

RF Test Report

Project Number: 4838347

Proposal: SUW-202108001523

Report Number: 4838347EMC01

Revision Level: 1

Client: Landis + Gyr

Equipment Under Test: 900MHz Radio Module

Model Number: M225

FCC ID: R7PEC6R1X1

IC ID: 5294A-EC6R1X1

Applicable Standards: ANSI C63.10: 2013 (FCC Part 15 Subpart C, § 15.247)

RSS-247, Issue 2

RSS-GEN Issue 5

Report issued on: 07 March 2022

Test Result: Compliant



FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER: 3212.01

This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the Federal Government.

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Reviewed by:


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Remarks: This report details the results of the testing carried out on one sample; the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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1 Summary of Test Results

Test Description	Test Specification		Test Result
Occupied Bandwidth 20dB Bandwidth	15.247(a)(1)	RSS-247 5.1(a) RSS-GEN 6.7	Compliant
Peak Power Output	15.247(a)(1)	RSS-247 5.4(b)	Compliant
Carrier Frequency Separation	15.247(a)(1)	RSS-247 5.1(b)	Compliant
Number of Hopping Channels	15.247(a)(1)(i)	RSS-247 5.1(d)	Compliant
Dwell Time	15.247(a)(1)(i)	RSS-247 5.1(d)	Compliant
Pseudo-Random Hop Sequence	15.247(a)(1)	RSS-247 5.1(a)	Compliant
Conducted Spurious Emissions	15.247(d)	RSS-247 5.5	Compliant
Radiated Spurious Emissions	15.35(b), 15.209	RSS-GEN 8.10	Compliant
Antenna Requirement	15.203	RSS-GEN 6.8	Compliant ¹
AC Powerline Conducted Emissions	15.107, 15.207	RSS-GEN 8.8	NA ²

- 1) The antenna is bent metal and permanently attached to the PCB.
- 2) The module is battery-powered with no facility for connection to the AC mains.

1.1 Modifications Required for Compliance

None

2 General Information

2.1 Client Information

Name: Landis+Gyr Technology, Inc.
Address: 30000 Mill Creek Avenue, Suite 100
City, State, Zip, Country: Alpharetta, GA 30022, USA

2.2 Test Laboratory

Name: SGS North America, Inc.
Address: 620 Old Peachtree Road NW, Suite 100
City, State, Zip, Country: Suwanee, GA 30024, USA

Accrediting Body: A2LA
Type of lab: Testing Laboratory
Certificate Number: 3212.01
Designation Number: US1126
CAB Identifier: US0186

2.3 General Information of EUT

Product Description: 900 Mhz Radio Module
Model Number: M225
Serial Numbers: Mesh NB/WB: M225Y292100123P25006
Mesh IP / WiSUN: M225Y292100122P25001

Antenna: Bent Metal Inverted F – 0dBi

Rated Voltage: 5Vdc
Test Voltage: 5Vdc

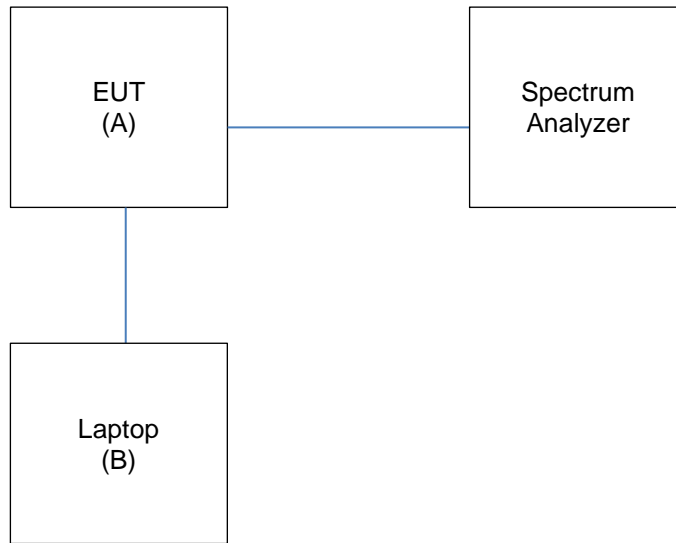
Sample Received Date: 05 October 2021
Dates of testing: 28 October – 01 November 2021

2.4 Operating Modes and Conditions

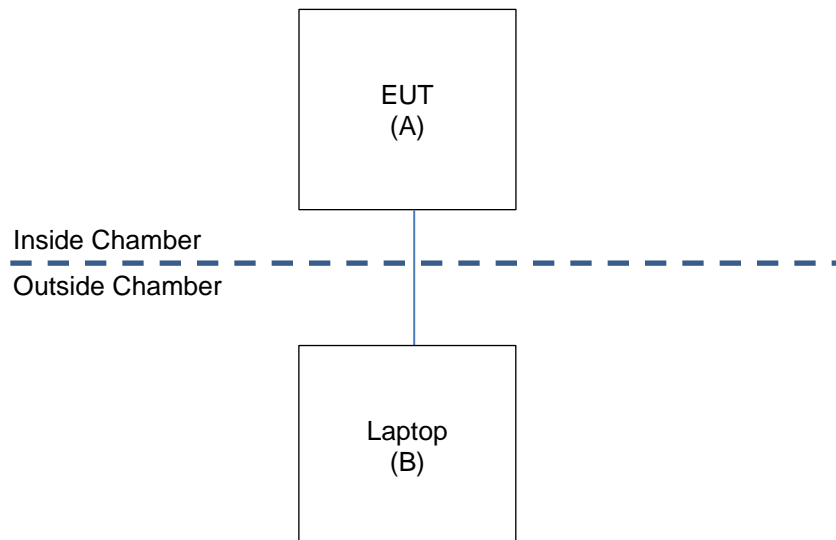
Mode of Operation	Frequency Range (MHz)	Number of Hopping Channels	Frequency Separation (kHz)	Data Rates Supported (kbps)
Mode 1 (RF Mesh – Wideband)	902.3 - 927.8	86	300	9.6, 19.2, 38.4
Mode 2 (RF Mesh – Narrowband)	904 – 927.8	239	100	9.6, 19.2, 38.4
Mode 3 (RF Mesh IP)	902.4 - 927.6	64	400	10, 20, 50
Mode 4 (WiSUN)	902.2 - 927.8	129	200	50
Mode 5 (WiSUN – Wideband)	902.4 – 927.6	64	400	150

The test samples were provided with special firmware (S5SL07-14.01.P07) which allowed control of channel, power, data-rate, and hopping operation. The high-power setting for all data-rates was configured with a register setting of 00CF which corresponded to a target power of 28.5dBm.

2.5 EUT Connection Block Diagram – Conducted Measurements



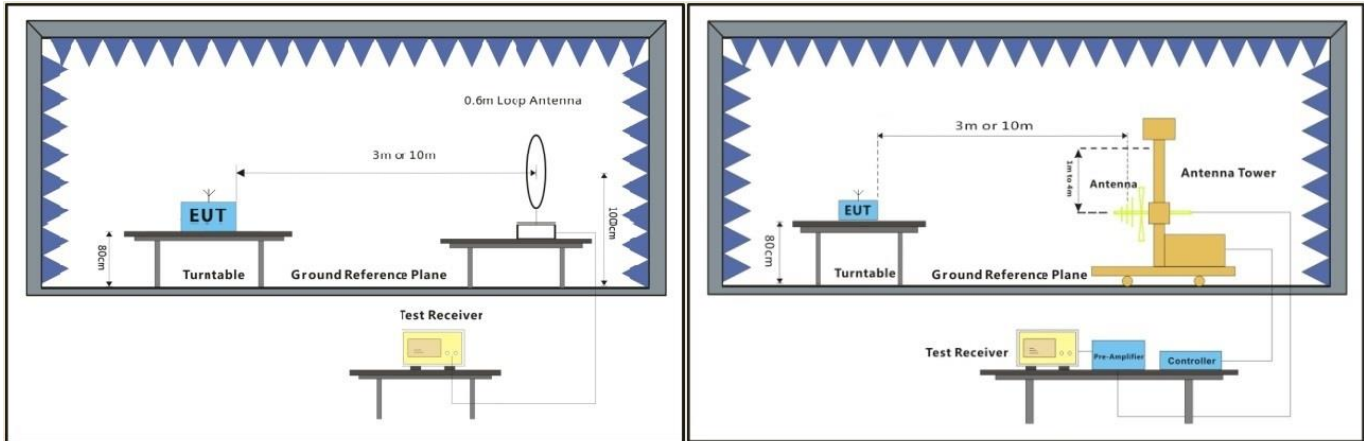
2.6 EUT Connection Block Diagram – Radiated Measurements



2.7 System Configurations

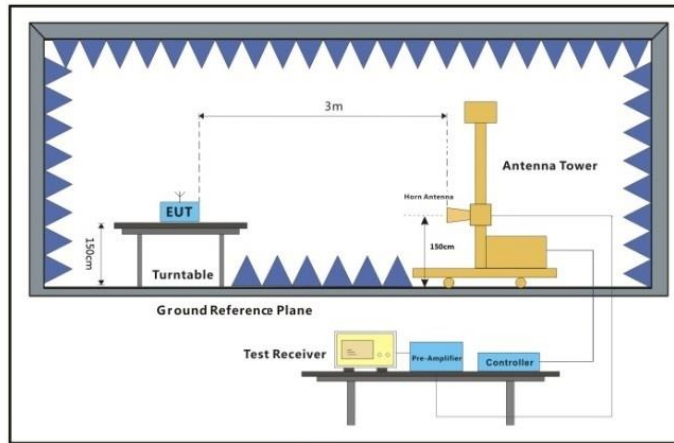
Device reference	Manufacturer	Description	Model Number	Serial Number
A	Landis + Gyr	900MHz Radio Module	M225	Mesh NB/WB: M225Y292100123P25006 Mesh IP / WiSUN: M225Y292100122P25001
B	Lenovo	Laptop	T440p	PB-00-UTCU

2.8 Configuration Diagrams (Radiated)



Below 30MHz

30MHz-1GHz



Above 1GHz

3 Occupied Bandwidth

3.1 Test Result

Test Description	Test Specification		Test Result
Occupied Bandwidth 20dB Bandwidth	15.247(a)(1)	RSS-247 5.1(a) RSS-GEN 6.7	Compliant

3.2 Test Method

The procedures from ANSI C63.10: 2013 Clause 6.9.2 were used to measure the 99% Occupied Bandwidth and 20dB Bandwidth.

3.3 Test Site

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.6 °C

Relative Humidity: 38.0 %

Atmospheric Pressure: 97.9 kPa

3.4 Test Equipment

Test End Date: 10/19/2021

Tester: AB/JP

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
ATTENUATOR, 10DB	BW-S10W2	MINI-CIRCUITS	15031	7-Oct-2021	7-Oct-2022
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM	20109	16-Mar-2021	16-Mar-2022
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	27-Dec-2019	27-Dec-2021

3.5 Test Data

RF Mesh – Mode 1: Wideband/Mode 2: Narrowband
86/239 Channels; 300kHz/100kHz Spacing

Data Rate (kbps)	Channel	Frequency (MHz)	20dB BW (kHz)	99% OBW (kHz)	Verdict
9.6	0	902.3	21.98	23.05	PASS
	127	915	22.48	23.84	PASS
	255	927.8	21.85	23.59	PASS
19.2	0	902.3	43.54	42.55	PASS
	127	915	42.70	43.42	PASS
	255	927.8	42.53	43.05	PASS
38.4	0	902.3	80.17	83.04	PASS
	127	915	80.98	85.84	PASS
	255	927.8	80.62	85.62	PASS

RF Mesh – IP – Mode 3
64 Channels; 400kHz

Data Rate (kbps)	Channel	Frequency (MHz)	20dB BW (kHz)	99% OBW (kHz)	Verdict
10	1	902.4	23.94	28.41	PASS
	63	914.8	23.88	24.11	PASS
	127	927.6	23.78	23.02	PASS
20	1	902.4	43.65	44.99	PASS
	63	914.8	44.19	44.27	PASS
	127	927.6	42.95	43.52	PASS
50	1	902.4	104.84	106.75	PASS
	63	914.8	110.26	110.28	PASS
	127	927.6	108.81	110.57	PASS

WiSUN – Mode 4
129 Channels; 200kHz Spacing

Data Rate (kbps)	Channel	Frequency (MHz)	20dB BW (kHz)	99% OBW (kHz)	Verdict
50	0	902.2	108.71	109.33	PASS
	64	915	108.74	107.61	PASS
	128	927.8	105.71	103.56	PASS

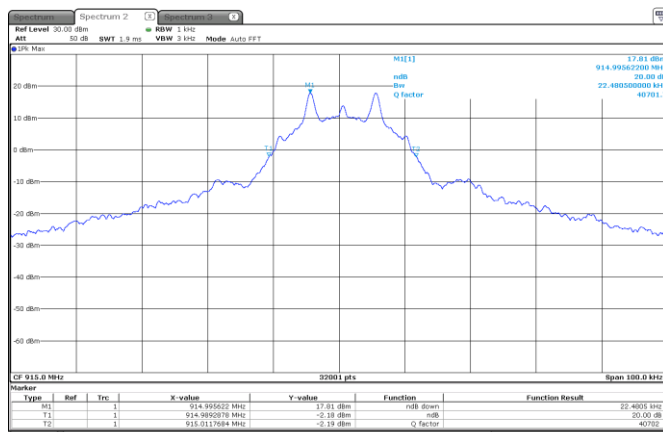
WiSUN – Mode 5
129 Channels; 200kHz Spacing

Data Rate (kbps)	Channel	Frequency (MHz)	20dB BW (kHz)	99% OBW (kHz)	Verdict
150	1	902.4	159.34	144.68	PASS
	63	914.8	163.65	146.63	PASS
	127	927.6	163.31	145.18	PASS

Sample Plots

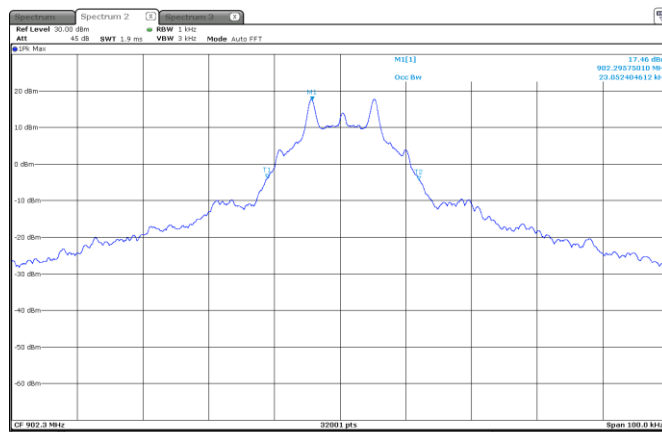
9.6kbps Mid Channel (915MHz)

20dB Bandwidth



Date: 14-OCT-2022 14:06:18

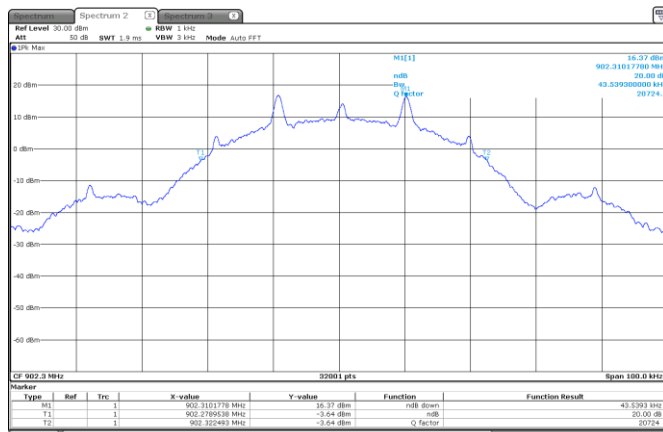
99% Occupied Bandwidth



Date: 14-OCT-2022 13:51:02

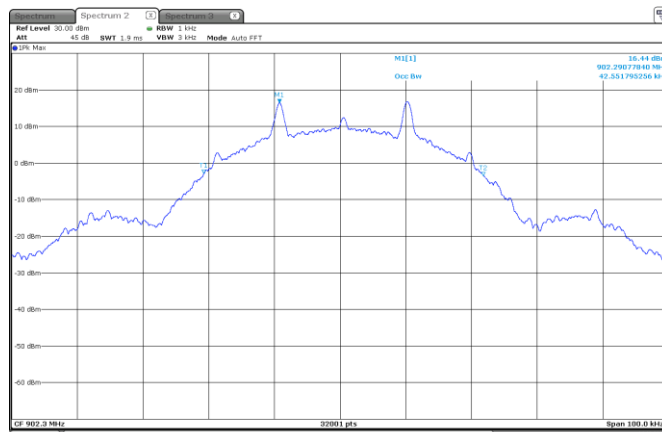
19.2kbps Low Channel (902.3MHz)

20dB Bandwidth



Date: 14-OCT-2022 14:47:48

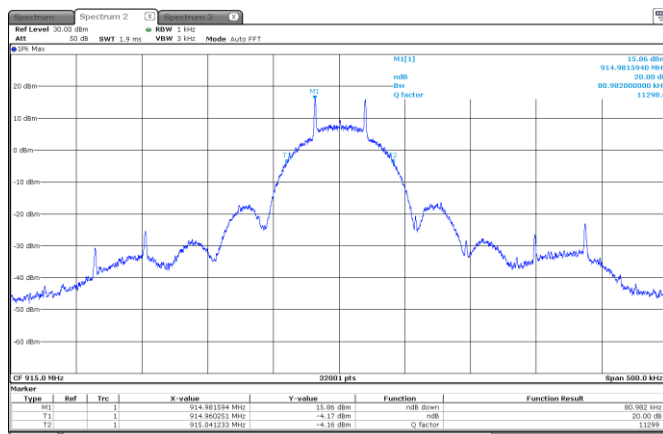
99% Occupied Bandwidth



Date: 14-OCT-2022 14:47:04

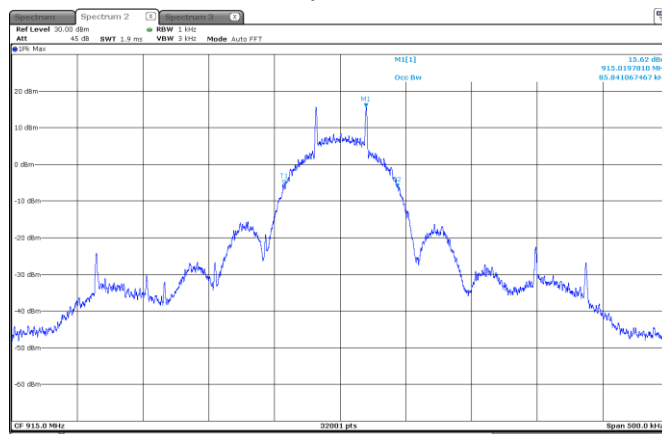
38.4kbps Mid Channel (915MHz)

20dB Bandwidth



Date: 14-OCT-2022 15:05:11

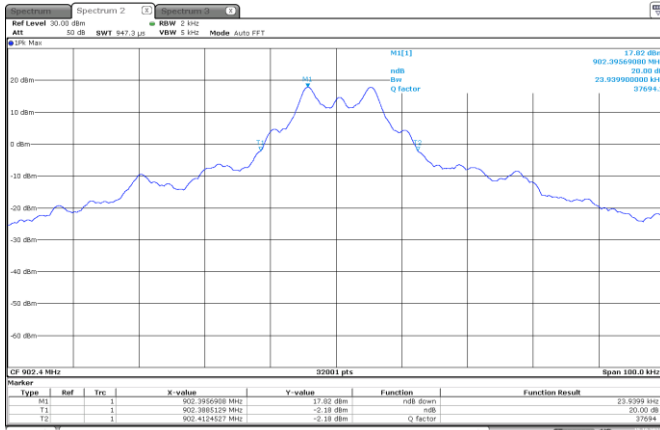
99% Occupied Bandwidth



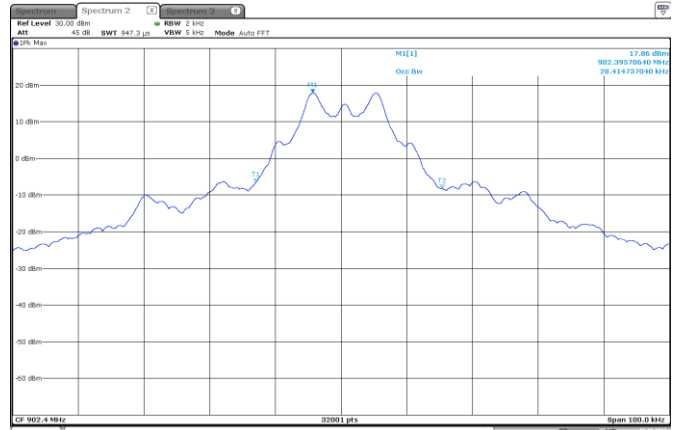
Date: 14-OCT-2022 15:48:39

10kbps Low Channel (902.4MHz)

20dB Bandwidth

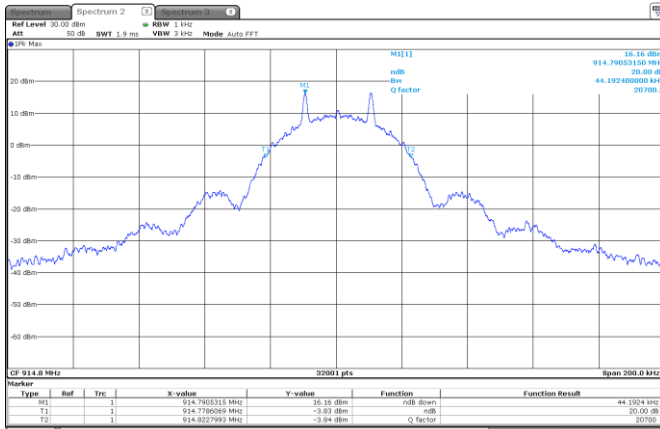


99% Occupied Bandwidth

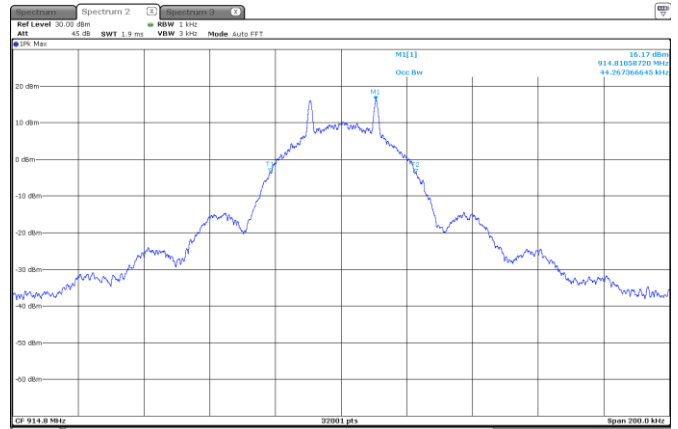


20kbps Mid Channel (914.8MHz)

20dB Bandwidth

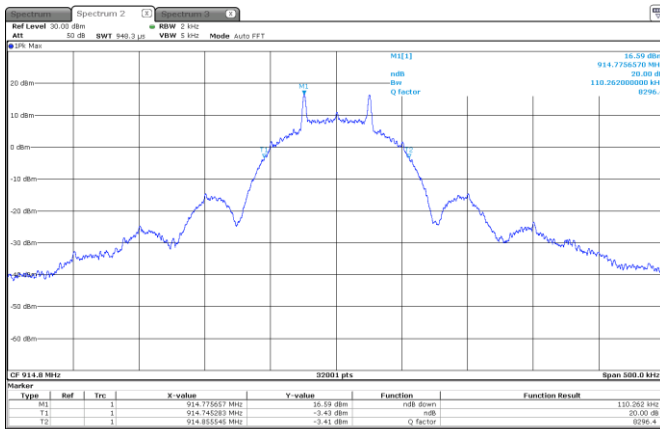


99% Occupied Bandwidth

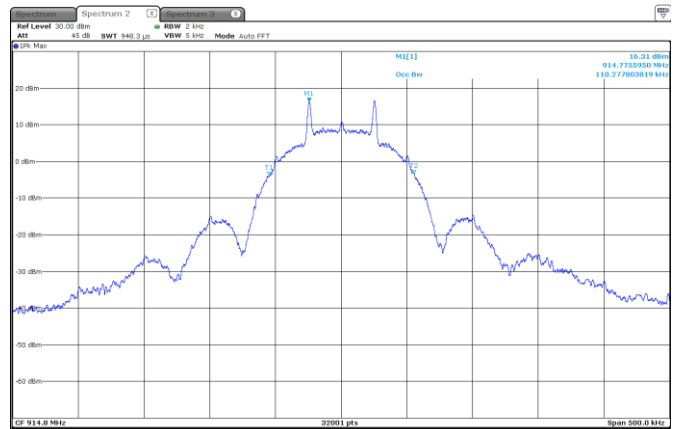


50kbps Mid Channel (914.8MHz)

20dB Bandwidth

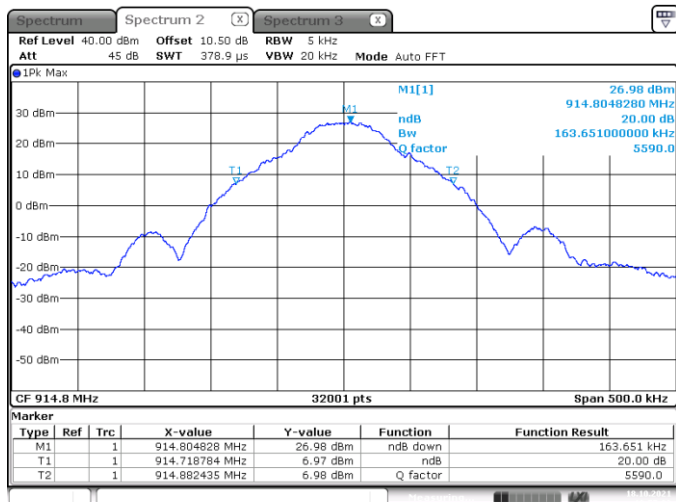


99% Occupied Bandwidth



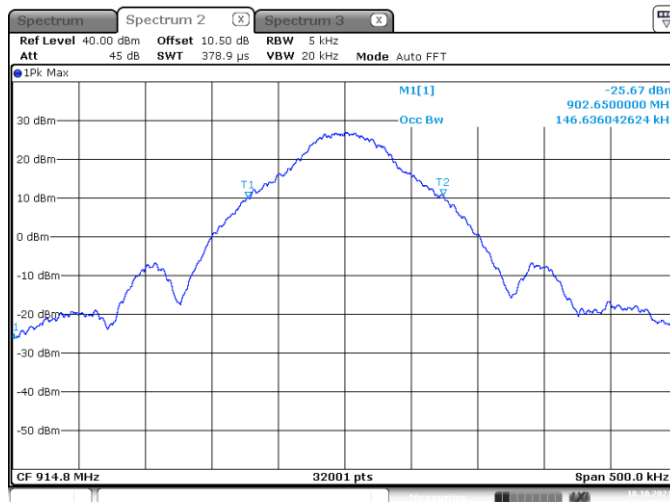
150kbps Mid Channel (914.8MHz)

20dB Bandwidth



Date: 18.OCT.2021 10:57:03

99% Occupied Bandwidth



Date: 18.OCT.2021 10:58:28

4 Peak Output Power

4.1 Test Result

Test Description	Test Specification		Test Result
Peak Output Power	15.247(b)(2)	RSS-247 5.4(a)	Compliant

4.2 Test Method

Output power measurements were taken using the methods defined in ANSI C63.10, Clause 7.8.5 using a spectrum analyzer.

Limit

For frequency hopping systems operating in the 902-928 MHz band employing at least 50 hopping channels: 1 watt.

4.3 Test Site

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.6 °C

Relative Humidity: 38.0 %

Atmospheric Pressure: 97.9 kPa

4.4 Test Equipment

Test End Date: 10/19/2021

Tester: AB/JP

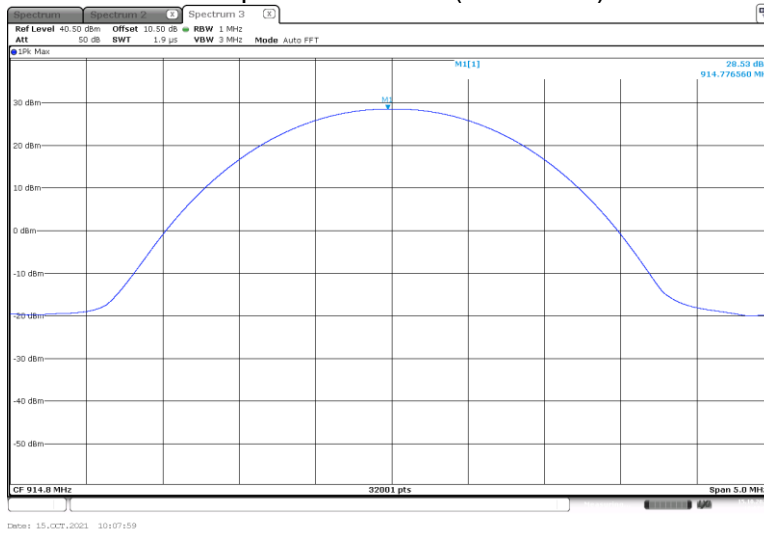
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
ATTENUATOR, 10DB	BW-S10W2	MINI-CIRCUITS	15031	7-Oct-2021	7-Oct-2022
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM	20109	16-Mar-2021	16-Mar-2022
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	27-Dec-2019	27-Dec-2021

4.5 Test Data

Data Rate (kbps)	Channel	Frequency (MHz)	Peak Power (dBm)	Peak Power (mW)	Mode
9.6	0	902.3	28.34	682.3	1 / 2
	127	915	28.42	695.0	1 / 2
	255	927.8	28.35	683.9	1 / 2
19.2	0	902.3	28.36	685.5	1 / 2
	127	915	28.39	690.2	1 / 2
	255	927.8	26.43	439.5	1 / 2
38.4	0	902.3	28.39	690.2	1 / 2
	127	915	28.45	699.8	1 / 2
	255	927.8	28.32	679.2	1 / 2
10	1	902.4	28.42	695.0	3
	63	914.8	28.46	701.5	3
	127	927.6	28.33	680.8	3
20	1	902.4	28.42	695.0	3
	63	914.8	28.46	701.5	3
	127	927.6	28.35	683.9	3
50	1	902.4	28.48	704.7	3 / 4
	63	914.8	28.53	712.9	3 / 4
	127	927.6	28.38	688.7	3 / 4
150	1	902.4	28.42	695.0	5
	63	914.8	28.35	683.9	5
	127	927.6	28.34	682.3	5

Sample Plot

50kbps Mid Channel (914.8MHz)



5 Carrier Frequency Separation

5.1 Test Result

Test Description	Test Specification		Test Result
Carrier Frequency Separation	15.247(a)(1)	RSS-247 5.1(a)	Compliant

5.2 Test Method

Measurements were taken using the methods defined in ANSI C63.10, Clause 7.8.2 using a spectrum analyzer.

Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

5.3 Test Site

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.6 °C

Relative Humidity: 38.0 %

Atmospheric Pressure: 97.9 kPa

5.4 Test Equipment

Test End Date: 10/19/2021

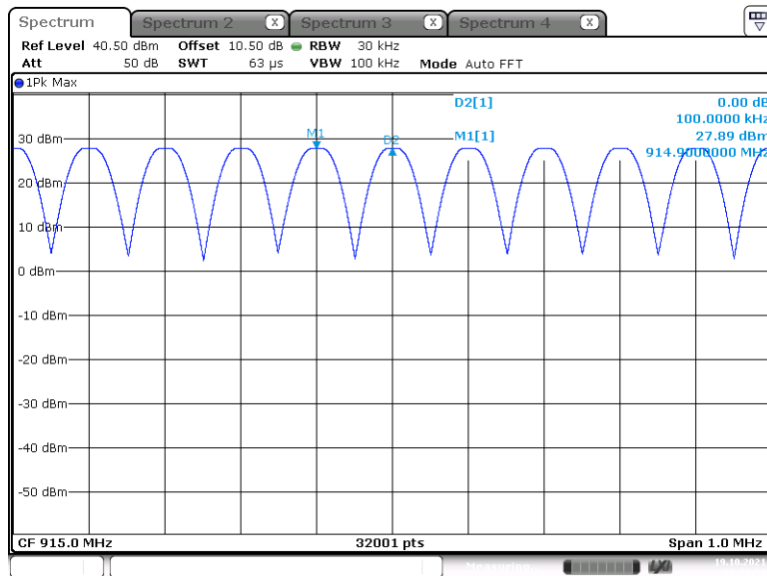
Tester: JP

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
ATTENUATOR, 10DB	BW-S10W2	MINI-CIRCUITS	15031	7-Oct-2021	7-Oct-2022
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM	20109	16-Mar-2021	16-Mar-2022
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	27-Dec-2019	27-Dec-2021

5.5 Test Data

Mode	TX Type	Channel Separation (kHz)	20dB Bandwidth (kHz)	Limits (kHz)	Verdict
1	SISO	300	80.98	≥ 80.98	PASS
2	SISO	100	80.98	≥ 80.98	PASS
3	SISO	400	110.26	≥ 110.26	PASS
4	SISO	200	108.74	≥ 108.74	PASS
5	SISO	400	163.65	≥ 163.65	PASS

Sample Plot – Mode 2



6 Number of Hopping Channels

6.1 Test Result

Test Description	Test Specification		Test Result
Number of Hopping Channels	15.247(a)(1)(i)	RSS-247 5.1(c)	Compliant

6.2 Test Method

Measurements were taken using the methods defined in ANSI C63.10, Clause 7.8.3 using a spectrum analyzer.

Limit

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies

6.3 Test Site

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.6 °C

Relative Humidity: 38.0 %

Atmospheric Pressure: 97.9 kPa

6.4 Test Equipment

Test End Date: 10/19/2021

Tester: JP

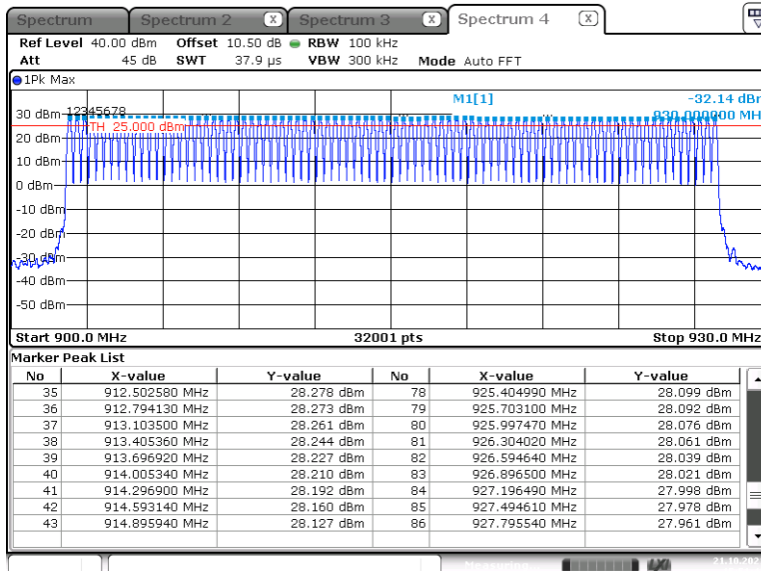
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
ATTENUATOR, 10DB	BW-S10W2	MINI-CIRCUITS	15031	7-Oct-2021	7-Oct-2022
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM	20109	16-Mar-2021	16-Mar-2022
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	27-Dec-2019	27-Dec-2021

6.5 Test Data

Mode	TX Type	Number of Hopping Channels	Limits (MHz)	Verdict
1	SISO	86	≥50	PASS
2	SISO	239	≥50	PASS
3	SISO	64	≥50	PASS
4	SISO	129	≥50	PASS
5	SISO	64	≥50	PASS

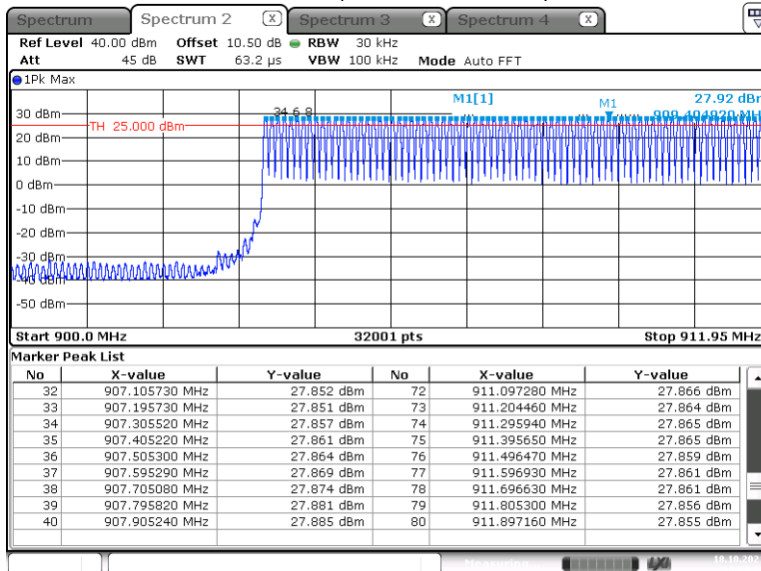
Plots

Mode 1



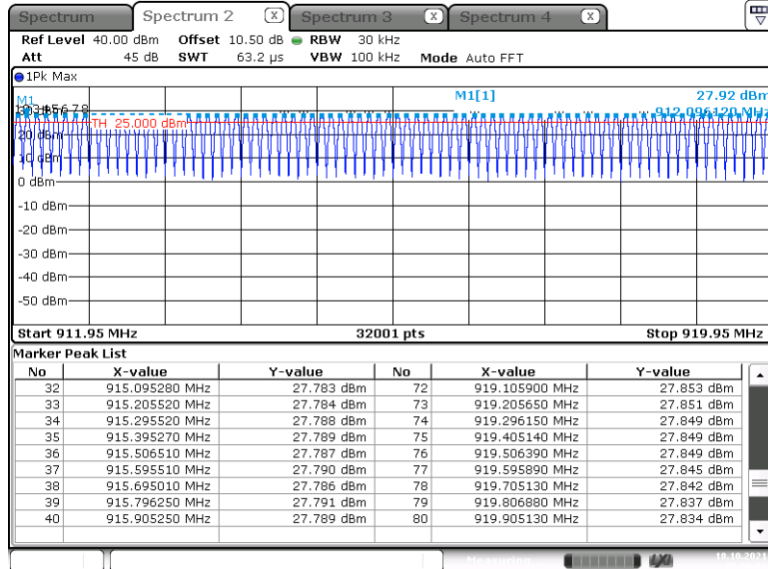
Date: 21.OCT.2021 15:51:42

Mode 2 (Channel 0 – 79)



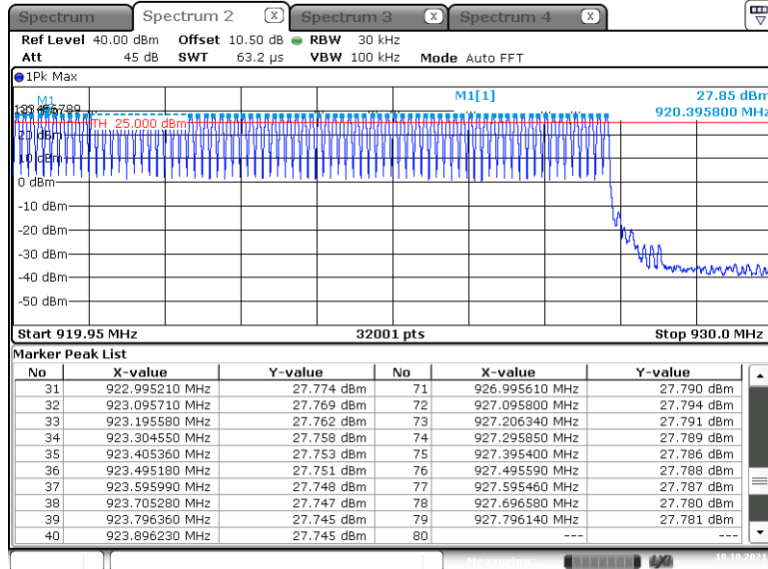
Date: 18.OCT.2021 16:09:02

Mode 2 (Channel 80 – 159)



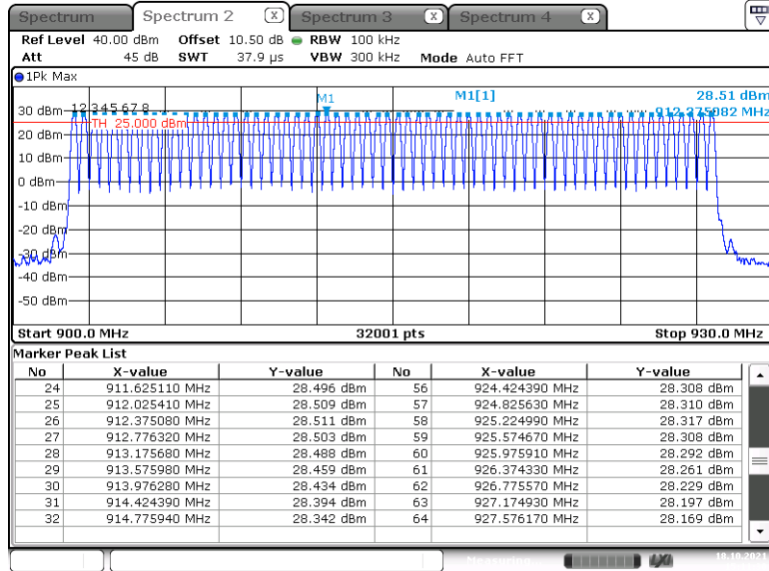
Date: 18.OCT.2021 15:59:52

Mode 2 (Channel 160 – 238)



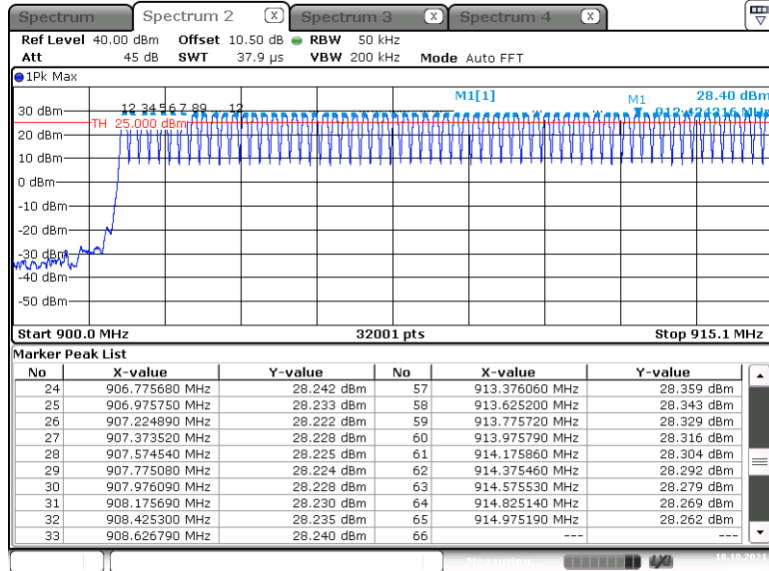
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Mode 3



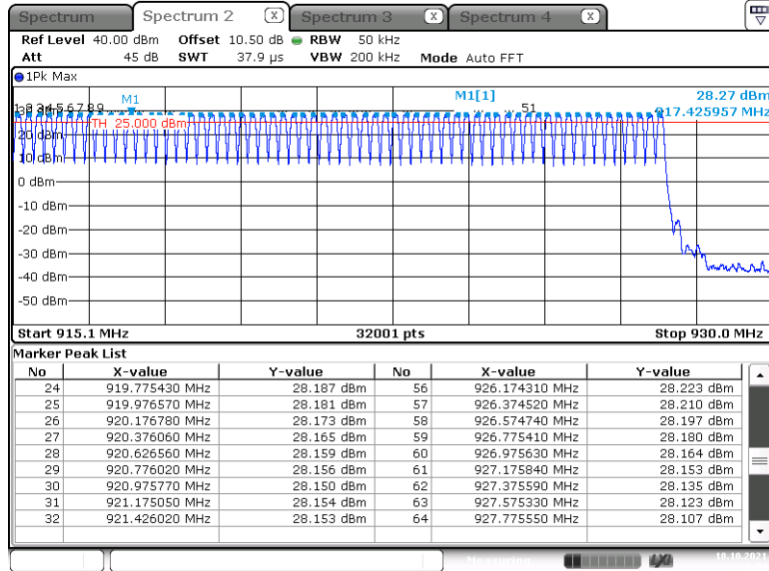
Date: 18.OCT.2021 15:11:30

Mode 4 (Channels 0-64)



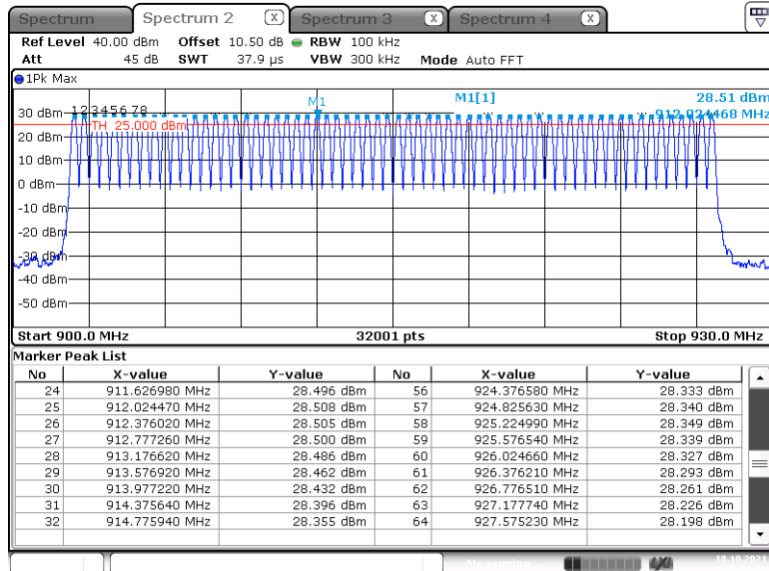
Date: 18.OCT.2021 15:20:44

Mode 4 (Channels 65 – 128)



Date: 18.OCT.2021 15:22:55

Mode 5



Date: 18.OCT.2021 15:09:06

7 Dwell Time

7.1 Test Result

Test Description	Test Specification		Test Result
Dwell Time	15.247(a)(1)(iii)	RSS-247 5.1(d)	Compliant

7.2 Test Method

The test modes available do not generate a worst-case channel dwell time. A detailed engineering analysis showing compliance with these requirements is provided in the Theory of Operation.

Requirement:

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

8 Pseudo-Random Hop Sequence

8.1 Test Result

Test Description	Test Specification		Test Result
Pseudo-Random Hop Sequence	15.247(a)(1)	RSS-247 5.1(a)	Compliant

8.2 Test Method

Compliance is demonstrated by Manufacturer's declaration or is stated in the Theory of Operation.

Requirement

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, while the long-term distribution appears evenly distributed.

9 Conducted Spurious Emissions / Band Edge

9.1 Test Result

Test Description	Test Specification		Test Result
Conducted Spurious Emissions	15.247(d)	RSS-247 5.5	Compliant

9.2 Test Method

Conducted spurious emissions measurements were taken using the methods defined in ANSI C63.10, Clauses 5.5 and 5.6.

Band edge measurements were investigated for all data rates. The highest data-rate for each mode was reported as worst-case for low and high channels as well as hopping mode.

Conducted spurious up to the 10th harmonic were evaluated at the lowest, middle, and highest channels. For these measurements worst-case was at the lowest data rate for each mode.

Limit:

The limit in any 100 kHz band outside of the authorized band is 20 dB below the maximum in-band peak level.

9.3 Test Site

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.6 °C

Relative Humidity: 38.0 %

Atmospheric Pressure: 97.9 kPa

9.4 Test Equipment

Test End Date: 10/18/2021

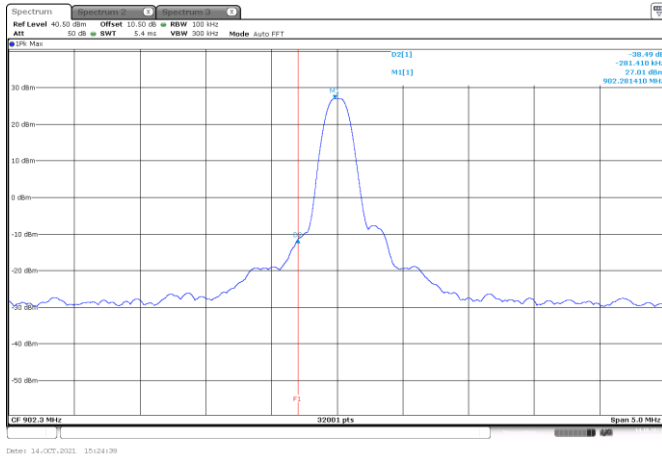
Tester: JP/AB

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
ATTENUATOR, 10DB	BW-S10W2	MINI-CIRCUITS	15031	7-Oct-2021	7-Oct-2022
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM	20109	16-Mar-2021	16-Mar-2022
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	27-Dec-2019	27-Dec-2021

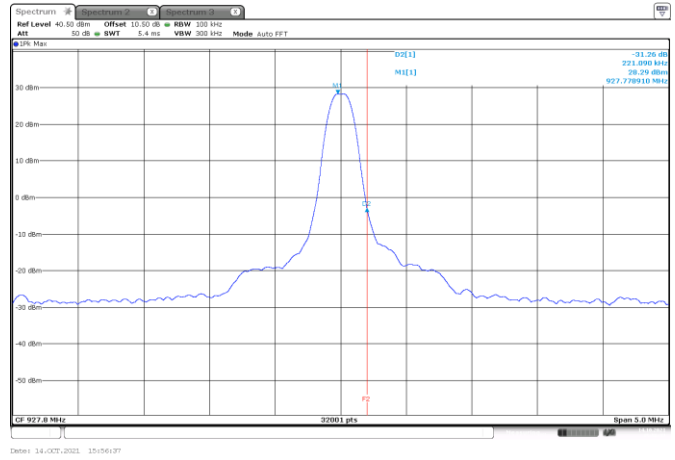
9.5 Test Data – Band Edge

Non-Hopping Mode

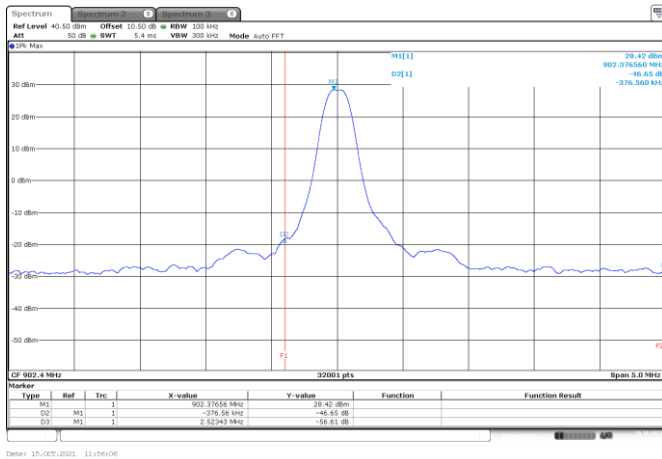
Lower Band Edge – Mode 1 / 2



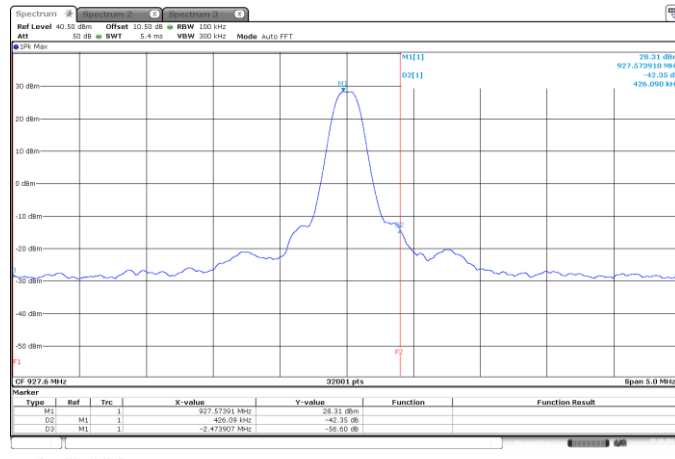
Upper Band Edge – Mode 1 / 2



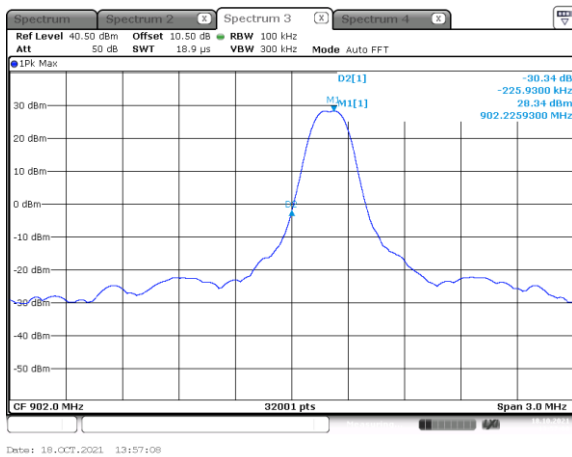
Lower Band Edge – Mode 3



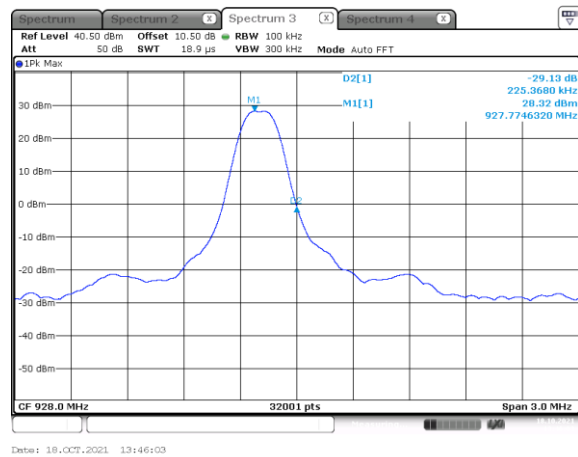
Upper Band Edge – Mode 3



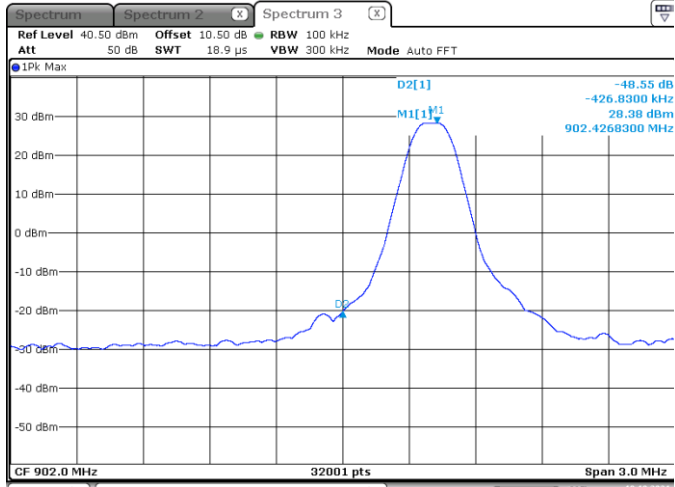
Lower Band Edge – Mode 4



Upper Band Edge – Mode 4

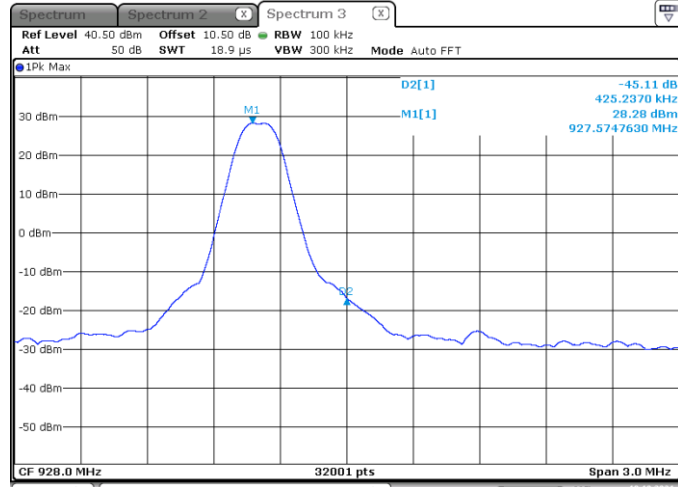


Lower Band Edge – Mode 5



Date: 18.OCT.2021 10:52:58

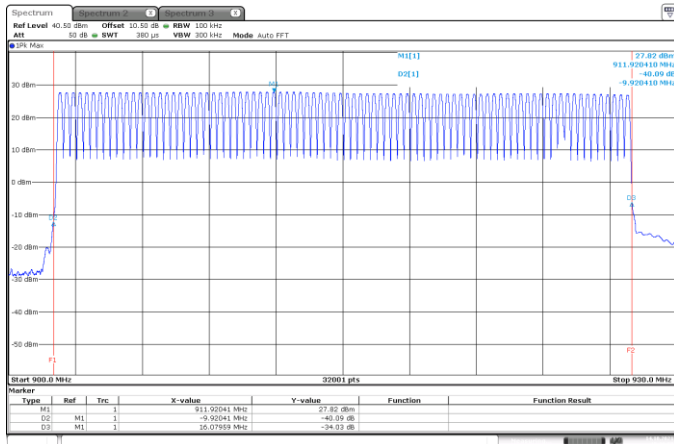
Upper Band Edge – Mode 5



Date: 18.OCT.2021 11:09:23

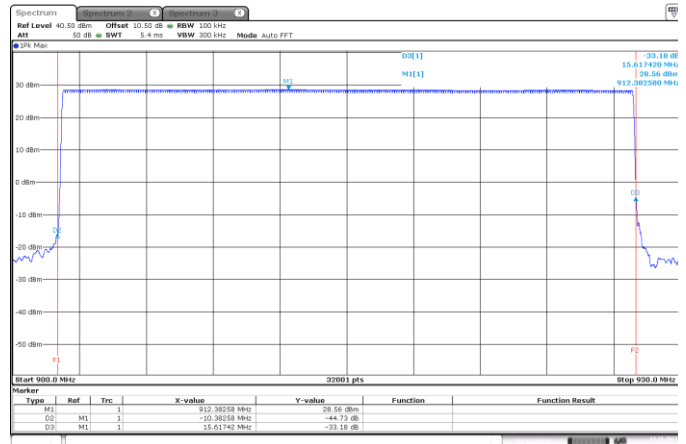
Hopping Mode

Band Edges – Mode 1



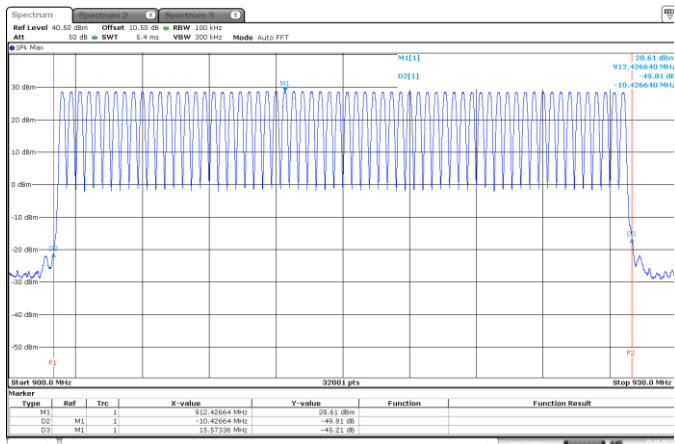
Date: 14.OCT.2021 15:02:56

Band Edges – Mode 2



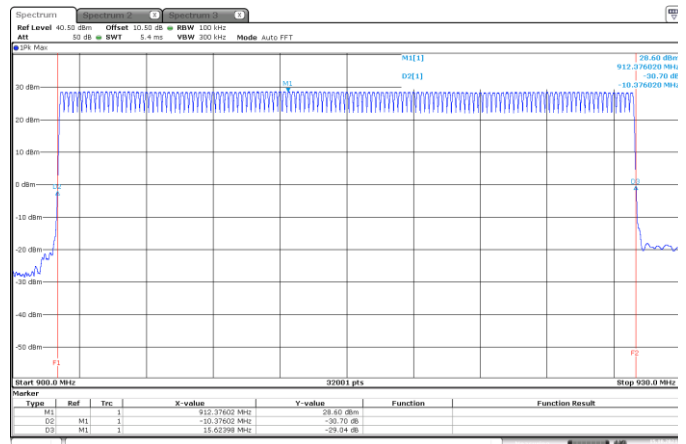
Date: 14.OCT.2021 15:31:20

Band Edges – Mode 3



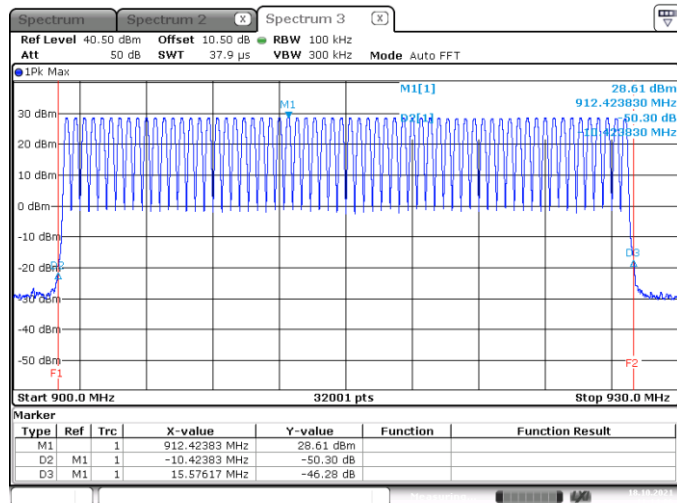
Date: 18.OCT.2021 10:48:11

Band Edges – Mode 4



Date: 15.OCT.2021 10:42:55

Band Edges – Mode 5



Date: 18.OCT.2021 11:14:06

10 Field Strength of Spurious Radiation (Restricted Bands)

10.1 Test Result

Test Description	Test Specification		Test Result
Radiated Spurious Emissions	15.35(b),15.209	RSS-GEN 8.10	Compliant

10.2 Test Method

The measurement methods defined in ANSI C63.10: 2013 were used.

Lowest, middle, and highest channels were investigated – the device was commanded to continuously transmit on low, middle, and high channels. 9.6kbps and 50kbps were the worst-case operating conditions.

Test distance:

- 9k to 30 MHz – The EUT to measurement antenna distance was 3 meters
- 30 to 1000 MHz - The EUT to measurement antenna distance was 3 meters
- 1 to 18 GHz - The EUT to measurement antenna distance was 3 meters
- 18 to 26 GHz - The EUT to measurement antenna distance was 3 meters

Limits within restricted bands of operation:

Frequency	Limits ⁽¹⁾		Peak Limits dBuV/m
	Microvolts/m	dBuV/m	
30 - 88 MHz	100	40 ⁽²⁾	--
88 - 216 MHz	150	43.5 ⁽²⁾	--
216 - 960 MHz	200	46 ⁽²⁾	--
960 - 1000 MHz	500	54 ⁽²⁾	--
1 - 40 GHz	500	54 ⁽³⁾	74

(1) These limits are applicable to emissions outside of the intentional transmit frequency band.

(2) Quasi-peak limit

(3) Average limit

10.3 Test Site

10m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions

Temperature: 22.4 °C

Relative Humidity: 40.9 %

Atmospheric Pressure: 97.05 kPa

10.4 Test Equipment

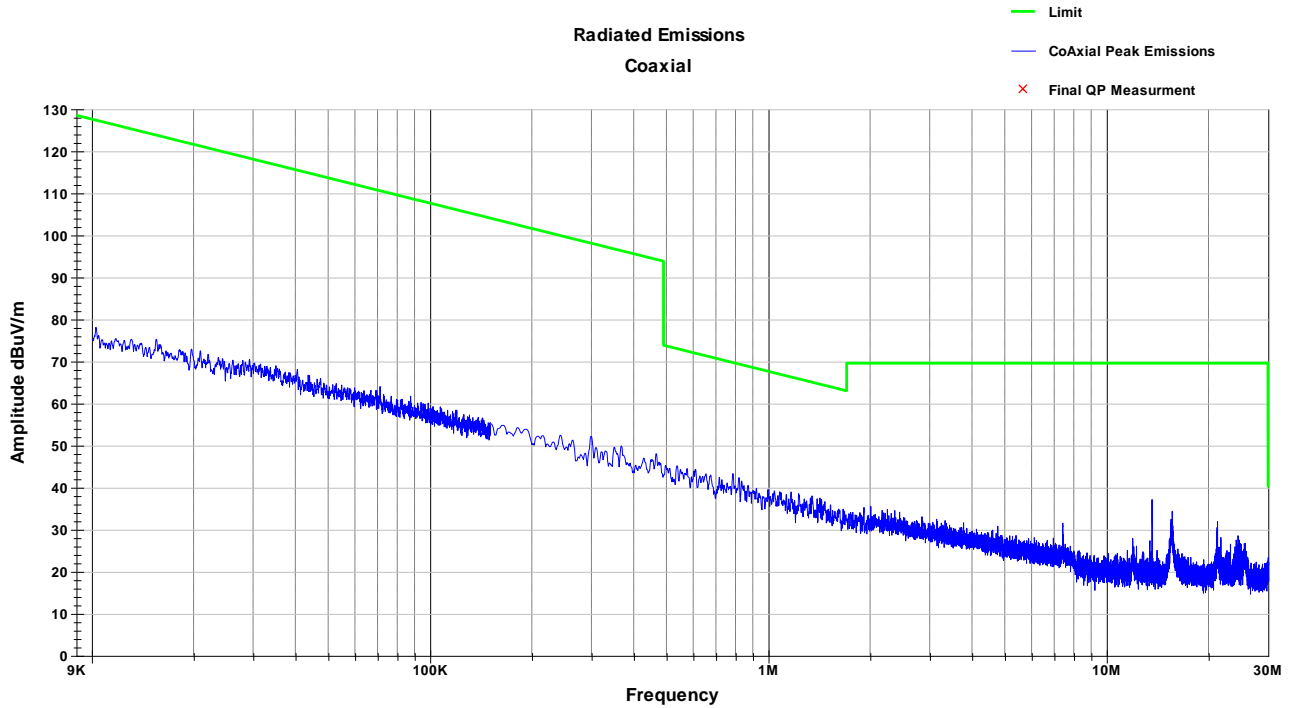
Test End Date: 11/1/2021

Tester: AB/JP/ZH

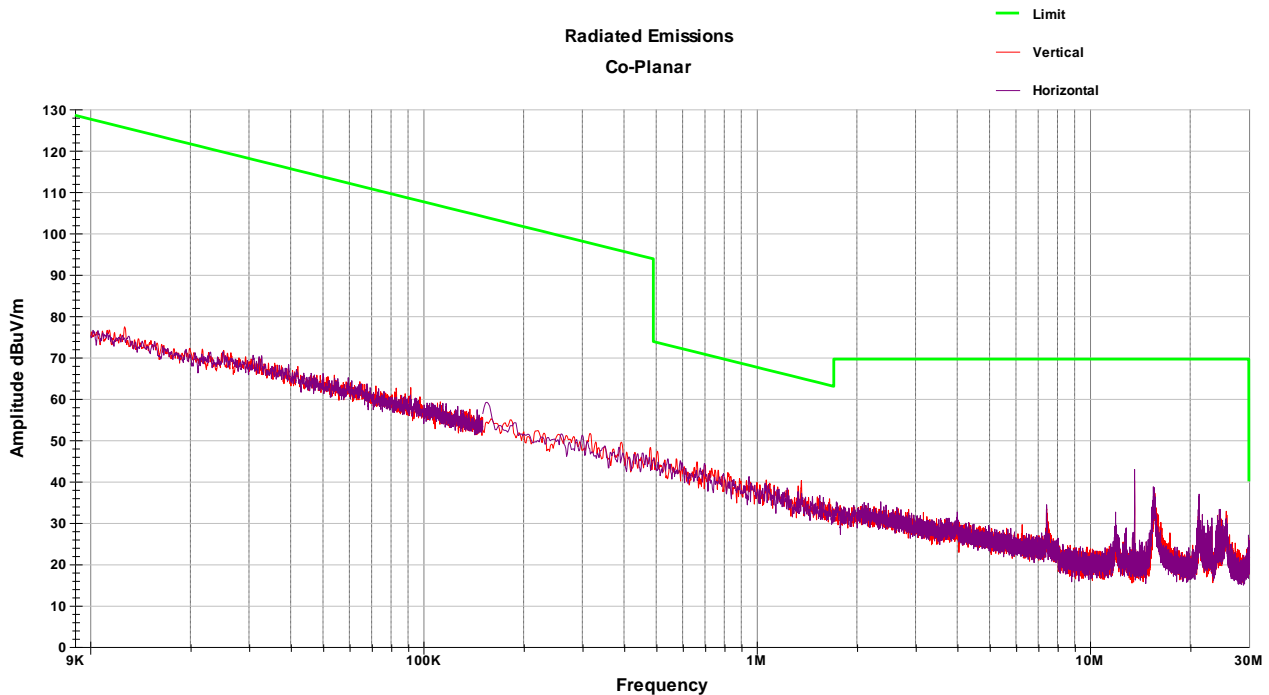
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-138	TELEDYNE STORM	20111	16-Mar-2021	16-Mar-2022
RF CABLE NM TO NM, 0.01-18GHZ	90-195-354	TELEDYNE STORM	20119	18-Feb-2021	18-Feb-2022
RF CABLE, NM TO NM.	90-195-157	TELEDYNE STORM	21019	26-Mar-2021	26-Mar-2022
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	21-Jun-2021	21-Jun-2022
ANTENNA, DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079699	15-Jul-2020	15-Jul-2022
RF CABLE	SF106	HUBER & SUHNER	B079713	26-Aug-2021	26-Aug-2022
RF CABLE	104PE	HUBER & SUHNER	B079793	24-Aug-2021	24-Aug-2022
LOW NOISE AMPLIFIER	ZKL-2+	MINI-CIRCUITS	B079800	18-Oct-2021	18-Oct-2022
FILTER, HIGH PASS, >1000MHZ	HPM50108	MICRO-TRONICS	B079802	6-Jul-2021	6-Jul-2022
LOW NOISE AMPLIFIER	ZKL-2+	MINI-CIRCUITS	B079817	26-Aug-2021	26-Aug-2022
ANTENNA, LOOP, ACTIVE	6502	ETS LINDGREN	B085752	20-Aug-2020	20-Aug-2022
EMI TEST RECEIVER	ESU8	ROHDE & SCHWARZ	B085759	9-Jul-2021	9-Jul-2022
RF CABLE	SF106	HUBER & SUHNER	B085903	25-Aug-2021	25-Aug-2022
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	7-Jul-2021	7-Jul-2022

10.5 Test Data – Peak Plots

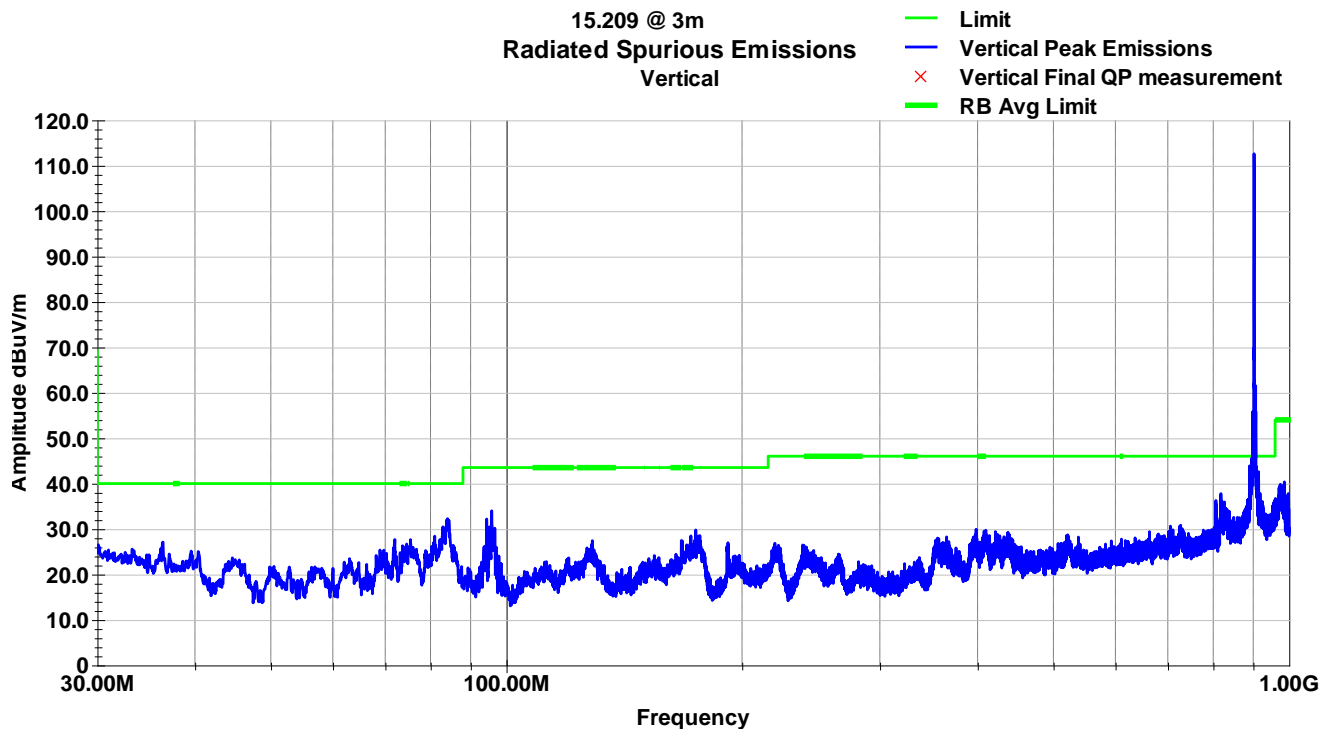
Between 9kHz and 30MHz, there was no significant deviation with respect to axis or channel
Co-Axial Radiated Spurious Emissions – 9kHz-30MHz (LCH)



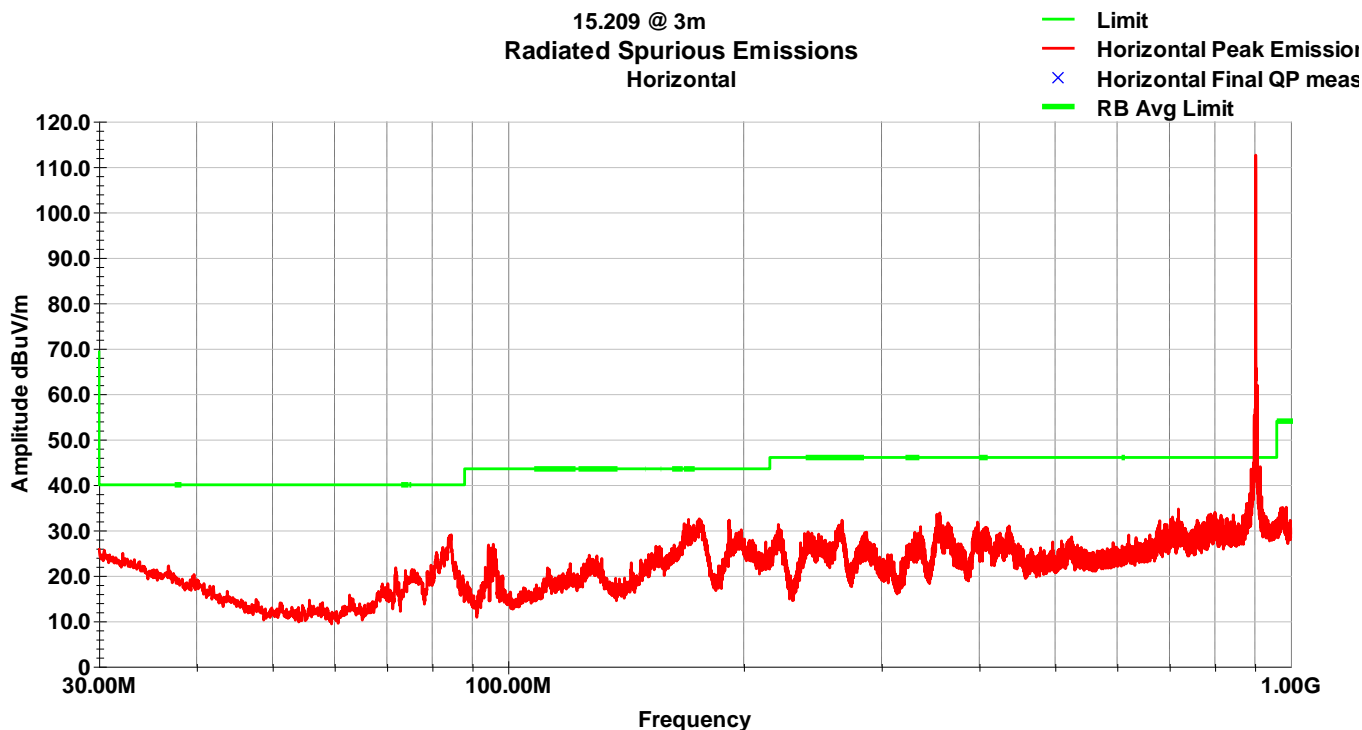
Co-Planar Vertical Radiated Spurious Emissions – 9kHz-30MHz (LCH)



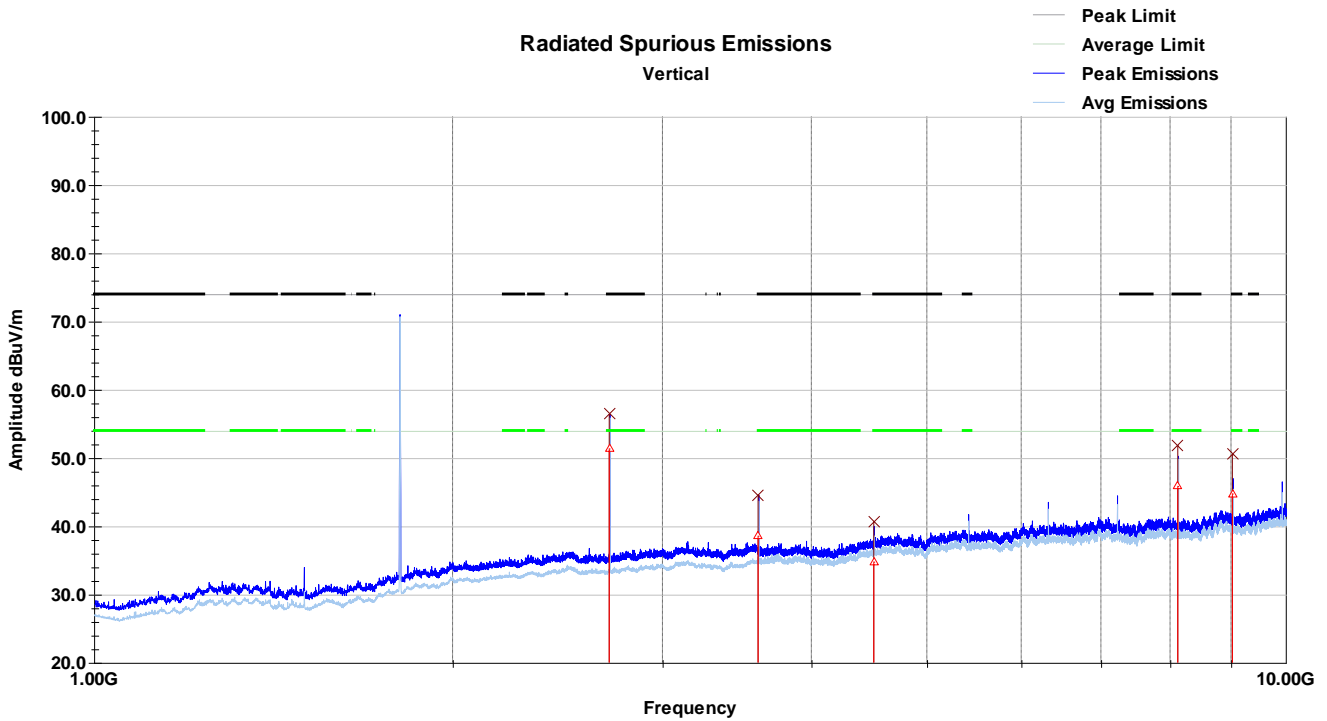
Vertical Radiated Spurious Emissions – 30-1000MHz (9.6kbps LCH)



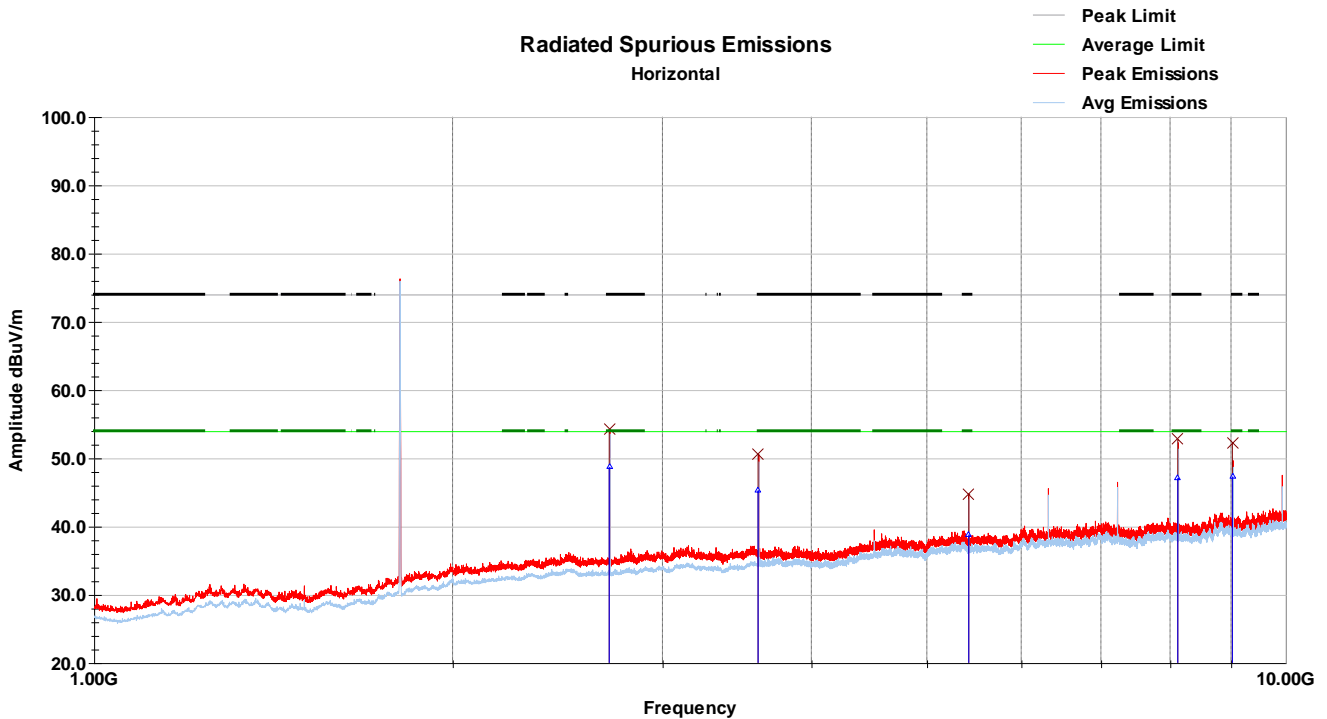
Horizontal Radiated Spurious Emissions – 30-1000MHz (9.6kbps LCH)



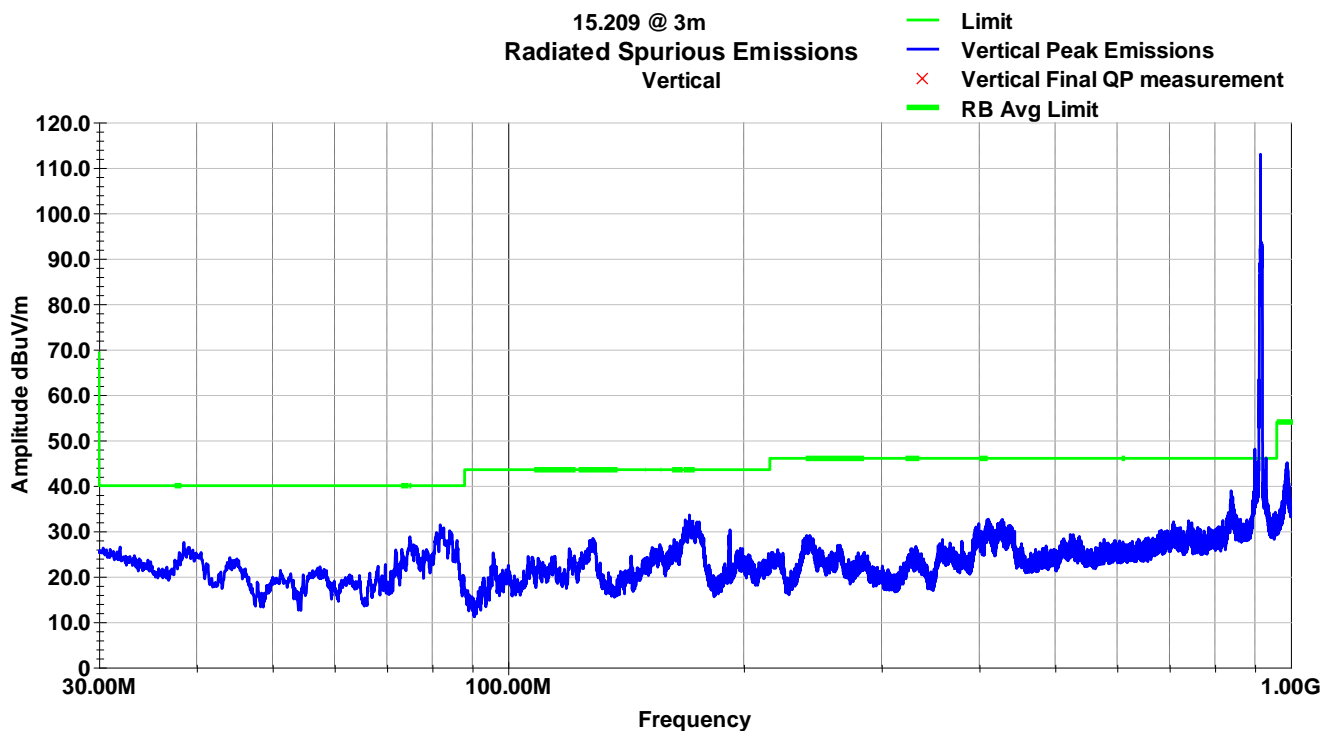
Vertical Radiated Spurious Emissions – 1-10GHz (9.6kbps LCH)



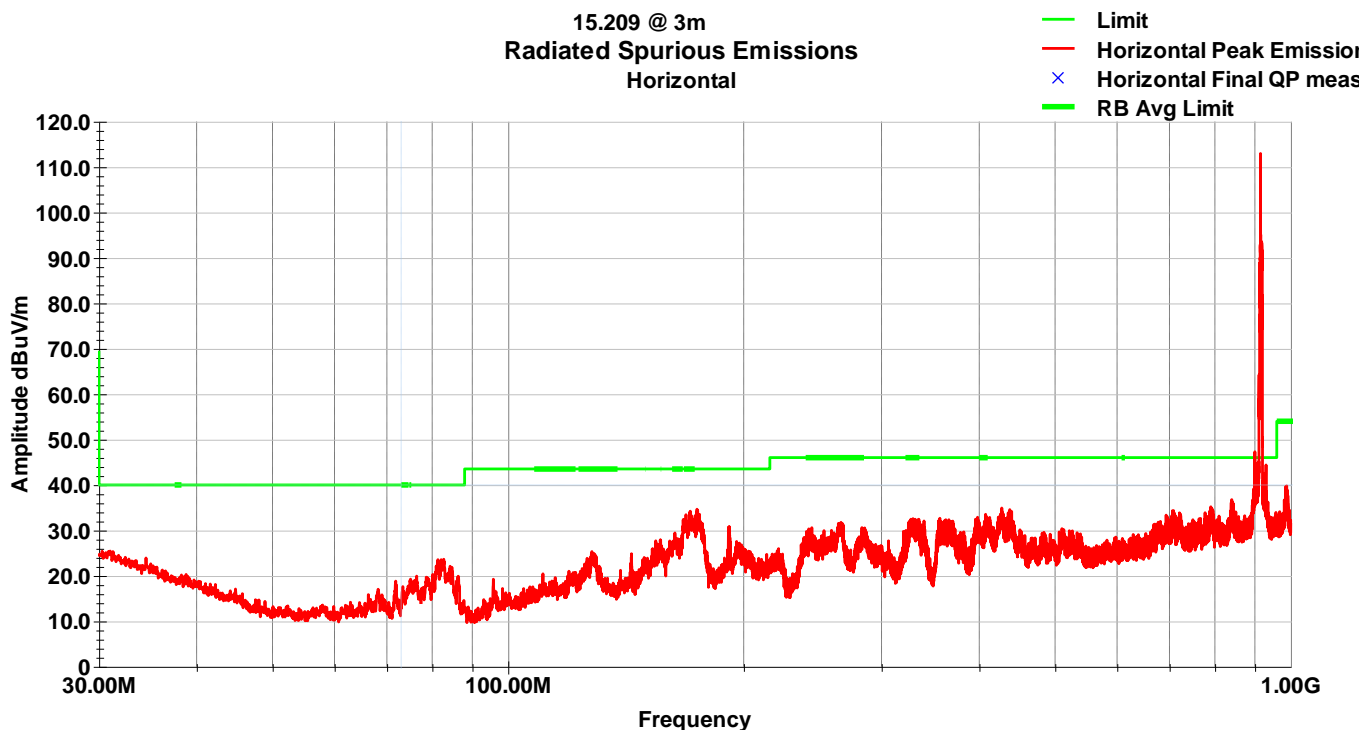
Horizontal Radiated Spurious Emissions – 1-10GHz (9.6kbps LCH)



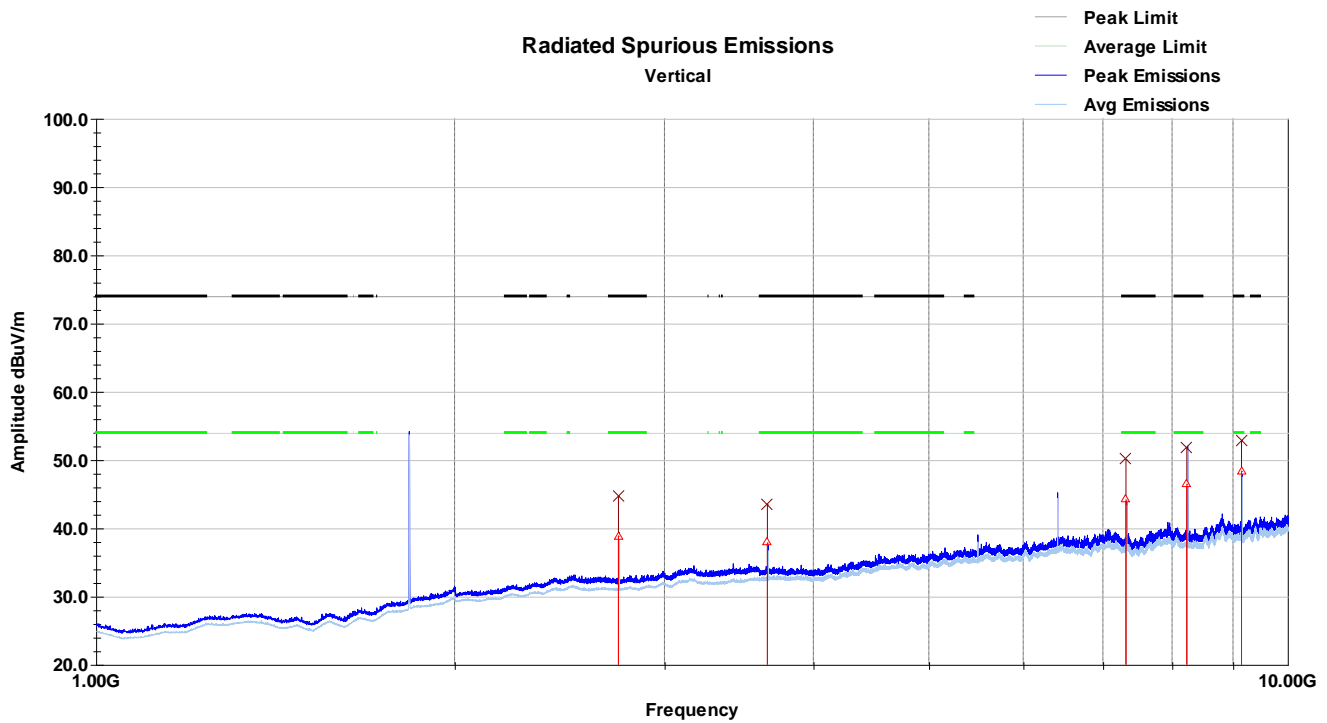
Vertical Radiated Spurious Emissions – 30-1000MHz (9.6kbps MCH)



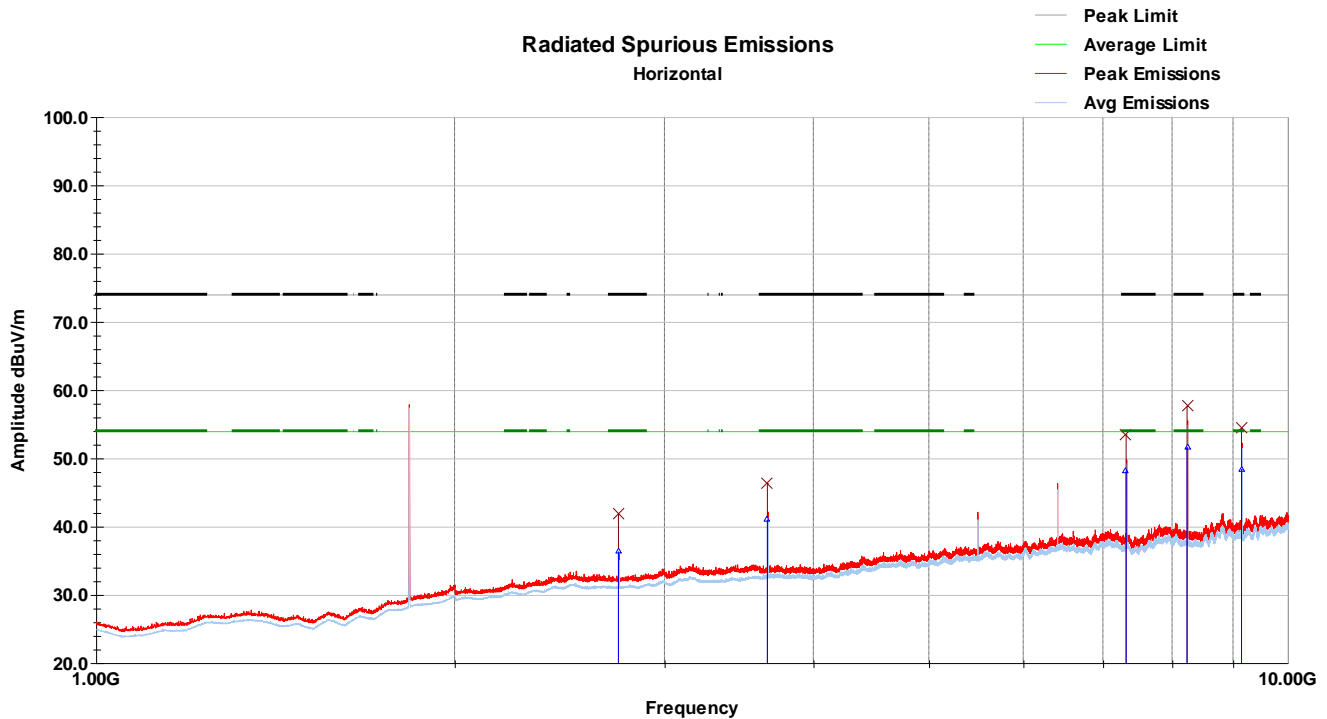
Horizontal Radiated Spurious Emissions – 30-1000MHz (9.6kbps MCH)



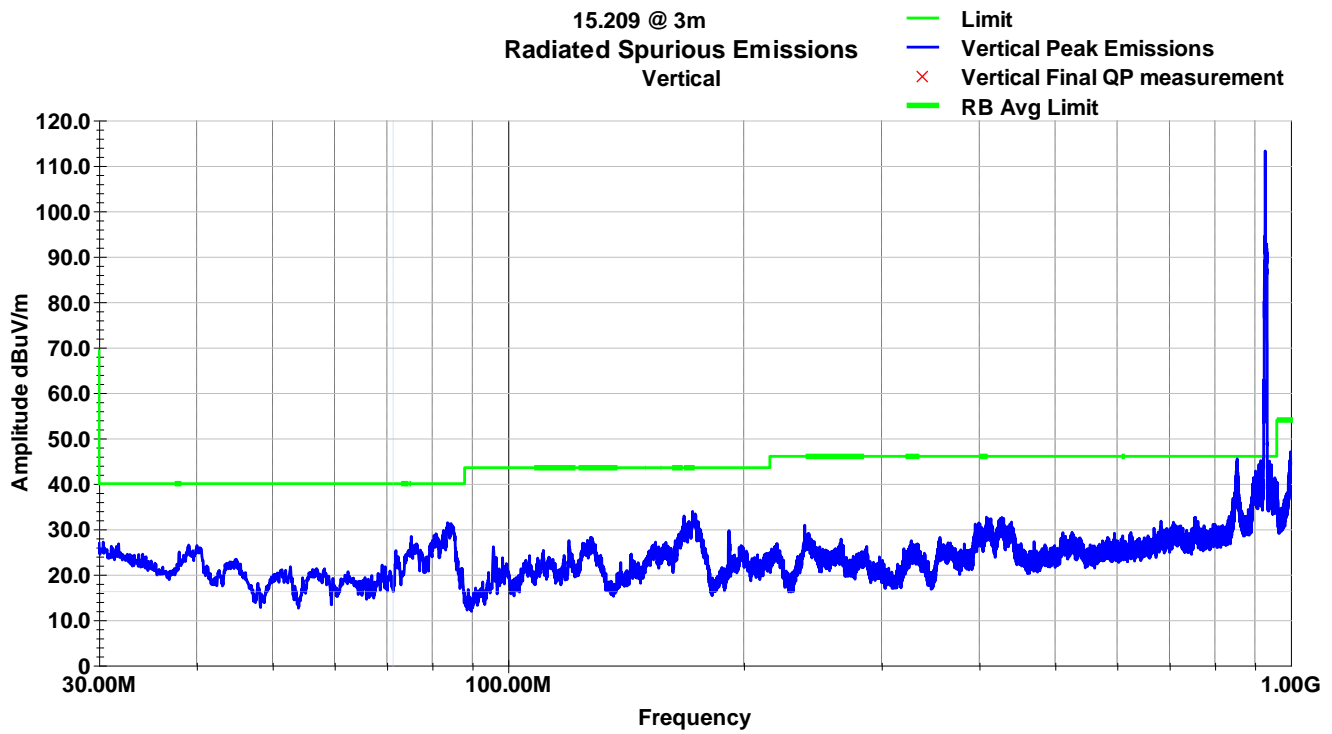
Vertical Radiated Spurious Emissions – 1-10GHz (9.6kbps MCH)



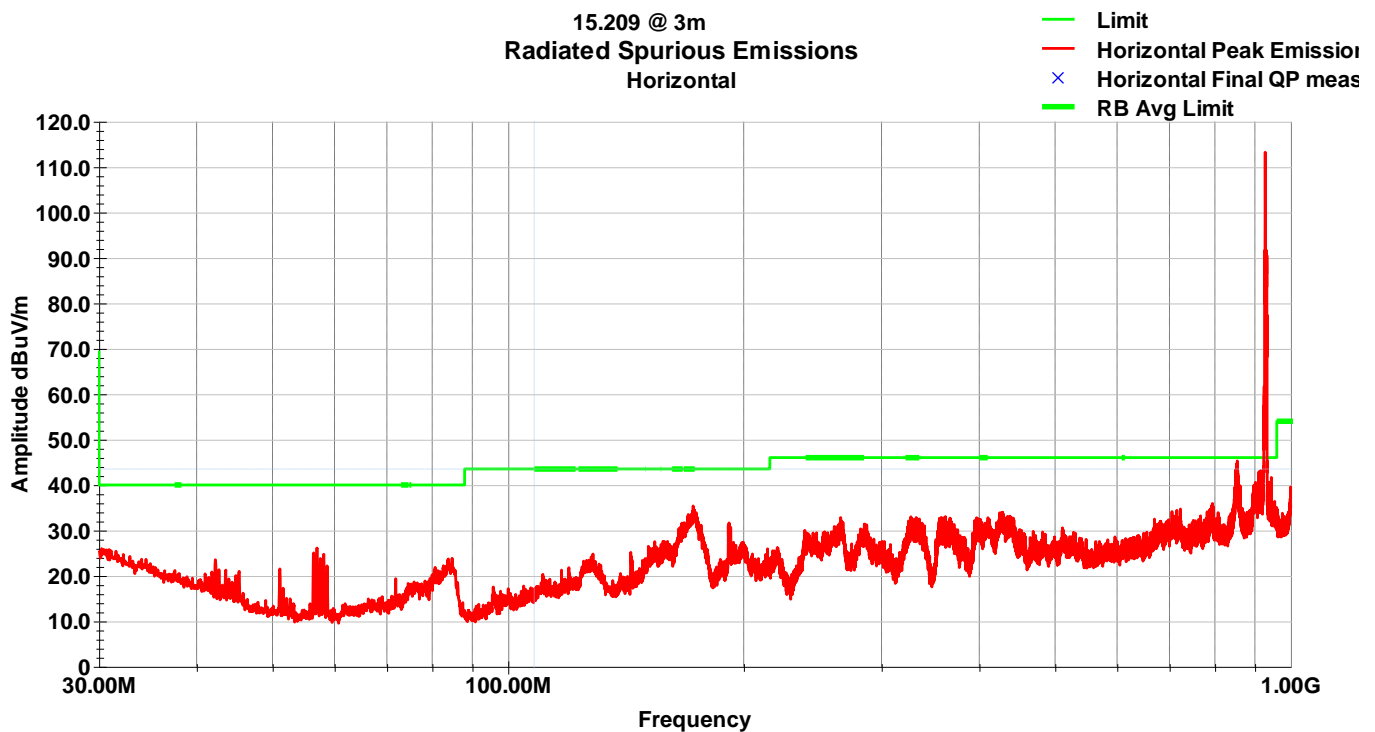
Horizontal Radiated Spurious Emissions – 1-10GHz (9.6kbps MCH)



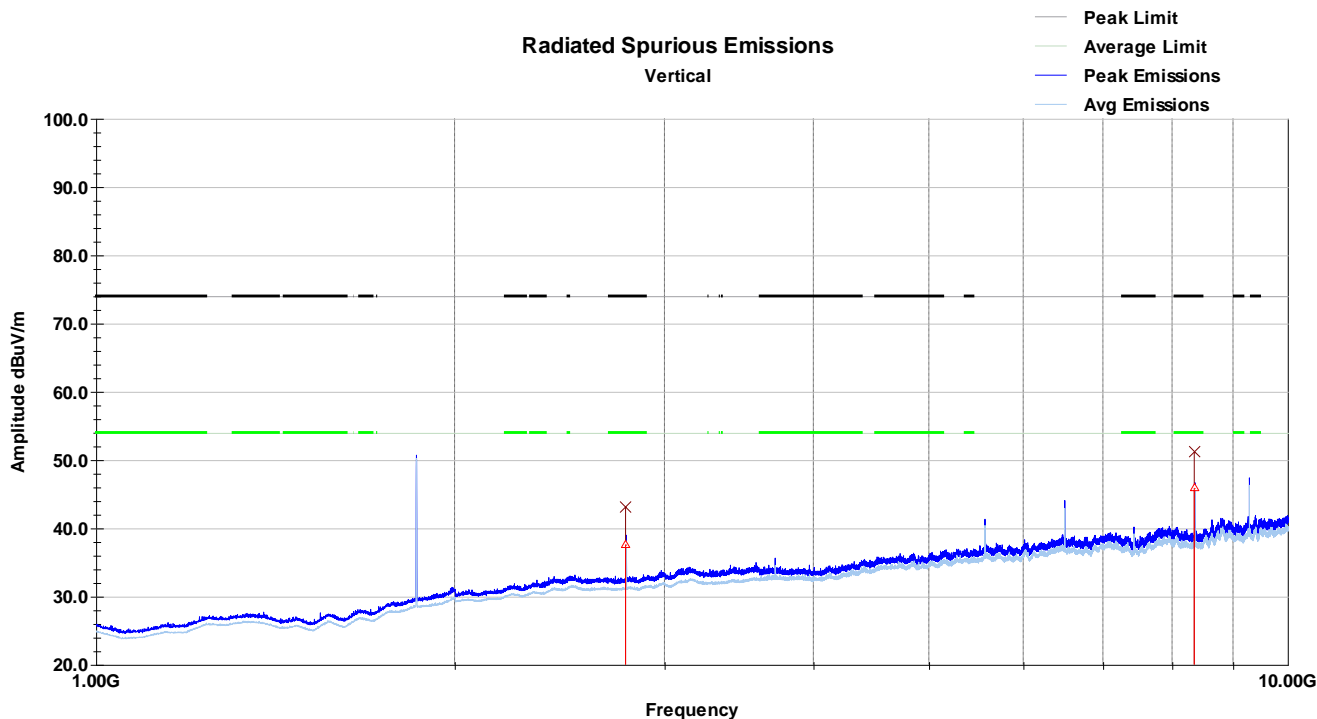
Vertical Radiated Spurious Emissions – 30-1000MHz (9.6kbps HCH)



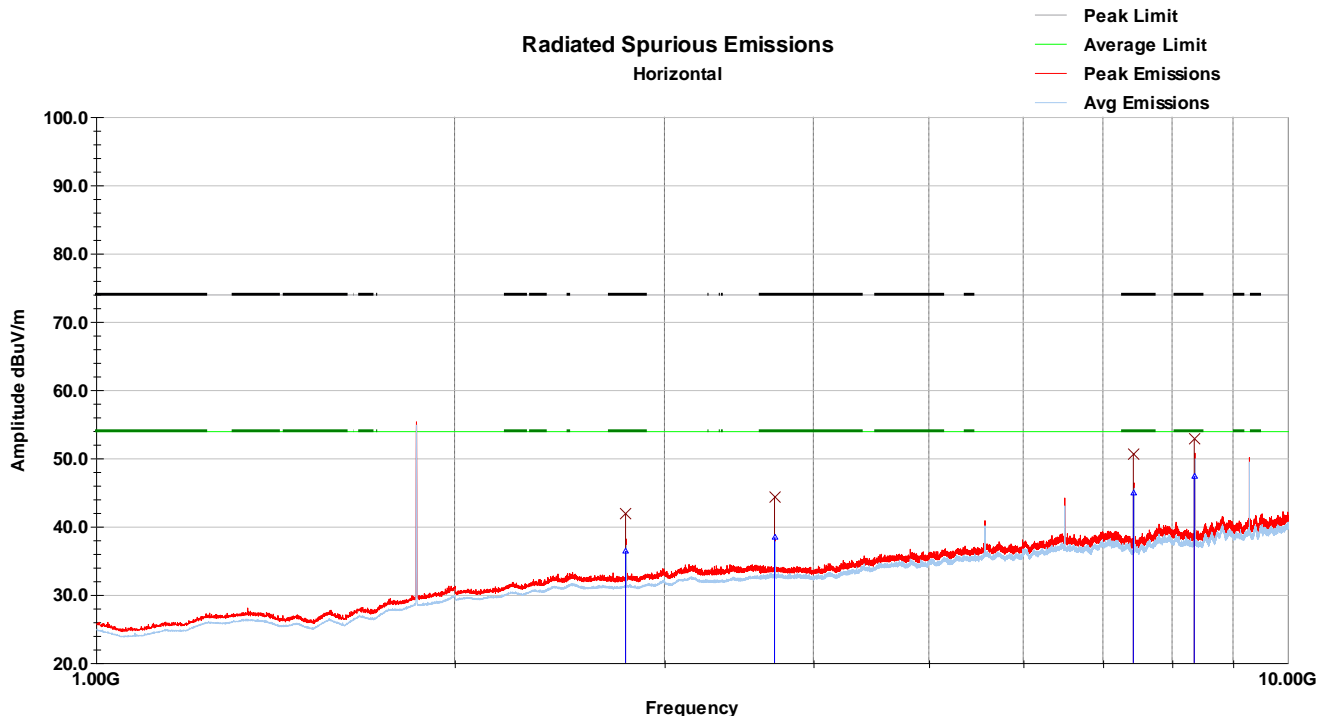
Horizontal Radiated Spurious Emissions – 30-1000MHz (9.6kbps HCH)



Vertical Radiated Spurious Emissions – 1-10GHz (9.6kbps HCH)



Horizontal Radiated Spurious Emissions – 1-10GHz (9.6kbps HCH)



10.6 Test Data – Peak Tabular Data

Frequency MHz	Raw Pk dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Final Pk dBuV/m	Limit dBuV/m	Margin dB
9.6kbps - LCH (902.3MHz)										
2706.90	56.1	V	149.0	117.0	32.3	2.3	34.9	56.4	74.0	-17.6
3609.20	45.4	V	171.0	133.0	33.0	2.7	34.9	44.6	74.0	-29.4
4511.50	42.9	V	185.0	185.0	34.1	3.0	34.9	40.7	74.0	-33.3
8120.70	56.5	V	306.0	159.0	35.8	4.2	35.3	51.8	74.0	-22.2
9023.00	56.0	V	323.0	118.0	36.1	4.4	35.0	50.5	74.0	-23.5
2706.90	53.9	H	358.0	142.0	32.3	2.3	34.9	54.2	74.0	-19.8
3609.20	51.4	H	3.0	110.0	33.0	2.7	34.9	50.6	74.0	-23.4
5423.21	48.2	H	254.0	131.0	34.7	3.4	34.7	44.8	74.0	-29.2
8120.63	57.4	H	75.0	132.0	35.8	4.2	35.3	52.7	74.0	-21.3
9023.21	57.8	H	62.0	143.0	36.1	4.4	35.0	52.3	74.0	-21.7
9.6kbps - MCH (915MHz)										
2745.00	44.7	V	158.0	213.0	32.3	2.3	34.8	44.7	74.0	-29.3
3660.00	44.3	V	151.0	169.0	33.1	2.7	35.0	43.5	74.0	-30.5
7320.00	54.5	V	191.0	150.0	35.7	3.9	35.3	50.2	74.0	-23.8
8235.00	56.6	V	304.0	133.0	35.9	4.2	35.3	51.8	74.0	-22.2
9150.00	58.4	V	220.0	193.0	36.2	4.4	35.1	52.9	74.0	-21.1
2745.00	41.7	H	144.0	100.0	32.3	2.3	34.8	41.9	74.0	-32.1
3660.00	47.2	H	359.0	100.0	33.1	2.7	35.0	46.4	74.0	-27.6
7320.00	57.8	H	135.0	183.0	35.7	3.9	35.3	53.5	74.0	-20.5
8235.00	62.4	H	62.0	170.0	35.9	4.2	35.3	57.6	74.0	-16.4
9150.00	59.8	H	40.0	169.0	36.2	4.4	35.1	54.3	74.0	-19.7
9.6kbps - HCH (927.8MHz)										
2783.40	43.3	V	142.0	114.0	32.4	2.3	34.8	43.2	74.0	-30.8
8350.20	46.4	V	308.0	145.0	35.9	4.2	35.4	51.1	74.0	-22.9
2783.40	42.0	H	200.0	117.0	32.4	2.3	34.8	41.9	74.0	-32.1
3711.20	43.3	H	15.0	100.0	33.2	2.8	35.0	44.3	74.0	-29.7
7422.40	46.4	H	137.0	196.0	35.7	4.0	35.4	50.7	74.0	-23.3
8350.20	48.1	H	58.0	180.0	35.9	4.2	35.4	52.8	74.0	-21.2
Final Pk = Raw Pk + AF + Loss - Amp										
Margin = Final Pk - Limit										

10.7 Test Data – Average Tabular Data

Frequency MHz	Raw Avg dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Final Avg dBuV/m	Limit (dBuV/m)	Margin (dB)
9.6kbps - LCH (902.3MHz)										
2706.89	51.1	V	149.0	117.0	32.3	2.3	34.9	51.4	54.0	-2.6
3609.14	39.4	V	171.0	133.0	33.0	2.7	34.9	38.6	54.0	-15.4
4513.19	37.0	V	185.0	185.0	34.1	3.0	34.9	34.8	54.0	-19.2
8120.60	50.6	V	306.0	159.0	35.8	4.2	35.3	45.9	54.0	-8.1
9023.21	50.3	V	323.0	118.0	36.1	4.4	35.0	44.8	54.0	-9.2
2707.01	48.4	H	358.0	142.0	32.3	2.3	34.9	48.7	54.0	-5.3
3609.26	46.1	H	3.0	110.0	33.0	2.7	34.9	45.3	54.0	-8.7
5423.21	42.2	H	254.0	131.0	34.7	3.4	34.7	38.8	54.0	-15.2
8120.63	51.8	H	75.0	132.0	35.8	4.2	35.3	47.1	54.0	-6.9
9023.21	52.8	H	62.0	143.0	36.1	4.4	35.0	47.3	54.0	-6.7
9.6kbps - MCH (915MHz)										
2745.00	38.7	V	158.0	213.0	32.3	2.3	34.8	38.9	54.0	-15.1
3660.00	38.7	V	151.0	169.0	33.1	2.7	35.0	37.9	54.0	-16.1
7320.00	48.5	V	191.0	150.0	35.7	3.9	35.3	44.2	54.0	-9.8
8235.00	51.3	V	304.0	133.0	35.9	4.2	35.3	46.5	54.0	-7.5
9150.00	52.7	V	220.0	193.0	36.2	4.4	35.1	47.2	54.0	-6.8
2745.00	36.1	H	144.0	100.0	32.3	2.3	34.8	36.3	54.0	-17.7
3660.00	41.8	H	359.0	100.0	33.1	2.7	35.0	41.0	54.0	-13.0
7320.00	52.6	H	135.0	183.0	35.7	3.9	35.3	48.3	54.0	-5.7
8235.00	56.4	H	62.0	170.0	35.9	4.2	35.3	51.6	54.0	-2.4
9150.00	53.9	H	40.0	169.0	36.2	4.4	35.1	48.4	54.0	-5.6
9.6kbps - HCH (927.8MHz)										
2783.40	37.5	V	142.0	114.0	32.4	2.3	34.8	37.6	54.0	-16.4
8350.20	50.6	V	308.0	145.0	35.9	4.2	35.4	45.9	54.0	-8.1
2783.40	36.3	H	200.0	117.0	32.4	2.3	34.8	36.4	54.0	-17.6
3711.20	39.4	H	15.0	100.0	33.2	2.8	35.0	38.4	54.0	-15.6
7422.40	49.3	H	137.0	196.0	35.7	4.0	35.4	45.0	54.0	-9.0
8350.20	52.1	H	58.0	180.0	35.9	4.2	35.4	47.4	54.0	-6.6
Final Avg = Raw Avg + AF + Loss - Amp										
Margin = Final Avg - Limit										

11 Measurement Uncertainty

The measurement uncertainty figures are be calculated in accordance with TR 100 028-1 [2] and correspond to an expansion factor (coverage factor) $k = 2$ (which provide confidence levels of 95,45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).

Parameter	Expanded Uncertainty for Normal k factor equal to 2	
	Required	Laboratory Actual
Radio Frequency	$\pm 1 \times 10^{-5}$	$\pm 9.8 \times 10^{-8}$
total RF power, conducted	± 1.5 dB	± 1.2 dB
RF power density, conducted	± 3 dB	± 0.7 dB
spurious emissions, conducted	± 3 dB	± 2.1 dB
all emissions, radiated	± 6 dB	± 4.8 dB
temperature	$\pm 1^{\circ}\text{C}$	$\pm 0.5^{\circ}\text{C}$
humidity	± 5 %	± 3.5 %
DC and low frequency voltages	± 3 %	± 0.4 %

12 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	18 November 2021
1	- Corrected AC test results designation in Section 1	07 March 2022