TIMCO ENGINEERING, Inc.

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FCC PART 15.247 & IC RSS-247

900 MHz FHSS

TEST REPORT

Applicant	**BLACKLINE SAFETY CORP**
Address	**SUITE 101, 1215 13TH STREET NE**
	CALGARY AB T2G 3J4 CANADA
FCC ID	**W77G7X**
IC Certification Number	**8255A-G7X**
Model Number	G7x
Product Description	LONE WORKER SAFETY POD
Date Sample Received	4/13/2017
Final Test Date	5/15/2017
Tested By	Tim Royer
Approved By	Sid Sanders

Report Number	Version Number	Description	Issue Date
603AUT17TestReport	Rev1	Initial Issue	5/22/2017
603AUT17TestReport	Rev2	Updated Report	6/19/2017

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GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

Summary

The device under test does:

☒ Fulfill the general approval requirements as identified in this test report and was selected by the customer.

☐ Not fulfill the general approval requirements as identified in this test report

Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.

I attest that the necessary measurements were made at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, FL 32669

Tested by:
Name and Title: Tim Royer, Project Manager/Testing Engineer

Date: 5/21/2017

Reviewed and approved by: Name and Title: Sid Sanders, Engineer

Date: 6/7/17

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GENERAL INFORMATION

EUT Specification

Regulatory Standards	FCC Title 47 CFR Part 15.247 IC RSS-247 Issue 1 & RSS-GEN Issue 4		
FCC ID	**W77G7X**		
IC Certification Number	**8255A-G7X**		
Model	G7x		
EUT Description	LONE WORKER SAFETY POD		
Modulation Types	GFSK		
Operating Frequency	TX: 902 – 928 MHz	RX: 902 – 928 MHz	
EUT Power Source	☐ 110–120Vac/50– 60Hz		
	☐ DC Power		
	☒ Battery Operated Exclusively 3.7V DC		
Test Item	☐ Prototype	☒ Pre-Production	☐ Production
Type of Equipment	☐ Fixed	☐ Mobile	☒ Portable
Antenna Connector	None (Temporary Connector Provided for Testing)		
Antenna	Integrated		
Test Facility	**Timco Engineering Inc. located at 849 NW State Road 45 Newberry, FL 32669 USA.**		
Test Conditions	Temperature: 24-26ºC, Relative humidity: 50-65%		
Measurement Standard	ANSI C63.10-2013 ANSI C63.4-2014 FCC DA 00-705		
Test Exercise	Engineering Software was used to enable the modes of operation, all modes of modulation were tested.		

Test Supporting Equipment

Device	Manufacturer	Model	Supplied By	Used For
N/A				

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RESULTS SUMMARY

FCC Rule Part No.	IC Standard Ref.	Requirement	Test Item	Result
15.215 (c)	RSS-GEN 6.6	Occupied Bandwidth	99% Bandwidth	Pass
			20 dB Bandwidth	Pass
15.247(a,1)	RSS-247 § 5.1	FHSS Requirements	Channel Separation	Pass
			Hopping Sequence	Pass
			System Receiver Bandwidth	Pass
			Number of Hopping Channels	Pass
			Hopping Channel Occupancy Time	Pass
15.247(b,2) & (b,4)	RSS-247 § 5.4.2	Peak Power Output	Peak Power Output (ERP)	Pass
			Antenna Gain (EIRP)	Pass
15.247(d)	RSS-247 § 5.5	Unwanted Emissions	Bandedge	Pass
			Radiated Spurious	Pass

Notes:

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PEAK POWER OUTPUT

Rules Part No.: FCC 15.247(b) (2) (4), IC RSS 247 § 5.4.1

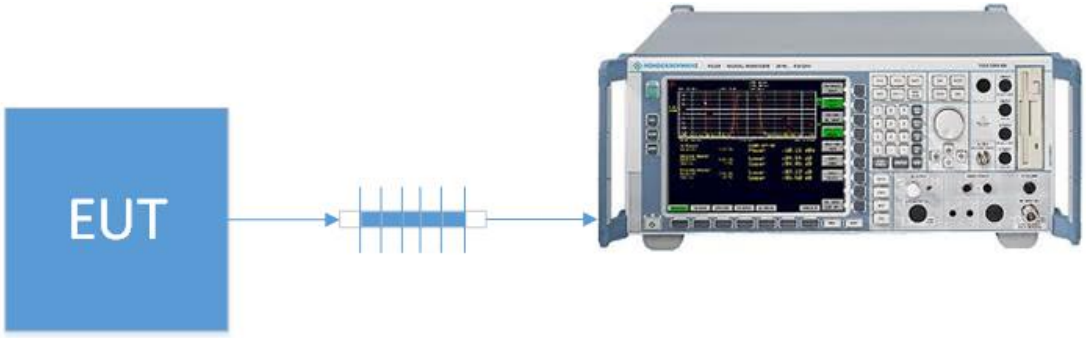
Requirements:

FHSS Using Hopset ≥ 50 Channels

The maximum peak conducted output power shall not exceed 1.0 W, and the e.i.r.p. shall not exceed 4 W if the hopset uses 50 or more hopping channels.

Test Method: ANSI C63.10 § 7.8.5 Output Power test procedure for FHSS

Setup:



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PEAK POWER OUTPUT

Test Data: **Peak Power Output Measurement Table**

Peak Conducted Power Output Measurement				
Tuned Frequency (MHz)	PConducted (dBm)	PConducted (mW)	Limit (W)	Margin (W)
903.8	28.17	656.1	1	0.344
915	28.37	687.1	1	0.313
926.5	28.31	677.6	1	0.322

Peak EIRP Power Output Calculation				
Tuned Frequency (MHz)	PConducted (dBm)	EIRP (mW)	Limit (W)	Margin (W)
903.8	28.17	1076.5	4	2.924
915	28.37	1127.2	4	2.873
926.5	28.31	1111.7	4	2.888

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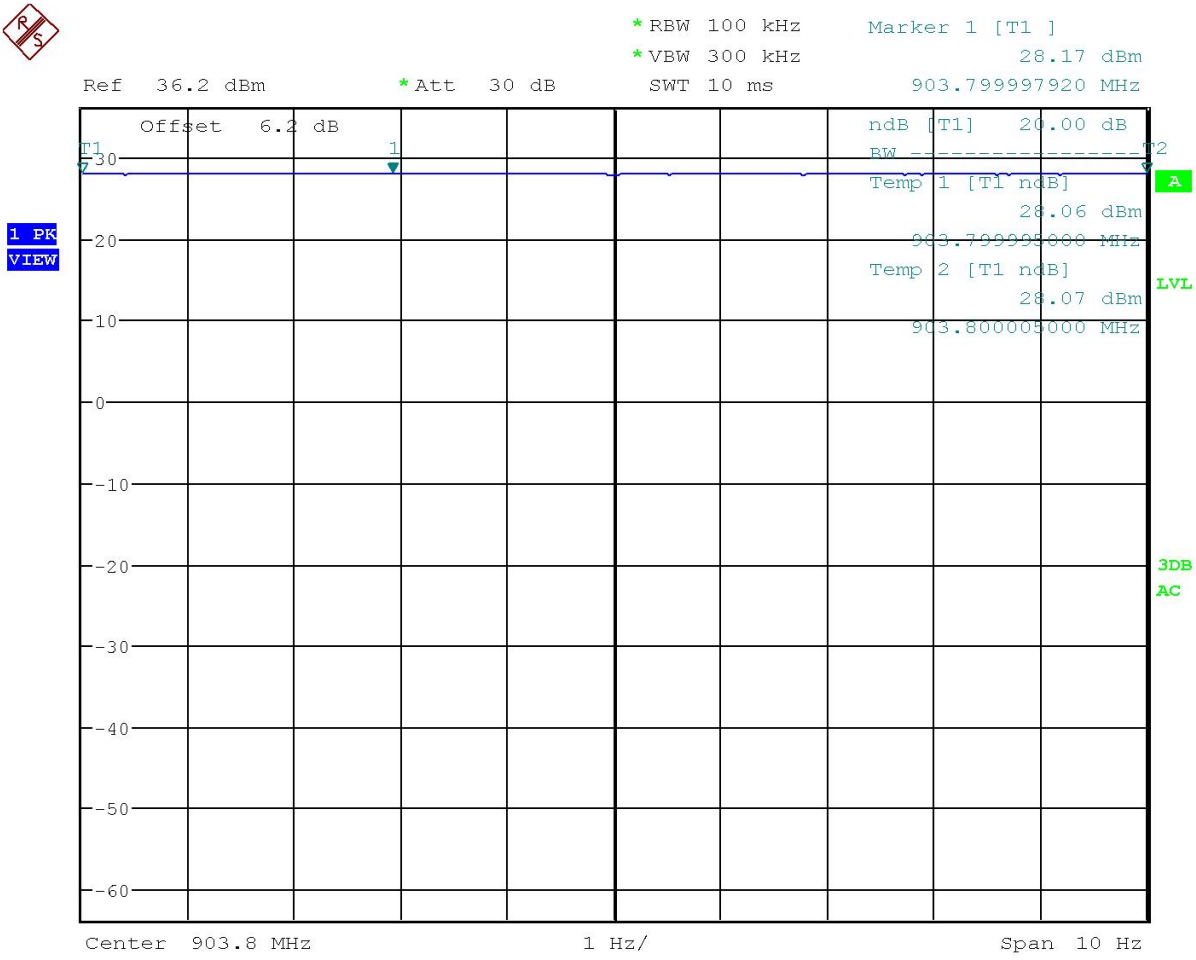
PEAK POWER OUTPUT

Test Data: **Low End of Band Peak Conducted Power Plot**



Date: 12.MAY.2017 16:25:03

RESULTS: Meets Requirements

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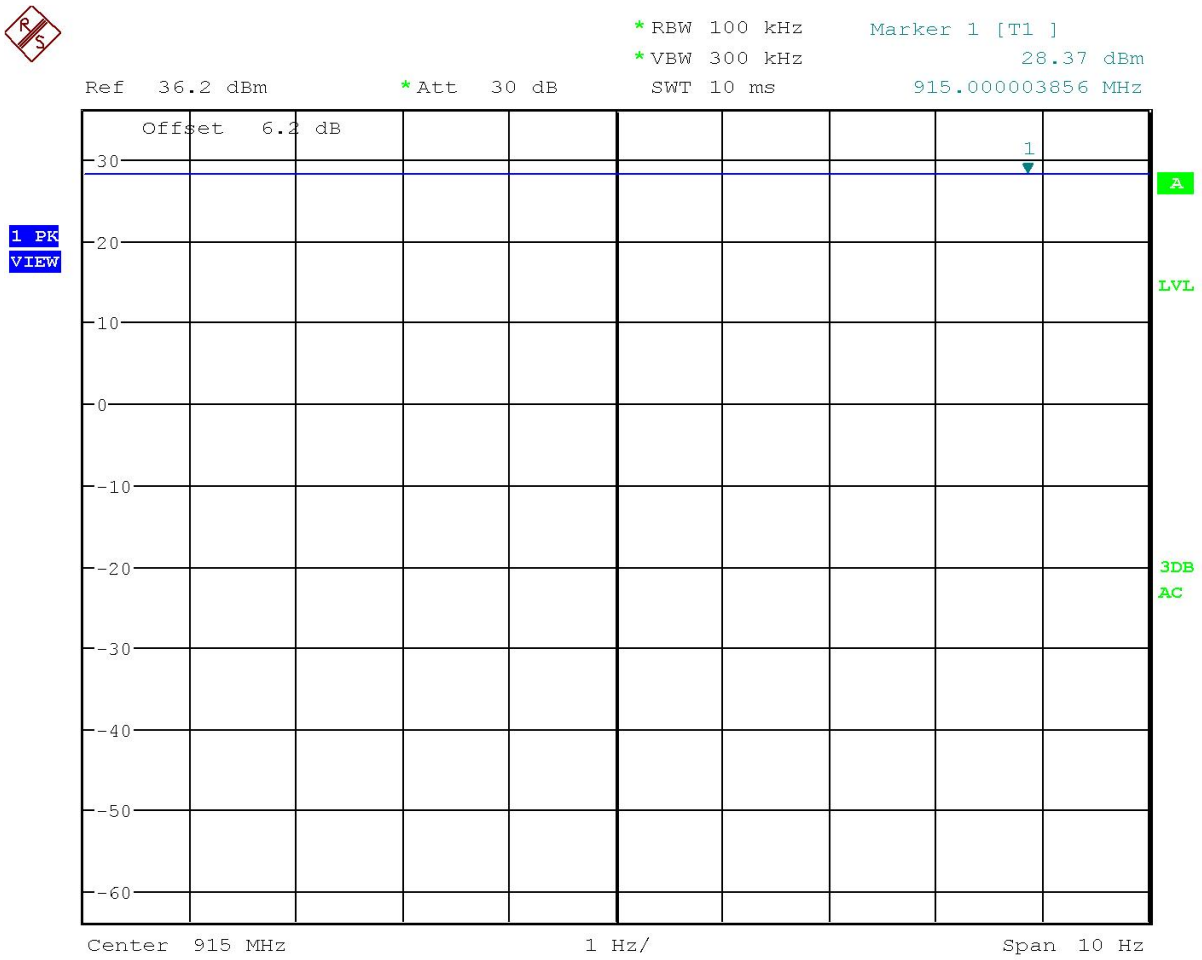
PEAK POWER OUTPUT

Test Data: **Middle of Band Peak Conducted Power Plot**



Date: 12.MAY.2017 13:58:07

RESULTS: Meets Requirements

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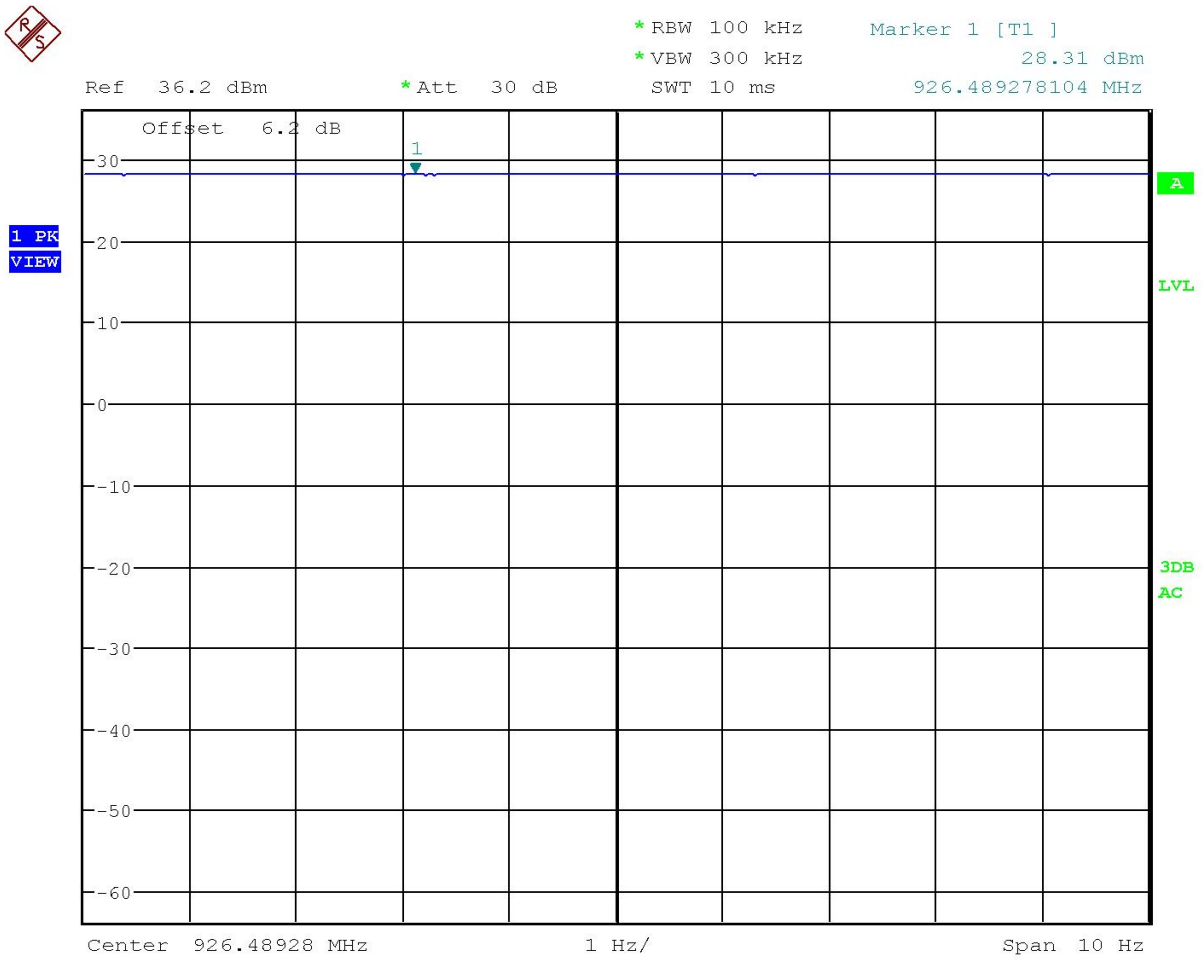
PEAK POWER OUTPUT

Test Data: **High End of Band Peak Conducted Power Plot**



Date: 12.MAY.2017 16:26:21

RESULTS: Meets Requirements

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OCCUPIED BANDWIDTH

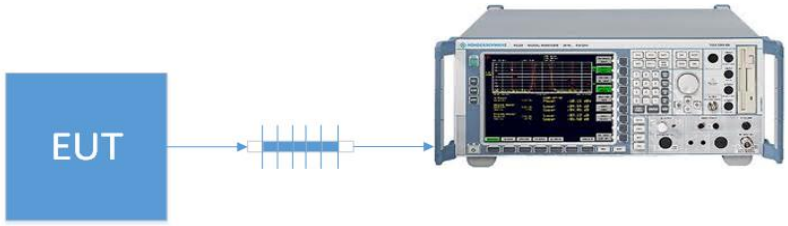
Rules Part No.: FCC 15.215(C), IC RSS 247 § 5.1.1, 5.1.1.3

FCC Requirements: The 20 dB bandwidth of the emission shall be contained within the frequency band designated in the rule section under which the equipment is operated.

IC Requirements: The maximum 20 dB bandwidth shall be 500 KHz

Test Method: ANSI C63.10 § 6.9.2 Occupied bandwidth-20dB Relative procedure

Setup:



Test Data: **20 dB Occupied Bandwidth Measurement Table**

Tuned Frequency (MHz)	20 dB BW (KHz)	Limit (KHz)	Margin (KHz)
903.8	42.72	≤ 500	457.28
915	41.92	≤ 500	458.08
926.5	42.88	≤ 500	457.12

Test Data: **99% Occupied Bandwidth Measurement Table**

Tuned Frequency (MHz)	99% BW (KHz)
903.8	41.12
915	41.12
926.5	40.93

RESULTS: Meets Requirements

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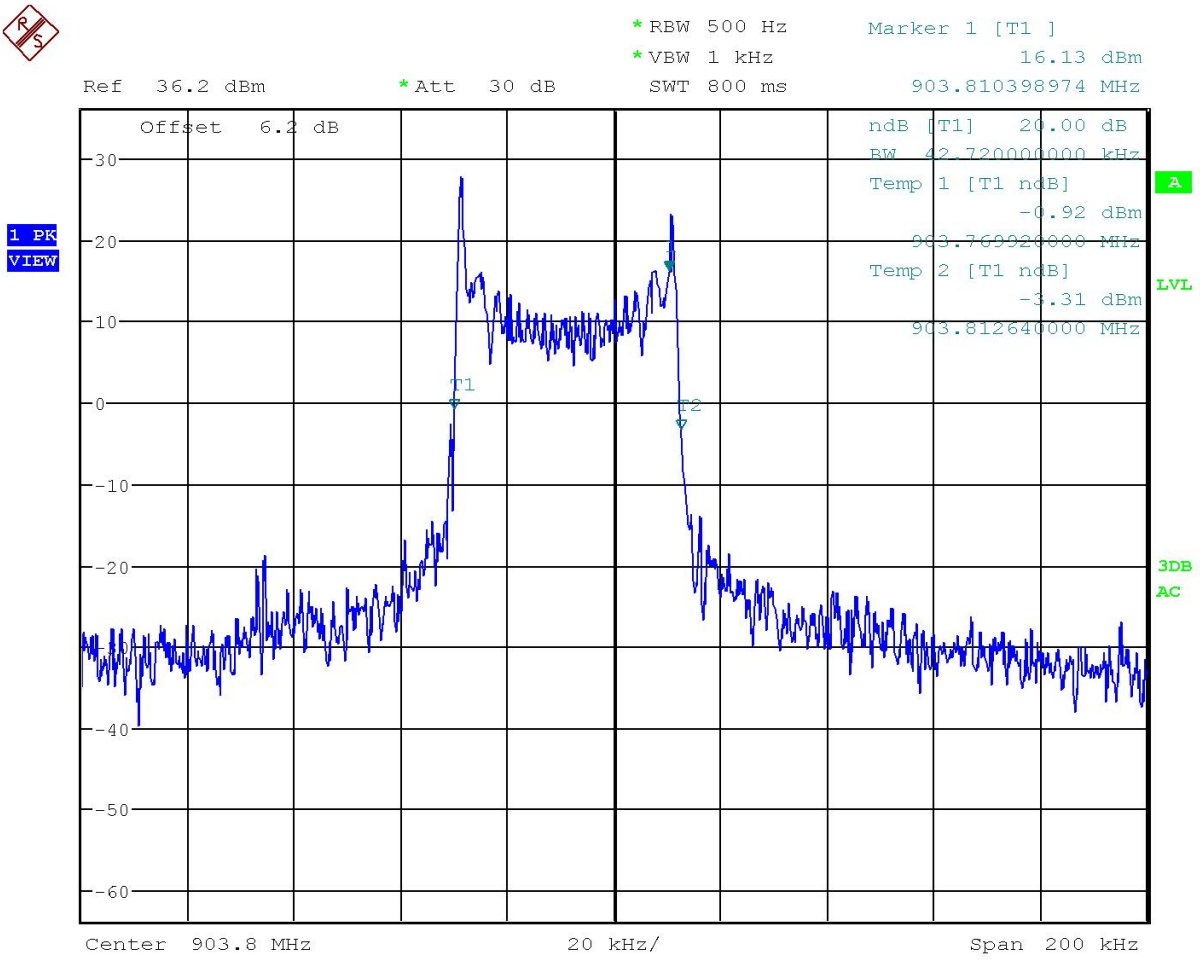
OCCUPIED BANDWIDTH

Test Data: **Low End of Band20 dB Plot**



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RESULTS: Meets Requirements

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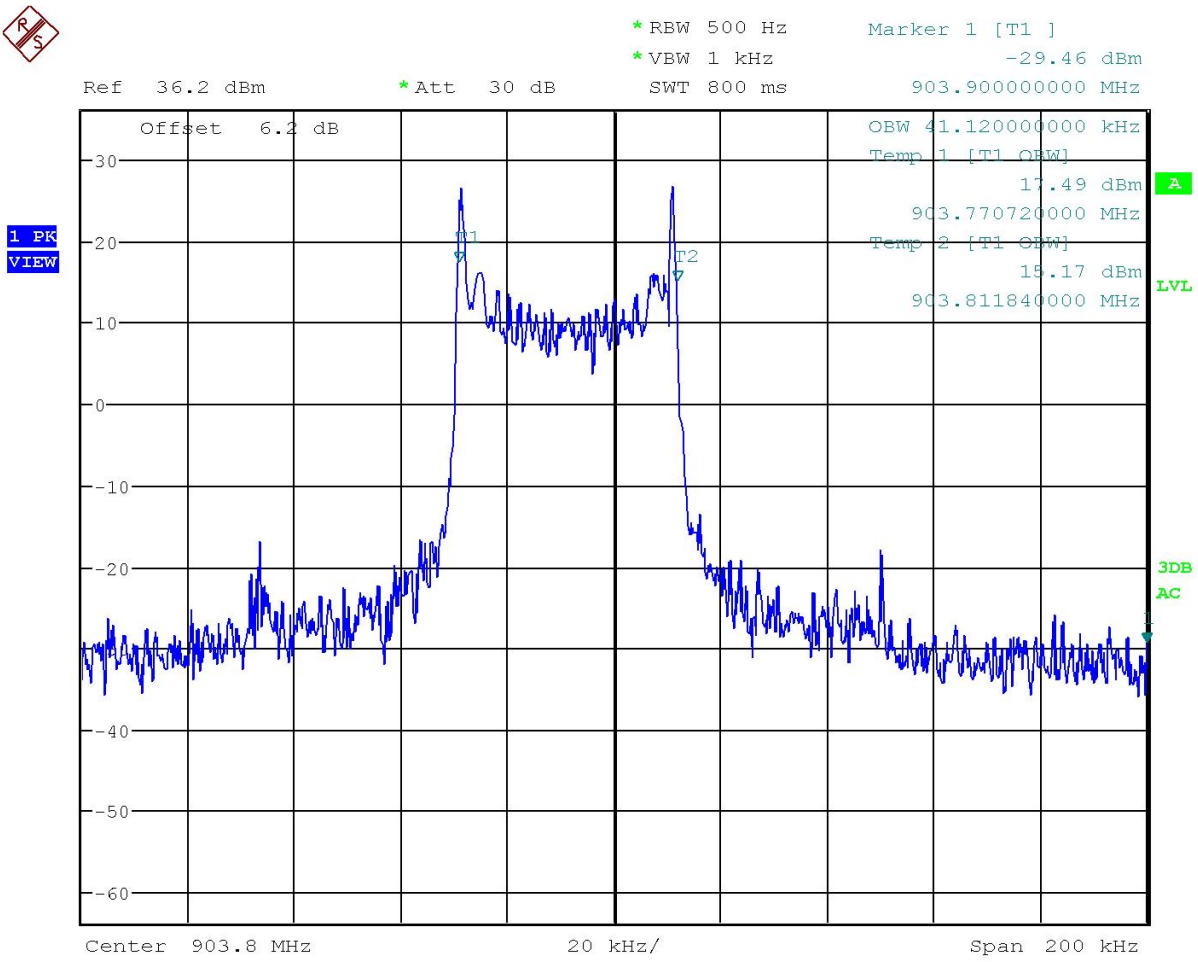
OCCUPIED BANDWIDTH

Test Data: **Low End of Band 99% Plot**



Date: 12.MAY.2017 16:23:30

RESULTS: Meets Requirements

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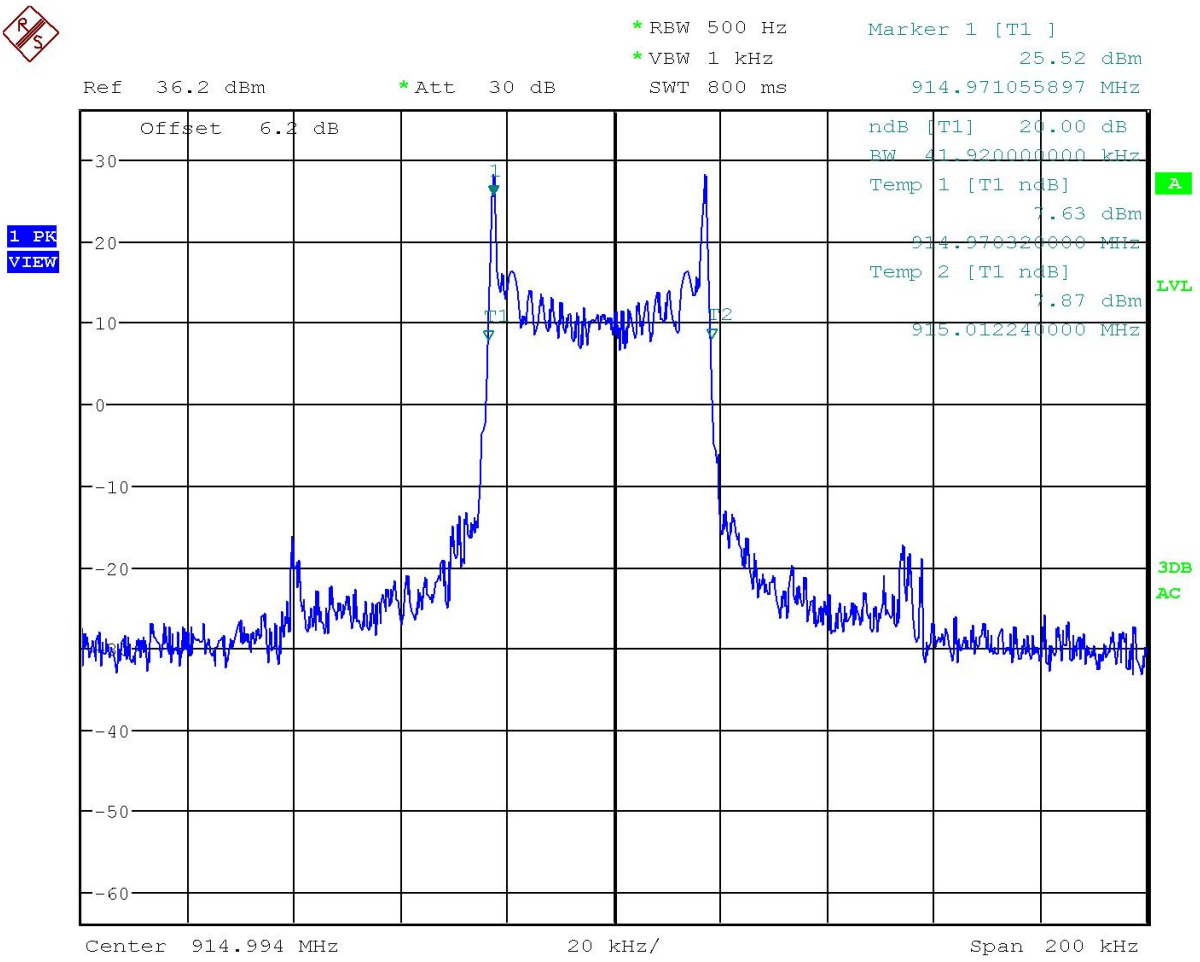
OCCUPIED BANDWIDTH

Test Data: **Middle of Band 20 dB Plot**



Date: 12.MAY.2017 11:28:45

RESULTS: Meets Requirements

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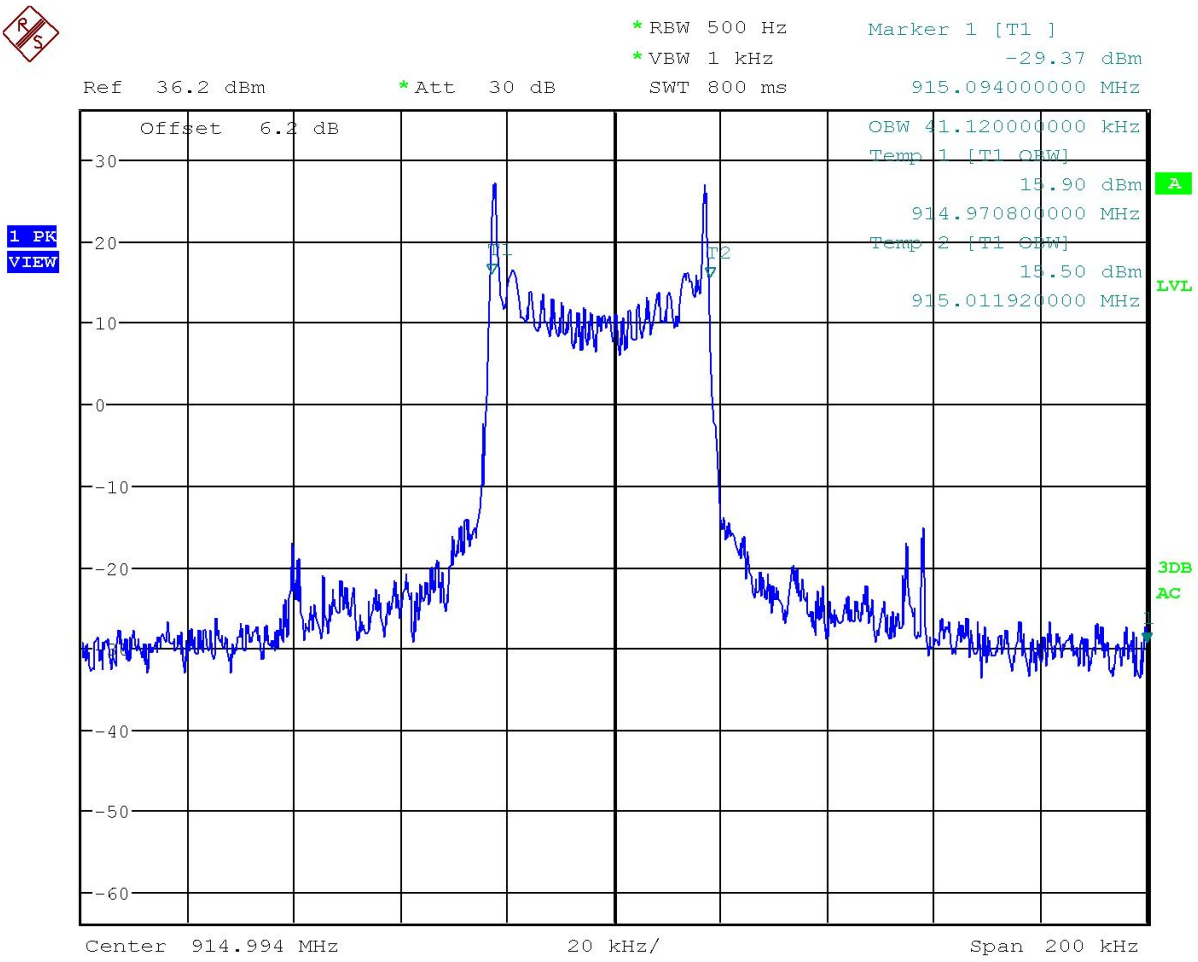
OCCUPIED BANDWIDTH

Test Data: **Middle of Band 99% Plot**



Date: 12.MAY.2017 11:28:00

RESULTS: Meets Requirements

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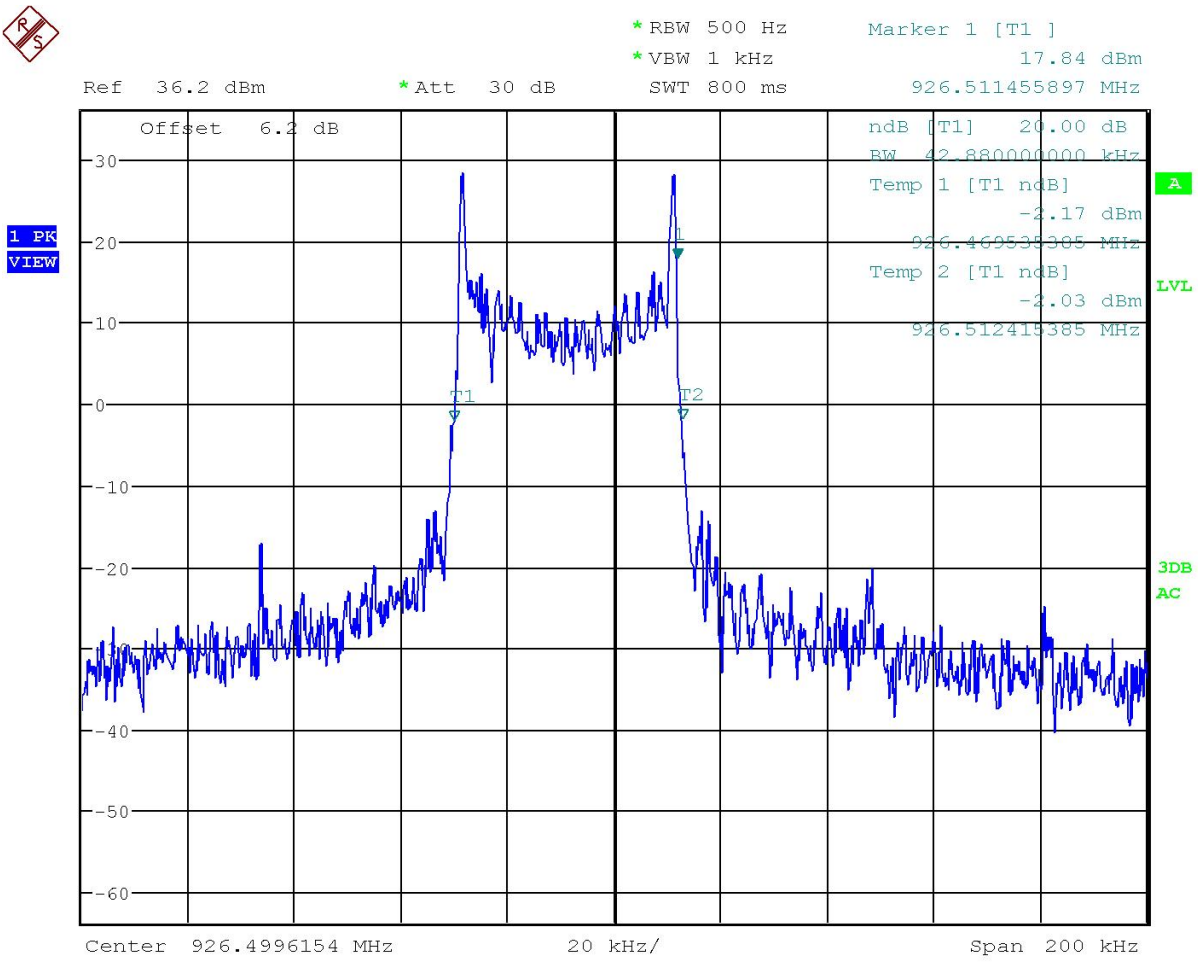
OCCUPIED BANDWIDTH

Test Data: **High end of Band 20 dB Plot**



Date: 12.MAY.2017 16:21:59

RESULTS: Meets Requirements

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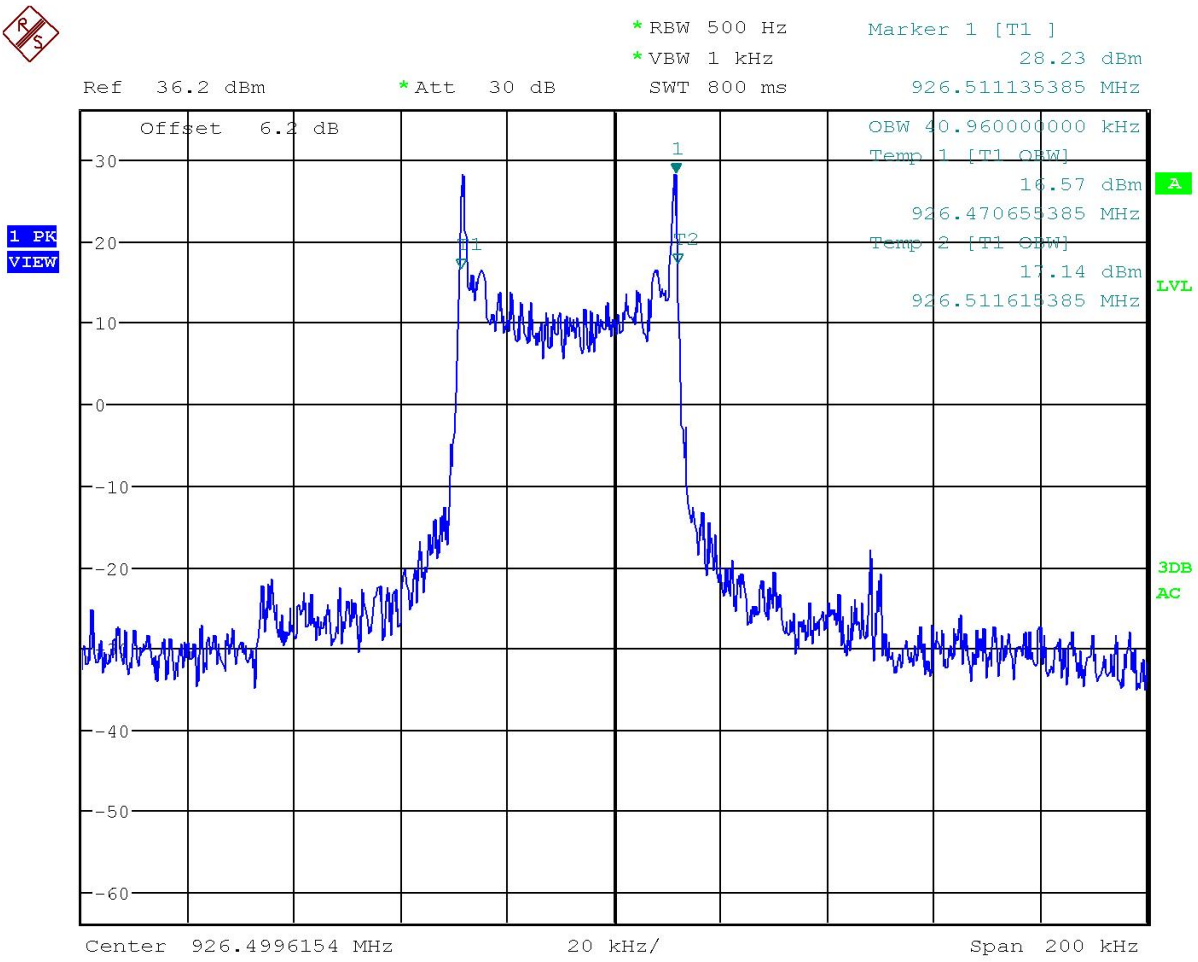
OCCUPIED BANDWIDTH

Test Data: **High end of Band 99% Plot**



Date: 12.MAY.2017 16:21:17

RESULTS: Meets Requirements

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FHSS REQUIREMENTS

Rules Part No.: FCC 15.247(a)(1), IC RSS 247 § 5.1.1, 5.1.2, 5.1.3

Requirements:

Maximum 20 dB Bandwidth
The bandwidth of a frequency hopping channel is the -20 dB emission bandwidth, measured with the hopping stopped. The maximum 20 dB bandwidth of the hopping channel shall be 500 kHz.

Channel Separation
FHSs shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the -20 dB bandwidth of the hopping channel, whichever is greater.

Dwell Time and Number of Hopping Channels
If the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 20-second period. If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping channels 0.4 seconds within a 10-second period.

Hopping Sequence
The hopset shall be such that the near-term distribution of frequencies appears random, with sequential hops randomly distributed in both direction and magnitude of change in the hopset, whereas the long-term distribution appears evenly distributed.

Receiver Input Bandwidth
The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

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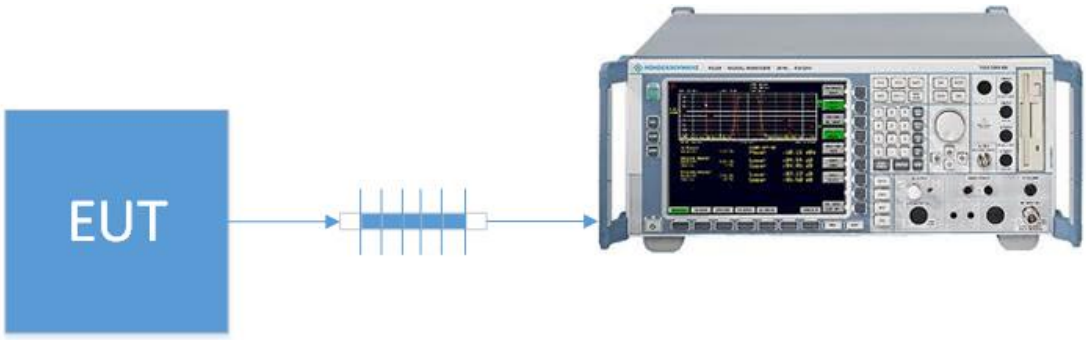
Test Method: ANSI C63.10 § 7.8.2 Carrier frequency separation
ANSI C63.10 § 7.8.3 Number of hopping frequencies
ANSI C63.10 § 7.8.3 Time of Occupancy
DA 00-705 § Pseudorandom Frequency Hopping Sequence
DA 00-705 § Equal Hopping Frequency Use
DA 00-705 § System Receiver Input Bandwidth

Setup:



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FHSS REQUIREMENTS

Test Data: **Channel Separation Measurement Table**

Separation (KHz)	Limit (KHz)	Pass / Fail
367.78	> 42.88	Pass

Test Data: **Number of Hopping Channels Measurement Table**

Number of channels	Limit	Pass / Fail
53	≥ 50	Pass

Test Data: **Hopping Channel Occupancy Time Measurement Table**

Hops over Occupancy Time	Packet Transfer Time (ms)	Dwell Time (s)	Limit (s)	Pass / Fail
2	93.65	187.3	≤ 0.4	Pass

RESULTS: Meets Requirements

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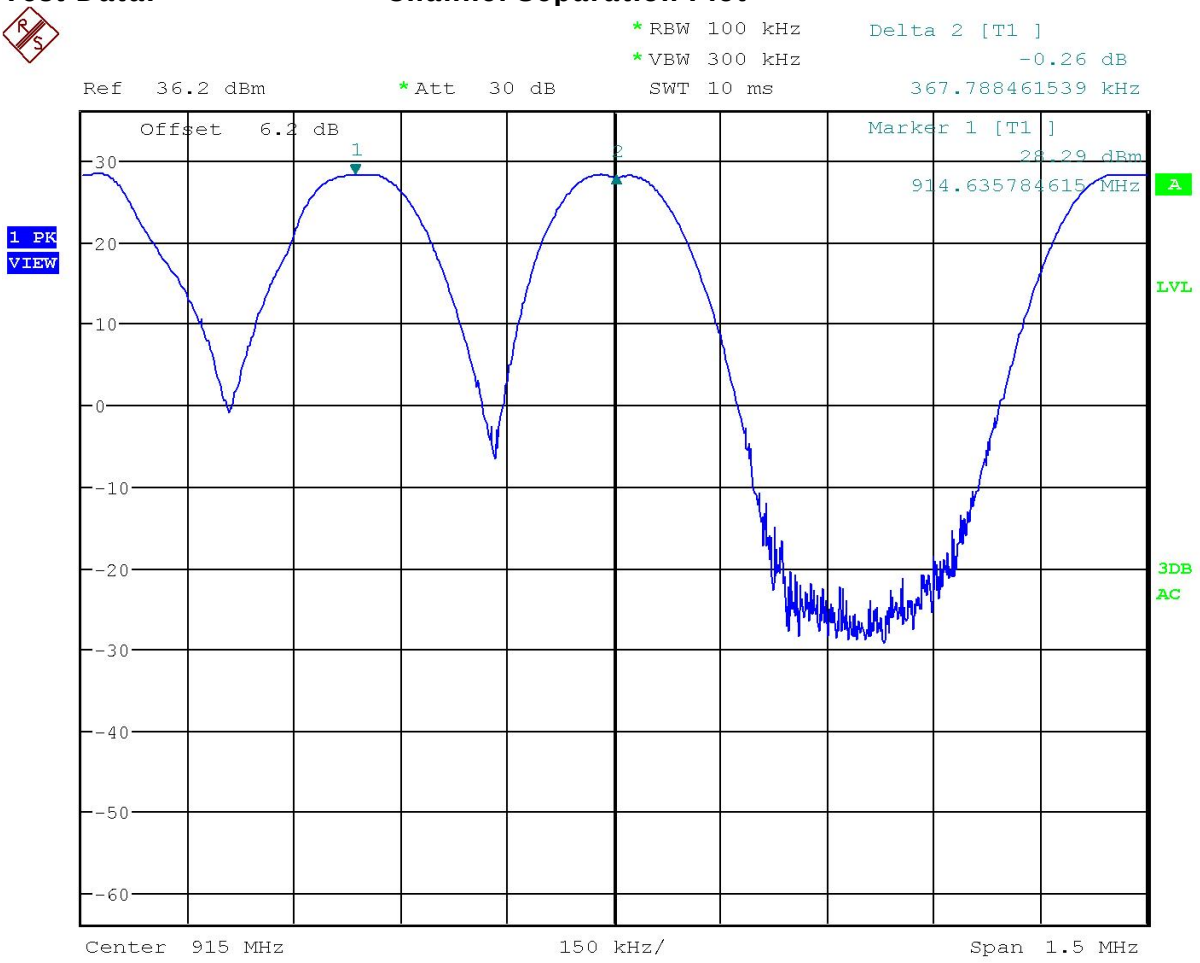
FHSS REQUIREMENTS

Test Data: **Channel Separation Plot**



Date: 12.MAY.2017 11:43:05

Note:

RESULTS: Meets Requirements

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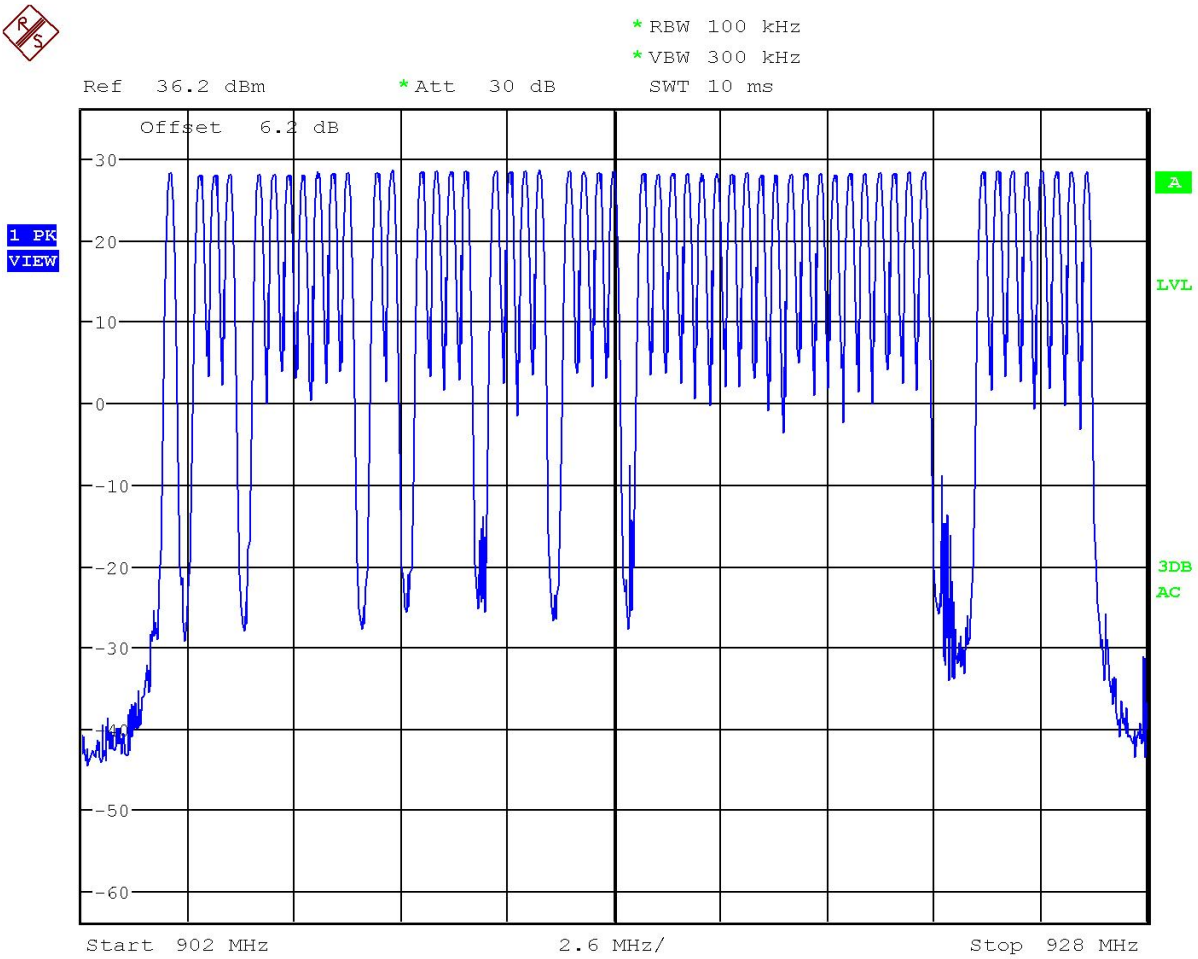
FHSS REQUIREMENTS

Test Data: **Number of Hopping Channels Plot**



Date: 12.MAY.2017 11:46:38

Note:

RESULTS: Meets Requirements

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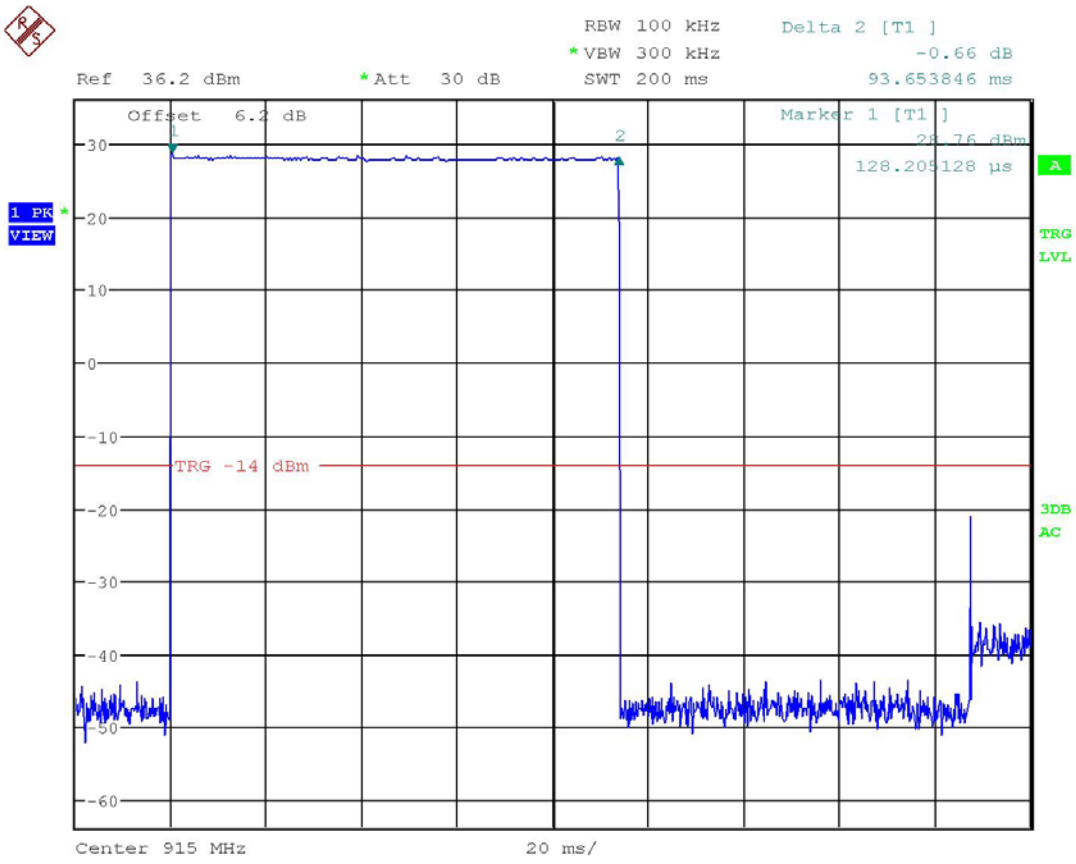
FHSS REQUIREMENTS

Test Data: **DH5 Packet Transfer Time Plot Time Plot**



Notes:

RESULTS: Meets Requirements

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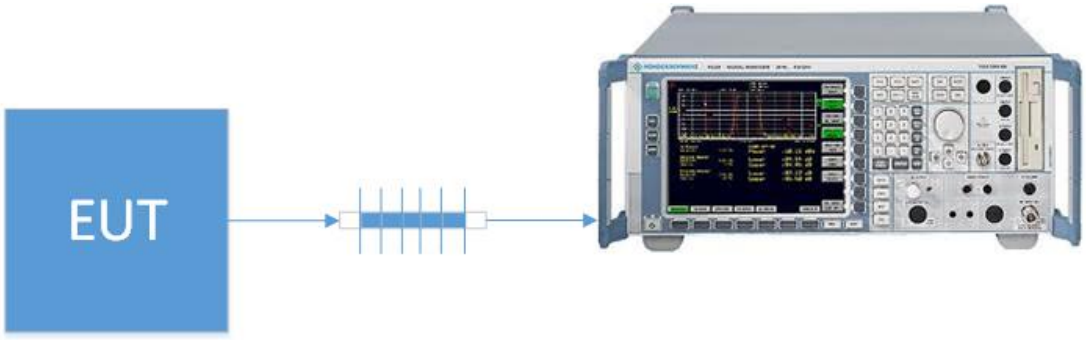
BANDEDGE

Rule Part No.: FCC 15.247(d) & 15.209, IC RSS 247 § 5.5 & RSS GEN § 8.9

Requirements: Emissions must be at least 20dB down from the highest emission level Within the authorized band as measured with a 100 kHz RBW, additionally adjacent restricted band edge emissions must comply with 15.209 and RSS-GEN 8.9 limits.

Test Method: ANSI C63.10 § 6.10.4 Authorized band-edge relative method

Setup:



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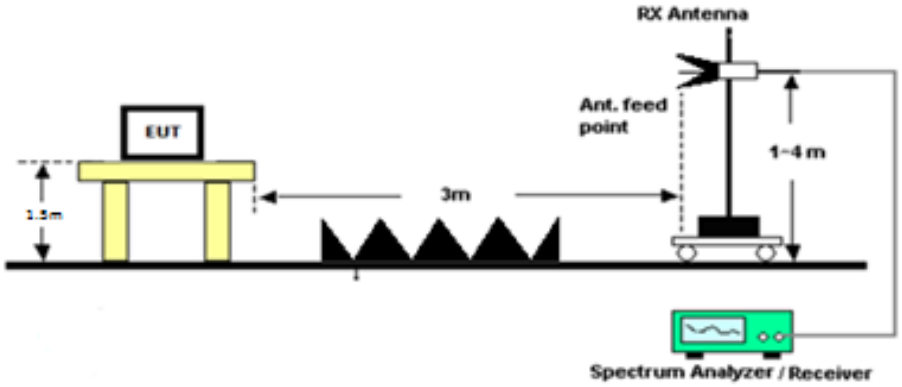
Conducted Measurement



Radiated Measurement

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BANDEDGE

Test Data: **Conducted Lower Band Edge**

Bandedge	Tuned Frequency (MHz)	Measured Level (dBc)	Limit (dBc)	Margin (dB)
Lower	903.8	64.4	20	44.4
	Hopping	48.8	20	28.8

RESULTS: Meets Requirements

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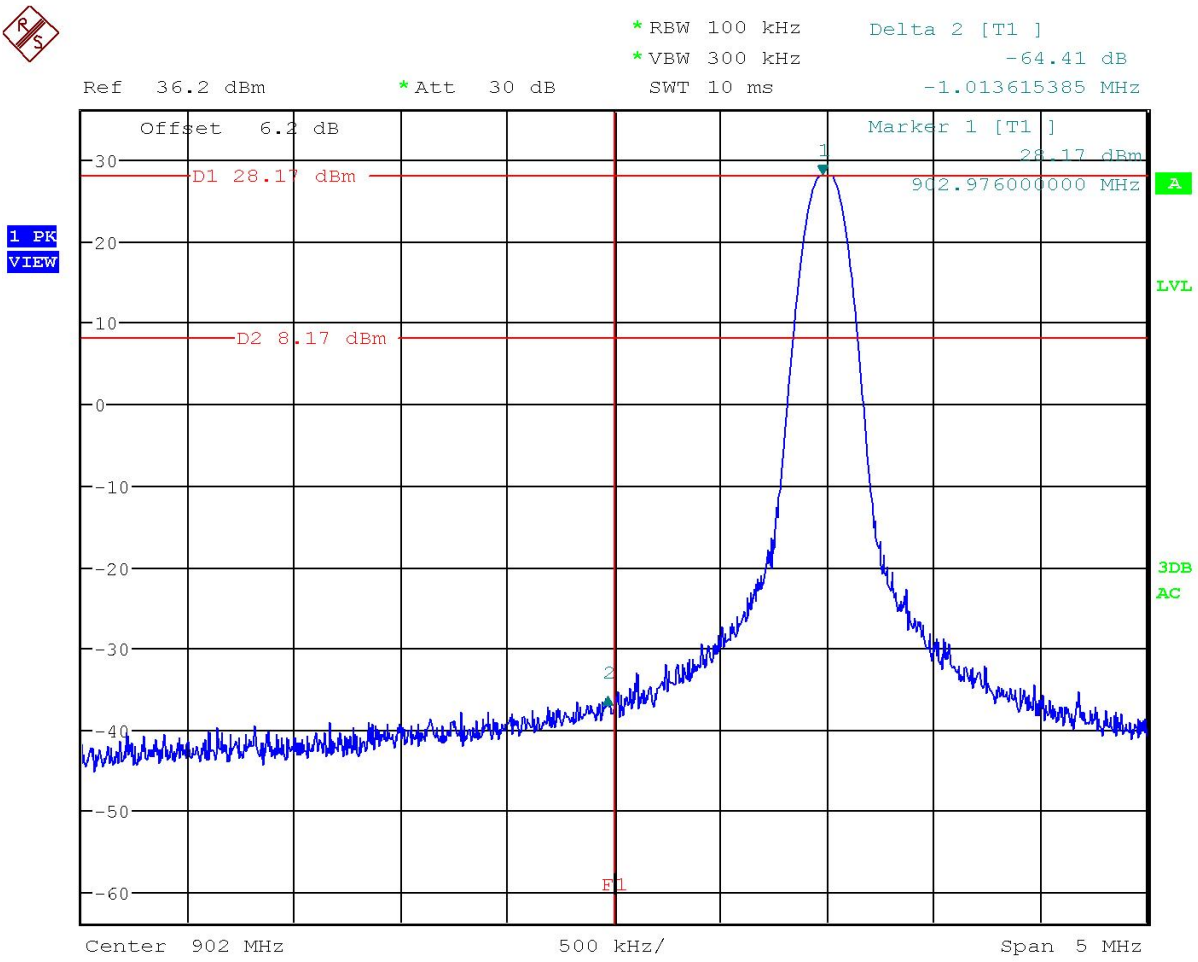
BANDEDGE

Test Data: **Conducted Lower Band Edge Stopped Plot**



Date: 12.MAY.2017 14:56:15

RESULTS: Meets Requirements

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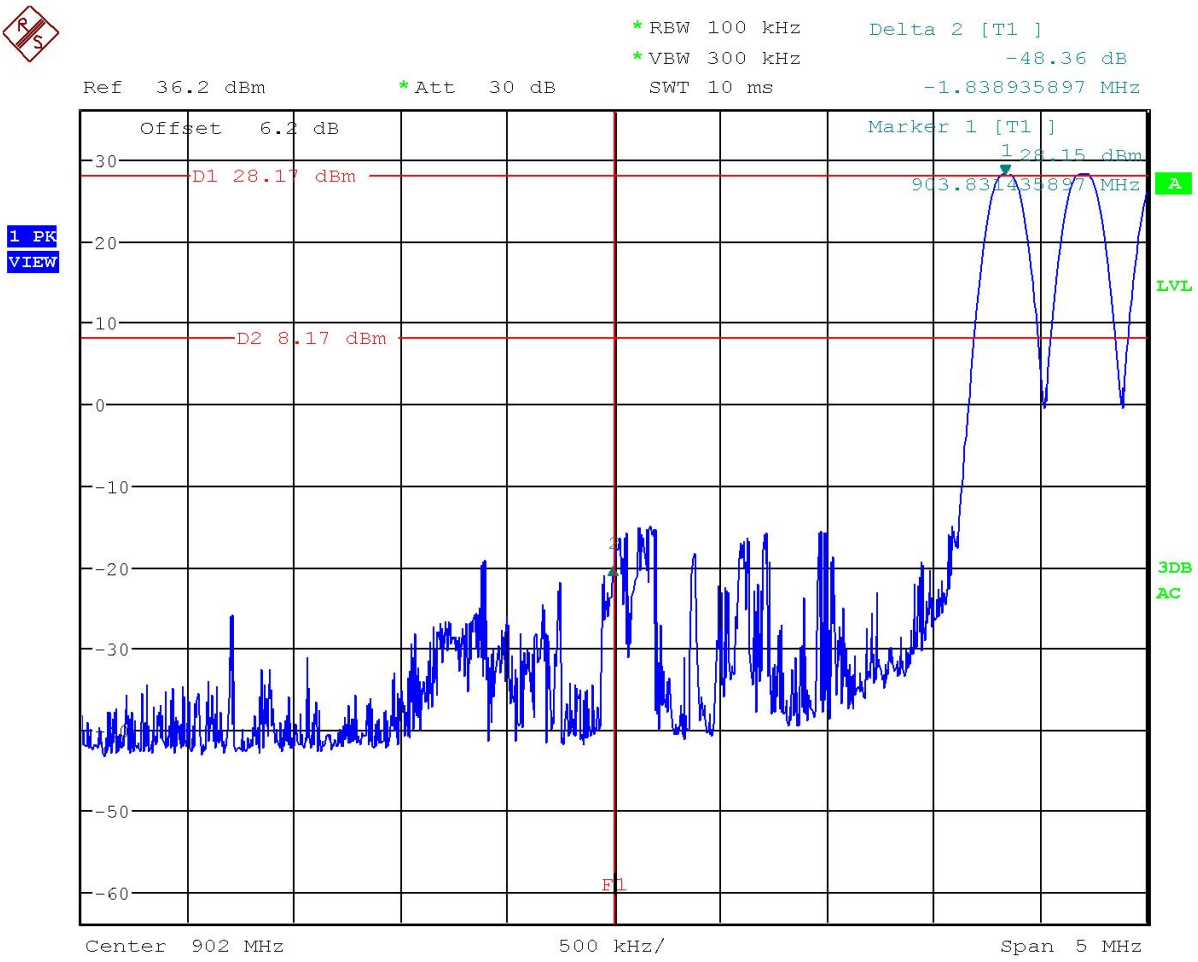
BANDEDGE

Test Data: **Conducted Lower Band Edge Hopping Plot**



Date: 12.MAY.2017 15:55:58

RESULTS: Meets Requirements

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BANDEDGE

Test Data: **Conducted Upper Band Edge**

Bandedge	Tuned Frequency (MHz)	Measured Level (dBc)	Limit (dBc)	Margin (dB)
Lower	926.5	66.5	20	46.5
	Hopping	56.3	20	36.3

RESULTS: Meets Requirements

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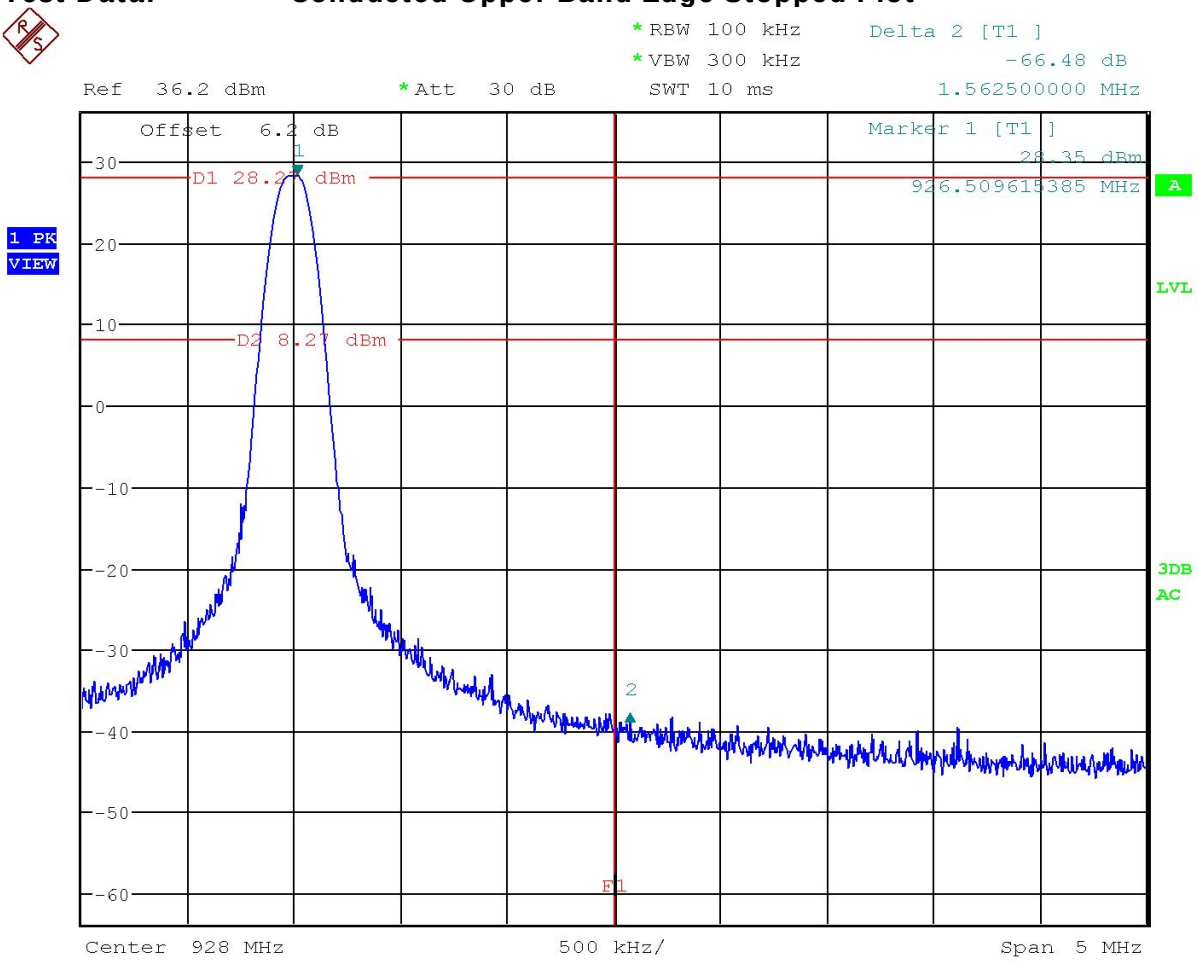
BANDEDGE

Test Data: **Conducted Upper Band Edge Stopped Plot**



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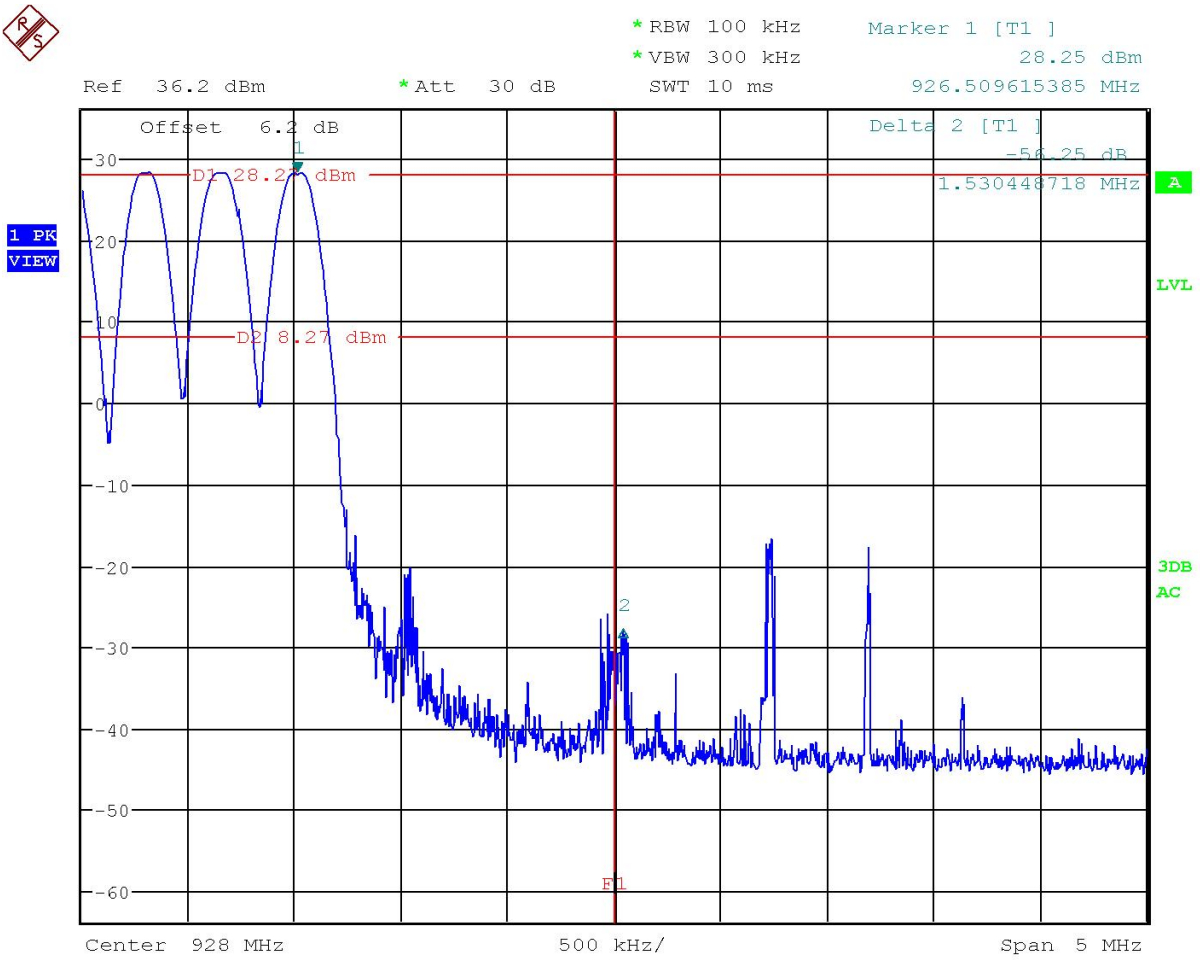
BANDEDGE

Test Data: **Mode 1 Conducted Upper Band Edge Hopping Plot**



Date: 12.MAY.2017 16:14:20

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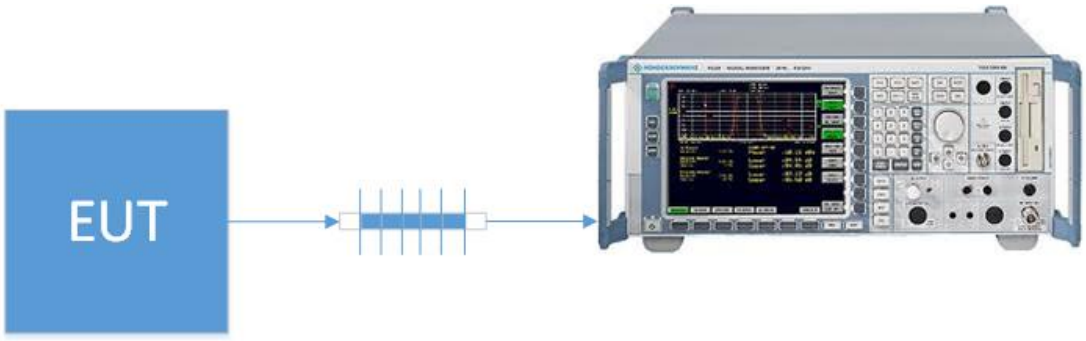
ANTENNA CONDUCTED SPURIOUS EMISSIONS

Rules Part No.: FCC part 15.247 (d) & 15.209, IC RSS 247 § 5.5 & RSS GEN § 8.9

Requirements: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below

Test Method: ANSI C63.10 § 11.11.1 General Information
ANSI C63.10 § 11.11.2 Reference level measurement
ANSI C63.10 § 11.11.3 Emission level measurement

Setup:



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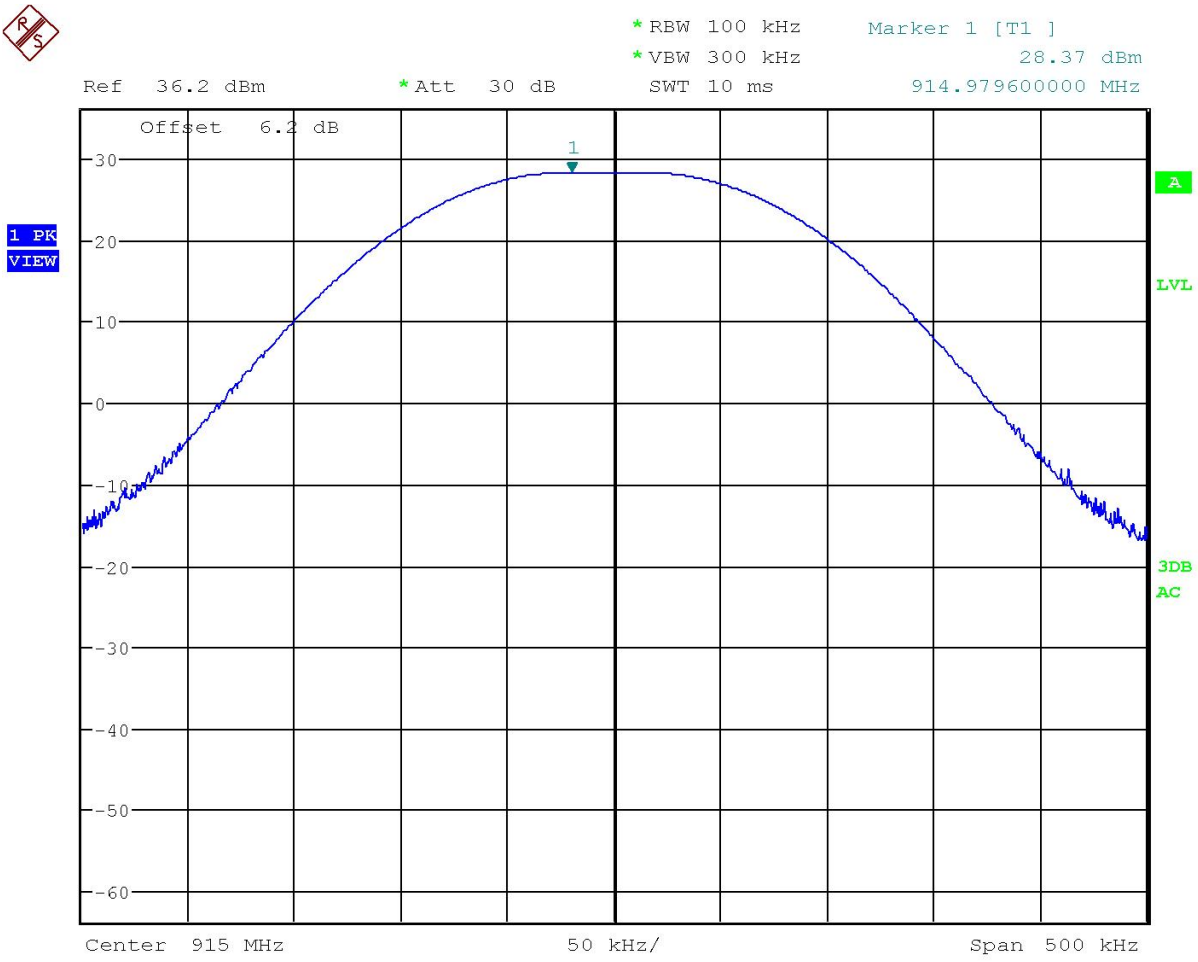
ANTENNA CONDUCTED SPURIOUS EMISSIONS

Test Data: **100 KHz Reference Level Plot**



Date: 15.MAY.2017 08:33:02

RESULTS: Meets Requirements

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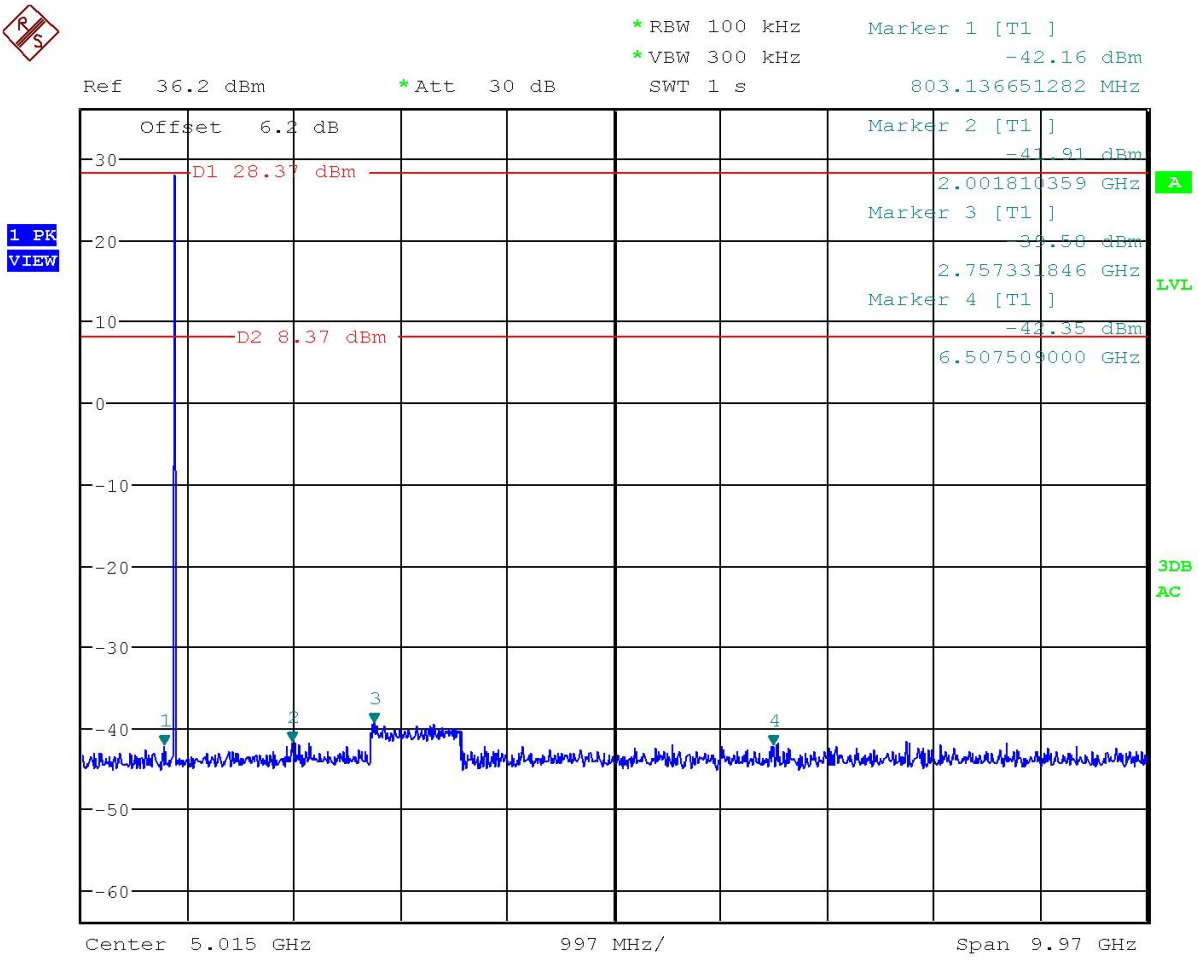
ANTENNA CONDUCTED SPURIOUS EMISSIONS

Test Data: **Low End of Band 30 MHz – 25 GHz Plot**



Date: 15.MAY.2017 08:41:39

RESULTS: Meets Requirements

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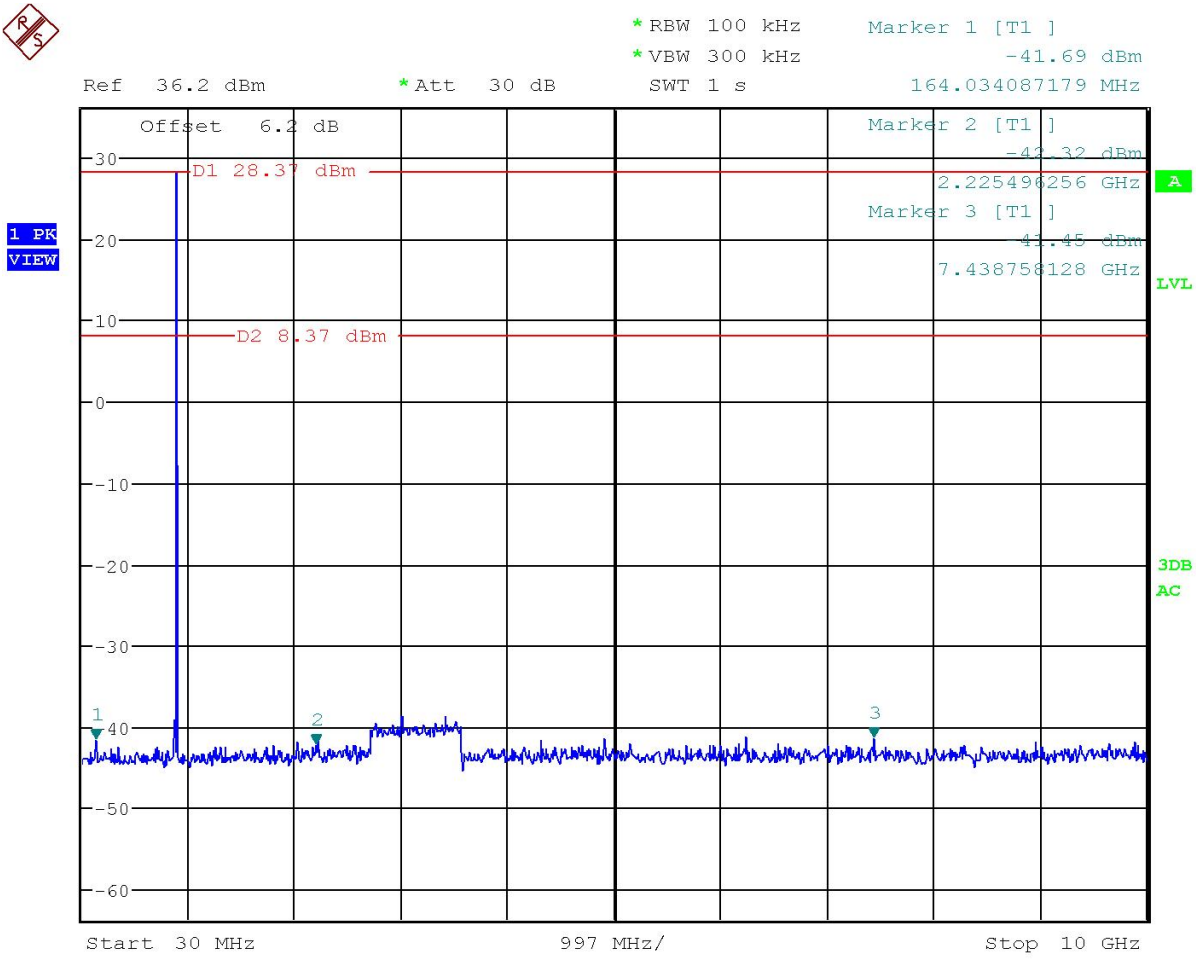
ANTENNA CONDUCTED SPURIOUS EMISSIONS

Test Data: **Middle of Band 30 MHz – 25 GHz Plot**



Date: 15.MAY.2017 08:39:41

RESULTS: Meets Requirements

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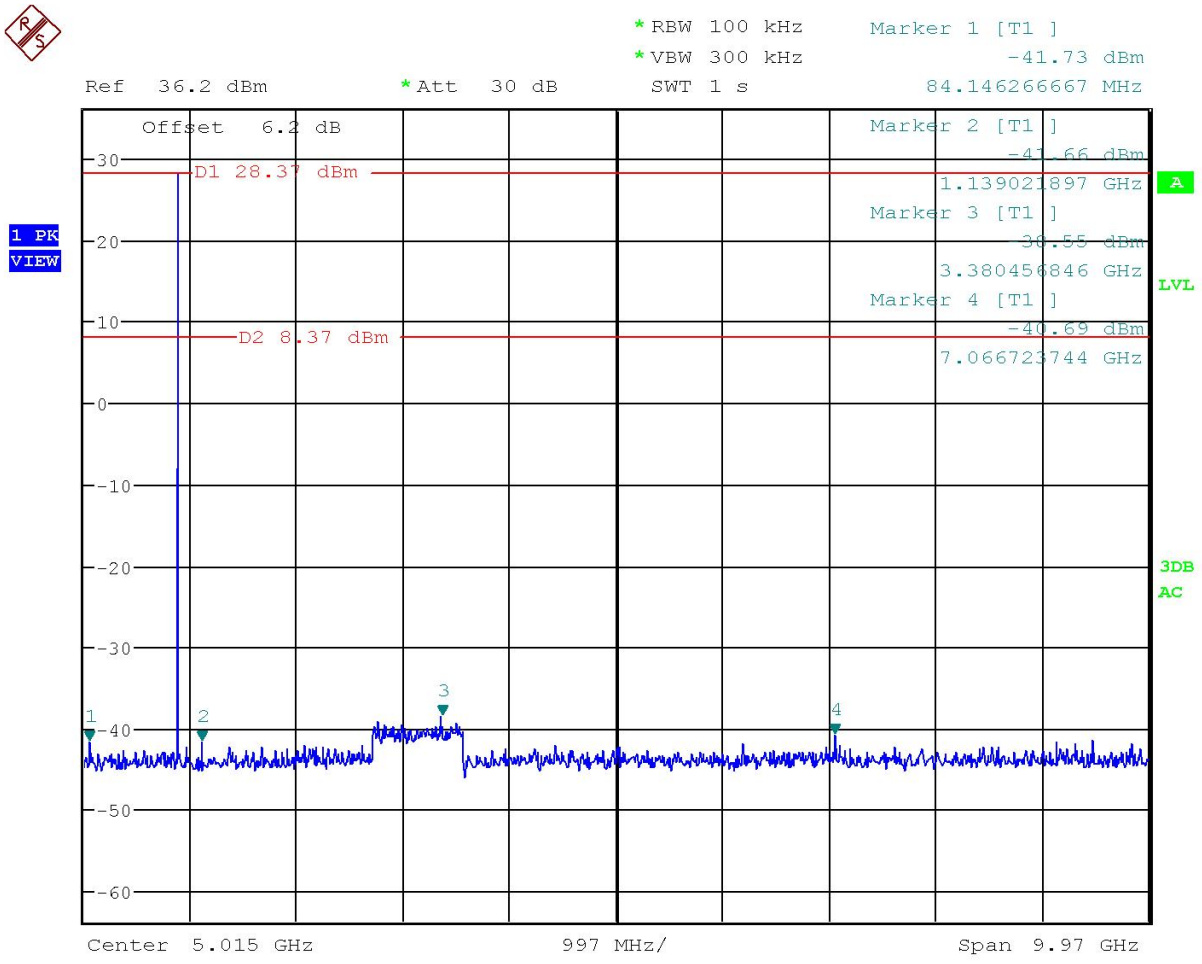
ANTENNA CONDUCTED SPURIOUS EMISSIONS

Test Data: **High End of Band 30 MHz – 25 GHz Plot**



Date: 15.MAY.2017 08:42:53

RESULTS: Meets Requirements

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RADIATED SPURIOUS EMISSIONS

Rules Part No.: FCC part 15.247 (d) & 15.209, IC RSS 247 § 5.5 & RSS GEN § 8.9

Requirements: Emissions found in restricted bands the levels must comply with the general limits found in FCC part 15.209

Frequency	Limits
FCC Part 15.209, IC RSS-GEN 8.9	
9 to 490 kHz	2400/F (kHz) µV/m @ 300 meters
490 to 1705 kHz	24000/F (kHz) µV/m @ 30 meters
1705 kHz to 30 MHz	29.54 dBµV/m @ 30 meters
30 – 88	40.0 dBµV/m @ 3 meters
80 – 216	43.5 dBµV/m @ 3 meters
216 – 960	46.0 dBµV/m @ 3 meters
Above 960	54.0 dBµV/m @ 3 meters

Test Method: ANSI C63.4 § Annex D Validation of radiated emissions standard test sites
ANSI C63.10 § 6.3 Common requirements radiated emissions
ANSI C63.10 § 6.4 Emissions below 30 MHz
ANSI C63.10 § 6.5 Emissions between 30 & 1000 MHz
ANSI C63.10 § 6.6 Emissions above 1 GHz

Field Strength Calculation:

The field strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBµV) to the antenna correction factor supplied by the antenna manufacturer plus the coax loss. The antenna correction factors are stated in terms of dB. The gain of the preselector was accounted for in the spectrum analyzer meter reading.

Example:

Freq (MHz)	Meter Reading	+ ACF	+ CL = FS
33	20 dBµV	+ 10.36 dB	+ 0.5 = 30.86 dBµV/m @ 3m

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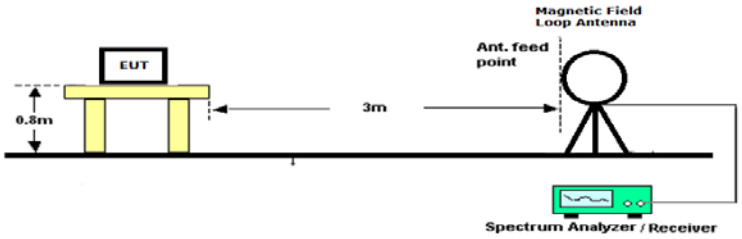
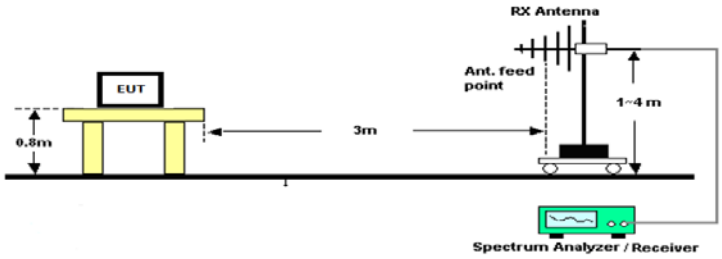
RADIATED SPURIOUS EMISSIONS

Setup:

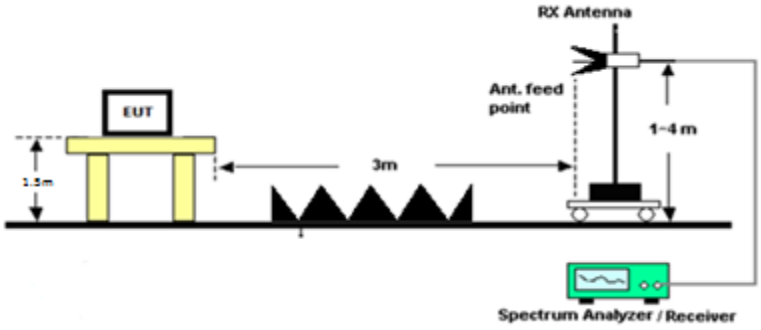
Emissions below 30 MHz



Emissions 30 – 1000 MHz



Emissions above 1 GHz



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RADIATED SPURIOUS EMISSIONS

Notes: The EUT was checked in three orthogonal planes as required, a setup photo is provided to show the orientation of the worst case position.

Only the worst case data rate and Output Power which produced emissions within 20dB of the limit are reported.

The spectrum was measured from 9 KHz to 25 GHz

When necessary measurements were taken at distance closer than the limit distance, the readings were extrapolated back to be compared at the limit distance following FCC part 15.31 (f)(1)(2).

Test Data: **Measurement Table (Hopping)**

Emission Frequency MHz	Detector	Meter Reading dBu V	Antenna Polarity	Coax Loss Db	Correction Factor dB/M	Field Strength dBu V/M	Margin
52.9	Peak	10.1	V	0.9	10.0	21.0	19.0
56.2	Peak	6.3	H	0.9	8.8	16.1	23.9
56.4	Peak	16.4	V	0.9	8.7	26.0	14.0
153.9	Peak	6.4	H	1.4	17.0	24.8	18.7
156.9	Peak	6.6	V	1.4	17.1	25.1	18.4
408.6	Peak	27.9	V	2.3	15.3	45.5	81.9
788.8	Peak	27.8	V	3.2	21.3	52.2	75.1
882.2	Peak	32.1	H	3.4	21.8	57.3	70.1

Results Meet Requirements

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RADIATED SPURIOUS EMISSIONS

Test Data: **Measurement Table (903.8MHz)**

Emission Frequency MHz	Detector	Meter Reading dBu V	Antenna Polarity	Coax Loss Db	Correction Factor dB/M	Field Strength dBu V/M	Margin
1808	Peak	42.1	H	4.9	30.8	77.9	49.5
2709	Peak	9.9	H	8.7	34.5	53.0	1.0
4515	Peak	8.7	H	9.4	35.6	53.7	0.3
6321	Peak	5.9	H	10.6	35.7	52.2	1.8

Results Meet Requirements

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RADIATED SPURIOUS EMISSIONS

Test Data: Measurement Table (915MHz)

Emission Frequency MHz	Detector	Meter Reading dBu V	Antenna Polarity	Coax Loss Db	Correction Factor dB/M	Field Strength dBu V/M	Margin
1830	Peak	10.1	V	4.9	31.1	46.2	81.2
2745	Peak	11.7	V	6.1	32.5	50.2	3.8
3660	Peak	8.9	V	7.0	33.7	49.7	4.3
4575	Peak	8.7	V	7.9	34.2	50.8	3.2
5490	Peak	9.9	H	8.7	34.5	53.0	1.0
6405	Peak	8.7	H	9.4	35.6	53.7	0.3
8235	Peak	5.9	H	10.6	35.7	52.2	1.8

Results Meet Requirements

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RADIATED SPURIOUS EMISSIONS

Test Data: Measurement Table (926.5MHz)

Emission Frequency MHz	Detector	Meter Reading dBu V	Antenna Polarity	Coax Loss Db	Correction Factor dB/M	Field Strength dBu V/M	Margin
1853	Peak	17.3	V	4.9	31.4	53.7	20.3
1853	Peak	4.3	V	4.9	31.4	40.7	13.3
2779.5	Peak	15.4	V	6.1	32.4	53.9	20.1
2779.5	Peak	-1.0	V	6.1	32.4	37.5	16.5
3706	Peak	11.5	V	7.1	33.9	52.5	21.5
3706	Peak	-12.5	V	7.1	33.9	28.4	25.6
4632.5	Peak	9.7	V	7.9	34.2	51.9	2.1
5559	Peak	9.3	V	8.7	34.6	52.6	1.4
6485.5	Peak	7.7	V	9.4	35.7	52.9	1.1
7412	Peak	5.5	V	10.1	35.7	51.2	2.8
8338.5	Peak	7.2	H	10.6	35.8	53.6	0.4

Results Meet Requirements

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EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
DC Power Supply	HP	6286A	1744A03842	N/A	N/A
Antenna: Biconical 1096 Chamber	Eaton	94455-1	1096	07/14/15	07/14/17
Antenna: Log-Periodic 1122	Electro-Metrics	LPA-25	1122	07/14/15	07/14/17
CHAMBER	Panashield	3M	N/A	04/25/16	12/31/17
Antenna: Double-Ridged Horn/ETS Horn 2	ETS-Lindgren Chamber	3117	00041534	03/01/17	03/01/19
Software: Field Strength Program	Timco	N/A	Version 4.10.7.0	N/A	N/A
Antenna: Active Loop	ETS-Lindgren	6502	00062529	11/18/15	11/18/17
Coaxial Cable #103 - KMKM-0180-01 Aqua	Micro-Coax	UFB142A-0-0720-200200	225363-002 (#103)	08/05/15	08/05/17
Coaxial Cable #101 - NMNM-0180-01 Aqua DC-40G	Micro-Coax	UFB311A-0-0720-50U50U	225362-002 (#101)	07/18/16	07/18/18
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	04/01/16	04/01/18
Coaxial Cable - Chamber 3 cable set (Primary)	Micro-Coax	Chamber 3 cable set (Primary)	KMKM-0244-01; KMKM-0670-00; KFKF-0198-01	08/09/16	08/09/18

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Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Attenuator K 6dB 2W DC-40G	Narda	4768-6	1044-2	06/25/15	06/25/17

***EMI RECEIVER SOFTWARE VERSION**

The receiver firmware used was version 4.43 Service Pack 3

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