The Nebraska Center for Excellence in Electronics
4740 Discovery Drive
Lincoln, NE 68521
Phone: 402.323.6233
Fax: 402.323.6238
www.nceelabs.com

FCC/IC Test Report

Prepared for:	**Digital Monitoring Products**
Address:	**2500 North Partnership Blvd. Springfield, MO 6582**
Product:	**1136 Wireless Doorbell Module**
FCC ID: **IC:**	**CCKPC0193** **5251A-PC0193**
Test Report No:	**R20170718-26**
Approved By:	**Nic S. Johnson, NCE** **Technical Manager** **iNARTE Certified EMC Engineer #EMC-003337-NE**
DATE:	**31 August 2017**
Total Pages:	**44**

ACCREDITED
TESTING LABORATORY
CERTIFICATE NO. 1953.01

Table of Figures

Figure Number **Page**

Table Number **Page**

1.0 Summary of test results

1.1 Test Results

The EUT has been tested according to the following specifications:

SUMMARY			
Standard Section	**Test Type and Limit**	**Result**	**Remark**
FCC 15.203	Unique Antenna Requirement	Pass	Internal Antenna
FCC 15.209 RSS-Gen, 7.1.2	Receiver Radiated Emissions	Pass	Meets the requirement of the limit.
FCC 15.247(a)(1)(i) RSS-247, 5.1c	Minimum Bandwidth, Limit: Max. <250 kHz/ 50+ channels	Pass	Meets the requirement of the limit.
FCC 15.247(b)(1) RSS-247, 5.4	Maximum Peak Output Power, Limit: Max. 30 dBm	Pass	Meets the requirement of the limit.
FCC 15.209 RSS-Gen, 8.9 RSS-247, 5.3	Transmitter Radiated Emissions	Pass	Meets the requirement of the limit.
FCC 15.247(a) (1) (i) RSS-247, 5.1c	Frequency hopping system, Limit: Max. 0.4 Seconds in 20 Second Period	Pass	Meets the requirement of the limit.
FCC 15.209, 15.205 RSS-247, 5.5 RSS-Gen, 8.9	Band Edge Measurement, Limit: 20dB less than the peak value of fundamental frequency	Pass	Meets the requirement of the limit.
FCC 15.207 RSS-Gen, 8.8	Conducted AC Emissions	Pass	Meets the requirement of the limit.

2.0 Description

2.1 Equipment under test

The Equipment Under Test (EUT) was 1136 Wireless Remote Chime, a multi-function sounder manufactured by DMP wireless devices. It operates from 905 to 925 MHz and has transmit and receive capabilities.

EUT Received Date: 11 August 2017
EUT Tested Dates: 11 August 2017 – 25 August 2017

MODEL	1136
Serial No.	NCEETEST1 (assigned); 15240878(used for duty cycle measurements)
POWER SUPPLY	120VAC / 60Hz
ANTENNA TYPE	Antenna is not user replaceable

NOTE: For more detailed features description, please refer to the manufacturer's specifications or user's manual.

2.2 Laboratory description

All testing was performed at the following Facility:

The Nebraska Center for Excellence in Electronics (NCEE Labs)
4740 Discovery Drive
Lincoln, NE 68521

A2LA Certificate Number :	1953.01
FCC Accredited Test Site Designation No:	US1060
Industry Canada Test Site Registration No:	4294A-1
NCC CAB Identification No:	US0177

Environmental conditions varied slightly throughout the tests:
Relative humidity of 32 ± 4%
Temperature of 22 ± 3° Celsius

2.3 Description of test modes

The EUT operates on, and was tested at the frequencies below:

Channel	Frequency
Low	905.6
Middle	915.0
High	924.4

These are the only three representative channels tested in the frequency range according to FCC Part 15.31 and RSS-Gen Table A1. See the operational description for a list of all channel frequency and designations.

2.4 Applied standards

The EUT is a frequency hopping device operating in the 905 MHz to 924 MHz amateur band. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C; 15.209 and 15.247
Industry Canada, RSS-247, Issue 2
Industry Canada, RSS-Gen, Issue 4
ANSI C63.10:2013

All test items have been performed and recorded as per the above.

2.5 Description of support units

None

2.6 Configuration of system under test

This EUT was set to transmit in a worse-case scenario with modulation on. The manufacturer modified the unit to transmit continuously on the lowest, highest and one channel in the middle.

3.0 Test equipment used

DESCRIPTION AND MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CALIBRATION DATE	CALIBRATION DUE DATE
Rohde & Schwarz Test Receiver	ES126	100037	24 Jan 2017	24 Jan 2018
EMCO Biconilog Antenna	3141	1212	26 Jan 2017	26 Jan 2018
EMCO Horn Antenna	3115	6416	25 Jan 2016	25 Jan 2018
Rohde & Schwarz Preamplifier	TS-PR18	3545700803	9 Feb 2017*	9 Feb 2018*
Trilithic High Pass Filter	6HC330	23042	9 Feb 2017*	9 Feb 2018*
Mini Circuits 1700 – 5000Mhz High Pass Filter***	15542	31618	9 Feb 2017*	9 Feb 2018*
Rohde & Schwarz LISN	ESH3-Z5	100023	23 Jan 2017	23 Jan 2018
RF Cable (preamplifier to antenna)	MFR-57500	01-07-002	09 Feb 2017*	09 Feb 2018*
RF Cable (antenna to 10m chamber bulkhead)	FSCM 64639	01E3872	09 Feb 2017*	09 Feb 2018*
RF Cable (10m chamber bulkhead to control room bulkhead)	FSCM 64639	01E3874	09 Feb 2017*	09 Feb 2018*
RF Cable (Control room bulkhead to RF switch)	FSCM 64639	01E3871	09 Feb 2017*	09 Feb 2018*
RF Cable (RF switch to test receiver)	FSCM 64639	01F1206	09 Feb 2017*	09 Feb 2018*
RF switch – Rohde and Schwarz	TS-RSP	1113.5503.14	09 Feb 2017*	09 Feb 2018*
N connector bulkhead (10m chamber)	PE9128	NCEEBH1	09 Feb 2017*	09 Feb 2018*
N connector bulkhead (control room)	PE9128	NCEEBH2	09 Feb 2017*	09 Feb 2018*

*Internal Characterization

4.0 Detailed results

4.1 Unique antenna requirement

4.1.1 Standard applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

4.1.2 Antenna description

The antenna on the EUT is an antenna on the PCB so it’s not user replaceable.

4.2 Radiated emissions

Test Method: ANSI C63.10, Section(s) 6.5, 6.6

4.2.1 Limits for radiated emissions measurements

Emissions radiated outside of the specified bands shall be applied to the limits in 15.209 as followed:

FREQUENCIES (MHz)	FIELD STRENGTH (μV/m)	MEASUREMENT DISTANCE (m)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	3
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

NOTE:
1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 * log * Emission level (μV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits by more than 20dB under any condition of modulation.

4.2.2 Test procedures

a. The EUT was placed on the top of a rotating table above the ground plane in a 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. The table was 0.8m high for measurements form 30MHz-1Ghz and 1.5m for measurements from 1GHz and higher.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna was a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are used to make the measurement.

d. For each suspected emission, the EUT was arranged to maximize its emissions and then the antenna height was varied from 1 meter to 4 meters and the rotating table was turned from 0 degrees to 360 degrees to find the maximum emission reading.

e. The test-receiver system was set to use a peak detector with a specified resolution bandwidth. For spectrum analyzer measurements, the composite maximum of several analyzer sweeps was used for final measurements.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

g. The EUT was maximized in all 3 orthogonal positions.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequencies below 1GHz.

2. The resolution bandwidth 1 MHz for all measurements and at frequencies above 1GHz, A peak detector was used for all measurements above 1GHz. Measurements were made with an EMI Receiver.

4.2.3 Deviations from test standard

No deviation.

4.2.4 Test setup

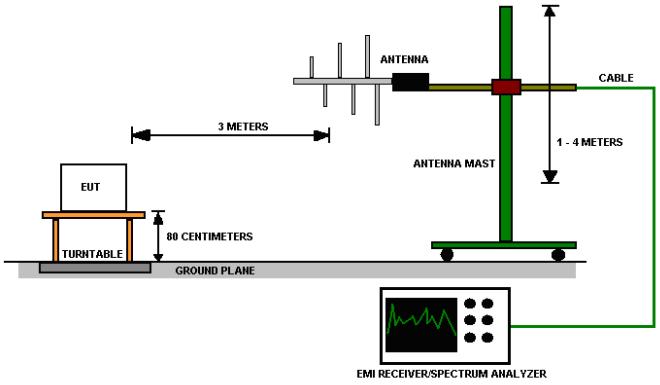


Figure 1 - Radiated Emissions Test Setup

The EUT was tested in all 3 orthogonal axis of the EUT and meet the requirements from ANS C63.10 Section 5.10.1.

4.2.5 EUT operating conditions

The EUT was powered by 120 VAC / 60Hz unless specified and set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range.

4.2.6 Test results

EUT	1136	MODE	Receive
INPUT POWER	120 VAC / 60Hz	FREQUENCY RANGE	30MHz – 10GHz
ENVIRONMENTAL CONDITIONS	32 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

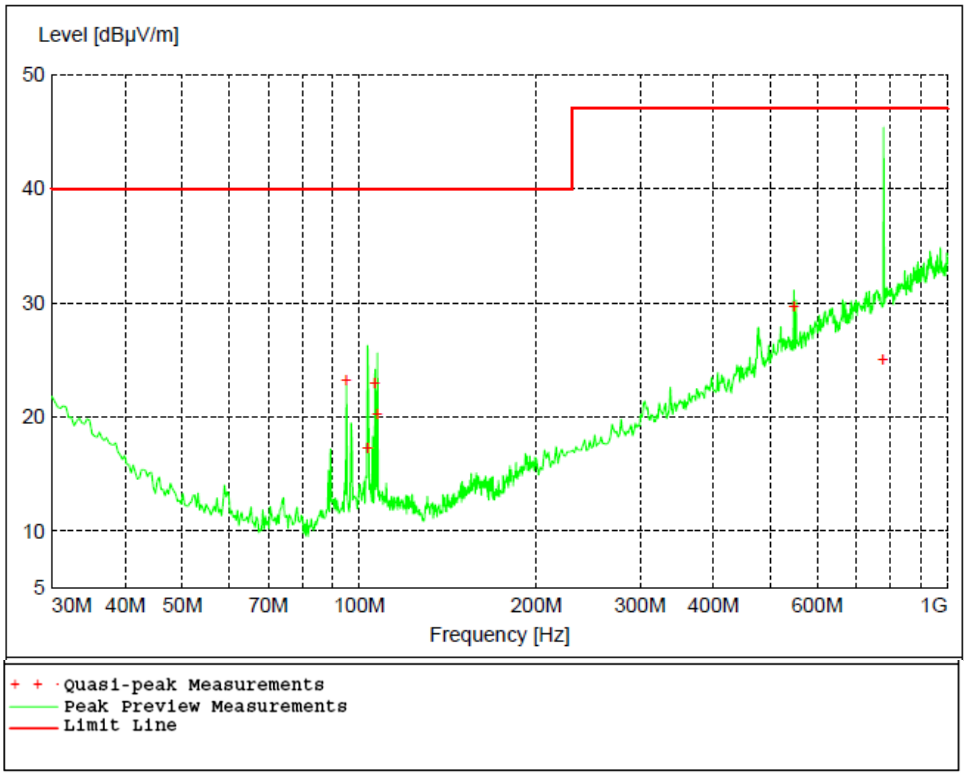


Figure 2 - Radiated Emissions Plot, Receive

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value
5. The EUT was measured in both the horizontal and vertical orientation. It was found that the Horizontal position produced the highest emissions, and this orientation was used for all testing. See Annex A for test photos.

Table 1 - Radiated Emissions Quasi-peak Measurements, Receive

Frequency	Level	Limit	Margin	Height	Angle	Pol	Axis
MHz	dBµV/m	dBµV/m	dB	cm.	deg.		
95.100000	23.20	43.50	20.30	136	300	VERT	Y
103.260000	17.34	43.50	26.20	99	78	VERT	Y
106.320000	22.96	43.50	20.60	156	0	VERT	Y
107.220000	20.24	43.50	23.30	136	141	VERT	Y
548.160000	29.69	46.00	16.30	193	359	VERT	Y
777.360000	25.08	46.00	20.90	136	360	HORI	Y

Table 2 - Radiated Emissions Peak Measurement vs Average Limits, Receive

Frequency	Level	Limit	Margin	Height	Angle	Pol	Axis
MHz	dBµV/m	dBµV/m	dB	cm.	deg.		
1825.800000	33.52	54.00	20.48	200	351	VERT	Y
2736.800000	35.62	54.00	18.38	200	292	VERT	Y
3649.000000	39.35	54.00	14.65	200	217	HORI	Y
4573.800000	40.88	54.00	13.12	200	52	VERT	Y
5475.200000	42.59	54.00	11.41	200	124	VERT	Y

Peak measurements were compared to average limit and found to be compliant so average measurements were not performed

EUT	1136	MODE	Transmit, Low Channel
INPUT POWER	120 VAC / 60Hz	FREQUENCY RANGE	30MHz – 10GHz
ENVIRONMENTAL CONDITIONS	32 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

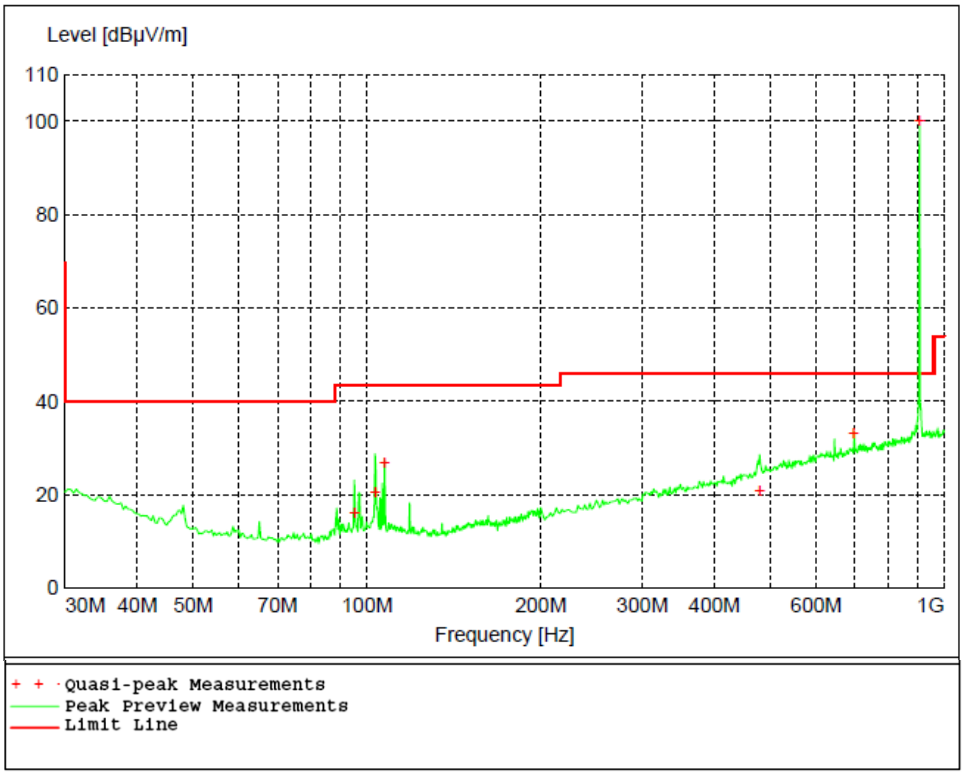


Figure 3 - Radiated Emissions Plot, Low Channel

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value
5. The EUT was measured in both the horizontal and vertical orientation. It was found that the Horizontal position produced the highest emissions, and this orientation was used for all testing. See Annex A for test photos.

Table 3 - Radiated Emissions Quasi-peak Measurements, Low Channel

Frequency	Level	Limit	Margin	Height	Angle	Pol	Axis
MHz	dBµV/m	dBµV/m	dB	cm.	deg.		
95.100000	16.10	43.50	27.40	102	58	VERT	Y
103.320000	20.74	43.50	22.80	324	154	VERT	Y
107.220000	27.01	43.50	16.50	109	212	VERT	Y
479.160000	20.95	46.00	25.10	367	95	VERT	Y
697.560000	33.23	46.00	12.80	99	275	VERT	Y
905.60000	100.18	NA	NA	136	131	VERT	Y

Table 4 - Radiated Emissions Average Measurements, Low Channel

Frequency	Level	Limit	Margin	Height	Angle	Pol	Axis
MHz	dBµV/m	dBµV/m	dB	cm.	deg.		
1811.200000	42.50	54.00	11.50	143	33	HORI	Y
2716.800000	28.91	54.00	25.09	204	0	VERT	Y
3622.200000	33.38	54.00	20.62	217	12	VERT	Y
5433.600000	48.49	54.00	5.51	173	82	VERT	Y
6339.000000	35.49	54.00	18.51	261	99	VERT	Y
7244.600000	44.98	54.00	9.02	101	86	VERT	Y
8150.200000	35.30	54.00	18.70	134	199	VERT	Y
9055.600000	39.05	54.00	14.95	98	84	VERT	Y
9961.600000	32.50	54.00	21.50	163	195	VERT	Y

Note: Average Level = Peak Level – Duty Cycle Correction Factor
Duty Cycle Correction Factor is calculated in Figures 6 and 7. 18.4 dB was used.

Table 5 - Radiated Emissions Peak Measurements, Low Channel

Frequency	Level	Limit	Margin	Height	Angle	Pol	Axis
MHz	dBµV/m	dBµV/m	dB	cm.	deg.		
1811.200000	60.90	74.00	13.10	143	33	HORI	Y
2716.800000	47.31	74.00	26.69	204	0	VERT	Y
3622.200000	51.78	74.00	22.22	217	12	VERT	Y
5433.600000	66.89	74.00	7.11	173	82	VERT	Y
6339.000000	53.89	74.00	20.11	261	99	VERT	Y
7244.600000	63.38	74.00	10.62	101	86	VERT	Y
8150.200000	53.70	74.00	20.30	134	199	VERT	Y
9055.600000	57.45	74.00	16.55	98	84	VERT	Y
9961.600000	50.90	74.00	23.10	163	195	VERT	Y

EUT	1136	MODE	Transmit, Mid Channel
INPUT POWER	120 VAC / 60Hz	FREQUENCY RANGE	30MHz – 10GHz
ENVIRONMENTAL CONDITIONS	32 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

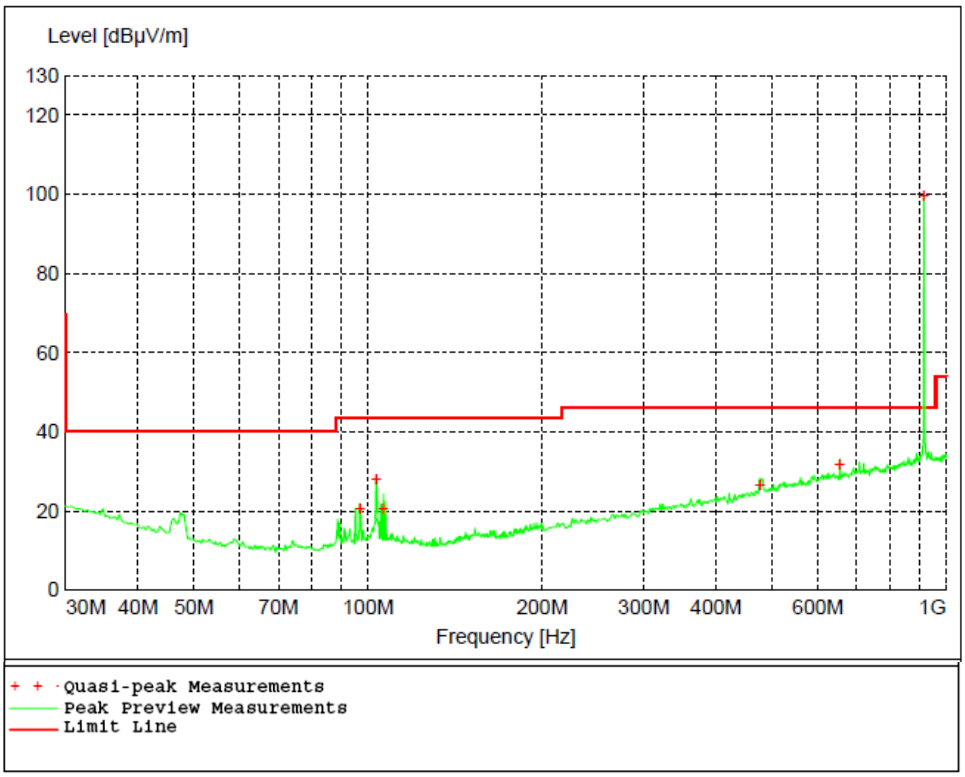


Figure 4 - Radiated Emissions Plot, Mid Channel

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. The EUT was measured in both the horizontal and vertical orientation. It was found that the Horizontal position produced the highest emissions, and this orientation was used for all testing. See Annex A for test photos.

Table 6 - Radiated Emissions Quasi-peak Measurements, Mid Channel

Frequency	Level	Limit	Margin	Height	Angle	Pol	Axis
MHz	dBµV/m	dBµV/m	dB	cm.	deg.		
96.840000	20.65	43.50	22.90	103	60	VERT	Y
103.320000	28.16	43.50	15.40	99	155	VERT	Y
106.320000	20.74	43.50	22.80	154	197	VERT	Y
476.280000	26.66	46.00	19.30	216	17	VERT	Y
654.960000	31.73	46.00	14.30	101	189	VERT	Y
915.000000	99.85	NA	NA	126	133	VERT	Y

The EUT was maximized in all 3 orthogonal axis. The worst-case is shown in the table above.

Table 7 - Radiated Emissions Average Measurements, Mid Channel

Frequency	Level	Limit	Margin	Height	Angle	Pol	Axis
MHz	dBµV/m	dBµV/m	dB	cm.	deg.		
1830.000000	42.86	54.00	11.14	146	35	HORI	Y
2745.000000	30.06	54.00	23.94	177	11	VERT	Y
3660.000000	36.33	54.00	17.67	190	360	VERT	Y
4575.000000	30.18	54.00	23.82	164	63	HORI	Y
5490.000000	47.57	54.00	6.43	167	68	VERT	Y
6405.000000	37.45	54.00	16.55	216	81	VERT	Y
7320.000000	44.98	54.00	9.02	99	172	VERT	Y
8234.800000	36.65	54.00	17.35	257	174	VERT	Y
9150.000000	43.20	54.00	10.80	137	78	VERT	Y

The EUT was maximized in all 3 orthogonal axis. The worst-case is shown in the table above.
Note: Average Level = Peak Level – Duty Cycle Correction Factor
Duty Cycle Correction Factor is calculated in Figures 6 and 7. 18.4 dB was used.

Table 8 - Radiated Emissions Peak Measurements, Mid Channel

Frequency	Level	Limit	Margin	Height	Angle	Pol	Axis
MHz	dBµV/m	dBµV/m	dB	cm.	deg.		
1830.000000	61.26	74.00	12.74	146	35	HORI	Y
2745.000000	48.46	74.00	25.54	177	11	VERT	Y
3660.000000	54.73	74.00	19.27	190	360	VERT	Y
4575.000000	48.58	74.00	25.42	164	63	HORI	Y
5490.000000	65.97	74.00	8.03	167	68	VERT	Y
6405.000000	55.85	74.00	18.15	216	81	VERT	Y
7320.000000	63.38	74.00	10.62	99	172	VERT	Y
8234.800000	55.05	74.00	18.95	257	174	VERT	Y
9150.000000	61.60	74.00	12.40	137	78	VERT	Y

The EUT was maximized in all 3 orthogonal axis. The worst-case is shown in the table above.

EUT	1136	MODE	Transmit, High Channel
INPUT POWER	120 VAC / 60Hz	FREQUENCY RANGE	30MHz – 10GHz
ENVIRONMENTAL CONDITIONS	32 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

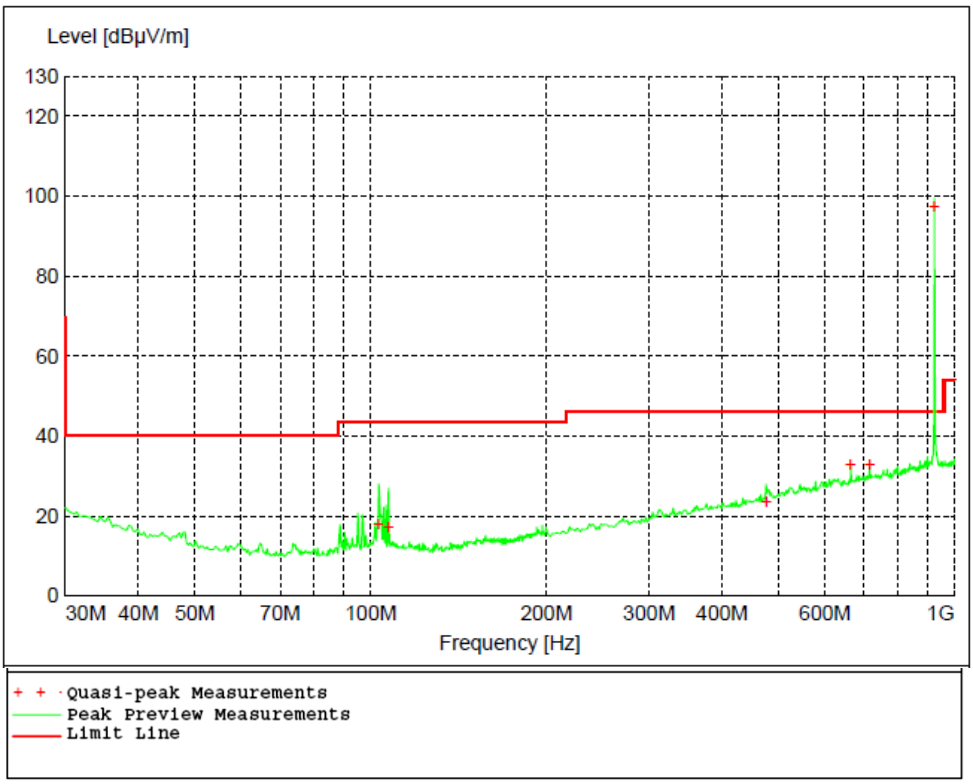


Figure 5 - Radiated Emissions Plot, High Channel

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. The EUT was measured in both the horizontal and vertical orientation. It was found that the Horizontal position produced the highest emissions, and this orientation was used for all testing. See Annex A for test photos.

Table 9 - Radiated Emissions Quasi-peak Measurements, High Channel

Frequency	Level	Limit	Margin	Height	Angle	Pol	Axis
MHz	dBµV/m	dBµV/m	dB	cm.	deg.		
103.260000	18.24	43.50	25.30	388	339	VERT	Y
107.340000	17.28	43.50	26.20	388	200	VERT	Y
476.280000	23.59	46.00	22.40	364	284	VERT	Y
664.380000	32.84	46.00	13.20	109	170	VERT	Y
716.400000	33.02	46.00	13.00	100	213	VERT	Y
924.400000	97.51	NA	NA	100	339	VERT	Y

The EUT was maximized in all 3 orthogonal axis. The worst-case is shown in the table above.

Table 10 - Radiated Emissions Average Measurements, High Channel

Frequency	Level	Limit	Margin	Height	Angle	Pol	Axis
MHz	dBµV/m	dBµV/m	dB	cm.	deg.		
1848.800000	42.06	54.00	11.94	146	33	HORI	Y
2773.200000	28.91	54.00	25.09	129	18	VERT	Y
3697.800000	35.45	54.00	18.55	197	8	VERT	Y
4622.000000	28.95	54.00	25.05	98	56	HORI	Y
5546.200000	45.24	54.00	8.76	167	68	VERT	Y
6471.000000	38.11	54.00	15.89	295	89	VERT	Y
7395.400000	47.10	54.00	6.90	123	174	VERT	Y
8319.400000	36.02	54.00	17.98	244	173	VERT	Y
9244.200000	42.28	54.00	11.72	129	79	VERT	Y

The EUT was maximized in all 3 orthogonal axis. The worst-case is shown in the table above.

Note: Average Level = Peak Level – Duty Cycle Correction Factor
Duty Cycle Correction Factor is calculated in Figures 6 and 7. 18.4 dB was used.

Table 11 - Radiated Emissions Peak Measurements, High Channel

Frequency	Level	Limit	Margin	Height	Angle	Pol	Axis
MHz	dBµV/m	dBµV/m	dB	cm.	deg.		
1848.800000	60.46	74.00	13.54	146	33	HORI	Y
2773.200000	47.31	74.00	26.69	129	18	VERT	Y
3697.800000	53.85	74.00	20.15	197	8	VERT	Y
4622.000000	47.35	74.00	26.65	98	56	HORI	Y
5546.200000	63.64	74.00	10.36	167	68	VERT	Y
6471.000000	56.51	74.00	17.49	295	89	VERT	Y
7395.400000	65.50	74.00	8.50	123	174	VERT	Y
8319.400000	54.42	74.00	19.58	244	173	VERT	Y
9244.200000	60.68	74.00	13.32	129	79	VERT	Y

The EUT was maximized in all 3 orthogonal axis. The worst-case is shown in the table above.

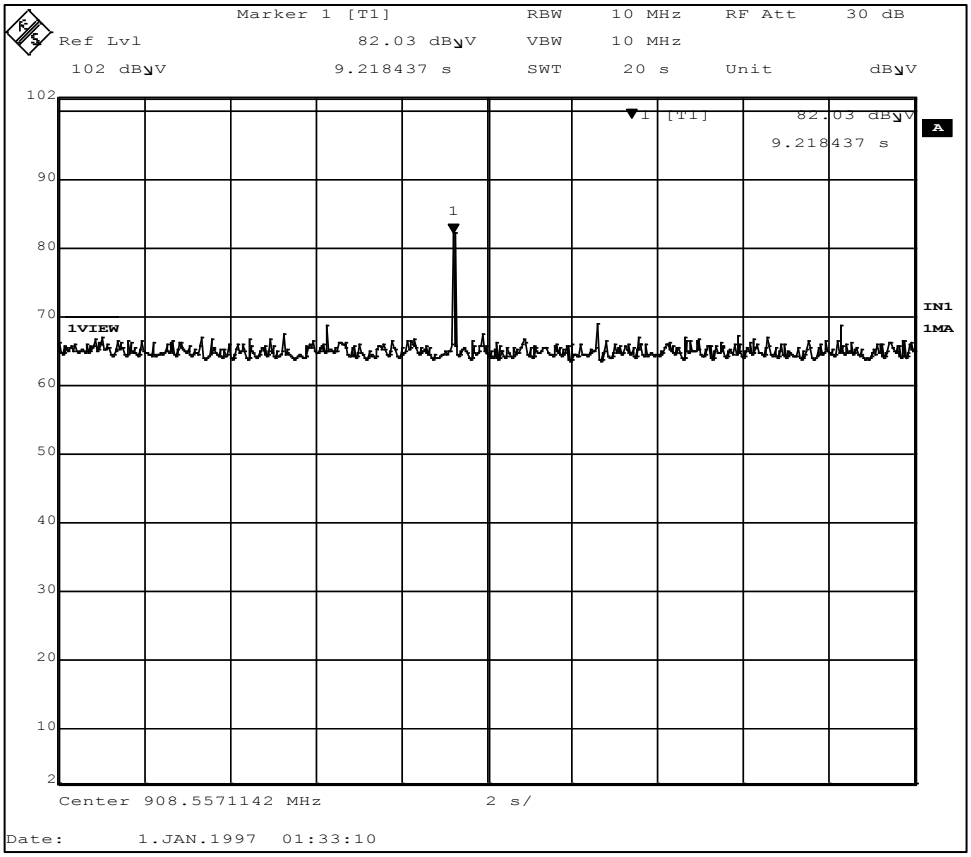


Figure 6 – Period

A maximum of 1 pulse can occur in any 100 ms window

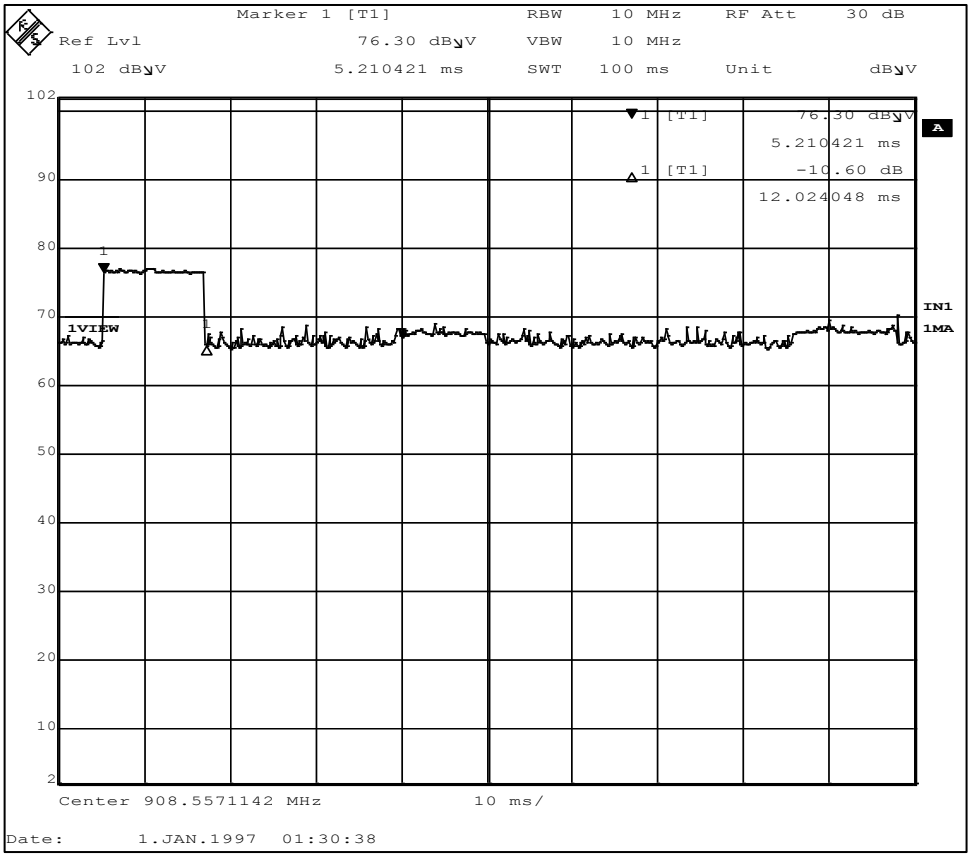


Figure 7 – Maximum Pulse Width

Duty cycle correction factor = 20*log(12.02/100) = -18.40 dB

Note 1: 100ms is the longest allowed period per FCC Part 15.35

Note 2: There was only one 12.02 ms pulses per 100ms period.

4.3 Bandwidth and Peak EIRP

Test Method: ANSI C63.10, Section(s) 7.8.5, 6.9.2

4.3.1 Limits of bandwidth measurements

From FCC Part 15.247 (1) (i) and RSS-247 5.1(c)

The 20 dB occupied bandwidth and peak EIRP are displayed separately. The peak EIRP was measured using a 10 MHz RBW. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz. The output power is required to be less than 30 dBm for systems employing more than 50 channels. EIRP was calculated from field strength measurements using ANSI C63.10:2013, Section 9.5, Equation (22).

4.3.2 Test procedures

All measurements were taken at a distance of 3m from the EUT. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 3 kHz RBW and 10 kHz VBW.

The 20dB band width is defined as the bandwidth that is measured 20 dB down from the peak of the signal.

The maximum power was measured with the largest resolution bandwidth possible (10MHz) and this value was recorded.

4.3.3 Deviations from test standard

No deviation.

4.3.4 Test setup

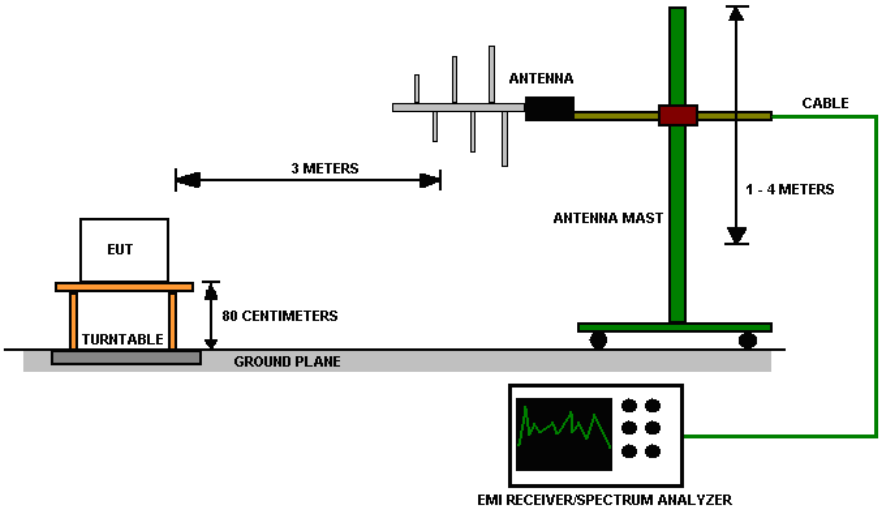


Figure 8 - Bandwidth Measurements Test Setup

4.3.5 EUT operating conditions

The EUT was powered by 120 VAC / 60Hz unless specified and set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range.

4.3.6 Test results

EUT MODULE	1136	MODE	Transmit
INPUT POWER	120 VAC / 60Hz	FREQUENCY RANGE	905.6 MHz – 924.4 MHz
ENVIRONMENTAL CONDITIONS	32 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

20 dB Bandwidth

CHANNEL	CHANNEL FREQUENCY (MHz)	20dB BW (kHz)
1	905.6	10.49
2	915.0	10.34
3	924.4	10.24

*The measurements were conducted at 3 kHz RBW and 10 kHz VBW.

REMARKS:
None

Peak EIRP

CHANNEL	CHANNEL FREQUENCY (MHz)	EIRP PEAK POWER OUTPUT (dBm)	EIRP LIMIT (dBm)	RESULT
1	905.6	5.73	30	PASS
2	915.0	5.59	30	PASS
3	924.4	4.04	30	PASS

EIRP was calculated from field strength measurements using ANSI C63.10:2013, Section 9.5, Equation (22).

All measurements were taken from the Output Power screen captures.

REMARKS:
None

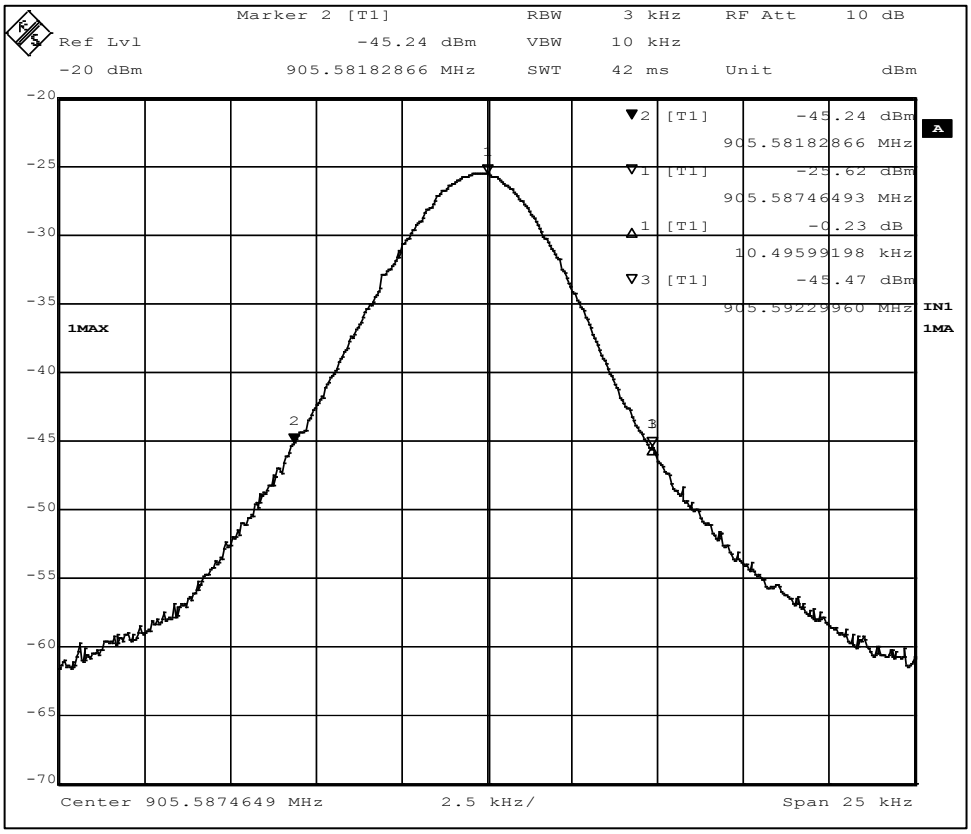


Figure 9 – 20 dB Bandwidth, Low Channel. 10.49 kHz

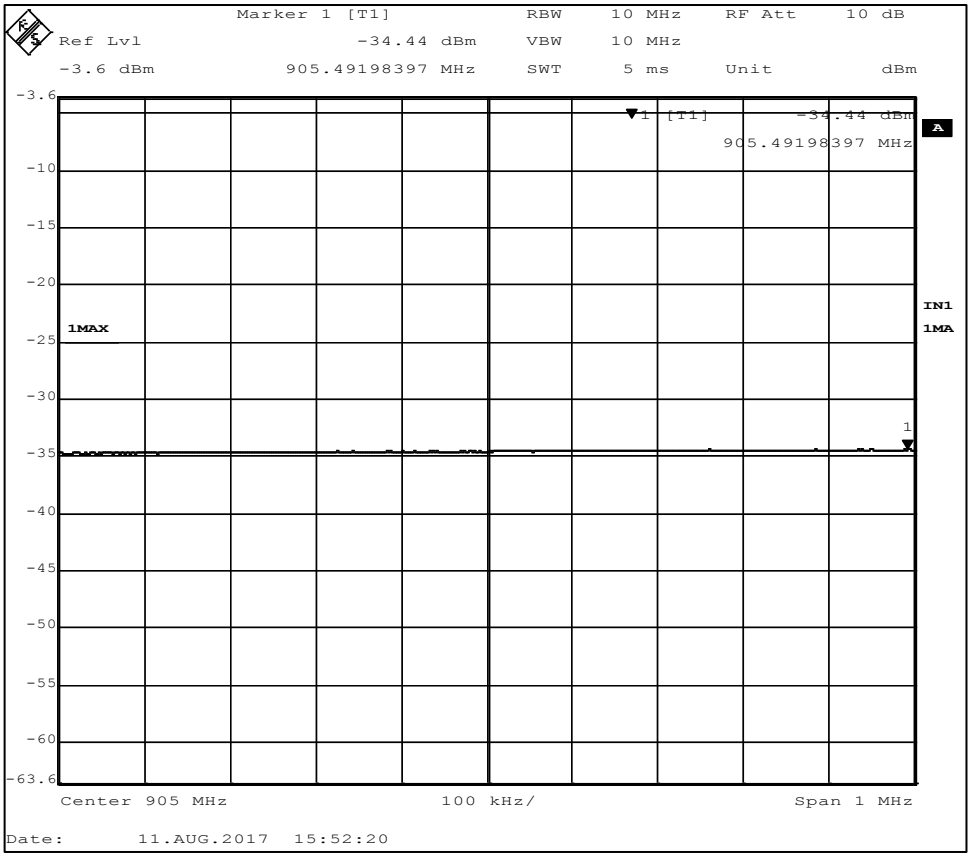


Figure 10 – Output Power, Low Channel.

Maximum power = -34.44 dBm + 107 + CL + AF - 95.23 = 5.73 dBm*
CL = cable loss = 4.70 dB
AF = antenna factor = 23.70 dB
107 = conversion from dBm to dBµV on a 50Ω measurement system
-95.23 = Conversion from field strength (dBµV/m) to EIRP (dBm) at a 3m measurement distance.

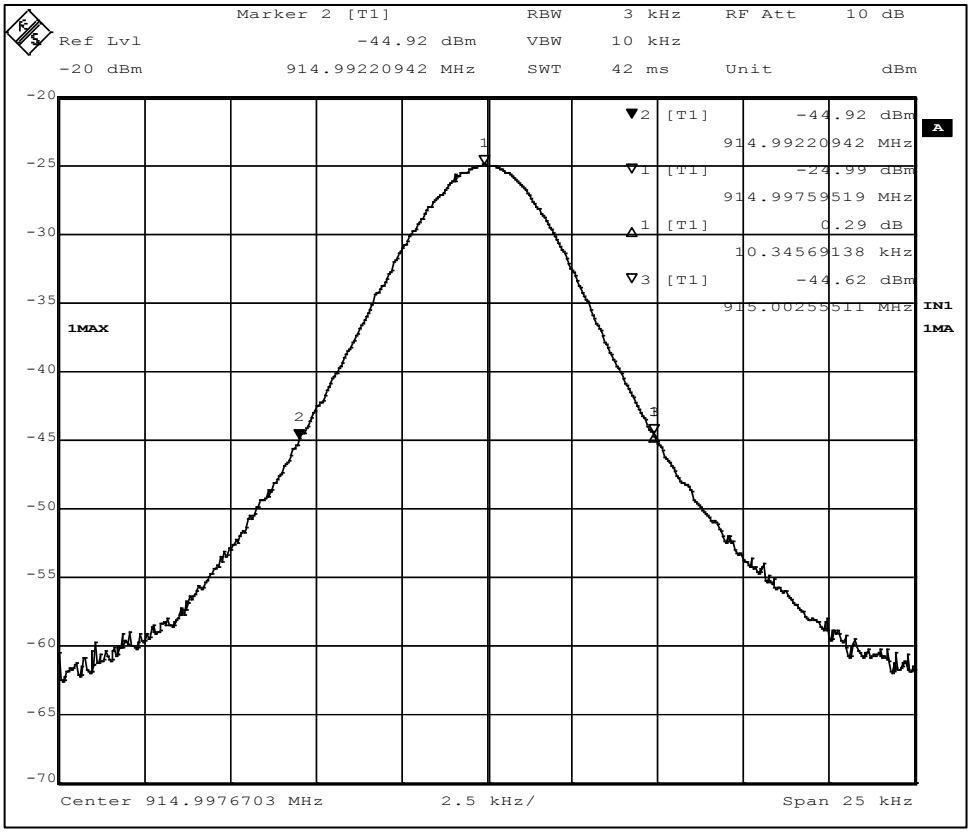


Figure 11 – 20 dB Bandwidth, Mid Channel, 10.34 kHz

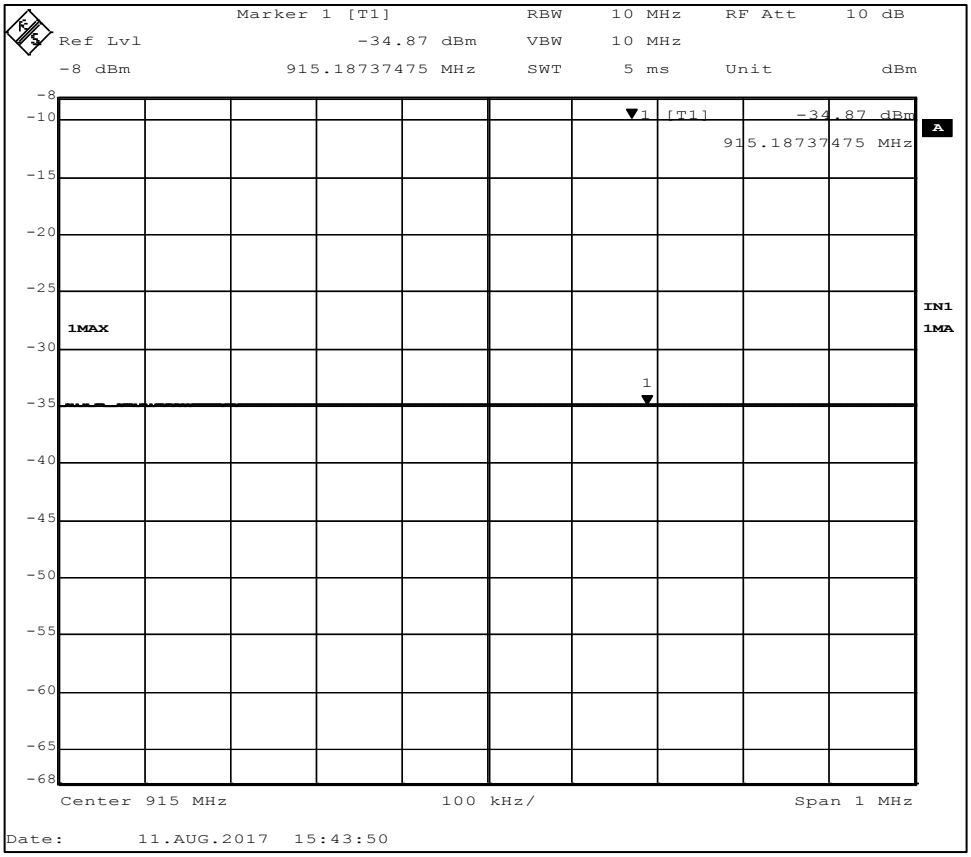


Figure 12 – Output Power, Mid Channel

Maximum power = -34.78 dBm + 107 + CL + AF - 95.23 = 5.59 dBm*
CL = cable loss = 4.80 dB
AF = antenna factor = 23.80 dB
107 = conversion from dBm to dBµV on a 50Ω measurement system
-95.23 = Conversion from field strength (dBµV/m) to EIRP (dBm) at a 3m measurement distance.

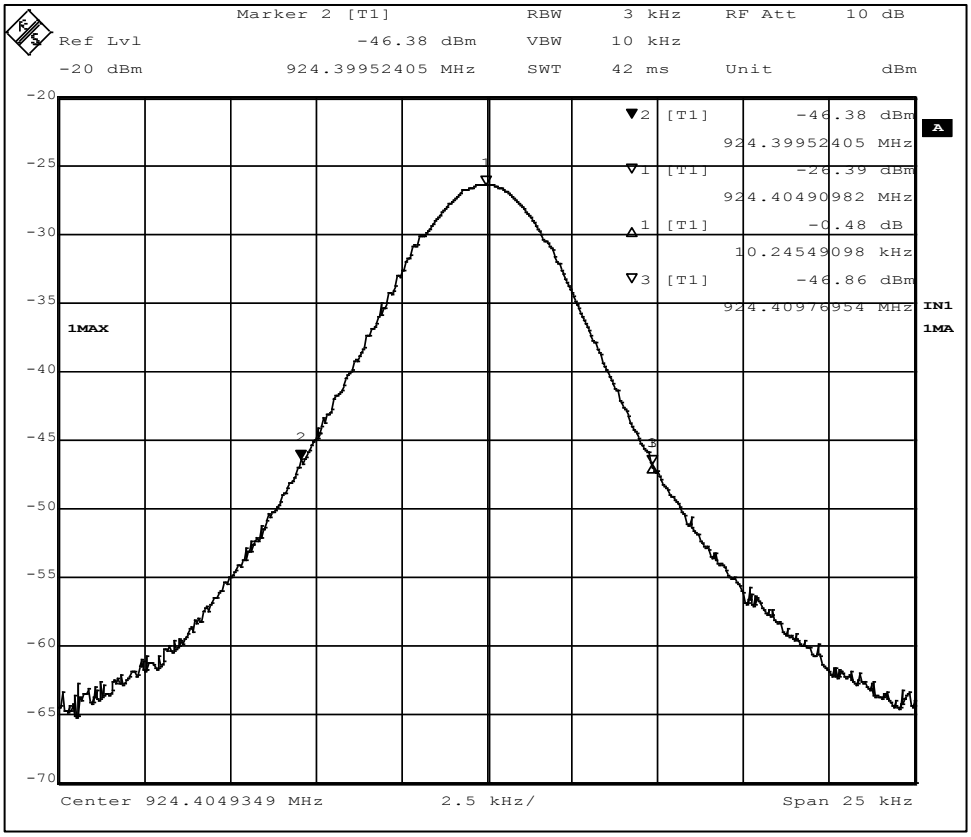


Figure 13 – 20 dB Bandwidth, High Channel, 10.24 kHz

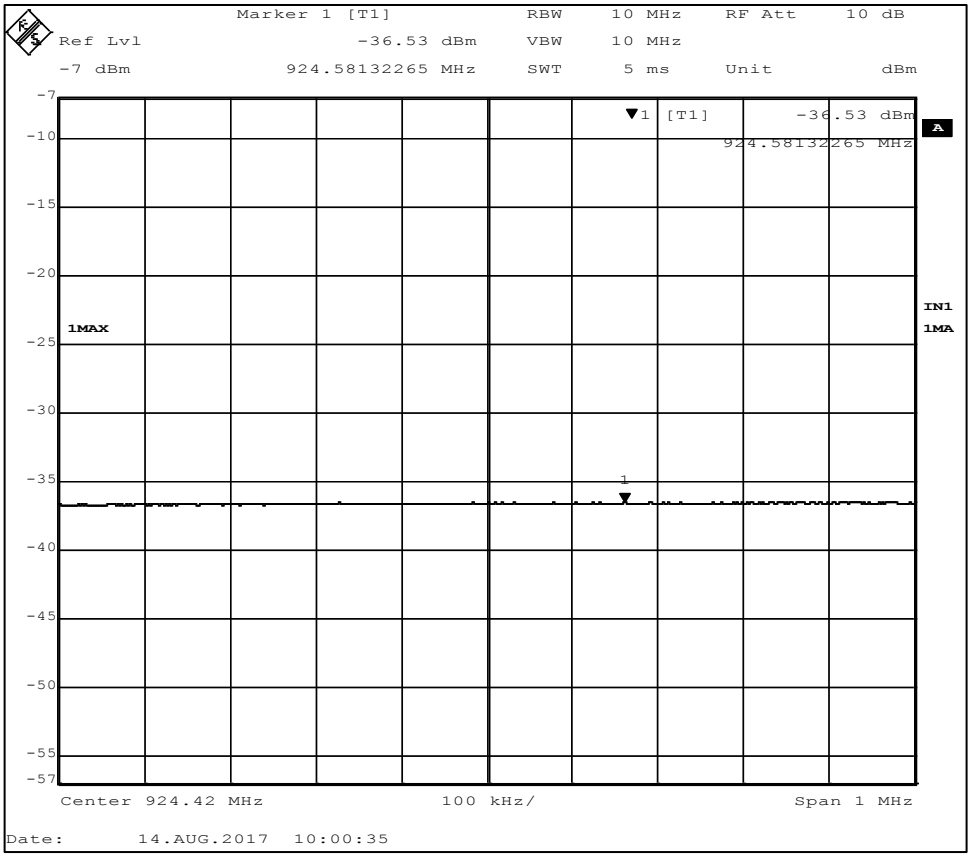


Figure 14 – Output Power, High Channel

Maximum power = -36.53 dBm + 107 + CL + AF - 95.23 = 4.04 dBm*
CL = cable loss = 4.90 dB
AF = antenna factor = 23.90 dB
107 = conversion from dBm to dBµV on a 50Ω measurement system
-95.23 = Conversion from field strength (dBµV/m) to EIRP (dBm) at a 3m measurement distance.

4.4 Bandedges

Test Method: ANSI C63.10, Section(s) 6.10.4

4.4.1 Limits of bandedge measurements

For emissions outside of the allowed band of operation (905.6 MHz – 924.4 MHz), the emission level needs to be 20dB under the maximum fundamental field strength. However, if the emissions fall within one of the restricted bands from 15.205 the field strength levels need to be under that of the limits in 15.209.

4.4.2 Test procedures

The EUT was tested in the same method as described in section *4.3 - Bandwidth*. The EUT was oriented as to produce the maximum emission levels. The resolution bandwidth was set to 30kHz and the EMI receiver was used to scan from the bandedge to the fundamental frequency with a quasi-peak detector. The highest emissions level beyond the bandedge was measured and recorded. All band edge measurements were evaluated to the general limits in Part 15.209.

4.4.3 Deviations from test standard

No deviation.

4.4.4 Test setup

See Section 4.3

4.4.5 EUT operating conditions

The EUT was powered by 120 VAC / 60Hz unless specified and set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range.

4.4.6 Test results

EUT	1136	MODE	Transmit
INPUT POWER	120 VAC / 60 Hz	FREQUENCY RANGE	905.6 MHz – 924.4 MHz
ENVIRONMENTAL CONDITIONS	32 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

Highest Out of Band Emissions

CHANNEL	Band edge Measurement Frequency (MHz)	Relative Highest out of band level dBm	Relative Fundamental Level (dBm)	Delta	Min (dBc)	Result
1	902	-86.70	-34.75	51.95	46.18	PASS
3	928	-85.51	-37.13	48.38	43.51	PASS

*Minimum delta = [highest fundamental peak field strength from Section 4.2] – [Part 15.209 radiated emissions limit.]

From Section 4.2

Fundamental average field strength at 905MHz for low channel = 100.18 dBµV/m
Fundamental average field strength at 924MHz for high channel = 97.51 dBµV/m

Channel 1 minimum delta = 100.18 - 54.0 dBµV/m = 46.18 dBc
Channel 3 minimum delta = 97.51 - 54.0 dBµV/m = 43.51 dBc

Measurements do not include correction factors and are intended to be relative measurements only.

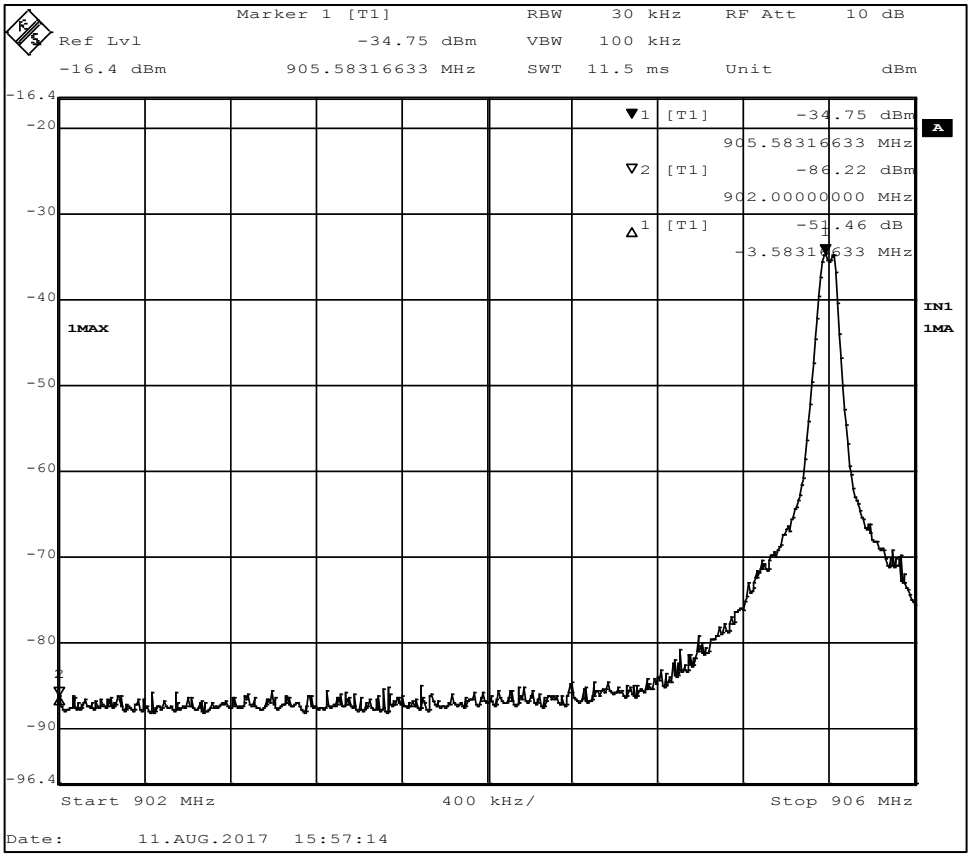


Figure 15 - Band-edge Measurement, Low Channel, Fundamental

The plot shows an uncorrected measurement, used for relative measurements only.

Delta = 51.46 dB Min = 20 dB

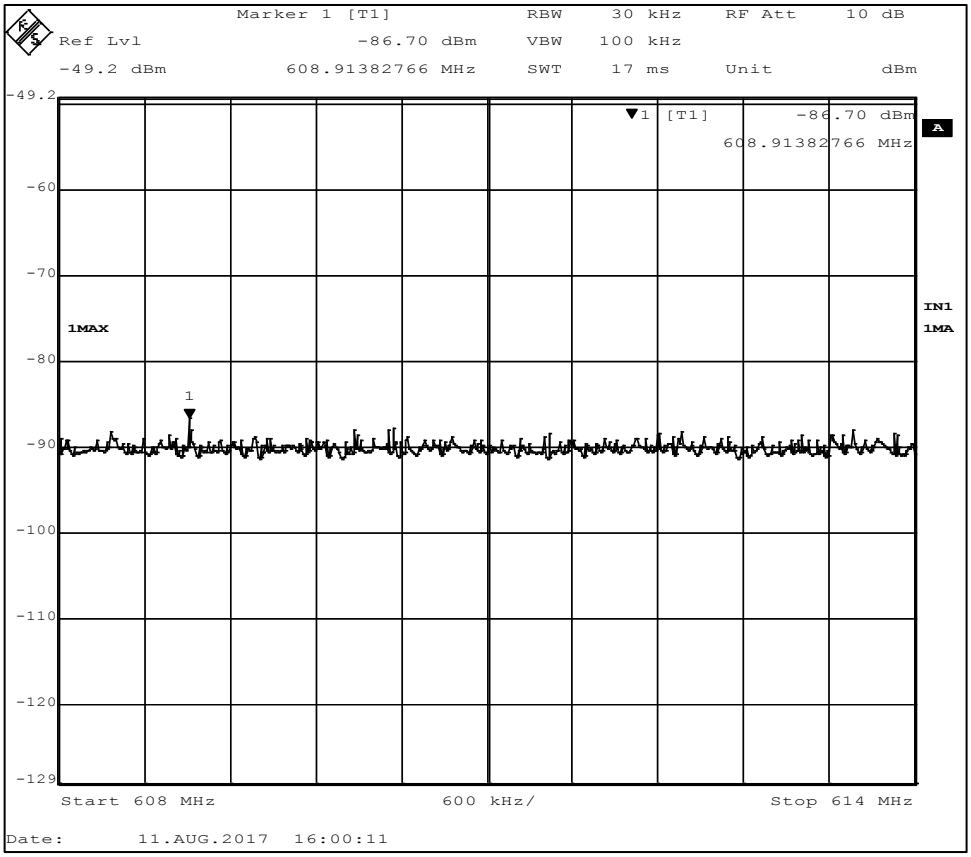


Figure 16 - Band-edge Measurement, Low Channel, Restricted

The plot shows an uncorrected measurement, used for relative measurements only.

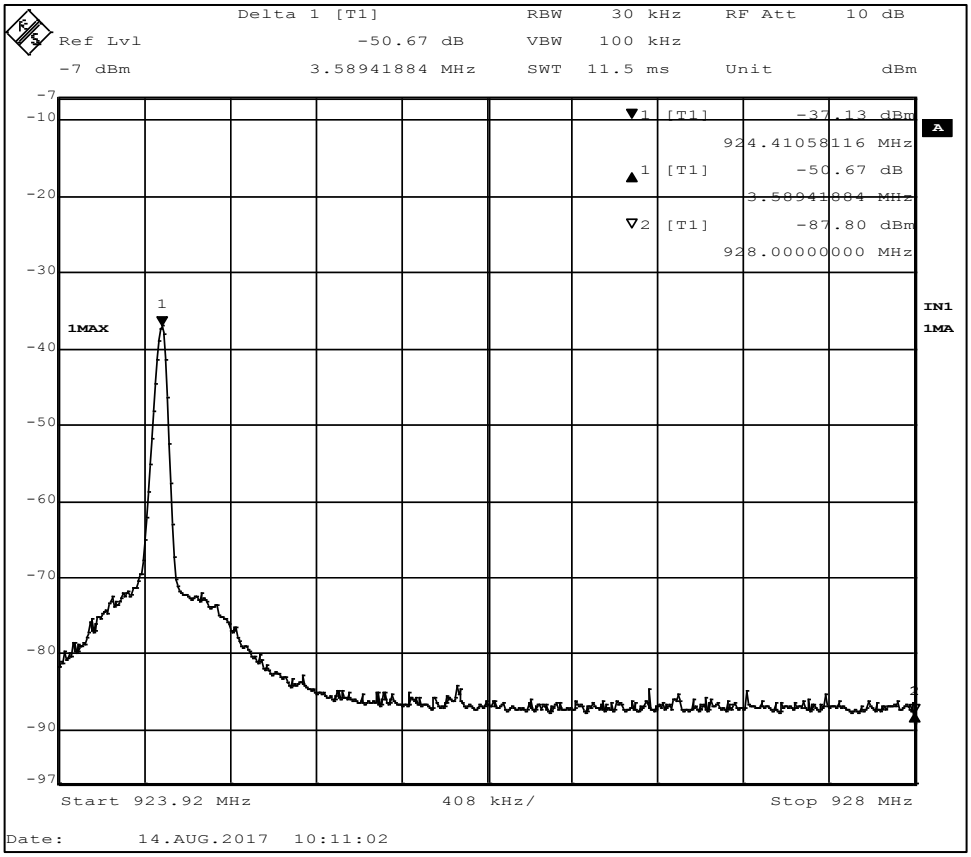


Figure 17 - Band-edge Measurement, High Channel, Fundamental

The plot shows an uncorrected measurement, used for relative measurements only.

Delta = 50.67 dB Min = 20 dB

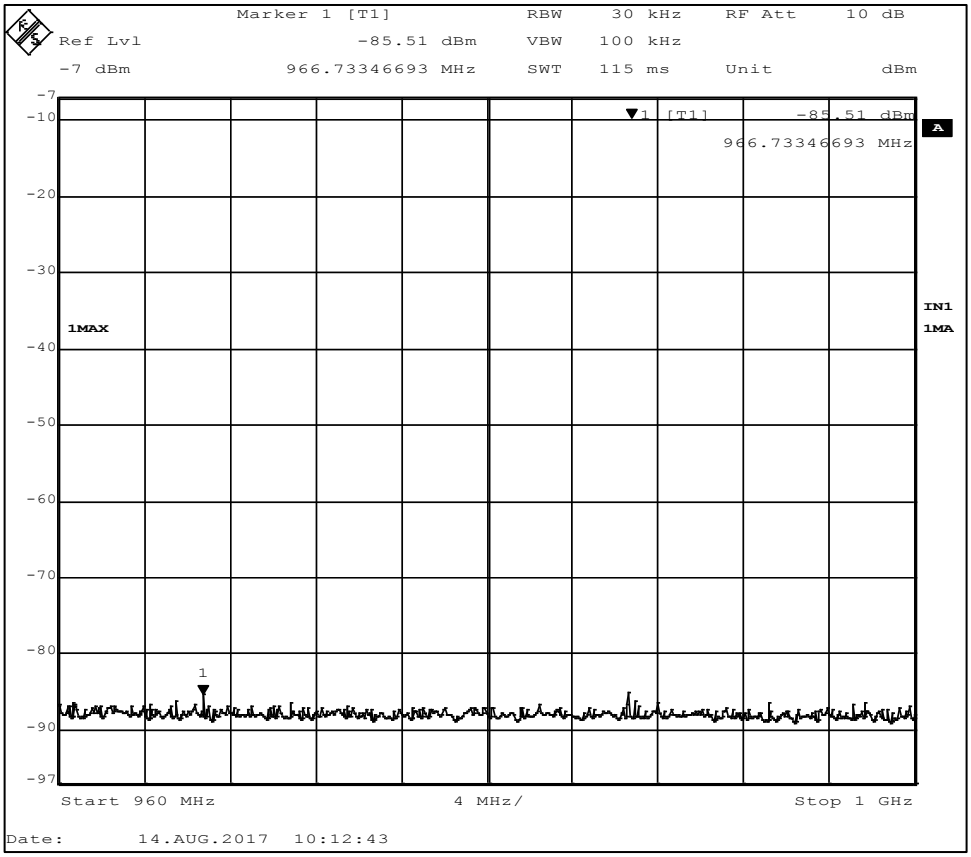


Figure 18 - Band-edge Measurement, High Channel, Restricted

The plot shows an uncorrected measurement, used for relative measurements only.

4.5 Carrier frequency separation, Number of hopping channels, Time of Occupancy

4.5.1 Limits for Time of Occupancy

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.

4.5.2 Test procedures

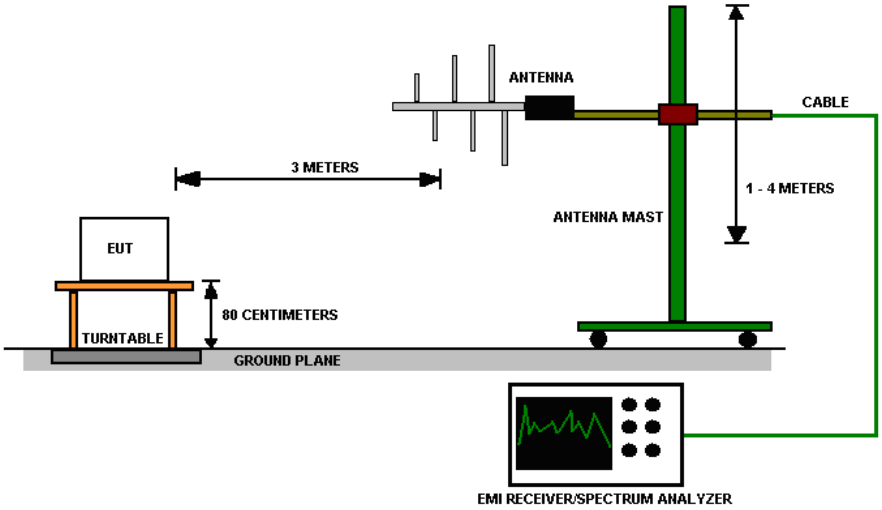
The method from FCC DA 00-705 was used.

All measurements were taken at a distance of 3m from the EUT.

4.5.3 Deviations from test standard

No deviation.

4.5.4 Test setup



4.5.5 EUT operating conditions

The EUT was powered by 120 VAC / 60Hz unless specified and set to continuously Hop on all the channels.

4.5.6 Test results

EUT	1136	MODE	Continuous Hop
INPUT POWER	120 VAC / 60 Hz	FREQUENCY RANGE	905.6 MHz – 924.4 MHz
ENVIRONMENTAL CONDITIONS	32 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

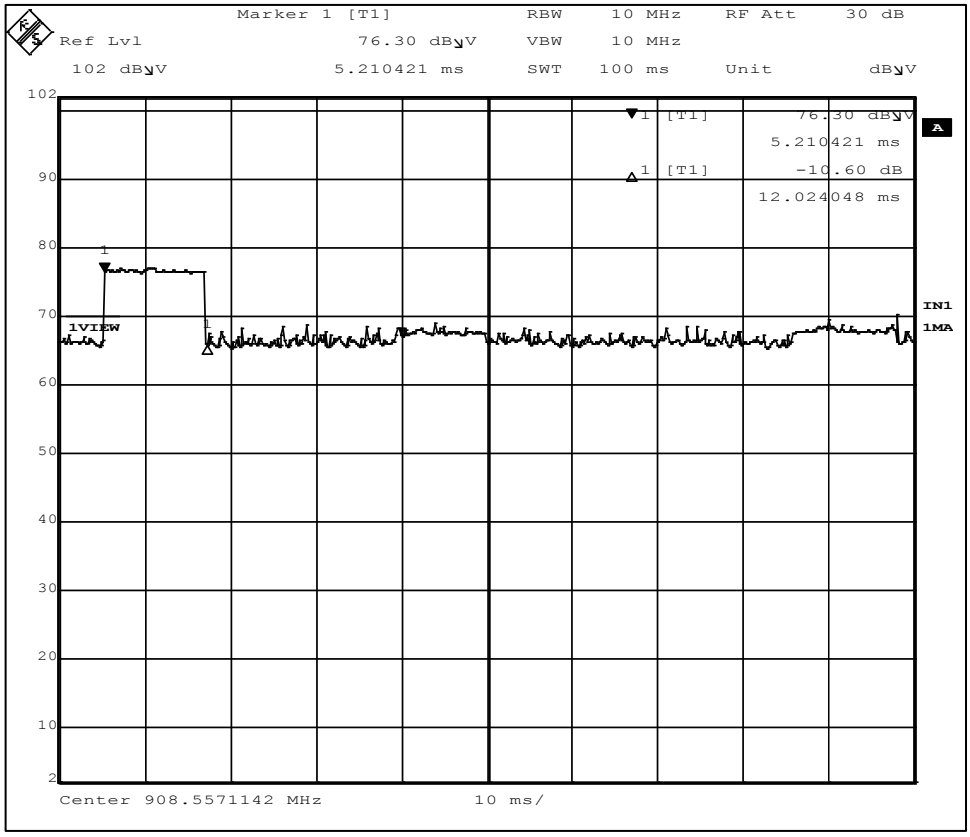


Figure 19 – Time of Occupancy (12.02 ms per Hop - Pass)

Max = 0.4 sec in 10 sec window

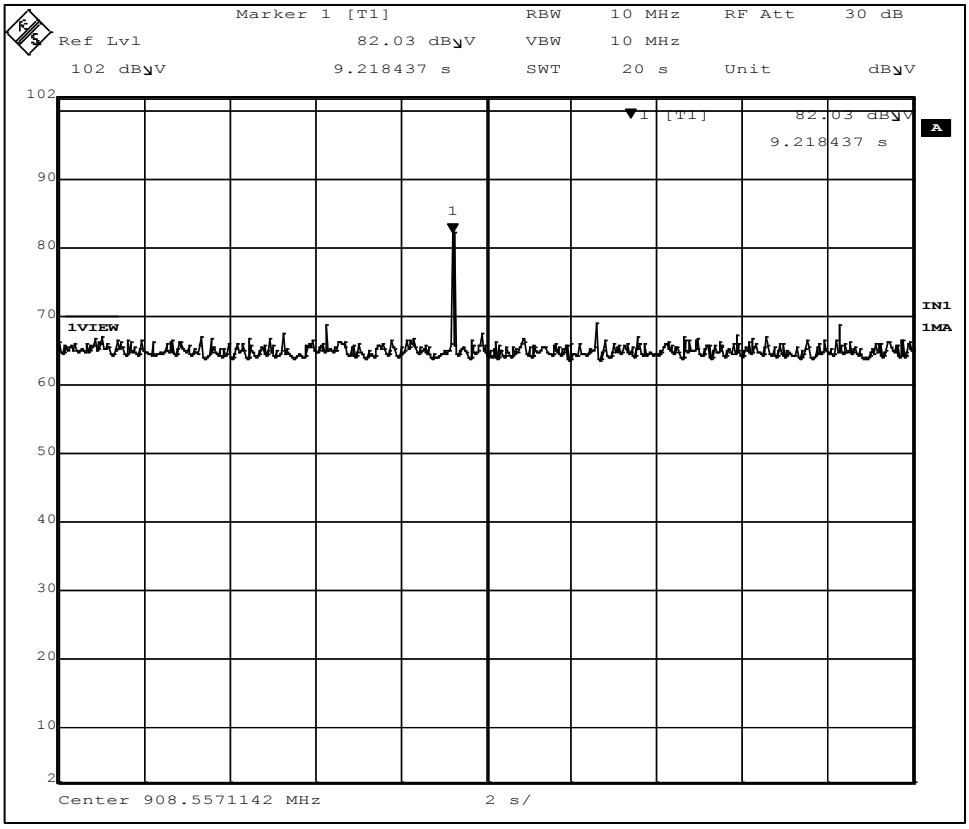


Figure 20 – Time of Occupancy - Period (Max – 1 peak in 20 seconds window)

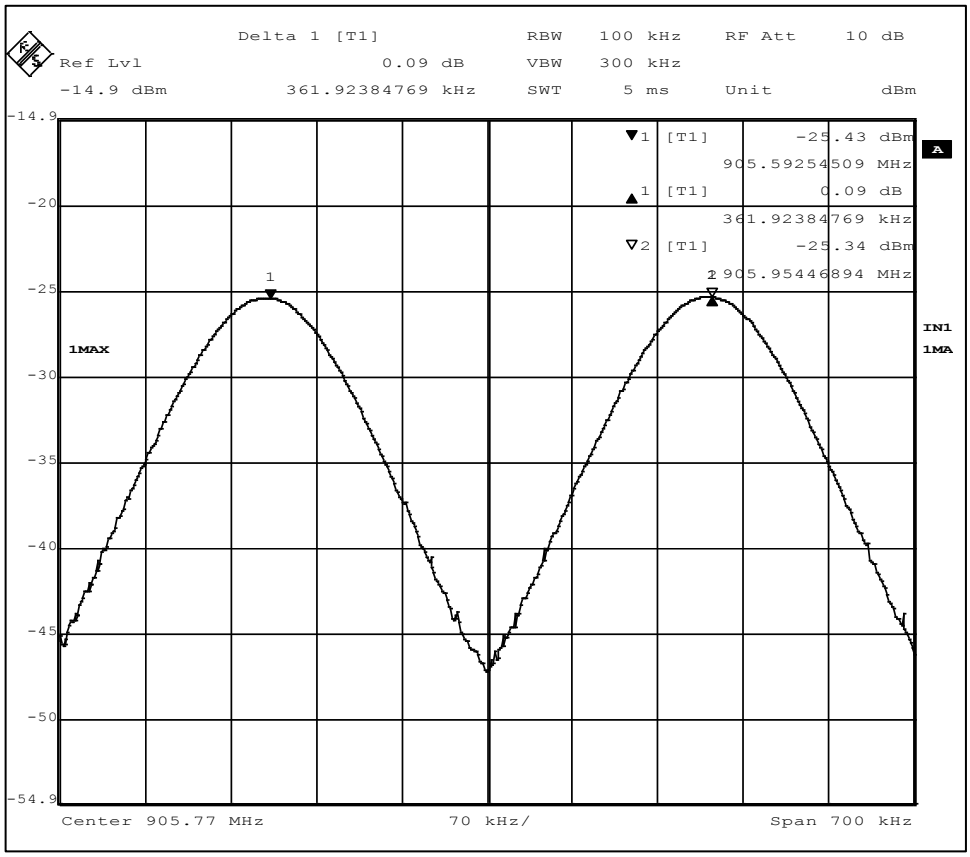


Figure 21 – Frequency Separation (361.92 kHz)

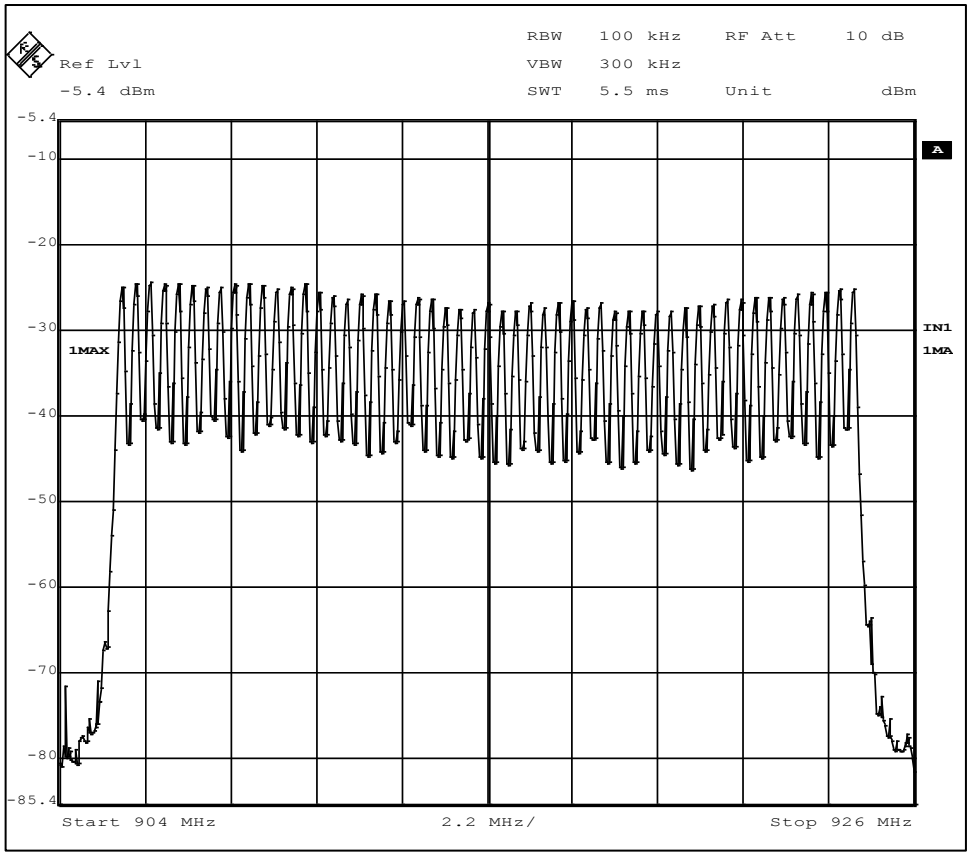


Figure 22 – Hopping Channel Count (53 Channels - Pass)

4.6 *Conducted AC Mains Emissions*

Test Method: ANSI C63.10, Section(s) 6.2

4.6.1 Limits for conducted emissions measurements

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

NOTE: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

4.6.2 Test Procedures

a. The EUT was placed 0.8m above a ground reference plane and 0.4 meters from the conducting wall of a shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). The LISN provides 50 ohm/ 50uH of coupling impedance for the measuring instrument.
b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference as well as the ground.
c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels over 10dB under the prescribed limits could not be reported.
d. Results were compared to the 15.207 limits.

4.6.3 Deviation from the test standard

No deviation

4.6.4 Test setup

See section 4.3.

4.6.5 EUT operating conditions

The EUT was powered by 120 VAC / 60Hz unless specified and set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range.

4.6.6 Test Results

EUT	1136	MODE	Transmit, Mid Channel
INPUT POWER	120 VAC / 60Hz	FREQUENCY RANGE	150 kHz – 30 MHz
ENVIRONMENTAL CONDITIONS	32 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

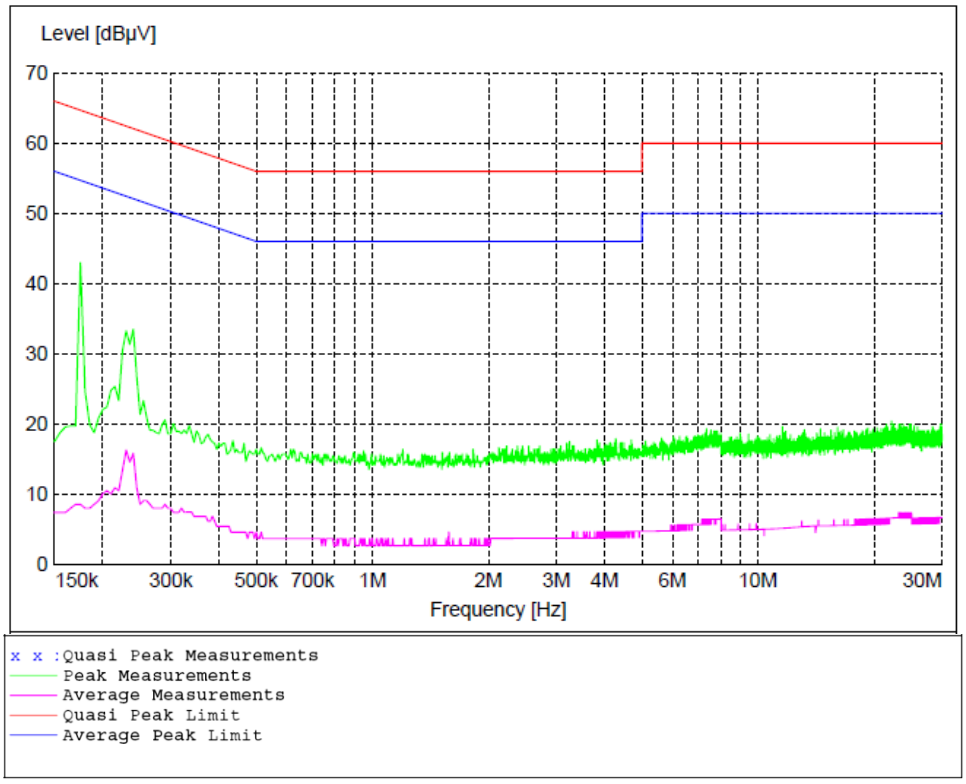


Figure 23 - Conducted Emissions Plot

Appendix A: Sample Calculation

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:
FS = RA + AF – (-CF + AG) + AV

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

AV = Averaging Factor (if applicable)

Assume a receiver reading of 55 dBμV is obtained. The Antenna Factor of 12 and a Cable Factor of 1.1 is added. The Amplifier Gain of 20 dB is subtracted, giving a field strength of 48.1 dBμV/m.

FS = 55 + 12 – (-1.1 + 20) + 0 = 48.1 dBμV/m

The 48.1 dBμV/m value can be mathematically converted to its corresponding level in μV/m.

Level in μV/m = Common Antilogarithm [(48.1 dBμV/m)/20]= 254.1 μV/m

AV is calculated by the taking the 20*log(T_{on}/100) where T_{on} is the maximum transmission time in any 100ms window.

EIRP Calculations

In cases where direct antenna port measurement is not possible or would be inaccurate, output power is measured in EIRP. The maximum field strength is measured at a specified distance and the EIRP is calculated using the following equation;

EIRP (Watts) = [Field Strength (V/m) x antenna distance (m)]^2 / [30 x Gain (numeric)]

Power (watts) = 10^[Power (dBm)/10] x 1000

Field Strength (dBµV/m) = Field Strength (dBm) + 107 (for 50Ω measurement systems)

Field Strength (V/m) = 10^[Field Strength (dBµV/m) / 20] / 10^6

Gain = 1 (numeric gain for isotropic radiator)

Conversion from 3m field strength to EIRP (d=3):

EIRP = (FS x d^2)/30 = FS [(d^2)/30] = FS [0.3}

EIRP(dBm) = FS(dBµV/m) – 10(log 10^9)+ 10log[0.3] = -95.23

10log(10^) is the conversion from micro to milli

Annex B – Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been for tests performed in this test report:

Test	Frequency Range	Uncertainty Value (dB)
Radiated Emissions, 3m	30MHz - 1GHz	3.82
Radiated Emissions, 3m	1GHz - 18GHz	4.44
Emissions limits, conducted	150kHz – 18GHz	±3.30 dB

Expanded uncertainty values are calculated to a confidence level of 95%.

CISPR 16-4-2:2011 was used to calculate the above values.