



Lidl US Trading, LLC

Application
For
Certification

FCC ID: 2AJ90-HG2955

Stereo 2.1 CH TV Soundbase

Model: HG02955-US

2.4GHz Transceiver

Report No.: 170626040GZU-001

We hereby certify that the sample of the above item is considered to comply with the requirements of FCC Part 15, Subpart C for Intentional Radiator, mention 47 CFR [10-1-15]

Prepared and Checked by:

Approved by:

Sign on file

Powell Bao
Engineer

Kidd Yang
Senior Project Engineer
Date: June 22, 2017

- The test results reported in this test report shall refer only to the sample actually tested and shall not refer or be deemed to refer to bulk from which such a sample may be said to have been obtained.
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- The evaluation data of the report will be kept for 3 years from the date of issuance.

TRF No.: FCC 15C_TX_c

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MEASUREMENT/TECHNICAL REPORT

Lidl US Trading, LLC

Model: HG02955-US

FCC ID: 2AJ90-HG2955

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

Equipment Type: DSS - Part 15 Spread Spectrum Transmitter

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

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

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

Report prepared by:

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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
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	agency.pdf
Cover Letter	Confidentiality Letter	request.pdf

EXHIBIT 1

GENERAL DESCRIPTION

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1.0 General Description

1.1 Product Description

The equipment under test (EUT) is a Stereo 2.1 CH TV Soundbase with Bluetooth FHSS technology operating in 2402-2480MHz. The EUT is powered by AC 120V, 60Hz, 30W. For more detail information pls. refer to the user manual.

Bluetooth Version: 4.2

Antenna Type: Integral antenna

Antenna Gain: 1 dBi

Modulation Type: GFSK, $\pi/4$ -DQPSK and 8-DPSK

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

1.2 Related Submittal(s) Grants

This is an application for certification of transceiver for the Stereo 2.1 CH TV Soundbase which has Bluetooth function, and for the other function was tested and demonstrated in report 170626040GZU-002.

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1.3 Test Methodology

Both AC mains line-conducted and Radiated emission measurements were performed according to the procedures in ANSI C63.10: 2013 and DA 00-705. Radiated emission measurement was performed in semi-anechoic chamber. 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. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

1.4 Test Facility

The Semi-anechoic chamber used to collect the radiated data is **EMTEK (Shenzhen) Co., Ltd.** and located at Bldg. 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, 518052, China. This test facility and site measurement data have been fully placed on file with the FCC (Registration Number: 406365).

EXHIBIT 2
SYSTEM TEST CONFIGURATION

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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 C63.10: 2013.

The EUT was powered by AC120V, 60Hz during the test.

All packets DH1, DH3 & DH5 mode in modulation type GFSK, $\pi/4$ -DQPSK and 8-DPSK were tested and only the worst data was reported in this report.

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 rear of unit shall be flushed with the rear of the table.

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

The EUT exercise program (provided by client) used during radiated testing was designed to exercise the various system components in a manner similar to a typical use. The worst case configuration is used in all specified testing.

The parameters of test software setting:

During the test, Channel and power controlling software provided by the applicant was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the application and is going to be fixed on the firmware of the end product.

2.3 Special Accessories

No special accessory attached.

2.4 Equipment Modification

Any modifications installed previous to testing by Lidl US Trading, LLC will be incorporated in each production model sold / leased in the United States.

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

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2.5 Measurement Uncertainty

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

2.6 Support Equipment List and Description

Description	Manufacturer	Model No.
iPod	Apple	A1446
Audio In Cable	N/A	Unshielded, Length 120cm
USB Cable	N/A	Unshielded, Length 120cm
HDMI In Cable	N/A	Unshielded, Length 150cm
USB Disk	TOSHIBA	UHYBS-004G-BL
Detached AC power cord	Richsound	Unshielded, Length 150cm
Optical Cable with Load	N/A	Unshielded, Length 120cm
Coaxial Cable	N/A	Unshielded, Length 120cm
Dummy Load	N/A	N/A

EXHIBIT 3
TEST RESULTS

3.0 Test Results

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

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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 dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- 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 dB μ V 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 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

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

AV = -10 dB

$$FS = 62 + 7.4 + 1.6 - 29 + 0 + (-10) = 32 \text{ dB}\mu\text{V/m}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm} [(32 \text{ dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}$$

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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 320.010 MHz

Judgement: Passed by 3.0 dB

TEST PERSONNEL:

Sign on file

Powell Bao, Engineer
Typed/Printed Name

May 27, 2017
Date

INTERTEK TESTING SERVICES

Applicant: Lidl US Trading, LLC
Date of Test: May 27, 2017
Model: HG02955-US
Sample: 1/1
Worst-case operating Mode: Transmit (CH00)
Modulation type: GFSK

Table 1

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	240.005	41.8	20.0	10.9	32.7	46.0	-13.3
Horizontal	320.010	48.4	20.0	14.6	43.0	46.0	-3.0
Horizontal	800.180	35.0	20.0	19.9	34.9	46.0	-11.1
Vertical	319.999	45.3	20.0	7.3	32.6	46.0	-13.4
Vertical	560.105	31.6	20.0	19.2	30.8	46.0	-15.2
Vertical	720.155	41.9	20.0	13.0	34.9	46.0	-11.1

- 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.

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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 7440.000 MHz

Judgement: Passed by 16.6 dB

TEST PERSONNEL:

Sign on file

Powell Bao, Engineer
Typed/Printed Name

May 27, 2017
Date

INTERTEK TESTING SERVICES

Applicant: Lidl US Trading, LLC
 Date of Test: May 27, 2017
 Model: HG02955-US
 Sample: 1/1
 Worst-case operating Mode: Transmit (2402 MHz)
 Modulation type: GFSK

Table 2

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Peak Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	**2402.000	101.4	36.7	28.1	92.8	--	--
Horizontal	*4804.000	55.8	36.1	35.5	55.2	74.0	-18.8

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dB μ V/m)	Average Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	**2402.000	101.4	36.7	28.1	22.5	70.3	-	-
Horizontal	*4804.000	55.8	36.1	35.5	22.5	32.7	54.0	-21.3

- 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.

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Applicant: Lidl US Trading, LLC
 Date of Test: May 27, 2017
 Model: HG02955-US
 Sample: 1/1
 Worst-case operating Mode: Transmit (2441 MHz)
 Modulation type: GFSK

Table 3

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Peak Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	*4882.000	55.6	36.1	35.5	55.0	74.0	-19.0
Horizontal	*7323.000	55.5	36.2	37.9	57.2	74.0	-16.8

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dB μ V/m)	Average Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	*4882.000	55.6	36.1	35.5	22.5	32.5	54.0	-21.5
Horizontal	*7323.000	55.5	36.2	37.9	22.5	34.7	54.0	-19.3

- 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.

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Applicant: Lidl US Trading, LLC
 Date of Test: May 27, 2017
 Model: HG02955-US
 Sample: 1/1
 Worst-case operating Mode: Transmit (2480 MHz)
 Modulation type: GFSK

Table 4

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Peak Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	**2480.000	98.7	36.7	28.1	90.1	--	--
Horizontal	*4960.000	54.7	36.1	35.5	54.1	74.0	-19.9
Horizontal	*7440.000	55.4	36.2	38.2	57.4	74.0	-16.6

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dB μ V/m)	Average Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	**2480.000	98.7	36.7	28.1	22.5	67.6	--	--
Horizontal	*4960.000	54.7	36.1	35.5	22.5	31.6	54.0	-22.4
Horizontal	*7440.000	55.4	36.2	38.2	22.5	34.9	54.0	-19.1

- 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.

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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 Live-Conducted Configuration
At

0.374 MHz

Judgement: Passed by 17.1 dB margin

TEST PERSONNEL:

Sign on file

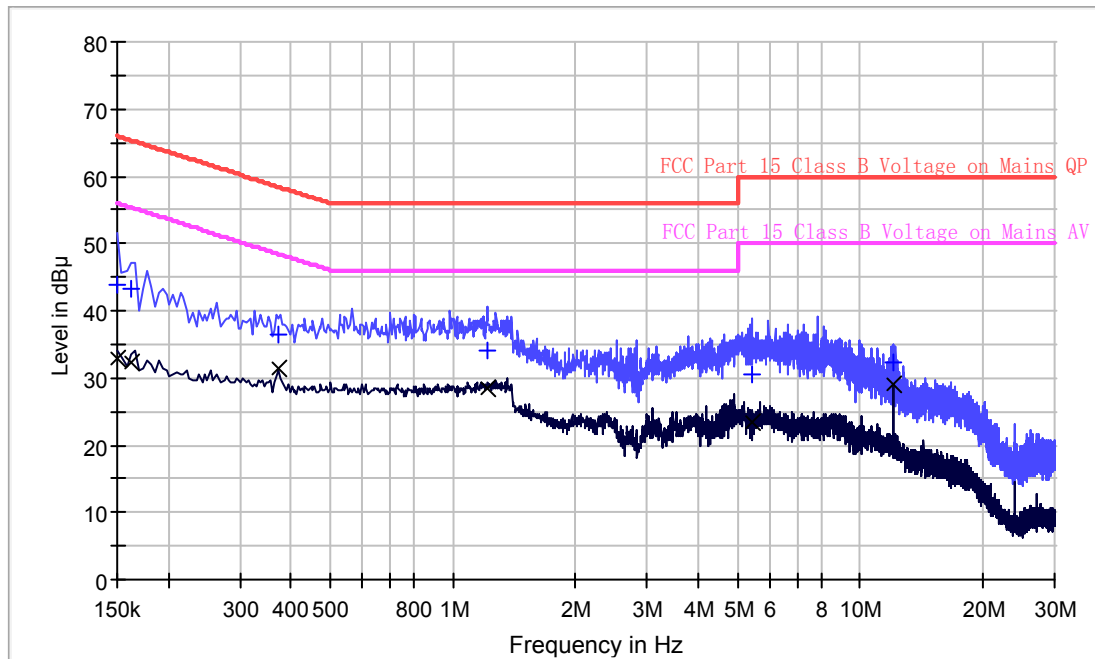
Powell Bao, Engineer
Typed/Printed Name

May 27, 2017
Date

INTERTEK TESTING SERVICES

Applicant: Lidl US Trading, LLC
 Date of Test: May 27, 2017
 Model: HG02955-US
 Sample: 1/1
 Worst-case operating Mode: BT Link
 Modulation type: GFSK
 Phase: Live

Conducted Emission Test - FCC



Result Table QP

Frequency (MHz)	QuasiPeak (dB µV)	Line	Corr. (dB)	Margin (dB)	Limit (dB µV)
0.150	43.8	L1	9.5	22.2	66.0
0.162	43.2	L1	9.5	22.2	65.4
0.374	36.4	L1	9.6	22.0	58.4
1.218	34.0	L1	9.6	22.0	56.0
5.422	30.4	L1	9.7	29.6	60.0
12.010	32.2	L1	9.8	27.8	60.0

Result Table AV

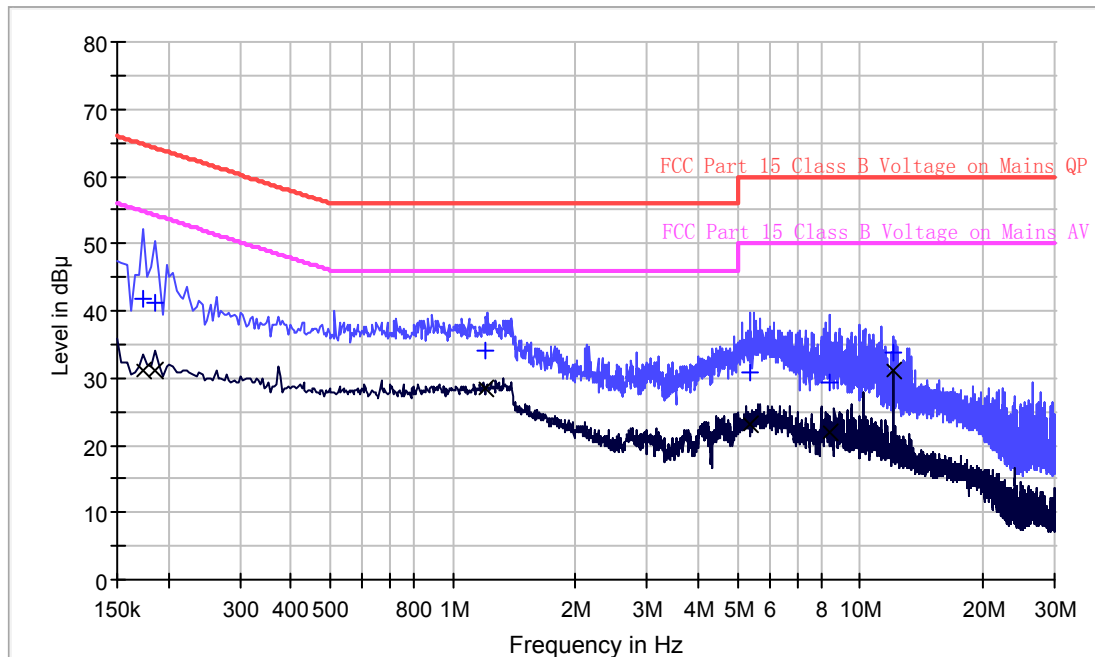
Frequency (MHz)	Average (dB µV)	Line	Corr. (dB)	Margin (dB)	Limit (dB µV)
0.150	32.8	L1	9.5	23.2	56.0
0.162	32.4	L1	9.5	23.0	55.4
0.374	31.3	L1	9.6	17.1	48.4
1.218	28.4	L1	9.6	17.6	46.0
5.422	23.5	L1	9.7	26.5	50.0
12.010	29.1	L1	9.8	20.9	50.0

TRF No.: FCC 15C_TX_b
 FCC ID: 2AJ90-HG2955
 Report No.: 170626040GZU-001

INTERTEK TESTING SERVICES

Applicant: Lidl US Trading, LLC
 Date of Test: May 27, 2017
 Model: HG02955-US
 Sample: 1/1
 Worst-case operating Mode: BT Link
 Modulation type: GFSK
 Phase: Neutral

Conducted Emission Test - FCC



Result Table QP

Frequency (MHz)	QuasiPeak (dB µ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.174	41.9	N	9.6	22.9	64.8
0.186	41.2	N	9.6	23.0	64.2
1.206	34.1	N	9.6	21.9	56.0
5.374	31.0	N	9.7	29.0	60.0
8.398	29.3	N	9.7	30.7	60.0
12.010	33.8	N	9.8	26.2	60.0

Result Table AV

Frequency (MHz)	Average (dB µ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.174	31.1	N	9.6	23.7	54.8
0.186	31.2	N	9.6	23.0	54.2
1.206	28.4	N	9.6	17.6	46.0
5.374	23.0	N	9.7	27.0	50.0
8.398	22.0	N	9.7	28.0	50.0
12.010	31.2	N	9.8	18.8	50.0

TRF No.: FCC 15C_TX_b
 FCC ID: 2AJ90-HG2955
 Report No.: 170626040GZU-001

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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, and frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier

Antenna Gain = 1dBi			
Modulation Type	Frequency (MHz)	Output Power (dBm)	Output Power (mW)
GFSK	2402	-1.30	0.74
	2441	-1.25	0.75
	2480	-1.07	0.78

frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, the systems operate with an output power no greater than 125 mW.

Cable loss: 2.0 dB External Attenuation: 0 dB

Cable Loss, External attenuation has been included in OFF SET function.

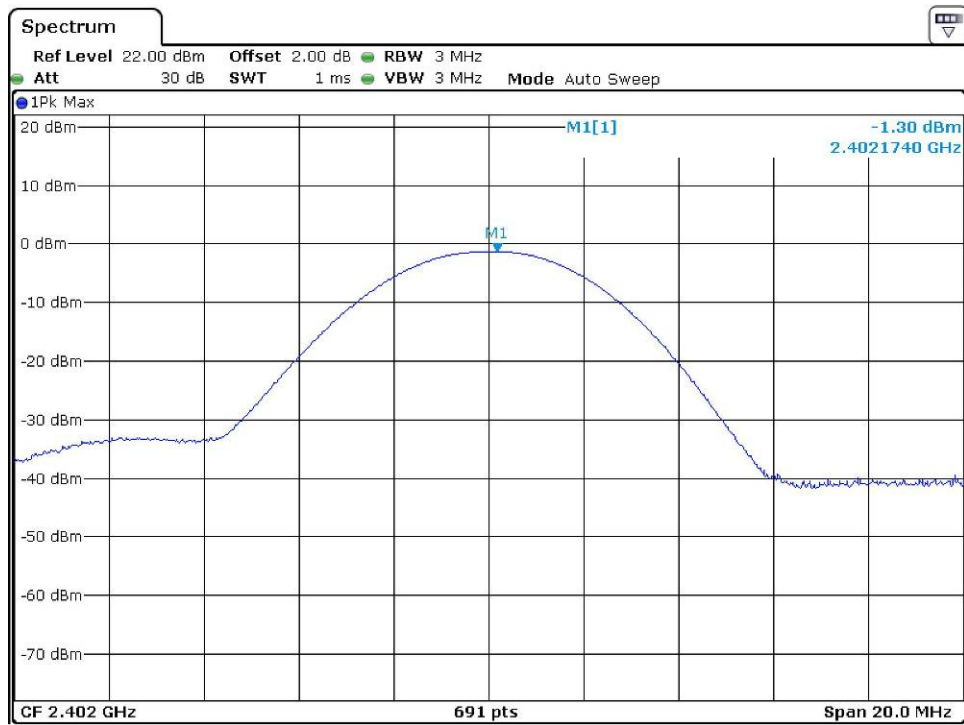
EUT max. output level = -1.07dBm

For RF exposure, the information is saved with filename: RF exposure.pdf.

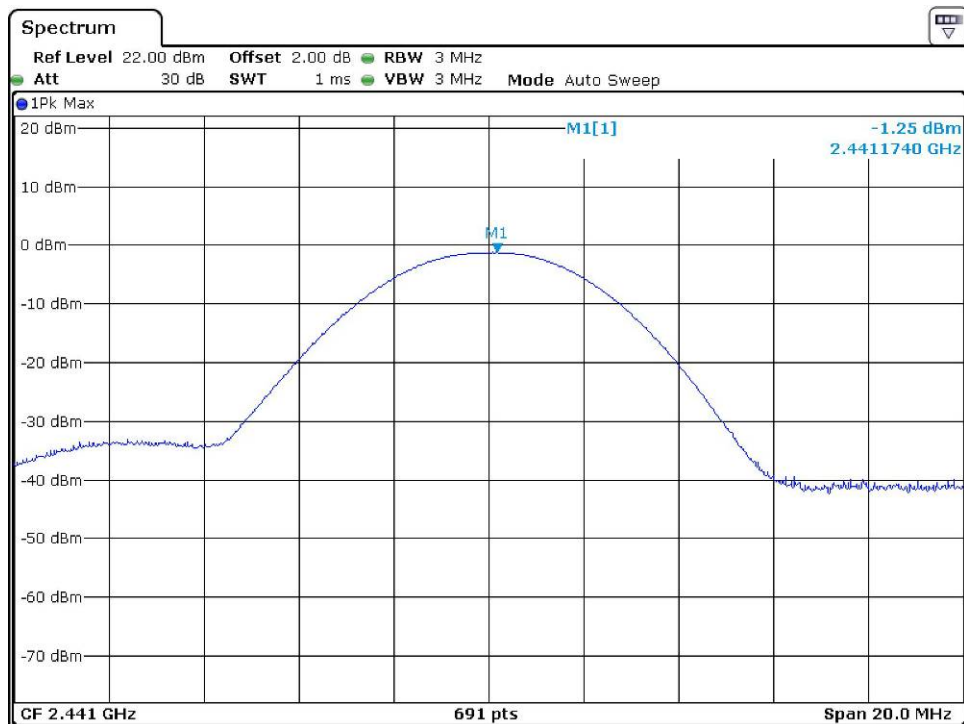
INTERTEK TESTING SERVICES

Modulation Type: GFSK

CH00



CH39



TRF No.: FCC 15C_TX_b
FCC ID: 2AJ90-HG2955
Report No.: 170626040GZU-001

INTERTEK TESTING SERVICES

CH78



TRF No.: FCC 15C_TX_b
FCC ID: 2AJ90-HG2955
Report No.: 170626040GZU-001

INTERTEK TESTING SERVICES

3.4 20dB Bandwidth

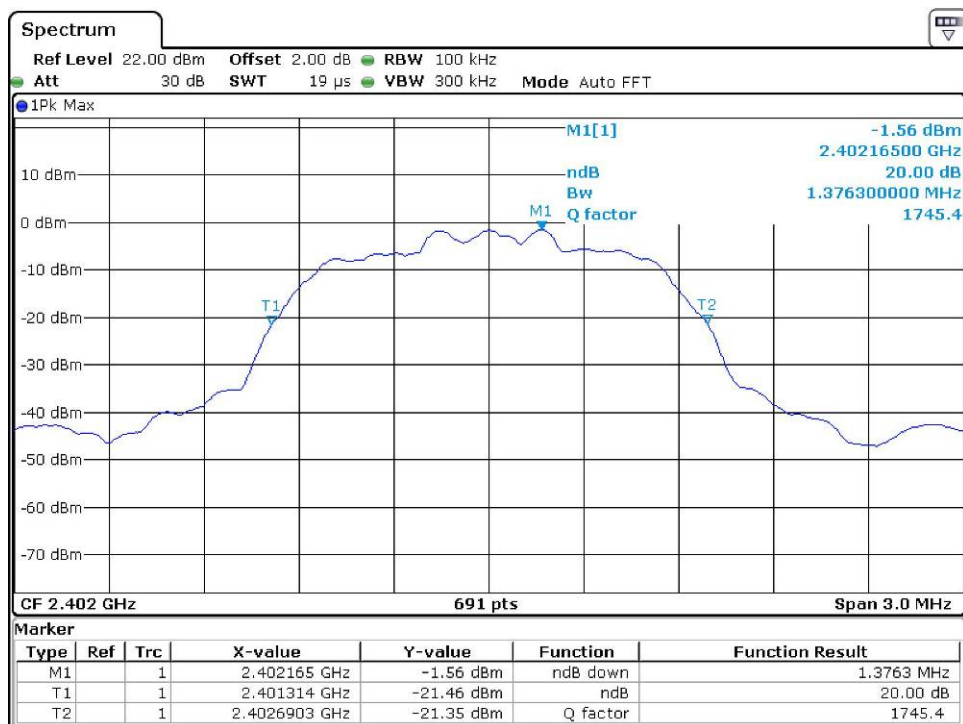
Maximum 20dB RF Bandwidth, FCC Rule 15.247(a) (1):

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	1.3763
2441	1.3806
2480	1.3806

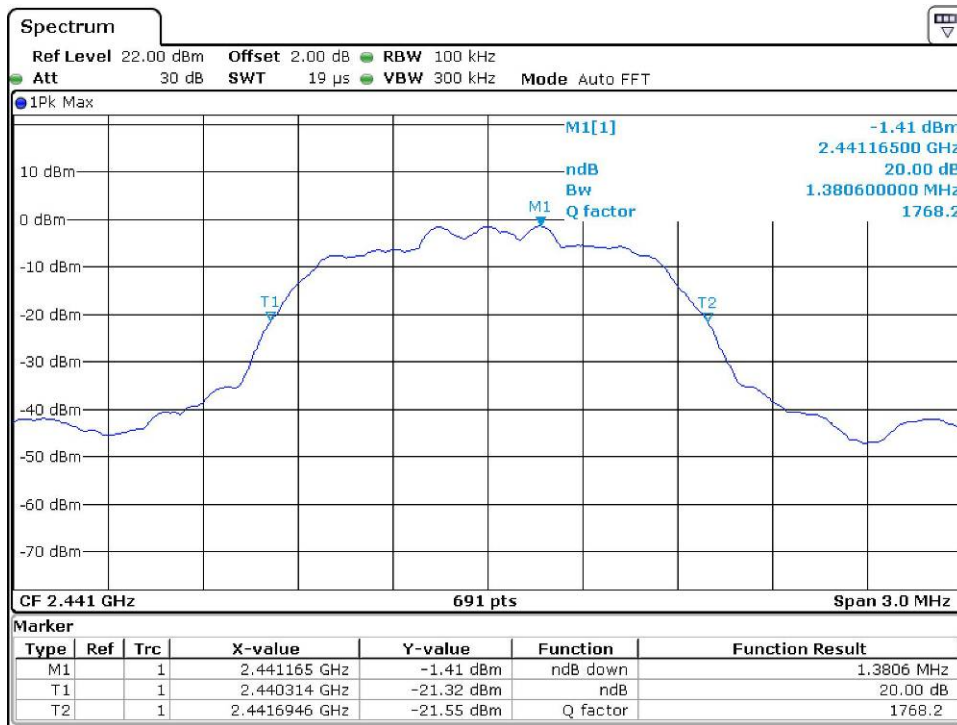
Modulation Type: 8DPSK

CH00

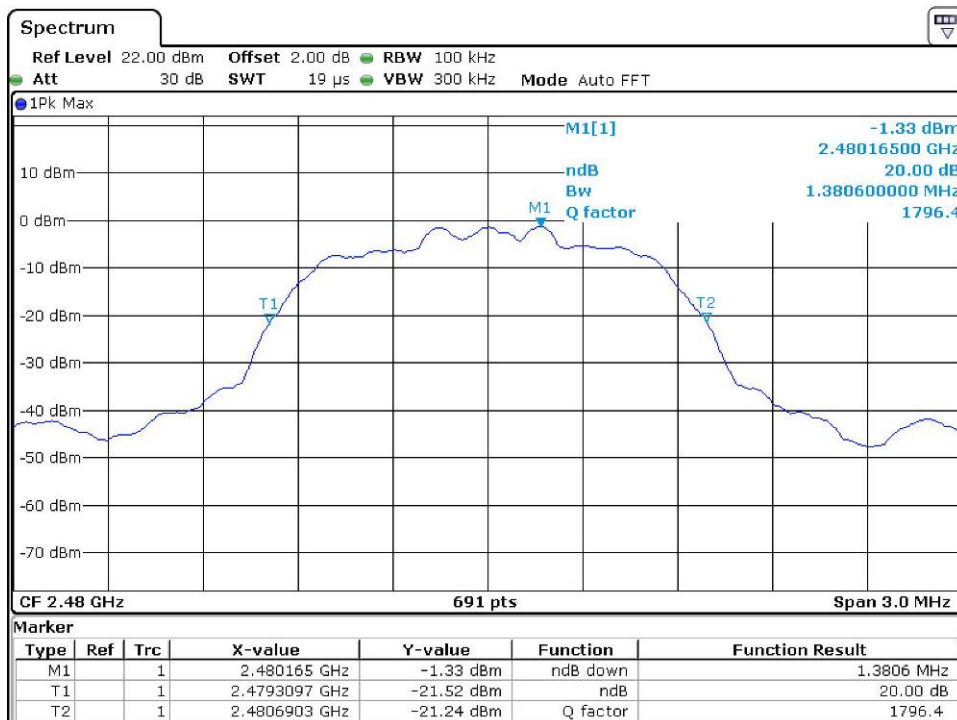


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CH39



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3.5 Channel Number (Number of Hopping Frequencies)

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

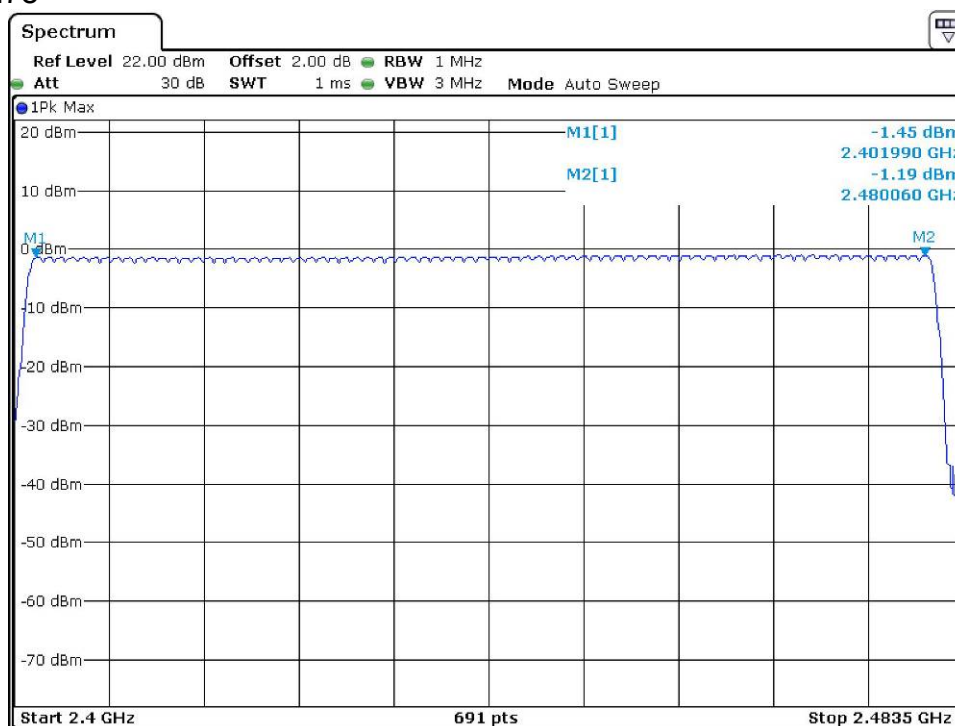
The RF passband of the EUT was divided into 3 approximately equal bands. With the analyzer set to MAX HOLD readings were taken for 2-3 minutes. The channel peaks so recorded were added together, and the total number compared to the minimum number of channels required in the regulation.

Number of hopping channels =	79
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Note: In AFH mode, this device operates using 20 channels and it's satisfied the requirement of limit of minimum of 15 hopping channels.

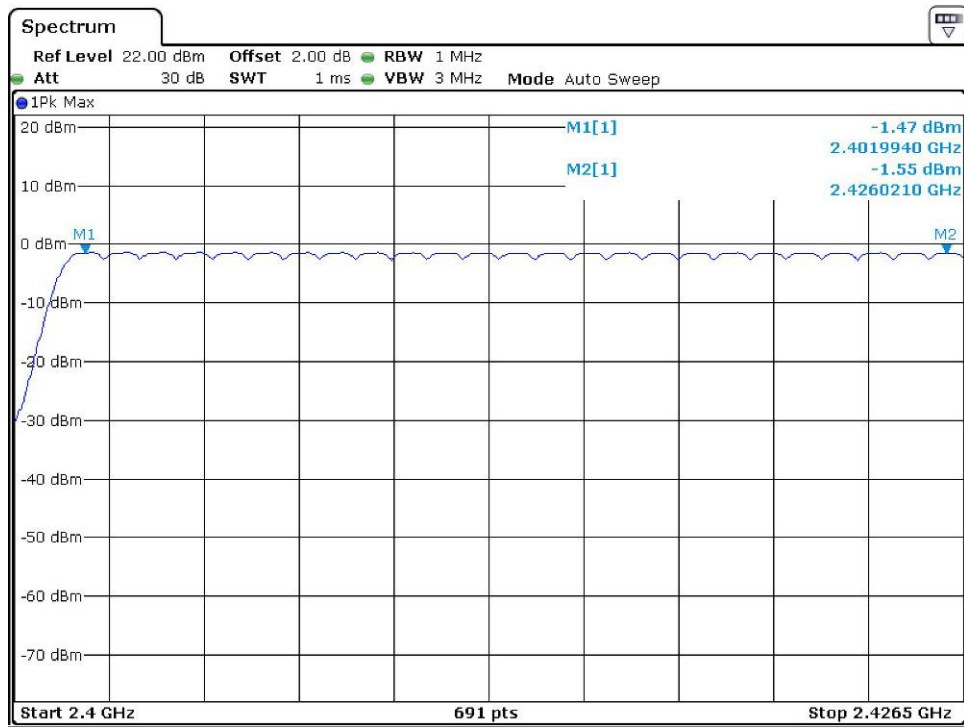
Modulation Type: GFSK

CH00-CH78

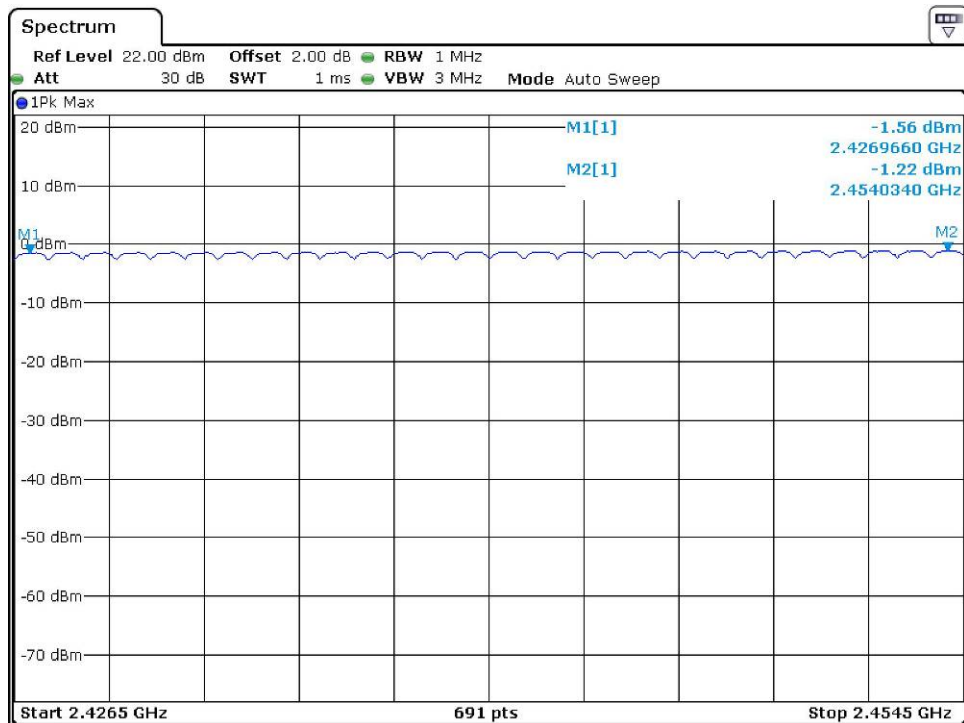


INTERTEK TESTING SERVICES

CH00-CH24

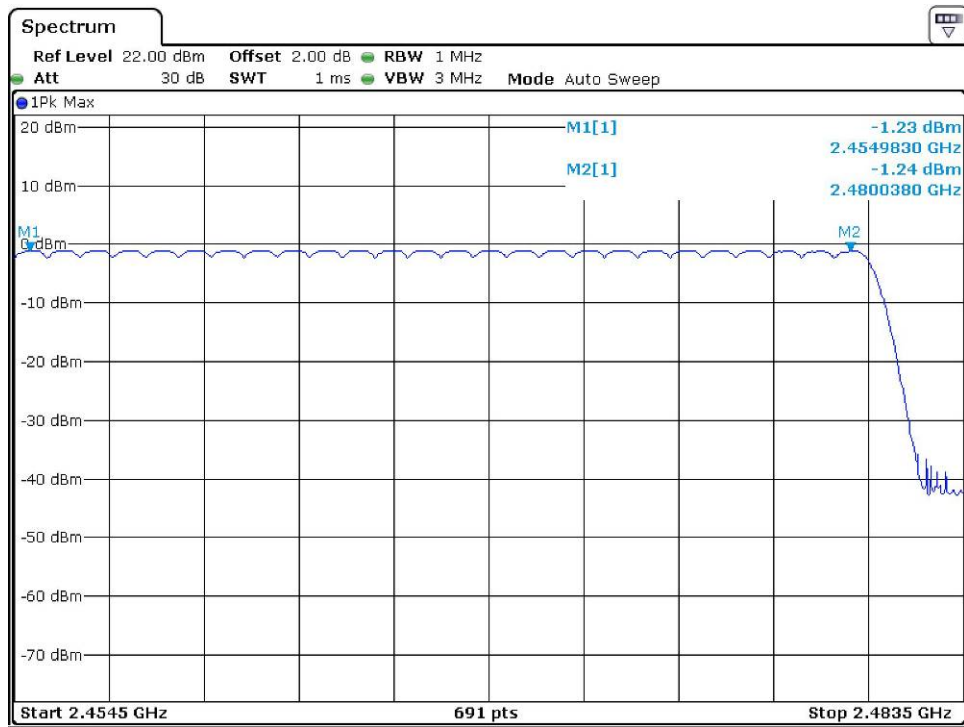


CH25-CH52



INTERTEK TESTING SERVICES

CH53-CH78



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FCC ID: 2AJ90-HG2955
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INTERTEK TESTING SERVICES

3.6 Channel Separation (Carrier Frequency Separation)

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

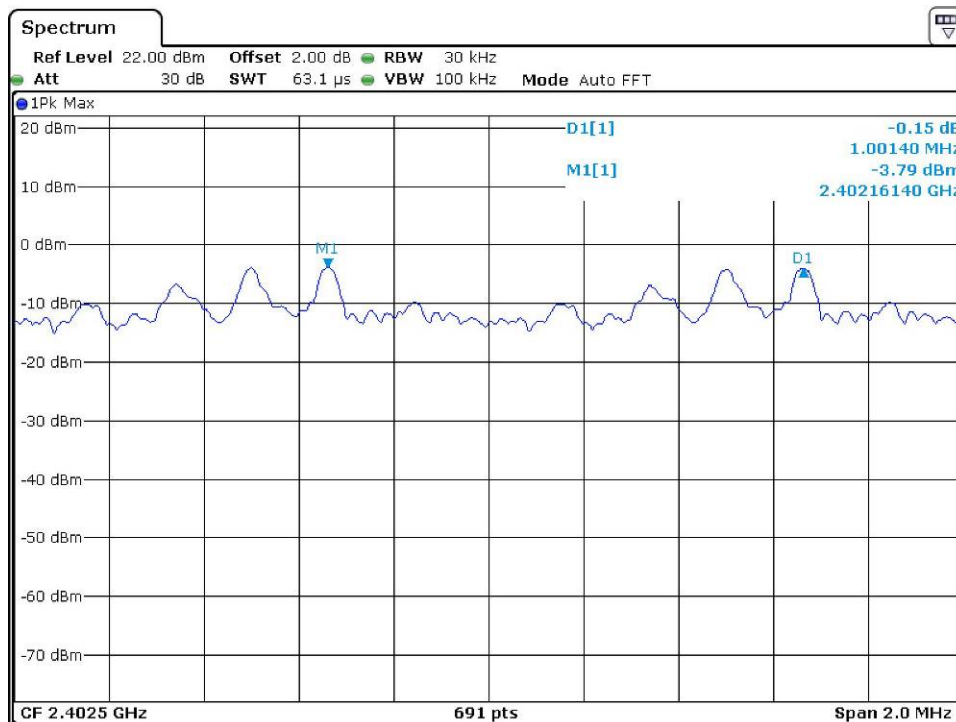
Using the DELTA MARKER function of the analyzer, the frequency separation between two adjacent channels was measured and compared against the limit:

Not less than 2/3 of 20dB bandwidth of hopping channel: $1.3806 \times 2/3 = 0.920\text{MHz}$

Minimum Channel Separation	1.0014 MHz
----------------------------	------------

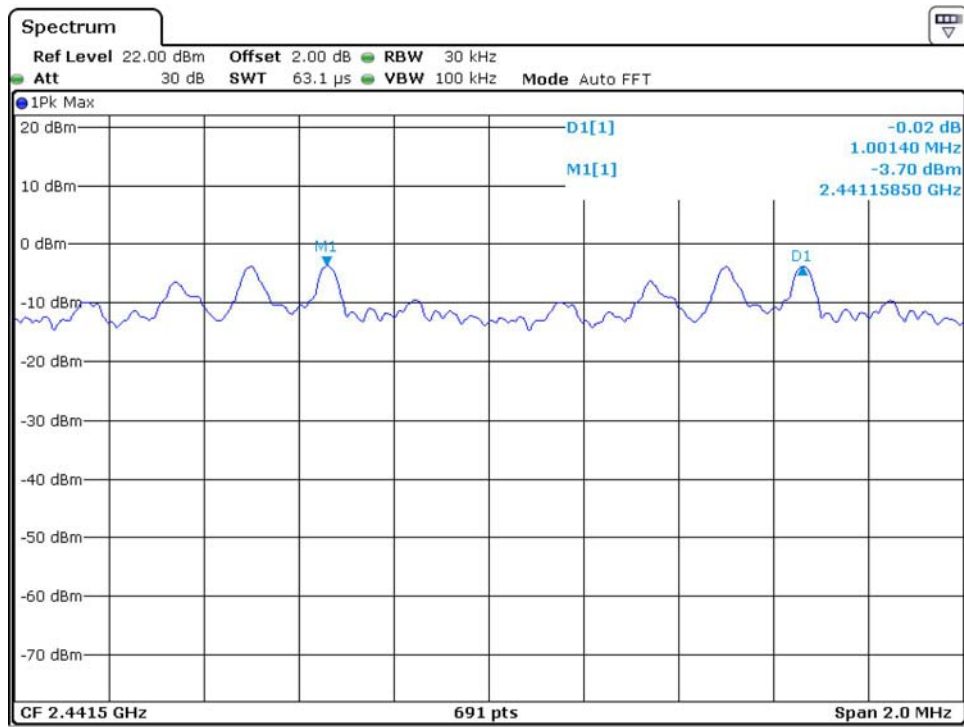
Modulation Type: 8DPSK

Low Channel

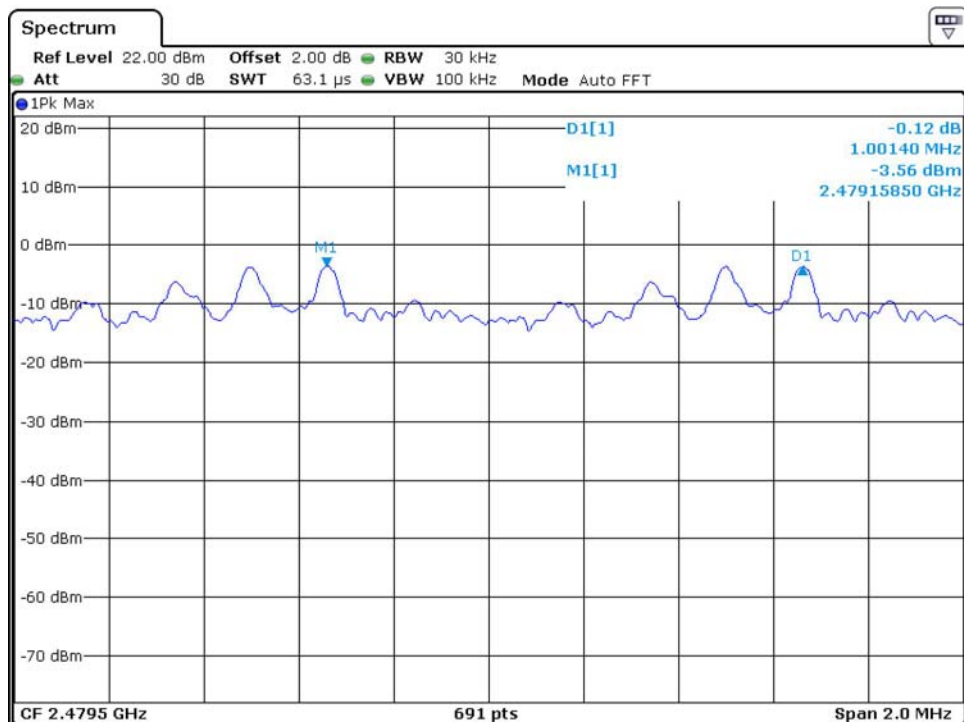


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Middle Channel



High Channel



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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 TRIGGER 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	
8DPSK	DH1	0.393	ms * 320=	125.76	ms	0.4	Pass
	DH3	1.649	ms * 160=	263.84	ms	0.4	Pass
	DH5	2.893	ms * 107=	309.55	ms	0.4	Pass

AFH mode:

The maximum number of hopping channels in 8s for DH1
 $=800 / 2 / 20 * 8=160$

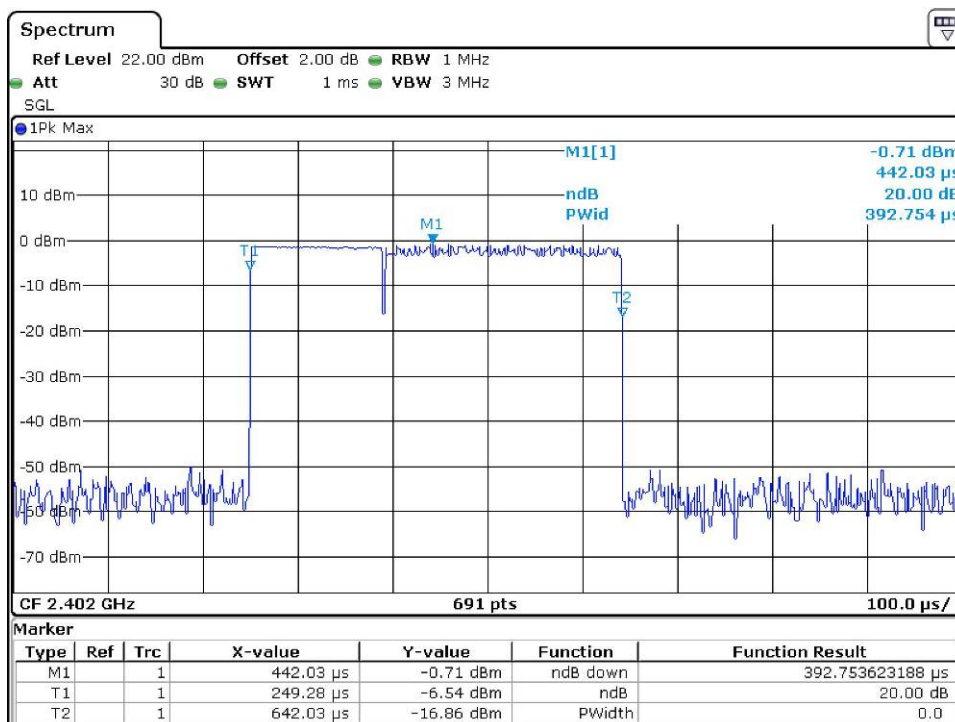
The maximum number of hopping channels in 8s for DH3
 $=800 / 4 / 20 * 8=80$

The maximum number of hopping channels in 8s for DH5
 $=800 / 6 / 20 * 8=53.33$

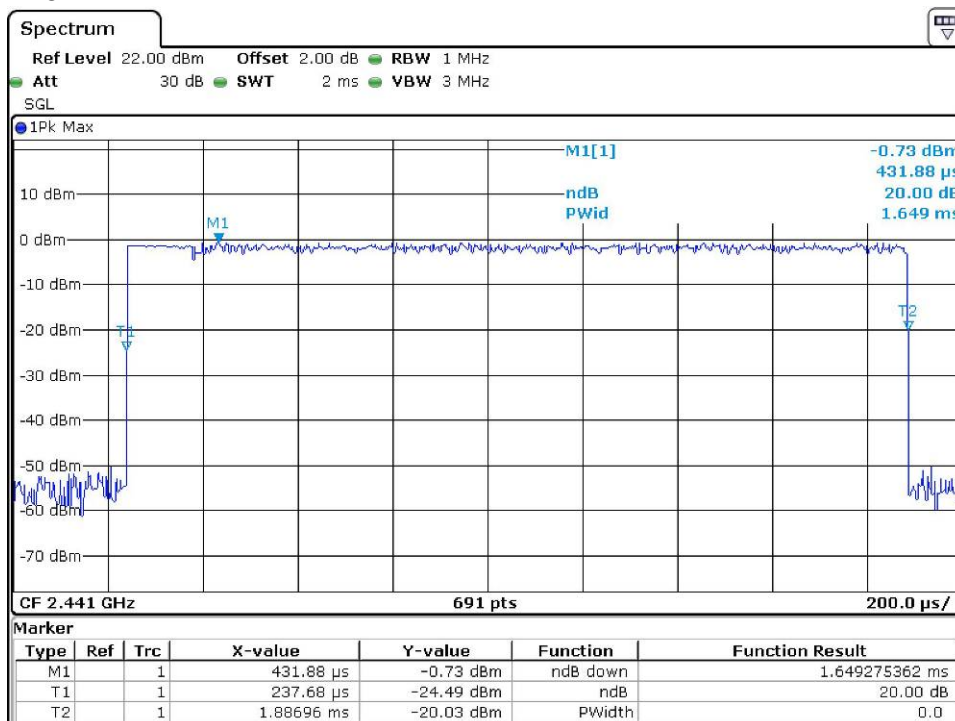
Modulation Type	Packet	Max Dwell Time			Limit (s)	Result	
8DPSK	DH1	0.393	ms * 160=	62.88	ms	0.4	Pass
	DH3	1.649	ms * 80=	131.92	ms	0.4	Pass
	DH5	2.893	ms * 53.33=	154.28	ms	0.4	Pass

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Modulation Type: 8DPSK
 Packet: DH1



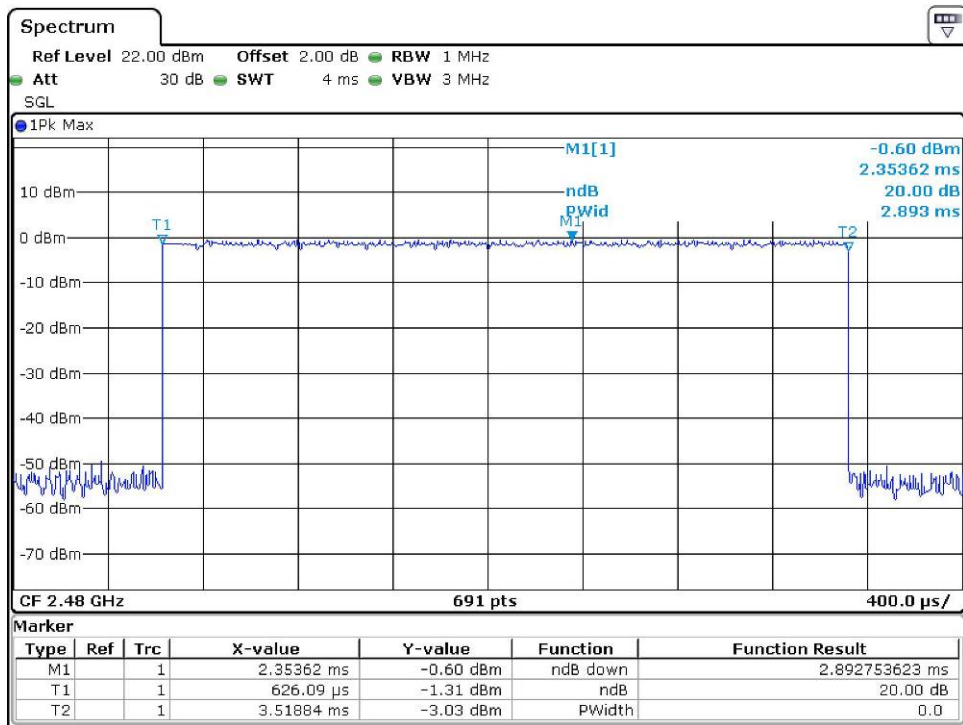
Packet: DH3



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Packet: DH5



TRF No.: FCC 15C_TX_b
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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:

$$\begin{aligned}\text{Peak Resultant field strength} &= \text{Fundamental emissions (peak value)} - \text{delta} \\ &\quad \text{from the bandedge plot} \\ &= 92.8\text{dB}\mu\text{V/m} - 31.3\text{dB} \\ &= 61.5\text{dB}\mu\text{V/m}\end{aligned}$$

$$\begin{aligned}\text{Average Resultant field strength} &= \text{Fundamental emissions (Average value)} - \\ &\quad \text{delta from the bandedge plot}\end{aligned}$$

$$\begin{aligned}&= 70.3\text{ dB}\mu\text{V/m} - 31.3\text{ dB} \\ &= 39.0\text{ dB}\mu\text{V/m}\end{aligned}$$

(ii) Upper channel 2480MHz:

$$\begin{aligned}\text{Peak Resultant field strength} &= \text{Fundamental emissions (peak value)} - \text{delta} \\ &\quad \text{from the bandedge plot} \\ &= 90.1\text{dB}\mu\text{V/m} - 48.5\text{dB} \\ &= 41.6\text{dB}\mu\text{V/m}\end{aligned}$$

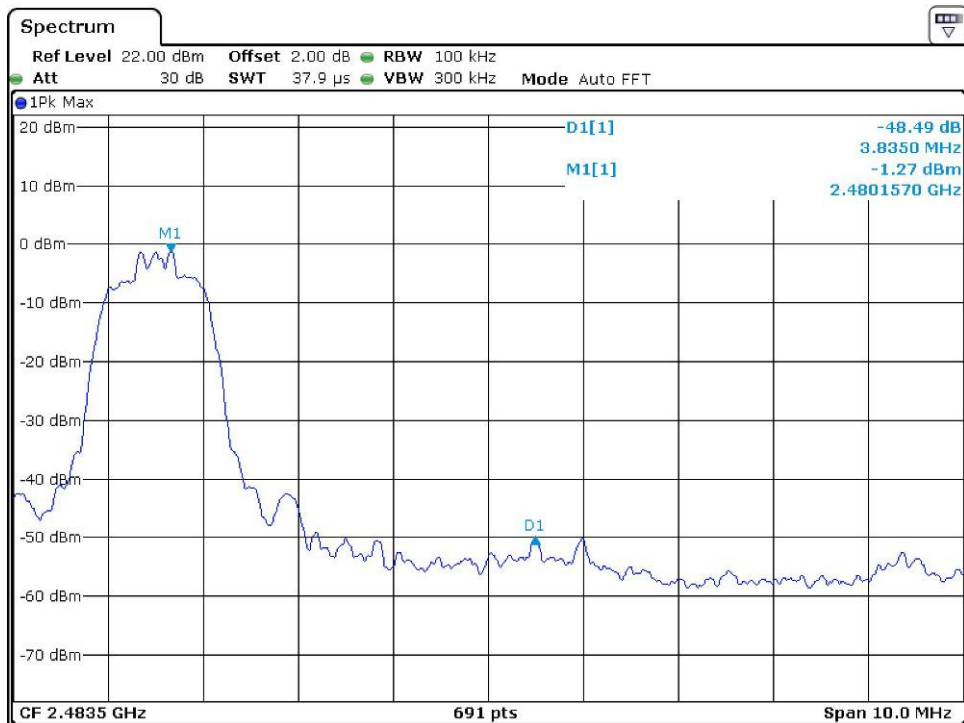
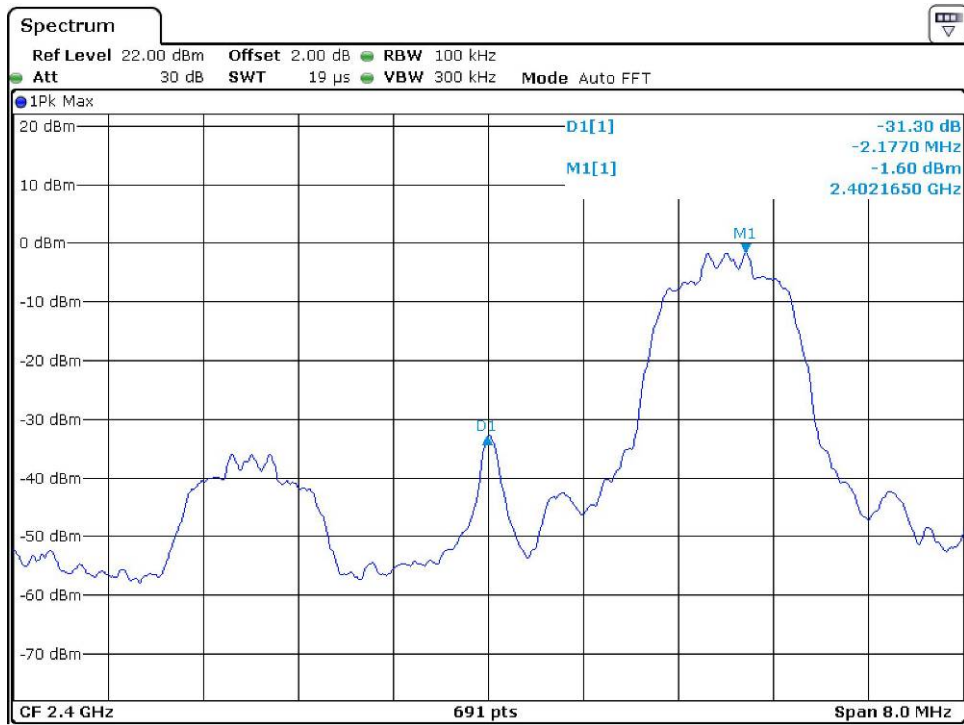
$$\begin{aligned}\text{Average Resultant field strength} &= \text{Fundamental emissions (Average value)} - \\ &\quad \text{delta from the bandedge plot}\end{aligned}$$

$$\begin{aligned}&= 67.6\text{ dB}\mu\text{V/m} - 48.5\text{ dB} \\ &= 19.1\text{ dB}\mu\text{V/m}\end{aligned}$$

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

INTERTEK TESTING SERVICES

Modulation Type: 8DPSK



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3.9 Transmitter Spurious Emissions (Conducted)

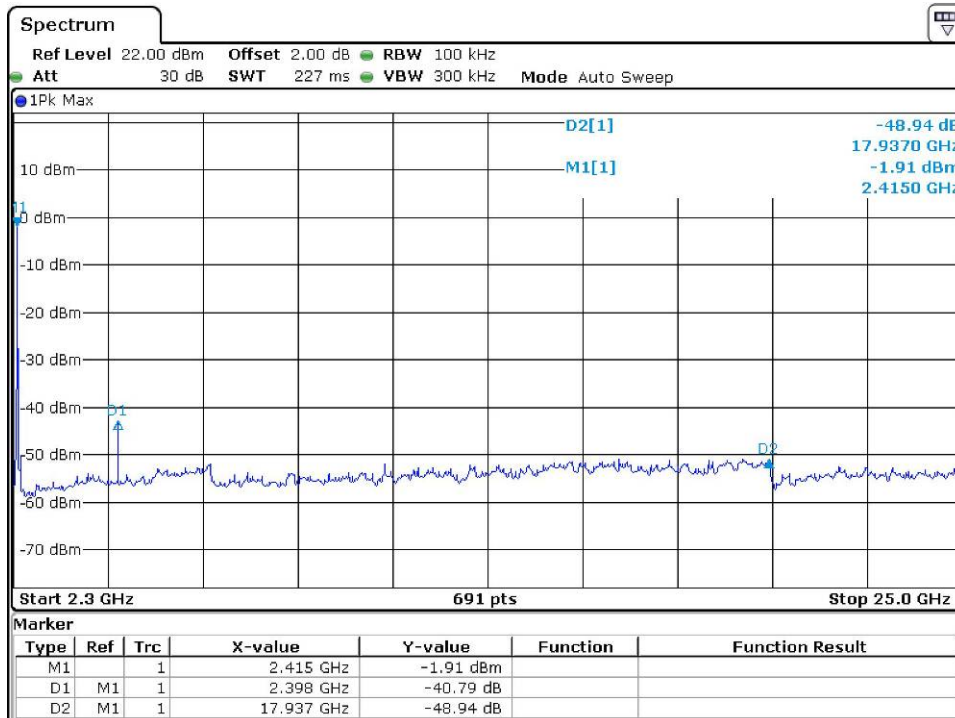
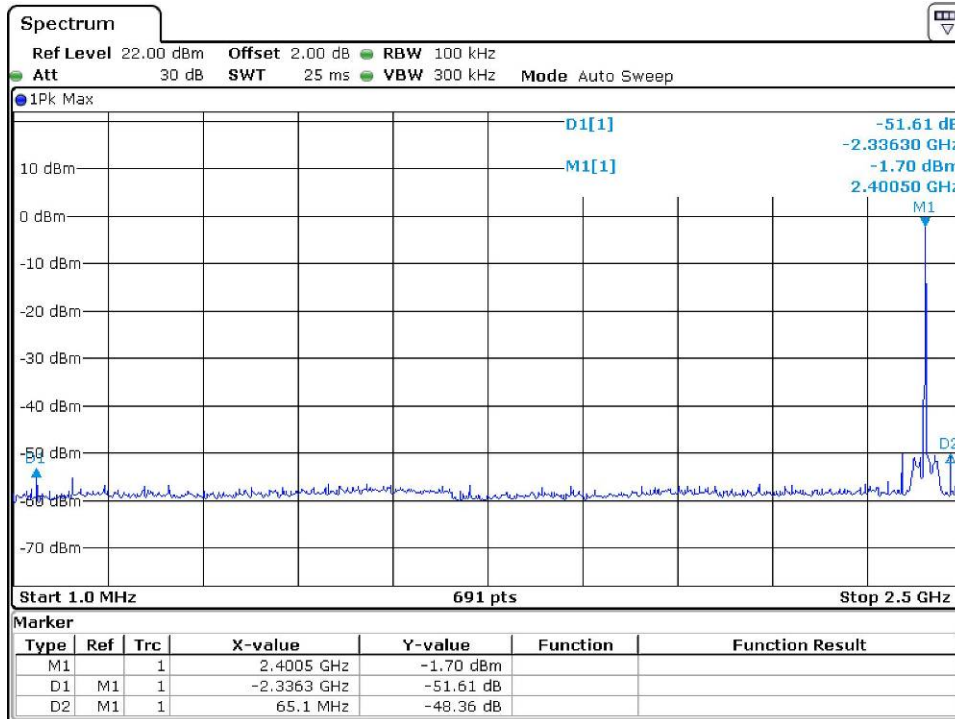
Out of Band Conducted Spurious Emissions, FCC Rule 15.247(d):

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.

INTERTEK TESTING SERVICES

Modulation Type: GFSK

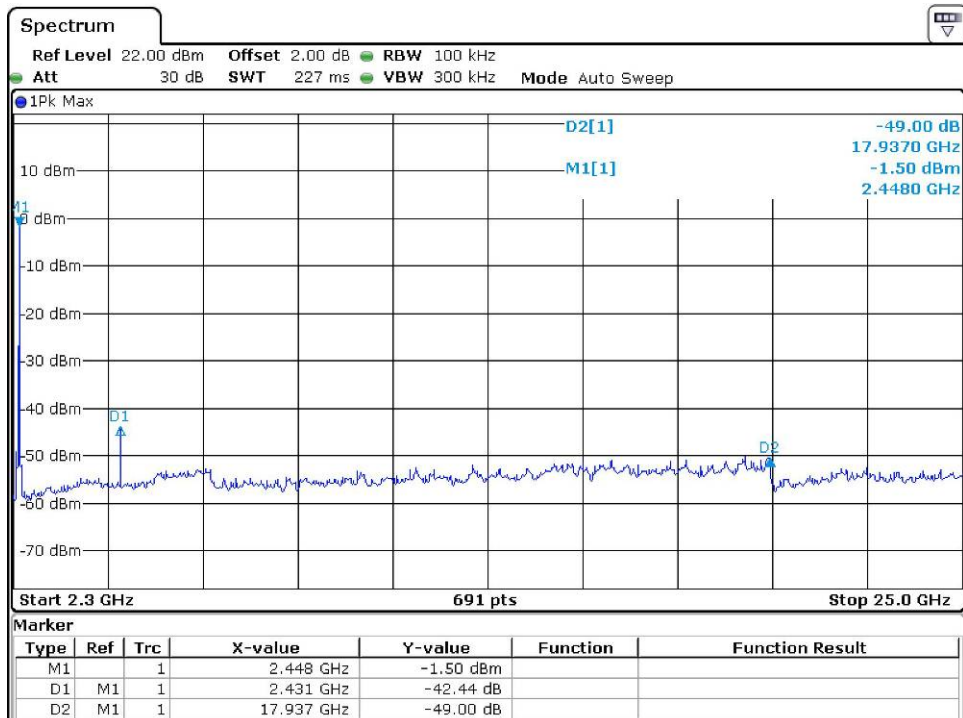
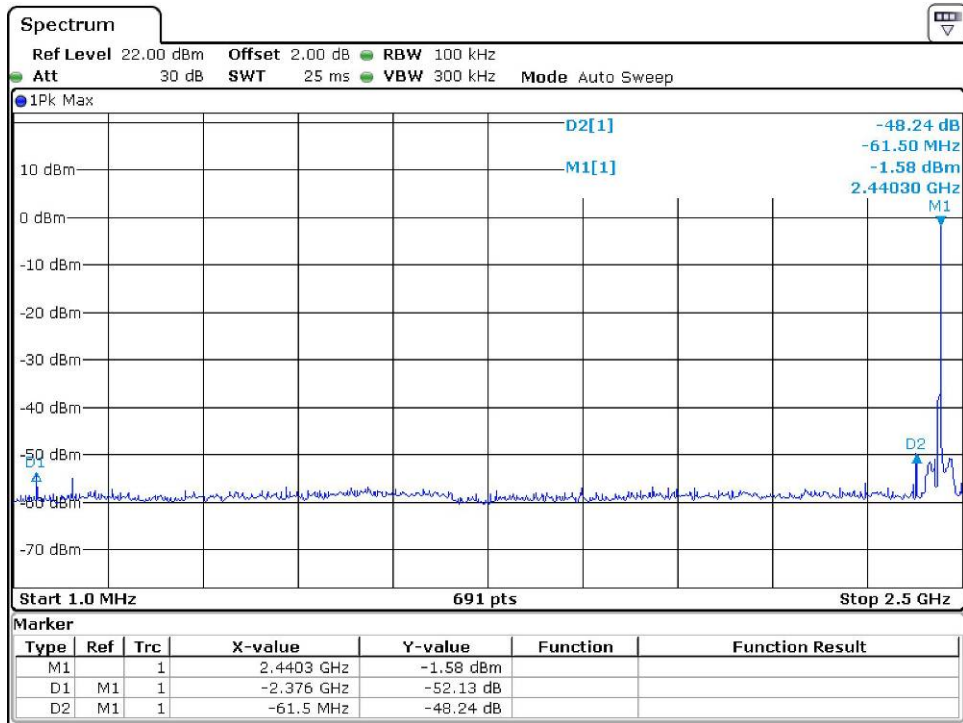
CH00



TRF No.: FCC 15C_TX_b
 FCC ID: 2AJ90-HG2955
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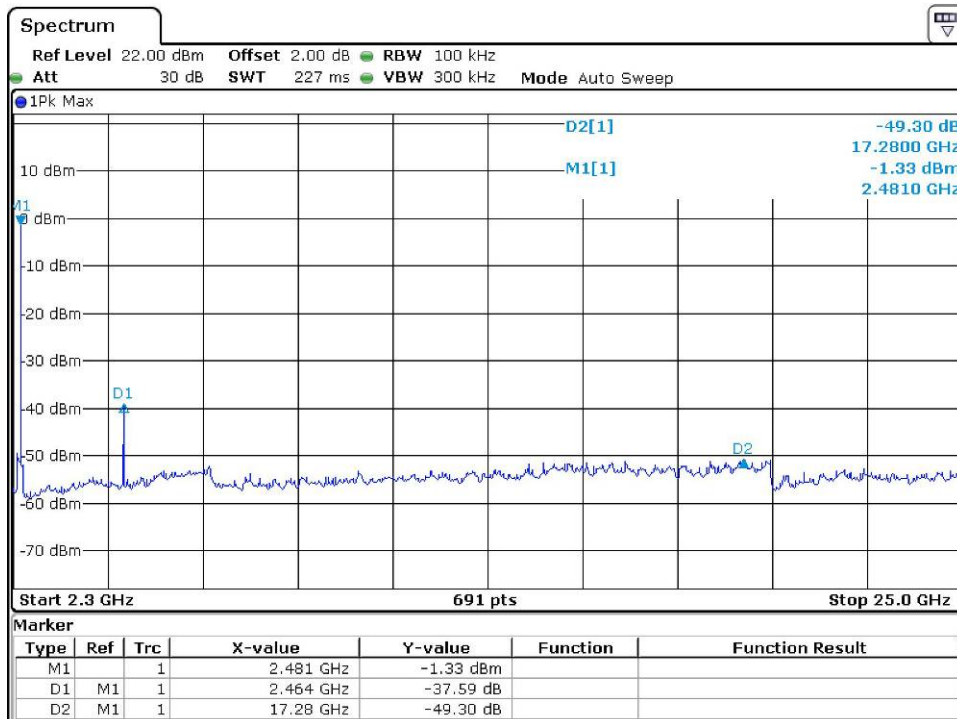
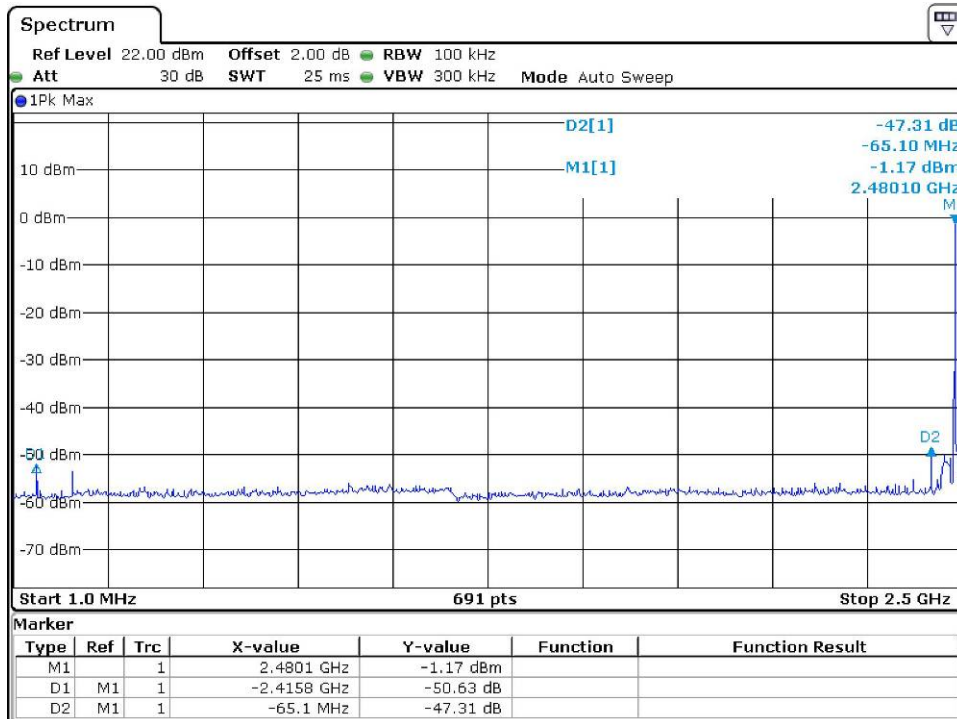
CH39



TRF No.: FCC 15C_TX_b
 FCC ID: 2AJ90-HG2955
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TRF No.: FCC 15C_TX_b
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EXHIBIT 4
EQUIPMENT PHOTOGRAPHS

INTERTEK TESTING SERVICES

4.0 Equipment Photographs

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

INTERTEK TESTING SERVICES

EXHIBIT 5
PRODUCT LABELLING

INTERTEK TESTING SERVICES

5.0 Product Labelling

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

INTERTEK TESTING SERVICES

EXHIBIT 6
TECHNICAL SPECIFICATIONS

INTERTEK TESTING SERVICES

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.

INTERTEK TESTING SERVICES

EXHIBIT 7
INSTRUCTION MANUAL

INTERTEK TESTING SERVICES

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.

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EXHIBIT 8

MISCELLANEOUS INFORMATION

INTERTEK TESTING SERVICES

8.0 Miscellaneous Information

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

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8.1 Discussion of Pulse Desensitization

Pulse desensitivity is not applicable for this device. The effective period (T_{eff}) is approximately 625 μs for Bluetooth. With a resolution bandwidth (3dB) of 1MHz, so the pulse desensitivity factor is 0dB.

INTERTEK TESTING SERVICES

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

Based on the Bluetooth Specification, 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 625 μ s.

Each TX and RX time slot is 625 μ s 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:

Normal Mode:

Channel hop rate=1600 hops/second

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

AFH Mode:

Channel hop rate = 800 hops/second (AFH Mode)

Adjusted channel hop rate for DH5 mode = 133.33 hops/second

Time per channel hop = 1 / 133.33 hops/second = 7.5 ms

Time to cycle through all channels = 7.5 x 20 channels = 150 ms

Number of times transmitter hits on one channel = 100 ms / 150 ms = 1 time(s)

Worst case dwell time = 7.5 ms

Duty cycle connection factor = 20log₁₀(7.5ms / 100ms) = -22.5 dB

INTERTEK TESTING SERVICES

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 C63.10: 2013.

The transmitting equipment under test (EUT) is placed on a styrene turntable which is four feet in diameter, up to 1GHz 0.8m and above 1GHz 1.5m 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 with RBW 9KHz used.

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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.

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 (RBW 3MHz used for fundamental emission).

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.

INTERTEK TESTING SERVICES

EXHIBIT 9
CONFIDENTIALITY REQUEST

INTERTEK TESTING SERVICES

9.0 Confidentiality Request

For electronic filing, the confidentiality request of the tested EUT is saved with filename: request.pdf.

INTERTEK TESTING SERVICES

EXHIBIT 10
TEST EQUIPMENT LIST

INTERTEK TESTING SERVICES

10 Test Equipment List

Equipment No.	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
EE089	EMI Test Receiver	Rohde & Schwarz	ESU	1302.600 5.26	17-May-2017	17-May-2018
EE040	Pre-Amplifier	HP	8447F	2944A07 999	17-May-2017	17-May-2018
EE043	Bilog Antenna	Schwarzbeck	VULB916 3	142	17-May-2017	17-May-2018
EE147	Cable	Schwarzbeck	AK9513	ACRX1	17-May-2017	17-May-2018
EE169	Cable	Rosenberger	N/A	FP2RX2	17-May-2017	17-May-2018
EE168	Cable	Schwarzbeck	AK9513	CRPX1	17-May-2017	17-May-2018
EE170	Cable	Schwarzbeck	AK9513	CRRX2	17-May-2017	17-May-2018
EE096	Pre-Amplifier	A.H.	PAM- 0126	1415261	17-May-2017	17-May-2018
EE094	Horn Antenna	Schwarzbeck	BBHA 9120	707	17-May-2017	17-May-2018
EE097	Cable	H+B	0.5M SF104- 26.5	289147/4	17-May-2017	17-May-2018
EE100	Cable	H+B	3M SF104- 26.5	295838/4	17-May-2017	17-May-2018
EE101	Cable	H+B	6M SF104- 26.5	295840/4	17-May-2017	17-May-2018
EE095	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA917 0399	17-May-2017	17-May-2018
EE343	EMI Test Receiver	Rohde & Schwarz	FSV40	132.1- 3008K39- 100967- AP	17-May-2017	17-May-2018
EE240	Pre-Amplifier	Lunar EM	LNA26G4 0-40	J1013131 028001	17-May-2017	17-May-2018
EE234	Horn Antenna	AHS/USA	SAS-573	184	17-May-2017	17-May-2018
EE312	Cable	A.H	SAC- 40G-1	414	17-May-2017	17-May-2018
EE313	Cable	A.H	SAC- 40G-1	413	17-May-2017	17-May-2018
EE023	Test Receiver	Rohde & Schwarz	ESCS30	879	29-May-2016	29-May-2017
EE145	L.I.S.N.	Rohde & Schwarz	ENV216	590	29-May-2016	29-May-2017
EE021	L.I.S.N.	ROHDE & SCHWARZ	ESH2-Z5	236	29-May-2016	29-May-2017