FCC Testing of the MiX Telematics International (Pty) Ltd MiX41MC-3G Model 440FT0426 In accordance with FCC 47 CFR Part 15C

Prepared for: MiX Telematics Europe Ltd
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FCC ID: 2AFMS-41MC3G

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RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Steven White	19 November 2019	
Authorised Signatory	Matthew Russell	19 November 2019	

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD document control rules.

ENGINEERING STATEMENT
The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15C. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Mehadi Choudhury	19 November 2019	
Testing	Graeme Lawler	19 November 2019	

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY
A sample of this product was tested and found to be in compliance with FCC 47 CFR Part 15C: 2017.

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1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	08 March 2017
2	To include a declared variant	02 November 2018
3	To include declared variants	19 November 2019

Table 1

1.2 Introduction

Applicant	MiX Telematics Europe Limited
Manufacturer	MiX Telematics International (Pty) Ltd
Model Number(s)	1) MiX41MC-3G 2) MiX424C-2G*
Declared Variant(s)	MiX 45MC-4G (440FT0187) MiX 45MC-4G-B (440FT0191) MiX 44MC-3G-B (U0034MT) MiX 424C-2G MiX 424C-2G-B MiX 494C-2G MiX 494C-2G-B
Serial Number(s)	1) 40000279 2) 41000265
Hardware Version(s)	1) V5A 2) V1 [V2E (pcb)]
Software Version(s)	1) V1.0.9 2) V1.0.9
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2017**
Order Number Date	PO086320 18-October-2016
Date of Receipt of EUT	03-November-2016
Start of Test	05-December-2016
Finish of Test	15-December-2016
Name of Engineer(s)	Mehadi Choudhury and Graeme Lawler
Related Document(s)	ANSI C63.10 (2013) KDB 558074 D01 v03 r05

* The bluetooth low energy circuitry is identical in the products used for testing and therefore conducted testing on the MiX424C-2G is representative.

**The original testing was performed in December 2016 in accordance with FCC 47 CFR Part 15C: 2015. A gap-analysis between the 2015 and 2017 versions of FCC 47 CFR Part 15C was performed by the test lab and it was confirmed that there were no changes to the clauses tested in the present document.

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration: Bluetooth Low Energy				
2.1	15.247 (a)(2)	6 dB Bandwidth	Pass	ANSI C63.10
2.2	15.247 (b)(3)	Maximum Conducted Output Power	Pass	ANSI C63.10
2.3	15.247 (d) and 15.205	Spurious Radiated Emissions	Pass	ANSI C63.10
2.4	15.205	Restricted Band Edges	Pass	ANSI C63.10
2.5	15.247 (d)	Authorised Band Edges	Pass	ANSI C63.10
2.6	15.247 (e)	Power Spectral Density	Pass	ANSI C63.10

Table 2

1.4 Customer Declared Variants

The following product variants (with part numbers) are available:

Part ID	Official Name	Modem	Description
440FT0187	MiX 45MC-4G	SARA-R410M (LTE Cat M1)	MiX 4000 LTE (Model 45MC-4G) Electronic Unit with SRD 434MHz and 915MHz support
440FT0191	MiX 45MC-4G-B	SARA-R410M (LTE Cat M1)	MiX 4000 LTE (Model 45MC-4G-B) Electronic Unit with Battery plugged in and SRD 434MHz and 915MHz support.
U0032MT	MiX 44MC-3G	SARA-U201 (3G)	MiX 44MC-3G (SARA-U201) with SRD (433MHz and 915MHz)
U0034MT	MiX 44MC-3G-B	SARA-U201 (3G)	MiX 44MC-3G (SARA-U201) with Backup Battery Electronic Unit 3G (Global) and SRD (433MHz and 915MHz) support
440FT0082	MiX 494C-2G	SARA-G450 (2G)	MiX 4000 2G (SARA-G450) (Model 494C-2G) Electronic Unit with SRD 434MHz support
440FT0088	MiX 494C-2G-B	SARA-G450 (2G)	MiX 4000 2G (SARA-G450) Electronic Unit with backup battery plugged in and with SRD 434MHz support
U0022MT	MiX 424C-2G	SARA-G350 (2G)	MiX 4000 2G (SARA-G350) with SRD (433MHz) support

All variants listed above contain the same PCB 440AWZ124 but contains different modems. The modems are all of the same manufacturer (uBlox) and have the same PCB footprint.

The LTE and 3G variants have a dual SRD (434 and 915 MHz), while the 2G variants only have SRD support the 434 MHz frequency.

1.5 Application Form

EQUIPMENT DESCRIPTION	
Model Name/Number	MiX41MC-3G
Part Number	440FT0426
Hardware Version	V5A
Software Version	V1.0.9
FCC ID (if applicable)	2AFMS-41MC3G
Industry Canada ID (if applicable)	
Technical Description (Please provide a brief description of the intended use of the equipment)	The MiX4000 is a high-end Fleet Management product integrating 3G GSM modem, GPS receiver, Blue Tooth Low Energy, 915MHz short range transceiver and CAN bus.

POWER SOURCE

☐ AC mains State voltage

AC supply frequency (Hz)

VAC

Max Current

Hz

☐ Single phase ☐ Three phase

And / Or

☒ External DC supply

Nominal voltage 12 V Max Current 0.500 A

Extreme upper voltage 33 V

Extreme lower voltage 10.5 V

Battery

☐ Nickel Cadmium ☐ Lead acid (Vehicle regulated)

☐ Alkaline ☐ Leclanche

☐ Lithium ☐ Other Details :

Volts nominal.

End point voltage as quoted by equipment manufacturer V

FREQUENCY INFORMATION

Frequency Range	2402 to 2480	MHz			
Channel Spacing (where applicable)	2 MHz				
Receiver Frequency Range (if different)	2402 to 2480	MHz			
Channel Spacing (if different)					
Test Frequencies*	Bottom	2402	MHz	Channel Number (if applicable)	0
	Middle	2440	MHz	Channel Number (if applicable)	19
	Top	2480	MHz	Channel Number (if applicable)	39
Intermediate Frequencies			MHz		
Highest Internally Generated Frequency :		2100 MHz			

POWER CHARACTERISTICS						
Maximum TX power	0.01	W				
Minimum TX power		W (if variable)				
Is transmitter intended for :						
Continuous duty				☒	Yes	☒ No
Intermittent duty				☒	Yes	☐ No
If intermittent state DUTY CYCLE						
Transmitter ON	0 seconds					
Transmitter OFF		seconds				

ANTENNA CHARACTERISTICS						
☐	Antenna connector			State impedance		Ohm
☐	Temporary antenna connector			State impedance		Ohm
☒	Integral antenna	Type	PCB tracked	State gain	1.4	dBi
☐	External antenna	Type		State gain		dBi

MODULATION CHARACTERISTICS			
☐	Amplitude	☒	Frequency
☐	Phase	☐	Other (please provide details):
Can the transmitter operate un-modulated?		☐	Yes ☐ No

CLASS OF EMISSION USED	
ITU designation or Class of Emission:	
1	1M50G7D
(if applicable) 2	
(if applicable) 3	
If more than three classes of emission, list separately:	

BATTERY POWER SUPPLY	
Model name/number	Identification/Part number
Manufacturer	Country of Origin

ANCILLARIES (If applicable)	
Model name/number	Identification/Part number
Manufacturer	Country of Origin

EXTREME CONDITIONS					
Extreme test voltages (Max)	33	V	Extreme test voltages (Min)	10.5	V
Nominal DC Voltage	12	V	DC Maximum Current	0.5	A
Maximum temperature	-20	°C	Minimum temperature	60	°C

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

Name: Steve Dawes Position held: Engineering Manager
Date: 03/11/16

1.6 Product Information

1.6.1 Technical Description

The MiX41MC-3G is a high-end Fleet Management product integrating 3G GSM modem, GPS receiver, Blue Tooth Low Energy, 915MHz short range transceiver and CAN bus.

1.7 Deviations from the Standard

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

1.8 EUT Modification Record

The table below details modifications made to the EUT during the test programme.
The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Serial Number: 41000265			
0	As supplied by the customer	Not Applicable	Not Applicable
1	EUT configured using V.29 of test application	Mehadi Choudhury	13-December-2016
Serial Number: 40000279			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

1.9 Test Location

TÜV SÜD Product Service conducted the following tests at our Fareham Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: Bluetooth Low Energy		
6 dB Bandwidth	Mehadi Choudhury	UKAS
Maximum Conducted Output Power	Mehadi Choudhury	UKAS
Spurious Radiated Emissions	Graeme Lawler	UKAS
Restricted Band Edges	Graeme Lawler	UKAS
Authorised Band Edges	Graeme Lawler	UKAS
Power Spectral Density	Mehadi Choudhury	UKAS

Table 4

Office Address:

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

2 Test Details

2.1 6 dB Bandwidth

2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(2)

2.1.2 Equipment Under Test and Modification State

MiX424C-2G, S/N: 41000265 - Modification State 1

2.1.3 Date of Test

12-December-2016

2.1.4 Test Method

The test was performed in accordance with KDB 558074 D01, Clause 8.2.

2.1.5 Environmental Conditions

Ambient Temperature 23.5 °C
Relative Humidity 45.7 %

2.1.6 Test Results

Bluetooth Low Energy

Modulation/Packet Type: GFSK/DH1

Frequency (MHz)	6 dB Bandwidth (kHz)
2402	1052.4
2440	1042.2
2480	1039.3

Table 5

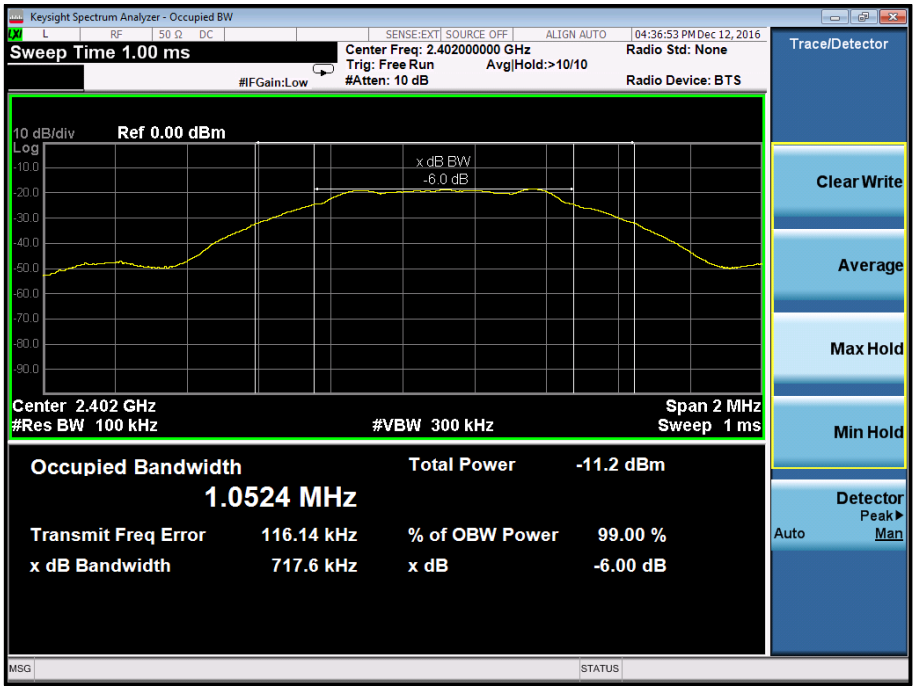

Figure 1 - 2402 MHz

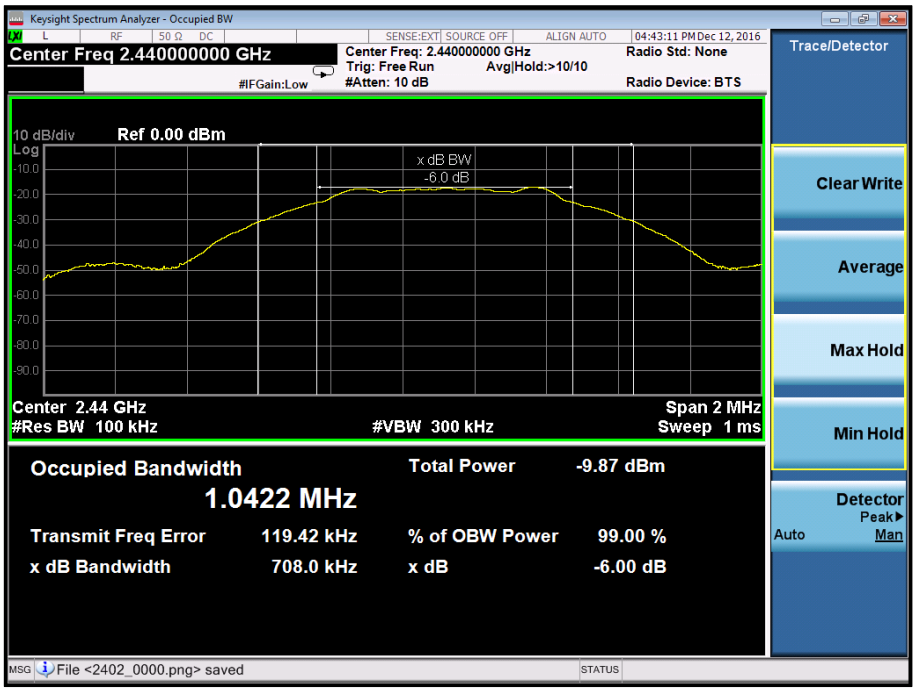

Figure 2 - 2440 MHz

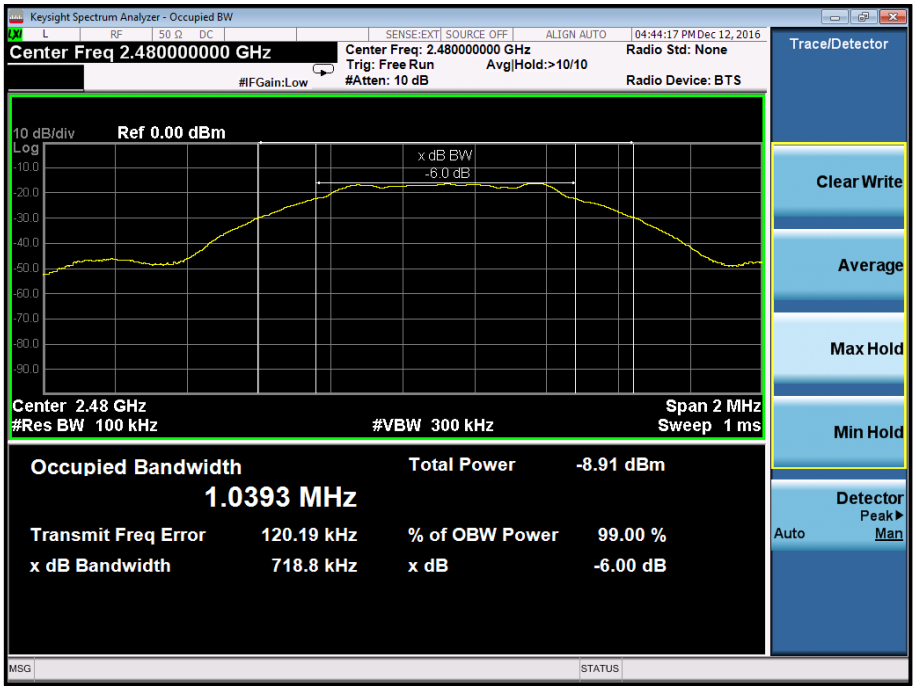

Figure 3 - 2480 MHz

FCC 47 CFR Part 15, Limit Clause 15.247 (a)(2)

The minimum 6 dB Bandwidth shall be at least 500 kHz.

2.1.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Dual Power Supply Unit	Hewlett Packard	6253A	271	-	O/P Mon
20dB SMA Attenuator dc - 18GHz	Sealectro	60-674-1020-89	345	12	30-Jun-2017
Multimeter	Iso-tech	IDM101	2419	12	14-Nov-2017
Hygrometer	Rotronic	I-1000	3220	12	23-Aug-2017
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	15-Sep-2017
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	08-Sep-2017
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	05-Mar-2017
PXA Signal Analyser	Keysight Technologies	N9030A	4653	12	24-Oct-2017
1 metre SMA Cable	IW Microwave	3PS-1806LC-394-3PS	4726	12	03-Aug-2017

Table 6

O/P Mon – Output Monitored using calibrated equipment

2.2 Maximum Conducted Output Power

2.2.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (b)(3)

2.2.2 Equipment Under Test and Modification State

MiX424C-2G, S/N: 41000265 - Modification State 1

2.2.3 Date of Test

13-December-2016

2.2.4 Test Method

The test was performed in accordance with ANSI C63.10, Clause 11.9.1.1

2.2.5 Environmental Conditions

Ambient Temperature 24.5 °C
Relative Humidity 44.0 %

2.2.6 Test Results

Bluetooth Low Energy

Modulation/Packet Type: GFSK/DH1

Frequency (MHz)	Output Power	
	dBm	mW
2402	6.15	4.12
2440	6.34	4.31
2480	6.45	4.42

Table 7

FCC 47 CFR Part 15, Limit Clause 15.247 (b)

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

2.2.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Dual Power Supply Unit	Hewlett Packard	6253A	271	-	O/P Mon
20dB SMA Attenuator dc - 18GHz	Sealectro	60-674-1020-89	345	12	30-Jun-2017
Multimeter	Iso-tech	IDM101	2419	12	14-Nov-2017
Hygrometer	Rotronic	I-1000	3220	12	23-Aug-2017
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	15-Sep-2017
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	08-Sep-2017
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	05-Mar-2017
PXA Signal Analyser	Keysight Technologies	N9030A	4653	12	24-Oct-2017
1 metre SMA Cable	IW Microwave	3PS-1806LC-394-3PS	4726	12	03-Aug-2017

Table 8

O/P Mon – Output Monitored using calibrated equipment

2.3 Spurious Radiated Emissions

2.3.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d) and 15.205

2.3.2 Equipment Under Test and Modification State

MiX41MC-3G, S/N: 40000279 - Modification State 0

2.3.3 Date of Test

06-December-2016

2.3.4 Test Method

Testing was performed in accordance with ANSI C63.10, Clause 11.11, 11.12.1 and 11.12.2.7

Plots for average measurements were taken in accordance with ANSI C63.10, Clause 4.1.4.2.3

Final average measurements were taken in accordance with ANSI C63.10, Clause 4.1.4.2.2

2.3.5 Environmental Conditions

Ambient Temperature	19.5 °C
Relative Humidity	45.0 %

2.3.6 Test Results

Bluetooth Low Energy

2402 MHz

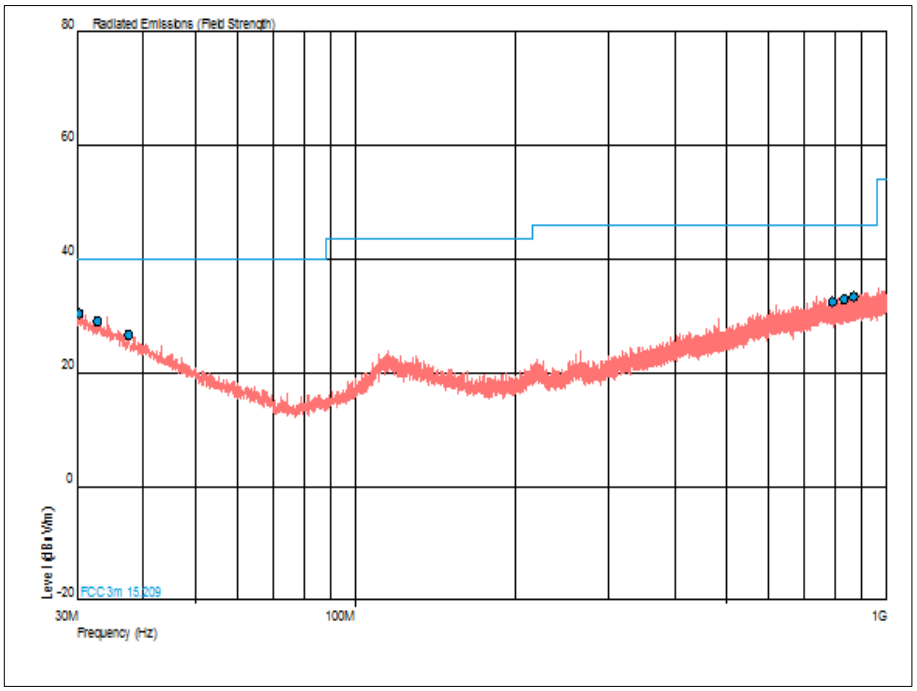

Figure 4 - Frequency Range Under Test: 30 MHz to 1 GHz - Polarity Horizontal and Vertical

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle(Deg)	Height(m)	Polarity
30.211	30.4	40.0	-9.6	0	1.00	Horizontal
32.746	29.0	40.0	-11.0	0	1.00	Horizontal
37.555	26.6	40.0	-13.4	0	1.00	Vertical
791.660	32.5	46.0	-13.5	0	1.00	Vertical
833.862	32.9	46.0	-13.1	0	1.00	Horizontal
866.252	33.4	46.0	-12.6	0	1.00	Horizontal

Table 9

1 GHz to 25 GHz

Frequency (GHz)	Result (µV/m)		Limit (µV/m)		Margin (µV/m)	
	Peak	Average	Peak	Average	Peak	Average
4.804240	668.34	369.40	5000.00	500.00	4331.66	130.60
12.011327	1417.42	420.73	5000.00	500.00	3582.58	79.27

Table 10

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

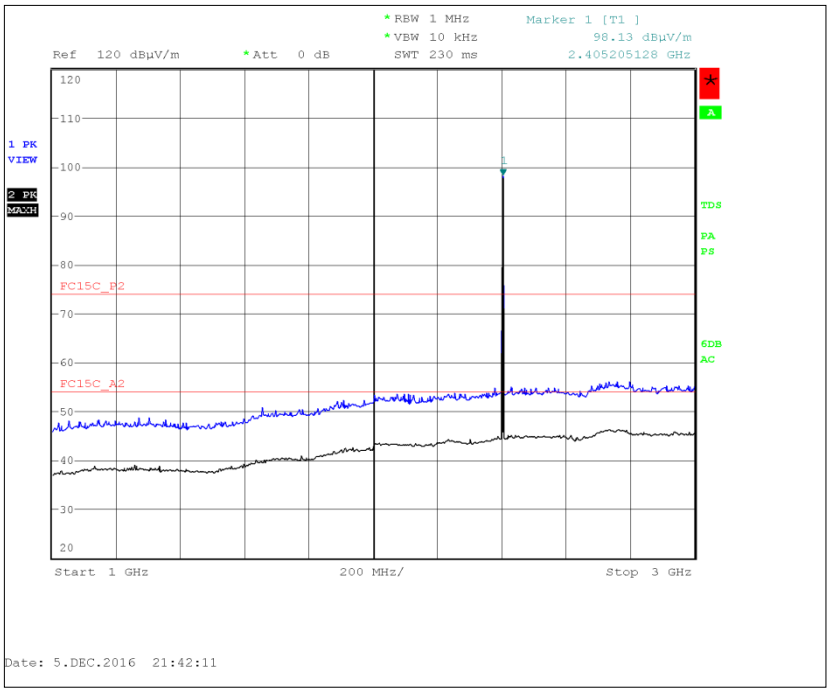

Figure 5 - Frequency Range Under Test: 1 GHz to 3 GHz - Polarity: Horizontal and Vertical

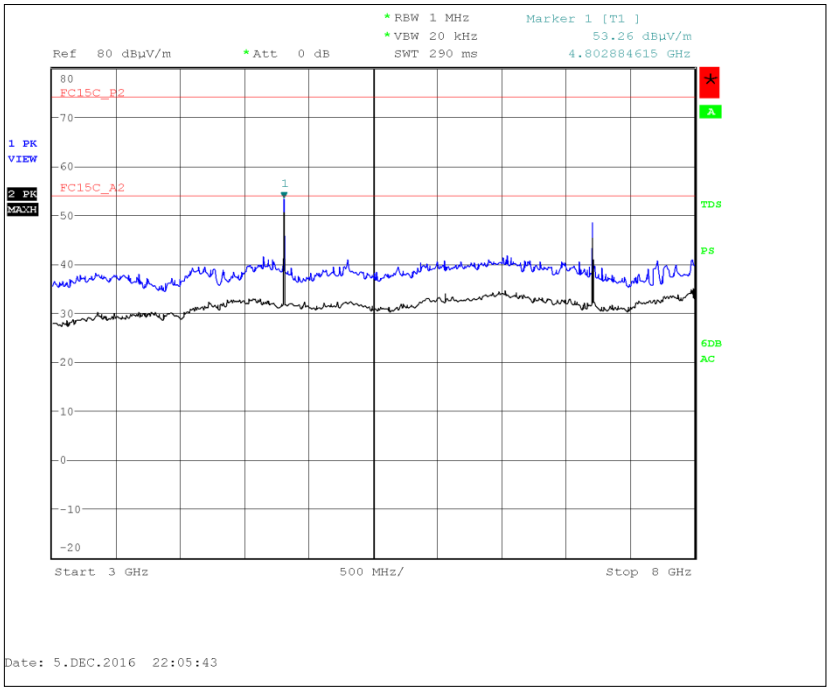

Figure 6 - Frequency Range Under Test: 3 GHz to 8 GHz - Polarity: Horizontal and Vertical

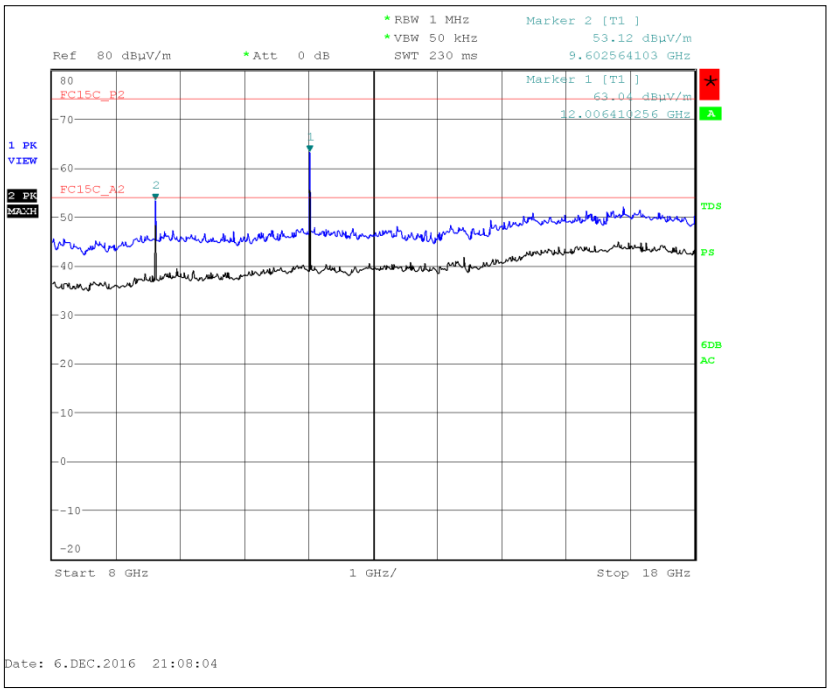

Figure 7 - Frequency Range Under Test: 8 GHz to 18 GHz - Polarity: Horizontal and Vertical

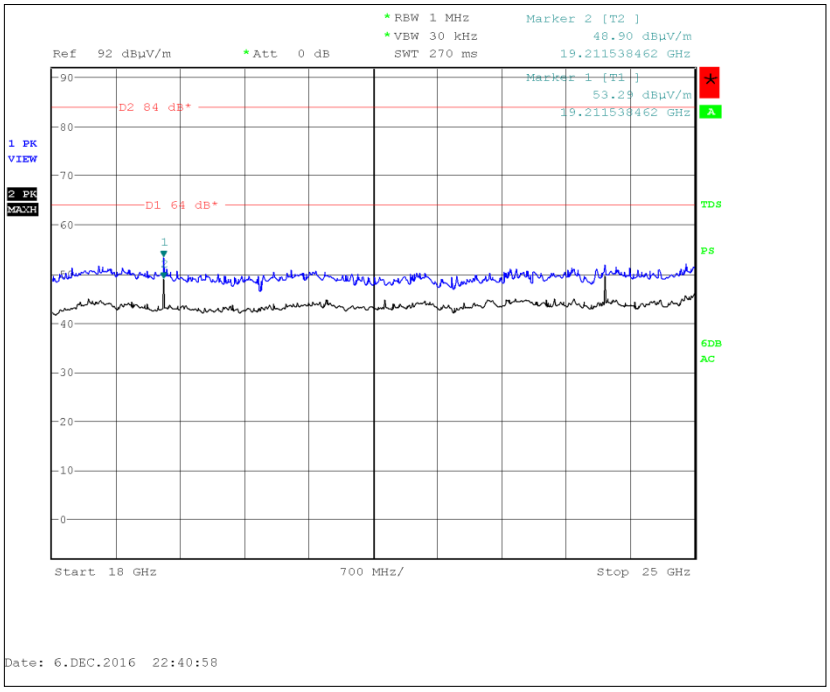

Figure 8 - Frequency Range Under Test: 18 GHz to 25 GHz - Polarity: Horizontal and Vertical

2440 MHz

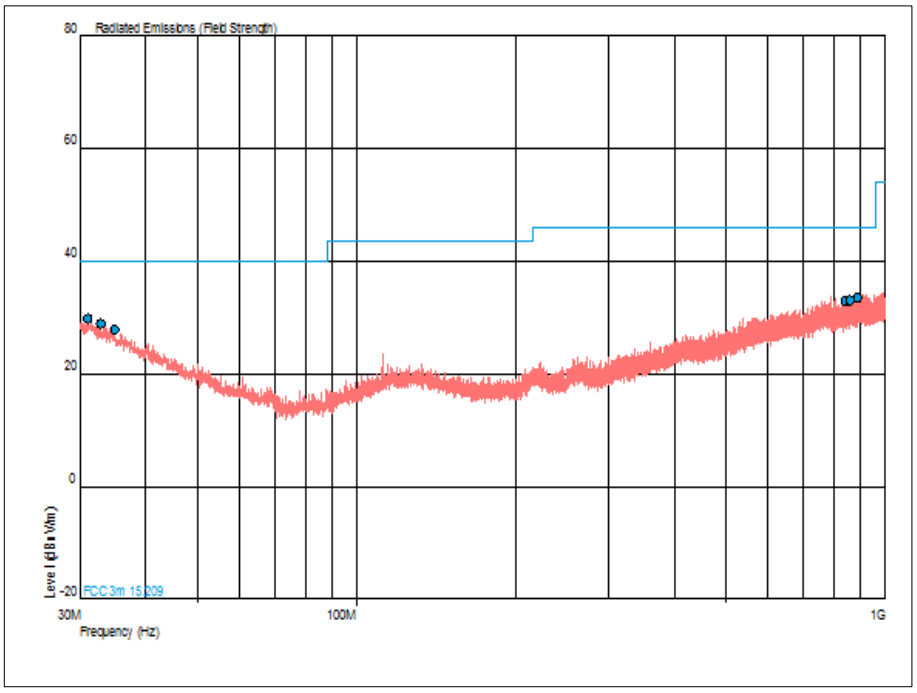

Figure 9 - Frequency Range Under Test: 30 MHz to 1 GHz - Polarity Horizontal and Vertical

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle(Deg)	Height(m)	Polarity
31.126	29.7	40.0	-10.3	0	1.00	Vertical
32.902	28.8	40.0	-11.2	0	1.00	Vertical
34.897	27.8	40.0	-12.2	0	1.00	Vertical
840.228	32.9	46.0	-13.1	0	1.00	Vertical
858.823	33.0	46.0	-13.0	0	1.00	Vertical
888.516	33.5	46.0	-12.5	0	1.00	Vertical

Table 11

1 GHz to 25 GHz

Frequency (GHz)	Result (µV/m)		Limit (µV/m)		Margin (µV/m)	
	Peak	Average	Peak	Average	Peak	Average
4.880269	819.41	451.86	5000.00	500.00	4180.59	48.14
7.320393	434.51	266.99	5000.00	500.00	4565.49	233.01
12.200680	1061.70	342.37	5000.00	500.00	3938.30	157.63

Table 12

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

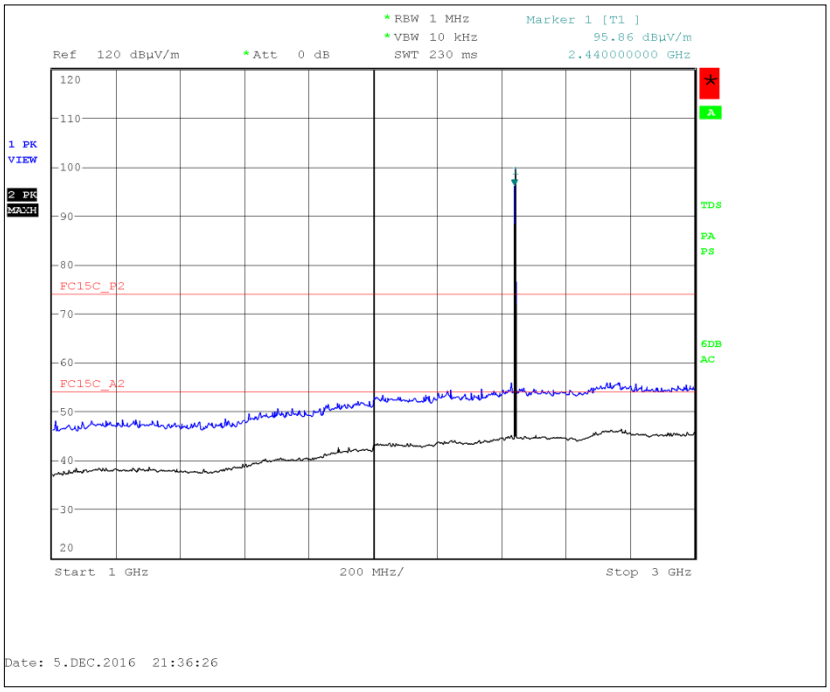

Figure 10 - Frequency Range Under Test: 1 GHz to 3 GHz - Polarity: Horizontal and Vertical

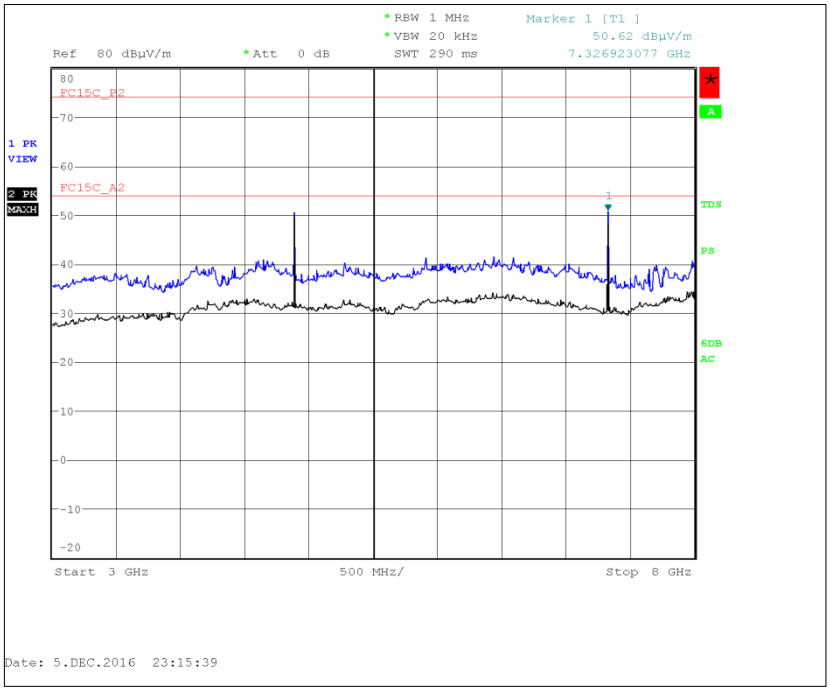

Figure 11 - Frequency Range Under Test: 3 GHz to 8 GHz - Polarity: Horizontal and Vertical

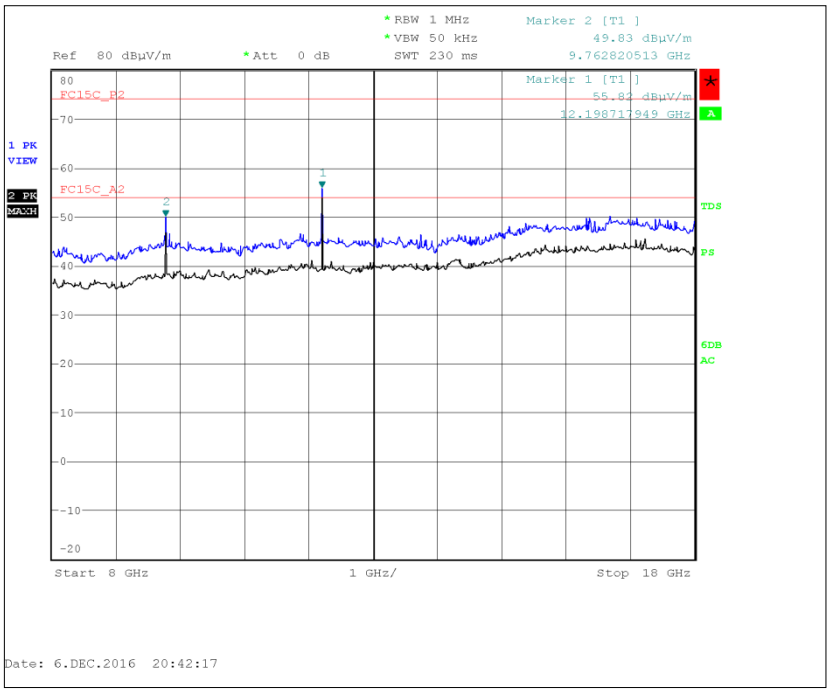

Figure 12 - Frequency Range Under Test: 8 GHz to 18 GHz - Polarity: Horizontal and Vertical

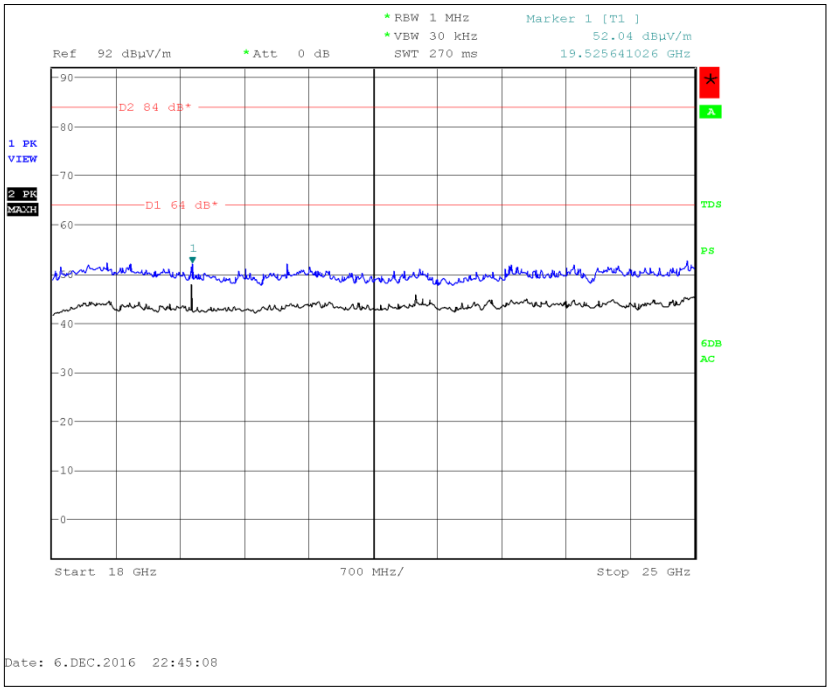

Figure 13 - Frequency Range Under Test: 18 GHz to 25 GHz - Polarity: Horizontal and Vertical

2480 MHz

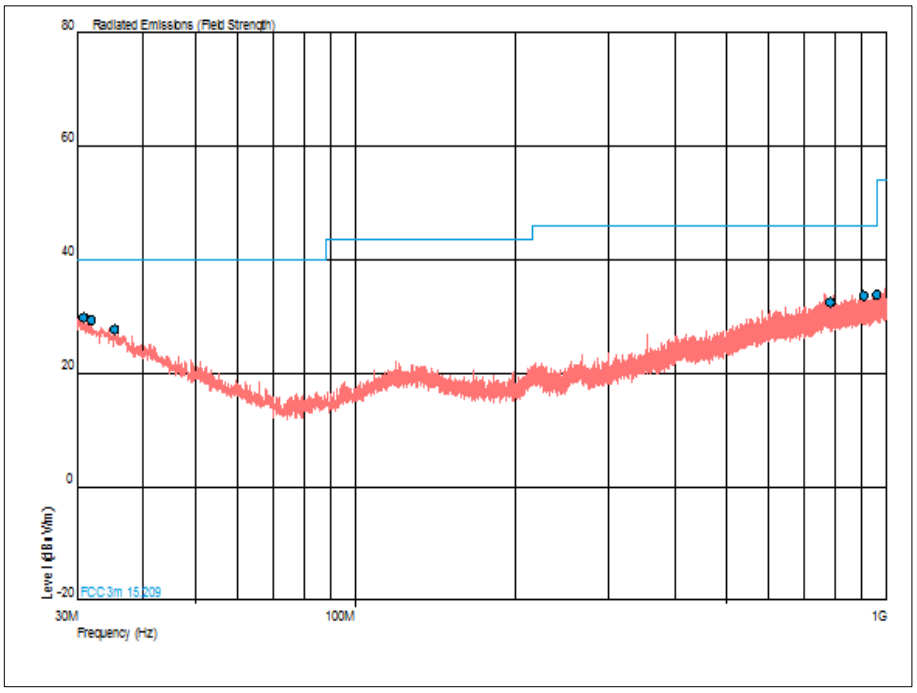

Figure 14 - Frequency Range Under Test: 30 MHz to 1 GHz - Polarity Horizontal and Vertical

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle(Deg)	Height(m)	Polarity
30.843	29.8	40.0	-10.2	0	1.00	Vertical
31.940	29.4	40.0	-10.6	0	1.00	Vertical
35.329	27.6	40.0	-12.4	0	1.00	Vertical
783.019	32.5	46.0	-13.5	0	1.00	Vertical
906.350	33.6	46.0	-12.4	0	1.00	Vertical
958.513	33.7	46.0	-12.3	0	1.00	Vertical

Table 13

1 GHz to 25 GHz

Frequency (GHz)	Result (µV/m)		Limit (µV/m)		Margin (µV/m)	
	Peak	Average	Peak	Average	Peak	Average
7.440440	457.61	260.02	5000.00	500.00	4542.39	239.98
12.401341	861.99	345.94	5000.00	500.00	4138.01	154.06

Table 14

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

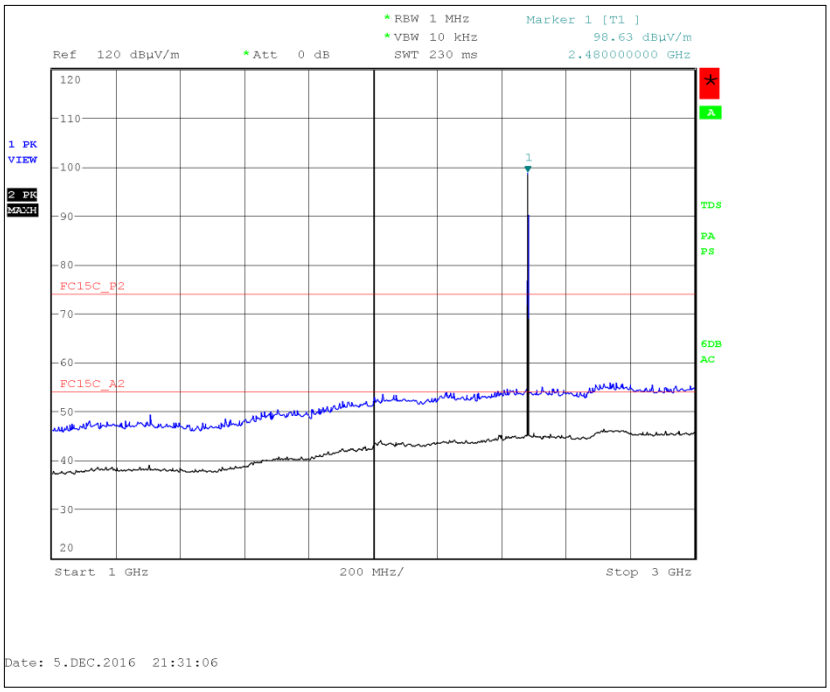

Figure 15 - Frequency Range Under Test: 1 GHz to 3 GHz - Polarity: Horizontal and Vertical

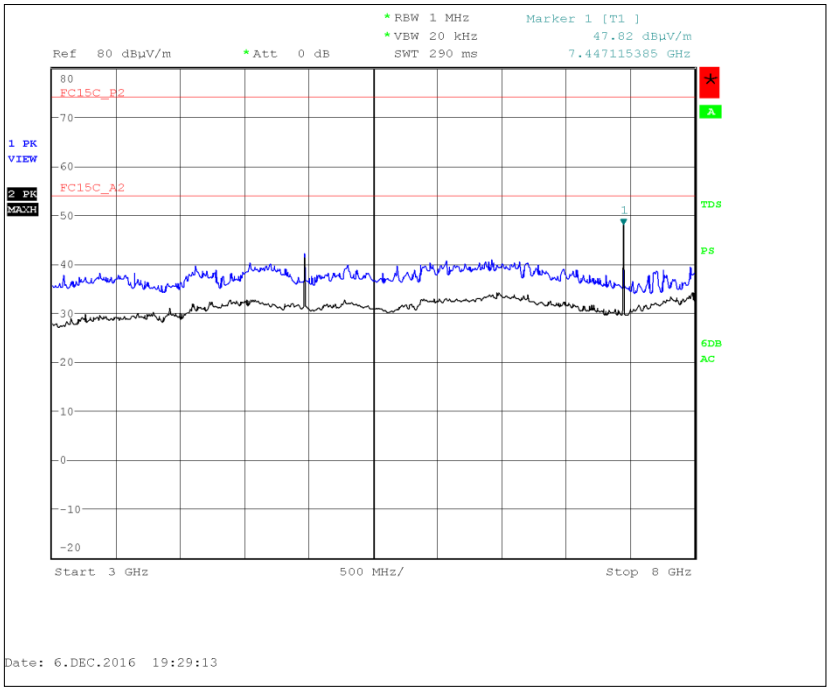

Figure 16 - Frequency Range Under Test: 3 GHz to 8 GHz - Polarity: Horizontal and Vertical

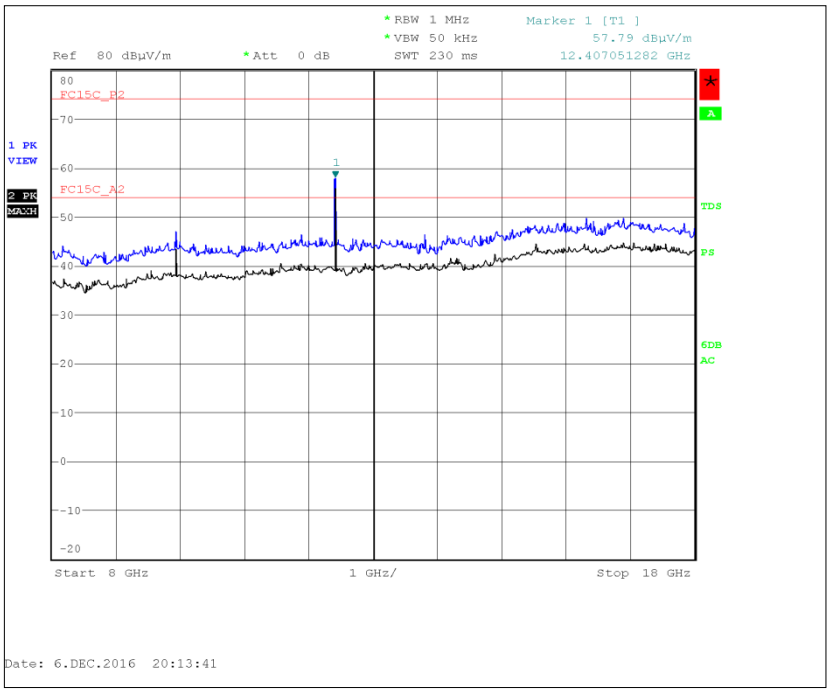

Figure 17 - Frequency Range Under Test: 8 GHz to 18 GHz - Polarity: Horizontal and Vertical

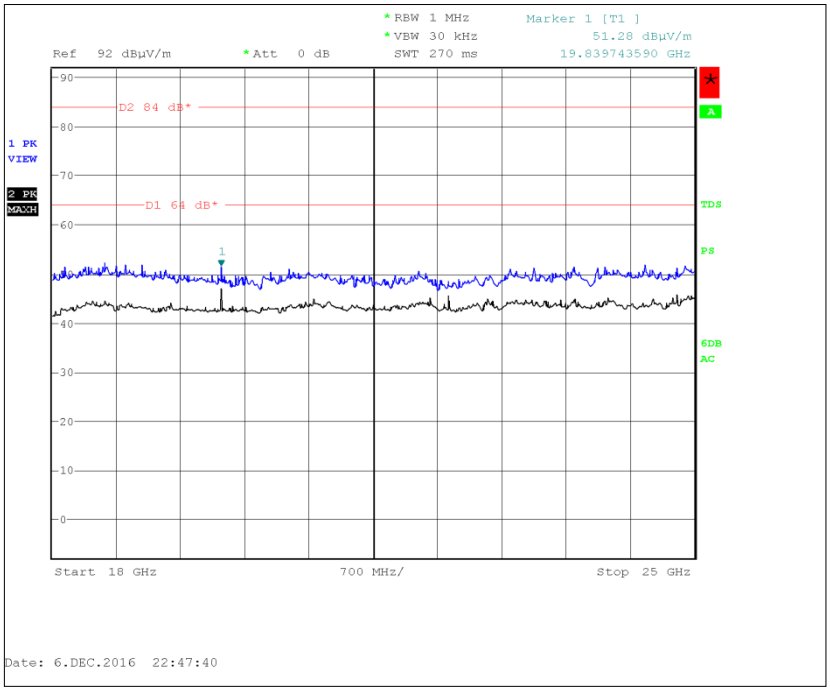

Figure 18 - Frequency Range Under Test: 18 GHz to 25 GHz - Polarity: Horizontal and Vertical

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in 15.209(a)

2.3.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Pre-Amplifier	Phase One	PS04-0086	1533	12	29-Jul-2017
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Hygrometer	Rotronic	HYGROPALM 1	2338	12	21-Sep-2017
Multimeter	Iso-tech	IDM101	2417	12	30-Sep-2017
Antenna (Bilog)	Chase	CBL6143	2904	24	11-Jun-2017
Signal Generator (10MHz to 40GHz)	Rohde & Schwarz	SMR40	3171	12	02-Nov-2017
Cable (N-N, 8m)	Rhophase	NPS-2302-8000-NPS	3248	-	O/P Mon
Signal Generator: 10MHz to 20GHz	Rohde & Schwarz	SMR20	3475	12	26-Feb-2017
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	12-Nov-2017
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
1GHz to 8GHz Low Noise Amplifier	Wright Technologies	APS04-0085	4365	12	17-Oct-2017
Suspended Substrate Highpass Filter	Advance Power Components	11SH10-3000/X18000-O/O	4411	12	23-Mar-2017
Suspended Substrate Highpass Filter	Advance Power Components	11SH10-3000/X18000-O/O	4412	12	23-Mar-2017
Cable (Yellow, Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4527	-	O/P Mon
Cable (Rx, SMAm-SMAm 0.5m)	Scott Cables	SLSLL18-SMSM-00.50M	4528	6	03-Feb-2017
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	29-Dec-2016
4 Channel PSU	Rohde & Schwarz	HMP4040	4736	-	O/P Mon

Table 15

TU – Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment

2.4 Restricted Band Edges

2.4.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.205

2.4.2 Equipment Under Test and Modification State

MiX41MC-3G, S/N: 40000279 - Modification State 0

2.4.3 Date of Test

05-December-2016

2.4.4 Test Method

The test was performed in accordance ANSI C63.10 clause 11.13.1, 6.3, 6.6 and 6.10.5.

Plots for average measurements were taken in accordance with ANSI C63.10, clause 4.1.4.2.3.

Final average measurements were taken in accordance with ANSI C63.10, clause 4.1.4.2.2.

2.4.5 Environmental Conditions

Ambient Temperature 24.0 °C
Relative Humidity 45.5.0 %

2.4.6 Test Results

Bluetooth Low Energy

Modulation	Frequency (MHz)	Measured Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBµV/m)
GFSK	2402	2390.0	62.38	46.19
GFSK	2480	2483.5	62.93	46.44

Table 16

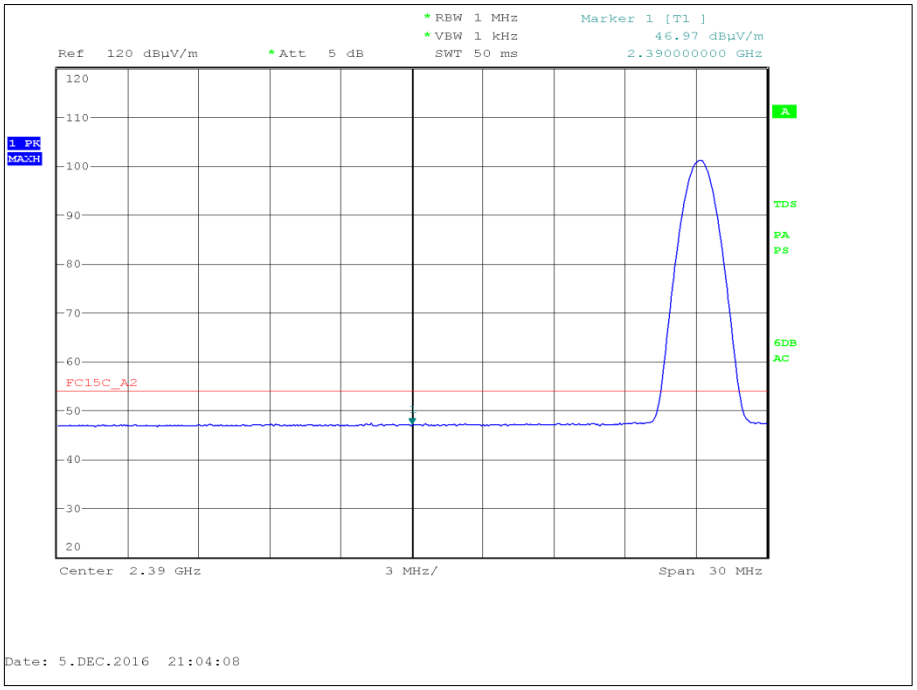

Figure 19 - GFSK 2402 MHz, Measured Frequency 2390.0 MHz, Average

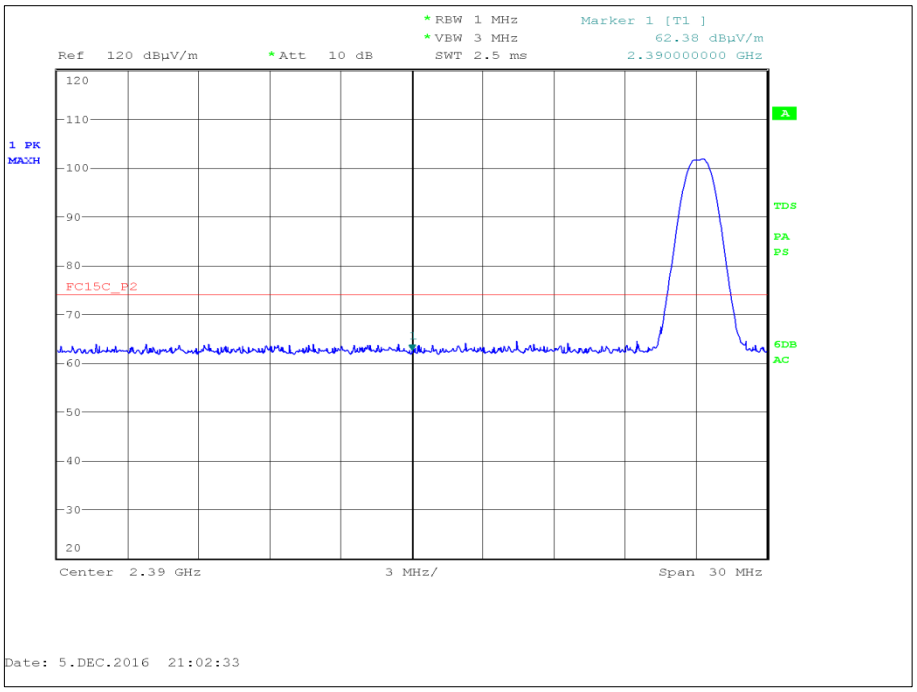

Figure 20 – GFSK 2402 MHz, Measured Frequency 2390.0 MHz, Peak

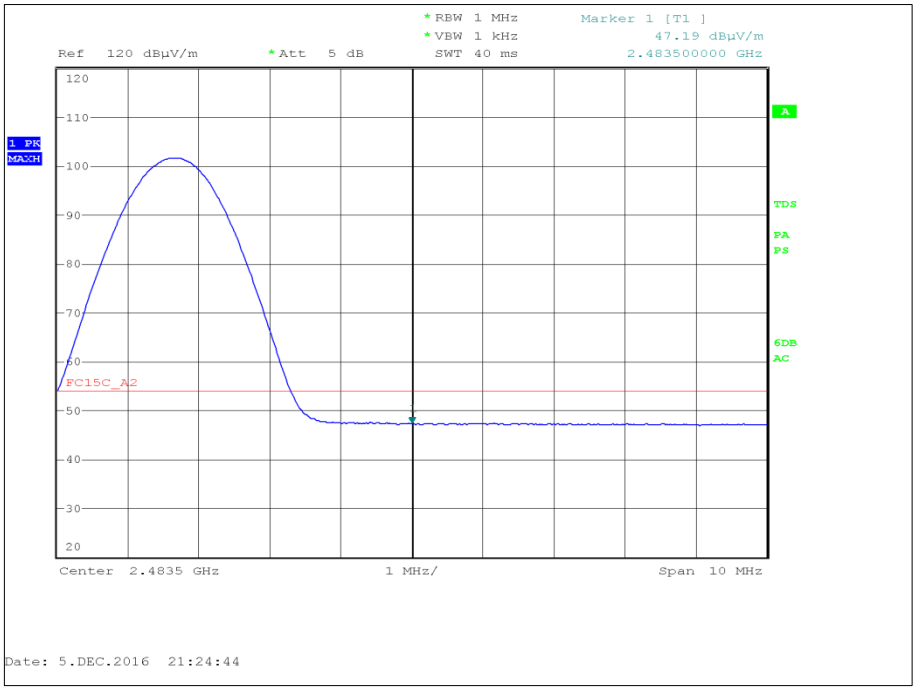

Figure 21 - GFSK 2480 MHz, Measured Frequency 2483.5 MHz, Average

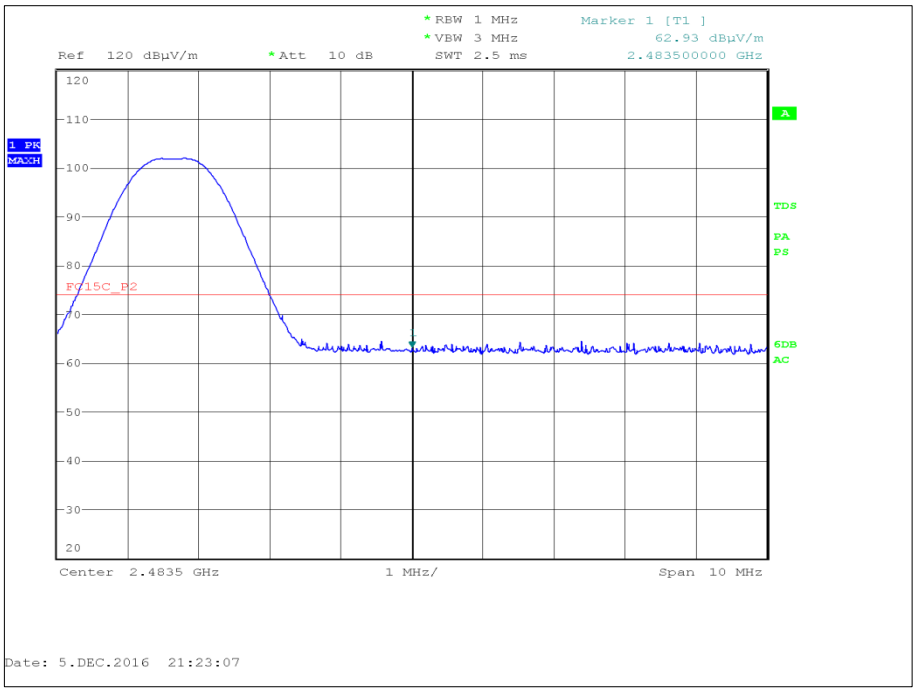

Figure 22 - GFSK 2480 MHz, Measured Frequency 2483.5 MHz, Peak

FCC 47 CFR Part 15, Limit Clause 15.205

	Peak (dBµV/m)	Average (dBµV/m)
Restricted Bands of Operation	74	54

Table 17

2.4.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Hygrometer	Rotronic	A1	1388	12	13-Apr-2017
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Hygrometer	Rotronic	HYGROPALM 1	2338	12	21-Sep-2017
Cable (N-N, 8m)	Rhophase	NPS-2302-8000-NPS	3248	-	O/P Mon
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	12-Nov-2017
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
Cable (Yellow, Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4527	-	O/P Mon
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	29-Dec-2016
4 Channel PSU	Rohde & Schwarz	HMP4040	4736	-	O/P Mon

Table 18

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment

2.5 Authorised Band Edges

2.5.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d)

2.5.2 Equipment Under Test and Modification State

MiX41MC-3G, S/N: 40000279 - Modification State 0

2.5.3 Date of Test

05-December-2016

2.5.4 Test Method

The test was performed in accordance ANSI C63.10, Clause 11.13.1, 6.3, 6.6 and 6.10.4.

2.5.5 Environmental Conditions

Ambient Temperature 22.7 °C
Relative Humidity 24.0 %

2.5.6 Test Results

Bluetooth Low Energy

Modulation	Frequency (MHz)	Measured Frequency (MHz)	Peak Level (dBµV/m)
GFSK	2402	2400.0	52.07
GFSK	2480	2483.5	51.80

Table 19

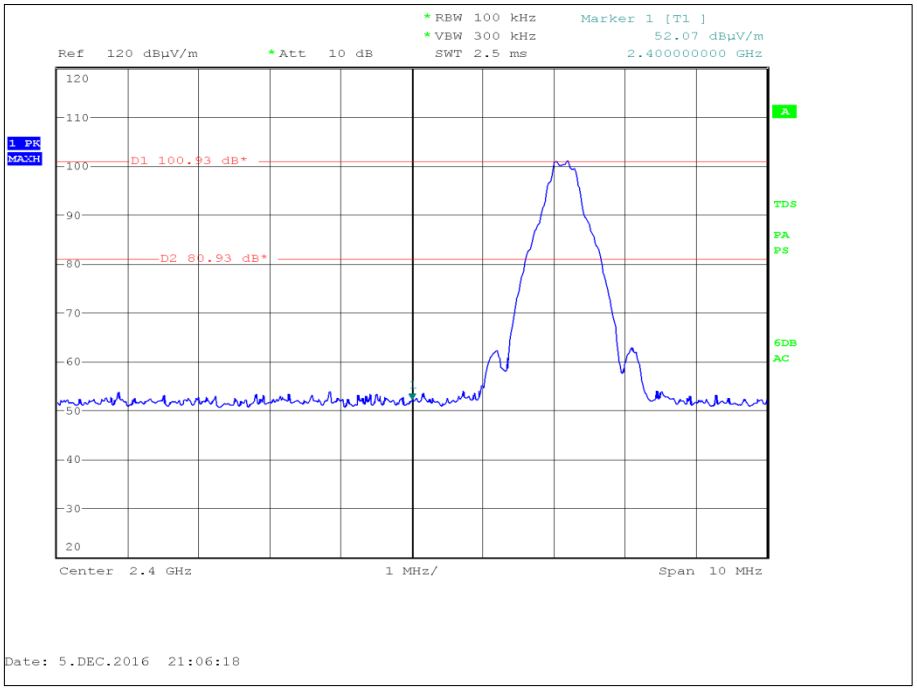

Figure 23 – GFSK 2402 MHz, Measured Frequency 2400.00 MHz

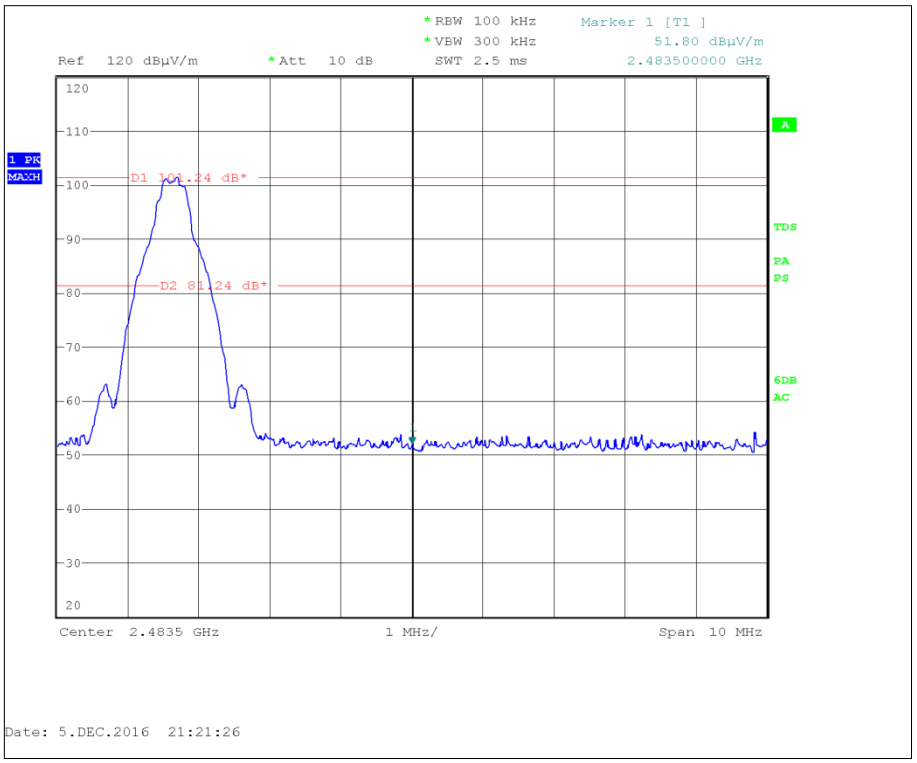

Figure 24 – GFSK 2480 MHz, Measured Frequency 2483.50 MHz

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

20 dB below the fundamental measured in a 100 kHz bandwidth using a peak detector. If the transmitter complies with the conducted power limits, based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB below the fundamental instead of 20 dB.

2.5.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Hygrometer	Rotronic	A1	1388	12	13-Apr-2017
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Hygrometer	Rotronic	HYGROPALM 1	2338	12	21-Sep-2017
Cable (N-N, 8m)	Rhophase	NPS-2302-8000-NPS	3248	-	O/P Mon
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	12-Nov-2017
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
Cable (Yellow, Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4527	-	O/P Mon
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	29-Dec-2016
4 Channel PSU	Rohde & Schwarz	HMP4040	4736	-	O/P Mon

Table 20

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment

2.6 Power Spectral Density

2.6.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (e)

2.6.2 Equipment Under Test and Modification State

MiX424C-2G, S/N: 41000265 - Modification State 1

2.6.3 Date of Test

13-December-2016

2.6.4 Test Method

The test was performed in accordance with ANSI C63.10, Clause 11.10.2.

2.6.5 Environmental Conditions

Ambient Temperature 24.5 °C
Relative Humidity 44.0 %

2.6.6 Test Results

Bluetooth Low Energy, GFSK

Frequency (MHz)	Power Spectral Density (dBm)
2402	-3.79
2440	-3.63
2480	-3.67

Table 21

Figure 25 - 2402 MHz

Figure 26 - 2440 MHz

Figure 27 - 2480 MHz

FCC 47 CFR Part 15, Limit Clause 15.247 (e)

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

2.6.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Dual Power Supply Unit	Hewlett Packard	6253A	271	-	O/P Mon
20dB SMA Attenuator dc - 18GHz	Sealectro	60-674-1020-89	345	12	30-Jun-2017
Multimeter	Iso-tech	IDM101	2419	12	14-Nov-2017
Hygrometer	Rotronic	I-1000	3220	12	23-Aug-2017
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	15-Sep-2017
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	08-Sep-2017
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	05-Mar-2017
PXA Signal Analyser	Keysight Technologies	N9030A	4653	12	24-Oct-2017
1 metre SMA Cable	IW Microwave	3PS-1806LC-394-3PS	4726	12	03-Aug-2017

Table 22

O/P Mon – Output Monitored using calibrated equipment

3 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Name	Measurement Uncertainty
6 dB Bandwidth	± 212.114 kHz
Maximum Conducted Output Power	± 0.70 dB
Spurious Radiated Emissions	30 MHz to 1 GHz: ± 5.1 dB 1 GHz to 40 GHz: ± 6.3 dB
Restricted Band Edges	30 MHz to 1 GHz: ± 5.1 dB 1 GHz to 40 GHz: ± 6.3 dB
Authorised Band Edges	Conducted: ± 3.08 dB Radiated: 30 MHz to 1 GHz: ± 5.1 dB Radiated: 1 GHz to 40 GHz: ± 6.3 dB
Power Spectral Density	± 3.0 dB

Table 23