

Test Report

Product	Wireless Module
Name and address of the applicant	Cisco Systems Norway AS Philip Pedersens vei 1 1366 Lysaker, NORWAY
Name and address of the manufacturer	Cisco Systems, Inc. 170 West Tasman Drive San Jose, CA 95134, USA
Model	LBEE5XV2EA
Trademark	CISCO
Additional information	Bluetooth LE, Bluetooth Classic, WiFi 6E
Tested according to	Parts of FCC Part 15.247 Frequency Hopping Transmitters / Digital Transmission Systems Parts of Industry Canada RSS-247, Issue 3 Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
Order number	PRJ0039024
Tested in period	2023-09-19 to 2023-10-02 and 2023-12-07
Issue date	2023-12-14
Name and address of the testing laboratory	 Nemko Scandinavia AS Instituttveien 6 2007 Kjeller, Norway www.nemko.com CAB Number: FCC: NO0001 ISED: NO0470 ISED No: 2040D-1   An accredited technical test executed under the Norwegian accreditation scheme
 Prepared by [Frode Sveinsen]  Approved by [Jan G Eriksen]	
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Revision history

Revision	Date	Comment	Sign
A	2023-12-14	First edition	FS

GENERAL REMARKS

This report applies only to the sample(s) tested. It is the manufacturer's responsibility to ensure the additional production units of this product are manufactured with identical electrical and mechanical components. The manufacturer is solely responsible for any modifications to the product that could result in non-compliance with the relevant regulations.

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Opinions expressed within this report regarding general assessments and qualifications for PASS or FAIL to the standards limits and requirements, are not part of the current accreditation. Neither are opinions expressed regarding model variants covered by the testing of this report.

CALIBRATION

All instruments used in the tests given in this test report are calibrated and traceable to national or international standards. Between calibrations all test set-ups are controlled and verified on a regular basis by periodic checks to ensure, with 95% confidence, that the instruments remain within the calibrated levels.

MEASUREMENT UNCERTAINTY

Measurement uncertainties are calculated or considered for all instruments and instrument set-ups used during these tests. Uncertainty figures are found in a separate clause in this report.

1 INFORMATION

1.1 Test Item

Name	Cisco
Model No.	LBEE5XV2EA
FCC ID	LDKXV2EA2797
ISED ID	2461N-XV2EA2797
Serial number	/
Hardware identity and/or version	1.0
Software identity and/or version	1.1.1.1 1.1.2.1 1.1.1.2 1.1.2.2
Frequency Range	2402 – 2480 MHz
Number of Channels	40
Operating Modes	Bluetooth Low Energy ☒ 1Mb ☒ 2Mb
Type of Modulation	GFSK
Conducted Output Power	0.74 mW
Antenna Connector	Internal U-FL
Number of Antennas	1
Diversity or Smart Antennas	No
Power Supply	Powered from Host
Antennas	Amphenol Model OCF608-15-000-R

Description of Test Item

The tested EUT is a module with WiFi and Bluetooth.

This report covers additional tests for use with the specified antennas.

All radiated tests were performed with the module installed in host model TTC60-36 and verified on TTC60-35.

1.2 Hosts Used During Testing

Name	Cisco
Model No.	TTC60-35 TTC60-36
Serial number	TTC60-35: WZS2731L008 TTC60-36: WZS2731M00N
Hardware identity and/or version	DV1
Software identity and/or version	CE 11.9.0 / s01845-2.58.0.0
Antenna Connector	Internal U-FL
Power Supply	Mains (120V 60Hz AC)
Rating	TTC60-35: 100-240V _{AC} 50/60Hz 3.0-1.5A TTC60-36: 100-240V _{AC} 50/60Hz 4.0-2.0A

1.3 Normal test condition

Temperature:	20 - 24 °C
Relative humidity:	20 - 50 %
Normal test voltage:	120 V 60 Hz

The values are the limit registered during the test period.

The EUT was powered from the AC Power Source.

1.4 Test Engineers

Frode Sveinsen

Jørn Gustavsen (Power Line Conducted)

1.5 Antenna Requirement

Does the EUT have detachable antenna(s)?	☐ YES	☒ NO
If detachable, is the antenna connector(s) non-standard?	☐ YES	☐ NO
The EUT have internal antennas.		

Requirement: FCC 15.203, 15.204

1.6 EUT Operating Modes

Description of operating modes	All tests were performed with the EUT set to transmit continuously at the selected channel.
Additional information	The EUT was transmitting bursts at the selected channel and with the selected output power.

1.7 Comments

The measurements were done with the EUT powered by 120 V AC. It was checked that power variations between 85% and 115% did not have any influence on the measurements.

2 TEST REPORT SUMMARY

2.1 General

All measurements are traceable to national standards.

The tests were conducted for demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.247 and ISED RSS-247 Issue 3 and RSS-GEN Issue 5.

Tests were performed in accordance with ANSI C63.4-2014 and ANSI C63.10-2013.

Radiated tests were performed in a semi-anechoic chamber.

A description of the test facility is on file with the FCC and ISED.

☐ New Submission	☒ Production Unit
☒ Class II Permissive Change	☐ Pre-production Unit
DTS Equipment Code	☐ Family Listing

2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-247 Issue 3, RSS-GEN Issue 5 reference	ANSI C63.10-2013 Reference	Result
Supply Voltage Variations	15.31(e)	6.11 (RSS-GEN)	5.13	Complies
Antenna Requirement	15.203	6.8 (RSS-GEN)	5.8	Complies
Power Line Conducted Emission	15.107(a) 15.207(a)	7.2 / 8.8 (RSS-GEN)	6.2	Complies
Occupied Bandwidth (99% BW)	N/A	6.7 (RSS-GEN)	6.9.3	Complies*
DTS Bandwidth	15.247(a)(2)	5.2 (1) (RSS-247)	11.8 Option 2	Complies*
Peak Power Output	15.247(b)	5.4 (RSS-247)	11.9.1.1	Complies*
Power Spectral Density	15.247(d)	5.2 (2) (RSS-247)	11.10.2 PKPSD (DTS)	Complies*
Spurious Emissions (Antenna Conducted)	15.247(c)	5.5 (RSS-247)	6.7 11.11 (DTS)	Complies*
Spurious Emissions (Radiated)	15.247(c) 15.109(a) 15.209(a)	5.5 (RSS-247) 7.3 (RSS-GEN) 8.9 (RSS-GEN)	6.3, 6.5, 6.6, 6.10 11.12, 11.13 (DTS)	Complies

*Covered by SGS Test report No. TERF2211002257ER

3 TEST RESULTS

3.1 Power Line Conducted Emissions

FCC Part 15.207

ISED RSS-GEN Issue 5, Clause 7.2 / 8.8

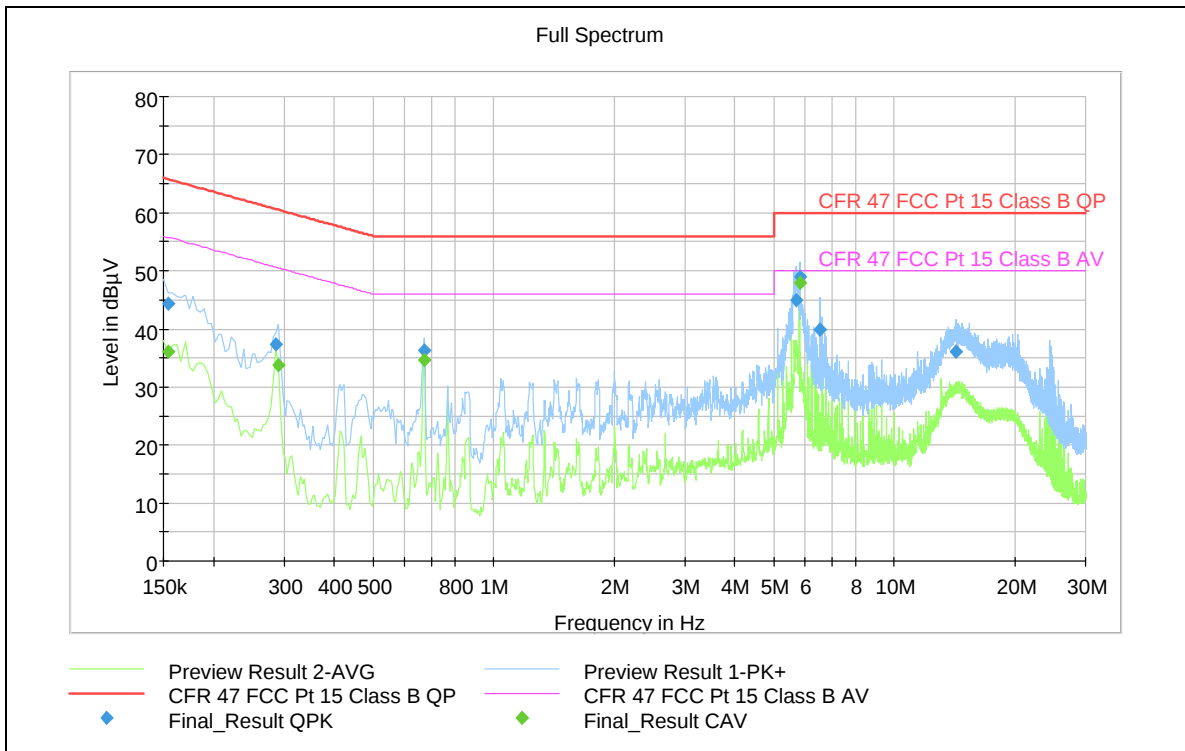
Measurement procedure: ANSI C63.4-2014 using 50 μ H/50 ohms LISN

Test Results: Complies

Measurement Data: 120V 60Hz, See attached plots

Highest measured value (L1 and N)

Frequency (MHz)	QuasiPeak (dB μ V)	CAverage (dB μ V)	Limit (dB μ V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.154000	---	36.04	55.78	19.74	15000.0	9.000	L1	OFF	9.7
0.154000	44.31	---	65.78	21.47	15000.0	9.000	L1	OFF	9.7
0.286000	37.46	---	60.64	23.18	15000.0	9.000	L1	OFF	9.7
0.290000	---	33.79	50.52	16.74	15000.0	9.000	L1	OFF	9.7
0.670000	---	34.72	46.00	11.28	15000.0	9.000	N	OFF	9.6
0.670000	36.33	---	56.00	19.67	15000.0	9.000	N	OFF	9.6
5.690000	44.92	---	60.00	15.08	15000.0	9.000	L1	OFF	9.8
5.798000	48.89	---	60.00	11.11	15000.0	9.000	L1	OFF	9.8
5.798000	---	47.84	50.00	2.16	15000.0	9.000	L1	OFF	9.8
6.510000	39.81	---	60.00	20.19	15000.0	9.000	N	OFF	9.6
14.234000	36.09	---	60.00	23.91	15000.0	9.000	N	OFF	9.7



3.2 Radiated Emissions, Band Edge

FCC Part 15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 7.3 / 8.9

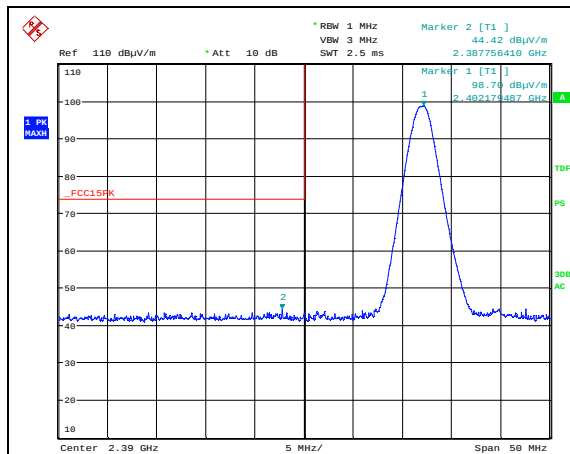
Measurement procedure: ANSI C63.10-2013 Clause 11.12

Test Results: Complies

Measurement Data:

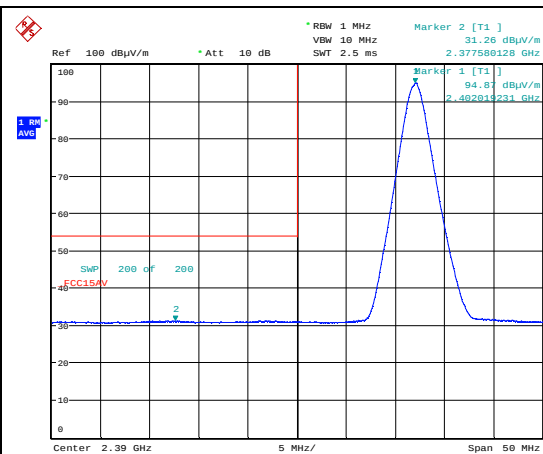
CF (MHz)	Band Edge (MHz)	Modulation and Bitrate	Measured field strength (dBμV/m)		Limit (dBμV/m)		Margin (dB)	
			Peak	Average	Pk	Av	Pk	Av
2402	2390	GFSK, 1Mb	44.4	31.3	74	54	29.6	22.7
	2390	GFSK, 2Mb	43.6	31.2	74	54	30.4	22.8
2480	2483.5	GFSK, 1Mb	56.5	49.9	74	54	17.5	4.1
	2483.5	GFSK, 2Mb	59.6	50.1	74	54	14.4	3.9

See attached plots.



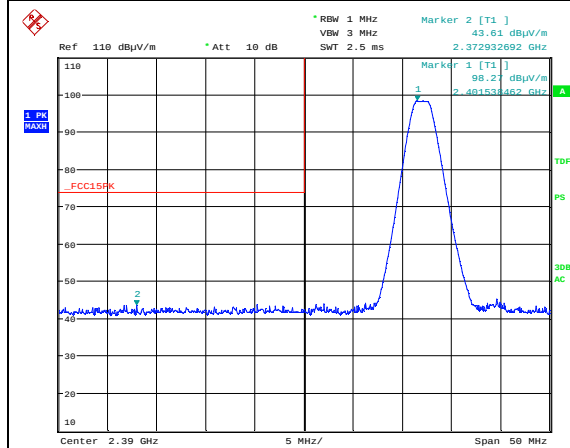
Date: 29.NOV.2023 18:13:29

Lower Band Edge, 2402 MHz, 1Mb, Peak



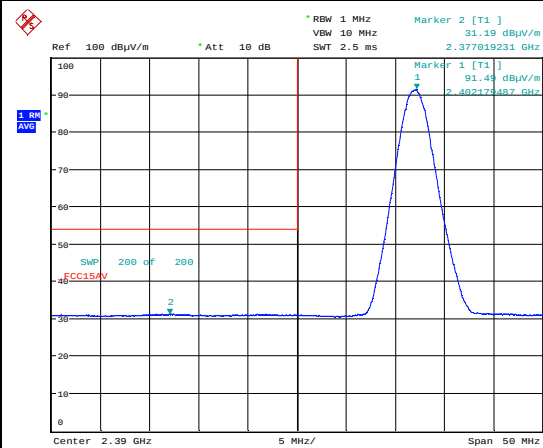
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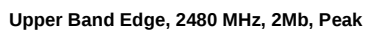
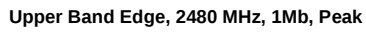
Date: 29.NOV.2023 18:17:39

Lower Band Edge, 2402 MHz, 2Mb, Peak



Date: 29.NOV.2023 18:18:00

Av



3.3 Radiated Emissions, 30 – 1000 MHz.

FCC Part 15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 7.3/8.9

Measurement procedure: ANSI C63.10-2013 Clause 11.12

Test Results: Complies

Measurement Data:

Detector: Quasi-Peak

Measuring distance 3m

Tested in test mode with EUT transmitting

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
73.223374	36.04	40.00	3.96	15000.0	120.000	300.0	V	335.0	-17.7

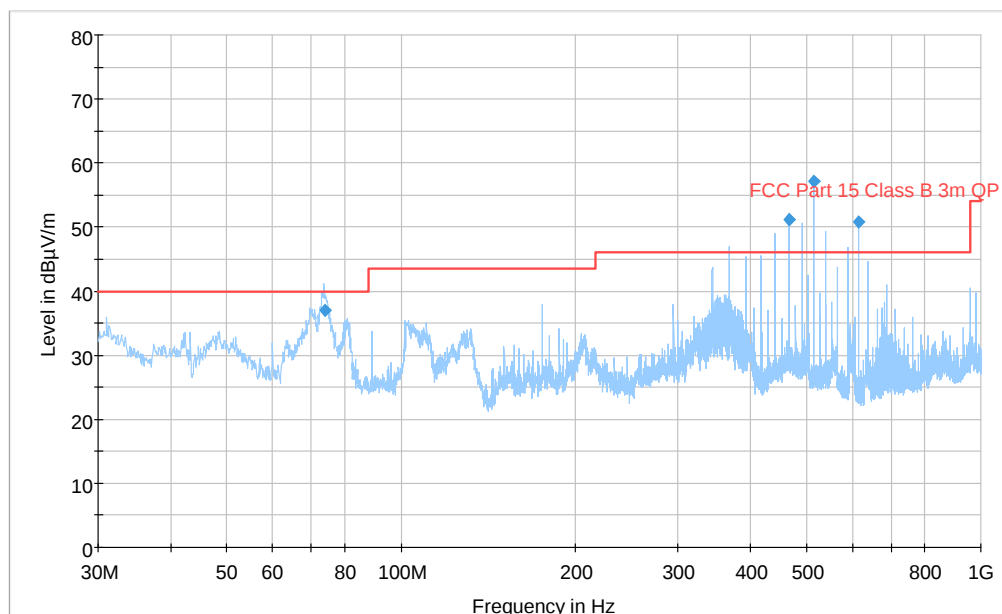
Only frequencies in Restricted Band are listed above.

See attached plots.

Requirements/Limit

FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10	
Frequency	Radiated emission limit @3 meters	
30 – 88 MHz	100 μV/m	40.0 dBμV/m
88 – 216 MHz	150 μV/m	43.5 dBμV/m
216 – 960 MHz	200 μV/m	46.0 dBμV/m
960 – 1000 MHz	500 μV/m	54.0 dBμV/m
Limits above are with Quasi Peak Detector		

Full Spectrum



Radiated Emissions, 30-1000 MHz, GFSK

3.4 Radiated Emissions, 1 – 26 GHz

FCC Part 15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 7.3/8.9

Measurement procedure: ANSI C63.10-2013 Clause 11.12

Test Results: Complies

Measurement Data:

Measuring distance: 3m (1 – 18 GHz)
1m (18 – 26 GHz)

RBW/VBW = 1MHz/3MHz

Carrier Frequency (MHz)	Measured Frequency (GHz)	Mode	Measured Emissions (dBµV/m)		Limit (dBµV/m)		Margin (dB)	
			Peak	Average	Pk	Av	Pk	Av
2402	4804	1Mb	56.8	50.3	74	54	17.2	3.7
		2Mb	56.8	45.6	74	54	17.2	8.4
2440	4880	1Mb	54.5	46.8	74	54	19.5	7.2
		2Mb	54.0	42.2	74	54	20.0	11.8
2480	4960	1Mb	50.9	41.1	74	54	23.1	12.9
		2Mb	51.3	38.3	74	54	22.7	15.7
Any	2971*	Any	65.5	/	N/A	/	N/A	/
Any	5941*	Any	65.1	/	N/A	/	N/A	/
Any	Any other	Any	< 56	< 46	74	54	> 18	> 8

*Not in a Restricted Band

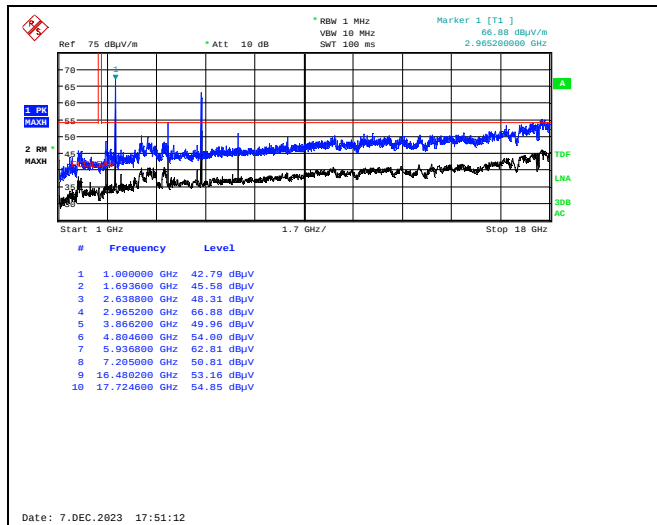
A Band Reject Filter was used for measurements from 1 GHz to 18 GHz

Antenna factor, amplifier gain and cable loss are included in spectrum analyzer "Transducer factor".

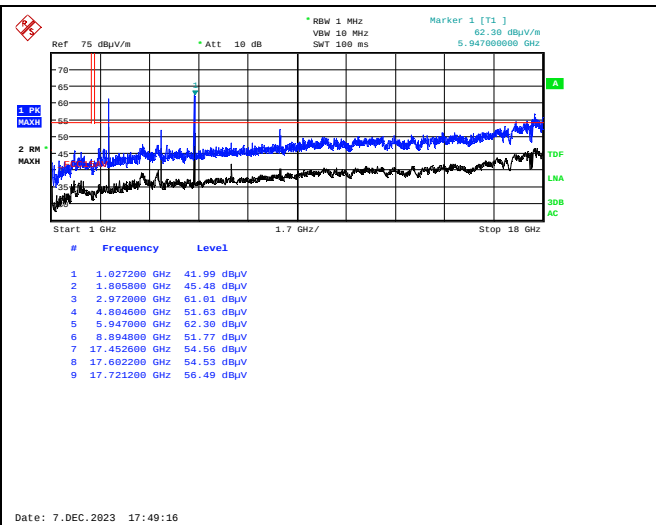
See plots.

Requirements/Limit

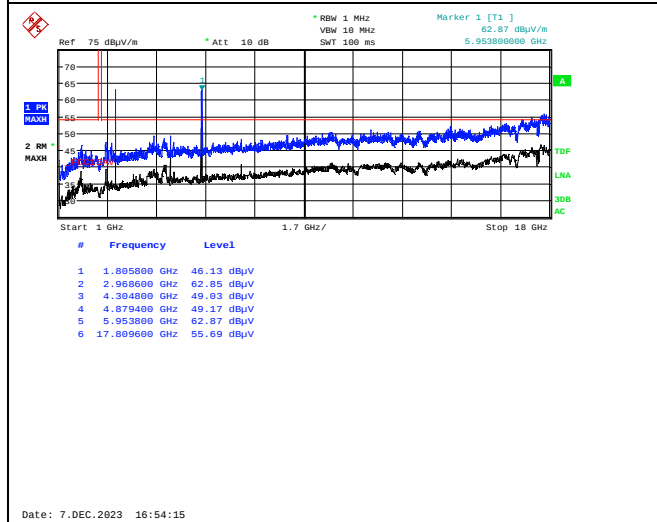
FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency	Average Detector	Peak Detector
1 – 26 GHz	54.0 dBµV/m	74.0 dBµV/m



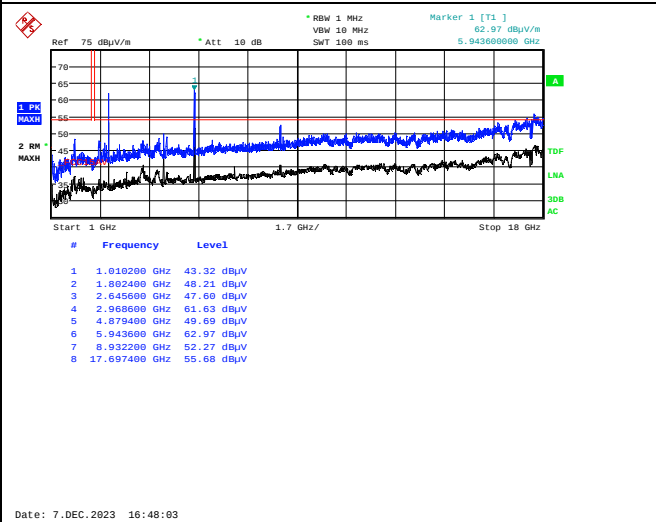
Radiated Emissions 1 - 18 GHz, 2402 MHz, 1M, HP



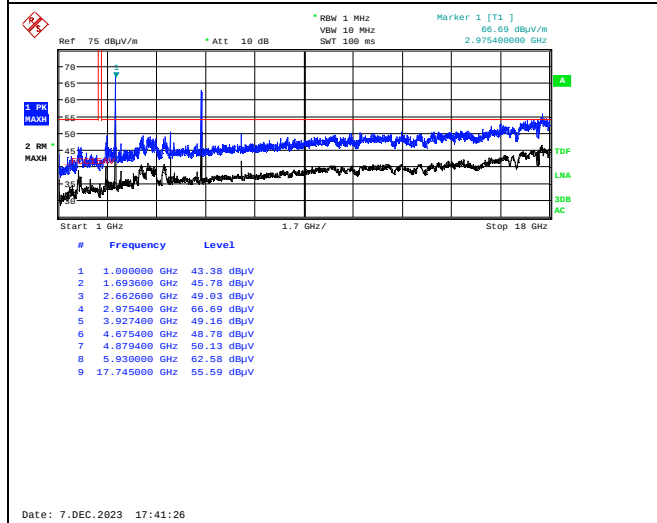
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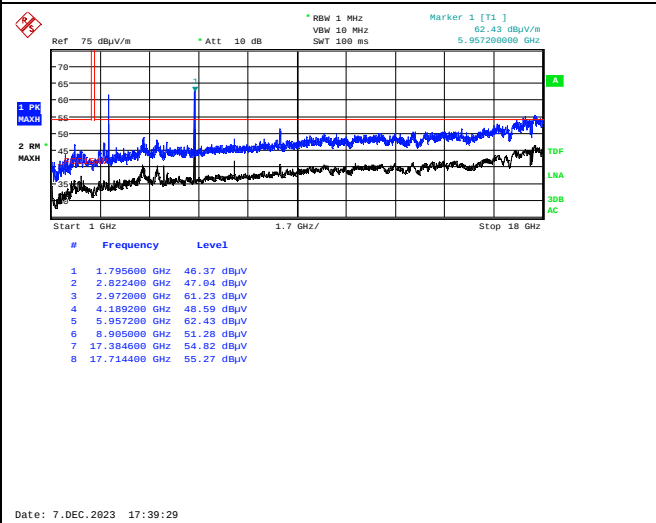
Radiated Emissions 1 - 18 GHz, 2440 MHz, 1M, HP



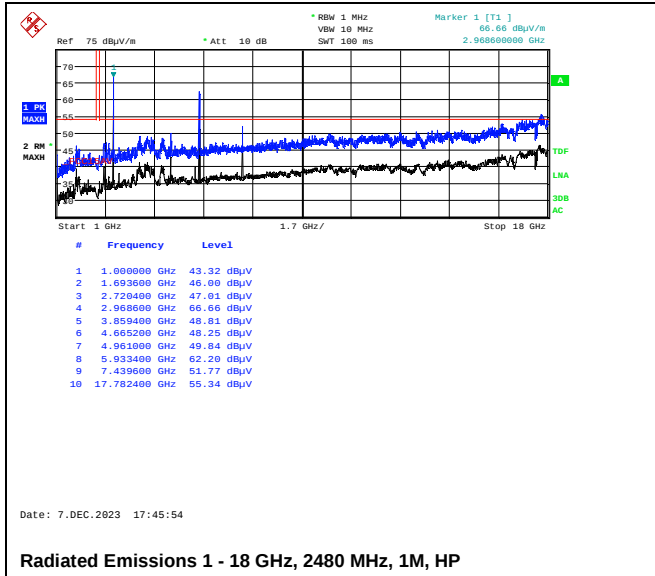
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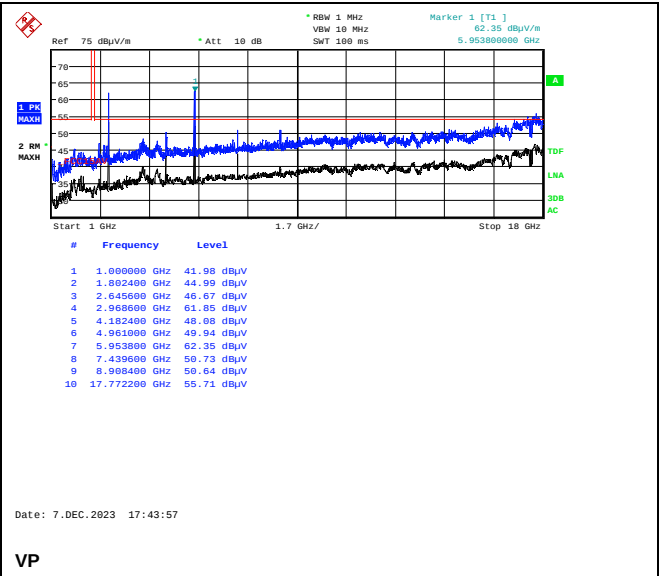
Radiated Emissions 1 - 18 GHz, 2440 MHz, 2M, HP



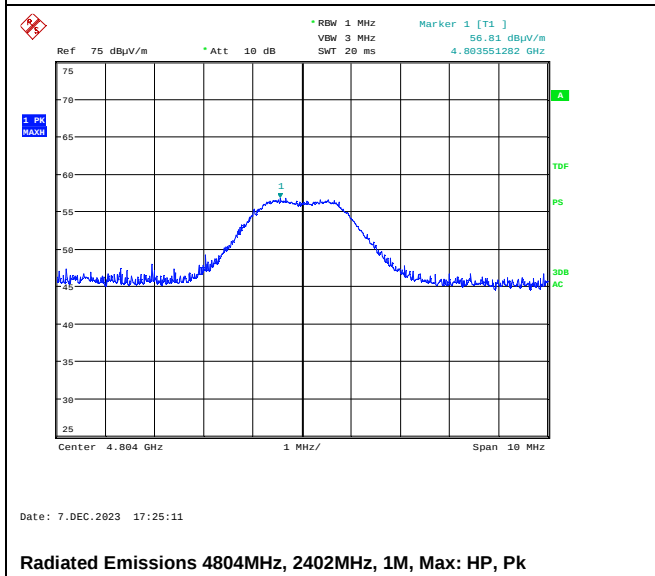
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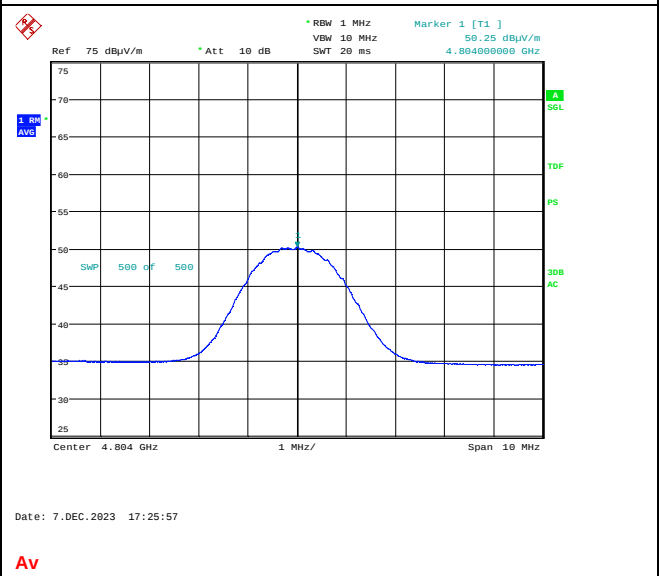
Radiated Emissions 1 - 18 GHz, 2480 MHz, 1M, HP



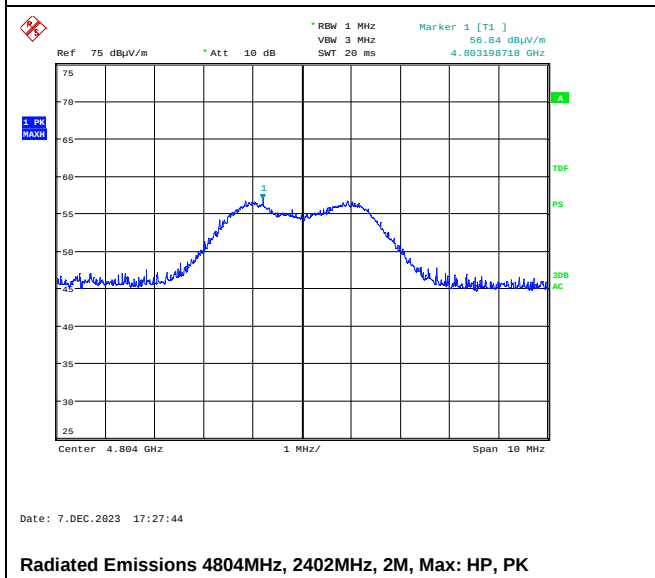
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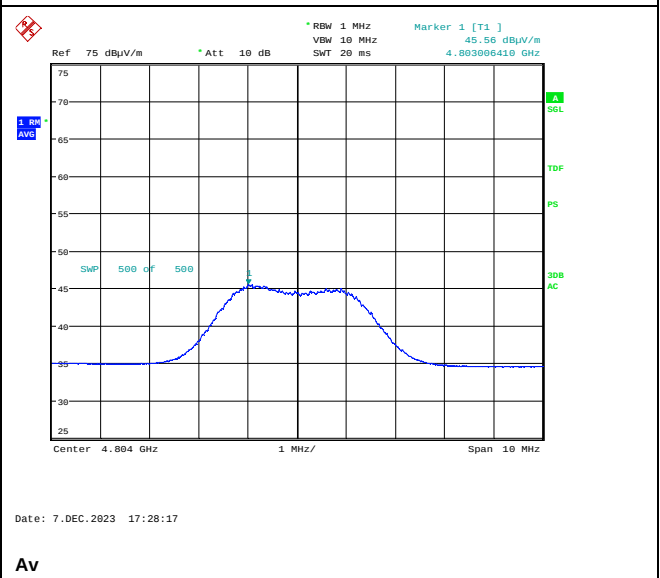
Radiated Emissions 4804MHz, 2402MHz, 1M, Max: HP, Pk



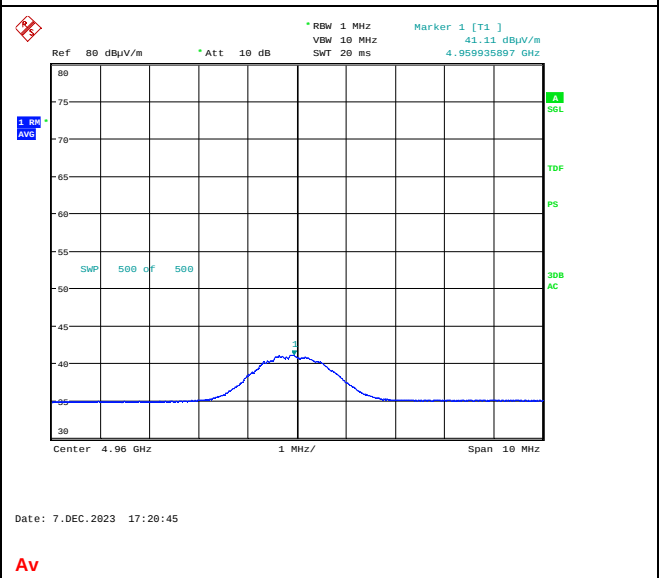
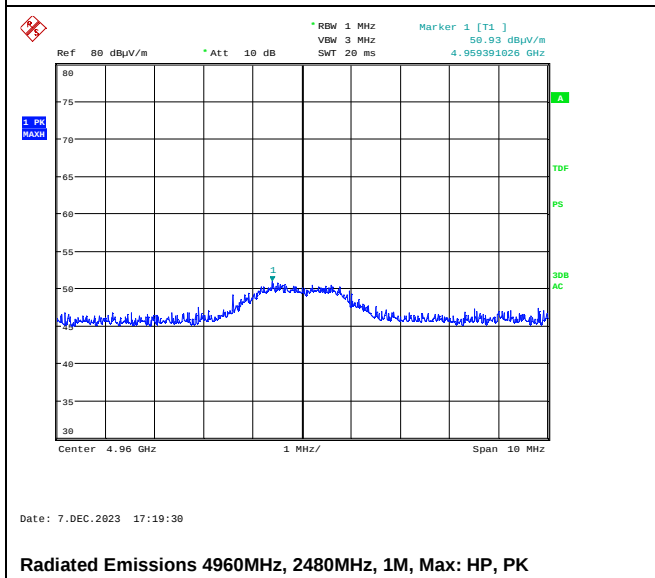
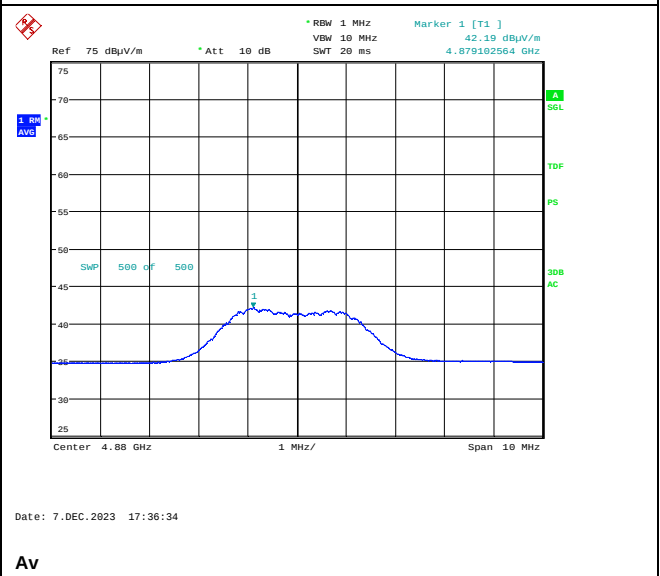
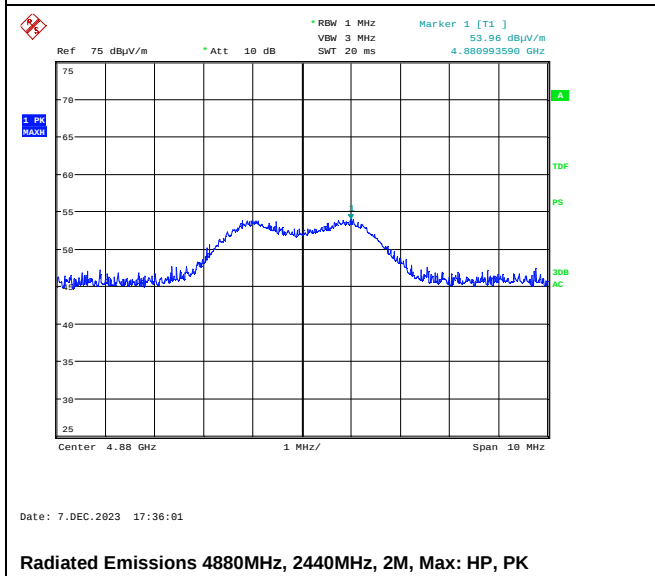
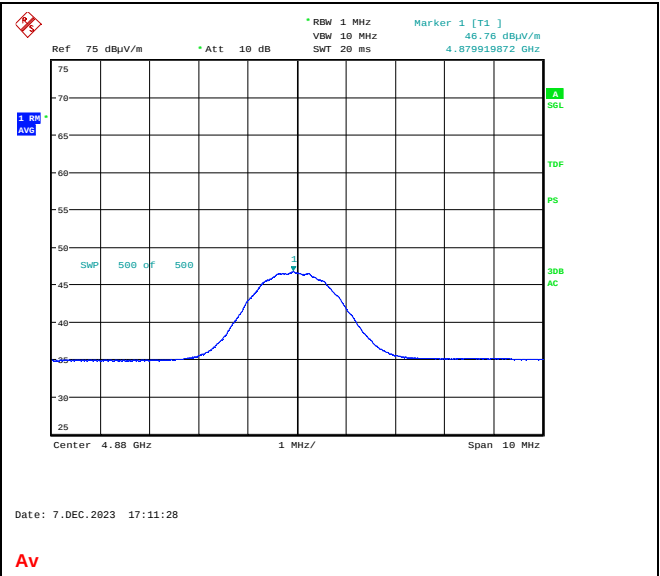
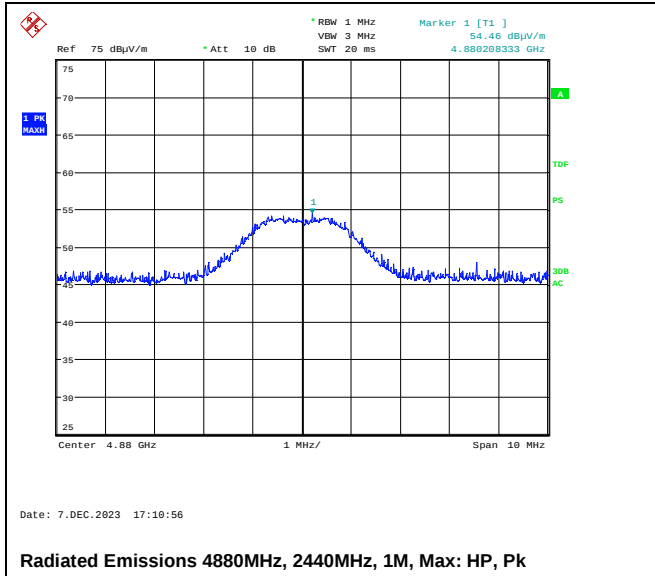
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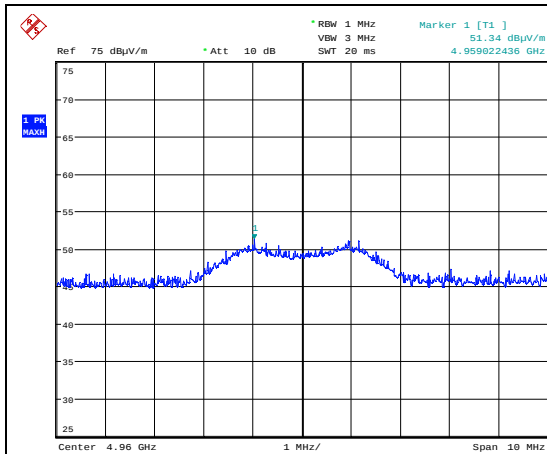


Radiated Emissions 4804MHz, 2402MHz, 2M, Max: HP, Pk



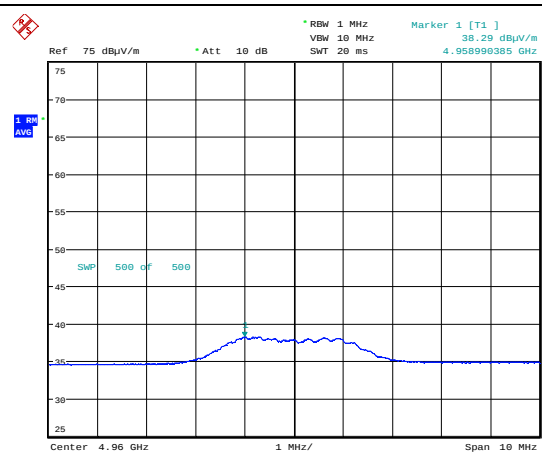
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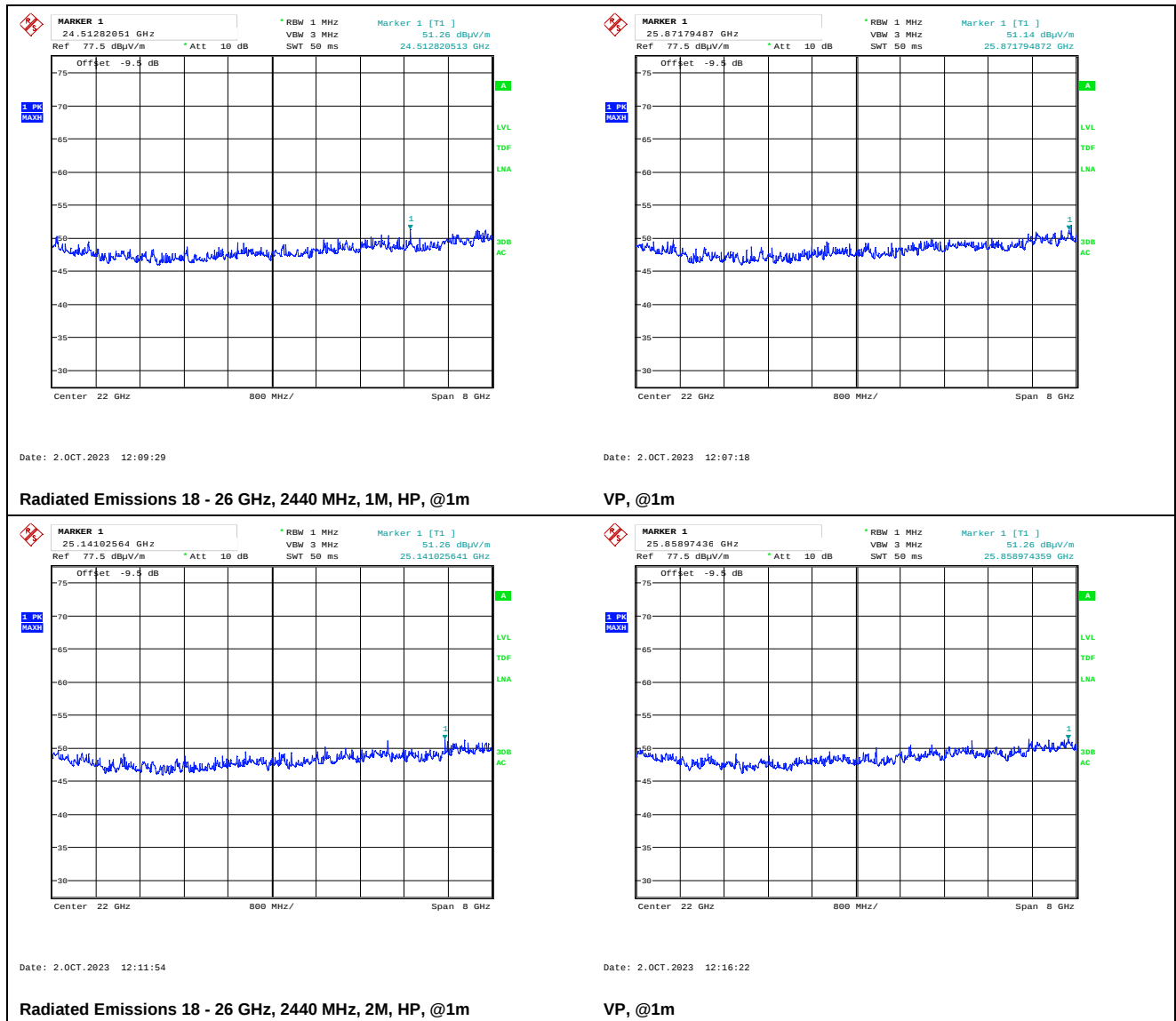
Date: 7.DEC.2023 17:32:03

Radiated Emissions 4960MHz, 2480MHz, 2M, Max: HP, PK



Date: 7.DEC.2023 17:32:37

Av



4 Measurement Uncertainty

Measurement Uncertainty Values		
Test Item		Uncertainty
Output Power		±0.5 dB
Power Spectral Density		±0.5 dB
Out of Band Emissions, Conducted	< 3.6 GHz	±0.6 dB
	> 3.6 GHz	±0.9 dB
Spurious Emissions, Radiated	< 1 GHz	±2.5 dB
	> 1 GHz	±2.2 dB
Emission Bandwidth		±4 %
Power Line Conducted Emissions		+2.9 / -4.1 dB
Spectrum Mask Measurements	Frequency	±5 %
	Amplitude	±1.0 dB
Frequency Error		±0.6 ppm
Temperature Uncertainty		±1 °C

All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2

5 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	FSW43	Spectrum Analyzer	Rohde & Schwarz	LR 1690	2023-01	2024-01
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2023-01	2024-01
3	6810.17B	Attenuator	Suhner	LR 1669	2023-05	2024-05
4	NO324415	Band Reject Filter (2.4 GHz)	Microwave Circuits	LR 1760	COU	
5	VULB 9163	BiLog Antenna	Schwarzbech	LR 1616	2021-05	2024-05
6	310	Pre-amplifier	Sonoma Inst.	LR 1686	2023-08	2024-08
7	3117-PA	Horn Antenna +PreAmp	EMCO	LR 1717	2023-08	2024-08
8	L01G18G1	LowPass Filter (1 GHz)	Microwave Circuits	LR 1768	COU	
9	8449B	Pre-amplifier	Hewlett Packard	LR 1322	2023-08	2024-08
10	3115	Horn Antenna	EMCO	LR 1226	2022-11	2027-11
11	638	Antenna Horn	Narda	LR 1480	N/A	
12	6812B	AC Power Source	Agilent	LR 1515	2022-11	2024-11
13	Model 87V	Multimeter	Fluke	LR 1600	2022-03	2024-03
14	ENV216	Two Line V-Network	Rohde & Schwarz	LR 1665	2021-12	2023-12
15	ESCI3	Measuring Receiver	Rohde & Schwarz	N-4259	2021-10 2023-11	2023-10 2025-11
16	ST18/SMA/N/36	RF Cable	Suhner	LR 1627	COU	

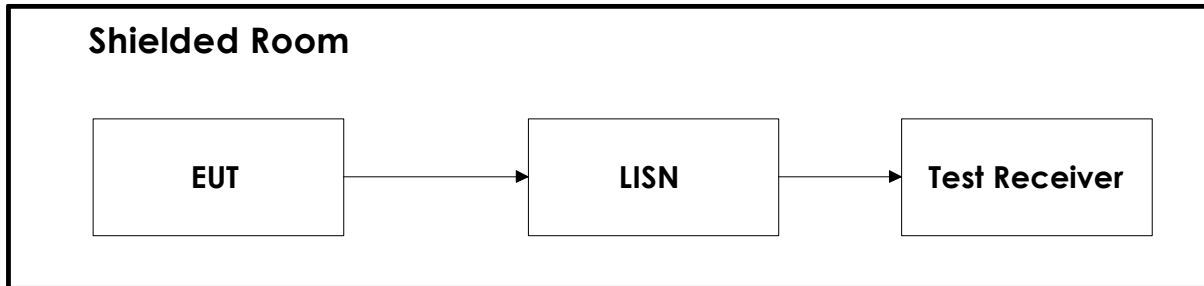
Note: COU – calibrate on use; N/A – Not Applicable

The software listed below has been used for one or more tests.

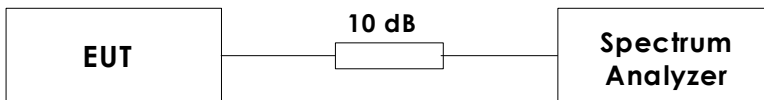
No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	EMC32	10.50.40	EMC test software
2	Nemko AS	RSPlot	1.0.8.0	Screen capture from R&S Spectrum Analyzers

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission

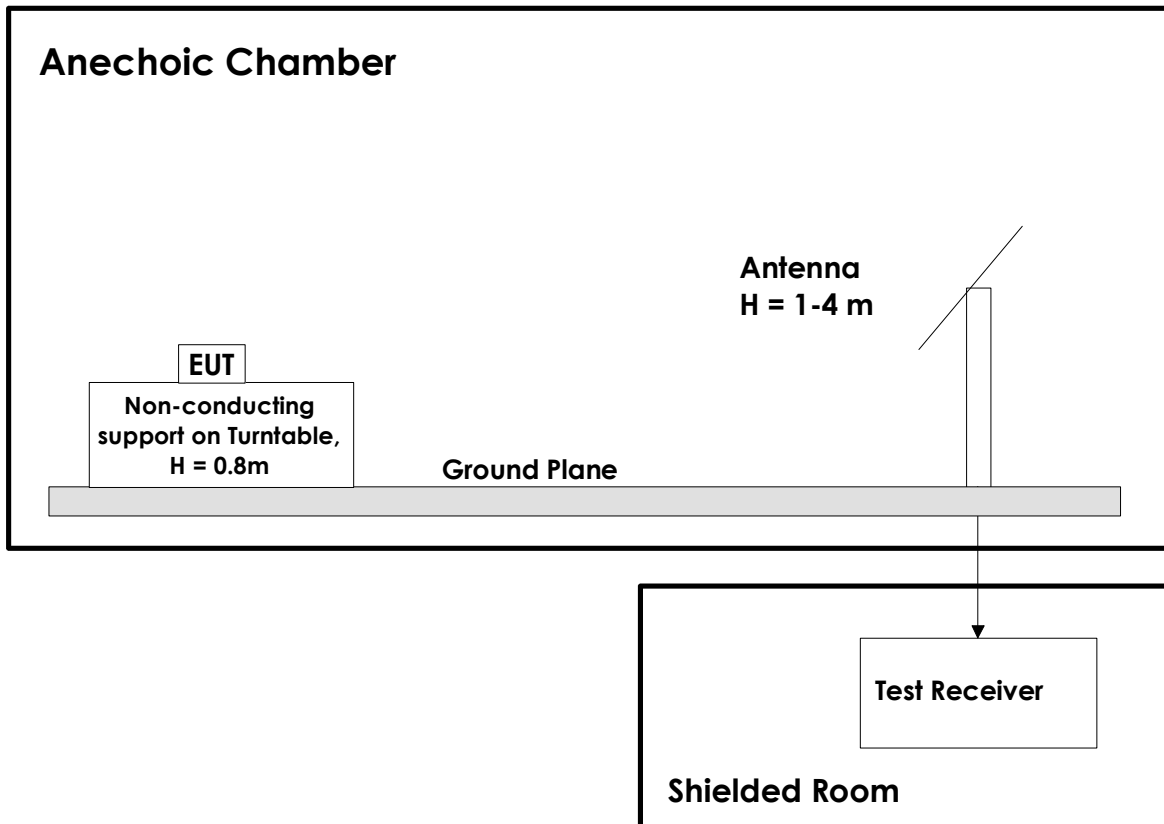


6.2 Conducted Tests



This test set-up is used for all Conducted tests.
For Frequency Stability test the EUT was placed in a climatic chamber.

6.3 Test Site Radiated Emission



This test setup is used for all radiated emissions tests. For frequencies below 30 MHz the measuring distance is 10m, for all other frequencies it is 3m or 1m. Emissions above 1 GHz are measured with a Spectrum Analyzer and Horn Antenna. For measurements above 18 GHz the test receiver is moved inside the anechoic chamber and located next to the antenna to minimize the cable loss. All measurements at 1GHz and above were performed with turntable height 1.5m and with the ground plane covered by absorbers. A pre-amplifier is used for all measurements above 30 MHz, and High-Pass or Band-Pass filter is used for all harmonics.