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시점확인 진본 2024-09-13 11:13:02 KST 공무시점확인센터

RF TEST REPORT

Report Number		KIEL2409-YW10506		
Applicant	Company Name	BETTERWHY		
	Address	24-13, 2saneopdanji 2-gil, Waegwan-eup, Chilgok-gun, Gyeongsangbuk-do, Republic of Korea		
Product	Product Name	EVCheck		
	Model Name	EVCHECK24BCV01		
	FCC/IC ID	2BKUPEVCHECK24BCV01		
	Manufacturer	DAEHYUN HI-TECH		
Other	Receipt Date	2024.08.21	Receipt Number	RQW2409-0352
	Issued Date	2024.09.12	Tested Date	2024.08.30 ~ 2024.09.06
Standards		FCC Part 15 Subpart C ANSI C63.13 : 2020		
Tested by		Dominic Sim (Sign)		
Approved by		David Jang (Sign)		

KIEL Institute

Daewoo Technopark A-403, 261, Doyak-ro, Bucheon-si, Gyeonggi-do, 14523, Korea.
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o This is certified that the above mentioned products have been tested for the sample provided by client.
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o This test report is irrelevant to KS Q ISO/IEC 17025 and KOLAS accreditation

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Revision History

Issued Date	Issued Report No.	Revisions
2024.09.12	KIEL2409-YW10506	Initial Issue

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Contents

1.0 LABORATORY INFORMATION 5

2.0 APPLICANT INFORMATION 5

3.0 SUMMARY OF TEST RESULTS 6

3.1 Meaurement Uncertainty 7

4.0 GENERAL INFORMATION 8

4.1 EUT Description 8
4.1.1 List of Accessories 8
4.1.2 Auxiliary Test equipment 8
4.1.3 Antenna Information 9
4.1.4 Channel List of EUT 9
4.2 Description of Test Mode 10
4.2.1 Test Mode Configuration 10
4.3 General Description of Applied Standard 13

5.0 TEST EQUIPMENT 14

6.0 TEST RESULTS 15

6.1 Antenna Requirement 15
6.1.1 Result 15
6.2 6 dB Bandwidth 16
6.2.1 Regulation 16
6.2.2 Test Procedure 16
6.2.3 Test Setup 16
6.2.4 Test Result 17
6.3 Maximum Peak Output Power 19
6.3.1 Regulation 19
6.3.2 Test Procedure 19
6.3.3 Test Setup 20
6.3.4 Test Result 21
6.4 Power Spectral Density 23
6.4.1 Regulation 23
6.4.2 Test Procedure 23
6.4.3 Test Setup 23
6.4.4 Test Result 24
6.5 Spurious Emission, Band edge and Restricted Bands 26
6.5.1 Regulation 26
6.5.2 Test Procedure 27
6.5.3 Test Setup 30
6.5.4 Test Result 32
6.6 AC Conducted Emissionss (150 kHz to 30 MHz) 41

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6.6.1 Regulation.....41
6.6.2 Test Procedure.....41
6.6.3 Test Setup 41
6.6.4 Test Result 42

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1.0 Laboratory Information

Laboratory Name	KIEL Institute
Location	1-1, Gilju-ro, Bucheon-city, Gyeonggi-do, Korea 14505
FCC Registration No.	KR0167 (RRA accredited Lab.)
IC Registration No.	KR0167 (31291)
Phone	+82-32-325-7045
Fax	+82-32-670-8889

2.0 Applicant Information

Applicant Name	BETTERWHY
Address	24-13, 2saneopdanji 2-gil, Waegwan-eup, Chilgok-gun, Gyeongsangbuk-do, Republic of Korea
Manufacturer	DAEHYUN HI-TECH
Address	35-7, Geumo-daero 4-gil, Buksam-eup, Chilgok-gun, Gyeongsangbuk-do, Republic of Korea

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3.0 Summary of Test Results

Applied standard: FCC part 15, subpart C 15.247

FCC Part Section(s)	Test Item	Reference	Result
15.247 (a)(2)	6 dB Channel Bandwidth (DTS Bandwith)	Section 6.2	P
15.247 (b)(3)	Maximum Conducted Output Power	Section 6.3	P
15.247 €	Power Spectral Density	Section 6.4	P
15.247 (d)	Band Edge / Out-of-Band Emissions (Conducted Spurious Emission)	Section 6.5	P
15.205 15.209	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Section 6.5	P
15.207	AC Power Line Conducted Emissions (150 kHz – 30 MHz)	Section 6.6	P

(Note 1) P = Pass, NC = Not comply, NT = Not Tested, NA = Not Applicable
(Note 2) The general test methods used to test on this devices are ANSI C63.10.
(Note 3) Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
(Note 4) For emission test from 9 ㎑ to 30 ㎒,
Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30 m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

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3.1 Meaurement 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 Items	Frequency Range	Expanded Uncertainty U = kUc (*k* = 2)
Conducted Emission at main ports	150 kHz – 30 MHz	3.24 dB
Radiated Spurious Emissions	9 kHz – 30 MHz	3.39 dB
	30 MHz – 1 GHz	5.14 dB
	1 GHz – 18 GHz	3.18 dB
	18 GHz – 40 GHz	4.54 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of k = 2.

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4.0 General Information

4.1 EUT Description

Product name	EVCheck
Basic model	EVCHECK24BCV01
Product S/N	-
Variant model(s)	-
Model Difference	-
Power supply	DC 12 V
Modulation	GFSK
Transfer Rate	BLE : 1 [Mbps]
Operating Frequency	2 402 ~ 2 480 [MHz]
Number of channel	40 channels
Output Power	3.83 dBm (2.42 mW)
Antenna Type	PCB Pattern(1T1R)
Antenna Connector	Integral antenna

(Note 1) The above equipment has been tested by KIEL Institute, 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.

4.1.1 List of Accessories

Accessories	Brand	Model	Manufacturer	Specification
-	-	-	-	-

4.1.2 Auxiliary Test equipment

Accessories	Brand	Model	Manufacturer	Specification
Laptop	Lenovo IdeaPad S500 Touch	20248	Lenovo PC HK Limited	-
AC Adapter(Laptop)	Lenovo	ADLX45NCC3A	CHICONY POWER TECHNOLOGY (SUZHOU) CO.,LTD.	Input: AC 100 V ~ 240 V / 50 ~ 60 Hz Ouput: DC 20 V

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4.1.3 Antenna Information

Antenna	Type	Frequency Range	Peak Gain
Ant A (Bluetooth)	PCB Pattern	2 400 MHz – 2 483.5 MHz	3.42 dBi

4.1.4 Channel List of EUT

Bluetooth							
Channel	Frequency [MHz]	Channel	Frequency [MHz]	Channel	Frequency [MHz]	Channel	Frequency [MHz]
0	2 402	10	2 422	20	2 442	30	2 462
1	2 404	11	2 424	21	2 444	31	2 464
2	2 406	12	2 426	22	2 446	32	2 466
3	2 408	13	2 428	23	2 448	33	2 468
4	2 410	14	2 430	24	2 450	34	2 470
5	2 412	15	2 432	25	2 452	35	2 472
6	2 414	16	2 434	26	2 454	36	2 474
7	2 416	17	2 436	27	2 456	37	2 476
8	2 418	18	2 438	28	2 458	38	2 478
9	2 420	19	2 440	29	2 460	39	2 480

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4.2 Description of Test Mode

4.2.1 Test Mode Configuration

- Axis worst case

Pre-Scan has been performed to determine the worst case axis between antenna port, XYZ axis and frequency band.

EUT Configuration	Applicable to	Description
	Ant A(Bluetooth)	
Transmission	X axis	-

- Radiated Emission (Below 1 GHz, Above 18 GHz, and AC Power line conducted emission) worst case

Radiated emission below 1 GHz, above 18 GHz and AC power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Tested Mode	Tested Channel	Packet Type	Description
LE1M	39	1 Mbps	-

- Radiated Emission (Above 1 GHz)

Radiated emission above 1 GHz was performed with the EUT set to transmit Low/Mid/High channels.

Tested Mode	Tested Channel	Data Rate / Packet Type	Description
LE1M	0, 19, 39	1 Mbps	-

- Antenna Port Conducted Measurement

This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

Tested Mode	Tested Channel	Data Rate / Packet Type	Description
LE1M	0, 19, 39	1 Mbps	-

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- Test Conditon

Applecable to	Environmental Conditions	Test Voltage	Tested by
Radiated emissions(< 1GHz)	(21.5 ± 2) ºC, (43.7 ± 3) % R.H.	DC 12 V	Dominic Sim
Radiated emissions(> 1GHz)	(23.2 ± 2) ºC, (45.6 ± 3) % R.H.	DC 12 V	Dominic Sim
AC power line emission	(20.4 ± 2) ºC, (57.6 ± 3) % R.H.	DC 12 V	Dominic Sim
Antenna port conducted	(22.3 ± 2) ºC, (45.2 ± 3) % R.H.	DC 12 V	Dominic Sim

- Worst case of data rates

Transmission	Test Mode	Bandwidth [MHz]	Worst Case Data Rate / Packet Type
SISO	LE1M	1	1 Mbps

Test Mode	Data Rate	Max Peak Output Power
LE1M	1 Mbps	3.83 dBm

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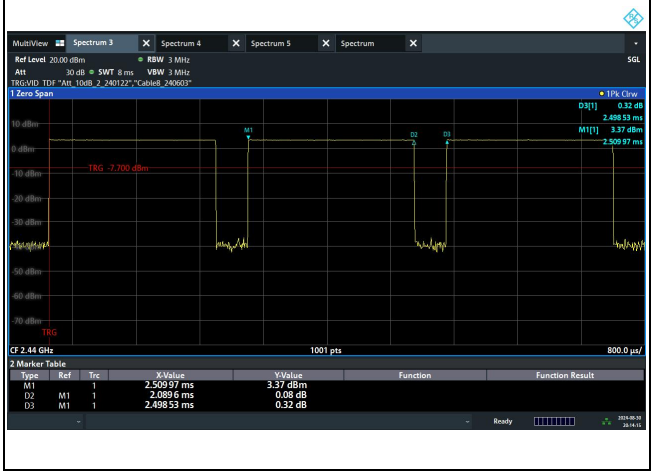
- Duty Cycle of Test Signal

Test Mode	On Time [msec]	Period [msec]	Duty cycle X [Linear]	Duty Cycle [%]	DCCF [dB]
LE1M	2.090	2.499	0.836	83.63	0.78

- Test Plots of Duty Cycle

LE1M



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4.3 General Description of Applied Standard

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

FCC CFR 47 Part 15, Subpart C (§15.247)
KDB 558074 D01 15.247 Meas Guidance v05r02
ANSI C63.10-2020

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

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5.0 Test Equipment

Test Equipment is traceable to the National Institute of Standards and Technology (NIST). Measurement antenna used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

	Equipment	Manufacturer	Model	S/N	Description	Cal Due
■	Spectrum Analyzer	Rohde & Schwarz	FSV3044	101034	10 Hz ~ 44 GHz	2025-01-22
■	Spectrum Analyzer	Rohde & Schwarz	FSV3030	102117	10 Hz ~ 30 GHz	2025-05-21
■	DC Power Supply	ODA	OPM-305D	ODA-04-0923-07960	DC 30 V, 5 A, 2Ch	2025-01-24
■	Signal Generator	Rohde & Schwarz	SMBV100B	101818	8 kHz ~ 6 GHz	2025-01-23
■	Vector Signal Generator	Rohde & Schwarz	SMB100A	180880	100 kHz ~ 40 GHz	2025-05-20
■	Attenuator	INMET	26A-10	2	DC to 26.5 GHz,10 dB.	2025-01-22
■	Attenuator	INMET	26A-10	3	DC to 26.5 GHz,10 dB.	2025-01-22
■	True RMS Multimeter	FLUKE	177	59570153	1000 V, 10 A	2025-01-24
■	Power Meter	Rohde & Schwarz	NRX	101971	DC ~ 40 GHz	2025-01-23
■	Power Sensor	Rohde & Schwarz	NRP-Z86	104137	50 MHz ~ 40 GHz	2025-05-27
■	Notch Filter	Micro-Tronics	BRM50702	G577	Stop band: 2 400 MHz ~ 2 500 MHz	2025-05-22
■	High Pass Filter	WT Microwave INC.	WT-A3331-HS	23041001-1	Pass band: 6.0 GHz ~ 24.5 GHz	2025-05-22
■	EMI Test Receiver	Rohde & Schwarz	ESW44	101737	1 Hz ~ 44 GHz	2025-01-22
■	EMI Test Receiver	Rohde & Schwarz	ESW26	103106	1 Hz ~ 26.5 GHz	2025-01-22
■	Active Loop Antenna	Rohde & Schwarz	HFH2-Z2E	100858	8.3 kHz ~ 30 MHz	2026-05-24
■	Bi-Log Antenna	SCHWARZBECK	VULB9168	00916	25 MHz ~ 2 GHz	2025-06-01
■	Horn Antenna	Rohde & Schwarz	HF907	102722	800 MHz ~ 18 GHz	2025-05-30
■	Horn Antenna	SCHWARZBECK	BBHA9170	00981	15 GHz ~ 40 GHz	2025-01-30
■	Preamplifier	Rohde & Schwarz	SCU-01F	010096	10 kHz ~ 1 GHz, 35 dB	2025-05-20
■	Preamplifier	Rohde & Schwarz	SCU-18F	180084	1 GHz ~ 18 GHz	2025-05-20
■	Preamplifier	EXYNOD	ELNA40-50	2305161	18 GHz ~ 40 GHz	2025-05-22
■	6dB Attenuator	Fairview Microwave	SA3N5W-06	190311029	DC ~ 3 GHz, 6 dB	2025-06-01
■	EMI Test Receiver	Rohde & Schwarz	ESR3	102444	10 Hz ~ 3 GHz	2025-05-20
■	LISN	Rohde & Schwarz	ENV216	102347	9 kHz ~ 30 MHz	2025-05-20
■	LISN	AFJ	LT32C/10	32031816260	9 kHz ~ 30 MHz	2025-05-20
■	Turntable	Innco	DT 3000-3t	-	-	-
□	Antenna Mast_L	Innco	MA4000-EP	-	-	-
■	Antenna Mast_R	Innco	MA4000-EP	-	-	-
■	Controller_1	Innco	CO3000	1062	-	-
■	Controller_2	Innco	CO3000	1063	-	-

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■	Software	Rohde & Schwarz	EMC32	101535	-	-
■	Software	Rohde & Schwarz	ELEKTRA	102739	-	-

6.0 Test Results

6.1 Antenna Requirement

Except from §15.203 of the FCC Rules/Regulations:
An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of the section.

- The antenna(s) of the EUT are permanently attached antenna
- There are no provisions for connection to an external antenna.

6.1.1 Result

The EUT complies with the requirement of §15.203

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6.2 6 dB Bandwidth

6.2.1 Regulation

§15.247(a)(2) : Systems using digital modulation techniques 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.

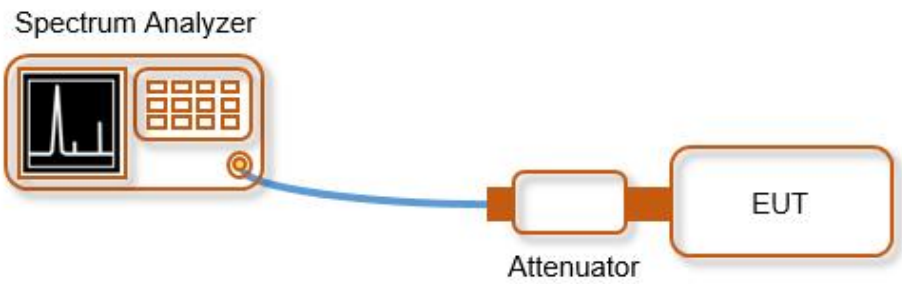
6.2.2 Test Procedure

The method of measurement used to test this DTS device is ANSI C63.10-2020.

The following procedures shall be used for measuring the OBW of the fundamental frequencies of certain unlicensed wireless devices, when required.

a) Use the following spectrum analyzer settings:
   1) Set RBW = shall be in the range of 1 % to 5 % of the OBW but not less than 100 kHz.
   2) Set the VBW ≥ [3 x RBW].
   3) Detector = Peak.
   4) Trace mode = Max hold.
   5) Sweep = No faster than coupled (auto) time.
b) Allow trace to stabilize
c) Use the N dB down function and set N value to -6.
d) In case of 99 % bandwidth, Use 99 % power bandwidth function.
e) A plot of the test results and setup description shall be included in the test report.

6.2.3 Test Setup



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6.2.4 Test Result

Test Mode	Channel	Frequency [MHz]	6 dB BW [MHz]
LE1M	0	2.402	0.650
	19	2.440	0.650
	39	2.480	0.650

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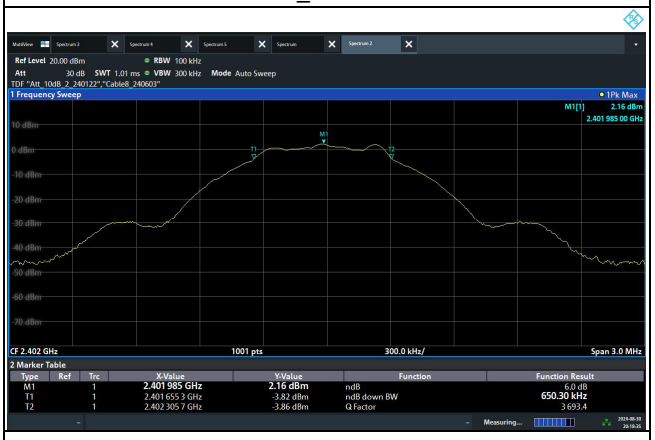
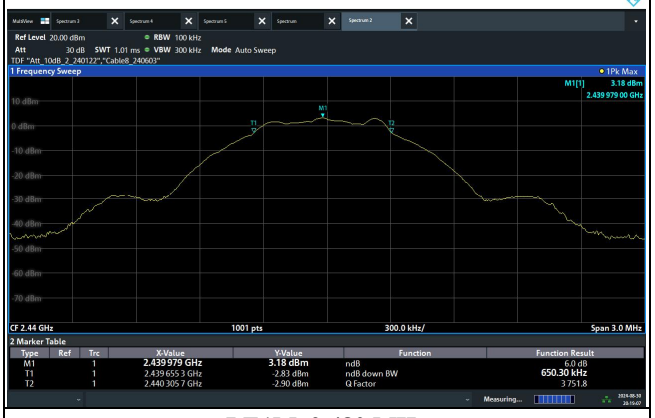
Test Plot of 6 dB Bandwidth

6 dB Bandwith

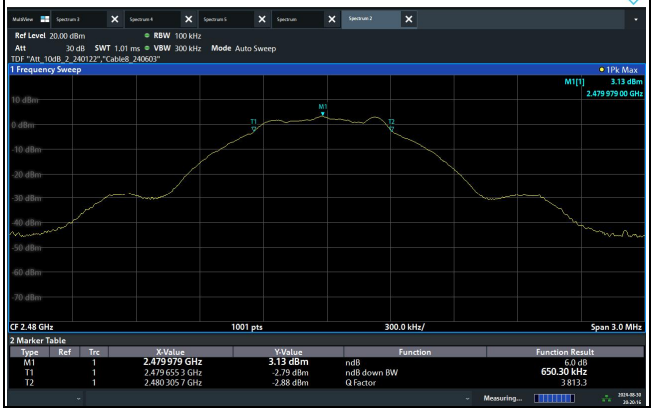
LE1M_2 402 MHz



LE1M_2 440 MHz



LE1M_2 480 MHz



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6.3 Maximum Peak Output Power

6.3.1 Regulation

§15.247(b)(3) : For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

§15.247(b)(4) : The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

6.3.2 Test Procedure

The method of measurement used to test this DTS device is ANSI C63.10-2020.

One of the following procedures may be used to determine the maximum peak conducted output power of a DTS EUT.

Peak Power Measurement

1. RBW ≥ DTS bandwidth

a) Use the following spectrum analyzer settings:
   1) Set the RBW ≥ DTS bandwidth.
   2) Set VBW ≥ [3 x RBW].
   3) Set Span ≥ [3 x RBW].
   4) Sweep time : No faster than coupled (auto) time.
   5) Detector = Peak.
   6) Trace mode = Max hold.

b) Allow trace to stabilize

c) Use peak marker function to determinie the peak amplitude level

Average Power Measurement

Measurement using a power meter.

a) Averge Power measurement using an RF average power meter, as follows:

1) The EUT is configured to transmit continuously, or to transmit with a constant duty cycle.
2) At all times when the EUT is transmitting, it shall be transmitting at its maximum power control level.
3) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

b) If the transmitter does not transmit continuously, measure the duty cycle, D, of the transmitter output signal.

c) Measure the average power of the transmitter.
This measurement is an average over both the ON and OFF periods of the transmitter.

d) Correct the measurement in dBm by adding [10 log (1 / D)], where D is the duty cycle.

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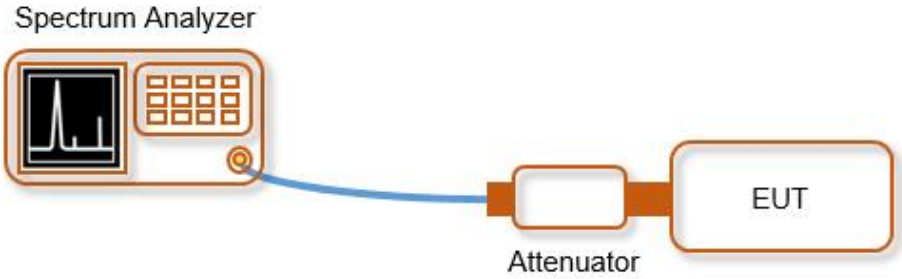
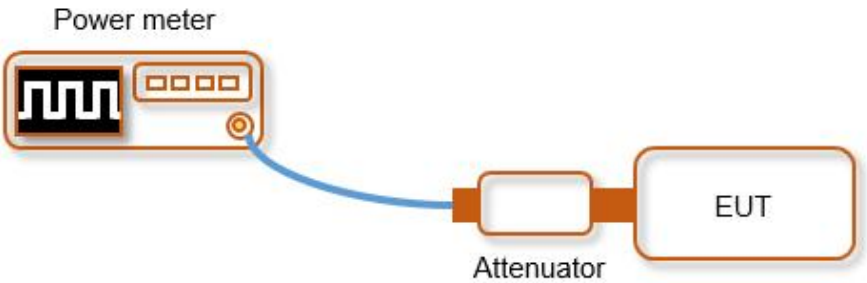
6.3.3 Test Setup





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6.3.4 Test Result

Test Mode	Channel	Frequency [MHz]	Peak Output Power [dBm]	Limit [dBm]	Margin [dB]
LE1M	0	2 402	2.81	30	27.19
	19	2 440	3.78		26.22
	39	2 480	3.83		26.17

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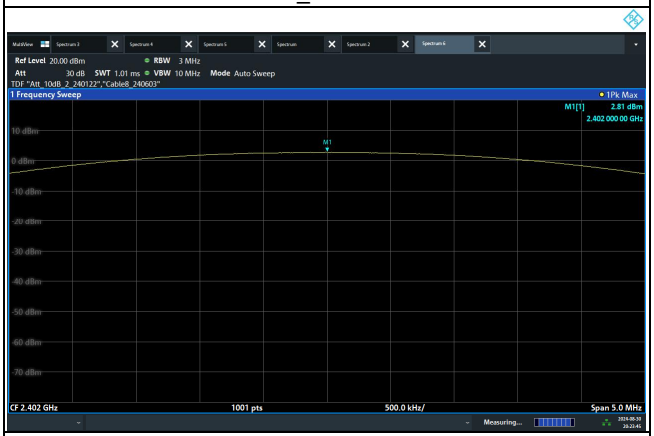
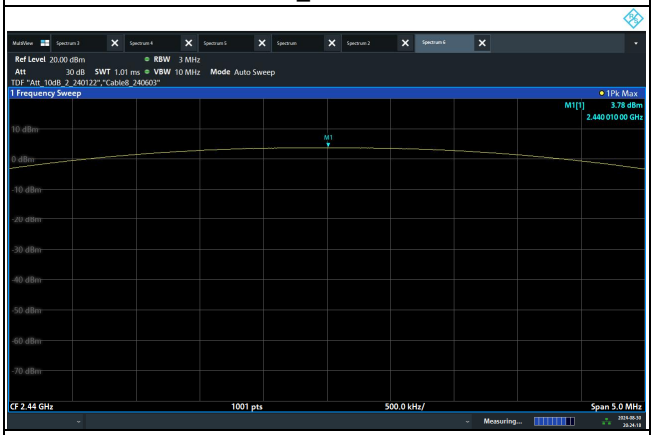
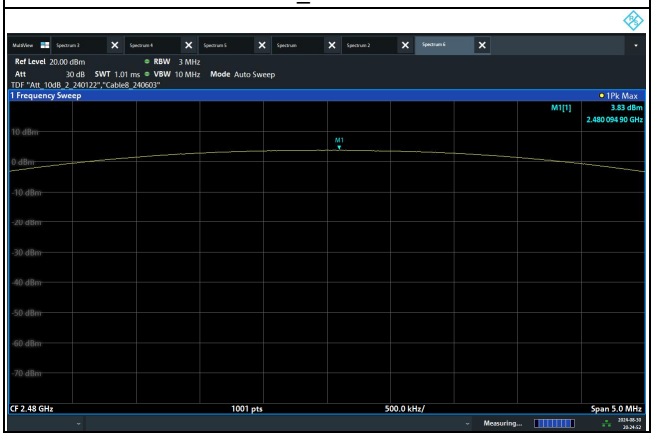
Test Plot of Peak Output power

Peak Output Power
LE1M_2 402 MHz



LE1M_2 440 MHz



LE1M_2 480 MHz