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Amended

FCC/IC Test Report

Includes NCEE Labs report R20170216-20-02D and its amendment in full

Prepared for: **Elster American Meter**

Address: **2221 Industrial Road**
Nebraska City, NE 68410

Product: **RFMD**
USB Wireless Dongle

Test Report No: **R20170216-20-02D**

Approved By:

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Technical Manager
iNARTE Certified EMC Engineer #EMC-003337-NE

DATE: **23 October 2017**

Total Pages: **65**

ACCREDITED
TESTING LABORATORY
CERTIFICATE NO. 1953.01

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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, 5.1(c)	Minimum Bandwidth, Limit: Min. 250kHz	Pass	Meets the requirement of the limit.
FCC 15.247(b)(1) RSS-247, 5.4	Maximum Peak Output Power, Limit: Max. 24 dBm	Pass	Meets the requirement of the limit.
FCC 15.209 RSS-Gen, 8.9	Transmitter Radiated Emissions	Pass	Meets the requirement of the limit.
FCC 15.247(a) (1) (i) RSS-247, 5.1(c)	Frequency hopping system, Limit: Max. 0.4 Seconds in 10 Second Period	Pass	Meets the requirement of the limit.
FCC 15.209 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 Part 15.207 RSS-Gen, Section 8.8	Conducted Emissions	Pass	Representative Power source was used

1.2 Reason for amendment

Conducted Emissions data was added.
Tables 1, 4 and 7 were corrected.

2.0 Description

2.1 Equipment under test

The Equipment Under Test (EUT) was a transceiver used to communicate with a wireless gas metering unit transmitter. It operates from 907 to 924 MHz and has transmit capabilities only.

EUT Received Date: 11 April 2017
EUT Tested Dates: 28 April 2017 - 18 September 2017

MODEL	RFMD
Part No.	55217G438 Rev 5 (used for spurious emissions, band edge, duty cycle and power measurements) 55217G438 Rev 4 (used for hop channel count, spacing and bandwidth testing)
POWER SUPPLY	5 VDC (USB 2.0 serial)
ANTENNA TYPE	EUT uses a reverse polarity connector

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	907.0
Middle	915.4
High	923.8

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.

The EUT was tested with 2 antenna options:

1. ANT-916-CW-QW, peak gain = 1.8 dBi
2. ANT-ELE-S01-005, peak gain = 3 dBi

2.4 Applied standards

The EUT is a frequency hopping device operating in the 902 MHz to 928 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 1
Industry Canada, RSS-Gen, Issue 4
ANSI C63.10:2013
ANSI C63.4:2014

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	3142B	1647	02 Aug 2016	02 Aug 2017
EMCO Horn Antenna	3115	6416	25 Jan 2016	25 Jan 2018
EMCO Horn Antenna	3116	2576	26 Jan 2016	26 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*
Rohde & Schwarz LISN	ESH3-Z5	100023	23 Jan 2017	23 Jan 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 EUT has a reverse polarity connector and it can be used with only two sets of antennas the manufacturer provides.

The antennas tested were from AntennaFactor by Linx. Models ANT-ELE-S01-005 and ANT-916-CW-QW

4.2 Radiated emissions

Test Method: ANSI C63.10, Section(s) 6.5
ANSI C63.4. Section(s) 8.3

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

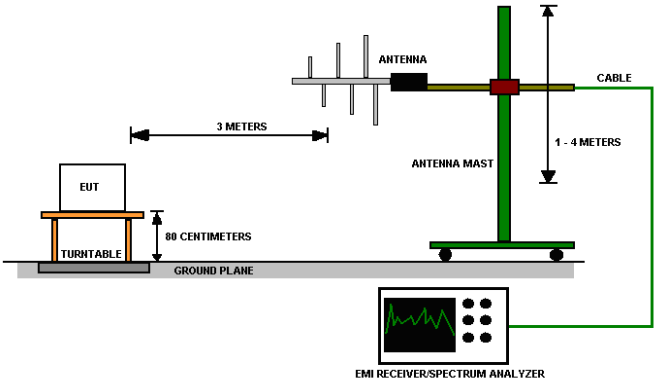

Figure 1 - Radiated Emissions Test Setup

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 5 VDC 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 MODULE	RFMD	MODE	Transmit, Low Channel, ANT-919-CW-QW antenna
INPUT POWER	5 VDC	FREQUENCY RANGE	30MHz – 10GHz
ENVIRONMENTAL CONDITIONS	32 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

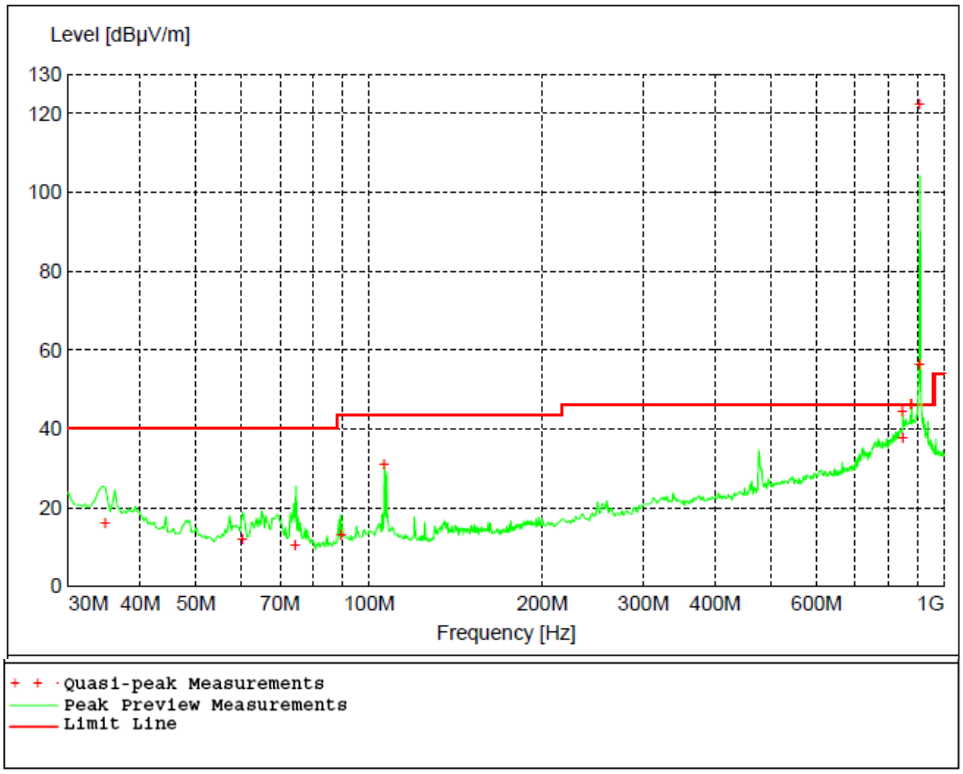

Figure 2 - Radiated Emissions Plot, Low Channel, ANT-919-CW-QW antenna

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, Low Channel, ANT-919-CW-QW antenna

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
34.740000	16.18	40.00	23.80	247	31	VERT
60.240000	12.26	40.00	27.70	100	332	VERT
74.340000	10.48	40.00	29.50	99	203	VERT
89.340000	13.08	43.50	30.40	295	360	HORI
106.320000	31.27	43.50	12.20	399	261	HORI
846.900000	44.40	46.00	1.60	101	243	HORI
848.460000	37.71	46.00	8.30	98	248	HORI
876.900000	46.26	102.42*	56.16	102	243	HORI
877.080000	46.23	102.42*	56.19	98	245	HORI
905.580000	56.35	46.00	NA	101	233	HORI
906.900000	122.42	46.00	NA	98	241	HORI

The EUT was maximized in all 3 orthogonal axis. The worst-case is shown in the table above.
*Unrestricted band, the field strength must be at least 20 dB below peak field strength.

Table 2 - Radiated Emissions Average Measurements, Low Channel, ANT-919-CW-QW antenna

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
1814.200000	35.59	54.00	18.41	113	317	HORI
2721.200000	31.82	54.00	22.18	174	28	VERT
3627.600000	32.91	54.00	21.09	136	0	VERT
4541.000000	31.68	54.00	22.32	103	236	HORI
5432.400000	33.64	54.00	20.36	106	53	HORI
6343.600000	33.75	54.00	20.25	291	187	HORI
7254.800000	34.74	54.00	19.26	136	212	VERT
8138.200000	37.20	54.00	16.80	231	95	VERT
9069.000000	40.78	54.00	13.22	100	105	VERT

The EUT was maximized in all 3 orthogonal axis. The worst-case is shown in the table above.
Average measurement = peak measurement + duty cycle correction. See Section 4.7 for calculation of duty cycle correction.

Table 3 - Radiated Emissions Peak Measurements, Low Channel, ANT-919-CW-QW antenna

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
1814.200000	44.46	74.00	29.54	113	317	HORI
2721.200000	40.69	74.00	33.31	174	28	VERT
3627.600000	41.78	74.00	32.22	136	0	VERT
4541.000000	40.55	74.00	33.45	103	236	HORI
5432.400000	42.51	74.00	31.49	106	53	HORI
6343.600000	42.62	74.00	31.38	291	187	HORI
7254.800000	43.61	74.00	30.39	136	212	VERT
8138.200000	46.07	74.00	27.93	231	95	VERT
9069.000000	49.65	74.00	24.35	100	105	VERT

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

EUT MODULE	RFMD	MODE	Transmit, Low Channel, ANT-ELE-S01-005 antenna
INPUT POWER	5 VDC	FREQUENCY RANGE	30MHz – 10GHz
ENVIRONMENTAL CONDITIONS	32 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

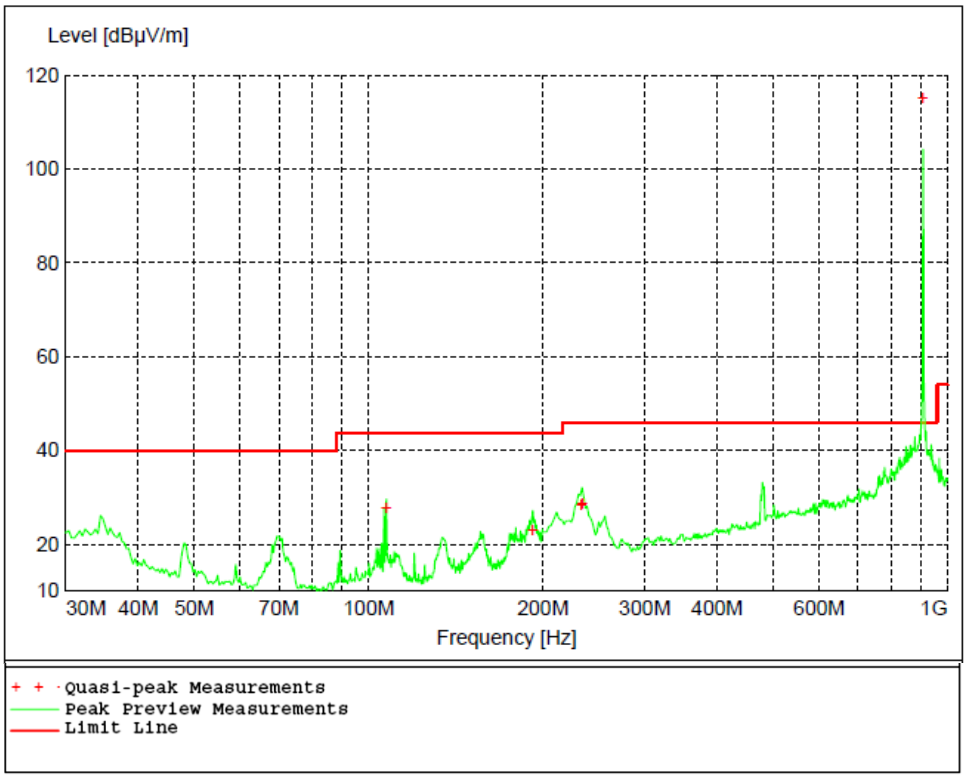

Figure 3 - Radiated Emissions Plot, Low Channel, ANT-ELE-S01-005 antenna

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 4 - Radiated Emissions Quasi-peak Measurements, Low Channel, ANT-ELE-S01-005 antenna

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
107.280000	27.93	43.50	15.60	100	265	VERT
192.000000	23.22	43.50	20.30	143	268	HORI
233.220000	28.51	46.00	17.50	136	255	HORI
234.180000	28.64	46.00	17.40	100	255	HORI
906.900000	115.13	NA	NA	109	61	HORI

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

Table 5 - Radiated Emissions Average Measurements, Low Channel, ANT-ELE-S01-005 antenna

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
1814.400000	29.91	54.00	24.09	399	202	VERT
2728.600000	29.32	54.00	24.68	358	165	VERT
3628.400000	33.18	54.00	20.82	99	329	VERT
4525.000000	32.45	54.00	21.55	285	360	HORI
5447.400000	34.57	54.00	19.43	380	101	VERT
6348.600000	34.35	54.00	19.65	366	123	VERT
7277.600000	34.29	54.00	19.71	399	0	VERT
8161.600000	39.09	54.00	14.91	400	136	HORI
9073.800000	29.91	54.00	24.09	169	208	HORI

The EUT was maximized in all 3 orthogonal axis. The worst-case is shown in the table above.
Average measurement = peak measurement + duty cycle correction. See Section 4.7 for calculation of duty cycle correction.

Table 6 - Radiated Emissions Peak Measurements, Low Channel, ANT-ELE-S01-005 antenna

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
1814.400000	38.78	74.00	35.22	399	202	VERT
2728.600000	38.19	74.00	35.81	358	165	VERT
3628.400000	42.05	74.00	31.95	99	329	VERT
4525.000000	41.32	74.00	32.68	285	360	HORI
5447.400000	43.44	74.00	30.56	380	101	VERT
6348.600000	43.22	74.00	30.78	366	123	VERT
7277.600000	43.16	74.00	30.84	399	0	VERT
8161.600000	47.96	74.00	26.04	400	136	HORI
9073.800000	46.26	74.00	27.74	169	208	HORI

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

EUT MODULE	RFMD	MODE	Transmit, Mid Channel, ANT-919-CW-QW antenna
INPUT POWER	5 VDC	FREQUENCY RANGE	30MHz – 10GHz
ENVIRONMENTAL CONDITIONS	32 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

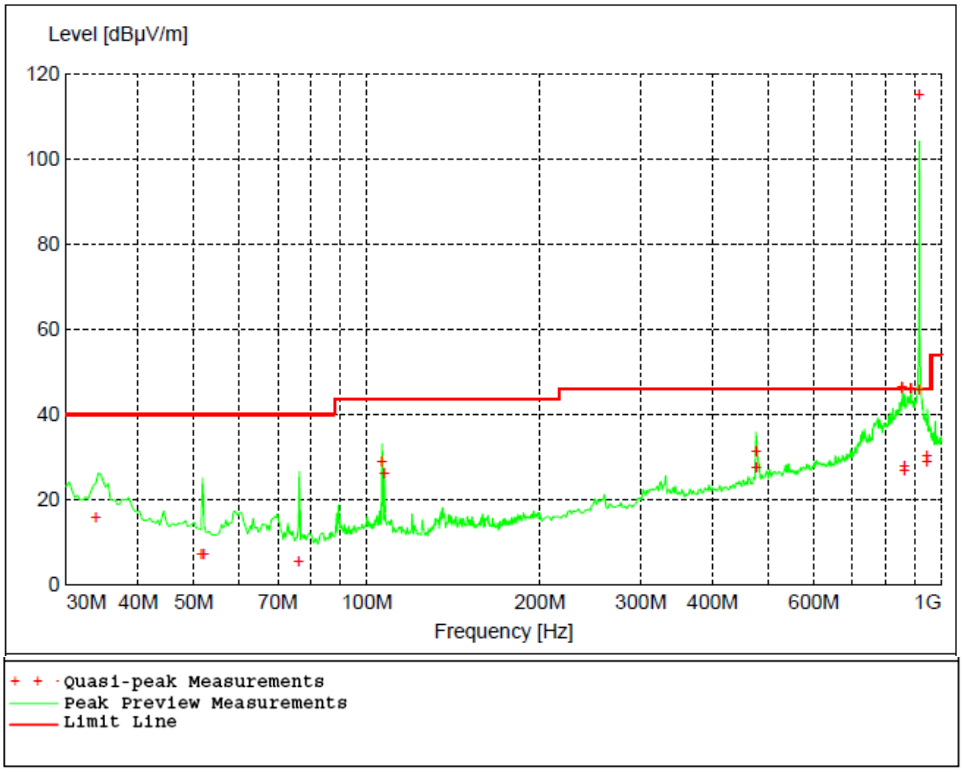

Figure 4 - Radiated Emissions Plot, Mid Channel, ANT-919-CW-QW antenna

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 7 - Radiated Emissions Quasi-peak Measurements, Mid Channel, ANT-919-CW-QW antenna

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
33.780000	15.91	40.00	24.09	267	344	VERT
51.600000	7.41	40.00	32.59	399	115	VERT
52.080000	7.32	40.00	32.68	336	165	VERT
76.140000	5.67	40.00	34.33	384	53	VERT
106.320000	29.19	43.50	14.31	350	227	VERT
107.280000	26.47	43.50	17.03	400	250	VERT
476.280000	31.62	46.00	14.38	400	38	VERT
477.060000	27.78	46.00	18.22	107	118	VERT
855.300000	46.48	103.07*	56.59	100	246	HORI
855.480000	46.16	103.07*	56.91	99	241	HORI
863.160000	27.06	46.00	18.94	101	260	HORI
863.820000	27.91	46.00	18.09	183	23	HORI
885.300000	46.39	103.07*	56.68	99	254	HORI
885.480000	46.30	103.07*	56.77	101	245	HORI
915.300000	123.07	46.00	NA	99	57	VERT
917.460000	46.10	46.00	NA	101	61	VERT
945.300000	28.95	46.00	17.05	98	246	HORI
945.480000	30.47	46.00	15.53	112	77	HORI

The EUT was maximized in all 3 orthogonal axis. The worst-case is shown in the table above.
*Unrestricted band, the field strength must be at least 20 dB below peak field strength.

Table 7 - Radiated Emissions Peak Measurements, Mid Channel, ANT-919-CW-QW antenna

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
1831.000000	35.08	54.00	18.92	143	70	HORI
2746.400000	31.67	54.00	22.33	172	70	VERT
3662.000000	34.60	54.00	19.40	203	13	VERT
4572.600000	32.73	54.00	21.27	134	266	HORI
5486.200000	33.75	54.00	20.25	264	78	HORI
6415.400000	34.33	54.00	19.67	127	246	HORI
7317.200000	34.03	54.00	19.97	291	20	VERT
8225.600000	37.37	54.00	16.63	160	297	HORI
9152.800000	37.51	54.00	16.49	124	307	VERT

The EUT was maximized in all 3 orthogonal axis. The worst-case is shown in the table above.
Average measurement = peak measurement + duty cycle correction. See Section 4.7 for calculation of duty cycle correction.

Table 8 - Radiated Emissions Peak Measurements, Mid Channel, ANT-919-CW-QW antenna

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
1831.000000	43.95	74.00	30.05	143	70	HORI
2746.400000	40.54	74.00	33.46	172	70	VERT
3662.000000	43.47	74.00	30.53	203	13	VERT
4572.600000	41.60	74.00	32.40	134	266	HORI
5486.200000	42.62	74.00	31.38	264	78	HORI
6415.400000	43.20	74.00	30.80	127	246	HORI
7317.200000	42.90	74.00	31.10	291	20	VERT
8225.600000	46.24	74.00	27.76	160	297	HORI
9152.800000	46.38	74.00	27.62	124	307	VERT

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

EUT MODULE	RFMD	MODE	Transmit, Mid Channel, ANT-ELE-S01-005 antenna
INPUT POWER	5 VDC	FREQUENCY RANGE	30MHz – 10GHz
ENVIRONMENTAL CONDITIONS	32 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

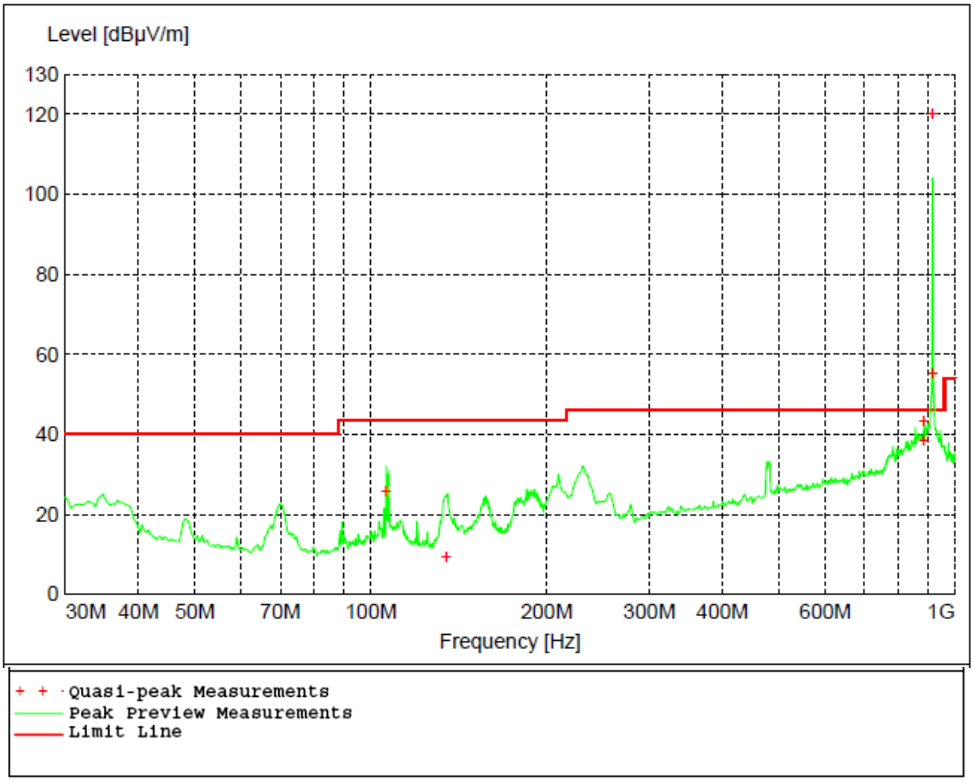

Figure 5 - Radiated Emissions Plot, Mid Channel, ANT-ELE-S01-005 antenna

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, Mid Channel, ANT-ELE-S01-005 antenna

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
106.320000	25.84	43.50	17.70	236	82	VERT
134.760000	9.62	43.50	33.90	100	243	VERT
885.300000	43.30	46.00	2.70	109	275	VERT
885.900000	38.58	46.00	7.40	115	234	VERT
915.300000	120.23	NA	NA	115	130	VERT
916.800000	55.42	NA	NA	119	217	VERT

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

Table 10- Radiated Emissions Average Measurements, Mid Channel, ANT-ELE-S01-005 antenna

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
1831.000000	33.11	54.00	20.89	100	209	VERT
2724.000000	28.91	54.00	25.09	113	212	HORI
3662.200000	32.98	54.00	21.02	147	24	VERT
4574.400000	32.85	54.00	21.15	106	344	HORI
5499.200000	34.55	54.00	19.45	396	316	VERT
6417.000000	34.58	54.00	19.42	100	360	HORI
7303.000000	34.37	54.00	19.63	117	217	HORI
8224.000000	38.17	54.00	15.83	345	91	VERT
9147.200000	38.45	54.00	15.55	99	97	VERT

The EUT was maximized in all 3 orthogonal axis. The worst-case is shown in the table above.
Average measurement = peak measurement + duty cycle correction. See Section 4.7 for calculation of duty cycle correction.

Table 11- Radiated Emissions Peak Measurements, Mid Channel, ANT-ELE-S01-005 antenna

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
1831.000000	41.98	74.00	32.02	100	209	VERT
2724.000000	37.78	74.00	36.22	113	212	HORI
3662.200000	41.85	74.00	32.15	147	24	VERT
4574.400000	41.72	74.00	32.28	106	344	HORI
5499.200000	43.42	74.00	30.58	396	316	VERT
6417.000000	43.45	74.00	30.55	100	360	HORI
7303.000000	43.24	74.00	30.76	117	217	HORI
8224.000000	47.04	74.00	26.96	345	91	VERT
9147.200000	47.32	74.00	26.68	99	97	VERT

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

EUT MODULE	RFMD	MODE	Transmit, High Channel, ANT-919-CW-QW antenna
INPUT POWER	5 VDC	FREQUENCY RANGE	30MHz – 10GHz
ENVIRONMENTAL CONDITIONS	32 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

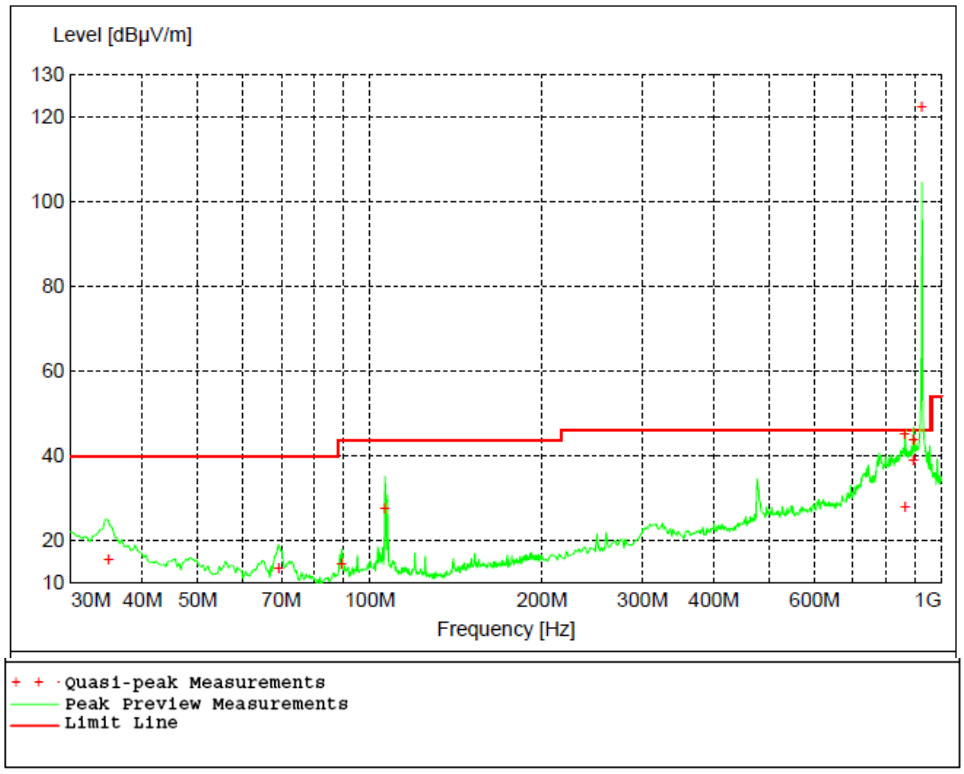

Figure 6 - Radiated Emissions Plot, High Channel, ANT-919-CW-QW antenna

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 12 - Radiated Emissions Quasi-peak Measurements, High Channel, ANT-919-CW-QW antenna

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
34.920000	15.54	40.00	24.50	213	177	VERT
69.360000	13.73	40.00	26.30	188	216	VERT
89.280000	14.77	43.50	28.80	103	173	HORI
106.320000	27.54	43.50	16.00	108	202	HORI
863.700000	45.43	46.00	0.60	100	242	HORI
865.140000	27.93	46.00	18.10	102	236	HORI
893.760000	43.91	102.46*	58.55	99	128	HORI
894.360000	39.07	102.46*	63.39	101	241	HORI
923.700000	122.46	NA	NA	98	246	HORI

The EUT was maximized in all 3 orthogonal axis. The worst-case is shown in the table above.
*Unrestricted band, the field strength must be at least 20 dB below peak field strength.

Table 13 - Radiated Emissions Average Measurements, High Channel, ANT-919-CW-QW antenna

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
1847.800000	33.47	54.00	20.53	156	253	HORI
2771.400000	31.37	54.00	22.63	175	175	HORI
3695.400000	32.61	54.00	21.39	170	360	VERT
4628.400000	32.61	54.00	21.39	399	100	HORI
5529.400000	34.06	54.00	19.94	359	54	HORI
6460.800000	34.48	54.00	19.52	400	142	HORI
7381.000000	34.64	54.00	19.36	193	333	VERT
8315.400000	37.94	54.00	16.06	138	26	HORI
9220.000000	37.35	54.00	16.65	308	240	VERT

The EUT was maximized in all 3 orthogonal axis. The worst-case is shown in the table above.
Average measurement = peak measurement + duty cycle correction. See Section 4.7 for calculation of duty cycle correction.

Table 14- Radiated Emissions Peak Measurements, High Channel, ANT-919-CW-QW antenna

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
1847.800000	42.34	74.00	31.66	156	253	HORI
2771.400000	40.24	74.00	33.76	175	175	HORI
3695.400000	41.48	74.00	32.52	170	360	VERT
4628.400000	41.48	74.00	32.52	399	100	HORI
5529.400000	42.93	74.00	31.07	359	54	HORI
6460.800000	43.35	74.00	30.65	400	142	HORI
7381.000000	43.51	74.00	30.49	193	333	VERT
8315.400000	46.81	74.00	27.19	138	26	HORI
9220.000000	46.22	74.00	27.78	308	240	VERT

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

EUT MODULE	RFMD	MODE	Transmit, High Channel, ANT-ELE-S01-005 antenna
INPUT POWER	5 VDC	FREQUENCY RANGE	30MHz – 10GHz
ENVIRONMENTAL CONDITIONS	32 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

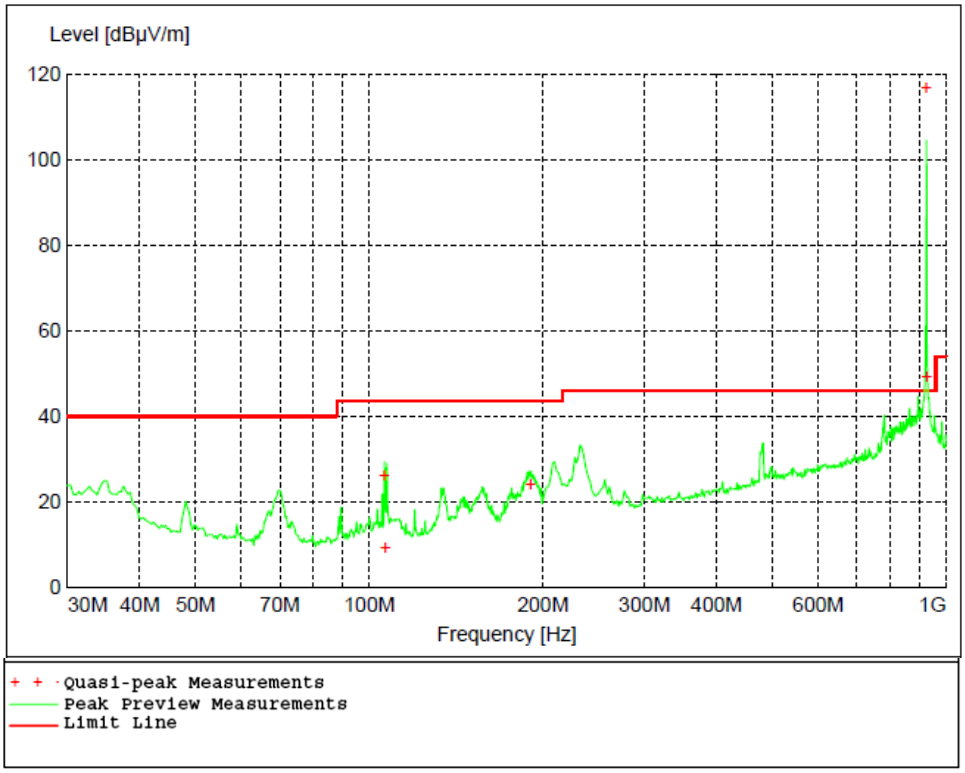

Figure 7 - Radiated Emissions Plot, High Channel, ANT-ELE-S01-005 antenna

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 15 - Radiated Emissions Quasi-peak Measurements, High Channel, ANT-ELE-S01-005 antenna

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
106.320000	26.43	43.50	17.10	243	16	VERT
106.680000	9.37	43.50	34.20	99	116	VERT
190.380000	24.33	43.50	19.20	193	251	HORI
923.700000	116.95	46.00	NA	190	60	VERT
925.680000	49.45	96.95*	47.50	179	59	VERT

The EUT was maximized in all 3 orthogonal axis. The worst-case is shown in the table above.
*unrestricted band. Emissions is required to be at least 20 dB below peak emission.

Table 16 - Radiated Emissions Average Measurements, High Channel, ANT-ELE-S01-005 antenna

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
1847.600000	32.50	54.00	21.50	146	209	VERT
2771.800000	28.86	54.00	25.14	99	334	VERT
3693.400000	30.40	54.00	23.60	166	64	HORI
4630.000000	32.36	54.00	21.64	258	234	VERT
5546.800000	33.49	54.00	20.51	143	310	HORI
6467.400000	34.36	54.00	19.64	99	267	HORI
7381.200000	36.29	54.00	17.71	295	250	VERT
8335.000000	37.27	54.00	16.73	312	90	HORI
9234.000000	37.72	54.00	16.28	398	55	HORI

The EUT was maximized in all 3 orthogonal axis. The worst-case is shown in the table above.
Average measurement = peak measurement + duty cycle correction. See Section 4.7 for calculation of duty cycle correction.

Table 17 - Radiated Emissions Peak Measurements, High Channel, ANT-ELE-S01-005 antenna

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
1847.600000	41.37	74.00	32.63	146	209	VERT
2771.800000	37.73	74.00	36.27	99	334	VERT
3693.400000	39.27	74.00	34.73	166	64	HORI
4630.000000	41.23	74.00	32.77	258	234	VERT
5546.800000	42.36	74.00	31.64	143	310	HORI
6467.400000	43.23	74.00	30.77	99	267	HORI
7381.200000	45.16	74.00	28.84	295	250	VERT
8335.000000	46.14	74.00	27.86	312	90	HORI
9234.000000	46.59	74.00	27.41	398	55	HORI

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

EUT MODULE	RFMD	MODE	Receive, High Channel, ANT-919-CW-QW antenna
INPUT POWER	5 VDC	FREQUENCY RANGE	30MHz – 10GHz
ENVIRONMENTAL CONDITIONS	32 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

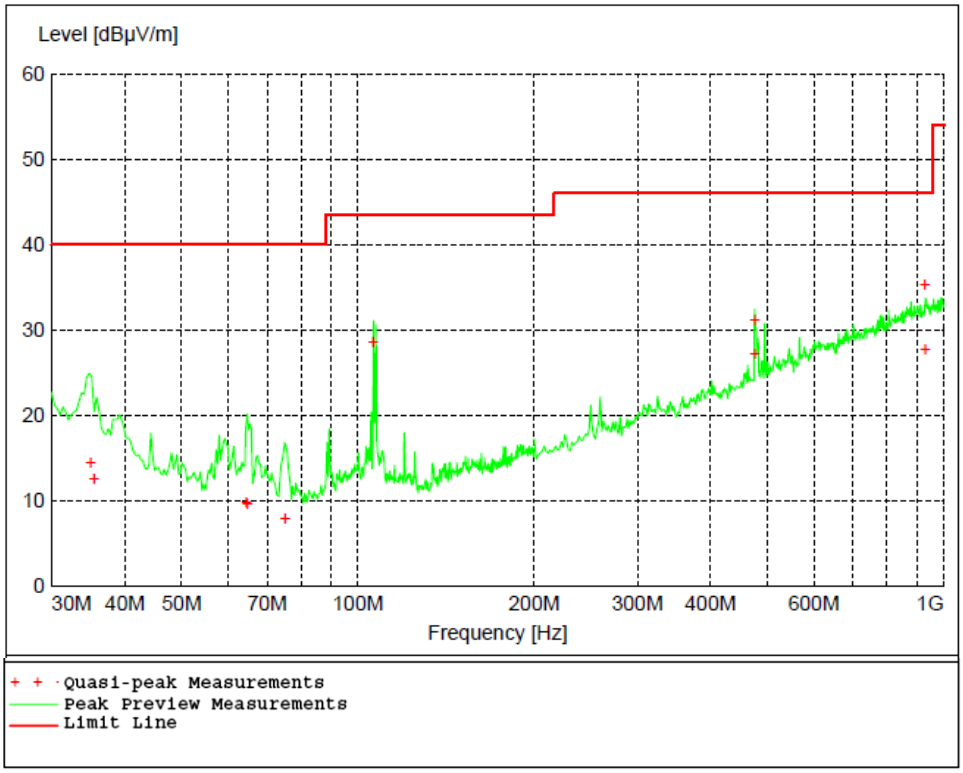

Figure 8 - Radiated Emissions Plot, Receive Mode, ANT-919-CW-QW antenna

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 18 - Radiated Emissions Quasi-peak Measurements, Receive Mode, ANT-919-CW-QW antenna

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
34.980000	14.57	40.00	25.40	179	0	VERT
35.460000	12.61	40.00	27.40	377	344	VERT
64.500000	9.95	40.00	30.10	100	159	VERT
64.740000	9.76	40.00	30.20	99	36	VERT
75.180000	7.94	40.00	32.10	122	289	VERT
106.320000	28.67	43.50	14.80	400	236	HORI
476.280000	31.21	46.00	14.80	180	0	VERT
476.580000	27.23	46.00	18.80	163	349	VERT
929.760000	35.36	46.00	10.60	121	359	VERT
930.480000	27.84	46.00	18.20	381	75	VERT

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

Table 19 - Radiated Emissions Peak Measurements, Receive Mode, ANT-919-CW-QW antenna

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
1841.200000	32.91	54.00	21.09	98	309	VERT
2746.800000	35.75	54.00	18.25	98	137	VERT
3667.200000	38.79	54.00	15.21	101	341	HORI
4562.400000	40.08	54.00	13.92	101	92	VERT
5473.200000	42.07	54.00	11.93	101	104	VERT
9509.000000	45.00	54.00	9.00	98	90	VERT

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

Peak measurements were compared to the average limit.

EUT MODULE	RFMD	MODE	Receive, High Channel, ANT-ELE-S01-005 antenna
INPUT POWER	5 VDC	FREQUENCY RANGE	30MHz – 10GHz
ENVIRONMENTAL CONDITIONS	32 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

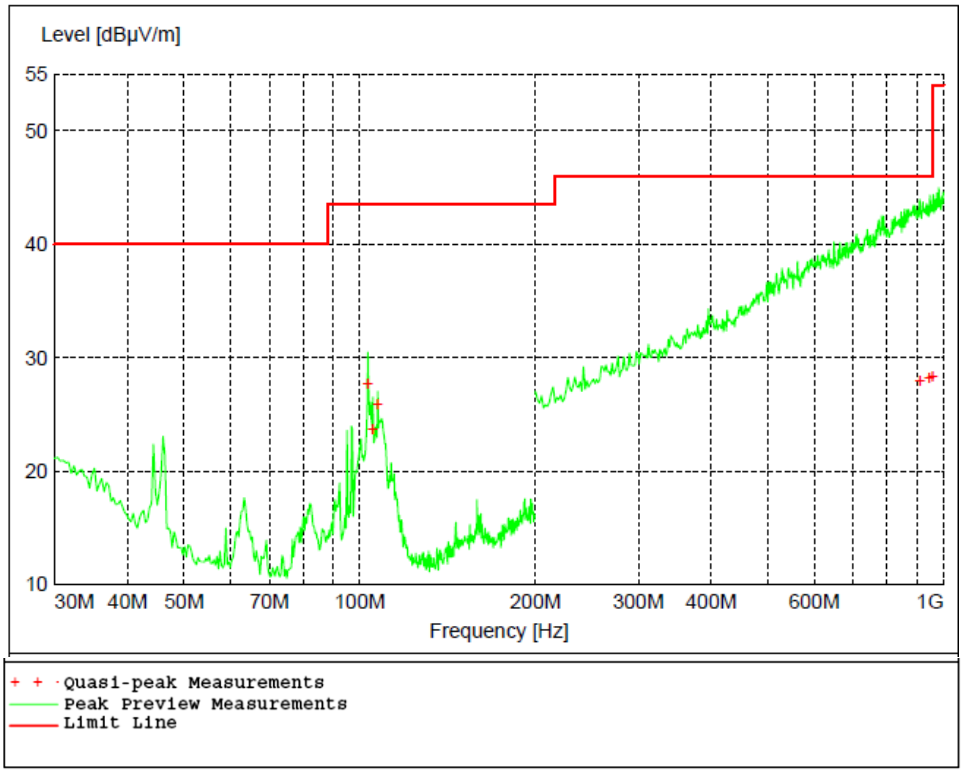

Figure 9 - Radiated Emissions Plot, Receive Mode, ANT-ELE-S01-005 antenna

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 20 - Radiated Emissions Quasi-peak Measurements, Receive Mode, ANT-ELE-S01-005 antenna

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
103.320000	27.69	43.50	15.81	101	360	VERT
105.300000	23.76	43.50	19.74	99	360	VERT
107.280000	25.97	43.50	17.53	100	265	VERT
911.880000	27.97	46.00	18.03	390	195	VERT
946.020000	28.24	46.00	17.76	233	222	VERT
958.260000	28.36	46.00	17.64	148	60	HORI

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

Table 21 - Radiated Emissions Peak Measurements, Receive Mode, ANT-ELE-S01-005 antenna

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
1823.000000	32.15	54.00	21.85	101	165	HORI
2736.200000	34.99	54.00	19.01	98	121	VERT
3649.200000	38.97	54.00	15.03	399	94	VERT
4574.200000	40.00	54.00	14.00	313	0	VERT
5490.400000	42.38	54.00	11.62	399	172	VERT
9469.800000	45.20	54.00	8.80	145	235	VERT

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

Peak measurements were compared to the average limit.

4.3 Bandwidth and Peak Output Power

Test Method: ANSI C63.10, Section(s) 6.7, 6.9, 7.8.5

4.3.1 Limits of bandwidth measurements

The 20 dB occupied bandwidth limit is 250 kHz minimum and peak output power limit is 24 dBm are displayed for informational purposes only. The peak EIRP was measured using a 10 MHz RBW, which was over-laid on the plot showing the bandwidth using a 100 kHz RBW.

4.3.2 Test procedures

The EUT was connected to the spectrum analyzer directly with a low-loss shielded coaxial cable and an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 3 kHz RBW and 10 kHz VBW.

The signal was captured with a 3 kHz resolution bandwidth and the frequencies where the measurements were 20dB below the maximum power were marked. The bandwidth between these frequencies was recorded as the 20 dB bandwidth.

4.3.3 Deviations from test standard

No deviation.

4.3.4 Test setup

Figure 10 - Bandwidth Measurements Test Setup

*20dB Attenuator was used and it was accounted for in the plots

4.3.5 EUT operating conditions

The EUT was powered by 5 VDC 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	RFMD	MODE	Transmit
INPUT POWER	5 VDC	FREQUENCY RANGE	907MHz – 924 MHz
ENVIRONMENTAL CONDITIONS	32 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

20 dB Bandwidth

CHANNEL	CHANNEL FREQUENCY (MHz)	20 dB BW (kHz)
1	907.0	303.40
2	915.4	303.00
3	923.8	304.40

*The limit is 250 kHz minimum. The measurements were conducted at 3 kHz RBW and 10 kHz VBW.

REMARKS:
None

Peak Output Power

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (dBm)	RESULT
1	907.0	22.33*	PASS
2	915.4	22.03*	PASS
3	923.8	21.65*	PASS

The limit is 24dBm. The measurements were conducted at 10 MHz RBW and 10 MHz VBW. See marker 1 on the plots.

*Measurements were found to be the same as measured previously before the modifications within 1 dB, which is within the lab's measurement uncertainty. See Annex B for details.

All measurements were taken from Figures 16 - 18

REMARKS:
None

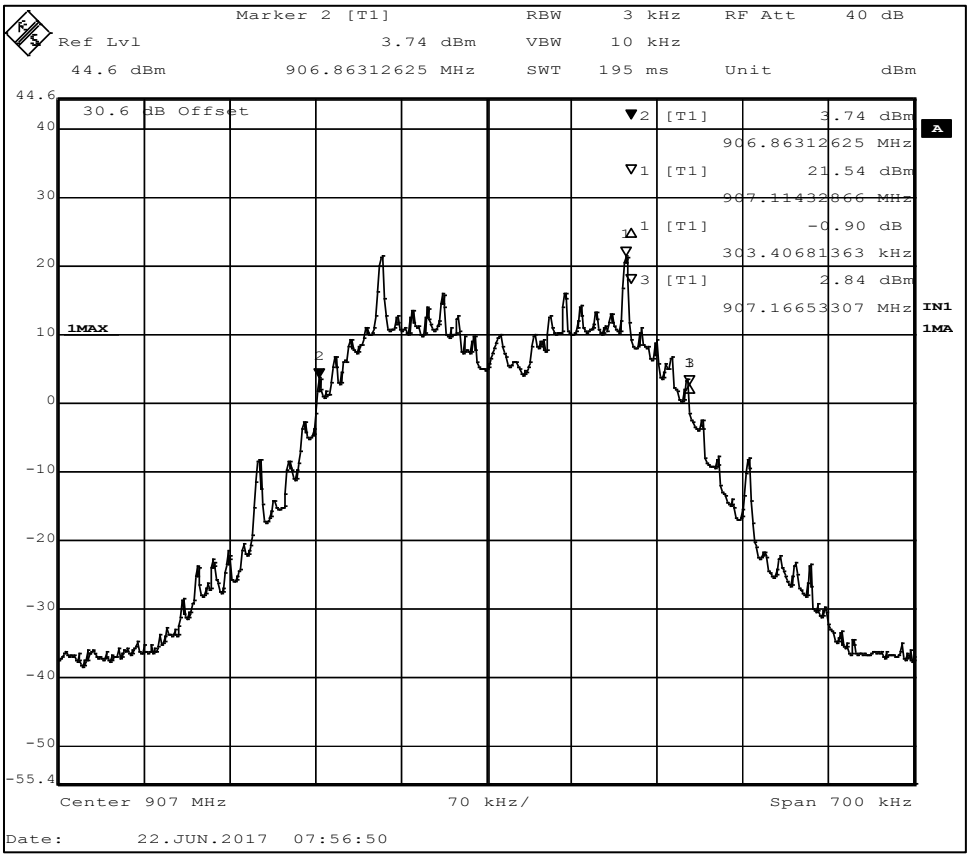

Figure 11 - 20 dB Bandwidth, Low Channel. 303.40 kHz

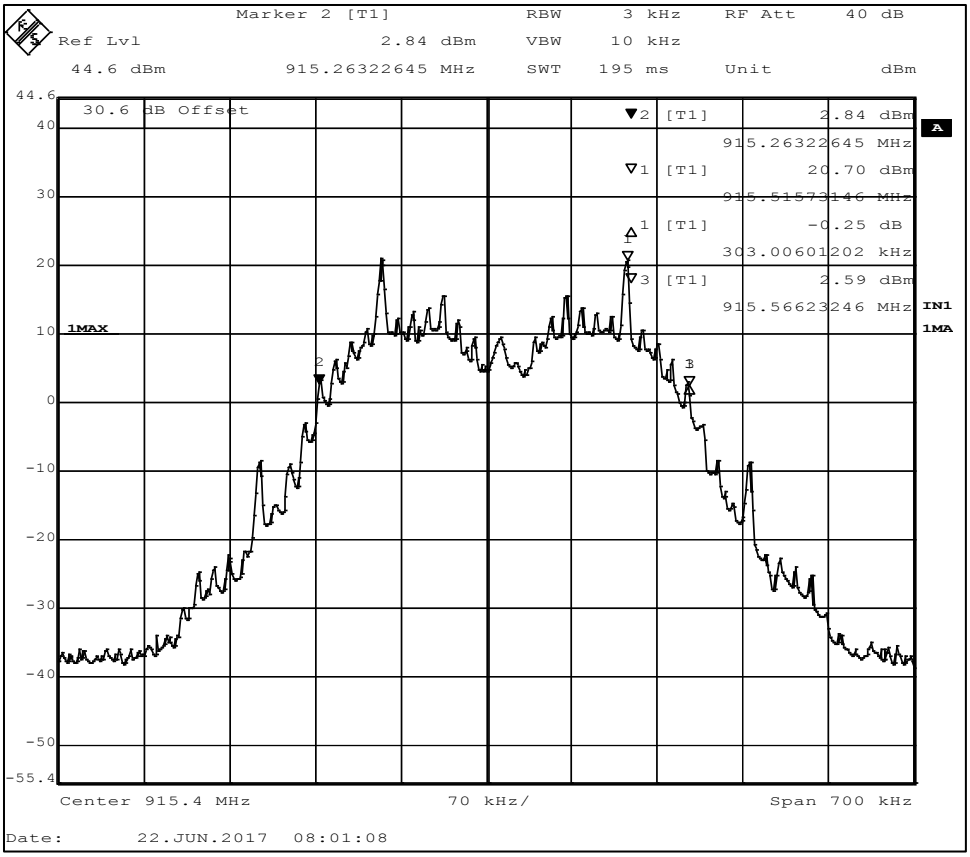

Figure 12 - 20 dB Bandwidth, Mid Channel, 303.00 kHz

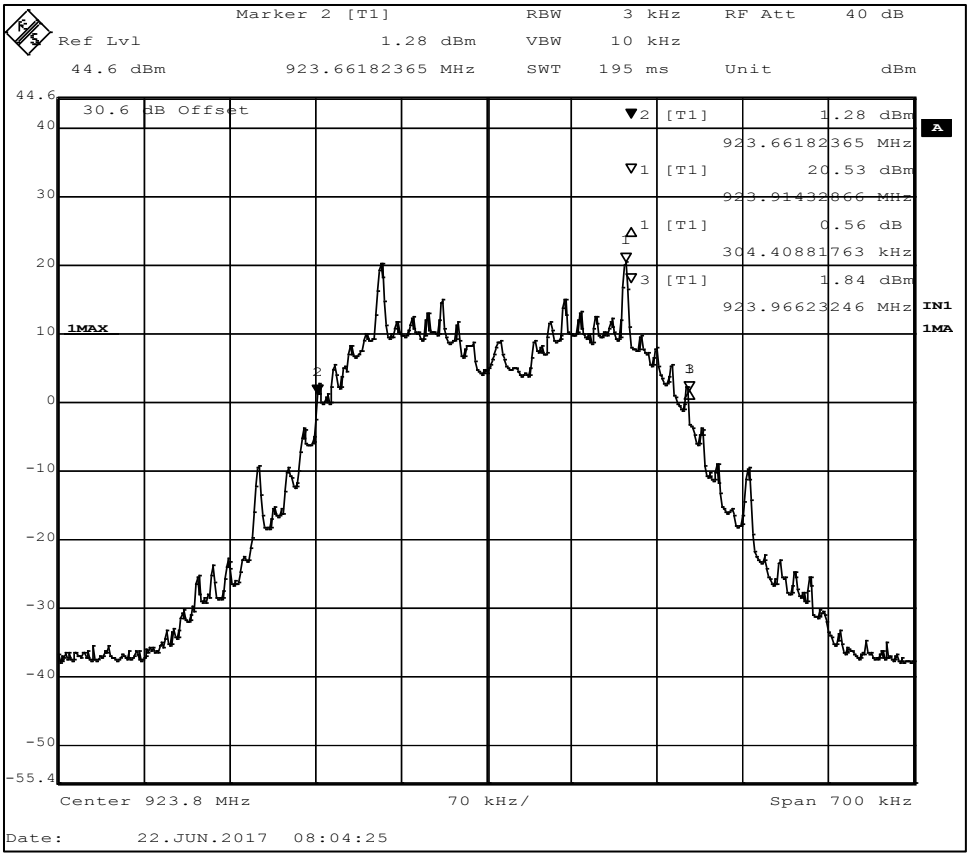

Figure 13 - 20 dB Bandwidth, High Channel, 304.40 kHz

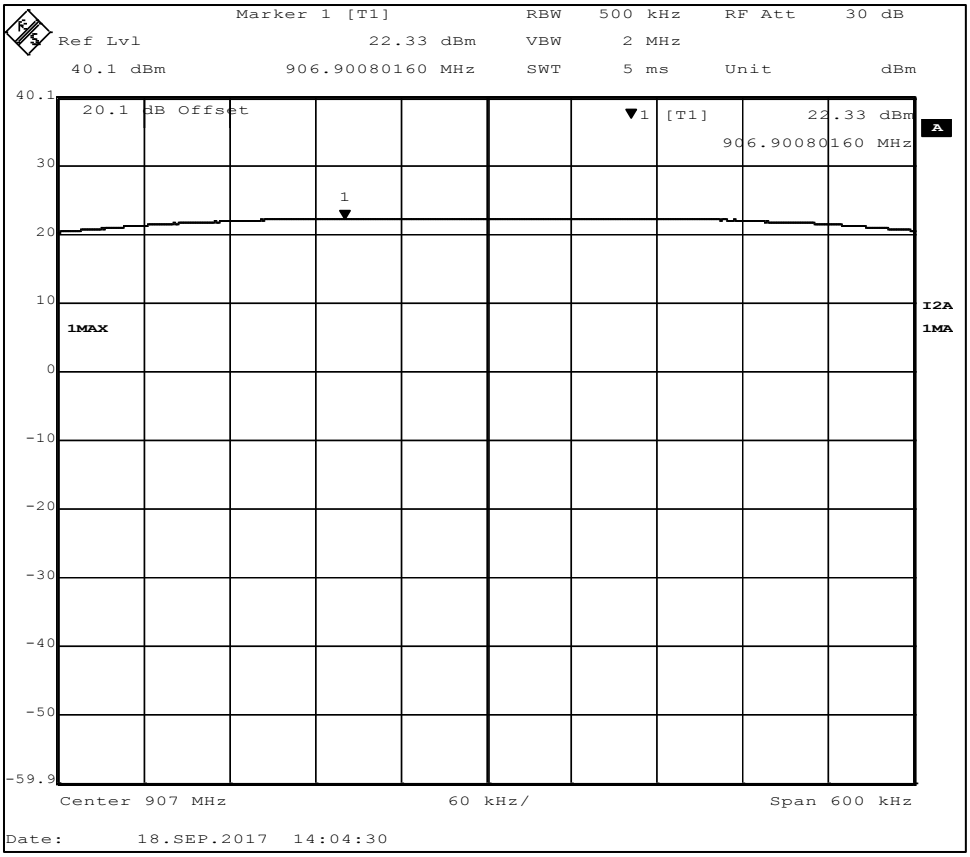

Figure 14 - Output Power, Low Channel

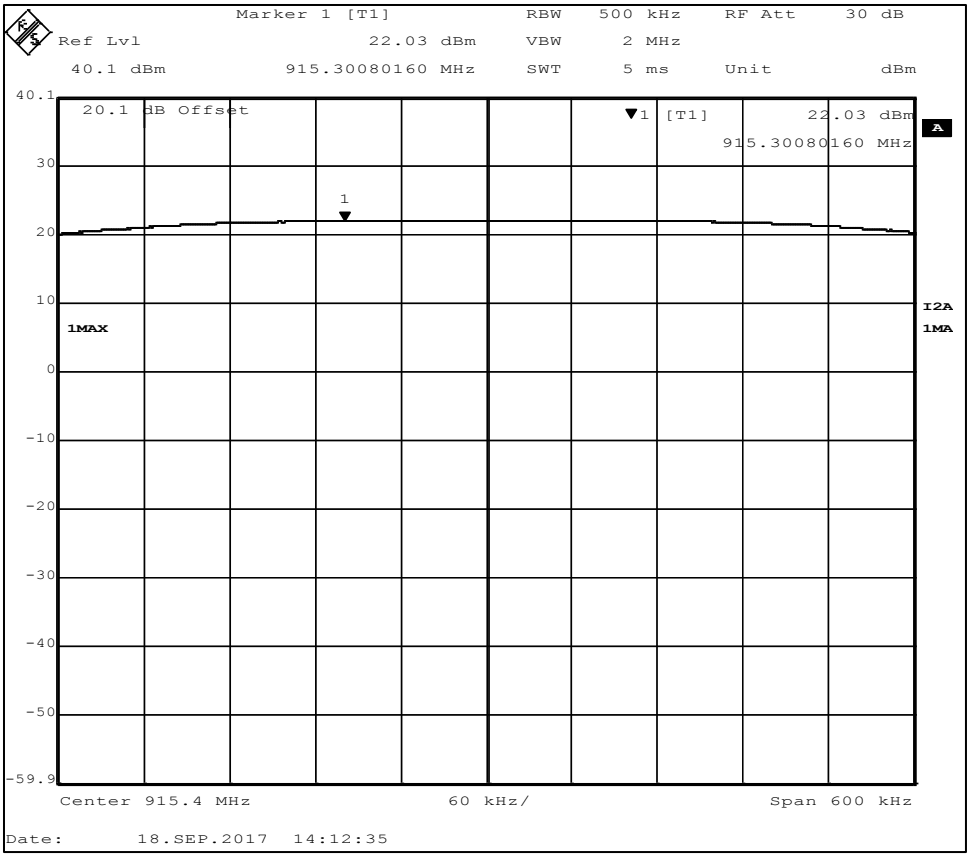

Figure 15 - Output Power, Mid Channel

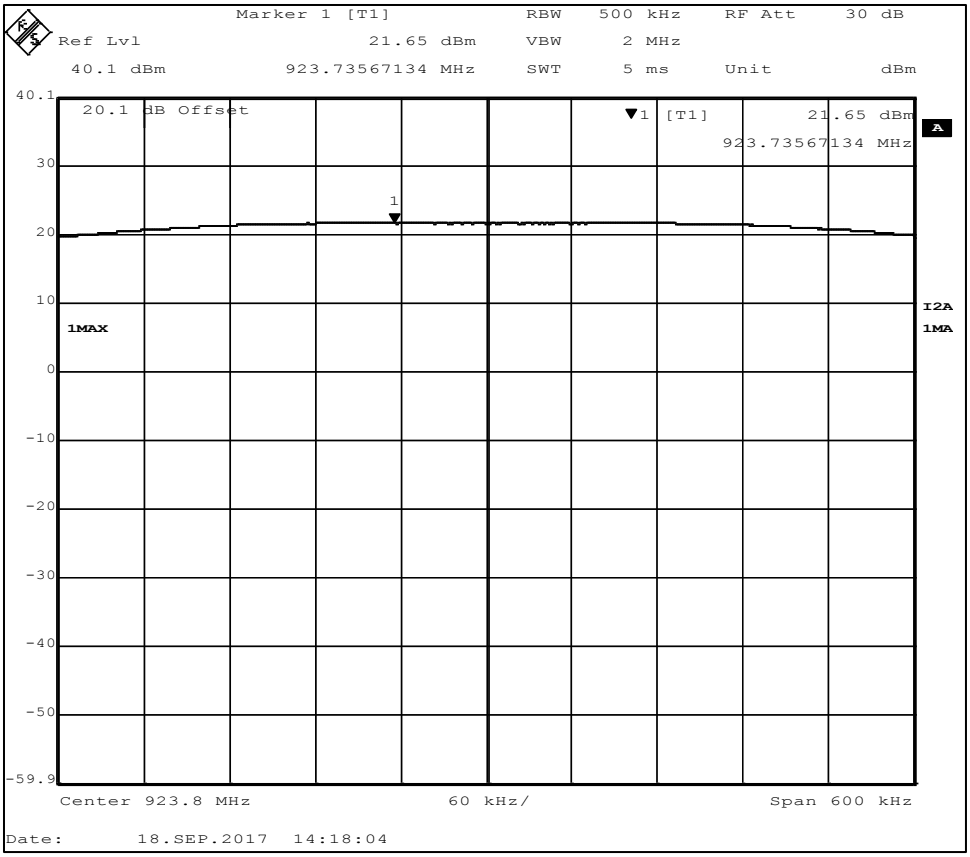

Figure 16 - Output Power, High Channel

4.4 Bandedges

Test Method: ANSI C63.10, Section(s) 6.10.5.2

4.4.1 Limits of bandedge measurements

For emissions outside of the allowed band of operation (902 to 928 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 resolution bandwidth was set to 100kHz 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 5 VDC 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 MODULE	RFMD	MODE	Transmit
INPUT POWER	5 VDC	FREQUENCY RANGE	907MHz – 924 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	907	-70.61	28.17	98.78	69.12	PASS
3	924	-58.41	21.39	79.80	70.95	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 902MHz for low channel = 121.11dBµV/m
Fundamental average field strength at 928MHz for high channel = 121.39dBµV/m

Channel 1 minimum delta = 115.12- 46.0 dBµV/m = 69.12 dBc
Channel 3 minimum delta = 116.95 - 46.0 dBµV/m = 70.95 dBc

*ANT-ELE-S01-005 antenna
Measurements do not include correction factors and are intended to be relative measurements only.

The restricted bandedges below 914 MHz and above 960 MHz were measured in the spurious emissions scans of Section 4.2. They were found to be at least 10 dB below the limits from Part 15.209 or are reported in the tables.

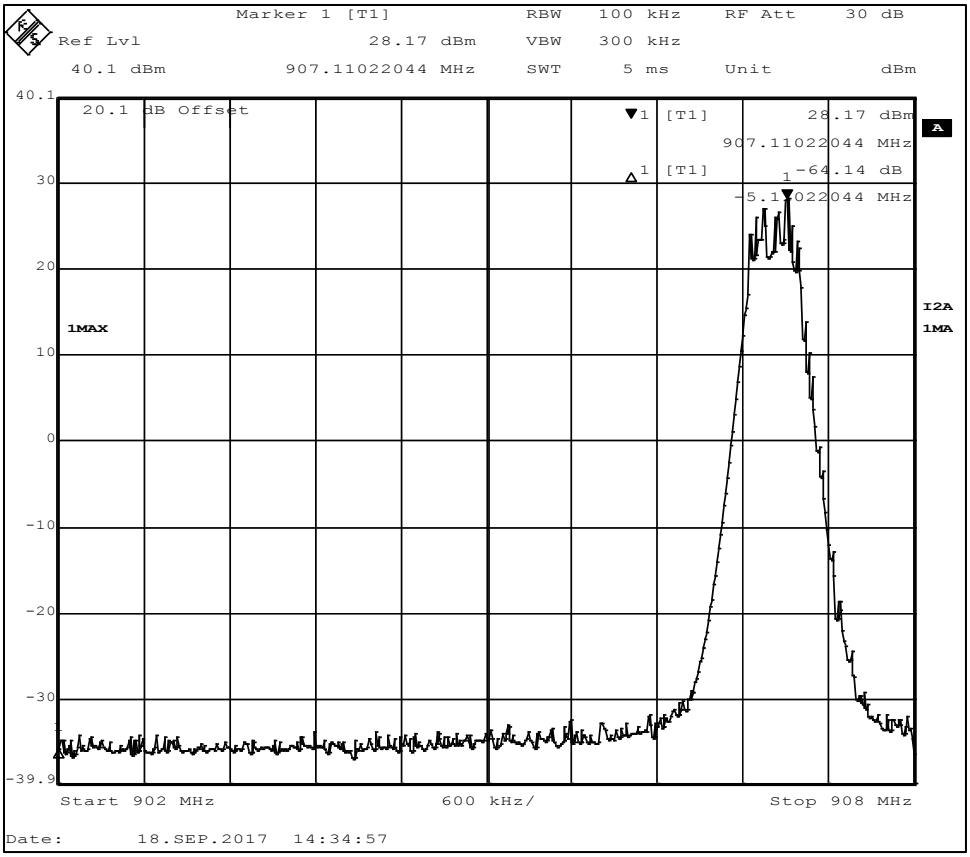

Figure 17 - Band-edge Measurement, Low Channel

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

Delta = 64.14 dB Min = 20 dB

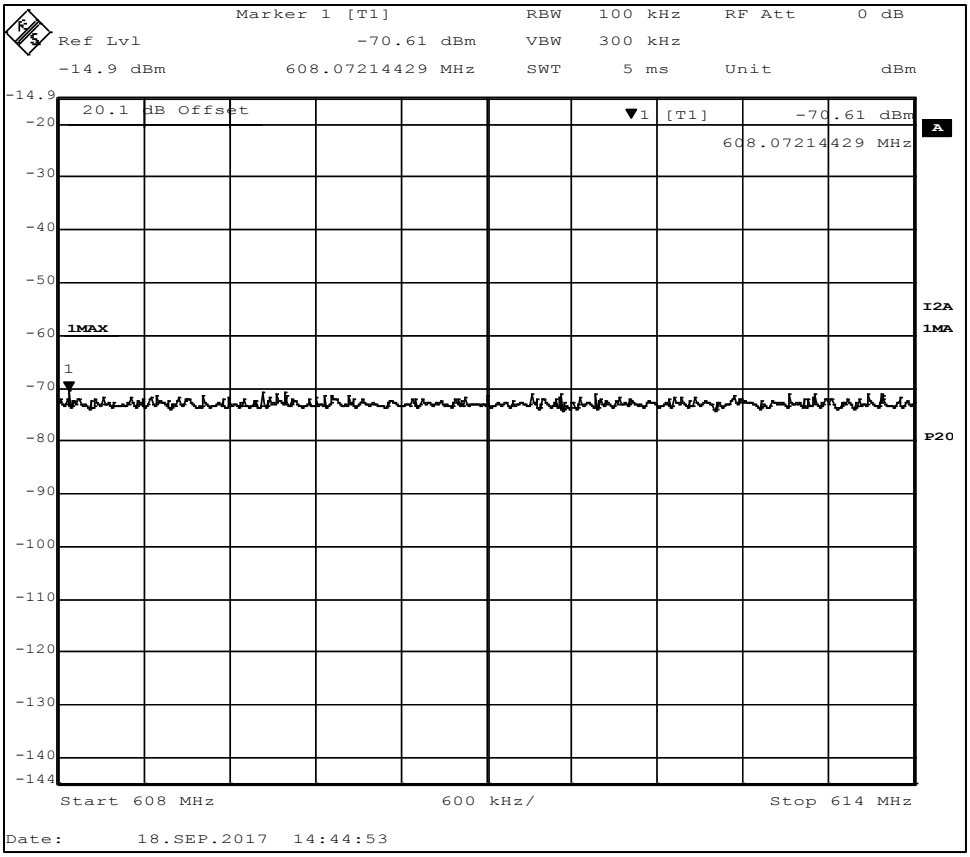

Figure 18 - Band-edge Measurement, Low Channel, Restricted

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

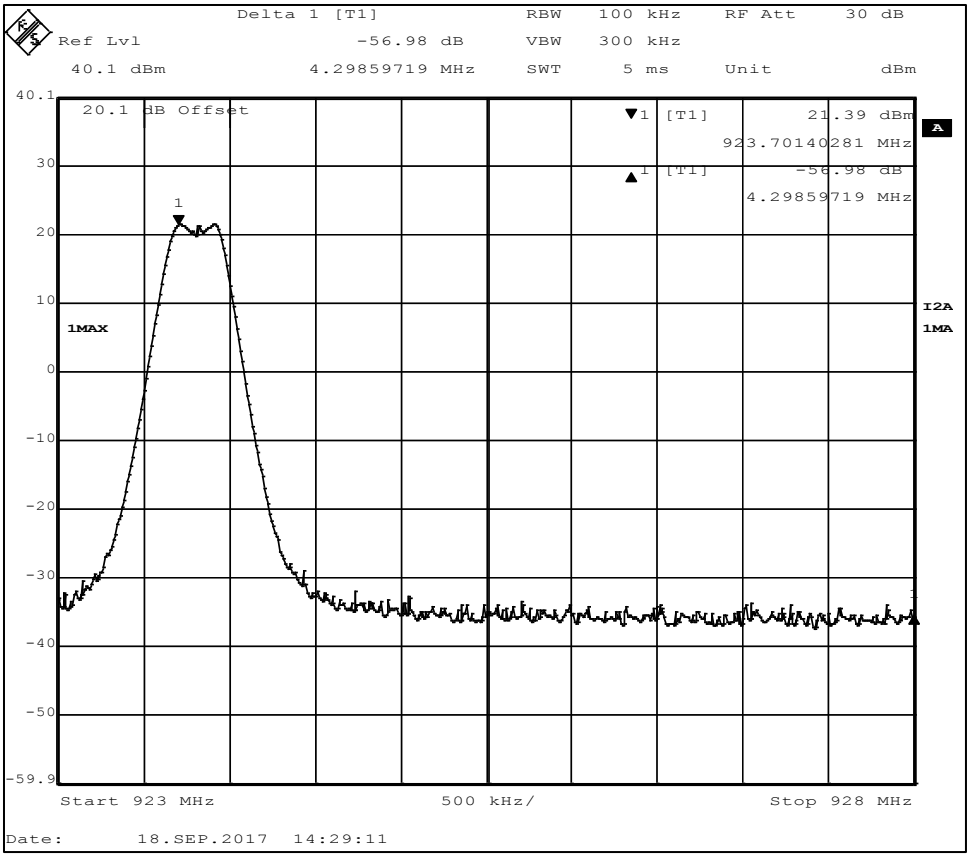

Figure 19 - Band-edge Measurement, High Channel, Unrestricted Frequency

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

Delta = 56.98 dB Min = 20 dB

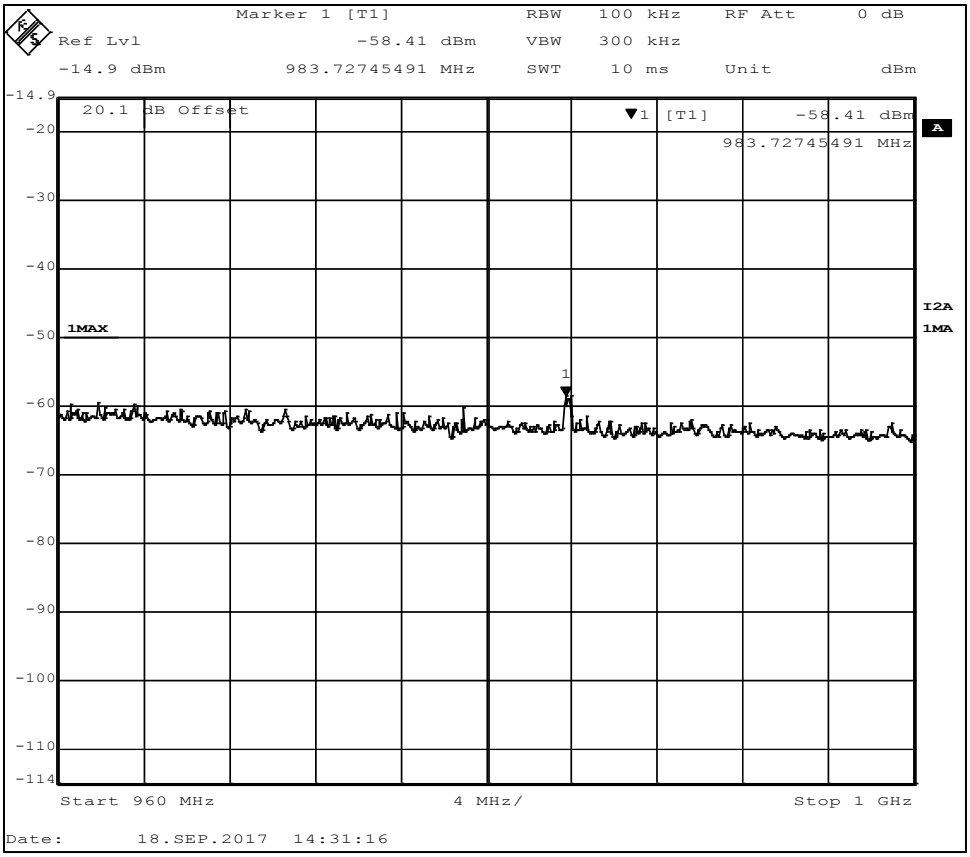

Figure 20 - Band-edge Measurement, High Channel, Restricted Frequency

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

Average time of occupancy on any frequency not to exceed 0.4 seconds

4.5.2 Test procedures

The method from ANSI C63.10 Section 7.7.2, 7.7.3 and 7.7.4 were used.

The EUT was connected to the spectrum analyzer directly with a low-loss shielded coaxial cable and an attenuator.

4.5.3 Deviations from test standard

No deviation.

4.5.4 Test setup

*20dB Attenuator was used.

4.7.5 EUT operating conditions

The EUT was powered by 5 VDC unless specified and set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range.

4.5.6 Test results

EUT MODULE	RFMD	MODE	Continuous Hop
INPUT POWER	5 VDC	FREQUENCY RANGE	907MHz – 924 MHz
ENVIRONMENTAL CONDITIONS	32 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

Data taken from Section 4.7:

36.07 ms per channel on time
124.27 ms between hops

25 hop channels
124.27 ms × 25 channels = 3.11 s per sequence
Each frequency can occur up to 4 times per 10s window
4 × 36.07 ms = 144 ms < 400 ms

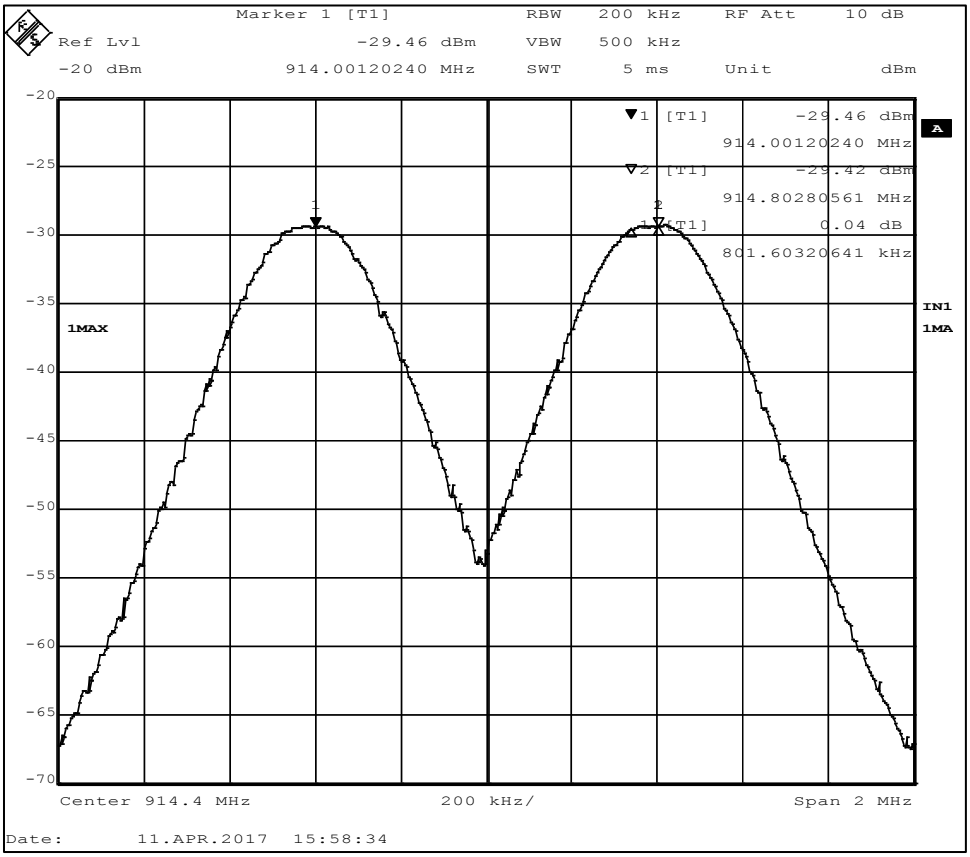

Figure 21 – Frequency Separation (801.60 kHz)

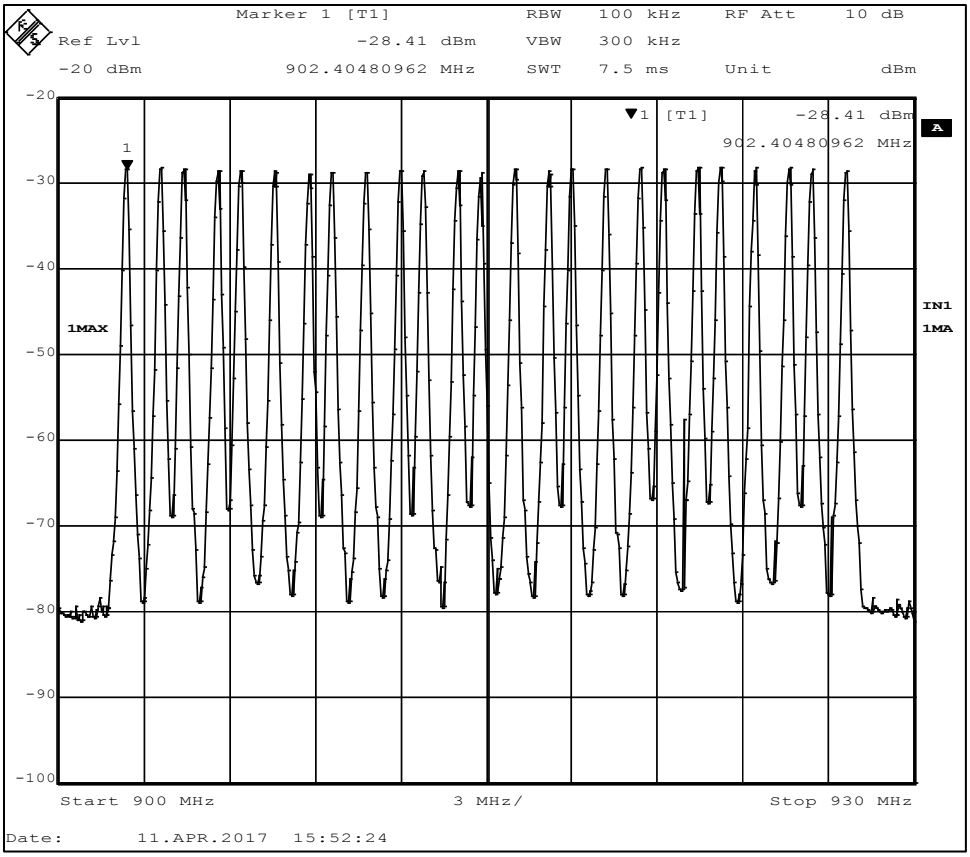

Figure 22 – Hopping Channel Count (25 Channels)

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

The EUT was tested as part of a system and a Laptop computer was used for the test as a representative sample only.

4.6.5 EUT operating conditions

The EUT was powered by 5 VDC using a DELL Latitude D 620 computer for conducted emissions test and is set to transmit continuously on the lowest

frequency channel, however the power supply (MN: DA130PE1-00 SN:CN-OJU012-48661-98E-6C1W-A02) for the laptop was powered by 120 VAC/ 60 Hz for the test.

4.6.6 Test Results

EUT MODULE	RFMD	MODE	Transmit (low channel used)
INPUT POWER	5 VDC	FREQUENCY RANGE	150kHz – 30MHz
ENVIRONMENTAL CONDITIONS	32 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

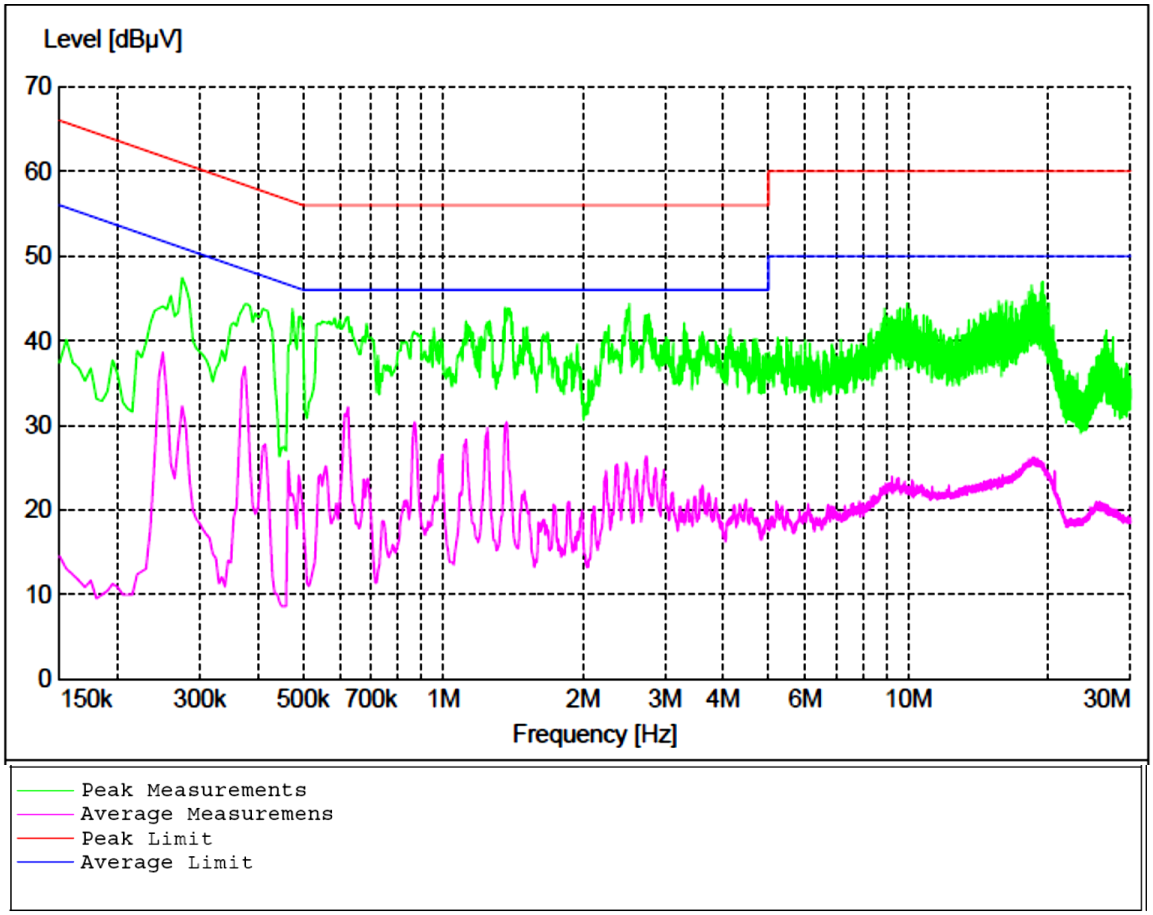

Figure 23 - Conducted Emissions Plot

*All measurements were found to be at least 10dB below the applicable limit.

4.7 Duty Cycle

4.7.1 Limits for Duty Cycle

The duty cycle can be applied to the peak measurements as a duty cycle correction to obtain average measurements. This is defined in FCC Part 15.35, paragraph (c). The maximum allowed period is 0.1 s. For the worse-case duty cycle, the correction was **-8.87 dB**

4.7.2 Test procedures

The method from ANSI C63.10 Section 7.5 was used.

The EUT was connected to the spectrum analyzer directly with a low-loss shielded coaxial cable and an attenuator.

4.7.3 Deviations from test standard

No deviation.

4.7.4 Test setup

*20dB Attenuator was used.

The EUT was tested in 4 possible modes to determine which mode has the highest duty cycle:

1. Polling – The dongle is looking for meters to respond
2. Firmware update – the dongle sends a firmware update to a meter
3. Meter query – The dongle sends a query to obtain information from a meter
4. Valve control – The dongle sends a command to open or close a valve.

4.7.5 EUT operating conditions

The EUT was powered by 5 VDC unless specified and set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range.

4.7.6 Test results

EUT MODULE	RFMD	MODE	Polling
INPUT POWER	5 VDC	FREQUENCY RANGE	907MHz – 924 MHz
ENVIRONMENTAL CONDITIONS	32 % ± 5% RH 23 ± 3ºC	TECHNICIAN	NJohnson

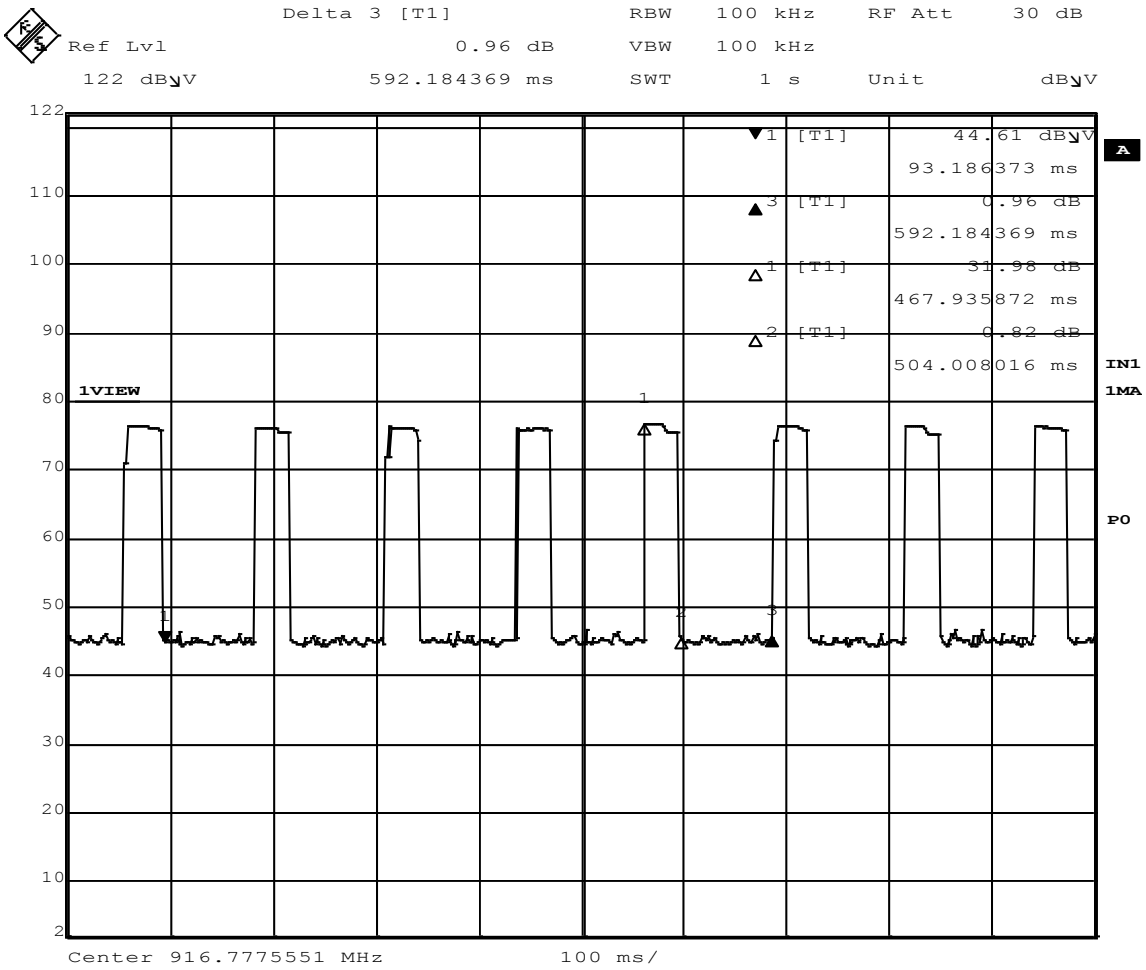

Figure 24 - Polling Mode, Period and On Time Plot

On Time = 504.01 – 467.94 = **36.07 ms**
Period = 592.18 – 467.94 = **124.24 ms**

Duty cycle = 36.07/100.00 = **0.36 % = -8.87 dB**

Note: 100 ms was used as the maximum allowed period per FCC Part 15.35.

EUT MODULE	RFMD	MODE	Frimware update
INPUT POWER	5 VDC	FREQUENCY RANGE	907MHz – 924 MHz
ENVIRONMENTAL CONDITIONS	32 % ± 5% RH 23 ± 3ºC	TECHNICIAN	NJohnson

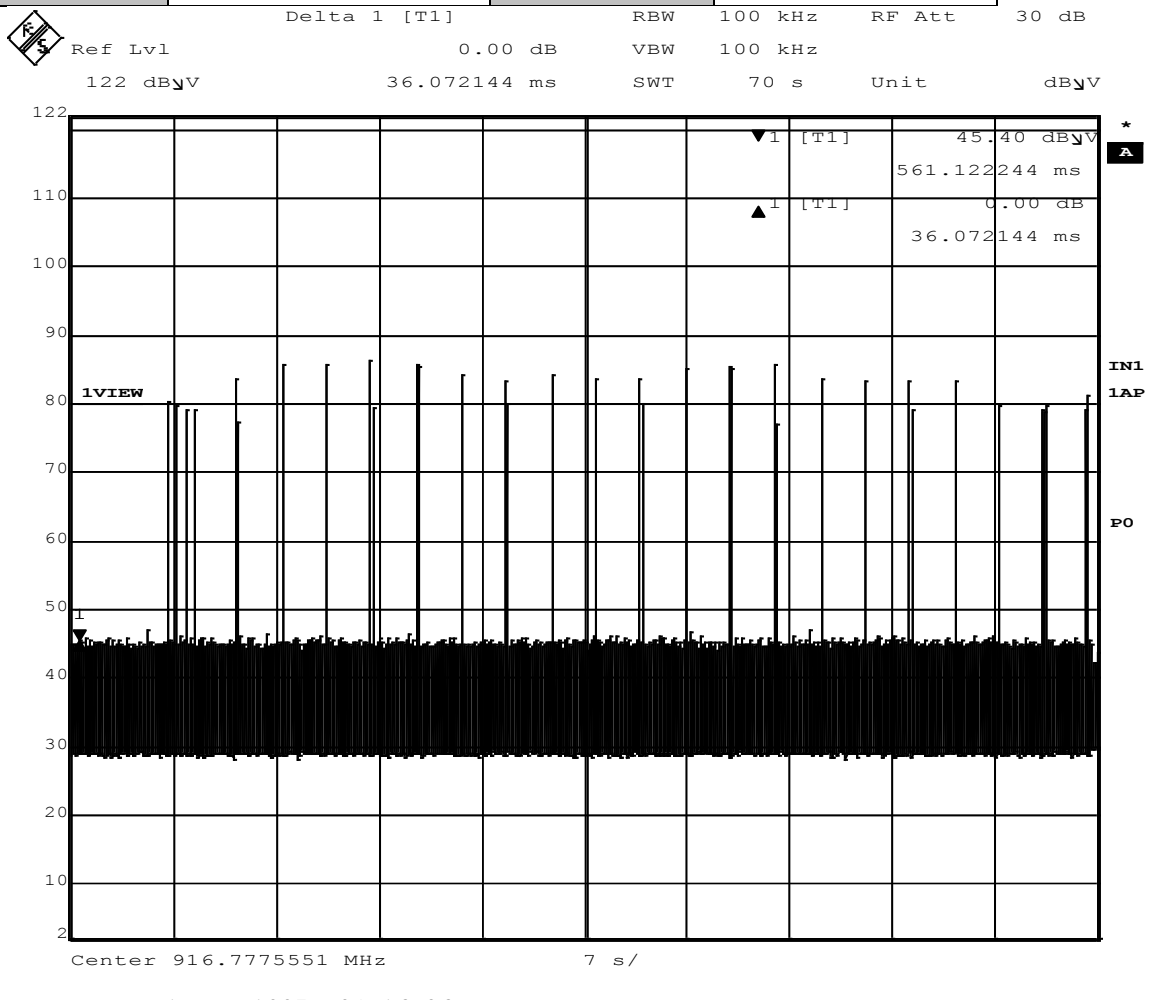

Figure 25 – Firmware Update Mode, Full duration

> 63 ms

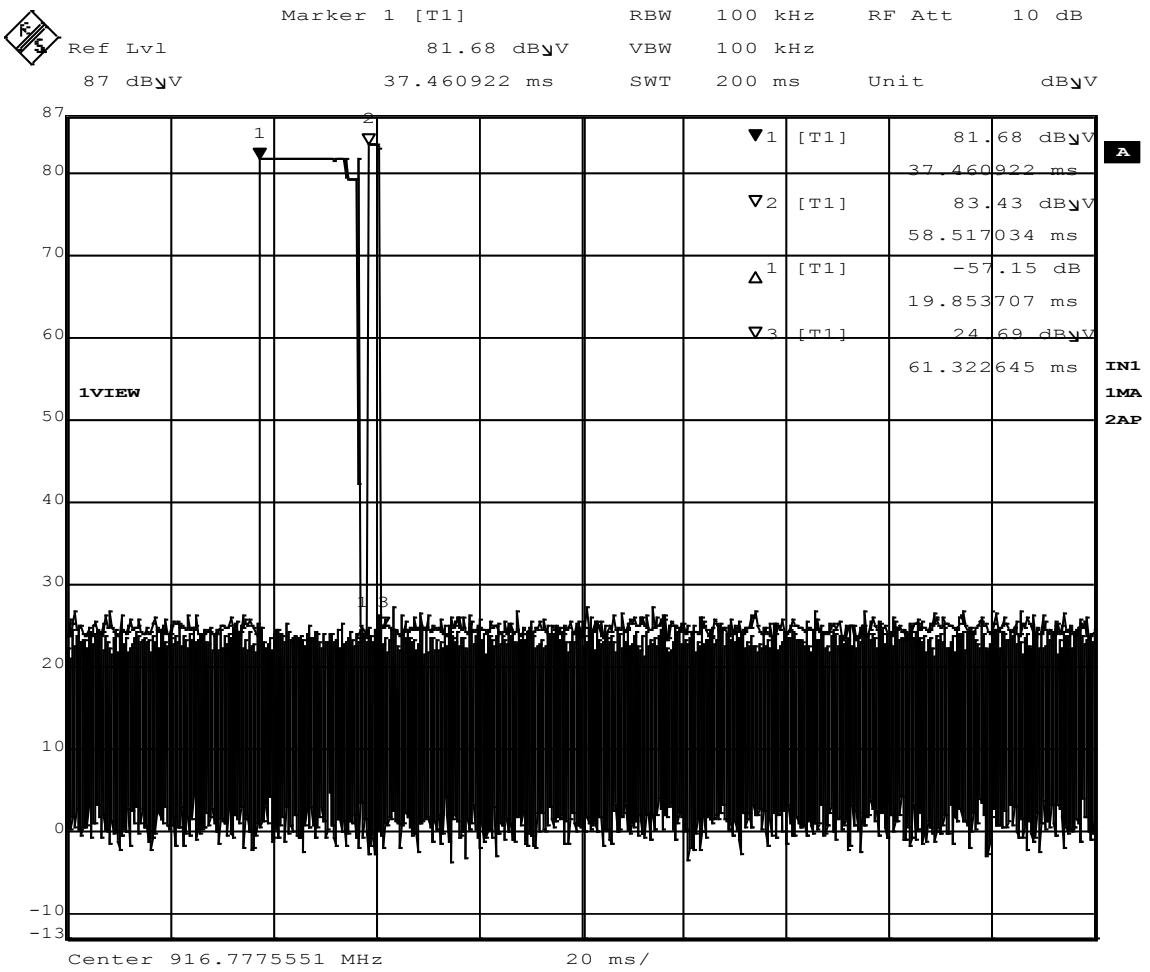

Figure 26 - Firmware Update Mode, On Time

19.85 + (61.32 – 58.52) = 22.65 ms

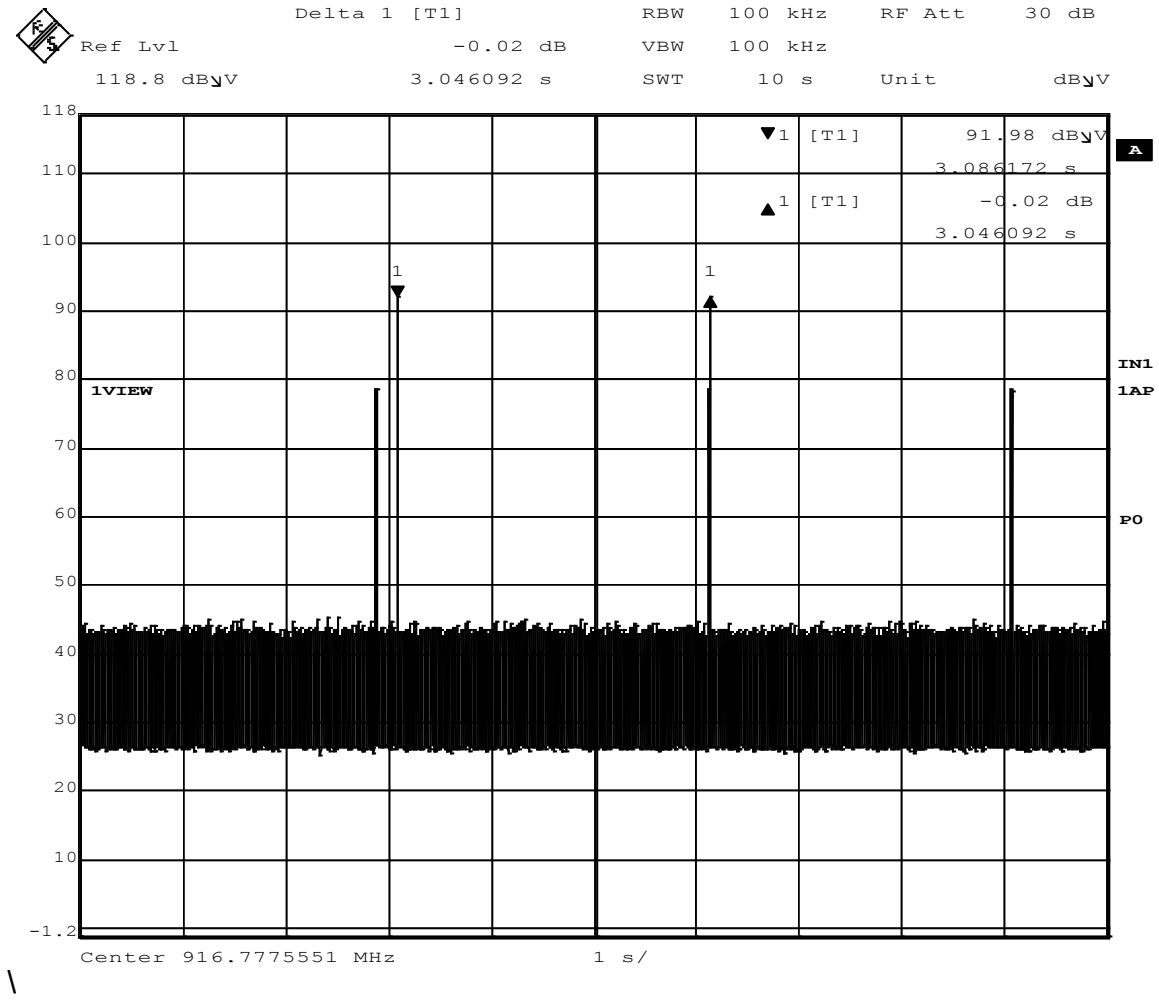

Figure 27 - Firmware Update Mode, Period

3.05 s

Duty cycle = 22.65 / 100.00 = **22.65% = -12.90 dB**

Note: 100 ms was used as the maximum allowed period per FCC Part 15.35.

EUT MODULE	RFMD	MODE	Meter query
INPUT POWER	5 VDC	FREQUENCY RANGE	907MHz – 924 MHz
ENVIRONMENTAL CONDITIONS	32 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

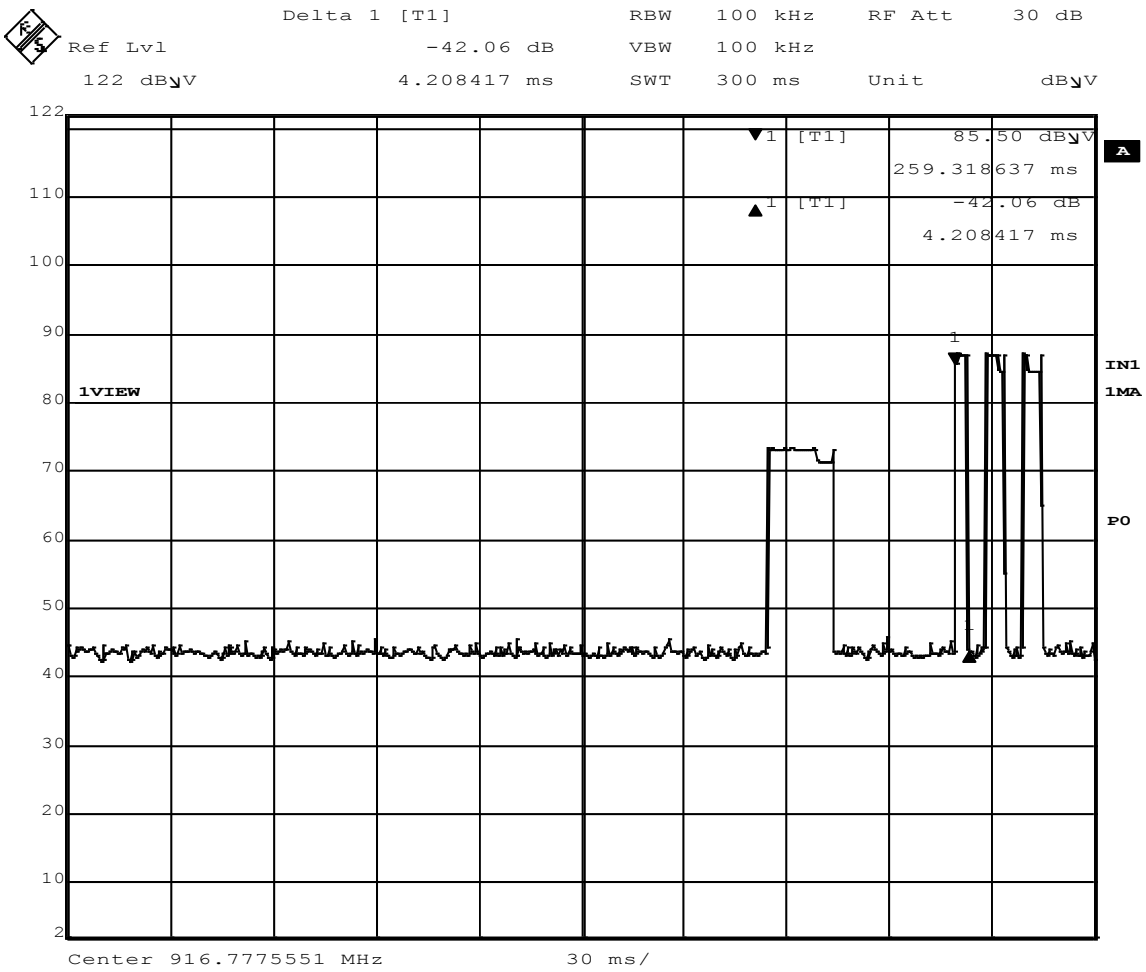

Figure 28 – Meter Query, On Time 1

On Time 1 = 4.21 ms

Note: the first wider pulse is the meter, which is not under test in this report

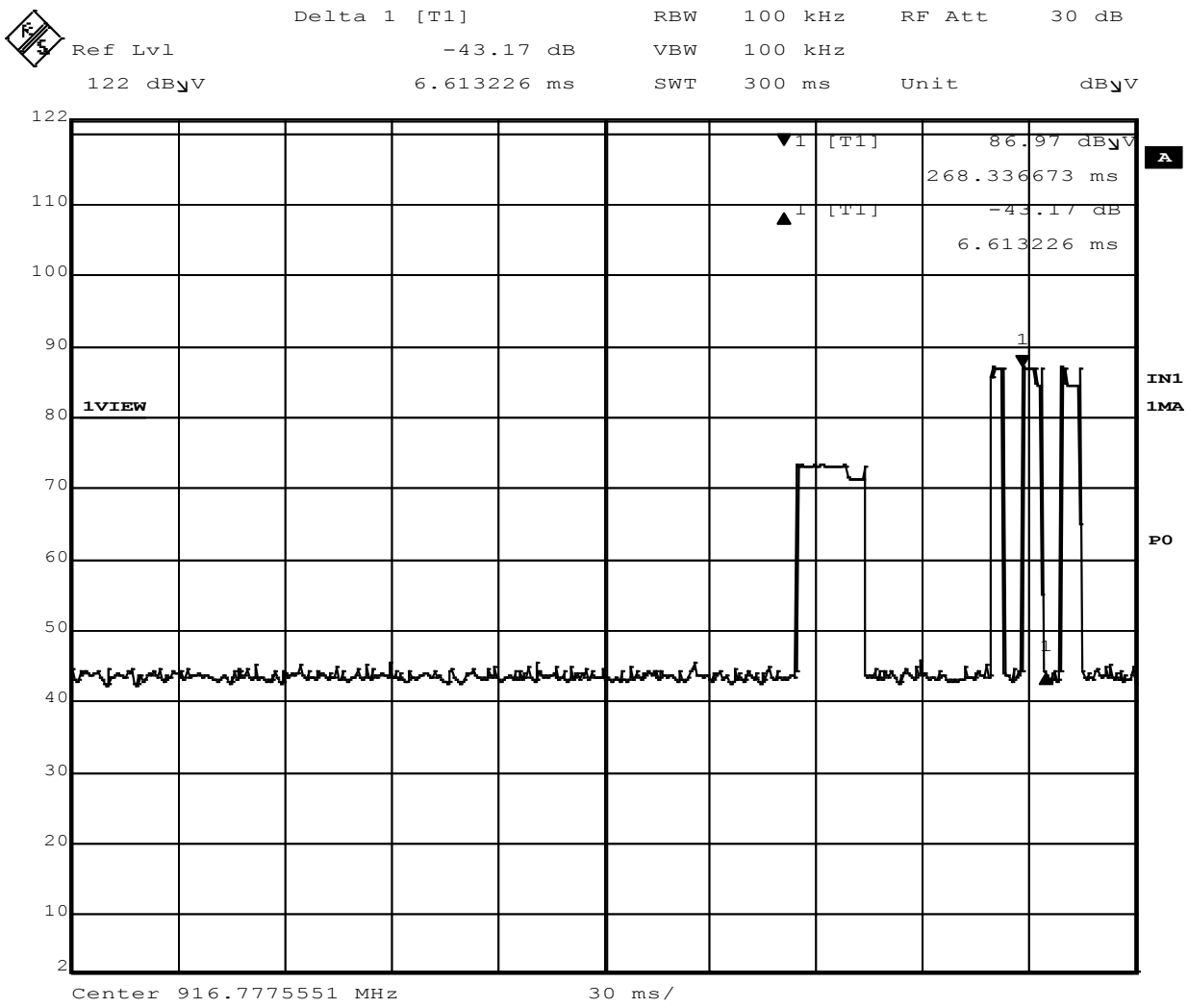

Figure 29 - Meter Query, On Time 2

On Time 2 = 6.61 ms

Note: the first wider pulse is the meter, which is not under test in this report

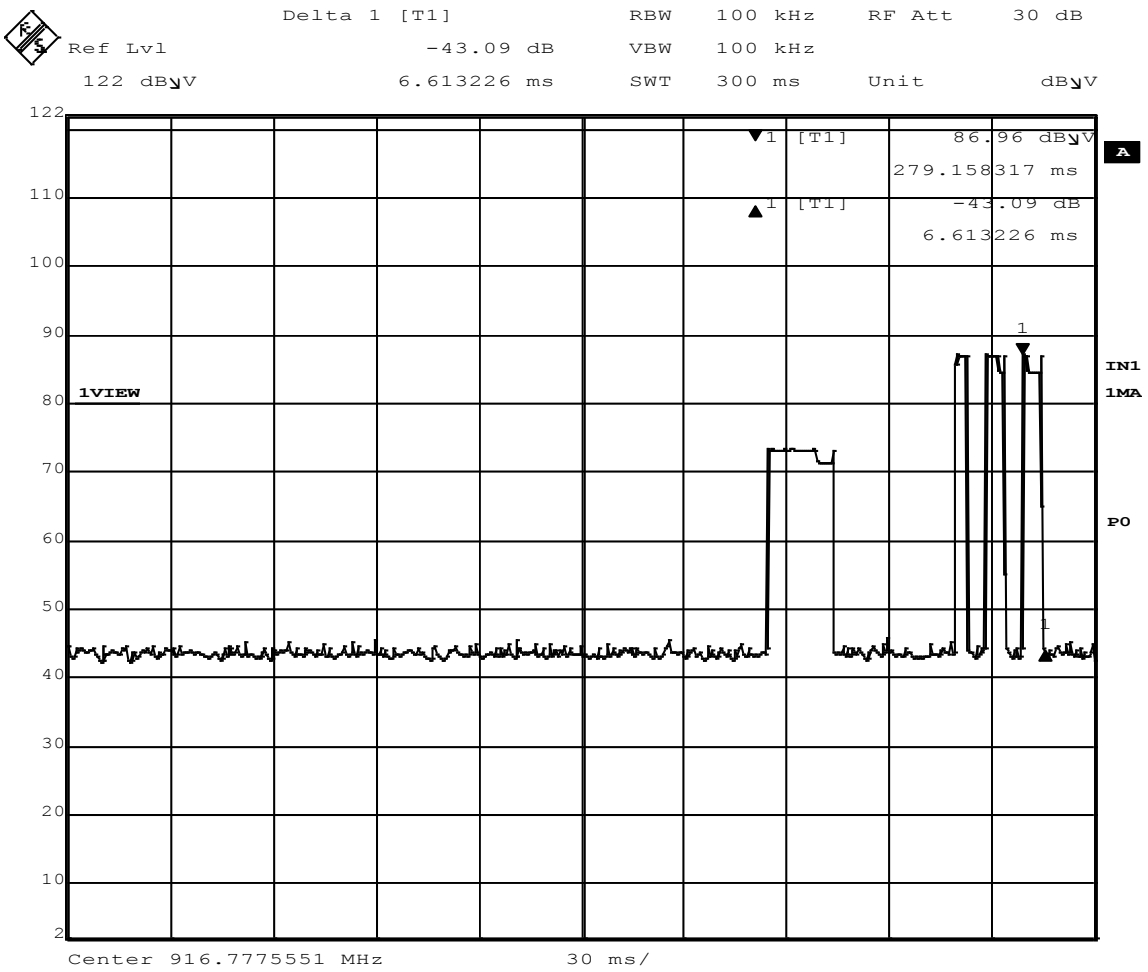

Figure 30 - Meter Query, On Time 3

On Time 3 = 6.61 ms

Note: the first wider pulse is the meter, which is not under test in this report

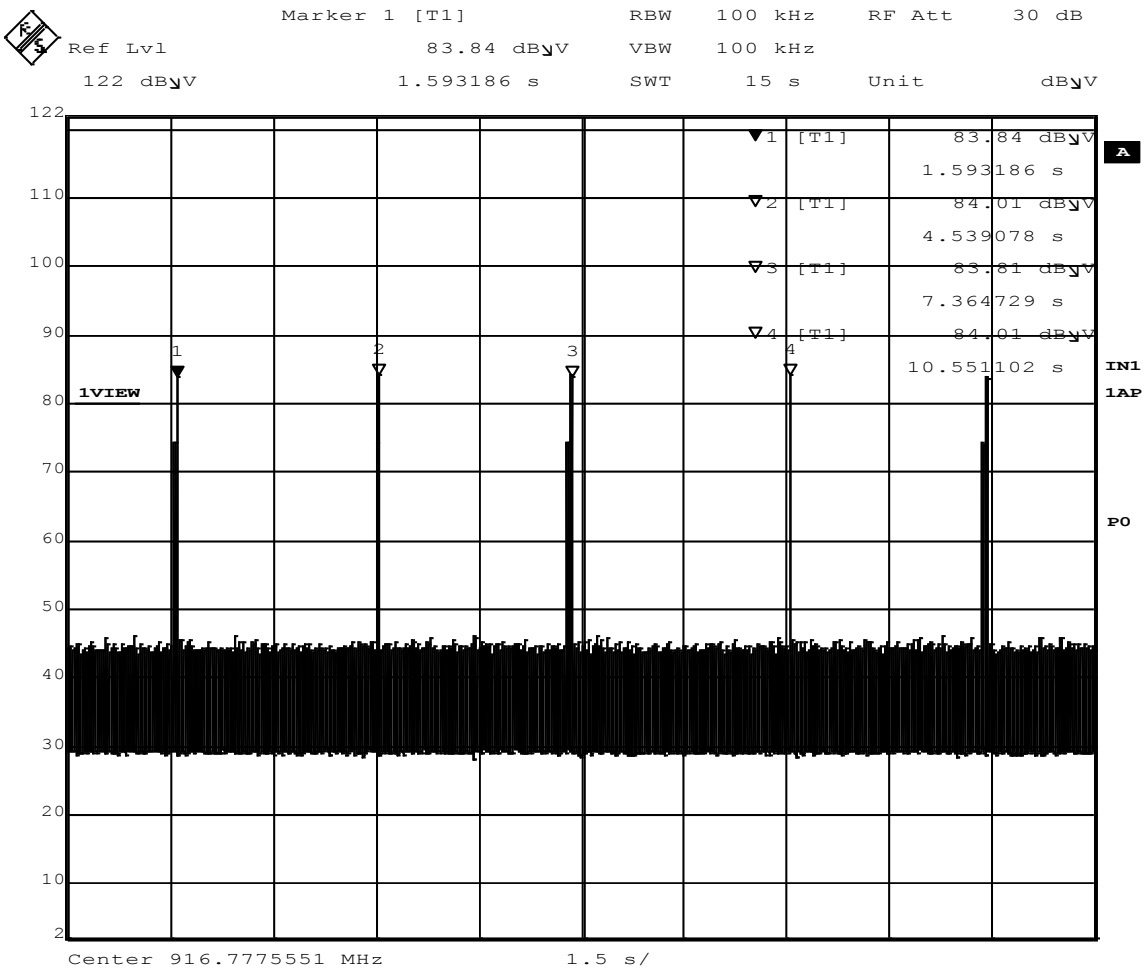

Figure 31 - Meter Query, Period

Period = 4.54 – 1.59 = 2.95 s

Duty cycle = (4.21 + 6.61 + 6.61) / 100 = **17.4 % = -15.17 dB**

Note: 100 ms was used as the maximum allowed period per FCC Part 15.35.

EUT MODULE	RFMD	MODE	Valve control
INPUT POWER	5 VDC	FREQUENCY RANGE	907MHz – 924 MHz
ENVIRONMENTAL CONDITIONS	32 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

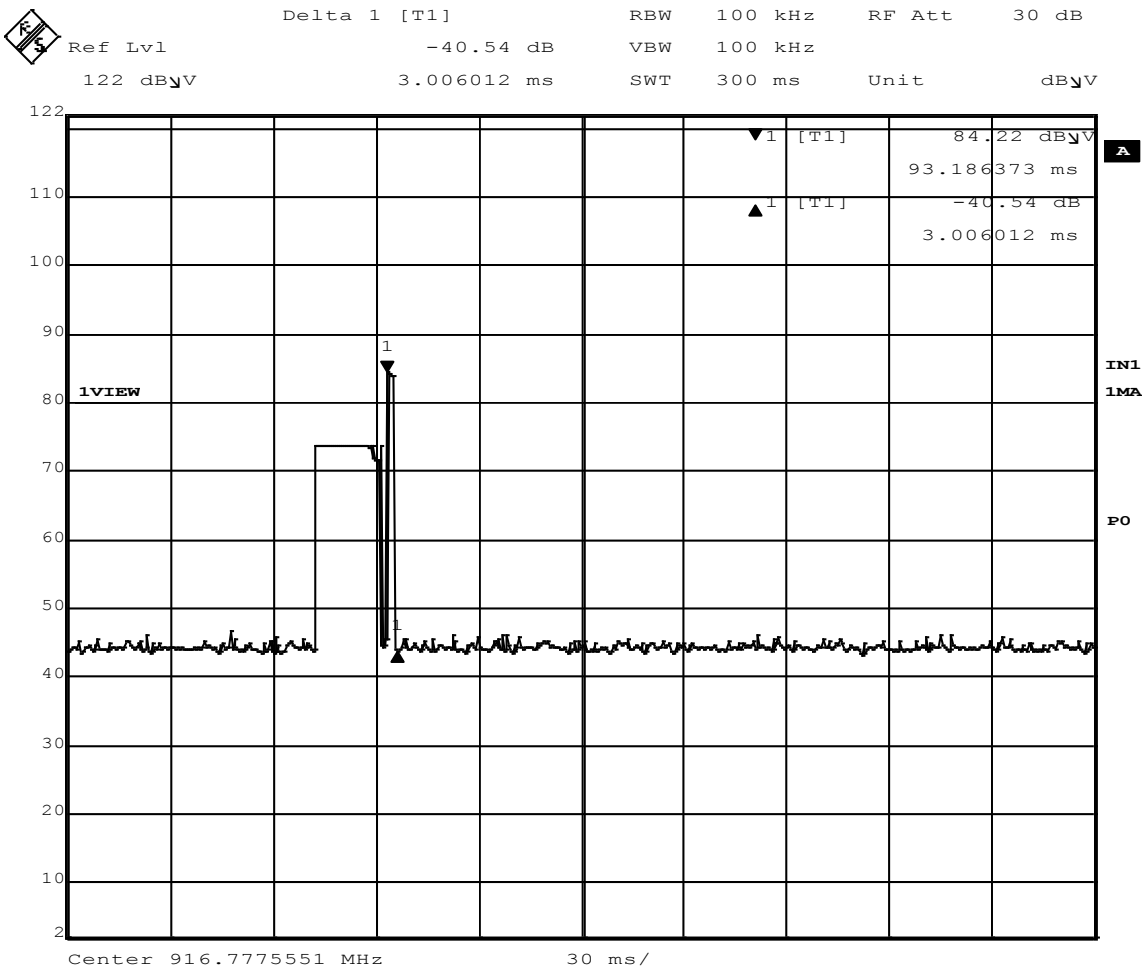

Figure 32 - Valve Control - On Time

On Time = 3.00 ms

Period > 100ms (firmware will not allow valve control any faster)

Duty cycle = 3.00 / 100.00 = 3% = -20.00 dB (max duty cycle correction allowed)

Note: the first wider pulse is the meter, which is not under test in this report

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 dB
Radiated Emissions, 3m	1GHz – 27.5GHz	±4.44 dB
Emissions limits, conducted	150kHz – 18GHz	±3.30 dB
Direct antenna port conducted	9 kHz – 26.5 GHz	±0.82 dB

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

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