



ISRAEL TESTING LABORATORIES  
Global Certifications You Can Trust



**Date: 21 January 2024**

**I.T.L. Product Testing Ltd.**

**FCC/ISED Radio Test Report**

for

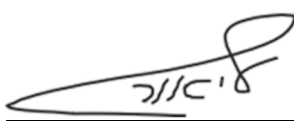
**Orpak Systems Ltd.**


**Equipment under test:**

**Data Unit**

**DataPass**

FCC ID: W8F800907300

Tested by:   
L. Tenenbaum

Approved by:   
M. Zohar

This report must not be reproduced, except in full, without the written permission of  
I.T.L. Product Testing Ltd. This report relates only to items tested.



This report concerns:	Original Grant
Equipment type:	FCC: Digital Transmission System (DTS) IC: Spread Spectrum Digital Device (2400-2483.5)
Limits used:	47CFR15 Section 15.247 RSS-247, Issue 3, August 2023, Section 5 RSS-Gen, Issue 5, April 2018
Measurement procedure used:	KDB 558074 D01 v03r05, ANSI C63.10:2013 and RSS-Gen, Issue 5, April 2018

**Prepared by:**

R. Ezra  
I.T.L. Product Testing Ltd.  
3 Ha'oreg Street, Modi'in Maccabim  
Reut 7177909, Israel  
Email: rame@itlglobal.org

**Applicant:**

Yair Elul  
Orpak Systems Ltd.  
31 Lechi St., Bnei Brak 5111401, Israel  
Email: yairelul@orpak.com



## Table of Contents

<b>1</b>	<b>General Information -----</b>	<b>5</b>
1.1	Administrative Information .....	5
1.2	List of Accreditations .....	5
1.3	Product Description .....	6
1.4	Test Methodology .....	6
1.5	Measurement Uncertainty .....	7
<b>2</b>	<b>System Test Configuration -----</b>	<b>8</b>
2.1	Justification .....	8
2.2	EUT Exercise Software .....	8
2.3	Special Accessories .....	8
2.4	Equipment Modifications .....	8
2.5	Configuration of Tested System .....	8
<b>3</b>	<b>Setup Photos -----</b>	<b>9</b>
<b>4</b>	<b>Maximum Conducted Output Power -----</b>	<b>9</b>
4.1	Test Specification .....	9
4.2	Test Procedure .....	9
4.3	Test Limit .....	9
4.4	Test Results .....	9
4.5	Test Equipment Used; Maximum Conducted Output Power .....	13
<b>5</b>	<b>6 dB Minimum Bandwidth -----</b>	<b>14</b>
5.1	Test Specification .....	14
5.2	Test Procedure .....	14
5.3	Test Limit .....	14
5.4	Test Results .....	14
5.5	Test Equipment Used; 6dB Bandwidth .....	16
<b>6</b>	<b>Band Edge Spectrum -----</b>	<b>17</b>
6.1	Test Specification .....	17
6.2	Test Procedure .....	17
6.3	Test Limit .....	17
6.4	Test Results .....	17
6.5	Test Equipment Used; Band Edge .....	19
<b>7</b>	<b>Transmitted Power Density -----</b>	<b>20</b>
7.1	Test Specification .....	20
7.2	Test Procedure .....	20
7.3	Test Limit .....	20
7.4	Test Results .....	20
7.5	Test Equipment Used; Transmitted Power Density .....	22
<b>8</b>	<b>Occupied Bandwidth -----</b>	<b>23</b>
8.1	Test Specification .....	23
8.2	Test Procedure .....	23
8.3	Test Limit .....	23
8.4	Test Results .....	23
8.5	Test Equipment Used; Occupied Bandwidth .....	26
<b>9</b>	<b>Emissions in Non-Restricted Frequency Bands -----</b>	<b>27</b>
9.1	Test Specification .....	27
9.2	Test Procedure .....	27
9.3	Test Limit .....	27
9.4	Test Results .....	27
9.5	Test Instrumentation Used, Emission in Non- Restricted Frequency Bands .....	27
9.6	Field Strength Calculation .....	28



<b>10</b>	<b>Emissions in Restricted Frequency Bands</b>	<b>29</b>
10.1	Test Specification	29
10.2	Test Procedure	29
10.3	Test Limits	29
10.4	Test Results	30
10.5	Test Instrumentation Used; Emissions in Restricted Frequency Bands	32
<b>11</b>	<b>Appendix A - Correction Factors</b>	<b>33</b>



# 1 General Information

## 1.1 Administrative Information

Manufacturer: Orpak Systems Ltd.  
Manufacturer's Address: 31 Lechi St., Bnei Brak 5111401, Israel  
Equipment Under Test (E.U.T): Data Unit  
Equipment Model No.: DataPass  
Equipment Serial No.: N/A  
Date of Receipt of E.U.T: 1 Feb. 2023  
Start of Test: 1 Feb. 2023  
End of Test: 26 Oct. 2023  
Test Laboratory Location: I.T.L Product Testing Ltd.  
3 Ha'oreg Street, Modi'in Maccabim Reut  
7177909, Israel  
Test Specifications: FCC Part 15, Subpart C  
RSS-247, Issue 3, August 2023, Section 5  
RSS-Gen, Issue 5, April 2018

## 1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), FCC Designation No. IL1005.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.



### 1.3 Product Description

The EUT is a device intended for installation in vehicles. It is connected by wires to the vehicle bus/power lines and collects accurate data from the vehicle computer via either the CAN or the K-Line and transmits it via 2.4GHz Zigbee interface to Orpak's Wireless Gateway Terminals (WGT).

<b>Type of Equipment</b>							
<input checked="" type="checkbox"/>	Stand Alone (Equipment with/without its own control provisions)						
<input type="checkbox"/>	Combined (Equipment where radio part is fully integrated with another type of equipment)						
<input type="checkbox"/>	Plug in card (Equipment intended for a variety of host systems)						
<b>Intended Use</b>				<b>Condition of use</b>			
<input type="checkbox"/>	Fixed			Always of distance >2m from the people			
<input checked="" type="checkbox"/>	Mobile			Always of distance >20cm from the people			
<input type="checkbox"/>	Portable			Always of distance <20cm to human body			
<b>Assigned frequency band</b>				2400MHz – 2485MHz			
<b>Operational frequencies</b>				2400MHz – 2485MHz			
<b>Maximum rated output power</b>				At transmitter 50Ω RF output connector [dBm]			
				Effective Radiated Power (for equipment without RF connector)		9dBm Include antenna gain	
<b>Antenna Connection</b>							
<input type="checkbox"/>	Unique Coupling	<input type="checkbox"/>	Standard Connection	<input checked="" type="checkbox"/>	Integral	<input type="checkbox"/>	With temporary RF connector
						<input checked="" type="checkbox"/>	Without temporary RF connector
<b>Antenna Gain (peak)</b>				3.3dBi			
<b>Operating channel bandwidth</b>				2MHz			
<b>Type of modulation</b>				OFDM			
<b>Bit rate</b>				250K			
<b>Maximum transmitter duty cycle</b>				10%			
<b>Transmitter power source</b>							
<input type="checkbox"/>	AC			Nominal rated voltage			
<input checked="" type="checkbox"/>	DC			Nominal rated voltage			
<input type="checkbox"/>	Battery			Nominal rated voltage			
<b>Receiver Class</b>							
<b>Temperature and Voltage extreme condition</b>				-40°C to +70°C, 9V – 32V			

### 1.4 Test Methodology

Testing was performed according to the procedures in KDB 558074 D01 v03r05, ANSI C63.10: 2013 and RSS-Gen, Issue 5, April 2018. Radiated testing was performed at an antenna to EUT distance of 3 meters.



## **1.5 Measurement Uncertainty**

### **1.5.1 Conducted Emission**

Conducted Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4)

0.15 – 30 MHz:

Expanded Uncertainty (95% Confidence, K=2):  $\pm 3.44$  dB

### **1.5.2 Radiated Emission**

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4):

30-1000MHz:

Expanded Uncertainty (95% Confidence, K=2):  $\pm 4.96$  dB

1 GHz to 6 GHz

Expanded Uncertainty (95% Confidence, K=2):  $\pm 5.19$  dB

>6 GHz

Expanded Uncertainty (95% Confidence, K=2):  $\pm 5.51$  dB

## 2 System Test Configuration

### 2.1 Justification

1. The E.U.T contains an IEEE 802.15.1, 2.4GHz Zigbee transceiver.
2. The EUT was evaluated while transmitting at the low channel (2402MHz), the mid channel (2440MHz) and the high channel (2480MHz).
3. The evaluation was performed while the E.U.T was connected to an AC/DC adapter via laptop in charge mode as the “worst case”.
4. Final radiated emission tests were performed after exploratory emission testing that was performed in three orthogonal polarities to determine the “worst case” radiation.
5. According to screening results below, the “worst case” was the X axis.

Frequency	Field Strength	2 <sup>nd</sup> Harmonic	3 <sup>rd</sup> Harmonic	Band Edge
(MHz)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)
2405.0	94.5	61.8	56.1	51.5
2440.0	96.4	60.6	57.5	-
2480.0	95.6	57.8	56.2	63.5

Figure 1. Screening Results

### 2.2 EUT Exercise Software

No special exercise software was used.

### 2.3 Special Accessories

No special accessory was used.

### 2.4 Equipment Modifications

No modifications were necessary in order to achieve compliance.

### 2.5 Configuration of Tested System



Figure 2. Configuration of Tested System



### 3 Setup Photos

See a separate file.

## 4 Maximum Conducted Output Power

### 4.1 Test Specification

FCC, Part 15, Subpart C, Section 247(b)(3)

RSS-247, Section 5.4(d)

### 4.2 Test Procedure

(Temperature (22°C)/ Humidity (70%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested in the chamber, placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization. The emissions were measured at a distance of 3 meters.

Radiated output power levels were measured at selected operation frequencies and the results were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} \text{ [W]}$$

E - Field Strength (V/m)

d – Distance from transmitter (m)

G – Antenna gain

P – Peak power (W)

### 4.3 Test Limit

The maximum peak conducted output power of the intentional radiator for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

### 4.4 Test Results

Complies.

Operation Frequency	Pol.	Field Strength	EIRP	Ant. Gain <sup>1</sup>	Power	Power	Limit	Margin
(MHz)	(V/H)	(dBuV/m)	(dBm)	(dBi)	(dBm)	(mW)	(mW)	(mW)
2402	V	98.0	2.8	3.3	-0.50	0.9	1000.0	-999.10
	H	97.5	2.3	3.3	-1.00	0.8	1000.0	-999.20
2440	V	98.1	2.9	3.3	-0.40	0.9	1000.0	-999.10
	H	97.5	2.3	3.3	-1.00	0.8	1000.0	-999.20

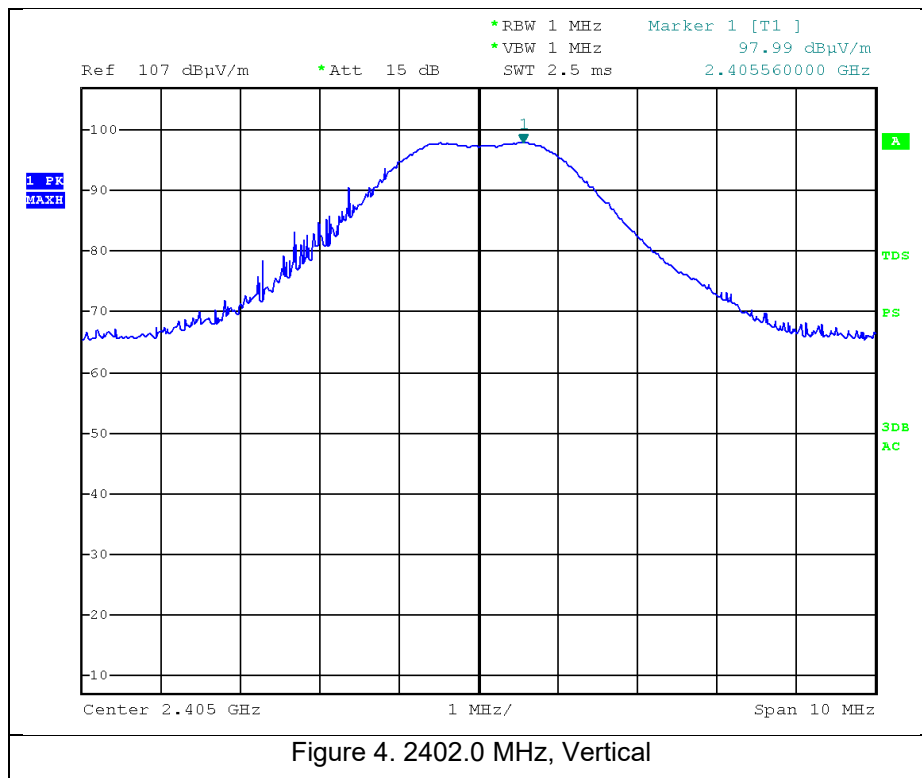
<sup>1</sup> Provided by the customer. I.T.L. Product Testing Ltd. is not responsible for its validity or accuracy.



Operation Frequency	Pol.	Field Strength	EIRP	Ant. Gain <sup>1</sup>	Power	Power	Limit	Margin
(MHz)	(V/H)	(dBuV/m)	(dBm)	(dBi)	(dBm)	(mW)	(mW)	(mW)
2480	V	96.2	1.0	3.3	-2.3	0.6	1000.0	-999.40
	H	98.3	3.1	3.3	-0.2	0.9	1000.0	-999.10

Figure 3 Maximum Peak Power Output

For additional information see the next figures.



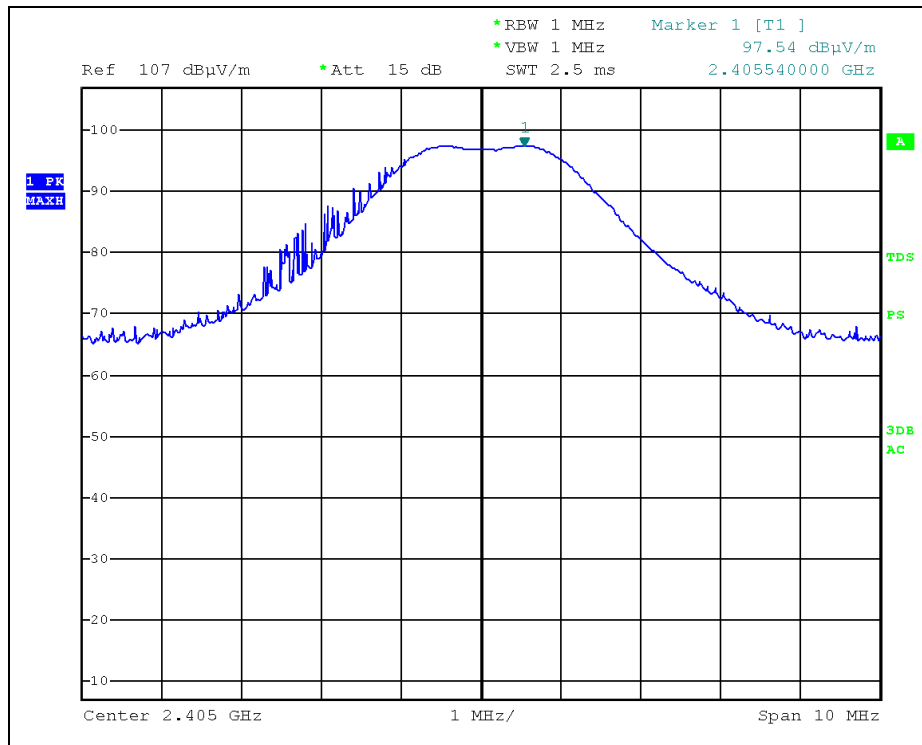


Figure 5. 2402.0 MHz, Horizontal

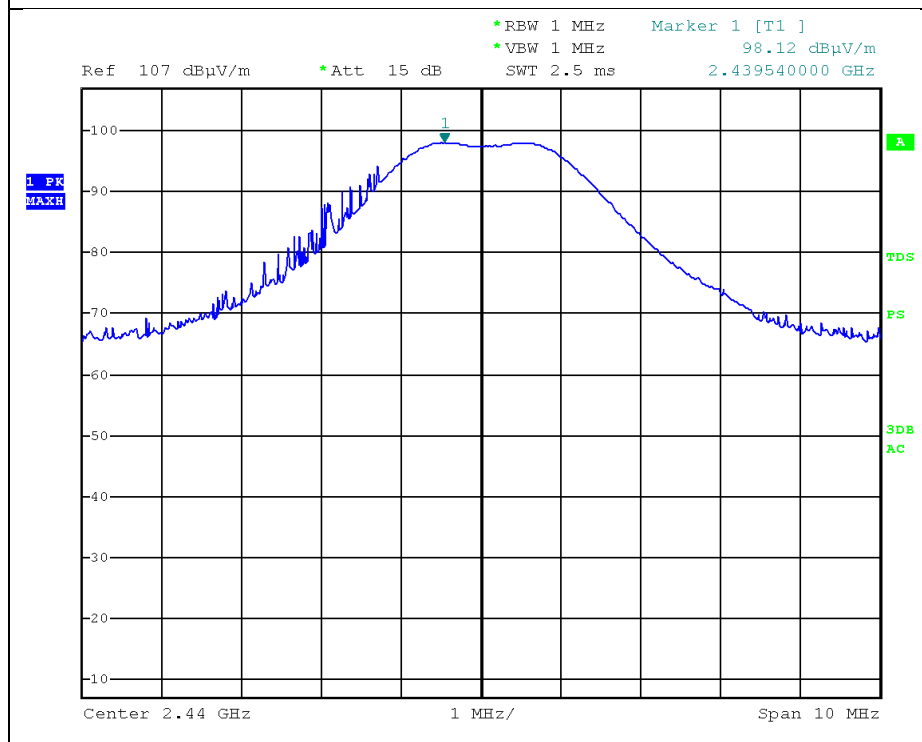


Figure 6. 2440.0 MHz, Vertical

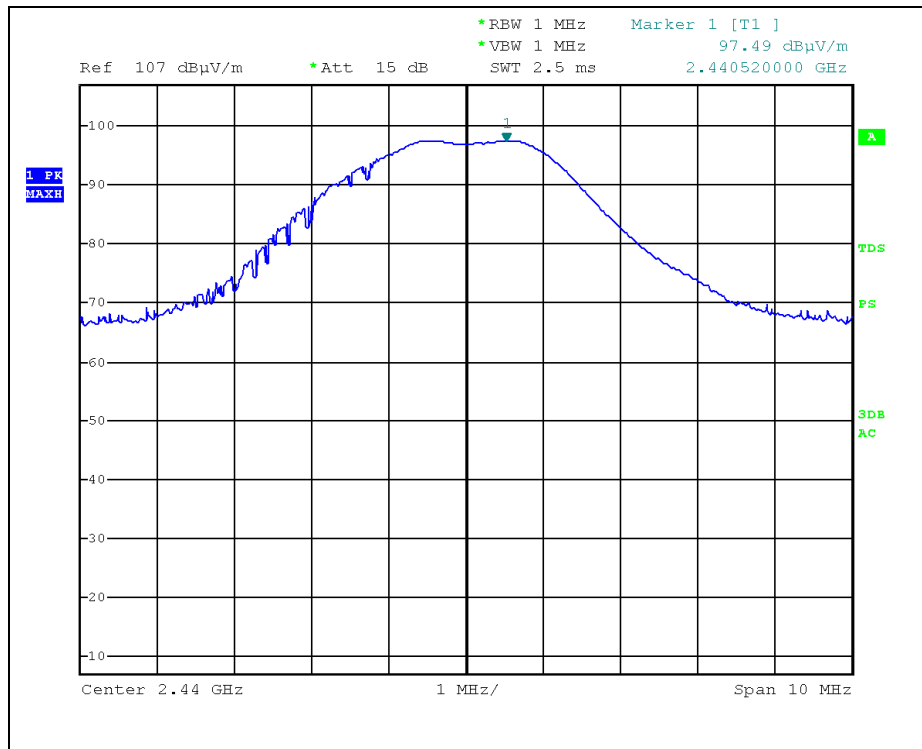


Figure 7. 2440.0 MHz, Horizontal

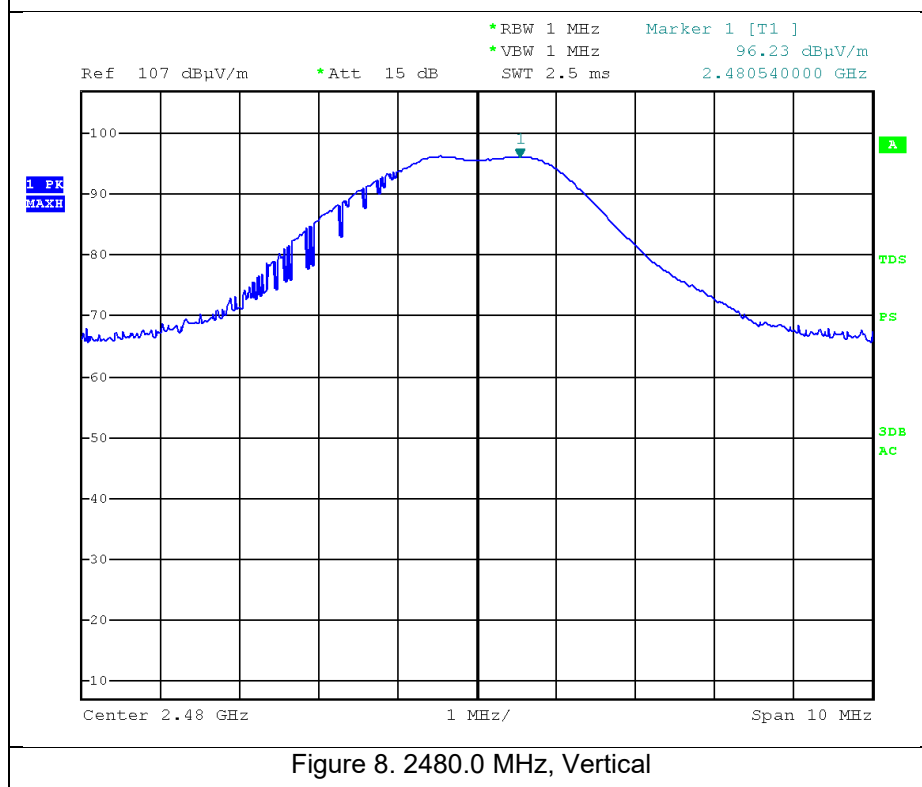
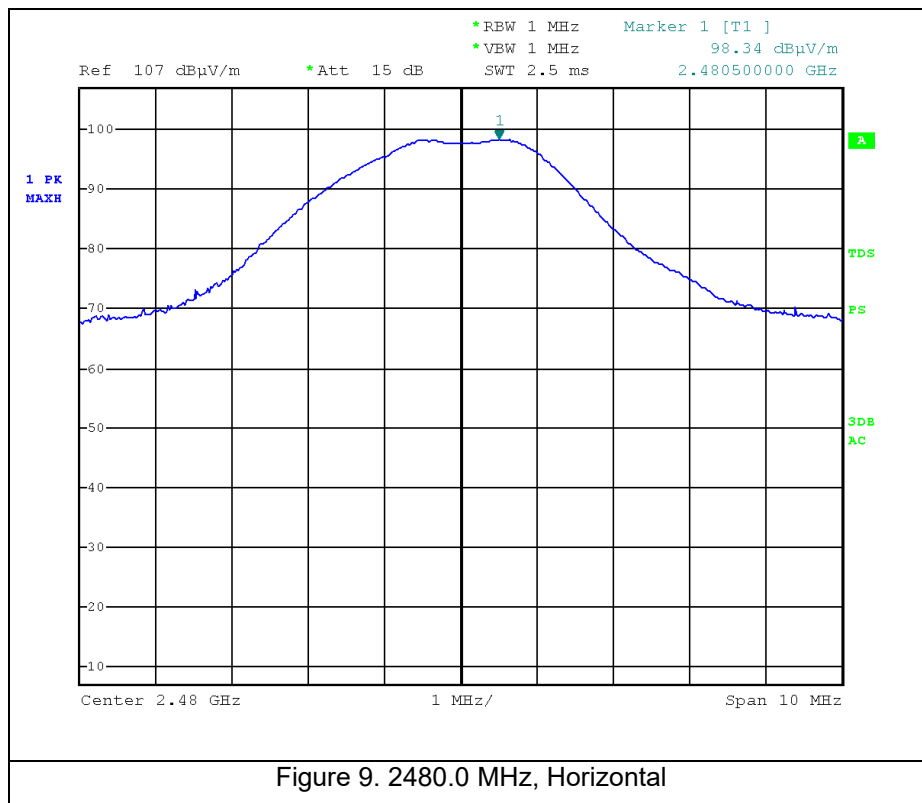


Figure 8. 2480.0 MHz, Vertical



#### 4.5 Test Equipment Used; Maximum Conducted Output Power

I.T.L. #	Instrument	Manufacturer	Model	Serial No.	Last Cal.	Cal. Due
1507	EMI Test Receiver	Rohde & Schwarz	ESCI7	100724	Feb 20, 2023	Feb 20, 2024
1352	Horn Antenna	ETS	3115	29845	Oct 19, 2023	Oct 19, 2026
1778	Antenna Cable for KA Band	OSR Electronics	37297C KPS	1503-590 (05032006)	Aug 9, 2023	Aug 9, 2024
2210	Semi Anechoic Chamber	Frankonia Group	SAC-3	-	May 30, 2023	May 30, 2024

Figure 10 Test Equipment Used



## 5 6 dB Minimum Bandwidth

### 5.1 Test Specification

FCC Part 15, Subpart C, Section 247(a)(2)

RSS-247, Section 5.2(a)

### 5.2 Test Procedure

(Temperature (22°C)/ Humidity (61%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested in the chamber and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The emissions were measured at a distance of three meters.

The spectrum bandwidth of the E.U.T. at the point of 6 dB below maximum peak power was measured and recorded. The RBW was set to 100 kHz.

### 5.3 Test Limit

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.

### 5.4 Test Results

Complies.

Operation Frequency (MHz)	Reading (kHz)	Limit (kHz)
2405.0	1340	>500.0
2440.0	1580	>500.0
2480.0	1580	>500.0

Figure 11 6 dB Minimum Bandwidth

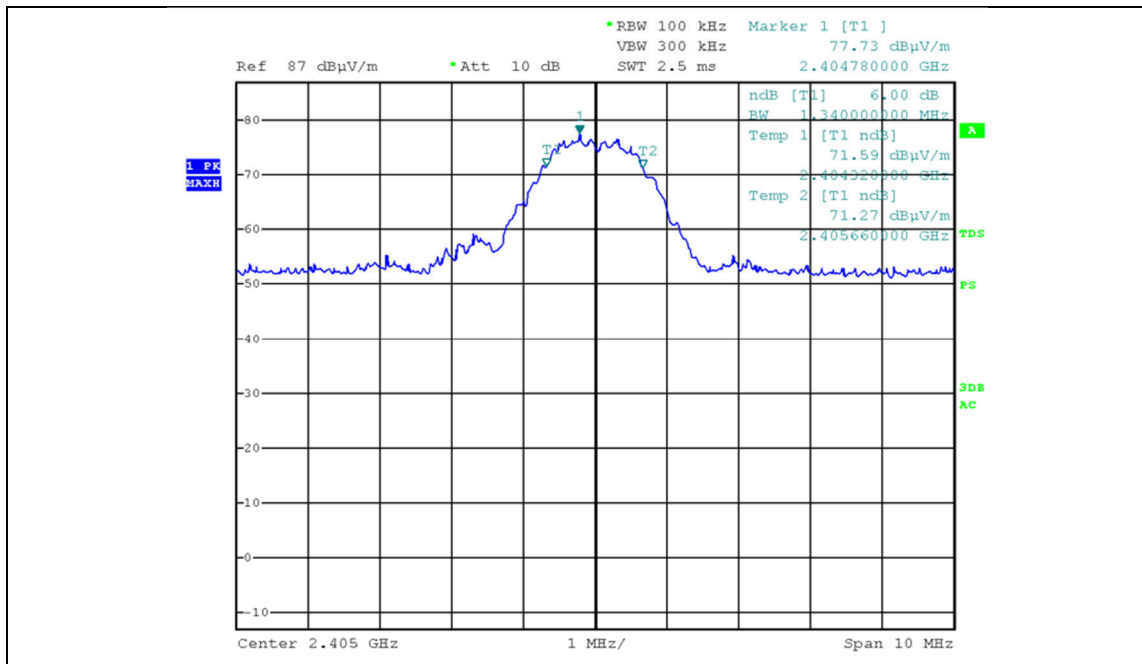


Figure 12. 2405.0 MHz

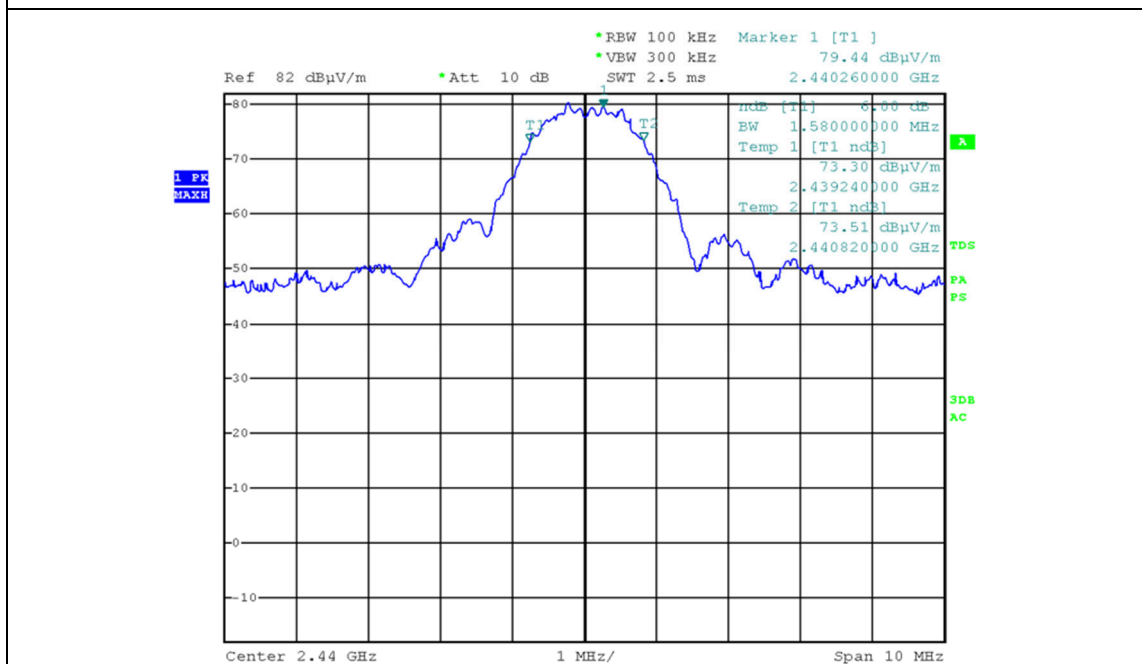
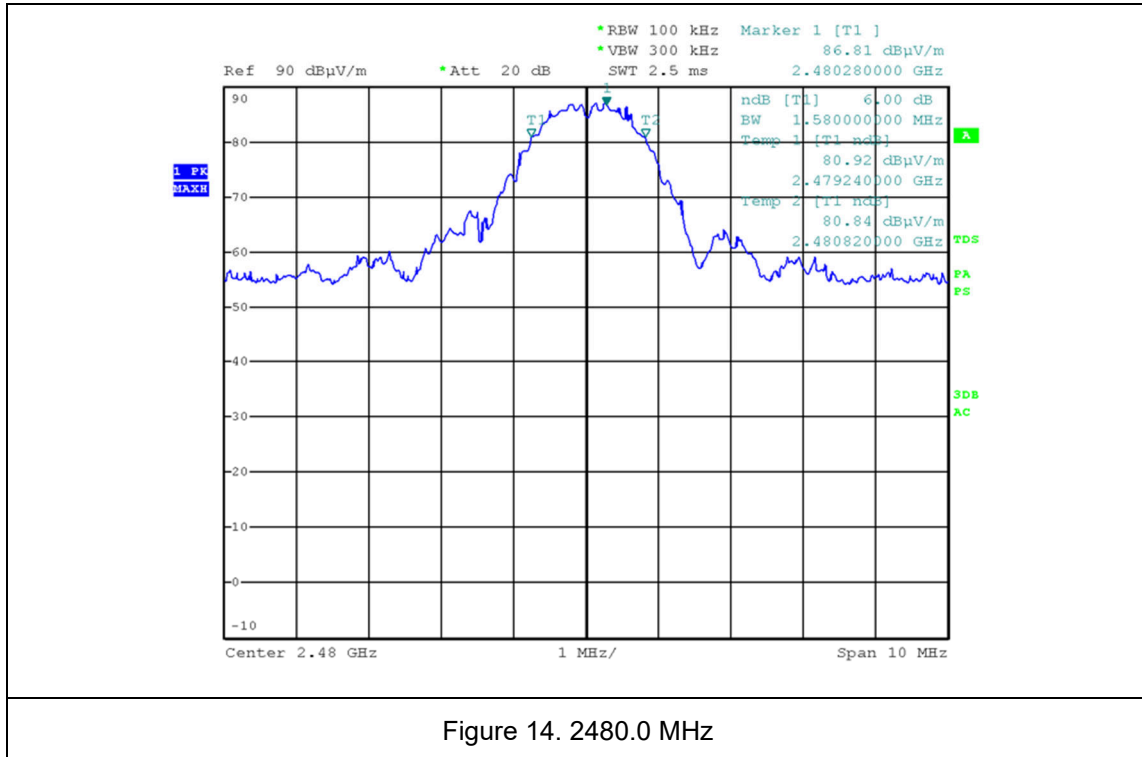


Figure 13. 2440.0 MHz



## 5.5 Test Equipment Used; 6dB Bandwidth

ITL #	Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
1507	EMI Test Receiver	Rohde & Schwarz	ESCI7	100724	Feb 20, 2023	Feb 20, 2024
1352	Horn Antenna	ETS	3115	29845	Oct 19, 2023	Oct 19, 2026
1778	Antenna Cable for KA Band	OSR Electronics	37297C KPS	1503-590 (05032006)	Aug 9, 2023	Aug 9, 2024
2210	Semi Anechoic Chamber	Frankonia Group	SAC-3	-	May 30, 2023	May 30, 2024

Figure 15 Test Equipment Used



## 6 Band Edge Spectrum

### 6.1 Test Specification

FCC, Part 15, Subpart C, Section 247(d)

RSS-247, Section 5.5

### 6.2 Test Procedure

(Temperature (20°C)/ Humidity (59%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested in the chamber, placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization. The emissions were measured at a distance of three meters.

The RBW was set to 100 kHz.

### 6.3 Test Limit

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.

### 6.4 Test Results

Complies.

Operation Frequency	Band Edge Frequency	Spectrum Level	Limit	Margin
(MHz)	(MHz)	(dBuV/m)	(dBuV/m)	(dB)
2405.0	2400.0	48.3	55.1	-6.8
2480.0	2483.5	51.1	67.3	-16.2

Figure 16 Band Edge Spectrum

For additional information see the next figures.

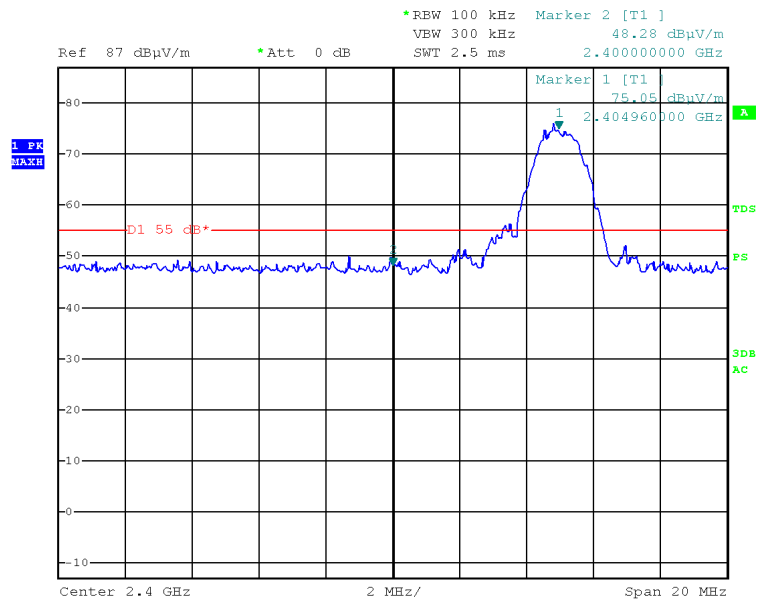


Figure 17 Band Edge Low

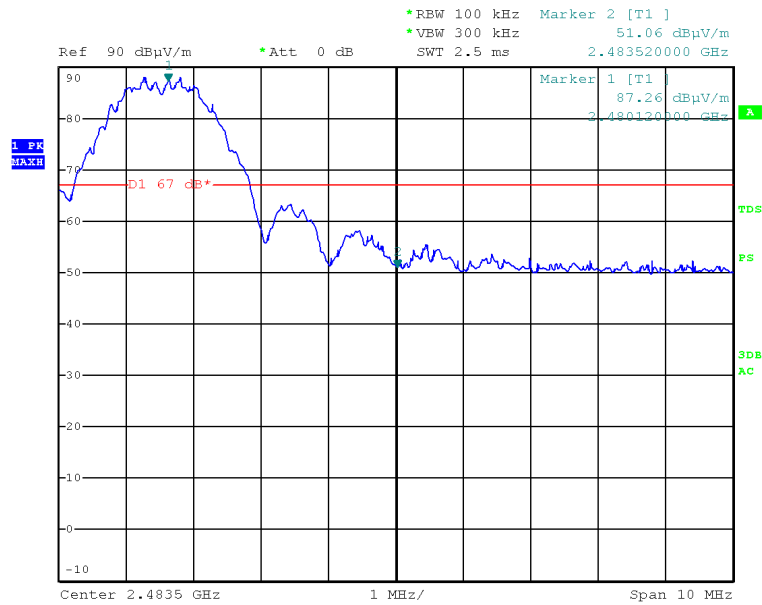


Figure 18 Band Edge High



## 6.5 Test Equipment Used; Band Edge

ITL #	Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
1507	EMI Test Receiver	Rohde & Schwarz	ESCI7	100724	Feb 20, 2023	Feb 20, 2024
1366	Horn Antenna	EMCO	3115	9702-511	Oct 18, 2023	Oct 18, 2025
1778	Cable for KA Band Antenna	OSR Electronics (Serge)	37297C KPS	1503-590 (05032006)	Aug 9, 2023	Aug 9, 2024
2210	Semi Anechoic Chamber	Frankonia Group	SAC-3	-	May 30, 2023	May 30, 2024

Figure 19 Test Equipment Used

## 7 Transmitted Power Density

### 7.1 Test Specification

FCC, Part 15, Subpart C, Section 247(e)

RSS-247, Section 5.2(b)

### 7.2 Test Procedure

(Temperature (22°C)/ Humidity (70%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested in the chamber, and placed on a remote-controlled turntable.

The E.U.T was placed on a non-metallic table, 1.5 meters above the ground.

The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The emissions were measured at a distance of 3 meters.

The spectrum analyzer was set to 3 kHz RBW and VBW to 10 kHz.

Radiated output power levels were measured at selected operation frequencies and the results were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} \text{ [W]}$$

E - Field Strength (V/m)

d – Distance from transmitter (m)

G – Antenna gain

P – Peak power (W)

### 7.3 Test Limit

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.

### 7.4 Test Results

Complies.

Operation Frequency	Reading Spectrum Analyzer	Reading Spectrum Analyzer	Limit	Margin
(MHz)	(dBμV/m)	(dBm)	(dBm)	(dB)
2405.0	88.99	-6.21	8.0	-14.21
2440.0	88.98	-6.22	8.0	-14.22
2480.0	90.31	-4.89	8.0	-14.89

Figure 20 Test Results

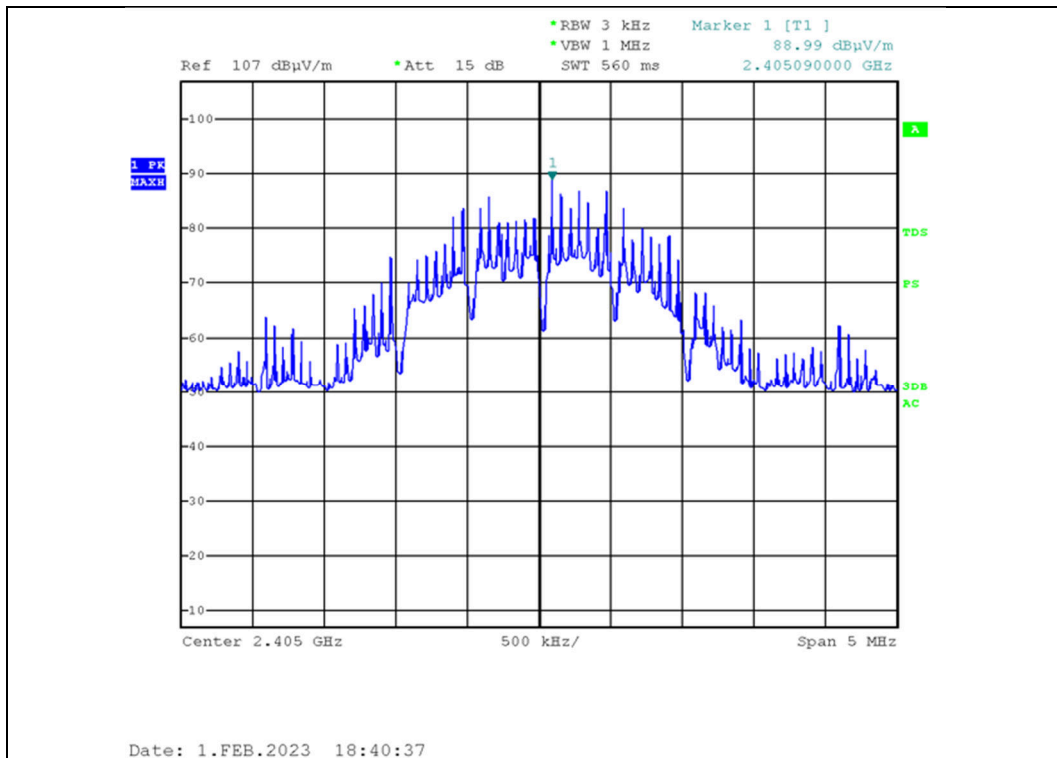


Figure 21. 2405.0 MHz

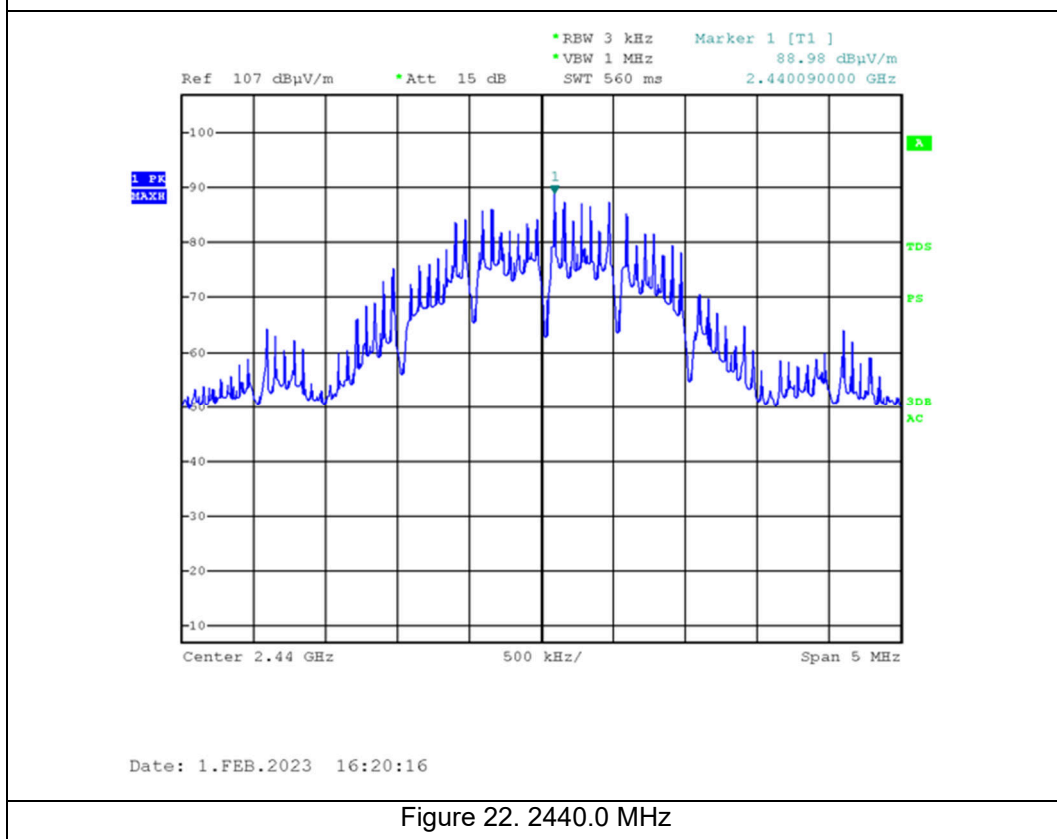
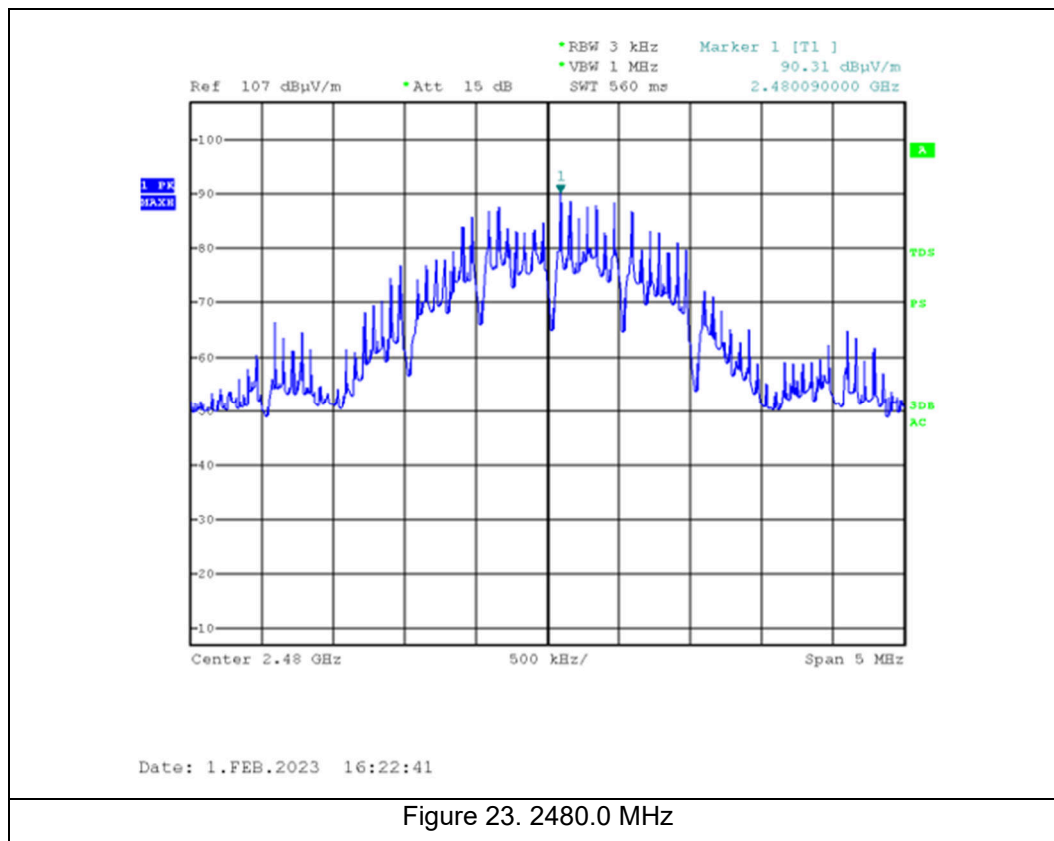


Figure 22. 2440.0 MHz



## 7.5 Test Equipment Used; Transmitted Power Density

ITL #	Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
1507	EMI Test Receiver	Rohde & Schwarz	ESCI7	100724	Feb 20, 2023	Feb 20, 2024
1366	Horn Antenna	EMCO	3115	9702-511	Oct 18, 2023	Oct 18, 2025
1778	Cable for KA Band Antenna	OSR Electronics (Serge)	37297C KPS	1503-590 (05032006)	Aug 9, 2023	Aug 9, 2024
2210	Semi Anechoic Chamber	Frankonia Group	SAC-3	-	May 30, 2023	May 30, 2024

Figure 24 Test Equipment Used



## 8 Occupied Bandwidth

### 8.1 Test Specification

FCC, Part 2, Sub part J, Section 2.1049

RSS-Gen, Issue 5: 2018, Section 6.6

### 8.2 Test Procedure

(Temperature (22°C)/ Humidity (56%RH))

The E.U.T. operation mode and test set-up are as described in Section 2 of this report. The E.U.T. was placed in the chamber on a non-conductive table, 0.8 meters above the ground.

The distance between the E.U.T. and test antenna was three meters.

The transmitter unit was operated with normal modulation. The RBW set to the range of 1% to 5% of the OBW.

The span was set between 1.5 to 5 times of the OBW.

99% occupied bandwidth function was set on.

### 8.3 Test Limit

N/A

### 8.4 Test Results

Complies.

Operation Frequency (MHz)	Reading (MHz)
2405.0	2.8
2440.0	2.5
2480.0	2.6

Figure 25. Bandwidth Test Results

See additional information in the next figures.

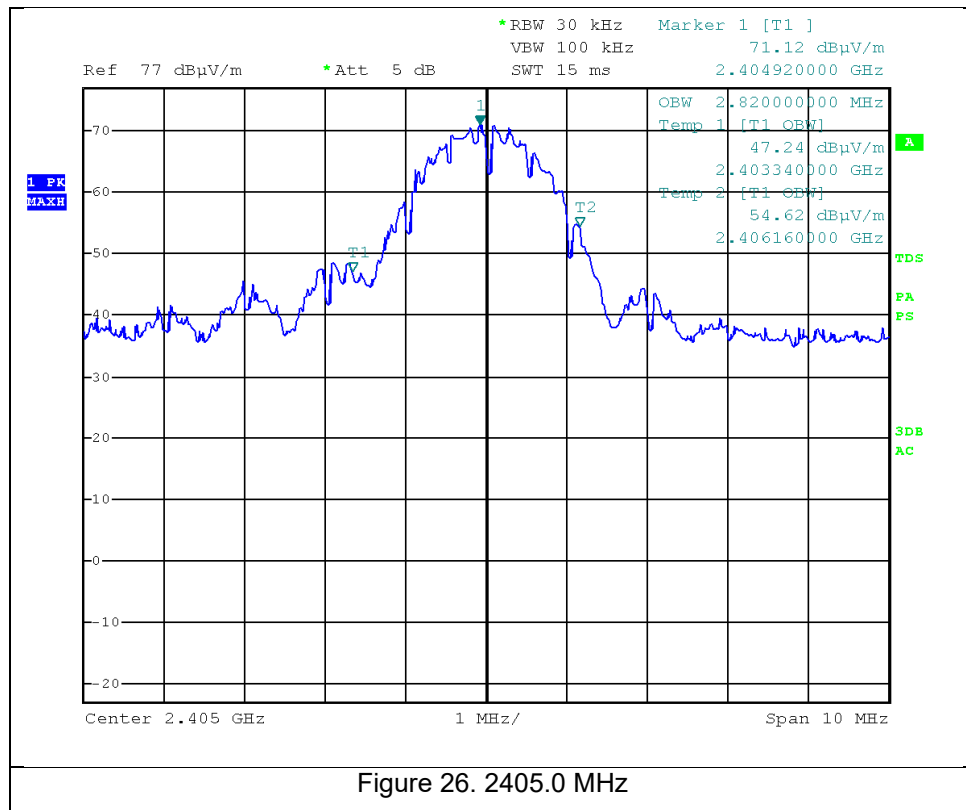


## Occupied Bandwidth

E.U.T Description

Model Number

Part Number:





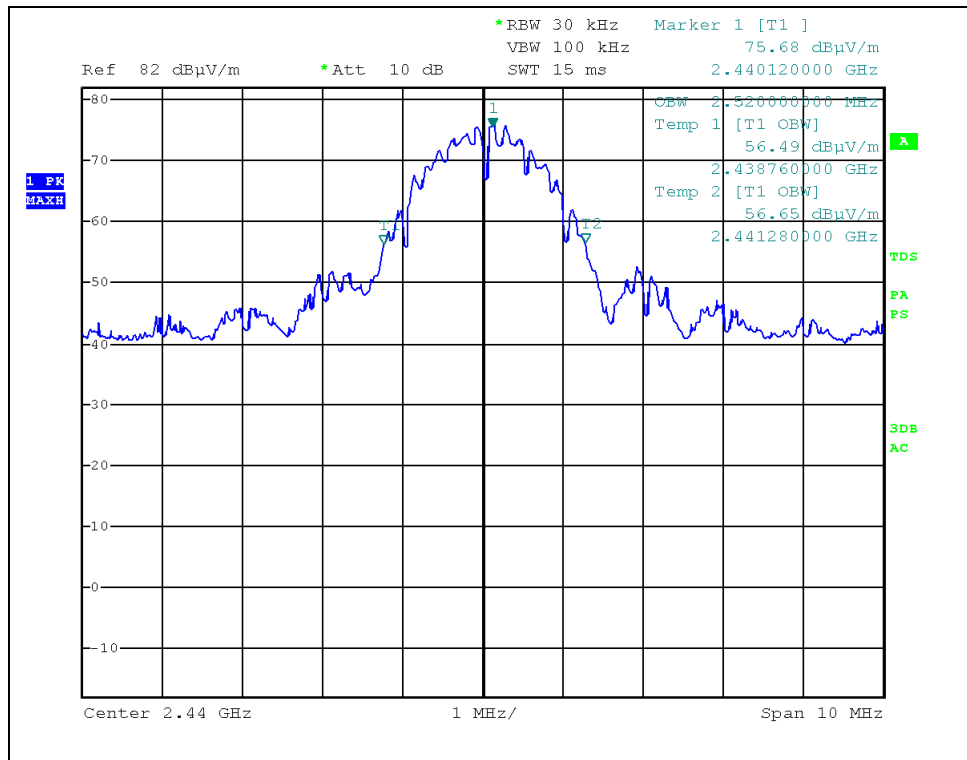


Figure 27. 2440.0 MHz

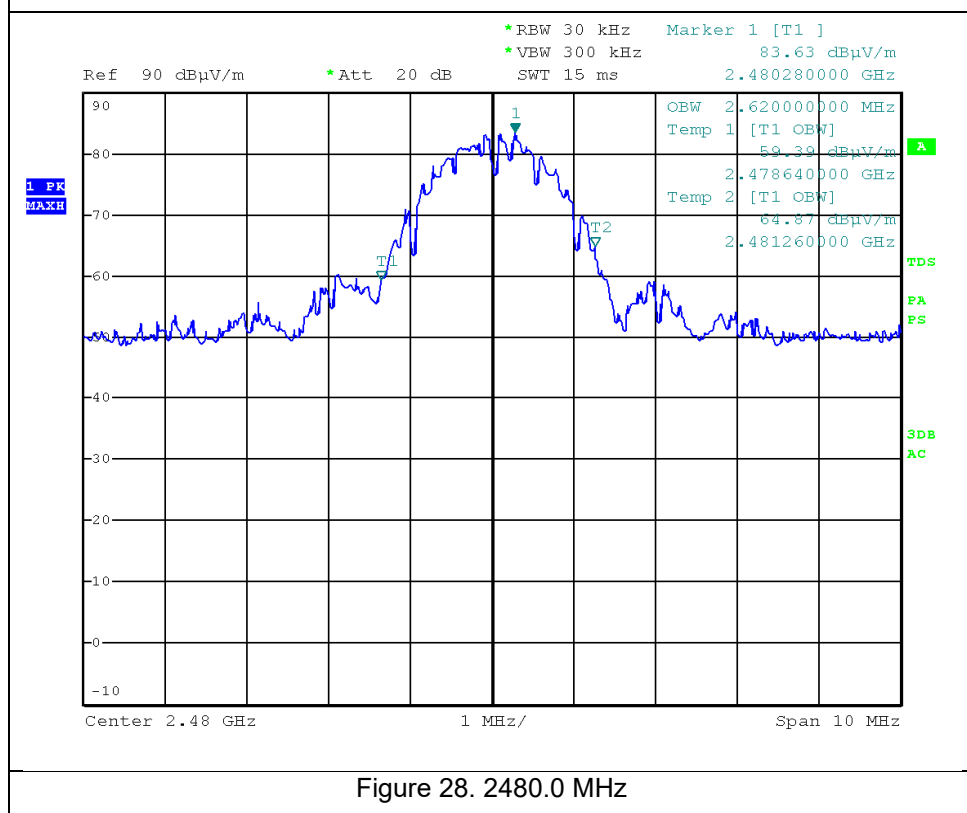


Figure 28. 2480.0 MHz



## 8.5 Test Equipment Used; Occupied Bandwidth

ITL #	Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
1507	EMI Test Receiver	Rohde & Schwarz	ESCI7	100724	Feb 20, 2023	Feb 20, 2024
1366	Horn Antenna	EMCO	3115	9702-511	Oct 18, 2023	Oct 18, 2025
1778	Cable for KA Band Antenna	OSR Electronics (Serge)	37297C KPS	1503-590 (05032006)	Aug 9, 2023	Aug 9, 2024
2210	Semi Anechoic Chamber	Frankonia Group	SAC-3	-	May 30, 2023	May 30, 2024

Figure 29 Test Equipment Used



## 9 Emissions in Non-Restricted Frequency Bands

### 9.1 Test Specification

FCC, Part 15, Subpart C, Section 247(d)

RSS-247, Section 5.5

### 9.2 Test Procedure

(Temperature (°C)/ Humidity (%RH))

The E.U.T was tested inside the shielded room and placed on a non-metallic table, 0.8 meters above the ground in the band 9.0 kHz-1000 MHz and 1.5 meters in the band 1.0-25.0 GHz. The emissions were measured at a distance of three meters.

The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The frequency range 9.0 kHz -25.0 GHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The RBW was set to 100 kHz, the detector to max. peak, and the trace to “max hold”.

### 9.3 Test Limit

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.

### 9.4 Test Results

Complies. All the detected emissions were at least 20dBc below the fundamental level.

### 9.5 Test Instrumentation Used, Emission in Non- Restricted Frequency Bands

ITL #	Instrument	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
1175	Spectrum Analyzer	HP	8564E	3442A00275	Feb 28, 2023	Feb 28, 2024
2163	Signal Analyzer	Keysight	N9010A	my51170071	Feb 13, 2022	Feb 13, 2024
1180	EMI Receiver	HP Agilent	8542E	3906A00276	Feb 20, 2023	Feb 20, 2024
1181	RF Filter	HP Agilent	85420E	3705A00248	Feb 20, 2023	Feb 20, 2024
1075	Active Loop Antenna	EMCO	6502	2950	Oct. 7, 2023	Oct. 7, 2024
1366	Horn Antenna	EMCO	3115	9702-511	Oct 18, 2023	Oct 18, 2025
1353	Horn Antenna	ARA	SWH-28	1007	Nov 2, 2021	Nov 2, 2024
1777	LNA Horn Antenna Amplifier Ka band	OSR Electronics	PE9850R-20	J202021732	Sep 22, 2022	Sep 22, 2025

1037	Low Noise Amplifier 16-30 GHz	Sophia Wireless	LNA28-B	232	Aug 9, 2023	Aug 9, 2024
1778	Antenna Cable for KA Band	OSR Electronics	37297C KPS	1503-590 (05032006)	Aug 9, 2023	Aug 9, 2024
1998	Band Pass Filter 9-18GHz	OSR	-	-	Oct 1, 2023	Oct 1, 2024
1783	20 cm Cable for KA Band Antenna	Rhophase Microwave	01536 263440 (A1673)	A1673	Jun 7, 2023	Jun 7, 2024
2210	Semi Anechoic Chamber	Frankonia Group	SAC-3	-	May 30, 2023	May 30, 2024

Figure 30 Test Equipment Used

## 9.6 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors", using the following equation:

$$FS = RA + AF + CF$$

FS: Field Strength [dB $\mu$ V/m]

RA: Receiver Amplitude [dB $\mu$ V]

AF: Receiving Antenna Correction Factor [dB/m]

CF: Cable Attenuation Factor [dB]

No external pre-amplifiers were used.

## 10 Emissions in Restricted Frequency Bands

### 10.1 Test Specification

FCC Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d)

RSS-247, Section 3.3

RSS-Gen, Section 8.10

### 10.2 Test Procedure

(Temperature (23°C)/ Humidity (65%RH))

The E.U.T. operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested inside the shielded room and placed on a non-metallic table, 0.8 meters above the ground in the band 9.0 kHz-1000 MHz and 1.5 meters in the band 1.0-25.0 GHz. The emissions were measured at a distance of three meters.

The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The frequency range 9.0 kHz -25.0 GHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The tests were done for all the worst cases, in each protocol type. The highest radiations are described in the tables below.

### 10.3 Test Limits

#### 10.3.1 FCC

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)).

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)	Field strength* (dBμV/m)	Field strength* (dBμV/m)@3m
0.009-0.490	2400/F(kHz)	300	48.5-13.8	128.5-73.8
0.490-1.705	24000/F(kHz)	30	33.8-23.0	73.8-63.0
1.705-30.0	30	30	29.5	69.5
30-88	100	3	40.0	40.0
88-216	150	3	43.5	43.5
216-960	200	3	46.0	46.0
Above 960	500	3	54.0	54.0

\*The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector. For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

Figure 31 Table of Limits



### 10.3.2 ISED

The search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver, or 30 MHz, whichever is higher, to at least five times the highest tunable or local oscillator frequency, whichever is higher, without exceeding 40 GHz.

Table 3 – Receiver radiated emissions limits	
Frequency (MHz)	Field strength ( $\mu\text{V/m}$ at 3 metres) <sup>Note 1</sup>
30 – 88	100
88 – 216	150
216 – 960	200
Above 960	500

**Note 1:** Measurements for compliance with the limits in table 3 may be performed at distances other than 3 metres, in accordance with [section 6.6](#).

## 10.4 Test Results

Complies. The details of the highest emissions are given in the next figures.



## Emissions in Restricted Frequency Bands

E.U.T Description    Data Unit  
Type                      DataPass  
Serial Number:        N/A

Specifications: FCC, Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d)  
RSS-247, Section 3.3; RSS-Gen, Issue 5, Section 8.10

Antenna Polarization: Horizontal/Vertical    Frequency Range: 9kHz to 25.0 GHz  
Detector: Peak, Average

Operation Frequency	2 <sup>nd</sup> Freq.	Pol	Peak Reading	Peak Limit	Peak Margin	Average Reading	Average Limit	Average Margin
(MHz)	(MHz)	(H/V)	(dBμV/m)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
2405.0	4810.0	V	61.8	74.0	-12.2	48.0	54.0	-6.0
	4810.0	H	60.1	74.0	-13.9	49.1	54.0	-4.9
2480.0	4960.0	V	57.8	74.0	-16.2	45.2	54.0	-8.8
	4960.0	H	59.2	74.0	-14.8	44.5	54.0	-9.5

Figure 32. Radiated Emission Results

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Amp” includes correction factor.

\* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain



## 10.5 Test Instrumentation Used; Emissions in Restricted Frequency Bands

ITL #	Instrument	Manufacturer	Model	Serial No.	Cal. Date	Cal.Due
1175	Spectrum Analyzer	HP	8564E	3442A00275	Feb 28, 2023	Feb 28, 2024
2163	Signal Analyzer	Keysight	N9010A	my51170071	Feb 13, 2022	Feb 13, 2024
1180	EMI Receiver	HP Agilent	8542E	3906A00276	Feb 20, 2023	Feb 20, 2024
1181	RF Filter	HP Agilent	85420E	3705A00248	Feb 20, 2023	Feb 20, 2024
1075	Active Loop Antenna	EMCO	6502	2950	Oct. 7, 2023	Oct. 7, 2024
1366	Horn Antenna	EMCO	3115	9702-511	Oct 18, 2023	Oct 18, 2025
1353	Horn Antenna	ARA	SWH-28	1007	Nov 2, 2021	Nov 2, 2024
1777	LNA Horn Antenna Amplifier Ka band	OSR Electronics	PE9850R-20	J202021732	Sep 22, 2022	Sep 22, 2025
1037	Low Noise Amplifier 16-30 GHz	Sophia Wireless	LNA28-B	232	Aug 9, 2023	Aug 9, 2024
1778	Antenna Cable for KA Band	OSR Electronics	37297C KPS	1503-590 (05032006)	Aug 9, 2023	Aug 9, 2024
1998	Band Pass Filter 9-18GHz	OSR	-	-	Oct 1, 2023	Oct 1, 2024
1783	20 cm Cable for KA Band Antenna	Rhophase Microwave	01536 263440 (A1673)	A1673	Jun 7, 2023	Jun 7, 2024
2210	Semi Anechoic Chamber	Frankonia Group	SAC-3	-	May 30, 2023	May 30, 2024

Figure 33 Test Equipment Used





## 11 Appendix A - Correction Factors

ITL # 1075: Active Loop Antenna						
Frequency (MHz)	MAF (dBs/m)	AF (dB/m)		Frequency (MHz)	MAF (dBs/m)	AF (dB/m)
0.01	-33.1	18.4		2.0	-40.0	11.5
0.02	-37.2	14.3		3.0	-40.0	11.5
0.03	-38.2	13.3		4.0	-40.1	11.4
0.05	-39.8	11.7		5.0	-40.2	11.3
0.1	-40.1	11.4		6.0	-40.4	11.1
0.2	-40.3	11.2		7.0	-40.4	11.1
0.3	-40.3	11.2		8.0	-40.4	11.1
0.5	-40.3	11.2		9.0	-40.5	11.0
0.7	-40.3	11.2		10.0	-40.5	11.0
1.0	-40.1	11.4		20.0	-41.5	10.0

ITL # 1352: Horn Antenna			
Frequency (MHz)	AF (dB/m)	Frequency (MHz)	AF (dB/m)
0.75	25	9.5	38
1.0	23.5	10.0	38.5
1.5	26.0	10.5	38.5
2.0	29.0	11.0	38.5
2.5	27.5	11.5	38.5
3.0	30.0	12.0	38.0
3.5	31.5	12.5	38.5
4.0	32.5	13.0	40.0
4.5	32.5	13.5	41.0
5.0	33.0	14.0	40.0
5.5	35.0	14.5	39.0
6.0	36.5	15.0	38.0
6.5	36.5	15.5	37.5
7.0	37.5	16.0	37.5
7.5	37.5	16.5	39.0
8.0	37.5	17.0	40.0
8.5	38.0	17.5	42.0
9.0	37.5	18.0	42.5



**ITL # 1353: Horn Antenna (@ 3m distance)<sup>2</sup>**

Frequency (MHz)	Measured antenna factor (dB/m)	Frequency (MHz)	Measured antenna factor (dB/m)
18000.0	32.4	22500.0	33.0
18500.0	32.0	23000.0	33.1
19000.0	32.3	23500.0	33.8
19500.0	32.4	24000.0	33.5
20000.0	32.3	24500.0	33.5
20500.0	32.8	25000.0	33.8
21000.0	32.8	25500.0	33.9
21500.0	32.7	26000.0	34.2
22000.0	33.1	26500.0	34.7

**ITL #1840: Anechoic Chamber RF Cable**

Frequency (MHz)	Cable Loss (dB)	Frequency (MHz)	Cable Loss (dB)
1000.0	-1.4	10000.0	-6.0
1500.0	-1.7	10500.0	-6.2
2000.0	-2.0	11000.0	-6.2
2500.0	-2.3	11500.0	-6.0
3000.0	-2.6	12000.0	-6.0
3500.0	-2.8	12500.0	-6.1
4000.0	-3.1	13000.0	-6.3
4500.0	-3.3	13500.0	-6.5
5000.0	-3.6	14000.0	-6.7
5500.0	-3.7	14500.0	-7.0
6000.0	-4.0	15000.0	-7.3
6500.0	-4.4	15500.0	-7.5
7000.0	-4.7	16000.0	-7.6
7500.0	-4.8	16500.0	-8.0
8000.0	-5.0	17000.0	-8.0
8500.0	-5.1	17500.0	-8.1
9000.0	-5.6	18000.0	-8.2
9500.0	-5.8		

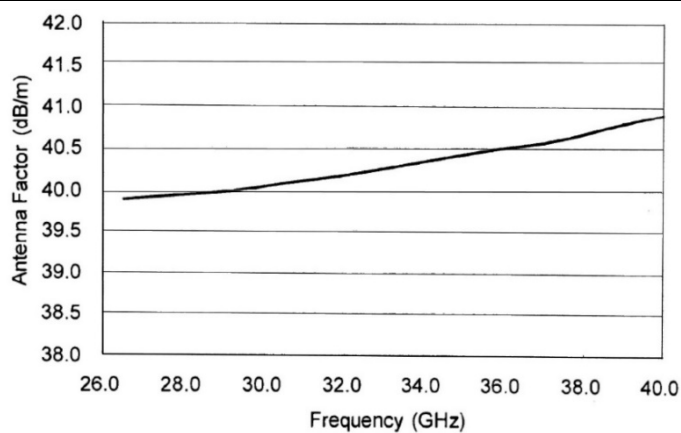
<sup>2</sup> The antenna factor shall be added to the receiver reading in dBμV to obtain field strength in dBμV/m



---

**ITL # 1777: 26.5-40 GHz Horn Antenna**

---



---

**ITL # 2199 Trilog Broadband Antenna 30 MHz - 1 GHz + RF cables**

---

Frequency (MHz)	Measured antenna factor (dB/m)	Frequency (MHz)	Measured antenna factor (dB/m)
30.00	14.30	80.00	11.10
40.00	16.20	90.00	13.40
50.00	17.40	100.00	15.20
60.00	16.30	150.00	11.40
70.00	13.00	200.00	14.10
80.00	11.10	300.00	16.10
90.00	13.40	400.00	18.10
100.00	15.20	500.00	19.50
150.00	11.40	600.00	21.10
30.00	14.30	700.00	22.50
40.00	16.20	800.00	23.50
50.00	17.40	900.00	24.70
60.00	16.30	1000.00	25.50
70.00	13.00		

**End of Report**