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04-Feb-26

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Subject: SUBTEL, Chile (Resolution 737) Certification Compliance 2026
Commercial Name: Fenix 8 51mm, AMOLED

| | Información (Information) |
|---|---|
| Tipo de equipo (Equipment type) | Portable Digital Transceiver |
| Marca (Brand) | Garmin  |
| Modelo (Model) | A04808 |
| Tecnología o modulación (Technology or modulation) | ASK for NFC / GFSK for ANT/ GFSK for BTBR / $\pi/4$ -DQPSK, 8DPSK for BTEDR / GFSK for BLE/ DSSS for 802.11b / OFDM for 802.11g/n |
| Frecuencias (Frequencies) | 13.56 MHz / 2402-2480 MHz / 2402-2480 MHz / 2402-2480 MHz / 2402-2480 MHz / 2412-2462 MHz |
| Ganancia de antena (dBi) (Antenna gain (dBi)) | ANT -3.80 dBi / 802.15.1 -3.80 dBi / 802.15.1 -3.80 dBi / BLE -3.80 dBi / 802.11b/g/n -3.80 dBi |
| P.i.r.e. (E.I R P.) | -40.37 dBm, 0.00 mW / -2.70 dBm, 0.53 mW / 6.20 dBm, 4.16 mW / 5.50 dBm, 3.54 mW / -2.30 dBm, 0.58 mW / 11.90 dBm, 15.48 mW |
| Módulos (Modules) | NFC, ANT, BTBR, BTEDR, BLE, WiFi |

As all measurements for NFC are made in radiated mode to comply with the field strength limits, gain information is not required to be noted in the reports or any additional documentation.

Declaration of Conformity Statement: the equipment previously identified complies with the provisions established in the Technical Standard for Small Range Equipment, approved by Exempt Resolution No.1,985 of 2017, of the Undersecretary of Telecommunications.

Declaración de conformidad: El equipo anteriormente identificado cumple con las disposiciones establecidas en la Norma Técnica para Equipos de Corto Alcance, aprobada mediante la Resolución Exenta N° 1.985 de 2017, de la Subsecretaría de Telecomunicaciones.



| | |
|----------------------------|---------------|
| Test Report Serial Number: | 45461922 R2.0 |
| Test Report Date: | 29 April 2024 |
| Project Number: | 1658 |

EMC Test Report - New Certification

Applicant:



Garmin International Inc.
1200 East 151 St
Olathe, KS, 66062
USA

FCC ID:

IPH-04808

Product Model Number / HVIN

A04808

Product Marketing Name / PMN

A04808

In Accordance With:

CFR Title 47, Part 15 Subpart C (§15.249), (§15.225), Part 15 Subpart B
 Part 15 Low Power Communication Device Transmitter (DXX)

Approved By:



Ben Hewson, President
 Celltech Labs Inc.
 21-364 Lougheed Rd.
 Kelowna, BC, V1X 7R8
 Canada



Test Lab Certificate: 2470.01



**Industry
Canada**

IC Registration 3874A



FCC Registration: CA3874

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1.0 DOCUMENT CONTROL

| Revision History | | | | | |
|----------------------------|--------------------------------|------------------|-------------------------------|---------------|--------------------------|
| Samples Tested By: | | Art Voss, P.Eng. | Date(s) of Evaluation: | | 18 March - 6 April, 2024 |
| Report Prepared By: | | Art Voss, P.Eng. | Report Reviewed By: | | Ben Hewson |
| Report Revision | Description of Revision | Revised Section | Revised By | Revision Date | |
| 0.1 | Draft | n/a | Art Voss | 11 April 2024 | |
| 0.2 | Revised per applicant's review | - | Art Voss | 15 April 2024 | |
| 1.0 | Initial Release | - | Art Voss | 19 April 2024 | |
| 2.0 | Revised NFC OBW Results | 7 | Art Voss | 29 April 2024 | |

2.0 CLIENT AND DUT INFORMATION

| Client Information | |
|--|--|
| Applicant Name | Garmin International Inc. |
| Applicant Address | 1200 East 151 St |
| | Olathe, KS, 66062 |
| | USA |
| DUT Information | |
| Device Identifier(s): | ISED ID: 1792A-04808 |
| Device Model(s) / HVIN: | A04808 |
| Device Marketing Name / PMN: | A04808 |
| Test Sample Serial No.: | 3469058597 - Conducted, 3469058595 - OTA |
| Device Type: | Portable Transceiver |
| Equipment Class: | Wireless Local Area Network Device |
| | General Field Strength Device |
| Transmit Frequency Range: | WiFi (DTS): 2412-2472MHz |
| | BT/BLE/ANT: 2402-2480MHz |
| | NFC: 13.56MHz |
| Manuf. Max. Rated Output Power: | WiFi - Digital Transmission System (DTS): 12.2dBm EIRP |
| | BlueTooth - Spread Spectrum Transmitter (DSS): 6.2dBm EIRP |
| | BLE/ANT - Low Power Communication Device Transmitter (DTS): -2.3dBm EIRP |
| | NFC - Low Power Communication Device Transmitter (DXX): 55.62dBuV/m |
| Antenna Type and Gain: | -3.8dBi Max Slot Antenna |
| Modulation: | WiFi: DSSS, OFDM, CCK, MCS0-7 |
| | BT BR: GFSK |
| | BT EDR: Pi/4-DQPSK, 8DPSK |
| | BLE: GMSK |
| | ANT: GFSK |
| | NFC: ASK |
| DUT Power Source: | 4.5VDC Rechargeable Li-Ion |
| DUT Dimensions [LxWxH] | H x W x D: 51mm dia x 4.5mm |
| Deviation(s) from standard/procedure: | None |
| Modification of DUT: | None |

3.0 SCOPE

Preface:

This Certification Report was prepared on behalf of:

Garmin International Inc.

, (the 'Applicant'), in accordance with the applicable Federal Communications Commission (FCC) CFR 47 and Innovation, Scientific and Economic Development (ISED) Canada rules parts and regulations (the 'Rules'). The scope of this investigation was limited to only the equipment, devices and accessories (the 'Equipment') supplied by the Applicant. The tests and measurements performed on this Equipment were only those set forth in the applicable Rules and/or the Test and Measurement Standards they reference. The Rules applied and the Test and Measurement Standards used during this evaluation appear in the Normative References section of this report. The limits set forth in the technical requirements of the applicable Rules were applied to the measurement results obtained during this evaluation and, unless otherwise noted, these limits were used as the Pass/Fail criteria. The Pass/Fail statements made in this report apply to only the tests and measurements performed on only the Equipment tested during this evaluation. Where applicable and permissible, information including test and measurement data and/or results from previous evaluations of same or similar equipment, devices and/or accessories may be cited in this report.

Device:

The Garmin Model/HVIN: A04808 is a portable transceiver device consisting of a WiFi, BlueTooth (BT), BlueTooth Low Energy (BLE), Adaptive Network Topology (ANT) and Near Field Communication (NFC) transceivers. The WiFi and BT/BLE/ANT transceivers share the same antenna and cannot simultaneously transmit.

Requirement:

The transceivers of this equipment are subject to emissions evaluation in accordance with FCC: 47 CFR 2, 15C. As per FCC 47 CFR §2.1093, an RF Exposure (SAR) evaluation is required for this Equipment and the results of the RF Exposure (SAR) evaluation appear in a separate report.

Application:

This is an application for a New Certification.

Scope:

The scope of this investigation is limited to the evaluation and reporting of the wanted and spurious emissions in accordance with the rule parts cited in Normative References section of this report.

4.0 TEST RESULT SUMMARY

| TEST SUMMARY | | | | | |
|---------------------|--------------------------------|---------------------------------------|------------------------------------|------------------|---------------|
| Section | Description of Test | Procedure Reference | Applicable Rule Part(s) FCC | Test Date | Result |
| 7.0 | Occupied Bandwidth | ANSI C63.10-2013 KDB 558074 D01v05 | §2.1049 | 2-3 April 2024 | Pass |
| 8.0 | NFC Field Strength, Mask | ANSI C63.10-2013 KDB 558074 D01v05 | §15.225(a)(c) | 2-3 April 2024 | Pass |
| 9.0 | Radiated Tx Emission | ANSI C63.10-2013 KDB 558074 D01v05 | §15.249(d)(e) §15.209 | 2-3 April 2024 | Pass |
| 10.0 | Radiated Rx Emissions | ANSI C63.10-2013 KDB 558074 D01v05 | §15.249(d)(e) §15.209 | 2-3 April 2024 | Pass |
| 11.0 | Power Line Conducted Emissions | ANSI C63.4-2014 | §15.107 | 5 April 2024 | Pass |
| 12.0 | Frequency Stability | ANSI C63.10-2013 KDB 558074 D01v05 | §15.225 | 5 April 2024 | Pass |

| Test Station Day Log | | | | | |
|-----------------------------|--------------------------|------------------------------|----------------------------------|---------------------|-----------------------------------|
| Date | Ambient Temp (°C) | Relative Humidity (%) | Barometric Pressure (kPa) | Test Station | Tests Performed Section(s) |
| 2 Apr 2024 | 10.0 | 60 | 101.9 | OATS | 7,8,9,10 |
| 3 Apr 2024 | 9.0 | 36 | 101.9 | OATS | 7,8,9,10 |
| 5 Apr 2024 | 17.0 | 37 | 100.7 | LISN | 11,12 |

EMC - EMC Test Bench **SAC** - Semi-Anechoic Chamber
OATS - Open Area Test Site **TC** - Temperature Chamber
LISN - LISN Test Area **ESD** - ESD Test Bench
IMM - Immunity Test Area **RI** - Radiated Immunity Chamber

| | |
|---|---|
| <p>I attest that the data reported herein is true and accurate within the tolerance of the Measurement Instrument Uncertainty; that all tests and measurements were performed in accordance with accepted practices or procedures; and that all tests and measurements were performed by me or by trained personnel under my direct supervision. The results of this investigation are based solely on the test sample(s) provided by the client which were not adjusted, modified or altered in any manner whatsoever, except as required to carry out specific tests or measurements. This test report has been completed in accordance with ISO/IEC 17025.</p> |  <hr/> Art Voss, P.Eng. Technical Manager Celltech Labs Inc. <hr/> 11 April 2024 Date |
|---|---|



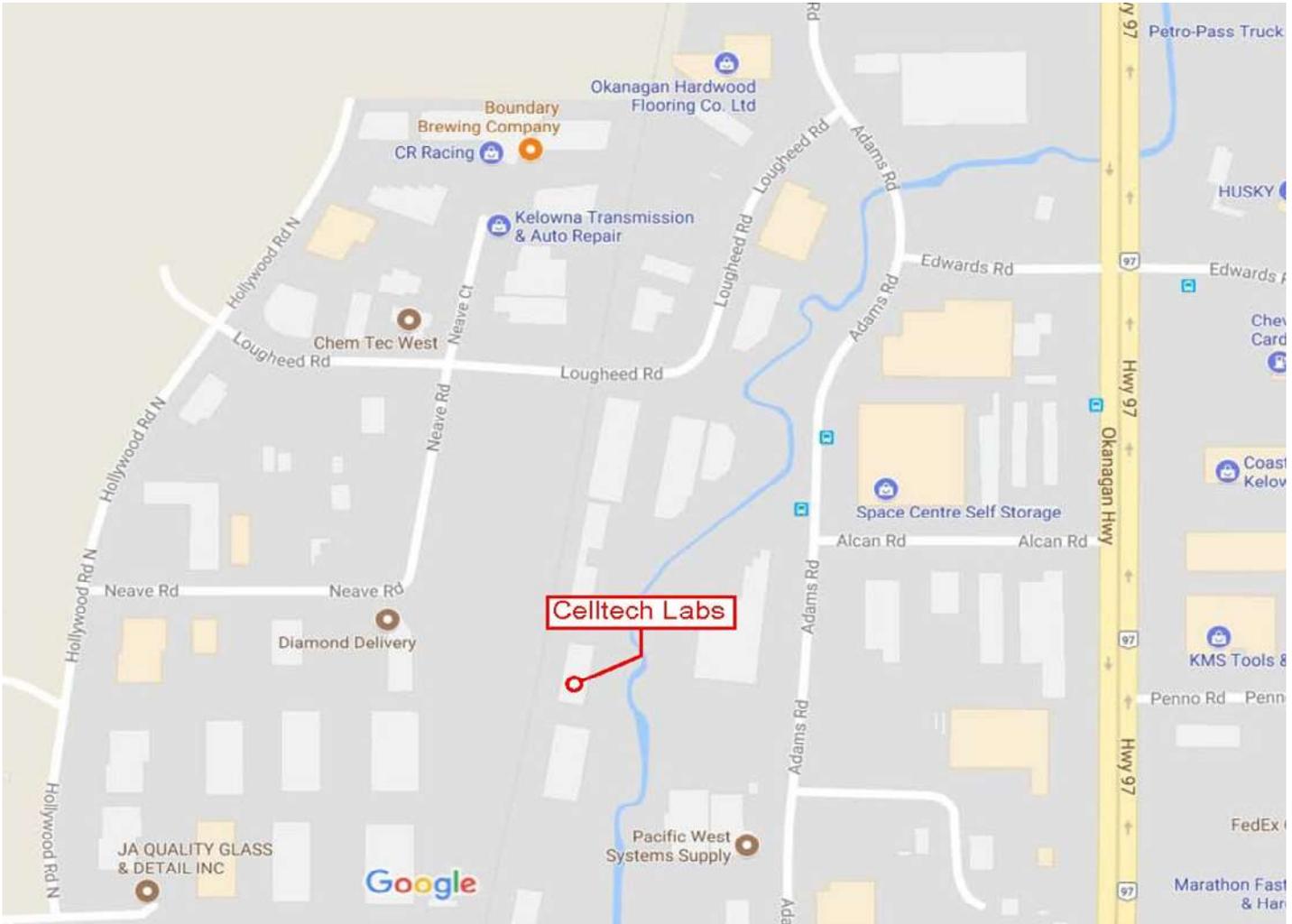
5.0 NORMATIVE REFERENCES

| Normative References | |
|-----------------------------|---|
| ISO/IEC 17025:2017 | General requirements for the competence of testing and calibration laboratories |
| ANSI C63.4-2014 | American National Standard of Procedures for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electric and Electronic Equipment in the Range of 9kHz to 40GHz |
| ANSI C63.10-2013 | American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices |
| CFR | Code of Federal Regulations Title 47: Telecommunication Part 2: Frequency Allocations and Radio Treaty Matters; General Rules and Regulations |
| CFR | Code of Federal Regulations Title 47: Telecommunication Part 15: Radio Frequency Devices Subpart B: Unintentional Radiators |
| CFR | Code of Federal Regulations Title 47: Telecommunication Part 15: Radio Frequency Devices Sub Part C (15.225) Intentional Radiators |
| CFR | Code of Federal Regulations Title 47: Telecommunication Part 15: Radio Frequency Devices Sub Part C (15.249) Intentional Radiators |
| FCC KDB 558074 D01v05r02 | OET Major Guidance Publications, Knowledge Data Base Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under Section 15.247 |

6.0 FACILITIES AND ACCREDITATIONS

Facility and Accreditation:

The facilities used to evaluate this device outlined in this report are located at 21-364 Loughheed Road, Kelowna, British Columbia, Canada V1X 7R8. The radiated emissions site (OATS) conforms to the requirements set forth in ANSI C63.4 and is filed and listed with the FCC under Test Firm Registration Number CA3874 and Industry Canada under Test Site File Number IC 3874A. Celltech is accredited to ISO 17025, through accrediting body A2LA and with certificate 2470.01.



7.0 OCCUPIED BANDWIDTH

Test Procedure

| | |
|------------------|---|
| Normative | FCC 47 CFR §2.1046, §15.225 |
| Reference | KDB 558074 (8.3.2.1), ANSI C63.10 (6.9.3) |

General Procedure

C63.10 (6.9.3)

6.9.3 Occupied bandwidth—power bandwidth (99%) measurement procedure

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. The following procedure shall be used for measuring 99% power bandwidth:

- a) The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
- b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement.
- c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than $[10 \log (OBW/RBW)]$ below the reference level. Specific guidance is given in 4.1.5.2.
- d) Step a) through step c) might require iteration to adjust within the specified range.
- e) Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
- f) Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.

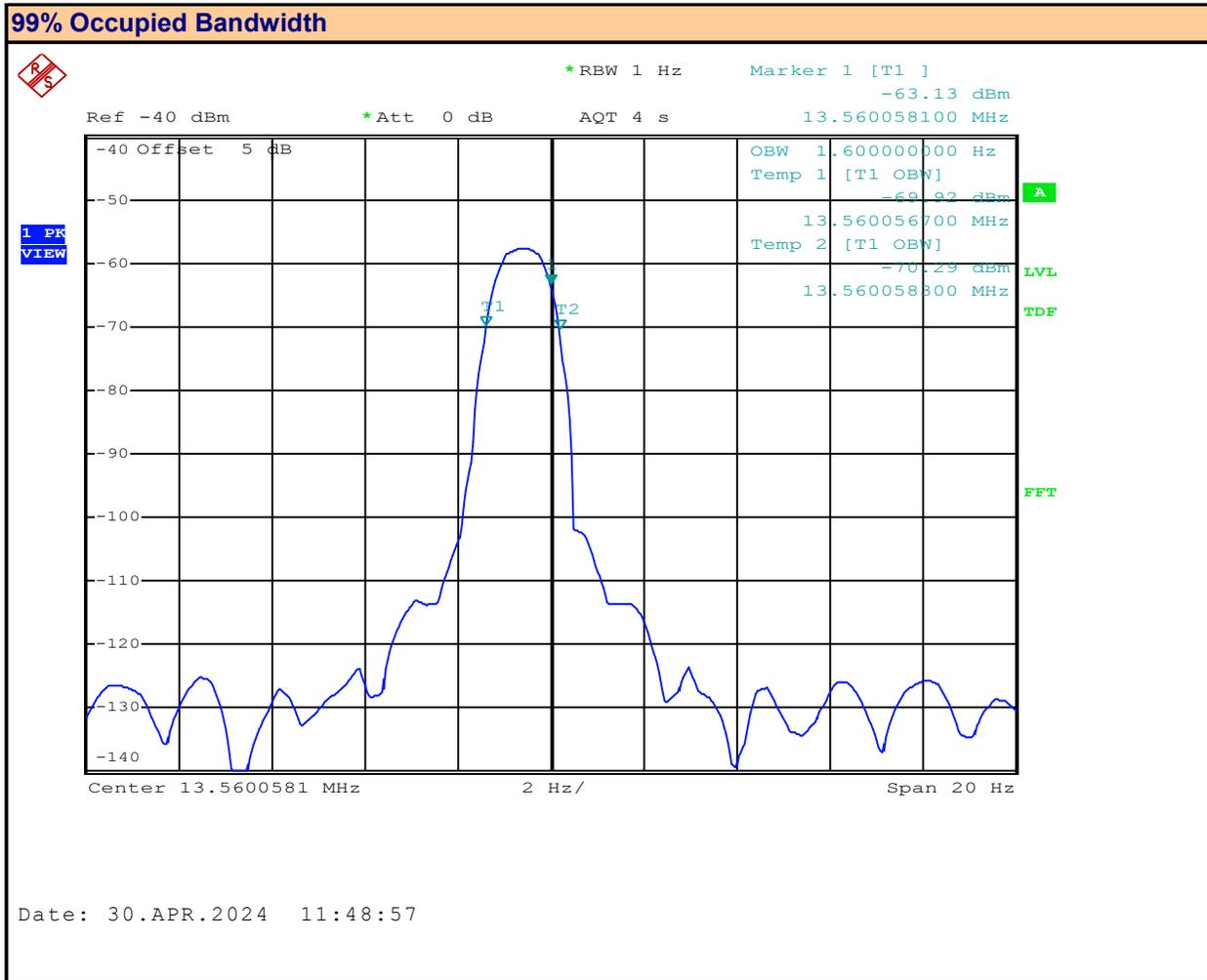
Test Setup

Appendix A - Figure A.1

Measurement Procedure

The DUT was connected to a Spectrum Analyzer (SA) via a 30dB attenuator connected to the DUT's antenna port. The SA was configured as described above using the 99% Occupied Bandwidth function. The output power of the DUT was set to the manufacturer's highest output power setting at the Low, Mid and High frequency channels as permitted by the device. The DUT was set to transmit at its maximum Duty Cycle. The 99% Occupied Bandwidth was measured and recorded.

Plot 7.1 – Occupied Bandwidth, NFC



Channel:
 Mode:

Channel Frequency: MHz
 Modulation:

Measured Occupied Bandwidth: Hz

Table 7.1 - Summary of Occupied Bandwidth Measurements (NFC)

| 99% Occupied Bandwidth Results: NFC | | | | | |
|--|--------------------------------|-------------|-------------------|---|----------------------------|
| Channel Number | Channel Frequency (MHz) | Mode | Modulation | Measured Occupied Bandwidth (Hz) | Emission Designator |
| - | 13.56 | NFC | ASK | 66.00 | 1H60K1D |
| Result: | | | | | Complies |

8.0 NFC FIELD STRENGTH / EMISSIONS MASK

Test Procedure

| | |
|----------------------------|--|
| Normative Reference | FCC 47 CFR §2.1046, §15.225 |
| | KDB 558074 (8.3.2), ANSI C63.10 (11.9.2.2.6) |

Limits

| | |
|-----------------|--|
| §15.225 | <p>Operation within the band 13.110-14.010 MHz.</p> <p>(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.</p> <p>(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.</p> <p>(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.</p> <p>(d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.</p> |
| RSS-210 B.10(6) | <p>Band 13.110-14.010 MHz</p> <p>(a) the field strength of any emission shall not exceed the following limits:</p> <p>(i) 15.848 mV/m (84 dBµV/m) at 30 m, within the band 13.553-13.567 MHz</p> <p>(ii) 334 µV/m (50.5 dBµV/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz</p> <p>(iii) 106 µV/m (40.5 dBµV/m) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz</p> <p>(iv) RSS-Gen general field strength limits for frequencies outside the band 13.110-14.010 MHz</p> |

General Procedure

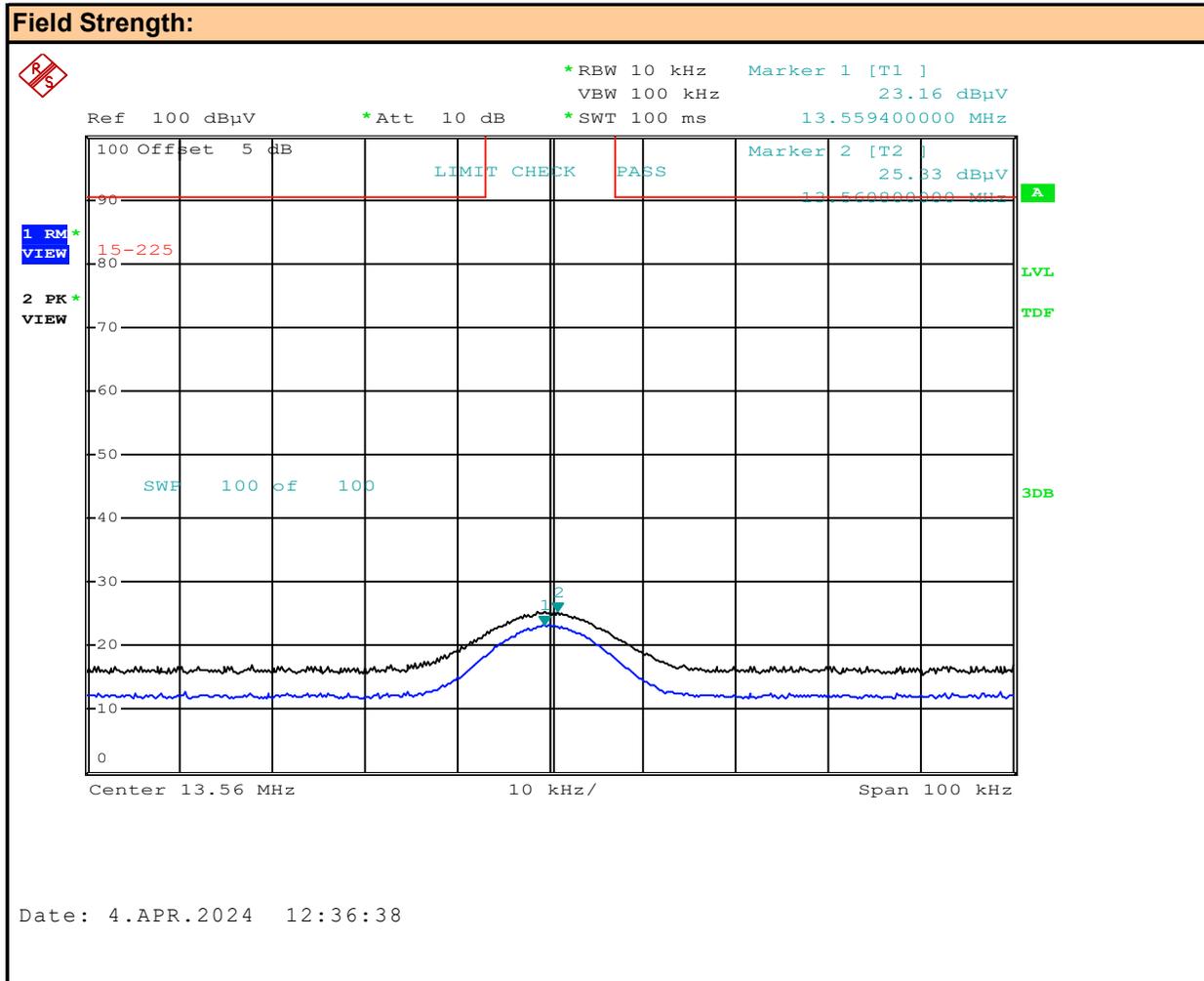
| | |
|----------------|---|
| C63.10 (6.5.4) | <p>6.5.4 Final radiated emission tests</p> <p>Using the orientation and equipment arrangement of the EUT, and based on the measurement results found during the exploratory measurement in 6.5.3, the EUT arrangement, appropriate modulation, and modes of operation that produce the emissions that have the highest amplitude relative to the limit shall be selected for the final measurement. The final measurement shall follow all the procedures in 6.3 with the EUT operating on frequencies per 5.6. For each mode selected, record the frequency and amplitude of the highest fundamental emission (if applicable) and the frequency and amplitude of the six highest spurious emissions relative to the limit; emissions more than 20 dB below the limit do not need to be reported.</p> <p>Measurements are performed with the EUT rotated from 0° to 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Variations in cable or wire placement shall be explored to maximize the measured emissions.</p> |
|----------------|---|

| | | |
|-------------------|-------------------|-------------------|
| Test Setup | Appendix A | Figure A.2 |
|-------------------|-------------------|-------------------|

Measurement Procedure

The DUT place on a 80cm high turntable on an Open Area Test Site (OATS) at a distance of 3m from the measurement antenna. The DUT was set to transmit at maximum power and duty cycle. The DUT was rotated 360 degrees and scanned with the receive antenna elevated from 1 to 4m. The emissions were measured and recorded.

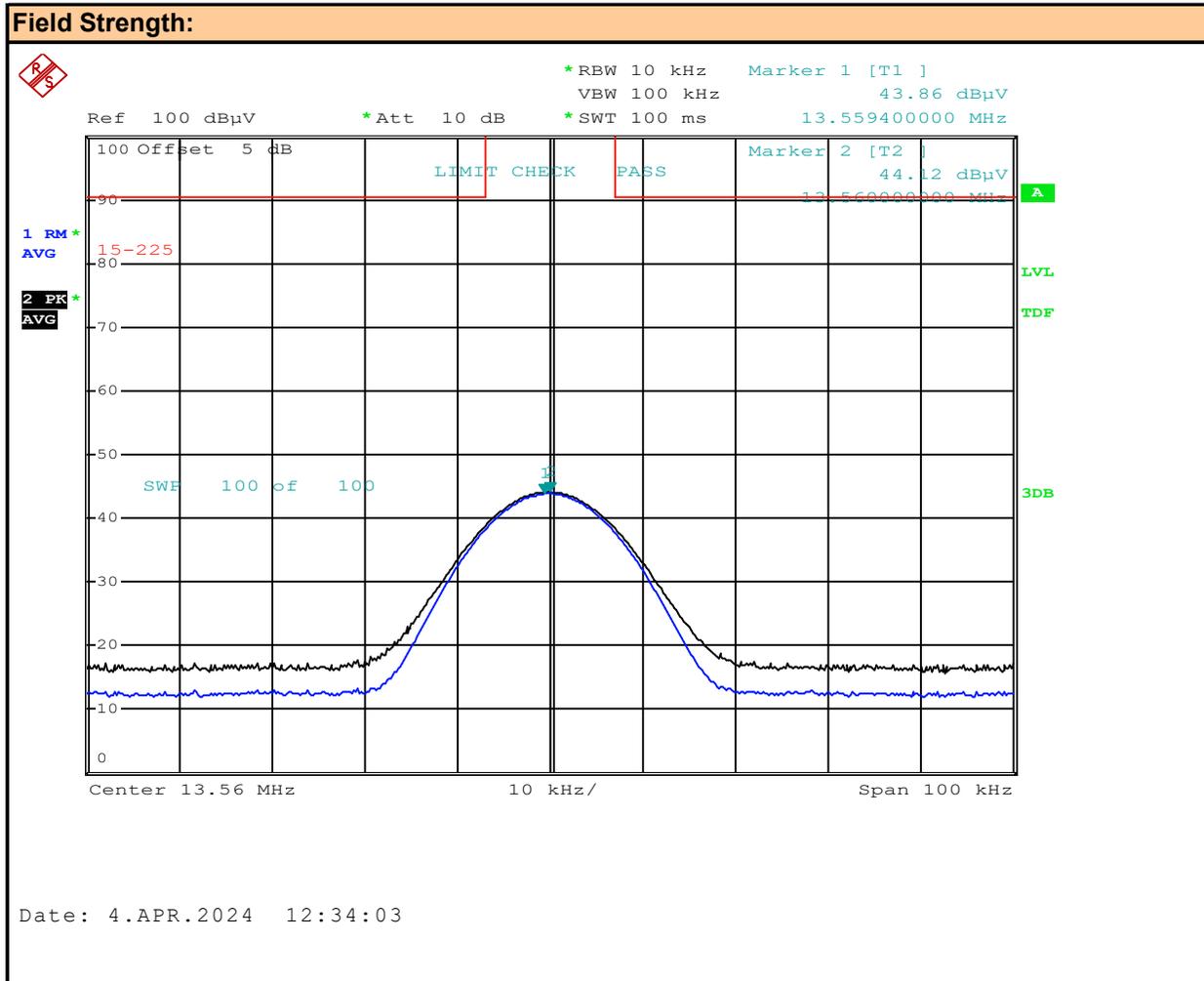
Plot 8.1 – Field Strength, NFC, Front



Polarization:
 Channel:
 Mode:

Channel Frequency: MHz
 Modulation:
 Measured Field Strength (Pk): dBuV/m
 Measured Field Strength (Av): dBuV/m

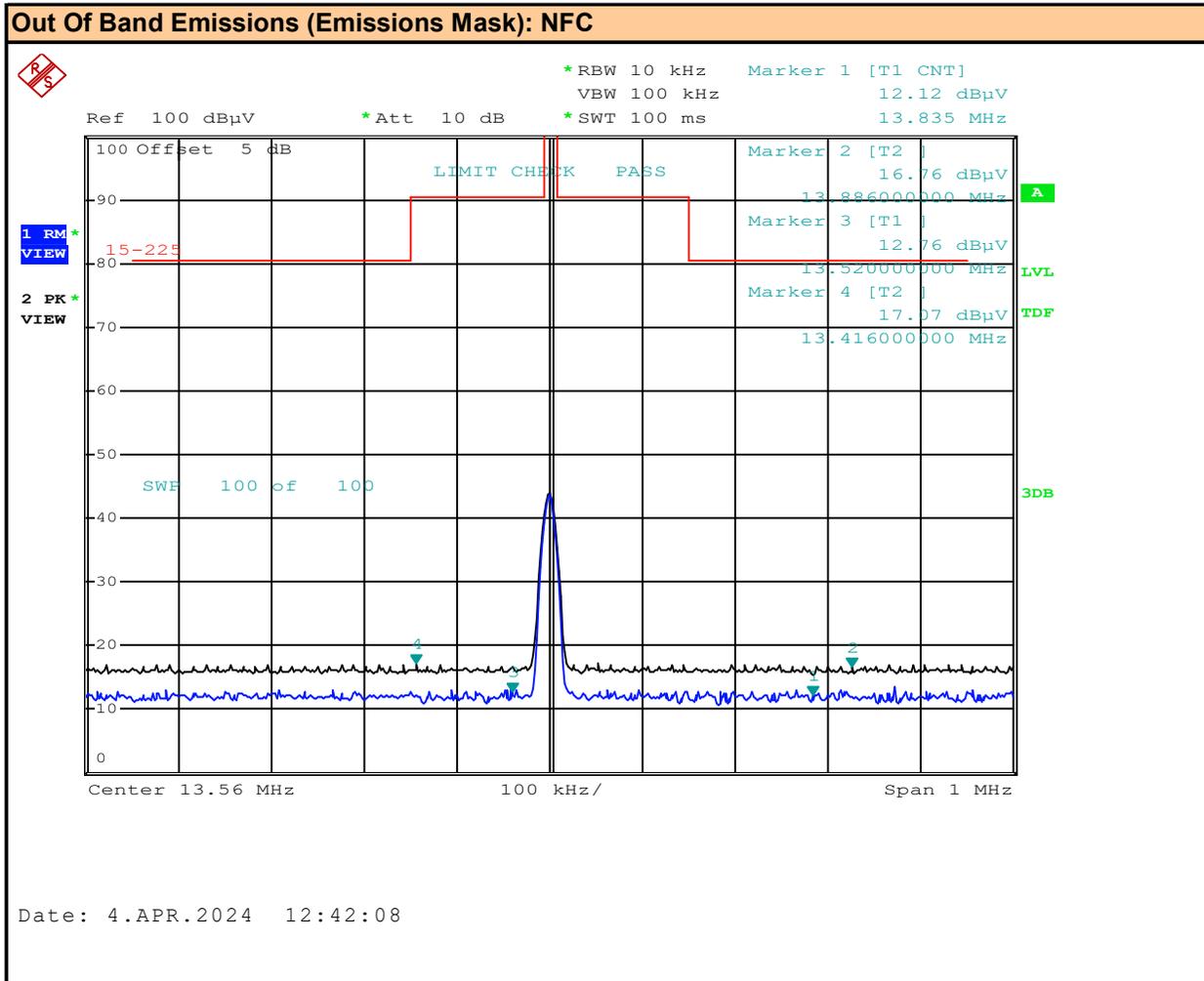
Plot 8.2 – Field Strength, NFC, Side



Polarization:
 Channel:
 Mode:

Channel Frequency: MHz
 Modulation:
 Measured Field Strength (Pk): dBuV/m
 Measured Field Strength (Av): dBuV/m

Plot 8.3 – Emissions Mask, NFC, Side



Polarization:

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Table 8.1 – Summary of Field Strength Measurements (NFC)

| Radiated Field Strength | | | | | | | | | | | | |
|-------------------------|------|------------|----------|-------------------------|--|---|-------------------------------------|--|--|---|-----------------|-------------------|
| Frequency (MHz) | Mode | Modulation | Detector | Antenna Polarization | Measured Field Strength [FS _{Meas}] (dBuV @ 3m) | Cable Loss [L _c] (dBm) | Receive Antenna [ACF] (dB) | Corrected Field Strength [FS _{Corr}] (dBuV/m @3m) | Limit @30m [Lim _{30m}] (dBuV/m) | Limit* @3m [Lim _{3m}] (dBuV/m) | Margin (dB) | Emissions Mask |
| 13.56 | NFC | ASK | RMS | Front | 23.16 | 0.5 | 10.5 | 34.16 | 84.00 | 124.0 | 89.8 | Pass |
| | | | | Side | 43.86 | | | 54.86 | | | 69.1 | Pass |
| | | | Peak | Front | 25.33 | | | 36.33 | 104.00 | 144.0 | 107.7 | Pass |
| | | | | Side | 44.12 | | | 55.12 | | | 88.9 | Pass |
| Result: | | | | | | | | | | | Complies | |

* Limit @ 3m = Limit @ 30m + 40dB/decade = 84dBuV/m + 40dB = 124dBuV/m (Average)

* Limit @ 3m = Limit @ 30m + 40dB/decade = 104dBuV/m + 40dB = 144dBuV/m (Peak)

$$FS_{Corr} = FS_{Meas} + ACF + L_C$$

$$Margin = Limit_{3m} - FS_{Corr}$$

Table 8.1 – Summary of Field Strength Measurements (NFC) – Cont.

| Radiated Field Strength | | | | | | | | | | | | |
|-------------------------|------|------------|----------|-------------------------|--|---|---|---|--|--|-----------------|-------------------|
| Frequency (MHz) | Mode | Modulation | Detector | Antenna Polarization | Measured Field Strength [FS _{Meas}] (dBuV @ 3m) | Cable Loss [L _c] (dBm) | Receive Antenna [ACF ^H] (dBuA/m) | Corrected Field Strength [H _{Corr}] (dBuA/m @3m) | Limit @30m [Lim _{30m}] (dBuV/m) | Limit** @3m [Lim _{3m}] (dBuA/m) | Margin (dB) | Emissions Mask |
| 13.56 | NFC | ASK | RMS | Front | 23.16 | 0.5 | -41 | -17.34 | 84.00 | 72.5 | 89.8 | Pass |
| | | | | Side | 43.86 | | | 3.36 | | | 69.1 | Pass |
| | | | Peak | Front | 25.33 | | | -15.17 | 104.00 | 92.5 | 107.7 | Pass |
| | | | | Side | 44.12 | | | 3.62 | | | 88.9 | Pass |
| Result: | | | | | | | | | | | Complies | |

** Limit @ 3m = Limit @ 30m + 40dB/decade = 84dBuV/m + 40dB = 124dBuV/m (Average)

** Limit @ 3m = Limit @ 30m + 40dB/decade = 104dBuV/m + 40dB = 144dBuV/m (Peak)

In accordance with ISED Notice 2020 - DRS0023:

"Guidance on Magnetic Field Strength Radiated Emissions Measurements 9kHz - 30MHz"

Limit Correction

$$\text{Limit}^H (\text{dBuA/m}) = \text{Limit}^E (\text{dBuV/m}) - Z_0 (\text{dB}\Omega)$$

Where Z_0 = Free-Space Impedance = $120\pi\Omega = 377\Omega \Rightarrow 20\text{Log}377\Omega = 51.5\text{dB}\Omega$

$$\text{Limit}^H (\text{dBuA/m}) = \text{Limit}^E (\text{dBuV/m}) - Z_0 (\text{dB}\Omega) = 124\text{dBuV/m} - 51.5\text{dB}\Omega = 72.5\text{dBuA/m @ 3m (Average)}$$

$$\text{Limit}^H (\text{dBuA/m}) = \text{Limit}^E (\text{dBuV/m}) - Z_0 (\text{dB}\Omega) = 144\text{dBuV/m} - 51.5\text{dB}\Omega = 92.5\text{dBuA/m @ 3m (Peak)}$$

Measurement Correction

$$H_{\text{Corr}}(\text{dBuA/m}) = E_{\text{Meas}}(\text{dBuV}) + \text{ACF}^H(\text{dB}/\Omega\text{m}) + L_c - G_A$$

Where ACF^H is the Magnetic Antenna Correction Factor, L_c is Cable Loss, G_A is Pre-Amplifier Gain

External Pre-Amplifier (G_A) not used

$$\text{Margin} = \text{Limit}_{3m} - H_{\text{Corr}}$$

9.0 RADIATED SPURIOUS EMISSIONS – RESTRICTED BANDS

Test Procedure

| | |
|----------------------------|---|
| Normative Reference | FCC 47 CFR §2.1051, §, §15.205(a), §15.205(c), §15.209(a) |
| | KDB 558074 (8.6), ANSI C63.10 (11.12) |

Limits

| | | |
|-------------------|---|--|
| 47 CFR §15.209(a) | §15.209 Radiated emission limits; general requirements. | |
| | (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table: | |
| | Frequency (MHz) | Field Strength (microvolts/meter) |
| | 0.009 - 0.490 | 2400/F (kHz) @300m |
| | 0.490 - 1.705 | 24000/F (kHz) @30m |
| | 1.705 - 30 | 30 @ 30m |
| | 30 - 88 | 100 @3m |
| | 88 - 216 | 150 @3m |
| | 216 - 960 | 200 @3m |
| Above 960 | 500 @3m | |

Table 9.1 – Summary of Radiated Tx Emissions

See Appendix I for Measurement Plots

| Summary of Radiated Tx Emissions | | | | | | | | | | | |
|---|-------------------------|----------------------|--------------------------|---|------------------------|-----------------------------------|---------------------------------------|--|--------------|-----------------|--|
| Measured Frequency Range (MHz) | Channel Frequency (MHz) | Antenna Polarization | Emission Frequency (MHz) | Measured Emission [E _{Meas}] (dBuV) | Antenna ACF [ACF] (dB) | Cable Loss [L _c] (dB) | Amplifier Gain [G _A] (dB) | Corrected Emission [E _{Corr}] (dBuV/m) | Limit (dBuV) | Margin (dB) | |
| 30-1000 MHz | 13.6 | Horizontal | ND | (1) AV | n/a | n/a | 0.00 (3) | ND | n/a | (1) | |
| | | Vertical | ND | (1) AV | n/a | n/a | 0.00 (3) | ND | n/a | (1) | |
| Results: | | | | | | | | | | Complies | |

- (1) No Emissions Detected (ND) above ambient or within 20dB of the limit
- (2) Antenna ACF, Cable Loss and Amplifier Gain corrected in Spectrum Analyzer Transducer Factor
- (3) External Amplifier not used

$$E_{\text{Corr}} = E_{\text{Meas}} + ACF^E + L_C - G_A$$

Where ACF^E is the Electric Antenna Correction Factor

* Without Manufacturer's Accessories, ** With Manufacturer's Accessories

10.0 RADIATED RX SPURIOUS EMISSIONS

Test Procedure

| | |
|----------------------------|---|
| Normative Reference | FCC 47 CFR §2.1046 |
| | KDB 558074 (8.3.2), ANSI C63.10 (11.9.2.2.6) |

General Procedure

| | |
|----------------|---|
| C63.10 (6.5.4) | <p>6.5.4 Final radiated emission tests</p> <p>Using the orientation and equipment arrangement of the EUT, and based on the measurement results found during the exploratory measurement in 6.5.3, the EUT arrangement, appropriate modulation, and modes of operation that produce the emissions that have the highest amplitude relative to the limit shall be selected for the final measurement. The final measurement shall follow all the procedures in 6.3 with the EUT operating on frequencies per 5.6. For each mode selected, record the frequency and amplitude of the highest fundamental emission (if applicable) and the frequency and amplitude of the six highest spurious emissions relative to the limit; emissions more than 20 dB below the limit do not need to be reported.</p> <p>Measurements are performed with the EUT rotated from 0° to 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Variations in cable or wire placement shall be explored to maximize the measured emissions.</p> |
|----------------|---|

| | | |
|-------------------|-------------------|-------------------|
| Test Setup | Appendix A | Figure A.2 |
|-------------------|-------------------|-------------------|

Measurement Procedure

The DUT place on a 80cm high turntable on an Open Area Test Site (OATS) at a distance of 3m from the measurement antenna. The DUT was set to transmit at maximum power and duty cycle. The DUT was rotated 360 degrees and scanned with the receive antenna elevated from 1 to 4m. The emissions were measured and recorded.

Table 10.1 – Summary of Radiated Rx Emissions

See Appendix J for Measurement Plots

| Summary of Radiated Rx Emissions | | | | | | | | | | |
|----------------------------------|-------------------------|----------------------|--------------------------|---|------------------------|-----------------------------------|---------------------------------------|--|-----------------|-------------|
| Measured Frequency Range (MHz) | Channel Frequency (MHz) | Antenna Polarization | Emission Frequency (MHz) | Measured Emission [E _{Meas}] (dBuV) | Antenna ACF [ACF] (dB) | Cable Loss [L _c] (dB) | Amplifier Gain [G _A] (dB) | Corrected Emission [E _{Corr}] (dBuV/m) | Limit (dBuV) | Margin (dB) |
| 30-1000 | - | Horizontal | (1) | (1) AV | - | - | 0.00 (3) | (1) | - | (1) |
| 30-1000 | - | Vertical | (1) | (1) AV | - | - | 0.00 (3) | (1) | - | (1) |
| Results: | | | | | | | | | Complies | |

(1) No Emissions Detected (ND) above ambient or within 20dB of the limit

(3) External Amplier not used

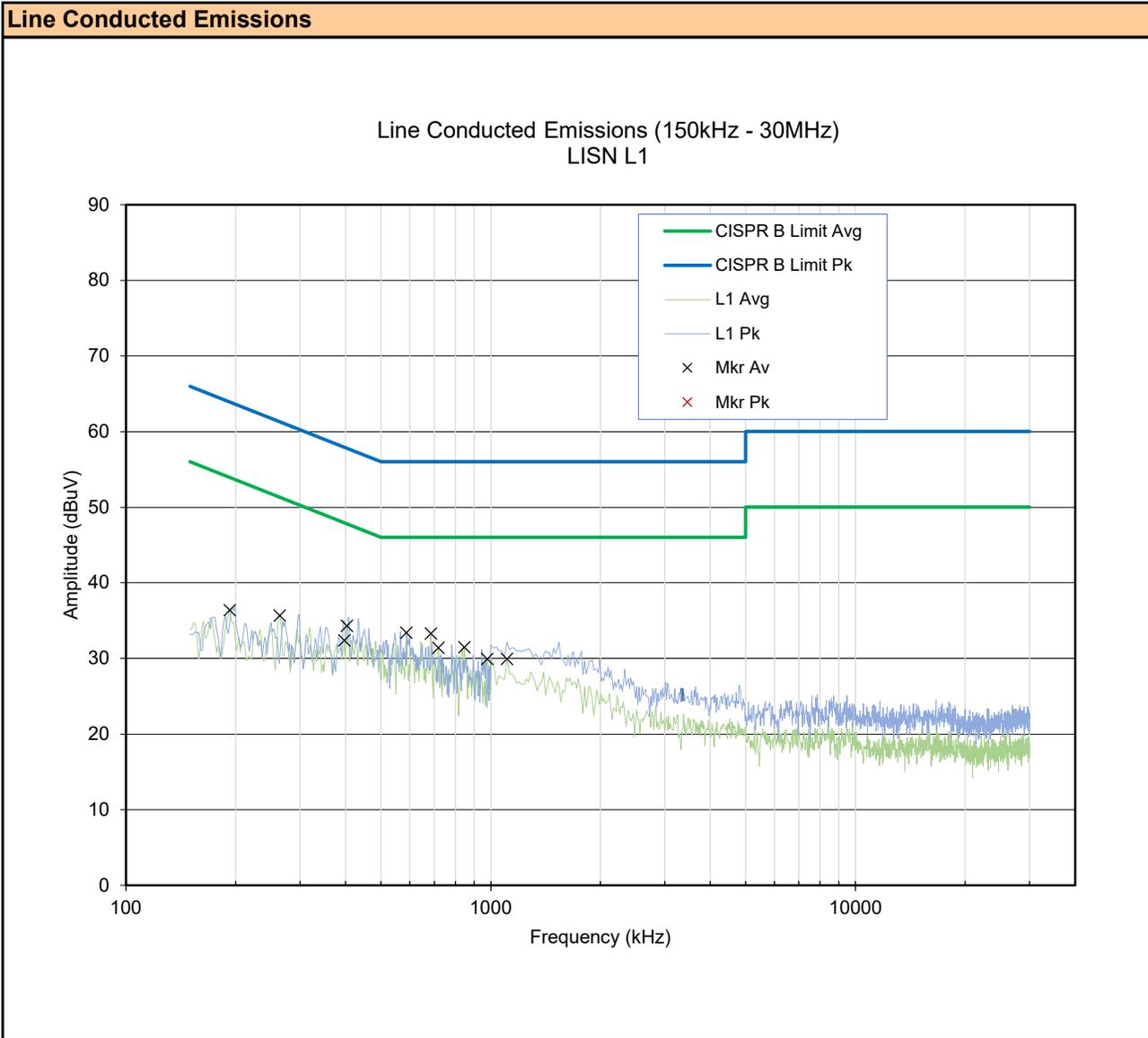
$$E_{\text{Corr}} = E_{\text{Meas}} + ACF^E + L_C - G_A$$

Where ACF^E is the Electric Antenna Correction Factor

11.0 POWER LINE CONDUCTED EMISSIONS

| Test Procedure | |
|----------------------------|--|
| Normative Reference | FCC 47 CFR §15.107, ICES-003(6.1) ANSI C63.4-2014 |
| Limits | |
| 47 CFR §15.107 | (a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges. 0.15-0.5MHz: 66-56 dBuV Quasi Peak, 56-46 dBuV Average, Decreases with the logarithm of the frequency 0.5 - 5.0 MHz: 56 dBuV Quasi Peak, 46 dBuV Average 5.0 - 30.0 MHz: 60 dBuV Quasi Peak, 50 dBuV Average |
| ICES-003(6.1) | 6.1 - AC Power Line Conducted Emissions Limits Class B: ITE that does not meet the conditions for Class A operation shall comply with the Class B radiated limits set out in Table 2. 0.15-0.5MHz: 66-56 dBuV Quasi Peak, 56-46 dBuV Average, Decreases with the logarithm of the 0.5 - 5.0 MHz: 56 dBuV Quasi Peak, 46 dBuV Average 5.0 - 30.0 MHz: 60 dBuV Quasi Peak, 50 dBuV Average |
| Test Setup | Appendix A Figure A.7 |

Plot 11.1 – Power Line Conducted Emissions, Line 1



Plot 11.2 – Power Line Conducted Emissions, Line 2

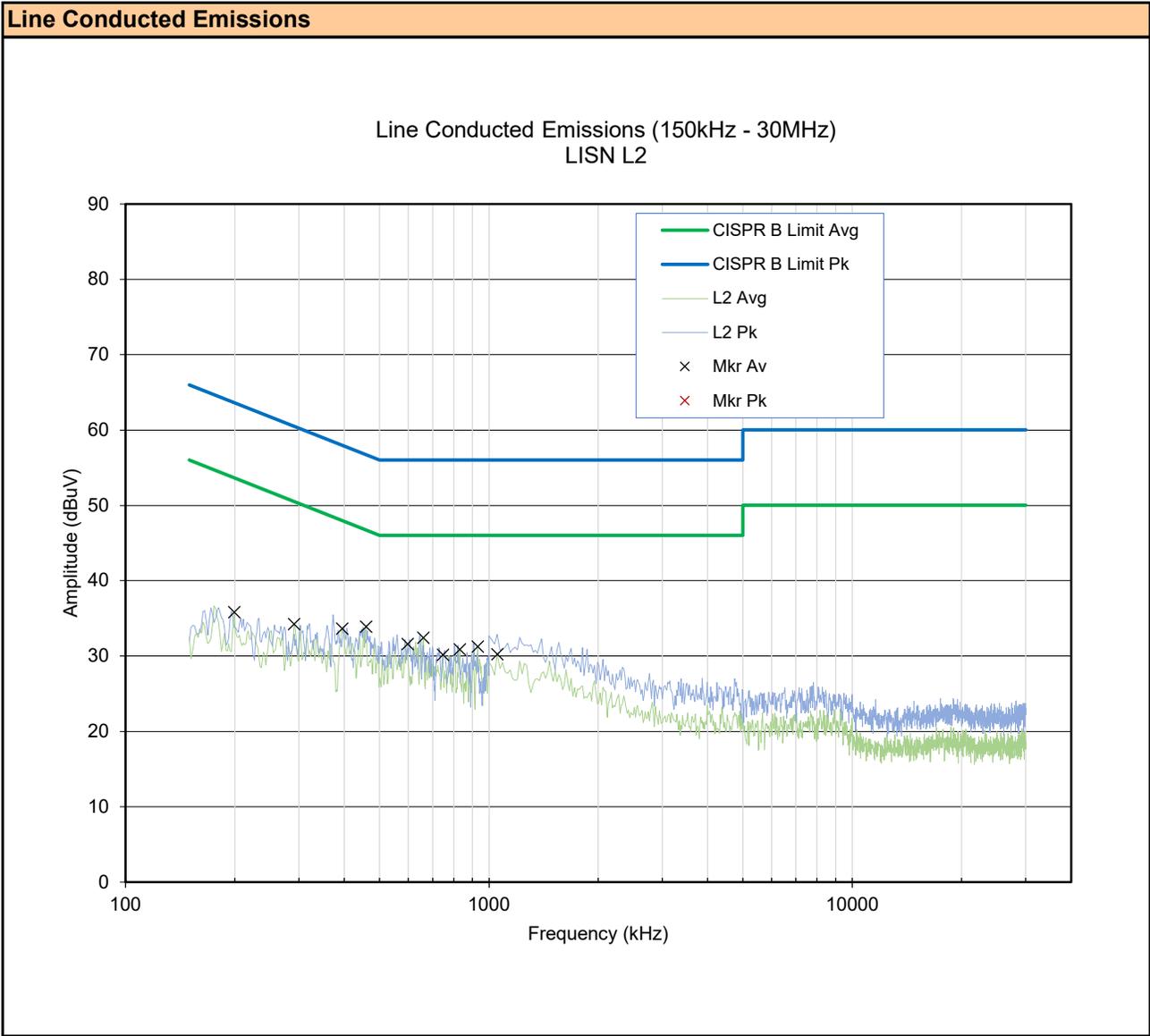


Table 11.1 – Summary of Power Line Conducted Emissions – L1

| §15.107, ICES-003 (6.1) | | | | | |
|--------------------------------|-------------|-----------------|----------------------------|-----------------|-----------------|
| Emission | LISN | Detector | Corrected Emission | Limit | Margin |
| Frequency | Port | | [E_{Corr}]* | [Limit] | [Margin] |
| | | | (W) | (dBuV/m) | (dB) |
| 192.5 kHz | L1 | Average | 36.40 | 54.3 | 17.9 |
| 263.9 kHz | L1 | Average | 35.65 | 51.6 | 15.9 |
| 396.5 kHz | L1 | Average | 32.39 | 48.0 | 15.6 |
| 403.3 kHz | L1 | Average | 34.31 | 47.9 | 13.6 |
| 586.9 kHz | L1 | Average | 33.40 | 46.0 | 12.6 |
| 685.5 kHz | L1 | Average | 33.26 | 46.0 | 12.7 |
| 717.8 kHz | L1 | Average | 31.38 | 46.0 | 14.6 |
| 847.0 kHz | L1 | Average | 31.48 | 46.0 | 14.5 |
| 977.9 kHz | L1 | Average | 29.92 | 46.0 | 16.1 |
| 1108.0 kHz | L1 | Average | 29.92 | 46.0 | 16.1 |
| Results: | | | | Complies | |

* Measurement Compensated for Cable Loss and Antenna Correction Factor

$$E_{Corr} = E_{Meas} + L_C + AFC$$

$$Margin = Limit - E_{Corr}$$

Table 11.2 – Summary of Power Line Conducted Emissions – L2

| §15.107, ICES-003 (6.1) | | | | | |
|--------------------------------|-------------|-----------------|----------------------------|-----------------|-----------------|
| Emission | LISN | Detector | Corrected Emission | Limit | Margin |
| Frequency | Port | | [E_{Corr}]* | [Limit] | [Margin] |
| | | | (W) | (dBuV/m) | (dB) |
| 199.3 kHz | L2 | Average | 35.83 | 54.0 | 18.2 |
| 291.1 kHz | L2 | Average | 34.22 | 50.7 | 16.5 |
| 394.8 kHz | L2 | Average | 33.64 | 48.1 | 14.4 |
| 459.4 kHz | L2 | Average | 33.88 | 46.7 | 12.9 |
| 597.1 kHz | L2 | Average | 31.59 | 46.0 | 14.4 |
| 660.0 kHz | L2 | Average | 32.40 | 46.0 | 13.6 |
| 746.7 kHz | L2 | Average | 30.14 | 46.0 | 15.9 |
| 831.7 kHz | L2 | Average | 30.85 | 46.0 | 15.2 |
| 932.0 kHz | L2 | Average | 31.23 | 46.0 | 14.8 |
| 1054.0 kHz | L2 | Average | 30.22 | 46.0 | 15.8 |
| Results: | | | | Complies | |

* Measurement Compensated for Cable Loss and Antenna Correction Factor

$$E_{Corr} = E_{Meas} + L_C + AFC$$

$$Margin = Limit - E_{Corr}$$

12.0 FREQUENCY STABILITY (NFC)

Test Conditions

| | |
|----------------------------|------------------------------------|
| Normative Reference | FCC 47 CFR §2.1055, §15.225 |
|----------------------------|------------------------------------|

Limits

| | |
|----------------|---|
| 47 CFR §15.225 | (e) The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+ 50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery. |
|----------------|---|

Measurement Procedure

47 CFR §2.1055 Frequency Stability

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From -30° to $+50^{\circ}$ centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

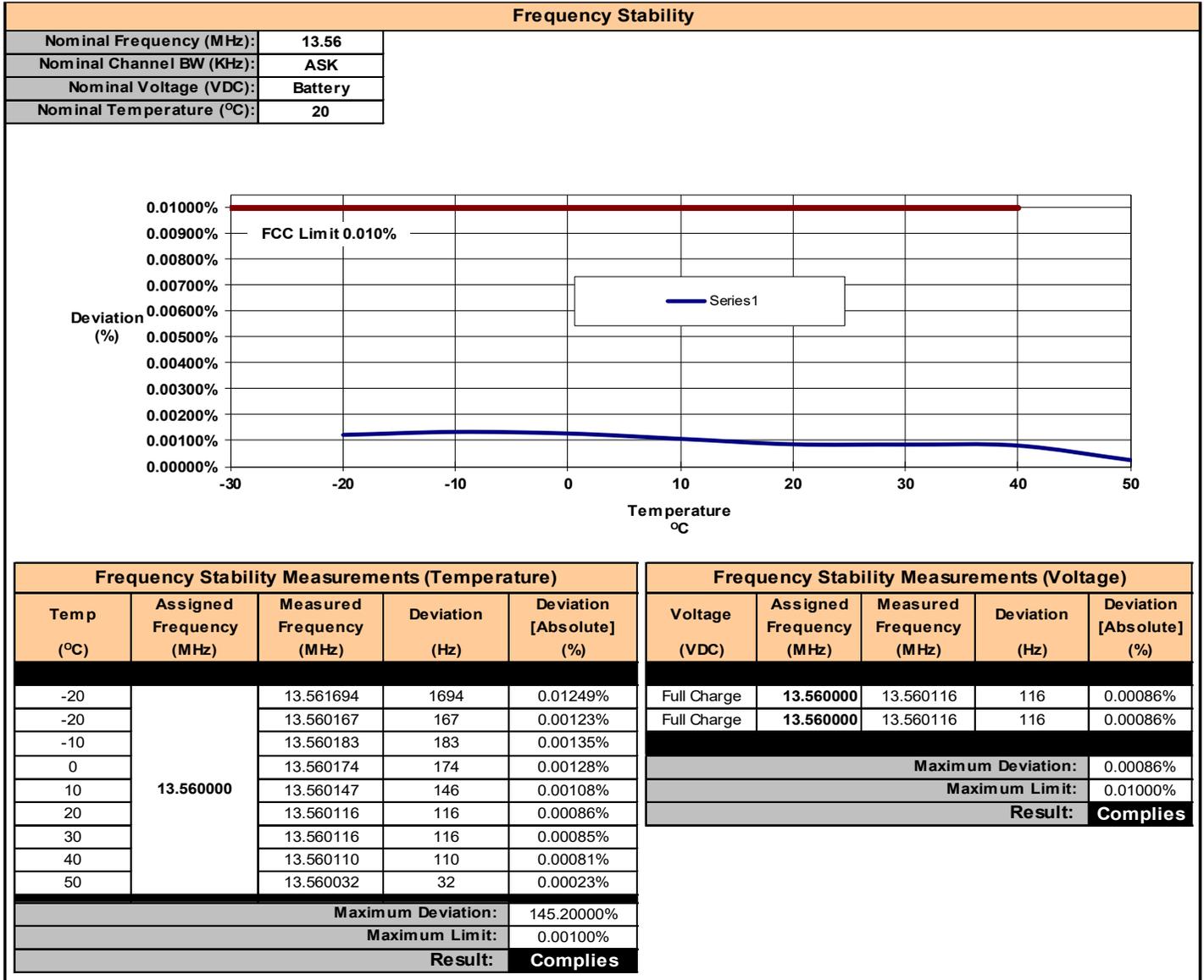
(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

| | | |
|-------------------|-------------------|----------|
| Test Setup | Appendix A | 5 |
|-------------------|-------------------|----------|

Table 12.1 – Summary of Frequency Stability Measurements – FCC



APPENDIX A – TEST SETUP DRAWINGS AND EQUIPMENT

Table A.1 – Setup - Conducted Measurements Equipment List

| Equipment List | | | | |
|----------------|--------------|---------------|---------------|-------------------|
| Asset Number | Manufacturer | Model Number | Serial Number | Description |
| 00241 | R&S | FSU40 | 100500 | Spectrum Analyzer |
| 00263 | Koaxis | KP10-1.00M-TD | 263 | 1m Armoured Cable |

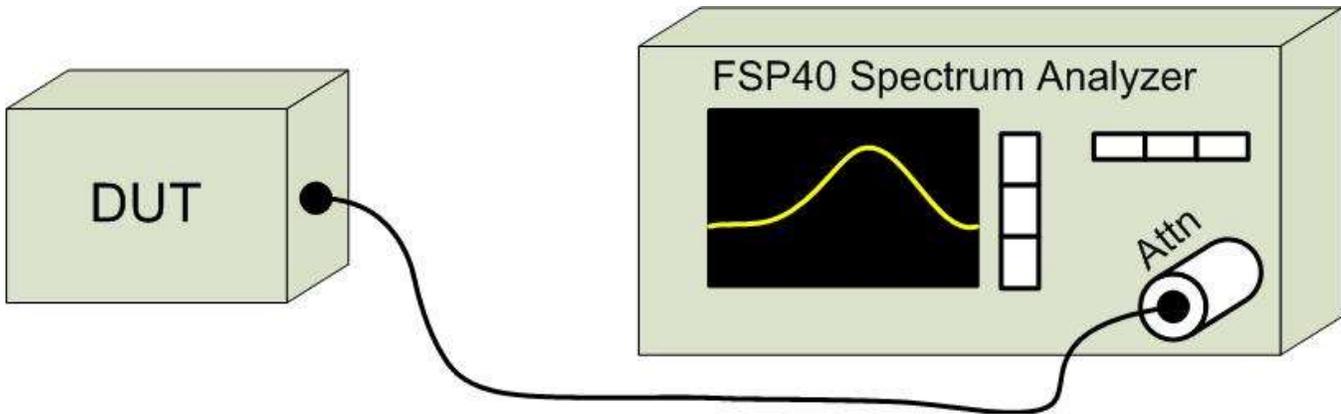


Figure A.1 – Test Setup Conducted Measurements

Table A.2 – Setup - Radiated Emissions Equipment List

| Equipment List | | | | |
|-----------------------|---------------------|---------------------|----------------------|-----------------------------|
| Asset Number | Manufacturer | Model Number | Serial Number | Description |
| 00050 | Chase | CBL-6111A | 1607 | Bilog Antenna |
| 00034 | ETS | 3115 | 6267 | Double Ridged Guide Horn |
| 00035 | ETS | 3115 | 6276 | Double Ridged Guide Horn |
| 00085 | EMCO | 6502 | 9203-2724 | Loop Antenna |
| 00161 | Waveline Inc. | 889 | | Standard Gain Horn 18-26GHz |
| 00162 | Waveline Inc. | 889 | | Standard Gain Horn 18-26GHz |
| 00165 | Waveline Inc. | 801-KF | | Waveguide Adapter 18-26GHz |
| 00166 | Waveline Inc. | 801-KF | | Waveguide Adapter 18-26GHz |
| 00333 | HP | 85685A | 3010A01095 | RF Preselector |
| 00049 | HP | 85650A | 2043A00162 | Quasi-peak Adapter |
| 00051 | HP | 8566B | 2747A05510 | Spectrum Analyzer |
| 00241 | R&S | FSU40 | 100500 | Spectrum Analyzer |
| 00265 | Miteq | JS32-00104000-58-5P | 1939850 | Microwave L/N Amplifier |
| 00071 | EMCO | 2090 | 9912-1484 | Multi-Device Controller |
| 00072 | EMCO | 2075 | 0001-2277 | Mini-mast |
| 00073 | EMCO | 2080 | 0002-1002 | Turn Table |
| 00263 | Koaxis | KP10-1.00M-TD | 263 | 1m Armoured Cable |
| 00263B | Koaxis | KP10-1.00M-TD | 263B | 1m Armoured Cable |
| 00275 | TMS | LMR400 | n/a | 25m Cable |
| 00278 | TILE | 34G3 | n/a | TILE Test Software |

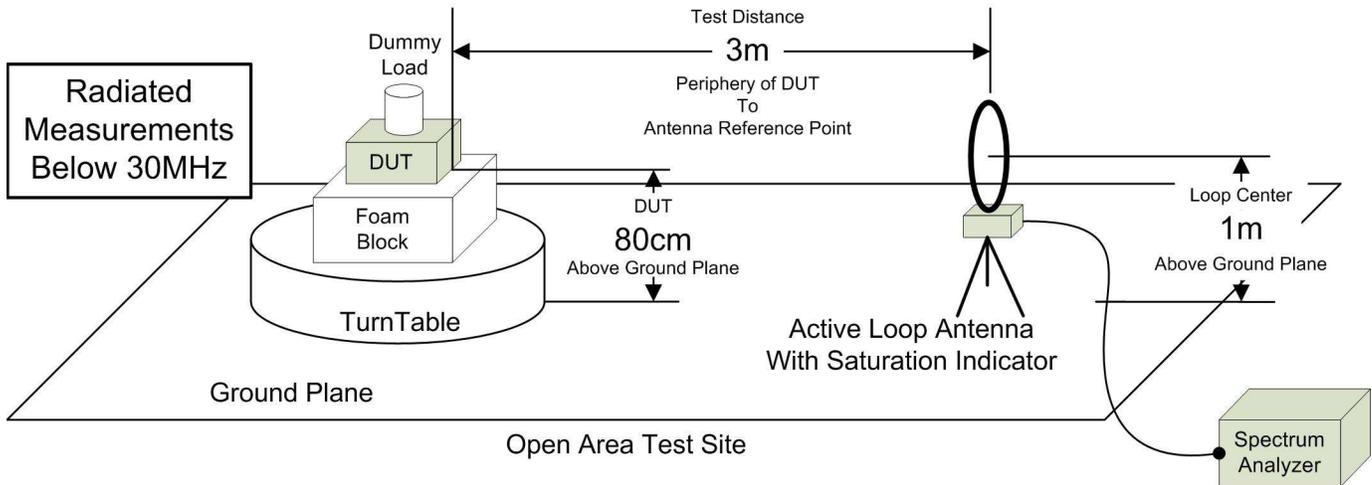


Figure A.2 – Test Setup Radiated Emissions Measurements Below 30MHz

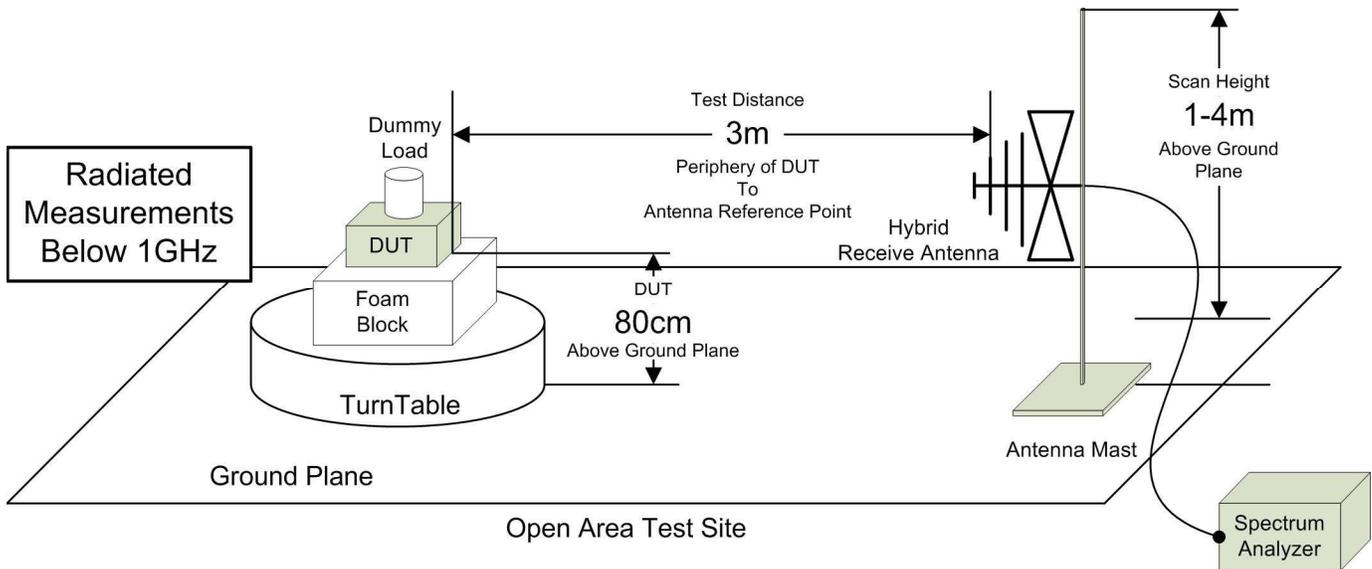


Figure A.3 – Test Setup Radiated Emissions Measurements 30 – 100MHz

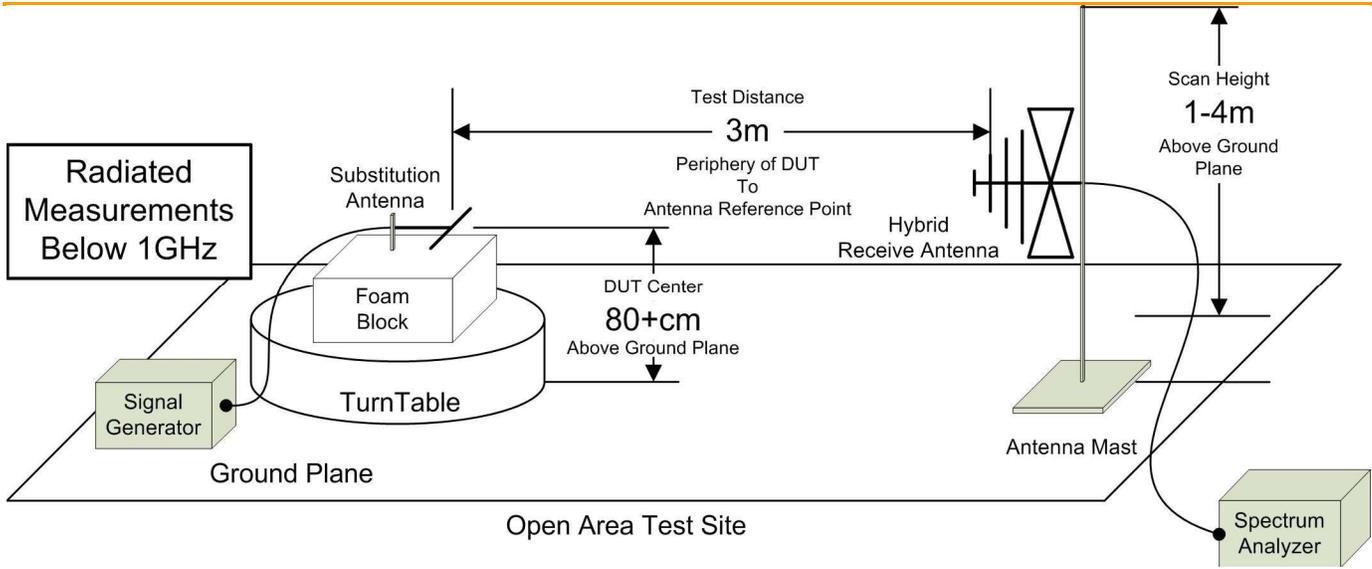


Figure A.4 – Test Setup Radiated Emissions Measurements 30 – 1000MHz Signal Substitution

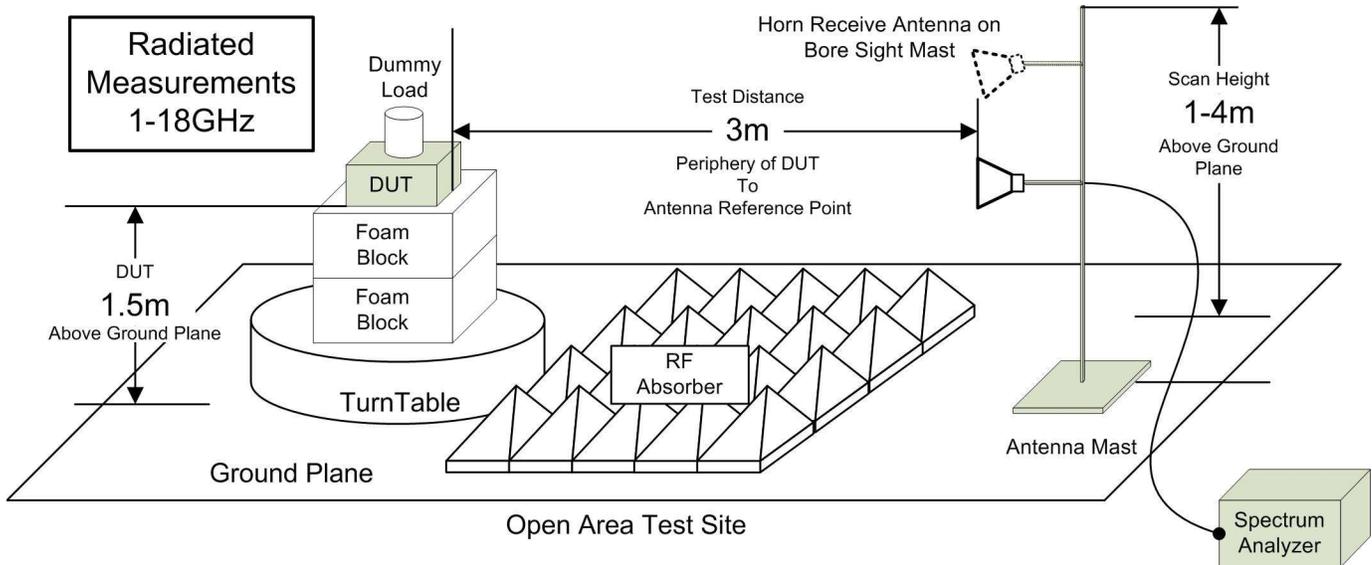


Figure A.5 – Test Setup Radiated Emissions Measurements 1 – 18GHz

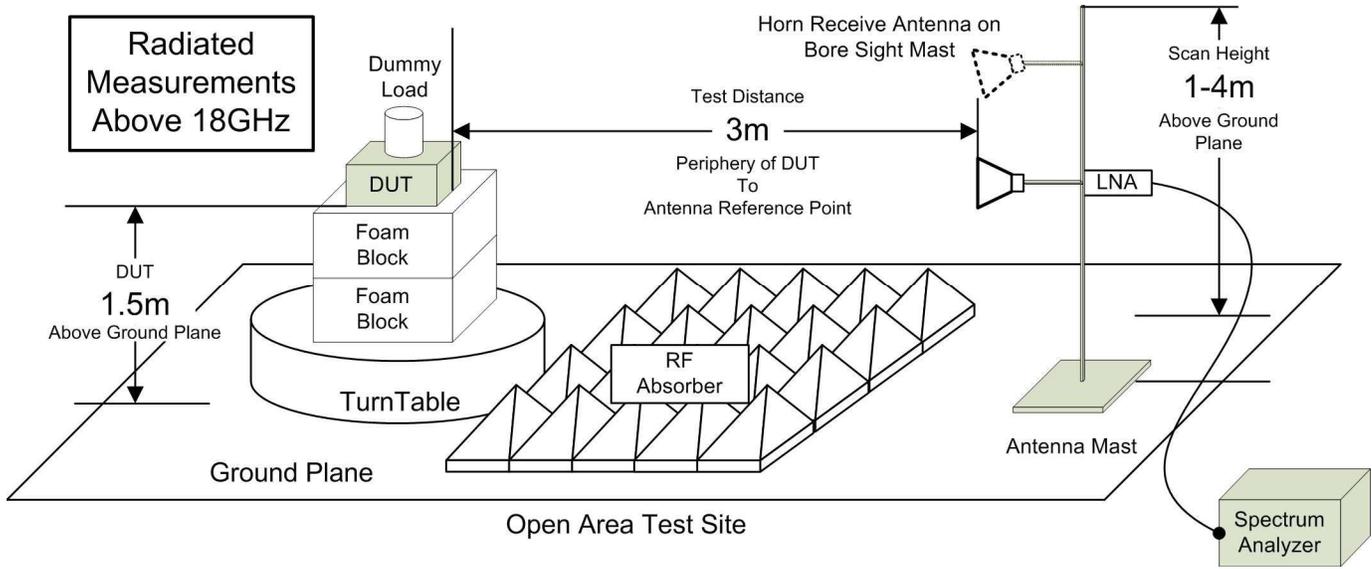


Figure A.6 – Test Setup Radiated Emissions Measurements Above 18 GHz

Table A.3 – Power Line Conducted Measurement Equipment

| Equipment List | | | |
|----------------|--------------|--------------|--------------------|
| Asset Number | Manufacturer | Model Number | Description |
| 00241 | R&S | FSU40 | Spectrum Analyzer |
| 00275 | Coaxis | LMR400 | 25m Cable |
| 00276 | Coaxis | LMR400 | 4m Cable |
| 00278 | TILE | 34G3 | TILE Test Software |
| 00257 | Comm Power | LI-215A | LISN |

Figure A.7 – Test Setup Power Line Conducted Measurements

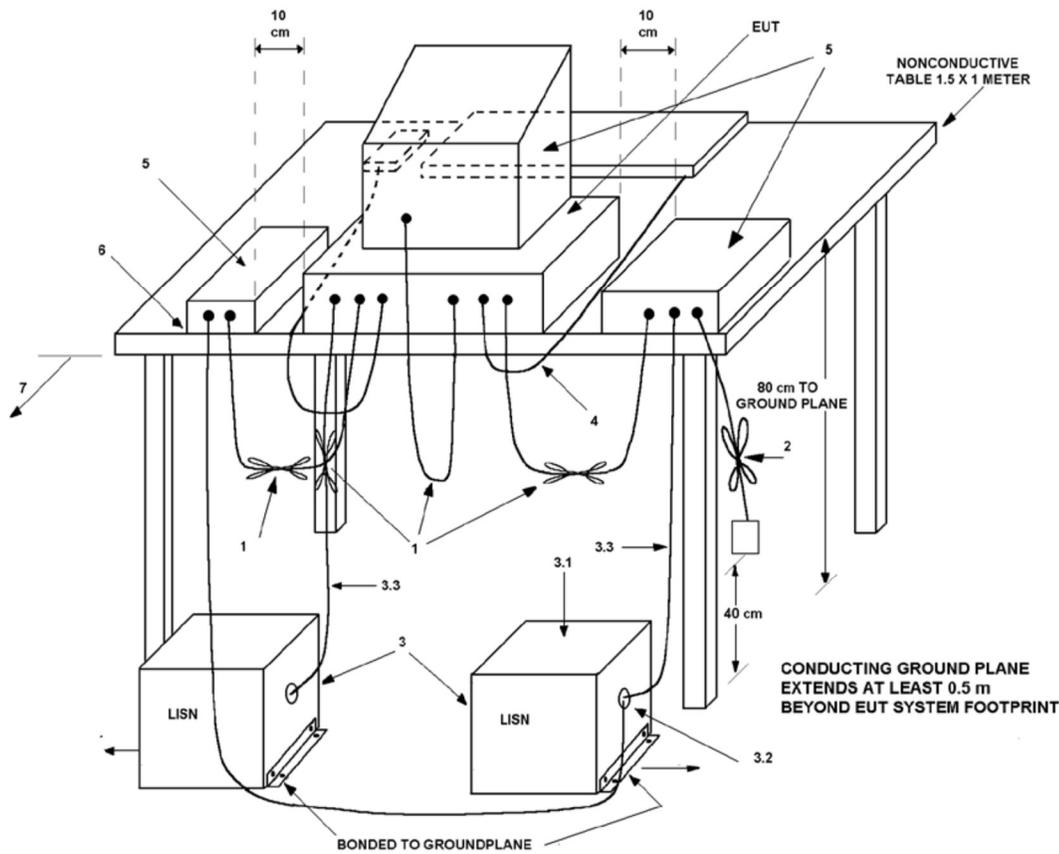


Table A.4 – Setup – Frequency Stability Equipment List

| Equipment List | | | | |
|-----------------------|---------------------|---------------------|----------------------|-----------------------|
| Asset Number | Manufacturer | Model Number | Serial Number | Description |
| 00241 | R&S | FSU40 | 100500 | Spectrum Analyzer |
| 00081 | ESPEC | ECT-2 | 0510154-B | Environmental Chamber |
| 00234 | VWR | 61161-378 | 140320430 | Temp/Humidity Meter |

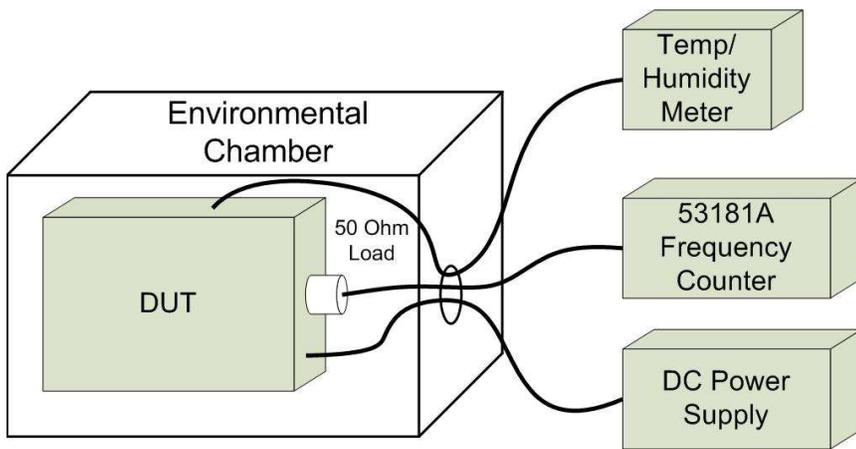


Figure A.8 – Frequency Stability

APPENDIX B – EQUIPMENT LIST AND CALIBRATION

| Equipment List | | | | | Last | Calibration | Calibration |
|----------------|---------------|---------------|---------------|-----------------------------|-------------|-------------|-------------|
| Asset Number | Manufacturer | Model Number | Serial Number | Description | Calibrated | Interval | Due |
| 00050 | Chase | CBL-6111A | 1607 | Bilog Antenna | 16 Nov 2023 | Triennial | 16 Nov 2026 |
| 00035 | ETS | 3115 | 6276 | Double Ridged Guide Horn | 4 Mar 2022 | Triennial | 4 Mar 2025 |
| 00085 | EMCO | 6502 | 9203-2724 | Loop Antenna | 6 Sep 2022 | Triennial | 6 Sep 2025 |
| 00161 | Waveline Inc. | 889 | | Standard Gain Horn 18-26GHz | NCR | n/a | NCR |
| 00165 | Waveline Inc. | 801-KF | | Waveguide Adapter 18-26GHz | NCR | n/a | NCR |
| 00241 | R&S | FSU40 | 100500 | Spectrum Analyzer | 10 Aug 2021 | Triennial | 10 Aug 2024 |
| 00005 | HP | 8648D | 3847A00611 | Signal Generator | 28 Jun 2023 | Triennial | 28 Jun 2026 |
| 00003 | HP | 53181A | 3736A05175 | Frequency Counter | 28 Jun 2023 | Triennial | 28 Jun 2026 |
| 00257 | Com-Power | LI-215A | 191934 | LISN | 27 Dec 2021 | Triennial | 27 Dec 2024 |
| 00071 | EMCO | 2090 | 9912-1484 | Multi-Device Controller | n/a | n/a | n/a |
| 00072 | EMCO | 2075 | 0001-2277 | Mini-mast | n/a | n/a | n/a |
| 00073 | EMCO | 2080 | 0002-1002 | Turn Table | n/a | n/a | n/a |
| 00081 | ESPEC | ECT-2 | 0510154-B | Environmental Chamber | NCR | n/a | CNR |
| 00234 | VWR | 61161-378 | 140320430 | Temp/Humidity Meter | New | Triennial | New |
| 00263 | Koaxis | KP10-1.00M-TD | 263 | 1m Armoured Cable | COU | n/a | COU |
| 00275 | TMS | LMR400 | n/a | 25m Cable | COU | n/a | COU |
| 00276 | TMS | LMR400 | n/a | 4m Cable | COU | n/a | COU |
| 00278 | TILE | 34G3 | n/a | TILE Test Software | NCR | n/a | NCR |

NCR: No Calibration Required
 COU: Calibrate On Use

APPENDIX C – MEASUREMENT INSTRUMENT UNCERTAINTY

| CISPR 16-4 Measurement Uncertainty (U_{LAB}) | |
|---|--|
| This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence interval using a coverage factor of k=2 | |
| Radiated Emissions 30MHz - 200MHz | |
| U _{LAB} = 5.14dB U _{CISPR} = 6.3dB | |
| Radiated Emissions 200MHz - 1000MHz | |
| U _{LAB} = 5.90dB U _{CISPR} = 6.3dB | |
| Radiated Emissions 1GHz - 6GHz | |
| U _{LAB} = 4.80dB U _{CISPR} = 5.2dB | |
| Radiated Emissions 6GHz - 18GHz | |
| U _{LAB} = 5.1dB U _{CISPR} = 5.5dB | |
| Power Line Conducted Emissions 9kHz to 150kHz | |
| U _{LAB} = 2.96dB U _{CISPR} = 3.8dB | |
| Power Line Conducted Emissions 150kHz to 30MHz | |
| U _{LAB} = 3.12dB U _{CISPR} = 3.4dB | |

| | |
|--|--|
| If the calculated uncertainty U _{lab} is less than U _{CISPR} then: | |
| 1 | Compliance is deemed to occur if NO measured disturbance exceeds the disturbance limit |
| 2 | Non-Compliance is deemed to occur if ANY measured disturbance EXCEEDS the disturbance limit |
| If the calculated uncertainty U _{lab} is greater than U _{CISPR} then: | |
| 3 | Compliance is deemed to occur if NO measured disturbance, increased by (U _{lab} - U _{CISPR}), exceeds the disturbance limit |
| 4 | Non-Compliance is deemed to occur if ANY measured disturbance, increased by (U _{lab} - U _{CISPR}), EXCEEDS the disturbance limit |

| Other Measurement Uncertainties (U_{LAB}) | |
|--|--|
| RF Conducted Emissions 9kHz - 40GHz | |
| U _{LAB} = 1.0dB U _{CISPR} = n/a | |
| Frequency/Bandwidth 9kHz - 40GHz | |
| U _{LAB} = 0.1ppm U _{CISPR} = n/a | |
| Temperature | |
| U _{LAB} = 1°C U _{CISPR} = n/a | |

END OF REPORT

APPENDIX I– RADIATED TX EMISSIONS MEASUREMENT PLOTS

APPENDIX J– RADIATED RX MEASUREMENT PLOTS



| | |
|----------------------------|---------------|
| Test Report Serial Number: | 45461921 R2.0 |
| Test Report Date: | 29 April 2024 |
| Project Number: | 1658 |

EMC Test Report - New Certification

Applicant:



Garmin International Inc.
1200 East 151 St
Olathe, KS, 66062
USA

FCC ID:

IPH-04808

Product Model Number / HVIN

A04808

Product Marketing Name / PMN

A04808

In Accordance With:

CFR Title 47, Part 15 Subpart C (§15.247), Part 15 Subpart B
 Digital Transmission System (DTS)

Approved By:

Ben Hewson, President
 Celltech Labs Inc.
 21-364 Lougheed Rd.
 Kelowna, BC, V1X7R8
 Canada



Test Lab Certificate: 2470.01



**Industry
 Canada**

IC Registration 3874A



FCC Registration: CA3874

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1.0 REVISION HISTORY

| Revision History | | | | | |
|----------------------------|----------------------------------|------------------|-------------------------------|---------------|--------------------------|
| Samples Tested By: | | Art Voss, P.Eng. | Date(s) of Evaluation: | | 18 March - 6 April, 2024 |
| Report Prepared By: | | Art Voss, P.Eng. | Report Reviewed By: | | Ben Hewson |
| Report Revision | Description of Revision | Revised Section | Revised By | Revision Date | |
| 0.1 | Draft | n/a | Art Voss | 11 April 2024 | |
| 0.2 | Revised per applicant's comments | - | Art Voss | 15 April 2024 | |
| 1.0 | Initial Release | - | Art Voss | 19 April 2024 | |
| 2.0 | Revised OBW Measurements | 7 | Art Voss | 29 April 2024 | |

2.0 CLIENT AND DUT INFORMATION

| Client Information | |
|--|--|
| Applicant Name | Garmin International Inc. |
| Applicant Address | 1200 East 151 St |
| | Olathe, KS, 66062 |
| | USA |
| DUT Information | |
| Device Identifier(s): | FCC ID: IPH-04808 |
| Device Model(s) / HVIN: | A04808 |
| Device Marketing Name / PMN: | A04808 |
| Test Sample Serial No.: | 3469058597 - Conducted, 3469058595 - OTA |
| Device Type: | Portable Transceiver |
| Equipment Class: | Digital Transmission Systems (DTS) |
| | Spread Spectrum Transmitter (DSS) |
| | Low Power Communication Device (DTS) |
| | Global Navigation Satellite System (GNSS) Receivers |
| | NFC - Low Power Communication Device Transmitter (DXX) |
| Transmit Frequency Range: | WiFi (DTS): 2412-2472MHz |
| | BT/BLE/ANT: 2402-2480MHz |
| | NFC: 13.56MHz |
| Manuf. Max. Rated Output Power: | WiFi - Digital Transmission System (DTS): 12.2dBm EIRP |
| | BlueTooth - Spread Spectrum Transmitter (DSS): 6.2dBm EIRP |
| | BLE/ANT - Low Power Communication Device Transmitter (DTS): -2.3dBm EIRP |
| | NFC - Low Power Communication Device Transmitter (DXX): 55.62dBuV/m |
| Antenna Type and Gain: | -3.8dBi Max Slot Antenna |
| Modulation: | WiFi: DSSS, OFDM, CCK, MCS0-7 |
| | BT BR: GFSK |
| | BT EDR: Pi/4-DQPSK, 8DPSK |
| | BLE: GMSK |
| | ANT: GFSK |
| | NFC: ASK |
| DUT Power Source: | 4.5VDC Rechargeable Li-Ion |
| DUT Dimensions [LxWxD] | H x W x D: 51mm dia x 4.5mm |
| Deviation(s) from standard/procedure: | None |
| Modification of DUT: | None |

3.0 SCOPE

Preface:

This Certification Report was prepared on behalf of:

Garmin International Inc.

, (the '*Applicant*'), in accordance with the applicable Federal Communications Commission (FCC) CFR 47 and Innovation, Scientific and Economic Development (ISED) Canada rules parts and regulations (the '*Rules*'). The scope of this investigation was limited to only the equipment, devices and accessories (the '*Equipment*') supplied by the *Applicant*. The tests and measurements performed on this *Equipment* were only those set forth in the applicable *Rules* and/or the Test and Measurement Standards they reference. The *Rules* applied and the Test and Measurement Standards used during this evaluation appear in the Normative References section of this report. The limits set forth in the technical requirements of the applicable *Rules* were applied to the measurement results obtained during this evaluation and, unless otherwise noted, these limits were used as the Pass/Fail criteria. The Pass/Fail statements made in this report apply to only the tests and measurements performed on only the *Equipment* tested during this evaluation. Where applicable and permissible, information including test and measurement data and/or results from previous evaluations of same or similar equipment, devices and/or accessories may be cited in this report.

Device:

The Garmin Model/HVIN: A04808 is a portable transceiver device consisting of a WiFi, BlueTooth (BT), BlueTooth Low Energy (BLE), Adaptive Network Topology (ANT) and Near Field Communication (NFC) transceivers. The WiFi and BT/BLE/ANT transceivers share the same antenna and cannot simultaneously transmit.

Requirement:

The transceivers of this *equipment* are subject to emissions evaluation in accordance with FCC: 47 CFR 2, 15C. As per FCC 47 CFR §2.1093, an RF Exposure (SAR) evaluation is required for this *Equipment* and the results of the RF Exposure (SAR) evaluation appear in a separate report.

Application:

This is an application for a New Certification.

Scope:

The scope of this investigation is limited to the evaluation and reporting of the wanted and spurious emissions in accordance with the rule parts cited in Normative References section of this report.

4.0 TEST SUMMARY

| TEST SUMMARY | | | | | |
|---------------------|--|---------------------------------------|------------------------------------|------------------|---------------|
| Section | Description of Test | Procedure Reference | Applicable Rule Part(s) FCC | Test Date | Result |
| 7.0 | Occupied Bandwidth | ANSI C63.10-2013 KDB 558074 D01v05 | §2.1049 | 26 Mar 2024 | Pass |
| 8.0 | DTS Bandwidth | ANSI C63.10-2013 KDB 558074 D01v05 | §15.247(a)(2) | 26 Mar 2024 | Pass |
| 9.0 | Conducted Power (Fundamental) | ANSI C63.10-2013 KDB 558074 D01v05 | §2.1046 §15.247(b)(3) | 29 Feb 2024 | Pass |
| 10.0 | Conducted Power (Fundamental) | ANSI C63.10-2013 KDB 558074 D01v05 | §2.1046 §15.247(b)(1) | 21 Mar 2024 | Pass |
| 11.0 | Power Spectral Density | ANSI C63.10-2013 KDB 558074 D01v05 | §15.247(e) | 26 Mar 2024 | Pass |
| 12.0 | FHSS Hopping Characteristics | ANSI C63.4-2014 KDB 558074 D01v05 | §15.247(a)(1)(iii) | 28 Mar 2024 | Pass |
| 13.0 | FHSS Channel Separation | ANSI C63.4-2014 KDB 558074 D01v05 | §15.247(a)(1) | 28 Mar 2024 | Pass |
| 14.0 | FHSS Time of Occupancy | ANSI C63.4-2014 KDB 558074 D01v05 | §15.247(a)(1)(iii) | 28 Mar 2024 | Pass |
| 15.0 | Conducted Tx Spurious Emissions Band Edge | ANSI C63.10-2013 KDB 558074 D01v05 | §2.1051 §15.247(d) | 21 Mar 2024 | Pass |
| 16.0 | Conducted Tx Spurious Emissions | ANSI C63.10-2013 KDB 558074 D01v05 | §2.1051 §15.247(d) | 1 Apr 2020 | Pass |
| 17.0 | Radiated Tx Spurious Emissions And Restricted Band | ANSI C63.4-2014 KDB 558074 D01v05 | §15.109 §15.247(d) | 2-3 Apr 2024 | Pass |
| 18.0 | Radiated Rx Spurious Emissions | ANSI C63.4-2014 KDB 558074 D01v05 | §15.109 | 2-3 Apr 2024 | Pass |
| 19.0 | Power Line Conducted Emissions | ANSI C63.4-2014 | §15.107 | 5 Apr 2024 | Pass |

| Test Station Day Log | | | | | |
|----------------------|-------------------|-----------------------|---------------------------|--------------|----------------------------|
| Date | Ambient Temp (°C) | Relative Humidity (%) | Barometric Pressure (kPa) | Test Station | Tests Performed Section(s) |
| 29 Feb 2024 | 20.8 | 17 | 101.3 | EMC | 9 |
| 21 Mar 2024 | 21.2 | 16 | 101.2 | EMC | 10, 15 |
| 26 Mar 2024 | 20.0 | 16 | 101.2 | EMC | 7, 8, 11 |
| 28 Mar 2024 | 23.1 | 16 | 100.8 | EMC | 12, 13, 14 |
| 1 Apr 2024 | 22.1 | 17 | 100.9 | EMC | 16 |
| 2 Apr 2024 | 10.0 | 60 | 101.9 | OATS | 17, 18 |
| 3 Apr 2024 | 9.0 | 36 | 101.9 | OATS | 17, 18 |
| 5 Apr 2024 | 17.0 | 37 | 100.7 | LISN | 19 |

EMC - EMC Test Bench **SAC** - Semi-Anechoic Chamber
OATS - Open Area Test Site **TC** - Temperature Chamber
LISN - LISN Test Area **ESD** - ESD Test Bench
IMM - Immunity Test Area **RI** - Radiated Immunity Chamber

| | |
|---|--|
| <p>I attest that the data reported herein is true and accurate within the tolerance of the Measurement Instrument Uncertainty; that all tests and measurements were performed in accordance with accepted practices or procedures; and that all tests and measurements were performed by me or by trained personnel under my direct supervision. The results of this investigation are based solely on the test sample(s) provided by the client which were not adjusted, modified or altered in any manner whatsoever, except as required to carry out specific tests or measurements. This test report has been completed in accordance with ISO/IEC 17025.</p> |  <hr/> <p>Art Voss, P.Eng. Technical Manager Celltech Labs Inc.</p> <p>11 April 2024 Date</p>  |
|---|--|

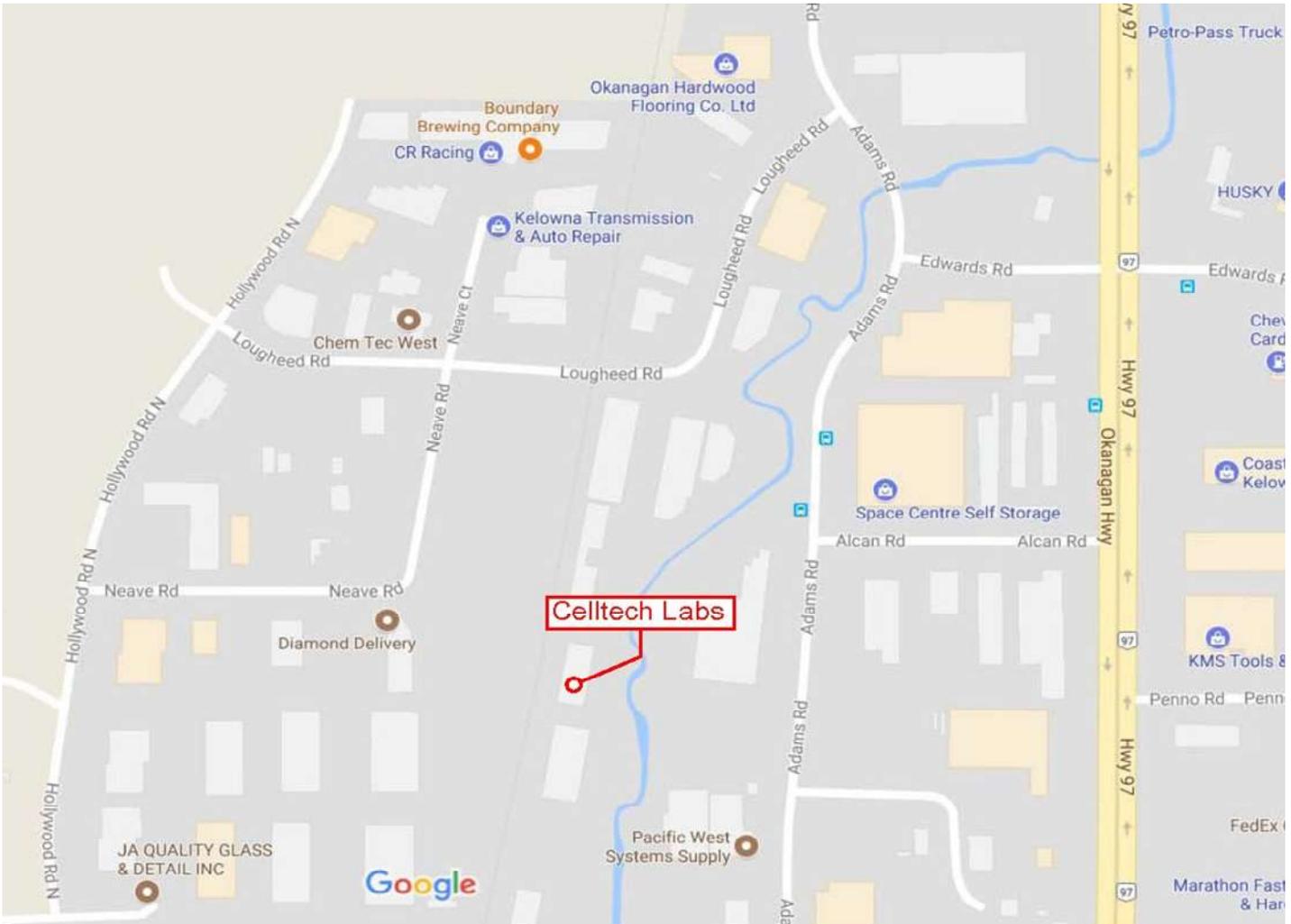
5.0 NORMATIVE REFERENCES

| Normative References | |
|-----------------------------|---|
| ISO/IEC 17025:2017 | General requirements for the competence of testing and calibration laboratories |
| ANSI C63.4-2014 | American National Standard of Procedures for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electric and Electronic Equipment in the Range of 9kHz to 40GHz |
| ANSI C63.10-2013 | American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices |
| CFR | Code of Federal Regulations Title 47: Telecommunication Part 2: Frequency Allocations and Radio Treaty Matters; General Rules and Regulations |
| CFR | Code of Federal Regulations Title 47: Telecommunication Part 15: Radio Frequency Devices Subpart B: Unintentional Radiators |
| CFR | Code of Federal Regulations Title 47: Telecommunication Part 15: Radio Frequency Devices Sub Part C (15.247) Intentional Radiators |
| FCC KDB 558074 D01v05r02 | OET Major Guidance Publications, Knowledge Data Base Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under Section 15.247 |

6.0 FACILITIES AND ACCREDITATIONS

Facility and Accreditation:

The facilities used to evaluate this device outlined in this report are located at 21-364 Lougheed Road, Kelowna, British Columbia, Canada V1X 7R8. The radiated emissions site (OATS) conforms to the requirements set forth in ANSI C63.4 and is filed and listed with the FCC under Test Firm Registration Number CA3874 and Innovation, Science and Economic Development Canada under Test Site File Number ISED 3874A. Celltech is accredited to ISO 17025, through accrediting body A2LA and with certificate 2470.01.



7.0 OCCUPIED BANDWIDTH

Test Procedure

| | |
|----------------------------|--|
| Normative Reference | FCC 47 CFR §2.1046, §15.247(b)(3), RSS-Gen (6.1.2), RSS-247 (5.4)(d), KDB 558074 (8.3.2.1), ANSI C63.10 (6.9.3) |
|----------------------------|--|

General Procedure

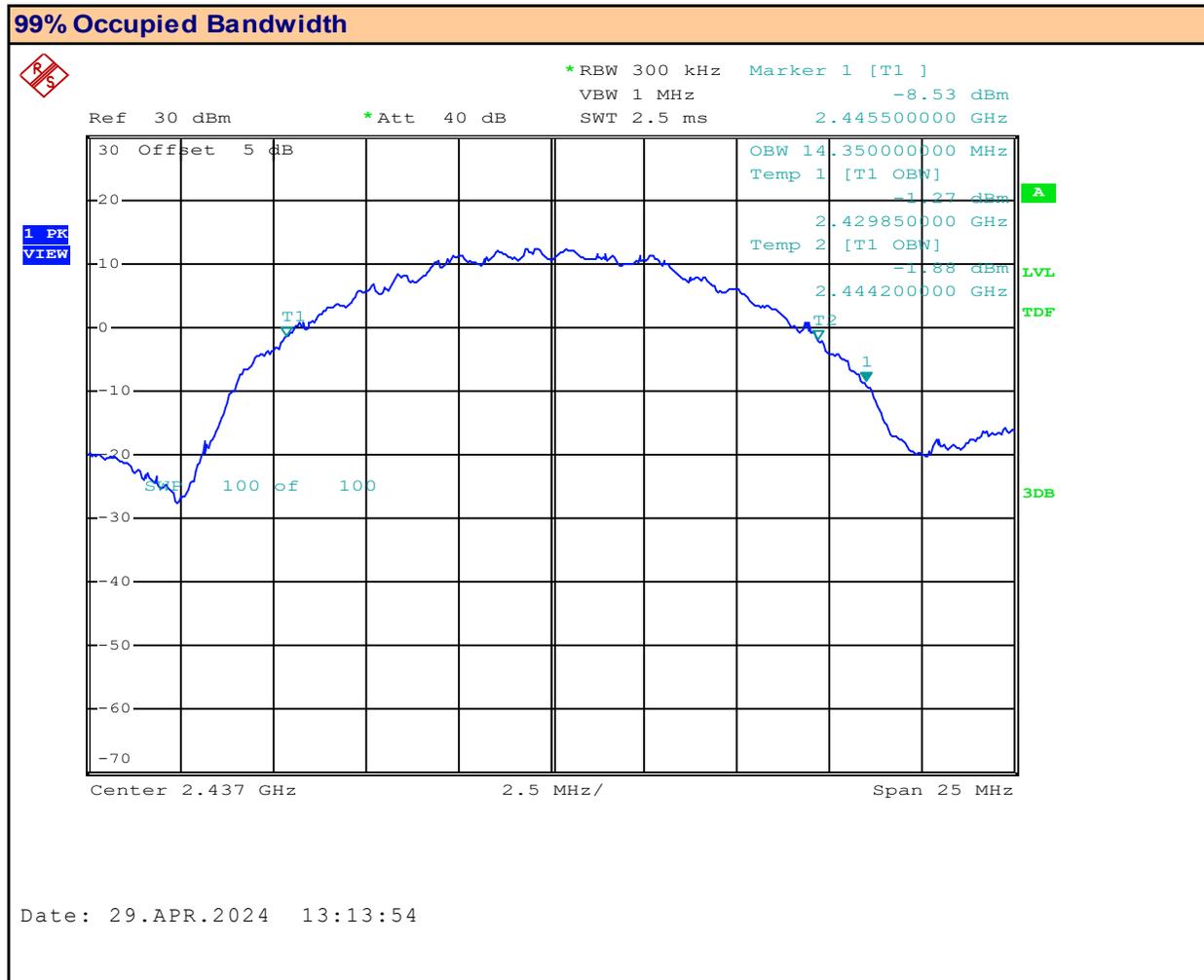
| | |
|----------------------|---|
| KDB 558074 (8.3.2.1) | <p>8.3.2.1 General</p> <p>Section 15.247 permits the maximum conducted (average) output power to be measured as an alternative to the maximum peak conducted output power for demonstrating compliance to the limit. When this option is exercised, the measured power is to be referenced to the OBW rather than the DTS bandwidth.</p> |
| C63.10 (6.9.3) | <p>6.9.3 Occupied bandwidth—power bandwidth (99%) measurement procedure</p> <p>The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. The following procedure shall be used for measuring 99% power bandwidth:</p> <ol style="list-style-type: none"> The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW. The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement. Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than $[10 \log (\text{OBW}/\text{RBW})]$ below the reference level. Specific guidance is given in 4.1.5.2. Step a) through step c) might require iteration to adjust within the specified range. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used. Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth. |

| | |
|-------------------|--------------------------------|
| Test Setup | Appendix A - Figure A.1 |
|-------------------|--------------------------------|

Measurement Procedure

The DUT was connected to a Spectrum Analyzer (SA) via a 30dB attenuator connected to the DUT's antenna port. The SA was configured as described above using the 99% Occupied Bandwidth function. The output power of the DUT was set to the manufacturer's highest output power setting at the Low, Mid and High frequency channels as permitted by the device. The DUT was set to transmit at its maximum Duty Cycle. The 99% Occupied Bandwidth was measured and recorded and used for the basis for measuring the Conducted Output Power (See Section 10.0) and Power Spectral Density (See Section 11.0).

Plot 7.1 – Occupied Bandwidth, 802.11b

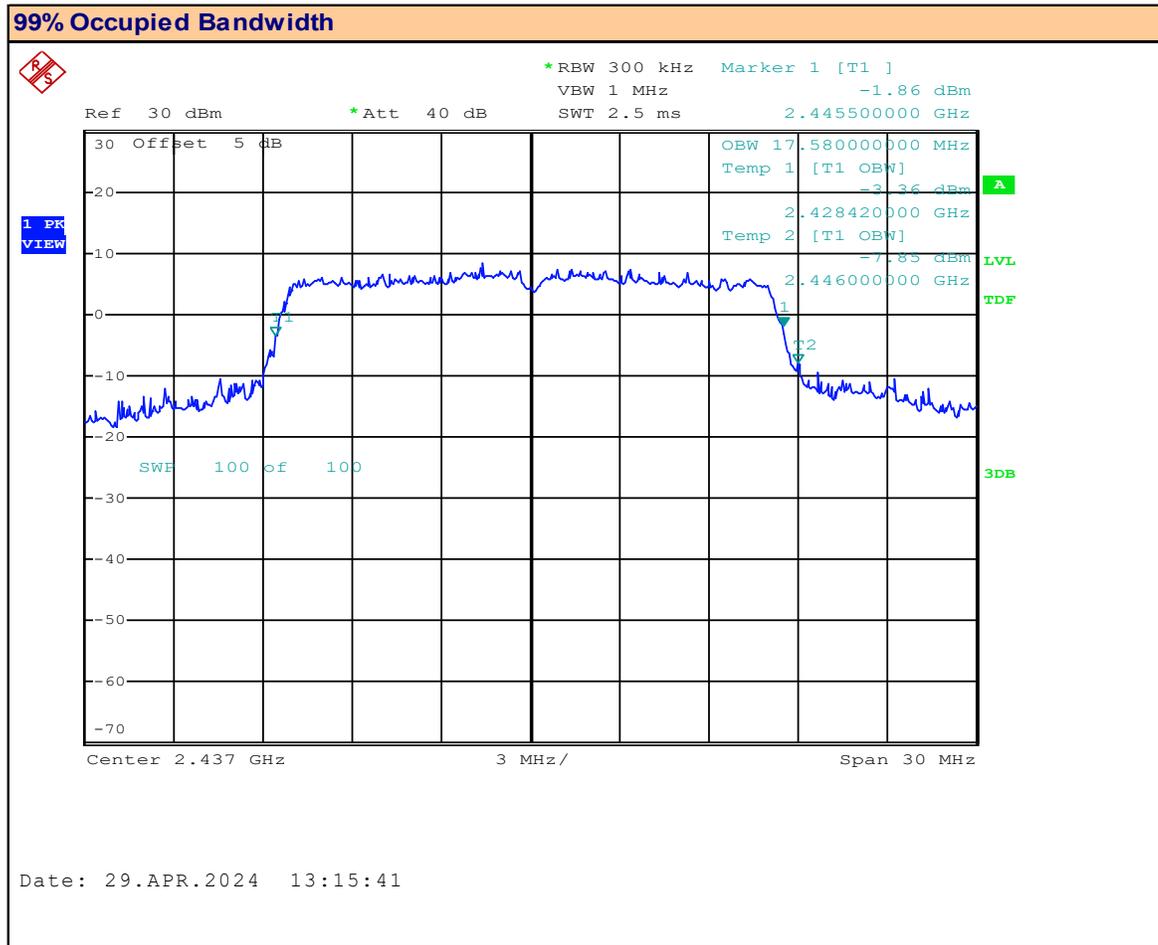


Channel: **6**
 Mode: **802.11b**

Channel Frequency: **2437** MHz
 Modulation: **DSSS 5.5**

Measured Occupied Bandwidth: **14.35** MHz

Plot 7.2 – Occupied Bandwidth, 802.11g

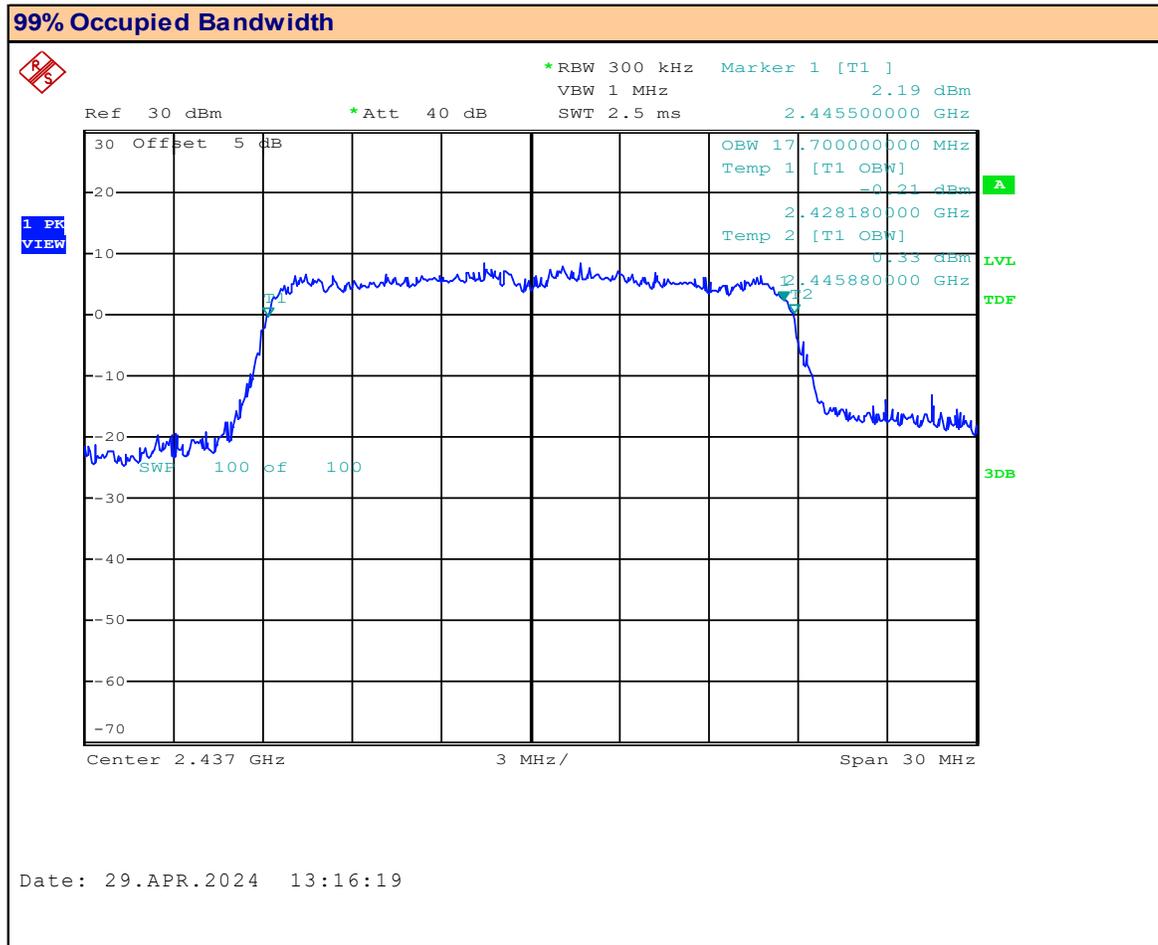


Channel: **6**
 Mode: **802.11g**

Channel Frequency: **2437** MHz
 Modulation: **OFDM 12**

Measured Occupied Bandwidth: **17.58** MHz

Plot 7.3 – Occupied Bandwidth, 802.11n



Channel: **6**
 Mode: **802.11n**

Channel Frequency: **2437** MHz
 Modulation: **MCS0**
 Measured Occupied Bandwidth: **17.7** MHz

Plot 7.4 – Occupied Bandwidth, BLE1



Channel:
 Mode:

Channel Frequency: MHz
 Modulation:
 Measured Occupied Bandwidth: MHz

Plot 7.5 – Occupied Bandwidth, BLE2

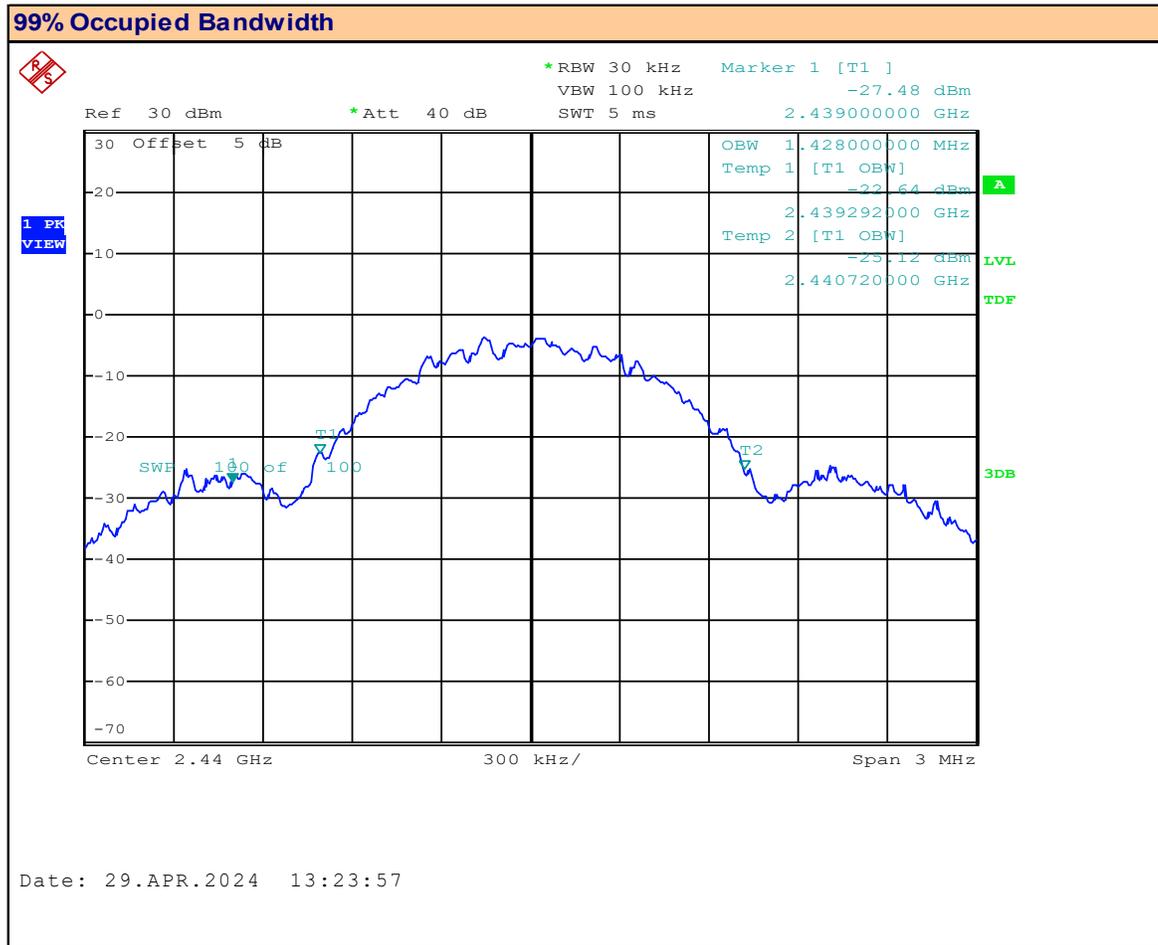


Channel:
 Mode:

Channel Frequency: MHz
 Modulation:

Measured Occupied Bandwidth: MHz

Plot 7.6 – Occupied Bandwidth, ANT



Channel:
 Mode:

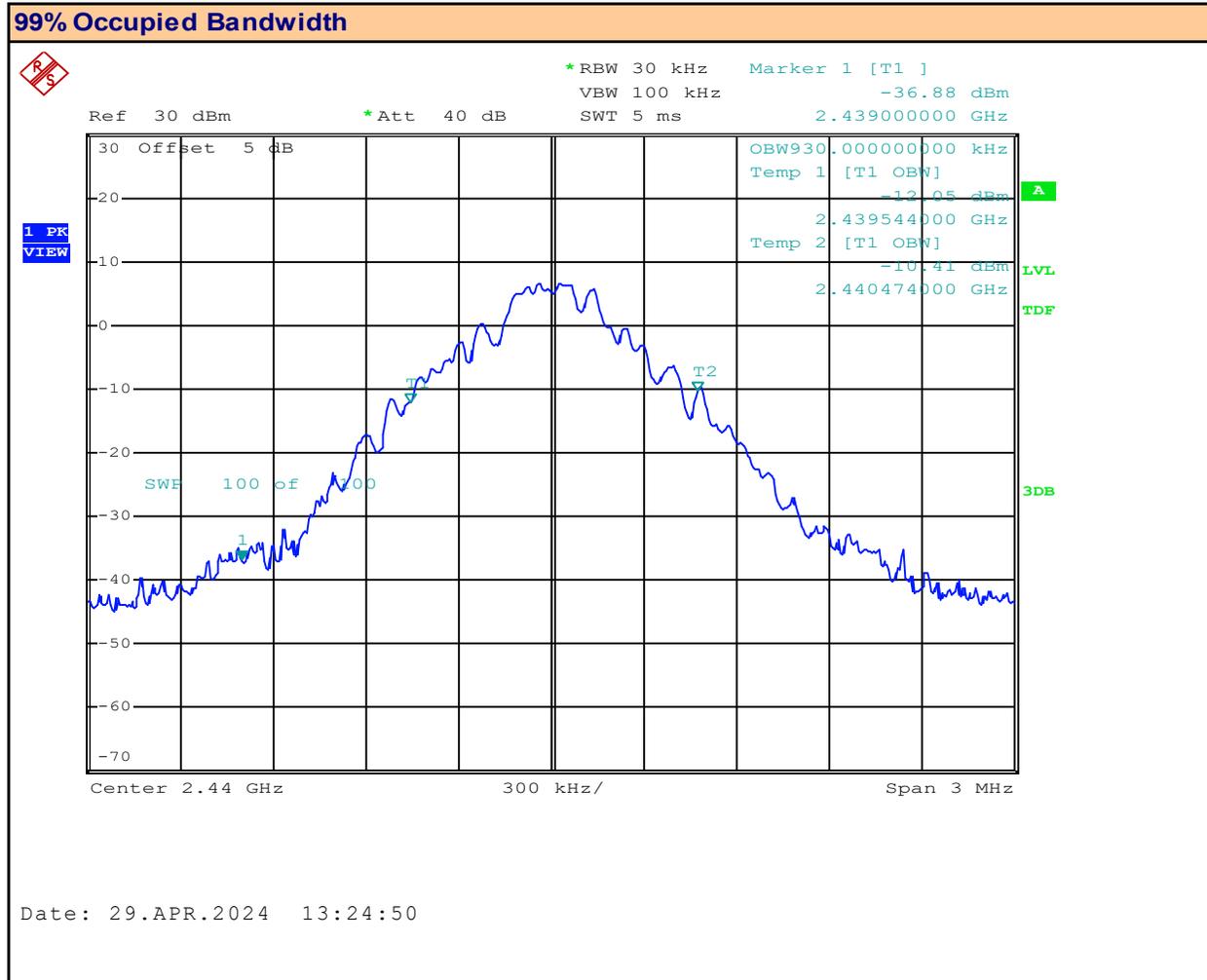
Channel Frequency: MHz
 Modulation:

Measured Occupied Bandwidth: kHz

Table 7.1 – Summary of Occupied Bandwidth Measurements, (DTS)

| 99% Occupied Bandwidth Results: DTS | | | | | |
|--|--------------------------------|-------------|-------------------|--|----------------------------|
| Channel Number | Channel Frequency (MHz) | Mode | Modulation | Measured Occupied Bandwidth (MHz) | Emission Designator |
| 6 | 2437.0 | 802.11b | DSSS 5.5 | 14.4 | 14M4D1D |
| | | 802.11g | OFDM 12 | 17.6 | 17M6D1D |
| | | 802.11n | MCS0 | 17.7 | 17M7D1D |
| 17 | 2440.0 | BLE 1mb | GMSK | 1.38 | 1M38G1D |
| 17 | | BLE 2mb | GMSK | 2.65 | 2M65G1D |
| 38 | | ANT | GFSK | 1.43 | 1M43F1D |
| Result: | | | | | Complies |

Plot 7.7 – Occupied Bandwidth, BT BR

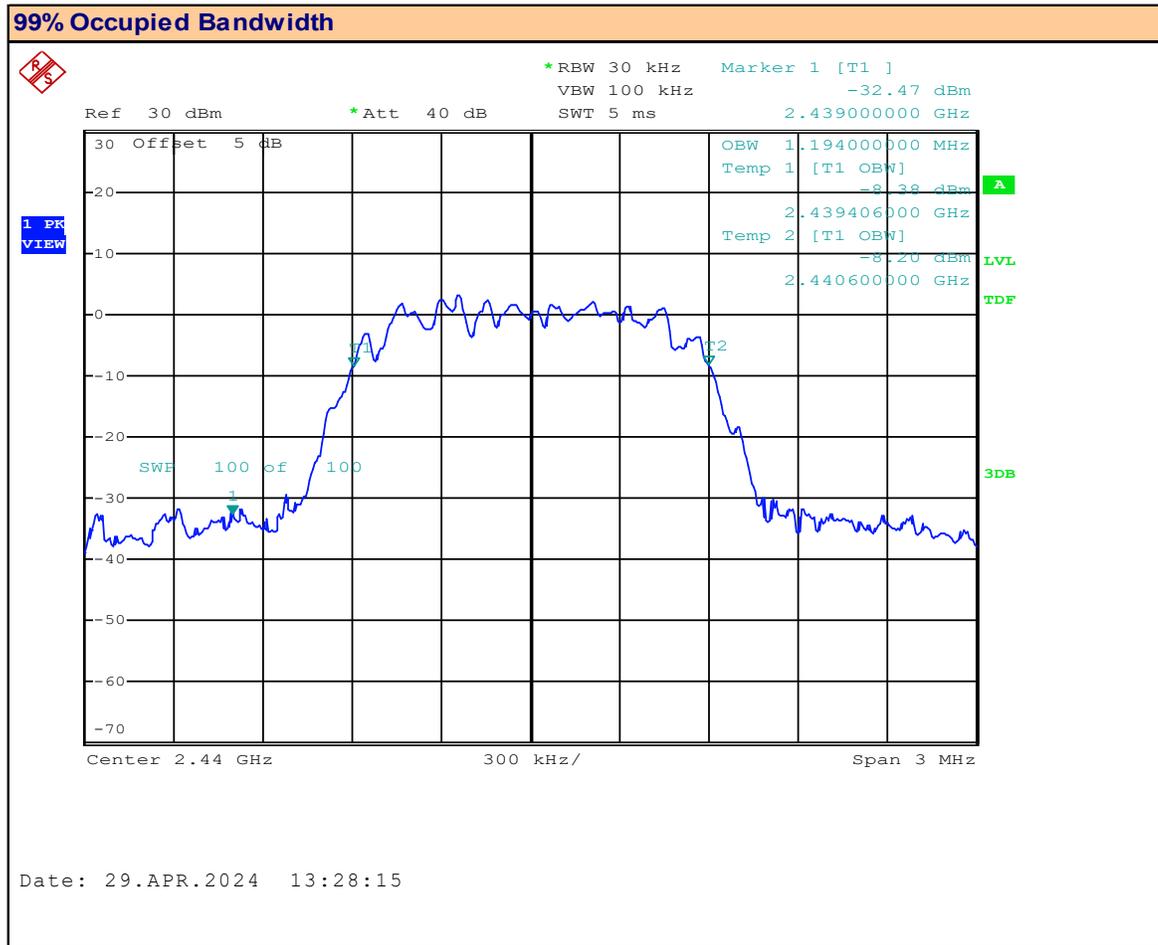


Channel:
 Mode:

Channel Frequency: MHz
 Modulation:

Measured Occupied Bandwidth: kHz

Plot 7.8 – Occupied Bandwidth, BT 2EDR



Channel: **38**
 Mode: **BT 2EDR**

Channel Frequency: **2440** MHz
 Modulation: **Pi/4-DQPSK**

Measured Occupied Bandwidth: **1194** kHz

Plot 7.9 – Occupied Bandwidth, BT 3EDR



Channel: **38**
 Mode: **BT 3EDR**

Channel Frequency: **2440** MHz
 Modulation: **8-DPSK**

Measured Occupied Bandwidth: **1242** kHz

Table 7.2 – Summary of Occupied Bandwidth Measurements (DSS)

| 99% Occupied Bandwidth Results: DSS | | | | | |
|--|--------------------------------|-------------|-------------------|--|----------------------------|
| Channel Number | Channel Frequency (MHz) | Mode | Modulation | Measured Occupied Bandwidth (kHz) | Emission Designator |
| 38 | 2440.0 | BT BR | GFSK | 930.0 | 930KF1D |
| | | BT 2EDR | PI/4-DQPSK | 1194.0 | 1M19G1D |
| | | BT 3EDR | 8-DPSK | 1242.0 | 1M24G1D |
| Result: | | | | | Complies |

8.0 DTS BANDWIDTH

Test Procedure

| | |
|----------------------------|---|
| Normative Reference | FCC 47 CFR §2.1049, §15.247(a)(2), RSS-Gen (6.7), RSS-247 (5.2)(a), KDB 558074 (8.2), ANSI C63.10 (11.8.2) |
|----------------------------|---|

Limits

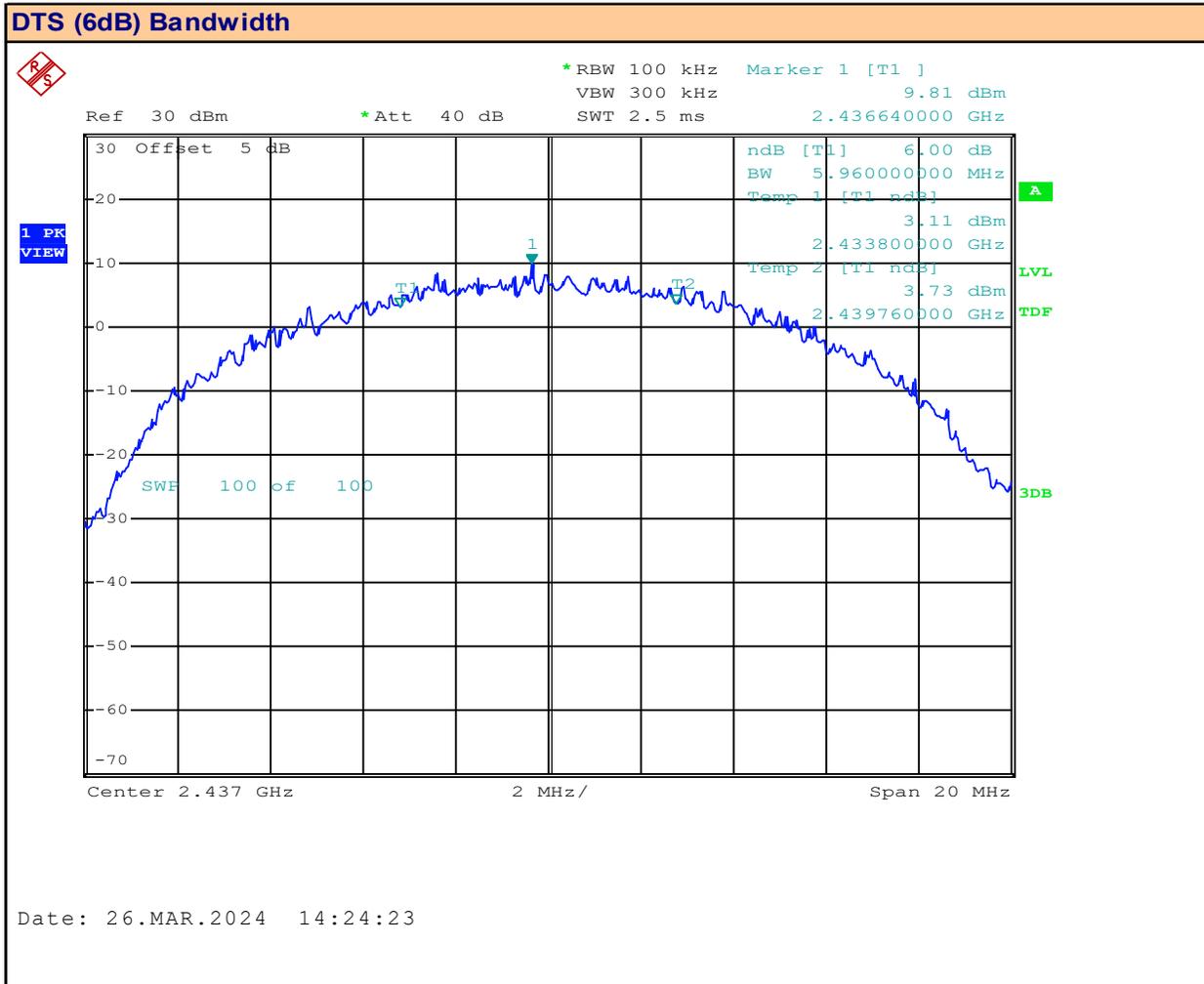
| | |
|-------------------------------------|---|
| 47 CFR §15.247(a)(2) | (a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions: (2) Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz. |
| RSS-247 (5.2)(a) | 5.2 Digital transmission systems DTSs include systems that employ digital modulation techniques resulting in spectral characteristics similar to direct sequence systems. The following applies to the bands 902-928 MHz and 2400 - 2483.5 MHz: a) The minimum 6 dB bandwidth shall be 500 kHz. |
| KDB 558074 (8.2) C63.10 (11.8.2) | 8.2 Option 2 The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW ≥ 3 X RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB. |

| | |
|-------------------|-------------------------------------|
| Test Setup | Appendix A Figure A.1 |
|-------------------|-------------------------------------|

Measurement Procedure

The DUT was connected to a Spectrum Analyzer (SA) via a 30dB attenuator connected to the DUT's antenna port. The SA was configured as above using the Automatic 6dB Cursor Bandwidth measurement. The output power of the DUT was set to the manufacturer's highest output power setting at the Low, Mid and High frequency channels as permitted by the device. The DUT was set to transmit at 100% Duty Cycle.

Plot 8.1 – 6dB DTS Bandwidth 802.11b

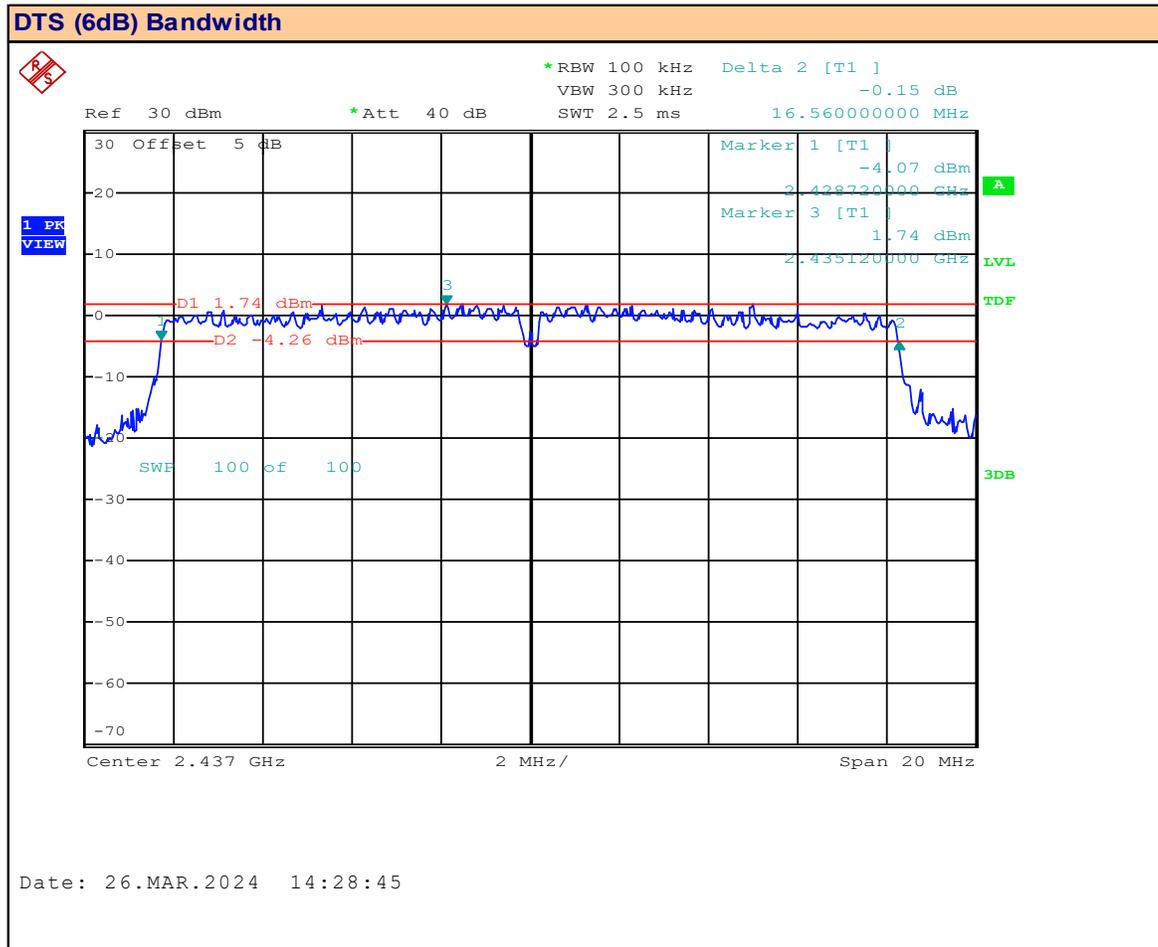


Channel: **6**
 Mode: **802.11b**

Channel Frequency: **2437** MHz
 Modulation: **DSSS 5.5**

Measured Occupied Bandwidth: **5.96** MHz

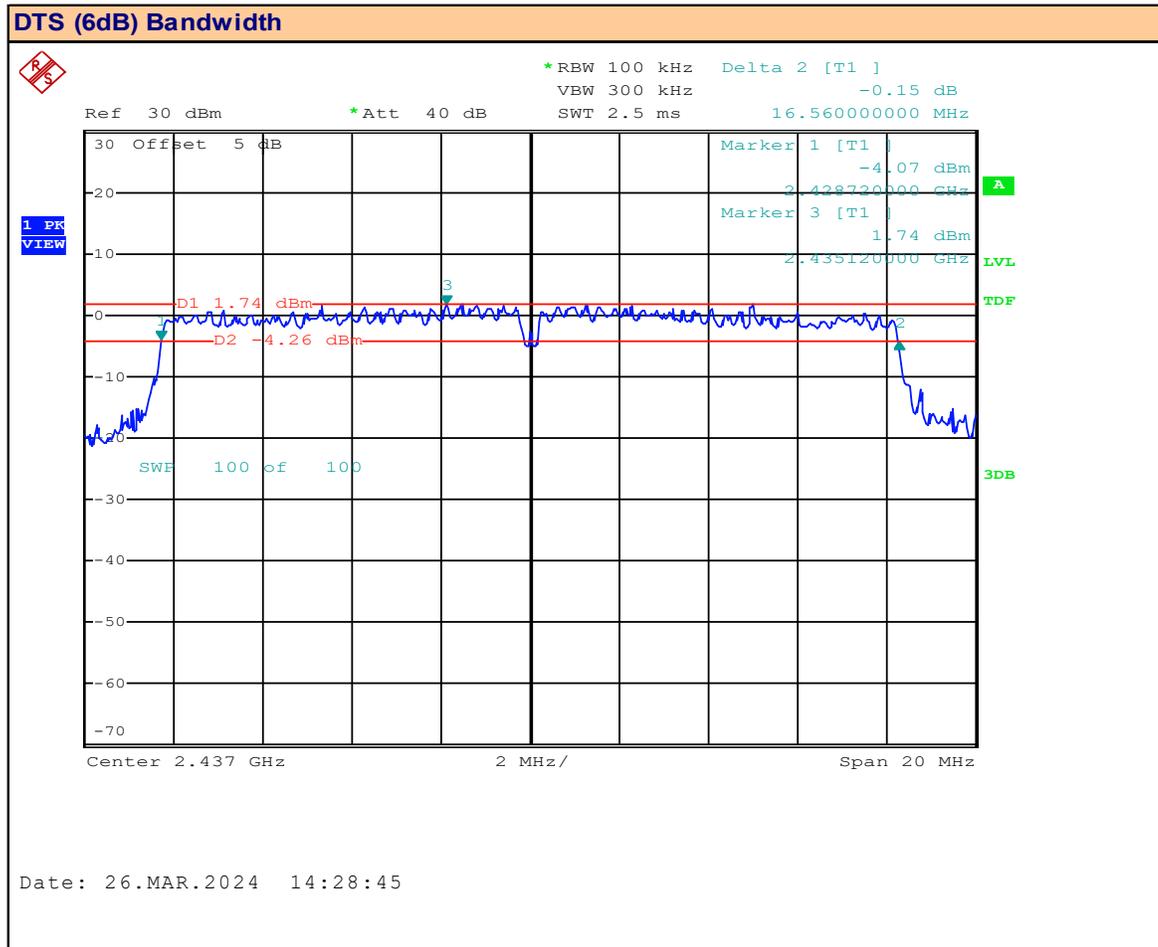
Plot 8.2 – 6dB DTS Bandwidth 802.11g



Channel: **6**
 Mode: **802.11g**

Channel Frequency: **2437** MHz
 Modulation: **OFDM 12**
 Measured Occupied Bandwidth: **16.56** MHz

Plot 8.3 – 6dB DTS Bandwidth 802.11n

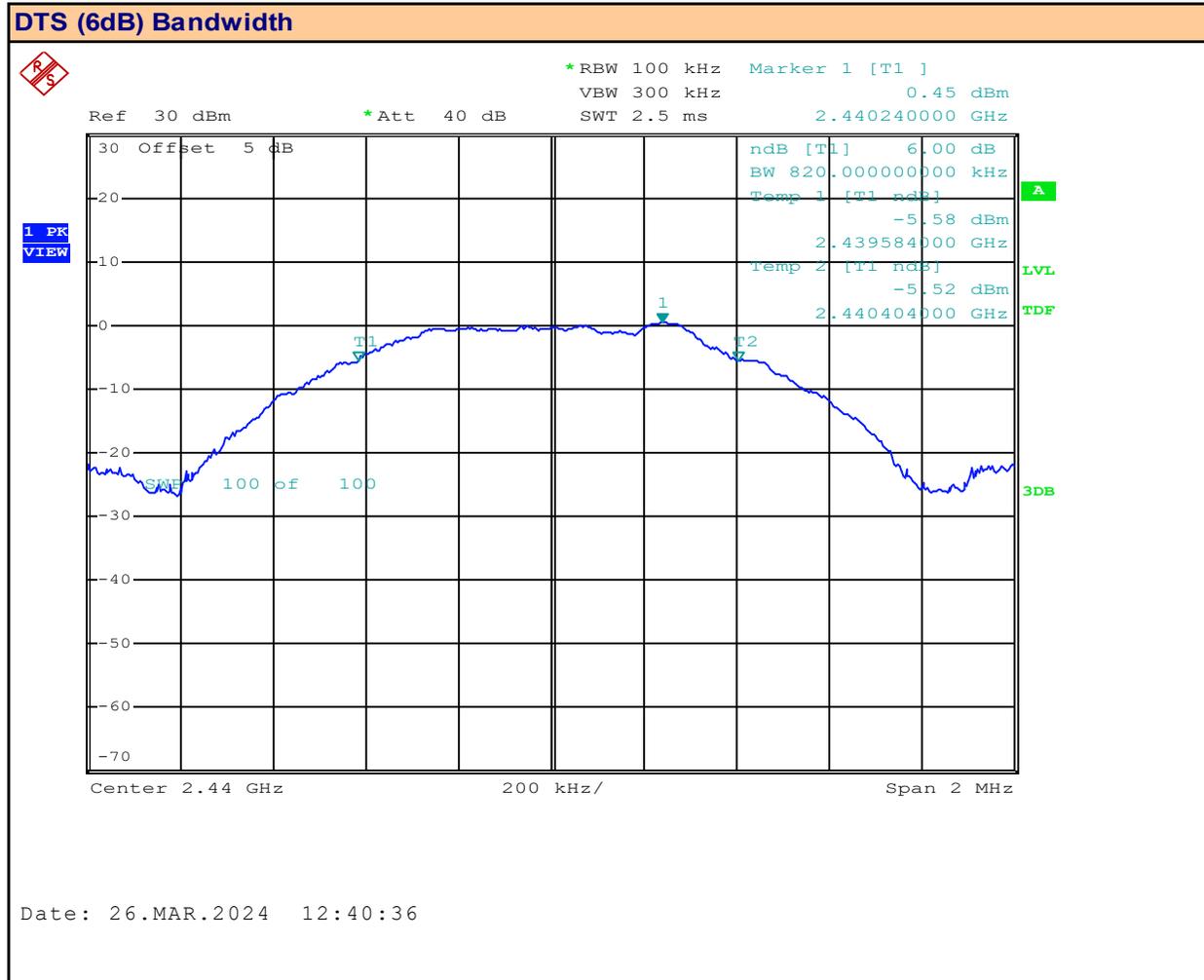


Channel: **6**
 Mode: **802.11g**

Channel Frequency: **2437** MHz
 Modulation: **OFDM 12**

Measured Occupied Bandwidth: **16.56** MHz

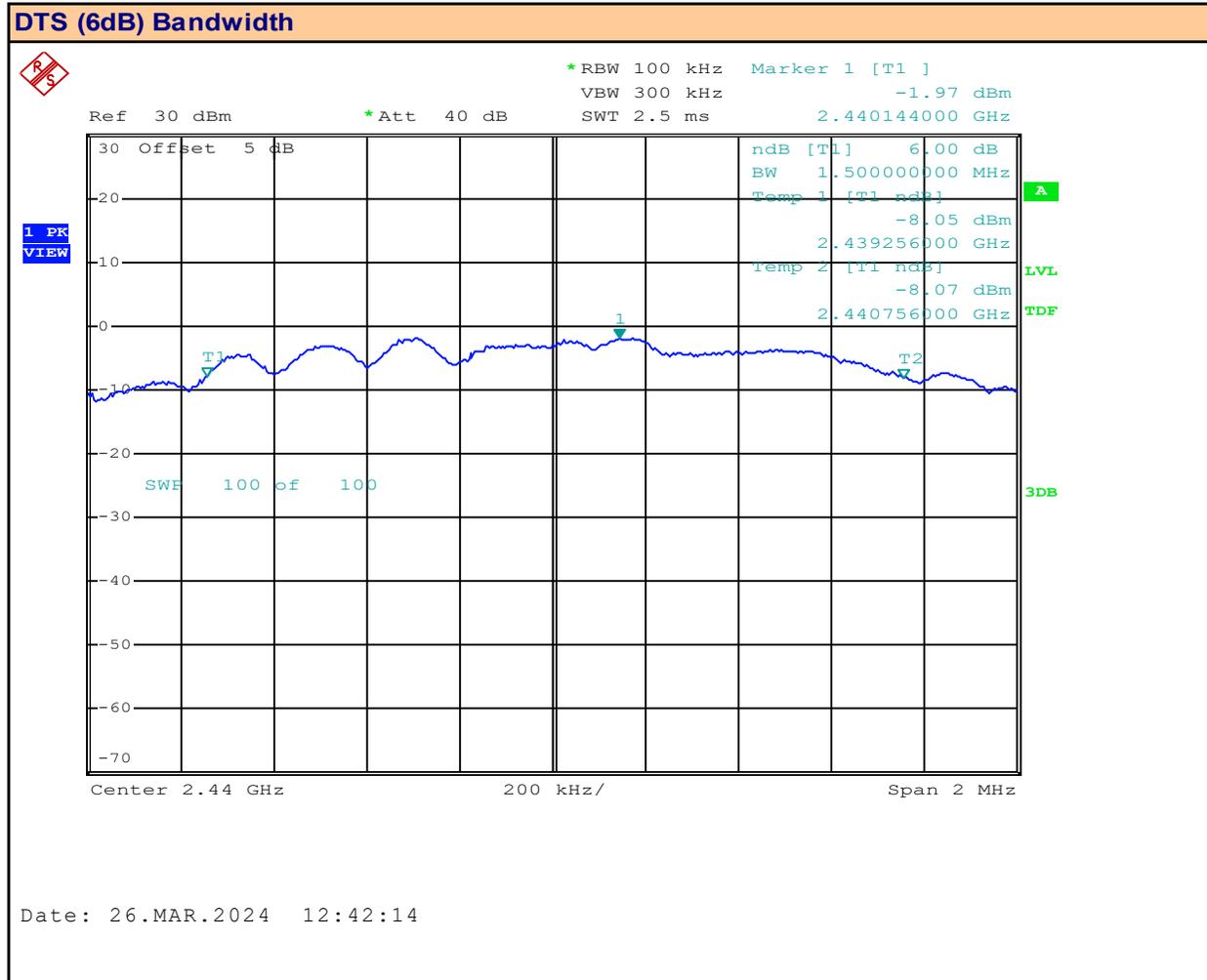
Plot 8.4 – 6dB DTS Bandwidth BLE1



Channel: **17**
 Mode: **BLE 1mb**

Channel Frequency: **2440** MHz
 Modulation: **GMSK**
 Measured Occupied Bandwidth: **0.82** MHz

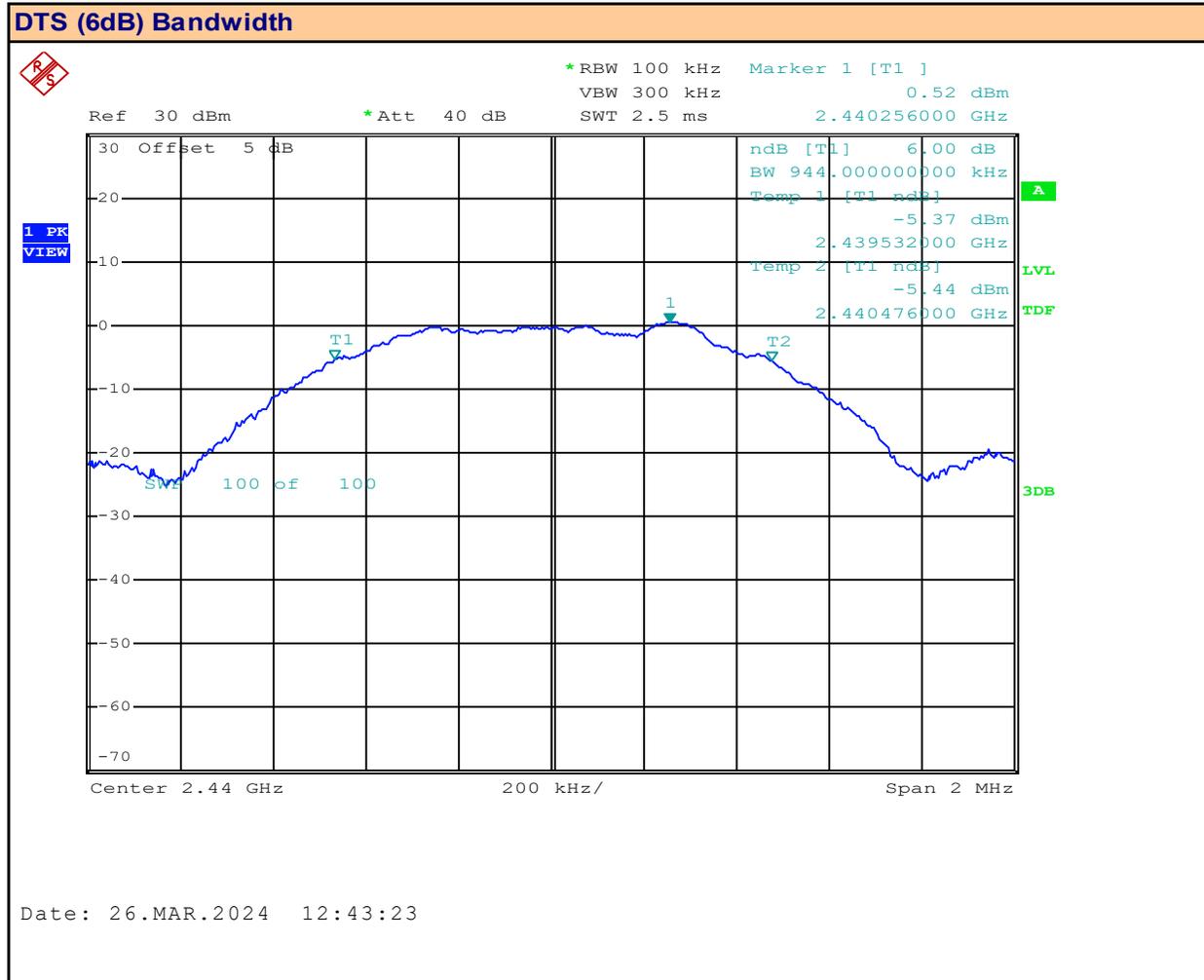
Plot 8.5 – 6dB DTS Bandwidth BLE2



Channel: **17**
 Mode: **BLE 2mb**

Channel Frequency: **2440** MHz
 Modulation: **GMSK**
 Measured Occupied Bandwidth: **1.5** MHz

Plot 8.6 – 6dB DTS Bandwidth ANT



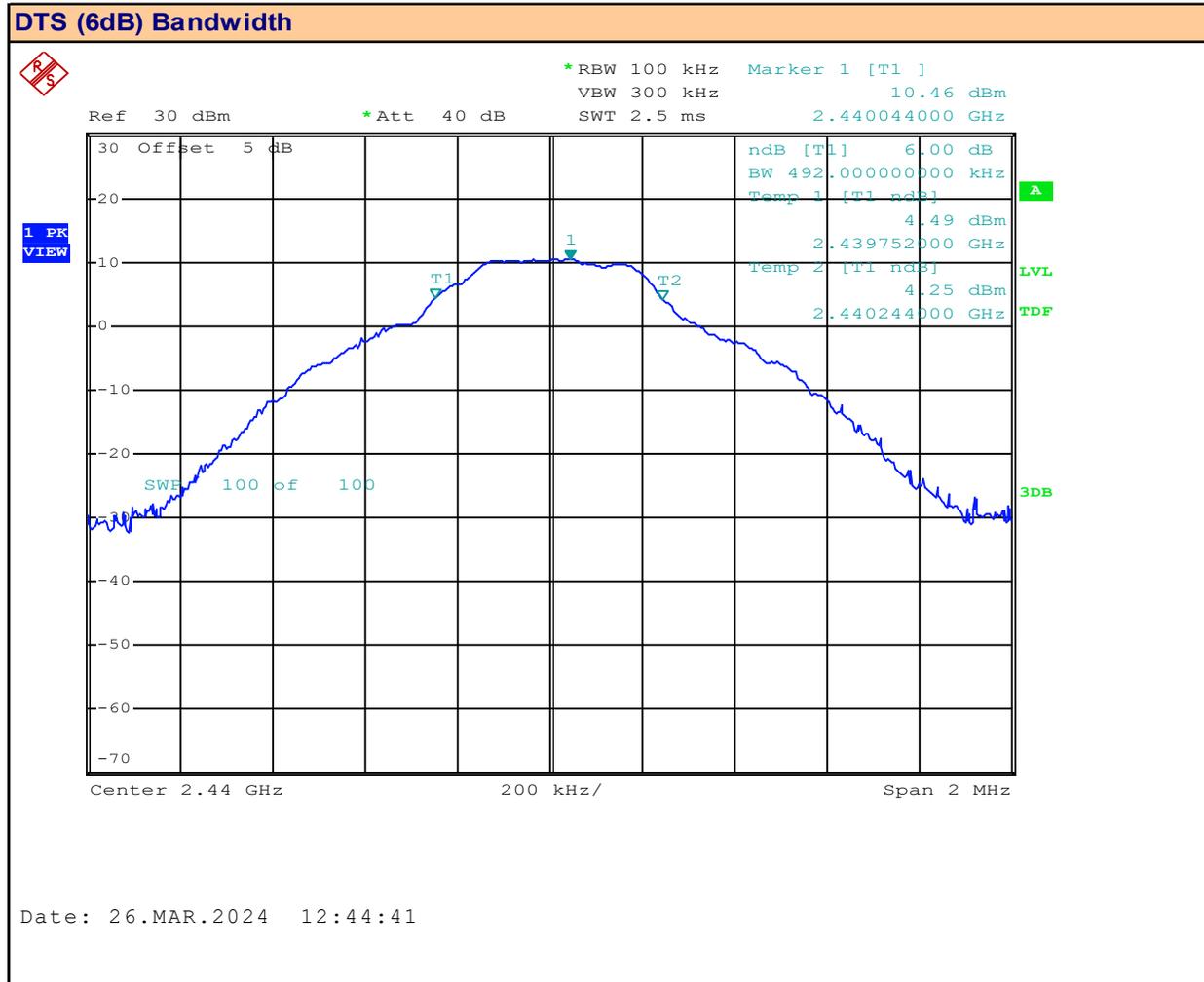
Channel: **38**
 Mode: **ANT**

Channel Frequency: **2440** MHz
 Modulation: **GFSK**
 Measured Occupied Bandwidth: **0.944** MHz

Table 8.1 – Summary of 6dB DTS Bandwidth Measurements, (DTS)

| DTS Bandwidth Results: (DTS) | | | | | | |
|-------------------------------------|--------------------------------|-------------|-------------------|-----------------------------------|--|---------------------|
| Channel Number | Channel Frequency (MHz) | Mode | Modulation | Measured 6dB BW [BW] (MHz) | Minimum 6dB BW [BW_{Min}] (MHz) | Margin (MHz) |
| 6 | 2437.0 | 802.11b | DSSS 5.5 | 5.96 | 0.50 | 5.46 |
| | | 802.11g | OFDM 12 | 16.60 | | 16.10 |
| | | 802.11n | MCS0 | 17.60 | | 17.10 |
| 17 | 2440.0 | BLE1 | GMSK | 0.82 | 0.50 | 0.32 |
| 17 | | BLE2 | GMSK | 1.50 | | 1.00 |
| 38 | | ANT | GFSK | 0.94 | | 0.44 |
| Result: | | | | | | Complies |

Plot 8.7 – 6dB DTS Bandwidth, BT BR

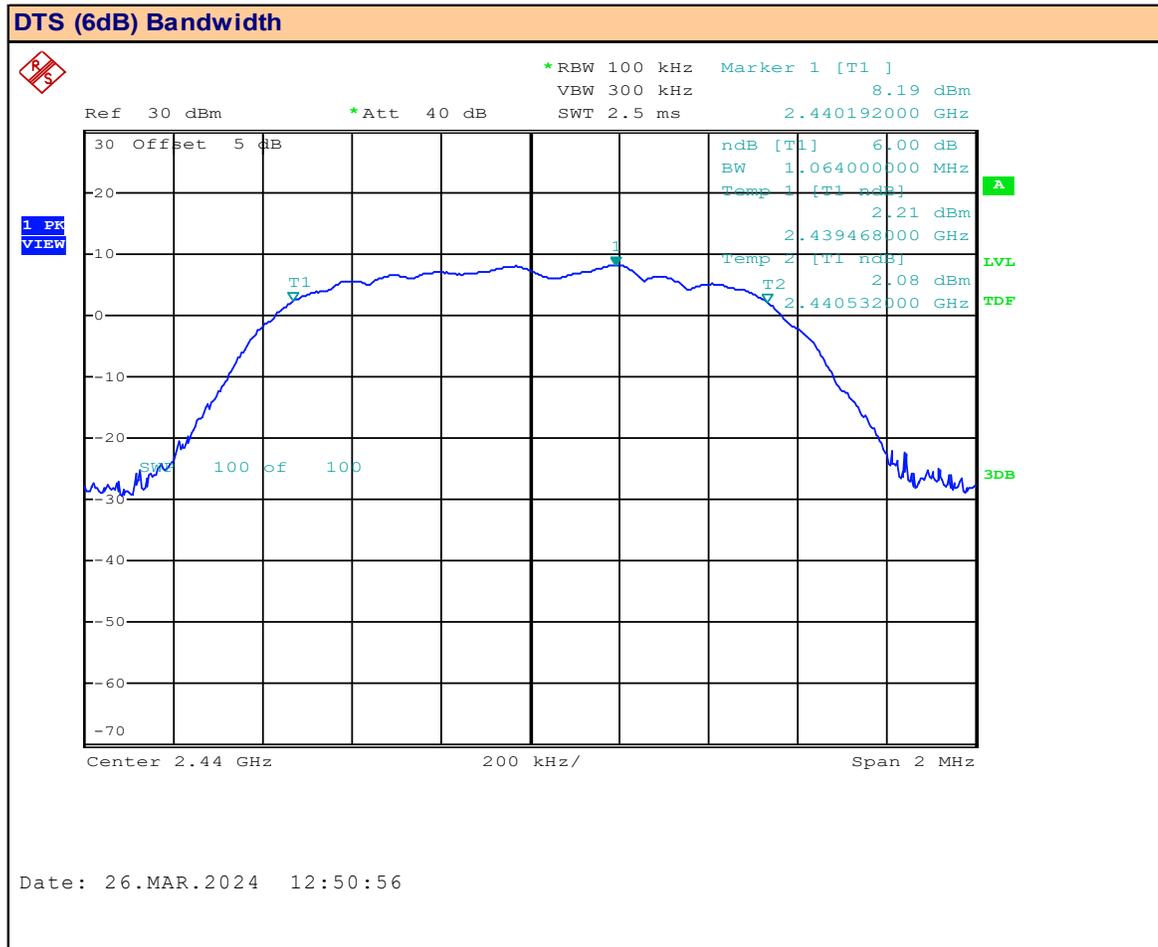


Channel: **38**
 Mode: **BT BR**

Channel Frequency: **2440** MHz
 Modulation: **GFSK**

Measured Occupied Bandwidth: **492** kHz

Plot 8.8 – 6dB DTS Bandwidth, BT 2EDR

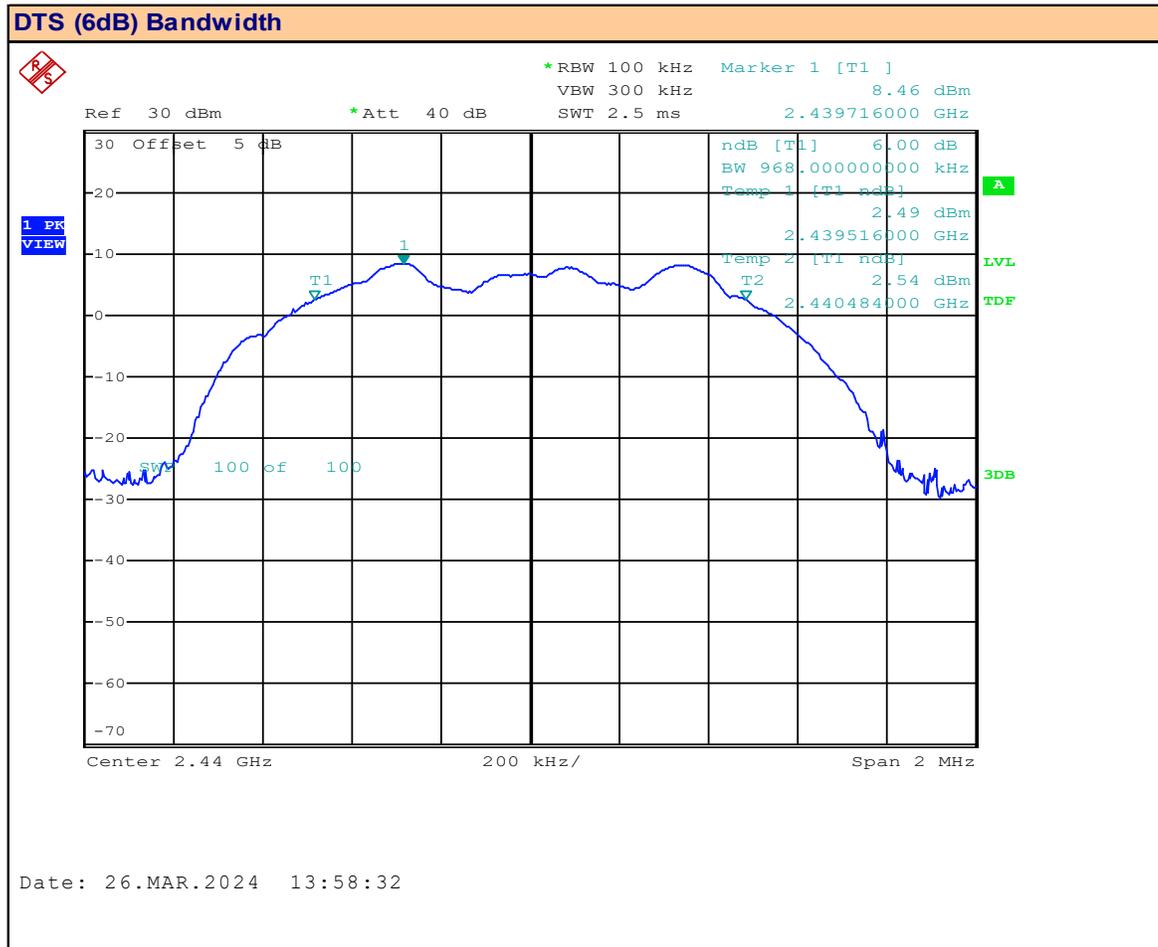


Channel: **38**
 Mode: **BT 2EDR**

Channel Frequency: **2440** MHz
 Modulation: **Pi/4-DQPSK**

Measured Occupied Bandwidth: **1064** kHz

Plot 8.9 – 6dB DTS Bandwidth, BT 3EDR



Channel: **38**
 Mode: **BT 3EDR**

Channel Frequency: **2440** MHz
 Modulation: **8-DPSK**

Measured Occupied Bandwidth: **968** kHz

Table 8.2 – Summary of 6dB DTS Bandwidth Measurements, (DSS)

| DTS Bandwidth Results: (DSS) | | | | | |
|-------------------------------------|--------------------------------|-------------|-------------------|-----------------------------------|-----------------|
| Channel Number | Channel Frequency (MHz) | Mode | Modulation | Measured 6dB BW [BW] (kHz) | Margin |
| 38 | 2440.0 | BT BR | GFSK | 492.00 | n/a |
| | | BT 2EDR | PI/4-DQPSK | 1064.00 | |
| | | BT 3EDR | 8-DPSK | 968.00 | |
| Result: | | | | | Complies |

9.0 ANTENNA PORT CONDUCTED POWER, (DTS)

Test Procedure

| | |
|----------------------------|---|
| Normative Reference | FCC 47 CFR §2.1046, §15.247(b)(3), RSS-Gen (6.1.2), RSS-247 (5.4)(d), KDB 558074 (8.3.2), ANSI C63.10 (11.9.2.2.2) |
|----------------------------|---|

Limits

| | |
|----------------------|--|
| 47 CFR §15.247(b)(3) | (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. |
| RSS-247 (5.4)(d) | 5.4 Transmitter output power and equivalent isotropically radiated power (e.i.r.p.) Devices shall comply with the following requirements, where applicable: d) For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e). As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. |

Table 9.1 – Summary of Conducted Power Measurements, (DTS)

See Appendix D for Measurement Plots

| Conducted Power Measurement Results: DTS | | | | | | | | | | | | |
|---|-------------------------|---------|------------|--------------------|---|---------------------------------|-----------------------|------------------------|---------------------------------|--------------------------------------|------------------|--|
| Channel Number | Channel Frequency (MHz) | Mode | Modulation | Rated Power (EIRP) | Measured Power [P _{Meas}] (dBm) | Limit [P _{Lim}] (dBm) | Conducted Margin (dB) | Antenna Gain [G] (dBi) | EIRP [E _{Meas}] (dBm) | EIRP Limit [E _{Lim}] (dBm) | EIRP Margin (dB) | |
| 6 | 2437.00 | 802.11b | CCK 1 | 12.2 | 15.080 | 30 | 14.9 | -3.8 | 11.3 | 36 | 24.7 | |
| | | | CCK 2 | | 15.270 | | 14.7 | | 11.5 | | 24.5 | |
| | | | DSSS 5.5 | | 15.560 | | 14.4 | | 11.8 | | 24.2 | |
| | | | DSSS 11 | | 15.100 | | 14.9 | | 11.3 | | 24.7 | |
| 1 | 2412.00 | 802.11g | DSSS 5.5 | 11.2 | 15.630 | 14.4 | 11.8 | 24.2 | | | | |
| 2 | 2417.00 | | | | 15.720 | 14.3 | 11.9 | 24.1 | | | | |
| 11 | 2462.00 | | | | 15.070 | 14.9 | 11.3 | 24.7 | | | | |
| 13 | 2472.00 | | | | 15.070 | 14.9 | 11.3 | 24.7 | | | | |
| 6 | 2437.00 | 802.11g | OFDM6 | 11.2 | 14.140 | 15.9 | 10.3 | 25.7 | | | | |
| | | | OFDM9 | | 14.640 | 15.4 | 10.8 | 25.2 | | | | |
| 1 | 2412.00 | 802.11n | MCS0 | 11.2 | 14.640 | 15.4 | 10.8 | 25.2 | | | | |
| 2 | 2417.00 | | | | 12.580 | 17.4 | 8.8 | 27.2 | | | | |
| 11 | 2462.00 | | | | 14.910 | 15.1 | 11.1 | 24.9 | | | | |
| 13 | 2472.00 | | | | 14.200 | 15.8 | 10.4 | 25.6 | | | | |
| 6 | 2437.00 | 802.11n | MCS3 | 11.2 | 11.380 | 18.6 | 7.6 | 28.4 | | | | |
| | | | MCS7 | | 14.440 | 15.6 | 10.6 | 25.4 | | | | |
| 1 | 2412.00 | 802.11n | MCS0 | 11.2 | 13.680 | 16.3 | 9.9 | 26.1 | | | | |
| 11 | 2462.00 | | | | 8.800 | 21.2 | 5.0 | 31.0 | | | | |
| 13 | 2472.00 | | | | 14.610 | 15.4 | 10.8 | 25.2 | | | | |
| | | | | | 13.860 | 16.1 | 10.1 | 25.9 | | | | |
| | | | | | 12.100 | 17.9 | 8.3 | 27.7 | | | | |
| Result: | | | | | | | | | | | Complies | |

Conducted Margin = Conducted Limit [P_{Limit}] - Measure Power [P_{Meas}]

EIRP [E_{Meas}] = Measure Power [P_{Meas}] + Antenna Gain [G]

EIRP Margin = EIRP Limit [E_{Lim}] - EIPR [E_{Meas}]

Table 9.1 – Summary of Conducted Power Measurements, (DTS) – Cont.

See Appendix D for Measurement Plots

| Conducted Power Measurement Results: DTS | | | | | | | | | | | | |
|---|-------------------------|---------|------------|--------------------|---|---------------------------------|-----------------------|------------------------|---------------------------------|--------------------------------------|------------------|-------------------------|
| Channel Number | Channel Frequency (MHz) | Mode | Modulation | Rated Power (EIRP) | Measured Power [P _{Meas}] (dBm) | Limit [P _{Lim}] (dBm) | Conducted Margin (dB) | Antenna Gain [G] (dBi) | EIRP [E _{Meas}] (dBm) | EIRP Limit [E _{Lim}] (dBm) | EIRP Margin (dB) | |
| 37 | 2402.00 | BLE 1mb | GMSK | -2.8 | -1.67 | 30 | 31.7 | -3.8 | -5.5 | 36 | 41.5 | Result: Complies |
| 17 | 2440.00 | | | | 0.70 | | 29.3 | | -3.1 | | 39.1 | |
| 39 | 2480.00 | | | | -3.37 | | 33.4 | | -7.2 | | 43.2 | |
| 1 | 2404.00 | BLE 2mb | | 1.48 | 28.5 | | -2.3 | | 38.3 | | | |
| 17 | 2440.00 | | | -2.3 | 1.00 | | 29.0 | | -2.8 | | 38.8 | |
| 36 | 2478.00 | | | -3.63 | 33.6 | | -7.4 | | 43.4 | | | |
| 0 | 2402.00 | ANT | GFSK | -2.3 | -1.41 | 30 | 31.4 | -3.8 | -5.2 | 36 | 41.2 | |
| 38 | 2440.00 | | | | 1.07 | | 28.9 | | -2.7 | | 38.7 | |
| 78 | 2480.00 | | | | -3.37 | | 33.4 | | -7.2 | | 43.2 | |

Conducted Margin = Conducted Limit [P_{Limit}] - Measure Power [P_{Meas}]

EIRP [E_{Meas}] = Measure Power [P_{Meas}] + Antenna Gain [G]

EIRP Margin = EIRP Limit [E_{Lim}] - EIPR [E_{Meas}]

10.0 ANTENNA PORT CONDUCTED POWER, (DSS)

Test Procedure

| | |
|----------------------------|---|
| Normative Reference | FCC 47 CFR §2.1046, §15.247(b)(3), RSS-Gen (6.1.2), RSS-247 (5.4)(d), KDB 558074 (8.3.2), ANSI C63.10 (11.9.2.2.2) |
|----------------------------|---|

Limits

| | |
|----------------------|---|
| 47 CFR §15.247(b)(3) | (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. |
| RSS-247 (5.4)(d) | 5.4 Transmitter output power and equivalent isotropically radiated power (e.i.r.p.) Devices shall comply with the following requirements, where applicable: d) For DTSSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e). As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. |

Table 10.1 – Summary of Conducted Power Measurements, (DSS)

See Appendix D for Measurement Plots

| Conducted Power Measurement Results: DSS | | | | | | | | | | | | |
|---|-------------------------|---------|------------|--------------------|---|---------------------------------|-----------------------|------------------------|---------------------------------|--------------------------------------|------------------|--|
| Channel Number | Channel Frequency (MHz) | Mode | Modulation | Rated Power (EIRP) | Measured Power [P _{Meas}] (dBm) | Limit [P _{Lim}] (dBm) | Conducted Margin (dB) | Antenna Gain [G] (dBi) | EIRP [E _{Meas}] (dBm) | EIRP Limit [E _{Lim}] (dBm) | EIRP Margin (dB) | |
| 2 | 2404.00 | BT BR | GFSK | 6.2 | 10.00 | 30 | 20.0 | -3.8 | 6.2 | 36 | 29.8 | |
| 38 | 2440.00 | | | | 9.91 | | 20.1 | | 6.1 | | 29.9 | |
| 78 | 2480.00 | | | | 8.93 | | 21.1 | | 5.1 | | 30.9 | |
| 2 | 2404.00 | BT 2EDR | Pi/4-DQPSK | | 9.16 | | 20.8 | | 5.4 | | 30.6 | |
| 38 | 2440.00 | | | | 9.30 | | 20.7 | | 5.5 | | 30.5 | |
| 78 | 2480.00 | | | | 8.26 | | 21.7 | | 4.5 | | 31.5 | |
| 2 | 2404.00 | BT 3EDR | 8-DPSK | | 9.17 | | 20.8 | | 5.4 | | 30.6 | |
| 38 | 2440.00 | | | | 9.12 | | 20.9 | | 5.3 | | 30.7 | |
| 78 | 2480.00 | | | | 8.10 | | 21.9 | | 4.3 | | 31.7 | |
| Result: | | | | | | | | | | | Complies | |

Conducted Margin = Conducted Limit [P_{Limit}] - Measure Power [P_{Meas}]

EIRP [E_{Meas}] = Measure Power [P_{Meas}] + Antenna Gain [G]

EIRP Margin = EIRP Limit [E_{Lim}] - EIPR [E_{Meas}]

11.0 POWER SPECTRAL DENSITY

Test Procedure

| | |
|----------------------------|--|
| Normative Reference | FCC 47 CFR §15.247(e), RSS-247 (5.2)(b), KDB 558074 (10.3), ANSI C63.10 (11.10.3) |
|----------------------------|--|

Limits

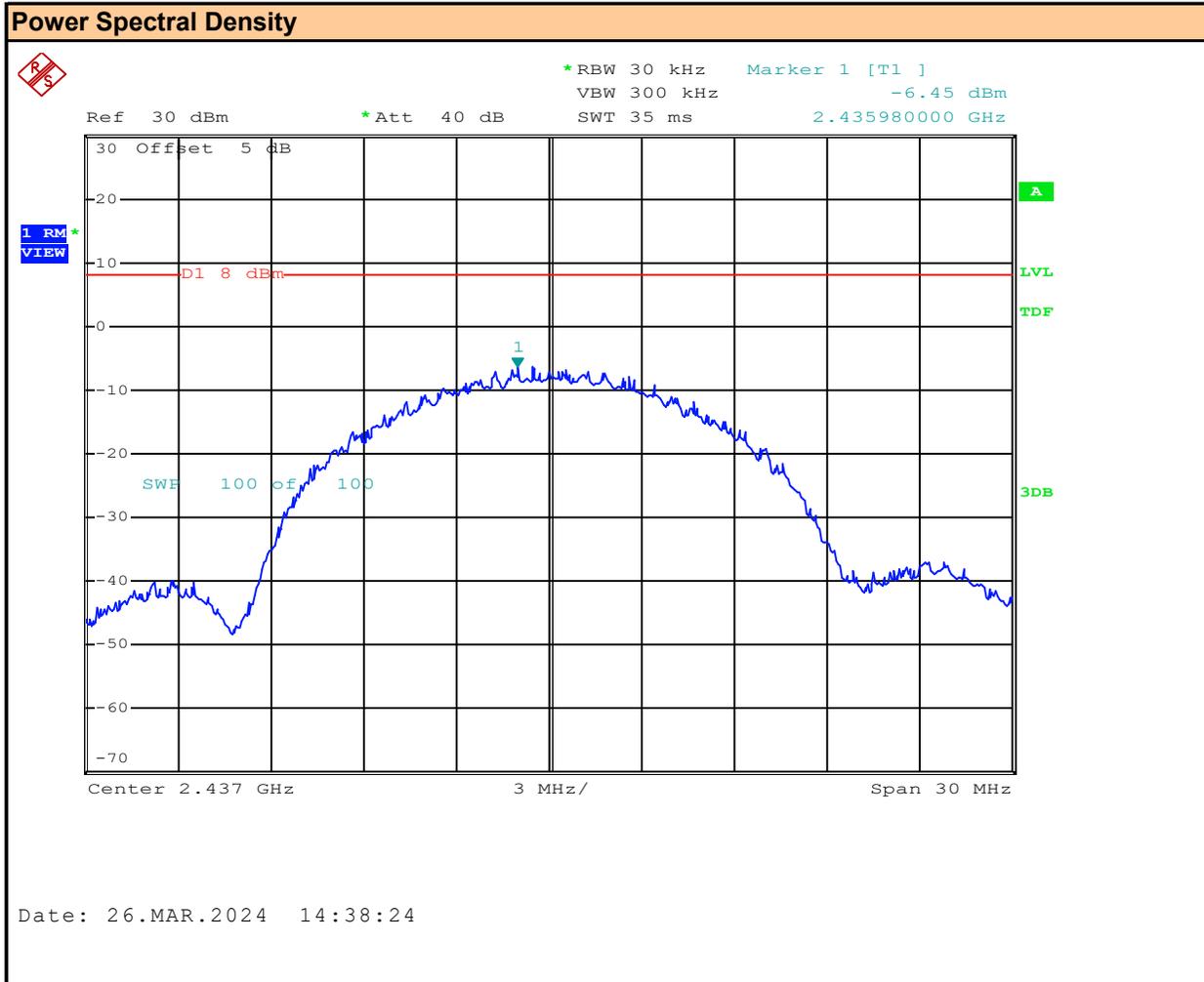
| | |
|---------------------------------------|---|
| 47 CFR §15.247(e) | (e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density. |
| RSS-247 (5.2)(b) | b) The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of section 5.4(d), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power). |
| KDB 558074 (10.3) C63.10 (11.10.3) | <p>Method AVGPSD-1 (trace averaging with EUT transmitting at full power throughout each sweep)</p> <p>This procedure may be used when the maximum (average) conducted output power was used to demonstrate compliance to the output power limit. This is the baseline method for determining the maximum (average) conducted PSD level. If the instrument has an RMS power averaging detector, it must be used; otherwise, use the sample detector. The EUT must be configured to transmit continuously (duty cycle $\geq 98\%$); otherwise sweep triggering/signal gating must be implemented to ensure that measurements are made only when the EUT is transmitting at its maximum power control level (no transmitter off time is to be considered).</p> <p>a) Set instrument center frequency to DTS channel center frequency.</p> <p>b) Set span to at least 1.5 X OBW.</p> <p>c) Set RBW to: $3\text{ kHz} \leq \text{RBW} \leq 100\text{ kHz}$.</p> <p>d) Set VBW $\geq 3 \times \text{RBW}$.</p> <p>e) Detector = RMS</p> <p>f) Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span}/\text{RBW}$.</p> <p>g) Sweep time = auto couple.</p> <p>h) Employ trace averaging (RMS) mode over a minimum of 100 traces.</p> <p>i) Use the peak marker function to determine the maximum amplitude level.</p> <p>j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span in order to meet the minimum measurement point requirement as the RBW is reduced).</p> |

| | |
|-------------------|---|
| Test Setup | Appendix A Figure A.1 |
|-------------------|---|

Measurement Procedure

The DUT was connected to a Spectrum Analyzer (SA) via a 30dB attenuator connected to the DUT's antenna port. The SA was configured as described above. Number of Sweep Points $\geq 2 \times \text{Span} / \text{RBW} = 2 \times (1.5\text{MHz} / 3\text{kHz}) = 1000$, the SA was configured for 1001 Points. The output power of the DUT was set to the manufacturer's highest output power setting at the Low, Mid and High frequency channels as permitted by the device. The DUT was set to transmit at 100% Duty Cycle. The Power Spectral Density was measured and recorded.

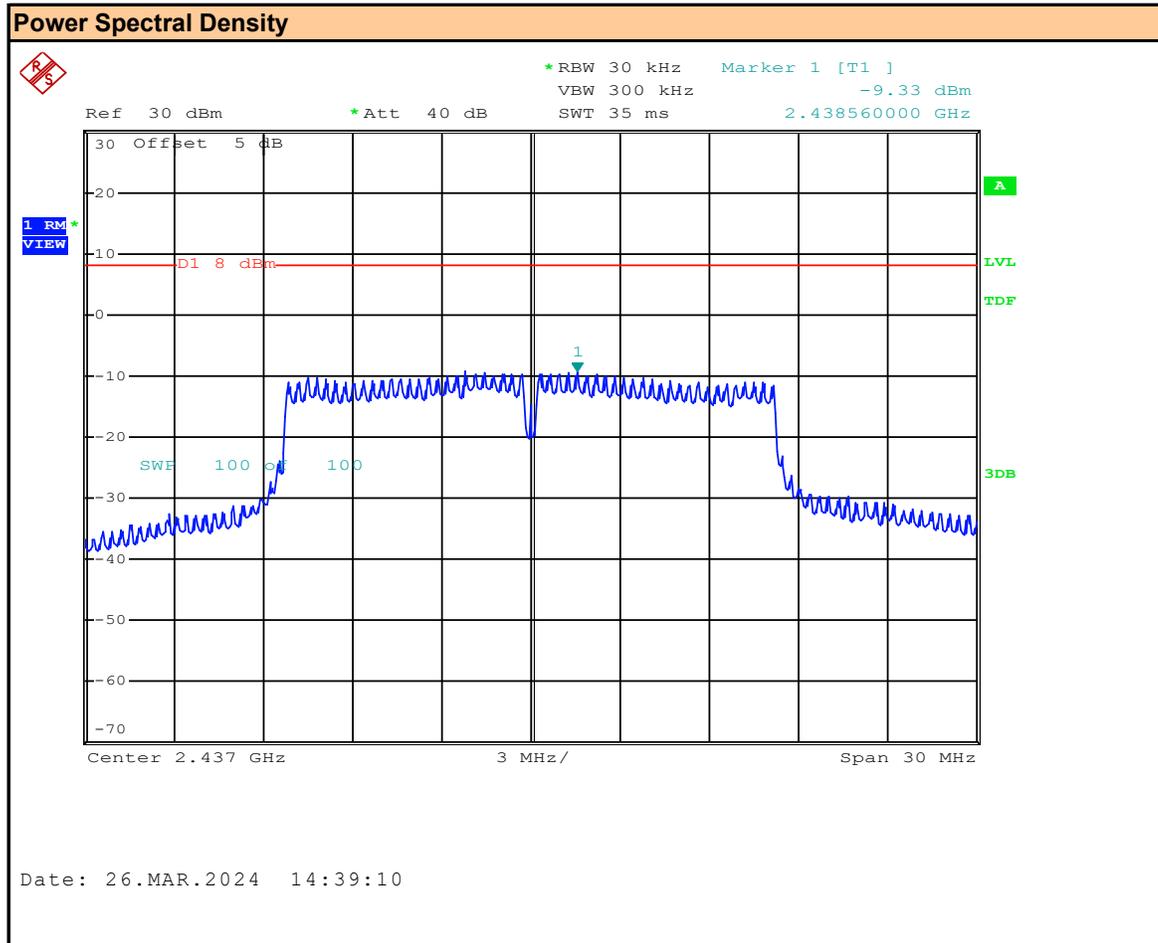
Plot 11.1 – Power Spectral Density, 802.11b



Channel:
 Mode:

Channel Frequency: MHz
 Modulation:
 Measured PSD: dBm

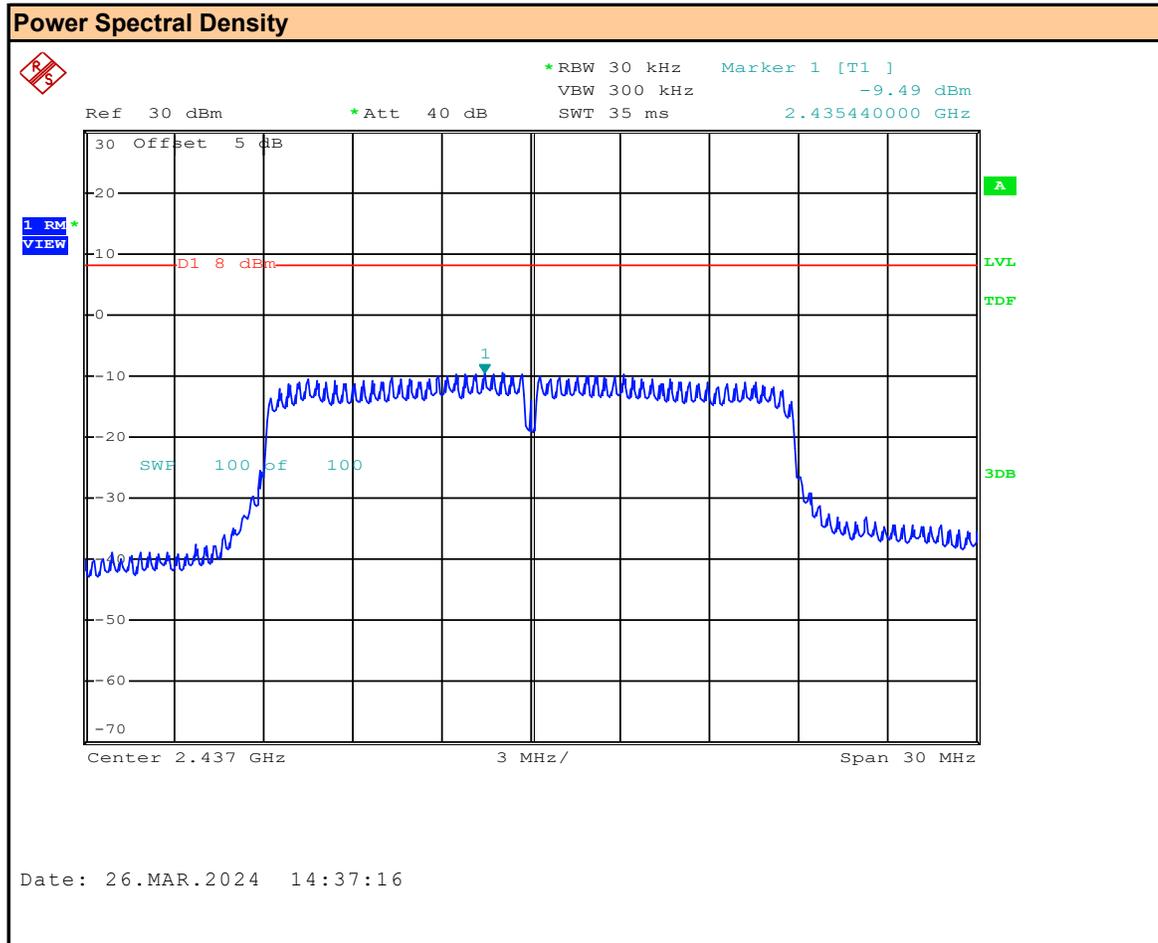
Plot 11.2 – Power Spectral Density, 802.11g



Channel:
 Mode:

Channel Frequency: MHz
 Modulation:
 Measured PSD: dBm

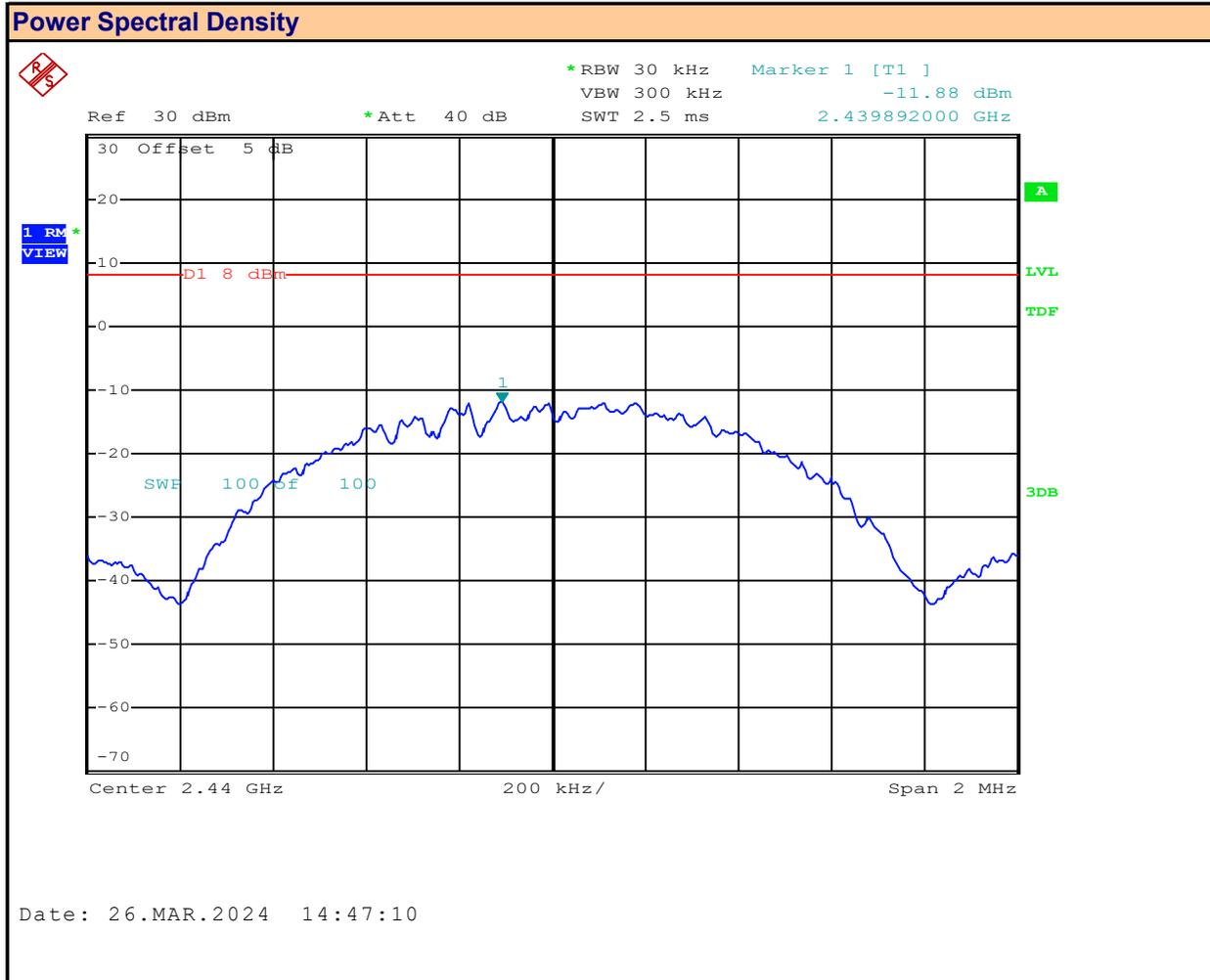
Plot 11.3 – Power Spectral Density, 802.11n



Channel:
 Mode:

Channel Frequency: MHz
 Modulation:
 Measured PSD: dBm

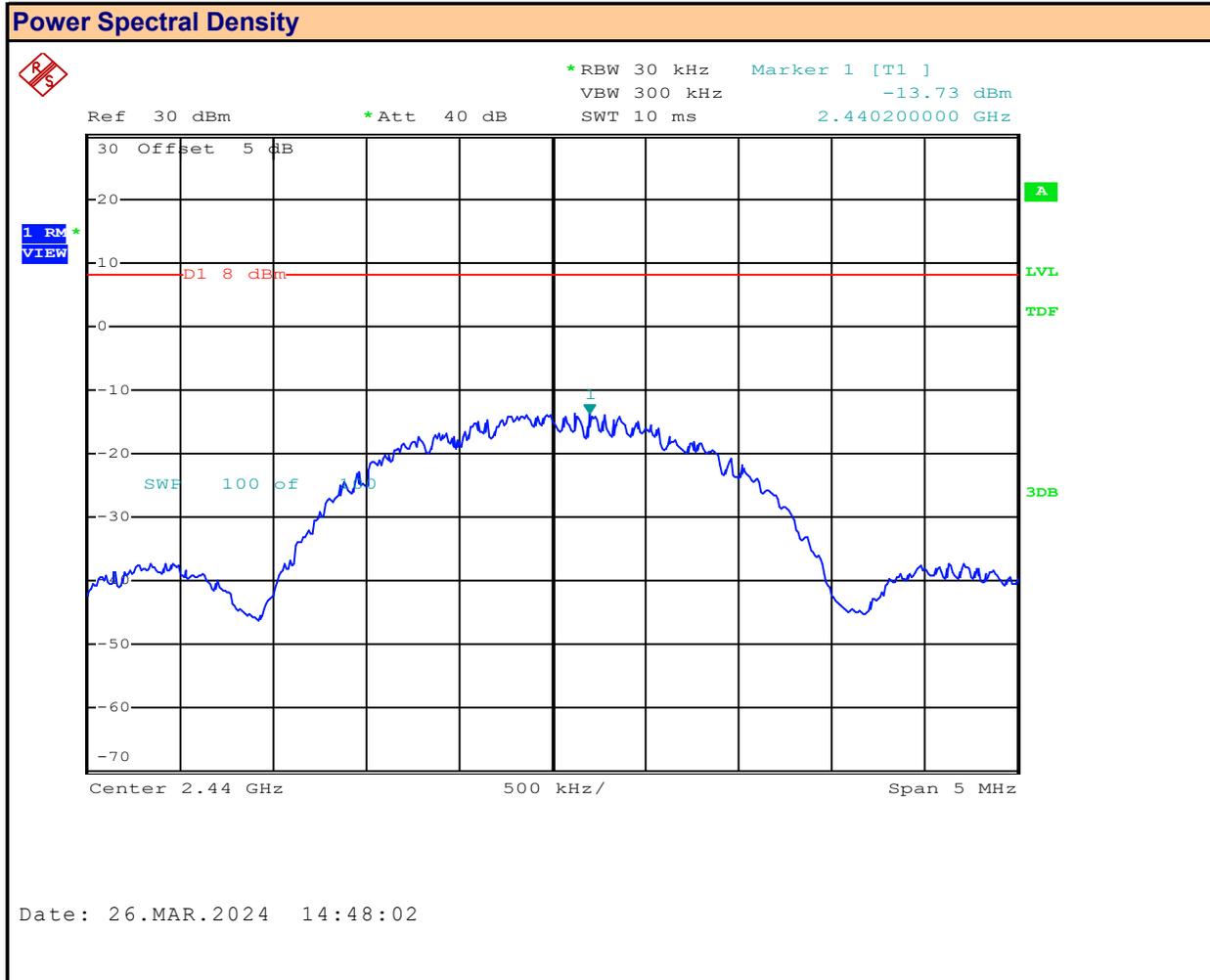
Plot 11.4 – Power Spectral Density, BLE1



Channel:
 Mode:

Channel Frequency: MHz
 Modulation:
 Measured PSD: dBm

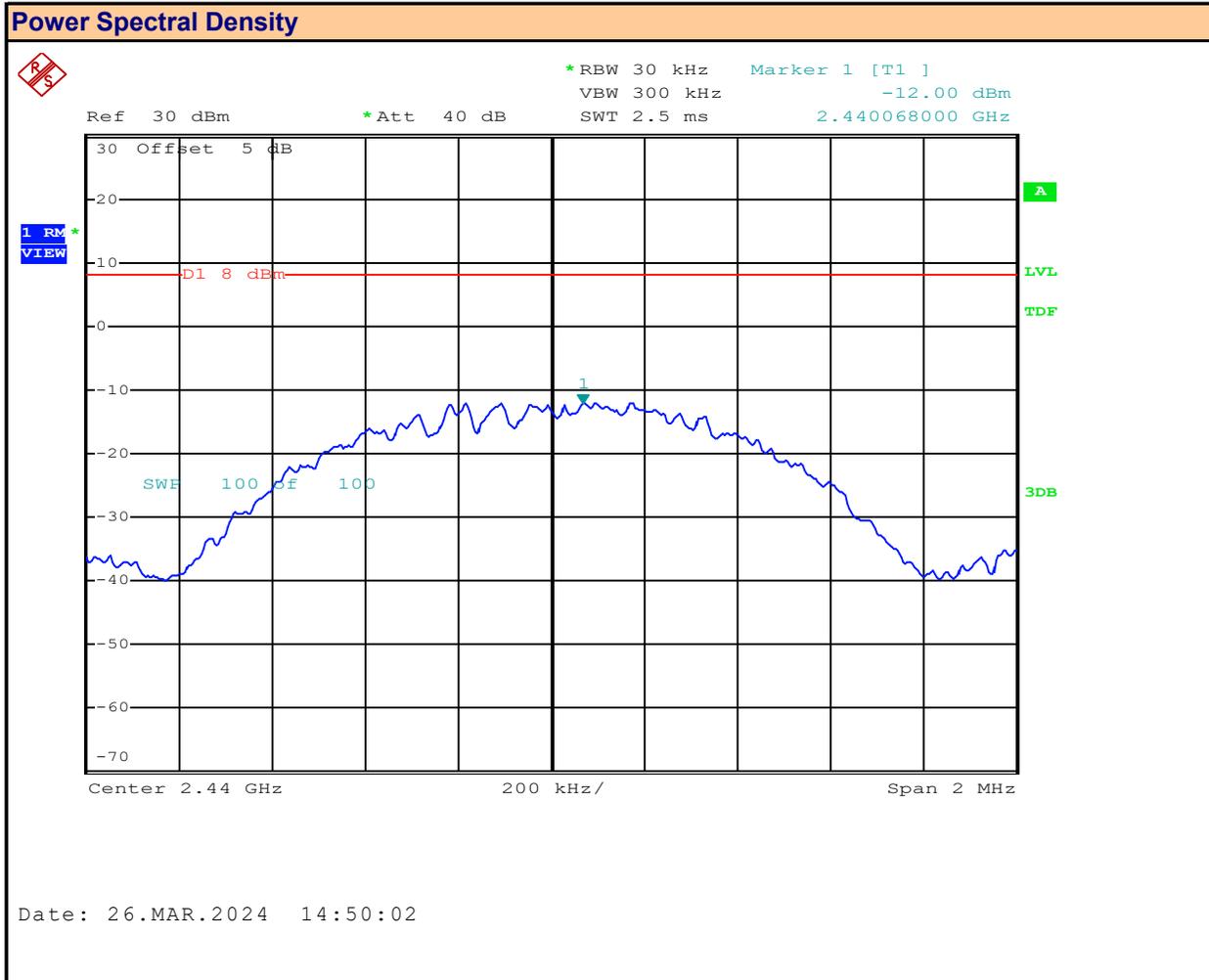
Plot 11.5 – Power Spectral Density, BLE2



Channel:
 Mode:

Channel Frequency: MHz
 Modulation:
 Measured PSD: dBm

Plot 11.6 – Power Spectral Density, ANT



Channel:
 Mode:

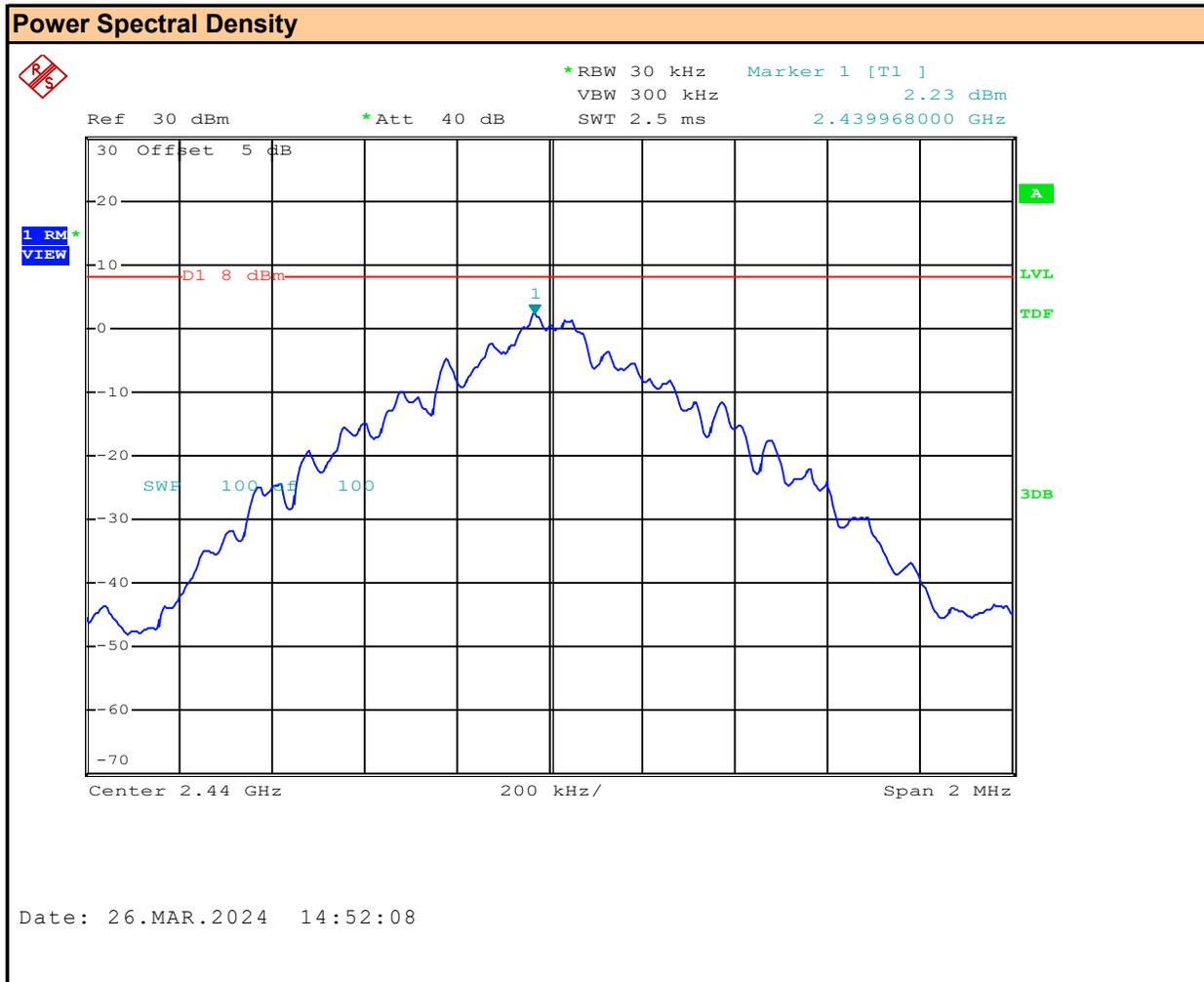
Channel Frequency: MHz
 Modulation:
 Measured PSD: dBm

Table 11.1 – Summary of Power Spectral Density Measurements, (DTS)

| PSD Results: | | | | | | |
|---------------------|-------------------------|---------|------------|---|-------------------------------------|-----------------|
| Channel Number | Channel Frequency (MHz) | Mode | Modulation | Measured PSD [P _{Meas}] (dBm) | PSD Limit [P _{Lim}] (dBm) | Margin (dB) |
| 6 | 2437.0 | 802.11b | DSSS 5.5 | -6.45 | 8.0 | 14.45 |
| | | 802.11g | OFDM12 | -9.33 | | 17.33 |
| | | 802.11n | MCS0 | -9.49 | | 17.49 |
| 17 | 2440.0 | BLE1 | GMSK | -11.88 | 8.0 | 19.88 |
| 17 | | BLE2 | GMSK | -13.73 | | 21.73 |
| 38 | | ANT | GFSK | -12.00 | | 20.00 |
| | | | | | Result: | Complies |

$$\text{Margin} = [P_{\text{Lim}}] - [P_{\text{Meas}}]$$

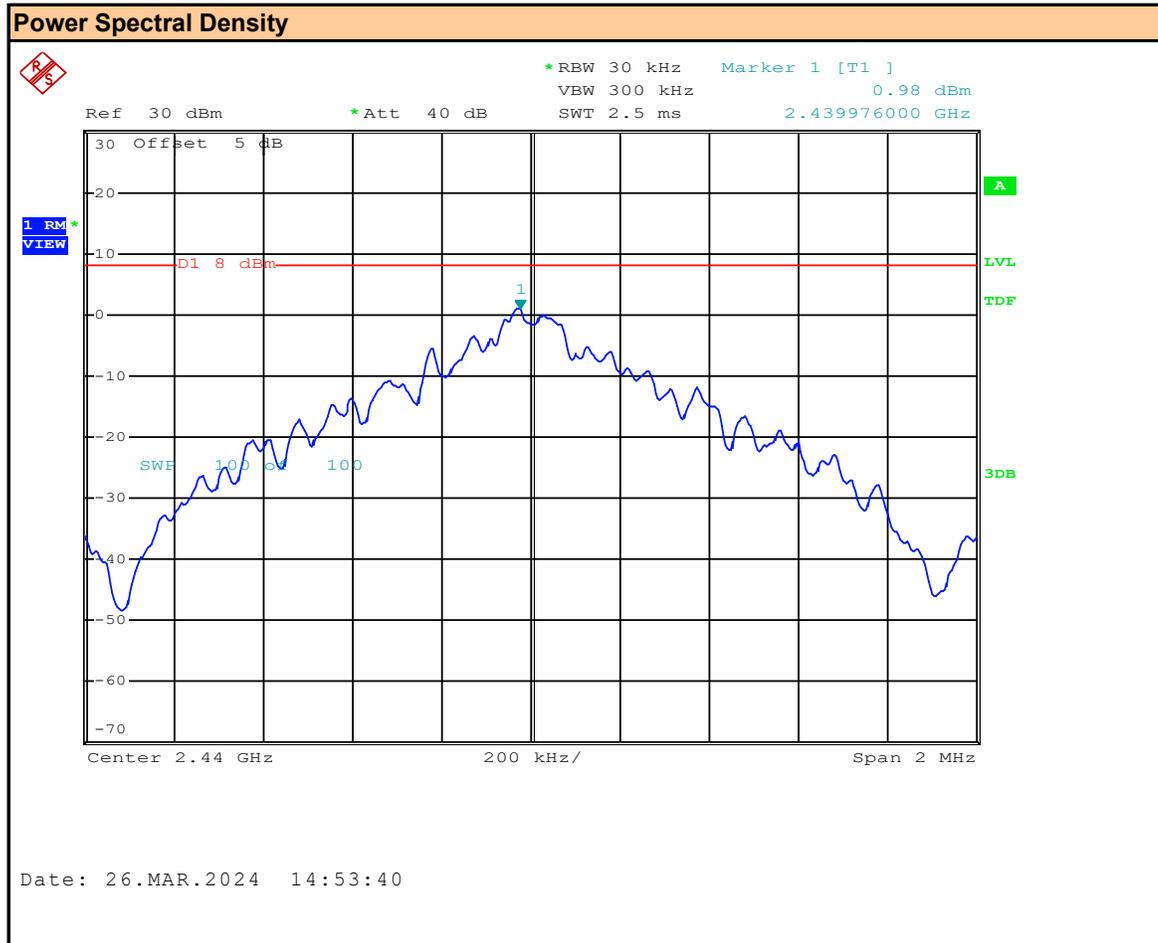
Plot 11.7 – Power Spectral Density, BT BR



Channel:
 Mode:

Channel Frequency: MHz
 Modulation:
 Measured PSD: dBm

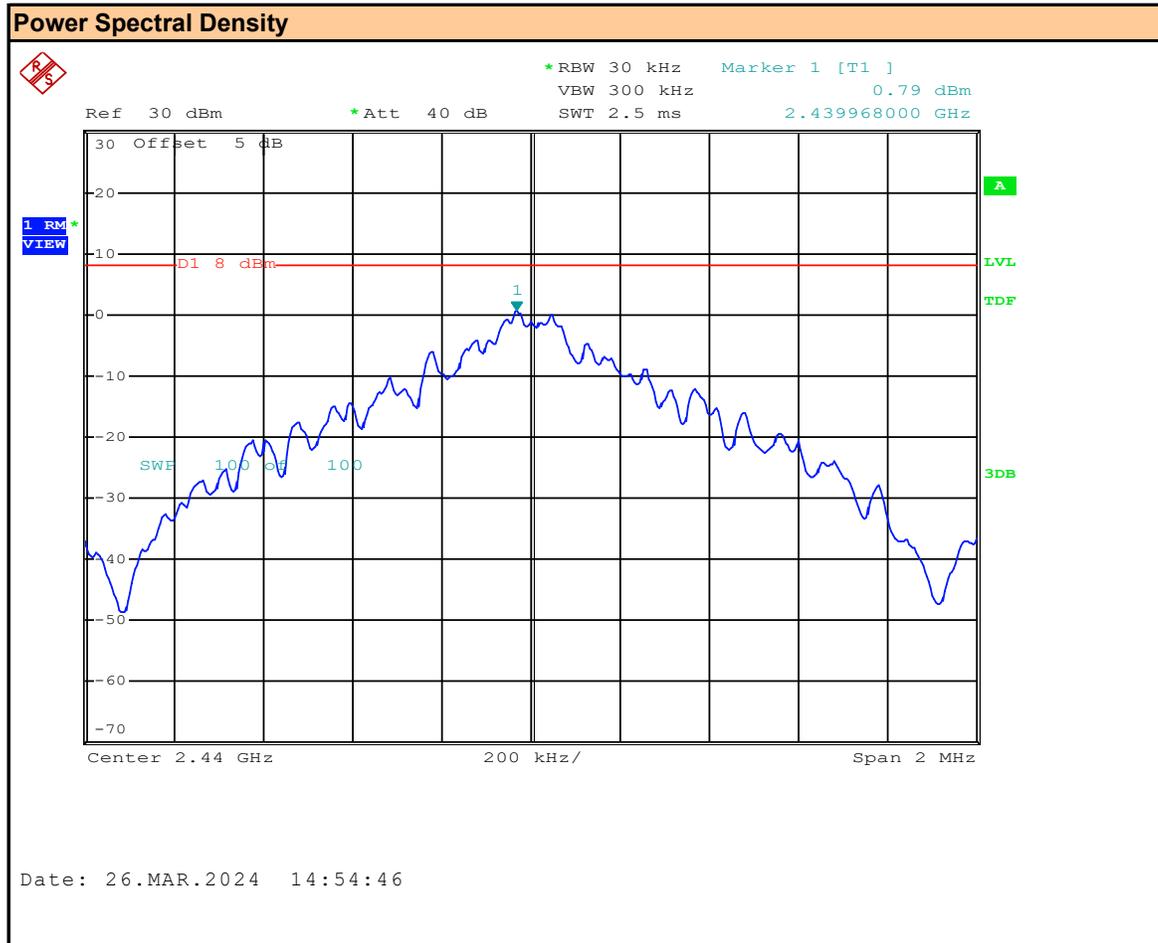
Plot 11.8 – Power Spectral Density, BT 2EDR



Channel:
 Mode:

Channel Frequency: MHz
 Modulation:
 Measured PSD: dBm

Plot 11.9 – Power Spectral Density, BT 3EDR



Channel:
 Mode:

Channel Frequency: MHz
 Modulation:
 Measured PSD: dBm

Table 11.2 – Summary of Power Spectral Density Measurements, (DSS)

| PSD Results: | | | | | | |
|-----------------------|--------------------------------|-------------|-------------------|--|--|--------------------|
| Channel Number | Channel Frequency (MHz) | Mode | Modulation | Measured PSD [P_{Meas}] (dBm) | PSD Limit [P_{Lim}] (dBm) | Margin (dB) |
| 38 | 2440.0 | BT BR | GFSK | 2.23 | 8.0 | 5.77 |
| | | BT 2EDR | Pi/4-DQPSK | 0.98 | | 7.02 |
| | | BT 3EDR | 8-DPSK | 0.79 | | 7.21 |
| | | | | | Result: | Complies |

Margin = [P_{Lim}] - [P_{Meas}]

12.0 FHSS NUMBER OF HOPPING CHANNELS

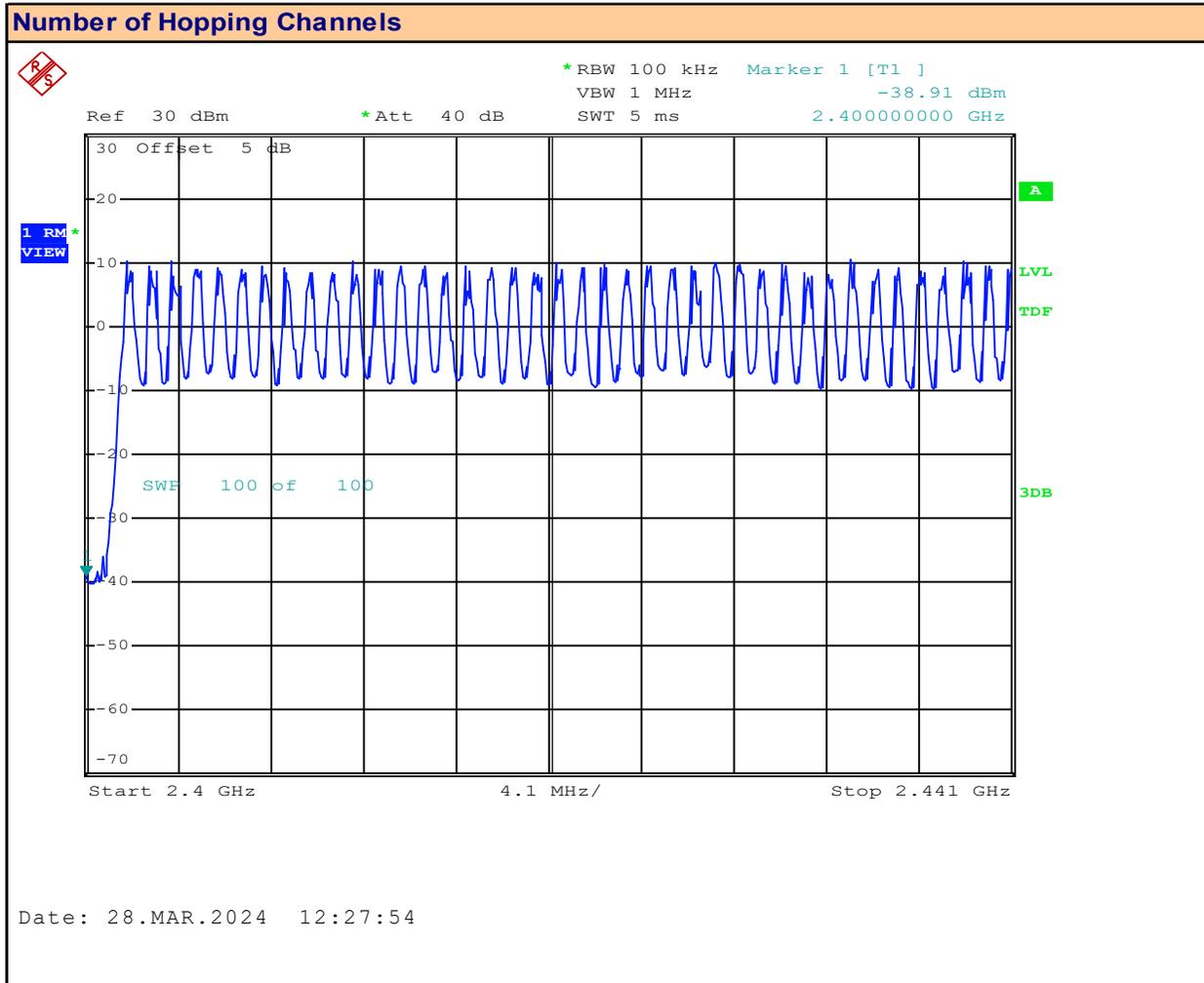
Test Procedure

| | |
|------------------|------------------------------------|
| Normative | FCC 47 CFR §15.247, RSS-247 |
| Reference | KDB 558074, ANSI C63.10 |

Limits

| | |
|----------------------|--|
| 47 CFR §15.247(a)(1) | (iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used. |
| RSS-247 (5.1)(d) | 5.1 Frequency hopping systems (FHS) The following applies to FHSs in each of the three bands: 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. |

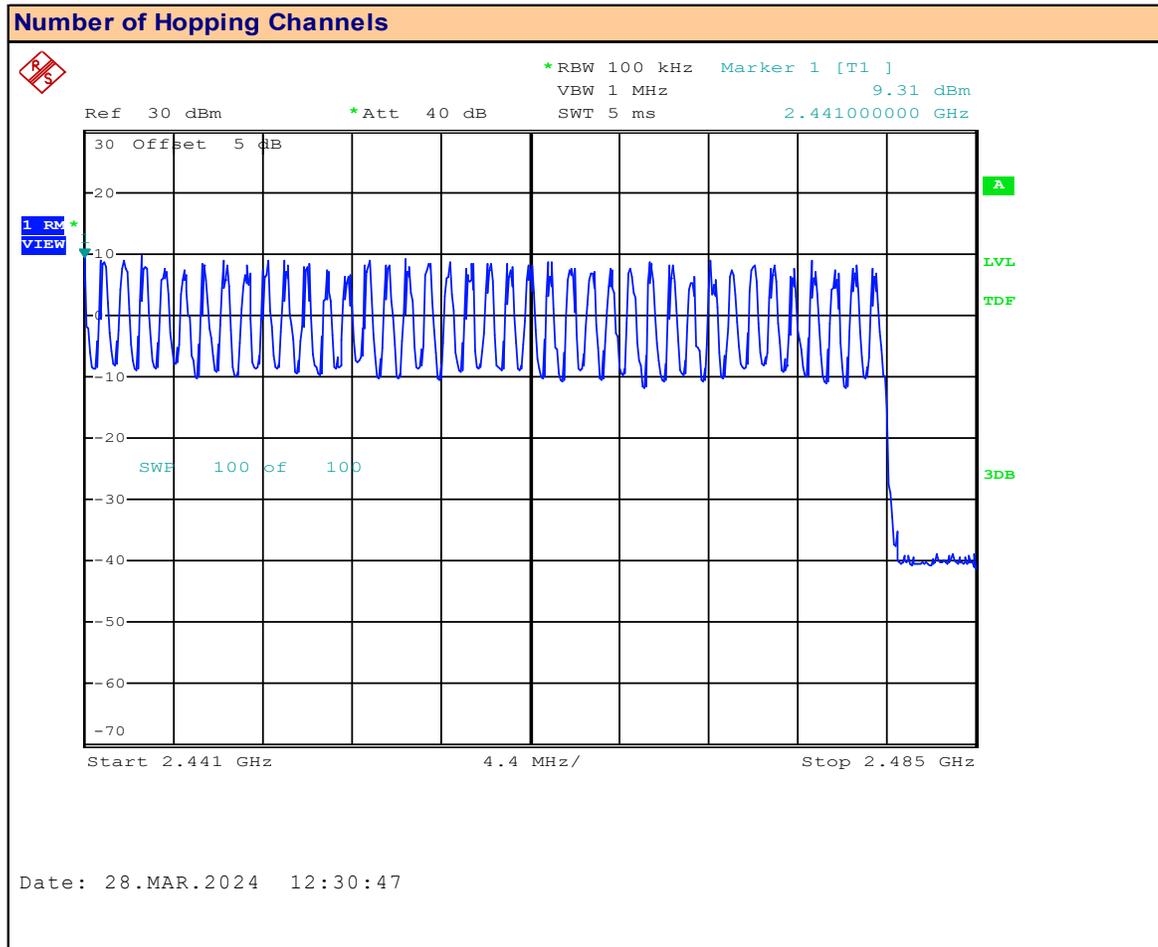
Plot 12.1 – Number of Hopping Channels, BT BR



Start Freq: MHz
 Mode:

Stop Freq: MHz
 Modulation:
 Number of Channels: kHz

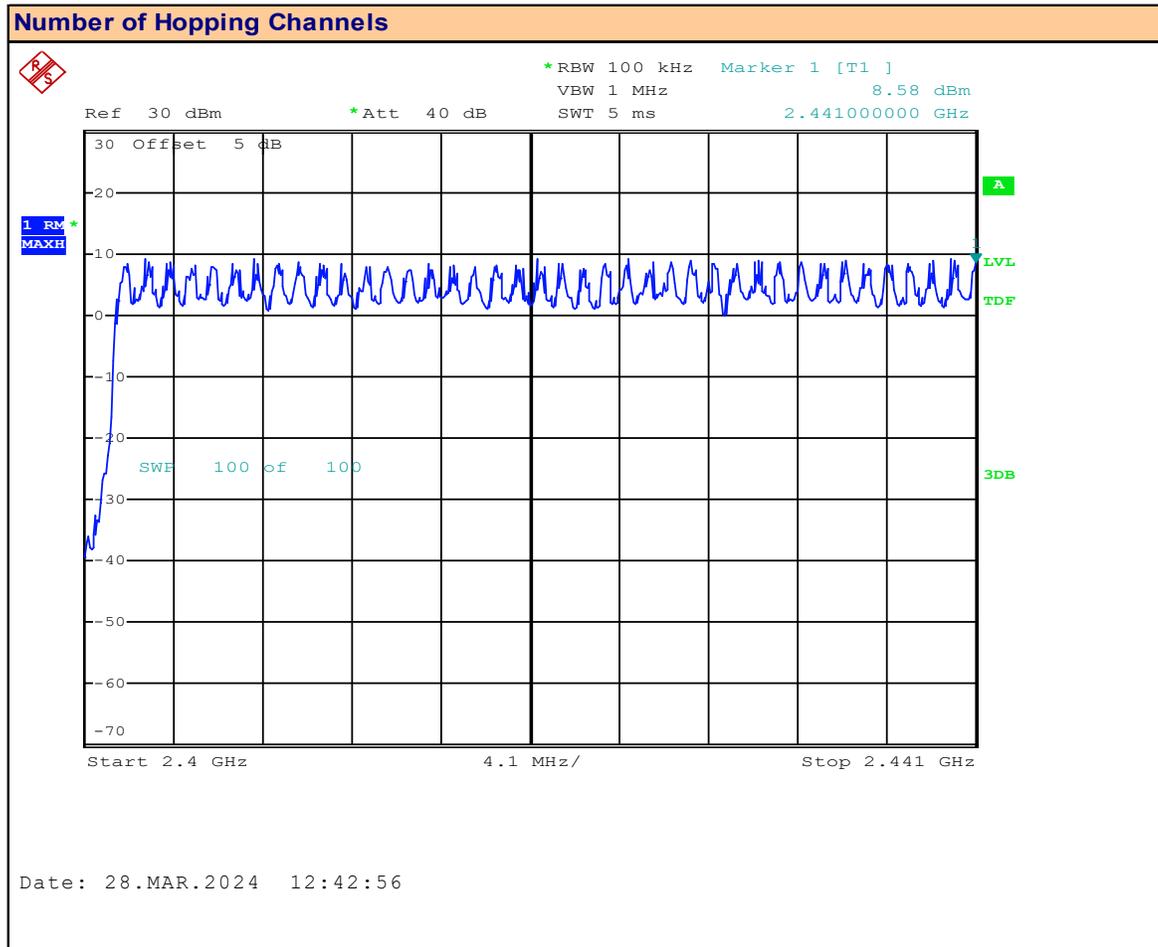
Plot 12.2 – Number of Hopping Channels, BT BR



Start Freq: MHz
 Mode:

Stop Freq: MHz
 Modulation:
 Number of Channels: kHz

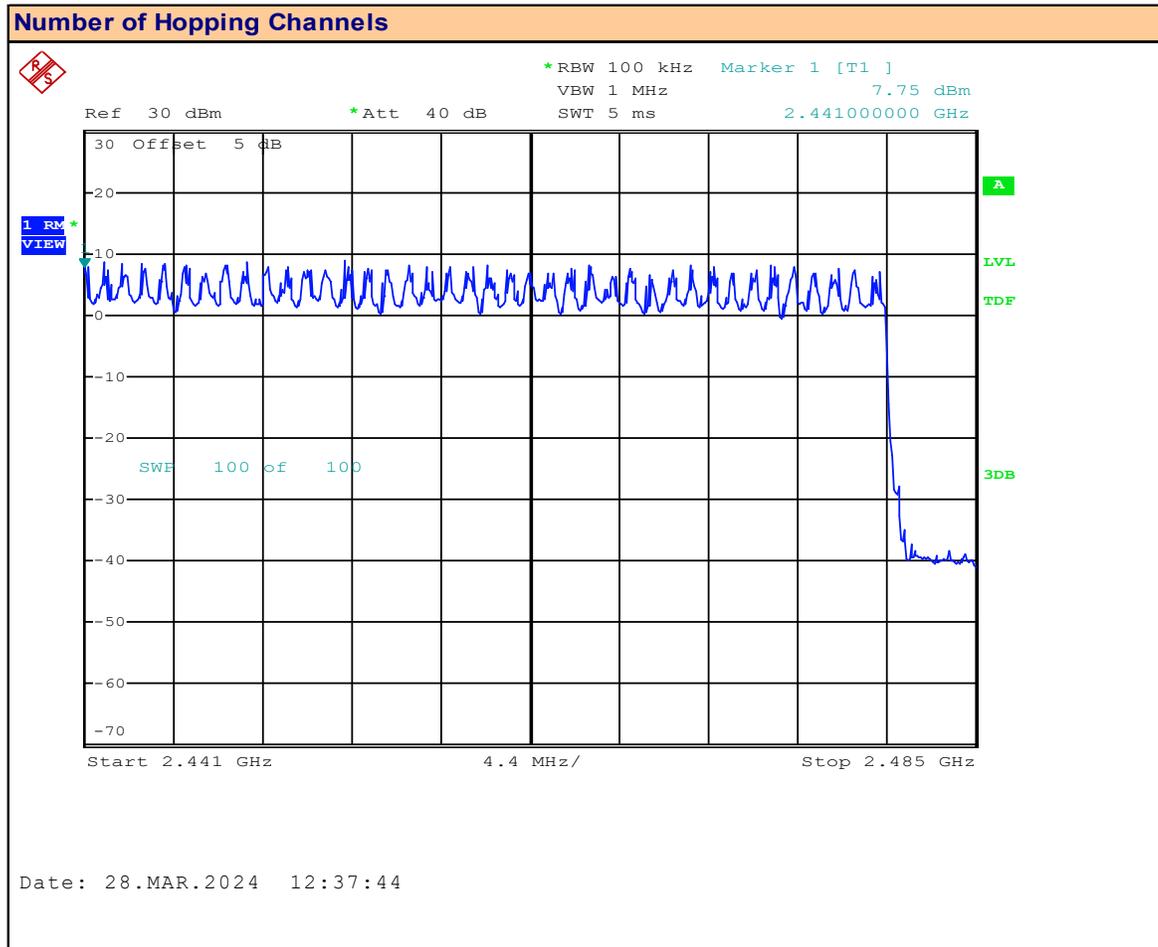
Plot 12.3 – Number of Hopping Channels, BT 2EDR



Start Freq: MHz
 Mode:

Stop Freq: MHz
 Modulation:
 Number of Channels: kHz

Plot 12.4 – Number of Hopping Channels, BT 2EDR



Start Freq: MHz
 Mode:

Stop Freq: MHz
 Modulation:
 Number of Channels: kHz

Table 12.2 – Summary of FHSS Number of Hopping Channels

| Number of Hopping Channels | | | | |
|-----------------------------------|--------------------------------|-------------|-------------------|---------------------------|
| Start Frequency (MHz) | Channel Frequency (MHz) | Mode | Modulation | Number of Channels |
| 2400 | 2441.0 | BT BR | GFSK | 40 |
| 2441 | 2485.0 | | | 39 |
| Total [N_{Chan}] | | | | 79 |
| 2400 | 2441.0 | BT 2EDR | Pi/4-DQPSK | 40 |
| 2441 | 2485.0 | | | 39 |
| Total [N_{Chan}] | | | | 79 |

13.0 FHSS CHANNEL SEPARATION

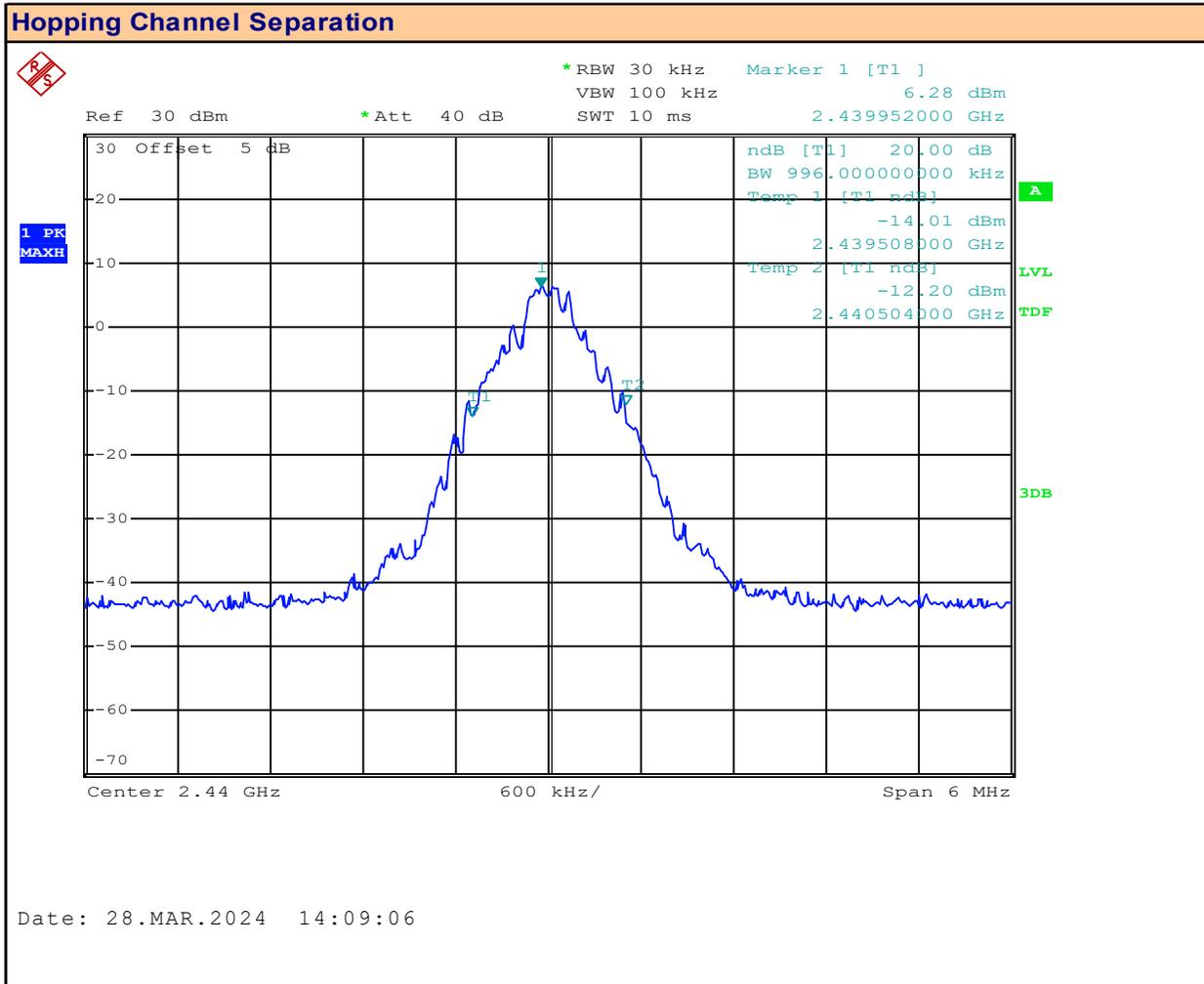
Test Procedure

| | |
|------------------|------------------------------------|
| Normative | FCC 47 CFR §15.247, RSS-247 |
| Reference | KDB 558074, ANSI C63.10 |

Limits

| | |
|----------------------|---|
| 47 CFR §15.247(a)(1) | (1) Frequency hopping systems 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, frequency hopping systems operating in the 2400- 2483.5 MHz band 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 the systems operate with an output power no greater than 125 mW. |
| RSS-247 (5.1)(db) | 5.1 Frequency hopping systems (FHS) The following applies to FHSs in each of the three bands: 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. |

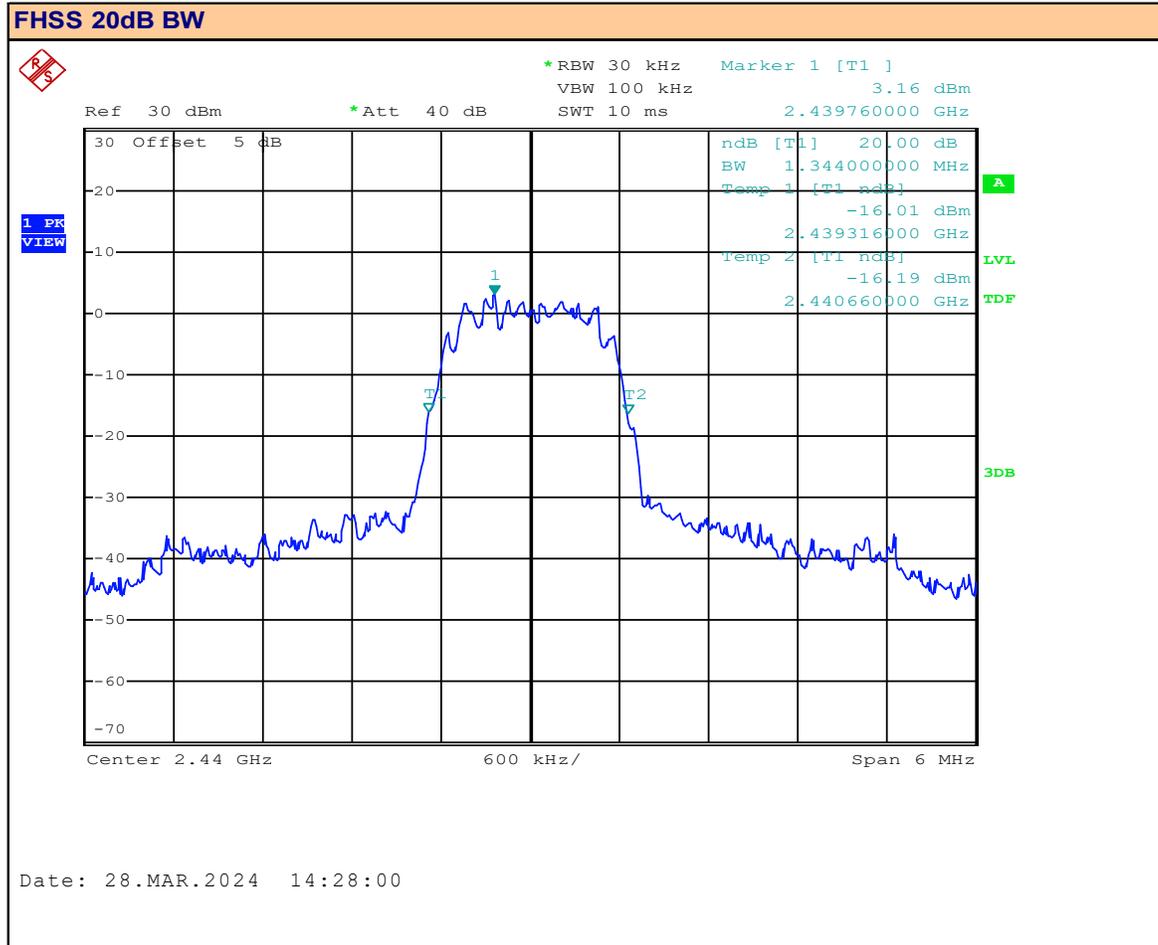
Plot 13.1 – 20dB BW, BT BR



Channel:
 Mode:

Frequency: MHz
 Modulation:
 Measured 20dB BW: MHz

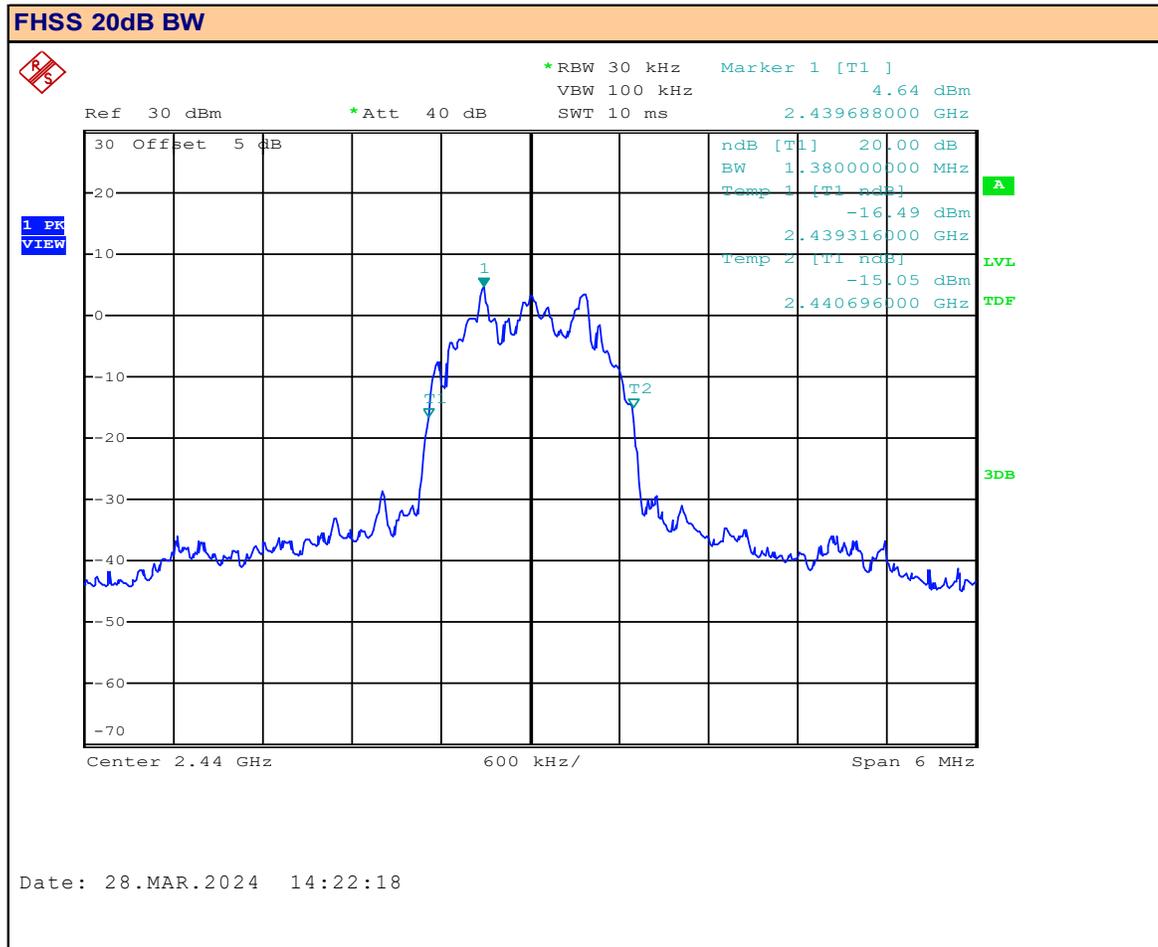
Plot 13.2 – 20dB BW, BT 2EDR



Channel: **38**
 Mode: **BT 2EDR**

Frequency: **2440** MHz
 Modulation: **Pi/4-DQPSK**
 Measured 20dB BW: **1.344** MHz

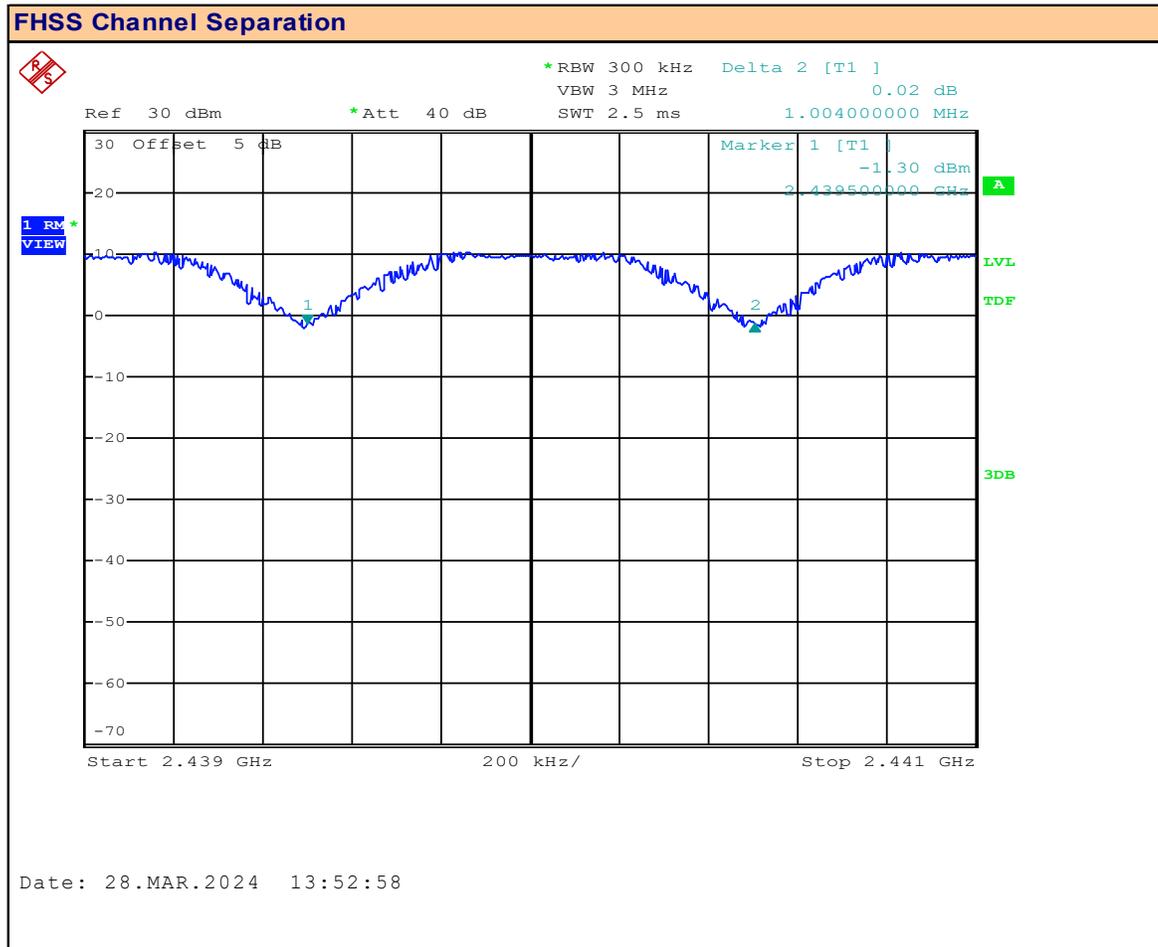
Plot 13.3 – 20dB BW, BT 3EDR



Channel: **38**
 Mode: **BT 3EDR**

Frequency: **2440** MHz
 Modulation: **8-DPSK**
 Measured 20dB BW: **1.38** MHz

Plot 13.4 – FHSS Channel Separation, BT BR



Channel:

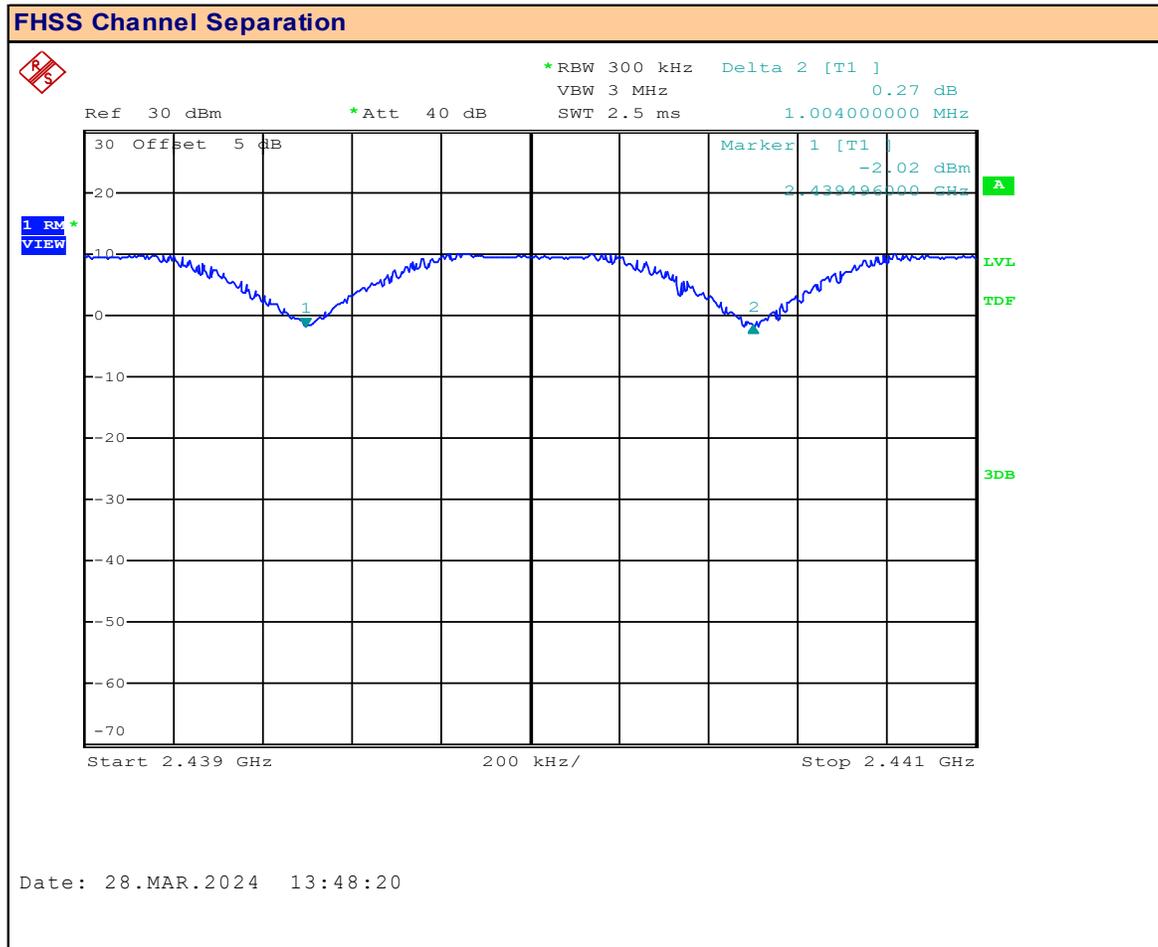
Mode:

Frequency: MHz

Modulation:

Measured Channel Separation: MHz

Plot 13.5 – FHSS Channel Separation, BT 2EDR

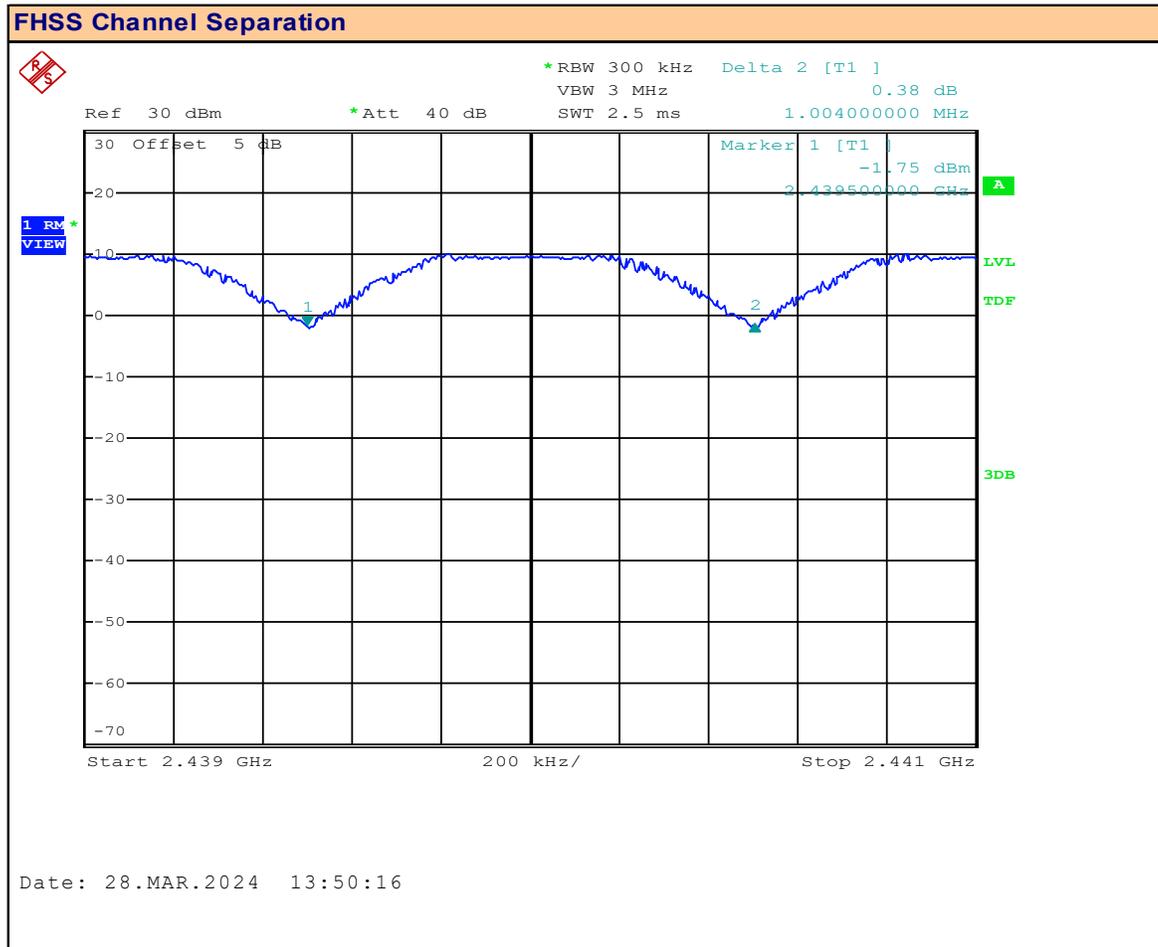


Channel:
 Mode:

Frequency: MHz
 Modulation:

Measured Channel Separation: MHz

Plot 13.6 – FHSS Channel Separation, BT 3EDR



Channel:
 Mode:

Frequency: MHz
 Modulation:

Measured Channel Separation: MHz

Table 13.1 – Summary of FHSS Channel Separation

| Hopping Channel Separation | | | | | |
|-----------------------------------|-------------------|-------------------------------------|---|---|-------------------------|
| Mode | Modulation | 20dB Bandwidth (MHz) | Channel Separation (MHz) | Minimum Separation (MHz) | Margin (MHz) |
| BT BR | GFSK | 0.996 | 1.004 | 0.664 | 0.340 |
| BT 2EDR | Pi/4-DQPSK | 1.344 | 1.004 | 0.896 | 0.108 |
| BT 3EDR | 8-DPSK | 1.380 | 1.004 | 0.920 | 0.084 |
| Result: | | | | | Complies |

Minimum Bandwidth = 20dB BW X 2/3

Margin = Channel Separation - 20dB Bandwidth

14.0 FHSS TIME OF OCCUPANCY

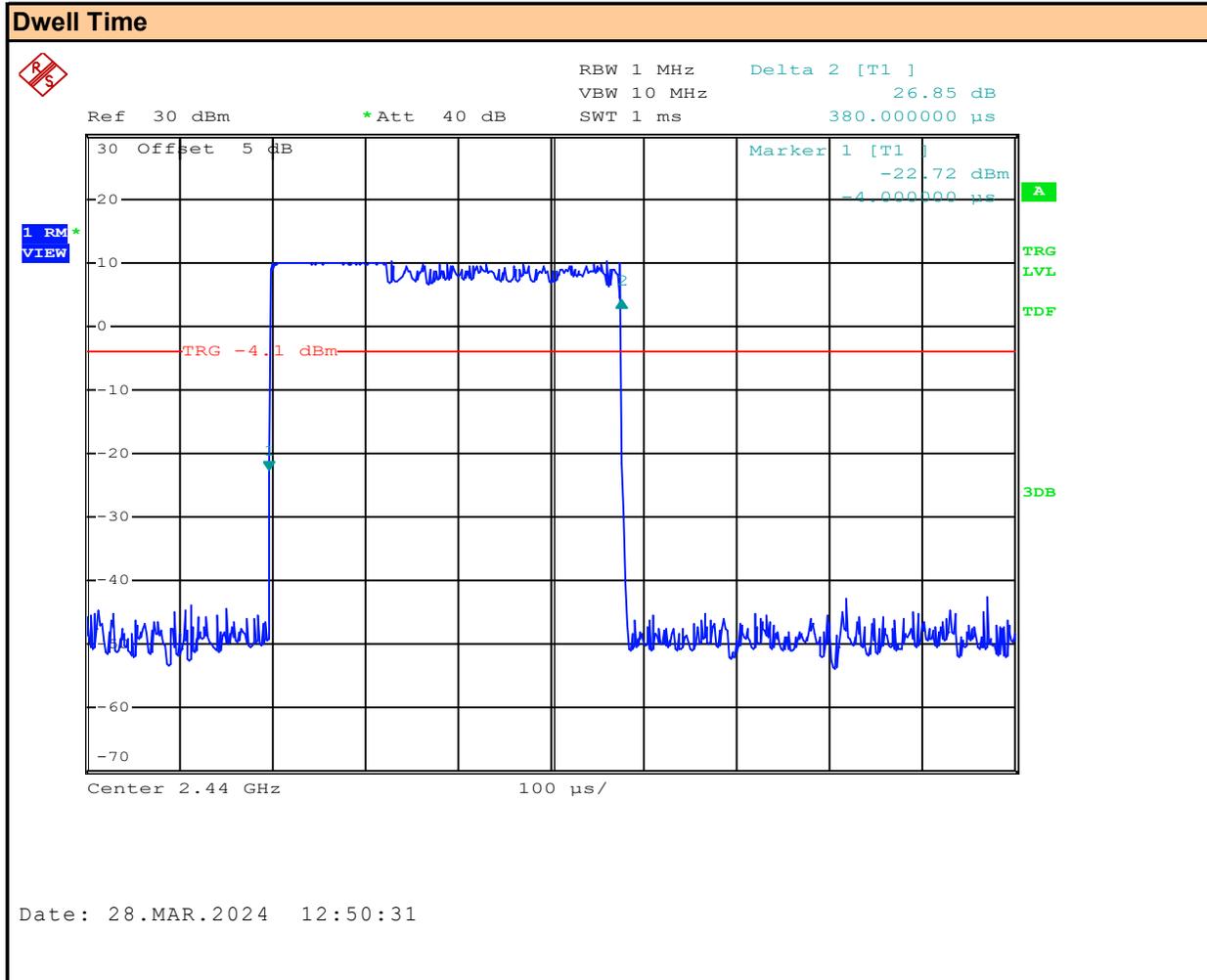
Test Procedure

| | |
|----------------------------|------------------------------------|
| Normative Reference | FCC 47 CFR §15.247, RSS-247 |
| | KDB 558074, ANSI C63.10 |

Limits

| | |
|----------------------|--|
| 47 CFR §15.247(a)(1) | (iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used. |
| RSS-247 (5.1)(d) | 5.1 Frequency hopping systems (FHS) 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. |

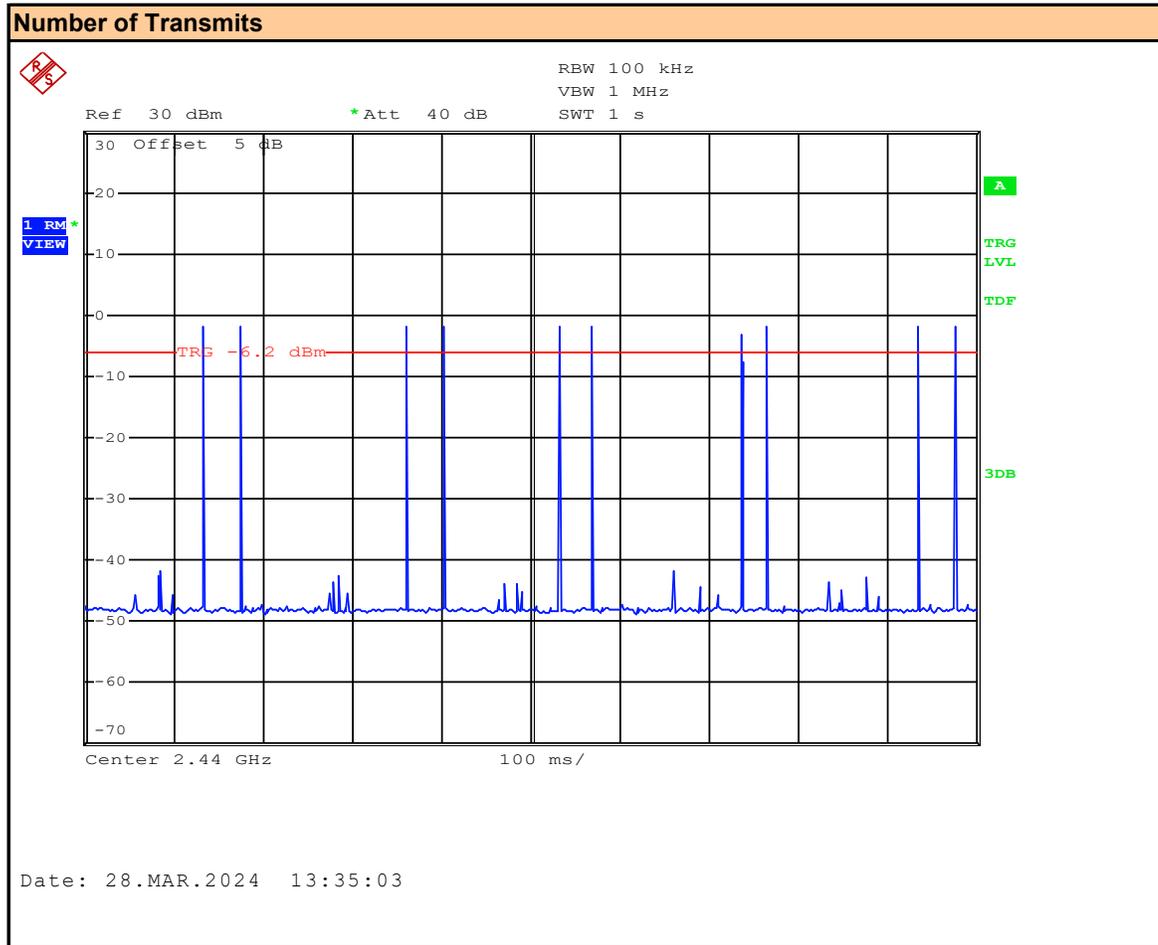
Plot 14.1 – Time of Occupancy, DH1, 2-DH1, 3-DH1, DM1



Packet: **DH1, DM1, 2-DH1, 3-DH1**

Measured Dwell Time: **0.38** mSec

Plot 14.2 – Time of Occupancy, DH1, 2-DH1, 3-DH1, DM1

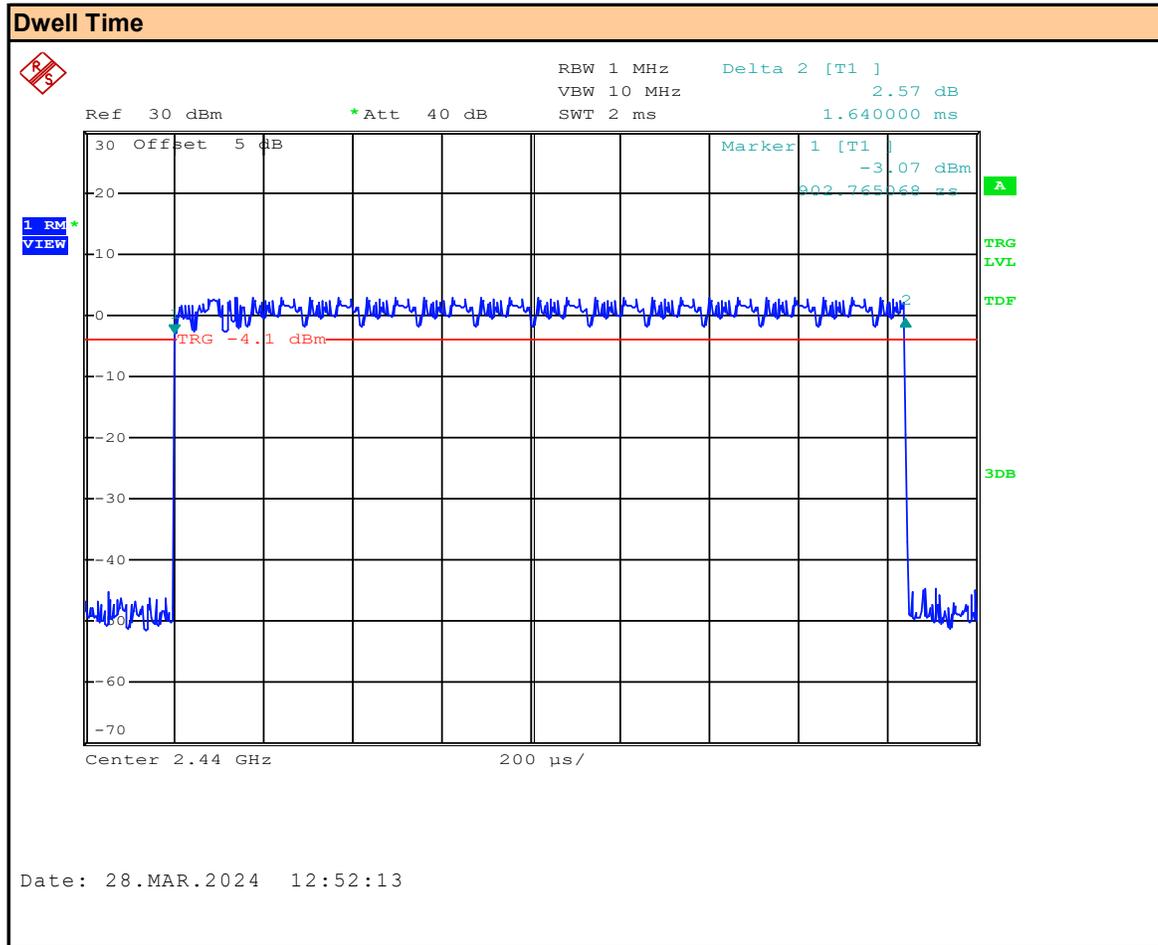


Date: 28.MAR.2024 13:35:03

Packet: **DH1, DM1, 2-DH1, 3-DH1**

Transmit Count: **10** /1000 mSec
 Measurement Period: **1000** mSec

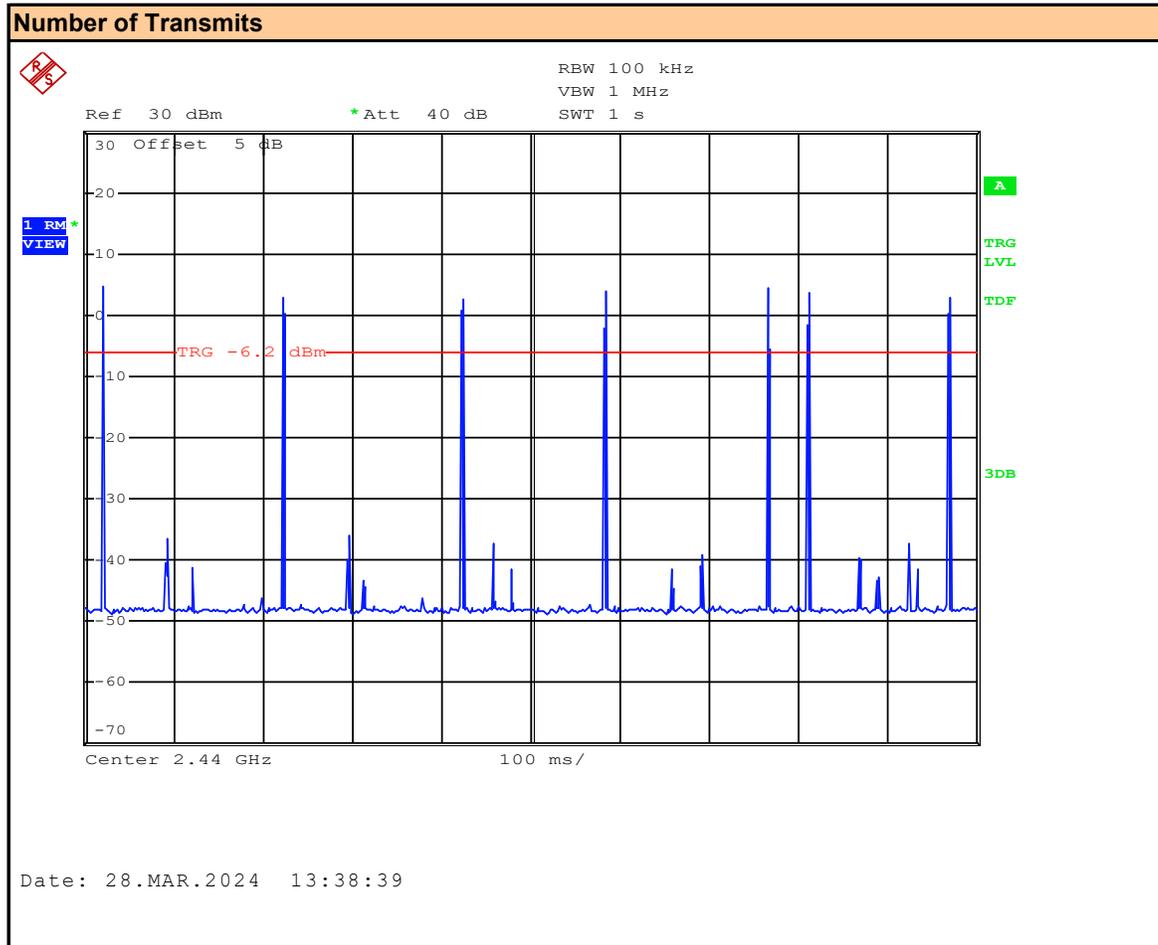
Plot 14.3 – Time of Occupancy, DH3, 2-DH3, 3-DH3, DM3



Packet: **DH3, DM3, 2-DH3, 3-DH3**

Measured Dwell Time: **1.64** mSec

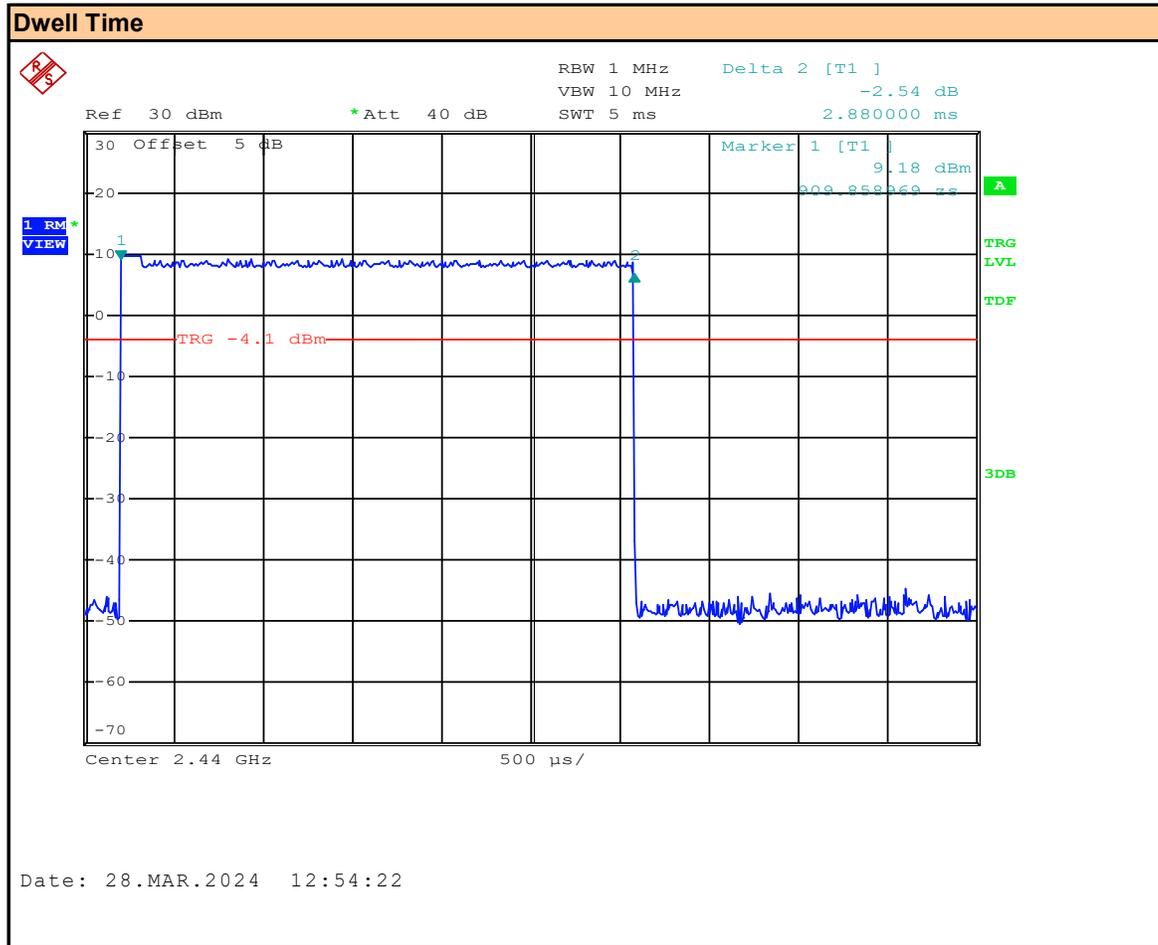
Plot 14.4 – Time of Occupancy, DH3, 2-DH3, 3-DH3, DM3



Packet: **DH3, DM3, 2-DH3, 3-DH3**

Transmit Count: **7** /1000 mSec
 Measurement Period: **1000** mSec

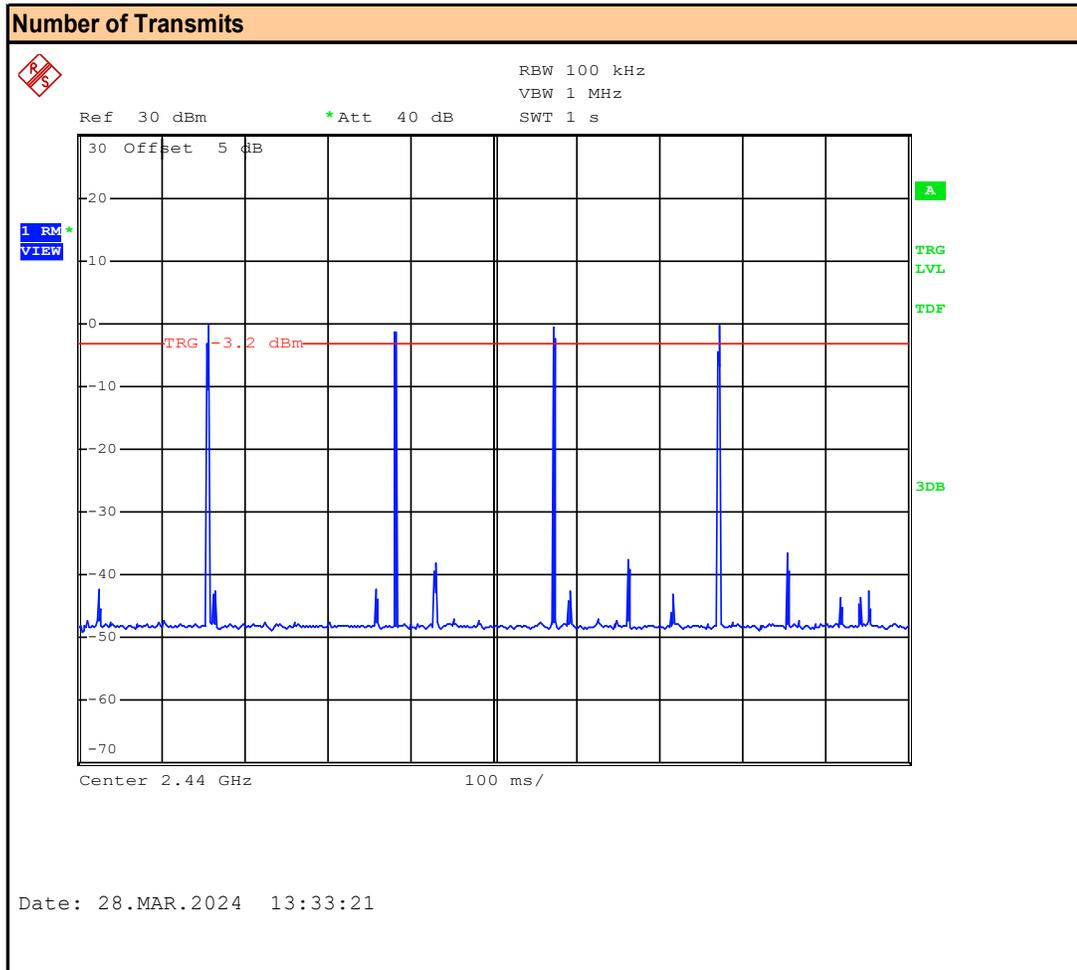
Plot 14.5 – Time of Occupancy, DH5, 2-DH5, 3-DH5, DM5



Packet: **DH5, DM5, 2-DH5, 3-DH5**

Measured Dwell Time: **2.88** mSec

Plot 14.6 – Time of Occupancy, DH5, 2-DH5, 3-DH5, DM5



Packet: **DH5, DM5, 2-DH5, 3-DH5**

Transmit Count: **4** /1000 mSec

Measurement Period: **1000** mSec

Table 14.1 – Summary of FHSS Time of Occupancy

| Accumulated Time of Occupancy DSS | | | | | | | | | | |
|-----------------------------------|----------|--|---|--|--|--|--|--|----------------------|---------------|
| Channel Frequency (MHz) | Packet | Channel On Time (Dwell) [t _{Dwell}] (mSec) | Meas Period [t _{Meas}] (mSec) | Number of Tx per Period [N _{Tx}] | Number of Channels Employed [N _{Chan}] | Maximum TOO Per Channel [t _{Max}] (mSec) | Maximum TOO Period [t _{Period}] (mSec) | Accumulated Time of Occupancy [t _{Occ}] (mSec) | Limit [Limit] (mSec) | Margin (mSec) |
| 2440.00 | DH1, ... | 0.380 | 1000 | 10 | 79 | 400.0 | 31600 | 120.1 | 400 | 279.9 |
| | DH3, ... | 1.640 | | 7 | | | | 362.8 | | 37.2 |
| | DH5, ... | 2.880 | | 4 | | | | 364.0 | | 36.0 |
| Result: | | | | | | | | | Complies | |

TOO = Time of Occupancy

Number of Channels Employed [N_{Chan}]: See Table 11.1

Maximum TOO Period [t_{Period}] = Number of Channels [N_{Chan}] X 0.4Sec, as per §15.247, RSS-247

$$\text{Accumulated Time of Occupancy [t}_{\text{Occ}}] = \frac{(\text{Number of Tx per Period [N}_{\text{Tx}}] \times \text{Dwell Time [t}_{\text{Dwell}}] \times \text{Maximum TOO Period [t}_{\text{Period}}])}{\text{Measurement Period [t}_{\text{Meas}}]}$$

Margin = Limit [Limit] - Accumulated Time of Occupancy [t_{Occ}]

15.0 CONDUCTED SPURIOUS EMISSIONS -BAND EDGE

Test Procedure

| | |
|----------------------------|--|
| Normative Reference | FCC 47 CFR §2.1051, §15.247(d), RSS-Gen (6.13), RSS-247 (5.5), |
| | KDB 558074 (11.3), ANSI C63.10 (11.11.3) |

Limits

| | |
|---------------------------------------|---|
| 47 CFR §15.247(d) | (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. |
| KDB 558074 (11.3) C63.10 (11.11.3) | <p>11.1 General</p> <p>The DTS rules specify that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions:</p> <p>b) If maximum conducted (average) output power was used to demonstrate compliance as described in 9.2, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 30 dBc).</p> <p>11.2 Reference level measurement</p> <p>a) Set instrument center frequency to DTS channel center frequency.</p> <p>b) Set the span to $\geq 1.5 \times DTS \text{ bandwidth}$.</p> <p>c) Set the RBW = 100 kHz.</p> <p>d) Set the VBW $\geq 3 \times RBW$.</p> <p>e) Detector = peak.</p> <p>f) Sweep time = auto couple.</p> <p>g) Trace mode = max hold.</p> <p>h) Allow trace to fully stabilize.</p> <p>i) Use the peak marker function to determine the maximum PSD level.</p> <p>Note that the channel found to contain the maximum PSD level can be used to establish the reference</p> |

Table 15.1 – Summary of Spurious Emission Measurements – Band Edge, (DTS)

See Appendix E for Measurement Plots

| Band Edge Measurement Results: DTS | | | | | | | | | | | | | | | |
|---|----------------|-----------------|------------|---|--|--------------------------|------------|-------------|--------------------|--|---|-------------------------------|----------------|------------------|--|
| Mode | Channel Number | Frequency (MHz) | Modulation | Emission Power [P _{Em}] (dBm) | Fundamental Power [P _{Fund}] (dBm) | Attenuation [Atten] (dB) | Limit (dB) | Margin (dB) | Antenna Gain (dBi) | Emission EIRP [E _{Em}] (dBm) | Fundamental EIRP [E _{Fund}] (dBm) | EIRP Attenuation [Atten] (dB) | Limit (dB) | EIRP Margin (dB) | |
| 802.11b | 1 | 2412.00 | DSSS 5.5 | -24.78 | 15.63 | 40.41 | 30 | 10.4 | -3.8 | -28.58 | 11.83 | 40.41 | 30 | 10.4 | |
| | 11 | 2462.00 | | -37.01 | 15.07 | 52.08 | | 22.1 | | -40.81 | 11.27 | 52.08 | | 22.1 | |
| | 12 | 2467.00 | | -30.98 | 15.07 | 46.05 | | 16.1 | | -34.78 | 11.27 | 46.05 | | 16.1 | |
| | 13 | 2472.00 | | -20.75 | 15.07 | 35.82 | | 5.8 | | -24.55 | 11.27 | 35.82 | | 5.8 | |
| 802.11g | 1 | 2412.00 | OFDM 12 | -22.21 | 12.58 | 34.79 | | 4.8 | | -26.01 | 8.78 | 34.79 | | 4.8 | |
| | 11 | 2462.00 | | -22.08 | 14.20 | 36.28 | | 6.3 | | -25.88 | 10.40 | 36.28 | | 6.3 | |
| | 12 | 2467.00 | | -16.51 | 14.15 | 30.66 | | 0.7 | | -20.31 | 10.35 | 30.66 | | 0.7 | |
| | 13 | 2472.00 | | -20.28 | 11.38 | 31.66 | | 1.7 | | -24.08 | 7.58 | 31.66 | | 1.7 | |
| 802.11n | 1 | 2412.00 | MCS0 | -22.18 | 14.61 | 36.79 | | 6.8 | | -25.98 | 10.81 | 36.79 | | 6.8 | |
| | 11 | 2462.00 | | -26.21 | 13.86 | 40.07 | | 10.1 | | -30.01 | 10.06 | 40.07 | | 10.1 | |
| | 12 | 2467.00 | | -18.08 | 13.80 | 31.88 | | 1.9 | | -21.88 | 10.00 | 31.88 | | 1.9 | |
| | 13 | 2472.00 | | -18.37 | 12.10 | 30.47 | | 0.5 | | -22.17 | 8.30 | 30.47 | | 0.5 | |
| BLE 1mb | 37 | 2402.00 | GMSK | -38.44 | 0.70 | 39.14 | | 9.1 | | -42.24 | -3.10 | 39.14 | | 9.1 | |
| | 39 | 2480.00 | | -39.99 | 0.70 | 40.69 | | 10.7 | | -43.79 | -3.10 | 40.69 | | 10.7 | |
| BLE 2mb | 0 | 2404.00 | GMSK | -36.97 | 1.48 | 38.45 | | 8.5 | | -40.77 | -2.32 | 38.45 | | 8.5 | |
| | 39 | 2480.00 | | -39.40 | 1.48 | 40.88 | | 10.9 | | -43.20 | -2.32 | 40.88 | | 10.9 | |
| ANT | 0 | 2402.00 | GFSK | -39.52 | 1.07 | 40.59 | 10.6 | -43.32 | -2.73 | 40.59 | 10.6 | | | | |
| | 78 | 2480.00 | | -40.03 | 1.07 | 41.10 | 11.1 | -43.83 | -2.73 | 41.10 | 11.1 | | | | |
| | | | | | | | | | | | | | Result: | Complies | |

Attenuation [Atten] = [P_{Fund}] - [P_{Em}]

Margin = [Atten] - Limit

Table 15.2 – Summary of Spurious Emission Measurements – Band Edge, (DSS)

See Appendix E for Measurement Plots

| Band Edge Measurement Results: DSS | | | | | | | | | | | | | | | | | |
|---|----------------|-----------------|------------|---|--|--------------------------|------------|-------------|--------------------|--|---|-------------------------------|----------------|------------------|----|------|------|
| Mode | Channel Number | Frequency (MHz) | Modulation | Emission Power [P _{Em}] (dBm) | Fundamental Power [P _{Fund}] (dBm) | Attenuation [Atten] (dB) | Limit (dB) | Margin (dB) | Antenna Gain (dBi) | Emission EIRP [E _{Em}] (dBm) | Fundamental EIRP [E _{Fund}] (dBm) | EIRP Attenuation [Atten] (dB) | Limit (dB) | EIRP Margin (dB) | | | |
| BT BR | 0 | 2402.00 | GFSK | -34.33 | 10.00 | 44.33 | 30 | 14.3 | -3.8 | -38.13 | 6.20 | 44.33 | 30 | 14.3 | | | |
| | 78 | 2480.00 | | -39.60 | | 39.60 | | 9.6 | | -43.40 | -3.80 | 39.60 | | 9.6 | | | |
| BT 2EDR | 0 | 2402.00 | Pi/4-DQPSK | -32.95 | 9.30 | 42.25 | | 12.3 | | -3.8 | -36.75 | 5.50 | | 42.25 | 30 | 12.3 | |
| | 78 | 2480.00 | | -39.57 | | 39.57 | | 9.6 | | | -43.37 | -3.80 | | 39.57 | | 9.6 | |
| BT 3EDR | 2 | 2404.00 | 8-DPSK | -38.41 | 9.17 | 47.58 | | 17.6 | | | -42.21 | 5.37 | | 47.58 | | 30 | 17.6 |
| | 78 | 2480.00 | | -39.63 | | 39.63 | | 9.6 | | | -43.43 | -3.80 | | 39.63 | | | 9.6 |
| | | | | | | | | | | | | | Result: | Complies | | | |

Attenuation [Atten] = [P_{Fund}] - [P_{Em}]

Margin = [Atten] - Limit

16.0 CONDUCTED SPURIOUS EMISSIONS

Test Procedure

| | |
|----------------------------|--|
| Normative Reference | FCC 47 CFR §2.1051, §15.247(d), RSS-Gen (6.13), RSS-247 (5.5), |
| | KDB 558074 (11.3), ANSI C63.10 (11.11.3) |

Limits

| | |
|---------------------------------------|---|
| 47 CFR §15.247(d) | (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. |
| KDB 558074 (11.3) C63.10 (11.11.3) | <p>11.1 General</p> <p>The DTS rules specify that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions:</p> <p>b) If maximum conducted (average) output power was used to demonstrate compliance as described in 9.2, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 30 dBc).</p> <p>11.2 Reference level measurement</p> <p>a) Set instrument center frequency to DTS channel center frequency.</p> <p>b) Set the span to $\geq 1.5 \times DTS \text{ bandwidth}$.</p> <p>c) Set the RBW = 100 kHz.</p> <p>d) Set the VBW $\geq 3 \times RBW$.</p> <p>e) Detector = peak.</p> <p>f) Sweep time = auto couple.</p> <p>g) Trace mode = max hold.</p> <p>h) Allow trace to fully stabilize.</p> <p>i) Use the peak marker function to determine the maximum PSD level.</p> <p>Note that the channel found to contain the maximum PSD level can be used to establish the reference</p> |

Table 16.1 – Summary of Conducted Spurious Emissions, (DTS)

See Appendix F for Measurement Plots

| Conducted Spurious Emissions Measurement Results: | | | | | | | | |
|--|-----------------|------------|---|--------------------------|--|--------------------------|-----------------|-------------|
| Channel Number | Frequency (MHz) | Modulation | Emission Power [P _{Em}] (dBm) | Emission Frequency (MHz) | Fundamental Measurement [P _{Fund}] (dBm) | Attenuation [Atten] (dB) | Limit (dB) | Margin (dB) |
| 6 | 2437.00 | DSSS 5.5 | -38.47 | 3588 | 8.25 | 46.72 | 30 | 16.7 |
| | | | | | | | Complies | |

Attenuation [Atten] = [P_{Fund}] - [P_{Em}]
 Margin = Attenuation - Limit
 ND = None Detected

Table 16.2 – Summary of Conducted Spurious Emissions, (DSS)

See Appendix F for Measurement Plots

| Conducted Spurious Emissions Measurement Results: | | | | | | | | |
|--|-----------------|------------|---|--------------------------|--|--------------------------|-----------------|-------------|
| Channel Number | Frequency (MHz) | Modulation | Emission Power [P _{Em}] (dBm) | Emission Frequency (MHz) | Fundamental Measurement [P _{Fund}] (dBm) | Attenuation [Atten] (dB) | Limit (dB) | Margin (dB) |
| 38 | 2440.00 | GFSK | ND | ND | 4.86 | n/a | 30 | n/a |
| | | | | | | | Complies | |

Attenuation [Atten] = [P_{Fund}] - [P_{Em}]
 Margin = Attenuation - Limit
 ND = None Detected

17.0 RADIATED TX SPURIOUS EMISSIONS

Test Procedure

| | |
|----------------------------|---|
| Normative Reference | FCC 47 CFR §2.1051, §15.247(d), §15.205(a), §15.205(c), §15.209(a) |
| | KDB 558074 (8.6), ANSI C63.10 (11.12) |

Limits

| 47 CFR §15.247(d) | (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)). | | | | | | | | | | | | | | | | |
|-------------------|--|-----------------|-----------------------------------|---------------|--------------------|---------------|--------------------|------------|----------|---------|---------|----------|---------|-----------|---------|-----------|---------|
| 47 CFR §15.209(a) | <p>§15.209 Radiated emission limits; general requirements.</p> <p>(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:</p> <table border="1"> <thead> <tr> <th>Frequency (MHz)</th> <th>Field Strength (microvolts/meter)</th> </tr> </thead> <tbody> <tr> <td>0.009 - 0.490</td> <td>2400/F (kHz) @300m</td> </tr> <tr> <td>0.490 - 1.705</td> <td>24000/F (kHz) @30m</td> </tr> <tr> <td>1.705 - 30</td> <td>30 @ 30m</td> </tr> <tr> <td>30 - 88</td> <td>100 @3m</td> </tr> <tr> <td>88 - 216</td> <td>150 @3m</td> </tr> <tr> <td>216 - 960</td> <td>200 @3m</td> </tr> <tr> <td>Above 960</td> <td>500 @3m</td> </tr> </tbody> </table> | Frequency (MHz) | Field Strength (microvolts/meter) | 0.009 - 0.490 | 2400/F (kHz) @300m | 0.490 - 1.705 | 24000/F (kHz) @30m | 1.705 - 30 | 30 @ 30m | 30 - 88 | 100 @3m | 88 - 216 | 150 @3m | 216 - 960 | 200 @3m | Above 960 | 500 @3m |
| Frequency (MHz) | Field Strength (microvolts/meter) | | | | | | | | | | | | | | | | |
| 0.009 - 0.490 | 2400/F (kHz) @300m | | | | | | | | | | | | | | | | |
| 0.490 - 1.705 | 24000/F (kHz) @30m | | | | | | | | | | | | | | | | |
| 1.705 - 30 | 30 @ 30m | | | | | | | | | | | | | | | | |
| 30 - 88 | 100 @3m | | | | | | | | | | | | | | | | |
| 88 - 216 | 150 @3m | | | | | | | | | | | | | | | | |
| 216 - 960 | 200 @3m | | | | | | | | | | | | | | | | |
| Above 960 | 500 @3m | | | | | | | | | | | | | | | | |

Table 17.1 – Summary of Radiated Tx Spurious Emissions, (DTS)

See Appendix G for Measurement Plots

| Summary of Radiated Tx Emissions | | | | | | | | | | | |
|----------------------------------|-------------------------|----------------------|--------------------------|---|------------------------|-----------------------------------|---------------------------------------|-----|--|-----------------|-------------|
| Measured Frequency Range (MHz) | Channel Frequency (MHz) | Antenna Polarization | Emission Frequency (MHz) | Measured Emission [E _{Meas}] (dBuV) | Antenna ACF [ACF] (dB) | Cable Loss [L _c] (dB) | Amplifier Gain [G _A] (dB) | | Corrected Emission [E _{Corr}] (dBuV/m) | Limit (dBuV) | Margin (dB) |
| 30-1000 MHz | 2437.0 | Horizontal | ND | (1) AV | n/a | n/a | 0.00 | (3) | ND | n/a | (1) |
| 30-1000 MHz | | Vertical | ND | (1) AV | n/a | n/a | 0.00 | (3) | ND | n/a | (1) |
| 1-18 GHz | | Horizontal | ND | (1) AV | n/a | n/a | 0.00 | (3) | ND | n/a | (1) |
| 1-18GHz | | Vertical | ND | (1) AV | n/a | n/a | 0.00 | (3) | ND | n/a | (1) |
| 18-25 GHz | | Horizontal | ND | (1) AV | n/a | n/a | 0.00 | (3) | ND | n/a | (1) |
| 18-25 GHz | | Vertical | ND | (1) AV | n/a | n/a | 0.00 | (3) | ND | n/a | (1) |
| Results: | | | | | | | | | | Complies | |

- (1) No Emissions Detected (ND) above ambient or within 20dB of the limit
- (2) Antenna ACF, Cable Loss and Amplifier Gain corrected in Spectrum Analyzer Transducer Factor
- (3) External Amplifier not used

$$E_{\text{Corr}} = E_{\text{Meas}} + ACF^E + L_C - G_A$$

Where ACF^E is the Electric Antenna Correction Factor

* Without Manufacturer's Accessories, ** With Manufacturer's Accessories

Table 17.2 – Summary of Radiated Tx Spurious Emissions, (DSS)

See Appendix G for Measurement Plots

| Summary of Radiated Tx Emissions | | | | | | | | | | | |
|----------------------------------|-------------------------|----------------------|--------------------------|---|------------------------|-----------------------------------|---------------------------------------|--|-----------------|-------------|--|
| Measured Frequency Range (MHz) | Channel Frequency (MHz) | Antenna Polarization | Emission Frequency (MHz) | Measured Emission [E _{Meas}] (dBuV) | Antenna ACF [ACF] (dB) | Cable Loss [L _c] (dB) | Amplifier Gain [G _A] (dB) | Corrected Emission [E _{Corr}] (dBuV/m) | Limit (dBuV) | Margin (dB) | |
| 30-1000 MHz | 2440.0 | Horizontal | ND | (1) AV | n/a | n/a | 0.00 (3) | ND | n/a | (1) | |
| 30-1000 MHz | | Vertical | ND | (1) AV | n/a | n/a | 0.00 (3) | ND | n/a | (1) | |
| 1-18 GHz | | Horizontal | ND | (1) AV | n/a | n/a | 0.00 (3) | ND | n/a | (1) | |
| 1-18GHz | | Vertical | ND | (1) AV | n/a | n/a | 0.00 (3) | ND | n/a | (1) | |
| 18-25 GHz | | Horizontal | ND | (1) AV | n/a | n/a | 0.00 (3) | ND | n/a | (1) | |
| 18-25 GHz | | Vertical | ND | (1) AV | n/a | n/a | 0.00 (3) | ND | n/a | (1) | |
| Results: | | | | | | | | | Complies | | |

- (1) No Emissions Detected (ND) above ambient or within 20dB of the limit
- (2) Antenna ACF, Cable Loss and Amplifier Gain corrected in Spectrum Analyzer Transducer Factor
- (3) External Amplier not used

$$E_{Corr} = E_{Meas} + ACF^E + L_C - G_A$$

Where ACF^E is the Electric Antenna Correction Factor

* Without Manufacturer's Accessories, ** With Manufacturer's Accessories

18.0 RADIATED RX SPURIOUS EMISSIONS

Test Procedure

| | |
|----------------------------|--|
| Normative Reference | FCC 47 CFR §15.109, ICES-003(6.2) ANSI C63.4:2014 |
|----------------------------|--|

Limits

| | |
|-----------------|---|
| 47 CFR §15.109 | (a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values: 30-88MHz: 40dBuV/m 88-216MHz: 43.5dBuV/m 216-960MHz: 46dBuV/m > 960MHz: 54dBuV/m |
| ICES-003(6.2.1) | 6.2.1 - Radiated Emissions Limits Below 1 GHz Class B: ITE that does not meet the conditions for Class A operation shall comply with the Class B radiated limits set out in Table 5 determined at a distance of 3 metres. 30-88MHz: 40dBuV/m 88-216MHz: 43.5dBuV/m 216-960MHz: 46dBuV/m > 960MHz: 54dBuV/m |

| | |
|-------------------|-------------------------------------|
| Test Setup | Appendix A Figure A.2 |
|-------------------|-------------------------------------|

Measurement Procedure

The DUT was set up as per ANSI C63.4:2014. Emissions were scanned between 30MHz and 1000MHz. The turntable was rotated 360 degrees and the antenna was elevated to 4m to optimize the measured emissions.

Table 18.1 – Summary of Radiated Rx Spurious Emissions

See Appendix H Measurement Plots

| Summary of Radiated Rx Emissions | | | | | | | | | | |
|---|-------------------------|----------------------|--------------------------|---|------------------------|-----------------------------------|---------------------------------------|--|-----------------|-------------|
| Measured Frequency Range (MHz) | Channel Frequency (MHz) | Antenna Polarization | Emission Frequency (MHz) | Measured Emission [E _{Meas}] (dBuV) | Antenna ACF [ACF] (dB) | Cable Loss [L _c] (dB) | Amplifier Gain [G _A] (dB) | Corrected Emission [E _{Corr}] (dBuV/m) | Limit (dBuV) | Margin (dB) |
| 30-1000 | - | Horizontal | (1) | (1) AV | - | - | 0.00 (3) | (1) | - | (1) |
| 30-1000 | - | Vertical | (1) | (1) AV | - | - | 0.00 (3) | (1) | - | (1) |
| 1000-25000 | - | Horizontal | (1) | (1) AV | - | - | 0.00 (3) | (1) | 54.0 | (1) |
| 1000-25000 | - | Vertical | (1) | (1) AV | - | - | 0.00 (3) | (1) | 54.0 | (1) |
| Results: | | | | | | | | | Complies | |

(1) No Emissions Detected (ND) above ambient or within 20dB of the limit

(3) External Amplifier not used

$$E_{Corr} = E_{Meas} + ACF^E + L_C - G_A$$

Where ACF^E is the Electric Antenna Correction Factor

19.0 LINE CONDUCTED EMISSIONS

Test Procedure

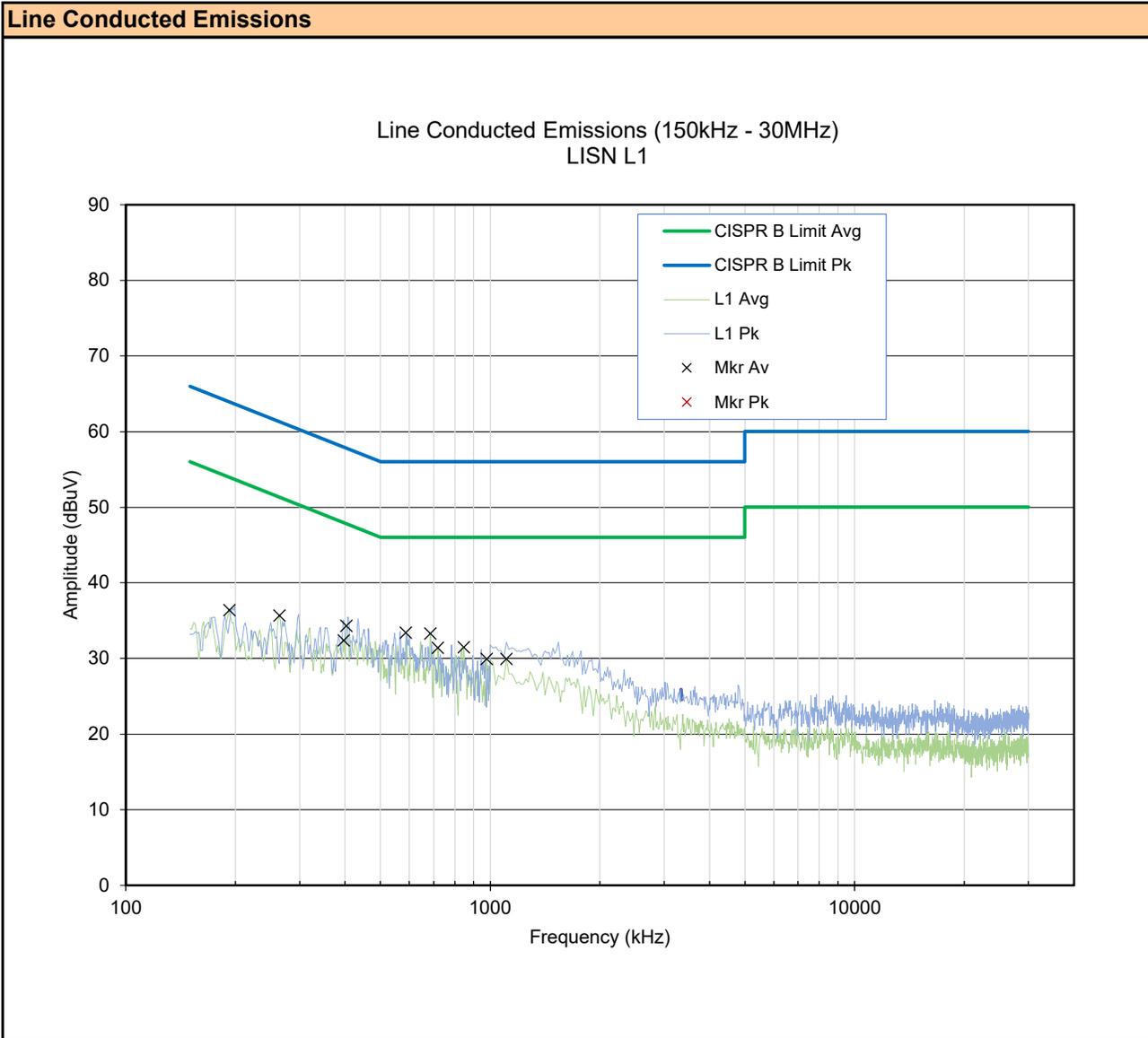
| | |
|----------------------------|--|
| Normative Reference | FCC 47 CFR §15.107, ICES-003(6.1) ANSI C63.4-2014 |
|----------------------------|--|

Limits

| | |
|----------------|---|
| 47 CFR §15.107 | (a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges. 0.15-0.5MHz: 66-56 dBuV Quasi Peak, 56-46 dBuV Average, Decreases with the logarithm of the frequency 0.5 - 5.0 MHz: 56 dBuV Quasi Peak, 46 dBuV Average 5.0 - 30.0 MHz: 60 dBuV Quasi Peak, 50 dBuV Average |
| ICES-003(6.1) | 6.1 - AC Power Line Conducted Emissions Limits Class B: ITE that does not meet the conditions for Class A operation shall comply with the Class B radiated limits set out in Table 2. 0.15-0.5MHz: 66-56 dBuV Quasi Peak, 56-46 dBuV Average, Decreases with the logarithm of the 0.5 - 5.0 MHz: 56 dBuV Quasi Peak, 46 dBuV Average 5.0 - 30.0 MHz: 60 dBuV Quasi Peak, 50 dBuV Average |

| | |
|-------------------|---|
| Test Setup | Appendix A Figure A.7 |
|-------------------|---|

Plot 19.1 – Power Line Conducted Emissions, Line 1



Plot 19.2 – Power Line Conducted Emissions, Line 2

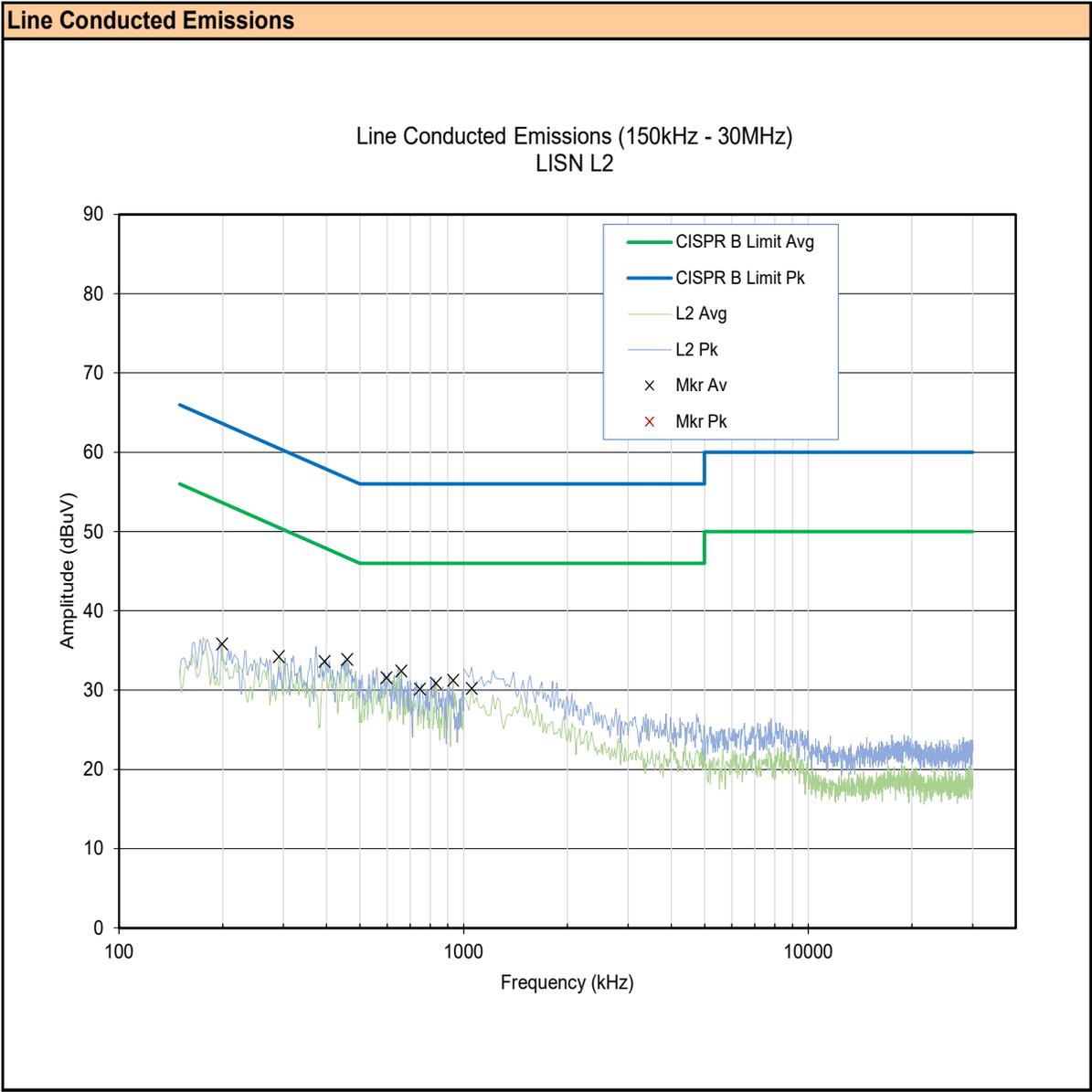


Table 19.1 – Summary of Power Line Conducted Emissions – L1

| §15.107, ICES-003 (6.1) | | | | | |
|--------------------------------|-------------|-----------------|----------------------------|-----------------|-----------------|
| Emission | LISN | Detector | Corrected Emission | Limit | Margin |
| Frequency | Port | | [E_{Corr}]* | [Limit] | [Margin] |
| | | | (W) | (dBuV/m) | (dB) |
| 192.5 kHz | L1 | Average | 36.40 | 54.3 | 17.9 |
| 263.9 kHz | L1 | Average | 35.65 | 51.6 | 15.9 |
| 396.5 kHz | L1 | Average | 32.39 | 48.0 | 15.6 |
| 403.3 kHz | L1 | Average | 34.31 | 47.9 | 13.6 |
| 586.9 kHz | L1 | Average | 33.40 | 46.0 | 12.6 |
| 685.5 kHz | L1 | Average | 33.26 | 46.0 | 12.7 |
| 717.8 kHz | L1 | Average | 31.38 | 46.0 | 14.6 |
| 847.0 kHz | L1 | Average | 31.48 | 46.0 | 14.5 |
| 977.9 kHz | L1 | Average | 29.92 | 46.0 | 16.1 |
| 1108.0 kHz | L1 | Average | 29.92 | 46.0 | 16.1 |
| Results: | | | | Complies | |

* Measurement Compensated for Cable Loss and Antenna Correction Factor

$$E_{\text{Corr}} = E_{\text{Meas}} + L_C + \text{AFC}$$

$$\text{Margin} = \text{Limit} - E_{\text{Corr}}$$

Table 19.1 – Summary of Power Line Conducted Emissions – L2

| §15.107, ICES-003 (6.1) | | | | | |
|--------------------------------|-------------|-----------------|----------------------------|-----------------|-----------------|
| Emission | LISN | Detector | Corrected Emission | Limit | Margin |
| Frequency | Port | | [E_{Corr}]* | [Limit] | [Margin] |
| | | | (W) | (dBuV/m) | (dB) |
| 199.3 kHz | L2 | Average | 35.83 | 54.0 | 18.2 |
| 291.1 kHz | L2 | Average | 34.22 | 50.7 | 16.5 |
| 394.8 kHz | L2 | Average | 33.64 | 48.1 | 14.4 |
| 459.4 kHz | L2 | Average | 33.88 | 46.7 | 12.9 |
| 597.1 kHz | L2 | Average | 31.59 | 46.0 | 14.4 |
| 660.0 kHz | L2 | Average | 32.40 | 46.0 | 13.6 |
| 746.7 kHz | L2 | Average | 30.14 | 46.0 | 15.9 |
| 831.7 kHz | L2 | Average | 30.85 | 46.0 | 15.2 |
| 932.0 kHz | L2 | Average | 31.23 | 46.0 | 14.8 |
| 1054.0 kHz | L2 | Average | 30.22 | 46.0 | 15.8 |
| Results: | | | | Complies | |

* Measurement Compensated for Cable Loss and Antenna Correction Factor

$$E_{\text{Corr}} = E_{\text{Meas}} + L_C + \text{AFC}$$

$$\text{Margin} = \text{Limit} - E_{\text{Corr}}$$

APPENDIX A – TEST SETUP DRAWINGS

Table A.1 – Conducted Measurement Setup

| Equipment List | | | | |
|----------------|--------------|---------------|---------------|-------------------|
| Asset Number | Manufacturer | Model Number | Serial Number | Description |
| 00241 | R&S | FSU40 | 100500 | Spectrum Analyzer |
| 00263 | Koaxis | KP10-1.00M-TD | 263 | 1m Armoured Cable |

Figure A.1 – Test Setup – Conducted Measurements

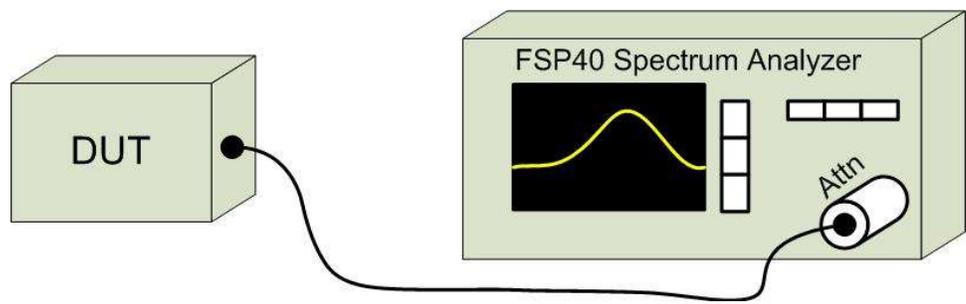


Table A.2 – Radiated Emissions Measurement Equipment

| Equipment List | | | | |
|----------------|---------------|---------------------|---------------|-----------------------------|
| Asset Number | Manufacturer | Model Number | Serial Number | Description |
| 00050 | Chase | CBL-6111A | 1607 | Bilog Antenna |
| 00034 | ETS | 3115 | 6267 | Double Ridged Guide Horn |
| 00035 | ETS | 3115 | 6276 | Double Ridged Guide Horn |
| 00085 | EMCO | 6502 | 9203-2724 | Loop Antenna |
| 00161 | Waveline Inc. | 889 | | Standard Gain Horn 18-26GHz |
| 00162 | Waveline Inc. | 889 | | Standard Gain Horn 18-26GHz |
| 00165 | Waveline Inc. | 801-KF | | Waveguide Adapter 18-26GHz |
| 00166 | Waveline Inc. | 801-KF | | Waveguide Adapter 18-26GHz |
| 00333 | HP | 85685A | 3010A01095 | RF Preselector |
| 00049 | HP | 85650A | 2043A00162 | Quasi-peak Adapter |
| 00051 | HP | 8566B | 2747A05510 | Spectrum Analyzer |
| 00241 | R&S | FSU40 | 100500 | Spectrum Analyzer |
| 00265 | Miteq | JS32-00104000-58-5P | 1939850 | Microwave L/N Amplifier |
| 00071 | EMCO | 2090 | 9912-1484 | Multi-Device Controller |
| 00072 | EMCO | 2075 | 0001-2277 | Mini-mast |
| 00073 | EMCO | 2080 | 0002-1002 | Turn Table |
| 00263 | Koaxis | KP10-1.00M-TD | 263 | 1m Armoured Cable |
| 00263B | Koaxis | KP10-1.00M-TD | 263B | 1m Armoured Cable |
| 00275 | TMS | LMR400 | n/a | 25m Cable |
| 00278 | TILE | 34G3 | n/a | TILE Test Software |

Figure A.2 – Test Setup Radiated Measurements 9kHzMHz – 30MHz

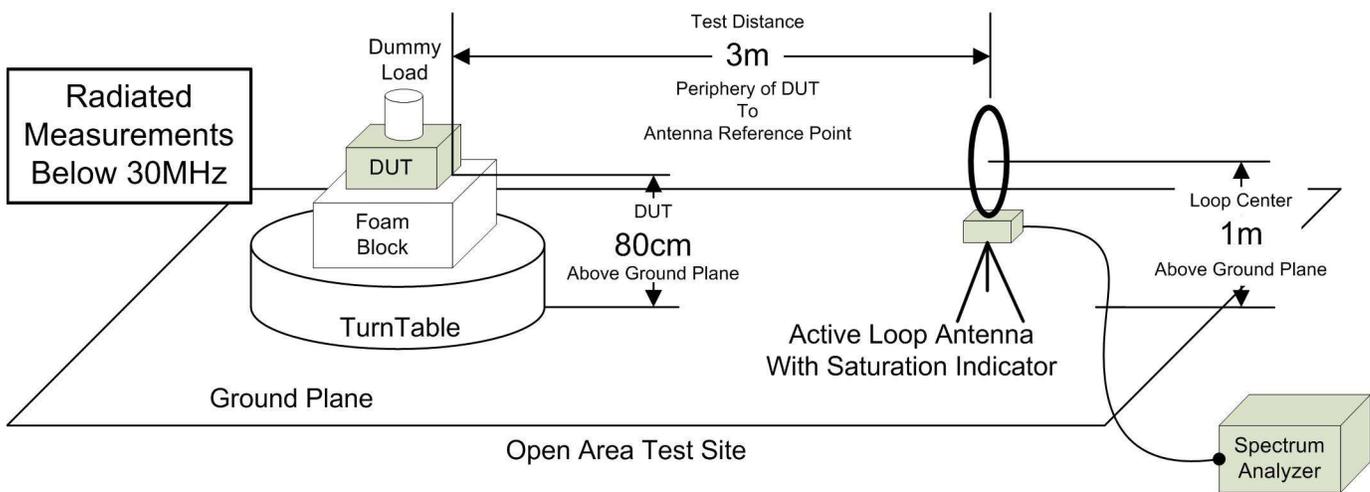


Figure A.3 – Test Setup Radiated Measurements 30MHz – 1GHz

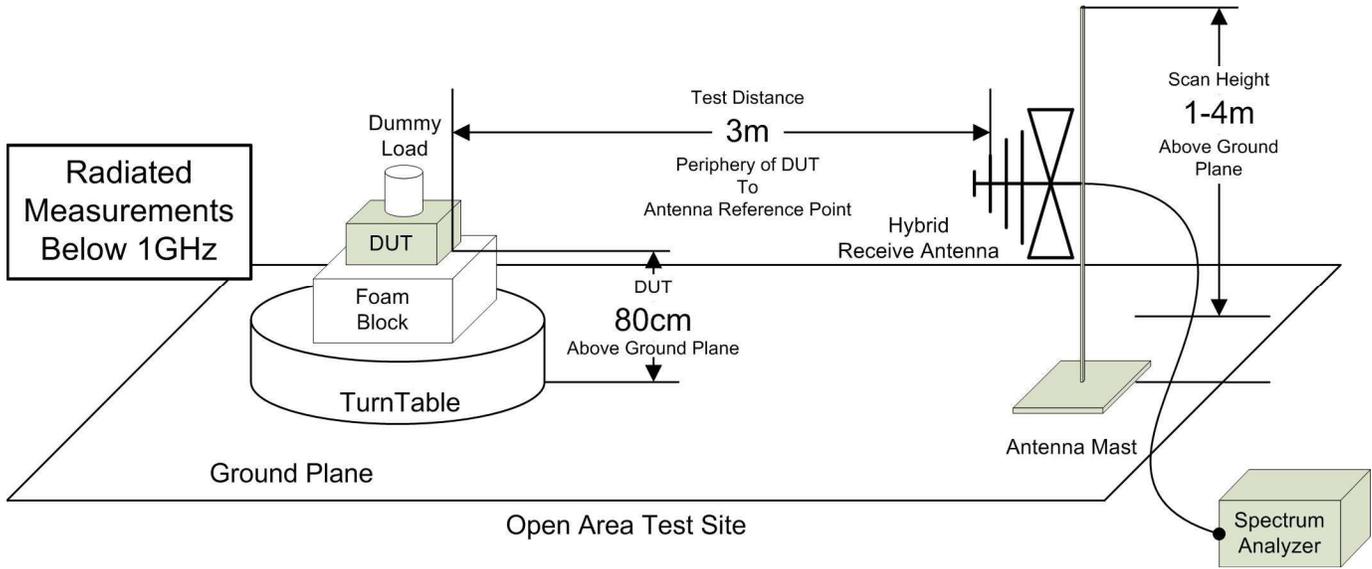


Figure A.4 – Test Setup Radiated Measurements 30MHz – 1GHz, Signal Substitution

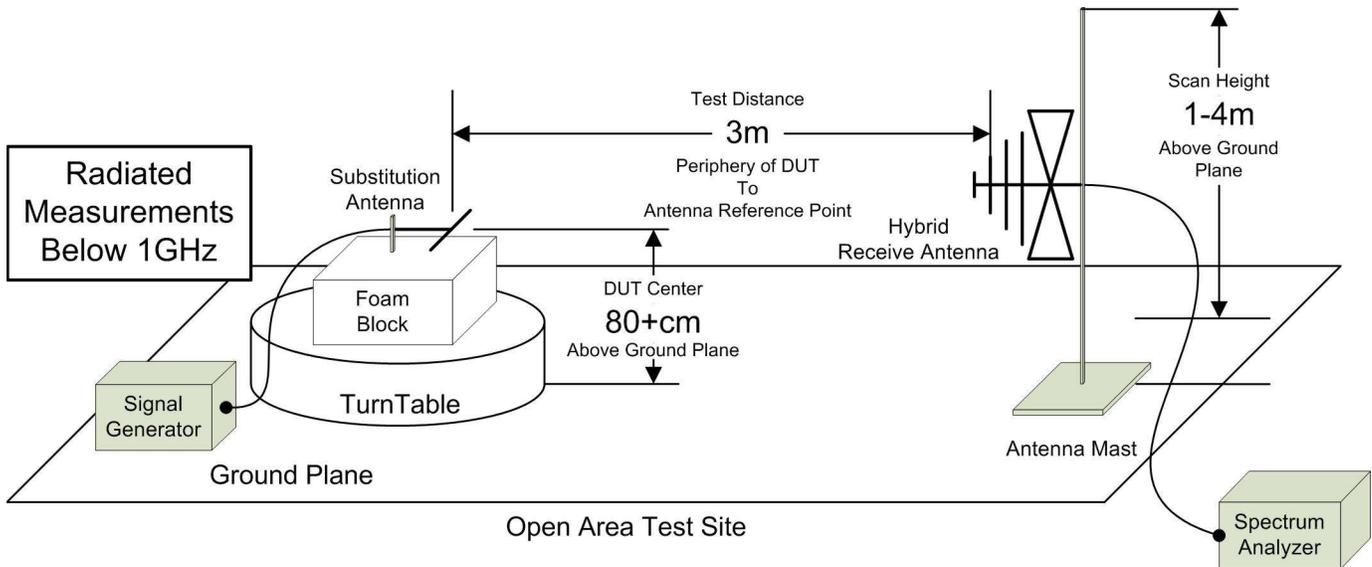


Figure A.5 – Test Setup Radiated Measurements 1 – 18GHz,

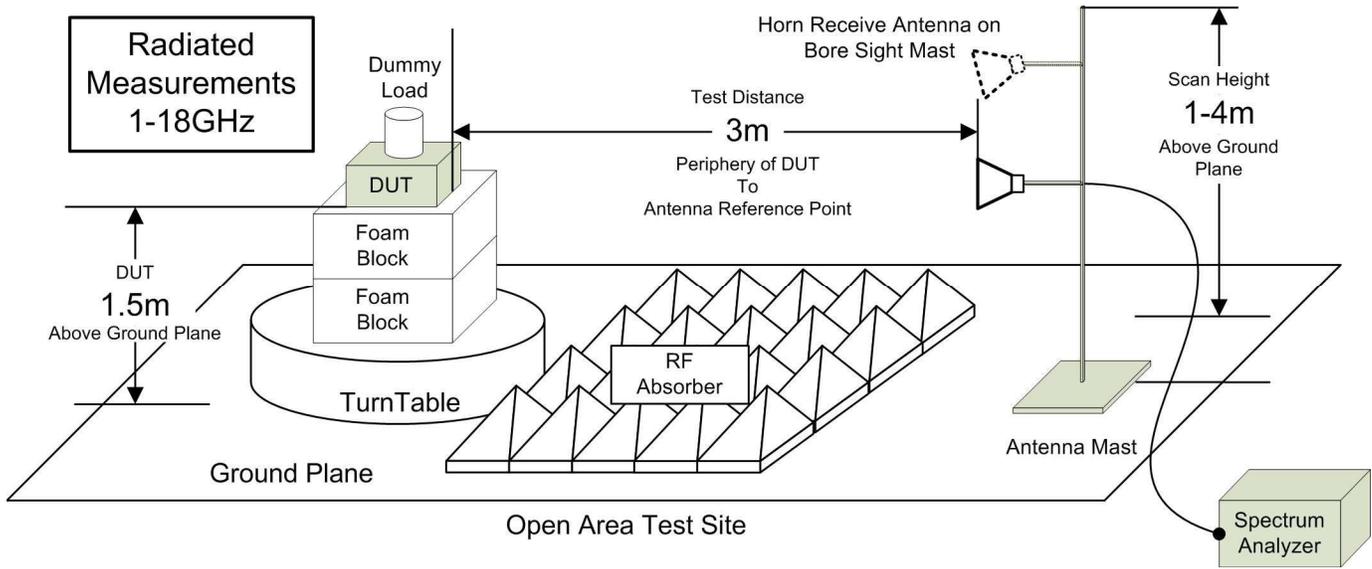
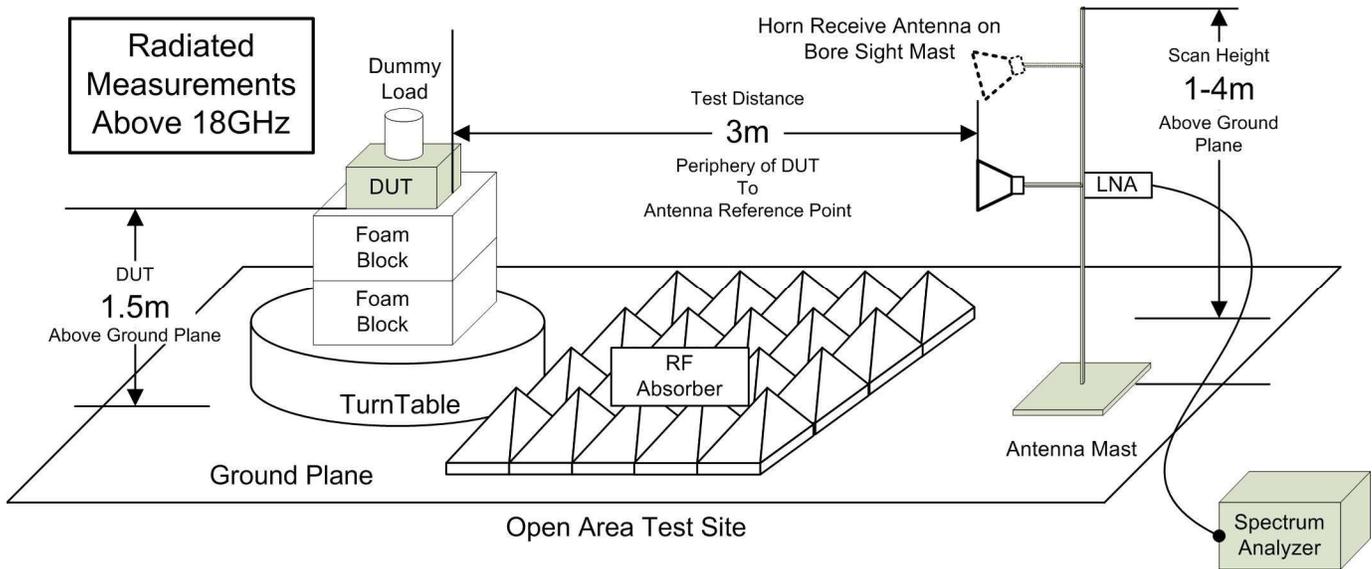


Figure A.6 – Test Setup Radiated Measurements 18 – 26.5GHz,



APPENDIX B – EQUIPMENT LIST AND CALIBRATION

| Equipment List | | | | | Last Calibrated | Calibration Interval | Calibration Due |
|----------------|---------------|---------------|---------------|-----------------------------|-----------------|----------------------|-----------------|
| Asset Number | Manufacturer | Model Number | Serial Number | Description | | | |
| 00050 | Chase | CBL-6111A | 1607 | Bilog Antenna | 16 Nov 2023 | Triennial | 16 Nov 2026 |
| 00035 | ETS | 3115 | 6276 | Double Ridged Guide Horn | 4 Mar 2022 | Triennial | 4 Mar 2025 |
| 00085 | EMCO | 6502 | 9203-2724 | Loop Antenna | 6 Sep 2022 | Triennial | 6 Sep 2025 |
| 00161 | Waveline Inc. | 889 | | Standard Gain Horn 18-26GHz | NCR | n/a | NCR |
| 00165 | Waveline Inc. | 801-KF | | Waveguide Adapter 18-26GHz | NCR | n/a | NCR |
| 00241 | R&S | FSU40 | 100500 | Spectrum Analyzer | 10 Aug 2021 | Triennial | 10 Aug 2024 |
| 00005 | HP | 8648D | 3847A00611 | Signal Generator | 28 Jun 2023 | Triennial | 28 Jun 2026 |
| 00003 | HP | 53181A | 3736A05175 | Frequency Counter | 28 Jun 2023 | Triennial | 28 Jun 2026 |
| 00257 | Com-Power | LI-215A | 191934 | LISN | 27 Dec 2021 | Triennial | 27 Dec 2024 |
| 00071 | EMCO | 2090 | 9912-1484 | Multi-Device Controller | n/a | n/a | n/a |
| 00072 | EMCO | 2075 | 0001-2277 | Mini-mast | n/a | n/a | n/a |
| 00073 | EMCO | 2080 | 0002-1002 | Turn Table | n/a | n/a | n/a |
| 00081 | ESPEC | ECT-2 | 0510154-B | Environmental Chamber | NCR | n/a | CNR |
| 00234 | VWR | 61161-378 | 140320430 | Temp/Humidity Meter | New | Triennial | New |
| 00263 | Koaxis | KP10-1.00M-TD | 263 | 1m Armoured Cable | COU | n/a | COU |
| 00275 | TMS | LMR400 | n/a | 25m Cable | COU | n/a | COU |
| 00276 | TMS | LMR400 | n/a | 4m Cable | COU | n/a | COU |
| 00278 | TILE | 34G3 | n/a | TILE Test Software | NCR | n/a | NCR |

NCR: No Calibration Required

COU: Calibrate On Use

APPENDIX C – MEASUREMENT INSTRUMENT UNCERTAINTY

CISPR 16-4 Measurement Uncertainty (U_{LAB})

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

Radiated Emissions 30MHz - 200MHz

$U_{LAB} = 5.14\text{dB}$ $U_{CISPR} = 6.3\text{dB}$

Radiated Emissions 200MHz - 1000MHz

$U_{LAB} = 5.90\text{dB}$ $U_{CISPR} = 6.3\text{dB}$

Radiated Emissions 1GHz - 6GHz

$U_{LAB} = 4.80\text{dB}$ $U_{CISPR} = 5.2\text{dB}$

Radiated Emissions 6GHz - 18GHz

$U_{LAB} = 5.1\text{dB}$ $U_{CISPR} = 5.5\text{dB}$

Power Line Conducted Emissions 9kHz to 150kHz

$U_{LAB} = 2.96\text{dB}$ $U_{CISPR} = 3.8\text{dB}$

Power Line Conducted Emissions 150kHz to 30MHz

$U_{LAB} = 3.12\text{dB}$ $U_{CISPR} = 3.4\text{dB}$

If the calculated uncertainty U_{lab} is **less** than U_{CISPR} then:

- | | |
|---|---|
| 1 | Compliance is deemed to occur if NO measured disturbance exceeds the disturbance limit |
| 2 | Non-Compliance is deemed to occur if ANY measured disturbance EXCEEDS the disturbance limit |

If the calculated uncertainty U_{lab} is **greater** than U_{CISPR} then:

- | | |
|---|--|
| 3 | Compliance is deemed to occur if NO measured disturbance, increased by ($U_{lab} - U_{CISPR}$), exceeds the disturbance limit |
| 4 | Non-Compliance is deemed to occur if ANY measured disturbance, increased by ($U_{lab} - U_{CISPR}$), EXCEEDS the disturbance limit |

Other Measurement Uncertainties (U_{LAB})

RF Conducted Emissions 9kHz - 40GHz

$U_{LAB} = 1.0\text{dB}$ $U_{CISPR} = \text{n/a}$

Frequency/Bandwidth 9kHz - 40GHz

$U_{LAB} = 0.1\text{ppm}$ $U_{CISPR} = \text{n/a}$

Temperature

$U_{LAB} = 1^{\circ}\text{C}$ $U_{CISPR} = \text{n/a}$

END OF REPORT

APPENDIX D – CONDUCTED POWER MEASUREMENT PLOTS

APPENDIX E – CONDUCTED BAND EDGE PLOTS

APPENDIX F – CONDUCTED SPURIOUS EMISSIONS MEASUREMENT PLOTS

APPENDIX G – RADIATED TX EMISSIONS MEASUREMENT PLOTS

APPENDIX H – RADIATED RX EMISSIONS MEASUREMENT PLOTS

Conducted Power Measurement Results: DTS

| Channel Number | Channel Frequency (MHz) | Mode | Modulation | Rated Power (EIRP) | Measured Power [P _{Meas}] (dBm) | Limit [P _{Lim}] (dBm) | Conducted Margin (dB) | Antenna Gain [G] (dBi) | EIRP [E _{Meas}] (dBm) | EIRP Limit [E _{Lim}] (dBm) | EIRP Margin (dB) | | |
|----------------|-------------------------|---------|------------|--------------------|---|---------------------------------|-----------------------|------------------------|---------------------------------|--------------------------------------|------------------|------|------|
| 6 | 2437.00 | 802.11b | CCK 1 | 12.2 | 15.080 | 30 | 14.9 | -3.8 | 11.3 | 36 | 24.7 | | |
| | | | CCK 2 | | 15.270 | | 14.7 | | 11.5 | | 24.5 | | |
| | | | DSSS 5.5 | | 15.560 | | 14.4 | | 11.8 | | 24.2 | | |
| | | | DSSS 11 | | 15.100 | | 14.9 | | 11.3 | | 24.7 | | |
| 1 | 2412.00 | 802.11g | DSSS 5.5 | 11.2 | 15.630 | 14.4 | 11.8 | 24.2 | | | | | |
| 2 | 2417.00 | | | | 15.720 | 14.3 | 11.9 | 24.1 | | | | | |
| 11 | 2462.00 | | | | 15.070 | 14.9 | 11.3 | 24.7 | | | | | |
| 13 | 2472.00 | | | | 15.070 | 14.9 | 11.3 | 24.7 | | | | | |
| 6 | 2437.00 | 802.11g | OFDM6 | 11.2 | 14.140 | 30 | 15.9 | -3.8 | 10.3 | 36 | 25.7 | | |
| | | | OFDM9 | | 14.640 | | 15.4 | | 10.8 | | 25.2 | | |
| 1 | 2412.00 | 802.11n | OFDM12 | 11.2 | 14.640 | 30 | 15.4 | -3.8 | 10.8 | 36 | 25.2 | | |
| | | | | | 11 | | 2462.00 | | 12.580 | | 17.4 | 8.8 | 27.2 |
| | | | | | 2 | | 2417.00 | | 14.910 | | 15.1 | 11.1 | 24.9 |
| | | | | | 13 | | 2472.00 | | 14.200 | | 15.8 | 10.4 | 25.6 |
| 6 | 2437.00 | 802.11n | MCS0 | 11.2 | 11.380 | 30 | 18.6 | -3.8 | 7.6 | 36 | 28.4 | | |
| | | | MCS3 | | 14.440 | | 15.6 | | 10.6 | | 25.4 | | |
| | | | MCS7 | | 13.680 | | 16.3 | | 9.9 | | 26.1 | | |
| 1 | 2412.00 | 802.11n | MCS0 | 11.2 | 8.800 | 30 | 21.2 | -3.8 | 5.0 | 36 | 31.0 | | |
| | | | | | 11 | | 2462.00 | | 14.610 | | 15.4 | 10.8 | 25.2 |
| | | | | | 13 | | 2472.00 | | 13.860 | | 16.1 | 10.1 | 25.9 |
| | | | | | | | | | | | 27.7 | | |

Result: Complies

Conducted Margin = Conducted Limit [P_{Limit}] - Measure Power [P_{Meas}]

EIRP [E_{Meas}] = Measure Power [P_{Meas}] + Antenna Gain [G]

EIRP Margin = EIRP Limit [E_{Lim}] - EIPR [E_{Meas}]

Conducted Power Measurement Results: DTS

| Channel Number | Channel Frequency (MHz) | Mode | Modulation | Rated Power (EIRP) | Measured Power [P _{Meas}] (dBm) | Limit [P _{Lim}] (dBm) | Conducted Margin (dB) | Antenna Gain [G] (dBi) | EIRP [E _{Meas}] (dBm) | EIRP Limit [E _{Lim}] (dBm) | EIRP Margin (dB) |
|----------------|-------------------------|---------|------------|--------------------|---|---------------------------------|-----------------------|------------------------|---------------------------------|--------------------------------------|------------------|
| 37 | 2402.00 | BLE 1mb | GMSK | -2.8 | -1.67 | 30 | 31.7 | -3.8 | -5.5 | 36 | 41.5 |
| 17 | 2440.00 | | | | 0.70 | | 29.3 | | -3.1 | | 39.1 |
| 39 | 2480.00 | | | | -3.37 | | 33.4 | | -7.2 | | 43.2 |
| 1 | 2404.00 | BLE 2mb | | 1.48 | 28.5 | | -2.3 | | 38.3 | | |
| 17 | 2440.00 | | | -2.3 | 1.00 | | 29.0 | | -2.8 | | 38.8 |
| 36 | 2478.00 | | | -3.63 | 33.6 | | -7.4 | | 43.4 | | |
| 0 | 2402.00 | ANT | GFSK | -2.3 | -1.41 | 30 | 31.4 | -3.8 | -5.2 | 36 | 41.2 |
| 38 | 2440.00 | | | | 1.07 | | 28.9 | | -2.7 | | 38.7 |
| 78 | 2480.00 | | | | -3.37 | | 33.4 | | -7.2 | | 43.2 |
| Result: | | | | | | | | | | | Complies |

Conducted Margin = Conducted Limit [P_{Limit}] - Measure Power [P_{Meas}]

EIRP [E_{Meas}] = Measure Power [P_{Meas}] + Antenna Gain [G]

EIRP Margin = EIRP Limit [E_{Lim}] - EIPR [E_{Meas}]

Conducted Power:



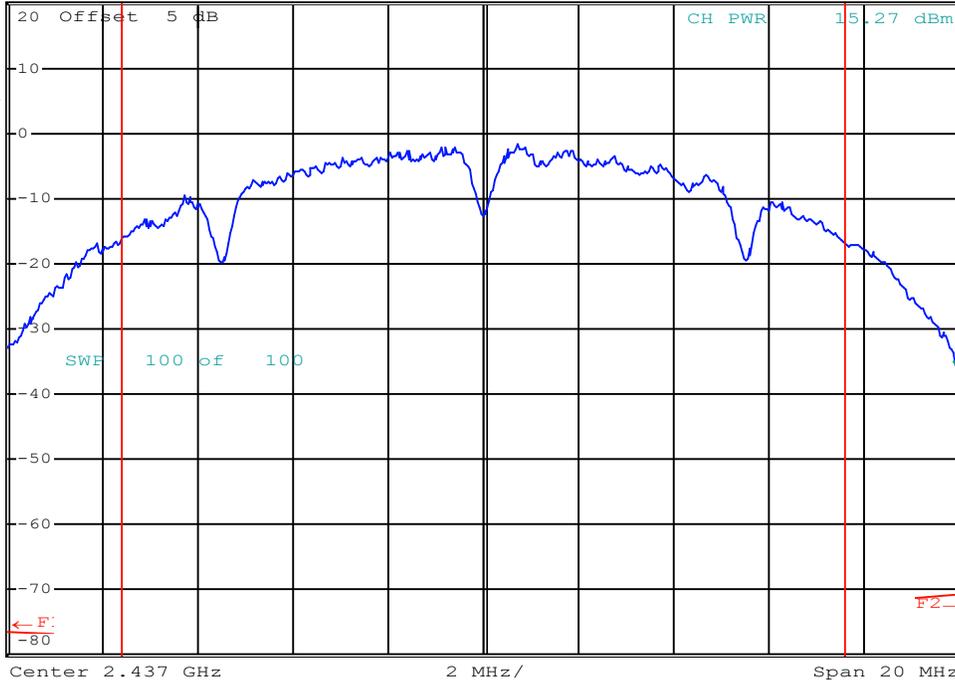
*RBW 100 kHz Marker 1 [T1]
VBW 1 MHz -36.35 dBm
SWT 2.5 ms 2.447000000 GHz

Ref 20 dBm

Att 30 dB

CH PWR 15.27 dBm

1 RM*
VIEW



Date: 21.MAR.2024 13:34:51

Channel:

Mode:

Channel Frequency: MHz

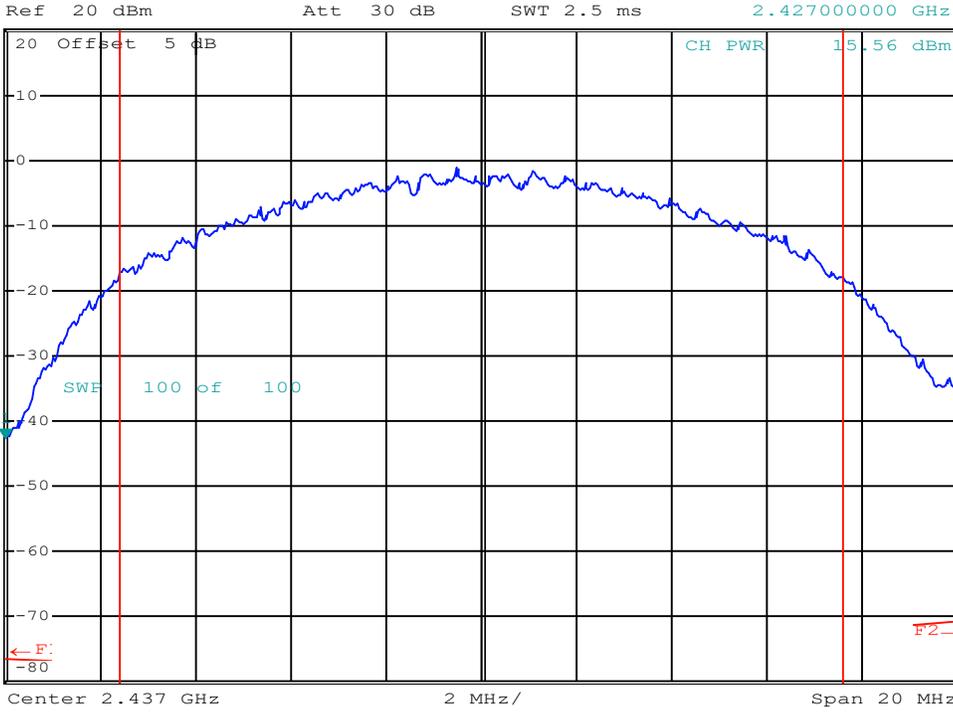
Modulation:

Measured Channel Power: dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VBW 1 MHz -42.57 dBm
SWT 2.5 ms 2.427000000 GHz



Date: 21.MAR.2024 13:29:48

Channel:

Channel Frequency: MHz

Mode:

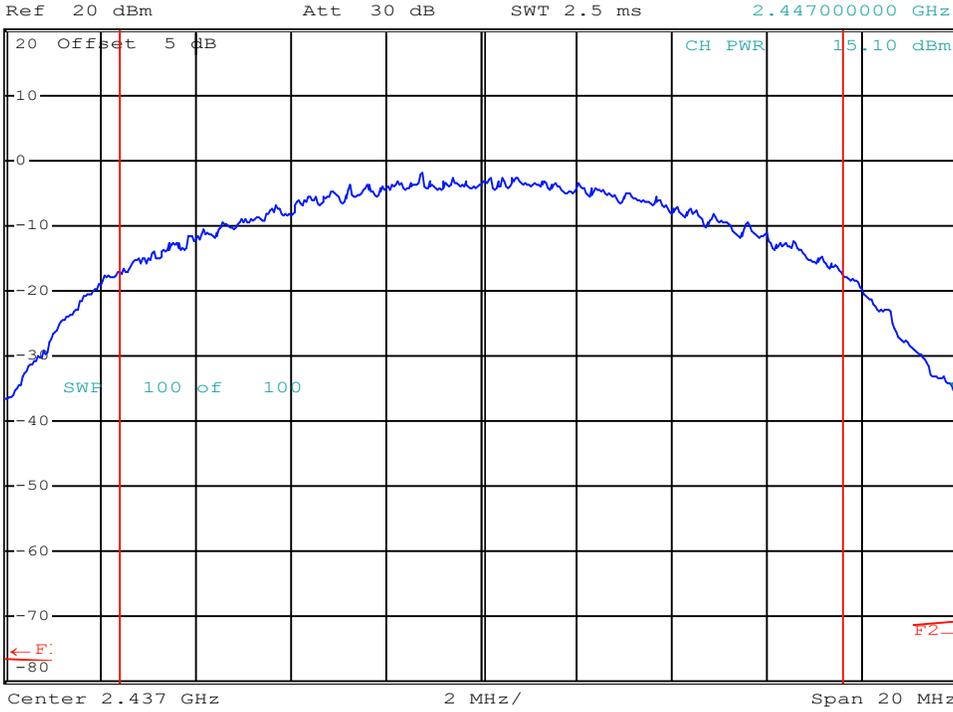
Modulation:

Measured Channel Power: dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VBW 1 MHz -35.60 dBm
SWT 2.5 ms 2.447000000 GHz



Date: 21.MAR.2024 13:32:43

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

Conducted Power:



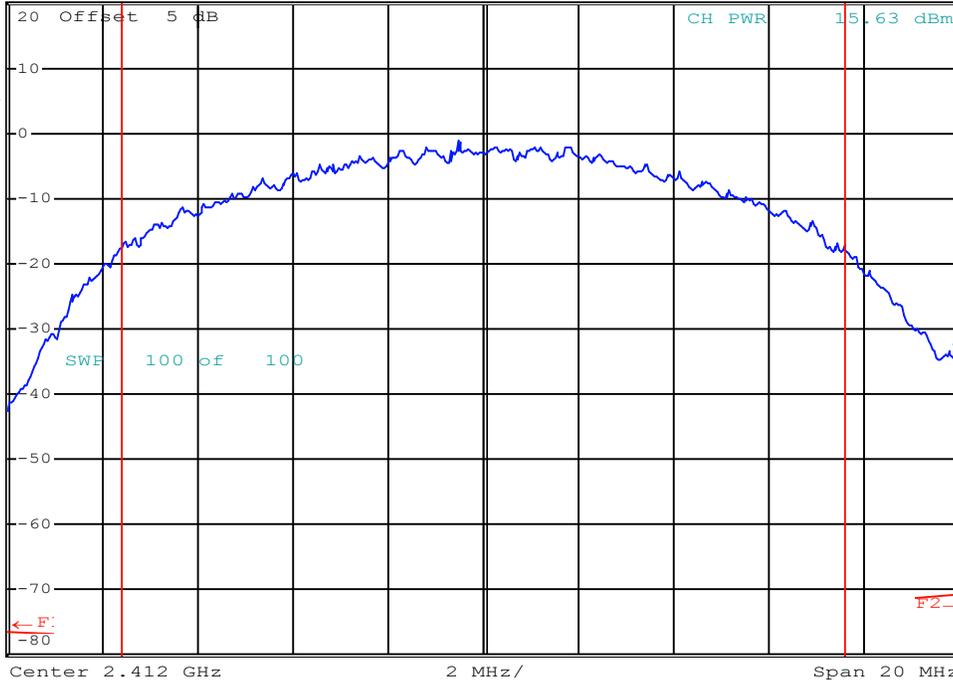
*RBW 100 kHz Marker 1 [T1]
VBW 1 MHz -33.70 dBm
SWT 2.5 ms 2.422000000 GHz

Ref 20 dBm

Att 30 dB

CH PWR 15.63 dBm

1 RM*
VIEW



Date: 21.MAR.2024 13:28:37

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

Conducted Power:



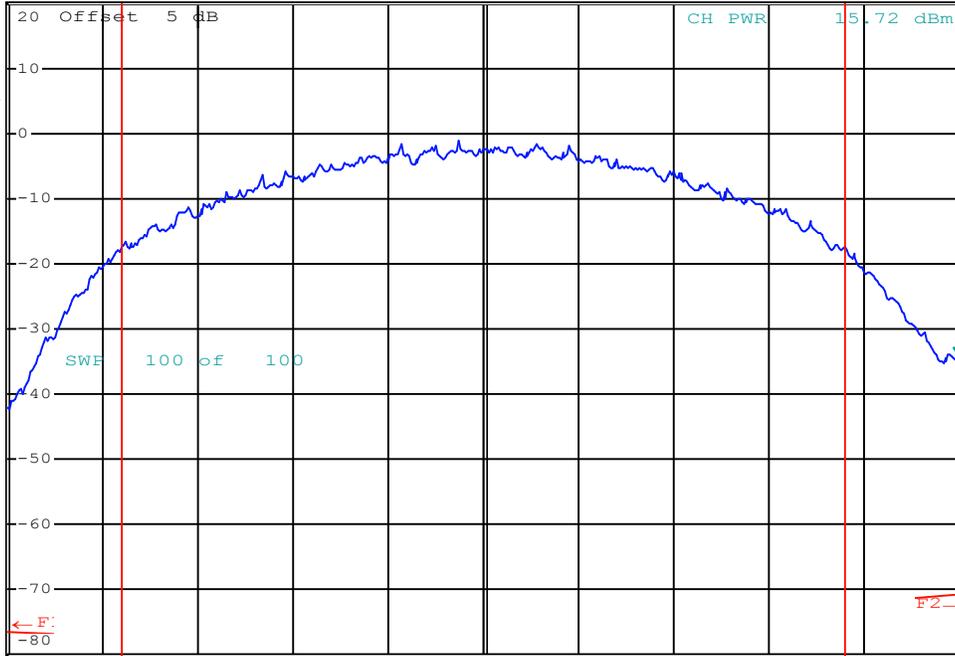
*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -34.13 dBm
SWT 2.5 ms 2.427000000 GHz

Ref 20 dBm

Att 30 dB

CH PWR 15.72 dBm

1 RM*
VIEW



Center 2.417 GHz

2 MHz/

Span 20 MHz

Date: 21.MAR.2024 13:25:23

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Channel Power: dBm

Conducted Power:



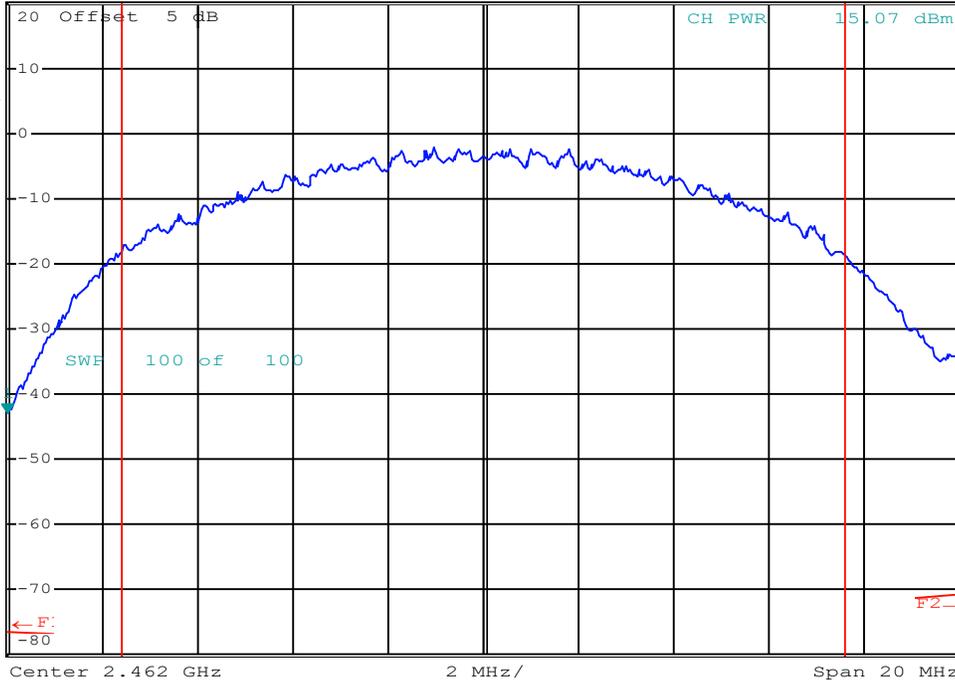
*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -42.76 dBm
SWT 2.5 ms 2.452000000 GHz

Ref 20 dBm

Att 30 dB

CH PWR 15.07 dBm

1 RM*
VIEW



Date: 21.MAR.2024 13:30:59

Channel: 11

Channel Frequency: 2462 MHz

Mode: 802.11b

Modulation: DSSS 5.5

Measured Channel Power: 15.07 dBm

Conducted Power:



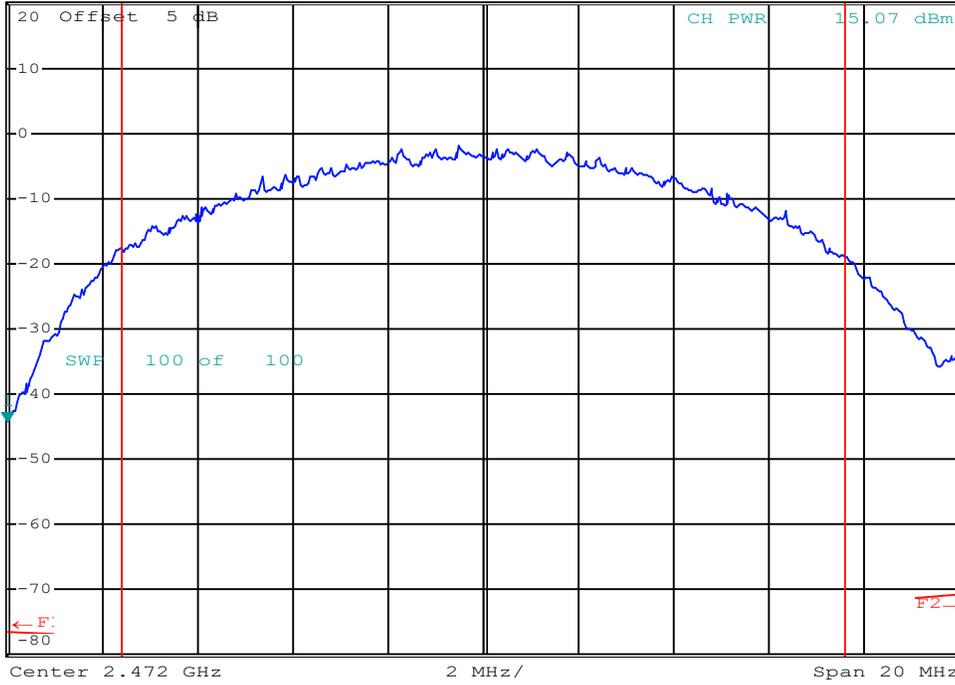
*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -44.23 dBm
SWT 2.5 ms 2.462000000 GHz

Ref 20 dBm

Att 30 dB

CH PWR 15.07 dBm

1 RM*
VIEW



Date: 21.MAR.2024 13:26:56

Channel: 13

Mode: 802.11b

Channel Frequency: 2472 MHz

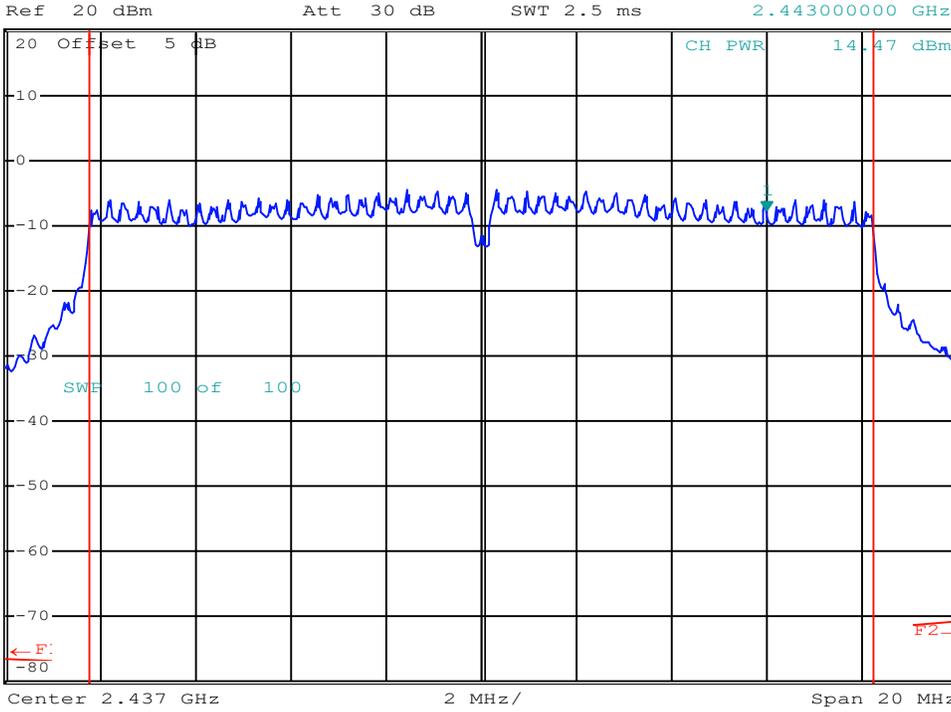
Modulation: DSSS 5.5

Measured Channel Power: 15.07 dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VBW 1 MHz -7.64 dBm
SWT 2.5 ms 2.443000000 GHz



Date: 21.MAR.2024 12:52:47

Channel:

Mode:

Channel Frequency: MHz

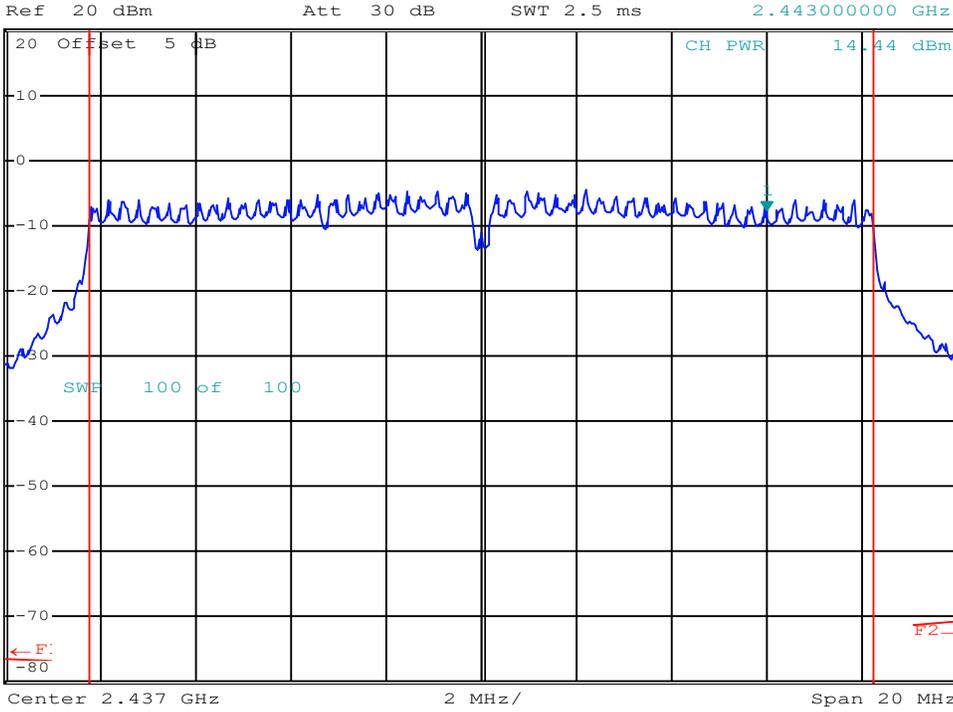
Modulation:

Measured Channel Power: dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -7.63 dBm
SWT 2.5 ms 2.443000000 GHz



Date: 21.MAR.2024 12:54:02

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Channel Power: dBm

Conducted Power:



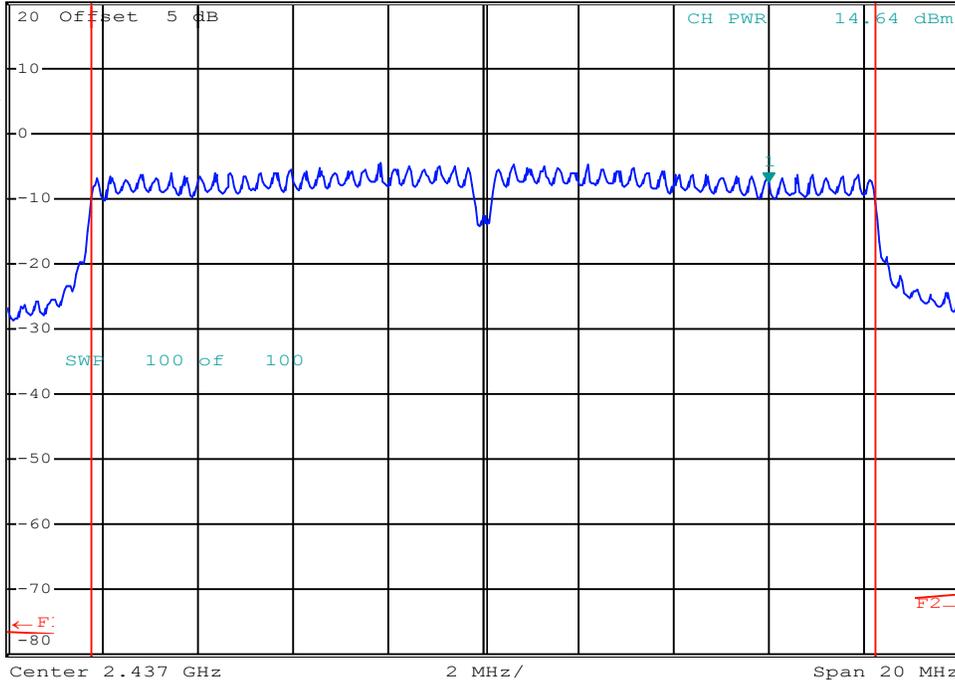
*RBW 100 kHz Marker 1 [T1]
VBW 1 MHz -7.37 dBm
SWT 2.5 ms 2.443000000 GHz

Ref 20 dBm

Att 30 dB

CH PWR 14.64 dBm

1 RM*
VIEW



Date: 21.MAR.2024 12:54:55

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

Conducted Power:



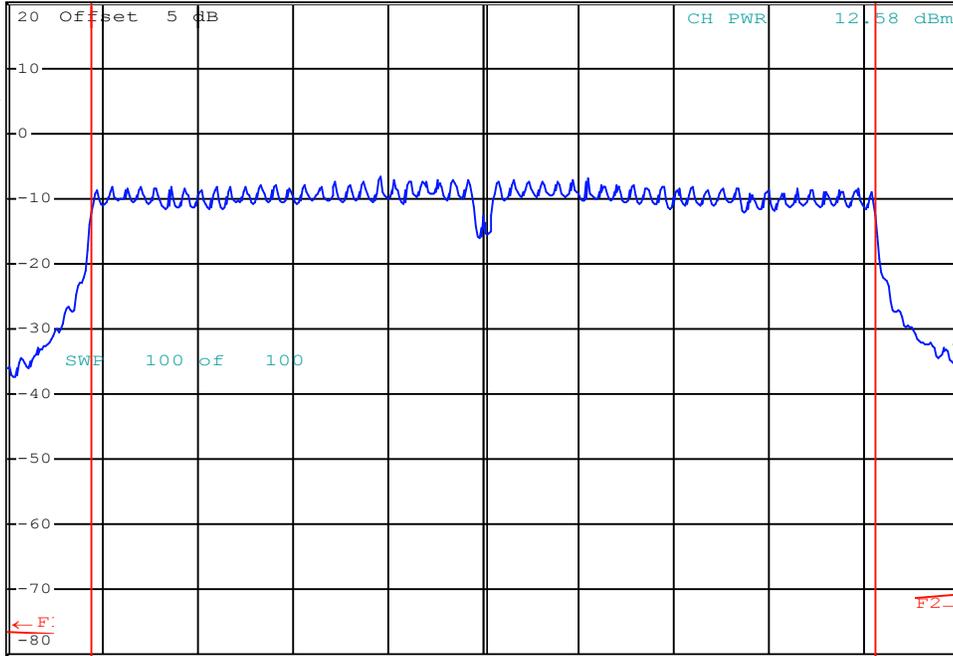
*RBW 100 kHz Marker 1 [T1]
VBW 1 MHz -33.71 dBm
SWT 2.5 ms 2.422000000 GHz

Ref 20 dBm

Att 30 dB

CH PWR 12.58 dBm

1 RM*
VIEW



Date: 21.MAR.2024 13:39:11

Channel: 1

Mode: 802.11g

Channel Frequency: 2412 MHz

Modulation: OFDM12

Measured Channel Power: 12.58 dBm

Conducted Power:



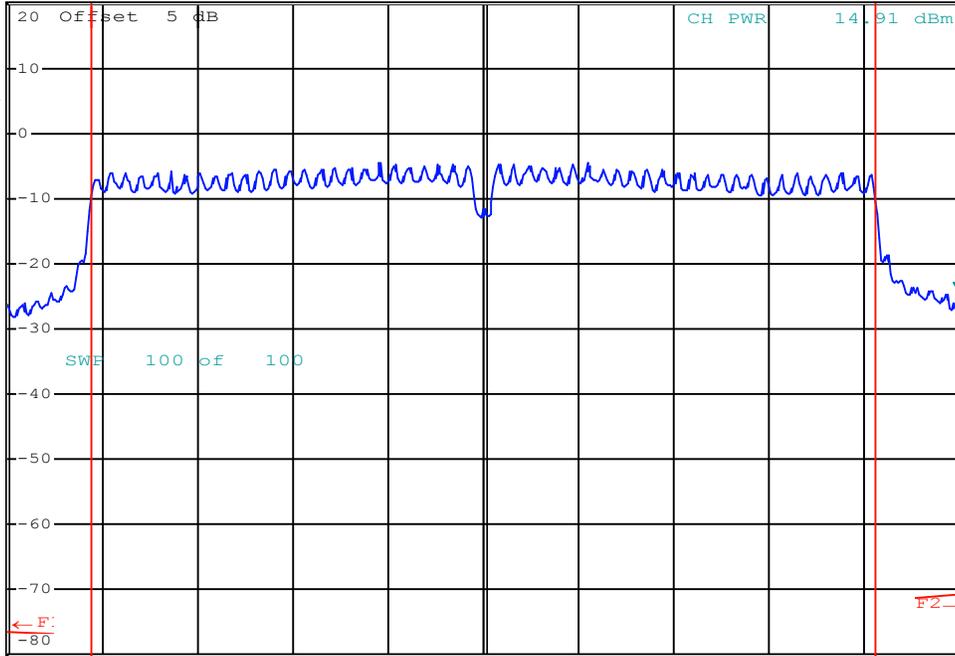
*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -24.35 dBm
SWT 2.5 ms 2.427000000 GHz

Ref 20 dBm

Att 30 dB

CH PWR 14.91 dBm

1 RM*
VIEW



Date: 21.MAR.2024 13:23:48

Channel:

Mode:

Channel Frequency: MHz

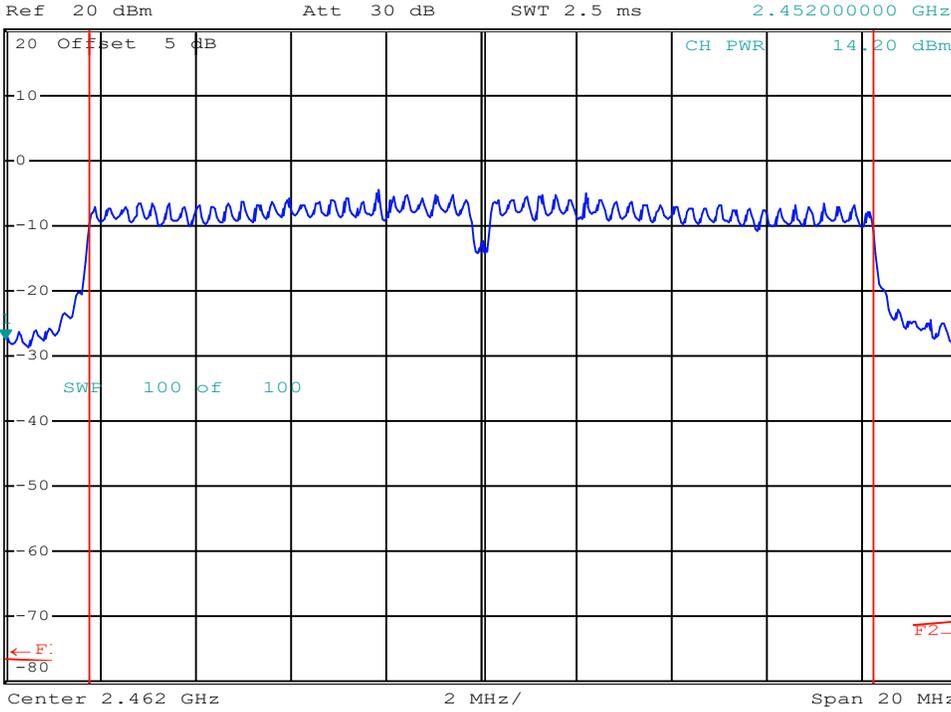
Modulation:

Measured Channel Power: dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VBW 1 MHz -27.42 dBm
SWT 2.5 ms 2.452000000 GHz



Date: 21.MAR.2024 13:20:50

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Channel Power: dBm

Conducted Power:



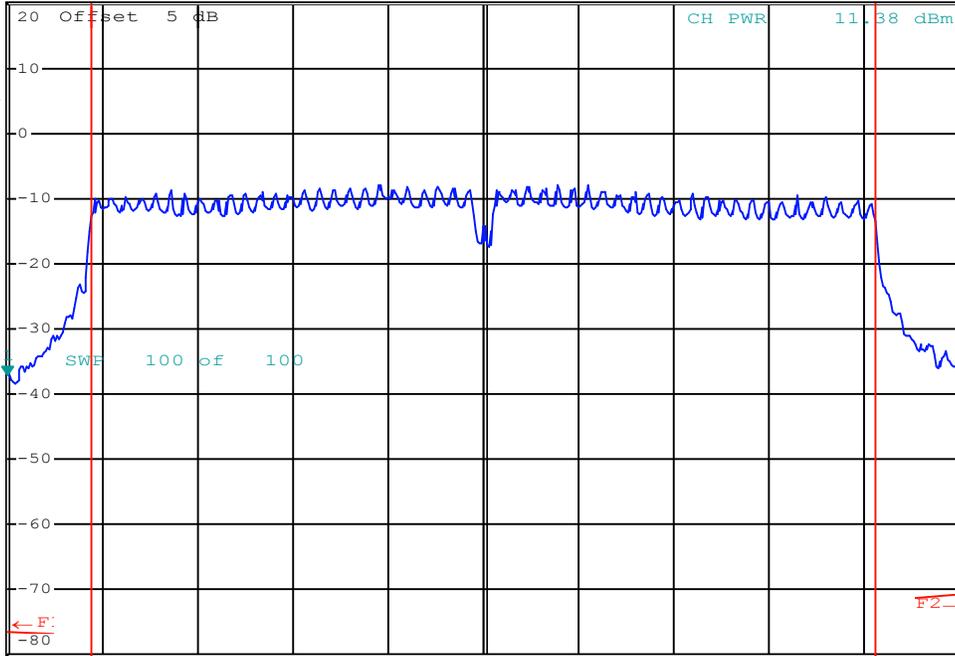
*RBW 100 kHz Marker 1 [T1]
VBW 1 MHz -37.17 dBm
SWT 2.5 ms 2.462000000 GHz

Ref 20 dBm

Att 30 dB

CH PWR 11.38 dBm

1 RM*
VIEW



Center 2.472 GHz 2 MHz/ Span 20 MHz

Date: 21.MAR.2024 13:18:35

Channel: 13

Channel Frequency: 2472 MHz

Mode: 802.11g

Modulation: OFDM12

Measured Channel Power: 11.38 dBm

Conducted Power:



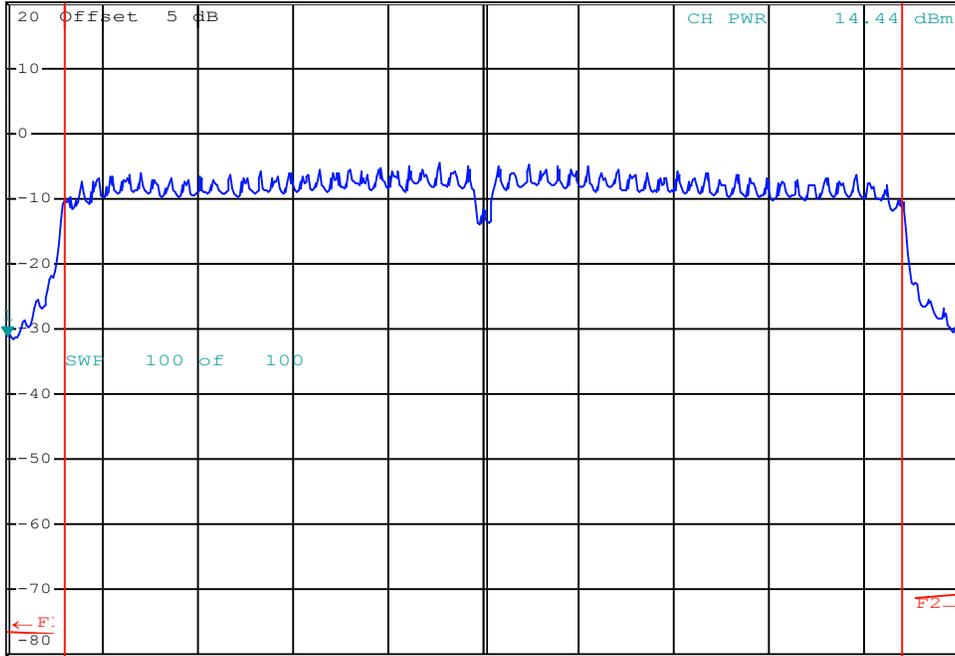
*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -31.07 dBm
SWT 2.5 ms 2.427000000 GHz

Ref 20 dBm

Att 30 dB

CH PWR 14.44 dBm

1 RM*
VIEW



Center 2.437 GHz

2 MHz/

Span 20 MHz

Date: 21.MAR.2024 13:42:09

Channel:

Mode:

Channel Frequency: MHz

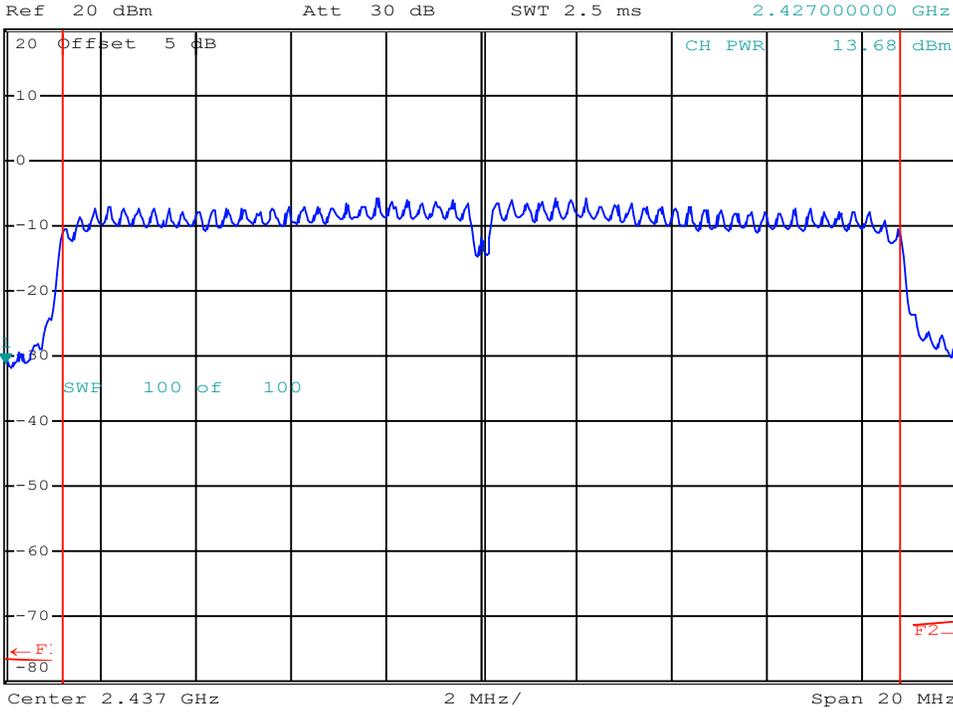
Modulation:

Measured Channel Power: dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -31.01 dBm
SWT 2.5 ms 2.427000000 GHz



Date: 21.MAR.2024 13:43:07

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Channel Power: dBm

Conducted Power:



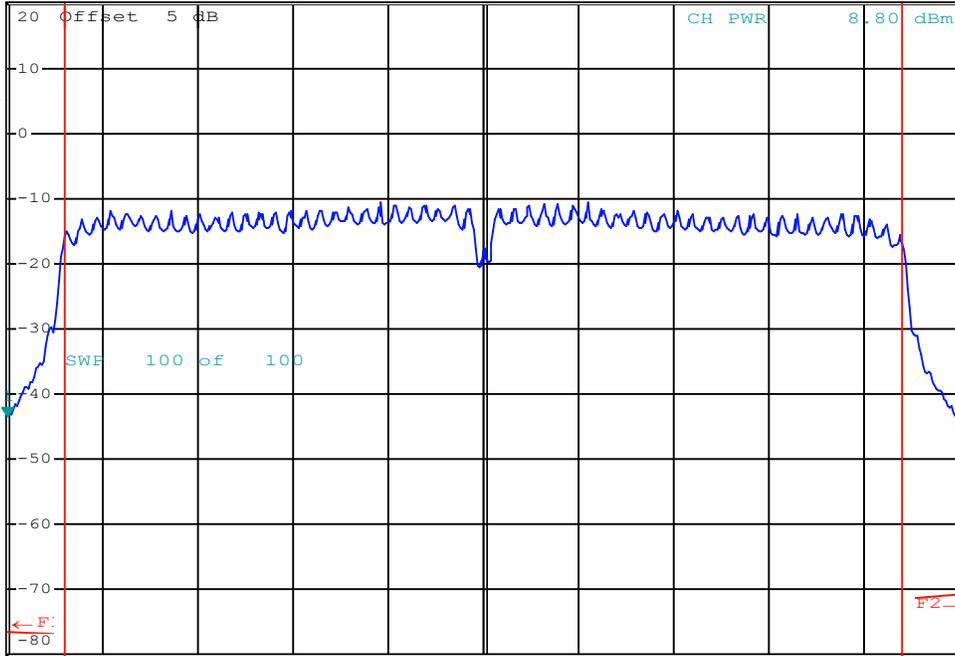
*RBW 100 kHz Marker 1 [T1]
VBW 1 MHz -43.48 dBm
SWT 2.5 ms 2.427000000 GHz

Ref 20 dBm

Att 30 dB

CH PWR 8.80 dBm

1 RM*
VIEW



Center 2.437 GHz

2 MHz/

Span 20 MHz

Date: 21.MAR.2024 13:44:16

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Channel Power: dBm

Conducted Power:



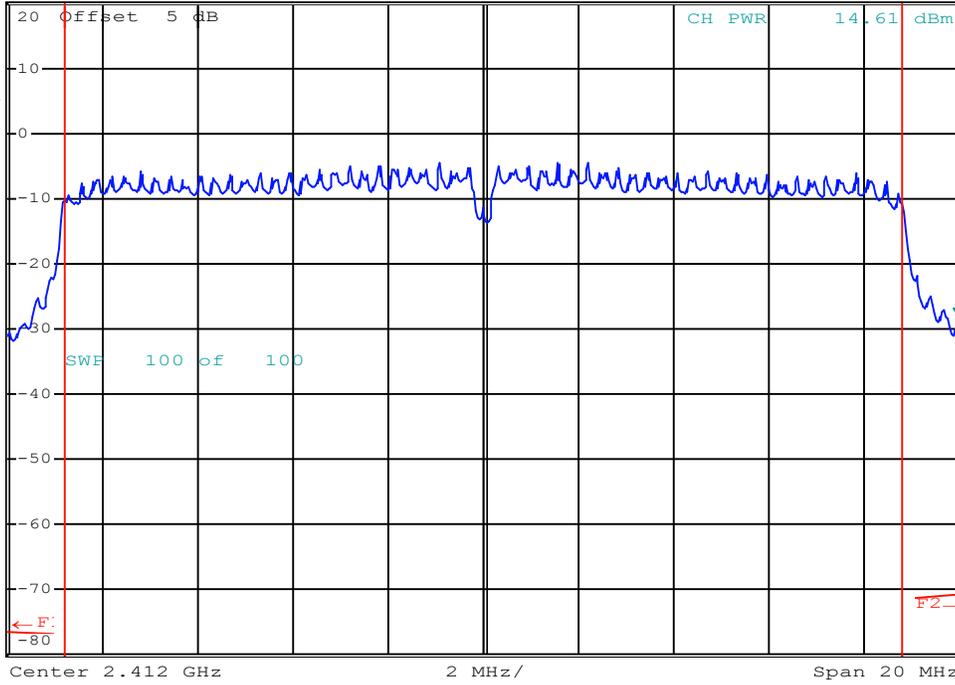
*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -28.23 dBm
SWT 2.5 ms 2.422000000 GHz

Ref 20 dBm

Att 30 dB

CH PWR 14.61 dBm

1 RM*
VIEW



Date: 21.MAR.2024 13:56:49

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

Conducted Power:



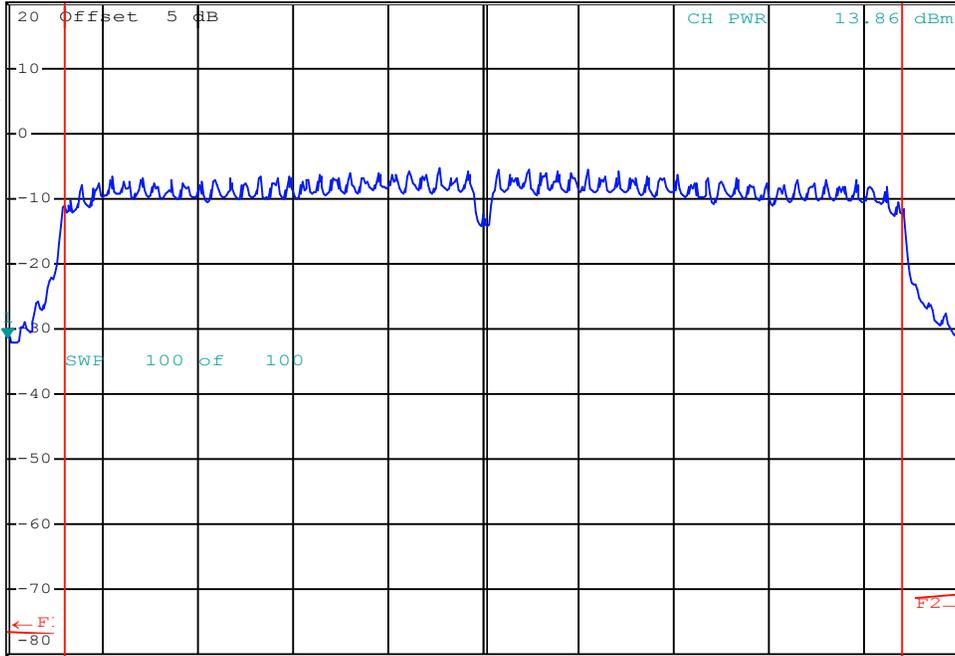
*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -31.24 dBm
SWT 2.5 ms 2.452000000 GHz

Ref 20 dBm

Att 30 dB

CH PWR 13.86 dBm

1 RM*
VIEW



Center 2.462 GHz

2 MHz/

Span 20 MHz

Date: 21.MAR.2024 14:00:46

Channel: 11

Mode: 802.11n

Channel Frequency: 2462 MHz

Modulation: MCS0

Measured Channel Power: 13.86 dBm

Conducted Power:

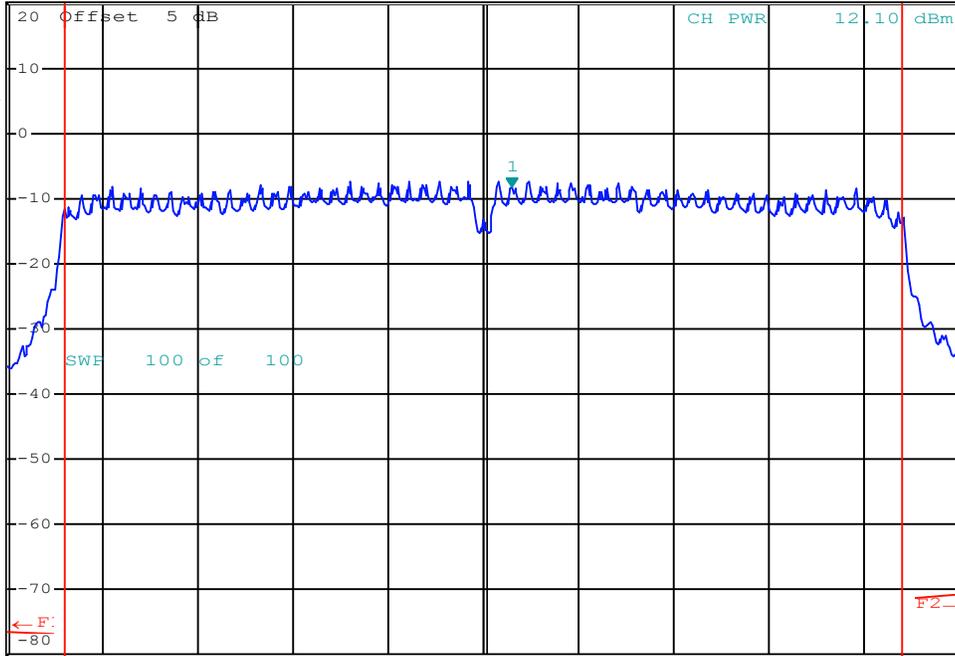


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -8.35 dBm
SWT 2.5 ms 2.472600000 GHz

Ref 20 dBm

Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:55:26

Channel: 13

Mode: 802.11n

Channel Frequency: 2472 MHz

Modulation: MCS0

Measured Channel Power: 12.1 dBm

Conducted Power:

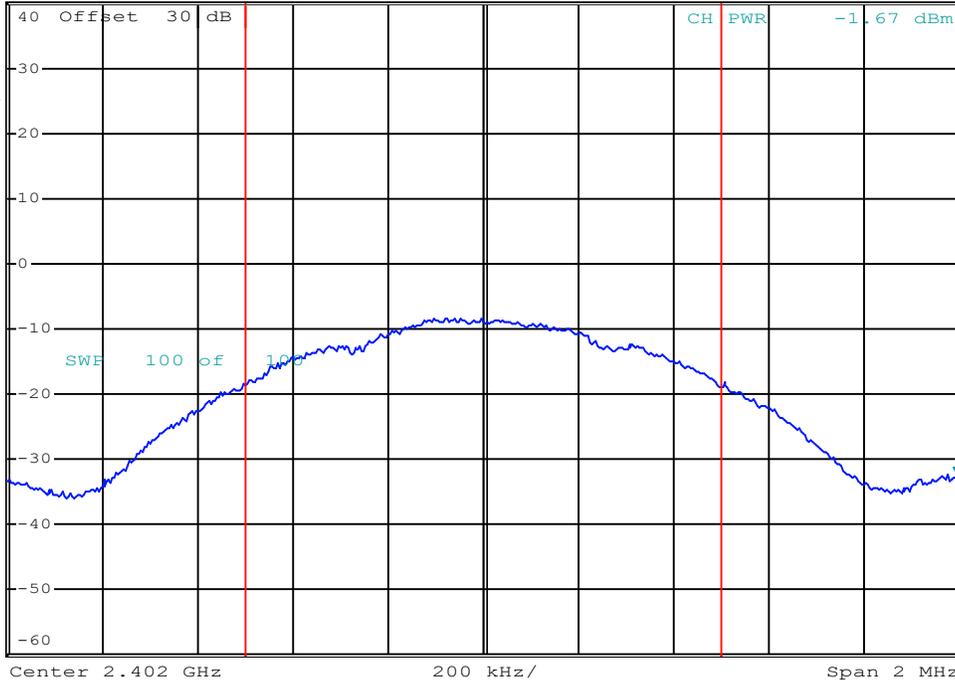


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -32.56 dBm
SWT 2.5 ms 2.403000000 GHz

Ref 40 dBm

*Att 30 dB

1 RM*
VIEW



Date: 29.FEB.2024 11:35:01

Channel: 37

Mode: BLE 1mb

Channel Frequency: 2402 MHz

Modulation: GMSK

Measured Channel Power: -1.67 dBm

Conducted Power:

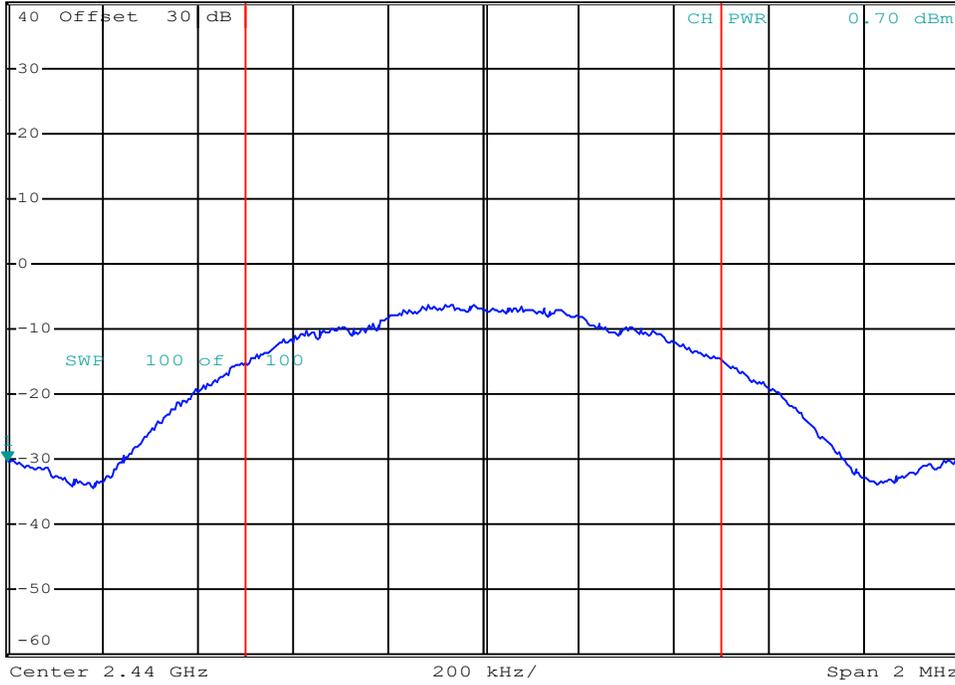


*RBW 100 kHz Marker 1 [T1]
VBW 1 MHz -30.16 dBm
SWT 2.5 ms 2.439000000 GHz

Ref 40 dBm

*Att 30 dB

1 RM*
VIEW



Date: 29.FEB.2024 11:39:27

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Channel Power: dBm

Conducted Power:

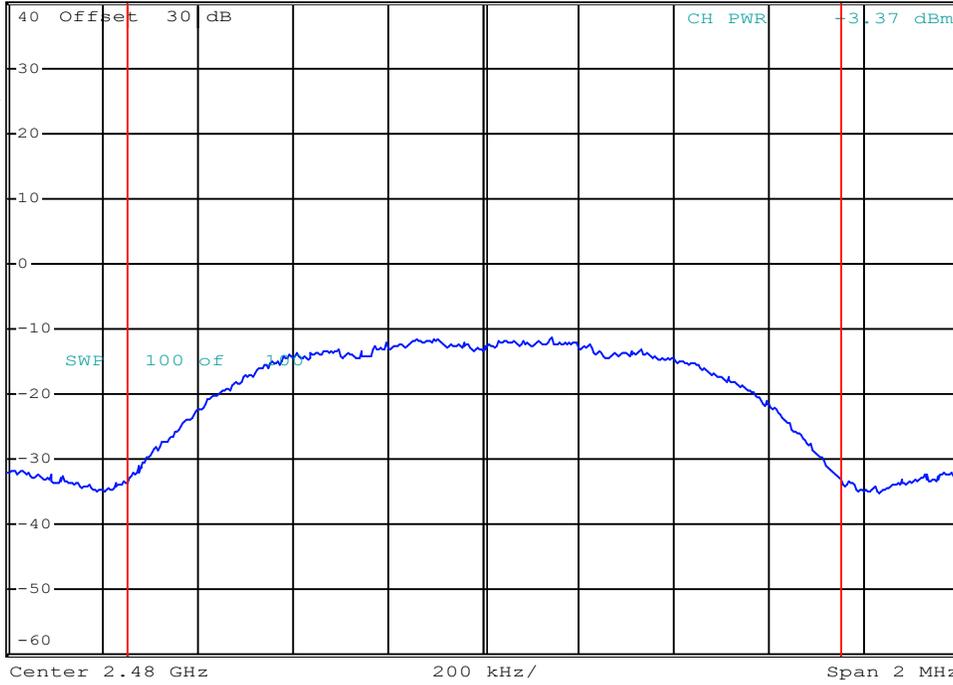


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 40 dBm

*Att 30 dB

1 RM*
VIEW



Date: 29.FEB.2024 13:17:16

Channel:

Channel Frequency: MHz

Mode:

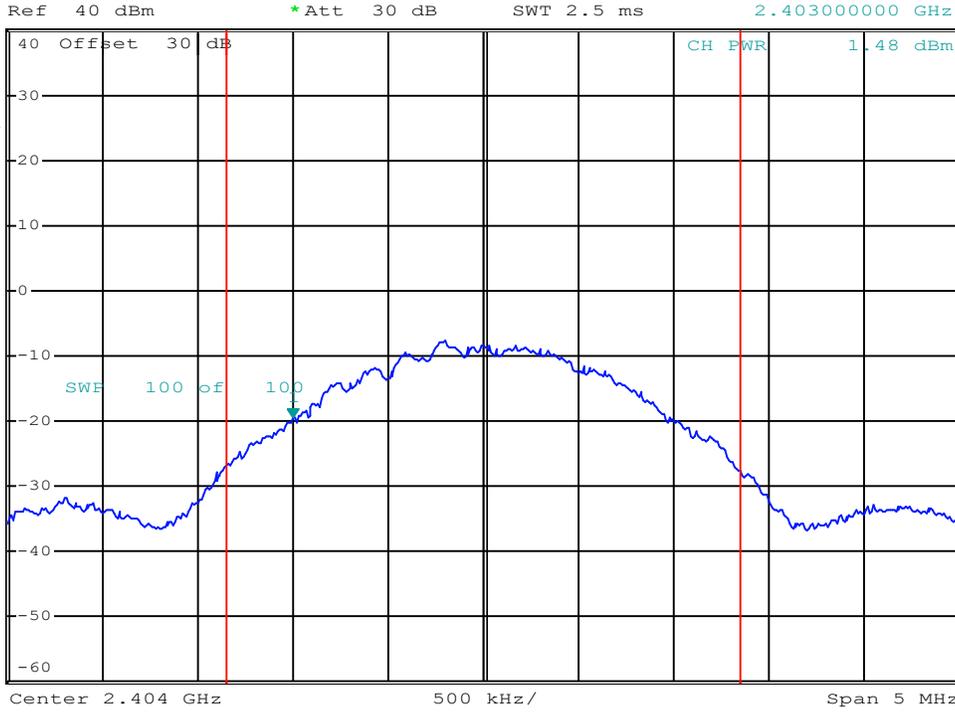
Modulation:

Measured Channel Power: dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -19.45 dBm
SWT 2.5 ms 2.403000000 GHz



Date: 29.FEB.2024 11:45:23

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

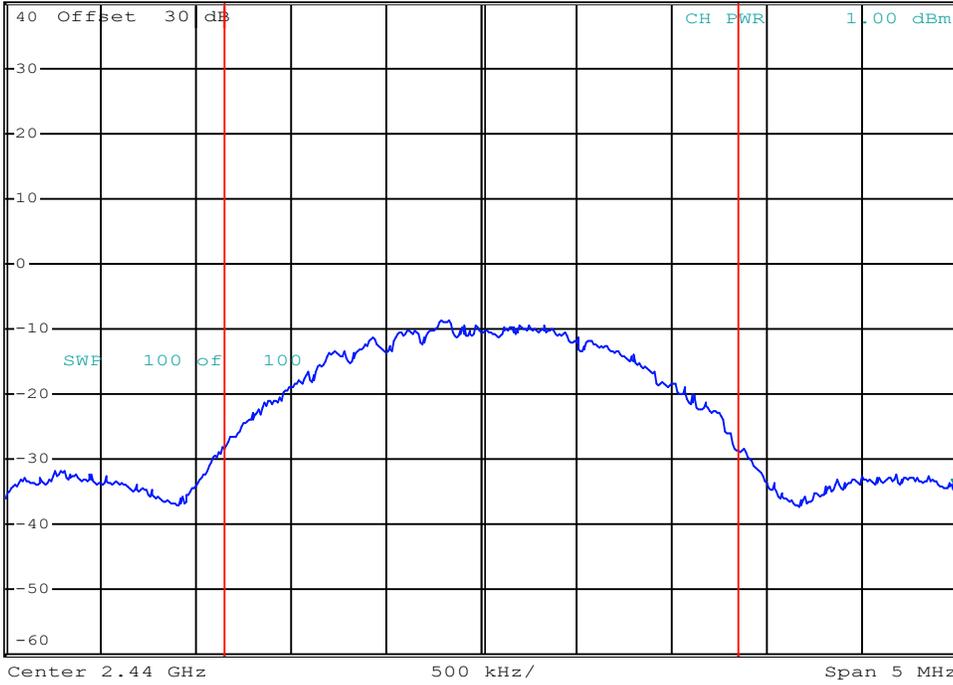
Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -34.53 dBm
SWT 2.5 ms 2.442500000 GHz

Ref 40 dBm *Att 30 dB

1 RM*
VIEW



Date: 29.FEB.2024 11:46:49

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Channel Power: dBm

Conducted Power:

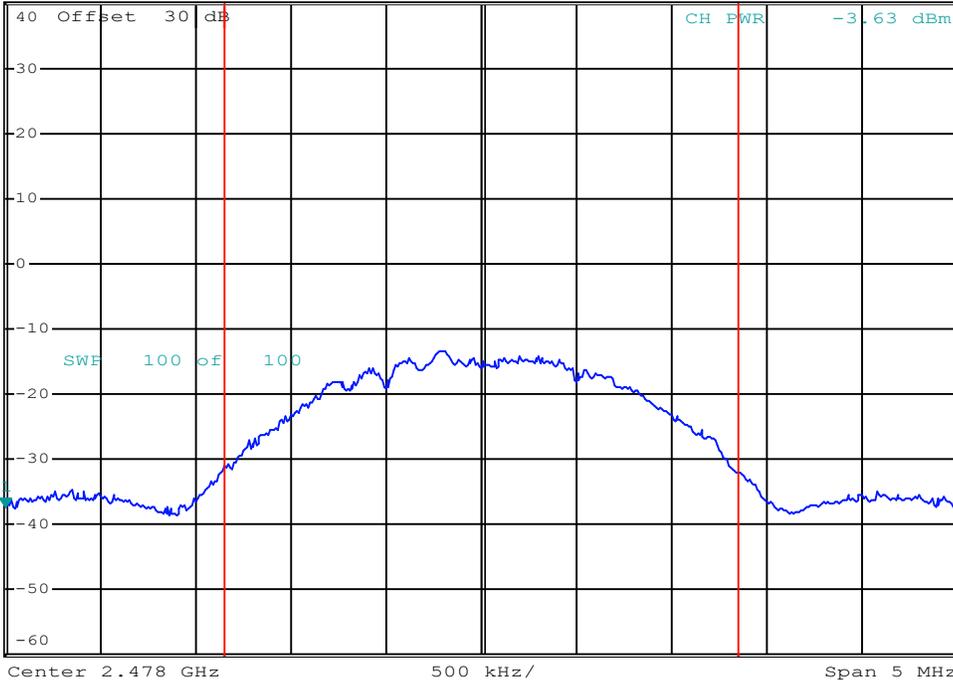


*RBW 100 kHz Marker 1 [T1]
VBW 1 MHz -37.32 dBm
SWT 2.5 ms 2.475500000 GHz

Ref 40 dBm

*Att 30 dB

1 RM*
VIEW



Date: 29.FEB.2024 11:48:00

Channel: 36

Channel Frequency: 2478 MHz

Mode: BLE 2mb

Modulation: GMSK

Measured Channel Power: -3.63 dBm

Conducted Power:

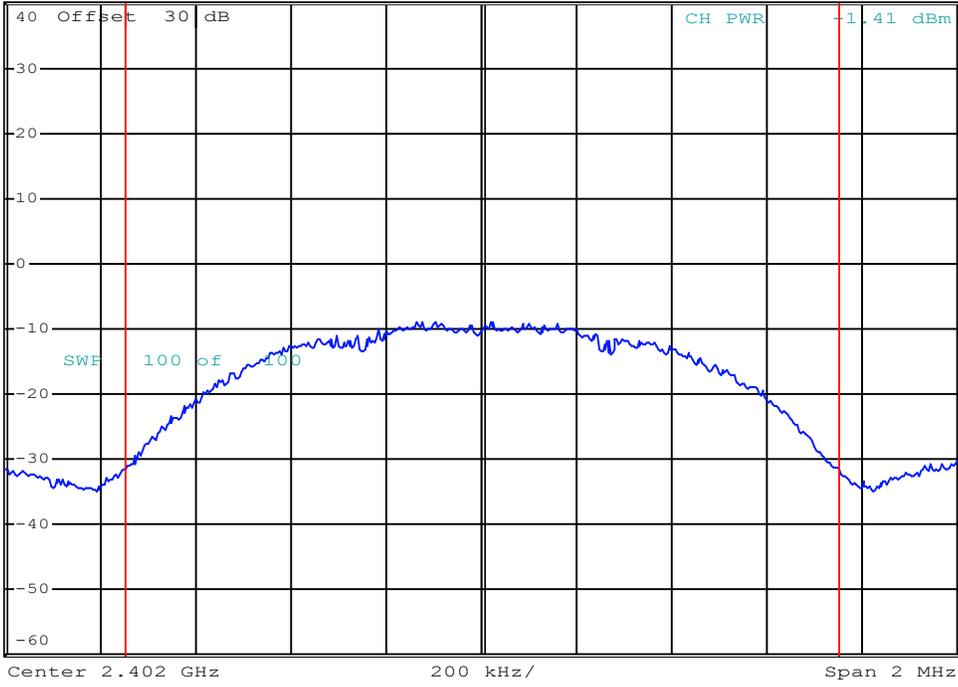


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 40 dBm

*Att 30 dB

1 RM*
VIEW



Date: 29.FEB.2024 11:52:32

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Channel Power: dBm

Conducted Power:

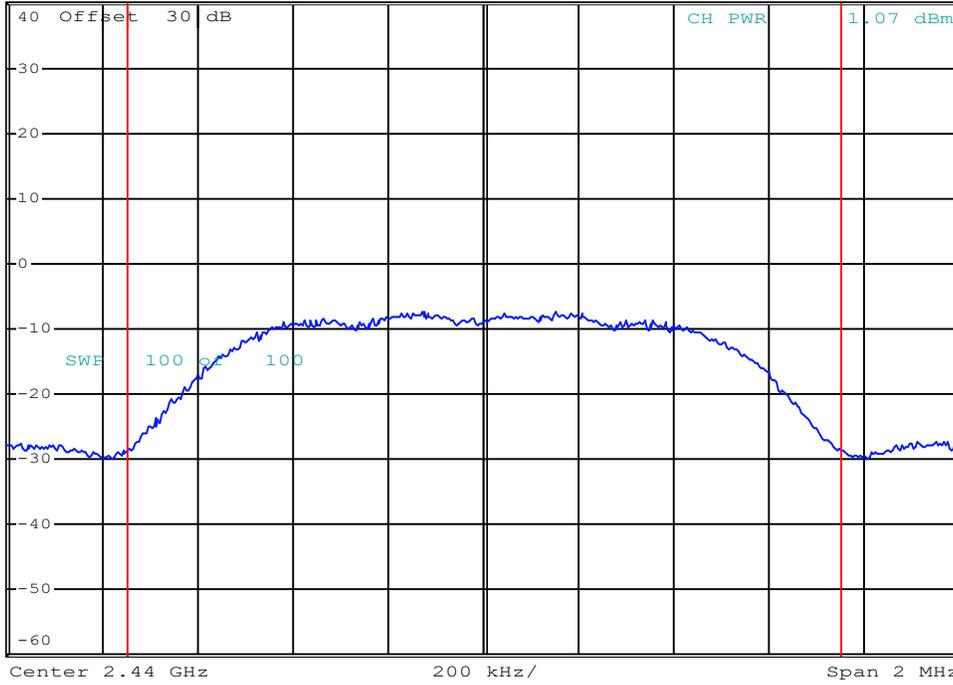


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 40 dBm

*Att 30 dB

1 RM*
VIEW



Date: 29.FEB.2024 11:53:47

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

Conducted Power:

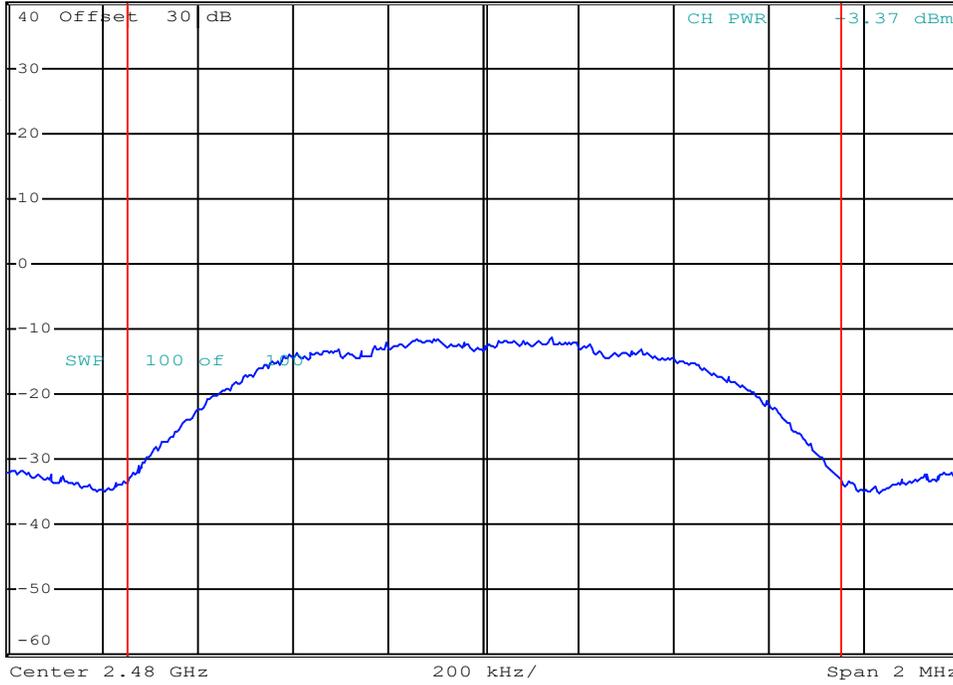


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 40 dBm

*Att 30 dB

1 RM*
VIEW



Date: 29.FEB.2024 13:17:16

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Channel Power: dBm

Conducted Power Measurement Results: DSS

| Channel Number | Channel Frequency (MHz) | Mode | Modulation | Rated Power (EIRP) | Measured Power [P _{Meas}] (dBm) | Limit [P _{Lim}] (dBm) | Conducted Margin (dB) | Antenna Gain [G] (dBi) | EIRP [E _{Meas}] (dBm) | EIRP Limit [E _{Lim}] (dBm) | EIRP Margin (dB) |
|----------------|-------------------------|---------|------------|--------------------|---|---------------------------------|-----------------------|------------------------|---------------------------------|--------------------------------------|------------------|
| 2 | 2404.00 | BT BR | GFSK | 6.2 | 10.00 | 30 | 20.0 | -3.8 | 6.2 | 36 | 29.8 |
| 38 | 2440.00 | | | | 9.91 | | 20.1 | | 6.1 | | 29.9 |
| 78 | 2480.00 | | | | 8.93 | | 21.1 | | 5.1 | | 30.9 |
| 2 | 2404.00 | BT 2EDR | Pi/4-DQPSK | | 9.16 | | 20.8 | | 5.4 | | 30.6 |
| 38 | 2440.00 | | | | 9.30 | | 20.7 | | 5.5 | | 30.5 |
| 78 | 2480.00 | | | | 8.26 | | 21.7 | | 4.5 | | 31.5 |
| 2 | 2404.00 | BT 3EDR | 8-DPSK | | 9.17 | | 20.8 | | 5.4 | | 30.6 |
| 38 | 2440.00 | | | | 9.12 | | 20.9 | | 5.3 | | 30.7 |
| 78 | 2480.00 | | | | 8.10 | | 21.9 | | 4.3 | | 31.7 |
| Result: | | | | | | | | | | | Complies |

Conducted Margin = Conducted Limit [P_{Limit}] - Measure Power [P_{Meas}]

EIRP [E_{Meas}] = Measure Power [P_{Meas}] + Antenna Gain [G]

EIRP Margin = EIRP Limit [E_{Lim}] - EIPR [E_{Meas}]

Conducted Power:

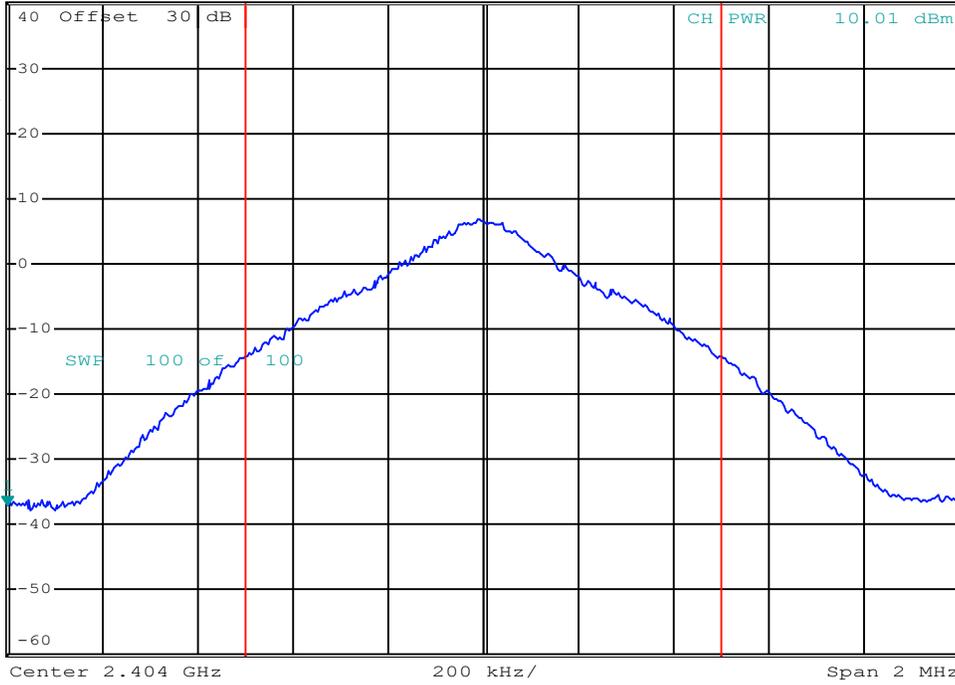


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -36.98 dBm
SWT 2.5 ms 2.403000000 GHz

Ref 40 dBm

*Att 30 dB

1 RM*
VIEW



Date: 29.FEB.2024 13:27:54

Channel:

Mode:

Channel Frequency: MHz

Modulation:

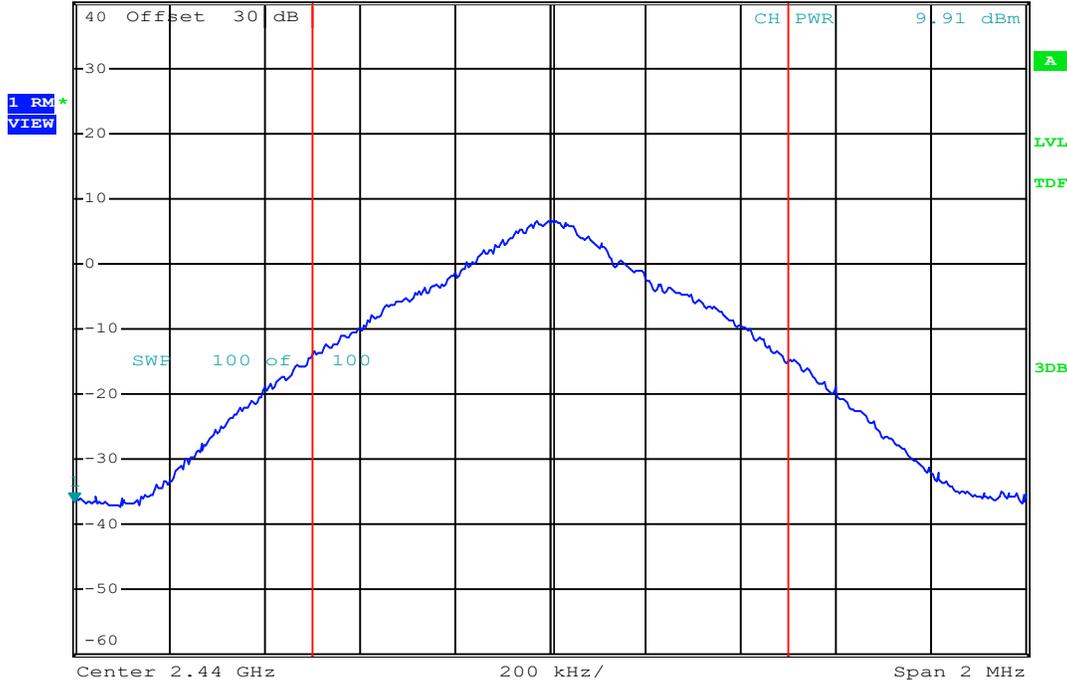
Measured Channel Power: dBm

Conducted Power:



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -36.44 dBm
SWT 2.5 ms 2.439000000 GHz

Ref 40 dBm *Att 30 dB



Date: 29.FEB.2024 13:32:07

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

Conducted Power:

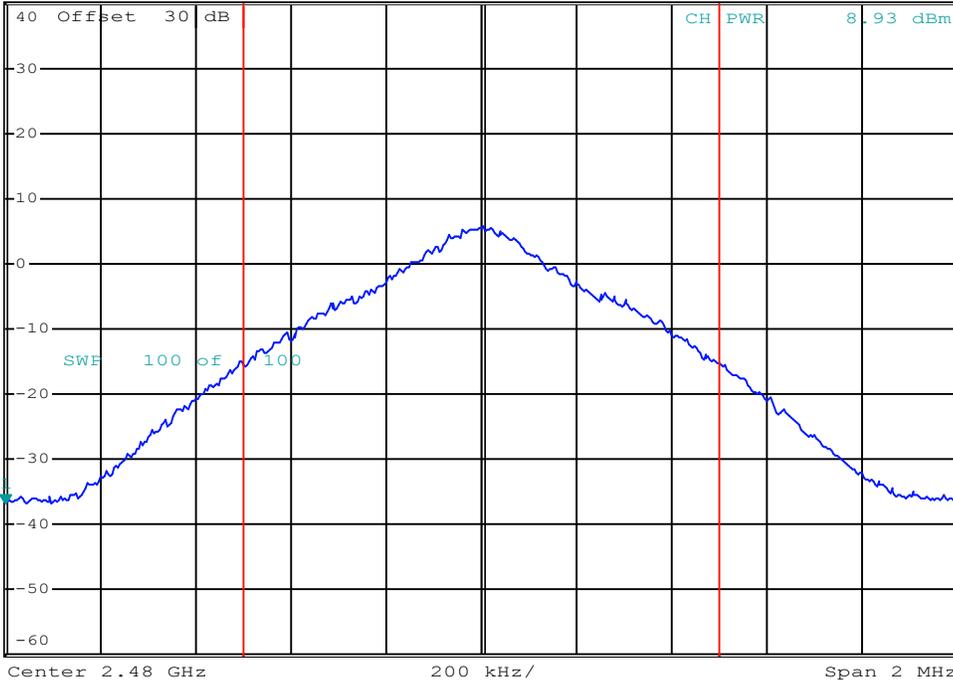


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -36.82 dBm
SWT 2.5 ms 2.479000000 GHz

Ref 40 dBm

*Att 30 dB

1 RM*
VIEW



Date: 29.FEB.2024 13:37:08

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Measured Channel Power: dBm

Conducted Power:

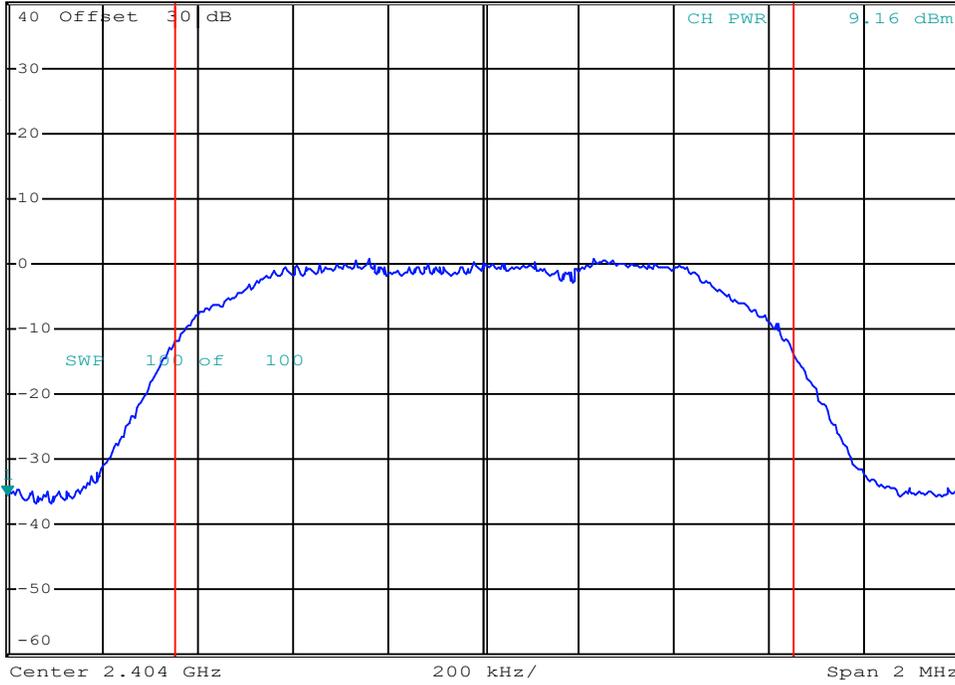


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -35.44 dBm
SWT 2.5 ms 2.403000000 GHz

Ref 40 dBm

*Att 30 dB

1 RM*
VIEW



Date: 29.FEB.2024 13:41:18

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

Conducted Power:

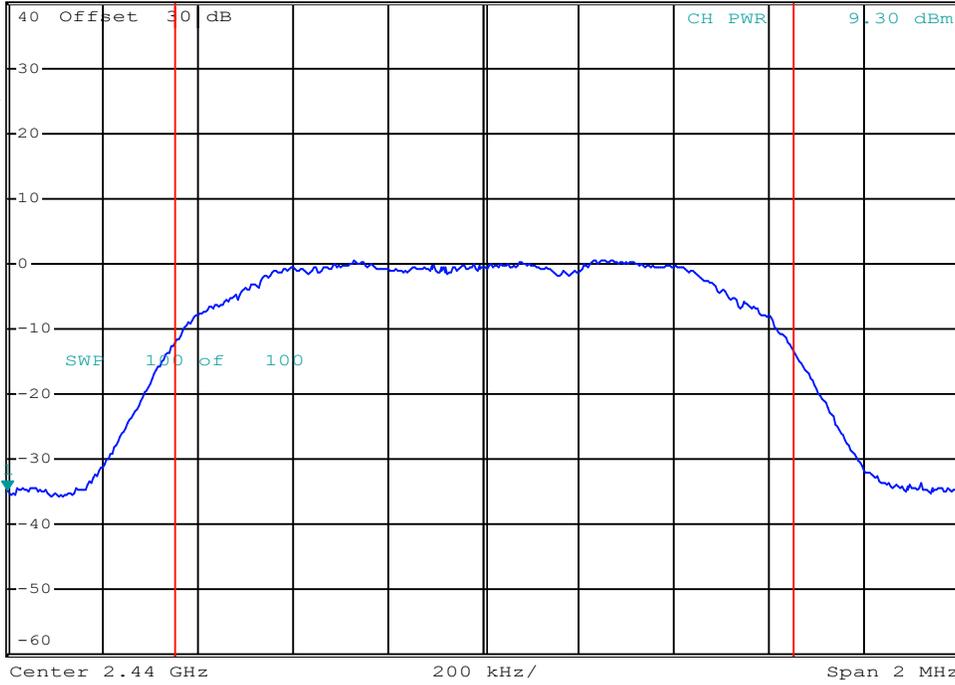


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -34.80 dBm
SWT 2.5 ms 2.439000000 GHz

Ref 40 dBm

*Att 30 dB

1 RM*
VIEW



Date: 29.FEB.2024 13:47:40

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

Conducted Power:

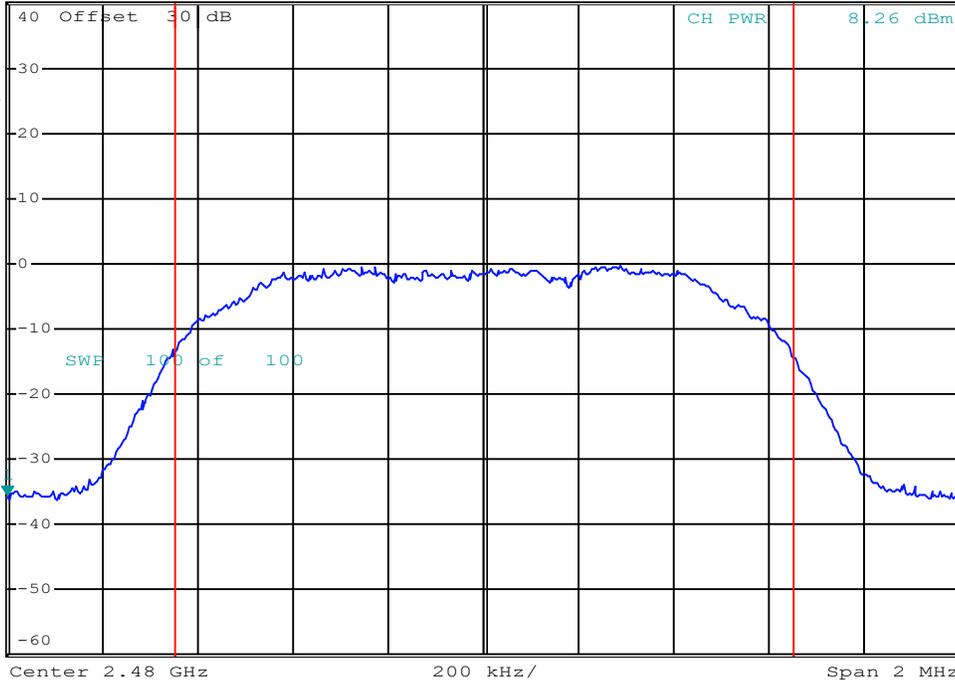


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -35.44 dBm
SWT 2.5 ms 2.479000000 GHz

Ref 40 dBm

*Att 30 dB

1 RM*
VIEW



Date: 29.FEB.2024 13:53:31

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

Conducted Power:

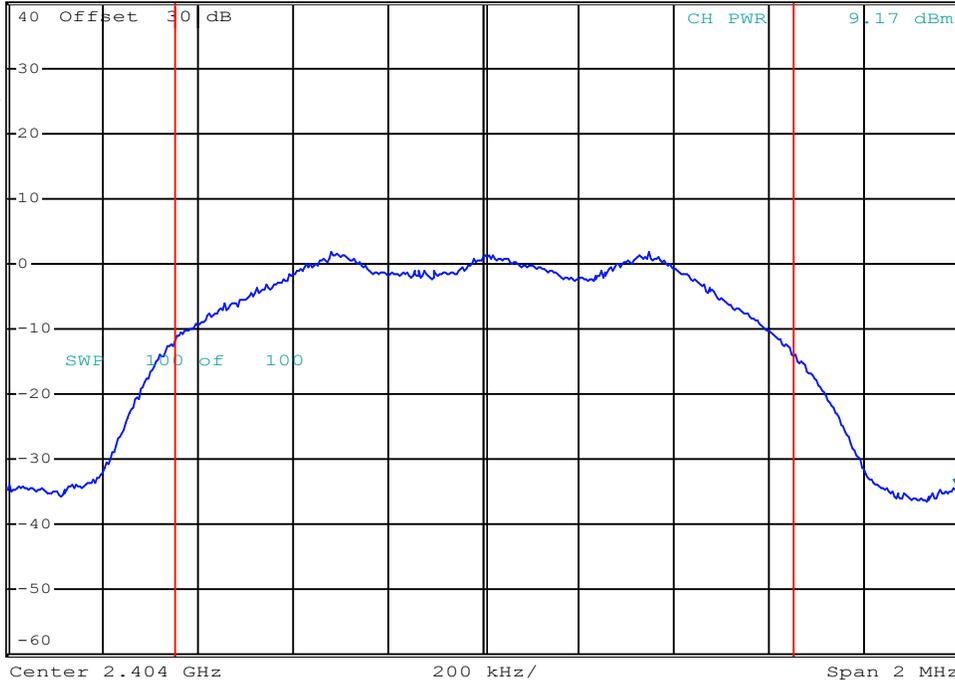


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -34.43 dBm
SWT 2.5 ms 2.405000000 GHz

Ref 40 dBm

*Att 30 dB

1 RM*
VIEW



Date: 29.FEB.2024 13:55:22

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Measured Channel Power: dBm

Conducted Power:

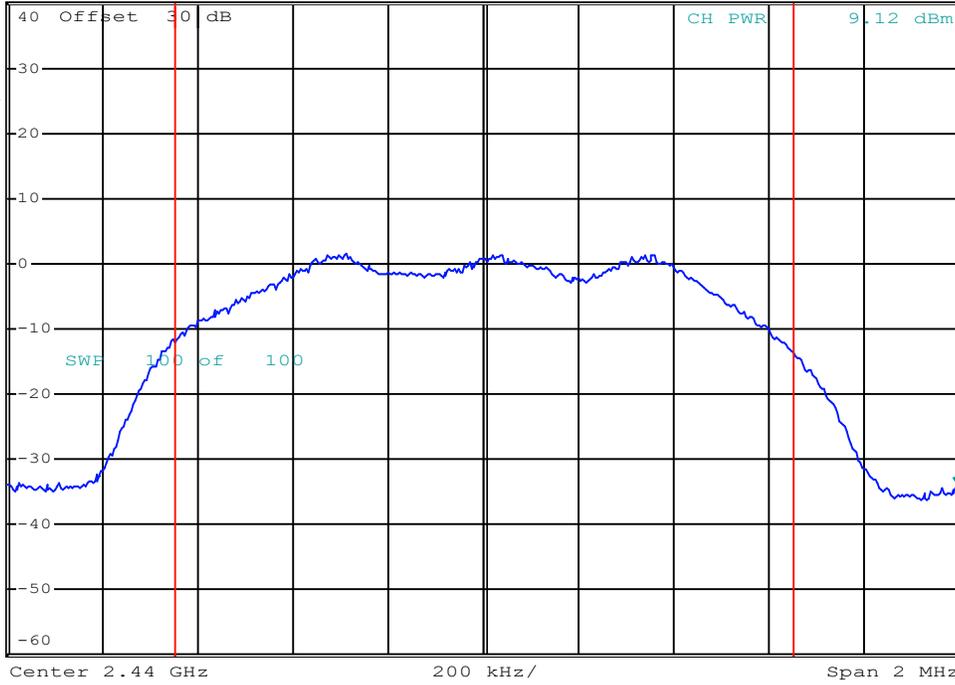


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -34.20 dBm
SWT 2.5 ms 2.441000000 GHz

Ref 40 dBm

*Att 30 dB

1 RM*
VIEW



Date: 29.FEB.2024 13:59:22

Channel: 38

Channel Frequency: 2440 MHz

Mode: BT 3EDR

Modulation: 8-DPSK

Measured Channel Power: 9.12 dBm

Conducted Power:

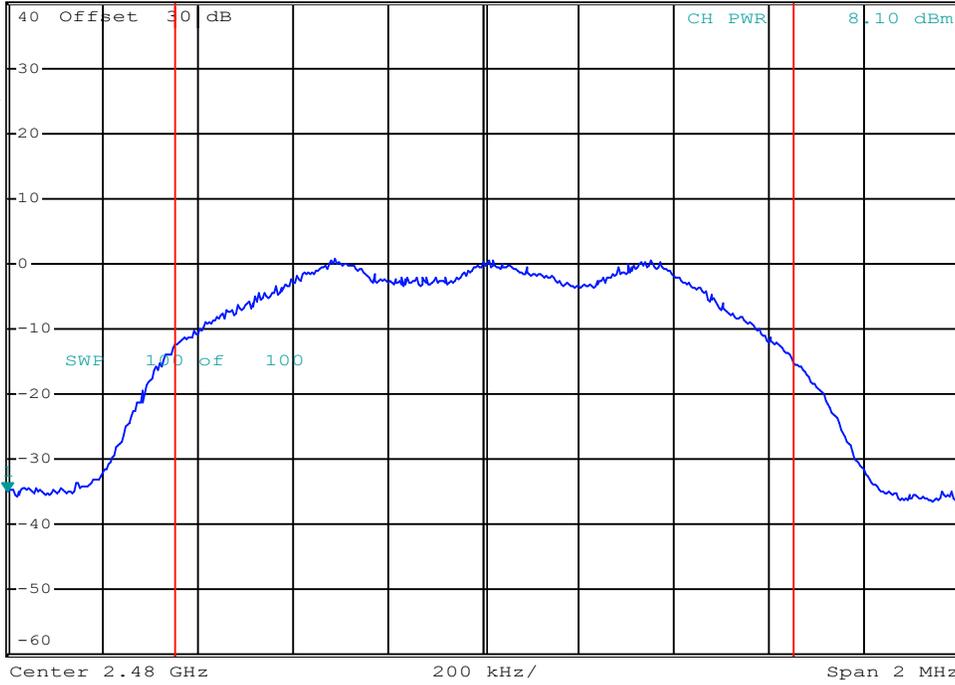


*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -34.83 dBm
SWT 2.5 ms 2.479000000 GHz

Ref 40 dBm

*Att 30 dB

1 RM*
VIEW



Date: 29.FEB.2024 13:57:13

Channel: 78

Channel Frequency: 2480 MHz

Mode: BT 3EDR

Modulation: 8-DPSK

Measured Channel Power: 8.1 dBm

Band Edge Measurement Results: DTS

| Mode | Channel Number | Frequency (MHz) | Modulation | Emission Power [P _{Em}] (dBm) | Fundamental Power [P _{Fund}] (dBm) | Attenuation [Atten] (dB) | Limit (dB) | Margin (dB) | Antenna Gain (dBi) | Emission EIRP [E _{Em}] (dBm) | Fundamental EIRP [E _{Fund}] (dBm) | EIRP Attenuation [Atten] (dB) | Limit (dB) | EIRP Margin (dB) |
|---------|----------------|-----------------|------------|---|--|--------------------------|------------|-------------|--------------------|--|---|-------------------------------|------------|------------------|
| 802.11b | 1 | 2412.00 | DSSS 5.5 | -24.78 | 15.63 | 40.41 | 30 | 10.4 | -3.8 | -28.58 | 11.83 | 40.41 | 30 | 10.4 |
| | 11 | 2462.00 | | -37.01 | 15.07 | 52.08 | | 22.1 | | -40.81 | 11.27 | 52.08 | | 22.1 |
| | 12 | 2467.00 | | -30.98 | 15.07 | 46.05 | | 16.1 | | -34.78 | 11.27 | 46.05 | | 16.1 |
| | 13 | 2472.00 | | -20.75 | 15.07 | 35.82 | | 5.8 | | -24.55 | 11.27 | 35.82 | | 5.8 |
| 802.11g | 1 | 2412.00 | OFDM 12 | -22.21 | 12.58 | 34.79 | 30 | 4.8 | -3.8 | -26.01 | 8.78 | 34.79 | 30 | 4.8 |
| | 11 | 2462.00 | | -22.08 | 14.20 | 36.28 | | 6.3 | | -25.88 | 10.40 | 36.28 | | 6.3 |
| | 12 | 2467.00 | | -16.51 | 14.15 | 30.66 | | 0.7 | | -20.31 | 10.35 | 30.66 | | 0.7 |
| | 13 | 2472.00 | | -20.28 | 11.38 | 31.66 | | 1.7 | | -24.08 | 7.58 | 31.66 | | 1.7 |
| 802.11n | 1 | 2412.00 | MCS0 | -22.18 | 14.61 | 36.79 | 30 | 6.8 | -3.8 | -25.98 | 10.81 | 36.79 | 30 | 6.8 |
| | 11 | 2462.00 | | -26.21 | 13.86 | 40.07 | | 10.1 | | -30.01 | 10.06 | 40.07 | | 10.1 |
| | 12 | 2467.00 | | -18.08 | 13.80 | 31.88 | | 1.9 | | -21.88 | 10.00 | 31.88 | | 1.9 |
| | 13 | 2472.00 | | -18.37 | 12.10 | 30.47 | | 0.5 | | -22.17 | 8.30 | 30.47 | | 0.5 |
| BLE 1mb | 37 | 2402.00 | GMSK | -38.44 | 0.70 | 39.14 | 30 | 9.1 | -3.8 | -42.24 | -3.10 | 39.14 | 30 | 9.1 |
| | 39 | 2480.00 | | -39.99 | 0.70 | 40.69 | | 10.7 | | -43.79 | -3.10 | 40.69 | | 10.7 |
| BLE 2mb | 0 | 2404.00 | GMSK | -36.97 | 1.48 | 38.45 | 30 | 8.5 | -3.8 | -40.77 | -2.32 | 38.45 | 30 | 8.5 |
| | 39 | 2480.00 | | -39.40 | 1.48 | 40.88 | | 10.9 | | -43.20 | -2.32 | 40.88 | | 10.9 |
| ANT | 0 | 2402.00 | GFSK | -39.52 | 1.07 | 40.59 | 30 | 10.6 | -3.8 | -43.32 | -2.73 | 40.59 | 30 | 10.6 |
| | 78 | 2480.00 | | -40.03 | 1.07 | 41.10 | | 11.1 | | -43.83 | -2.73 | 41.10 | | 11.1 |

Result: Complies

Attenuation [Atten] = [P_{Fund}] - [P_{Em}]

Margin = [Atten] - Limit

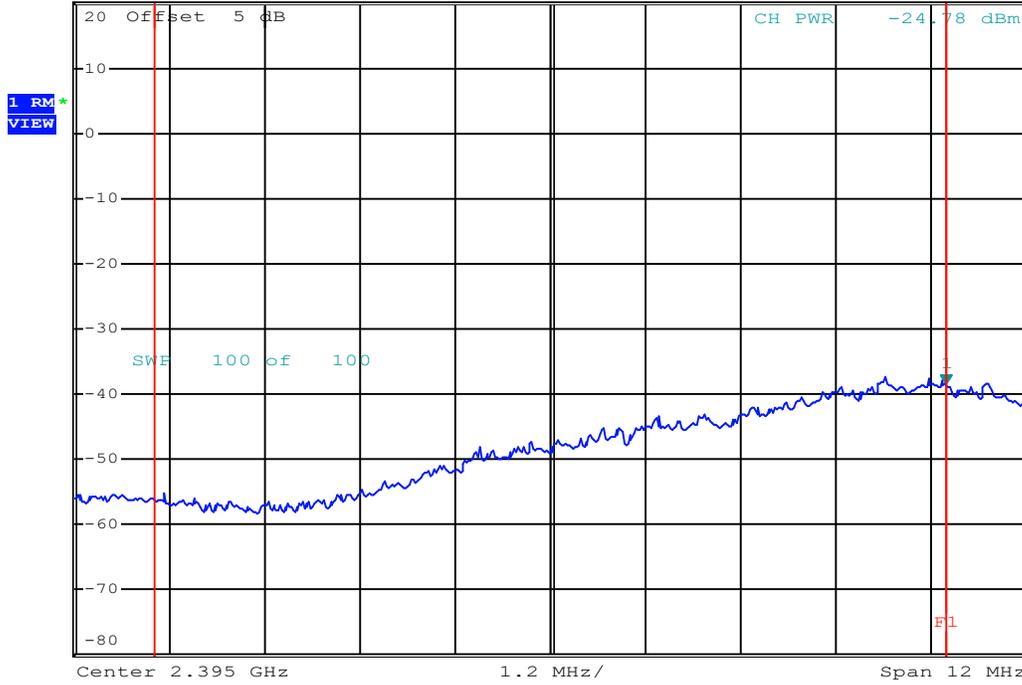
Band Edge: Lower Band Edge



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -38.41 dBm
SWT 2.5 ms 2.40000000 GHz

Ref 20 dBm

Att 30 dB



Date: 21.MAR.2024 11:14:37

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

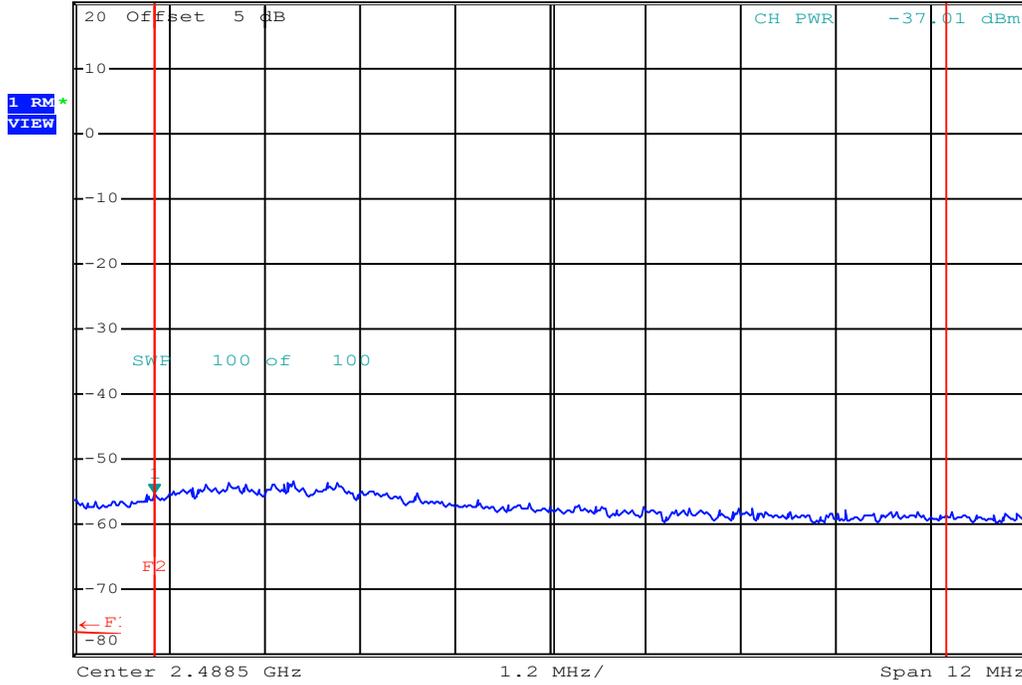
Band Edge: Upper Band Edge



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -55.32 dBm
SWT 2.5 ms 2.483500000 GHz

Ref 20 dBm

Att 30 dB



Date: 21.MAR.2024 11:19:56

Channel: 11

Mode: 802.11b

Channel Frequency: 2462 MHz

Modulation: DSSS 5.5

Emission Power: -37.01 dBm

Band Edge: Upper Band Edge



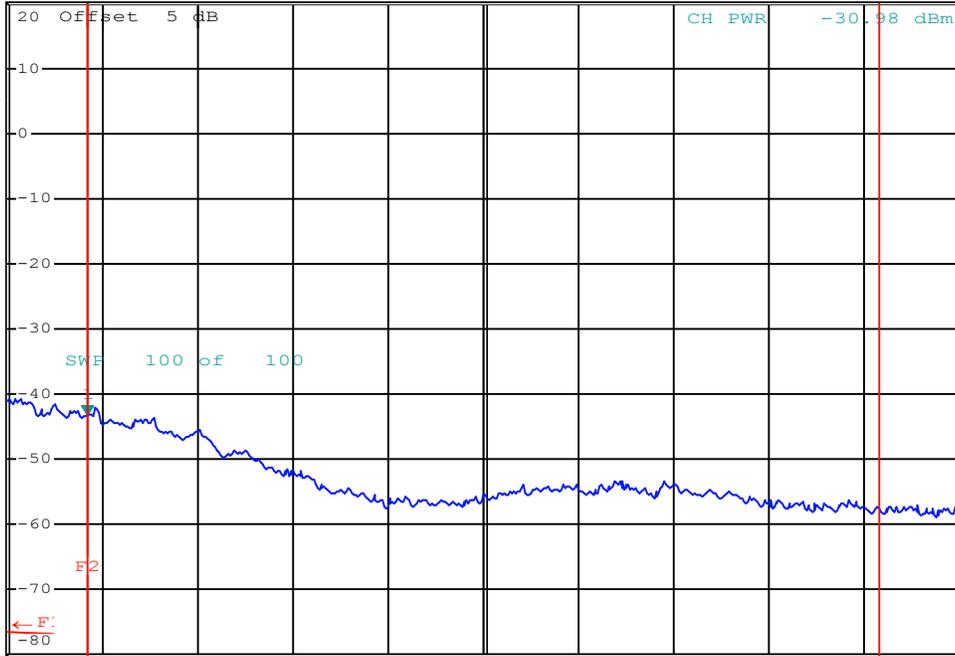
*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -43.22 dBm
SWT 2.5 ms 2.483500000 GHz

Ref 20 dBm

Att 30 dB

CH PWR -30.98 dBm

1 RM*
VIEW



Date: 21.MAR.2024 11:22:40

Channel: 12

Mode: 802.11b

Channel Frequency: 2467 MHz

Modulation: DSSS 5.5

Emission Power: -30.98 dBm

Band Edge: Upper Band Edge



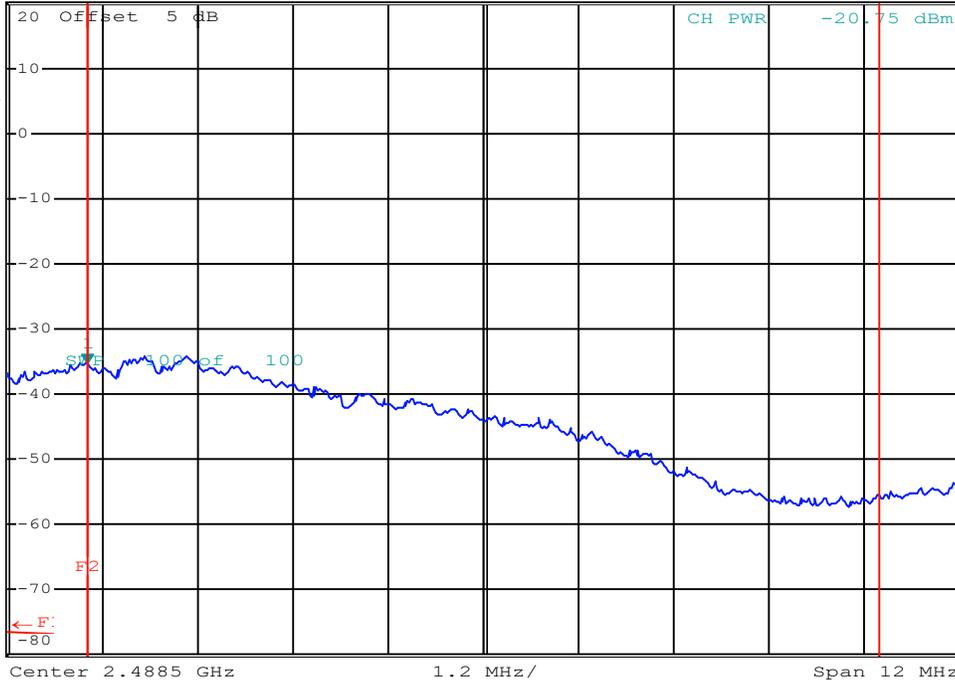
*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -35.28 dBm
SWT 2.5 ms 2.483500000 GHz

Ref 20 dBm

Att 30 dB

CH PWR -20.75 dBm

1 RM*
VIEW



Date: 21.MAR.2024 12:46:22

Channel: 13

Mode: 802.11b

Channel Frequency: 2472 MHz

Modulation: DSSS 5.5

Emission Power: -20.75 dBm

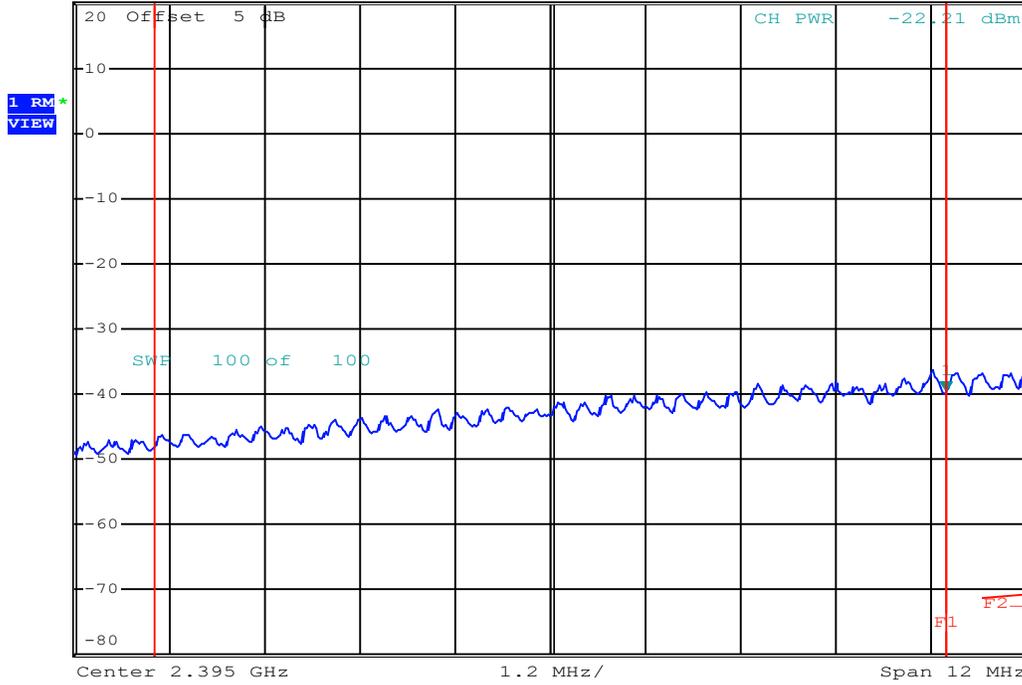
Band Edge: Lower Band Edge



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -39.57 dBm
SWT 2.5 ms 2.400000000 GHz

Ref 20 dBm

Att 30 dB



Date: 21.MAR.2024 13:07:15

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Upper Band Edge



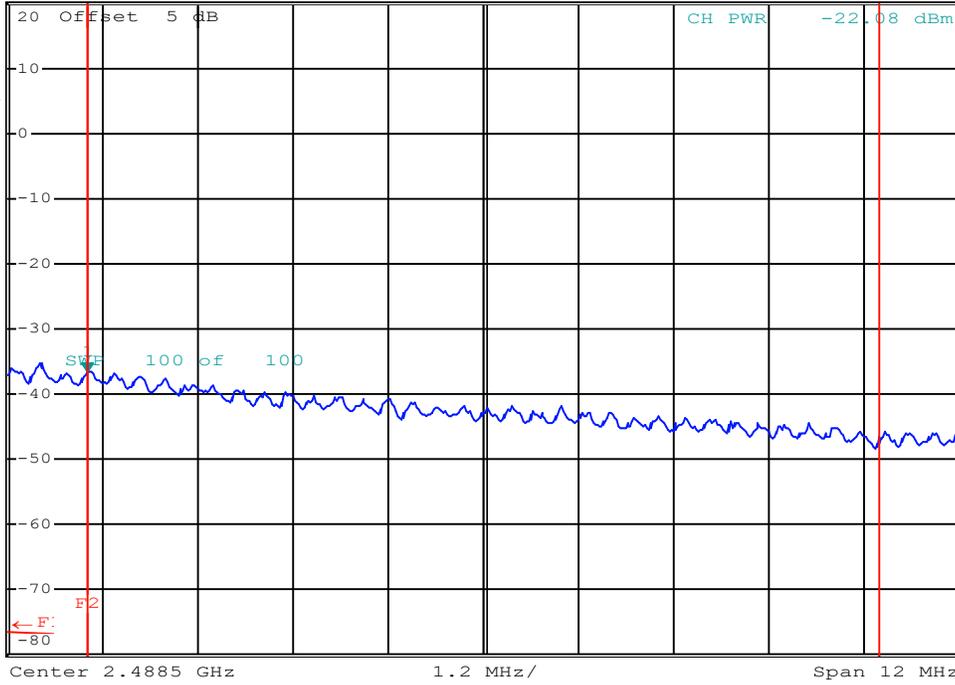
*RBW 100 kHz Marker 1 [T1]
 VBW 1 MHz -36.49 dBm
 SWT 2.5 ms 2.483500000 GHz

Ref 20 dBm

Att 30 dB

CH PWR -22.08 dBm

1 RM*
 VIEW



Date: 21.MAR.2024 13:09:07

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Upper Band Edge

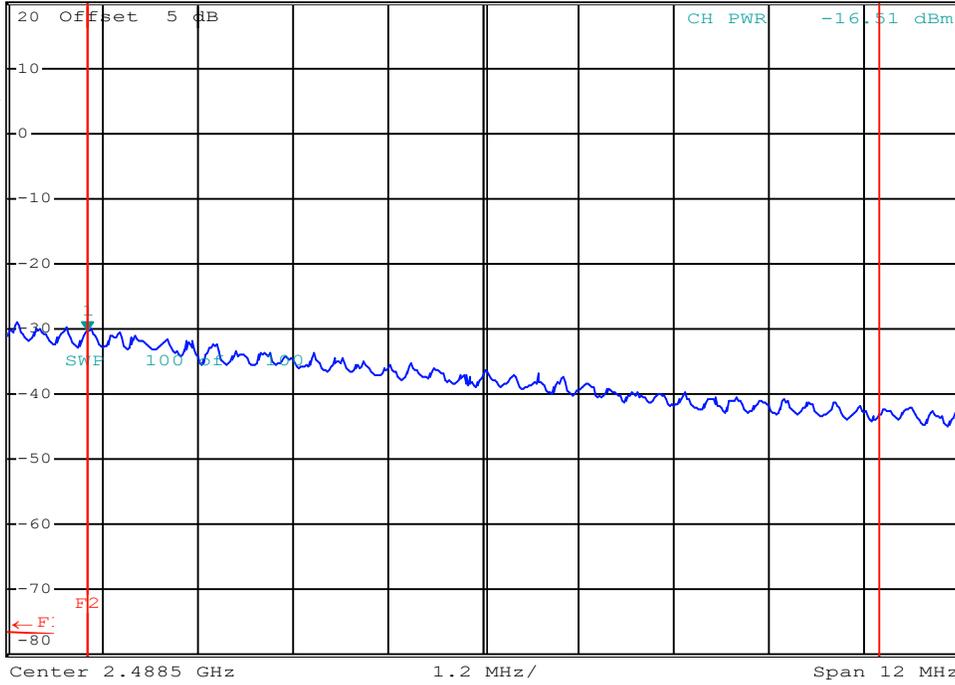


*RBW 100 kHz Marker 1 [T1]
 VBW 1 MHz -30.32 dBm
 SWT 2.5 ms 2.483500000 GHz

Ref 20 dBm

Att 30 dB

1 RM*
 VIEW



Date: 21.MAR.2024 13:11:02

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Upper Band Edge



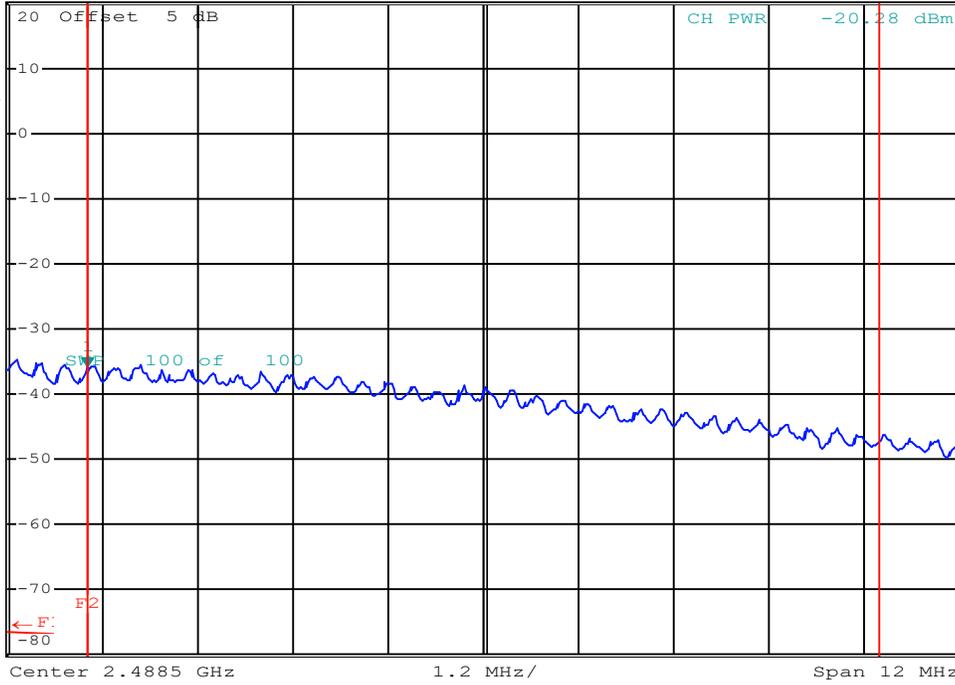
*RBW 100 kHz Marker 1 [T1]
 VBW 1 MHz -35.73 dBm
 SWT 2.5 ms 2.483500000 GHz

Ref 20 dBm

Att 30 dB

CH PWR -20.28 dBm

1 RM*
 VIEW



Date: 21.MAR.2024 13:16:38

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

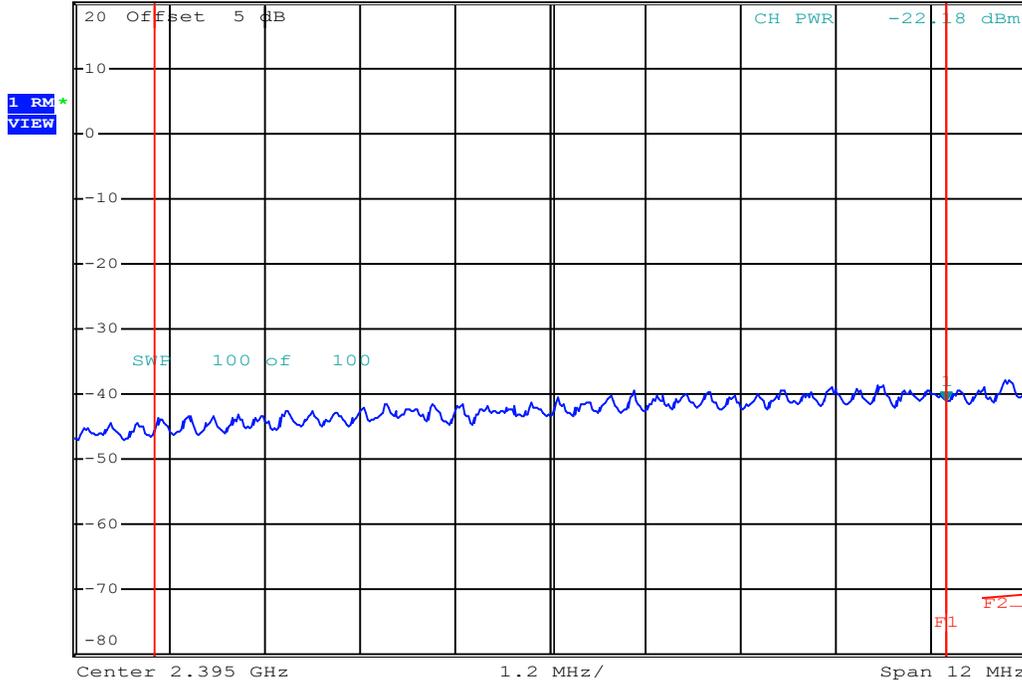
Band Edge: Lower Band Edge



*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -40.95 dBm
SWT 2.5 ms 2.40000000 GHz

Ref 20 dBm

Att 30 dB



Date: 21.MAR.2024 13:46:44

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Upper Band Edge



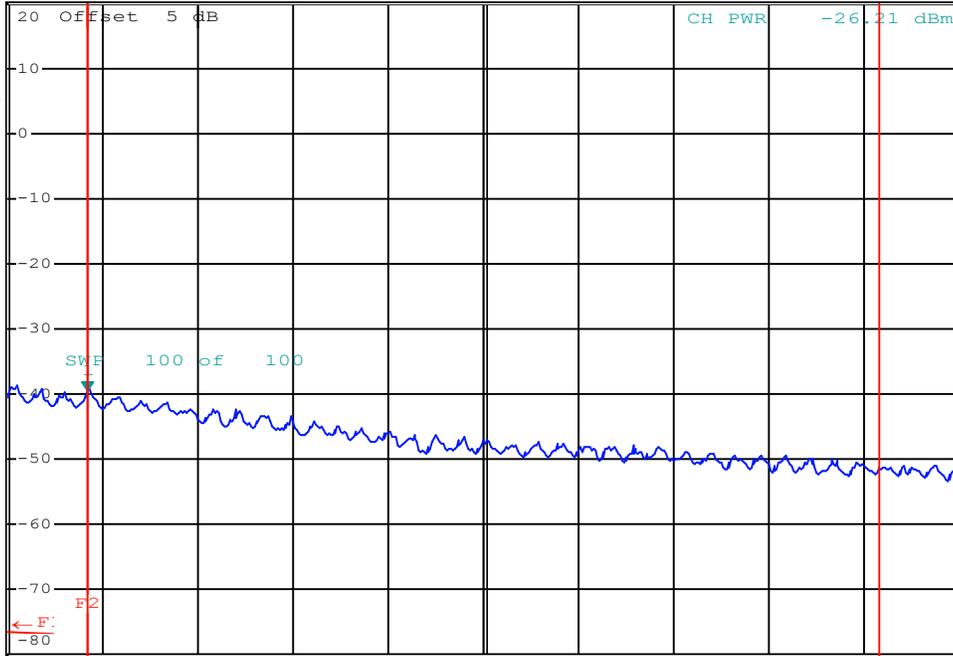
*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -39.50 dBm
SWT 2.5 ms 2.483500000 GHz

Ref 20 dBm

Att 30 dB

CH PWR -26.21 dBm

1 RM*
VIEW



Center 2.4885 GHz

1.2 MHz/

Span 12 MHz

Date: 21.MAR.2024 13:47:58

Channel: 11

Mode: 802.11n

Channel Frequency: 2462 MHz

Modulation: MCS0

Emission Power: -26.21 dBm

Band Edge: Upper Band Edge



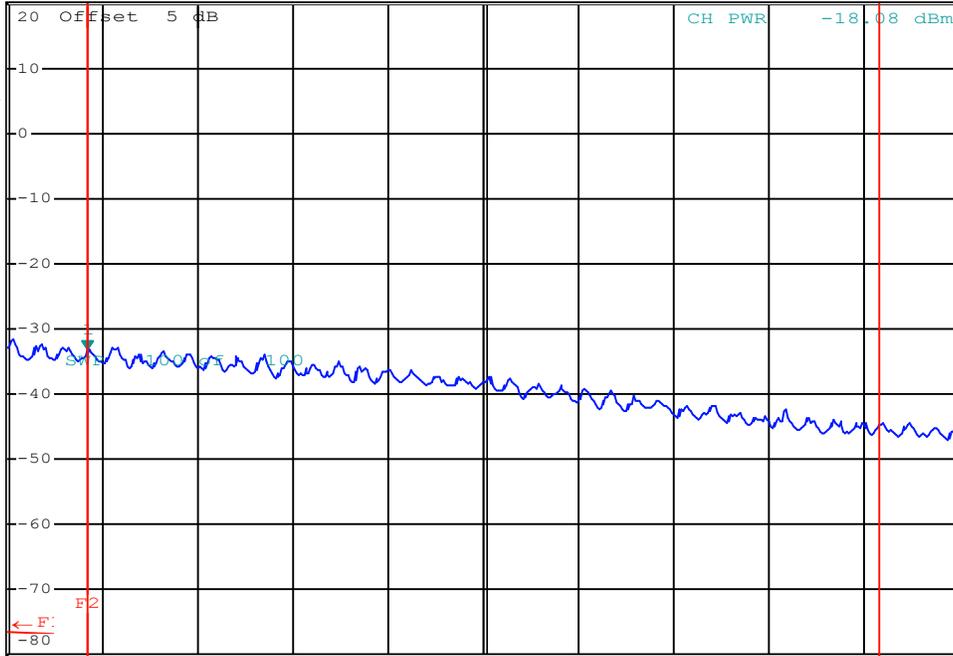
*RBW 100 kHz Marker 1 [T1]
VEW 1 MHz -33.24 dBm
SWT 2.5 ms 2.48350000 GHz

Ref 20 dBm

Att 30 dB

CH PWR -18.08 dBm

1 RM*
VIEW



Center 2.4885 GHz

1.2 MHz/

Span 12 MHz

Date: 21.MAR.2024 13:48:41

Channel: 12

Mode: 802.11n

Channel Frequency: 2467 MHz

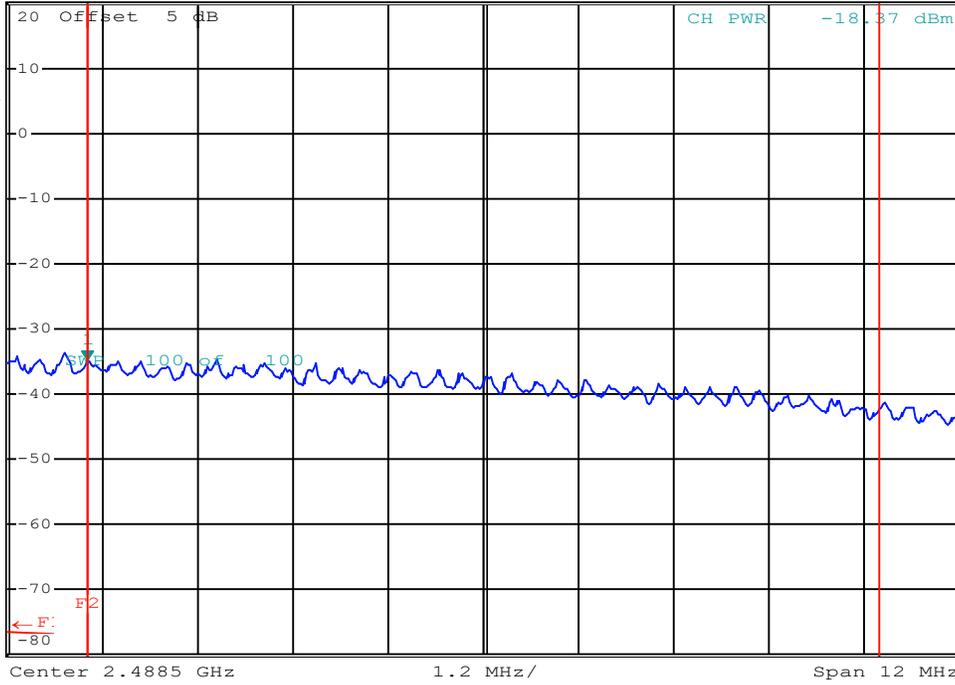
Modulation: MCS0

Emission Power: -18.08 dBm

Band Edge: Upper Band Edge



*RBW 100 kHz Marker 1 [T1]
 VBW 1 MHz -34.66 dBm
 Ref 20 dBm Att 30 dB SWT 2.5 ms 2.483500000 GHz



Date: 21.MAR.2024 13:53:22

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Lower Band Edge

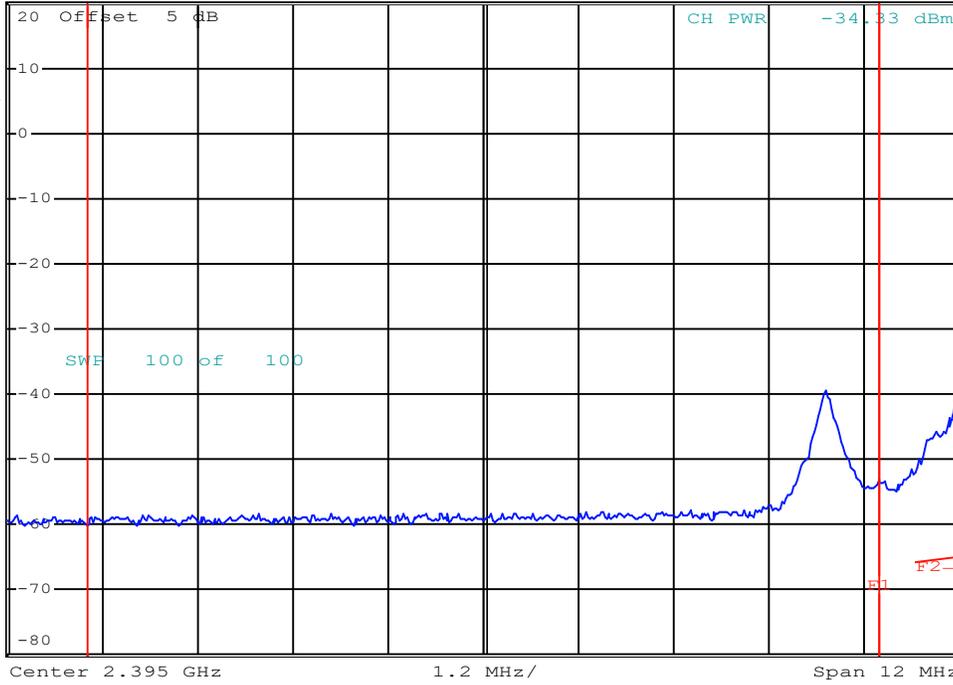


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:27:45

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Upper Band Edge

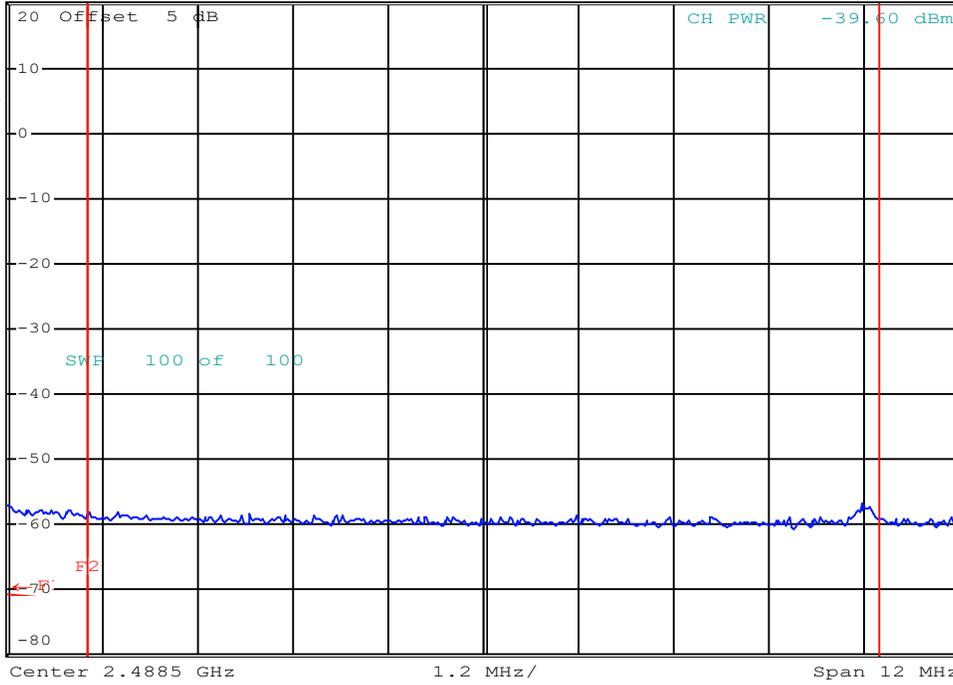


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:36:39

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Lower Band Edge

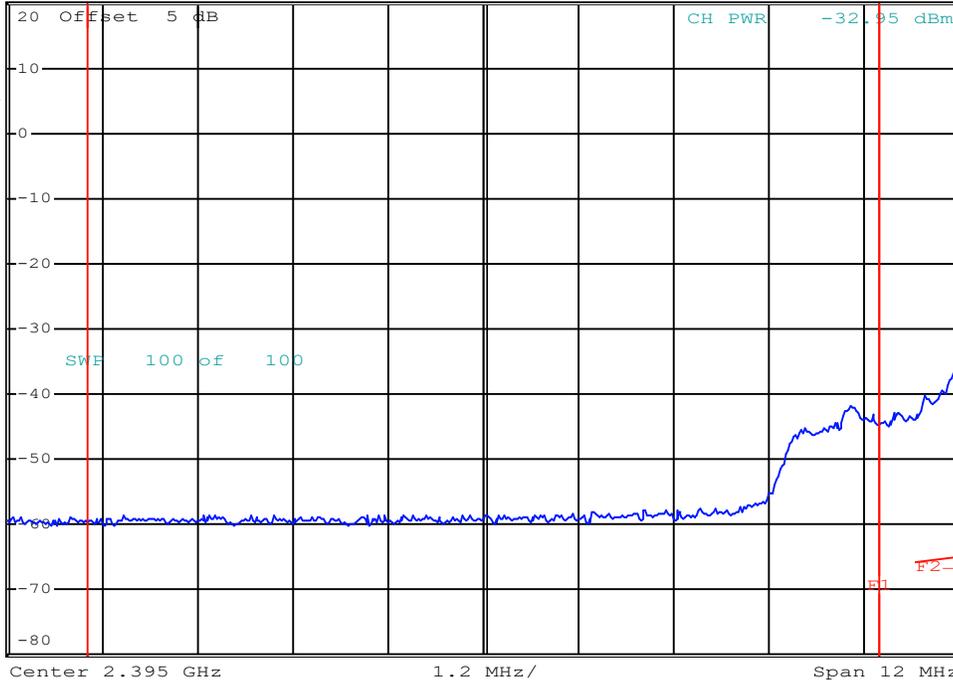


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:42:29

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Upper Band Edge

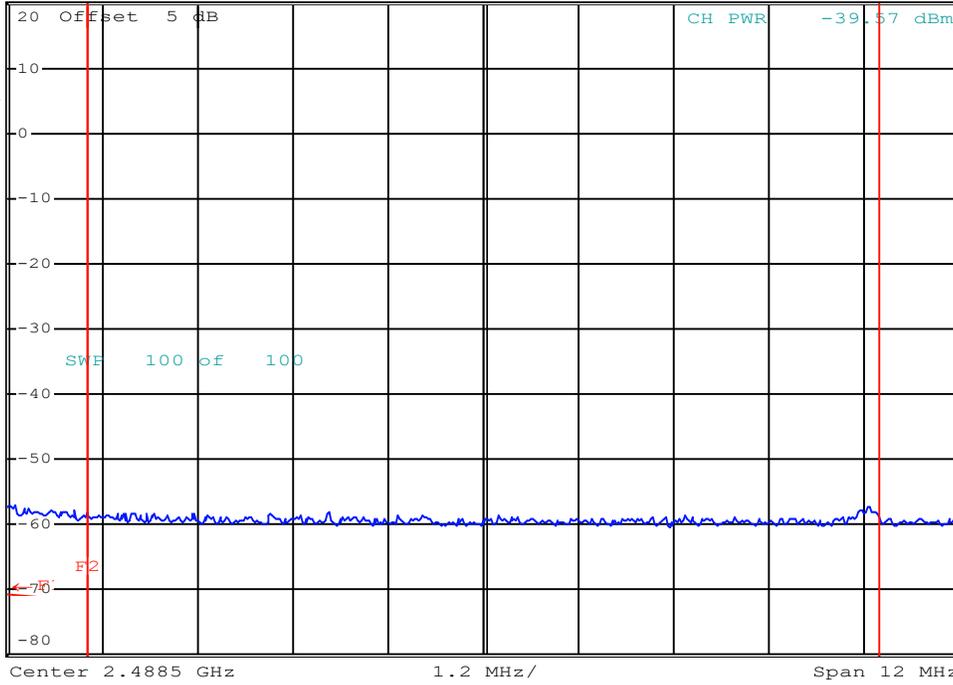


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:37:36

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Lower Band Edge

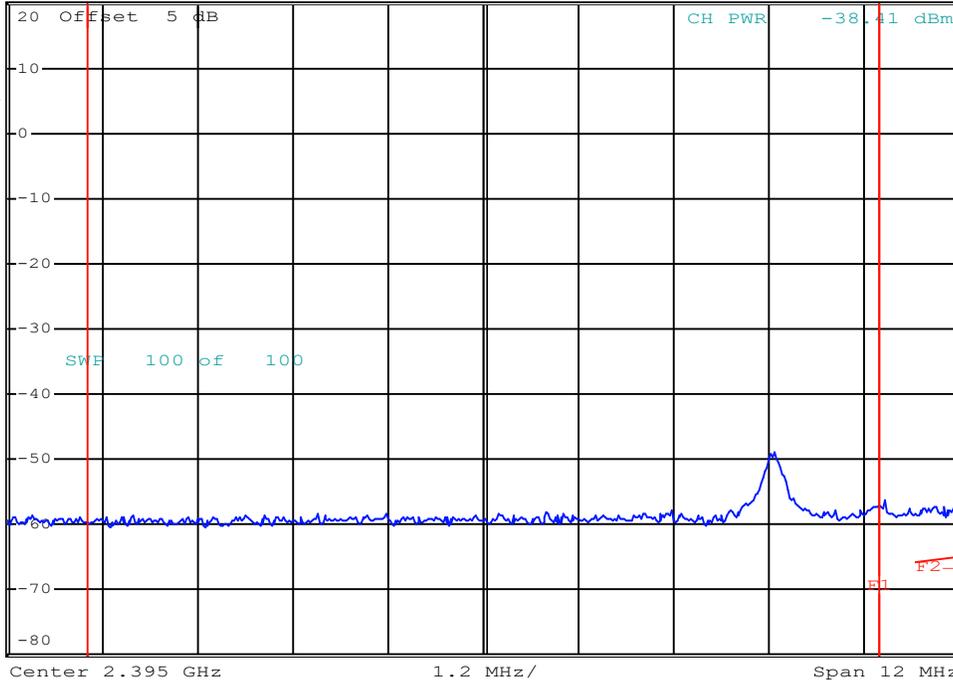


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:47:08

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Upper Band Edge

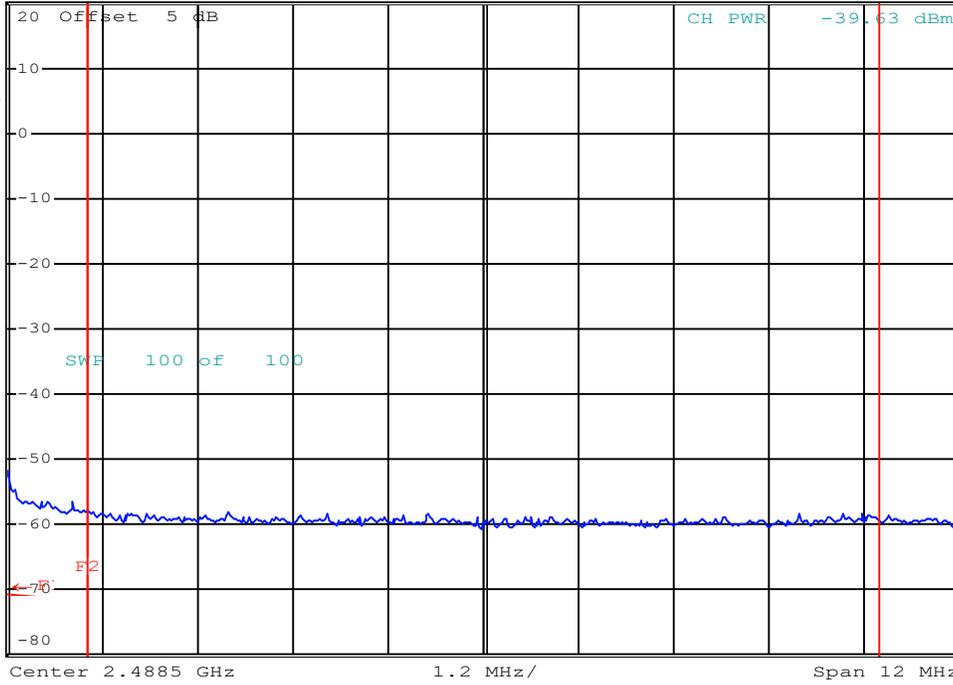


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:53:14

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Lower Band Edge

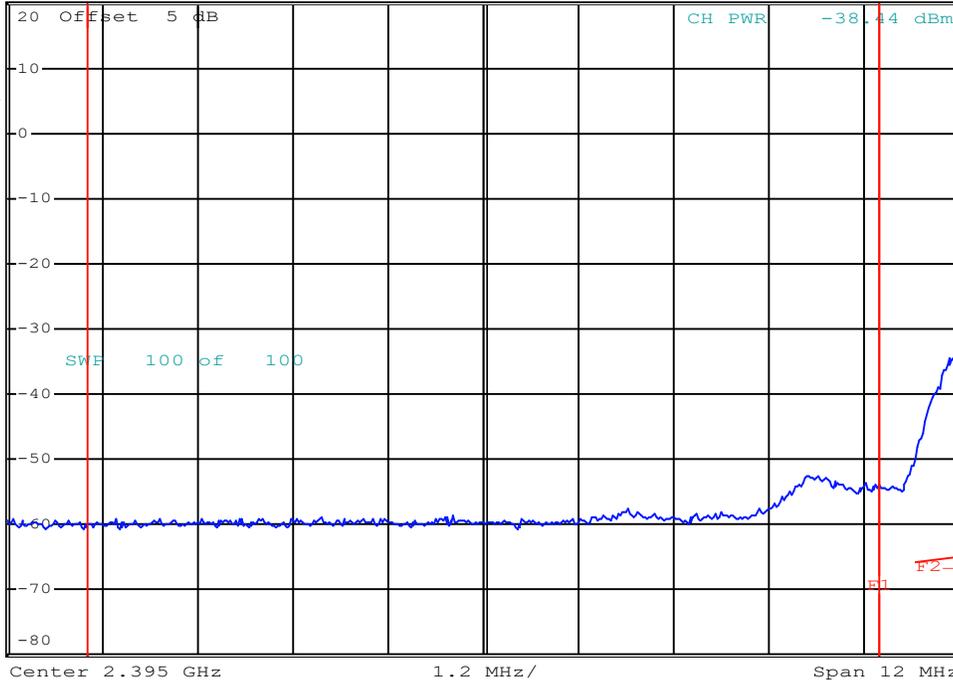


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:20:18

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Upper Band Edge

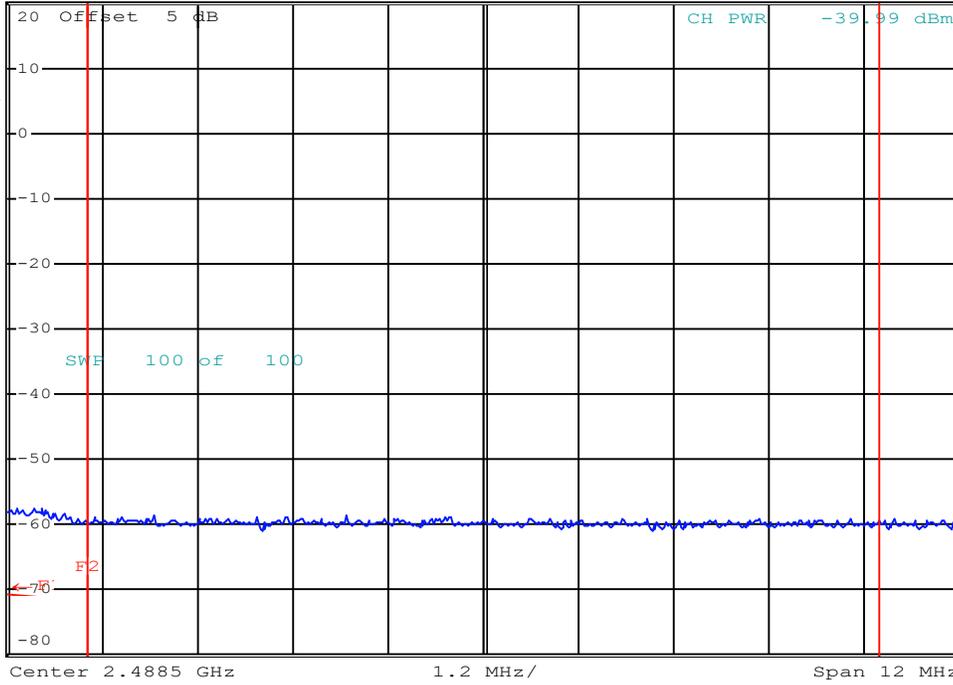


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:30:40

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Lower Band Edge

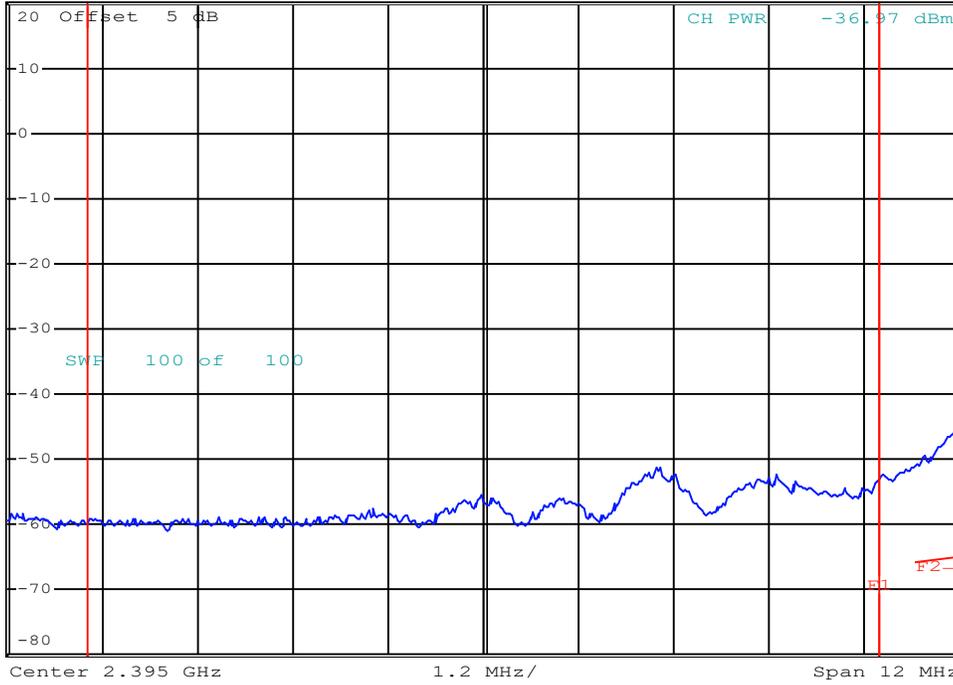


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:21:22

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Upper Band Edge

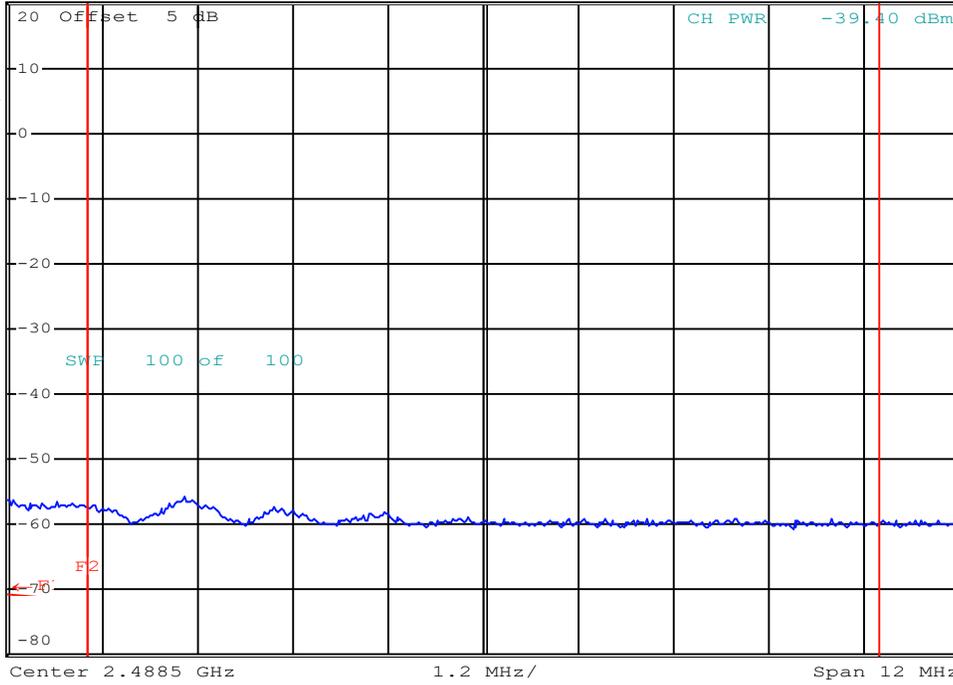


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:23:22

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Lower Band Edge

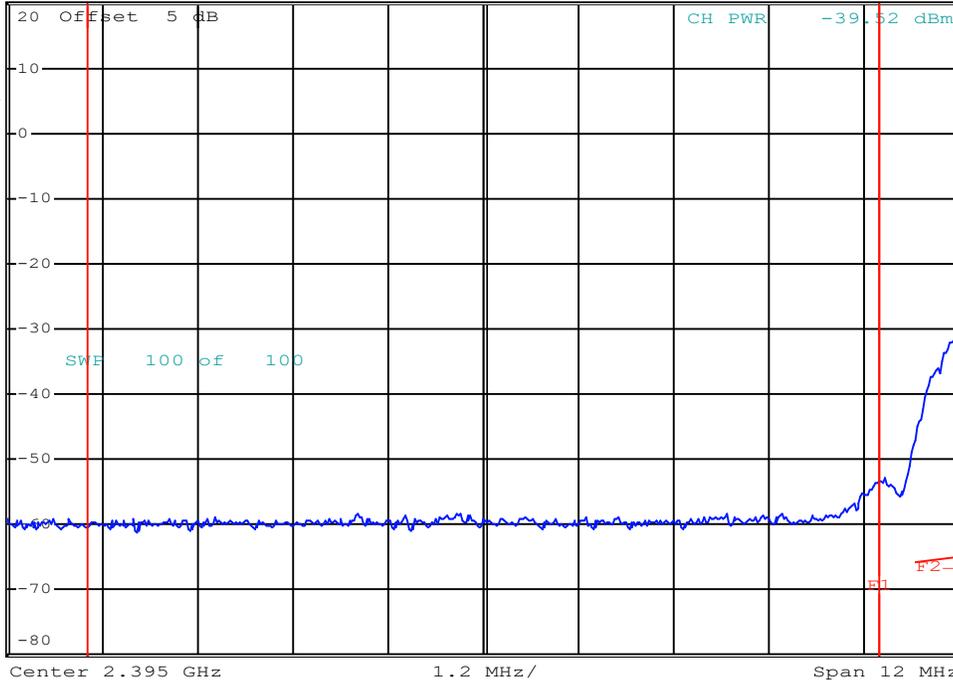


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:26:41

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Upper Band Edge

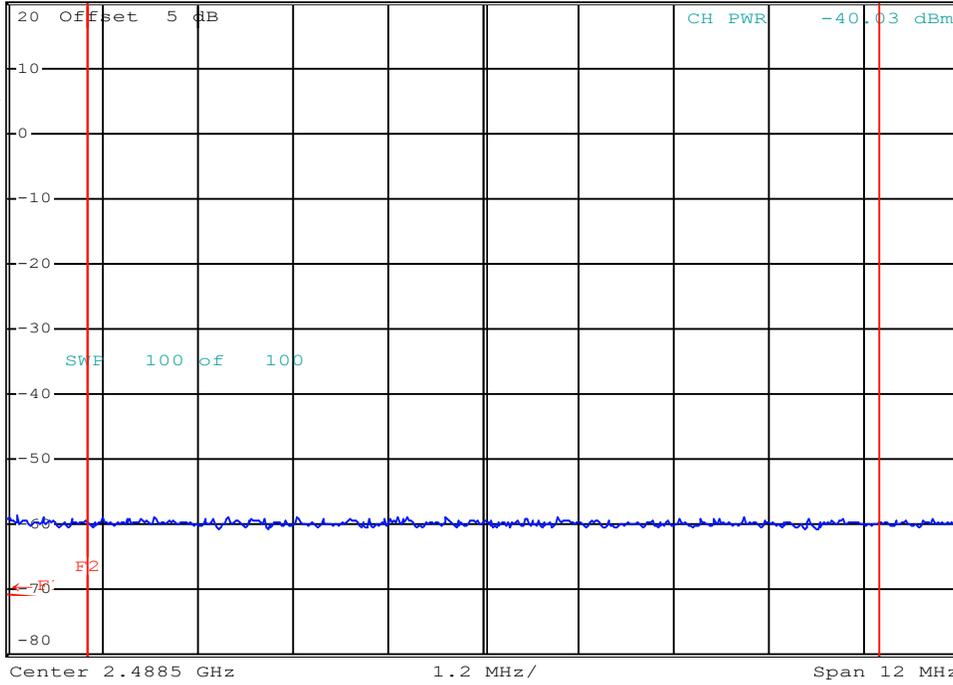


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:25:05

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge Measurement Results: 802.15

| Mode | Channel Number | Frequency (MHz) | Modulation | Emission Power [P _{Em}] (dBm) | Fundamental Power [P _{Fund}] (dBm) | Attenuation [Atten] (dB) | Limit (dB) | Margin (dB) | Antenna Gain (dBi) | Emission EIRP [E _{Em}] (dBm) | Fundamental EIRP [E _{Fund}] (dBm) | EIRP Attenuation [Atten] (dB) | Limit (dB) | EIRP Margin (dB) | | | |
|----------------|----------------|-----------------|------------|---|--|--------------------------|------------|-------------|--------------------|--|---|-------------------------------|-----------------|------------------|----|------|------|
| BT BR | 0 | 2402.00 | GFSK | -34.33 | 10.00 | 44.33 | 30 | 14.3 | -3.8 | -38.13 | 6.20 | 44.33 | 30 | 14.3 | | | |
| | 78 | 2480.00 | | -39.60 | | 39.60 | | 9.6 | | -43.40 | -3.80 | 39.60 | | 9.6 | | | |
| BT 2EDR | 0 | 2402.00 | Pi/4-DQPSK | -32.95 | 9.30 | 42.25 | | 12.3 | | -3.8 | -36.75 | 5.50 | | 42.25 | 30 | 12.3 | |
| | 78 | 2480.00 | | -39.57 | | 39.57 | | 9.6 | | | -43.37 | -3.80 | | 39.57 | | 9.6 | |
| BT 3EDR | 2 | 2404.00 | 8-DPSK | -38.41 | 9.17 | 47.58 | | 17.6 | | | -42.21 | 5.37 | | 47.58 | | 30 | 17.6 |
| | 78 | 2480.00 | | -39.63 | | 39.63 | | 9.6 | | | -43.43 | -3.80 | | 39.63 | | | 9.6 |
| Result: | | | | | | | | | | | | | Complies | | | | |

Attenuation [Atten] = [P_{Fund}] - [P_{Em}]

Margin = [Atten] - Limit

Band Edge: Lower Band Edge

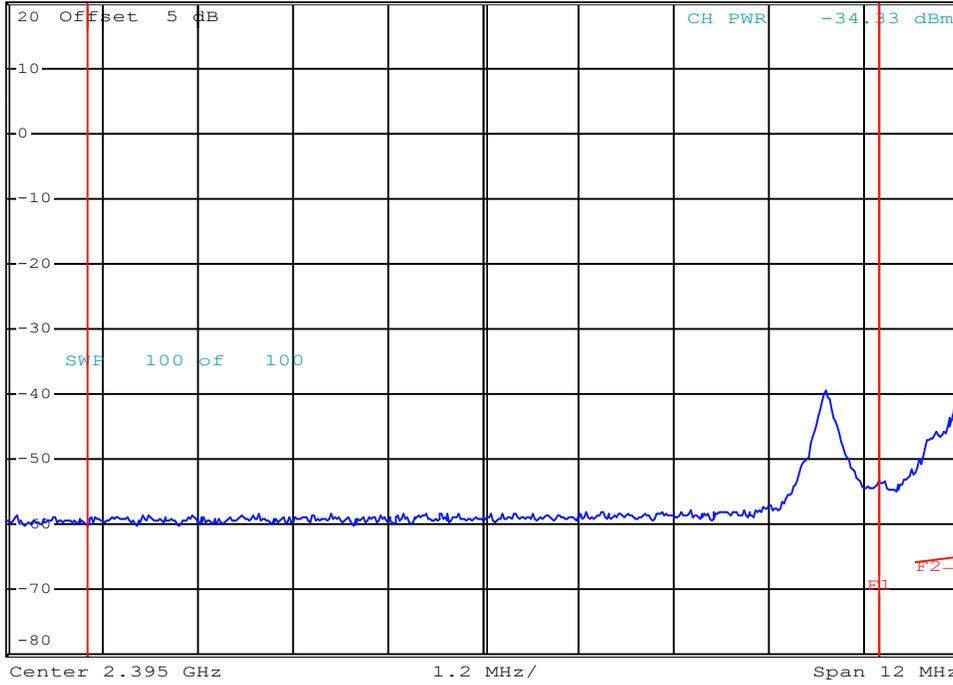


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:27:45

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Upper Band Edge

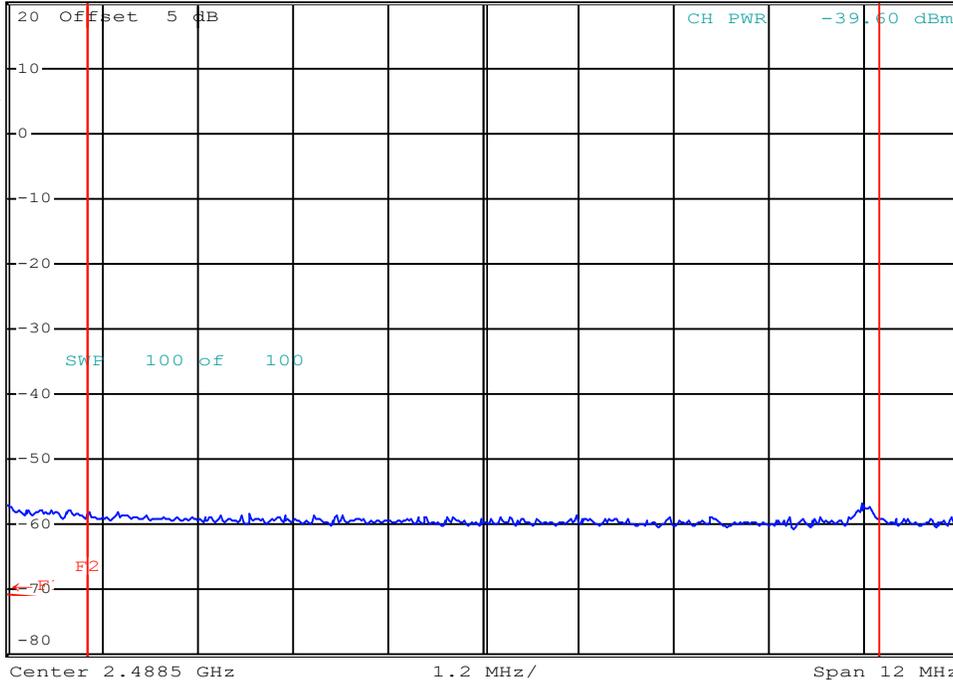


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:36:39

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Lower Band Edge

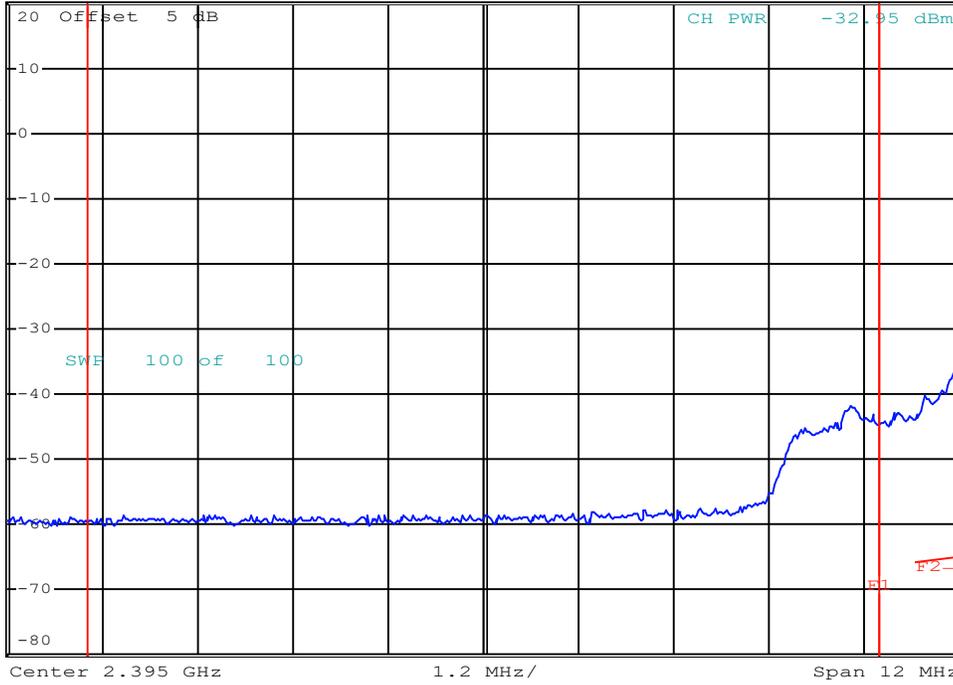


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:42:29

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Upper Band Edge

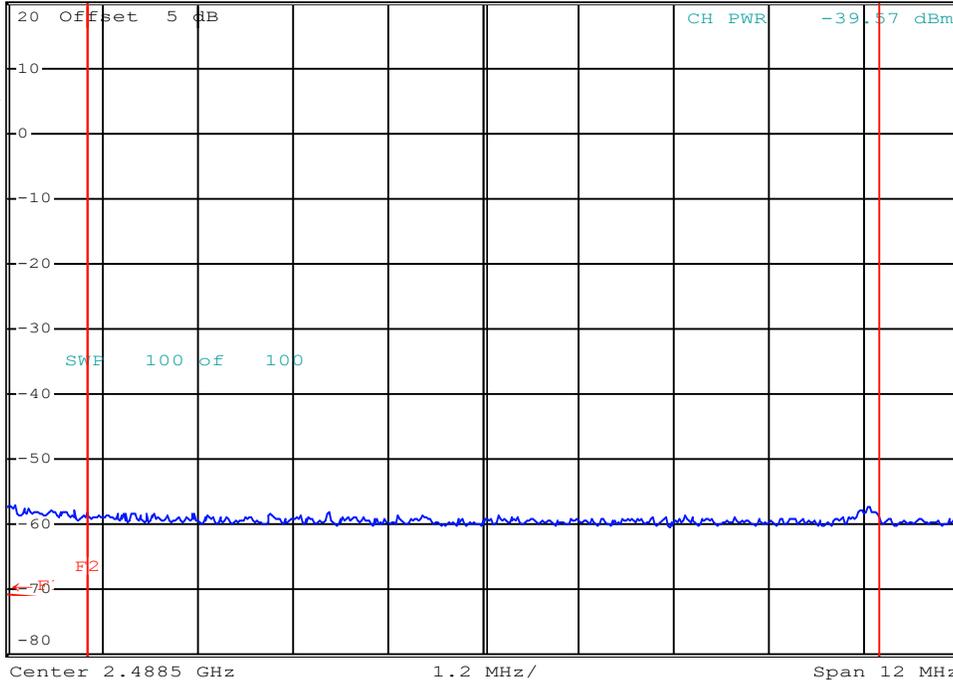


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:37:36

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Lower Band Edge

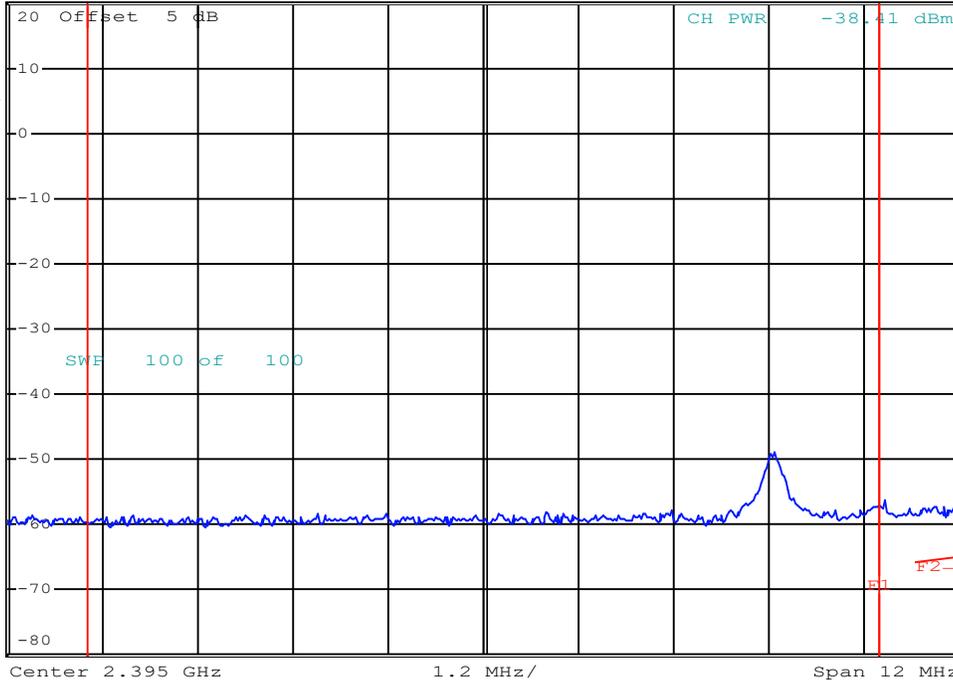


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:47:08

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Upper Band Edge

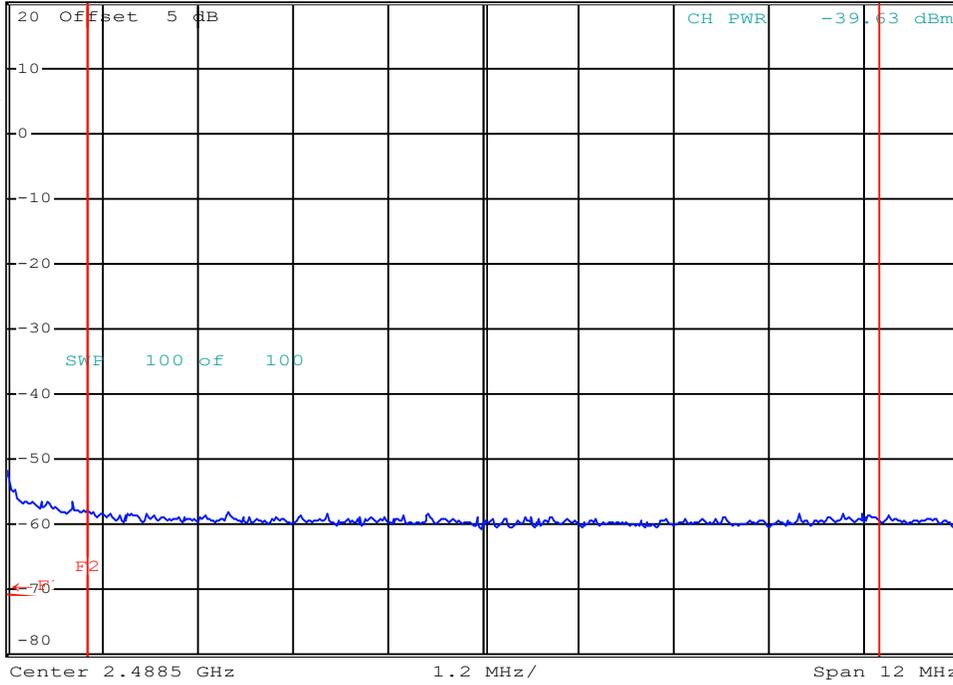


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:53:14

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Lower Band Edge

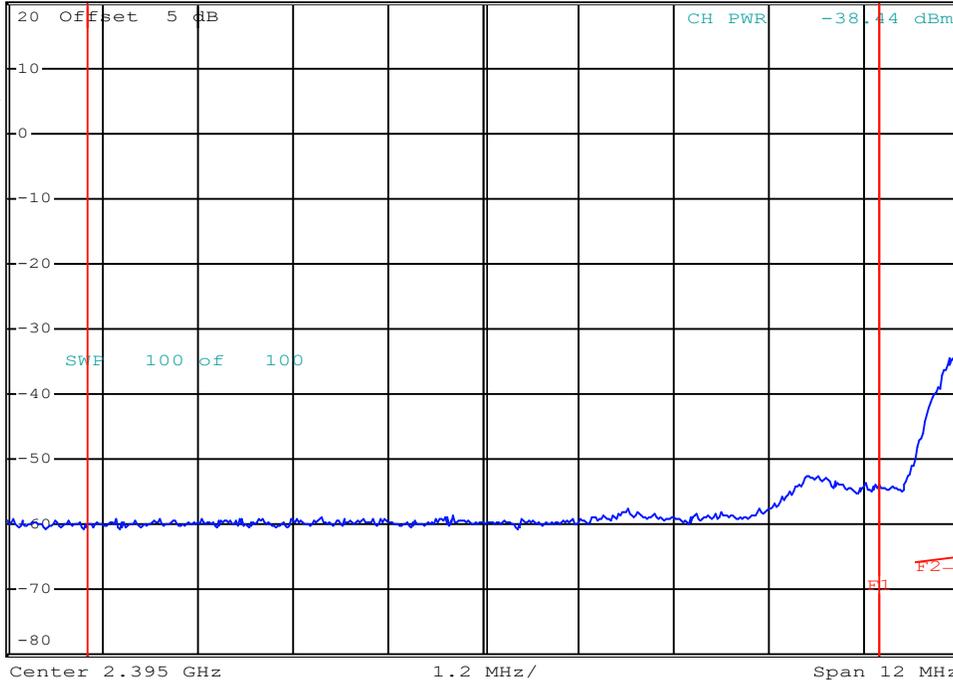


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:20:18

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Upper Band Edge

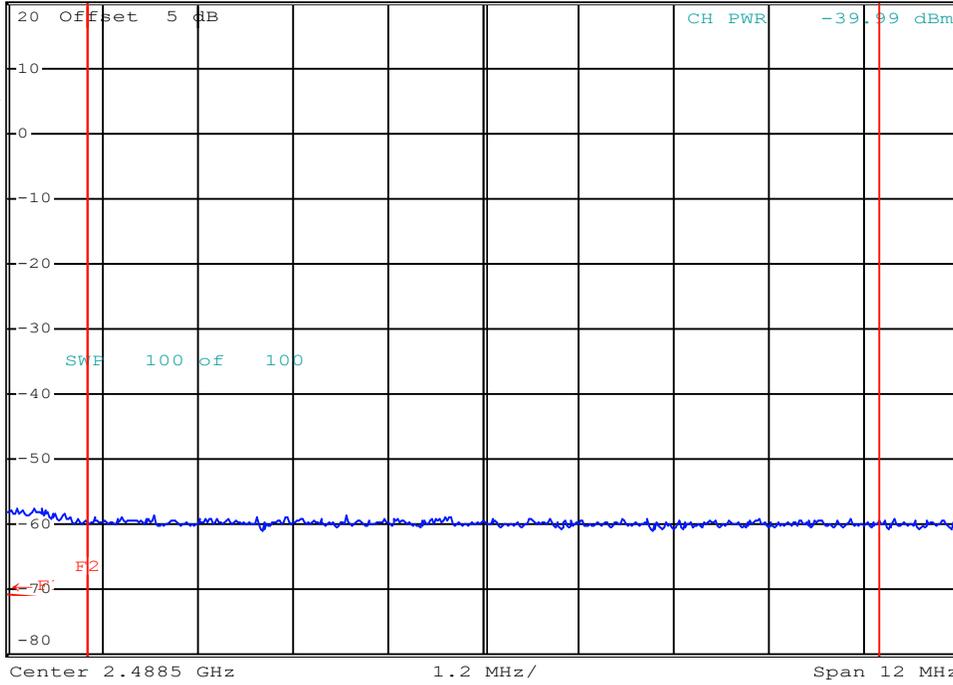


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:30:40

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Lower Band Edge

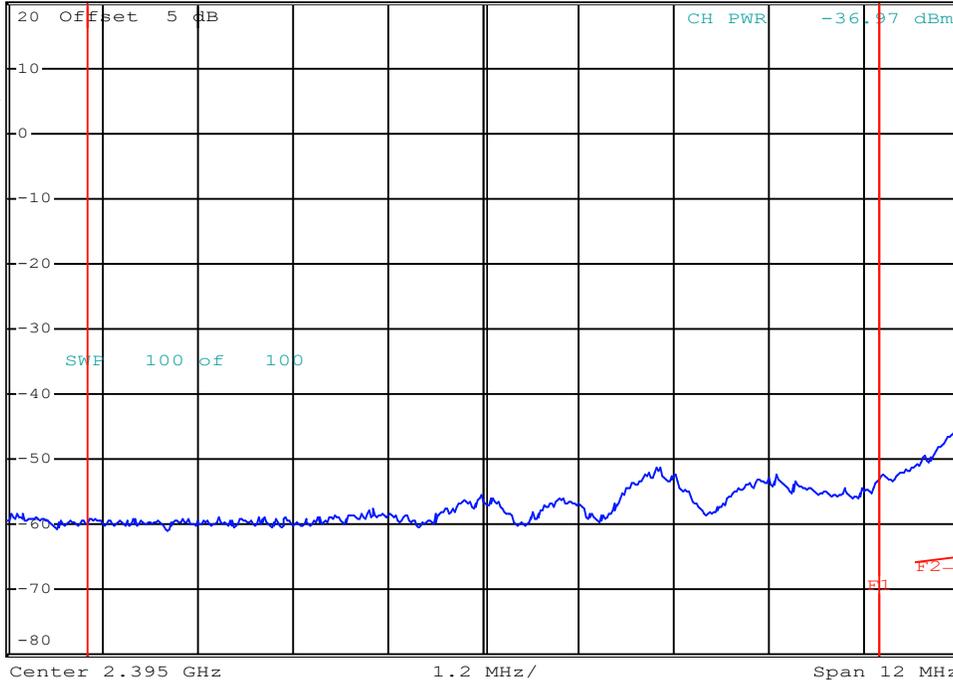


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:21:22

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Upper Band Edge

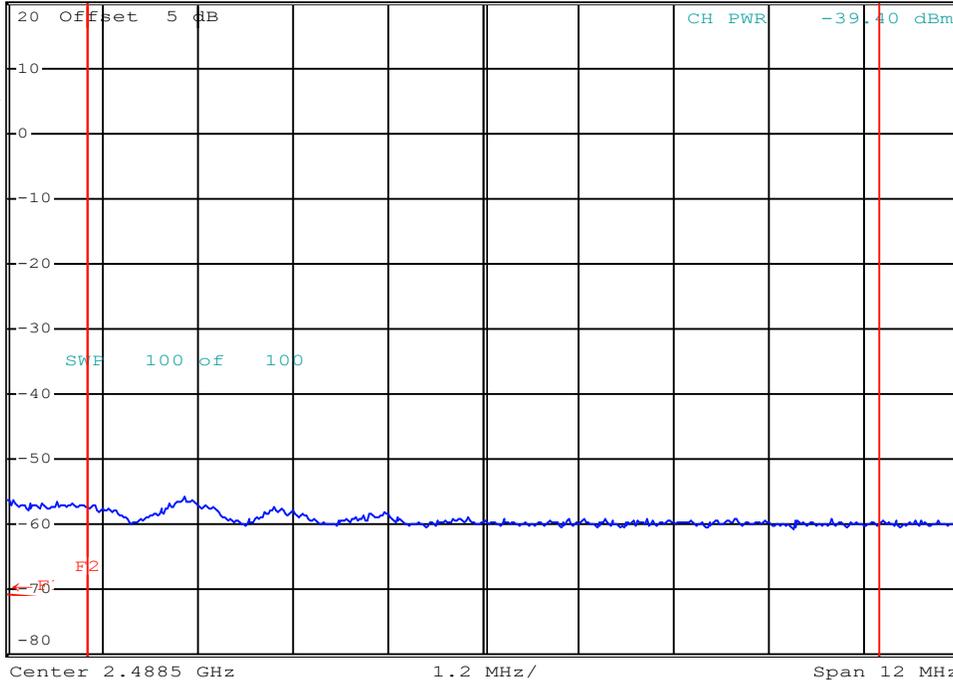


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:23:22

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Lower Band Edge

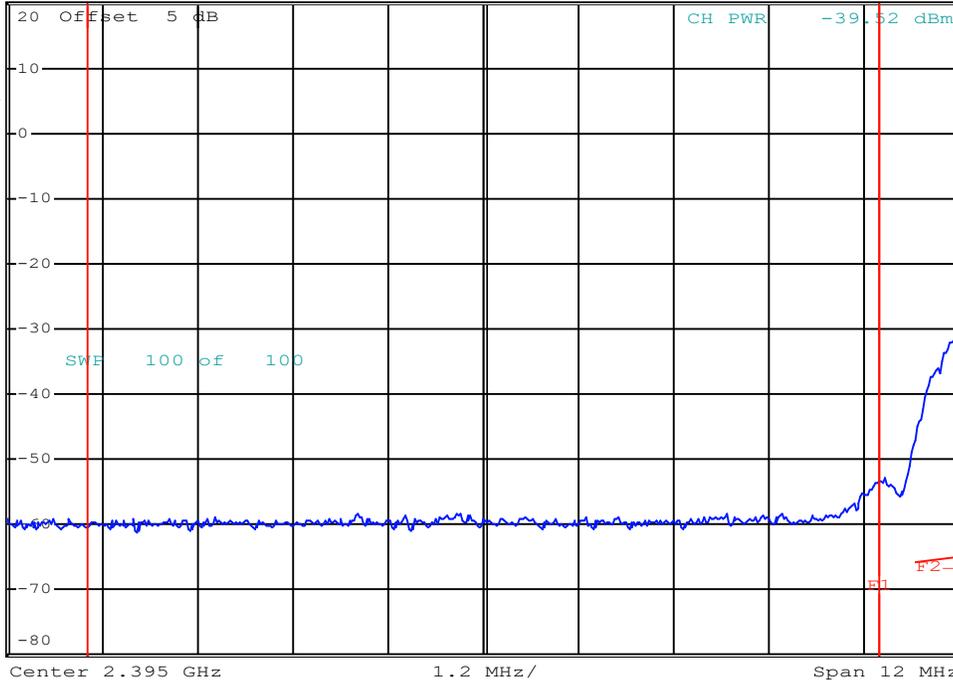


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:26:41

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

Band Edge: Upper Band Edge

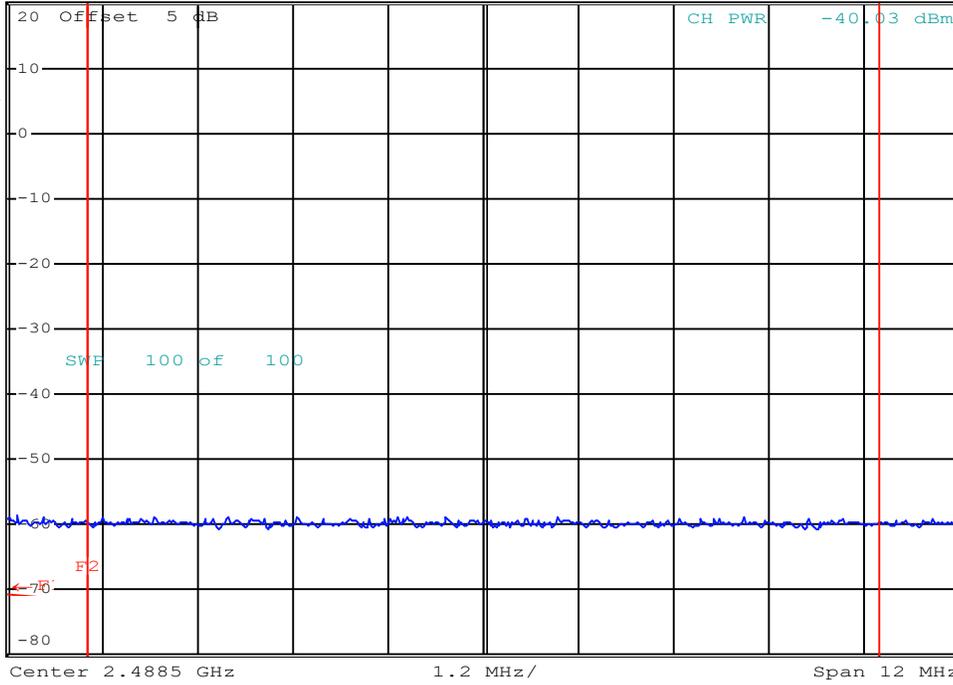


*RBW 100 kHz
VBW 1 MHz
SWT 2.5 ms

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 21.MAR.2024 13:25:05

Channel:

Mode:

Channel Frequency: MHz

Modulation:

Emission Power: dBm

| Conducted Spurious Emissions Measurement Results: | | | | | | | | |
|---|-----------------|------------|---|--------------------------|--|--------------------------|------------|-----------------|
| Channel Number | Frequency (MHz) | Modulation | Emission Power [P _{Em}] (dBm) | Emission Frequency (MHz) | Fundamental Measurement [P _{Fund}] (dBm) | Attenuation [Atten] (dB) | Limit (dB) | Margin (dB) |
| 6 | 2437.00 | DSSS 5.5 | -38.47 | 3588 | 8.25 | 46.72 | 30 | 16.7 |
| | | | | | | | | Complies |

Attenuation [Atten] = [P_{Fund}] - [P_{Em}]

Margin = Attenuation - Limit

ND = None Detected

Conducted Spurious Emissions:

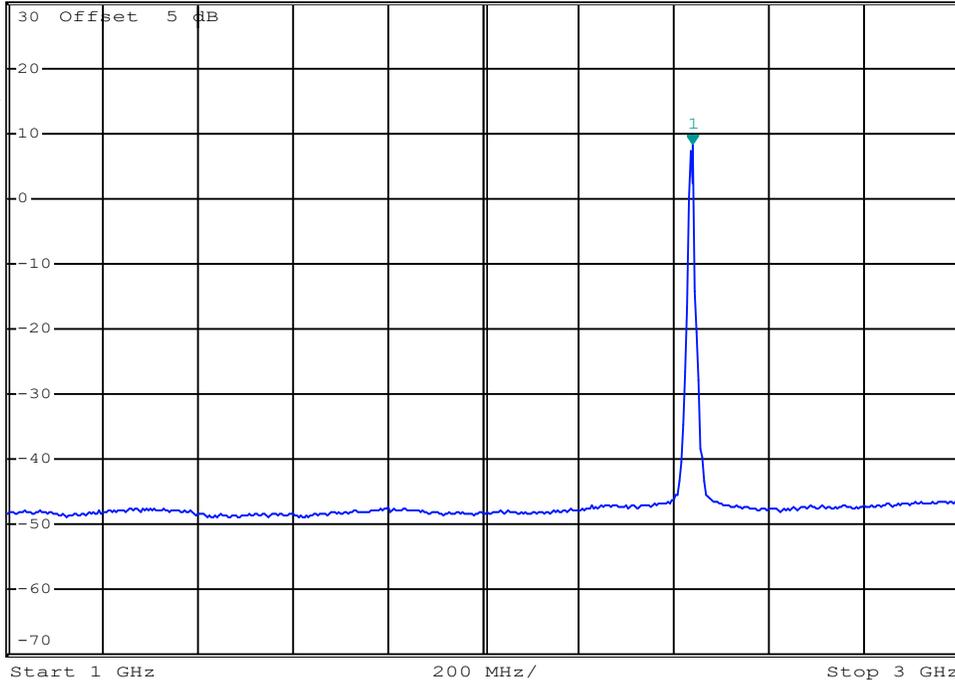


*RBW 1 MHz Marker 1 [T1]
VEW 10 MHz 8.25 dBm
SWT 10 ms 2.439760000 GHz

Ref 30 dBm

*Att 40 dB

1 RM*
VIEW



Date: 1.APR.2024 13:40:19

Channel:

Mode:

Fundamental Freq: MHz

Channel Frequency: MHz

Modulation:

Measured Power: dBm

Conducted Spurious Emissions:

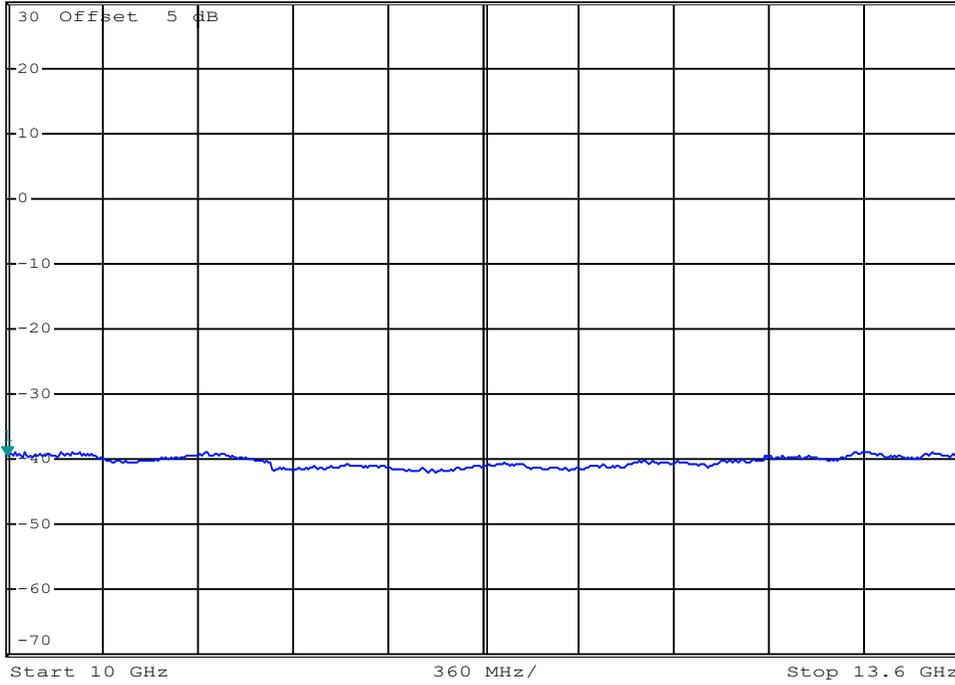


*RBW 1 MHz Marker 1 [T1]
VEW 10 MHz -39.48 dBm
SWT 75 ms 10.000000000 GHz

Ref 30 dBm

*Att 40 dB

1 RM*
VIEW



Date: 1.APR.2024 13:41:04

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Emission Frequency: MHz

Measured Emission: dBm

Conducted Spurious Emissions:

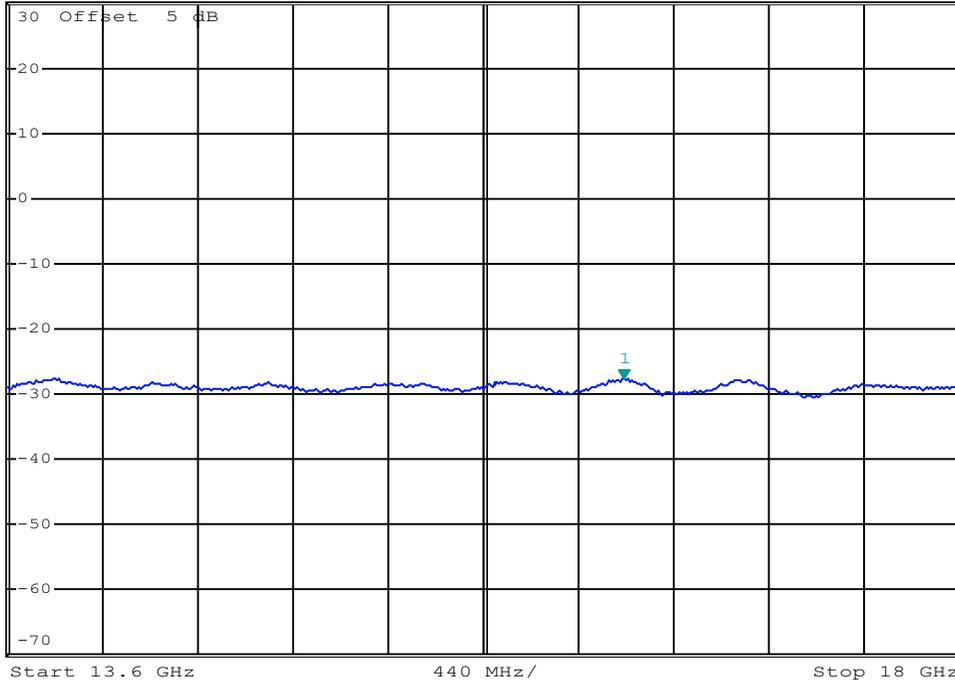


*RBW 1 MHz Marker 1 [T1]
VEW 10 MHz -27.52 dBm
SWT 90 ms 16.451200000 GHz

Ref 30 dBm

*Att 40 dB

1 RM*
VIEW



Date: 1.APR.2024 13:41:34

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Emission Frequency: MHz

Measured Emission: dBm

| Conducted Spurious Emissions Measurement Results: | | | | | | | | |
|---|-----------------|------------|---|--------------------------|--|--------------------------|-----------------|-------------|
| Channel Number | Frequency (MHz) | Modulation | Emission Power [P _{Em}] (dBm) | Emission Frequency (MHz) | Fundamental Measurement [P _{Fund}] (dBm) | Attenuation [Atten] (dB) | Limit (dB) | Margin (dB) |
| 38 | 2440.00 | GFSK | ND | ND | 4.86 | n/a | 30 | n/a |
| | | | | | | | Complies | |

Attenuation [Atten] = [P_{Fund}] - [P_{Em}]

Margin = Attenuation - Limit

ND = None Detected

Conducted Spurious Emissions:

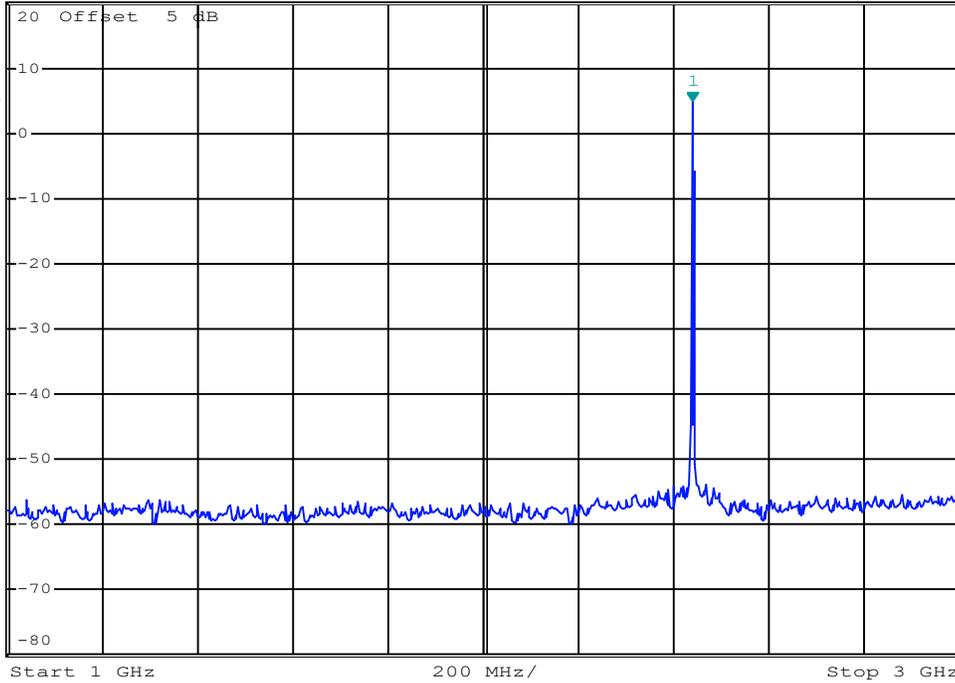


*RBW 1 MHz Marker 1 [T1]
VEW 10 MHz 4.86 dBm
SWT 10 ms 2.440000000 GHz

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 1.APR.2024 15:57:09

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Fundamental Freq: MHz

Measured Power: dBm

Conducted Spurious Emissions:

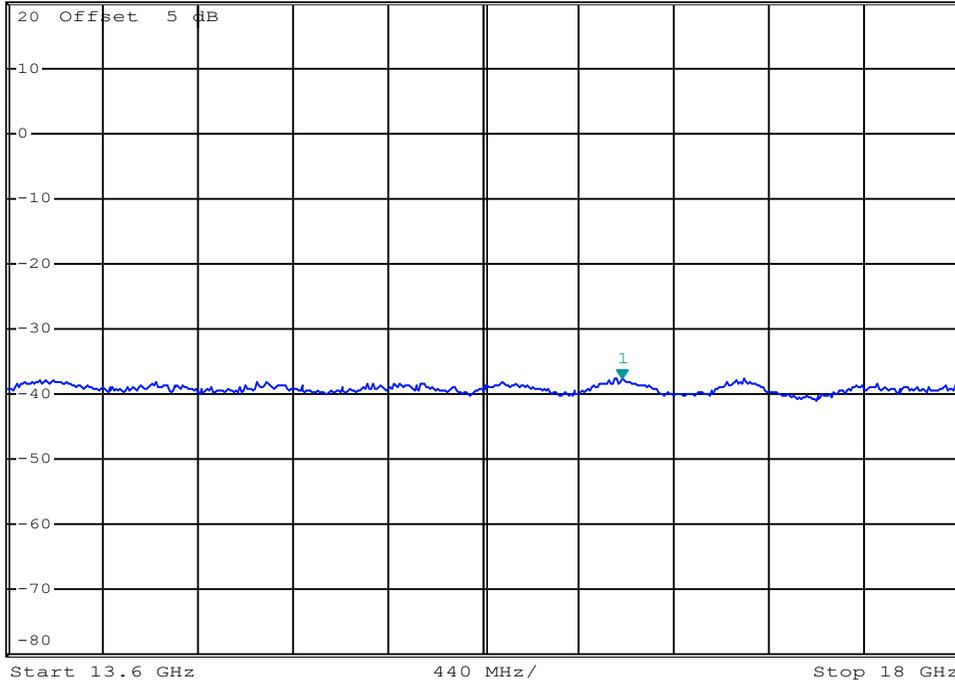


*RBW 1 MHz Marker 1 [T1]
VEW 10 MHz -37.56 dBm
SWT 90 ms 16.442400000 GHz

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 1.APR.2024 15:58:07

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Emission Freq: MHz

Emission Power: dBm

Conducted Spurious Emissions:

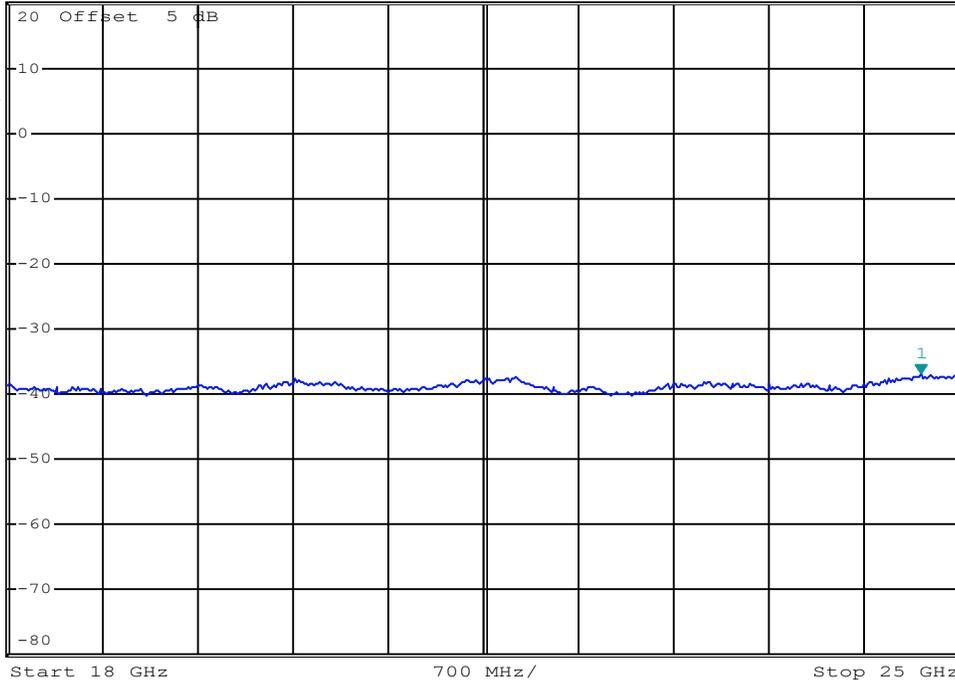


*RBW 1 MHz Marker 1 [T1]
VEW 10 MHz -36.81 dBm
SWT 140 ms 24.720000000 GHz

Ref 20 dBm

*Att 30 dB

1 RM*
VIEW



Date: 1.APR.2024 15:58:33

Channel: 38

Mode: BT BR

Emission Freq: 2440 MHz

Channel Frequency: 2440 MHz

Modulation: GFSK

Emission Power: ND dBm

Summary of Radiated Tx Emissions

| Measured Frequency Range (MHz) | Channel Frequency (MHz) | Antenna Polarization | Emission Frequency (MHz) | Measured Emission [E _{Meas}] (dBuV) | Antenna ACF [ACF] (dB) | Cable Loss [L _c] (dB) | Amplifier Gain [G _A] (dB) | Corrected Emission [E _{Corr}] (dBuV/m) | Limit (dBuV) | Margin (dB) |
|--------------------------------|-------------------------|----------------------|--------------------------|---|------------------------|-----------------------------------|---------------------------------------|--|-----------------|-------------|
| 30-1000 MHz | 2437.0 | Horizontal | ND | (1) AV | n/a | n/a | 0.00 (3) | ND | n/a | (1) |
| 30-1000 MHz | | Vertical | ND | (1) AV | n/a | n/a | 0.00 (3) | ND | n/a | (1) |
| 1-18 GHz | | Horizontal | ND | (1) AV | n/a | n/a | 0.00 (3) | ND | n/a | (1) |
| 1-18GHz | | Vertical | ND | (1) AV | n/a | n/a | 0.00 (3) | ND | n/a | (1) |
| 18-25 GHz | | Horizontal | ND | (1) AV | n/a | n/a | 0.00 (3) | ND | n/a | (1) |
| 18 -25 GHz | | Vertical | ND | (1) AV | n/a | n/a | 0.00 (3) | ND | n/a | (1) |
| Results: | | | | | | | | | Complies | |

(1) No Emissions Detected (ND) above ambient or within 20dB of the limit

(2) Antenna ACF, Cable Loss and Amplifier Gain corrected in Spectrum Analyzer Transducer Factor

(3) External Amplifier not used

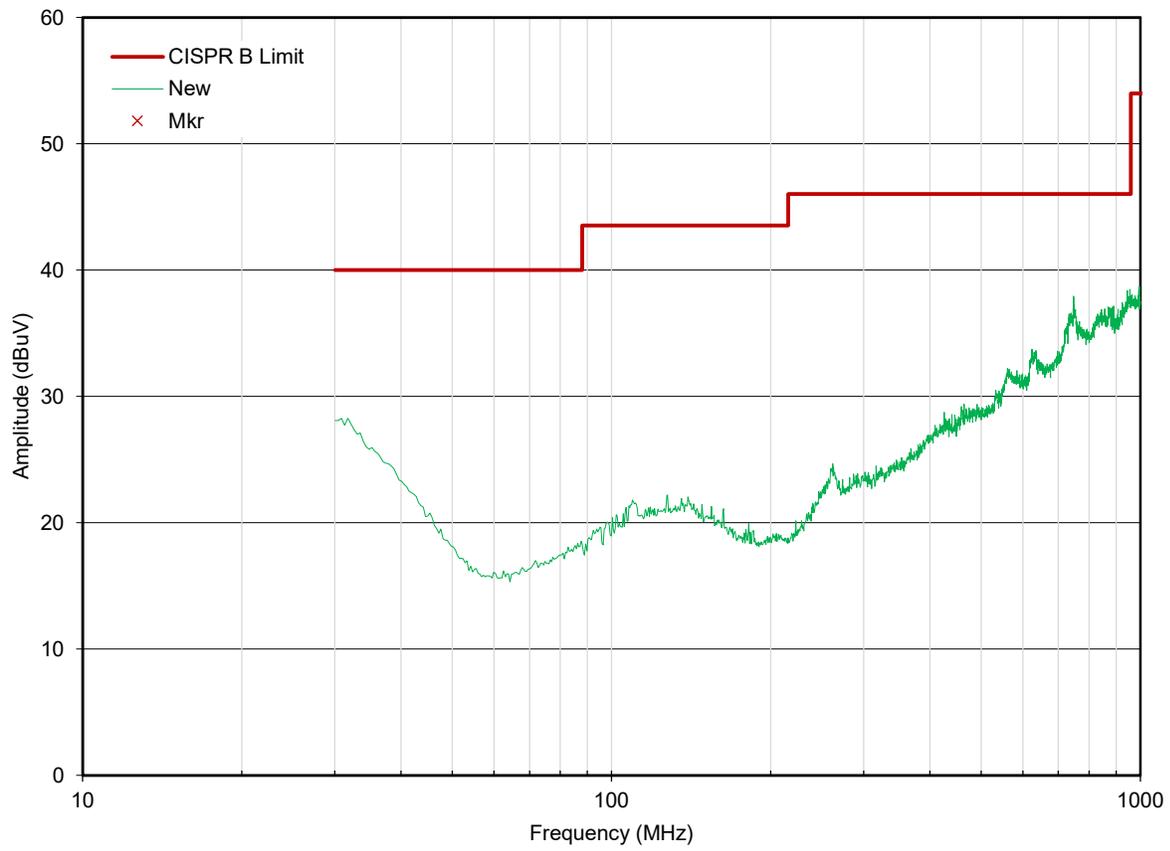
$$E_{\text{Corr}} = E_{\text{Meas}} + ACF^E + L_C - G_A$$

Where ACF^E is the Electric Antenna Correction Factor

* Without Manufacturer's Accessories, ** With Manufacturer's Accessories

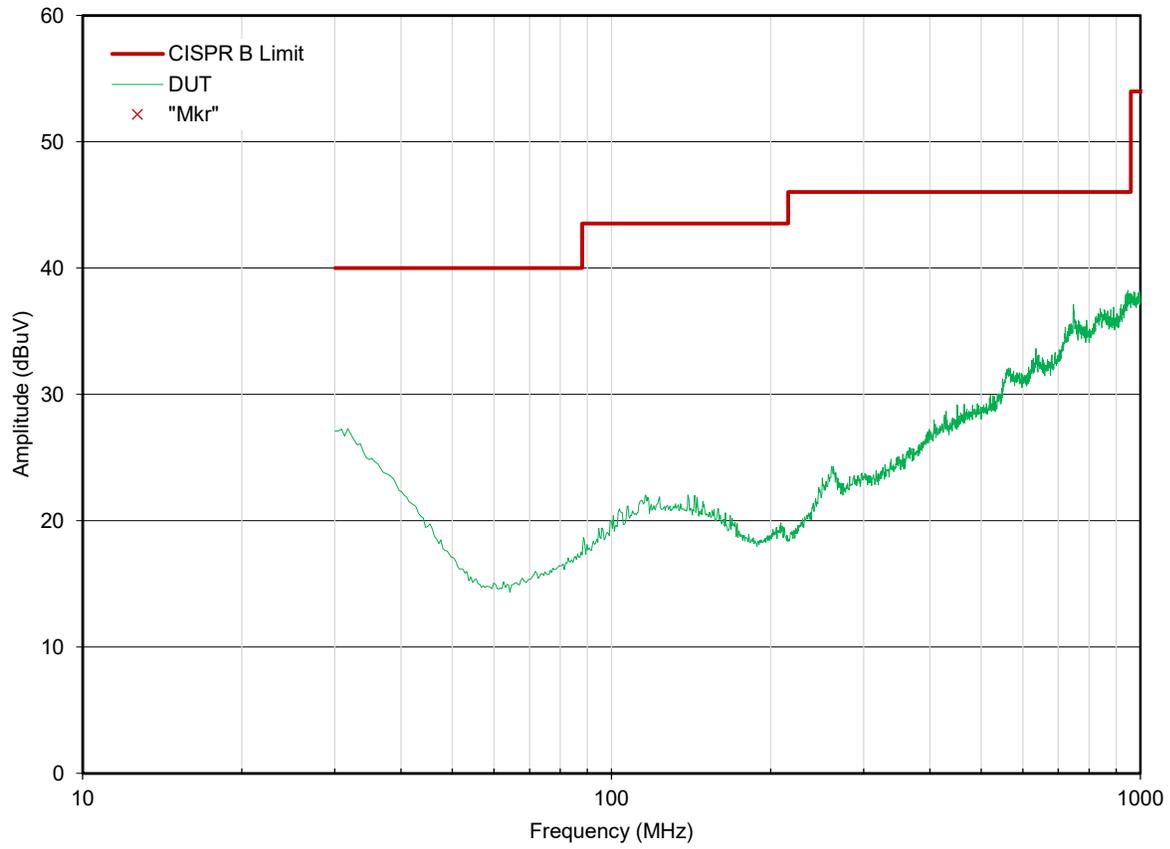
Radiated Tx Emissions:

Radiated Tx Emissions (30MHz - 1GHz)
OATS Horizontal



Radiated Tx Emissions:

Radiated Tx Emissions (30MHz - 1GHz)
OATS Vertical



Radiated Tx Emissions:



*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 56.24 dBuV
SWT 10 ms 2.437000000 GHz

Ref 77 dBuV

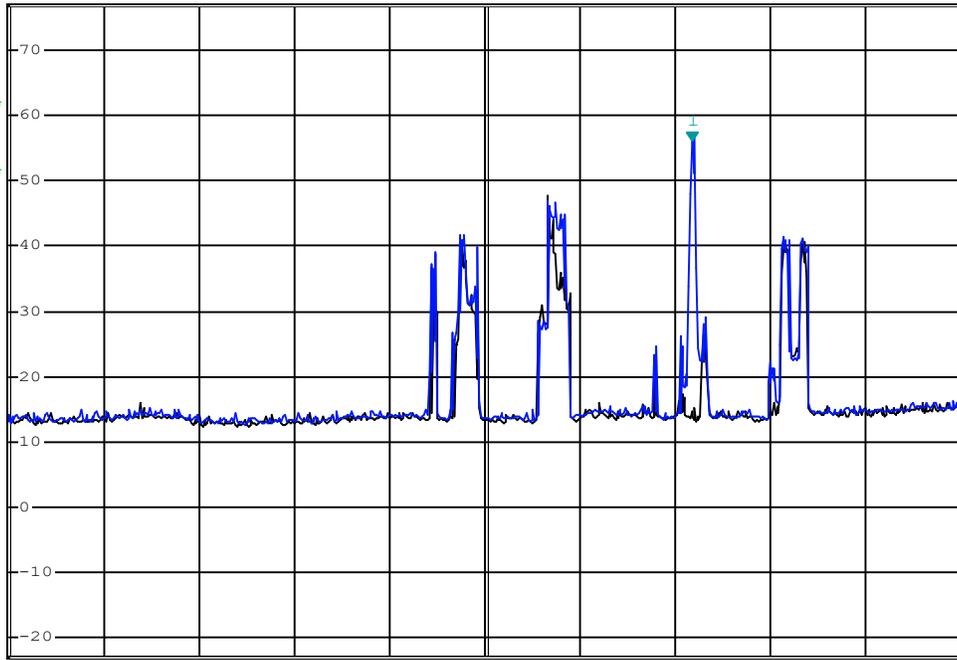
*Att 0 dB

1 RM*

VIEW

2 RM*

VIEW



Date: 3.APR.2024 16:25:16

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Channel Power: dBuV

Emission Frequency: MHz

Radiated Tx Emissions:



*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 59.09 dBuV
SWT 10 ms 2.437000000 GHz

Ref 77 dBuV

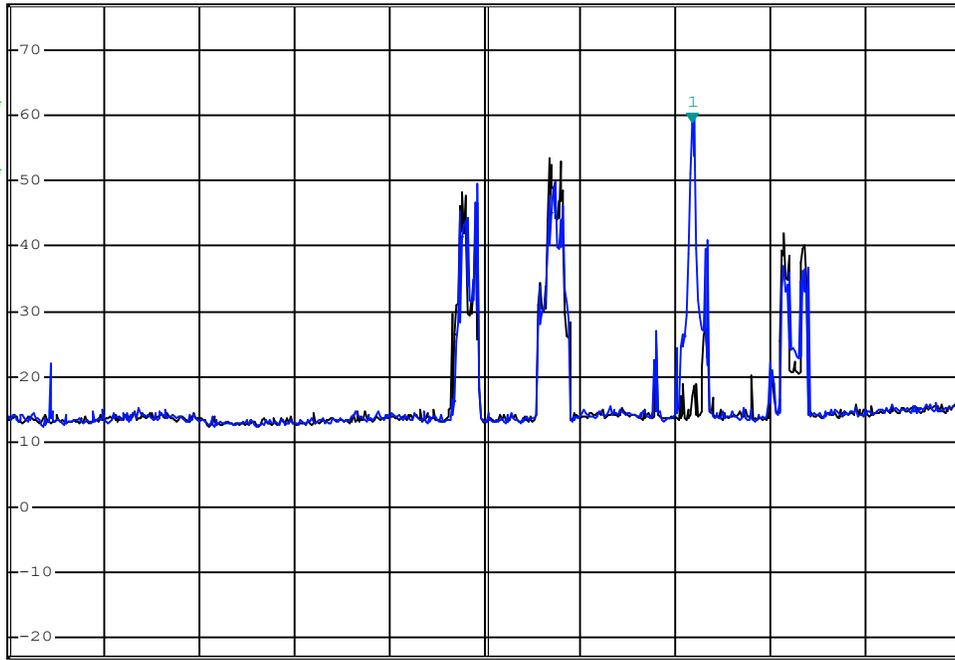
*Att 0 dB

1 RM*

VIEW

2 RM*

VIEW



Date: 3.APR.2024 16:19:54

Channel: 6

Mode: 802.11b

Polarization: Horizontal

Emission Frequency: Fundamental MHz

Channel Frequency: 2437 MHz

Modulation: DSSS 5.5

Measured Channel Power: 59.09 dBuV

Radiated Tx Emissions:

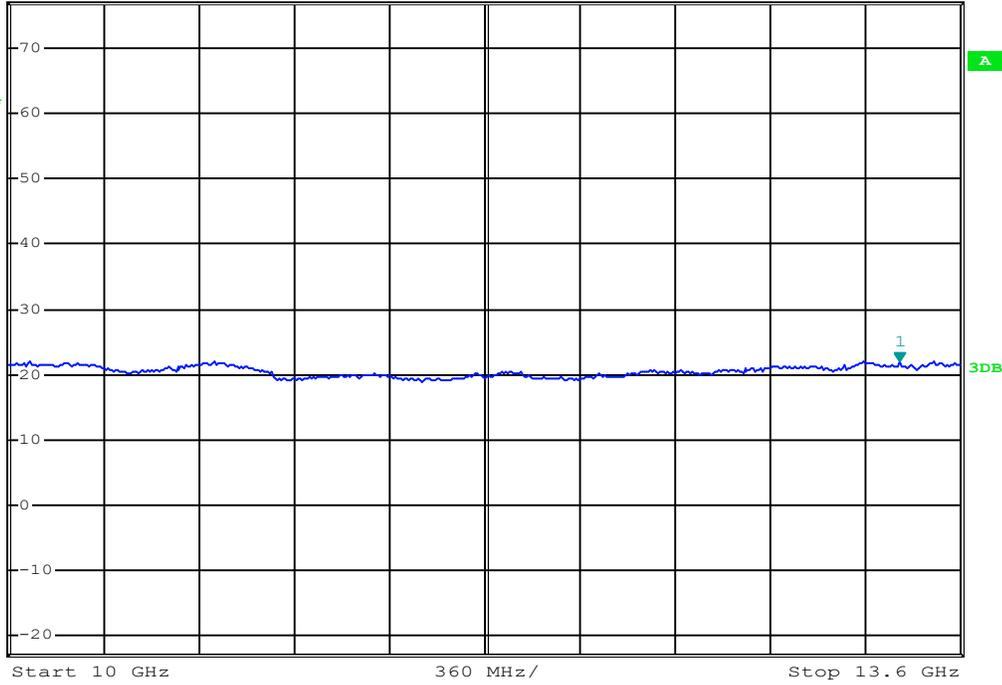


*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 22.05 dBuV
SWT 75 ms 13.369600000 GHz

Ref 77 dBuV

*Att 0 dB

1 RM*
VIEW



Date: 3.APR.2024 15:35:37

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Emission Power: dBuV

Emission Frequency: MHz

Radiated Tx Emissions:

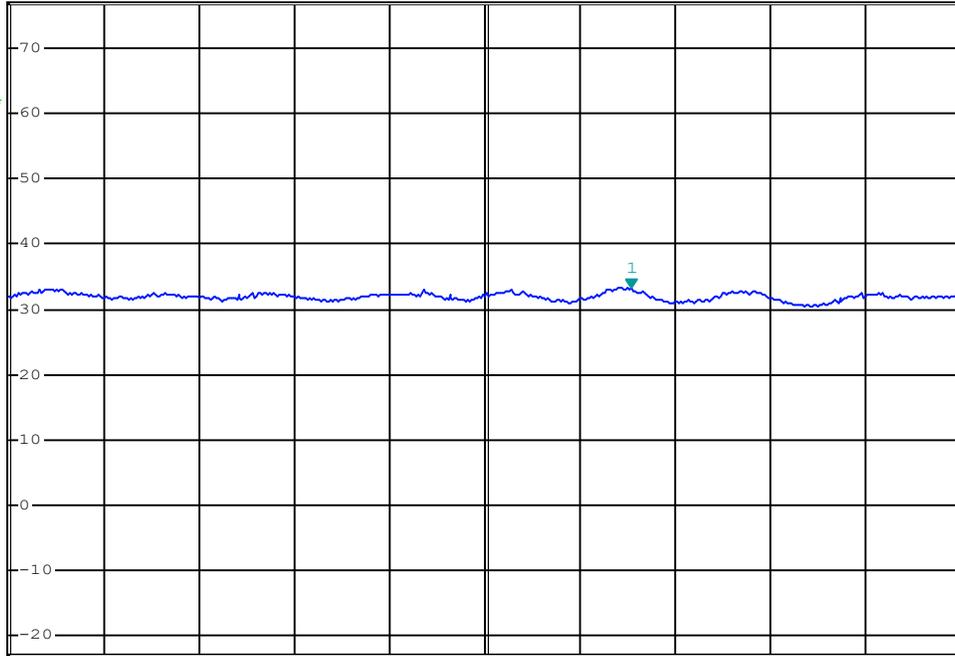


*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 33.36 dBuV
SWT 90 ms 16.477600000 GHz

Ref 77 dBuV

*Att 0 dB

1 RM*
VIEW



Start 13.6 GHz 440 MHz/ Stop 18 GHz

Date: 3.APR.2024 16:26:26

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Emission Power: dBuV

Emission Frequency: MHz

Radiated Tx Emissions:

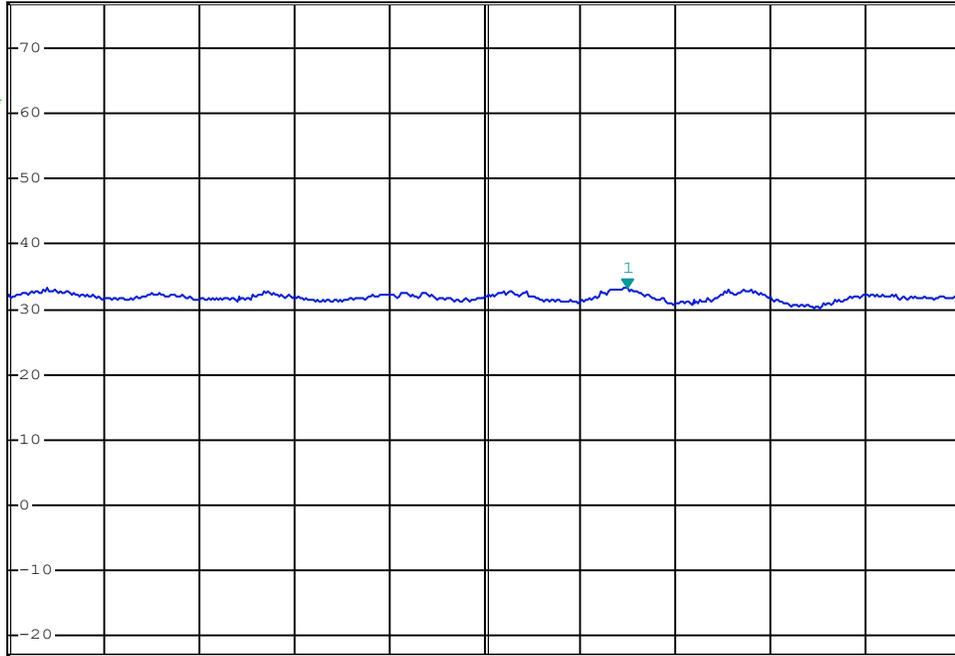


*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 33.42 dBuV
SWT 90 ms 16.460000000 GHz

Ref 77 dBuV

*Att 0 dB

1 RM*
VIEW



Start 13.6 GHz 440 MHz/ Stop 18 GHz

Date: 3.APR.2024 16:27:53

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Emission Power: dBuV

Emission Frequency: MHz

Summary of Radiated Tx Emissions

| Measured Frequency Range (MHz) | Channel Frequency (MHz) | Antenna Polarization | Emission Frequency (MHz) | Measured Emission [E _{Meas}] (dBuV) | Antenna ACF [ACF] (dB) | Cable Loss [L _c] (dB) | Amplifier Gain [G _A] (dB) | Corrected Emission [E _{Corr}] (dBuV/m) | Limit (dBuV) | Margin (dB) |
|--------------------------------|-------------------------|----------------------|--------------------------|---|------------------------|-----------------------------------|---------------------------------------|--|-----------------|-------------|
| 30-1000 MHz | 2440.0 | Horizontal | ND | (1) AV | n/a | n/a | 0.00 (3) | ND | n/a | (1) |
| 30-1000 MHz | | Vertical | ND | (1) AV | n/a | n/a | 0.00 (3) | ND | n/a | (1) |
| 1-18 GHz | | Horizontal | ND | (1) AV | n/a | n/a | 0.00 (3) | ND | n/a | (1) |
| 1-18GHz | | Vertical | ND | (1) AV | n/a | n/a | 0.00 (3) | ND | n/a | (1) |
| 18-25 GHz | | Horizontal | ND | (1) AV | n/a | n/a | 0.00 (3) | ND | n/a | (1) |
| 18 -25 GHz | | Vertical | ND | (1) AV | n/a | n/a | 0.00 (3) | ND | n/a | (1) |
| Results: | | | | | | | | | Complies | |

(1) No Emissions Detected (ND) above ambient or within 20dB of the limit

(2) Antenna ACF, Cable Loss and Amplifier Gain corrected in Spectrum Analyzer Transducer Factor

(3) External Amplifier not used

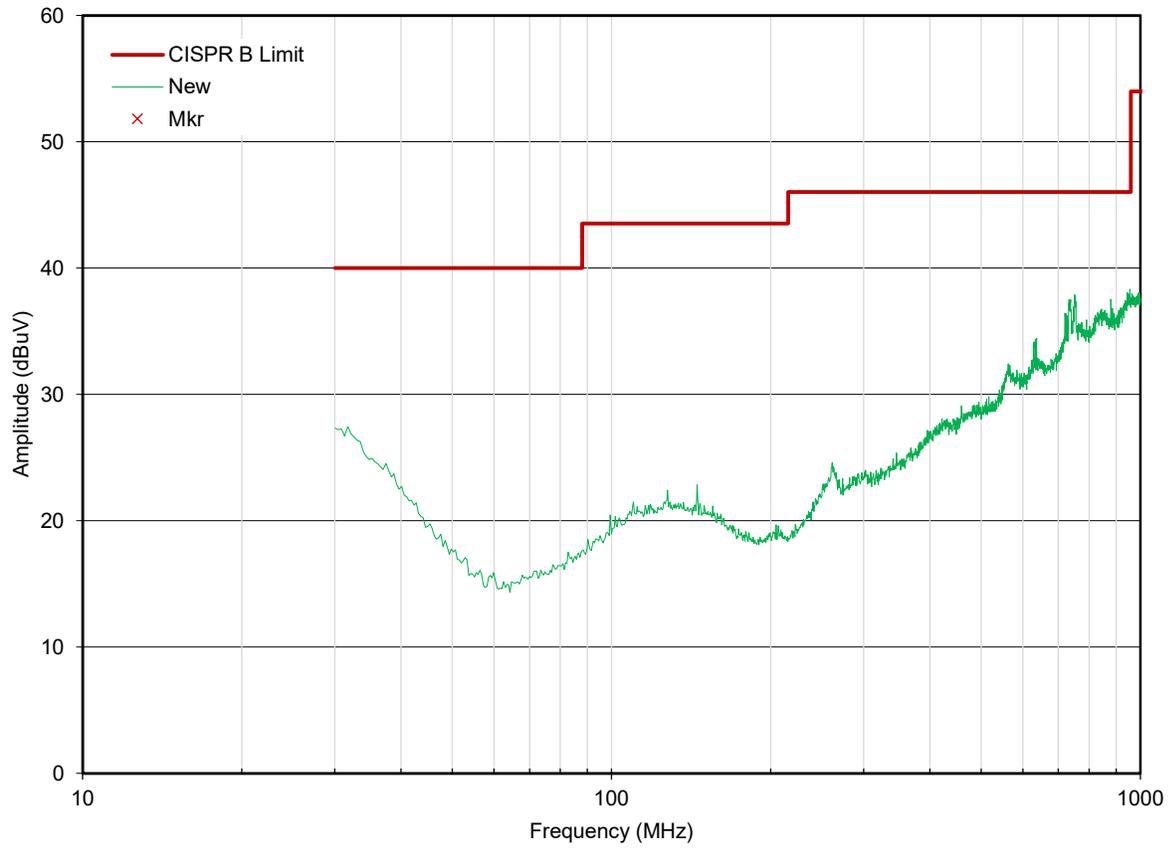
$$E_{\text{Corr}} = E_{\text{Meas}} + ACF^E + L_C - G_A$$

Where ACF^E is the Electric Antenna Correction Factor

* Without Manufacturer's Accessories, ** With Manufacturer's Accessories

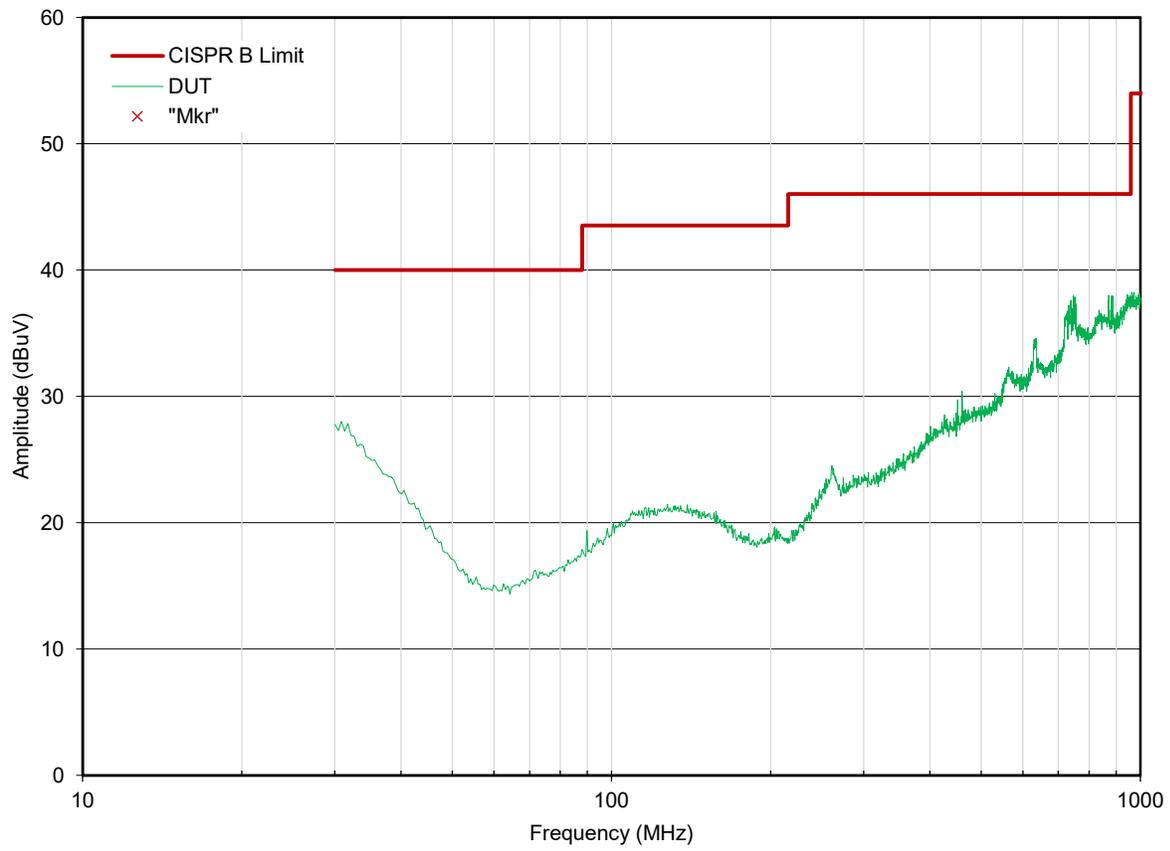
Radiated Tx Emissions:

Radiated Tx Emissions (30MHz - 1GHz)
OATS Horizontal



Radiated Tx Emissions:

Radiated Tx Emissions (30MHz - 1GHz)
OATS Vertical



Radiated Tx Emissions:



*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 40.71 dBuV
SWT 10 ms 2.404020000 GHz

Ref 77 dBuV

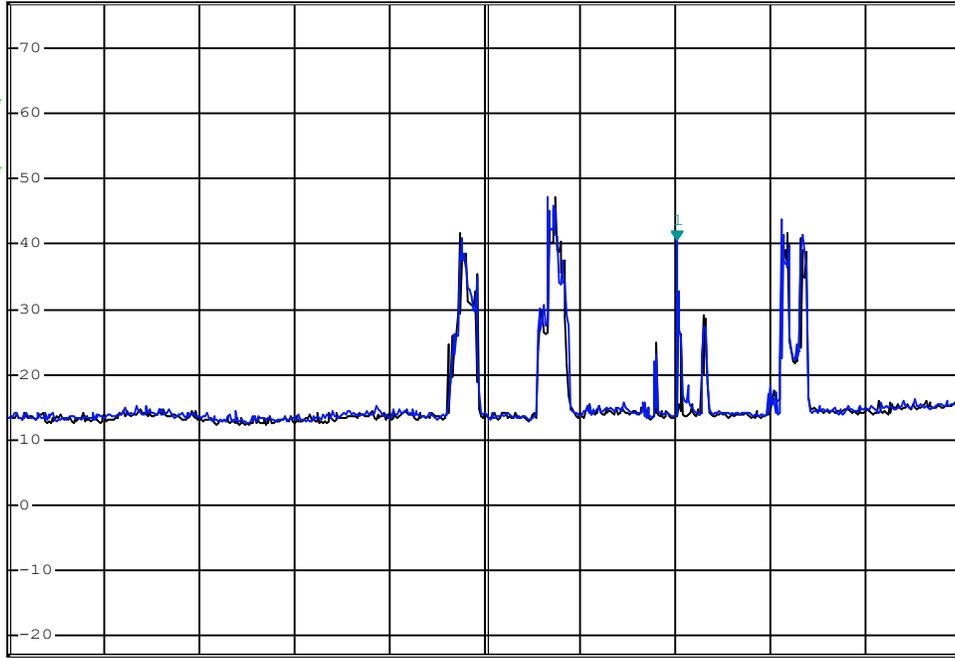
*Att 0 dB

1 RM*

VIEW

2 RM*

VIEW



Date: 3.APR.2024 16:06:20

Channel: 2

Channel Frequency: 2404 MHz

Mode: BT BR

Modulation: GFSK

Polarization: Horizontal

Measured Channel Power: 40.71 dBuV

Emission Frequency: Fundamental MHz

Radiated Tx Emissions:

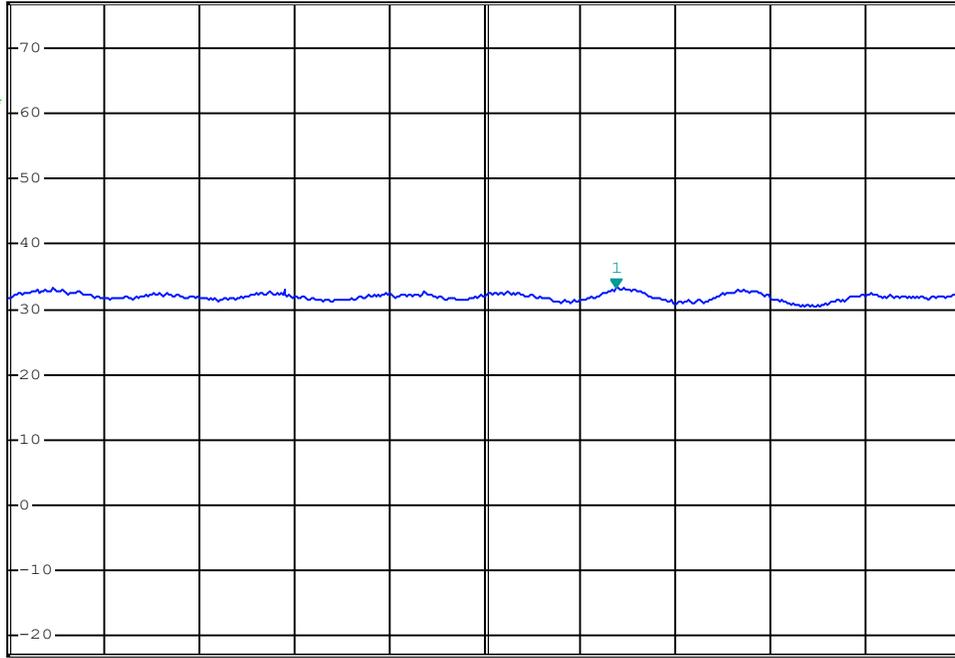


*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 33.26 dBuV
SWT 90 ms 16.407200000 GHz

Ref 77 dBuV

*Att 0 dB

1 RM*
VIEW



Start 13.6 GHz 440 MHz/ Stop 18 GHz

Date: 3.APR.2024 16:09:08

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Emission Power: dBuV

Emission Frequency: MHz

Radiated Tx Emissions:

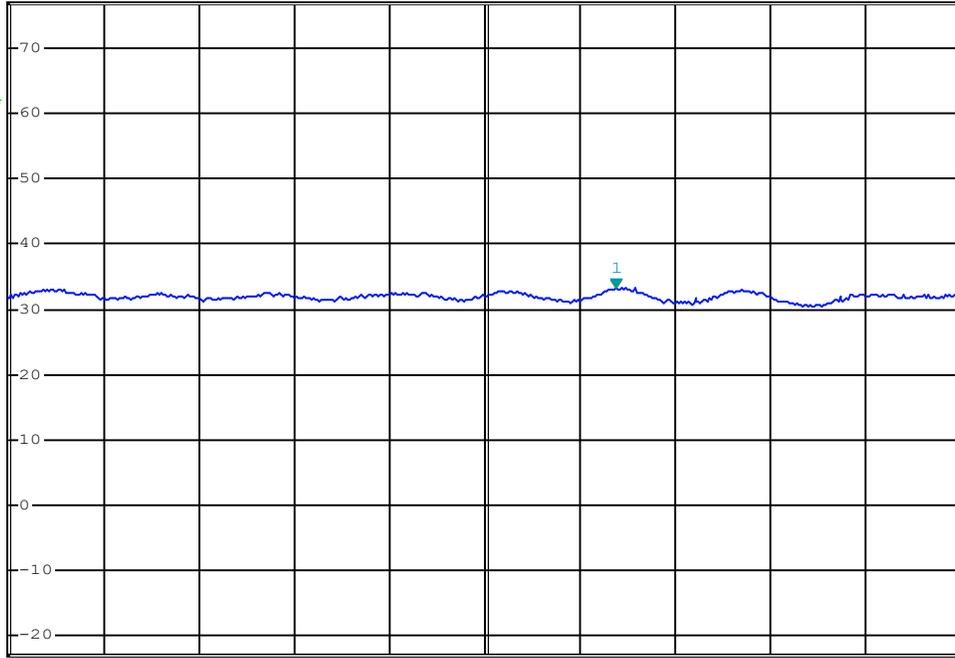


*RBW 1 MHz Marker 1 [T1]
VBW 10 MHz 33.36 dBuV
SWT 90 ms 16.407200000 GHz

Ref 77 dBuV

*Att 0 dB

1 RM*
VIEW



Start 13.6 GHz 440 MHz/ Stop 18 GHz

Date: 3.APR.2024 16:11:21

Channel:

Channel Frequency: MHz

Mode:

Modulation:

Polarization:

Measured Emission Power: dBuV

Emission Frequency: MHz

SAR Test Report - New Application

Applicant:



Garmin International Inc.
1200 East 151 St.
Olathe, KS, 66062
USA

FCC ID:

| |
|-----------------------------|
| IPH-04808 |
| Product Model Number / HVIN |
| A04808 |

IC Registration Number

| |
|--------------------|
| |
| Product Name / PMN |
| A04808 |

| Maximum <i>reported</i> SAR | | |
|-----------------------------|----------------|-------------------|
| DTS - 2.4GHz WLAN: | 0.23 | 1g Head (W/kg) |
| DSS/DTS Bluetooth: | <0.1 | |
| General Pop. Limit: | 1.60 | |

| Maximum <i>reported</i> SAR | | |
|-----------------------------|----------------|----------------------------|
| DTS - 2.4GHz WLAN: | <0.1 | 10g Extremity (W/kg) |
| DSS/DTS Bluetooth: | <0.1 | |
| General Pop. Limit: | 4.00 | |

In Accordance With:

FCC 47 CFR §2.1093

Radiofrequency Radiation Exposure Evaluation: Portable Devices

Approved By:



Ben Hewson, President
Celltech Labs Inc.
21-364 Lougheed Rd.
Kelowna, BC, V1X 7R8
Canada



Test Lab Certificate: 2470.01



**Industry
Canada**

IC Registration 3874A



FCC Registration: CA3874

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|--|-----------|
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1.0 DOCUMENT CONTROL

| Revision History | | | | | |
|----------------------------|----------------------------------|----------------------------------|-------------------------------|---------------|------------------|
| Samples Tested By: | | Ben Hewson/ Trevor Whillock | Date(s) of Evaluation: | | 21-22 March 2024 |
| Report Prepared By: | | Ben Hewson | Report Reviewed By: | | Art Voss |
| Report Revision | Description of Revision | Revised Section | Revised By | Revision Date | |
| 0.1 | Draft | n/a | Ben Hewson | 11 April 2024 | |
| 0.2 | Edits for device ref. | 2.0, 3.0, 8.1, 13.1, 13.2, App B | Ben Hewson | 17 April 2024 | |
| 0.3 | additional edits for device ref. | App B | Ben Hewson | 19 April 2024 | |
| 1.0 | Initial Release | n/a | Ben Hewson | 19 April 2024 | |
| 2.0 | Date edits | 1.0, 5.0 | Ben Hewson | 20 April 2024 | |
| 3.0 | Revised WiFi Channel Range | 2.0 | Art Voss | 26 April 2024 | |

2.0 CLIENT AND DEVICE INFORMATION

| Client Information | |
|---------------------------------------|---|
| Applicant Name | Garmin International Inc. |
| Applicant Address | 1200 East 151 St |
| | Olathe, KS, 66062 |
| | USA |
| DUT Information | |
| Device Identifier(s): | FCC ID: IPH-04808 |
| Device Model(s) / HVIN: | A04808 |
| Device Marketing Name / PMN: | A04808 |
| Test Sample Serial No.: | 3469058597 - Conducted, 3469058595 - OTA |
| Device Type: | Portable Transceiver |
| Equipment Class: | Digital Transmission Systems (DTS) |
| | Spread Spectrum Transmitter (DSS) |
| | Low Power Communication Device (DXX) |
| | Global Navigation Satellite System (GNSS) Receivers |
| | NFC - Low Power Communication Device Transmitter (DXX) |
| Transmit Frequency Range: | WiFi (DTS): 2412-2472MHz |
| | BT/BLE/ANT: 2402-2480MHz |
| | NFC: 13.56MHz |
| Manuf. Max. Rated Output Power: | WiFi - Digital Transmission System (DTS): 12.2dBm EIRP |
| | BlueTooth - Spread Spectrum Transmitter (DSS): 6.2dBm EIRP |
| | BLE/ANT - Low Power Communication Device Transmitter (DXX): 0.2dBm EIRP |
| | NFC - Low Power Communication Device Transmitter (DXX): 55.62dBuV/m |
| Antenna Type and Gain: | -3.8dBi Max Slot Antenna |
| Modulation: | WiFi: DSSS, OFDM, CCK, MCS0-7 |
| | BT BR: GFSK |
| | BT EDR: Pi/4-DQPSK, 8DPSK |
| | BLE: GMSK |
| | ANT: GFSK |
| | NFC: ASK |
| DUT Power Source: | 4.5VDC Rechargeable Li-Ion |
| DUT Dimensions [LxWxH] | H x W x D: 51mm dia x 4.5mm |
| Deviation(s) from standard/procedure: | None |
| Modification of DUT: | None |

3.0 SCOPE OF EVALUATION

This Certification Report was prepared on behalf of:

Garmin International Inc.

, (the '*Applicant*'), in accordance with the applicable Federal Communications Commission (FCC) CFR 47 and Innovation, Scientific and Economic Development (ISED) Canada rules parts and regulations (the '*Rules*'). The scope of this investigation was limited to only the equipment, devices and accessories (the '*Equipment*') supplied by the *Applicant*. The tests and measurements performed on this *Equipment* were only those set forth in the applicable *Rules* and/or the Test and Measurement Standards they reference. The *Rules* applied and the Test and Measurement Standards used during this evaluation appear in the Normative References section of this report. The limits set forth in the technical requirements of the applicable *Rules* were applied to the measurement results obtained during this evaluation and, unless otherwise noted, these limits were used as the Pass/Fail criteria. The Pass/Fail statements made in this report apply to only the tests and measurements performed on only the *Equipment* tested during this evaluation. Where applicable and permissible, information including test and measurement data and/or results from previous evaluations of same or similar equipment, devices and/or accessories may be cited in this report.

The A04808, operates as a Portable transceiver near extremity, that is capable of operating in the 2.4GHz WiFi and Bluetooth, BLE & ANT frequency bands and has an additional NFC feature that operates at a fixed transmit frequency of 13.56MHz. The device is intended for General Population Use. The product operates from an internal proprietary Li-ion rechargeable battery which can be connected to a compliant USB interface port, AC or DC adapter for charging. Test samples provided by the manufacturer were capable of transmitting at select frequencies and modulations preset by the manufacturer. An additional antenna modification was prepared for one sample allowing the ability to connect test equipment for antenna port conducted power analysis.

Application:

This is an application for a new device certification.

Scope:

The scope of this evaluation limited to the evaluation of SAR for intended applications. It will include evaluation of the 2.4 GHz WiFi/BT transmitters for all required RF exposure configurations including Extremity and Head Configuration as the device may be operational while held to face.

The Test Plan developed for this evaluation is based on the required test channels and configurations which produced the highest worst case SAR and where applicable, SAR test reduction and/or SAR test exclusion may be utilized. The DUT was evaluated for SAR at the maximum tune up tolerance and conducted output power level, preset by the manufacturer and in accordance with the procedures described in RSS-102, IEC/IEEE 62209-1528, FCC KDB 447498 and FCC KDB 248227.

4.0 NORMATIVE REFERENCES

| Normative References* | |
|---|---|
| ANSI / ISO 17025:2017 | General Requirements for competence of testing and calibration laboratories |
| FCC CFR Title 47 Part 2 Title 47: Part 2.1093: | Code of Federal Regulations Telecommunication Radiofrequency Radiation Exposure Evaluation: Portable Devices |
| IEC International Standard /IEEE International Committee on Electromagnetic Safety IEC/IEEE 62209-1528 | Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Part 1528; Human models, instrumentation, and procedures (Frequency range of 4 MHz to 10 GHz) |
| FCC KDB KDB 865664 D01v01r04 KDB 865664 D02v01r02 | SAR Measurement Requirements for 100MHz to 6GHz RF Exposure Compliance Reporting and Documentation Considerations |
| FCC KDB KDB 447498 D04v01 | RF Exposure Procedures and Equipment Authorization Policies for Mobile and Portable Devices Interim General RF Exposure Guidance |
| FCC KDB KDB 248227 D01v02r02 | SAR Guidance for IEEE 802.11 (WiFi) Transmitters |
| * When the issue number or issue date is omitted, the latest version is assumed. | |

5.0 STATEMENT OF COMPLIANCE

This measurement report demonstrates that samples of the product model(s) were evaluated for Specific Absorption Rate (SAR) on the date(s) shown, in accordance with the Measurement Procedures cited and were found to comply with the Standard(s) Applied based on the Exposure Limits of the Use Group indicated for which the product is intended to be used.

| | | |
|--|---|---|
| Applicant: Garmin International Inc. | Model / HVIN: A04808 | |
| Standard(s) Applied: Health Canada's Safety Code 6 | Measurement Procedure(s): Industry Canada RSS-102 Issue 5 IEC/IEEE Standard 62209-1528 FCC KDB 865664, FCC KDB 447498, FCC KDB 248227 | |
| Reason For Issue: <input checked="" type="checkbox"/> New Certification <input type="checkbox"/> Class I Permissive Change <input type="checkbox"/> Class II Permissive Change | Use Group: <input checked="" type="checkbox"/> General Population / Uncontrolled <input type="checkbox"/> Occupational / Controlled | Limits Applied: <input checked="" type="checkbox"/> 1.6W/kg - 1g Volume <input type="checkbox"/> 8.0W/kg - 1g Volume <input checked="" type="checkbox"/> 4.0W/kg - 10g Volume |
| Reason for Change: | Date(s) Evaluated: 21-22 March 2024 | |

The results of this investigation are based solely on the test sample(s) provided by the applicant which was not adjusted, modified or altered in any manner whatsoever except as required to carry out specific tests or measurements. A description of the device, operating configuration, detailed summary of the test results, methodologies and procedures used during this evaluation, the equipment used and the various provisions of the rules are included in this test report.

| | |
|---|---|
| <p>I attest that the data reported herein is true and accurate within the tolerance of the Measurement Instrument Uncertainty; that all tests and measurements were performed in accordance with accepted practices or procedures; and that all tests and measurements were performed by me or by trained personnel under my direct supervision. The results of this investigation are based solely on the test sample(s) provided by the client which were not adjusted, modified or altered in any manner whatsoever, except as required to carry out specific tests or measurements. This test report has been completed in accordance with ISO/IEC 17025.</p> |  |
| | <p>Trevor Whillock Celltech Labs Inc.</p> |
| | <p>20 April 2024 Date</p> |

6.0 SAR MEASUREMENT SYSTEM

SAR Measurement System

Celltech Labs Inc. SAR measurement facility employs a Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland. The DASY6 measurement system is comprised of the measurement server, a robot controller, a computer, a near-field probe, a probe alignment sensor, an Elliptical Planar Phantom (ELI) phantom and a specific anthropomorphic mannequin (SAM) phantom for Head and/or Body SAR evaluations. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF). A cell controller system contains the power supply, robot controller and a teach pendant (Joystick) to control the robot's servo motors. The Staubli robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical form the DAE to digital electronic signal and transfers data to the DASY6 measurement server. The DAE4 utilizes a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter, a command decoder and a control logic unit. Transmission to the DASY6 measurement server is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe-mounting device includes two different sensor systems for frontal and sidewise probe contacts. The sensor systems are also used for mechanical surface detection and probe collision detection. The robot utilizes a controller with built in VME-bus computer.



DASY 6 SAR System with SAM Phantom



DASY 6 Measurement Controller

7.0 RF CONDUCTED POWER MEASUREMENT

Table 7.0 Conducted Power Measurements – 2.4GHz WiFi BT BLE ANT

| Conducted Power Measurements | | | | | | | | | | | | | |
|------------------------------|---------|-----------------|---------|-----------------|------------|-----------------|----------------------|-------------------|-----------------|------------|------------------------|----------------|---------------------|
| Band | Mode | Bandwidth (MHz) | Channel | Frequency (MHz) | Modulation | Bit Rate (Mbps) | Measured Power (dBm) | Rated Power (dBm) | Rated Power (W) | Delta (dB) | SAR Test Channel (Y/-) | Duty Cycle (%) | Crest Factor (1/DC) |
| WLAN 2.4G | 802.11b | 20 | 6 | 2437 | CCK | 1 | 15.08 | 16.00 | 0.040 | -0.92 | - | - | - |
| | | | 6 | 2437 | CCK | 2 | 15.27 | 16.00 | 0.040 | -0.73 | - | - | - |
| | | | 6 | 2437 | DSSS | 5.5 | 15.56 | 16.00 | 0.040 | -0.44 | - | - | - |
| | | | 6 | 2437 | DSSS | 11 | 15.10 | 16.00 | 0.040 | -0.90 | - | - | - |
| | | | 1 | 2412 | DSSS | 5.5 | 15.63 | 16.00 | 0.040 | -0.37 | - | - | - |
| | | | 2 | 2417 | | | 15.72 | 16.00 | 0.040 | -0.28 | Y | 100.0 | 1.000 |
| | | | 6 | 2437 | | | 15.56 | 16.00 | 0.040 | -0.44 | - | - | - |
| | | | 11 | 2462 | | | 15.07 | 16.00 | 0.040 | -0.93 | - | - | - |
| 13 | 2472 | 15.07 | 16.00 | 0.040 | | | -0.93 | - | - | - | | | |
| WLAN 2.4G | 802.11g | 20 | 6 | 2437 | OFDM | 6 | 14.14 | 15.00 | 0.032 | -0.86 | - | - | - |
| | | | | | | 9 | 14.64 | 15.00 | 0.032 | -0.36 | - | - | - |
| | | | | | | 12 | 14.64 | 15.00 | 0.032 | -0.36 | - | - | - |
| | | | 1 | 2412 | | 12 | 12.58 | 15.00 | 0.032 | -2.42 | - | - | - |
| | | | | | | | 14.91 | 15.00 | 0.032 | -0.09 | - | - | - |
| | | | | | | | 14.64 | 15.00 | 0.032 | -0.36 | - | - | - |
| | | | | | | | 14.20 | 15.00 | 0.032 | -0.80 | - | - | - |
| | | | | | | | 11.38 | 15.00 | 0.032 | -3.62 | - | - | - |
| WLAN 2.4G | 802.11n | 20 | 6 | 2437 | MCS0 | 0 | 14.44 | 15.00 | 0.032 | -0.56 | - | - | - |
| | | | | | MCS3 | | 13.68 | 15.00 | 0.032 | -1.32 | - | - | - |
| | | | | | MCS7 | | 8.80 | 15.00 | 0.032 | -6.20 | - | - | - |
| | | | 1 | 2412 | MCS0 | | 14.61 | 15.00 | 0.032 | -0.39 | - | - | - |
| | | | | | MCS0 | | 14.44 | 15.00 | 0.032 | -0.56 | - | - | - |
| | | | | | MCS0 | | 13.86 | 15.00 | 0.032 | -1.14 | - | - | - |
| | | | | | MCS0 | | 12.10 | 15.00 | 0.032 | -2.90 | - | - | - |
| | | | | | MCS0 | | 10.0 | 10.0 | 0.010 | 0.00 | Y | 100.0 | 1.000 |
| BT | BR | 1 | 2 | 2404 | GFSK | - | 9.91 | 10.0 | 0.01 | -0.09 | - | - | - |
| | | | | | | | 8.93 | 10.0 | 0.010 | -1.07 | - | - | - |
| | | | | | | | 9.16 | 10.0 | 0.010 | -0.84 | - | - | - |
| | 2EDR | 1 | 38 | 2440 | Pi/4-DQPSK | - | 9.30 | 10.0 | 0.010 | -0.70 | - | - | - |
| | | | | | | | 8.26 | 10.0 | 0.010 | -1.74 | - | - | - |
| | | | | | | | 9.17 | 10.0 | 0.010 | -0.83 | - | - | - |
| | 3EDR | 1 | 2 | 2404 | 8DPSK | - | 9.12 | 10.0 | 0.010 | -0.88 | - | - | - |
| | | | | | | | 8.10 | 10.0 | 0.010 | -1.90 | - | - | - |
| | | | | | | | 0 | 2404 | GMSK | - | -1.67 | 1.00 | 0.001 |
| | 19 | 2440 | 0.70 | 1.00 | 0.001 | -0.30 | - | - | | | - | | |
| | 39 | 2480 | -3.97 | 1.00 | 0.001 | -4.97 | - | - | | | - | | |
| | ANT | ANT | 1 | 0 | 2402 | GFSK | - | -1.41 | 1.50 | 0.001 | -2.91 | - | - |
| 38 | | | | 2440 | 1.07 | | | 1.50 | 0.001 | -0.43 | - | - | - |
| 78 | | | | 2480 | -3.37 | | | 1.50 | 0.001 | -4.87 | - | - | - |

The rated power and tolerance are stated for typical transmission modes and data rates. Some modes and data rates may produce lower than rated conducted power levels. Power measurements taken across the various channels, modes and data rates did not produce levels in excess of the Rated Power plus Tolerance. SAR was evaluated using the power level setting and duty cycle specified by the manufacturer to be the max output power and produce the most conservative SAR. SAR was evaluated at the maximum average tune up tolerance. See section 2.0 Client and Device Information for details. The reported SAR was not scaled down.

8.0 MEASUREMENT METHOD

Table 8.1 Number of Test Channels and SAR test reduction

The intended use of the device would have it transmit as a portable transceiver near extremity and/or held to face. As such the device was evaluated for both Extremity SAR (10g - 0mm) and Head SAR (10g - 10mm). Also a foreseeable use of the device would have it transmit in pocket, and was evaluated for Body SAR (1g 0mm) on the front side.

Wi-Fi SAR Evaluation:

SAR was evaluated in DSSS mode at the maximum duty cycle. The power level setting selected was specified by the manufacturer to be the maximum output power and produce the most conservative SAR.

The device supports channel 1 thru 13 for 2.5 GHz WLAN, though channel 13 was reduced in power. Per FCC KDB 248227, provided higher maximum output power is not specified for other channels, channels 1, 6 and 11 are used to configure 22 MHz and 20MHz OFDM channels for SAR measurements; otherwise, the closest adjacent channel with the highest maximum output power specified for production units should be tested instead of channels 1, 6 or 11. When 40 MHz channels are supported, and provided higher maximum output power is not specified for other applicable 40 MHz channels, channel 6 is used to measure SAR. The highest conducted output power was found on Channel 1 and selected for initial evaluation.

SAR test reduction methodology was applied to reduce the total number of required test channels from the SAR test evaluation.

When applicable, SAR test reduction methods may be utilized.

802.11b DSSS SAR test reduction is determined according to the following:

- a) When the reported SAR of the highest measured maximum output power channel is \leq to 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
- b) When the reported SAR is $>$ 0.8 W/kg, SAR is required for that exposure configuration using the next highest output power channel. When any reported SAR is $>$ 1.2 W/kg, SAR is required for the third channel.

2.4 GHz 802.11g/n OFDM SAR Test Exclusion Requirements

- a) When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
- b) When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is \leq 1.2 W/kg.

The initial test configuration for 2.4 GHz is determined by the 802.11 configuration with the highest maximum output power specified for production units, including tune-up tolerance, in each standalone and aggregated frequency band.

When the same maximum output power was specified for multiple transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration with the largest channel bandwidth, lowest order modulation and lowest data rate. When the maximum output power are the same for multiple test channels, SAR is measured using the channel closest to the middle frequency band. When all the channels have the same maximum output power use the higher number channel.

When the reported SAR of the initial test configuration is $>$ 0.8 W/kg, SAR measurement is required for subsequent next highest measured output power channel(s) in the initial test configuration until reported SAR is \leq 1.2 W/kg or all required channels are tested.

1-g SAR Estimates Based on Area Scans per KDB 447498 - the SAR measurements in 2.4GHz met the conditions and were evaluated using the provisions of 447498, with SAR measurements below 1.0W/kg and no warning messages.

Table 8.2 Exemptions for Single RF Source

Per FCC KDB 447498 D04 Appendix B Exemptions for Single RF Sources

B.4 SAR-based Exemption

SAR-based thresholds are derived based on frequency, power, and separation distance of the RF source. The formula defines the thresholds in general for either available maximum time-averaged power or maximum time-averaged ERP, whichever is greater.

If the ERP of a device is not easily determined, such as for a portable device with a small form factor, the available maximum time averaged power may be used if the device antenna or radiating structure does not exceed an electrical length of $\lambda/4$.

The separation distance is the smallest distance from any part of the antenna or radiating structure to all persons, and for portable or mobile devices this is from the device outer housing to the closest antenna.

$P_{th} \text{ (mW)} = ERP_{20cm} \text{ (mW)} = 2040f$ for $0.3\text{GHz} \leq f < 1.5\text{GHz}$ (B.1)

$P_{th} \text{ (mW)} = ERP_{20cm} \text{ (mW)} = 3060$ for $1.5\text{GHz} \leq f \leq 6\text{GHz}$ (B.1)

$P_{th} \text{ (mW)} = (ERP_{20cm})(d/20cm)^x$ for $d \leq 20\text{cm}$ (B.2)

$P_{th} \text{ (mW)} = (ERP_{20cm})$ for $20\text{cm} < d \leq 40\text{cm}$ (B.2)

$x = -\log_{10} (60/(ERP_{20cm})(vf))$

where **f** is in GHz, **d** is separation distance (cm), **ERP_{20cm}** is per Formula (B.1).

| Transmitter | Frequency (f) (GHz) | Separation Distance (d) (cm) | Average Power (mW) | Antenna Gain (dBi) | ERP or Avg. Power (mW)* | P _{th} (mW) |
|-------------|---------------------|------------------------------|--------------------|--------------------|-------------------------|----------------------|
| ANT | 2.48 | 0.5 | 1.41 | -3.8 | 0.59 | 2.72 |
| BLE | 2.48 | 0.5 | 1.25 | -3.8 | 0.52 | 2.72 |

*If the ERP of a device is not easily determined, such as for a portable device with a small form factor, the available maximum time averaged power may be used if the device antenna or radiating structure does not exceed an electrical length of $\lambda/4$.

The BLE and ANT transmitters has a maximum frequency of 2480MHz. The BLE and ANT power was measured by the client and has a maximum average transmission power of 2.4mW and a minimum antenna separation distance of 5 mm.

Based on 447498 D04 Appendix B the BLE and ANT transmitters are exempt from further evaluation.

NFC Test Exclusion

The field strength of NFC Transmitter was measured and found to be 55.6dBuV/m @3m. The conversion of field strength to EIRP is given by:

$EIRP = FS - 104.7 + 20 \cdot \log_{10}(d)$ where FS = field strength, d = measurement distance (3m)

$EIRP = 55.6 - 104.7 + 20 \cdot \log_{10}(3)$

$EIRP = -9.5 \text{ dBm}$ or 0.11mW

The test exclusion threshold from the equations above, at 13.56MHz is 3W.

The NFC Transmitter qualifies for SAR Test Exclusion.

9.0 ACCESSORIES EVALUATED

Table 9.0 Accessories Evaluated

| Accessory List | | | | |
|-----------------------|----------------------------|-----------------------------|---------------|------------|
| Test Report ID Number | Manufacturer's Part Number | Description | SAR Evaluated | SAR Tested |
| B1 | 010-12864-03 | QUICKFIT 26 - Silicone Band | Y | Y |
| B2 | 010-12741-01 | QUICKFIT 26 - Metal Band | Y | Y |

10.0 SAR MEASUREMENT SUMMARY

Table 10.0: Measured Results -Extremity 10g

| Measured 10g SAR Results - EXTREMITY Configuration | | | | | | | | | | | | | | | | | |
|--|---------|----------------------|-----------------------------|---------|----|------|-----|---------------------------------|----------|--------------|---------------------|----------------|------------------|------------------|-----------------------|-----------------|---------------------|
| Date | Plot ID | Test Frequency (MHz) | DUT Configuration | | | | | Accessories | Spacing | | Measured SAR (W/kg) | SAR Drift (dB) | Delta Power (dB) | Crest Factor (n) | Fluid Sensitivity (n) | Duty Factor (%) | reported SAR (W/kg) |
| | | | Pos | Mode | BW | Mod | BR | | DUT (mm) | Antenna (mm) | | | | | | | |
| Area Scan | | | | | | | | | | | | | | | | | |
| 3/22/2024 | E21 | 2417 | Back Touch | 802.11b | 20 | DSSS | 5.5 | - Band 1 - | 0 | 5 | 0.145 | 0.000 | -0.280 | 1.000 | 1.000 | 100.000 | 0.155 |
| 3/22/2024 | E22 | 2417 | Back Touch | 802.11b | 20 | DSSS | 5.5 | - Bnd2 - Metal - | 0 | 5 | 0.070 | 0.310 | -0.280 | 1.000 | 1.000 | 100.000 | 0.074 |
| 3/22/2024 | E23 | 2437 | Back Touch | 802.11b | 20 | DSSS | 5.5 | - Band 1 - | 0 | 5 | 0.100 | 0.060 | -0.440 | 1.000 | 1.000 | 100.000 | 0.111 |
| 3/22/2024 | E24 | 2462 | Back Touch | 802.11b | 20 | DSSS | 5.5 | - Band 1 - | 0 | 5 | 0.084 | 0.050 | -0.930 | 1.000 | 1.000 | 100.000 | 0.104 |
| 3/22/2024 | E25 | 2404 | Back Touch | BT BR | 1 | GFSK | 1 | - Band 1 - | 0 | 5 | 0.044 | 0.190 | 0.000 | 1.000 | 1.000 | 100.000 | 0.044 |
| Zoom Scan | | | | | | | | | | | | | | | | | |
| 3/22/2024 | E21Z | 2417 | Back Touch | 802.11b | 20 | DSSS | 5.5 | - Band 1 - | 0 | 5 | 0.05 | 0.210 | -0.280 | 1.000 | 1.000 | 100.000 | 0.05 |
| 3/22/2024 | E25Z | 2404 | Back Touch | BT BR | 1 | GFSK | 1 | - Band 1 - | 0 | 5 | 0.04 | 0.190 | 0.000 | 1.000 | 1.000 | 100.000 | 0.04 |
| Applicable SAR Limit | | | | | | | | Use Group | | | | Limit | | | | | |
| FCC CFR 2.1093 | | | Health Canada Safety Code 6 | | | | | General Population/User Unaware | | | | 4 W/kg | | | | | |

Table 10.1: Measured Results -Head – Held-to Face 1g

| Measured 1g SAR Results - FACE Configuration | | | | | | | | | | | | | | | | | |
|--|---------|----------------------|-----------------------------|------------|----|------|-----|---------------------------------|----------|--------------|---------------------|----------------|------------------|------------------|-----------------------|-----------------|---------------------|
| Date | Plot ID | Test Frequency (MHz) | DUT Configuration | | | | | Accessories | Spacing | | Measured SAR (W/kg) | SAR Drift (dB) | Delta Power (dB) | Crest Factor (n) | Fluid Sensitivity (n) | Duty Factor (%) | reported SAR (W/kg) |
| | | | Pos | Mode | BW | Mod | BR | | DUT (mm) | Antenna (mm) | | | | | | | |
| Area Scan | | | | | | | | | | | | | | | | | |
| 3/22/2024 | F23 | 2417 | Front 10mm | 802.11b-NA | 20 | DSSS | 5.5 | - Band 1 - | 10 | 15 | 0.208 | -0.200 | -0.280 | 1.000 | 1.000 | 100.000 | 0.232 |
| 3/22/2024 | F24 | 2404 | Front 10mm | BT BR | 1 | GFSK | 1 | - Band 1 - | 10 | 15 | 0.074 | 0.050 | 0.000 | 1.000 | 1.000 | 100.000 | 0.074 |
| Zoom Scan | | | | | | | | | | | | | | | | | |
| 3/22/2024 | F23Z | 2417 | Front 10mm | 802.11b-NA | 20 | DSSS | 5.5 | - Band 1 - | 10 | 15 | 0.20 | -0.250 | -0.280 | 1.000 | 1.000 | 100.000 | 0.23 |
| 3/22/2024 | F24Z | 2404 | Front 10mm | BT BR | 1 | GFSK | 1 | - Band 1 - | 10 | 15 | 0.07 | 0.140 | 0.000 | 1.000 | 1.000 | 100.000 | 0.07 |
| Applicable SAR Limit | | | | | | | | Use Group | | | | Limit | | | | | |
| FCC CFR 2.1093 | | | Health Canada Safety Code 6 | | | | | General Population/User Unaware | | | | 1.6 W/kg | | | | | |

11.0 SCALING OF MAXIMUM MEASURE SAR

Table 11.0 SAR Scaling – Extremity 10g

| Scaling of Maximum Measured SAR (10g) | | | | |
|---|------------------------|----------------|-----------|--------|
| Measured Parameters | | Configuration | | |
| | | Extremity | Extremity | |
| Plot ID | | E21Z | E25Z | |
| Maximum Measured SAR _M | | 0.047 | 0.044 | (W/kg) |
| Frequency | | 2417 | 2404 | (MHz) |
| Drift | Power Drift | 0.210 (2) | 0.190 (7) | (dB) |
| Conducted Power | | 15.720 | 10.000 | (dBm) |
| DC | Transmitter Duty Cycle | (3) | (8) | (%) |
| DF | Use Duty Factor | 100.0 (4) | 100.0 (9) | (%) |
| Fluid Deviation from Target | | | | |
| Δe | Permittivity | -6.62% | -6.50% | |
| Δσ | Conductivity | -0.17% | -1.25% | |
| Fluid Sensitivity Calculation (1g) | | EEE 62209-1528 | | |
| Delta SAR = Ce * Δe + Cσ * Δσ | | | | |
| Ce = (0.003456*f ³) - (0.03531*f ²) + (0.07675*f) - 0.186 | | | | |
| Cσ = (0.004479*f ³) - (0.01586*f ²) - (0.1972*f) + 0.7717 | | | | |
| f | Frequency (GHz) | 2.417 | 2.404 | |
| Ce | | -0.158 | -0.158 | |
| Cσ | | 0.266 | 0.268 | |
| Ce * Δe | | 0.010 | 0.010 | |
| Cσ * Δσ | | 0.000 | -0.003 | |
| ΔSAR | | 0.010 (1) | 0.007 (5) | (%) |
| Manufacturer's Tuneup Tolerance | | | | |
| Measured Conducted Power | | 15.720 | 10.000 | (dBm) |
| Rated Conducted Power | | 16.000 | 10.000 | (dBm) |
| ΔP | | -0.280 (2) | 0.000 (6) | (dB) |
| Transmitter Duty Cycle [Crest Factor] | | | | |
| Transmitter Duty Cycle (DC) | | 100.0 | 100.0 | (%) |
| CF (1/DC) | | 1.00 (3) | 1.00 (8) | |
| SAR Adjustment for Fluid Sensitivity | | | | |
| SAR ₁ = SAR _M X [ΔSAR] | | 0.047 (1) | 0.044 (5) | (W/kg) |
| SAR Adjustment for Tuneup Tolerance | | | | |
| SAR ₂ = SAR ₁ + [ΔP] | | 0.050 (2) | 0.044 (6) | (W/kg) |
| SAR Adjustment for Drift | | | | |
| SAR ₃ = SAR ₂ + [Drift] | | 0.050 (2) | 0.044 (7) | (W/kg) |
| SAR Adjustment for Transmitter Duty Cycle [Crest Factor] | | | | |
| SAR ₄ = SAR ₃ x [CF] | | 0.050 (3) | 0.044 (8) | (W/kg) |
| SAR Adjustment for Use Duty Factor | | | | |
| SAR ₅ = SAR ₄ x [DF] | | 0.050 (4) | 0.044 (9) | (W/kg) |
| <u>reported</u> 1g SAR | | | | |
| <u>reported</u> SAR | | 0.05 | 0.04 | (W/kg) |

Table 11.1 SAR Scaling – Head – Held to Face 1g

| Scaling of Maximum Measured SAR (1g) | | | | |
|---|------------------------|----------------|-----------|--------|
| Measured Parameters | | Configuration | | |
| | | Face | Face | |
| Plot ID | | F23Z | F24Z | |
| Maximum Measured SAR _M | | 0.203 | 0.073 | (W/kg) |
| Frequency | | 2417 | 2404 | (MHz) |
| Drift | Power Drift | -0.250 | 0.140 (6) | (dB) |
| Conducted Power | | 15.720 | 10.000 | (dBm) |
| DC | Transmitter Duty Cycle | (2) | (7) | (%) |
| DF | Use Duty Factor | 100.0 (3) | 100.0 (8) | (%) |
| Fluid Deviation from Target | | | | |
| Δε | Permittivity | -6.62% | -6.50% | |
| Δσ | Conductivity | -0.17% | -1.25% | |
| Fluid Sensitivity Calculation (1g) | | EEE 62209-1528 | | |
| Delta SAR = Ce * Δε + Cσ * Δσ | | | | |
| Ce = (-0.0007854*f ³) + (0.009402*f ²) - (0.02742*f) - 0.2026 | | | | |
| Cσ = (0.009804*f ³) - (0.08661*f ²) + (0.02981*f) + 0.7829 | | | | |
| f | Frequency (GHz) | 2.417 | 2.404 | |
| Ce | | -0.225 | -0.225 | |
| Cσ | | 0.487 | 0.490 | |
| Ce * Δε | | 0.015 | 0.015 | |
| Cσ * Δσ | | -0.001 | -0.006 | |
| ΔSAR | | 0.014 (1) | 0.009 (4) | (%) |
| Manufacturer's Tuneup Tolerance | | | | |
| Measured Conducted Power | | 15.720 | 10.000 | (dBm) |
| Rated Conducted Power | | 16.000 | 10.000 | (dBm) |
| ΔP | | -0.280 | 0.000 (5) | (dB) |
| Transmitter Duty Cycle [Crest Factor] | | | | |
| Transmitter Duty Cycle (DC) | | 100.0 | 100.0 | (%) |
| CF (1/DC) | | 1.00 (2) | 1.00 (7) | |
| SAR Adjustment for Fluid Sensitivity | | | | |
| SAR ₁ = SAR _M X [ΔSAR] | | 0.203 (1) | 0.073 (4) | (W/kg) |
| SAR Adjustment for Tuneup Tolerance | | | | |
| SAR ₂ = SAR ₁ + [ΔP] | | 0.217 | 0.073 (5) | (W/kg) |
| SAR Adjustment for Drift | | | | |
| SAR ₃ = SAR ₂ + [Drift] | | 0.229 | 0.073 (6) | (W/kg) |
| SAR Adjustment for Transmitter Duty Cycle [Crest Factor] | | | | |
| SAR ₄ = SAR ₃ x [CF] | | 0.229 (2) | 0.073 (7) | (W/kg) |
| SAR Adjustment for Use Duty Factor | | | | |
| SAR ₅ = SAR ₄ x [DF] | | 0.229 (3) | 0.073 (8) | (W/kg) |
| reported 1g SAR | | | | |
| reported SAR | | 0.23 | 0.07 | (W/kg) |

Per IEC/IEEE 62209-1528, FCC KDB 865664 and ISED RSS-102, adjustment is required only when Measured Drift is negative (-). The absolute value of Measured Drift is ADDED (logarithmically) to the SAR.

Drift is given in dB. The absolute value of Drift is ADDED (logarithmically) to the SAR when Drift is negative (-).

SAR₄

Per IEC/IEEE 62209-1528, FCC KDB 865664 and ISED RSS-102, when the transmit Duty Cycle (DC) is less than 100%, the reported SAR must be scaled to 100% by the Crest Factor (CF). $CF = 1/DC$ where DC is in decimal.

CF is given as a decimal. The SAR is MULTIPLIED by this scaling factor only when the scaling factor is greater than 1.

SAR₅

Use Duty Factor applies to Push-To-Talk (PTT) transceivers or other devices whereby the user has some control of the transmitter on-off period. Per IEC/IEEE 62209-1528, FCC KDB 447498, FCC KDB 643646 and ISED RSS-102, a Duty Factor (DF) of 50% may be applied. In cases where Voice Activated transmit is employed, a DF of 75% may be applied.

DF is given as a percentage (5). The SAR is MULTIPLIED by this scaling factor only when the scaling factor is less than 100%.

reported SAR

The reported SAR is the Maximum SAR after all applicable adjustments have been made and is indicated on the cover page of this report.

- Note (1): Delta SAR is Positive, SAR Adjustment for Fluid Sensitivity is not Required, in accordance with ISED Notice 2012-DRS0529
- Note (2): Power Drift is Positive, Drift Adjustment not Required.
- Note (3): Crest Factor = 1 (100% Duty Cycle), Crest Factor Adjustment not Required.
- Note (4): Use Duty Factor is 100%. No Duty Factor Correction applied.
- Note (5): Delta SAR is Positive, SAR Adjustment for Fluid Sensitivity is not Required, in accordance with ISED Notice 2012-DRS0529
- Note (6): SAR was Evaluated at the Maximum Tuneup Tolerance. SAR Adjustment is not Required.
- Note (7): Power Drift is Positive, Drift Adjustment not Required.
- Note (8): Crest Factor = 1 (100% Duty Cycle), Crest Factor Adjustment not Required.
- Note (9): Use Duty Factor is 100%. No Duty Factor Correction applied.
- Note (10): Delta SAR is Positive, SAR Adjustment for Fluid Sensitivity is not Required, in accordance with ISED Notice 2012-DRS0529
- Note (11): Crest Factor = 1 (100% Duty Cycle), Crest Factor Adjustment not Required.
- Note (12): Use Duty Factor is 100%. No Duty Factor Correction applied.
- Note (13): Delta SAR is Positive, SAR Adjustment for Fluid Sensitivity is not Required, in accordance with ISED Notice 2012-DRS0529
- Note (14): SAR was Evaluated at the Maximum Tuneup Tolerance. SAR Adjustment is not Required.
- Note (15): Power Drift is Positive, Drift Adjustment not Required.
- Note (16): Crest Factor = 1 (100% Duty Cycle), Crest Factor Adjustment not Required.
- Note (17): Use Duty Factor is 100%. No Duty Factor Correction applied.

12.0 SAR EXPOSURE LIMITS

Table 12.0 Exposure Limits

| SAR RF EXPOSURE LIMITS | | | |
|--|-----------------------------|--|--|
| FCC 47 CFR§2.1093 | Health Canada Safety Code 6 | General Population / Uncontrolled Exposure ⁽⁴⁾ | Occupational / Controlled Exposure ⁽⁵⁾ |
| Spatial Average ⁽¹⁾ (averaged over the whole body) | | 0.08 W/kg | 0.4 W/kg |
| Spatial Peak ⁽²⁾ (Head and Trunk averaged over any 1 g of tissue) | | 1.6 W/kg | 8.0 W/kg |
| Spatial Peak ⁽³⁾ (Hands/Wrists/Feet/Ankles averaged over 10 g) | | 4.0 W/kg | 20.0 W/kg |
| (1) The Spatial Average value of the SAR averaged over the whole body. | | | |
| (2) The Spatial Peak value of the SAR averaged over any 1 gram of tissue, defined as a tissue volume in the shape of a cube and over the appropriate averaging time. | | | |
| (3) The Spatial Peak value of the SAR averaged over any 10 grams of tissue, defined as a tissue volume in the shape of a cube and over the appropriate averaging time. | | | |
| (4) Uncontrolled environments are defined as locations where there is potential exposure to individuals who have no knowledge or control of their potential exposure. | | | |
| (5) Controlled environments are defined as locations where there is potential exposure to individuals who have knowledge of their potential exposure and can exercise control over their exposure. | | | |

13.0 DETAILS OF SAR EVALUATION

13.0 Day Log

| DAY LOG | | | | | Fluid Dielectric | SPC | Test | Task |
|-------------|-------------------|-----------------|-----------------------|---------------------------|------------------|-----|------|--------------|
| Date | Ambient Temp (°C) | Fluid Temp (°C) | Relative Humidity (%) | Barometric Pressure (kPa) | | | | |
| 21 Mar 2024 | 26.6 | 23.6 | 25% | 101.7 | X | X | X | 2450H Fluids |
| 22 Mar 2024 | 23.1 | 23.0 | 26% | 101.6 | | | X | 2450H Fluids |

*Per IEC/IEEE 62209-1528, test series was started within 24 hours of Fluid Parameter Measurement

13.1 DUT Setup and Configuration

| DUT Setup and Configuration | |
|-----------------------------|---|
| 1 | The device was evaluated for Extremity at a 0mm distance, for Head (held-to-face) at a 10mm distance, from a flat phantom filled with head tissue-equivalent medium. The DUT was evaluated for SAR in accordance with the procedures as described in FCC KDB 447498, 248227, 865664 and IEC/IEEE |
| 2 | <p>2.4GHz 802.11g/n OFDM SAR Test Exclusion</p> <p>As Per KDB 248227 D01v02r02 - 5.2.2, b) When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is $\leq 1.2W/kg$</p> <p>When applying this formula to 10-g, the threshold should be multiplied by 2.5, i.e. when 10-g extremity SAR s considered the threshold adjusted SAR is $\leq 3.0W/kg$</p> <p>Maximum 802.11g/n OFDM specified power(POFDM)= 15dBm (31.62mW) Maximum 802.11b DSSS specified power (PDSSS)= 16 dBm (39.81mW) Ratio OFDM/DSSS power = 79.42% Highest reported SAR (SARMAX)= 0.23W/kg</p> <p>$POFDM/PDSSS \times SARMAX = 0.18 W/kg \leq 3.0 W/kg$ (Extremity) and $\leq 1.5 W/kg$ (Body) and SAR test exclusion applies.</p> |
| 3 | The Device was capable of transmitting at various modulations, data rates and duty cycles. The Conducted Power was highest when measured in DSSS Mode-5.5 Mbps at 100% Duty cycle than any other configuration in the 2.4GHz Band. The DUT was evaluated for SAR at the maximum conducted output power level, preset by the manufacturer. |
| 4 | Bluetooth was evaluated for SAR in BT BR (GFSK) mode with a transmit duty cycle of 100% in the worst-case configuration from the WiFi test evaluation. The Duty cycle could not be altered in test mode or by the user. The DUT was evaluated for SAR at the maximum conducted output power level, preset by the manufacturer. |
| 5 | Each SAR evaluation was performed with a fully charged battery. |

13.2 DUT Positioning

| DUT Positioning | |
|--------------------------------|---|
| Positioning | The DUT Positioner was securely fastened to the Phantom Platform. Registration marks were placed on the DUT and the Positioner to ensure consistent positioning of the DUT for each test evaluation. |
| FACE Configuration | Head SAR - (held- to-face). Devices that are designed to be near extremity and may operate with in a mode for voice communication, with the device positioned next to the mouth. When next-to-mouth SAR evaluation is required, the device is positioned at 10mm from a flat phantom filled with head tissue-equivalent medium. |
| BODY Configuration | Devices that are designed to be worn on the Body are positioned on the device holder with the surface of the DUT being 5mm from bottom of the phantom in the Body configuration. |
| HEAD Configuration | This device is not intended to be held to the ear and was not tested in the HEAD configuration. |
| LIMB Worn Configuration | Extremity SAR - (limb-worn) Devices that are designed to be near extremity are positioned with the back side directly against the phantom surface with the strap removed or opened to allow direct contact of the DUT to the phantom surface. |

13.3 General Procedures and Report

a

| General Procedures and Reporting | |
|----------------------------------|---|
| General Procedures | <p>The fluid dielectric parameters of the Active Tissue Simulating Liquid (TSL) were measured as described in this Section, recorded and entered into the DASY Measurement Server. Active meaning the TSL used during the SAR evaluation of the DUT. The temperature of the Active TSL was measured and recorded prior to performing a System Performance Check (SPC). An SPC was performed with the Active TSL prior to the start of the test series. The temperature of the Active TSL was measured throughout the day and the Active TSL temperature was maintained to $\pm 0.5^{\circ}\text{C}$. The Active TSL temperature was maintained to within $\pm 1.0^{\circ}\text{C}$ throughout the test series. TSL analysis and SPC were repeated when the Active TSL use exceeded 84 hours.</p> <p>An Area Scan exceeding the length and width of the DUT projection was performed and the locations of all maximas within 2dB of the Peak SAR recorded. A Zoom Scan centered over the Peak SAR location(s) was performed and the 1g and 10g SAR values recorded. The resolutions of the Area Scan and Zoom Scan are described in the Scan Resolution table(s) in this Section. A Power Reference Measurement was taken at the phantom reference point immediately prior to the Area Scan. A Power Drift measurement was taken at the phantom reference point immediately following the Zoom Scan to determine the power drift. A Z-Scan from the <u>Maximum Distance to Phantom Surface</u> to the fluid surface was performed following the power drift measurement.</p> |
| Reporting | <p>Where appropriate the 1g SAR, 10g SAR and power drift measurements are recorded in the SAR Measurement Summary tables in the SAR Measurement Summary Section of this report. The SAR values shown in the 100% DC (Duty Cycle) column are the SAR values reported by the SAR Measurement Server with the DUT operating at or compensated for a 100% transmit duty cycle. A duty cycle compensation (crest factor) and fluid sensitivity scaling factor is shown, as well as other information such as transmit channel and frequency, modulation, accessories tested and DUT-phantom separation distance.</p> <p>In the Scaling of Maximum Measured SAR Section of this report, the highest measured SAR in the BODY and/or FACE and/or EXTREMITY (limb-worn) configurations, within the entire scope of this assessment, are, when applicable, scaled for Fluid Sensitivity, Manufacturer's Tune-Up Tolerance, Simultaneous Transmission and Drift. With the exception of Duty Cycle correction/compensation, SAR values are <u>ONLY</u> scaled up, not down. The final results of this scaling is the <u>reported SAR</u> which appears on the Cover Page of this report.</p> |

13.4 Fluid Dielectric and Systems Performance Check

| Fluid Dielectric and Systems Performance Check | |
|--|--|
| Fluid Dielectric Measurement Procedure | |
| <p>The fluid dielectric parameters of the Tissue Simulating Liquid (TSL) are measured using the Open-Ended Coax Method connected to an Agilent 8753ET Network Analyzer connected to a measurement server running April Dielectric Property Measurement System. A frequency range of $\pm 100\text{MHz}$ for frequencies $> 300\text{MHz}$ and $\pm 50\text{MHz}$ for frequencies $\leq 300\text{MHz}$ with frequency step size of 10MHz is used. The center frequency is centered around the SAR measurement probe's calibration point for that TSL frequency range. A calibration of the setup is performed using a short-open-deionized water (at 23°C in a 300ml beaker) method. A sample of the TSL is placed in a 300ml beaker and the open-ended coax is submerged approximately 8mm below the fluid surface in the approximate center of the beaker. A check of the setup is made to ensure no air is trapped under the open-ended coax. The sample of TSL is measured and compared to the FCC KDB 865664 targets for HEAD or BODY for the entire fluid measurement range. Fluid adjustment are made if the dielectric parameters are $> 5\%$ in range that the DUT is to be tested. If the adjustments fail to bring the parameters to $\leq 5\%$ but are $< 10\%$, the SAR Fluid Sensitivity as per IEC\IEEE 62209-1528 and FCC KDB 865664 are applied to the highest measured SAR. A TSL with dielectric parameters $> 10\%$ in the DUT test frequency range are not used.</p> | |
| Systems Performance Check | |
| <p>The fluid dielectric parameters of the Active TSL are entered into the DASY Measurement Server at each of the 10MHz step size intervals. Active meaning the TSL used during the SAR evaluation of the DUT. The DASY Measurement System will automatically interpolate the dielectric parameters for DUT test frequencies that fall between the 10MHz step intervals.</p> <p>A Systems Performance Check (SPC) is performed in accordance with IEC\IEEE 62209-1528 "System Check" and FCC KDB 865664 "System Verification". A validation source, dipole or Confined Loop Antenna (CLA), is placed under the geometric center of the phantom and separated from the phantom in accordance to the validation source's Calibration Certificate data. A CW signal set to the frequency of the validate source's and SAR measurement probe's calibration frequency with a forward power set to the validation source's Calibration Certificate data power setting is applied to the validation source. An Area Scan is centered over the projection of the validation source's feed point and an Area Scan is taken. A Zoom Scan centered over the Peak SAR measurement of the Area Scan and the 1g and 10g SAR is measured. The measured 1g and 10g SAR is compared to the 1g and 10g SAR measurements from the validation source's Calibration Certificate. When required, the measured SAR is normalized to 1.0W and compared to the normalized SAR indicated on the validation source's Calibration Certificate. The SPC is considered valid when the measured and normalized SAR is $\leq 10\%$ of the measured and normalize SAR of the validation source's Calibration Certificate.</p> <p>The fluid dielectric parameters of the Active TSL and SPC are repeated when the Active TSL has been in use for greater than 84 hours or if the Active TSL temperature has exceed $\pm 1^\circ\text{C}$ of the initial fluid analysis.</p> | |

13.5 Scan Resolution 100MHz to 2GHz

| Scan Resolution 100MHz to 2GHz | |
|--|--|
| Maximum distance from the closest measurement point to phantom surface: (Geometric Center of Probe Center) | $4 \pm 1 \text{ mm}$ |
| Maximum probe angle normal to phantom surface. (Flat Section ELI Phantom) | $5^\circ \pm 1^\circ$ |
| Area Scan Spatial Resolution $\Delta X, \Delta Y$ | 15 mm |
| Zoom Scan Spatial Resolution $\Delta X, \Delta Y$ | 7.5 mm |
| Zoom Scan Spatial Resolution ΔZ (Uniform Grid) | 5 mm |
| Zoom Scan Volume X, Y, Z | 30 mm |
| Fluid Depth | $150 \pm 5 \text{ mm}$ |
| An Area Scan with an area extending beyond the device was used to locate the candidate maximas within 2dB of the global maxima. | |
| A Zoom Scan centered over the peak SAR location(s) determined by the Area Scan was used to determine the 1-gram and 10-gram peak spatial-average SAR | |

13.6 Scan Resolution 2GHz to 3GHz

| Scan Resolution 2GHz to 3GHz | |
|--|-------------------|
| Maximum distance from the closest measurement point to phantom surface: (Geometric Center of Probe Center) | 4 ± 1 mm |
| Maximum probe angle normal to phantom surface. (Flat Section ELI Phantom) | 5° ± 1° |
| Area Scan Spatial Resolution $\Delta X, \Delta Y$ | 12 mm |
| Zoom Scan Spatial Resolution $\Delta X, \Delta Y$ | 5 mm |
| Zoom Scan Spatial Resolution ΔZ (Uniform Grid) | 5 mm |
| Zoom Scan Volume X, Y, Z | 30 mm |
| Fluid Depth | 150 ± 5 mm |
| An Area Scan with an area extending beyond the device was used to locate the candidate maximas within 2dB of the global maxima. | |
| A Zoom Scan centered over the peak SAR location(s) determined by the Area Scan was used to determine the 1-gram and 10-gram peak spatial-average SAR | |

13.7 Scan Resolution 5GHz to 6GHz

| Scan Resolution 5GHz to 6GHz | |
|--|-------------------|
| Maximum distance from the closest measurement point to phantom surface: (Geometric Center of Probe Center) | 4 ± 1 mm |
| Maximum probe angle normal to phantom surface. (Flat Section ELI Phantom) | 5° ± 1° |
| Area Scan Spatial Resolution $\Delta X, \Delta Y$ | 10 mm |
| Zoom Scan Spatial Resolution $\Delta X, \Delta Y$ | 4 mm |
| Zoom Scan Spatial Resolution ΔZ (Uniform Grid) | 2 mm |
| Zoom Scan Volume X, Y, Z | 22 mm |
| Fluid Depth | 100 ± 5 mm |
| An Area Scan with an area extending beyond the device was used to locate the candidate maximas within 2dB of the global maxima. | |
| A Zoom Scan centered over the peak SAR location(s) determined by the Area Scan was used to determine the 1-gram and 10-gram peak spatial-average SAR | |

14.0 SAR MEASUREMENT VARIABILITY & UNCERTAINTY

Table 14.1 Measurement Variability

Per FCC KDB Publication 865664, SAR measurement variability is not required to be assessed for each frequency band where all measured SAR values are <0.8 W/kg for 1g and < 2.0 W/kg for 10g.

Table 14.2 Measurement Uncertainty

Per FCC KDB 865664 when the highest measured SAR is <1.5 W/kg for 1 g and < 3.75 W/kg for 10g all frequency bands, the extensive SAR measurement uncertainty analysis tables described in IEEE std 1528-2013 are not required.

15.0 FLUID DIELECTRIC PARAMETERS

Table 15.0 Fluid Dielectric Parameters 2450MHz HEAD TSL

| FLUID DIELECTRIC PARAMETERS | | | | | | | | Fluid Sensitivity Calculation IEC/IEEE 62209-1528 7.8.2 | | | |
|-----------------------------|-------------|-----------------|----------|-------------------|---------------------------|---------------------------|--------|--|-------------|------------------------------|-------|
| Date: | 21-Mar-2024 | Fluid Temp: | 23.6 | Frequency: | 2450MHz | Tissue: | Head | ΔSAR 1g | ΔSAR 10g | SAR Correction Factor (1) | |
| Freq (MHz) | Test ε | Test σ (S/m) | Target ε | Target σ (S/m) | Deviation Permittivity | Deviation Conductivity | 1g | | | 10g | |
| 2400.0000 | | 36.7800 | 1.7300 | 39.2900 | 1.76 | -6.39% | -1.70% | 0.006 | 0.005 | 1.000 | 1.000 |
| 2404.0000 | * | 36.7280 | 1.7380 | 39.2820 | 1.76 | -6.50% | -1.25% | 0.009 | 0.007 | 1.000 | 1.000 |
| 2410.0000 | | 36.6500 | 1.7500 | 39.2700 | 1.76 | -6.67% | -0.57% | 0.012 | 0.009 | 1.000 | 1.000 |
| 2412.0000 | * | 36.6520 | 1.7540 | 39.2660 | 1.76 | -6.66% | -0.45% | 0.013 | 0.009 | 1.000 | 1.000 |
| 2417.0000 | * | 36.6570 | 1.7640 | 39.2560 | 1.77 | -6.62% | -0.17% | 0.014 | 0.010 | 1.000 | 1.000 |
| 2420.0000 | | 36.6600 | 1.7700 | 39.2500 | 1.77 | -6.60% | 0.00% | 0.015 | 0.010 | 1.000 | 1.000 |
| 2430.0000 | | 36.6800 | 1.7700 | 39.2400 | 1.78 | -6.52% | -0.56% | 0.012 | 0.009 | 1.000 | 1.000 |
| 2437.0000 | * | 36.6660 | 1.7910 | 39.2260 | 1.79 | -6.53% | 0.22% | 0.016 | 0.011 | 1.000 | 1.000 |
| 2440.0000 | | 36.6600 | 1.8000 | 39.2200 | 1.79 | -6.53% | 0.56% | 0.017 | 0.012 | 1.000 | 1.000 |
| 2450.0000 | | 36.7200 | 1.7900 | 39.2000 | 1.80 | -6.33% | -0.56% | 0.012 | 0.009 | 1.000 | 1.000 |
| 2460.0000 | | 36.6300 | 1.8200 | 39.1900 | 1.81 | -6.53% | 0.55% | 0.017 | 0.012 | 1.000 | 1.000 |
| 2462.0000 | * | 36.6660 | 1.8180 | 39.1860 | 1.81 | -6.43% | 0.33% | 0.016 | 0.011 | 1.000 | 1.000 |
| 2470.0000 | | 36.8100 | 1.8100 | 39.1700 | 1.82 | -6.03% | -0.55% | 0.011 | 0.008 | 1.000 | 1.000 |
| 2472.0000 | * | 36.7460 | 1.8180 | 39.1680 | 1.82 | -6.18% | -0.22% | 0.013 | 0.009 | 1.000 | 1.000 |
| 2480.0000 | | 36.4900 | 1.8500 | 39.1600 | 1.83 | -6.82% | 1.09% | 0.021 | 0.014 | 1.000 | 1.000 |

*Channel Frequency Tested

16.0 SYSTEM VERIFICATION TEST RESULTS

Table 16.0 System Verification Results 2450MHz HEAD TSL

| System Verification Test Results | | | | | |
|--|------------------|--------------------|-------------------------|-----------------------|------------------------|
| Date | | Frequency (MHz) | Validation Source | | |
| | | | P/N | | S/N |
| 21 Mar 2024 | | 2450 | D2450V2 | | 825 |
| Fluid Type | Fluid Temp °C | Ambient Temp °C | Ambient Humidity (%) | Forward Power (mW) | Source Spacing (mm) |
| Head | 23.6 | 27 | 25% | 250 | 10 |
| Fluid Parameters | | | | | |
| Permittivity | | | Conductivity | | |
| Measured | Target | Deviation | Measured | Target | Deviation |
| 36.72 | 39.20 | -6.33% | 1.79 | 1.80 | -0.56% |
| Measured SAR | | | | | |
| 1 gram | | | 10 gram | | |
| Measured | Target | Deviation | Measured | Target | Deviation |
| 12.60 | 13.18 | -4.40% | 5.79 | 6.01 | -3.58% |
| Measured SAR Normalized to 1.0W | | | | | |
| 1 gram | | | 10 gram | | |
| Normalized | Target | Deviation | Normalized | Target | Deviation |
| 50.40 | 52.72 | -4.40% | 23.16 | 24.02 | -3.56% |
| <p>Prior to the SAR evaluations, system checks were performed on the planar section of the phantom and a SPEAG validation dipole in accordance with the procedures described in IEC/IEEE 62209-1528 and FCC KDB 846224,</p> <p>The dielectric parameters of the simulated tissue mixture were measured prior to the system performance check using a Dielectric Probe Kit and a Network Analyzer.</p> <p>The forward power was applied to the dipole and the system was verified to a tolerance of +10% from the system manufacturer's dipole calibration target SAR value.</p> <p>The forward power applied was same forward power applied by the calibration lab during the calibration of this validation source.</p> | | | | | |

17.0 SYSTEM VALIDATION SUMMARY

Table 17.0 System Validation Summary

| SAR Validation Summary Chart | | | | | | | |
|------------------------------|-------------|-----------|-------------------|-----------------|--------------------|----------|---------------|
| Validation Date | Probe Model | Probe S/N | Validation Source | Frequency (MHz) | Validation Results | | |
| | | | | | Linearity | Isotropy | Extrapolation |
| | | ✓ | = Complete | | ✓ = Not Required | | |
| 21-Jun-23 | EX3DV4 | 7826 | D2450V2 | 2450 | Pass | Pass | Pass |

18.0 MEASUREMENT SYSTEM SPECIFICATIONS

Table 18.0 Measurement System Specifications

| Measurement System Specification | |
|---|--|
| Specifications | |
| Positioner | Stäubli Unimation Corp. Robot Model: TX90XL |
| Repeatability | +/- 0.035 mm |
| No. of axis | 6.0 |
| Data Acquisition Electronic (DAE) System | |
| Cell Controller | |
| Processor | Intel(R) Core(TM) i7-7700 |
| Clock Speed | 3.60 GHz |
| Operating System | Windows 10 Professional |
| Data Converter | |
| Features | Signal Amplifier, multiplexer, A/D converter, and control logic |
| Software | Measurement Software: DASY6, V 6.4.0.12171 / DASY52 V10.2(1504) Postprocessing Software: SEMCAD X, V14.6.12(7470) |
| Connecting Lines | Optical downlink for data and status info., Optical uplink for commands and clock |
| DASY Measurement Server | |
| Function | Real-time data evaluation for field measurements and surface detection |
| Hardware | Intel ULV Celeron CPU 400 MHz; 128 MB chip disk; 128 MB RAM |
| Connections | COM1, COM2, DAE, Robot, Ethernet, Service Interface |
| E-Field Probe | |
| Model | EX3DV4 |
| Serial No. | 7826 |
| Construction | Triangular core fiber optic detection system |
| Frequency | 10 MHz to 6 GHz |
| Linearity | ±0.2 dB (30 MHz to 3 GHz) |
| Phantom | |
| Type | MFP V5.1C Planar Phantom |
| Shell Material | Fiberglass |
| Thickness | 2mm +/- .2mm |
| Volume | > 8 Liter |

Table 18.1

| Measurement System Specification (Continued) | | |
|--|---|---|
| Probe Specification | | |
| Construction: | Symmetrical design with triangular core; Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents (e.g. DGBE)) |  |
| Calibration: | ISO/IEC 17025 | |
| Frequency: | 4 MHz - 10 GHz; Linearity: ± 0.2 dB (30 MHz - 10 GHz) | |
| Directivity: | ± 0.1 dB in TSL (rotation around probe axis) ± 0.3 dB in TSL (rotation normal to probe axis) | |
| Dynamic Range: | 10 μ W/g to > 100 mW/g; Linearity: ± 0.2 dB (noise: typically <1 mW/g) | |
| Dimensions: | Overall length: 337 mm; (tip: 20 mm) Tip diameter: 2.5 mm; Tip (body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm | |
| Application: | High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields); the only probe that enables compliance testing for frequencies up to 6 GHz with precision of better than 30% | EX3DV4 E-Field Probe |
| Phantom Specification | | |
| The ELI V5.0 phantom is an elliptical planar fiberglass shell phantom with a shell thickness of 2.0mm +/- .2mm at the planar area. This phantom conforms to OET Bulletin 65, Supplement C, IEC/IEEE 62209-1528. | |  |
| | | ELI Phantom |
| Phantom Specification | | |
| The SAM V4.0 phantom is a flat planar fiberglass shell phantom with a shell thickness of 2.0mm +/- .2mm at the planar area. This phantom conforms to OET Bulletin 65, Supplement C, IEC/IEEE 62209-1528. | |  |
| | | SAM Phantom |
| Phantom Specification | | |
| The MFP V5.1C phantom is a flat planar fiberglass shell phantom with a shell thickness of 2.0mm +/- .2mm at the planar area. This phantom conforms to OET Bulletin 65, Supplement C, IEC/IEEE 62209-1528. | |  |
| | | MFP Phantom |
| Device Positioner Specification | | |
| The DASY device positioner has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65°. The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. | |  |
| | | Device Positioner |

19.0 TEST EQUIPMENT LIST

Table 19.0 Equipment List and Calibration

| Test Equipment List | | | | |
|---|-----------|-------------|-----------------|-----------------|
| DESCRIPTION | ASSET NO. | SERIAL NO. | DATE CALIBRATED | CALIBRATION DUE |
| Schmid & Partner DASY 6 System | - | - | - | - |
| -DASY Measurement Server | 00158 | 1078 | CNR | CNR |
| -Robot | 00046 | 599396-01 | CNR | CNR |
| -DAE4 | 00019 | 353 | 16-Apr-23 | 16-May-24 |
| -EX3DV4 E-Field Probe | 00357 | 7826 | 16-May-23 | 16-May-24 |
| -D2450V2 Validation Dipole | 00219 | 825 | 24-Apr-21 | 16-May-24 |
| ELI Phantom | 00247 | 1234 | CNR | CNR |
| SAM Phantom | 00154 | 1033 | CNR | CNR |
| MFP Phantom | 00355 | 1177/2 | CNR | CNR |
| HP 85070C Dielectric Probe Kit | 00033 | none | CNR | CNR |
| Gigatronics 8652A Power Meter | 00007 | 1835801 | 10-May-22 | 10-May-25 |
| Gigatronics 80701A Power Sensor | 00186 | 1837002 | COU | COU |
| Gigatronics 80334A Power Sensor | 00237 | 1837001 | 10-May-22 | 10-May-25 |
| HP 8753ET Network Analyzer | 00134 | US39170292 | 6-Jan-24 | 6-Jan-27 |
| Rohde & Schwarz SMR20 Signal Generator | 00006 | 100104 | COU | COU |
| Amplifier Research 10W1000C Power Amplifier | 00041 | 27887 | CNR | CNR |
| Amplifier Research 5S1G4 Power Amplifier | 00106 | 26235 | CNR | CNR |
| Narda Directional Coupler 3020A | 00064 | - | CNR | CNR |
| Bipolar Power Supply 6299A | 00086 | 1144A02155 | CNR | CNR |
| DC-18G 10W 30db Attenuator | 00102 | - | COU | COU |
| R&S FSP40 Spectrum Analyzer | 00241 | 100500 | 9-Aug-21 | 9-Aug-24 |
| HP 8566B Spectrum Analyzer | 00051 | 2747A055100 | 6-Jul-24 | 6-Jul-27 |
| RF Cable-SMA | 00311 | - | CNR | CNR |
| HP Calibration Kit | 00145 | - | CNR | CNR |

CNR = Calibration Not Required

SB=Stand By

COU = Calibrate on Use

Note: Per KDB 865664, Dipoles are evaluated annually for return loss and impedance. The dipole's SAR target can only be assessed by the SAR equipment manufacturer and remains the target until the dipole is recalibrated by the manufacturer. The dipole's SAR is evaluated and compared to this target during each and every System Verification which is performed prior to and/or during each DUT SAR evaluation. The results of these verifications are shown in Section 16.0

20.0 FLUID COMPOSITION

Table 20.0 Fluid Composition 2450MHz HEAD TSL

| Tissue Simulating Liquid (TSL) Composition | | | | 2450MHz Head |
|--|--------|---------------------|--------------------|-----------------------------|
| Component by Percent Weight | | | | |
| Water | Glycol | Salt ⁽¹⁾ | HEC ⁽²⁾ | Bacteriacide ⁽³⁾ |
| 52.0 | 48.0 | 0.0 | 0.0 | 0.0 |

(1) Non-Iodinized

(2) HydroxyEthyl-Cellulose: Sigma-Aldrich P/N 54290-500g

(3) Dow Chemical Dowicil 75 Antimicrobial Perservative

END OF REPORT

APPENDIX A – SYSTEM VERIFICATION PLOTS

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:825
Procedure Name: SPC 2450H_Input=250mw, Target=[11.86]13.18][14.50]W/kg 3 2 2 2 2

Communication System: UID 0, CW (0); Frequency: 2450 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 2450$ MHz; $\sigma = 1.79$ S/m; $\epsilon_r = 36.72$; $\rho = 1000$ kg/m³
Phantom section: Left Section

Date/Time: 3/21/2024 7:04:03 PM

DASY5 Configuration:

- Probe: EX3DV4 - SN7826; ConvF(7.91, 7.42, 7.62) @ 2450 MHz; Calibrated: 5/16/2023
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 4/18/2023
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1177/2
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

SPC/SPC 2450H_Input=250mw, Target=[11.86]13.18][14.50]W/kg/Area Scan (81x31x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Reference Value = 89.58 V/m; Power Drift = 0.01 dB

Fast SAR: SAR(1 g) = 12.7 W/kg; SAR(10 g) = 6.11 W/kg

Maximum value of SAR (interpolated) = 15.1 W/kg

SPC/SPC 2450H_Input=250mw, Target=[11.86]13.18][14.50]W/kg 3 2 2 2 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 89.58 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 26.9 W/kg

SAR(1 g) = 12.6 W/kg; SAR(10 g) = 5.79 W/kg

Smallest distance from peaks to all points 3 dB below = 10.8 mm

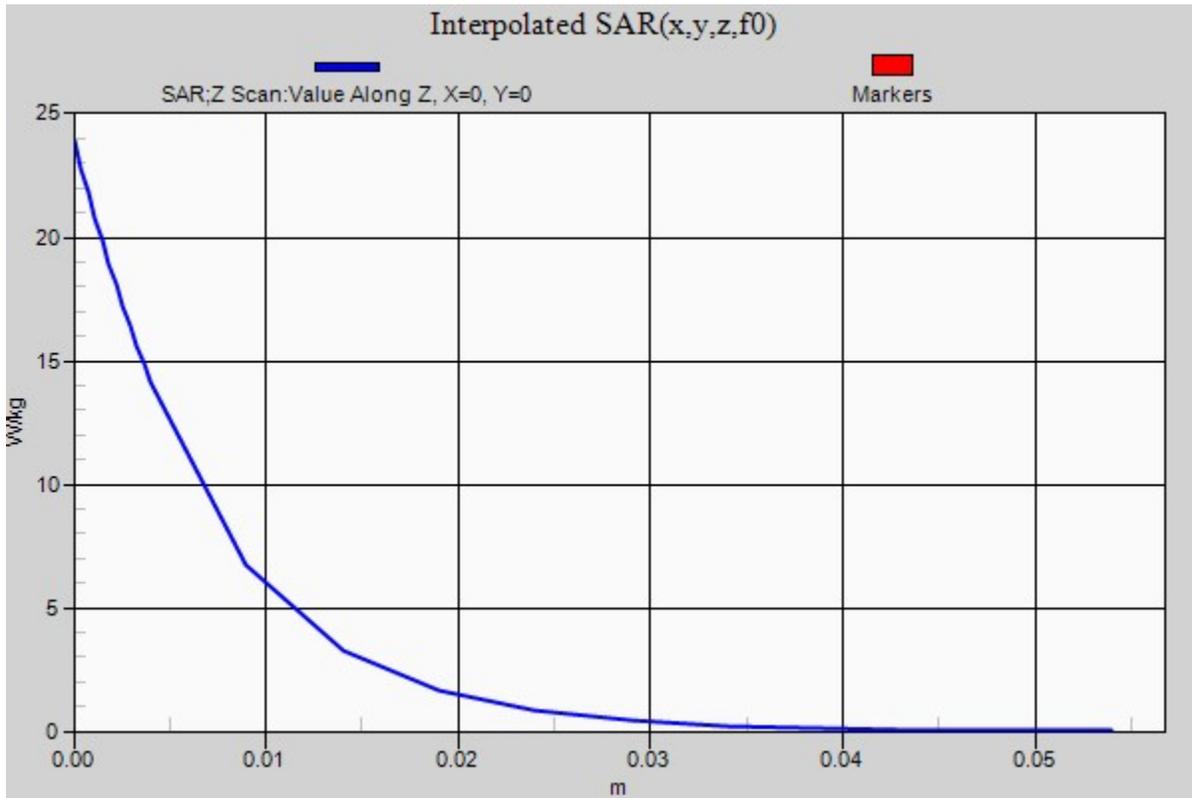
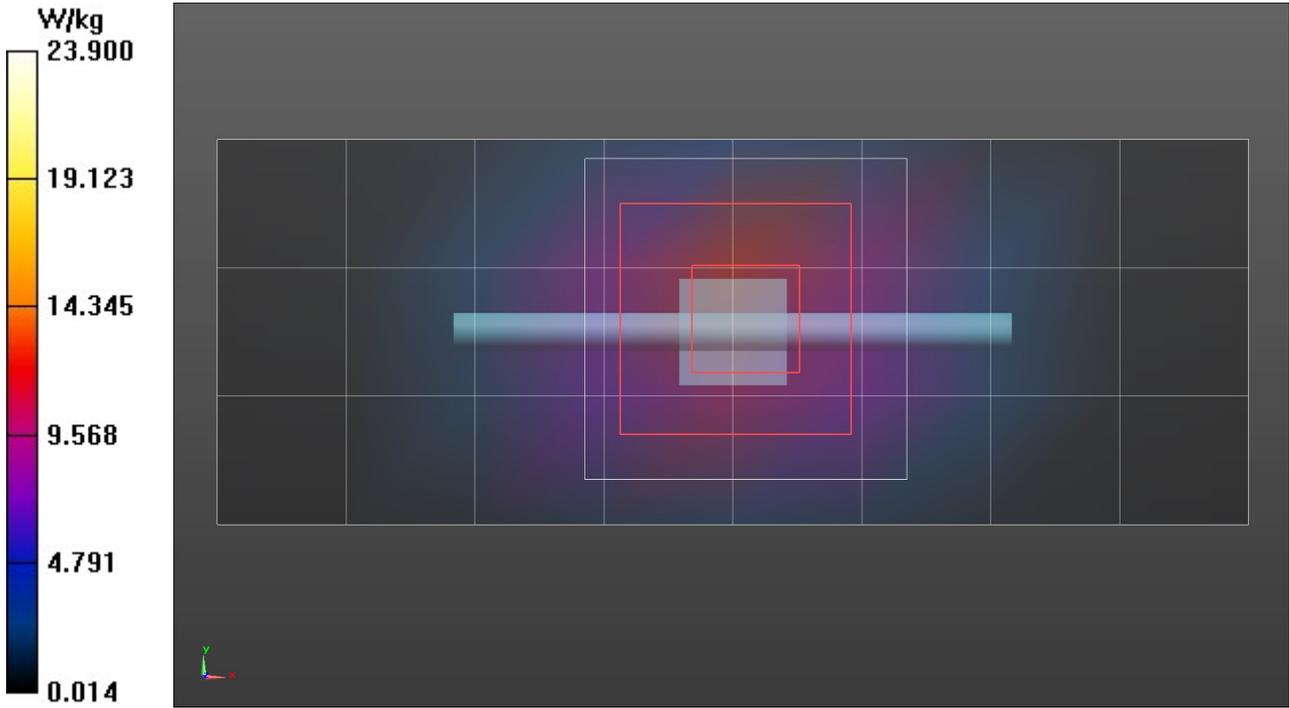
Ratio of SAR at M2 to SAR at M1 = 47.5%

Maximum value of SAR (measured) = 14.3 W/kg

SPC/SPC 2450H_Input=250mw, Target=[11.86]13.18][14.50]W/kg 3 2 2 2 2/Z Scan (1x1x22): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Penetration depth = 6.950 (6.751, 7.055) [mm]

Maximum value of SAR (interpolated) = 23.9 W/kg



APPENDIX B – MEASUREMENT PLOTS OF MAXIMUM MEASURED SAR

Plot E21/21Z

DUT: Portable Transceiver; Type: Extremity; Serial: 3469058595

Procedure Name: E21-A04808,Extremity-Back Side, 2417 MHz, Silicone Band-WIFI, DSSS-5.5Mbps

Communication System: UID 0, CW (0); Frequency: 2417 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 2417$ MHz; $\sigma = 1.764$ S/m; $\epsilon_r = 36.657$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Date/Time: 3/22/2024 1:53:00 PM

DASY5 Configuration:

- Probe: EX3DV4 - SN7826; ConvF(7.91, 7.42, 7.62) @ 2417 MHz; Calibrated: 5/16/2023
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 4/18/2023
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1177/2
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

2450H/E21-A04808,Extremity-Back Side, 2417 MHz, Silicone Band-WIFI, DSSS-5.5Mbps/Area Scan 2 (71x71x1): Interpolated grid:
dx=1.200 mm, dy=1.200 mm

Reference Value = 8.652 V/m; Power Drift = 0.00 dB

Fast SAR: SAR(10 g) = 0.145 W/kg

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.325 W/kg

2450H/E21-A04808,Extremity-Back Side, 2417 MHz, Silicone Band-WIFI, DSSS-5.5Mbps/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.276 V/m; Power Drift = 0.21 dB

Peak SAR (extrapolated) = 0.456 W/kg

SAR(1 g) = 0.105 W/kg; SAR(10 g) = 0.047 W/kg

Smallest distance from peaks to all points 3 dB below = 18 mm

Ratio of SAR at M2 to SAR at M1 = 50.8%

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.111 W/kg

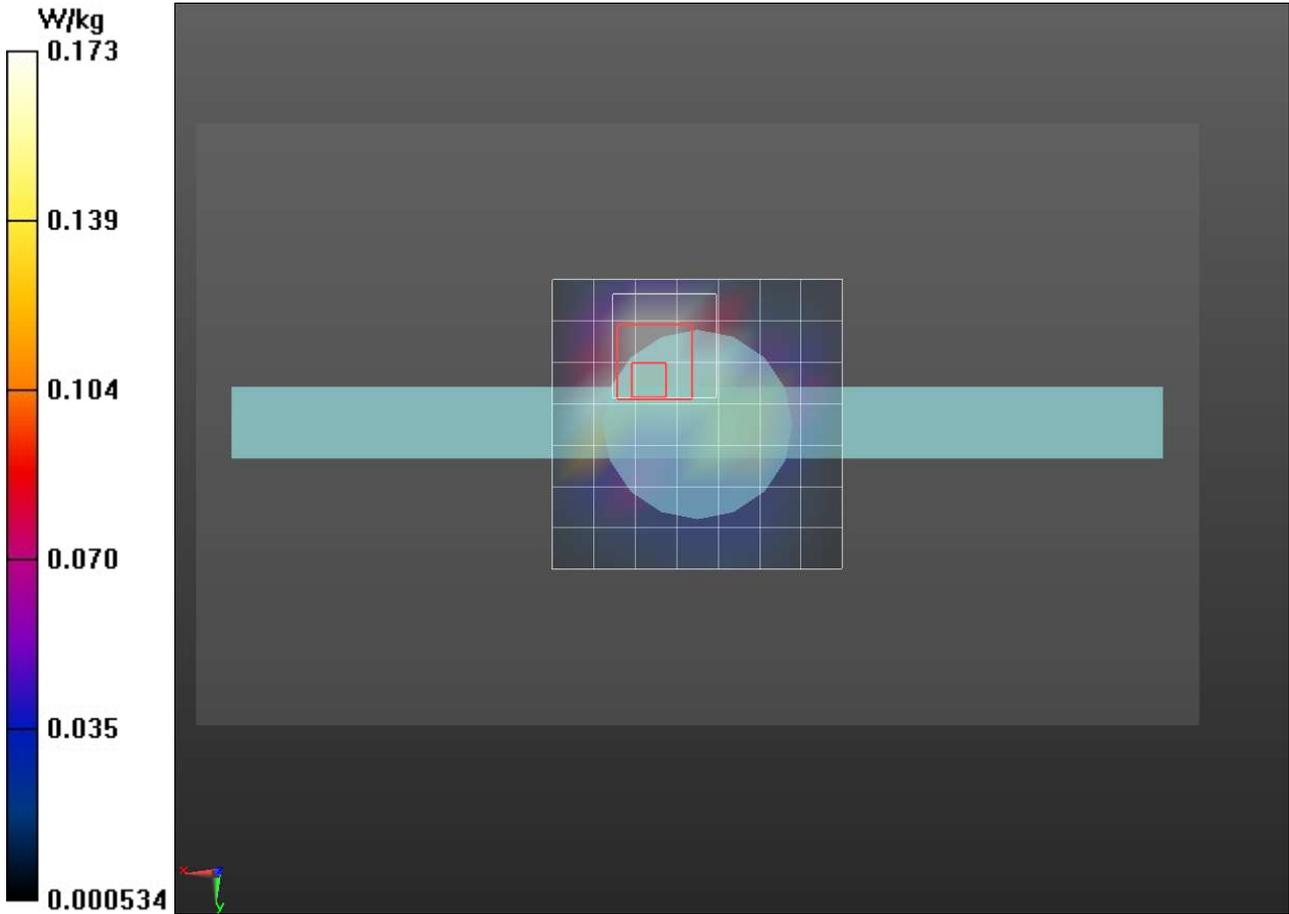
2450H/E21-A04808,Extremity-Back Side, 2417 MHz, Silicone Band-WIFI, DSSS-5.5Mbps/Z Scan (1x1x17): Measurement grid:

dx=20mm, dy=20mm, dz=20mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Penetration depth = n/a (n/a, 7.921) [mm]

Maximum value of SAR (interpolated) = 0.173 W/kg



F23/23Z

DUT: Portable Transceiver; Type: Head ; Serial: 3469058595

Procedure Name: F23-A04808, Front Side-10mm, 2417 MHz, w/c Band-WIFI, DSSS-5.5Mbps

Communication System: UID 0, CW (0); Frequency: 2417 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 2417$ MHz; $\sigma = 1.764$ S/m; $\epsilon_r = 36.657$; $\rho = 1000$ kg/m³
Phantom section: Left Section

Date/Time: 3/22/2024 3:48:22 PM

DASY5 Configuration:

- Probe: EX3DV4 - SN7826; ConvF(7.91, 7.42, 7.62) @ 2417 MHz; Calibrated: 5/16/2023
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 4/18/2023
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1177/2
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

2450H/F23-A04808, Front Side-10mm, 2417 MHz, w/c Band-WIFI, DSSS-5.5Mbps/Area Scan (71x71x1): Interpolated grid:

$dx=1.200$ mm, $dy=1.200$ mm
Reference Value = 9.458 V/m; Power Drift = -0.20 dB

Fast SAR: SAR(1 g) = 0.208 W/kg

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.246 W/kg

2450H/F23-A04808, Front Side-10mm, 2417 MHz, w/c Band-WIFI, DSSS-5.5Mbps/Zoom Scan (7x7x7)/Cube 0: Measurement grid:

$dx=5$ mm, $dy=5$ mm, $dz=5$ mm
Reference Value = 9.232 V/m; Power Drift = -0.25 dB
Peak SAR (extrapolated) = 0.391 W/kg

SAR(1 g) = 0.203 W/kg; SAR(10 g) = 0.098 W/kg

Smallest distance from peaks to all points 3 dB below = 8.2 mm

Ratio of SAR at M2 to SAR at M1 = 52.3%

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.231 W/kg

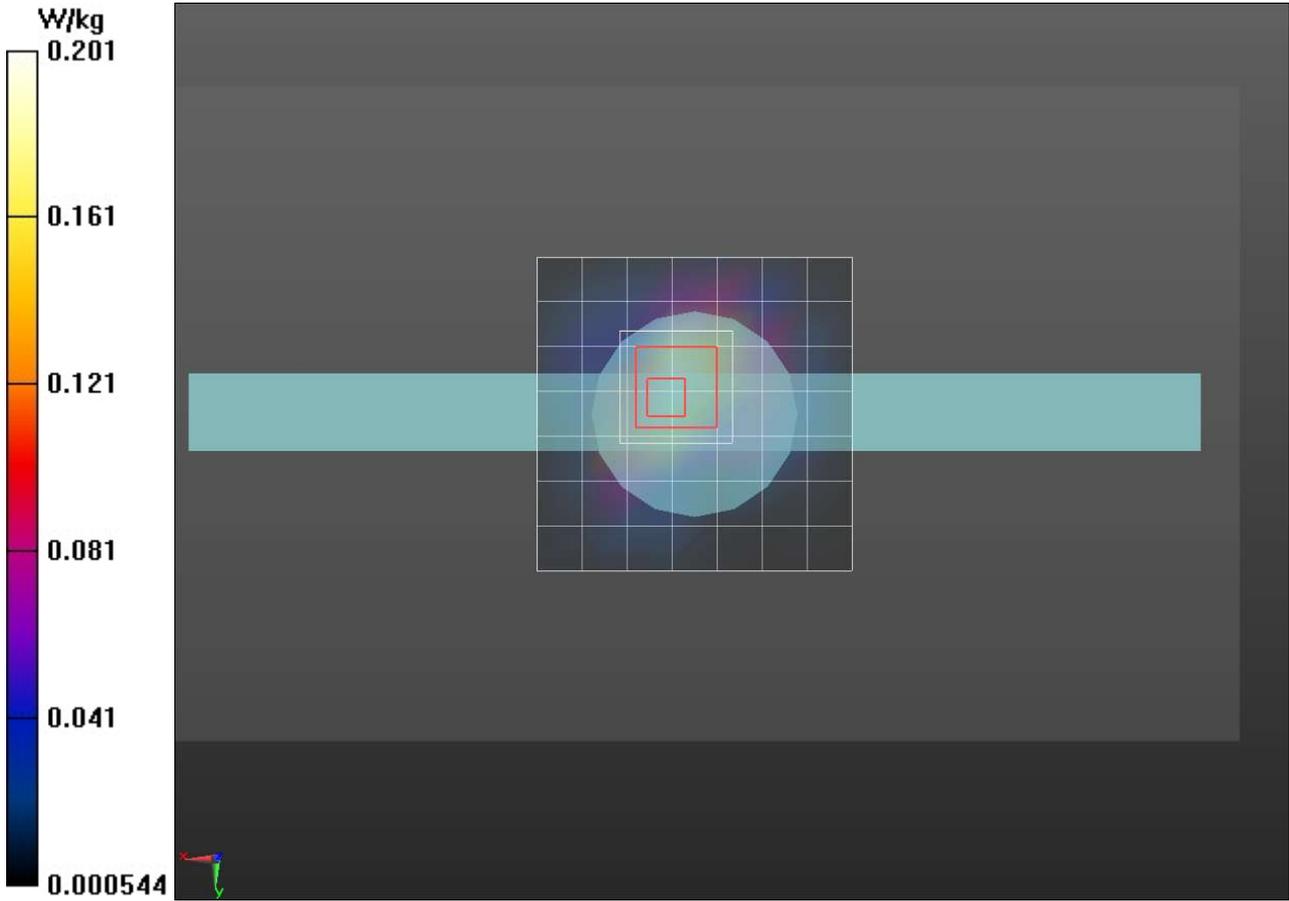
2450H/F23-A04808, Front Side-10mm, 2417 MHz, w/c Band-WIFI, DSSS-5.5Mbps/Z Scan (1x1x17): Measurement grid: $dx=20$ mm,

$dy=20$ mm, $dz=20$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Penetration depth = n/a (n/a, 7.648) [mm]

Maximum value of SAR (interpolated) = 0.201 W/kg



APPENDIX D – PROBE CALIBRATION



Accredited by the Swiss Accreditation Service (SAS)
 The Swiss Accreditation Service is one of the signatories to the EA
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **Celltech**
 Kelowna, Canada

Certificate No. **EX-7826_May23**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:7826**

Calibration procedure(s) **QA CAL-01.v10, QA CAL-12.v10, QA CAL-14.v7, QA CAL-23.v6, QA CAL-25.v8
 Calibration procedure for dosimetric E-field probes**

Calibration date **May 16, 2023**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3) °C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID | Cal Date (Certificate No.) | Scheduled Calibration |
|----------------------------|------------------|-----------------------------------|-----------------------|
| Power meter NRP2 | SN: 104778 | 30-Mar-23 (No. 217-03804/03805) | Mar-24 |
| Power sensor NRP-Z91 | SN: 103244 | 30-Mar-23 (No. 217-03804) | Mar-24 |
| OCP DAK-3.5 (weighted) | SN: 1249 | 20-Oct-22 (OCP-DAK3.5-1249_Oct22) | Oct-23 |
| OCP DAK-12 | SN: 1016 | 20-Oct-22 (OCP-DAK12-1016_Oct22) | Oct-23 |
| Reference 20 dB Attenuator | SN: CC2552 (20x) | 30-Mar-23 (No. 217-03809) | Mar-24 |
| DAE4 | SN: 660 | 16-Mar-23 (No. DAE4-660_Mar23) | Mar-24 |
| Reference Probe ES3DV2 | SN: 3013 | 06-Jan-23 (No. ES3-3013_Jan23) | Jan-24 |

| Secondary Standards | ID | Check Date (in house) | Scheduled Check |
|-------------------------|------------------|-----------------------------------|------------------------|
| Power meter E4419B | SN: GB41293874 | 06-Apr-16 (in house check Jun-22) | In house check: Jun-24 |
| Power sensor E4412A | SN: MY41498087 | 06-Apr-16 (in house check Jun-22) | In house check: Jun-24 |
| Power sensor E4412A | SN: 000110210 | 06-Apr-16 (in house check Jun-22) | In house check: Jun-24 |
| RF generator HP 8648C | SN: US3642U01700 | 04-Aug-99 (in house check Jun-22) | In house check: Jun-24 |
| Network Analyzer E8358A | SN: US41080477 | 31-Mar-14 (in house check Oct-22) | In house check: Oct-24 |

| | Name | Function | Signature |
|---------------|--------------------|-----------------------|-----------|
| Calibrated by | Aidonia Georgiadou | Laboratory Technician | |
| Approved by | Sven Kühn | Technical Manager | |

Issued: May 17, 2023

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Calibration Laboratory of

Schmid & Partner
Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Glossary

| | |
|--------------------------|--|
| TSL | tissue simulating liquid |
| NORM _{x,y,z} | sensitivity in free space |
| ConvF | sensitivity in TSL / NORM _{x,y,z} |
| DCP | diode compression point |
| CF | crest factor (1/duty_cycle) of the RF signal |
| A, B, C, D | modulation dependent linearization parameters |
| Polarization φ | φ rotation around probe axis |
| Polarization ϑ | ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis |
| Connector Angle | information used in DASY system to align probe sensor X to the robot coordinate system |

Calibration is Performed According to the Following Standards:

- IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices – Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,y,z} * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal. DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,y,z}**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).

Parameters of Probe: EX3DV4 - SN:7826

Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k = 2) |
|---|----------|----------|----------|-------------|
| Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A | 0.69 | 0.63 | 0.62 | ±10.1% |
| DCP (mV) ^B | 105.4 | 106.8 | 105.5 | ±4.7% |

Calibration Results for Modulation Response

| UID | Communication System Name | | A dB | B dB $\sqrt{\mu\text{V}}$ | C | D dB | VR mV | Max dev. | Max Unc ^E k = 2 |
|-----|---------------------------|---|---------|------------------------------|------|---------|----------|-------------|----------------------------------|
| 0 | CW | X | 0.00 | 0.00 | 1.00 | 0.00 | 125.9 | ±1.9% | ±4.7% |
| | | Y | 0.00 | 0.00 | 1.00 | | 125.5 | | |
| | | Z | 0.00 | 0.00 | 1.00 | | 146.6 | | |

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

^A The uncertainties of Norm X,Y,Z do not affect the E²-field uncertainty inside TSL (see Page 5).

^B Linearization parameter uncertainty for maximum specified field strength.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

Parameters of Probe: EX3DV4 - SN:7826**Other Probe Parameters**

| | |
|---|------------|
| Sensor Arrangement | Triangular |
| Connector Angle | -23.1° |
| Mechanical Surface Detection Mode | enabled |
| Optical Surface Detection Mode | disabled |
| Probe Overall Length | 337 mm |
| Probe Body Diameter | 10 mm |
| Tip Length | 9 mm |
| Tip Diameter | 2.5 mm |
| Probe Tip to Sensor X Calibration Point | 1 mm |
| Probe Tip to Sensor Y Calibration Point | 1 mm |
| Probe Tip to Sensor Z Calibration Point | 1 mm |
| Recommended Measurement Distance from Surface | 1.4 mm |

Note: Measurement distance from surface can be increased to 3–4 mm for an *Area Scan* job.

Parameters of Probe: EX3DV4 - SN:7826

Calibration Parameter Determined in Head Tissue Simulating Media

| f (MHz) ^C | Relative Permittivity ^F | Conductivity ^F (S/m) | ConvF X | ConvF Y | ConvF Z | Alpha ^G | Depth ^G (mm) | Unc (k = 2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-------------|
| 30 | 55.0 | 0.75 | 15.21 | 15.21 | 15.21 | 0.00 | 1.25 | ±13.3% |
| 150 | 52.3 | 0.76 | 12.21 | 12.21 | 12.21 | 0.00 | 1.25 | ±13.3% |
| 450 | 43.5 | 0.87 | 10.71 | 10.71 | 10.71 | 0.16 | 1.30 | ±13.3% |
| 750 | 41.9 | 0.89 | 10.00 | 9.21 | 9.80 | 0.39 | 1.27 | ±12.0% |
| 835 | 41.5 | 0.90 | 9.91 | 9.10 | 9.48 | 0.39 | 1.27 | ±12.0% |
| 900 | 41.5 | 0.97 | 9.19 | 8.86 | 8.85 | 0.38 | 1.27 | ±12.0% |
| 1640 | 40.2 | 1.31 | 7.98 | 7.52 | 7.78 | 0.45 | 1.27 | ±12.0% |
| 1810 | 40.0 | 1.40 | 8.33 | 7.82 | 8.03 | 0.29 | 1.27 | ±12.0% |
| 1900 | 40.0 | 1.40 | 8.35 | 7.86 | 8.09 | 0.28 | 1.27 | ±12.0% |
| 2300 | 39.5 | 1.67 | 7.87 | 7.38 | 7.59 | 0.30 | 1.27 | ±12.0% |
| 2450 | 39.2 | 1.80 | 7.91 | 7.42 | 7.62 | 0.30 | 1.27 | ±12.0% |
| 2600 | 39.0 | 1.96 | 7.85 | 7.34 | 7.56 | 0.29 | 1.27 | ±12.0% |
| 5250 | 35.9 | 4.71 | 5.59 | 5.24 | 5.42 | 0.36 | 1.53 | ±14.0% |
| 5600 | 35.5 | 5.07 | 4.82 | 4.57 | 4.70 | 0.38 | 1.67 | ±14.0% |
| 5750 | 35.4 | 5.22 | 5.14 | 4.73 | 4.93 | 0.34 | 1.75 | ±14.0% |

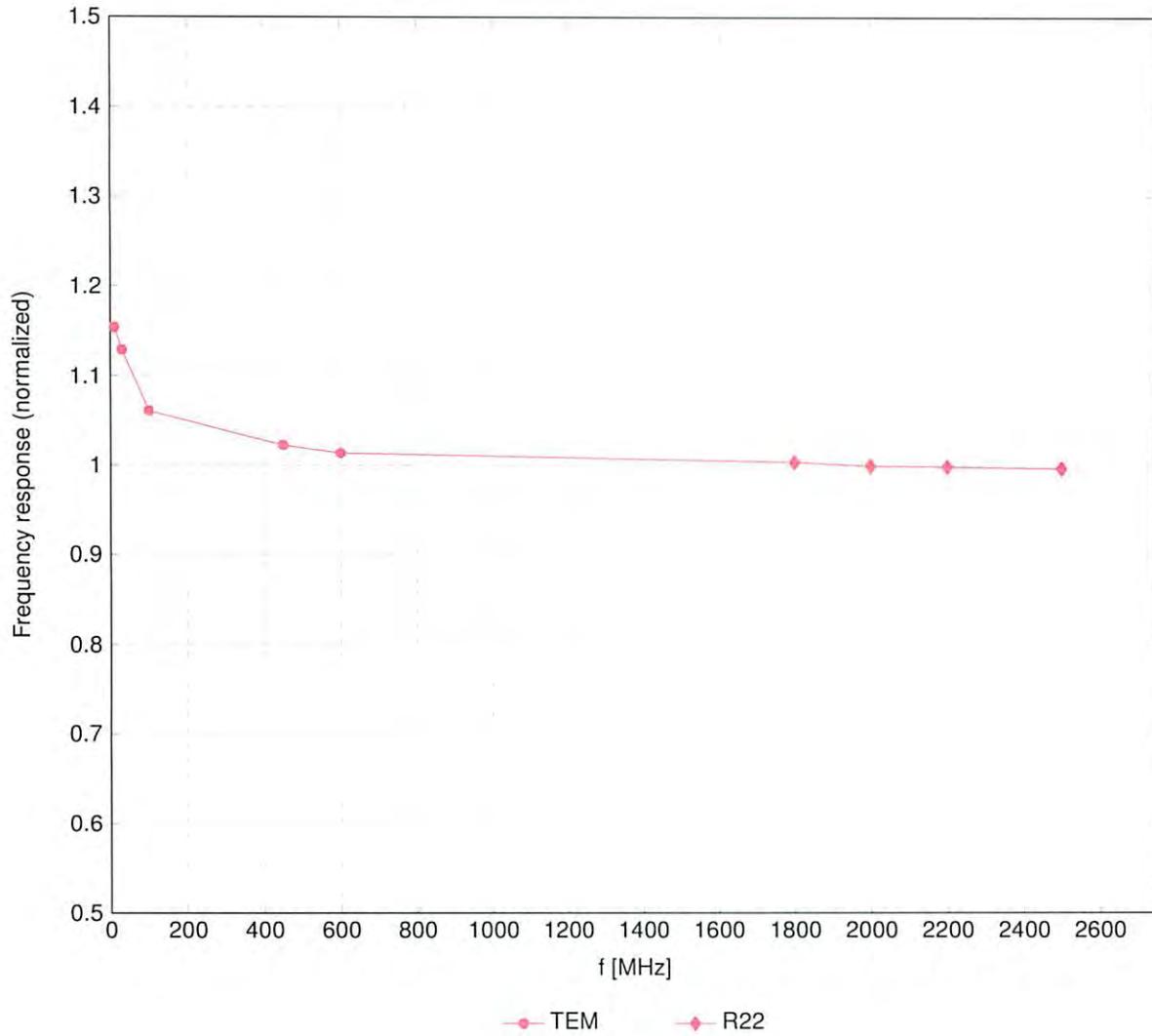
^C Frequency validity above 300 MHz of ±100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ±50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ±10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4–9 MHz, and ConvF assessed at 13 MHz is 9–19 MHz. Above 5 GHz frequency validity can be extended to ±110 MHz.

^F The probes are calibrated using tissue simulating liquids (TSL) that deviate for ϵ and σ by less than ±5% from the target values (typically better than ±3%) and are valid for TSL with deviations of up to ±10%. If TSL with deviations from the target of less than ±5% are used, the calibration uncertainties are 11.1% for 0.7 - 3 GHz and 13.1% for 3 - 6 GHz.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ±1% for frequencies below 3 GHz and below ±2% for frequencies between 3–6 GHz at any distance larger than half the probe tip diameter from the boundary.

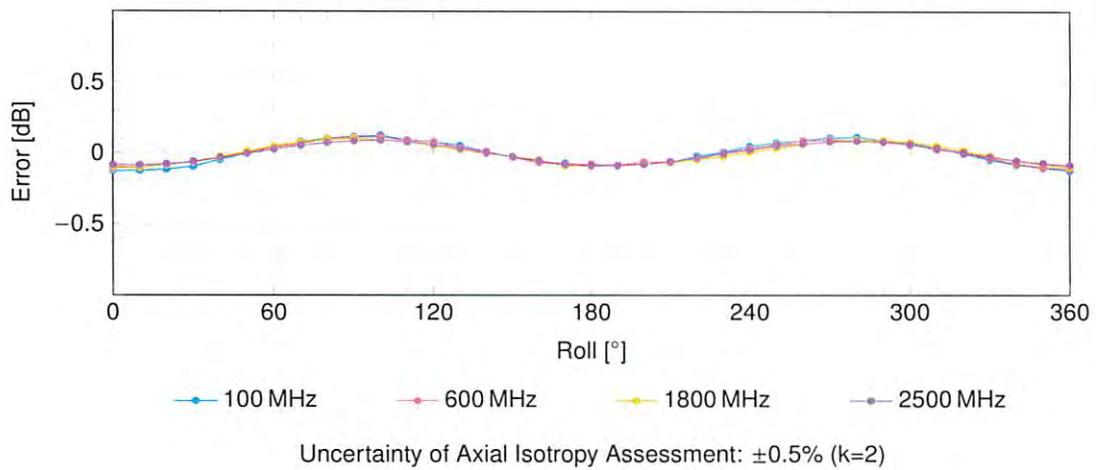
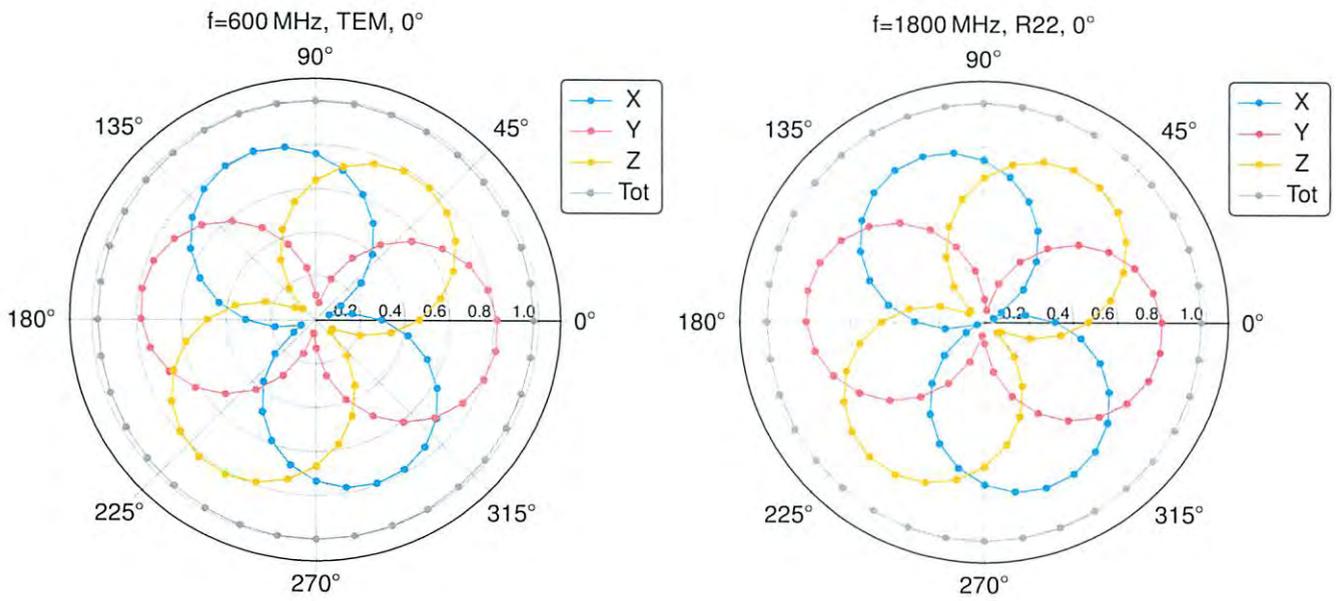
Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide:R22)



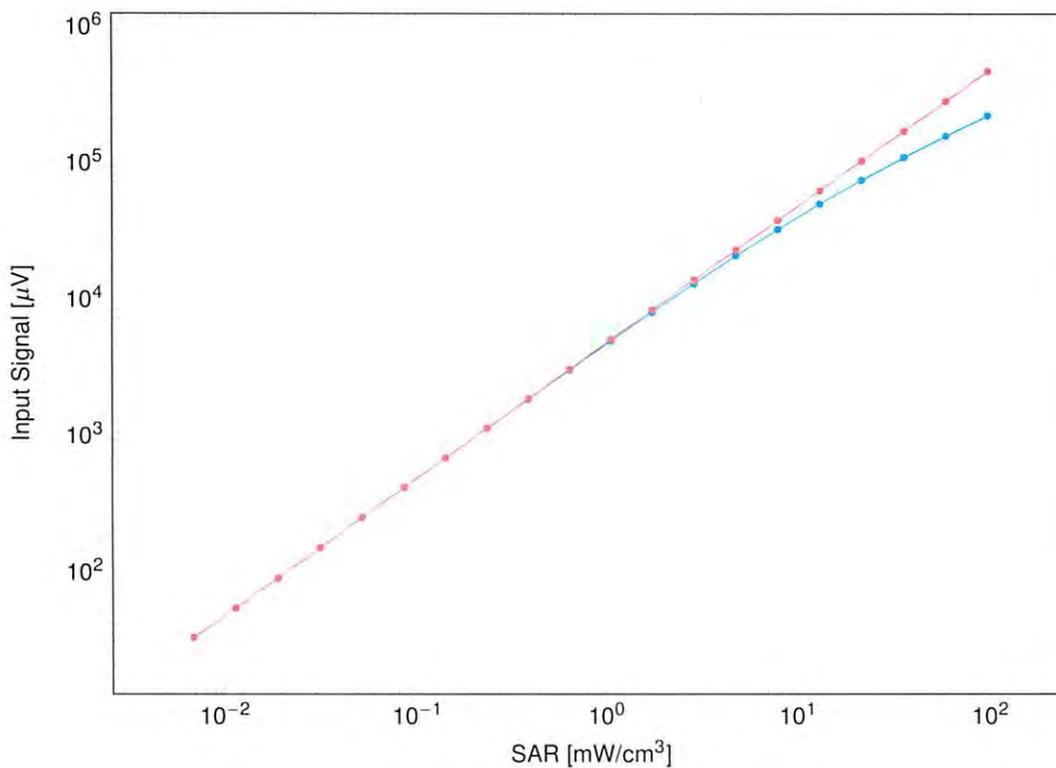
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

Receiving Pattern (ϕ), $\vartheta = 0^\circ$

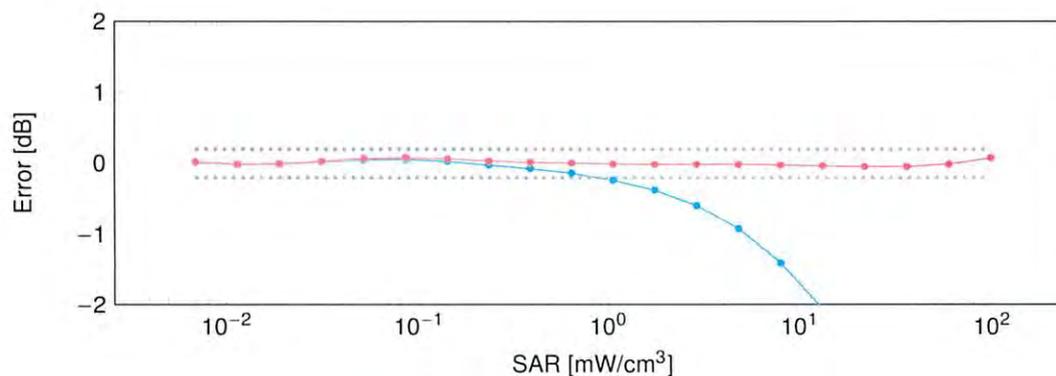


Dynamic Range f(SAR_{head})

(TEM cell, f_{eval} = 1900MHz)



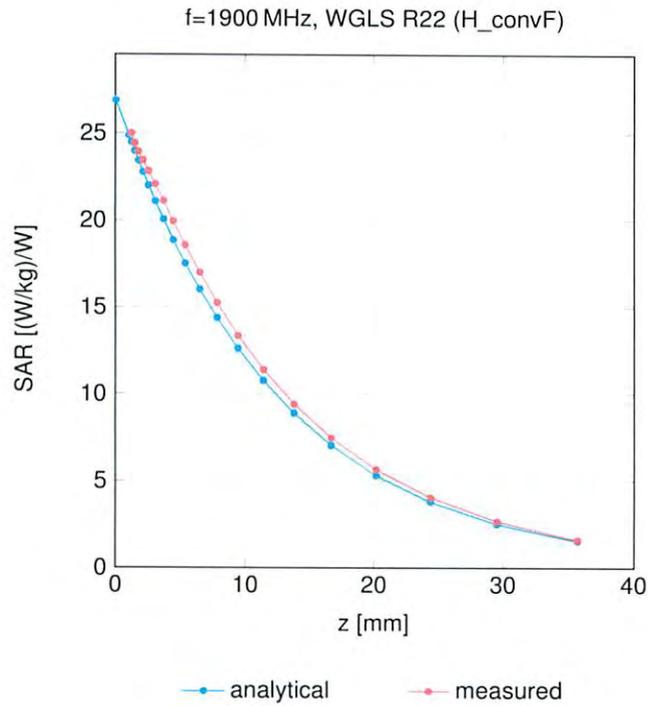
— not compensated — compensated



— not compensated — compensated

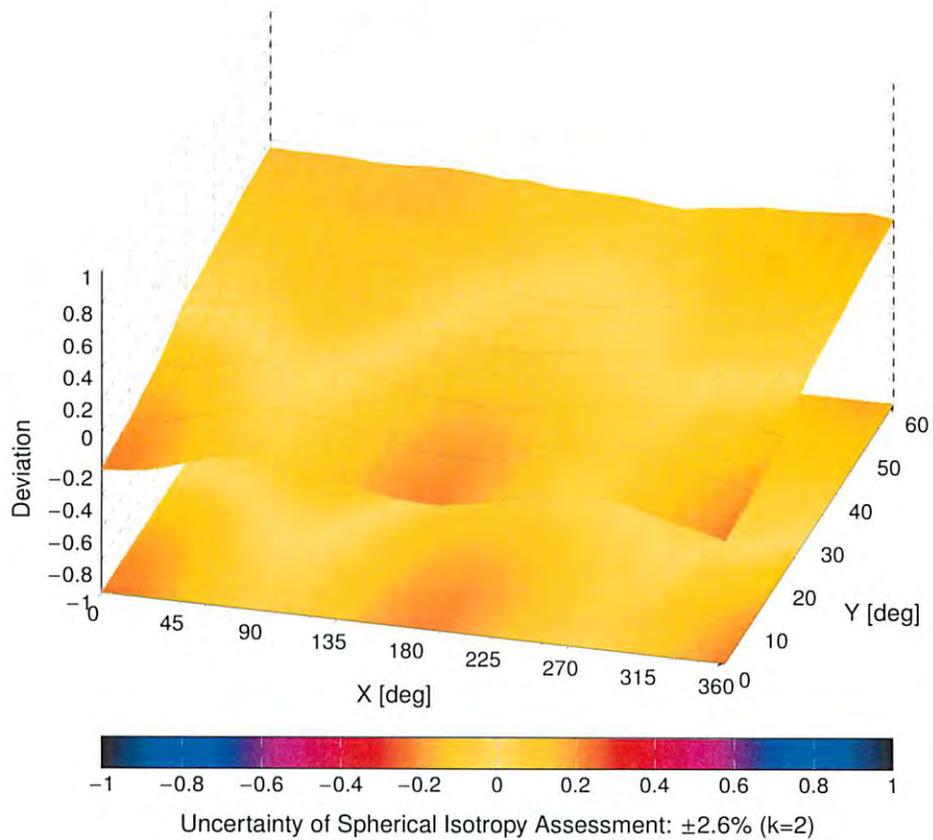
Uncertainty of Linearity Assessment: ±0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), f = 900 MHz



APPENDIX E – DIPOLE CALIBRATION

NCL CALIBRATION LABORATORIES

Calibration File No: DC-1904

Project Number: 5921

Client.: Celltech

Address: 21 – 364 Lougheed Road, Kelowna, BC V1X 7R8, Canada

CERTIFICATE OF CALIBRATION

It is certified that the equipment identified below has been calibrated in the **NCL CALIBRATION LABORATORIES** by qualified personnel following recognized procedures and using transfer standards traceable to NRC/NIST.

Validation Dipole (Head)

Manufacturer: SPEAG

Part number: D2450V2

Frequency: 2450 MHz

Serial No: 825

Calibrated: 27/04/2021

Released on: 05/05/2021

This Calibration Certificate is incomplete unless accompanied by the Calibration Results Summary

Released by: _____

Pieter Erasmus, Quality Manager

NCL Calibration Laboratories

Suite 102, 303 Terryfox Dr.
Ottawa, Ontario, K2K 3J1
Canada

Division of APREL Lab.
Tel: (613) 435-8300
Fax: (613) 435-8306

Conditions

Dipole SN 825 was a re-calibration.

Ambient Temperature of the Laboratory: 21 °C +/- 0.5°C
Temperature of the Tissue: 21 °C +/- 0.5°C

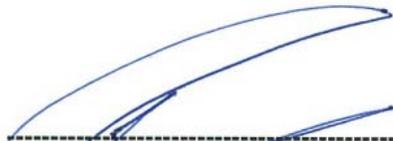
Primary Measurement Standards

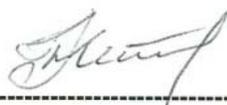
| Instrument | | Serial Number | | Cal due date |
|-------------------|----------|---------------|------------|----------------|
| Signal Generator | HP | 83640B | 3844A00689 | Sept. 17, 2022 |
| Network Analyzer | Keysight | E5063A | MY54502902 | Mar. 9, 2023 |
| Spectrum Analyzer | Keysight | N9030B | MY57140772 | Apr. 20, 2023 |

Attestation

The below named signatories have conducted the calibration and review of the data which is presented in this calibration report.

We the undersigned attest that to the best of our knowledge the calibration has been accurately conducted and that all information contained within this report has been reviewed for accuracy and any uncertainties if applicable disclosed.



Pieter Erasmus
Quality Manager

Maryna Nesterova
Test and Calibration Engineer

Calibration Results Summary

The following results relate the Calibrated Dipole and should be used as a quick reference for the user.

Tissue Validation

| Tissue | Frequency | Dielectric constant, ϵ_r | Conductivity, σ [S/m] |
|--------|-----------|-----------------------------------|------------------------------|
| Head | 2450 MHz | 40.73 | 1.86 |

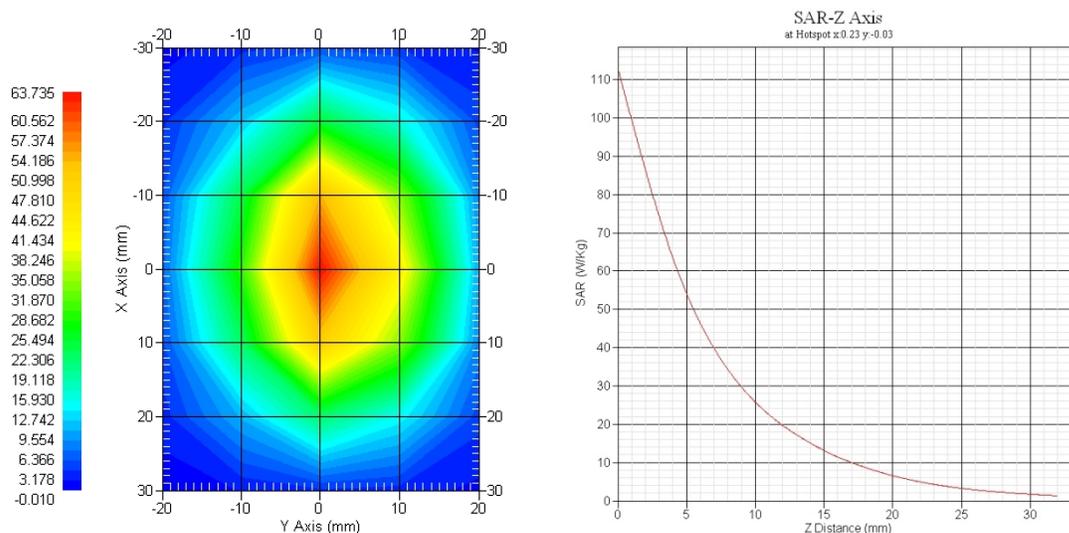
Electrical Specification

| Tissue | Frequency | Return Loss | Impedance | SWR: |
|--------|-----------|-------------|----------------|-------|
| Head | 2450 MHz | -19.83 dB | 43.26 Ω | 1.23U |

System Validation Results

| Tissue | Frequency | 1-Gram SAR | 10-Gram SAR | Uncertainty |
|--------|-----------|-------------|-------------|-------------|
| Head | 2450 MHz | 52.719 W/kg | 24.015 W/kg | 19.8% |

Head



Introduction

This Calibration Report has been produced in line with the SSI Dipole Calibration Procedure SSI-TP-018-ALSAS. The results contained within this report are for Validation Dipole SN 825. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the mechanical specifications. Step 2 was an Electrical Calibration for the Validation Dipole, where the SWR, Impedance, and the Return loss were assessed. Step 3 involved a System Validation using the ALSAS-10U, along with APREL E-020 30 MHz to 6 GHz E-Field Probe Serial Number 225.

References

- IEEE Standard 1528:2013
IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
- EN 62209-1:2016
Human Exposure to RF Fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 1: Procedure to measure the Specific Absorption Rate (SAR) for hand-held mobile wireless devices
- IEC 62209-2:2019
Human exposure to RF fields from hand-held and body-mounted wireless devices - Human models, instrumentation, and procedures - Part 2: specific absorption rate (SAR) for wireless communication devices (30 MHz - 6 GHz)
- D22-012-Tissue dielectric tissue calibration procedure
- D28-002-Dipole procedure for validation of SAR system using a dipole
- IEEE 1309 Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9 kHz to 40 GHz

Conditions

Ambient Temperature of the Laboratory: 21 °C +/- 0.5°C

Temperature of the Tissue: 21 °C +/- 0.5°C

Dipole Calibration uncertainty

The calibration uncertainty for the dipole is made up of various parameters presented below.

| | Tolerance, % |
|--------------------------------------|--------------|
| Mechanical | 2.00 |
| Positioning Error | 0.10 |
| Electrical | 0.37 |
| Tissue Permittivity | 3.88 |
| Tissue Conductivity | 3.56 |
| Dipole Validation | 1.70 |
| Combined Uncertainty, k=2 | 4.81 |

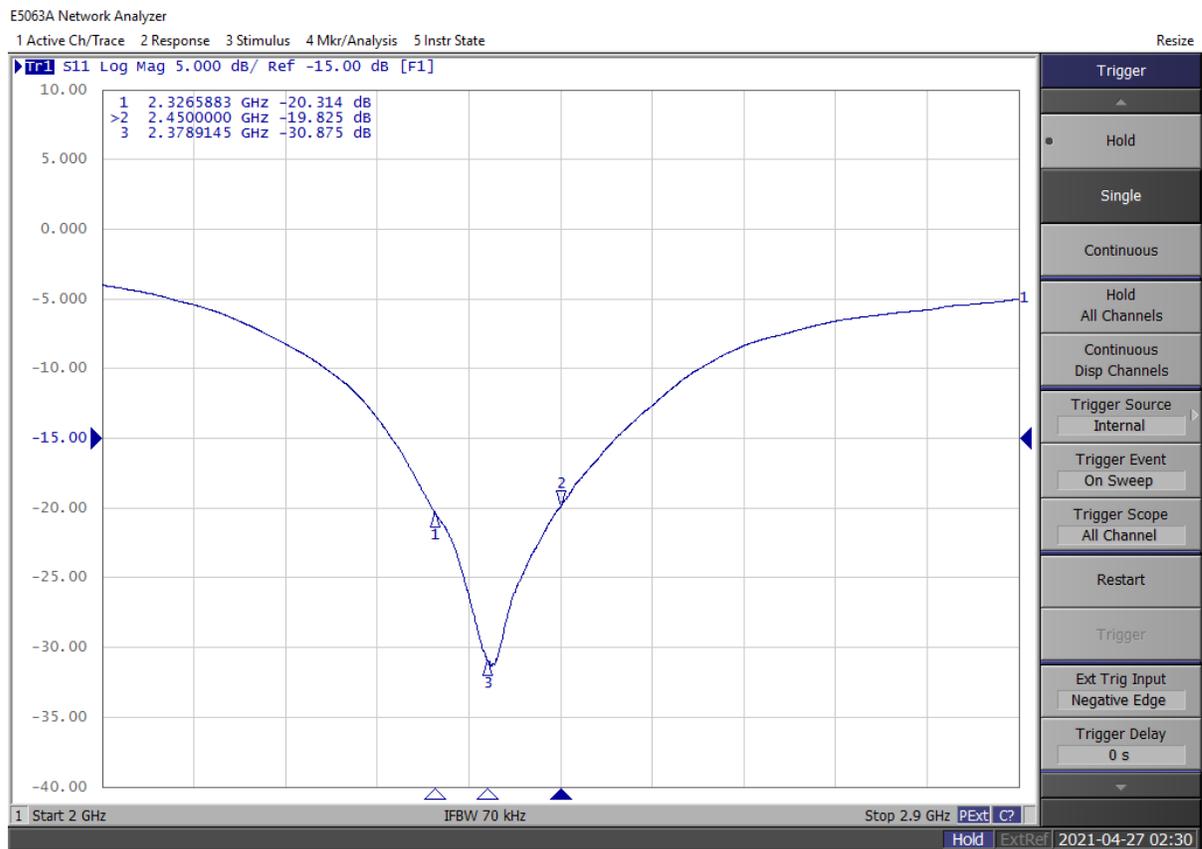
The Following Graphs are the results as displayed on the Vector Network Analyzer.
Electrical Calibration

| Test | Head |
|-----------|----------------|
| S11 R/L | -19.83 dB |
| Impedance | 43.26 Ω |
| SWR | 1.23 U |

S11 Parameter Return Loss

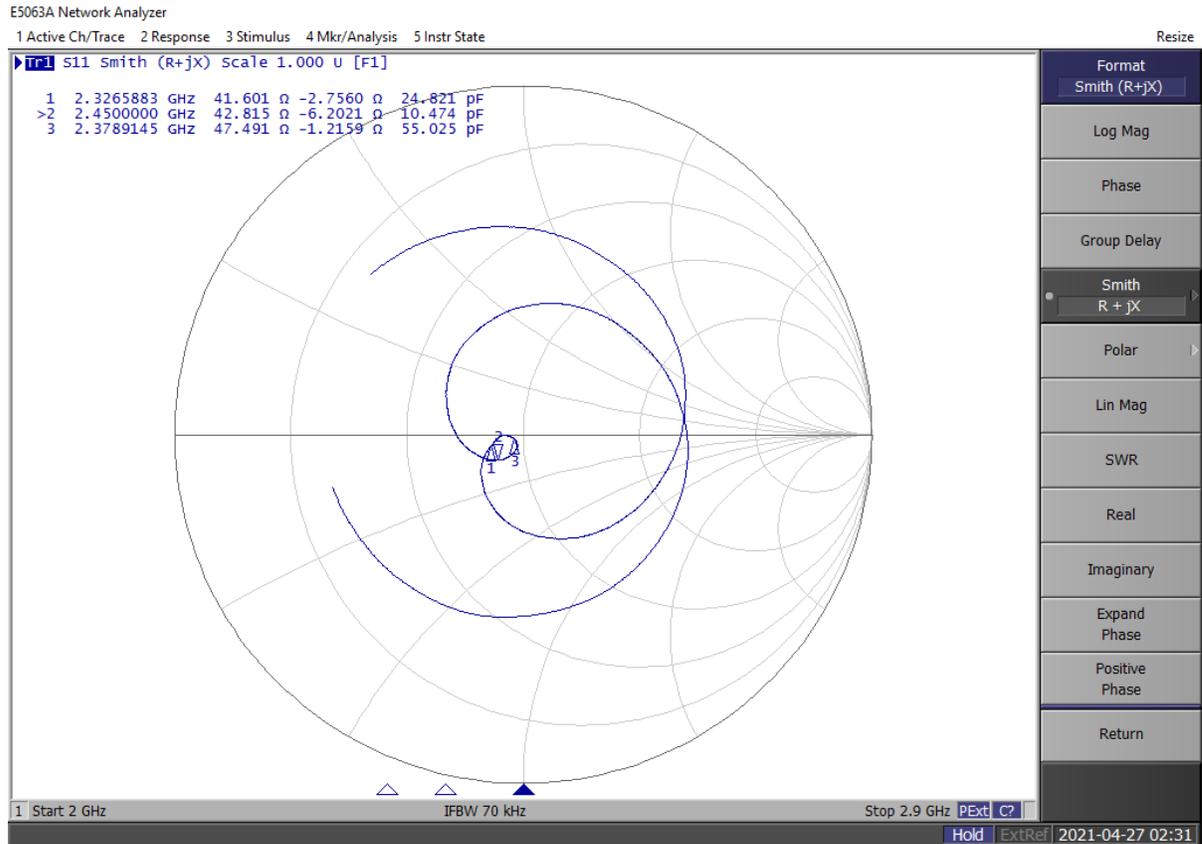
Head

Frequency Range 2326.59 MHz to 2450 MHz



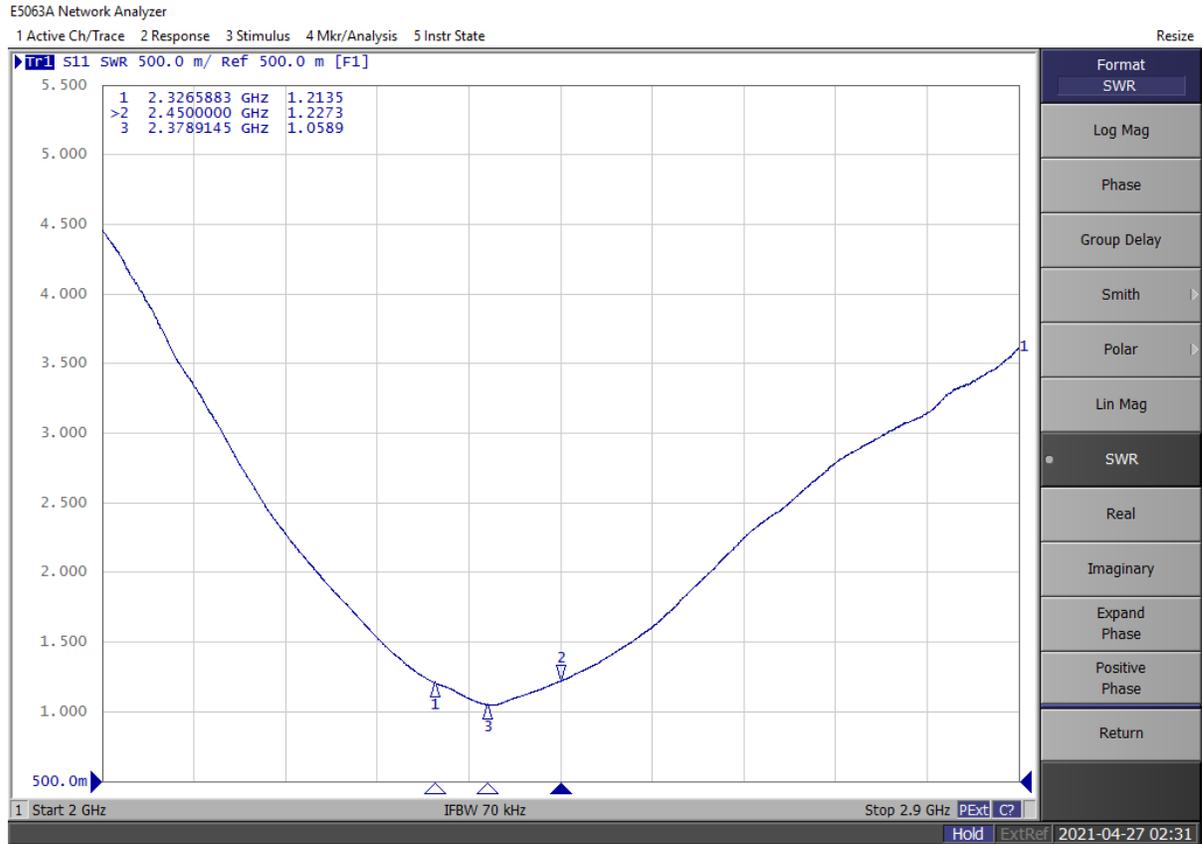
Smith Chart Dipole Impedance

Head



SWR

Head



APPENDIX F - PHANTOM

Certificate of conformity / First Article Inspection

| | |
|-----------------------|---|
| Item | Triple Modular Flat Phantom V5.1 |
| Type No | QD 000 P51 C |
| Series No | 1100 and higher |
| Manufacturer / Origin | Untersee Composites Knebelstrasse 8, CH-8268 Mannenbach, Switzerland |

Tests

The sub-units of item 1100 are identified with the designation 1100/1, 1100/2 and 1100/3. Tests were conducted on all 3 sub-units of this phantom.

| Test | Requirement | Details | Units tested |
|----------------------|--|---|--------------------|
| Material thickness | Compliant with the standard requirements. | 2 mm +/- 0.2 mm 30 points over the bottom area | all |
| Material parameters | Dielectric parameters for required frequencies | 200 MHz – 6 GHz - Relative permittivity 3 - 5 Loss tangent < 0.05. | Material sample |
| Material resistivity | The material is compatible with the liquids defined in the standards if handled and cleaned according to the instructions. | DGBE based simulating liquids. Observe Technical Note for material compatibility. | Material Samples |
| Shape | Internal dimensions | Internal height: > 175 mm Bottom internal length: 280 mm Bottom internal width: 175 mm Nominal filling height: 155 mm Nominal volume: 9.2 l | Pre-series, design |
| Sagging | Depending on standard | No initial sagging (negative preshaped, change < 0.5 mm) | 1100/2 |

Standards

- [1] IEEE 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- [2] IEC 62209 – 1, "Specific Absorption Rate (SAR) in the frequency range of 300 MHz to 3 GHz – Measurement Procedure, Part 1: Hand-held mobile wireless communication devices", February 2005
- [3] IEC 62209 – 2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation and Procedures, Part 2: Procedure to determine the Specific Absorption Rate (SAR) for ... including accessories and multiple transmitters", March 2010
- [4] KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Conformity

Based on the dimensions and sample tests above, we certify that this item is in compliance with the standards [1] to [4] for frequencies > 700 MHz, if operated according to the specific requirements.

Date 16.07.2015

Signature / Stamp

s p e a g

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