Test Report for the EMC Testing of

A 312 Amie

Model 63604/30

For

Tunstall Healthcare (UK) Ltd

Test Report number 12451TR2

Project number: C3425

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Issue	Description			Issue by	Date
2	*Copy 1*	*PDF*		**EW**	**1st August 2017**

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Test Report Change History

Issue	Date	Modification Details
1	29th June 2017	Original issue of test report
2	1st August 2017	Minor modification to Annex B
3		
4		
5		
6		
7		
8		
9		
10		

Section 1 Test Location

All testing was performed at;

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

Except for the following

Tests:	Bandwidth and transmitter shut off
Location:	3 Lane Ends Business Centre Methley Road Castleford
	WF10 1PN

1.1 UKAS Accreditation

The tests are not included in the UKAS Accreditation Schedule for our laboratory.

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

York EMC Services latest accreditation schedule can be found at:

http://www.ukas.org/testing/lab_detail.asp?lab_id=989&location_id=&vMenuOption=3

Section 2 Customer Information

Company name	Tunstall Healthcare (UK) Ltd
Address	Whitley Lodge, Whitley Bridge West Yorkshire DN14 0HR
Tel:	+44 (0)1977 660338
Contact	Mark Jennings
Email	Mark.jennings@tunstall.com
Customer Representative(s) present during testing	None

Section 3 Equipment Details

3.1 Equipment Under Test (EUT)

Date received:	19th June 2017					
EUT name:	312Amie					
Type/Part no:	63604/30					
EUT description:	312Amie Grey/White 34bit-nonDTC periodic operation transmitter. Manual operation. Modulation scheme: The transmitter incorporates a Tunstall proprietary protocol. The transmitter utilises 2FSK modulation scheme with +/- 2 kHz of deviation. In addition to 2FSK modulation, the transmitter is on for 50 ms and off for 50 ms thereby giving a 50% duty-cycle. The center frequency is 312 MHz with a 3 kbps data rate over-the-air.					
No of units tested:	One					
EUT power:	3V DC	Battery operation: CR2032 Lithium coin cell 3V DC				
Highest internal frequency:	312MHz carrier					
Cables:	None					
Size of EUT (m)	L: -	5.5	W: -	1.9	H: -	1.5
Tested as	Body worn					
Mode/s of operation	Continuously transmitting an unmodulated carrier at 312MHz					
	Continuously transmitting a modulated carrier at 312MHz					
Software Version	422V0R1.39					
Client modification statement:	The samples were not modified during testing					

3.2 EUT Photos

Photographs are presented separately.

3.3 EUT Monitoring/Auxiliary Equipment

None.

3.4 Monitoring Software

None.

Section 4 Test Specifications

4.1

4.2 USA Requirements

Regulation / Test Standard	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

Test	FCC Rule Part	Comments and deviations from the standard	Result
Radiated spurious electric field emissions 9kHz to 3120MHz	47CFR15.231(b) 47CFR15209	Applies Frequency range of measurement determined from 47CFR15.33(a)(1)	Complies
AC mains conducted emissions	47CFR15.207	Not applicable – battery powered	Not applicable
Transmission on time	47CFR15.231(a)	Applies	Complies
Intentional Emission Frequency	47CFR15.231(b)	Applies	Complies
Intentional emission field strength	47CFR15.231(b)	Applies	Complies
Intentional emission band occupancy	47CFR15.215	Applies	Complies
Integral antenna arrangements	15.203	Applies. Test for band edge compliance.	Complies
Restricted bands	15.205	Applies	Complies
Variation of the input power or the radiated signal level of the fundamental frequency component of the emission.	15.31(e)	Not applicable	Not applicable

4.3 Canadian Requirements

ISED (Innovation, Science and Economic Development Canada) requirements:

Regulation / Test Standard	RSS-210 — License-exempt Radio Apparatus (All Frequency Bands): Category I Equipment. Issue 9 And, RSS-Gen — General Requirements for Compliance of Radio Apparatus Issue 4

Test	RSS-210 Clause reference	RSS-Gen Clause reference	Comments and deviations from the standard	Result
Radiated spurious electric field emissions 9kHz to 3120MHz	A1.2	8.9	Applies	Complies
AC mains conducted emissions	-	8.9	Not applicable – battery powered	Not applicable
Transmission on time	A1.1	-	Applies	Complies
Intentional Emission Frequency	A1.2	-	Applies	Complies
Intentional emission field strength	A1.2	-	Applies	Complies
Intentional emission band occupancy	A1.3	-	Applies	Complies
Integral antenna arrangements	-	8.3	Applies	Complies
Restricted bands	4.1	8.10	Applies	Complies

The tests were performed in accordance with York EMC Services Quotation QuC3425.

Note 1 :All testing was carried out at a test distance of 3m.

4.4 Knowledge Database References

The following KDBs were referenced during the testing of the 312 Amie:

The latest knowledge database references are available via the FCC KDB website at:

https://apps.fcc.gov/kdb

4.4.1 Conducted Emissions

Not applicable. The apparatus is battery powered and does not derive power in any way from the public mains supply.

4.4.2 Radiated Emissions (9kHz to 30MHz)

Publication Number	Keyword	Publication Date
937606	Test Site Requirements for Part 15 and 18 Devices Operating Below 30 MHz	10/10/2014
460108	Radiated emission measurements below 30 MHz	06/15/2015

4.4.3 Radiated Emissions (30MHz to 1000MHz)

Publication Number	Keyword	Publication Date
746324	CE Mark and use of CISPR 22 limits	06/12/2015
913591	Measurement of radiated emissions at the band-edge for a Part 15 RF Device	04/05/2017

4.4.4 Radiated Emissions (1GHz to 40GHz)

Publication Number	Keyword	Publication Date
746324	CE Mark and use of CISPR 22 limits	12/06/2015
714737	15B, Average Detector for Unintentional Radiator	30/11/2010
704992	Test Site Validation Requirements above 1 GHZ.	12/06/2015
414788	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
414788	Comparison Noise Emitters (CNE), test equipment, Broadband.pdf	05/04/2007

4.5 Compliance Statement

The 312 Amie as tested, was shown to meet requirements of the standards listed in Section 4**Error! Reference source not found.** of this report.

Section 5 Conducted Emission Results

Not applicable. The apparatus is battery powered and does not derive power in any way from the public mains supply.

Section 6 Radiated Emission Results

6.1 Test Specification

Standard	USA: 47CFR15.209, 47CFR15.231 and ANSI C63.10-2013 Canada: RSS210 Issue 9 Clause A1.2
Measurement Uncertainty	The reported uncertainty of measurement y ± U, where expanded 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 +/- 4.27dB for the frequency range from 9kHz to 30MHz +/- 5.81dB 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 +/- 4.77dB for the frequency range from 18GHz to 40GHz

6.2 Procedure and Test Software Version

Test procedure	Relevant clauses within ANSI C63.10-2013

6.3 Radiated Emissions (30MHz to 1GHz)

6.3.1 Fundamental Limits at 3m

The limits specified in Section 47CFR15.231(b) and RSS210 Issue 9 Clause A1.2 are:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter) (average detector)
40.66-40.70	2,250
70-130	1,250
130-174	1,250 to 3,750
174-260	3,750
260-470	3,750 to 12,500
Above 470	12,500

At 312MHz the limit was calculated as 5916.7μV/m using linear interpolation. This equates to 75.4dBμV/m

6.3.2 Spurious Emission Limits at 3m

Frequency (MHz)	Spurious Emission Limits 47CFR 15.209 (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 15.209 specifies test limits at 3m.

6.3.3 Emissions measurements

6.3.4 Date of Test

19th June 2017 to 20th June 2017

6.3.5 Test Area

LAB 1 (SAC)

6.3.6 Test Setup

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

The measurement was performed with an antenna to EUT separation distance of 3m. The Quasi peak limits are therefore increased by 10dB (from the 10m values), to allow for the reduction in the measurement distance.

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

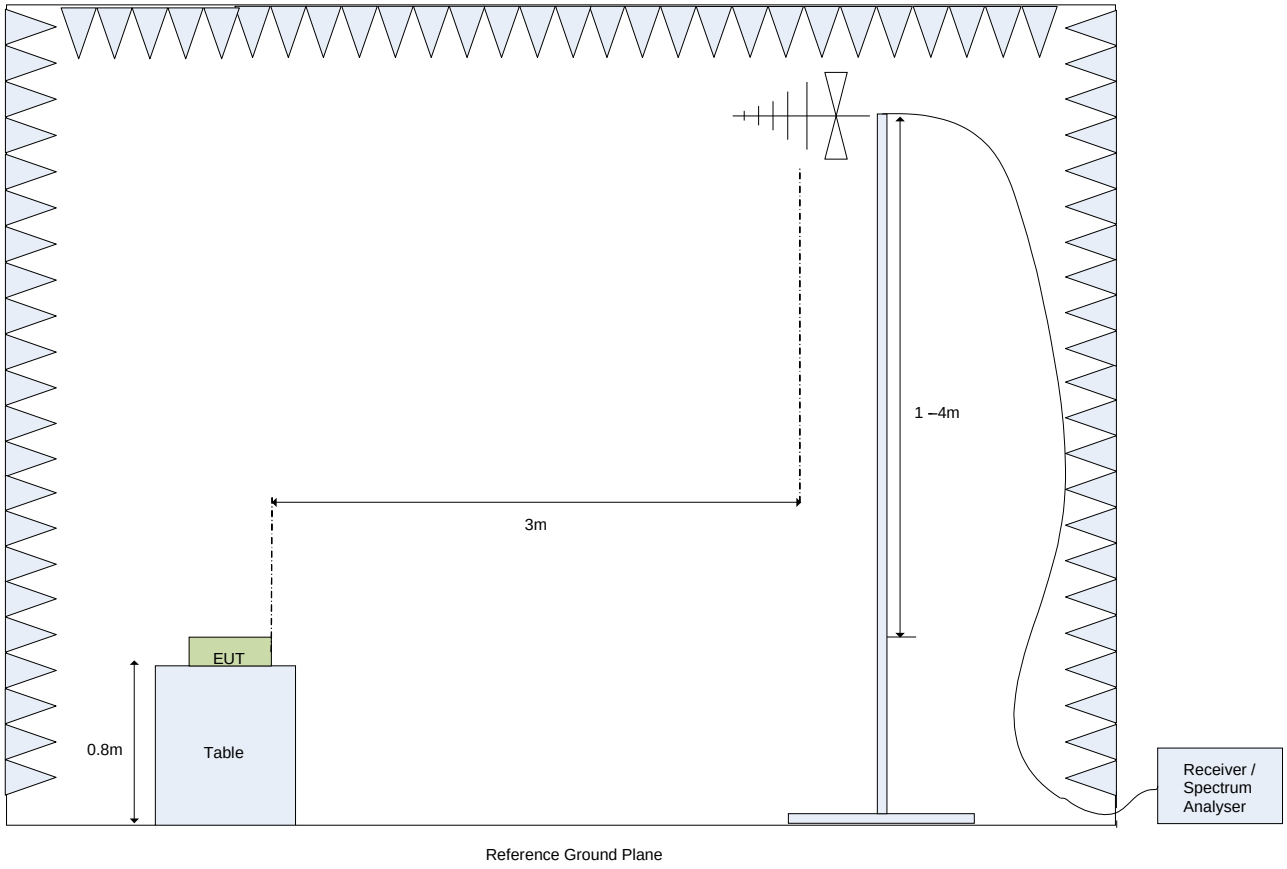

Figure 1: Test Setup for E-Field Measurements from 30MHz to 1GHz

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.

Receiver or spectrum anlyser Parameters	Setting
Detector Function	EMI Average (Section 15.231(b)(2))
Start Frequency	30MHz
Stop Frequency	1000MHz
Resolution Bandwidth	120kHz receiver 100kHz spectrum analyser
Video Bandwidth	Three times RBW

Analyser Settings for 30MHz to 1GHz

6.3.7 Fundamental Emission

Rule part: 47CFR15.231(b).

Procedure: ANSIC63.10 Clause 6.5

RSS210 Issue 9 Clause A1.2

The value of the fundamental emission was measured and recorded. The measurement procedure for finding the maximum value of the emission by investigating different orientations of the apparatus under test. The fundamental emission was tuned to directly for this measurement. The turntable was rotated 360 degrees and the mast varied in height betewen 1 and 4m.

In addition, a pulse correction factor was measured and applied according to 47CFR15.35 and ANSIC63.10-2013.

Pol	frequency (MHz)	Amplitude (dBuV) (Peak detector)	Cable loss (dB)	AF (dB/m)	E dBuV/m	Pulse correction factor (dB) (Note 1)	Corrected E dBuV/m	limit (dBuV/m)	Margin(dB)
V	312.000	37.9	1.4	19.4	58.7	-6.3	52.4	75.4	-23.2
H	312.000	56.0	1.4	19.4	76.8	-6.3	70.5	75.4	-4.9

Note 1: The measurement and calculation is contained within Appendix B.

Note 2: In addition band edge measurement s were made to test the apparatus compliance with the restricted bands in Section 46CFR15.205.

6.3.8 Radiated spurious emissions (30MHz to 1GHz)

Rule part: 47CFR15.209.

Procedure: ANSIC63.10 Clause 6.5

RSS210 Issue 9 Clause 1.2

RSS-GEN Issue 4 Clause 8.9

Initial measurements were performed in a SAC using a spectrum analyser set to max hold. Horizontal and vertical polarities were measures separately. The graphical data is presented below:

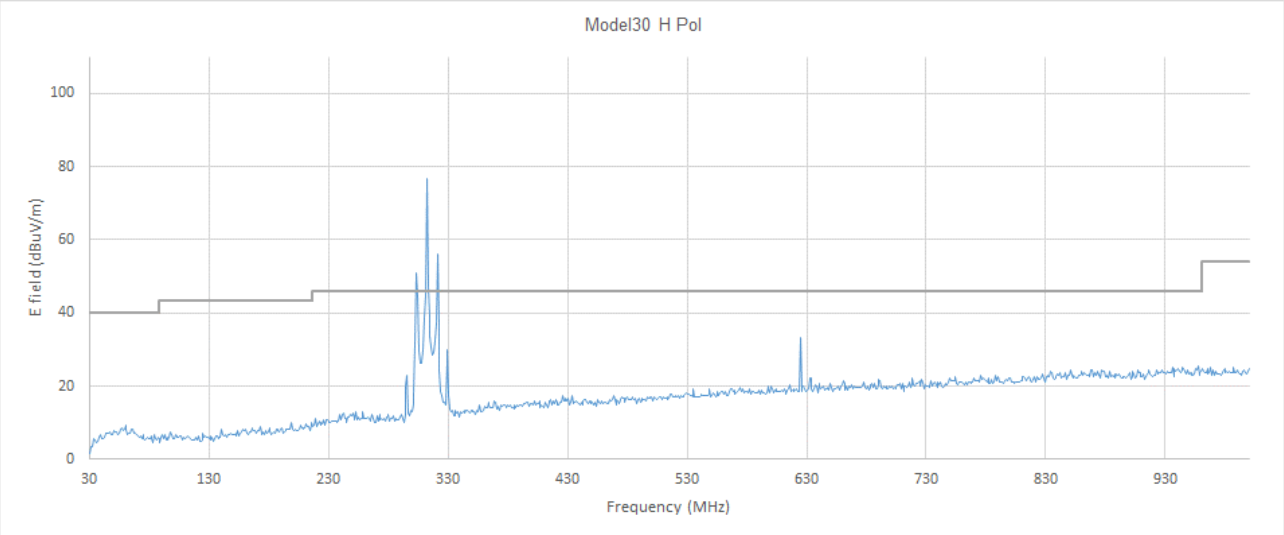

Figure 2: Electric field emissions Plot, 30MHz to 1GHz, Horizontal

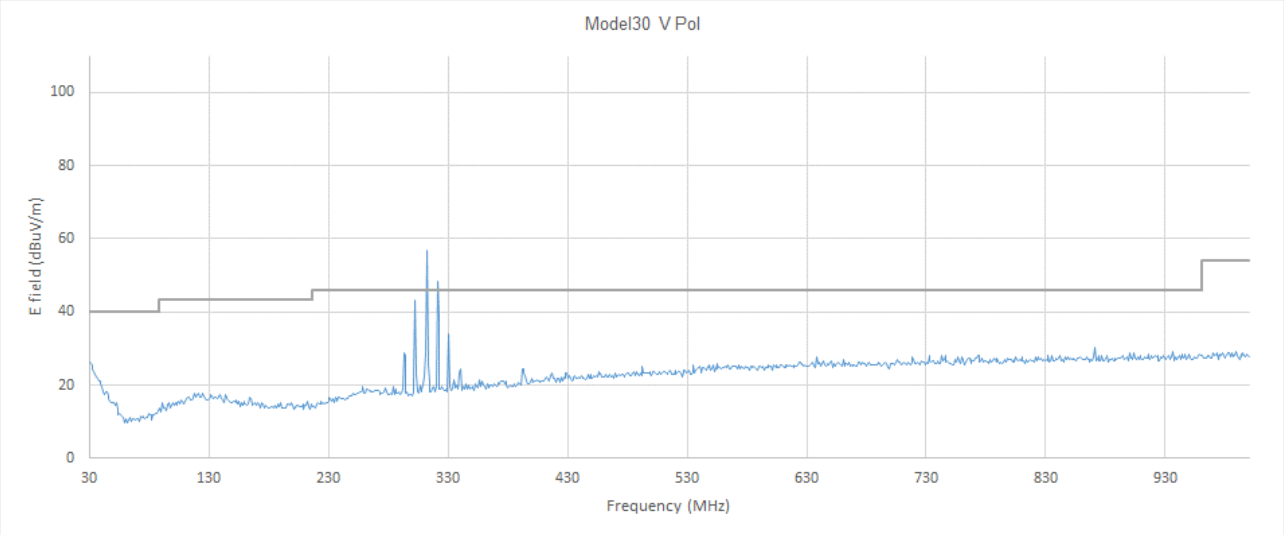

Figure 3: Electric field emissions Plot, 30MHz to 1GHz, Vertical

The following individual disturbances were measured:

Pol	Height (m)	frequency (MHz)	Amplitude (dBuV)	Pre amp (dB)	Cable loss (dB)	AF (dB/m)	E dBuV/m	limit (dBuV/ m)	Margin (dB)
h	1	240	16.2	-30.1	1.1	17.5	4.7	46	-41.3
v	1	240	16.2	-30.1	1.1	17.5	4.7	46	-41.3
V	1	288.1	25.0	-30.2	1.3	19	15.1	46	-30.9
h	1	288.1	17.1	-30.2	1.3	19	7.2	46	-38.8
h	1	300.1	16.26	-30.2	1.4	19.1	6.56	46	-39.44
v	1	322	16.3	-30.2	1.4	19.6	7.1	46	-38.9
h	1	322	16.4	-30.2	1.4	19.6	7.2	46	-38.8
h	1	328.46	42.7	-30.2	1.4	19.8	33.7	46	-12.3
v	1	328.46	21.2	-30.2	1.4	19.8	12.2	46	-33.8
v	1	334.28	25.9	-30.2	1.5	19.9	17.1	46	-28.9
h	1	334.28	43	-30.2	1.5	19.9	34.2	46	-11.8

Note: The pulse correction factor was not applied in this case due to the low level of emissions measured during the initial scan.

6.4 Radiated Spurious Emissions (1GHz to 4GHz)

Rule part: 47CFR15.209.
Procedure: ANSIC63.10 Clause 6.5
RSS210 Issue 9 Clause 1.2
RSS-GEN Issue 4 Clause 8.9

6.4.1 Limits

Frequency (GHz)	Limit (dBµV/m)	
	Average	Peak
1-4	54.0	74.0

6.4.2 Emissions measurements

6.4.3 Date of Test

20th June 2017

6.4.4 Test Area

LAB 1 (SAC)

6.4.5 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 6.4.6.

The measurement was then performed with an antenna to EUT separation distance of 3m.

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.

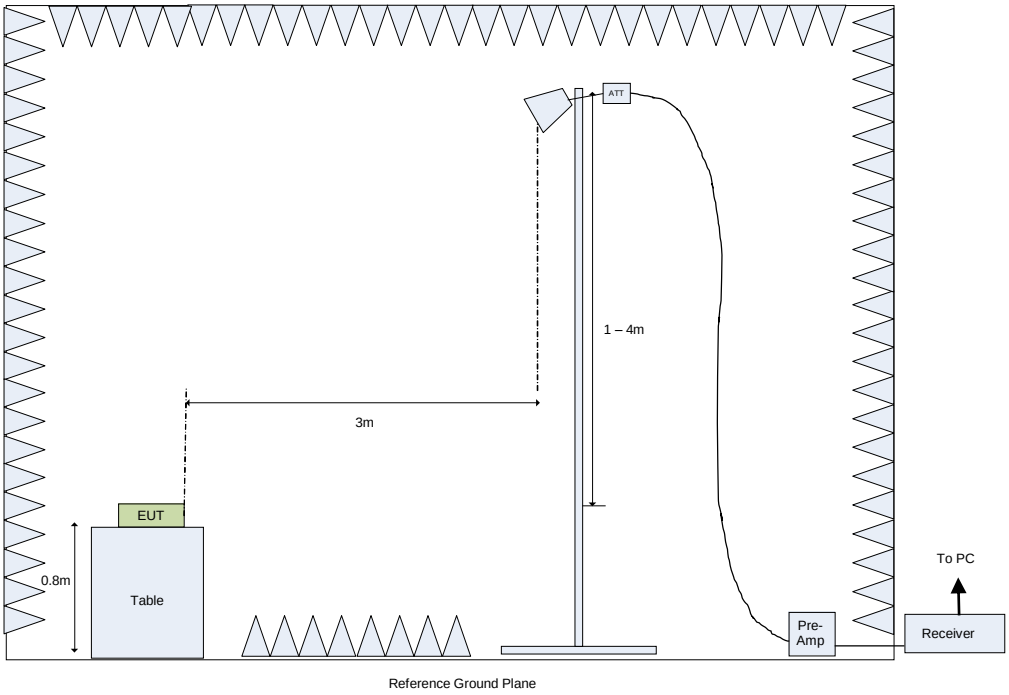

Figure 4: Test Setup for Final E-Field Measurements from 1GHz to 18GHz

Note 1 : 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.

Receiver Parameters	Setting
Detector Function	Average
Start Frequency	1GHz
Stop Frequency	4GHz
Resolution Bandwidth	1MHz
Video Bandwidth	3MHz

Receiver Settings

6.4.6 Exploratory Radiated Emission Maximization

Rule part: 47CFR15.209.

Procedure: ANSIC63.10 Clause 6.5

RSS210 Issue 9 Clause 1.2

RSS-GEN Issue 4 Clause 8.9

Initial measurements were performed in a SAC using a spectrum analyser set to max hold. Horizontal and vertical polarities were measures separately. The graphical data is presented below:

No emissions were identified for further investigation

Note 1 : The front face of the EUT is deemed to be 0°, which is then turned in a clockwise direction through 360°.

Note 2 : The method for the exploratory radiated emission maximisation is as detailed in ANSIC63.10:2013.

6.4.7 Radiated Spurious Emissions, 1GHz to 4GHz

The following initial spectrum analyser graphical data is presented below:

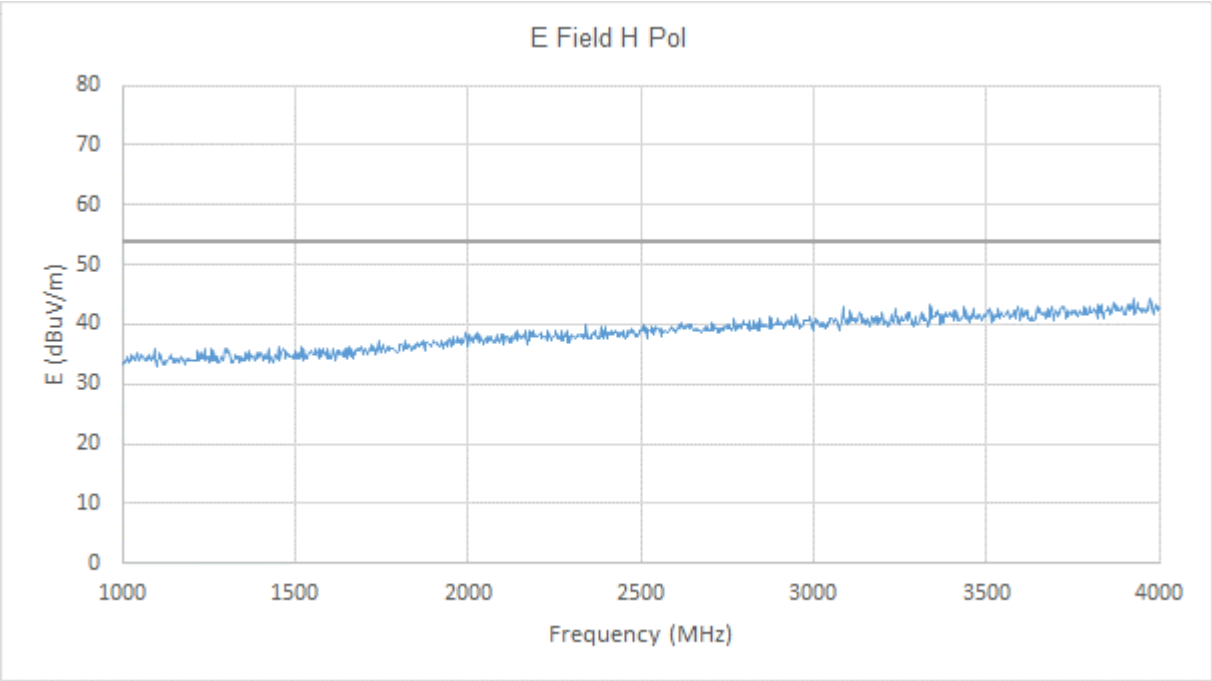

Figure 5: Electric field emissions Plot, 1GHz to 4GHz – Horizontal Polarity

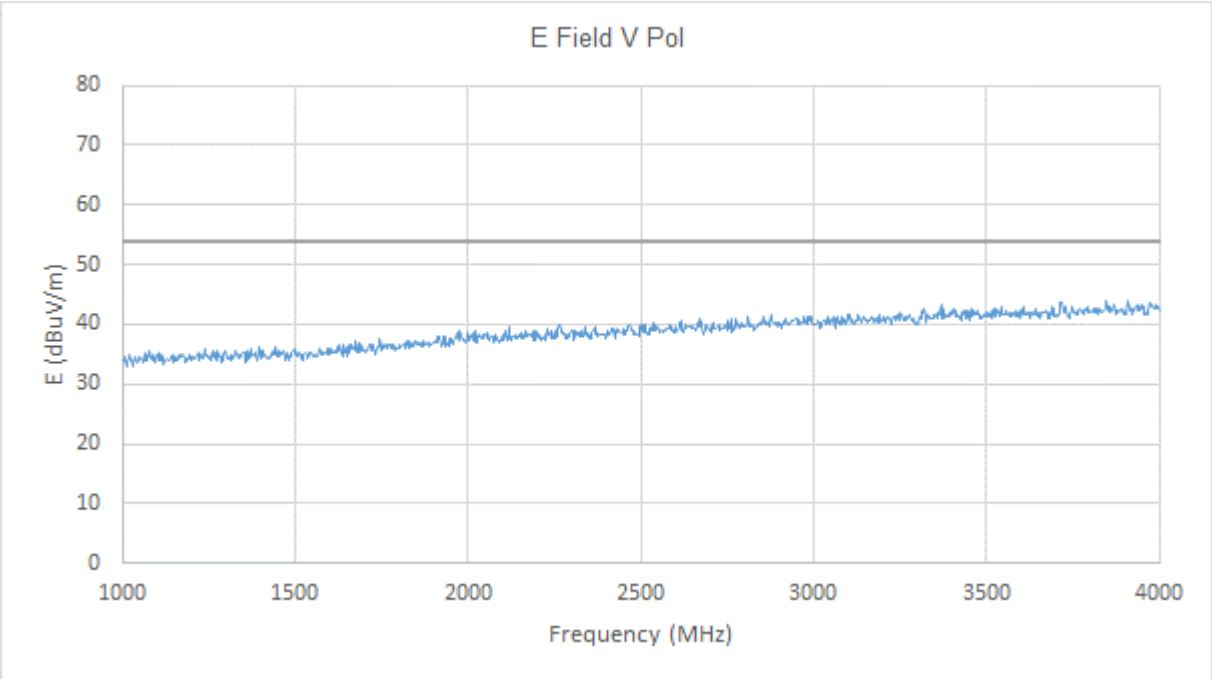

Figure 6: Electric field emissions Plot, 1GHz to 4GHz – Horizontal Polarity

No disturbances were identified requiring further investigation.

6.4.8 Correction factors

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

Field strength (FS) is calculated as follows:

FS (dBµV/m) = Indicated Signal Level (dBµV) - PG (dB) + AF (dB/m) + CL (dB)

Section 7 Band Edge Measurements

The purpose of this test is to test compliance to the following part of the FCC Rules:

47CFR15.205 – Restricted bands
RSS210 Issue 9 Clause A1.2

Test methods: ANSIC63.10-2013 Clause reference 6.10.5 Restricted band-edge measurements.
For the operating frequency of 312MHz the closest restricted bands are:

240 to 285MHz and,
322 to 335.4MHz

Within these bands only spurious emissions are permitted.

Radiated measurements were performed and in addition calculations of field strength are provided. The reference level offset was set to zero as per ANSIC63.10-2013 Clause 6.10.5.2, e), 2).

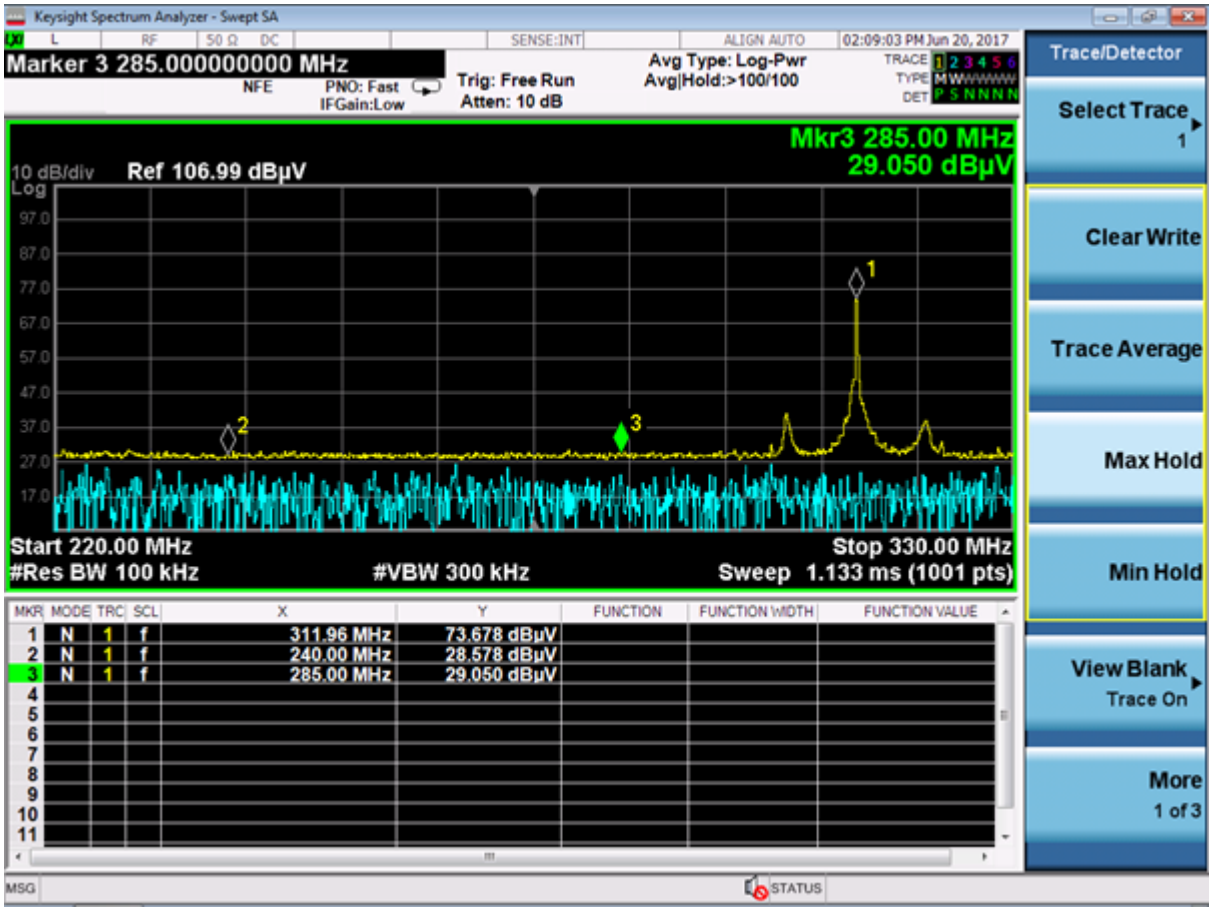

Figure 7 Lower restricted band measurement

Pol	Hgt (m)	frequency (MHz)	Amplitude (dBuV)	Preamp (dB)	Cable loss (dB)	AF (dB/m)	E dBuV/m	Pulse correction factor (dB)	E afrer correct. dBuV/m	limit (dBuV/m)	Margin (dB)
v	1	240	28.6	-30.1	1.1	17.5	17.1	-6.3	10.8	46	-35.4
v	1	285	29.05	-30.2	1.3	19	19.15	-6.3	12.85	46	-33.15

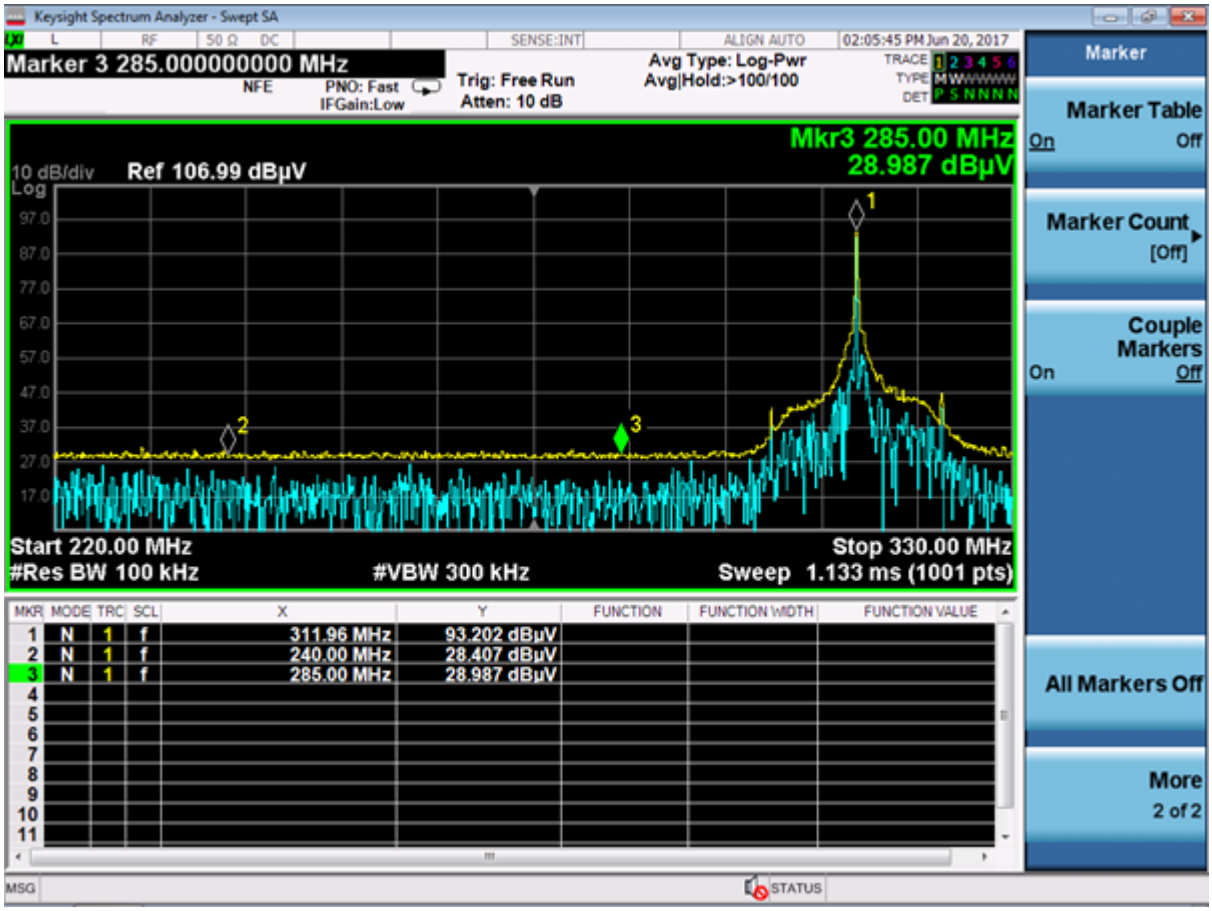

Figure 8 Lower restricted band measurement

Pol	Hgt. (m)	frequency (MHz)	Amplitude (dBuV)	Pre-amp (dB)	Cable loss (dB)	AF (dB/m)	E (dBuV/m)	Pulse correction factor (dB)	E afrer correction dBuV/m	limit (dBuV/m)	Margin (dB)
h	1	240	28.4	-30.1	1.1	17.5	16.9	-6.3	10.6	46	-35.4
h	1	285	28.97	-30.2	1.3	19	19.07	-6.3	12.77	46	-33.23

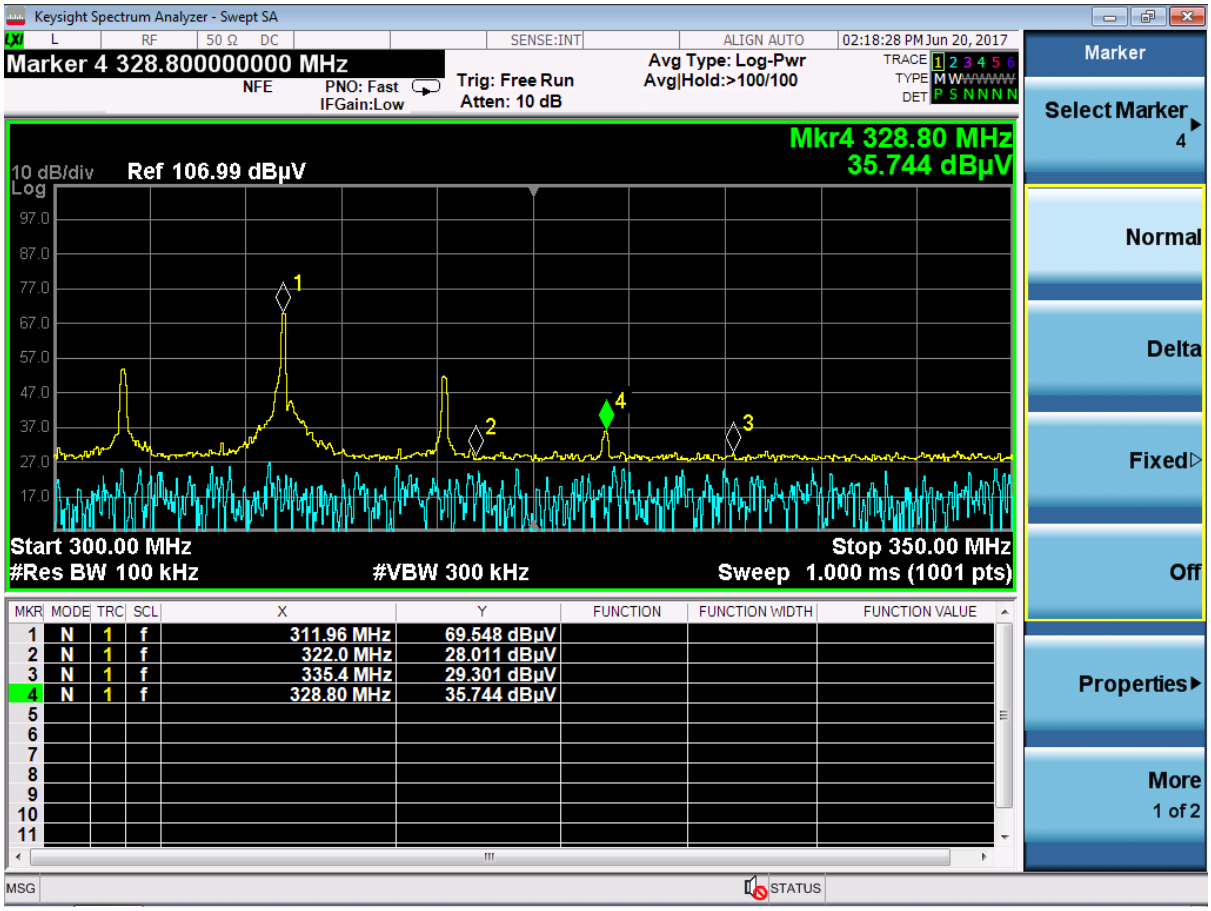

Figure 9 Lower restricted band measurement

Pol	Height (m)	Freq. (MHz)	Amplitude (dBuV)	Pre-amp (dB)	Cable loss (dB)	AF(dB/m)	E dBuV/m	Pulse correction factor (dB)	E afrer correction dBuV/m	limit (dBuV/m)	Margin(dB)
v	1	322	28	-30.2	1.4	19.6	18.8	-6.3	12.5	46	-33.7
v	1	335.4	29.3	-30.2	1.5	19.9	20.5	-6.3	14.2	46	-32
v	1	328.8	35.74	-30.2	1.4	19.8	26.74	-6.3	20.44	46	-25.56

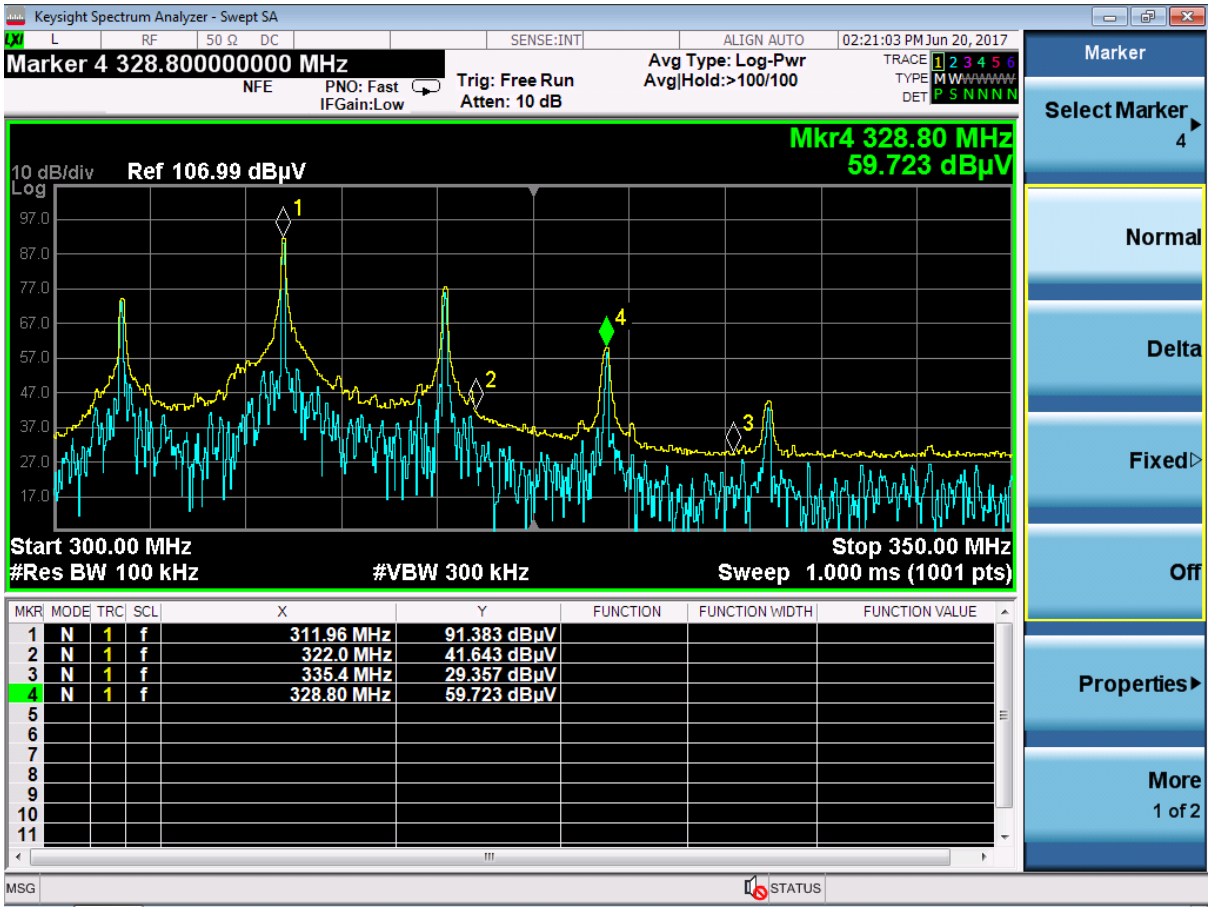

Figure 10 Lower restricted band measurement

Pol	Height (m)	frequency (MHz)	Amplitude (dBuV)	Preamp (dB)	Cable loss (dB)	AF (dB/m)	E dBuV/m	Pulse correction factor (dB)	E afrer correction dBuV/m	limit (dBuV/m)	Margin (dB)
h		322	41.6	-30.2	1.4	19.6	32.4	-6.3	26.1	46	-19.9
h		335.4	29.4	-30.2	1.5	19.9	20.6	-6.3	14.3	46	-31.7
h		328.8	59.7	-30.2	1.4	19.8	50.7	-6.3	44.4	46	-1.6

Section 8 Bandwidth Measurements

The purpose of this test is to test compliance to the following part of the FCC and ICES Rules:

47CFR15.231(c)
Rss210 Issue 9 Clause A1.2

Requirement:
The bandwidth of the emission shall be no wider than 0.25% of the centre frequency for devices operating above 70 MHz and below 900 MHz.

The bandwidth measurements are summarised as follows:

Polarity	Centre frequency (MHz)	0.25% of centre frequency (MHz)	0.25% of centre frequency (kHz)	Measured 20dB bandwidth (kHz)	99% occupied bandwidth (kHz)	Summary	Figure
H	312.00	0.780	780.0	6.741	6.808	Complies	Figure 11
V	312.00	0.780	780.0	6.742	6.808	Complies	Figure 12

Figure 11 Bandwidth measurement horizontal polarity

Figure 12 bandwidth measurement vertical polarity

Section 9 Transmission On Time

The purpose of this test is to test compliance to the following part of the FCC Rules:

47CFR14.231(a)(1)
RSS210 Issue 9 Clause A1.1

Requirement:
A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

Methods: Test methods: ANSIC63.10-2013 Clause reference 7.4.

The output of the apparatus was measured using an antenna. The spectrum analyser centre frequency was tuned to 312MHz and the span set to zero span. The sweep time was set such that the complete pulse train was captured. The apparatus was operated manually until the pulse train was captured.

Measured length until automatic deactivation (seconds)	Limit (Seconds)	Result summary	Figure
1.182	5.0	Complies	Figure 13

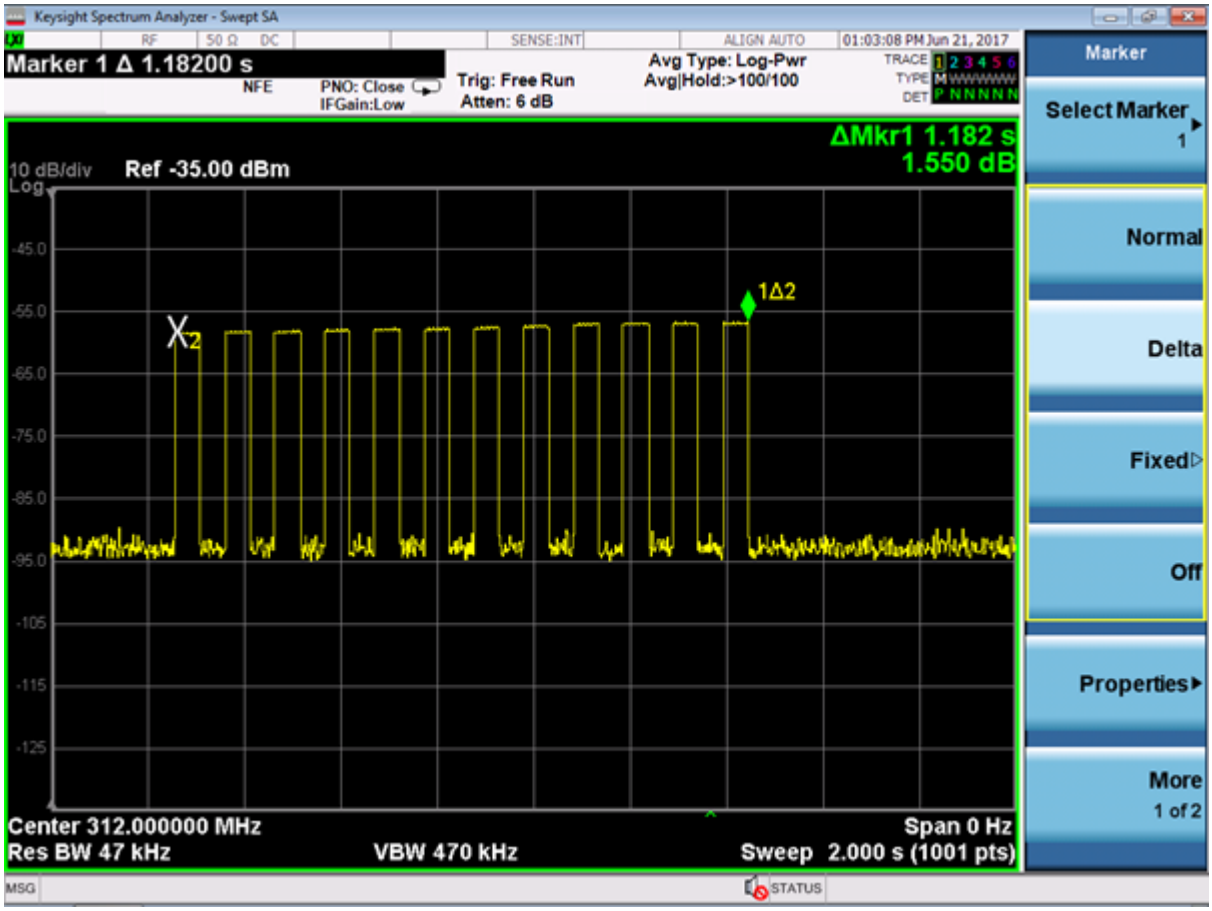

Figure 13 Measurement of pulse deactivation time.

Appendix A EUT Test Photos

Test set up photographs are supplied separately.

Appendix B Pulse correction factor

Since the apparatus employs pulsed operation it is necessary to apply a correction factor.

FCC Rule Part: 47CFR15.35 (c)

Procedure: ANSIC63.10-2013 Clause 7.5.

Refer to Figures 14 and 15.

The centre frequency of the spectrum analyser was tuned to 312MHz and the span set to zero span mode. The sweep time was adjusted to capture the pulse

Method of ANSIC63.10 Clause 10.6.3

Correction = (nt)/T

Where n = 1, t=48.5ms, T = >100ms (measured values)

Therefore correction - = 48.5/100 = 0.485

In dB = 20log(0.471) = **-6.3dB**

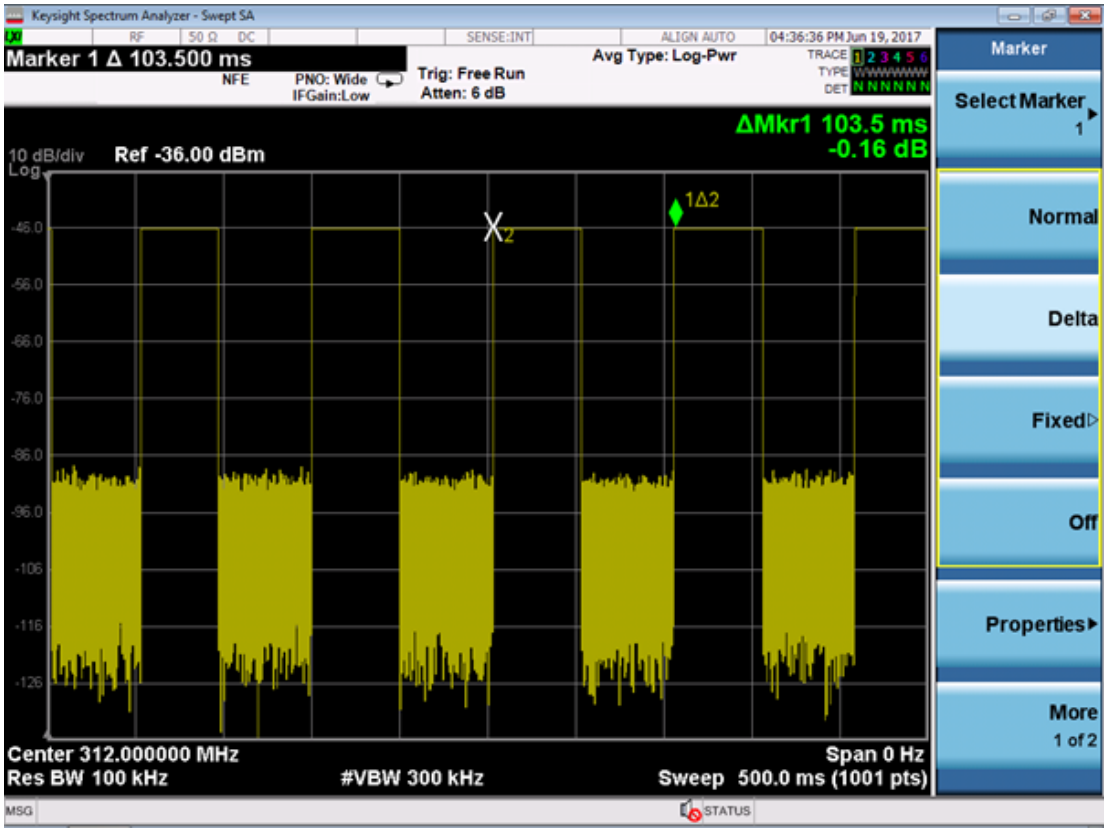

Figure 14 Measurement of pulse width T

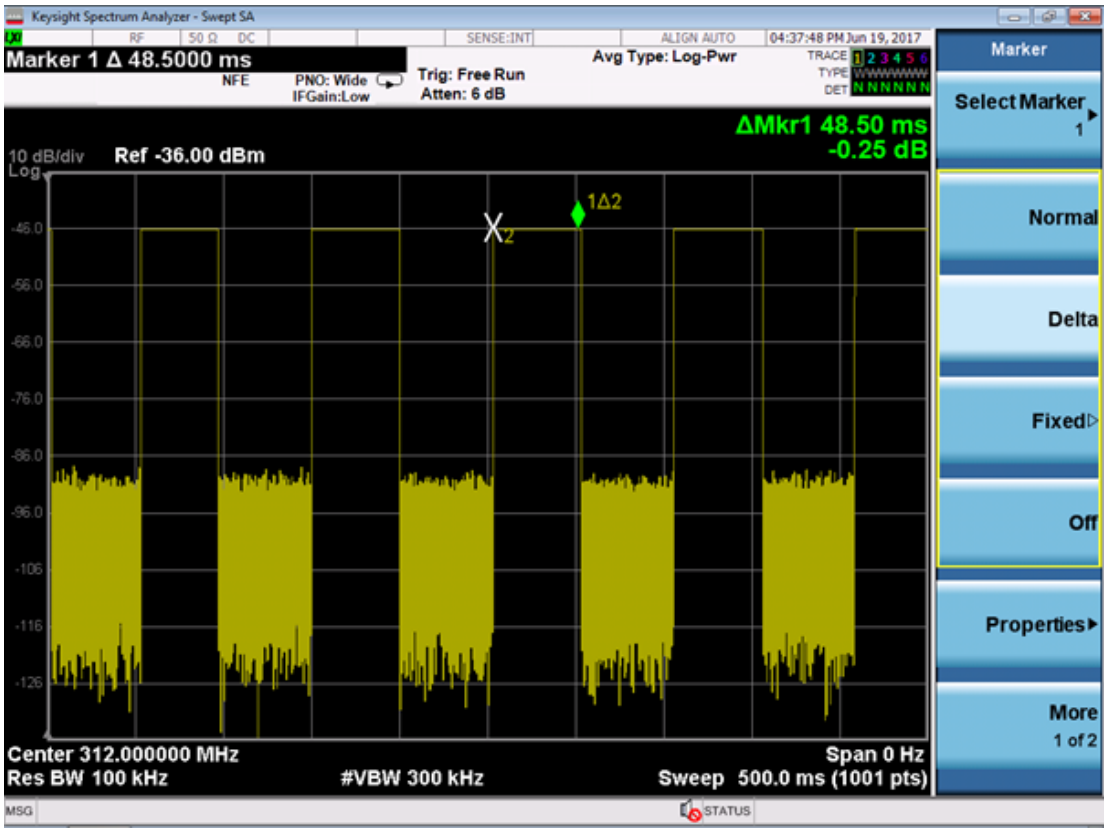

Figure 15 Measurement of pulse width t

Appendix C Test Equipment List

Radiated Emissions Equipment

Item	Serial No.	Last Calibration Date	Calibration Interval
Laboratory 1 Semi-Anechoic Chamber	Lab 1	07/12/2016	24 Months
ETS Lindgren 2017B Mast (1 – 4m) with tilting mechanism	--	N/A	N/A
EMCO Loop antenna 6512	00148043	20/04/2016	24 Months
Chase CPA9231 Pre amplifier	1434	14/02/2017	12 Months
HF18 Cable (For use from 9kHz to 18GHz)	167004-001	14/02/2017	12 Months
Keysight PXA EMI Receiver / signal analyser	MY54170531	07/09/2016	12 Months
Chase CBL6112B Bilog Antenna	2763	21/02/2017	12 Months
6dB Attenuator (For use with Bilog Antenna)	78708B	21/02/2017	12 Months
HF14 Cable (For use from 9kHz to 18GHz)	167003-001	14/02/2017	12 Months
HF17 Cable (For use from 9kHz to 18GHz)	167002-001	14/02/2017	12 Months
EMCO 3115 Horn Antenna	9712-5380	04/05/2016	24 Months
BONN BLMA 0118-5A Preamplifier	149759	11/11/2016	12 Months
ETS Lindgren 3116C-PA Horn Antenna with Integral Preamplifier	00209121	21/10/2016	24 Months
Cable (For use from 18GHz to 40GHz)	HF19	03/05/2017	12 Months