FCC and Industry Canada Testing of the Inmarsat Global Ltd Handheld Satellite Phone, Model: IsatPhone2w In accordance with FCC 47 CFR Part 15C, Industry Canada RSS-247 and Industry Canada RSS-GEN

Product Service

Choose certainty.
Add value.

Prepared for: Inmarsat Global Ltd
99 City Road
London
England
EC1Y 1AX
United Kingdom

FCC ID: YCT-IsatPhone2w
IC: 8944A-IsatPhone2w

COMMERCIAL-IN-CONFIDENCE

Date: July 2017
Document Number: 75935241-06 | Issue: 01

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Steven White	21 July 2017	
Authorised Signatory	Simon Bennett	21 July 2017	

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service 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, Industry Canada RSS-247 and Industry Canada RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Graeme Lawler	21 July 2017	
Testing	Dan Ralley	21 July 2017	

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

Industry Canada Accreditation
IC2932B-1 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:2016, Industry Canada RSS-247: Issue 1 (05-2015) and Industry Canada RSS-GEN: Issue 4 (11-2014).

TÜV SÜD Product Service
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Product Service

Contents

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	21 July 2017

Table 1

1.2 Introduction

Applicant	Inmarsat Global Ltd
Manufacturer	Inmarsat Global Ltd
Model Number(s)	IsatPhone2w
Serial Number(s)	IMEI 353032044022321 and IMEI 353032044022966
Hardware Version(s)	2403
Software Version(s)	Isat2.1-20170202004652
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2016 Industry Canada RSS-247: Issue 1 (05-2015) Industry Canada RSS-GEN: Issue 4 (11-2014)
Order Number Date	57/00098-01 03-June-2016
Date of Receipt of EUT	13-February-2017
Start of Test	14-February-2017
Finish of Test	23-March-2017
Name of Engineer(s)	Graeme Lawler and Dan Ralley
Related Document(s)	ANSI C63.10 (2013)

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C, Industry Canada RSS-247 and Industry Canada RSS-GEN is shown below.

Section	Specification Clause			Test Description	Result	Comments/Base Standard
	Part 15C	RSS-247	RSS-GEN			
Configuration: Bluetooth						
2.1	15.207	-	8.8	AC Power Line Conducted Emissions	Pass	ANSI C63.10
2.2	15.247 (b)(1)	5.4	-	Maximum Conducted Output Power	Pass	ANSI C63.10
2.3	15.247 (a)(1)(iii)	5.1	-	Frequency Hopping Systems - Average Time of Occupancy	Pass	ANSI C63.10
2.4	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - Channel Separation	Pass	ANSI C63.10
2.5	15.247 (a)(1)(iii)	5.1	-	Frequency Hopping Systems - Number of Hopping Channels	Pass	ANSI C63.10
2.6	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - 20 dB Bandwidth	Pass	ANSI C63.10
2.7	15.247 (d) and 15.205	5.5	8.10	Spurious Radiated Emissions	Pass	ANSI C63.10
2.8	15.205	-	8.10	Restricted Band Edges	Pass	ANSI C63.10
2.9	15.247 (d)	5.5	-	Authorised Band Edges	Pass	ANSI C63.10

Table 2

1.4 Application Form

EQUIPMENT DESCRIPTION	
Model Name/Number	Isatphone2w
Part Number	
Hardware Version	2403
Software Version	Isat2.1-20170202004652
FCC ID (if applicable)	YCT-IsatPhone2w
Industry Canada ID (if applicable)	8944A-IsatPhone2w
Technical Description (Please provide a brief description of the intended use of the equipment)	Handheld Satellite phone for Inmarsat GMR2+ satellite network system

Types of Modulations used by the Equipment	
☒	FHSS
☐	Other forms of modulation
In case of FHSS Modulation	
In case of non-Adaptive Frequency Hopping equipment:	
	Number of Hopping Frequencies: 79
In case of Adaptive Frequency Hopping Equipment:	
	Maximum number of Hopping Frequencies: 79
	Minimum number of Hopping Frequencies: 20
Dwell Time: 0.625	
Adaptive / non-adaptive equipment:	
☐	non-adaptive Equipment
☐	adaptive Equipment without the possibility to switch to a non-adaptive mode
☒	adaptive Equipment which can also operate in a non-adaptive mode
In case of adaptive equipment:	
The maximum Channel Occupancy Time implemented by the equipment: 2.905 ms	
☐	The equipment has implemented an LBT based DAA mechanism
In case of equipment using modulation different from FHSS:	
☐	The equipment is Frame Based equipment
☐	The equipment is Load Based equipment
☐	The equipment can switch dynamically between Frame Based and Load Based equipment
The CCA time implemented by the equipment: µs	
☒	The equipment has implemented an non-LBT based DAA mechanism
☐	The equipment can operate in more than one adaptive mode

In case of non-adaptive Equipment:		
The maximum RF Output Power (e.i.r.p.): 6.2 dBm		
The maximum (corresponding) Duty Cycle: 77 %		
Equipment with dynamic behaviour, that behaviour is described here. (e.g. the different combinations of duty cycle and corresponding power levels to be declared):		
NA		
The worst case operational mode for each of the following tests:		
RF Output Power:		
Power Spectral Density:		
Duty cycle, Tx-Sequence, Tx-gap:		
Accumulated Transmit Time, Frequency Occupation & Hopping Sequence (only for FHSS equipment):		
Hopping Frequency Separation (only for FHSS equipment):		
Medium Utilisation:		
Adaptivity & Receiver Blocking:		
Nominal Channel Bandwidth:		
Transmitter unwanted emissions in the OOB domain:		
Transmitter unwanted emissions in the spurious domain: DH5		
Receiver spurious emissions:		
The different transmit operating modes (tick all that apply):		
☒	Operating mode 1: Single Antenna Equipment	
	☒	Equipment with only 1 antenna
	☐	Equipment with 2 diversity antennas but only 1 antenna active at any moment in time
	☐	Smart Antenna Systems with 2 or more antennas, but operating in a (legacy) mode where only 1 antenna is used. (e.g. IEEE 802.11™ [i.3] legacy mode in smart antenna systems)
☐	Operating mode 2: Smart Antenna Systems - Multiple Antennas without beam forming	
	☐	Single spatial stream / Standard throughput / (e.g. IEEE 802.11™ [i.3] legacy mode)
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 2
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 3
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 4
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 5
NOTE: Add more lines if more channel bandwidths are supported.		
☐	Operating mode 3: Smart Antenna Systems - Multiple Antennas with beam forming	
	☐	Single spatial stream / Standard throughput (e.g. IEEE 802.11™ [i.3] legacy mode)
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 2
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 3
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 4
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 5
NOTE: Add more lines if more channel bandwidths are supported.		

In case of Smart Antenna Systems:
The number of Receive chains:
The number of Transmit chains:
☐ symmetrical power distribution
☐ asymmetrical power distribution
In case of beam forming, the maximum (additional) beam forming gain: dB
NOTE: The additional beam forming gain does not include the basic gain of a single antenna.
Operating Frequency Range(s) of the equipment:
Operating Frequency Range 1: 2402 MHz to 2480 MHz
Operating Frequency Range 2: MHz to MHz
Operating Frequency Range 3: MHz to MHz
NOTE: Add more lines if more Frequency Ranges are supported.
Nominal Channel Bandwidth(s):
Nominal Channel Bandwidth1: 1 MHz
Nominal Channel Bandwidth2: MHz
Nominal Channel Bandwidth3: MHz
Nominal Channel Bandwidth4: MHz
Nominal Channel Bandwidth5: MHz
NOTE: Add more lines if more channel bandwidths are supported.
Type of Equipment (stand-alone, combined, plug-in radio device, etc.):
☐ Stand-alone
☒ Combined Equipment (Equipment where the radio part is fully integrated within another type of equipment)
☐ Plug-in radio device (Equipment intended for a variety of host systems)
☐ Other
The normal and extreme operating conditions that apply to the equipment:
Normal operating conditions (if applicable):
Operating temperature: +25 °C
Other (please specify if applicable):
Extreme operating conditions:
Operating temperature range: Minimum -20 °C to Maximum +55 °C
Other (please specify if applicable): Minimum °C to Maximum °C
Details provided are for the:
☒ stand-alone equipment
☐ combined (or host) equipment
☐ test jig

Product Service

The intended combination(s) of the radio equipment power settings and one or more antenna assemblies and their corresponding e.i.r.p levels:			
Antenna Type:			
☒ Integral Antenna (information to be provided in case of conducted measurements)			
Antenna Gain: 2.2 dBi			
If applicable, additional beamforming gain (excluding basic antenna gain): dB			
☒ Temporary RF connector provided			
☐ No temporary RF connector provided			
☐ Dedicated Antennas (equipment with antenna connector)			
☐ Single power level with corresponding antenna(s)			
☐ Multiple power settings and corresponding antenna(s)			
Number of different Power Levels:			
Power Level 1: dBm			
Power Level 2: dBm			
Power Level 3: dBm			
NOTE 1: Add more lines in case the equipment has more power levels.			
NOTE 2: These power levels are conducted power levels (at antenna connector).			
For each of the Power Levels, provide the intended antenna assemblies, their corresponding gains (G) and the resulting e.i.r.p. levels also taking into account the beamforming gain (Y) if applicable			
Power Level 1: dBm			
Number of antenna assemblies provided for this power level:			
Assembly #	**Gain (dBi)**	**e.i.r.p (dBm)**	**Part number or model number**
1			
2			
3			
4			
NOTE: Add more rows in case more antenna assemblies are supported for this power level.			
Power Level 2: dBm			
Number of antenna assemblies provided for this power level:			
Assembly #	**Gain (dBi)**	**e.i.r.p (dBm)**	**Part number or model number**
1			
2			
3			
4			
NOTE: Add more rows in case more antenna assemblies are supported for this power level.			
Power Level 3: dBm			
Number of antenna assemblies provided for this power level:			
Assembly #	**Gain (dBi)**	**e.i.r.p (dBm)**	**Part number or model number**
1			
2			
3			
4			
NOTE: Add more rows in case more antenna assemblies are supported for this power level.			

The nominal voltages of the stand-alone radio equipment or the nominal voltages of the combined (host) equipment or test jig in case of plug-in devices:	
Details provided are for the:	
☒ stand-alone equipment	
☐ combined (or host) equipment	
☐ test jig	
Supply Voltage ☐ AC mains State AC voltage V	
☒ DC State DC voltage 3.7 V	
In case of DC, indicate the type of power source	
☐ Internal Power Supply	
☐ External Power Supply or AC/DC adapter	
☒ Battery	
☐ Other:	
Describe the test modes available which can facilitate testing:	
BT DUT Testmode to allow tester communication and control. Activated via PC with provided script	
The equipment type (e.g. Bluetooth®, IEEE 802.11™ [i.3] IEEE 802.15.4™ [i.4], proprietary, etc.):	
BLuetooth	
If applicable, the statistical analysis referred in clause 5.4.1 q)	
To be provided as separate attachment	
If applicable, the statistical analysis referred in clause 5.4.1 r)	
To be provided as separate attachment	
Geo-location capability supported by the equipment:	
☐ Yes	
☐ The geographical location determined by the equipment as defined in clause 4.3.1.13.2 or clause 4.3.2.12.2 is not accessible to the user.	
☒ No	
Describe the minimum performance criteria that apply to the equipment (see clause 4.3.1.12.3 or 4.3.2.11.3)	
Combination for testing (see clause 5.3.2.3 of EN 300 328 V21.1)	
From all combinations of conducted power settings and intended antenna assembly(ies) specified in clause 5.4.1 m), specify the combination resulting in the highest e.i.r.p. for the radio equipment. Unless otherwise specified in ETSI EN 300 328, this power setting is to be used for testing against the requirements of ETSI EN 300 328. In case there is more than one such conducted power setting resulting in the same (highest) e.i.r.p. level, the highest power setting is to be used for testing. See also ETS EN 300 328, clause 5.3.2.3	
Highest overall e.i.r.p. value: 6.2 dBm	
Corresponding Antenna assembly gain: 2.2 dBi	Antenna Assembly #: Internal antenna
Corresponding conducted power setting: 4 dBm (also the power level to be used for testing)	Listed as Power Setting #:
Additional information provided by the applicant	
Modulation	
ITU Class(es) of emission: F7D	
Can the transmitter operate unmodulated? ☐ Yes ☒ No	

Duty Cycle	
The transmitter is intended for:	
☒	Continuous duty
☐	Intermittent duty
☐	Continuous operation possible for testing purposes
About the UUT	
☐	The equipment submitted are representative production models
☒	If not, the equipment submitted are pre-production models?
☒	If pre-production equipment are submitted, the final production equipment will be identical in all respects with the equipment tested
☐	If not, supply full details
☐	The equipment submitted is CE marked
Additional items and/or supporting equipment provided	
☒	Spare batteries (e.g. for portable equipment)
☒	Battery charging device
☒	External Power Supply or AC/DC adapter
☐	Test Jig or interface box
☐	RF test fixture (for equipment with integrated antennas)
☐	Host System
	Manufacturer
	Model
	Model Name
☒	Combined equipment
	Manufacturer Inmarsat
	Model Isatphone2w
	Model Name
☒	User Manual
☒	Technical documentation (Handbook and circuit diagrams)

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

Name: Ari Tastula Position held: Senior HW Lead Architect
Date: 10.02.2017

1.5 Product Information

1.5.1 Technical Description

Handheld Satellite phone for Inmarsat GMR2+ satellite network system.

1.6 Deviations from the Standard

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

1.7 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: IMEI 353032044022321			
0	As supplied by the customer	Not Applicable	Not Applicable
Serial Number: IMEI 353032044022966			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

1.8 Test Location

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

Test Name	Name of Engineer(s)	Accreditation
Configuration: Bluetooth		
AC Power Line Conducted Emissions	Graeme Lawler	UKAS
Maximum Conducted Output Power	Dan Ralley	UKAS
Frequency Hopping Systems - Average Time of Occupancy	Dan Ralley	UKAS
Frequency Hopping Systems - Channel Separation	Dan Ralley	UKAS
Frequency Hopping Systems - Number of Hopping Channels	Dan Ralley	UKAS
Frequency Hopping Systems - 20 dB Bandwidth	Dan Ralley	UKAS
Spurious Radiated Emissions	Graeme Lawler	UKAS

Table 4

Product Service

Office Address:

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

2 Test Details

2.1 AC Power Line Conducted Emissions

2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.207
Industry Canada RSS-GEN, Clause 8.8

2.1.2 Equipment Under Test and Modification State

IsatPhone2w, S/N: IMEI 353032044022966 - Modification State 0

2.1.3 Date of Test

15-February-2017

2.1.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.2.

2.1.5 Environmental Conditions

Ambient Temperature	18.0 °C
Relative Humidity	44.0 %

2.1.6 Test Results

Bluetooth

Applied supply Voltage: 60 Hz

Applied supply frequency: 120 V AC

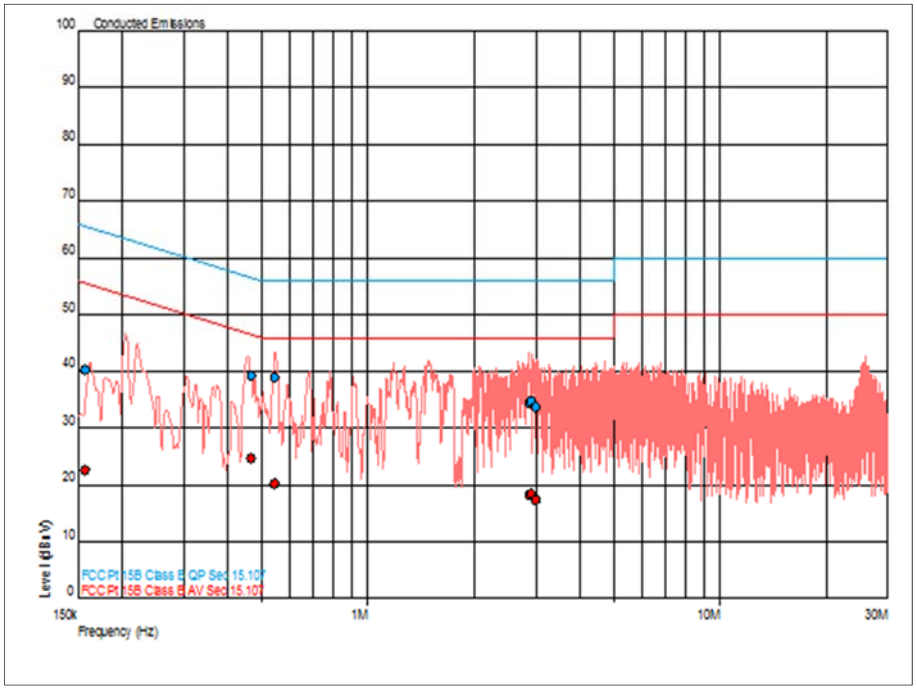

Figure 1 – Live Line

Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Level (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)
0.158	40.3	65.6	-25.3	22.7	55.6	-32.9
0.466	39.2	56.6	-17.4	24.8	46.6	-21.8
0.544	38.8	56.0	-17.2	20.2	46.0	-25.8
2.883	34.4	56.0	-21.6	18.3	46.0	-27.7
2.918	34.7	56.0	-21.3	18.5	46.0	-27.5
3.002	33.7	56.0	-22.3	17.4	46.0	-28.6

Table 5

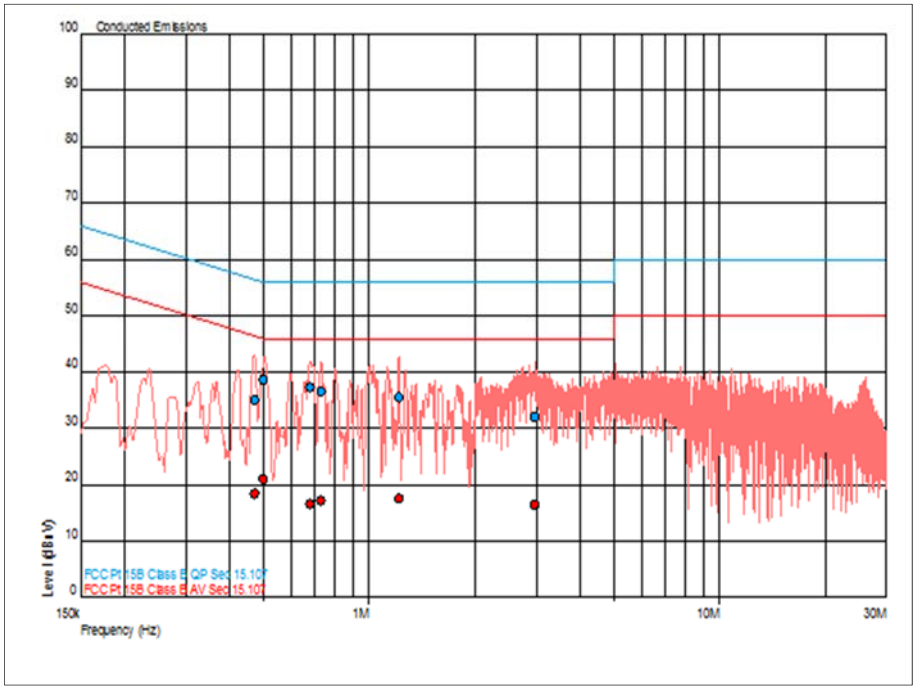

Figure 2 – Neutral Line

Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Level (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)
0.471	35.0	56.5	-21.5	18.5	46.5	-28.0
0.498	38.6	56.0	-17.5	20.9	46.0	-25.1
0.679	37.3	56.0	-18.7	16.6	46.0	-29.4
0.729	36.5	56.0	-19.5	17.2	46.0	-28.8
1.214	35.5	56.0	-20.5	17.5	46.0	-28.5
2.972	32.1	56.0	-23.9	16.5	46.0	-29.5

Table 6

FCC 47 CFR Part 15, Limit Clause 15.207,

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-Peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50

Table 7

*Decreases with the logarithm of the frequency.

Industry Canada RSS-GEN, Limit Clause 8.8,

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-Peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50

Table 8

*Decreases with the logarithm of the frequency.

2.1.7 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
3 phase LISN	Rohde & Schwarz	ESH2-Z5	323	12	07-Apr-2017
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Hygrometer	Rotronic	HYGROPALM 1	2338	12	21-Sep-2017
Transient Limiter	Hewlett Packard	11947A	2378	12	06-Jul-2017
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	12-Nov-2017
Cable (Rx, Nm-Nm, 5m)	Scott Cables	SLU18-NMNM-05.00M	4482	6	06-Jun-2017

Table 9

2.2 Maximum Conducted Output Power

2.2.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (b)(1)
Industry Canada RSS-247, Clause 5.4

2.2.2 Equipment Under Test and Modification State

IsatPhone2w, S/N: IMEI 353032044022321 - Modification State 0

2.2.3 Date of Test

23-February-2017 to 23-March-2017

2.2.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 7.8.5.

The operational mode of the EUT was controlled by a Bluetooth test set.

2.2.5 Environmental Conditions

Ambient Temperature	22.3 °C
Relative Humidity	35.0 %

2.2.6 Test Results

Bluetooth

Testing was performed on the modulation/packet type with the highest conducted output power. This modulation/packet type was 8-DPSK/3DH5.

Frequency (MHz)	Output Power	
	dBm	mW
2402	8.35	6.84
2441	8.24	6.67
2480	7.90	6.17

Table 10

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 frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non overlapping hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

Industry Canada RSS-247, Limit Clause 5.4 (2)

For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W and the e.i.r.p. shall not exceed 4 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W and the e.i.r.p. shall not exceed 0.5 W if the hopset uses less than 75 hopping channels (see Section 5.4(5) for exceptions).

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
Attenuator (20dB/ 2W)	Pasternack	PE7004-20	489	12	14-Dec-2017
Multimeter	Fluke	79 Series III	611	12	14-Sep-2017
Hygrometer	Rotronic	I-1000	3220	12	23-Aug-2017
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	15-Sep-2017
'3.5mm' - '3.5mm' RF Cable (2m)	Rhophase	3PS-1803-2000-3PS	3702	12	13-Dec-2017
Combiner/Splitter	Weinschel	1506A	3877	12	30-Mar-2017
DC - 12.4 GHz 10 dB Attenuator	Suhner	6810.17.A	3965	12	25-Oct-2017
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	08-Sep-2017
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	09-Sep-2017
2 Channel PSU	Rohde & Schwarz	HMP2020	4735	-	O/P Mon
2 metre SMA Cable	IW Microwave	3PS-1806LC-788-3PS	4829	12	24-Jan-2018

Table 11

O/P Mon – Output Monitored

2.3 Frequency Hopping Systems - Average Time of Occupancy

2.3.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)(iii)
Industry Canada RSS-247, Clause 5.1(4)

2.3.2 Equipment Under Test and Modification State

IsatPhone2w, S/N: IMEI 353032044022321 - Modification State 0

2.3.3 Date of Test

24-February-2017

2.3.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 7.8.4.

The trace data was recorded and analysed to determine the number of transmissions. The Average Occupancy Time was calculated by multiplying the number of transmissions by the measured dwell time.

The operational mode of the EUT was controlled by a Bluetooth test set.

2.3.5 Environmental Conditions

Ambient Temperature	22.4 °C
Relative Humidity	33.5 %

2.3.6 Test Results

Bluetooth

Packet Type	Dwell Time (ms)	Number of Transmissions	Average Occupancy Time (ms)
DH1	0.398	320	127.36
DH3	1.648	161	265.33
DH5	2.893	100	289.30

Table 12

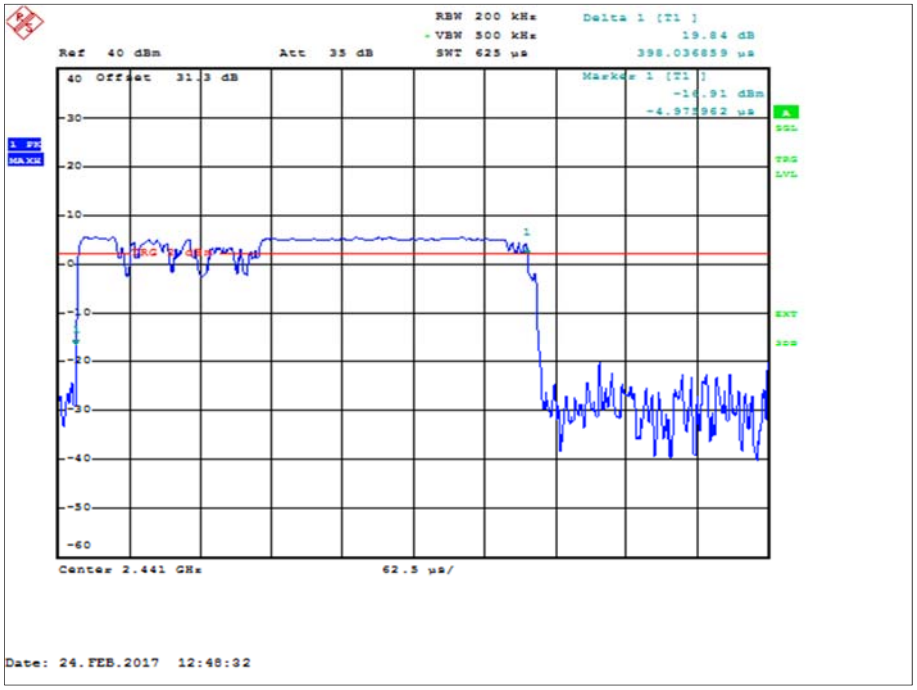

Figure 3 - DH1, Dwell Time

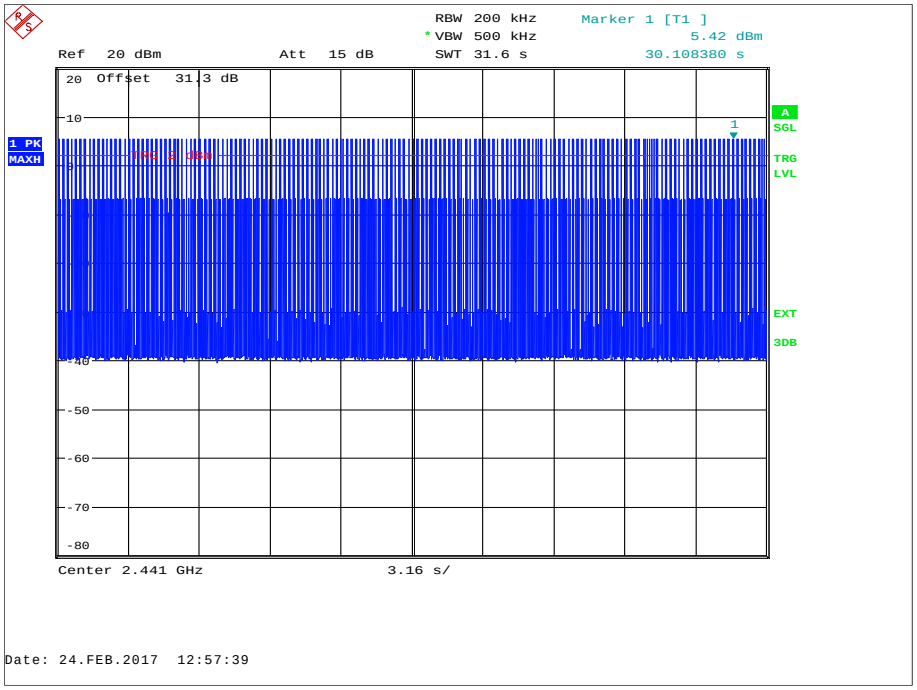

Figure 4 - DH1, Total Average Time of Occupancy

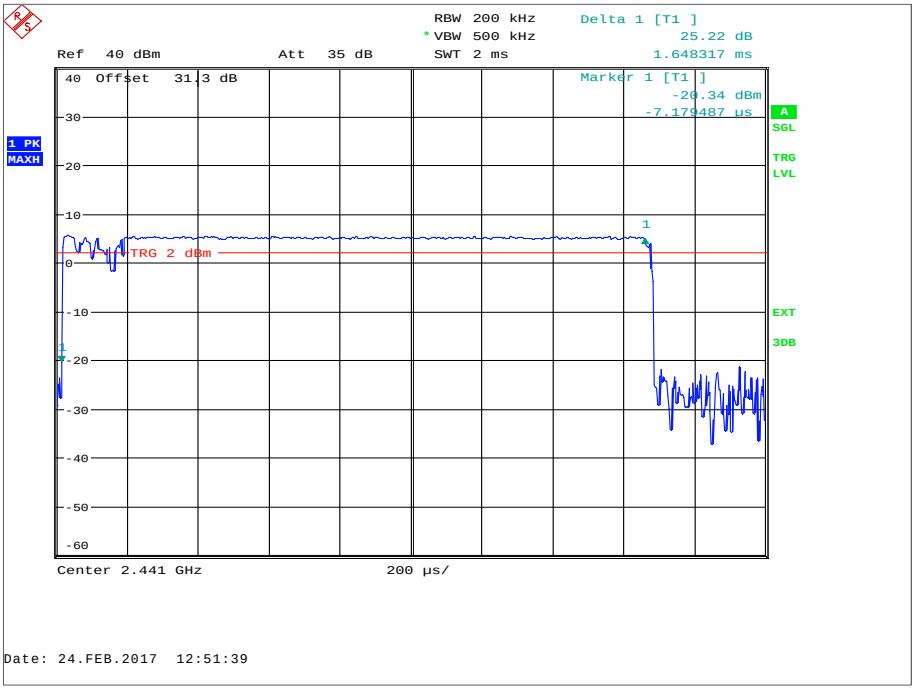

Figure 5 - DH3, Dwell Time

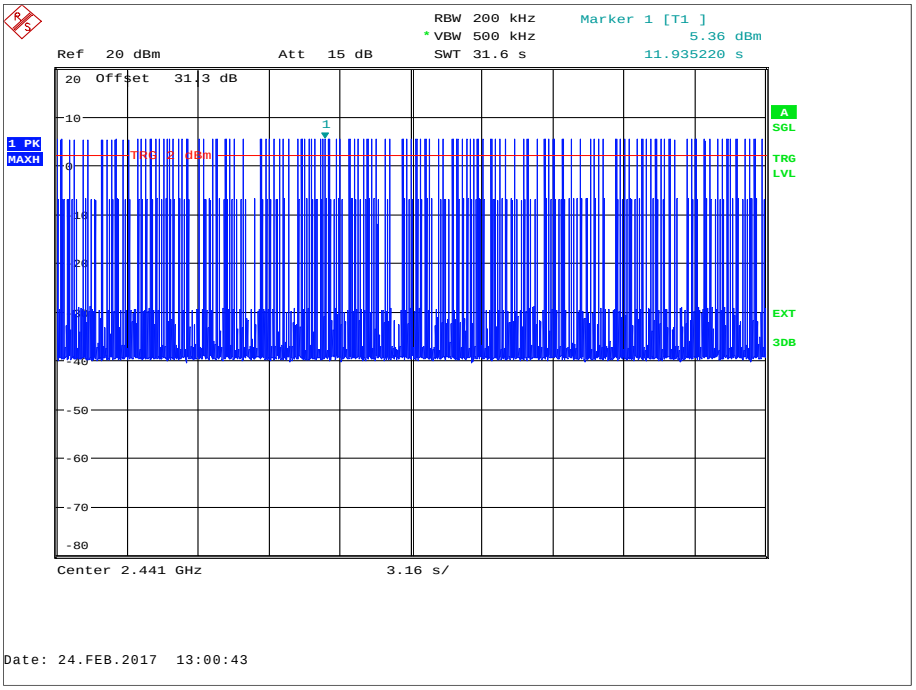

Figure 6 - DH3, Total Average Time of Occupancy

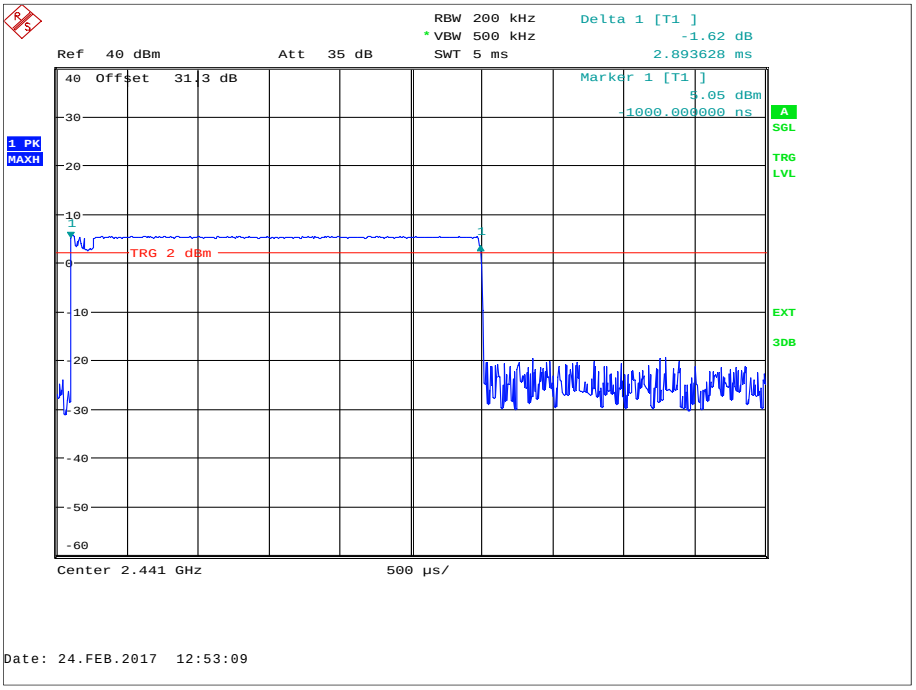

Figure 7 - DH5, Dwell Time

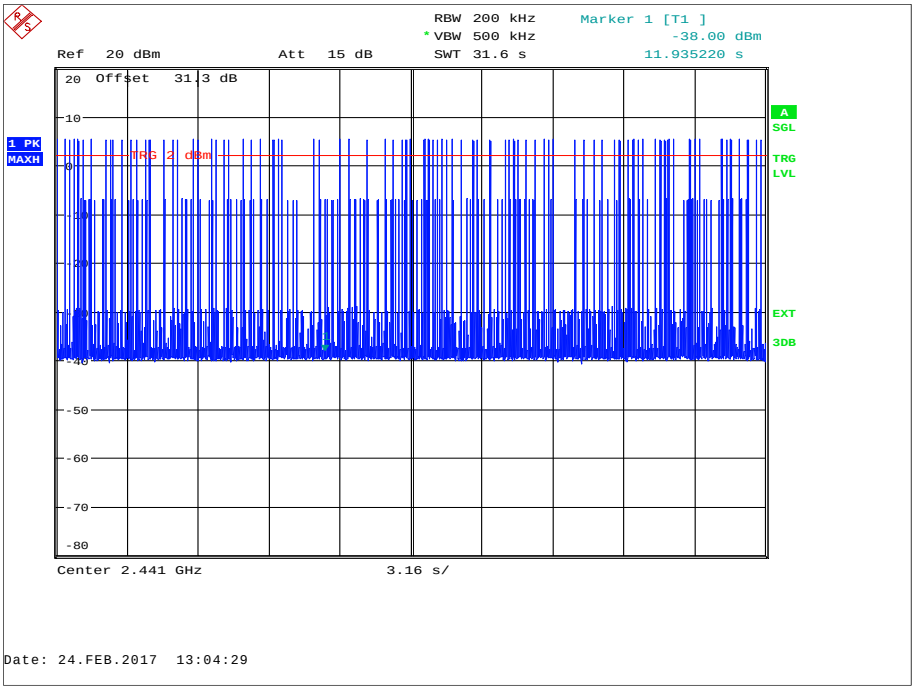

Figure 8 - DH5, Total Average Time of Occupancy

FCC 47 CFR Part 15, Limit Clause 15.247 (a)(1)(iii)

Frequency hopping systems operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. 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. Transmissions on particular hopping frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

Industry Canada RSS-247, Limit Clause 5.1 (4)

FHSs operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. 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. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

2.3.7 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
Attenuator (20dB/ 2W)	Pasternack	PE7004-20	489	12	14-Dec-2017
Multimeter	Fluke	79 Series III	611	12	14-Sep-2017
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	02-Feb-2018
Hygrometer	Rotronic	I-1000	3220	12	23-Aug-2017
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	15-Sep-2017
'3.5mm' - '3.5mm' RF Cable (2m)	Rhophase	3PS-1803-2000-3PS	3702	12	13-Dec-2017
Combiner/Splitter	Weinschel	1506A	3877	12	30-Mar-2017
DC - 12.4 GHz 10 dB Attenuator	Suhner	6810.17.A	3965	12	25-Oct-2017
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	08-Sep-2017
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	09-Sep-2017
2 Channel PSU	Rohde & Schwarz	HMP2020	4735	-	O/P Mon
2 metre SMA Cable	IW Microwave	3PS-1806LC-788-3PS	4829	12	24-Jan-2018

Table 13

O/P Mon – Output Monitored

2.4 Frequency Hopping Systems - Channel Separation

2.4.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)
Industry Canada RSS-247, Clause 5.1

2.4.2 Equipment Under Test and Modification State

IsatPhone2w, S/N: IMEI 353032044022321 - Modification State 0

2.4.3 Date of Test

24-February-2017

2.4.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 7.8.2.

The operational mode of the EUT was controlled by a Bluetooth test set.

2.4.5 Environmental Conditions

Ambient Temperature	22.4 °C
Relative Humidity	33.2 %

2.4.6 Test Results

Bluetooth

Modulation	Channel Separation (MHz)
GFSK	1.005
π/4 DQPSK	1.005
8-DPSK	1.005

Table 14

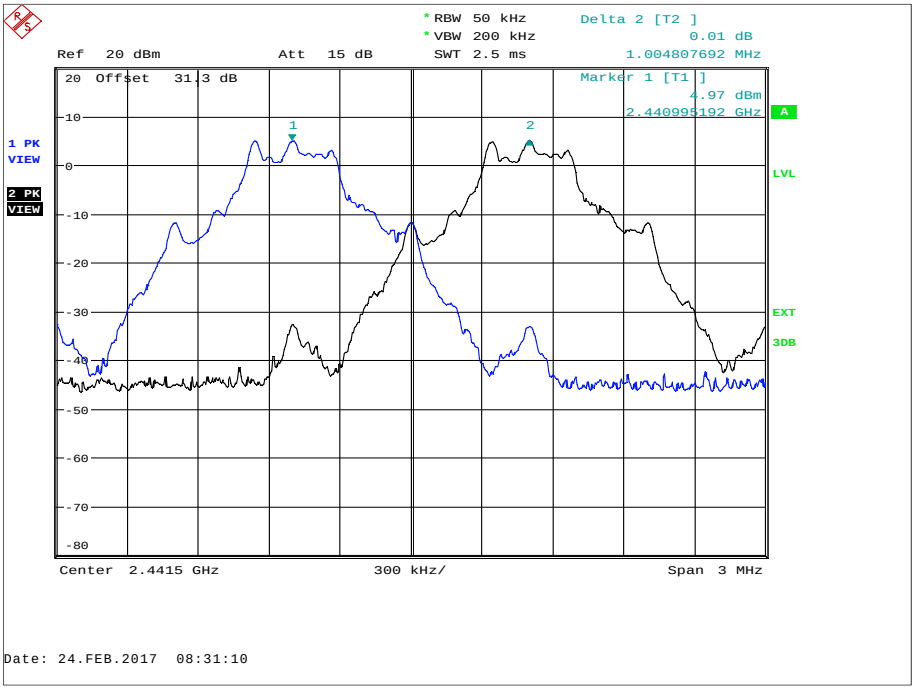

Figure 9 - GFSK

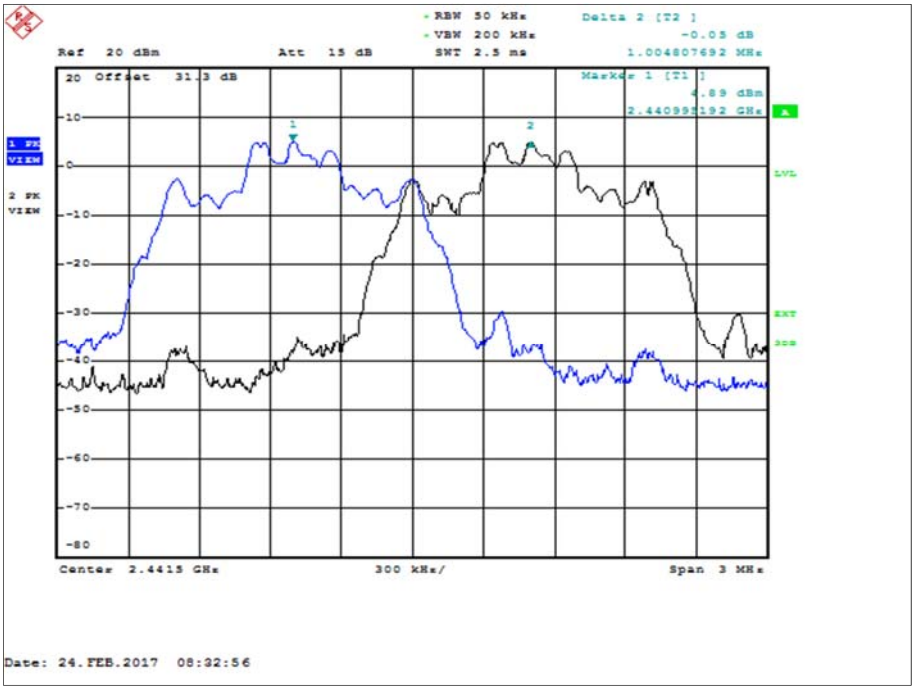

Figure 10 - π/4 DQPSK

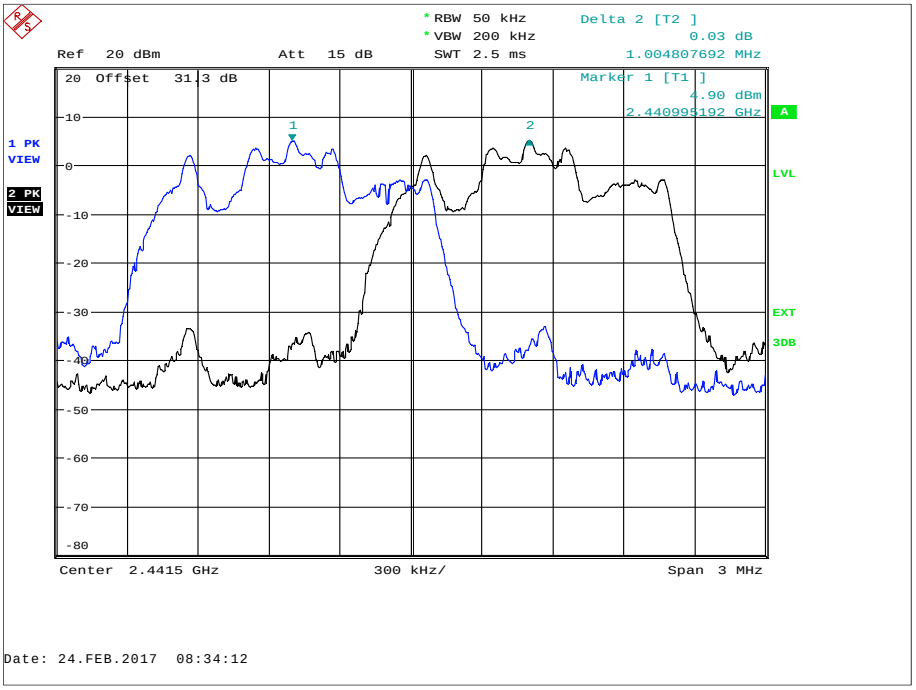

Figure 11 - 8-DPSK

FCC 47 CFR Part 15, Limit Clause 15.247 (a)(1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Alternatively, frequency hopping systems operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 0.125 W.

Industry Canada RSS-247, Limit Clause 5.1 (2)

FHSs shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the -20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, FHSs operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two thirds of the -20 dB bandwidth of the hopping channel, whichever is greater, provided that the systems operate with an output power no greater than 0.125 W. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

2.4.7 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
Attenuator (20dB/ 2W)	Pasternack	PE7004-20	489	12	14-Dec-2017
Multimeter	Fluke	79 Series III	611	12	14-Sep-2017
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	02-Feb-2018
Hygrometer	Rotronic	I-1000	3220	12	23-Aug-2017
'3.5mm' - '3.5mm' RF Cable (2m)	Rhophase	3PS-1803-2000-3PS	3702	12	13-Dec-2017
Combiner/Splitter	Weinschel	1506A	3877	12	30-Mar-2017
DC - 12.4 GHz 10 dB Attenuator	Suhner	6810.17.A	3965	12	25-Oct-2017
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	09-Sep-2017
2 Channel PSU	Rohde & Schwarz	HMP2020	4735	-	O/P Mon
2 metre SMA Cable	IW Microwave	3PS-1806LC-788-3PS	4829	12	24-Jan-2018

Table 15

O/P Mon – Output Monitored

2.5 Frequency Hopping Systems - Number of Hopping Channels

2.5.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)(iii)
Industry Canada RSS-247, Clause 5.1

2.5.2 Equipment Under Test and Modification State

IsatPhone2w, S/N: IMEI 353032044022321 - Modification State 0

2.5.3 Date of Test

24-February-2017

2.5.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 7.8.3.

The operational mode of the EUT was controlled by a Bluetooth test set.

2.5.5 Environmental Conditions

Ambient Temperature	22.4 °C
Relative Humidity	33.1 %

2.5.6 Test Results

Bluetooth

Number of Hopping Channels: 79

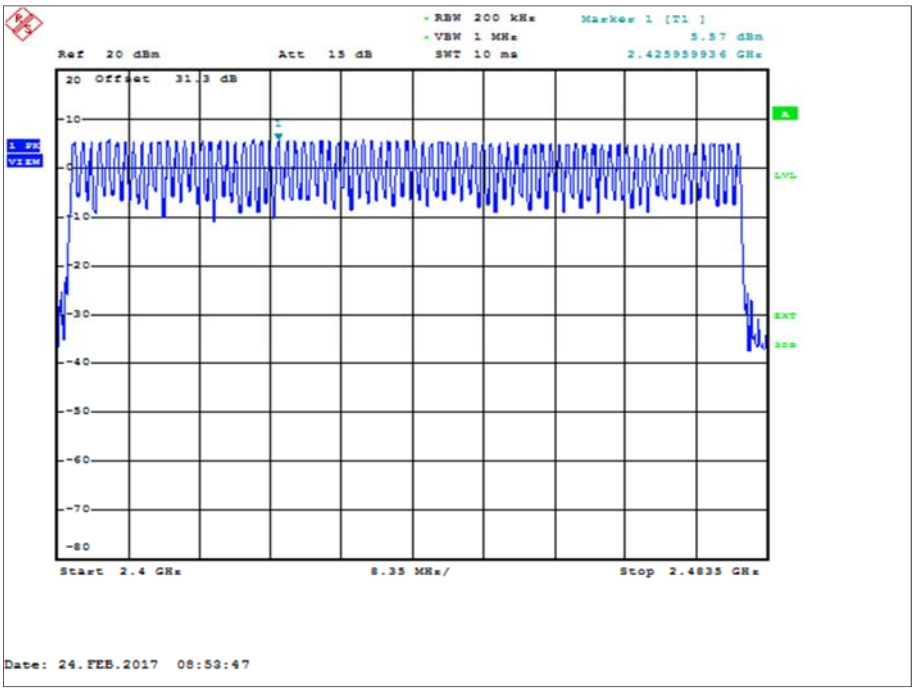

Figure 12 - Measurement Frequency Range: 2400.0 MHz to 2483.5 MHz

FCC 47 CFR Part 15, Limit Clause 15.247 (a)(1)(iii) and Industry Canada RSS-247, Limit Clause 5.1 (4)

≥ 15 channels

2.5.7 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
Attenuator (20dB/ 2W)	Pasternack	PE7004-20	489	12	14-Dec-2017
Multimeter	Fluke	79 Series III	611	12	14-Sep-2017
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	02-Feb-2018
Hygrometer	Rotronic	I-1000	3220	12	23-Aug-2017
'3.5mm' - '3.5mm' RF Cable (2m)	Rhophase	3PS-1803-2000-3PS	3702	12	13-Dec-2017
Combiner/Splitter	Weinschel	1506A	3877	12	30-Mar-2017
DC - 12.4 GHz 10 dB Attenuator	Suhner	6810.17.A	3965	12	25-Oct-2017
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	09-Sep-2017
2 Channel PSU	Rohde & Schwarz	HMP2020	4735	-	O/P Mon
2 metre SMA Cable	IW Microwave	3PS-1806LC-788-3PS	4829	12	24-Jan-2018

Table 16

O/P Mon – Output Monitored

2.6 Frequency Hopping Systems - 20 dB Bandwidth

2.6.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)
Industry Canada RSS-247, Clause 5.1

2.6.2 Equipment Under Test and Modification State

IsatPhone2w, S/N: IMEI 353032044022321 - Modification State 0

2.6.3 Date of Test

23-February-2017

2.6.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.9.2.

The operational mode of the EUT was controlled by a Bluetooth test set.

2.6.5 Environmental Conditions

Ambient Temperature	22.5 °C
Relative Humidity	33.0 %

2.6.6 Test Results

Bluetooth

Frequency (MHz)	20 dB Bandwidth (kHz)		
	GFSK	π/4 DQPSK	8-DPSK
2402	869.2	1287.5	1297.1
2441	868.3	1300.0	1304.8
2480	788.5	1283.7	1283.7

Table 17

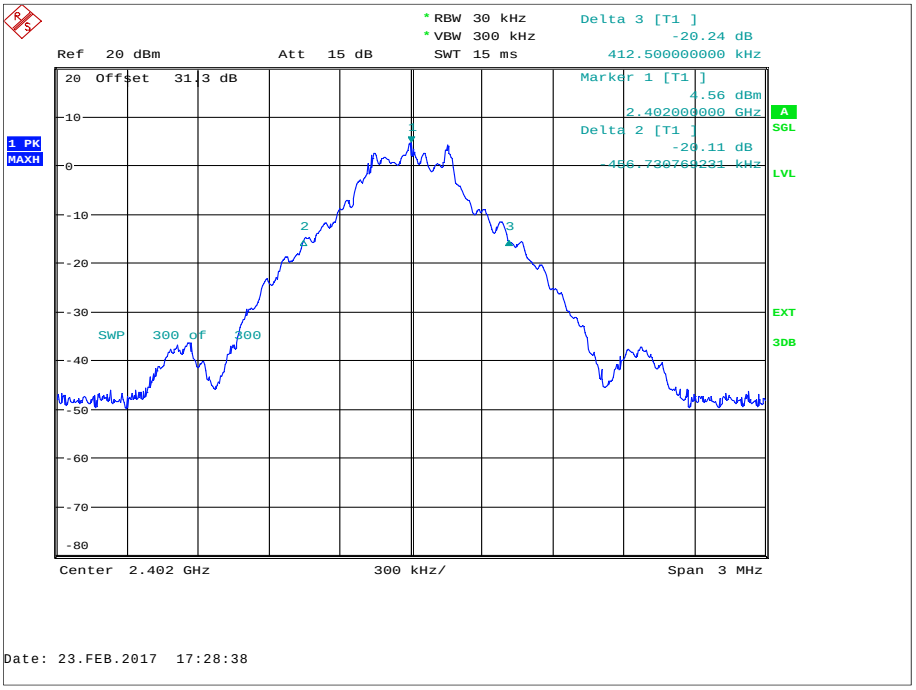

Figure 13 - 2402 MHz - GFSK

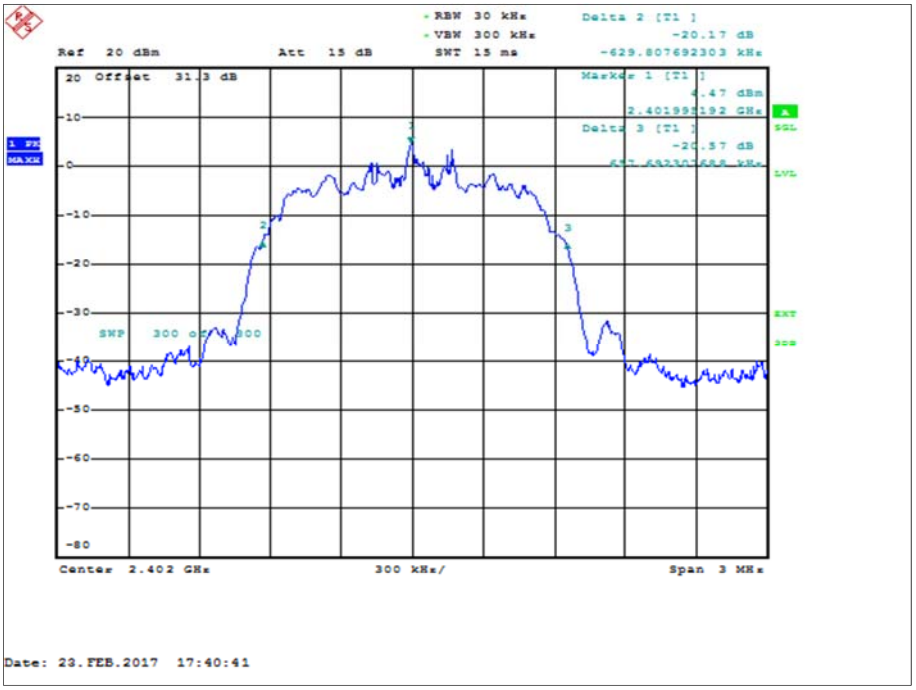

Figure 14 – 2402 MHz - π/4 DQPSK

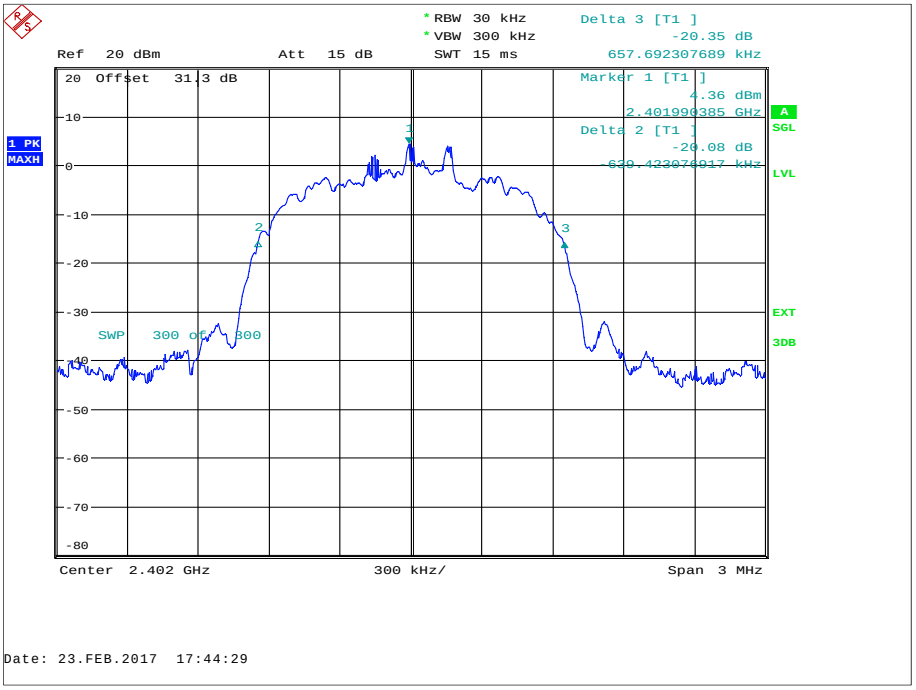

Figure 15 – 2402 MHz - 8-DPSK

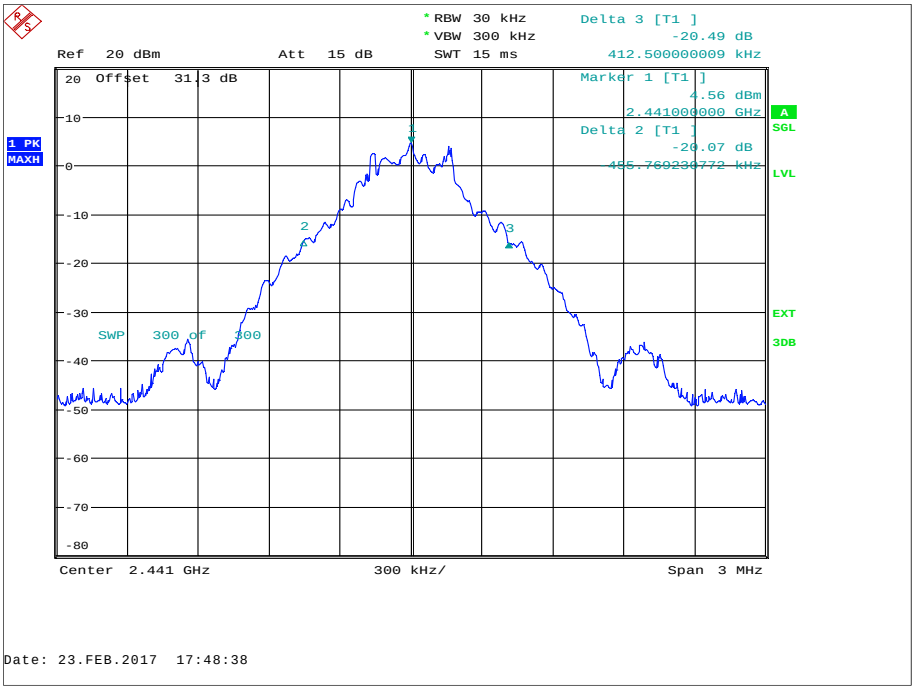

Figure 16 - 2441 MHz - GFSK

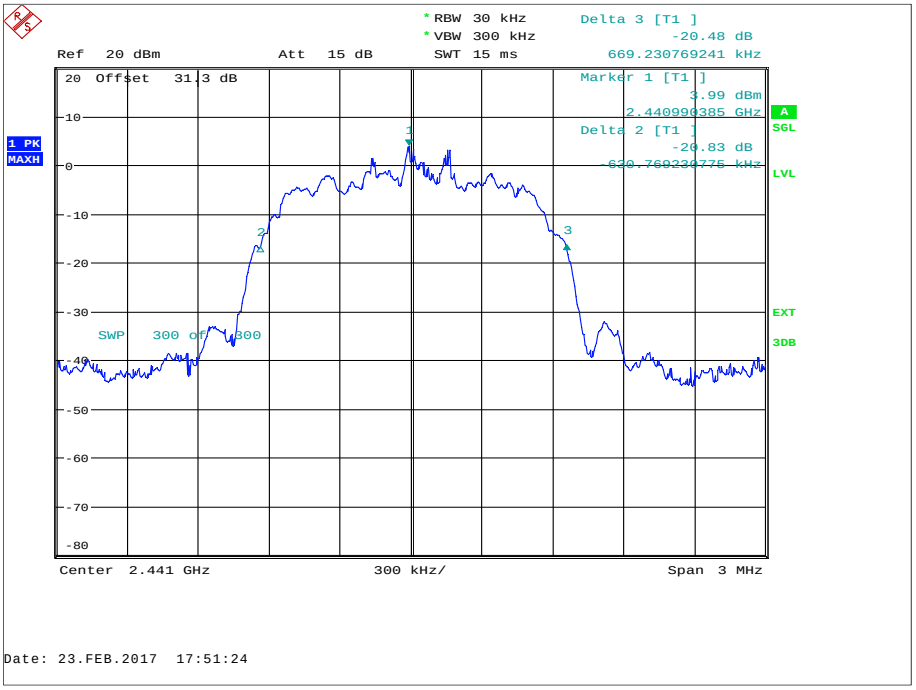

Figure 17 - 2441 MHz - π/4 DQPSK

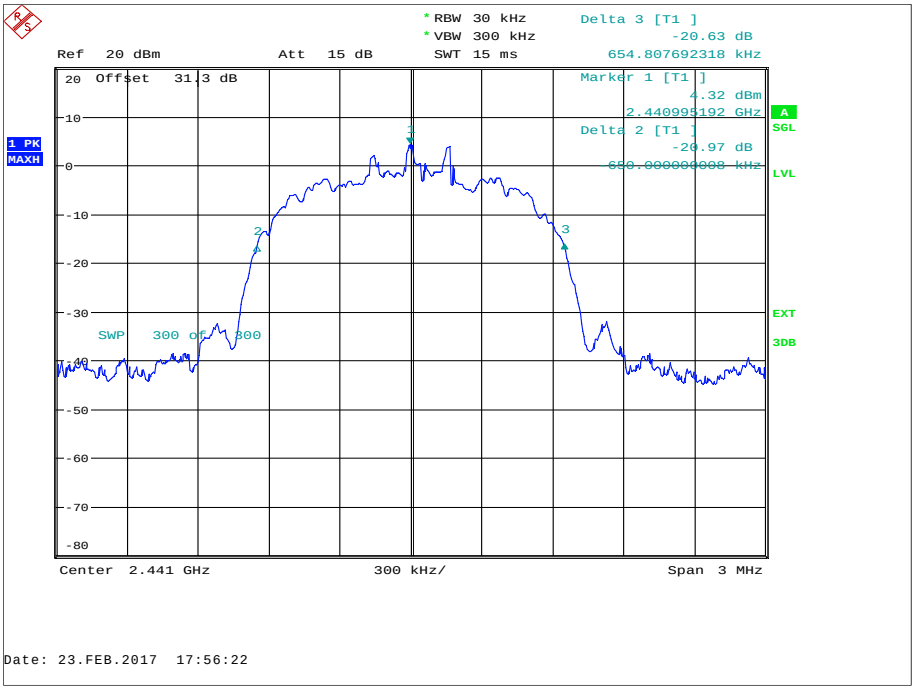

Figure 18 - 2441 MHz - 8-DPSK

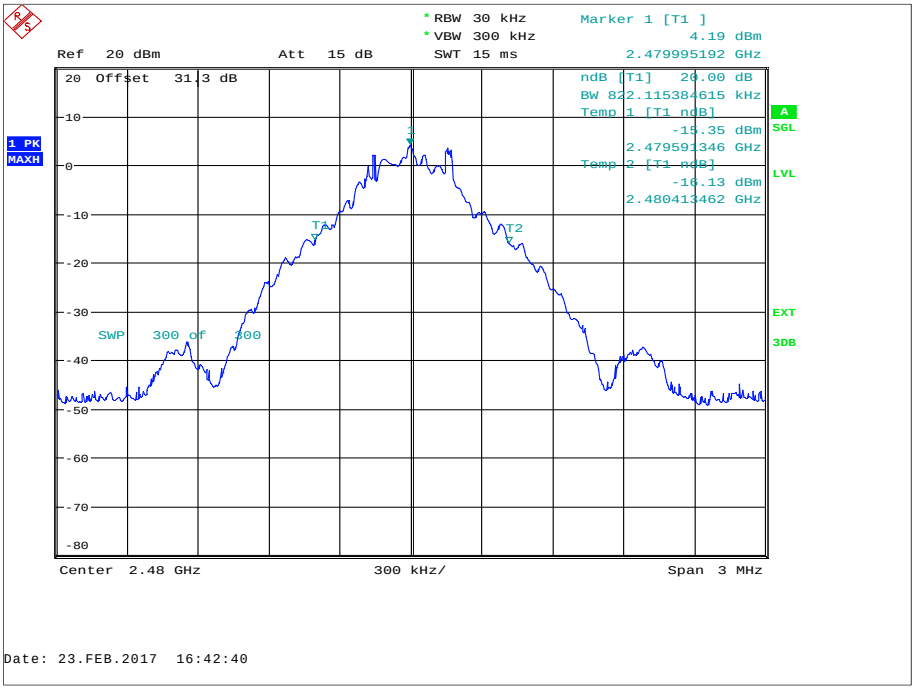

Figure 19 – 2480 MHz - GFSK

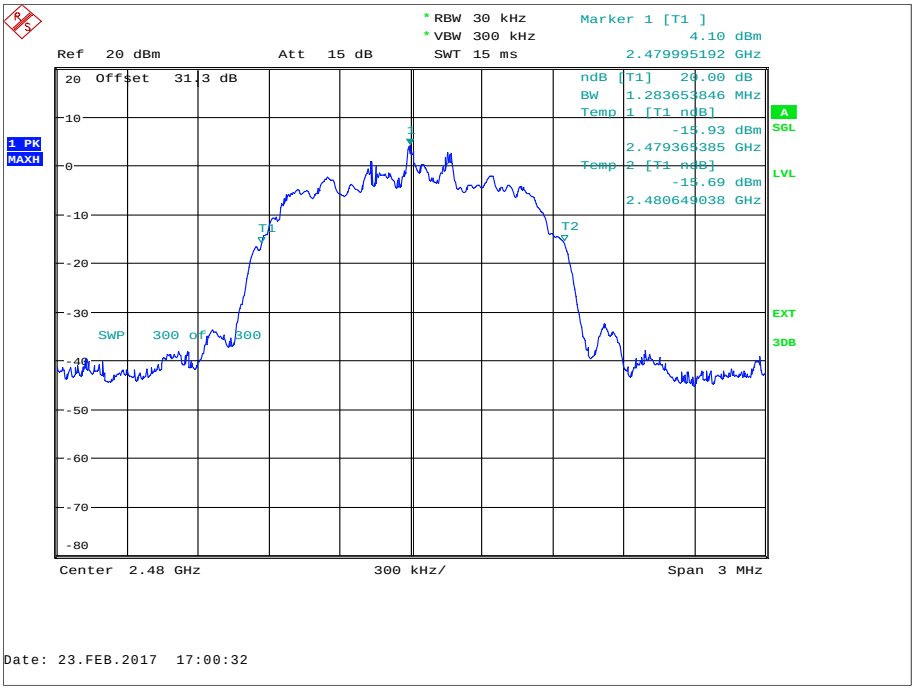

Figure 20 - 2480 MHz - π/4 DQPSK

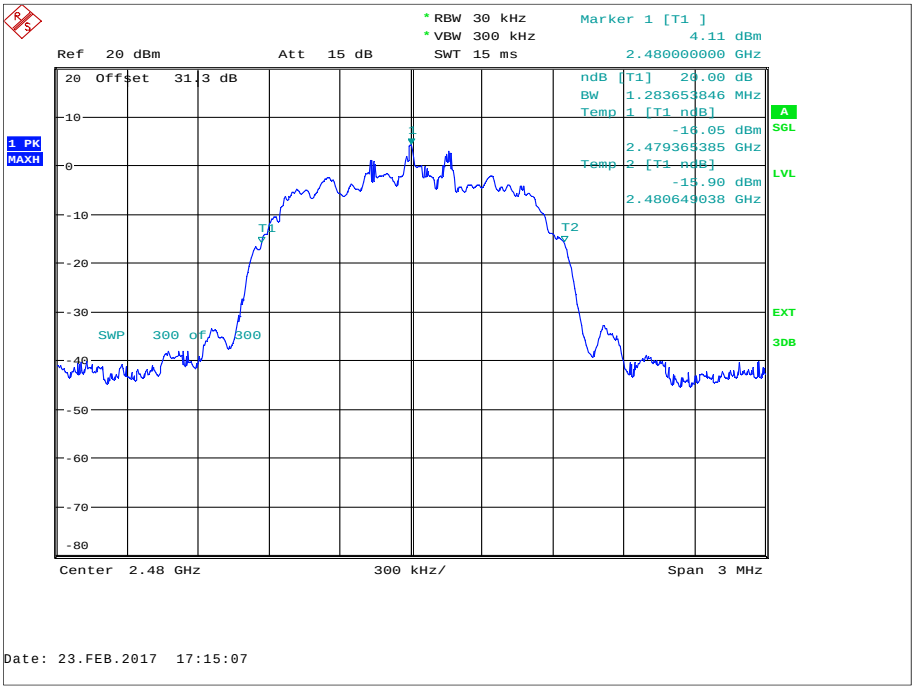

Figure 21 - 2480 MHz - 8-DPSK

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
Attenuator (20dB/ 2W)	Pasternack	PE7004-20	489	12	14-Dec-2017
Multimeter	Fluke	79 Series III	611	12	14-Sep-2017
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	02-Feb-2018
Hygrometer	Rotronic	I-1000	3220	12	23-Aug-2017
'3.5mm' - '3.5mm' RF Cable (2m)	Rhophase	3PS-1803-2000-3PS	3702	12	13-Dec-2017
Combiner/Splitter	Weinschel	1506A	3877	12	30-Mar-2017
DC - 12.4 GHz 10 dB Attenuator	Suhner	6810.17.A	3965	12	25-Oct-2017
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	09-Sep-2017
2 Channel PSU	Rohde & Schwarz	HMP2020	4735	-	O/P Mon
2 metre SMA Cable	IW Microwave	3PS-1806LC-788-3PS	4829	12	24-Jan-2018

Table 18

O/P Mon – Output Monitored

2.7 Spurious Radiated Emissions

2.7.1 Specification Reference

FCC 47 CFR Part 15C, 15.247 (d) and 15.205
Industry Canada RSS-247, Clause 5.5
Industry Canada RSS-GEN, Clause 8.10

2.7.2 Equipment Under Test and Modification State

IsatPhone2w, S/N: IMEI 353032044022966 - Modification State 0

2.7.3 Date of Test

14-February-2017 to 15-February-2017

2.7.4 Test Method

Testing was performed in accordance with ANSI C63.10-2013 clause 11.11, 11.12.1 and 11.12.2.7

Plots for average measurements were taken in accordance with ANSI C63.10-2013 clause 4.1.4.2.3 to characterize the EUT. Where emissions were detected, final average measurements were taken in accordance with ANSI C63.10-2013 clause 4.1.4.2.2.

The plots shown are the characterization of the EUT. The limits on the plots represent the most stringent case for restricted bands, (54/74 dBuV/m) when compared to 20 dBc outside restrcited bands. The limits shown have been used as a threshold to determine where further measurements are necessary. Where results are within 10 dB of the limits shown on the plots, further investigation was carried out and reported in results tables.

Remarks

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

2.7.5 Environmental Conditions

Ambient Temperature	18.0 - 18.3 °C
Relative Humidity	33.0 - 44.0 %

2.7.6 Test Results

Bluetooth

Testing was performed on the modulation and packet type which resulted in the highest conducted output power. This modulation/packet type was 8-DPSK/3DH5.

2402 MHz

30 MHz to 1 GHz

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle(Deg)	Height(m)	Polarity
30.120	30.4	40.0	-9.6	102	1.00	Vertical
32.289	29.3	40.0	-10.7	354	1.00	Vertical

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle(Deg)	Height(m)	Polarity
37.328	26.7	40.0	-13.3	155	1.00	Vertical
84.123	20.5	40.0	-19.5	181	1.17	Vertical
923.326	39.3	46.0	-6.7	92	1.00	Vertical
960.000	33.8	46.0	-12.2	109	1.00	Vertical

Table 19

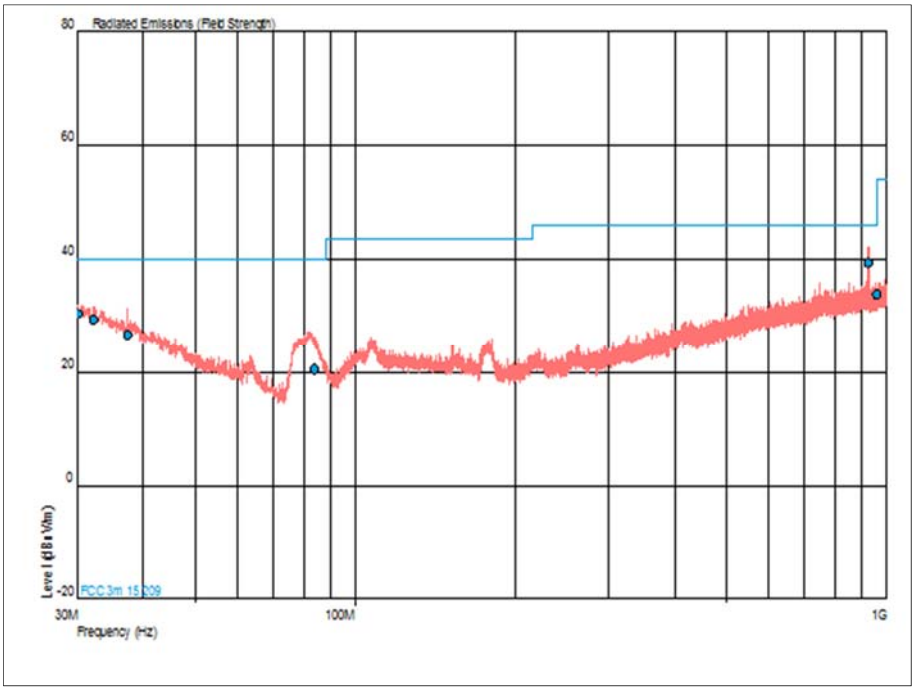

Figure 22 - 30 MHz to 1 GHz - Horizontal and Vertical

1 GHz to 25 GHz

Frequency (MHz)	Result (µV/m)		Limit (µV/m)		Margin (µV/m)	
	Peak	Average	Peak	Average	Peak	Average
*						

Table 20

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

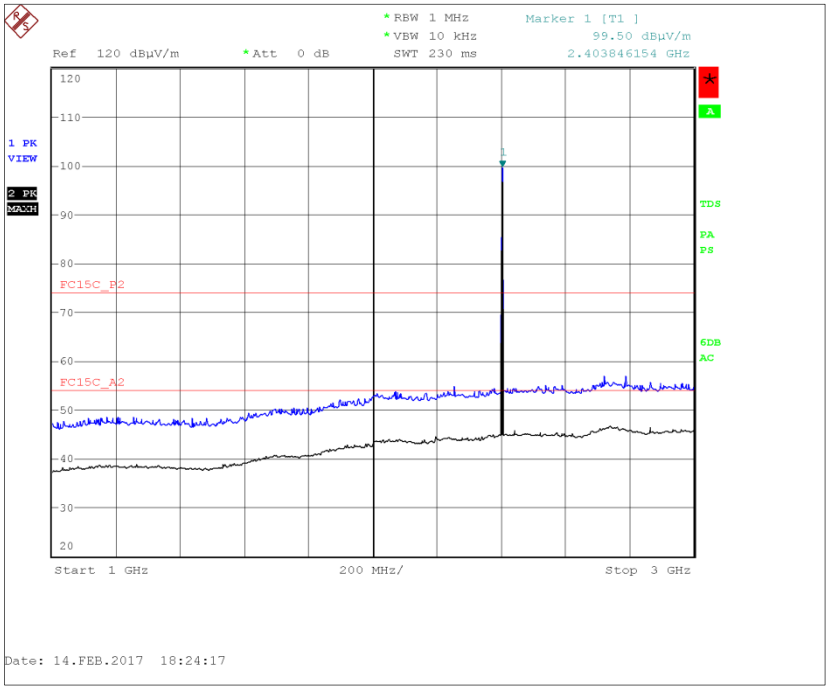

Figure 23 - 1 GHz to 3 GHz - Horizontal and Vertical

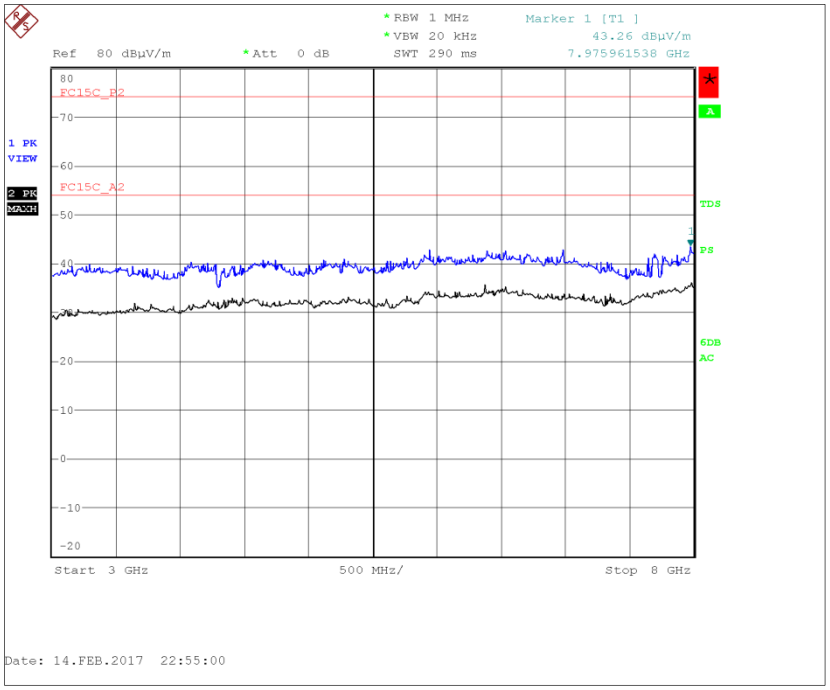

Figure 24 - 3 GHz to 8 GHz - Horizontal and Vertical

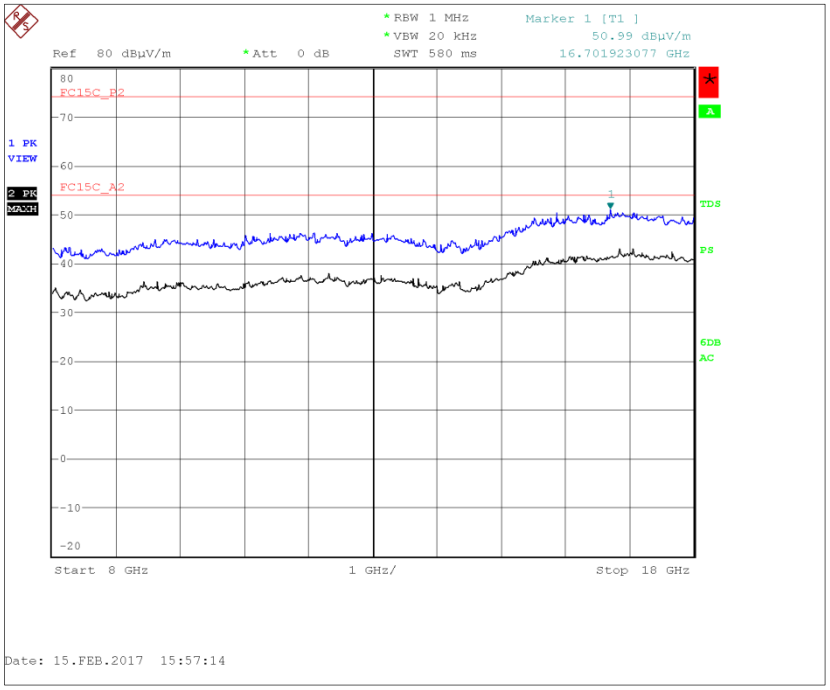

Figure 25 - 8 GHz to 18 GHz - Horizontal and Vertical

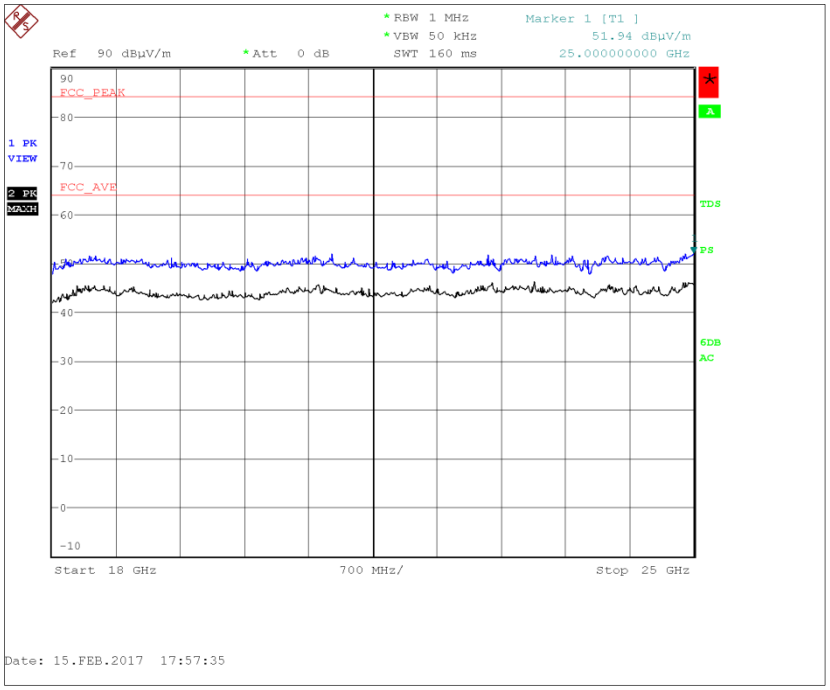

Figure 26 - 18 GHz to 25 GHz - Horizontal and Vertical

2441 MHz

30 MHz to 1 GHz

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle(Deg)	Height(m)	Polarity
30.311	30.1	40.0	-9.9	360	1.00	Vertical
31.275	30.1	40.0	-9.9	28	1.00	Vertical
32.739	28.9	40.0	-11.1	161	2.93	Vertical
35.294	27.7	40.0	-12.3	359	1.00	Vertical
923.374	38.7	46.0	-7.3	60	1.00	Vertical
960.000	33.8	46.0	-12.2	244	1.00	Vertical

Table 21

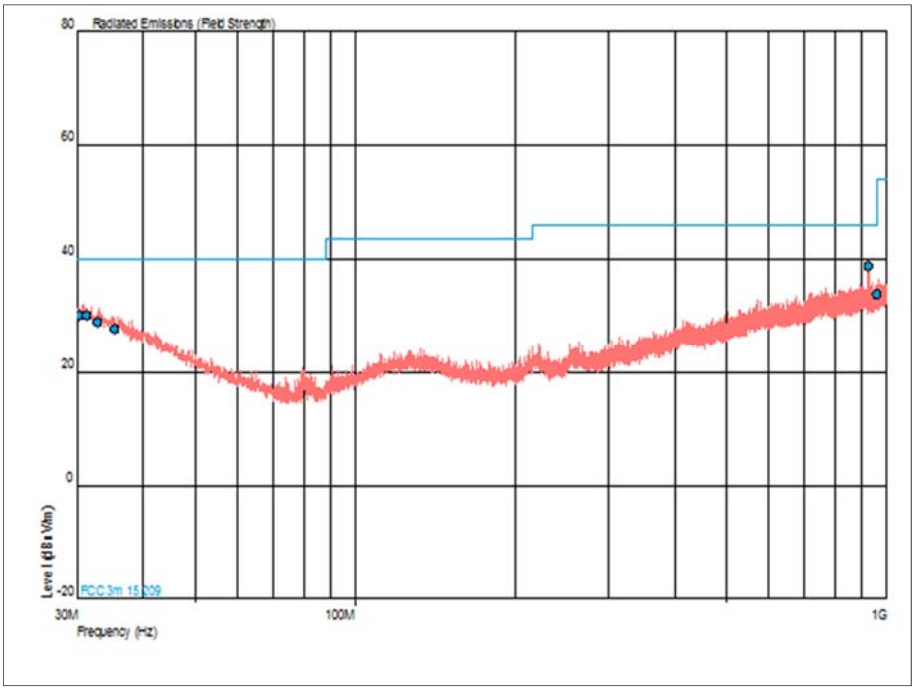

Figure 27 - 30 MHz to 1 GHz - Horizontal and Vertical

1 GHz to 25 GHz

Frequency (MHz)	Result (µV/m)		Limit (µV/m)		Margin (µV/m)	
	Peak	Average	Peak	Average	Peak	Average
*						

Table 22

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

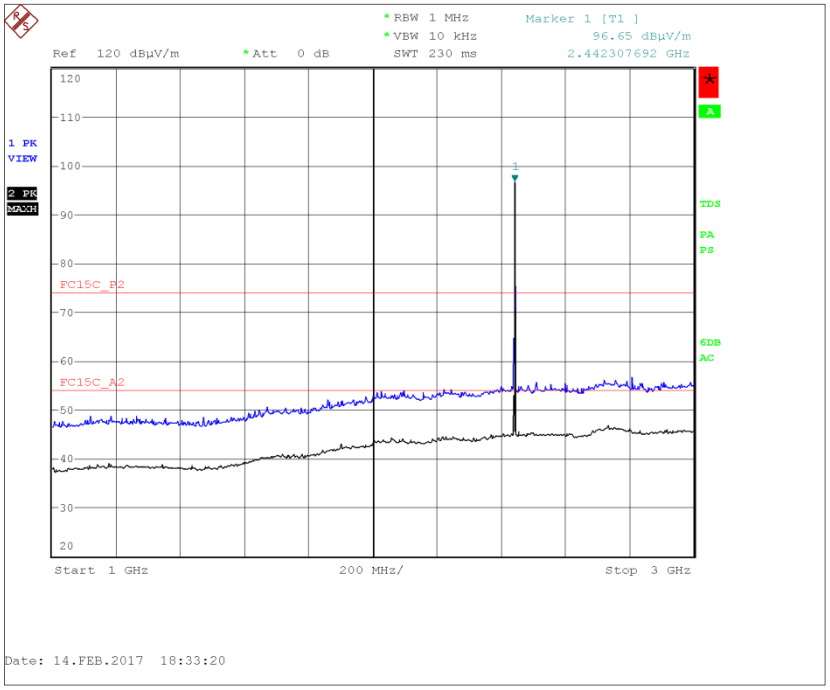

Figure 28 - 1 GHz to 3 GHz - Horizontal and Vertical

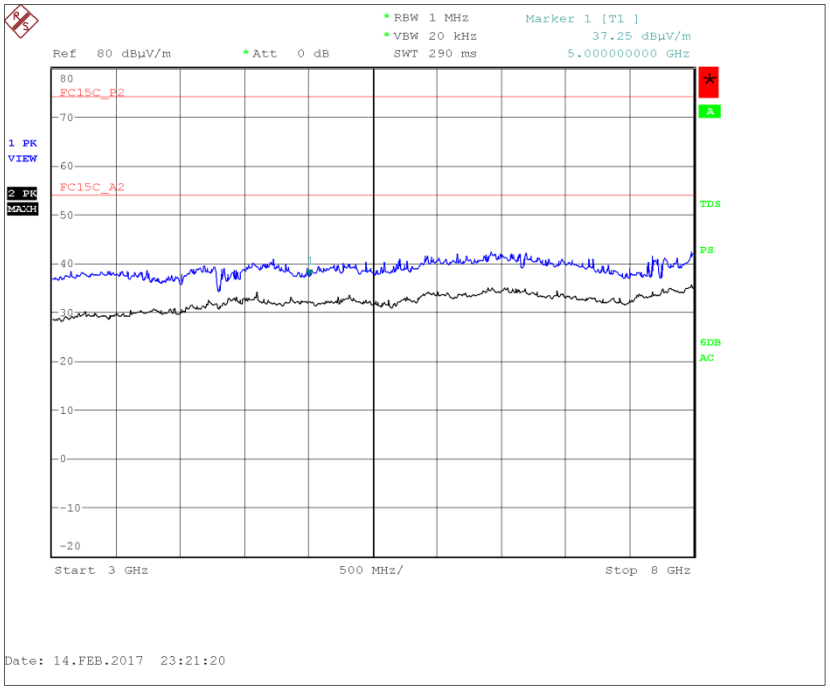

Figure 29 - 3 GHz to 8 GHz - Horizontal and Vertical

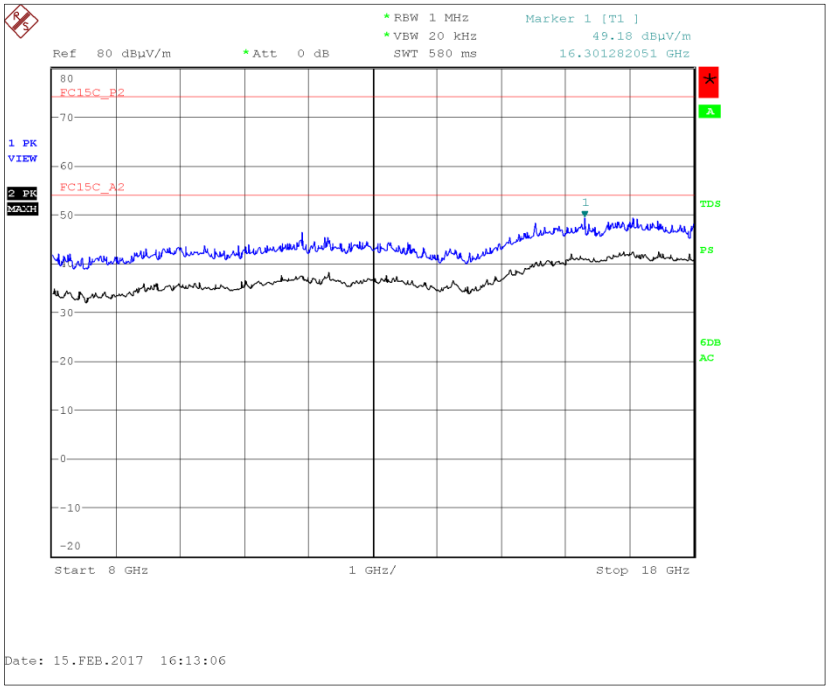

Figure 30 - 8 GHz to 18 GHz - Horizontal and Vertical

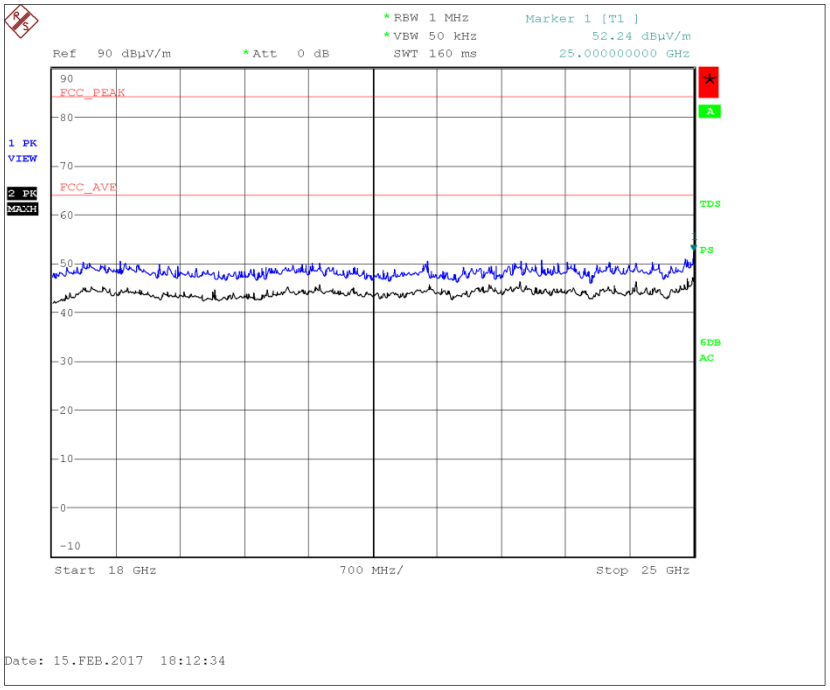

Figure 31 - 18 GHz to 25 GHz - Horizontal and Vertical

2480 MHz

30 MHz to 1 GHz

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle(Deg)	Height(m)	Polarity
30.038	30.3	40.0	-9.7	333	1.00	Vertical
31.006	29.7	40.0	-10.3	79	1.00	Vertical
32.558	29.0	40.0	-11.0	338	3.27	Vertical
78.065	17.2	40.0	-22.8	289	1.00	Vertical
923.395	39.0	46.0	-7.0	0	1.88	Vertical
960.000	33.8	46.0	-12.2	79	1.00	Vertical

Table 23

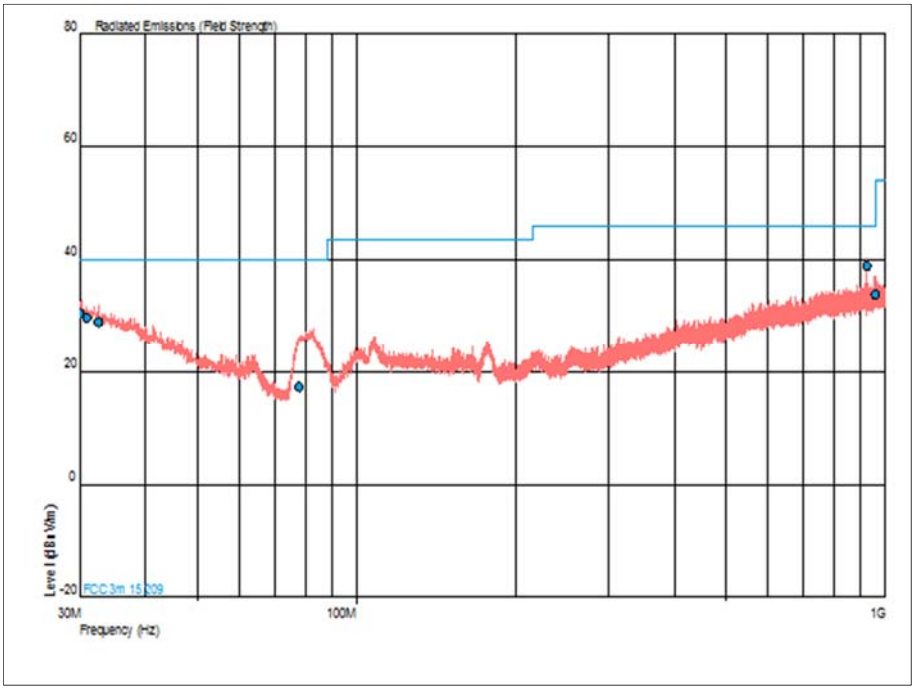

Figure 32 - 30 MHz to 1 GHz - Horizontal and Vertical

1 GHz to 25 GHz

Frequency (MHz)	Result (µV/m)		Limit (µV/m)		Margin (µV/m)	
	Peak	Average	Peak	Average	Peak	Average
*						

Table 24

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

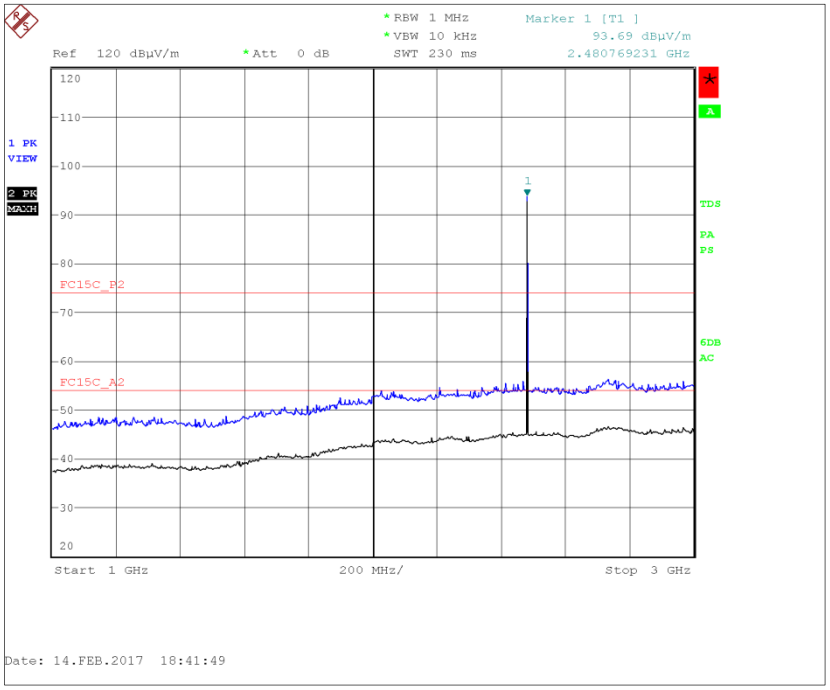

Figure 33 - 1 GHz to 3 GHz - Horizontal and Vertical

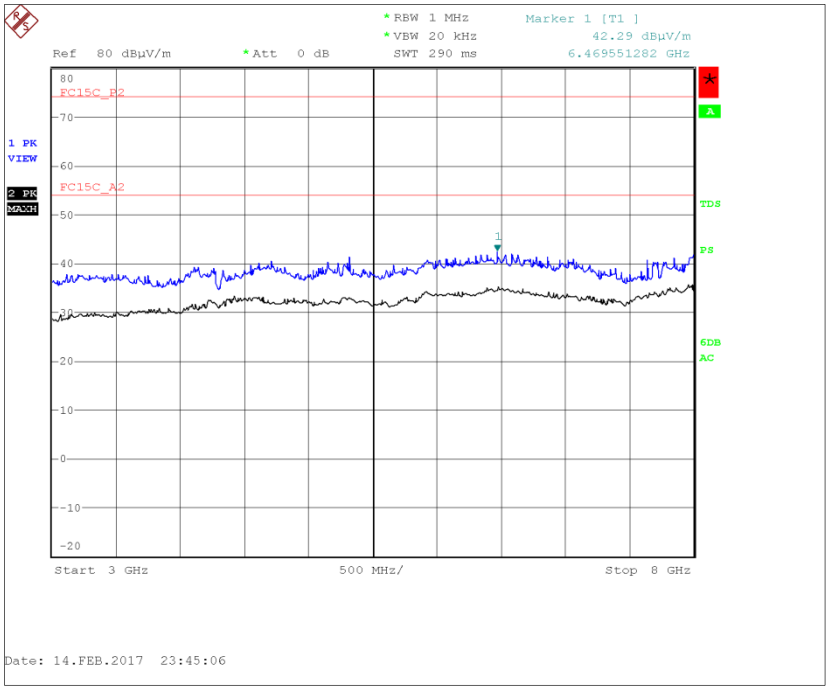

Figure 34 - 3 GHz to 8 GHz - Horizontal and Vertical

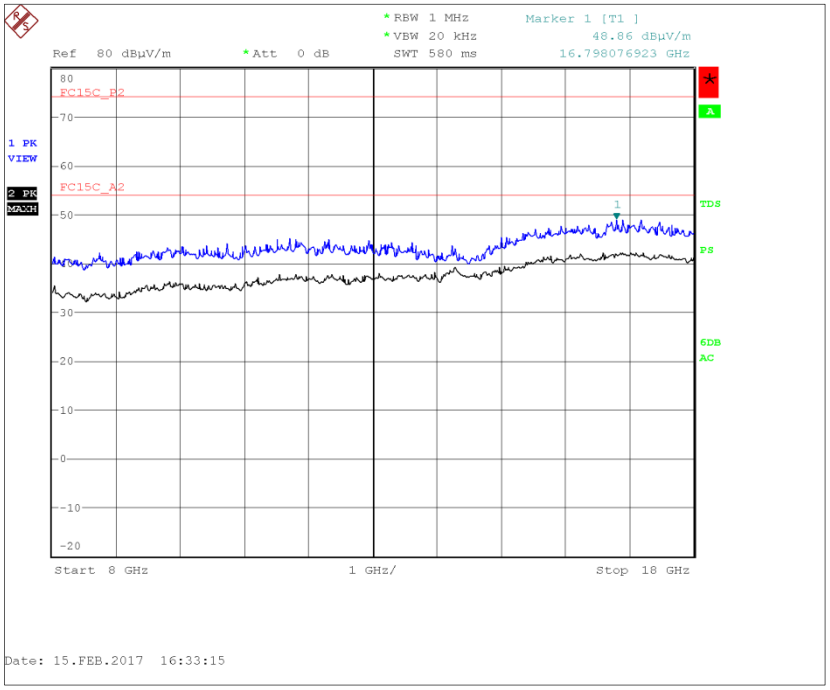

Figure 35 - 8 GHz to 18 GHz - Horizontal and Vertical

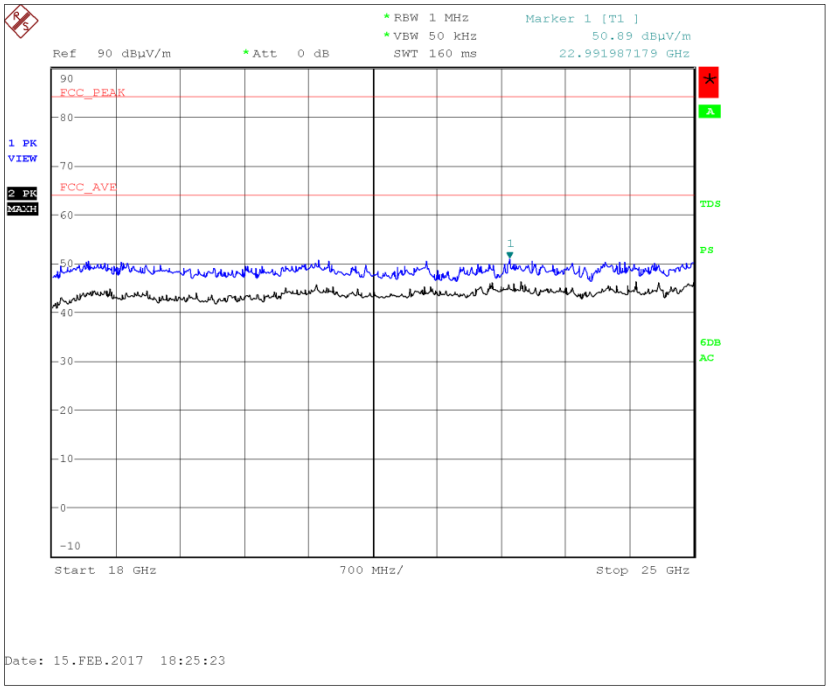

Figure 36 - 18 GHz to 25 GHz - Horizontal and Vertical

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)

Industry Canada RSS-247, Limit Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

2.7.7 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
Antenna (DRG Horn)	ETS-Lindgren	3115	3125	12	25-Jul-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
1501A 4.0M Km Km Cable	Rhophase	KPS-1501A-4000-KPS	4301	12	3-Aug-2017
Suspended Substrate Highpass Filter	Advance Power Components	11SH10-3000/X18000-O/O	4411	12	23-Mar-2017

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Cable (Rx, Nm-Nm, 5m)	Scott Cables	SLU18-NMNM-05.00M	4482	6	6-Jun-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	-	O/P Mon
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	27-Feb-2017

Table 25

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

2.8 Restricted Band Edges

2.8.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.205
Industry Canada RSS-GEN, Clause 8.10

2.8.2 Equipment Under Test and Modification State

IsatPhone2w, S/N: IMEI 353032044022966 - Modification State 0

2.8.3 Date of Test

14-February-2017

2.8.4 Test Method

Testing was performed in accordance with ANSI C63.10, clause 6.10.5

Remarks

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

2.8.5 Environmental Conditions

Ambient Temperature	18.0 °C
Relative Humidity	33.0 %

2.8.6 Test Results

Bluetooth

Mode	Modulation	Measured Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBµV/m)
Static	GFSK	2390.0	62.55	46.44
Static	π/4 DQPSK	2390.0	62.73	46.42
Static	8-DPSK	2390.0	62.96	46.45
Hopping	GFSK	2390.0	63.72	46.48
Hopping	π/4 DQPSK	2390.0	64.10	46.46
Hopping	8-DPSK	2390.0	63.69	46.47

Table 26 – 2402 MHz

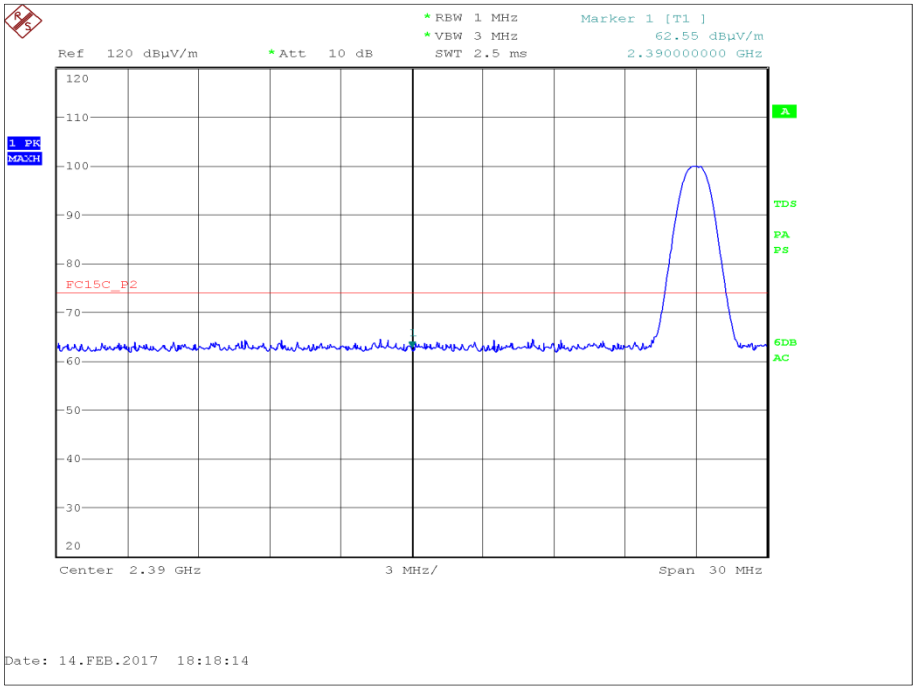

Figure 37 - Static, GFSK, 2402 MHz, Measured Frequency 2390.0 MHz, Peak

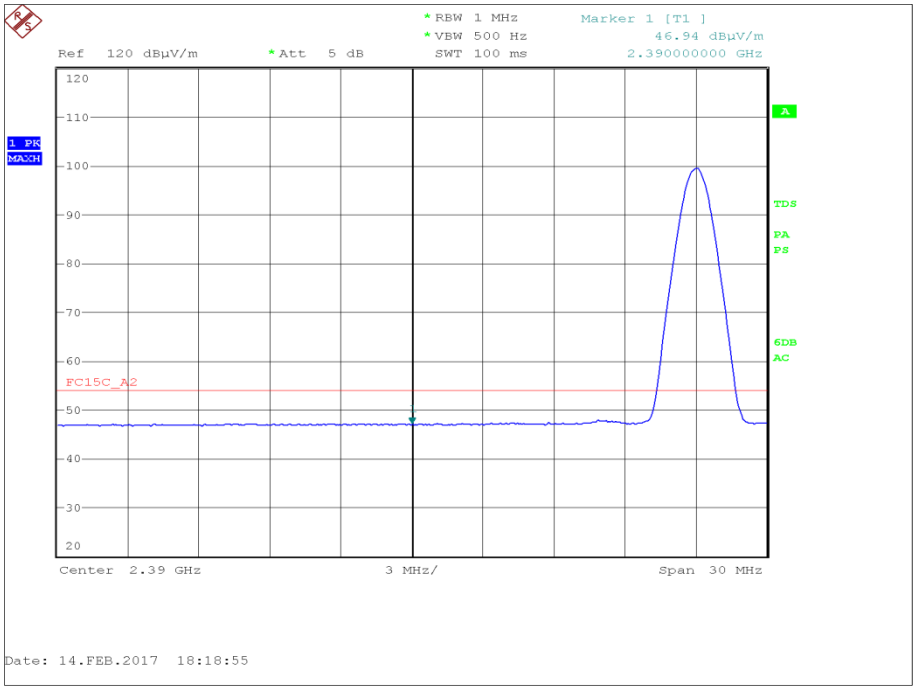

Figure 38 - Static, GFSK, 2402 MHz, Measured Frequency 2390.0 MHz, Average

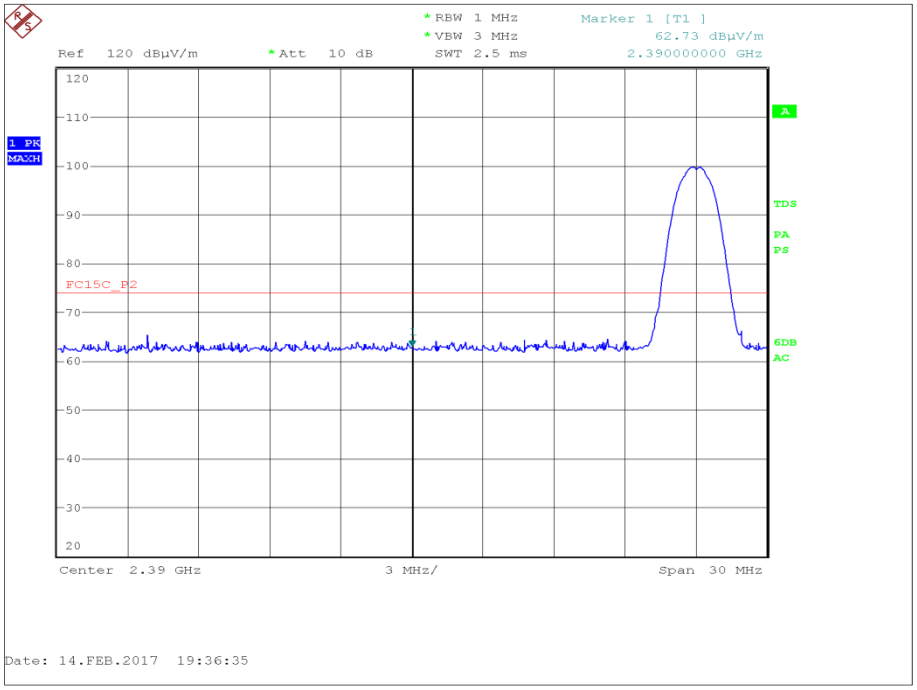

Figure 39 - Static, π/4 DQPSK, 2402 MHz, Measured Frequency 2390.0 MHz, Peak

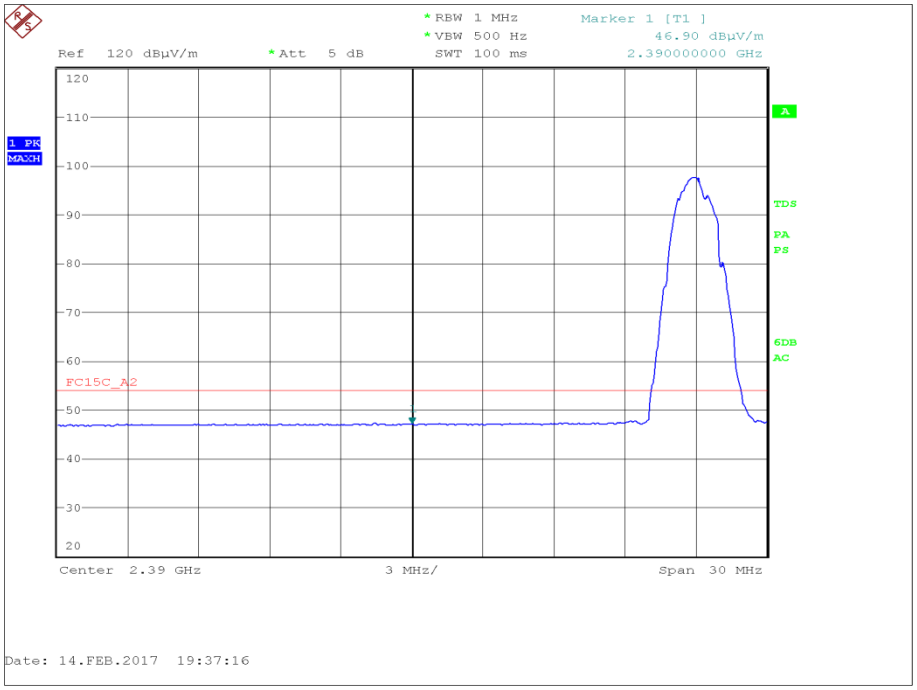

Figure 40 - Static, π/4 DQPSK, 2402 MHz, Measured Frequency 2390.0 MHz, Average

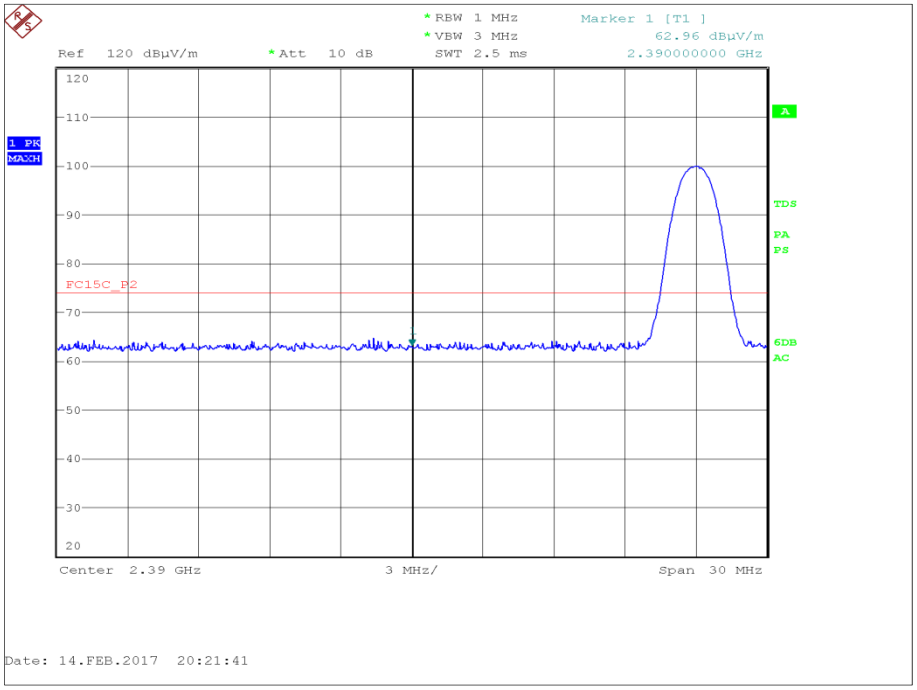

Figure 41 - Static, 8-DPSK, 2402 MHz, Measured Frequency 2390.0 MHz, Peak

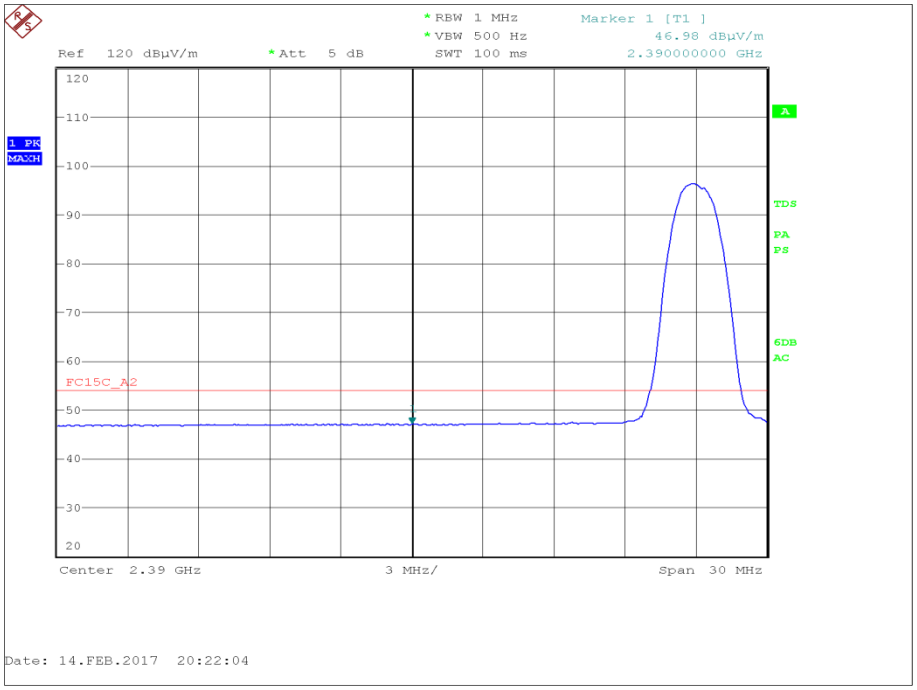

Figure 42 - Static, 8-DPSK, 2402 MHz, Measured Frequency 2390.0 MHz, Average

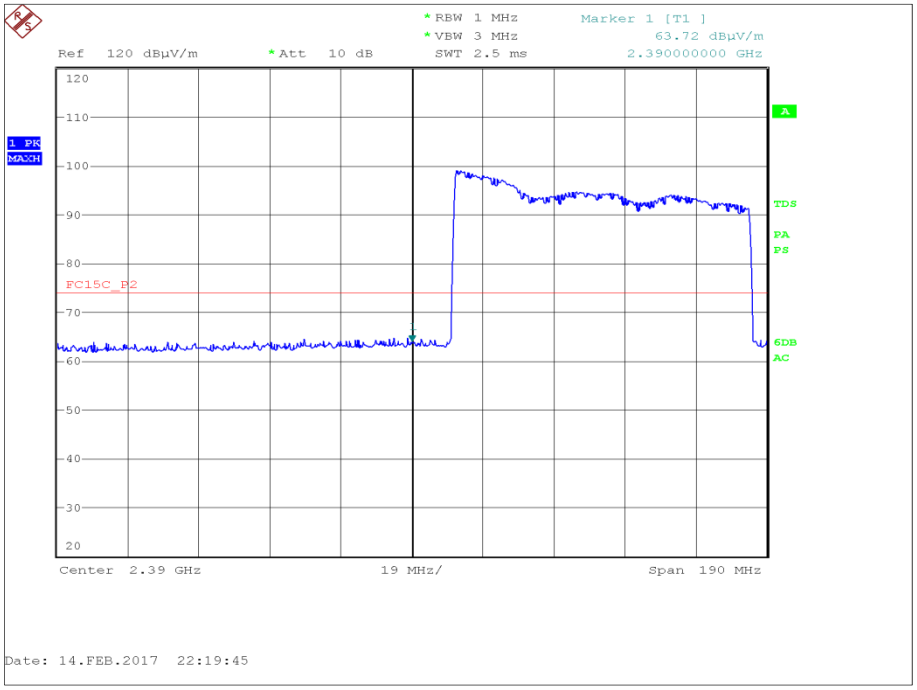

Figure 43 - Hopping, GFSK, 2402 MHz, Measured Frequency 2390.0 MHz, Peak

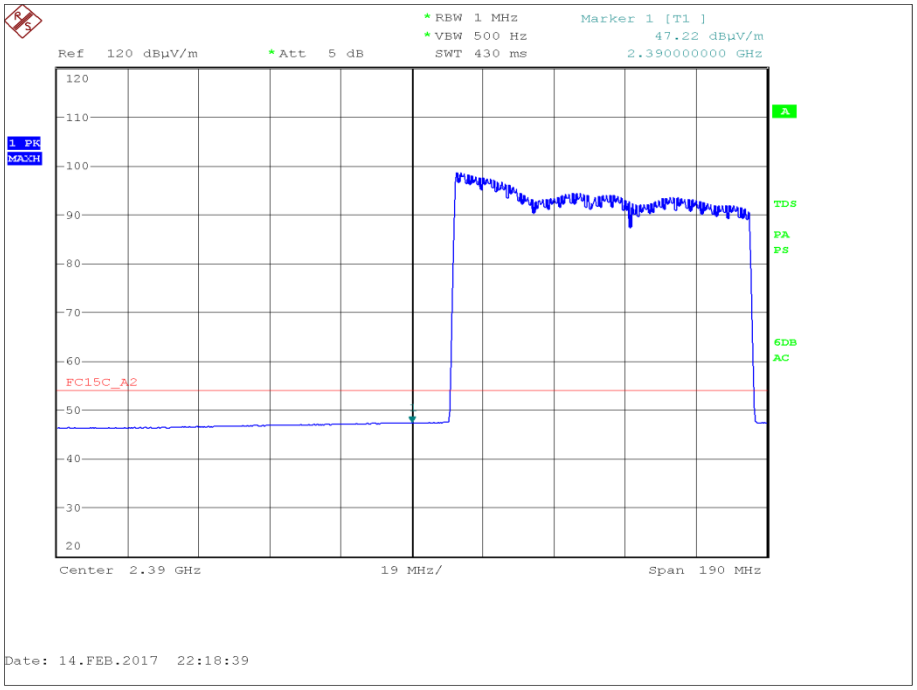

Figure 44 - Hopping, GFSK, 2402 MHz, Measured Frequency 2390.0 MHz, Average

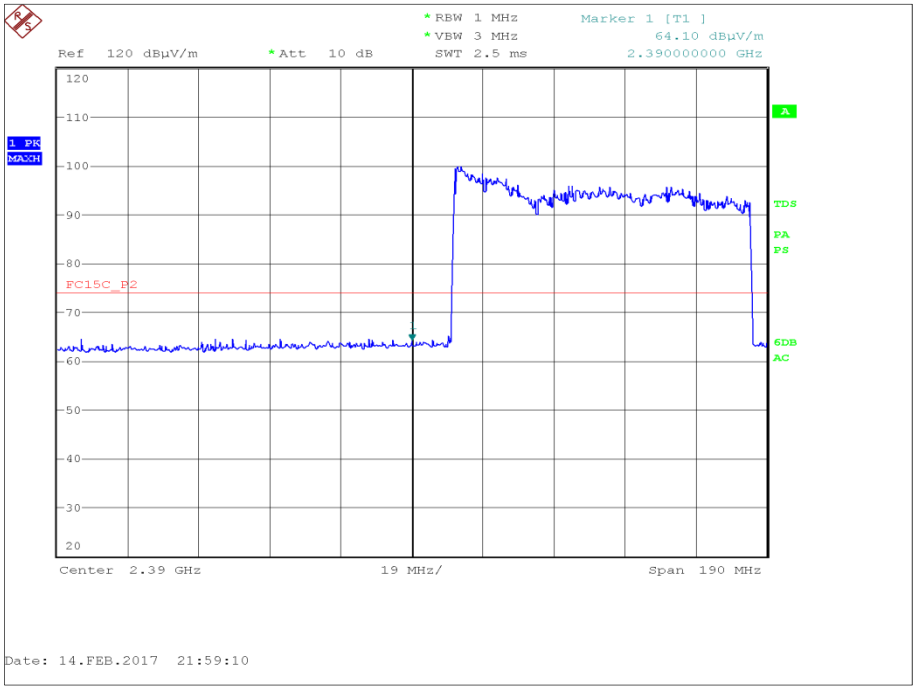

Figure 45 - Hopping, π/4 DQPSK, 2402 MHz, Measured Frequency 2390.0 MHz, Peak

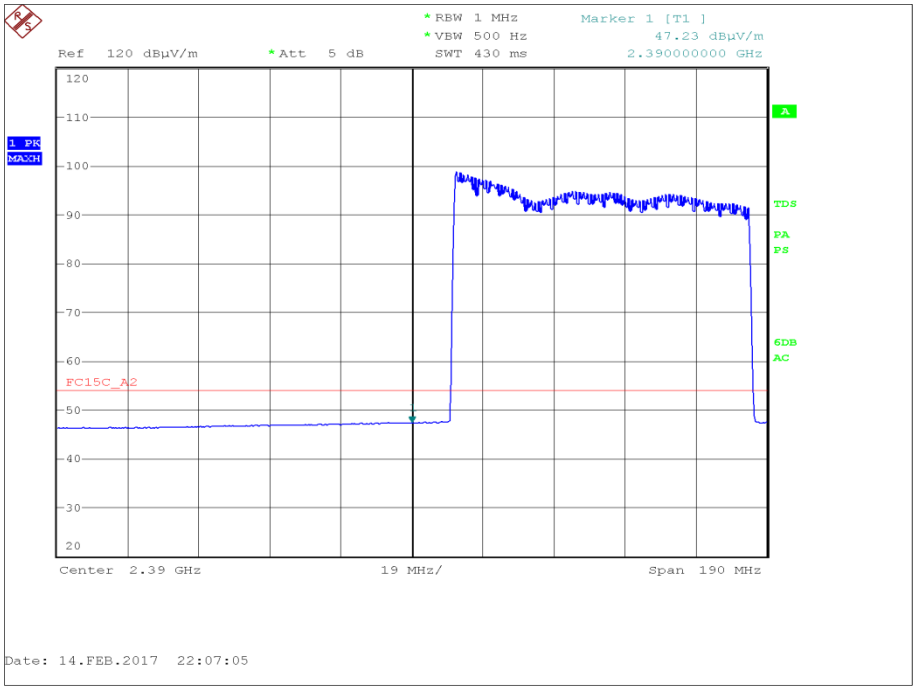

Figure 46 - Hopping, π/4 DQPSK, 2402 MHz, Measured Frequency 2390.0 MHz, Average

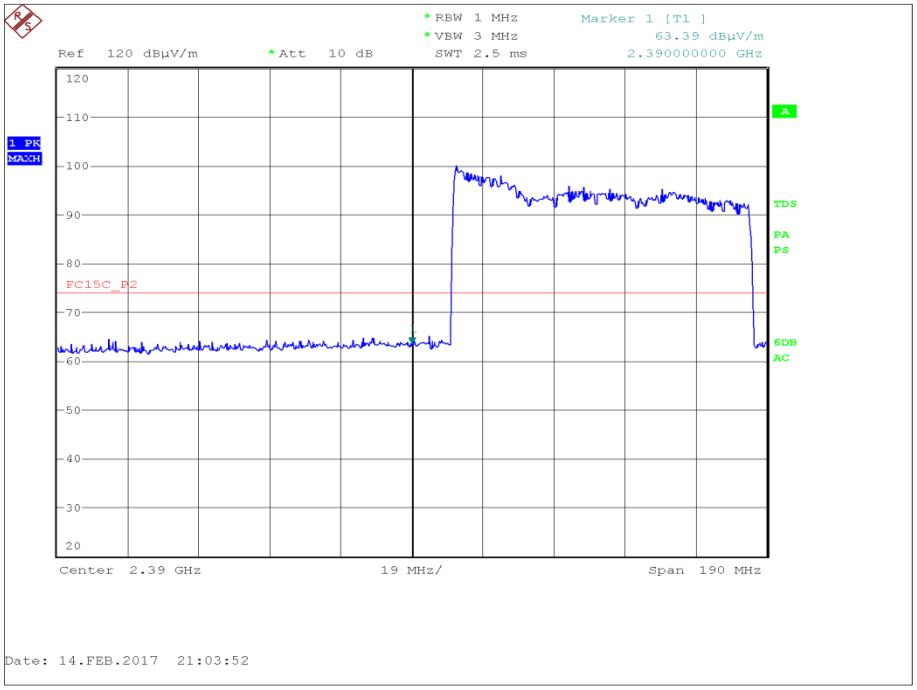

Figure 47 - Hopping, 8-DPSK, 2402 MHz, Measured Frequency 2390.0 MHz, Peak

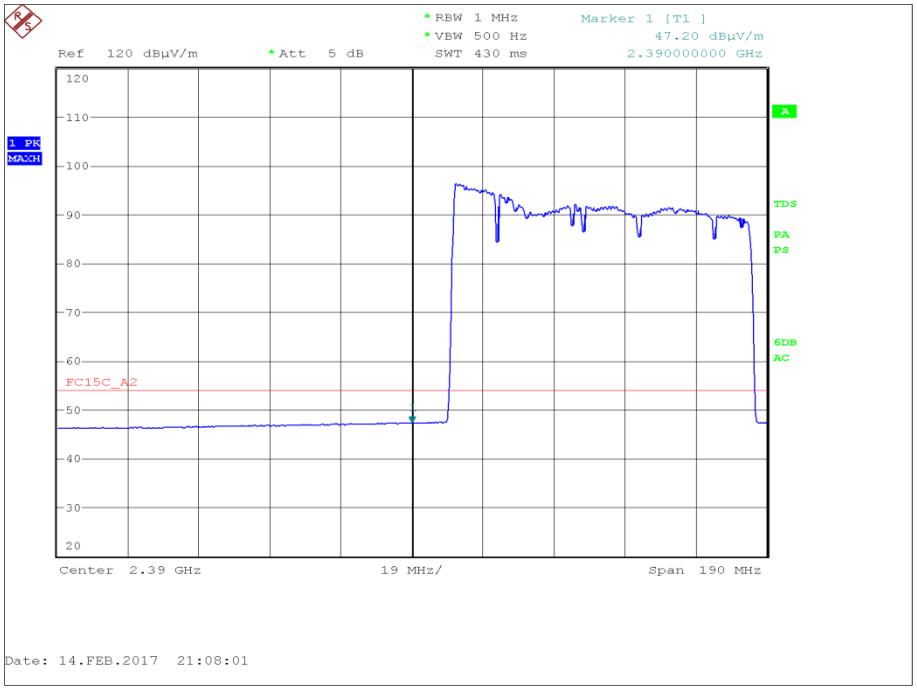

Figure 48 - Hopping, 8-DPSK, 2402 MHz, Measured Frequency 2390.0 MHz, Average

Mode	Modulation	Measured Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBµV/m)
Static	GFSK	2483.5	63.03	46.55
Static	π/4 DQPSK	2483.5	62.59	46.51
Static	8-DPSK	2483.5	63.24	46.55
Hopping	GFSK	2483.5	63.68	46.55
Hopping	π/4 DQPSK	2483.5	64.19	46.53
Hopping	8-DPSK	2483.5	62.86	46.53

Table 27 – 2480 MHz

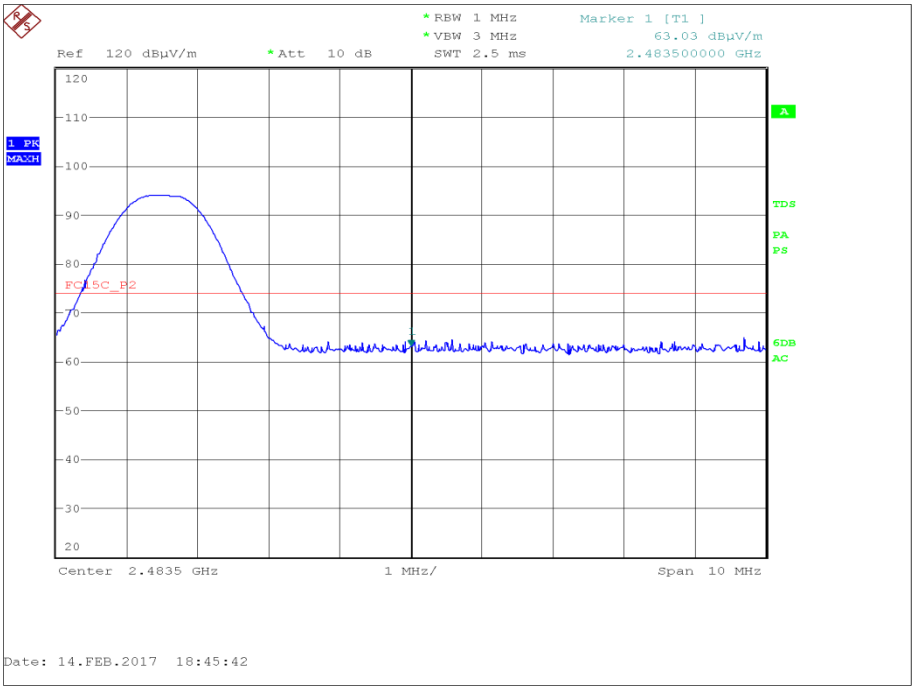

Figure 49 - Static, GFSK, 2480 MHz, Measured Frequency 2483.5 MHz, Peak

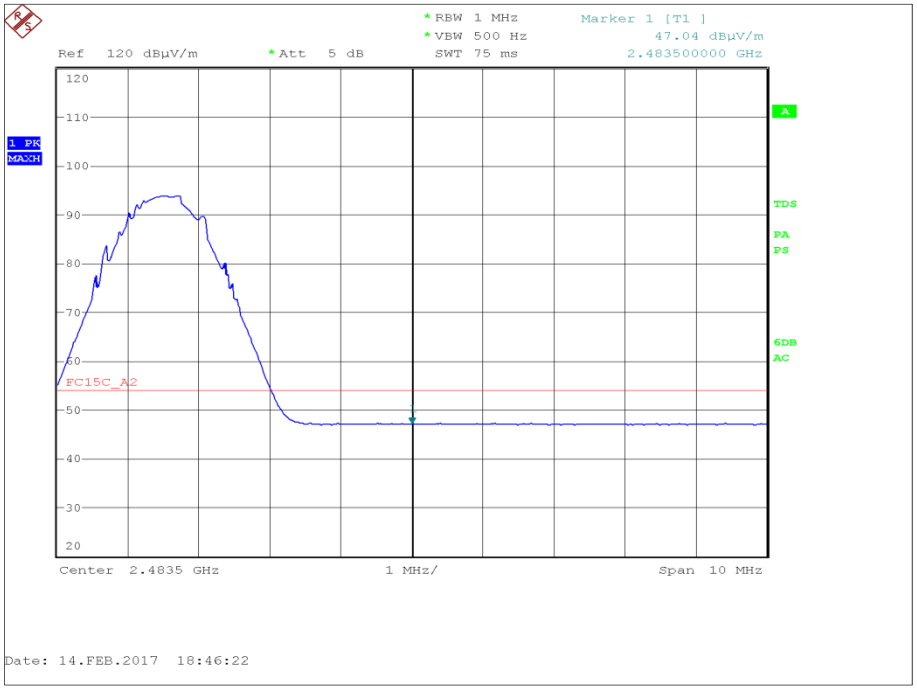

Figure 50 - Static, GFSK, 2480 MHz, Measured Frequency 2483.5 MHz, Average

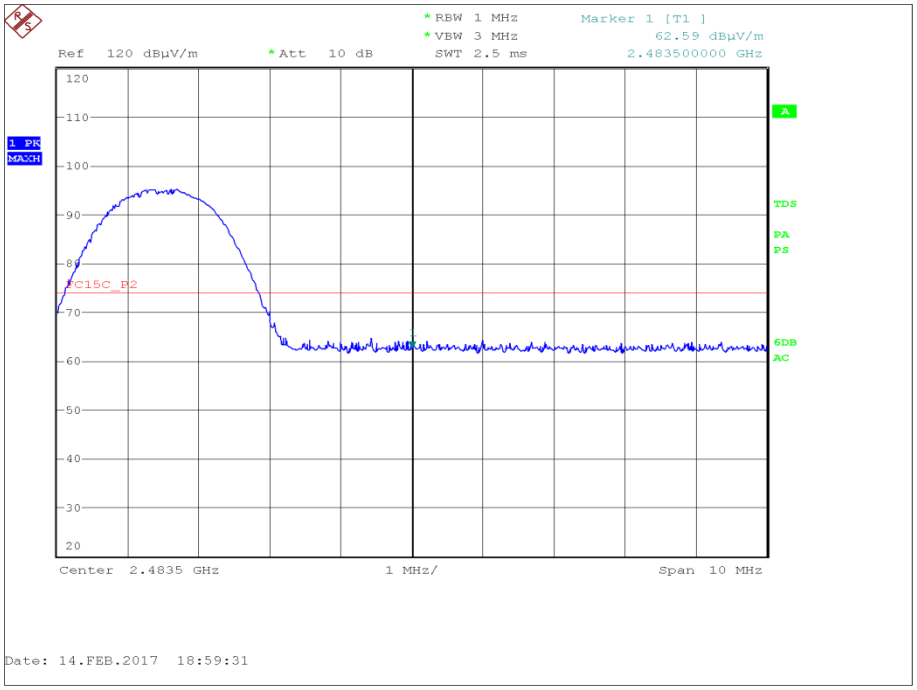

Figure 51 - Static, π/4 DQPSK, 2480 MHz, Measured Frequency 2483.5 MHz, Peak

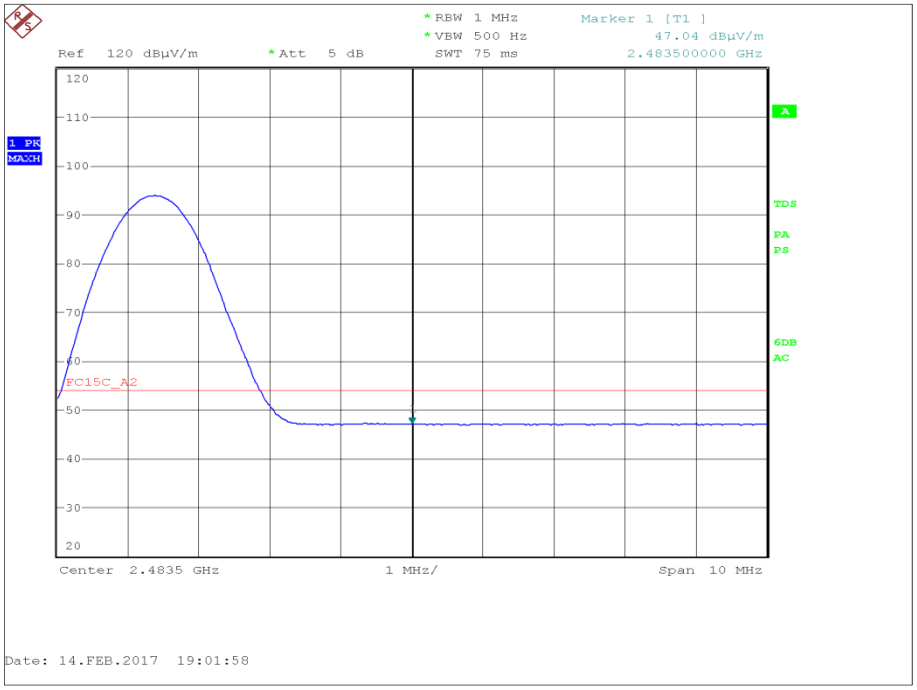

Figure 52 - Static, π/4 DQPSK, 2480 MHz, Measured Frequency 2483.5 MHz, Average

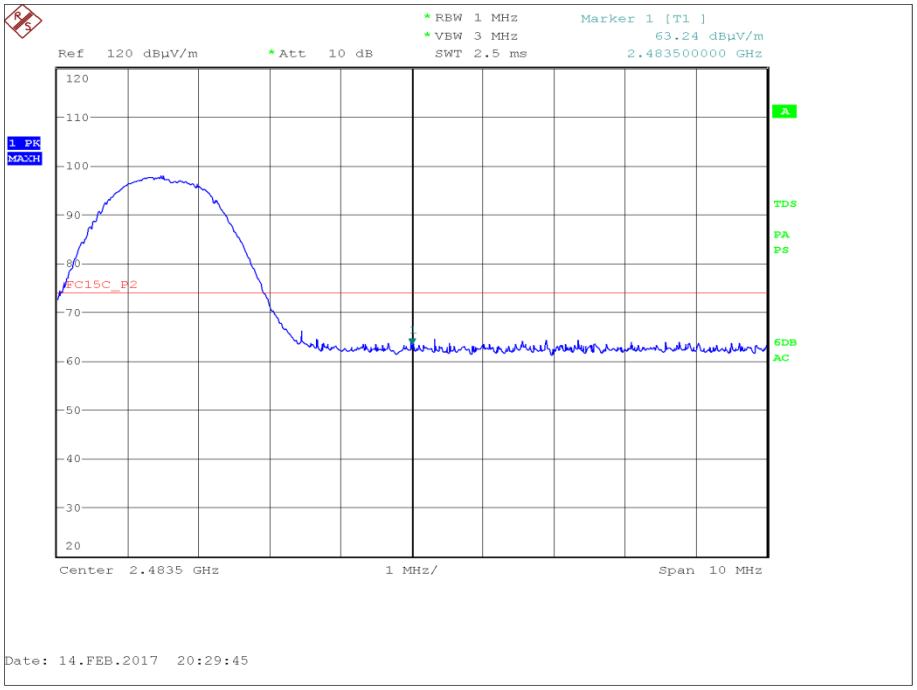

Figure 53 - Static, 8-DPSK, 2480 MHz, Measured Frequency 2483.5 MHz, Peak

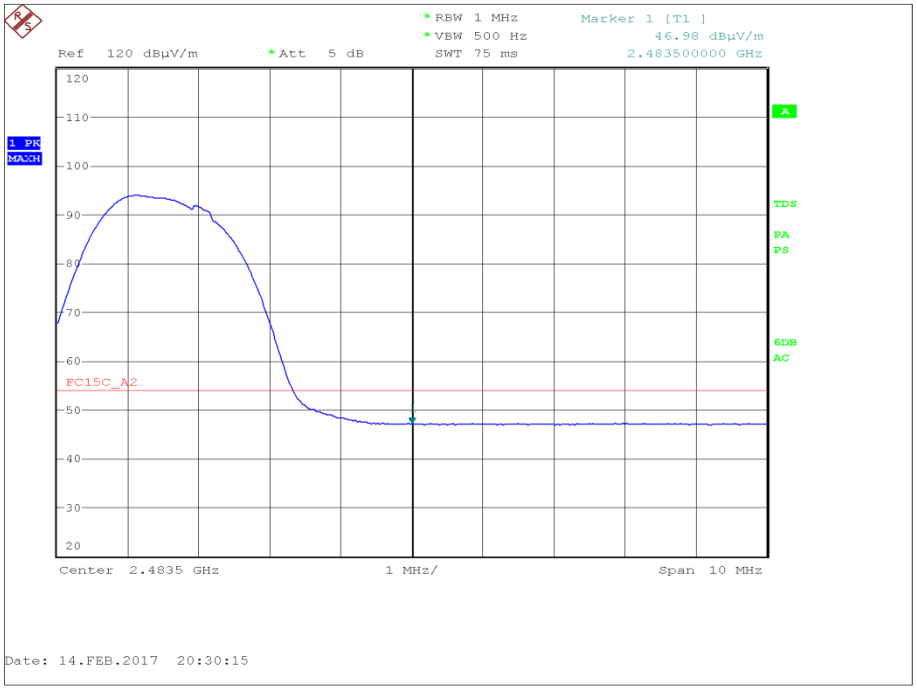

Figure 54 - Static, 8-DPSK, 2480 MHz, Measured Frequency 2483.5 MHz, Average

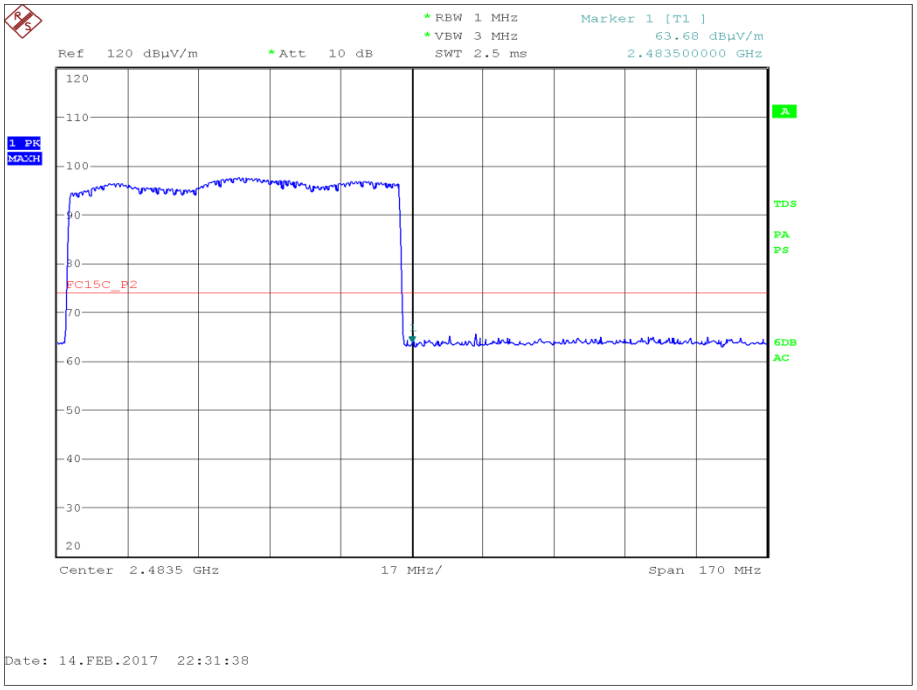

Figure 55 - Hopping, GFSK, 2480 MHz, Measured Frequency 2483.5 MHz, Peak

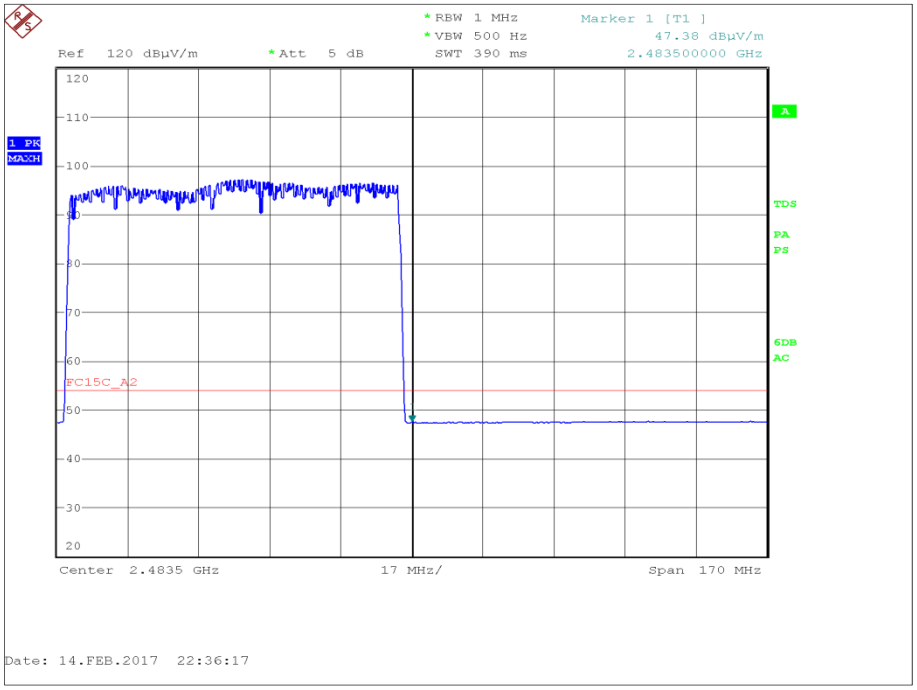

Figure 56 - Hopping, GFSK, 2480 MHz, Measured Frequency 2483.5 MHz, Average

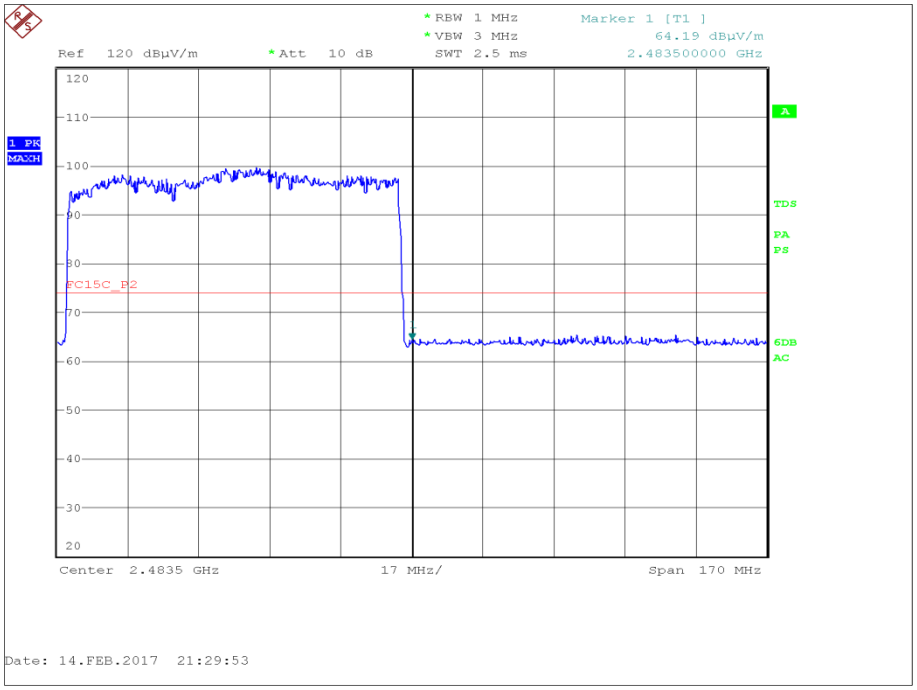

Figure 57 - Hopping, π/4 DQPSK, 2480 MHz, Measured Frequency 2483.5 MHz, Peak

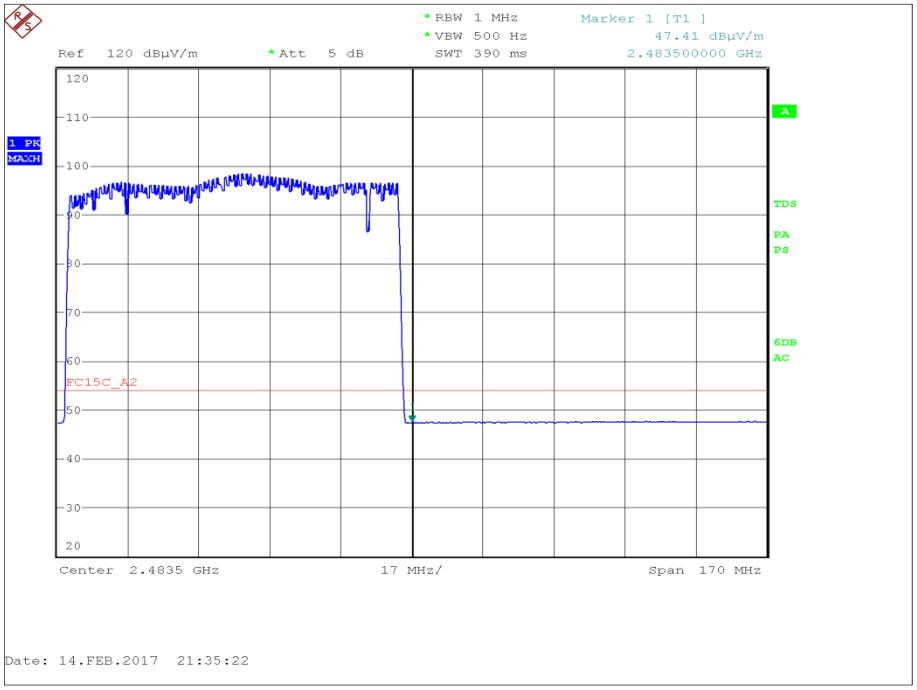

Figure 58 - Hopping, π/4 DQPSK, 2480 MHz, Measured Frequency 2483.5 MHz, Average

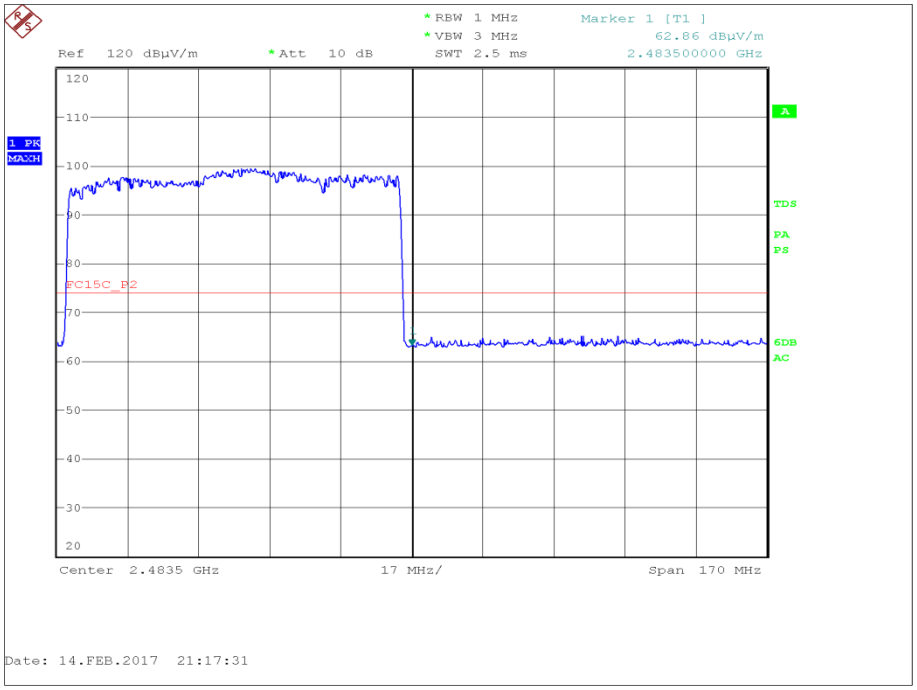

Figure 59 - Hopping, 8-DPSK, 2480 MHz, Measured Frequency 2483.5 MHz, Peak

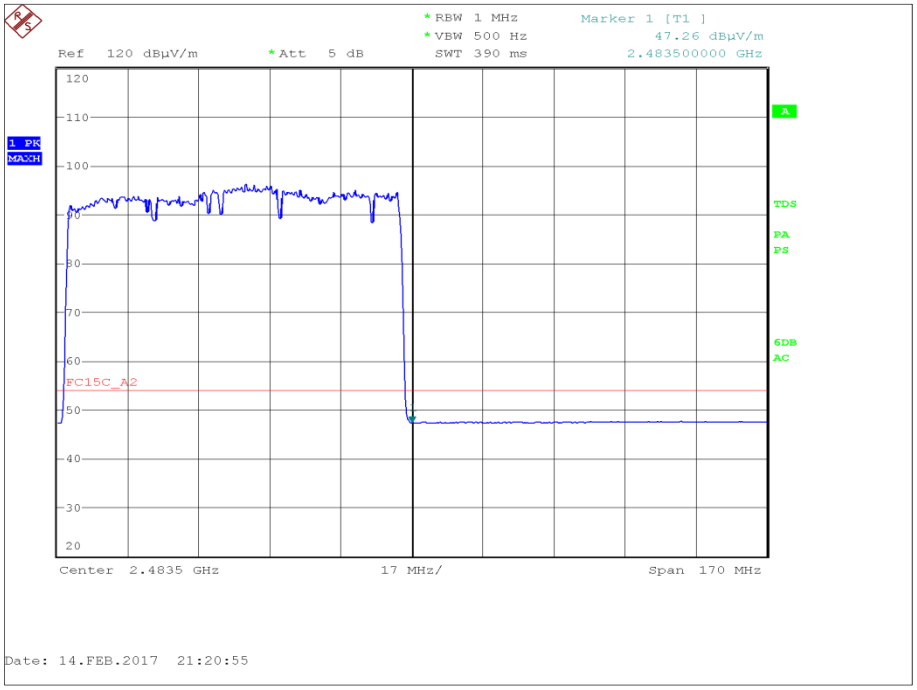

Figure 60 - Hopping, 8-DPSK, 2480 MHz, Measured Frequency 2483.5 MHz, Average

FCC 47 CFR Part 15, Limit Clause 15.205

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

Table 28

Industry Canada RSS-GEN, Limit Clause 8.9

Frequency (MHz)	Field Strength (µV/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960	500

Table 29

Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.

2.8.7 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
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	27-Feb-2017

Table 30

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

2.9 Authorised Band Edges

2.9.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d)
Industry Canada RSS-247, Clause 5.5

2.9.2 Equipment Under Test and Modification State

IsatPhone2w, S/N: IMEI 353032044022966 - Modification State 0

2.9.3 Date of Test

14-February-2017

2.9.4 Test Method

Testing was performed in accordance with ANSI C63.10-2013 clause 6.10.4

2.9.5 Environmental Conditions

Ambient Temperature	18.3 °C
Relative Humidity	33.0 %

2.9.6 Test Results

Bluetooth

Mode	Modulation	Measured Frequency (MHz)	Peak Level (dBµV/m)
Static	GFSK	2400.0	51.09
Static	π/4 DQPSK	2400.0	52.32
Static	8-DPSK	2400.0	53.46
Hopping	GFSK	2400.0	53.29
Hopping	8-DPSK	2400.0	54.68
Hopping	π/4 DQPSK	2400.0	53.39

Table 31 – 2402 MHz

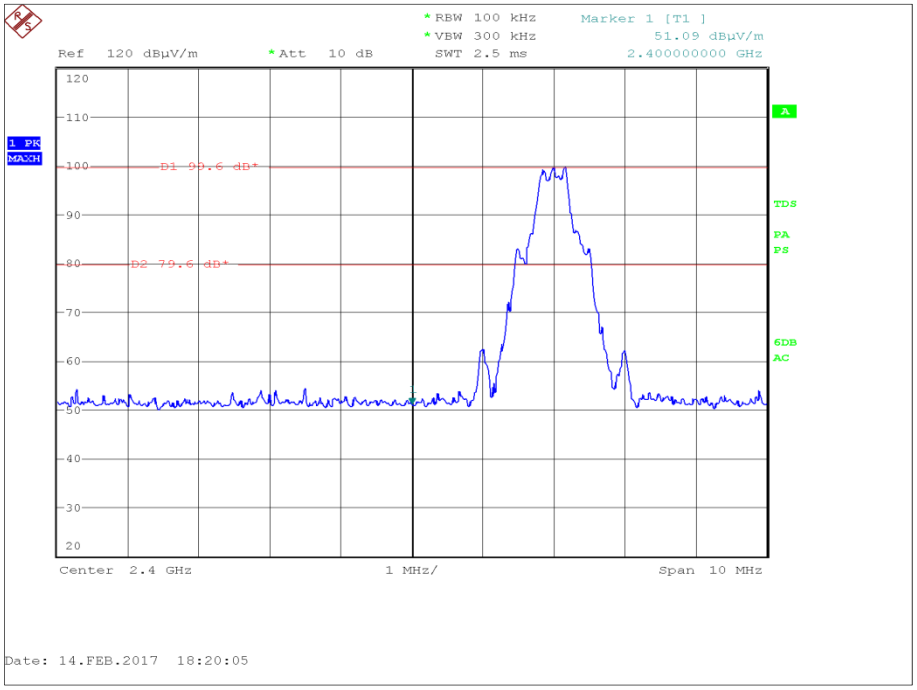

Figure 61 - Static, GFSK, 2402 MHz, Measured Frequency 2400.0 MHz

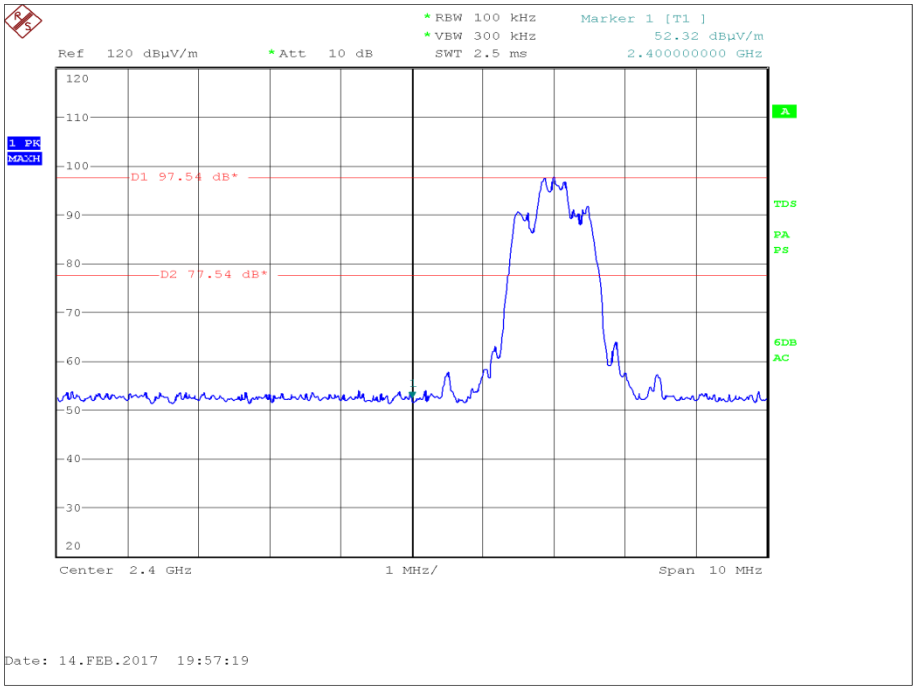

Figure 62 - Static, π/4 DQPSK, 2402 MHz, Measured Frequency 2400.0 MHz

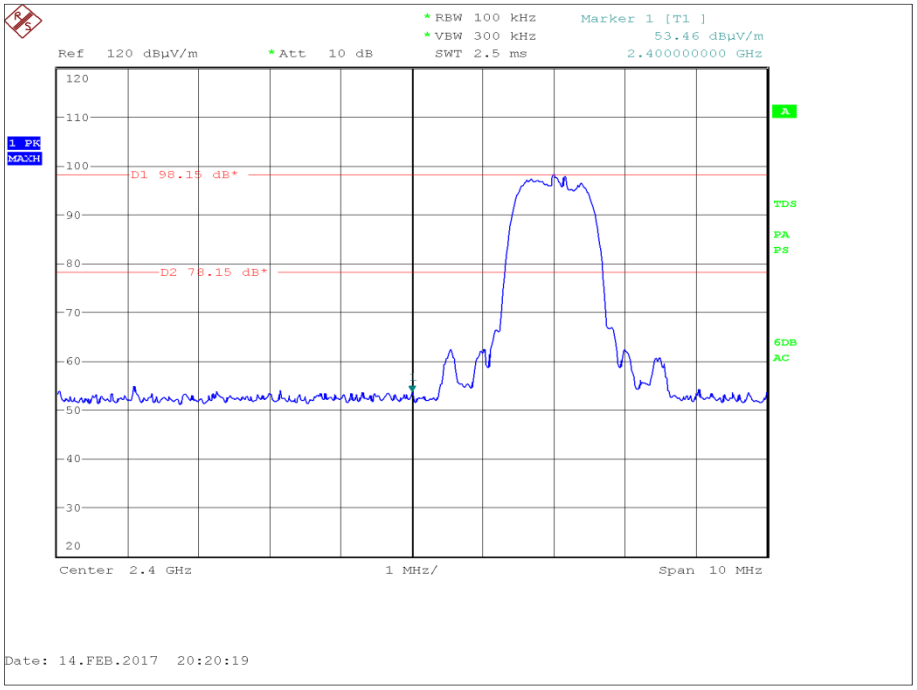

Figure 63 - Static, 8-DPSK, 2402 MHz, Measured Frequency 2400.0 MHz

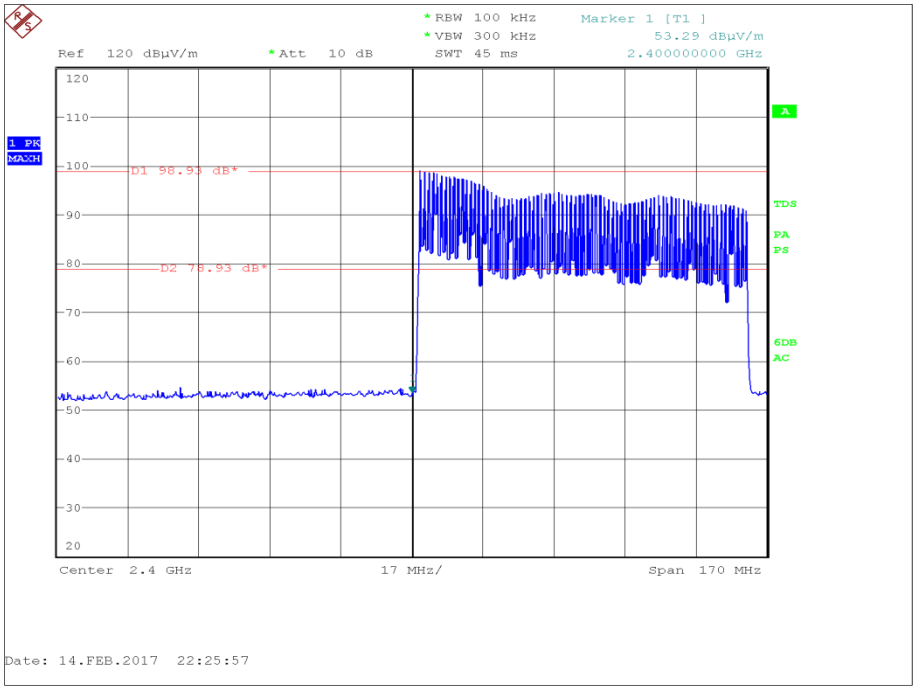

Figure 64 - Hopping, GFSK, 2402 MHz, Measured Frequency 2400.0 MHz

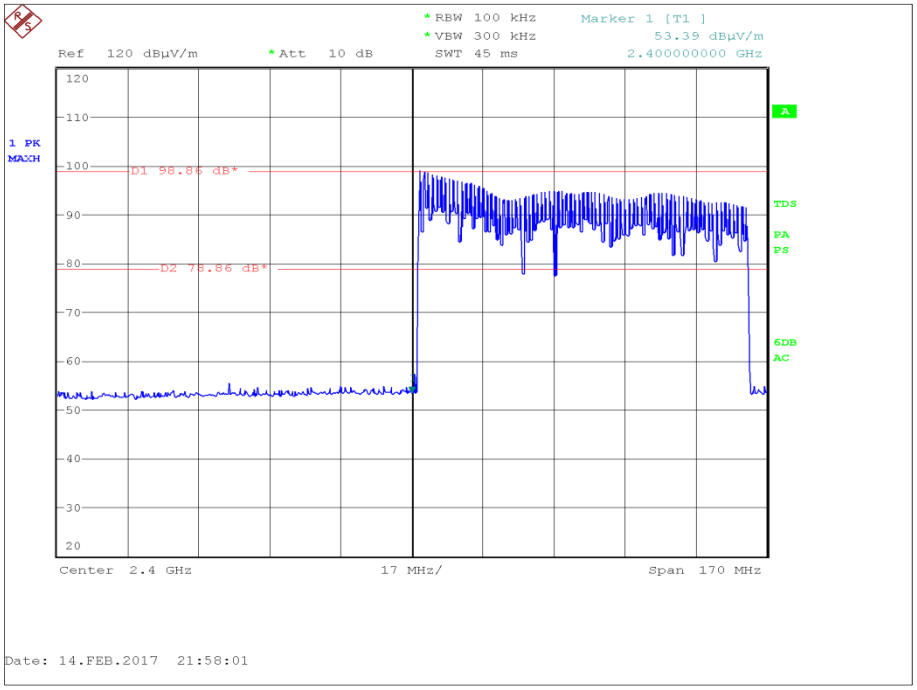

Figure 65 - Hopping, π/4 DQPSK, 2402 MHz, Measured Frequency 2400.0 MHz

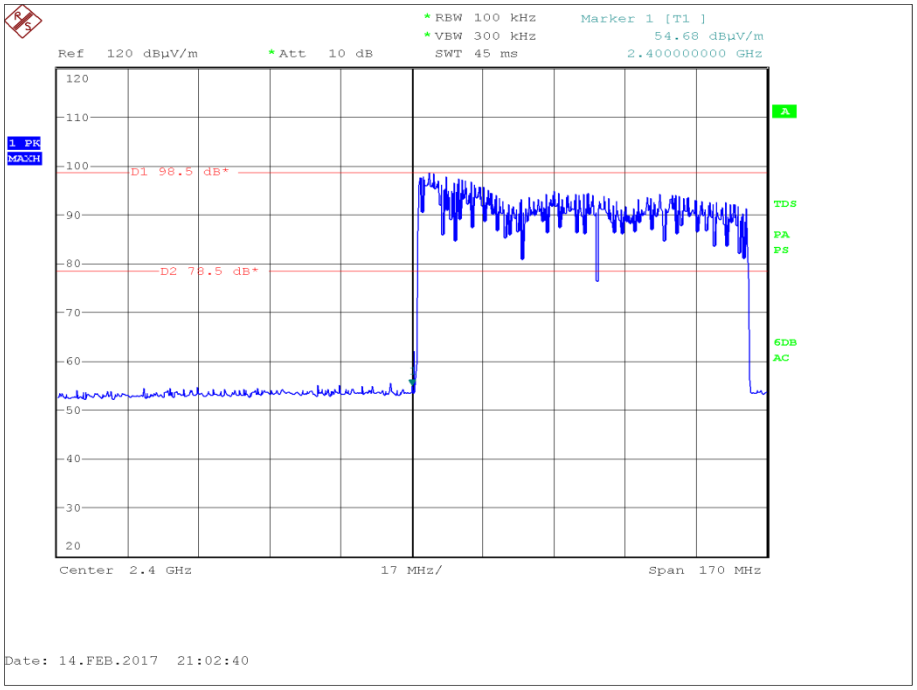

Figure 66 - Hopping, 8-DPSK, 2402 MHz, Measured Frequency 2400.0 MHz

Mode	Modulation	Measured Frequency (MHz)	Peak Level (dBµV/m)
Static	GFSK	2483.5	52.98
Static	π/4 DQPSK	2483.5	52.29
Static	8-DPSK	2483.5	52.29
Hopping	GFSK	2483.5	53.81
Hopping	π/4 DQPSK	2483.5	52.90
Hopping	8-DPSK	2483.5	52.68

Table 32 – 2480 MHz

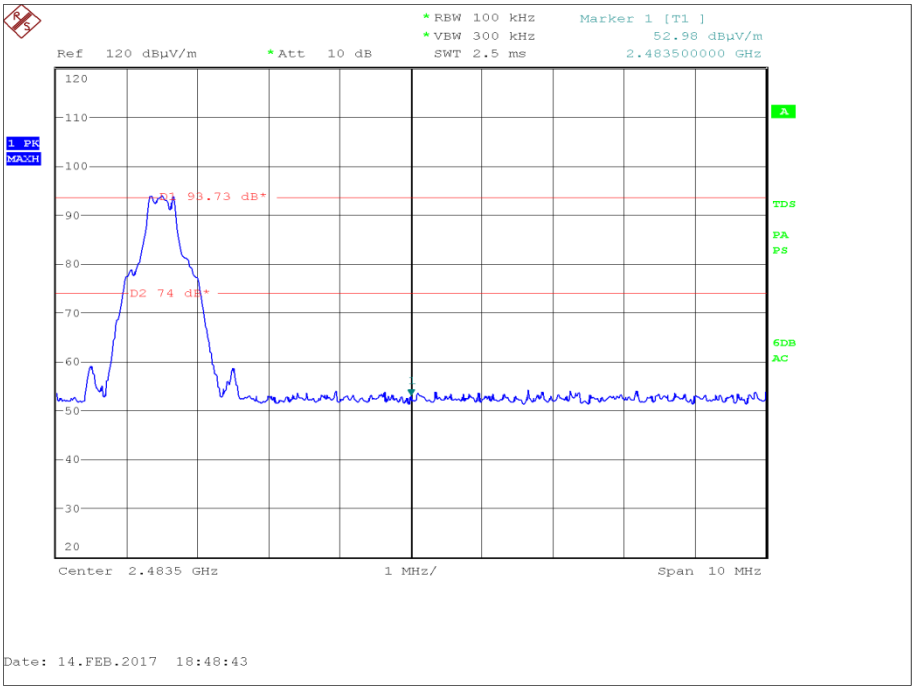

Figure 67 - Static, GFSK, 2480 MHz, Measured Frequency 2483.5 MHz

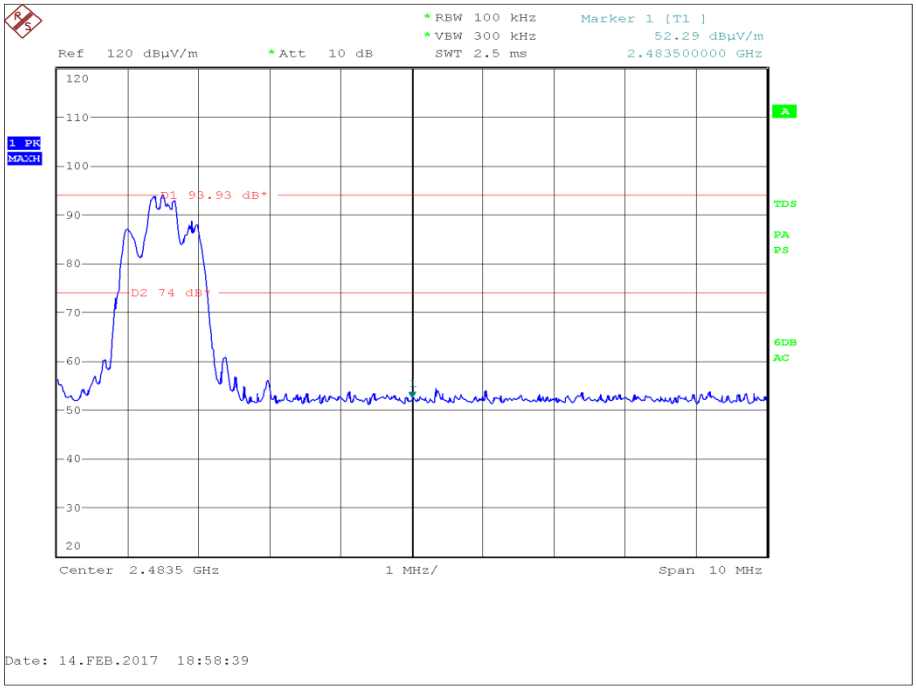

Figure 68 - Static, π/4 DQPSK, 2480 MHz, Measured Frequency 2483.5 MHz

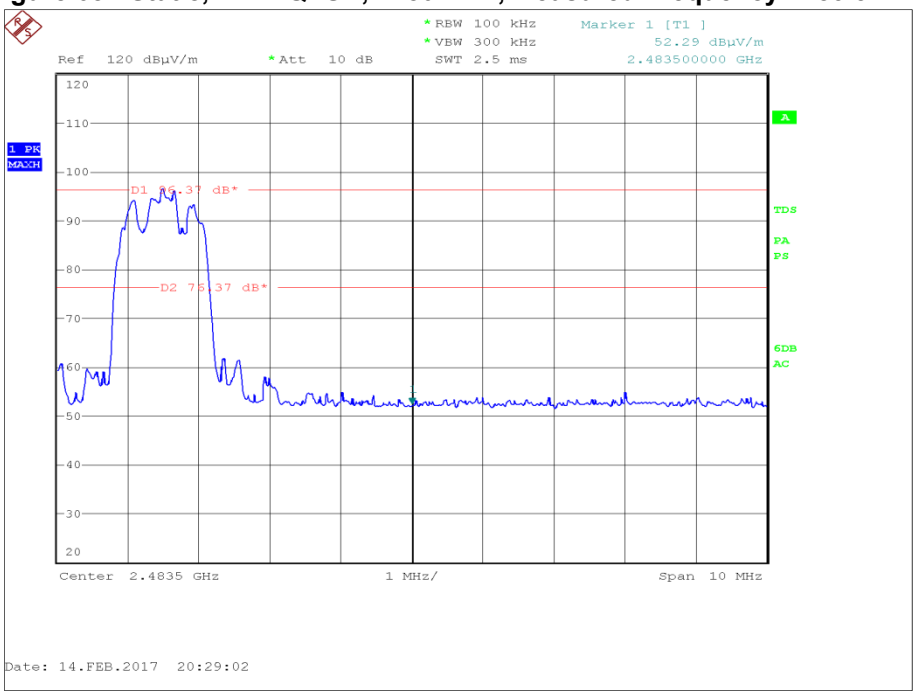

Figure 69 - Static, 8-DPSK, 2480 MHz, Measured Frequency 2483.5 MHz

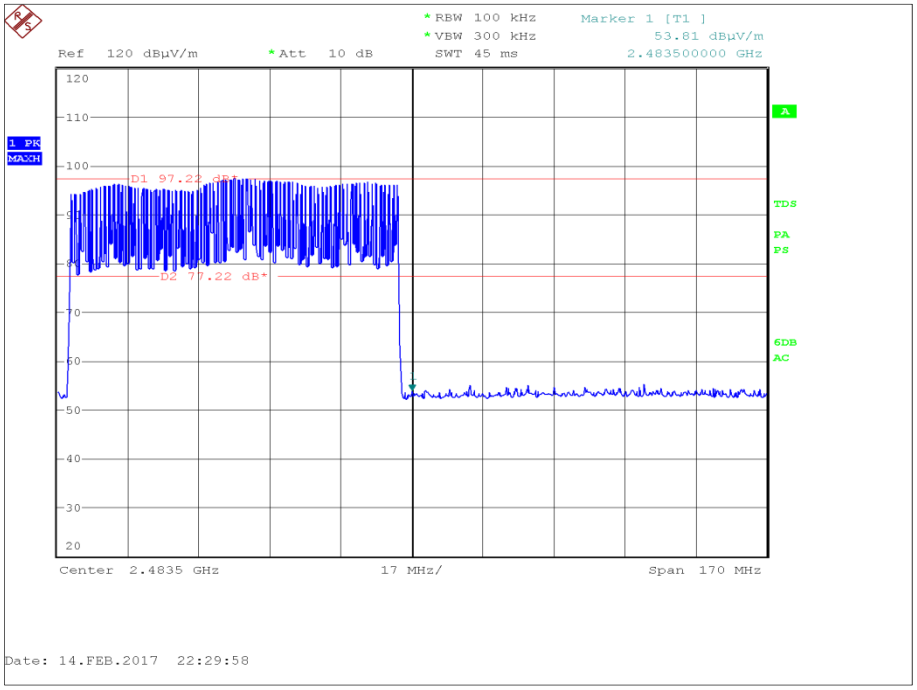

Figure 70 - Hopping, GFSK, 2480 MHz, Measured Frequency 2483.5 MHz

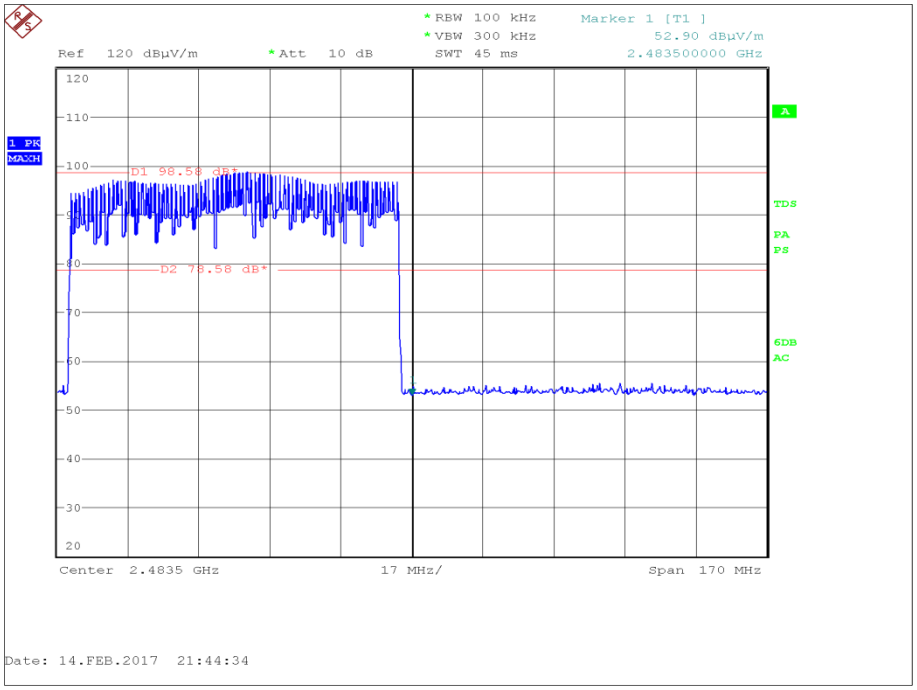

Figure 71 - Hopping, π/4 DQPSK, 2480 MHz, Measured Frequency 2483.5 MHz

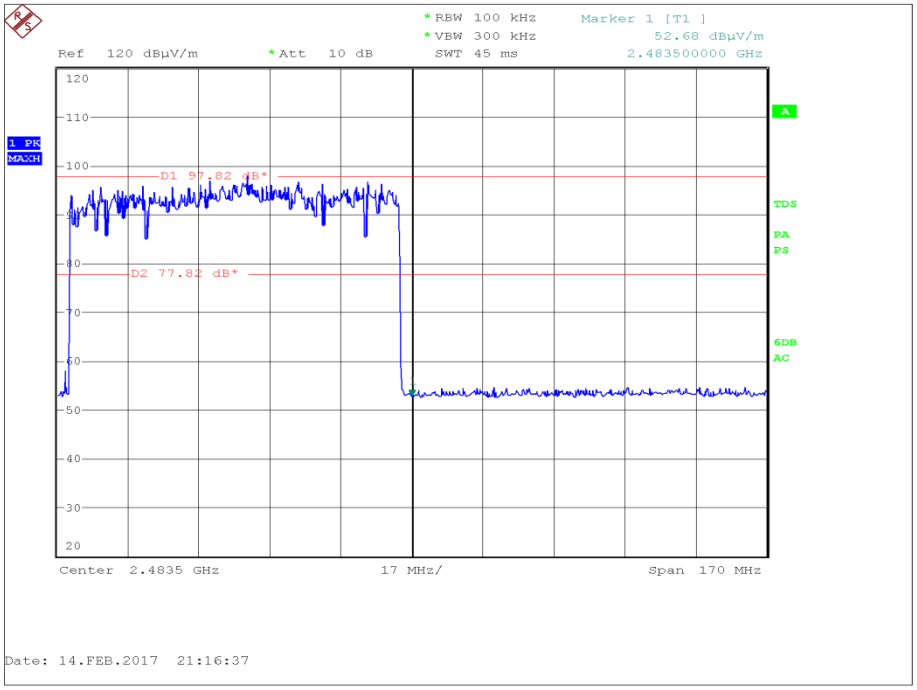

Figure 72 - Hopping, 8-DPSK, 2480 MHz, Measured Frequency 2483.5 MHz

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.

Industry Canada RSS-247, Limit Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

2.9.7 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
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	12	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	6	O/P Mon
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	27-Feb-2017

Table 33

TU - Traceability Unscheduled
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
AC Power Line Conducted Emissions	150 kHz to 30 MHz, LISN, ±3.7 dB
Maximum Conducted Output Power	± 0.96 dB
Frequency Hopping Systems - Average Time of Occupancy	-
Frequency Hopping Systems - Channel Separation	± 16.74 kHz
Frequency Hopping Systems - Number of Hopping Channels	-
Frequency Hopping Systems - 20 dB Bandwidth	± 16.74 kHz
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	30 MHz to 1 GHz: ± 5.1 dB 1 GHz to 40 GHz: ± 6.3 dB

Table 34