

FCC and ISEDC Test Report

Sepura Ltd
Tetra Handset, Model: SC2028

In accordance with FCC 47 CFR Part 15C,
ISEDC RSS-247 and ISEDC RSS-GEN

Prepared for: Sepura Ltd
9000 Cambridge Research Park
Beach Drive, Waterbeach
Cambridge, CB25 9TL
United Kingdom



Add value.
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FCC ID: XX6SC2028

IC: 8739A-SC2028

COMMERCIAL-IN-CONFIDENCE

Document 75947270-04 Issue 01

SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Jon Kenny	Senior Engineer	Authorised Signatory	10 February 2020

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD document control rules.

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15C, ISEDC RSS-247 and ISEDC RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Connor Lee	10 February 2020	

FCC Accreditation

90987 Octagon House, Fareham Test Laboratory

ISEDC Accreditation

12669A Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15C, ISEDC RSS-247 and ISEDC RSS-GEN: 2018, Issue 2 (2017-02) and Issue 5 A1 (2019-03) for the tests detailed in section 1.3.



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ACCREDITATION

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1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	10 February 2020

Table 1

1.2 Introduction

Applicant	Sepura Ltd
Manufacturer	Sepura Ltd
Model Number(s)	SC2028
Serial Number(s)	1PR001925GK63ZJ
Hardware Version(s)	Pre-Production
Software Version(s)	2001 730 07367
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2018 ISED RSS-247: Issue 2 (2017-02) ISED RSS-GEN: Issue 5 (2018-04) + A1 (2019-03)
Order Number	PLC-PO014257-2
Date	11-October-2019
Date of Receipt of EUT	22-October-2019 and 06-December-2019
Start of Test	12-December-2019
Finish of Test	06-January-2020
Name of Engineer(s)	Connor Lee
Related Document(s)	ANSI C63.10 (2013)



1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C, ISED RSS-247 and ISED RSS-GEN is shown below.

Section	Specification Clause			Test Description	Result	Comments/Base Standard
	Part 15C	RSS-247	RSS-GEN			
Configuration and Mode: 2.4 GHz Bluetooth Low Energy						
-	15.247 (a)(1)	-	5.1	Frequency Hopping Systems - Average Time of Occupancy	N/T	Refer to Document 75944487-11*
-	15.247 (a)(1)	-	5.1	Frequency Hopping Systems - Channel Separation	N/T	Refer to Document 75944487-11*
-	15.247 (a)(1)	-	5.1	Frequency Hopping Systems - Number of Hopping Channels	N/T	Refer to Document 75944487-11*
-	15.247 (a)(1)	-	5.1	Frequency Hopping Systems - 20 dB Bandwidth	N/T	Refer to Document 75944487-11*
-	15.247 (b)	5.4	6.12	Maximum Conducted Output Power	N/T	Refer to Document 75944487-11*
2.1	15.207	-	8.8	AC Power Line Conducted Emissions	Pass	ANSI C63.10 (2013)
2.2	15.247 (d)	5.5	-	Authorised Band Edges	Pass	ANSI C63.10 (2013)
2.3	15.205	-	8.10	Restricted Band Edges	Pass	ANSI C63.10 (2013)
2.4	15.247 (d) and 15.205	5.5	6.13	Spurious Radiated Emissions	Pass	ANSI C63.10 (2013)

Table 2

N/T – Not Tested

* EUT contains the same pre-approved module



1.4 Application Form

Equipment Description

Equipment Description

Technical Description: (Please provide a brief description of the intended use of the equipment)	The SC2028 hand-portable terminal is a TETRA enabled radio with Bluetooth and Wi-Fi capability
Manufacturer:	Sepura Limited
Model:	SC2028
Part Number:	N/A
Hardware Version:	Pre-Production
Software Version:	2001 730 07367
FCC ID (if applicable)	XX6SC2028
IC ID (if applicable)	8739A-SC2028

Intentional Radiators

Technology	TETRA	TETRA	BT Classic/EDR	BLE	WLAN
Frequency Band (MHz)	806-824	851-869	2402-2480	2402-2480	2412-2462
Conducted Declared Output Power (dBm)	34	34	7.382	7.382	16.5
Antenna Gain (dBi)	> 0	> 0	2.5	2.5	2.5
Supported Bandwidth(s) (MHz)	25 kHz	25 kHz	1	2	16.5 22
Modulation Scheme(s)	$\pi/4$ DQPSK	$\pi/4$ DQPSK	8-DPSK, $\pi/4$ DQPSK, GFSK	GFSK	BPSK, 16-QAM, 64-QAM
ITU Emission Designator	22K0DXW	22K0DXW	1M00F1D	2M00F1D	16M5G1D 22M0G1D
Bottom Frequency (MHz)	806	851	2402	2402	2412
Middle Frequency (MHz)	815	860	2441	2441	2437
Top Frequency (MHz)	824	869	2480	2480	2462

Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	2480 MHz
Lowest frequency generated or used in the device or on which the device operates or tunes	32.768 kHz
Class A Digital Device (Use in commercial, industrial or business environment) ☒	
Class B Digital Device (Use in residential environment only) ☐	



DC Power Source

Nominal voltage:	7.4	V
Extreme upper voltage:	7.4	V
Extreme lower voltage:	6.2	V
Max current:	2	A

Battery Power Source

Voltage:	7.4	V
End-point voltage:	6.2	V (Point at which the battery will terminate)
Alkaline ☐ Leclanche ☒ Lithium ☐ Nickel Cadmium ☐ Lead Acid* ☐ *(Vehicle regulated)		
Other ☐	Please detail:	

Charging

Can the EUT transmit whilst being charged	Yes ☒ No ☐
---	---

Temperature

Minimum temperature:	-30	°C
Maximum temperature:	+65	°C

Antenna Characteristics

Antenna connector ☒ TETRA	State impedance	50	Ohm
Temporary antenna connector ☐	State impedance		Ohm
Integral antenna ☒ Type: PCB	State impedance	50	Ohm
External antenna ☐ Type:	State impedance		dBI

Ancillaries (if applicable)

Manufacturer:		Part Number:	
Model:		Country of Origin:	

The SC2028 may be used with standard SC20 accessories, batteries, chargers, belt clips, holsters, remote speaker and microphones, earpieces etc

I hereby declare that the information supplied is correct and complete.

Name: Chris Beecham
Position held: Conformance Engineer
Date: 21 October 2019



1.5 Product Information

1.5.1 Technical Description

The SC2028 hand-portable terminal is a TETRA enabled radio with Bluetooth and Wi-Fi capability.

1.6 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

1.7 EUT Modification Record

The table below details modifications made to the EUT during the test programme.

The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Model: SC2028, Serial Number: 1PR001925GK63ZJ			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

1.8 Test Location

TÜV SÜD conducted the following tests at our Fareham Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: 2.4 GHz Bluetooth Low Energy		
AC Power Line Conducted Emissions	Connor Lee	UKAS
Authorised Band Edges	Connor Lee	UKAS
Restricted Band Edges	Connor Lee	UKAS
Spurious Radiated Emissions	Connor Lee	UKAS

Table 4

Office Address:

Octagon House
Concorde Way
Segensworth North
Fareham
Hampshire
PO15 5RL
United Kingdom



2 Test Details

2.1 AC Power Line Conducted Emissions

2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.207
ISED RSS-GEN, Clause 8.8

2.1.2 Equipment Under Test and Modification State

SC2028, S/N: 1PR001925GK63ZJ - Modification State 0

2.1.3 Date of Test

06-January-2020

2.1.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.2.

2.1.5 Environmental Conditions

Ambient Temperature	19.9 °C
Relative Humidity	34.0 %

2.1.6 Test Results

2.4 GHz Bluetooth Low Energy

Applied supply Voltage: 120 V AC
 Applied supply frequency: 60 Hz

Frequency (MHz)	QP Level (dBμV)	QP Limit (dBμV)	QP Margin (dBμV)	AV Level (dBμV)	AV Limit (dBμV)	AV Margin (dBμV)
0.159	37.9	66.0	-28.1	26.9	56.0	-29.1
0.186	36.8	66.0	-29.2	25.9	56.0	-30.1
0.213	33.0	66.0	-33.0	24.3	56.0	-31.7
0.400	33.7	66.0	-32.3	31.8	56.0	-24.2

Table 5 - Live Line Emissions Results

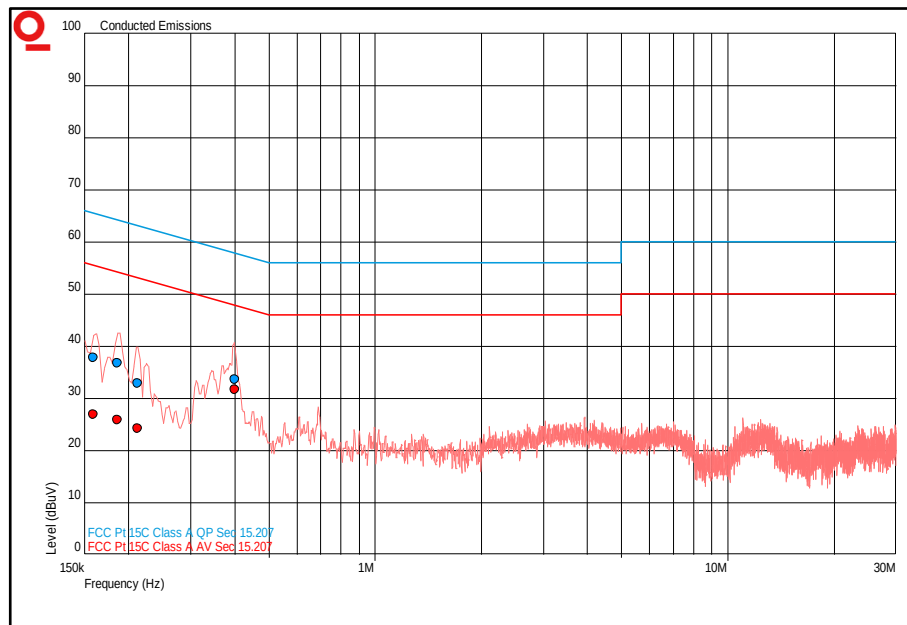


Figure 1 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	QP Level (dBμV)	QP Limit (dBμV)	QP Margin (dBμV)	AV Level (dBμV)	AV Limit (dBμV)	AV Margin (dBμV)
0.218	30.9	66	-35.1	21.8	56	-34.2
0.347	36.9	66	-29.1	31.2	56	-24.8
0.4	40.1	66	-25.9	35.7	56	-20.3

Table 6 - Neutral Line Emissions Results

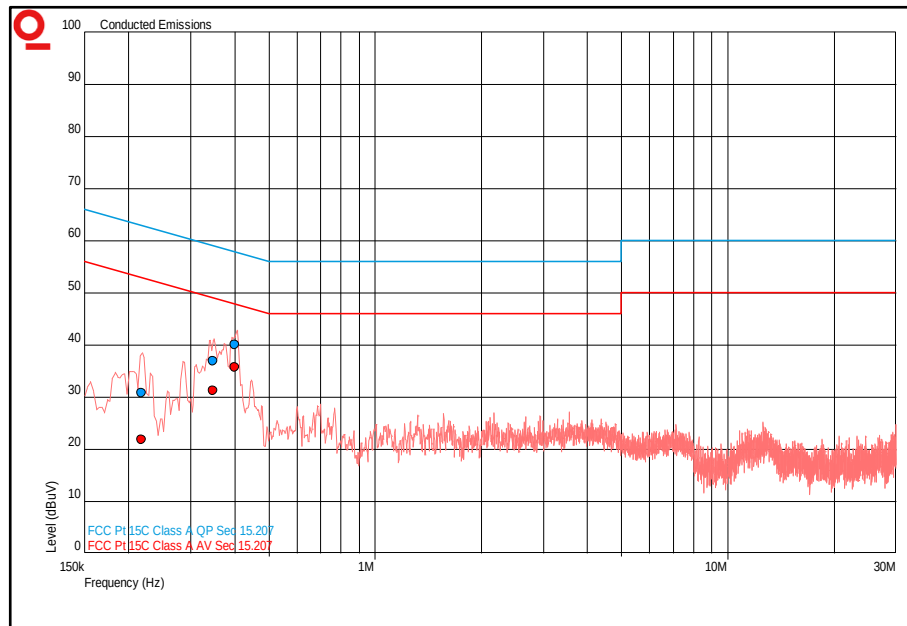


Figure 2 - Neutral Line - 150 kHz to 30 MHz

FCC 47 CFR Part 15, Limit Clause 15.207 and ISEDC RSS-GEN, Limit Clause 8.8

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-Peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50

Table 7

*Decreases with the logarithm of the frequency.



2.1.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
3 Phase Artificial Mains Network (LISN)	Rohde & Schwarz	ESH2-Z5	16	12	28-Feb-2020
Screened Room (5)	Rainford	Rainford	1545	36	23-Jan-2021
Transient Limiter	Hewlett Packard	11947A	2377	12	26-Feb-2020
Hygrometer	Rotronic	A1	2677	12	20-Feb-2020
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	03-Jan-2021
8 Meter Cable	Teledyne	PR90-088-8MTR	5212	12	30-Aug-2020

Table 8

2.2 Authorised Band Edges

2.2.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d)
ISED RSS-247, Clause 5.5

2.2.2 Equipment Under Test and Modification State

SC2018, S/N: 1PR001925GK63ZJ - Modification State 0

2.2.3 Date of Test

20-December-2019

2.2.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.10.4.

2.2.5 Environmental Conditions

Ambient Temperature 17.7 °C
Relative Humidity 46.0 %

2.2.6 Test Results

2.4 GHz Bluetooth Low Energy

Modulation/Packet Type	Channel Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
GFSK/DH1	2402.0	2400.0	-52.36

Table 9 - Authorised Band Edge Results

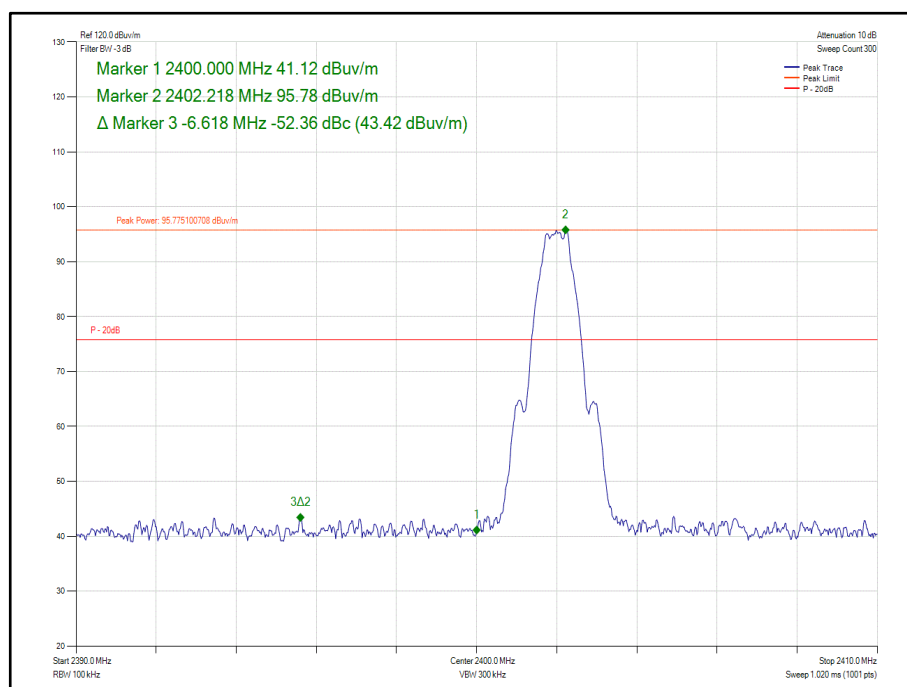


Figure 3 - GFSK/DH1 – 2402.0 MHz - Measured Frequency 2400.0 MHz



FCC 47 CFR Part 15, Limit Clause 15.247 (d)

20 dB below the fundamental measured in a 100 kHz bandwidth using a peak detector. If the transmitter complies with the conducted power limits, based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB below the fundamental instead of 20 dB.

ISED RSS-247, Limit Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

2.2.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Screened Room (5)	Rainford	Rainford	1545	36	23-Jan-2021
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Hygrometer	Rotronic	A1	2677	12	20-Feb-2020
'2.92mm' - '2.92mm' RF Cable (2m)	Rhophase	KPS-1503-2000-KPS	3695	12	11-Jun-2020
Mast Controller	Maturo GmbH	NCD	4810	-	TU
Tilt Antenna Mast	Maturo GmbH	TAM 4.0-P	4811	-	TU
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	11-Mar-2020
EmX Emissions Software	TUV SUD	EmX V.V1.5.3	5125	-	Software
8 Meter Cable	Teledyne	PR90-088-8MTR	5212	12	30-Aug-2020
EMI Test Receiver	Rohde & Schwarz	ESW44	5382	12	08-Oct-2020

Table 10

TU – Traceability Unscheduled



2.3 Restricted Band Edges

2.3.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.205
ISED RSS-GEN, Clause 8.10

2.3.2 Equipment Under Test and Modification State

SC2028, S/N: 1PR001925GK63ZJ - Modification State 0

2.3.3 Date of Test

20-December-2019

2.3.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.10.5 in a semi-anechoic chamber at a test distance of 3 m.

Plots for average measurements were taken in accordance with ANSI C63.10 clause 4.1.4.2.5.

The following conversion can be applied to convert from dBμV/m to μV/m:
 $10^{(\text{Field Strength in dB}\mu\text{V/m}/20)}$

2.3.5 Environmental Conditions

Ambient Temperature	17.7 °C
Relative Humidity	46.0 %

2.3.6 Test Results

2.4 GHz Bluetooth Low Energy

Modulation/Packet Type	Frequency (MHz)	Measured Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
GFSK/DH1	2402.0	2400.0	50.64	54.45
GFSK/DH1	2480.0	2483.5	50.91	52.71

Table 11 - Restricted Band Edge Results

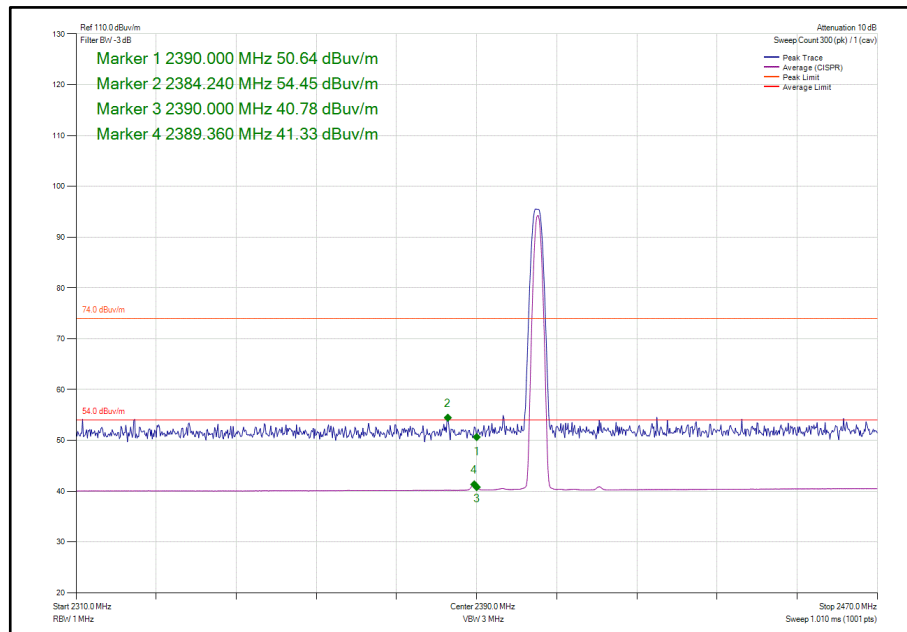


Figure 4 - GFSK/DH1 – 2402.0 MHz - Measured Frequency 2400 MHz

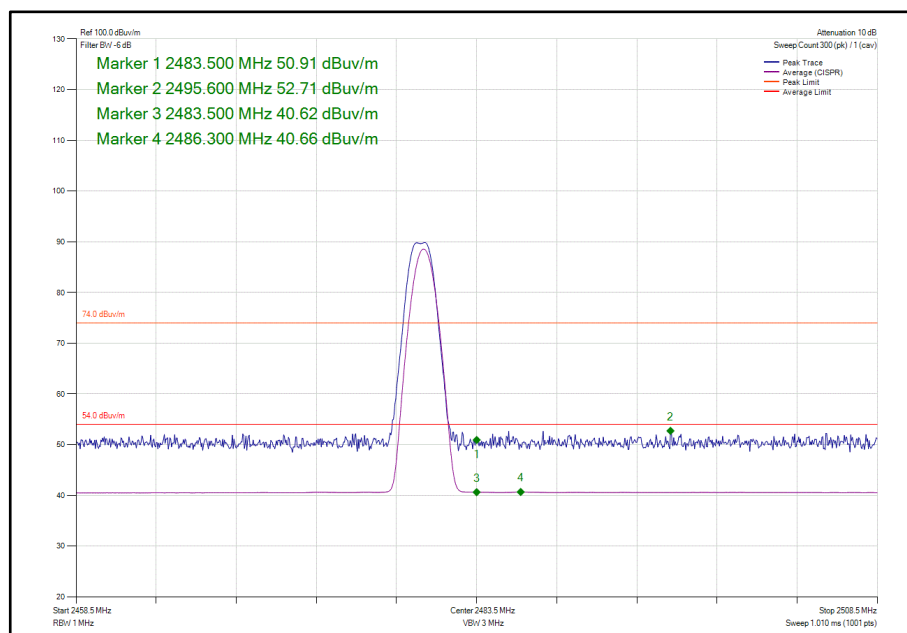


Figure 5 - GFSK/DH1 – 2480.0 MHz - Measured Frequency 2483.5 MHz



FCC 47 CFR Part 15, Limit Clause 15.209

Frequency (MHz)	Field Strength ($\mu\text{V}/\text{m}$ at 3 m)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

Table 12

ISED RSS-GEN, Limit Clause 8.9

Frequency (MHz)	Field Strength ($\mu\text{V}/\text{m}$ at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960*	500

Table 13

*Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.



2.3.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Screened Room (5)	Rainford	Rainford	1545	36	23-Jan-2021
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Hygrometer	Rotronic	A1	2677	12	20-Feb-2020
'2.92mm' - '2.92mm' RF Cable (2m)	Rhophase	KPS-1503-2000-KPS	3695	12	11-Jun-2020
Mast Controller	Maturo GmbH	NCD	4810	-	TU
Tilt Antenna Mast	Maturo GmbH	TAM 4.0-P	4811	-	TU
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	11-Mar-2020
EmX Emissions Software	TUV SUD	EmX V.V1.5.3	5125	-	Software
8 Meter Cable	Teledyne	PR90-088-8MTR	5212	12	30-Aug-2020
EMI Test Receiver	Rohde & Schwarz	ESW44	5382	12	08-Oct-2020

Table 14

TU – Traceability Unscheduled



2.4 Spurious Radiated Emissions

2.4.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d) and 15.205
ISED RSS-247, Clause 5.5
ISED RSS-GEN, Clause 6.13

2.4.2 Equipment Under Test and Modification State

SC2028, S/N: 1PR001925GK63ZJ - Modification State 0

2.4.3 Date of Test

12-December-2019

2.4.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.3, 6.5 and 6.6.

The EUT was placed on the non-conducting platform in a manner typical of a normal installation. For an EUT which could reasonable be used in multiple planes, pre-scans were performed with the EUT orientated in X, Y and Z planes with reference to the ground plane.

Ports on the EUT were terminated with loads as described in ANSI C63.4 clause 6.2.4. For EUT's with multiple connectors of the same type, additional interconnecting cables were connected, and pre-scans performed to determine whether the level of the emissions were increased by >2 dB.

For frequencies > 1 GHz, plots for average measurements were taken in accordance with ANSI C63.10 clause 4.1.4.2.5 to characterize the EUT. Where emissions were detected, final average measurements were taken in accordance with ANSI C63.10, clause 4.1.4.2.2.

The plots shown are the characterization of the EUT. The limits on the plots represent the most stringent case for restricted bands, (74/54 dBuV/m) when compared to -20 dBc outside restricted bands. The limits shown have been used as a threshold to determine where further measurements are necessary. Where results are within 10 dB of the limits shown on the plots, further investigation was carried out and reported in results tables.

The following conversion can be applied to convert from dBμV/m to μV/m:
 $10^{(\text{Field Strength in dB}\mu\text{V/m}/20)}$

.

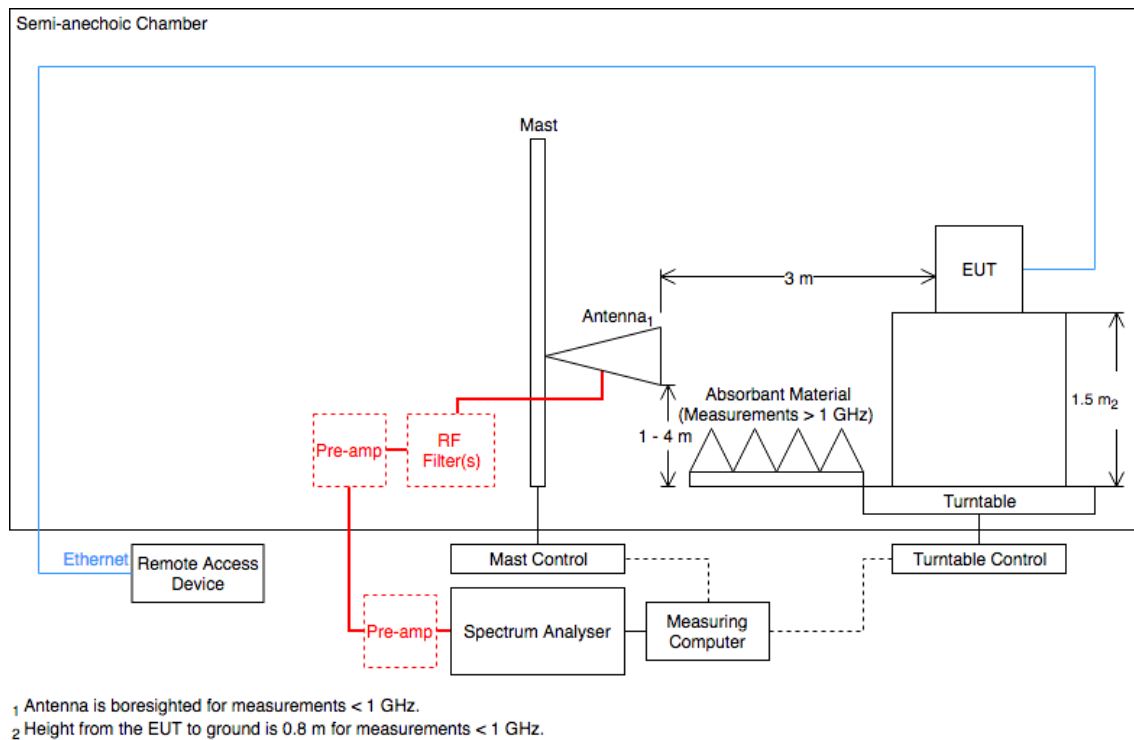


Figure 6 - Radiated Emissions Test Setup Diagram

2.4.5 Environmental Conditions

Ambient Temperature 17.0 °C
Relative Humidity 37.0 %

2.4.6 Test Results

2.4 GHz Bluetooth Low Energy

Modulation/Packet Type: GFSK/DH1

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
938.489	29.8	46.0	-16.2	Peak	292	118	Vertical	X
938.743	34.9	46.0	-11.1	Peak	288	100	Horizontal	X
926.486	29.9	46.0	-16.1	Peak	38	133	Vertical	Y
934.485	32.2	46.0	-13.8	Peak	12	106	Horizontal	Y
938.041	28.8	46.0	-17.2	Peak	307	100	Vertical	Z
934.996	27.9	46.0	-18.1	Peak	112	400	Horizontal	Z

Table 15 - Radiated Emissions Results, 30 MHz to 1 GHz - 2402 MHz

No other emissions were detected within 10 dB of the limit.

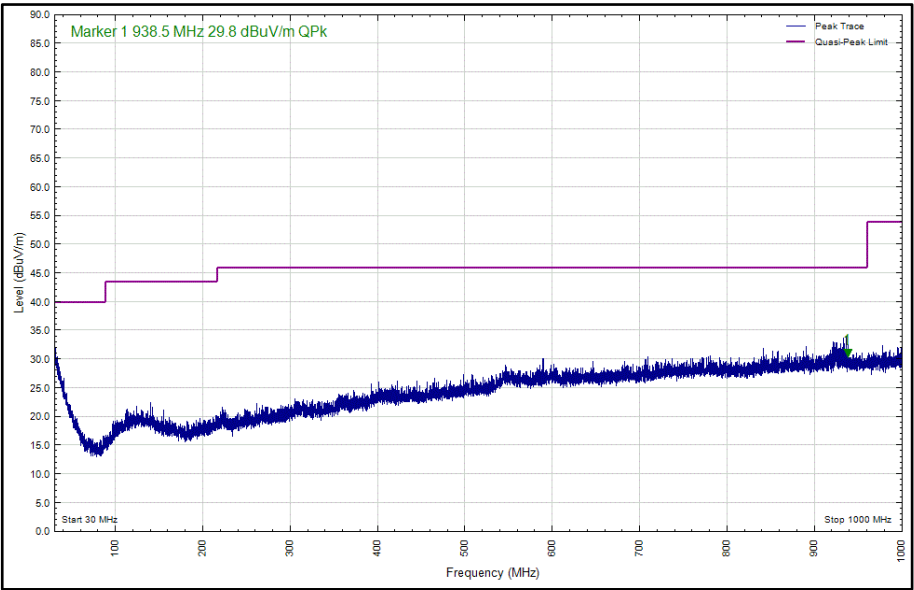


Figure 7 - 30 MHz to 1 GHz, 2402 MHz, Polarity: Vertical, EUT Orientation X

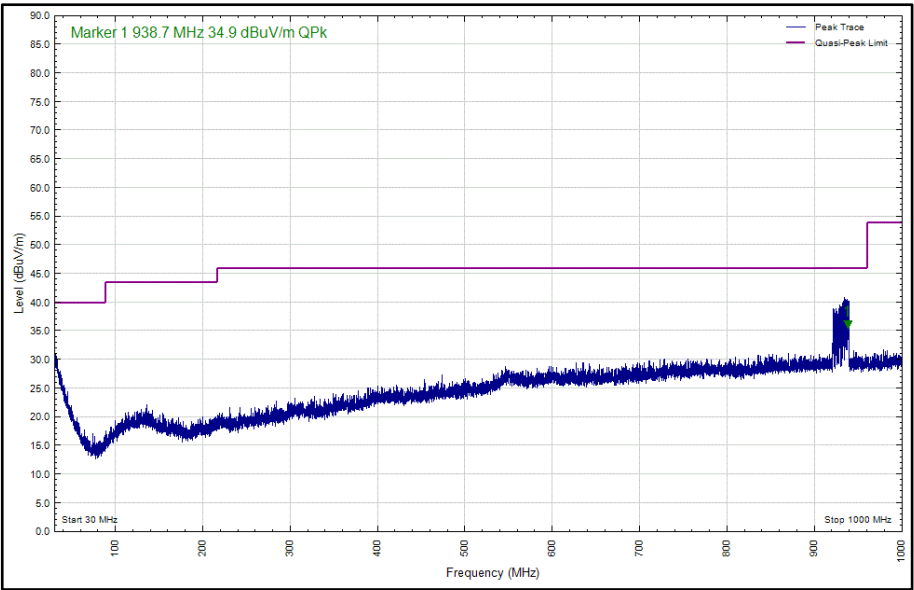


Figure 8 - 30 MHz to 1 GHz, 2402 MHz, Polarity: Horizontal, EUT Orientation X

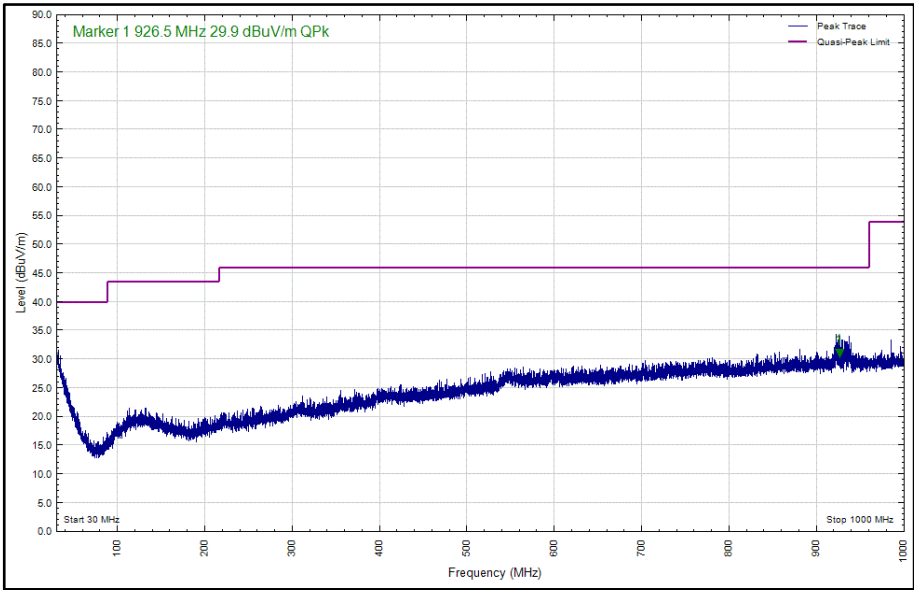


Figure 9 - 30 MHz to 1 GHz, 2402 MHz, Polarity: Vertical, EUT Orientation Y

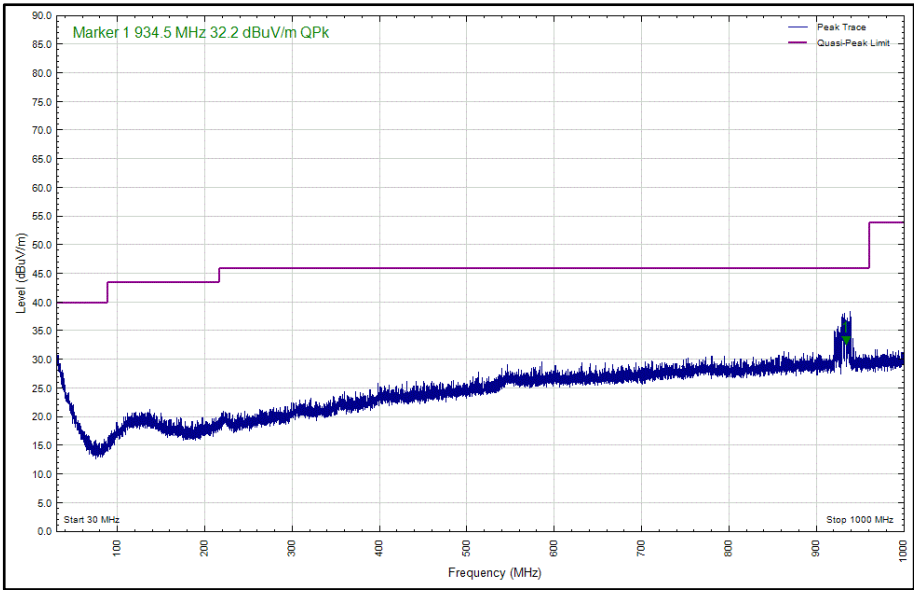


Figure 10 - 30 MHz to 1 GHz, 2402 MHz, Polarity: Horizontal, EUT Orientation Y

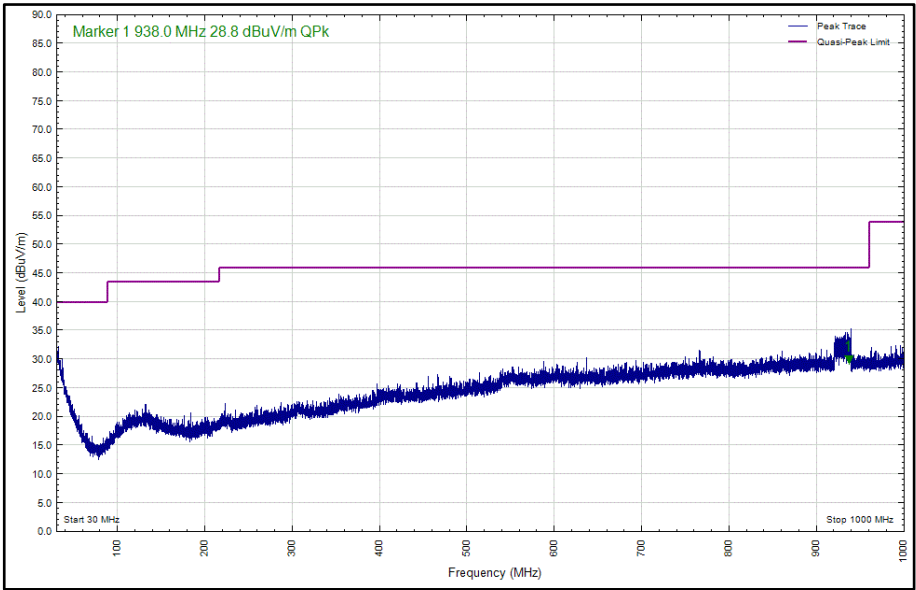


Figure 11 - 30 MHz to 1 GHz, 2402 MHz, Polarity: Vertical, EUT Orientation Z

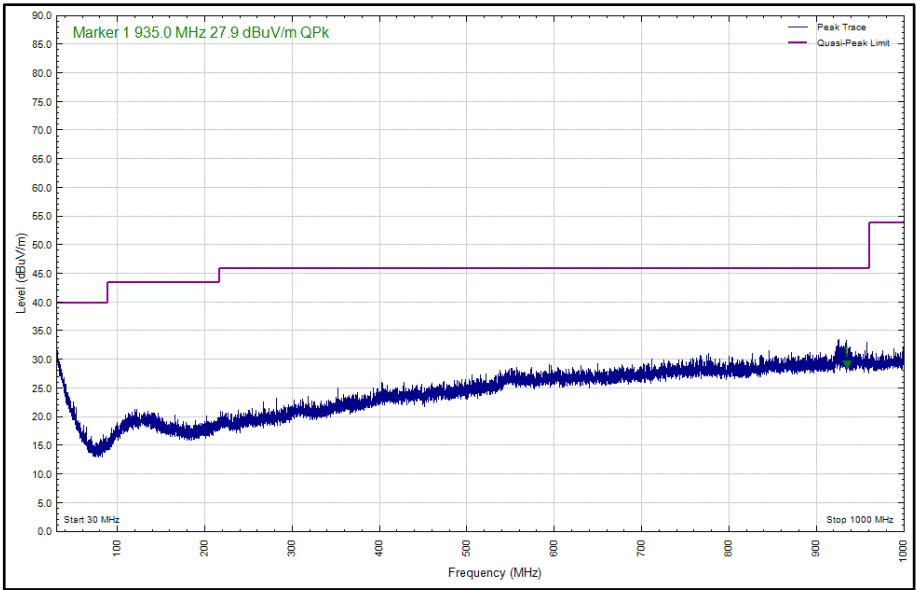


Figure 12 - 30 MHz to 1 GHz, 2402 MHz, Polarity: Horizontal, EUT Orientation Z

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
4650.756	32.3	54.0	-21.7	Average	137	103	Vertical	X
4803.296	32.4	54.0	-21.6	Average	39	108	Vertical	X
7206.620	39.4	54.0	-14.6	Average	265	100	Vertical	X
4687.189	36.4	54.0	-17.7	Average	199	124	Horizontal	X
4804.396	36.1	54.0	-17.9	Average	158	110	Horizontal	X
7206.700	40.5	54.0	-13.5	Average	217	169	Horizontal	X
3698.633	28.6	54.0	-25.4	Average	192	100	Vertical	Y
4661.740	36.1	54.0	-17.9	Average	37	106	Vertical	Y
3726.753	28.4	54.0	-25.6	Average	187	103	Horizontal	Y
4649.802	32.5	54.0	-21.5	Average	100	294	Horizontal	Y
4804.111	34.7	54.0	-19.3	Average	73	105	Horizontal	Y
3736.105	29.7	54.0	-24.3	Average	360	104	Vertical	Z
4673.666	53.4	74.0	-20.6	Peak	350	171	Vertical	Z
4685.984	37.9	54.0	-16.1	Average	350	173	Vertical	Z
4677.043	32.5	54.0	-21.5	Average	50	110	Horizontal	Z
3721.806	29.9	54.0	-24.1	Average	128	110	Horizontal	X

Table 16 - 2402 MHz - 1 GHz to 26 GHz, Emissions Results

No other emissions were detected within 10 dB of the limit.

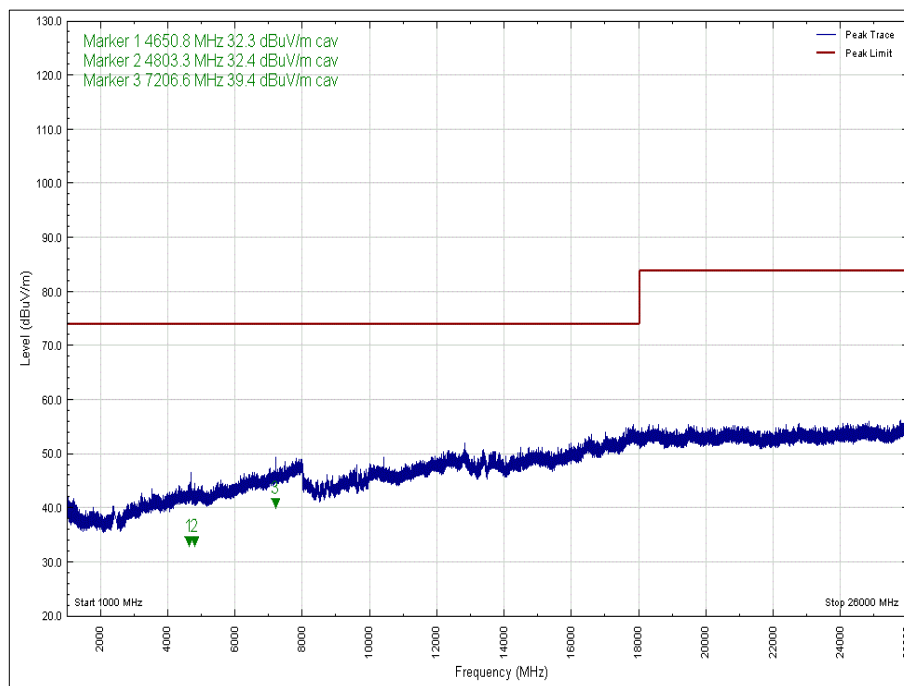


Figure 13 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: X, Peak

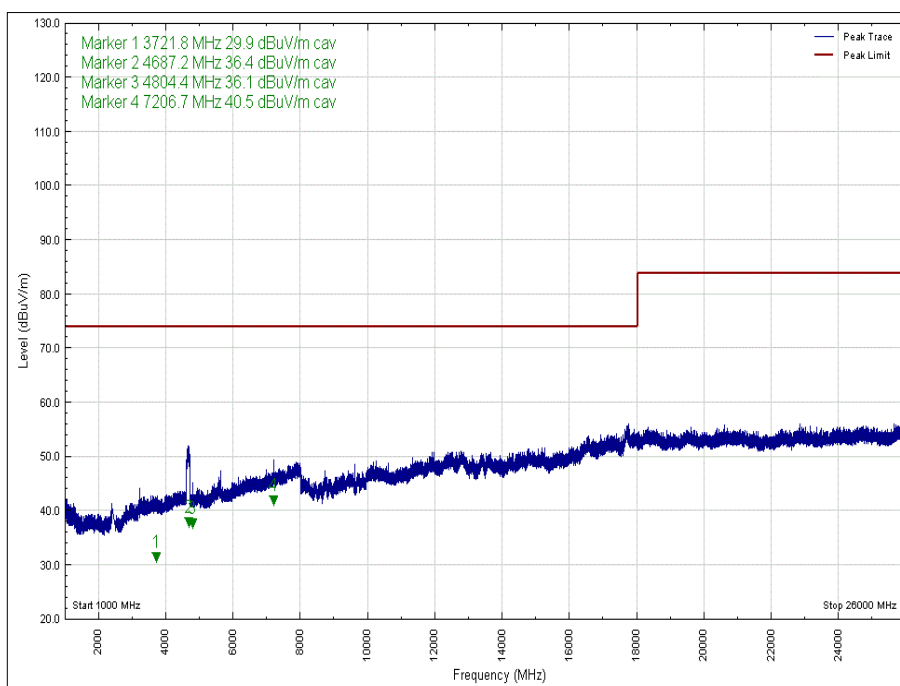


Figure 14 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: X, Peak

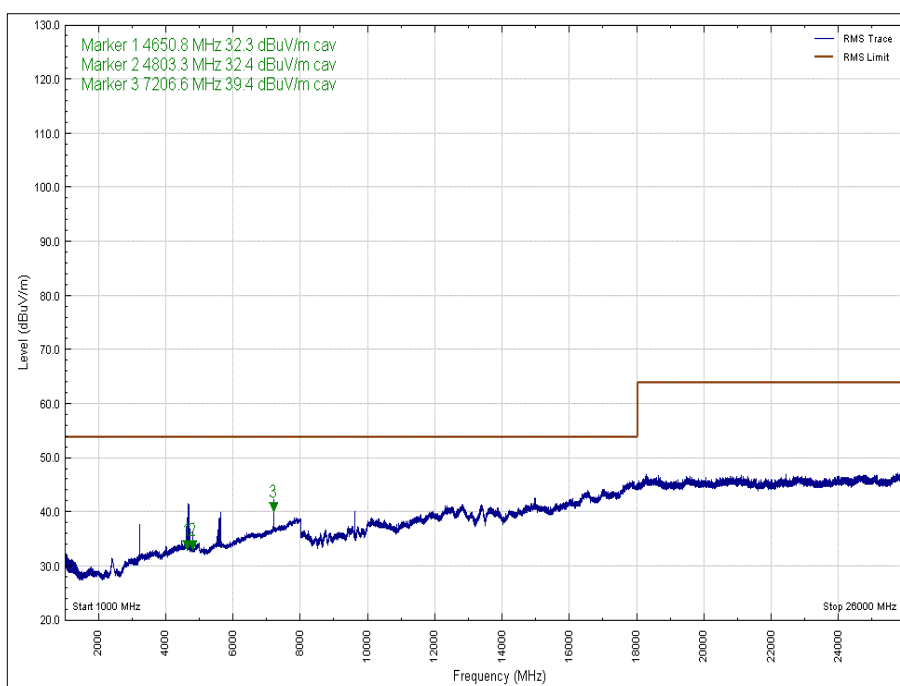


Figure 15 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: X, Average

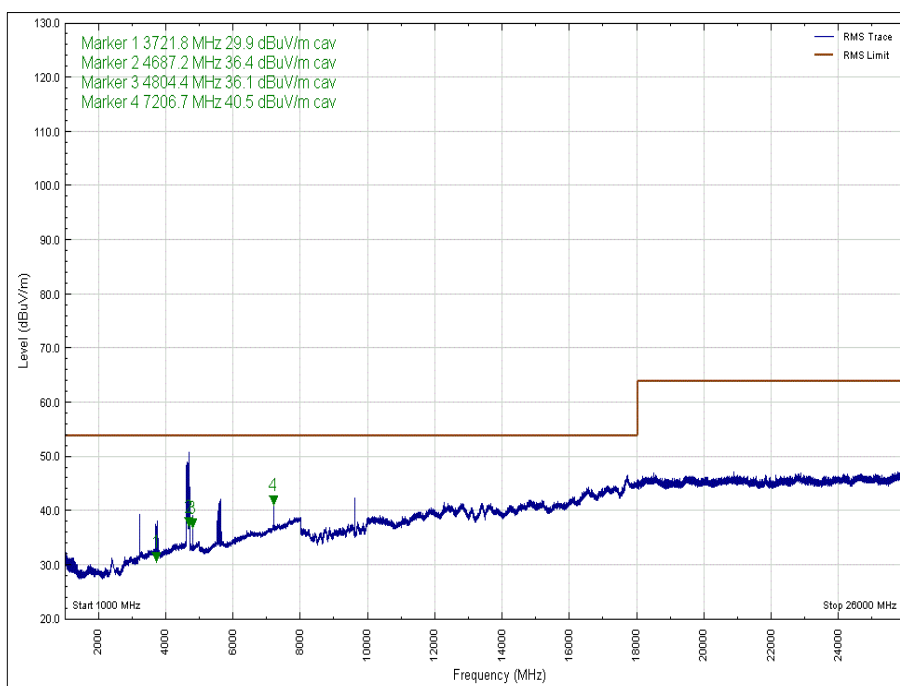


Figure 16 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: X, Average

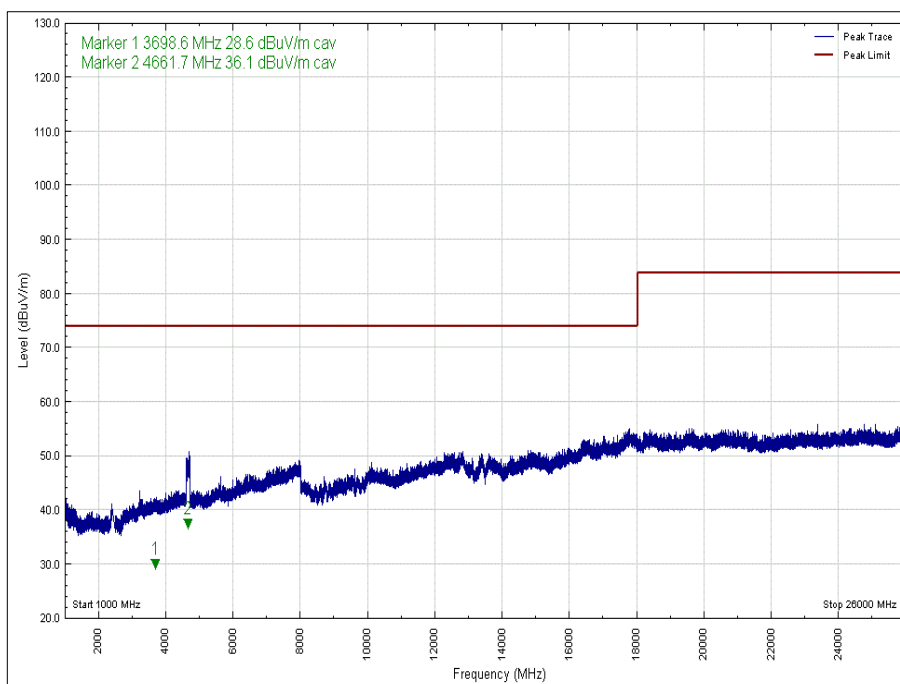


Figure 17 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Y, Peak

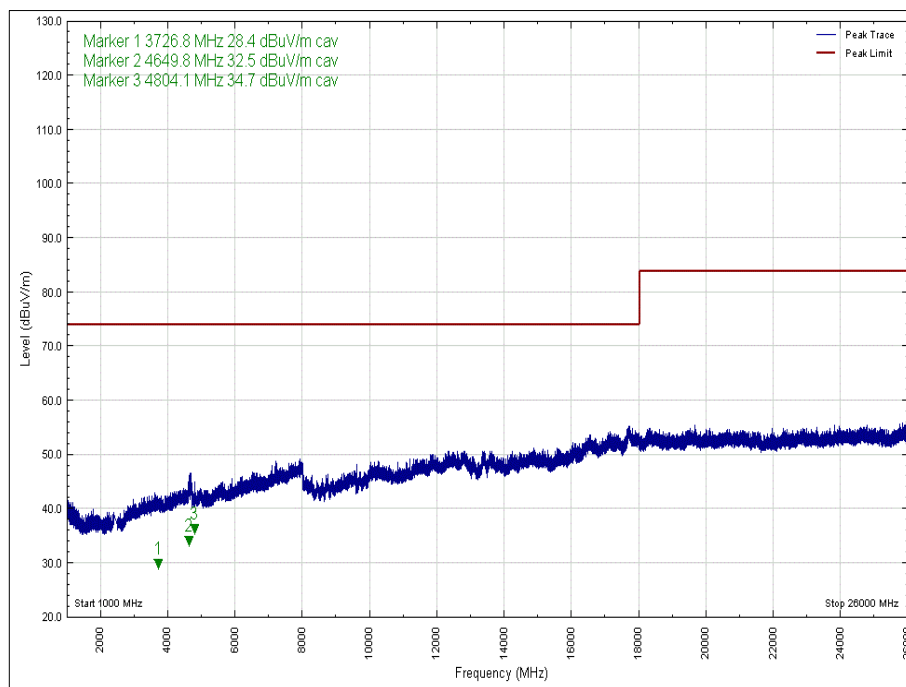


Figure 18 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Y, Peak

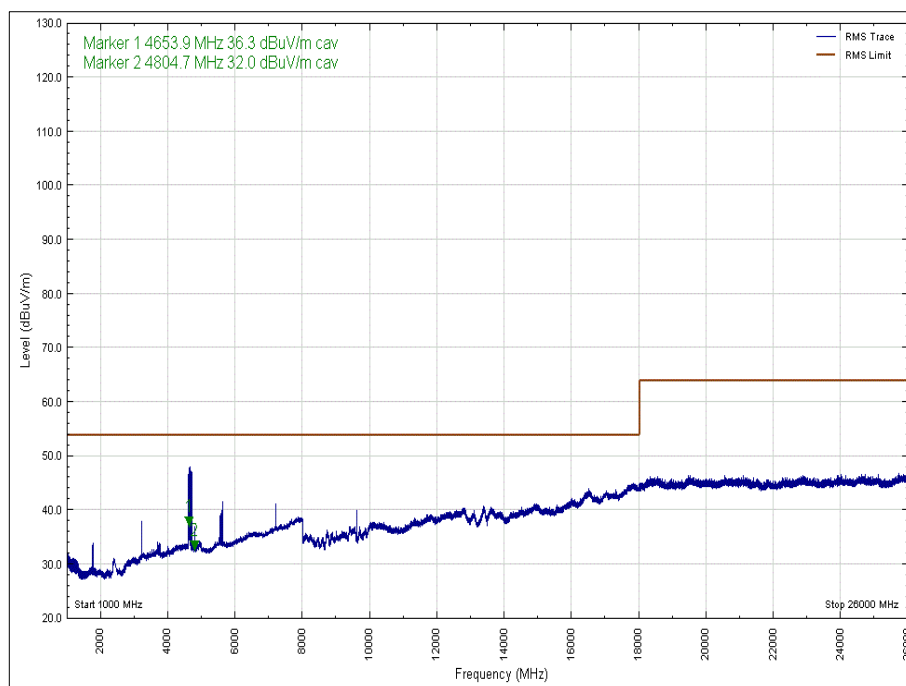


Figure 19 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Y, Average

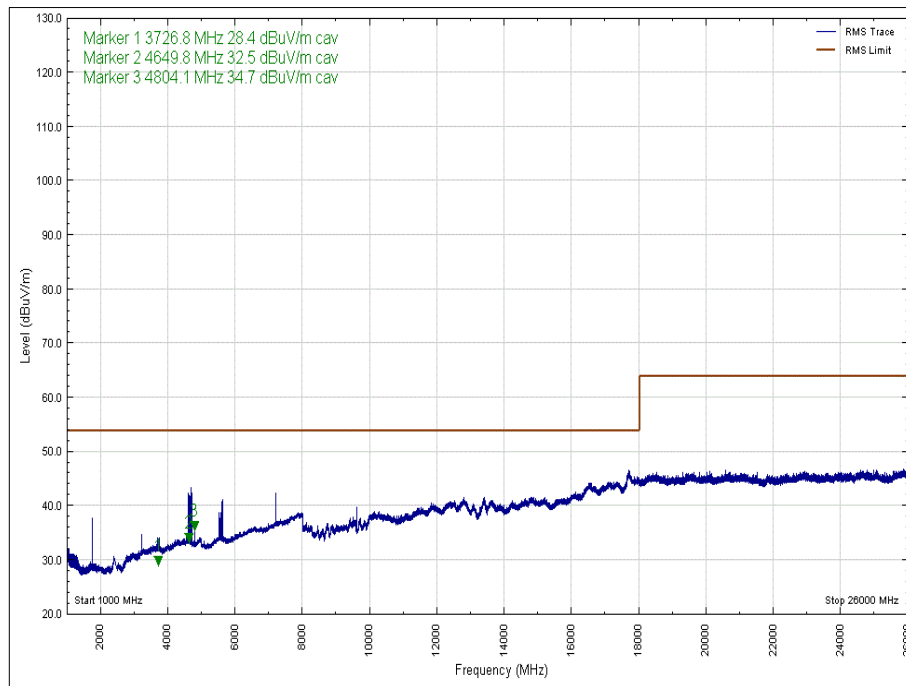


Figure 20 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Y, Average

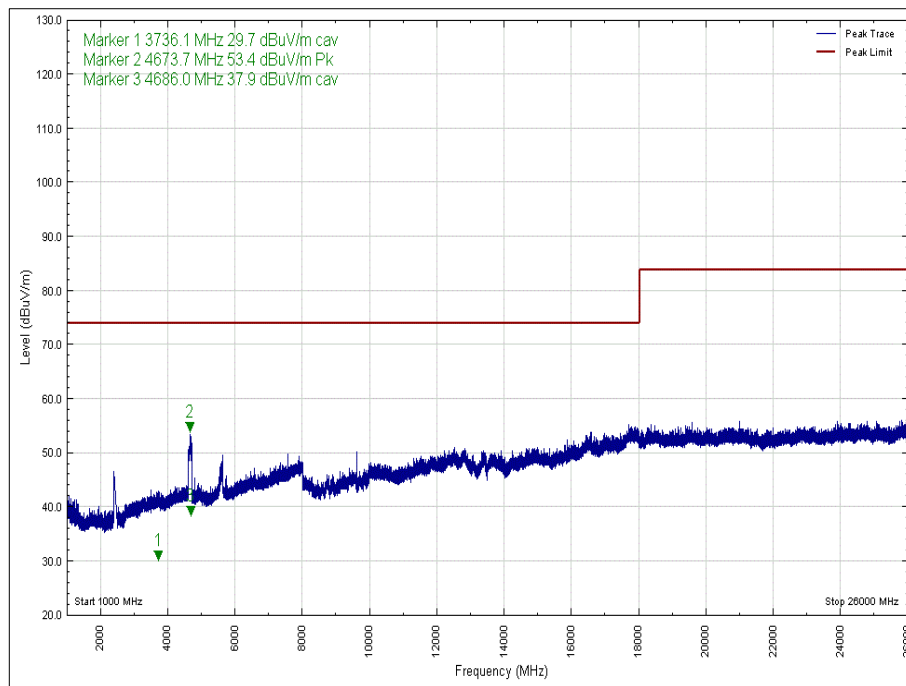


Figure 21 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Z, Peak

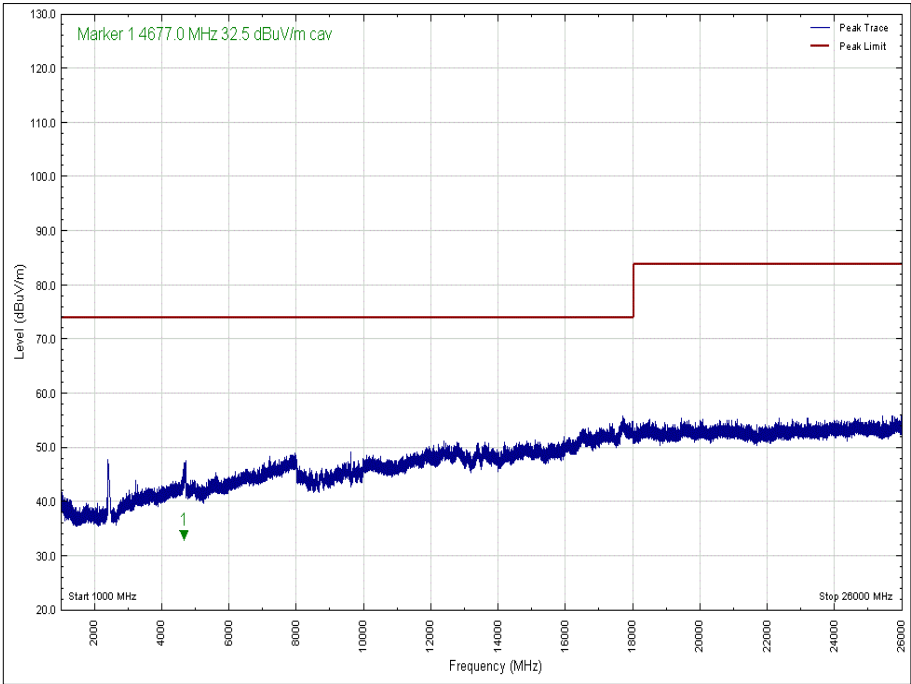


Figure 22 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Z, Peak

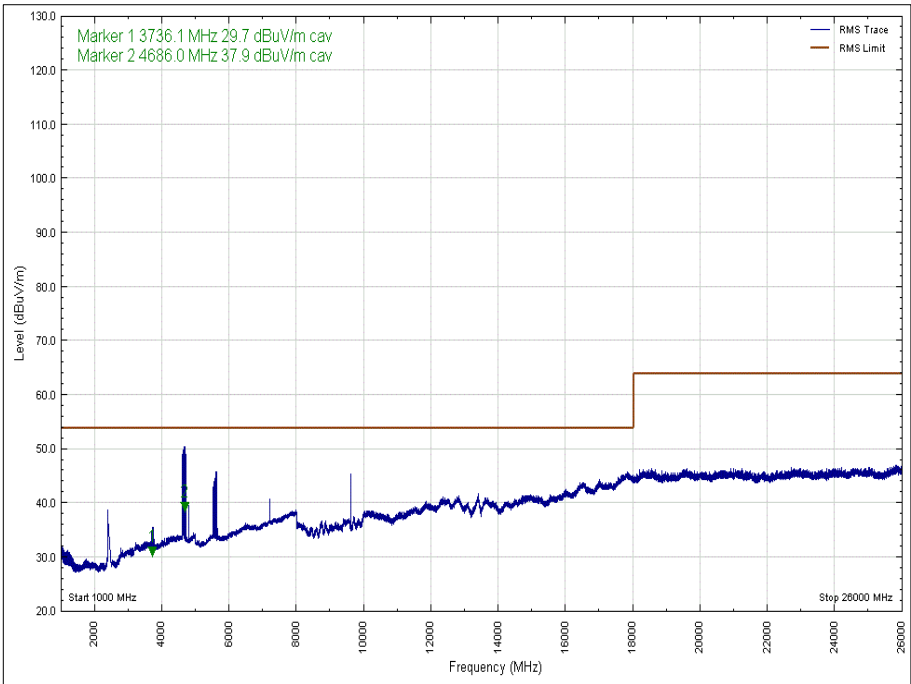


Figure 23 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Z, Average

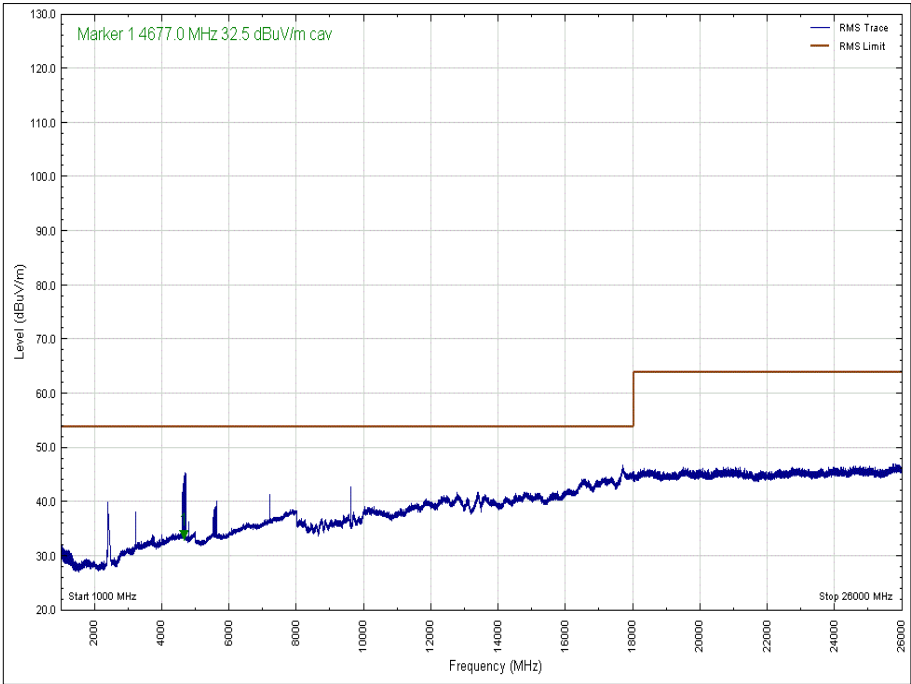


Figure 24 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Z, Average

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
933.454	28.1	46.0	-17.9	Peak	293	211	Vertical	X
938.959	34.9	46.0	-11.2	Peak	285	100	Horizontal	X
939.128	25.7	46.0	-20.3	Peak	276	100	Vertical	Y
938.323	33.2	46.0	-12.8	Peak	288	104	Horizontal	Y
931.580	31.0	46.0	-15.0	Peak	130	328	Vertical	Z
923.769	26.6	46.0	-19.4	Peak	148	309	Horizontal	Z

Table 17 - Radiated Emissions Results, 30 MHz to 1 GHz - 2402 MHz

No other emissions were detected within 10 dB of the limit.

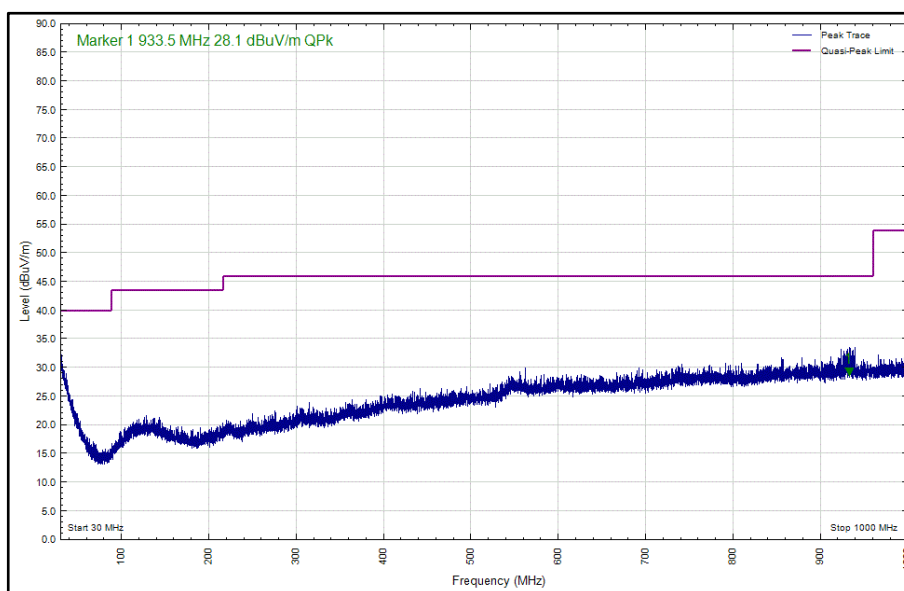


Figure 25 - 30 MHz to 1 GHz, 2441 MHz, Polarity: Vertical, EUT Orientation X

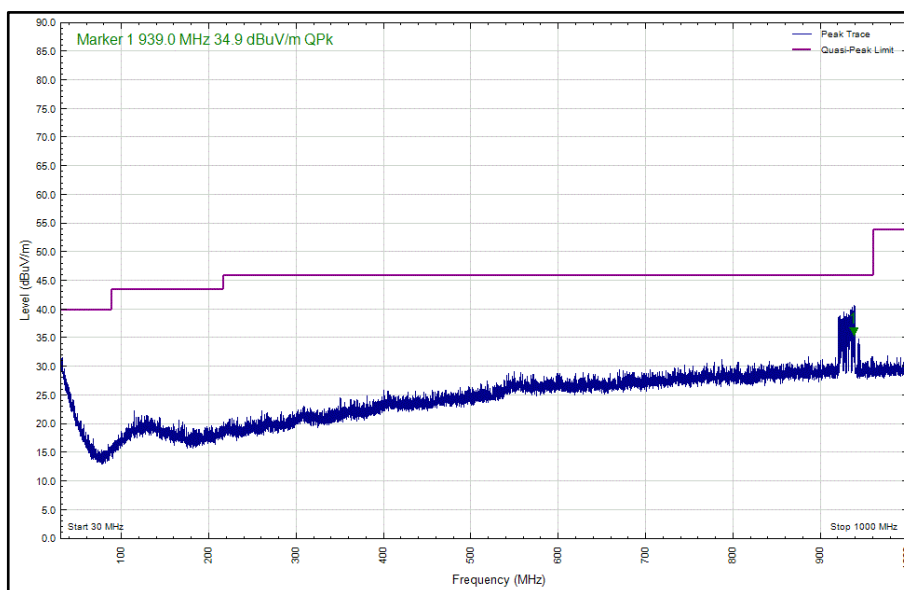


Figure 26 - 30 MHz to 1 GHz, 2441 MHz, Polarity: Horizontal, EUT Orientation X

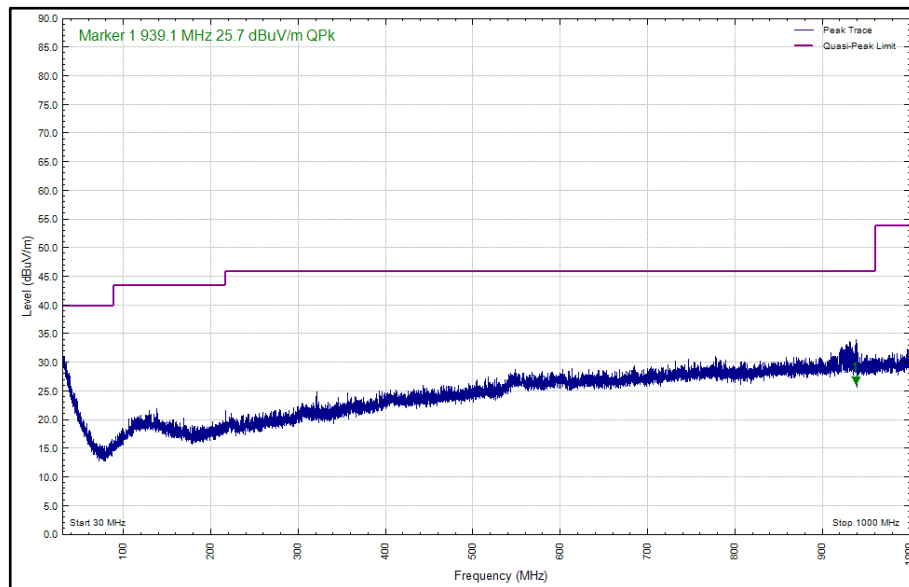


Figure 27 - 30 MHz to 1 GHz, 2441 MHz, Polarity: Vertical, EUT Orientation Y

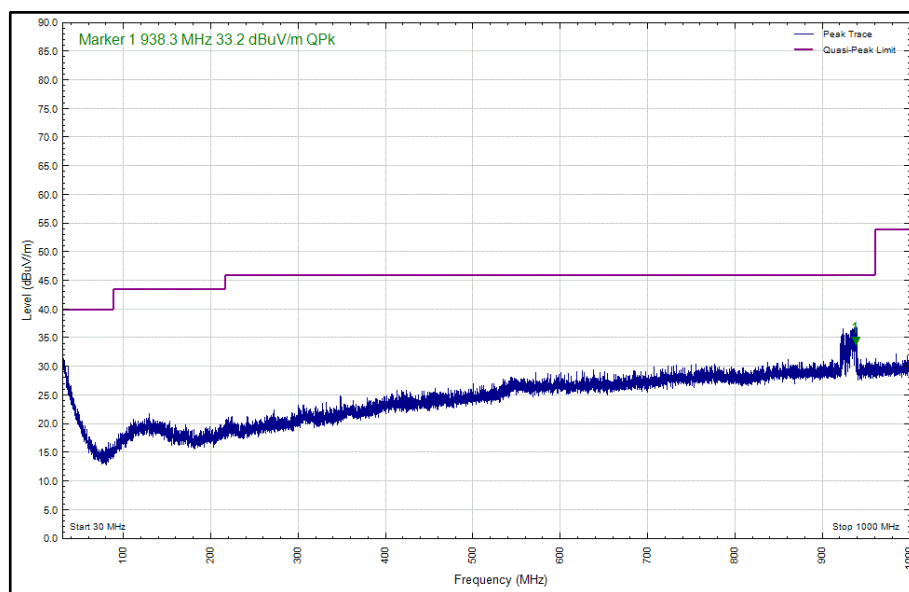


Figure 28 - 30 MHz to 1 GHz, 2441 MHz, Polarity: Horizontal, EUT Orientation Y

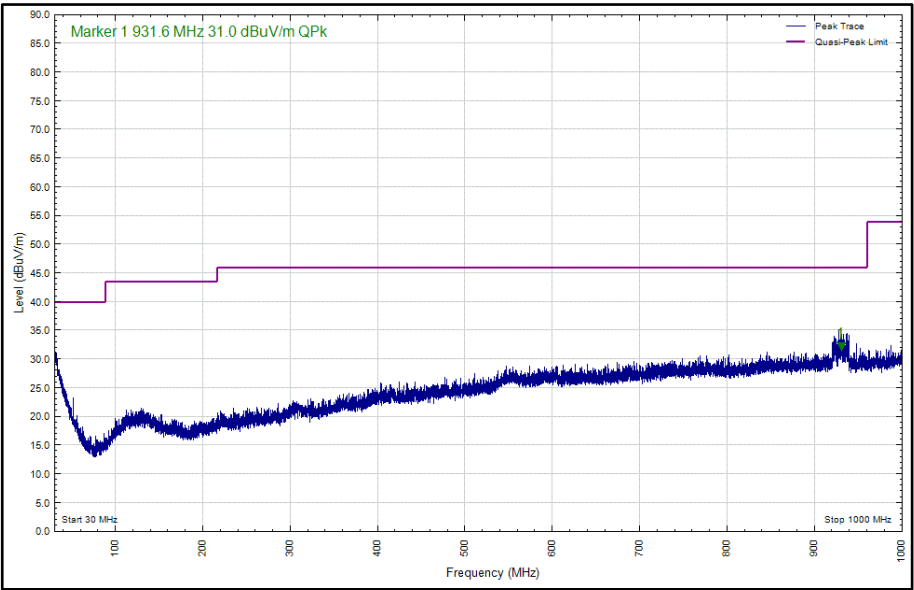


Figure 29 - 30 MHz to 1 GHz, 2441 MHz, Polarity: Vertical, EUT Orientation Z

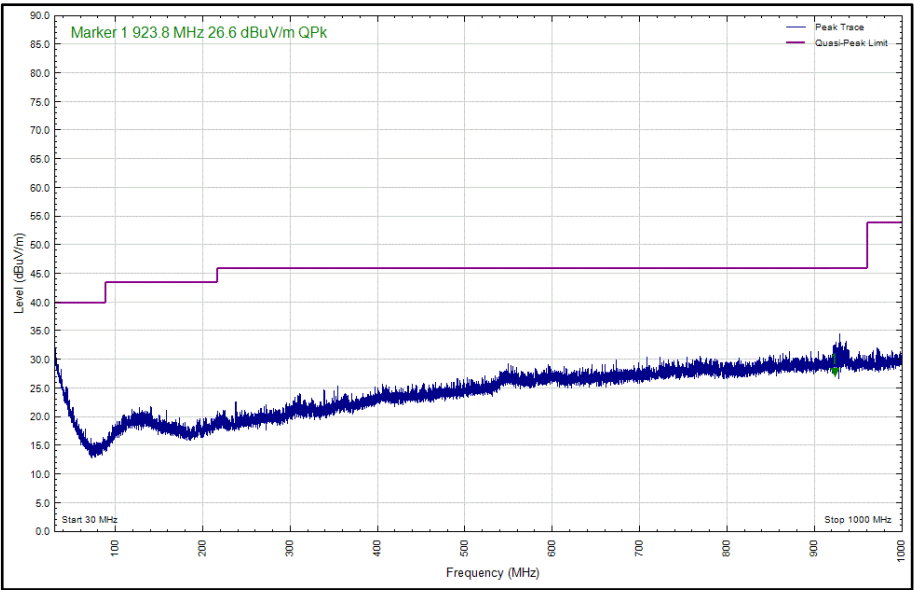


Figure 30 - 30 MHz to 1 GHz, 2441 MHz, Polarity: Horizontal, EUT Orientation Z



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
4695.514	33.2	54.0	-20.8	Average	135	176	Vertical	X
4879.376	34.0	54.0	-20.1	Average	50	110	Vertical	X
4694.074	38.2	54.0	-15.8	Average	158	112	Horizontal	X
3719.743	30.0	54.0	-24.0	Average	229	107	Horizontal	X
4705.609	29.3	54.0	-24.8	Average	161	103	Horizontal	X
4880.216	37.1	54.0	-17.0	Average	132	285	Horizontal	X
7320.484	37.8	54.0	-16.2	Average	276	104	Vertical	X
7320.744	37.5	54.0	-16.5	Average	218	271	Horizontal	X
7320.479	35.1	54.0	-18.9	Average	297	107	Vertical	Y
4659.852	36.2	54.0	-17.8	Average	60	100	Vertical	Y
3737.168	29.7	54.0	-24.3	Average	255	105	Vertical	Y
4879.696	34.9	54.0	-19.1	Average	125	100	Vertical	Y
7320.584	37.8	54.0	-16.3	Average	266	138	Horizontal	Y
7320.584	37.8	54.0	-16.3	Average	266	138	Horizontal	Y
4640.318	31.6	54.0	-22.4	Average	232	109	Horizontal	Y
4879.676	35.4	54.0	-18.6	Average	53	100	Horizontal	Y
4659.587	53.0	74.0	-21.0	Peak	12	276	Vertical	Z
4695.233	37.2	54.0	-16.8	Average	0	110	Vertical	Z
3725.491	29.6	54.0	-24.4	Average	351	101	Vertical	Z
7320.649	35.6	54.0	-18.4	Average	67	105	Vertical	Z
4653.640	32.8	54.0	-21.2	Average	45	110	Horizontal	Z
7320.924	36.8	54.0	-17.2	Average	68	121	Horizontal	Z

Table 18 - 2441 MHz - 1 GHz to 26 GHz, Emissions Results

No other emissions were detected within 10 dB of the limit.

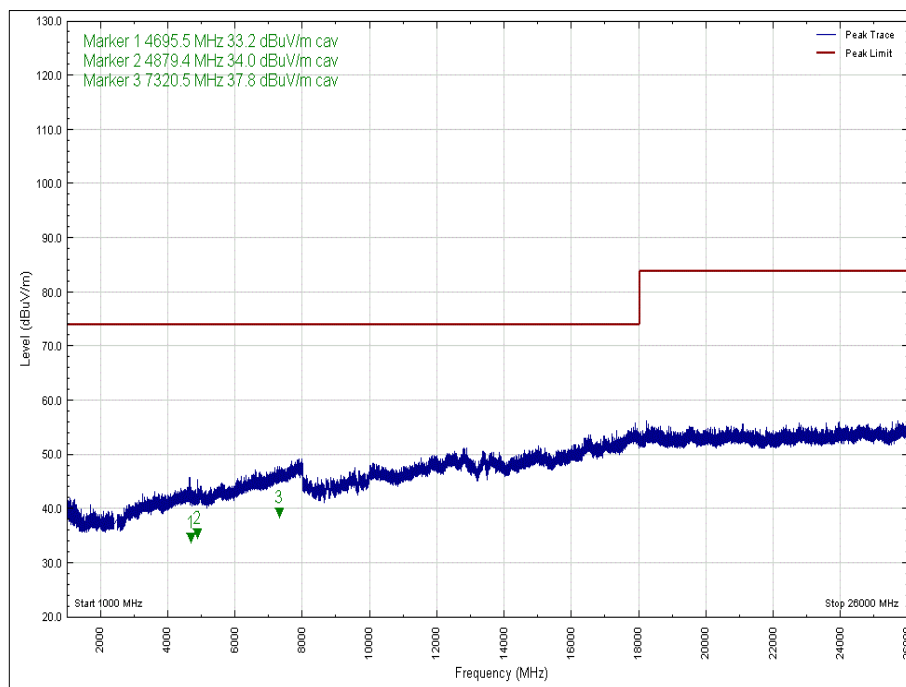


Figure 31 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: X, Peak

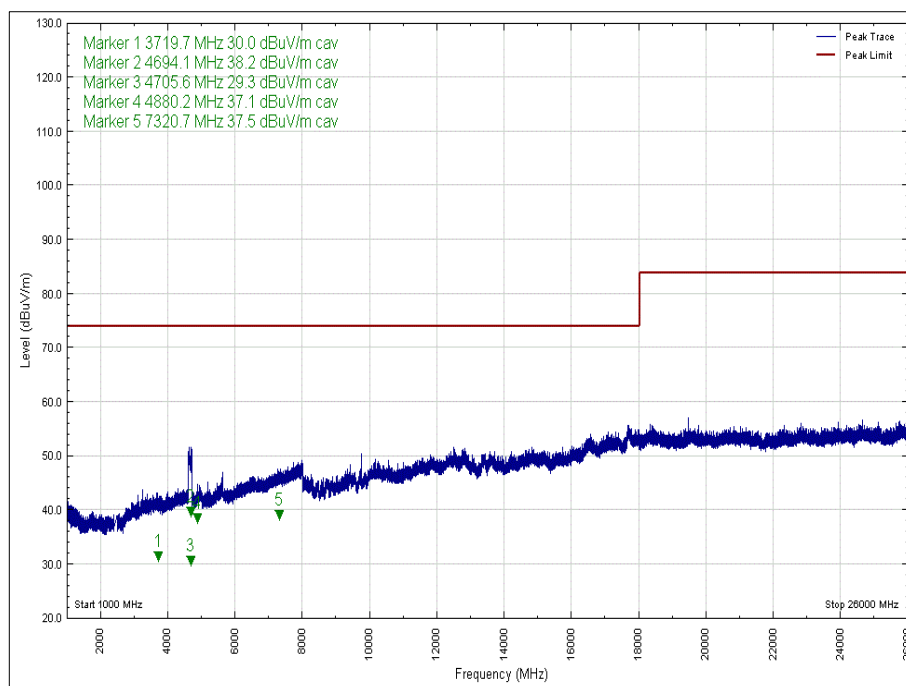


Figure 32 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: X, Peak

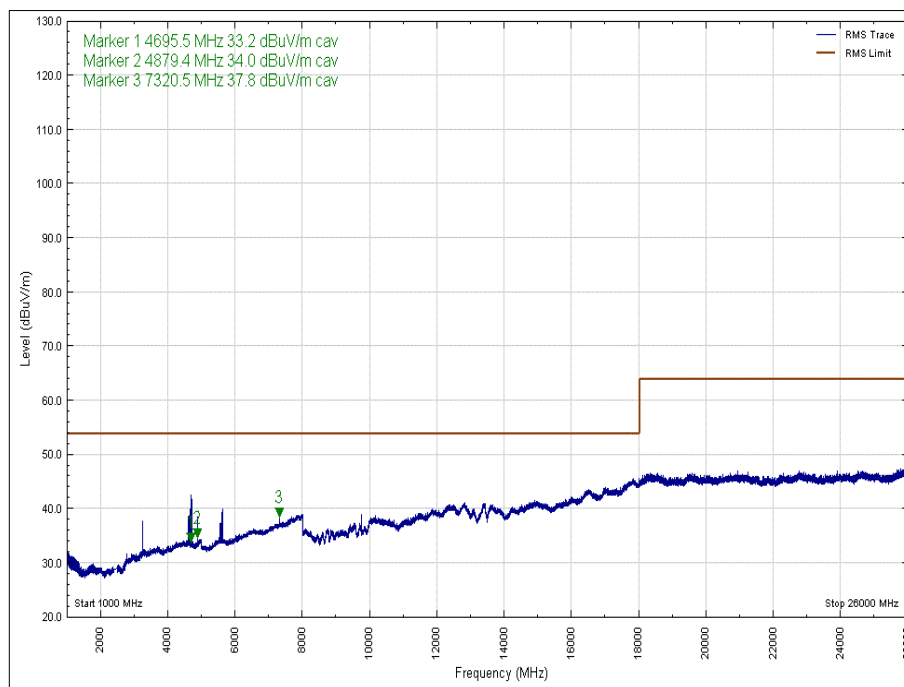


Figure 33 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: X, Average

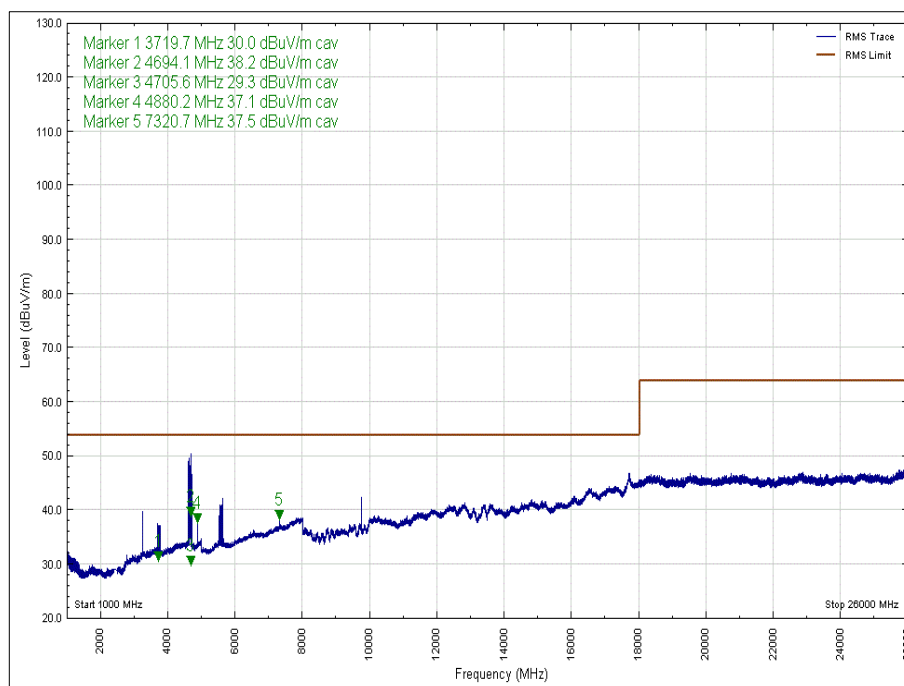


Figure 34 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: X, Average

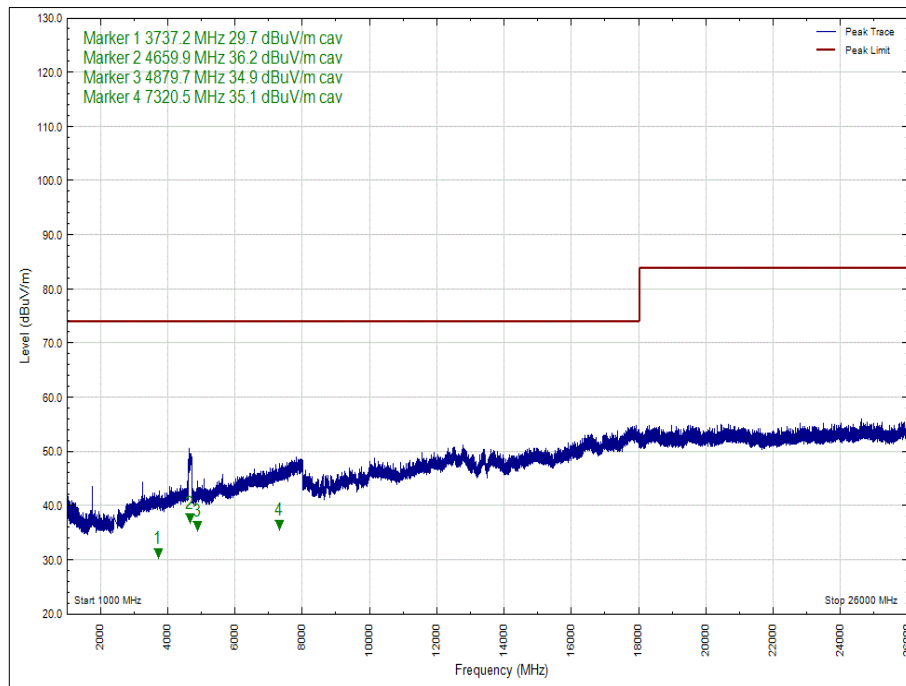


Figure 35 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Y, Peak

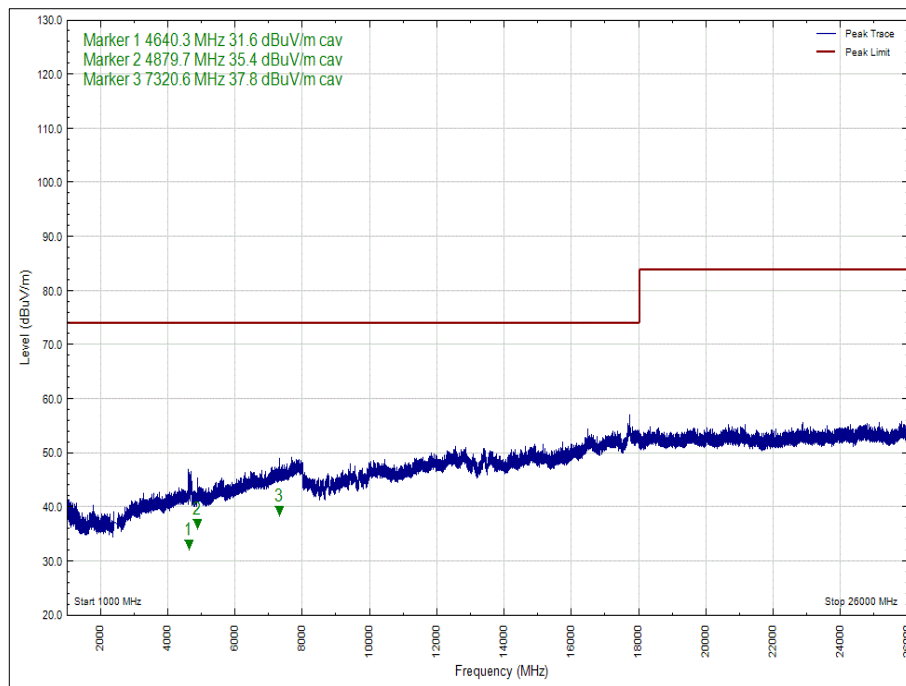


Figure 36 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Y, Peak

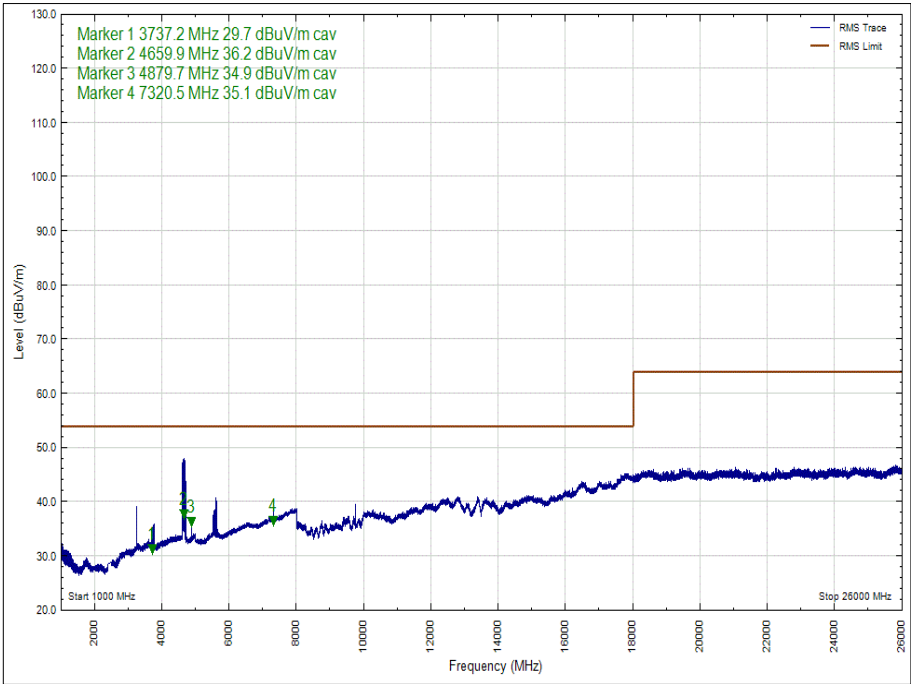


Figure 37 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Y, Average

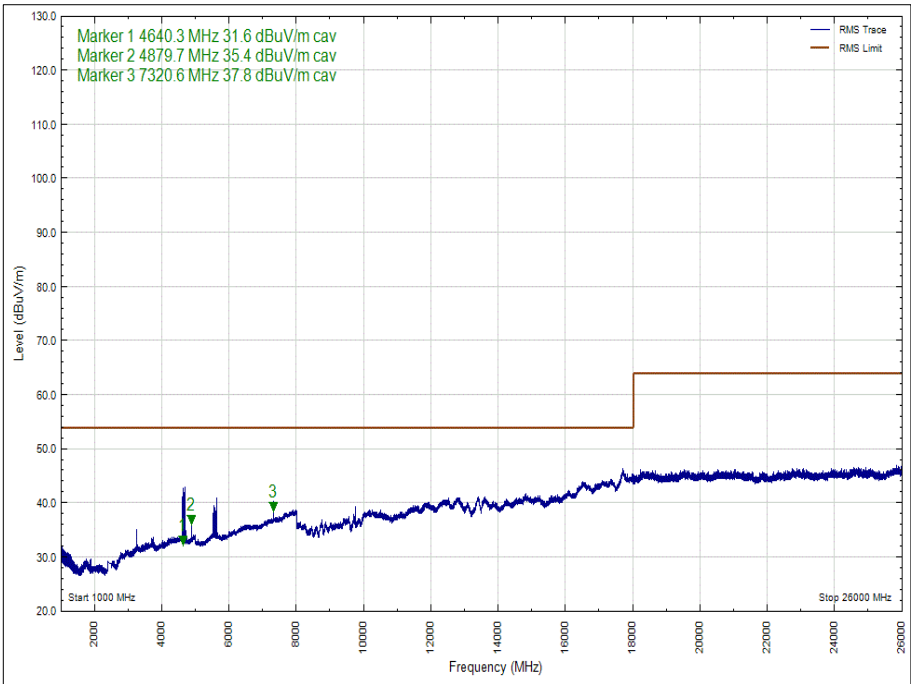


Figure 38 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Y, Average

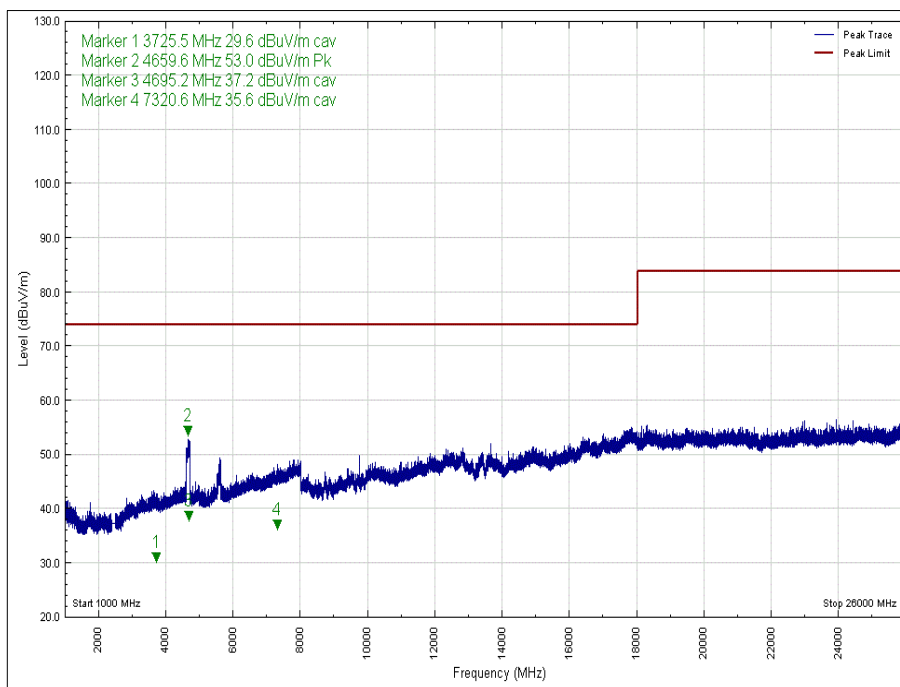


Figure 39 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Z, Peak

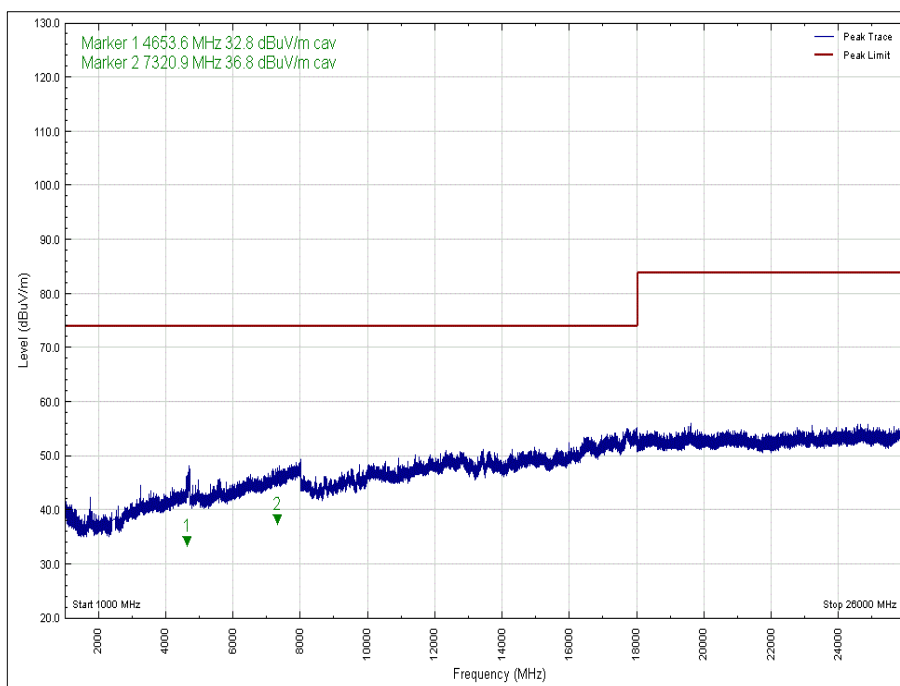


Figure 40 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Z, Peak

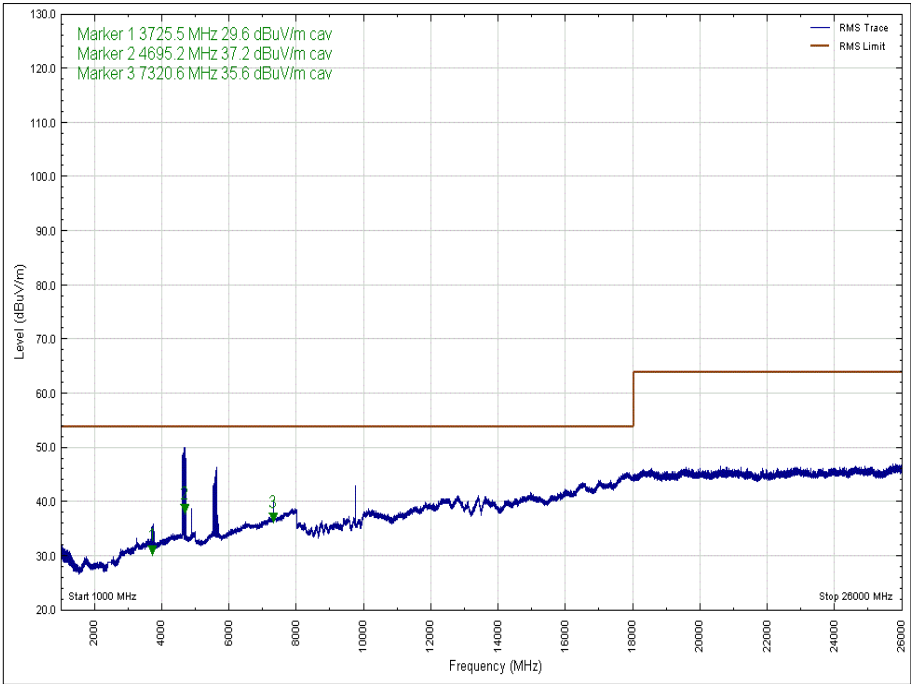


Figure 41 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Z, Average

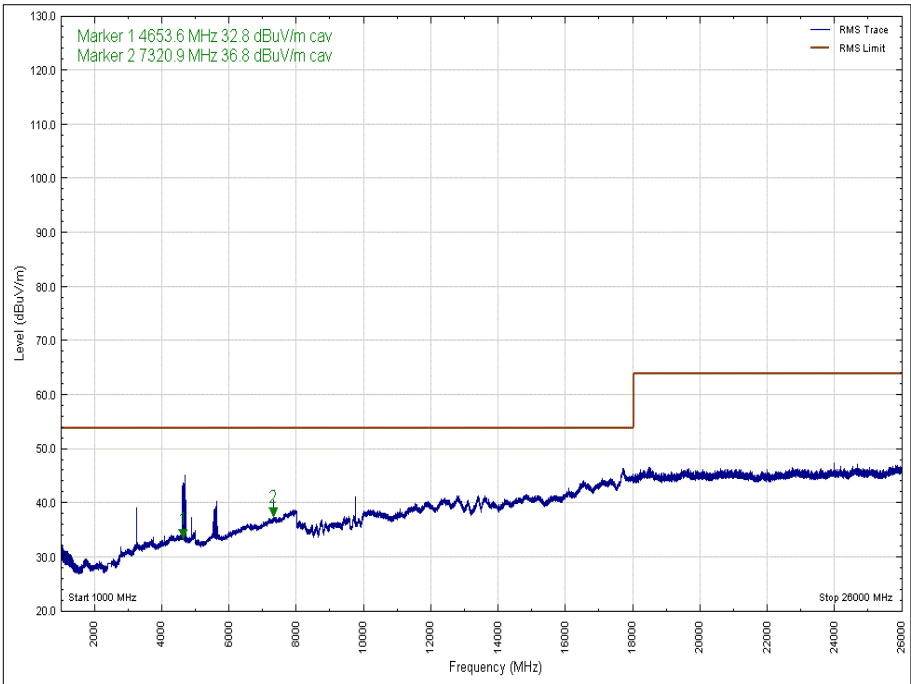


Figure 42 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Z, Average

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
920.694	26.8	46.0	-19.2	Peak	291	108	Vertical	X
933.065	35.3	46.0	-10.7	Peak	303	161	Horizontal	X
938.579	27.0	46.0	-19.0	Peak	148	381	Vertical	Y
938.947	32.5	46.0	-13.5	Peak	301	100	Horizontal	Y
937.405	28.4	46.0	-17.6	Peak	337	101	Vertical	Z
924.923	28.6	46.0	-17.4	Peak	95	311	Horizontal	Z

Table 19 - Radiated Emissions Results, 30 MHz to 1 GHz – 2480 MHz

No other emissions were detected within 10 dB of the limit.

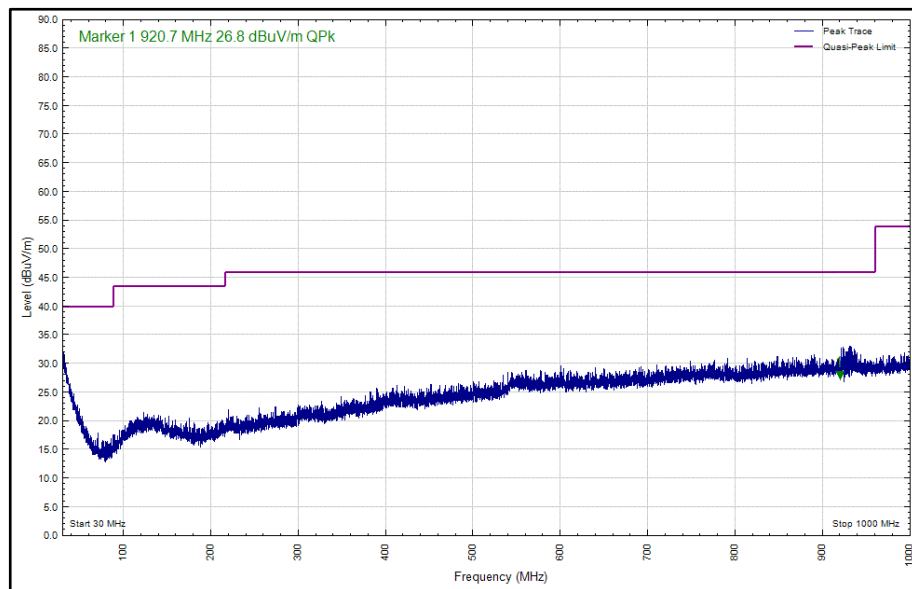


Figure 43 - 30 MHz to 1 GHz, 2480 MHz, Polarity: Vertical, EUT Orientation X

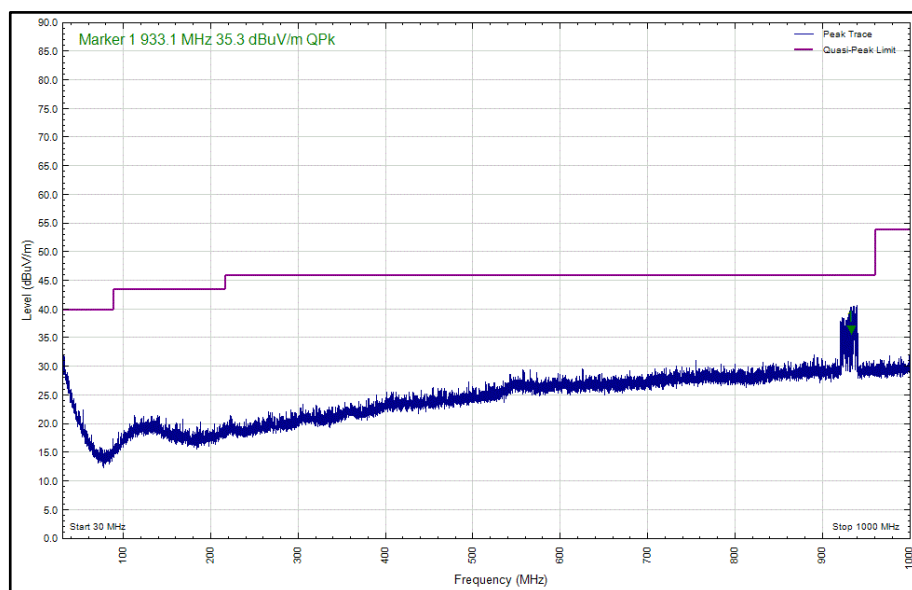


Figure 44 - 30 MHz to 1 GHz, 2480 MHz, Polarity: Horizontal, EUT Orientation X

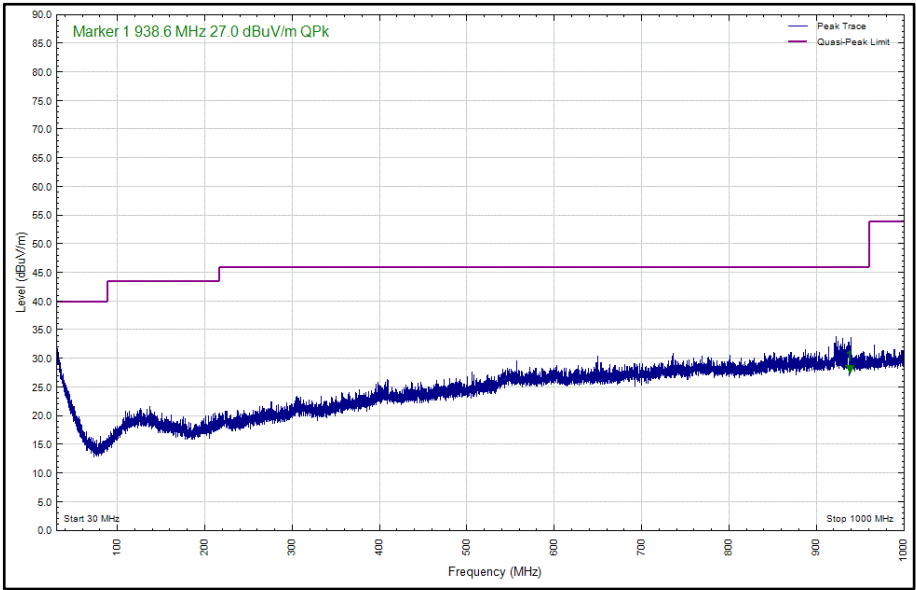


Figure 45 - 30 MHz to 1 GHz, 2480 MHz, Polarity: Vertical, EUT Orientation Y

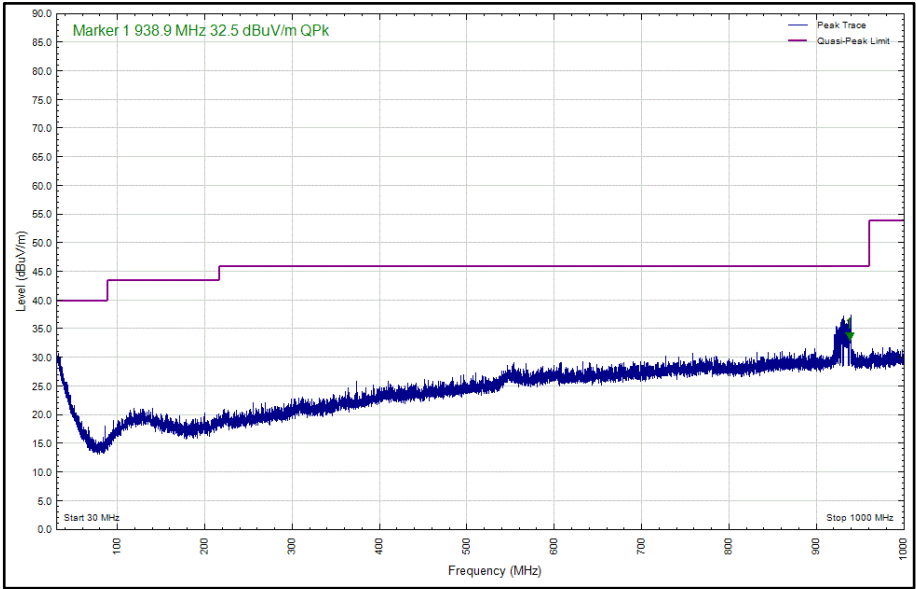


Figure 46 - 30 MHz to 1 GHz, 2480 MHz, Polarity: Horizontal, EUT Orientation Y

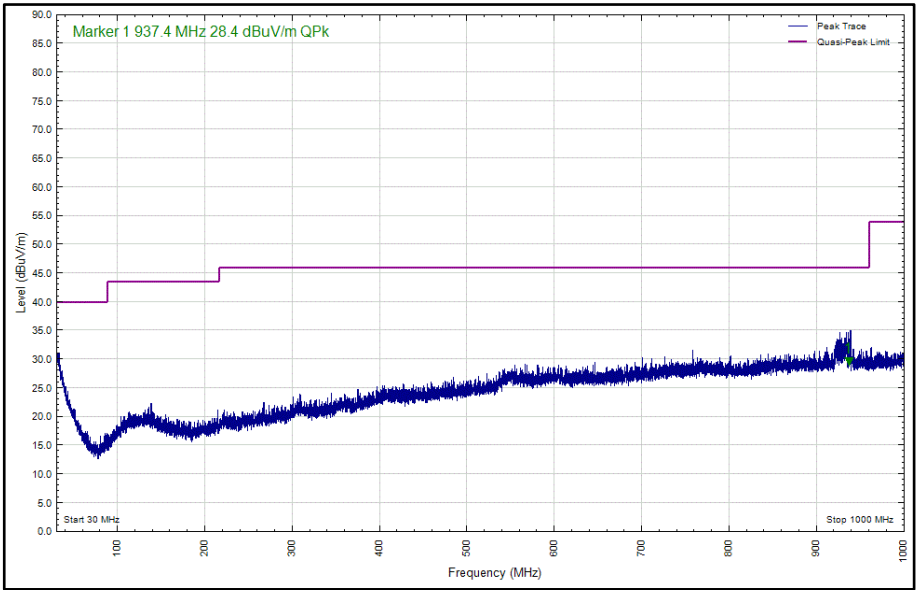


Figure 47 - 30 MHz to 1 GHz, 2480 MHz, Polarity: Vertical, EUT Orientation Z

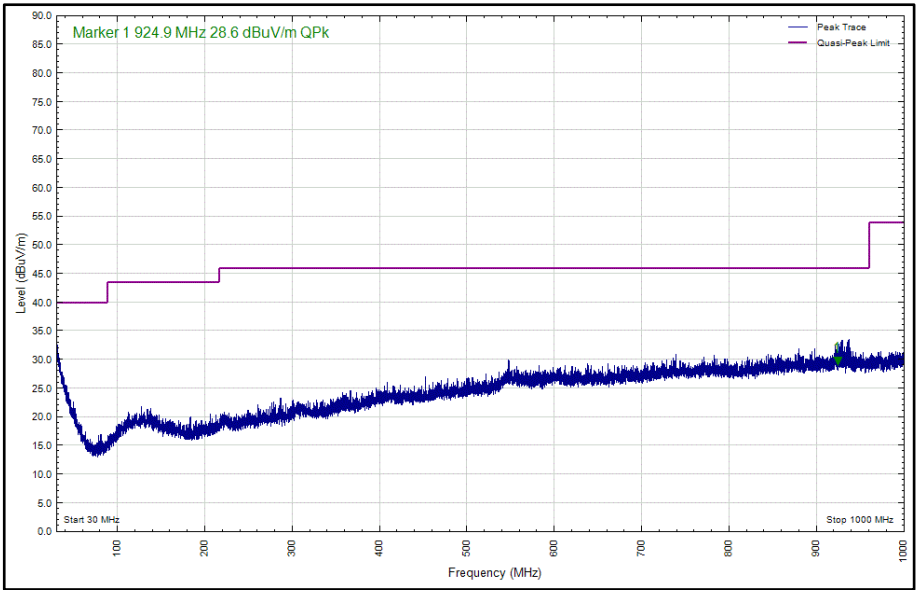


Figure 48 - 30 MHz to 1 GHz, 2480 MHz, Polarity: Horizontal, EUT Orientation Z

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
4669.207	32.4	54.0	-21.6	Average	131	113	Vertical	X
4960.487	43.9	54.0	-10.1	Average	21	108	Vertical	X
7440.819	37.2	54.0	-16.8	Average	274	100	Vertical	X
3713.736	29.7	54.0	-24.3	Average	134	156	Horizontal	X
4654.740	35.9	54.0	-18.1	Average	190	117	Horizontal	X
4959.477	44.1	54.0	-9.9	Average	280	102	Horizontal	X
7439.519	39.1	54.0	-14.9	Average	169	102	Horizontal	X
3695.797	27.7	54.0	-26.3	Average	58	269	Vertical	Y
4685.544	36.3	54.0	-17.7	Average	350	100	Vertical	Y
4654.473	33.9	54.0	-20.2	Average	197	108	Horizontal	Y
7439.414	40.4	54.0	-13.6	Average	66	119	Horizontal	Y
7440.344	38.0	54.0	-16.0	Average	232	100	Vertical	Y
1745.127	62.4	74.0	-11.6	Peak	8	133	Vertical	Z
1970.116	41.3	74.0	-32.8	Peak	311	134	Vertical	Z
3725.902	29.4	54.0	-24.6	Average	0	110	Vertical	Z
4655.060	37.2	54.0	-16.8	Average	353	227	Vertical	Z
7439.179	37.7	54.0	-16.3	Average	64	203	Vertical	Z
4655.712	31.1	54.0	-22.9	Average	278	110	Horizontal	Z
7439.229	41.1	54.0	-13.0	Average	326	105	Horizontal	Z

Table 20 - 2480 MHz - 1 GHz to 26 GHz, Emissions Results

No other emissions were detected within 10 dB of the limit.

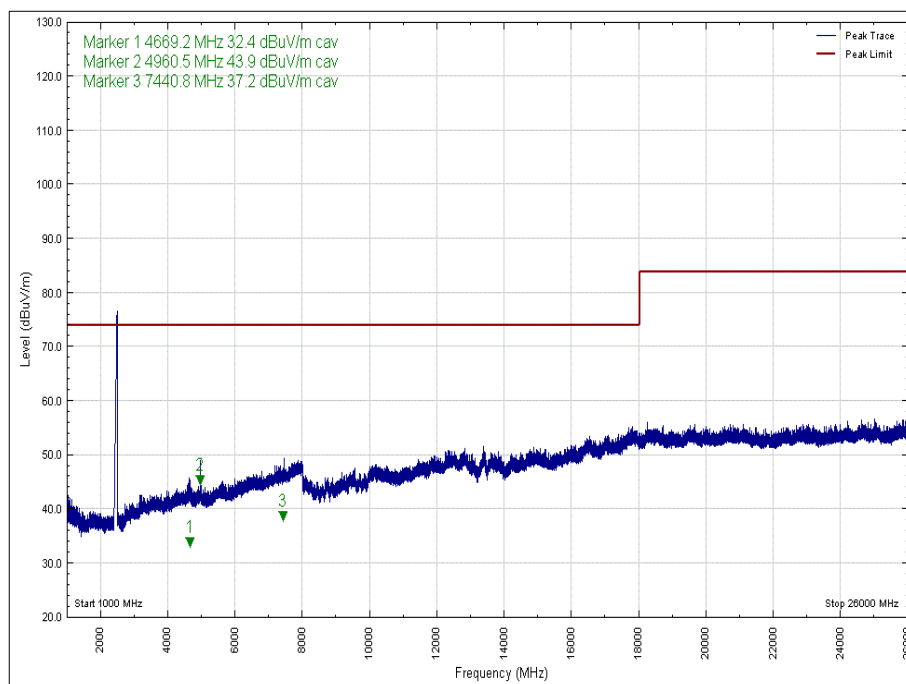


Figure 49 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: X, Peak

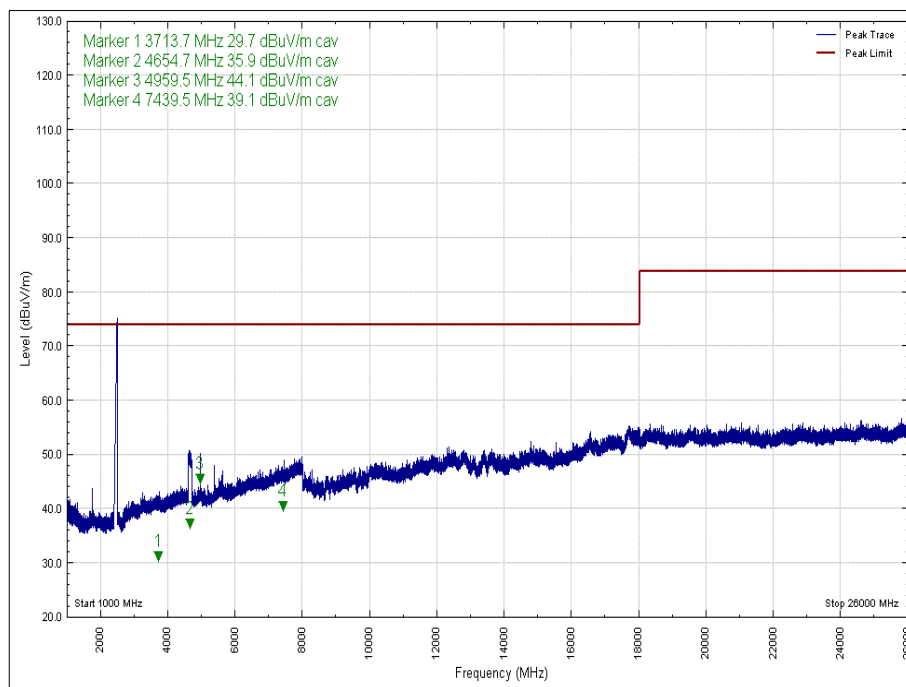


Figure 50 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: X, Peak

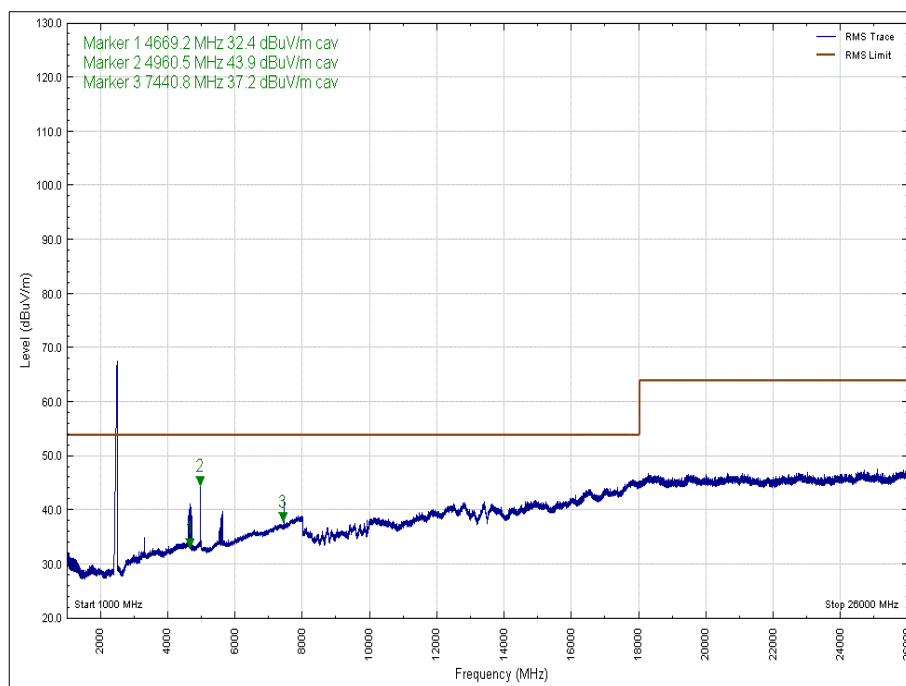


Figure 51 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: X, Average

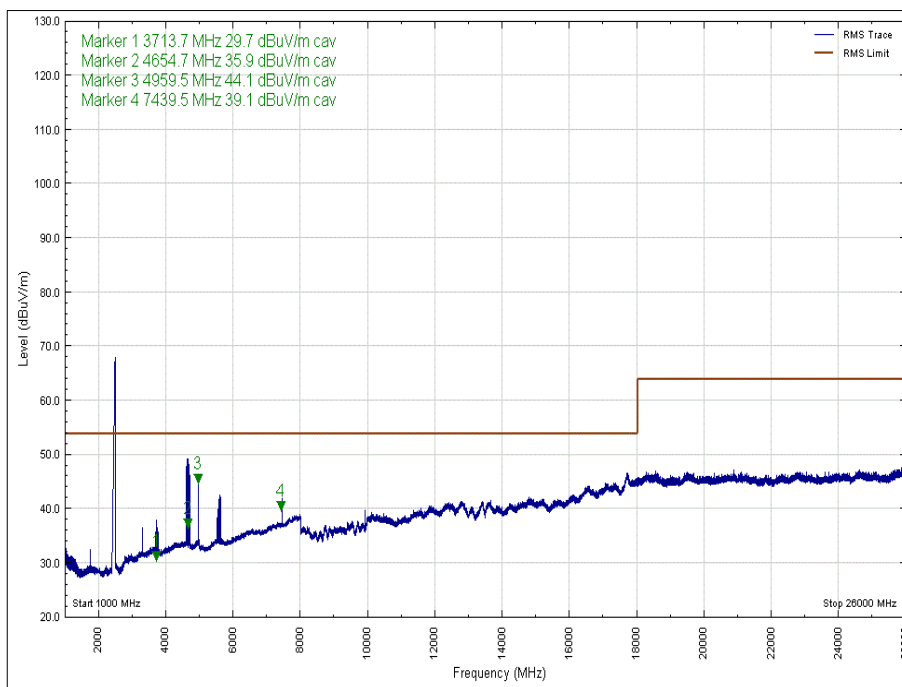


Figure 52 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: X, Average

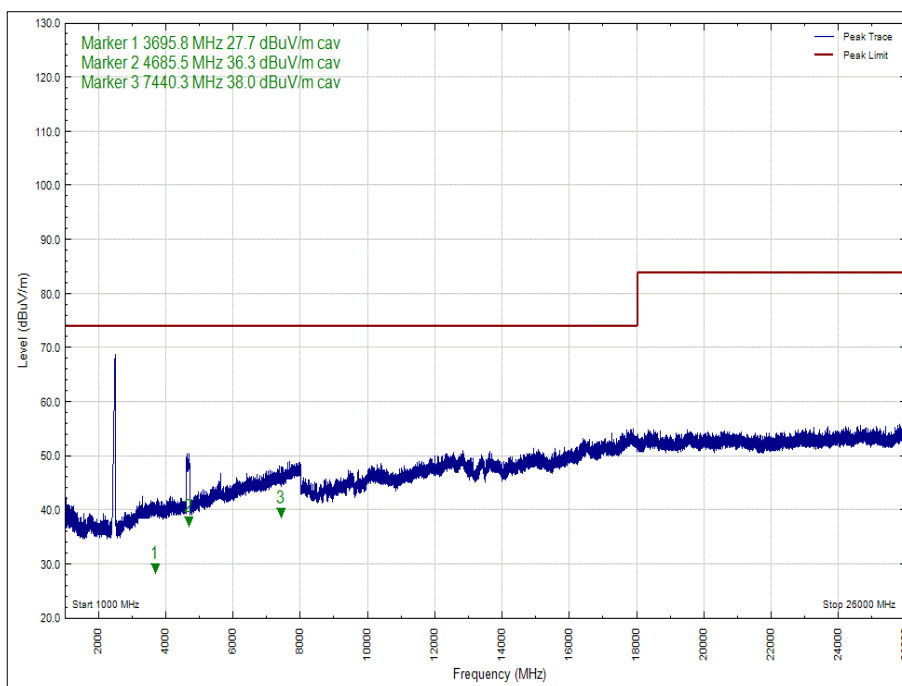


Figure 53 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Y, Peak

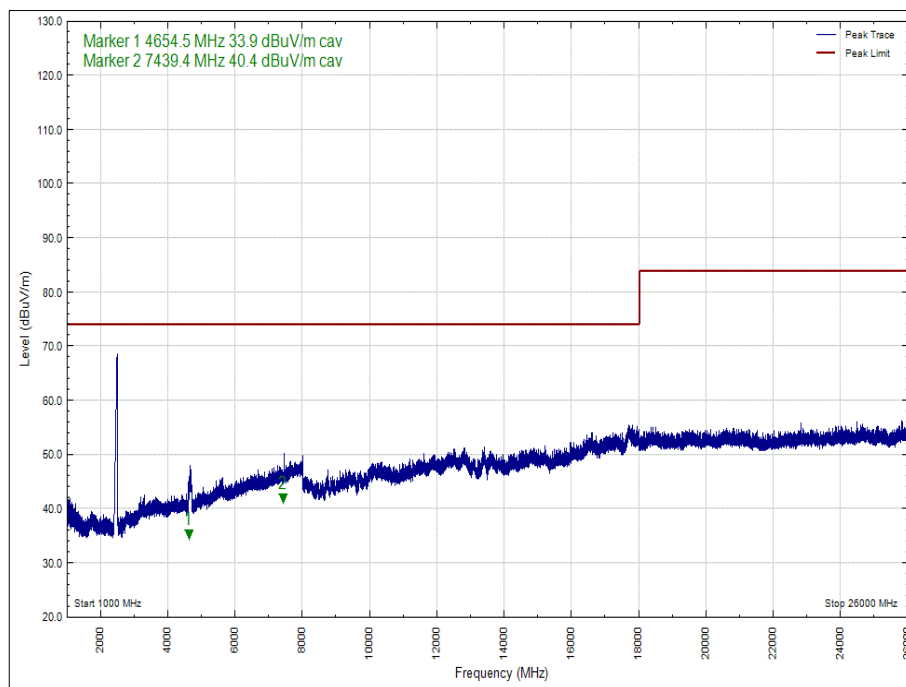


Figure 54 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Y, Peak

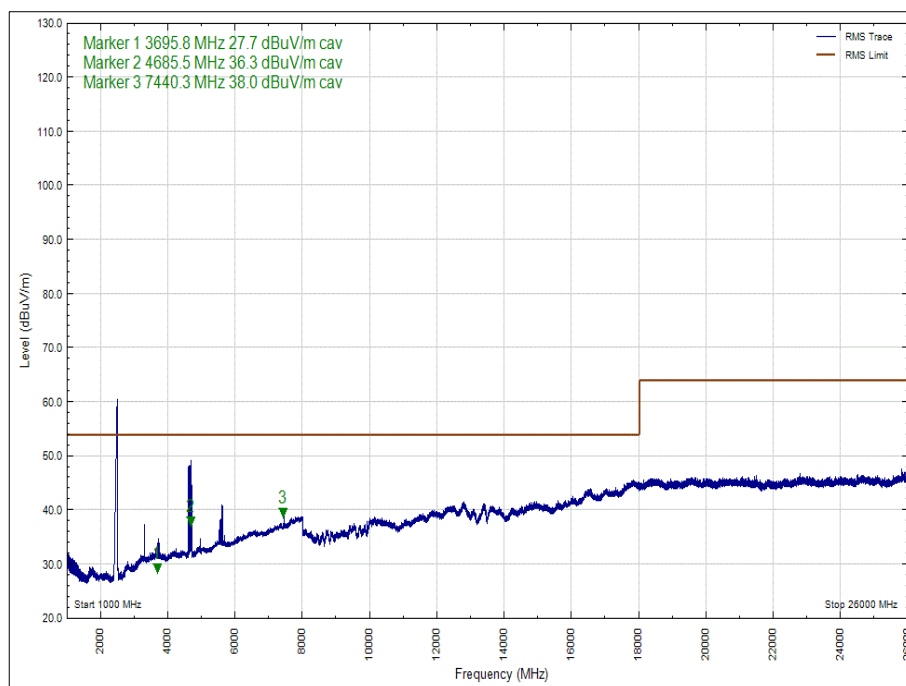


Figure 55 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Y, Average

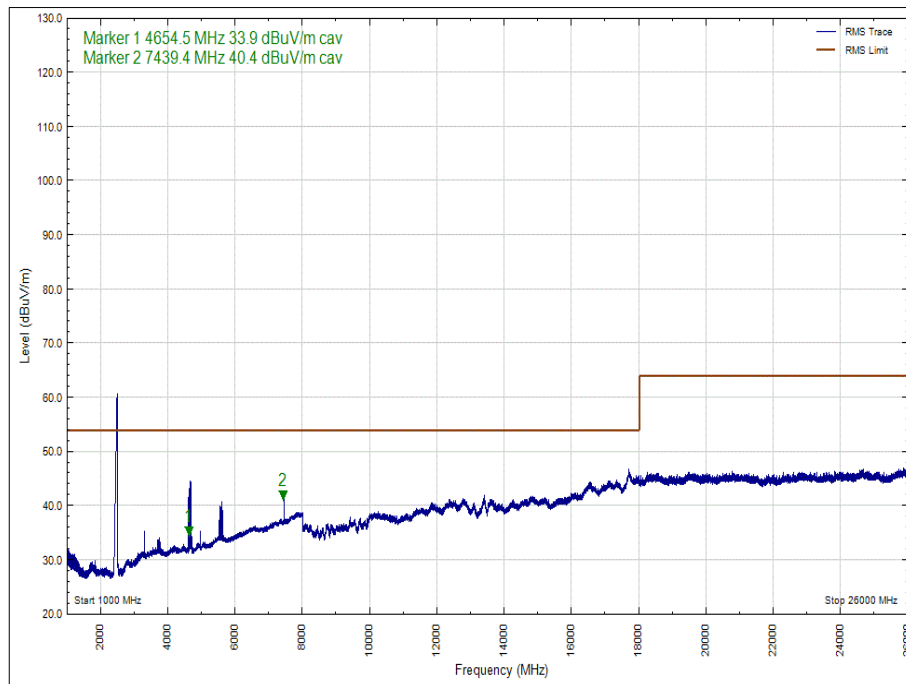


Figure 56 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Y, Average

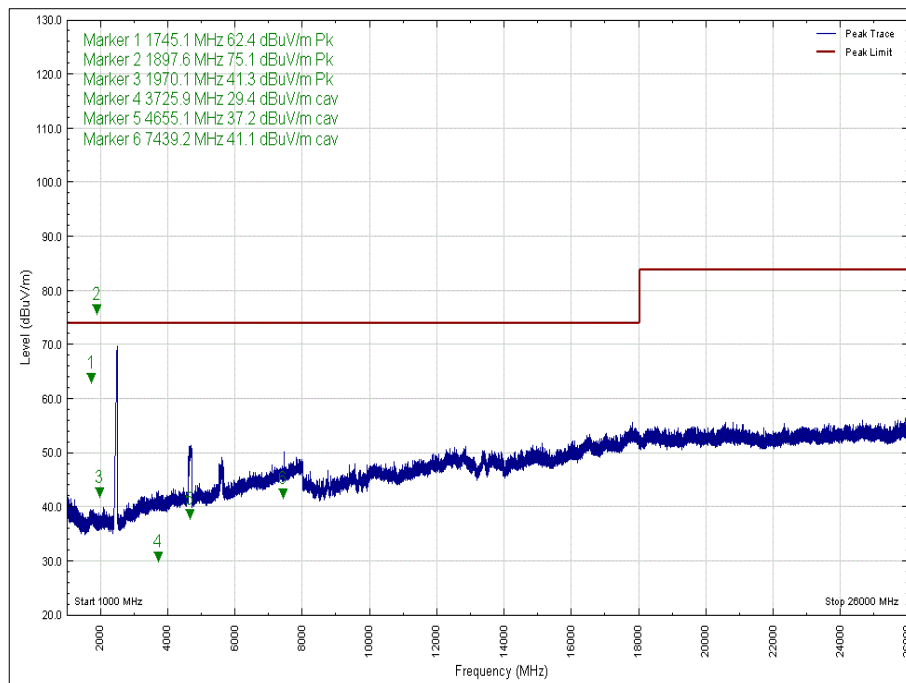


Figure 57 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Z, Peak

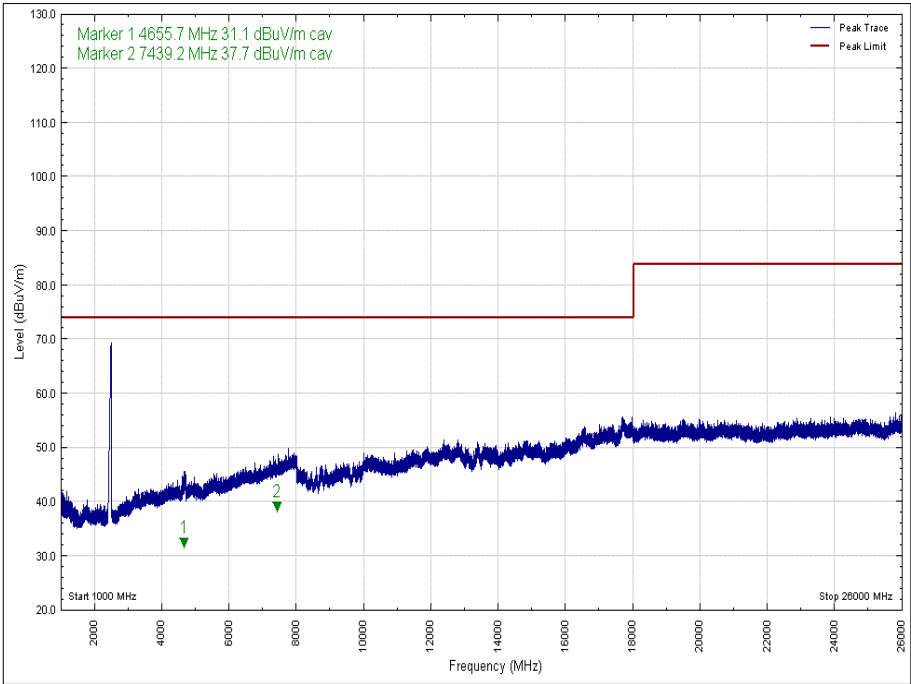


Figure 58 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Z, Peak

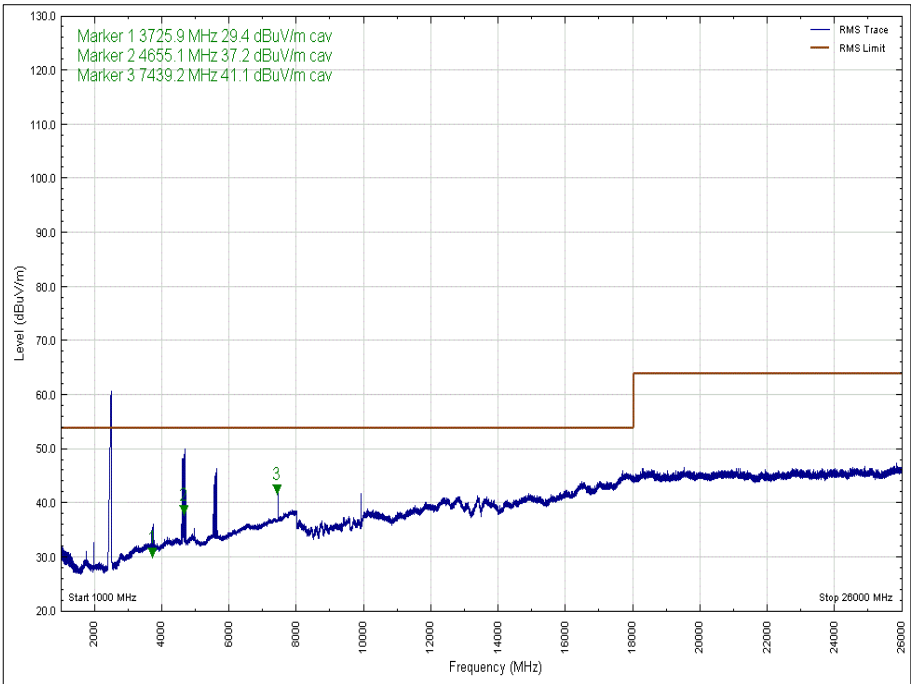


Figure 59 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Z, Average

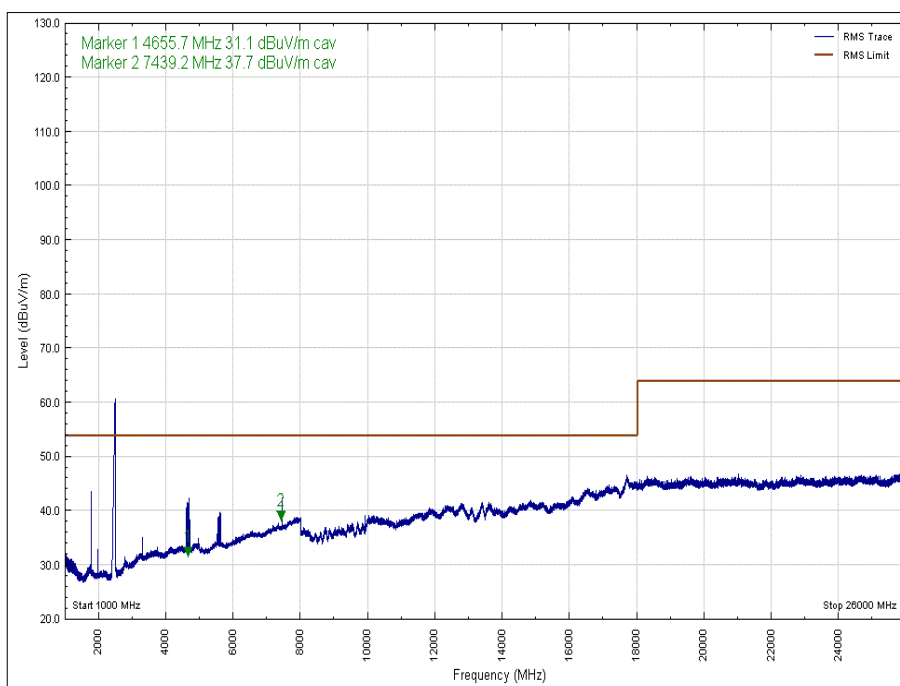


Figure 60 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Z, Average

FCC 47 CFR Part 15, Limit Clause 15.247 (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)

ISED RSS-247, Limit Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.



2.4.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Antenna 18-40GHz (Double Ridge Guide)	Link Microtek Ltd	AM180HA-K-TU2	230	24	02-May-2020
Filter (High Pass)	Lorch	SHP7-7000-SR	566	12	06-Jun-2020
Pre-Amplifier	Phase One	PS04-0086	1533	12	08-Feb-2020
18GHz - 40GHz Pre-Amplifier	Phase One	PS04-0087	1534	12	05-Feb-2020
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Hygrometer	Rotronic	A1	2677	12	20-Feb-2020
'2.92mm' - '2.92mm' RF Cable (2m)	Rhophase	KPS-1503-2000-KPS	3695	12	11-Jun-2020
High Pass Filter (4GHz)	K&L Microwave	11SH10-4000/X18000-0/0	4599	12	05-Sep-2020
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	05-Mar-2020
Mast Controller	Maturo GmbH	NCD	4810	-	TU
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	11-Mar-2020
Band Reject Filter - 2.425 GHz	Wainwright	WRCGV14-2390-2400-2450-2460-50SS	5067	12	01-Oct-2020
Band Reject Filter - 2.4585 GHz	Wainwright	WRCGV14-2423.5-2433.5-2483.5-2493.5-50SS	5069	12	01-Oct-2020
1.5m 40GHz RF Cable	Scott Cables	KPS-1501-2000-KPS	5127	6	20-Jan-2020
8 Meter Cable	Teledyne	PR90-088-8MTR	5212	12	30-Aug-2020
Preamplifier (30dB 1GHz to 18GHz)	Schwarzbeck	BBV 9718 C	5261	12	26-Mar-2020
EMI Test Receiver	Rohde & Schwarz	ESW44	5382	12	08-Oct-2020

Table 21

TU – Traceability Unscheduled

3 Photographs

3.1 Test Setup Photographs

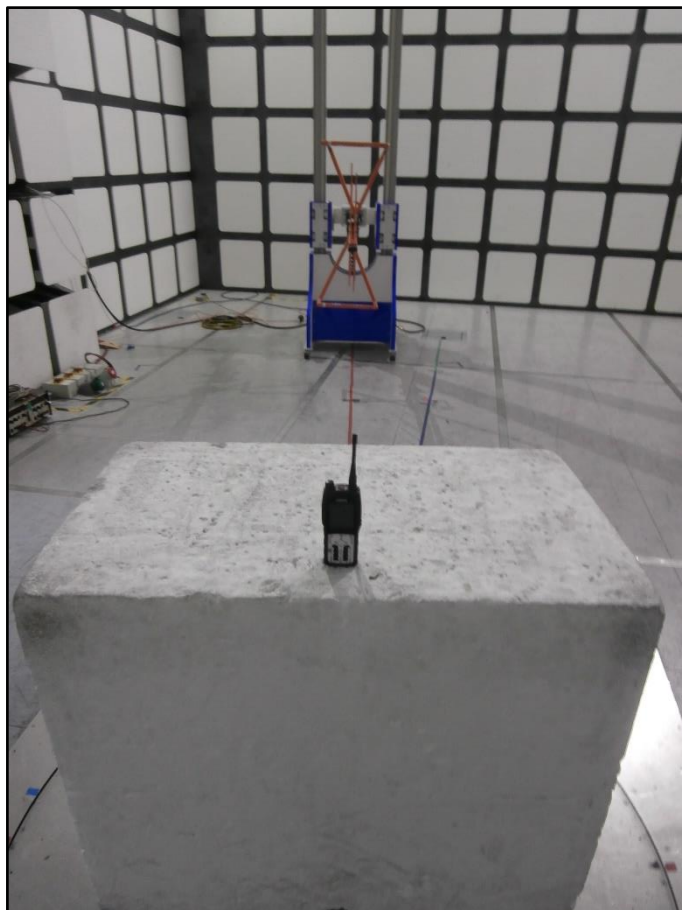


Figure 61 – 30 MHz to 1 GHz



Figure 62 – 1 GHz to 26 GHz



4 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Name	Measurement Uncertainty
Spurious Radiated Emissions	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
Restricted Band Edges	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
Authorised Band Edges	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
AC Power Line Conducted Emissions	150 kHz to 30 MHz, LISN, ± 3.7 dB

Table 22

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2007, clause 4.4.3 and 4.5.1.