



FCC Test Report

Report No.: CKLK-ESH-P23060126B-1

FCC ID: 2BCCD-CSCU-ST-WFP01

Product: STICK LOGGER

Model: CSCU-ST-WF01/CSCU-ST-WFP01

Received Date: Jun.07, 2023

Test Date: Jun.07 to Jun.28, 2023

Issued Date: Jun.29, 2023

Applicant: CSI Solar Co. Ltd.

Address: 199 Lushan Road, SND, Suzhou, 215129 Jiangsu, P.R. China

Manufacturer: CSI Solar Co. Ltd.

Address: 199 Lushan Road, SND, Suzhou, 215129 Jiangsu, P.R. China

Issued By: BUREAU VERITAS ADT (Shanghai) Corporation

Lab Address: No. 829, Xinzhuan Road, Shanghai, P.R.China (201612)

**FCC Registration /
Designation Number:** 176467/ CN1213



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Release Control Record

Issue No.	Description	Date Issued
CKLK-ESH-P23060126B-1	Original release	Jun.29, 2023



1 Certificate of Conformity

Product: STICK LOGGER

Brand:  CanadianSolar

Model: CSCU-ST-WF01/CSCU-ST-WFP01

Applicant: CSI Solar Co. Ltd.

Test Date: Jun.07 to Jun.29, 2023

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)
ANSI C63.10:2020

The above equipment has been tested by **BUREAU VERITAS ADT (Shanghai) Corporation**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by :



, **Date:** Jun.29, 2023

Yan ZHOU

Project Engineer

Approved by :



, **Date:** Jun.29, 2023

Sean YU

RF Supervisor

2 Summary of Test Results

The EUT has been tested according to the following specifications:

47 CFR FCC Part 15, Subpart C (SECTION 15.247)			
FCC Clause	Test Item	Result	Remarks
15.203	Antenna Requirement	PASS	No antenna connector is used.
15.207	AC Power Conducted Emission	NA	EUT is powered by DC 5V-12V.
15.247(a)(2)	Minimum 6dB Bandwidth	PASS	Meet the requirement of limit.
15.247(b)	Conducted Output Power	PASS	Meet the requirement of limit.
15.247(e)	Power Spectral Density	PASS	Meet the requirement of limit.
15.247(d)	Conducted Band Edges Measurement	PASS	Meet the requirement of limit.
15.247(d)	Conducted Spurious Emissions	PASS	Meet the requirement of limit.
15.247(d)	Emissions in restricted frequency bands	PASS	Meet the requirement of limit.
15.205 / 15.209 / 15.247(d)	Radiated Emissions Measurement	PASS	Meet the requirement of limit.



2.1 Test Instruments

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Hybrid Antenna(30MHz-1GHz)	Schwarzbeck	VULB9168	E1A1012	8/18/2021	8/17/2023
Horn Antenna(1GHz -18GHz)	Schwarzbeck	BBHA9120D	E1A1017	7/25/2022	7/24/2024
Horn Antenna(18GHz-40GHz)	Com-Power	AH-840	E1A1040	7/25/2022	7/24/2024
Pre-Amplifier(0.1MHz~1300MHz)	Agilent	8447D	E1A2001	3/3/2023	3/2/2024
Pre-Amplifier(18GHz-40GHz)	EMC Instruments Corporation	EMC184045SE	E1A2008	8/12/2022	8/11/2023
EMI Test Receiver	R&S	ESR7	E1R1005	3/3/2023	3/2/2024
EMI Test Spectrum	Keysight	N9030B	E1S1003	8/30/2022	8/29/2023
Signal Analyzer	Keysight	N9020A	E1S1004	3/2/2023	3/1/2024
LISN(single phase)	Rohde&Schwarz	ENV216	E1L1011	9/2/2022	9/1/2023
RF Control Unit	Toscend	JS0806-2	E1C5003	N/A	N/A
Test Software	Toscend	JS32-CE	5.0.0.1	N/A	N/A
Test Software	Toscend	JS32-RE	5.0.0	N/A	N/A
Test Software	Toscend	JS1120-3	V3.2.22	N/A	N/A

2.2 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT:

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

Measurement	Frequency	Expanded Uncertainty ($k=2$) ($\pm$)
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.83 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.36 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	3.47 dB
	6GHz ~ 18GHz	3.75 dB
	18GHz ~ 40GHz	3.30 dB

2.3 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	STICK LOGGER
Brand	 CanadianSolar
Test Model	CSCU-ST-WF01/CSCU-ST-WFP01
Model Difference	--
Power Rating	DC 5V-12V
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	DSSS, OFDM
Operating Frequency	2412MHz-2462MHz
Number of Channel	802.11b, 802.11g and 802.11n (HT20):11 802.11n (HT40):9
Antenna Type	PIFA
Antenna Connector	--
Antenna Gain	2.92 dBi

Note:

1. For more details, please refer to the User's manual of the EUT.

Modulation Mode	TX /RX Function
802.11b	1TX / 1RX
802.11g	1TX / 1RX
802.11n (HT20)	1TX / 1RX
802.11n (HT40)	1TX / 1RX

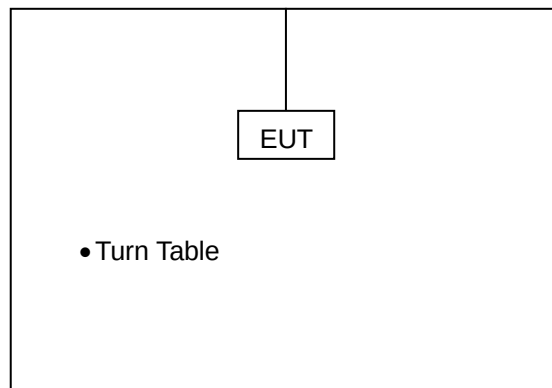
3.2 Description of Test Modes

11 channels are provided for 802.11b, 802.11g and 802.11n (HT20) and 7 channels are provided for 802.11n (HT40).

Channel	Frequency	Channel	Frequency
1	2412MHz	7	2442MHz
2	2417MHz	8	2447MHz
3	2422MHz	9	2452MHz
4	2427MHz	10	2457MHz
5	2432MHz	11	2462MHz
6	2437MHz	-	-

3.3 DESCRIPTION OF SYSTEM UNDER TEST

RADIATED TEST CONFIGURATION



3.3.1 Test Mode Applicability:

EUT Configure Mode	Applicable to				Description
	RE ≥ 1G	RE < 1G	PLC	APCM	
-	√	√	-	√	-

Note: EUT is powered by DC 5-12V so PLC test is NA.

Where **RE≥1G**: Radiated Emission above 1GHz

RE≤1G: Radiated Emission below 1GHz

PLC: Power Line Conducted Emission

APCM: Antenna Port Conducted Measurement

Radiated Emission Test (Above 1 GHz):

- ☒ 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.
- ☒ For different antenna gain, select high gain antenna for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0
-	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0
-	802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	6.5
-	802.11n (HT40)	3 to 9	3, 6, 9	OFDM	BPSK	13.5

Radiated Emission Test (Below 1 GHz):

- ☒ 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	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11b	1 to 11	1	DSSS	DBPSK	1.0

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	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11b	1 to 11	1	DSSS	DBPSK	1.0

Note: EUT is powered by DC 5-12V so PLC test is NA.

Antenna Port Conducted Measurement

- ☒ 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	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0
-	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0
-	802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	6.5
-	802.11n (HT40)	3 to 9	3, 6, 9	OFDM	BPSK	13.5

3.3.2 Test Condition:

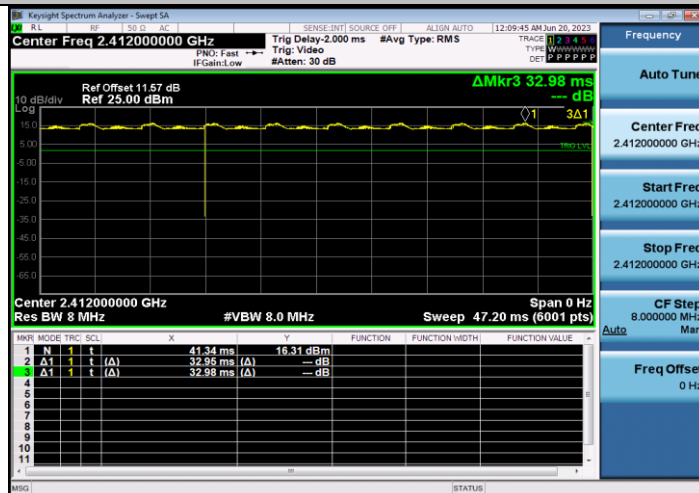
Applicable to	Normal Environmental Conditions	Normal Input Power
RE ≥ 1G	25deg. C, 60%RH	DC 12V
RE < 1G	25deg. C, 60%RH	DC 12V
PLC	--	--
APCM	25deg. C, 60%RH	DC 12V

Note: EUT is powered by DC 5-12V so PLC test is NA.

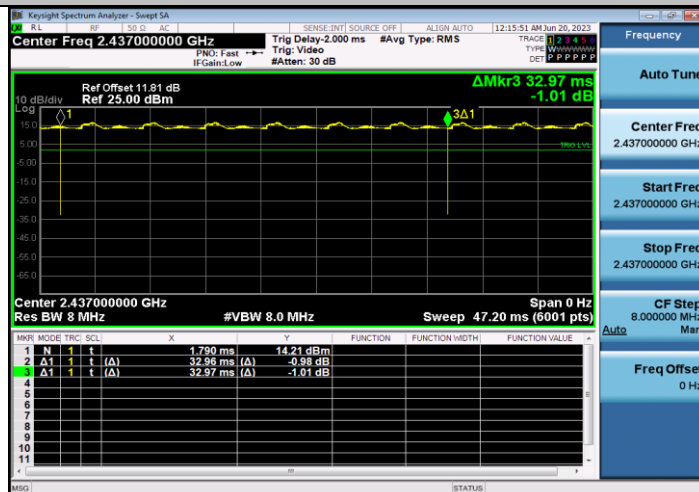
3.4 Duty Cycle of Test Signal

Test Mode	Antenna	Channel [MHz]	Duty Cycle [%]	10log(1/x) Factor[dB]
11B	Ant1	2412	99.91	0.00
		2437	99.97	0.00
		2462	99.94	0.00
11G	Ant1	2412	99.64	0.02
		2437	99.46	0.02
		2462	99.46	0.02
11N20SISO	Ant1	2412	99.61	0.02
		2437	99.61	0.02
		2462	99.41	0.03
11N40SISO	Ant1	2422	98.80	0.05
		2437	98.80	0.05
		2452	98.80	0.05

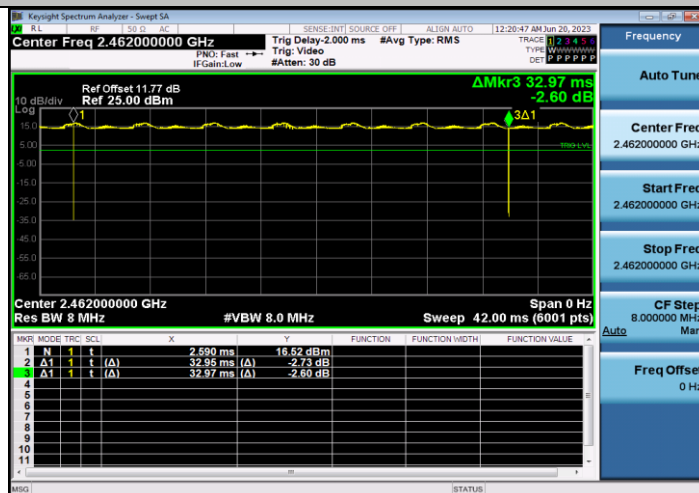
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11B_Ant1_2437



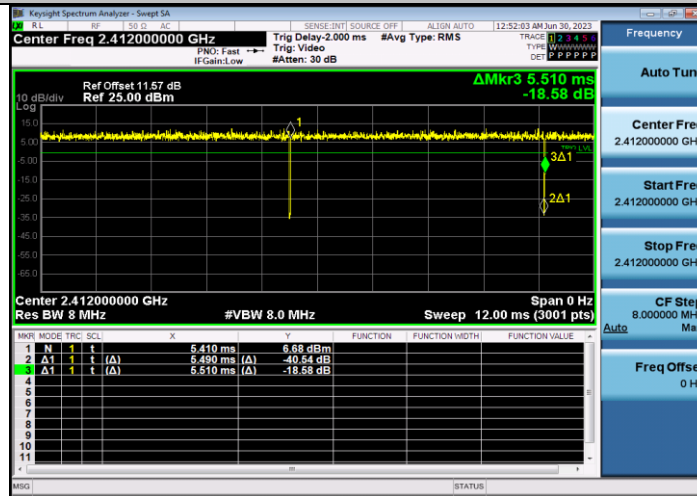
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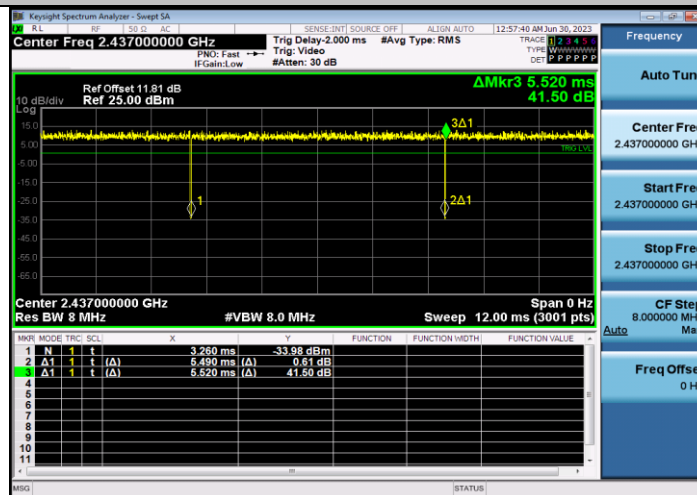


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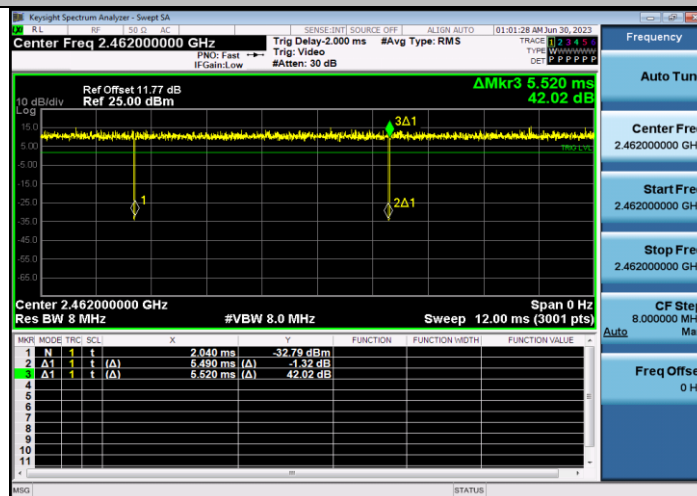
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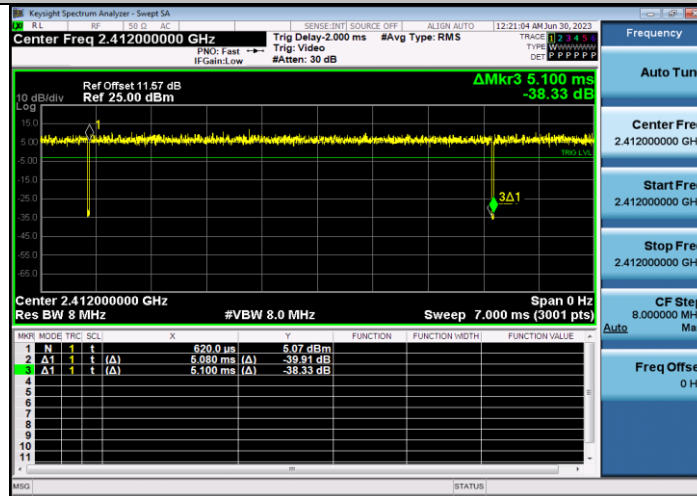
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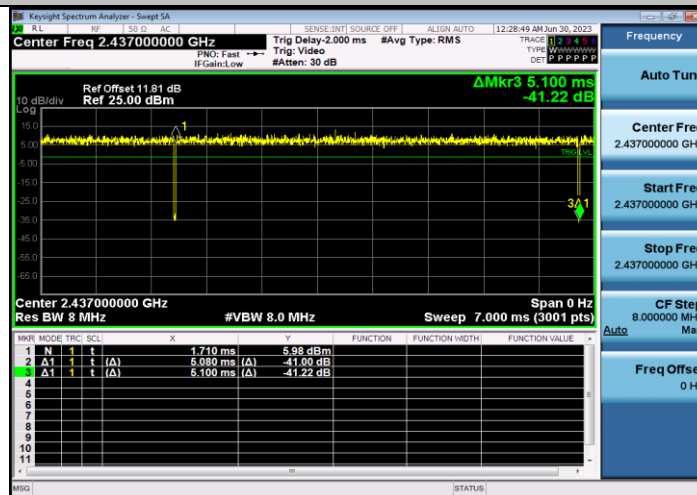
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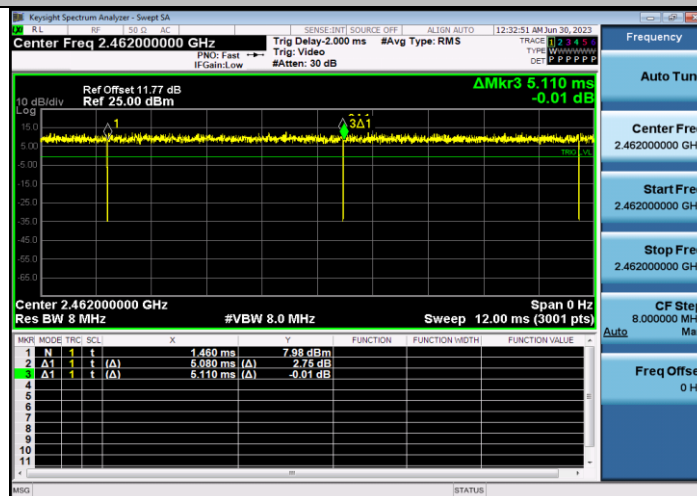
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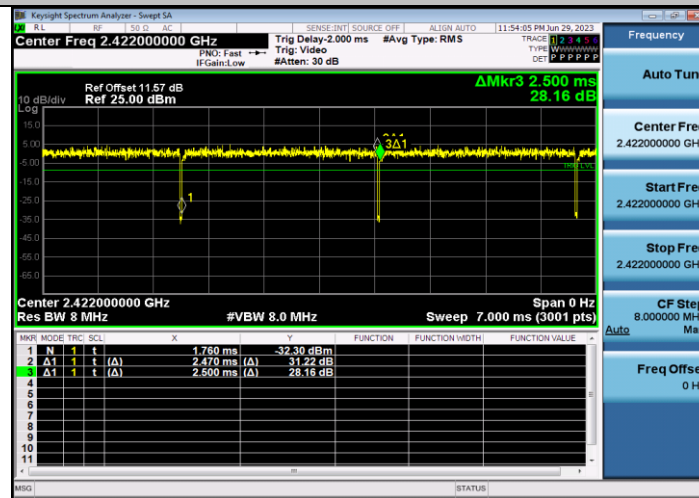
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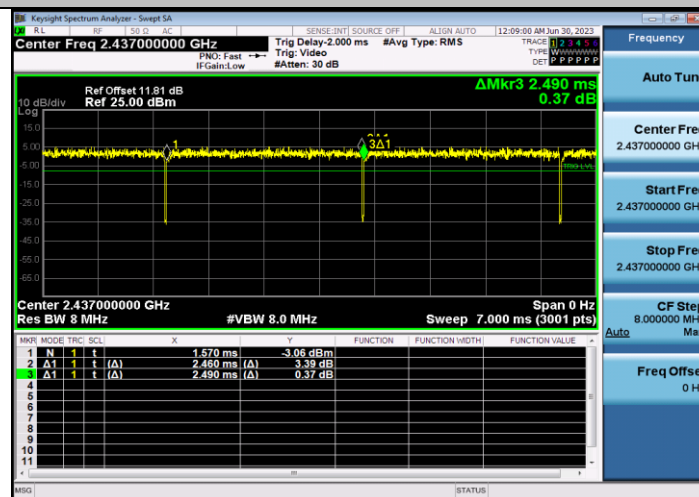
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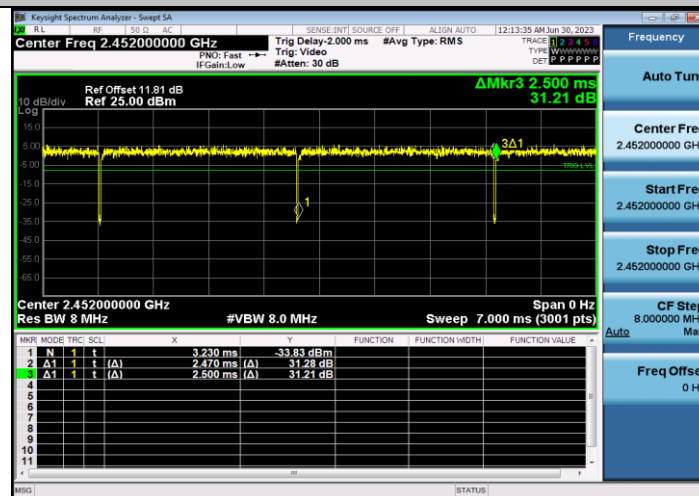
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11N40SISO_Ant1_2437



11N40SISO_Ant1_2452



3.5 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 standard:

FCC Part 15, Subpart C (15.247)

KDB 558074 D01 DTS Meas Guidance v05r02

ANSI C63.10:2020

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

4 Test Procedure and Results

4.1 AC Power Conducted Emission

4.1.1 Limits

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.

4.1.2 Test Procedures

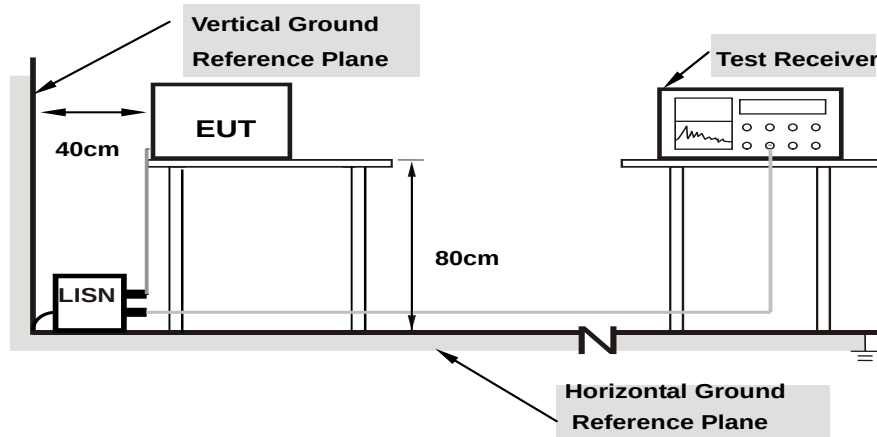
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

4.1.3 Deviation from Test Standard

No deviation.

4.1.4 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).

4.1.5 EUT Operating Conditions

Same as 4.1.6.

4.1.6 Test Results

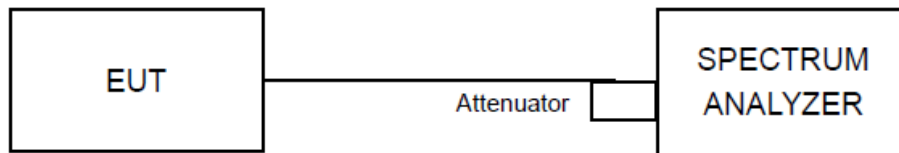
EUT is powered by DC 5-12V so PLC test is NA.

4.2 Minimum 6dB Bandwidth

4.2.1 Limit

For digital modulation systems, the minimum 6dB bandwidth shall be at least 500 kHz

4.2.2 Test Setup



4.2.3 Test Procedures

The EUT was tested according to DTS test procedure of “KDB558074 D01 DTS Meas Guidance” for compliance to FCC 47CFR 15.247 requirements (clause 8.2).

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW $\geq$ 3 RBW, peak detector with maximum hold) is implemented by the instrumentation function.

4.2.4 Deviation of Test Standard

No deviation.

4.2.5 Test Results

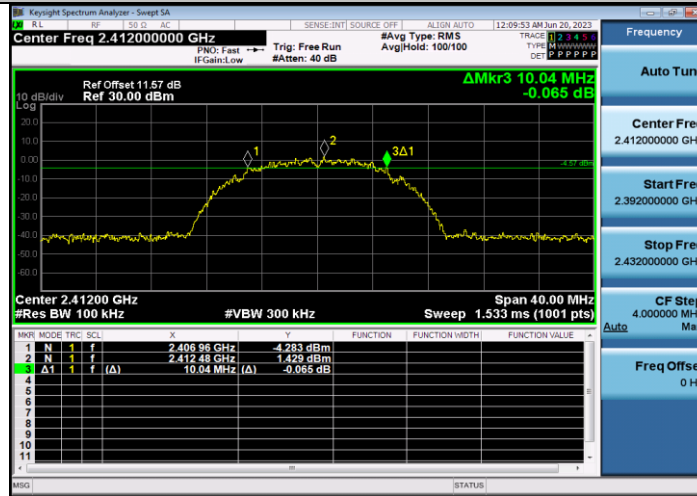
DTS Bandwidth

TestMode	Antenna	Frequency[MHz]	DTS BW [MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	10.040	0.5	PASS
		2437	9.280	0.5	PASS
		2462	8.680	0.5	PASS
11G	Ant1	2412	16.360	0.5	PASS
		2437	16.320	0.5	PASS
		2462	16.360	0.5	PASS
11N20SISO	Ant1	2412	17.760	0.5	PASS
		2437	17.560	0.5	PASS
		2462	17.560	0.5	PASS
11N40SISO	Ant1	2422	33.520	0.5	PASS
		2437	32.800	0.5	PASS
		2452	32.800	0.5	PASS

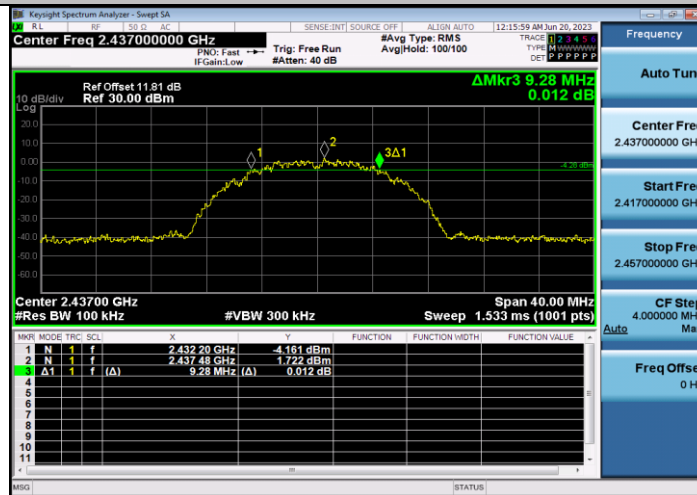


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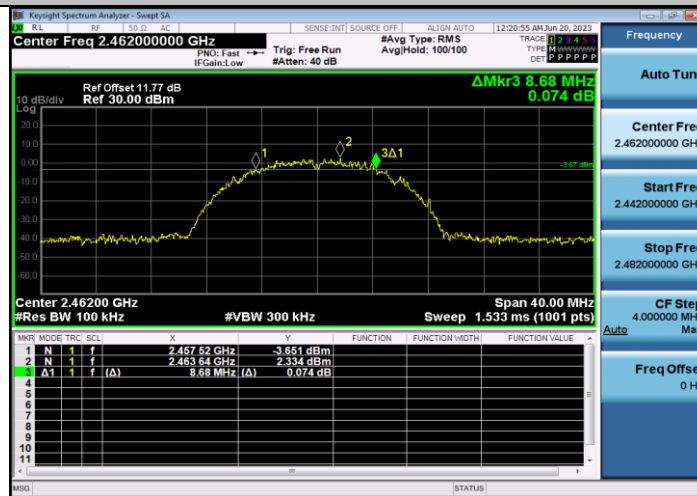
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11B_Ant1_2437



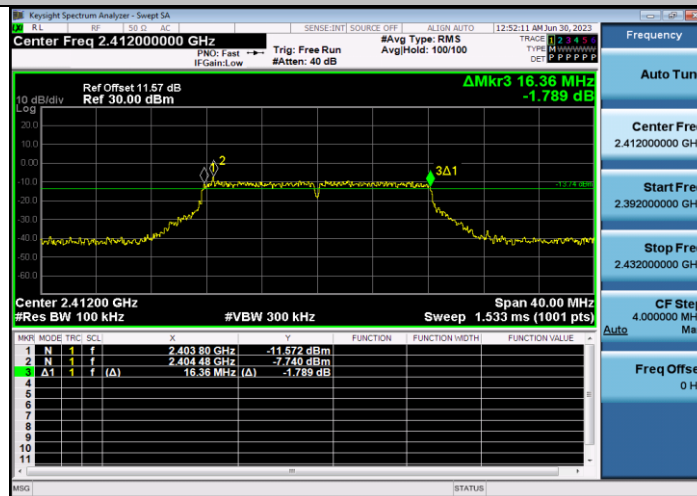
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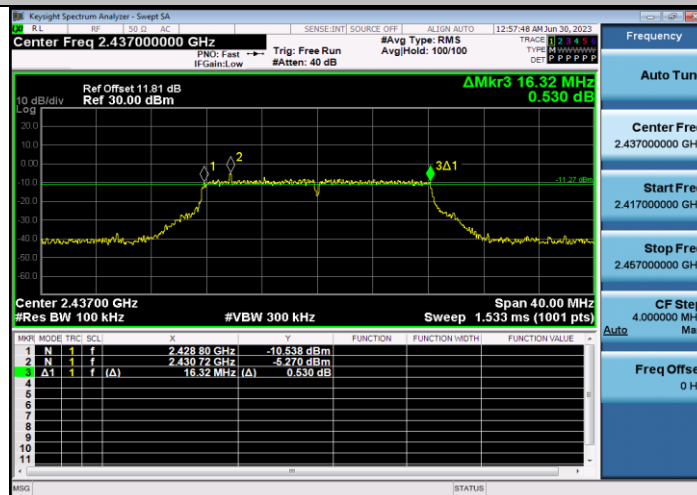


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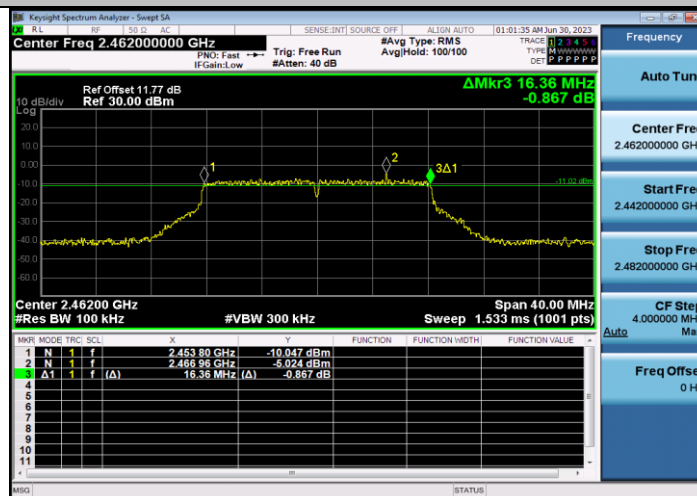
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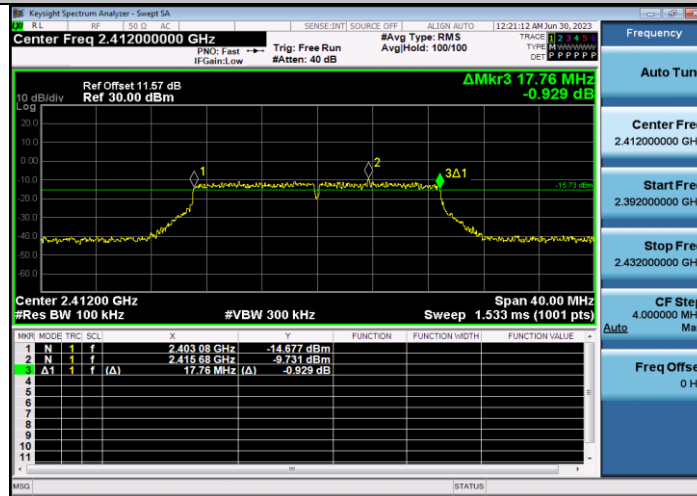
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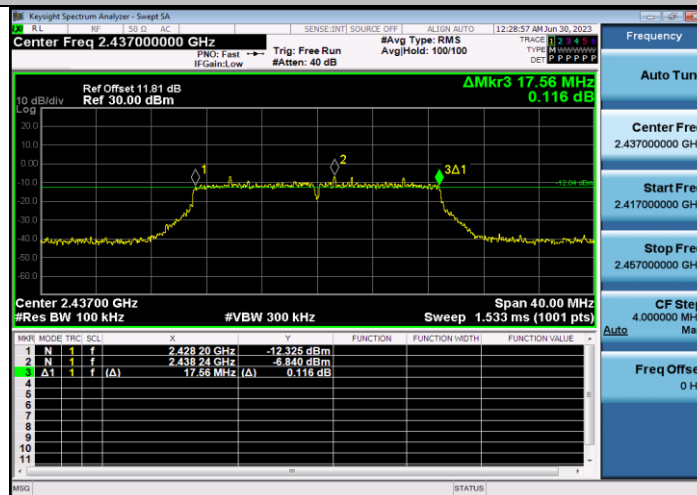
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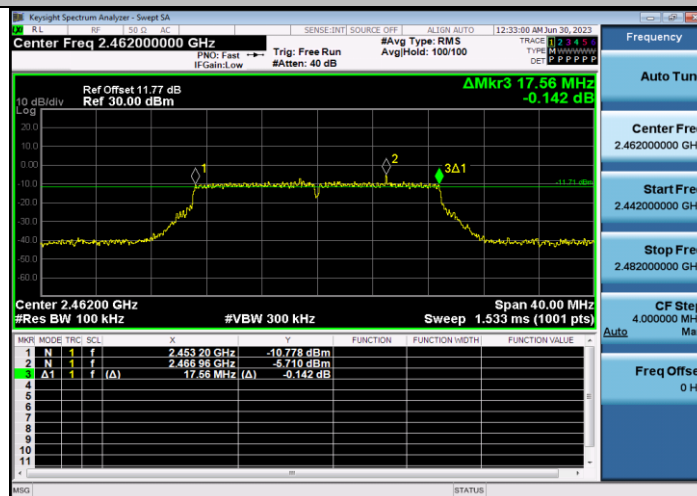
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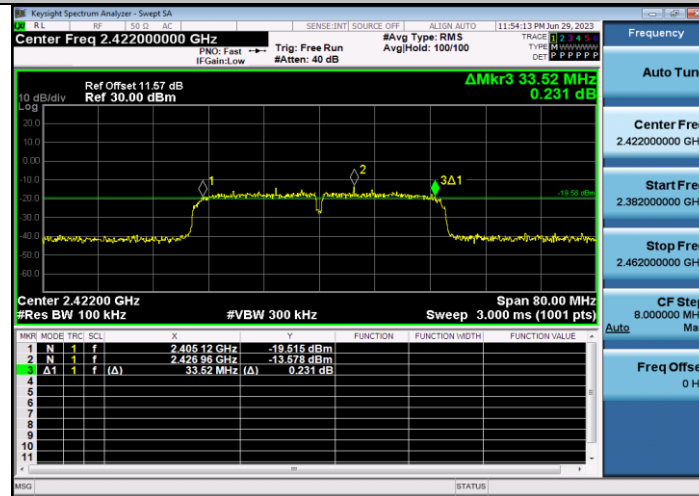
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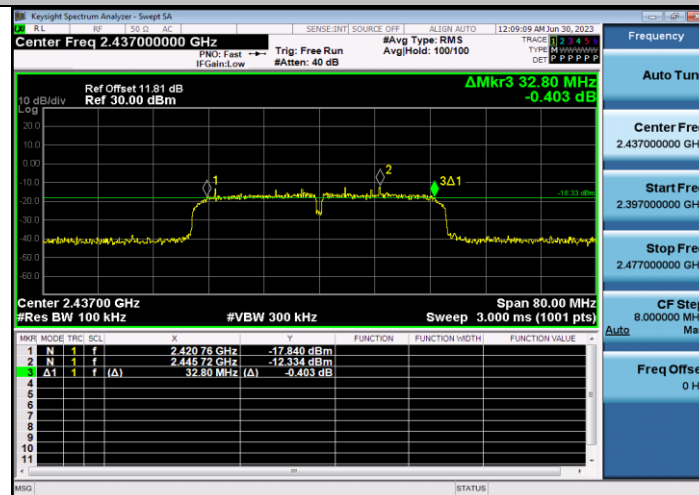
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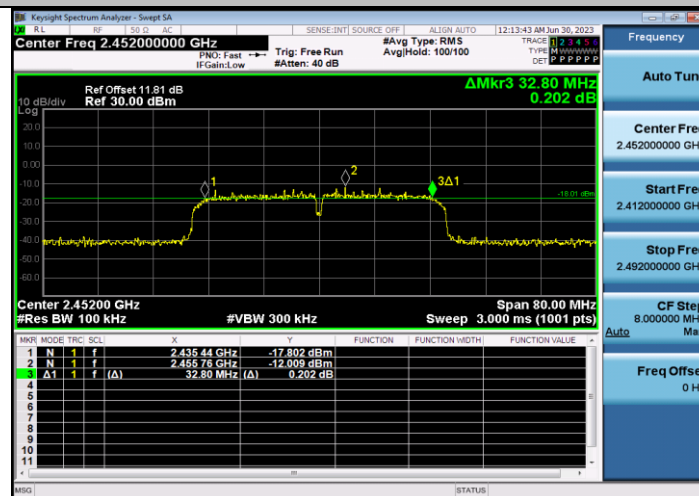
11N40SISO_Ant1_2422



11N40SISO_Ant1_2437



11N40SISO_Ant1_2452



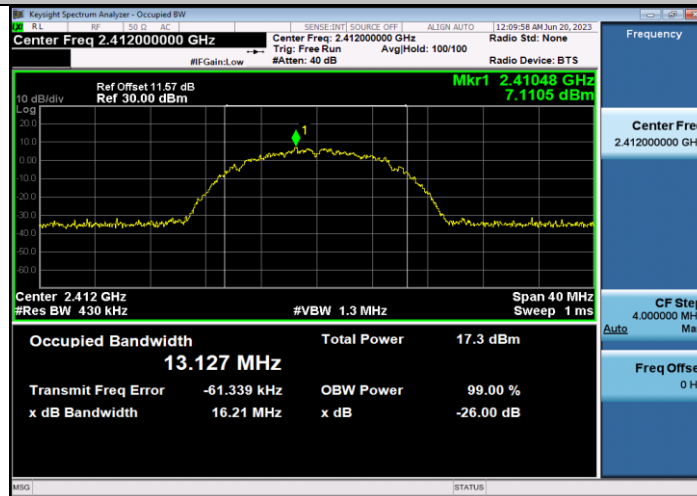
99% Bandwidth

TestMode	Antenna	Channel Frequency[MHz]	OCB [MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	13.127	---	PASS
		2437	13.098	---	PASS
		2462	13.076	---	PASS
11G	Ant1	2412	17.834	---	PASS
		2437	17.631	---	PASS
		2462	17.604	---	PASS
11N20SISO	Ant1	2412	18.653	---	PASS
		2437	18.579	---	PASS
		2462	18.665	---	PASS
11N40SISO	Ant1	2422	36.058	---	PASS
		2437	35.893	---	PASS
		2452	35.762	---	PASS

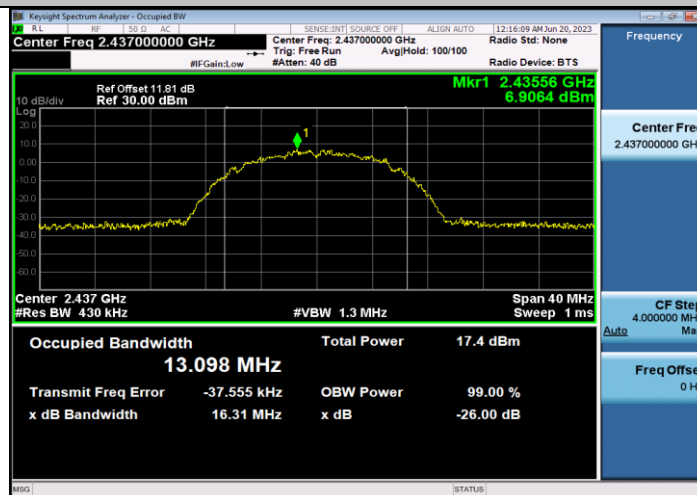


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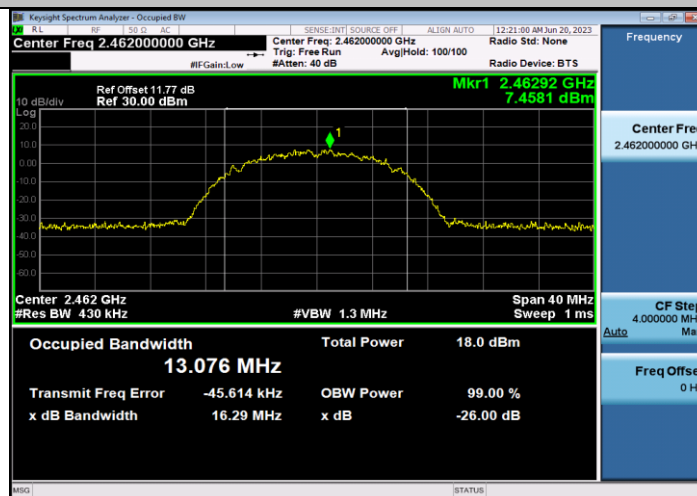
11B_Ant1_2412



11B_Ant1_2437



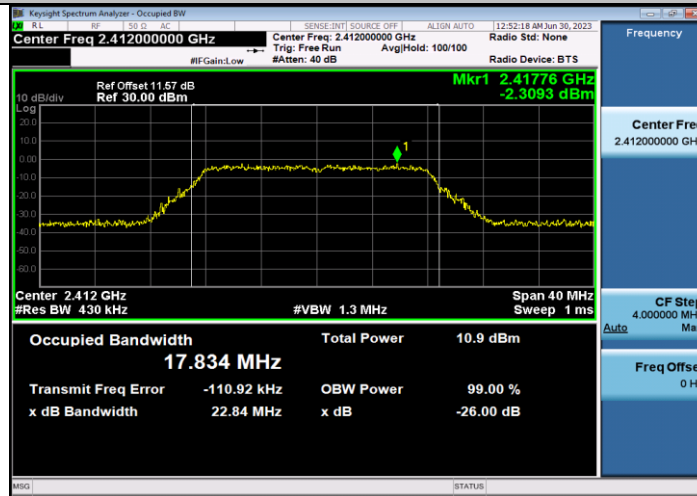
11B_Ant1_2462



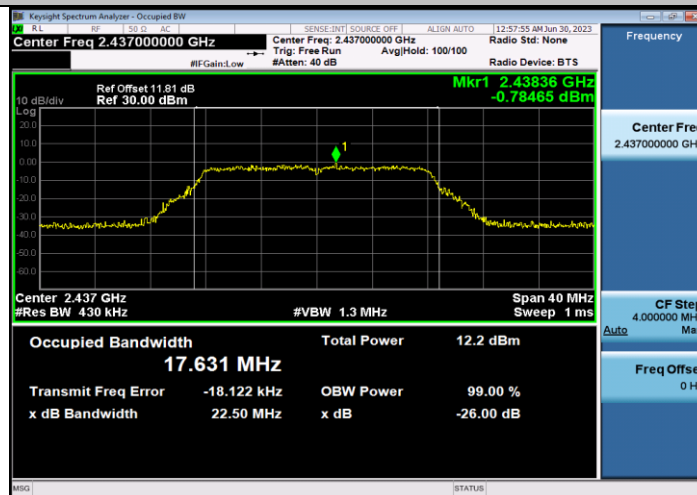


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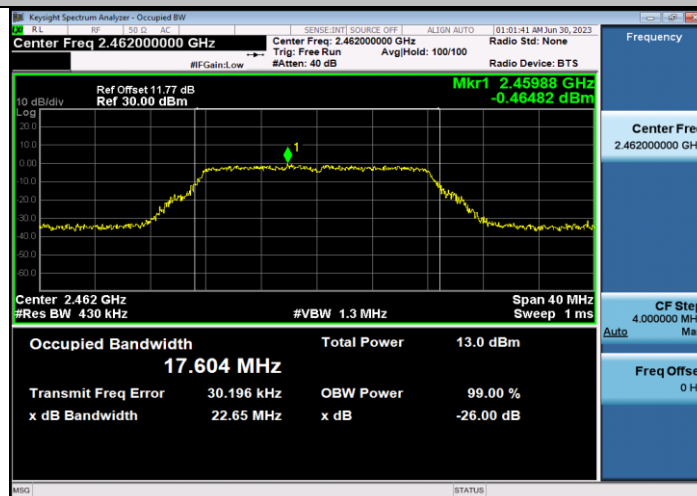
11G_Ant1_2412



11G_Ant1_2437



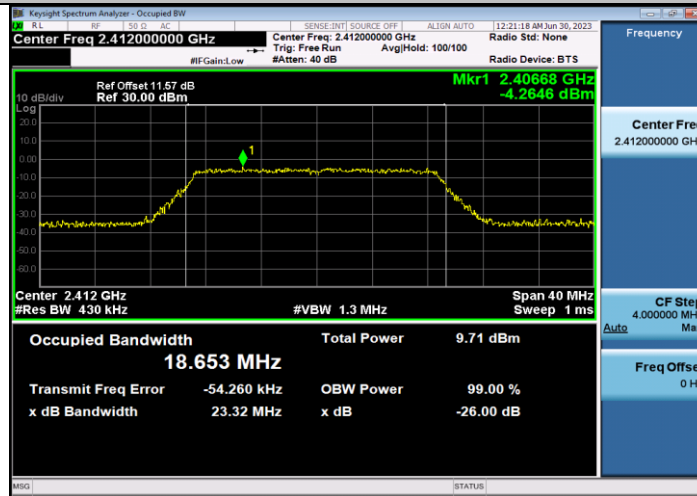
11G_Ant1_2462



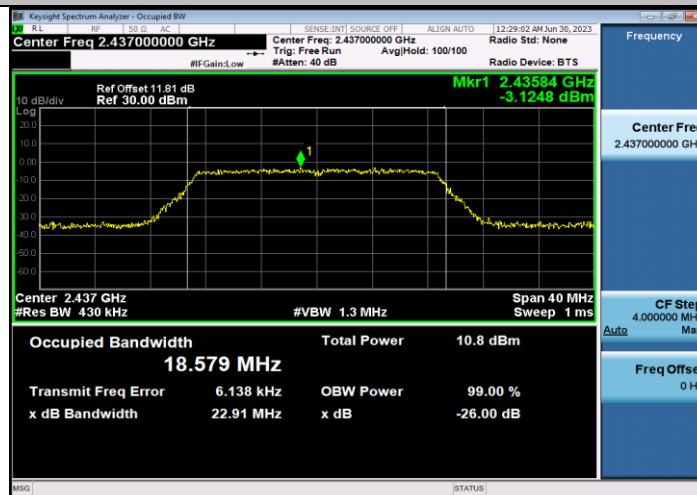


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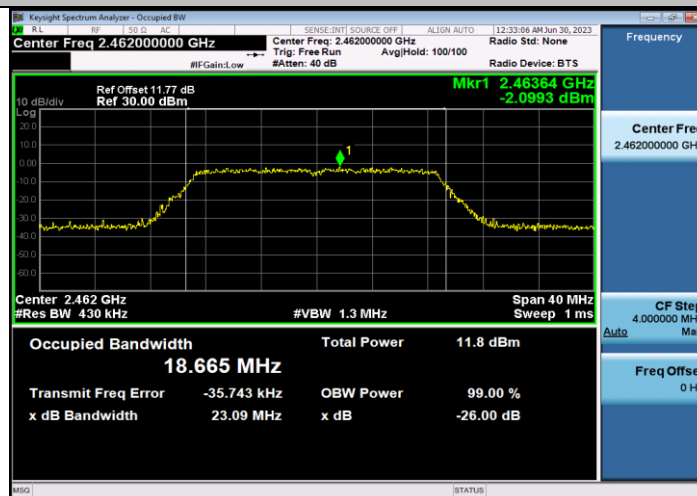
11N20SISO_Ant1_2412



11N20SISO_Ant1_2437



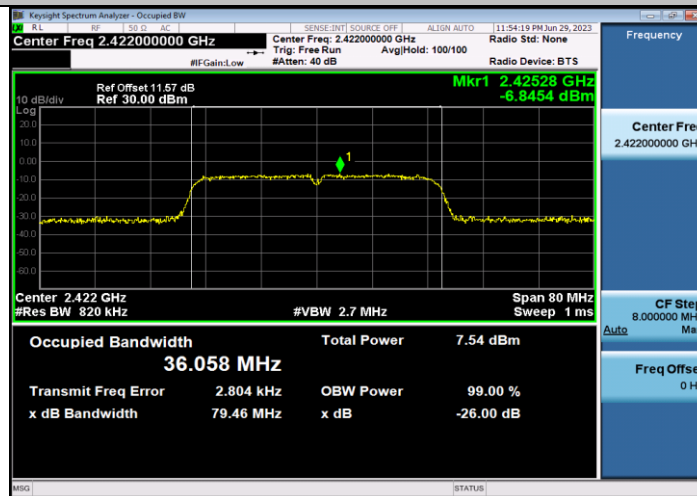
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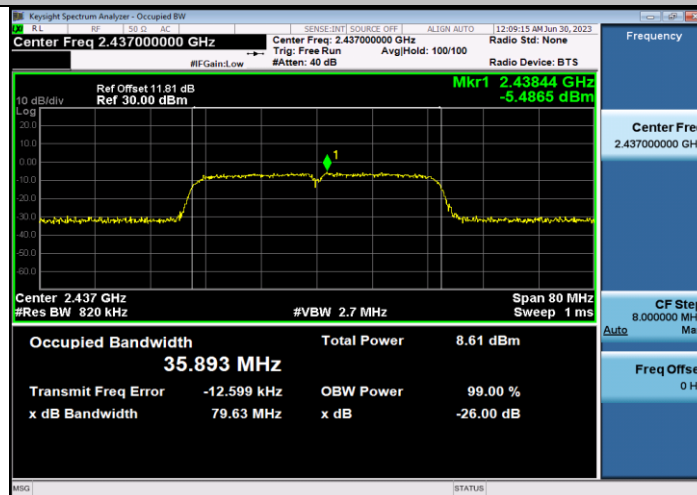


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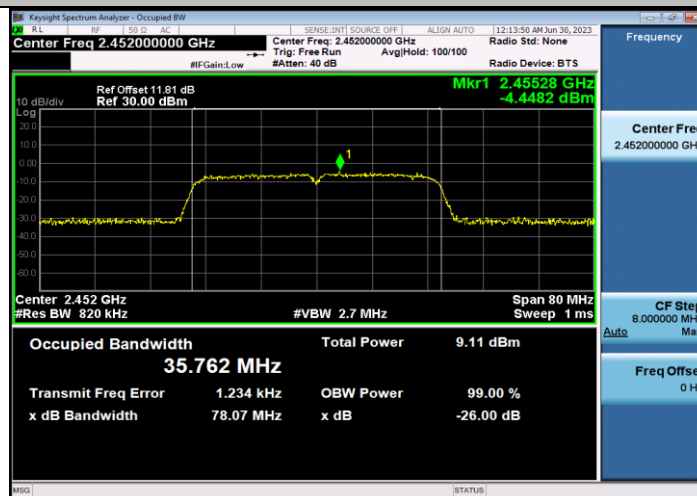
11N40SISO_Ant1_2422



11N40SISO_Ant1_2437



11N40SISO_Ant1_2452

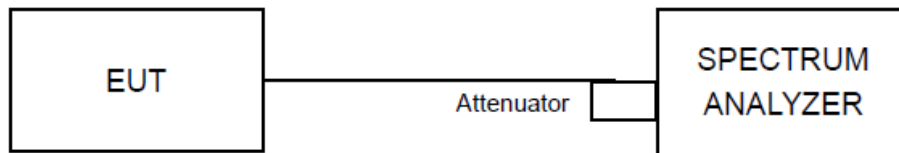


4.3 Conducted Output Power

4.3.1 Limit

For systems using digital modulation in the 2400-2483.5 MHz bands: 1 Watt (30 dBm)

4.3.2 Test Setup



4.3.3 Test Procedures

The EUT was tested according to DTS test procedure of “KDB558074 D01 DTS Meas Guidance” 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 Section 6.0.
- b) Set span to at least 1.5 OBW.
- c) Set RBW = 1 % to 5 % of the OBW, not to exceed 1 MHz.
- d) Set VBW $\geq$ 3 RBW.
- e) Number of points in sweep $\geq$ 2 span / RBW. (This gives bin-to-bin spacing $\leq$ 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 $10 \log (1/0.25) = 6$ dB if the duty cycle is 25 %.

4.3.4 Deviation of Test Standard

No deviation.

4.3.5 Test Results

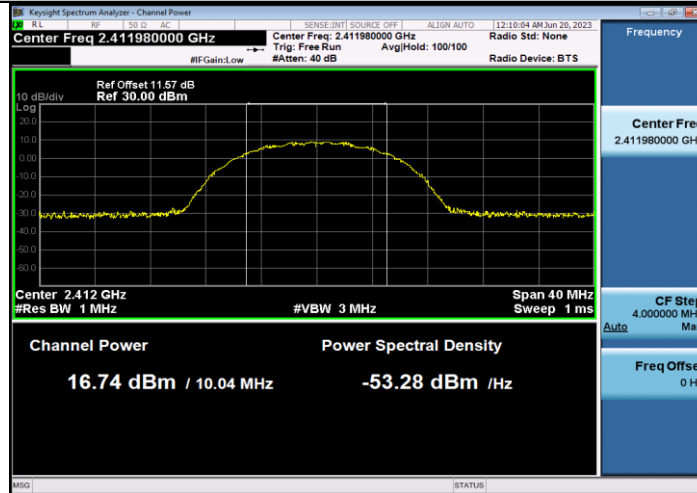
Test Mode	Antenna	Channel [MHz]	Level [dBm]	10log(1/x) Factor[dB]	Power [dBm]	Limit [dBm]	Verdict
11B	Ant1	2412	16.74	0.00	16.74	≤30	PASS
		2437	16.92	0.00	16.92	≤30	PASS
		2462	17.28	0.00	17.28	≤30	PASS
11G	Ant1	2412	11.91	0.02	11.93	≤30	PASS
		2437	13.21	0.02	13.23	≤30	PASS
		2462	13.93	0.02	13.95	≤30	PASS
11N20SISO	Ant1	2412	10.69	0.02	10.71	≤30	PASS
		2437	11.80	0.02	11.82	≤30	PASS
		2462	12.81	0.02	12.84	≤30	PASS
11N40SISO	Ant1	2422	7.78	0.02	7.83	≤30	PASS
		2437	8.70	0.02	8.75	≤30	PASS
		2452	9.17	0.02	9.22	≤30	PASS

Test Mode	Antenna	Channel [MHz]	Power [dBm]	Gain [dBi]	EIRP [dBm]	EIRP Limit [dBm]	Verdict
11B	Ant1	2412	16.74	2.92	19.66	≤36.00	PASS
		2437	16.92	2.92	19.84	≤36.00	PASS
		2462	17.28	2.92	20.2	≤36.00	PASS
11G	Ant1	2412	11.93	2.92	14.85	≤36.00	PASS
		2437	13.23	2.92	16.15	≤36.00	PASS
		2462	13.95	2.92	16.87	≤36.00	PASS
11N20SISO	Ant1	2412	10.71	2.92	13.63	≤36.00	PASS
		2437	11.82	2.92	14.74	≤36.00	PASS
		2462	12.84	2.92	15.76	≤36.00	PASS
11N40SISO	Ant1	2422	7.83	2.92	10.75	≤36.00	PASS
		2437	8.75	2.92	11.67	≤36.00	PASS
		2452	9.22	2.92	12.14	≤36.00	PASS

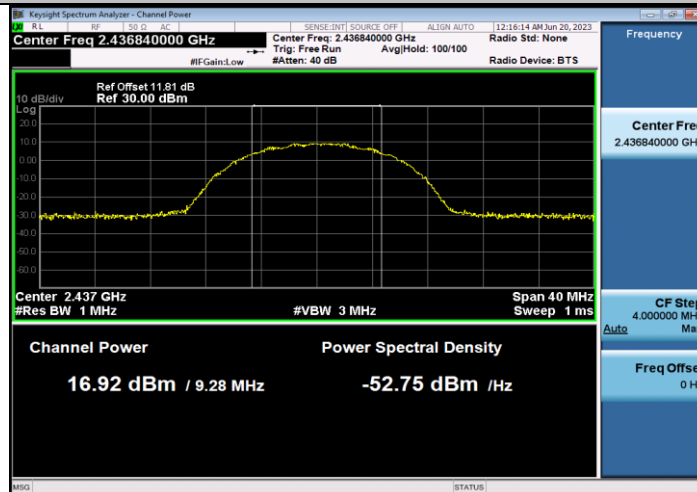


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11B_Ant1_2412



11B_Ant1_2437



11B_Ant1_2462

