

Company: HP Inc

Test of: 0960-4025 and 0960-4034

To: FCC 15.247 & IC RSS-247 (FHSS)

Report No.: MARS11-U13 FHSS Rev B WiFi/BT Module

COMPLETE TEST REPORT



COMPLETE TEST REPORT

FROM



Test of: HP Inc 0960-4025 and 0960-4034

to

To: FCC 15.247 & IC RSS-247 (FHSS)

Test Report Serial No.: MARS11-U13 FHSS Rev B WiFi/BT Module

This report supersedes: MARS11-U13 FHSS Rev A

Applicant: HP Inc
1115 SE 164th Ave., Suite 210,
Vancouver,
Washington 98683,
USA

Product Function 802.11 a/b/g/n SDIO dual band
with BT/BLE

Issue Date: 27th October 2017

This Test Report is Issued Under the Authority of:

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MiCOM Labs is an ISO 17025 Accredited Testing Laboratory



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To: FCC 15.247 & IC RSS-247 (FHSS)
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1. ACCREDITATION, LISTINGS & RECOGNITION

1.1. TESTING ACCREDITATION

MiCOM Labs, Inc. is an accredited Electrical testing laboratory per the international standard ISO/IEC 17025:2005. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; <http://www.a2la.org/scopepdf/2381-01.pdf>



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1.2. RECOGNITION

MiCOM Labs, Inc has widely recognized wireless testing capabilities. Our international recognition includes Conformity Assessment Body designation by APEC MRA countries. MiCOM Labs test reports are accepted globally.

Country	Recognition Body	Status	Phase	Identification No.
USA	Federal Communications Commission (FCC)	TCB	-	US0159 Listing #: 102167
Canada	Industry Canada (IC)	FCB	APEC MRA 2	US0159 Listing #: 4143A-2 4143A-3
Japan	MIC (Ministry of Internal Affairs and Communication)	CAB	APEC MRA 2	RCB 210
	VCCI	--	--	A-0012
Europe	European Commission	NB	EU MRA	NB 2280
Australia	Australian Communications and Media Authority (ACMA)	CAB	APEC MRA 1	US0159
Hong Kong	Office of the Telecommunication Authority (OFTA)	CAB	APEC MRA 1	
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)	CAB	APEC MRA 1	
Singapore	Infocomm Development Authority (IDA)	CAB	APEC MRA 1	
Taiwan	National Communications Commission (NCC) Bureau of Standards, Metrology and Inspection (BSMI)	CAB	APEC MRA 1	
Vietnam	Ministry of Communication (MIC)	CAB	APEC MRA 1	

EU MRA – European Union Mutual Recognition Agreement.

NB – Notified Body

APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement. Recognition agreement under which test lab is accredited to regulatory standards of the APEC member countries.

Phase I - recognition for product testing

Phase II – recognition for both product testing and certification

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1.3. PRODUCT CERTIFICATION

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard ISO/IEC 17065:2012. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.02. MiCOM Labs test schedule is available at the following URL; <http://www.a2la.org/scopepdf/2381-02.pdf>



United States of America – Telecommunication Certification Body (TCB)
Industry Canada – Certification Body, CAB Identifier – US0159
Europe – Notified Body (NB), NB Identifier - 2280
Japan – Recognized Certification Body (RCB), RCB Identifier - 210



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2. DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft	23rd August 2017	Draft report for client review.
Rev A	11 th October 2017	Initial release.
Rev B	27 th October 2017	Removed module photographs.
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In the above table the latest report revision will replace all earlier versions.

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3. TEST RESULT CERTIFICATE

Manufacturer: HP Inc 1115 SE 164th Ave., Suite 210, Vancouver, Washington 98683, USA	Tested By: MiCOM Labs, Inc. 575 Boulder Court Pleasanton California 94566 USA
Model: HP Part # 0960-4025 and HP Part # 0960-4034	Telephone: +1 925 462 0304
Type Of Equipment: WLAN BT Radio module	Fax: +1 925 462 0306
S/N's: D80F99748D64, D80F99748D68	
Test Date(s): 28 July - 02 August 2017	Website: www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC 15.247 & IC RSS-247 (FHSS)	EQUIPMENT COMPLIES

MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

Notes:

1. This document reports conditions under which testing was conducted and the results of testing performed.
2. Details of test methods used have been recorded and kept on file by the laboratory.
3. Test results apply only to the item(s) tested.

Approved & Released for MiCOM Labs, Inc. by:



Graeme Grieve
Quality Manager MiCOM Labs, Inc.

Gordon Hurst
President & CEO MiCOM Labs, Inc.

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4. REFERENCES AND MEASUREMENT UNCERTAINTY

4.1. Normative References

REF.	PUBLICATION	YEAR	TITLE
I	A2LA	June 2015	R105 - Requirement's When Making Reference to A2LA Accreditation Status
II	ANSI C63.10	2013	American National Standard for Testing Unlicensed Wireless Devices
III	ANSI C63.4	2014	American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
IV	CISPR 32	2012	Electromagnetic compatibility of multimedia equipment - Emission requirements
V	ETSI TR 100 028	2001-12	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
VI	FCC 47 CFR Part 15, Subpart B	2014	Title 47: Telecommunication PART 15—RADIO FREQUENCY DEVICES, SubPart B; Unintentional Radiators
VII	FCC 47 CFR Part 15.247	2016	Radio Frequency Devices; Subpart C – Intentional Radiators
VIII	FCC Public Notice DA 00-705	March 2000	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
IX	ICES-003	Issue 6 Jan 2016	Spectrum Management and Telecommunications; Interference-Causing Equipment Standard. Information Technology Equipment (Including Digital Apparatus) – Limits and methods of measurement.
X	M 3003	Edition 3 Nov.2012	Expression of Uncertainty and Confidence in Measurements
XI	RSS-247 Issue 2	Feb 2017	Digital Transmission Systems (DTSS), Frequency Hopping System (FHSs) and Licence-Exempt Local Area Network (LE-LEN) Devices
XII	RSS-Gen Issue 4	November 2014	General Requirements and Information for the Certification of Radiocommunication Equipment
XIII	FCC 47 CFR Part 2.1033	2016	FCC requirements and rules regarding photographs and test setup diagrams.

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4.2. Test and Uncertainty Procedure

Conducted and radiated emission measurements were conducted in accordance with American National Standards Institute ANSI C63.4, listed in the Normative References section of this report.

Measurement uncertainty figures are calculated in accordance with ETSI TR 100 028 Parts 1 and 2.

Measurement uncertainties stated are based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95 % in accordance with UKAS document M 3003 listed in the Normative References section of this report.

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5. PRODUCT DETAILS AND TEST CONFIGURATIONS

5.1. Technical Details

Details	Description
Purpose:	Test of the HP Inc 0960-4025 and 0960-4034 Bluetooth Radio in FHSS mode to FCC 15.247 & IC RSS-247 (FHSS).
Applicant:	HP Inc 1115 SE 164th Ave., Suite 210, Vancouver, Washington 98683, USA
Manufacturer:	HP Inc
Laboratory performing the tests:	MiCOM Labs, Inc. 575 Boulder Court Pleasanton California 94566 USA
Test report reference number:	MARS11-U13 FHSS Rev B WiFi/BT Module
Date EUT received:	12 th June 2017
Standard(s) applied:	FCC 15.247 & IC RSS-247 (FHSS)
Dates of test (from - to):	28 July - 02 August 2017
No of Units Tested:	2
Product Family Name:	VCVRA-1712
Model(s):	Model: HP Inc.'s VCVRA-1712 Part numbers: 0960-4025 and 0960-4034
Location for use:	Indoors
Declared Frequency Range(s):	2400 - 2483.5 MHz;
Type of Modulation:	Bluetooth - FHSS
EUT Modes of Operation:	2400 - 2483.5 MHz: DH1; 3DH5;
Declared Nominal Output Power:	6 dBm
Transmit/Receive Operation:	Transceiver - Full Duplex
Rated Input Voltage and Current:	3.3V+/-10%, 1A
Operating Temperature Range:	Declared Range 0°C to 70°C
ITU Emission Designator:	1M22G1D
Equipment Dimensions:	37mm x 40mm
Weight:	0.3 oz
Hardware Rev:	V4
Software Rev:	P130

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5.2. Scope Of Test Program

HP Inc 0960-4025 and 0960-4034

The scope of the test program was to test the HP Inc 0960-4025 and 0960-4034 Bluetooth Radio in FHSS mode in the frequency ranges 2400 - 2483.5 MHz; for compliance against the following specification:

FCC 15.247 & IC RSS-247 (FHSS)

Radio Frequency Devices; Subpart C – Intentional Radiators

Industry Canada RSS-247

Digital Transmission Systems (DTSs), Frequency Hopping System (FHSs) and Licence-Exempt Local Area Network (LE-LEN) Devices

The product is available as 2 model variants;-

0960-4025 has U.FL connectors to enable connection to external antennas.

0960-4034 has integral antennas only.

PCB Manufacturing Variation

Testing commenced on Rev 3.1 of the wireless device using VCVRA-1712 pcb's.

For manufacturability, HP agreed to remove an extra set of holes on the digital interface connector. This is designated as the Rev 4 design.

Differences: All traces and pads remained however holes are not drilled on the two extra connections, and thus the connector cannot be loaded into the wrong location.

Verification: The differences between Revision 3.1 and Revision 4 of the VCVRA-1712 radio were reviewed, tested and judged to have no significant effect on device compliance.

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5.3. Equipment Model(s) and Serial Number(s)

Type	Description	Manufacturer	Model	Serial no.	Delivery Date
EUT	802.11 a/b/g/n SDIO dual band 2.4G/5GHz WLAN with BT/BLE	HP Inc	Model: HP Inc.'s VCVRA-1712 Part numbers: 0960-4025 and 0960-4034	D80F99748D64, D80F99748D68	12 th June 2017
Support	Latitude Laptop, Linux	Dell	E6410	654C3Q1	12 th June 2017
Support	STYX SD Adapter Board	HP Inc	AB_W8977_STYX_ADAPTER_V1	-	12 th June 2017

The product is available as 2 model variants;-

0960-4025 has U.FL connectors to enable connection to external antennas.

0960-4034 has integral antennas only.

5.4. Antenna Details

Type	Manufacturer	Model	Family	Gain (dBi)	BF Gain	Dir BW	X-Pol	Frequency Band (MHz)
integral	HP	Integral	5	2.5	-	360	-	2400 - 2483.5
external	YAGEO	ANTX300P002B24553	5	0.7	-	360	-	2400 - 2483.5

BF Gain - Beamforming Gain
Dir BW - Directional BeamWidth
X-Pol - Cross Polarization

5.5. Cabling and I/O Ports

Port Type	Max Cable Length	# of Ports	Screened	Conn Type	Data Type	Bit Rate
24	5	1	--	SD	Data	10/100

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5.6. Test Configurations

Results for the following configurations are provided in this report:

Operational Mode(s) (802.11a/b/g/n/ac)	Data Rate with Highest Power MBit/s	Channel Frequency (MHz)		
		Low	Mid	High
2400 - 2483.5 MHz				
DH1	1	2,402.00	2,440.00	2,480.00
DH5	3	2,402.00	2,440.00	2,480.00

5.7. Equipment Modifications

The following modifications were required to bring the equipment into compliance:

1. NONE

5.8. Deviations from the Test Standard

The following deviations from the test standard were required in order to complete the test program:

1. NONE

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6. TEST SUMMARY

List of Measurements

Test Header	Result	Data Link
20 dB & 99% Bandwidth	Complies	View Data
Frequency Hopping Tests	Complies	-
Number of Hopping Channels	Complies	View Data
Channel Separation	Complies	View Data
Dwell Time	Complies	View Data
Channel Occupancy	Complies	View Data
Output Power	Complies	View Data
Emissions	Complies	-
(1) Conducted Emissions	Complies	-
(i) Conducted Unwanted Spurious Emissions	Complies	View Data
(ii) Conducted Band-Edge Emissions	Complies	View Data
(2) Radiated Emissions	Complies	-
(i) TX Spurious & Restricted Band Emissions	Complies	View Data
(ii) Restricted Edge & Band-Edge Emissions	Complies	View Data
(3) Digital Emissions (0.03 - 1 GHz)	Complies	View Data
(4) AC Wireline Emissions	Not Applicable	See Note 1

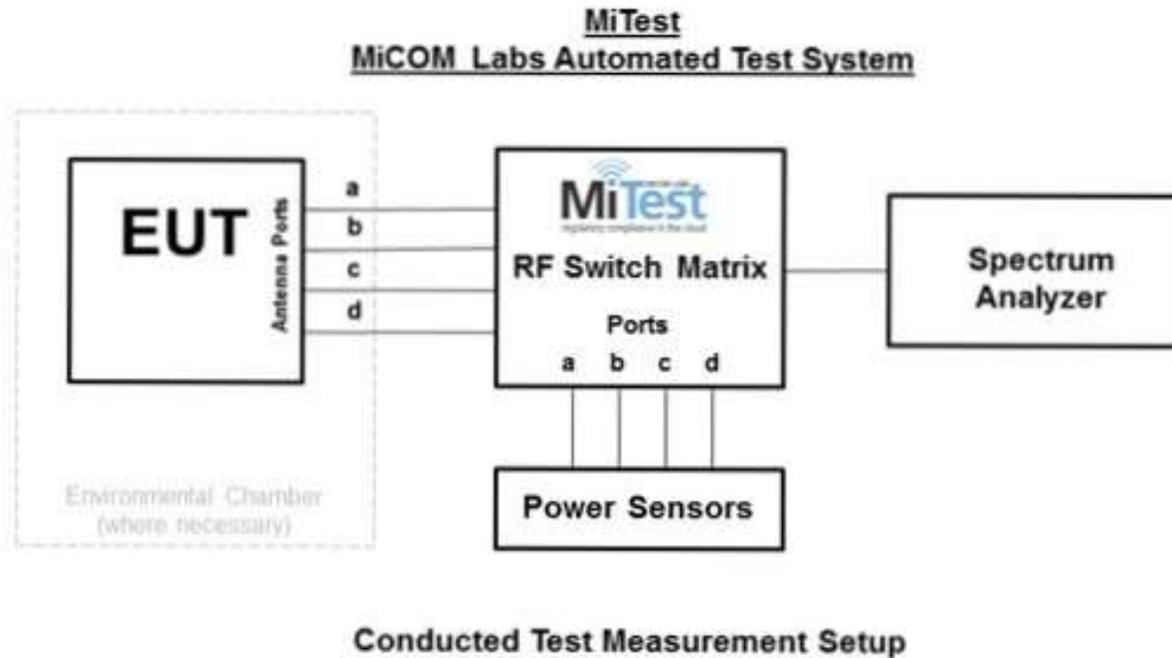
Note 1: EUT is DC Powered.

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7. TEST EQUIPMENT CONFIGURATION(S)

7.1. Conducted

Conducted RF Emission Test Set-up(s) The following tests were performed using the conducted test set-up shown in the diagram below.



A full system calibration was performed on the test station and any resulting system losses (or gains) were taken into account in the production of all final measurement data.

Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
#3 SA	MiTest Box to SA	Fairview Microwave	SCA1814-0101-72	#3 SA	2 Oct 2017
#3P1	EUT to MiTest box port 1	Fairview Microwave	SCA1814-0101-72	#3P1	2 Oct 2017
#3P2	EUT to MiTest box port 2	Fairview Microwave	SCA1814-0101-72	#3P2	2 Oct 2017
#3P3	EUT to MiTest box port 3	Fairview Microwave	SCA1814-0101-72	#3P3	2 Oct 2017
#3P4	EUT to MiTest box port 4	Fairview Microwave	SCA1812-0101-72	#3P4	2 Oct 2017
158	Barometer/Thermometer	Control Company	4196	E2846	30 Nov 2017
249	Resistance Thermometer	Thermotronics	GR2105-02	9340 #2	23 Oct 2017

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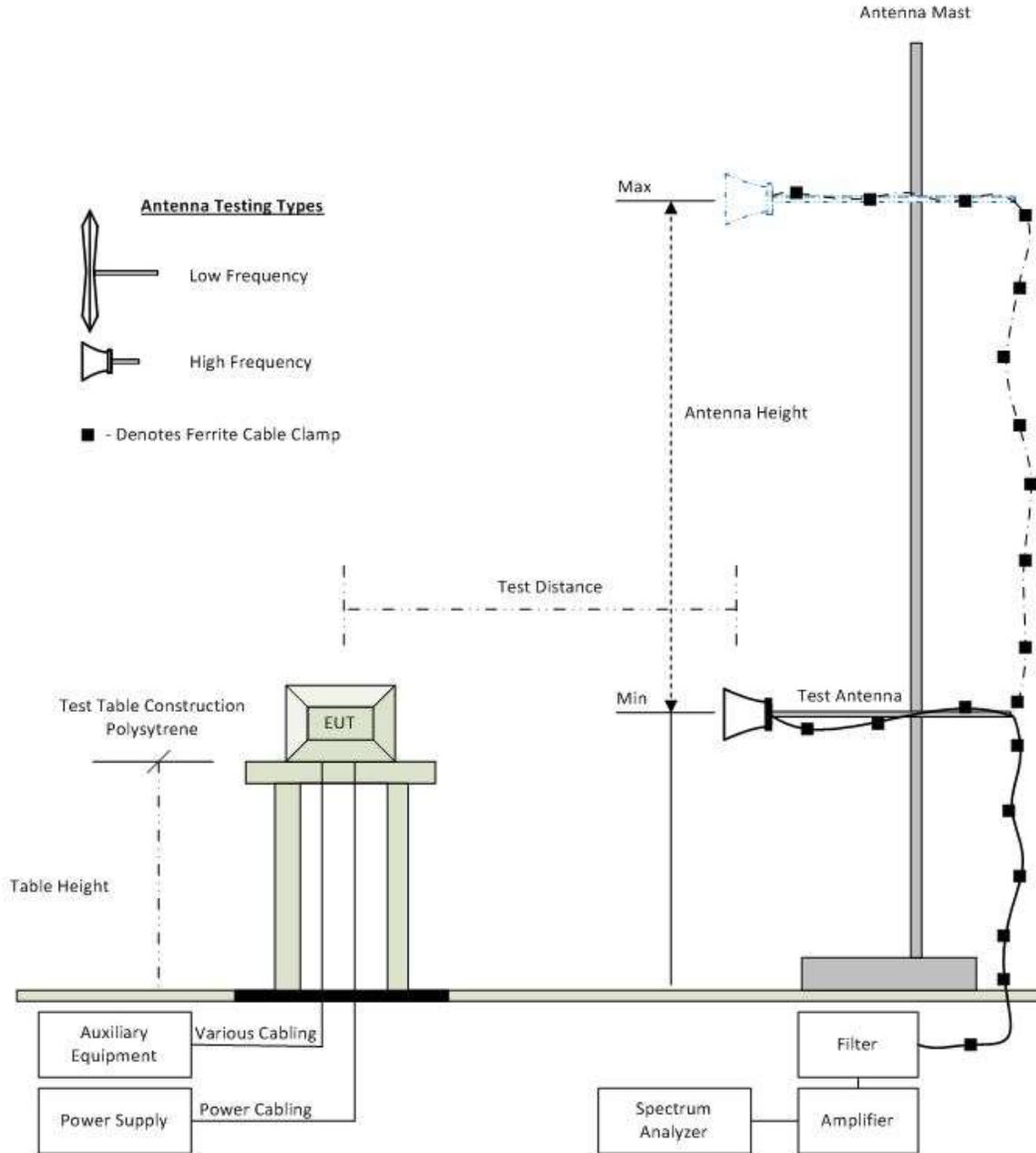
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287	Rohde & Schwarz 40 GHz Receiver	Rhode & Schwarz	ESIB40	100201	2 May 2018
361	Desktop for RF#1, Labview Software installed	Dell	Vostro 220	WS RF#1	Not Required
378	Rohde & Schwarz 40 GHz Receiver with Generator	Rhode & Schwarz	ESIB40	100107/040	4 Aug 2017
390	USB Power Head 50MHz - 24GHz -60 to +20dBm	Agilent	U2002A	MY50000103	17 Oct 2017
398	MiTest RF Conducted Test Software	MiCOM	MiTest ATS	Version 4.1	Not Required
405	DC Power Supply 0-60V	Agilent	6654A	MY4001826	Cal when used
408	USB to GPIB interface	National Instruments	GPIB-USB HS	14C0DE9	Not Required
436	USB Wideband Power Sensor	Boonton	55006	8731	14 Sep 2017
441	USB Wideband Power Sensor	Boonton	55006	9179	25 Sep 2017
443	4x4 RF Switch Box	MiCOM Labs	MiTest 4X4 RF Switch Box	MIC003	2 Oct 2017
445	PoE Injector	D-Link	DPE-101GL	QTAH1E2000625	Not Required
75	Environmental Chamber	Thermatron	SE-300-2-2	27946	24 Nov 2017

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7.2. Radiated Emissions - 3m Chamber

The following tests were performed using the radiated test set-up shown in the diagram below. Radiated emissions below 1GHz. Radiated Emissions above 1GHz.



Radiated Emission Test Setup

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A full system calibration was performed on the test station and any resulting system losses (or gains) were taken into account in the production of all final measurement data.

Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
158	Barometer/Thermometer	Control Company	4196	E2846	30 Nov 2017
170	Video System Controller for Semi Anechoic Chamber	Panasonic	WV-CU101	04R08507	Not Required
287	Rohde & Schwarz 40 GHz Receiver	Rhode & Schwarz	ESIB40	100201	2 May 2018
301	5470 to 5725 MHz Notch Filter	Microtronics	RBC50704	001	30 Oct 2017
302	5150 to 5350 MHz Notch Filter	Microtronics	BRC50703	002	30 Oct 2017
303	5725 to 5875 MHz Notch filter	Microtronics	BRC50705	003	30 Oct 2017
330	Variac 0-280 Vac	Staco Energy Co	3PN1020B	0546	Cal when used
338	Sunol 30 to 3000 MHz Antenna	Sunol	JB3	A052907	30 Oct 2017
341	900MHz Notch Filter	EWT	EWT-14-0199	H1	30 Oct 2017
342	2.4 GHz Notch Filter	EWT	EWT-14-0203	H1	30 Oct 2017
343	5.15 GHz Notch Filter	EWT	EWT-14-0200	H1	30 Oct 2017
344	5.35 GHz Notch Filter	EWT	EWT-14-0201	H1	30 Oct 2017
345	5.46 GHz Notch Filter	EWT	EWT-14-0202	H1	30 Oct 2017
373	26III RMS Multimeter	Fluke	Fluke 26 series III	76080720	26 Oct 2017
378	Rohde & Schwarz 40 GHz Receiver with Generator	Rhode & Schwarz	ESIB40	100107/040	4 Nov 2017
393	DC - 1050 MHz Low Pass Filter	Microcircuits	VLFX-1050	N/A	30 Oct 2017
396	2.4 GHz Notch Filter	Microtronics	BRM50701	001	30 Oct 2017
397	Amp 10 - 2500MHz	MiCOM Labs	Amp 10 - 2500 MHz	NA	9 Oct 2017
399	ETS 1-18 GHz Horn Antenna	ETS	3117	00154575	10 Oct 2017
406	Amplifier for Radiated Emissions	MiCOM Labs	40dB 1 to 18GHz Amp	0406	9 Oct 2017
410	Desktop Computer	Dell	Inspiron 620	WS38	Not Required
411	Mast/Turntable Controller	Sunol Sciences	SC98V	060199-1D	Not Required
412	USB to GPIB Interface	National Instruments	GPIB-USB HS	11B8DC2	Not Required
413	Mast Controller	Sunol Science	TWR95-4	030801-3	Not Required
414	DC Power Supply 0-60V	HP	6274	1029A01285	Cal when used

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415	Turntable Controller	Sunol Sciences	Turntable Controller	None	Not Required
416	Gigabit ethernet filter	ETS-Lingren	Gigafoil 260366	None	Not Required
447	MiTest Rad Emissions Test Software	MiCOM	Rad Emissions Test Software Version 1.0	447	Not Required
462	Schwarzbeck cable from Antenna to Amplifier.	Schwarzbeck	AK 9513	462	30 Oct 2017
463	Schwarzbeck cable from Amplifier to Bulkhead.	Schwarzbeck	AK 9513	463	30 Oct 2017
464	Schwarzbeck cable from Bulkhead to Receiver	Schwarzbeck	AK 9513	464	30 Oct 2017
480	Cable - Bulkhead to Amp	SRC Haverhill	157-3050360	480	30 Oct 2017
481	Cable - Bulkhead to Receiver	SRC Haverhill	151-3050787	481	30 Oct 2017
482	Cable - Amp to Antenna	SRC Haverhill	157-3051574	482	30 Oct 2017
87	Uninterruptible Power Supply	Falcon Electric	ED2000-1/2LC	F3471 02/01	Cal when used
VLF-1700	Low pass filter DC-1700 MHz	Mini Circuits	VLF-1700	None	30 Oct 2017

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8. MEASUREMENT AND PRESENTATION OF TEST DATA

The measurement and graphical data presented in this test report was generated automatically using state-of-the-art technology creating an easy to read report structure. Numerical measurement data is separated from supporting graphical data (plots) through hyperlinks. Numerical measurement data can be reviewed without scrolling through numerous graphical pages to arrive at the next data matrix.

Plots have been relegated into the Appendix 'Graphical Data'.

Test and report automation was performed by [MiTest](#). [MiTest](#) is an automated test system developed by MiCOM Labs. [MiTest](#) is the first cloud based modular test system enabling end-to-end automation of regulatory compliance testing for conducted RF testing.



The MiCOM Labs "[MiTest](#)" Automated Test System" (Patent Pending)

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9. TEST RESULTS

20 dB & 99% Bandwidth

Conducted Test Conditions for 20 dB and 99% Bandwidth			
Standard:	FCC CFR 47:15.247	Ambient Temp. (°C):	24.0 - 27.5
Test Heading:	20 dB and 99 % Bandwidth	Rel. Humidity (%):	32 - 45
Standard Section(s):	15.247 (a)(1)(i)/(ii)	Pressure (mBars):	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for 20 dB and 99% Bandwidth Measurement

The bandwidth at 20 dB and 99 % was measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

Testing was performed under ambient conditions at nominal voltage. Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured and reported.

Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.

Limits for 20 dB and 99% Bandwidth

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(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 2400-2483.5 MHz band 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 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. 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.

(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

(ii) Frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75 hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

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Equipment Configuration for 20 dB 99% Bandwidth

Variant:	DH1	Duty Cycle (%):	99
Data Rate:	1.00 MBit/s	Antenna Gain (dBi):	Not Applicable
Modulation:	FHSS	Beam Forming Gain (Y)(dB):	Not Applicable
TPC:	Not Applicable	Tested By:	SB
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured 20 dB Bandwidth (MHz)				20 dB Bandwidth (MHz)		Limit	Lowest Margin
	Port(s)				Highest	Lowest		
MHz	a	b	c	d			MHz	MHz
2402.0	1.110				1.110	1.110		--
2440.0	1.118				1.118	1.118		--
2480.0	1.114				1.114	1.114		--

Test Frequency	Measured 99% Bandwidth (MHz)				Maximum 99% Bandwidth (MHz)		
	Port(s)						
MHz	a	b	c	d			
2402.0	0.946				0.946		
2440.0	0.962				0.962		
2480.0	0.946				0.946		

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

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Equipment Configuration for 20 dB 99% Bandwidth

Variant:	DH5	Duty Cycle (%):	99
Data Rate:	3.00 MBit/s	Antenna Gain (dBi):	Not Applicable
Modulation:	FHSS	Beam Forming Gain (Y)(dB):	Not Applicable
TPC:	Not Applicable	Tested By:	SB
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured 20 dB Bandwidth (MHz)				20 dB Bandwidth (MHz)		Limit	Lowest Margin
	Port(s)				Highest	Lowest		
MHz	a	b	c	d			MHz	MHz
2402.0	1.383				1.383	1.383		--
2440.0	1.383				1.383	1.383		--
2480.0	1.391				1.391	1.391		--

Test Frequency	Measured 99% Bandwidth (MHz)				Maximum 99% Bandwidth (MHz)		
	Port(s)						
MHz	a	b	c	d			
2402.0	1.222				1.222		
2440.0	1.222				1.222		
2480.0	1.222				1.222		

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

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9.1. Frequency Hopping Tests

Conducted Test Conditions for Frequency Hopping Measurements			
Standard:	FCC CFR 47:15.247	Ambient Temp. (°C):	24.0 - 27.5
Test Heading:	Frequency Hopping Tests	Rel. Humidity (%):	32 - 45
Standard Section(s):	15.247 (a)(1)(i)/(ii)	Pressure (mBars):	999 - 1001
Reference Document(s):	See Normative References, FCC Public Notice DA 00-705		

Test Procedure for Frequency Hopping Measurements

These tests cover the following measurements:

- i) channel separation
- ii) channel occupancy
- iii) dwell time
- iv) number of hopping frequencies

Frequency hopping testing was measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency or hopping mode.

Testing was performed under ambient conditions at nominal voltage. Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured and reported.

Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.

Limits for Frequency Hopping Measurements

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(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 2400-2483.5 MHz band 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 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. 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.

(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

(ii) Frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75 hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

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9.1.1. Number of Hopping Channels

Equipment Configuration for Number of Hopping Channels

Variant:	DH1	Antenna:	Not Applicable
Data Rate:	1.00 MBit/s	Antenna Gain (dBi):	Not Applicable
Modulation:	FHSS	Beam Forming Gain (Y)(dB):	Not Applicable
Duty Cycle (%):	99.0	Tested By:	SB
Engineering Test Notes:			

Test Measurement Results

Frequency Range (MHz)	Number of Hopping Channels	Limit	Pass / Fail
2400.0-2428.0	27	--	--
2428.0-2456.0	26	--	--
2456.0-2483.5	24	--	--
Total number of Hops	78	15	Pass

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

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Equipment Configuration for Number of Hopping Channels

Variant:	DH5	Antenna:	Not Applicable
Data Rate:	3.00 MBit/s	Antenna Gain (dBi):	Not Applicable
Modulation:	FHSS	Beam Forming Gain (Y)(dB):	Not Applicable
Duty Cycle (%):	99.0	Tested By:	SB
Engineering Test Notes:			

Test Measurement Results

Frequency Range (MHz)	Number of Hopping Channels	Limit	Pass / Fail
2400.0-2428.0	27	--	--
2428.0-2456.0	26	--	--
2456.0-2483.5	25	--	--
Total number of Hops	78	15	Pass

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

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9.1.2. Channel Separation

Equipment Configuration for Channel Separation

Variant:	DH1	Antenna:	Not Applicable
Data Rate:	1.00 MBit/s	Antenna Gain (dBi):	Not Applicable
Modulation:	FHSS	Beam Forming Gain (Y)(dB):	Not Applicable
Duty Cycle (%):	99.0	Tested By:	SB
Engineering Test Notes:			

Test Measurement Results

Center Frequency (MHz)	Chan Separation (MHz)	Limit (MHz)	Pass / Fail
2440.0	1.00	0.642	Pass

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

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Equipment Configuration for Channel Separation			
--	--	--	--

Variant:	DH5	Antenna:	Not Applicable
Data Rate:	3.00 MBit/s	Antenna Gain (dBi):	Not Applicable
Modulation:	FHSS	Beam Forming Gain (Y)(dB):	Not Applicable
Duty Cycle (%):	99.0	Tested By:	SB
Engineering Test Notes:			

Test Measurement Results

Center Frequency (MHz)	Chan Separation (MHz)	Limit (MHz)	Pass / Fail
2440.0	1.004	0.814	Pass

Traceability to Industry Recognized Test Methodologies	
--	--

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

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9.1.3. Dwell Time & Channel Occupancy

Variant:	DH1	Antenna:	Not Applicable
Data Rate:	1.00 MBit/s	Antenna Gain (dBi):	Not Applicable
Modulation:	FHSS	Beam Forming Gain (Y)(dB):	Not Applicable
Duty Cycle (%):	99.0	Tested By:	SB
Engineering Test Notes:			

Test Measurement Results

Channel Frequency(MHz)	Dwell Time (Single Burst) (uS)	Channel Occupancy (mS)	Observation Period (S)	Channel Occupancy Limit (mS)	Pass / Fail
2440	405.814	1.620	0.40	400.000	Pass

Traceability to Industry Recognized Test Methodologies

Work Instruction:	
Measurement Uncertainty:	

Variant:	DH5	Antenna:	Not Applicable
Data Rate:	3.00 MBit/s	Antenna Gain (dBi):	Not Applicable
Modulation:	FHSS	Beam Forming Gain (Y)(dB):	Not Applicable
Duty Cycle (%):	99.0	Tested By:	SB
Engineering Test Notes:			

Test Measurement Results

Channel Frequency(MHz)	Dwell Time (Single Burst) (S)	Channel Occupancy (mS)	Observation Period (S)	Channel Occupancy Limit (mS)	Pass / Fail
2440	0.002840	5.680	0.40	400.000	Pass

Traceability to Industry Recognized Test Methodologies

Work Instruction:	
Measurement Uncertainty:	

Note: click the links in the above matrix to view the graphical image (plot).

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9.2. Output Power

Conducted Test Conditions for Fundamental Emission Output Power			
Standard:	FCC CFR 47:15.247	Ambient Temp. (°C):	24.0 - 27.5
Test Heading:	Output Power	Rel. Humidity (%):	32 - 45
Standard Section(s):	15.247 (a)(1), (b)(1)/(2)/(3)	Pressure (mBars):	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Fundamental Emission Output Power Measurement

In the case of average power measurements an average power sensor was utilized.

For peak power measurements the spectrum analyzer built-in power function was used to integrate peak power over the 20 dB bandwidth.

Testing was performed under ambient conditions, nominal voltage. Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured, summed (Σ) and reported.

Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.

Supporting Information

Calculated Power = $A + G + Y + 10 \log (1/x)$ dBm

A = Total Power [$10 \cdot \log_{10} (10^{a/10} + 10^{b/10} + 10^{c/10} + 10^{d/10})$]

G = Antenna Gain

Y = Beamforming Gain

x = Duty Cycle (average power measurements only)

Limits for Fundamental Emission Output Power

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(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 2400-2483.5 MHz band 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 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. 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.

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following for frequency hopping systems:

(1) 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 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

(2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and

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antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

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Equipment Configuration for Output Power Peak

Variant:	DH1	Duty Cycle (%):	99.0
Data Rate:	1.00 MBit/s	Antenna Gain (dBi):	0.70
Modulation:	FHSS	Beam Forming Gain (Y)(dB):	Not Applicable
TPC:	Not Applicable	Tested By:	SB
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Output Power (dBm)				Calculated Total Power Σ Port(s)	Limit	Margin	EUT Power Setting
	Port(s)							
MHz	a	b	c	d	dBm	dBm	dB	
2402.0	6.21				6.21	30.00	-23.79	10.00
2440.0	6.57				6.57	30.00	-23.43	9.00
2480.0	7.25				7.25	30.00	-22.75	8.00

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-01 MEASURING RF OUTPUT POWER
Measurement Uncertainty:	± 1.33 dB

The above measurements are true pulse readings and therefore a Duty Cycling correction factor is not required.

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Equipment Configuration for Output Power Peak

Variant:	DH5	Duty Cycle (%):	99.0
Data Rate:	3.00 MBit/s	Antenna Gain (dBi):	0.70
Modulation:	FHSS	Beam Forming Gain (Y)(dB):	Not Applicable
TPC:	Not Applicable	Tested By:	SB
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Output Power (dBm)				Calculated Total Power Σ Port(s)	Limit	Margin	EUT Power Setting
	Port(s)							
MHz	a	b	c	d	dBm	dBm	dB	
2402.0	5.58				5.58	30.00	-24.42	10.00
2440.0	5.43				5.43	30.00	-24.57	10.00
2480.0	5.40				5.40	30.00	-24.60	10.00

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-01 MEASURING RF OUTPUT POWER
Measurement Uncertainty:	± 1.33 dB

The above measurements are true pulse readings and therefore a Duty Cycling correction factor is not required.

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9.3. Emissions

9.3.1. Conducted Emissions

Conducted Test Conditions for Transmitter Conducted Spurious and Band-Edge Emissions			
Standard:	FCC CFR 47:15.247	Ambient Temp. (°C):	24.0 - 27.5
Test Heading:	Transmitter Conducted Spurious and Band-Edge Emissions	Rel. Humidity (%):	32 - 45
Standard Section(s):	15.247 (d)	Pressure (mBars):	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Transmitter Conducted Spurious and Band-Edge Emissions Measurement

Transmitter Conducted Spurious and Band-Edge emissions were measured at a limit of 30 dBc (average detector) or 20 dBc (peak detector) below the highest in-band spectral density measured with a spectrum analyzer connected to the antenna terminal. Measurements were made while EUT was operating in transmit mode of operation at the appropriate centre frequency closest to the band-edge. Emissions were maximized during the measurement and limits derived from the peak spectral power and drawn on each plot.

Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured separately. Testing was performed under ambient conditions at nominal voltage only.

Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.

Limits Transmitter Conducted Spurious and Band-Edge Emissions

(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) (see §15.205(c)).

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9.3.1.1. Conducted Unwanted Spurious Emissions

Equipment Configuration for Unwanted Emissions Peak

Variant:	DH1	Duty Cycle (%):	99
Data Rate:	1.00 MBit/s	Antenna Gain (dBi):	Not Applicable
Modulation:	FHSS	Beam Forming Gain (Y):	Not Applicable
TPC:	Not Applicable	Tested By:	SB
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Frequency Range	Unwanted Emissions Peak (dBm)							
		Port a		Port b		Port c		Port d	
MHz	MHz	SE	Limit	SE	Limit	SE	Limit	SE	Limit
2402.0	30.0 - 26000.0	-43.704	-11.43						
2440.0	30.0 - 26000.0	-43.263	-11.85						
2480.0	30.0 - 26000.0	-42.950	-12.72						

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ± 2.37 dB, > 40 GHz ± 4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

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Equipment Configuration for Unwanted Emissions Peak

Variant:	DH5	Duty Cycle (%):	99
Data Rate:	3.00 MBit/s	Antenna Gain (dBi):	Not Applicable
Modulation:	FHSS	Beam Forming Gain (Y):	Not Applicable
TPC:	Not Applicable	Tested By:	SB
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Frequency Range	Unwanted Emissions Peak (dBm)							
		Port a		Port b		Port c		Port d	
		SE	Limit	SE	Limit	SE	Limit	SE	Limit
2402.0	30.0 - 26000.0	-43.190	-13.68						
2440.0	30.0 - 26000.0	-43.125	-19.33						
2480.0	30.0 - 26000.0	-42.872	-16.98						

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

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9.3.1.2. Conducted Band-Edge Emissions

Equipment Configuration for Conducted Low Band-Edge Emissions (Hopping) Peak

Variant:	DH1	Duty Cycle (%):	99.0
Data Rate:	1.00 MBit/s	Antenna Gain (dBi):	Not Applicable
Modulation:	FHSS	Beam Forming Gain (Y)(dB):	Not Applicable
TPC:	Not Applicable	Tested By:	SB
Engineering Test Notes:			

Test Measurement Results

Channel Frequency:	2402.0 MHz					
Band-Edge Frequency:	2400.0 MHz					
Test Frequency Range:	2350.0 - 2405.0 MHz					
Port(s)	Band-Edge Markers and Limit			Revised Limit		Margin
	M1 Amplitude (dBm)	Plot Limit (dBm)	M2 Frequency (MHz)	Amplitude (dBm)	M2A Frequency (MHz)	(MHz)
a	-47.89	-10.60	2401.50			-1.500

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz \pm 2.37 dB, > 40 GHz \pm 4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

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Equipment Configuration for Conducted Low Band-Edge Emissions (Hopping) Peak

Variant:	DH5	Duty Cycle (%):	99.0
Data Rate:	3.00 MBit/s	Antenna Gain (dBi):	Not Applicable
Modulation:	FHSS	Beam Forming Gain (Y)(dB):	Not Applicable
TPC:	Not Applicable	Tested By:	SB
Engineering Test Notes:			

Test Measurement Results

Channel Frequency:	2402.0 MHz					
Band-Edge Frequency:	2400.0 MHz					
Test Frequency Range:	2350.0 - 2405.0 MHz					
Port(s)	Band-Edge Markers and Limit			Revised Limit		Margin
	M1 Amplitude (dBm)	Plot Limit (dBm)	M2 Frequency (MHz)	Amplitude (dBm)	M2A Frequency (MHz)	(MHz)
a	-49.36	-13.53	2401.80			-1.800

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ± 2.37 dB, > 40 GHz ± 4.6 dB

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Equipment Configuration for Conducted Low Band-Edge Emissions (Static) Peak

Variant:	DH1	Duty Cycle (%):	99.0
Data Rate:	3.00 MBit/s	Antenna Gain (dBi):	Not Applicable
Modulation:	FHSS	Beam Forming Gain (Y)(dB):	Not Applicable
TPC:	Not Applicable	Tested By:	SB
Engineering Test Notes:			

Test Measurement Results

Channel Frequency:	2402.0 MHz					
Band-Edge Frequency:	2400.0 MHz					
Test Frequency Range:	2350.0 - 2405.0 MHz					
Port(s)	Band-Edge Markers and Limit			Revised Limit		Margin
	M1 Amplitude (dBm)	Plot Limit (dBm)	M2 Frequency (MHz)	Amplitude (dBm)	M2A Frequency (MHz)	(MHz)
a	-42.15	-10.70	2401.40			-1.400

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz \pm 2.37 dB, > 40 GHz \pm 4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

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Equipment Configuration for Conducted Low Band-Edge Emissions (Static) Peak

Variant:	DH5	Duty Cycle (%):	99.0
Data Rate:	3.00 MBit/s	Antenna Gain (dBi):	Not Applicable
Modulation:	FHSS	Beam Forming Gain (Y)(dB):	Not Applicable
TPC:	Not Applicable	Tested By:	SB
Engineering Test Notes:			

Test Measurement Results

Channel Frequency:	2402.0 MHz					
Band-Edge Frequency:	2400.0 MHz					
Test Frequency Range:	2350.0 - 2405.0 MHz					
Port(s)	Band-Edge Markers and Limit			Revised Limit		Margin
	M1 Amplitude (dBm)	Plot Limit (dBm)	M2 Frequency (MHz)	Amplitude (dBm)	M2A Frequency (MHz)	(MHz)
a	-39.88	-13.51	2401.30			-1.300

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB

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Equipment Configuration for Conducted Upper Band-Edge Emissions (Hopping) Peak

Variant:	DH1	Duty Cycle (%):	99.0
Data Rate:	1.00 MBit/s	Antenna Gain (dBi):	Not Applicable
Modulation:	FHSS	Beam Forming Gain (Y)(dB):	Not Applicable
TPC:	Not Applicable	Tested By:	SB
Engineering Test Notes:			

Test Measurement Results

Channel Frequency:	2480.0 MHz					
Band-Edge Frequency:	2483.5 MHz					
Test Frequency Range:	2478.0 - 2534.0 MHz					
Port(s)	Band-Edge Markers and Limit			Revised Limit		Margin
	M3 Amplitude (dBm)	Plot Limit (dBm)	M2 Frequency (MHz)	Amplitude (dBm)	M2A Frequency (MHz)	(MHz)
a	-49.09	-11.61	2480.40			-3.100

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ± 2.37 dB, > 40 GHz ± 4.6 dB

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Equipment Configuration for Conducted Upper Band-Edge Emissions (Hopping) Peak

Variant:	DH5	Duty Cycle (%):	99.0
Data Rate:	3.00 MBit/s	Antenna Gain (dBi):	Not Applicable
Modulation:	FHSS	Beam Forming Gain (Y)(dB):	Not Applicable
TPC:	Not Applicable	Tested By:	SB
Engineering Test Notes:			

Test Measurement Results

Channel Frequency:	2480.0 MHz					
Band-Edge Frequency:	2483.5 MHz					
Test Frequency Range:	2478.0 - 2534.0 MHz					
Port(s)	Band-Edge Markers and Limit			Revised Limit		Margin
	M3 Amplitude (dBm)	Plot Limit (dBm)	M2 Frequency (MHz)	Amplitude (dBm)	M2A Frequency (MHz)	(MHz)
a	-48.96	-14.48	2480.50			-3.000

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ± 2.37 dB, > 40 GHz ± 4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

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Equipment Configuration for Conducted Upper Band-Edge Emissions (Static) Peak

Variant:	DH1	Duty Cycle (%):	99.0
Data Rate:	1.00 MBit/s	Antenna Gain (dBi):	Not Applicable
Modulation:	FHSS	Beam Forming Gain (Y)(dB):	Not Applicable
TPC:	Not Applicable	Tested By:	SB
Engineering Test Notes:			

Test Measurement Results

Channel Frequency:	2480.0 MHz					
Band-Edge Frequency:	2483.5 MHz					
Test Frequency Range:	2478.0 - 2533.0 MHz					
Port(s)	Band-Edge Markers and Limit			Revised Limit		Margin
	M3 Amplitude (dBm)	Plot Limit (dBm)	M2 Frequency (MHz)	Amplitude (dBm)	M2A Frequency (MHz)	(MHz)
a	-48.17	-11.56	2480.50			-3.000

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz \pm 2.37 dB, > 40 GHz \pm 4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

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Equipment Configuration for Conducted Upper Band-Edge Emissions (Static) Peak

Variant:	DH5	Duty Cycle (%):	99.0
Data Rate:	3.00 MBit/s	Antenna Gain (dBi):	Not Applicable
Modulation:	FHSS	Beam Forming Gain (Y)(dB):	Not Applicable
TPC:	Not Applicable	Tested By:	SB
Engineering Test Notes:			

Test Measurement Results

Channel Frequency:	2480.0 MHz					
Band-Edge Frequency:	2483.5 MHz					
Test Frequency Range:	2478.0 - 2533.0 MHz					
Port(s)	Band-Edge Markers and Limit			Revised Limit		Margin
	M3 Amplitude (dBm)	Plot Limit (dBm)	M2 Frequency (MHz)	Amplitude (dBm)	M2A Frequency (MHz)	(MHz)
a	-47.77	-14.43	2480.60			-2.900

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ± 2.37 dB, > 40 GHz ± 4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

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9.3.2. Radiated Emissions

Radiated Test Conditions for Radiated Spurious and Band-Edge Emissions (Restricted Bands)			
Standard:	FCC CFR 47:15.247	Ambient Temp. (°C):	20.0 - 24.5
Test Heading:	Radiated Spurious and Band-Edge Emissions	Rel. Humidity (%):	32 - 45
Standard Section(s):	15.205, 15.209	Pressure (mBars):	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Radiated Spurious and Band-Edge Emissions (Restricted Bands)

Radiated emissions for restricted bands above 1 GHz are measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode. Depending on the frequency band spanned a notch filter and waveguide filter was used to remove the fundamental frequency. The highest emissions relative to the limit are listed for each frequency spanned. Measurements on any restricted band frequency or frequencies above 1 GHz are based on the use of measurement instrumentation employing peak and average detectors. All measurements were performed using a resolution bandwidth of 1 MHz.

Test configuration and setup for Radiated Spurious and Band-Edge Measurement were per the Radiated Test Set-up specified in this document.

Limits for [Restricted Bands](#)
Peak emission: 74 dBuV/m
Average emission: 54 dBuV/m

Field Strength Calculation
The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data.
 $FS = R + AF + CORR - FO$

where:
FS = Field Strength
R = Measured Spectrum analyzer Input Amplitude
AF = Antenna Factor
CORR = Correction Factor = CL – AG + NFL
CL = Cable Loss
AG = Amplifier Gain
FO = Distance Falloff Factor
NFL = Notch Filter Loss or Waveguide Loss

Example:
Given receiver input reading of 51.5 dBmV; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB and Notch Filter Loss of 1 dB. The Field Strength (FS) of the measured emission is:

$$FS = 51.5 + 8.5 + 1.3 - 26.0 + 1 = 36.3 \text{ dBmV/m}$$

Conversion between dBmV/m (or dBmV) and mV/m (or mV) are as follows:
Level (dBmV/m) = 20 * Log (level (mV/m))

40 dBmV/m = 100 mV/m
48 dBmV/m = 250 mV/m

Restricted Bands of Operation (15.205)

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

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Frequency Band			
MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

(b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

(c) Except as provided in paragraphs (d) and (e) of this section, regardless of the field strength limits specified elsewhere in this subpart, the provisions of this section apply to emissions from any intentional radiator.

(d) The following devices are exempt from the requirements of this section:

- (1) Swept frequency field disturbance sensors operating between 1.705 and 37 MHz provided their emissions only sweep through the bands listed in paragraph (a) of this section, the sweep is never stopped with the fundamental emission within the bands listed in paragraph (a) of this section, and the fundamental emission is outside of the bands listed in paragraph (a) of this section more than 99% of the time the device is actively transmitting, without compensation for duty cycle.
- (2) Transmitters used to detect buried electronic markers at 101.4 kHz which are employed by telephone companies.
- (3) Cable locating equipment operated pursuant to §15.213.
- (4) Any equipment operated under the provisions of §15.253, 15.255, and 15.256 in the frequency band 75-85 GHz, or §15.257 of this part.
- (5) Biomedical telemetry devices operating under the provisions of §15.242 of this part are not subject to the restricted band 608-614 MHz but are subject to compliance within the other restricted bands.
- (6) Transmitters operating under the provisions of subparts D or F of this part.
- (7) Devices operated pursuant to §15.225 are exempt from complying with this section for the 13.36-13.41 MHz band only.

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(8) Devices operated in the 24.075-24.175 GHz band under §15.245 are exempt from complying with the requirements of this section for the 48.15-48.35 GHz and 72.225-72.525 GHz bands only, and shall not exceed the limits specified in §15.245(b).

(9) Devices operated in the 24.0-24.25 GHz band under §15.249 are exempt from complying with the requirements of this section for the 48.0-48.5 GHz and 72.0-72.75 GHz bands only, and shall not exceed the limits specified in §15.249(a).

(e) Harmonic emissions appearing in the restricted bands above 17.7 GHz from field disturbance sensors operating under the provisions of §15.245 shall not exceed the limits specified in §15.245(b).

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9.3.2.3. TX Spurious & Restricted Band Emissions

Equipment Configuration for TX Spurious & Restricted Band Emissions

Antenna:	Integral	Variant:	8DPSK
Antenna Gain (dBi):	2.50	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2402.00	Data Rate:	3.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
#1	2245.90	64.11	2.64	-12.14	54.61	Max Peak	Vertical	142	269	74.0	-19.4	Pass
#2	2245.90	36.98	2.64	-12.14	27.48	Max Avg	Vertical	142	269	54.0	-26.5	Pass
#3	4803.81	58.61	3.51	-11.12	51.00	Max Peak	Horizontal	117	356	74.0	-23.0	Pass
#4	4803.81	45.66	3.51	-11.12	38.05	Max Avg	Horizontal	117	356	54.0	-16.0	Pass

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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Equipment Configuration for TX Spurious & Restricted Band Emissions

Antenna:	Integral	Variant:	8DPSK
Antenna Gain (dBi):	2.50	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2440.00	Data Rate:	3.00 MBit/s
Power Setting:	9	Tested By:	JMH

Test Measurement Results

1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
#1	2441.06	52.84	2.72	-11.72	43.84	Fundamental	Vertical	100	0	--	--	
#2	4882.10	60.13	3.63	-11.26	52.50	Max Peak	Horizontal	114	353	74.0	-21.5	Pass
#3	4882.10	47.14	3.63	-11.26	39.51	Max Avg	Horizontal	114	353	54.0	-14.5	Pass
#4	7323.04	55.43	4.26	-7.26	52.43	Max Peak	Vertical	101	351	74.0	-21.6	Pass
#5	7323.04	41.32	4.26	-7.26	38.32	Max Avg	Vertical	101	351	54.0	-15.7	Pass

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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Equipment Configuration for TX Spurious & Restricted Band Emissions

Antenna:	Integral	Variant:	8DPSK
Antenna Gain (dBi):	2.50	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2480.00	Data Rate:	3.00 MBit/s
Power Setting:	8	Tested By:	JMH

Test Measurement Results

1000.00 - 18000.00 MHz

Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
#1	2479.81	52.50	2.72	-11.65	43.57	Fundamental	Horizontal	150	0	--	--	
#2	4959.65	62.54	3.57	-11.48	54.63	Max Peak	Horizontal	109	352	74.0	-19.4	Pass
#3	4959.65	48.29	3.57	-11.48	40.38	Max Avg	Horizontal	109	352	54.0	-13.6	Pass

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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Equipment Configuration for TX Spurious & Restricted Band Emissions

Antenna:	Integral	Variant:	8DPSK
Antenna Gain (dBi):	2.50	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	Hopping	Data Rate:	3.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
#1	2446.02	54.89	2.71	-11.70	45.90	Fundamental	Vertical	100	0	--	--	
#2	4958.24	63.08	3.57	-11.48	55.17	Max Peak	Horizontal	98	0	74.0	-18.8	Pass
#3	4958.24	37.35	3.57	-11.48	29.44	Max Avg	Horizontal	98	0	54.0	-24.6	Pass
#4	7326.47	55.57	4.27	-7.26	52.58	Max Peak	Vertical	123	354	74.0	-21.4	Pass
#5	7326.47	35.05	4.27	-7.26	32.06	Max Avg	Vertical	123	354	54.0	-21.9	Pass

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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Equipment Configuration for TX Spurious & Restricted Band Emissions			
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Antenna:	Integral	Variant:	Pi_4 DQPSK
Antenna Gain (dBi):	2.50	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2402.00	Data Rate:	2.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

Click here to view measurement data...
--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.
--

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Title: HP Inc. 0960-4025 and 0960-4034
To: FCC 15.247 & IC RSS-247 (FHSS)
Serial #: MARS11-U13 FHSS Rev B WiFi/BT Module
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Equipment Configuration for TX Spurious & Restricted Band Emissions

Antenna:	Integral	Variant:	Pi_4 DQPSK
Antenna Gain (dBi):	2.50	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2440.00	Data Rate:	2.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

1000.00 - 18000.00 MHz

Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
#1	2440.95	51.50	2.72	-11.72	42.50	Fundamental	Vertical	100	0	--	--	
#2	4881.70	59.01	3.62	-11.26	51.37	Max Peak	Horizontal	114	355	74.0	-22.6	Pass
#3	4881.70	49.72	3.62	-11.26	42.08	Max Avg	Horizontal	114	355	54.0	-11.9	Pass

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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Title: HP Inc. 0960-4025 and 0960-4034
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Equipment Configuration for TX Spurious & Restricted Band Emissions

Antenna:	Integral	Variant:	Pi_4 DQPSK
Antenna Gain (dBi):	2.50	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2480.00	Data Rate:	2.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

1000.00 - 18000.00 MHz

Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#1	2479.86	49.56	2.72	-11.65	40.63	Fundamental	Vertical	100	0	--	--	
#2	4959.88	62.41	3.57	-11.48	54.50	Max Peak	Horizontal	116	353	74.0	-19.5	Pass
#3	4959.88	53.90	3.57	-11.48	45.99	Max Avg	Horizontal	116	353	54.0	-8.0	Pass

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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Title: HP Inc. 0960-4025 and 0960-4034
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Equipment Configuration for TX Spurious & Restricted Band Emissions

Antenna:	Integral	Variant:	Pi_4 DQPSK
Antenna Gain (dBi):	2.50	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	Hopping	Data Rate:	2.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

1000.00 - 18000.00 MHz

Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
#1	2441.40	50.36	2.72	-11.72	41.36	Fundamental	Vertical	100	0	--	--	
#2	4953.28	57.47	3.55	-11.47	49.55	Max Peak	Horizontal	167	358	74.0	-24.5	Pass
#3	4953.28	39.19	3.55	-11.47	31.27	Max Avg	Horizontal	167	358	54.0	-22.7	Pass

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. Hopping

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Equipment Configuration for TX Spurious & Restricted Band Emissions			
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Antenna:	YAGEO ANTX300P002B24553	Variant:	8DPSK
Antenna Gain (dBi):	0.70	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2402.00	Data Rate:	1.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

Click here to view measurement data...
--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. 2.4 G Notch in front of amp to prevent overload
--

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Equipment Configuration for TX Spurious & Restricted Band Emissions			
---	--	--	--

Antenna:	YAGEO ANTX300P002B24553	Variant:	8DPSK
Antenna Gain (dBi):	0.70	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2440.00	Data Rate:	1.00 MBit/s
Power Setting:	9	Tested By:	JMH

Test Measurement Results

Click here to view measurement data...
--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. 2.4 G Notch in front of amp to prevent overload
--

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Equipment Configuration for TX Spurious & Restricted Band Emissions			
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Antenna:	YAGEO ANTX300P002B24553	Variant:	8DPSK
Antenna Gain (dBi):	0.70	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2480.00	Data Rate:	3.00 MBit/s
Power Setting:	8	Tested By:	JMH

Test Measurement Results

Click here to view measurement data...
--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. 2.4 G Notch in front of amp to prevent overload
--

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Equipment Configuration for TX Spurious & Restricted Band Emissions			
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Antenna:	YAGEO ANTX300P002B24553	Variant:	8DPSK
Antenna Gain (dBi):	0.70	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	Hopping	Data Rate:	1.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

Click here to view measurement data...
--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. 2.4 G Notch in front of amp to prevent overload
--

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Equipment Configuration for TX Spurious & Restricted Band Emissions			
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Antenna:	YAGEO ANTX300P002B24553	Variant:	Pl_4 DQPSK
Antenna Gain (dBi):	0.70	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2402.00	Data Rate:	2.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

Click here to view measurement data...
--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. 2.4 G Notch in front of amp to prevent overload.

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Equipment Configuration for TX Spurious & Restricted Band Emissions

Antenna:	YAGEO ANTX300P002B24553	Variant:	Pl_4 DQPSK
Antenna Gain (dBi):	0.70	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2440.00	Data Rate:	2.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
#1	1728.16	64.02	2.45	-14.71	51.76	Peak (NRB)	Horizontal	150	360	--	--	Pass

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. 2.4 G Notch in front of amp to prevent overload.

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Equipment Configuration for TX Spurious & Restricted Band Emissions			
---	--	--	--

Antenna:	YAGEO ANTX300P002B24553	Variant:	Pl_4 DQPSK
Antenna Gain (dBi):	0.70	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2480.00	Data Rate:	3.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

Click here to view measurement data...
--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. 2.4 G Notch in front of amp to prevent overload.

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Equipment Configuration for TX Spurious & Restricted Band Emissions			
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Antenna:	YAGEO ANTX300P002B24553	Variant:	Pl_4 DQPSK
Antenna Gain (dBi):	0.70	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	Hopping	Data Rate:	2.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

Click here to view measurement data...
--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. 2.4 G Notch in front of amp to prevent overload. Hopping

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9.3.2.4. Restricted Edge & Band-Edge Emissions

Equipment Configuration for Radiated - Lower Restricted Band-Edge Emissions

Antenna:	Integral	Variant:	8DPSK
Antenna Gain (dBi):	2.50	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2402.00	Data Rate:	3.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

2310.00 - 2422.00 MHz

Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
#1	2388.78	31.01	2.68	32.04	65.73	Max Peak	Vertical	156	357	74.0	-8.3	Pass
#2	2390.00	1.53	2.69	32.04	36.26	Max Avg	Vertical	156	357	54.0	-17.7	Pass
#3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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Equipment Configuration for Radiated - Lower Restricted Band-Edge Emissions

Antenna:	Integral	Variant:	8DPSK
Antenna Gain (dBi):	0.70	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	Hopping Mode	Data Rate:	3.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

2310.00 - 2422.00 MHz

Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
#1	2316.73	2.45	2.67	31.71	36.83	Max Avg	Vertical	156	357	54.0	-17.2	Pass
#2	2388.56	25.43	2.68	32.04	60.15	Max Peak	Vertical	156	357	74.0	-13.9	Pass
#3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. Hopping

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Equipment Configuration for Radiated - Lower Restricted Band-Edge Emissions

Antenna:	Integral	Variant:	Pi_4 DQPSK
Antenna Gain (dBi):	0.70	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2402.00	Data Rate:	2.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

2310.00 - 2422.00 MHz

Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
#1	2383.62	21.97	2.68	31.99	56.64	Max Peak	Vertical	156	357	74.0	-17.4	Pass
#2	2390.00	2.00	2.69	32.04	36.73	Max Avg	Vertical	156	357	54.0	-17.3	Pass
#3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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Equipment Configuration for Radiated - Lower Restricted Band-Edge Emissions

Antenna:	Integral	Variant:	Pi_4 DQPSK
Antenna Gain (dBi):	0.70	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	Hopping Mode	Data Rate:	2.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

2310.00 - 2422.00 MHz

Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
#1	2386.31	24.57	2.68	32.01	59.26	Max Peak	Vertical	156	357	74.0	-14.7	Pass
#2	2390.00	2.00	2.69	32.04	36.73	Max Avg	Vertical	156	357	54.0	-17.3	Pass
#3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. Hopping

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Equipment Configuration for Radiated - Lower Restricted Band-Edge Emissions

Antenna:	YAGEO ANTX300P002B24553	Variant:	8DPSK
Antenna Gain (dBi):	0.70	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2402.00	Data Rate:	3.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

2310.00 - 2422.00 MHz												
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
#1	2379.68	24.69	2.69	31.96	59.34	Max Peak	Vertical	195	361	74.0	-14.7	Pass
#2	2387.76	11.08	2.68	32.03	45.79	Max Avg	Vertical	195	361	54.0	-8.2	Pass
#3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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Equipment Configuration for Radiated - Lower Restricted Band-Edge Emissions

Antenna:	YAGEO ANTX300P002B24553	Variant:	8DPSK
Antenna Gain (dBi):	0.70	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	Hopping Mode	Data Rate:	3.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

2310.00 - 2422.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
#1	2341.20	22.18	2.68	31.70	56.56	Max Peak	Vertical	195	361	74.0	-17.4	Pass
#2	2389.90	1.04	2.69	32.04	35.77	Max Avg	Vertical	195	361	54.0	-18.2	Pass
#3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. Hopping

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Equipment Configuration for Radiated - Lower Restricted Band-Edge Emissions

Antenna:	YAGEO ANTX300P002B24553	Variant:	Pl_4 DQPSK
Antenna Gain (dBi):	0.70	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2402.00	Data Rate:	2.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

2310.00 - 2422.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
#1	2310.90	16.76	2.67	31.72	51.15	Max Peak	Vertical	195	361	74.0	-22.9	Pass
#2	2390.00	1.04	2.69	32.04	35.77	Max Avg	Vertical	195	361	54.0	-18.2	Pass
#3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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Equipment Configuration for Radiated - Lower Restricted Band-Edge Emissions

Antenna:	YAGEO ANTX300P002B24553	Variant:	Pl_4 DQPSK
Antenna Gain (dBi):	2.50	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	Hopping Mode	Data Rate:	2.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

2310.00 - 2422.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
#1	2348.83	19.33	2.65	31.69	53.67	Max Peak	Vertical	195	361	74.0	-20.3	Pass
#2	2374.64	1.99	2.70	31.91	36.60	Max Avg	Vertical	195	361	54.0	-17.4	Pass
#3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. Hopping

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Equipment Configuration for Radiated - Upper Restricted Band-Edge Emissions

Antenna:	Integral	Variant:	8DPSK
Antenna Gain (dBi):	2.50	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2480.00	Data Rate:	3.00 MBit/s
Power Setting:	8	Tested By:	JMH

Test Measurement Results

2475.00 - 2550.00 MHz

Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
#1	2483.50	2.46	2.73	32.37	37.56	Max Avg	Vertical	151	274	54.0	-16.4	Pass
#3	2502.66	27.62	2.73	32.40	62.75	Max Peak	Vertical	151	274	74.0	-11.3	Pass
#2	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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Equipment Configuration for Radiated - Upper Restricted Band-Edge Emissions

Antenna:	Integral	Variant:	8DPSK
Antenna Gain (dBi):	2.50	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	Hopping Mode	Data Rate:	3.00 MBit/s
Power Setting:	8	Tested By:	JMH

Test Measurement Results

2475.00 - 2550.00 MHz

Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
#2	2490.93	27.44	2.74	32.38	62.56	Max Peak	Vertical	151	274	74.0	-11.4	Pass
#3	2548.95	2.86	2.75	32.49	38.10	Max Avg	Vertical	151	274	54.0	-15.9	Pass
#1	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. Hopping

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Equipment Configuration for Radiated - Upper Restricted Band-Edge Emissions

Antenna:	Integral	Variant:	Pi_4 DQPSK
Antenna Gain (dBi):	2.50	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2480.00	Data Rate:	2.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

2475.00 - 2550.00 MHz

Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
#1	2483.50	6.27	2.73	32.37	41.37	Max Avg	Vertical	151	274	54.0	-12.6	Pass
#3	2491.17	24.22	2.74	32.38	59.34	Max Peak	Vertical	151	274	74.0	-14.7	Pass
#2	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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Equipment Configuration for Radiated - Upper Restricted Band-Edge Emissions

Antenna:	Integral	Variant:	Pi_4 DQPSK
Antenna Gain (dBi):	2.50	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	Hopping Mode	Data Rate:	2.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

2475.00 - 2550.00 MHz

Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
#2	2484.02	23.41	2.73	32.37	58.51	Max Peak	Vertical	151	274	74.0	-15.5	Pass
#3	2534.37	2.45	2.74	32.46	37.65	Max Avg	Vertical	151	274	54.0	-16.4	Pass
#1	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. Hopping

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Equipment Configuration for Radiated - Upper Restricted Band-Edge Emissions

Antenna:	YAGEO ANTX300P002B24553	Variant:	8DPSK
Antenna Gain (dBi):	0.70	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2480.00	Data Rate:	3.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

2475.00 - 2550.00 MHz												
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
#1	2483.50	3.29	2.73	32.37	38.39	Max Avg	Vertical	162	49	54.0	-15.6	Pass
#3	2490.11	24.66	2.74	32.38	59.78	Max Peak	Vertical	162	49	74.0	-14.2	Pass
#2	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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Equipment Configuration for Radiated - Upper Restricted Band-Edge Emissions

Antenna:	YAGEO ANTX300P002B24553	Variant:	8DPSK
Antenna Gain (dBi):	0.70	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	Hopping Mode	Data Rate:	3.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

2475.00 - 2550.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
#2	2487.47	27.23	2.73	32.37	62.33	Max Peak	Vertical	162	49	74.0	-11.7	Pass
#3	2520.62	1.53	2.74	32.44	36.71	Max Avg	Vertical	162	49	54.0	-17.3	Pass
#1	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. Hopping

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Equipment Configuration for Radiated - Upper Restricted Band-Edge Emissions

Antenna:	YAGEO ANTX300P002B24553	Variant:	Pl_4 DQPSK
Antenna Gain (dBi):	0.70	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	2480.00	Data Rate:	2.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

2475.00 - 2550.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
#1	2483.50	5.07	2.73	32.37	40.17	Max Avg	Vertical	162	49	54.0	-13.8	Pass
#3	2485.15	24.30	2.73	32.37	59.40	Max Peak	Vertical	162	49	74.0	-14.6	Pass
#2	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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Equipment Configuration for Radiated - Upper Restricted Band-Edge Emissions

Antenna:	YAGEO ANTX300P002B24553	Variant:	Pl_4 DQPSK
Antenna Gain (dBi):	0.70	Modulation:	FHSS
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	Hopping Mode	Data Rate:	2.00 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

2475.00 - 2550.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
#1	2483.50	1.54	2.73	32.37	36.64	Max Avg	Vertical	162	49	54.0	-17.4	Pass
#3	2485.45	22.20	2.73	32.37	57.30	Max Peak	Vertical	162	49	74.0	-16.7	Pass
#2	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. Hopping

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9.3.3. Digital Emissions (0.03 - 1 GHz)

Radiated Test Conditions for Radiated Digital Emissions (0.03 – 1 GHz)			
Standard:	FCC CFR 47:15.247	Ambient Temp. (°C):	20.0 - 24.5
Test Heading:	Digital Emissions	Rel. Humidity (%):	32 - 45
Standard Section(s):	15.209	Pressure (mBars):	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Radiated Digital Emissions (0.03 – 1 GHz)

Testing 30M-1 GHz was performed in a 3-meter anechoic chamber using a CISPR compliant receiver. Preliminary radiated emissions were measured on every azimuth and with the receiving antenna in both horizontal and vertical polarizations. To further maximize emissions the receive antenna was varied between 1 and 4 meters. The emissions are recorded with receiver in peak hold mode. Emissions closest to the limits are measured in the quasi-peak mode with the tuned receiver using a bandwidth of 120 kHz. Only the highest emissions relative to the limit are listed.

Test configuration and setup for Radiated Spurious and Band-Edge Measurement were per the Radiated Test Set-up specified in this document.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. In this test facility, the Antenna Factor, Cable Loss, and Amplifier Gains are loaded into the Rohde & Schwarz Receiver and the corrected field strength can be read directly on the receiver.

$$FS = R + AF + CORR$$

where:

FS = Field Strength

R = Measured Receiver Input Amplitude

AF = Antenna Factor

CORR = Correction Factor = CL – AG + NFL

CL = Cable Loss

AG = Amplifier Gain

For example:

Given a Receiver input reading of 51.5dBmV; Antenna Factor of 8.5dB; Cable Loss of 1.3dB; Falloff Factor of 0dB, an Amplifier Gain of 26dB and Notch Filter Loss of 1dB. The Field Strength of the measured emission is:

$$FS = 51.5 + 8.5 + 1.3 - 26.0 + 1 = 36.3\text{dBmV/m}$$

Conversion between dBmV/m (or dBmV) and mV/m (or mV) are done as:

$$\text{Level (dBmV/m)} = 20 * \text{Log (level (mV/m))}$$

$$40 \text{ dBmV/m} = 100\text{mV/m}$$

$$48 \text{ dBmV/m} = 250\text{mV/m}$$

Limits for Radiated Digital Emissions (0.03 – 1 GHz)

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

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Frequency (MHz)	Field Strength		Measurement Distance (m)
	$\mu\text{V/m}$ (microvolts/meter)	$\text{dB}\mu\text{V/m}$ (dB microvolts/meter)	
0.009-0.490	2400/F(kHz)	--	300
0.490-1.705	24000/F(kHz)	--	30
1.705-30.0	30	29.5	30
30-88	100**	40	3
88-216	150**	43.5	3
216-960	200**	46.0	3
Above 960	500	54.0	3

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241. (b) In the emission table above, the tighter limit applies at the band edges. (c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency. (d) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector. (e) The provisions in §§15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part. (f) In accordance with §15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in §15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in §15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit. Emissions which must be measured above the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator and which fall within the restricted bands shall comply with the general radiated emission limits in §15.109 that are applicable to the incorporated digital device. (g) Perimeter protection systems may operate in the 54-72 MHz and 76-88 MHz bands under the provisions of this section. The use of such perimeter protection systems is limited to industrial, business and commercial applications.

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Equipment Configuration for Radiated Digital Emissions			
--	--	--	--

Antenna:	Yangeo	Variant:	FHSS
Antenna Gain (dBi):	Not Applicable	Modulation:	
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	
Channel Frequency (MHz):	2439.00	Data Rate:	1 MBit/s
Power Setting:	10	Tested By:	JMH

Test Measurement Results

Click here to view measurement data...
--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.Laptop put in suspend mode to limit 50 MHz harmonics.

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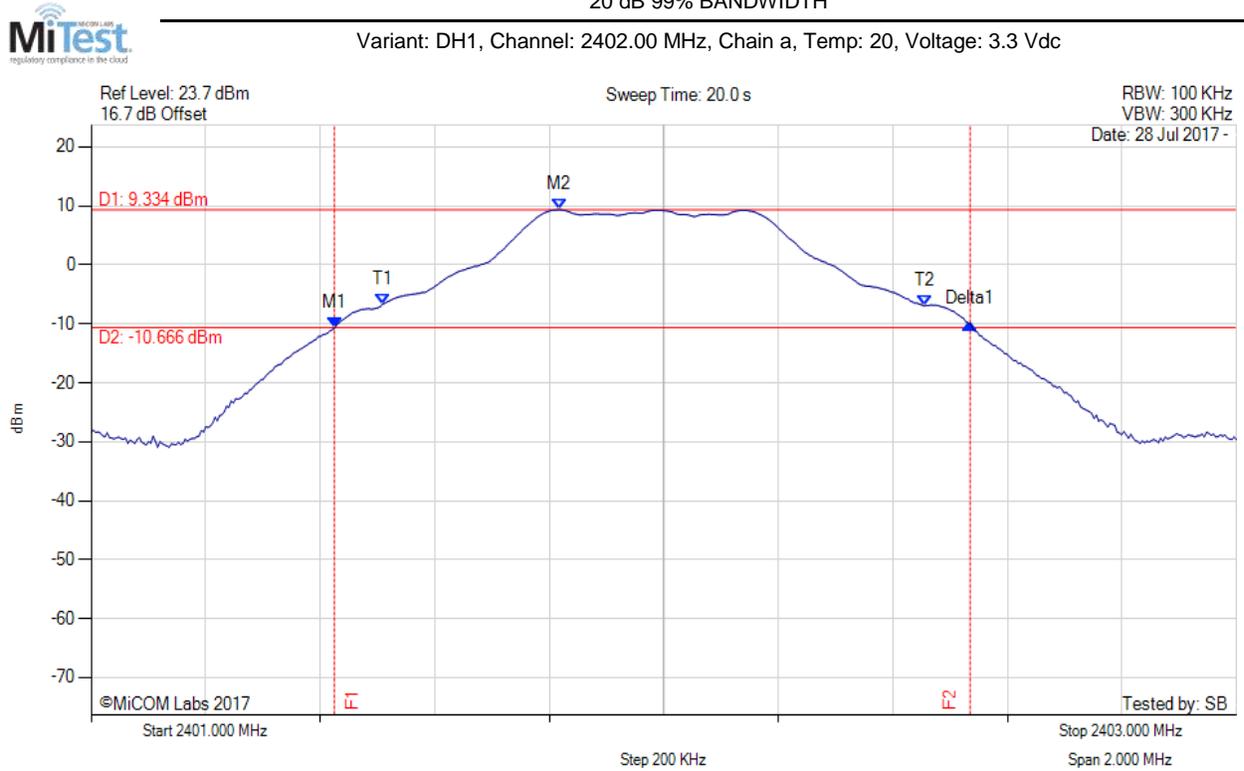
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A. APPENDIX - GRAPHICAL IMAGES

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A.1. 20 dB & 99% Bandwidth



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 2401.425 MHz : -10.750 dBm M2 : 2401.818 MHz : 9.334 dBm Delta1 : 1.110 MHz : 0.750 dB T1 : 2401.509 MHz : -6.627 dBm T2 : 2402.455 MHz : -6.969 dBm OBW : 946 KHz	Measured 20 dB Bandwidth: 1.110 MHz Limit: kHz Margin: #VALUE! MHz

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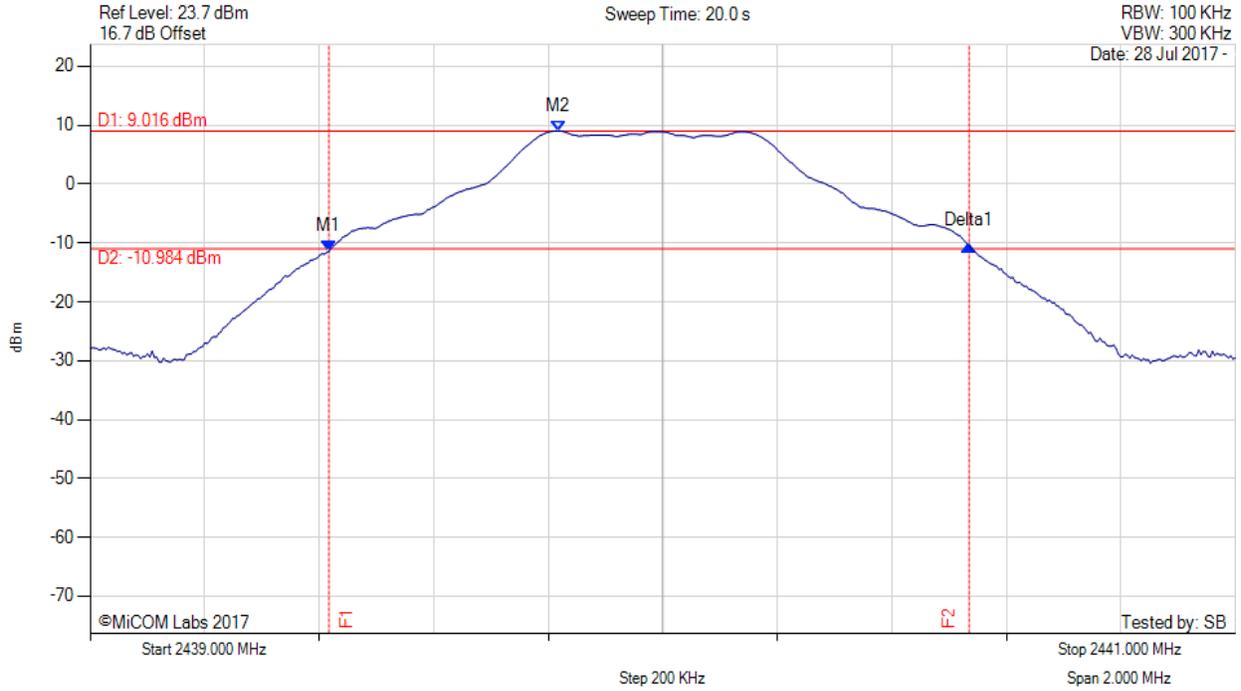


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20 dB 99% BANDWIDTH

Variant: DH1, Channel: 2440.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 2439.417 MHz : -11.449 dBm M2 : 2439.818 MHz : 9.016 dBm Delta1 : 1.118 MHz : 1.025 dB T1 : 0 Hz : 500.000 dBm T2 : 0 Hz : 500.000 dBm OBW : 962 KHz	Measured 20 dB Bandwidth: 1.118 MHz Limit: kHz Margin: #VALUE! MHz

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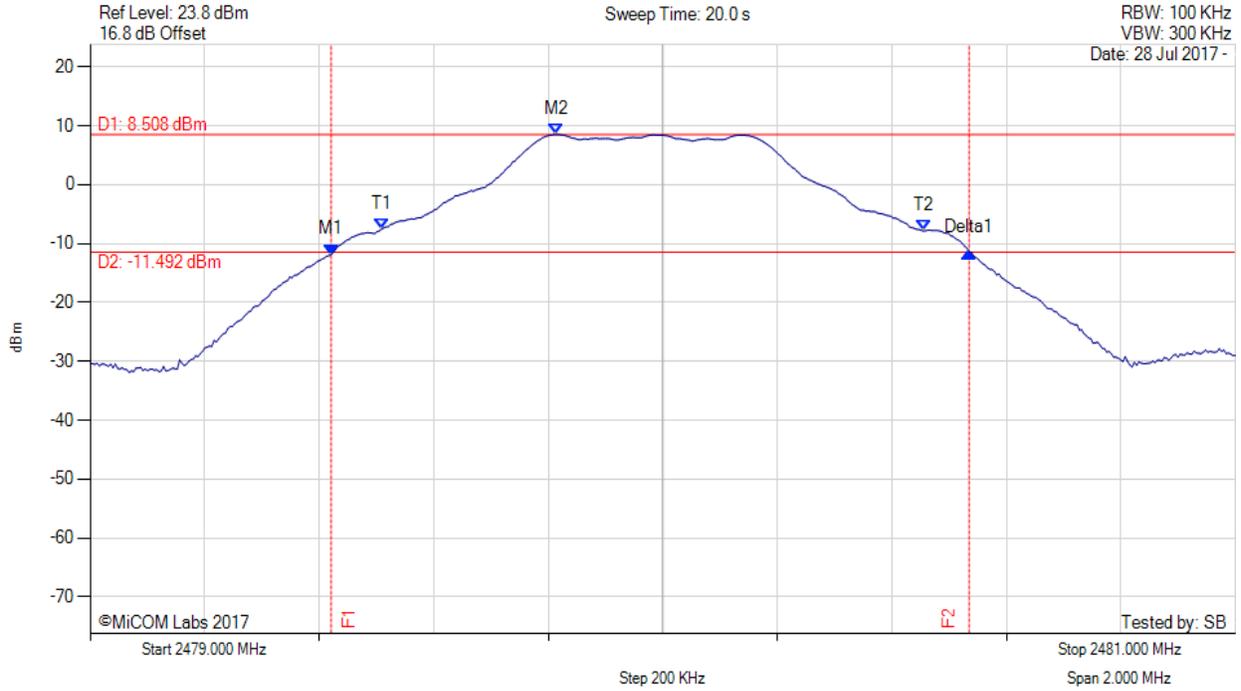


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20 dB 99% BANDWIDTH

Variant: DH1, Channel: 2480.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 2479.421 MHz : -11.870 dBm M2 : 2479.814 MHz : 8.508 dBm Delta1 : 1.114 MHz : 0.451 dB T1 : 2479.509 MHz : -7.571 dBm T2 : 2480.455 MHz : -7.859 dBm OBW : 946 KHz	Measured 20 dB Bandwidth: 1.114 MHz Limit: kHz Margin: #VALUE! MHz

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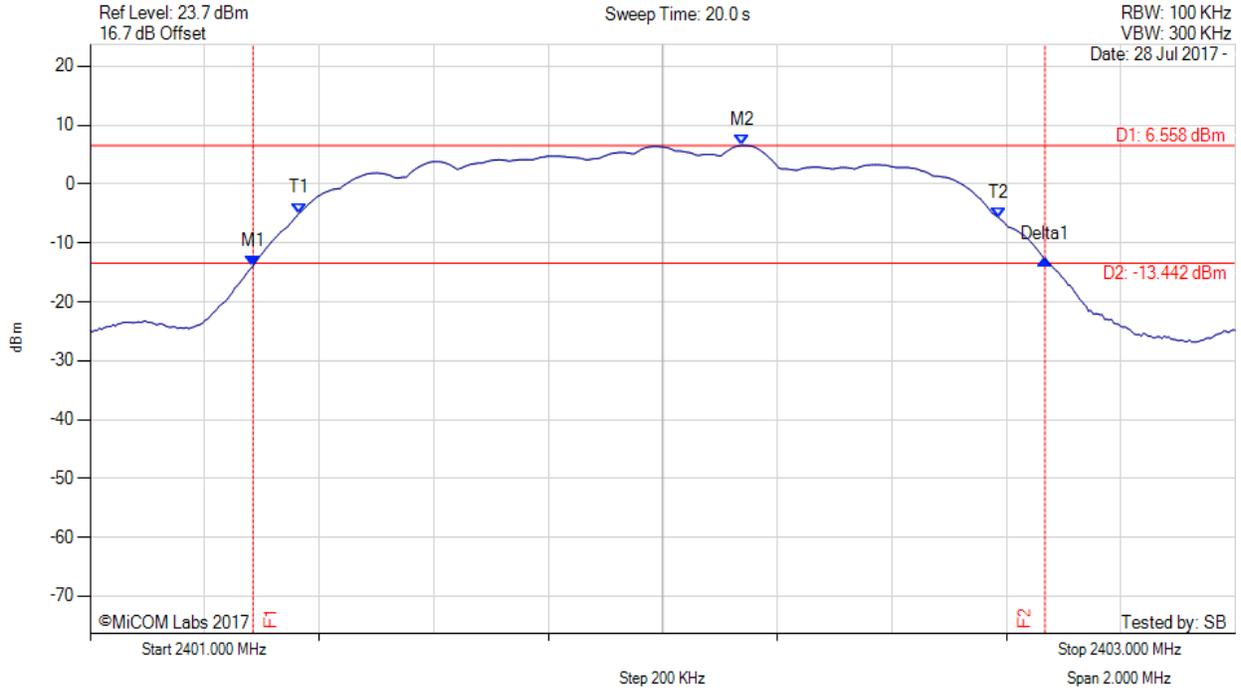


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20 dB 99% BANDWIDTH

Variant: DH5, Channel: 2402.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 2401.285 MHz : -13.934 dBm M2 : 2402.138 MHz : 6.558 dBm Delta1 : 1.383 MHz : 1.218 dB T1 : 2401.365 MHz : -4.949 dBm T2 : 2402.587 MHz : -5.765 dBm OBW : 1.222 MHz	Measured 20 dB Bandwidth: 1.383 MHz Limit: kHz Margin: #VALUE! MHz

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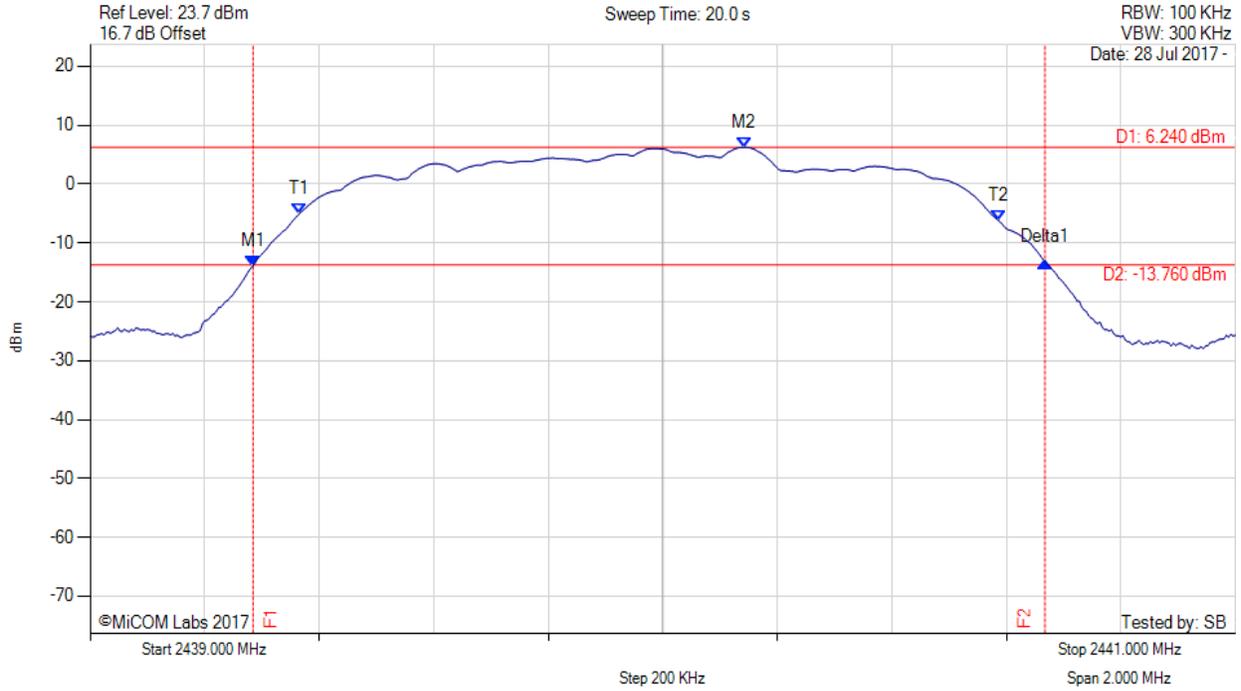


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20 dB 99% BANDWIDTH

Variant: DH5, Channel: 2440.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 2439.285 MHz : -13.865 dBm M2 : 2440.142 MHz : 6.240 dBm Delta1 : 1.383 MHz : 0.685 dB T1 : 2439.365 MHz : -5.124 dBm T2 : 2440.587 MHz : -6.277 dBm OBW : 1.222 MHz	Measured 20 dB Bandwidth: 1.383 MHz Limit: kHz Margin: #VALUE! MHz

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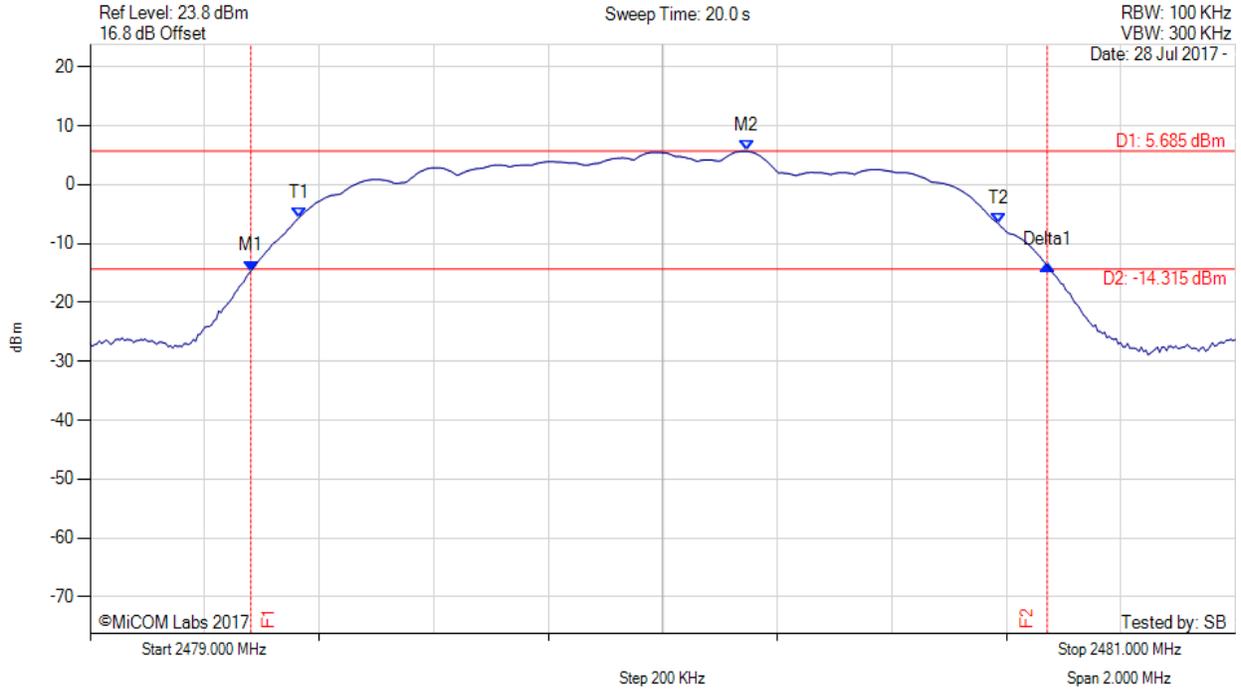


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20 dB 99% BANDWIDTH

Variant: DH5, Channel: 2480.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 2479.281 MHz : -14.676 dBm M2 : 2480.146 MHz : 5.685 dBm Delta1 : 1.391 MHz : 0.966 dB T1 : 2479.365 MHz : -5.602 dBm T2 : 2480.587 MHz : -6.702 dBm OBW : 1.222 MHz	Measured 20 dB Bandwidth: 1.391 MHz Limit: kHz Margin: #VALUE! MHz

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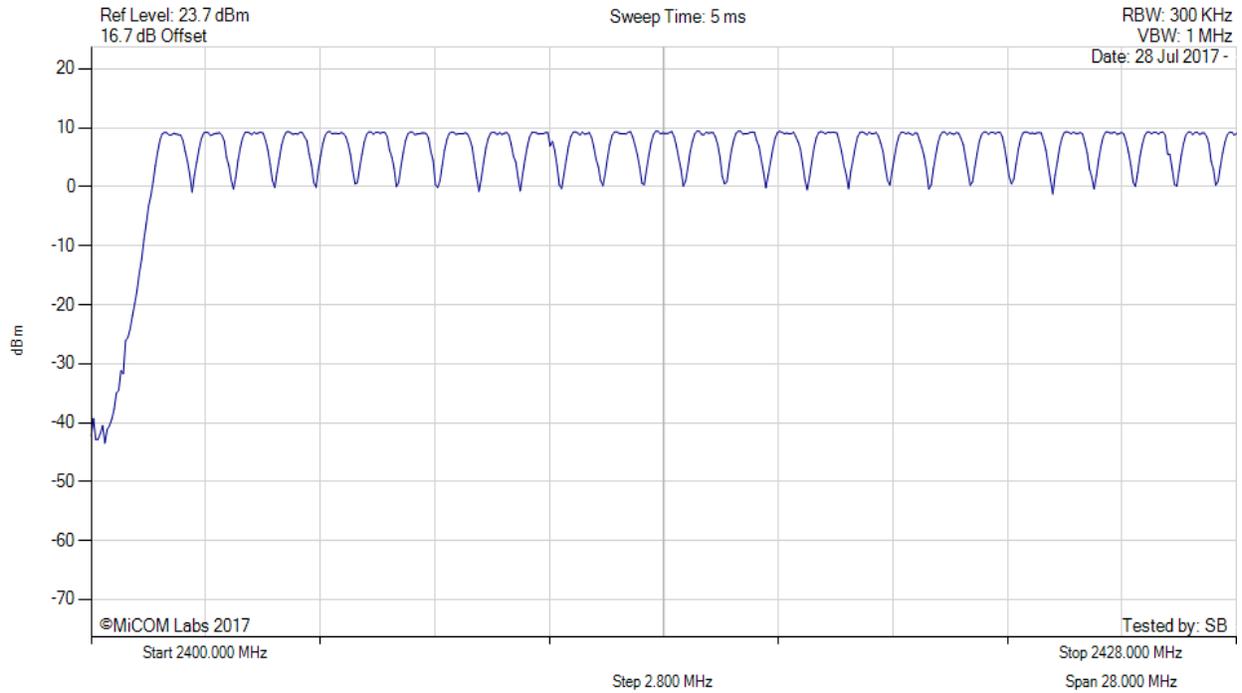
A.2. Frequency Hopping Tests

A.2.1. Number of Hopping Channels



NUMBER OF HOPPING CHANNELS

Variant: DH1, Channel: 2440.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW		Channel Frequency: 2440.00 MHz

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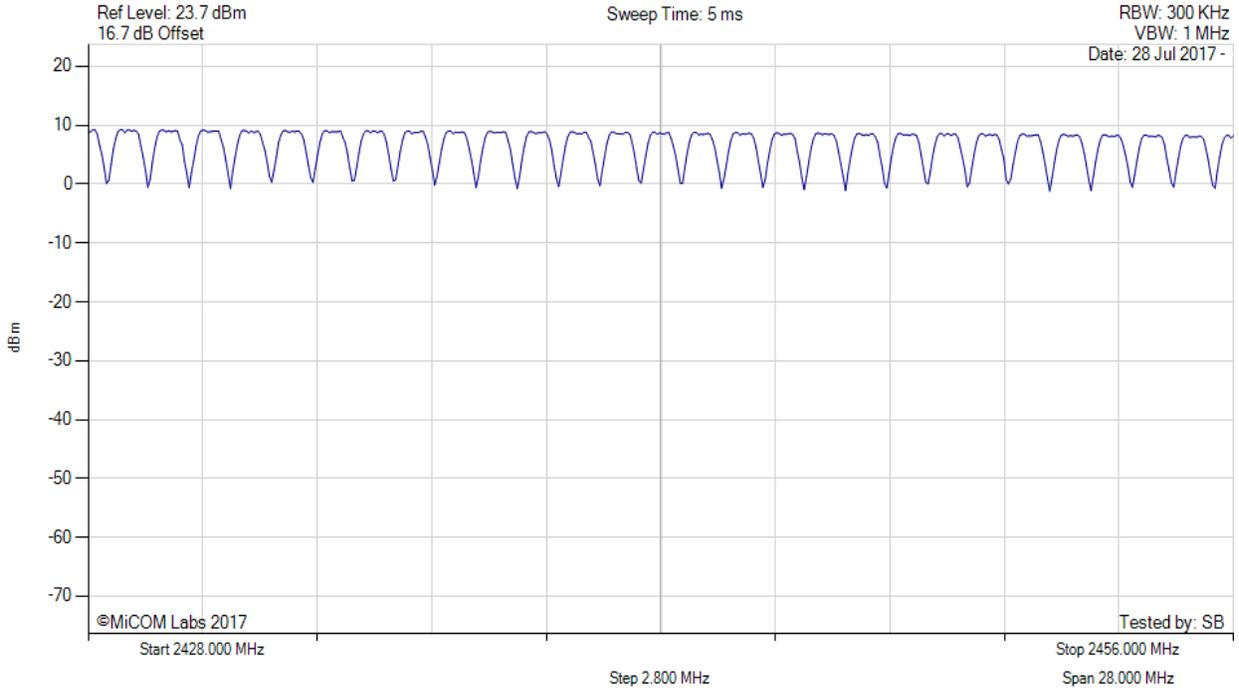


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NUMBER OF HOPPING CHANNELS



Variant: DH1, Channel: 2440.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEWS		Channel Frequency: 2440.00 MHz

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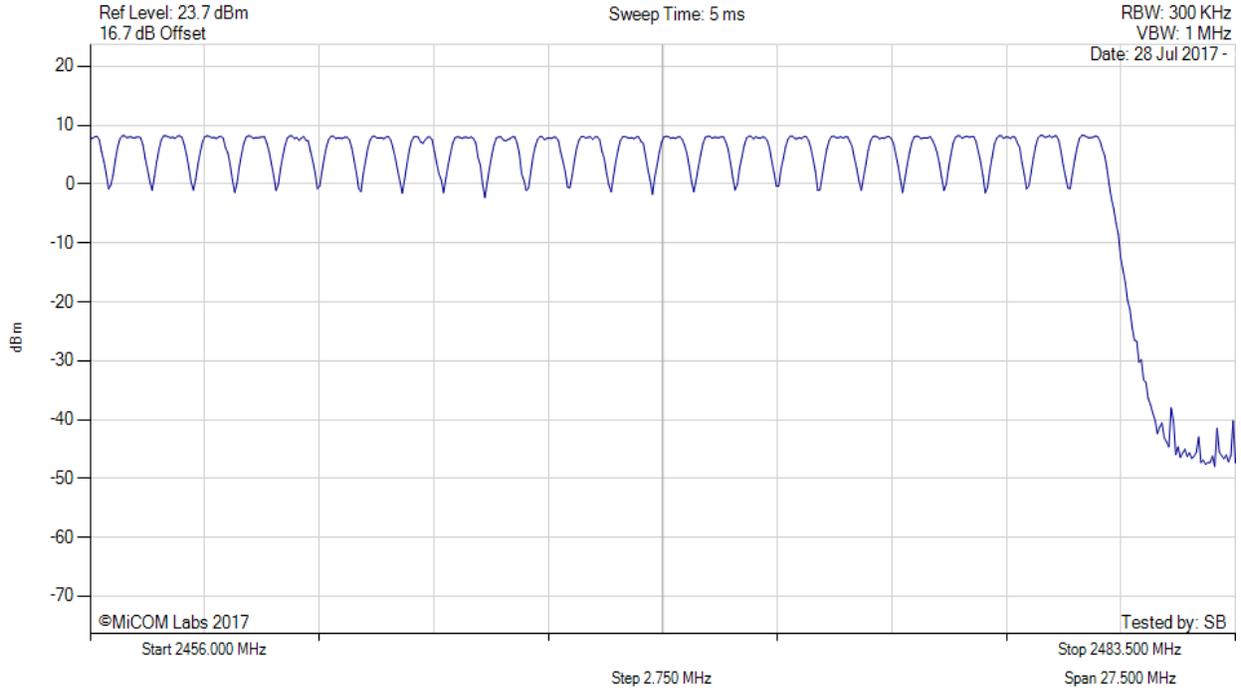


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NUMBER OF HOPPING CHANNELS



Variant: DH1, Channel: 2440.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEWS		Channel Frequency: 2440.00 MHz

[back to matrix](#)

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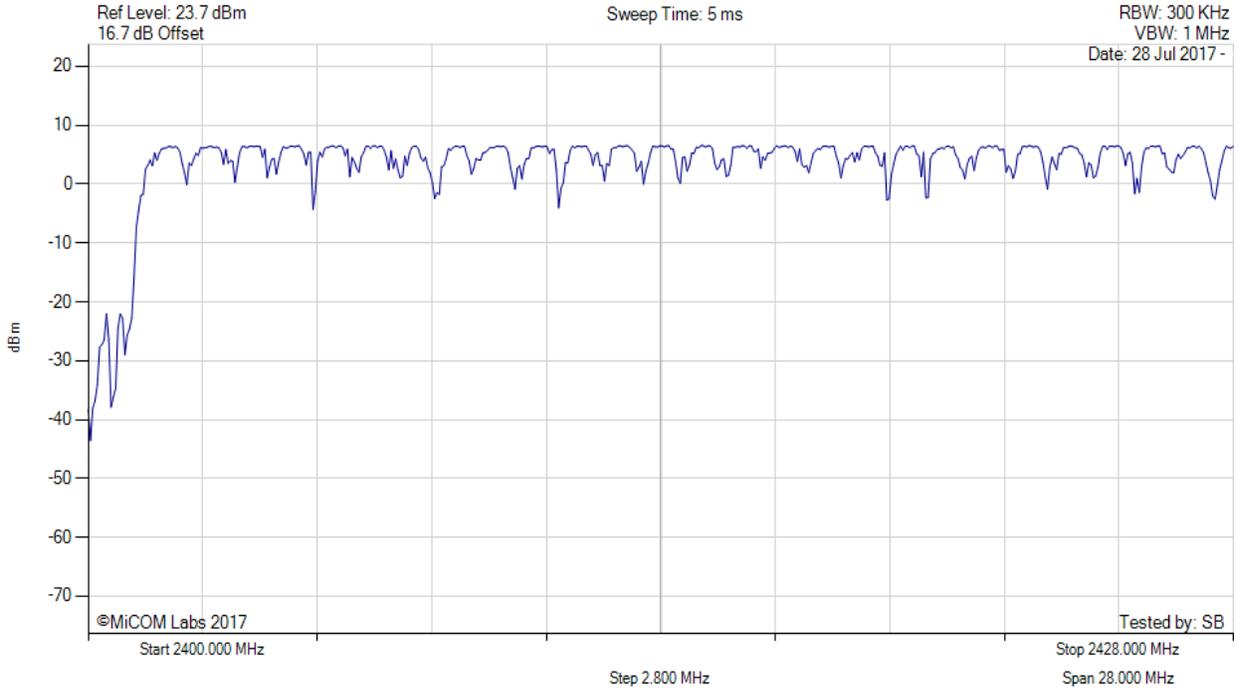


Title: HP Inc. 0960-4025 and 0960-4034
To: FCC 15.247 & IC RSS-247 (FHSS)
Serial #: MARS11-U13 FHSS Rev B WiFi/BT Module
Issue Date: 27th October 2017
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NUMBER OF HOPPING CHANNELS



Variant: DH5, Channel: 2440.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEWS		Channel Frequency: 2440.00 MHz

[back to matrix](#)

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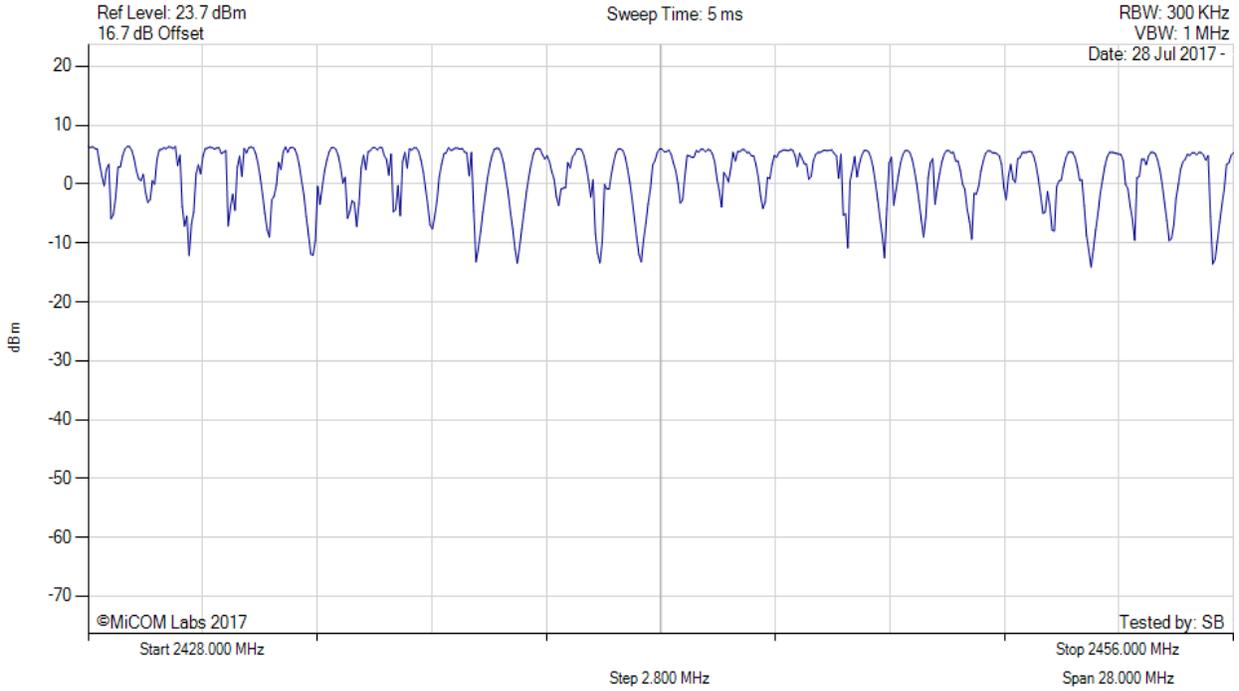


Title: HP Inc. 0960-4025 and 0960-4034
To: FCC 15.247 & IC RSS-247 (FHSS)
Serial #: MARS11-U13 FHSS Rev B WiFi/BT Module
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NUMBER OF HOPPING CHANNELS



Variant: DH5, Channel: 2440.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEWS		Channel Frequency: 2440.00 MHz

[back to matrix](#)

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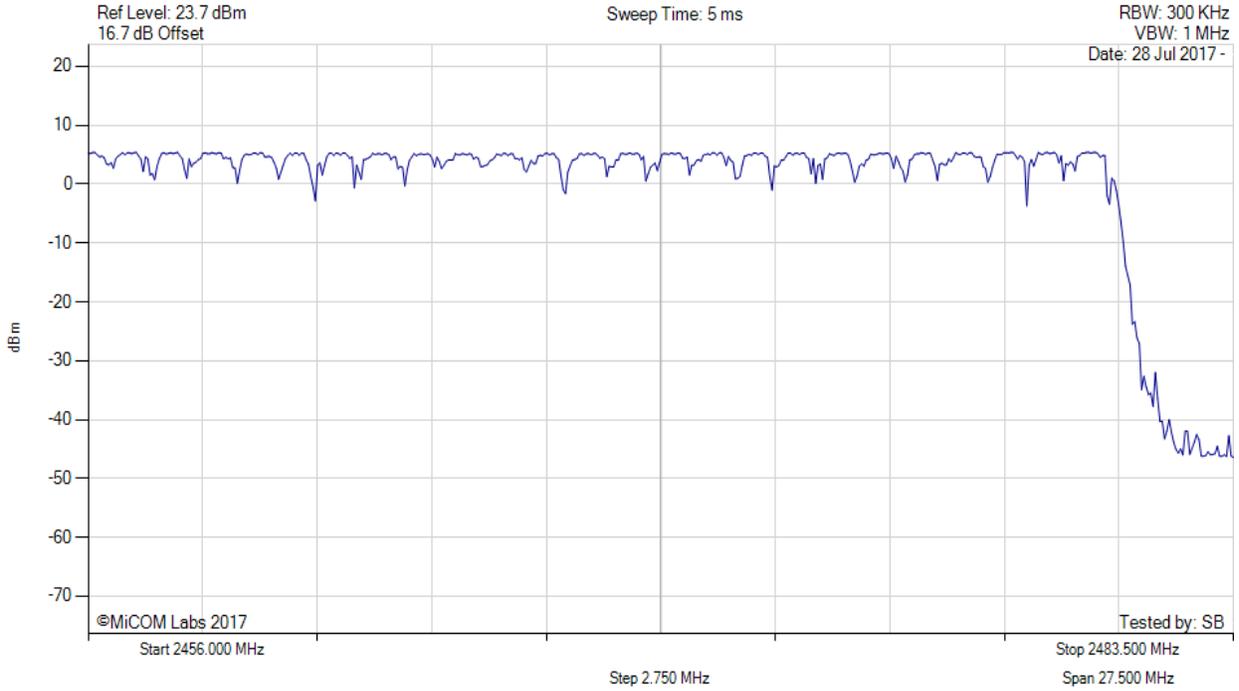


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NUMBER OF HOPPING CHANNELS



Variant: DH5, Channel: 2440.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEWS		Channel Frequency: 2440.00 MHz

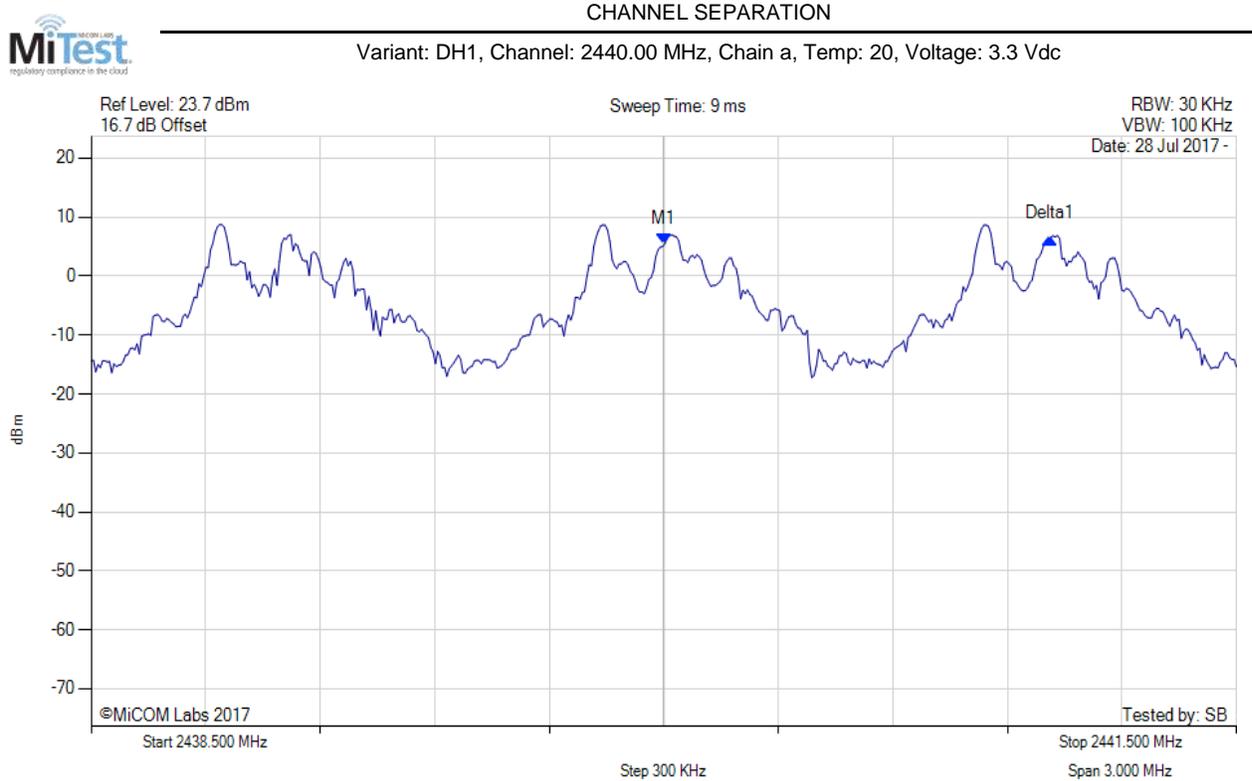
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A.2.2. Channel Separation



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2440.000 MHz : 5.476 dBm Delta1 : 1.012 MHz : 0.881 dB	Channel Frequency: 2440.00 MHz

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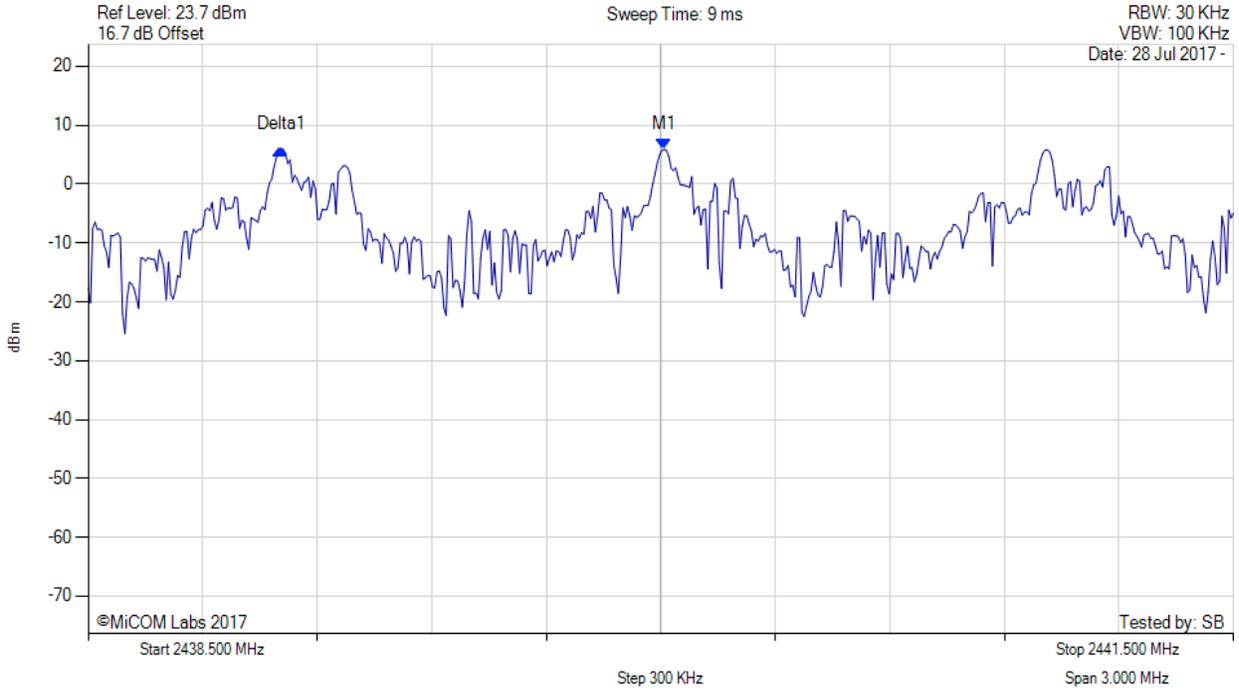


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CHANNEL SEPARATION



Variant: DH5, Channel: 2440.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEWS	M1 : 2440.009 MHz : 5.876 dBm Delta1 : -1004008 Hz : 0.049 dB	Channel Frequency: 2440.00 MHz

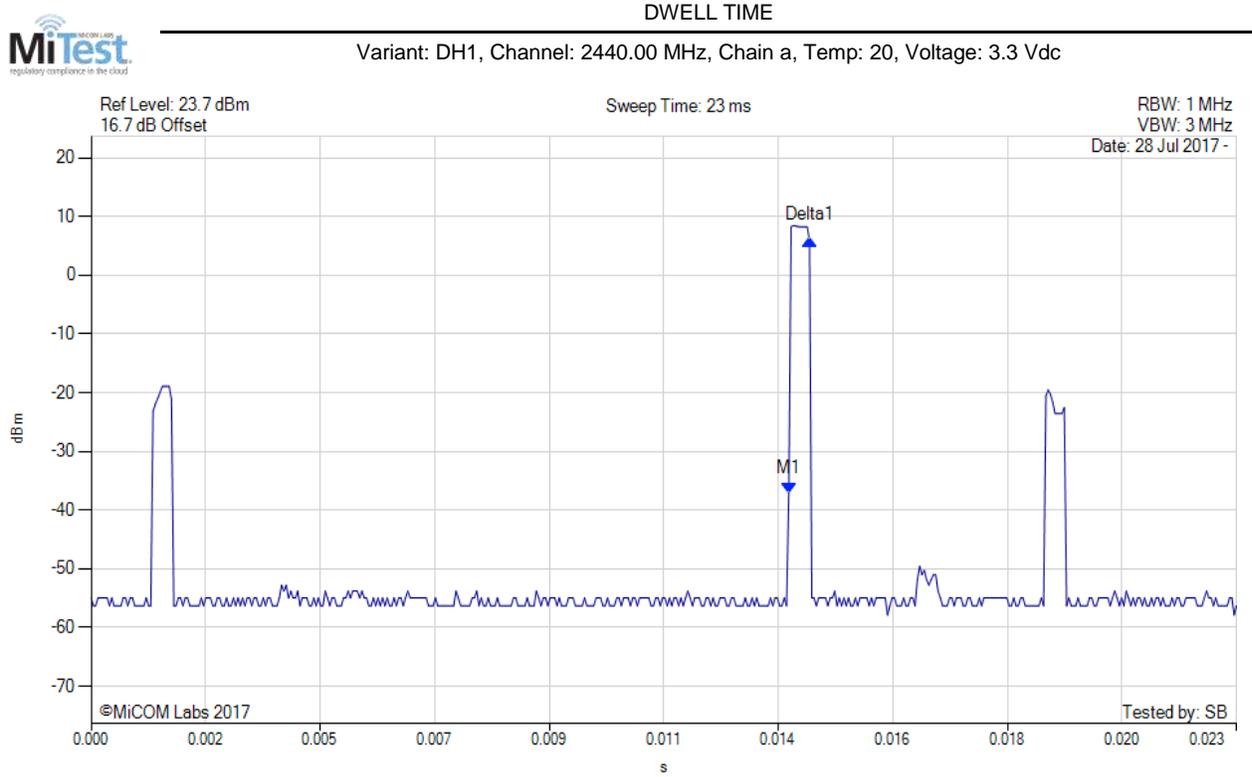
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A.2.3. Dwell Time



Analyzer Setup	Marker:Time:Amplitude	Test Results
Detector = RMS Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1(2440.00 MHz) : 0.014 s : -37.058 dBm Delta1(2440.00 MHz) : 0.40581 ms : 43.013 dB	Channel Frequency: 2440.00 MHz

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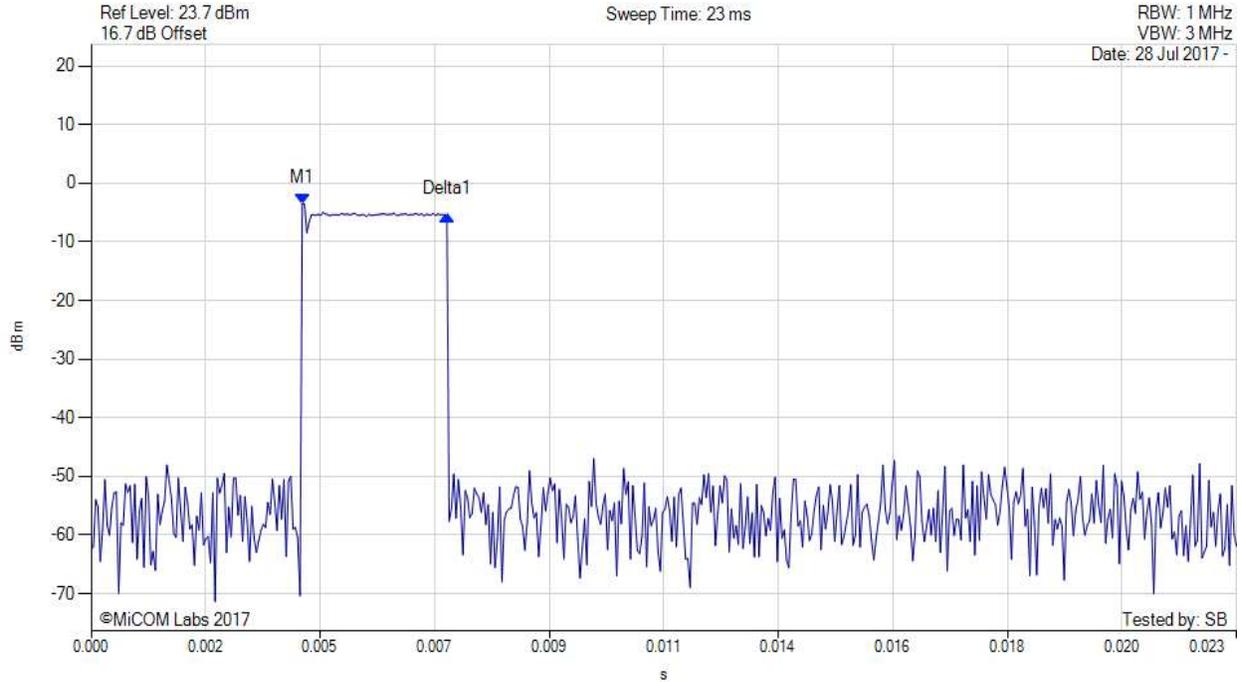


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DWELL TIME



Variant: DH5, Channel: 2440.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Time:Amplitude	Test Results
Detector = SAMPLE Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1(2440.00 MHz) : 0.004 s : -3.465 dBm Delta1(2440.00 MHz) : 0.002840 s : -1.861 dB	Channel Frequency: 2440.00 MHz

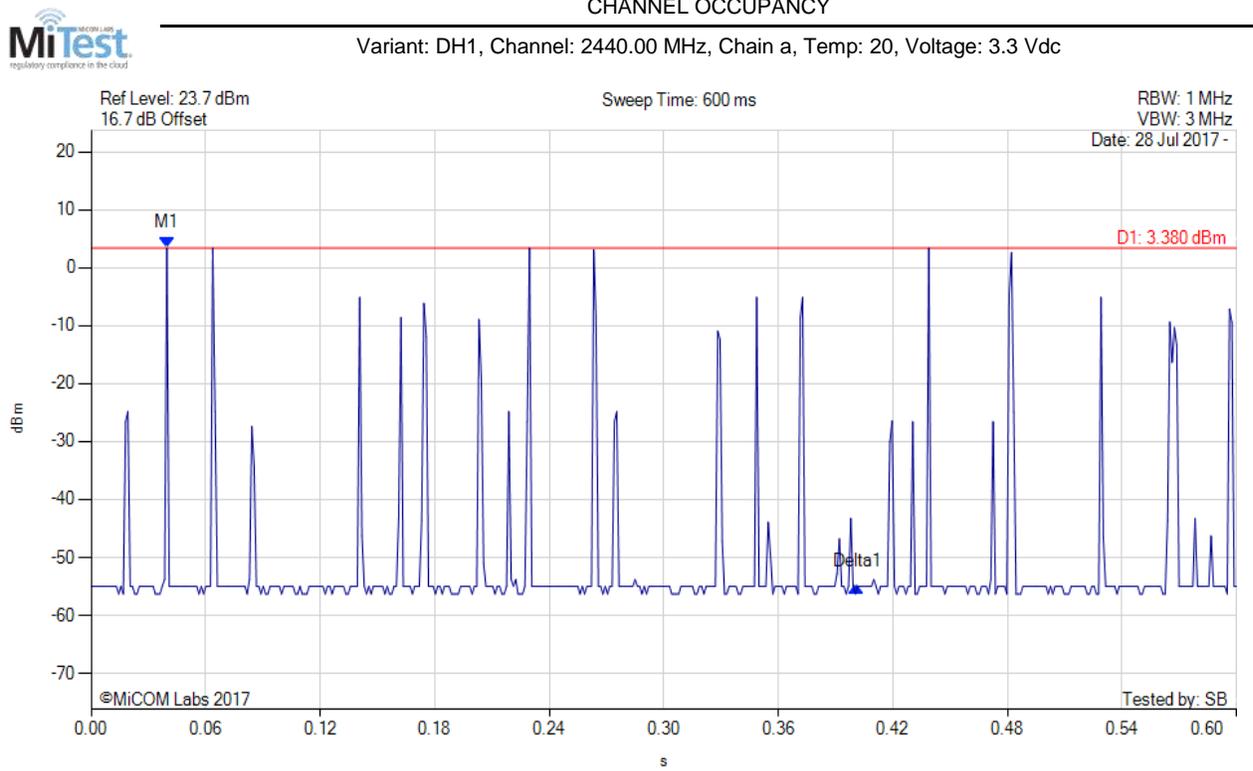
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A.2.4. Channel Occupancy



Analyzer Setup	Marker:Time:Amplitude	Test Results
Detector = RMS Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1(2440.00 MHz) : 0.040 s : 3.379 dBm Delta1(2440.00 MHz) : 0.362 s : -58.343 dB	Channel Frequency: 2440.00 MHz

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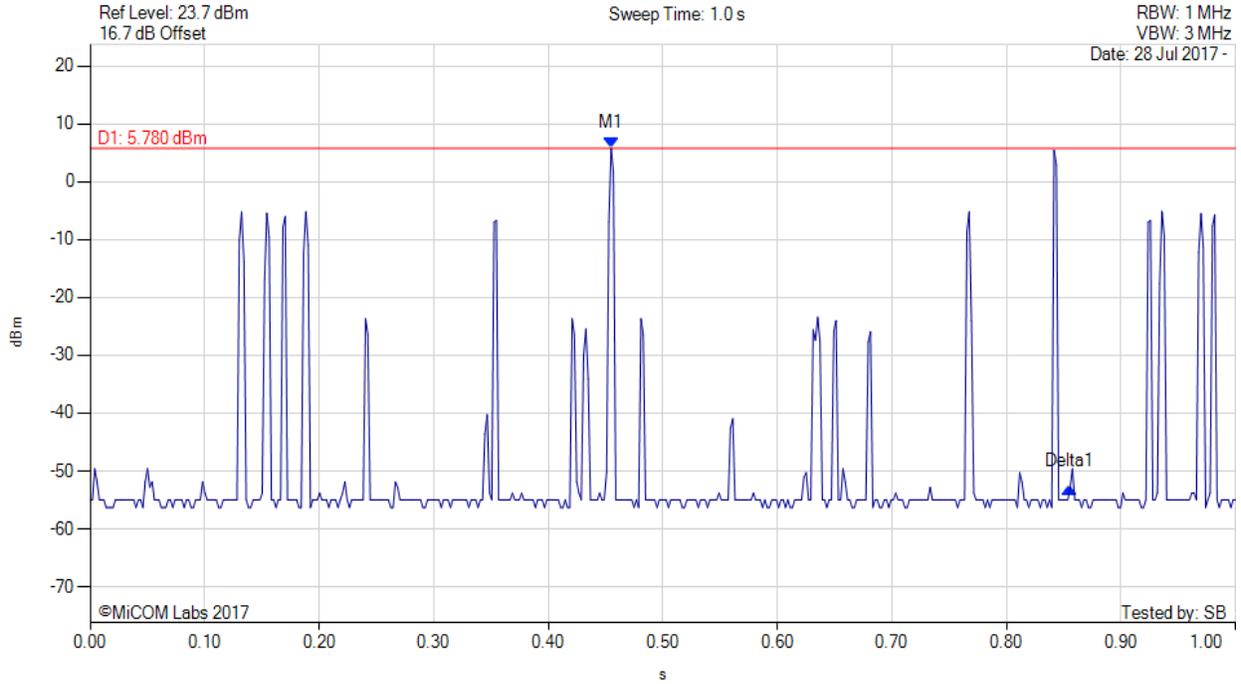


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CHANNEL OCCUPANCY



Variant: DH5, Channel: 2440.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Time:Amplitude	Test Results
Detector = RMS Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEWS	M1(24.40 GHz) : 0.455 s : 5.776 dBm Delta1(24.40 GHz) : 0.400 s : -58.557 dB	Channel Frequency: 2440.00 MHz

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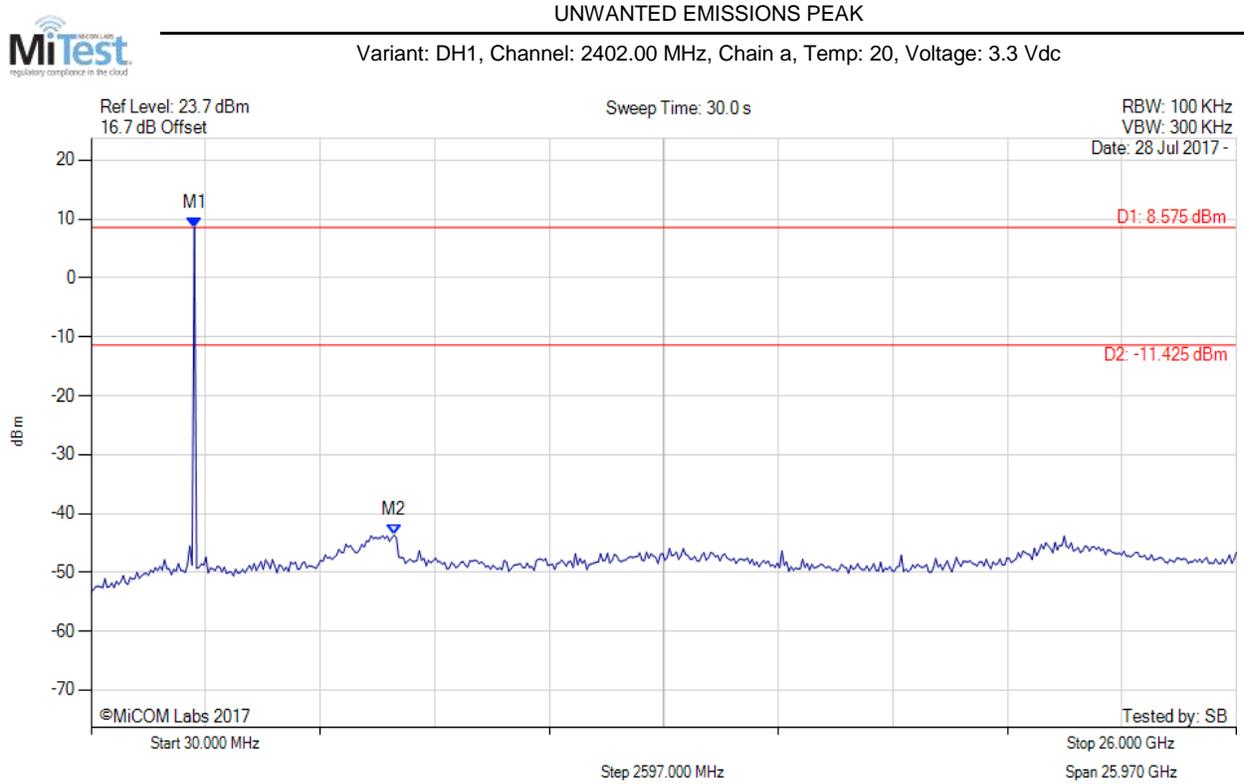
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A.3. Emissions

A.3.1. Conducted Emissions

A.3.1.1. Conducted Unwanted Spurious Emissions



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2371.984 MHz : 8.575 dBm M2 : 6899.820 MHz : -43.704 dBm	Limit: -11.43 dBm Margin: -32.27 dB

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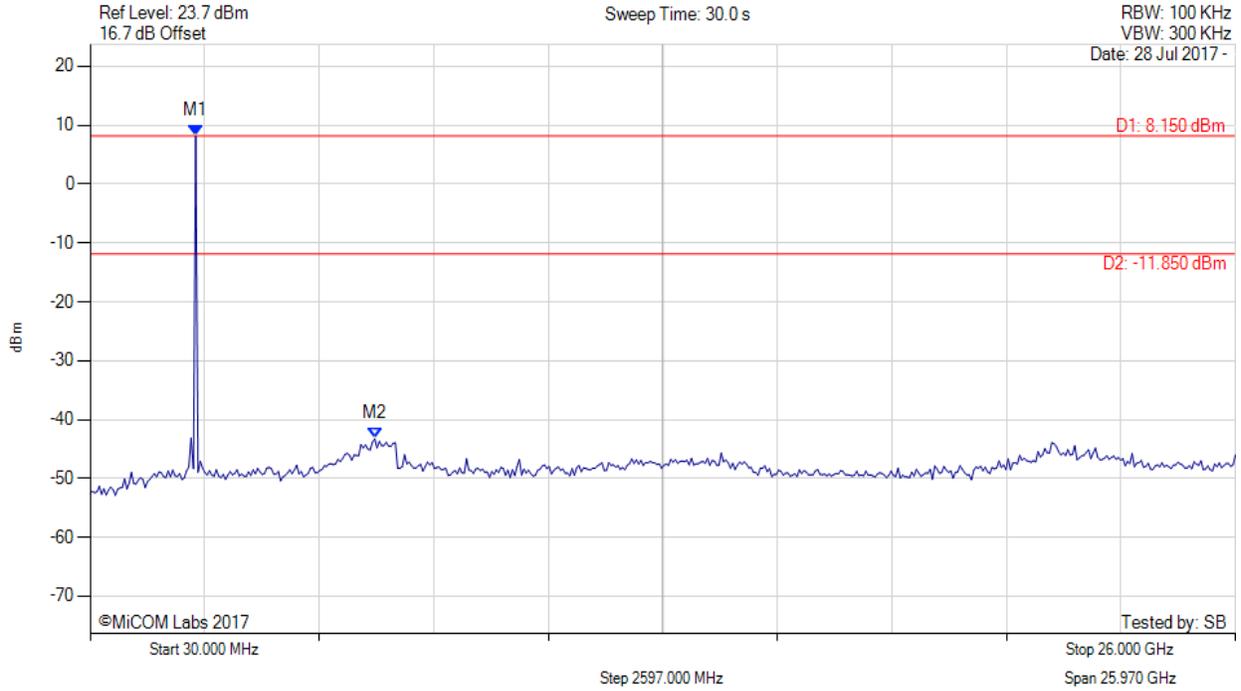


Title: HP Inc. 0960-4025 and 0960-4034
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UNWANTED EMISSIONS PEAK



Variants: DH1, Channel: 2440.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEWS	M1 : 2424.028 MHz : 8.150 dBm M2 : 6483.467 MHz : -43.263 dBm	Limit: -11.85 dBm Margin: -31.41 dB

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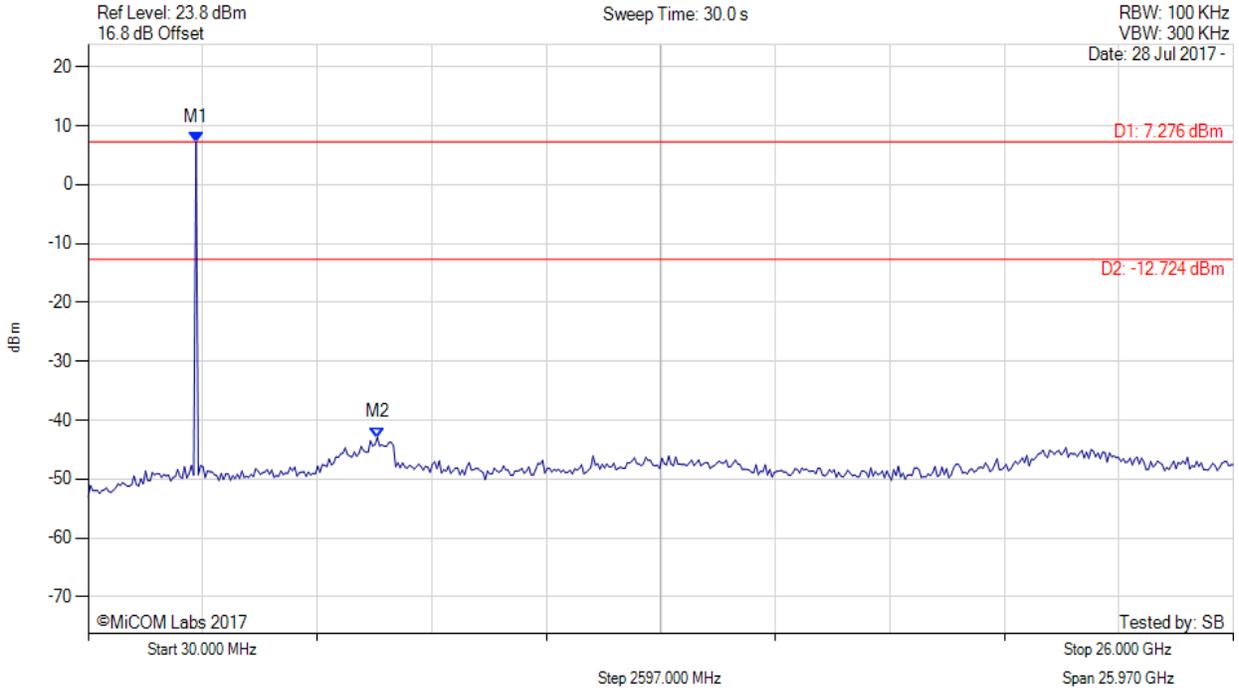


Title: HP Inc. 0960-4025 and 0960-4034
To: FCC 15.247 & IC RSS-247 (FHSS)
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UNWANTED EMISSIONS PEAK



Variants: DH1, Channel: 2480.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEWS	M1 : 2476.072 MHz : 7.276 dBm M2 : 6587.555 MHz : -42.950 dBm	Limit: -12.72 dBm Margin: -30.23 dB

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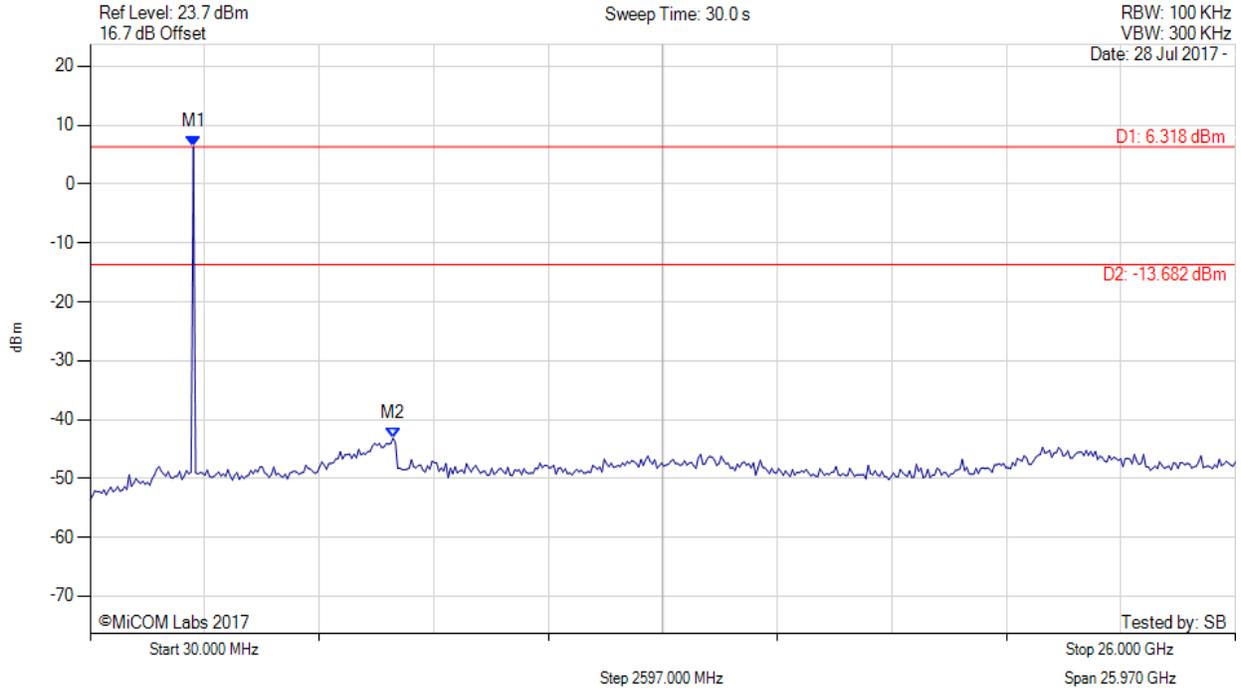


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UNWANTED EMISSIONS PEAK



Variant: DH5, Channel: 2402.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEWS	M1 : 2371.984 MHz : 6.318 dBm M2 : 6899.820 MHz : -43.190 dBm	Limit: -13.68 dBm Margin: -29.51 dB

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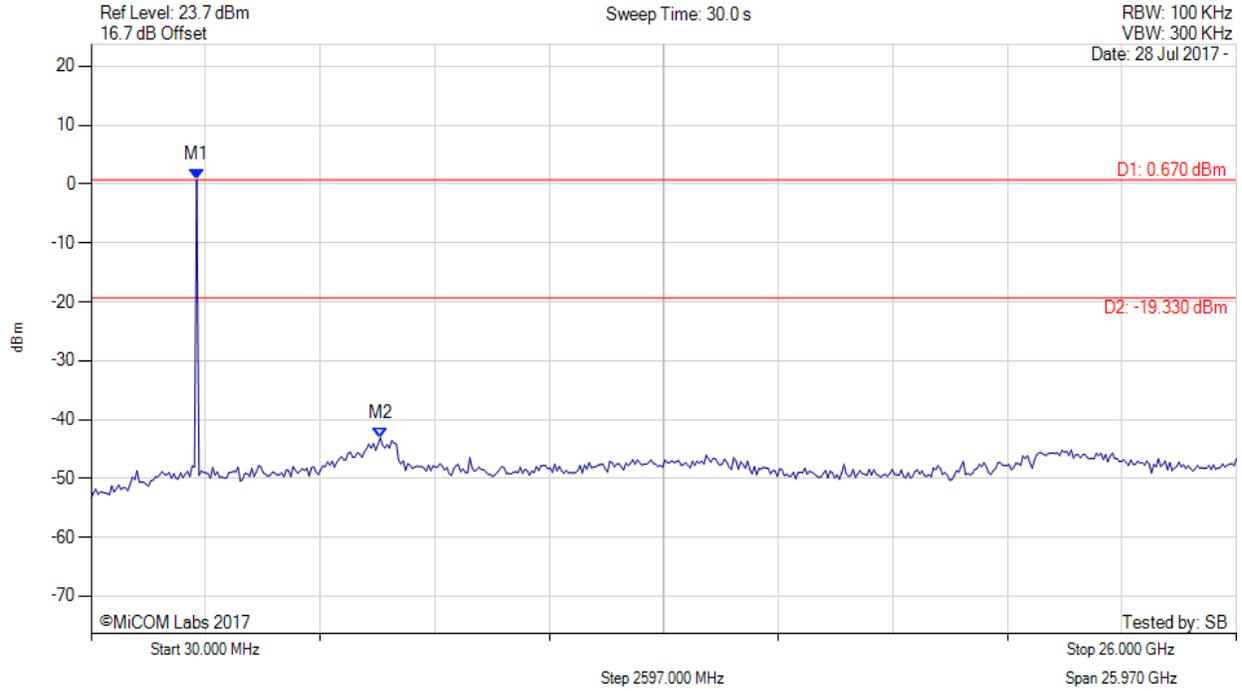


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UNWANTED EMISSIONS PEAK



Variants: DH5, Channel: 2440.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEWS	M1 : 2424.028 MHz : 0.670 dBm M2 : 6587.555 MHz : -43.125 dBm	Limit: -19.33 dBm Margin: -23.80 dB

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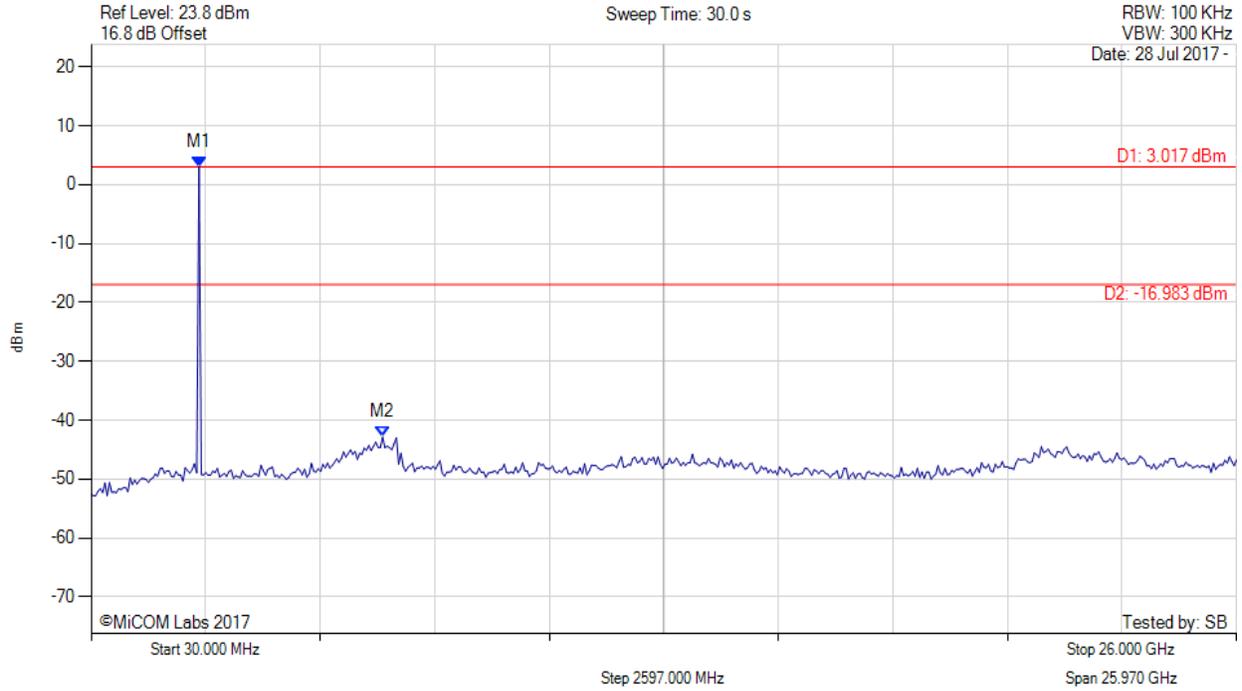


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UNWANTED EMISSIONS PEAK



Variants: DH5, Channel: 2480.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEWS	M1 : 2476.072 MHz : 3.017 dBm M2 : 6639.599 MHz : -42.872 dBm	Limit: -16.98 dBm Margin: -25.89 dB

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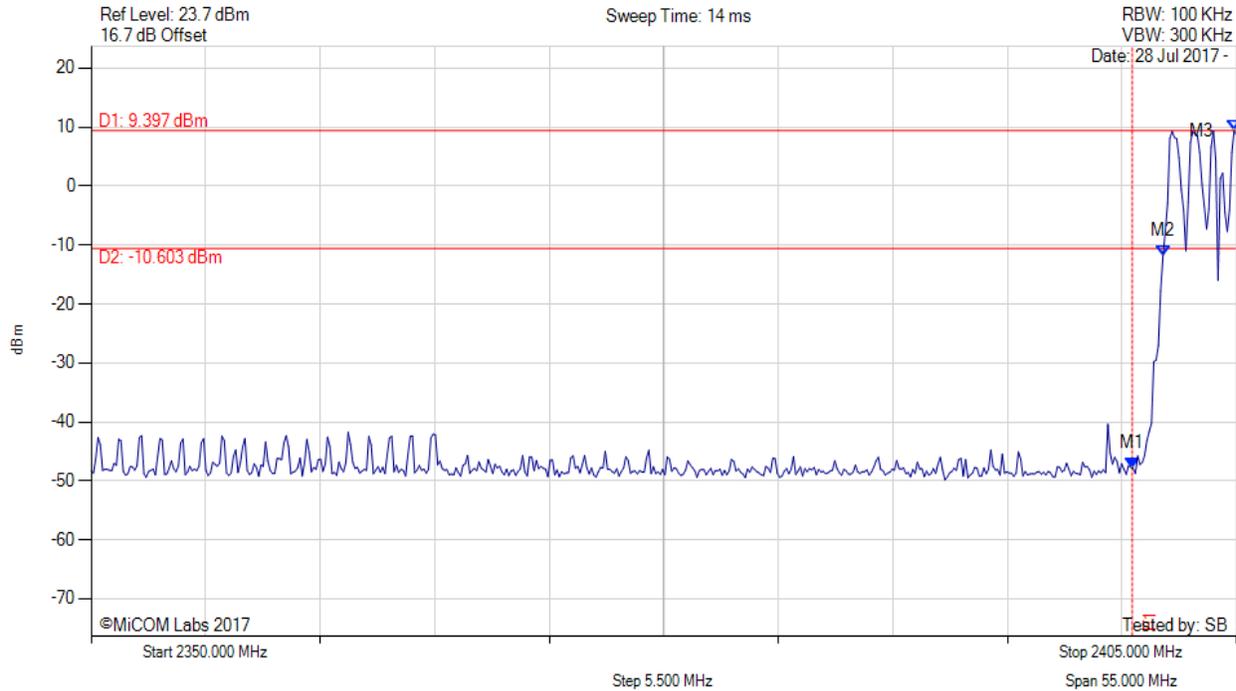
Title: HP Inc. 0960-4025 and 0960-4034
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A.3.1.2. Conducted Band-Edge Emissions



CONDUCTED LOW BAND-EDGE EMISSIONS (HOPPING) PEAK

Variant: DH1, Channel: 2402.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2400.000 MHz : -47.886 dBm M2 : 2401.473 MHz : -11.909 dBm M3 : 2404.890 MHz : 9.397 dBm	Channel Frequency: 2402.00 MHz

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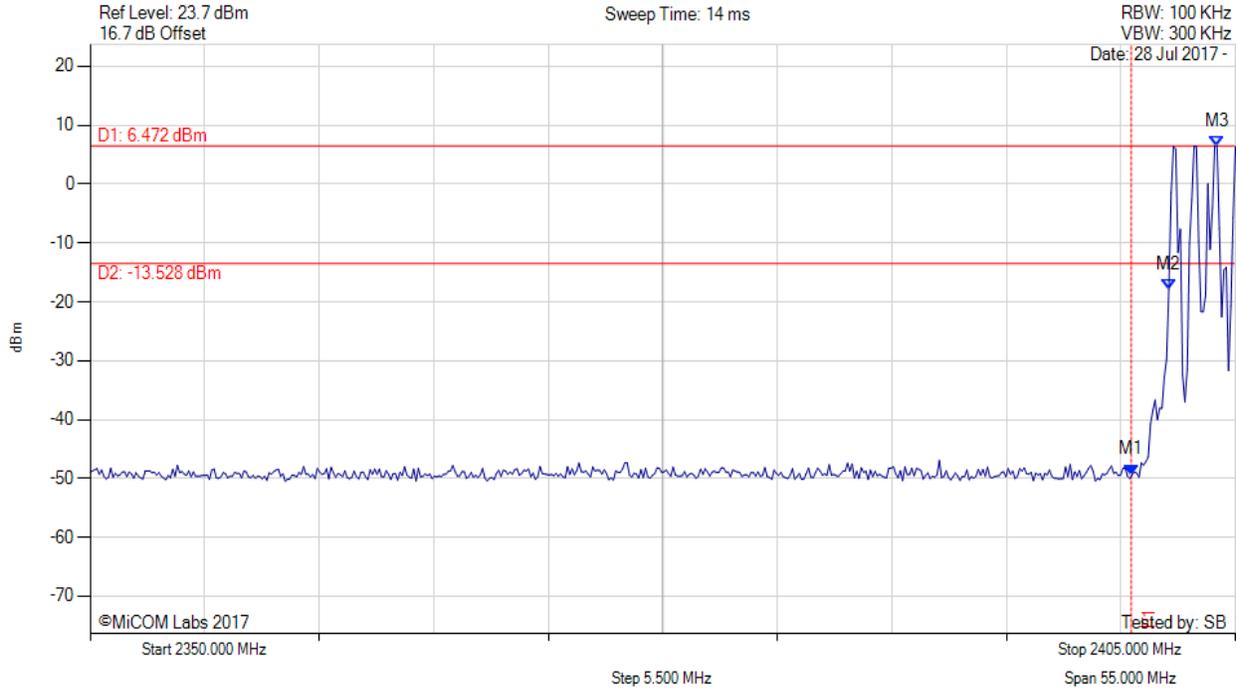


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CONDUCTED LOW BAND-EDGE EMISSIONS (HOPPING) PEAK

Variant: DH5, Channel: 2402.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEWS	M1 : 2400.000 MHz : -49.360 dBm M2 : 2401.804 MHz : -17.953 dBm M3 : 2404.118 MHz : 6.472 dBm	Channel Frequency: 2402.00 MHz

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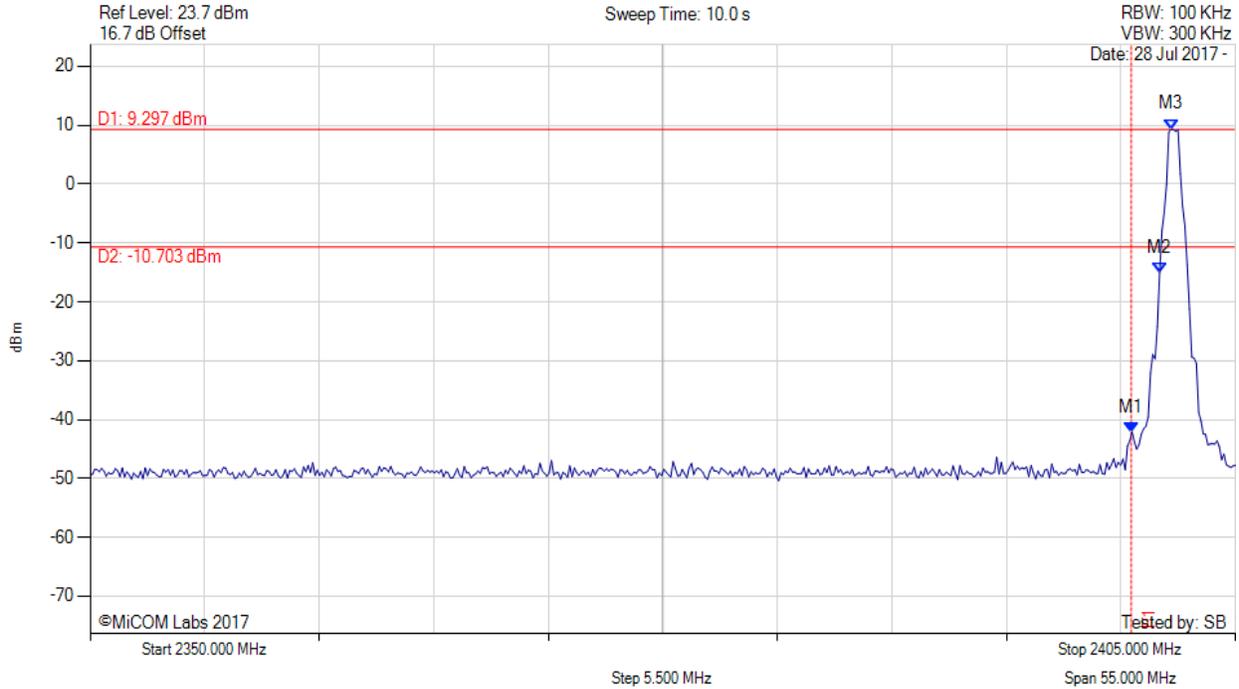


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CONDUCTED LOW BAND-EDGE EMISSIONS (STATIC) PEAK

Variant: DH1, Channel: 2402.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEWS	M1 : 2400.000 MHz : -42.153 dBm M2 : 2401.363 MHz : -15.029 dBm M3 : 2401.914 MHz : 9.297 dBm	Channel Frequency: 2402.00 MHz

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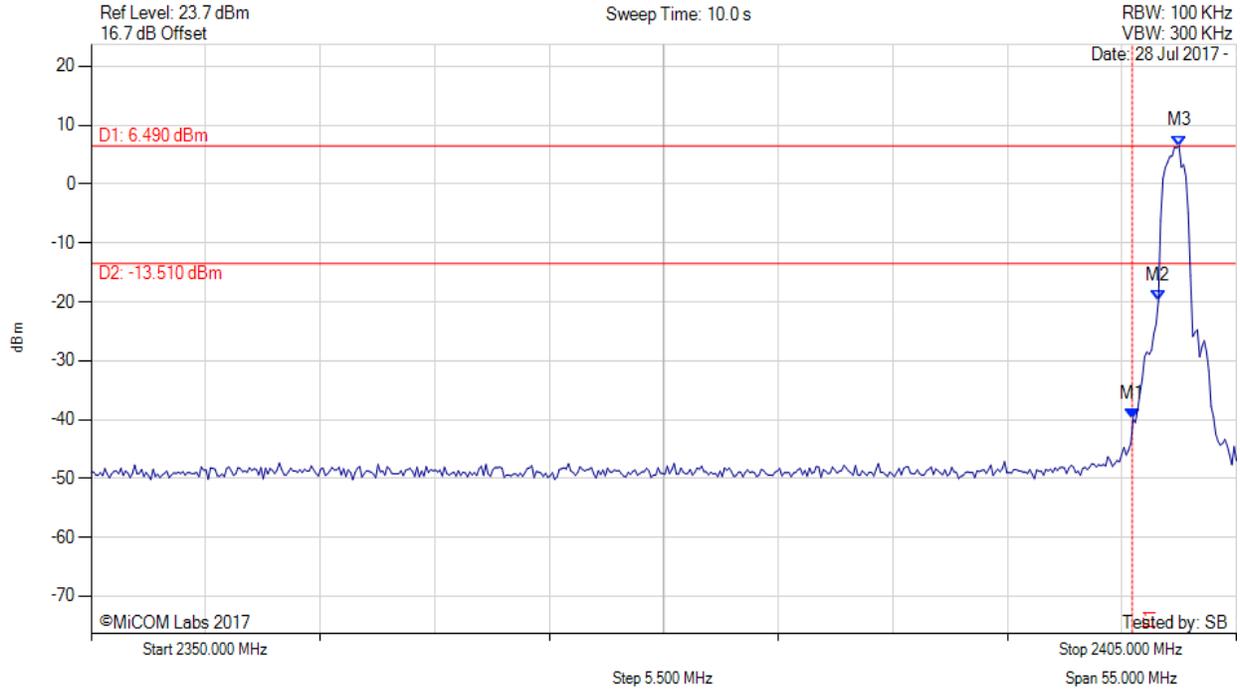


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CONDUCTED LOW BAND-EDGE EMISSIONS (STATIC) PEAK



Variant: DH5, Channel: 2402.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEWS	M1 : 2400.000 MHz : -39.883 dBm M2 : 2401.253 MHz : -19.897 dBm M3 : 2402.244 MHz : 6.490 dBm	Channel Frequency: 2402.00 MHz

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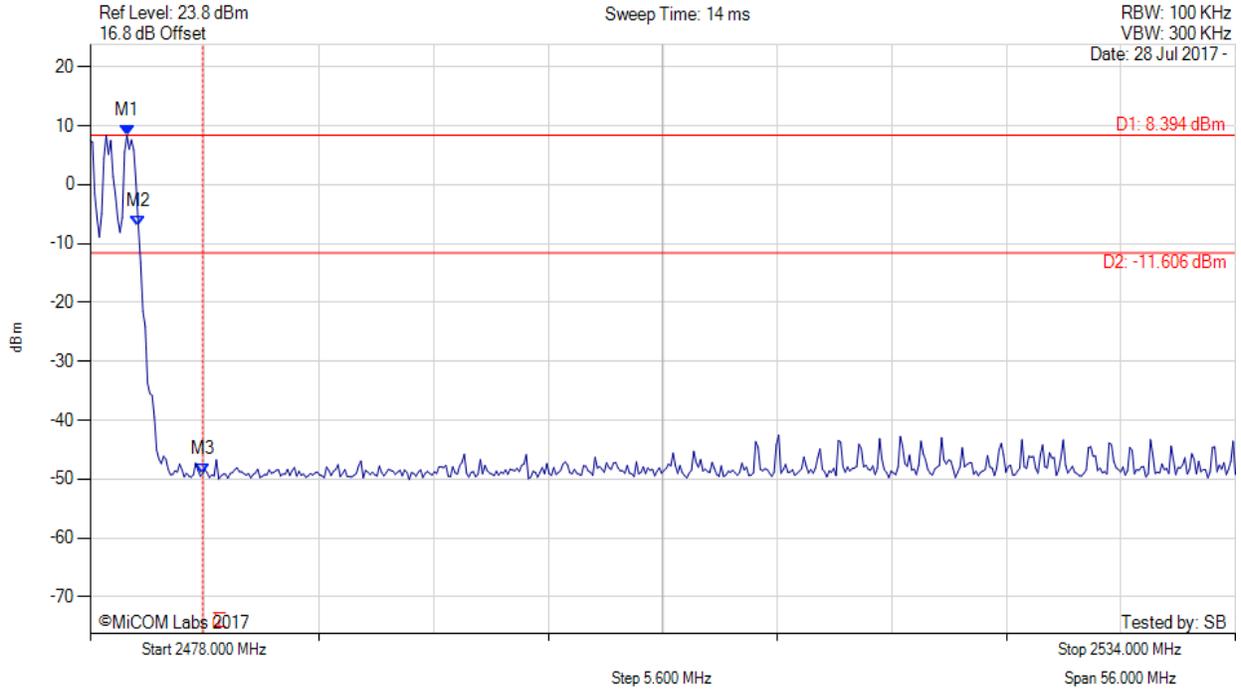


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CONDUCTED UPPER BAND-EDGE EMISSIONS (HOPPING) PEAK



Variants: DH1, Channel: 2480.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEWS	M1 : 2479.796 MHz : 8.394 dBm M2 : 2480.357 MHz : -6.991 dBm M3 : 2483.500 MHz : -49.091 dBm	Channel Frequency: 2480.00 MHz

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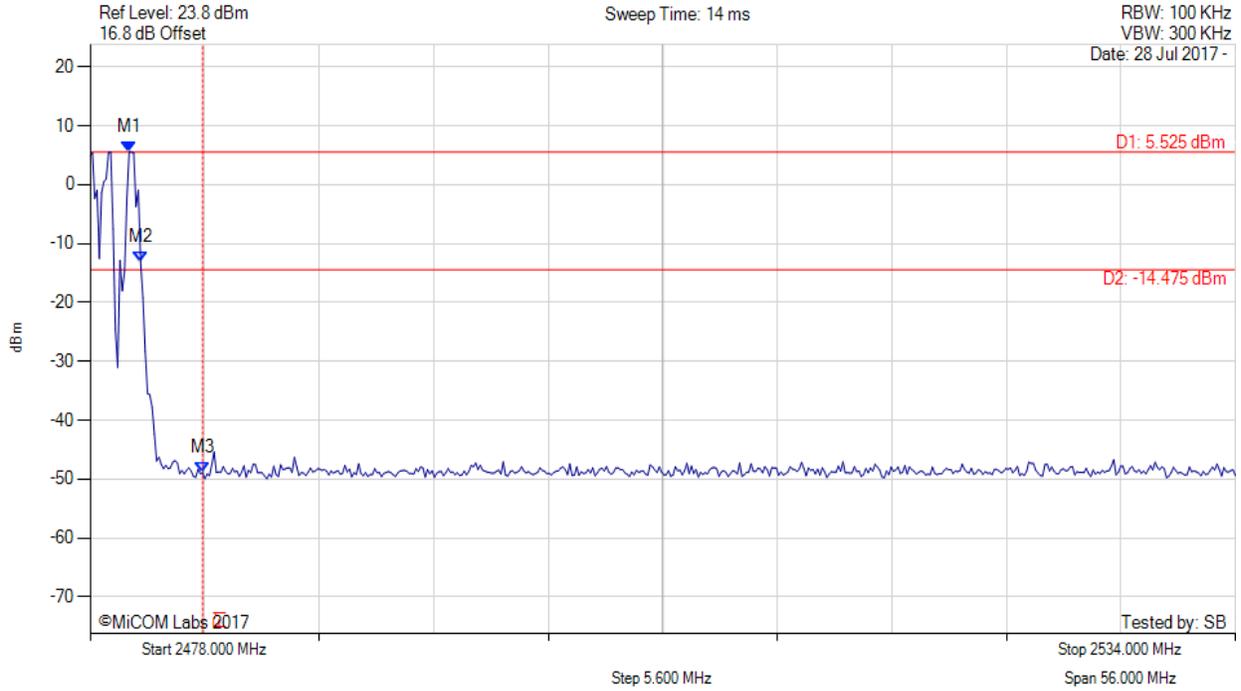


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CONDUCTED UPPER BAND-EDGE EMISSIONS (HOPPING) PEAK



Variant: DH5, Channel: 2480.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2479.908 MHz : 5.525 dBm M2 : 2480.469 MHz : -13.153 dBm M3 : 2483.500 MHz : -48.963 dBm	Channel Frequency: 2480.00 MHz

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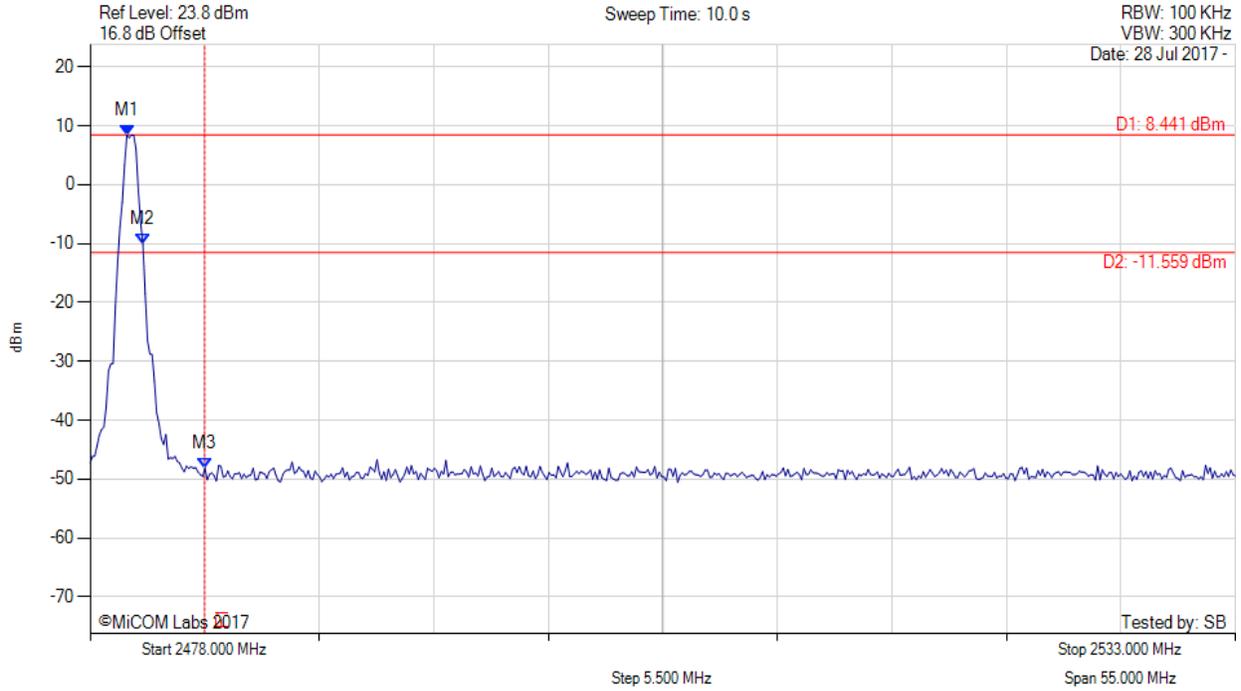


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CONDUCTED UPPER BAND-EDGE EMISSIONS (STATIC) PEAK



Variant: DH1, Channel: 2480.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2479.764 MHz : 8.441 dBm M2 : 2480.535 MHz : -10.190 dBm M3 : 2483.500 MHz : -48.174 dBm	Channel Frequency: 2480.00 MHz

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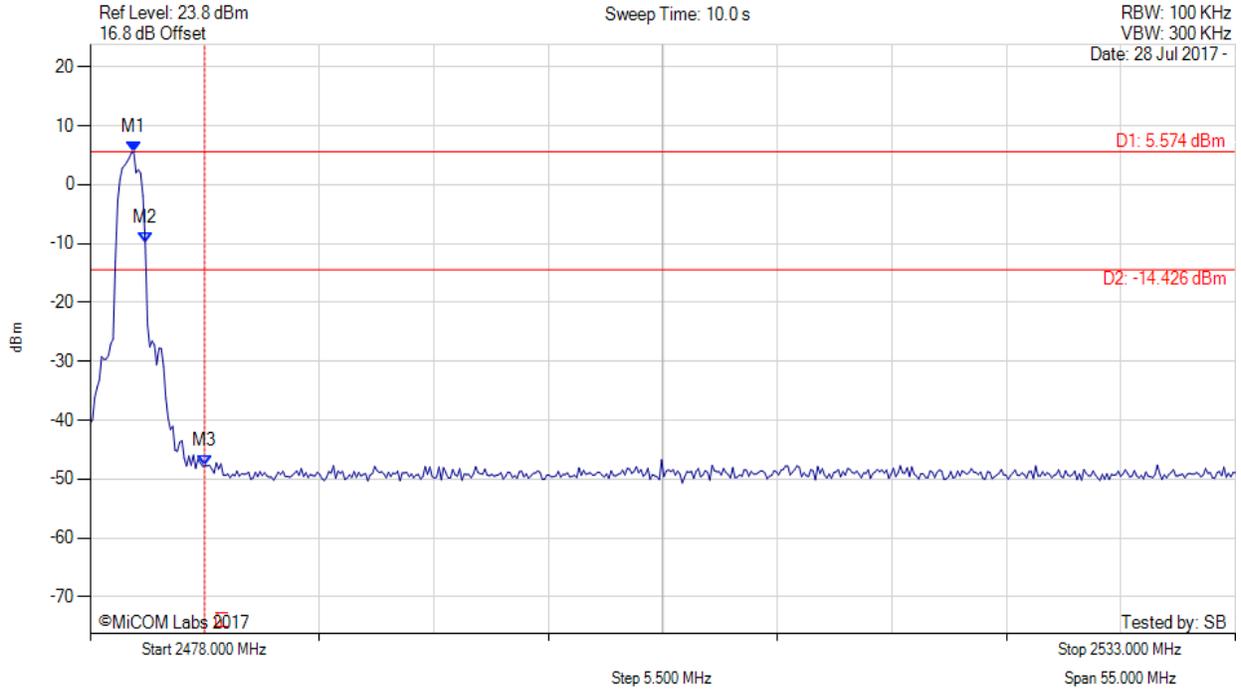


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CONDUCTED UPPER BAND-EDGE EMISSIONS (STATIC) PEAK



Variant: DH5, Channel: 2480.00 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2480.094 MHz : 5.574 dBm M2 : 2480.645 MHz : -9.822 dBm M3 : 2483.500 MHz : -47.770 dBm	Channel Frequency: 2480.00 MHz

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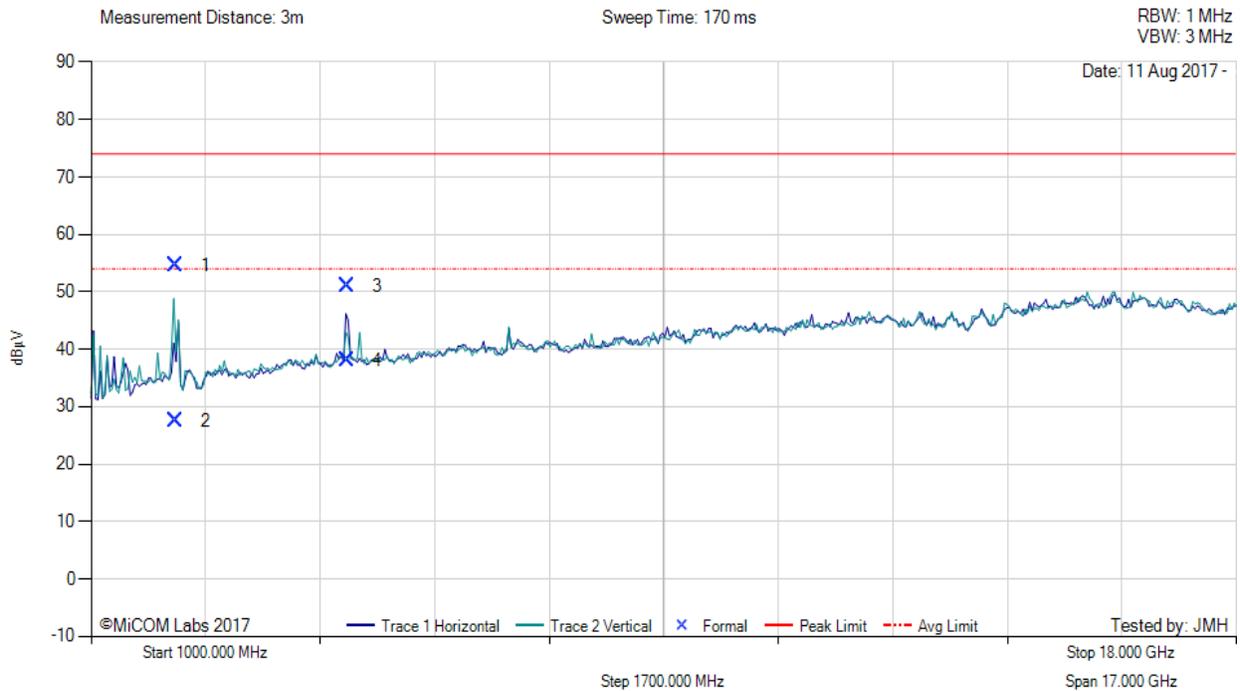
A.3.2. Radiated Emissions

A.3.2.3. TX Spurious & Restricted Band Emissions



TX SPURIOUS & RESTRICTED BAND EMISSIONS

Variant: 8DPSK, Test Freq: 2402.00 MHz, Antenna: Integral, Power Setting: 10, Duty Cycle (%): 99



1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2245.90	64.11	2.64	-12.14	54.61	Max Peak	Vertical	142	269	74.0	-19.4	Pass
2	2245.90	36.98	2.64	-12.14	27.48	Max Avg	Vertical	142	269	54.0	-26.5	Pass
3	4803.81	58.61	3.51	-11.12	51.00	Max Peak	Horizontal	117	356	74.0	-23.0	Pass
4	4803.81	45.66	3.51	-11.12	38.05	Max Avg	Horizontal	117	356	54.0	-16.0	Pass

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

[back to matrix](#)

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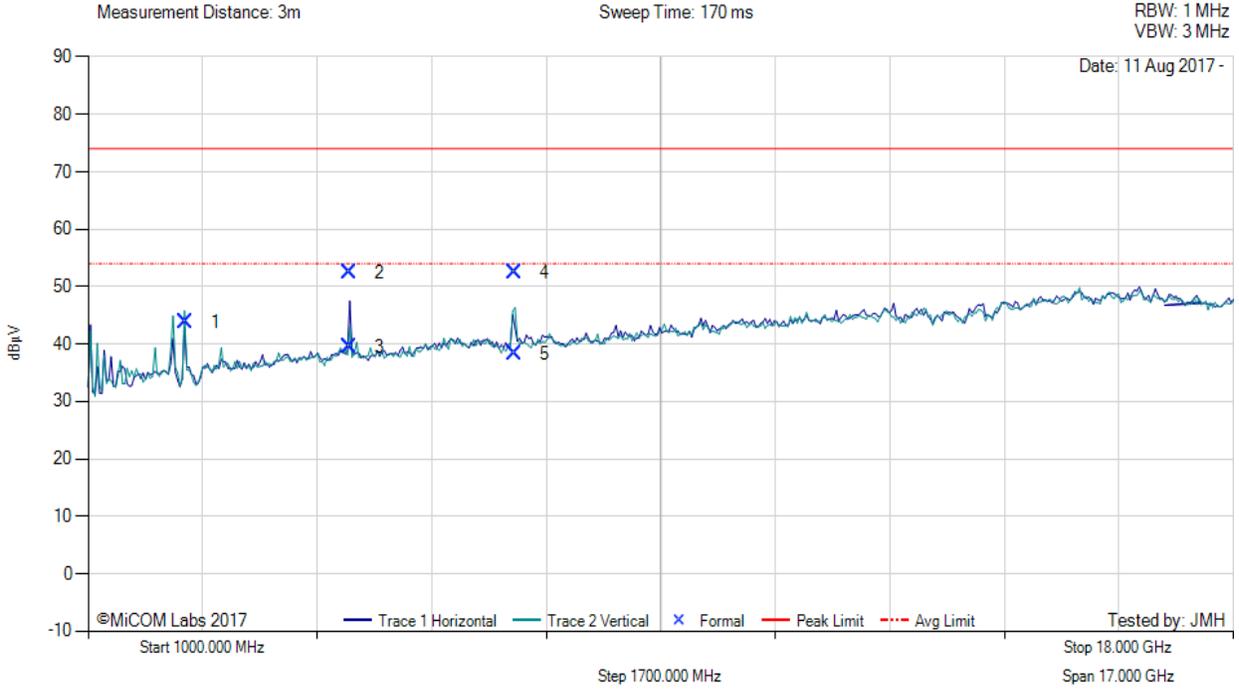


Title: HP Inc. 0960-4025 and 0960-4034
To: FCC 15.247 & IC RSS-247 (FHSS)
Serial #: MARS11-U13 FHSS Rev B WiFi/BT Module
Issue Date: 27th October 2017
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TX SPURIOUS & RESTRICTED BAND EMISSIONS

Variant: 8DPSK, Test Freq: 2440.00 MHz, Antenna: Integral, Power Setting: 9, Duty Cycle (%): 99



1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2441.06	52.84	2.72	-11.72	43.84	Fundamental	Vertical	100	0	--	--	
2	4882.10	60.13	3.63	-11.26	52.50	Max Peak	Horizontal	114	353	74.0	-21.5	Pass
3	4882.10	47.14	3.63	-11.26	39.51	Max Avg	Horizontal	114	353	54.0	-14.5	Pass
4	7323.04	55.43	4.26	-7.26	52.43	Max Peak	Vertical	101	351	74.0	-21.6	Pass
5	7323.04	41.32	4.26	-7.26	38.32	Max Avg	Vertical	101	351	54.0	-15.7	Pass

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

[back to matrix](#)

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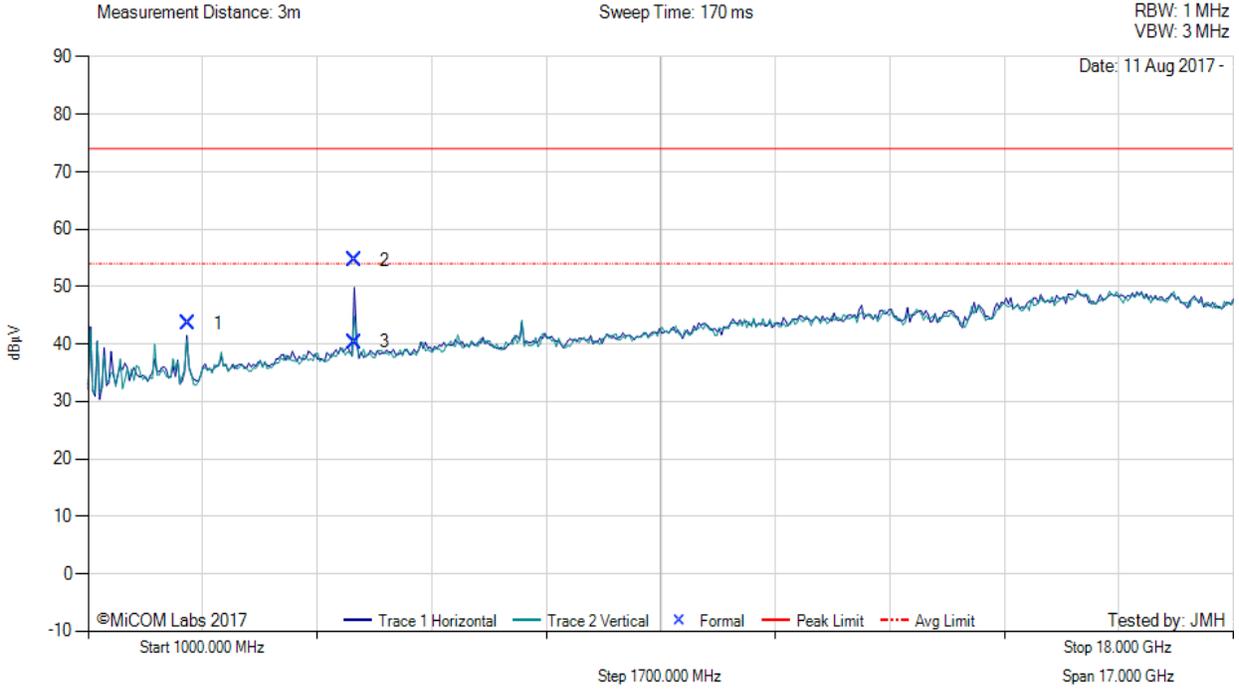


Title: HP Inc. 0960-4025 and 0960-4034
To: FCC 15.247 & IC RSS-247 (FHSS)
Serial #: MARS11-U13 FHSS Rev B WiFi/BT Module
Issue Date: 27th October 2017
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TX SPURIOUS & RESTRICTED BAND EMISSIONS

Variant: 8DPSK, Test Freq: 2480.00 MHz, Antenna: Integral, Power Setting: 8, Duty Cycle (%): 99



1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2479.81	52.50	2.72	-11.65	43.57	Fundamental	Horizontal	150	0	--	--	
2	4959.65	62.54	3.57	-11.48	54.63	Max Peak	Horizontal	109	352	74.0	-19.4	Pass
3	4959.65	48.29	3.57	-11.48	40.38	Max Avg	Horizontal	109	352	54.0	-13.6	Pass

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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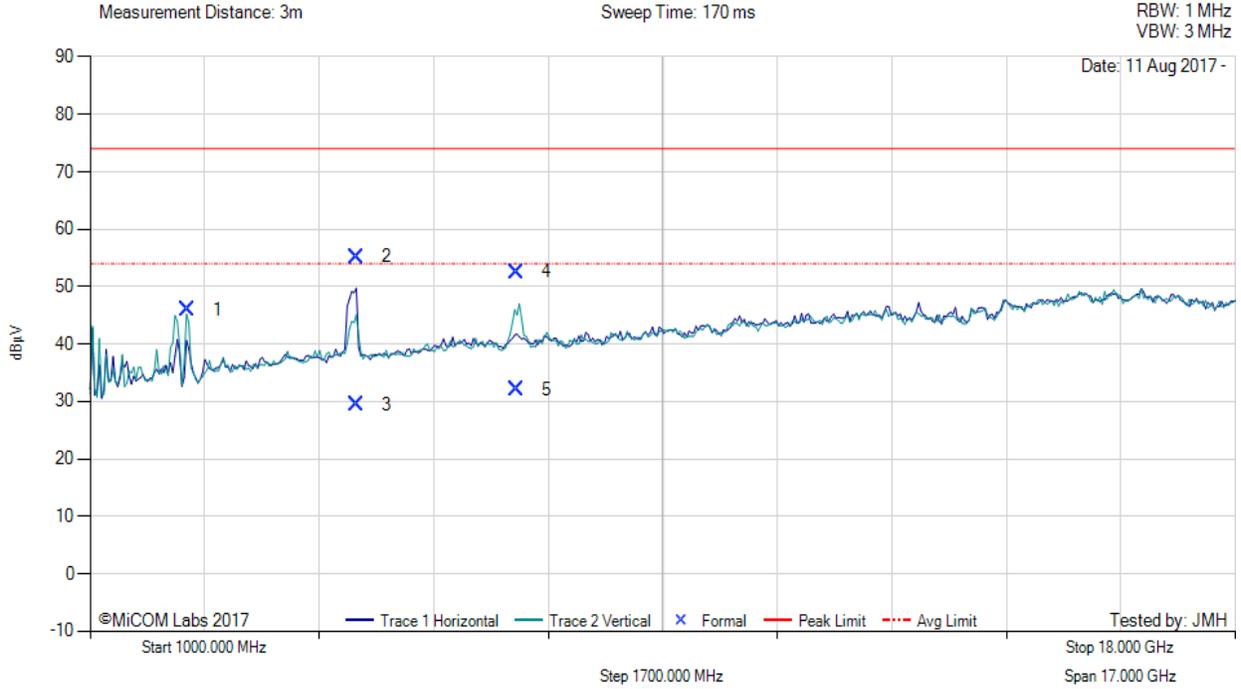


Title: HP Inc. 0960-4025 and 0960-4034
To: FCC 15.247 & IC RSS-247 (FHSS)
Serial #: MARS11-U13 FHSS Rev B WiFi/BT Module
Issue Date: 27th October 2017
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TX SPURIOUS & RESTRICTED BAND EMISSIONS

Variant: 8DPSK, Test Freq: Hopping, Antenna: Integral, Power Setting: 10, Duty Cycle (%): 99



1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2446.02	54.89	2.71	-11.70	45.90	Fundamental	Vertical	100	0	--	--	
2	4958.24	63.08	3.57	-11.48	55.17	Max Peak	Horizontal	98	0	74.0	-18.8	Pass
3	4958.24	37.35	3.57	-11.48	29.44	Max Avg	Horizontal	98	0	54.0	-24.6	Pass
4	7326.47	55.57	4.27	-7.26	52.58	Max Peak	Vertical	123	354	74.0	-21.4	Pass
5	7326.47	35.05	4.27	-7.26	32.06	Max Avg	Vertical	123	354	54.0	-21.9	Pass

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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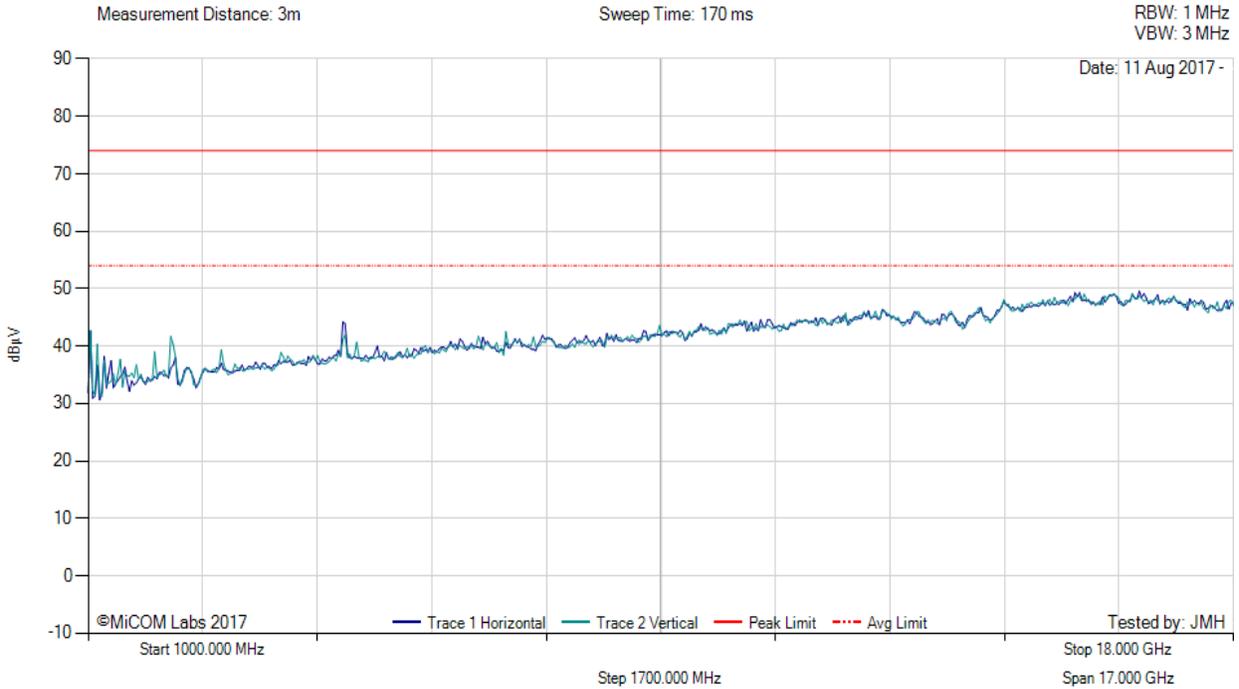


Title: HP Inc. 0960-4025 and 0960-4034
To: FCC 15.247 & IC RSS-247 (FHSS)
Serial #: MARS11-U13 FHSS Rev B WiFi/BT Module
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TX SPURIOUS & RESTRICTED BAND EMISSIONS

Variant: Pi_4 DQPSK, Test Freq: 2402.00 MHz, Antenna: Integral, Power Setting: 10, Duty Cycle (%): 99



There are no emissions found within 6dB of the limit line.

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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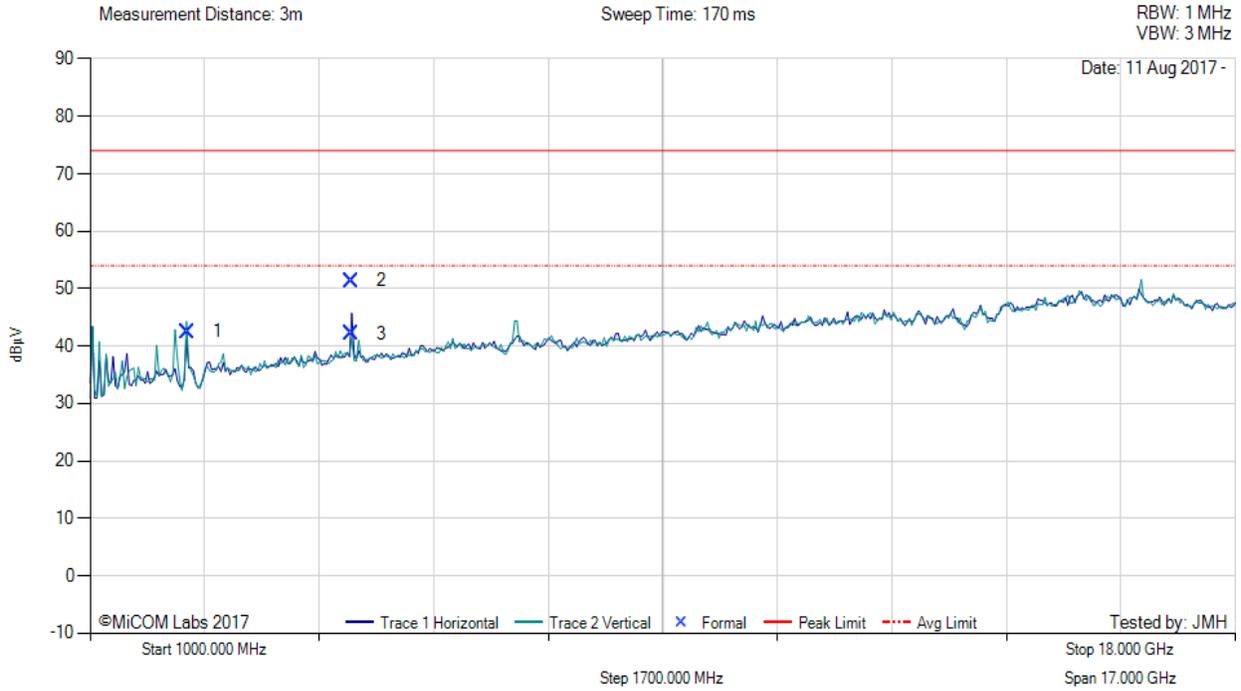


Title: HP Inc. 0960-4025 and 0960-4034
To: FCC 15.247 & IC RSS-247 (FHSS)
Serial #: MARS11-U13 FHSS Rev B WiFi/BT Module
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TX SPURIOUS & RESTRICTED BAND EMISSIONS

Variant: Pi_4 DQPSK, Test Freq: 2440.00 MHz, Antenna: Integral, Power Setting: 10, Duty Cycle (%): 99



1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2440.95	51.50	2.72	-11.72	42.50	Fundamental	Vertical	100	0	--	--	
2	4881.70	59.01	3.62	-11.26	51.37	Max Peak	Horizontal	114	355	74.0	-22.6	Pass
3	4881.70	49.72	3.62	-11.26	42.08	Max Avg	Horizontal	114	355	54.0	-11.9	Pass

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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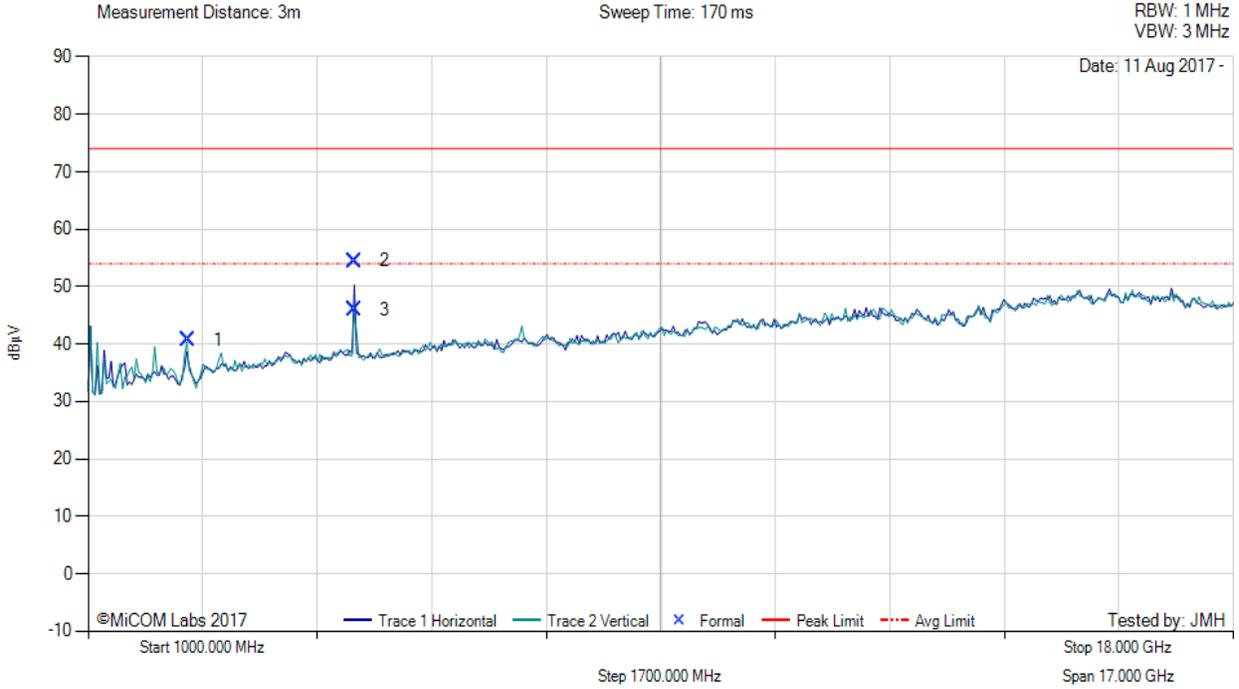


Title: HP Inc. 0960-4025 and 0960-4034
To: FCC 15.247 & IC RSS-247 (FHSS)
Serial #: MARS11-U13 FHSS Rev B WiFi/BT Module
Issue Date: 27th October 2017
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TX SPURIOUS & RESTRICTED BAND EMISSIONS

Variant: Pi_4 DQPSK, Test Freq: 2480.00 MHz, Antenna: Integral, Power Setting: 10, Duty Cycle (%): 99



1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2479.86	49.56	2.72	-11.65	40.63	Fundamental	Vertical	100	0	--	--	
2	4959.88	62.41	3.57	-11.48	54.50	Max Peak	Horizontal	116	353	74.0	-19.5	Pass
3	4959.88	53.90	3.57	-11.48	45.99	Max Avg	Horizontal	116	353	54.0	-8.0	Pass

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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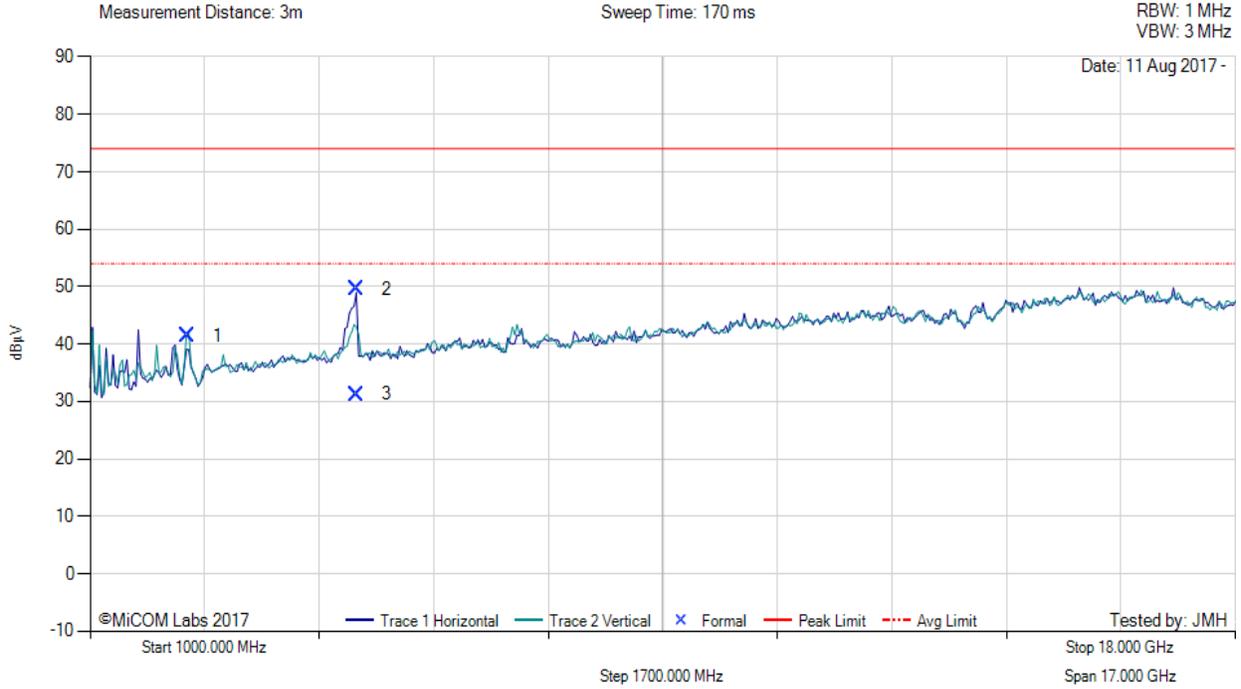


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TX SPURIOUS & RESTRICTED BAND EMISSIONS

Variant: Pi_4 DQPSK, Test Freq: Hopping, Antenna: Integral, Power Setting: 10, Duty Cycle (%): 99



1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2441.40	50.36	2.72	-11.72	41.36	Fundamental	Vertical	100	0	--	--	
2	4953.28	57.47	3.55	-11.47	49.55	Max Peak	Horizontal	167	358	74.0	-24.5	Pass
3	4953.28	39.19	3.55	-11.47	31.27	Max Avg	Horizontal	167	358	54.0	-22.7	Pass

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. Hopping

[back to matrix](#)

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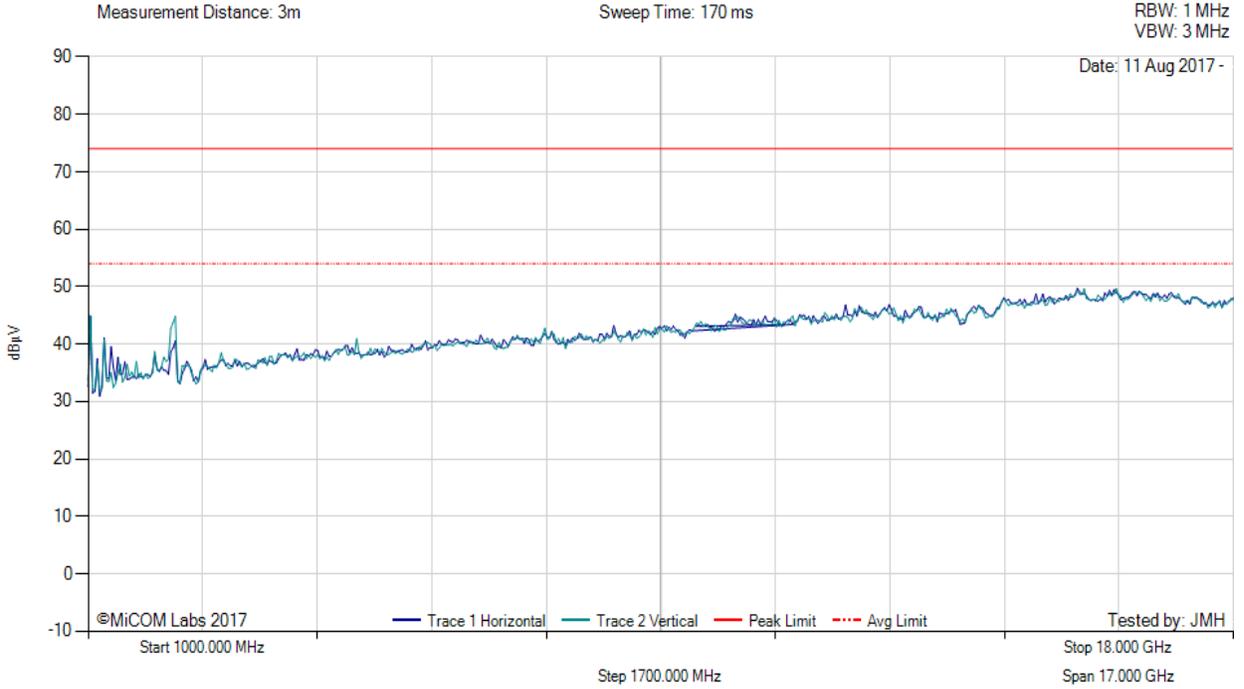


Title: HP Inc. 0960-4025 and 0960-4034
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TX SPURIOUS & RESTRICTED BAND EMISSIONS



Variant: 8DPSK, Test Freq: 2402.00 MHz, Antenna: YAGEO ANT300P002B24553, Power Setting: 10, Duty Cycle (%): 99



There are no emissions found within 6dB of the limit line.

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. 2.4 G Notch in front of amp to prevent overload

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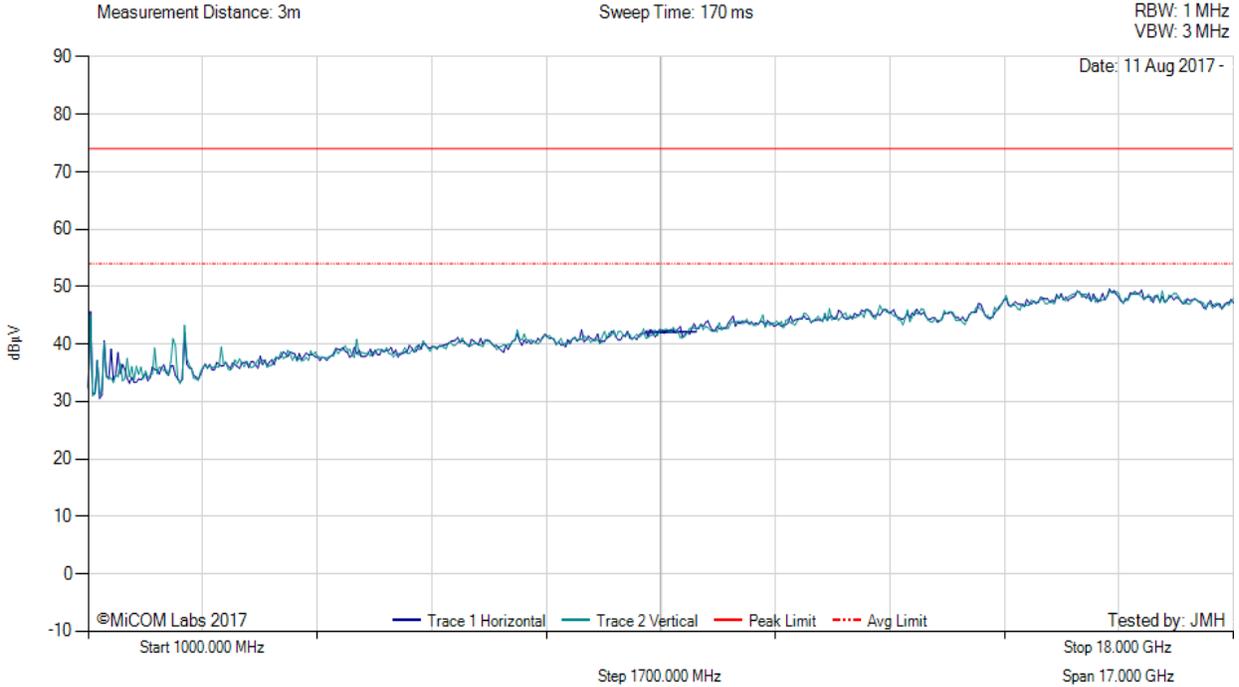


Title: HP Inc. 0960-4025 and 0960-4034
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Serial #: MARS11-U13 FHSS Rev B WiFi/BT Module
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TX SPURIOUS & RESTRICTED BAND EMISSIONS



Variant: 8DPSK, Test Freq: 2440.00 MHz, Antenna: YAGEO ANTX300P002B24553, Power Setting: 9, Duty Cycle (%): 99



There are no emissions found within 6dB of the limit line.

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. 2.4 G Notch in front of amp to prevent overload

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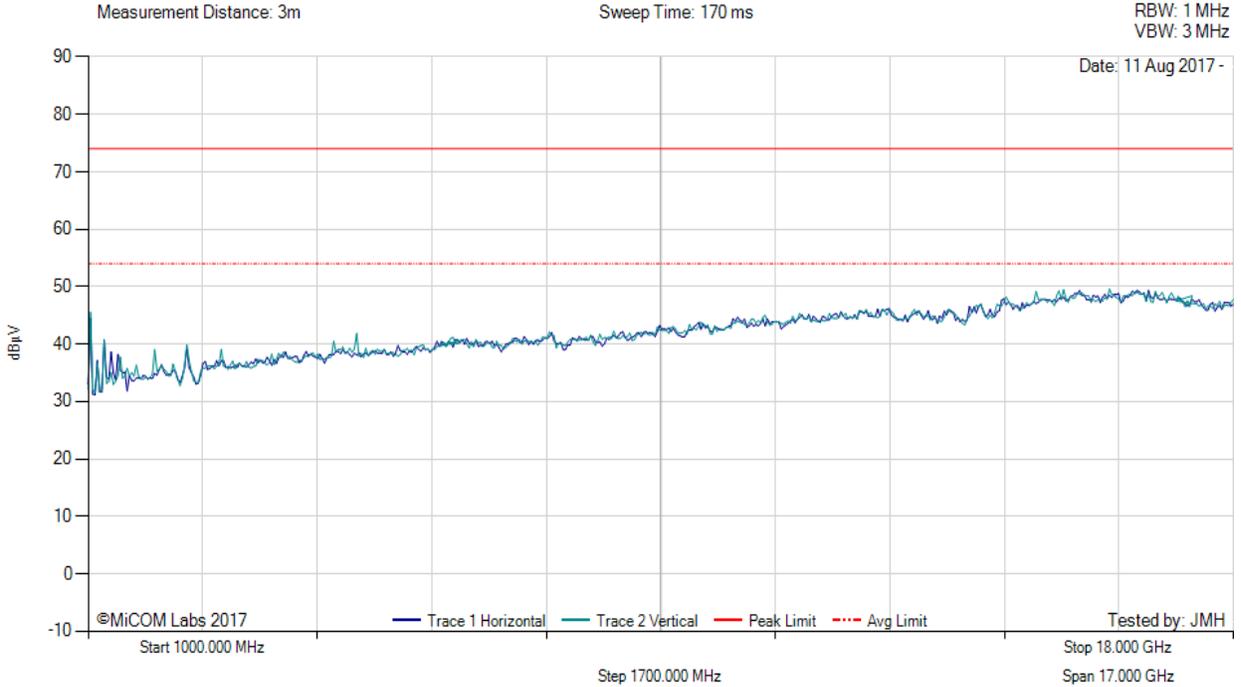


Title: HP Inc. 0960-4025 and 0960-4034
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TX SPURIOUS & RESTRICTED BAND EMISSIONS



Variant: 8DPSK, Test Freq: 2480.00 MHz, Antenna: YAGEO ANTX300P002B24553, Power Setting: 8, Duty Cycle (%): 99



There are no emissions found within 6dB of the limit line.

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. 2.4 G Notch in front of amp to prevent overload

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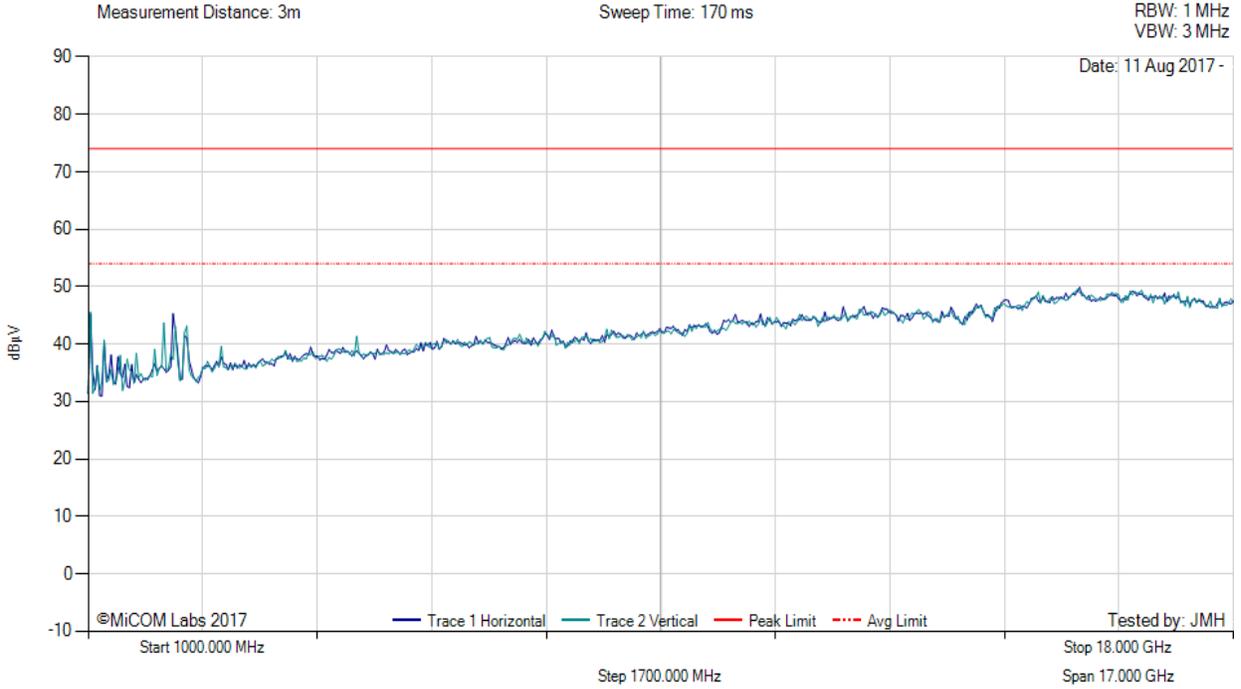


Title: HP Inc. 0960-4025 and 0960-4034
To: FCC 15.247 & IC RSS-247 (FHSS)
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TX SPURIOUS & RESTRICTED BAND EMISSIONS



Variant: 8DPSK, Test Freq: Hopping, Antenna: YAGEO ANTX300P002B24553, Power Setting: 10, Duty Cycle (%): 99



There are no emissions found within 6dB of the limit line.

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. 2.4 G Notch in front of amp to prevent overload

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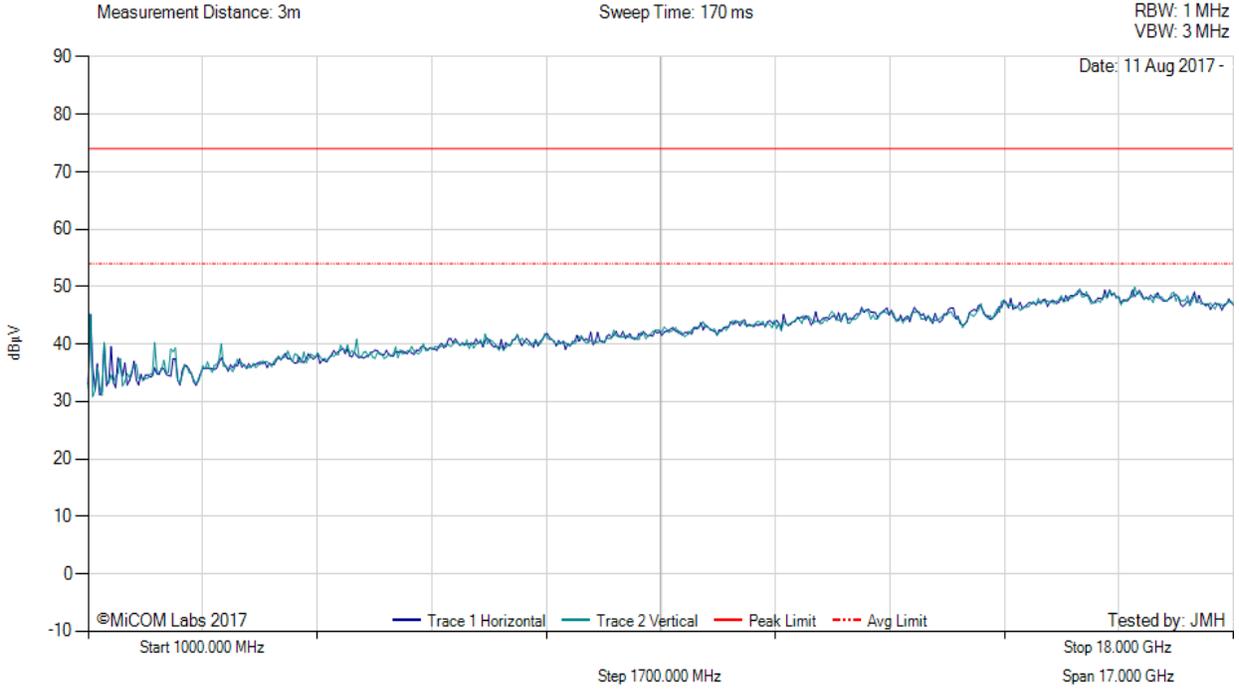


Title: HP Inc. 0960-4025 and 0960-4034
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TX SPURIOUS & RESTRICTED BAND EMISSIONS

Variant: Pi_4 DQPSK, Test Freq: 2402.00 MHz, Antenna: YAGEO ANT X300P002B24553, Power Setting: 10, Duty Cycle (%): 99



There are no emissions found within 6dB of the limit line.

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. 2.4 G Notch in front of amp to prevent overload.

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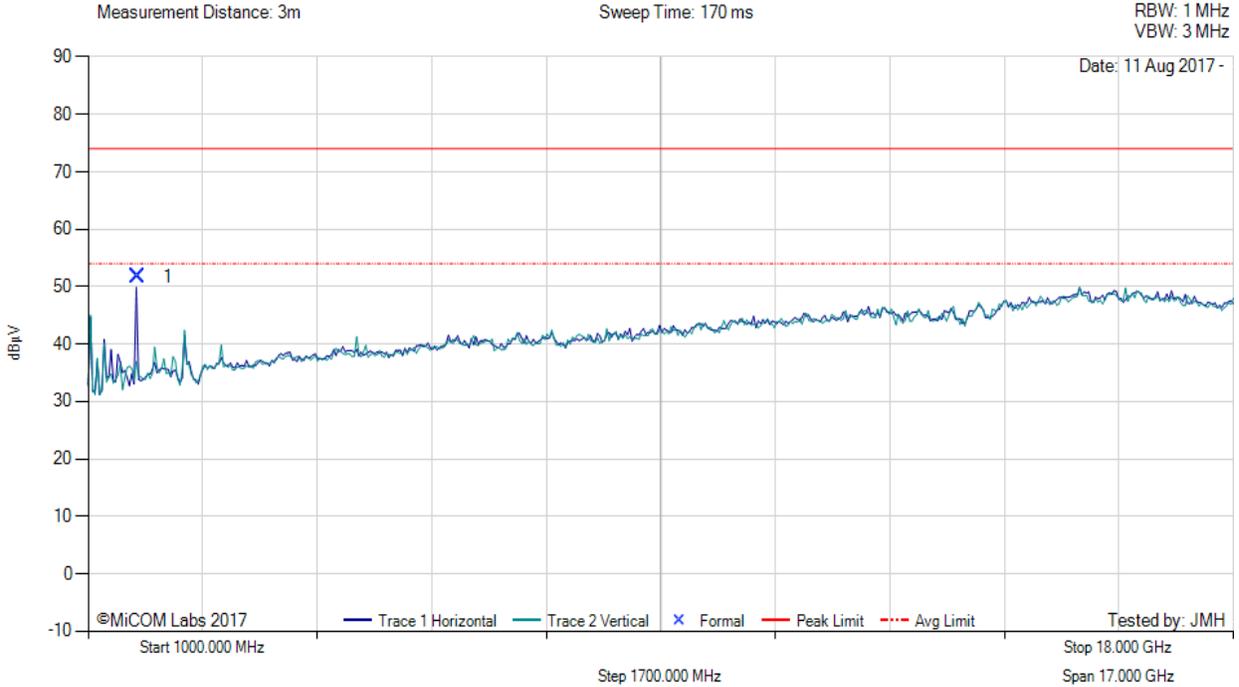


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TX SPURIOUS & RESTRICTED BAND EMISSIONS



Variant: Pi_4 DQPSK, Test Freq: 2440.00 MHz, Antenna: YAGEO ANTX300P002B24553, Power Setting: 10, Duty Cycle (%): 99



1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	1728.16	64.02	2.45	-14.71	51.76	Peak (NRB)	Horizontal	150	360	--	--	Pass

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. 2.4 G Notch in front of amp to prevent overload.

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TX SPURIOUS & RESTRICTED BAND EMISSIONS



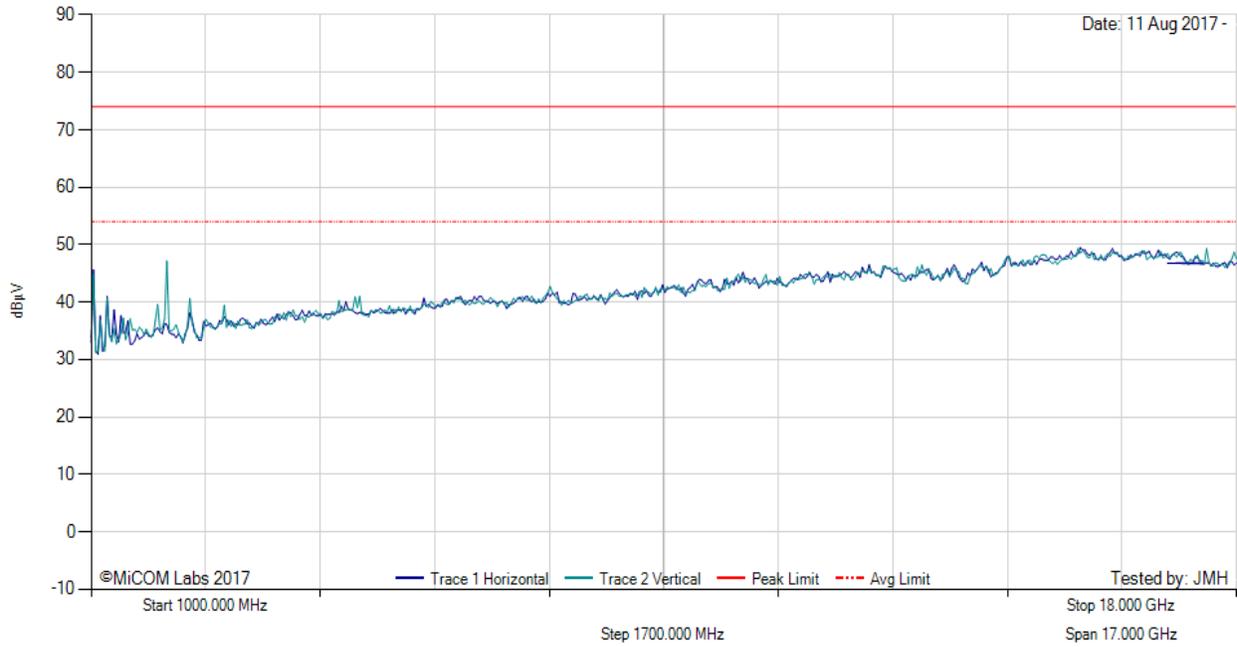
Variant: Pi_4 DQPSK, Test Freq: 2480.00 MHz, Antenna: YAGEO ANT X300P002B24553, Power Setting: 10, Duty Cycle (%): 99

Measurement Distance: 3m

Sweep Time: 170 ms

RBW: 1 MHz
VBW: 3 MHz

Date: 11 Aug 2017 -



There are no emissions found within 6dB of the limit line.

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. 2.4 G Notch in front of amp to prevent overload.

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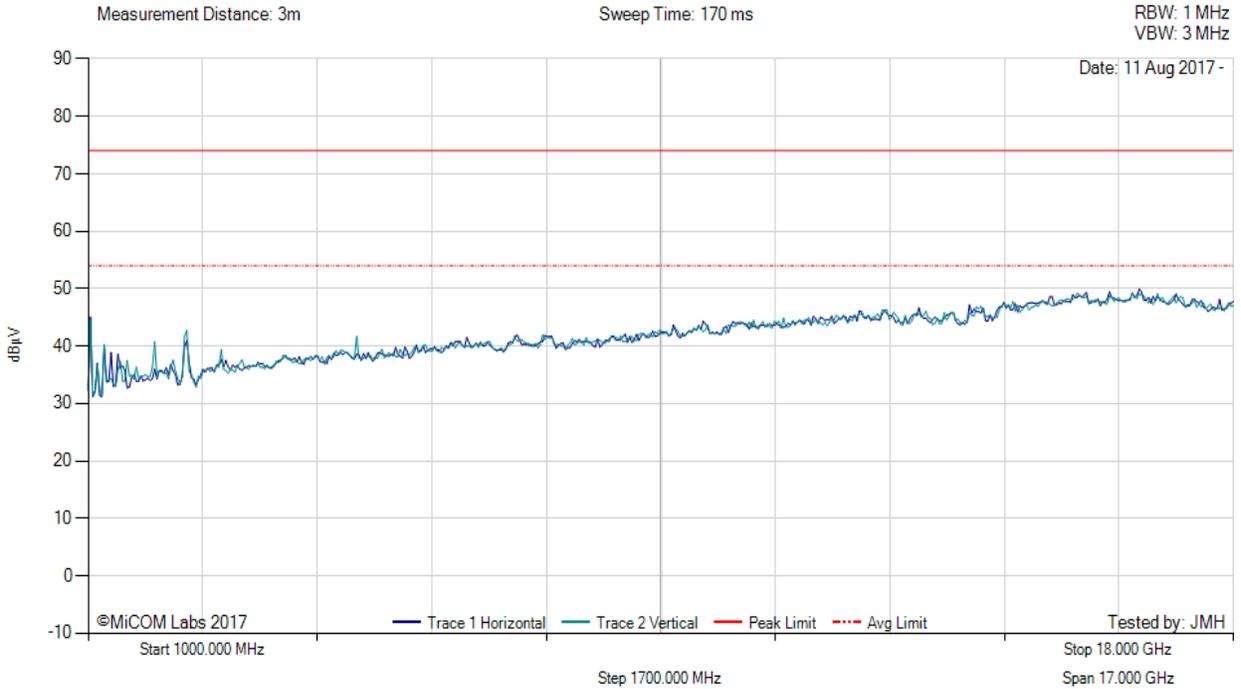


Title: HP Inc. 0960-4025 and 0960-4034
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TX SPURIOUS & RESTRICTED BAND EMISSIONS



Variant: Pi_4 DQPSK, Test Freq: Hopping, Antenna: YAGEO ANTX300P002B24553, Power Setting: 10, Duty Cycle (%): 99



There are no emissions found within 6dB of the limit line.

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. 2.4 G Notch in front of amp to prevent overload. Hopping

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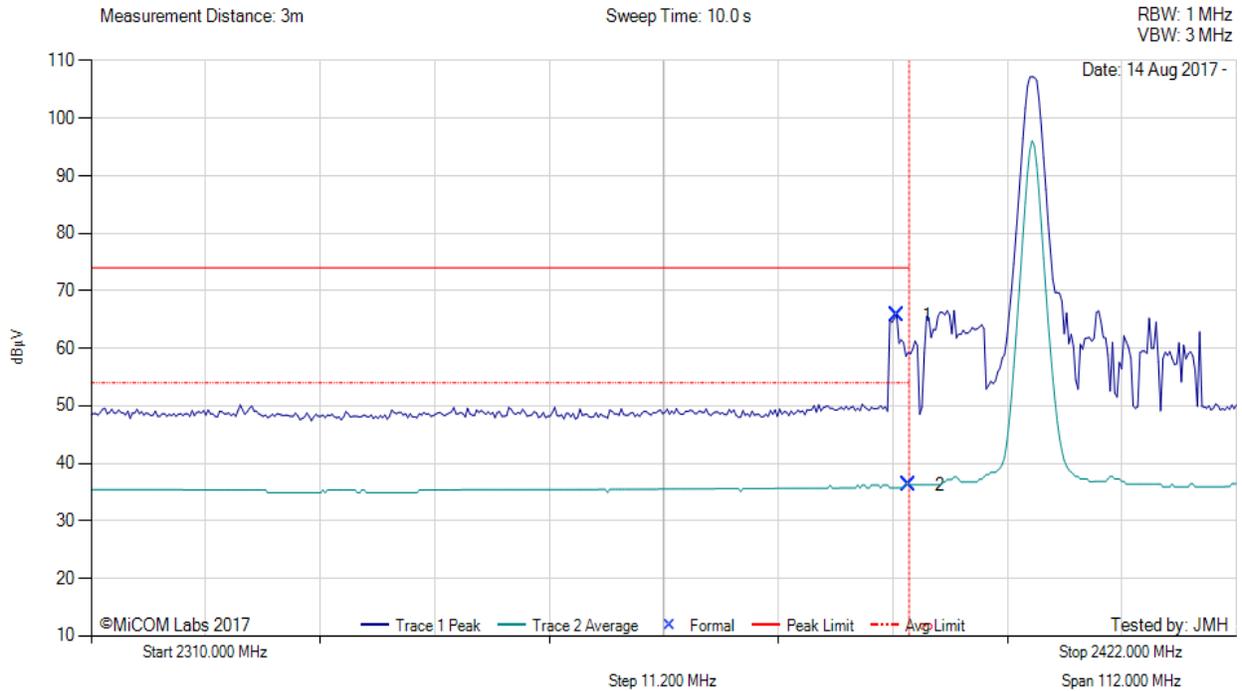


A.3.2.4. Restricted Edge & Band-Edge Emissions



RADIATED - LOWER RESTRICTED BAND-EDGE EMISSIONS

Variant: 8DPSK, Test Freq: 2402.00 MHz, Antenna: Integral, Power Setting: 10



2310.00 - 2422.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2388.78	31.01	2.68	32.04	65.73	Max Peak	Vertical	156	357	74.0	-8.3	Pass
2	2390.00	1.53	2.69	32.04	36.26	Max Avg	Vertical	156	357	54.0	-17.7	Pass
3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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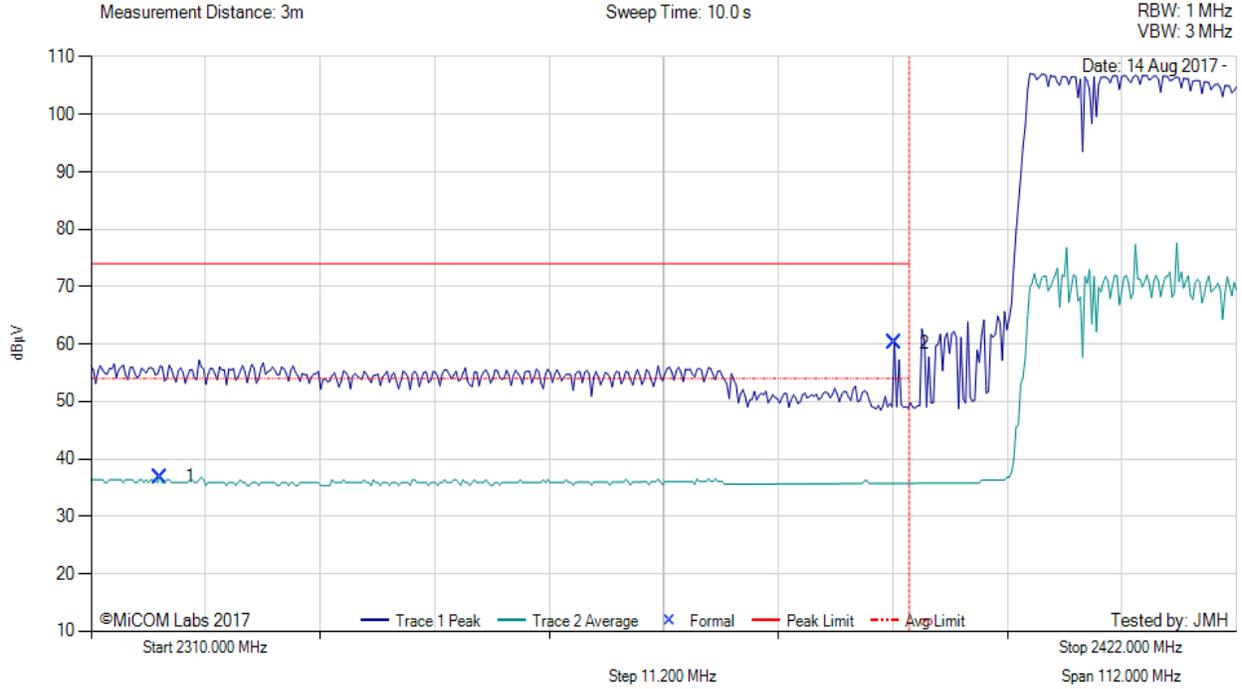


Title: HP Inc. 0960-4025 and 0960-4034
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RADIATED - LOWER RESTRICTED BAND-EDGE EMISSIONS

Variant: 8DPSK, Test Freq: Hopping, Antenna: Integral, Power Setting: 10



2310.00 - 2422.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2316.73	2.45	2.67	31.71	36.83	Max Avg	Vertical	156	357	54.0	-17.2	Pass
2	2388.56	25.43	2.68	32.04	60.15	Max Peak	Vertical	156	357	74.0	-13.9	Pass
3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. Hopping

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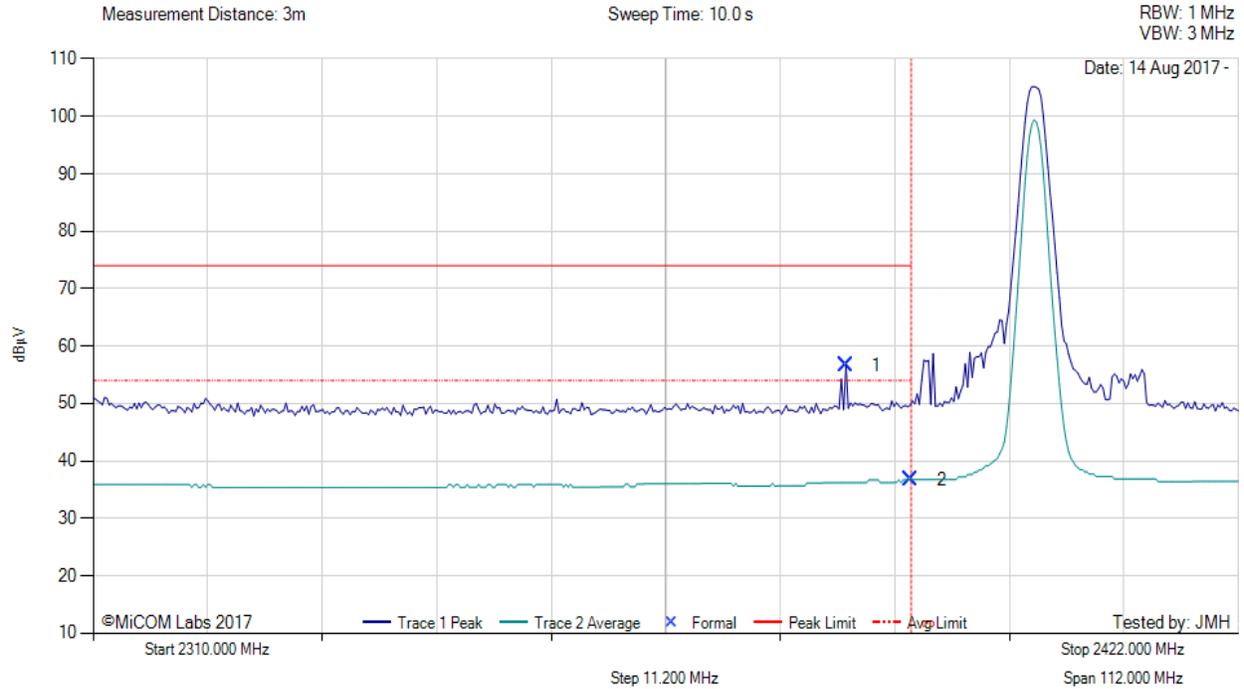


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RADIATED - LOWER RESTRICTED BAND-EDGE EMISSIONS

Variant: Pi_4 DQPSK, Test Freq: 2402.00 MHz, Antenna: Integral, Power Setting: 10



2310.00 - 2422.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2383.62	21.97	2.68	31.99	56.64	Max Peak	Vertical	156	357	74.0	-17.4	Pass
2	2390.00	2.00	2.69	32.04	36.73	Max Avg	Vertical	156	357	54.0	-17.3	Pass
3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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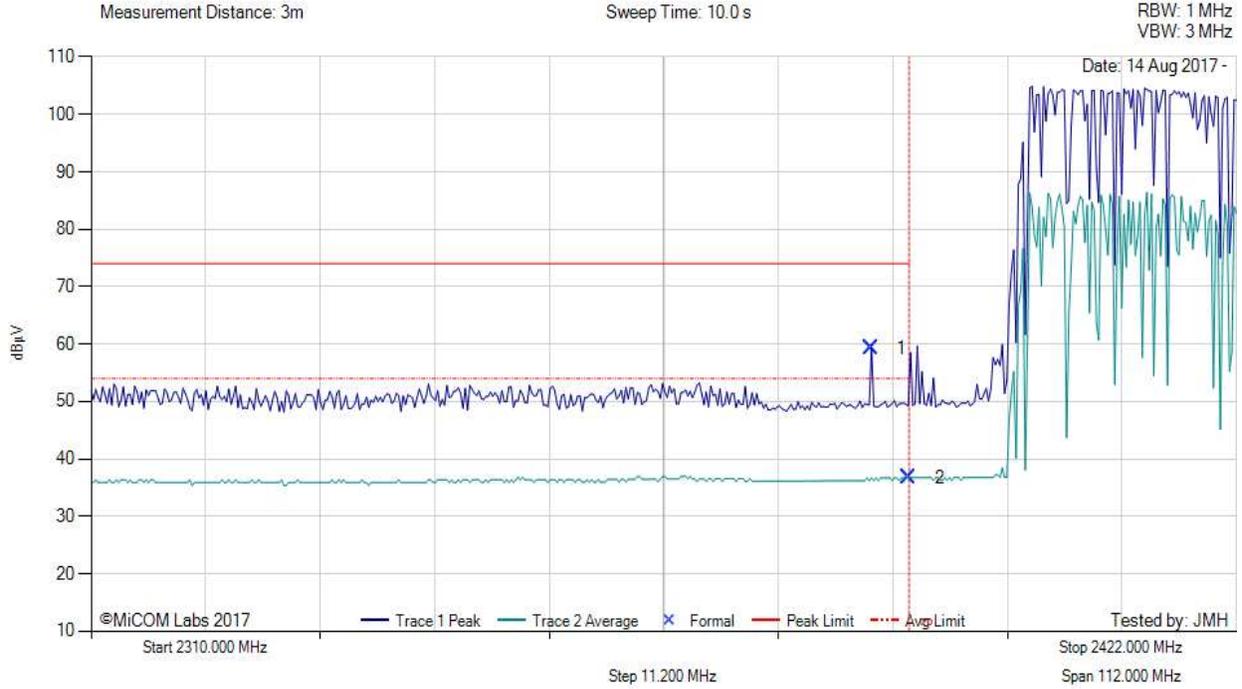


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RADIATED - LOWER RESTRICTED BAND-EDGE EMISSIONS

Variant: Pi_4 DQPSK, Test Freq: Hopping, Antenna: Integral, Power Setting: 10



2310.00 - 2422.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2386.31	24.57	2.68	32.01	59.26	Max Peak	Vertical	156	357	74.0	-14.7	Pass
2	2390.00	2.00	2.69	32.04	36.73	Max Avg	Vertical	156	357	54.0	-17.3	Pass
3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. Hopping

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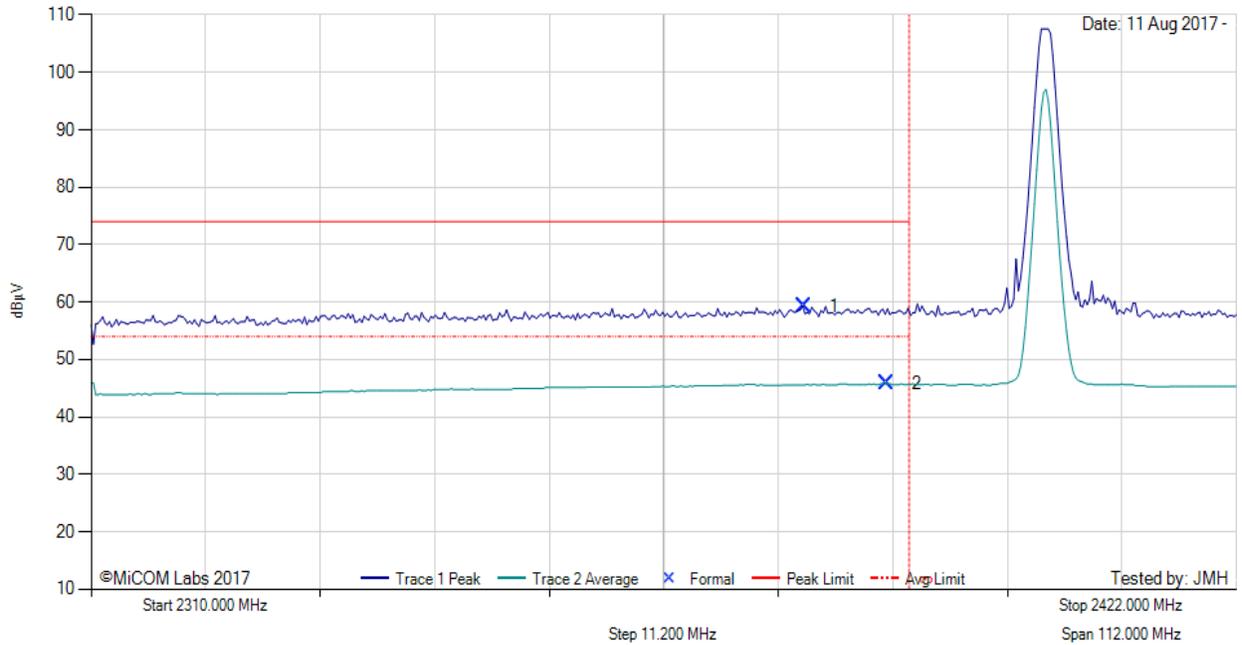
RADIATED - LOWER RESTRICTED BAND-EDGE EMISSIONS

Variant: 8DPSK, Test Freq: 2402.00 MHz, Antenna: YAGEO ANTX300P002B24553, Power Setting: 10, Duty Cycle (%): 99

Measurement Distance: 3m

Sweep Time: 10.0 s

RBW: 1 MHz
VBW: 3 MHz



2310.00 - 2422.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2379.68	24.69	2.69	31.96	59.34	Max Peak	Vertical	195	361	74.0	-14.7	Pass
2	2387.76	11.08	2.68	32.03	45.79	Max Avg	Vertical	195	361	54.0	-8.2	Pass
3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

[back to matrix](#)

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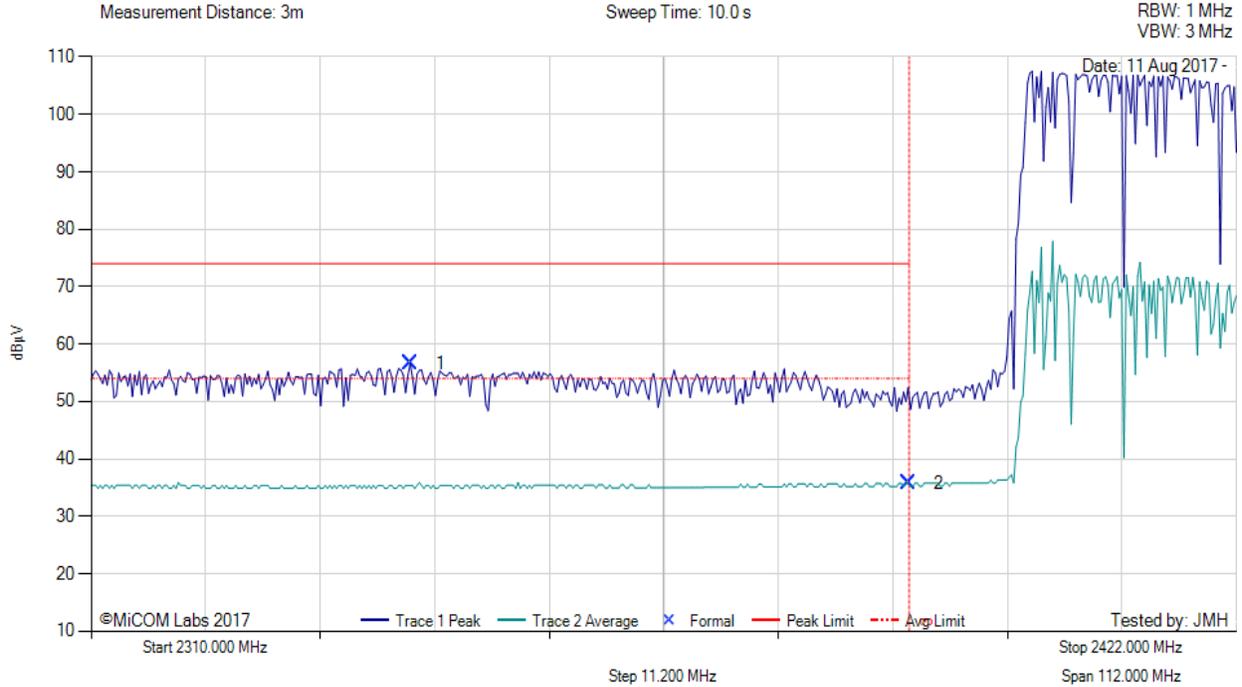


Title: HP Inc. 0960-4025 and 0960-4034
To: FCC 15.247 & IC RSS-247 (FHSS)
Serial #: MARS11-U13 FHSS Rev B WiFi/BT Module
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RADIATED - LOWER RESTRICTED BAND-EDGE EMISSIONS

Variant: 8DPSK, Test Freq: Hopping, Antenna: YAGEO ANT300P002B24553, Power Setting: 10, Duty Cycle (%): 99



2310.00 - 2422.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2341.20	22.18	2.68	31.70	56.56	Max Peak	Vertical	195	361	74.0	-17.4	Pass
2	2389.90	1.04	2.69	32.04	35.77	Max Avg	Vertical	195	361	54.0	-18.2	Pass
3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. Hopping

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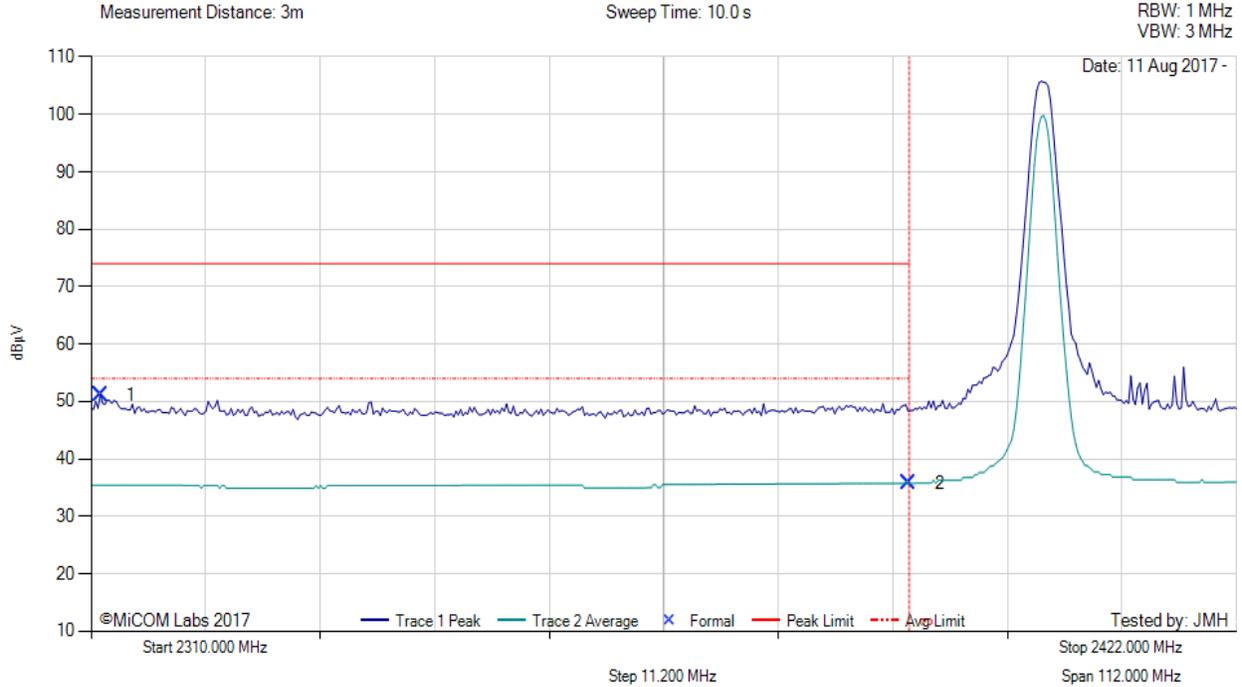


Title: HP Inc. 0960-4025 and 0960-4034
To: FCC 15.247 & IC RSS-247 (FHSS)
Serial #: MARS11-U13 FHSS Rev B WiFi/BT Module
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RADIATED - LOWER RESTRICTED BAND-EDGE EMISSIONS

Variant: Pi_4 DQPSK, Test Freq: 2402.00 MHz, Antenna: YAGEO ANTX300P002B24553, Power Setting: 10, Duty Cycle (%): 99



2310.00 - 2422.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2310.90	16.76	2.67	31.72	51.15	Max Peak	Vertical	195	361	74.0	-22.9	Pass
2	2390.00	1.04	2.69	32.04	35.77	Max Avg	Vertical	195	361	54.0	-18.2	Pass
3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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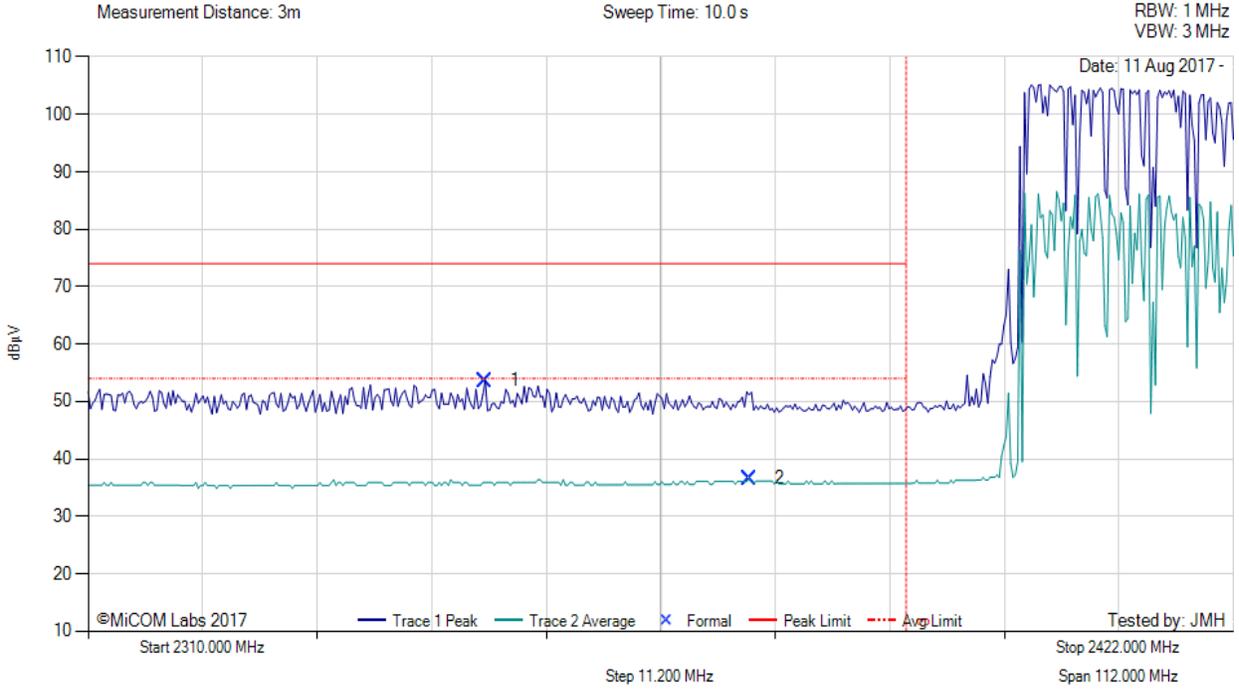


Title: HP Inc. 0960-4025 and 0960-4034
To: FCC 15.247 & IC RSS-247 (FHSS)
Serial #: MARS11-U13 FHSS Rev B WiFi/BT Module
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RADIATED - LOWER RESTRICTED BAND-EDGE EMISSIONS



Variant: Pi_4 DQPSK, Test Freq: Hopping, Antenna: YAGEO ANTX300P002B24553, Power Setting: 10, Duty Cycle (%): 99



2310.00 - 2422.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2348.83	19.33	2.65	31.69	53.67	Max Peak	Vertical	195	361	74.0	-20.3	Pass
2	2374.64	1.99	2.70	31.91	36.60	Max Avg	Vertical	195	361	54.0	-17.4	Pass
3	2390.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. Hopping

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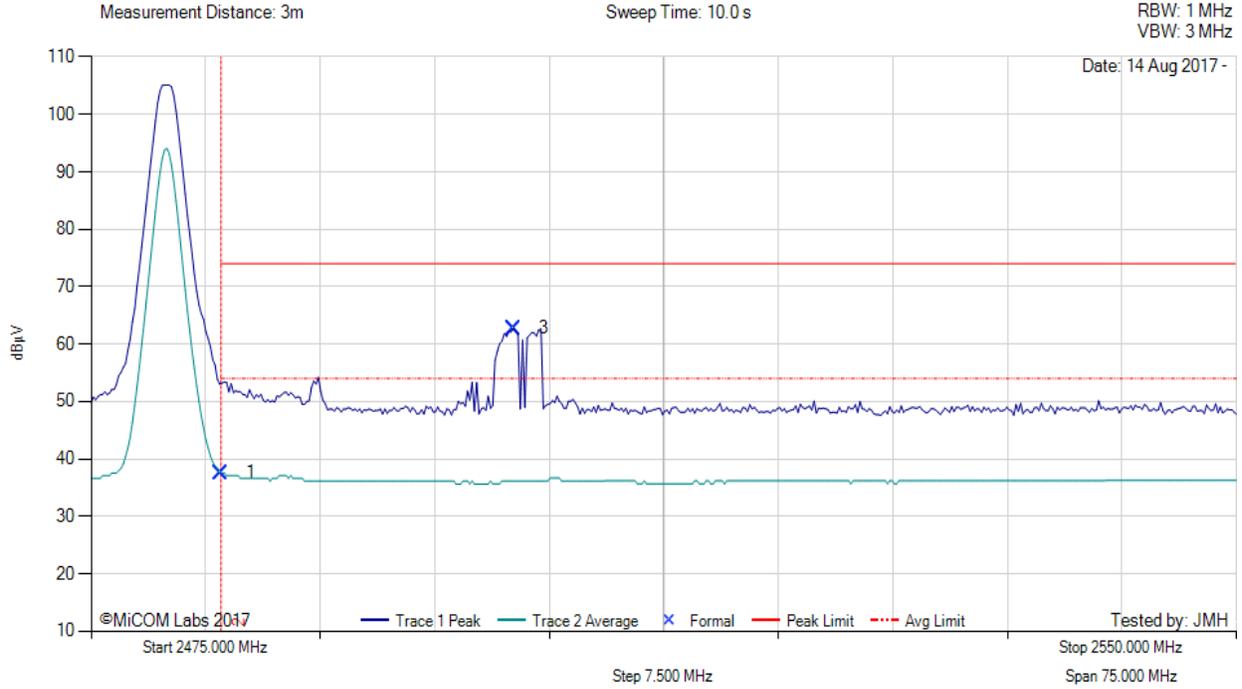


Title: HP Inc. 0960-4025 and 0960-4034
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RADIATED - UPPER RESTRICTED BAND-EDGE EMISSIONS

Variant: 8DPSK, Test Freq: 2480.00 MHz, Antenna: Integral, Power Setting: 8



2475.00 - 2550.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2483.50	2.46	2.73	32.37	37.56	Max Avg	Vertical	151	274	54.0	-16.4	Pass
3	2502.66	27.62	2.73	32.40	62.75	Max Peak	Vertical	151	274	74.0	-11.3	Pass
2	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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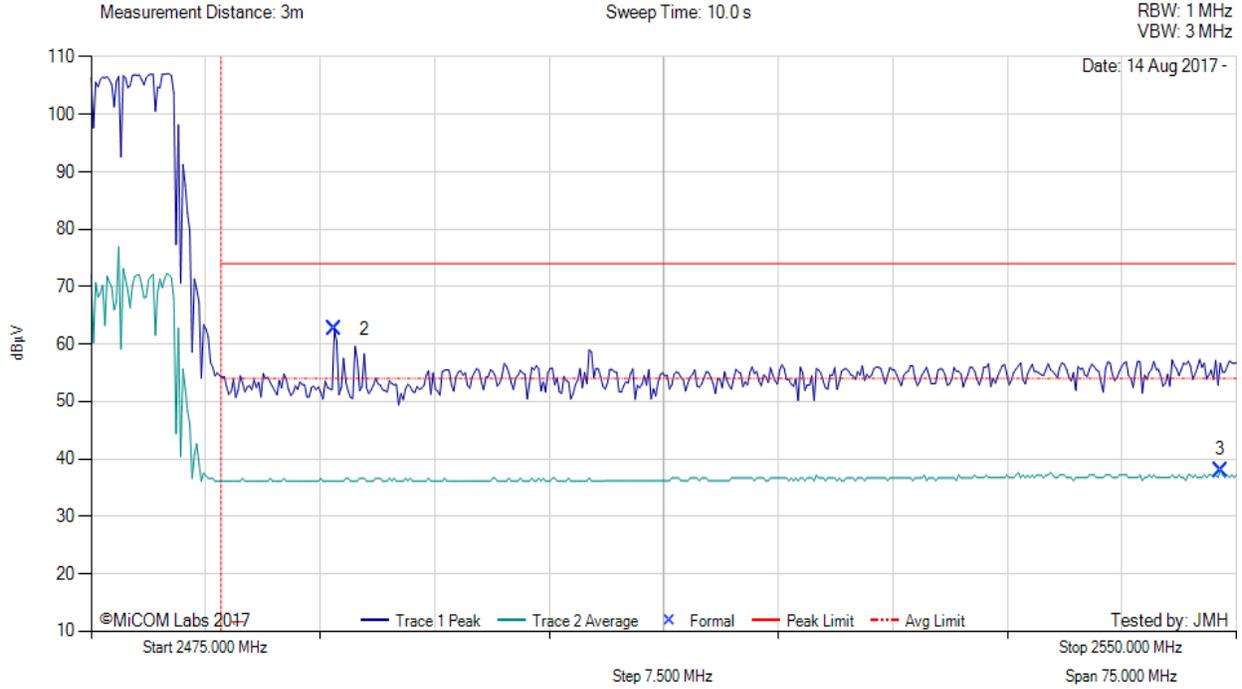


Title: HP Inc. 0960-4025 and 0960-4034
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RADIATED - UPPER RESTRICTED BAND-EDGE EMISSIONS

Variant: 8DPSK, Test Freq: Hopping, Antenna: Integral, Power Setting: 8



2475.00 - 2550.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
2	2490.93	27.44	2.74	32.38	62.56	Max Peak	Vertical	151	274	74.0	-11.4	Pass
3	2548.95	2.86	2.75	32.49	38.10	Max Avg	Vertical	151	274	54.0	-15.9	Pass
1	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. Hopping

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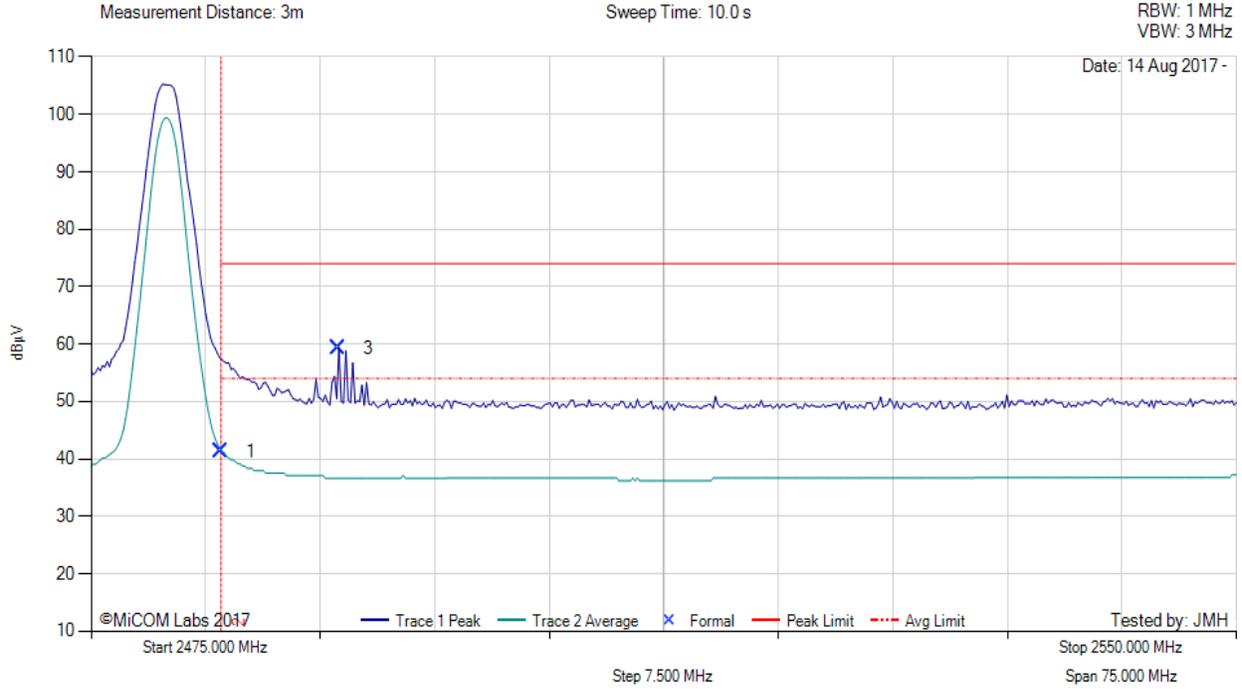


Title: HP Inc. 0960-4025 and 0960-4034
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RADIATED - UPPER RESTRICTED BAND-EDGE EMISSIONS

Variant: Pi_4 DQPSK, Test Freq: 2480.00 MHz, Antenna: Integral, Power Setting: 10



2475.00 - 2550.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2483.50	6.27	2.73	32.37	41.37	Max Avg	Vertical	151	274	54.0	-12.6	Pass
3	2491.17	24.22	2.74	32.38	59.34	Max Peak	Vertical	151	274	74.0	-14.7	Pass
2	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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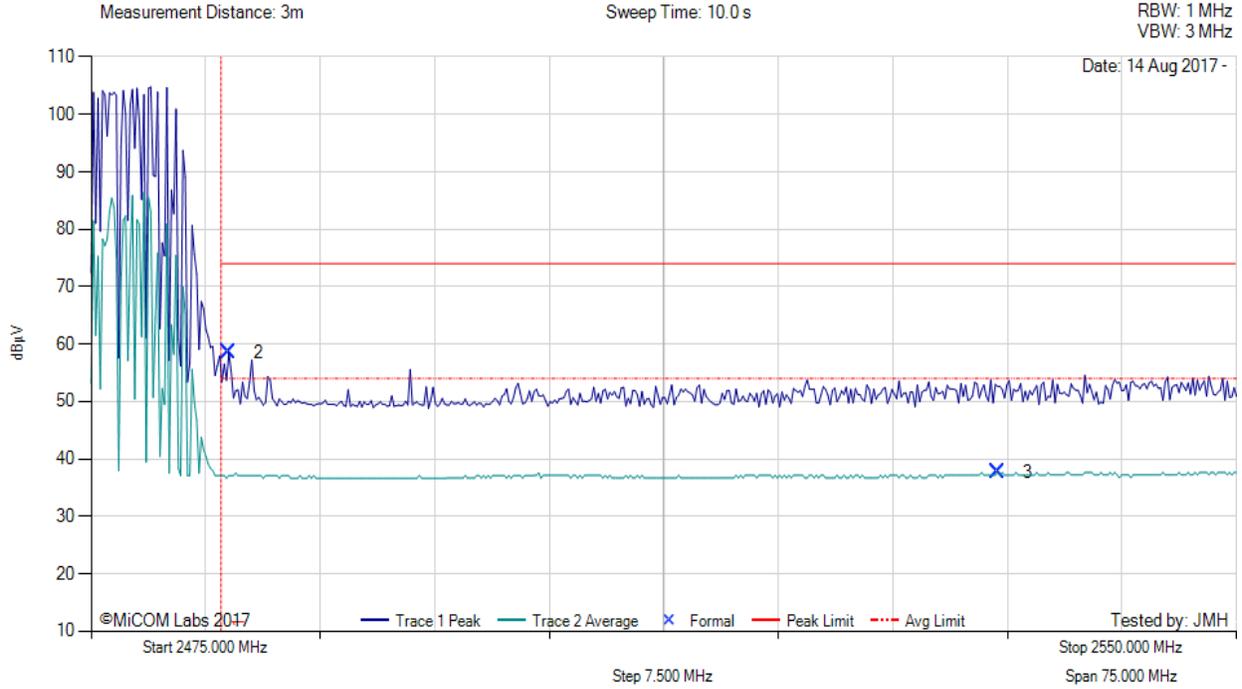


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RADIATED - UPPER RESTRICTED BAND-EDGE EMISSIONS

Variant: Pi_4 DQPSK, Test Freq: Hopping, Antenna: Integral, Power Setting: 10



2475.00 - 2550.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
2	2484.02	23.41	2.73	32.37	58.51	Max Peak	Vertical	151	274	74.0	-15.5	Pass
3	2534.37	2.45	2.74	32.46	37.65	Max Avg	Vertical	151	274	54.0	-16.4	Pass
1	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. Hopping

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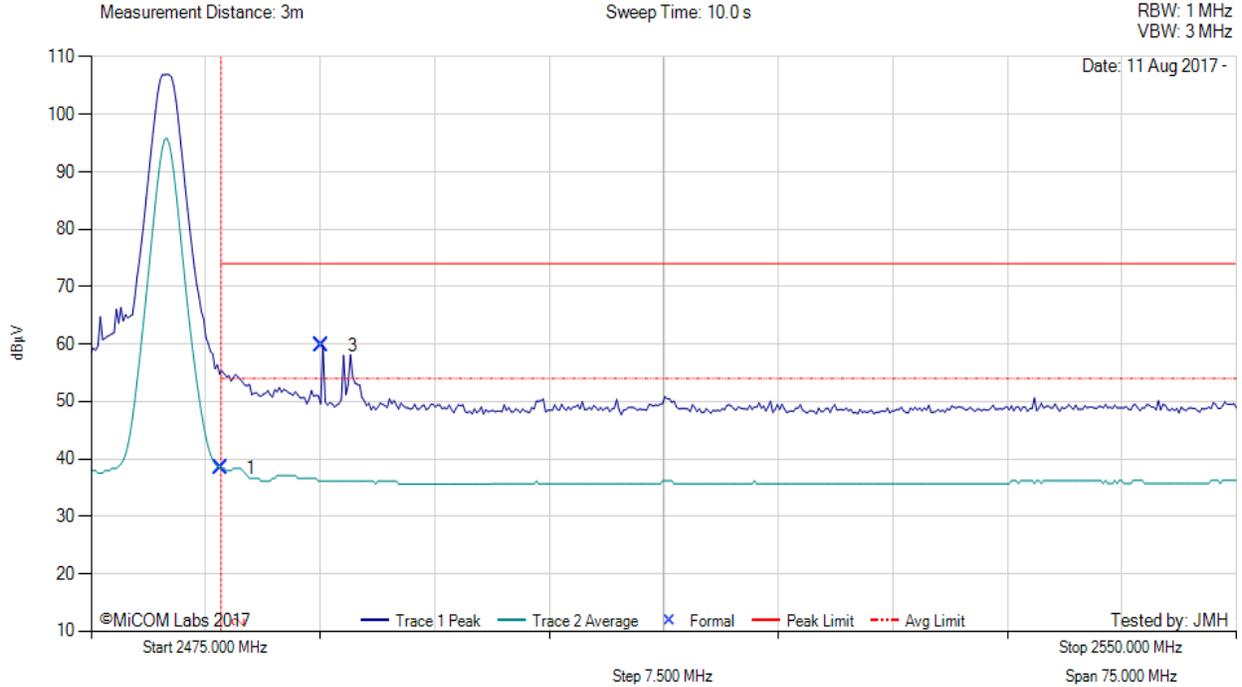


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RADIATED - UPPER RESTRICTED BAND-EDGE EMISSIONS



Variant: 8DPSK, Test Freq: 2480.00 MHz, Antenna: YAGEO ANTX300P002B24553, Power Setting: 10, Duty Cycle (%): 99



2475.00 - 2550.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2483.50	3.29	2.73	32.37	38.39	Max Avg	Vertical	162	49	54.0	-15.6	Pass
3	2490.11	24.66	2.74	32.38	59.78	Max Peak	Vertical	162	49	74.0	-14.2	Pass
2	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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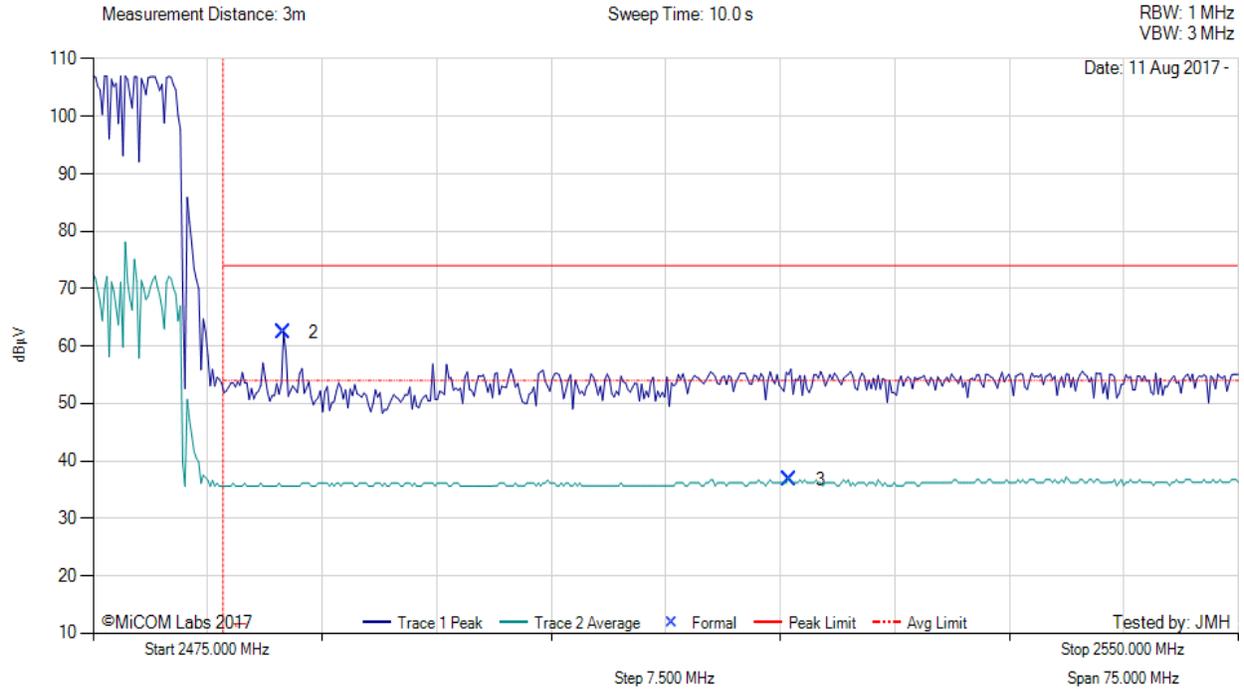


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RADIATED - UPPER RESTRICTED BAND-EDGE EMISSIONS



Variant: 8DPSK, Test Freq: Hopping, Antenna: YAGEO ANT300P002B24553, Power Setting: 10, Duty Cycle (%): 99



2475.00 - 2550.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
2	2487.47	27.23	2.73	32.37	62.33	Max Peak	Vertical	162	49	74.0	-11.7	Pass
3	2520.62	1.53	2.74	32.44	36.71	Max Avg	Vertical	162	49	54.0	-17.3	Pass
1	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. Hopping

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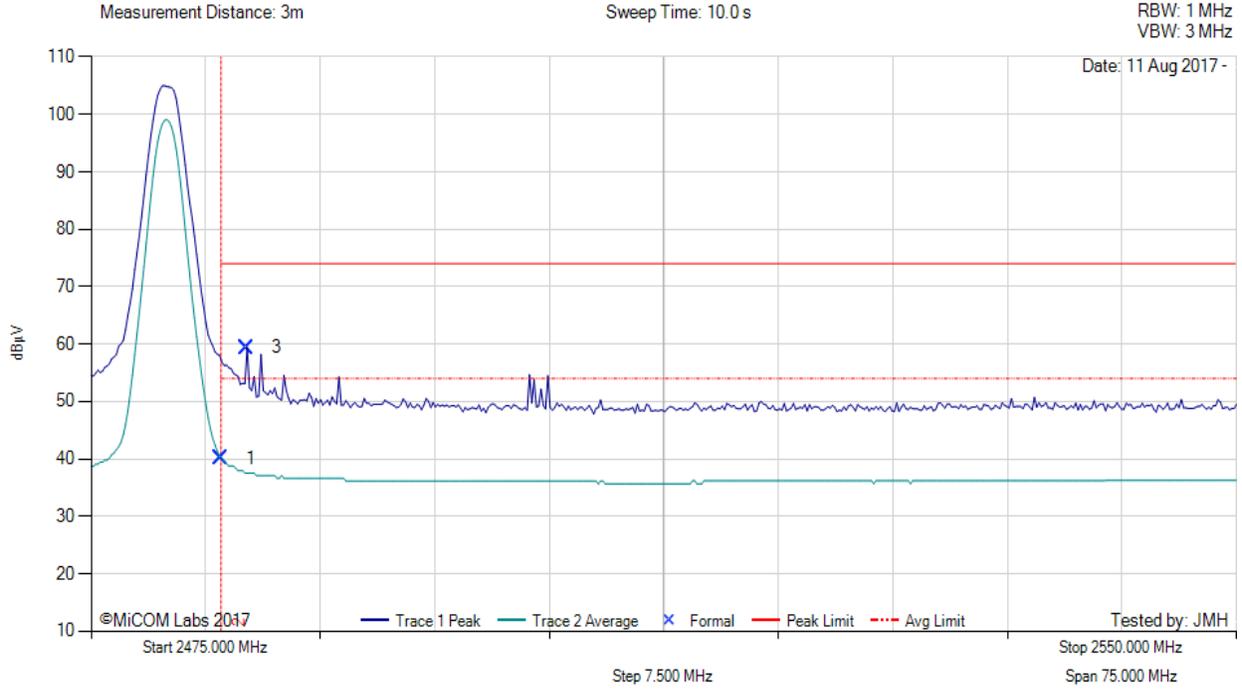


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RADIATED - UPPER RESTRICTED BAND-EDGE EMISSIONS

Variant: Pi_4 DQPSK, Test Freq: 2480.00 MHz, Antenna: YAGEO ANTX300P002B24553, Power Setting: 10, Duty Cycle (%): 99



2475.00 - 2550.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2483.50	5.07	2.73	32.37	40.17	Max Avg	Vertical	162	49	54.0	-13.8	Pass
3	2485.15	24.30	2.73	32.37	59.40	Max Peak	Vertical	162	49	74.0	-14.6	Pass
2	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot.

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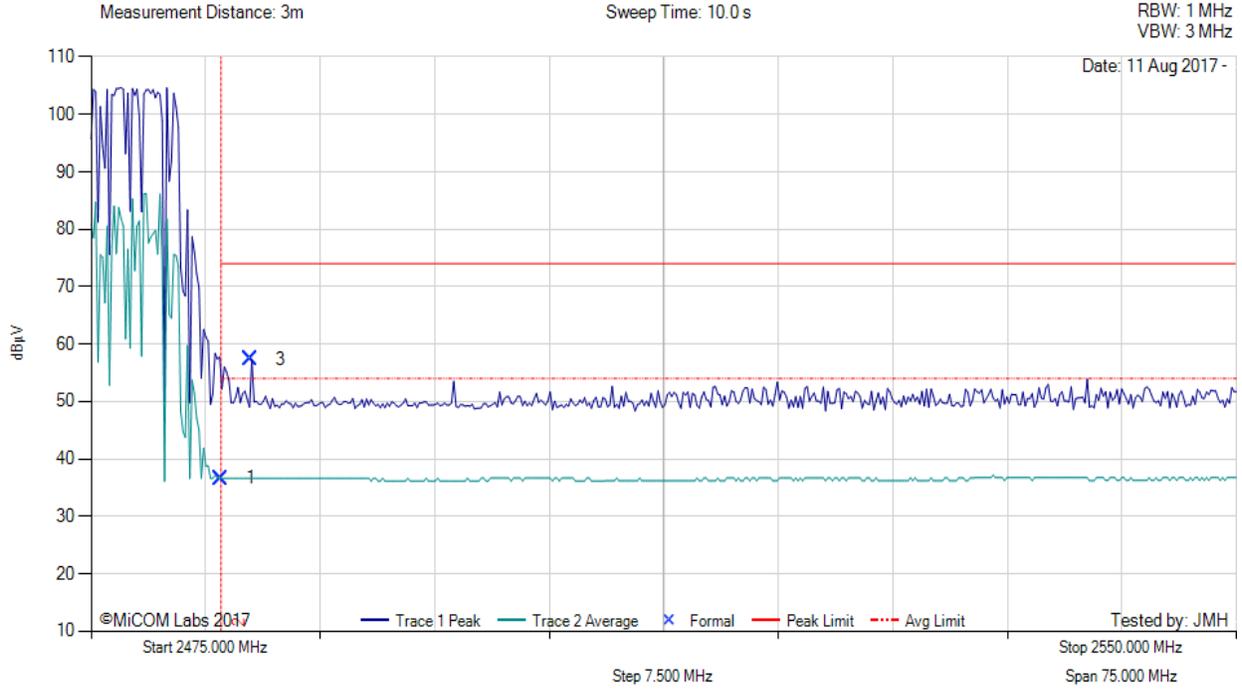


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RADIATED - UPPER RESTRICTED BAND-EDGE EMISSIONS



Variant: Pi_4 DQPSK, Test Freq: Hopping, Antenna: YAGEO ANTX300P002B24553, Power Setting: 10, Duty Cycle (%): 99



2475.00 - 2550.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2483.50	1.54	2.73	32.37	36.64	Max Avg	Vertical	162	49	54.0	-17.4	Pass
3	2485.45	22.20	2.73	32.37	57.30	Max Peak	Vertical	162	49	74.0	-16.7	Pass
2	2483.50	--	--	--	--	Restricted-Band	--	--	--	--	--	--

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. Hopping

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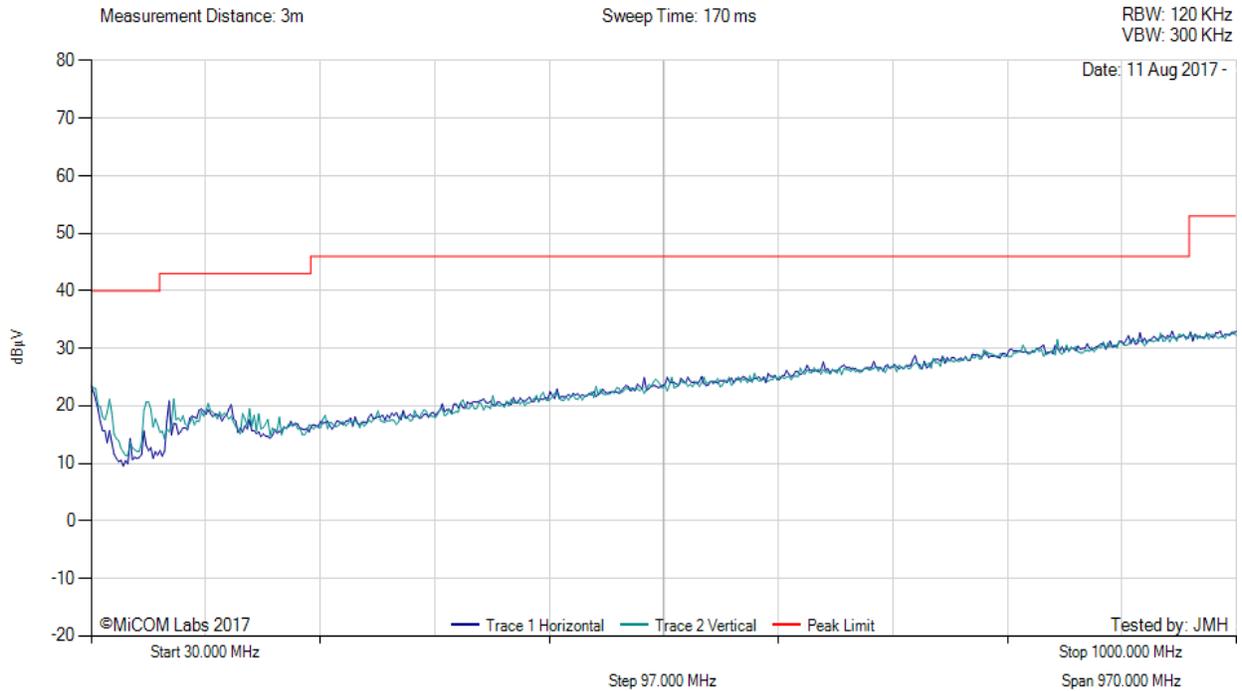


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A.3.3. Digital Emissions (0.03 - 1 GHz)



Variant: FHSS, Test Freq: 2439.00 MHz, Power Setting: 10



There are no emissions found within 6dB of the limit line.

Test Notes: EUT powered by 5V ps, connected to Laptop via SD slot. Laptop put in suspend mode to limit 50 MHz harmonics.

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