



## Radio Test Report

### Element Materials Technology

### KTS350-X

47 CFR Part 90I Effective Date 1st October 2019

↳ 47CFR part 2J 2018

TNB: Licensed Non-Broadcast Station Transmitter

Test Date: 11th March 2020

Report Number: 03-11750-1-20 Issue 02

Supersedes Report Number: 03-11750-1-20 Issue 01

#### ***R.N. Electronics Ltd.***

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Arnolds Court, Arnolds Farm Lane, Mountnessing, Brentwood Essex, CM13 1UT  
**Certificate of Test 11750-1**

The equipment noted below has been partially tested by R.N. Electronics Limited and, where appropriate, conforms to the relevant subpart of FCC Part 90I. This is a certificate of test only and should not be confused with an equipment authorisation. Other standards may also apply.

Equipment:	KTS350-X
Model Number:	KTS350-X
Unique Serial Number:	02017
Applicant:	Element Materials Technology Unit E, South Orbital Trading Park, Hedon Road Hull, East Yorkshire, HU9 1NJ
Proposed FCC ID	S7Y-MV1K
Full measurement results are detailed in Report Number:	03-11750-1-20 Issue 02
Test Standards:	47 CFR Part 90I Effective Date 1st October 2019 ↳ 47CFR part 2J 2018 TNB: Licensed Non-Broadcast Station Transmitter

**NOTE:**

Certain tests were not performed based upon manufacturer's declarations. Certain other requirements are subject to manufacturer declaration only and have not been tested/verified. For details refer to section 3 of this report.

**DEVIATIONS:**

The following tests have not been performed at the request of Element Materials Technology:- Adjacent channel power, Conducted emissions, Conducted power, Emission mask, Frequency stability, Modulation frequency response, Modulation limiting, Occupied bandwidth, Transient frequency behaviour. Results pertaining to these tests can be found in Element Materials Technology Ltd report number TRA-041847-45-00.

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

Date Of Test: 11th March 2020

Test Engineer:

Approved By:  
Technical Director

Customer  
Representative:



## 0 Revision History

Issue Number	Revision History	Page Reference(s)
01	First Issue	-
02	Corrected serial number from 2017 to 02017. Corrected Emission mask reference from 90.210(b) to 90.210(c). Added reference to applicants test report for all tests not performed by RN Electronics Ltd. All photographs obscured at request of applicant.	2 & 5 8 2, 8, 9 &11 19-24

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## 2 Equipment under test (EUT)

### 2.1 Equipment specification

Applicant	Element Materials Technology Unit E South Orbital Trading Park Hedon Road Hull East Yorkshire HU9 1NJ	
Manufacturer of EUT	Navtech Radar Ltd	
Full Name of EUT	KTS350-X	
Model Number of EUT	KTS350-X	
Serial Number of EUT	02017	
Date Received	5th March 2020	
Date of Test:	11th March 2020	
Purpose of Test	To demonstrate design compliance to the relevant rules of Chapter 47 of the Code of Federal Regulations.	
Date Report Issued	15th May 2020	
Main Function	FMCW radar.	
Information Specification	Height	514 mm
	Width	424 mm
	Depth	424 mm
	Weight	12 kg
	Voltage	22-25 V DC
	Current	1.2 A
EUT Supplied PSU	Manufacturer	Siemens
	Model number	6EP1332-1SH52
	Serial number	YSU/H0115225
	Input voltage	100-240 V AC
	Input current	1.95-0.97 A
	Output	24 V DC @ 4 A

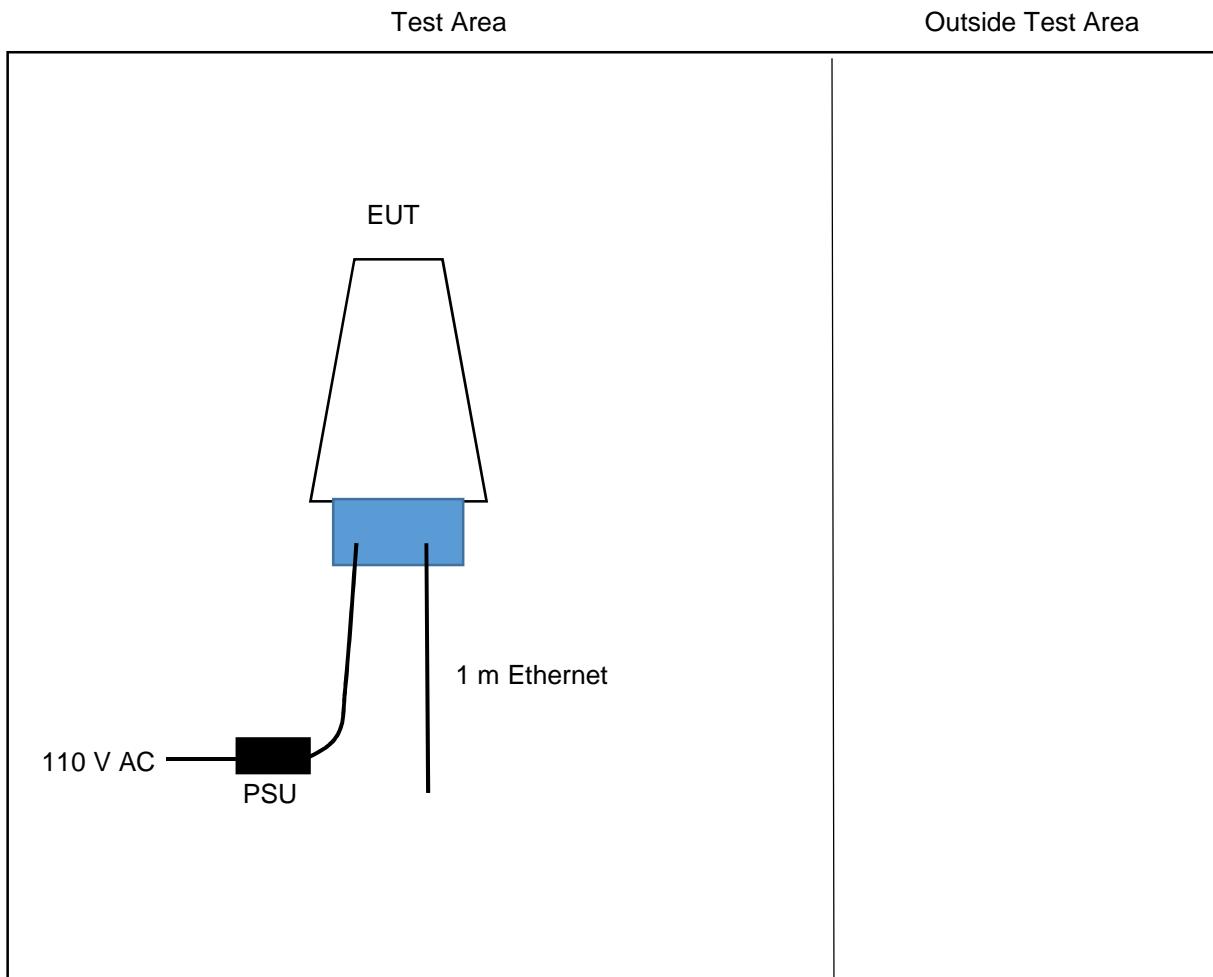
## 2.3 Functional description

FMCW radar operating in the 34-35 GHz range. The unit has a 24 V DC supply port and a gigabit Ethernet port for data communications.

## 2.4 Modes of operation

Mode Reference	Description	Used for testing
TX1	47 dBm FMCW rotating antenna	Yes

## 2.5 Emissions configuration



The unit was powered from 24 V D from the supplied AC/DC adaptor run from 110 V AC. The internal antenna was disconnected and a load connected to the final output stage. The unit was in its operational mode from power up with FMCW (34-35 GHz) and the antenna was rotating. The transmit mode was 100% continuous and the power setting was as stated below:-

Single Channel (34-35 GHz) = +47dBm EiRP

### 2.5.1 Signal leads

Port Name	Cable Type	Connected
DC power	Round multi pin, 4-core cable	Yes
Ethernet	RJ45 CAT5E cable	Yes

### 3 Summary of test results

The KTS350-X was tested for compliance to the following standard(s) :

47 CFR Part 90I Effective Date 1st October 2019

↳ 47CFR part 2J 2018

TNB: Licensed Non-Broadcast Station Transmitter

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

Title	References	Results
<b>Transmitter Tests</b>		
1. Radiated emissions	FCC Part 90I Clause 90.210(b), 47CFR part 2J Clause 2.1053	PASSED <sup>2</sup>
2. Conducted emissions	FCC Part 90I Clause 90.210(b), 47CFR part 2J Clause 2.1051	NOT TESTED <sup>1, 3</sup>
3. Conducted power	FCC Part 90I Clause 90.205(o), FCC Part 90I Clause 2.1046	NOT TESTED <sup>1, 3</sup>
4. Frequency stability	FCC Part 90I Clause 90.213(a), 47CFR part 2J Clause 2.1055	NOT TESTED <sup>1, 3</sup>
5. Occupied bandwidth	FCC Part 90I Clause 90.209, 47CFR part 2J Clause 2.1049	NOT TESTED <sup>1, 3</sup>
6. Emission mask	FCC Part 90I Clause 90.210(c)	NOT TESTED <sup>1, 3</sup>
7. Modulation limiting	47CFR part 2J Clause 2.1047(b)	NOT TESTED <sup>1, 3</sup>
8. Modulation frequency response	47CFR part 2J Clause 2.1047(a)	NOT TESTED <sup>1, 3</sup>
9. Transient frequency behaviour	FCC Part 90I Clause 90.214	NOT TESTED <sup>1, 3</sup>
10. Adjacent channel power	FCC Part 90I Clause 90.221	NOT TESTED <sup>1, 3</sup>

<sup>1</sup> Not tested at request of applicant.

<sup>2</sup> Spectrum investigated 110 GHz to 175 GHz at request of applicant.

<sup>3</sup> Results pertaining to these tests can be found in Element Materials Technology Ltd report number TRA-041847-45-00.

## 4 Specifications

The tests were performed and operated in accordance with R.N. Electronics Ltd procedures and the relevant standards listed below.

### 4.1 Relevant standards

Ref.	Standard Number	Version	Description
4.1.1	FCC Part 90I	2019	Part 90 - Private Land Mobile Radio Services - Subpart I - General Technical standards
4.1.2	47CFR part 2J	2018	Part 2 – Frequency Allocations and radio treaty matters; General rules and regulations
4.1.3	ANSI C63.26	2015	American National Standard for Compliance testing of transmitters used in Licensed radio services

### 4.2 Deviations

The following tests have not been performed at the request of Element Materials Technology:-  
Adjacent channel power, Conducted emissions, Conducted power, Emission mask, Frequency stability, Modulation frequency response, Modulation limiting, Occupied bandwidth and Transient frequency behaviour. Results pertaining to these tests can be found in Element Materials Technology Ltd report number TRA-041847-45-00.

## 5 Tests, methods and results

### 5.1 Radiated emissions

#### 5.1.1 Test methods

Test Requirements:	FCC Part 90I Clause 90.210(b) [Reference 4.1.1 of this report], 47CFR part 2J Clause 2.1053 [Reference 4.1.2 of this report]
Test Method:	ANSI C63.26 Clause 5.5 [Reference 4.1.3 of this report]
Limits:	FCC Part 90I Clause 90.210(b)(3) [Reference 4.1.1 of this report]

#### 5.1.2 Configuration of EUT

The EUT was tested in an ALSE and ambient conditions were monitored. The EUT was examined in its declared normal use position. A single mode of operation was available and therefore, the EUT was operated in TX1 mode for this test.

#### 5.1.3 Test procedure

Tests were made in accordance with the Test Method noted above using the measuring equipment noted in the 'Test Equipment' Section at Site H. Peak field strength from the EUT was maximised by rotating it 360 degrees. A peak detector was used for final measurements. Measurement distances used were 0.01 m for 110 GHz -140 GHz and 0.03 m for 140 GHz – 175 GHz.

110 GHz – 175 GHz.

The measuring antenna was used in both Horizontal and Vertical polarisations. Substitution method was performed using standard gain horn antennas.

#### 5.1.4 Test equipment

E562, E714, E719, E720, E722, E755, E760, E771, E777, E781, E908, E941

See Section 8 for more details

#### 5.1.5 Test results

Temperature of test environment	18°C
Humidity of test environment	42%
Pressure of test environment	102kPa

Setup Table

Band	33.4-36 GHz
Power Level	47 dBm (EiRP)
Channel Spacing	Single Channel
Mod Scheme	FMCW
Single channel	34-35 GHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No spurious emissions were detected within 6 dB of limits				

#### LIMITS:

Part 90.210(b)(3), -13 dBm.

These results show that the EUT has PASSED this test.

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

110 – 175 GHz  $\pm$ 5.9dB.

## 5.2 Conducted emissions

NOT TESTED: Not tested at request of applicant. Results pertaining to this test can be found in Element Materials Technology Ltd report number TRA-041847-45-00.

## 5.3 Conducted power

NOT TESTED: Not tested at request of applicant. Results pertaining to this test can be found in Element Materials Technology Ltd report number TRA-041847-45-00.

## 5.4 Frequency stability

NOT TESTED: Not tested at request of applicant. Results pertaining to this test can be found in Element Materials Technology Ltd report number TRA-041847-45-00.

## 5.5 Occupied bandwidth

NOT TESTED: Not tested at request of applicant. Results pertaining to this test can be found in Element Materials Technology Ltd report number TRA-041847-45-00.

## 5.6 Emission mask

NOT TESTED: Not tested at request of applicant. Results pertaining to this test can be found in Element Materials Technology Ltd report number TRA-041847-45-00.

## 5.7 Modulation limiting

NOT TESTED: Not tested at request of applicant. Results pertaining to this test can be found in Element Materials Technology Ltd report number TRA-041847-45-00.

## 5.8 Modulation frequency response

NOT TESTED: Not tested at request of applicant. Results pertaining to this test can be found in Element Materials Technology Ltd report number TRA-041847-45-00.

## 5.9 Transient frequency behaviour

NOT TESTED: Not tested at request of applicant. Results pertaining to this test can be found in Element Materials Technology Ltd report number TRA-041847-45-00.

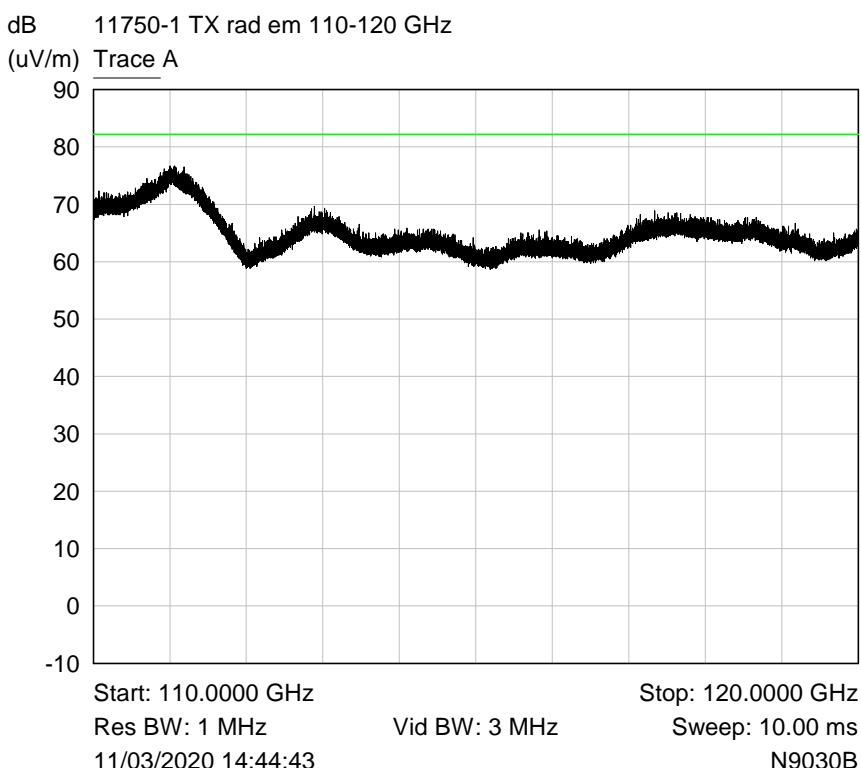
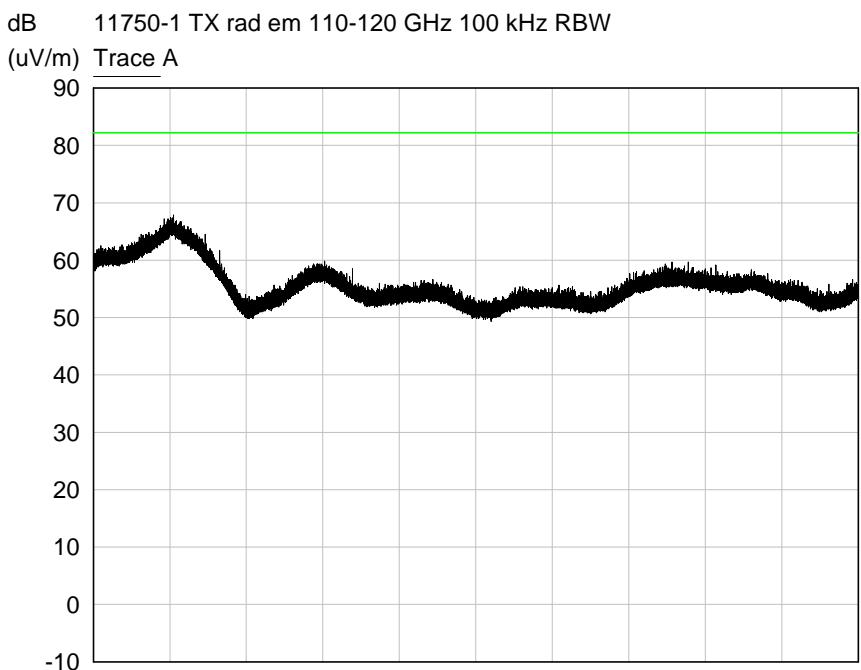
## 5.10 Adjacent channel power

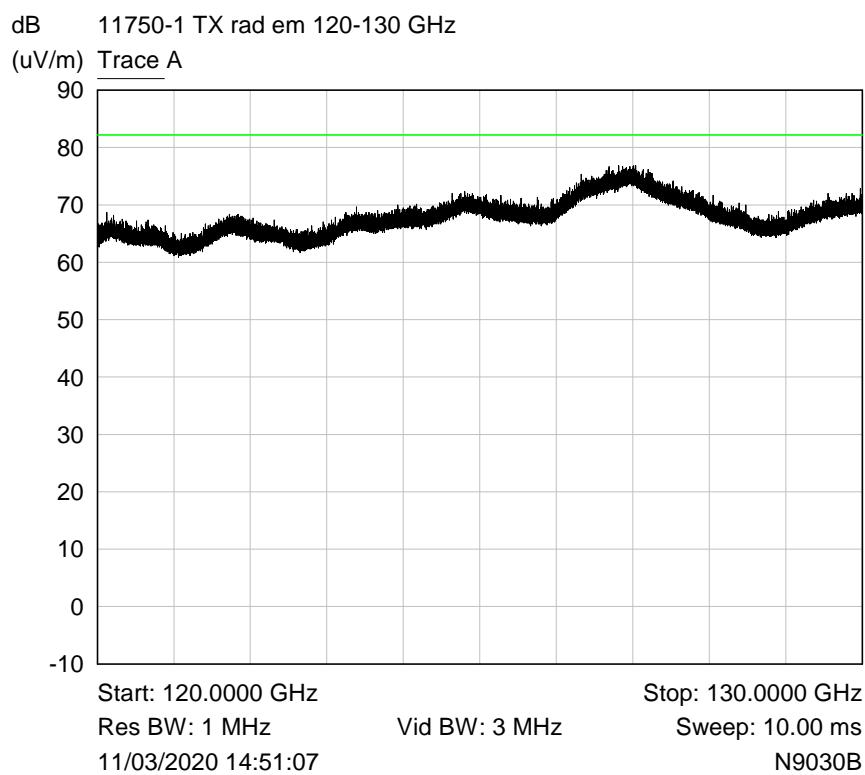
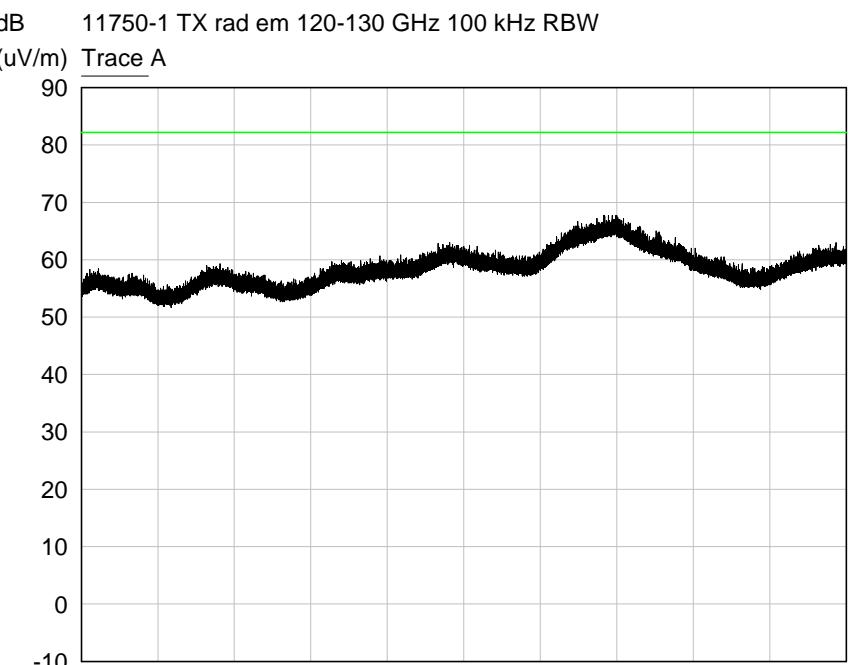
NOT TESTED: Not tested at request of applicant. Results pertaining to this test can be found in Element Materials Technology Ltd report number TRA-041847-45-00.

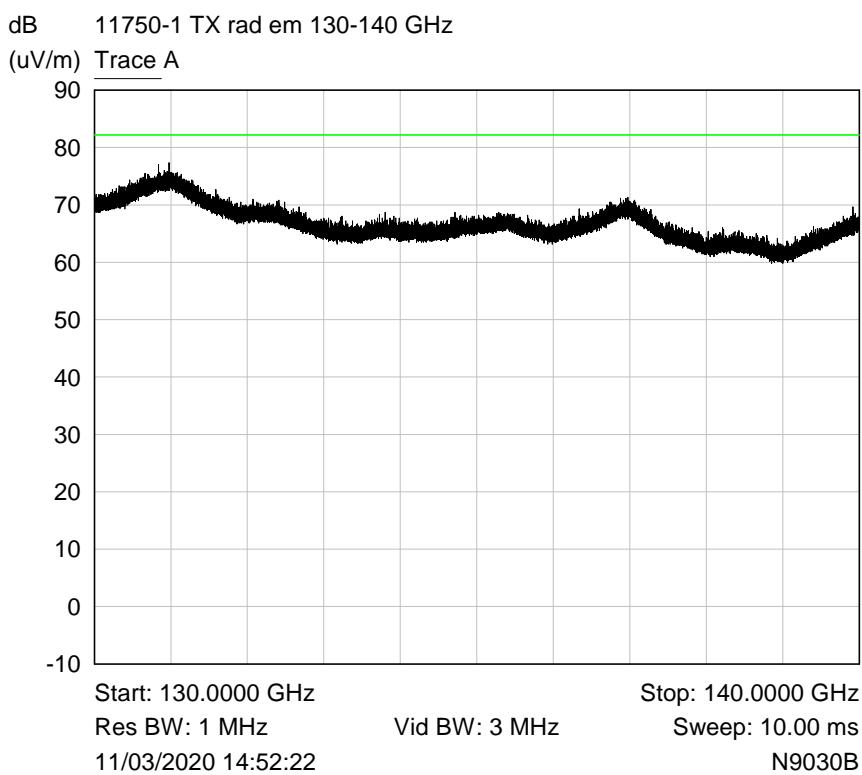
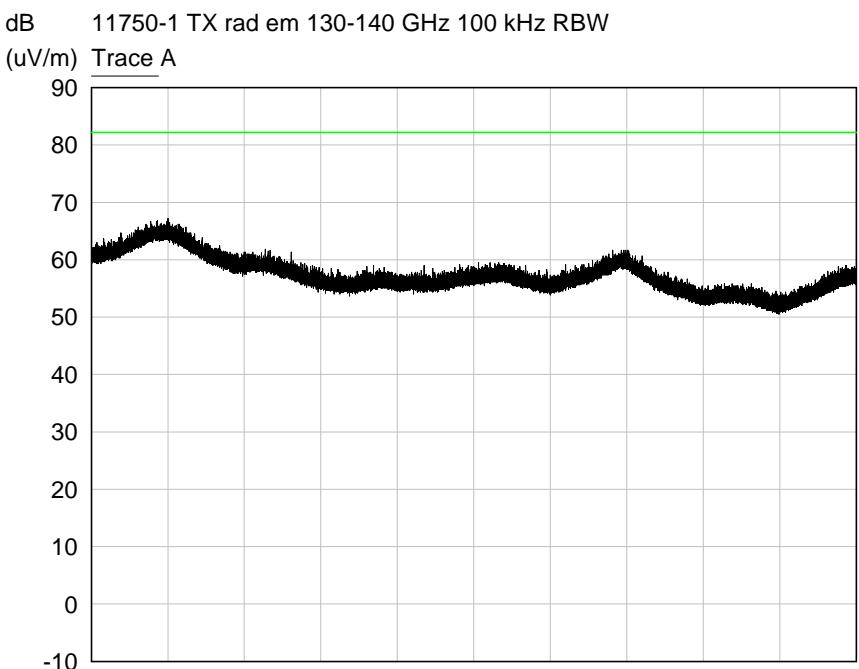
## 6 Plots/Graphical results

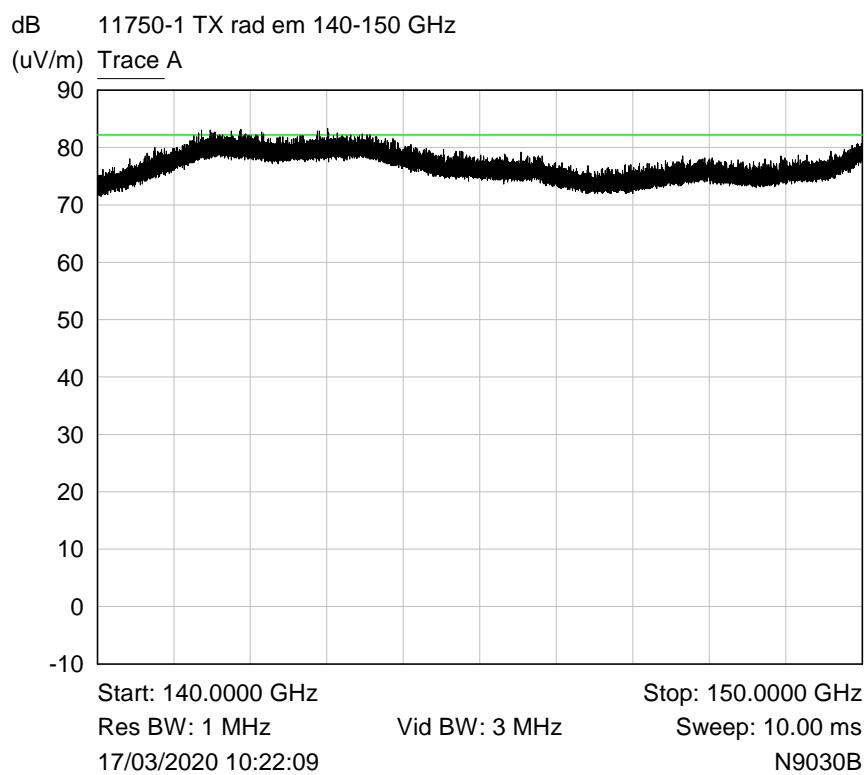
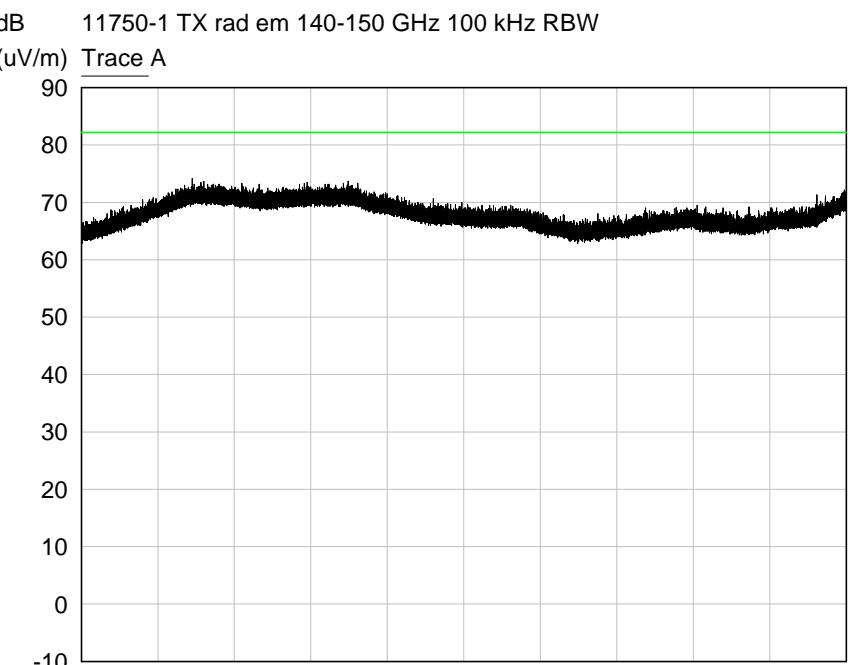
### 6.1 Radiated emissions

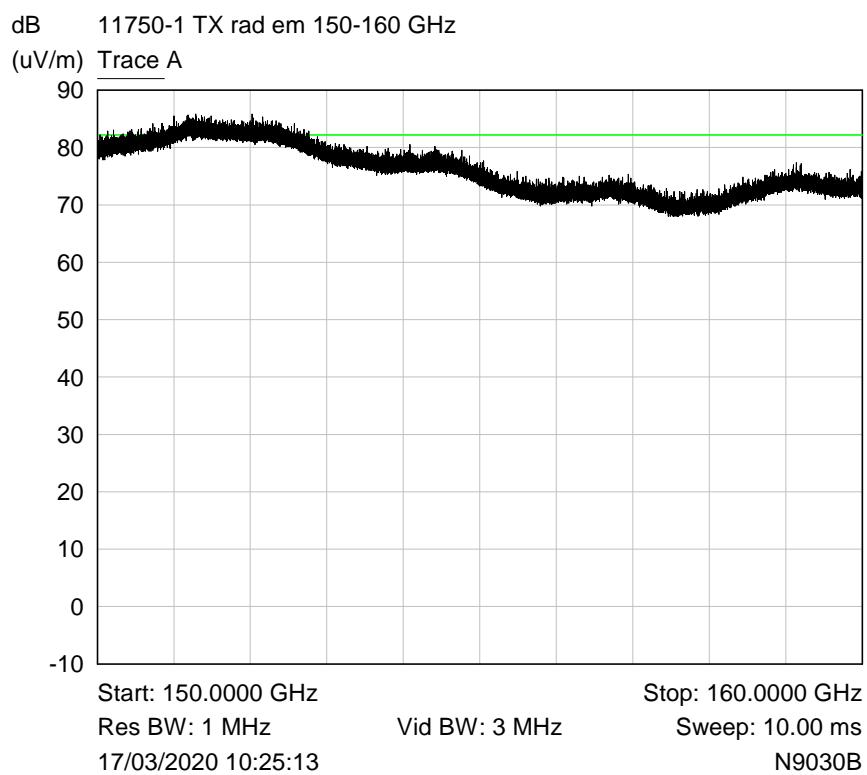
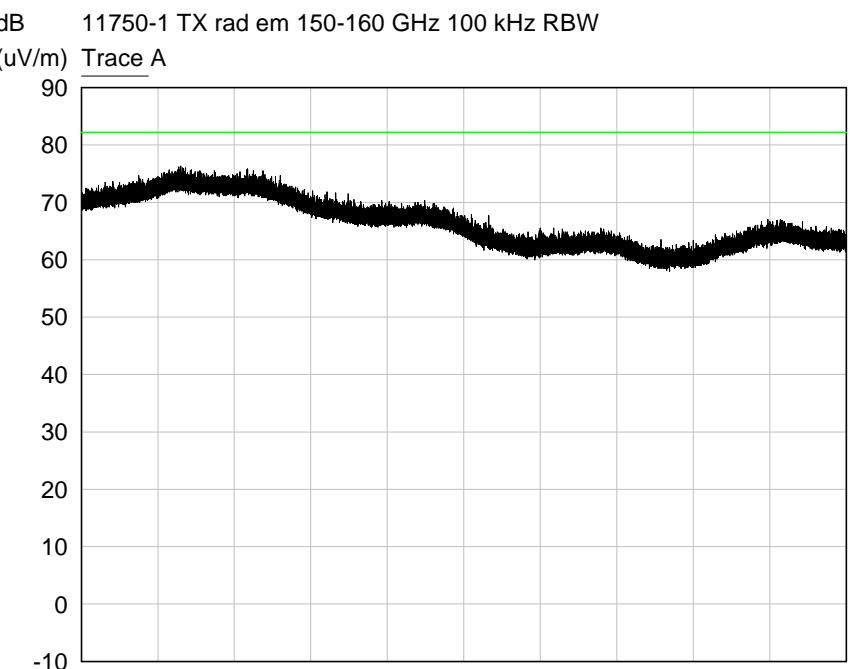
Plots included for reference only (limit line of 82.2 dB $\mu$ V/m is equivalent to -13 dBm). Measurement distances used were 0.01 m for 110 GHz -140 GHz and 0.03 m for 140 GHz – 175 GHz.

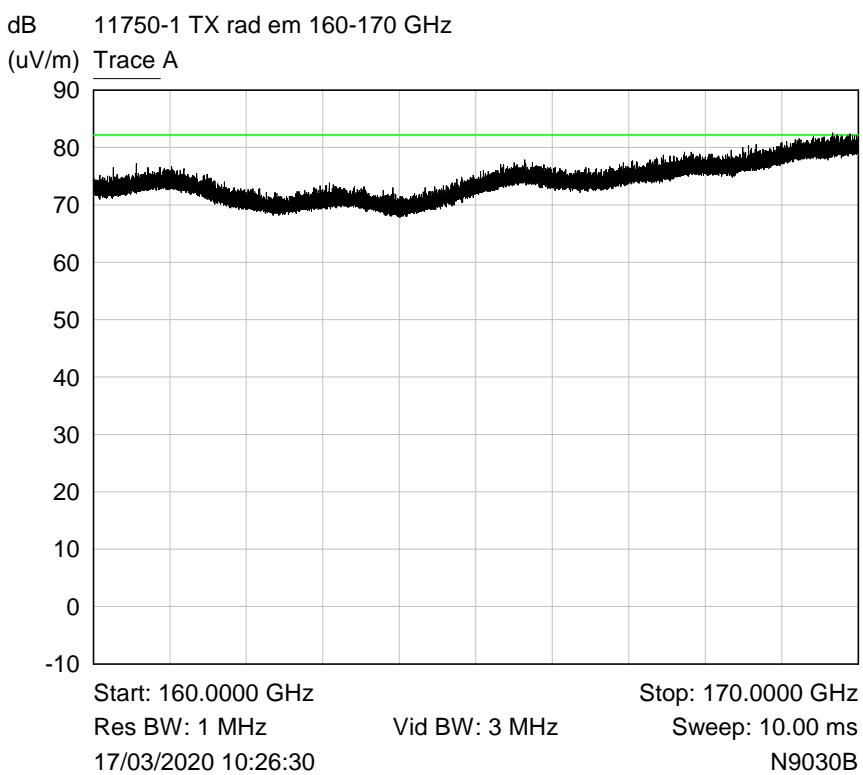
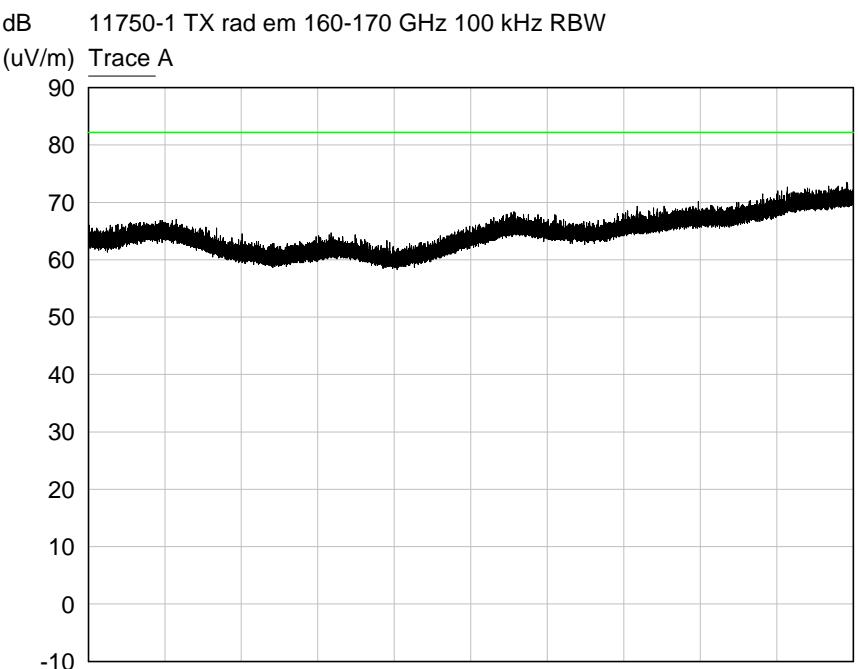


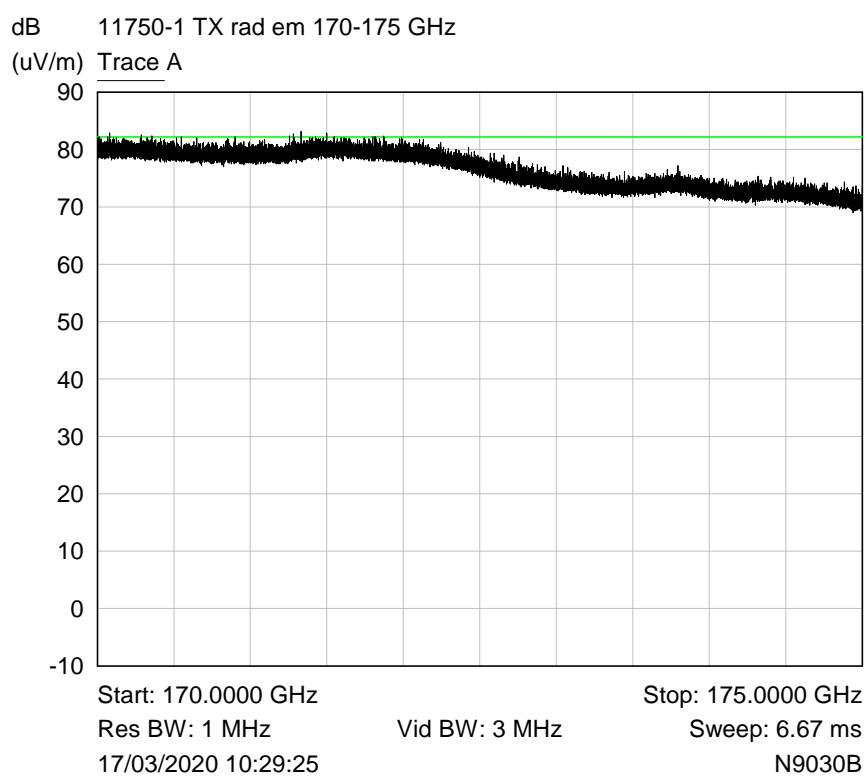
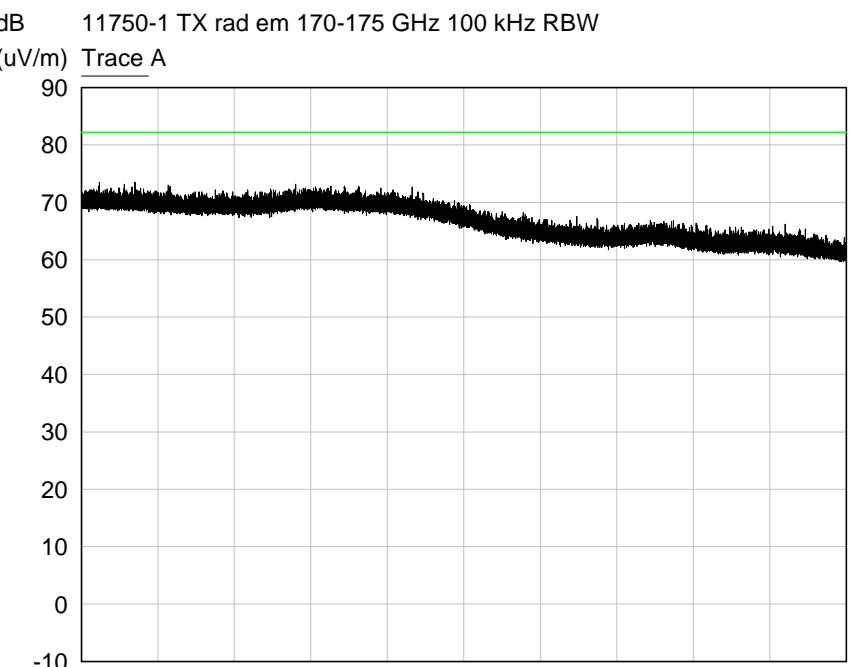








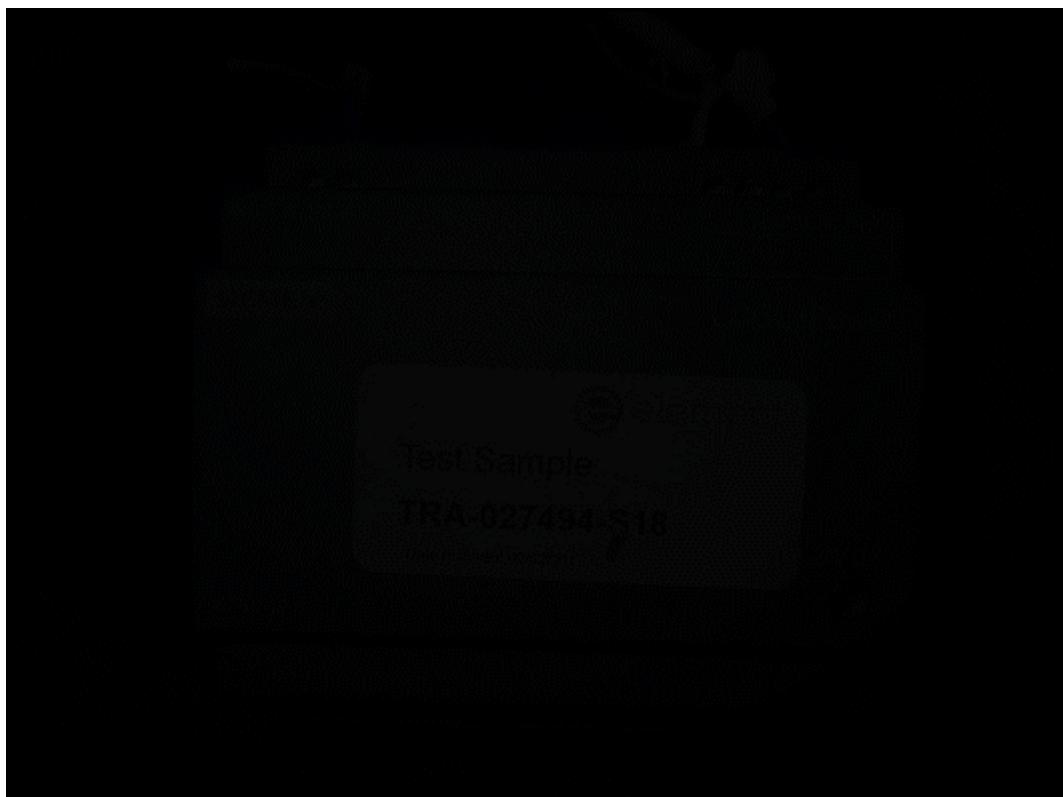
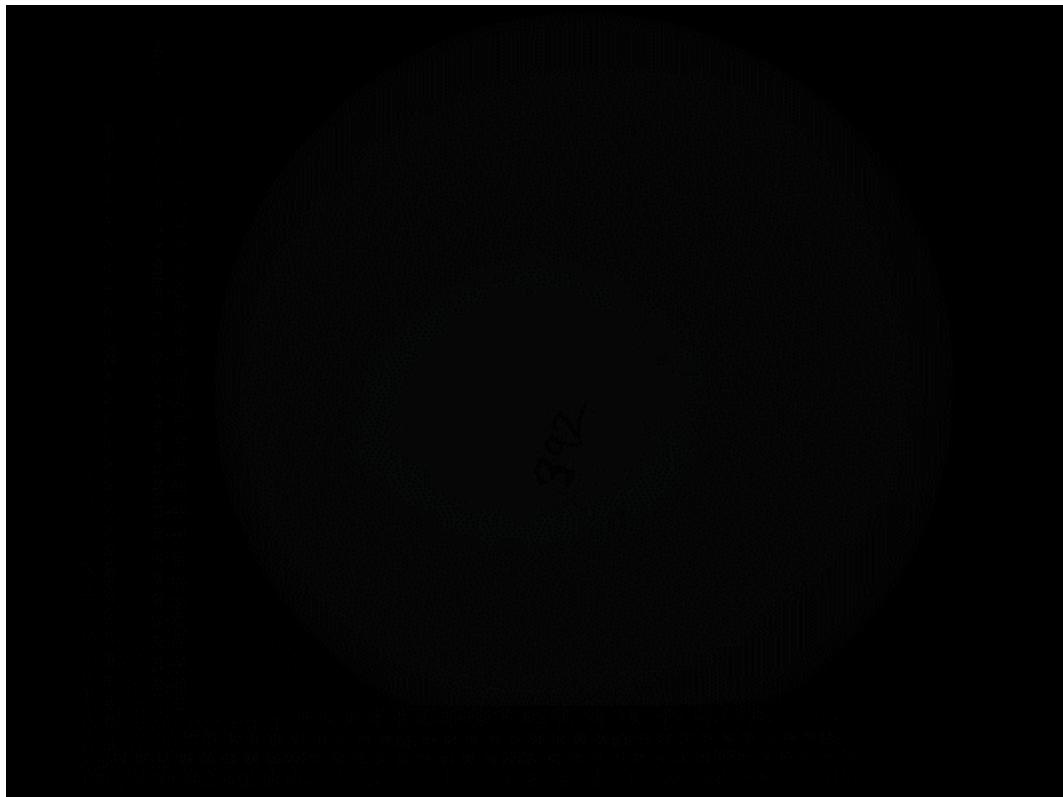




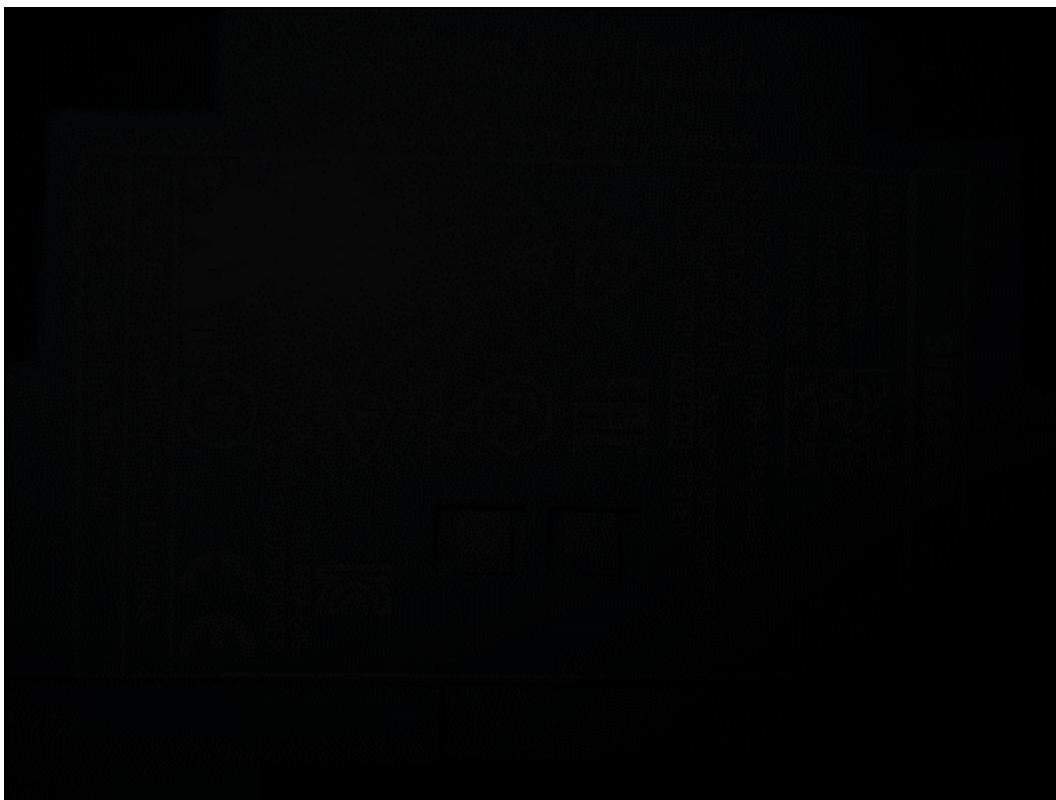
## 7 Photographs

All photos removed at request of applicant.

### 7.1 EUT Front View



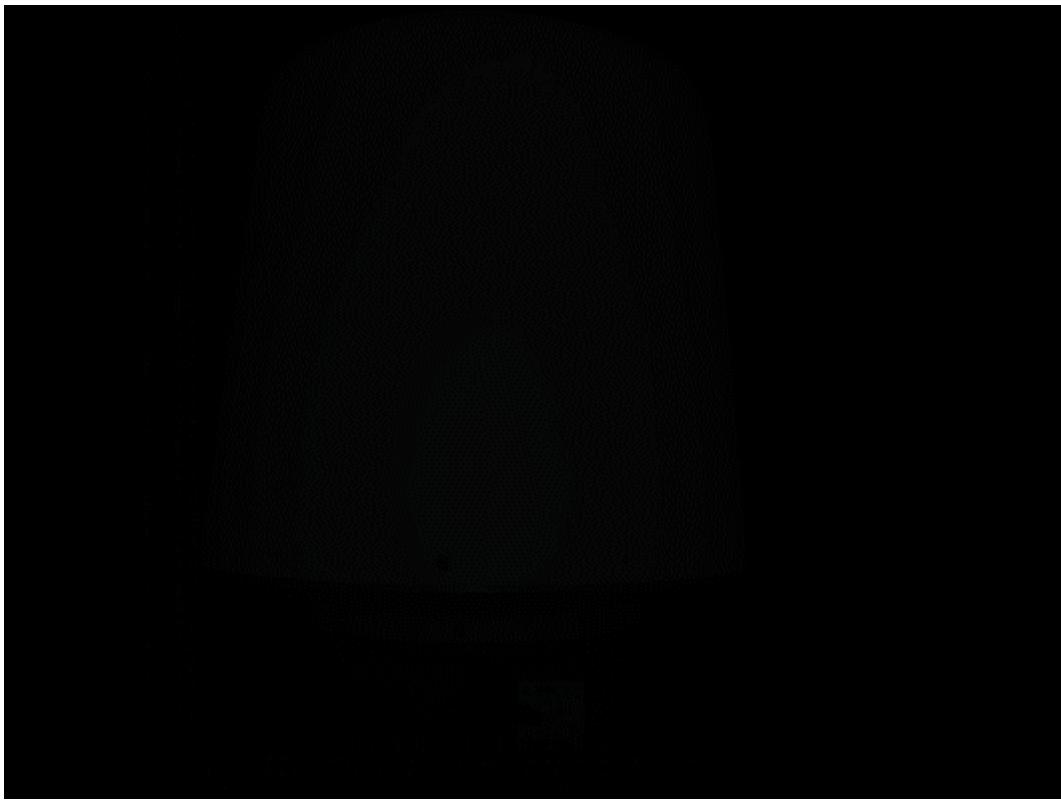
Supplied PSU



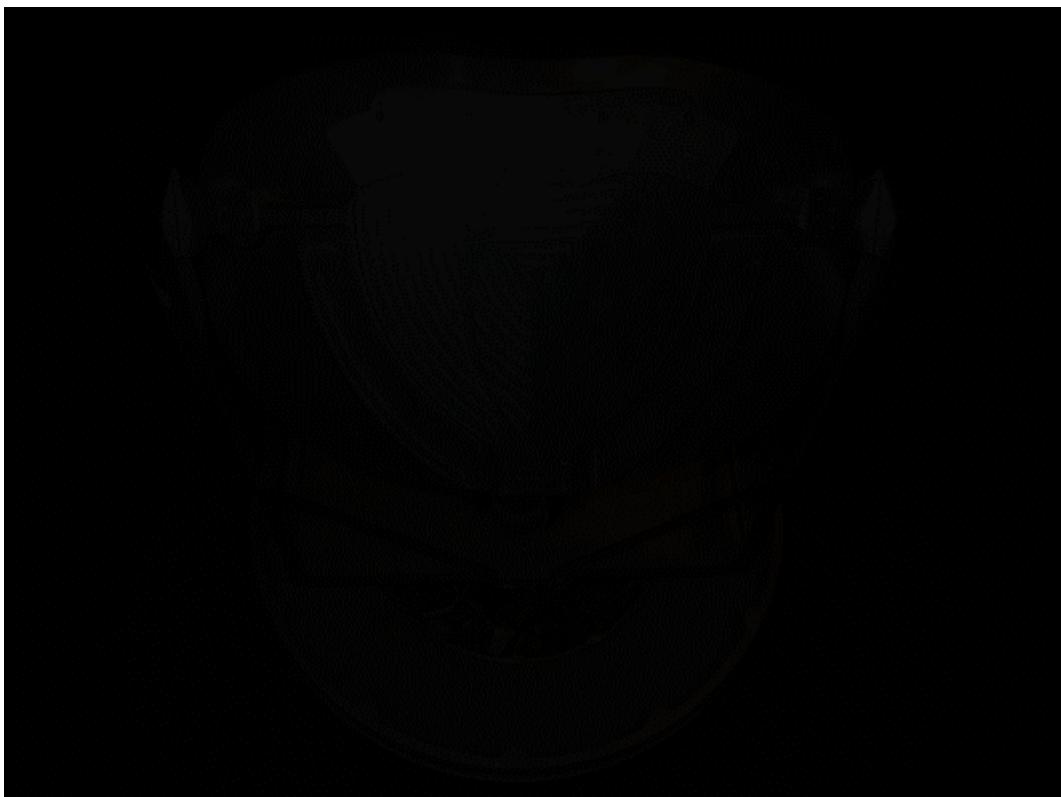
## 7.2 EUT Reverse Angle

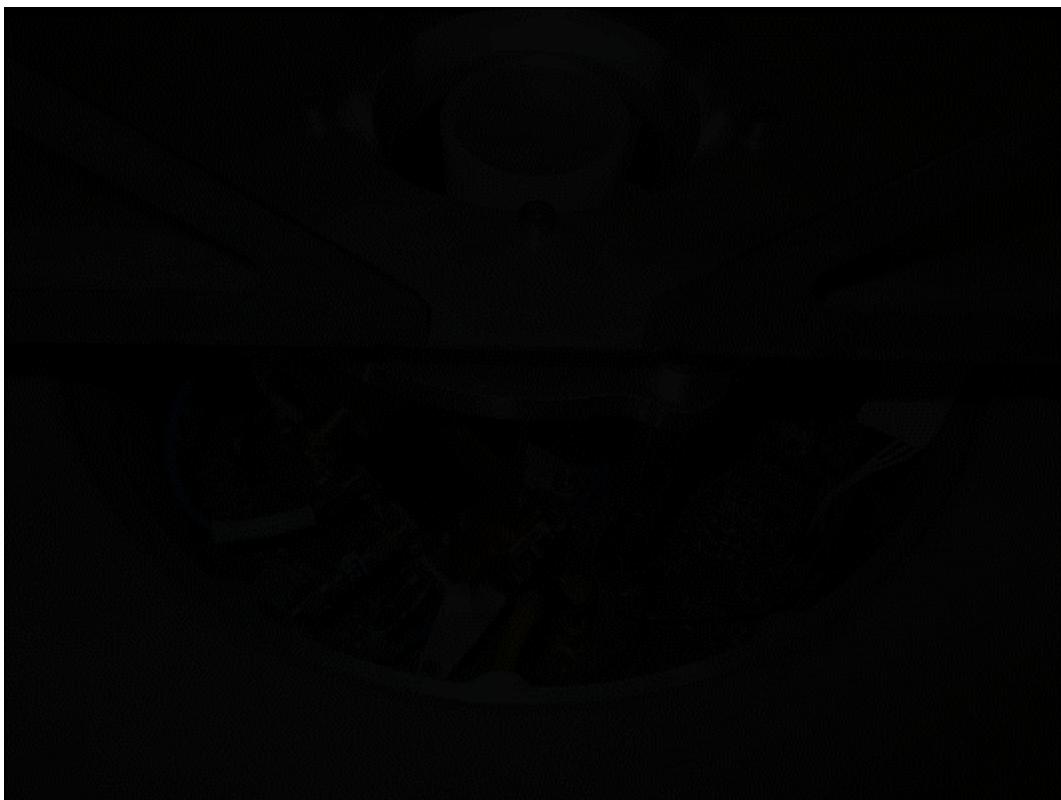


### 7.3 EUT Left side View



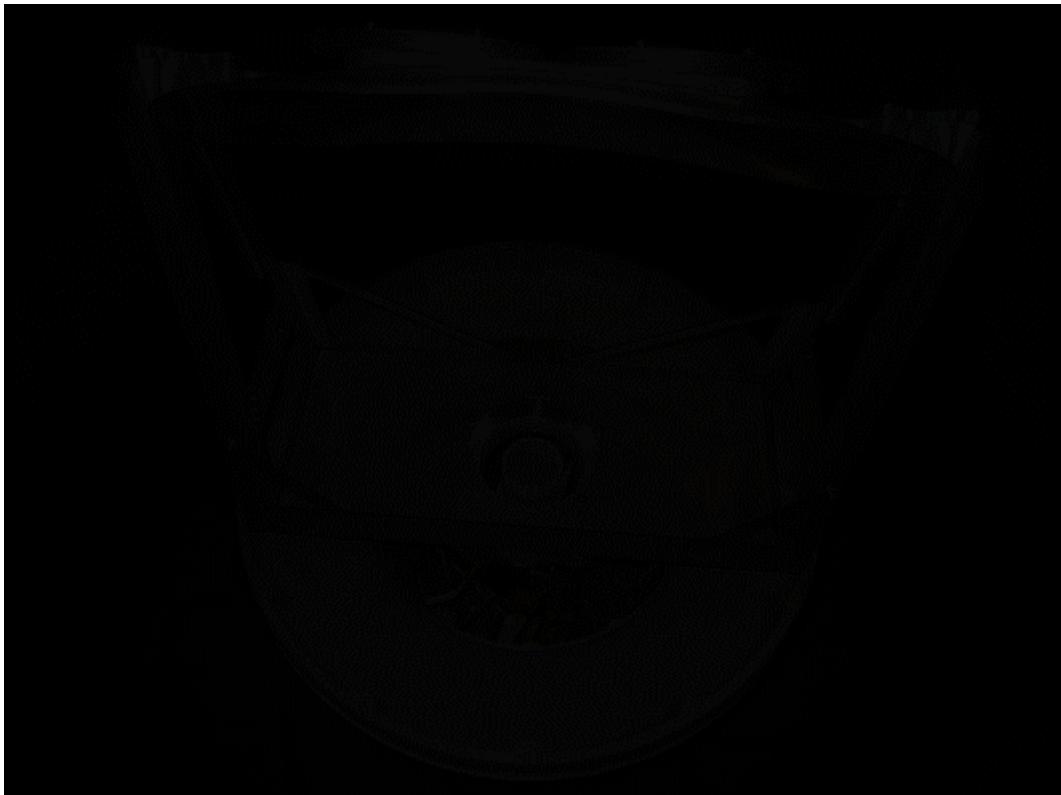
### 7.4 EUT Antenna Port

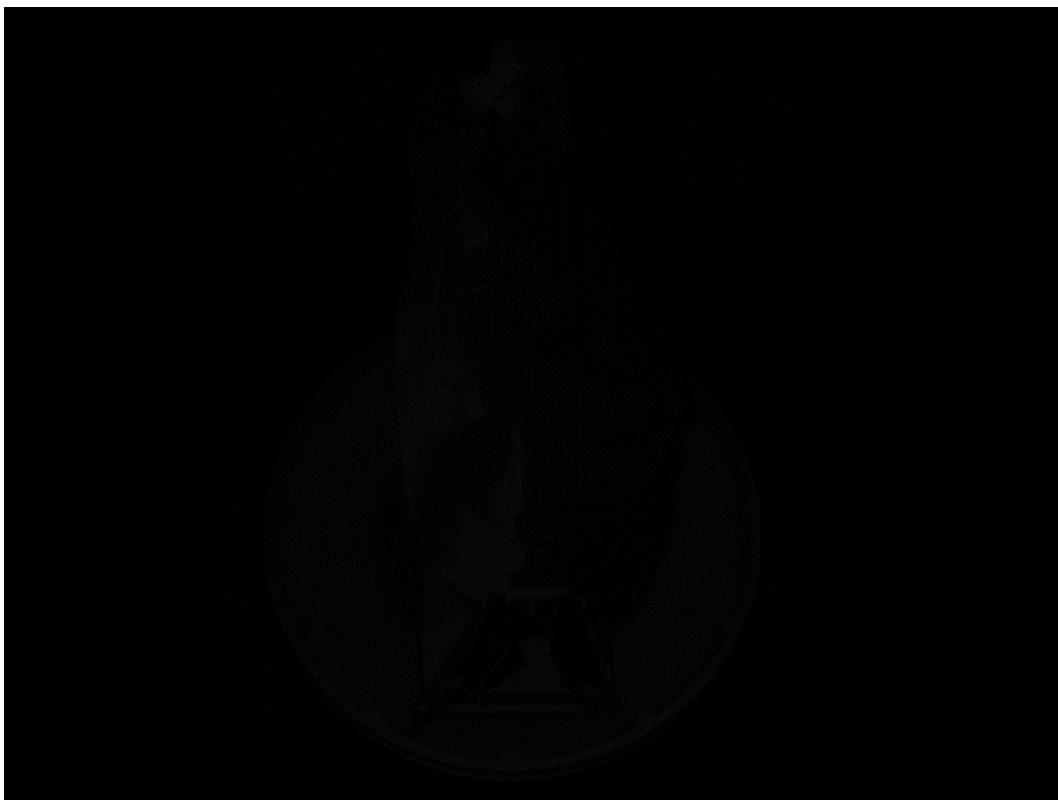




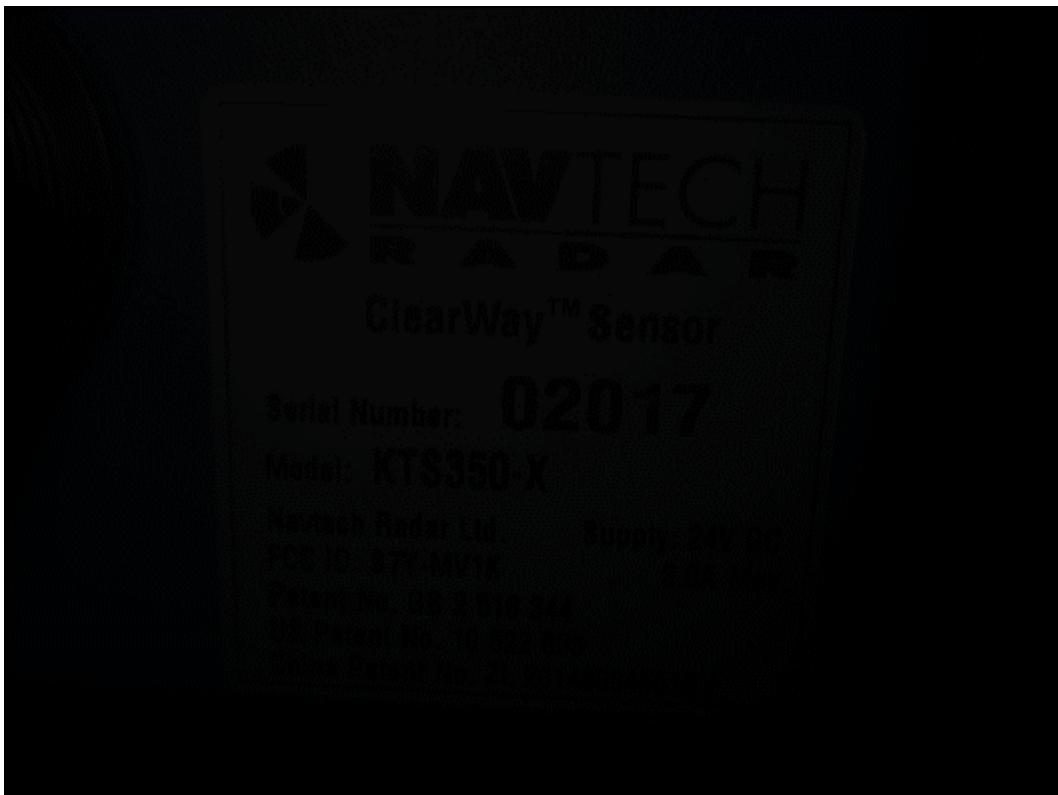
TX port terminated internally

## 7.5 EUT Internal photos

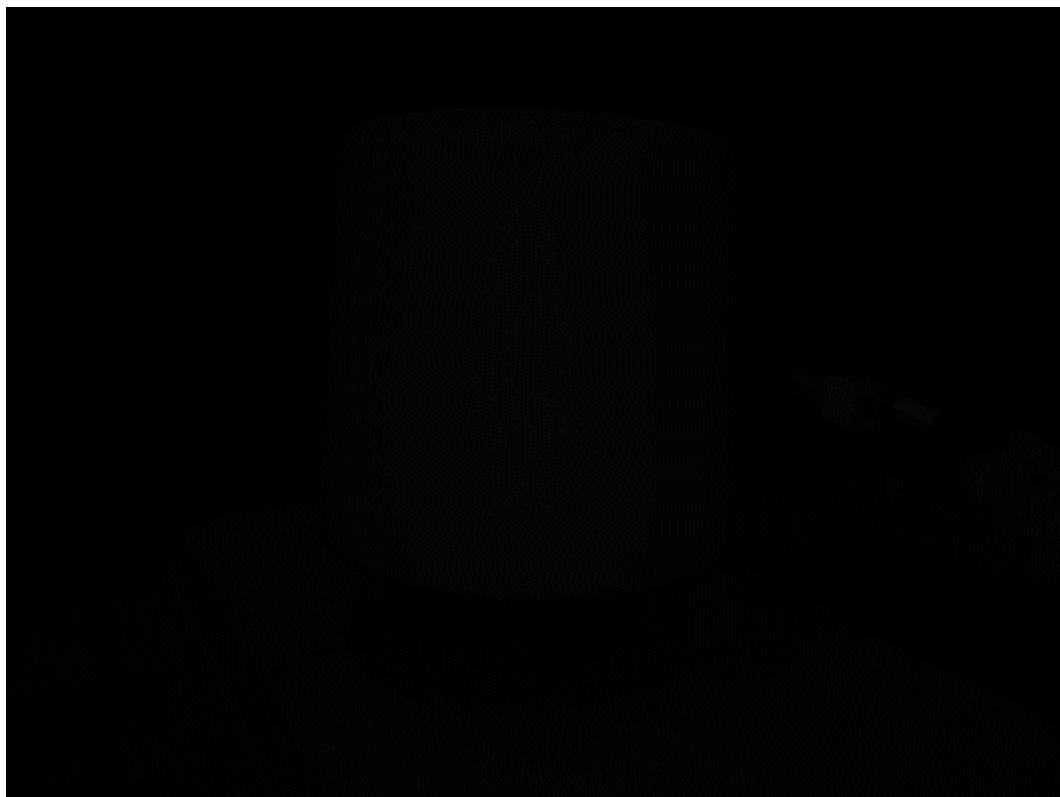




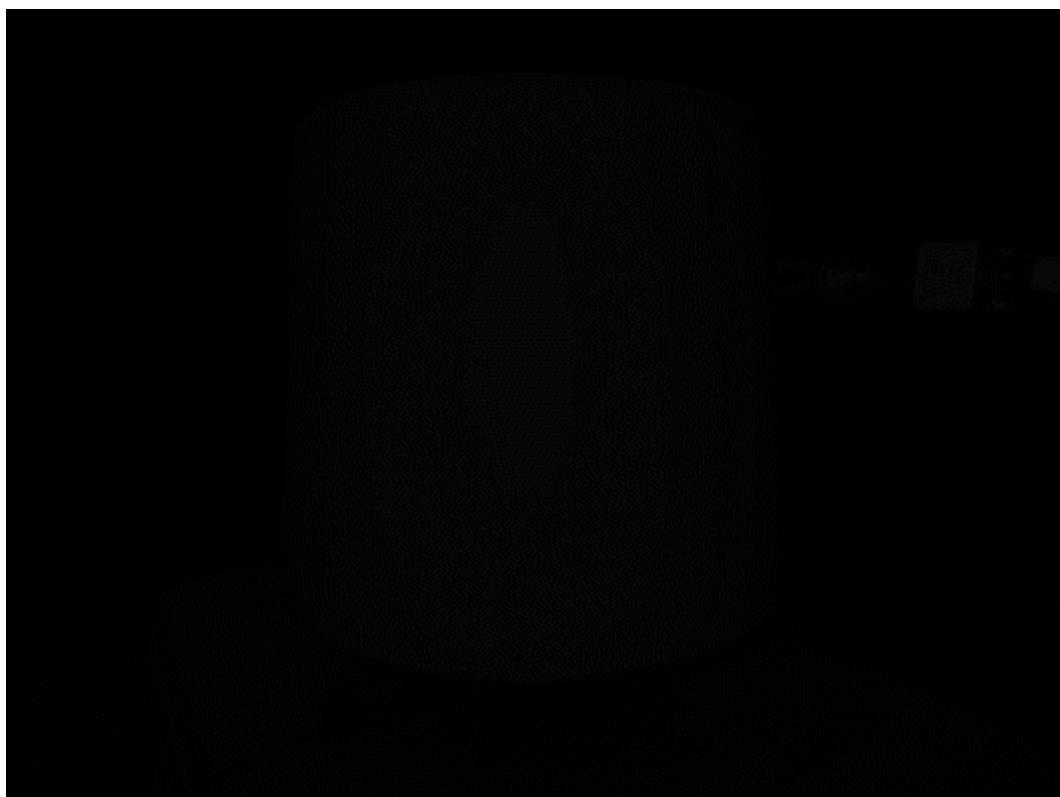
## 7.6 EUT ID Label



## 7.7 Above 1GHz Spurious emissions test set-up



110-140 GHz



140-175 GHz

## 8 Test equipment calibration list

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

RN No.	Model No.	Description	Manufacturer	Calibration date	Cal period
E562	83555A	Source 33-50GHz	Agilent Technologies	25-Feb-2020	12 months
E714	PM 140_3_1	Frequency Tripler 110-170GHz	Teratech Components Ltd	17-Feb-2020	36 months
E719	28240-20	Horn Std Gain 90-140GHz	fmi	25-Jul-2019	12 months
E720	28240-20	Horn Std Gain 90-140GHz	fmi	25-Jun-2019	12 months
E722	861G/387	Horn Std Gain 140-220GHz WR5	Alpha	25-Jul-2019	12 months
E755	N9030B	PXA 3Hz to 50GHz	Keysight Technologies	11-May-2019	12 months
E760	M05HWDX	Mixer 140-220GHz	OML Inc	25-Jun-2019	24 months
E771	861G/387	Horn Std Gain 140-220GHz WR5	Alpha	23-Apr-2019	12 months
E777	MG3695B	Signal Generator 8MHz - 50GHz	Anritsu	18-Jun-2019	12 months
E781	MX4-15-F	Multiplier 50 - 75GHz X4 WR15	MMWave Group (Quantum)	10-Sep-2019	12 months
E908	00365-60004	Isolator 50-75GHz WR15	Hewlett Packard	10-Jun-2019	12 months
E941	M08HWDX	Mixer 90-140GHz	OML Inc	08-Jul-2019	12 months

## 9 Auxiliary and peripheral equipment

### 9.1 Customer supplied equipment

No customer equipment was supplied.

### 9.2 RN Electronics supplied equipment

No RN Electronics Ltd supplied equipment was used.

## 10 Condition of the equipment tested

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

### 10.1 Modifications before test

No modifications were made before test by RN Electronics Ltd.

### 10.2 Modifications during test

No modifications were made during test by RN Electronics Ltd.

## 11 Description of test sites

Site A Radio Laboratory and Anechoic Chamber

Site B Semi-Anechoic Chamber and Control Room  
FCC Registration No. 293246  
IC Registration No. 5612A-4

Site C Transient Laboratory

Site D Screened Room (Conducted Immunity)

Site E Screened Room (Control Room for Site D)

Site F Screened Room (Conducted Emissions)

Site G Screened Room (Control Room for Site H)

Site H 3m Semi-Anechoic Chamber (indoor OATS)  
FCC Registration No. 293246  
IC Registration No. 5612A-2

Site J Transient Laboratory

Site K Screened Room (Control Room for Site M)

Site M 3m Semi-Anechoic Chamber (indoor OATS)  
FCC Registration No. 293246  
IC Registration No. 5612A-3

Site N Radio Laboratory

Site Q Fully-Anechoic Chamber

Site OATS 3m and 10m Open Area Test Site  
FCC Registration No. 293246  
IC Registration No. 5612A-1

Site R Screened Room (Conducted Immunity)

Site S Safety Laboratory

Site T Transient Laboratory

## 12 Abbreviations and units

%	Percent	LBT	Listen Before Talk
$\mu\text{A}/\text{m}$	microAmps per metre	LO	Local Oscillator
$\mu\text{V}$	microVolts	mA	milliAmps
$\mu\text{W}$	microWatts	max	maximum
AC	Alternating Current	kPa	Kilopascal
ALSE	Absorber Lined Screened Enclosure	Mbit/s	MegaBits per second
AM	Amplitude Modulation	MHz	MegaHertz
Amb	Ambient	mic	Microphone
ATPC	Automatic Transmit Power Control	min	minimum
BER	Bit Error Rate	mm	milliMetres
$^{\circ}\text{C}$	Degrees Celsius	ms	milliSeconds
C/I	Carrier / Interferer	mW	milliWatts
CEPT	European Conference of Postal and Telecommunications Administrations	NA	Not Applicable
COFDM	Coherent OFDM	nom	Nominal
CS	Channel Spacing	nW	nanoWatt
CW	Continuous Wave	OATS	Open Area Test Site
dB	deciBels	OFDM	Orthogonal Frequency Division Multiplexing
dB $\mu\text{A}/\text{m}$	deciBels relative to 1 $\mu\text{A}/\text{m}$	ppm	Parts per million
dB $\mu\text{V}$	deciBels relative to 1 $\mu\text{V}$	PRBS	Pseudo Random Bit Sequence
dBc	deciBels relative to Carrier	QAM	Quadrature Amplitude Modulation
dBm	deciBels relative to 1mW	QPSK	Quadrature Phase Shift Keying
DC	Direct Current	R&TTE	Radio and Telecommunication Terminal Equipment
DTA	Digital Transmission Analyser	Ref	Reference
EIRP	Equivalent Isotropic Radiated Power	RF	Radio Frequency
ERP	Effective Radiated Power	RFC	Remote Frequency Control
EU	European Union	RSL	Received Signal Level
EUT	Equipment Under Test	RTP	Room Temperature and Pressure
FM	Frequency Modulation	RTPC	Remote Transmit Power Control
FSK	Frequency Shift Keying	Rx	Receiver
g	Grams	s	Seconds
GHz	GigaHertz	SINAD	Signal to Noise And Distortion
Hz	Hertz	Tx	Transmitter
IF	Intermediate Frequency	V	Volts
kHz	kiloHertz		