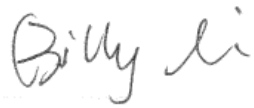
Nokia Corporation

Application For Certification (FCC ID: PYAMD-50W)

Nokia Play 360°Wireless Speaker MD-50W

Model: MD-50W (HW: 4.3, SW: V0.23, ME: 4.3)

2.4GHz Transceiver



SZ11060014-1
Billy Li
30 July, 2011

Intertek Testing Services Shenzhen Ltd. Kejiyuan Branch
6F, D Block, Huahan Building, Langshan Road, Nanshan District, Shenzhen, P. R. China
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LIST OF EXHIBITS

INTERTEK TESTING SERVICES

MEASUREMENT/TECHNICAL REPORT

Nokia Corporation

MODEL: MD-50W (HW: 4.3, SW: V0.23, ME: 4.3)

FCC ID: PYAMD-50W

12 July, 2011

This report concerns (check one:) Original Grant ___X___ Class II Change _____

Equipment Type: DSS - Part 15 Spread Spectrum Transmitter

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? Yes _____ No __X__

If yes, defer until: _____
date

Company Name agrees to notify the Commission by: _____
date

of the intended date of announcement of the product so that the grant can be issued on that date.

Transition Rules Request per 15.37? Yes _____ No __X__

If no, assumed Part 15, Subpart C for intentional radiator – the new 47 CFR [10-1-10 Edition] provision.

Report prepared by:

Shawn Xing
Intertek Testing Services Shenzhen Ltd.
Kejiyuan Branch
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Table of Contents

List of attached file

Exhibit type	File Description	filename
Test Report	Test Report	report.pdf
Operational Description	Technical Description	descri.pdf
Test Setup Photo	Radiated Emission	radiated photos.pdf
Test Setup Photo	Conducted Emission	conducted photos.pdf
External Photos	External Photo	external photos.pdf
Internal Photos	Internal Photo	internal photos.pdf
ID Label/Location Info	Label Artwork and Location	label.pdf
Block Diagram	Block Diagram	block.pdf
Schematics	Circuit Diagram	circuit.pdf
Users Manual	User Manual	manual.pdf
Cover Letter	Letter of Agency	letter of agency.pdf
RF Exposure	RF Exposure	RF Exposure.pdf

EXHIBIT 1

GENERAL DESCRIPTION

1.0 General Description

1.1 Product Description

The Equipment under Test (EUT) is a Nokia Play 360° Bluetooth Wireless Speaker MD-50W model: MD-50W (HW: 4.3, SW: V0.23, ME: 4.3). It is powered by an internal 3.7V rechargeable battery and charged by an external adapter (Input: 100-240VAC, 50/60Hz, output: DC 5.0V).

Antenna Type: Integral antenna

For electronic filing, the brief circuit description is saved with filename: descri.pdf.

1.2 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.4 (2003) and DA 00-705. Radiated emission measurement was performed in semi-anechoic chamber and conducted emission measurement was performed in shield room. For radiated emission measurement, preliminary scans were performed in the semi-anechoic chamber only to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

1.3 Test Facility

The Semi-Anechoic chamber and shield room used to collect the radiated data and conducted data is **Interterk Testing Services Shenzhen Ltd. Kejiyuan Branch** and located at 6F, Block D, Huahan Building, Langshan Road, Nanshan District, Shenzhen, P. R. China. This test facility and site measurement data have been fully placed on file with the FCC.

EXHIBIT 2

SYSTEM TEST CONFIGURATION

2.0 System Test Configuration

2.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in ANSI C63.4 (2003).

The EUT was powered by a fully charged 3.7V internal rechargeable battery and charged by an external adaptor (AC-10U: Input: 100-240V AC, 50/ 60Hz, output: DC 5.0V) in the testing. Only the worst case data was reported.

All packets DH1, DH3 & DH5 mode in all modulation types GFSK, π/4 –DQPSK and 8-DPSK were tested.

For maximizing emissions, the EUT was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data reported in Exhibit 3.0.

The unit was placed in the center of the turntable when powered by internal rechargeable battery and the rear of unit shall be flushed with the rear of the table when powered by adapter.

The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). The EUT was placed on a turn table, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

2.2 EUT Exercising Software

No software is used.

2.3 Special Accessories

No special accessories used

2.4 Equipment Modification

Any modifications installed previous to testing by Nokia Corporation will be incorporated in each production model sold / leased in the United States.

No modifications were installed by Intertek Testing Services Shenzhen Ltd. Kejiyuan Branch.

2.5 Measurement Uncertainty

When determining the test conclusion, the Measurement Uncertainty of test has been considered.

2.6 Support Equipment List and Description

This product was tested in the following configuration:

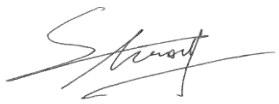
Refer List:

Description	Manufacturer	Model No.
Mobile Phone	Nokia	C7
Adapter	Nokia	AC-10U (INPUT: AC 100-240V/50-60Hz/160mA/16VA; OUTPUT: DC 5V/1200mA)
Bluetooth Tester	R&S	CBT

All the items listed under section 2.0 of this report are

Confirmed by:

Shawn Xing
Manager
Intertek Testing Services Shenzhen Ltd. Kejiyuan Branch
Agent for Nokia Corporation



Signature

12 July, 2011 Date

EXHIBIT 3

TEST RESULTS

3.0 **Test Results**

Data is included worst-case configuration (the configuration which resulted in the highest emission levels).

3.1 **Radiated Test Results**

A sample calculation, configuration photographs and data tables of the emissions are included.

3.1.1 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

FS = RA + AF + CF - AG + PD + AV

Where FS = Field Strength in dBµV/m
RA = Receiver Amplitude (including preamplifier) in dBµV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB
PD = Pulse Desensitization in dB
AV = Average Factor in -dB

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

FS = RA + AF + CF - AG + PD + AV

Assume a receiver reading of 62.0 dBµV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB, and the resultant average factor was -10 dB. The net field strength for comparison to the appropriate emission limit is 32 dBµV/m. This value in dBµV/m was converted to its corresponding level in µV/m.

RA = 62.0 dBµV
AF = 7.4 dB
CF = 1.6 dB
AG = 29.0 dB
PD = 0 dB

AV = -10 dB

FS = 62 + 7.4 + 1.6 - 29 + 0 + (-10) = 32 dBµV/m

Level in µV/m = Common Antilogarithm [(32 dBµV/m)/20] = 39.8 µV/m

3.1.2 Radiated Emission Configuration Photograph

For electronic filing, the worst case radiated emission configuration photograph is saved with filename: radiated photos. pdf.

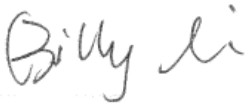
3.1.3 Radiated Emissions- FCC section 15.209

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Worst Case Radiated Emission
at
30.970 MHz

Judgement: Passed by 16.9 dB

TEST PERSONNEL:



Signature

Billy Li, Compliance Engineer
Typed/Printed Name

12 July, 2011
Date

Applicant: Nokia Corporation
Model: MD-50W (HW: 4.3, SW: V0.23, ME: 4.3)
Sample: 2/3
Mode: BT Link With Cell Phone + Adapter

Date of Test: 12 July, 2011

Table 1

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	30.970	24.3	20.0	18.8	23.1	40.0	-16.9
Horizontal	91.110	23.8	20.0	9.7	13.5	43.5	-30.0
Horizontal	185.200	23.9	20.0	12.0	15.9	43.5	-27.6
Vertical	33.395	24.4	20.0	17.3	21.7	40.0	-18.3
Vertical	52.795	29.5	20.0	9.4	18.9	40.0	-21.1
Vertical	186.655	26.5	20.0	12.0	18.5	43.5	-25.0

NOTES:
1. Quasi-Peak detector is used except for others stated.
2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. All emissions are below the QP limit.

Test Engineer: Billy Li

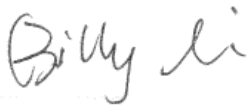
3.1.4 Transmitter Spurious Emissions (Radiated) - FCC section 15.209

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Worst Case Radiated Emission
at
4960.000 MHz

Judgement: Passed by 17.3 dB

TEST PERSONNEL:



Signature

Billy Li, Compliance Engineer
Typed/Printed Name

12 July, 2011
Date

Applicant: Nokia Corporation Date of Test: 12 July, 2011
Model: MD-50W (HW: 4.3, SW: V0.23, ME: 4.3)
Sample: 2/3
Mode: TX-CH00 (2402MHz)

Table 2

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	**2402.000	107.7	36.7	28.5	99.5	--	--
Vertical	*4804.000	58.6	36.1	33.1	55.6	74.0	-18.4
Vertical	*1600.000	52.0	36.8	26.5	41.7	74.0	-32.3

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Vertical	*4804.000	58.6	36.1	33.1	30.1	25.5	54.0	-28.5

NOTES: 1. Peak detector is used except for others stated.

2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative value in the margin column shows emission below limit.

4. Horn antenna used for the emission over 1000MHz.

* Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

** Fundamental emission was measured for determining band-edge compliance of using delta measurement technique.

Test Engineer: Billy Li

Applicant: Nokia Corporation
Model: MD-50W (HW: 4.3, SW: V0.23, ME: 4.3)
Sample: 2/3
Mode: TX-CH39 (2441MHz)

Date of Test: 12 July, 2011

Table 3

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
Vertical	*4882.000	59.2	36.1	33.3	56.4	74.0	-17.6
Vertical	*7323.000	51.9	36.2	37.9	53.6	74.0	-20.4

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Vertical	*4882.000	59.2	36.1	33.3	30.1	26.3	54.0	-27.7
Vertical	*7323.000	51.9	36.2	37.9	30.1	23.5	54.0	-30.5

NOTES: 1. Peak detector is used except for others stated.

2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative value in the margin column shows emission below limit.

4. Horn antenna used for the emission over 1000MHz.

* Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

Test Engineer: Billy Li

Applicant: Nokia Corporation Date of Test: 12 July, 2011
Model: MD-50W (HW: 4.3, SW: V0.23, ME: 4.3)
Sample: 2/3
Mode: TX-CH78 (2480MHz)

Table 4

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	**2480.000	106.4	36.7	28.6	98.3	--	--
Vertical	*4960.000	59.4	36.1	33.4	56.7	74.0	-17.3
Vertical	*7440.000	51.8	36.2	38.2	53.8	74.0	-20.2

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Vertical	*4960.000	59.4	36.1	33.4	30.1	26.6	54.0	-27.4
Vertical	*7440.000	51.8	36.2	38.2	30.1	23.7	54.0	-30.3

NOTES: 1. Peak detector is used except for others stated.

2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative value in the margin column shows emission below limit.

4. Horn antenna used for the emission over 1000MHz.

* Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

** Fundamental emission was measured for determining band-edge compliance of using delta measurement technique.

Test Engineer: Billy Li

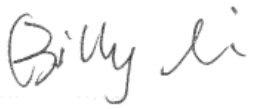
3.1.5 Receiver Spurious Emissions (Radiated) - FCC section 15.109

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Worst Case Radiated Emission
at
465.329 MHz

Judgement: Passed by 13.1 dB

TEST PERSONNEL:



Signature

Billy Li, Compliance Engineer
Typed/Printed Name

12 July, 2011
Date

Company: Nokia Corporation
Model: MD-50W (HW: 4.3, SW: V0.23, ME: 4.3)
Sample: 3/3
Mode: BT Idle + Adapter

Date of Test: 12 July, 2011

Table 5

Radiated Scan
Pursuant to 15.109 Emissions Requirement

Polarization	Frequency (MHz)	Net at 3m (dBµV/m)	Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	222.231	26.0	46.0	-20.0
Horizontal	298.542	25.8	46.0	-20.2
Horizontal	465.299	32.8	46.0	-13.2
Vertical	48.915	17.1	40.0	-22.9
Vertical	146.800	20.2	43.5	-23.3
Vertical	465.329	32.9	46.0	-13.1

Notes:
1. Quasi peak detector data for frequencies below 1000 MHz and average detector data for frequencies over 1000 MHz.
2. Negative sign (–) in the margin column signify levels below the limit.
3. Horn antenna is used for the emission over 1000MHz.
4. Uncertainty: ±4.8dB at a level of confidence of 95%.

3.2 **Conducted Emission at Mains Terminal**

3.2.1 Conducted Emissions Configuration Photograph

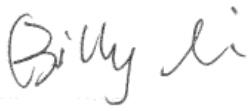
For electronic filing, the worst case conducted emission configuration photograph is saved with filename: conducted photos.pdf.

3.2.2 Conducted Emissions

Worst Case Neutral-Conducted Configuration
at
0.326 MHz

Judgement: Passed by 16.9 dB margin

TEST PERSONNEL:



Signature

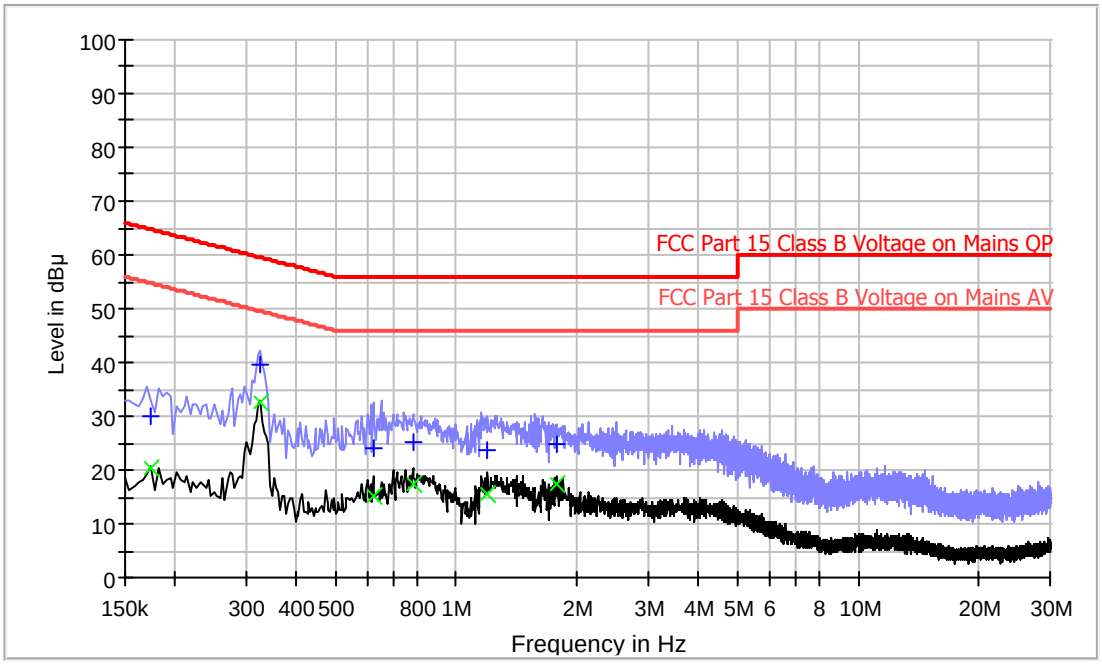
Billy Li, Compliance Engineer
Typed/Printed Name

12 July, 2011
Date

Company: Nokia Corporation Date of Test: 12 July, 2011
Model: MD-50W (HW: 4.3, SW: V0.23, ME: 4.3)
Sample: 2/3
Worst Case Operating Mode: BT Link With Cell Phone + Adapter

Conducted Emission Test – FCC

Pursuant to 15.207 Emissions Requirement



Result Table-QP

Frequency (MHz)	QuasiPeak (dB µ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.174000	30.0	L1	9.6	34.8	64.8
0.326000	39.7	L1	9.6	19.9	59.6
0.622000	24.2	L1	9.6	31.8	56.0
0.782000	25.2	L1	9.7	30.8	56.0
1.198000	23.8	L1	9.7	32.2	56.0
1.770000	25.0	L1	9.8	31.0	56.0

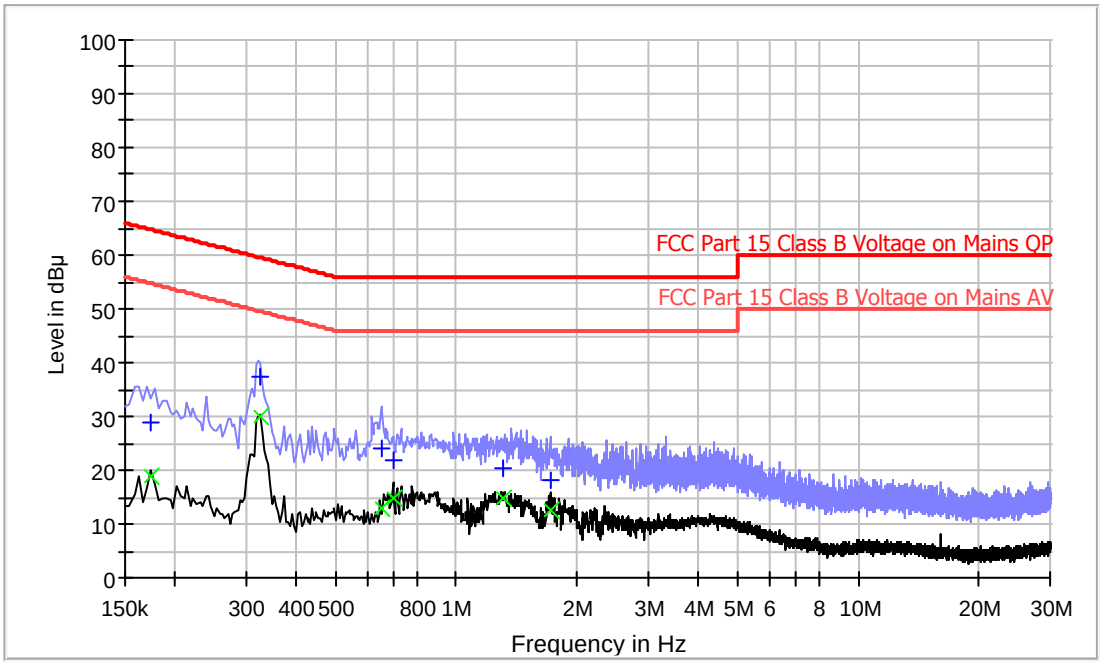
Result Table-AV

Frequency (MHz)	Average (dB µ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.174000	20.3	L1	9.6	34.5	54.8
0.326000	32.7	L1	9.6	16.9	49.6
0.622000	15.2	L1	9.6	30.8	46.0
0.782000	17.3	L1	9.7	28.7	46.0
1.198000	15.4	L1	9.7	30.6	46.0
1.770000	17.5	L1	9.8	28.5	46.0

Company: Nokia Corporation Date of Test: 12 July, 2011
Model: MD-50W (HW: 4.3, SW: V0.23, ME: 4.3)
Sample: 2/3
Worst Case Operating Mode: BT Link With Cell Phone + Adapter

Conducted Emission Test – FCC

Pursuant to 15.207 Emissions Requirement



Result Table-QP

Frequency (MHz)	QuasiPeak (dB µ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.174000	28.8	N	9.6	36.0	64.8
0.326000	37.4	N	9.6	22.2	59.6
0.650000	23.9	N	9.6	32.1	56.0
0.698000	21.9	N	9.6	34.1	56.0
1.302000	20.5	N	9.7	35.5	56.0
1.710000	18.2	N	9.8	37.8	56.0

Result Table-AV

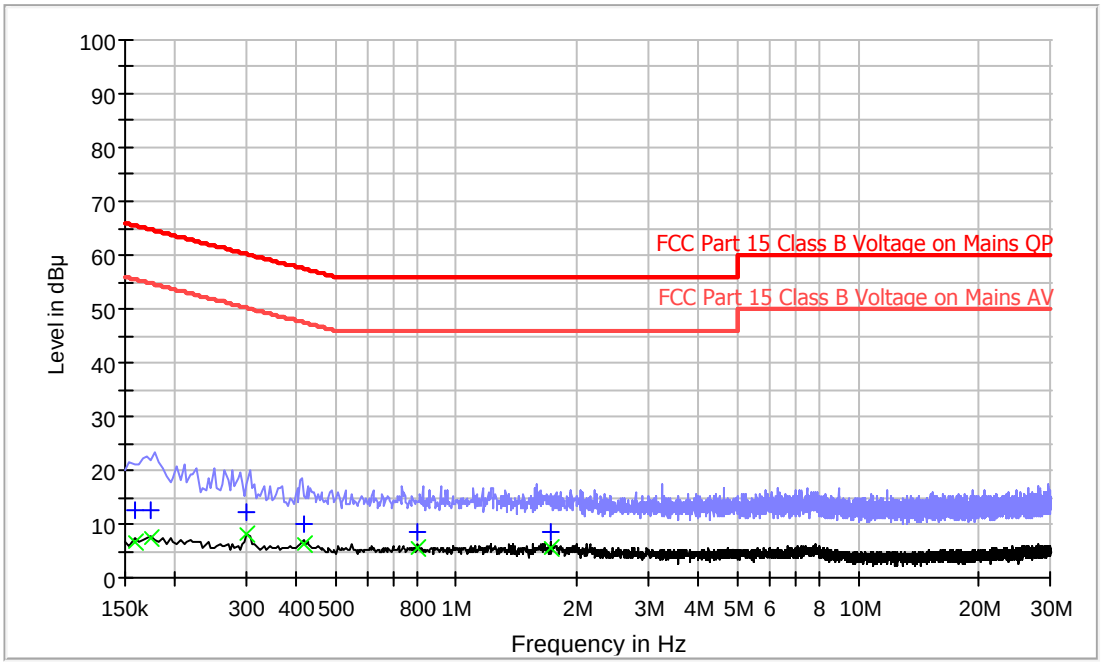
Frequency (MHz)	Average (dB µ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.174000	19.0	N	9.6	35.8	54.8
0.326000	30.0	N	9.6	19.6	49.6
0.650000	13.0	N	9.6	33.0	46.0
0.698000	14.9	N	9.6	31.1	46.0
1.302000	14.7	N	9.7	31.3	46.0
1.710000	12.5	N	9.8	33.5	46.0

Company: Nokia Corporation
Model: MD-50W (HW: 4.3, SW: V0.23, ME: 4.3)
Sample: 3/3
Worst Case Operating Mode: BT Idle + Adapter

Date of Test: 12 July, 2011

Conducted Emission Test - FCC

Pursuant to 15.107 Emissions Requirement



Result Table-QP

Frequency (MHz)	QuasiPeak (dB µ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.158000	12.7	L1	9.6	52.9	65.6
0.174000	12.6	L1	9.6	52.2	64.8
0.302000	12.2	L1	9.6	48.0	60.2
0.418000	10.0	L1	9.6	47.5	57.5
0.802000	8.4	L1	9.7	47.6	56.0
1.722000	8.5	L1	9.8	47.5	56.0

Result Table-AV

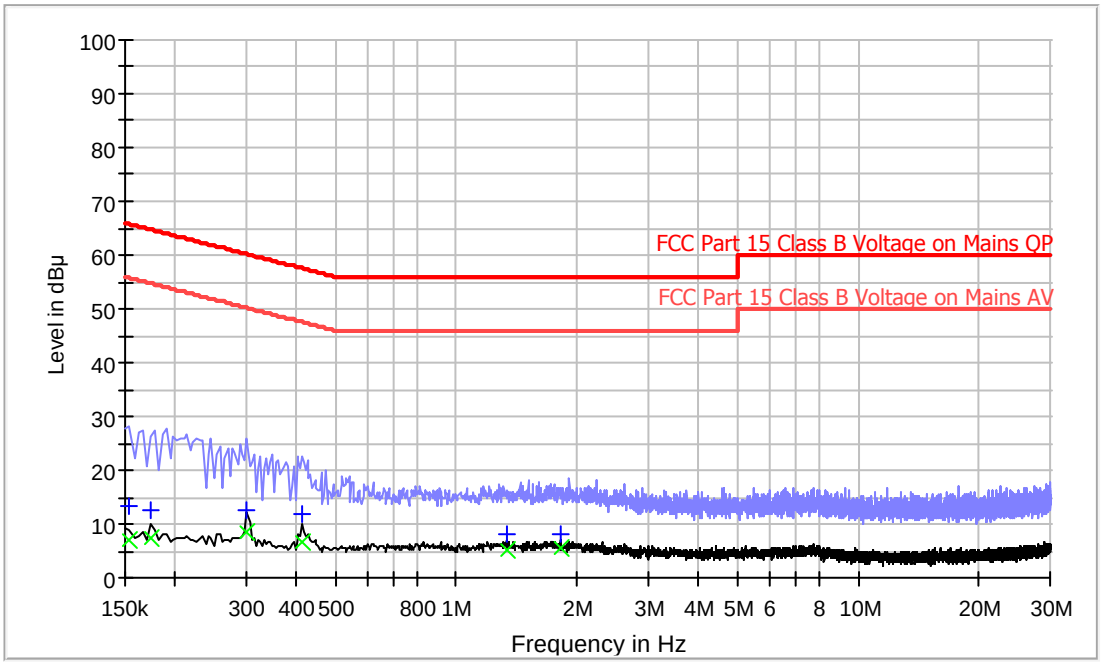
Frequency (MHz)	Average (dB µ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.158000	6.7	L1	9.6	48.9	55.6
0.174000	7.3	L1	9.6	47.5	54.8
0.302000	8.3	L1	9.6	41.9	50.2
0.418000	6.5	L1	9.6	41.0	47.5
0.802000	5.6	L1	9.7	40.4	46.0
1.722000	5.5	L1	9.8	40.5	46.0

Company: Nokia Corporation
Model: MD-50W (HW: 4.3, SW: V0.23, ME: 4.3)
Sample: 3/3
Worst Case Operating Mode: BT Idle + Adapter

Date of Test: 12 July, 2011

Conducted Emission Test - FCC

Pursuant to 15.107 Emissions Requirement



Result Table-QP

Frequency (MHz)	QuasiPeak (dB µ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.154000	13.3	N	9.6	52.5	65.8
0.174000	12.7	N	9.6	52.1	64.8
0.302000	12.8	N	9.6	47.4	60.2
0.414000	12.0	N	9.6	45.6	57.6
1.330000	8.2	N	9.7	47.8	56.0
1.818000	8.2	N	9.8	47.8	56.0

Result Table-AV

Frequency (MHz)	Average (dB µ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.154000	7.0	N	9.6	48.8	55.8
0.174000	7.3	N	9.6	47.5	54.8
0.302000	8.6	N	9.6	41.6	50.2
0.414000	6.7	N	9.6	40.9	47.6
1.330000	5.3	N	9.7	40.7	46.0
1.818000	5.4	N	9.8	40.6	46.0

3.3 **Peak Power**

Maximum Conducted Output Power at Antenna Terminals, FCC Rules 15.247(b)(1)

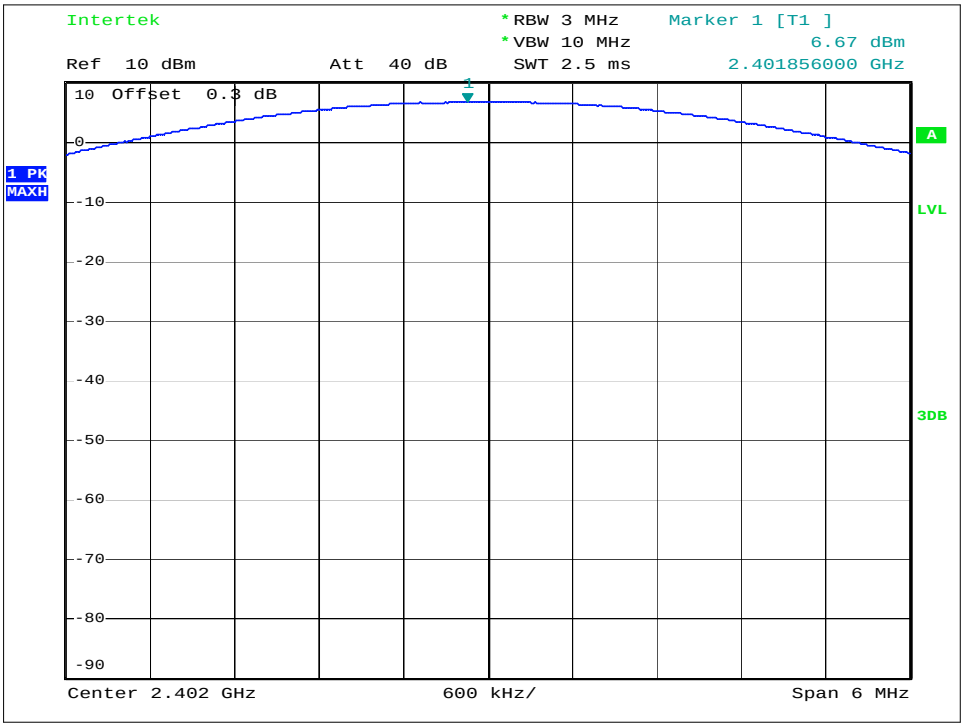
The antenna port of the EUT was connected to the input of a spectrum analyzer. The analyzer was set for RBW > 20dB bandwidth and power was read directly in dBm.

For antenna with gains of 6dBi or less, maximum allowed transmitter output 1 watt (+30dBm)

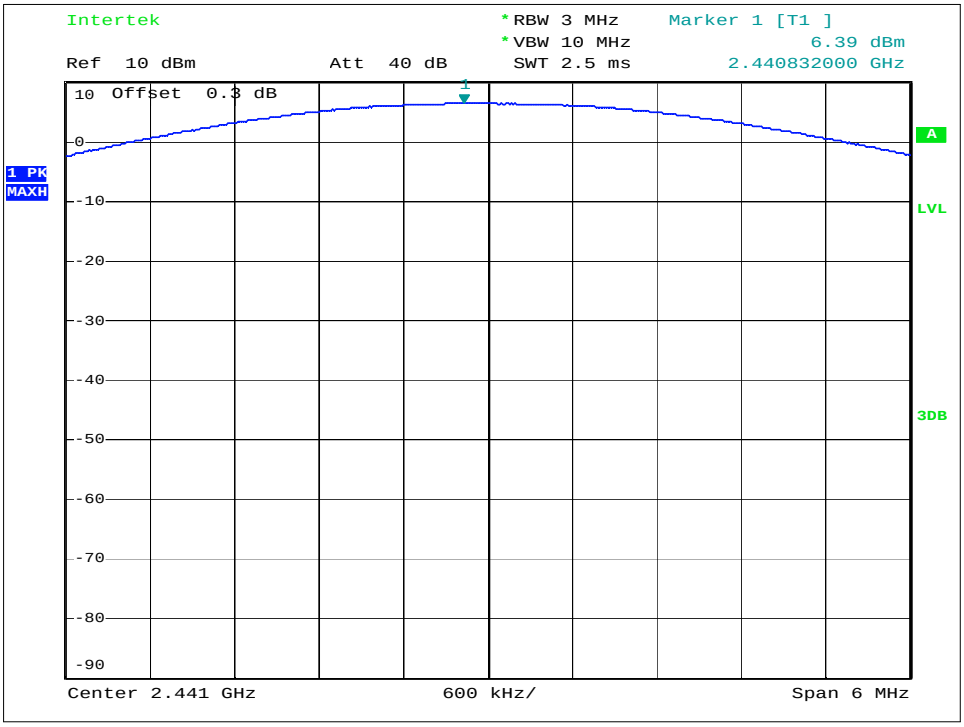
Antenna Gain = -2dBi			
Modulation Type	Frequency (MHz)	Output Power (dBm)	Output Power (mW)
GFSK	2402	6.67	4.65
	2441	6.39	4.36
	2480	6.12	4.09
π/4-DQPSK	2402	5.60	3.63
	2441	5.17	3.29
	2480	4.84	3.05
8DPSK	2402	5.84	3.84
	2441	5.39	3.46
	2480	5.11	3.24

Modulation Type: GFSK

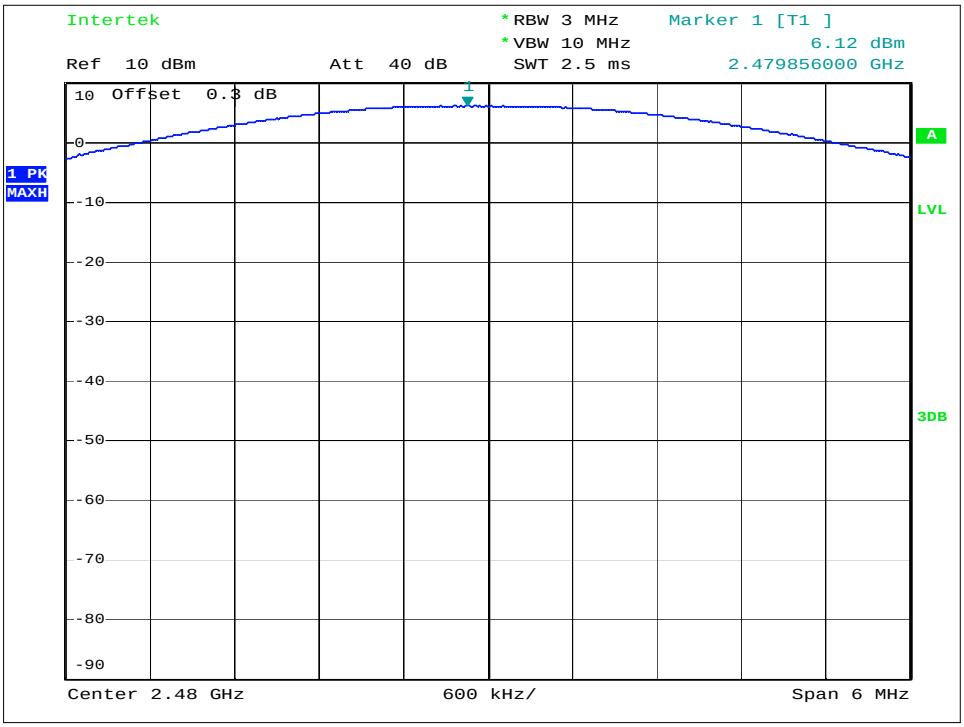
CH00



CH39

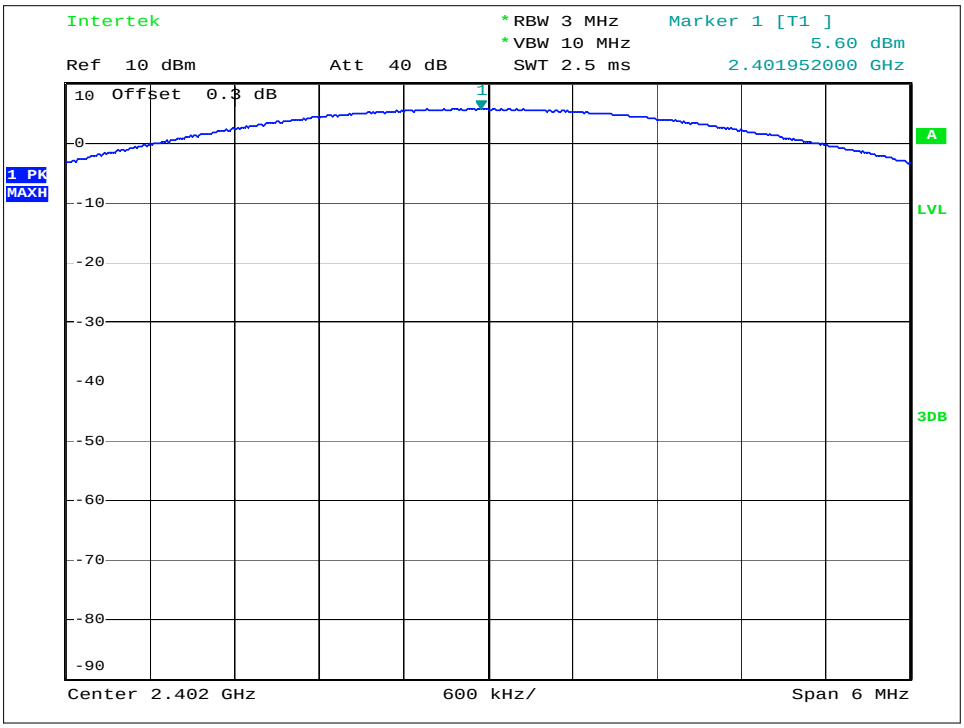


CH78

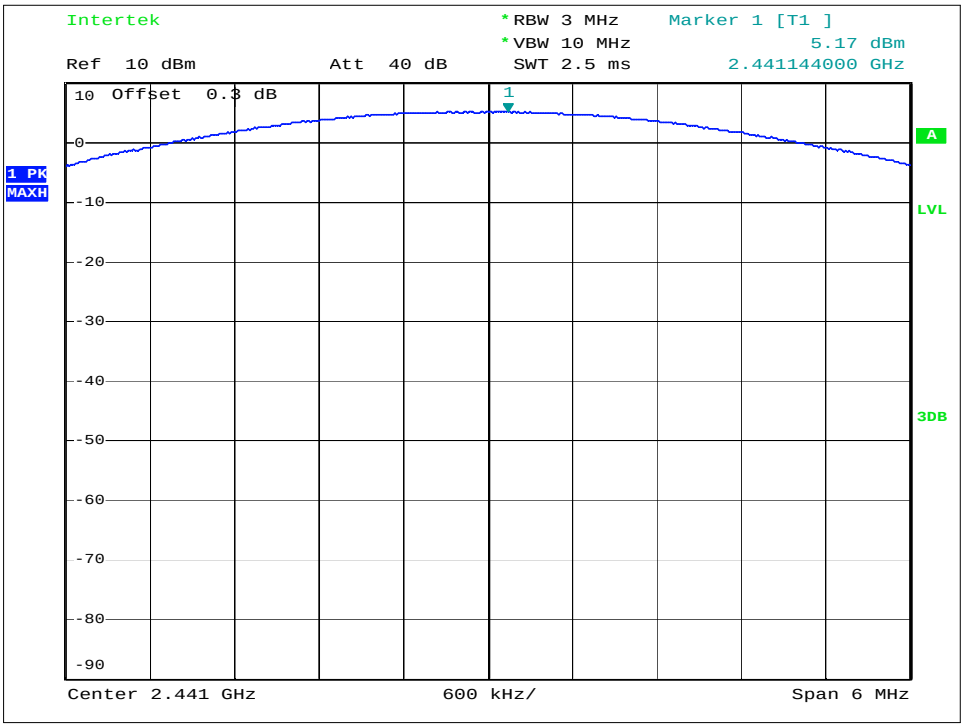


Modulation Type: π/4 –DQPSK

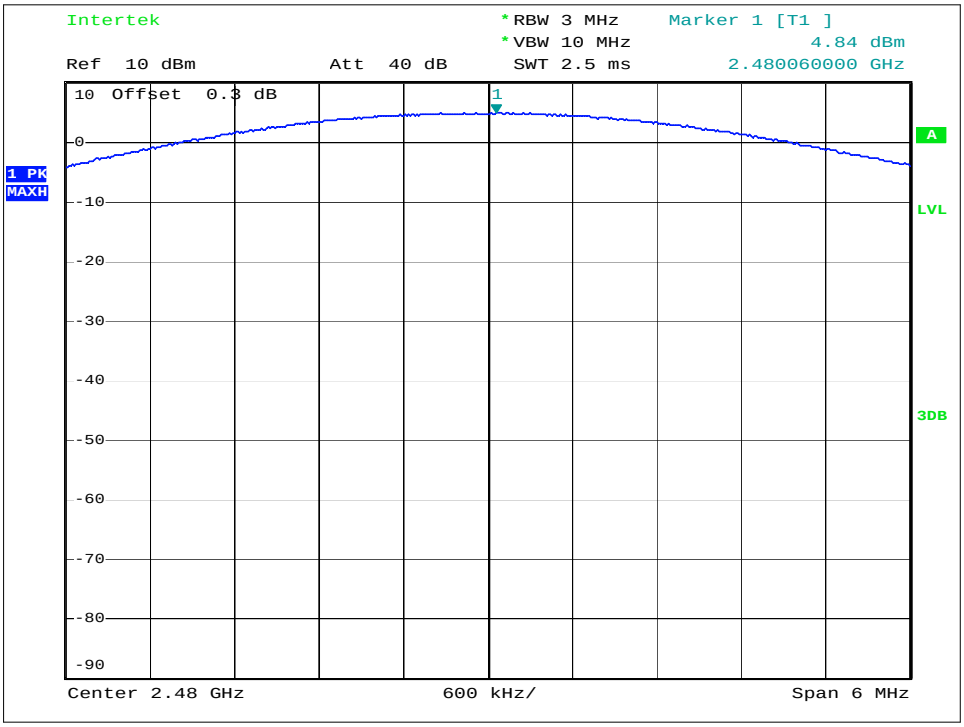
CH00



CH39

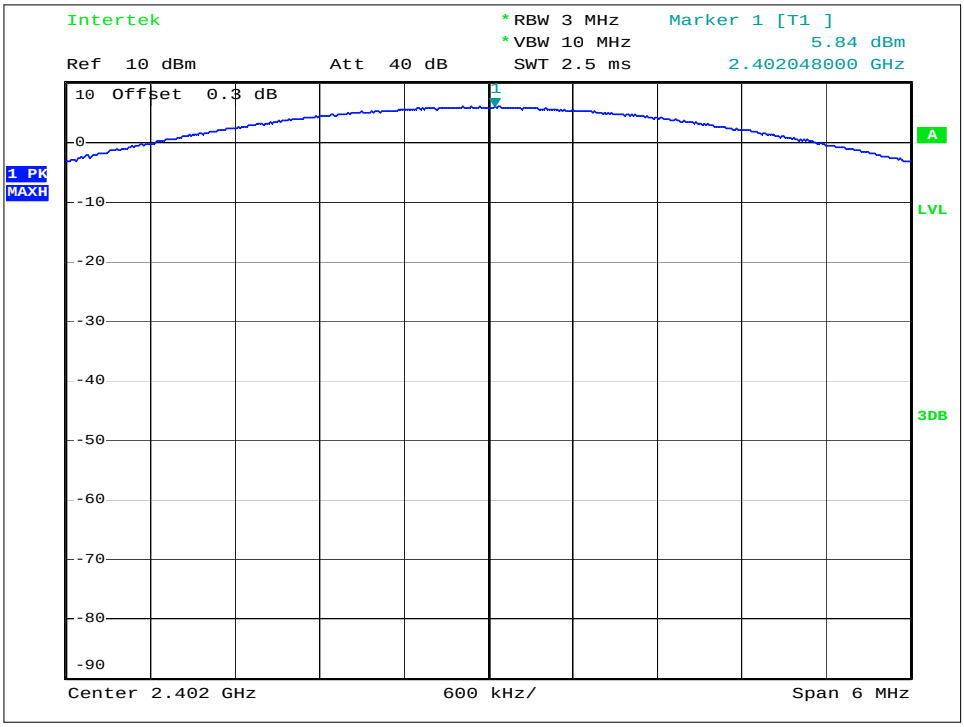

Intertek
*RBW 3 MHz
*VBW 10 MHz
SWT 2.5 ms
Marker 1 [T1]
5.17 dBm
2.441144000 GHz
Ref 10 dBm
Att 40 dB
10 Offset 0.3 dB
1 PK
MAXH
A
LVL
3DB
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.441 GHz
600 kHz/
Span 6 MHz

CH78

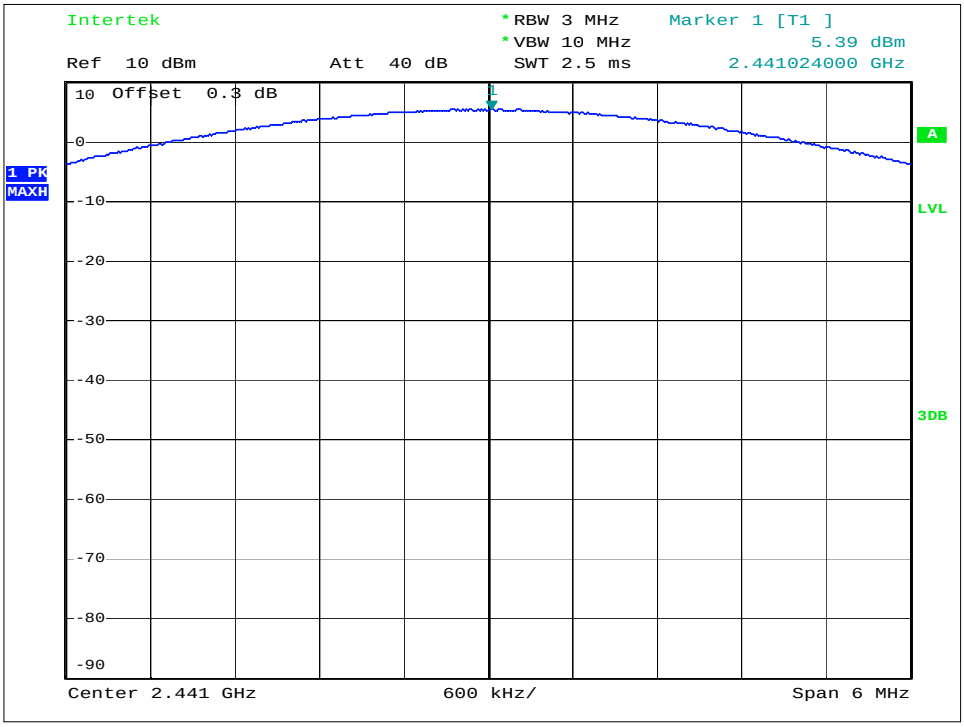

Intertek
*RBW 3 MHz
*VBW 10 MHz
SWT 2.5 ms
Marker 1 [T1]
4.84 dBm
2.480060000 GHz
Ref 10 dBm
Att 40 dB
10 Offset 0.3 dB
1 PK
MAXH
A
LVL
3DB
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.48 GHz
600 kHz/
Span 6 MHz

Modulation Type: 8DPSK

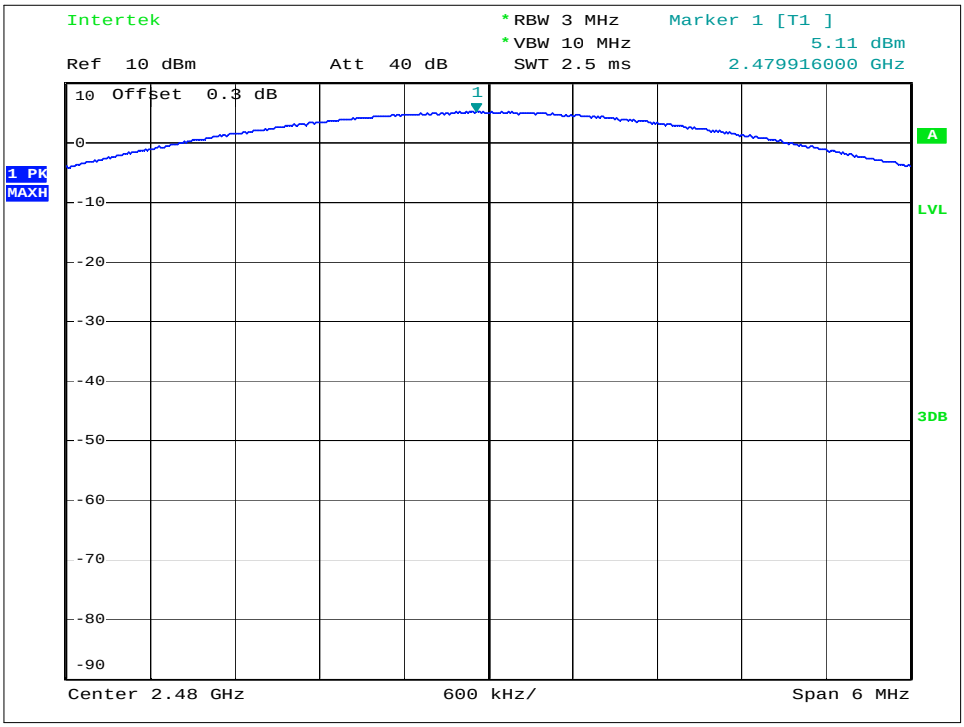
CH00



CH39



CH78


Intertek
*RBW 3 MHz
Marker 1 [T1]
*VBW 10 MHz
5.11 dBm
Ref 10 dBm
Att 40 dB
SWT 2.5 ms
2.479916000 GHz
10 Offset 0.3 dB
1
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
1 PK
MAXH
A
LVL
3DB
Center 2.48 GHz
600 kHz/
Span 6 MHz

3.4 20dB Bandwidth

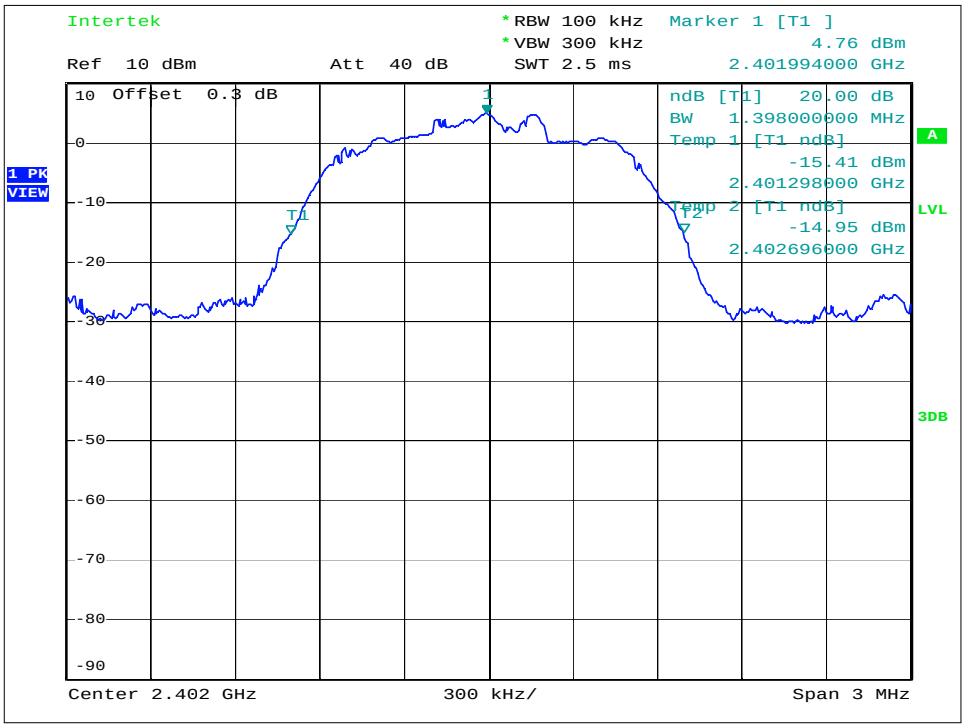
Maximum 20dB RF Bandwidth, FCC Rule 15.247(a) (1):

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RBW was chosen so that the display was a result of the hopping channel modulation. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. Use the spectrum 20dB down delta function to measure the bandwidth.

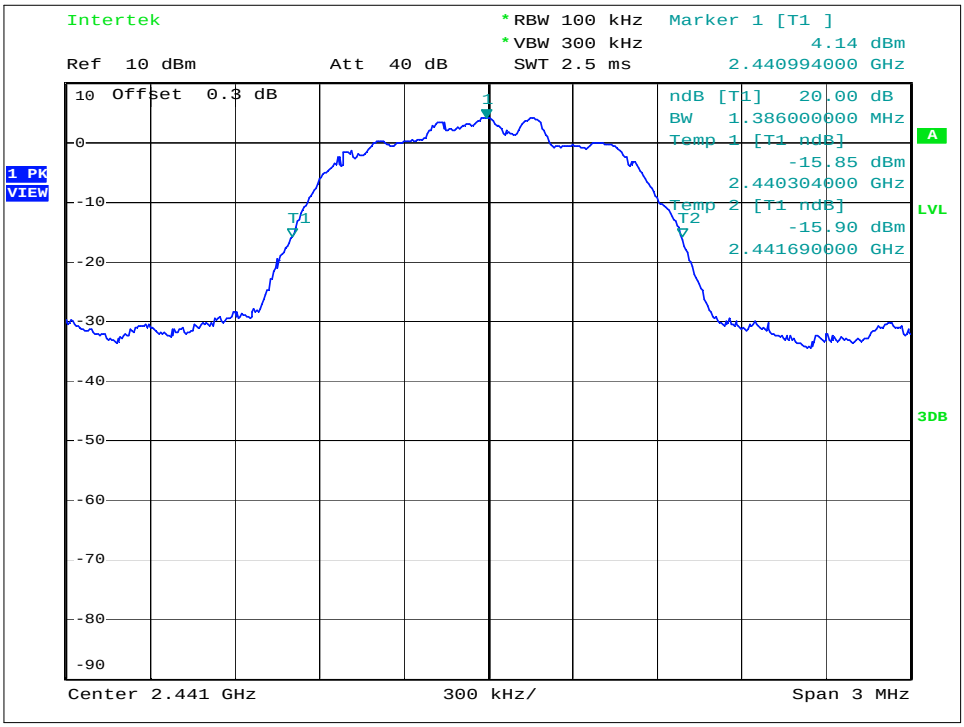
Frequency (MHz)	20 dB Bandwidth (MHz)
2402	1.398
2441	1.386
2480	1.386

Modulation Type: 8DPSK

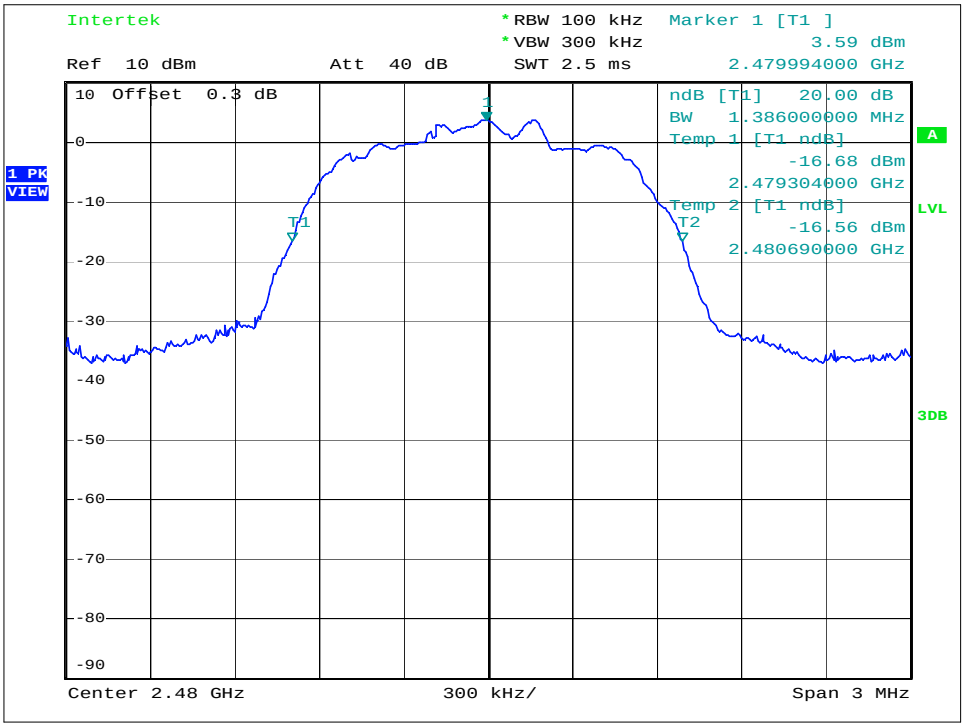
CH00



CH39


Intertek
*RBW 100 kHz
*VBW 300 kHz
SWT 2.5 ms
Marker 1 [T1]
4.14 dBm
2.440994000 GHz
Ref 10 dBm
Att 40 dB
10 Offset 0.3 dB
ndB [T1] 20.00 dB
BW 1.386000000 MHz
Temp 1 [T1 ndB]
-15.85 dBm
2.440304000 GHz
Temp 2 [T1 ndB]
-15.90 dBm
2.441690000 GHz
1 PK VIEW
A
LVL
3DB
T1
T2
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.441 GHz
300 kHz/
Span 3 MHz

CH78


Intertek
*RBW 100 kHz
*VBW 300 kHz
SWT 2.5 ms
Marker 1 [T1]
3.59 dBm
2.479994000 GHz
Ref 10 dBm
Att 40 dB
10 Offset 0.3 dB
ndB [T1] 20.00 dB
BW 1.386000000 MHz
Temp 1 [T1 ndB]
-16.68 dBm
2.479304000 GHz
Temp 2 [T1 ndB]
-16.56 dBm
2.480690000 GHz
1 PK VIEW
A
LVL
3DB
T1
T2
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.48 GHz
300 kHz/
Span 3 MHz

3.5 Channel Number (Number of Hopping Frequencies)

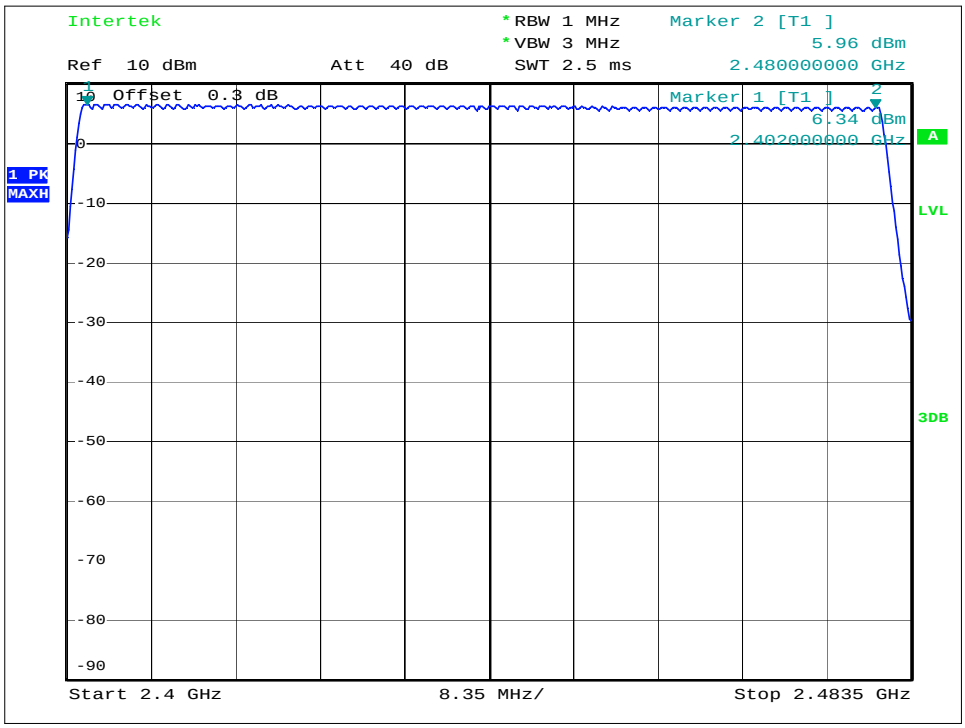
Minimum Number of Hopping Frequencies, FCC Rule 15.247(a) (1) (iii):

The RF passband of the EUT was divided into 3 approximately equal bands. With the analyzer set to MAX HOLD readings were taken for 2-3 minutes. The channel peaks so recorded were added together, and the total number compared to the minimum number of channels required in the regulation.

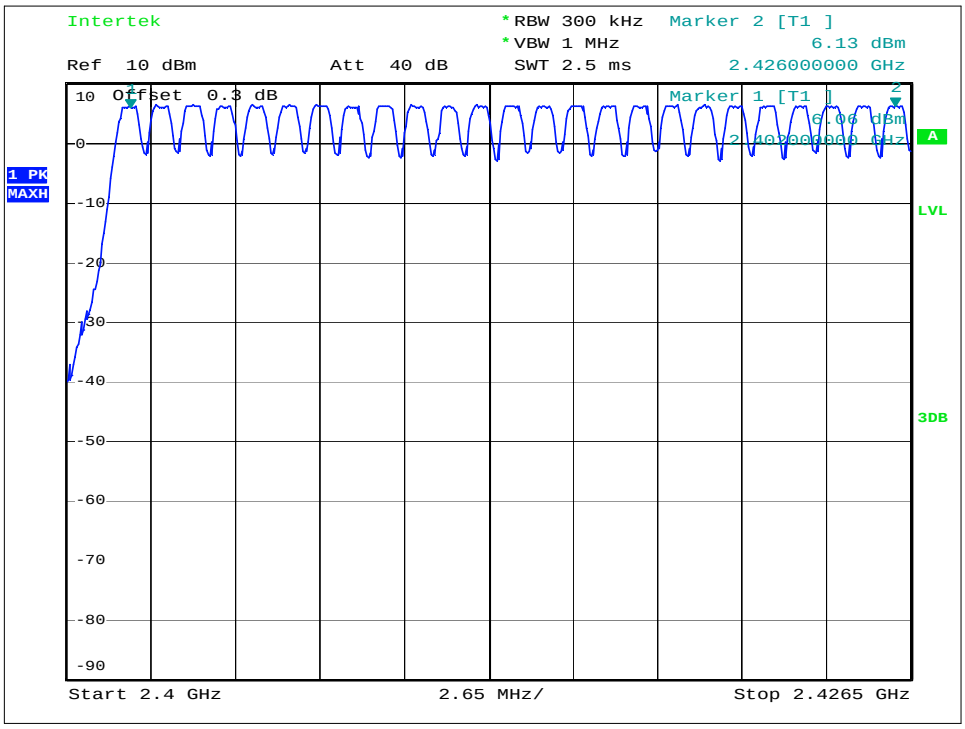
Number of hopping channels =	79

Modulation Type: GFSK

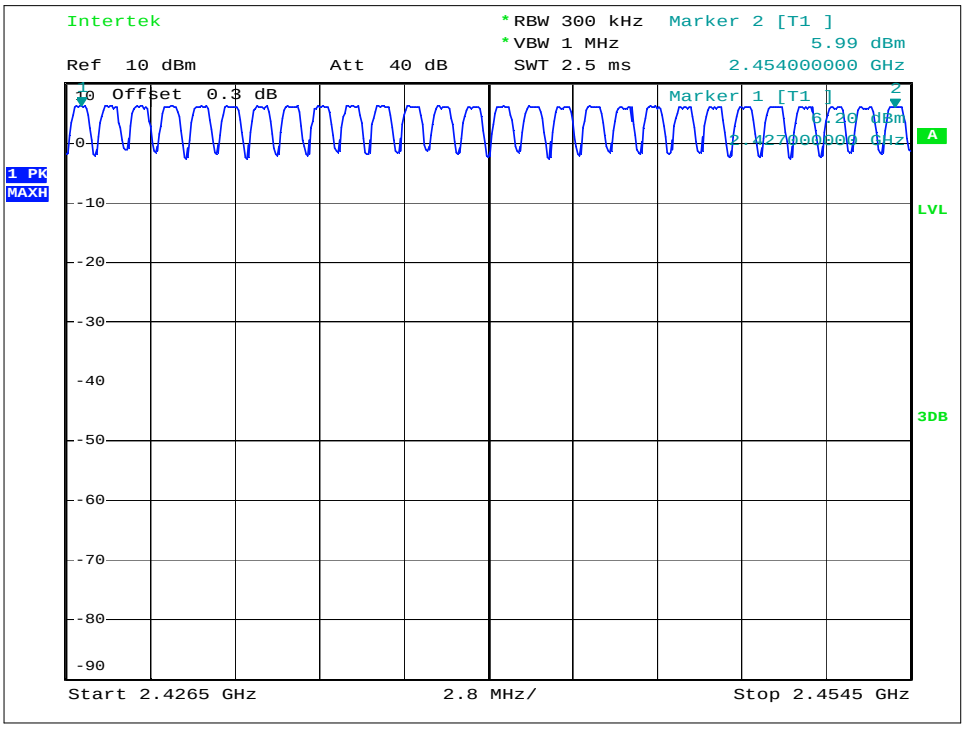
CH00-CH78



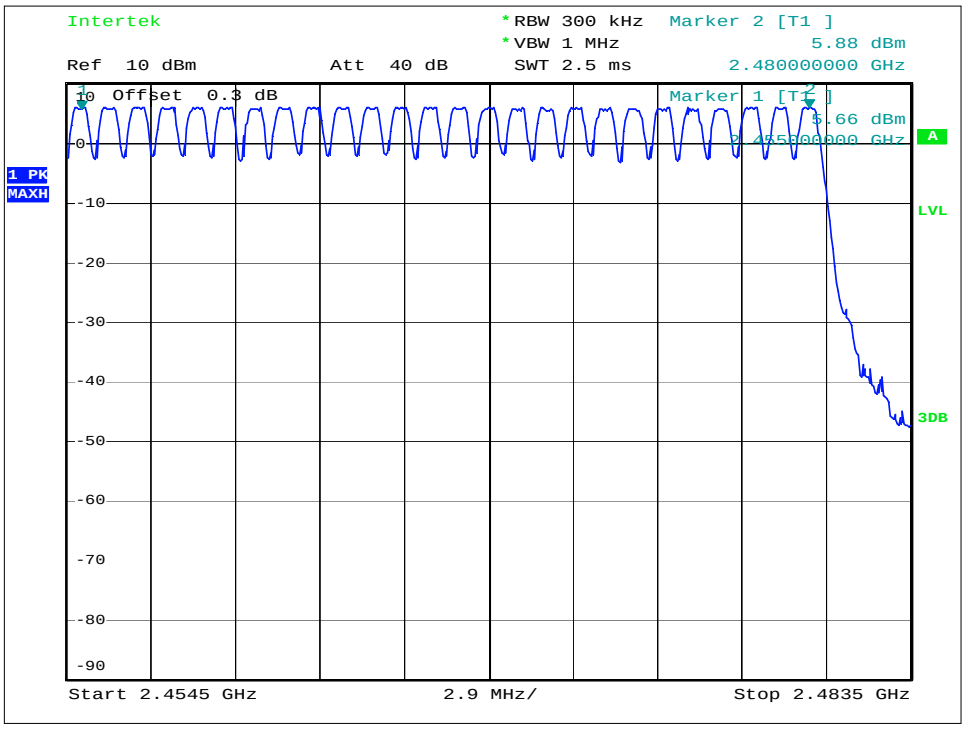
CH00-CH24



CH25-CH52



CH53-CH78


Intertek
*RBW 300 kHz
*VBW 1 MHz
SWT 2.5 ms
Marker 2 [T1]
5.88 dBm
2.480000000 GHz
Ref 10 dBm
Att 40 dB
10 Offset 0.3 dB
Marker 1 [T1]
5.66 dBm
2.485000000 GHz
1 PK
MAXH
A
LVL
3DB
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Start 2.4545 GHz
2.9 MHz/
Stop 2.4835 GHz

3.6 Channel Separation (Carrier Frequency Separation)

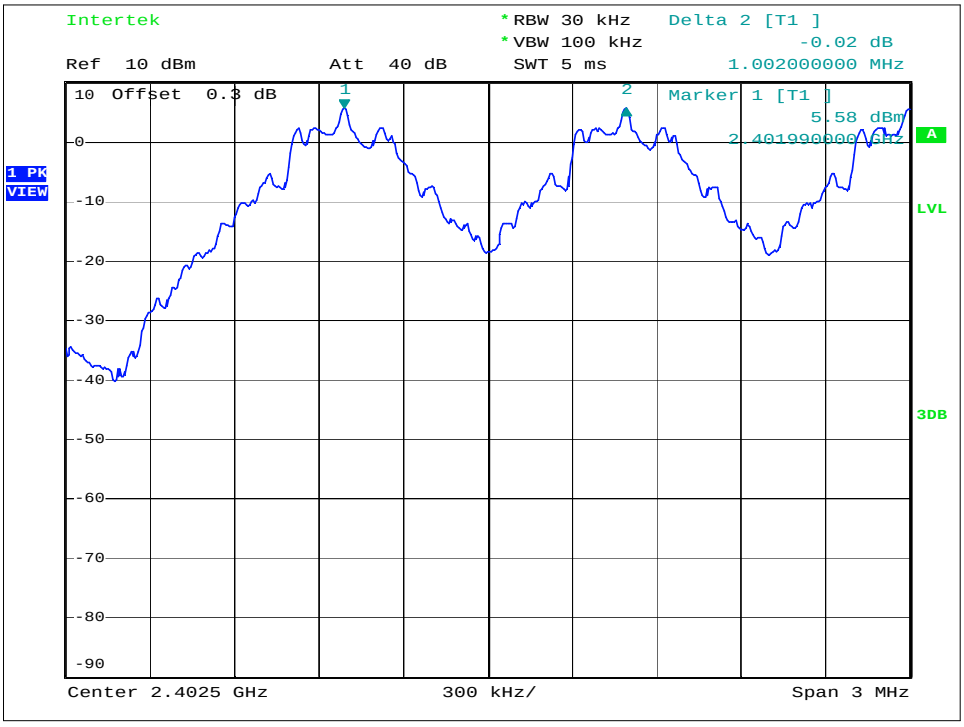
Minimum Hopping Channel Carrier Frequency Separation, FCC Ref: 15.247(a)(1):

Using the DELTA MARKER function of the analyzer, the frequency separation between two adjacent channels was measured and compared against the limit:

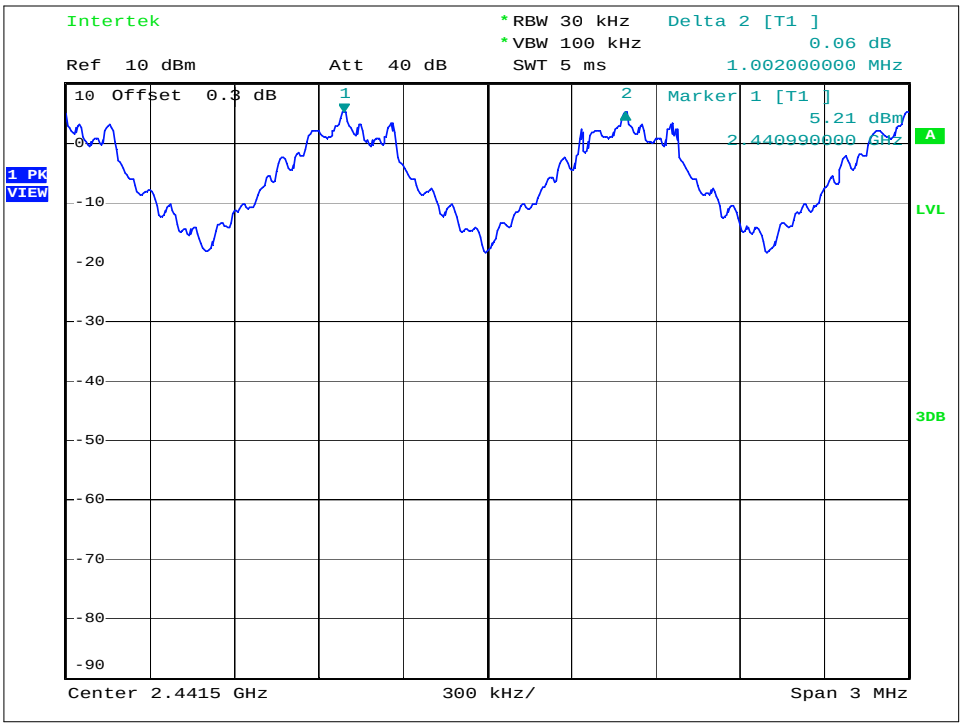
Not less than 2/3 of 20dB bandwidth of hopping channel: 1.392 × 2/3 = 0.932 MHz

Channel Separation	1.002 MHz

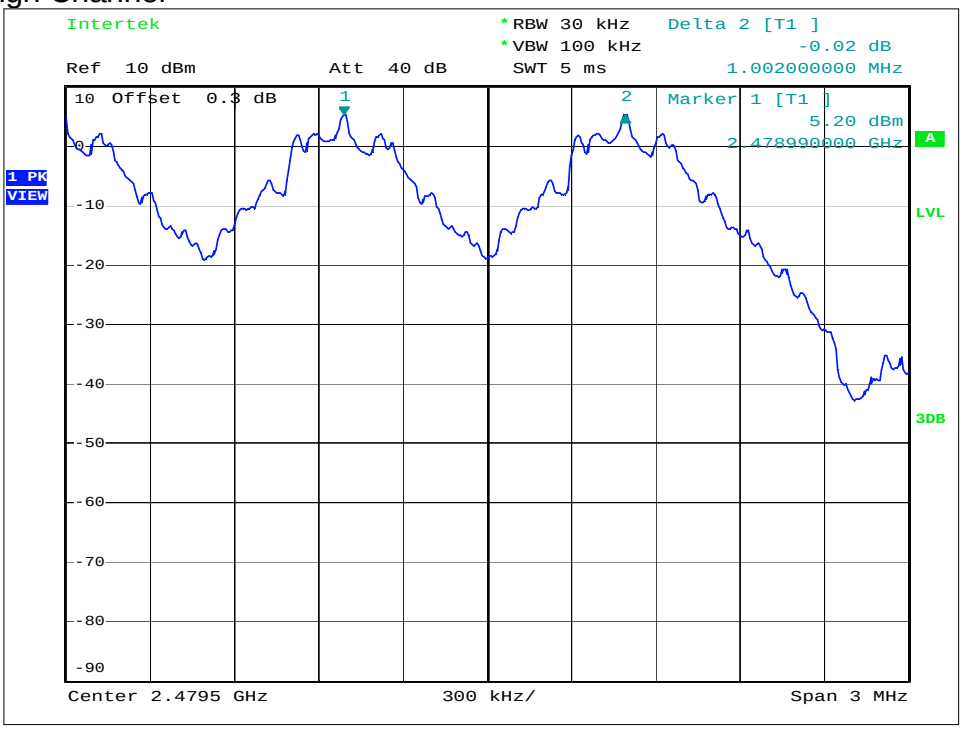
Low Channel



Middle Channel



High Channel



3.7 Dwell Time (Time of Occupancy)

Average Channel Occupancy Time, FCC Ref: 15.247(a)(1)(iii):

The spectrum analyzer center frequency was set to one of the known hopping channels. The SWEEP was set to 10ms, the SPAN was set to ZERO SPAN, and the TRGGER was set to VIDEO. The time duration of the transmissions so captured was measured with the MARKER DELTA function.

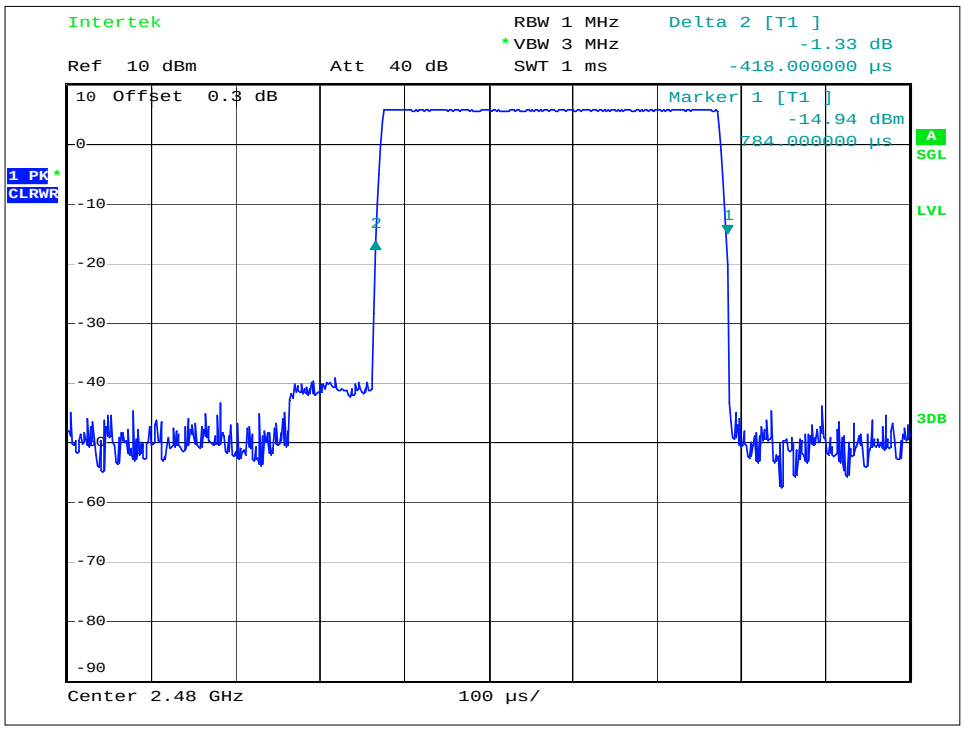
The maximum number of hopping channels in 31.6s for DH1
=1600 / 2 / 79 *31.6=320

The maximum number of hopping channels in 31.6s for DH3
=1600 / 4 / 79 *31.6=160

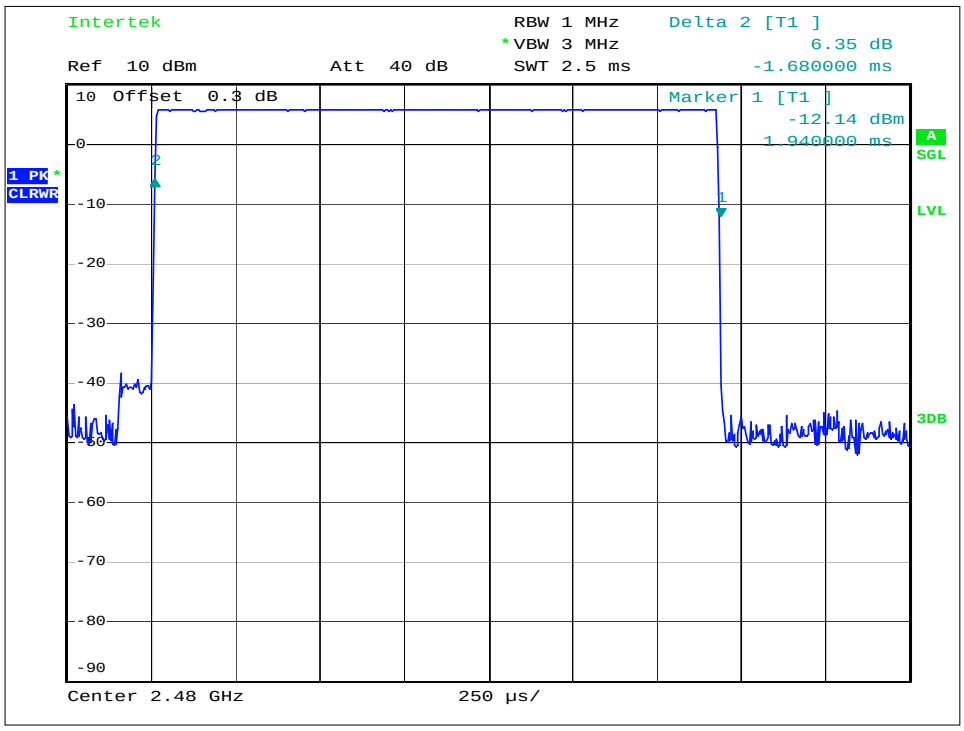
The maximum number of hopping channels in 31.6s for DH5
=1600 / 6 / 79 *31.6=107

Modulation Type	Packet	Max Dwell Time	Limit (s)	Result
GFSK	DH1	0.418 ms * 320= 133.76 ms	0.4	Pass
	DH3	1.680 ms * 160= 268.80 ms	0.4	Pass
	DH5	2.933 ms * 107= 313.83 ms	0.4	Pass
π/4-DQPSK	DH1	0.434 ms * 320= 138.88 ms	0.4	Pass
	DH3	1.695 ms * 160= 271.20 ms	0.4	Pass
	DH5	2.947 ms * 107= 315.33 ms	0.4	Pass
8DPSK	DH1	0.436 ms * 320= 139.52 ms	0.4	Pass
	DH3	1.695 ms *160= 271.20 ms	0.4	Pass
	DH5	2.947 ms *107= 315.33 ms	0.4	Pass

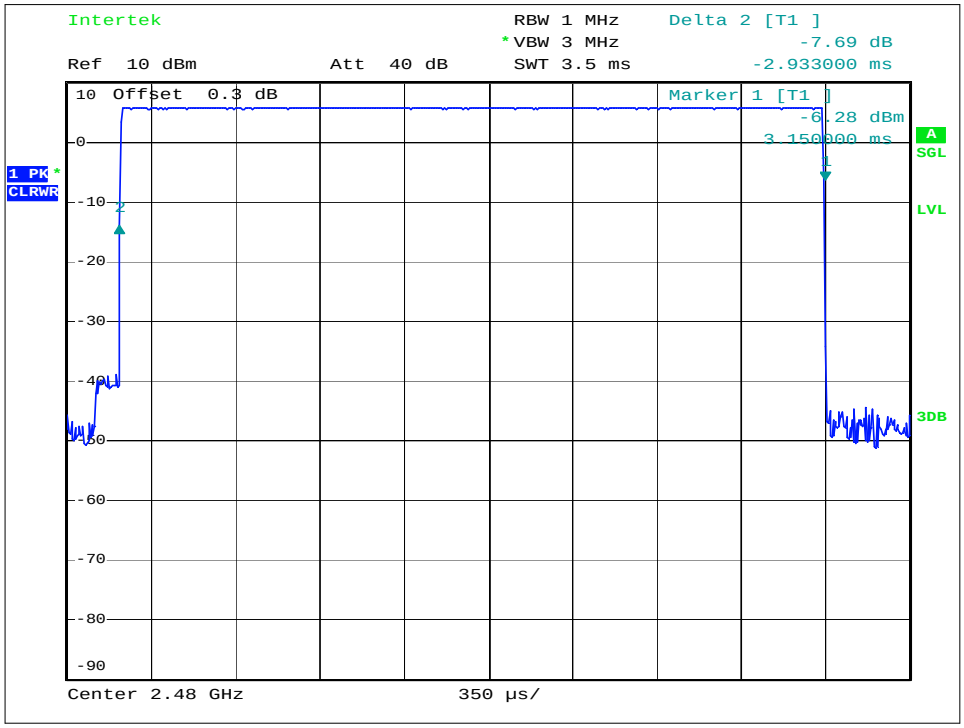
Modulation Type: GFSK
Packet: DH1



Packet: DH3

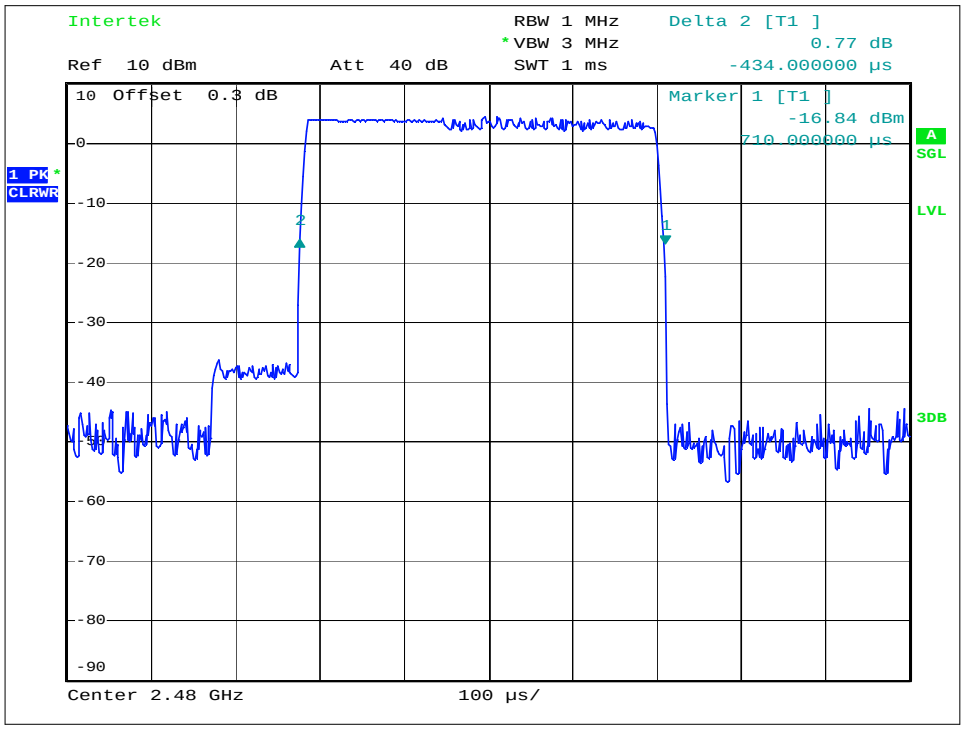


Packet: DH5

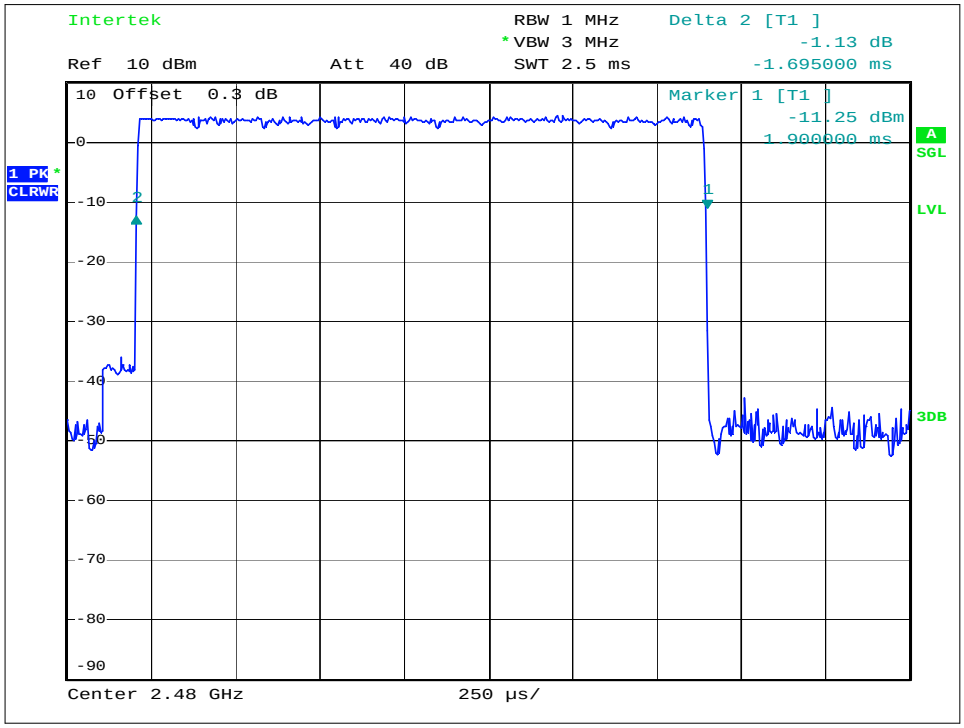


Modulation Type: π/4 –DQPSK

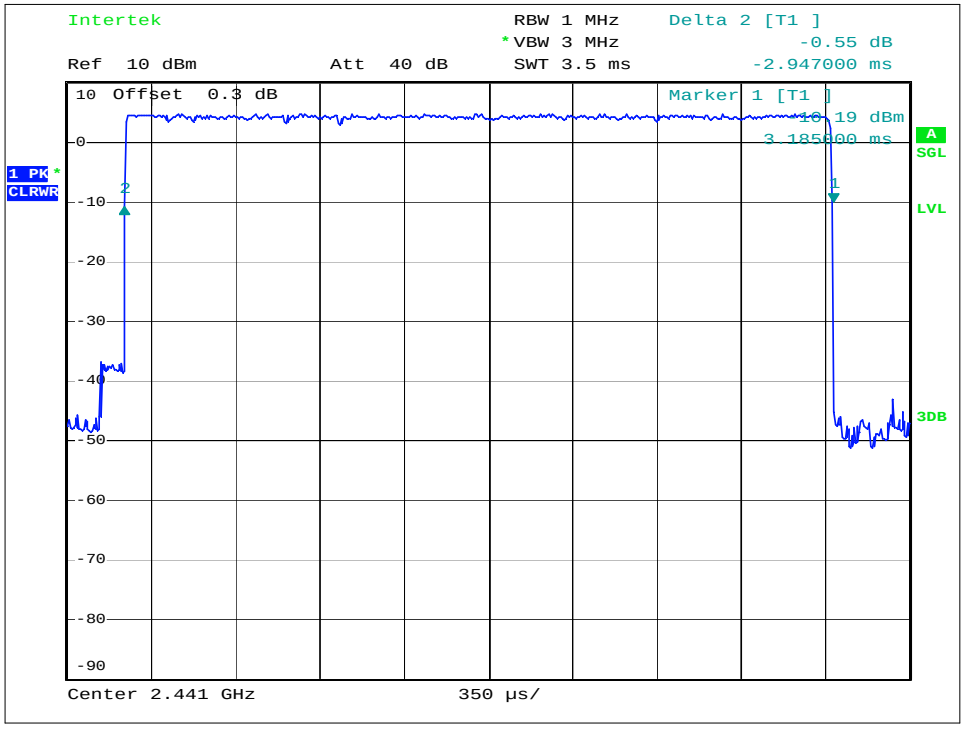
Packet: DH1



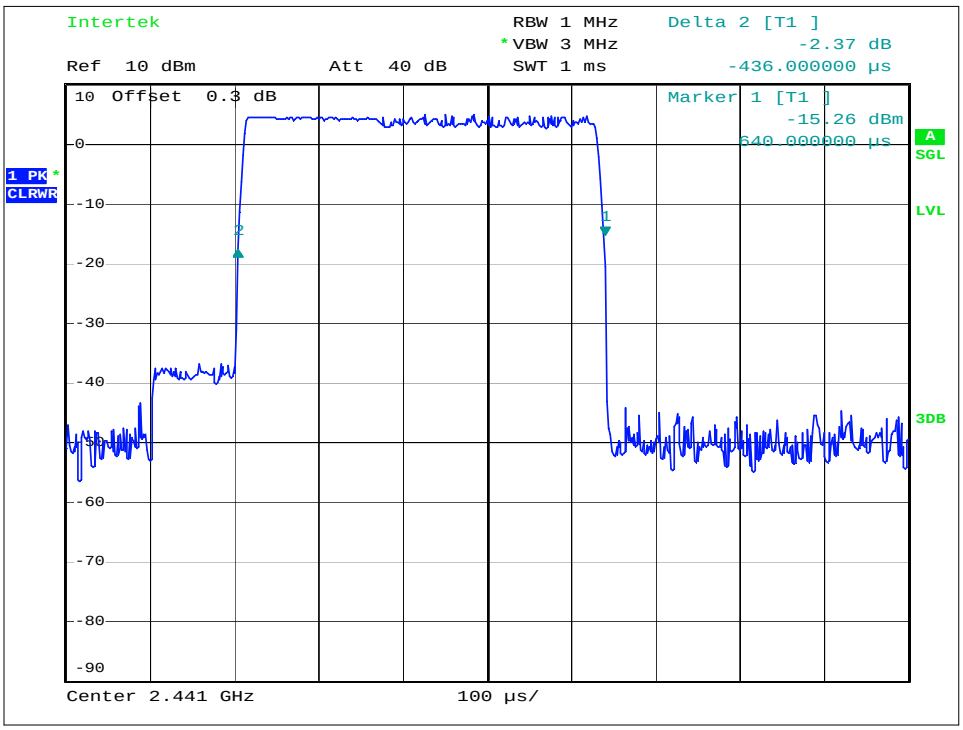
Packet: DH3



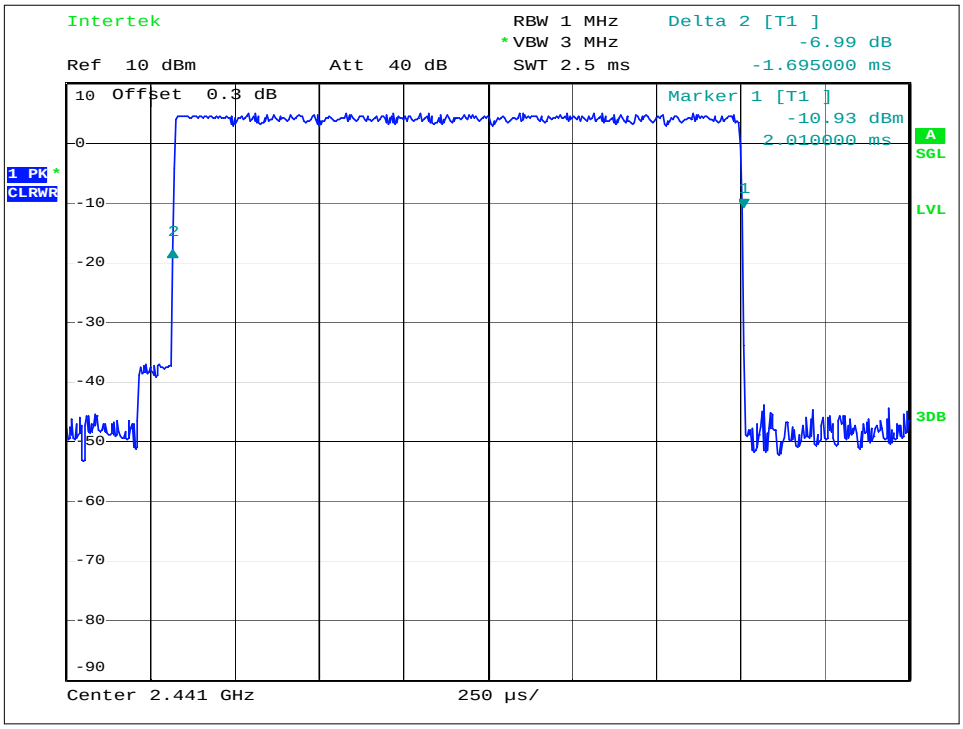
Packet: DH5



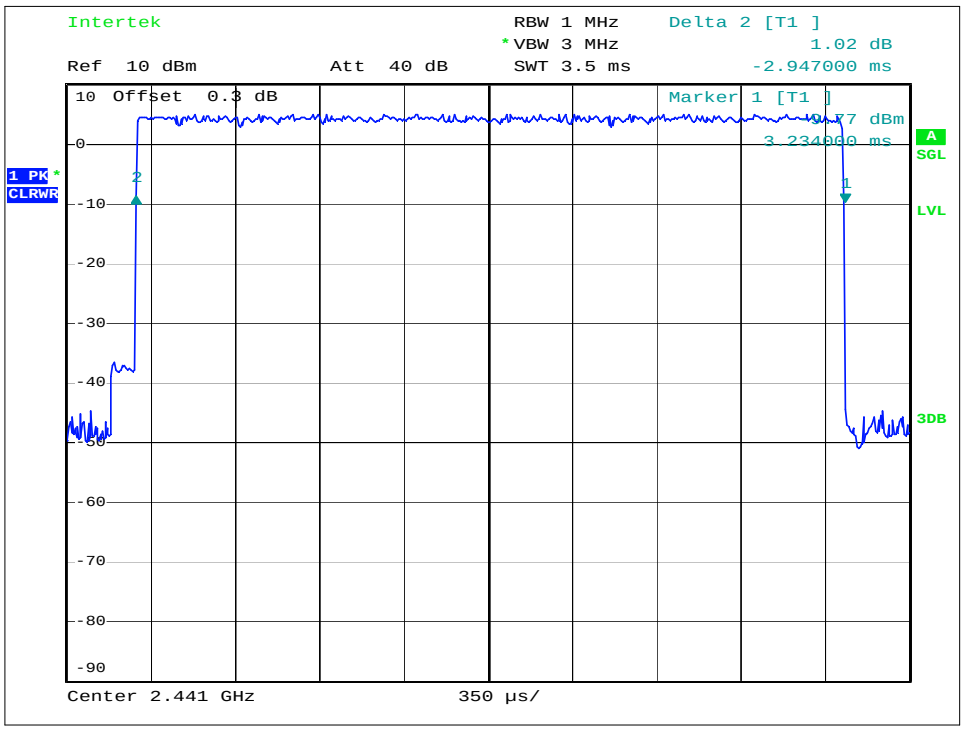
Modulation Type: 8DPSK
Packet: DH1



Packet: DH3



Packet: DH5


Intertek
RBW 1 MHz
*VBW 3 MHz
SWT 3.5 ms
Delta 2 [T1]
1.02 dB
-2.947000 ms
Ref 10 dBm
Att 40 dB
10 Offset 0.3 dB
Marker 1 [T1]
9.77 dBm
3.234000 ms
1 PK
CLRWR
A
SGL
LVL
3DB
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.441 GHz
350 µs/

3.8 Band Edge

Out of Band Conducted Emissions, FCC Rule 15.247(d):

In any 100 KHz bandwidth outside the EUT passband, the RF power produced by the modulation products of the spreading sequence, the information sequence, and the carrier frequency shall be at least 20 dB below that of the maximum in-band 100 kHz emission, or else shall meet the general limits for radiated emissions at frequencies outside the passband, whichever results in lower attenuation.

Furthermore, delta measurement technique for measuring bandage emissions was shown as below:

(i) Lower channel 2402MHz:

Peak Resultant field strength = Fundamental emissions (peak value) – delta from the bandedge plot

= 99.5dBµv/m-39.1dB
= 60.4dBµv/m

Average Resultant field strength = 60.4dBµv/m-30.1dB
= 30.3dBµv/m

(ii) Upper channel 2480MHz:

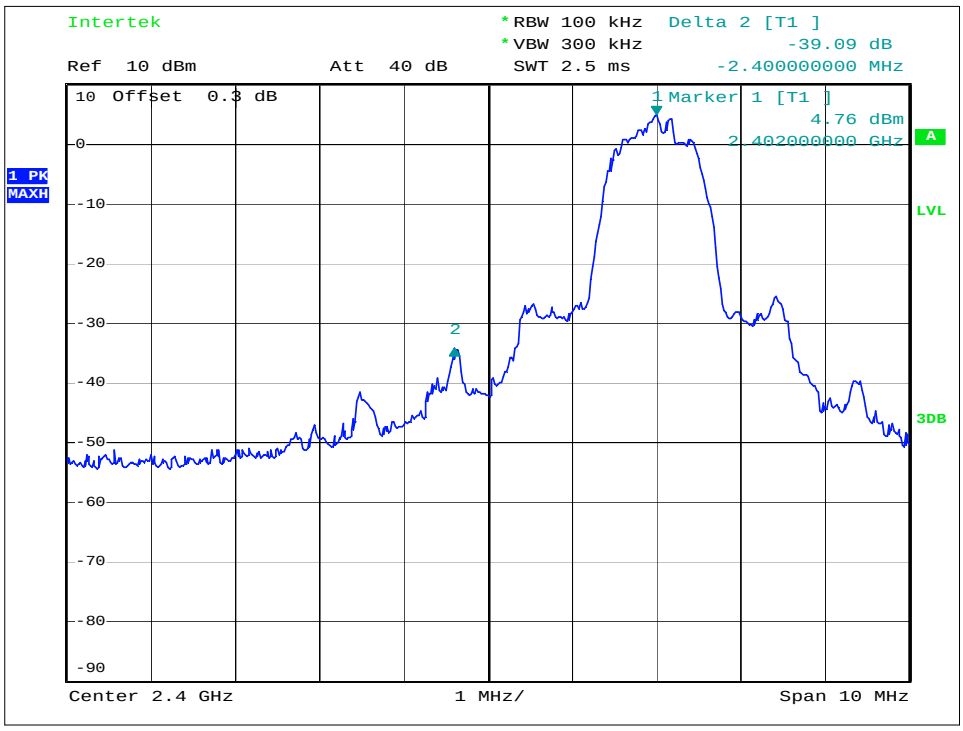
Peak Resultant field strength = Fundamental emissions (peak value) – delta from the bandedge plot

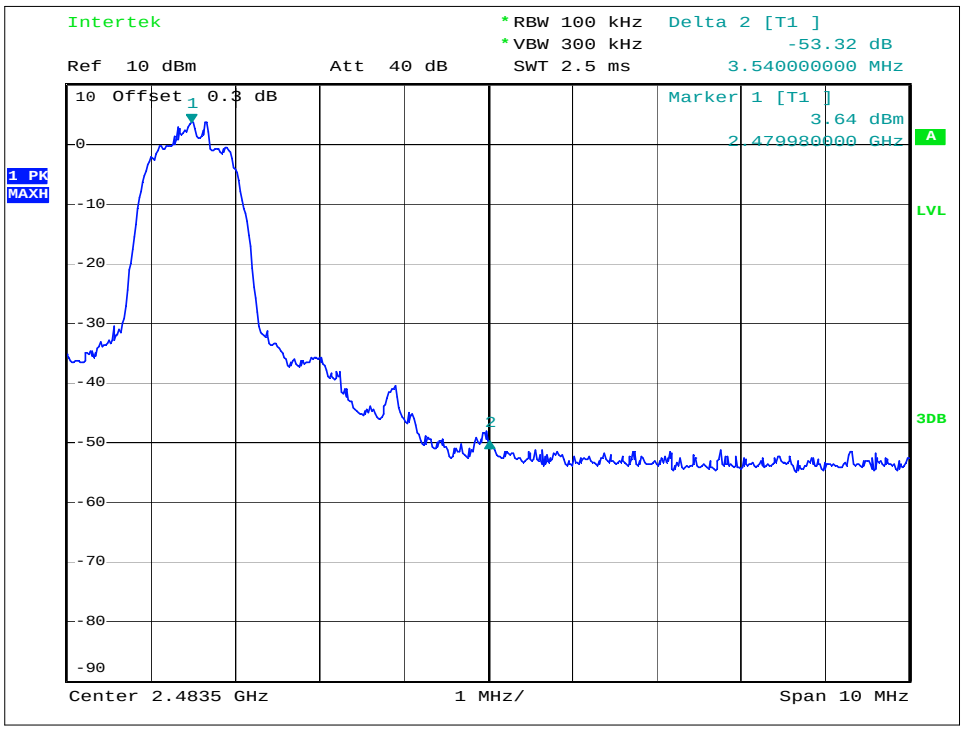
= 98.3dBµv/m-53.3dB
= 45.0dBµv/m

Average Resultant field strength = 45.0dBµv/m-30.1dB
= 14.9dBµv/m

The resultant field strength meets the general radiated emission limit in section 15.209, which does not exceed 74 dBµv/m (Peak Limit) and 54dBµv/m (Average Limit).

Modulation Type: 8DPSK





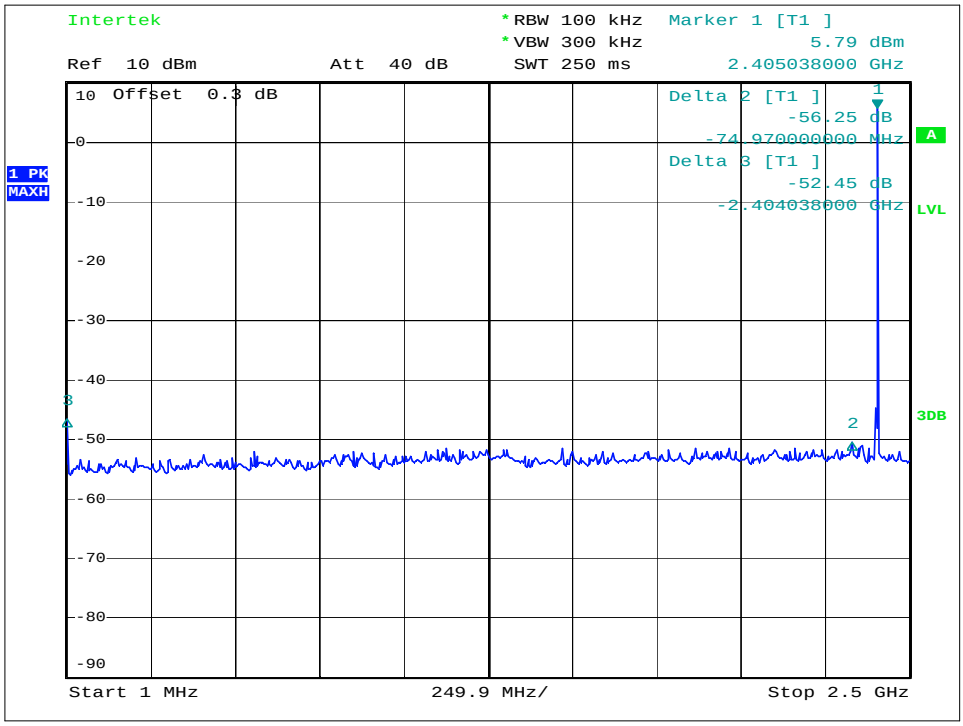
3.9 **Transmitter Spurious Emissions (Conducted)**

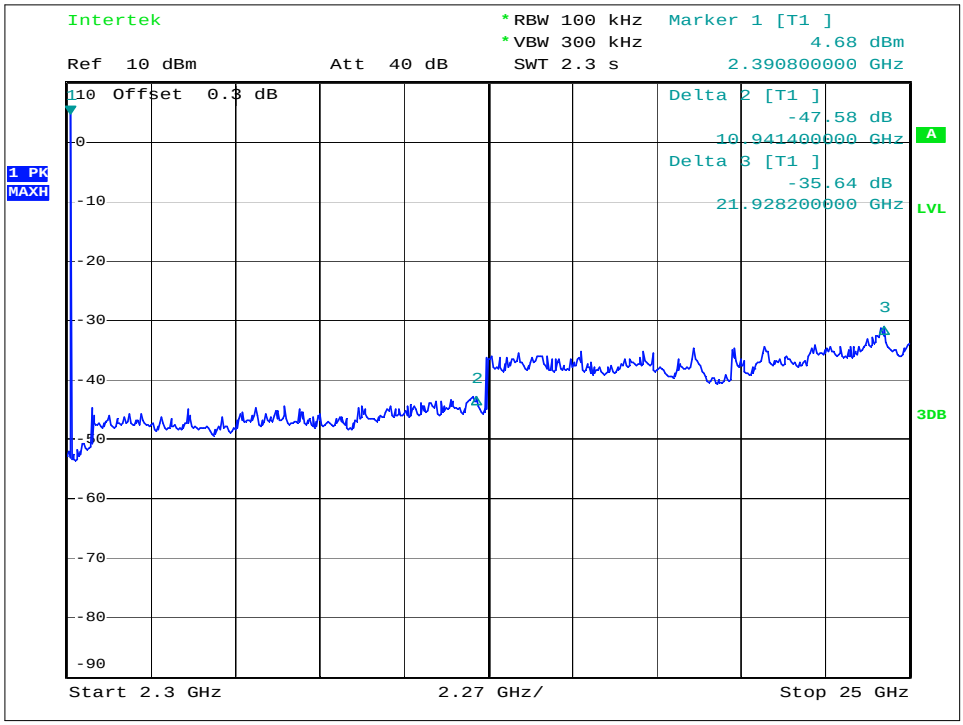
Out of Band Conducted Spurious Emissions, FCC Rule 15.247(d):

All spurious emission and up to the tenth harmonic was measured and they were found to be at least 20 dB below the highest level of the desired power in the passband.

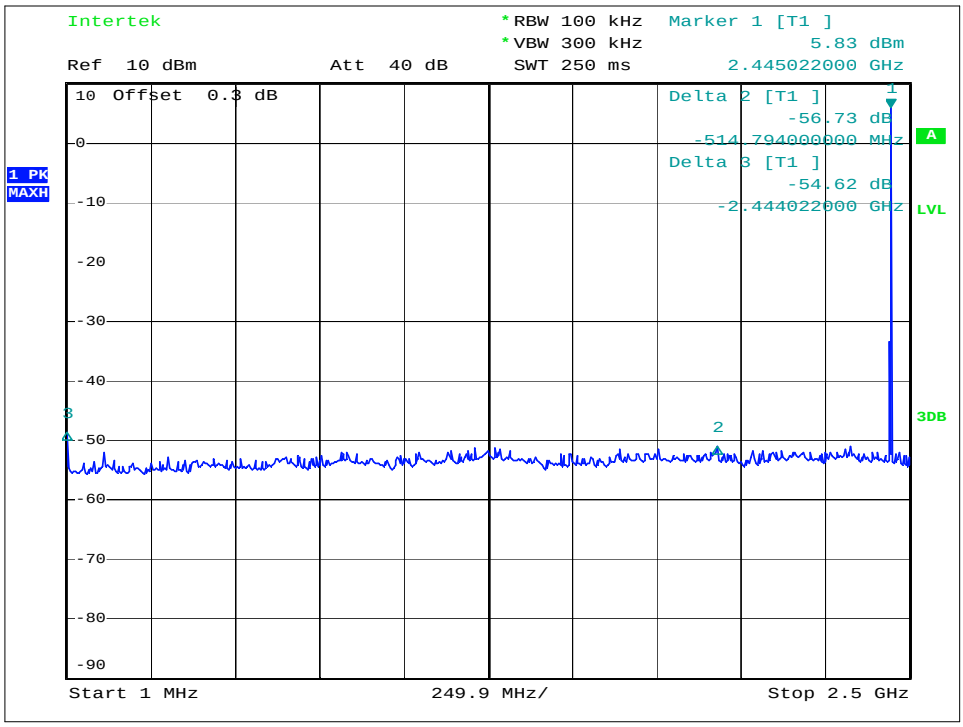
Modulation Type: GFSK

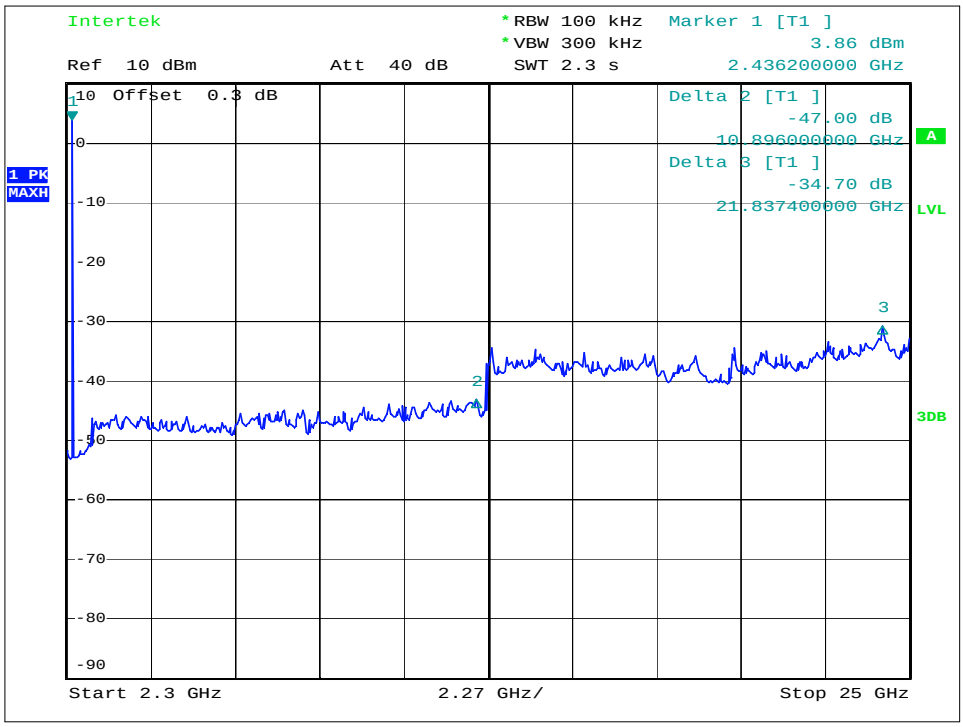
CH00



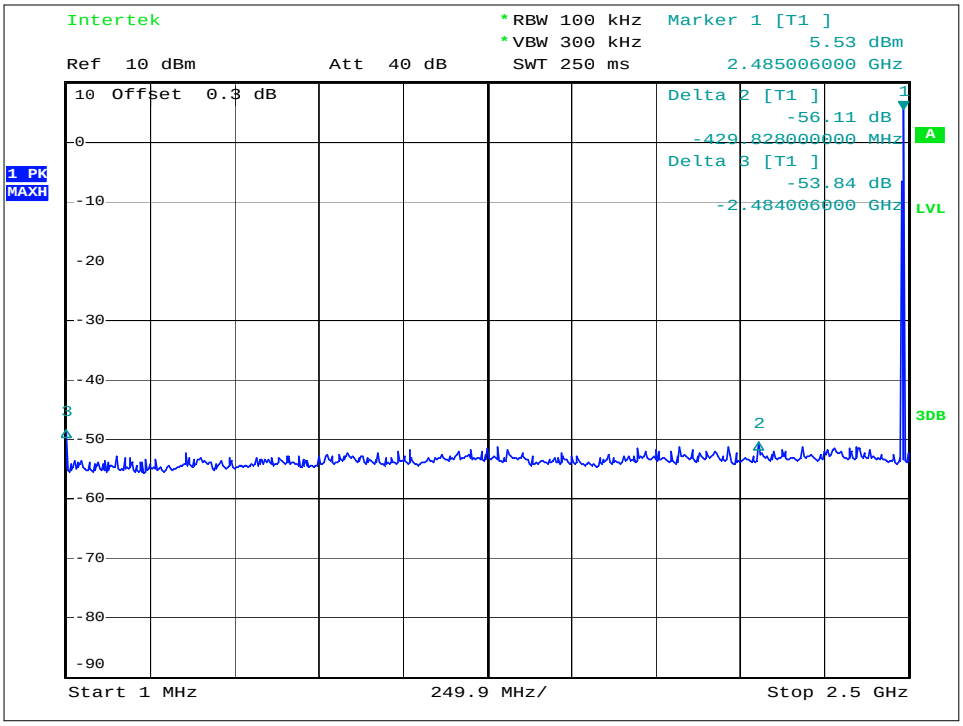


CH39


Intertek
*RBW 100 kHz
*VBW 300 kHz
SWT 250 ms
Marker 1 [T1]
5.83 dBm
2.445022000 GHz
Ref 10 dBm
Att 40 dB
10 Offset 0.3 dB
Delta 2 [T1]
-56.73 dB
-514.794000000 MHz
Delta 3 [T1]
-54.62 dB
-2.444022000 GHz
1 PK
MAXH
A
LVL
3DB
Start 1 MHz
249.9 MHz/
Stop 2.5 GHz


Intertek
*RBW 100 kHz
*VBW 300 kHz
SWT 2.3 s
Marker 1 [T1]
3.86 dBm
2.436200000 GHz
Ref 10 dBm
Att 40 dB
10 Offset 0.3 dB
Delta 2 [T1]
-47.00 dB
10.896000000 GHz
Delta 3 [T1]
-34.70 dB
21.837400000 GHz
1 PK
MAXH
A
LVL
3DB
Start 2.3 GHz
2.27 GHz/
Stop 25 GHz

CH78


Intertek
*RBW 100 kHz
*VBW 300 kHz
SWT 250 ms
Marker 1 [T1]
5.53 dBm
2.485006000 GHz
Ref 10 dBm
Att 40 dB
10 Offset 0.3 dB
Delta 2 [T1]
-56.11 dB
-429.828000000 MHz
Delta 3 [T1]
-53.84 dB
-2.484006000 GHz
1 PK
MAXH
A
LVL
3DB
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Start 1 MHz
249.9 MHz/
Stop 2.5 GHz

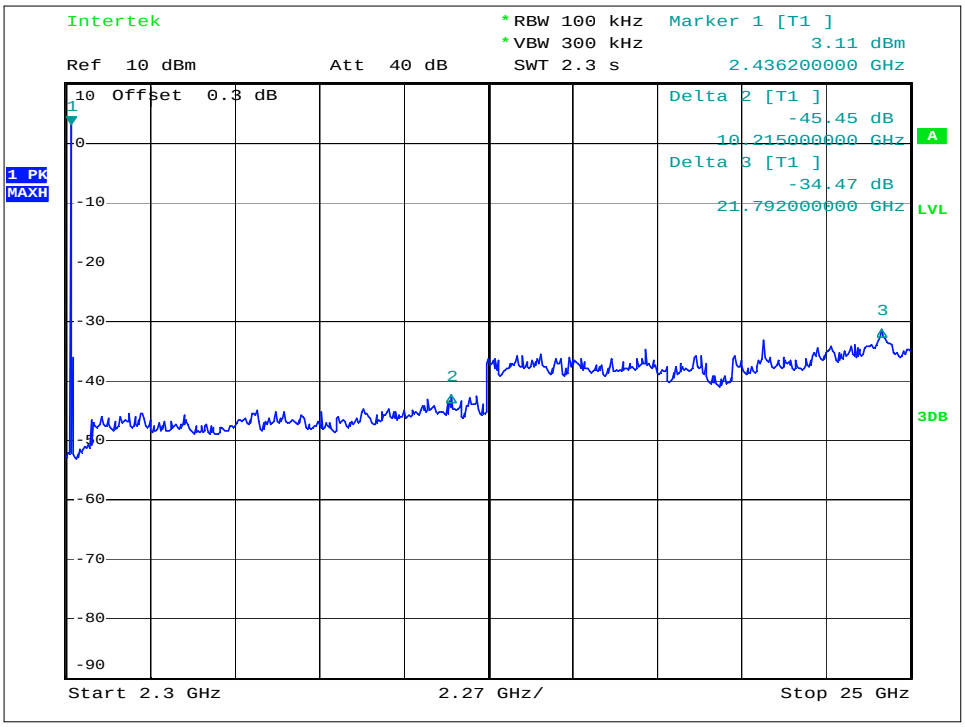

Intertek
*RBW 100 kHz
*VBW 300 kHz
SWT 2.3 s
Marker 1 [T1]
3.11 dBm
2.436200000 GHz
Ref 10 dBm
Att 40 dB
10 Offset 0.3 dB
Delta 2 [T1]
-45.45 dB
10.215000000 GHz
Delta 3 [T1]
-34.47 dB
21.792000000 GHz
1 PK
MAXH
A
LVL
3DB
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Start 2.3 GHz
2.27 GHz/
Stop 25 GHz

EXHIBIT 4

EQUIPMENT PHOTOGRAPHS

4.0 **Equipment Photographs**

For electronic filing, the photographs of the tested EUT are saved with filename: external photos.pdf & internal photos.pdf.

EXHIBIT 5

PRODUCT LABELLING

5.0 **Product Labelling**

For electronic filing, the FCC ID label artwork and the label location are saved with filename: label.pdf.

EXHIBIT 6

TECHNICAL SPECIFICATIONS

6.0 Technical Specifications

For electronic filing, the block diagram and schematics of the tested EUT are saved with filename: block.pdf and circuit.pdf respectively.

EXHIBIT 7

INSTRUCTION MANUAL

7.0 **Instruction Manual**

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States.

EXHIBIT 8

MISCELLANEOUS INFORMATION

8.0 Miscellaneous Information

This miscellaneous information includes details of the measured bandedge, the test procedure and calculation of factor such as pulse desensitization.

8.1 Discussion of Pulse Desensitization

Pulse desensitivity is not applicable for this device. The effective period (T_{eff}) is approximately 360µs for Bluetooth. With a resolution bandwidth (3dB) of 1MHz, so the pulse desensitivity factor is 0dB.

8.2 Transmitter Duty Cycle Calculation, FCC Rule 15.35(b, c)

Based on the Bluetooth Specification Version 2.1+ EDR, transmitter ON time is independent of packet type (DH1, DH3 and DH5) and packet length (single-slot and multi-slot). The maximum transmitter ON time for the Bluetooth is 625µs.

Each TX and RX time slot is 625µs in length. A TDD scheme is used where master and slave alternately transmit. For one period for a pseudo-random hopping through all 79 RF channels, for DH5:

Time of 1 hopset (5 TX slots + 1 RX slot) = 0.625 ms x 6 = 3.75 ms

Time of 1 cycle =3.75 ms x 79 = 296.25 ms

Average factor = 20 log (3.125 / 100) = -30.1 dB

8.3 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services in the measurements of transmitters operating under Part 15, Subpart C rules.

The test set-up and procedures described below are designed to meet the requirements of ANSI C63.4 - 2003.

The transmitting equipment under test (EUT) is placed on a wooden turntable which is four feet in diameter and approximately one meter in height above the ground plane. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The EUT is adjust through all three orthogonal axes to obtain maximum emission levels. The antenna height and polarization are varied during the testing to search for maximum signal levels.

Detector function for radiated emissions is in peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings.

The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower. For line conducted emissions, the range scanned is 150 kHz to 30 MHz.

8.3 **Emissions Test Procedures (cont'd)**

The EUT is warmed up for 15 minutes prior to the test.

AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Conducted measurements are made as described in ANSI C63.4 - 2003.

The IF bandwidth used for measurement of radiated signal strength was 10 kHz for emission below 30 MHz and 120 kHz for emission from 30 MHz to 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. Above 1000 MHz, a resolution bandwidth of 1 MHz is used.

Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the restricted bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, but those measurements taken at a closer distance are so marked.

EXHIBIT 9

TEST EQUIPMENT LIST

9.0 Test Equipment List

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Equipment No.	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
SZ061-03	BiConiLog Antenna	ETS	3142C	00066460	25-Mar-11	25-Sep-11
SZ185-01	EMI Receiver	R&S	ESCI	100547	08-Mar-11	08-Mar-12
SZ061-08	Horn Antenna	ETS	3115	00092346	15-Mar-10	15-Sep-11
SZ056-03	Spectrum Analyzer	R&S	FSP 30	101148	08-Mar-11	08-Mar-12
SZ181-04	Preamplifier	Agilent	8449B	3008A02474	08-Mar-11	08-Mar-12
SZ188-01	Anechoic Chamber	ETS	RFD-F/A-100	4102	15-Jan-11	15-Jan-12
SZ062-02	RF Cable	RADIALL	RG 213U	--	25-Mar-11	25-Sep-11
SZ062-06	RF Cable	RADIALL	0.04-26.5GHz	--	16-Sep-10	16-Sep-11
SZ062-12	RF Cable	RADIALL	0.04-26.5GHz	--	16-Sep-10	16-Sep-11
SZ067-04	Notch Filter	Micro-Tronics	BRM50702-02	--	25-Mar-11	25-Sep-11
SZ185-02	EMI Test Receiver	R&S	ESCI	100692	12-Nov-10	12-Nov-11
SZ187-01	Two-Line V-Network	R&S	ENV216	100072	12-Nov-10	12-Nov-11
SZ187-02	Two-Line V-Network	R&S	ENV216	100073	12-Nov-10	12-Nov-11
SZ188-03	Shielding Room	ETS	RFD-100	4100	16-Sep-10	16-Sep-13

10.0 **Annex**

Document History

Report No.	Issue Date	Change
SZ11060014-1	30 July, 2011	Original