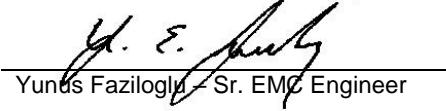




BUREAU
VERITAS

Curtis-Straus LLC, a wholly owned subsidiary of BV CPS

Test Report

Report No	ER2499-6
Client	Harman International Industries, Inc. Mark Bowman
Address	30001 Cabot Drive Novi, MI 48377
Phone	248-254-7751
Items tested	G31 MID
FCC ID	2AHPN-BE2833
IC	6434C-BE2833
FRN	0026894154
Equipment Type	Part 15 Spread Spectrum Transmitter
Equipment Code	DSS
FCC/IC Rule Parts	CFR Title 47 FCC Part 15.247, ISED Canada RSS-247 Issue 2
Test Dates	September 22 - October 17, 2017
Results	As detailed within this report
Prepared by	 Zachary Johnson - Test Engineer
Authorized by	 Yunus Faziloglu - Sr. EMC Engineer
Issue Date	<u>10\26\2017</u>
Conditions of Issue	This Test Report is issued subject to the conditions stated in the 'Conditions of Testing' section on page 16 of this report.

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Report REV Sep-08-2017 - YF



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Summary

This test report supports an application for certification of a transmitter operating pursuant to:
CFR Title 47 FCC Part 15.247, ISED Canada RSS-247 Issue 2

The product is the G31 MID. It is a frequency hopping spread spectrum transmitter that operates in the 2402 – 2480MHz frequency range. This report covers the Bluetooth portion of the device.

Antenna Type: Switching PCB trace antenna

Gain: 1.18dBi maximum in 2.4GHz – 2.5GHz band

We found that the product met the above requirements without modification.

Test samples were received in good condition.



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Test Methodology

All testing was performed according to the following rules/procedures/documents; CFR 47 Part 15.247, RSS-247 Issue 2, RSS-Gen Issue 4 and ANSI C63.10-2013.

Radiated emissions were maximized by measuring the device in normal operating position, as well as varying the test antenna's height and polarity.

EUT operating voltage is 11-16V DC

The following bandwidths were used during radiated spurious and AC line conducted emissions testing.

Frequency	RBW	VBW
0.15-30MHz	9kHz	30kHz
30-1000MHz	120kHz	1MHz
1-25GHz	1MHz	3MHz



Product Tested - Configuration Documentation

EUT Configuration										
Work Order:	R2499									
Company:	Harman International Industries, Incorporated									
Company Address:	30001 Cabot Drive									
	Novi, MI, 48377									
Contact:	Mark Bowman									
EUT:	MN	G31 MID			PN	--			SN	--
EUT Description:	Car Stereo System									
EUT Components	MN								SN	
Back up camera	--								--	
FM/AM antenna	--								--	
Support Equipment	MN								SN	
CS Supplied Laptop.	--								--	
USB to Ethernet Converter	--								--	
13.5Vdc Power Supply	--								--	
Port Label	Port Type	# ports	# populated	cable type	shielded	ferrites	length (m)	in/out	under test	comment
DC main	Power DC	2	2	Power DC	No	No	1.2	in	yes	
Audio		1	1	-	Yes	No	3	in	yes	
USB	USB	3	1	USB	Yes	No	1	in	yes	
xm/Dab connection		1	1	Coaxial	Yes	No	1.2	in	yes	
FM/AM antenna	-	1	1		Yes	No	0.4	in	yes	
Back up camera		1	1		Yes	No	0.3	in	yes	
Next Gen port	-	1	0	-				in	no	
Software Operating Mode Description:										
EUT will be operating in a test mode for Immunity tests, RX for non intentional REMI, and Constant TX internal mode for Spurious.										
Performance Criteria:										
EUT will connect to CMW and preform less than 10% PER during test.BT- EUT will connect to tablet or CMW over bluetooth and stay connected at appropriate distance.										



Statement of Conformity

RSS-GEN	RSP-100	RSS 247	Part 15	Comments
6.3			15.15(b)	There are no controls accessible to the user that varies the output power to operate in violation of the regulatory requirements.
	3.1		15.19	The label is shown in the label exhibit.
	4		15.21	Information to the user is shown in the instruction manual exhibit.
			15.27	No special accessories are required for compliance.
3, 6.1			15.31	The EUT was tested in accordance with the measurement standards in this section.
6.13			15.33	Frequency range was investigated according to this section, unless noted in specific rule section under which the equipment operates.
8.1			15.35	The EUT emissions were measured using the measurement detector and bandwidth specified in this section, unless noted in specific rule section under which the equipment operates.
8.3			15.203	EUT employs single switching PCB trace antenna with maximum 1.18dBi gain
8.10			15.205 15.209	The fundamental is not in a Restricted band and the spurious and harmonic emissions in the Restricted bands comply with the general emission limits of 15.209 or RSS-Gen as applicable
8.8			15.207	N/A. Unit is powered by a vehicle battery only.

Refer to Appendix A of this report for antenna port conducted measurements.



Test Results

Radiated Spurious Emissions

LIMITS

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

[15.247(d)]

Device was measured in normal operating position.

MEASUREMENTS / RESULTS

Curtis Straus - a Bureau Veritas Company			Work Order - R2499						
Radiated Emissions Electric Field 3m Distance			EUT Power Input - 12VDC						
30-1000MHz Vertical Data			Test Site - CH1						
Operator: Mike Leonard			Temp; Humid; Pres - 23°C; 39%RH; 1010mBar						
EUT is running Bluetooth			Witnessed by - N/A						
Hopping VIA CMW									
Frequency	Raw QP Reading	Correction Factor	Adjusted QP		Margin Req 1	Test Results Req 1	Antenna Height	EUT Azimuth	Worst Margin Req 1
			Amplitude	Limit Req 1					
MHz	(dB μ V)	(dB/m)	(dB μ V/m)	(dB μ V/m)	(dB)	(Pass/Fail)	(cm)	(degrees)	(dB)
30.712	40.8	-15	25.9	40	-14.1	PASS	143	6	
37.69	40.1	-20.9	19.2	40	-20.8	PASS	125	78	
420.018	48.4	-17.4	31	46	-15.1	PASS	125	340	
720.003	51.3	-12.1	39.2	46	-6.8	PASS	112	223	-6.8
957.507	34.1	-9.1	25.1	46	-21	PASS	174	292	
960.033	45.5	-9	36.5	54	-17.5	PASS	186	79	



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Curtis Straus - a Bureau Veritas Company				Work Order - R2499							
Radiated Emissions Electric Field 3m Distance				EUT Power Input - 12VDC							
30-1000MHz Horizontal Data				Test Site - CH1							
Operator: Mike Leonard				Temp; Humid; Pres - 23°C; 39%RH; 1010mBar							
EUT is running Bluetooth				Witnessed by - N/A							
Hopping VIA CMW											
Frequency	Raw QP Reading	Correction Factor	Adjusted QP		Limit Req 1	Margin Req 1	Test Results		Antenna Height	EUT Azimuth	Worst Margin Req 1
			Amplitude	1			Req 1	Req 1			
MHz	(dB μ V)	(dB/m)	(dB μ V/m)	(dB μ V/m)	(dB)	(dB)	(Pass/Fail)	(cm)	(degrees)	(dB)	
30.638	40.5	-14.9	25.6	40	-14.4	PASS		224		34	
478.994	44.9	-16.1	28.8	46	-17.3	PASS		243		184	
479.032	45.9	-16.1	29.8	46	-16.2	PASS		202		205	
720.006	55.1	-12.1	43	46	-3	PASS		229		251	-3
958.507	39.3	-9	30.2	46	-15.8	PASS		110		103	
960.011	51.2	-9	42.2	54	-11.7	PASS		104		67	

30-1000MHz Mid Channel

Curtis Straus - a Bureau Veritas Company				Work Order - R2499							
Radiated Emissions Electric Field 3m Distance				EUT Power Input - 13.8V DC							
1-6GHz Vertical Data				Test Site - CH2							
Operator: CCH				Temp; Humid; Pres - 24°C; 50%RH; 1006mBar							
BT Mode DH5 CH00											
Frequency	Raw Peak Reading	Raw Avg Reading	Correction Factor	Adjusted Peak		Adjusted Avg		Avg Results	Antenna Height	EUT Azimuth	Worst Peak Margin
				Amplitude	Amplitude	Peak Limit	Peak Margin				
MHz	(dB μ V)	(dB μ V)	(dB/m)	(dB μ V/m)	(dB μ V/m)	(dB μ V/m)	(dB)	(Pass/Fail)	(dB μ V/m)	(dB)	(Pass/Fail)
4493.3	33.3	24.6	2.5	35.8	27.1	74	-38.2	PASS	54	-26.9	PASS
4623.9	34.8	25.3	3.1	37.9	28.4	74	-36.1	PASS	54	-25.6	PASS
5263.5	34.5	25.2	4.2	38.7	29.5	74	-35.3	PASS	54	-24.5	PASS
5622.7	34.9	26.7	5.2	40.1	31.9	74	-33.8	PASS	54	-22.1	PASS
5993.2	34.2	26.4	6.1	40.4	32.5	74	-33.6	PASS	54	-21.5	PASS



Curtis Straus - a Bureau Veritas Company				Work Order - R2499											
Radiated Emissions Electric Field 3m Distance				EUT Power Input - 13.8V DC											
1-6GHz Horizontal Data				Test Site - CH2											
Operator: CCH [®]				Temp; Humid; Pres - 24°C; 50%RH; 1006mBar											
BT Mode DHS CH00															
Frequency	Raw Peak Reading	Raw Avg Reading	Correction Factor	Adjusted Peak	Adjusted Avg	Peak Limit	Peak Margin	Peak Results	Avg Limit	Avg Margin	Avg Results	Antenna Height	EUT Azimuth	Worst Peak Margin	Worst Average Margin
				Amplitude	Amplitude										
MHz	(dB μ V)	(dB μ V)	(dB/m)	(dB μ V/m)	(dB μ V/m)	(dB μ V/m)	(dB μ V/m)	(dB)	(Pass/Fail)	(dB μ V/m)	(dB)	(Pass/Fail)	(cm)	(degrees)	(dB)
4491.5	34.9	24.6	2.5	37.4	27.1	74	-36.6	PASS	54	-26.9	PASS	125	247		
4622	34.2	25.3	3.1	37.3	28.4	74	-36.6	PASS	54	-25.6	PASS	290	167		
5259.1	34.7	25.3	4.2	38.9	29.5	74	-35.1	PASS	54	-24.5	PASS	275	99		
5731.8	34.1	26.2	5.6	39.7	31.7	74	-34.3	PASS	54	-22.2	PASS	205	137		
5985.4	35.3	26.4	6.1	41.4	32.5	74	-32.6	PASS	54	-21.5	PASS	285	168	-32.6	-21.5

1-6GHz Low Channel

Curtis Straus - a Bureau Veritas Company				Work Order - R2499											
Radiated Emissions Electric Field 3m Distance				EUT Power Input - 13.8V DC											
1-6GHz Vertical Data				Test Site - CH2											
Operator: CCH [®]				Temp; Humid; Pres - 24°C; 50%RH; 1006mBar											
BT Mode DHS CH 38															
Frequency	Raw Peak Reading	Raw Avg Reading	Correction Factor	Adjusted Peak	Adjusted Avg	Peak Limit	Peak Margin	Peak Results	Avg Limit	Avg Margin	Avg Results	Antenna Height	EUT Azimuth	Worst Peak Margin	Worst Avg Margin
				Amplitude	Amplitude										
MHz	(dB μ V)	(dB μ V)	(dB/m)	(dB μ V/m)	(dB μ V/m)	(dB μ V/m)	(dB μ V/m)	(dB)	(Pass/Fail)	(dB μ V/m)	(dB)	(Pass/Fail)	(cm)	(degrees)	(dB)
3522.6	32.6	24	0.9	33.5	24.9	74	-40.4	PASS	54	-29.1	PASS	125	78		
5771.7	33.6	23.4	5.6	39.2	29	74	-34.8	PASS	54	-25	PASS	300	243	-34.8	-25

Curtis Straus - a Bureau Veritas Company				Work Order - R2499											
Radiated Emissions Electric Field 3m Distance				EUT Power Input - 13.8V DC											
1-6GHz Horizontal Data				Test Site - CH2											
Operator: CCH [®]				Temp; Humid; Pres - 24°C; 50%RH; 1006mBar											
BT Mode DHS CH 38															
Frequency	Raw Peak Reading	Raw Avg Reading	Correction Factor	Adjusted Peak	Adjusted Avg	Peak Limit	Peak Margin	Peak Results	Avg Limit	Avg Margin	Avg Results	Antenna Height	EUT Azimuth	Worst Peak Margin	Worst Average Margin
				Amplitude	Amplitude										
MHz	(dB μ V)	(dB μ V)	(dB/m)	(dB μ V/m)	(dB μ V/m)	(dB μ V/m)	(dB μ V/m)	(dB)	(Pass/Fail)	(dB μ V/m)	(dB)	(Pass/Fail)	(cm)	(degrees)	(dB)
5670.4	32.5	24	5.5	37.9	29.5	74	-36.1	PASS	54	-24.5	PASS	100	26	-36.1	-24.5

1-6GHz Mid Channel



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Testing Cert. No. 1627-01

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Curtis Straus - a Bureau Veritas Company				Work Order - R2499											
Radiated Emissions Electric Field 3m Distance				EUT Power Input - 13.8V DC											
1-6GHz Vertical Data				Test Site - CH2											
Operator: CCH				Temp; Humid; Pres - 24°C; 50%RH; 1006mBar											
BT Mode DHS CH78															
Frequency	Raw Peak Reading	Raw Avg Reading	Correction Factor	Adjusted Peak Amplitude	Adjusted Avg Amplitude	Peak Limit	Peak Margin	Peak Results	Avg Limit	Avg Margin	Avg Results	Antenna Height	EUT Azimuth	Worst Peak Margin	Worst Avg Margin
				(dB μ V)	(dB μ V)										
MHz	(dB μ V)	(dB μ V)	(dB/m)	(dB μ V/m)	(dB μ V/m)	(dB μ V/m)	(dB μ V/m)	(dB)	(Pass/Fail)	(dB μ V/m)	(dB)	(Pass/Fail)	(cm)	(degrees)	(dB)
4624.6	34	25.2	3.1	37.1	28.3	74	-36.9	PASS	54	-25.7	PASS	205	179		
5175.4	35.1	25.3	3.8	38.9	29.1	74	-35.1	PASS	54	-24.9	PASS	175	188		
5262.2	34.2	25.2	4.2	38.4	29.4	74	-35.6	PASS	54	-24.6	PASS	175	228		
5285	34.5	25.1	4.4	38.9	29.5	74	-35.1	PASS	54	-24.5	PASS	175	203		
5760.1	35.4	25.9	5.6	41	31.5	74	-33	PASS	54	-22.5	PASS	125	129	-33	-22.5

Curtis Straus - a Bureau Veritas Company				Work Order - R2499											
Radiated Emissions Electric Field 3m Distance				EUT Power Input - 13.8V DC											
1-6GHz Horizontal Data				Test Site - CH2											
Operator: CCH				Temp; Humid; Pres - 24°C; 50%RH; 1006mBar											
BT Mode DHS CH78															
Frequency	Raw Peak Reading	Raw Avg Reading	Correction Factor	Adjusted Peak Amplitude	Adjusted Avg Amplitude	Peak Limit	Peak Margin	Peak Results	Avg Limit	Avg Margin	Avg Results	Antenna Height	EUT Azimuth	Worst Peak Margin	Worst Average Margin
				(dB μ V)	(dB μ V)										
MHz	(dB μ V)	(dB μ V)	(dB/m)	(dB μ V/m)	(dB μ V/m)	(dB μ V/m)	(dB μ V/m)	(dB)	(Pass/Fail)	(dB μ V/m)	(dB)	(Pass/Fail)	(cm)	(degrees)	(dB)
4066.9	40.8	31.9	1.6	42.3	33.5	74	-31.7	PASS	54	-20.5	PASS	299	25		
4171.3	40	31.7	2	42	33.7	74	-32	PASS	54	-20.3	PASS	125	176		
4489.7	41.2	31.4	2.5	43.7	33.9	74	-30.3	PASS	54	-20.1	PASS	175	256		
4615.7	40.7	31.7	3.1	43.8	34.8	74	-30.1	PASS	54	-19.2	PASS	102	87		
5756.9	41.8	30.8	5.6	47.4	36.4	74	-26.6	PASS	54	-17.6	PASS	106	87	-26.6	-17.6

1-6GHz High Channel

Curtis Straus - a Bureau Veritas Company				Work Order - R2499											
Radiated Emissions Electric Field 1m Distance				EUT Power Input - 13.8V DC											
6-18GHz Vertical Data				Test Site - CH2											
Operator: CCH				Temp; Humid; Pres - 24°C; 50%RH; 1006mBar											
BT Mode DHS CH 38															
Frequency	Raw Peak Reading	Raw Avg Reading	Correction Factor	Adjusted Peak Amplitude	Adjusted Avg Amplitude	Peak Limit	Peak Margin	Peak Results	Avg Limit	Avg Margin	Avg Results	Antenna Height	EUT Azimuth	Worst Peak Margin	Worst Avg Margin
				(dB μ V)	(dB μ V)										
MHz	(dB μ V)	(dB μ V)	(dB/m)	(dB μ V/m)	(dB μ V/m)	(dB μ V/m)	(dB μ V/m)	(dB)	(Pass/Fail)	(dB μ V/m)	(dB)	(Pass/Fail)	(cm)	(degrees)	(dB)
10538.3	37.3	28.8	11.1	48.4	40	83.5	-35.1	PASS	63.5	-23.5	PASS	200	249		
12345.7	39.5	30.3	13.7	53.2	44	83.5	-30.3	PASS	63.5	-19.5	PASS	200	209		
14409.3	40.7	30.8	13.8	54.6	44.6	83.5	-28.9	PASS	63.5	-18.9	PASS	100	33		
15720.7	39.7	30.2	15.3	55	45.5	83.5	-28.5	PASS	63.5	-18	PASS	100	77		
16844.6	40.8	30	17.5	58.3	47.5	83.5	-25.2	PASS	63.5	-16	PASS	100	0	-25.2	
17966.5	36.8	27.1	20.9	57.7	48	83.5	-25.8	PASS	63.5	-15.5	PASS	179	179		-15.5



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Curtis Straus - a Bureau Veritas Company				Work Order - R2499										
Radiated Emissions Electric Field 1m Distance				EUT Power Input - 13.8V DC										
6-18GHz Horizontal Data				Test Site - CH2										
Operator: CCH				Temp; Humid; Pres - 24°C; 50%RH; 1006mBar										
BT Mode DHC CH 38														
Frequency	Raw Peak Reading	Raw Avg Reading	Correction Factor	Adjusted Peak Amplitude	Adjusted Avg Amplitude	Peak Limit	Peak Margin	Peak Test Results	Avg Limit	Avg Margin	Avg Test Results	Antenna Height	EUT Azimuth	Worst Peak Margin
				Amplitude	Amplitude									
MHz				(dB μ V)	(dB μ V)	(dB/m)	(dB μ V/m)	(dB μ V/m)	(dB μ V/m)	(dB)	(Pass/Fail)	(dB μ V/m)	(dB)	(Pass/Fail)
15646.7	38.6	30.1	15.4	54	45.5	83.5	-29.5	PASS	63.5	-18	PASS	181	20	
17026.1	37.3	28.2	18.8	56.1	47	83.5	-27.4	PASS	63.5	-16.5	PASS	151	261	-27.4
														-16.5

Rev. 9/30/2017

Spectrum Analyzers / Receivers /Preselectors		Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Rental MXE EMI Receiver(1170725)		20Hz-26.5GHz	N9038A	Agilent	MY51210151	1170725	I	12/22/2017	12/22/2016
Radiated Emissions Sites									
EMI Chamber 2		719150	2762A-7	A-0015	30-1000MHz	1686	I	12/21/2018	12/21/2016
EMI Chamber 2		719150	2762A-7	A-0015	1-18GHz	1686	I	12/21/2018	12/21/2016
Preamps /Couplers Attenuators / Filters		Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Blue		0.009-2000MHz	ZFL-1000-LN	CS	N/A	759	II	5/9/2018	5/9/2017
2311 PA		1-1000MHz	PAM-103	COM-POWER	441175	2311	II	2/4/2018	2/4/2017
2444 PA		9KHz-6GHz	BBV9744	SCWARZBECK	67	2444	I	9/29/2018	9/29/2017
Antennas		Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Red-Black Biog		30-2000MHz	JB1	Sunol	A091604-2	1106	I	2/28/2019	2/28/2017
Meteorological Meters/Chambers		Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Weather Clock (Pressure Only)			BA928	Oregon Scientific	C3166-1	831	I	4/28/2018	4/28/2016
TH A#2082			HTC-1	HDE		2082	II	3/23/2018	3/23/2017
Cables		Range	Mfr				Cat	Calibration Due	Calibrated on
Asset #1509		9kHz - 18GHz	Florida RF				II	10/2/2017	10/2/2016
Asset #1522		9kHz - 18GHz	Florida RF				II	2/11/2018	2/11/2017
Asset #2052		9kHz - 18GHz	Florida RF				II	3/5/2018	3/5/2017
Asset #2053		9kHz - 18GHz	Florida RF				II	10/30/2017	10/30/2016

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

6-18GHz Mid Channel

Radiated Emissions Table																									
Date: 17-Oct-17			Company: Harman International				Work Order: R2499																		
Engineer: Chris Hamel			EUT Desc: G31 MID				EUT Operating Voltage/Frequency: 13.8V DC																		
Temp: 24.2°C			Humidity: 42%				Pressure: 1010mbar																		
Frequency Range: 18-26.5GHz					Measurement Distance: 0.1 m																				
Notes: No emissions Found									EUT Max Freq:																
Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dB μ V)	Average Reading (dB μ V)	Preamp Factor (dB)	Antenna Factor (dB)	Cable Factor (dB)	Adjusted Peak Reading (dB μ V/m)	Adjusted Avg Reading (dB μ V/m)	FCC Class B High Frequency - Peak		FCC Class B High Frequency - Average														
									Limit (dB μ V/m)	Margin (dB)	Result (Pass/Fail)	Limit (dB μ V/m)	Margin (dB)	Result (Pass/Fail)											
No Emissions Found										---	---	---	---	---											
Table Result: Pass by N/A dB					Worst Freq: N/A MHz																				
Test Site: EMI Chamber 2			Cable 1: Asset #2324			Cable 2: ---			Cable 3: ---			Preselector: ---													
Analyzer: Gold			Preamp: 18-26.5GHz			Antenna: 18-26.5GHz Horn			Copyright Curtis-Straus LLC 2000																
CSsoft Radiated Emissions Calculator v 1.017.188																									
Adjusted Reading = Reading - Preamp Factor + Antenna Factor + Cable Factor																									



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Rev. 9/20/2017

Spectrum Analyzers / Receivers /Preselectors		Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Gold	100Hz-26.5 GHz	E4407B	Agilent	MY45113816	1284	I		2/28/2018	2/28/2017
Radiated Emissions Sites	FCC Code	IC Code	VCCI Code	Range	Asset	Cat	Calibration Due	Calibrated on	
EMI Chamber 2	719150	2762A-7	A-0015	30-1000MHz	1686	I	12/21/2018	12/21/2016	
EMI Chamber 2	719150	2762A-7	A-0015	1-18GHz	1686	I	12/21/2018	12/21/2016	
Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on	
HF (Yellow)	18-26.5GHz	AFS4-18002650-60-8P-4	CS	467559	1266	II	10/16/2017	9/16/2016	
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on	
HF (White) Horn	18-26.5GHz	801-WLM	Waveline	758	758	III	Verify before Use	date of test	
Meteorological Meters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on	
Weather Clock (Pressure Only)	BA928	Oregon Scientific	C3166-1	831	I		4/28/2018	4/28/2016	
TH A#2084	HTC-1	HDE		2084	II		3/23/2018	3/23/2017	
Cables	Range	Mfr					Calibration Due	Calibrated on	
Asset 2324	1-26.5GHz	TM26-S1S1-120	MEGAPHASE	17139101 001	2324	II	8/19/2018	8/19/2017	

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

18-26.5GHz Mid Channel

Radiated Emissions Table

Date: 17-Oct-17	Company: Harman International	Work Order: R2499												
Engineer: Chris Hamel	EUT Desc: G31 MID	EUT Operating Voltage/Frequency: 13.8V DC												
Temp: 24.2°C	Humidity: 42%	Pressure: 1010mbar												
Frequency Range: 26.5-40GHz		Measurement Distance: 0.1 m												
Notes: No emissions Found		EUT Max Freq:												
Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dB μ V)	Average Reading (dB μ V)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dB μ V/m)	Adjusted Avg Reading (dB μ V/m)	FCC Class B High Frequency - Peak	FCC Class B High Frequency - Average				
o Emissions Found									Limit (dB μ V/m)	Margin (dB)	Result (Pass/Fail)	Limit (dB μ V/m)	Margin (dB)	Result (Pass/Fail)
Table Result:		Pass	by	N/A dB				Worst Freq:		N/A MHz				
Test Site: EMI Chamber 1	Cable 1: Asset #2323		Cable 2: Asset #2324		Cable 3: ---		Antenna: 40GHz Mixer		Preselector: ---					
Analyzer: Gold	Preamp: 40GHz Mixer								Copyright Curtis-Straus LLC 2000					
CSsoft Radiated Emissions Calculator	v 1.017.195													
Adjusted Reading = Reading - Preamp Factor + Antenna Factor + Cable Factor														

Rev. 10/18/2017

Spectrum Analyzers / Receivers /Preselectors		Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Gold	100Hz-26.5 GHz	E4407B	Agilent	MY45113816	1284	I		2/28/2018	2/28/2017
Radiated Emissions Sites	FCC Code	IC Code	VCCI Code	Range	Asset	Cat	Calibration Due	Calibrated on	
EMI Chamber 1	719150	2762A-6	A-0015	1-18GHz	1685	I	12/21/2018	12/21/2016	
Mixers/Diplexers	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on	
Mixer / Horn	26.5-40 GHz	11970A	Agilent	3003A10230	2154	I	3/12/2019	3/12/2016	
Meteorological Meters/Chambers	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on	
Weather Clock (Pressure Only)	BA928	Oregon Scientific	C3166-1	831	I		4/28/2018	4/28/2016	
TH A#2084	HTC-1	HDE		2084	II		3/23/2018	3/23/2017	
Cables	Range	Mfr					Calibration Due	Calibrated on	
Asset 2323	1-26.5GHz	TM26-S1S1-120	MEGAPHASE	17139101 002	2323	II	8/19/2018	8/19/2017	
Asset 2324	1-26.5GHz	TM26-S1S1-120	MEGAPHASE	17139101 001	2324	II	8/19/2018	8/19/2017	

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26.5-40GHz Mid Channel



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Radiated Band Edge**Radiated Emissions Table**

Date: 19-Sep-17		Company: Harman International Industries, Inc.							Work Order: R2499					
Engineer: Chris Hamel		EUT Desc: G31 MID			Humidity: 50%				EUT Operating Voltage/Frequency: 13.8V DC					
Temp: 24.8°C		Pressure: 1013mBar			Measurement Distance: 3 m									
Frequency Range:											Measurement Distance: 3 m			
Notes: BT band edge DH5											EUT Max Freq:			
Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dB μ V)	Average Reading (dB μ V)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dB μ V/m)	Adjusted Avg Reading (dB μ V/m)	FCC Class B High Frequency - Peak			FCC Class B High Frequency - Average		
									Limit (dB μ V/m)	Margin (dB)	Result (Pass/Fail)	Limit (dB μ V/m)	Margin (dB)	Result (Pass/Fail)
Max H	2412.9	57.7		0.0	32.3	3.4	---	---	74.0	---	---	54.0	---	---
Max V	2408.2	58.9		0.0	32.2	3.4	---	---	74.0	---	---	54.0	---	---
Low Edge V	2390.0	17.1	9.1	0.0	32.2	3.4	52.7	44.7	74.0	-21.3	Pass	54.0	-9.3	Pass
High Edge V	2483.5	18.5	9.0	0.0	32.4	3.5	54.4	44.9	74.0	-19.6	Pass	54.0	-9.1	Pass

Table Result: Pass by -9.1 dB**Worst Freq:** 2483.5 MHz

Test Site: EMI Chamber 2	Cable 1: Asset #2052	Cable 2: Asset #2053	Cable 3: ...
Analyzer: Rental SA#3	Preamp: none	Antenna: Blue Horn	Preselector: ...
CCsoft Radiated Emissions Calculator v 1.017.188			
Adjusted Reading = Reading - Preamp Factor + Antenna Factor + Cable Factor			

Rev. 10/22/2017

Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
	Rental MXE EMI Receiver(1170725)	20Hz-26.5GHz	N9038A	Agilent	MY51210151	1170725	I
Radiated Emissions Sites							
EMI Chamber 2	719150	2762A-7	A-0015	1-18GHz	1686	I	12/21/2018
Antennas							
Orange Horn	1-18GHz	3115	EMCO	0004-6123	390	I	10/13/2018
Blue Horn	1-18Ghz	3117	ETS	157647	1861	I	2/14/2019
Meteorological Meters/Chambers							
Weather Clock (Pressure Only)	BA928	Oregon Scientific	C3166-1	831	I	4/28/2018	
TH A#2082	HTC-1	HDE		2082	II	3/23/2018	
Cables							
Asset #2052	9kHz - 18GHz		Florida RF		II	3/5/2018	
Asset #2053	9kHz - 18GHz		Florida RF		II	10/30/3017	

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.



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AC Line Conducted Emissions**LIMITS**

Frequency of emission (MHz)	Quasi-peak limit (dB μ V)	Average limit (dB μ V)
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

[47 CFR 15.207(a)]

MEASUREMENTS / RESULTS

**EUT is vehicle battery powered only.



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Measurement Uncertainty

The listed uncertainties are the worst case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

Measurement	Expanded Uncertainty k=2	Maximum allowable uncertainty
Radiated Emissions (30-1000MHz)		
NIST	5.6dB	N/A
CISPR	4.6dB	5.2dB (Ucispqr)
Radiated Emissions (1-26.5GHz)	4.6dB	N/A
Radiated Emissions (above 26.5GHz)	4.9dB	N/A
Magnetic Radiated Emissions	5.6dB	N/A
Conducted Emissions		
NIST	3.9dB	N/A
CISPR	3.6dB	3.6dB (Ucispqr)
Telco Conducted Emissions (Current)	2.9dB	N/A
Telco Conducted Emissions (Voltage)	4.4dB	N/A
Electrostatic Discharge	11.5%	N/A
Radiated RF Immunity (Uniform Field)	1.6dB	N/A
Electrical Fast Transients	23.1%	N/A
Surge	23.1%	N/A
Conducted RF Immunity	3dB	N/A
Magnetic Immunity	12.8%	N/A
Dips and Interrupts	2.3V	N/A
Harmonics	3.5%	N/A
Flicker	3.5%	N/A
Radio frequency (@ 2.4GHz)	3.23×10^{-8}	1×10^{-7}
RF power, conducted	0.40dB	0.75dB
Maximum frequency deviation:		
• Within 300Hz and 6kHz of audio frequency / Within 6kHz and 25kHz of audio frequency	3.4% 0.3dB	5% 3dB
Adjacent channel power	1.9dB	3dB
Conducted spurious emission of transmitter, valid up to 12.75GHz	2.39dB	3dB
Conducted emission of receivers	1.3dB	3dB
Radiated emission of transmitter, valid up to 26.5GHz	3.9dB	6dB
Radiated emission of transmitter, valid up to 80GHz	3.3dB	6dB
Radiated emission of receiver, valid up to 26.5GHz	3.9dB	6dB
Radiated emission of receiver, valid up to 80GHz	3.3dB	6dB
Humidity	2.37%	5%
Temperature	0.7°C	1.0°C
Time	4.1%	10%
RF Power Density, Conducted	0.4dB	3dB
DC and low frequency voltages	1.3%	3%
Voltage (AC, <10kHz)	1.3%	2%
Voltage (DC)	0.62%	1%
The above reflects a 95% confidence level		



Conditions Of Testing

[Bureau Veritas Consumer Products Services, Inc., a Massachusetts corporation], and/or its affiliates (collectively, the "Company") will conduct, at the request of the Submitter ("Client"), the tests specified on the submitted Test Request Form or equivalent in accordance with, and subject to, the following terms and conditions (collectively, "Conditions"):

1. All orders for tests are subject to acceptance by the Company, and no order will constitute a binding commitment of the Company unless and until such order is accepted by it, as evidenced by the issuance of a written report ("Test Report") by the Company. The Test Report is issued solely by the Company, is intended for the exclusive use of Client and shall not be published, used for advertising purposes, copied or replicated for distribution to any other person or entity or otherwise publicly disclosed without the prior written consent of the Company. By submitting a request for services to the Company, Client consents to the disclosure to accreditation bodies of those records of Client relevant to the accreditation body's assessment of the Company's competence and compliance with relevant accreditation criteria. The Company shall not be liable for any loss or damage whatsoever resulting from the failure of the Company to provide its services within any time period for completion estimated by the Company. If Client anticipates using the Test Report in any legal proceeding, arbitration, dispute resolution forum or other proceeding, it shall so notify the Company prior to submitting the Test Report in such proceeding. The Company has no obligation to provide a fact or expert witness at such proceeding unless the Company agrees in advance to do so for a separate and additional fee.
2. The Test Report will set forth the findings of the Company solely with respect to the test samples identified therein. Unless specifically and expressly indicated in the Test Report, the results set forth in such Test Report are not intended to be indicative or representative of the quality or characteristics of the lot from which a test sample is taken, and Client shall not rely upon the Test Report as being so indicative or representative of the lot or of the tested product in general. The Test Report will reflect the findings of the Company at the time of testing only, and the Company shall have no obligation to update the Test Report after its issuance. The Test Report will set forth the results of the tests performed by the Company based upon the written information provided to the Company. The Test Report will be based solely on the samples and written information submitted to the Company by Client, and the Company shall not be obligated to conduct any independent investigation or inquiry with respect thereto.
3. The Company may, in its sole discretion, destroy samples which have been furnished to the Company for testing and which have not been destroyed in the course of testing. The Company may delegate the performance of all or a portion of the services contemplated hereunder to an affiliate, agent or subcontractor of the Company, and Client consents to such delegation.
4. These Conditions and the Test Report represent the entire understanding of the parties hereto with respect to the subject matter hereof and of the Test Report, and no modification, variance or extrapolation with respect thereto shall be permitted without the prior written consent of the Company.
5. The names, service marks, trademarks and copyrights of the Company and its affiliates, including the names "**BUREAU VERITAS**," "**BUREAU VERITAS CONSUMER PRODUCTS SERVICES**," "**BVCPs**," "**MTL**," "**ACTS**," "**MTL-ACTS**" and **CURTIS-STRAUS** (collectively, the "Marks") are and shall remain the sole property of the Company or its affiliates and shall not be used by Client except solely to the extent that Client obtains the prior written approval of the Company and then only in the manner prescribed by the Company. Client shall not contest the validity of the Marks or take any action that might impair the value or goodwill associated with the Marks or the image or reputation of the Company or its affiliates.
6. Payment in full shall be due 30 days after the date of invoice. Interest shall be due on overdue amounts from the due date until paid at an interest rate of 1.5% per month or, if less, the maximum rate permitted by law. The Company reserves the right, at any time and from time to time, to revoke any credit extended to Client. Client shall reimburse the Company for any costs it incurs in collecting past due amounts, including court costs and fees and expenses of attorneys and collection agencies. The Test Report may not be used or relied upon by Client if and for so long as Client fails to pay when due any invoice issued by the Company or any affiliate of it to Client or any affiliate or subsidiary of Client together with interest and penalties, if any, accrued thereon.
7. The Company disclaims any and all responsibility or liability arising out of or in connection with e-mail transmissions of such information.
8. Client understands and agrees that the Company is neither an insurer nor a guarantor, that the Company does not take the place of Client or any designer, manufacturer, agent, buyer, distributor or transportation or shipping company, and that the Company disclaims all liability in such capacities. Client further understands that if it seeks assurance against loss or damage, it should obtain appropriate insurance.
9. Client agrees that the Company, by providing the services, does not take the place of Client nor any third party, nor does the Company release them from any of their obligations, nor does the Company otherwise assume, abridge, abrogate or undertake to discharge any duty of any third party to Client or any duty of Client or any third party to any other third party, and Client will not release any third party from its obligations and duties with respect to the tested goods.
10. Client shall, on a timely basis, (a) provide adequate instructions to the Company in order to enable the Company to perform properly its services, (b) provide, or cause Client's suppliers and contractors to provide, the Company with all documents necessary to enable the Company to perform its services, (c) furnish the Company with all relevant information regarding Client's intended use and purposes of the tested goods, (d) advise the Company of essential dates and deadlines relevant to the tested goods and (e) fully exercise all rights and remedies available to Client against third parties in respect of the tested goods.
11. The Company shall undertake due care and ordinary skill in the performance of its services to Client, and the Company shall accept responsibility only were such skill has not been exercised and, even in such event, only to the extent of the limitation of liability set forth herein.
12. If Client desires to assert a claim arising from or relating to (i) the performance, purported performance or non-performance of any services by the Company or (ii) the sale, resale, manufacture, distribution or use of any tested goods, it must submit that claim to the Company in a writing that sets forth with particularity the basis for such claim within 60 days from discovery of the potential claim and not more than six months after the date of issuance of the Test Report to Client. Client waives any and all such claims including, without limitation, claims that the Test Report is inaccurate, incomplete or misleading or that additional or different testing is required, unless and then only to the extent that Client submits a written claim to the Company within both such time periods.
13. CLIENT SHALL, EXCEPT TO THE EXTENT OF COMPANY'S LIABILITY TO CLIENT HEREUNDER (WHICH IN NO EVENT SHALL EXCEED THE LIMITATION OF LIABILITY HEREIN), HOLD HARMLESS AND INDEMNIFY THE COMPANY, ITS AFFILIATES AND THEIR RESPECTIVE DIRECTORS, OFFICERS, EMPLOYEES, AGENTS AND SUBCONTRACTORS AGAINST ALL ACTUAL OR ALLEGED THIRD PARTY CLAIMS FOR LOSS, DAMAGE OR EXPENSE OF WHATSOEVER NATURE AND HOWSOEVER ARISING FROM OR RELATING TO (i) THE PERFORMANCE, PURPORTED PERFORMANCE OR NON-PERFORMANCE OF ANY SERVICES BY THE COMPANY OR (ii) THE SALE, RESALE, MANUFACTURE, DISTRIBUTION OR USE OF ANY TESTED GOODS.
14. EXCEPT AS MAY OTHERWISE BE EXPRESSLY AGREED TO IN WRITING BY THE COMPANY AND NOTWITHSTANDING ANY PROVISION TO THE CONTRARY CONTAINED HEREIN OR IN ANY TEST REPORT, NO WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, IS MADE.



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15. (A) IN NO EVENT WHATSOEVER SHALL THE COMPANY BE LIABLE FOR ANY CONSEQUENTIAL, SPECIAL, INCIDENTAL, EXEMPLARY OR PUNITIVE DAMAGES IN CONNECTION WITH, RELATING TO OR ARISING OUT OF THE TEST REPORT OR THE SERVICES PROVIDED BY THE COMPANY HEREUNDER, INCLUDING WITHOUT LIMITATION LOSS OF OR DAMAGE TO PROPERTY; LOSS OF INCOME, PROFIT OR USE; OR ANY CLAIMS OR DEMANDS MADE AGAINST CLIENT OR ANY OTHER PERSON BY ANY THIRD PARTY IN CONNECTION WITH, RELATING TO OR ARISING OUT OF THE SERVICES PROVIDED BY THE COMPANY HEREUNDER.

(B) NOTWITHSTANDING ANY PROVISION TO THE CONTRARY CONTAINED HEREIN, AND IN RECOGNITION OF THE RELATIVE RISKS AND BENEFITS TO CLIENT AND THE COMPANY ASSOCIATED WITH THE TESTING SERVICES CONTEMPLATED HEREBY, THE RISKS HAVE BEEN ALLOCATED SUCH THAT UNDER NO CIRCUMSTANCES WHATSOEVER SHALL THE LIABILITY OF THE COMPANY TO CLIENT OR ANY THIRD PARTY IN RESPECT OF ANY CLAIM FOR LOSS, DAMAGE OR EXPENSE, OF WHATSOEVER NATURE OR MAGNITUDE, AND HOWSOEVER ARISING, EXCEED AN AMOUNT EQUAL TO FIVE (5) TIMES THE AMOUNT OF THE FEES PAID TO THE COMPANY FOR THE SPECIFIC SERVICES WHICH GAVE RISE TO SUCH CLAIM OR U.S.\$10,000, WHICHEVER IS THE LESSER AMOUNT.

16. The Company shall not be liable for any loss or damage resulting from any delay or failure in performance of its obligations hereunder resulting directly or indirectly from any event of force majeure or any event outside the control of the Company. If any such event occurs, the Company may immediately cancel or suspend its performance hereunder without incurring any liability whatsoever to Client.

17. Company's services, including these Conditions, shall be governed by, and construed in accordance with, the local laws of the country where the Company performs the tests or, in the case of tests performed in the United States of America, the laws of Massachusetts without regard to conflicts of laws principles. If any aspect(s) of these Conditions is found to be illegal or unenforceable, the validity, legality and enforceability of all remaining aspects of these Conditions shall not in any way be affected or impaired thereby. Any proceeding related to the subject matter hereof shall be brought, if at all, in the courts of the country where the Company performs the tests or, in the case of tests performed in the United States of America, in the courts of Massachusetts. Client waives the right to interpose any counterclaim or setoffs of any nature in any litigation arising hereunder.

The complete list of the Approved Subcontractors Curtis-Straus may use to delegate the performance of work can be provided upon request. Rev.160009121(2)_#684340 v14CS



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Appendix A:**CFR Title 47 FCC Part §15.247 and ISED Canada RSS-247 Issue 2****DUT Information**

DUT Name: G31 MID
 Manufacturer: Harman International Industries, Inc.
 Serial Number: 047

Frequencies

BT CH 0 (2402 MHz)	BT CH 2 (2404 MHz)	BT CH 3 (2405 MHz)
BT CH 1 (2403 MHz)	BT CH 5 (2407 MHz)	BT CH 6 (2408 MHz)
BT CH 4 (2406 MHz)	BT CH 8 (2410 MHz)	BT CH 9 (2411 MHz)
BT CH 7 (2409 MHz)	BT CH 11 (2413 MHz)	BT CH 12 (2414 MHz)
BT CH 10 (2412 MHz)	BT CH 14 (2416 MHz)	BT CH 15 (2417 MHz)
BT CH 13 (2415 MHz)	BT CH 17 (2419 MHz)	BT CH 18 (2420 MHz)
BT CH 16 (2418 MHz)	BT CH 20 (2422 MHz)	BT CH 21 (2423 MHz)
BT CH 19 (2421 MHz)	BT CH 23 (2425 MHz)	BT CH 24 (2426 MHz)
BT CH 22 (2424 MHz)	BT CH 26 (2428 MHz)	BT CH 27 (2429 MHz)
BT CH 25 (2427 MHz)	BT CH 29 (2431 MHz)	BT CH 30 (2432 MHz)
BT CH 28 (2430 MHz)	BT CH 32 (2434 MHz)	BT CH 33 (2435 MHz)
BT CH 31 (2433 MHz)	BT CH 35 (2437 MHz)	BT CH 36 (2438 MHz)
BT CH 34 (2436 MHz)	BT CH 38 (2440 MHz)	BT CH 39 (2441 MHz)
BT CH 37 (2439 MHz)	BT CH 41 (2443 MHz)	BT CH 42 (2444 MHz)
BT CH 40 (2442 MHz)	BT CH 44 (2446 MHz)	BT CH 45 (2447 MHz)
BT CH 43 (2445 MHz)	BT CH 47 (2449 MHz)	BT CH 48 (2450 MHz)
BT CH 46 (2448 MHz)	BT CH 50 (2452 MHz)	BT CH 51 (2453 MHz)
BT CH 49 (2451 MHz)	BT CH 53 (2455 MHz)	BT CH 54 (2456 MHz)
BT CH 52 (2454 MHz)	BT CH 56 (2458 MHz)	BT CH 57 (2459 MHz)
BT CH 55 (2457 MHz)	BT CH 59 (2461 MHz)	BT CH 60 (2462 MHz)
BT CH 58 (2460 MHz)	BT CH 62 (2464 MHz)	BT CH 63 (2465 MHz)
BT CH 61 (2463 MHz)	BT CH 65 (2467 MHz)	BT CH 66 (2468 MHz)
BT CH 64 (2466 MHz)	BT CH 68 (2470 MHz)	BT CH 69 (2471 MHz)
BT CH 67 (2469 MHz)	BT CH 71 (2473 MHz)	BT CH 72 (2474 MHz)
BT CH 70 (2472 MHz)	BT CH 74 (2476 MHz)	BT CH 75 (2477 MHz)
BT CH 73 (2475 MHz)	BT CH 77 (2479 MHz)	BT CH 78 (2480 MHz)

DUT Settings

No. of transmission chains 1
 Equipment Type Frequency Hopping Spread Spectrum

Antenna Gain:

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Frequency (MHz)	Efficiency (dB)	Efficiency (%)	Gain (dBi)
2400	-4.35	36.70	0.94
2410	-4.40	36.33	0.93
2420	-4.43	36.06	0.92
2430	-4.46	35.78	1.18
2440	-4.44	35.94	0.95
2450	-4.50	35.47	0.87
2460	-4.61	34.60	0.88
2470	-4.80	33.13	0.71
2480	-4.90	32.38	0.93
2490	-5.06	31.18	0.85
2500	-5.33	29.32	0.24

Test Equipment Used:

Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
FSV40 Signal Generator	10Hz-40GHz	FSV40	ROHDE & SCHWARZ	101551	2200	I	6/30/2018	6/30/2017
Signal Generators								
SMBV100A Vector Signal Generator	9KHz-6GHz	SMBV100A	ROHDE & SCHWARZ	261919	2201	I	6/26/2018	6/26/2017
SMB100A Signal Generator	100KHz-40GHz	SMB100A	ROHDE & SCHWARZ	179846	2434	I	5/30/2018	5/30/2017
R&S®OSP120 with R&S®OSP-B157	30MHz-18GHz	OSP120	ROHDE & SCHWARZ	101674		I	6/1/2018	6/1/2017
Cables								
Asset #2052	9kHz - 18GHz		Florida RF			II	3/5/2018	3/5/2017
DUT1	30MHz-26GHz		Micro-Coax			II	6/21/2018	6/21/2017
Attenuators								
10dB Attenuator-01 Brown	30MHz-26GHz		Mini Circuits			II	7/13/2018	7/14/2017
10dB Attenuator-02 Yellow	30MHz-26GHz		Mini Circuits			II	7/13/2018	7/14/2017
Wideband Radio Communication Tester								
(Rental)CMW500	DC to 6GHz	CMW500	ROHDE & SCHWARZ	155905		I	6/2/2018	6/2/2017



Summary

Test	Frequency (MHz)	DH1 Result	DH3 Result	DH5 Result	2-DH1 Result	2-DH3 Result	2-DH5 Result	3-DH1 Result	3-DH3 Result	3-DH5 Result
Hopping Frequencies	--- (hopping)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Band Edge (during hopping)	--- (hopping)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Carrier Frequency Separation	2402.000 (hopping)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Carrier Frequency Separation	2480.000 (hopping)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Time of Channel Occupancy	2402.000 (hopping)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Time of Channel Occupancy	2441.000 (hopping)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Time of Channel Occupancy	2480.000 (hopping)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Emission Bandwidth 20 dB	2402.000 (single)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Band Edge low	2402.000 (single)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Peak output power	2402.000 (single)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Conducted Spurious Emissions	2402.000 (single)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Emission Bandwidth 20 dB	2441.000 (single)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Peak output power	2441.000 (single)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Conducted Spurious Emissions	2441.000 (single)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Emission Bandwidth 20 dB	2480.000 (single)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Band Edge high	2480.000 (single)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Peak output power	2480.000 (single)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Conducted Spurious Emissions	2480.000 (single)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS

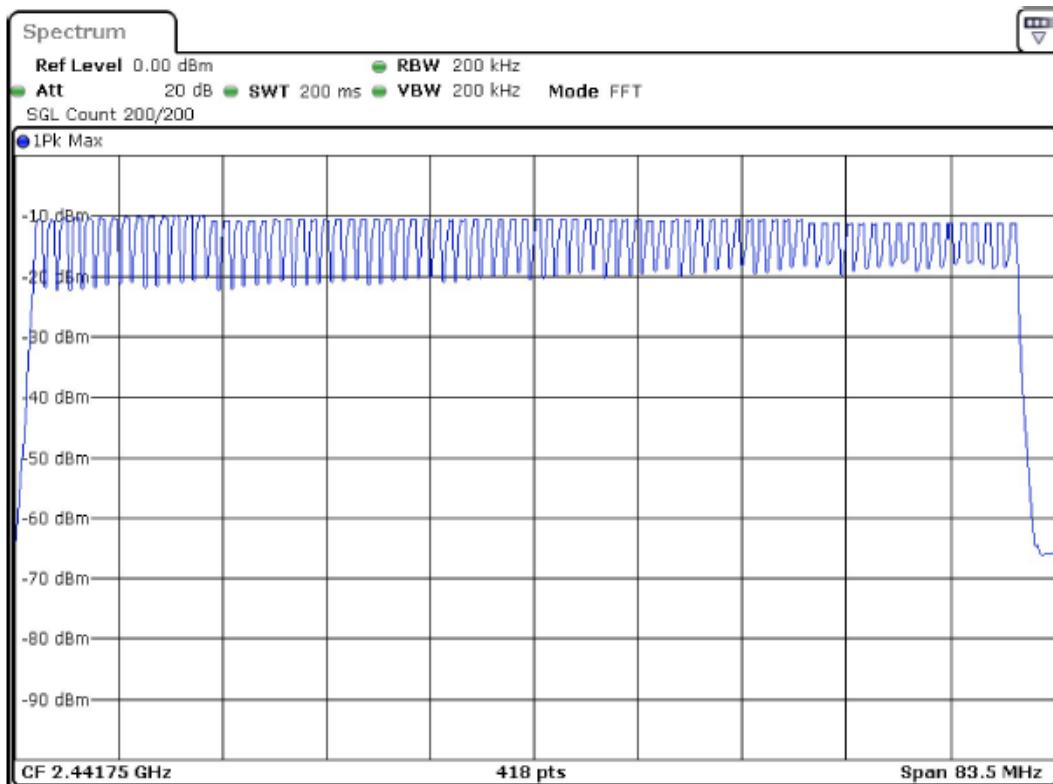
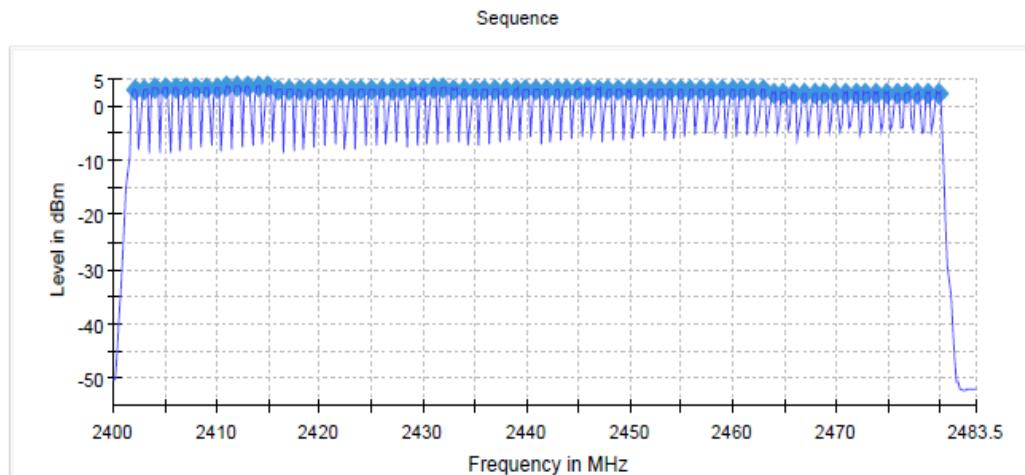


Number of Hopping Frequencies

Test procedure in accordance with ANSI C63.10-2013

Channels

Channels	Limit Min	Result
79	15	PASS



Band Edge (during hopping)

Test procedure in accordance with ANSI C63.10-2013

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1. Expanded Uncertainty (K=2) < 0.8 dB

Inband Peak

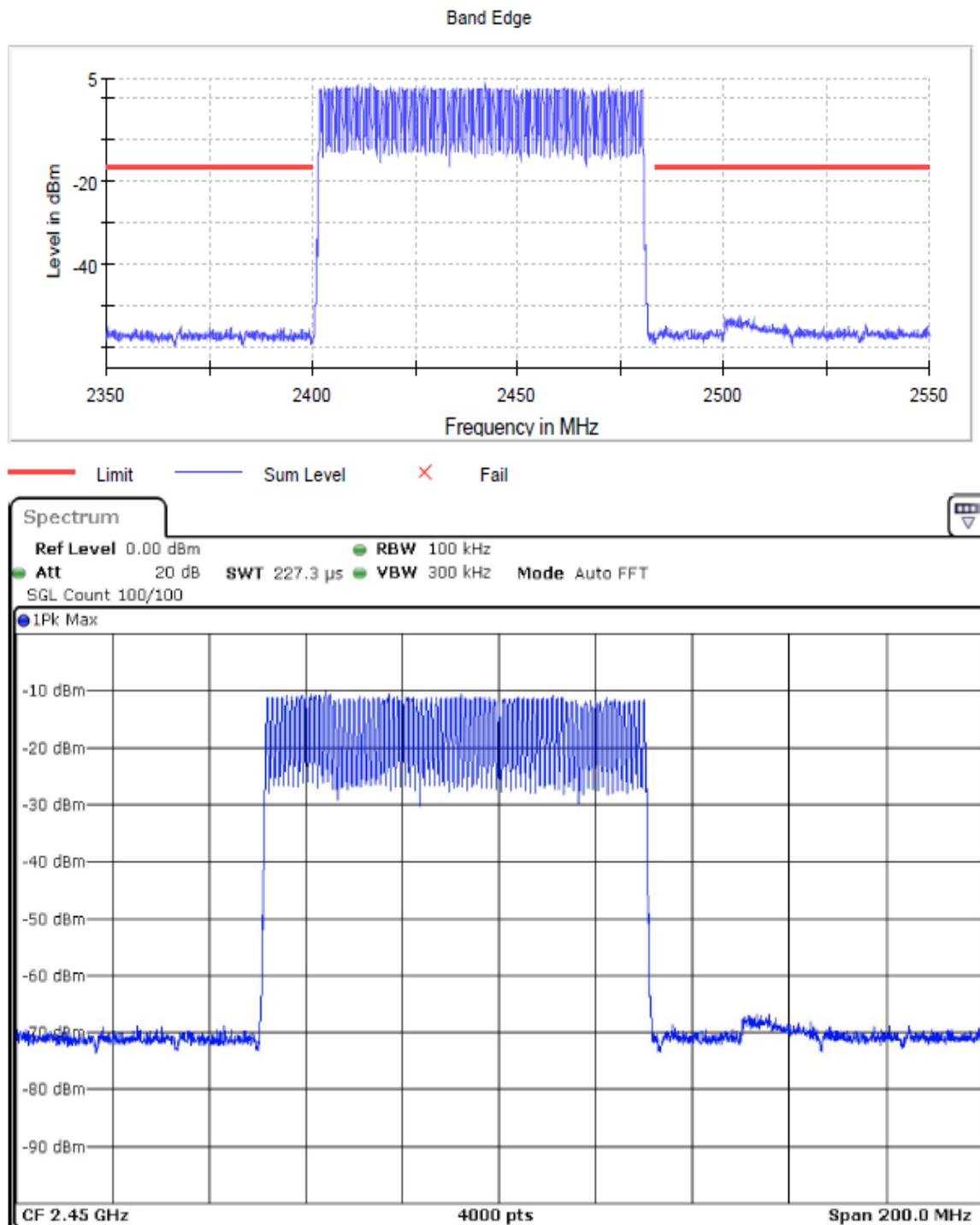
Data Rate	Frequency (MHz)	Level (dBm)
DH1	2412.159460	3.2
DH3	2415.008748	3.3
DH5	2414.158960	3.6
2-DH1	2430.854786	0.1
2-DH3	2431.004749	-0.2
2-DH5	2413.159210	-0.2
3-DH1	2429.855036	0.0
3-DH3	2413.009248	-0.2
3-DH5	2430.154961	0.0

Plots for packet type DH5 shown below.

Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2503.436641	-53.0	36.6	-16.4	PASS
2505.936016	-53.1	36.7	-16.4	PASS
2501.737066	-53.2	36.8	-16.4	PASS
2505.986003	-53.3	36.9	-16.4	PASS
2504.136466	-53.3	36.9	-16.4	PASS
2504.186453	-53.3	36.9	-16.4	PASS
2501.637091	-53.4	37.0	-16.4	PASS
2501.787053	-53.4	37.0	-16.4	PASS
2503.486628	-53.5	37.1	-16.4	PASS
2501.687078	-53.5	37.1	-16.4	PASS
2500.837291	-53.6	37.2	-16.4	PASS
2507.135716	-53.6	37.2	-16.4	PASS
2505.186203	-53.6	37.2	-16.4	PASS
2507.085729	-53.6	37.2	-16.4	PASS
2501.537116	-53.6	37.2	-16.4	PASS





Carrier Frequency Separation

Test procedure in accordance with ANSI C63.10-2013.

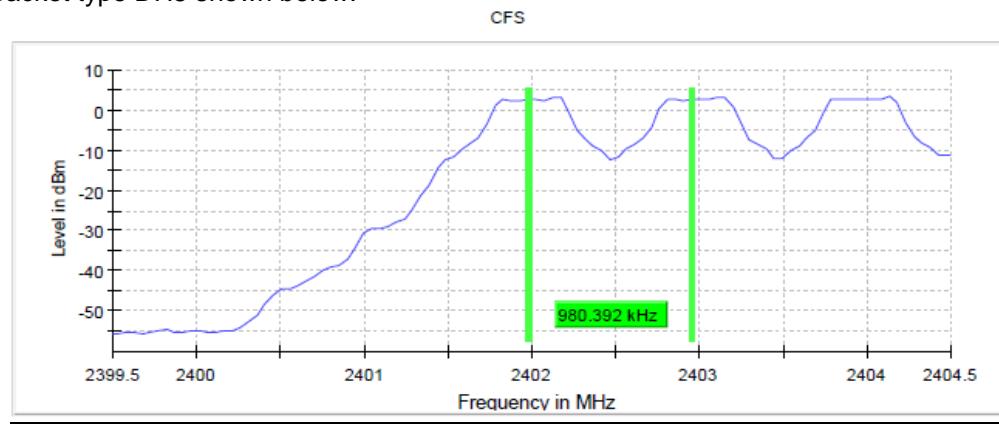
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1. Expanded Uncertainty($k = 2$) < 1%

2402 MHz

Limit is 2/3 of the widest 20dB bandwidth measured for worst case.

Data Rate	DUT Frequency (MHz)	Frequency Separation (MHz)	Minimum Limit (MHz)	Result
DH1	2402.000000	0.980392	0.94118	PASS
DH3	2402.000000	0.980392	0.94118	PASS
DH5	2402.000000	0.980392	0.94118	PASS
2-DH1	2402.000000	0.980392	0.94118	PASS
2-DH3	2402.000000	0.980392	0.94118	PASS
2-DH5	2402.000000	0.980392	0.94118	PASS
3-DH1	2402.000000	0.980392	0.94118	PASS
3-DH3	2402.000000	0.980392	0.94118	PASS
3-DH5	2402.000000	0.980392	0.94118	PASS

Plots for packet type DH5 shown below.



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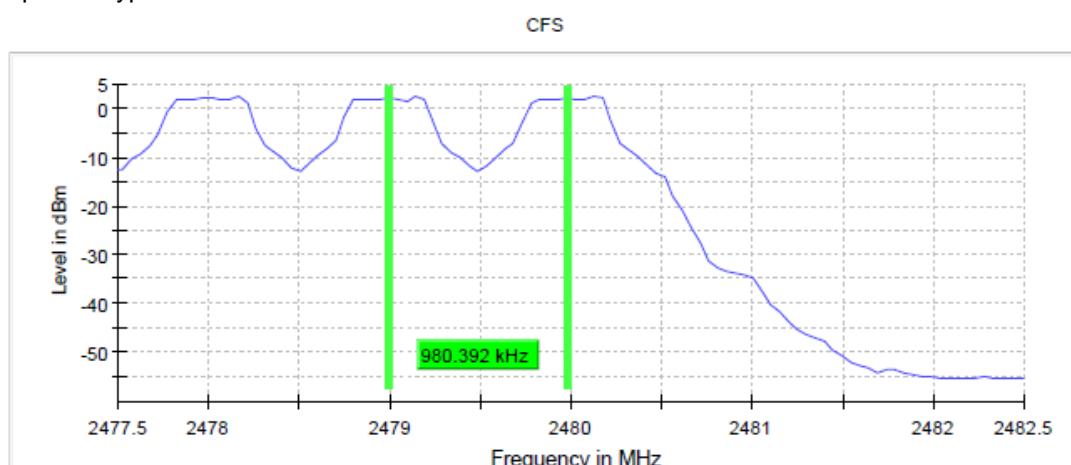


2480 MHz

Limit is 2/3 of the widest 20dB bandwidth measured for worst case.

Data Rate	DUT Frequency (MHz)	Frequency Separation (MHz)	Minimum Limit (MHz)	Result
DH1	2480.000000	0.980392	0.94118	PASS
DH3	2480.000000	0.980392	0.94118	PASS
DH5	2480.000000	0.980392	0.94118	PASS
2-DH1	2480.000000	0.980392	0.94118	PASS
2-DH3	2480.000000	0.980392	0.94118	PASS
2-DH5	2480.000000	0.980392	0.94118	PASS
3-DH1	2480.000000	0.980392	0.94118	PASS
3-DH3	2480.000000	0.980392	0.94118	PASS
3-DH5	2480.000000	0.980392	0.94118	PASS

Plots for packet type DH5 shown below.



Time of Channel Occupancy (Dwell Time)

Test procedure in accordance with ANSI C63.10-2013

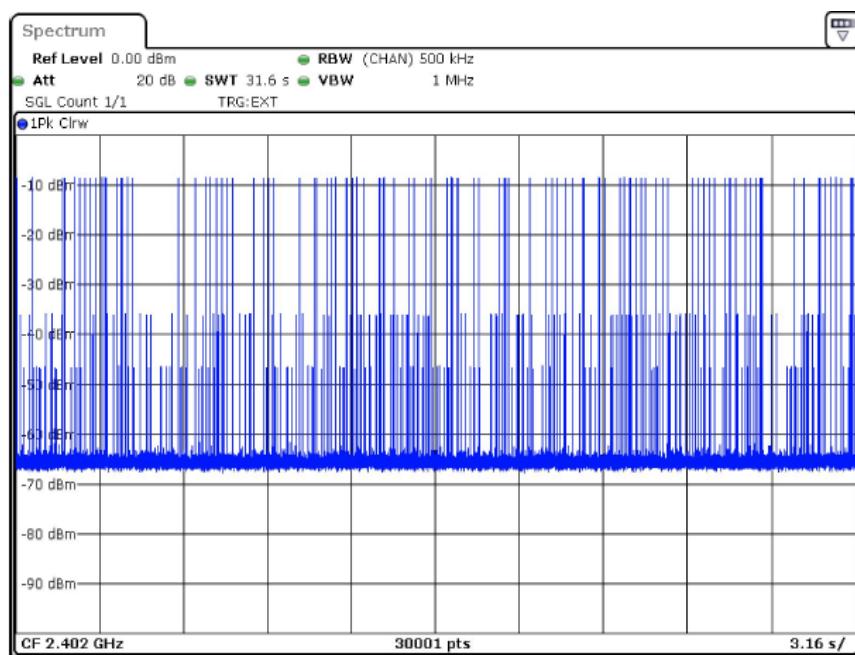
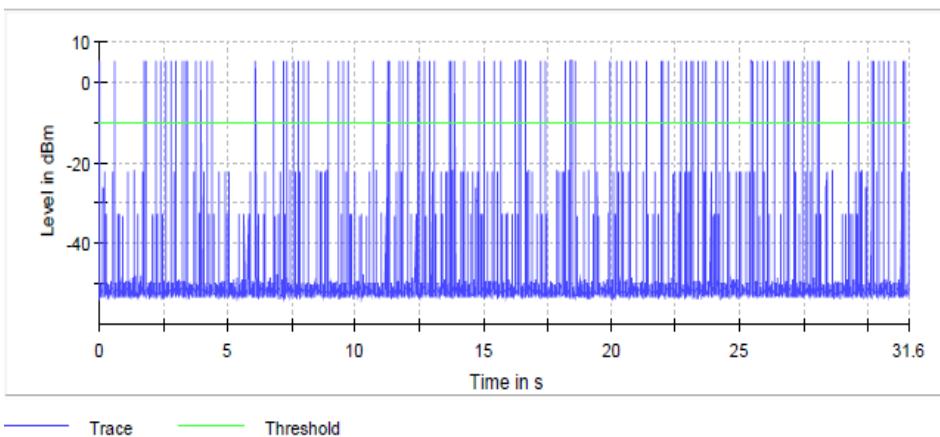
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1. Expanded Uncertainty (K=2) < 1%

2402 MHz

Data Rate	Time (ms)	Limit Max (ms)	Result
DH1	122.960	400.000	PASS
DH3	272.260	400.000	PASS
DH5	306.150	400.000	PASS
2-DH1	110.640	400.000	PASS
2-DH3	230.320	400.000	PASS
2-DH5	285.410	400.000	PASS
3-DH1	112.630	400.000	PASS
3-DH3	220.000	400.000	PASS
3-DH5	280.080	400.000	PASS

Plots for packet type DH5 shown below.

Time of Channel Occupancy



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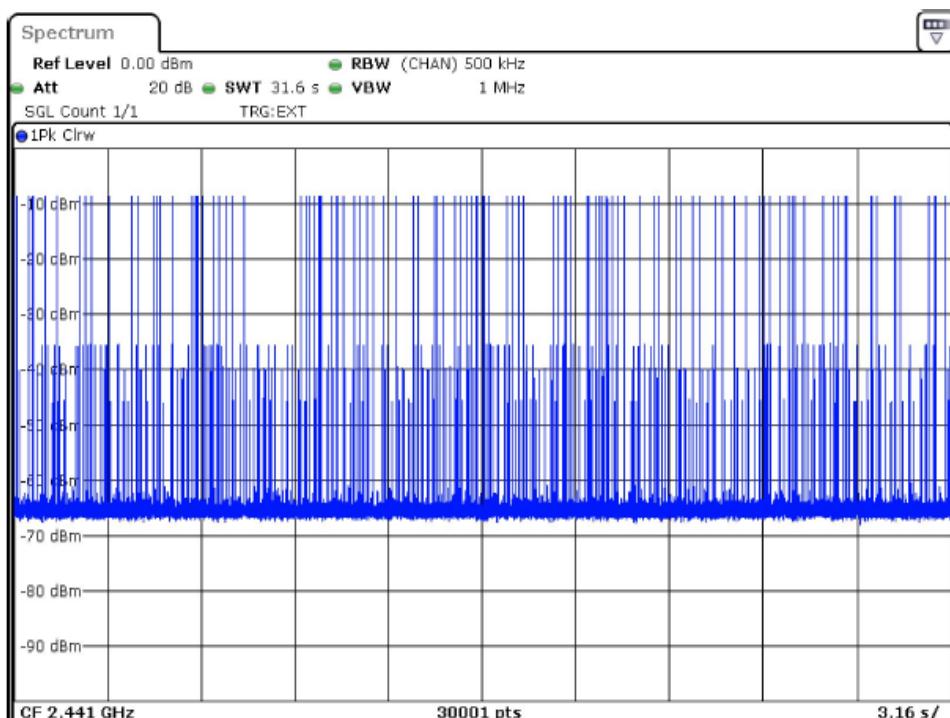
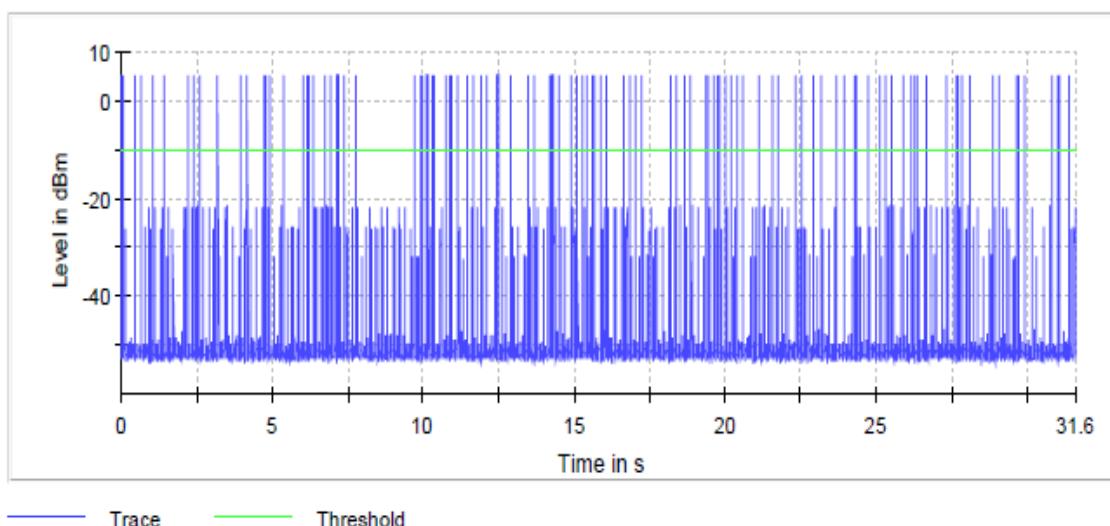


2441 MHz

Data Rate	Time (ms)	Limit Max (ms)	Result
DH1	122.960	400.000	PASS
DH3	270.620	400.000	PASS
DH5	323.480	400.000	PASS
2-DH1	111.640	400.000	PASS
2-DH3	228.750	400.000	PASS
2-DH5	263.710	400.000	PASS
3-DH1	113.560	400.000	PASS
3-DH3	228.250	400.000	PASS
3-DH5	306.860	400.000	PASS

Plots for packet type DH5 shown below.

Time of Channel Occupancy

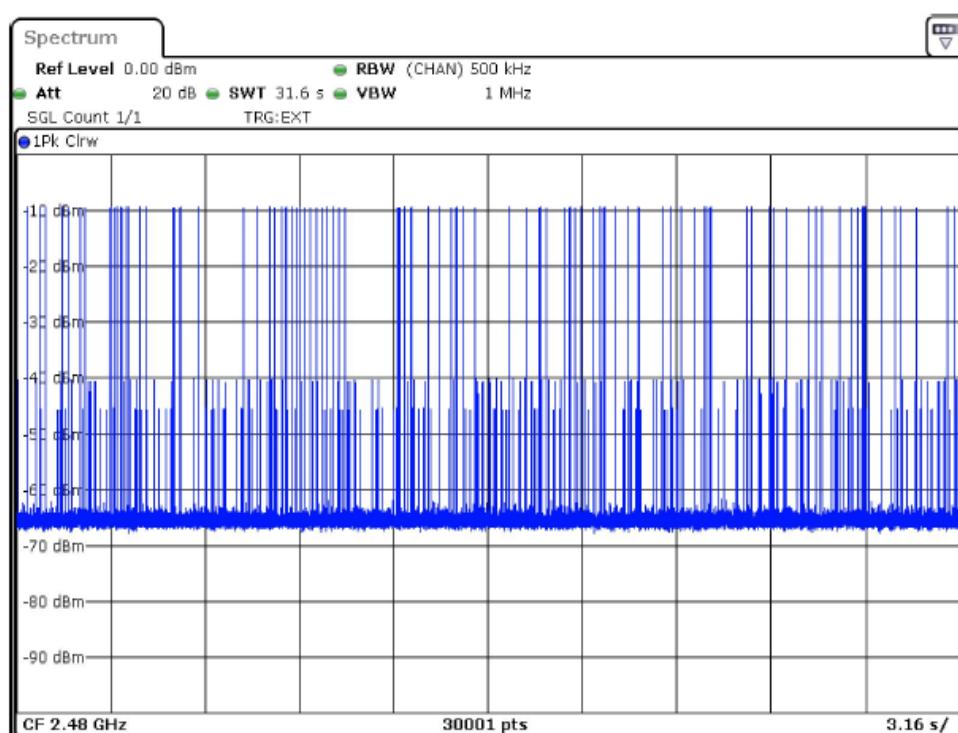
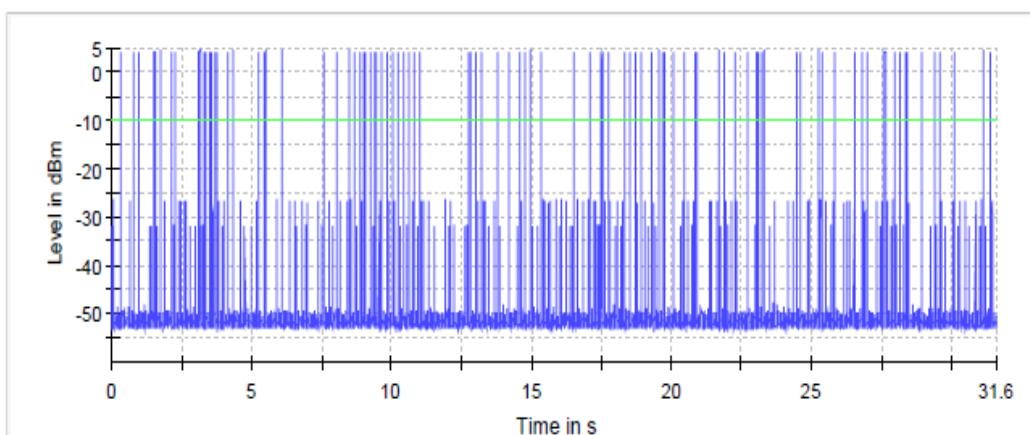


2480 MHz

Data Rate	Time (ms)	Limit Max (ms)	Result
DH1	122.940	400.000	PASS
DH3	265.690	400.000	PASS
DH5	274.340	400.000	PASS
2-DH1	109.180	400.000	PASS
2-DH3	220.630	400.000	PASS
2-DH5	244.450	400.000	PASS
3-DH1	110.520	400.000	PASS
3-DH3	232.170	400.000	PASS
3-DH5	255.490	400.000	PASS

Plots for packet type DH5 shown below.

Time of Channel Occupancy



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Peak Output Power

Test procedure in accordance with ANSI C63.10-2013

Data Rate	2402 MHz	2441 MHz	2480 MHz	Limit dBm
DH1	3.098	3.118	2.479	30
DH3	3.237	3.252	2.608	30
DH5	3.277	3.256	2.585	30
2-DH1	1.493	1.681	0.847	30
2-DH3	1.826	1.779	0.934	30
2-DH5	1.829	1.922	0.975	30
3-DH1	1.93	1.9	1.097	30
3-DH3	2.091	2.235	1.333	30
3-DH5	2.132	2.225	1.338	30

Plots for packet type DH5 shown below.



Emission Bandwidth 20 dB

Test procedure in accordance with ANSI C63.10-2013

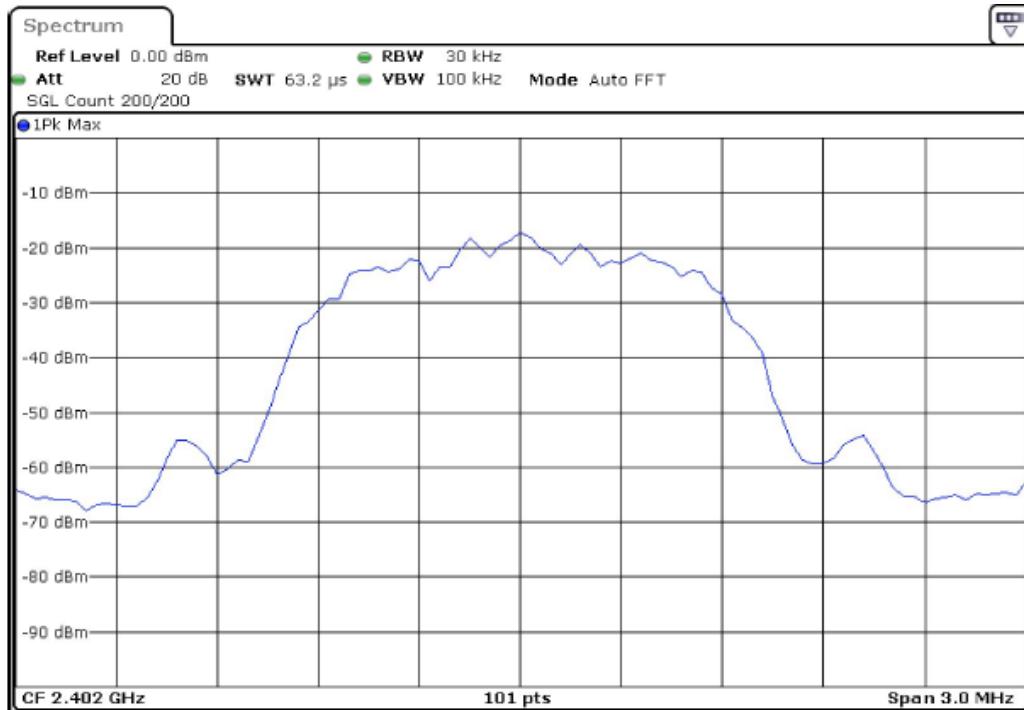
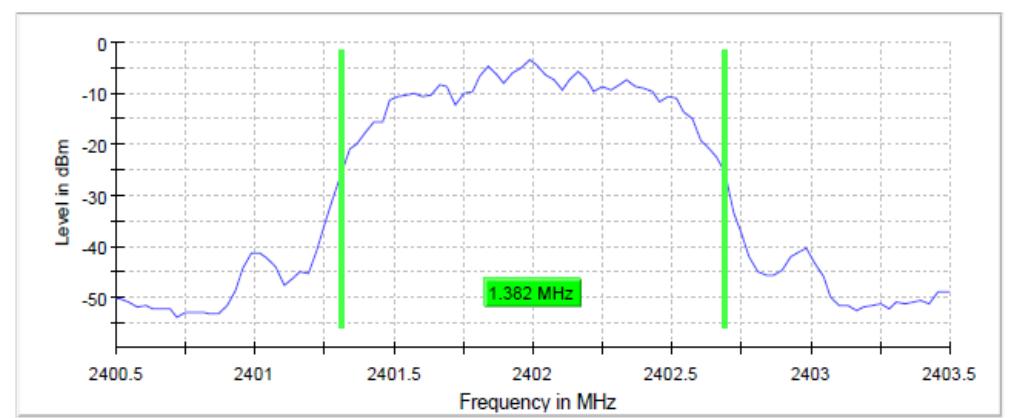
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1. Expanded Uncertainty (K=2) < 2%

2402 MHz

Data Rate	Bandwidth (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Result
DH1	1.058824	2401.485294	2402.544118	PASS
DH3	1.058824	2401.485294	2402.544118	PASS
DH5	1.058824	2401.485294	2402.544118	PASS
2-DH1	1.382352	2401.308824	2402.691176	PASS
2-DH3	1.382352	2401.308824	2402.691176	PASS
2-DH5	1.382352	2401.308824	2402.691176	PASS
3-DH1	1.352941	2401.338235	2402.691176	PASS
3-DH3	1.382352	2401.308824	2402.691176	PASS
3-DH5	1.382352	2401.308824	2402.691176	PASS

Plots for packet type 2-DH1 shown below.

20 dB Bandwidth



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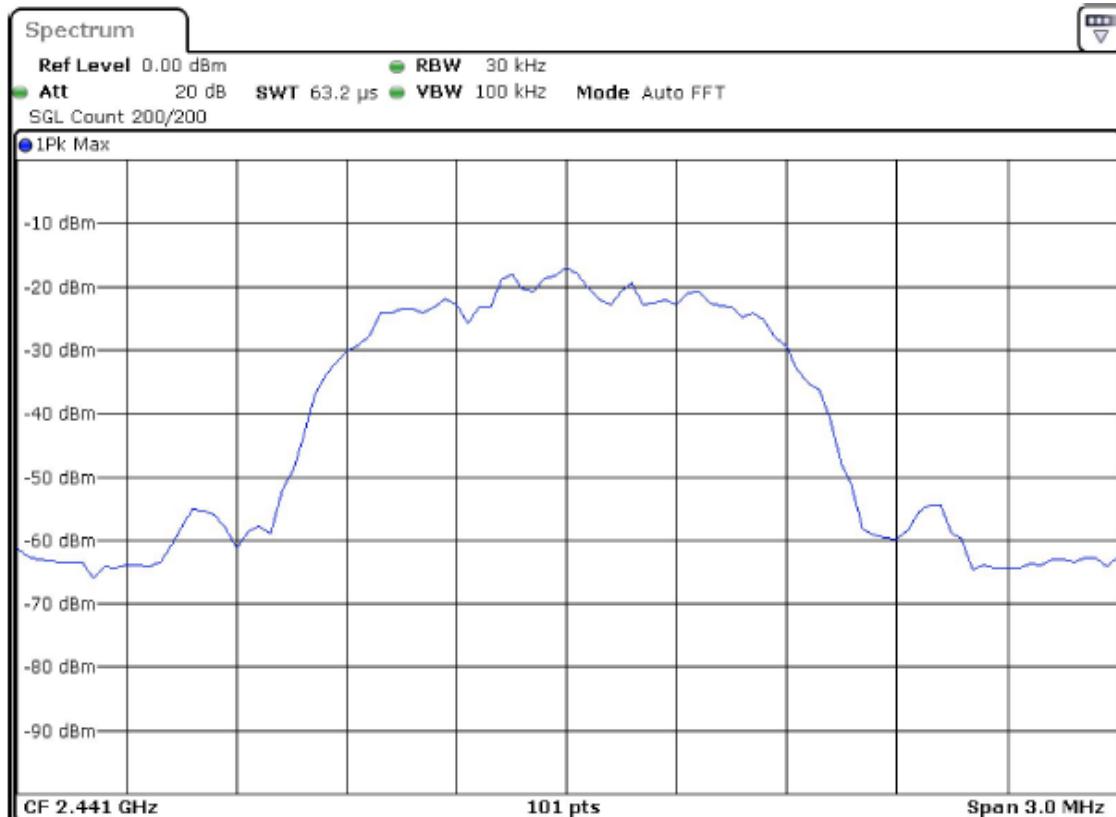
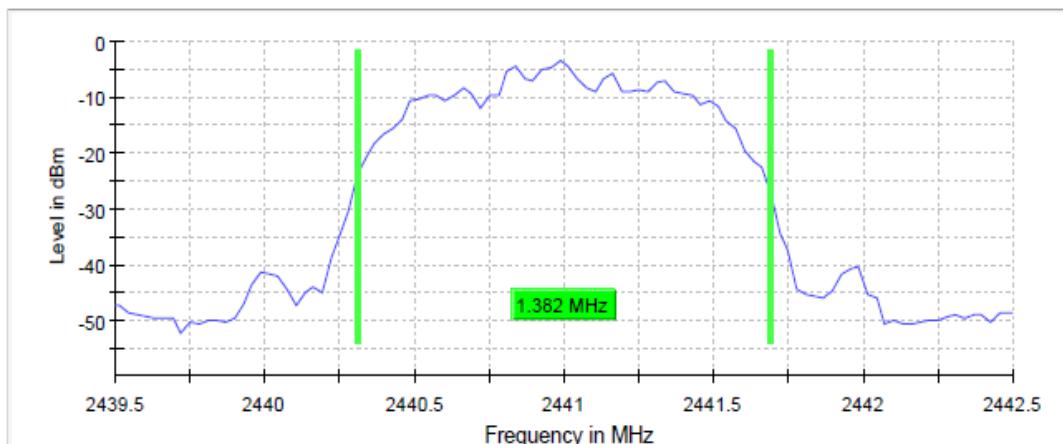
Testing Cert. No. 1627-01

2441 MHz

Data Rate	Bandwidth (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Result
DH1	1.058824	2440.485294	2441.544118	PASS
DH3	1.058824	2440.485294	2441.544118	PASS
DH5	1.058824	2440.485294	2441.544118	PASS
2-DH1	1.382352	2440.308824	2441.691176	PASS
2-DH3	1.382352	2440.308824	2441.691176	PASS
2-DH5	1.382352	2440.308824	2441.691176	PASS
3-DH1	1.323530	2440.338235	2441.661765	PASS
3-DH3	1.382352	2440.308824	2440.308824	PASS
3-DH5	1.382352	2440.308824	2441.691176	PASS

Plots for packet type 2-DH1 shown below.

20 dB Bandwidth



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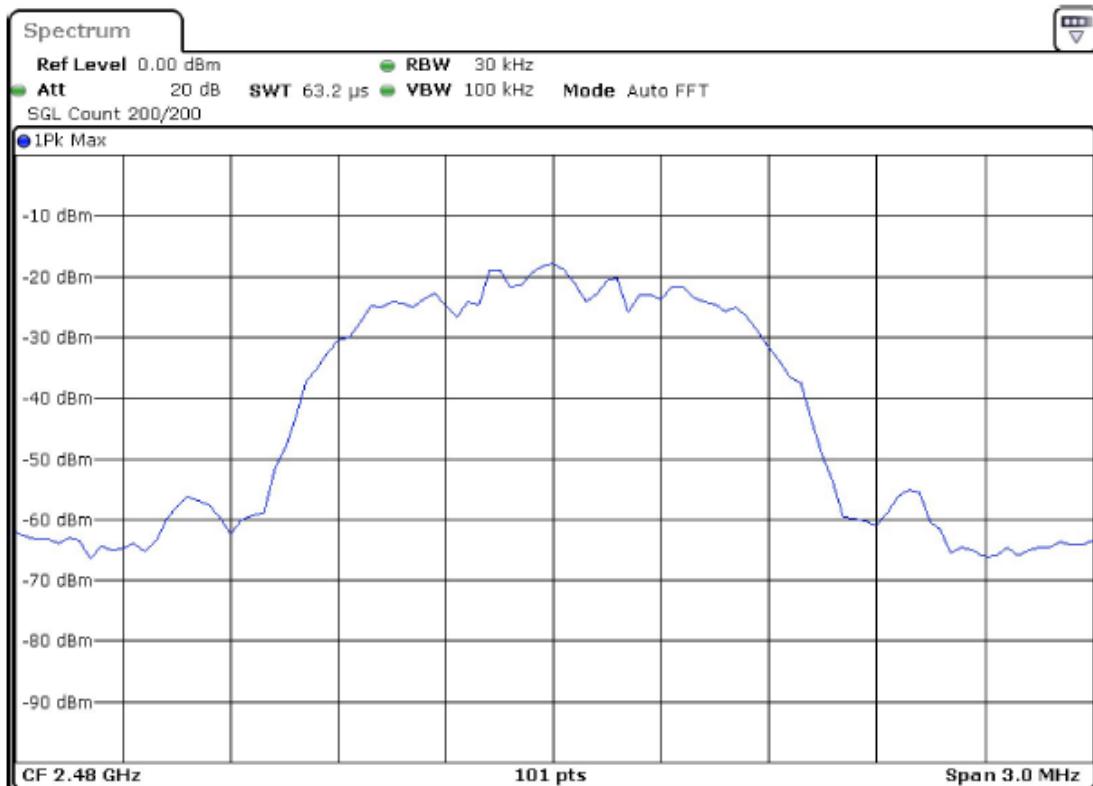
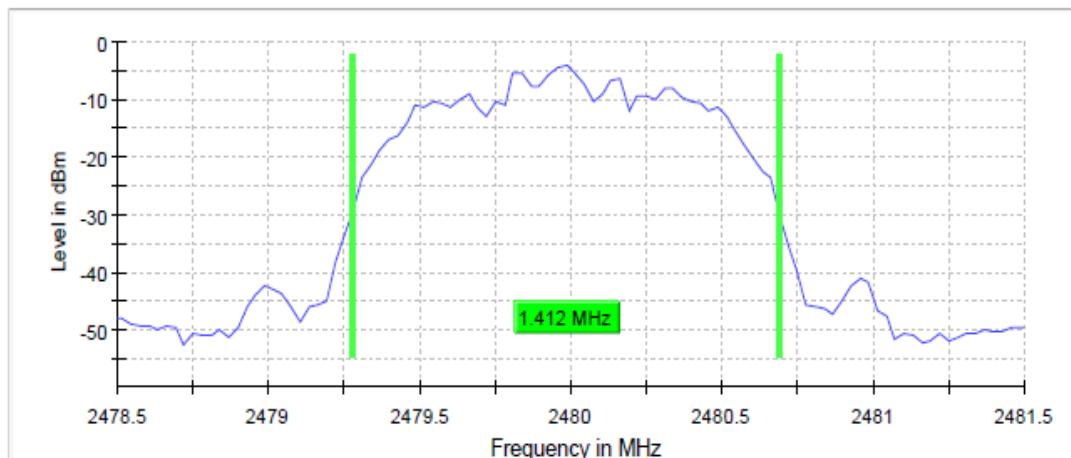
Testing Cert. No. 1627-01

2480 MHz

Data Rate	Bandwidth (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Result
DH1	1.029412	2479.485294	2480.514706	PASS
DH3	1.029412	2479.485294	2480.514706	PASS
DH5	1.058824	2479.455882	2480.514706	PASS
2-DH1	1.411764	2479.279412	2480.691176	PASS
2-DH3	1.411764	2479.279412	2480.691176	PASS
2-DH5	1.411764	2479.279412	2480.691176	PASS
3-DH1	1.352941	2479.308824	2480.661765	PASS
3-DH3	1.382353	2479.279412	2480.661765	PASS
3-DH5	1.382353	2479.279412	2480.661765	PASS

Plots for packet type 2-DH1 shown below.

20 dB Bandwidth



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Band Edge Low (2402 MHz)

Test procedure in accordance with ANSI C63.10-2013

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1. Expanded Uncertainty (K=2) < 0.8 dB

Inband Peak

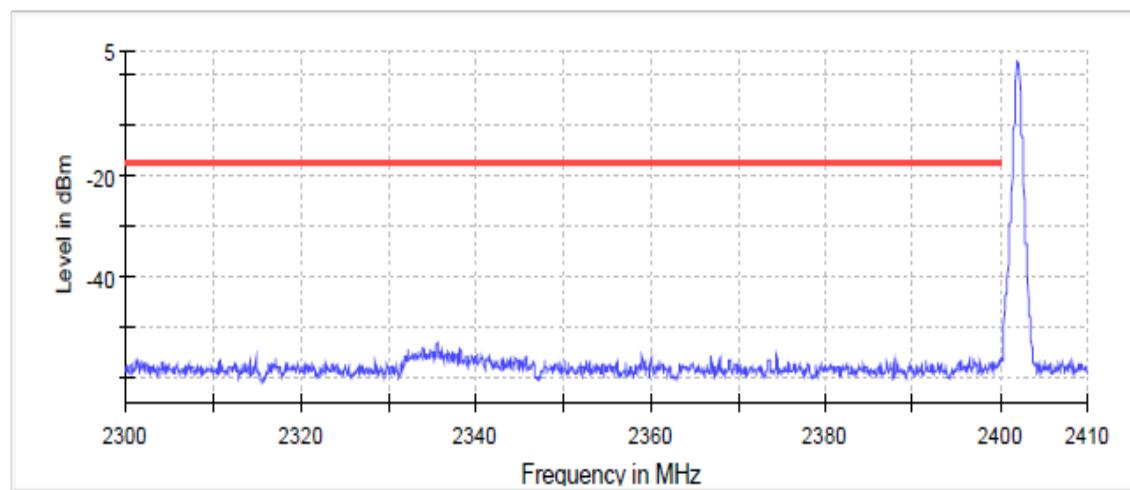
Data Rate	Frequency (MHz)	Level (dBm)
DH1	2401.828714	2.9
DH3	2401.978646	2.7
DH5	2401.978646	2.7
2-DH1	2401.828714	-0.7
2-DH3	2401.978646	-0.8
2-DH5	2401.828714	-0.6
3-DH1	2401.828714	-0.5
3-DH3	2402.128578	-0.4
3-DH5	2402.128578	-0.6

Plots for packet type DH5 shown below.

Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2335.608814	-53.4	36.1	-17.3	PASS
2335.558837	-53.6	36.3	-17.3	PASS
2335.658791	-54.0	36.7	-17.3	PASS
2333.909587	-54.3	37.0	-17.3	PASS
2335.458882	-54.3	37.1	-17.3	PASS
2338.257610	-54.4	37.1	-17.3	PASS
2332.310313	-54.4	37.1	-17.3	PASS
2334.059518	-54.4	37.2	-17.3	PASS
2334.009541	-54.5	37.2	-17.3	PASS
2334.809178	-54.6	37.3	-17.3	PASS
2333.859609	-54.6	37.3	-17.3	PASS
2333.959564	-54.6	37.4	-17.3	PASS
2332.360291	-54.7	37.4	-17.3	PASS
2334.109496	-54.7	37.4	-17.3	PASS
2335.408905	-54.7	37.4	-17.3	PASS

Band Edge



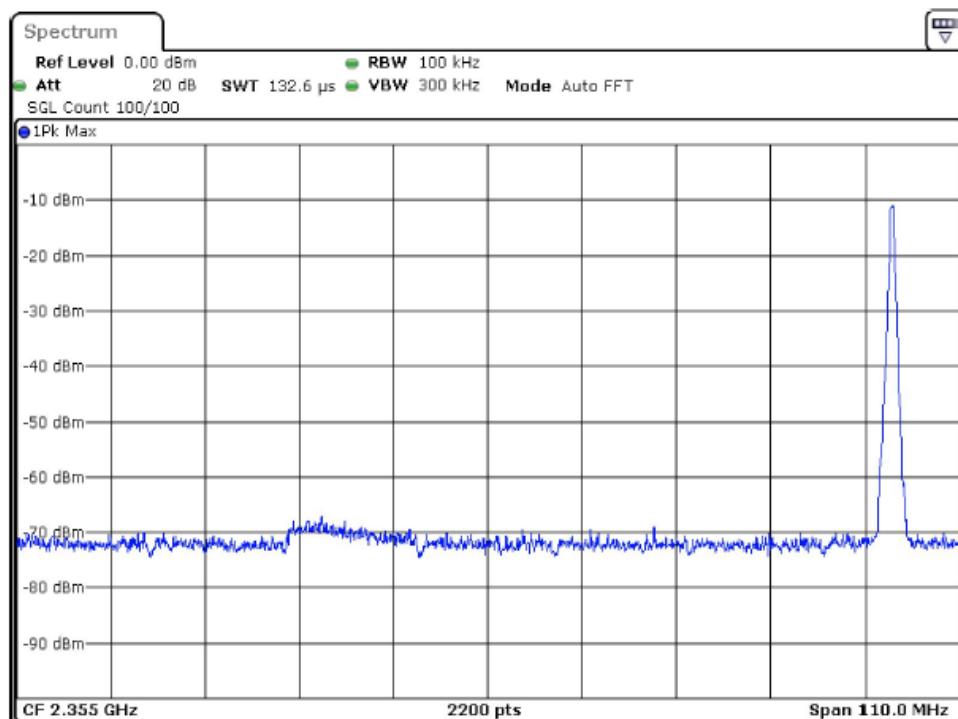
— Limit — Sum Level ✕ Fail



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Testing Cert. No. 1627-01

Band Edge High (2480 MHz)

Test procedure in accordance with ANSI C63.10-2013

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1. Expanded Uncertainty (K=2) < 0.8 dB

Inband Peak

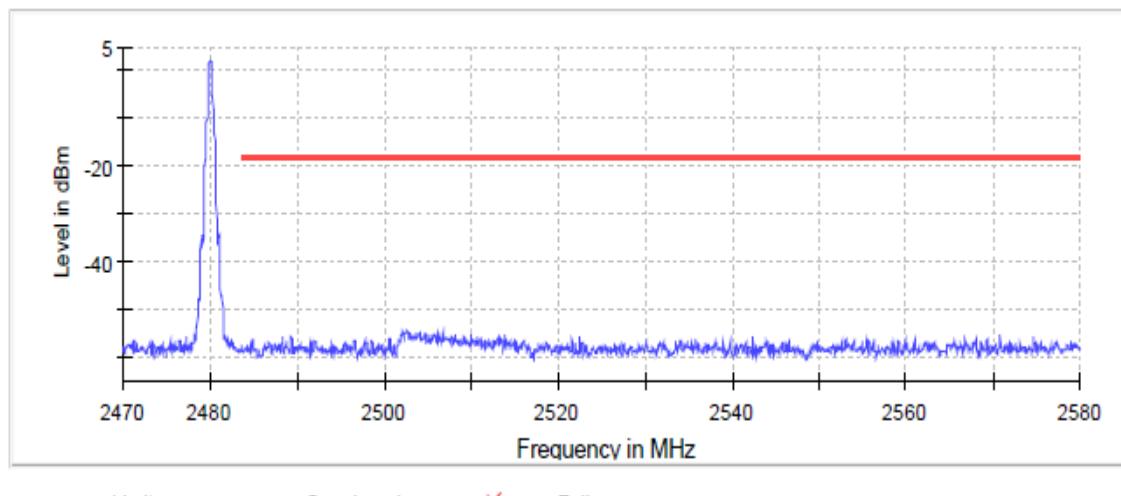
Data Rate	Frequency (MHz)	Level (dBm)
DH1	2479.820536	2.4
DH3	2480.020445	2.1
DH5	2480.070423	1.8
2-DH1	2479.820536	-1.3
2-DH3	2401.978646	-0.8
2-DH5	2480.020445	-1.5
3-DH1	2479.820536	-1.1
3-DH3	2480.170377	-1.2
3-DH5	2480.170377	-1.3

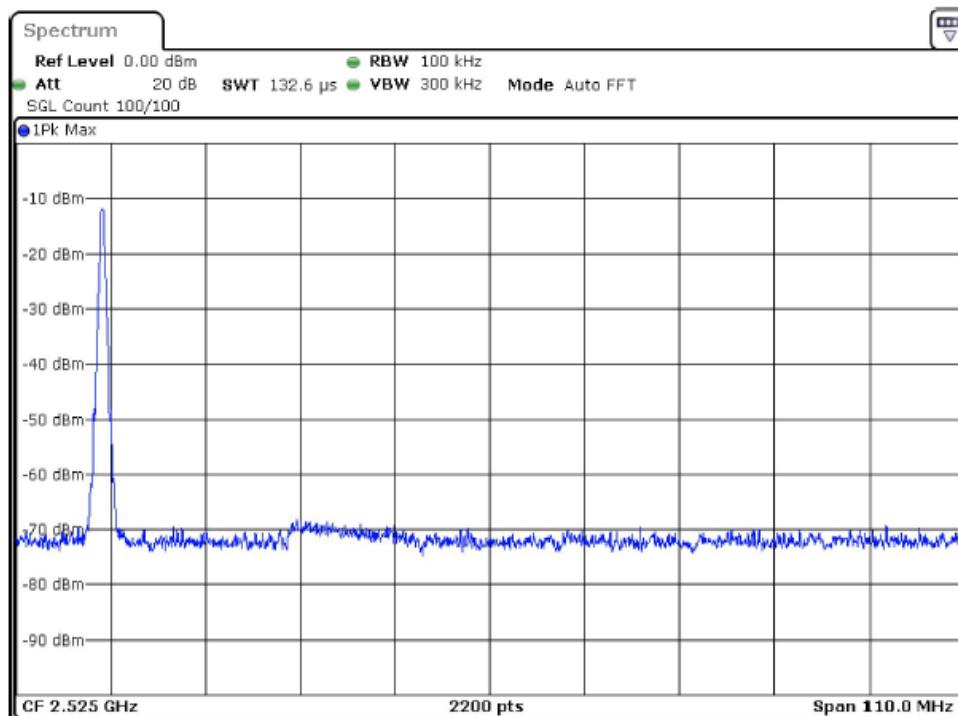
Plots for packet type DH5 shown below.

Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2502.560200	-54.4	36.2	-18.2	PASS
2502.610177	-54.4	36.2	-18.2	PASS
2502.510223	-54.6	36.4	-18.2	PASS
2506.108587	-54.7	36.5	-18.2	PASS
2502.460245	-54.8	36.5	-18.2	PASS
2503.009995	-54.8	36.6	-18.2	PASS
2504.059518	-54.8	36.6	-18.2	PASS
2503.659700	-54.8	36.6	-18.2	PASS
2504.109496	-54.8	36.6	-18.2	PASS
2503.609723	-54.8	36.6	-18.2	PASS
2502.410268	-54.9	36.7	-18.2	PASS
2506.058610	-54.9	36.7	-18.2	PASS
2502.660154	-54.9	36.7	-18.2	PASS
2506.708314	-55.0	36.8	-18.2	PASS
2504.759200	-55.0	36.8	-18.2	PASS

Band Edge





Conducted Spurious Emission

Test procedure in accordance with ANSI C63.10-2013

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1. Expanded Uncertainty (K=2) < 0.8 dB

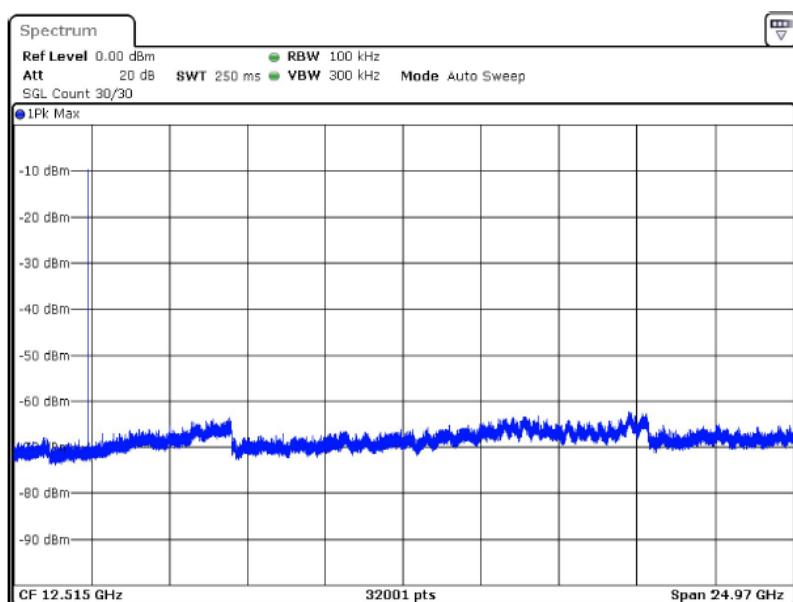
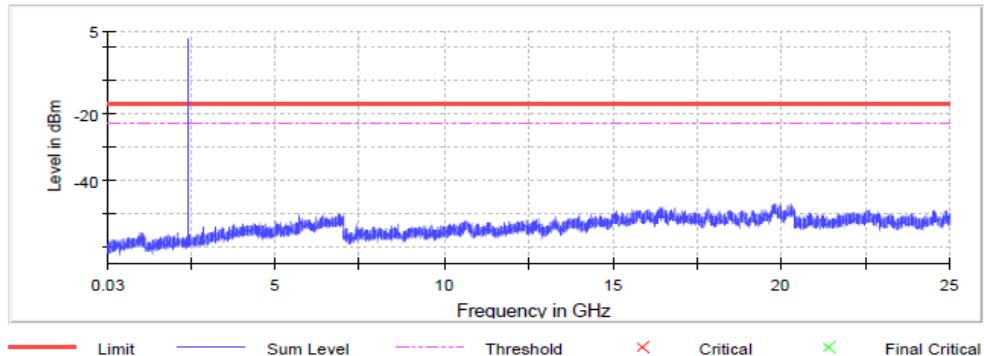
2402 MHz

Plots for packet type DH5 shown below.

Pre Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
19853.770546	-46.9	29.8	-17.1
19760.138898	-47.1	30.0	-17.1
19789.008656	-47.2	30.1	-17.1
20307.103775	-47.2	30.1	-17.1
19850.649491	-47.4	30.3	-17.1
20291.498500	-47.4	30.3	-17.1
19943.500875	-47.4	30.4	-17.1
19819.438941	-47.4	30.4	-17.1
19757.798106	-47.6	30.6	-17.1
19778.084963	-47.6	30.6	-17.1
20198.647116	-47.6	30.6	-17.1
19772.623117	-47.6	30.6	-17.1
19988.756171	-47.7	30.7	-17.1
19849.088963	-47.7	30.7	-17.1
19781.986282	-47.7	30.7	-17.1

Spurious



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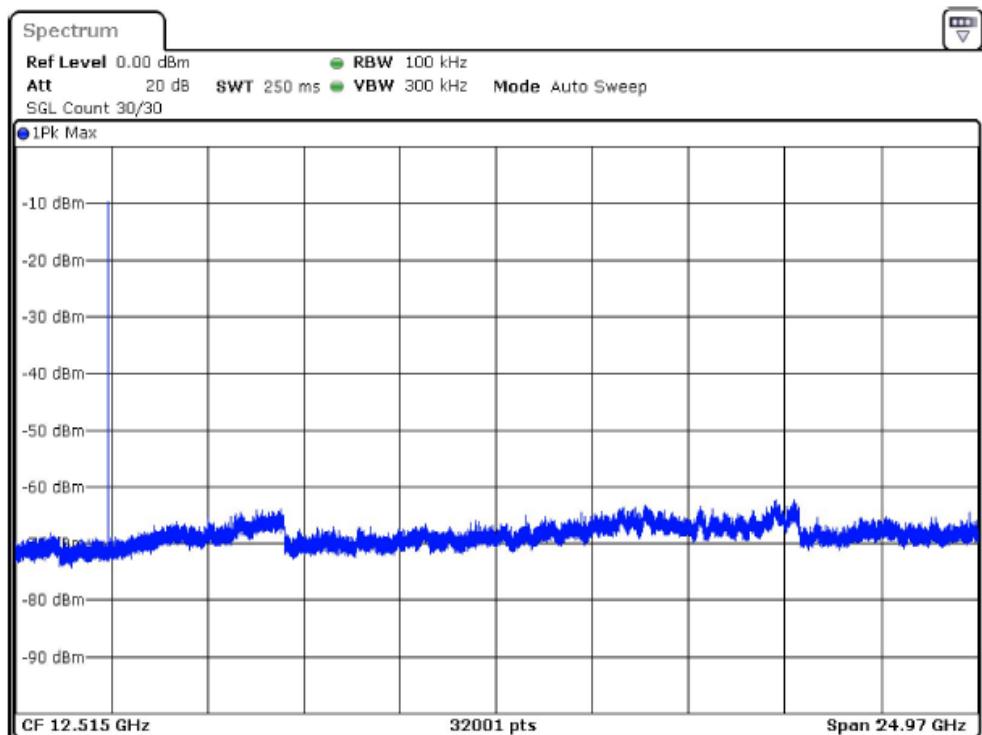
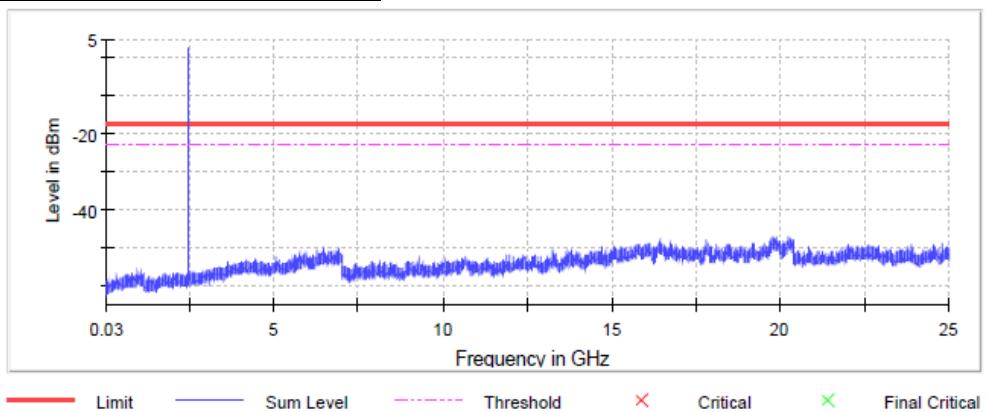
Testing Cert. No. 1627-01

2441 MHz

Plots for packet type DH5 shown below.

Pre Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
20247.023467	-47.0	29.9	-17.1
19777.304700	-47.1	30.0	-17.1
19792.909974	-47.3	30.2	-17.1
19742.973095	-47.3	30.2	-17.1
19782.766546	-47.4	30.3	-17.1
20292.278764	-47.5	30.4	-17.1
19882.640304	-47.5	30.4	-17.1
20313.345885	-47.6	30.4	-17.1
20244.682676	-47.7	30.5	-17.1
19835.824480	-47.7	30.5	-17.1
19775.744172	-47.7	30.5	-17.1
19761.699425	-47.7	30.6	-17.1
20215.812918	-47.8	30.6	-17.1
20289.157709	-47.8	30.6	-17.1
19756.237579	-47.8	30.7	-17.1



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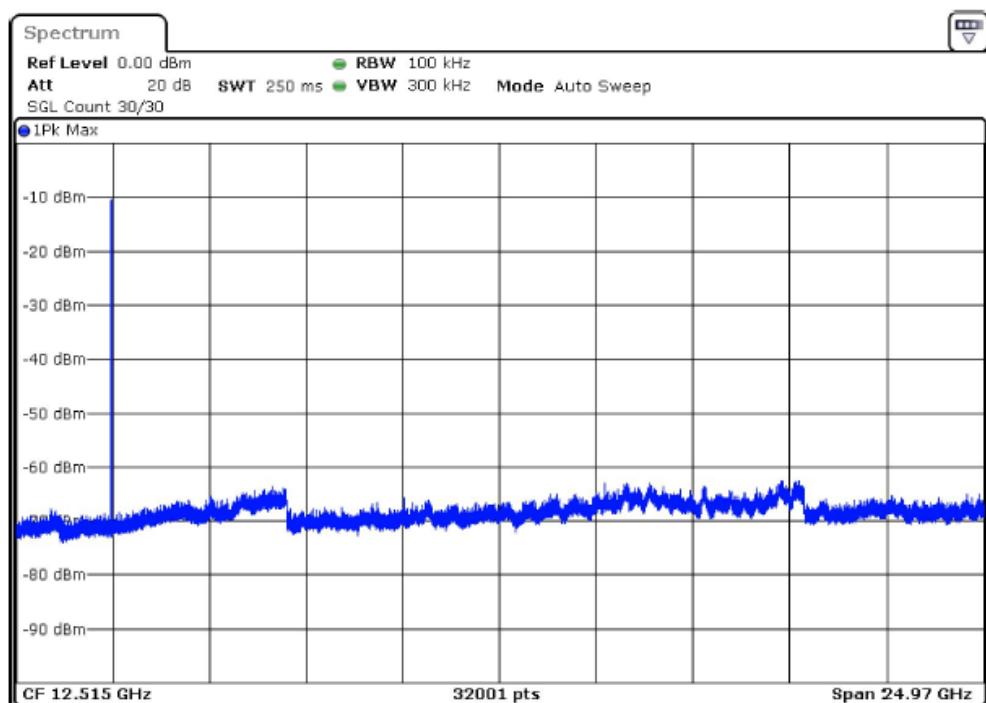
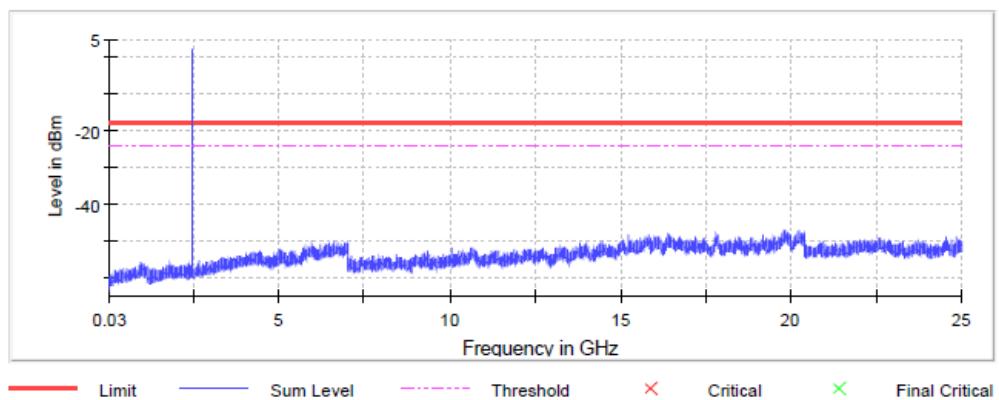
2480 MHz

Plots for packet type DH5 shown below.

Pre Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
19835.044216	-47.0	29.2	-17.8
19829.582370	-47.1	29.3	-17.8
20244.682676	-47.2	29.4	-17.8
19781.206018	-47.3	29.4	-17.8
19849.088963	-47.5	29.7	-17.8
19822.559996	-47.5	29.7	-17.8
19831.923161	-47.6	29.8	-17.8
19789.788919	-47.6	29.8	-17.8
20250.144522	-47.7	29.9	-17.8
20177.579995	-47.7	29.9	-17.8
20267.310324	-47.7	29.9	-17.8
20179.920786	-47.7	29.9	-17.8
19923.994282	-47.8	29.9	-17.8
19849.869227	-47.8	30.0	-17.8
20186.943160	-47.8	30.0	-17.8

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