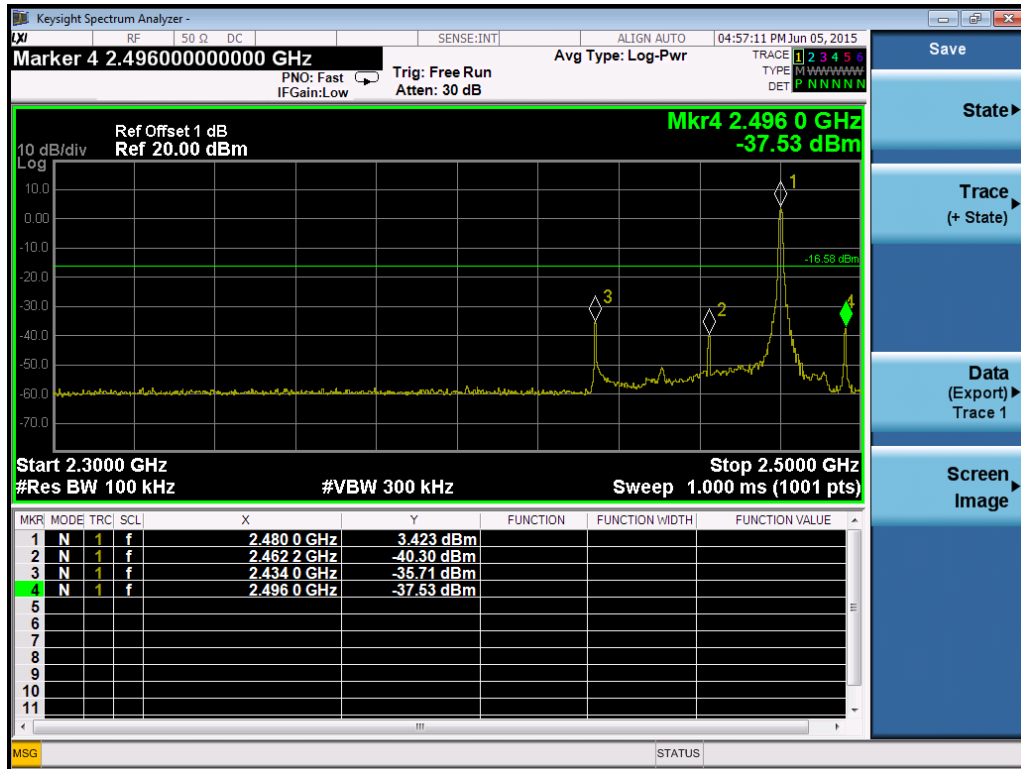
Channel L



Channel M



Channel H



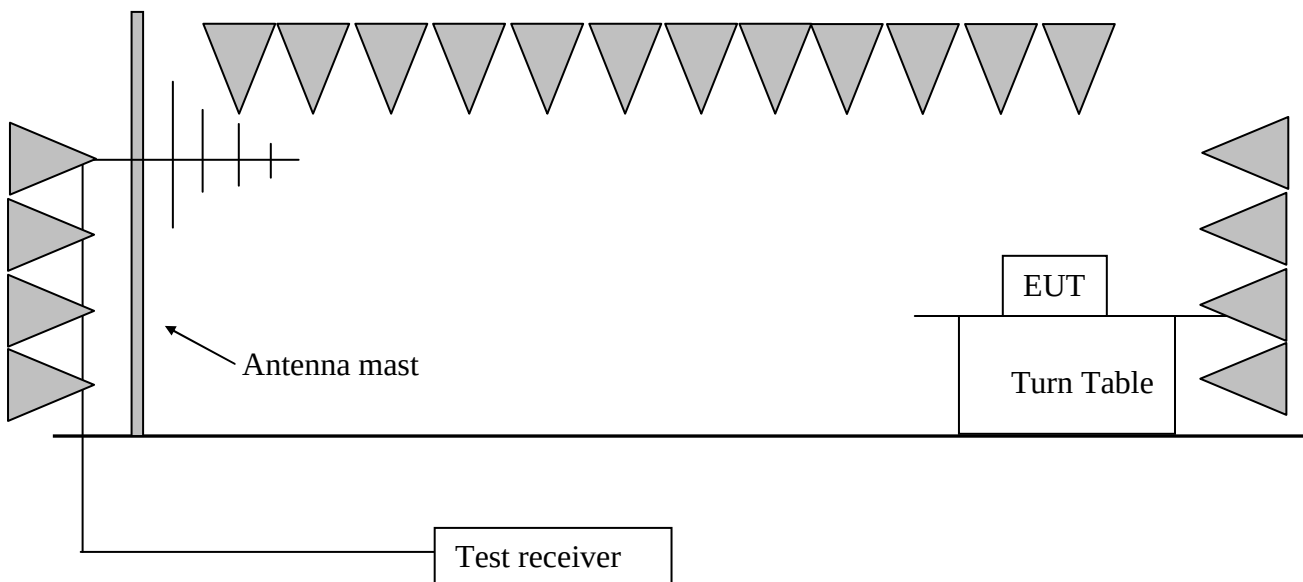
8. Radiated Emissions in restricted frequency bands

Test result: Pass

8.1 Test limit

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

8.2 Test Configuration



8.3 Test procedure and test setup

The measurement was applied in a semi-anechoic chamber. While testing for spurious emission higher than 1GHz, if applied, the pre-amplifier would be equipped just at the output terminal of the antenna.

Tabletop devices shall be placed on a nonconducting platform with nominal top surface dimensions 1 m by 1.5 m. For emissions testing at or below 1 GHz, the table height shall be 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m.

The turn table rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mast. The antenna moved up and down between from 1meter to 4 meters to find out the maximum emission level.

The radiated emission was measured using the Spectrum Analyzer with the resolutions bandwidth set as:

RBW = 100 kHz, VBW = 300 kHz (30MHz-1GHz)

RBW = 1MHz, VBW = 3MHz (>1GHz for PK);

RBW = 1MHz, VBW = 10Hz (>1GHz for AV);

Remark:

1. Factor= Antenna Factor + Cable Loss (-Amplifier, is employed)
2. Measured level= Original Receiver Reading + Factor
3. Margin = limit – Measured level
4. If the PK measured level is lower than AV limit, the AV test can be elided.

Example:

Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,

Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10dBuV.

Then Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m;

Measured level = 10dBuV + 0.20dB/m = 10.20dBuV/m

Assuming limit = 54dBuV/m,

Measured level = 10.20dBuV/m, then Margin = 54 -10.20 = 43.80dBuV/m.

8.4 Test Protocol

Temperature: 25 °C

Relative Humidity: 55 %

CH	Antenna	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
L	H	2401.78	34.30	90.90	Fundamental	/	PK
	V	61.10	7.80	38.40	40.00	1.60	PK
	H	80.54	8.80	30.10	40.00	9.90	PK
	H	688.97	23.00	29.70	46.00	16.30	PK
	V	873.64	25.30	41.40	46.00	4.60	PK
	V	2372.12	34.20	54.90	74.00	19.10	PK
	V	2372.12	34.20	41.80	54.00	12.20	AV
	H	4795.59	-3.60	40.20	54.00	13.80	PK
	H	9621.24	4.90	42.20	54.00	11.80	PK
M	H	2442.18	34.30	88.80	Fundamental	/	PK
	V	61.10	7.80	38.40	40.00	1.60	PK
	H	80.54	8.80	30.10	40.00	9.90	PK
	H	688.97	23.00	29.70	46.00	16.30	PK
	V	873.64	25.30	41.40	46.00	4.60	PK
	H	4882.19	-3.10	39.80	54.00	14.20	PK
	H	9771.56	5.30	41.60	54.00	12.40	PK
H	H	2480.04	34.30	87.00	Fundamental	/	PK
	V	61.10	7.80	38.40	40.00	1.60	PK
	H	80.54	8.80	30.10	40.00	9.90	PK
	H	688.97	23.00	29.70	46.00	16.30	PK
	V	873.64	25.30	41.40	46.00	4.60	PK
	H	2492.66	34.70	54.40	74.00	19.60	PK
	H	2492.66	34.70	44.40	54.00	9.60	AV
	H	4958.16	-2.90	39.20	54.00	14.80	PK
	H	9925.73	5.80	41.10	54.00	12.90	PK

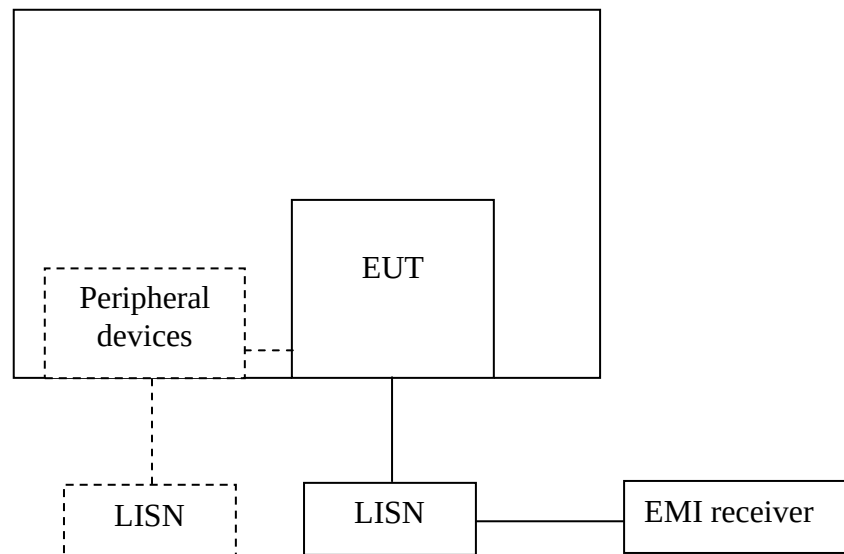
9. Power line conducted emission

Test result: Pass

9.1 Limit

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	QP	AV
0.15-0.5	66 to 56*	56 to 46 *
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

9.2 Test configuration



- ☐ For table top equipment, wooden support is 0.8m height table
- ☒ For floor standing equipment, wooden support is 0.1m height rack.

9.3 Test procedure and test set up

The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a $50\Omega/50\mu\text{H}$ coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a $50\Omega/50\mu\text{H}$ coupling impedance with 50Ω termination.

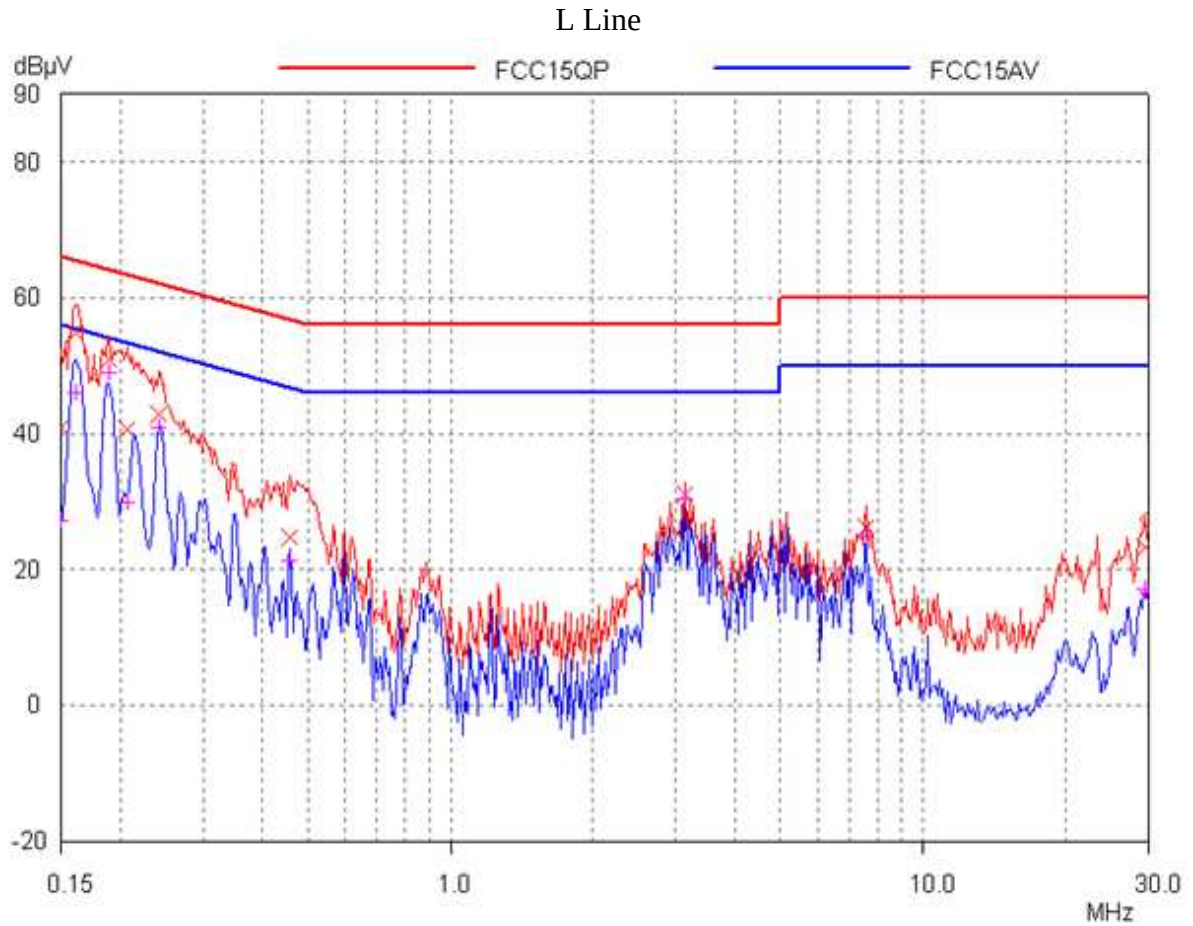
Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to RSS-gen on conducted measurement. The bandwidth of the test receiver is set at 9 kHz.

During this test, The EUT was set at the BLE transmission mode and fixed at channel 2402MHz, 2442MHz, 2480MHz.

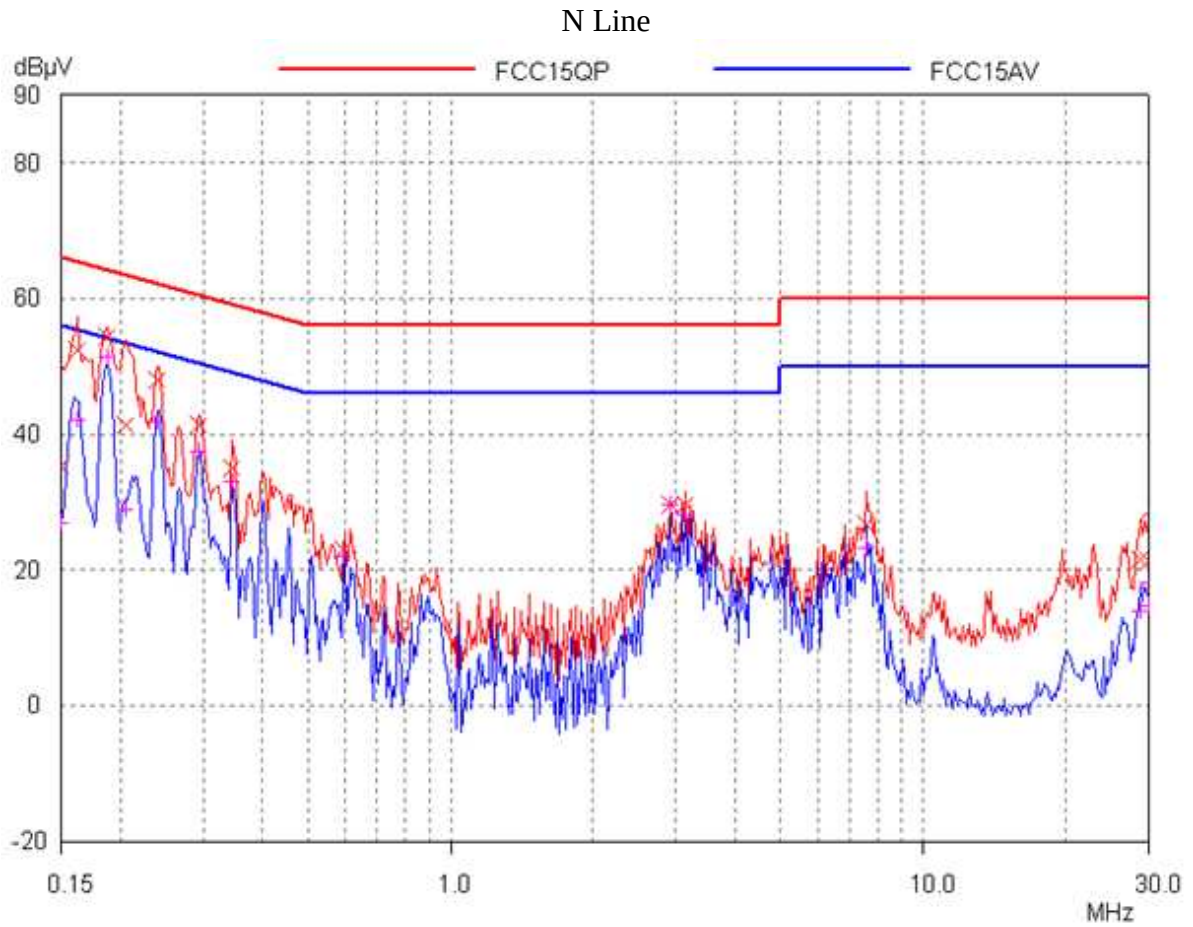
The test results of channel L (2402MHz) was worst and chosen to list in the report as representative.

9.4 Test protocol

Temperature : 21 °C
Relative Humidity : 55 %



Frequency (MHz)	Quasi-peak			Average		
	level dB(μV)	Limit dB(μV)	Margin (dB)	level dB(μV)	limit dB(μV)	Margin (dB)
0.15	40.97	66.00	25.03	27.11	56.00	28.89
0.16	54.74	65.40	10.66	45.97	55.40	9.43
0.19	51.01	64.08	13.07	48.99	54.08	5.09
0.21	40.67	63.35	22.68	29.93	53.35	23.42
0.24	42.95	62.05	19.10	40.94	52.05	11.11
3.12	31.04	56.00	24.96	30.40	46.00	15.60
7.53	26.13	60.00	33.87	24.87	50.00	25.13



Frequency (MHz)	Quasi-peak			Average		
	level dB(μV)	Limit dB(μV)	Margin (dB)	level dB(μV)	limit dB(μV)	Margin (dB)
0.15	35.17	66.00	30.83	27.00	56.00	29.00
0.16	52.32	65.34	13.02	42.15	55.34	13.19
0.19	54.35	64.18	9.83	51.40	54.18	2.78
0.21	41.39	63.38	21.99	28.99	53.38	24.39
0.24	47.99	62.12	14.13	41.95	52.12	10.17
0.29	41.25	60.43	19.18	37.56	50.43	12.87