

E&E

Eurofins York Castleford Unit 5, Speedwell Road Castleford, WF10 5PY United Kingdom +44 (0) 1977 731173 enquiryyork@eurofins.com eurofins.co.uk/york

Test Report for the FCC and ISED Testing of a

# T2 terminal (WiFi function)

for Mitrefinch Ltd

Test Report number: 14098TR3 Project number: C5814

)

Author: ..... J Beevers MPhys(Hons), PhD Test Engineer

McReh

Checked: ..... M Render BSc(Hons), PhD, MIET Senior Test Engineer

McReh

Approved: ..... M Render BSc(Hons), PhD, MIET Senior Test Engineer

Issue	Description					Issue by	Date	
3	Copy 1		Copy 2		PDF	~	MR	5 <sup>th</sup> November 2021

This report shall not be reproduced, except in full without the prior written approval of Eurofins York The results contained in this report are only applicable to the apparatus tested.



Registered Address: Eurofins York i54 Business Park, Valiant Way Wolverhampton, WV9 5GB, UK

Registered in England and Wales Company Reg. No. 6048589 VAT Reg. No. GB 887 1276 83

## CONTENTS

Test Report Change History4				
Section	1 Test Location	5		
1.1	UKAS Accreditation	5		
Section	2 Customer Information	6		
Section	3 Equipment Details	7		
3.1	Fauipment Under Test (FUT)	7		
3.2	EUT Photographs	8		
3.3	Configuration of EUT	8		
3.4	EUT Monitoring/Auxiliary Equipment	8		
3.5	Monitoring Software	8		
3.6	Modifications	8		
Section	4 Test Specifications	9		
4.1	Knowledge Database References	11		
4.1.1	Radiated Emissions (30MHz to 1000MHz)	11		
4.1.2	Radialed Emissions (TGHZ to 40GHZ)			
4.1.3	Compliance Statement			
۲.۲				
Section	5 Spurious Emission Results – Radiated and Conducted	12		
5.1	Test Specification	12		
5.2	Procedure and Test Software Version	12		
5.3	Radiated Emissions (30MHz to 1GHz)	13		
5.3.1	Limits at 3m	13		
5.3.2	Date of Test	13		
5.3.3	Test Area	13		
5.3.4	Tested by	13		
5.3.5	Test Setup	14		
5.3.6	Electric field emissions, 30MHz to 1GHz	15		
5.3.7	Example field strength calculation	19		
5.3.8	Sample Data	19		
5.4	Kadiated Emissions (1GHz to 18GHz)	20		
54.1	LITIIIS	20		
5/3	Neceiver Settings	20		
544	Test Area	20		
545	Tested by	20		
546	Test Setup	21		
5.4.7	Exploratory Radiated Emission Maximization	22		
5.4.8	Electric field emissions, 1GHz to 18GHz	23		
5.4.9	Example field strength calculation	28		
5.4.1	) Sample Data	28		
5.5	Radiated Emissions (18GHz to 26GHz)	29		
5.5.1	Limits	29		
5.5.2	Receiver Settings	29		
5.5.3	Date of Test	29		
5.5.4	Lest Area	29		
5.5.5	Tested by	29		
5.5.0 5.5.7	resi oelup Evploratory Radiated Emission Maximization	29 20		
5.5.7	Electric field emissions 18GHz to 26GHz			
5.6	Conducted Spurious Emissions 30MHz to 26GHz			
5.6.1	Limits	35		
5.6.2	Date of Test	35		
5.6.3	Test Area	35		
5.6.4	Tested by	35		
5.6.5	Test Setup	36		
5.6.6	Test Results	36		

## **Commercial in Confidence**

Date:	5 <sup>th</sup>	November	2021
-------	-----------------	----------	------

Report N	lumber: 14098TR3	Date: 5 <sup>th</sup> November 202
Section	6 6dB Bandwidth and 99% Occupied Bandwidth	
6.1	Test Specification	
6.2	Procedure and Test Software Version	
6.2.1	Date of Test	
6.2.2	Test Area	
6.2.3	Tested by	
6.2.4	Test Setup	
6.3	Test Results	
O a ati a m	7 Deals Outent Denne	40
	7 Peak Oulpul Power	
7.1	Test Specification	
1.2	Procedure and Test Software Version	
7.2.1		
7.2.2	Test Area	
7.2.3	Tested by	
7.2.4	Test Setup	
7.3	Test Result	
Section	8 Power Spectral Density	
8.1	Test Specification	
8.2	Procedure and Test Software Version	
8.2.1	Date of Test	54
822	Test Area	54
823	Tested by	54
824	Test Setun	54
8.3	Test Results	
Section	9 Band Edge Compliance	
9.1	Test Specification	
9.2	Procedure and Test Software Version	
9.2.1	Date of Test	
9.2.2	Test Area	
9.2.3	Tested by	
9.2.4	Test Setup	
9.3	Test Results	59
Soction	10 AC Mains Conducted Emissions	66
10.1	Test Specification	
10.1	Dewer Line Emission Limite	
10.2	Power Line Emission Limits	
10.3	Receiver Settings	
10.4	Procedure and Test Software Version	
10.4.1		
10.4.2		
10.4.3	3 Tested by	
10.4.4	Test Setup	
10.5	Test Results	
10.5.1	Example calculation	
10.5.2	2 Sample Data	
Appendi	x A EUT Test Photos	
Appendi	x B Test Equipment List	

# **Test Report Change History**

Issue	Date	Modification Details
1	6 <sup>th</sup> May 2021	First Issue
2	14 <sup>th</sup> October 2021	Updated to specify lowest and highest frequencies as defined within KDB 634817D01
3	5 <sup>th</sup> November 2021	Modification HVIN
4		
5		
6		
7		
8		
9		
10		

# Section 1 Test Location

All testing was performed at;

Eurofins York	Unit 5
	Speedwell Road
	Castleford
	WF10 5PY
Tel:	01977 731173
Website	http://www.yorkemc.co.uk
UKAS Testing No.	1574

#### 1.1 UKAS Accreditation

Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.

Eurofins York latest accreditation schedule can be found at: http://www.ukas.org/testing/lab\_detail.asp?lab\_id=989&location\_id=&vMenuOption=3

Eurofins York Castleford Laboratory, is an Accredited facility recognised by the Federal Communications Commission (FCC) for certification testing.

The appropriate FCC Designation Number is number is UK02013, dated 1<sup>st</sup> March 2021.

Eurofins York Castleford Laboratory is recognised by ISED for certification testing.

ISED Assigned Code: 22959

# **Section 2 Customer Information**

Company name	Mitrefinch Ltd
Address	Mitrefinch House
	Green Lane Trading Estate,
	Clifton
	York
	North Yorkshire
	YO30 5YY
Tel:	01904 693115
Contact	Mr Chris Flynn
Email	Chris.Flynn@mitrefinch.co.uk

# Section 3 Equipment Details

# 3.1 Equipment Under Test (EUT)

Date received:	5 <sup>th</sup> November 2020			
FCC ID	2AZ53-T2			
ISED Certification Number	27361-T2			
Product Marketing Name:	T2 Terminal			
Hardware Version Identification Number	T2 Terminal			
Firmware Version Identification Number	N/A			
EUT description:	Secure Facility. It is to 15 to 19VDC Input essor nt Sensor 2V 2 N/C and 2 N/O co pole. 8 outputs 4 inputs rt with external PIN for y versions Test 14" for 66 Rated)	V 2 N/C and 2 N/O connections per relay. So with external PIN for Clock Data 5V versions Test 14" for EMC S Rated)		
WiFi module manufacturer	Formike Wireless Te	chnology		
WiFi module description	KWH-8723-BU is a highly integrated single-chip 802.11n Wireless LAN (WLAN) USB 2.0			
WiFi module	Model KWH-8723-	BU		
EUT power:	100 -240 V, 50 – 60	Hz mains supply		
Operating frequency band	2400MHz to 2483.5M	ИНz		
Centre frequency of lowest channel	2411.0MHz for wides	st permitted frequency	range	
Centre frequency of highest channel	2463.0MHz for widest permitted frequency range			
Output power setting	Maximum power (Maximum 0.12W measured)			
Transmission system	Digital Transmission System (DTS)			
Modulation scheme(s)	CCK and OFDM			
Bandwidth tested	20 MHz			
Size of EUT (mm)	Width: 125 mmDepth: 50 mmHeight: 300 mm			
Mode/s of operation	Continuous transmit of packetised data at top, middle and bottom channels.			
Modifications incorporated during testing:	ted None			

## 3.2 EUT Photographs

Photographs are supplied separately.

#### 3.3 Configuration of EUT

The apparatus was supplied in one single possible configuration.

## 3.4 EUT Monitoring/Auxiliary Equipment

None.

## 3.5 Monitoring Software

None. The channel required was selected via software prior to the testing.

### 3.6 Modifications

None.

# Section 4 Test Specifications

For USA:

Regulation / Test Standard	Regulation: Title 47 of the Code of Federal Regulations (CFR) Part 15 (47CFR15) Subpart C – Intentional Radiators		
	Measurement standard:		
	ANSI C63.10-2013		
	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		

Requirement	FCC Rule Part	Comments	Result Summary
6 dB Bandwidth	FCC § 15.247(a)(2)	Applies	Pass
Maximum peak conducted power	FCC § 15.247(b)(3)	Applies	Pass
Power spectral density	FCC § 15.247(e)	Applies	Pass
AC power line conducted emissions	FCC § 15.207	Applies	Pass
Band edge compliance	FCC § 15.247(d)	Applies	Pass
Conducted spurious emissions	FCC § 15.247(d)	Applies	Pass
Transmitter radiated spurious emissions	FCC § 15.247(d) FCC § 15.209 FCC § 15.205	Applies	Pass

# For Canada

Regulation / Test Standard	RSS-247 Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices Issue 2 February 2017		
	And,		
	RSS-Gen — General Requirements for Compliance of Radio Apparatus Issue 5		

Requirement	ISED Ragulation	Comments	Results Summary
Occupied Bandwidth	RSS-Gen 6.6	Applies	Pass
6 dB Bandwidth	ISED RSS-247 § 5.2	Applies	Pass
Maximum peak conducted power	ISED RSS-247 § 5.4	Applies	Pass
Power spectral density	ISED RSS-247 § 5.2	Applies	Pass
AC power line conducted emissions	ISED RSS-247 § 3.1	Applies	Pass
Band edge compliance	ISED RSS-247 § 3.3 and 5.5 RSS-GEN Issue 5 Section 8.10	Applies	Pass
Conducted spurious emissions	ISED RSS-247 § 5.5	Applies	Pass
Transmitter radiated spurious emissions	ISED RSS-GEN § 8.9	Applies	Pass
Receiver radiated spurious emissions	ISED RSS-247 § 3.1	Applies	Pass

#### 4.1 Knowledge Database References

The following KDBs were referenced during the testing of the T2 terminal The latest knowledge database references are available via the FCC KDB website at:

https://apps.fcc.gov/kdb

### 4.1.1 Radiated Emissions (30MHz to 1000MHz)

Publication Number	Keyword	Publication Date
913591	Measurement of radiated emissions at the band-edge for a Part 15 RF Device	04/05/2017

#### 4.1.2 Radiated Emissions (1GHz to 40GHz)

Publication Number	Keyword	Publication Date
704992	Test Site Validation Requirements above 1 GHz.	12/06/2015
149045	Comparison Noise Emitter (CNE), reference noise source, .pdf	05/04/2007
913591	Measurement of radiated emissions at the band-edge for a Part 15 RF Device	04/05/2017
934285	Comparison Noise Emitters (CNE), test equipment, Broadband.pdf	05/04/2007

## 4.1.3 Frequency Range Listing for Certification Grants

Publication Number	Keyword	Publication Date
634817	Frequency range listings for Certification grants. Part 15 unlicensed transmitters	

#### 4.2 Compliance Statement

The T2 terminal, as tested, was shown to meet requirements of the standards listed in Section 4 of this report.

# Section 5 Spurious Emission Results – Radiated and Conducted

## 5.1 Test Specification

FCC Rule Part	47CFR 15.247 (d)
Standard	ANSI C63.10:2013
Measurement Uncertainty Radiated tests	The reported uncertainty of measurement $y \pm U$ , where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95% is +/- 5.85dB for the frequency range 30MHz to 1GHz +/- 4.64dB for the frequency range from 1GHz to 6GHz +/- 4.96dB for the frequency range from 6GHz to 18GHz
Measurement Uncertainty Conducted tests	±1.4dB

## 5.2 Procedure and Test Software Version

## Radiated tests:- 47CFR15.205 Restricted Bands Only

Eurofins York test procedure (30MHz to 1GHz)	CEP23b Issue 8
Eurofins York test procedure (1GHz to 40GHz)	CEP64b Issue 8
Test software	RadiMation Version 2016.2.8

## Conducted Tests 47CFR 15.205 Unrestricted Bands

ANSi C63.10-2013 Clause reference:	11.11.2 and 11.11.3
Test software	Keysight Connection Expert

## 5.3 Radiated Emissions (30MHz to 1GHz)

Radiated electric field emission measurements are applied to the restricted bands only, defined in 47CFR15.205.

## 5.3.1 Limits at 3m

Frequency (MHz)	Limit (dBµV/m)
	Quasi Peak
30 - 88	40.0
88 -216	43.5
216 - 960	46.0
960- 1000	54.0

Note: FCC 47 CFR Part 15 Section 15.109 specifies test limits at 3m

#### **Receiver Settings**

Receiver Parameters	Setting
Detector Function	Quasi Peak
Start Frequency	30MHz
Stop Frequency	1000MHz
Resolution Bandwidth	120kHz
Video Bandwidth	Auto

## 5.3.2 Date of Test

19th March 2021

## 5.3.3 Test Area

LAB 1 (SAC)

### 5.3.4 Tested by

J Beevers

#### 5.3.5 Test Setup

The EUT was configured in the SAC on an 80cm high polystyrene table.

The measurement was performed with an antenna to EUT separation distance of 3m. The results were maximised in orientation 0-360 degrees and height 1-4m.



Reference Ground Plane

Figure 5.3.5.1: Test Setup for E-Field Measurements from 30MHz to 1GHz

- Note 1: With the EUT de-energized the ambient radio noise and signals met the 6dB peak detection requirement of ANSI C63.10-2013.
- Note 2 : There were no significant environmental temperature changes during the test duration and hence it was not considered necessary to consider any variation in cable loss.

#### 5.3.6 Electric field emissions, 30MHz to 1GHz

The equipment under test was pre-scanned using peak detection when operating on all three channels with both CCK and OFDM modulation. Final measurements were performed with the equipment under test operating on channel 11 with OFDM modulation.



Figure 5.3.6.1: Electric field emissions Plot, 30MHz to 1GHz, operation on Channel 11 OFDM modulation

Frequency	Quasi- Peak	Quasi Peak Limit	Quasi- Peak Difference	Quasi- Peak Status	Angle	Height	Polarization
MHz	dBµV/m	dBµV/m	dB		degrees	m	
155.616	32.2	40	-7.8	Pass	170	1.8	Horizontal
604.920	43.0	47	-4.0	Pass	340	1.4	Horizontal
43.818	39.0	40	-1.0	Pass	250	1.0	Vertical
47.808	38.3	40	-1.7	Pass	240	1.0	Vertical
40.356	34.5	40	-5.5	Pass	180	1.0	Vertical
64.776	35.3	40	-4.7	Pass	225	1.7	Vertical
40.122	33.1	40	-6.9	Pass	44	1.0	Vertical
66.294	35.4	40	-4.6	Pass	124	1.8	Vertical
39.600	31.7	40	-8.3	Pass	90	1.0	Vertical
49.200	36.5	40	-3.5	Pass	65	1.0	Vertical
390.000	44.2	47	-2.8	Pass	195	1.0	Horizontal
70.830	33.4	40	-6.6	Pass	94	2.1	Vertical
78.360	20.5	40	-19.5	Pass	360	3.1	Vertical
139.140	29.8	40	-10.2	Pass	195	2.7	Horizontal
94.392	32.4	40	-7.6	Pass	95	1.0	Vertical

Table 5.3.6.1: Electric Field Emission Peaks, 30MHz to 1GHz, operation on Channel 11 OFDM
modulation



Figure 5.3.6.2: Electric field emissions Plot, 30MHz to 1GHz, operation on Channel 11 CCK modulation- Peak detector scan



Figure 5.3.6.3: Electric field emissions Plot, 30MHz to 1GHz, operation on Channel 5 OFDM modulation- Peak detector scan



Figure 5.3.6.4: Electric field emissions Plot, 30MHz to 1GHz, operation on Channel 5 CCK modulation-Peak detector scan



Figure 5.3.6.5: Electric field emissions Plot, 30MHz to 1GHz, operation on Channel 1 OFDM modulation- Peak detector scan



Figure 5.3.6.6: Electric field emissions Plot, 30MHz to 1GHz, operation on Channel 1 CCK modulation-Peak detector scan

#### 5.3.7 Example field strength calculation

Field strength (FS) is calculated as follows:

FS (dB $\mu$ V/m) = Indicated Signal Level (dB $\mu$ V) + AF (dB/m) + CL (dB)

### 5.3.8 Sample Data

From Figure 5.3.6.1, table 5.3.6.1, the Quasi-Peak level at 155.616 MHz is calculated as follows:

FS  $(dB\mu V/m) = 14.6 (dB\mu V) + 16.3 (dB/m) + 1.3 (dB) = 32.2 dB\mu V/m$ 

## 5.4 Radiated Emissions (1GHz to 18GHz)

## 5.4.1 Limits

Frequency (GHz)	Limit (dBµV/m)	Limit (dBµV/m)	
	Peak	Average	
1-18	74.0	54.0	

## 5.4.2 Receiver Settings

Receiver Parameters	Setting
Detector Function	Average and Peak
Start Frequency	1GHz
Stop Frequency	18GHz
Resolution Bandwidth	1MHz
Video Bandwidth	Auto

#### 5.4.3 Date of Test

29th March 2021

## 5.4.4 Test Area

LAB 1 (SAC)

## 5.4.5 Tested by

J Beevers

#### 5.4.6 Test Setup

The EUT was configured in the SAC on an 80cm high table Exploratory measurements on the EUT were carried out to identify suspect frequencies and worst case orientations, see Section 5.4.7.

The measurement was then performed with an antenna to EUT separation distance of 1m.

The antenna was kept in the "cone of radiation" from the EUT and pointed at the area both in azimuth and elevation using the tilt mechanism on the antenna mast.

The results were maximised in orientation 0-360 degrees and height 1-4m.



Reference Ground Plane

#### Figure 5.4.6.1: Test Setup for Final E-Field Measurements from 1GHz to 18GHz

- Note 1: With the EUT de-energized the ambient radio noise and signals met the 6dB peak detection requirement of ANSI C63.4-2010.
- Note 2 : There were no significant environmental temperature changes during the test duration and hence it was not considered necessary to consider any variation in cable loss.

#### 5.4.7 Exploratory Radiated Emission Maximization

During exploratory testing, suspect emissions from the EUT were identified both in terms of the frequency and directionality. This was achieved by manually positioning the antenna close to the EUT and also by scanning it over all sides of the EUT whilst observing a spectral display. The typical distance between the surface of the EUT and the scanning antenna was circa 30cm.

Frequency (GHz)	Mode of operation	EUT face *	Emissions Angle (w.r.t. turntable)	Height	Polarization
None	Transmitting on channel 1	-	-	-	-
None	Transmitting on channel 5	-	-	-	-
None	Transmitting on channel 11	-	-	-	-

## Frequencies identified during Exploratory Radiated Emission maximization

Note 1 : The front face of the EUT is deemed to be  $0^{\circ}$ , which is then turned in a clockwise direction through  $360^{\circ}$ .

#### 5.4.8 Electric field emissions, 1GHz to 18GHz

The equipment under test was pre-scanned using peak detection when operating on all three channels with both CCK and OFDM modulation. Final measurements were performed with the equipment under test operating on channel 11 with OFDM modulation.



Figure 5.4.8.1: Electric field emissions Plot, 1GHz to 18GHz. Operation on Channel 11 OFDM modulation

Frequency	Average	Average Limit	Average Difference	Average Status	Angle	Height	Polarization
GHz	dBµV/m	dBµV/m	dB		degrees	m	
17.905	40.50	54	-13.50	Pass	50	3.6	Vertical
17.845	39.92	54	-14.08	Pass	205	2.6	Vertical
17.498	38.24	54	-15.76	Pass	340	3.1	Vertical
16.108	35.96	54	-18.04	Pass	305	4.0	Vertical
15.376	37.09	54	-16.91	Pass	325	2.6	Horizontal
15.035	36.70	54	-17.30	Pass	160	3.2	Vertical
14.832	36.60	54	-17.40	Pass	25	1.0	Vertical

Table 5.4.8.1: Electric Field Emissions Peaks, 1GHz to 18GHz – Operation on Channel 11 OFDN
modulation



Figure 5.4.8.2: Electric field emissions Plot, 1GHz to 18GHz, Operation on channel 11 CCK modulation - Peak detector scan



Figure 5.4.8.3: Electric field emissions Plot, 1GHz to 18GHz, Operation on Channel 5 OFDM modulation – Peak detector scan



Figure 5.4.8.4: Electric field emissions Plot, 1GHz to 18GHz, Operation on Channel 5 CCK modulation – Peak detector scan







Figure 5.4.8.6: Electric field emissions Plot, 1GHz to 18GHz, Operation on Channel 1 CCK modulation – Peak detector scan

#### 5.4.9 Example field strength calculation

The total average corrections are shown in the above table. This correction figure consists of Preamplifier gain (PG), Antenna factor (AF); Attenuator loss (AL) and Cable loss (CL).

Field strength (FS) is calculated as follows:

FS (dB $\mu$ V/m) = Indicated Signal Level (dB $\mu$ V) - PG (dB) + AF (dB) + AL (dB) + CL (dB)

#### 5.4.10 Sample Data

From Figure 54.9.1 and table 5.4.9.1, The Average level at 17.905GHz is calculated as follows:

FS  $(dB\mu V/m) = 21.37(dB\mu V) - 49.67(dB) + 47.70(dB/m) + 21.10 (dB) = 40.50 dB\mu V/m$ 

## 5.5 Radiated Emissions (18GHz to 26GHz)

## 5.5.1 Limits

Frequency (GHz)	Limit (dBµV/m)	Limit (dBµV/m)	
	Peak	Average	
18-26	74.0	54.0	

#### 5.5.2 Receiver Settings

Receiver Parameters	Setting	
Detector Function	Average and Peak	
Start Frequency	1GHz	
Stop Frequency	18GHz	
Resolution Bandwidth	1MHz	
Video Bandwidth	Auto	

#### 5.5.3 Date of Test

30th March 2021

## 5.5.4 Test Area

LAB 1 (SAC)

## 5.5.5 Tested by

J Beevers

## 5.5.6 Test Setup

This is the same as for the 1-18GHz range for final measurements.

#### 5.5.7 Exploratory Radiated Emission Maximization

During exploratory testing, suspect emissions from the EUT were identified both in terms of the frequency and directionality. This was achieved by manually positioning the antenna close to the EUT and also by scanning it over all sides of the EUT whilst observing a spectral display. The typical distance between the surface of the EUT and the scanning antenna was circa 30cm.

Frequency (GHz)	Mode of operation	EUT face *	Emissions Angle (w.r.t. turntable)	Height	Polarization
None	Transmitting on channel 1	-	-	-	-
None	Transmitting on channel 5	-	-	-	-
None	Transmitting on channel 11	-	-	-	-

## Table 5.5.7.1: Frequencies identified during Exploratory Radiated Emission maximization

Note 2 : The front face of the EUT is deemed to be  $0^{\circ}$ , which is then turned in a clockwise direction through  $360^{\circ}$ .

#### 5.5.8 Electric field emissions, 18GHz to 26GHz

The equipment under test was pre-scanned using peak detection when operating on all three channels with both CCK and OFDM modulation. No spurious emissions were detected above the measurement noise floor.



Figure 5.5.8.1: Electric field emissions Plot, 18GHz to 26GHz. Operation on Channel 11 OFDM modulation – Peak detector scan



Figure 5.5.8.2: Electric field emissions Plot, 18GHz to 26GHz. Operation on Channel 11 CCK modulation – Peak detector scan



Figure 5.5.8.3: Electric field emissions Plot, 18GHz to 26GHz. Operation on Channel 5 OFDM modulation – Peak detector scan



Figure 5.5.8.4: Electric field emissions Plot, 18GHz to 26GHz. Operation on Channel 5 CCK modulation – Peak detector scan



Figure 5.5.8.5: Electric field emissions Plot, 18GHz to 26GHz. Operation on Channel 1 OFDM modulation – Peak detector scan



Figure 5.5.8.6: Electric field emissions Plot, 18GHz to 26GHz. Operation on Channel 1 CCK modulation – Peak detector scan

## 5.6 Conducted Spurious Emissions 30MHz to 26GHz

## 5.6.1 Limits

Frequency	Limit, 47CFR 15.247(d)	
(MHz)	Peak	
30 – 26000	20dBc	

Spectrum analyser settings as specified by ANSI C63.10-2013 Clause 11.11.2

Receiver Parameters	Setting		
Detector Function	Peak		
Start Frequency A	30MHz		
Stop Frequency A	1000MHz		
Start Frequency B	1000MHz		
Stop Frequency B	26000MHz		
Resolution Bandwidth	100kHz		
Video Bandwidth	300kHz		
Sweep rate	Auto couple		
Trace mode	Max hold		

## 5.6.2 Date of Test

6<sup>th</sup> April 2021

#### 5.6.3 Test Area

LAB 7

## 5.6.4 Tested by

J Beevers

## 5.6.5 Test Setup

The antenna port was connected directly to the signal analyser.



## 5.6.6 Test Results

The results of the conducted spurious emissions are stated below and by the signal analyser images.

All disturbances detected were > 20dB below the carrier.
#### Antenna port conducted emissions 30MHz to 26GHz



Conducted emissions 30MHz to 1GHz. Operation on channel 1 CCK modulation.



Conducted emissions 1GHz to 26GHz. Operation on channel 1 CCK modulation.

Agile	nt Spectrum	Analyzer - Swept	SA							
Mai	kor 1 9	RF [50Ω			SENSE:INT	AL	Ava Type:	Log-Pwr	12:56:28 TR	PM Apr 06, 2021 ACE 1 2 3 4 5 6
Ma	Kei 13	41.000000		PNO: Fast 🕞	Trig: Free Atten: 26 d	Run 18	Avg Hold>	100/100	Т	P N N N N N
									Mkr1 941	.80 MHz
10 d	B/div	Ref 16.00 dB	m						-62.5	858 dBm
LUY										
6.00	I									
-4.00										
-14.0										-14.00 dBm
-24.0										
-34.0										
-34.0										
-44.0										
-54.0										<u>_1</u>
-64.0	L							l bider el	to a longiture of	
	n her and the second second	multin water with	ha an ann an Anna Anna Anna Anna Anna An	r and and a state of the state	halled of the second	Man Manda and Manager and M Manager and Manager and Mana Manager and Manager and Mana	y to the second second	≁IJŊĸĿŀĸĸſŔĸĬĬŸŊĨ <sup>ĸ</sup> ₩ĸ₩₩ŔĸŔ	-really all all all all all all all all all	anan na an
-74.0										
Sta #Re	rt 30.0 M IS BW 10	IHZ )û kHz		#VE	W 300 kHz			Sween	Stop 1	.0000 GHz (1001 nts)
MSG	S BAF IV			#VL			<b>STATUS</b>	oweep		(Too F pts)

Conducted emissions 30MHz to 1GHz. Operation on channel 1 OFDM modulation.



Conducted emissions 1GHz to 26GHz. Operation on channel 1 OFDM modulation.

Agiler	nt Spectru	um Ana	lyzer - Swept S/	l.							
L <mark>XI</mark>		RF	50 Ω AC			SENSE:INT	Al	.IGN AUTO	. <u> </u>	01:02:35	PM Apr 06, 2021
Mar	ker 1	956.	35000000	0 MHz	PNO: Fast 🕞 IFGain:Low	) Trig: Free Atten: 26 (	Run dB	Avg Type: Avg Hold:>⁺	Log-Pwr 100/100	TF	RACE 123456 TYPE MWWWWW DET PNNNN
10 di Log	B/div	Ref	16.00 dBm							Mkr1 950 -61.	6.35 MHz 994 dBm
6.00											
-4 00											
-14 በ											-14.00 dBm
-24 በ											
-34.0											
44.0											
-44.0											
-04.0		1									<b>,</b> ∳ <sup>1</sup>
64.0		lfriede	Multine and the second s	ward all flat and	huguelastar May	Who make whether the	ijnh <mark>a</mark> hannu illen til en ter	U. Harden and Antonian Antonia	have a fear the factor of the	pralyen allandra	www.elovellet.howsharest
-74.U											
Star	rt 30.0	MHz			,					Stop 1	.0000 GHz
#Re	SBW	100 k	Hz		#VE	W 300 kHz			Swee	o 92.73 ms	s (1001 pts)
MSG											

Conducted emissions 30MHz to 1GHz. Operation on channel 5 CCK modulation.



Conducted emissions 1GHz to 26GHz. Operation on channel 5 CCK modulation

Agiler	nt Spectru	m Analyze	er - Swept SA								
L <mark>XI</mark>		RF	50 Ω AC			SENSE:INT	AL	.IGN AUTO		01:01:33	PM Apr 06, 2021
Mar	ker 1	956.35	000000	0 MHz	PNO: Fast 🕞 FGain:Low	) Trig: Free Atten: 26 d	Run 18	Avg Type:  Avg Hold:>*	Log-Pwr 100/100	1h	ACE 123456 TYPE MWWWWW DET PNNNNN
10 d	B/div	Ref 16	i.00 dBm							Mkr1 950 -62.	6.35 MHz 369 dBm
6.00											
-4.00											
-14.0											-14.00 dBm
-24.0											
-34 N											
-44 0											
-54 0											
64.0											<b>1</b>
74.0	eerfided.com	within	http://www.apply.org	hillionnah	hand a provide and a	water	tweel for territory out of the second se	ard conversion	oghlatil styletanom	al and the second s	nnadhhatain
-74.0											
Star	t 30.0	MHz								Stop 1	.0000 GHz
#Re	s BW 1	100 kHz	2		#VB	W 300 kHz			Swee	o 92.73 ms	(1001 pts)
MSG	G STATUS										

Conducted emissions 30MHz to 1GHz. Operation on channel 5 OFDM modulation.



Conducted emissions 1GHz to 26GHz. Operation on channel 5 OFDM modulation

Agiler	nt Spectru	ım Anal	yzer - Swept S	A							
L <mark>XI</mark>		RF	50 Ω AC			SENSE:INT	AI	IGN AUTO	lag Dwr	01:05:24	PM Apr 06, 2021
Mar	Ker 1	956.	35000000	UMHZ	PNO: Fast 🕞 IFGain:Low	Trig: Free Atten: 26	Run dB	Avg Hold>*	100/100		
10 d	B/div	Ref	16.00 dBn	1						Mkr1 950 -61.	6.35 MHz 852 dBm
6.00											
-4.00											
-14.0											-14.00 dBm
-24.0											
-34.0	<u> </u>										
-44.0											
-54.0											<u> </u>
-64.0	Manual	առունել	nut-re-malut/home	Land With the second of the	hummenter	\.	<sup>₽</sup> √ <sup>₽4</sup> ┫┿ <b>╪╕</b> ┲╴╲╺┿╍┨╲┨┠┥╛	รรุปปฏิมาณา	nderk <mark>ylleks</mark> aander	++++++++++++++++++++++++++++++++++++++	manduadopatop
-74.0											
Stat	1 30 0	мца								Stop	0000 CH-
#Re	s BW 1	100 k	Hz		#VE	3W 300 kHz			Swee	p 92.73 ms	(1001 pts)
MSG								<b>I</b> STATUS			

Conducted emissions 30MHz to 1GHz. Operation on channel 11 CCK modulation.



Conducted emissions 1GHz to 26GHz. Operation on channel 11 CCK modulation

Agile	nt Spectru	ım Ana	lyzer - Swept S	A							
LXI		RF	50 Ω AC			SENSE:INT	Α		log Dwr	01:06:50	PM Apr 06, 2021
Mar	Ker 1	956.	35000000	UMHZ	PNO: Fast G	Trig: Free Atten: 26	Run dB	Avg Hold>	100/100		
10 d	B/div	Ref	16.00 dBm	1						Mkr1 950 -63.	6.35 MHz 272 dBm
6.UU											
-4.00											
-14.0											-14.00 dBm
-24.0											
-34.0											
-44.0											
-54.0											
-64.0											
-74-0	Henri A.	หม่งปรุง	hord and a series	n Marin Allynigal	Reguli Marcul Spole	hankrupplanerarih	www.c.addinglycom	∿ <b>↓}<sub>U</sub>}⊷\k∿[La¦\ra<sub>v</sub>-ŀr</b>	and the second states of the	unent for and a start	erveren an andar an
-74.0											
Sta	rt 30.0	MHz							1	Stop 1	.0000 GHz
#Re	s BW	100 k	Hz		#VE	300 kHz			Swee	p 92.73 ms	s (1001 pts)
MSG								<b>I</b> STATUS			

Conducted emissions 30MHz to 1GHz. Operation on channel 11 OFDM modulation.



Conducted emissions 1GHz to 26GHz. Operation on channel 11 OFDM modulation

# Section 6 6dB Bandwidth and 99% Occupied Bandwidth

## 6.1 Test Specification

FCC Rule Part	46CFR 15.247 (b)(2)
Standard	ANSI C63.10:2013

## 6.2 Procedure and Test Software Version

#### **Conducted Tests**

ANSi C63.10-2013 Clause reference:	11.9.1.1 (RBW>DTS bandwidth)
Test software	Keysight Connection Expert

Frequency (MHz)	Limit, 47CFR 15.247(a)(2)
	Peak
2400MHz to 2483.5MHz	At least 500kHz

Spectrum analyser settings as specified by ANSI C63.10-2013 Clause 11.8.1

Receiver Parameters	Setting
Detector Function	Peak
Span	3 x RBW
Resolution Bandwidth	100kHz
Video Bandwidth	300kHz
Sweep rate	Auto couple
Trace mode	Max hold

# 6.2.1 Date of Test

1st April 2021

#### 6.2.2 Test Area

LAB 7

#### 6.2.3 Tested by

J Beevers

#### 6.2.4 Test Setup

The antenna port was connected directly to the signal analyser.



#### 6.3 Test Results

The results of the 6dB bandwidth measurements are stated in the table below and by the signal analyser images.

Channel (MHz)	Modulation scheme	Measured 6dB bandwidth (MHz)	Minimum requirement (kHz)	99% Occupied bandwidth (MHz)	Figure	Result
2411.0	CCK	10.11	500.0	15.210	6.3.1	Pass
2411.0	OFDM	16.58	500.0	16.505	6.3.2	Pass
2432.0	ССК	10.11	500.0	15.224	6.3.3	Pass
2432.0	OFDM	16.58	500.0	16.502	6.3.4	Pass
2463.0	ССК	10.12	500.0	15.222	6.3.5	Pass
2463.0	OFDM	16.60	500.0	16.507	6.3.6	Pass

#### 6dB and 99% Bandwidth Measurements



Figure 6.3.1 Bandwidth at 6dB Point. Operation on Channel 1 CCK modulation



Figure 6.3.2 Bandwidth at 6dB Point. Operation on Channel 1 OFDM modulation



Figure 6.3.3 Bandwidth at 6dB Point. Operation on Channel 5 CCK modulation



Figure 6.3.4 Bandwidth at 6dB Point. Operation on Channel 5 OFDM modulation



Figure 6.3.5 Bandwidth at 6dB Point. Operation on Channel 11 CCK modulation



Figure 6.3.6 Bandwidth at 6dB Point. Operation on Channel 11 OFDM modulation

# Section 7 Peak Output Power

## 7.1 Test Specification

FCC Rule Part	46CFR 15.247 (b)(3)
Standard	ANSI C63.10:2013

## 7.2 Procedure and Test Software Version

#### **Conducted Tests**

ANSi C63.10-2013 Clause reference:	11.9.1.2 (Integrated band power method)
Test software	Keysight Connection Expert

Frequency (MHz)	Limit, 47CFR 15.247(b)(2)		
	Peak		
2400MHz to 2483.5MHz	1 Watt		

Spectrum analyser settings as specified by ANSI C63.10-2013 Clause 11.9.1.2

Receiver Parameters	Setting			
Detector Function	Peak			
Span	[1.5 x DTS bandwidth]			
Resolution Bandwidth	1MHz			
Video Bandwidth	3MHz			
Sweep rate	Auto couple			
Trace mode	Max hold			
Integration Bandwidth	[DTS bandwidth]			

# 7.2.1 Date of Test

6<sup>th</sup> April 2021

#### 7.2.2 Test Area

LAB 7

#### 7.2.3 Tested by

J Beevers

## 7.2.4 Test Setup

The antenna port was connected directly to the signal analyser.



#### 7.3 Test Result

The results of the peak output power measurements are stated in the table below and by the signal analyser images.

Channel (MHz)	Modulation scheme	Peak output power (Watts)*	Limit (Watts)	Figure
2411.0	ССК	0.0657	1	7.3.1
2411.0	OFDM	0.1165	1	7.3.2
2432.0	ССК	0.0676	1	7.3.3
2432.0	OFDM	0.1200	1	7.3.4
2463.0	ССК	0.0698	1	7.3.5
2463.0	OFDM	0.1263	1	7.3.6

#### **Peak Output Power Measurement**

\*note: this is the power measured in the DTS bandwidth.

Agnent Spectrum Analy	zer - Chann	el Power								
L <mark>XI</mark> RF	50 Ω /	A.C		SEI	NSE:INT	ALI	GNAUTO		11:3	9:34 AM Apr 06, 2021
Span 15.165 M	Hz				Center Freq	: 2.411800000	GHz		Radio St	d: None
			(#IFGain:Low	₽	#Atten: 26 d	un B	Avg Hold:>1	10/10	Radio De	vice: BTS
10 dB/div Re	f 1.000 \	N								
Log										
100 mW										_
10.0 mW										
1.00 mW										
100 WW										
10.0 pm										
1.00 µVV										
100 nW										
10.0 nW										
1.00 nW										
Center 2.412 G	Hz								Sp	an 15.17 MHz
#Res BW 1 MH	Z				#VBW	3 MHz				Sweep 1 ms
Channel Pe	ower				Power	Spectral	Density			
05.7	70 ·····)	M				C 400				
ອວ. <i>1</i>	U MN	/V / 10.	11 MHz			6.498	TIVV /H	z		
MSG										

Figure 7.3.1 Peak output power. Operation on channel 1 CCK modulation



Figure 7.3.2 Peak output power. Operation on channel 1 OFDM modulation

Agilent Spectrun	n Analyzer - C	hannel Powe	r								
LXI	RF 50	Ω AC		S	ENSE:INT	ALI	IGN AUTO		1	.1:54:13 AM	Apr 06, 2021
Span 15.1	65 MHz				Center Free	: 2.432000000	GHz		Radio	Std: Non	e
				$\mathbf{P}$	Trig: Free R	un	Avg Hold:>*	10/10			
			#IFGain:Lov	N	#Atten: 26 d	8			Radio	Device: E	315
	D-6.054	0									
	Rel 25	1.2 mvv									
23.1 11100											
2.51 m₩		_									
251 μW											
25.1 JW											
23.1 µ 🗤											
2.51 μW											
251 nW											
25.1 n\A/											
20.1 1111											
2.51 nW											
251 pW											
Center 2.4	32 GHz									Span 1	5.17 MHz
#Res BW 1	l MHz				#VBW	3 MHz				Swe	ep 1 ms
,											
					_	~					
Channe	el Powe	r			Power	Spectral	Density				
6	7 63 .	m M	40 44 MIL-			6 600	- <b>D\A</b> /	-			
	1.051	IIVV /				0.000	IIVV /H	Z			
MSG							<b>STATUS</b>				





Figure 7.3.4 Peak output power. Operation on channel 5 OFDM modulation

Agilent Spectru	m Analyze	er - Chan	nel Powe	э <b>г</b>									
LXI	RF	50 Ω	AC			SE	NSE:INT	A	LIGNAUTO			12:01:32	PM Apr 06, 2021
Span 15.1	80 MF	z					Center Free	: 2.46200000	0 GHz		Radio	o Std: N	one
				#IFG	ain:Low	₽	#Atten: 26 d	un B	AVg[Hold:>	10/10	Radio	o Device	: BTS
	Dof	1 005	1A/										
	Kei	1.335	1										
200 mVV									_				
20.0 mVV ———													
2.00 mVV													
200 µW													
20.0 µW													
2.00 µW													
200 nW													
20.0 nV													
2.00 nV/													
Center 2.4	62 GH	Z										Span	15.18 MHz
#Res BW /	1 MHz						#VBW	3 MHz				Sw	veep 1 ms
Chann	el Po	wer					Power	Spectra	l Density	,			
6	<b>59.7</b>	6 m`	W /	10.12 N	ЛНz			6.893	3 nW /⊦	z			
MSG									STATUS				
									<b>U</b>				

Figure 7.3.5 Peak output power. Operation on channel 11 CCK modulation



Figure 7.3.6 Peak output power. Operation on channel 11 OFDM modulation

# Section 8 Power Spectral Density

## 8.1 Test Specification

FCC Rule Part	46CFR 15.247 (e)
Standard	ANSI C63.10:2013

# 8.2 Procedure and Test Software Version

#### **Conducted Tests**

ANSi C63.10-2013 Clause reference:	Clause 11.10.2
Test software	Keysight Connection Expert

Frequency (MHz)	Limit, 47CFR 15.247(e)			
	Peak			
2400MHz to 2483.5MHz	<8dBm in any 3kHz band during any time interval of complete transmission			

Spectrum analyser settings as specified by ANSI C63.10-2013 Clause 11.10.2

Receiver Parameters	Setting
Detector Function	Peak
Span	1.5xDTS bandwidth
Resolution Bandwidth	3kHz ≤RBW ≤100kHz
Video Bandwidth	3 x RBW
Sweep rate	Auto couple
Trace mode	Max hold

# 8.2.1 Date of Test

6<sup>th</sup> April 2021

#### 8.2.2 Test Area

LAB 7

#### 8.2.3 Tested by

J Beevers

#### 8.2.4 Test Setup

The antenna port was connected directly to the signal analyser.



#### 8.3 Test Results

Channel (MHz)	Modulation scheme	Power in 3kHz RBW (dBm)	Limit (dBm)	Figure	Result
2411.0	ССК	5.798	8.0	8.3.1	Pass
2411.0	OFDM	-0.137	8.0	8.3.2	Pass
2432.0	ССК	5.865	8.0	8.3.3	Pass
2432.0	OFDM	0.039	8.0	8.3.4	Pass
2463.0	ССК	5.999	8.0	8.3.5	Pass
2463.0	OFDM	0.269	8.0	8.3.6	Pass

Peak Spectral Density Measurements



Figure 8.3.1 Power spectral density. Operation on channel 1 CCK modulation



Figure 8.3.2 Power spectral density. Operation on channel 1 OFDM modulation



Figure 8.3.3 Power spectral density. Operation on channel 5 CCK modulation



Figure 8.3.4 Power spectral density. Operation on channel 5 OFDM modulation



Figure 8.3.5 Power spectral density. Operation on channel 11 CCK modulation



Figure 8.3.6 Power spectral density. Operation on channel 11 OFDM modulation

# Section 9 Band Edge Compliance

# 9.1 Test Specification

FCC Rule Part	46CFR 15.205
Standard	ANSI C63.10:2013

# 9.2 Procedure and Test Software Version

#### **Conducted Tests**

ANSi C63.10-2013 Clause reference:	Clause 6.10.4 Authorised band-edge measurements
Test software	Keysight Connection Expert

Frequency (MHz)	Limit, 47CFR 15.247(e)
	Peak
2400MHz to 2483.5MHz	Measured signal at the band edge must below the radiated emission limits of 47CFR15.209

Spectrum analyser settings as specified by ANSI C63.10-2013 Clause 6.10.5 "Restricted band-edge measurements"

Receiver Parameters	Setting			
Detector Function	Peak			
Span	As necessary			
Resolution Bandwidth	1MHz			
Video Bandwidth	3 x RBW			
Sweep rate	Auto couple			
Trace mode	Max hold			

#### 9.2.1 Date of Test

30<sup>th</sup> March 2021

#### 9.2.2 Test Area

LAB 1 (SAC)

#### 9.2.3 Tested by

J Beevers

#### 9.2.4 Test Setup

The test setup was identical to radiated emissions testing 1-18GHz. The measuring antenna was positioned at 1m from the sample. The limits were adjusted to reflect a 1m measurement distance, assuming an increase of 10dB per decade.

#### 9.3 Test Results

Results are presented in two formats:

Tabular results of measurements at the band edges. Manual measurements were performed to measure the maximum value of signal at the band edge. The tabular data includes the following:

- 1. Polarity of the measurement antenna
- 2. Modulation scheme
- 3. Frequency at the band edge
- 4. Amplitude of signal at the input of the test receiver
- 5. Pre-amplifier gain
- 6. Cable loss
- 7. Antenna factor
- 8. Resultant Electric field strength = 3-4+5+6

Spectrum analyser screen displays are also included. Please note that the screen displays do not include losses or antenna factor.

## Tabular Data

The following radiated measurements were made at the band edges:

# Upper band edge

Polarity	Frequency (MHz)	Modu- lation	Amplitude (dBuV)	Preamp (dB)	Cable loss (dB)	AF (dB/m)	E (dBuV/ m)	Limit at 1m (dBuV/ m)	Margin (dB)
н	2483.5	ССК	59.84	50.99	4.77	29.89	43.51	83.54	-40.03
V	2483.5	ССК	72.12	50.99	4.77	29.89	55.79	83.54	-27.75
н	2483.5	OFDM	66.48	50.99	4.77	29.89	50.15	83.54	-33.39
V	2483.5	OFDM	88.78	50.99	4.77	29.89	72.45	83.54	-11.09

**Operation on Channel 11, Peak detector measurements** 

Polarity	Frequency (MHz)	Modu- lation	Amplitude (dBuV)	Preamp (dB)	Cable loss (dB)	AF (dB/m )	E (dBuV /m)	Limit (dBuV/ m)	Margin (dB)
н	2483.5	ССК	48.95	50.99	4.77	29.89	32.62	63.54	-30.92
V	2483.5	ССК	62.29	50.99	4.77	29.89	45.96	63.54	-17.58
н	2483.5	OFDM	52.75	50.99	4.77	29.89	36.42	63.54	-27.12
V	2483.5	OFDM	75.55	50.99	4.77	29.89	59.22	63.54	-4.32

Operation on Channel 11, average detector measurements

# Lower band edge

Polarity	Frequency (MHz)	Modu- lation	Amplitude (dBuV)	Preamp (dB)	Cable loss (dB)	AF (dB/m )	E (dBuV /m)	Limit (dBuV/ m)	Margin (dB)
Н	2400	ССК	81.36	50.97	4.64	29.67	64.7	83.54	-18.84
V	2400	ССК	78.00	50.97	4.64	29.67	61.34	83.54	-22.20
Н	2400	OFDM	89.90	50.97	4.64	29.67	73.24	83.54	-10.30
V	2400	OFDM	85.81	50.97	4.64	29.67	69.15	83.54	-14.39

**Operation on Channel 1 Peak detector measurements** 

Polarity	Frequency (MHz)	Modu- lation	Amplitude (dBuV)	Preamp (dB)	Cable loss (dB)	AF (dB/m )	E (dBuV /m)	Limit (dBuV/ m)	Margin (dB)
н	2400	ССК	77.81	50.97	4.64	29.67	61.15	63.54	-2.39
V	2400	ССК	74.05	50.97	4.64	29.67	57.39	63.54	-6.15
н	2400	OFDM	76.27	50.97	4.64	29.67	59.61	63.54	-3.93
V	2400	OFDM	69.32	50.97	4.64	29.67	52.66	63.54	-10.88

**Operation on Channel 1 average detector measurements** 

# Report Number: 14098TR3 Spectrum analyser displays

Agilent Spectrum Analyzer - Swept SA						
LXI RF PRESEL 50 Ω AC		SENSE:	NT	ALIGN AUTO	01:24:20 PM Ma	ar 30, 2021
Ref Level 121.99 dBµV	PNO: Fast ⊂ IFGain:Low	Trig: Free Ru #Atten: 28 dE	Avg In Avg i }	Type: RMS Hold:>100/100	TRACE 1 TYPE M DET P	23456 WWWWWW ANNNN
				Mkr	3 2.500 00	) GHz
10 dB/div Ref 121.99 dBµV					55.547	dBµV
112	1					
102	100 Martin					
92.0						
82.0						
72.0		A 2	. 2			
62.0 whoh have the	<b></b>	Mummer		and the second second	العام الأطريق	
52.0 What has been what		In Mahalan I.	to to to the Marson		n a A.A. Mar I. A	lik Linn mar
42.0		t tel III. faldari	L KUMANAK I IL ANA MA	Wheel we will be to the	eal Y Newlean Wheel	T/M/MM
32.0				· ·		
Start 2 42000 GHz					Ston 2 5664	
#Res BW (CISPR) 1 MHz	#VB	W 3.0 MHz*		Sweep 1	.000 ms (10	01 pts)
MKR MODE TRC SCL X		Y	FUNCTION	FUNCTION WIDTH	FUNCTION V.	ALUE
1 N 1 f 2.4	52 60 GHz	108.564 dBµV				
3 N 1 f 2.4	00 00 GHz	55.547 dBuV				
4						
5						=
7						
8						
10						
11						~
MSG				STATUS		2
				NO STATUS		

Band Edge Measurement – upper band edge – CCK modulation - horizontal polarity



Band Edge Measurement – upper band edge – CCK modulation - vertical polarity

Agilent Spectrum Analyzer -	Swept SA				
LXI RF PRESEL 5	ΟΩ AC	SE	INSE:INT	ALIGN AUTO	01:22:03 PM Mar 30, 2021
Ref Level 121.99	dBµV PNO: IFGai	Fast Trig: Fre	Av eRun Av 28 dB	/g Type: RMS g Hold:>100/100	TRACE 123456 TYPE MW <del>MMMM</del> DET PANNNN
10 dB/div Ref 121.	99 dBµV			Mkr	3 2.500 00 GHz 55.438 dBµV
112	1	~			
92.0	Mr. Wirah				
82.0 72.0		2			
52.0	₩ <sup>¶¶¶¶</sup>			-	Mining and the second
42.0 42.0 32.0			U ANNU A ANA ANA AN	MANATA BARATA	dat harandahan kandahada
Start 2.42000 GHz #Res BW (CISPR) 1	MHz	#VBW 3.0 MH;	<b>z</b> *	Sweep 1.	Stop 2.56640 GHz 000 ms (1001 pts)
MKR MODE TRC SCL	×	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1 N 1 f	2.462 60 0	Hz 108.937 d	3µV		
2 N 1 f	2.483 50 0	GHZ -40.537 d	Bm		
4	2.500 00 0	-01.0010	BIII		
5					
6					
8					
9					
10					
<					>
MSG				<b>I</b> STATUS	

Band Edge Measurement – upper band edge – OFDM modulation - horizontal polarity



Band Edge Measurement – upper band edge – OFDM modulation - vertical polarity

Agilent Spec	trum Ana	lyzer - Swe	ept SA							
LXI	RF PRES	GEL 50 Ω	AC		SENS	E:INT		ALIGN AUTO	01:26:25 PM	4 Mar 30, 2021
Marker	4 2.31	000000	)0000 GI	Ηz		_	Avg Type	: RMS	TRAC	<sup>Έ</sup> 123456
			PI	NO: Fast	Trig: Free	Run	Avg Hold	>100/100	TYP	
			IFO	Gain:Low	#Atten: 28	dB				
								Mkr	4 2 310	00 GH7
	_								55 47	
10 dB/div	Ref	121.99	αΒμν						- 00.47	ν ubμv
LUg							()1			
112							A MARINA			
102										
						( <sup>p</sup>	<b>۳</b> ۱			
92.0						<b>1</b>	├── <b>\</b>			
82.0							L	<u>^</u>		
						/ W	Y	1		
72.0						<b>* 1</b>		1		
62.0	4									
Marine	Rosel Surgers	الدارة وسري وروار	مراسيات مارسوا	and and an alternation	mar and			and the second	and a start of the	mentionen
52.0	A. 11	1.1.1.1.1.1	<u>ко , 1 к</u>	histori di a	Libraha Mat . Ph			- What was	المرابع التلقيقاته	alter a Mari
42 n <b>h</b> ill <b>h</b>	n ni M	44 B A B	Manna	NNMAN	MARKAR AND A C			11.64	n"Y Munani	N MANNAU
-12.0	. W.W	יייורך יי	Londak Lond	and off					ի հերելու հ	12 <b>1</b> 1 111
32.0			<u> </u>							
Start 2.3	30000	GHz							Stop 2.48	8000 GHz
#Res BV	V (CISF	PR) 1 M	Hz	#VE	3W 3.0 MHz*			Sweep 1	.000 ms (	1001 pts)
		,						L L	`	
MKR MODE	TRC SCL		×		Y	FUNC	CTION FUI	ICTION WIDTH	FUNCTIO	JN VALUE
1 N	1 f		2.413 0	4 GHz	<u>112.431 dB</u>	N N				
2 N			2,400 0		80.576 dBi					
	1 6		2.390 0		55 477 dB					
5			2.0100	5-511Z	00.477 UDJ					-
6										
7										
8										
9										
10										
										2
MSG										
the second se										

Band Edge Measurement – lower band edge – CCK modulation - horizontal polarity



Band Edge Measurement – lower band edge – CCK modulation - vertical polarity



Band Edge Measurement - lower band edge - OFDM modulation - horizontal polarity



Band Edge Measurement – lower band edge – OFDM modulation - vertical polarity

# Section 10 AC Mains Conducted Emissions

## 10.1 Test Specification

Standard	ANSI C63.10:2013
Measurement Uncertainty	The reported uncertainty of measurement $y \pm U$ , where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 % is +/- 3.45dB

# 10.2 Power Line Emission Limits

Frequency (MHz)	Clas (dBj	s A µV)	Class B (dBµV)		
	Quasi Peak	Average	Quasi Peak	Average	
0.15 – 0.5	79.0	66.0	66 – 56*	56 – 46*	
0.5 – 5.0	73.0	60.0	56.0	46.0	
5.0 - 30	73.0	60.0	60.0	50.0	

Note: \* The limit decreases linearly with the logarithm of the frequency in the range

#### 10.3 Receiver Settings

Receiver Parameters	Setting		
Detector Function	Quasi Peak and Average		
Start Frequency	150kHz		
Stop Frequency	30MHz		
Resolution Bandwidth	10kHz		
Video Bandwidth	Auto		

# 10.4 Procedure and Test Software Version

Eurofins York test procedure	CEP19 Issue 5
Test software	RadiMation Version 2016.1.6

#### 10.4.1 Date of Test

6<sup>th</sup> April 2021

#### 10.4.2 Test Area

LAB 2

#### 10.4.3 Tested by

J Beevers

## 10.4.4 Test Setup

This test was applied to the EUT's Live and Neutral lines. The EUT was configured in the screened room on an 80cm high table was positioned 40cm from the room wall.

A calibrated mains extension lead was used to ensure a known impedance was presented to the EUT

The EUT was then powered from the mains supply via a Line Impedance Stabilisation Network (LISN).



#### Report Number: 14098TR3

# 10.5 Test Results

Modulation scheme	Channel	Conductor	Result summary
ССК	1	Live	Pass
ССК	1	Neutral	Pass
OFDM	1	Live	Pass
OFDM	1	Neutral	Pass
ССК	5	Live	Pass
ССК	5	Neutral	Pass
OFDM	5	Live	Pass
OFDM	5	Neutral	Pass
ССК	11	Live	Pass
ССК	11	Neutral	Pass
OFDM	11	Live	Pass
OFDM	11	Neutral	Pass

This section contains graphical and tabulated data. The following data is presented

The equipment under test was pre-scanned using peak detection when operating on all three channels with both CCK and OFDM modulation. Final measurements were performed with the equipment under test operating on channel 1 with CCK modulation.



AC mains conducted emissions. Operating on channel 1 CCK modulation – Live

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average Difference (dB)	Average Status	Quasi- Peak (dBμV)	Quasi- Peak Limit (dBμV)	Quasi- Peak Difference (dB)	Quasi- Peak Status
0.150	35.7	56.0	-20.28	Pass	46.4	66.0	-19.61	Pass
0.480	22.7	46.3	-23.61	Pass	29.4	56.3	-26.96	Pass
0.615	34.0	46.0	-11.98	Pass	41.1	56.0	-14.93	Pass
0.765	20.6	46.0	-25.43	Pass	27.3	56.0	-28.69	Pass
1.135	18.9	46.0	-27.14	Pass	25.9	56.0	-30.07	Pass
1.465	18.5	46.0	-27.53	Pass	25.1	56.0	-30.85	Pass



AC mains conducted emissions. Operating on channel 1 CCK modulation – Neutral

Frequency (MHz)	Average (dBμV)	Average Limit (dBµV)	Average Difference (dB)	Average Status	Quasi- Peak (dBμV)	Quasi- Peak Limit (dBµV	Quasi- Peak Difference (dB)	Quasi- Peak Status
0.150	35.7	56.0	-20.35	Pass	45.8	66.0	-20.19	Pass
0.475	20.8	46.4	-25.60	Pass	28.0	56.4	-28.45	Pass
0.615	33.3	46.0	-12.71	Pass	40.4	56.0	-15.56	Pass
0.765	19.1	46.0	-26.86	Pass	26.2	56.0	-29.83	Pass
0.890	16.8	46.0	-29.18	Pass	23.7	56.0	-32.27	Pass
1.118	17.8	46.0	-28.16	Pass	25.1	56.0	-30.92	Pass



AC mains conducted emissions – Peak detector scan. Operating on channel 1 OFDM modulation – Live



AC mains conducted emissions – Peak detector scan. Operating on channel 1 OFDM modulation – Neutral



AC mains conducted emissions – Peak detector scan. Operating on channel 5 CCK modulation – Live



AC mains conducted emissions – Peak detector scan. Operating on channel 5 CCK modulation – Neutral


AC mains conducted emissions – Peak detector scan. Operating on channel 5 OFDM modulation – Live



AC mains conducted emissions – Peak detector scan. Operating on channel 5 OFDM modulation – Neutral



AC mains conducted emissions – Peak detector scan. Operating on channel 11 CCK modulation – Live



AC mains conducted emissions – Peak detector scan. Operating on channel 11 CCK modulation – Neutral



AC mains conducted emissions – Peak detector scan. Operating on channel 11 OFDM modulation – Live



AC mains conducted emissions – Peak detector scan. Operating on channel 11 OFDM modulation – Neutral

#### Report Number: 14098TR3

### 10.5.1 Example calculation

This correction factors required consists of LISN Insertion loss (IL), Cable loss (CL) and Transient Limiter Loss (TL)

The Actual Signal Level (ASL) is calculated as follows:

ASL (dBµV) = Indicated Signal Level (dBµV) + IL (dB) + CL (dB) + TL (dB)

#### 10.5.2 Sample Data

The Quasi-Peak level at 1.135 MHz

ASL  $(dB\mu V) = 25.90dB\mu V = 15.46B\mu V + 0.44dB + 0.10dB + 9.90dB$ 

# Appendix A EUT Test Photos

Test set up photographs are supplied separately.

# Appendix B Test Equipment List

### **Conducted Emissions from Antenna Port**

ltem	Serial No.	Last Calibration Date	Calibration Interval
RF Cable	Cable 9	January 2021	12 Months
Keysight MXE EMI Receiver	MY51210185	19 <sup>th</sup> October 2020	12 Months

## Report Number: 14098TR3 Radiated Emissions Equipment

Item	Serial No.	Last Calibration Date	Calibration Interval
Laboratory 1 Semi-Anechoic Chamber	Lab 1	28 <sup>th</sup> January 2020	36 Months
ETS Lindgren 2017B Mast (1 – 4m) with tilting mechanism		N/A	N/A
R & S ESR	C0499	26 <sup>th</sup> January 2021	12 Months
Chase CBL6112B Bilog Antenna, 78167	1503	13 <sup>th</sup> December 2019	36 Months
6dB Attenuator (For use with Bilog Antenna)	78708B	13 <sup>th</sup> December 2019	36 Months
HF26 Cable	167003-001	14 <sup>th</sup> February 2020	12 Months
HF17 Cable	167002-001	14 <sup>th</sup> February 2020	12 Months
HF27 Cable	-	14 <sup>th</sup> February 2020	12 Months
EMCO 3115 Horn Antenna 78347	9712-5380	25 <sup>th</sup> May 2020	24 Months
BONN BLMA 0118-5A Preamplifier	149759	3 <sup>rd</sup> March 2020	12 Months

### AC Mains conducted emissions equipment

ltem	Serial No.	Last Calibration Date	Calibration Interval
Rohde & Schwarz ESR7 Test receiver	-	26 <sup>th</sup> January 2021	12 Months
Cables J7, J9 and LF3	-	January 2021	12 Months
Rohde & Schwarz ESH3-Z5 LISN 78119	-	25th January 2021	12 Months
Teseq CFL 9206A transient limiter 10dB 9kHz - 30MHz	-	6 <sup>th</sup> January 2021	12 Months
Kikusui PCR2000M power supply	-	-	-