849 NW State Road 45
Newberry, FL 32669 USA
Ph.: 888.472.2424 or
352.472.5500
Fax: 352.472.2030
Email: info@timcoengr.com
Website: www.timcoengr.com

FCC PART 15.247 & IC RSS-247

900MHz FHSS

TEST REPORT

Applicant	**DIGITAL MONITORING PRODUCTS**
Address	**2500 N. PARTNERSHIP BLVD.**
	SPRINGFIELD MISSOURI 65802 USA
FCC ID	**CCKPC0123R8**
IC	**5251A-PC0123R8**
Model Number	1135
Product Description	WIRELESS SOUNDER
Date Sample Received	5/2/2016
Final Test Date	05/31/2016
Tested By	Cory Leverett
Approved By	Tim Royer

Report Number	Version Number	Description	Issue Date
719AUT16TestReport_	Rev1	Initial Issue	05/31/2016
719AUT16TestReport_	Rev2	Added Dwell Time Declaration from Applicant on page 14. Applied Duty cycle correction to measurement table on page 31.	06/06/2016

TABLE OF CONTENTS

GENERAL REMARKS

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

The test results relate only to the items tested.

Summary

The device under test does:
☒ Fulfill the general approval requirements as identified in this test report
☐ 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: 2005 requirements.

I attest that the necessary measurements were made at:

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

Authorized Signatory Name:

Cory Leverett
Engineering Project Manager
Date: 06/ 06/ 2016

Test report reviewed and approved by: __ _____

Tim Royer, Timco Engineering, Inc.
Date: 6/ 7/ 2016

GENERAL INFORMATION

EUT Specification

Regulatory Standards	FCC Title 47 CFR Part 15.247 IC RSS-247 Issue 1 & RSS-GEN Issue 4		
FCC ID	**CCKPC0123R8**		
IC	**5251A-PC0123R8**		
Model	1135		
EUT Description	WIRELESS SOUNDER		
Modulation Types	Mode 1:FSK		
Operating Frequency	TX: 902 - 928 MHz	RX: 902 – 928 MHz	
EUT Power Source	☐ 110–120Vac/50– 60Hz		
	☐ DC Power		
	☒ Battery Operated Exclusively		
Test Item	☐ Prototype	☒ Pre-Production	☐ Production
Type of Equipment	☒ Fixed	☐ Mobile	☐ Portable
Antenna Connector	None (Temporary Connector Provided for Testing)		
Antenna	PCB Trace Antenna		
Test Conditions	Temperature: 24-26ºC Relative humidity: 50-65%		
Measurement Standard	FCC DA 00-705 FCC Rule Part 15 ANSI C63.10-2013 ANSI C63.4-2014 (Radiated Site Validation)		
Test Exercise	Engineering sample with a button to enable the modes of operation, all modes of modulation were tested.		

Test Supporting Equipment

Device	Manufacturer	Model	S/N	Supplied By	Used For
NA					

RESULTS SUMMARY

FCC Rule Part No.	IC Standard Ref.	Requirement	Test Item	Result
15.247 (a,1,i)	RSS-247 § 5.1.3	Occupied Bandwidth	20 dB Bandwidth	Pass
15.247(a,1)	RSS-247 § 5.1	FHSS Requirements	Channel Separation	Pass
			Number of Hopping Channels	Pass
			Hopping Channel Occupancy Time	Pass
15.247(b,1) & (b,4)	RSS-247 § 5.4.2	Peak Power Output	Peak Power Output	Pass
			Antenna Gain (EIRP)	Pass
15.247(d)	RSS-247 § 5.5	Unwanted Emissions	Bandedge	Pass
			Radiated Spurious	Pass

Notes:

OCCUPIED BANDWIDTH

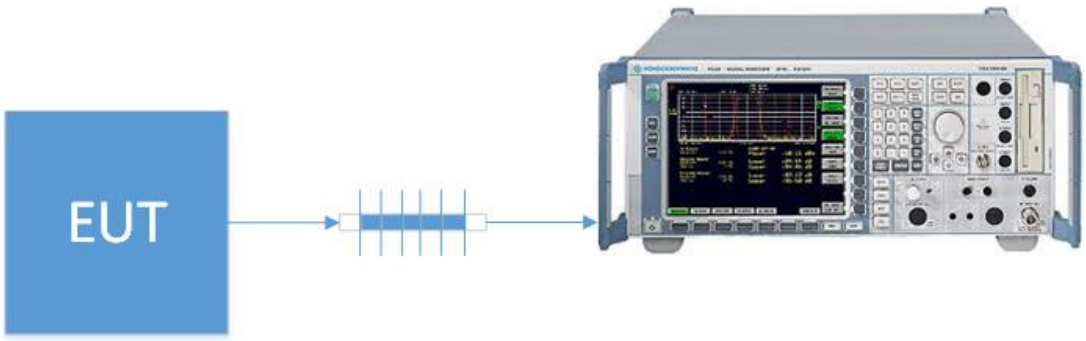
Rules Part No.: FCC 15.215(C), IC RSS 247 § 5.1.1, 5.1.1.3

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:



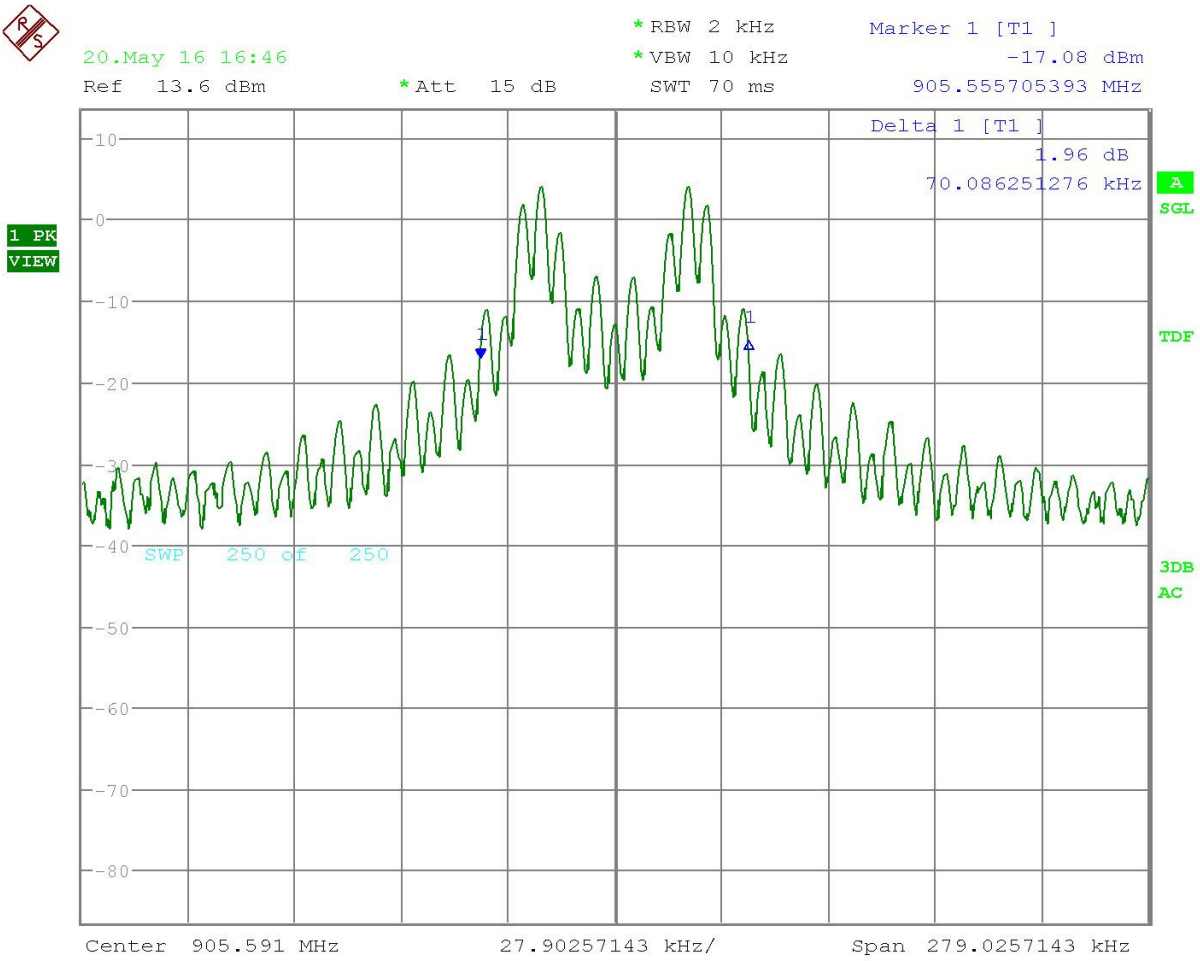
Test Data: **Mode 1 20 dB Occupied Bandwidth Measurement Table**

Tuned Frequency (MHz)	20 dB BW (KHz)	Limit (KHz)	Margin (KHz)
905.6	70.08	≤ 500	429.92
915.0	70.27	≤ 500	429.73
924.4	69.75	≤ 500	430.25

RESULTS: Meets Requirements

OCCUPIED BANDWIDTH

Test Data: **20 dB OBW Mode 1 Low End of Band Plot**

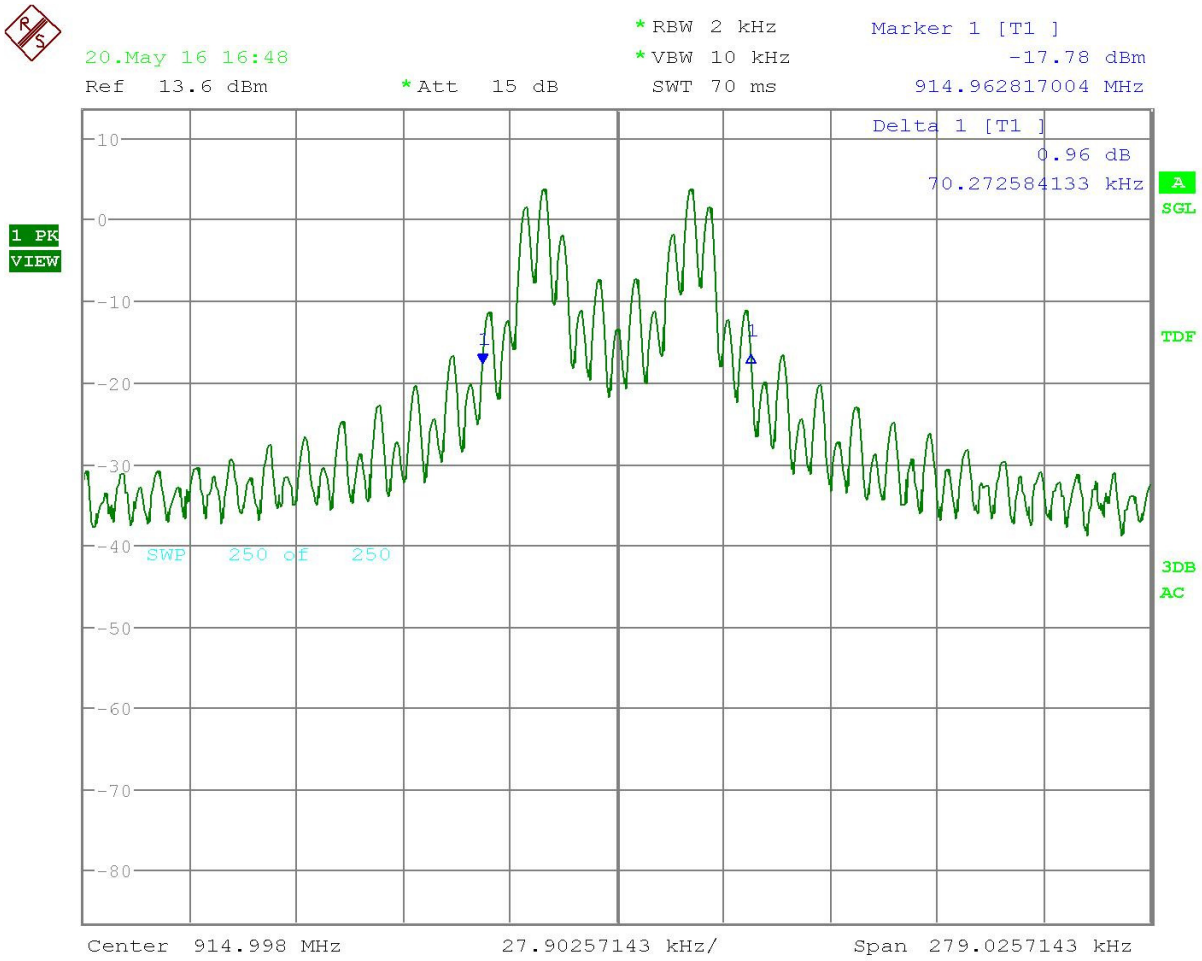


Date: 20.MAY.2016 16:46:41

RESULTS: Meets Requirements

OCCUPIED BANDWIDTH

Test Data: **20 dB OBW Mode 1 Middle of Band Plot**

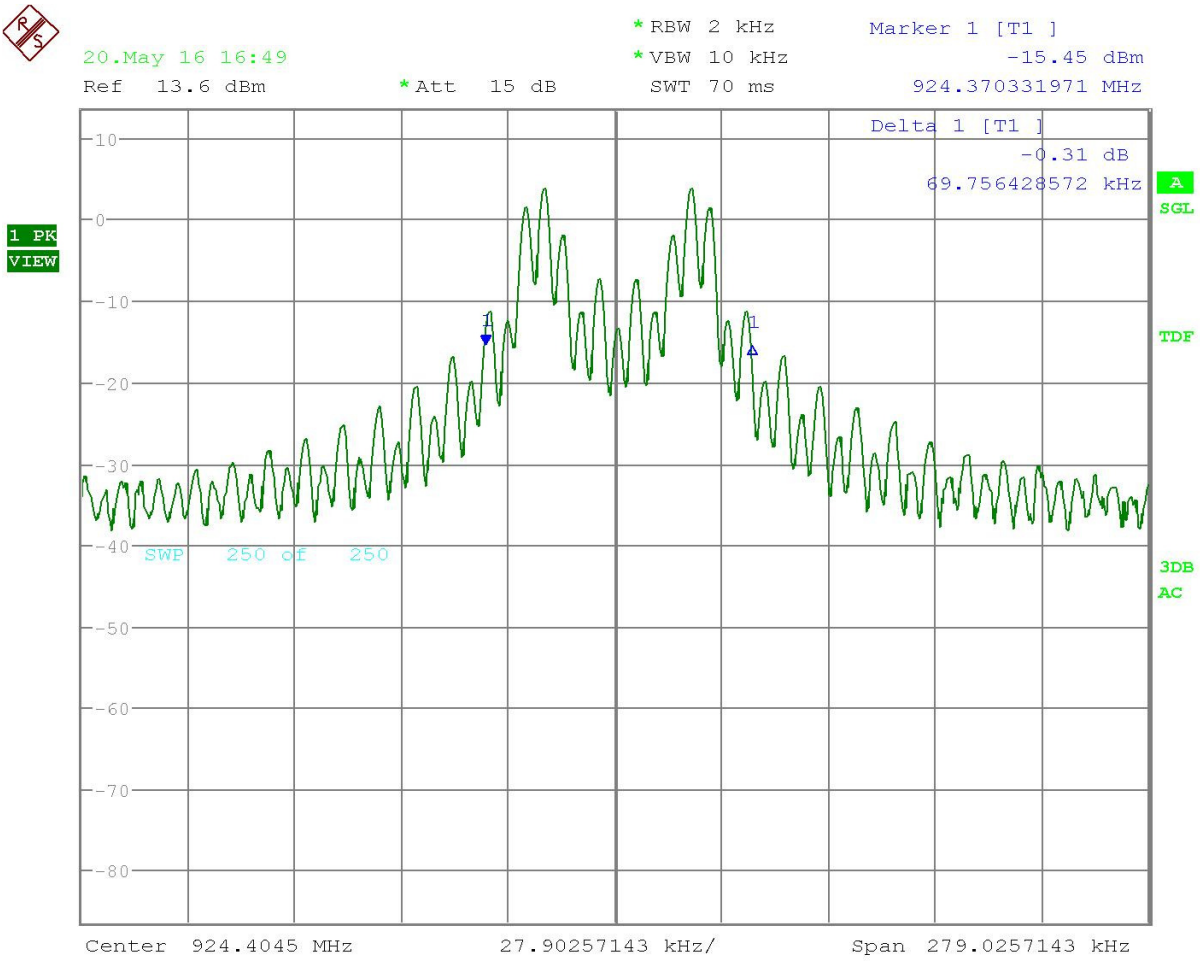


Date: 20.MAY.2016 16:48:00

RESULTS: Meets Requirements

OCCUPIED BANDWIDTH

Test Data: **20 dB OBW Mode 1 High end of Band Plot**



Date: 20.MAY.2016 16:49:41

RESULTS: Meets Requirements

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.

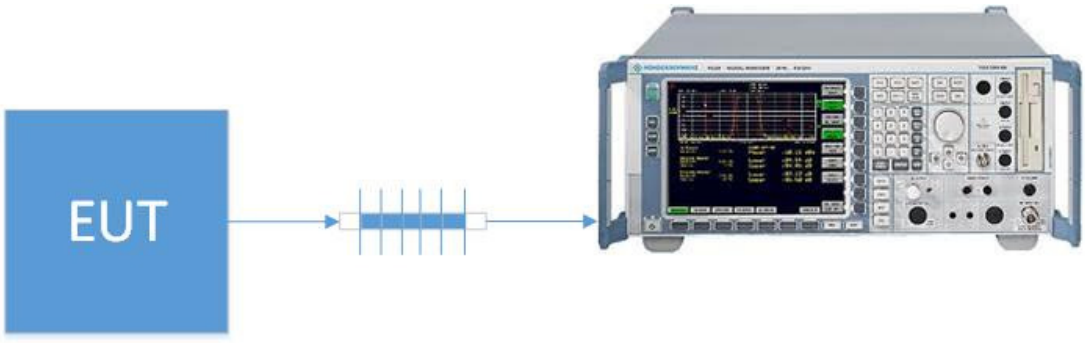
Dwell Time and Number of Hopping Channels
If the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 20-second period. If the 20 dB bandwidth of the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

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.

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:



FHSS REQUIREMENTS

Test Data: FHSS Channel Separation Measurement Table

Mode	Separation (KHz)	Limit (KHz)	Pass / Fail
1	368.58	≥70.27	Pass

Test Data: Number of Hopping Channels Measurement Table

Mode	Number of channels	Limit	Pass / Fail
1	53	≥50	Pass

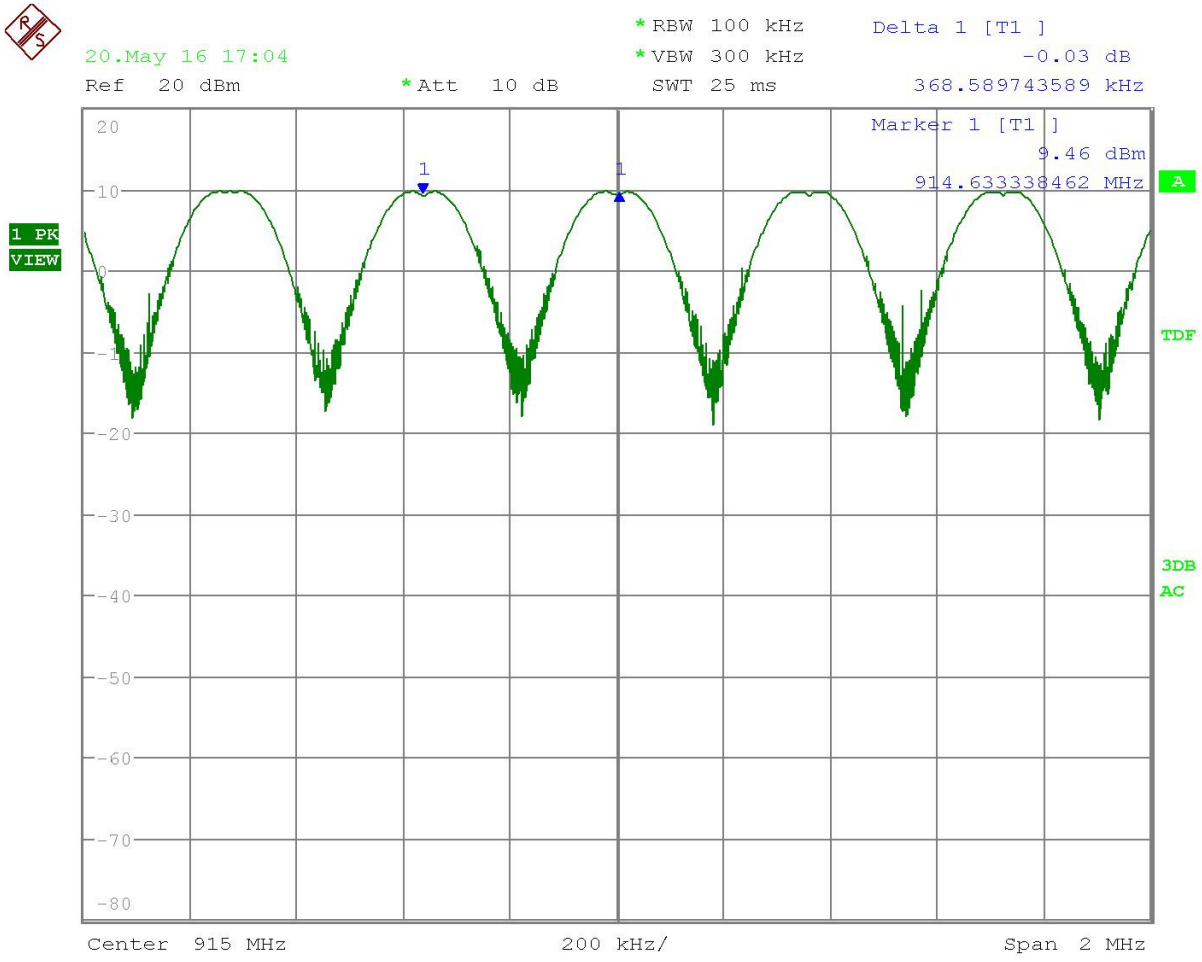
Test Data: Hopping Channel Occupancy Time Measurement Table

Mode	Burst Length (ms)	Number of Hops	Dwell Time (Sec)	Limit (sec)	Pass / Fail
NA	15	1	0.015	≤ 0.4	Pass

RESULTS: Meets Requirements

FHSS REQUIREMENTS

Test Data: **Mode 1 Channel Separation Plot**

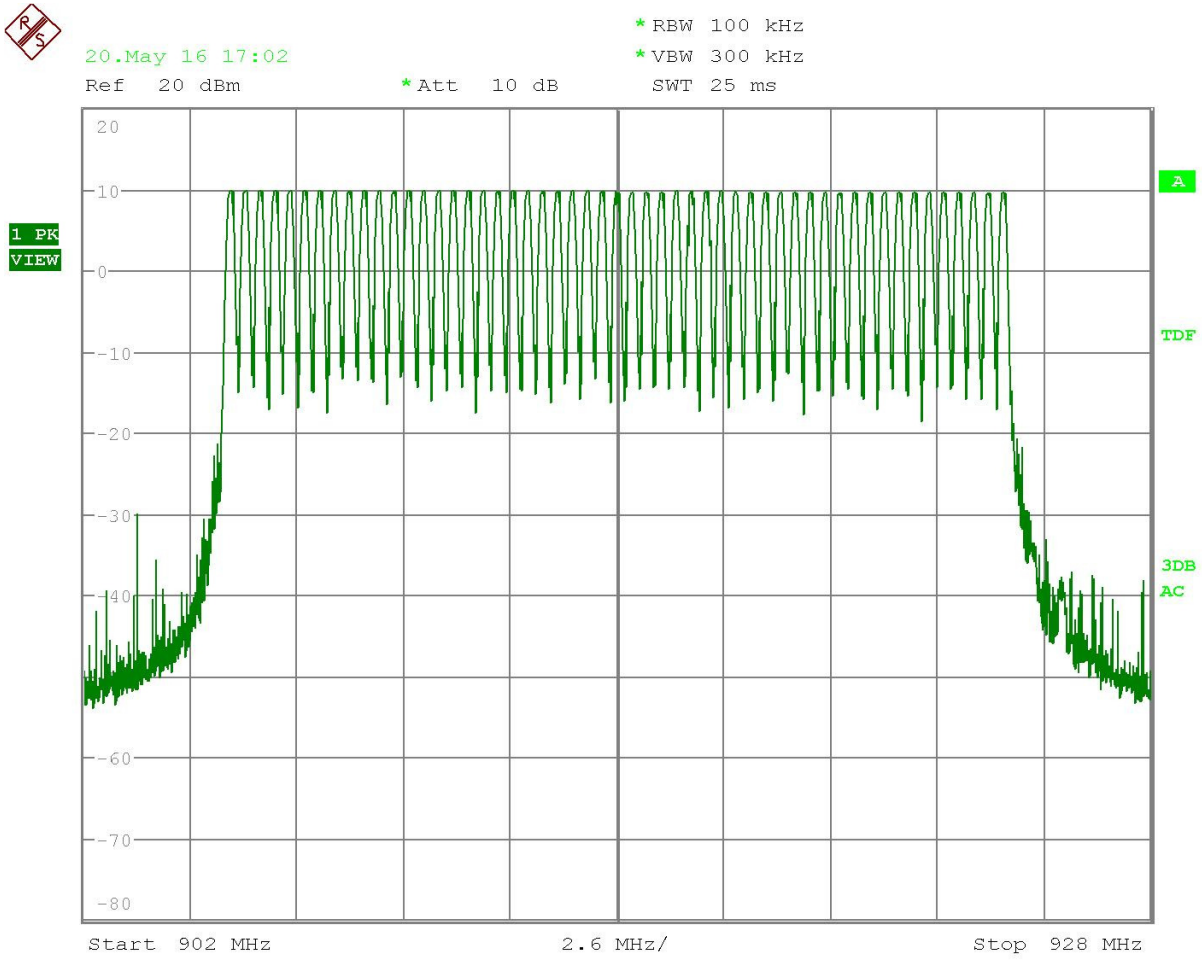


Date: 20.MAY.2016 17:04:50

RESULTS: Meets Requirements

FHSS REQUIREMENTS

Test Data: **Mode 1 Number of Hopping Channels Plot**



Date: 20.MAY.2016 17:02:14

RESULTS: Meets Requirements

FHSS REQUIREMENTS

Test Data: **Dwell Time & Duty Cycle declaration Statement from applicant**

DMP Model 1135 Wireless Sounder

Hopping Channel Occupancy

During normal operation, the 1135 transmits once every 15 seconds with a transmission burst length of 15 ms and with successive transmissions occurring on different channels. Thus, the maximum channel occupancy dwell time in any 20-second period is calculated below:

$DwellTi(ms) = BurstLength(ms) * NumberOfBursts = 15\ ms * 1 = \mathbf{15\ ms}$

Duty Cycle Correction Factor for Radiated Spurious Emissions

This product is tested with FCC test code for testing convenience. The FCC test code transmits with a duty cycle of 1. However, during normal operation, the 1135 transmits once every 15 seconds with a transmission burst length of 15 ms and with successive transmissions occurring on different channels. For a given 100 ms period of time, the transmission duty cycle is calculated below:

$DutyCycle = BurstLength(ms)100ms = 15ms100ms = \mathbf{0.15}$

Based on a 15% duty cycle, the following duty cycle correction factor should be applied to average field strength measurements:

$DutyCycleCorrectionFact(dB) = 20 * \log(DutyCycle) = 20 * \log(0.15) = \mathbf{-16.5\ dB}$

PEAK POWER OUTPUT

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

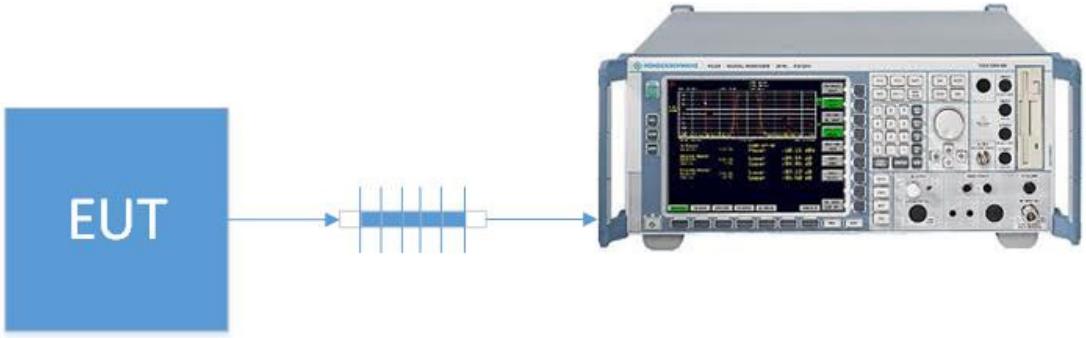
Requirements:

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:



PEAK POWER OUTPUT

Test Data: **Mode 1 Peak Power Output Measurement Table**

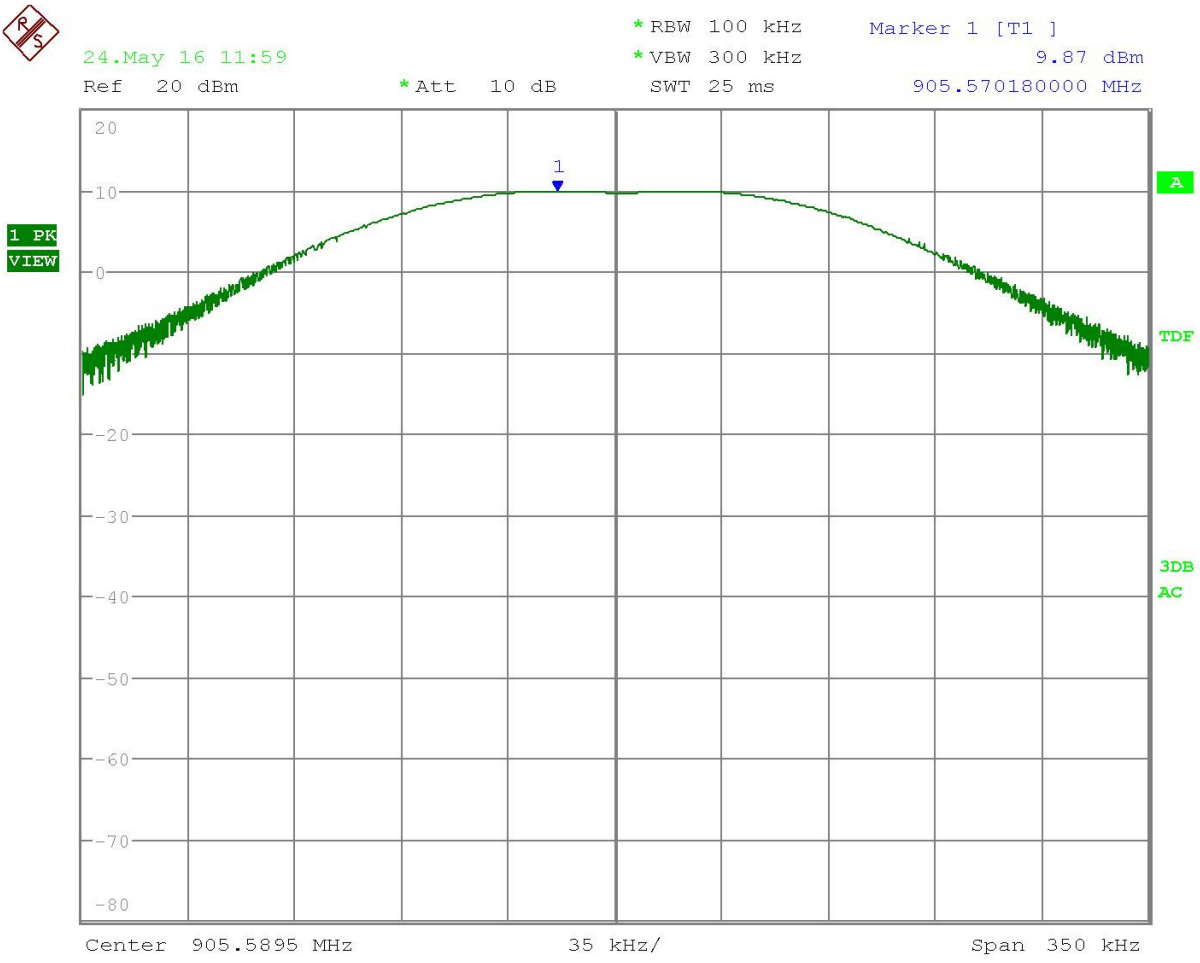
Peak Conducted Power Output Measurement				
Tuned Frequency (MHz)	Pconducted (dBm)	Pconducted (W)	Limit (W)	Margin (W)
905.6	9.87	0.00971	1.00	0.99029
915.0	9.67	0.00927	1.00	0.99073
924.4	9.63	0.00918	1.00	0.99082

Peak EIRP Power Output Calculation				
Tuned Frequency (MHz)	Pconducted (dBm)	EIRP (W)	Limit (W)	Margin (W)
905.6	9.87	0.01592	4.00	3.98408
915	9.67	0.01521	4.00	3.98479
924.4	9.63	0.01507	4.00	3.98493

RESULTS: Meets Requirements

PEAK POWER OUTPUT

Test Data: **Mode 1 Low End of Band Peak Conducted Power Plot**

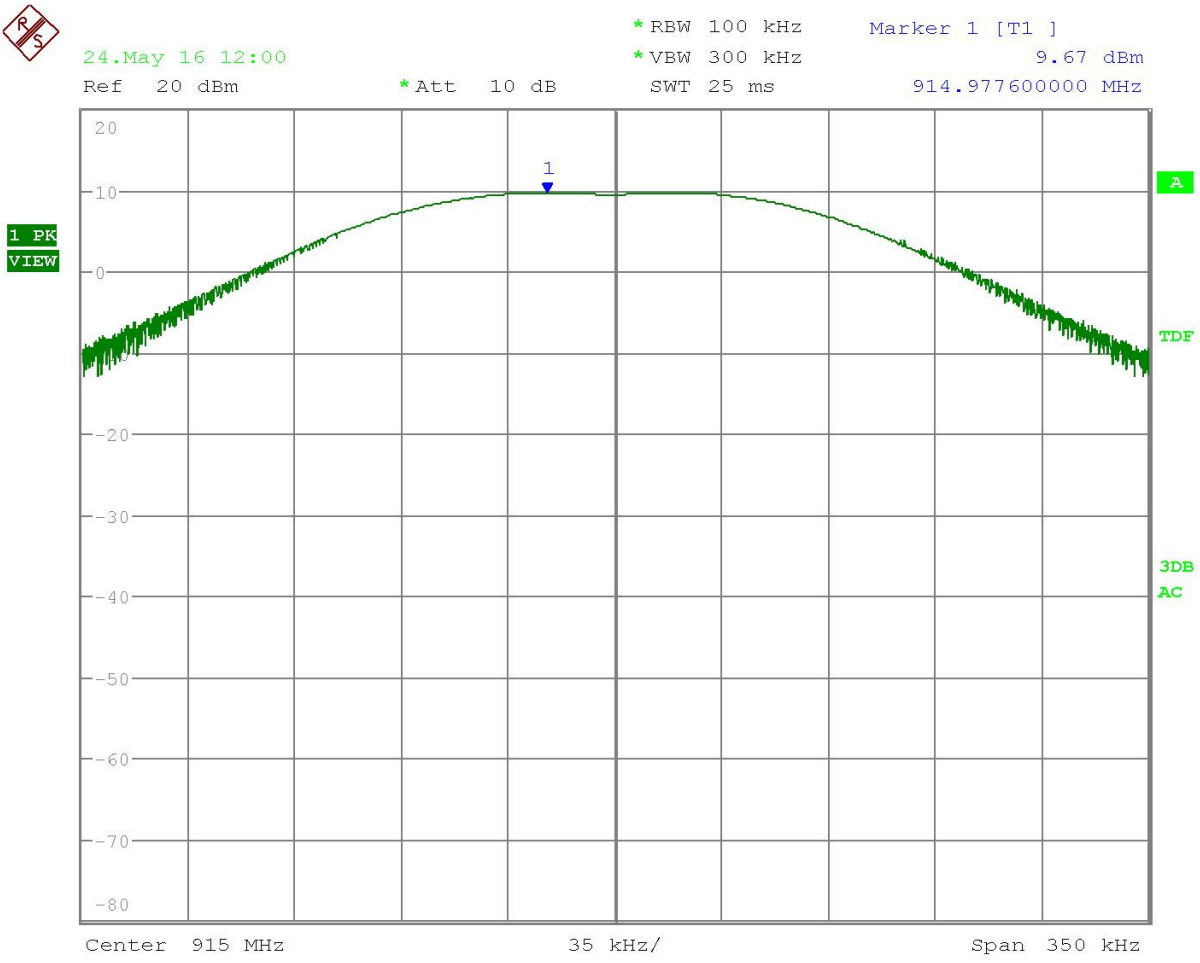


Date: 24.MAY.2016 11:59:39

RESULTS: Meets Requirements

PEAK POWER OUTPUT

Test Data: **Mode 1 Middle of Band Peak Conducted Power Plot**

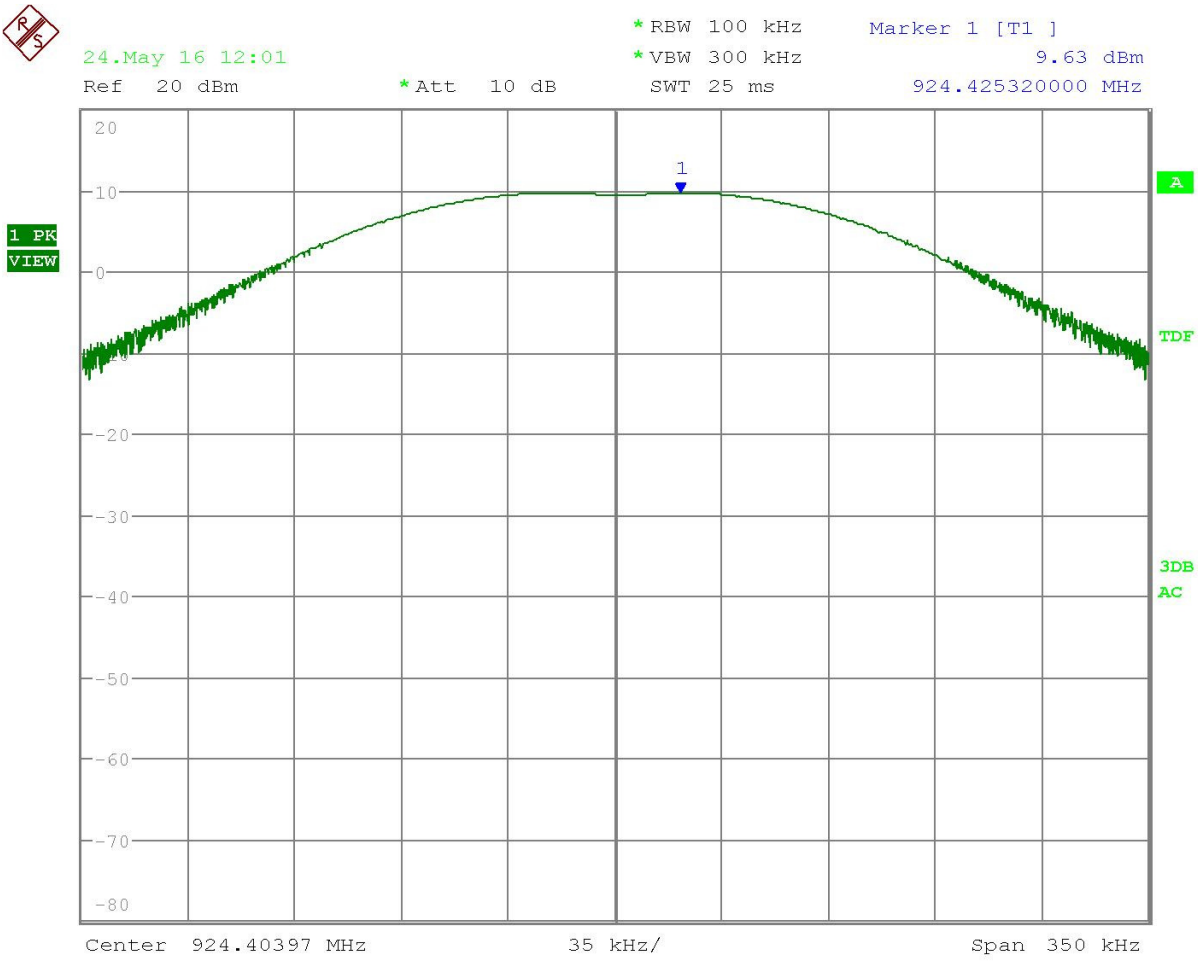


Date: 24.MAY.2016 12:00:11

RESULTS: Meets Requirements

PEAK POWER OUTPUT

Test Data: **Mode 1 High End of Band Peak Conducted Power Plot**



Date: 24.MAY.2016 12:01:22

RESULTS: Meets Requirements

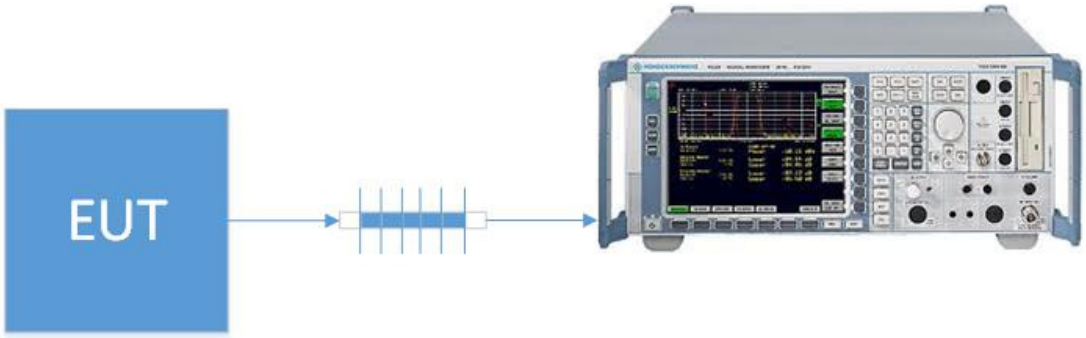
BANDEDGE

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:



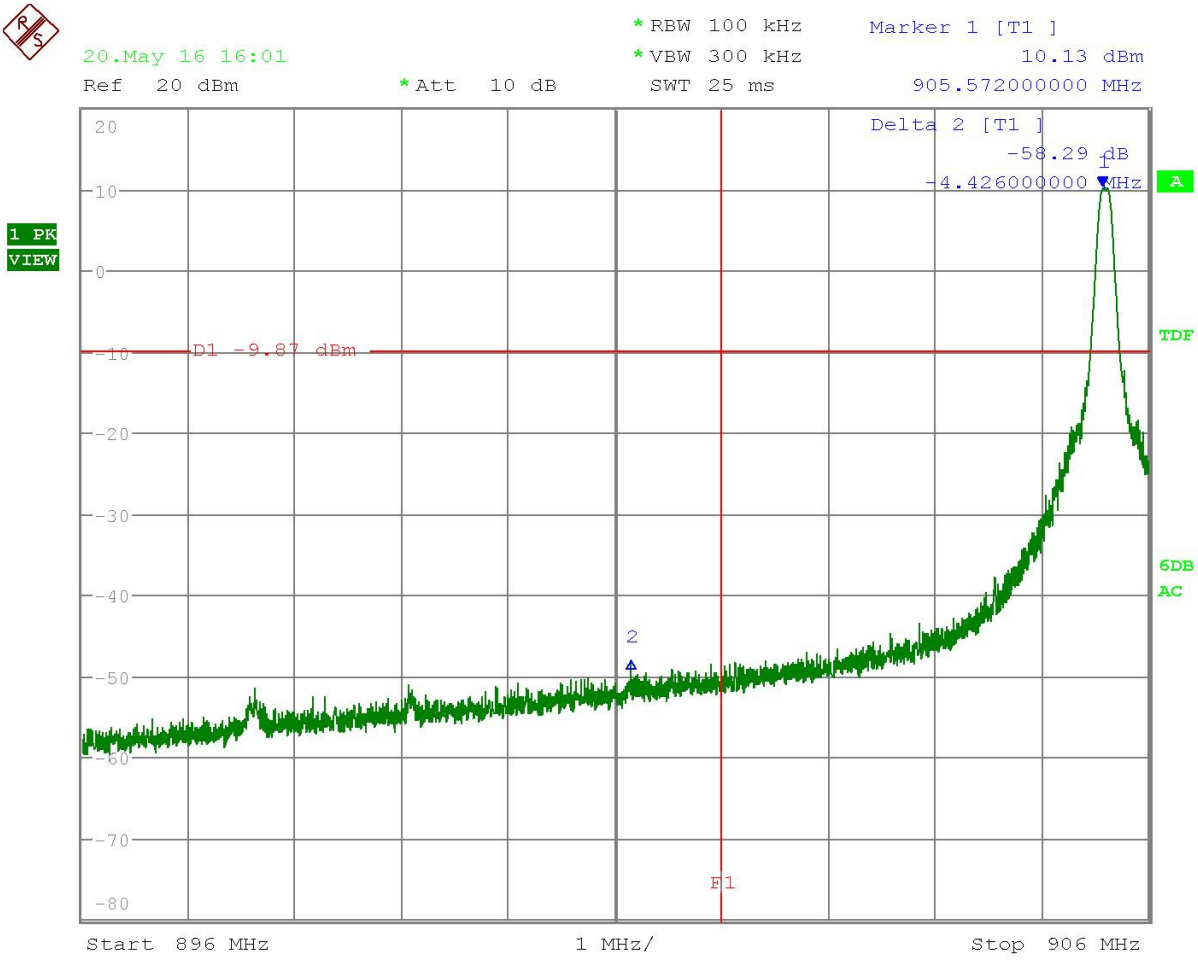
Test Data: **Mode 1 Bandedge Measurement Table**

Bandedge	Tuned Frequency (MHz)	Measured Level (dBc)	Limit (dBc)	Margin (dB)
Lower	905.6	58.29	20	38.29
	Hopping	51.59	20	31.59
Upper	924.4	59.22	20	39.22
	Hopping	47.61	20	27.61

Results Meet Requirements

BANDEDGE

Data: **Mode 1 Low End of Band Lower Band Edge Plot**

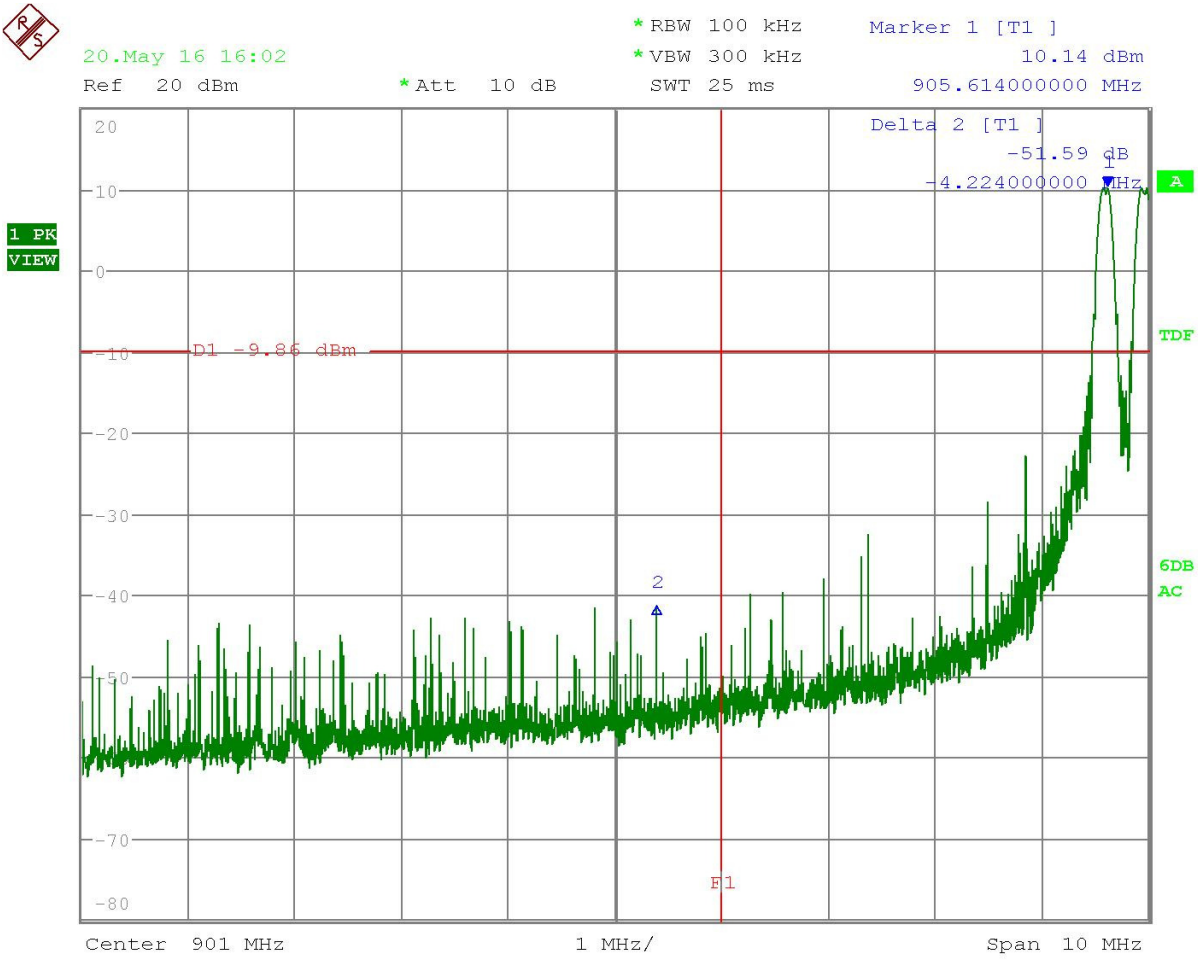


Date: 20.MAY.2016 16:01:05

RESULTS: Meets Requirements

BANDEDGE

Data: **Mode 1 Hopping Lower Band Edge Plot**

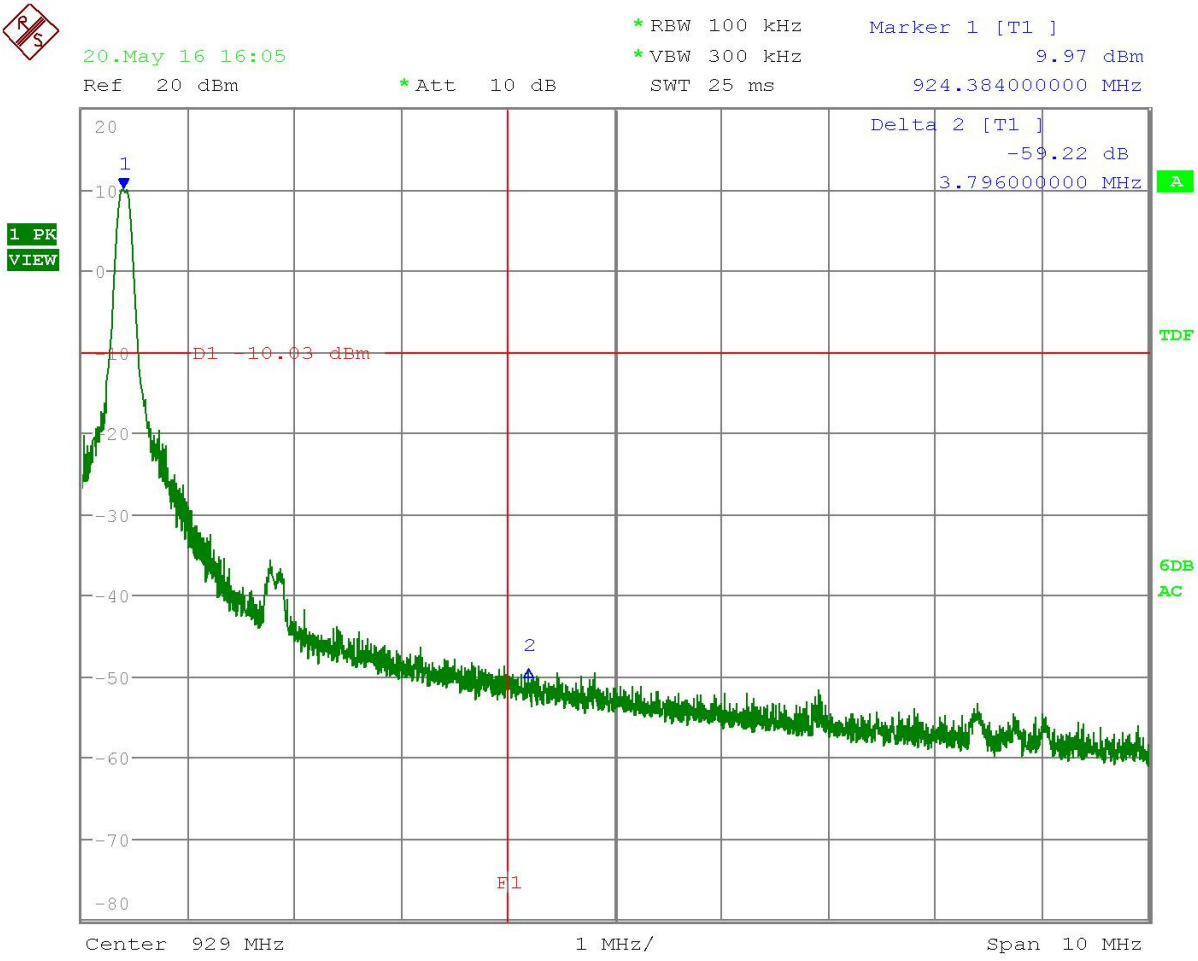


Date: 20.MAY.2016 16:02:48

RESULTS: Meets Requirements

BANDEDGE

Data: **Mode 1 High End of Band Upper Band Edge Plot**

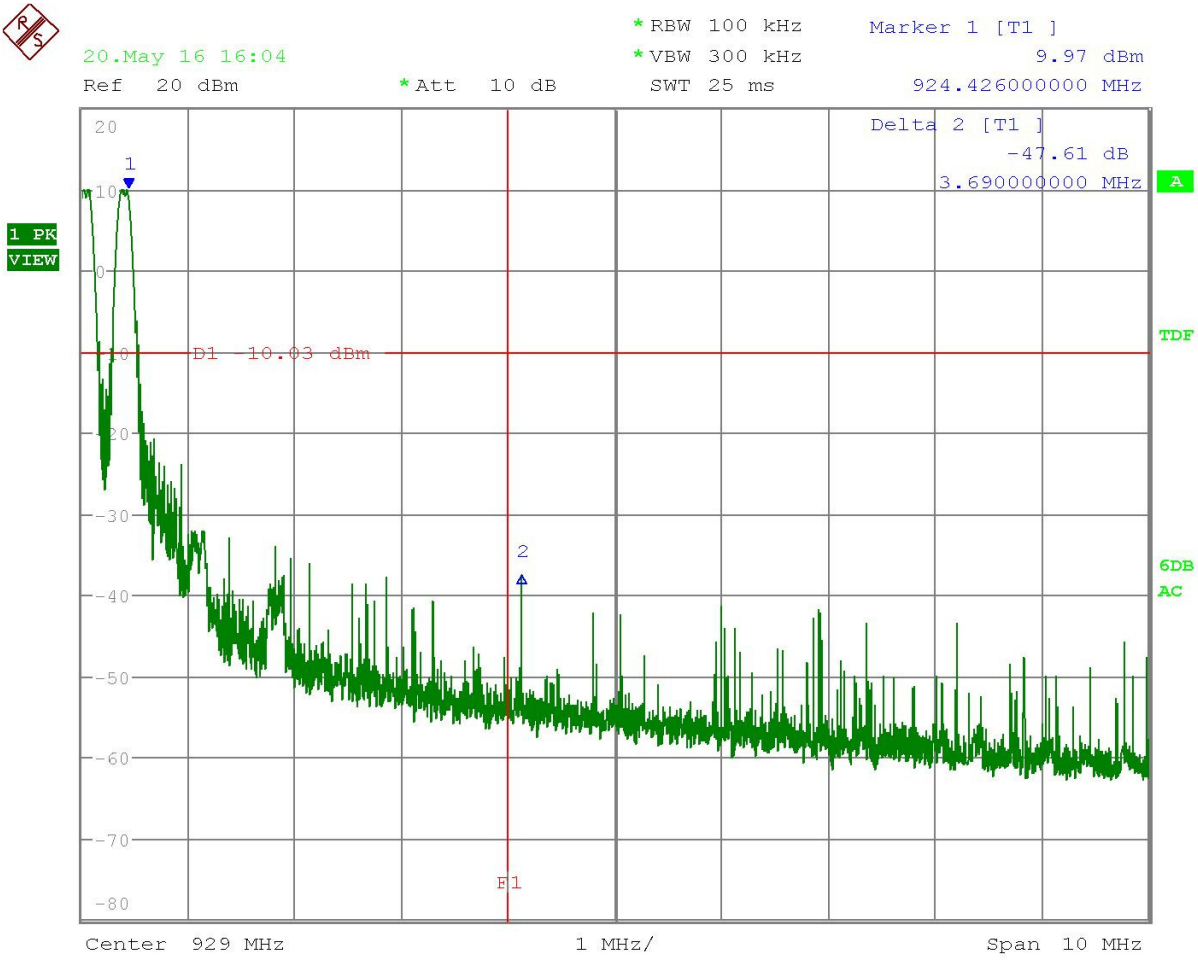


Date: 20.MAY.2016 16:05:50

RESULTS: Meets Requirements

BANDEDGE

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



Date: 20.MAY.2016 16:04:55

RESULTS: Meets Requirements

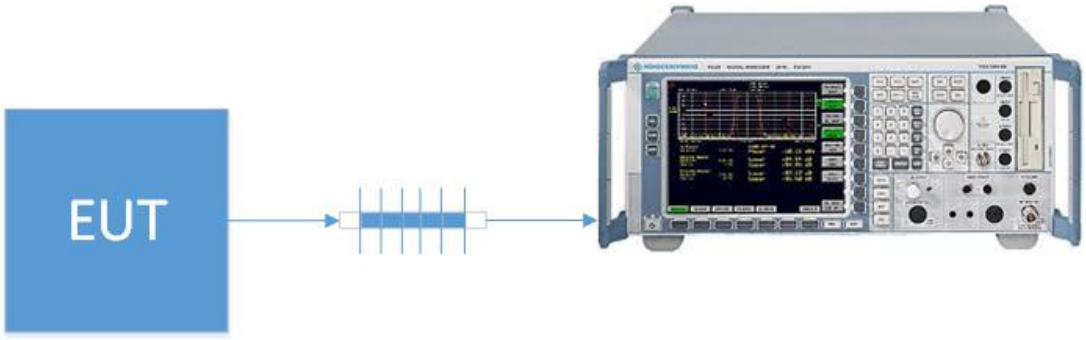
ANTENNA CONDUCTED SPURIOUS EMISSIONS

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

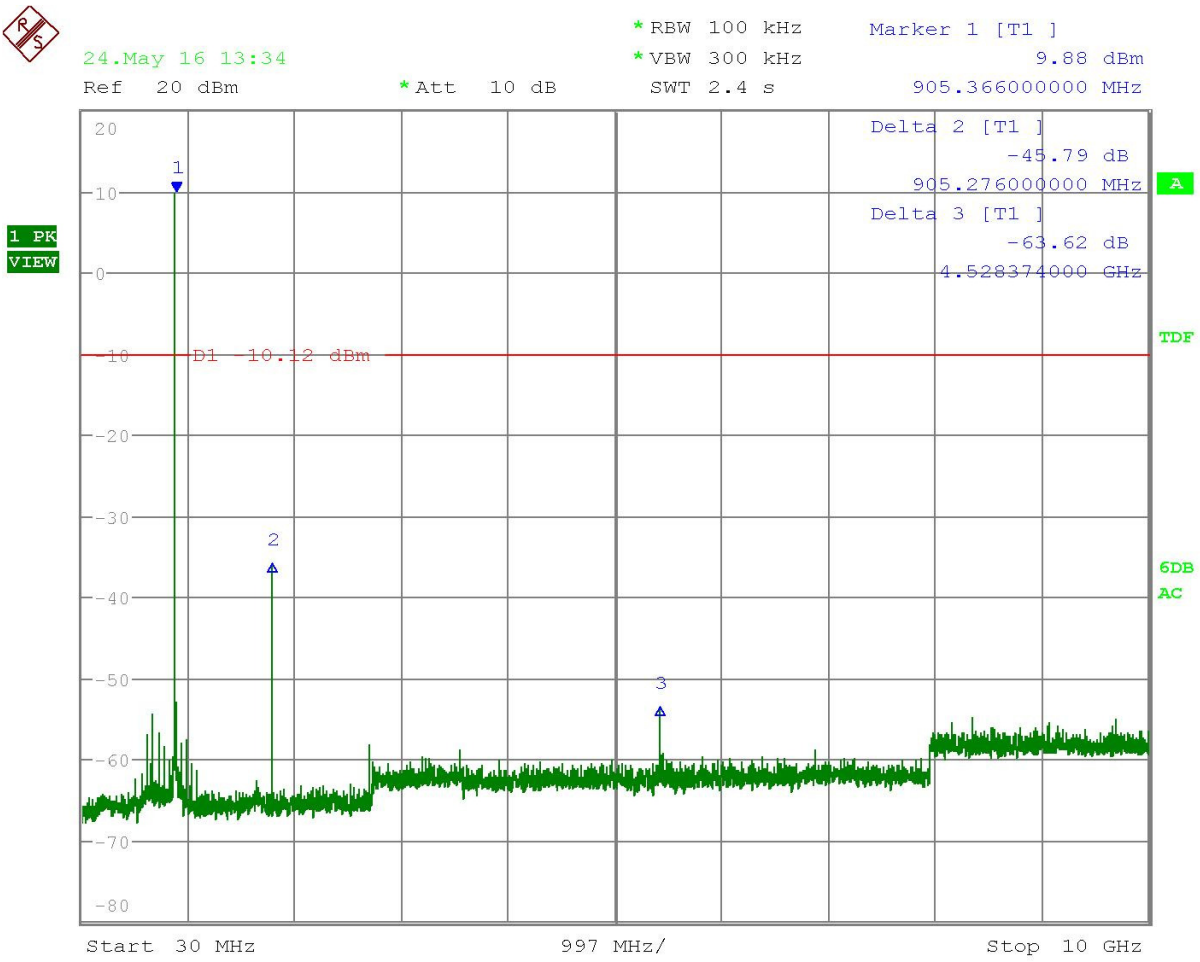
Test Method: ANSI C63.10 § 11.11.1 General Information
ANSI C63.10 § 11.11.2 Reference level measurement
ANSI C63.10 § 11.11.3 Emission level measurement

Setup:



ANTENNA CONDUCTED SPURIOUS EMISSIONS

Test Data: **Mode 1 Low End of Band 30 MHz – 10 GHz Plot**

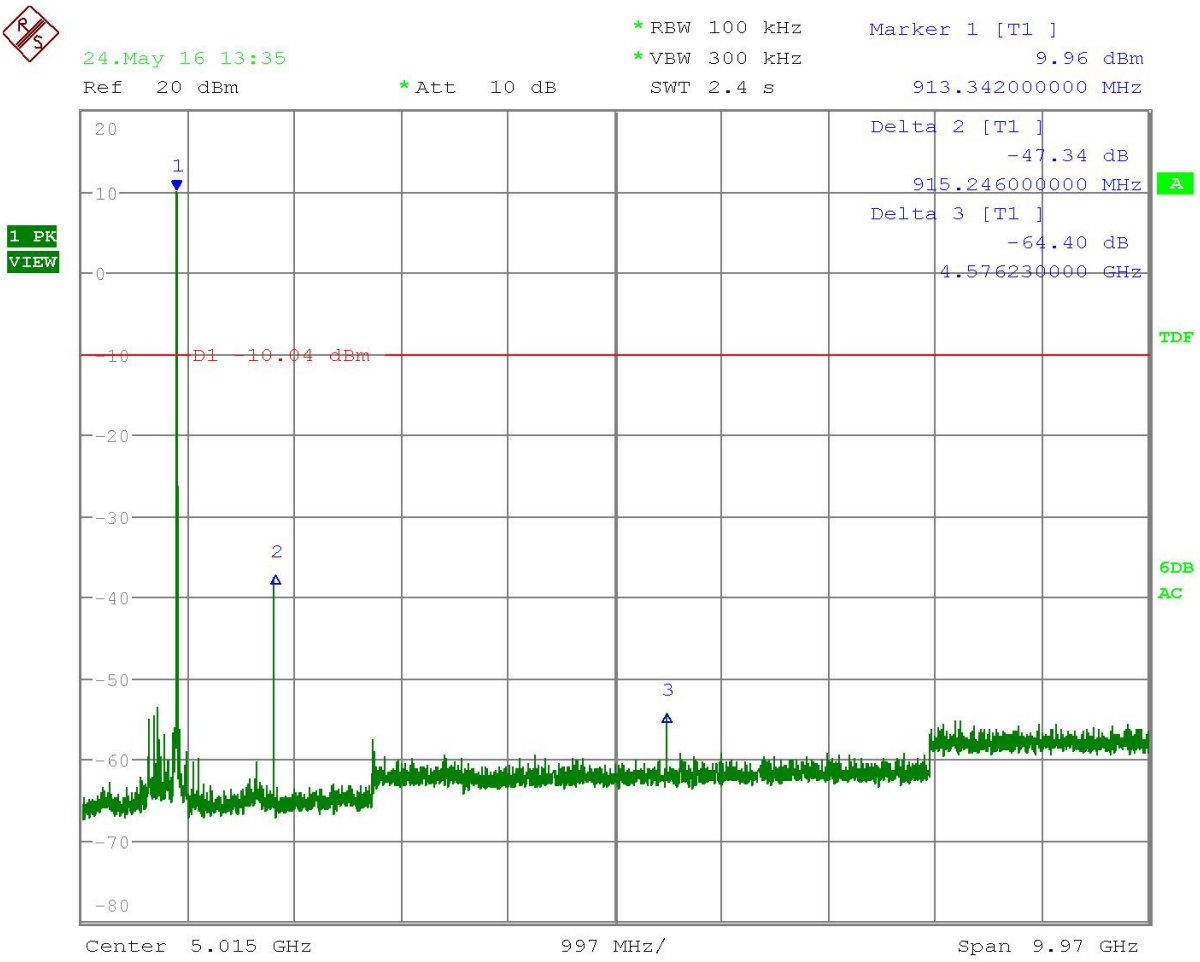


Date: 24.MAY.2016 13:34:31

RESULTS: Meets Requirements

ANTENNA CONDUCTED SPURIOUS EMISSIONS

Test Data: **Mode 1 Middle of Band 30 MHz – 10 GHz Plot**

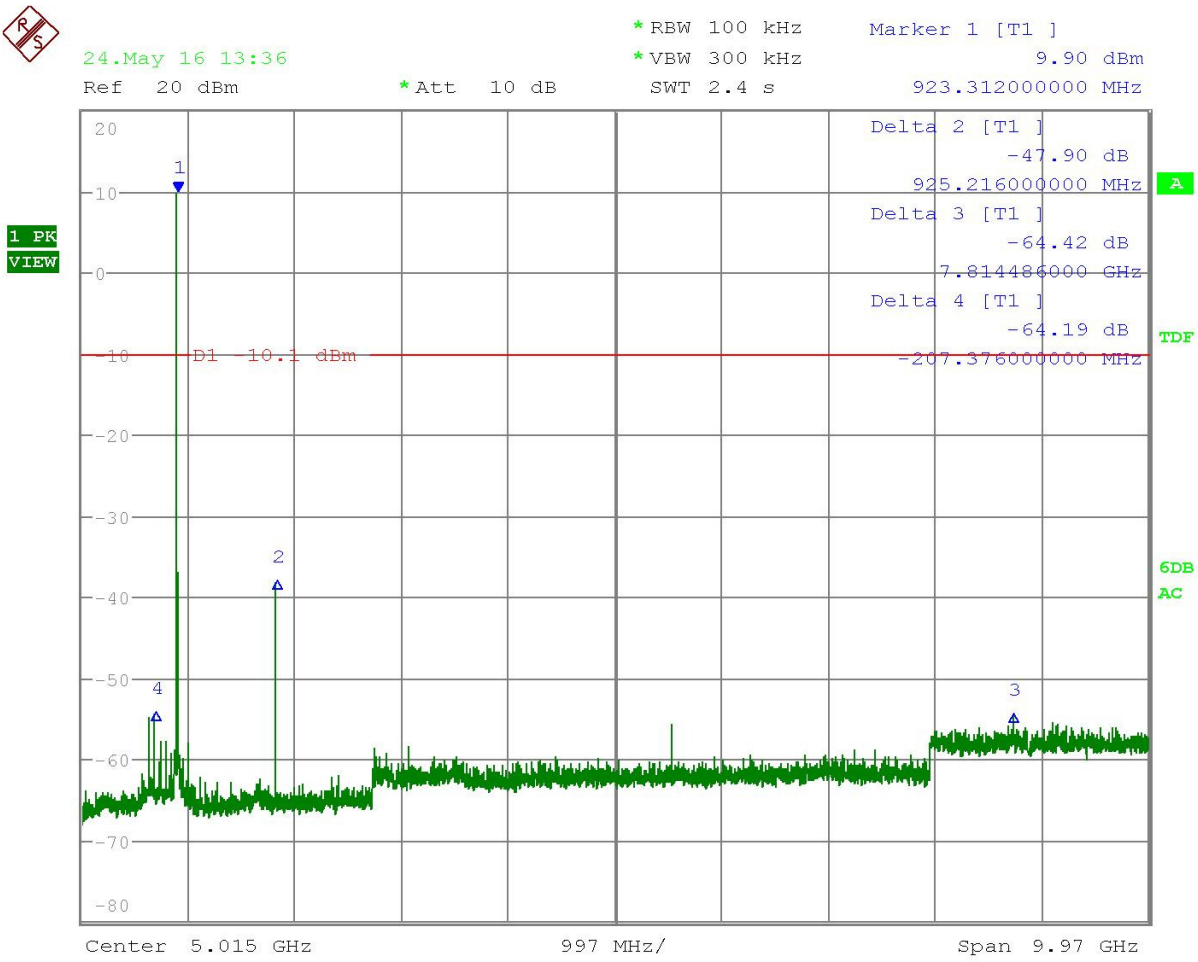


Date: 24.MAY.2016 13:35:56

RESULTS: Meets Requirements

ANTENNA CONDUCTED SPURIOUS EMISSIONS

Test Data: **Mode 1 High End of Band 30 MHz – 10 GHz Plot**



Date: 24.MAY.2016 13:36:58

RESULTS: Meets Requirements

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: FCC rule part § 15.31 Measurement standards
FCC rule part § 15.33 Frequency range of radiated measurements
FCC rule part § 15.35 Measurement detector functions and bandwidths
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

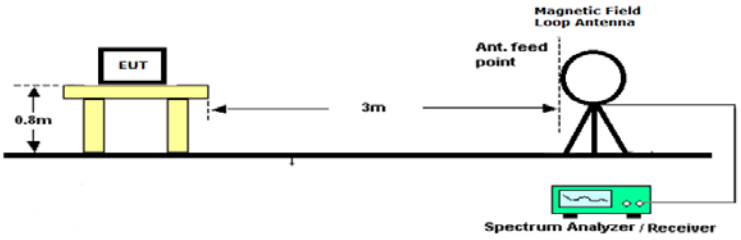
Average Value of Emission ≥ 1 GHz:

The peak levels of emissions above 1 GHz were corrected by reducing the measured peak level by the EUT's Duty Cycle to determine the averaged value of the emission.

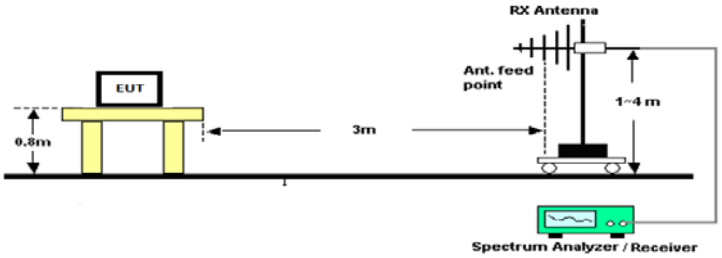
RADIATED SPURIOUS EMISSIONS

Setup:

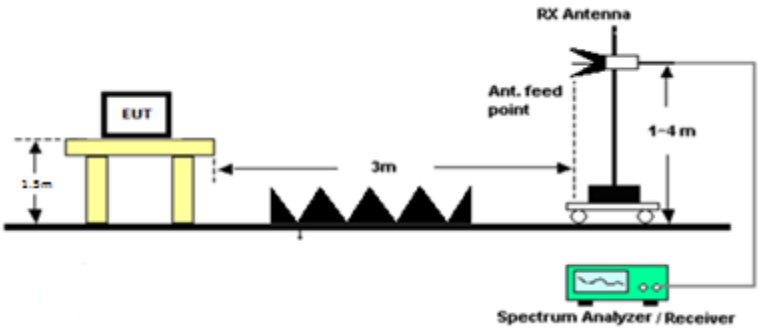
Emissions below 30 MHz



Emissions 30 – 1000 MHz



Emissions above 1 GHz



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.

The spectrum was measured from 9 KHz to 10 GHz, at a distance of 1.25 Meters and extrapolated back to 3 Meters using a 20 dB per decade factor.

The peak levels of emissions above 1 GHz were corrected by reducing the measured peak level by the EUT's Duty Cycle to determine the averaged value of the emission.

Only emissions within 20dB of the limit are reported.

Test Data: **Mode 1 Restricted Band Emissions Measurement Table**

Tuned Freq (MHz)	Emission Frequency (MHz)	Detector (PK/AV)	Meter Reading (dBuV)	Antenna Polarity (H/V)	Coax Loss (dB)	Correction Factor (dB)	Field Strength (dBuV/M)	Margin (dB)
905.6	4528	PK	26.6	H	7.8	25.3	59.8	14.2
905.6	4528	AV	10.1	H	7.8	25.3	43.2	10.8
905.6	5433.6	PK	34.2	H	8.6	26.9	69.7	4.3
905.6	5433.6	AV	17.7	H	8.6	26.9	53.2	0.8
905.6	7244.8	PK	21.6	H	9.9	27.4	58.9	15.1
905.6	7244.8	AV	5.1	H	9.9	27.4	42.4	11.6
905.6	8150.4	PK	20.3	H	10.5	28.4	59.2	14.8
905.6	8150.4	AV	3.8	H	10.5	28.4	42.7	11.3
915	3660	PK	21.4	V	7	24.5	52.9	21.1
915	3660	AV	4.9	V	7	24.5	36.4	17.6
915	4575	PK	27.2	H	7.9	25.4	60.5	13.5
915	4575	AV	10.7	H	7.9	25.4	44	10
915	7320	PK	26.3	H	10	27.5	63.8	10.2
915	7320	AV	9.8	H	10	27.5	47.3	6.7
915	8235	PK	20.8	V	10.6	28.5	59.9	14.1
915	8235	AV	4.3	V	10.6	28.5	43.4	10.6
924.4	3697.6	PK	22.5	H	7.1	24.6	54.2	19.8
924.4	3697.6	AV	6	H	7.1	24.6	37.7	16.3
924.4	4622	PK	28.2	H	7.9	25.5	61.6	12.4
924.4	4622	AV	11.7	H	7.9	25.5	45.1	8.9
924.4	7395.2	PK	22.4	H	10.1	27.6	60.1	13.9
924.4	7395.2	AV	5.9	H	10.1	27.6	43.6	10.4

Results Meet Requirements

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Antenna: Biconnical 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	01/05/16	12/31/17
Software: Field Strength Program	Timco	N/A	Version 4.0	NA	NA
Antenna: Active Loop	ETS-Lindgren	6502	00062529	11/18/15	11/18/17
Coaxial Cable - KMKM-0180-03 Aqua	Micro-Coax	UFB142A-0-0720-200200	225363-002	08/05/15	08/05/17
Attenuator- K 6dB 2W DC-40	Narda	4768-6	1044-3	06/25/15	06/25/17
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	04/01/16	04/01/18
Antenna: Double-Ridged Horn 18-40 GHz	EMCO	3116	9011-2145	11/18/15	11/18/17
Coaxial Cable - Chamber 3 cable set	Micro-Coax	CHBR3PC	Chamber 3 cable set	12/05/15	12/05/17
High Pass Filter	Microlab	HA-20N	---	06/17/15	06/17/17
Antenna: Standard Gain Horn 2.14-4.34 GHz	Polarad	CA-S	203	NA	NA
Antenna: Standard Gain Horn 3.95-5.85 GHz	Scientific-Atlanta Inc.	12-3.9	8105CF	NA	NA
Antenna: Standard Gain Horn 8.2-12.5 GHz	Systron Donner	DBG-520-20	Not Serialized	NA	NA
Antenna: Standard Gain Horn 5.85-8.2 GHz	ATM	137-442-2	D261908-01	NA	NA

*** EMI RECEIVER SOFTWARE VERSION**
The receiver firmware used was version 4.43 Service Pack 3