

FCC TEST REPORT for DTS Device (BLE) No. 150801628SHA-004

Applicant : Haier Telecom (Qingdao) Co., Ltd.
No1. Haier Road , Hi-tech Zone, Qingdao, 266101, China

Manufacturer : Haier Telecom (Qingdao) Co., Ltd.
No1. Haier Road , Hi-tech Zone, Qingdao, 266101, China

Product Name : Mobile Phone

Type/Model : L51

TEST RESULT : PASS

SUMMARY

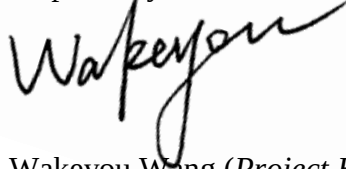
The equipment complies with the requirements according to the following standard(s) or specification:

47CFR Part 15 (2014): Radio Frequency Devices

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

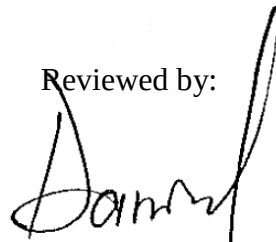
Date of issue: Aug 24, 2015

Prepared by:



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1 GENERAL INFORMATION

1.1 Description of Client

Applicant : Haier Telecom (Qingdao) Co., Ltd.
No1. Haier Road , Hi-tech Zone, Qingdao, 266101, China

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Manufacturer : Haier Telecom (Qingdao) Co., Ltd.
No1. Haier Road , Hi-tech Zone, Qingdao, 266101, China

1.2 Identification of the EUT

Product Name : Mobile Phone
Type/model : L51
Hardware version : MP
Software version : HL-L51-H01-S01
IMEI : 867747020003024
FCC ID : SG71507L51
Sample received date : June 20, 2015
Date of test : June 20, 2015 ~ Aug 10, 2015

1.3 Technical Specification

Tested	Mode	Intervals / Bandwidth (MHz)	TX & RX frequency (MHz)
☐	GSM/GPRS/EDGE 850	Intervals 0.2	Tx: 824.20 - 848.80 Rx: 869.20 - 893.80
☐	GSM/GPRS/EDGE 1900	Intervals 0.2	Tx: 1850.20 - 1909.80 Rx: 1930.20 - 1989.80
☐	WCDMA/HSDPA/HSUPA/ HSPA+ (Downlink Only) 850	Intervals 0.2	Tx: 826.40 - 846.60MHz Rx: 871.40 - 891.60MHz
☐	WCDMA/HSDPA/HSUPA/ HSPA+ (Downlink Only) 1900	Intervals 0.2	Tx: 1852.40 - 1907.60MHz Rx: 1932.40 - 1987.60MHz
☐	LTE 2	Bandwidth 1.4/3/5/10/15/20	Tx: 1850.7 MHz - 1909.3 Rx:1930.7 MHz - 1989.3
☐	LTE 4	Bandwidth 1.4/3/5/10/15/20	Tx: 1710.7 MHz - 1754.3 Rx:2110.7 MHz - 2154.3
☐	LTE 7	Bandwidth 5/10/15/20	Tx: 2502.5 MHz -2567.5 Rx:2622.5MHz - 2687.5
☐	LTE 17	Bandwidth 5/10	Tx: 706.5 MHz - 713.5 Rx:736.5 MHz - 743.5
☐	WLAN 802.11b / g /n20	/	/
☒	Bluetooth V4.0 LE / EDR	/	/

Antenna : Internal, un-detachable
main, 1.82dBi max;
Diversity, 1.62dBi max;
Wi-Fi & Bluetooth, 1.85dBi max;
aGPS, 1.51dBi max;

Rating : Normal voltage, 4.2V;
Extreme low voltage, 3.7V;
Extreme high voltage, 5V;
AC/DC adapter, 100-240V, 50/60Hz input, 5V DC
output

2 TEST SPECIFICATIONS

2.1 Standards or specification

47CFR Part 15 (2014)
ANSI C63.10 (2013)
KDB 558074 (V03R03)

2.2 Mode of operation during the test

While testing transmitting mode of EUT, the internal modulation and continuously transmission was applied.

2.3 Test software list

Test Items	Software	Manufacturer	Version
Conducted emission	ESxS-K1	R&S	V2.1.0
Radiated emission	ES-K1	R&S	V1.71

2.4 Test peripherals list

Item No.	Name	Band and Model	Description
1	PC	HP ProBook 6450b	/
2	POE Adapter	Xingjin S24G0Z-480A050-04	Non-Shielded, 1.8m
3	Adapter	Huntkey HKA08054015-6A	Non-Shielded, 1.8m

2.5 Instrument list

Equipment	Type	Manu.	Internal no.	Cal. Date	Due date
Test Receiver	ESCS 30	R&S	EC 2107	2014-10-21	2015-10-20
Test Receiver	ESIB 26	R&S	EC 3045	2014-10-20	2015-10-19
Test Receiver	ESCI 7	R&S	EC4501	2014-12-25	2015-12-24
Semi-anechoic chamber	-	Albatross project	EC 3048	2015-5-11	2016-5-10
High Pass Filter	WHKX 1.0/15G-10SS	Wainwright	EC4297-1	2015-1-8	2016-1-7
High Pass Filter	WHKX 2.8/18G-12SS	Wainwright	EC4297-2	2015-1-8	2016-1-7
High Pass Filter	WHKX 7.0/1.8G-8SS	Wainwright	EC4297-3	2015-1-8	2016-1-7
Band Reject Filter	WRCGV 2400/2483-2390/2493-35/10SS	Wainwright	EC4297-4	2015-1-8	2016-1-7
RF cable	SUCOFLEX 104	HUBER+SUHNER	/	2015-2-13	2016-2-12
Bilog Antenna	CBL 6112D	TESEQ	EC 4206	2015-4-27	2016-4-26
Horn antenna	HF 906	R&S	EC 3049	2015-4-27	2016-4-26
Pre-amplifier	Pre-amp 18	R&S	EC 3222	2015-4-20	2016-4-19
Spectrum analyzer	E7402A	Agilent	EC2254	2014-08-16	2015-08-15
Climate Chamber	SETH-Z-102U	ESPEC	EC4315	2015-4-9	2016-4-8
PXA Signal Analyzer	N9030A	Agilent	EC5338	2015-5-15	2016-4-14

2.6 Test Summary

This report applies to tested sample only. The test results have been compared directly with the limits, and the measurement uncertainty is recorded. This report shall not be reproduced in part without written approval of Intertek Testing Service Shanghai Limited.

TEST ITEM	FCC REFERENCE	RESULT
Minimum 6dB Bandwidth & Occupied bandwidth	15.247(a)(2)	Pass
Maximum peak output power	15.247(b)	Pass
Power spectrum density	15.247(e)	Pass
Radiated emission	15.205 & 15.209	Pass
Emission outside the frequency band	15.247(d)	Pass
Power line conducted emission	15.207	Pass
99% Bandwidth	/	NA

Notes: 1: NA =Not Applicable

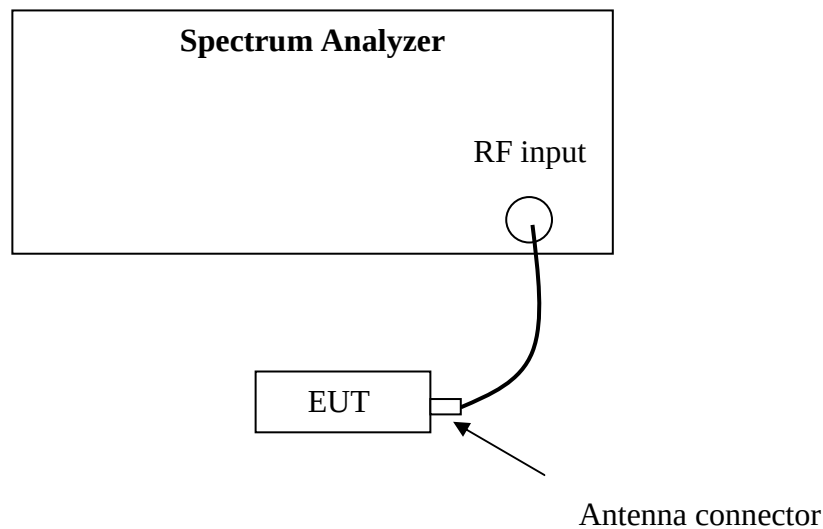
3 Minimum 6dB Bandwidth

Test result: Pass

3.1 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.

3.2 Test Configuration



3.3 Test Procedure and test setup

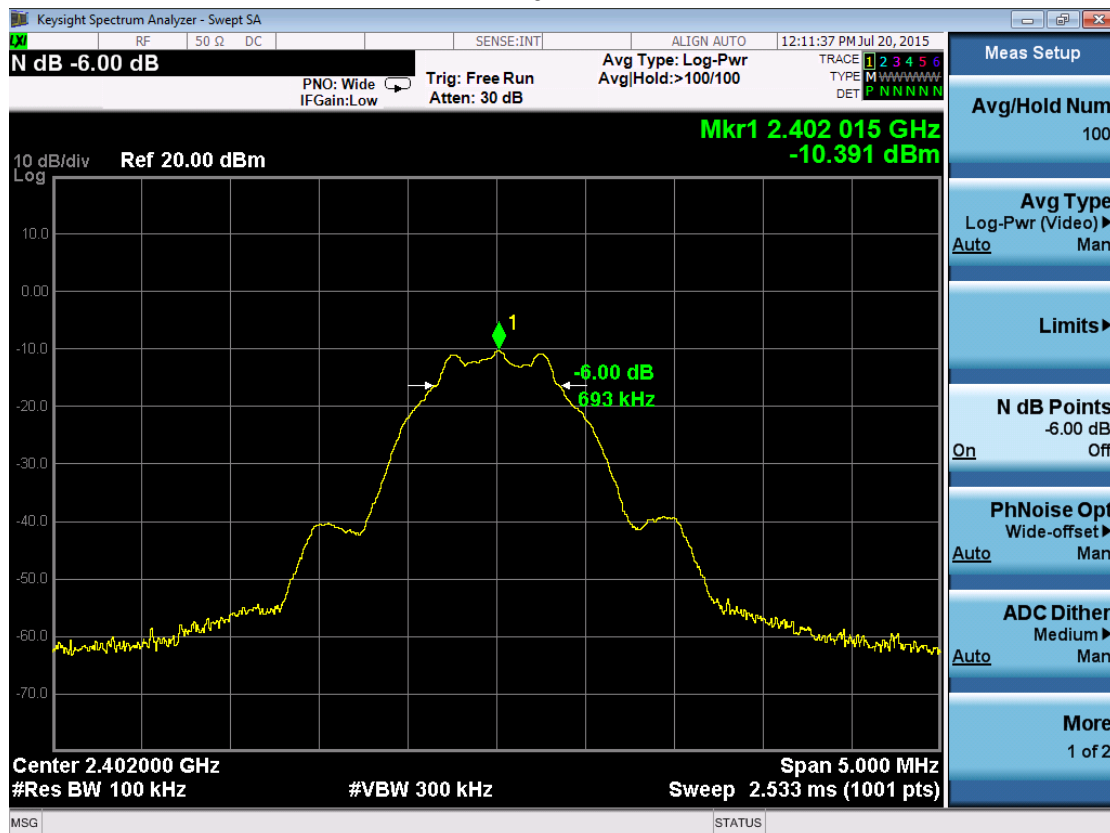
The minimum 6dB bandwidth per FCC §15.247(a)(2) is measured using the Spectrum Analyzer according to DTS test procedure of "KDB558074 D01 DTS Meas Guidance v03r03" for compliance to FCC 47CFR 15.247 requirements (clause 8.2).

3.4 Test Protocol

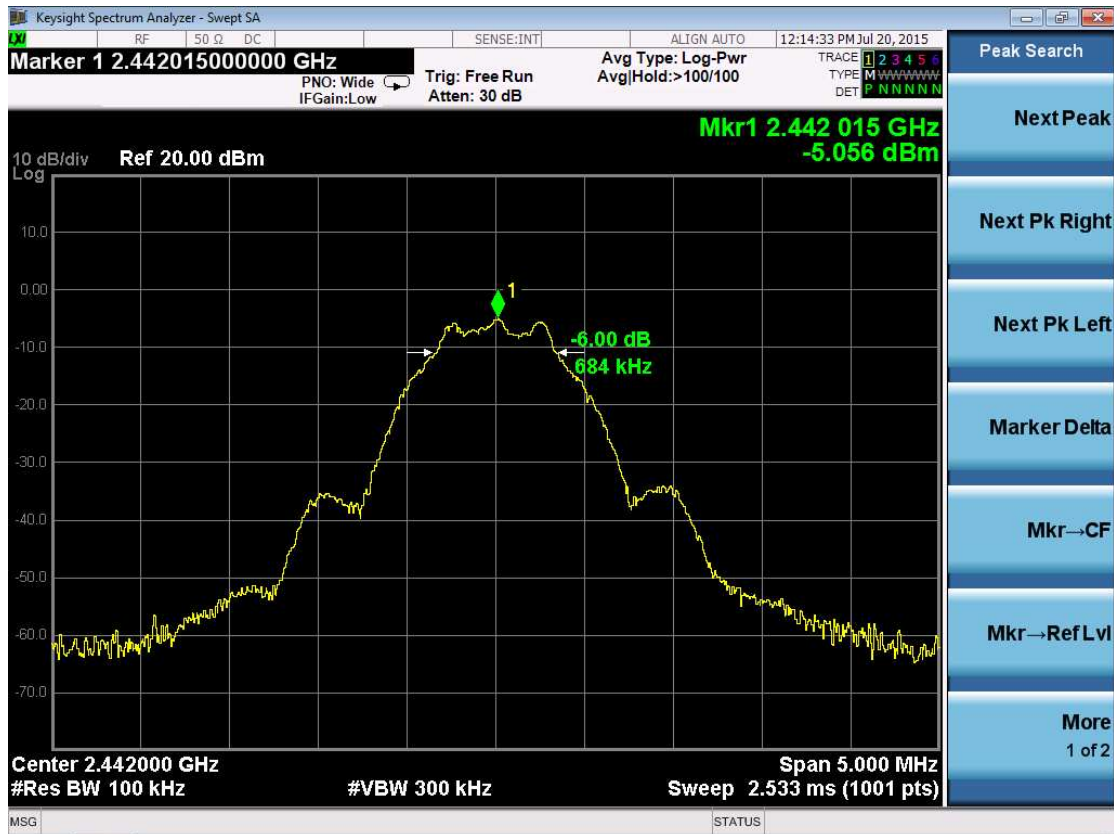
Temperature: 25 °C
Relative Humidity: 55 %

Modulation	Frequency (MHz)	Minimum 6dB Bandwidth(MHz)		Limits (MHz)
		Port 0	Port 1	
BLE	2402	693	/	> 0.5
	2442	684	/	> 0.5
	2480	695	/	> 0.5

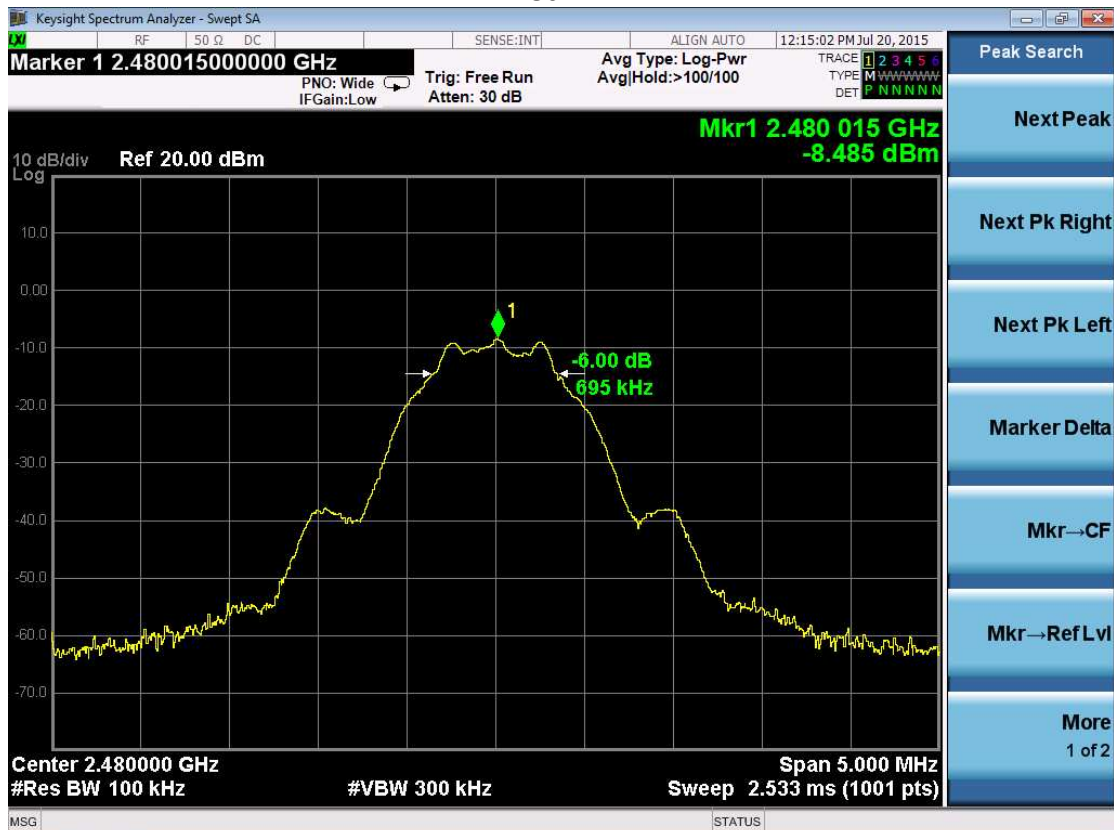
2402MHz



2442MHz



2480MHz



4 Maximum Conducted Output power

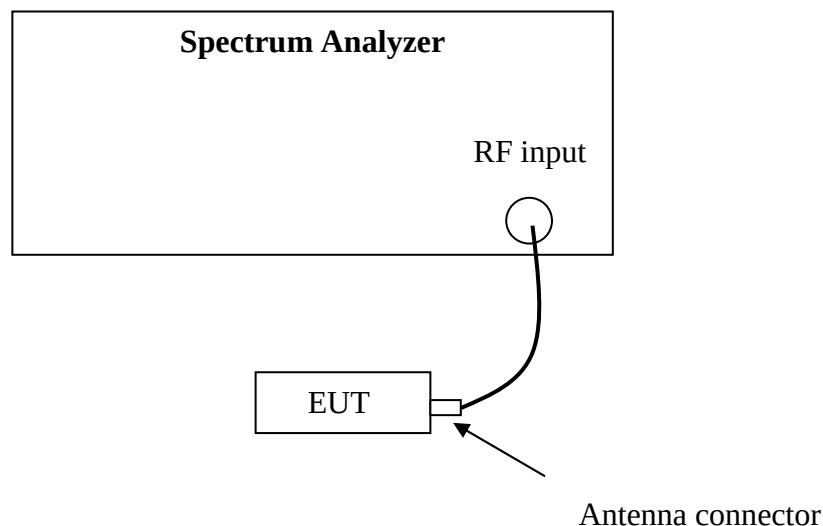
Test result: Pass

4.1 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.

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 30dBm and 30+ (6 –antenna gain-beam forming gain).

4.2 Test Configuration



4.3 Test procedure and test setup

The EUT was tested according to DTS test procedure of “KDB558074 D01 DTS Meas Guidance v03r03” for compliance to FCC 47CFR 15.247 requirements (clause 9.2.2.4).

- a) Measure the duty cycle, x , of the transmitter output signal as described in 6.0.
- b) Set span to at least 1.5 times the OBW.
- c) Set RBW = 1-5% of the OBW, not to exceed 1 MHz.
- d) Set VBW $\geq 3 \times$ RBW.
- e) Number of points in sweep $\geq 2 \text{ span} / \text{RBW}$. (This gives bin-to-bin spacing $\leq \text{RBW}/2$, so that narrowband signals are not lost between frequency bins.)
- f) Sweep time = auto.
- g) Detector = RMS (*i.e.*, power averaging), if available. Otherwise, use sample detector mode.
- h) Do not use sweep triggering. Allow the sweep to “free run”.
- i) Trace average at least 100 traces in power averaging (*i.e.*, RMS) mode; however, the number of traces to be averaged shall be increased above 100 as needed such that the average accurately represents the true average over the on and off periods of the transmitter.
- j) Compute power by integrating the spectrum across the OBW of the signal using the instrument’s band power measurement function with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.
- k) Add $10 \log (1/x)$, where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add $10 \log (1/0.25) = 6 \text{ dB}$ if the duty cycle is 25 %.

4.4 Test protocol

Temperature: 25 °C
Relative Humidity: 55 %

Test Mode	Frequency (MHz)	Reading (dBm)		Duty cycle factor (dB)	Total Power (dBm)	Limit (dBm)	Margin (dB)
		Port 0	Port 1				
802.11b	2402	-10.13	/	0	-10.13	30.00	40.13
	2442	-5.37	/	0	-5.37	30.00	35.37
	2480	-8.73	/	0	-8.73	30.00	38.73

Note:

Reading port x (mW) = $10^{(\text{reading port x (dBm)}/10 + \text{duty cycle factor (dB)}/10)}$;

x = 0, 1.

Total Power (mW) = reading port 0 (mW) + reading port 1 (mW)

Total power (dBm) = $10 * \log(\text{Total power(mW)})$

5 Power spectrum density

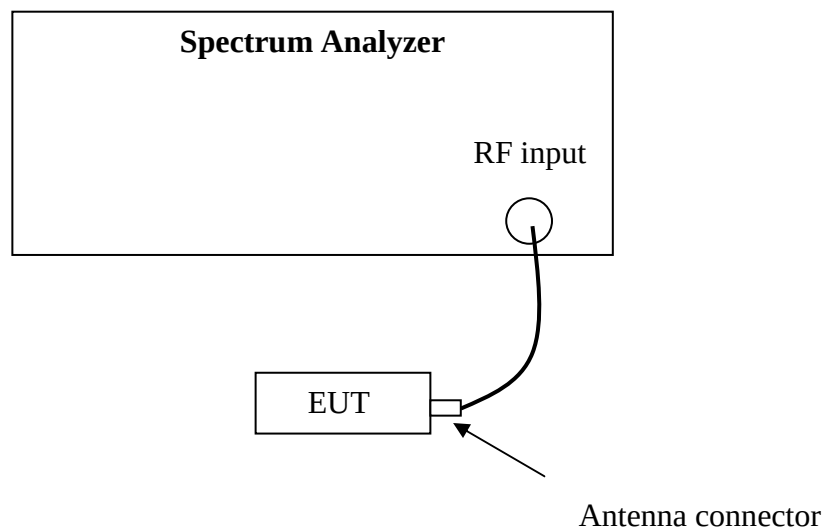
Test result: Pass

5.1 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 $8 + (6 - \text{antenna gain} - \text{beam forming gain})$.

5.2 Test Configuration



5.3 Test procedure and test setup

The power output per FCC §15.247(e) was tested according to DTS test procedure of “KDB558074 D01 DTS Meas Guidance v03r03” (clause 10.5) for compliance to FCC 47CFR 15.247 requirements.

This procedure is applicable when the EUT cannot be configured to transmit continuously (*i.e.*, duty cycle < 98%), and when sweep triggering/signal gating cannot be used to measure only when the EUT is transmitting at its maximum power control level, and when the transmission duty cycle is constant (*i.e.*, duty cycle variations are less than ± 2 percent):

- a) Measure the duty cycle (x) of the transmitter output signal as described in 6.0.
- b) Set instrument center frequency to DTS channel center frequency.
- c) Set span to at least 1.5 times the OBW.
- d) Set RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- e) Set VBW $\geq 3 \times \text{RBW}$.
- f) Detector = power averaging (RMS) or sample detector (when RMS not available).
- g) Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span/RBW}$.
- h) Sweep time = auto couple.
- i) Do not use sweep triggering. Allow sweep to “free run”.
- j) Employ trace averaging (RMS) mode over a minimum of 100 traces.
- k) Use the peak marker function to determine the maximum amplitude level.
- l) Add $10 \log (1/x)$, where x is the duty cycle measured in step (a), to the measured PSD to compute the average PSD during the actual transmission time.
- m) If resultant value exceeds the limit, then reduce RBW (no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span in order to meet the minimum measurement point requirement as the RBW is reduced).

5.4 Test Protocol

Temperature: 25 °C
Relative Humidity: 55 %

Test Mode	Frequency (MHz)	Reading (dBm/30kHz)		Duty cycle factor (dB)	Total PSD (dBm/30kHz)	Limit (dBm/3kHz)	Margin (dB)
		Port 0	Port 1				
BLE	2402	-21.50	/	0	-21.50	8.00	29.50
	2442	-16.50	/	0	-16.50	8.00	24.50
	2480	-20.30	/	0	-20.30	8.00	28.30

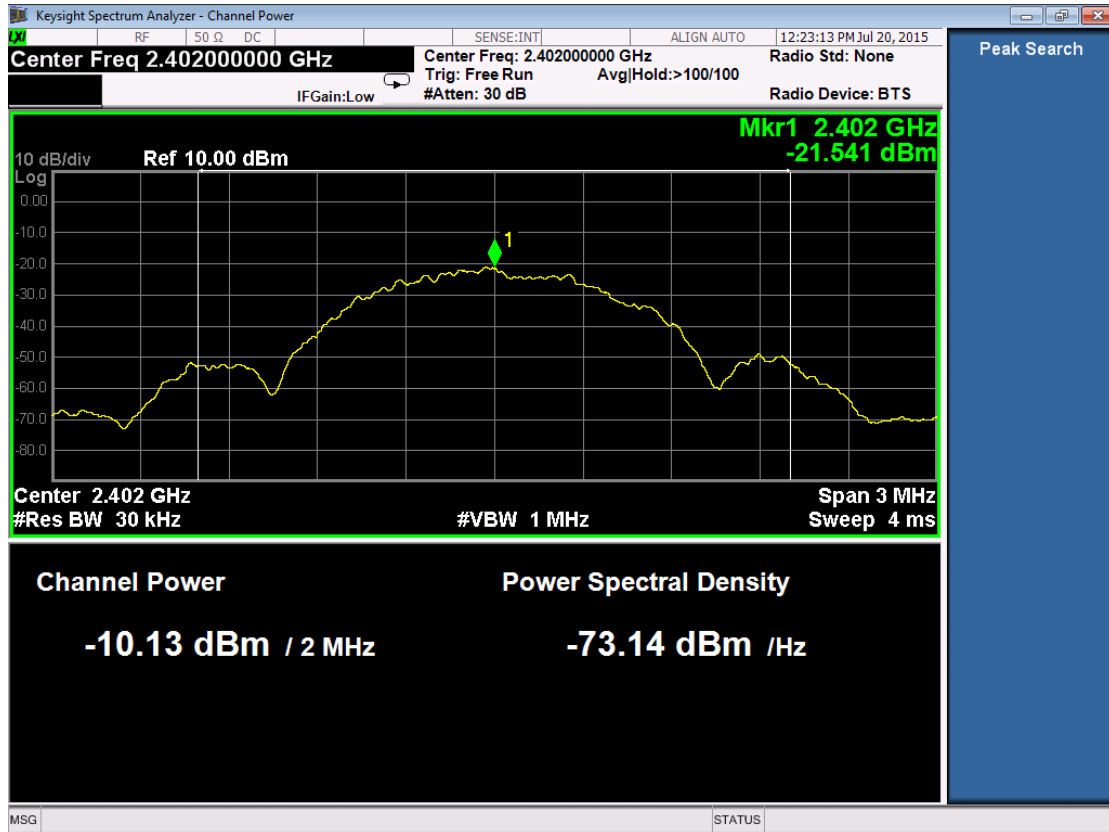
Note 1:

PSD port x (mW) = $10^{(\text{PSD port x (dBm)}/10 + \text{duty cycle factor (dB)}/10)}$;
x = 0, 1.

Total PSD (mW) = PSD port 0 (mW) + PSD port 1 (mW)

Total PSD (dBm) = $10 * \log(\text{Total PSD (mW)})$

2402MHz



2442MHz





2480MHz



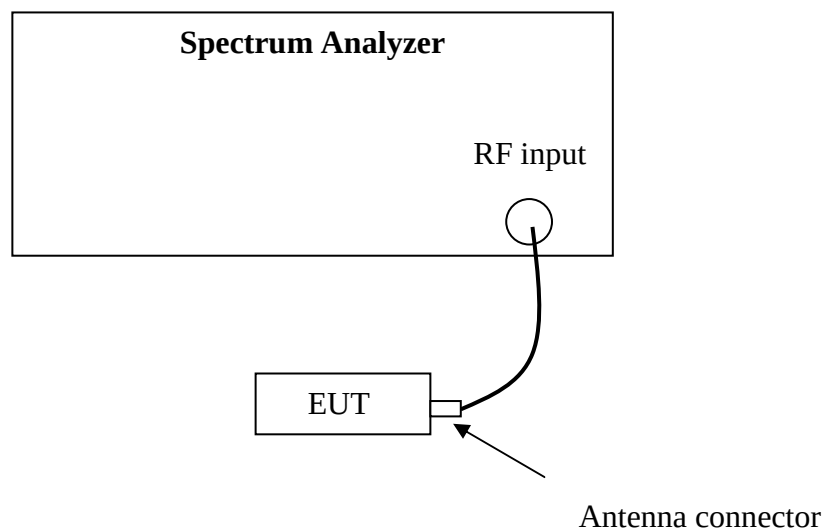
6 Emission outside the frequency band

Test result: Pass

6.1 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 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

6.2 Test Configuration



6.3 Test procedure and test setup

The Emission outside the frequency Band per FCC § 15.247(d) is measured using the Spectrum Analyzer with the resolutions bandwidth set at 100kHz, the video bandwidth set at 300kHz, and the SPAN>>RBW.

The EUT was tested according to DTS test procedure of “KDB558074 D01 DTS Meas Guidance v03r03” (clause 11.0) for compliance to FCC 47CFR 15.247 requirements.

If maximum conducted (average) output power was used to demonstrate compliance as described in 9.2, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz (*i.e.*, 30 dBc).

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.

Note that the channel found to contain the maximum PSD level can be used to establish the reference 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 $\geq$ 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.

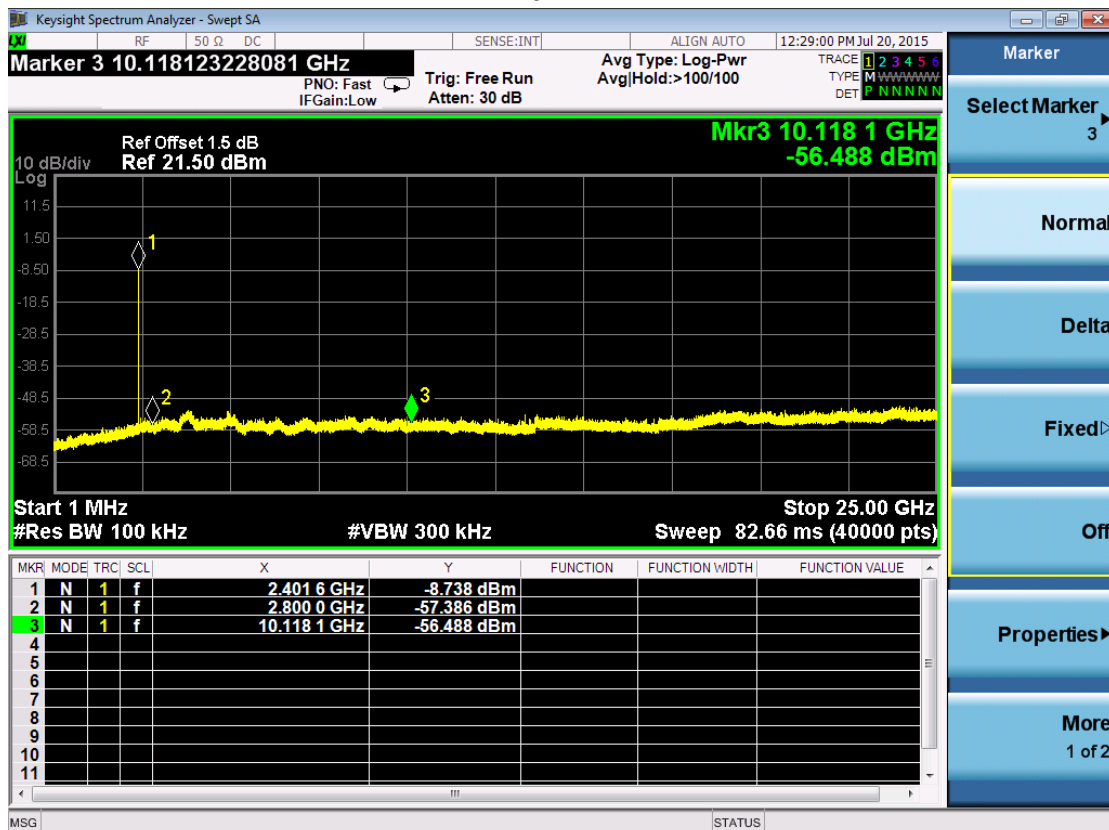
Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.1 a) or 11.1 b). Report the three highest emissions relative to the limit.

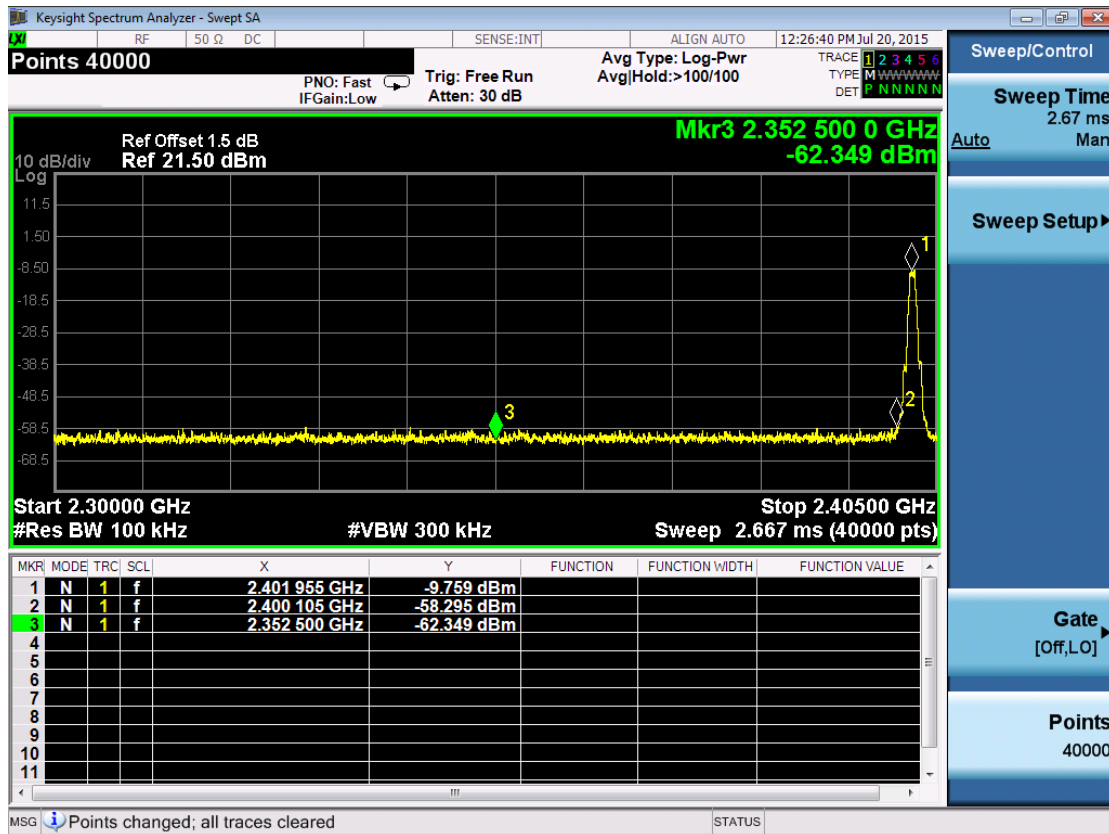
6.4 Test Protocol

Temperature: 25 °C
Relative Humidity: 55 %

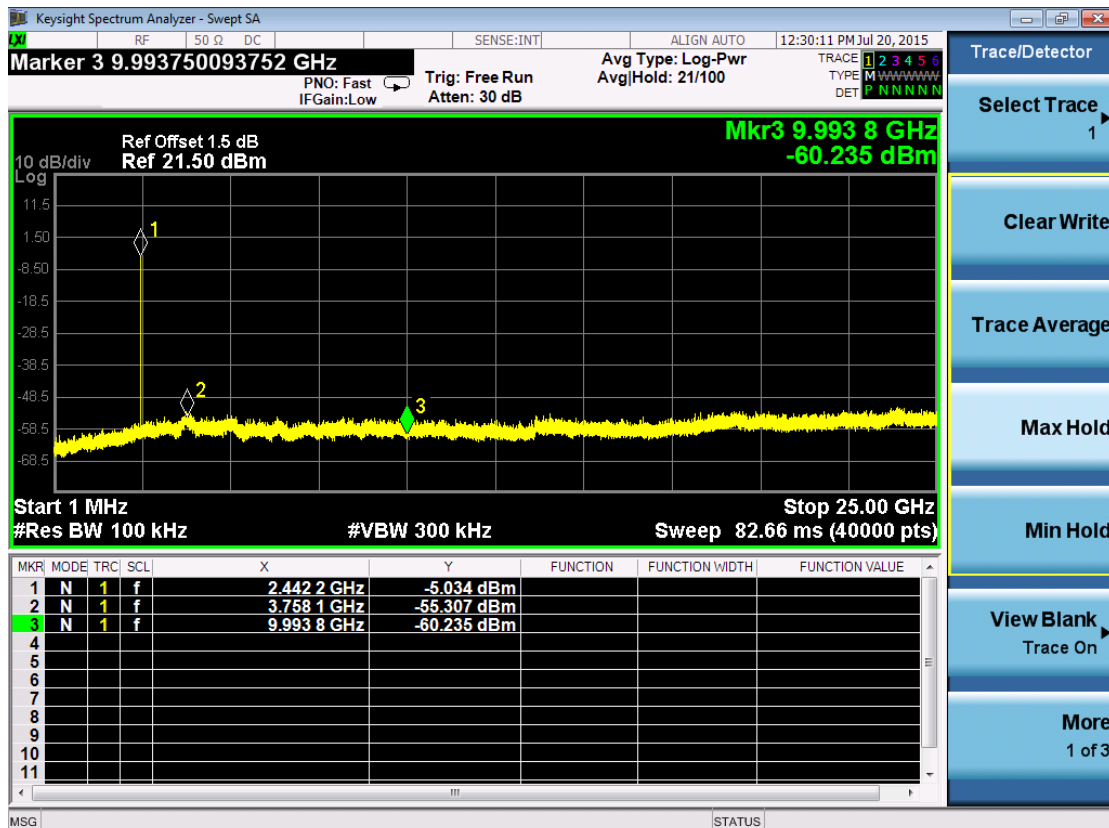
Test Mode	Frequency (MHz)	Results	
		Port 0	Port 1
BLE	2402	>30dBc	/
	2442	>30dBc	/
	2480	>30dBc	/

2402MHz

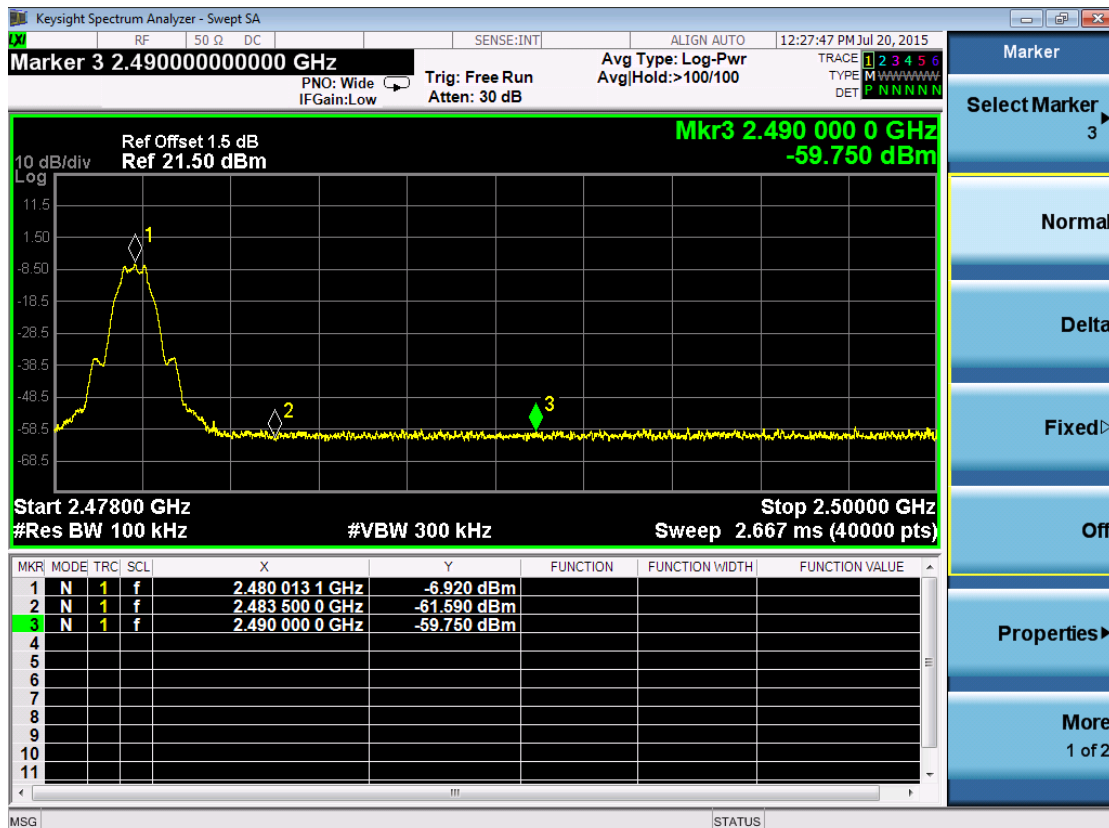
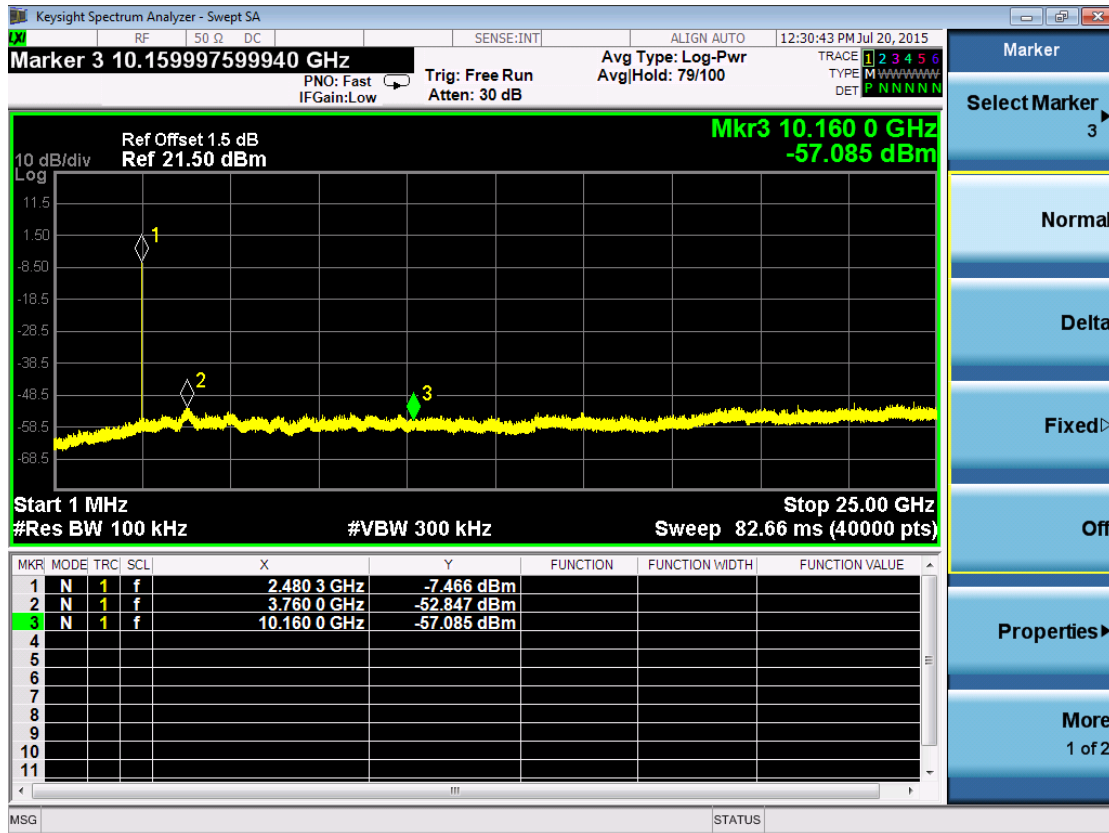




2442MHz



2480MHz



7 Radiated Emissions in restricted frequency bands

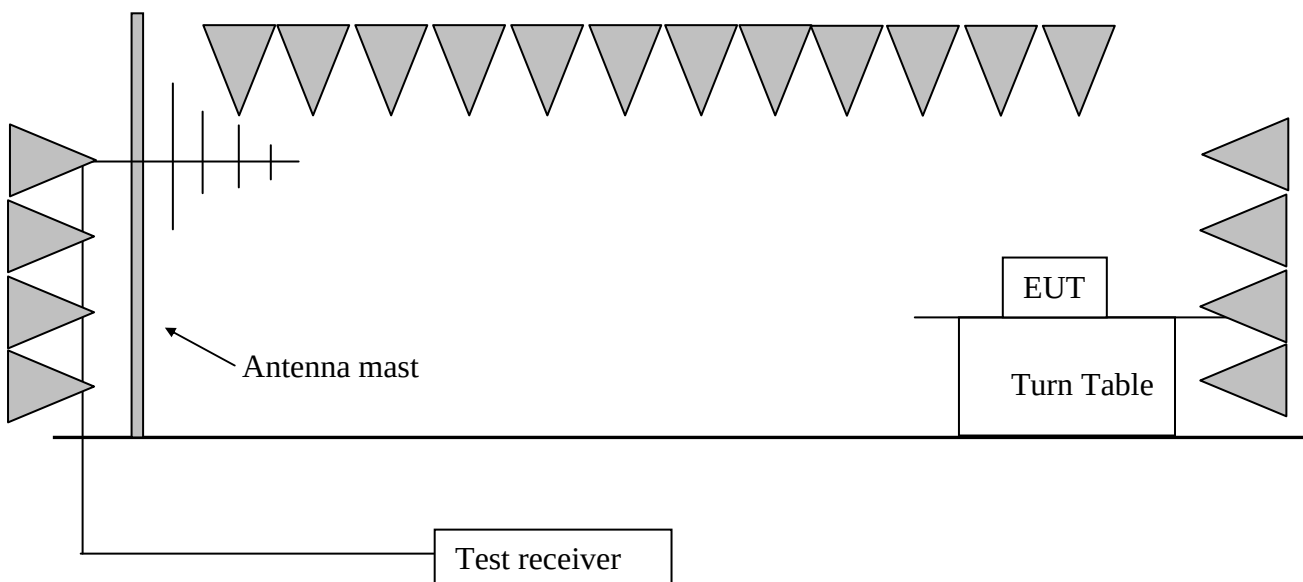
Test result: Pass

7.1 Test limit

The radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) showed as below:

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

7.2 Test Configuration



7.3 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 turntable 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 EUT was tested according to DTS test procedure of KDB558074 D01 DTS “Meas Guidance v03r03” for compliance to FCC 47CFR 15.247 requirements.

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

RBW = 300 Hz, VBW = 1 kHz (9 kHz~150 kHz);
RBW = 10 kHz, VBW = 30 kHz (150 kHz~30MHz);
RBW = 100 kHz, VBW = 300 kHz (30MHz~1GHz for PK)
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.

7.4 Test Protocol

Temperature: 25 °C
Relative Humidity: 55 %

Freq (MHz)	Antenna	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
2402	V	2402.16	37.80	81.80	/	/	PK
	H	66.93	8.70	38.70	40.00	1.30	PK
	H	344.91	16.60	40.30	46.00	5.70	PK
	V	482.92	20.20	39.20	46.00	6.80	PK
	V	2390.00	37.69	52.30	54.00	1.70	PK
	V	3612.81	-6.20	41.90	54.00	12.10	PK
	V	4812.55	-3.50	43.60	54.00	10.40	PK
2442	V	2443.59	37.89	85.00	/	/	PK
	H	66.93	8.70	38.70	40.00	1.30	PK
	H	344.91	16.60	40.30	46.00	5.70	PK
	V	482.92	20.20	39.20	46.00	6.80	PK
	V	3667.80	-6.20	41.00	54.00	13.00	PK
	V	4884.01	-3.40	43.40	54.00	10.60	PK
2480	V	2479.63	38.05	81.30	/	/	PK
	H	66.93	8.70	38.70	40.00	1.30	PK
	H	344.91	16.60	40.30	46.00	5.70	PK
	V	482.92	20.20	39.20	46.00	6.80	PK
	V	2483.50	38.15	52.30	54.00	1.70	PK
	H	3739.47	-6.20	41.60	54.00	12.40	PK
	V	4960.93	-3.30	42.80	54.00	11.20	PK

8 Power line conducted emission

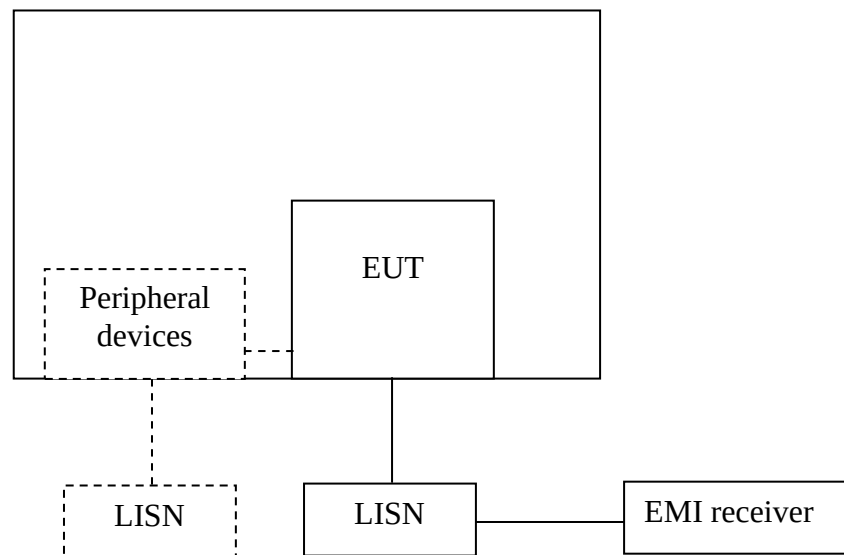
Test result: Pass

8.1 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.

8.2 Test configuration



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

8.3 Test procedure and test set up

Measured levels of ac power-line conducted emission shall be the emission voltages from the voltage probe, where permitted, or across the 50 Ω LISN port (to which the EUT is connected), where permitted, terminated into a 50 Ω measuring instrument. All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer. For those measurements using a LISN, the 50 Ω measuring port is terminated by a measuring instrument having 50 Ω input impedance. All other ports are terminated in 50 Ω loads.

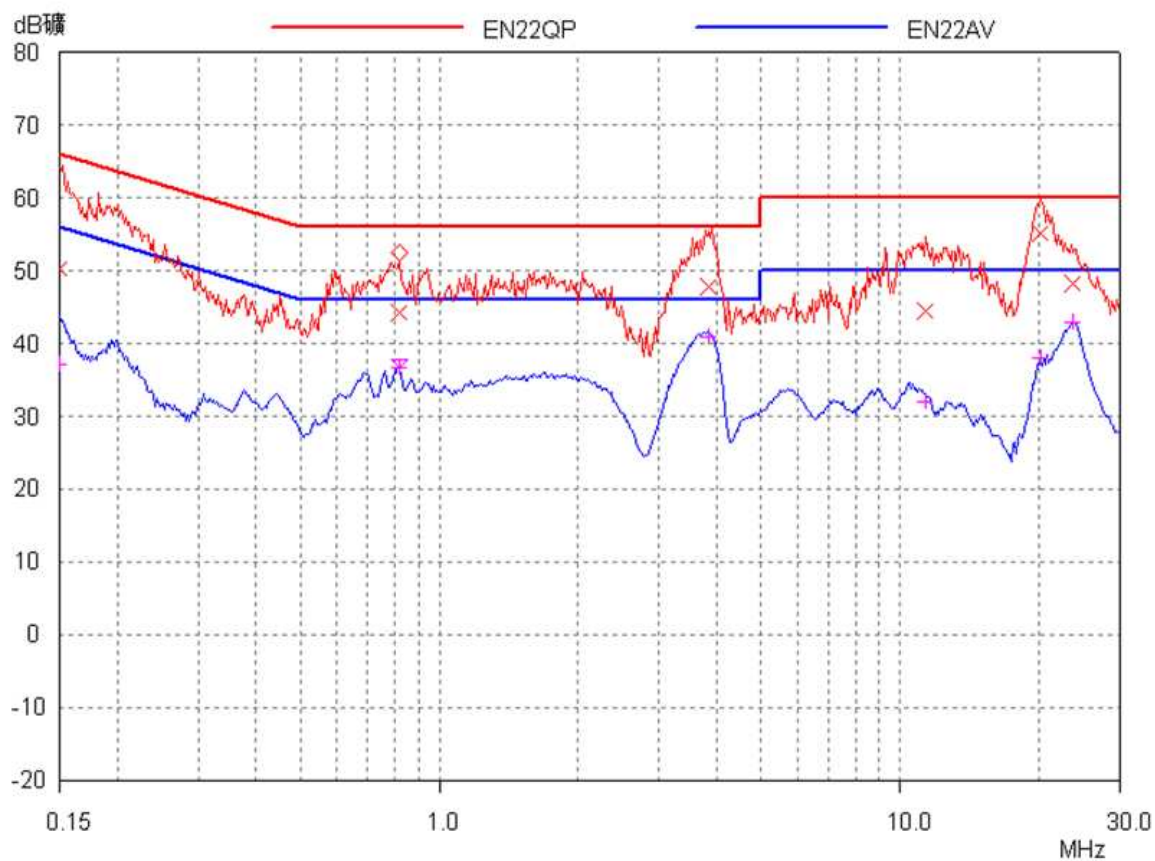
Tabletop devices shall be placed on a platform of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The vertical conducting plane or wall of an RF-shielded (screened) room shall be located 40 cm to the rear of the EUT. Floor-standing devices shall be placed either directly on the reference ground-plane or on insulating material as described in ANSI C63.4. All other surfaces of tabletop or floor-standing EUTs shall be at least 80 cm from any other grounded conducting surface, including the case or cases of one or more LISNs.

The bandwidth of the test receiver is set at 9 kHz.

8.4 Test protocol

Temperature: 25 °C

Relative Humidity: 55 %



Frequency	Correct Factor (dB)	Corrected Reading (dBuV)		Limit (dBuV)		Margin (dB)	
		QP	AV	QP	AV	QP	AV
0.15(L)	3.00	50.34	37.14	66.00	56.00	15.66	18.86
0.82(L)	3.00	44.24	36.61	56.00	46.00	11.76	9.39
3.81 (N)	3.00	47.82	40.93	56.00	46.00	8.18	5.07
11.27 (L)	3.00	44.39	32.11	60.00	50.00	15.61	17.89
20.11 (N)	3.00	55.07	38.10	60.00	50.00	4.93	11.90
23.68 (L)	3.00	48.19	42.93	60.00	50.00	11.81	7.07
Remark: 1. Correction Factor (dB) = LISN Factor (dB) + Cable Loss (dB). 2. Margin (dB) = Limit - Corrected Reading.							

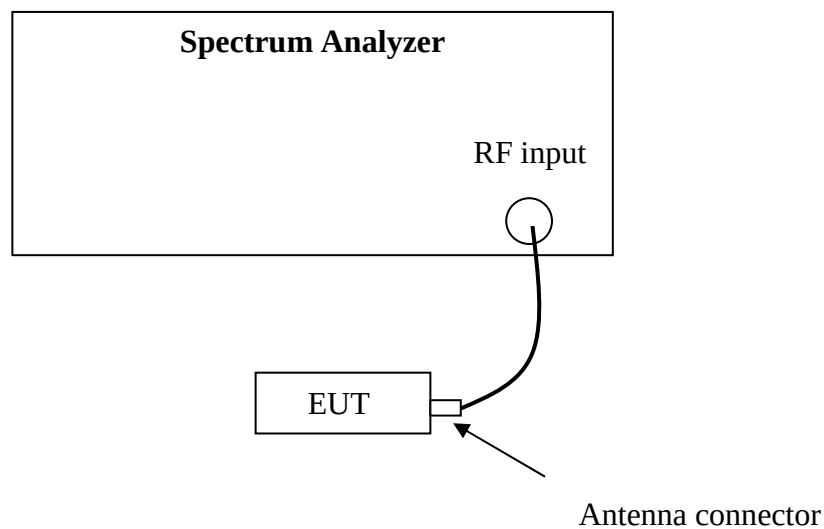
9 Occupied Bandwidth

Test Status: NA

9.1 Test limit

None

9.2 Test Configuration



9.3 Test procedure and test setup

The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.

The difference between the two recorded frequencies is the 99% occupied bandwidth.

9.4 Test protocol

Temperature : °C
Relative Humidity : %

Modulation	Frequency (MHz)	99% Bandwidth(MHz)	
		Port 0	Port 1
/	/	/	/
	/	/	/
	/	/	/
/	/	/	/
	/	/	/
	/	/	/
/	/	/	/
	/	/	/
	/	/	/