Test Report

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

Report No	ER2501-5
Client	Harman International Industries, Incorporated
Address	30001 Cabot Drive Novi, MI 48377
Phone	248-254-7751
Items tested FCC ID IC	GEN3.1 HIGH VA 2AHPN-BE2838 6434C-BE2838
Equipment Type Equipment Code	Part 15 Spread Spectrum Transmitter DSS
FCC/IC Rule Parts	CFR Title 47 FCC Part 15.247, ISED Canada RSS-247 Issue 2
Test Dates	October 20th to November 10th, 2017
Results	As detailed within this report
Prepared by	Zachary Johnson – EMC Engineer
Authorized by	Yunus Faziloglu – Sr. EMC Engineer
Issue Date	11/28/2017
Conditions of Issue	This Test Report is issued subject to the conditions stated in the '*Conditions of Testing*' section on page 14 of this report.

Curtis-Straus LLC is accredited by the American Association for Laboratory Accreditation for the specific scope of accreditation under Certificate Number 1627-01. This report may contain data which is not covered by the A2LA accreditation.

ACCREDITED Cert No. 1627-01

Contents

Contents....2
Summary....3
Test Methodology....4
Product Tested - Configuration Documentation....5
Statement of Conformity....6
Test Results....7
Radiated Spurious Emissions....7
MEASUREMENTS / RESULTS....7
AC Line Conducted Emissions....12
Measurement Uncertainty....13
Conditions Of Testing....14
Appendix A:....16

Report REV Sep-08-2017 - YF

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 GEN3.1 HIGH VA. It is a frequency hopping spread spectrum transmitter that operates in the 2402 – 2480 MHz frequency range.

Antenna Type: PCB Trace
Gain: 1.28 dBi maximum peak

We found that the product met the above requirements without modification.
Modifications: None

Test samples were received in good condition.

Issue No.	Reason for change	Date Issued
1	Original Release	November 28, 2017

Curtis-Straus LLC, a wholly owned subsidiary of BV CPS
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ACCREDITED
Testing Cert. No. 1627-01

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 testing the device in the in-vehicle setup orientation and varying the test antenna's height and polarity.

EUT operating voltage is 13.5V 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:	R2501		
Company:	Harman International Industries, Incorporated		
Company Address:	30001 Cabot Drive		
	Novi, MI, 48377		
Contact:	Mark Bowman		
	MN	**PN**	**SN**
EUT:	GEN3.1 HIGH VA		
EUT Description:	Car Stereo System		

EUT Components	**MN**	**SN**
Back up camera		
GPS antenna		
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	-	No	No	1.2	in	yes	
USB		3	1	USB	Yes	No	1	in	yes	Redundant
GPS antenna		1	1	Coaxial	Yes	No	1.3	in	yes	
FM/AM antenna	-	1	1		Yes	No	0.4	in	yes	
Back up camera		1	1		Yes	No	0.3	in	yes	
Dab/xm		1	1	Coaxial	Yes	No	1	in	yes	

Software Operating Mode Description:

EUT may be operating in 1 of 2 modes. For immunity, EUT will connect with a CMW and operate as normal with traffic while doing emissions scans eut will operate by transmitting a constant signal. For Bluetooth eut will still need to be connected to CMW.

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 PCB trace antenna with 1.28dBi maximum peak 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, EUT is vehicle battery powered 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)]

All results below are for the in-vehicle setup orientation only.

MEASUREMENTS / RESULTS

Curtis Straus - a Bureau Veritas Company					Work Order - R2501								
Radiated Emissions Electric Field 3m Distance					EUT Power Input - 13.8V DC								
30-1000MHz Vertical Data					Test Site - CH 1								
Operator: CCH					Conditions - 24.3°C; 37%RH; 1020mBar								
FCC B. Filtering 2300-2500MHz 0.8m Height 11/4/2017					Witnessed by - FCC B								
					EUT Maximum Frequency - Filtering 2300-2500MHz								
Frequency	Raw QP Reading	Correction Factor	Adjusted QP Amplitude	Lim1: FCC_pt15_109_Class_B	Margin to Lim1	Test Results Lim1	Worst Margin Lim1	Lim2: FCC_pt15_109_Class_B	Margin to Lim2	Test Results Lim2	Worst Margin Lim2	Antenna Height	EUT Azimuth
(MHz)	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)
39.389	49.4	-21.4	28	40	-12	PASS		40	-12	PASS		125	276
73.674	53.5	-27.3	26.2	40	-13.8	PASS		40	-13.8	PASS		115	20
176.719	49.6	-23.9	25.7	43.5	-17.8	PASS		43.5	-17.8	PASS		111	293
205.307	47.9	-23.7	24.1	43.5	-19.4	PASS		43.5	-19.4	PASS		175	155
336.059	54.8	-20	34.8	46	-11.2	PASS	-11.2	46	-11.2	PASS	-11.2	102	317
345.611	51	-20	31.1	46	-14.9	PASS		46	-14.9	PASS		125	340

Curtis Straus - a Bureau Veritas Company					Work Order - R2501								
Radiated Emissions Electric Field 3m Distance					EUT Power Input - 13.8V DC								
30-1000MHz Horizontal Data					Test Site - CH 1								
Operator: CCH					Conditions - 24.3°C; 37%RH; 1020mBar								
FCC B. Filtering 2300-2500MHz 0.8m Height 11/4/2017					Witnessed by - FCC B								
					EUT Maximum Frequency - Filtering 2300-2500MHz								
Frequency	Raw QP Reading	Correction Factor	Adjusted QP Amplitude	Lim1: FCC_pt15_109_Class_B	Margin to Lim1	Test Results Lim1	Worst Margin Lim1	Lim2: FCC_pt15_109_Class_B	Margin to Lim2	Test Results Lim2	Worst Margin Lim2	Antenna Height	EUT Azimuth
(MHz)	(dBµV)	(dB/m)	(dBµV/m)	(dbµV/m)	(dB)	(Pass/Fail)	(dB)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)
178.267	53.5	-23.9	29.6	43.5	-13.9	PASS	-13.9	43.5	-13.9	PASS	-13.9	125	205
206.964	47.7	-24	23.7	43.5	-19.8	PASS		43.5	-19.8	PASS		101	339
335.588	48.6	-20	28.6	46	-17.4	PASS		46	-17.4	PASS		161	220
335.955	50.1	-20	30.1	46	-15.9	PASS		46	-15.9	PASS		131	220
337.63	46.8	-19.9	26.9	46	-19.1	PASS		46	-19.1	PASS		126	215
951.15	34.9	-7	27.9	46	-18.2	PASS		46	-18.2	PASS		125	277

30-1000MHz Center Channel

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 3m Distance
1-6GHz Horizontal Data
Operator: CCH
Notes:
Etsi 300328. Filtering 2300-2500MHz 1.5m Height 11/4/2017

Work Order - R2501
EUT Power Input - 13.8V DC
Test Site - CH 1
Conditions - 24.3°C; 37%RH; 1020mBar
Witnessed by - Etsi 300328
EUT Maximum Frequency - Bluetooth mode CH 0

Frequency (MHz)	Raw Peak Reading (dBµV)	Raw Avg Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Pk Lim: FCC_pt15_109_ClassB_Peak (dBµV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBµV/m)	Av Lim: FCC_pt15_109_ClassB_AVG (dBµV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Average Margin (dB)
2190.5	35.6	25.7	7.9	43.4	74	-30.5	PASS		33.6	54	-20.4	PASS	
2801.8	38.2	25.7	11.3	49.5	74	-24.5	PASS	-24.5	37	54	-17	PASS	
5769.6	32.9	24.2	15.2	48.1	74	-25.9	PASS		39.4	54	-14.6	PASS	-14.6

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 3m Distance
1-6GHz Vertical Data
Operator: CCH
Notes:
Etsi 300328. Filtering 2300-2500MHz 1.5m Height 11/4/2017

Work Order - R2501
EUT Power Input - 13.8V DC
Test Site - CH 1
Conditions - 24.3°C; 37%RH; 1020mBar
Witnessed by - Etsi 300328
EUT Maximum Frequency - Bluetooth mode CH 0

Frequency (MHz)	Raw Peak Reading (dBµV)	Raw Avg Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Pk Lim: FCC_pt15_109_ClassB_Peak (dBµV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBµV/m)	Av Lim: FCC_pt15_109_ClassB_AVG (dBµV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)
1953.1	33.9	25.4	7	40.9	74	-33.1	PASS		32.4	54	-21.6	PASS	
2809.9	35	25.7	10.9	45.9	74	-28	PASS		36.6	54	-17.4	PASS	
5679.5	32.8	24.7	14.9	47.8	74	-26.2	PASS	-26.2	39.6	54	-14.3	PASS	-14.3

1-6GHz Low Channel

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 3m Distance
1-6GHz Vertical Data
Operator: CCH
FCC B. Filtering 2300-2500MHz 1.5m Height 11/4/2017

Work Order - R2501
EUT Power Input - 13.8V DC
Test Site - CH 1
Conditions - 24.3°C; 37%RH; 1020mBar
Witnessed by - FCC B
EUT Maximum Frequency - Bluetooth mode CH 39

Frequency	Raw Peak Reading	Raw Avg Reading	Correction Factor	Adjusted Peak Amplitude	Pk Lim: FCC_pt15_109_ClassB_Peak	Peak Margin	Peak Results	Worst Peak Margin	Adjusted Avg Amplitude	Av Lim: FCC_pt15_109_ClassB_AVG	Avg Margin	Avg Results	Worst Avg Margin	Antenna Height	EUT Azimuth
(MHz)	(dBµV)	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)
2170.6	34.6	25.8	7.7	42.3	74	-31.7	PASS		33.5	54	-20.5	PASS		175	256
2804	35.3	25.7	11.2	46.5	74	-27.5	PASS		36.9	54	-17.1	PASS		299	167
5989.4	33	24.6	15.6	48.7	74	-25.3	PASS	-25.3	40.2	54	-13.7	PASS	-13.7	193	262

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 3m Distance
1-6GHz Horizontal Data
Operator: CCH
FCC B. Filtering 2300-2500MHz 1.5m Height 11/4/2017

Work Order - R2501
EUT Power Input - 13.8V DC
Test Site - CH 1
Conditions - 24.3°C; 37%RH; 1020mBar
Witnessed by - FCC B
EUT Maximum Frequency - Bluetooth mode CH 39

Frequency	Raw Peak Reading	Raw Avg Reading	Correction Factor	Adjusted Peak Amplitude	Pk Lim: FCC_pt15_109_ClassB_Peak	Peak Margin	Peak Results	Worst Peak Margin	Adjusted Avg Amplitude	Av Lim: FCC_pt15_109_ClassB_AVG	Avg Margin	Avg Results	Worst Average Margin	Antenna Height	EUT Azimuth
(MHz)	(dBµV)	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)
2182.7	36.6	25.8	7.8	44.4	74	-29.6	PASS		33.6	54	-20.4	PASS		207	4
2801	35.5	25.7	11.3	46.8	74	-27.1	PASS		37	54	-16.9	PASS		175	28
5978.6	33.3	24.6	15.5	48.8	74	-25.2	PASS	-25.2	40.1	54	-13.9	PASS	-13.9	281	223

1-6GHz Mid Channel

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 3m Distance
1-6GHz Horizontal Data
Operator: CCH
Notes:
Etsi 300328. Filtering 2300-2500MHz 1.5m Height 11/4/2017

Work Order - R2501
EUT Power Input - 13.8V DC
Test Site - CH 1
Conditions - 24.3°C; 37%RH; 1020mBar
Witnessed by - Etsi 300328
EUT Maximum Frequency - Bluetooth mode CH 78

Frequency (MHz)	Raw Peak Reading (dBµV)	Raw Avg Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Pk Lim. FCC_pt15_109_ClassB_Peak (dBµV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBµV/m)	Av Lim. FCC_pt15_109_ClassB_AVG (dBµV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Average Margin (dB)
2193.5	35.9	25.8	7.9	43.8	74	-30.2	PASS		33.7	54	-20.3	PASS	
2806.9	34.2	25.7	11.1	45.2	74	-28.8	PASS		36.8	54	-17.2	PASS	
5767	33	24.2	15.2	48.2	74	-25.8	PASS	-25.8	39.4	54	-14.6	PASS	-14.6

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 3m Distance
1-6GHz Vertical Data
Operator: CCH
Notes:
Etsi 300328. Filtering 2300-2500MHz 1.5m Height 11/4/2017

Work Order - R2501
EUT Power Input - 13.8V DC
Test Site - CH 1
Conditions - 24.3°C; 37%RH; 1020mBar
Witnessed by - Etsi 300328
EUT Maximum Frequency - Bluetooth mode CH 78

Frequency (MHz)	Raw Peak Reading (dBµV)	Raw Avg Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Pk Lim. FCC_pt15_109_ClassB_Peak (dBµV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBµV/m)	Av Lim. FCC_pt15_109_ClassB_AVG (dBµV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)
2068.8	35.3	25.8	7.1	42.4	74	-31.6	PASS		32.9	54	-21.1	PASS	
2799.5	36.9	25.8	-36.6	0.2	74	-73.8	PASS		-10.9	54	-64.9	PASS	
5952.9	32.8	24.4	15.2	48	74	-26	PASS	-26	39.6	54	-14.3	PASS	-14.3

1-6GHz High Channel

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 1m Distance
6-18GHz Vertical Data
Operator: CCH
FCC B. Filtering 2300-2500MHz 1.5m Height 11/4/2017

Work Order - R2501
EUT Power Input - 13.8V DC
Test Site - CH 1
Conditions - 24.3°C; 37%RH; 1020mBar
Witnessed by - FCC B
EUT Maximum Frequency - Bluetooth mode CH 39

Frequency	Raw Peak Reading	Raw Avg Reading	Correction Factor	Adjusted Peak Amplitude	Pk Lim: FCC_pt15_109_ClassB_Peak	Peak Margin	Peak Results	Worst Peak Margin	Adjusted Avg Amplitude	Av Lim: FCC_pt15_109_ClassB_AVG	Avg Margin	Avg Results	Worst Avg Margin	Antenna Height	EUT Azimuth
(MHz)	(dBµV)	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)
7989.2	26.4	17	21.7	48.1	83.5	-35.4	PASS		38.6	63.5	-24.9	PASS		100	25
14101.4	27.5	18.1	31	58.5	83.5	-25	PASS		49	63.5	-14.5	PASS		189	176
16936.8	29.9	20.4	32.3	62.2	83.5	-21.3	PASS		52.7	63.5	-10.8	PASS		100	15
17715	27.5	19.1	38.6	66.1	83.5	-17.4	PASS	-17.4	57.7	63.5	-5.8	PASS	-5.8	100	35

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 1m Distance
6-18GHz Horizontal Data
Operator: CCH
FCC B. Filtering 2300-2500MHz 1.5m Height 11/4/2017

Work Order - R2501
EUT Power Input - 13.8V DC
Test Site - CH 1
Conditions - 24.3°C; 37%RH; 1020mBar
Witnessed by - FCC B
EUT Maximum Frequency - Bluetooth mode CH 39

Frequency	Raw Peak Reading	Raw Avg Reading	Correction Factor	Adjusted Peak Amplitude	Pk Lim: FCC_pt15_109_ClassB_Peak	Peak Margin	Peak Test Results	Worst Peak Margin	Adjusted Avg Amplitude	Av Lim: FCC_pt15_109_ClassB_AVG	Avg Margin	Avg Test Results	Worst Avg Margin	Antenna Height	EUT Azimuth
(MHz)	(dBµV)	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)
8013.3	26.2	17.2	21.5	47.7	83.5	-35.8	PASS		38.8	63.5	-24.7	PASS		186	245
13793.8	27.9	18.2	30.2	58.1	83.5	-25.4	PASS		48.4	63.5	-15.1	PASS		129	0
17002.2	29.9	20.2	32.3	62.2	83.5	-21.3	PASS		52.5	63.5	-11	PASS		174	256
17656.4	28.5	19.4	38.2	66.6	83.5	-16.9	PASS	-16.9	57.5	63.5	-6	PASS	-6	153	6

6-18GHz Center Channel

Radiated Emissions Table

Date: 07-Nov-17 **Company:** Harman International **Work Order:** R2501
Engineer: Mike Leonard **EUT Desc:** N/A High S/N 070 **EUT Operating Voltage/Frequency:** 13.5VDC
Temp: 23c **Humidity:** 31% **Pressure:** 1009mbar

Frequency Range: 18-26.5 **Measurement Distance:** 0.1 m

Notes: operating in Bluetooth mode with asset #2439 tablet **EUT Max Freq:** Not Provided

Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dBµV)	Average Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dBµV/m)	Adjusted Avg Reading (dBµV/m)	FCC Class B High Frequency - Peak Limit (dBµV/m)	FCC Class B High Frequency - Peak Margin (dB)	FCC Class B High Frequency - Peak Result (Pass/Fail)	FCC Class B High Frequency - Average Limit (dBµV/m)	FCC Class B High Frequency - Average Margin (dB)	FCC Class B High Frequency - Average Result (Pass/Fail)
no emissions found above noise floor														

Test Site: EMI Chamber 1 **Cable 1:** Asset #2328 **Cable 2:** --- **Cable 3:** ---
Analyzer: Gold **Preamp:** 18-26.5GHz **Antenna:** 18-26.5GHz Horn **Preselector:** ---
CSsoft Radiated Emissions Calculator v 1.017.197
Copyright Curtis-Straus LLC 2000
Adjusted Reading = Reading - Preamp Factor + Antenna Factor + Cable Factor

18-26.5GHz Center Channel

Rev. 11/5/2017

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
Rental MXE EMI Receiver(1170725)	20Hz-26.5GHz	N9038A	Agilent	MY51210151	1170725	I	12/22/2017	12/22/2016
Radiated Emissions Sites	**FCC Code**	**IC Code**	**VCCI Code**	**Range**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
EMI Chamber 1	719150	2762A-6	A-0015	30-1000MHz	1685	I	12/21/2018	12/21/2016
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
Preamps / Couplers Attenuators / Filters	**Range**	**MN**	**Mfr**	**SN**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
2310 PA	1-1000MHz	PAM-103	COM-POWER	441175	2310	II	10/29/2018	10/29/2017
2463 HF PA	.5-18GHz	PAM-118A	COM-POWER	443005	2463	II	10/9/2018	10/9/2017
HF (Yellow)	18-26.5GHz	AFS4-18002650-60-8P-4	CS	467559	1266	II	10/16/2018	10/16/2017
Antennas	**Range**	**MN**	**Mfr**	**SN**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
Red-Brown Bilog	30-2000MHz	JB1	Sunol	A0032406	1218	I	1/13/2019	1/13/2017
Orange Horn	1-18GHz	3115	EMCO	0004-6123	390	I	10/13/2018	10/13/2016
HF (White) Horn	18-26.5GHz	801-WLM	Waveline	758	758	III	Verify before Use	date of test
Meteorological Meters/Chambers		**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**			**Cat**	**Calibration Due**	**Calibrated on**
Asset #1509	9kHz - 18GHz		Florida RF			II	10/2/2018	10/2/2017
Asset #2456	9KHz-18GHz		MegaPhase			II	10/29/2018	10/29/2017
Asset #2457	9KHz-18GHz		MegaPhase			II	10/29/2018	10/29/2017
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

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

30MHz to 26.5GHz Test Equipment Used

Radiated Band Edge

Radiated Emissions Table

Date: 06-Nov-17 **Company:** Harman **Work Order:** R2501
Engineer: Chris Hamel **EUT Desc:** NA High **EUT Operating Voltage/Frequency:** 13.8V DC
Temp: 24.6°C **Humidity:** 25% **Pressure:** 1010mBar
Frequency Range: **Measurement Distance:** 3 m
Notes: BT Mode DH1 Packet Rate. **EUT Max Freq:**

Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dBµV)	Average Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dBµV/m)	Adjusted Avg Reading (dBµV/m)	FCC Class B High Frequency - Peak Limit (dBµV/m)	FCC Class B High Frequency - Peak Margin (dB)	FCC Class B High Frequency - Peak Result (Pass/Fail)	FCC Class B High Frequency - Average Limit (dBµV/m)	FCC Class B High Frequency - Average Margin (dB)	FCC Class B High Frequency - Average Result (Pass/Fail)
Channel 0				---	---	---	---	---	---	---	---	---	---	---
Max V	2401.9	57.2		0.0	28.0	3.1	---	---	74.0	---	---	54.0	---	---
Max H	2402.2	64.2		0.0	28.0	3.1	---	---	74.0	---	---	54.0	---	---
H	2310.0	18.2	4.2	0.0	27.9	3.1	49.2	35.2	74.0	-24.8	Pass	54.0	-18.8	Pass
H	2381.5	22.0	4.3	0.0	28.0	3.1	53.1	35.4	74.0	-20.9	Pass	54.0	-18.6	Pass
				---	---	---	---	---	---	---	---	---	---	---
Channel 78				---	---	---	---	---	---	---	---	---	---	---
Max V	2479.9	59.9		0.0	28.2	3.2	---	---	74.0	---	---	54.0	---	---
Max H	2479.8	62.1		0.0	28.2	3.2	---	---	74.0	---	---	54.0	---	---
H	2483.5	12.1	12.1	0.0	28.2	3.2	43.5	43.5	74.0	-30.5	Pass	54.0	-10.5	Pass
H	2492.7	16.4	16.4	0.0	28.3	3.3	48.0	48.0	74.0	-26.0	Pass	54.0	-6.0	Pass
				---	---	---	---	---	---	---	---	---	---	---

Table Result: Pass by -6.0 dB ***Worst Freq:*** 2492.7 MHz

Test Site: EMI Chamber 1 **Cable 1:** Asset #2456 **Cable 2:** Asset #2457 **Cable 3:** ---
Analyzer: Rental SA#3 **Preamp:** None **Antenna:** Orange Horn **Preselector:** ---
CSsoft Radiated Emissions Calculator v 1.017.197 Copyright Curtis-Straus LLC 2000
Adjusted Reading = Reading - Preamp Factor + Antenna Factor + Cable Factor

Rev. 11/5/2017

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	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

Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Orange Horn	1-18GHz	3115	EMCO	0004-6123	390	I	10/13/2018	10/13/2016

Meteorological Meters/Chambers		MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
TH A#2084		HTC-1	HDE		2084	II	3/23/2018	3/23/2017

Cables	Range	Mfr	Cat	Calibration Due	Calibrated on
Asset #2456	9KHz-18GHz	MegaPhase	II	10/29/2018	10/29/2017
Asset #2457	9KHz-18GHz	MegaPhase	II	10/29/2018	10/29/2017

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

Band Edge Test Equipment Used

AC Line Conducted Emissions

LIMITS

Frequency of emission (MHz)	Quasi-peak limit (dBµV)	Average limit (dBµV)
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

N/A. EUT is vehicle battery powered only.

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 CISPR	 5.6dB 4.6dB	 N/A 5.2dB (Ucispr)
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 CISPR	 3.9dB 3.6dB	 N/A 3.6dB (Ucispr)
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.

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

Appendix A:

ER2501-5 Appendix A
CFR Title 47 FCC Part §15.247 and ISED Canada RSS-247 Issue 2

DUT Information

DUT Name:	GEN3.1 HIGH VA
Manufacturer:	Harman International Industries, Inc.
Serial Number:	074

Frequencies

BT CH 0 (2402 MHz)		
BT CH 1 (2403 MHz)	BT CH 2 (2404 MHz)	BT CH 3 (2405 MHz)
BT CH 4 (2406 MHz)	BT CH 5 (2407 MHz)	BT CH 6 (2408 MHz)
BT CH 7 (2409 MHz)	BT CH 8 (2410 MHz)	BT CH 9 (2411 MHz)
BT CH 10 (2412 MHz)	BT CH 11 (2413 MHz)	BT CH 12 (2414 MHz)
BT CH 13 (2415 MHz)	BT CH 14 (2416 MHz)	BT CH 15 (2417 MHz)
BT CH 16 (2418 MHz)	BT CH 17 (2419 MHz)	BT CH 18 (2420 MHz)
BT CH 19 (2421 MHz)	BT CH 20 (2422 MHz)	BT CH 21 (2423 MHz)
BT CH 22 (2424 MHz)	BT CH 23 (2425 MHz)	BT CH 24 (2426 MHz)
BT CH 25 (2427 MHz)	BT CH 26 (2428 MHz)	BT CH 27 (2429 MHz)
BT CH 28 (2430 MHz)	BT CH 29 (2431 MHz)	BT CH 30 (2432 MHz)
BT CH 31 (2433 MHz)	BT CH 32 (2434 MHz)	BT CH 33 (2435 MHz)
BT CH 34 (2436 MHz)	BT CH 35 (2437 MHz)	BT CH 36 (2438 MHz)
BT CH 37 (2439 MHz)	BT CH 38 (2440 MHz)	BT CH 39 (2441 MHz)
BT CH 40 (2442 MHz)	BT CH 41 (2443 MHz)	BT CH 42 (2444 MHz)
BT CH 43 (2445 MHz)	BT CH 44 (2446 MHz)	BT CH 45 (2447 MHz)
BT CH 46 (2448 MHz)	BT CH 47 (2449 MHz)	BT CH 48 (2450 MHz)
BT CH 49 (2451 MHz)	BT CH 50 (2452 MHz)	BT CH 51 (2453 MHz)
BT CH 52 (2454 MHz)	BT CH 53 (2455 MHz)	BT CH 54 (2456 MHz)
BT CH 55 (2457 MHz)	BT CH 56 (2458 MHz)	BT CH 57 (2459 MHz)
BT CH 58 (2460 MHz)	BT CH 59 (2461 MHz)	BT CH 60 (2462 MHz)
BT CH 61 (2463 MHz)	BT CH 62 (2464 MHz)	BT CH 63 (2465 MHz)
BT CH 64 (2466 MHz)	BT CH 65 (2467 MHz)	BT CH 66 (2468 MHz)
BT CH 67 (2469 MHz)	BT CH 68 (2470 MHz)	BT CH 69 (2471 MHz)
BT CH 70 (2472 MHz)	BT CH 71 (2473 MHz)	BT CH 72 (2474 MHz)
BT CH 73 (2475 MHz)	BT CH 74 (2476 MHz)	BT CH 75 (2477 MHz)
BT CH 76 (2478 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

Frequency	Efficiency [%]	Peak Gain [dBi]	Efficiency [dB]
2400	28.4533	0.0733687	-5.458673571
2402	29.438	0.2508994	-5.31091699
2405	29.3776	0.220957	-5.319836867
2410	30.3714	0.33533	-5.175351884
2415	31.1824	0.426418	-5.060904617
2420	32.0601	0.474909	-4.940351274
2425	33.1718	0.585229	-4.792309617
2430	34.2808	0.702777	-4.649490516
2435	35.0979	0.721518	-4.547188677
2440	35.8381	0.701526	-4.45655023
2441	36.5783	0.681534	-4.367764825
2445	36.3931	0.635128	-4.389809492
2450	36.2933	0.511544	-4.401735414
2455	36.226	0.422265	-4.409796172
2460	36.4253	0.404181	-4.385968627
2462	36.6246	0.386097	-4.362271098
2465	36.1577	0.35627	-4.417992029
2470	35.7852	0.292361	-4.462965512
2475	36.1898	0.37715	-4.41413817
2480	36.6349	0.572204	-4.361049896
2485	36.5849	0.785245	-4.366981277
2490	36.7043	0.969106	-4.352830541
2495	37.4741	1.1403	-4.262687886
2500	37.5863	1.27655	-4.249704242

Test Equipment Used:

Rev. 11/9/2017								
Spectrum Analyzers / Receivers /Preselectors	**Range**	**MN**	**Mfr**	**SN**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
FSV40 Signal/Spectrum Analyzer	10Hz-40GHz	FSV40	ROHDE & SCHWARZ	101551	2200	I	6/30/2018	6/30/2017
Signal Generators/Comparaison Noise Emitter	**Range**	**MN**	**Mfr**	**SN**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
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
Power/Noise Meters		**MN**	**Mfr**	**SN**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
OSP - open switch and control platform	30MHz-18GHz	OSP120	ROHDE & SCHWARZ	101674		I	6/1/2018	6/1/2017
Cables	**Range**		**Mfr**			**Cat**	**Calibration Due**	**Calibrated on**
DUT1	30MHz-26GHz		Micro-Coax			II	6/21/2018	6/21/2017
DUT2	30MHz-26GHz		Micro-Coax			II	6/22/2018	6/22/2017
DUT3	30MHz-26GHz		Micro-Coax			II	6/23/2018	6/23/2017
DUT4	30MHz-26GHz		Micro-Coax			II	6/24/2018	6/24/2017
Attenuators / Couplers	**Range**	**MN**	**Mfr**	**SN**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
10dB Attenuator-01 Brown	30MHz-26GHz		Mini Curcuits			II	7/13/2018	7/14/2017
10dB Attenuator-02 Yellow	30MHz-26GHz		Mini Curcuits			II	7/13/2018	7/14/2017
10dB Attenuator-03 Red	30MHz-26GHz		Mini Curcuits			II	7/13/2018	7/14/2017
10dB Attenuator-04 orange	30MHz-26GHz		Mini Curcuits			II	7/13/2018	7/14/2017
API - 30dB 20W Attenuator	9KHz-40GHz	89-30-11	API Weinschel	703	2121	I	3/22/2018	3/22/2217
Directional Coupler	0.5GHz-18GHz	UDC	AA MCS	001040		II	8/11/2018	8/11/2017
Communication Tester	**Range**	**MN**	**Mfr**	**SN**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
CMW500 Wideband Radio Communication Tester	DC to 6GHz	CMW500	ROHDE & SCHWARZ	155905		I	6/2/2018	6/2/2017
Meteorological Meters/Chambers		**MN**	**Mfr**	**SN**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
Temp/Humidity Chamber #18		EPX-2H	Espec	137664	1645	I	4/21/2018	4/21/2017
All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.								

Summary

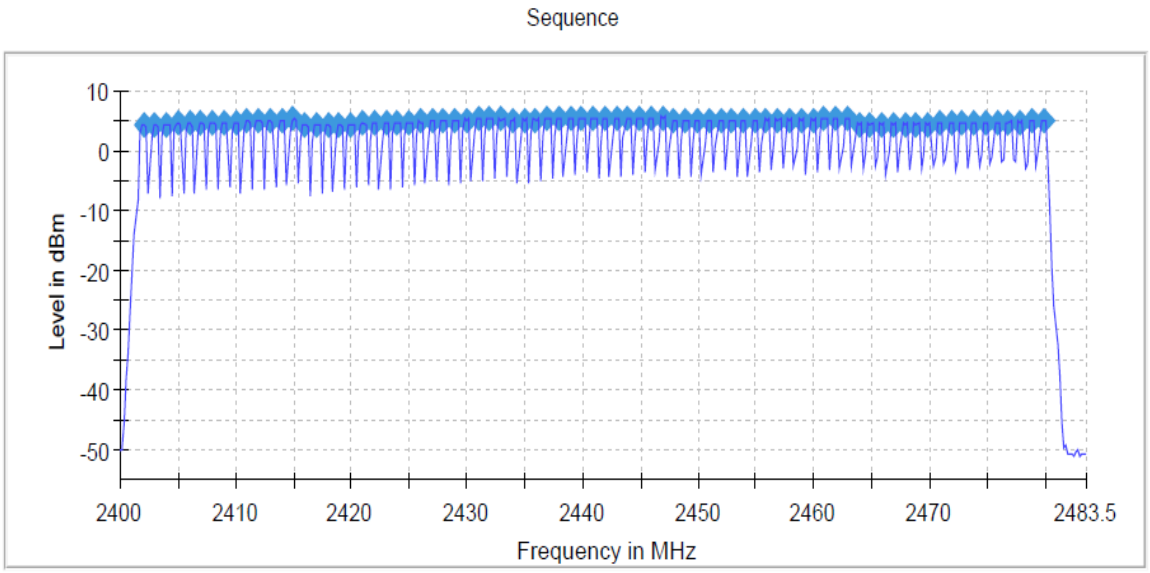
Test	Frequency (MHz)	DH1 Result	DH3 Result	DH5 Result	2-DH1 Result	2-DH3 Result	2-DH5 Result	3-DH1 Result	3-DH3 Result	3-DH5 Result
Hopping Frequencies	--- (hopping)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Band Edge (during hopping)	--- (hopping)	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Carrier 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	--	--	--	--	--	--	--
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	--	--	--	--	--	--	--
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	--	--	--	--	--	--	--

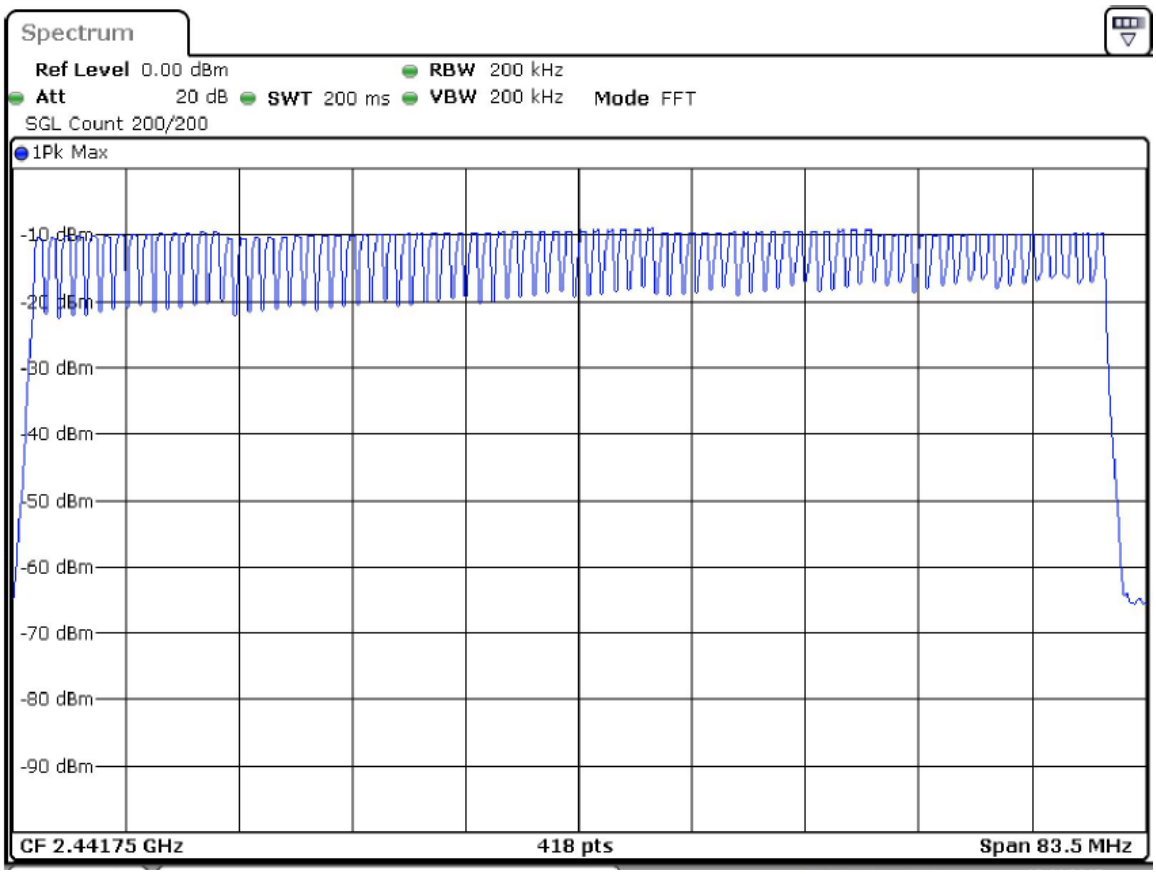
Number of Hopping Frequencies

Test procedure in accordance with ANSI C63.10-2013

Channels

Channels	Limit Min	Result
79	15	PASS




Spectrum
Ref Level 0.00 dBm
RBW 200 kHz
Att 20 dB
SWT 200 ms
VBW 200 kHz
Mode FFT
SGL Count 200/200
1Pk Max
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
-90 dBm
CF 2.44175 GHz
418 pts
Span 83.5 MHz

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

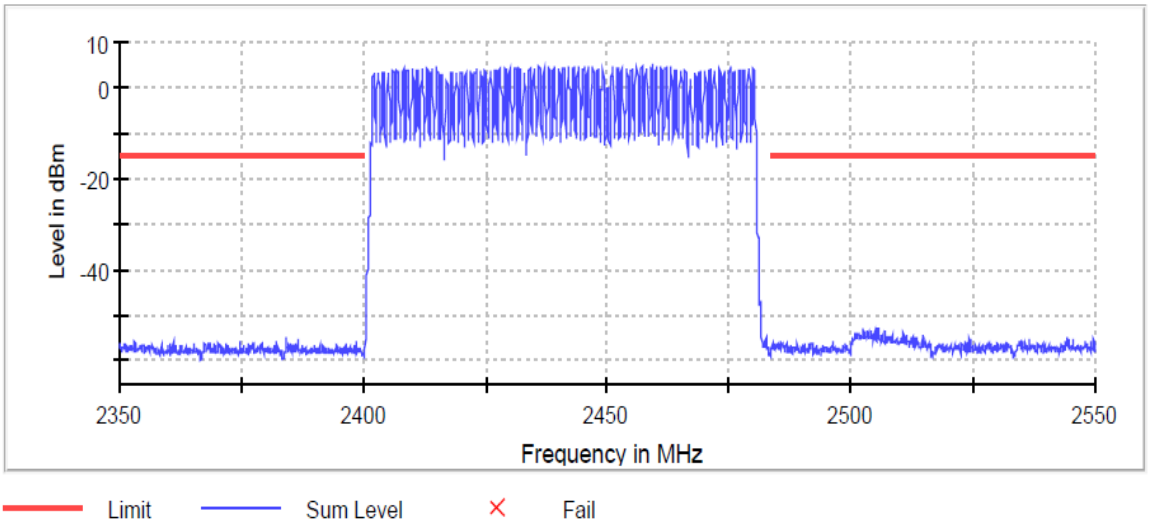
Data Rate	Frequency (MHz)	Level (dBm)
DH1	2445.151212	5.3
DH3	2459.147713	5.1
DH5	2446.150962	5.4
2-DH1	2430.804799	1.9
2-DH3	2444.001500	1.3
2-DH5	2428.155461	1.6
3-DH1	2429.855036	2.0
3-DH3	2428.155461	1.8
3-DH5	2428.155461	1.7

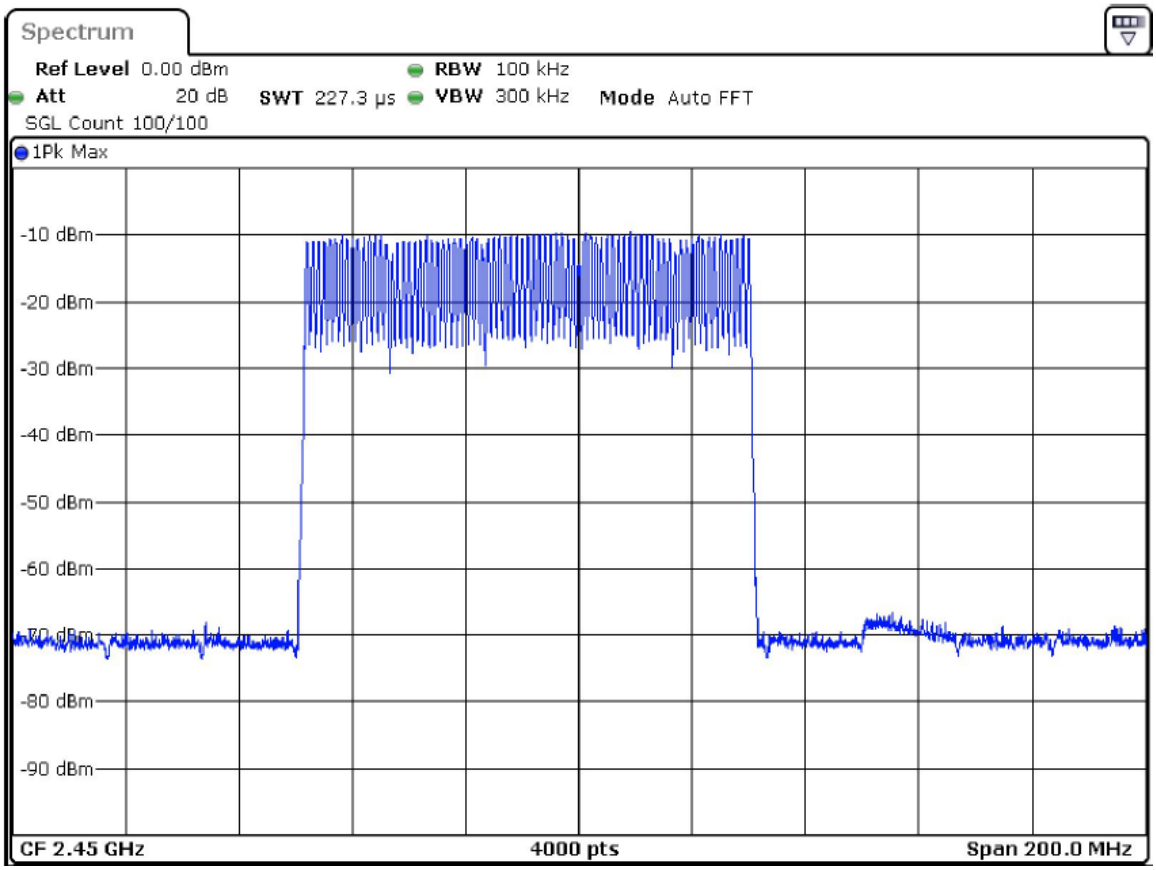
Plots for packet type DH3 shown below.

Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2505.436141	-52.8	38.0	-14.9	PASS
2502.486878	-53.0	38.1	-14.9	PASS
2505.486128	-53.0	38.1	-14.9	PASS
2502.536866	-53.1	38.2	-14.9	PASS
2504.836291	-53.3	38.4	-14.9	PASS
2503.936516	-53.4	38.5	-14.9	PASS
2503.136716	-53.4	38.5	-14.9	PASS
2506.785804	-53.5	38.6	-14.9	PASS
2503.086728	-53.5	38.6	-14.9	PASS
2504.686328	-53.5	38.7	-14.9	PASS
2503.986503	-53.6	38.7	-14.9	PASS
2503.186703	-53.7	38.8	-14.9	PASS
2500.787303	-53.7	38.8	-14.9	PASS
2503.436641	-53.7	38.9	-14.9	PASS
2506.835791	-53.8	38.9	-14.9	PASS

Band Edge


10
0
-20
-40
Level in dBm
2350
2400
2450
2500
2550
Frequency in MHz
Limit
Sum Level
Fail


Spectrum
Ref Level 0.00 dBm
RBW 100 kHz
Att 20 dB
SWT 227.3 µs
VBW 300 kHz
Mode Auto FFT
SGL Count 100/100
1Pk Max
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
-90 dBm
CF 2.45 GHz
4000 pts
Span 200.0 MHz

Carrier Frequency Separation

Test procedure in accordance with ANSI C63.10-2013

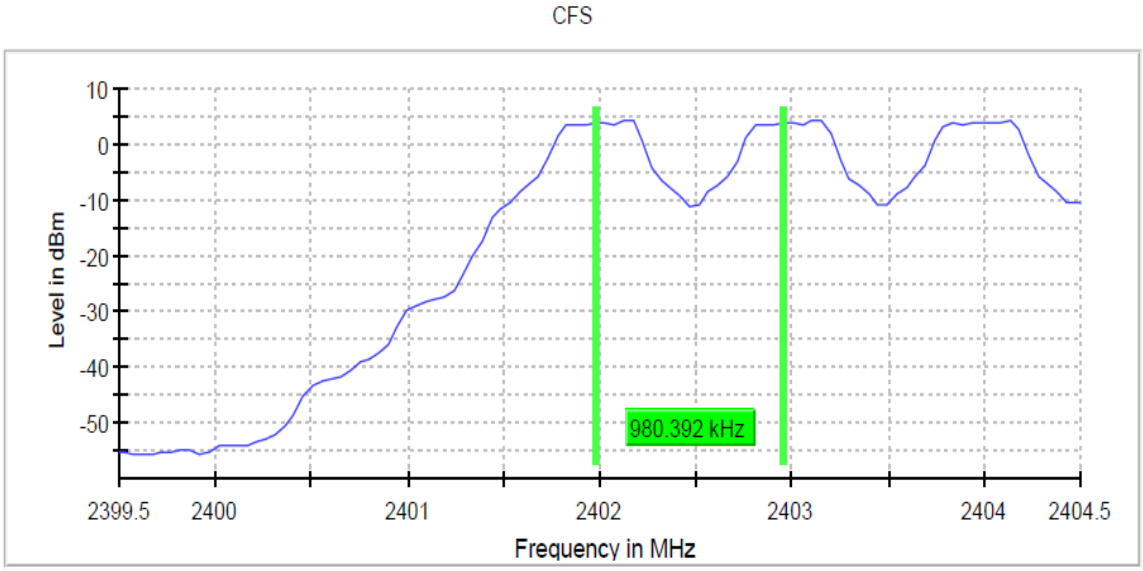
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1. Expanded Uncertainty(k = 2) < 1%

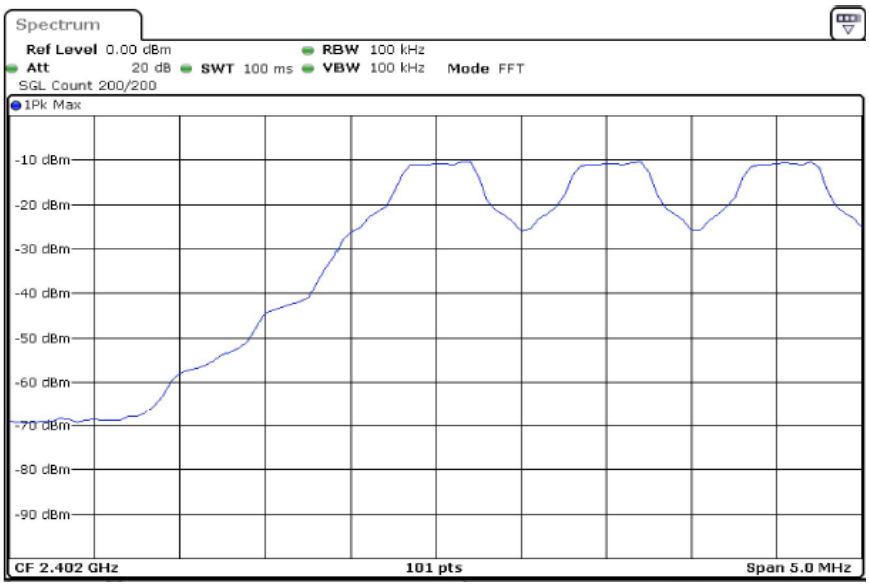
2402 MHz

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

Packet Type	DUT Frequency (MHz)	Frequency Separation (MHz)	Minimum Limit (MHz)	Result
DH1	2402.000000	0.980392	0.941176	PASS
DH3	2402.000000	0.980392	0.941176	PASS
DH5	2402.000000	0.980392	0.941176	PASS
2-DH1	2402.000000	0.980392	0.941176	PASS
2-DH3	2402.000000	0.980392	0.941176	PASS
2-DH5	2402.000000	0.980392	0.941176	PASS
3-DH1	2402.000000	0.980392	0.941176	PASS
3-DH3	2402.000000	0.980392	0.941176	PASS
3-DH5	2402.000000	0.980392	0.941176	PASS

Plots for packet type DH3 shown below.



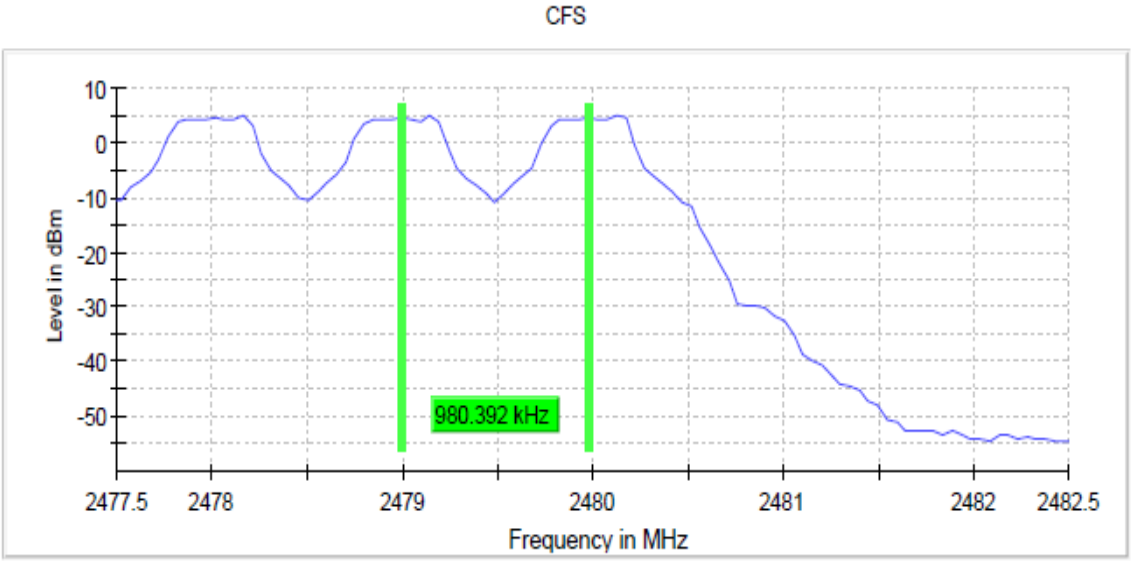


2480 MHz

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

Packet Type	DUT Frequency (MHz)	Frequency Separation (MHz)	Minimum Limit (MHz)	Result
DH1	2480.000000	0.980392	0.941176	PASS
DH3	2480.000000	0.980392	0.941176	PASS
DH5	2480.000000	0.980392	0.941176	PASS
2-DH1	2480.000000	0.980392	0.941176	PASS
2-DH3	2480.000000	0.980392	0.941176	PASS
2-DH5	2480.000000	0.980392	0.941176	PASS
3-DH1	2480.000000	0.980392	0.941176	PASS
3-DH3	2480.000000	0.980392	0.941176	PASS
3-DH5	2480.000000	0.980392	0.941176	PASS

Plots for packet type DH3 shown below.



Spectrum
Ref Level 0.00 dBm
RBW 100 kHz
Att 20 dB
SWT 100 ms
VBW 100 kHz
Mode FFT
SGL Count 200/200
1Pk Max
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
-90 dBm
CF 2.48 GHz
101 pts
Span 5.0 MHz

Time of Channel Occupancy (Dwell Time)

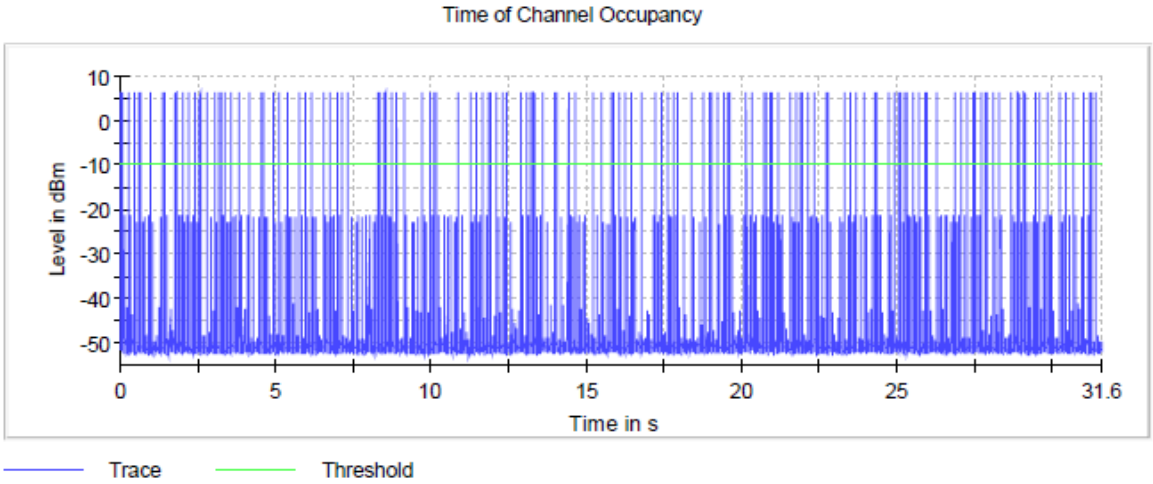
Test procedure in accordance with ANSI C63.10-2013

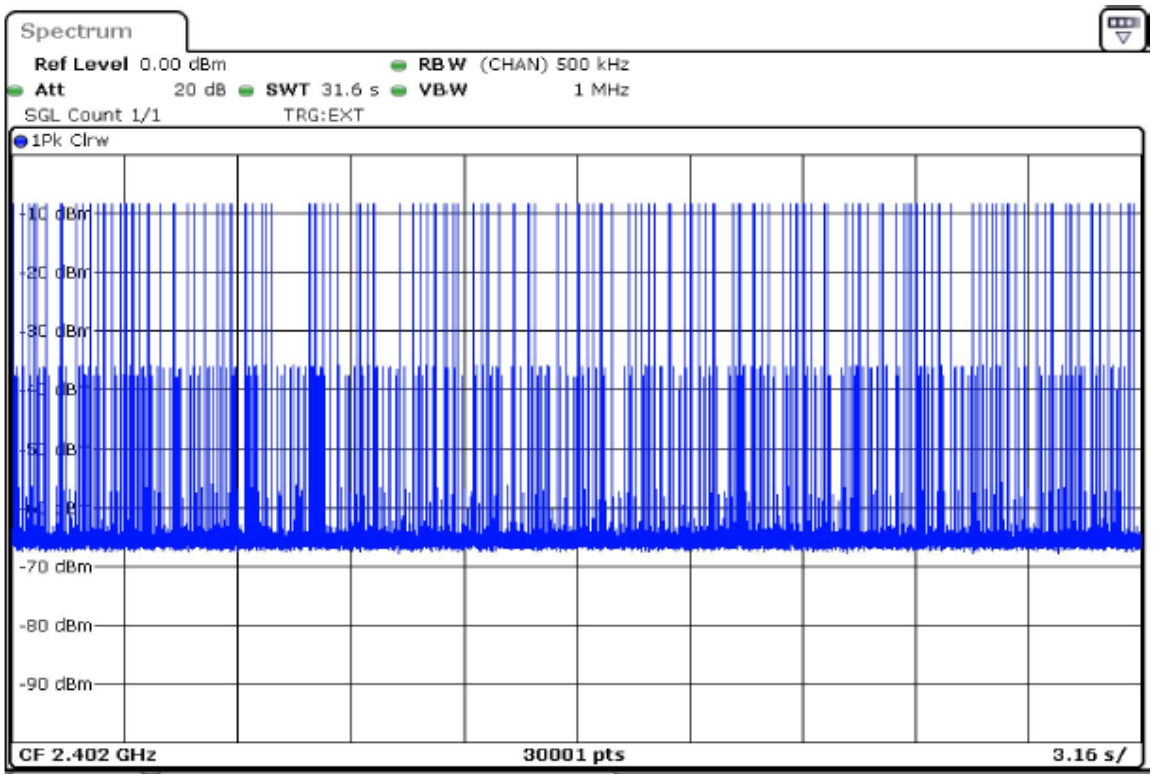
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1. Expanded Uncertainty (K=2) < 1%

2402 MHz

Data Rate	Time (ms)	Limit Max (ms)	Result
DH1	122.900	400.000	PASS
DH3	260.820	400.000	PASS
DH5	288.870	400.000	PASS
2-DH1	112.870	400.000	PASS
2-DH3	237.770	400.000	PASS
2-DH5	273.220	400.000	PASS
3-DH1	115.240	400.000	PASS
3-DH3	233.860	400.000	PASS
3-DH5	282.890	400.000	PASS

Plots for packet type DH3 shown below.



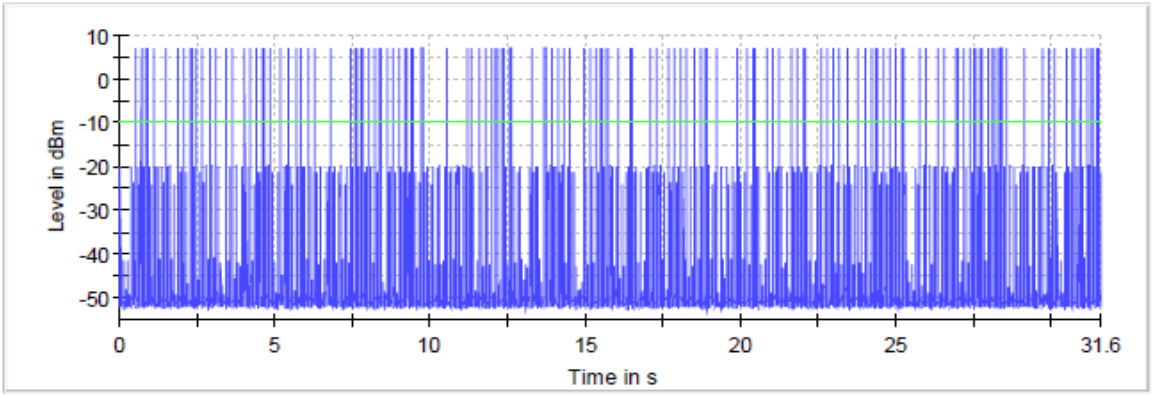


2441 MHz

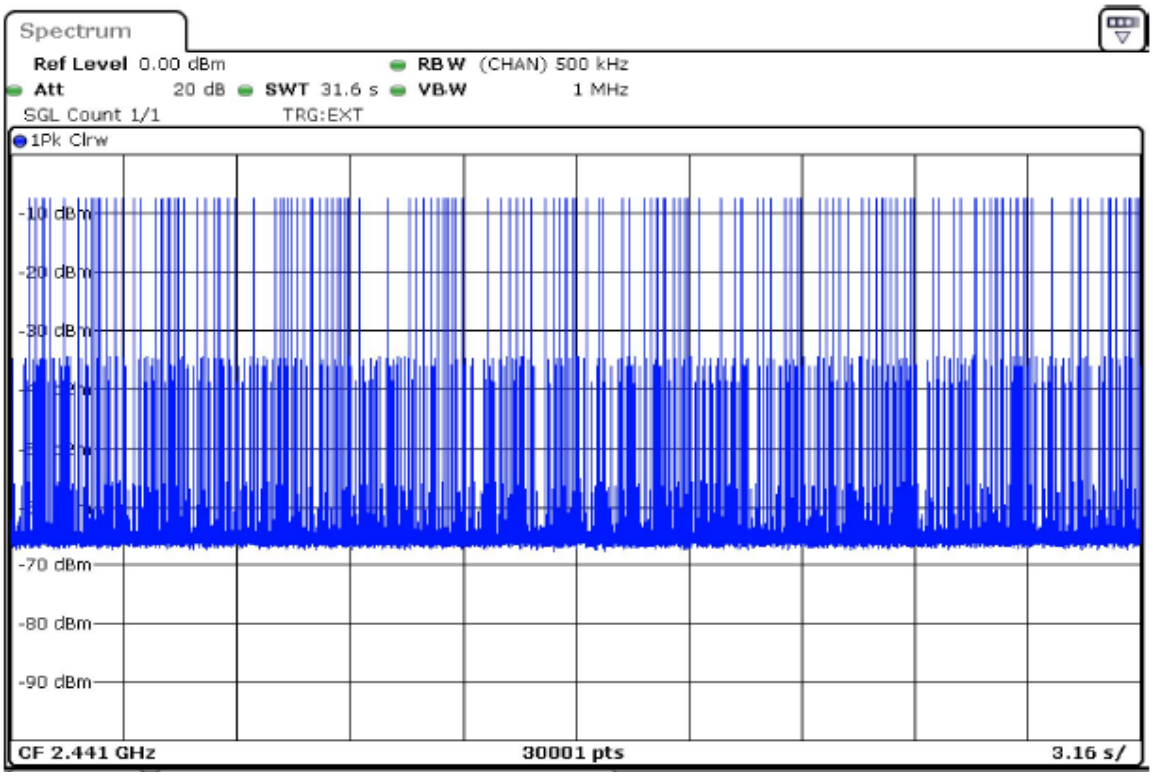
Data Rate	Time (ms)	Limit Max (ms)	Result
DH1	122.980	400.000	PASS
DH3	249.400	400.000	PASS
DH5	326.350	400.000	PASS
2-DH1	115.040	400.000	PASS
2-DH3	216.310	400.000	PASS
2-DH5	319.200	400.000	PASS
3-DH1	117.980	400.000	PASS
3-DH3	259.270	400.000	PASS
3-DH5	300.730	400.000	PASS

Plots for packet type DH3 shown below.

Time of Channel Occupancy



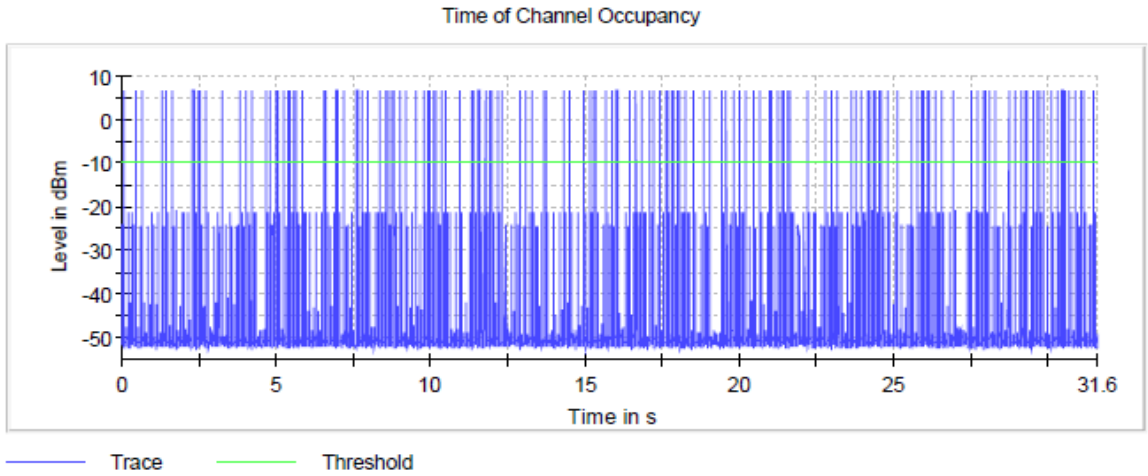
Trace Threshold

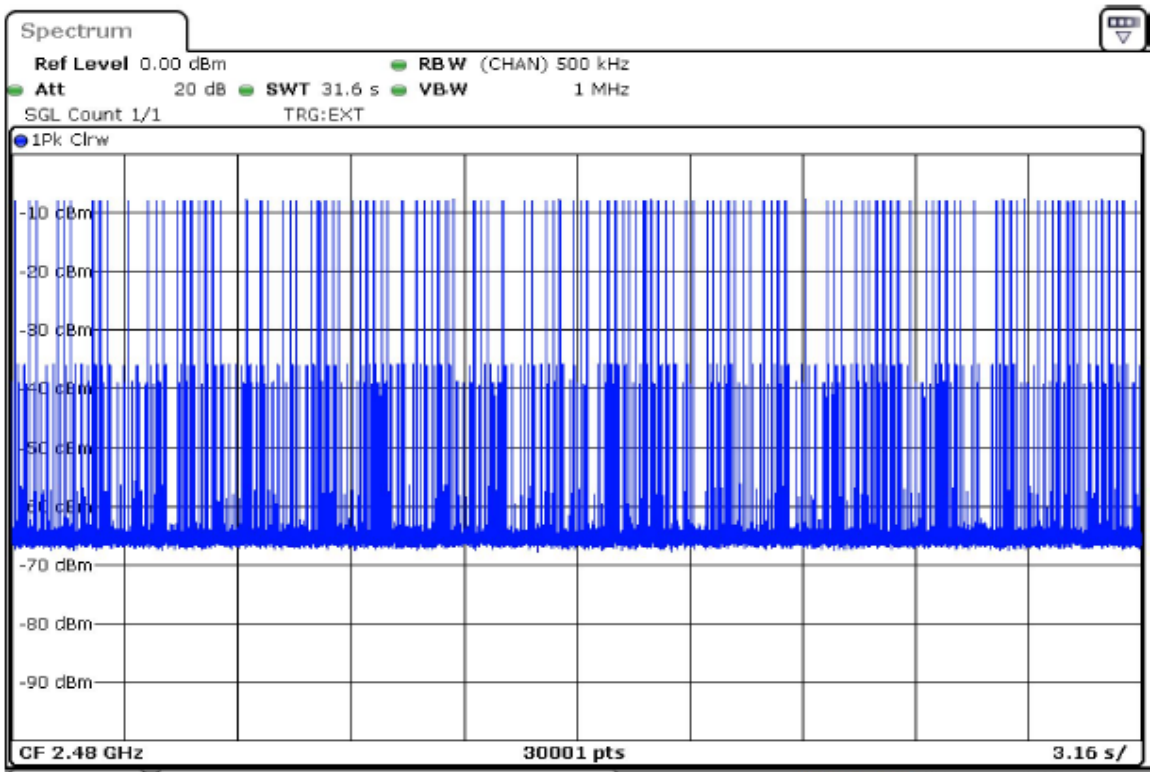


2480 MHz

Data Rate	Time (ms)	Limit Max (ms)	Result
DH1	123.020	400.000	PASS
DH3	262.450	400.000	PASS
DH5	268.560	400.000	PASS
2-DH1	114.150	400.000	PASS
2-DH3	238.520	400.000	PASS
2-DH5	251.380	400.000	PASS
3-DH1	117.630	400.000	PASS
3-DH3	240.110	400.000	PASS
3-DH5	288.080	400.000	PASS

Plots for packet type DH3 shown below.



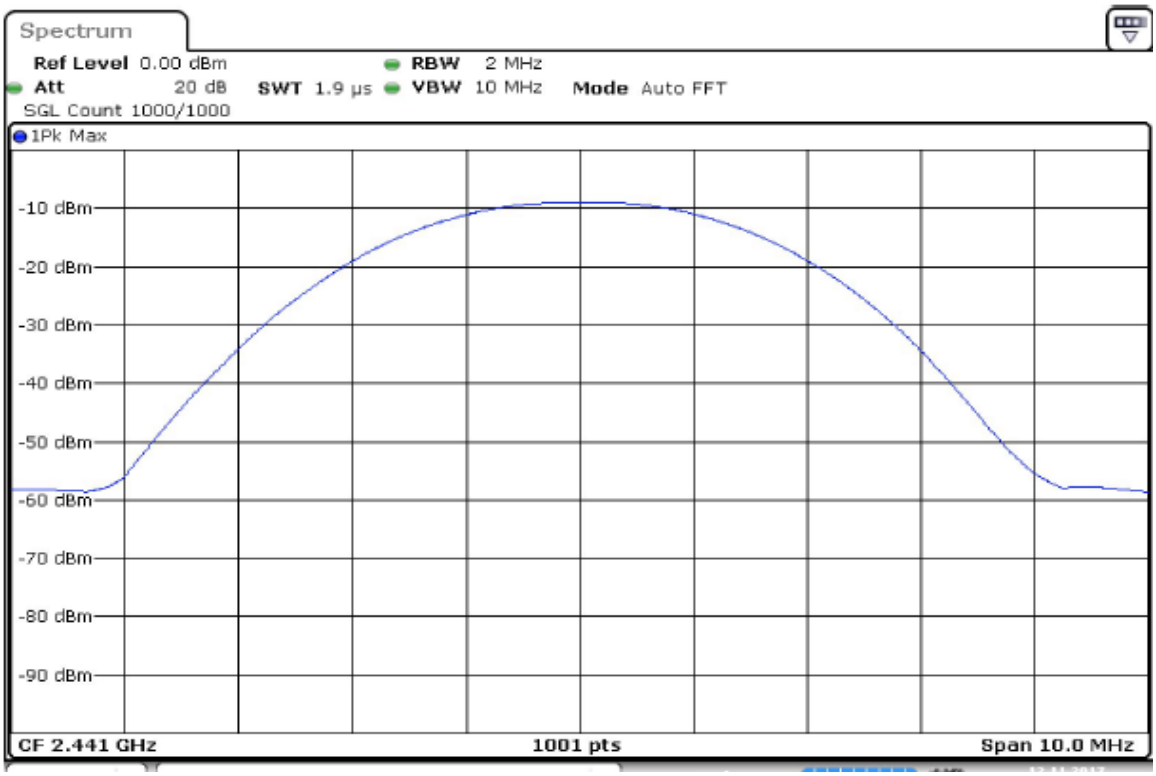

Spectrum
Ref Level 0.00 dBm
RBW (CHAN) 500 kHz
Att 20 dB
SWT 31.6 s
VBW 1 MHz
SGL Count 1/1
TRG:EXT
1Pk Clrw
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
-90 dBm
CF 2.48 GHz
30001 pts
3.16 s/

Peak Output Power

Test procedure in accordance with ANSI C63.10-2013

Data Rate	2402MHz	2441MHz	2480MHz	Limit dBm
DH1	3.61	4.63	4.23	**30**
DH3	3.67	4.73	4.34	**30**
DH5	3.63	4.67	4.31	**30**
2-DH1	1.94	3.07	2.57	**30**
2-DH3	1.96	3.16	2.68	**30**
2-DH5	2.18	3.19	2.75	**30**
3-DH1	2.19	3.22	2.74	**30**
3-DH3	2.35	3.45	3.05	**30**
3-DH5	2.35	3.47	3.009	**30**

Plot for packet type DH3 shown below.



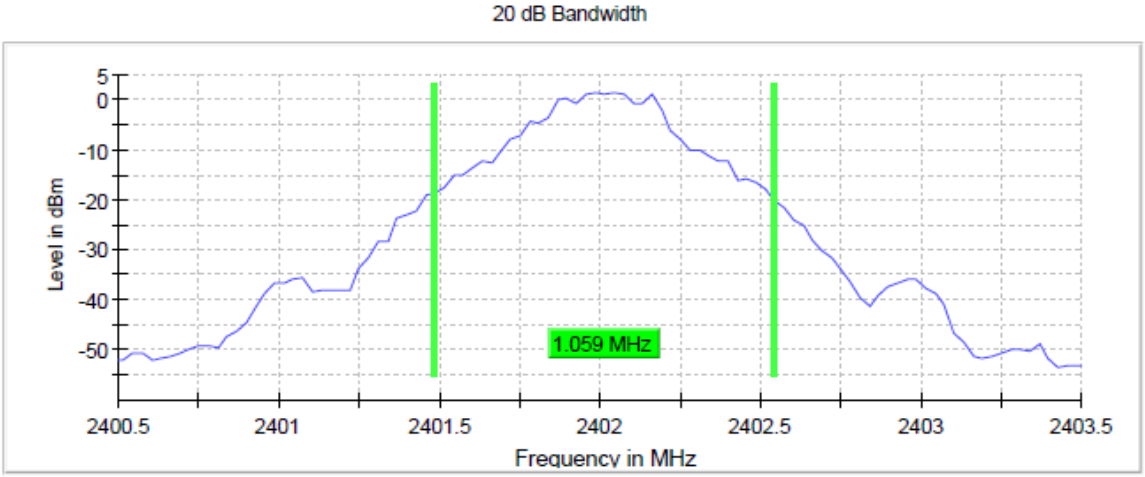
Emission Bandwidth 20 dB

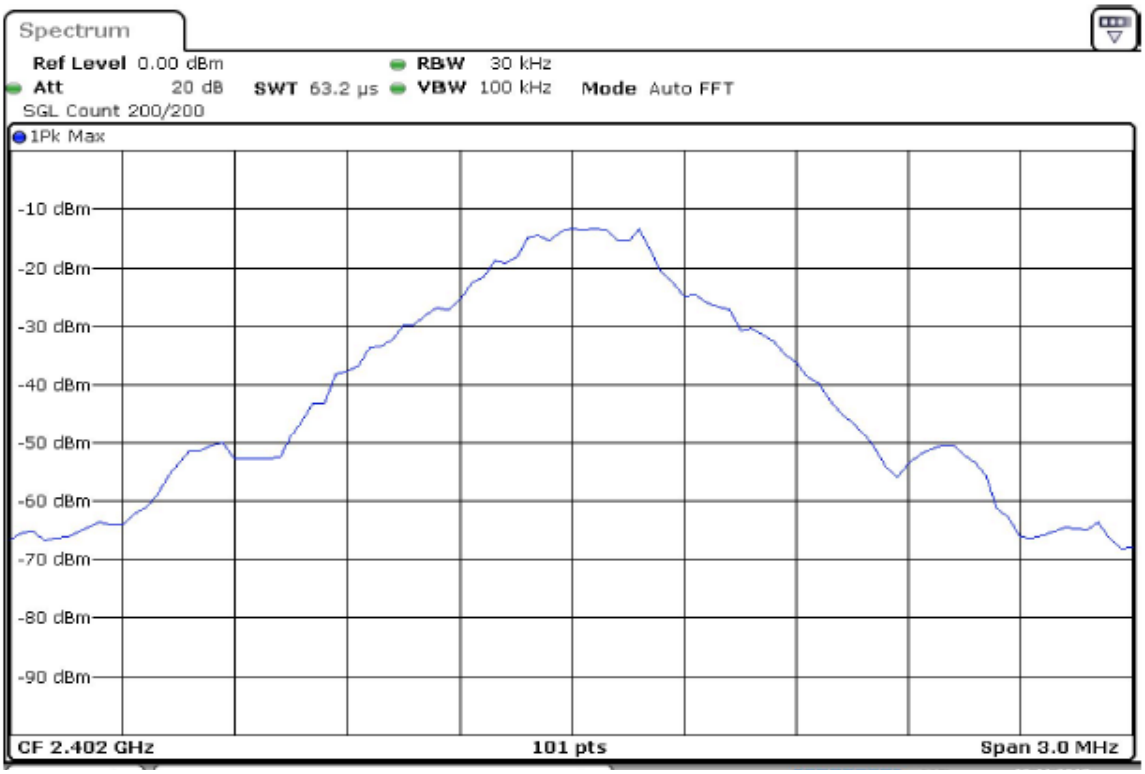
Test procedure in accordance with ANSI C63.10-2013
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1. Expanded Uncertainty (K=2) < 2%

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	1.382353	2401.308824	2402.691176	PASS
3-DH5	1.382352	2401.308824	2402.691176	PASS

Plots for packet type DH3 shown below.



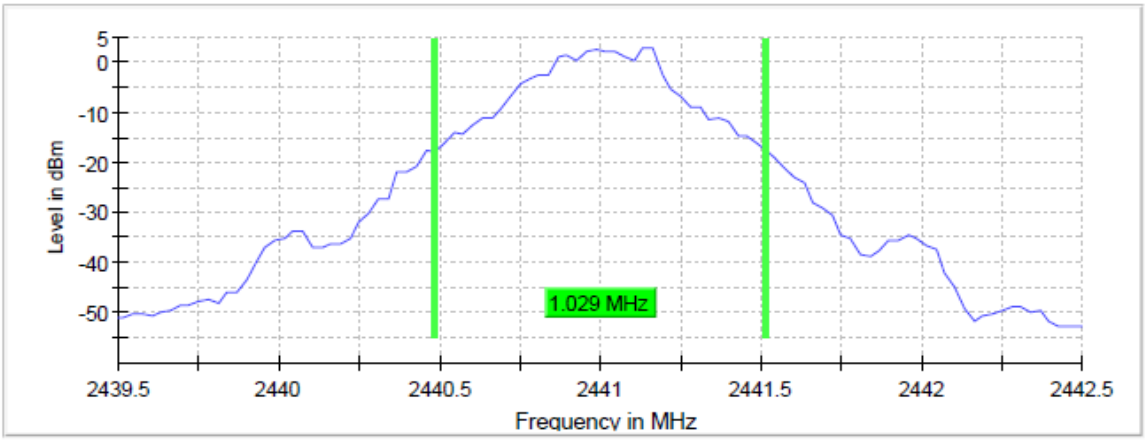


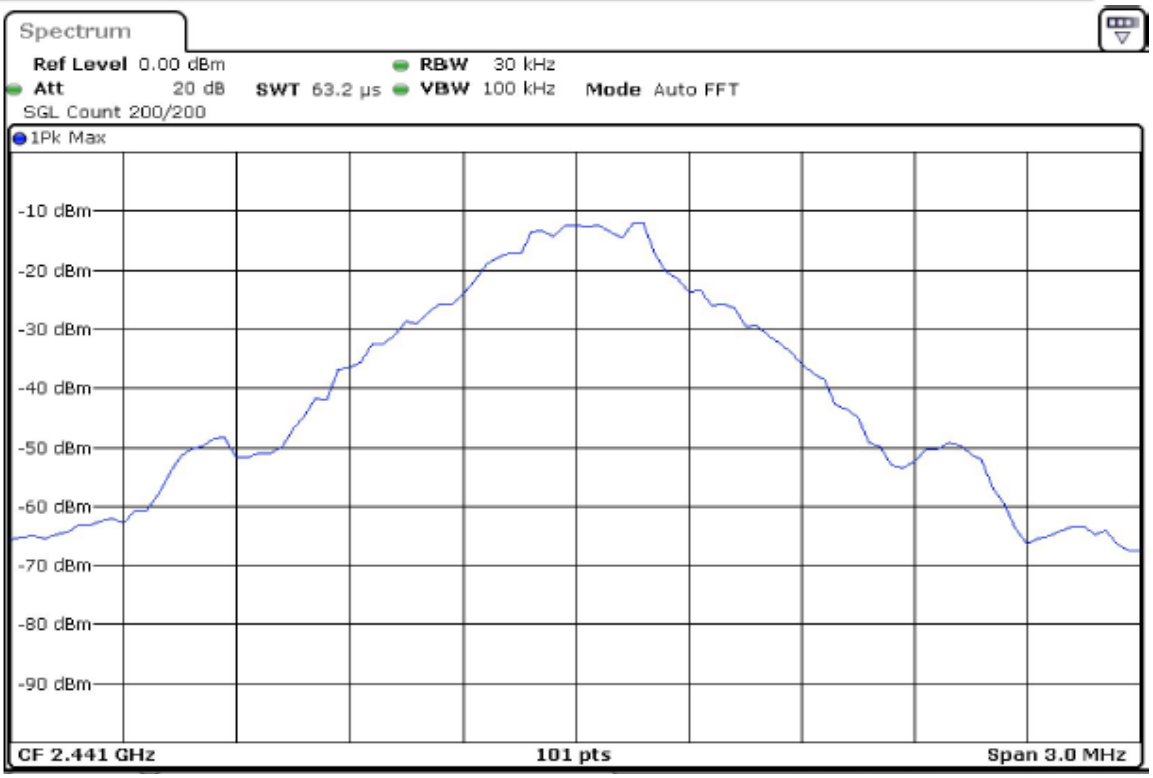
2441 MHz

Data Rate	Bandwidth (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Result
DH1	1.058824	2440.485294	2441.544118	PASS
DH3	1.029412	2440.485294	2441.514706	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	2441.691176	PASS
3-DH5	1.382352	2440.308824	2441.691176	PASS

Plots for packet type DH3 shown below.

20 dB Bandwidth



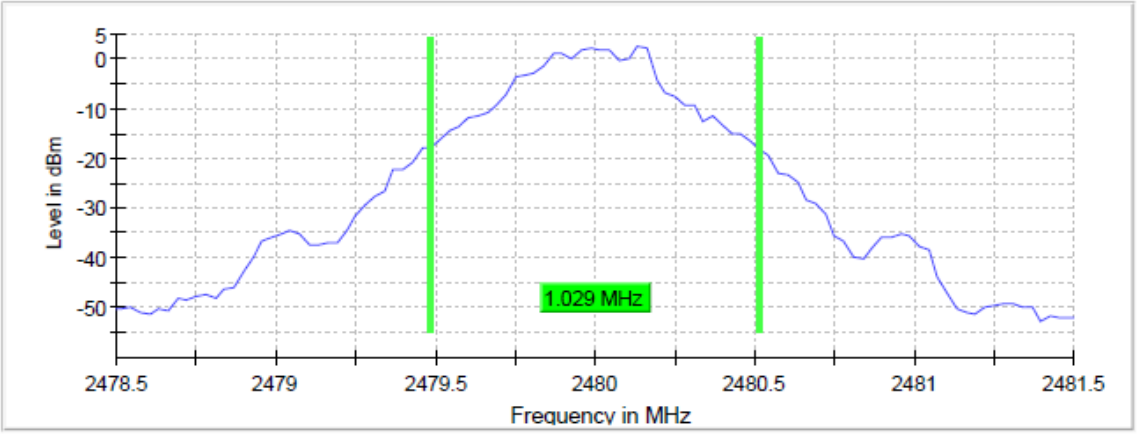


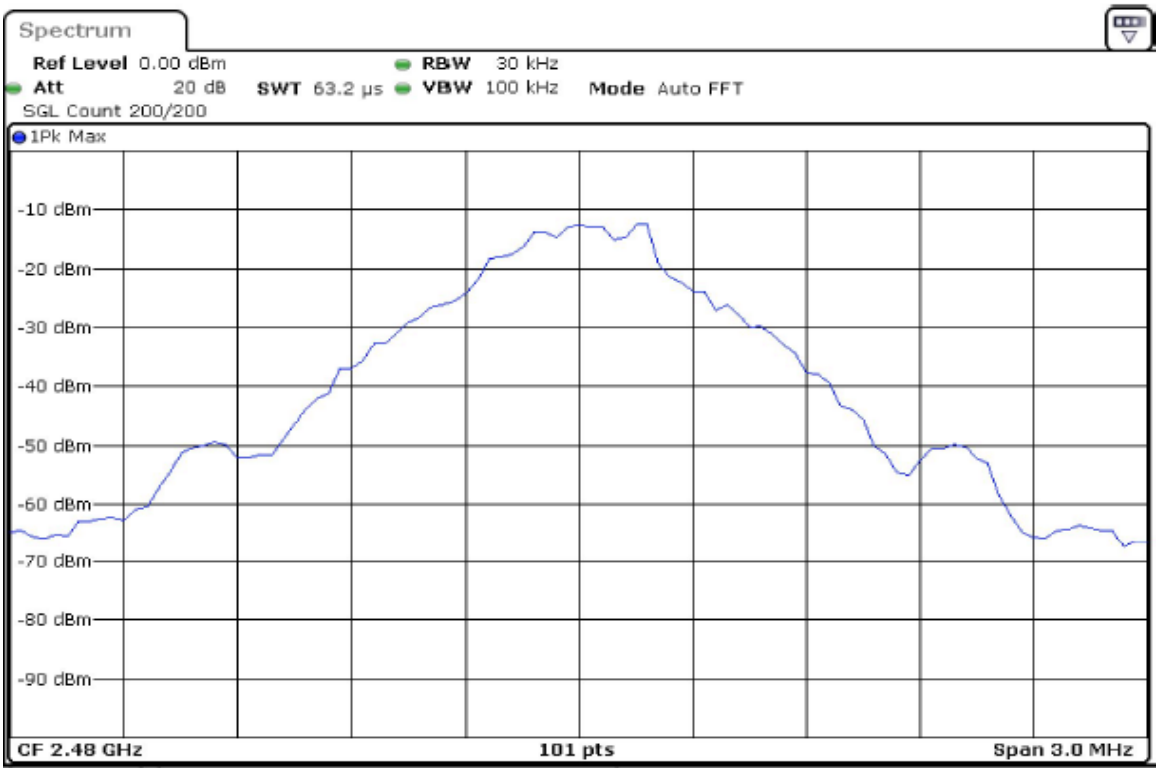
2480 MHz

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 DH3 shown below.

20 dB Bandwidth





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

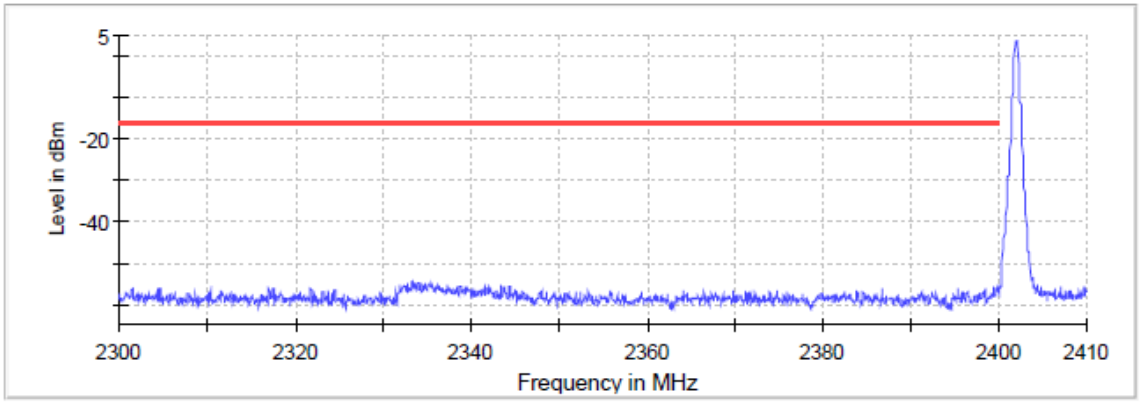
Data Rate	Frequency (MHz)	Level (dBm)
DH1	2401.828714	4.0
DH3	2402.128578	4.2
DH5	2401.978646	3.6
2-DH1	2401.828714	0.2
2-DH3	2401.978646	0.0
2-DH5	2401.828714	0.2
3-DH1	2401.828714	0.4
3-DH3	2402.128578	0.4
3-DH5	2401.978646	0.0

Plots for packet type DH3 shown below.

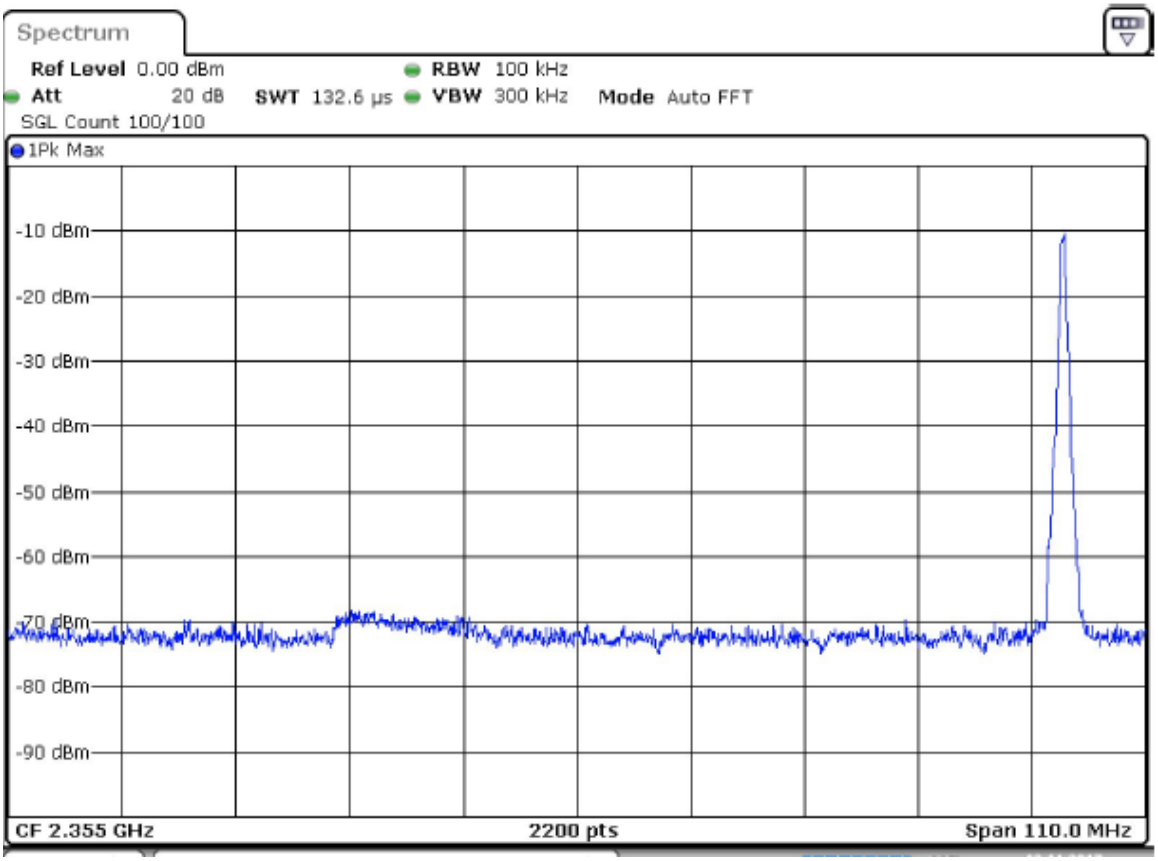
Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2333.209905	-54.5	38.6	-15.8	PASS
2333.159927	-54.7	38.9	-15.8	PASS
2335.558837	-54.8	39.0	-15.8	PASS
2334.009541	-54.9	39.0	-15.8	PASS
2333.959564	-54.9	39.0	-15.8	PASS
2332.760109	-54.9	39.1	-15.8	PASS
2334.759200	-55.0	39.1	-15.8	PASS
2332.710132	-55.0	39.2	-15.8	PASS
2334.809178	-55.0	39.2	-15.8	PASS
2335.508860	-55.0	39.2	-15.8	PASS
2333.509768	-55.1	39.2	-15.8	PASS
2335.208996	-55.1	39.3	-15.8	PASS
2333.459791	-55.2	39.3	-15.8	PASS
2334.509314	-55.2	39.3	-15.8	PASS
2337.258065	-55.2	39.4	-15.8	PASS

Band Edge



Limit Sum Level Fail



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

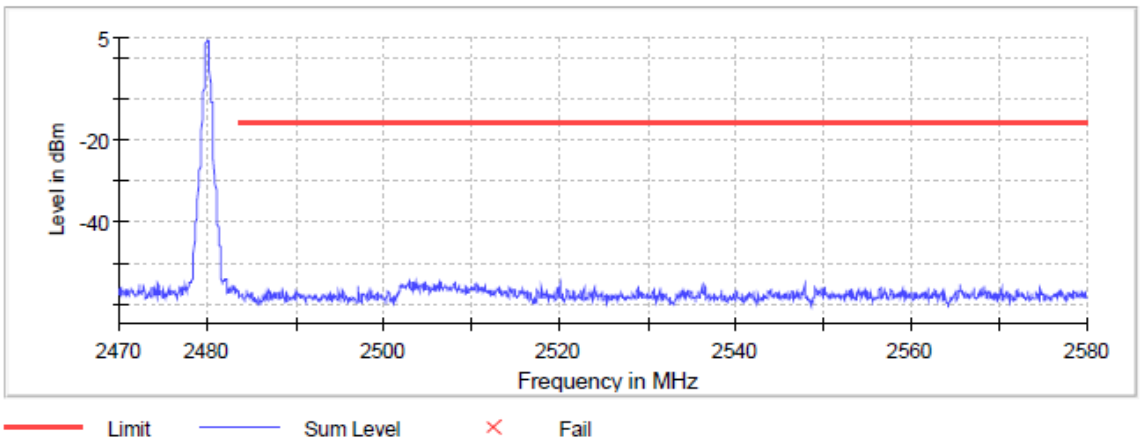
Data Rate	Frequency (MHz)	Level (dBm)
DH1	2479.820536	4.8
DH3	2480.170377	4.6
DH5	2480.170377	4.3
2-DH1	2479.820536	1.1
2-DH3	2480.020445	0.8
2-DH5	2480.170377	0.9
3-DH1	2479.820536	1.2
3-DH3	2480.170377	1.1
3-DH5	2480.170377	1.1

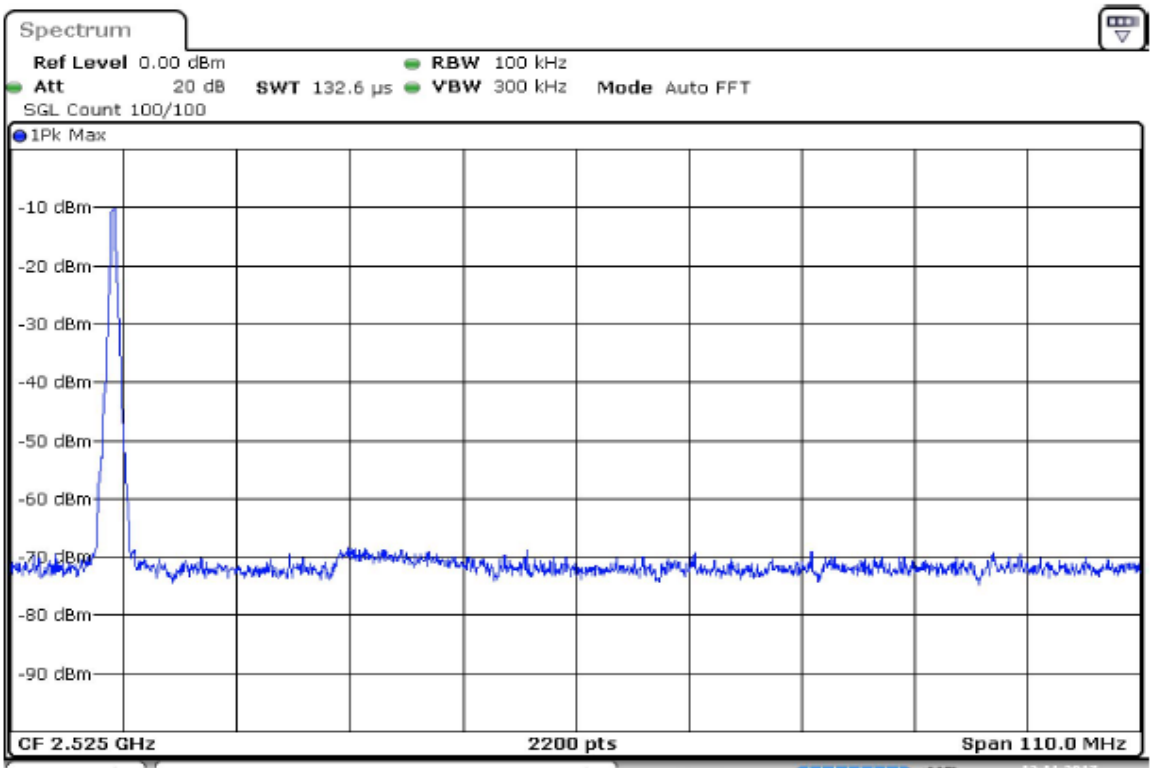
Plots for packet type DH3 shown below.

Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2502.910041	-54.6	39.2	-15.4	PASS
2504.559291	-54.8	39.4	-15.4	PASS
2503.609723	-54.8	39.4	-15.4	PASS
2503.309859	-54.8	39.5	-15.4	PASS
2504.509314	-54.9	39.5	-15.4	PASS
2508.107678	-55.0	39.6	-15.4	PASS
2503.909587	-55.0	39.6	-15.4	PASS
2506.258519	-55.0	39.6	-15.4	PASS
2508.157656	-55.0	39.6	-15.4	PASS
2503.559746	-55.0	39.7	-15.4	PASS
2504.709223	-55.1	39.7	-15.4	PASS
2506.508405	-55.1	39.7	-15.4	PASS
2502.960018	-55.1	39.7	-15.4	PASS
2503.359836	-55.1	39.8	-15.4	PASS
2520.052249	-55.2	39.8	-15.4	PASS

Band Edge




Spectrum
Ref Level 0.00 dBm
RBW 100 kHz
Att 20 dB
SWT 132.6 µs
VBW 300 kHz
Mode Auto FFT
SGL Count 100/100
1Pk Max
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
-90 dBm
CF 2.525 GHz
2200 pts
Span 110.0 MHz

Conducted Spurious Emissions

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

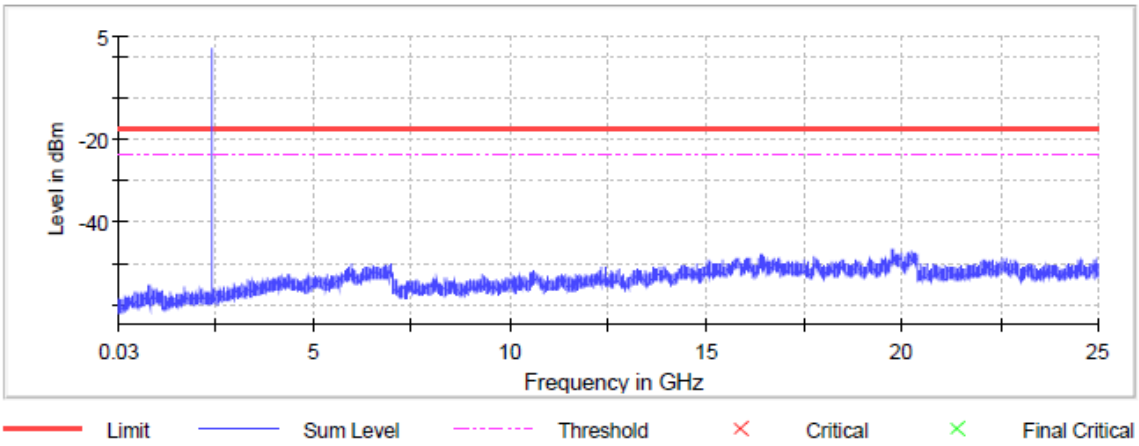
2402 MHz

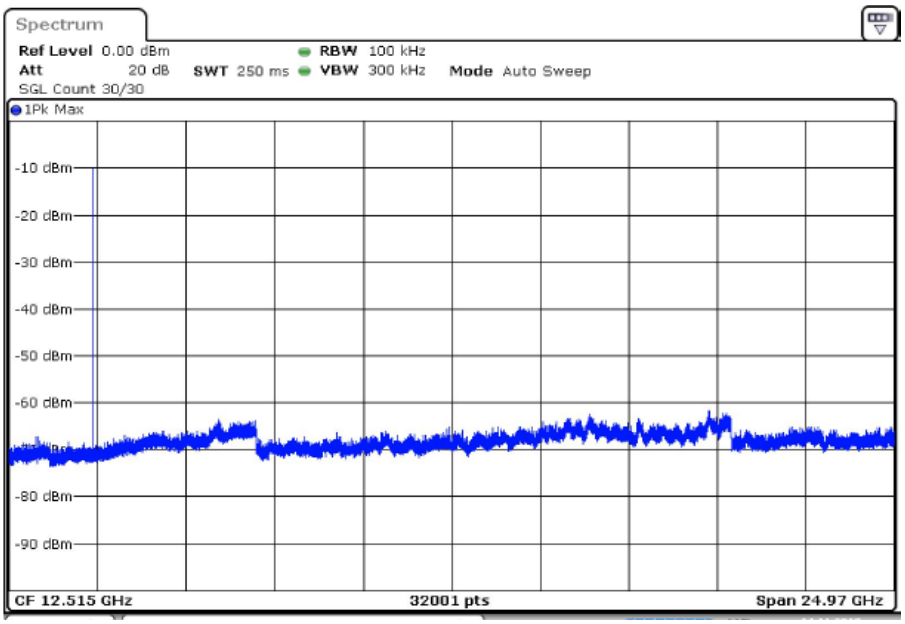
Plots for packet type DH3 shown below.

Pre Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
19795.250766	-46.5	29.0	-17.5
19737.511249	-46.7	29.2	-17.5
20262.628742	-47.0	29.5	-17.5
19736.730986	-47.0	29.5	-17.5
19774.963909	-47.1	29.6	-17.5
19779.645491	-47.1	29.6	-17.5
19784.327073	-47.1	29.6	-17.5
19741.412568	-47.2	29.7	-17.5
19785.107337	-47.3	29.8	-17.5
20160.414193	-47.3	29.8	-17.5
19785.887601	-47.4	29.9	-17.5
20353.919599	-47.4	29.9	-17.5
19771.062590	-47.4	29.9	-17.5
19775.744172	-47.4	29.9	-17.5
19781.986282	-47.4	29.9	-17.5

Spurious





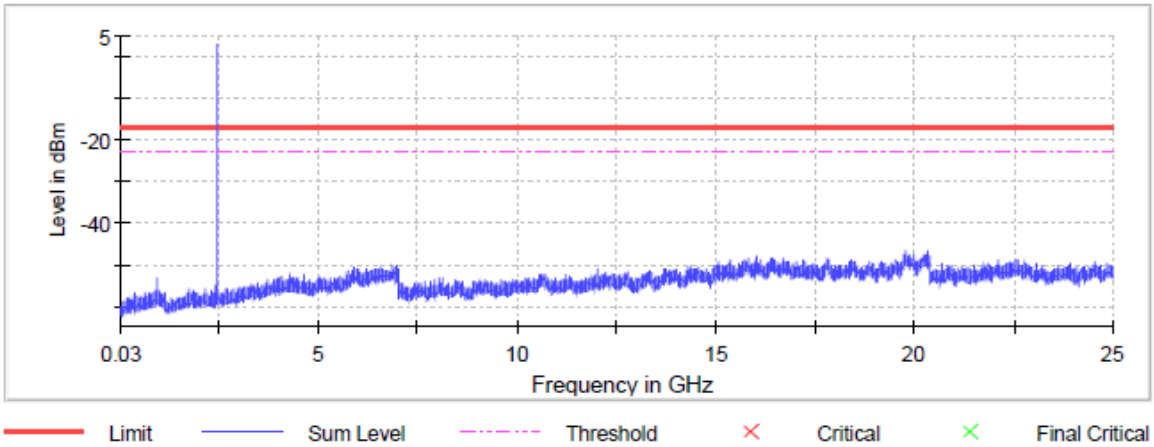
2441 MHz

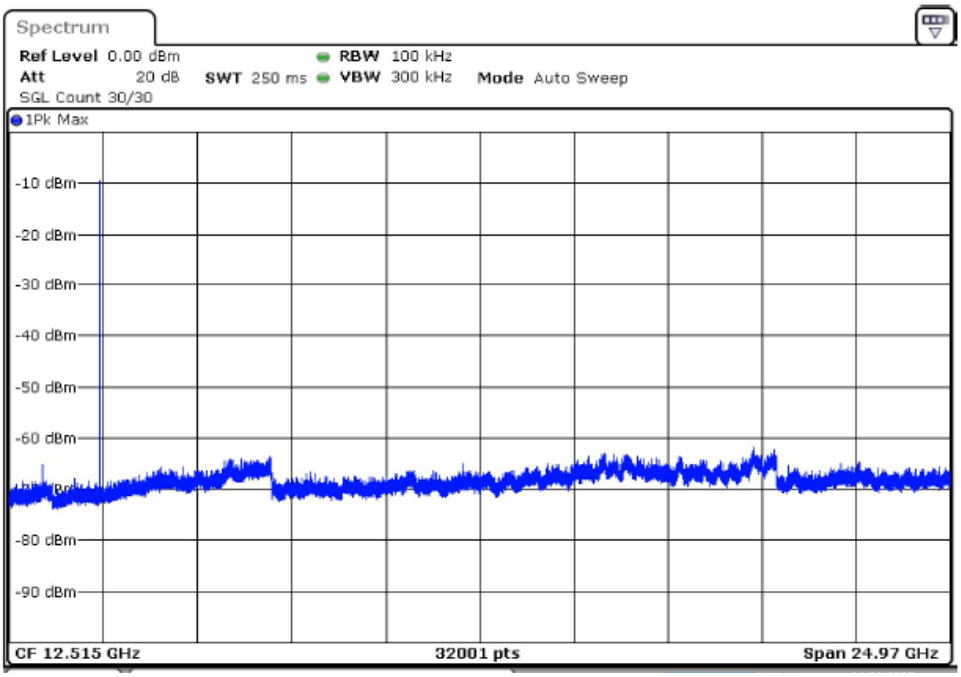
Plots for packet type DH3 shown below.

Pre Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
19775.744172	-46.6	29.9	-16.8
20335.973533	-46.8	30.0	-16.8
19760.919161	-47.4	30.7	-16.8
20224.395819	-47.5	30.7	-16.8
19760.138898	-47.6	30.8	-16.8
19789.788919	-47.6	30.8	-16.8
20284.476126	-47.6	30.9	-16.8
19743.753359	-47.7	30.9	-16.8
19967.689051	-47.7	30.9	-16.8
19872.496875	-47.7	30.9	-16.8
20223.615555	-47.7	30.9	-16.8
20301.641929	-47.8	31.1	-16.8
19838.165271	-47.9	31.1	-16.8
20348.457753	-47.9	31.1	-16.8
20300.081401	-47.9	31.1	-16.8

Spurious



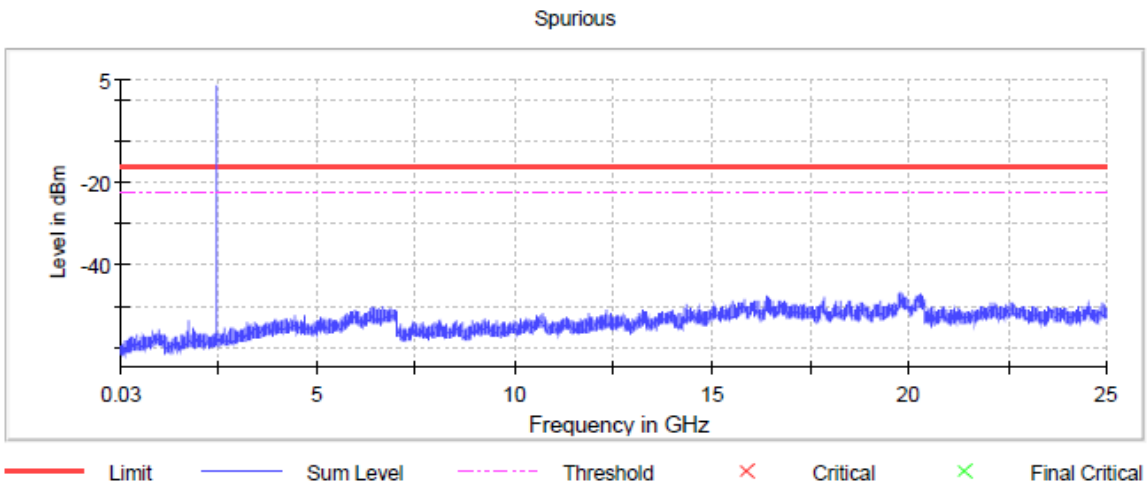


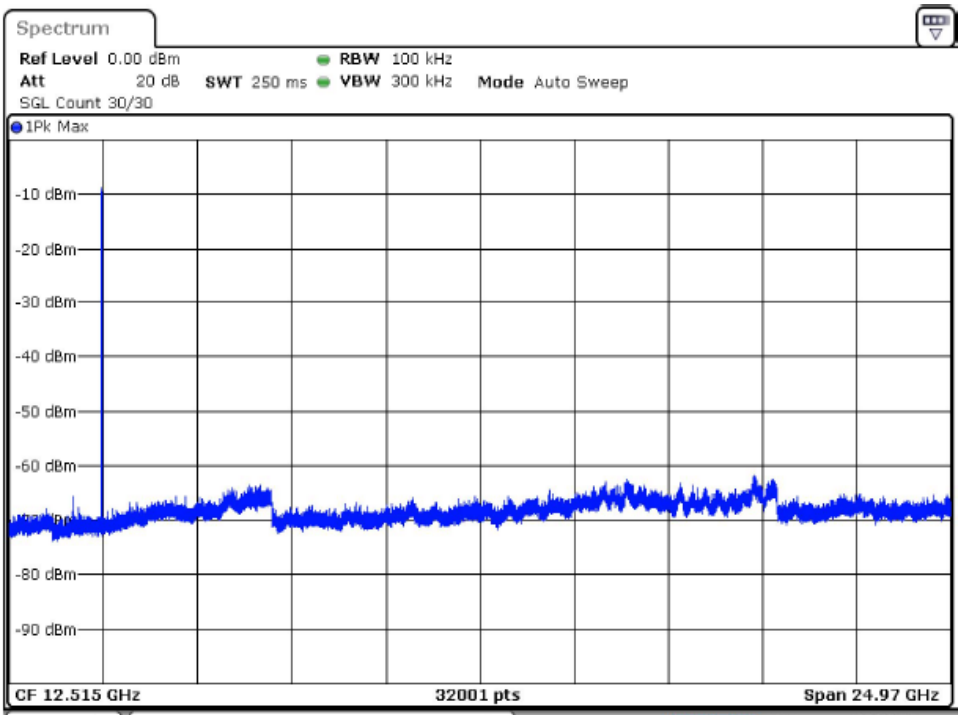
2480 MHz

Plots for packet type DH3 shown below.

Pre Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
19799.932348	-46.6	30.5	-16.1
19781.986282	-46.7	30.6	-16.1
20290.718236	-47.0	30.9	-16.1
19774.963909	-47.0	30.9	-16.1
19749.995469	-47.0	30.9	-16.1
19770.282326	-47.1	31.0	-16.1
19846.748172	-47.2	31.0	-16.1
19772.623117	-47.3	31.2	-16.1
20261.068214	-47.4	31.2	-16.1
20317.247203	-47.4	31.2	-16.1
19755.457315	-47.5	31.3	-16.1
19744.533623	-47.5	31.3	-16.1
19851.429754	-47.5	31.4	-16.1
20212.691863	-47.6	31.4	-16.1
19784.327073	-47.6	31.5	-16.1


Spurious
5
-20
-40
Level in dBm
0.03
5
10
15
20
25
Frequency in GHz
Limit
Sum Level
Threshold
Critical
Final Critical


Spectrum
Ref Level 0.00 dBm
RBW 100 kHz
Att 20 dB
SWT 250 ms
VBW 300 kHz
Mode Auto Sweep
SGL Count 30/30
1Pk Max
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
CF 12.515 GHz
32001 pts
Span 24.97 GHz