EMC TEST REPORT
No. 1058 FR

Issue#1: 28th March 2019

FCC Part 15c
Radio EMC Test Report

For

Dynamic Load Monitoring (UK) Limited

EUT: TW-3.0 Telemetry Tensile Link Module
Model: TW3.0-L

FCC ID: 2ASHV-TW30L

Project Engineer: R. Craig

Approval Signatory

Approved signatories: J. A. Jones ☐ D. Tiroke ☐ A. R. Coombes ☑

The above named are authorised Eurofins Hursley signatories.

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1.0 DECLARATION

1.1 FCC Part 15C Declaration Statement

The Equipment Under Test (EUT), as described and reported within this document, complies with the selected sections of part 15C of the CFR 47:2017 FCC rules.

For emissions outside the 2400 – 2483.5 MHz band the EUT, as described and reported within this document, complies with the parts 15.207 and 15.209 of the CFR 47 FCC rules in accordance with ANSI C63.10:2013, ANSI C63.4:2014 and KDB 558074 D01 DTS Meas Guidance v05r02.

This report relates to the sample tested and may not represent the entire population. It is valid only for the product identified, either in part or in full, to the relevant electromagnetic requirements necessary for compliance.

Eurofins Hursley is recognised by the Federal Communications Commissions (FCC) as an EMI laboratory, outside of the USA, for the measurement of conducted emissions and radiated emissions at three and ten metres.

1.2 Related Submittal(s) Grants

None

1.3 EUT Manufacturer

Trade name:	Dynamic Load Monitoring (UK) Ltd
Manufacturer:	Dynamic Loading Monitoring
Manufacturer address:	Dynamic Load Monitoring UK Ltd. Unit 3, Bridgers Farm Southampton SO16 0YA
Manufacturing address:	As above.
Company	Mr Charlie Blackham

2.0 EUT DETAILS

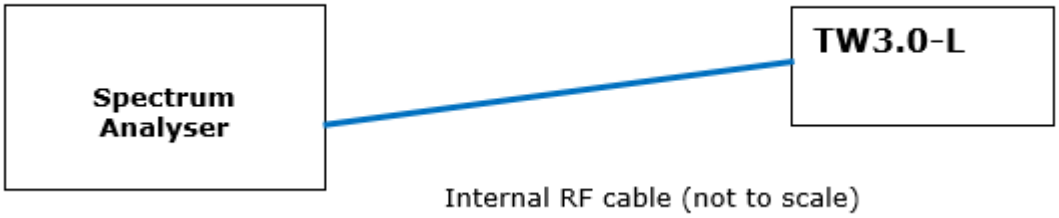
Product (EUT):	TW-3.0 Telemetry Tensile Link Module
Model:	TW3.0-L
Serial numbers:	11000055 and 11000062
Sample build:	Production sample
FCC ID:	2ASHV-TW30L
IC ID:	**N/A**
EUT power:	Internal battery / external 5V dc
Lowest Declared frequency:	**2402 MHz**
Highest declared frequency:	**2480 MHz**
Software version:	**1.4.76**
Test commissioned by:	Mr Charlie Blackham
Date EUT received:	12th February 2019
Test date(s):	28th February to 8th April 2019
EMC measurement site:	Eurofins Hursley
	Trafalgar House, Chandlers Ford, Hampshire

2.1 Product Operation

The device operates inside the 2400 – 2483.5 MHz band:

- 79 channels with centre frequencies on 1 MHz spacing from 2402 to 2480 MHz inclusive
- Operating mode: Frequency Hopping Spread Spectrum (FHSS)
- 20 hops per second
- All 79 channels used in pseudo random order. Sequence repetition rate 79/20 = 3.95s.

2.2 EUT Test Configuration



Conducted measurements

Radiated measurements

Description	Manufacturer	Name	Serial Number	Comment
TW-3.0 Telemetry Tensile link module	Dynamic Load Monitoring	TW3.0-L	11000062	Conducted measurements
TW-3.0 Telemetry Tensile link module	Dynamic Load Monitoring	TW3.0-L	11000055	Radiated measurements

2.3 EUT Test Exerciser

The following test frequencies were used to cover the full band of operation of the device:

Test mode	Description
TX1	Continuous transmit on 2402 MHz
TX2	Continuous transmit on 2440 MHz
TX3	Continuous transmit on 2480 MHz
TX4	Frequency hopping on all channels

2.4 Supported Antennae

The EUT supports operation with the following antennae:

Antenna type	Type	Gain
Internal	Connectorised	2.3 dBi

Note: The antenna is integral to the unit, but is connected to the main PCB via a co-axial cable and UFL connector. Spectrum analyser measurements are made at the UFL connector

3.0 MEASUREMENT PROCEDURE AND INSTRUMENTATION

3.1 EMI Site Address & Test Date

EMI Company Offices	Eurofins Hursley Trafalgar House , Trafalgar Close, Chandlers Ford, Eastleigh Hampshire, SO53 4BW , UK
EMI Measurement Site	Eurofins Hursley Hursley Park, Winchester, SO21 2JK, UK; FCC Registered UK Designation number: UK0006 Canada Registration Number: 7104A
Test Dates	28th February to 8th April 2019
Eurofins Hursley References:	1058 FR

3.2 General Operating Conditions

Testing was performed according to the procedures in ANSI C63.10:2013, using a test site that is compliant to ANSI C63.4 2014. Final radiated testing was performed at a EUT to antenna distance of three metres (above 30 MHz). Extrapolation measurements and calculations are provided.

Instrumentation, including receiver and spectrum analyser bandwidth, comply with the requirements of ANSI C63.2:1996.

3.3 Environmental Ambient

Test Type	Temperature	Humidity	Atmospheric Pressure
Radiated	18 to 21 degrees Celsius	42 to 51 % relative	1005 to 1030 millibars

3.4 Summary of tests performed

Test	Clause	Limit / Requirement	Result
Occupied bandwidth	15.215	20 dB bandwidth to be within 2400 – 2483.5 MHz band	Pass
FHSS Carrier Frequency Separation	15.247(a)(1)	> 25kHz Or $\frac{2}{3}$ * 20 dB BW (whichever is greater)	Pass
Number of hopping channels	15.247(a)(1)(iii)	> 15	Pass
Average time of occupancy	15.247(a)(1)(iii)	≤ 0.4s / (0.4 * number of channels used)	Pass
Max peak conducted TX power	15.247(b)(1)	1 W (> 75 channels used)	Pass
Out of Band Emissions Non-restricted bands: Radiated with antenna	15.247(d)	-20 dBc (peak power)	Pass
Out of Band Emissions Restricted-band: Radiated with antenna	15.247(d) / 15.205(a) and 15.209(a)	15.209(a) table	Pass
Max antenna gain	15.247(b)(4)	≤ 6dBi	Pass

3.5 Conducted Emissions,

A 230V 50Hz filtered supply was fed to the EUT via a 50Ω/50µH Artificial Mains Network (AMN). The AMN was bonded to a conductive ground plane. Line and neutral phases were measured separately.

A spectrum analyser was set to scan between 0.15MHz and 30.0MHz to record the peak emission profiles. The worst-case peaks were then measured using an average and/or quasi-peak receiver and compared to the CISPR Class B limits. Measurements made according to the CISPR test standard and Eurofins Hursley test procedure CON-02. The worst-case results are shown here.

Test Equipment

#ID	CP	Manufacturer	Type	Serial No	Description	Ext Calibration
147	1	Rohde & Schwarz	ESH3 Z5	846695/011	Single phase (LISN / AMN)	17/07/2019
189	1	Rohde & Schwarz	ESH£-Z2	-	Pulse limiter N type	15/11/2019
285	1	Huber+Suhner	BNC Cable	0	Cable	21/01/2020
679	2	Gauss	TDEIM30M	1510003	Receiver	20/11/2020

CP = Interval period [year] prescribed for external calibrations

Note: 'Calibration due date' means that the instrument is certified with a UKAS or traceable calibration certificate.
'Internal' means internally calibrated using Eurofins Hursley procedures

3.6 Conducted Emissions,

3.6.1 Data; TW30-L; 110V / 60Hz

MAINS – NEUTRAL

Frequency	Quasi-peak value (dBµV)			Average value (dBµV)			Status
	Measured	Class B Limit	Pass Margin	Measured	Class B Limit	Pass Margin	
646.114 kHz	38.79	56.00	17.21	32.03	47.89	15.86	Pass
3.793 MHz	31.16	56.00	24.84	24.29	46.00	21.71	Pass
6.344 MHz	31.00	60.00	29.00	24.54	50.00	25.46	Pass
11.313 MHz	28.13	60.00	31.87	23.12	50.00	26.88	Pass
14.799 MHz	28.18	60.00	31.82	23.18	50.00	26.82	Pass
16.887 MHz	28.20	60.00	31.80	23.23	50.00	26.77	Pass
20.554 MHz	28.22	60.00	31.78	23.23	50.00	26.77	Pass
24.002 MHz	28.37	60.00	31.63	23.50	50.00	26.50	Pass
26.758 MHz	28.58	60.00	31.42	23.66	50.00	26.34	Pass
29.824 MHz	28.84	60.00	31.16	23.92	50.00	26.08	Pass

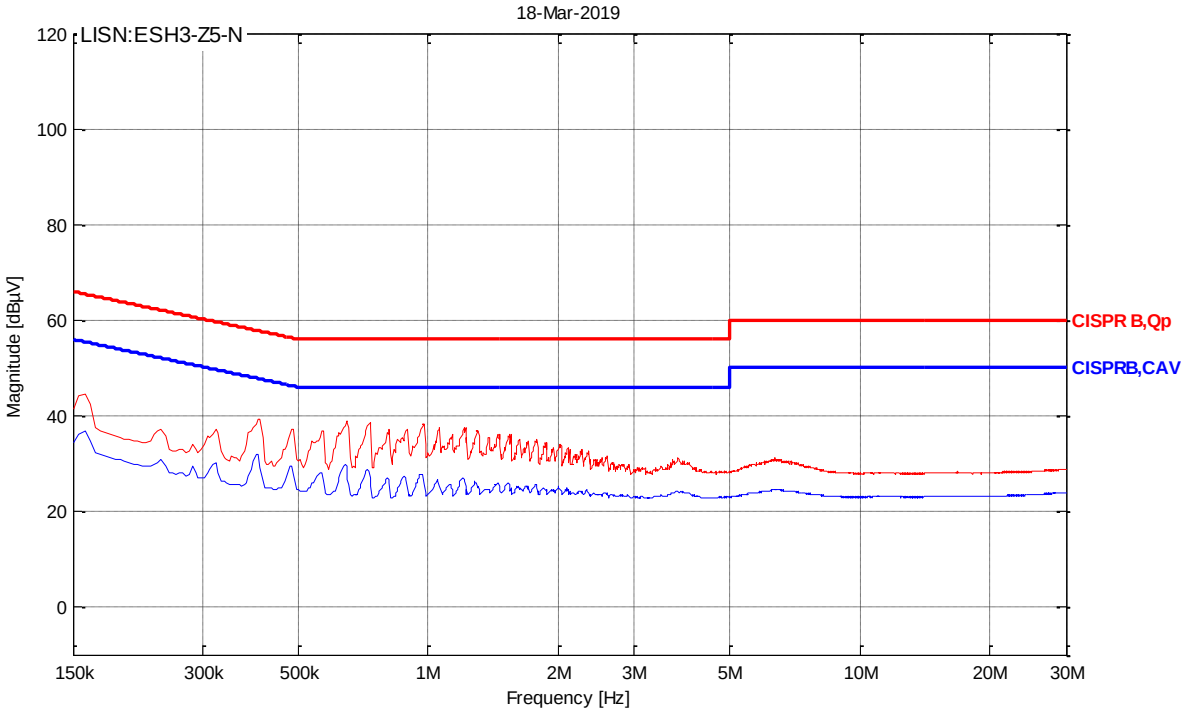
MAINS – LINE

Frequency	Quasi-peak value (dBµV)			Average value (dBµV)			Status
	Measured	Class B Limit	Pass Margin	Measured	Class B Limit	Pass Margin	
627.041 kHz	39.48	56.00	16.52	28.73	46.00	17.27	Pass
3.812 MHz	32.24	56.00	23.76	24.80	46.00	21.20	Pass
6.440 MHz	31.56	60.00	28.44	25.06	50.00	24.94	Pass
10.812 MHz	28.18	60.00	31.82	23.18	50.00	26.82	Pass
14.327 MHz	28.11	60.00	31.89	23.11	50.00	26.89	Pass
16.077 MHz	28.13	60.00	31.87	23.23	50.00	26.77	Pass
19.157 MHz	28.08	60.00	31.92	23.14	50.00	26.86	Pass
23.534 MHz	28.25	60.00	31.75	23.37	50.00	26.63	Pass
26.076 MHz	28.55	60.00	31.45	23.65	50.00	26.35	Pass
29.709 MHz	28.81	60.00	31.19	23.92	50.00	26.08	Pass

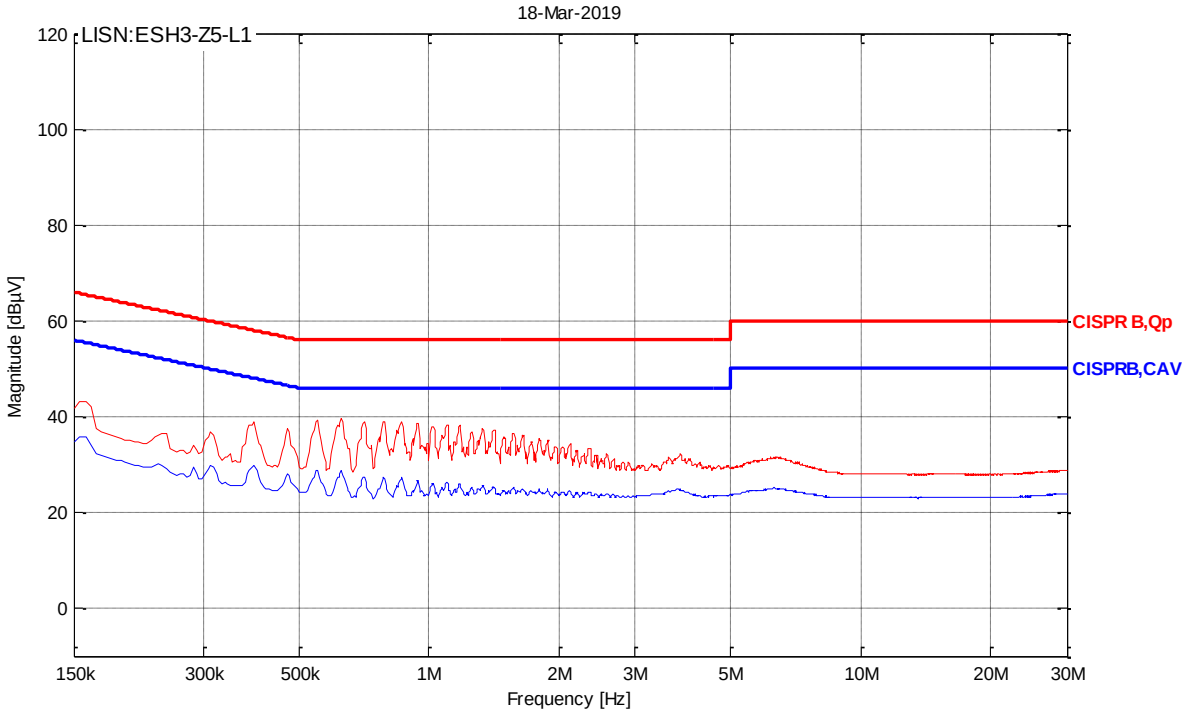
TEST ENGINEER: Luke Marsh

3.6.2 Profiles;

Shown here is the mains-neutral plot.



Shown here is the mains-line plot.



3.7 Conducted Emissions,

3.7.1 Data; TW30-L; 230V / 50Hz

MAINS – NEUTRAL

Frequency	Quasi-peak value (dBµV)			Average value (dBµV)			Status
	Measured	Class B Limit	Pass Margin	Measured	Class B Limit	Pass Margin	
1.047 MHz	43.43	56.00	12.57	38.61	46.00	7.39	Pass
3.459 MHz	37.51	56.00	18.49	29.46	46.00	16.54	Pass
6.902 MHz	36.75	60.00	23.25	28.35	50.00	21.65	Pass
9.100 MHz	32.52	60.00	27.48	25.46	50.00	24.54	Pass
14.627 MHz	30.20	60.00	29.80	24.13	50.00	25.87	Pass
15.261 MHz	30.32	60.00	29.68	24.24	50.00	25.76	Pass
18.833 MHz	30.15	60.00	29.85	24.12	50.00	25.88	Pass
21.398 MHz	29.14	60.00	30.86	23.74	50.00	26.26	Pass
26.925 MHz	28.64	60.00	31.36	23.70	50.00	26.30	Pass
29.871 MHz	28.87	60.00	31.13	23.96	50.00	26.04	Pass

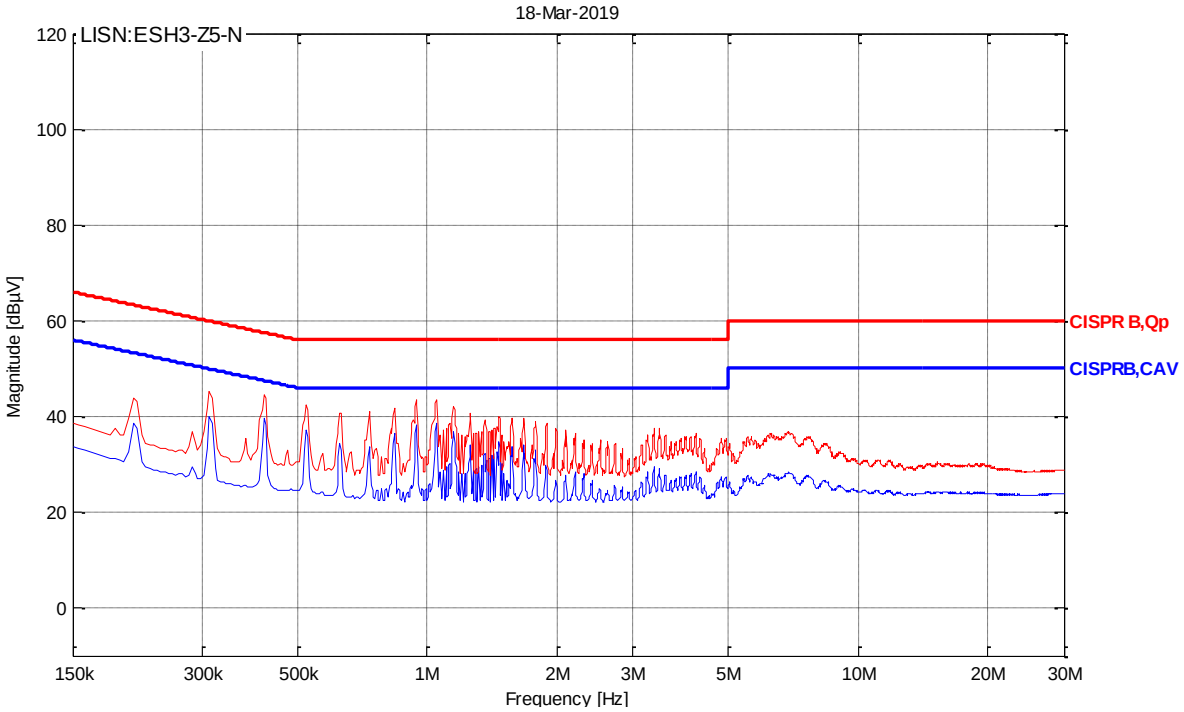
MAINS – LINE

Frequency	Quasi-peak value (dBµV)			Average value (dBµV)			Status
	Measured	Class B Limit	Pass Margin	Measured	Class B Limit	Pass Margin	
941.753 kHz	45.10	56.00	10.90	38.65	46.00	7.35	Pass
3.245 MHz	41.37	56.00	14.63	33.93	46.00	12.07	Pass
6.797 MHz	38.98	60.00	21.02	30.14	50.00	19.86	Pass
9.100 MHz	33.98	60.00	26.02	25.99	50.00	24.01	Pass
12.300 MHz	31.08	60.00	28.92	24.59	50.00	25.41	Pass
15.690 MHz	30.82	60.00	29.18	24.34	50.00	25.66	Pass
19.224 MHz	29.98	60.00	30.02	24.09	50.00	25.91	Pass
21.160 MHz	28.77	60.00	31.23	23.64	50.00	26.36	Pass
26.839 MHz	28.64	60.00	31.36	23.73	50.00	26.27	Pass
29.843 MHz	28.80	60.00	31.20	23.96	50.00	26.04	Pass

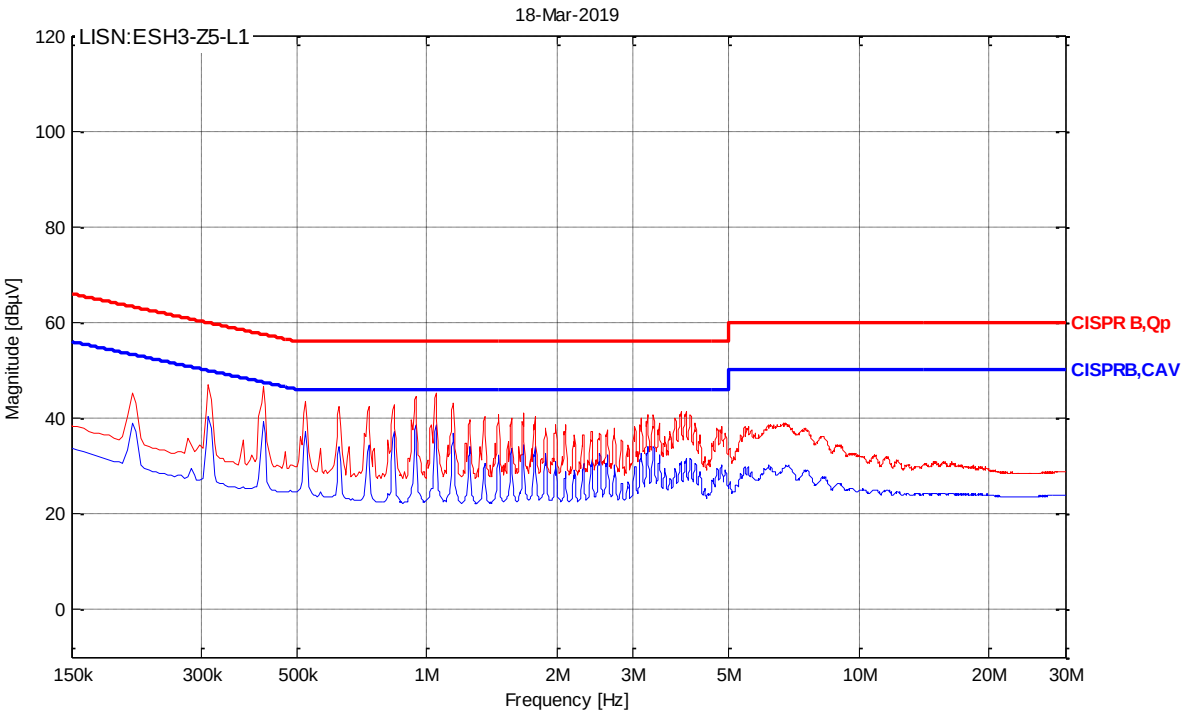
TEST ENGINEER: Luke Marsh

3.7.2 Profiles;

Shown here is the mains-neutral plot.



Shown here is the mains-line plot.



3.8 Radiated Emissions

The EUT was powered from an off the shelf AC/DC adapter but with internal rechargeable battery installed. The EUT was configured into the required test mode using a TL3.0-T handset unit.

Initial Scan

Radiated profile scans were taken at a three metre distance on eight azimuths in both the vertical and horizontal polarities of the antennae in a semi-anechoic chamber.

Measurements were made with the EUT rotated in all three orthogonal planes

The resulting data obtained from these scans was used to determine subsequent measurement for final measurement evaluation.

Test Equipment

#ID	CP	Manufacturer	Type	Serial No	Description	Ext Calibration
762	3	Schwarzbeck	VULB9162	129	30-7000MHz	07/04/2019
050	2	HP	8447D	1937A02341	Pre-amplifier (30-1000MHz)	06/10/2019
250	1	HP	8449B	3008A01077	Pre-amplifier (1.0-26.5GHz)	18/09/2019
466	3	Schwarzbeck	BBHA 9120 571	571	1-10GHz Horn	28/02/2022
071a	3	Q-par Angus	WBH218HN	5367	Horn antenna (2-18GHz)	22/06/2019
779	3	Steatite	QWH-SL-18-40-K-SG	17504	18-40GHz wideband horn antenna	11/05/2021
040	1	HP	8593EM	3536A00137	Spectrum analyser (9kHz-26.5GHz)	17/04/2019
289	1	Rohde & Schwarz	ESCI 7	100765	CISPR 7GHz Receiver	10/09/2019
552	1	Rohde & Schwarz	ESCI 7	100765	CISPR 7GHz Receiver	27/06/2019
750	1	Global	CISPR16 chamber	1	11 x 7 x 6.2m	10/12/2019
776	1	IntelliConnect	C-NPS-2301-4M-NPS	I11816	4M N-TYPE 18GHz CABLE	04/04/2019

CP = Interval period [year] prescribed for external calibrations

Note: 'Calibration due date' means that the instrument is certified with a UKAS or traceable calibration certificate.
'Internal' means internally calibrated using Eurofins Hursley procedures

Final Measurements

The EUT was then measured at a distance of three metres in the chamber using the pre-scan results as a guide. Emissions from the EUT were maximised by revolving the system on the turntable and moving the antennae in height and azimuth. Cable and system component positions had been investigated for maximum emissions, and the system under test represented the worst-case configuration. The values reported are the highest emissions relative to the 'FCC CFR 47 Section 15.209 and 15.225 Limits' at a measuring distance of three metres above 30MHz.

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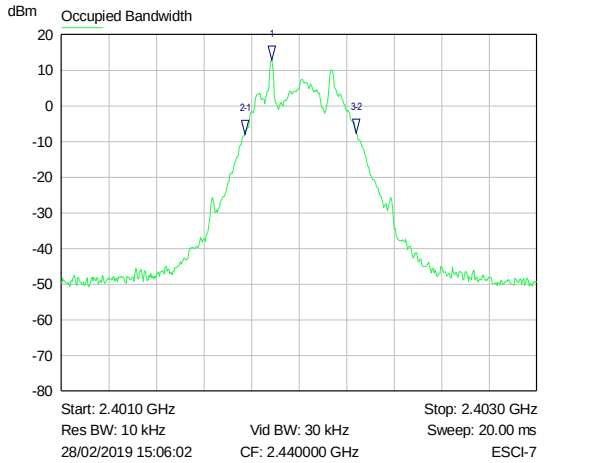
4.0 OCCUPIED BANDWIDTH

Test was conducted in accordance with ANSI C63-10 clause 6.9 and the 20dB occupied bandwidth measured using Softplot software relative markers

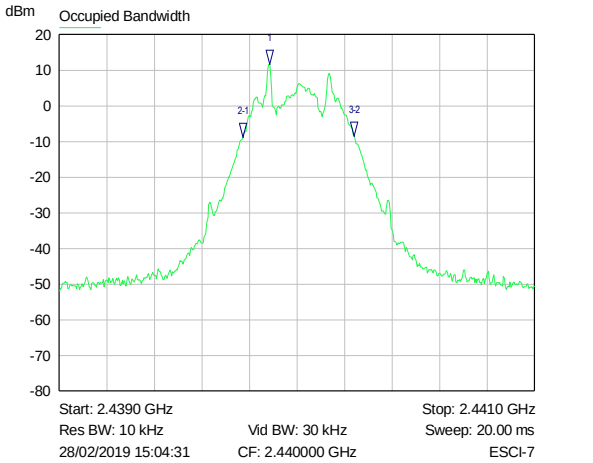
Channel	Occupied Bandwidth (kHz)	Requirement	Result
TX1	468.0	None	For information
TX2	468.0	None	For information
TX3	464.0	None	For information

Occupied Bandwidth



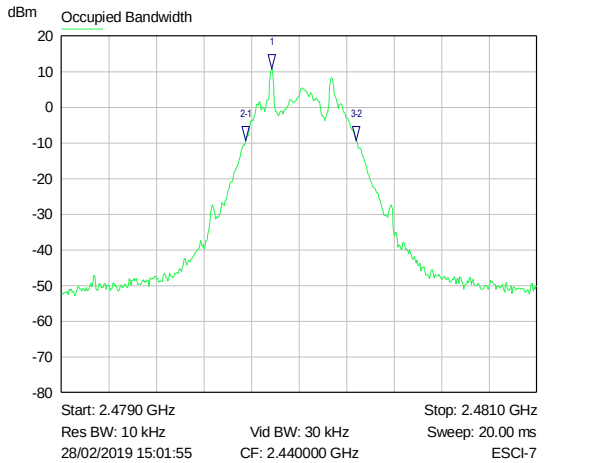
Mkr	Trace	X-Axis	Value	Notes
1	Occupied Bandwidth	2.4019 GHz	12.75 dBm	Peak
2-1	Occupied Bandwidth	2.4018 GHz	-20.70 dB	-20 dB point
3-2	Occupied Bandwidth	468.0000 kHz	0.36 dB	-20dB bandwidth

TX1



Mkr	Trace	X-Axis	Value	Notes
1	Occupied Bandwidth	2.4399 GHz	11.65 dBm	Peak
2-1	Occupied Bandwidth	2.4398 GHz	-20.55 dB	-20 dB point
3-2	Occupied Bandwidth	468.0000 kHz	0.36 dB	-20dB bandwidth

TX2



Mkr	Trace	X-Axis	Value	Notes
1	Occupied Bandwidth	2.4799 GHz	10.80 dBm	Peak
2-1	Occupied Bandwidth	2.4798 GHz	-20.07 dB	-20 dB point
3-2	Occupied Bandwidth	464.0000 kHz	-0.11 dB	-20dB bandwidth

TX3

Occupied Bandwidth plots

5.0 FHSS CARRIER FREQUENCY SEPARATION

5.1 Measurement method

Test was conducted in accordance with ANSI C63-10 clause 7.8.2:

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

a) Span: Wide enough to capture the peaks of two adjacent channels.
b) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
c) Video (or average) bandwidth (VBW) ≥ RBW.
d) Sweep: Auto.
e) Detector function: Peak.
f) Trace: Max hold.
g) Allow the trace to stabilize.

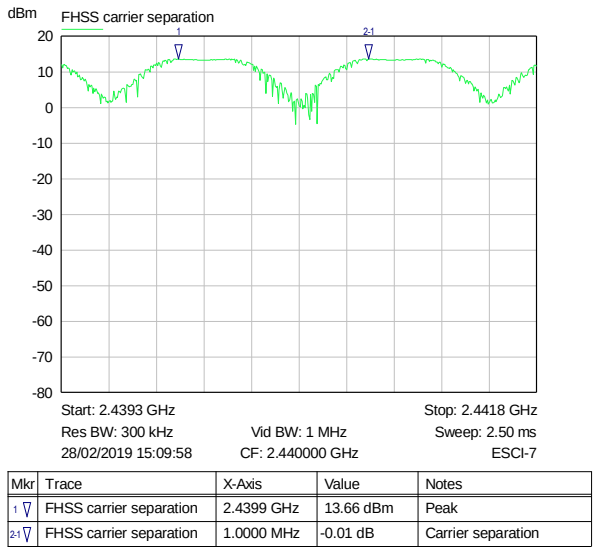
Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

The limit is 2/3 * the 20dB RBW measured above.

5.2 Test results

Mode	FHSS Carrier Frequency Separation (MHz)	Requirement (MHz)	Result
TX4	1.00	0.312	Pass

FHSS Carrier Frequency Separation



Mkr	Trace	X-Axis	Value	Notes
1	FHSS carrier separation	2.4399 GHz	13.66 dBm	Peak
2-1	FHSS carrier separation	1.0000 MHz	-0.01 dB	Carrier separation

TX4

FHSS Carrier Frequency Separation plot

6.0 NUMBER OF HOPPING CHANNELS

6.1 Measurement method

Test was conducted in accordance with ANSI C63-10 clause 7.8.3:

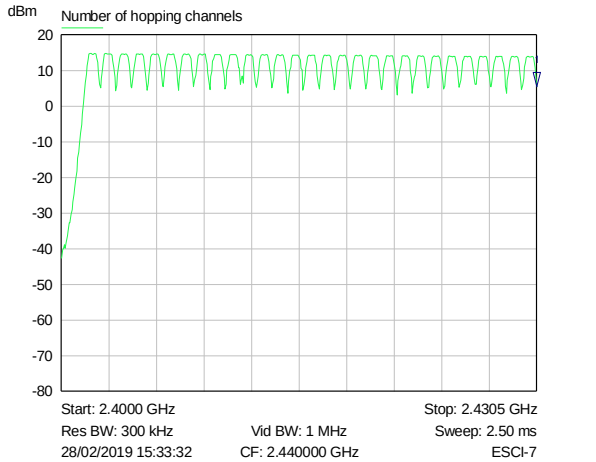
The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

a) Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
b) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
c) VBW ≥ RBW.
d) Sweep: Auto.
e) Detector function: Peak.
f) Trace: Max hold.
g) Allow the trace to stabilize.

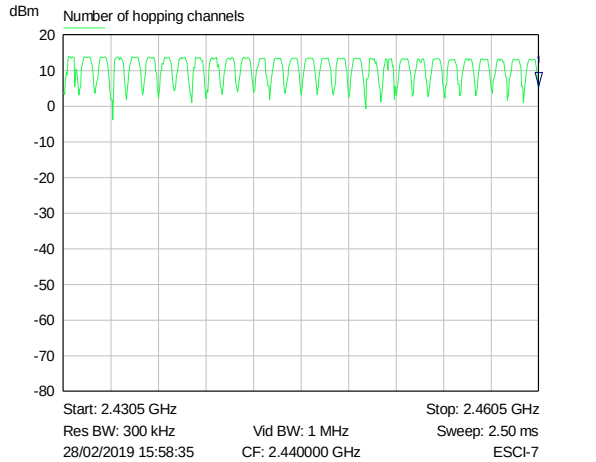
6.2 Test results

Mode	Number of channels	Requirement	Result
TX4	79	> 75	Pass

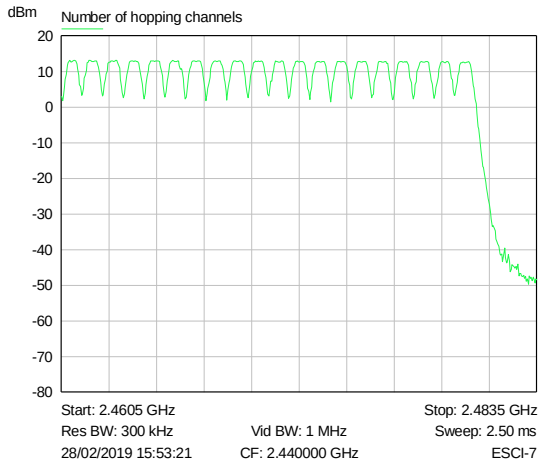
Number of hopping channels



Mkr	Trace	X-Axis	Value	Notes
1	Number of hopping channels	2.4305 GHz	5.44 dBm	Peak



Mkr	Trace	X-Axis	Value	Notes
1	Number of hopping channels	2.4605 GHz	5.50 dBm	Peak

	
TX4	

Number of hopping channels plots

7.0 AVERAGE TIME OF OCCUPANCY

7.1 Measurement method

Test was conducted in accordance with ANSI C63-10 clause 7.8.4:

a) Span: Zero span, centered on a hopping channel.
b) RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is theexpected dwell time per channel.
c) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
d) Detector function: Peak.
e) Trace: Max hold.

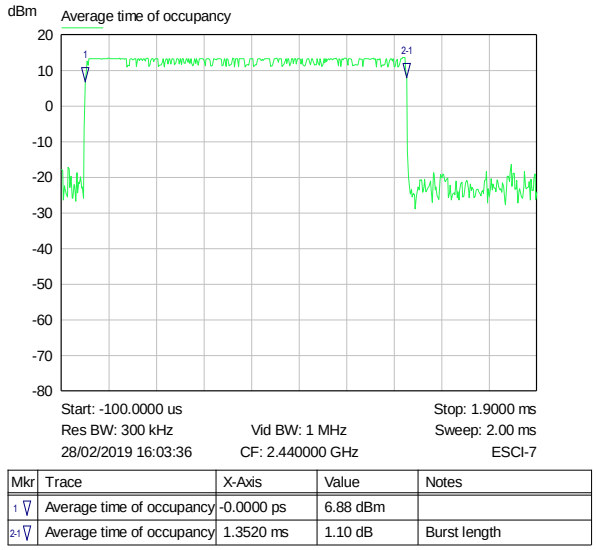
Limit:

- The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed
- 79 hopping channels are employed, so the measurement period is 0.4*79 = 31.6 seconds

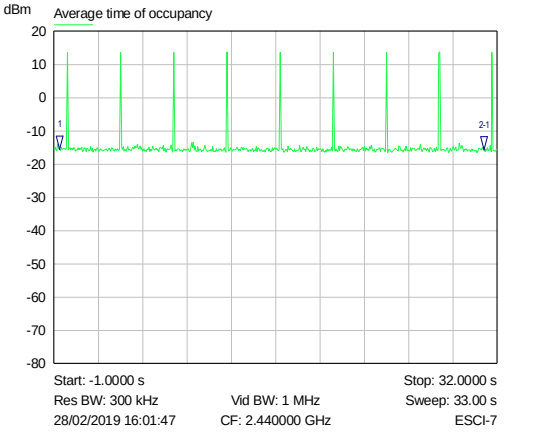
7.2 Test results

Mode	Average time of occupancy in 31.6 second period (s)	Maximum occupancy time (s)	Result
TX4	0.0135	0.4	Pass

Average time of occupancy



Mkr	Trace	X-Axis	Value	Notes
1	Average time of occupancy	-0.0000 ps	6.88 dBm	
2-1	Average time of occupancy	1.3520 ms	1.10 dB	Burst length



Mkr	Trace	X-Axis	Value	Notes
1	Average time of occupancy	-604.0000 ms	-15.53 dBm	
2-1	Average time of occupancy	31.6140 s	-0.18 dB	31.6 s elapsed time

Average time of occupancy plots

7.3 Determination of DCCF (Duty Cycle Correction Factor)

The DCCF is used to determine the average level of radiated emissions in section 9.2:

As shown above each channel transmits for 1.352 ms, 8 times in every 31.6 seconds. With 79 channels this equates to a transmission every 31.6/(8x79) = 50 ms.

Number of transmissions in any 100ms period = 100/50 = 2

The duty cycle is therefore 2 x 1.352 ms / 100 ms = 2.704%

The Duty cycle correction factor = 20x Log(0.02704) = -31.4 dB

8.0 MAXIMUM PEAK CONDUCTED OUTPUT POWER

8.1 Measurement method

Test was conducted in accordance with ANSI C63-10 clause 7.8.5:

a) Use the following analyser settings:
1. Span: 5x the 20dB bandwidth, centred on a hopping channel
2. Set the RBW ≥ 20dB bandwidth.
3. Set VBW ≥ RBW.
4. Sweep time = auto couple.
5. Detector = peak.
6. Trace mode = max hold.

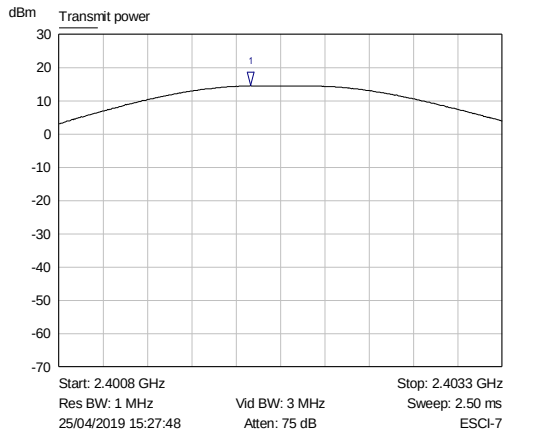
b) Allow trace to fully stabilize.
c) Use peak marker function to determine the peak amplitude level.

8.2 Test results

Mode	Channel Power (dBm)	Limit (dBm)	Result
TX1	14.62	30.0	Pass
TX2	13.76	30.0	Pass
TX3	12.51	30.0	Pass

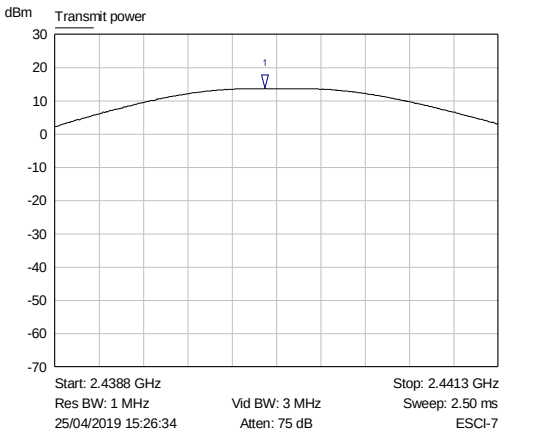
Channel Power

Peak Conducted Power plots



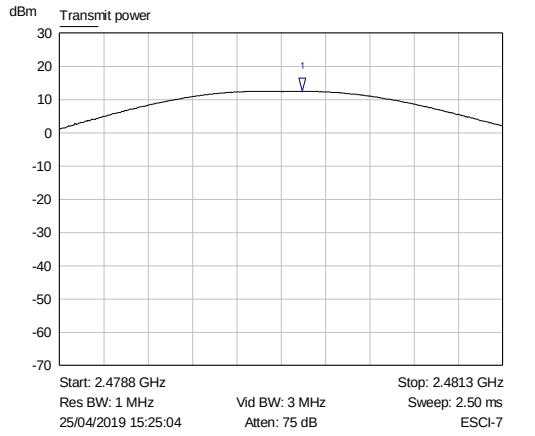
Mkr	Trace	X-Axis	Value	Notes
1	Transmit power	2.4018 GHz	14.62 dBm	

TX1



Mkr	Trace	X-Axis	Value	Notes
1	Transmit power	2.4399 GHz	13.76 dBm	

TX2



Mkr	Trace	X-Axis	Value	Notes
1	Transmit power	2.4801 GHz	12.51 dBm	

TX3

9.0 RADIATED EMISSIONS

The three axis for test are:

X – unit lying on its back

Y – unit standing up on its longer edge (antenna horizontal)

Z – unit standing up on its shorter edge (antenna vertical)

As noted above, emissions were investigated in for all three orthogonal axis, with continuous transmission and with frequency hopping and the worst case emissions are presented below

9.1 RESULTS - 30 MHz to 1000 MHz

Pre-scans were made on top, middle and bottom channels and with frequency hopping in all 3 polarisations of the EUT and the worst case mode was found to be Middle channel with the EUT lying on its back.

	Actual quasi-peak value	Specified limit	Antenna polarisation	EUT polarisation
Frequency	@ 3m	@ 3m		
MHz	dBµV/m	dBµV/m	H/V	X / Y / Z
30.1200	13.56	29.54	V	X
49.5900	16.48	29.54	V	X
101.0600	14.72	33.04	H	X
215.5200	15.56	33.04	H	X
425.4600	20.22	35.54	H	X
791.0400	27.57	35.54	H	X

Uncertainty of measurement: ± 4.2 dBµV/m for a 95% confidence level.

Procedure: In accordance with ANSI C63.4:2014

Measurements below 1.0 GHz performed with a quasi-peak detector (120 kHz BW). Measurements above 1.0 GHz performed with an average and peak detector (1MHz BW).

TEST ENGINEER: R. Craig

9.2 RESULTS - >1000 MHz

Measurements were maximised and measured using a Peak detector, and the Average value then determined by applying the Duty Cycle Correction Factor as specified in 47CFR15.35(c) and calculated in section 7.3 above as being -31.4 dB.

For 2.4835 GHz band edge compliance a single scan was recorded for top channel and Y-axis, but final measurements were made in all 3 orientations and additionally in worst case orientation with device hopping

	AVERAGE @ 3m			PEAK @ 3m					
Frequency	Calculated	Specified CLASS B Limit	Pass Margin	Measured	Specified CLASS B Limit	Pass Margin	Antenna polarity	EUT Polarity	
GHz	dBµV/m	dBµV/m	dB	dBµV/m	dBµV/m	dB	H/V	X/Y/Z	STATUS
2.3900	3.61	54.0	50.4	34.97	74.0	39.0	V	Y	Pass
2.3900	3.07	54.0	50.9	34.43	74.0	39.6	V	X	Pass
2.3900	4.30	54.0	49.7	35.66	74.0	38.3	V	Z	Pass
2.4835	13.27	54.0	40.7	44.63	74.0	29.4	H	Y	Pass
2.4835	13.49	54.0	40.5	44.85	74.0	29.2	V	X	Pass
2.4835	16.23	54.0	37.8	47.59	74.0	26.4	V	Z	Pass
4.8037	29.05	54.0	24.9	60.41	74.0	13.6	V	Z	Pass
4.8037	30.16	54.0	23.8	61.52	74.0	12.5	H	Y	Pass
4.8037	26.76	54.0	27.2	58.12	74.0	15.9	V	Z	Pass
4.9597	22.46	54.0	31.5	53.82	74.0	20.2	H	Y	Pass

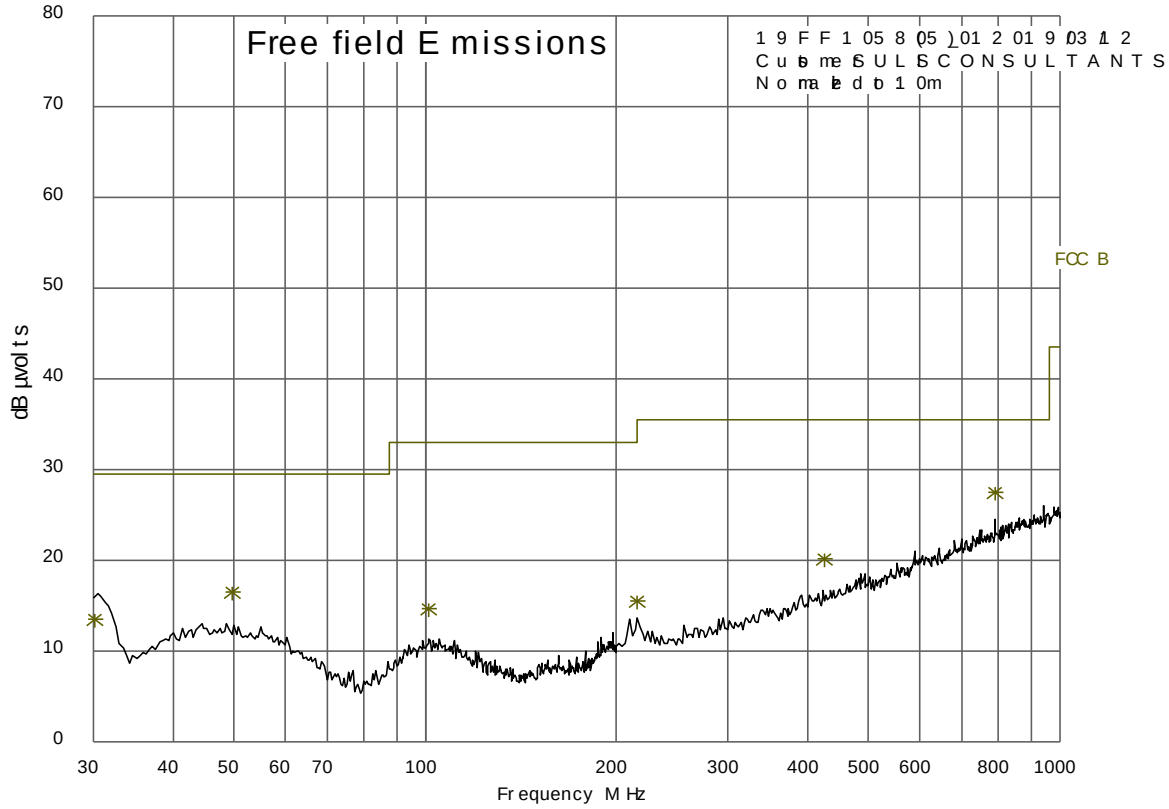
Uncertainty of measurement: ± 4.5dBµV/m for a 95% confidence level.

9.3 Emissions Plots

A search was made of the frequency spectrum from 9 kHz to 1 GHz and the measurements reported are the highest emissions relative to the 'FCC CFR 47 Section 15.209 /15.225 and RSS-210 A2.6 Issue 9, RSS Gen 8.9 Issue 5 Limits' at a measuring distance of three metres above 30MHz. Below 30 MHz the results measured at 3m with a corrected limit line extrapolated from 30m or 300m, the limits were extrapolated using 40dB per decade.

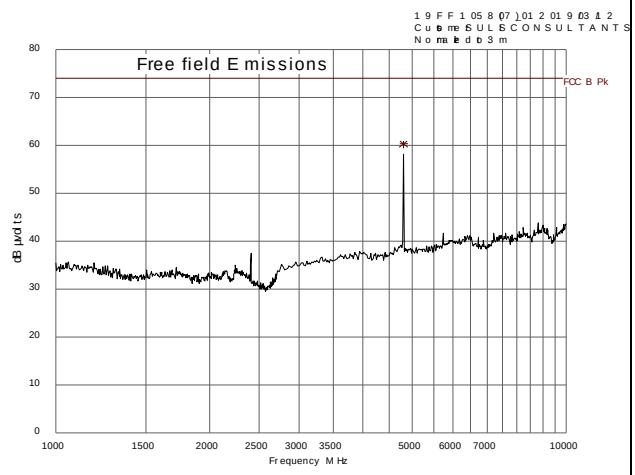
Measurements were made using a quasi-peak detector with a 9kHz bandwidth below 30MHz and a 120kHz bandwidth above 30MHz. Above 1GHz peak detectors are used with a 1MHz measurement bandwidth.

9.3.1 30MHz to 1GHz

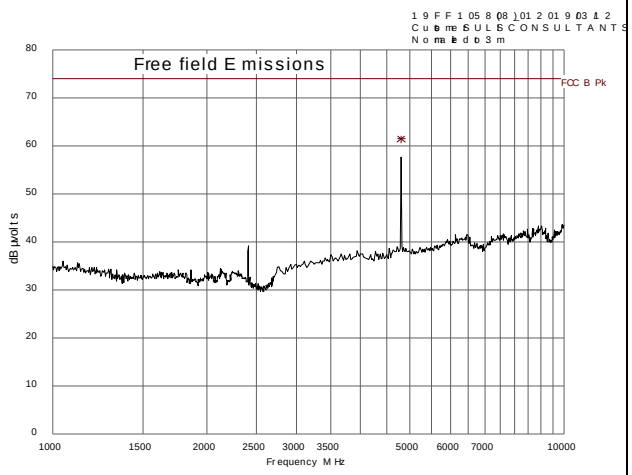


Middle channel: EUT horizontal

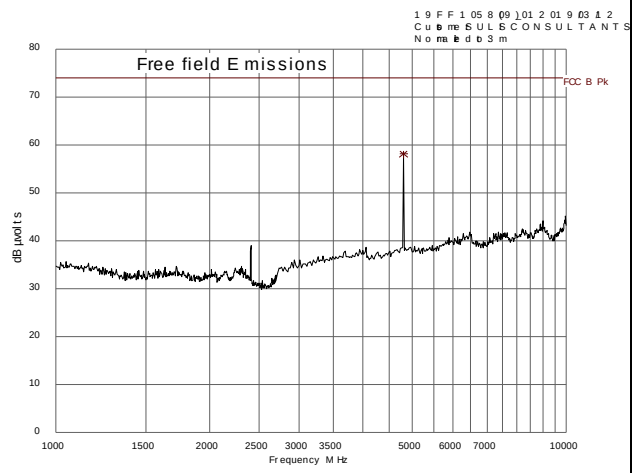
9.3.2 1-10 GHz



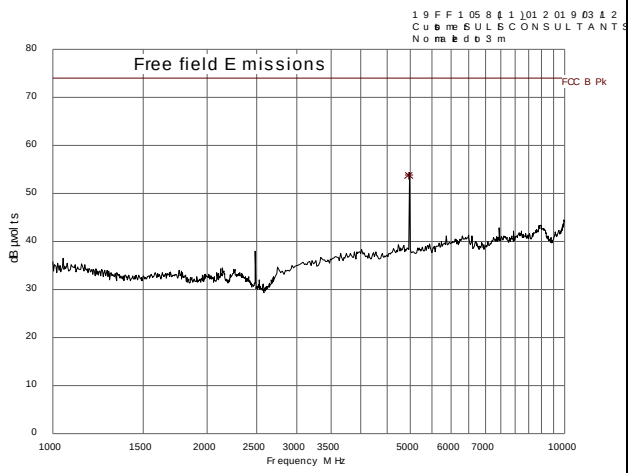
Bottom channel: Z-axis



Bottom channel: Y-axis

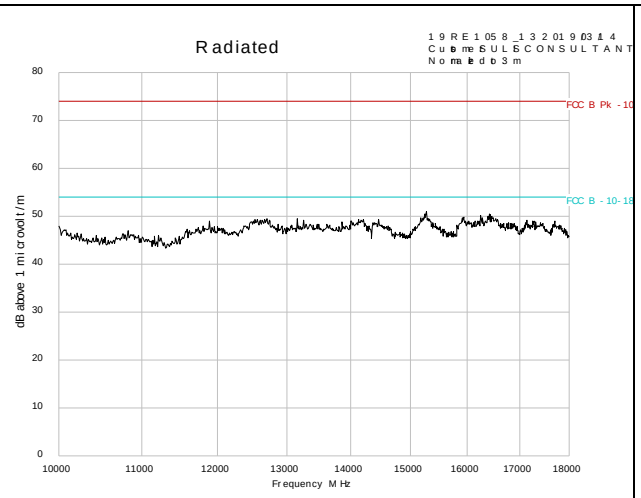


Bottom channel: X-axis

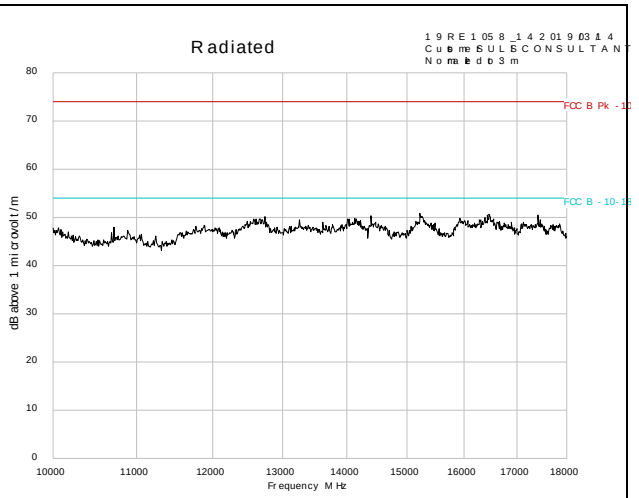


Top channel: Y-axis scan

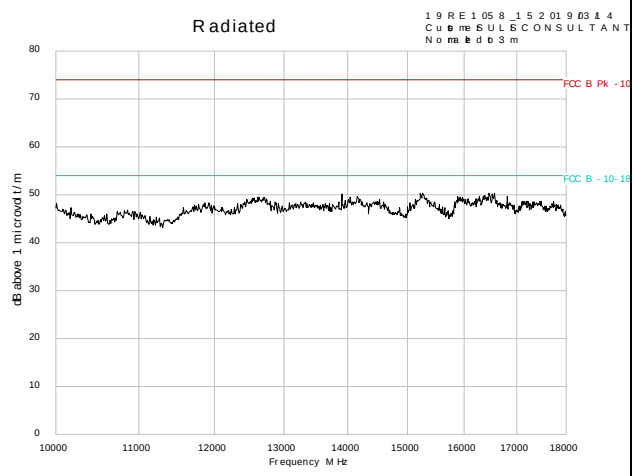
9.3.3 10-18 GHz



Bottom channel: X-axis

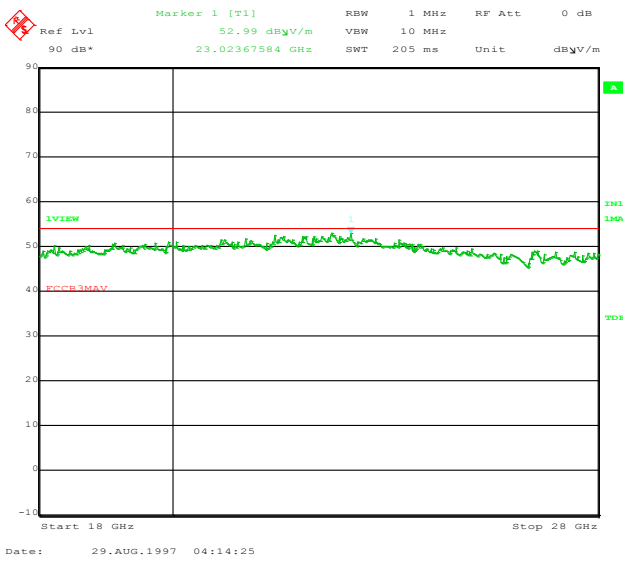


Middle channel: Y-axis

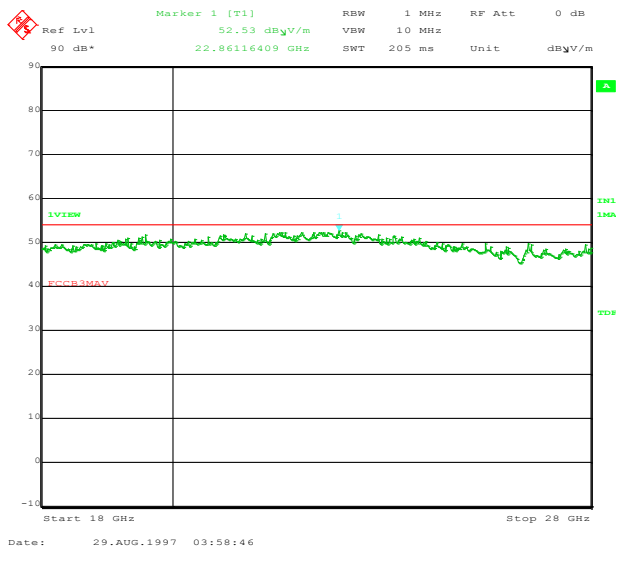


Hopping: Z-axis

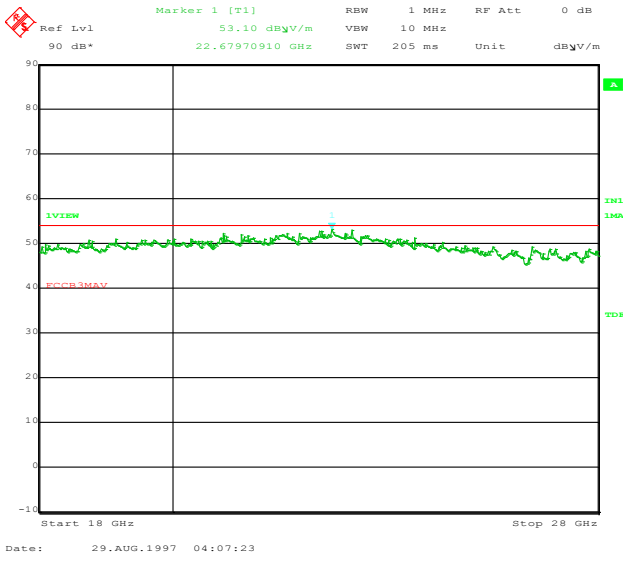
9.3.4 18 – 26 GHz



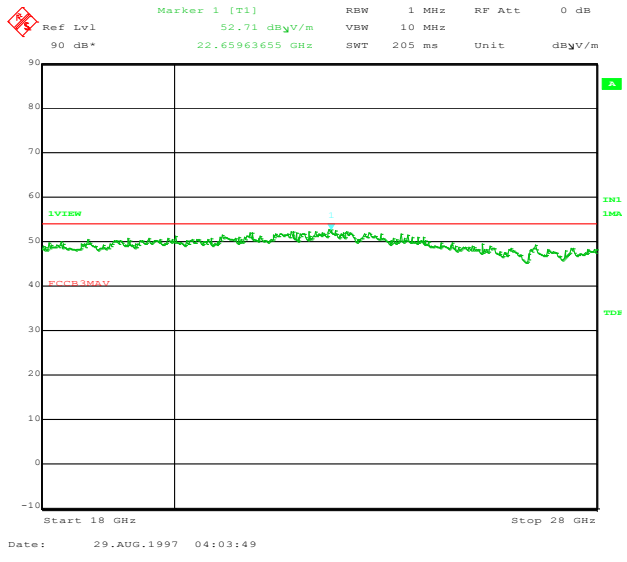
Middle channel: z-axis: vertical antenna



Middle channel: X-axis; Horizontal antenna



Hopping: Y-axis; horizontal antenna



Middle channel: Y-axis; vertical antenna

10.0 PHOTO LOG

Emissions:

Radiated emissions

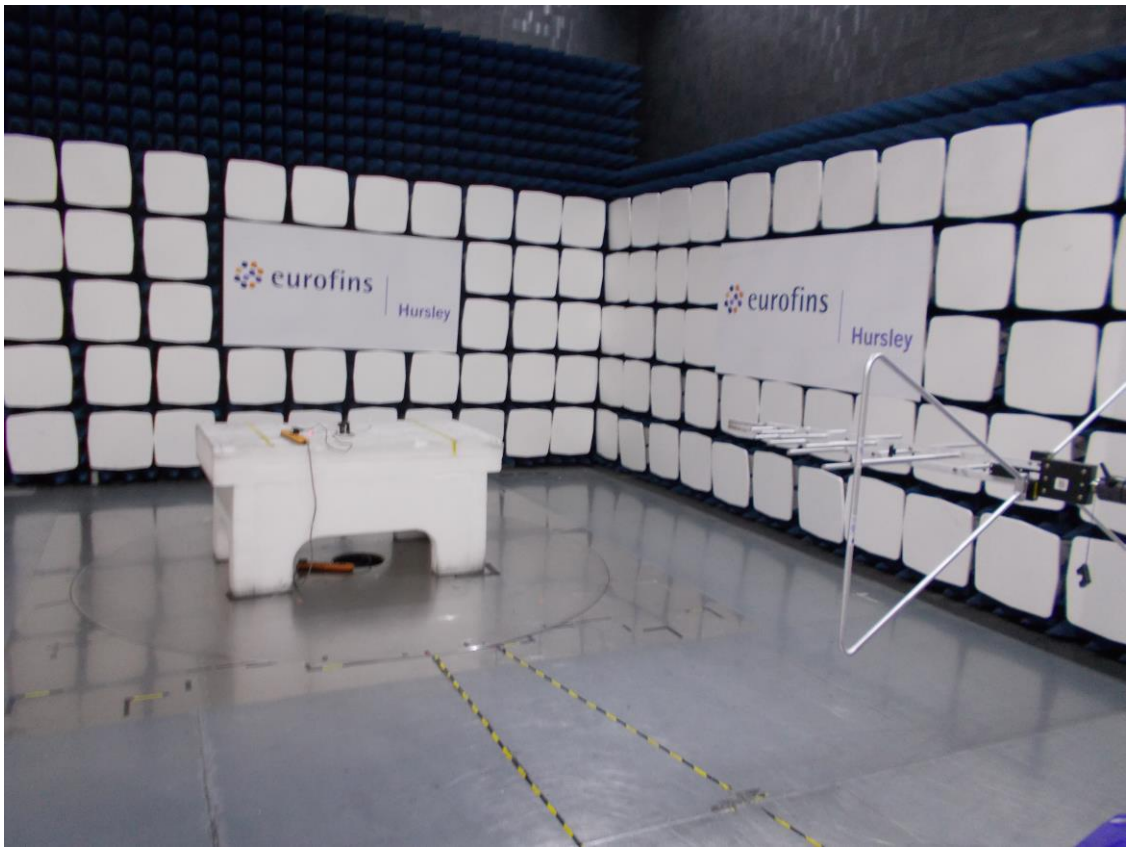
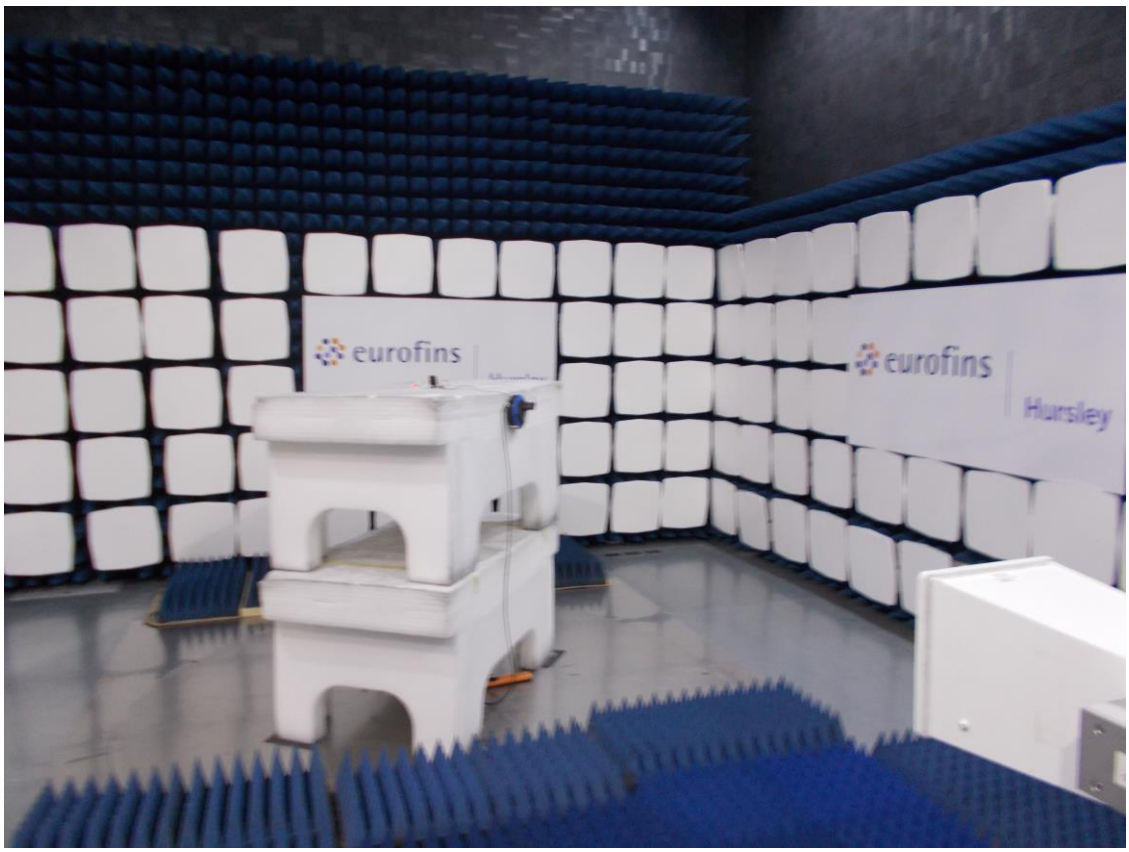


Photo Log (continued)

Radiated emissions



11.0 MEASUREMENT UNCERTAINTIES

Emissions tests

For all emissions tests, measurement uncertainties have been calculated in line with the requirements of CISPR 16-4-2 to give a confidence level of greater than 95%. In all cases the laboratories calculated uncertainty values (known as Ulab) are equal to or are less than the expected uncertainty values contained in CISPR 16-4-2 (known as Ucispr).

Below is a list of the laboratories calculated measurement uncertainties:

Conducted emissions:

Via AMN/LISN:	±3.3 dB (9 kHz – 150 kHz), ±3.3 dB (150 kHz – 30 MHz)
Via AAN/ISN:	±5.0 dB (150 kHz – 30 MHz)
Via CVP:	±3.5 dB (150 kHz – 30 MHz)
Via CP:	±2.7 dB (150 kHz – 30 MHz)
Via 100 Ω:	±2.7 dB (150 kHz – 30 MHz)
Clicks:	±2.8 dB (150 kHz – 30 MHz)
Harmonics:	±5.8 % (100 Hz – 2 kHz)
Flicker:	±3.8 % (worst case for all parameters)

Radiated emissions:

H-Field:	±2.7 dB (9 kHz – 3 MHz), ±2.9 dB (3 MHz – 30 MHz)
D = 3.0 m:	±2.8 dB (30 MHz – 200 MHz), ±2.9 dB (200 MHz – 1 GHz)
D = 3.0 m:	±4.5 dB (1 GHz – 6 GHz), ±4.4 dB (6 GHz – 40 GHz)
D = 10.0 m:	±4.4 dB (30 MHz – 200 MHz), ±4.8 dB (200 MHz – 1 GHz)

End of document