



Radio Test Report

Monitor Audio Ltd

Caspian 4G

Streaming Amplifier

47 CFR Part 15.247 Effective Date 1st October 2024

DSS: Part 15 Spread Spectrum Transmitter

Test Dates: 12th July 2024 to 16th August 2024 and 15th July 2025 to 18th July 2025

Report Number: 08-14745-3-24 Issue 02

Supersedes Report Number: 08-14745-3-24 Issue 01

The testing was carried out by Kiwa Ltd trading as Kiwa Electrical Compliance, an independent test house, at their test facility located at:

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Certificate of Test 14745-3

The equipment noted below has been fully tested by Kiwa Electrical Compliance and, where appropriate, conforms to the relevant subpart of 47 CFR Part 15.247. This is a certificate of test only and should not be confused with an equipment authorisation. Other standards may also apply.

Equipment:	Caspian 4G Streaming Amplifier
Model Number:	Streaming Amplifier
Unique Serial Number:	4292415000001
Applicant:	Monitor Audio Ltd Unit 2 24 Brook Road Rayleigh Essex SS6 7XJ UK
Proposed FCC ID:	O7V-MA102410
Full measurement results are detailed in Report Number:	08-14745-3-24 Issue 02
Test Standards:	47 CFR Part 15.247 Effective Date 1st October 2024 DSS: Part 15 Spread Spectrum Transmitter

NOTE:

With reference to the Rule part detailed, not all tests within the Rule part have been applied at the request of the applicant. Certain tests were not performed based upon applicant's declarations. Certain other requirements are subject to applicant's declaration only and have not been tested/verified. For details refer to section 3 of this report. This report pertains only to the BTC functionality of the Streaming Amplifier. For BTC functionality of the Integrated Amplifier please refer to KEC report number 09-14745-9-25. Equipment also Contains FCC ID's: 2AC7Z-ESPWROOM32UE and 2AATL-8223A-SR. Testing performed between dates 15th-18th July 2025 was for intermodulation radiated emissions 1-40GHz. All other tests performed between the dates 12th July and 16th August 2024.

DEVIATIONS: No deviations have been applied.

This certificate relates only to the unit tested as identified by a unique serial number and in the condition at the time it was tested. It does not relate to any other similar equipment and performance of the product before or after the test cannot be guaranteed. Whilst every effort is made to assure quality of testing, type tests are not exhaustive and although no non-conformances may be found, this doesn't exclude the possibility of unit not meeting the intentions of the standard or the requirements of the Federal Regulations, particularly under different conditions to those during testing. Any compliance statements are made reliant on (a) the application of the product and use of the assigned band being acceptable to the FCC and (b) the modes of operation as instructed to us by the Customer based on their specific knowledge of the application and functionality of the EUT. Statements of compliance, where measurements were made, do not include the measurement uncertainty. The measurement uncertainty, where stated, is the expanded uncertainty based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

Date of Test: 12th July 2024 to 16th August 2024 and 15th July 2025 to 18th July 2025

Test Engineer:
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1 Contents

1	Contents	3
2	Equipment under test (EUT)	5
2.1	Equipment specification	5
2.2	Configurations for testing	6
2.3	Functional description	8
2.4	Modes of operation	8
2.5	Emissions configuration	9
3	Summary of test results	12
4	Specifications	13
4.1	Relevant standards	13
4.2	Deviations	13
4.3	Declared extremes of temperature & voltage	13
4.4	Test fixtures	13
5	Tests, Methods and Results	14
5.1	AC power line conducted emissions	14
5.2	Radiated emissions 9 - 150 kHz	16
5.3	Radiated emissions 150 kHz - 30 MHz	18
5.4	Radiated emissions 30 MHz -1 GHz	20
5.5	Radiated emissions above 1 GHz	23
5.6	Effective radiated power field strength	26
5.7	Band Edge Compliance	30
5.8	Occupied bandwidth	33
5.9	Maximum Average conducted output power	37
5.10	Maximum Peak conducted output power	38
5.11	Maximum Power Spectral Density	42
5.12	Antenna power conducted emissions	42
5.13	Duty cycle	42
5.14	FHSS carrier frequency separation	43
5.15	Average time of occupancy	45
5.16	Number of Hop Channels	47
6	Plots/Graphical results	48
6.1	AC power line conducted emissions	48
6.2	Radiated emissions 9 - 150 kHz	50
6.3	Radiated emissions 150 kHz - 30 MHz	51
6.4	Radiated emissions 30 MHz -1 GHz	52
6.5	Radiated emissions above 1 GHz	54
6.6	Effective radiated power field strength	70
6.7	Band Edge Compliance	88
6.8	Occupied Bandwidth	100
6.9	FHSS carrier frequency separation	114
6.10	Average time of occupancy	116
6.11	Number of Hop Channels	119
6.12	Maximum Peak conducted output power	120
7	Explanatory Notes	138
7.1	Explanation of Table of Signals Measured	138
7.2	Explanation of limit line calculations for radiated measurements	138
8	Photographs	140
8.1	EUT Front View	140
8.2	EUT Reverse Angle	140
8.3	EUT Left side View	142
8.4	EUT Right side View	142
8.5	EUT Antenna Port	143
8.6	EUT Display & Controls	145
8.7	EUT Internal photos	146
8.8	EUT ID Label	147
8.9	EUT Chassis	148
8.10	AC power line conducted emissions	149

File Name: Monitor Audio Group.14745-3 Issue 02

QMF21J - Issue 05 - KEC Issue 04; 47 CFR Part 15.247 2024

8.11	Radiated emissions 9 - 150 kHz.....	150
8.12	Radiated emissions 150 kHz - 30 MHz	150
8.13	Radiated emissions 30 MHz -1 GHz	151
8.14	Radiated emissions above 1 GHz	152
8.15	Radiated emission diagrams	157
8.16	AC powerline conducted emission diagram	158
9	Test equipment calibration list	159
10	Auxiliary and peripheral equipment.....	160
10.1	Customer supplied equipment.....	160
10.2	Kiwa Electrical Compliance supplied equipment.....	160
11	Condition of the equipment tested	161
11.1	Modifications before test	161
11.2	Modifications during test.....	161
12	Description of test sites	162
13	Abbreviations and units.....	163
14	Revision History	165

2 Equipment under test (EUT)

2.1 Equipment specification

Applicant	Monitor Audio Ltd Unit 2 24 Brook Road Rayleigh Essex SS6 7XJ UK	
Manufacturer of EUT	Roksan	
Full Name of EUT	Caspian 4G Streaming Amplifier	
Model Number of EUT	Streaming Amplifier	
Serial Number of EUT	4292415000001	
Date Received	11th July 2024	
Date of Test:	12th July 2024 to 16th August 2024 and 15th July 2025 to 18th July 2025	
Purpose of Test	To demonstrate design compliance to the relevant rules of Chapter 47 of the Code of Federal Regulations.	
Date Report Issued	5th December 2025	
Main Function	Stereo Audio Amplifier, featuring digital and analogue inputs, A2DP, WiFi streaming and BLE control.	
Information Specification	Height	100 mm
	Width	430 mm
	Depth	345 mm
	Weight	17 kg
	Voltage	100-240 V AC
	Current	6.3 A

Alternative Model Numbers.

Monitor Audio Ltd have declared the following model numbers to be part of the product family: -

Model	Notes
Integrated Amplifier	Without 2.4/5GHz WiFi, LAN (Ethernet), USB and HDMI.

For BTC functionality of the Integrated Amplifier please refer to KEC report number 09-14745-9-25.

2.2 Configurations for testing

General Parameters	
EUT Normal use position	Tabletop
Choice of model(s) for type tests	Production sample
Antenna details	Applicant designed PIFA antenna 104699 A.5 08/12/2023 fitted into chassis rear panel. Gains 2.4 GHz 2.7 dBi, 2.44 GHz 3.65 dBi, 2.48 GHz 2.77 dBi. Refer to KEC report 10-14745-22-25 Antenna report Issue 01.
Antenna port	No
Baseband Data port (yes/no)?	No
Highest Signal generated in EUT	5825 MHz
Lowest Signal generated in EUT	32.768 kHz
Hardware Version (HVIN)	Streaming Amplifier
Software Version	N/A
Firmware Version (FVIN)	1.14.293
Type of Equipment	Multi-Radio
Technology Type	BTC, BLE, 2.4 + 5 GHz WiFi
Geo-location (yes/no)	No
Wi-Fi / Bluetooth / ZigBee Parameters	
TX Parameters	
Alignment range – transmitter	2402 - 2480 MHz
EUT Declared Modulation Parameters	GFSK, DQPSK & 8-DPSK
EUT Declared Power level	8.439 dBm
EUT Declared Signal Bandwidths	1 MHz
EUT Declared Channel Spacings	1 MHz
EUT declared Duty Cycle	Not Provided
Unmodulated carrier available?	No
Declared frequency stability	Not Provided
RX parameters	
Alignment range – receiver	2402 - 2480 MHz
EUT Declared RX Signal Bandwidth	1 MHz
Receiver Signal Level (RSL)	Not Provided
Method of Monitoring Receiver BER	Not Provided
General BT Parameters	
Specific Technology Type	Bluetooth Classic
Wi-Fi Slave, Master or both	N/A
Wi-Fi frame base / load based	N/A
Dynamic frequency selection employed	N/A
TPC	N/A
FHSS / Non-FHSS	FHSS
Number of hopping channels	79
Average dwell time	Not Provided
Adaptivity type	Both (AFA)
Priority class	Not Provided
Energy detection threshold option	Not Provided
Minimum performance criteria for blocking (BER)	Not Provided
Number of antennas and type used	1 x PIFA antenna 104699 A.5 08/12/2023 fitted into chassis rear panel. Gains 2.4 GHz 2.7 dBi, 2.44 GHz 3.65 dBi, 2.48 GHz 2.77 dBi. (Bluetooth classic operation).
Diversity	No
Beamforming	N/A
MIMO	N/A

File Name: Monitor Audio Group.14745-3 Issue 02

QMF21J - Issue 05 - KEC Issue 04; 47 CFR Part 15.247 2024

Supported data rates	DH1, DH3, DH5, 2-DH1, 2-DH3, 2-DH5, 3-DH1, 3-DH3 & 3-DH5
FCC Parameters	
FCC Transmitter Class	DSS: Part 15 Spread Spectrum Transmitter

2.3 Functional description

Stereo audio amplifier with the following:

Inputs - 2x RCA Analogue, 2x RCA for Turntables, 2x Balanced XLR, 2x Digital Coaxial, 2x Digital Optical, USB (BluOS Module - Streaming Amplifier only), HDMI (BluOS Module - Streaming Amplifier only)

Outputs - 4x RCA Analogue, 2x Balanced XLR, Speaker Outputs

Networking - 1x A2DP Bluetooth Audio, 1x BLE/WiFi (ESP32), 1x WiFi (BluOS Module - Streaming Amplifier only), 1x RJ45 Ethernet (BluOS Module - Streaming Amplifier only)

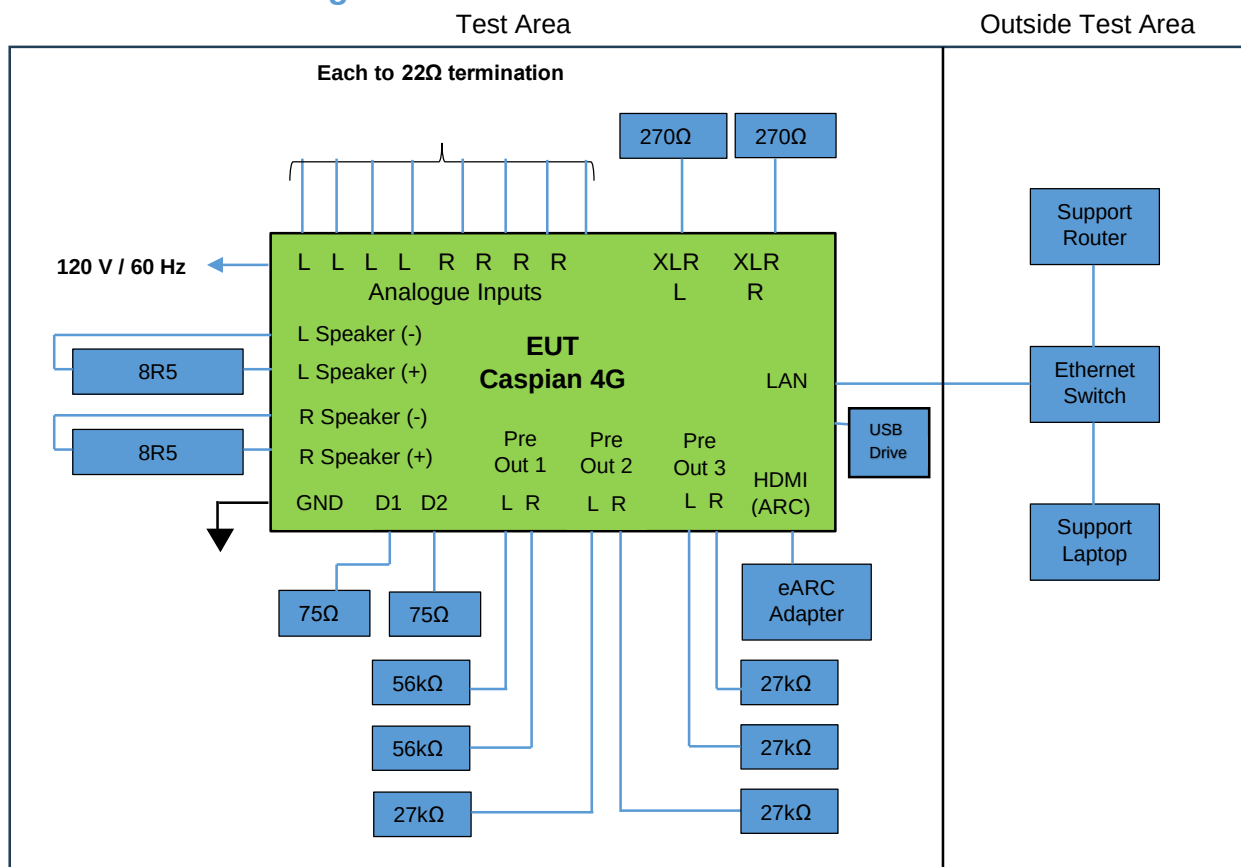
Product allows for control via remote control, physical controls on the front or via one of two mobile applications. MaestroUnite connects via Bluetooth Low Energy to provision WiFi and allows playback, audio and basic operation control. Streaming Amplifier models also include a BluOS streaming PCB, which enables music streaming over WiFi or Ethernet and system control over IP networks.

2.4 Modes of operation

Mode Reference	Description	Used for testing
Mode 1	Constant Transmit, BTC, Low Channel (2402 MHz), GFSK, DH1, Default Power setting	Yes
Mode 2	Constant Transmit, BTC, Mid Channel (2441 MHz), GFSK, DH1, Default Power setting	Yes
Mode 3	Constant Transmit, BTC, High Channel (2480 MHz), GFSK, DH1, Default Power setting	Yes
Mode 4	Constant Transmit, BTC, Low Channel (2402 MHz), GFSK, DH3, Default Power setting	Yes
Mode 5	Constant Transmit, BTC, Mid Channel (2441 MHz), GFSK, DH3, Default Power setting	Yes
Mode 6	Constant Transmit, BTC, High Channel (2480 MHz), GFSK, DH3, Default Power setting	Yes
Mode 7	Constant Transmit, BTC, Low Channel (2402 MHz), GFSK, DH5, Default Power setting	Yes
Mode 8	Constant Transmit, BTC, Mid Channel (2441 MHz), GFSK, DH5, Default Power setting	Yes
Mode 9	Constant Transmit, BTC, High Channel (2480 MHz), GFSK, DH5, Default Power setting	Yes
Mode 10	Constant Transmit, BTC, Low Channel (2402 MHz), $\pi/4$ -DQPSK, 2-DH1, Default Power setting	Yes
Mode 11	Constant Transmit, BTC, Mid Channel (2441 MHz), $\pi/4$ -DQPSK, 2-DH1, Default Power setting	Yes
Mode 12	Constant Transmit, BTC, High Channel (2480 MHz), $\pi/4$ -DQPSK, 2-DH1, Default Power setting	Yes
Mode 13	Constant Transmit, BTC, Low Channel (2402 MHz), $\pi/4$ -DQPSK, 2-DH3, Default Power setting	Yes
Mode 14	Constant Transmit, BTC, Mid Channel (2441 MHz), $\pi/4$ -DQPSK, 2-DH3, Default Power setting	Yes
Mode 15	Constant Transmit, BTC, High Channel (2480 MHz), $\pi/4$ -DQPSK, 2-DH3, Default Power setting	Yes
Mode 16	Constant Transmit, BTC, Low Channel (2402 MHz), $\pi/4$ -DQPSK, 2-DH5, Default Power setting	Yes
Mode 17	Constant Transmit, BTC, Mid Channel (2441 MHz), $\pi/4$ -DQPSK, 2-DH5, Default Power setting	Yes
Mode 18	Constant Transmit, BTC, High Channel (2480 MHz), $\pi/4$ -DQPSK, 2-DH5, Default Power setting	Yes
Mode 19	Constant Transmit, BTC, Low Channel (2402 MHz), 8-DPSK, 3-DH1, Default Power setting	Yes
Mode 20	Constant Transmit, BTC, Mid Channel (2441 MHz), 8-DPSK, 3-DH1, Default Power setting	Yes
Mode 21	Constant Transmit, BTC, High Channel (2480 MHz), 8-DPSK, 3-DH1, Default Power setting	Yes
Mode 22	Constant Transmit, BTC, Low Channel (2402 MHz), 8-DPSK, 3-DH3, Default Power setting	Yes
Mode 23	Constant Transmit, BTC, Mid Channel (2441 MHz), 8-DPSK, 3-DH3, Default Power setting	Yes
Mode 24	Constant Transmit, BTC, High Channel (2480 MHz), 8-DPSK, 3-DH3, Default Power setting	Yes

Mode 25	Constant Transmit, BTC, Low Channel (2402 MHz), 8-DPSK, 3-DH5, Default Power setting	Yes
Mode 26	Constant Transmit, BTC, Mid Channel (2441 MHz), 8-DPSK, 3-DH5, Default Power setting	Yes
Mode 27	Constant Transmit, BTC, High Channel (2480 MHz), 8-DPSK, 3-DH5, Default Power setting	Yes
Mode 28	Constant Transmit, BTC, Hopping on all channels, GFSK, DH5, Default Power setting	Yes
Mode 29	Constant Transmit, BTC, Hopping on all channels, $\pi/4$ -DQPSK, 2-DH5, Default Power setting	Yes
Mode 30	Constant Transmit, BTC, Hopping on all channels, 8-DPSK, 3-DH5, Default Power setting	Yes
Mode 31	Continuous Transmit, BTC 2402 MHz (Default Power) + BluOS 5180 MHz WiFi 802.11n MCS0 20 MHzBW (Power Setting: 15)	Yes
Mode 32	Continuous Transmit, BTC 2441 MHz (Default Power) + BluOS 5500 MHz WiFi 802.11n MCS0 20 MHzBW (Power Setting: 15)	Yes
Mode 33	Continuous Transmit, BTC 2480 MHz (Default Power) + BluOS 5825 MHz WiFi 802.11n MCS0 20 MHzBW (Power Setting: 15)	Yes

2.5 Emissions configuration



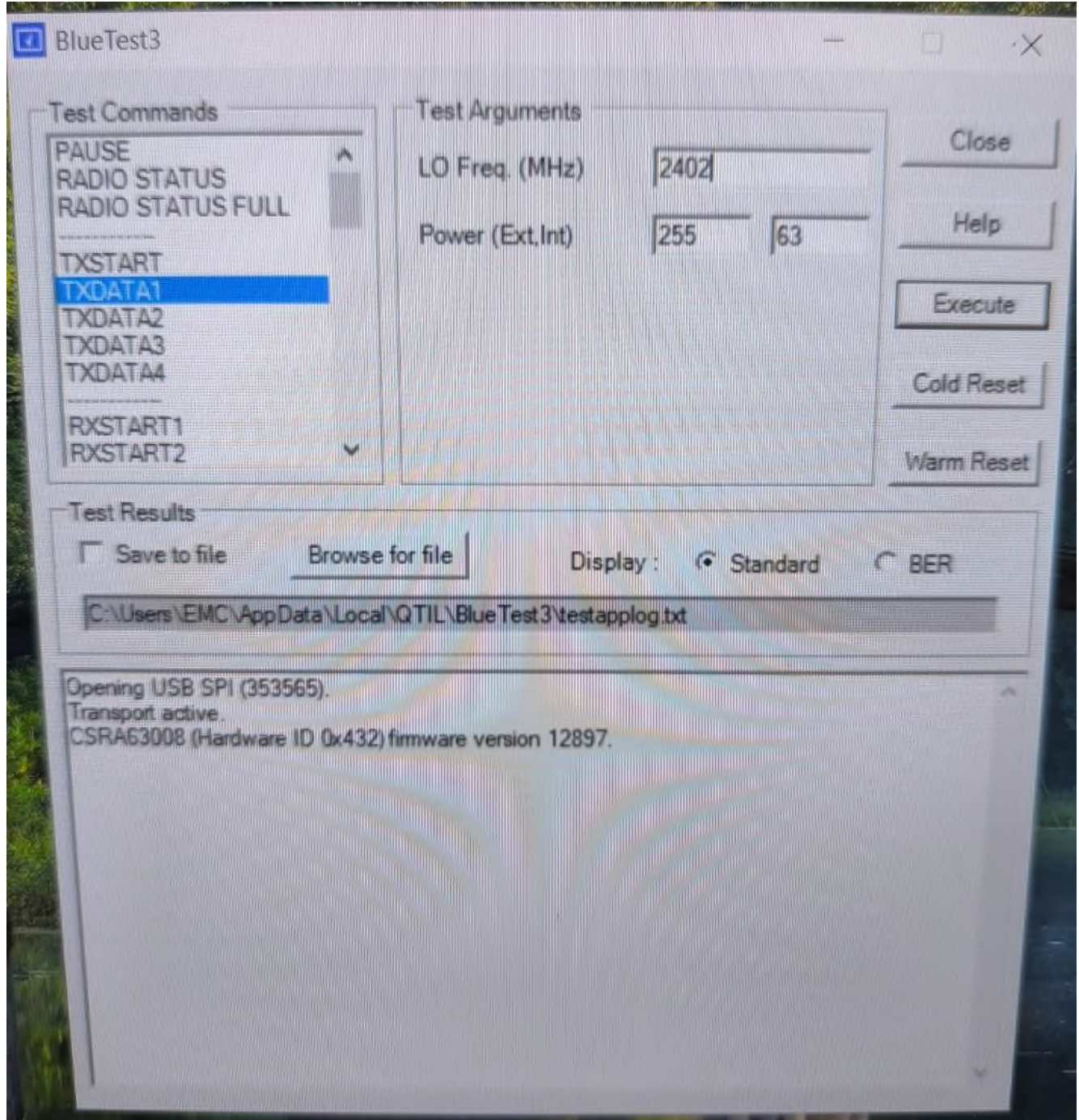
The unit was powered from 120 V AC mains. For conducted tests the internal antenna was disconnected and a UFL to SMA cable was connected in its place. The unit was configured using engineering software called "Blue test 3" provided by the Manufacturer to allow permanent transmit modes of device on the top, middle and bottom channels with modulation and with TX hopping sequence on and TX hopping sequence off, as stated within section 2.4 of this report. The 'GND' port was connected to the test chamber safety earth. Bluetooth classic Transmit modes were also set transmitting simultaneously with the WLAN transmit modes from the BluOS pre-approved module to check for any intermodulation emissions.

The Bluetooth Classic power setting was set to its default power setting as requested by the applicant – this was using (255, 63) command setting in the Bluetest 3 software (+8dBm).

Low Channel: 2402 MHz

Mid Channel: 2441 MHz
High Channel: 2480 MHz

Screen shot of GUI/software used to set Bluetooth Classic test modes:



2.5.1 Signal leads

Port Name	Cable Type	Connected
Mains	3 Core	Yes
A1 L	Analogue RCA Input	Yes
A1 R	Analogue RCA Input	Yes
A2 L	Analogue RCA Input	Yes
A2 R	Analogue RCA Input	Yes
A3 L	Balanced XLR Input	Yes
A3 R	Analogue RCA Input	Yes
MC L	Analogue RCA Input	Yes
MC R	Analogue RCA Input	Yes
MM L	Analogue RCA Input	Yes
MM R	Analogue RCA Input	Yes
D1	Digital Coaxial Input	Yes
D2	Digital Coaxial Input	Yes
D3	Digital Optical Input	No
D4	Digital Optical Input	No
HDMI	HDMI Input	Yes
USB	USB A Input	Yes
LAN	Cat5 Bi-Directional	Yes
Pre Out 1	Balanced XLR Output	Yes
Pre Out 2	Analogue RCA Output	Yes
Pre Out 3	Analogue RCA Output	Yes
Speaker L 1	4mm Banana Output	Yes
Speaker L 2	4mm Banana Output	Yes
Speaker R 1	4mm Banana Output	Yes
Speaker R 2	4mm Banana Output	Yes
IR Input	3.5mm Jack Input	No
12V Trigger 1	3.5mm Jack Input	No
12V Trigger 2	3.5mm Jack Input	No
GND	1 Core	Yes

3 Summary of test results

The Caspian 4G Streaming Amplifier was tested for compliance to the following standard(s):

47 CFR Part 15.247 Effective Date 1st October 2024
DSS: Part 15 Spread Spectrum Transmitter

Any compliance statements are made reliant on (a) the application of the product and use of the assigned band being acceptable to the FCC and (b) the modes of operation as instructed to us by the Customer based on their specific knowledge of the application and functionality of the EUT. Whilst every effort is made to assure quality of testing, type tests are not exhaustive and although no non-conformances may be found, this doesn't exclude the possibility of equipment not meeting the intentions of the standard or the essential requirements of the directive, particularly under different conditions to those during testing. Statements of compliance, where measurements were made, do not include the measurement uncertainty. The measurement uncertainty, where stated, is the expanded uncertainty based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95%.

Title	References	Results
Transmitter Tests		
1. AC power line conducted emissions	47 CFR Part 15.247 Part 15.207	PASSED
2. Radiated emissions 9 - 150 kHz	47 CFR Part 15.247 Part 15.209	PASSED ⁵
3. Radiated emissions 150 kHz - 30 MHz	47 CFR Part 15.247 Part 15.209	PASSED ⁵
4. Radiated emissions 30 MHz -1 GHz	47 CFR Part 15.247 Part 15.247(d) & 15.209	PASSED
5. Radiated emissions above 1 GHz	47 CFR Part 15.247 Part 15.247(d) & 15.209	PASSED ⁴
6. Effective radiated power field strength	47 CFR Part 15.247 Part 15.247(d)	PASSED
7. Band Edge Compliance	47 CFR Part 15.247 Part 15.215 & 15.247(d)	PASSED
8. Occupied bandwidth	47 CFR Part 15.247 Part 15.247(a)(1)(iii)	PASSED
9. Maximum Average conducted output power	47 CFR Part 15.247 Part 15.247(b)(3)	NOT APPLICABLE ¹
10. Maximum Peak conducted output power	47 CFR Part 15.247 Part 15.247(b)(1)	PASSED
11. Maximum Power Spectral Density	47 CFR Part 15.247 Part 15.247(e)	NOT APPLICABLE ²
12. Antenna power conducted emissions	47 CFR Part 15.247 Part 15.247(d)	NOT APPLICABLE ³
13. Duty cycle	47 CFR Part 15.247 Part 15.35(c)	NOT APPLICABLE ²
14. FHSS carrier frequency separation	47 CFR Part 15.247 Part 15.247(a1)	PASSED
15. Average time of occupancy	47 CFR Part 15.247 Part 15.247(a)(1)(iii)	PASSED
16. Number of Hop Channels	47 CFR Part 15.247 Part 15.247(a)(1)(iii)	PASSED

¹ Peak Conducted Power measured instead.

² EUT does not employ DTS technology.

³ Applies to EUT's with an antenna port. The EUT has an integral antenna only.

⁴ Spectrum investigated up to a frequency of 40GHz based on the highest frequency generated within the equipment of 5825MHz. Although the Bluetooth Classic radio highest channel frequency is only 2.48GHz, emissions have been continued up to 40GHz to check for any intermodulation emissions with the pre-approved 5GHz WLAN module.

⁵ Spectrum below 30MHz started at a frequency of 9 kHz up to a frequency of 30MHz based on the lowest signal generated/used within the equipment of 32.768 kHz.

4 Specifications

The tests were performed and operated in accordance with Kiwa Electrical Compliance procedures and the relevant standards listed below.

4.1 Relevant standards

Ref.	Standard Number	Version	Description
4.1.1	47 CFR Part 15.247	2024	Part 15 - Radio Frequency Devices - Subpart C - Intentional Radiators
4.1.2	ANSI C63.10	2020	American National Standard for Testing Unlicensed Wireless Devices
4.1.3	ANSI C63.4	2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
4.1.4	KDB 558074 D01 v05r02	2019	Federal Communications Commission Office of Engineering and Technology Laboratory Division; guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules

4.2 Deviations

No deviations were applied.

4.3 Declared extremes of temperature & voltage

The following nominal and extremes conditions were declared by the applicant.

Temperature Conditions		Voltage Conditions	
T nominal	20°C	V nominal	120 V AC
T minimum	5°C	V minimum	100 V AC
T maximum	35°C	V maximum	240 V AC

Extremes of temperature are based upon manufacturer's declaration.

The ambient test conditions of humidity and pressure in the laboratory were as specified in each specific test section within this report

4.4 Test fixtures

A permanent internal RF port was used for conducted power testing.

5 Tests, Methods and Results

5.1 AC power line conducted emissions

5.1.1 Test methods

Test Requirements:	47 CFR Part 15.247 Part 15.207 [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 6.2 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15.247 Part 15.207 [Reference 4.1.1 of this report]

5.1.2 Configuration of EUT

The EUT was placed on a wooden table 0.8m above the ground plane and connected to a LISN via a 1m mains cable.

Details of the Peripheral and Ancillary Equipment connected for this test are listed in section 10.

During the initial scan, modes 28, 29 and 30 were found to be worst case mode of operation. Therefore, full tests were performed using Mode 28.

5.1.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment listed in the 'Test Equipment' Section. Measurements were made on the live and neutral conductors using both average and quasi-peak detection.

At least 6 signals within 10dB of the limit were investigated.

Tests were performed in Test Site F.

5.1.4 Test equipment

E010, E035, E411, E624

See Section 8 for more details

5.1.5 Test results

Temperature of test environment	22°C
Humidity of test environment	62%
Pressure of test environment	101kPa

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH5
Single channel	Hopping

Plot refs
14745-3 Cond 1 AC Live 150k-30M Average
14745-3 Cond 1 AC Live 150k-30M Quasi-Peak
14745-3 Cond 1 AC Neutral 150k-30M Average
14745-3 Cond 1 AC Neutral 150k-30M Quasi-Peak

Table of signals measured for Cond 1 AC Live 150k-30M

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP -Lim (dB)	AV Amp (dBuV)	AV -Lim (dB)
1	0.152	59.8	54.4	-11.5	45.8	-10.1
2	0.205	51.8	47.9	-15.5	36.5	-16.9
3	0.268	54.6	51.0	-10.2	37.0	-14.2
4	0.270	55.1	50.7	-10.4	37.3	-13.8
5	0.299	53.0	49.2	-11.1	39.8	-10.5
6	0.394	51.5	47.9	-10.1	40.1	-7.9
7	0.398	50.9	48.5	-9.4	40.7	-7.2
8	0.488	40.4	35.8	-20.4	25.2	-21.0

Table of signals measured for Cond 1 AC Neutral 150k-30M

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP -Lim (dB)	AV Amp (dBuV)	AV -Lim (dB)
1	0.228	54.1	51.6	-10.9	40.1	-12.4
2	0.235	54.3	50.9	-11.4	39.4	-12.9
3	0.262	56.2	51.4	-10.0	39.6	-11.8
4	0.274	56.4	53.1	-7.9	42.5	-8.5
5	0.296	53.5	50.5	-9.9	39.5	-10.9
6	0.358	50.7	47.6	-11.2	37.7	-11.1
7	0.409	52.8	49.4	-8.3	40.8	-6.9
8	0.416	52.0	49.5	-8.0	42.0	-5.5
9	1.746	40.4	38.4	-17.6	32.2	-13.8

No discernible difference was noted in emissions between modulation (GFSK, $\pi/4$ -DQPSK & 8DPSK); therefore, the final measurements are presented for GFSK DH5 mode only.

Peak detector "Max held" Analyser plots against the Quasi-Peak / Average limit line(s) can be found in Section 6 of this report.

LIMITS:

15.207: as given in the above tables / drawn on the respective plots.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:

150kHz to 30MHz ± 3.40 dB (UE71).

5.2 Radiated emissions 9 - 150 kHz

5.2.1 Test methods

Test Requirements: 47 CFR Part 15.247 Part 15.209 [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 6.4 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15.247 Part 15.209/15.247(d) [Reference 4.1.1 of this report]

5.2.2 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was rotated in all three orthogonal planes. Radiated Emissions testing was performed whilst powered by 120 V AC.

The EUT was operated in Modes 1-27.

5.2.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below.

Measurements were made in a semi-anechoic chamber (pre-scan) with any final measurements required performed on an OATS without a ground plane. The antenna was placed 1m above the ground. The equipment was rotated 360 degrees to record the worst-case emissions.

At least 6 signals within 20 dB and all signals within 10dB of the limit were investigated.

Tests were performed using Test Site M.

5.2.4 Test equipment

E411, E624, TMS81

See Section 8 for more details

5.2.5 Test results

Temperature of test environment 19°C
Humidity of test environment 65%
Pressure of test environment 102kPa

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH1
Low channel	2402 MHz

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
All emissions were greater than 20 dB below the limit				

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH1
Mid channel	2441 MHz

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
All emissions were greater than 20 dB below the limit				

Plot refs
14745-3 Rad 1 9k-150kHz Para
14745-3 Rad 1 9k-150kHz Perp

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH1
High channel	2480 MHz

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
All emissions were greater than 20 dB below the limit				

No discernible difference was noted in emissions between modulation (GFSK, $\pi/4$ -DQPSK & 8DPSK) therefore, the final measurements are presented for GFSK DH1 mode only.

Peak detector "Max held" Analyser plots against the Quasi-Peak / Average limit line(s) can be found in Section 6 of this report.

LIMITS:

15.209 limits are applicable in the restricted bands of 15.205 with the relevant detector.

15.247(d) other emissions, outside the intentional band, must be attenuated by at least 20/30dB from the level of the fundamental / meet the general limits of 15.209.

The general limits of 15.209 are as drawn on the respective plots.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows: 9kHz to 30MHz ± 3.11 dB (UE30).

5.3 Radiated emissions 150 kHz - 30 MHz

5.3.1 Test methods

Test Requirements: 47 CFR Part 15.247 Part 15.209 [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 6.4 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15.247 Part 15.209/15.247(d) [Reference 4.1.1 of this report]

5.3.2 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was rotated in all three orthogonal planes. Radiated Emissions testing was performed whilst powered by 120 V AC.

The EUT was operated in Modes 1-27.

5.3.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below.

Measurements were made in a semi-anechoic chamber (pre-scan) with any final measurements required performed on an OATS without a ground plane. The antenna was placed 1m above the ground. The equipment was rotated 360 degrees to record the worst-case emissions.

At least 6 signals within 20dB and all signals within 10dB of the limit were investigated.

Tests were performed using Test Site M.

5.3.4 Test equipment

E411, E624, TMS81

See Section 8 for more details

5.3.5 Test results

Temperature of test environment 19°C
Humidity of test environment 65%
Pressure of test environment 102kPa

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH1
Low channel	2402 MHz

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
All emissions were greater than 20 dB below the limit				

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH1
Mid channel	2441 MHz

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
All emissions were greater than 20 dB below the limit				

Plot refs
14745-3 Rad 1 150k-30MHz Para
14745-3 Rad 1 150k-30MHz Perp

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH1
High channel	2480 MHz

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
All emissions were greater than 20 dB below the limit				

No discernible difference was noted in emissions between modulation (GFSK, $\pi/4$ -DQPSK & 8DPSK) therefore, the final measurements are presented for GFSK DH1 mode only.

Peak detector "Max held" Analyser plots against the Quasi-Peak / Average limit line(s) can be found in Section 6 of this report.

LIMITS:

15.209 limits are applicable in the restricted bands of 15.205 with the relevant detector.

15.247(d) other emissions, outside the intentional band, must be attenuated by at least 20/30dB from the level of the fundamental / meet the general limits of 15.209.

The general limits of 15.209 are as drawn on the respective plots.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows: 9kHz to 30MHz ± 3.11 dB (UE30).

5.4 Radiated emissions 30 MHz -1 GHz

5.4.1 Test methods

Test Requirements: 47 CFR Part 15.247 Part 15.247(d) & 15.209 [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 6.5 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15.247 Part 15.247(d) & 15.209 [Reference 4.1.1 of this report]

5.4.2 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was rotated in all three orthogonal planes. Radiated Emissions testing was performed whilst powered by 120 V AC. The EUT was operated in Modes 1-27.

5.4.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below.

Measurements were made on a site listed with the FCC. The equipment was rotated 360 degrees and the antenna scanned 1 – 4 metres in both horizontal and vertical polarisations to record the worst case emissions.

At least 6 signals within 20dB and all signals within 10dB of the limit were investigated.

Tests were performed using Test Site M.

5.4.4 Test equipment

E411, E624, E743, LPE364

See Section 8 for more details

5.4.5 Test results

Temperature of test environment 19°C
Humidity of test environment 65%
Pressure of test environment 102kPa

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH1
Low channel	2402 MHz

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
As GFSK DH1 2441 MHz (Mid Channel)				

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH1
Mid channel	2441 MHz

Table of signals measured for Rad 1 Horizontal 30M-1GHz

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
1	147.459	29.9	26.4	-17.1
2	159.748	31.6	30.0	-13.5
3	184.324	27.7	23.9	-19.6

4	196.613	31.0	28.9	-14.6
5	199.997	30.2	28.5	-15.0
6	208.901	28.3	25.2	-18.3
7	221.189	31.2	28.6	-17.4
8	233.477	33.5	31.6	-14.4
9	245.766	35.4	33.1	-12.9
10	307.207	35.2	33.1	-12.9
11	319.495	35.9	33.6	-12.4
12	344.072	33.8	31.1	-14.9
13	393.225	33.5	30.3	-15.7
14	399.995	35.0	31.4	-14.6
15	466.955	35.8	32.1	-13.9
16	589.838	38.3	35.7	-10.3
17	599.992	40.3	38.3	-7.7
18	638.992	36.4	32.6	-13.4
19	710.005	34.4	27.5	-18.5
20	737.297	39.7	36.2	-9.8
21	786.450	40.8	37.9	-8.1
22	799.990	41.7	38.5	-7.5
23	811.027	41.1	38.4	-7.6
24	835.603	41.6	39.4	-6.6
25	1000.000	45.0	43.0	-11.0

Table of signals measured for Rad 1 Vertical 30M-1GHz

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
1	36.865	34.4	31.6	-8.4
2	38.401	30.6	26.9	-13.1
3	49.153	27.9	25.4	-14.6
4	86.018	24.8	21.4	-18.6
5	159.748	32.3	30.5	-13.0
6	196.613	31.1	28.9	-14.6
7	199.998	34.9	33.3	-10.2
8	208.901	30.1	27.9	-15.6
9	245.766	31.2	27.8	-18.2
10	258.055	31.4	27.0	-19.0
11	270.342	33.3	30.7	-15.3
12	282.631	30.6	26.6	-19.4
13	294.919	31.8	28.3	-17.7
14	344.070	32.1	27.7	-18.3
15	393.225	33.2	29.7	-16.3
16	399.995	34.1	30.8	-15.2
17	479.214	32.0	26.1	-19.9
18	589.838	37.8	34.5	-11.5
19	599.993	38.7	35.9	-10.1
20	786.457	35.1	30.2	-15.8
21	799.991	37.8	33.9	-12.1
22	811.020	36.0	31.1	-14.9
23	835.604	36.3	32.8	-13.2
24	1000.000	41.6	37.8	-16.2

Plot refs

14745-3 Rad 1 VHF Horiz

14745-3 Rad 1 VHF Vert

File Name: Monitor Audio Group.14745-3 Issue 02

QMF21J - Issue 05 - KEC Issue 04; 47 CFR Part 15.247 2024

14745-3 Rad 1 UHF Horiz
14745-3 Rad 1 UHF Vert

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH1
High channel	2480 MHz

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
As GFSK DH1 2441 MHz (Mid Channel)				

No discernible difference was noted in emissions between modulation (GFSK, $\pi/4$ -DQPSK & 8DPSK) therefore, the final measurements are presented for GFSK DH1 mode only.

Peak detector "Max held" Analyser plots against the Quasi-Peak / Average limit line(s) can be found in Section 6 of this report.

No discernible difference was noted in emissions between channel settings (exploratory measurements), therefore final measurements are presented for TX mid channel mode only for these test ranges.

Whilst Low, Mid and High channels were tested, plots are for illustrative purposes only and only Mid channel plots are shown in this report.

LIMITS:

15.209 limits are applicable in the restricted bands of 15.205 with the relevant detector.

15.247(d) other emissions, outside the intentional band, must be attenuated by at least 20/30dB from the level of the fundamental / meet the general limits of 15.209.

The general limits of 15.209 are as drawn on the respective plots.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:

30MHz to 1GHz ± 6.16 dB (UE60a & UE60b).

5.5 Radiated emissions above 1 GHz

5.5.1 Test methods

Test Requirements: 47 CFR Part 15.247 Part 15.247(d) & 15.209 [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 6.6 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15.247 Part 15.247(d) & 15.209 [Reference 4.1.1 of this report]

5.5.2 Configuration of EUT

The EUT was placed on a 1.5 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was rotated in all three orthogonal planes. Radiated Emissions testing was performed whilst powered by 120 V AC.

The EUT was operated in Modes 31, 32 and 33.

5.5.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. Measurements were made in a semi-anechoic chamber with appropriate absorbing material for use in this range. Horn antennas were used at heights where the whole of the EUT was contained within the main beam. Emissions pre-scans were performed, including Antenna height scanning to determine any worst-case maximised emissions/point sources of radiation for final test. Final tests were performed with the antenna in worst case position. The EUT was rotated through 360 degrees to record the worst-case emissions. A measurement distance of 3m was used between the test range 1 - 6GHz, 1.2m was used in the test range 6 - 18GHz and 0.3m was used in the test range 18 - 40GHz. At least 6 signals within 20dB and all signals within 10dB of the limit were investigated.

Tests were performed using Test Sites B, H and M.

5.5.4 Test equipment

E136, E296-2, E311, E411, E414, E429, E478, E624, E996, TMS78, TMS79, TMS82

See Section 8 for more details

5.5.5 Test results

Temperature of test environment 20°C
Humidity of test environment 66%
Pressure of test environment 98kPa

Setup Table

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH1
Low channel	2402 MHz

Spurious Frequency (MHz)	Measured Peak Level (dBµV/m)	Difference to Peak Limit (dB)	Measured Average Level (dBµV/m)	Difference to Average Limit (dB)	EUT Polarisation	Antenna Polarisation
1000	47.59	-26.41	42.19	-11.81	Side	Horizontal
2285.027	44.7	-29.3	36.9	-17.1	Side	Horizontal
2311.025	45.2	-28.8	36.5	-17.5	Side	Horizontal
2336.998	47.57	-26.43	41.07	-12.93	Side	Horizontal
2337.013	44.69	-29.31	35.89	-18.11	Side	Vertical
2363.011	45.03	-28.97	36.93	-17.07	Side	Horizontal
2388.976	45.24	-28.76	36.54	-17.46	Side	Horizontal
2492.966	45.96	-28.04	38.36	-15.64	Side	Horizontal
2493.02	44.44	-29.56	35.54	-18.46	Side	Vertical
4804	50.08	-23.92	43.08	-10.92	Side	Horizontal

11890.199	47.35	-26.65	35.05	-18.95	Side	Horizontal
12466.097	46.28	-27.72	34.28	-19.72	Side	Vertical

Setup Table

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH1
Mid channel	2441 MHz

Spurious Frequency (MHz)	Measured Peak Level (dBµV/m)	Difference to Peak Limit (dB)	Measured Average Level (dBµV/m)	Difference to Average Limit (dB)	EUT Polarisation	Antenna Polarisation
1000	47.59	-26.41	42.19	-11.81	Side	Horizontal
2285.027	44.7	-29.3	36.9	-17.1	Side	Horizontal
2311.025	45.2	-28.8	36.5	-17.5	Side	Horizontal
2336.998	47.57	-26.43	41.07	-12.93	Side	Horizontal
2337.013	44.69	-29.31	35.89	-18.11	Side	Vertical
2363.011	45.03	-28.97	36.93	-17.07	Side	Horizontal
2388.976	45.24	-28.76	36.54	-17.46	Side	Horizontal
2492.966	45.96	-28.04	38.36	-15.64	Side	Horizontal
2493.02	44.44	-29.56	35.54	-18.46	Side	Vertical
4882	49.2	-24.8	41.1	-12.9	Side	Horizontal
7323	51.36	-22.64	43.46	-10.54	Side	Vertical
7323	50.56	-23.44	42.46	-11.54	Side	Horizontal
11890.199	47.35	-26.65	35.05	-18.95	Side	Horizontal
12466.097	46.28	-27.72	34.28	-19.72	Side	Vertical

Plots
14745-3 Rad 1 1-3GHz Horiz
14745-3 Rad 1 1-3GHz Vert
14745-3 Rad 1 3-5GHz Horiz
14745-3 Rad 1 3-5GHz Vert
14745-3 Rad 1 5-6GHz Horiz
14745-3 Rad 1 5-6GHz Vert
14745-3 Rad 1 6-7.77GHz Horiz
14745-3 Rad 1 6-7.77GHz Vert
14745-3 Rad 1 7.77-10GHz Horiz
14745-3 Rad 1 7.77-10GHz Vert
14745-3 Rad 1 10-12.5GHz Horiz
14745-3 Rad 1 10-12.5GHz Vert
14745-3 Rad 1 12-15GHz Horiz
14745-3 Rad 1 12-15GHz Vert
14745-3 Rad 1 15-18GHz Horiz
14745-3 Rad 1 15-18GHz Vert
14745-3 Rad 1 18-22GHz Horiz
14745-3 Rad 1 18-22GHz Vert
14745-3 Rad 1 22-25GHz Horiz
14745-3 Rad 1 22-25GHz Vert
14745-3 Rad 1 25-26.5 GHz Horiz
14745-3 Rad 1 25-26.5 GHz Vert
14745-3 Rad Em 26.5-29 GHz Horiz
14745-3 Rad Em 26.5-29 GHz Vert
14745-3 Rad Em 29-32 GHz Horiz
14745-3 Rad Em 29-32 GHz Vert

File Name: Monitor Audio Group.14745-3 Issue 02

QMF21J - Issue 05 - KEC Issue 04; 47 CFR Part 15.247 2024

14745-3 Rad Em 32-35 GHz Horiz
14745-3 Rad Em 32-35 GHz Vert
14745-3 Rad Em 35-38 GHz Horiz
14745-3 Rad Em 35-38 GHz Vert
14745-3 Rad Em 38-40 GHz Horiz
14745-3 Rad Em 38-40 GHz Vert

Setup Table

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH1
High channel	2480 MHz

Spurious Frequency (MHz)	Measured Peak Level (dBμV/m)	Difference to Peak Limit (dB)	Measured Average Level (dBμV/m)	Difference to Average Limit (dB)	EUT Polarisation	Antenna Polarisation
1000	47.59	-26.41	42.19	-11.81	Side	Horizontal
2285.027	44.7	-29.3	36.9	-17.1	Side	Horizontal
2311.025	45.2	-28.8	36.5	-17.5	Side	Horizontal
2336.998	47.57	-26.43	41.07	-12.93	Side	Horizontal
2337.013	44.69	-29.31	35.89	-18.11	Side	Vertical
2363.011	45.03	-28.97	36.93	-17.07	Side	Horizontal
2388.976	45.24	-28.76	36.54	-17.46	Side	Horizontal
2492.966	45.96	-28.04	38.36	-15.64	Side	Horizontal
2493.02	44.44	-29.56	35.54	-18.46	Side	Vertical
4960	47.85	-26.15	38.45	-15.55	Side	Horizontal
7440	50.03	-23.97	41.33	-12.67	Side	Vertical
7440	52.33	-21.67	43.73	-10.27	Side	Horizontal
11890.199	47.35	-26.65	35.05	-18.95	Side	Horizontal
12466.097	46.28	-27.72	34.28	-19.72	Side	Vertical

No discernible difference was noted in emissions between modulation (GFSK, $\pi/4$ -DQPSK & 8DPSK) therefore, the final measurements are presented for GFSK DH1 mode only.
Peak detector "Max held" Analyser plots against the Average limit line can be found in Section 6 of this report.

Note: Whilst Low, Mid and High channels were tested, plots are for illustrative purposes only and only Mid channel plots are shown in this report. Upper frequency test range was plotted up to 40 GHz based on the 5GHz WLAN channels operating simultaneously with the Bluetooth classic channels – to check for any intermodulation emissions.

LIMITS:

15.209 limits are applicable in the restricted bands of 15.205 with the relevant detector.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:
1GHz to 3GHz ± 4.81 dB (UE77), 6GHz to 12.5GHz ± 5.39 dB (UE79), 12GHz to 18GHz ± 5.38 dB (UE80), 18GHz to 26.5GHz ± 6.02 dB (UE110), 26.5GHz to 40GHz ± 4.2 dB (UE33).

5.6 Effective radiated power field strength

5.6.1 Test methods

Test Requirements: 47 CFR Part 15.247 Part 15.247(d) [Reference 4.1.1 of this report]
 Test Method: ANSI C63.10 Clause 6.6 [Reference 4.1.2 of this report]
 Limits: 47 CFR Part 15.247 Part 15.247(d) & 15.209(a) [Reference 4.1.1 of this report]

5.6.2 Configuration of EUT

The EUT was placed on a 1.5 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was rotated in all three orthogonal planes to maximise emissions. Final measurements were taken at 3m. The EUT was operated in Modes 1-27.

5.6.3 Test procedure

Tests were made in accordance with the Test Method noted above using the measuring equipment listed in the 'Test Equipment used' section. The power stated is Peak radiated field strength.

Tests were performed in test site H.

5.6.4 Test equipment

E642, LPE261, LPE333

See Section 8 for more details

5.6.5 Test results

Temperature of test environment 24°C
 Humidity of test environment 52%
 Pressure of test environment 103kPa

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH1
Low channel	2402 MHz
Mid channel	2440 MHz
High channel	2480 MHz

	Low channel	Mid channel	High channel
Peak Level (dBµV/m)	105.51	106.08	106.15
Plot reference	Vert Upright Low Chan GFSK DH1	Horiz Flat Mid Chan GFSK DH1	Vert Upright High Chan GFSK DH1
Antenna Polarisation	Vert	Horiz	Vert
EUT Polarisation	Upright	Upright	Upright

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	DQPSK 2-DH1
Low channel	2402 MHz
Mid channel	2440 MHz
High channel	2480 MHz

	Low channel	Mid channel	High channel
Peak Level (dBµV/m)	104.12	104.78	104.76
Plot reference	Vert Upright Low Chan 4-DQPSK 2- DH1	Horiz Flat Mid Chan 4-DQPSK 2-DH1	Vert Upright High Chan 4-DQPSK 2- DH1
Antenna Polarisation	Vert	Horiz	Vert
EUT Polarisation	Upright	Upright	Upright

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	8-DPSK 3-DH1
Low channel	2402 MHz
Mid channel	2440 MHz
High channel	2480 MHz

	Low channel	Mid channel	High channel
Peak Level (dBµV/m)	104.55	105.14	105.14
Plot reference	Vert Upright Low Chan 8-DPSK 3-DH1	Horiz Flat Mid Chan 8-DPSK 3-DH1	Vert Upright High Chan 8-DPSK 3-DH1
Antenna Polarisation	Vert	Horiz	Vert
EUT Polarisation	Upright	Upright	Upright

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH3
Low channel	2402 MHz
Mid channel	2440 MHz
High channel	2480 MHz

	Low channel	Mid channel	High channel
Peak Level (dBµV/m)	105.51	106.08	106.12
Plot reference	Vert Upright Low Chan GFSK DH3	Horiz Flat Mid Chan GFSK DH3	Vert Upright High Chan GFSK DH3
Antenna Polarisation	Vert	Horiz	Vert
EUT Polarisation	Upright	Upright	Upright

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	DQPSK 2-DH3
Low channel	2402 MHz
Mid channel	2440 MHz
High channel	2480 MHz

	Low channel	Mid channel	High channel
Peak Level (dBµV/m)	104.23	104.86	104.84
Plot reference	Vert Upright Low Chan 4-DQPSK 2- DH3	Horiz Flat Mid Chan 4-DQPSK 2-DH3	Vert Upright High Chan 4-DQPSK 2- DH3
Antenna Polarisation	Vert	Horiz	Vert
EUT Polarisation	Upright	Upright	Upright

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	8-DPSK 3-DH3
Low channel	2402 MHz
Mid channel	2440 MHz
High channel	2480 MHz

	Low channel	Mid channel	High channel
Peak Level (dBµV/m)	104.49	105.12	105.07
Plot reference	Vert Upright Low Chan 8-DPSK 3-DH3	Horiz Flat Mid Chan 8-DPSK 3-DH3	Vert Upright High Chan 8-DPSK 3-DH3
Antenna Polarisation	Vert	Horiz	Vert
EUT Polarisation	Upright	Upright	Upright

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH5
Low channel	2402 MHz
Mid channel	2440 MHz
High channel	2480 MHz

	Low channel	Mid channel	High channel
Peak Level (dBµV/m)	105.53	106.07	106.18
Plot reference	Vert Upright Low Chan GFSK DH5	Horiz Flat Mid Chan GFSK DH5	Vert Upright High Chan GFSK DH5
Antenna Polarisation	Vert	Horiz	Vert
EUT Polarisation	Upright	Upright	Upright

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	DQPSK 2-DH5
Low channel	2402 MHz
Mid channel	2440 MHz
High channel	2480 MHz

	Low channel	Mid channel	High channel
Peak Level (dBµV/m)	104.19	104.83	104.79
Plot reference	Vert Upright Low Chan 4-DQPSK 2- DH5	Horiz Flat Mid Chan 4-DQPSK 2-DH5	Vert Upright High Chan 4-DQPSK 2- DH5
Antenna Polarisation	Vert	Horiz	Vert
EUT Polarisation	Upright	Upright	Upright

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	8-DPSK 3-DH5
Low channel	2402 MHz
Mid channel	2440 MHz
High channel	2480 MHz

	Low channel	Mid channel	High channel
Peak Level (dBμV/m)	104.52	105.12	105.06
Plot reference	Vert Upright Low Chan 8-DQPSK 3- DH5	Horiz Flat Mid Chan 8-DPSK 3-DH5	Vert Upright High Chan 8-DQPSK 3- DH5
Antenna Polarisation	Vert	Horiz	Vert
EUT Polarisation	Upright	Upright	Upright

Analyser plots can be found in Section 6 of this report.

LIMITS:

The maximum output power in all cases is 30dBm/ 1watt = 125.2 dBuV/m
@ 3 m.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:
1GHz to 3GHz ±4.81dB (UE77).

5.7 Band Edge Compliance

5.7.1 Test methods

Test Requirements: 47 CFR Part 15.247 Part 15.215 & 15.247(d) [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 6.10 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15.247 Part 15.209(a) & 15.247(d) [Reference 4.1.1 of this report]

5.7.2 Configuration of EUT

The EUT was placed on a 1.5 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres.

The EUT was operated in Modes 7, 9, 16, 18, 25 and 27.

5.7.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. The emission from the EUT was maximised before taking the plots.

Tests were performed using Test Site M.

5.7.4 Test equipment

E136, E411, E429, E624, E996, TMS82

See Section 8 for more details

5.7.5 Test results

Temperature of test environment 20°C
Humidity of test environment 66%
Pressure of test environment 98kPa

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH5
Low channel	2402 MHz (Low Ch)
High channel	2480 MHz (High Ch)

Restricted Band Edges	Low channel	High channel
Restricted Peak Level measured (dBuV/m)	47.73	50.47
Restricted band edge Peak Plot	14745-3 Rest Band Edge Low chan GFSK DH5	14745-3 Rest Band Edge High chan GFSK DH5

Authorised Band Edges	Low channel	High channel
Authorised Band Edge (dBc) value measured	-51.3	-65.42
Authorised Band Edge Plot	14745-3 Auth Band Edge Low chan GFSK DH5	14745-3 Auth Band Edge High chan GFSK DH5
Authorised Band Edge (dBc) Hopping value measured	-53.86	-68.87
Authorised Band Edge Hopping Plot	14745-3 Auth band edge Low chan GFSK DH5 Hopping	14745-3 Auth band edge High chan GFSK DH5 Hopping

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	DQPSK 2-DH5
Low channel	2402 MHz (Low Ch)
High channel	2480 MHz (High Ch)

Restricted Band Edges	Low channel	High channel
Restricted Peak Level measured (dBuV/m)	48.2	49.54
Restricted band edge Peak Plot	14745-3 Rest Band Edge Low chan DQPSK 2-DH5	14745-3 Rest Band Edge High chan DQPSK 2-DH5

Authorised Band Edges	Low channel	High channel
Authorised Band Edge (dBc) value measured	-47.22	-63.15
Authorised Band Edge Plot	14745-3 Auth Band Edge Low chan DQPSK 2-DH5	14745-3 Auth Band Edge High chan DQPSK 2-DH5
Authorised Band Edge (dBc) Hopping value measured	-49.32	-65.53
Authorised Band Edge Hopping Plot	14745-3 Auth band edge Low chan DQPSK 2-DH5 Hopping	14745-3 Auth band edge High chan DQPSK 2-DH5 Hopping

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	8-DPSK 3-DH5
Low channel	2402 MHz (Low Ch)
High channel	2480 MHz (High Ch)

Restricted Band Edges	Low channel	High channel
Restricted Peak Level measured (dBuV/m)	47.96	49.4
Restricted band edge Peak Plot	14745-3 Rest Band Edge Low chan 8-DPSK 3-DH5	14745-3 Rest Band Edge High chan 8-DPSK 3-DH5

Authorised Band Edges	Low channel	High channel
Authorised Band Edge (dBc) value measured	-46.98	-63.61
Authorised Band Edge Plot	14745-3 Auth Band Edge Low chan 8-DPSK 3-DH5	14745-3 Auth Band Edge High chan 8-DPSK 3-DH5
Authorised Band Edge (dBc) Hopping value measured	-54.14	-65.55
Authorised Band Edge Hopping Plot	14745-3 Auth band edge Low chan 8-DPSK 3-DH5 Hopping	14745-3 Auth band edge High chan 8-DPSK 3-DH5 Hopping

No average measurements made as peak complies with average limit.

Analyser plots for the Band Edge Compliance can be found in Section 6 of this report. These show the 20/30dBc requirement of 15.247(d) are met at the band edges of 2400 and 2483.5 MHz. The closest restricted bands are 2310-2390 MHz and 2483.5-2500 MHz. Restricted band edge plots are also shown in section 6.

The tables list the field strengths observed in the adjacent restricted bands, which are required to meet the tighter 15.209 limits.

*The limit is 54dBuV/m for Average emissions. According to 15.35(c): when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. For a 10% duty cycle, the power measured would be reduced by $20 \log(0.10) = 20\text{dB}$. According to the declared duty cycle, therefore, the emissions observed are below the limit after averaging for pulse rate.

LIMITS:

AV = 54dBuV/m at band edges

PK = 74dBuV/m at band edges

The restricted band edges closest to the EUT frequency of 2400-2483.5MHz are 2390 & 2483.5MHz.

Further wider span plots have been taken to show the fact that there are no spurious emissions above the restricted limits of 15.209.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows: 1GHz to 3GHz $\pm 4.81\text{dB}$ (UE77).

5.8 Occupied bandwidth

5.8.1 Test methods

Test Requirements: 47 CFR Part 15.247 Part 15.247(a)(1)(iii)/15.215 [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 6.9 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15.247 Part 15.215(c)

5.8.2 Configuration of EUT

The EUT was measured on a bench using a spectrum analyser connected to the temporary RF port. The EUT was tested whilst connected to the AC power for maximised emissions. The EUT was operated in Modes 1-27.

5.8.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. A 20kHz RBW, 3x VBW, auto sweep time and max hold settings were used for the 20dB bandwidth.

Tests were performed using Test Site A.

5.8.4 Test equipment

E547, E755

See Section 8 for more details

5.8.5 Test results

Temperature of test environment 20°C
Humidity of test environment 50%
Pressure of test environment 102kPa

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH1
Low channel	2402 MHz
Mid channel	2441 MHz
High channel	2480 MHz

	Low channel	Mid channel	High channel
20 dB Bandwidth Result (MHz)	0.913	0.8395	0.8394
Plot for 20 dB Bandwidth Result (MHz)	14745-3 BW Low Chan GFSK DH1	14745-3 BW Mid Chan GFSK DH1	14745-3 BW High Chan GFSK DH1
99 % Bandwidth Result (MHz)	0.84539	0.83971	0.83849
Frequency Error (kHz)	2.968	-10.152	-11.276
Operating frequency (MHz)	2402	2441	2480
20 dB FLOW Worst case (MHz)	2401.546468	2440.570098	2479.569024
20 dB FHIGH Worst case (MHz)	2402.459468	2441.409598	2480.408424

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH3
Low channel	2402 MHz
Mid channel	2441 MHz
High channel	2480 MHz

	Low channel	Mid channel	High channel
20 dB Bandwidth Result (MHz)	0.9388	0.9287	0.9336
Plot for 20 dB Bandwidth Result (MHz)	14745-3 BW Low Chan GFSK DH3	14745-3 BW Mid Chan GFSK DH3	14745-3 BW High Chan GFSK DH3
99 % Bandwidth Result (MHz)	0.86348	0.84932	0.85279
Frequency Error (kHz)	2.266	-13.251	-14.408
Operating frequency (MHz)	2402	2441	2480
20 dB FLOW Worst case (MHz)	2401.532866	2440.522399	2479.518792
20 dB FHIGH Worst case (MHz)	2402.471666	2441.451099	2480.452392

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH5
Low channel	2402 MHz
Mid channel	2441 MHz
High channel	2480 MHz

	Low channel	Mid channel	High channel
20 dB Bandwidth Result (MHz)	0.9449	0.9407	0.9389
Plot for 20 dB Bandwidth Result (MHz)	14745-3 BW Low Chan GFSK DH5	14745-3 BW Mid Chan GFSK DH5	14745-3 BW High Chan GFSK DH5
99 % Bandwidth Result (MHz)	0.86966	0.8692	0.865
Frequency Error (kHz)	2.085	-10.855	-12.831
Operating frequency (MHz)	2402	2441	2480
20 dB FLOW Worst case (MHz)	2401.529635	2440.518795	2479.517719
20 dB FHIGH Worst case (MHz)	2402.474535	2441.459495	2480.456619

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	DQPSK 2-DH1
Low channel	2402 MHz
Mid channel	2441 MHz
High channel	2480 MHz

	Low channel	Mid channel	High channel
20 dB Bandwidth Result (MHz)	1.217	1.222	1.219
Plot for 20 dB Bandwidth Result (MHz)	14745-3 BW Low Chan 4-DQPSK 2-DH1	14745-3 BW Mid Chan 4-DQPSK 2-DH1	14745-3 BW High Chan 4-DQPSK DH1
99 % Bandwidth Result (MHz)	1.1619	1.1662	1.1607
Frequency Error (kHz)	-13.581	-13.037	-13.929
Operating frequency (MHz)	2402	2441	2480
20 dB FLOW Worst case (MHz)	2401.377919	2440.375963	2479.376571
20 dB FHIGH Worst case (MHz)	2402.594919	2441.597963	2480.595571

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	DQPSK 2-DH3
Low channel	2402 MHz
Mid channel	2441 MHz
High channel	2480 MHz

	Low channel	Mid channel	High channel
20 dB Bandwidth Result (MHz)	1.253	1.252	1.253
Plot for 20 dB Bandwidth Result (MHz)	14745-3 BW Low Chan 4-DQPSK 2-DH3	14745-3 BW Mid Chan 4-DQPSK 2-DH2	14745-3 BW High Chan 4-DQPSK DH3
99 % Bandwidth Result (MHz)	1.1675	1.1661	1.1674
Frequency Error (kHz)	-9.316	-8.818	-9.803
Operating frequency (MHz)	2402	2441	2480
20 dB FLOW Worst case (MHz)	2401.364184	2440.365182	2479.363697
20 dB FHIGH Worst case (MHz)	2402.617184	2441.617182	2480.616697

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	DQPSK 2-DH5
Low channel	2402 MHz
Mid channel	2441 MHz
High channel	2480 MHz

	Low channel	Mid channel	High channel
20 dB Bandwidth Result (MHz)	1.237	1.236	1.236
Plot for 20 dB Bandwidth Result (MHz)	14745-3 BW Low Chan 4-DQPSK 2-DH5	14745-3 BW Mid Chan 4-DQPSK 2-DH5	14745-3 BW High Chan 4-DQPSK DH5
99 % Bandwidth Result (MHz)	1.1709	1.1723	1.1722
Frequency Error (kHz)	-9.431	-9.602	-10.241
Operating frequency (MHz)	2402	2441	2480
20 dB FLOW Worst case (MHz)	2401.372069	2440.372398	2479.371759
20 dB FHIGH Worst case (MHz)	2402.609069	2441.608398	2480.607759

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	8-DPSK 3-DH1
Low channel	2402 MHz
Mid channel	2441 MHz
High channel	2480 MHz

	Low channel	Mid channel	High channel
20 dB Bandwidth Result (MHz)	1.205	1.205	1.201
Plot for 20 dB Bandwidth Result (MHz)	14745-3 BW Low Chan 8-DPSK 3-DH1	14745-3 BW Mid Chan 8-DPSK 3-DH1	14745-3 BW High Chan 8-DPSK DH1
99 % Bandwidth Result (MHz)	1.14	1.1392	1.138
Frequency Error (kHz)	0.286	0.671	0.641
Operating frequency (MHz)	2402	2441	2480
20 dB FLOW Worst case (MHz)	2401.397786	2440.398171	2479.400141
20 dB FHIGH Worst case (MHz)	2402.602786	2441.603171	2480.601141

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	8-DPSK 3-DH3
Low channel	2402 MHz
Mid channel	2441 MHz
High channel	2480 MHz

	Low channel	Mid channel	High channel
20 dB Bandwidth Result (MHz)	1.254	1.256	1.25
Plot for 20 dB Bandwidth Result (MHz)	14745-3 BW Low Chan 8-DPSK 3-DH3	14745-3 BW Mid Chan 8-DPSK 3-DH3	14745-3 BW High Chan 8-DPSK DH3
99 % Bandwidth Result (MHz)	1.1694	1.17	1.1716
Frequency Error (kHz)	-7.694	-7.48	-8.526
Operating frequency (MHz)	2402	2441	2480
20 dB FLOW Worst case (MHz)	2401.365306	2440.36452	2479.366474
20 dB FHIGH Worst case (MHz)	2402.619306	2441.62052	2480.616474

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	8-DPSK 3-DH5
Low channel	2402 MHz
Mid channel	2441 MHz
High channel	2480 MHz

	Low channel	Mid channel	High channel
20 dB Bandwidth Result (MHz)	1.251	1.254	1.256
Plot for 20 dB Bandwidth Result (MHz)	14745-3 BW Low Chan GFSK8-DPSK 3-DH5	14745-3 BW Mid Chan 8-DPSK 3-DH5	14745-3 BW High Chan 8-DPSK DH5
99 % Bandwidth Result (MHz)	1.1675	1.172	1.1597
Frequency Error (kHz)	-7.779	-7.12	-7.381
Operating frequency (MHz)	2402	2441	2480
20 dB FLOW Worst case (MHz)	2401.366721	2440.36588	2479.364619
20 dB FHIGH Worst case (MHz)	2402.617721	2441.61988	2480.620619

Analyser plots for the 20/6dB bandwidth can be found in Section 6 of this report.

LIMITS:

15.215(c) The 20dB bandwidth of the emission must be contained within the designated frequency band. These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows: $\pm 0.17 \%$ (UR19B).

5.9 Maximum Average conducted output power

NOT APPLICABLE: Peak Conducted Power measured instead.

5.10 Maximum Peak conducted output power

5.10.1 Test methods

Test Requirements: 47 CFR Part 15.247 Part 15.247(b)(1) [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 7.8.5 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15.247 Part 15.247(b)(1) [Reference 4.1.1 of this report]

5.10.2 Configuration of EUT

The EUT was measured on a bench using a spectrum analyser connected to the temporary internal RF port. The EUT was set to each mode and test signal in turn (see section 2.4) and highest power levels recorded. The EUT was operated in Modes 1-27 for this test.

5.10.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. Peak readings stated are maximum power observed using a spectrum analyser RBW > 20dB BW of the EUT.

Measurements were made in site H.

5.10.4 Test equipment

E547, E755

See Section 8 for more details

5.10.5 Test results

Temperature of test environment 22°C
Humidity of test environment 63%
Pressure of test environment 98kPa

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH1
Low channel	2402 MHz
Mid channel	2441 MHz
High channel	2490 MHz

Nominal voltage result (dBm)	7.31	7.88	7.95
Single port Plot reference	14745-3 BTC 2402 MHz (Low Ch) Conducted Power GFSK DH1	14745-3 BTC 2441 MHz (Mid Ch) Conducted Power GFSK DH1	14745-3 BTC 2480 MHz (High Ch) Conducted Power GFSK DH1
Limit in dBm	30.00	30.00	30.00
Maximum result (dBm)	7.31	7.88	7.95
Margin to Limit (dB)	-22.69	-22.12	-22.05
Result in (W)	0.005	0.006	0.006

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	DQPSK 2-DH1
Low channel	2402 MHz
Mid channel	2441 MHz
High channel	2490 MHz

Nominal voltage result (dBm)	5.92	6.58	6.56
Single port Plot reference	14745-3 BTC 2402 MHz (Low Ch) Conducted Power DQPSK 2-DH1	14745-3 BTC 2441 MHz (Mid Ch) Conducted Power DQPSK 2-DH1	14745-3 BTC 2480 MHz (High Ch) Conducted Power DQPSK 2-DH1
Limit in dBm	30.00	30.00	30.00
Maximum result (dBm)	5.92	6.58	6.56

File Name: Monitor Audio Group.14745-3 Issue 02

QMF21J - Issue 05 - KEC Issue 04; 47 CFR Part 15.247 2024

Margin to Limit (dB)	-24.08	-23.42	-23.44
Result in (W)	0.004	0.005	0.005

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	8-DPSK 3-DH1
Low channel	2402 MHz
Mid channel	2441 MHz
High channel	2490 MHz

Nominal voltage result (dBm)	6.35	6.94	6.94
Single port Plot reference	14745-3 BTC 2402 MHz (Low Ch) Conducted Power 8-DPSK 3-DH1	14745-3 BTC 2441 MHz (Mid Ch) Conducted Power 8-DPSK 3-DH1	14745-3 BTC 2480 MHz (High Ch) Conducted Power 8-DPSK 3-DH1
Limit in dBm	30.00	30.00	30.00
Maximum result (dBm)	6.35	6.94	6.94
Margin to Limit (dB)	-23.65	-23.06	-23.06
Result in (W)	0.004	0.005	0.005

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH3
Low channel	2402 MHz
Mid channel	2441 MHz
High channel	2490 MHz

Nominal voltage result (dBm)	7.31	7.88	7.92
Single port Plot reference	14745-3 BTC 2402 MHz (Low Ch) Conducted Power GFSK DH3	14745-3 BTC 2441 MHz (Mid Ch) Conducted Power GFSK DH3	14745-3 BTC 2480 MHz (High Ch) Conducted Power GFSK DH3
Limit in dBm	30.00	30.00	30.00
Maximum result (dBm)	7.31	7.88	7.92
Margin to Limit (dB)	-22.69	-22.12	-22.08
Result in (W)	0.005	0.006	0.006

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	DQPSK 2-DH3
Low channel	2402 MHz
Mid channel	2441 MHz
High channel	2490 MHz

Nominal voltage result (dBm)	6.03	6.66	6.64
Single port Plot reference	14745-3 BTC 2402 MHz (Low Ch) Conducted Power DQPSK 2-DH3	14745-3 BTC 2441 MHz (Mid Ch) Conducted Power DQPSK 2-DH3	14745-3 BTC 2480 MHz (High Ch) Conducted Power DQPSK 2-DH3
Limit in dBm	30.00	30.00	30.00
Maximum result (dBm)	6.03	6.66	6.64
Margin to Limit (dB)	-23.97	-23.34	-23.36
Result in (W)	0.004	0.005	0.005

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	8-DPSK 3-DH3
Low channel	2402 MHz
Mid channel	2441 MHz
High channel	2490 MHz

Nominal voltage result (dBm)	6.29	6.92	6.87
Single port Plot reference	14745-3 BTC 2402 MHz (Low Ch) Conducted Power 8-DPSK 3-DH3	14745-3 BTC 2441 MHz (Mid Ch) Conducted Power 8-DPSK 3-DH3	14745-3 BTC 2480 MHz (High Ch) Conducted Power 8-DPSK 3-DH3
Limit in dBm	30.00	30.00	30.00
Maximum result (dBm)	6.29	6.92	6.87
Margin to Limit (dB)	-23.71	-23.08	-23.13
Result in (W)	0.004	0.005	0.005

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH5
Low channel	2402 MHz
Mid channel	2441 MHz
High channel	2490 MHz

Nominal voltage result (dBm)	7.33	7.87	7.98
Single port Plot reference	14745-3 BTC 2402 MHz (Low Ch) Conducted Power GFSK DH5	14745-3 BTC 2441 MHz (Mid Ch) Conducted Power GFSK DH5	14745-3 BTC 2480 MHz (High Ch) Conducted Power GFSK DH5
Limit in dBm	30.00	30.00	30.00
Maximum result (dBm)	7.33	7.87	7.98
Margin to Limit (dB)	-22.67	-22.13	-22.02
Result in (W)	0.005	0.006	0.006

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	DQPSK 2-DH5
Low channel	2402 MHz
Mid channel	2441 MHz
High channel	2490 MHz

Nominal voltage result (dBm)	5.99	6.63	6.59
Single port Plot reference	14745-3 BTC 2402 MHz (Low Ch) Conducted Power DQPSK 2-DH5	14745-3 BTC 2441 MHz (Mid Ch) Conducted Power DQPSK 2-DH5	14745-3 BTC 2480 MHz (High Ch) Conducted Power DQPSK 2-DH5
Limit in dBm	30.00	30.00	30.00
Maximum result (dBm)	5.99	6.63	6.59
Margin to Limit (dB)	-24.01	-23.37	-23.41
Result in (W)	0.004	0.005	0.005

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	8-DPSK 3-DH5
Low channel	2402 MHz
Mid channel	2441 MHz
High channel	2490 MHz

Nominal voltage result (dBm)	6.32	6.92	6.86
Single port Plot reference	14745-3 BTC 2402 MHz (Low Ch) Conducted Power 8-DPSK 3-DH5	14745-3 BTC 2441 MHz (Mid Ch) Conducted Power 8-DPSK 3-DH5	14745-3 BTC 2480 MHz (High Ch) Conducted Power 8-DPSK 3-DH5
Limit in dBm	30.00	30.00	30.00
Maximum result (dBm)	6.32	6.92	6.86
Margin to Limit (dB)	-23.68	-23.08	-23.14
Result in (W)	0.004	0.005	0.005

ANSI C63.10 clause 7.8.5 method:

a) is RBW > 20dB BW method

If continuous tx refer to KDB558074 Clause 8.2.3

If duty cycle corrected refer to KDB558074 Clause 8.2.4

LIMITS:

15.247(b)(1)

For FHSS operating 2400-2483.5 MHz employing at least 75 channels 1 Watt /
These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:
<3 GHz ± 0.56 dB.

5.11 Maximum Power Spectral Density

NOT APPLICABLE: EUT does not employ DTS technology.

5.12 Antenna power conducted emissions

NOT APPLICABLE: Applies to EUT's with an antenna port. The EUT has an integral antenna only / The EUT was tested for radiated emissions with its dedicated antenna in position.

5.13 Duty cycle

NOT APPLICABLE: EUT does not employ DTS technology.

5.14 FHSS carrier frequency separation

5.14.1 Test methods

Test Requirements: 47 CFR Part 15.247 Part 15.247(a)(1) [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 7.8.2 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15.247 Part 15.247(a)(1) [Reference 4.1.1 of this report]

5.14.2 Configuration of EUT

The EUT was tested on the bench and ambient conditions were monitored. The EUT was operated in Modes 28, 29 and 30.

5.14.3 Test procedure

Tests were made using the measuring equipment listed in the 'Test Equipment' Section. With the EUT hopping, a span was set on the spectrum analyser to show two adjacent channel peaks. The analyser was set to Peak detector and a max held trace, the trace was allowed enough sweeps to stabilise.

Tests were performed in test site A.

5.14.4 Test equipment

E547, E755

See Section 8 for more details

5.14.5 Test results

Temperature of test environment 20°C
Humidity of test environment 50%
Pressure of test environment 102kPa

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH5
Single channel	2402 MHz

	Single channel
Separation (kHz)	999.6
Plot of Separation (kHz)	Carrier Frequency Separation BTC DH5

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	DQPSK 2-DH5
Single channel	2402 MHz

	Single channel
Separation (kHz)	999.6
Plot of Separation (kHz)	Carrier Frequency Separation BTC 2-DH5

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	8-DPSK 3-DH5
Single channel	2402 MHz

	Single channel
Separation (kHz)	999.6
Plot of Separation (kHz)	Carrier Frequency Separation BTC 3-DH5

Analyser plots for the carrier separation can be found in Section 6 of this report

LIMITS:

FHSS shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the -20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, FHSS operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two thirds of the -20 dB bandwidth of the hopping channel, whichever is greater, provided that the systems operate with an output power no greater than 0.125 W.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:
PSA+GPS (to 26.5 GHz) ± 0.013 ppm.

5.15 Average time of occupancy

5.15.1 Test methods

Test Requirements: 47 CFR Part 15.247 Part 15.247(a)(1)(iii) [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 7.8.4 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15.247 Part 15.247(a)(1)(iii) [Reference 4.1.1 of this report]

5.15.2 Configuration of EUT

The EUT was measured on a bench using a spectrum analyser connected to the temporary RF port. Ambient conditions were monitored. The EUT was operated in Modes 28, 29 and 30 for this test.

5.15.3 Test procedure

Tests were made using the measuring equipment listed in the 'Test Equipment' Section. The EUT was set into hopping mode for each applicable scheme/rate. A spectrum analyser was set to zero span and its Y amplitude/Video output connected to a high resolution oscilloscope input. TX bursts were captured using the appropriate sweep times. Accumulated TX time was then calculated from number of transmissions in the observation time multiplied by a single TX On time for the desired scheme.

Tests were performed in test site A.

5.15.4 Test equipment

E547, H071

See Section 8 for more details

5.15.5 Test results

Temperature of test environment 20°C
Humidity of test environment 50%
Pressure of test environment 102kPa

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH5
Single channel	Hopping

Measured Dwell time/pulse width (ms)	2.9163
Period time (s)	31.6
Instances of pulse within period time	130
Average time of occupancy (ms)	379.119
Plot reference for Measured Dwell time/pulse width	Occupancy Period DH5
Plot reference for Period time	31.6 S observation DH5

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	4-DQPSK 2-DH5
Single channel	Hopping

Measured Dwell time/pulse width (ms)	2.9291
Period time (s)	31.6
Instances of pulse within period time	109
Average time of occupancy (ms)	319.2719
Plot reference for Measured Dwell time/pulse width	Occupancy Period 2-DH5
Plot reference for Period time	31.6 S observation 2-DH5

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	8-DPSK 3-DH5
Single channel	Hopping

Measured Dwell time/pulse width (ms)	2.9291
Period time (s)	31.6
Instances of pulse within period time	107
Average time of occupancy (ms)	313.4137
Plot reference for Measured Dwell time/pulse width	Occupancy Period 3-DH5
Plot reference for Period time	31.6 S observation 3-DH5

Note: Regardless of number of hopping channels set in the test sequence within the test software, the same dwell time/pulse width was observed within each of the DH(GFSK), 2DH(4-DQPSK) and 3DH(8-DPSK) settings. Analyser plots showing pulse width and period /repetition can be found in Section 6 of this report.

LIMITS:

FHSS operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows: $\pm 9.6\%$ (UR26A).

5.16 Number of Hop Channels

5.16.1 Test methods

Test Requirements: 47 CFR Part 15.247 Part 15.247(a)(1)(iii) [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 7.8.3 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15.247 Part 15.247(a)(1)(iii) [Reference 4.1.1 of this report]

5.16.2 Configuration of EUT

The EUT was measured on a bench using a spectrum analyser connected to the temporary RF port. Ambient conditions were monitored. The EUT was operated in Mode 28 for this test.

5.16.3 Test procedure

Tests were made using the measuring equipment noted in the 'Test Equipment' Section at Site H. With the EUT hopping, a suitable span was set on the spectrum analyser to show clearly over a range of plots the number of channels being used by the EUT. The analyser was set to Peak detector and max held and the trace was allowed to stabilise for each plot.

Tests were performed in site H.

5.16.4 Test equipment

E547, E755

See Section 8 for more details

5.16.5 Test results

Temperature of test environment 20°C
Humidity of test environment 50%
Pressure of test environment 102kPa

Band	2400-2483.5 MHz
Power Level	Default
Channel Spacing	1 MHz
Mod Scheme	GFSK DH5
Single channel	Hopping

No of hopping Channels	79
Minimum No. Required number by specification	15
Plot of Hopping Channels 0-38	Number of Hopping Channels DH5 Plot 1 of 2
Plot of Hopping Channels 39-78	Number of Hopping Channels DH5 Plot 2 of 2

Analyser plots showing the number of hopping channels can be found in Section 6 of this report.

LIMITS:

FHSS operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

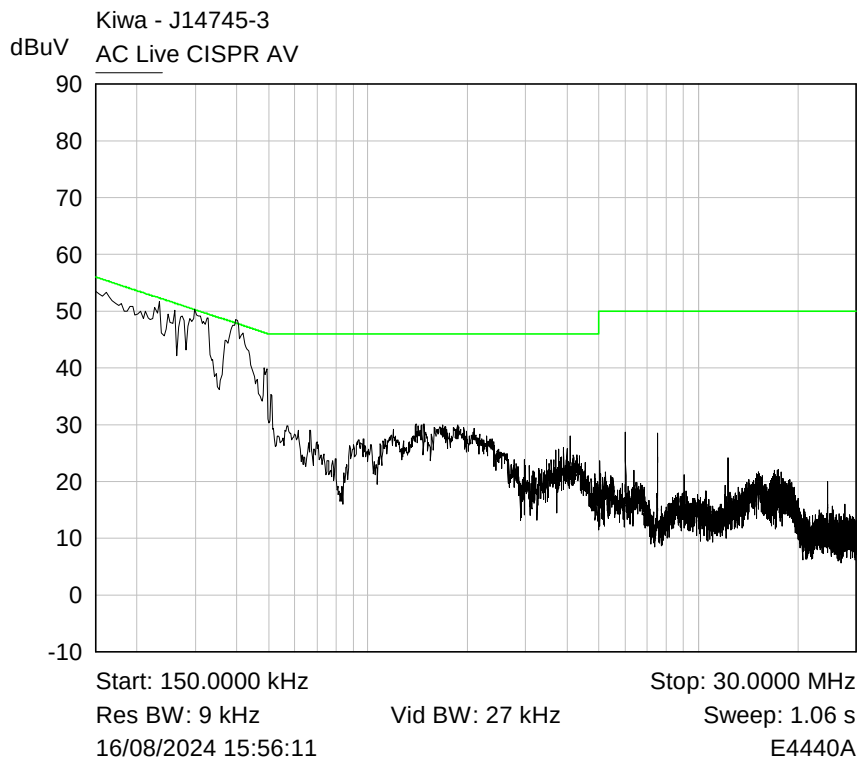
These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows: PSA, ±0.03 %, PXA, ±0.013 % (UR26C).

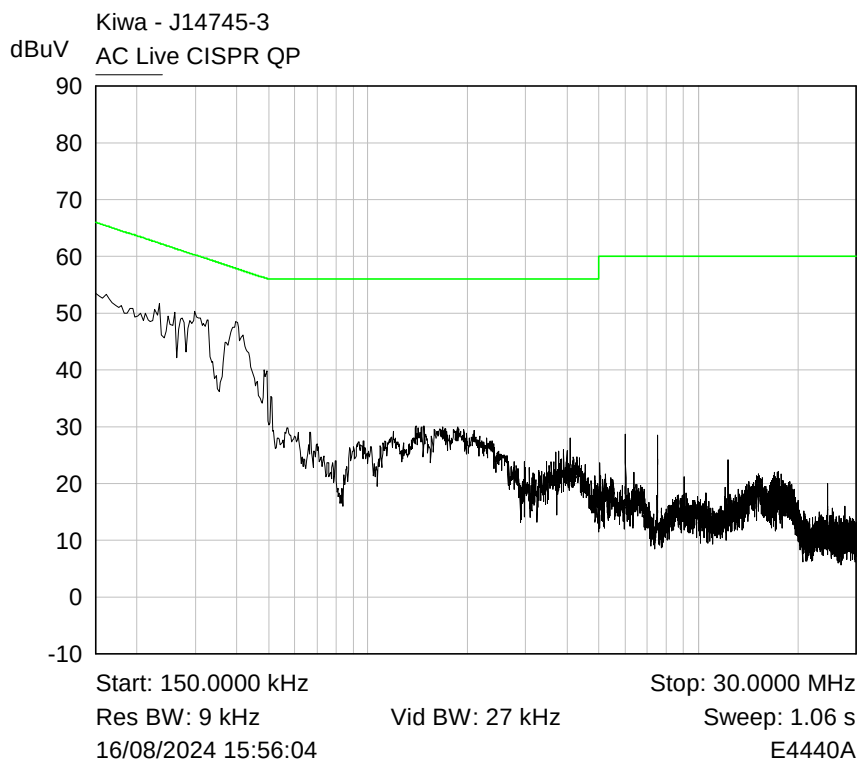
6 Plots/Graphical results

6.1 AC power line conducted emissions

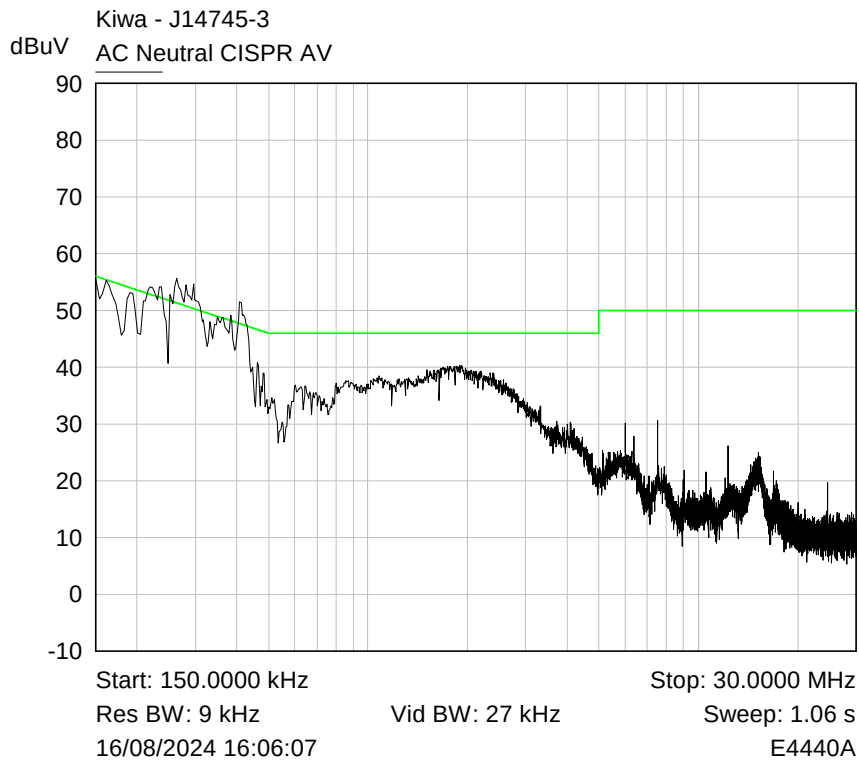
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1MHz, Modulation GFSK DH5, Channel Hopping



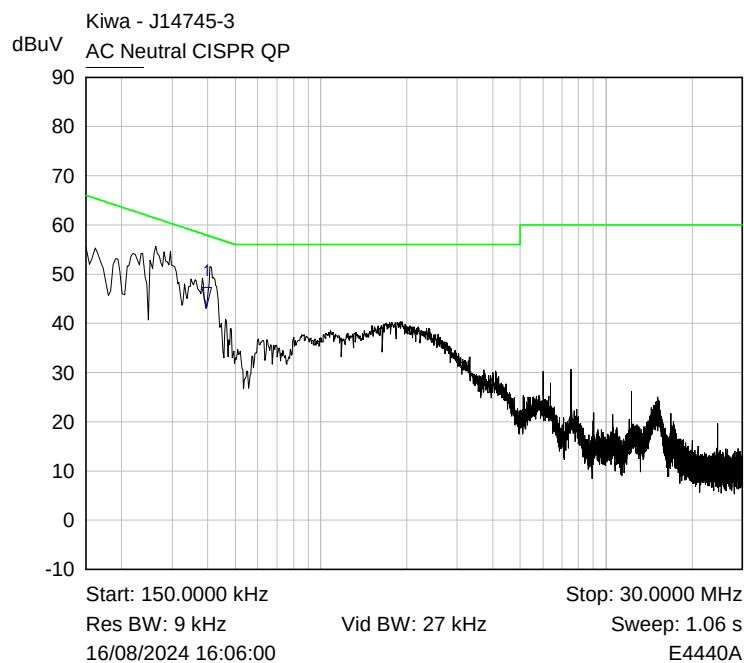
Plot of Live150k-30M Average



Plot of Live150k-30M Quasi-Peak



Plot of Neutral150k-30M Average

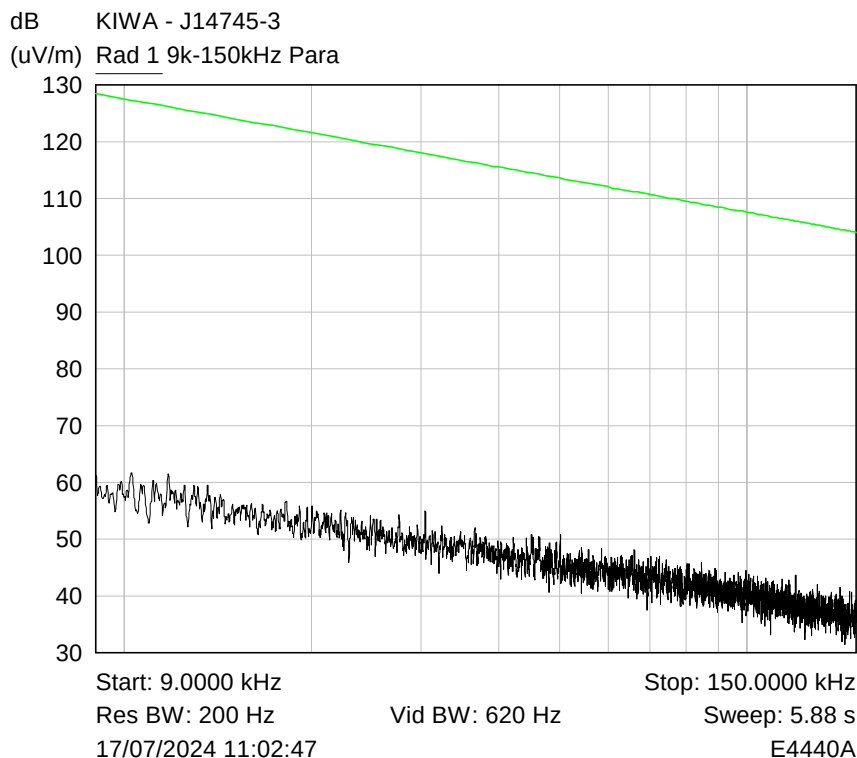


Mkr	Trace	X-Axis	Value	Notes
1 ▽	AC Neutral CISPR QP	307.8086 kHz	43.33 dBuV	

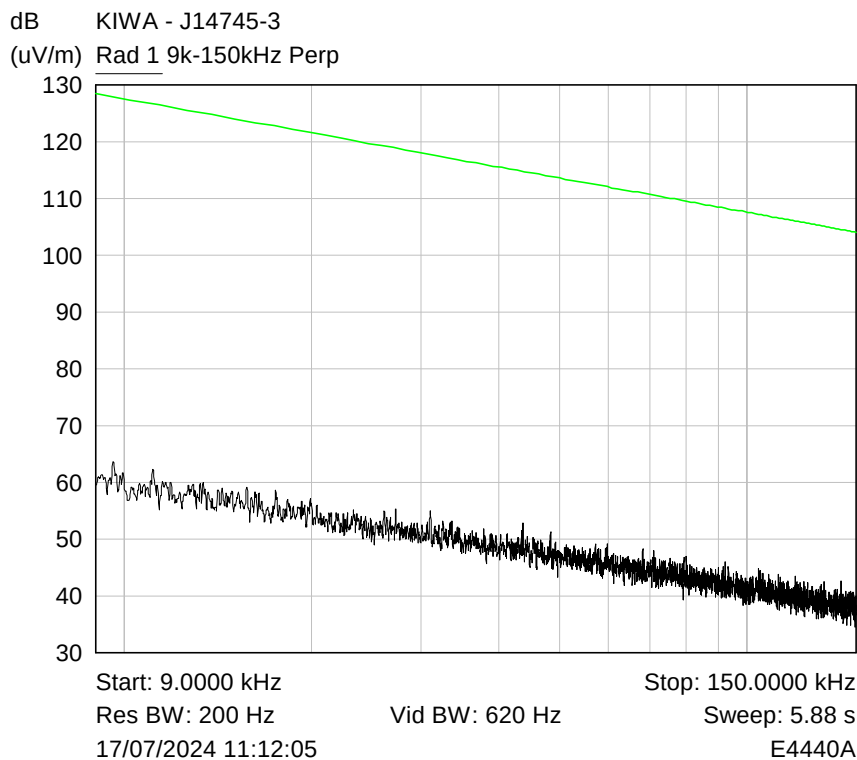
Plot of Neutral150k-30M Quasi-Peak

6.2 Radiated emissions 9 - 150 kHz

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH1, Channel 2441 MHz (Mid Ch)



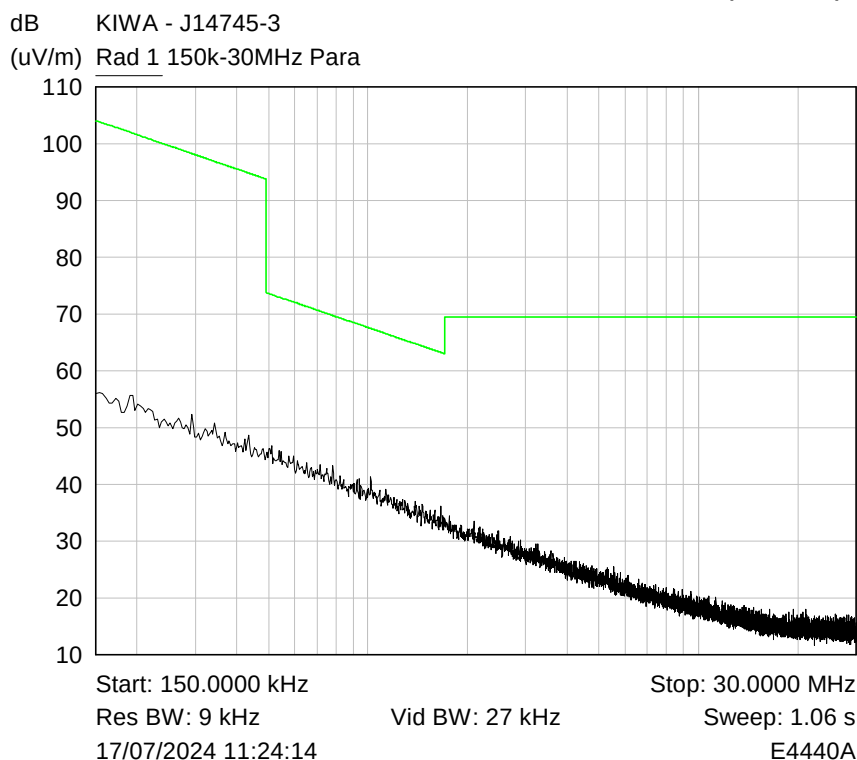
Plot of 9k-150kHz Parallel



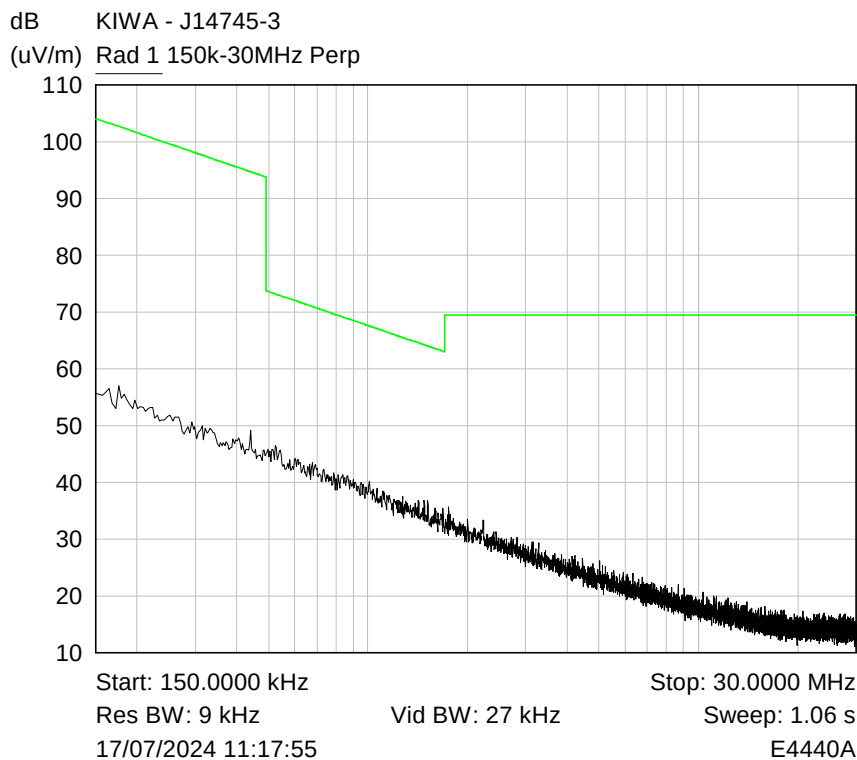
Plot of 9k-150kHz Perpendicular

6.3 Radiated emissions 150 kHz - 30 MHz

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH1, Channel 2441 MHz (Mid Ch)



Plot of 150kHz-30MHz Parallel



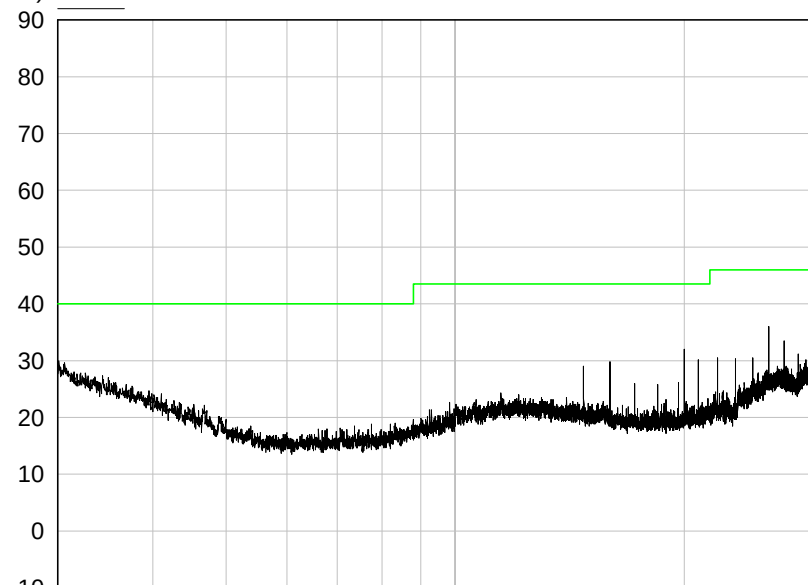
Plot of 150kHz-30MHz Perpendicular

6.4 Radiated emissions 30 MHz -1 GHz

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH1, Channel 2441 MHz (Mid Ch)

dB KIWA - J14745-3

(uV/m) Rad 1 VHF Horiz

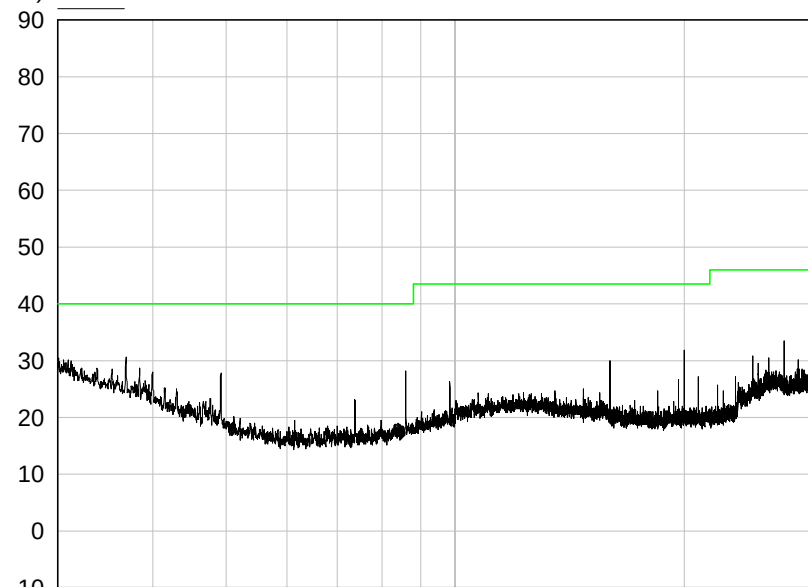


Start: 30.0000 MHz Stop: 300.0000 MHz
Res BW: 120 kHz Vid BW: 360 kHz Sweep: 147.44 ms
17/07/2024 10:20:05 E4440A

Plot of Peak emissions for VHF Horizontal against the QP limit line.

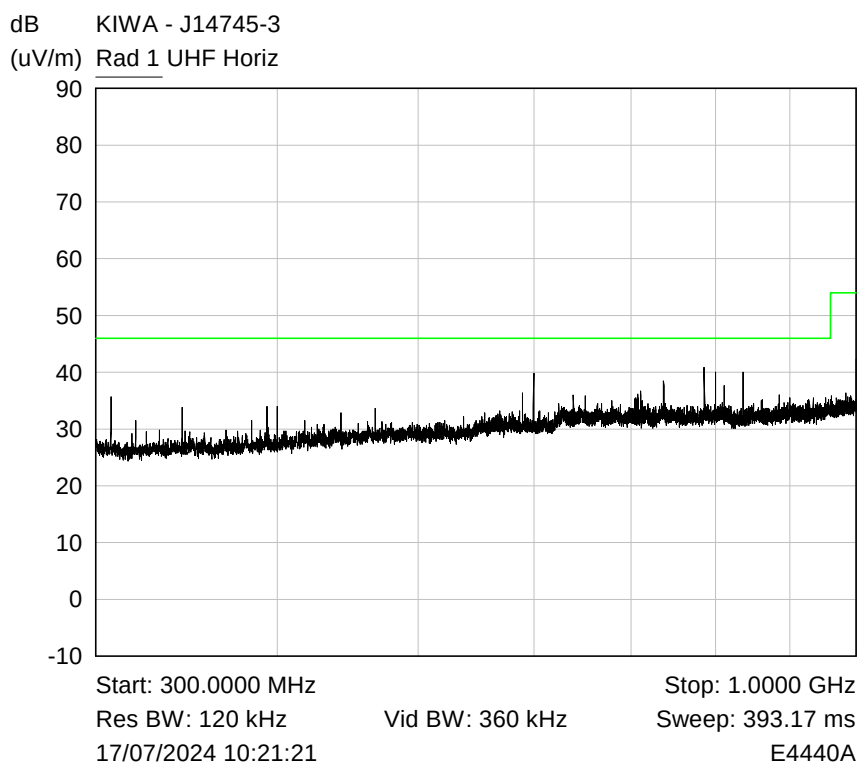
dB KIWA - J14745-3

(uV/m) Rad 1 VHF Vert

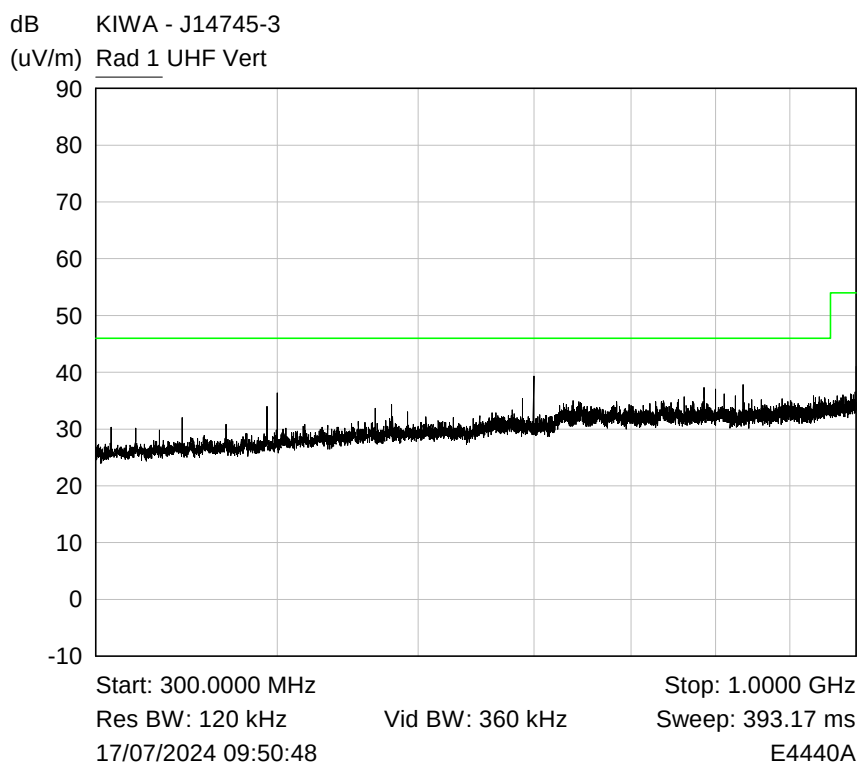


Start: 30.0000 MHz Stop: 300.0000 MHz
Res BW: 120 kHz Vid BW: 360 kHz Sweep: 147.44 ms
17/07/2024 09:49:26 E4440A

Plot of Peak emissions for VHF Vertical against the QP limit line.



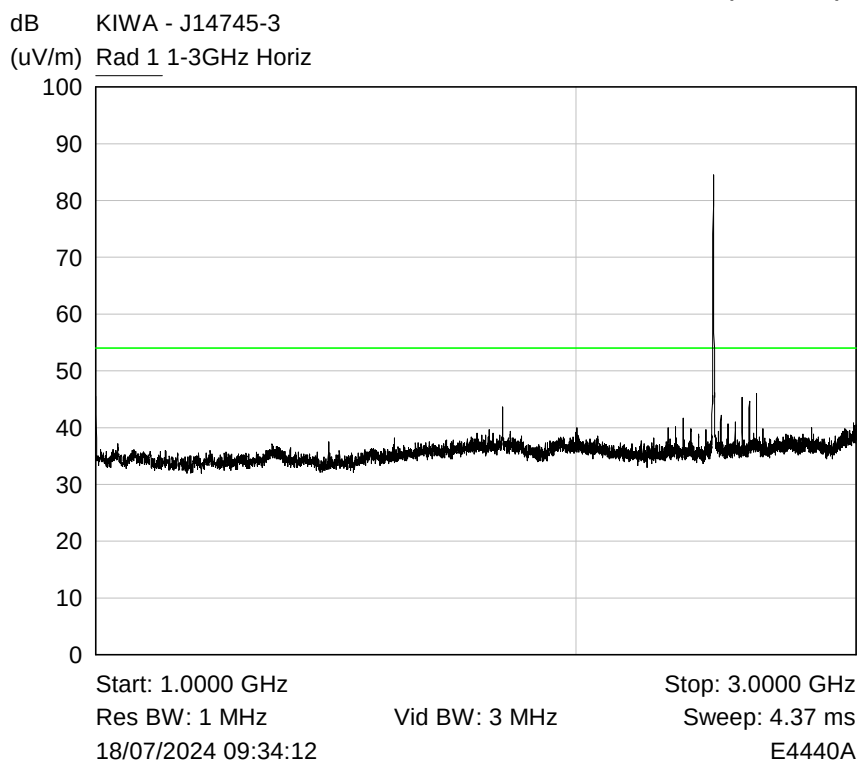
Plot of Peak emissions for UHF Horizontal against the QP limit line.



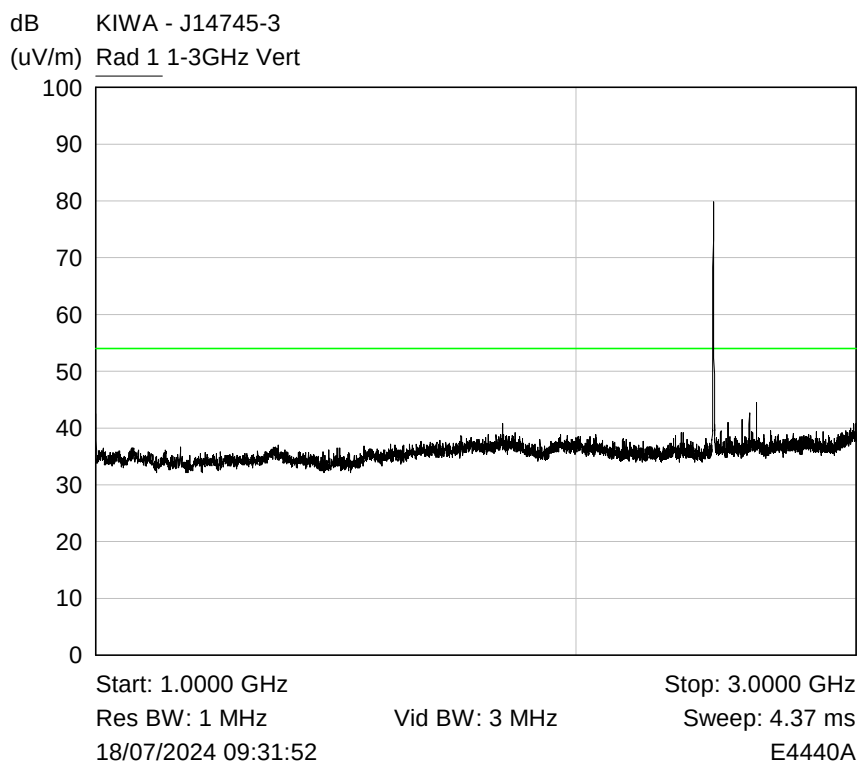
Plot of Peak emissions for UHF Vertical against the QP limit line.

6.5 Radiated emissions above 1 GHz

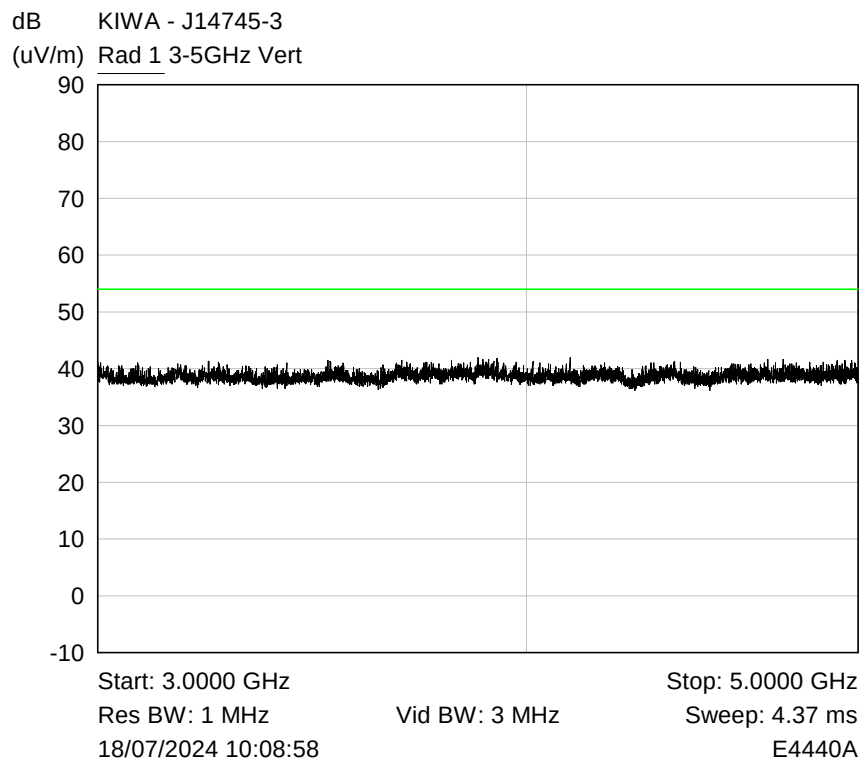
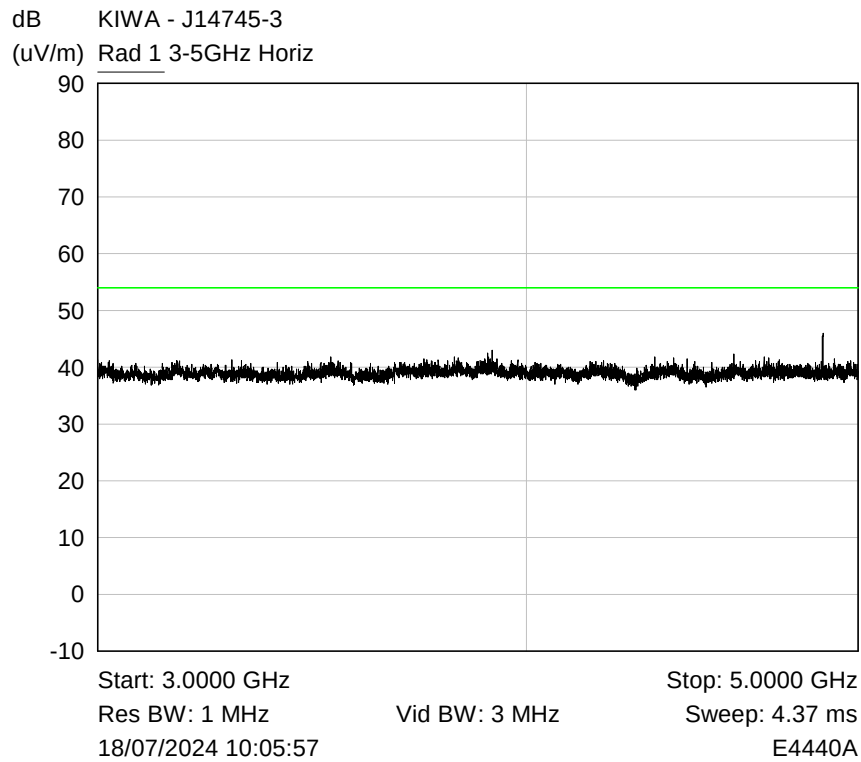
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH1, Channel 2441 MHz (Mid Ch)

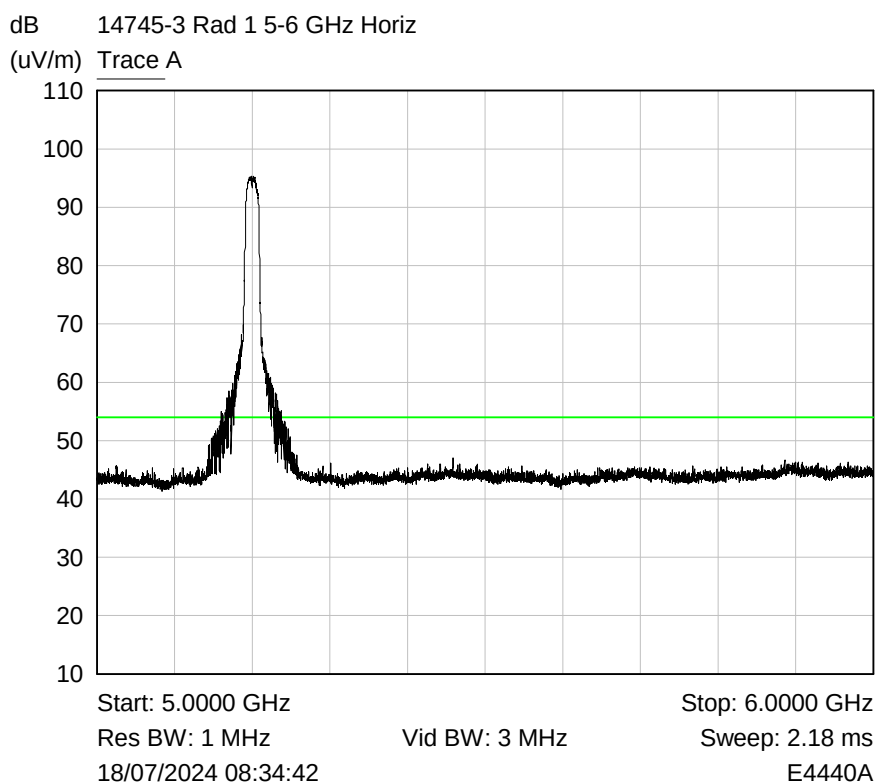


Plot shows intended BTC transmission at 2440 MHz

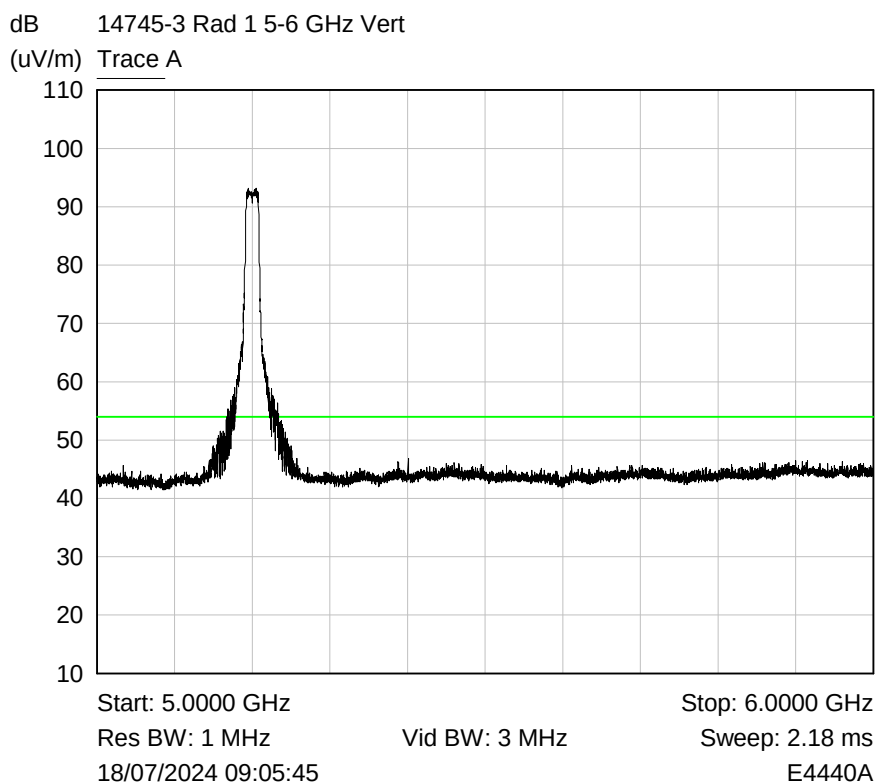


Plot shows intended BTC transmission at 2440 MHz

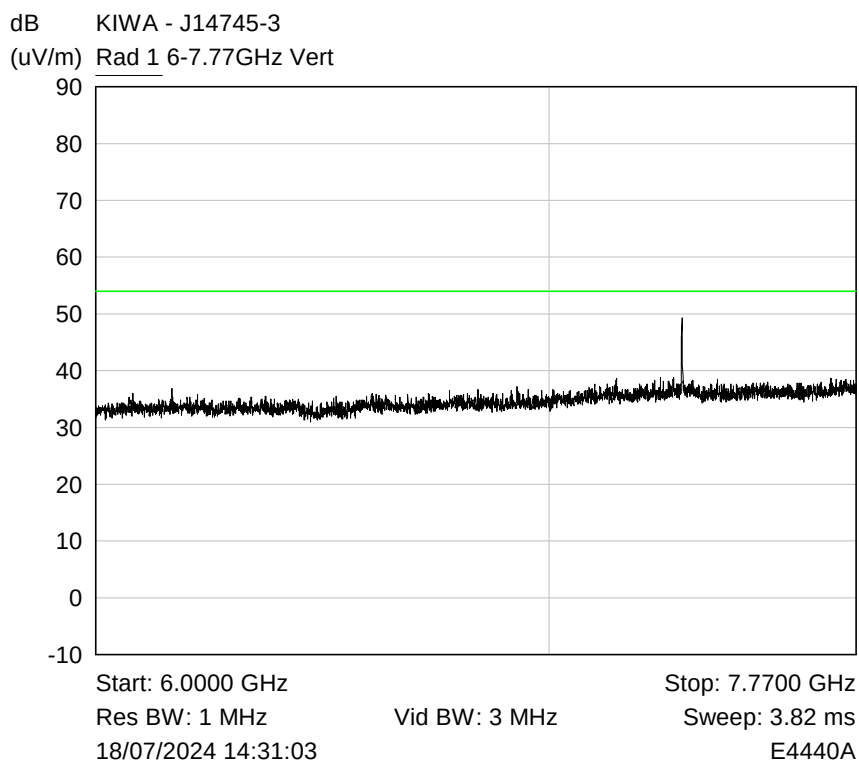
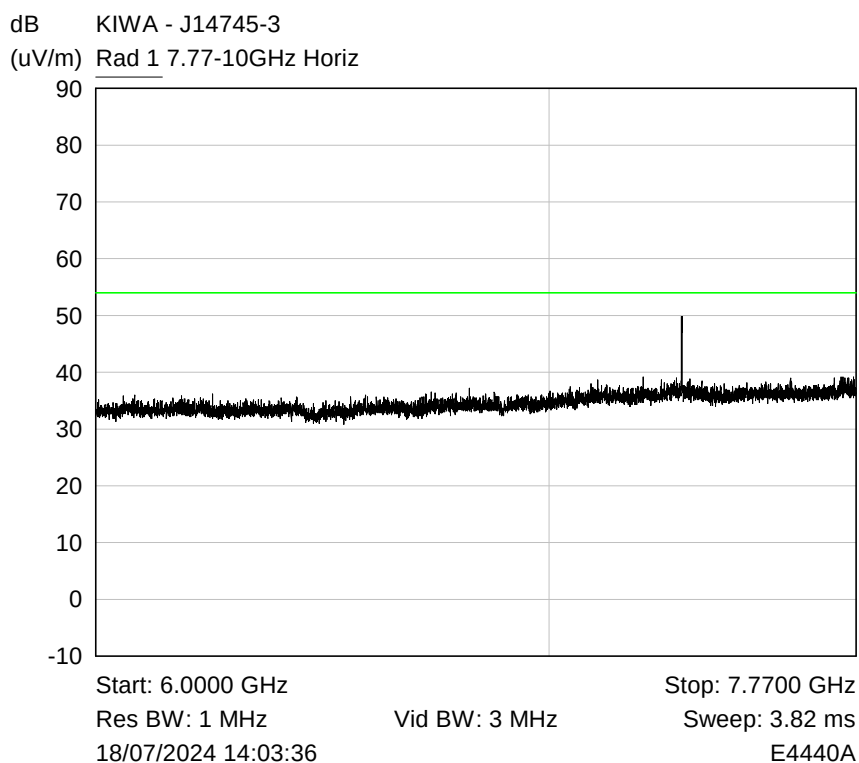


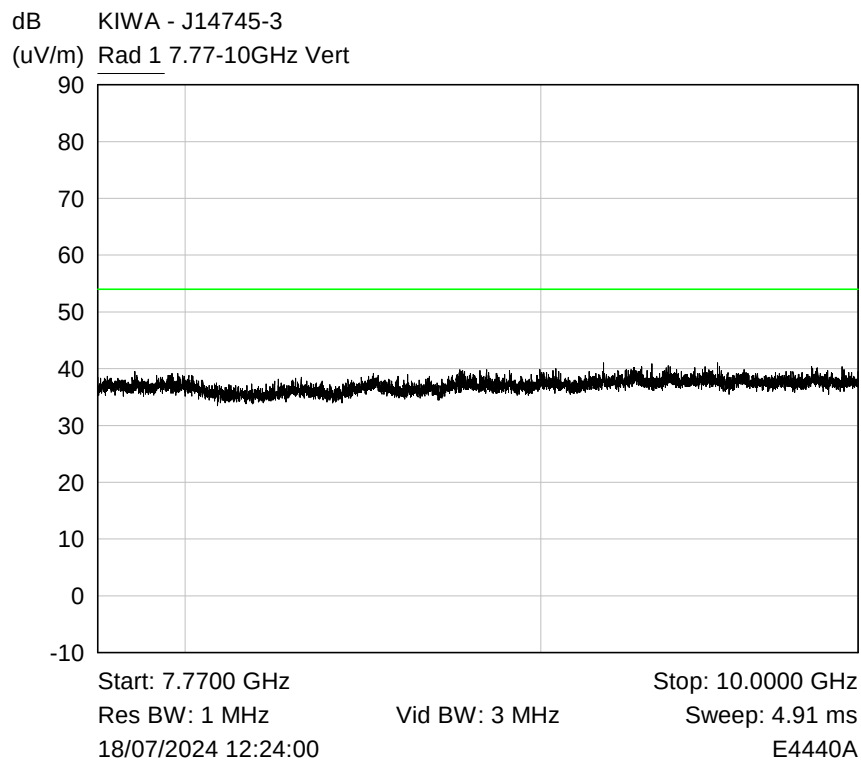
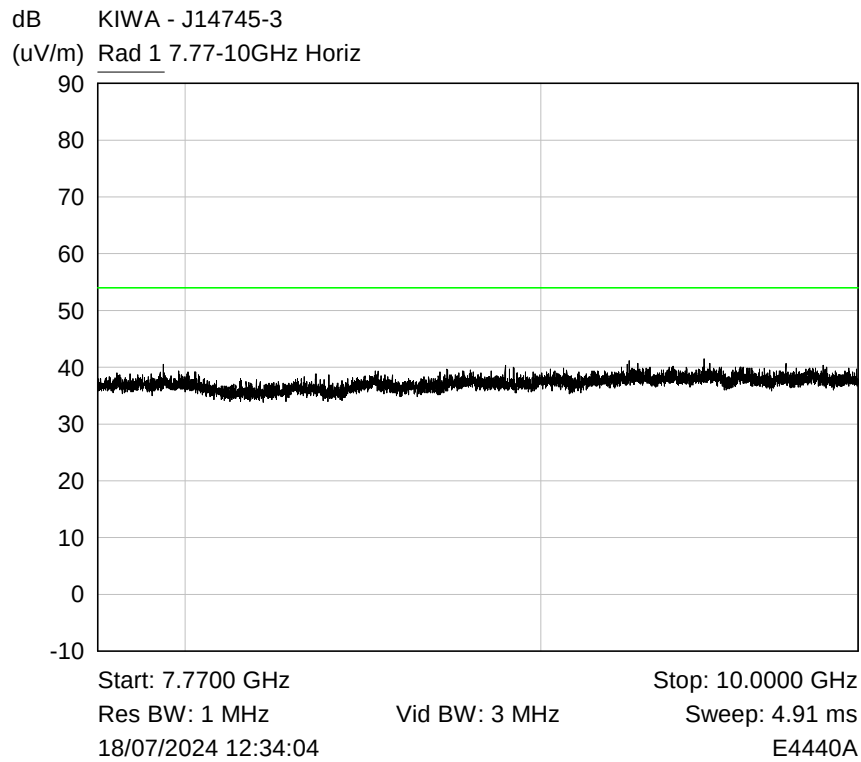


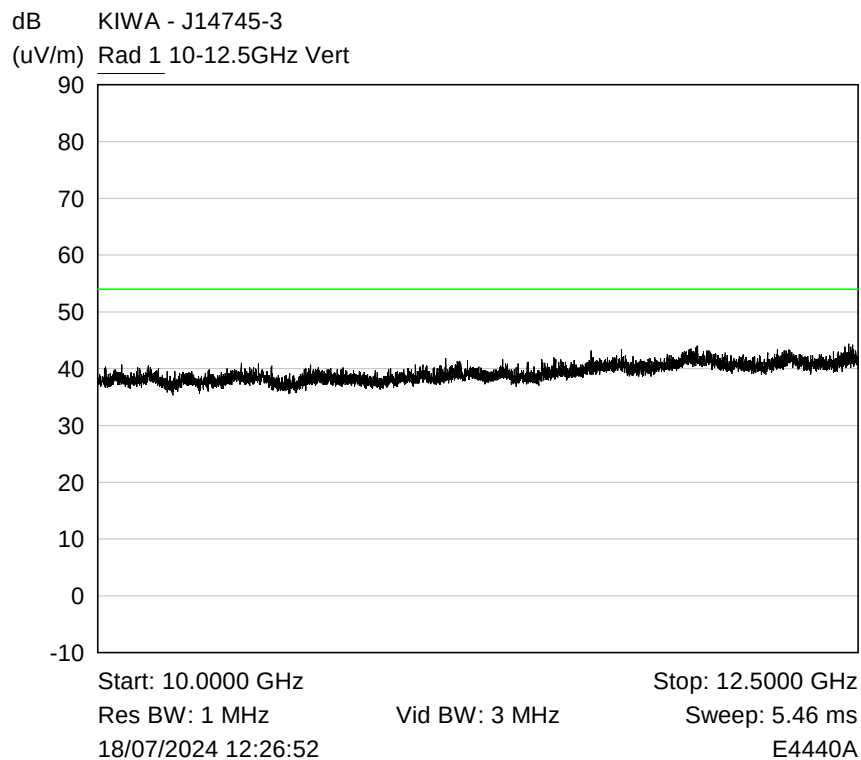
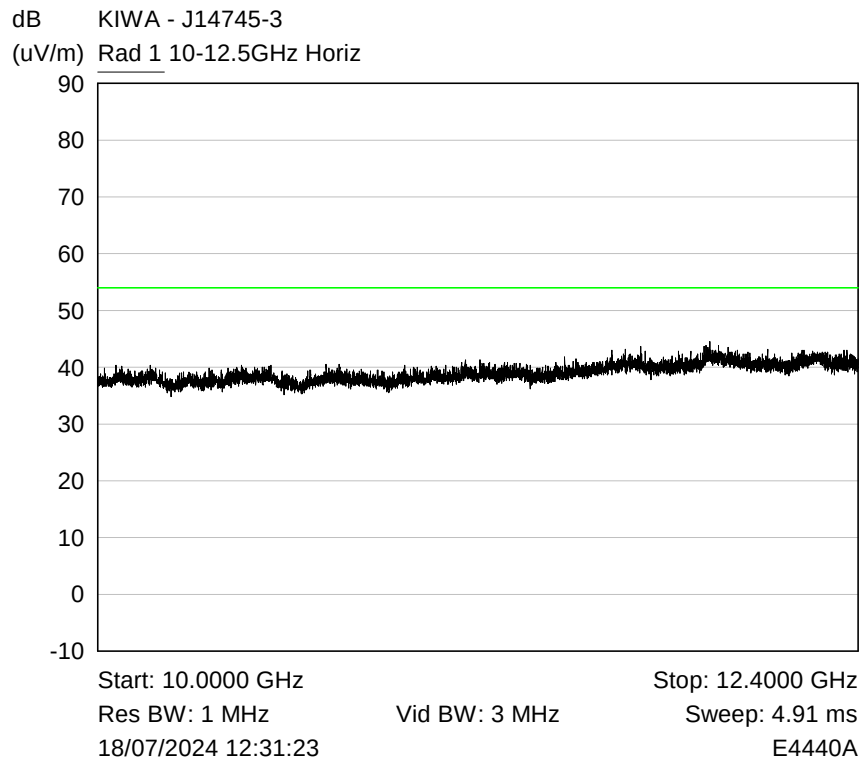
Plot shows intended WiFi transmission at 5200 MHz

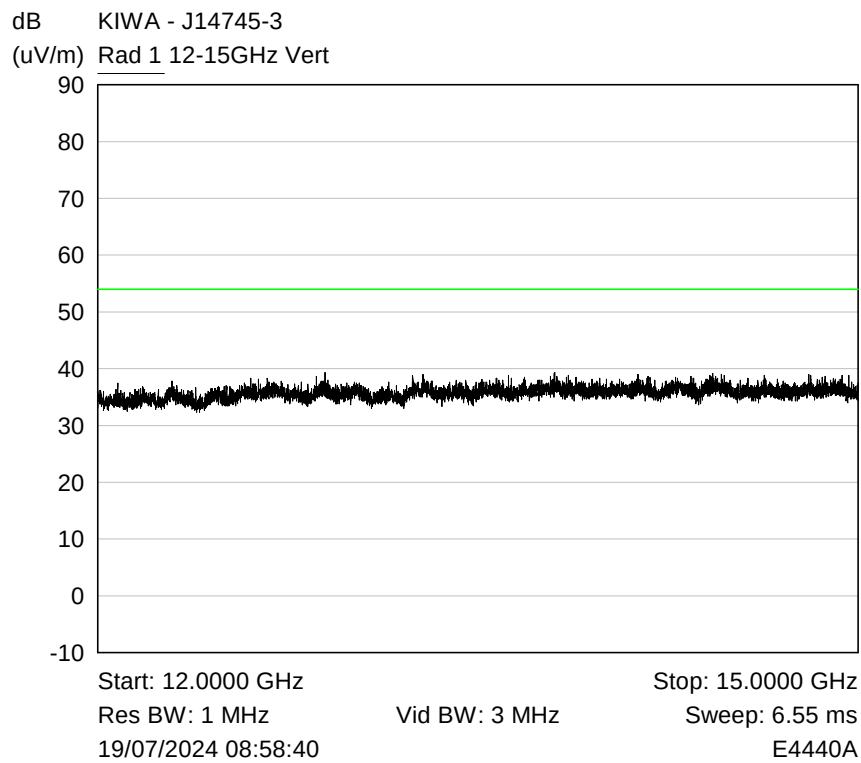
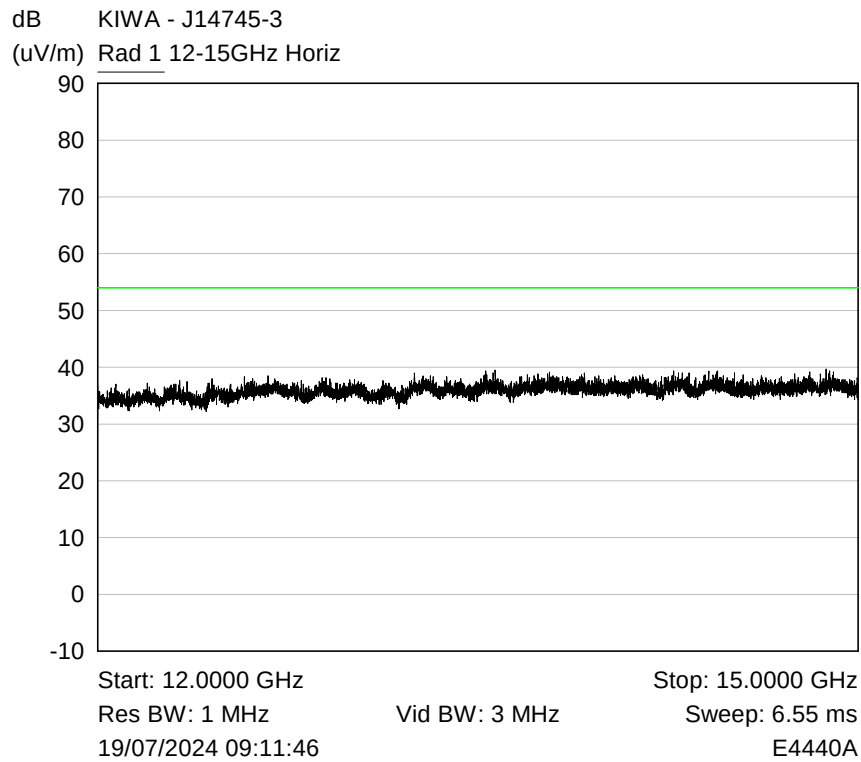


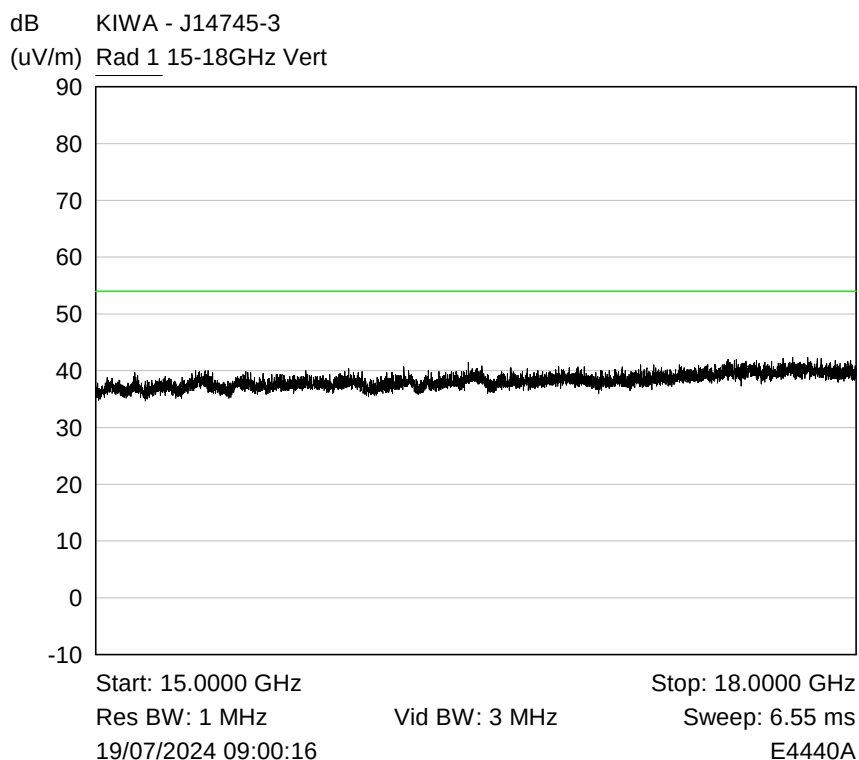
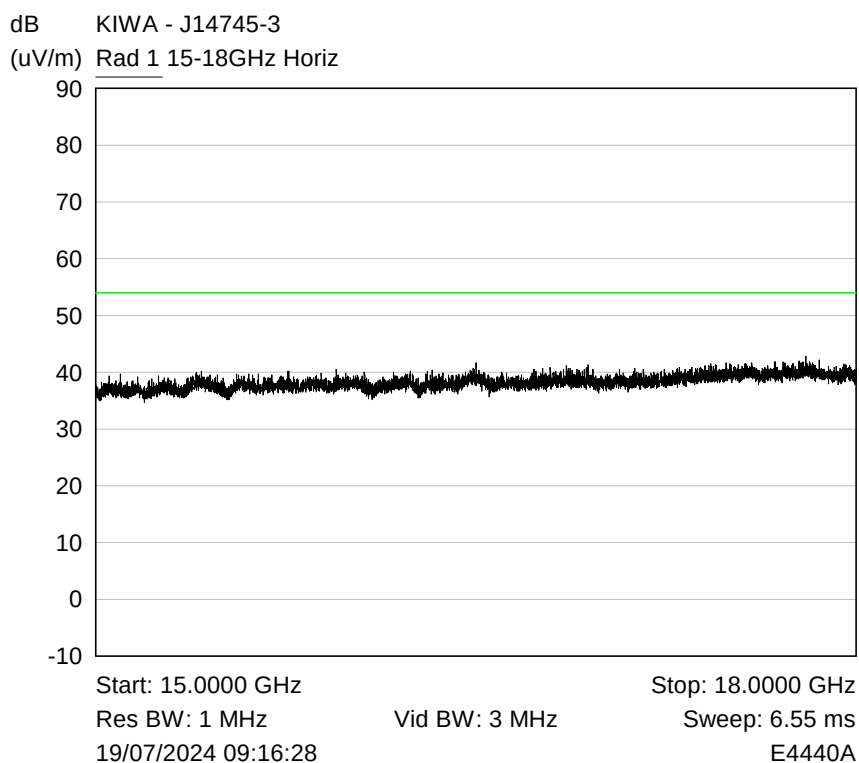
Plot shows intended WiFi transmission at 5200 MHz

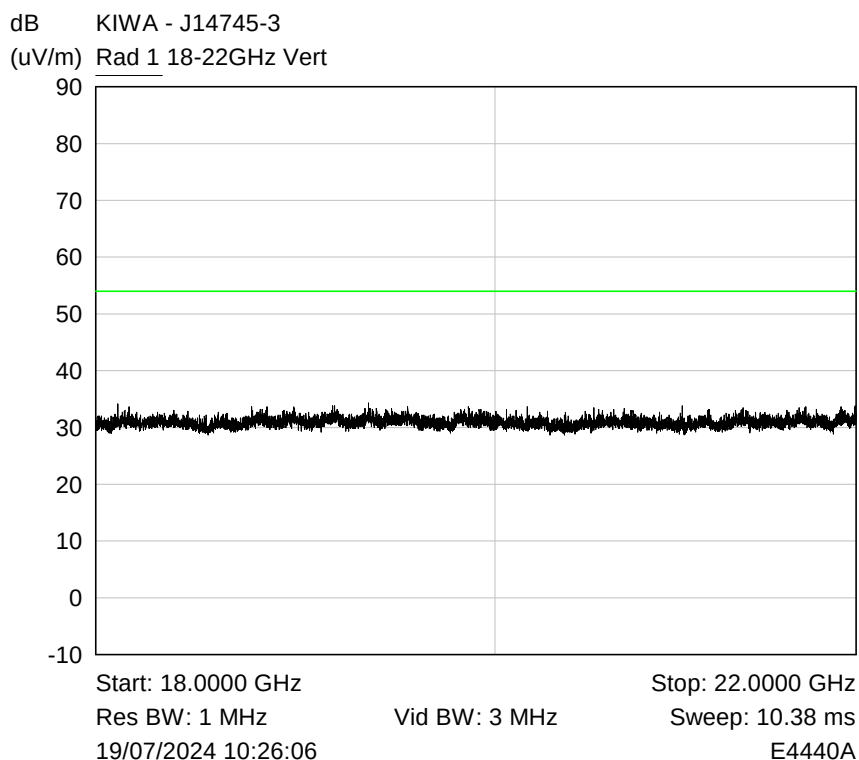
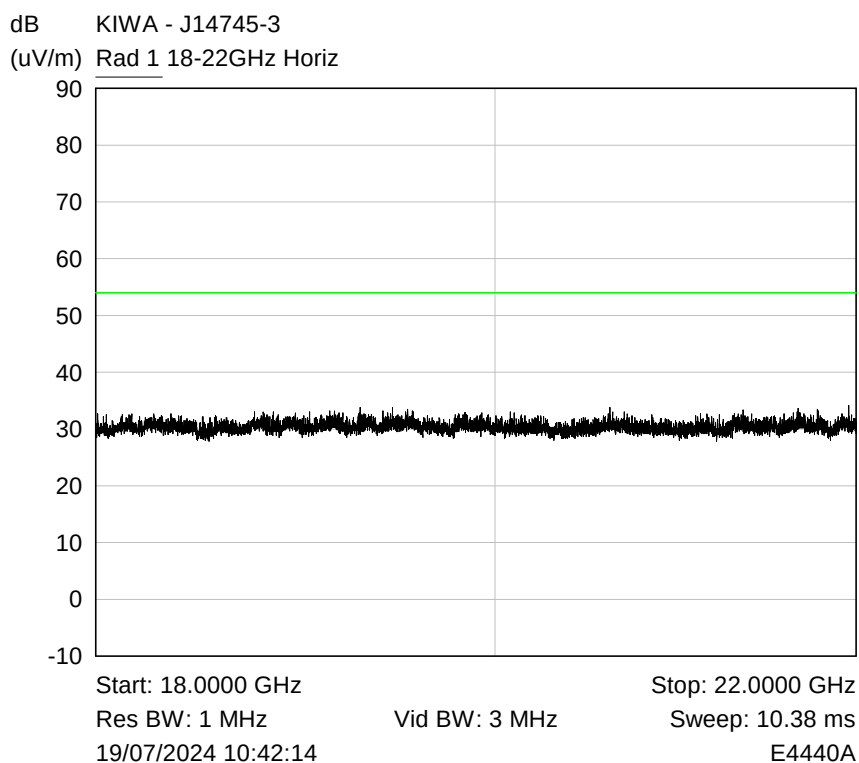


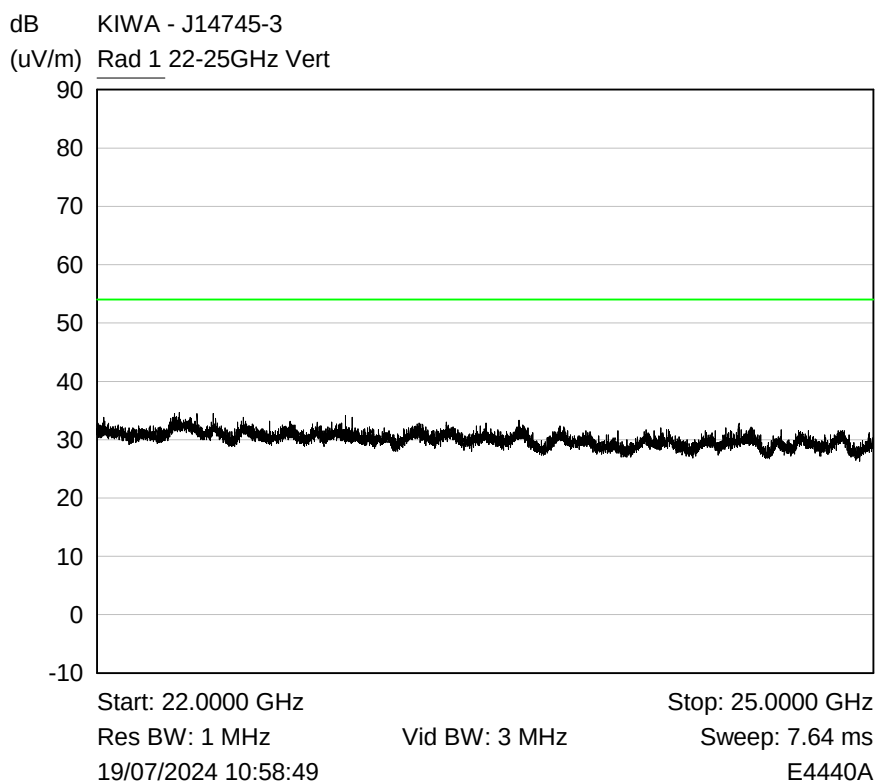
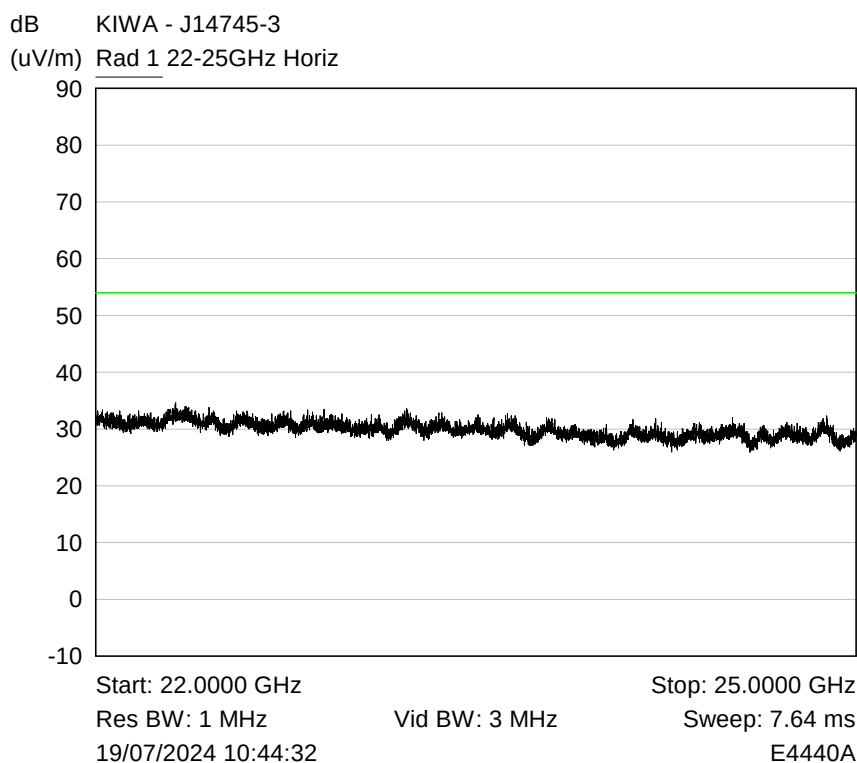


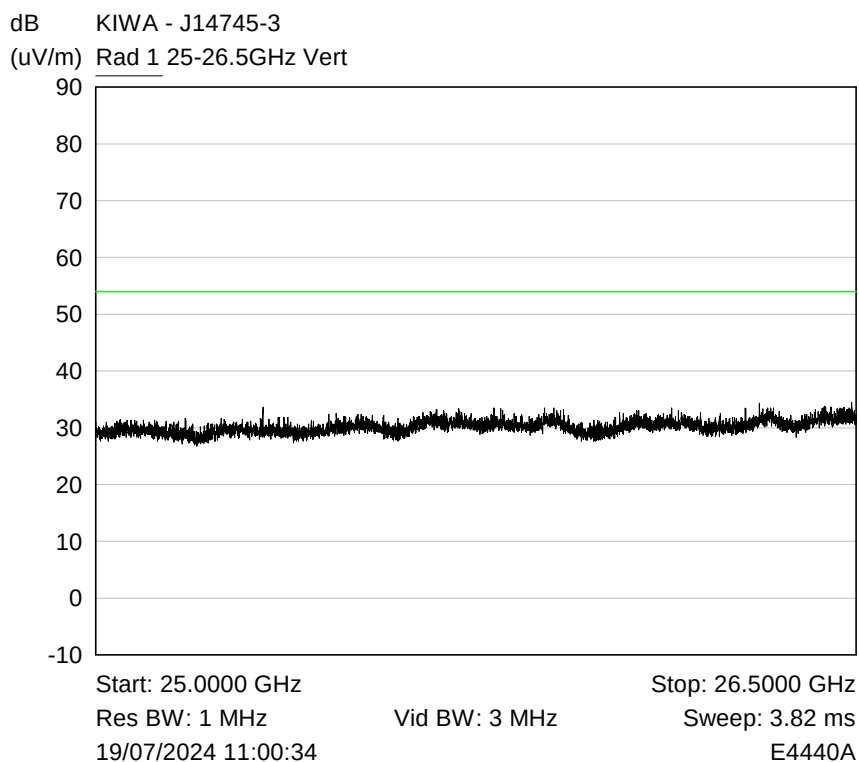
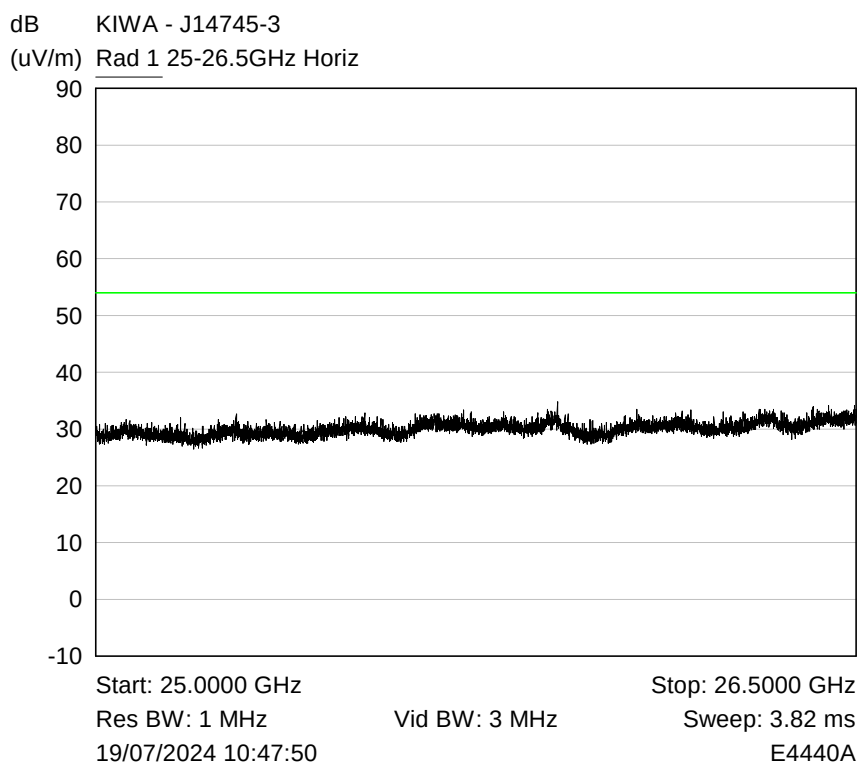






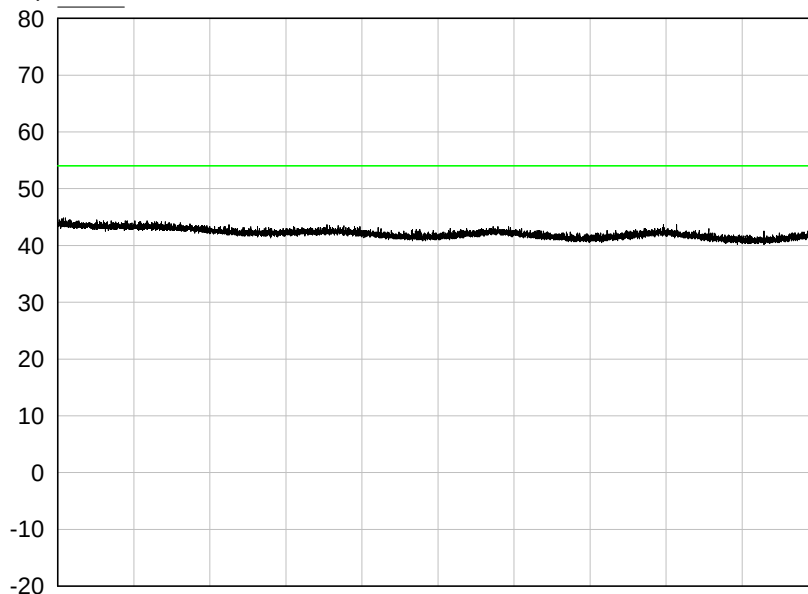






dB 14745-3 Rad 1 26.5-29 GHz Horiz

(uV/m) Trace A



Start: 26.5000 GHz

Res BW: 1 MHz

18/07/2025 14:37:06

Vid BW: 3 MHz

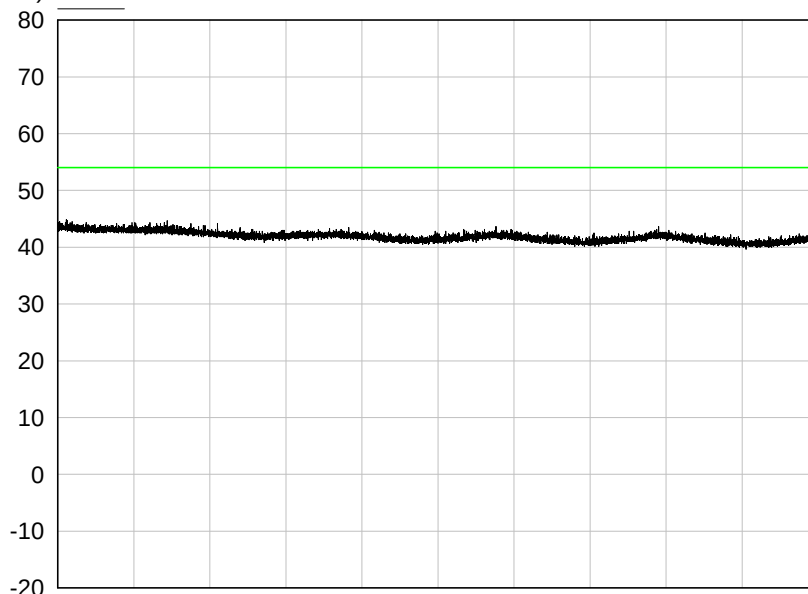
Stop: 29.0000 GHz

Sweep: 100.48 ms

E4440A

dB 14745-3 Rad 1 26.5-29 GHz Vert

(uV/m) Trace A



Start: 26.5000 GHz

Res BW: 1 MHz

18/07/2025 14:17:09

Vid BW: 3 MHz

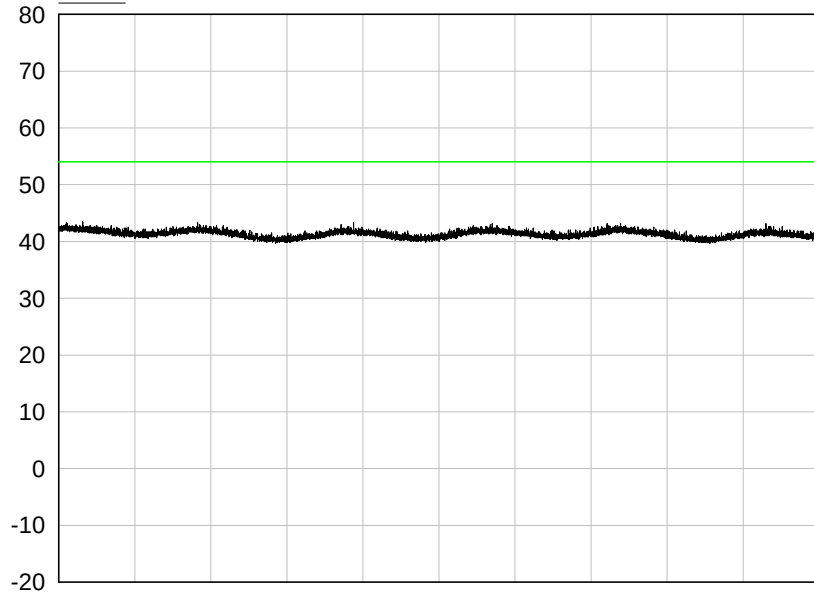
Stop: 29.0000 GHz

Sweep: 100.48 ms

E4440A

dB 14745-3 Rad 1 29-32 GHz Horiz

(uV/m) Trace A



Start: 29.0000 GHz

Res BW: 1 MHz

18/07/2025 14:34:06

Vid BW: 3 MHz

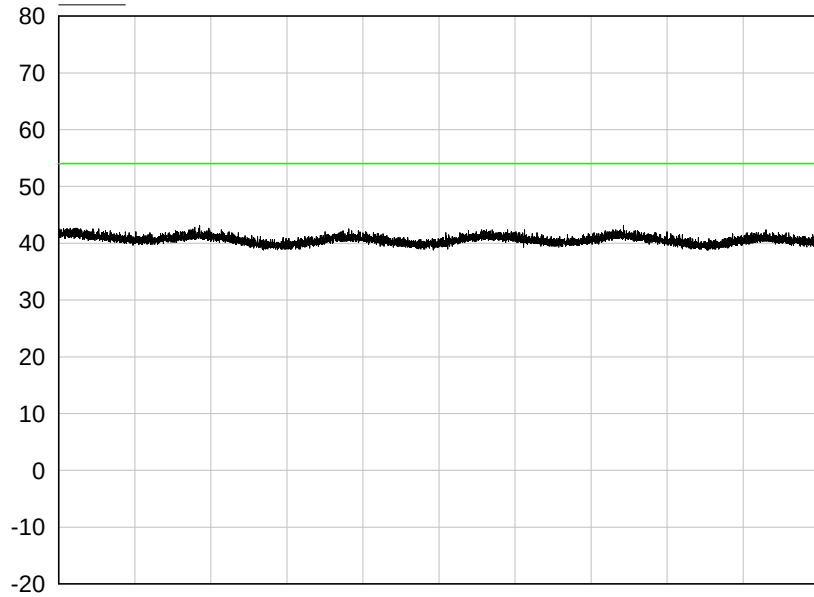
Stop: 32.0000 GHz

Sweep: 100.48 ms

E4440A

dB 14745-3 Rad 1 29-32 GHz Vert

(uV/m) Trace A



Start: 29.0000 GHz

Res BW: 1 MHz

18/07/2025 14:18:07

Vid BW: 3 MHz

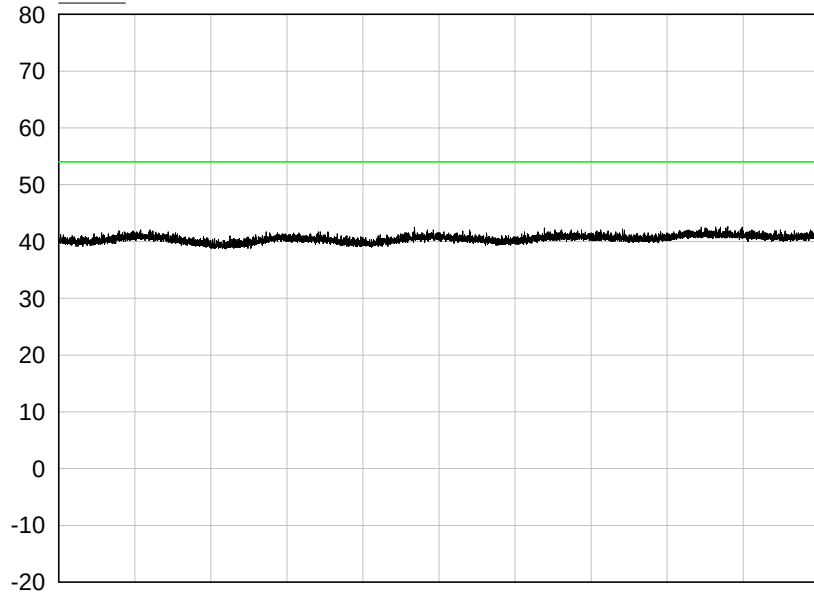
Stop: 32.0000 GHz

Sweep: 100.48 ms

E4440A

dB 14745-3 Rad 1 32-35 GHz Horiz

(uV/m) Trace A



Start: 32.0000 GHz

Stop: 35.0000 GHz

Res BW: 1 MHz

Vid BW: 3 MHz

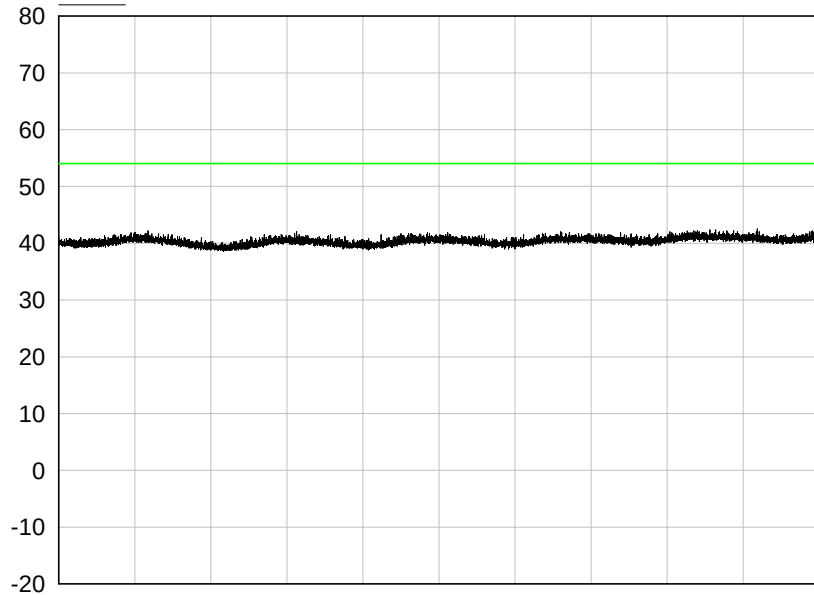
Sweep: 100.48 ms

18/07/2025 14:30:48

E4440A

dB 14745-3 Rad 1 32-35 GHz Vert

(uV/m) Trace A



Start: 32.0000 GHz

Stop: 35.0000 GHz

Res BW: 1 MHz

Vid BW: 3 MHz

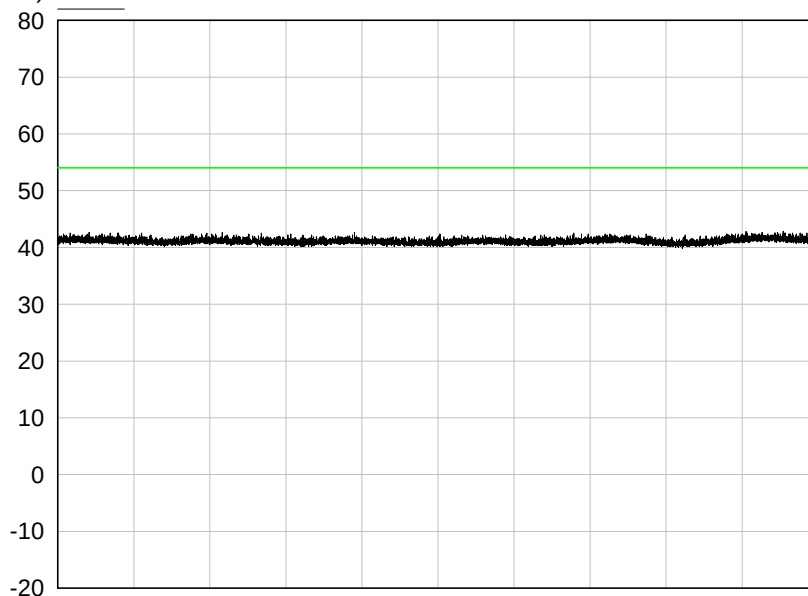
Sweep: 100.48 ms

18/07/2025 14:19:59

E4440A

dB 14745-3 Rad 1 35-38 GHz Horiz

(uV/m) Trace A



Start: 35.0000 GHz

Res BW: 1 MHz

18/07/2025 14:29:18

Vid BW: 3 MHz

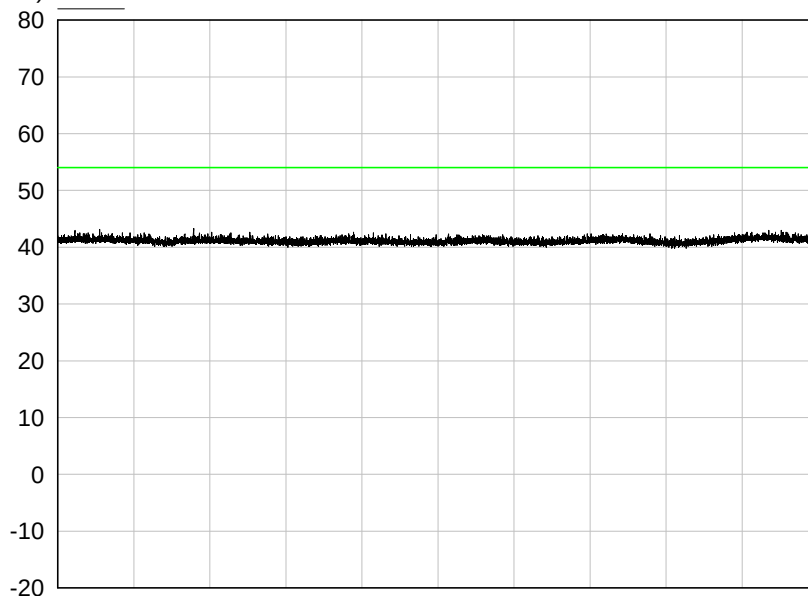
Stop: 38.0000 GHz

Sweep: 100.48 ms

E4440A

dB 14745-3 Rad 1 35-38 GHz Vert

(uV/m) Trace A



Start: 35.0000 GHz

Res BW: 1 MHz

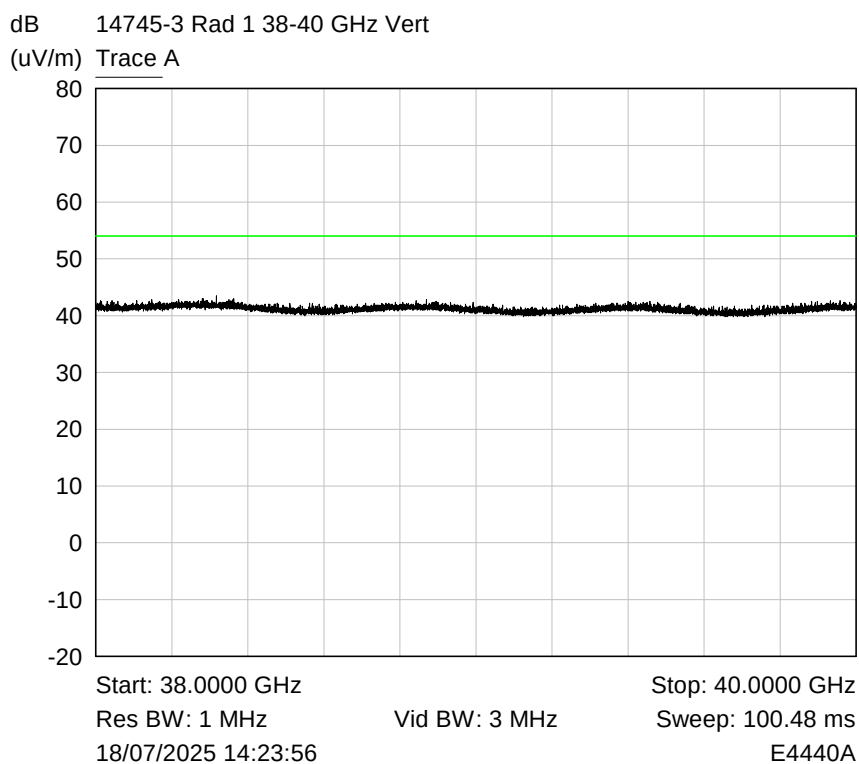
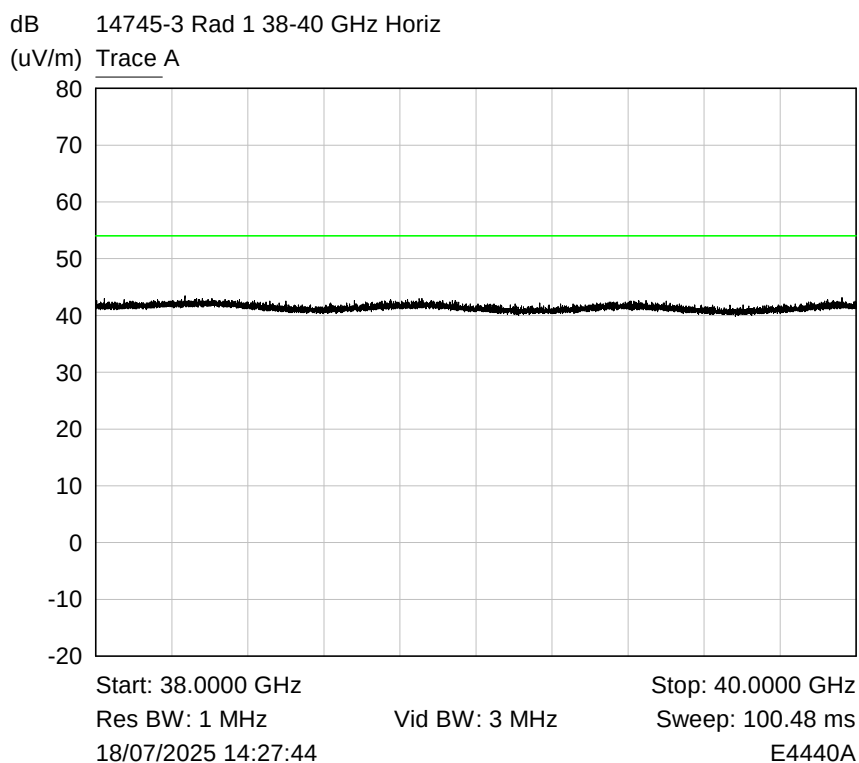
18/07/2025 14:21:44

Vid BW: 3 MHz

Stop: 38.0000 GHz

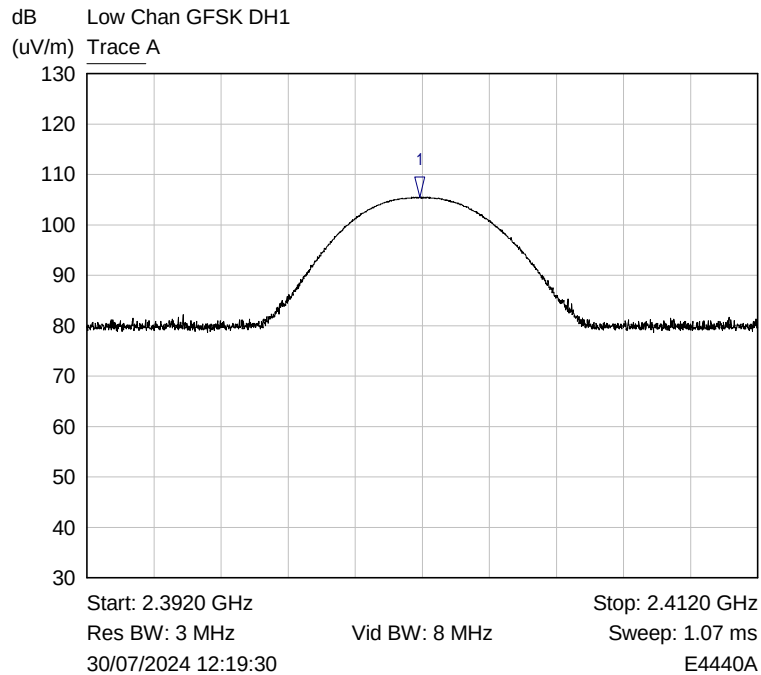
Sweep: 100.48 ms

E4440A



6.6 Effective radiated power field strength

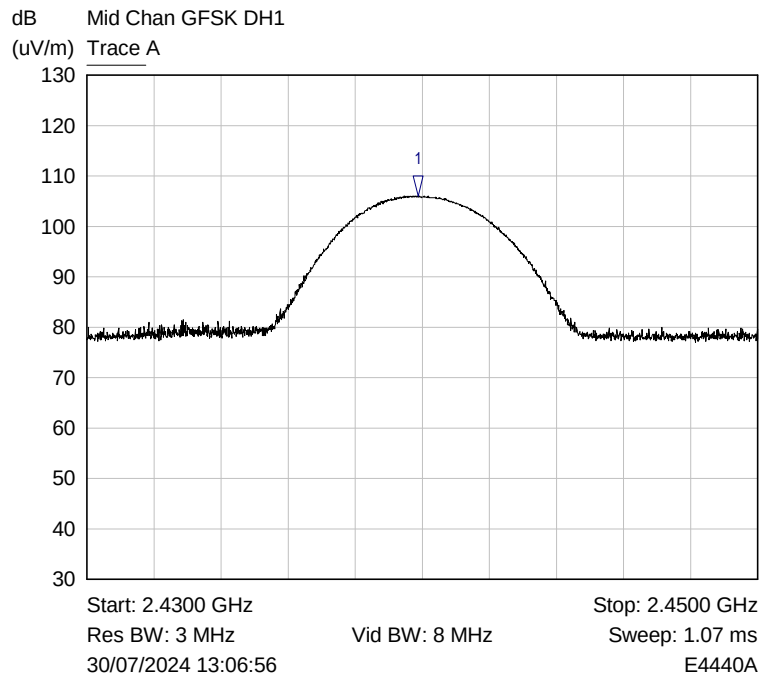
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH1, Channel 2402 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▾	Trace A	2.4019 GHz	105.51 dB(uV/m)	

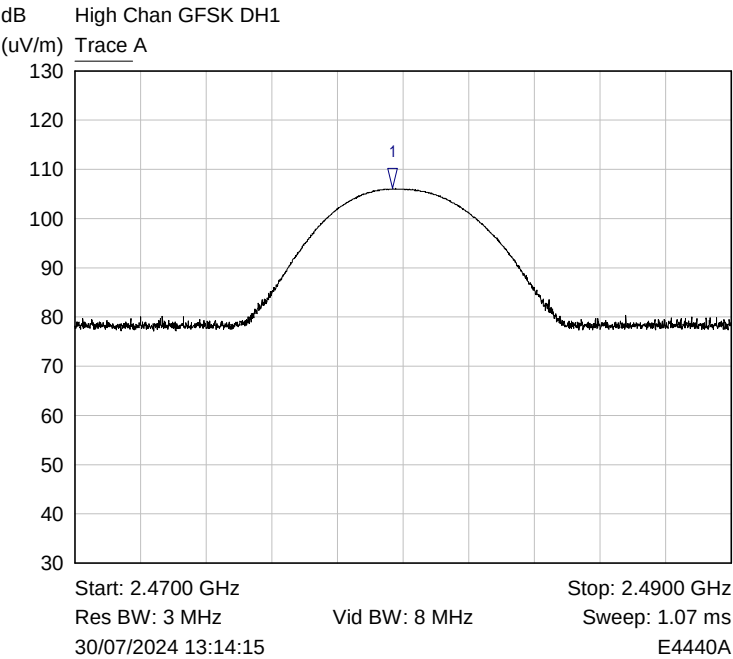
Plot ref of Vert polarisation and EUT in Upright position

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH1, Channel 2441 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▾	Trace A	2.4399 GHz	106.08 dB(uV/m)	

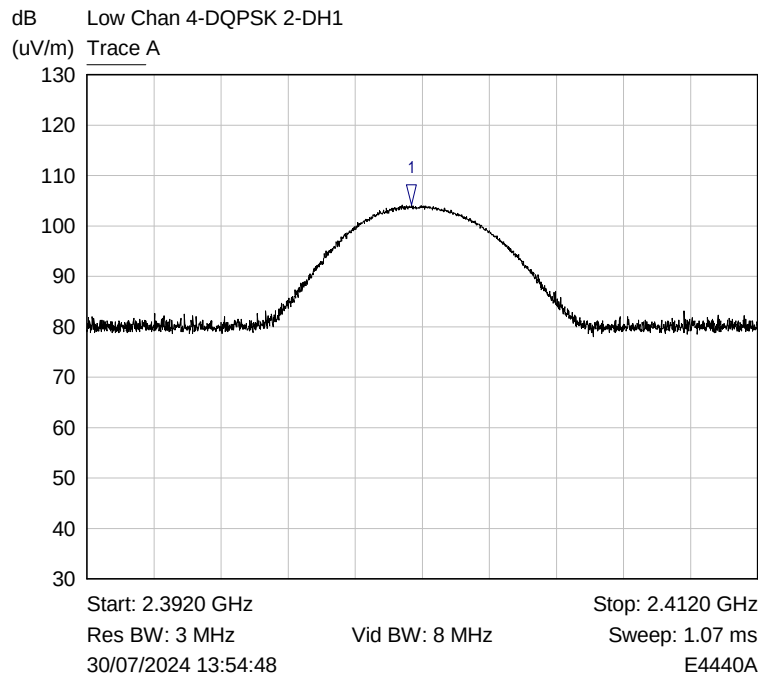
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH1, Channel 2480 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4797 GHz	106.15 dB(uV/m)	

Plot ref of Vert polarisation and EUT in Upright position

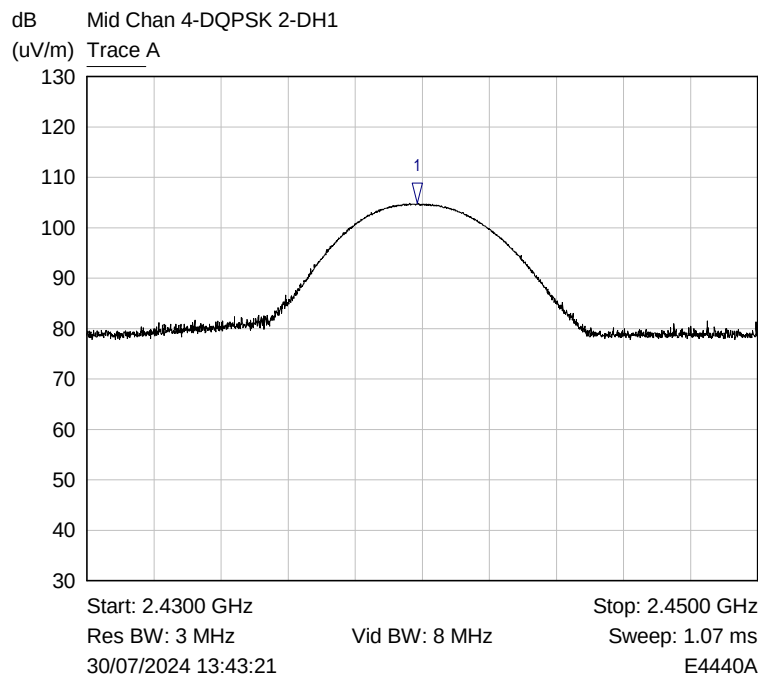
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation DQPSK 2-DH1, Channel 2402 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4017 GHz	104.12 dB(uV/m)	

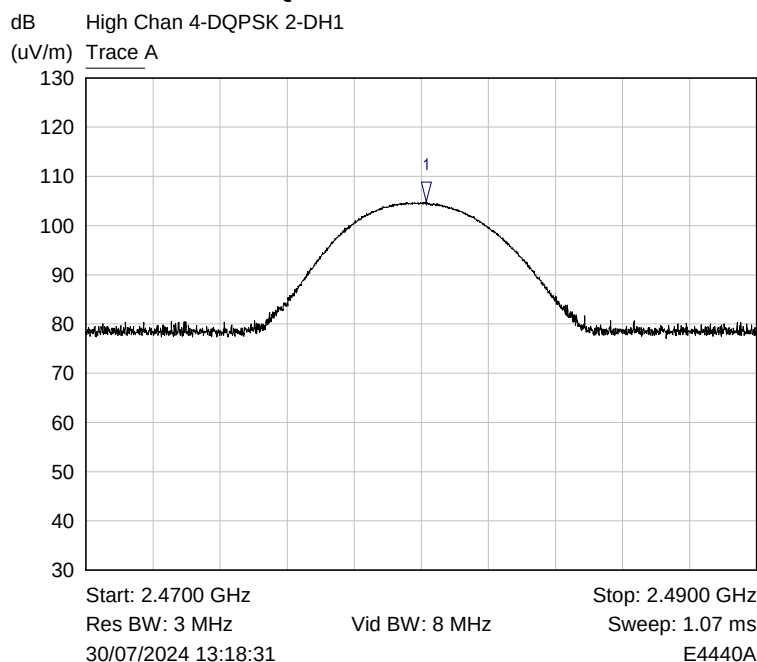
Plot ref of Vert polarisation and EUT in Upright position

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation DQPSK 2-DH1, Channel 2441 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4399 GHz	104.78 dB(uV/m)	

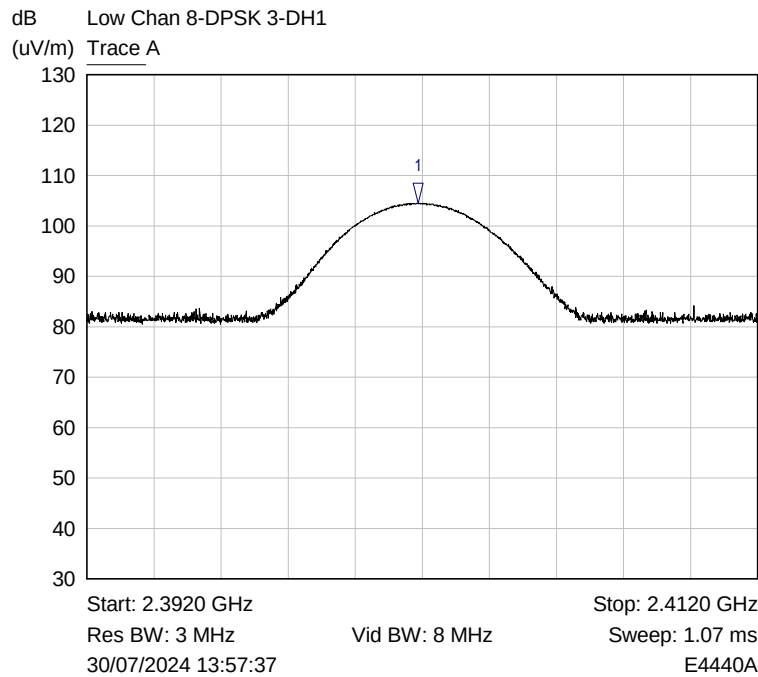
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation DQPSK 2-DH1, Channel 2480 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▾	Trace A	2.4801 GHz	104.76 dB(uV/m)	

Plot ref of Vert polarisation and EUT in Upright position

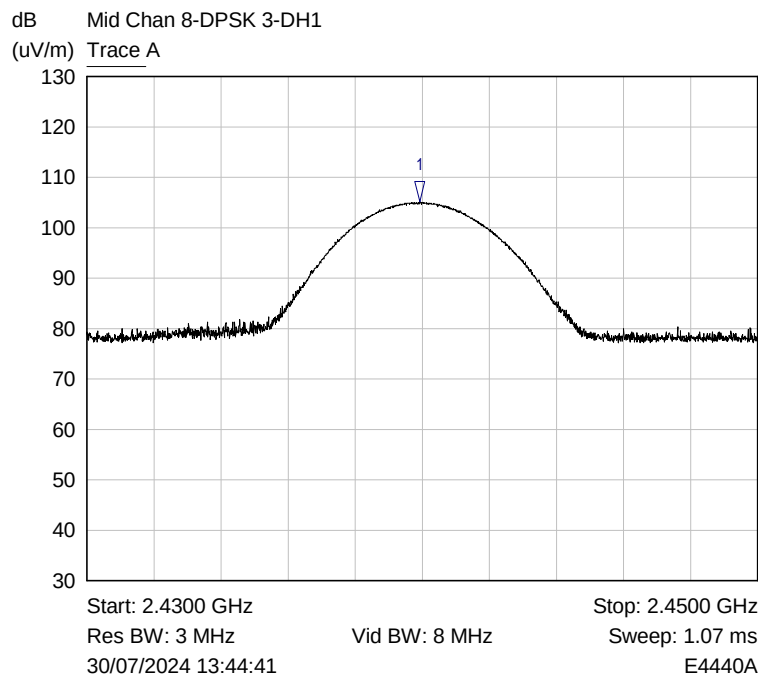
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH1, Channel 2402 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4019 GHz	104.55 dB(uV/m)	

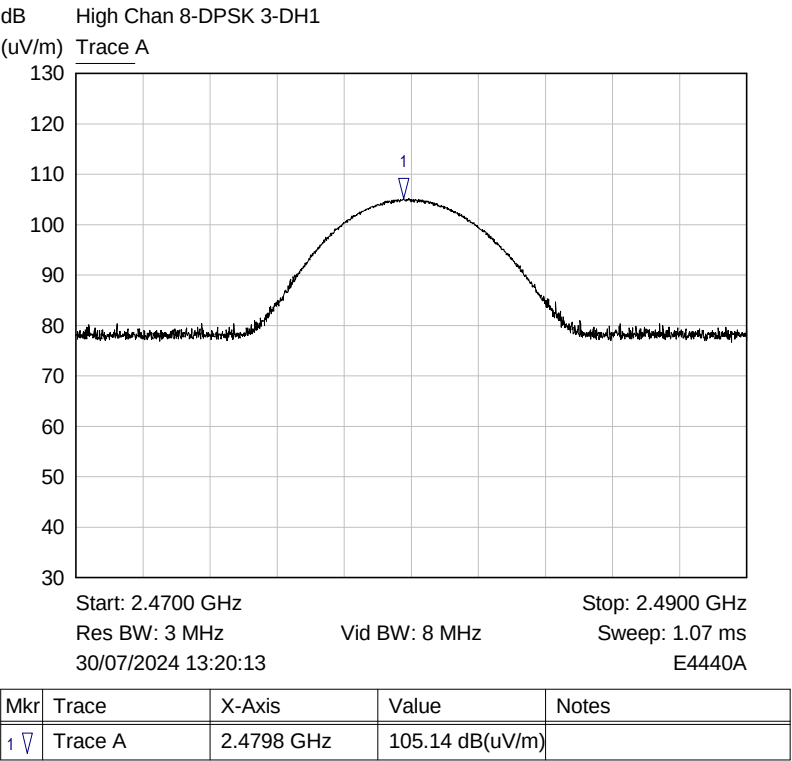
Plot ref of Vert polarisation and EUT in Upright position

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH1, Channel 2441 MHz



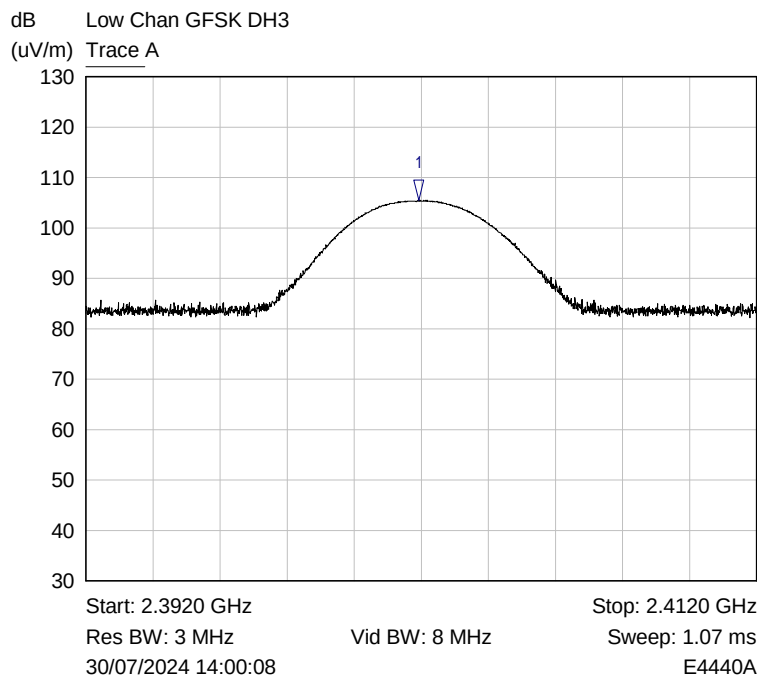
Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4399 GHz	105.14 dB(uV/m)	

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH1, Channel 2480 MHz



Plot ref of Vert polarisation and EUT in Upright position

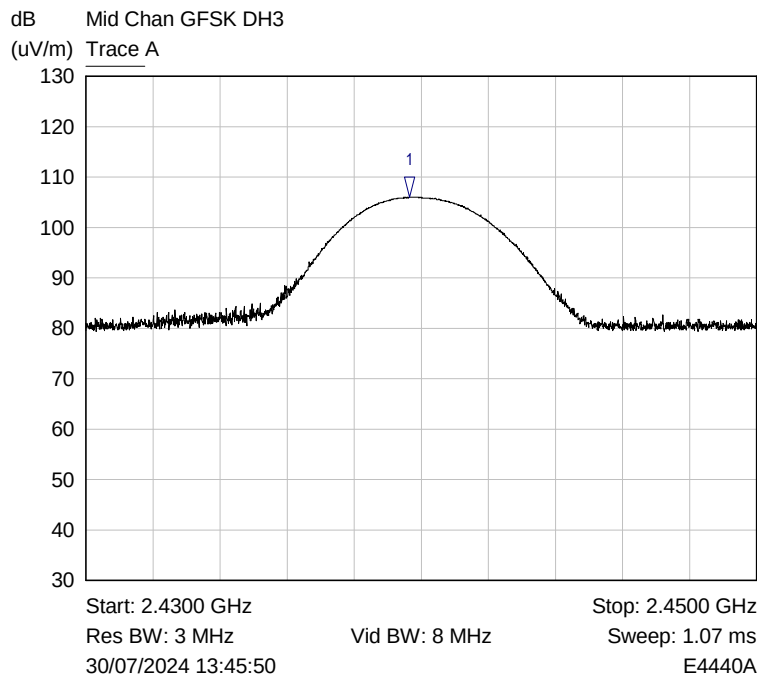
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH3, Channel 2402 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4019 GHz	105.51 dB(uV/m)	

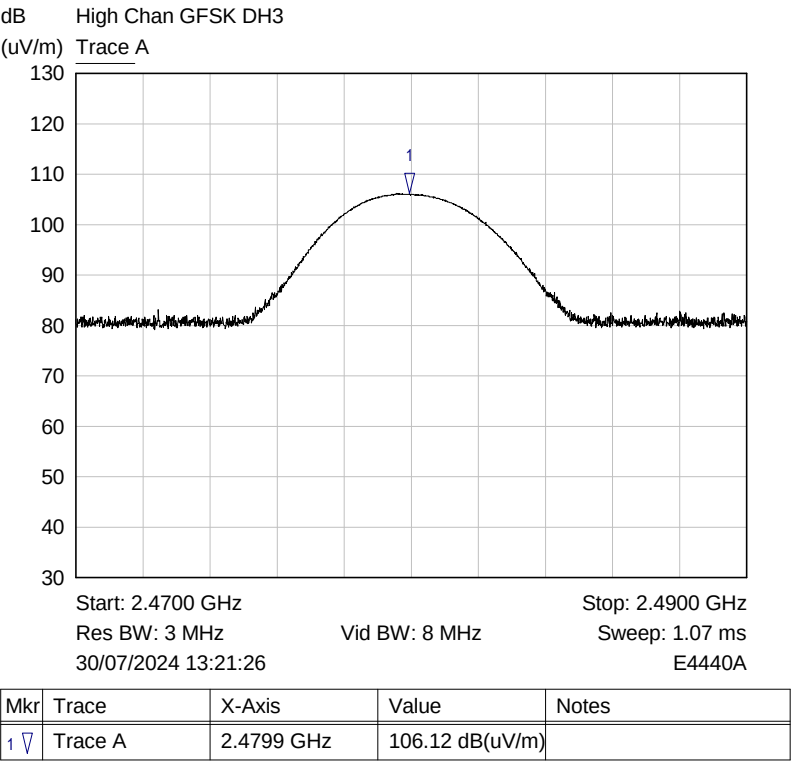
Plot ref of Vert polarisation and EUT in Upright position

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH3, Channel 2441 MHz



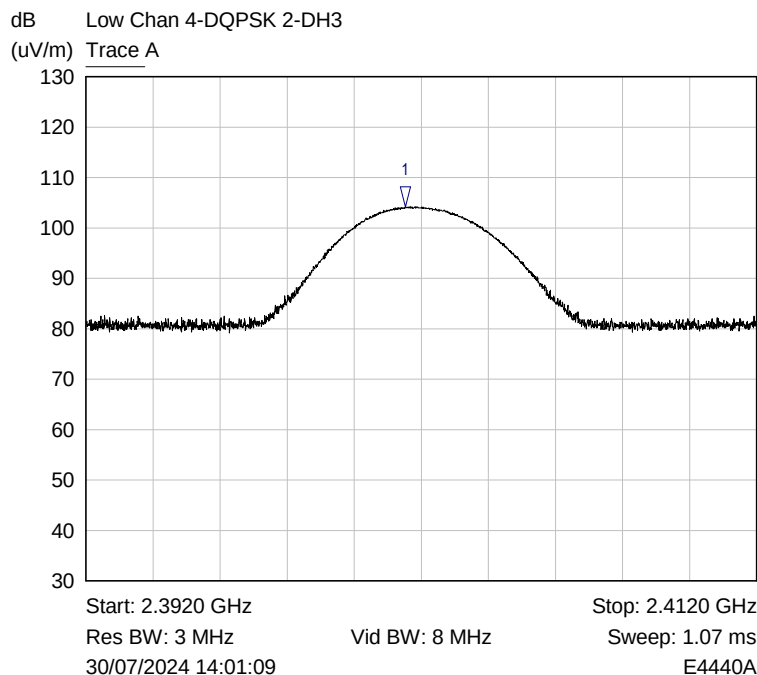
Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4396 GHz	106.08 dB(uV/m)	

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH3, Channel 2480 MHz



Plot ref of Vert polarisation and EUT in Upright position

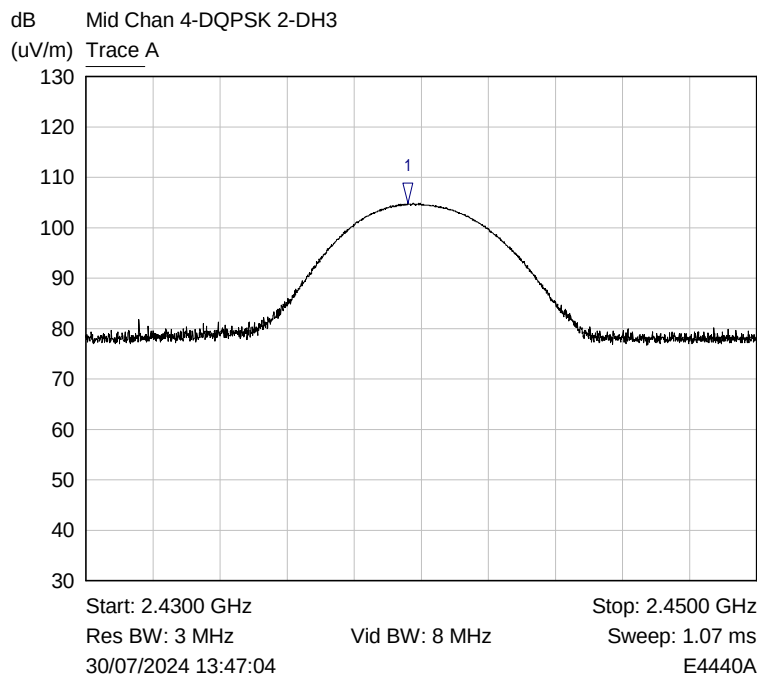
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation DQPSK 2-DH3, Channel 2402 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4015 GHz	104.23 dB(uV/m)	

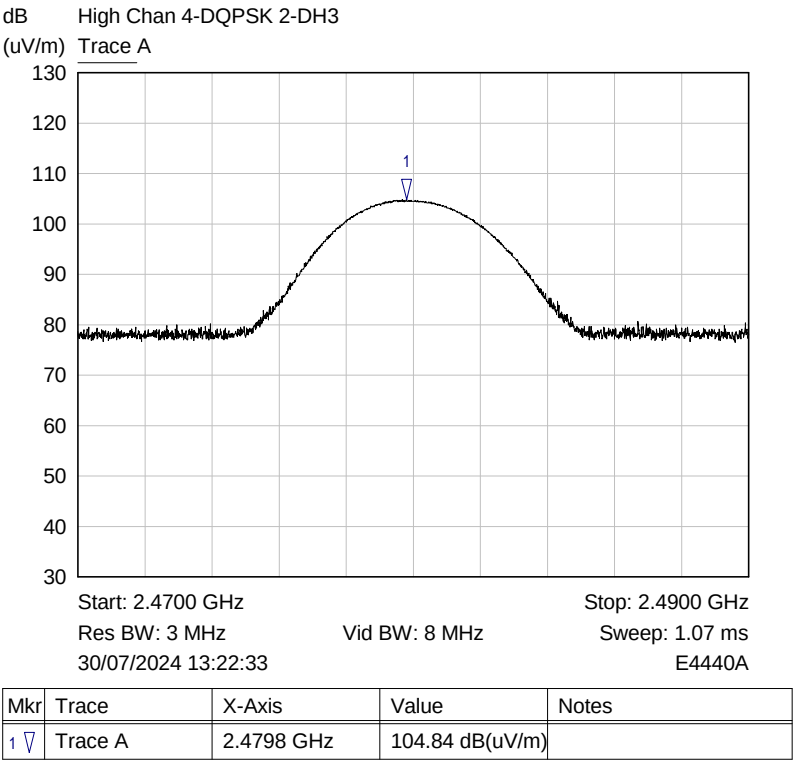
Plot ref of Vert polarisation and EUT in Upright position

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation DQPSK 2-DH3, Channel 2441 MHz



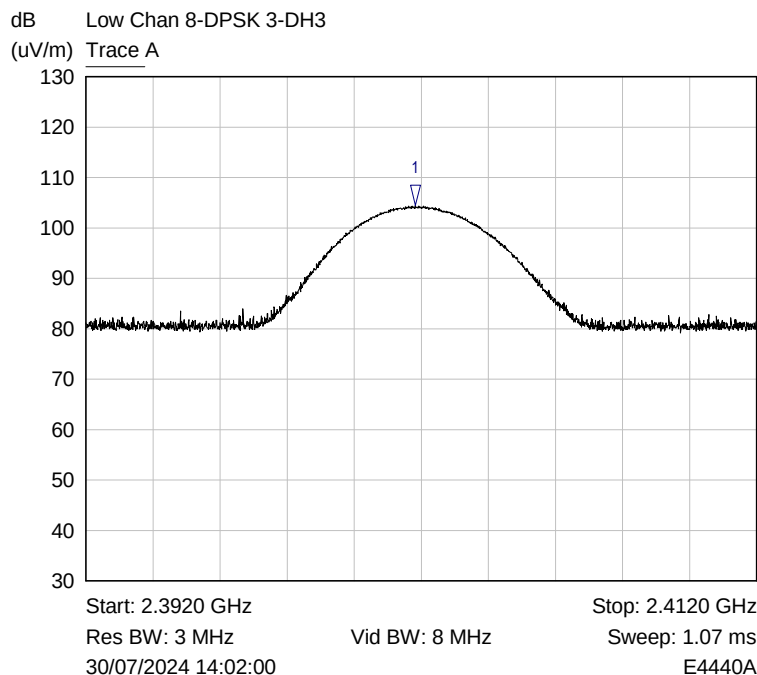
Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4396 GHz	104.86 dB(uV/m)	

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation DQPSK 2-DH3, Channel 2480 MHz



Plot ref of Vert polarisation and EUT in Upright position

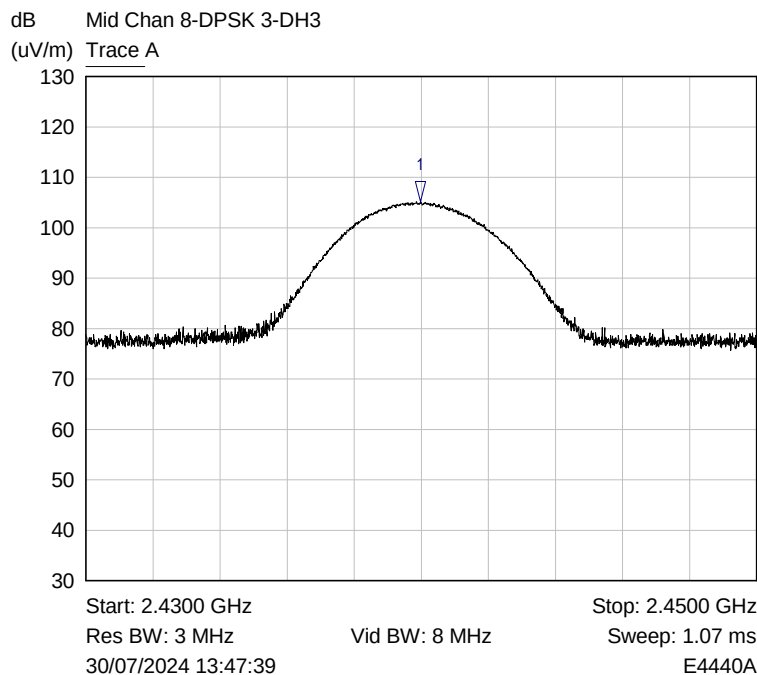
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH3, Channel 2402 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4018 GHz	104.49 dB(uV/m)	

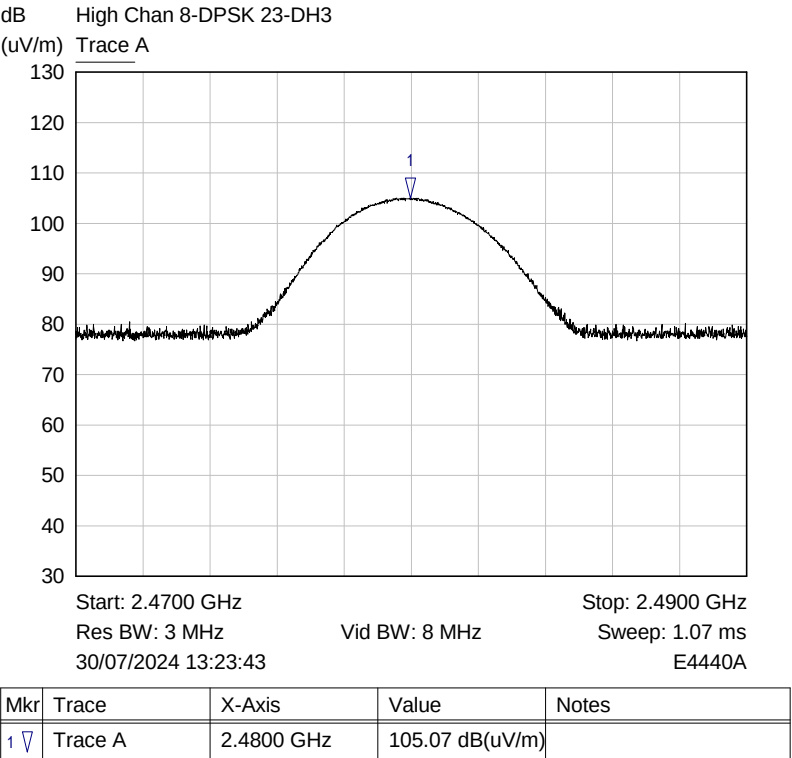
Plot ref of Vert polarisation and EUT in Upright position

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH3, Channel 2441 MHz



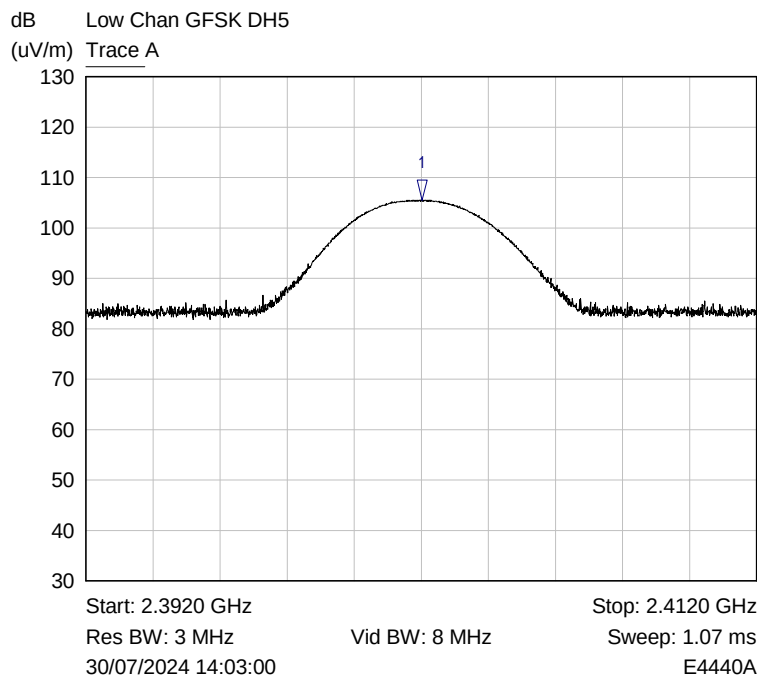
Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4400 GHz	105.12 dB(uV/m)	

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH3, Channel 2480 MHz



Plot ref of Vert polarisation and EUT in Upright position

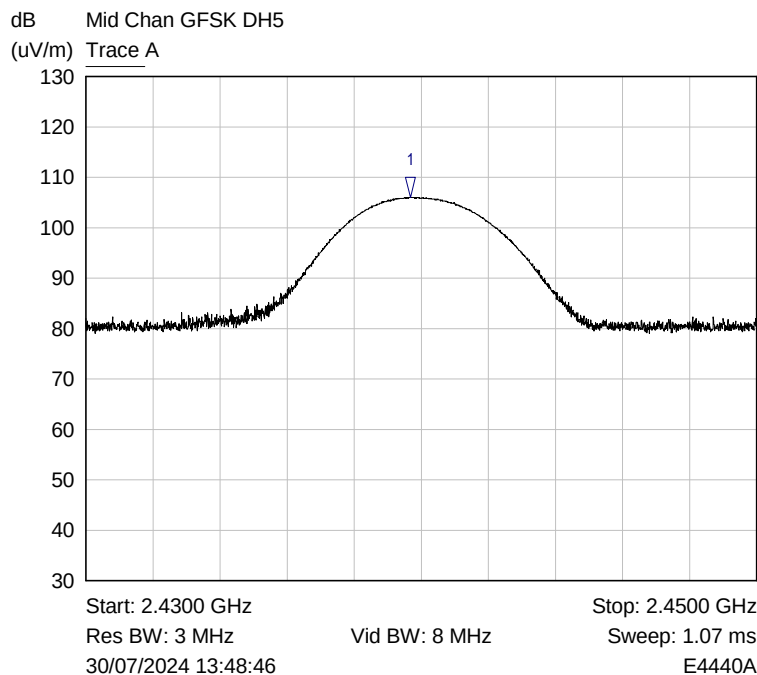
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH5, Channel 2402 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▾	Trace A	2.4020 GHz	105.53 dB(uV/m)	

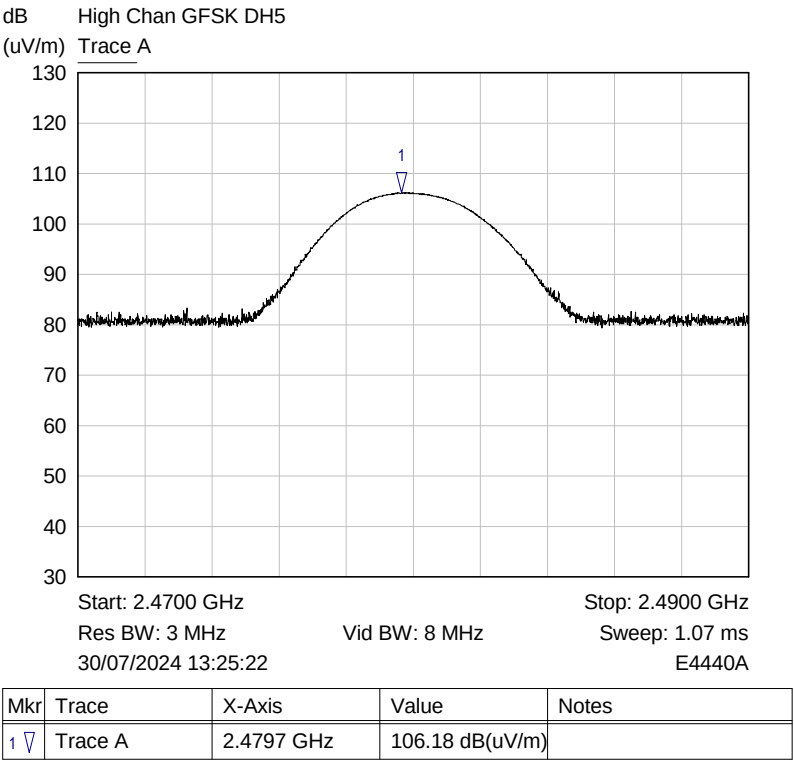
Plot ref of Vert polarisation and EUT in Upright position

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH5, Channel 2441 MHz



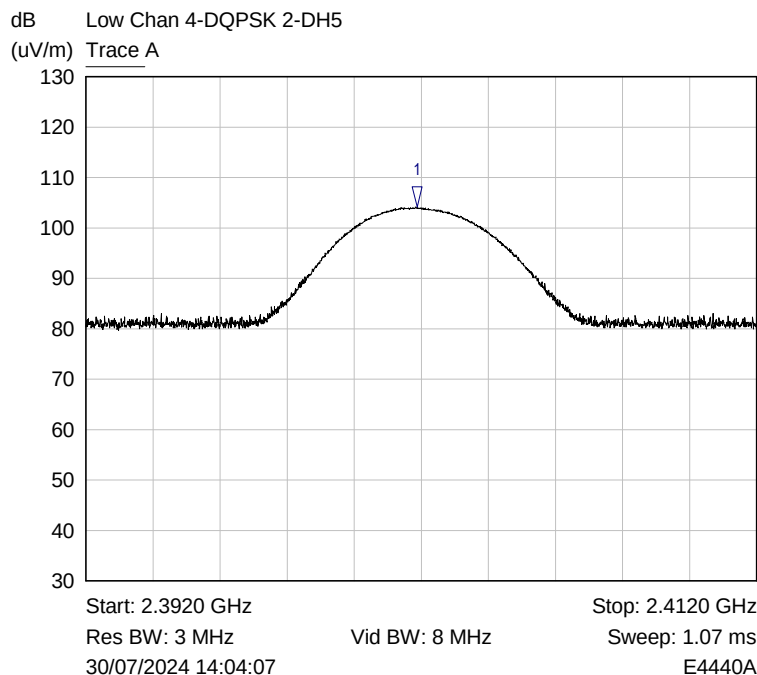
Mkr	Trace	X-Axis	Value	Notes
1 ▾	Trace A	2.4397 GHz	106.07 dB(uV/m)	

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH5, Channel 2480 MHz



Plot ref of Vert polarisation and EUT in Upright position

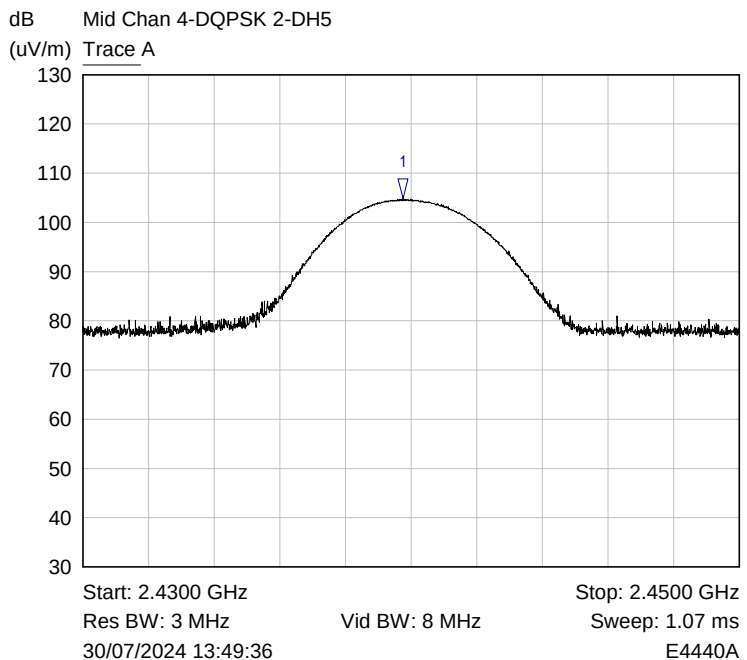
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation DQPSK 2-DH5, Channel 2402 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4019 GHz	104.19 dB(uV/m)	

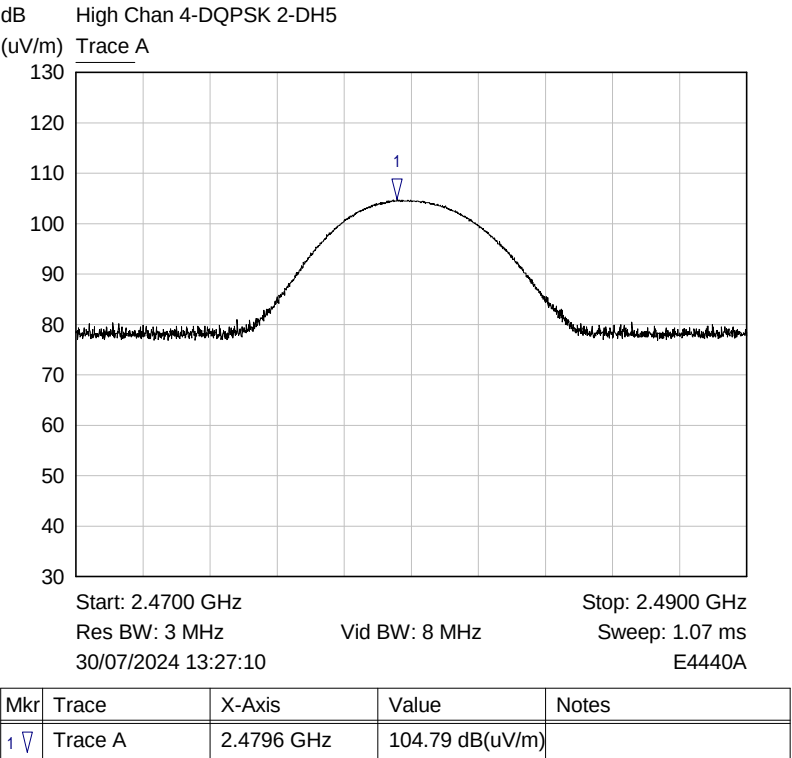
Plot ref of Vert polarisation and EUT in Upright position

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation DQPSK 2-DH5, Channel 2441 MHz



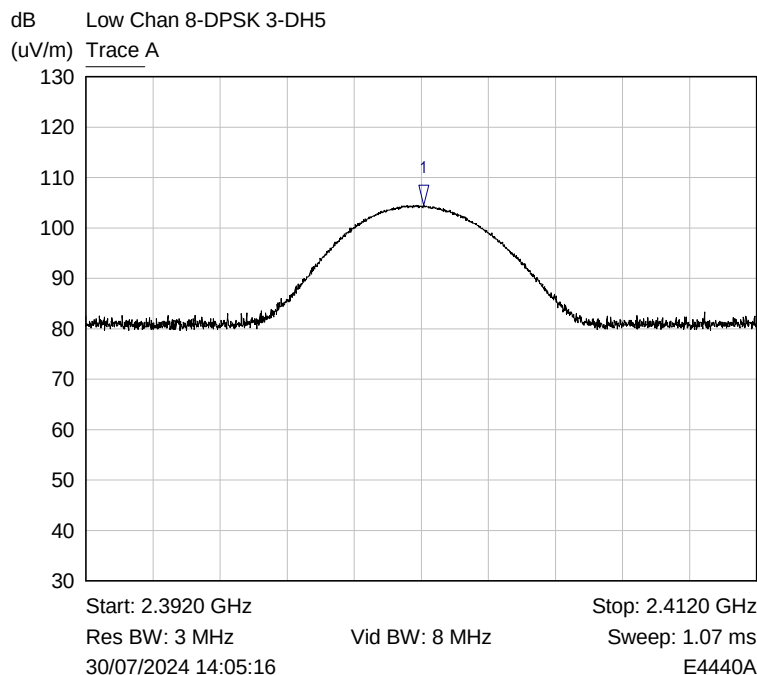
Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4397 GHz	104.83 dB(uV/m)	

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation DQPSK 2-DH5, Channel 2480 MHz



Plot ref of Vert polarisation and EUT in Upright position

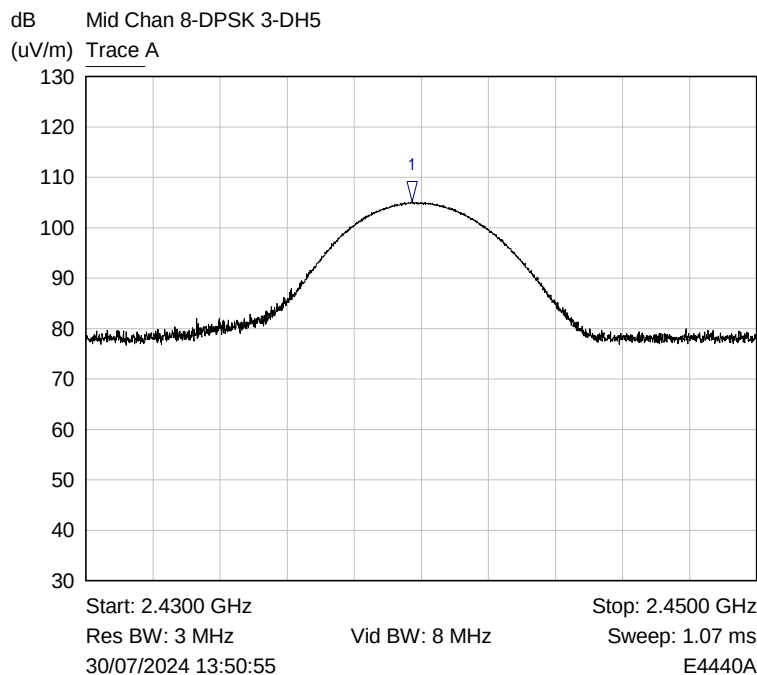
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH5, Channel 2402 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4021 GHz	104.52 dB(uV/m)	

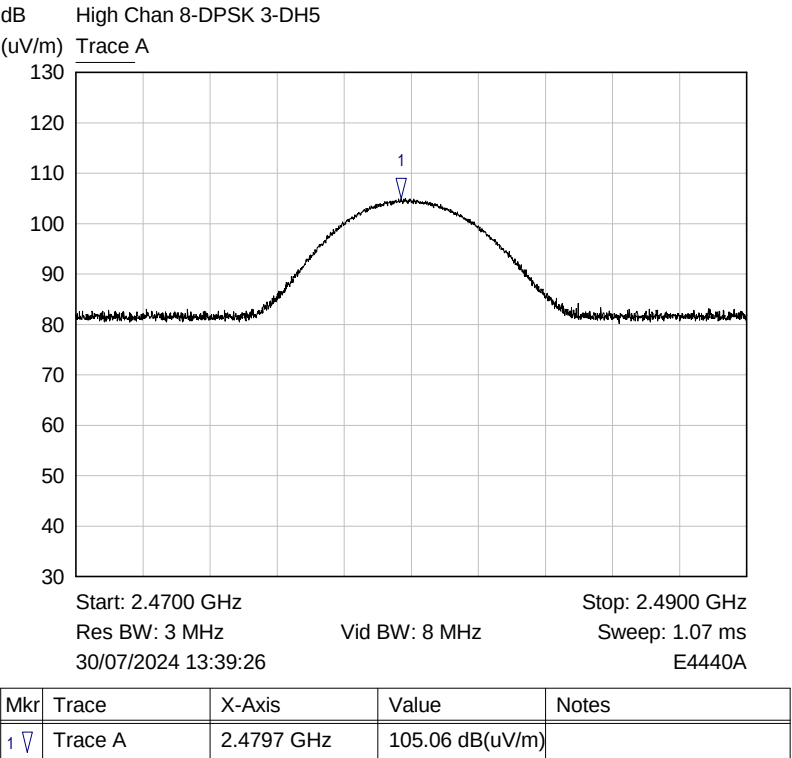
Plot ref of Vert polarisation and EUT in Upright position

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH5, Channel 2441 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4397 GHz	105.12 dB(uV/m)	

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH5, Channel 2480 MHz



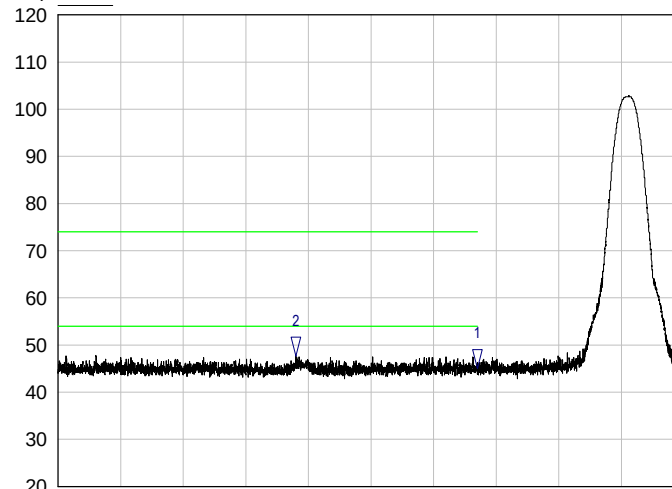
Plot ref of Vert polarisation and EUT in Upright position

6.7 Band Edge Compliance

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH5, Channel 2402 MHz (Low Ch)

dB 14745-3 Rest Band Edge Low chan GFSK DH5

(uV/m) PK



Start: 2.3565 GHz

Res BW: 1 MHz

Vid BW: 3 MHz

Stop: 2.4065 GHz

Sweep: 1.09 ms

15/07/2024 15:51:48

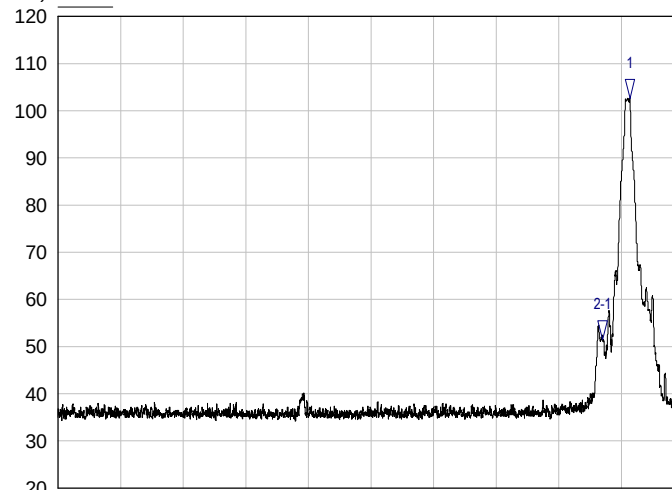
E4440A

Mkr	Trace	X-Axis	Value	Notes
1 ▽	PK	2.3900 GHz	45.08 dB(uV/m)	
2 ▽	PK	2.3755 GHz	47.73 dB(uV/m)	

Restricted band edge Peak Plot

dB 14745-3 Auth Band Edge Low chan GFSK DH5

(uV/m) Trace A



Start: 2.3565 GHz

Res BW: 100 kHz

Vid BW: 300 kHz

Stop: 2.4065 GHz

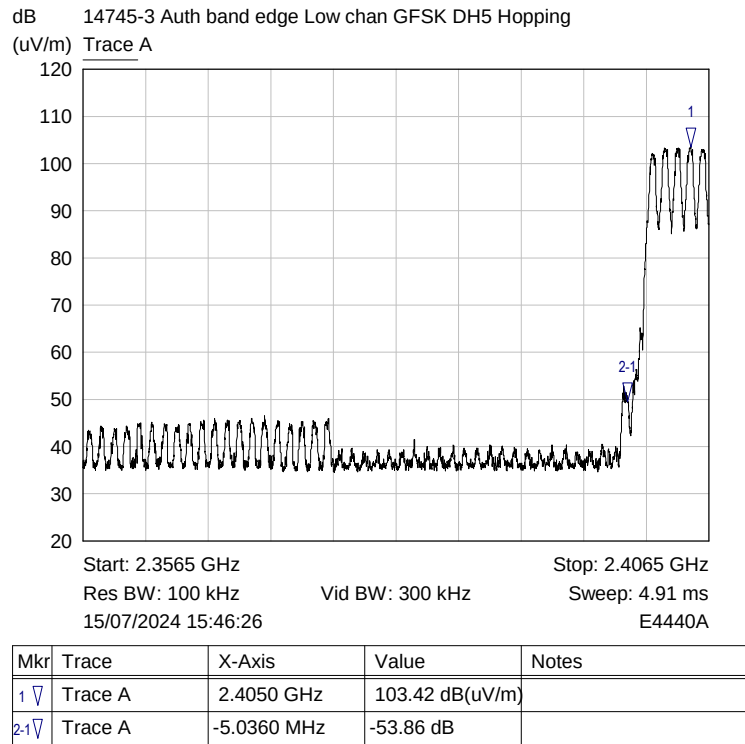
Sweep: 4.91 ms

15/07/2024 15:50:18

E4440A

Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4022 GHz	102.73 dB(uV/m)	
2-1 ▽	Trace A	2.4000 GHz	-51.30 dB	

Authorised Band Edge Plot

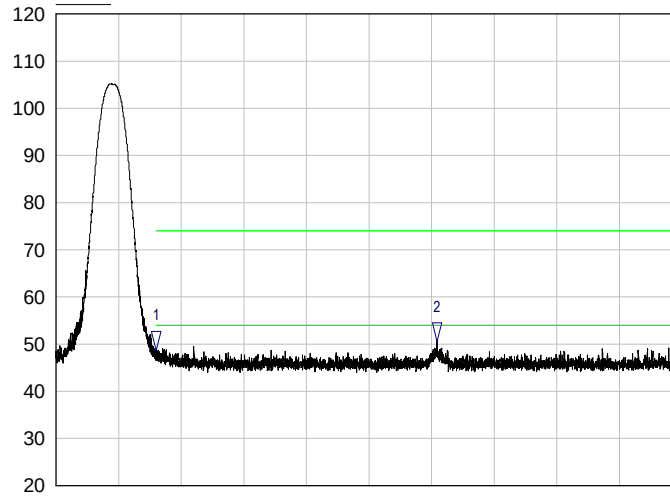


Auth Band Edge hop Plot

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH5, Channel 2480 MHz (High Ch)

dB 14745-3 Rest Band Edge High chan GFSK DH5

(uV/m) PK



Start: 2.4755 GHz

Stop: 2.5255 GHz

Res BW: 1 MHz

Vid BW: 3 MHz

Sweep: 1.09 ms

15/07/2024 15:36:05

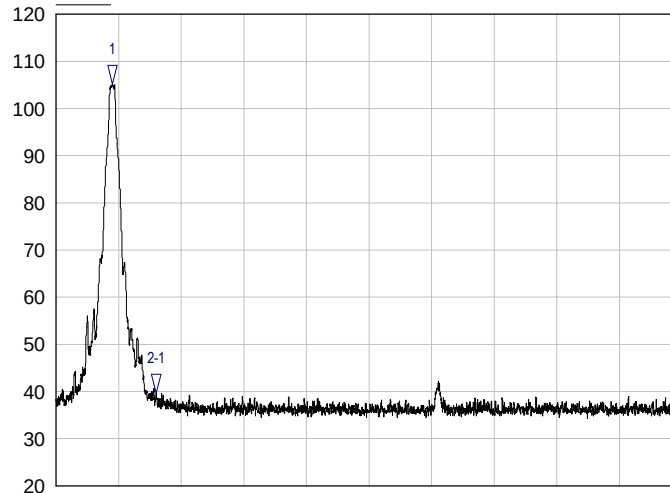
E4440A

Mkr	Trace	X-Axis	Value	Notes
1 ▽	PK	2.4835 GHz	48.65 dB(uV/m)	
2 ▽	PK	2.5059 GHz	50.47 dB(uV/m)	

Restricted band edge Peak Plot

dB 14745-3 Auth Band Edge High chan GFSK DH5

(uV/m) Trace A



Start: 2.4755 GHz

Stop: 2.5255 GHz

Res BW: 100 kHz

Vid BW: 300 kHz

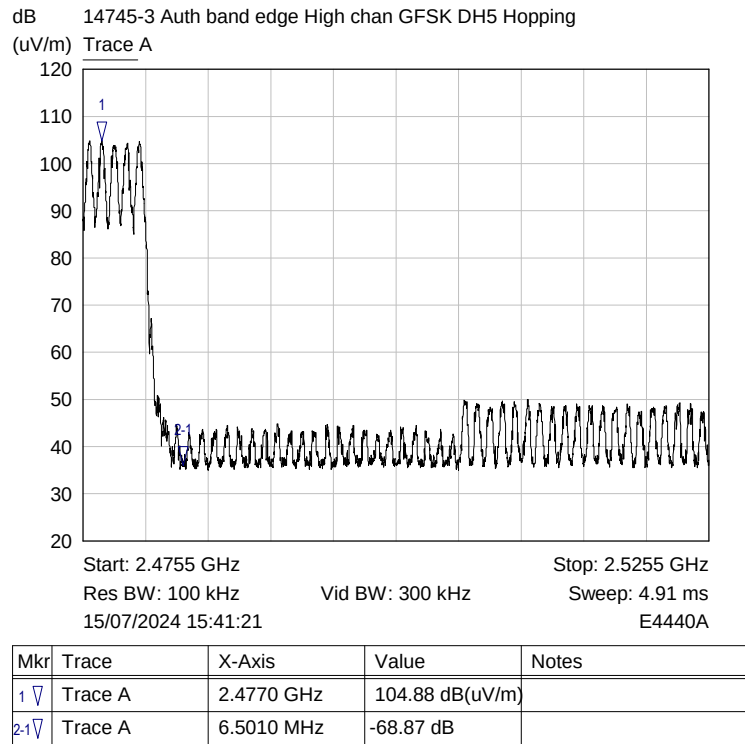
Sweep: 4.91 ms

15/07/2024 15:34:05

E4440A

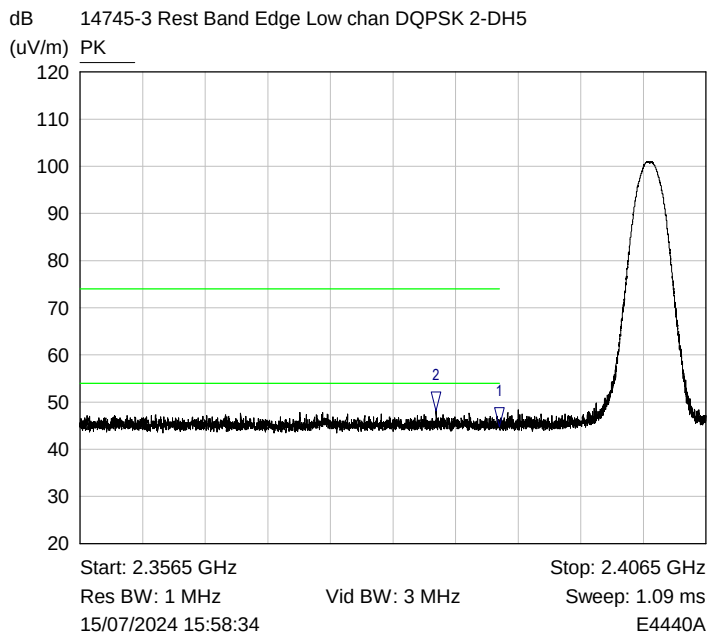
Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4800 GHz	105.11 dB(uV/m)	
2-1 ▽	Trace A	2.4835 GHz	-65.42 dB	

Authorised Band Edge Plot



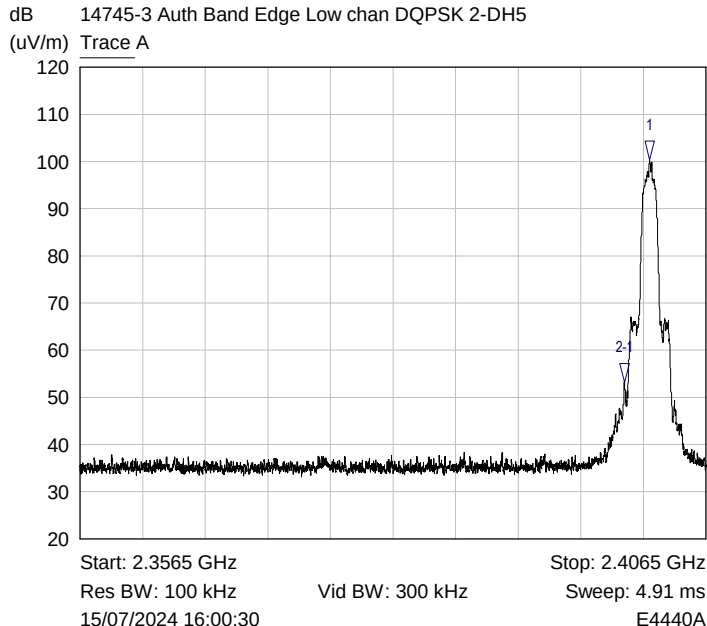
Auth Band Edge hop Plot

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation DQPSK 2-DH5, Channel 2402 MHz (Low Ch)



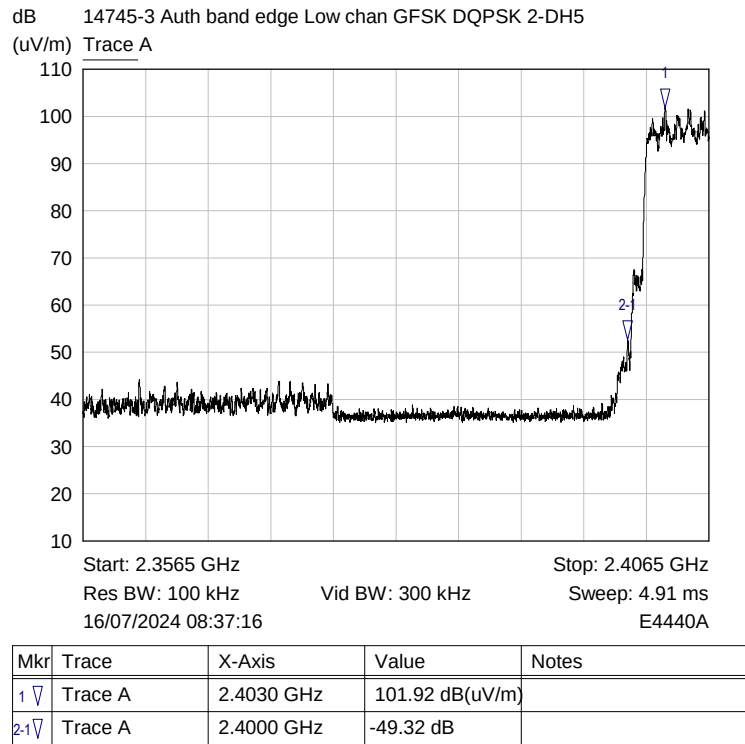
Mkr	Trace	X-Axis	Value	Notes
1 ▽	PK	2.3900 GHz	44.76 dB(uV/m)	
2 ▽	PK	2.3850 GHz	48.20 dB(uV/m)	

Restricted band edge Peak Plot



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4020 GHz	100.32 dB(uV/m)	
2 ▽	Trace A	2.4000 GHz	-47.22 dB	

Authorised Band Edge Plot

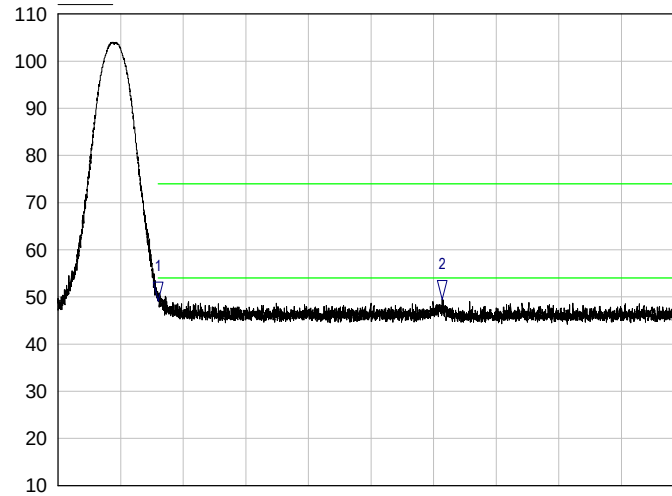


Auth Band Edge hop Plot

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation DQPSK 2-DH5, Channel 2480 MHz (High Ch)

dB 14745-3 Rest Band Edge High chan DQPSK 2-DH5

(uV/m) PK



Start: 2.4755 GHz

Stop: 2.5255 GHz

Res BW: 1 MHz

Vid BW: 3 MHz

Sweep: 1.09 ms

16/07/2024 08:47:53

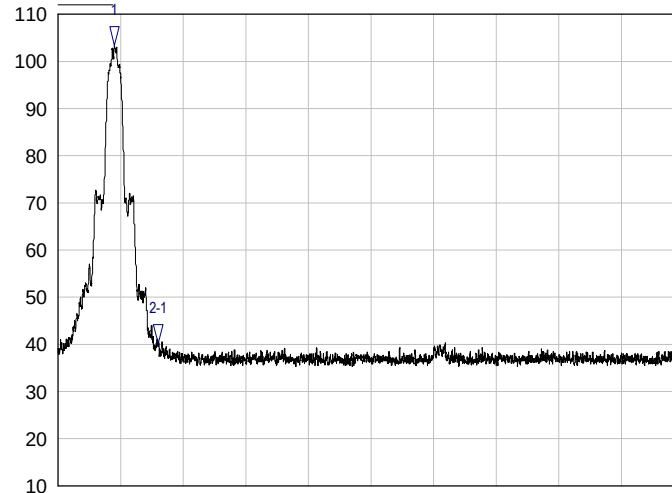
E4440A

Mkr	Trace	X-Axis	Value	Notes
1 ▽	PK	2.4835 GHz	49.12 dB(uV/m)	
2 ▽	PK	2.5062 GHz	49.54 dB(uV/m)	

Restricted band edge Peak Plot

dB 14745-3 Auth Band Edge High chan DQPSK 2-DH5

(uV/m) Trace A



Start: 2.4755 GHz

Stop: 2.5255 GHz

Res BW: 100 kHz

Vid BW: 300 kHz

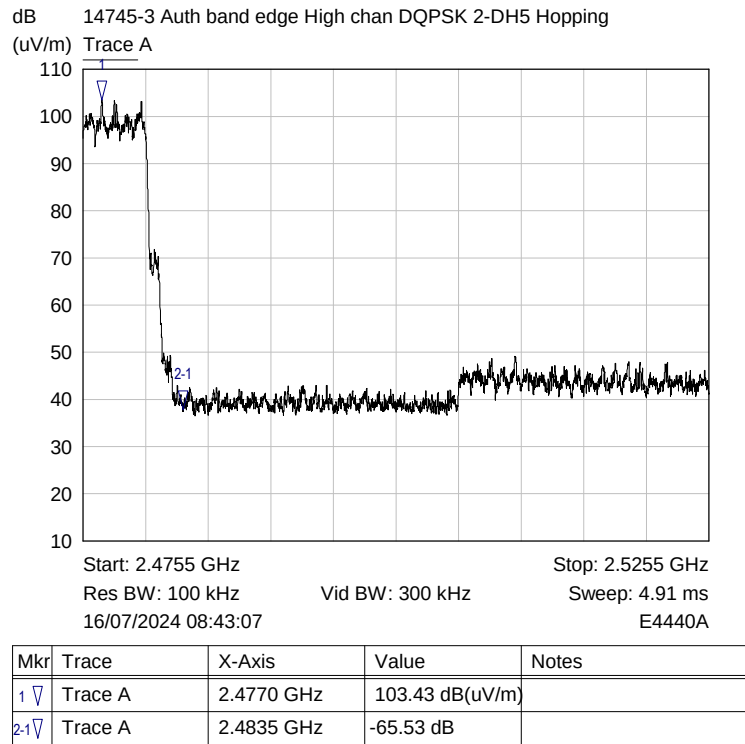
Sweep: 4.91 ms

16/07/2024 08:46:41

E4440A

Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4800 GHz	103.39 dB(uV/m)	
2-1 ▽	Trace A	2.4835 GHz	-63.15 dB	

Authorised Band Edge Plot

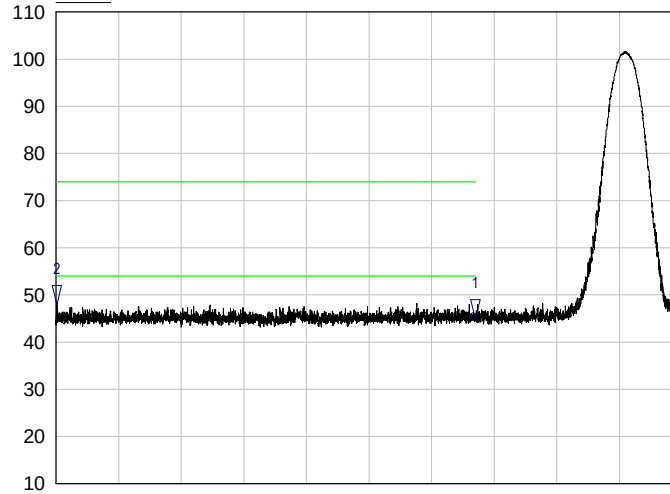


Auth Band Edge hop Plot

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH5, Channel 2402 MHz (Low Ch)

dB 14745-3 Rest Band Edge Low chan 8-DPSK 3-DH5

(uV/m) PK



Start: 2.3565 GHz

Stop: 2.4065 GHz

Res BW: 1 MHz

Vid BW: 3 MHz

Sweep: 1.09 ms

16/07/2024 09:04:22

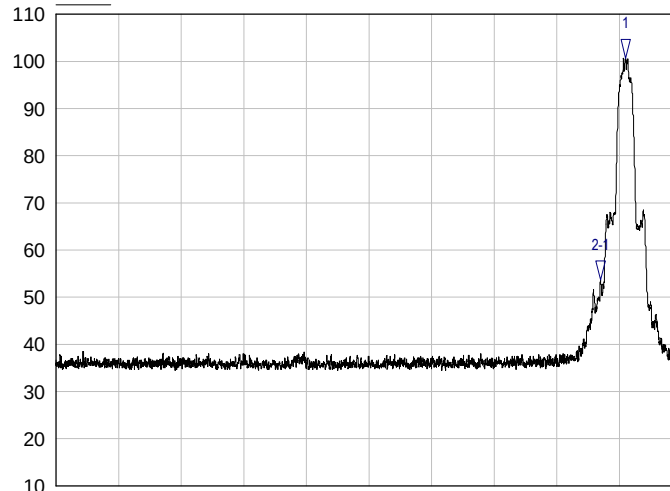
E4440A

Mkr	Trace	X-Axis	Value	Notes
1 ▽	PK	2.3900 GHz	45.04 dB(uV/m)	
2 ▽	PK	2.3566 GHz	47.96 dB(uV/m)	

Restricted band edge Peak Plot

dB 14745-3 Auth Band Edge Low chan 8-DPSK 3-DH5

(uV/m) Trace A



Start: 2.3565 GHz

Stop: 2.4065 GHz

Res BW: 100 kHz

Vid BW: 300 kHz

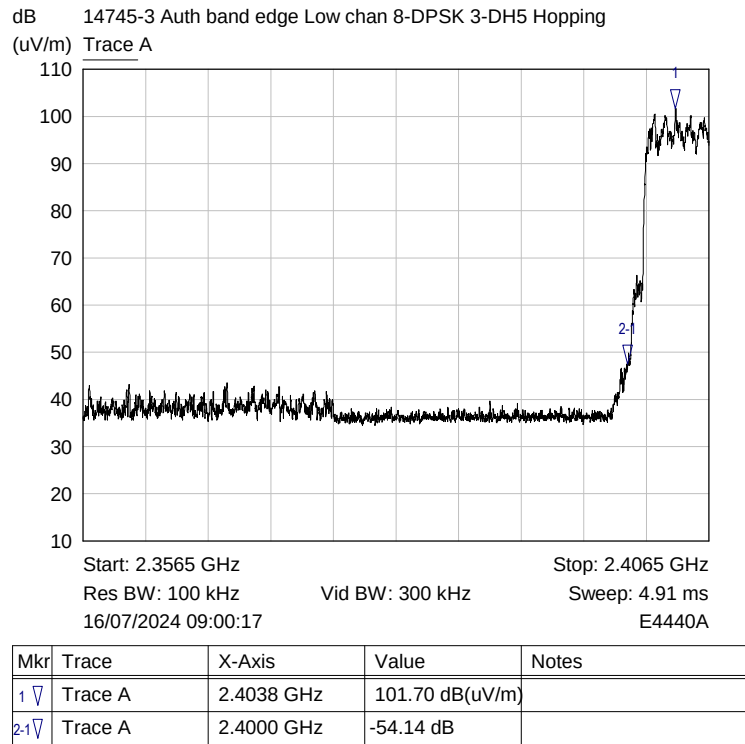
Sweep: 4.91 ms

16/07/2024 09:03:20

E4440A

Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4020 GHz	100.62 dB(uV/m)	
2-1 ▽	Trace A	2.4000 GHz	-46.98 dB	

Authorised Band Edge Plot

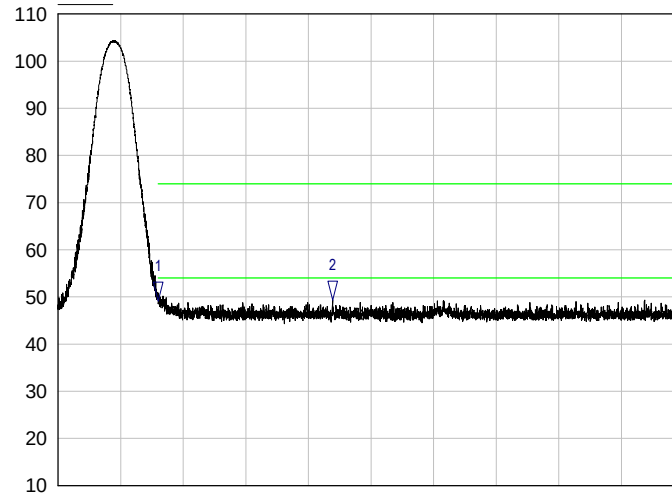


Auth Band Edge hop Plot

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH5, Channel 2480 MHz (High Ch)

dB 14745-3 Rest Band Edge High chan 8-DPSK 3-DH5

(uV/m) PK



Start: 2.4755 GHz

Stop: 2.5255 GHz

Res BW: 1 MHz

Vid BW: 3 MHz

Sweep: 1.09 ms

16/07/2024 08:51:57

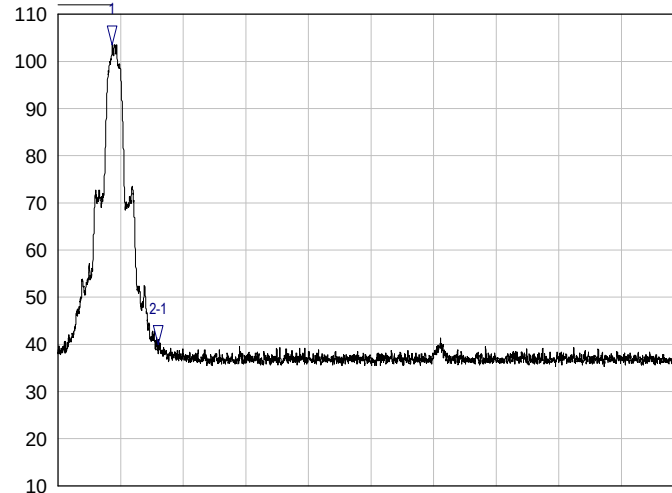
E4440A

Mkr	Trace	X-Axis	Value	Notes
1 ▽	PK	2.4835 GHz	49.21 dB(uV/m)	
2 ▽	PK	2.4974 GHz	49.40 dB(uV/m)	

Restricted band edge Peak Plot

dB 14745-3 Auth Band Edge High chan 8-DPSK 3-DH5

(uV/m) Trace A



Start: 2.4755 GHz

Stop: 2.5255 GHz

Res BW: 100 kHz

Vid BW: 300 kHz

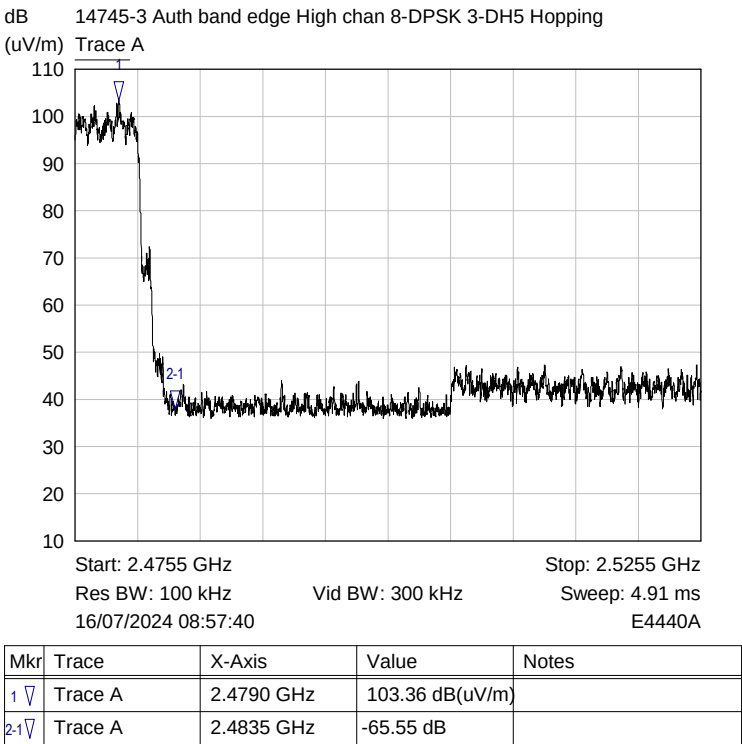
Sweep: 4.91 ms

16/07/2024 08:54:30

E4440A

Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4798 GHz	103.54 dB(uV/m)	
2-1 ▽	Trace A	2.4835 GHz	-63.61 dB	

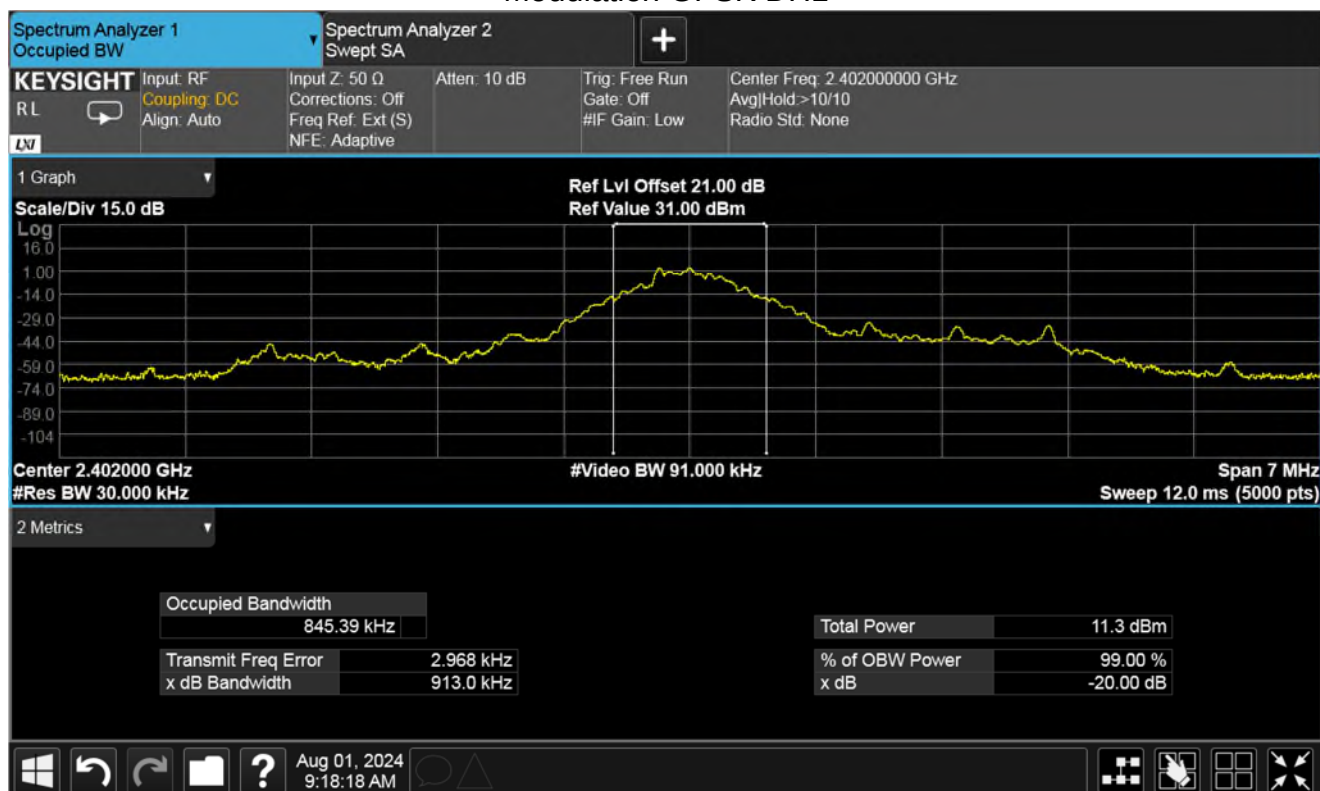
Authorised Band Edge Plot



Auth Band Edge hop Plot

6.8 Occupied Bandwidth

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH1



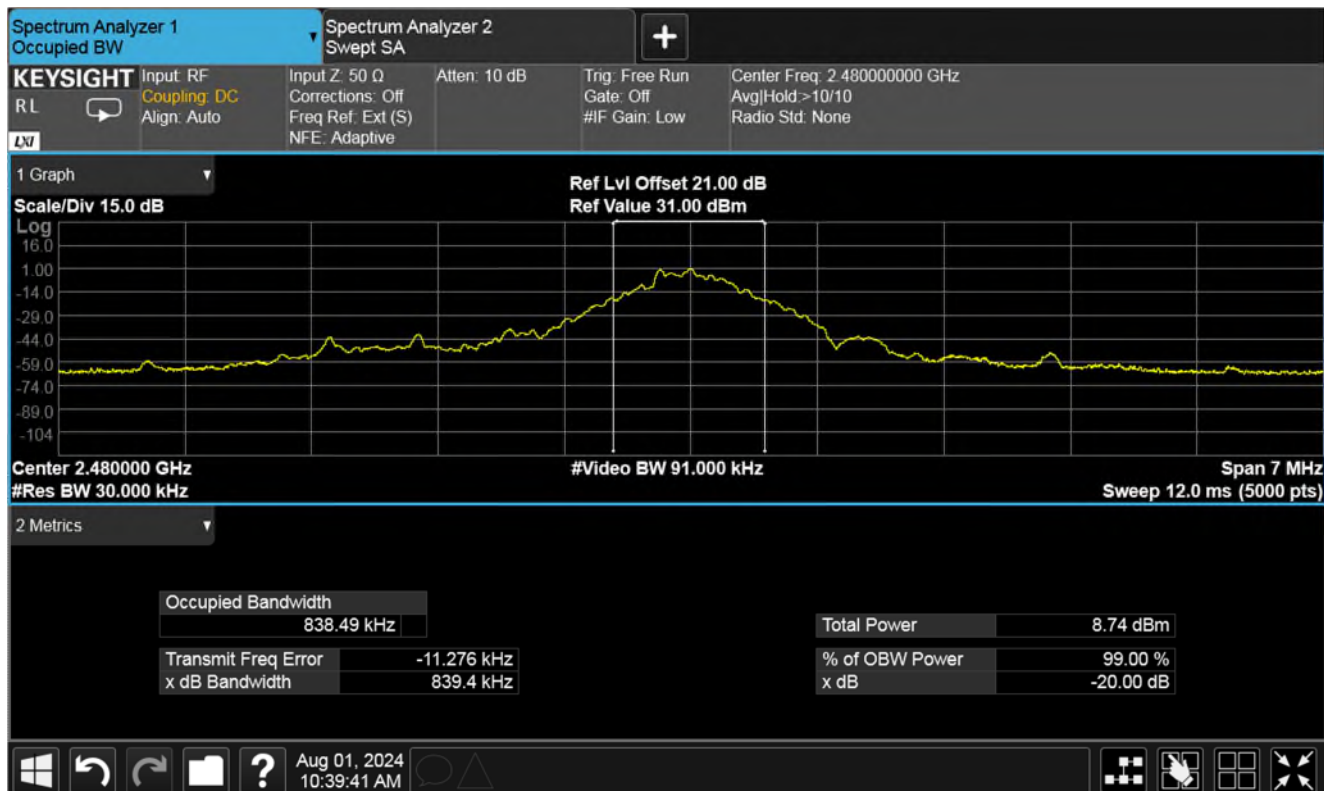
Occupied Bandwidth GFSK DH1 Low Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH1



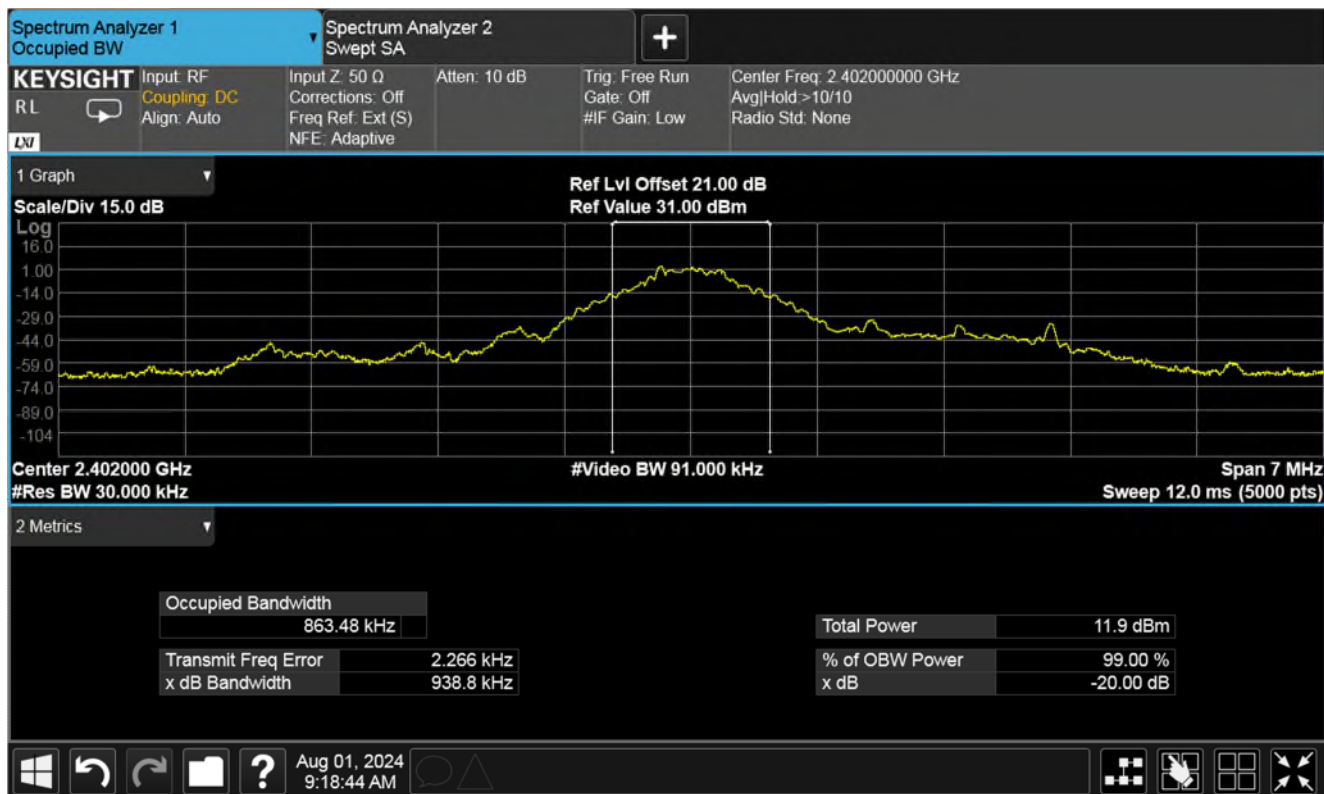
Occupied Bandwidth GFSK DH1 Mid Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH1



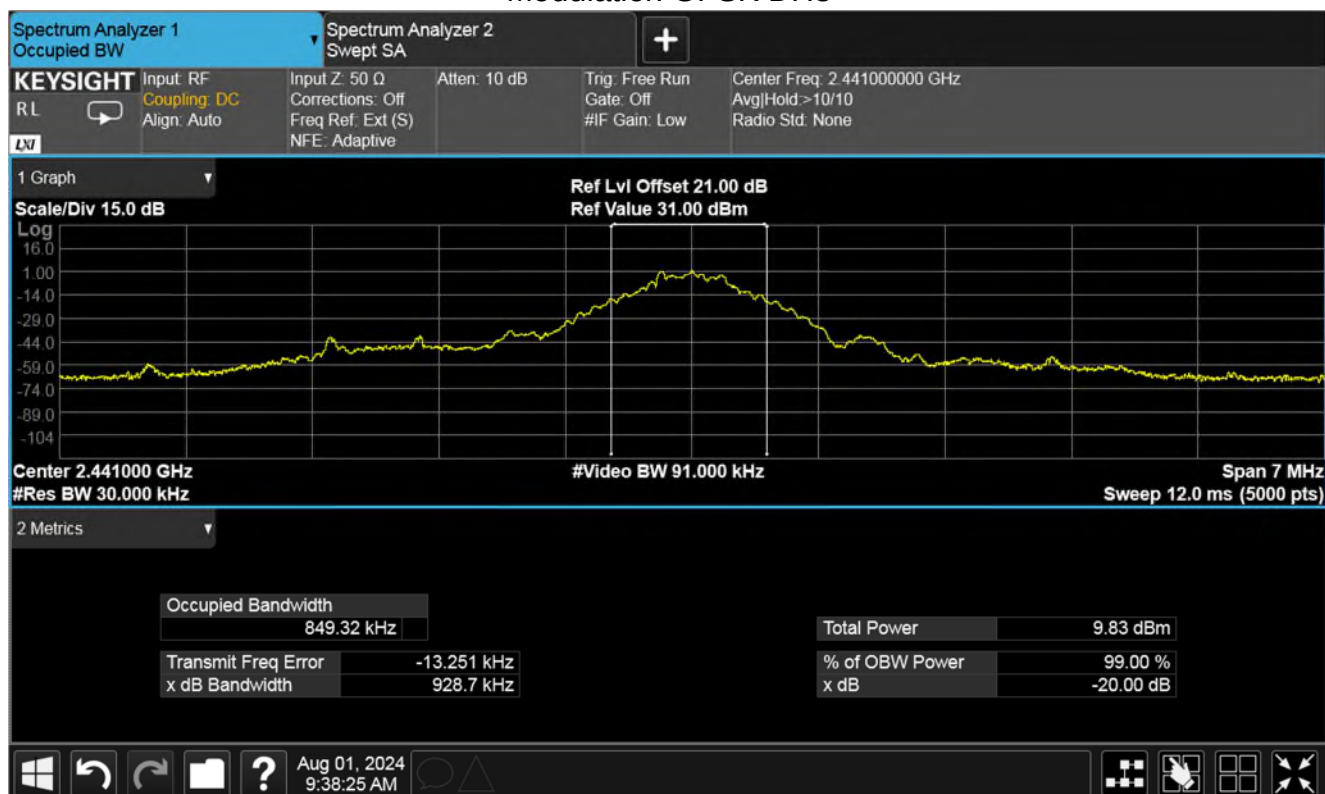
Occupied Bandwidth GFSK DH1 High Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH3



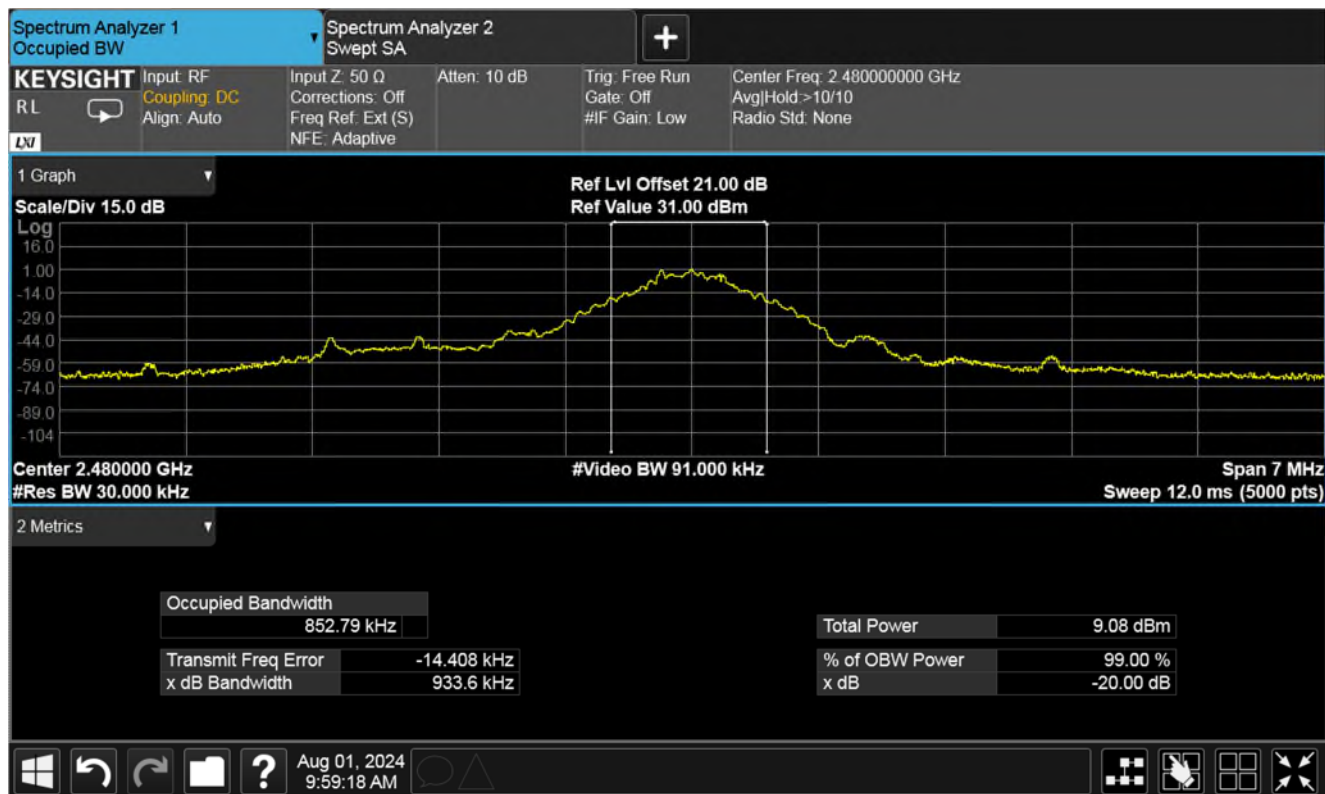
Occupied Bandwidth GFSK DH3 Low Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH3



Occupied Bandwidth GFSK DH3 Mid Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH3



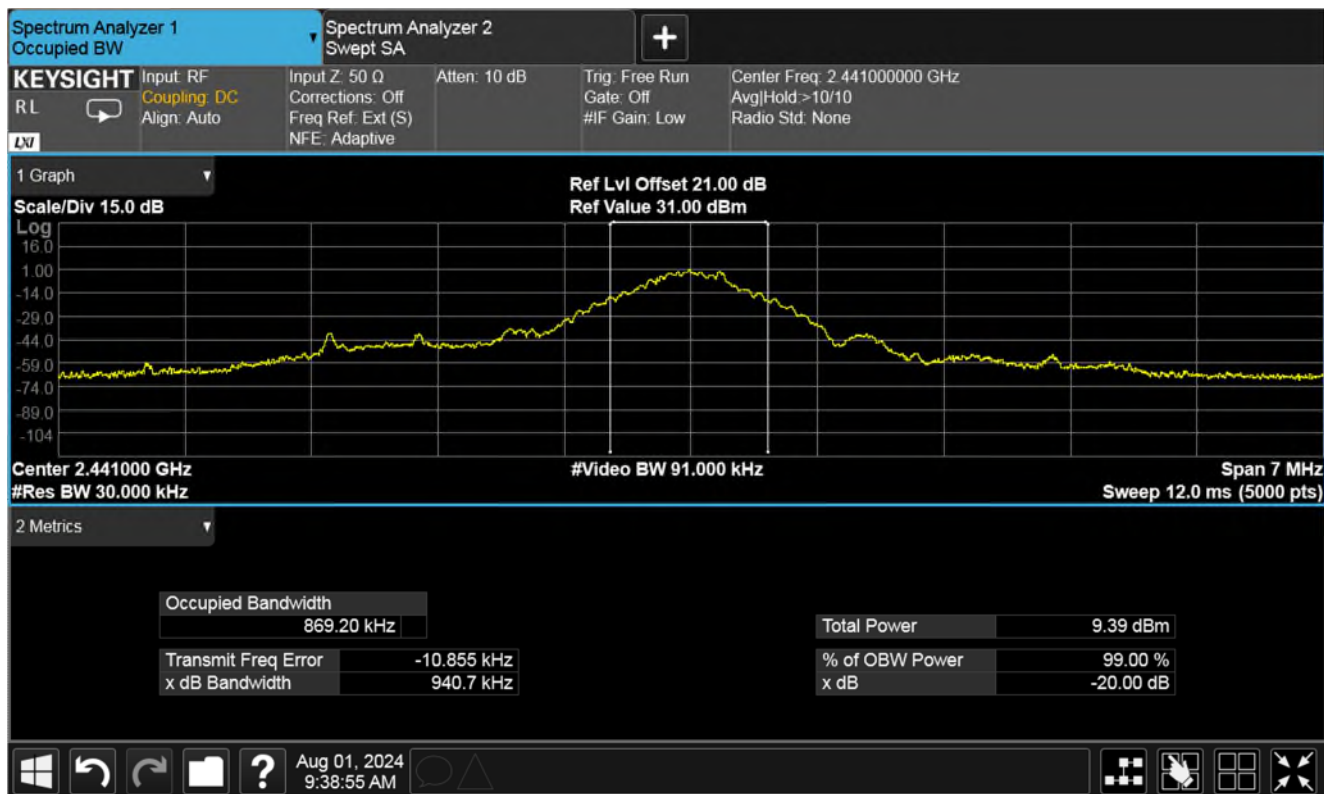
Occupied Bandwidth GFSK DH3 High Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH5



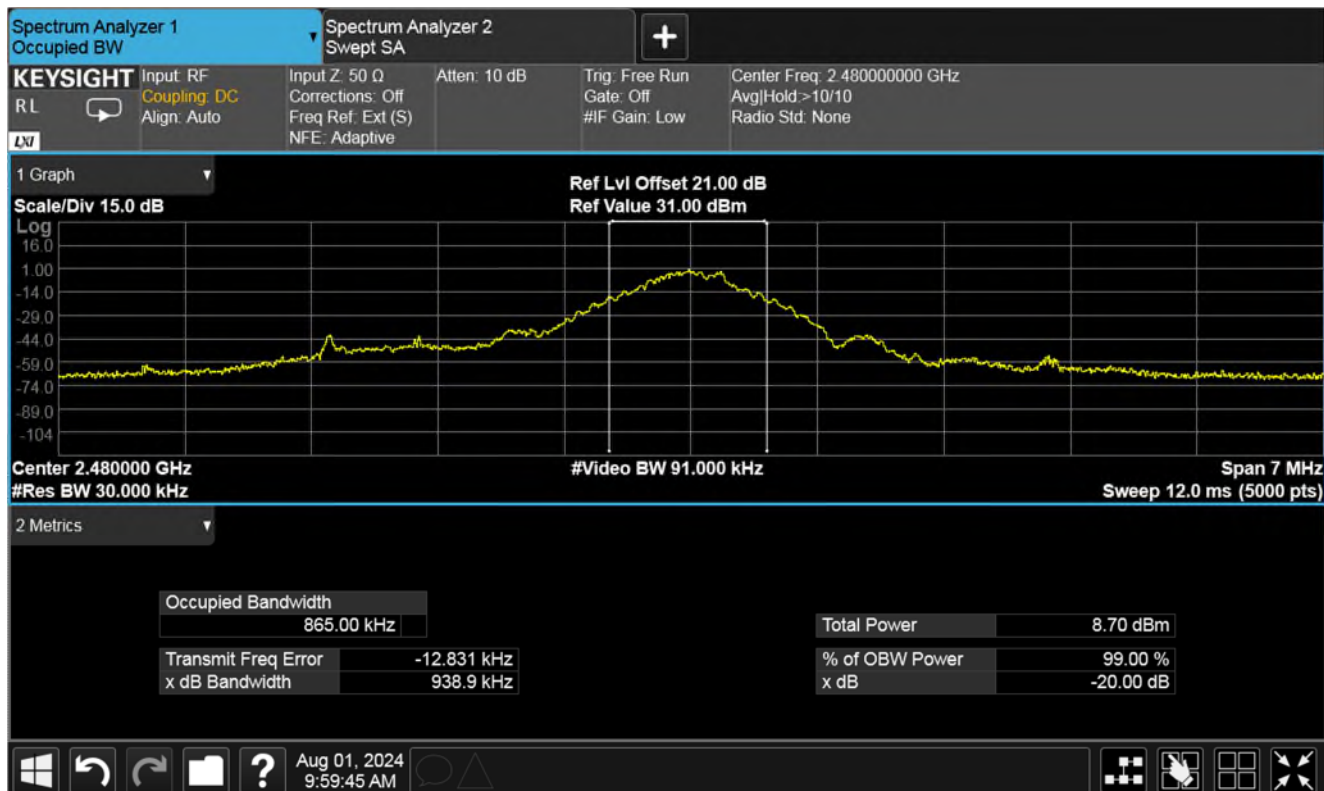
Occupied Bandwidth GFSK DH5 Low Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH5



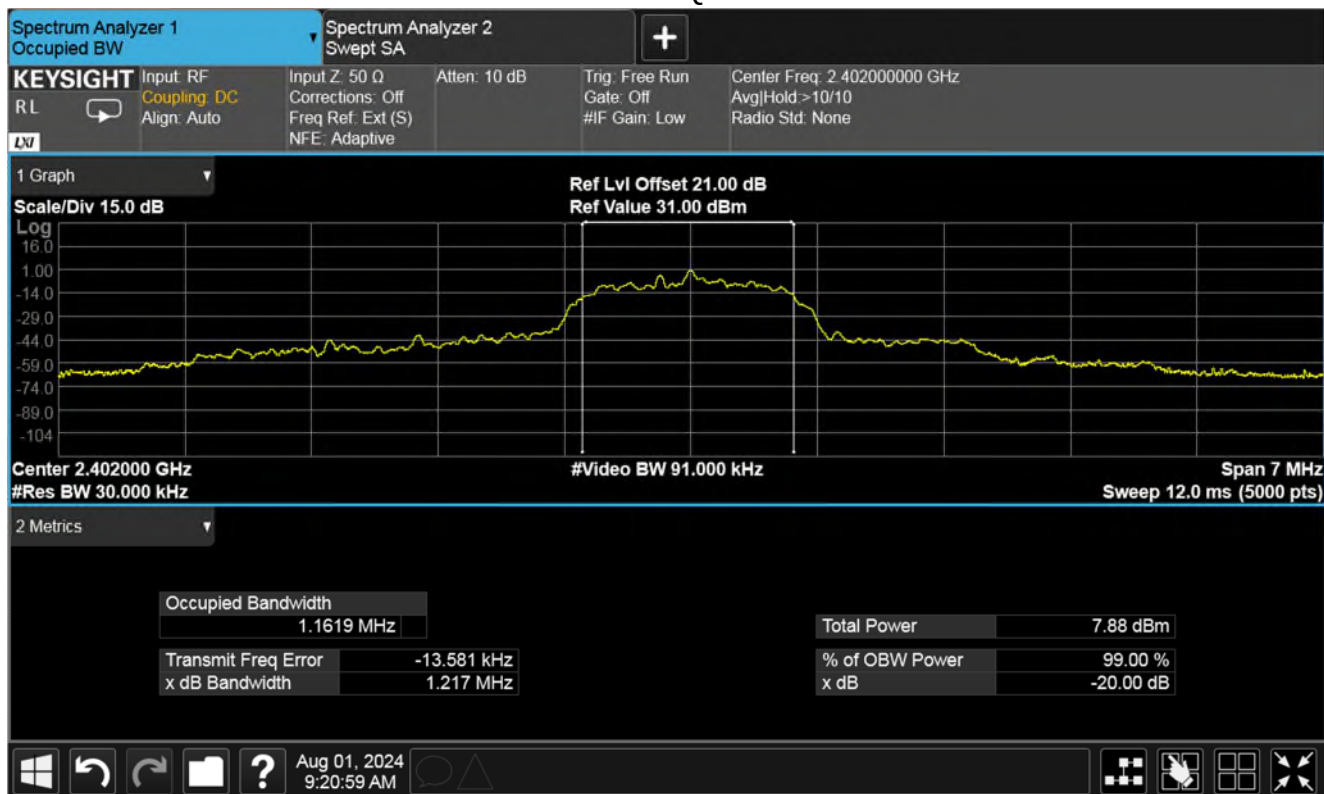
Occupied Bandwidth GFSK DH5 Mid Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH5



Occupied Bandwidth GFSK DH5 High Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 4-DQPSK 2-DH1



Occupied Bandwidth 4-DQPSK 2-DH1 Low Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 4-DQPSK 2-DH1



Occupied Bandwidth 4-DQPSK 2-DH1 Mid Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 4-DQPSK 2-DH1



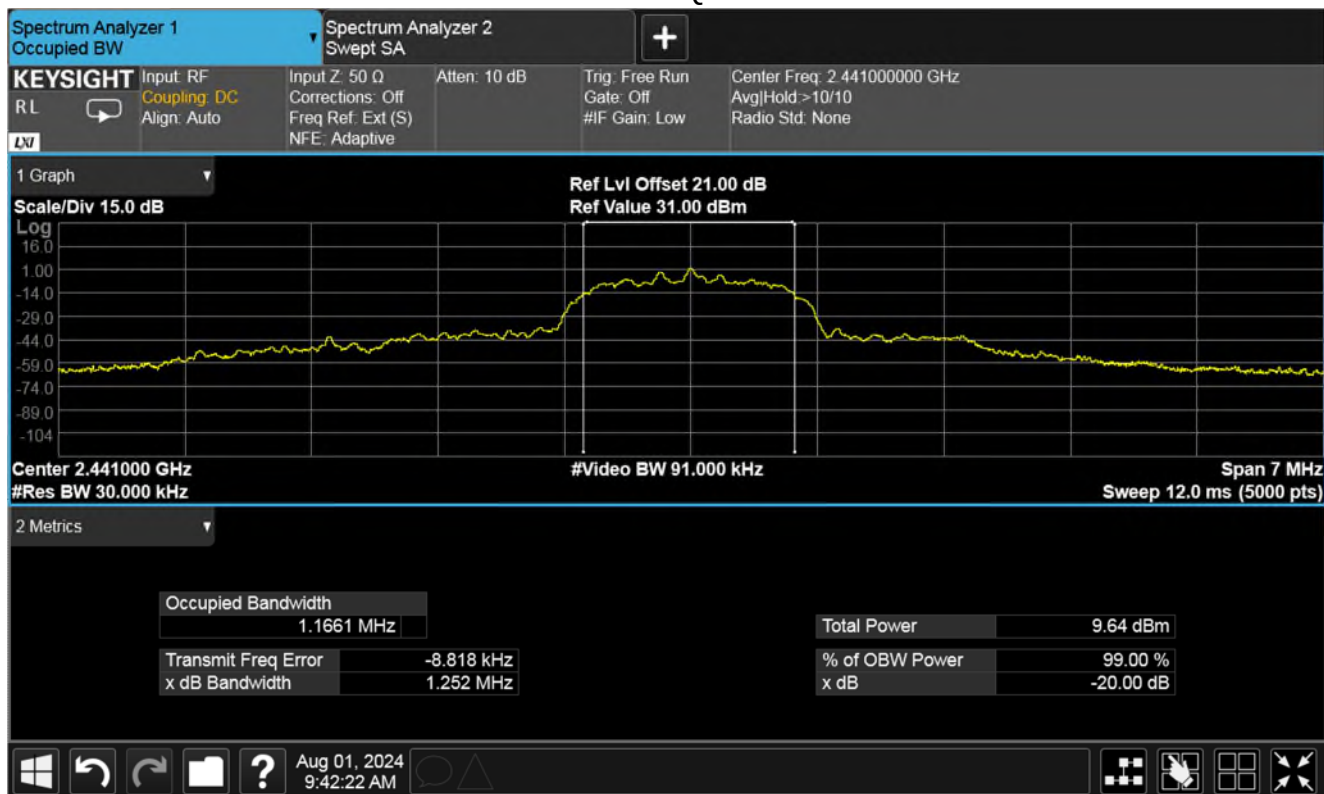
Occupied Bandwidth 4-DQPSK 2-DH1 High Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 4-DQPSK 2-DH3



Occupied Bandwidth 4-DQPSK 2-DH3 Low Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 4-DQPSK 2-DH3



Occupied Bandwidth 4-DQPSK 2-DH3 Mid Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 4-DQPSK 2-DH3



Occupied Bandwidth 4-DQPSK 2-DH3 High Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 4-DQPSK 2-DH5



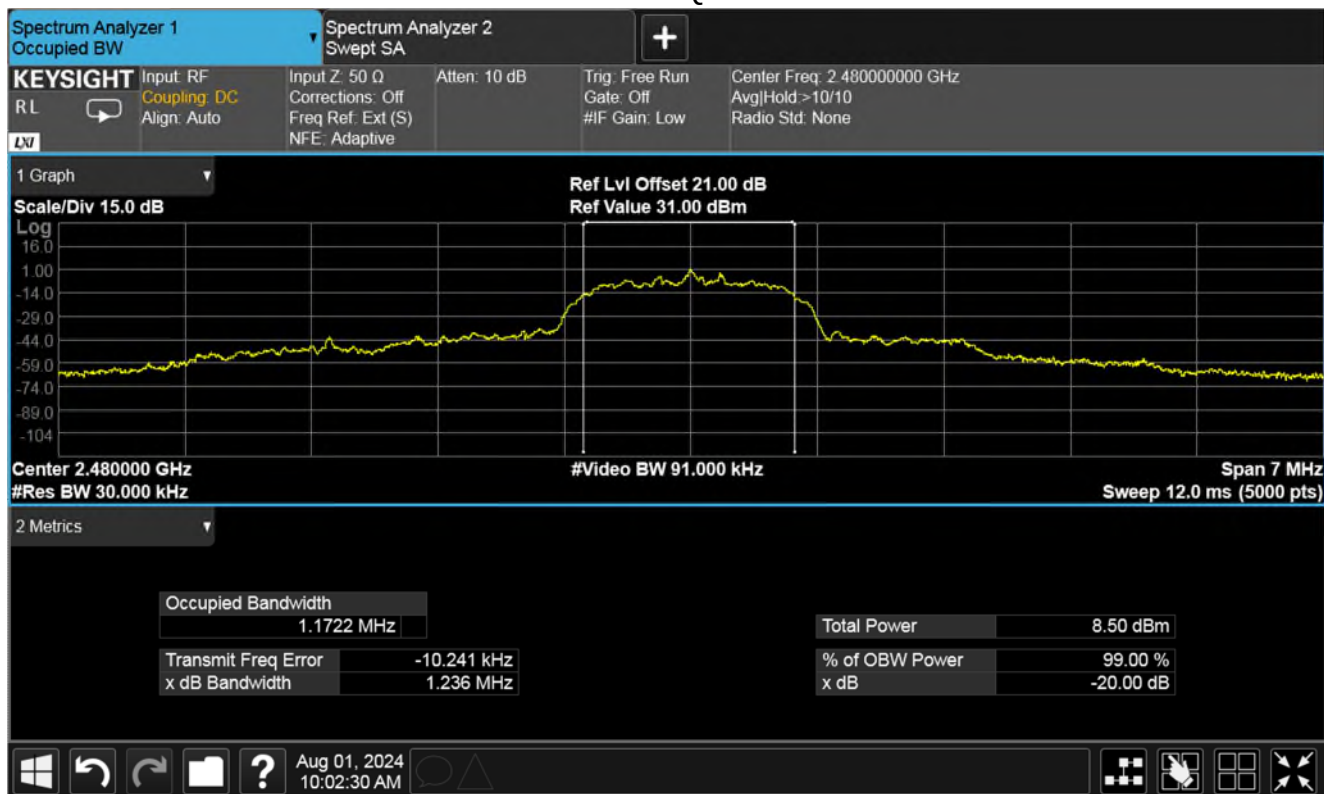
Occupied Bandwidth 4-DQPSK 2-DH5 Low Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 4-DQPSK 2-DH5



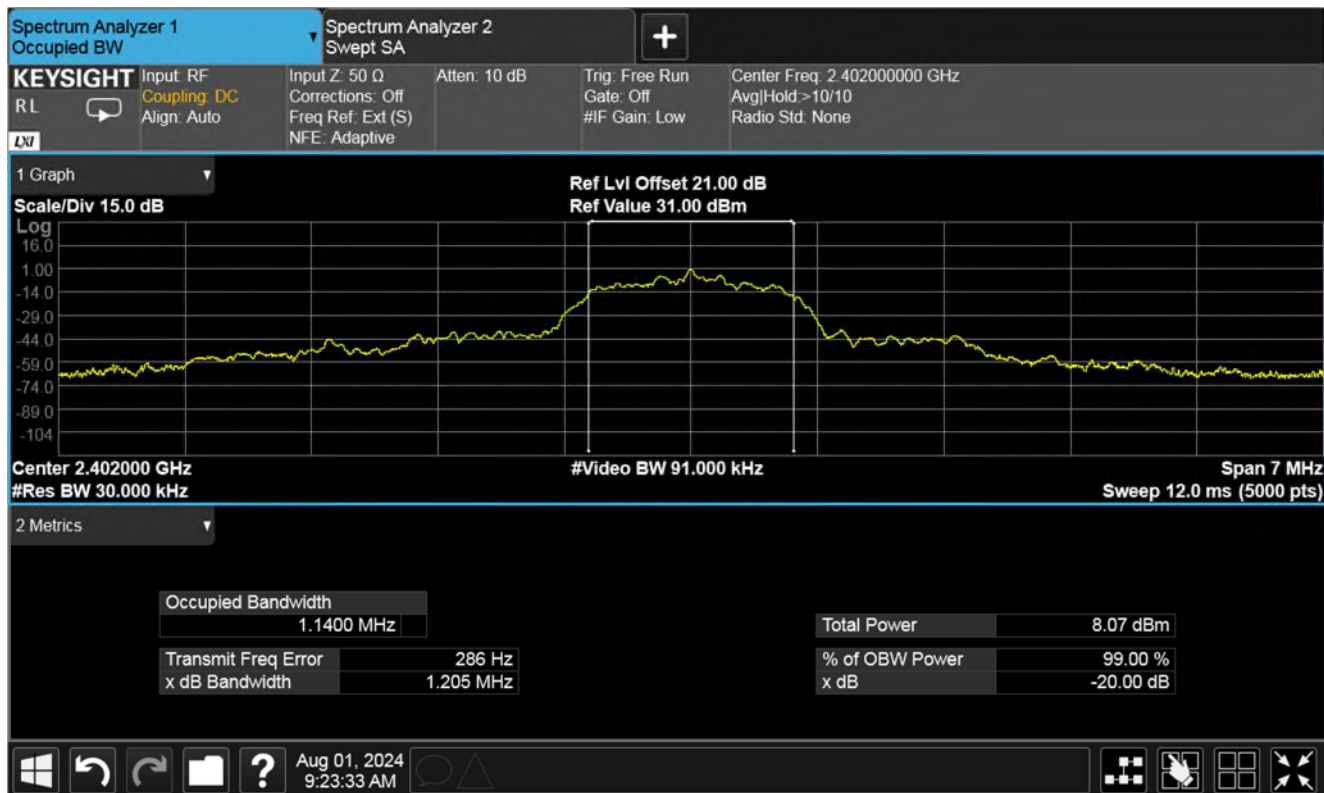
Occupied Bandwidth 4-DQPSK 2-DH5 Mid Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 4-DQPSK 2-DH5



Occupied Bandwidth 4-DQPSK 2-DH5 High Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH1



Occupied Bandwidth 8-DPSK 3-DH1 Low Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH1



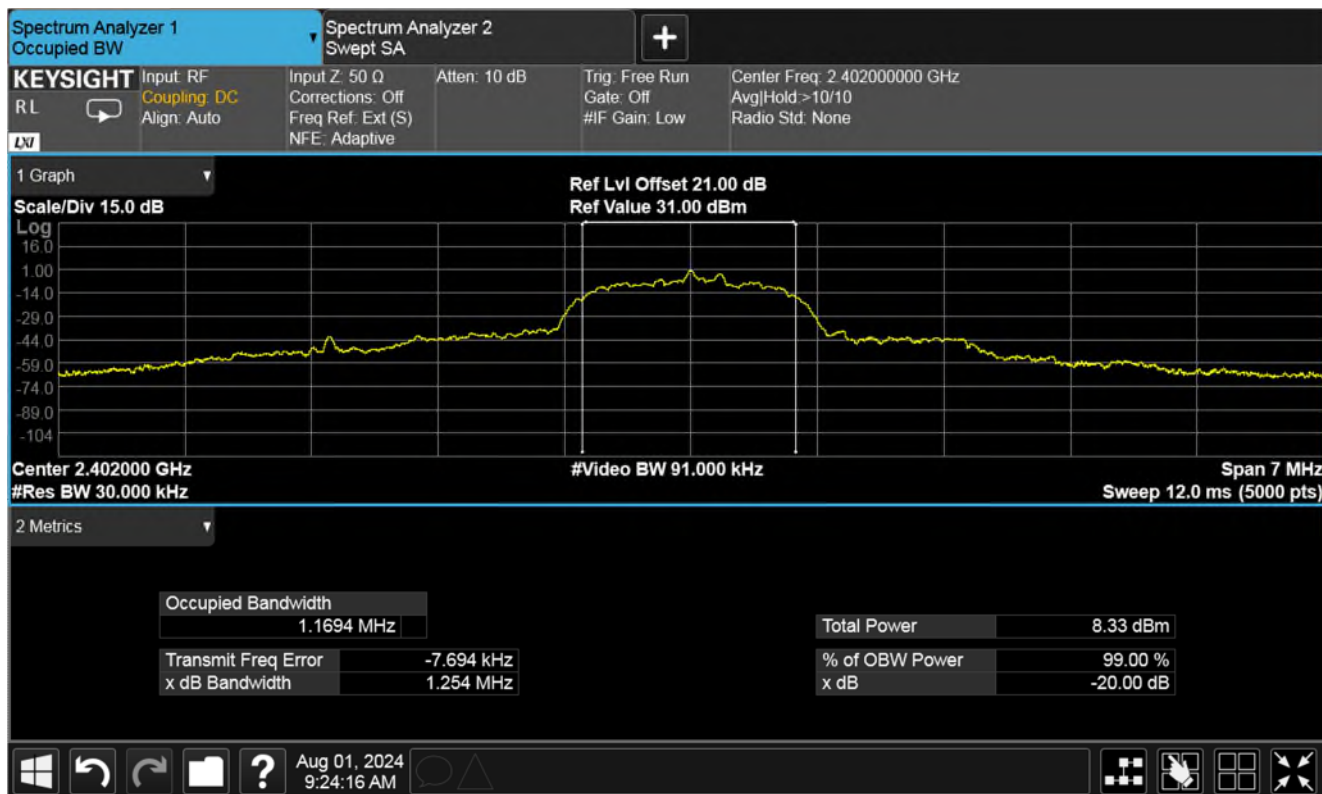
Occupied Bandwidth 8-DPSK 3-DH1 Mid Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH1



Occupied Bandwidth 8-DPSK 3-DH1 High Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH3



Occupied Bandwidth 8-DPSK 3-DH3 Low Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH3



Occupied Bandwidth 8-DPSK 3-DH3 Mid Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH3



Occupied Bandwidth 8-DPSK 3-DH3 High Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH5



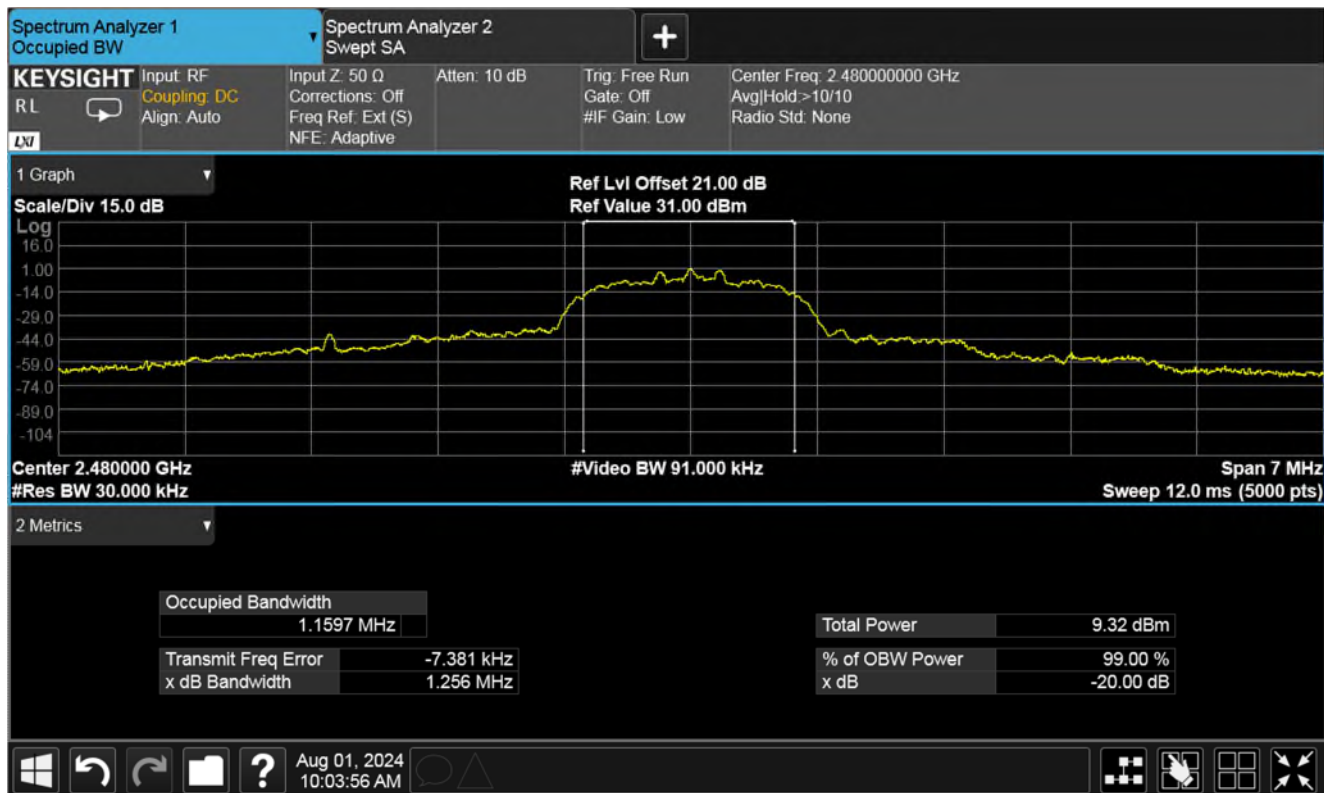
Occupied Bandwidth 8-DPSK 3-DH5 Low Channel

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH5



Occupied Bandwidth 8-DPSK 3-DH5 Mid Channel

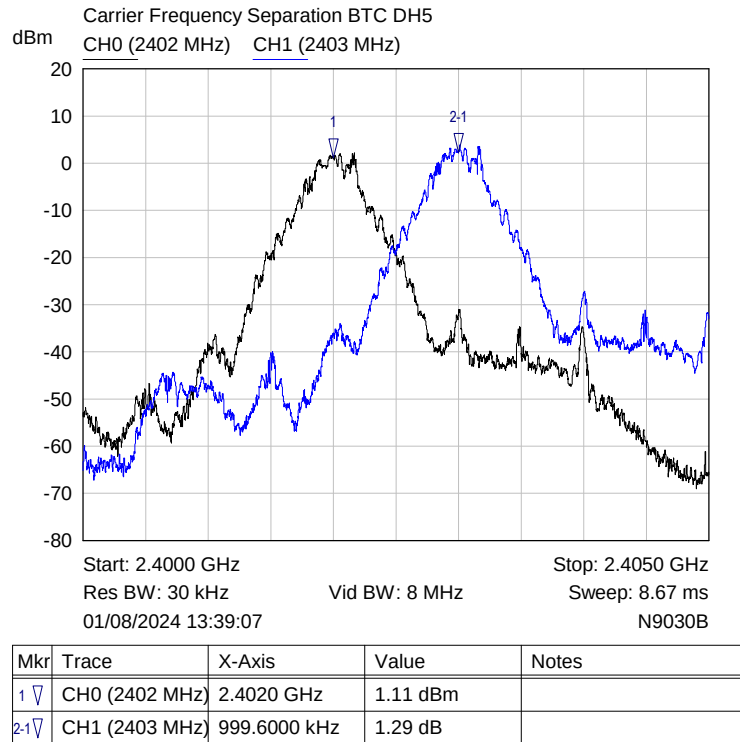
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH5



Occupied Bandwidth 8-DPSK 3-DH5 High Channel

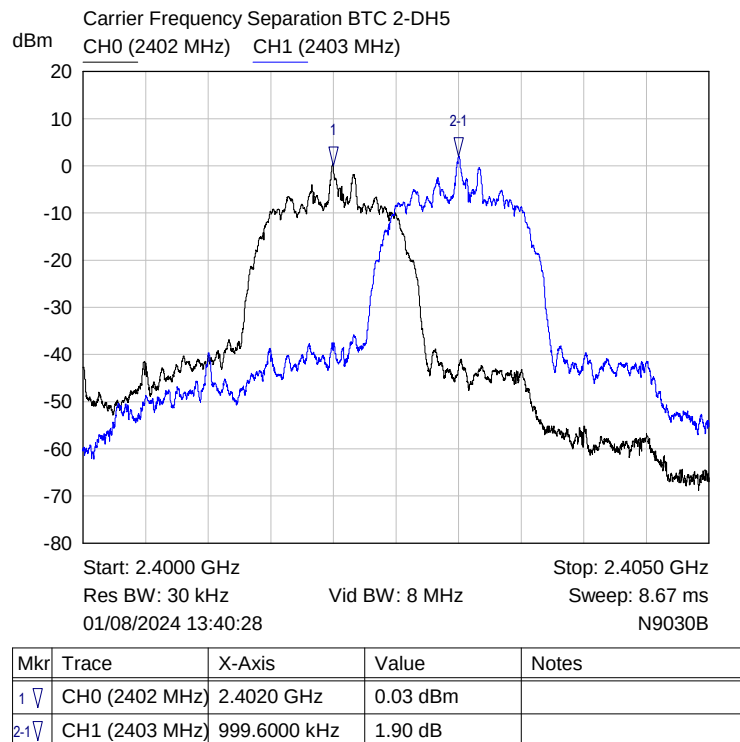
6.9 FHSS carrier frequency separation

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH5



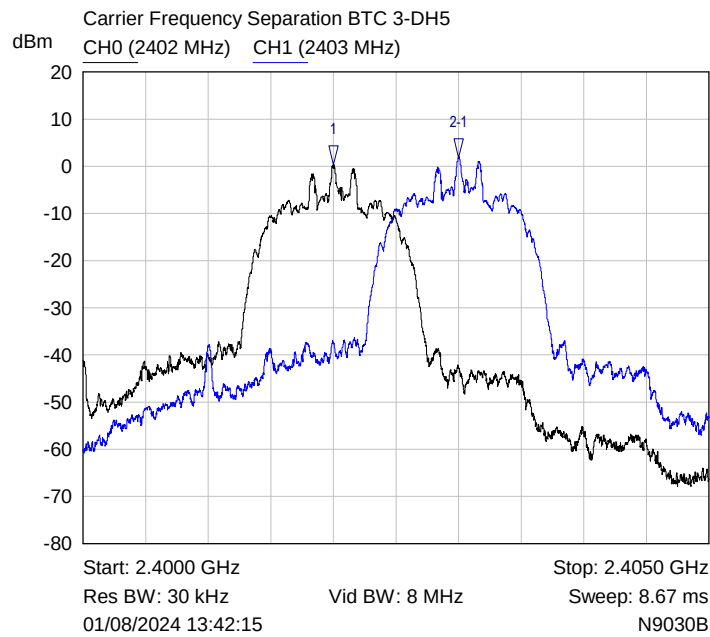
Plot of Separation (kHz)

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation DQPSK DH5



Plot of Separation (kHz)

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK DH5

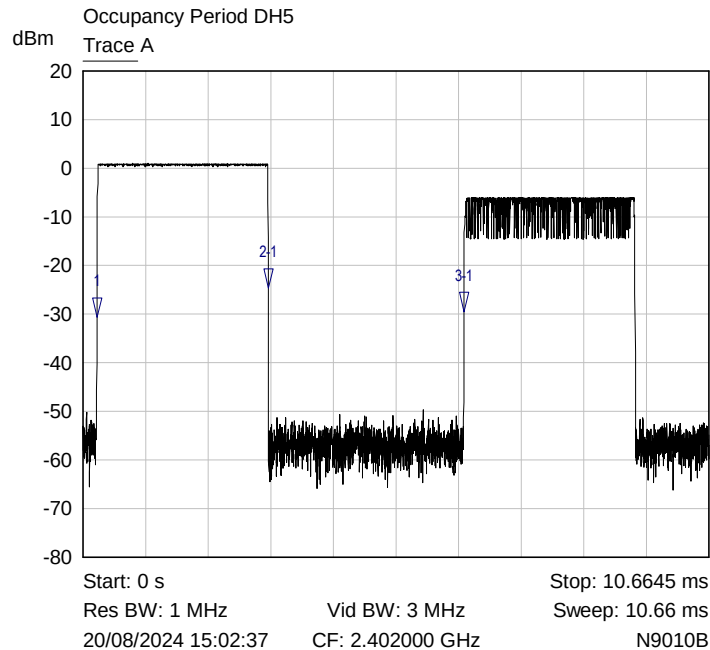


Mkr	Trace	X-Axis	Value	Notes
1 ▽	CH0 (2402 MHz)	2.4020 GHz	0.30 dBm	
2-1 ▽	CH1 (2403 MHz)	999.6000 kHz	1.53 dB	

Plot of Separation (kHz)

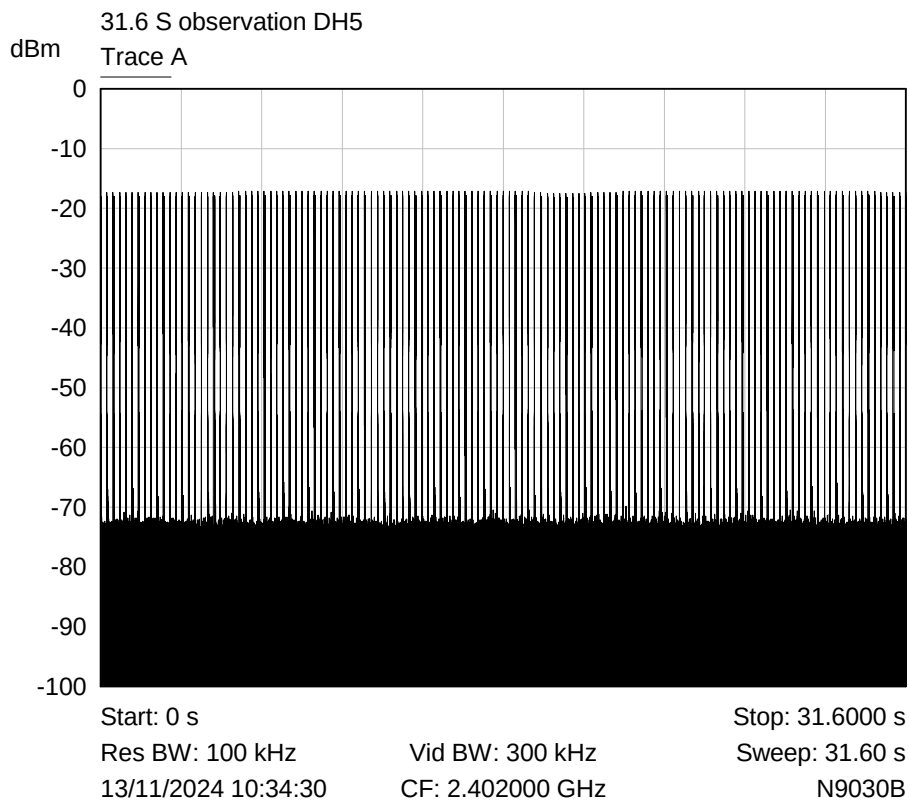
6.10 Average time of occupancy

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH5, Channel 2402 MHz



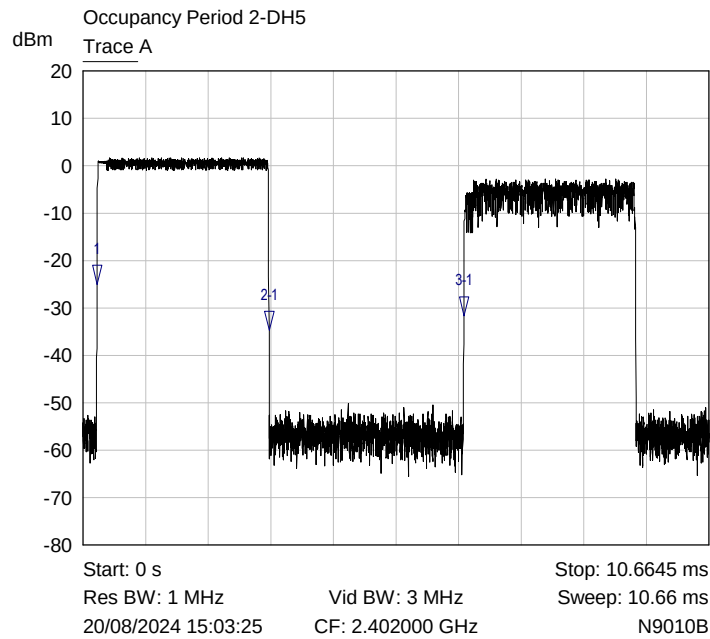
Mkr	Trace	X-Axis	Value	Notes
1 ▾	Trace A	238.9333 us	-30.70 dBm	
2-1 ▾	Trace A	2.9163 ms	-24.65 dBm	TX on time
3-1 ▾	Trace A	6.2507 ms	-29.54 dBm	Dwell incl. RX & Idle

Dwell Time plot



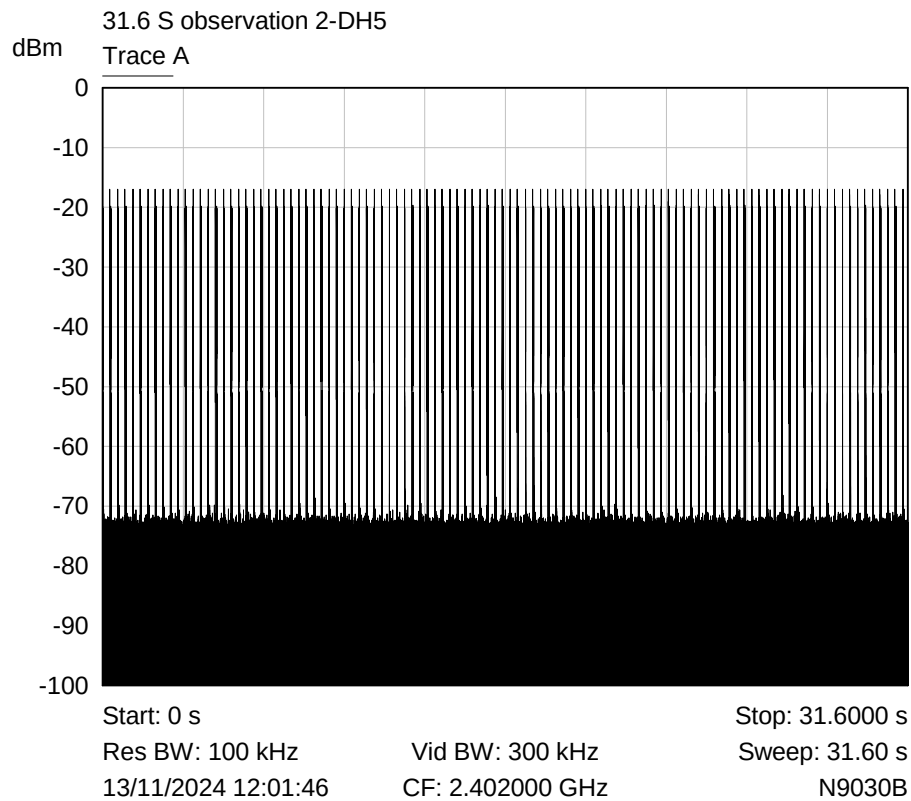
Accumulative TX Time plot

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 4-DQPSK,
Modulation 2-DH5, Channel 2402 MHz



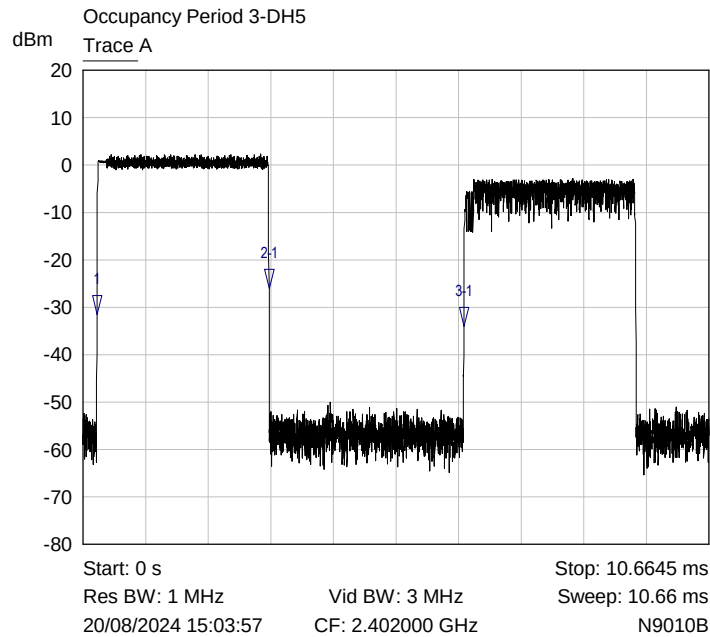
Mkr	Trace	X-Axis	Value	Notes
1 ▾	Trace A	238.9333 us	-24.97 dBm	
2-1 ▾	Trace A	2.9291 ms	-34.71 dBm	TX on time
3-1 ▾	Trace A	6.2507 ms	-31.65 dBm	Dwell incl. RX & Idle

Dwell Time plot



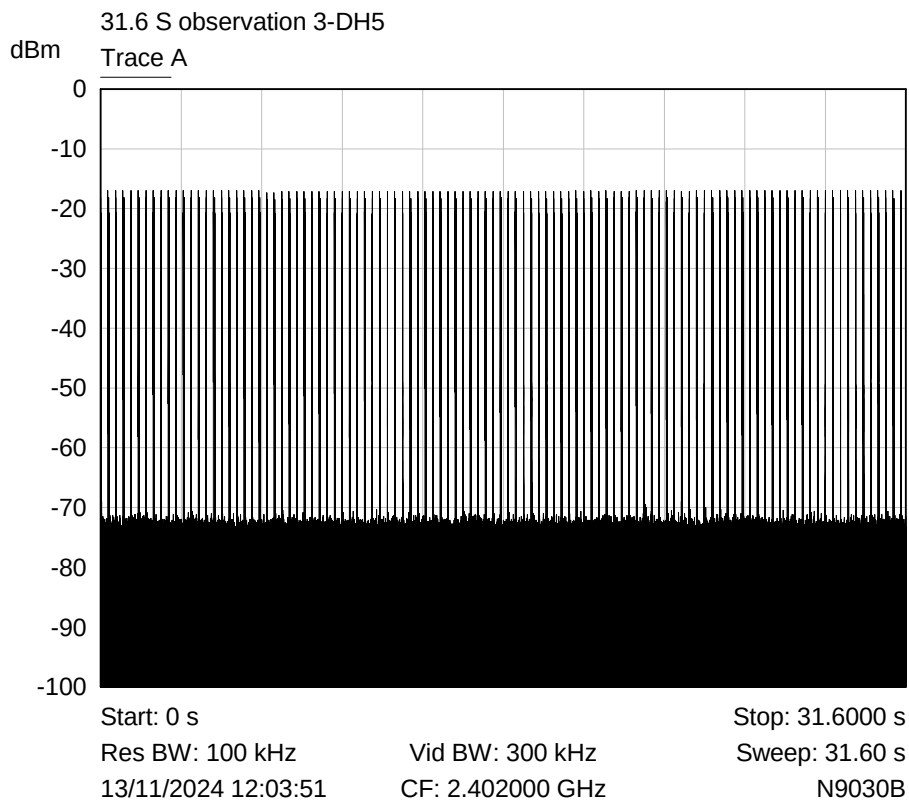
Accumulative TX Time plot

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 8-DPSK,
Modulation 3-DH5, Channel 2402 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	238.9333 us	-31.50 dBm	
2-1 ▽	Trace A	2.9291 ms	-25.99 dBm	TX on time
3-1 ▽	Trace A	6.2507 ms	-33.99 dBm	Dwell incl. RX & Idle

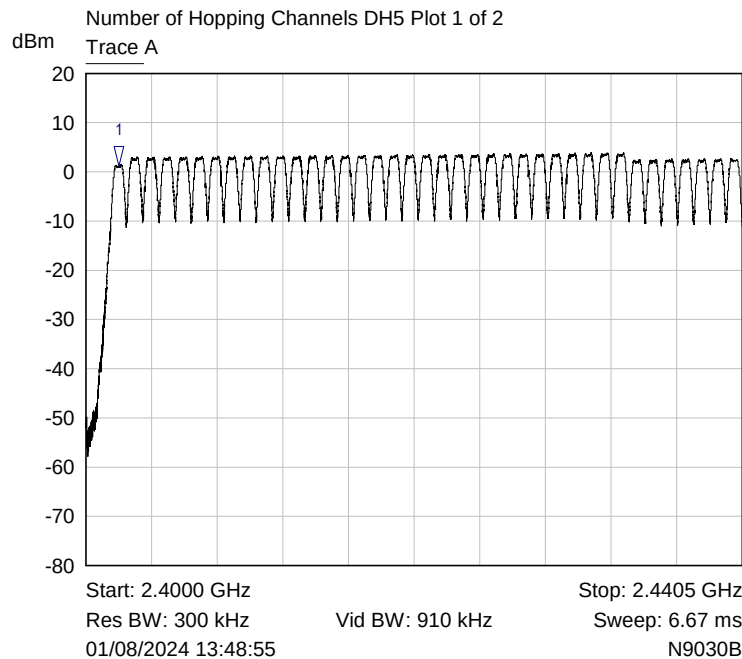
Dwell Time plot



Accumulative TX Time plot

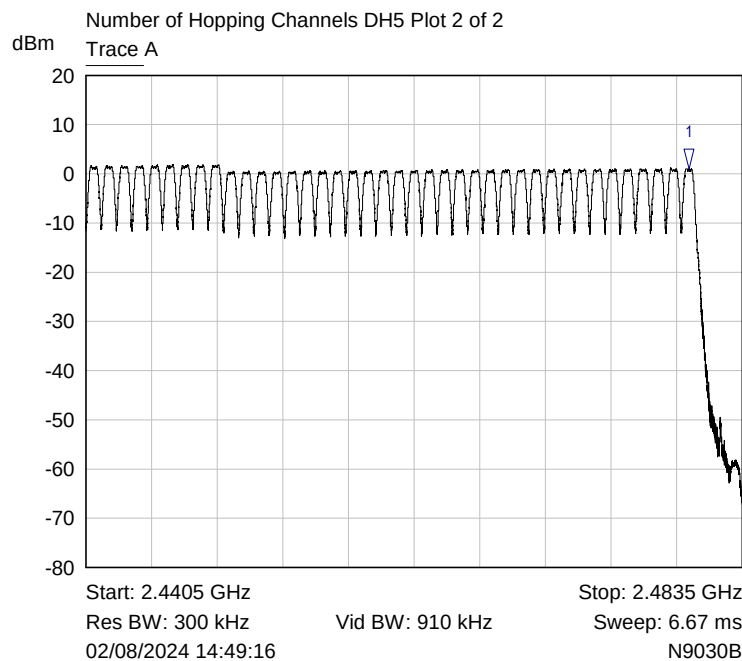
6.11 Number of Hop Channels

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH5, Channel Hopping



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4020 GHz	1.24 dBm	

Plot of Hopping Channels 0-38

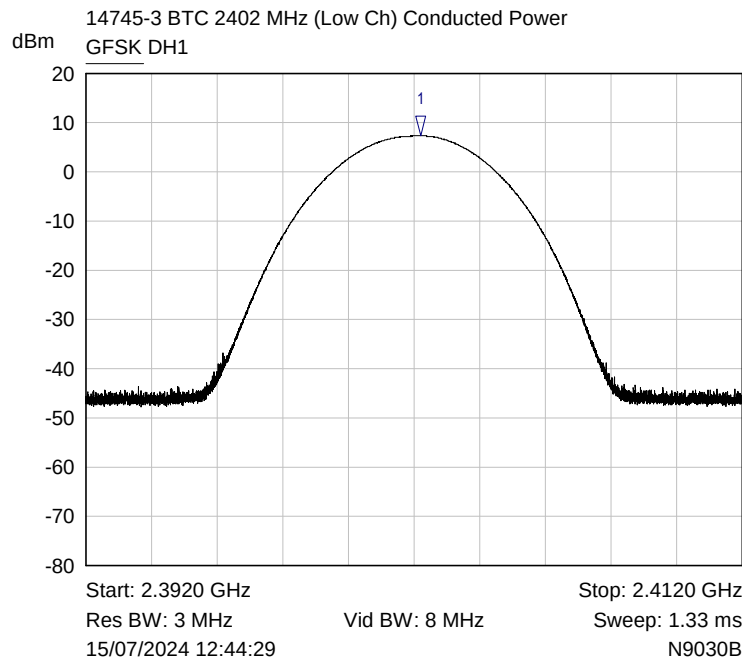


Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4800 GHz	1.02 dBm	

Plot of Hopping Channels 39-78

6.12 Maximum Peak conducted output power

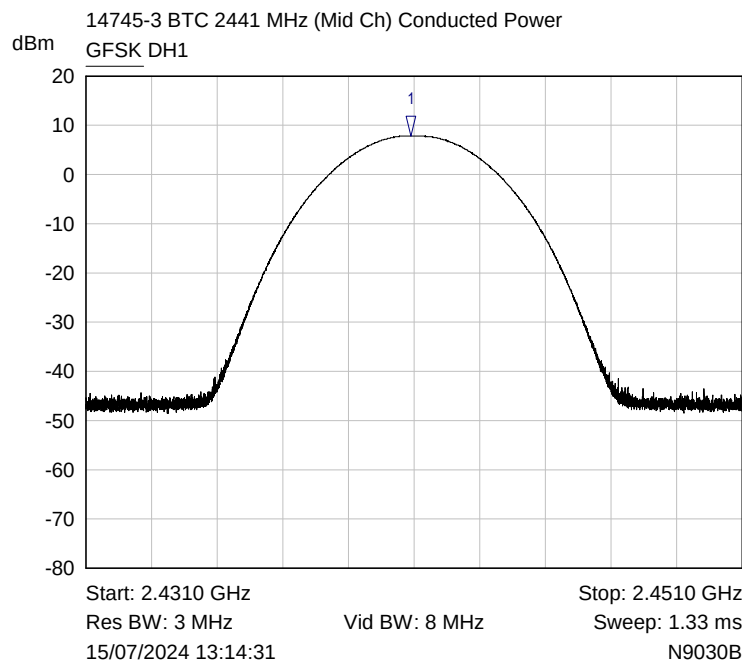
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH1, Channel 2402 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	GFSK DH1	2.4022 GHz	7.31 dBm	

Plot Conducted Power

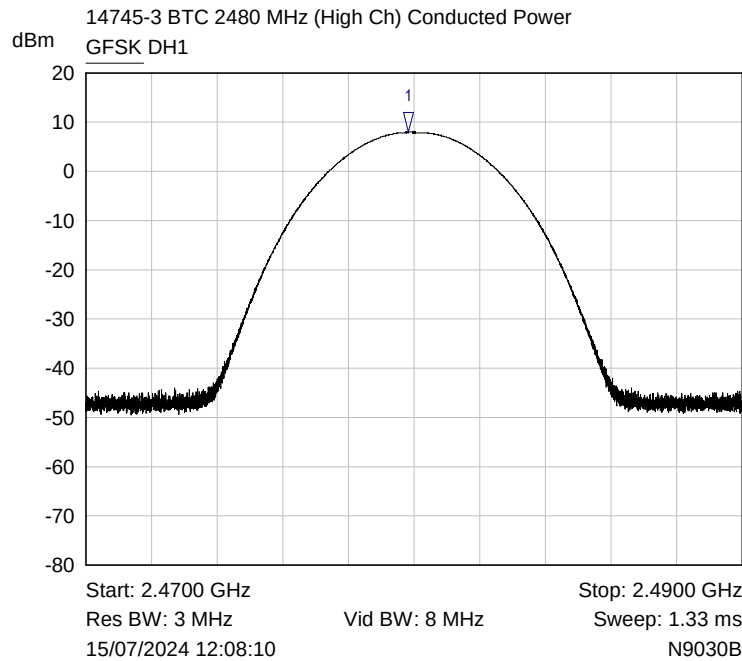
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH1, Channel 2441 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	GFSK DH1	2.4409 GHz	7.88 dBm	

Plot Conducted Power

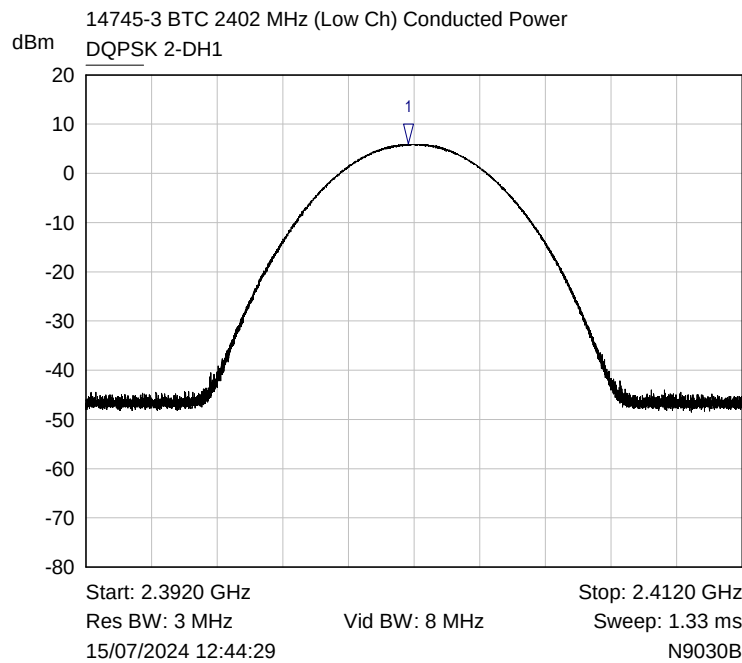
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH1, Channel 2480 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	GFSK DH1	2.4798 GHz	7.95 dBm	

Plot Conducted Power

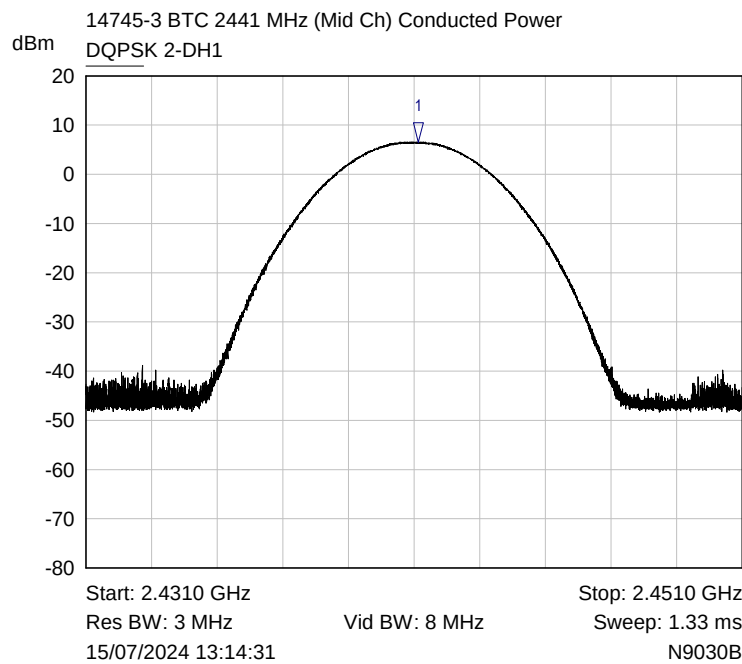
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation DQPSK 2-DH1, Channel 2402 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	DQPSK 2-DH1	2.4018 GHz	5.92 dBm	

Plot Conducted Power

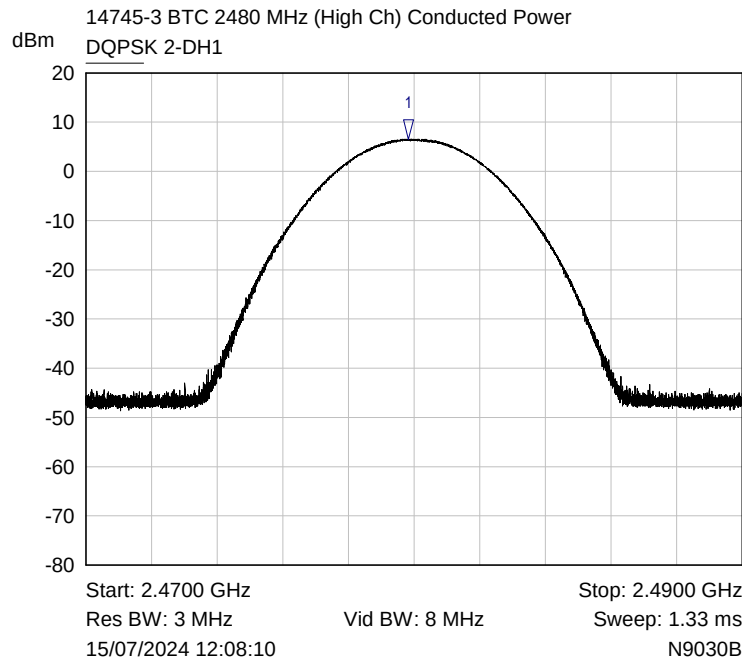
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation DQPSK 2-DH1, Channel 2441 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	DQPSK 2-DH1	2.4411 GHz	6.58 dBm	

Plot Conducted Power

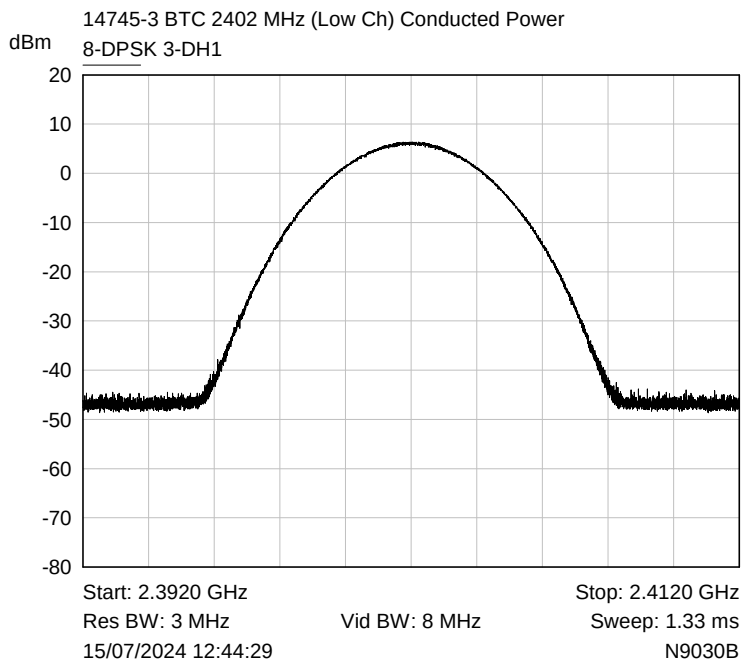
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation DQPSK 2-DH1, Channel 2480 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▾	DQPSK 2-DH1	2.4798 GHz	6.56 dBm	

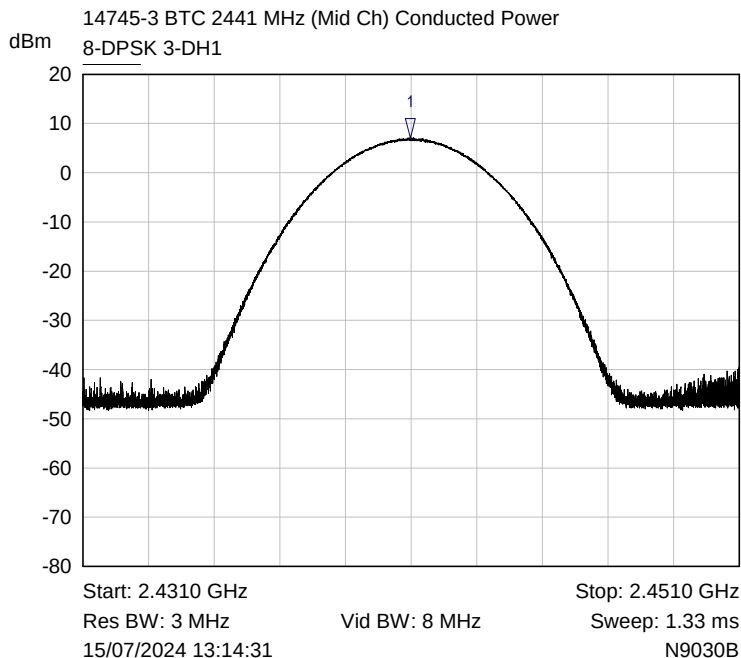
Plot Conducted Power

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH1, Channel 2402 MHz



Plot Conducted Power

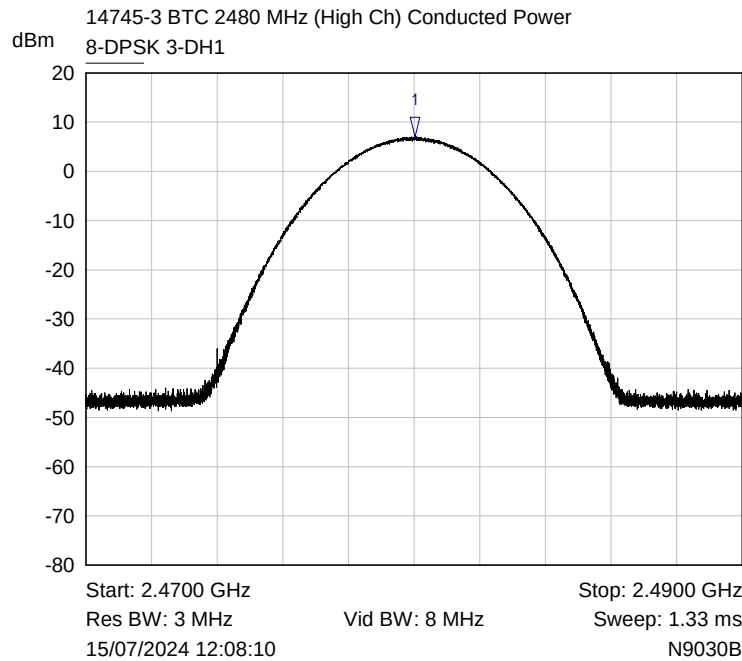
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH1, Channel 2441 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	8-DPSK 3-DH1	2.4410 GHz	6.94 dBm	

Plot Conducted Power

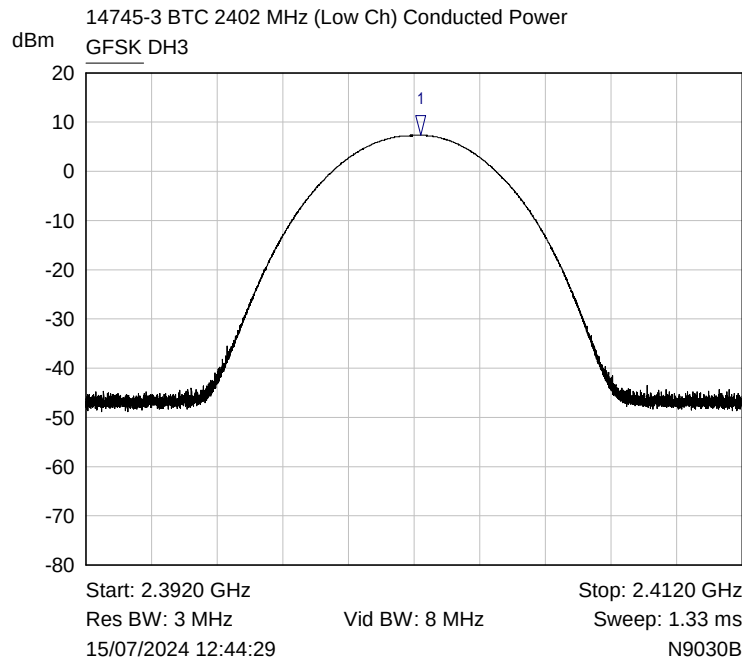
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH1, Channel 2480 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▾	8-DPSK 3-DH1	2.4800 GHz	6.94 dBm	

Plot Conducted Power

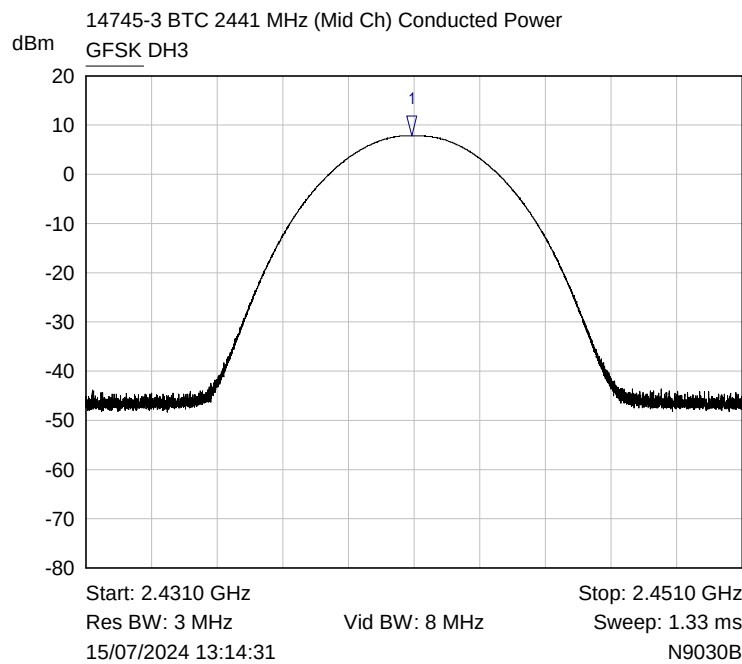
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH3, Channel 2402 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	GFSK DH3	2.4022 GHz	7.31 dBm	

Plot Conducted Power

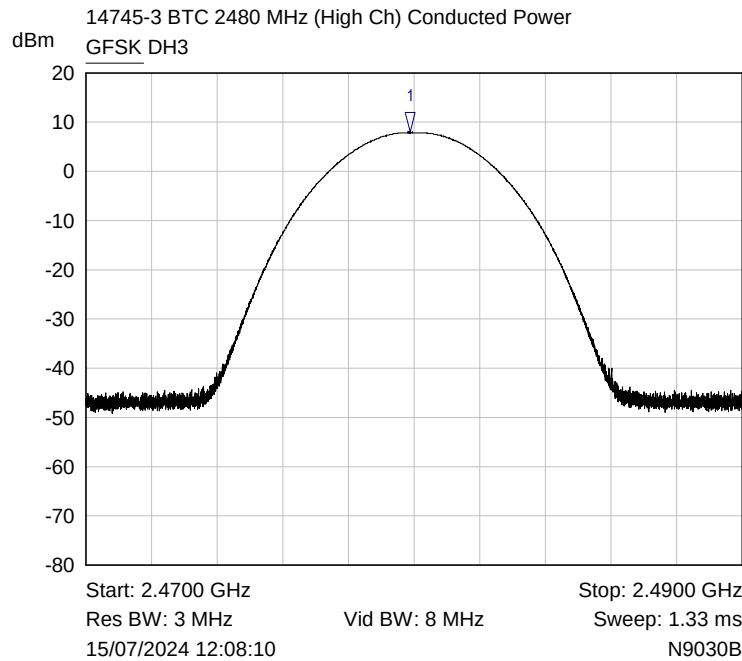
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH3, Channel 2441 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	GFSK DH3	2.4409 GHz	7.88 dBm	

Plot Conducted Power

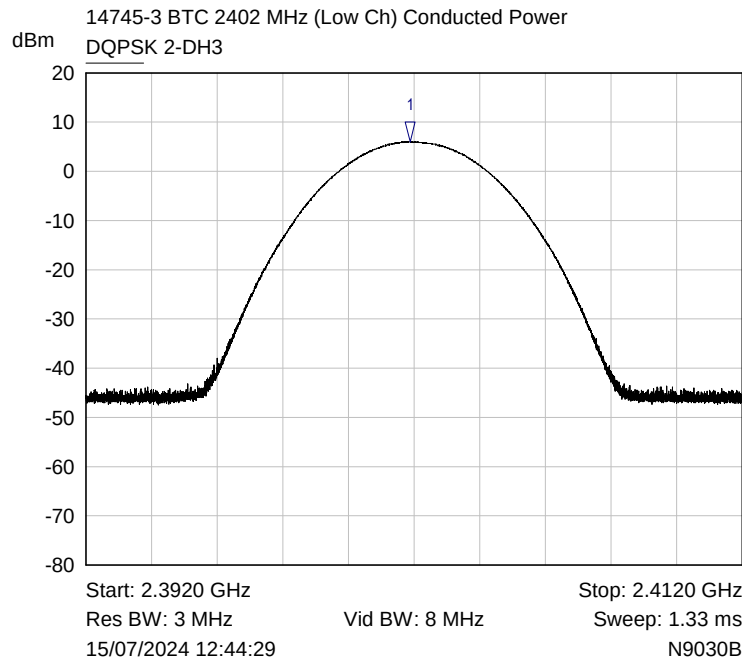
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH3, Channel 2480 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	GFSK DH3	2.4799 GHz	7.92 dBm	

Plot Conducted Power

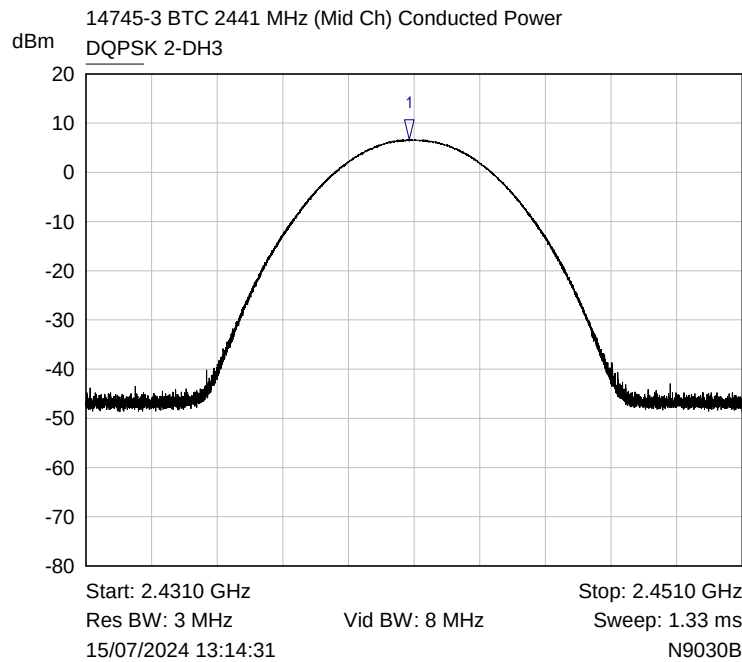
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation DQPSK 2-DH3, Channel 2402 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▾	DQPSK 2-DH3	2.4019 GHz	6.03 dBm	

Plot Conducted Power

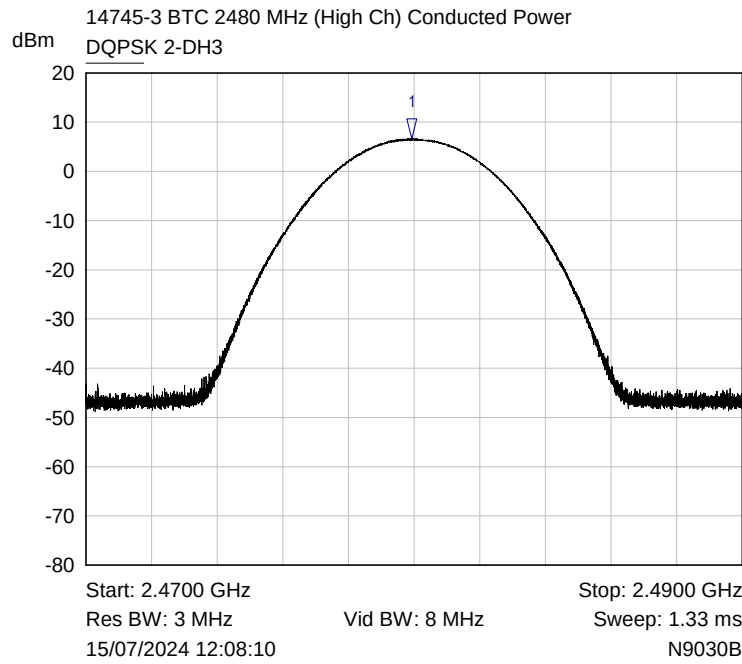
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation DQPSK 2-DH3, Channel 2441 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▾	DQPSK 2-DH3	2.4409 GHz	6.66 dBm	

Plot Conducted Power

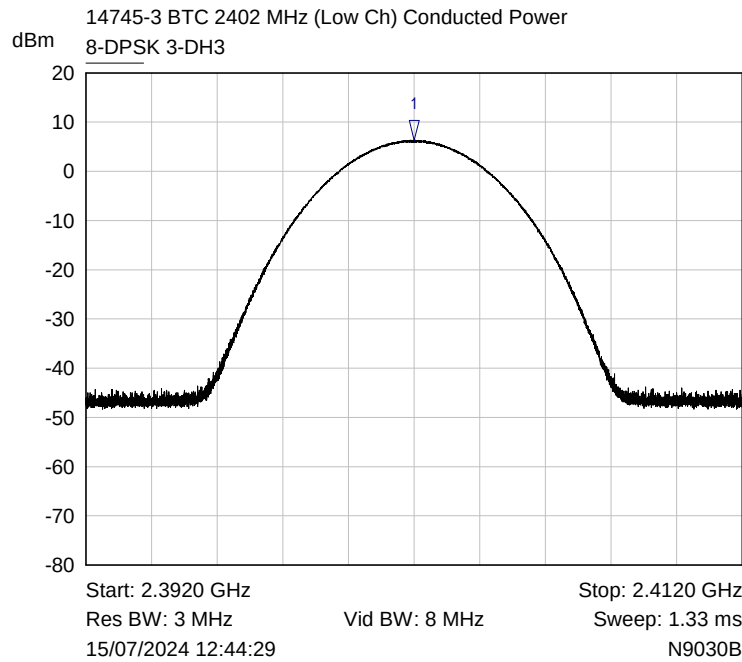
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation DQPSK 2-DH3, Channel 2480 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	DQPSK 2-DH3	2.4799 GHz	6.64 dBm	

Plot Conducted Power

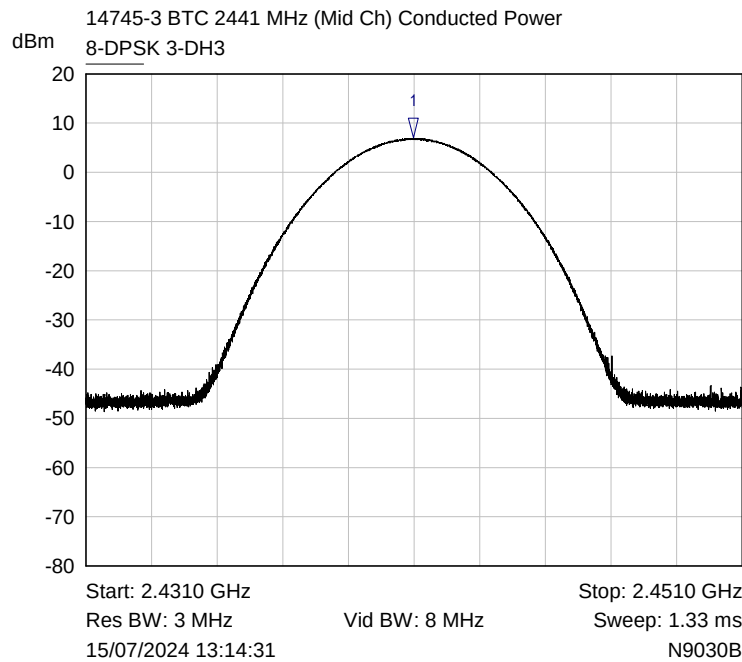
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH3, Channel 2402 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▾	8-DPSK 3-DH3	2.4020 GHz	6.29 dBm	

Plot Conducted Power

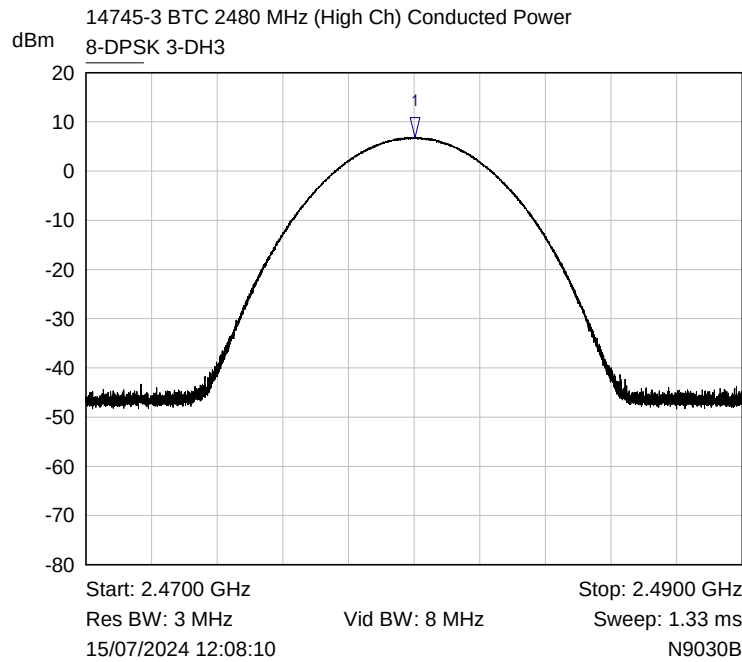
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH3, Channel 2441 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▾	8-DPSK 3-DH3	2.4410 GHz	6.92 dBm	

Plot Conducted Power

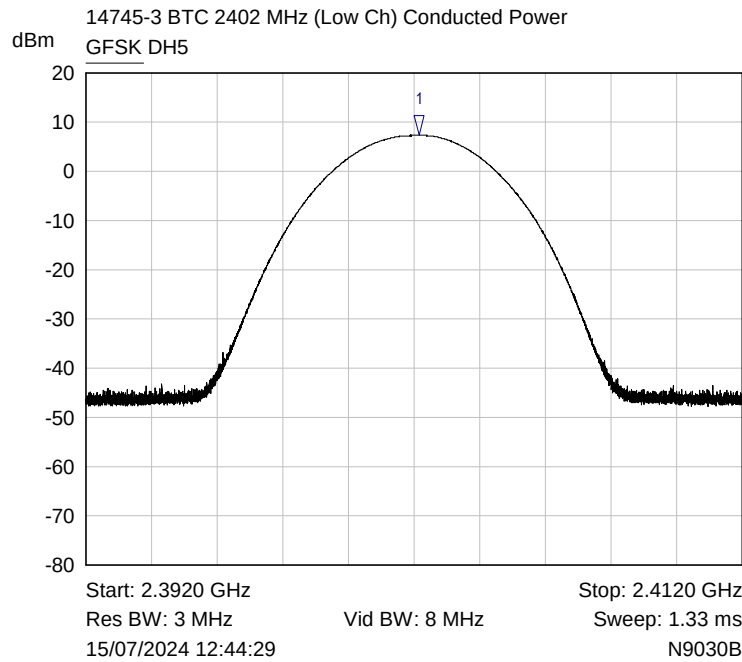
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH3, Channel 2480 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	8-DPSK 3-DH3	2.4800 GHz	6.87 dBm	

Plot Conducted Power

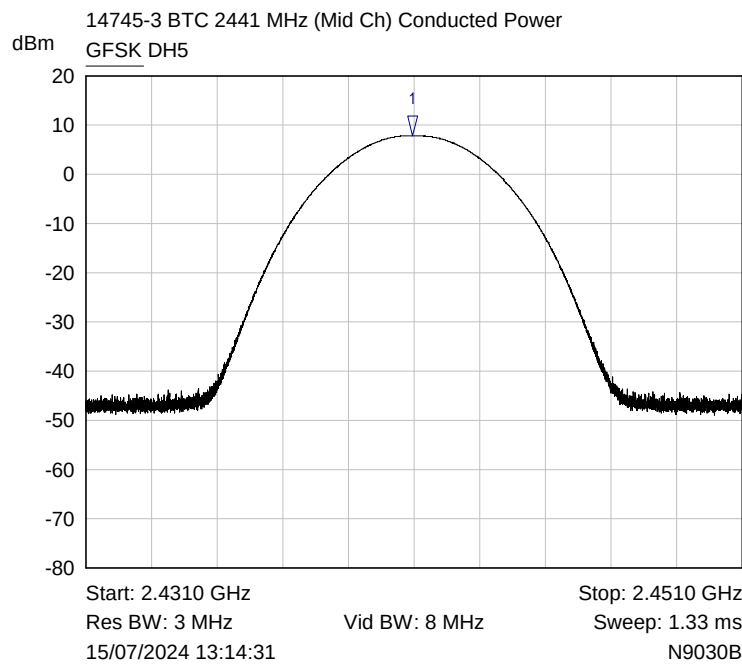
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH5, Channel 2402 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	GFSK DH5	2.4022 GHz	7.33 dBm	

Plot Conducted Power

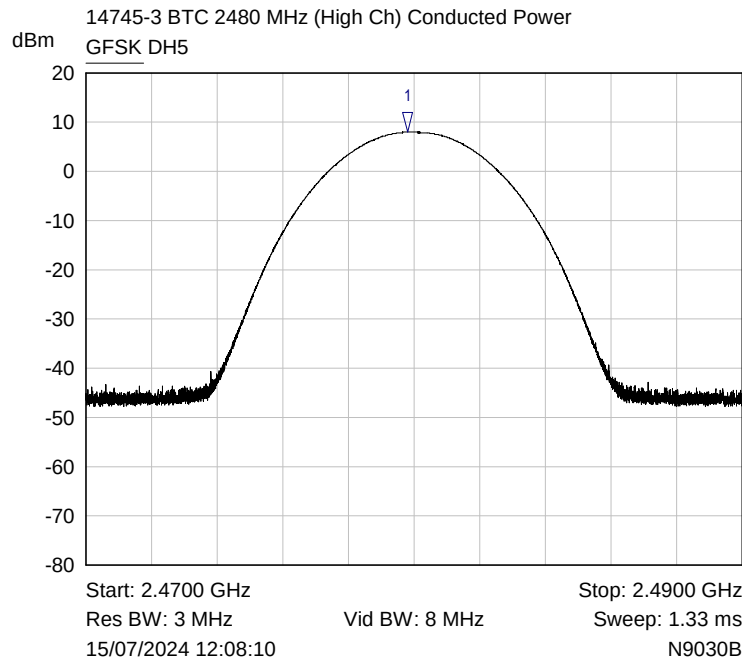
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH5, Channel 2441 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	GFSK DH5	2.4410 GHz	7.87 dBm	

Plot Conducted Power

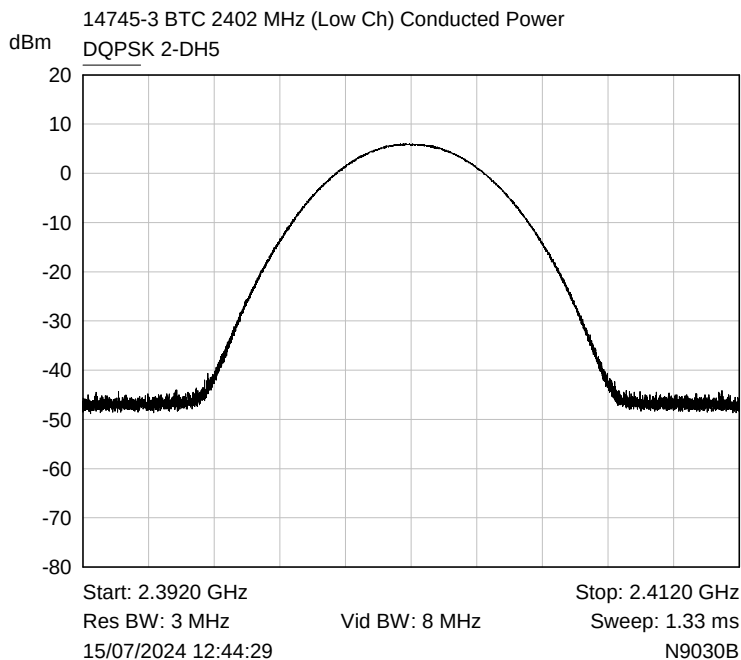
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation GFSK DH5, Channel 2480 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▾	GFSK DH5	2.4798 GHz	7.98 dBm	

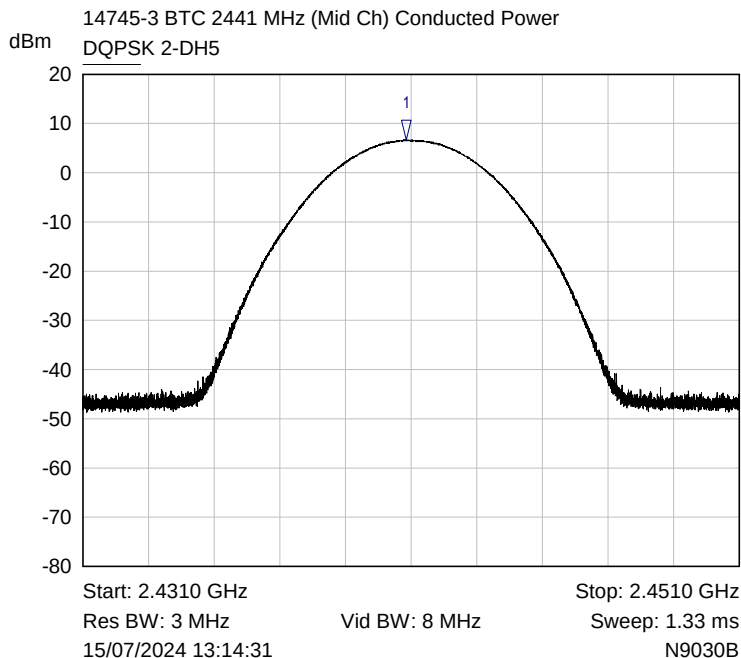
Plot Conducted Power

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation DQPSK 2-DH5, Channel 2402 MHz



Plot Conducted Power

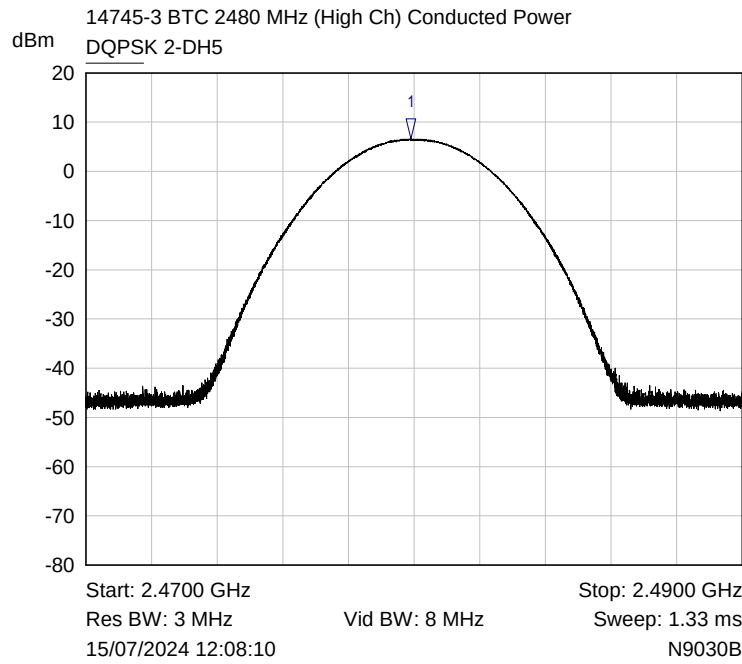
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation DQPSK 2-DH5, Channel 2441 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	DQPSK 2-DH5	2.4408 GHz	6.63 dBm	

Plot Conducted Power

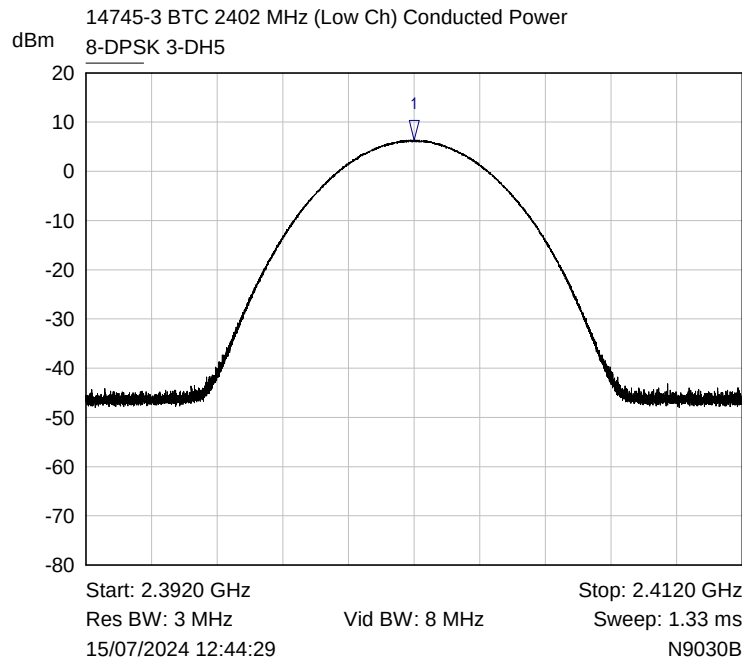
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation DQPSK 2-DH5, Channel 2480 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▾	DQPSK 2-DH5	2.4799 GHz	6.59 dBm	

Plot Conducted Power

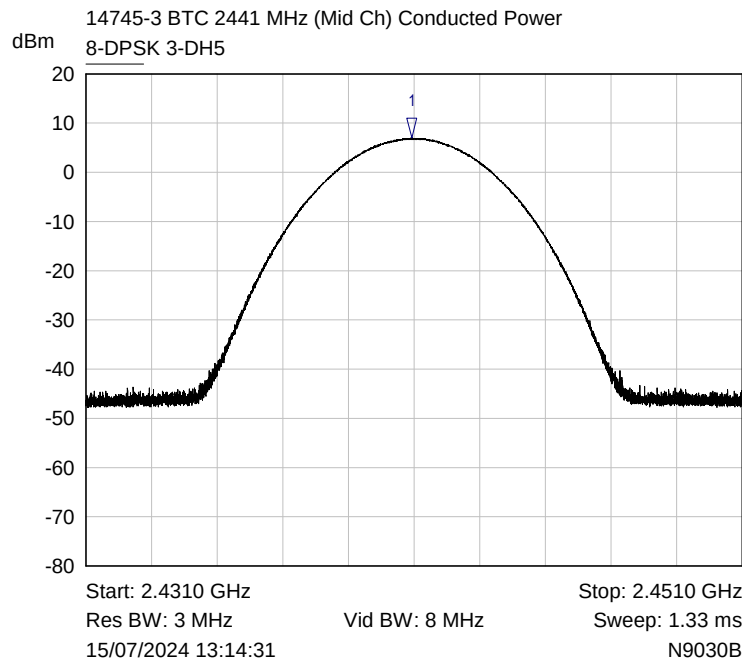
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH5, Channel 2402 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▾	8-DPSK 3-DH5	2.4020 GHz	6.32 dBm	

Plot Conducted Power

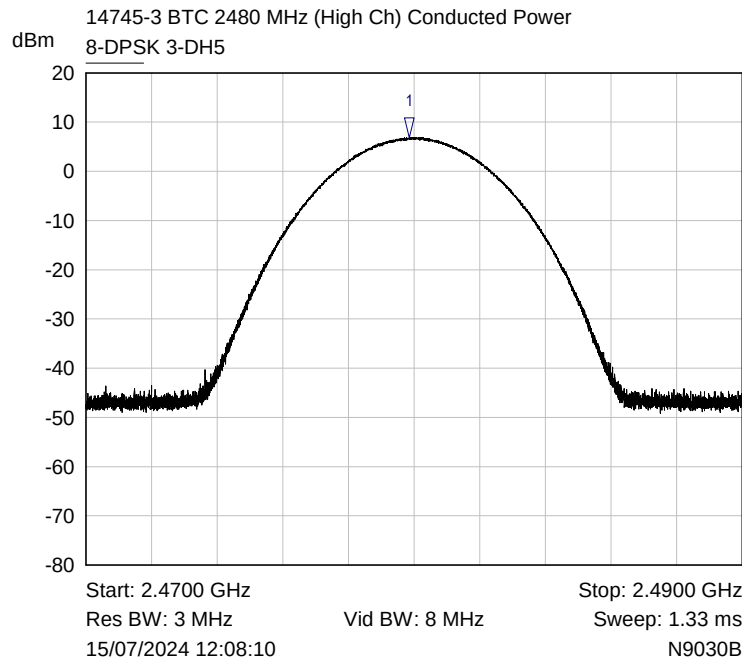
RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH5, Channel 2441 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▾	8-DPSK 3-DH5	2.4409 GHz	6.92 dBm	

Plot Conducted Power

RF Parameters: Band 2400-2483.5 MHz, Power Default, Channel Spacing 1 MHz,
Modulation 8-DPSK 3-DH5, Channel 2480 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▾	8-DPSK 3-DH5	2.4798 GHz	6.86 dBm	

Plot Conducted Power

7 Explanatory Notes

7.1 Explanation of Table of Signals Measured

Measurements are made as required by the standard. These measurements are made and recorded using detectors, either peak, quasi peak or average dependant on the test. A table of results has been given following the relevant plots. This table looks similar to the one illustrated below dependant on the measurements required by the test: -

Signal No.	Freq (MHz)	Peak Amp (dBμV)	Pk – Lim 1 (dB)	QP Amp (dBμV)	QP - Lim1 (dB)	Av Amp (dBμV)	Av - Lim1 (dB)
1	12345	54.9	-10.5	48	-12.6	37.6	-14.4

Column One - Labelled Signal No. is an incremental number that the receiver has given to each signal that has been measured.

Column Two - Labelled Freq (MHz) is the approximate frequency of the signal received.

Column Three - Labelled Peak Amp (dBμV) is the level of received signal that was measured in dB above 1μV using the peak detector.

Column Four - Labelled Pk - Lim1 (dB) is the difference in level from the peak signal given to the active limit line. If this column appears in the table the peak detector measurement is required by the standard for this test. The results entered in this column indicate the signal level relative to the compliance limit required. Negative numbers indicate that the product is compliant.

Column Five - Labelled QP Amp (dBμV) is the level of received signal that was measured in dB above 1μV using the quasi-peak detector.

Column Six - Labelled QP - Lim1 (dB) is the difference in level from the quasi-peak signal given to the active limit line. If this column appears in the table the quasi-peak detector measurement is required by the standard for this test. The results entered in this column indicate the signal level relative to the compliance limit required. Negative numbers indicate that the product is compliant.

Column Seven - Labelled Av Amp (dBμV) is the level of received signal that was measured in dB above 1μV using the average detector.

Column Eight - Labelled Av - Lim1 (dB) is the difference in level from the average signal given to the active limit line. If this column appears in the table the average detector measurement is required by the standard for this test. The results entered in this column indicate the signal level relative to the compliance limit required. Negative numbers indicate that the product is compliant.

Only signals highlighted in red are deemed to exceed the limit of the detector required.

7.2 Explanation of limit line calculations for radiated measurements

The limits given in the test standard are normally expressed as absolute values (e.g. in μV/m at a specified distance), whereas the measured values are expressed as peak, quasi peak or average values in dBμV/m referenced to the measuring instrument inputs. Kiwa Electrical Compliance calibrate the test set-up to account for any path losses, antenna gains, etc. so that the value read at the receiver relates directly to the absolute value required, except that it is expressed in dB relative to one microVolt and may need to take account of any alternative measuring distance used. Examples:

(a) limit of 500 μV/m equates to $20 \cdot \log(500) = 54 \text{ dB } \mu\text{V/m}$.

(b) limit of 300 μV/m at 10m equates to $20 \cdot \log(300 \cdot 10/3) = 60 \text{ dB } \mu\text{V/m at 3m}$

File Name: Monitor Audio Group.14745-3 Issue 02

QMF21J - Issue 05 - KEC Issue 04; 47 CFR Part 15.247 2024

(c) limit of 30 $\mu\text{V/m}$ at 30m, but below 30MHz, equates to $20.\log(30) + 40.\log(30/3) = 69.5 \text{ dB}\mu\text{V/m}$ at 3m, as extrapolation factor below 30MHz is 40dB/decade per 15.31(f)(2).

The measurement receiver used for emissions testing, performs the field strength (FS) calculations automatically.

The receiver combines the signal amplitude (RA), Antenna Factor (AF) and Cable Loss (CL) factors for the frequency to be measured.

Example calculation: - FS = RA + AF + CL.

Receiver amplitude (RA)	Antenna factor (3m) (AF)	Cable loss (CL)	Field strength result (3m) (FS)
20dBuV	25 dB	3 dB	48dBuV/m

Additional calculation examples per ANSI C63.10 clause 9.4 – 9.6 equations 21, 22, 25 & 26:

Equation 21: $E_{\text{Linear}} = 10^{((E_{\text{Log}} - 120)/20)}$

And therefore equation 21 transposed is: $E_{\text{Log}} = 20 \times \log(E_{\text{Linear}}) + 120$

Where:

E_{Linear} is the field strength of the emission in V/m

E_{Log} is the field strength of the emissions in dB $\mu\text{V/m}$

Equation 22: $\text{EIRP} = E_{\text{Meas}} + 20\log(d_{\text{Meas}}) - 104.7$

Where:

EIRP is equivalent isotropically radiated power in dBm

E_{Meas} is the field strength of the emission at the measurement distance in dB $\mu\text{V/m}$

d_{Meas} is the measurement distance in metres

Equation 25: $\text{PD} = \text{EIRP}_{\text{Linear}} / 4\pi d^2$

And therefore equation 25 transposed is: $\text{EIRP}_{\text{Linear}} = \text{PD} \times 4\pi d^2$

Where:

PD is the power density at distance specified by the limit, in W/m²

$\text{EIRP}_{\text{Linear}}$ is the equivalent isotropically radiated power in Watts

d is the distance at which the power density limit is specified in metres

Equation 26: $\text{PD} = E_{\text{Spec limit}}^2 / 377$

And therefore equation 26 transposed is: $E_{\text{Spec limit}} = \sqrt{\text{PD} \times 377}$

Where:

PD is the power density at distance specified by the limit, in W/m²

$E_{\text{Spec limit}}$ is the field strength at the distance specified by the limit in V/m

Example:

Radiated spurious emissions limit at 3metres of 90pW/cm².

$$90\text{pW/cm}^2 \times 100^2 = 0.9 \mu\text{W/m}^2 = (\text{EIRP Linear})$$

$$\text{Equation 25 transposed: } 0.9 \times 10^{-6} \times 4 \times \pi \times 3^2 = 0.0001017876 \text{ W}$$

And

$$\text{Equation 26 transposed: } E_{\text{Spec limit}} = \sqrt{(0.9 \times 10^{-6} \times 377)} = 0.01842 \text{ V/m.}$$

And

$$\text{Equation 21 transposed: } E_{\text{Log}} = 20\log(0.01842) + 120 = 85.3\text{dB}\mu\text{V/m @ 3m.}$$

8 Photographs

8.1 EUT Front View



8.2 EUT Reverse Angle





8.3 EUT Left side View



8.4 EUT Right side View

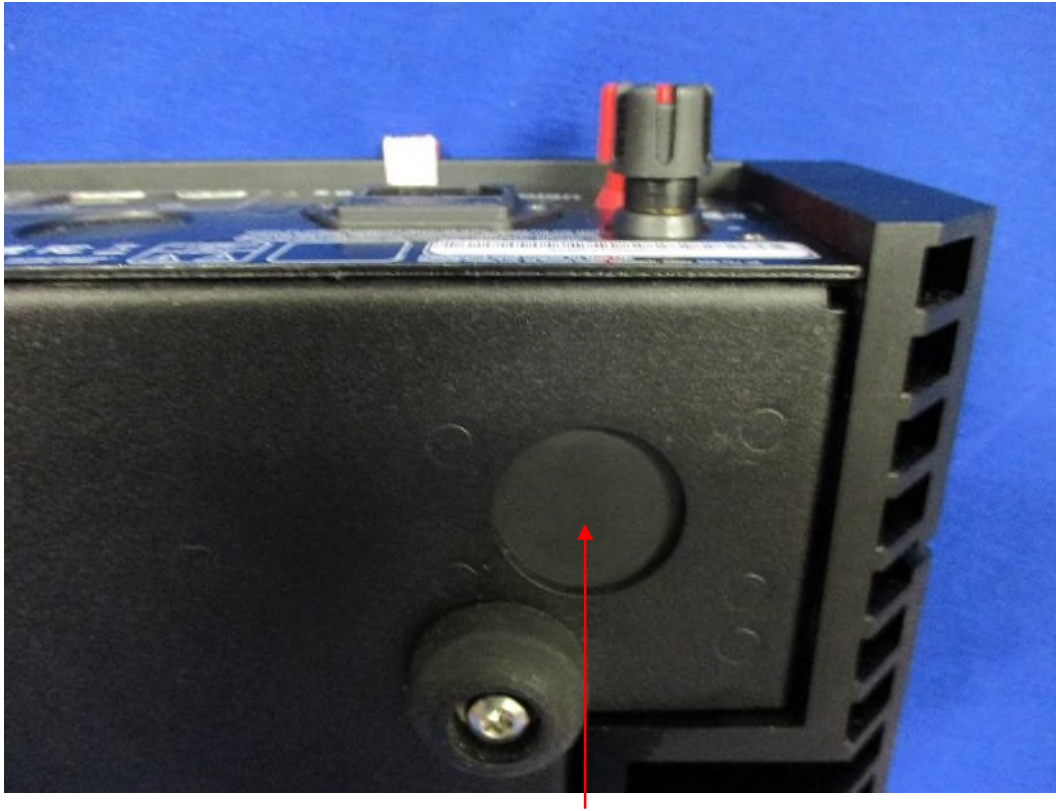


8.5 EUT Antenna Port

19SoM Antenna (2.4 & 5 GHz WiFi)



Bluetooth Classic Antenna

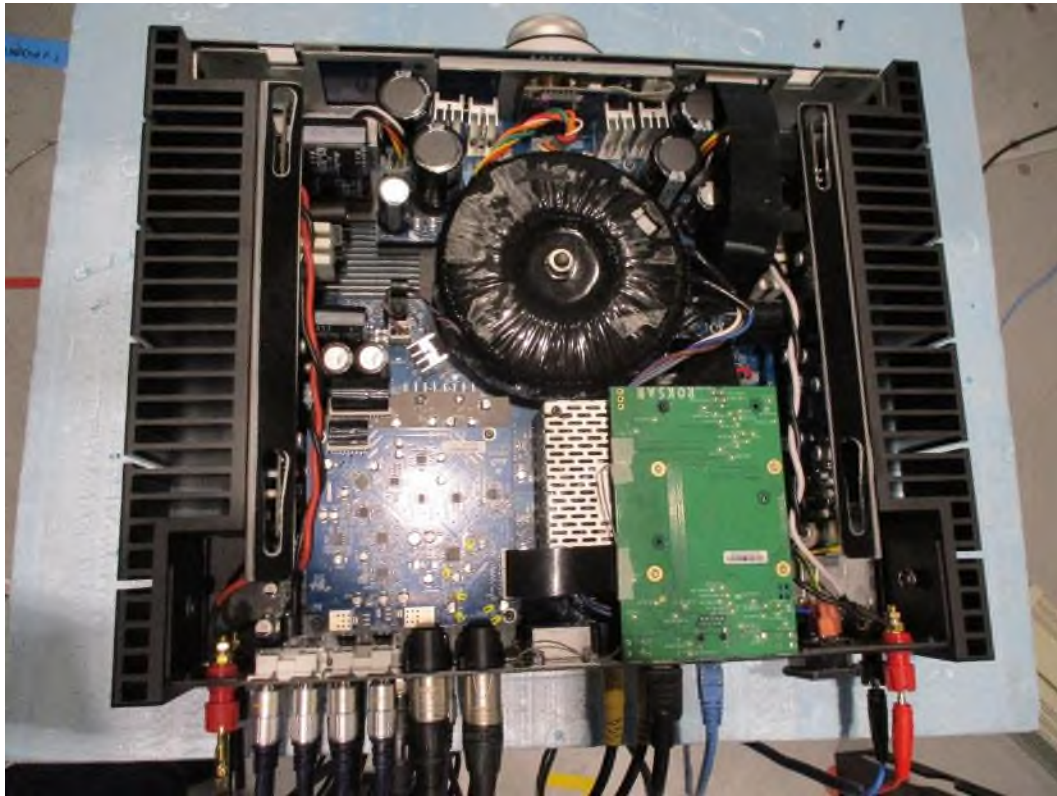


ESP32 Antenna (BLE & 2.4 GHz WiFi)

8.6 EUT Display & Controls



8.7 EUT Internal photos



8.8 EUT ID Label



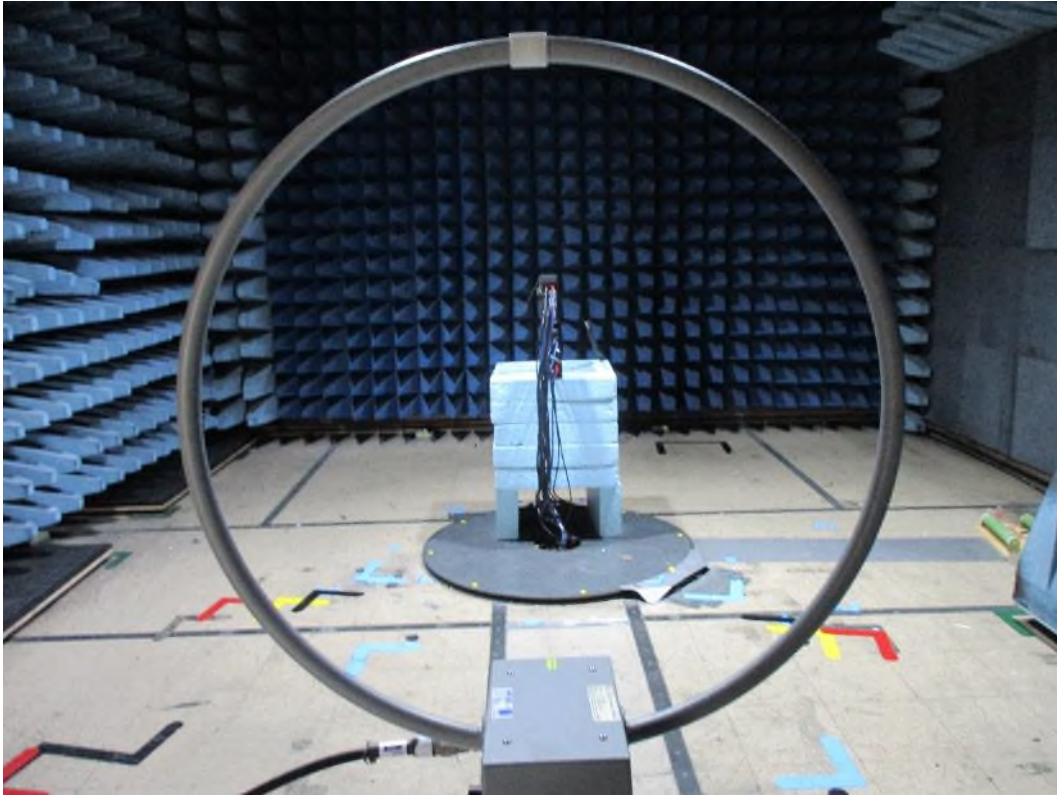
8.9 EUT Chassis



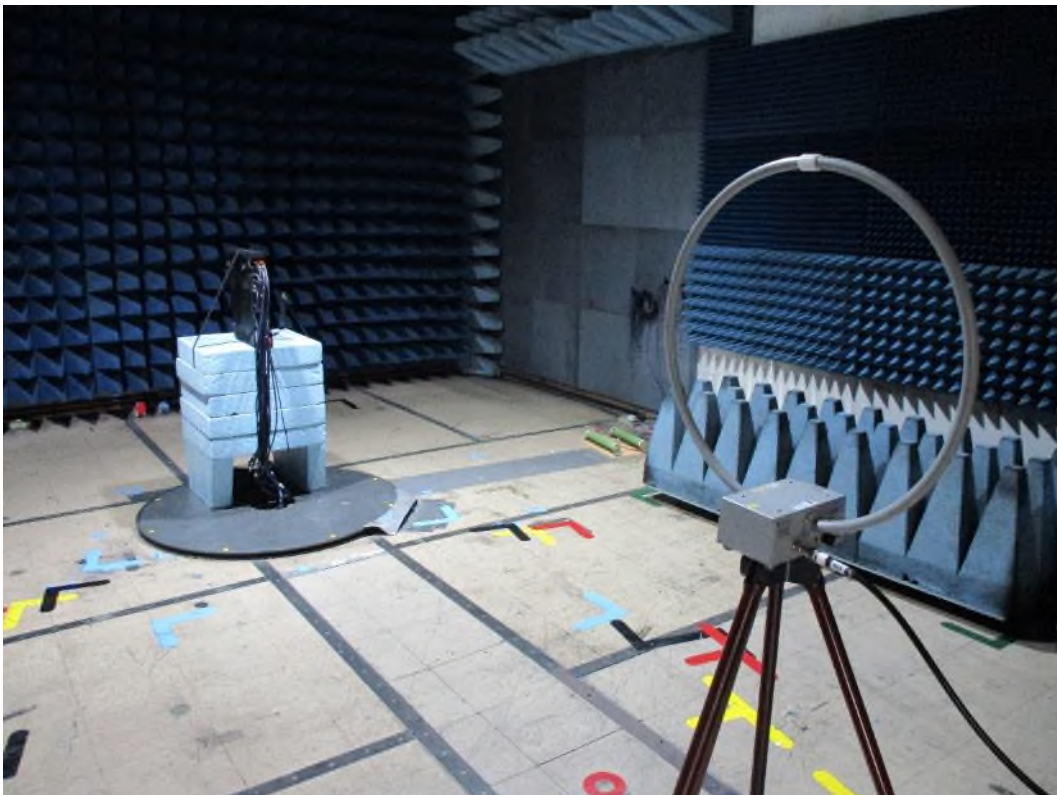
8.10 AC power line conducted emissions



8.11 Radiated emissions 9 - 150 kHz



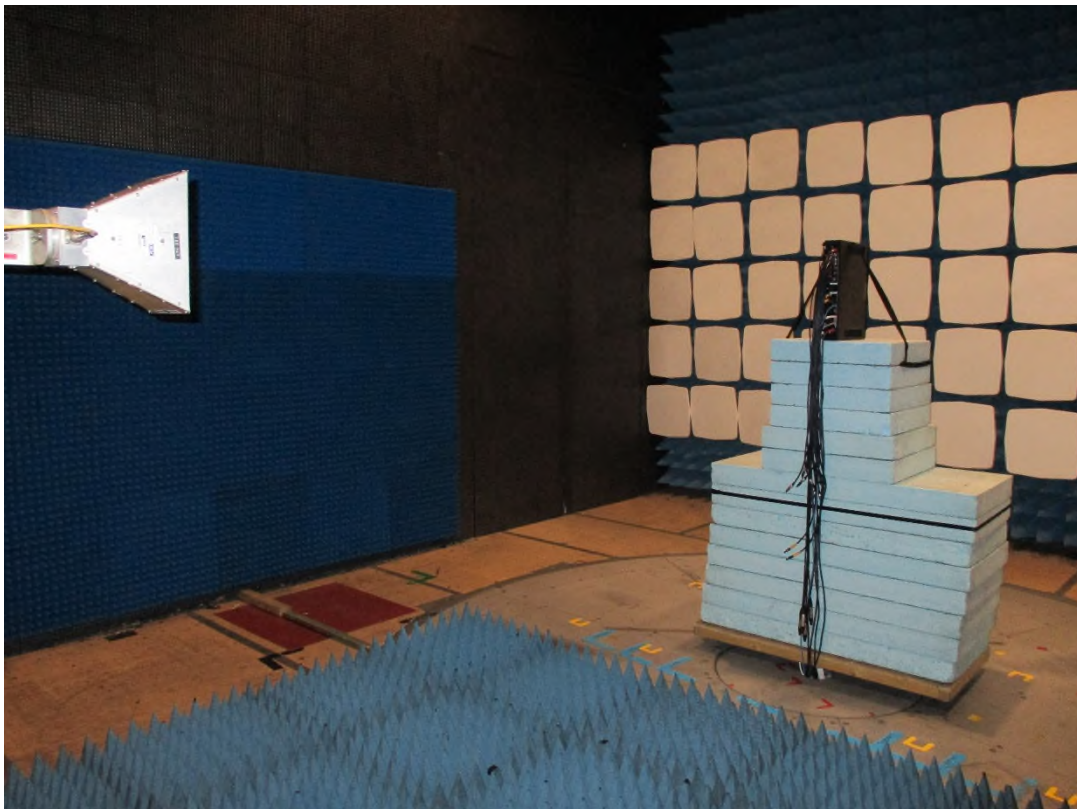
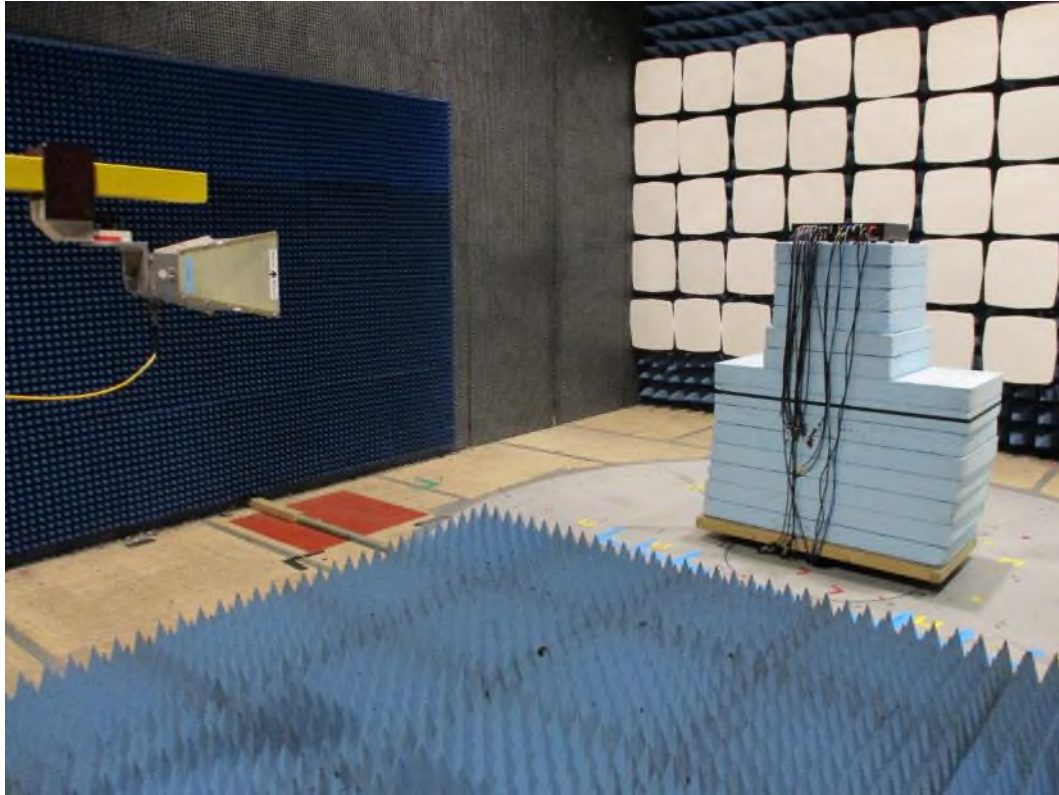
8.12 Radiated emissions 150 kHz - 30 MHz

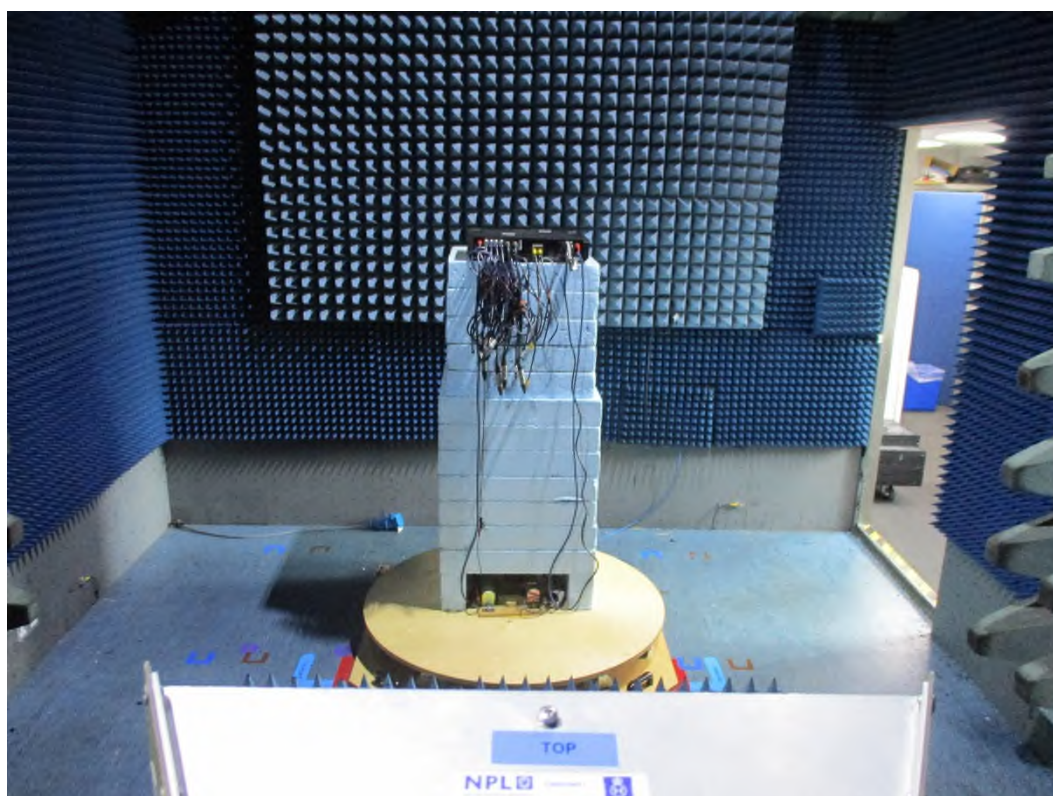
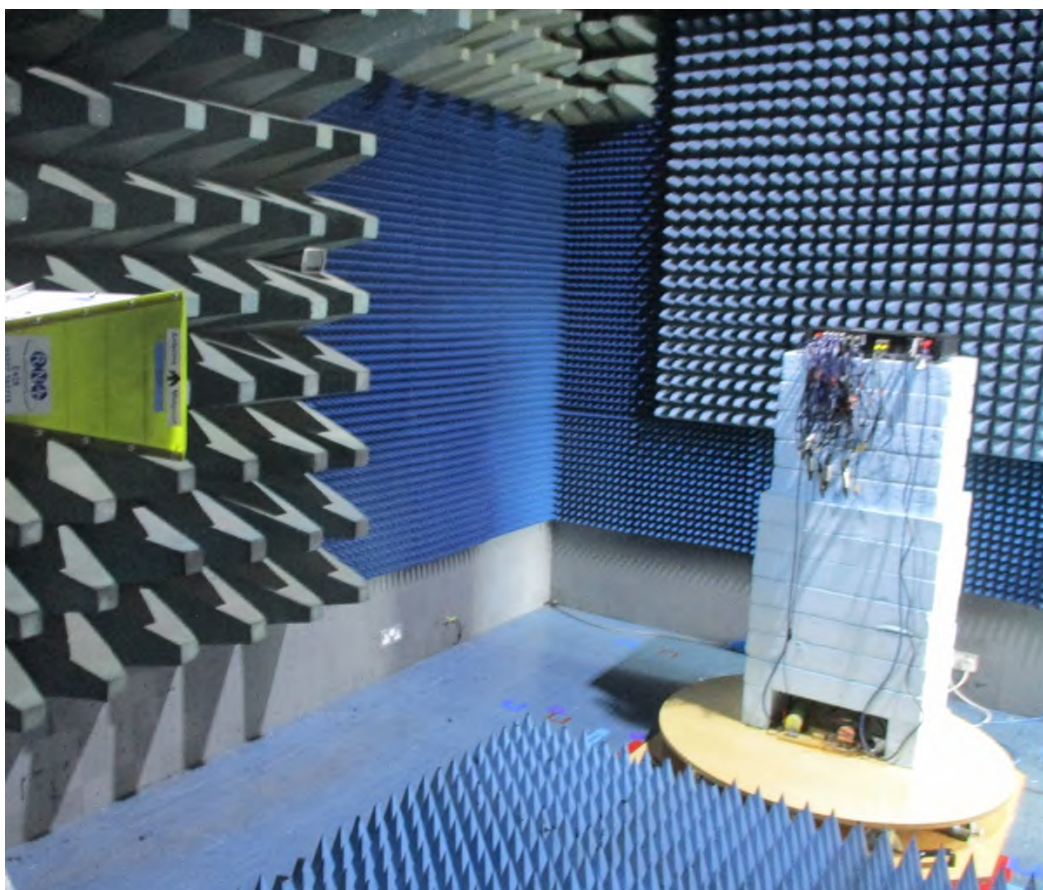


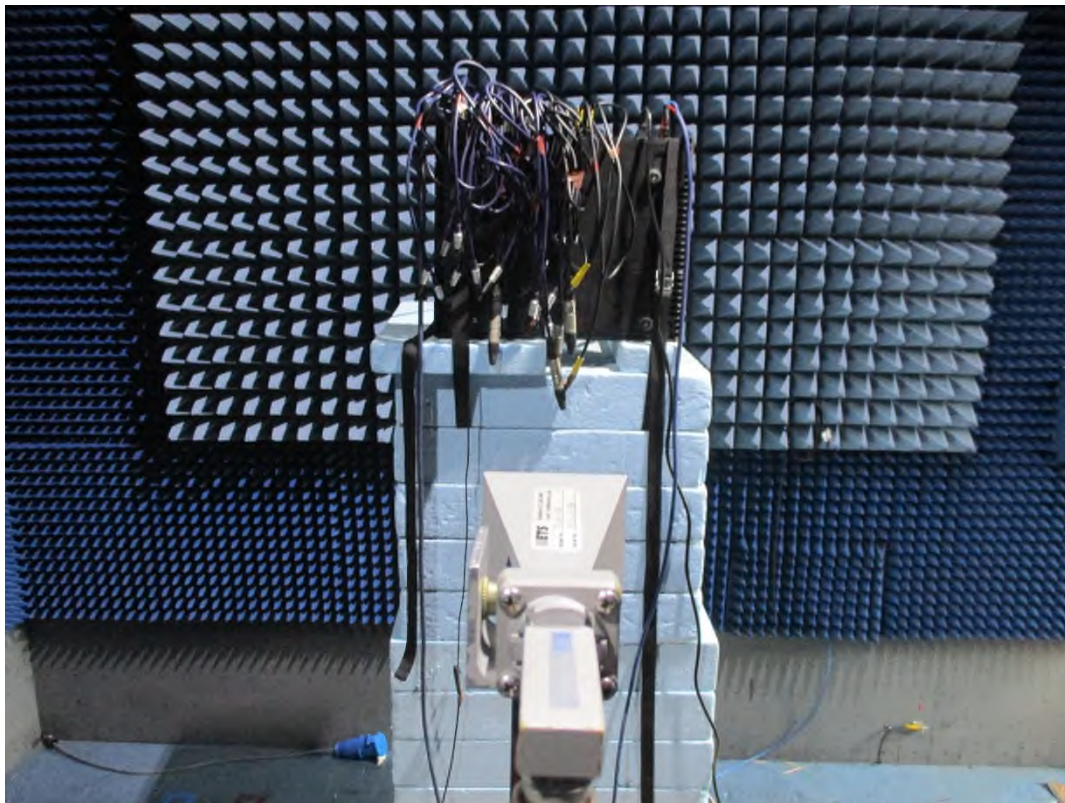
8.13 Radiated emissions 30 MHz -1 GHz

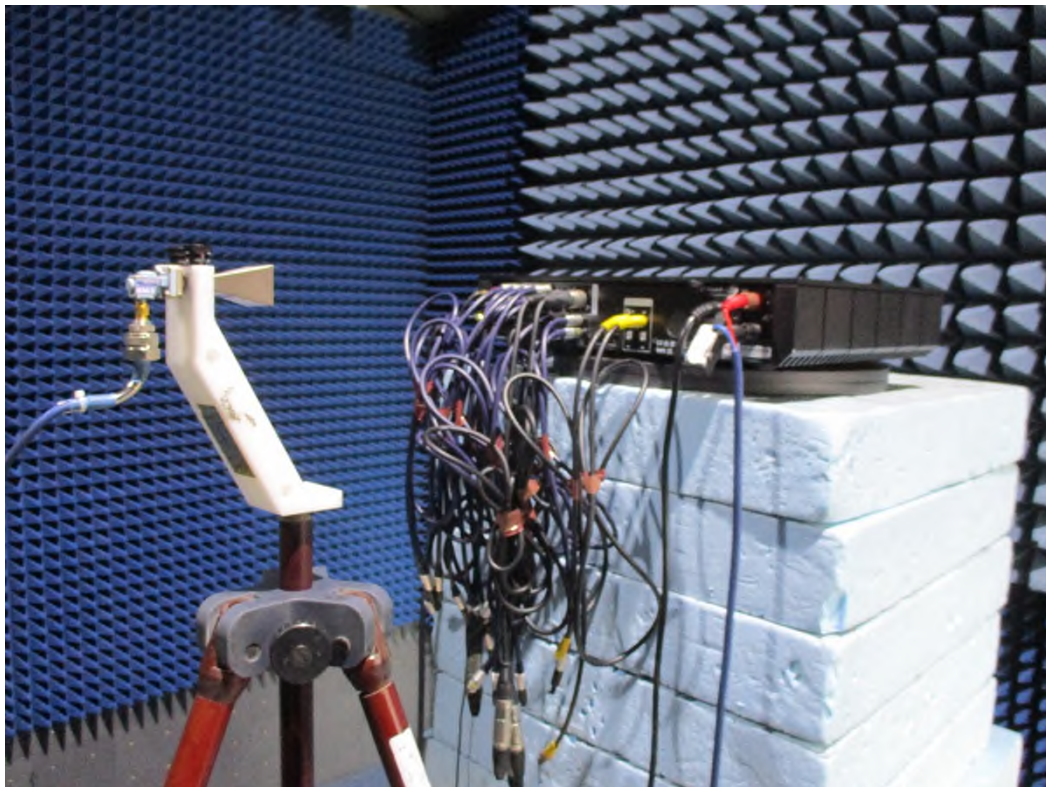


8.14 Radiated emissions above 1 GHz











8.15 Radiated emission diagrams

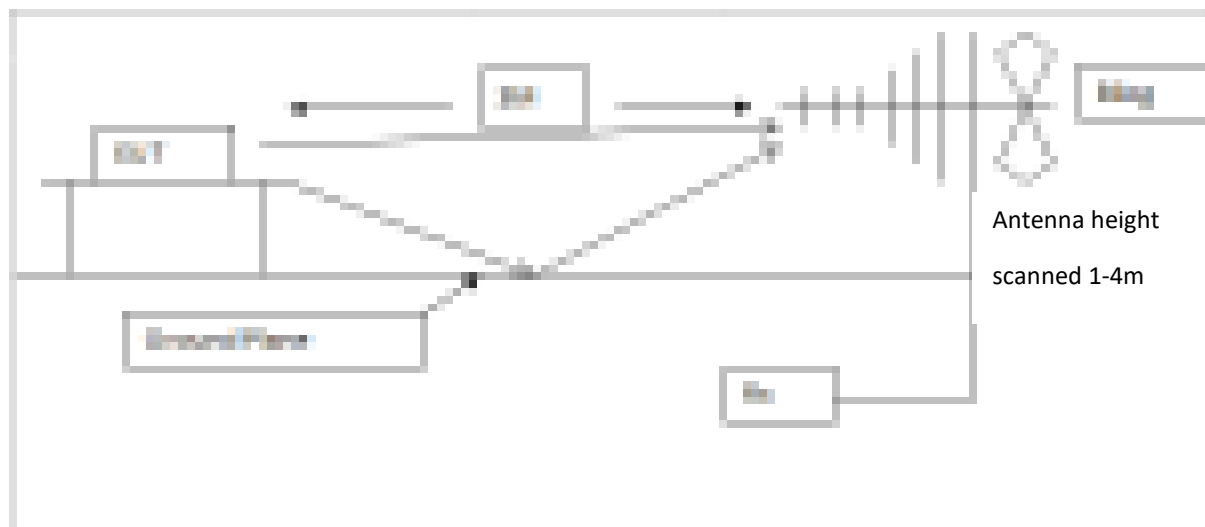


Diagram of the radiated emissions test setup 30 - 1000 MHz

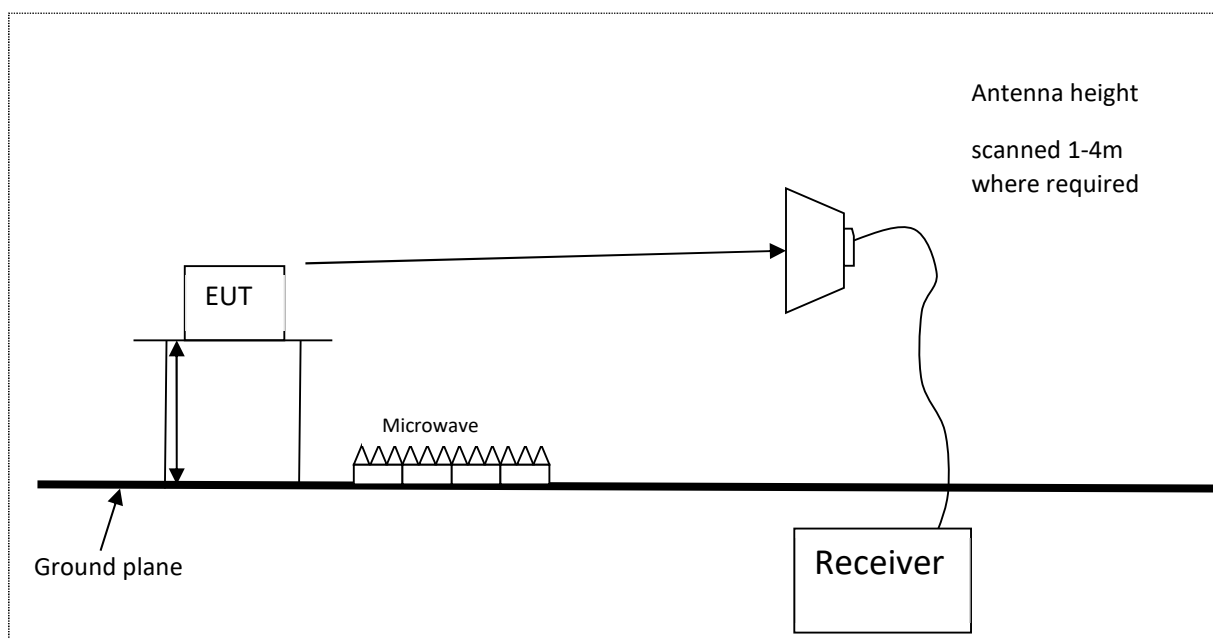


Diagram of the radiated emissions test setup above 1GHz

8.16 AC powerline conducted emission diagram

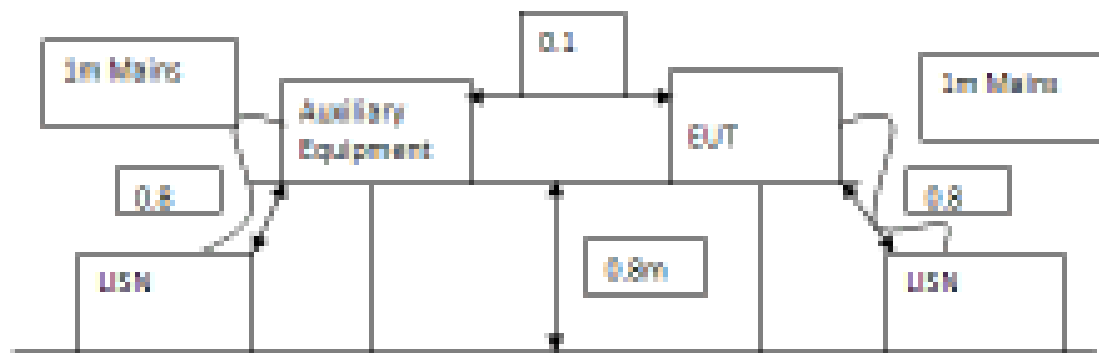


Diagram of the AC conducted emissions test setup

9 Test equipment calibration list

The following is a list of the test equipment used by Kiwa Electrical Compliance to test the unit detailed within this report. In line with our procedures, the equipment was within calibration for the period during which testing was carried out.

For testing carried out between 12th July 2024 to 16th August 2024: -

KEC No	Model	Description	Manufacturer	Calibrated Date	Period
E010	MN2050	LISN 13A	Chase	#02/06/2023	12 months
E035	11947A	Transient Limiter 9 kHz - 200 MHz	Hewlett Packard	03/01/2024	12 months
E136	3105	Horn Antenna 1 - 12.5 GHz	EMCO	15/05/2024	12 months
E411	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	02/07/2024	12 months
E429	-	Filter Box 5 Switch Filters 0.91 GHz - 16.3 GHz	RN Electronics	21/08/2023	12 months
E478	LQ2992/H	Filter Band pass 1-3GHz	RACAL-MESL	11/04/2024	12 months
E547	8493A	Attenuator 20dB 12.4GHz	Hewlett Packard	#27/07/2023	12 months
E624	E4440A	PSA 3 Hz - 26.5 GHz	Agilent Technologies	06/07/2023	24 months
E642	E4440A	PSA 3 Hz - 26.5 GHz	Agilent Technologies	20/02/2024	24 months
E743	2017 4/2dB	Attenuator 4/2dB 30-1000MHz	RN Electronics	22/02/2024	12 months
E755	N9030B	PXA Signal Analyser 3 Hz to 50 GHz	Keysight Technologies	#13/08/2024	12 months
E839	5244D	Oscilloscope 200MHz 2CH	Pico Technology	11/06/2024	12 months
E996	WRCT2200/2500-0.2/40-10SSK	Filter Notch tunable 2.2GHz to 2.5GHz SMA to SMA	Wainwright Instruments	Align during test	12 months
H071	N9010B	EXA Signal Analyser 10 Hz to 44 GHz	Keysight Technologies	12/12/2022	24 months
LPE261	3115	Horn Antenna 1 - 18 GHz	EMCO	15/05/2024	12 months
LPE333	8449B	Pre-Amplifier 1GHz - 26.5GHz	Hewlett Packard	09/07/2024	12 months
LPE364	CBL6112A	Antenna BiLog 30MHz - 2GHz	Chase Electronics Ltd	28/03/2022	36 months
TMS78	3160-08	Horn Std Gain 12.4 - 18 GHz	ETS Systems	#26/09/2024	12 months
TMS79	3160-09	Horn Std Gain 18 - 26.5 GHz	ETS Systems	11/07/2024	12 months
TMS81	6502	Antenna Active Loop	EMCO	17/08/2023	24 months
TMS82	8449B	Pre-Amplifier 1GHz - 26.5GHz	Agilent Technologies	08/01/2024	12 months

For testing carried out between 15th July 2025 to 18th July 2025: -

KEC No	Model	Description	Manufacturer	Calibrated Date	Period
E296-2	11970A	Harmonic Mixer 26.5-40GHz	Hewlett Packard	19/08/2024	12 months
E331	22093-KF20	Horn Antenna 26.5 - 40 GHz	Flann (FMI)	04/04/2025	12 months
E412	E4440A	PSA 3 Hz - 26.5 GHz	Agilent Technologies	22/09/2023	24 months
ZSW1	V2.5.7	KEC Measurement Software Suite	KEC	Not applicable	

Equipment was within calibration dates for tests and has been re-calibrated since/during date of tests.

10 Auxiliary and peripheral equipment

10.1 Customer supplied equipment

Item No.	Model No.	Description	Manufacturer	Serial No.
1	P56F	Laptop	Dell	5986433846
2	Arcana	eARC Adpater	Arcana	6000522018785
3	None Specified	8R5 Load Jig	Monitor Audio	None Specified
4	H13516v1_VAR0a	SPI-USB Converter	Not Specified	353565
5	2049L	ESP32 Prog Adaptor	Not Specified	None Specified
6	GL-MT300N-V2	300M Mini Smart Router	GL iNet	dB10e51bf3e8cbf0

10.2 Kiwa Electrical Compliance supplied equipment

No Kiwa Electrical Compliance supplied equipment was used.

11 Condition of the equipment tested

In order for the EUT to produce the results shown within this report the following modifications, if any, were implemented.

11.1 Modifications before test

No modifications were made before test by Kiwa Electrical Compliance.

11.2 Modifications during test

No modifications were made during test by Kiwa Electrical Compliance.

12 Description of test sites

Site A	Radio Laboratory and Anechoic Chamber
Site B	Semi-Anechoic Chamber and Control Room FCC Registration No. 654321, ISED Registration No. 5612A-4
Site C	Transient Laboratory
Site D	Screened Room (Conducted Immunity)
Site E	Screened Room (Control Room for Site D)
Site F	Screened Room (Conducted Emissions)
Site G	Screened Room (Control Room for Site H)
Site H	3m Semi-Anechoic Chamber (indoor OATS) FCC Registration No. 654321, ISED Registration No. 5612A-2, VCCI Registration No. 4065
Site J	Transient Laboratory
Site K	Screened Room (Control Room for Site M)
Site M	3m Semi-Anechoic Chamber (indoor OATS) FCC Registration No. 654321, ISED Registration No. 5612A-3
Site N	Radio Laboratory
Site Q	Fully-Anechoic Chamber
Site OATS 3m and 10m Open Area Test Site	FCC Registration No. 654321, ISED Registration No. 5612A-1
Site R	Screened Room (Conducted Immunity)
Site S	Safety Laboratory
Site T	Transient Laboratory

CAB identifier as issued by Innovation, Science and Economic Development Canada is UK0002
CAB identifier as issued by FCC is UK2015

13 Abbreviations and units

%	Percent	dBμV	decibelBels relative to 1μV
λ	Wavelength	dBμV/m	decibelBels relative to 1μV/m
μA/m	microAmps per metre	dBc	decibelBels relative to Carrier
μV	microVolts	dBd	decibelBels relative to dipole gain
μW	microWatts	dBi	decibelBels relative to isotropic gain
AC	Alternating Current	dBm	decibelBels relative to 1mW
ACK	ACKnowledgement	dBm	decibelBels relative to 1mW
ACP	Adjacent Channel Power	dBm	decibelBels relative to a maximum value
AFA	Adaptive Frequency Agility	dBW	decibelBels relative to 1W
ALSE	Absorber Lined Screened Enclosure	DC	Direct Current
AM	Amplitude Modulation	DFS	Dynamic Frequency Selection
Amb	Ambient	DMO	Dynamic Modulation Order
ANSI	American National Standards Institute	DSSS	Direct Sequence Spread Spectrum
ATPC	Automatic Transmit Power Control	DTA	Digital Transmission Analyser
AVG	Average	EIRP	Equivalent Isotropic Radiated Power
AWGN	Additive White Gaussian Noise	emf	electromotive force
BER	Bit Error Rate	ERC	European Radiocommunications Committee
BPSK	Binary Phase Shift Keying	ERP	Effective Radiated Power
BT	BlueTooth	ETSI	European Telecommunications Standards Institute
BLE	BlueTooth Low Energy	EU	European Union
BW	Bandwidth	EUT	Equipment Under Test
°C	Degrees Celsius	FCC	Federal Communications Commission
C/I	Carrier / Interferer	FER	Frame Error Rate
CAC	Channel Availability Check	FHSS	Frequency Hopping Spread Spectrum
CCA	Clear Channel Assessment	FM	Frequency Modulation
CEPT	European Conference of Postal and Telecommunications Administrations	FSK	Frequency Shift Keying
CFR	Code of Federal Regulations	FSS	Fixed Satellite Service
CISPR	Comité International Spécial des Perturbations Radioélectriques	g	Grams
cm	centimetre	GHz	GigaHertz
COFDM	Coherent OFDM	GNSS	Global Navigation Satellite System
COT	Channel Occupancy Time	GPS	Global Positioning System
CS	Channel Spacing	Hz	Hertz
CW	Continuous Wave	IEEE	Institute of Electrical and Electronics Engineers
DAA	Detect And Avoid	IF	Intermediate Frequency
dB	decibelBels	ISED	Innovation Science and Economic Development
dBμA/m	decibelBels relative to 1μA/m	ITU	International Telecommunications Union
		KDB	Knowledge DataBase

kg	kilogram	pW	picoWatts
kHz	kiloHertz	QAM	Quadrature Amplitude Modulation
kPa	Kilopascal	QP	Quasi Peak
LBT	Listen Before Talk	QPSK	Quadrature Phase Shift Keying
LISN	Line Impedance Stabilisation Network	RBW	Resolution Band Width
LNA	Low Noise Amplifier	RED	Radio Equipment Directive
LNB	Low Noise Block	R&TTE	Radio and Telecommunication Terminal Equipment
LO	Local Oscillator	Ref	Reference
m	metre	RF	Radio Frequency
mA	milliAmps	RFC	Remote Frequency Control
max	maximum	RFID	Radio Frequency IDentification
Mbit/s	MegaBits per second	RLAN	Radio Local Area Network
MCS	Modulation and Coding Scheme	RMS	Root Mean Square
MHz	MegaHertz	RNSS	Radio Navigation Satellite Service
mic	Microphone	RSL	Received Signal Level
MIMO	Multiple Input, Multiple Output	RSSI	Received Signal Strength Indicator
min	minimum	RTP	Room Temperature and Pressure
mm	millimetres	RTPC	Remote Transmit Power Control
ms	milliseconds	Rx	Receiver
mW	milliWatts	s	Seconds
NA	Not Applicable	SINAD	Signal to Noise And Distortion
NFC	Near Field Communications	SRD	Short Range Device
nom	Nominal	Tx	Transmitter
nW	nanoWatt	UKAS	United Kingdom Accreditation Service
OATS	Open Area Test Site	UKCA	United Kingdom Conformity Assessed
OBW	Occupied Band Width	UKRER	United Kingdom Radio Equipment Regulations
OCW	Occupied Channel Width	UHF	Ultra High Frequency
OFDM	Orthogonal Frequency Division Multiplexing	U-NII	Unlicensed National Information Infrastructure
OOB	Out Of Band	USB	Universal Serial Bus
ppm	Parts per million	UWB	Ultra Wide Band
PER	Packet Error Rate	V	Volts
PK	Peak	V/m	Volts per metre
PMR	Private Mobile Radio	VBW	Video Band Width
PRBS	Pseudo Random Bit Sequence	VHF	Very High Frequency
PRF	Pulse Repetition Frequency	VSAT	Very Small Aperture Terminal
PSD	Power Spectral Density	W	Watts
PSU	Power Supply Unit		

===== END OF TEST REPORT =====

14 Revision History

Issue Number	Revision History	Page Reference(s)
01	First Issue	-
02	Updated test dates to include Intermodulation emissions testing with 5GHz WLAN.	1, 2
	Removed customer rep signature box	2
	Updated section 2.1 to include the alternative model number and reference to the Integrated amplifier model version.	5
	Corrected Antenna part number and reference section.	6
	Added intermodulation test modes and text	8, 9
	Updated note 4 in relation to intermodulation test range	12
	Updated ANSI C63.10:2013 table reference to 2020 version	13
	Updated the Radiated emissions results above 1GHz to include any Intermodulation test results with 5GHz WLAN and the Bluetooth classic channels including note update under last table and plot references up to 40GHz	23-25
	Included plots for the range 26.5GHz to 40 GHz.	65-69
	Inserted missing conducted plot section and plots	120-137
	Included test range photo for 26.5-40GHz range	156

===== END OF TEST REPORT =====