ISEDC Test Report

DETNET SOUTH AFRICA (PTY) LTD
Blasting control of electronic detonators, Model: CE4 Commander

In accordance with ISEDC RSS-247 and ISEDC RSS-GEN

Prepared for: DETNET SOUTH AFRICA (PTY) LTD
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Document 75943624-16 Issue 02

SIGNATURE			
			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Matthew Russell	RF Team Leader	Authorised Signatory	03 February 2022

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 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	Graeme Lawler	03 February 2022	

ISEDC Accreditation
12669A Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY
A sample of this product was tested and found to be compliant with ISEDC RSS-247: Issue 2 (2017-02) and ISEDC RSS-GEN: Issue 5 (04-2018) + A1 (03-2019) for the tests detailed in section 1.3.

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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	21 January 2020
2	Added Declared Variant	

Table 1

1.2 Introduction

Applicant	DETNET SOUTH AFRICA (PTY) LTD
Manufacturer	DETNET SOUTH AFRICA (PTY) LTD
Model Number(s)	CE4 Commander
Manufacturer's Declared Variant(s)	CE4 Commander DS600
Serial Number(s)	15300000F
Hardware Version(s)	V5A
Software Version(s)	36230C
Number of Samples Tested	1
Test Specification/Issue/Date	ISEDC RSS-247: Issue 2 (2017-02) ISEDC RSS-GEN: Issue 5 (04-2018) + A1 (03-2019)
Order Number Date	4500348610 23-August-2018
Date of Receipt of EUT	07-September-2018
Start of Test	04-December-2019
Finish of Test	10-December-2019
Name of Engineer(s)	Graeme Lawler
Related Document(s)	ANSI C63.10 (2013)

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with ISEDC RSS-247 and ISEDC RSS-GEN is shown below.

Section	Specification Clause		Test Description	Result	Comments/Base Standard
	RSS-247	RSS-GEN			
Configuration and Mode: 2.4 GHz WLAN - 802.11b					
2.1	5.5	6.13	Spurious Radiated Emissions	Pass	ANSI C63.10 (2013)

Table 2

1.4 Manufacturer's Declared Variant(s)

Classification:	System/Product:	Document Ref:	Revision:
Restricted	DigiShot 600	TGN-00106	1
	Document Type: TGN-Tech General	Current Author: Morgan Lombard	
detnet the future of electronic initiation	Title: Changes between DigiShot 600 Commander and CE4 Commander.	Original Author: Morgan Lombard	
		Page: Page 1 of 3	

1 INTRODUCTION

1.1 Objective

This document describes the differences between the standard CE4 Commander and the DigiShot Commander. Note that from a branding perspective, the system will be branded as 'DigiShot' not 'DigiShot 600' – the latter name being used internally in DetNet to distinguish between the new and old systems.

1.2 Reference Documents

- URS-00111 : DigiShot 600

2 CHANGES

2.1 Hardware Changes

The number of Channels have been reduced to from 4 IOM to 2 IOM.

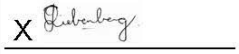
Table 1 - Hardware differences

	CE4 Commander	DigiShot Commander
Channels	4	2 *

* Channel 3 and 4 will be used on DigiShot.

2.2 Mechanical changes

- Main enclosure colour changed from Pantone Yellow 1235C to Pantone Orange 21C. Base material remains PA 66. Other elements remain the same.
- Top two IOM, bezels, spring-loaded wire terminals, associated gaskets and fastening hardware removed.
- The DigiShot UI Faceplate lacks the holes for the above bezels and spring-loaded wire terminals. A Matt Polycarbonate product label is placed over this area.
- Same packaging will be used as the CE4 Commander, at roughly the same weight (14Kg). Packaging tests are conducted to the nearest Kg so the difference in weight from the lack of two IOM is negligible.
- Fitted with an improved UI front plate and sealing.

APPROVER	APPROVER SIGNATURE	SIGNATURE DATE	ISSUE DATE
Abrie Liebenberg	X  Signed by: AJLieb 20200403	2020/10/20	2020/10/20

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Classification:	System/Product:	Document Ref:	Revision:
Restricted	DigiShot 600	TGN-00106	1
	Document Type:	Current Author:	
This page is valid only if it forms part of the complete document which is approved and dated on the first page and carries the same document reference and revision number on all pages.	TGN-Tech General	Morgan Lombard	
	Title:	Original Author:	
	Changes between DigiShot 600 Commander and CE4 Commander.	Morgan Lombard	
		Page: Page 2 of 3	

Figure 1: CE4 Commander UI vs. DigiShot Commander UI


Figure 2: DigiShot System packaging uses existing CE4 Commander Packaging.

Classification:	System/Product:	Document Ref:	Revision:
Restricted	DigiShot 600	TGN-00106	1
	Document Type:	Current Author:	
	TGN-Tech General	Morgan Lombard	
This page is valid only if it forms part of the complete document which is approved and dated on the first page and carries the same document reference and revision number on all pages.	Title: Changes between DigiShot 600 Commander and CE4 Commander.	Original Author: Morgan Lombard	
		Page: Page 3 of 3	

2.3 Firmware Changes

The Base is only allowed to connect to one Bench by default. A ticket option can be used to change the number of benches to two. The Bench only allows 300 detonators per channel. The Bench is limited to two channels. The Bench only works with DigiShot detonators.

Table 2 - Firmware differences

	CE4 Commander	DigiShot Commander
Benches	10	1 (2)
Channels	4	2
Detonators per Channel	400	300
Detonator Product	DigiShot+, IntelliShot	DigiShot

3 REVISION HISTORY

Revision 1: New document

1.5 Application Form

EQUIPMENT DESCRIPTION	
Model Name/Number	CE4 Commander
Part Number	
Hardware Version	V5A
Software Version	36230C
FCC ID (if applicable)	2ARNH-15305A
Industry Canada ID (if applicable)	24476-15351660
Technical Description (Please provide a brief description of the intended use of the equipment)	Free standing blast controller for testing and blasting of electronic detonators.

INTENTIONAL RADIATORS									
Technology	Frequency Band (MHz)	Conducted Declared Output Power (dBm)	Antenna Gain (dBi)	Supported Bandwidth (s) (MHz)	Modulation Scheme(s)	ITU Emission Designator	Test Channels (MHz)		
							Bottom	Middle	Top
WiFi	2400	18	2.1	2412 to 2457	BPSK, QPSK, 16QAM, 64QAM	2G40G1D	2412	2434	2457
NFC	13.56	6	2.1	13.56	Point to point communication	13M5D1D	-	13.56	-
RF	*900*	27	2.1	907.125 to913.325	4-GFSK	900MF1D	907.125	910.125	913.325

UN-INTENTIONAL RADIATOR	
Highest frequency generated or used in the device or on which the device operates or tunes	3177.2 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) ☐	

Power Source			
AC	Single Phase	Three Phase	Nominal Voltage
External DC	Nominal Voltage	Maximum Current	
Battery	Nominal Voltage	Battery Operating End Point Voltage	
Can EUT transmit whilst being charged?		Yes ☐ No ☒	

EXTREME CONDITIONS					
Maximum temperature	+60	°C	Minimum temperature	-30	°C

Ancillaries
Please list all ancillaries which will be used with the device.

ANTENNA CHARACTERISTICS						
☒	Antenna connector			State impedance	50	Ohm
☐	Temporary antenna connector			State impedance		Ohm
☒	Integral antenna	Type	PCB Trace Antenna			
☐	External antenna	Type				

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

Name: H van der Walt

Position held: Quality and Compliance Manager

Date: 17 January 2020

1.6 Product Information

1.6.1 Technical Description

Free standing blast controller for testing and blasting of electronic detonators.

1.7 Deviations from the Standard

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

1.8 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: CE4 Commander: Serial Number: 15300000F			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

1.9 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 WLAN - 802.11b		
Spurious Radiated Emissions	Graeme Lawler	UKAS

Table 4

Office Address:

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

2 Test Details

2.1 Spurious Radiated Emissions

2.1.1 Specification Reference

ISEDC RSS-247, Clause 5.5
ISEDC RSS-GEN, Clause 6.13

2.1.2 Equipment Under Test and Modification State

CE4 Commander, S/N: 15300000F - Modification State 0

2.1.3 Date of Test

04-December-2019 to 10-December-2019

2.1.4 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.

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^(Field Strength in dBµV/m/20).

At a measurement distance of 1 meter the limit line was increased by 20*LOG(3/1) = 9.54 dB. Where formal measurements have been necessary, the results have been presented in the emissions table.

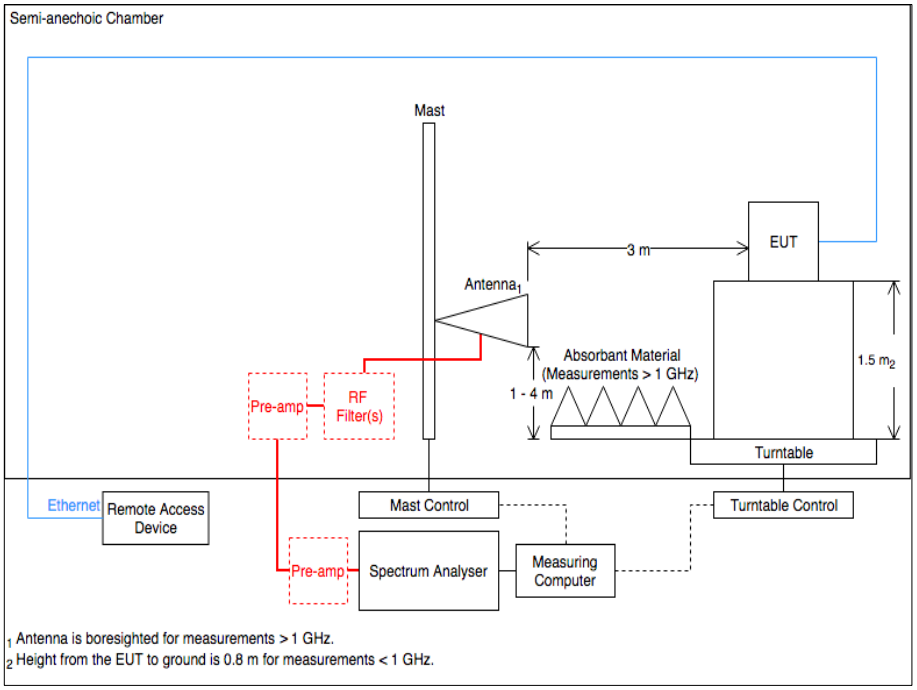

Figure 1 - Radiated Emissions Test Setup Diagram

2.1.5 Environmental Conditions

Ambient Temperature	17.7 °C
Relative Humidity	34.1 %

2.1.6 Test Results

2.4 GHz WLAN - 802.11b

Testing was performed on the Data Rate which resulted in the highest conducted output power.

The Data Rate used during testing was 5.5 Mbps. For configurations supporting multiple bandwidths, emission measurements were only made in the bandwidth with the highest conducted output power.

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
168.012	36.7	43.5	-6.9	Q-Peak	258	102	Vertical	-
215.975	36.5	43.5	-7.0	Q-Peak	350	251	Vertical	-

Table 5 - 2412 MHz - 30 MHz to 1 GHz Emissions Results

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

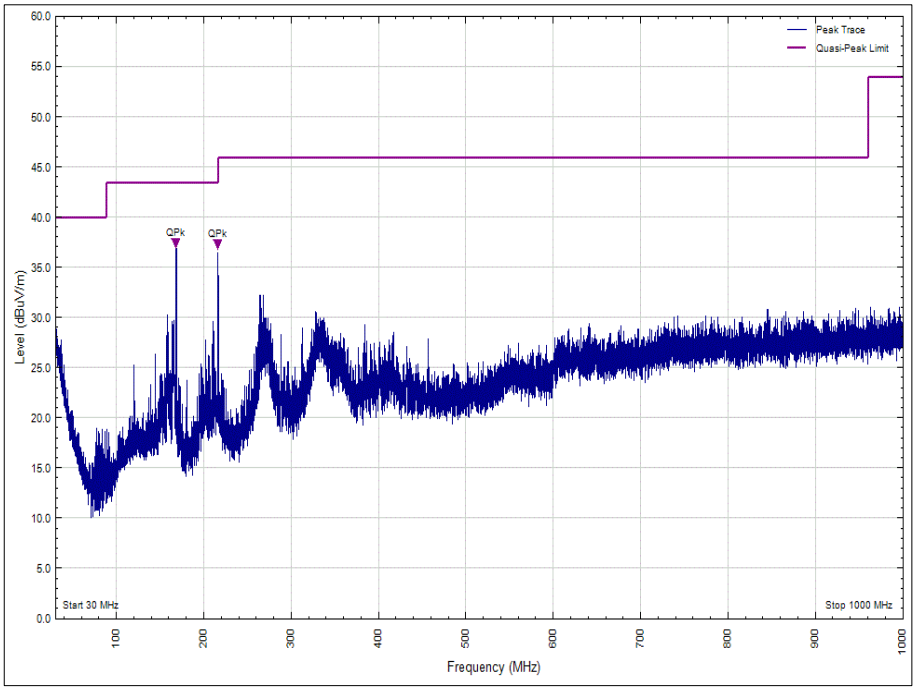

Figure 2 - 2412 MHz - 30 MHz to 1 GHz
Polarity: Vertical

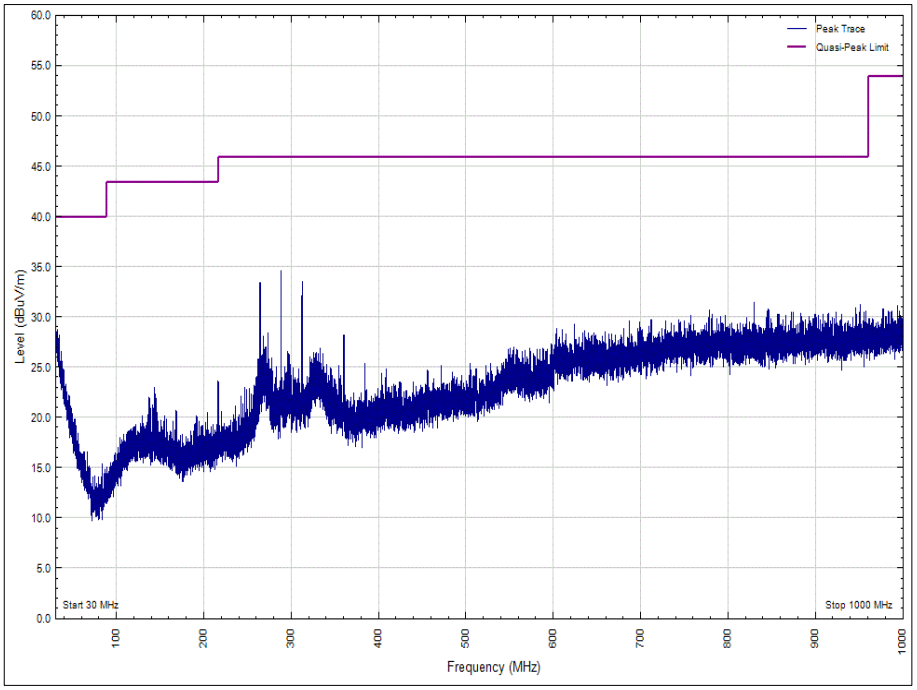

Figure 3 - 2412 MHz - 30 MHz to 1 GHz
Polarity: Horizontal

Frequency (GHz)	Result (dBµV/m)		Limit (dBµV/m)		Margin (dBµV/m)	
	Peak	Average	Peak	Average	Peak	Average
2.236330	-	47.00	-	53.98	-	6.98
2.277430	-	46.42	-	53.98	-	7.56

Table 6 - 2412 MHz - 1 GHz to 25 GHz Emissions Results

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

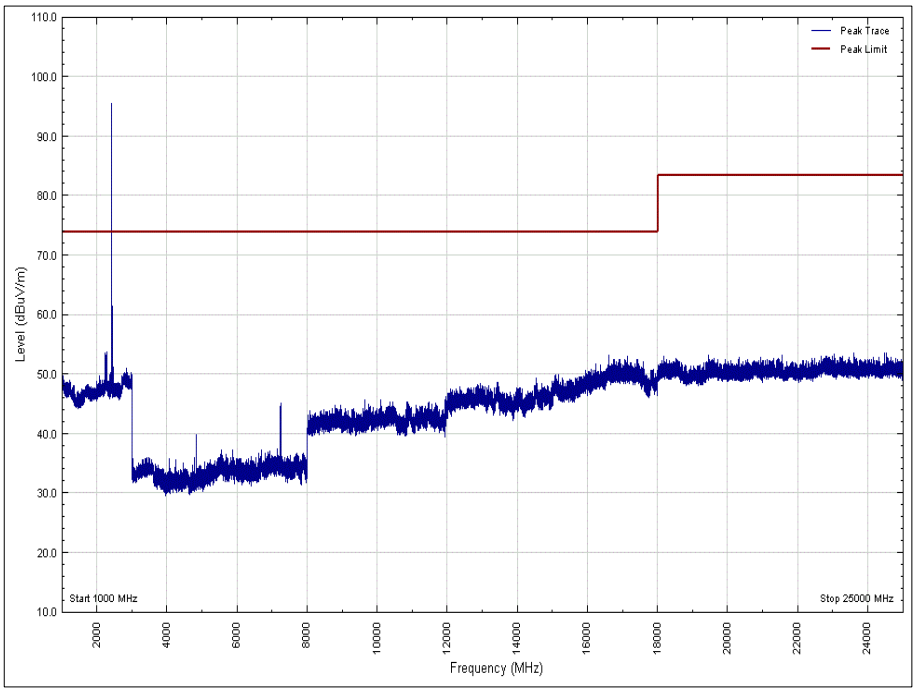

Figure 4 - 2412 MHz - 1 GHz to 25 GHz - Peak
Polarity: Vertical

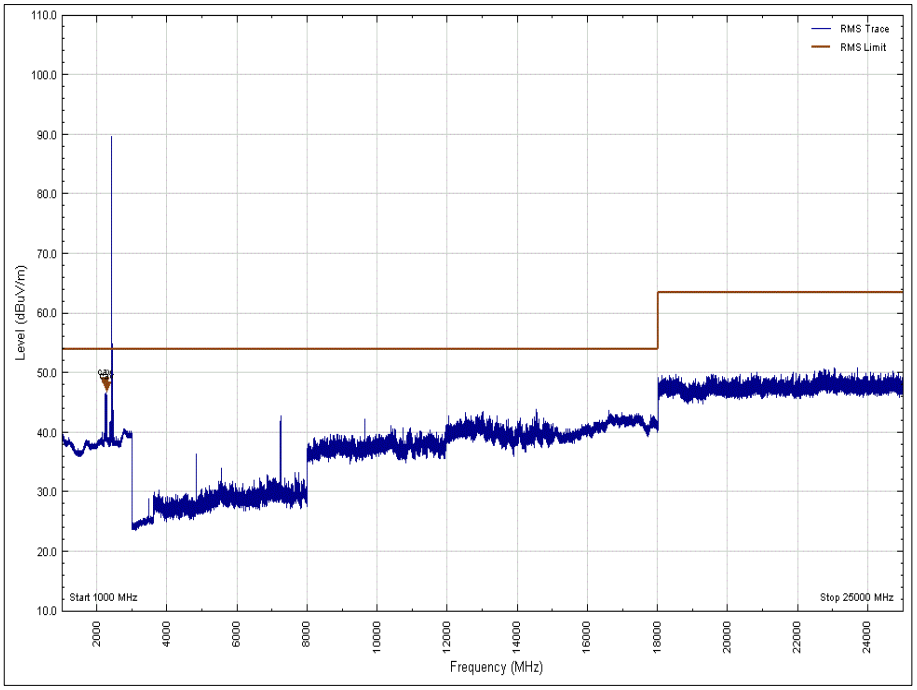

Figure 5 - 2412 MHz - 1 GHz to 25 GHz - Average
Polarity: Vertical

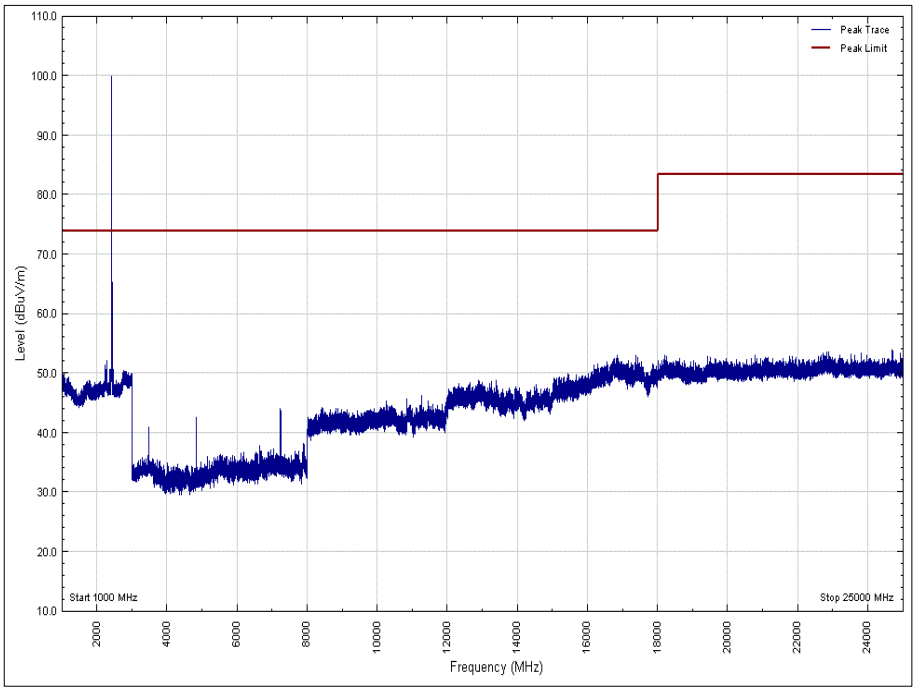

Figure 6 - 2412 MHz - 1 GHz to 25 GHz - Peak
Polarity: Horizontal

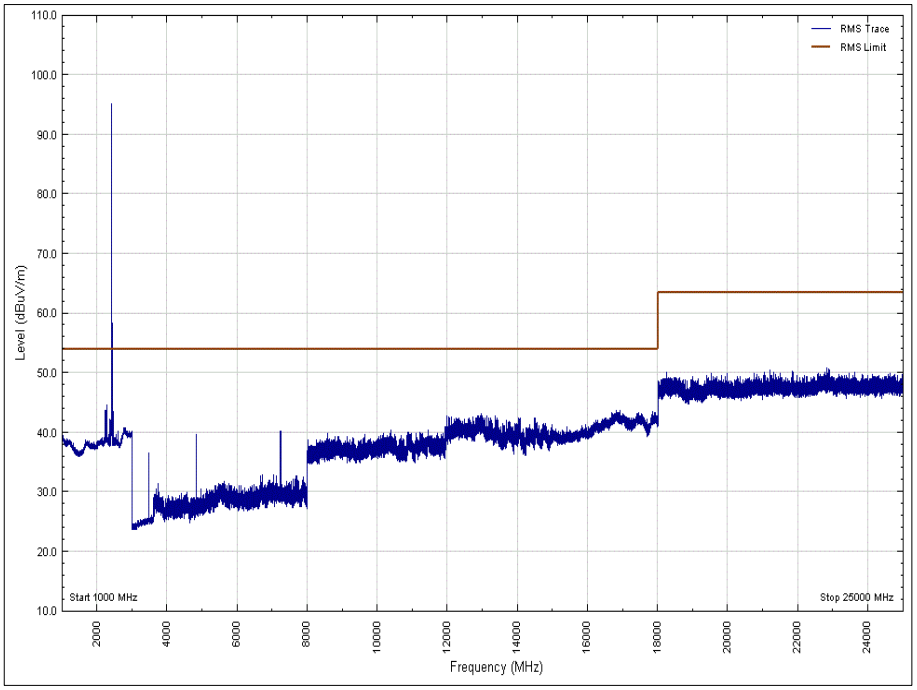

Figure 7 - 2412 MHz - 1 GHz to 25 GHz - Average
Polarity: Horizontal

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
168.003	36.7	43.5	-6.8	Q-Peak	281	100	Vertical	-
216.007	37.4	46.0	-8.6	Q-Peak	0	225	Vertical	-

Table 7 - 2437 MHz - 30 MHz to 1 GHz Emissions Results

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

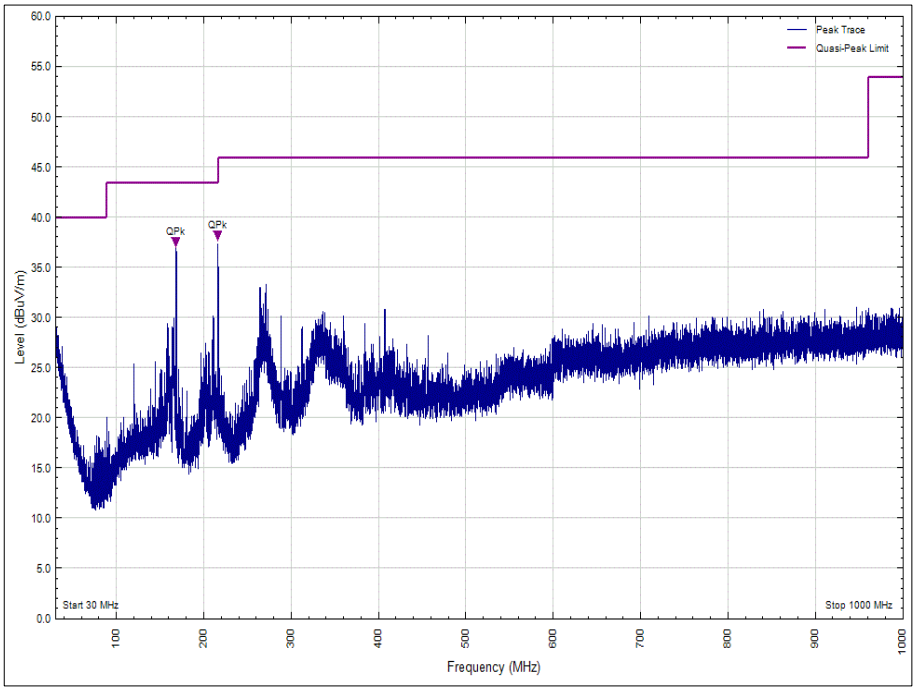

Figure 8 - 2437 MHz - 30 MHz to 1 GHz
Polarity: Vertical

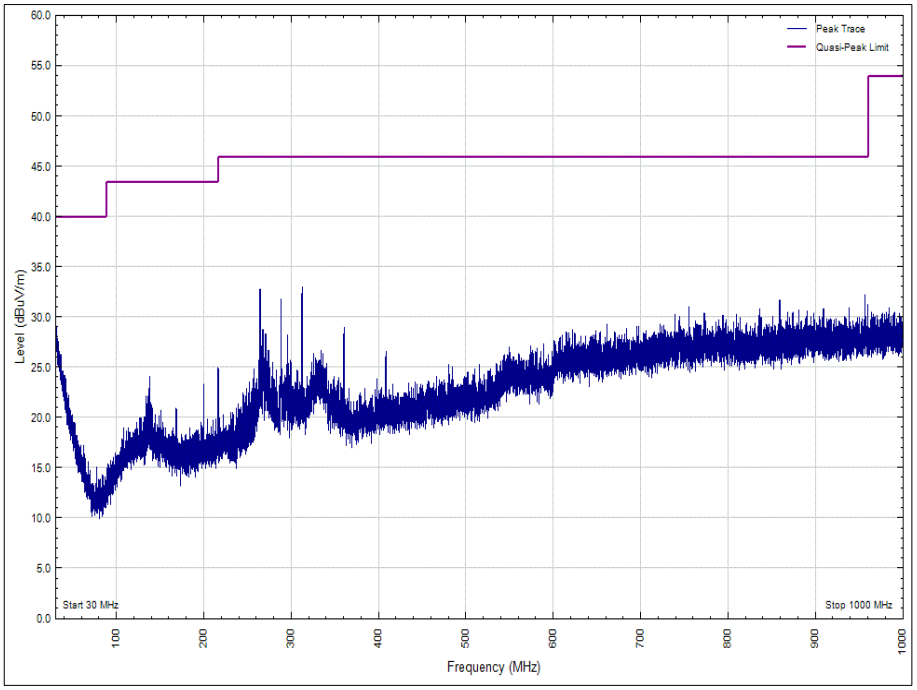

Figure 9 - 2437 MHz - 30 MHz to 1 GHz
Polarity: Horizontal

Frequency (GHz)	Result (dBµV/m)		Limit (dBµV/m)		Margin (dBµV/m)	
	Peak	Average	Peak	Average	Peak	Average
2.261380	-	47.75	-	53.98	-	6.23

Table 8 - 2437 MHz - 1 GHz to 25 GHz Emissions Results

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

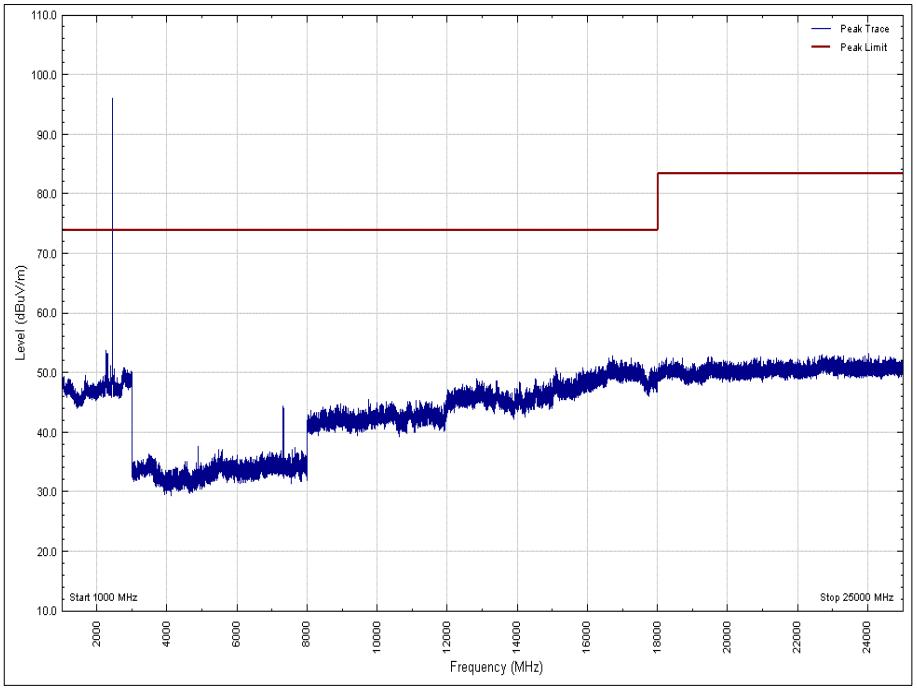

Figure 10 - 2437 MHz - 1 GHz to 25 GHz - Peak
Polarity: Vertical

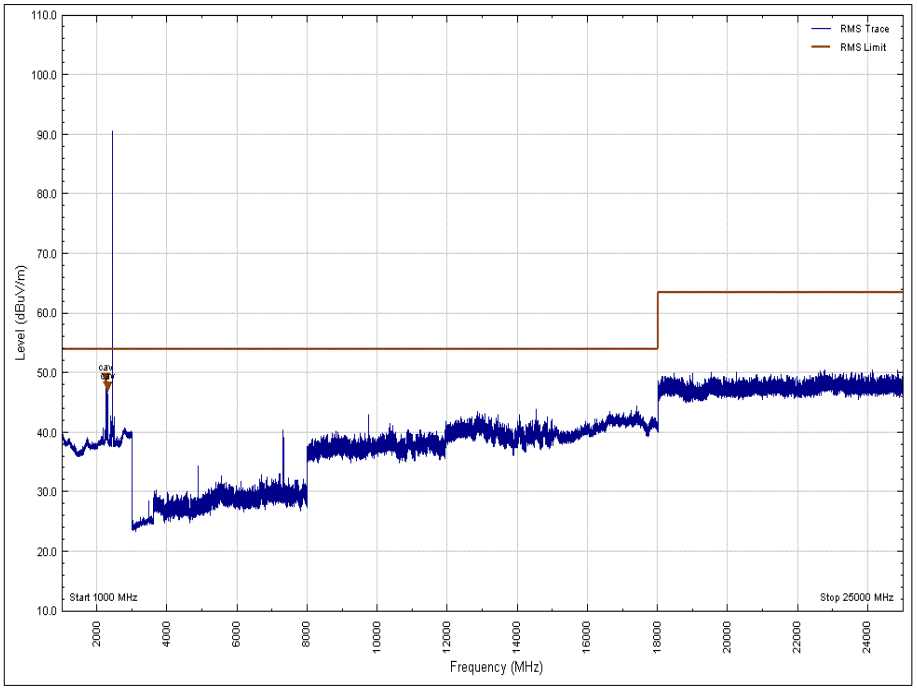

Figure 11 - 2437 MHz - 1 GHz to 25 GHz - Average
Polarity: Vertical

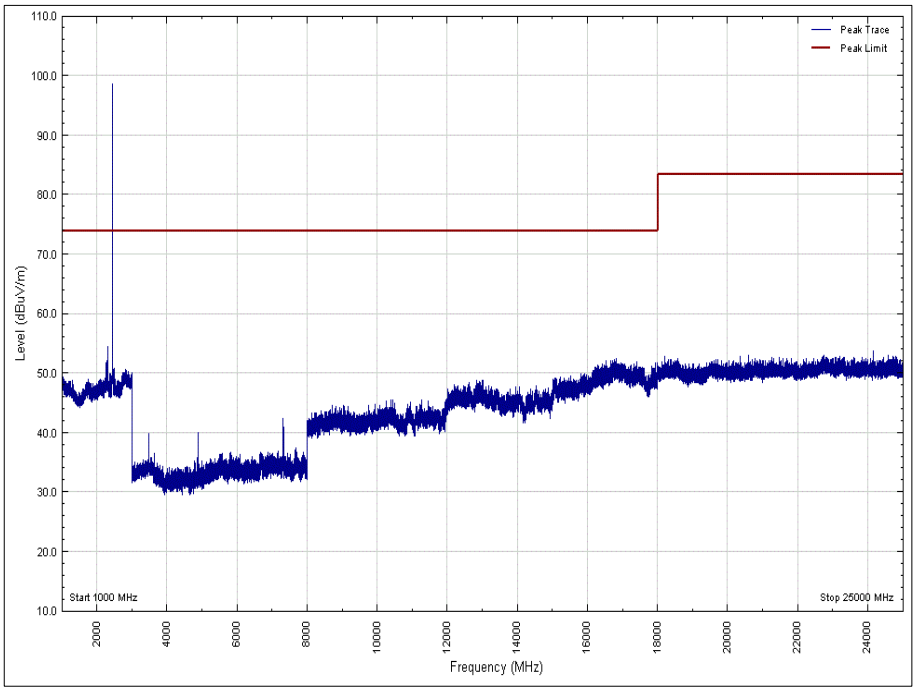

Figure 12 - 2437 MHz - 1 GHz to 25 GHz - Peak
Polarity: Horizontal

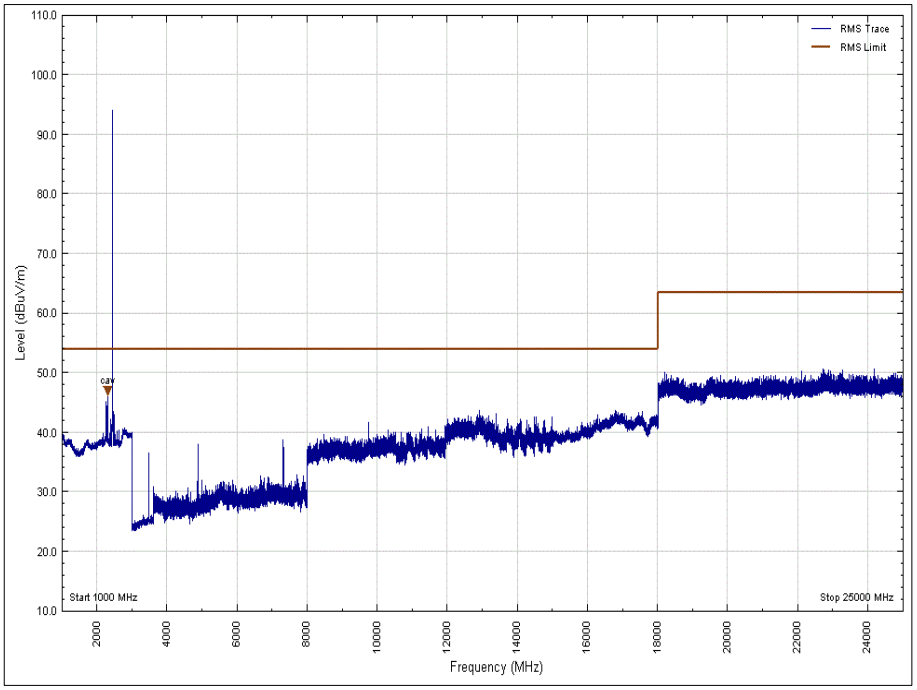

Figure 13 - 2437 MHz - 1 GHz to 25 GHz - Average
Polarity: Horizontal

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin dB	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
167.993	36.4	43.5	-7.1	Q-Peak	305	100	Vertical	-
216.011	37.0	46.0	-9.0	Q-Peak	15	256	Vertical	-

Table 9 - 2457 MHz - 30 MHz to 1 GHz Emissions Results

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

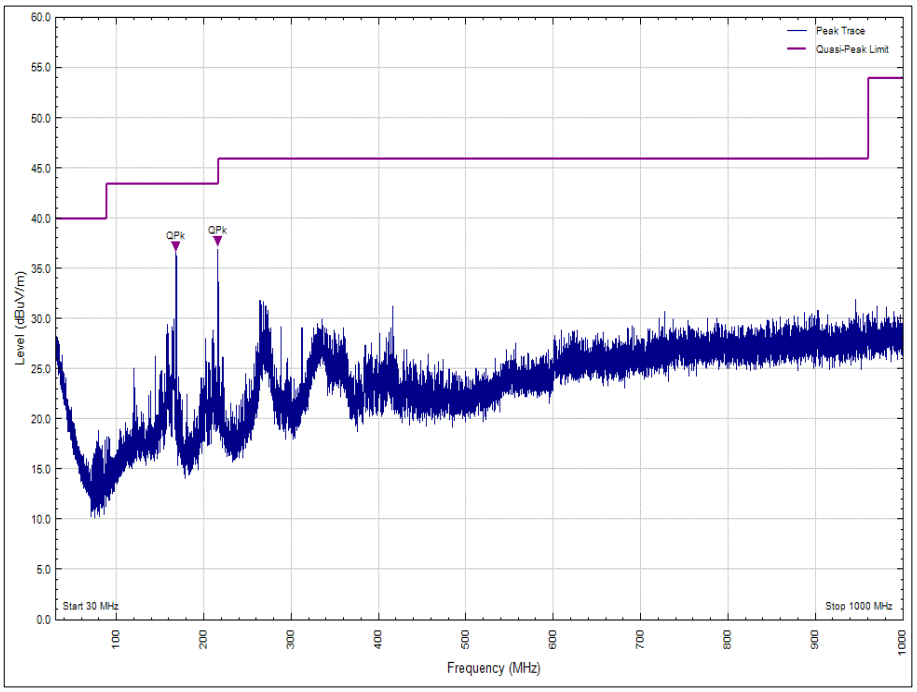

Figure 14 - 2457 MHz - 30 MHz to 1 GHz
Polarity: Vertical

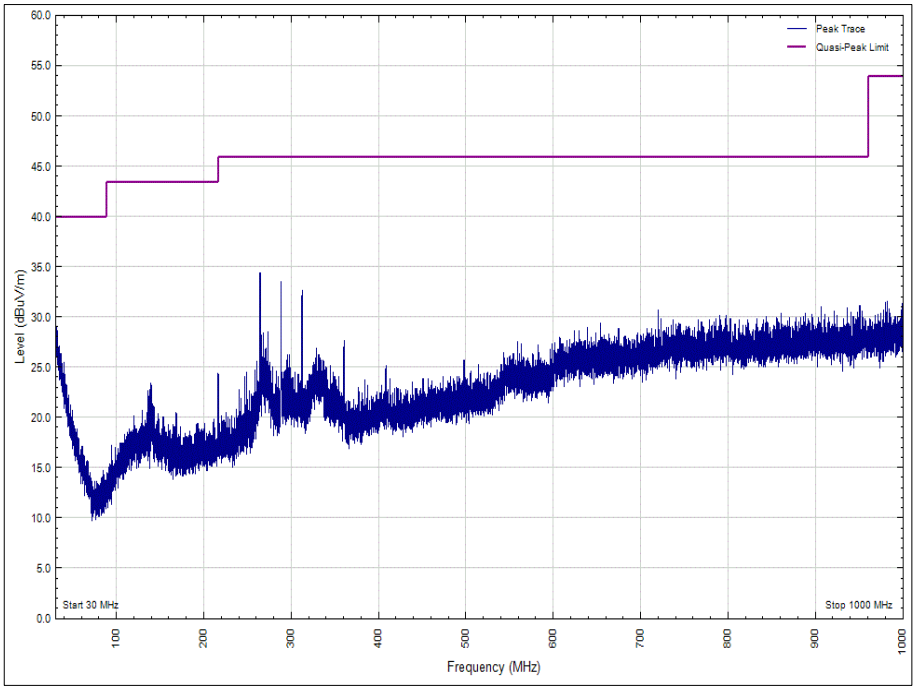

Figure 15 - 2457 MHz - 30 MHz to 1 GHz
Polarity: Horizontal

Frequency (GHz)	Result (dBµV/m)		Limit (dBµV/m)		Margin (dBµV/m)	
	Peak	Average	Peak	Average	Peak	Average
2.281560	-	50.50	-	53.98	-	3.48
2.323613	-	49.14	-	53.98	-	4.84

Table 10 - 2457 MHz - 1 GHz to 25 GHz Emissions Results

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

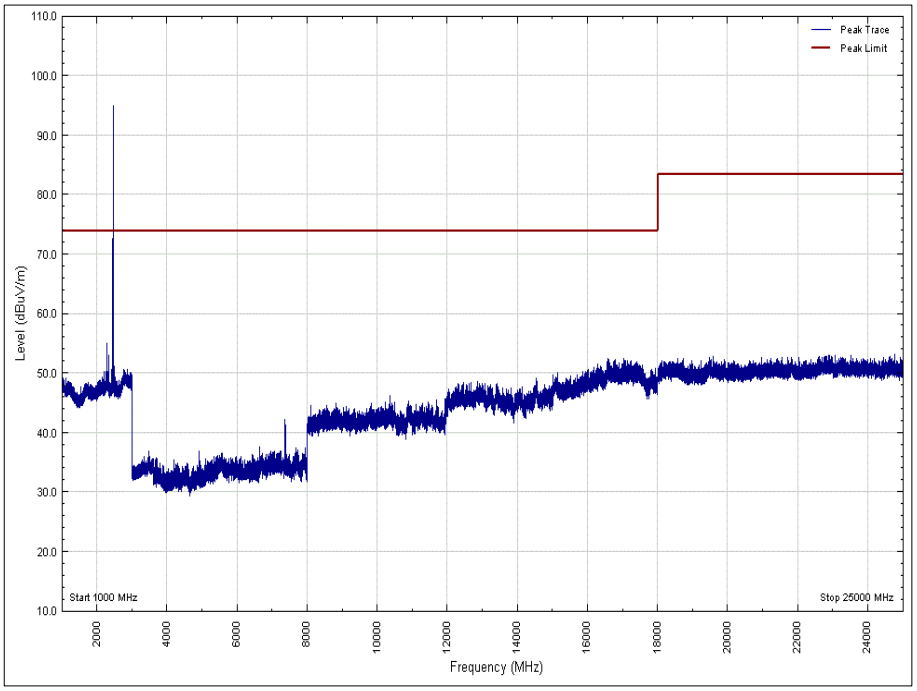

Figure 16 - 2457 MHz - 1 GHz to 25 GHz - Peak
Polarity: Vertical

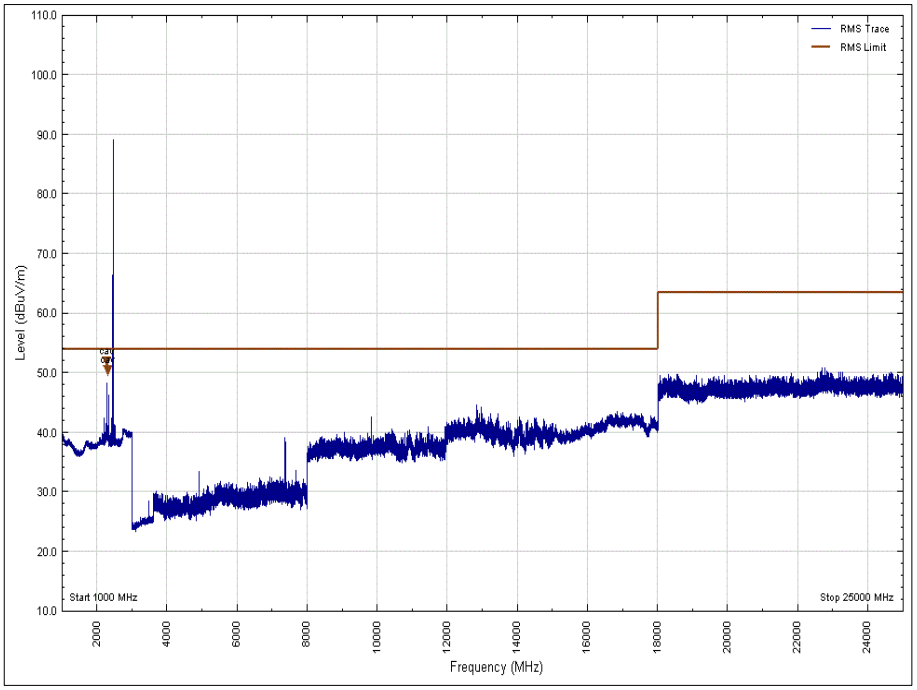

Figure 17 - 2457 MHz - 1 GHz to 25 GHz - Average
Polarity: Vertical

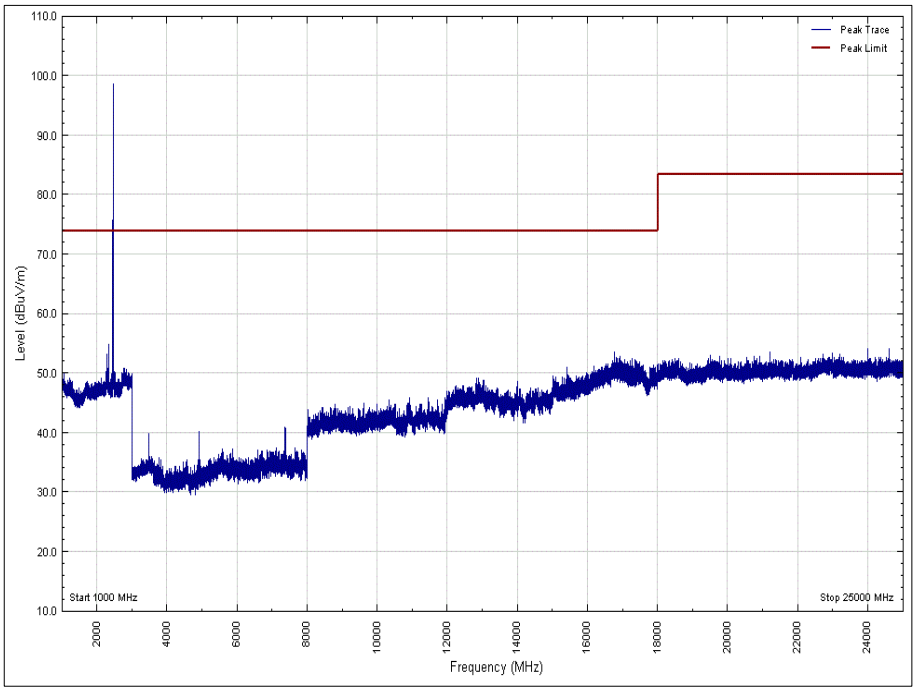

Figure 18 - 2457 MHz - 1 GHz to 25 GHz - Peak
Polarity: Horizontal

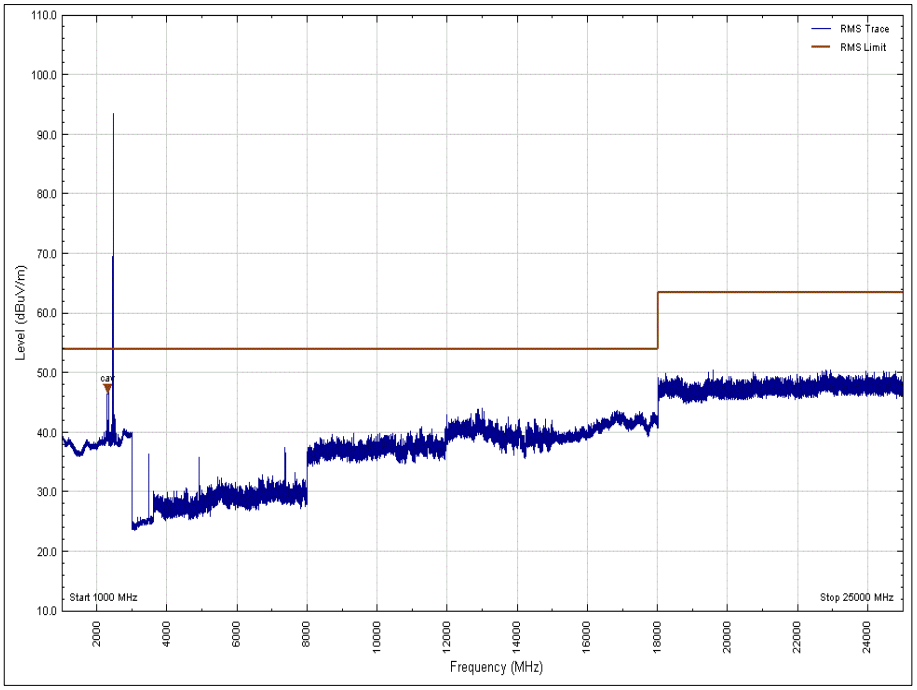

Figure 19 - 2457 MHz - 1 GHz to 25 GHz - Average
Polarity: Horizontal

ISEDC 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.

2.1.7 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
Antenna 18-40GHz (Double Ridge Guide)	Link Microtek Ltd	AM180HA-K-TU2	230	24	02-May-2020
Pre-Amplifier	Phase One	PS04-0086	1533	12	08-Feb-2020
18GHz - 40GHz Pre-Amplifier	Phase One	PSO4-0087	1534	12	05-Feb-2020
Screened Room (5)	Rainford	Rainford	1545	36	23-Jan-2021
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Hygromer	Rotronic	A1	2677	12	20-Feb-2020
Antenna with permanent attenuator (Bilog)	Chase	CBL6143	2904	24	30-Sep-2021
Comb Generator	Schaffner	RSG1000	3034	-	TU
Cable 1503 2M 2.92(P)m 2.92(P)m	Rhophase	KPS-1503A-2000-KPS	4293	12	08-Nov-2020
1GHz to 8GHz Low Noise Amplifier	Wright Technologies	APS04-0085	4365	12	14-Nov-2020
Cable (Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4526	6	11-Dec-2019
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	05-Mar-2020
1 - 18GHz DRG Antenna	ETS-Lindgren	3117	4738	12	05-Mar-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
Hygrometer	Rotronic	HP21	4989	12	02-May-2020
EmX Emissions Software	TUV SUD	EmX	5125	-	Software
1.5m 40GHz RF Cable	Scott Cables	KPS-1501-2000-KPS	5127	6	11-Dec-2019
8 Meter Cable	Teledyne	PR90-088-8MTR	5212	12	30-Aug-2020
3 GHz High pass filter	Wainwright	WHKX12-2580-3000-18000-80SS	5220	12	15-Feb-2020
EMI Test Receiver	Rohde & Schwarz	ESW44	5382	12	08-Oct-2020

Table 11

TU - Traceability Unscheduled

3 Photographs

3.1 Test Setup Photographs

Figure 20 - Test Setup - 30 MHz to 1 GHz

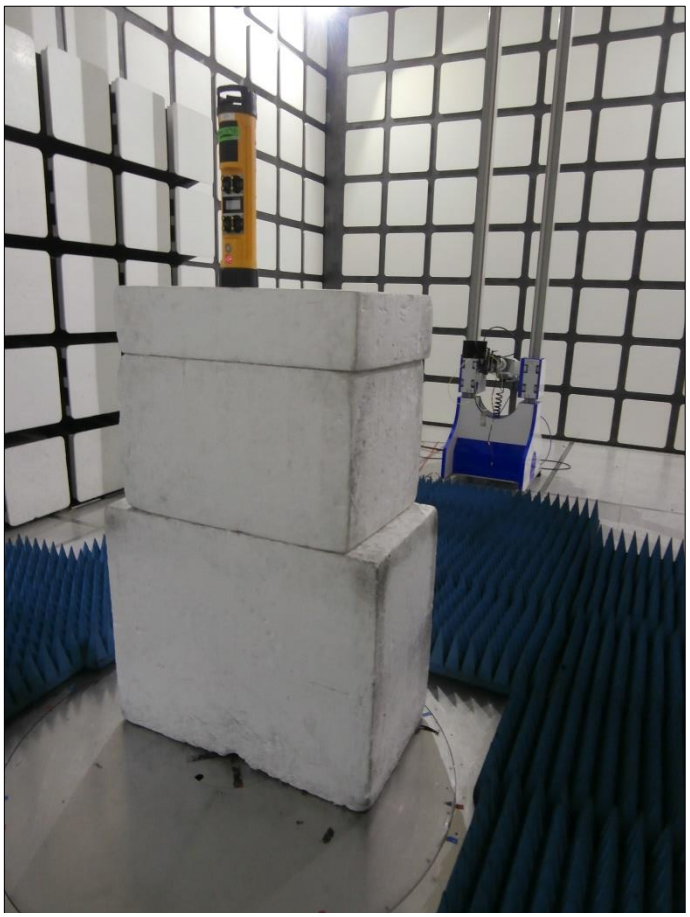

Figure 21 - Test Setup - 1 GHz to 1 GHz

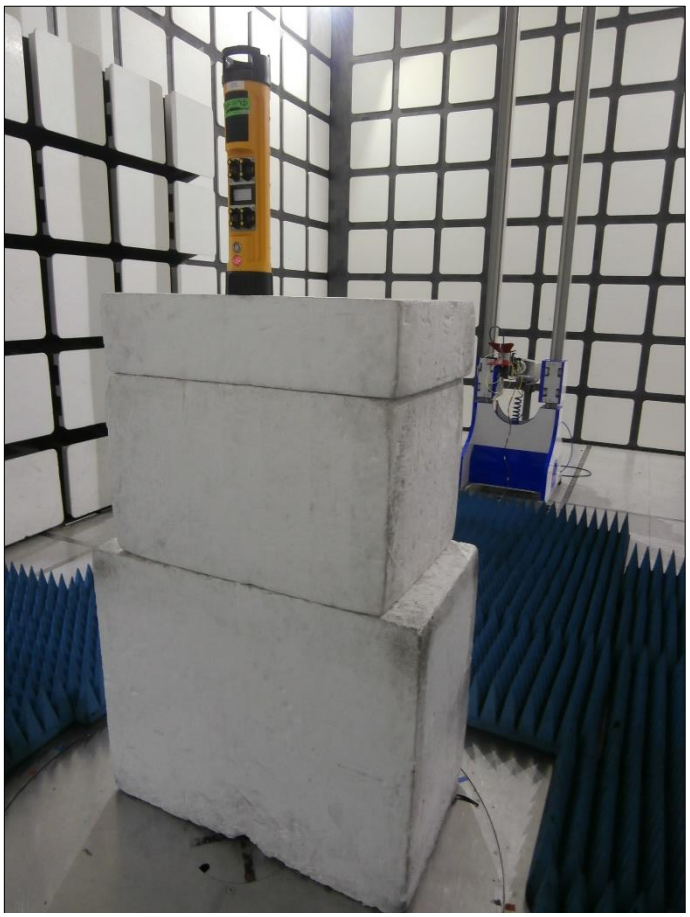

Figure 22 - Test Setup - 8 GHz to 18 GHz

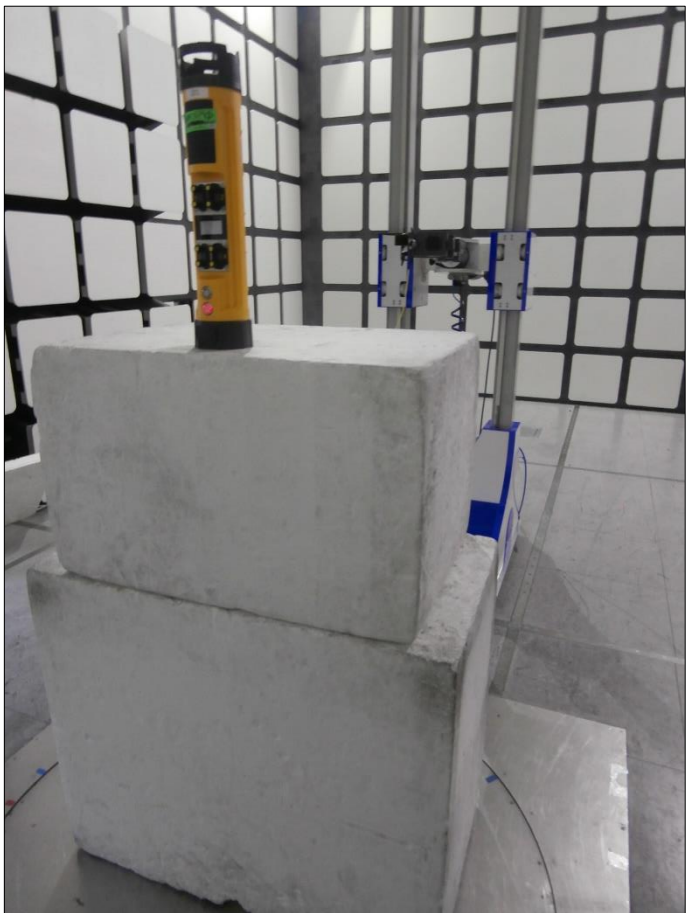

Figure 23 - Test Setup - 18 GHz to 25 GHz

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

Table 12

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.