

Electromagnetic Compatibility

Test Report

**FCC CFR47 Part 15 Subpart B, Subpart C 15.231 15.205;
 RSS Gen issue 4, ICES-003 Issue 5 & RSS 210 issue 8, Annex 1**

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Testing Laboratory.....: Quality Auditing Institute

Address.....: 16 – 211 Schoolhouse Street, Coquitlam, BC, V3K 4X9, Canada

Accreditations (ISO 17025):



Standard Council of Canada: Accredited Laboratory No. 743

International Accreditation Service Inc: Accredited Laboratory: No. TL-239

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Applicant's name: Versa Wireless

Address.....: 3725 159A Street, Surrey, BC Canada, V3Z 0P1

Contact.....: Justin Carlson, Email: justin@versawireless.com

Phone.....: (604) 807-3235

Test Standard.....: FCC CFR47 Part 15 Subpart B, Subpart C 15.231 ,15.205; RSS Gen issue 4 & RSS-210 Issue 8 Annex 1

Test item description.....: Multi-Protocol Security Sensors: Versa-X

Manufacturer.....: Versa Wireless

Model Number.....: Versa-X

FCC ID: 2AD9XVERSAX

IC Certification No.: 12637A-VERSAX



Security Sensors: Versa-X (EUT)

Revision History

Date	Report Number	Rev #	Details	Authors Initials
Feb-27-2015	E10676-1501	0.0	Draft Test Report	AJ
Mar-16-2015	E10676-1501	1.0	Final Test Report	JQ
April-08-2015	E10676-1501	2.0	Updated Final Test Report	JQ

All previous versions of this Report have been superseded by the latest dated Revision as listed in the above table. Please dispose of all previous electronic and paper printed revisions accordingly.

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EMC TEST SUMMARY

The following tests demonstrate the testimony to “FCC & IC” Mark Electromagnetic compatibility testing for “Versa-X” manufactured by Versa Wireless. The testing was performed pursuant to FCC CFR47 Part 15 Subpart B, Subpart C 15.231 15.205; RSS Gen issue 4, ICES-003 Issue 5 & RSS 210 issue 8, Annex 1


Test Item		Applicable Standard	Description	Performance Criteria
Part 1	Radiated Emissions	FCC CFR47 Part 15 Subpart B; RSS Gen issue 4, ICES-003 Issue 5	The emission are measured when the transmitter is not activated.	Complies
Part 2	Transmitter Radiated Emission	FCC CFR47 Part 15 Subpart C 15.231 15.205; RSS Gen issue 4 & RSS 210 issue 8, Annex 1	Field strength of fundamental and spurious emission are measured in the 30MHz-3.3Hz range	Complies
Part 3	Duty Cycle	FCC Part 15.35	Duty cycle correction factor	Complies
Part 4	20 dB Bandwidth	FCC CFR47 Part 15 Subpart C 15.231; RSS Gen issue 4 & RSS 210 issue 8, Annex 1	The bandwidth of the emission shall be no wider than 0.25% of the center frequency	Complies
Part 5	Transmitter Timing	FCC CFR47 Part 15 Subpart C 15.231; RSS Gen issue 4 & RSS 210 issue 8, Annex 1	transmitter shall cease transmission within 5 seconds after activation	Complies

Tests were conducted on a sample of the equipment as requested by Versa Wireless for the purpose of demonstrating compliance with FCC CFR47 Part 15 Subpart B, Subpart C 15.231 15.205; RSS Gen issue 4, ICES-003 Issue 5 & RSS 210 issue 8, Annex 1. Versa Wireless is responsible for the tested product configuration, continued product compliance with these standards listed, and for the appropriate auditing of subsequent products, as required. Please note that this list of tests may only comprise a partial list of the tests that are required before a FCC or IC label can be produced by the manufacturer.

This is to certify that the following report is true and correct to the best of our knowledge.

X 

Written by Jack Qin
RF/EMC Test Engineer/Technical Writer

X 

Reviewed by Aman Jathaul,
EMC Project Manager

PRODUCT DESCRIPTION

Applicant: Versa Wireless
 Equipment Under Test: Versa-X

EUT DESCRIPTION

EUT	Versa-X
Operational Description	<p>This device is a multi-protocol security sensor for windows. When the window is opened, a magnet is separated from the reed switch on the sensor, which triggers a change of state on the sensor's microprocessor. The microprocessor then powers up the RF transmitter (Pulse Width Modulated OOK) and sends a series of 4 identical packets that flag the change of state to a receiver. The 4 packets are sent with a random delay between them of 100 mS to 800 mS. Transmitting frequency can be configured to 319.5MHz, 345MHz and 433.9MHz using the address switched on the back of the unit.</p> <p>When there is no change of state occurring, the device goes into a very low-power mode, and wakes up 4x a second to check and see if there is a change of state on the reed switch. The sensor times out every 72 minutes and transmits a "heartbeat" message to allow the receiver to know it is still operational. Further, a battery level indicator (ok, or low) is sent with every message packet allowing a service technician to change the battery when it gets low.</p>
FRN	0024185001
FCC ID	2AD9XVERSAX
IC Certification No.	12637A-VERSAX
Model No.	Versa-X
Manufacturer	Versa Wireless
Transmitter Type	Short range device
Transmitter Frequency	319.5MHz, 345MHz and 433.9 MHz
Worst Transmit Power	65.57dB μ V/m @ 3m distance at 433.9MHz
Antenna Type	Wire loop antenna
Antenna Gain	-16dBi
EUT Power	3Vdc, Coin cell, CR2032
Received Date	Feb-02-2015
Received By	Aman
Sample Log	QAI Product Control Log (QM 1305 - Sample Inventory)

FACILITIES AND ACCREDITATION

Main Laboratory Headquarters: Quality Auditing Institute
Headquarters Location/Address: 16 – 211 Schoolhouse Street, Coquitlam, BC, 3K 4X9, Canada

Associated Laboratory: Quality Auditing Institute (Remote Location)
EMC Test Laboratory Location/Address: 19473 Fraser Way, Pitt Meadows, BC, V3Y 2V4, Canada

FCC Test Site Registration Number: (3 m /10 m Open Area Test Site [OATS] and
3 m Semi-Anechoic Chamber [SAC]): 226383

FCC Designation Number: CA9543

Industry Canada Test Site Registration Number (3m SAC) :9543B-1

Industry Canada Test Site Registration Number (OTAS) :9543C-1

Standard Council of Canada: ISO/IEC 17025:2005 Accredited Laboratory No. 743

International Accreditation Service Inc.: ISO/IEC 17025:2005 Accredited Laboratory: No. TL-239

ENVIRONMENTAL CONDITIONS:

INDOORS, Temperature: 22-28°C, R.H.: 39.7 - 54.4%

TESTING METHODOLOGY

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC CFR47, Part 15, Subpart C Section 15.231, 15.205, RSS Gen issue 4 & RSS 210 issue 8, Annex 1. Radiated tests were conducted in accordance with ANSI C63.4-2014 and ANSI C63.10:2013

EUT TESTING CONFIGURATION

EUT was powered up by 3Vdc of Coin cell CR2032 and set up to transmit continuously in modulated modes of operation.

WORST TEST CASE

Worst-case orientation was determined by rotating the EUT on three axes, during the pre-compliance test and final radiated emissions tests were performed in that orientation.

GENERAL TEST PROCEDURES

Radiated Emissions

The EUT is placed on the turntable 0.8m above a ground plane 3m away from a receiving antenna. Height of receiving antenna varied from 1m to 4m, its polarity changes from vertical to horizontal. Turntable rotates 360 degrees. Motion of turntable and receiving antenna allows determining position of maximum emission level. Quasi-peak detector applies for measurements of emissions with frequency range of 30 to 1000MHz. and average/peak detector otherwise.

AC Mains Conducted Emissions

No applicable, as the EUT is powered by a coin cell battery.

MEASUREMENT UNCERTAINTY

Radio Frequency	: ±1,5 x 10 ⁻⁵
Total RF power, conducted.....	: ±1 dB
RF power density, conducted.....	: ±2.75 dB
Spurious emissions, conducted.....	: ±3 dB
All emissions, radiated.....	: ±3.5 dB
Temperature.....	: ±1°C
Humidity.....	: ±5 %
DC and low frequency voltages.....	: ±3 %

TEST EQUIPMENT LIST

Emmission Testing Equipment					
Manufacturer	Model	Description	Serial No.	Last Cal	Cal Due Date
Sunol Sciences	SM46C	Turntable	051204-2	N/A	N/A
Sunol Sciences	TWR95	Mast	TREML0001	N/A	N/A
Sunol Sciences	JB3	Biconilog Antenna 30MHz – 3GHz	A042004	31-Oct-2012	31-Oct-2015
ETS Lindgren	2165	Turntable	00043677	N/A	N/A
ETS Lindgren	2125	Mast	00077487	N/A	N/A
Rohde & Schwarz	ESU40	EMI Receiver	100011	2014-11-20	2017-11-20
ETS Lindgren	S201	5 meter Semi-Anechoic Chamber	1030	N/A	N/A
ETS Lindgren	3117	Dual Ridge Horn Antenna 1G-18GHz	00075944	29-Aug-13	29-Aug-15
AH Systems	PAM118	Amplifier 100KHz-18GHz	189	Conditional Use	Conditional Use
Electro-Mechanics	6502	Loop Antenna 10k-30MHz	2178	8/21/2014	8/21/2017

Measurement Software List			
Manufacturer	Model	Version	Description
Rhode & Schwarz	EMC 32	6.20.0	Emissions Pre-scan Test Software

Part 1 - Radiated Emissions Testing (Unintentional Mode)

DATE: Feb-03-2015

TEST STANDARD: FCC CFR47 Part 15 Subpart B; RSS Gen issue 4, ICES-003 Issue 5

MINIMUM STANDARD: Except as provided elsewhere in FCC CFR47, Part 15, Subpart C & RSS 210 issue 8, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (dBµV/m) at 3m
30 – 88	40
88 – 216	43.5
216 - 960	46
960 – above	54

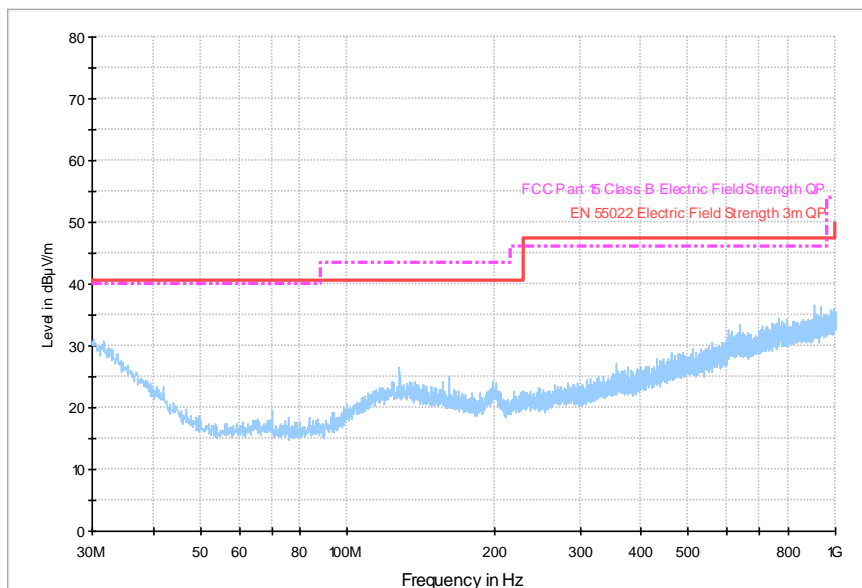
Note: In the above emission table, the tighter limit applies at the band edges.

TEST SETUP: The EUT was placed on a turntable, which is 0.8 m above ground plane. Emissions in both horizontal and vertical polarizations were measured while rotating the EUT on a turntable and moving the receiving antenna from 1m to 4 m high to maximize the emissions signal strength. The equipment was set up in a 3-meter Semi Anechoic Chamber for preliminary measurements and finals were completed in 3m/10m Open Air Test Site at 3 meters.

MODIFICATIONS: No modification is required to comply for this test.

PERFORMANCE: Complies with standard.

MEASUREMENT DATA & PLOT:



Note: All radiated emissions were at least 20 dB below the required limit line.

Part 2 - Transmitter Radiated Emissions Testing

DATE: Feb 2 and 17 2015

TEST STANDARD: FCC CFR47 Part 15 Subpart C 15.231 15.205; RSS Gen issue 4 & RSS 210 issue 8, Annex 1

MINIMUM STANDARD: The radiated emissions of fundamental and spurious frequency from the DUT shall meet the limits below:

Fundamental Frequency (MHz)	Field Strength of Fundamental ($\mu\text{V/m}$)	Field Strength of Spurious Emission ($\mu\text{V/m}$)
40.66 - 40.70	2250	225
70 - 130	1250	125
130 - 174	1250 - 3750**	125-375**
174 - 260	3750	375
260 - 470	3750 - 12500**	375-1250**
Above 470	12500	1250

Note: 1) In the above emission table, the tighter limit applies at the band edges.
 2) ** Linear interpolations.

Except as otherwise described in the standards, only spurious emissions are permitted in any of the Frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(2)
13.36-13.41			

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

If there is field strength of spurious emissions appearing within these restricted bands, it shall not exceed the limits shown in the below table

Frequency (MHz)	Field Strength (dB $\mu\text{V/m}$) at 3m
30 - 88	40
88 - 216	43.5
216 - 960	46
960 - above	54

Note: In the above emission table, the tighter limit applies at the band edges.

TEST SETUP: The EUT was placed on a turntable, which is 0.8 m above ground plane. Emissions in both horizontal and vertical polarizations were measured while rotating the EUT on a turntable and moving the receiving antenna from 1m to 4 m high to maximize the emissions signal strength. The equipment was set up in a 3-meter Semi Anechoic Chamber for preliminary measurements and finals were completed in 3m/10m Open Air Test Site at 3 meters. Measurements were also performed from 9 kHz to 30 MHz with active loop antenna, but no emissions were found in that range. During pre-compliance test, Worst-case orientation was determined by rotating the EUT on three axes and final radiated emissions tests were performed in that orientation. Radiated emissions testing was performed separately when the EUT was set to transmit at 319.5MHz, 345MHz and 433.9MHz

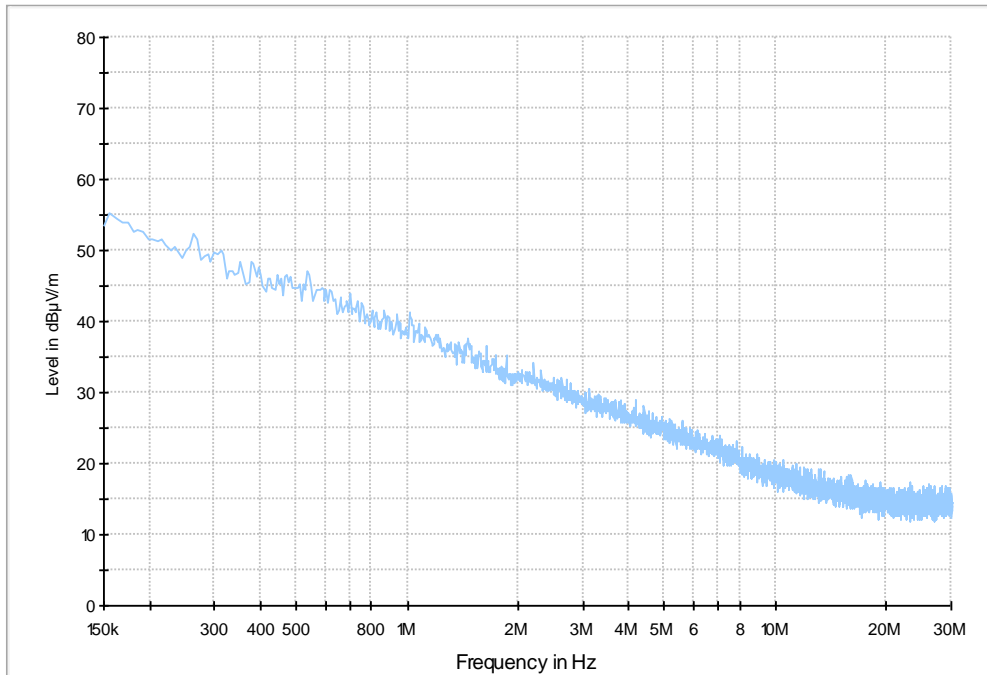
DEVICE DESCRIPTIONS: Refer to the Equipment Under Test Section.

MODIFICATIONS: No modification is required to comply for this test.

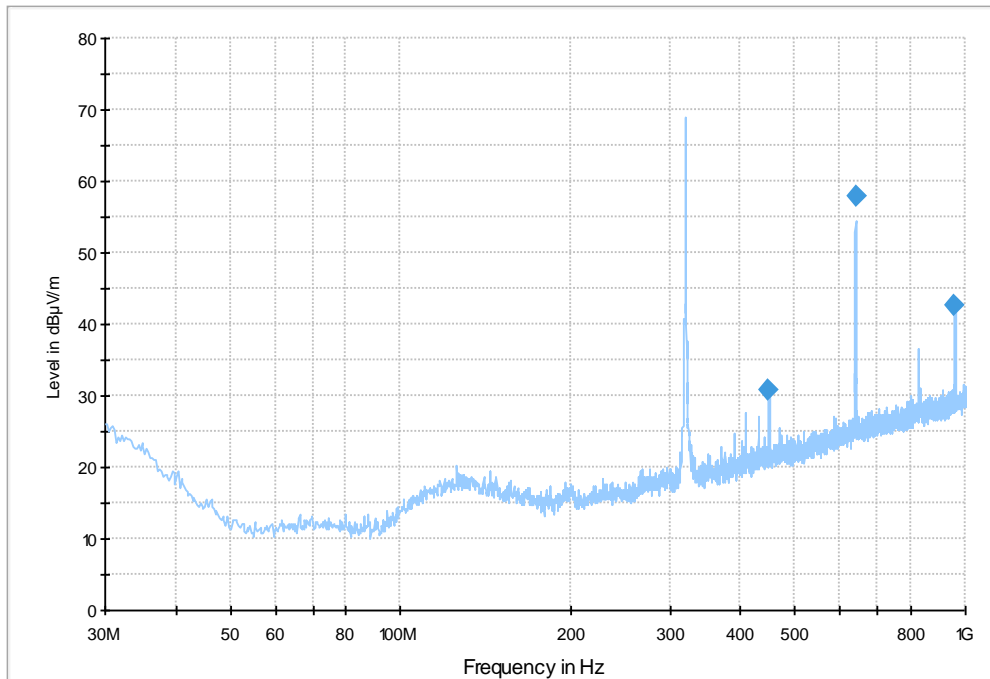
PERFORMANCE: Complies with standard.

MEASUREMENT DATA: See radiated emissions data

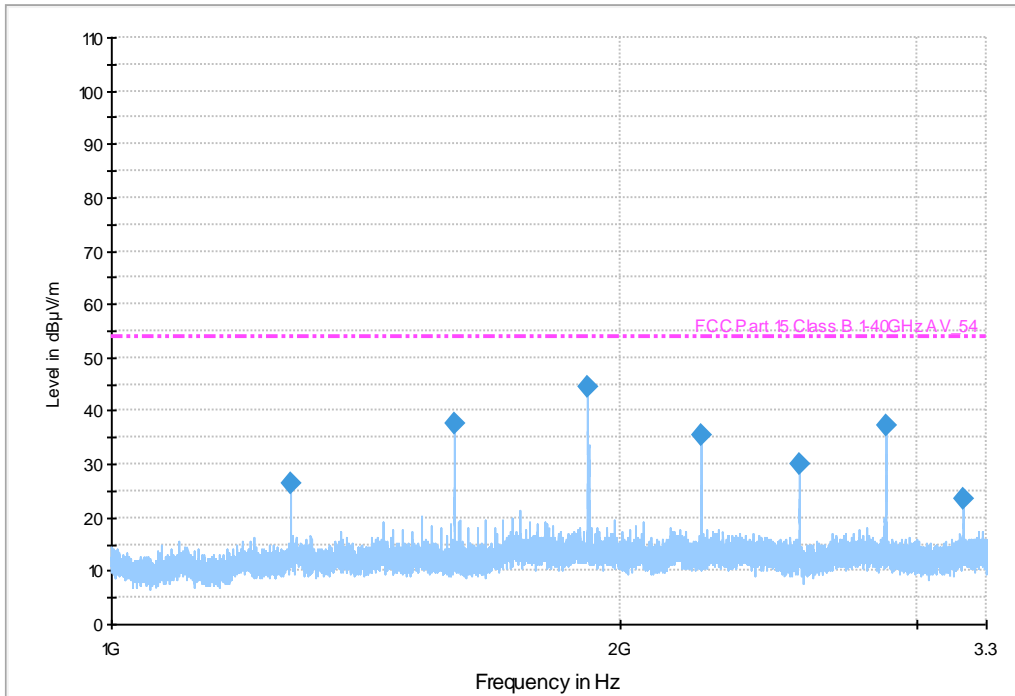
RADIATED EMISSIONS DATA TRANSMITTING AT 319.5MHz



Radiated Emissions 150kHz-30MHz at 3m – TX at 319.5MHz



Radiated Emissions 30MHz-1GHz at 3m - TX at 319.5MHz



Radiated Emissions 1GHz-3.3GHz at 3m - TX at 319.5MHz

Table 1: Radiated Emissions 30MHz-1GHz at 3m - TX at 319.5MHz

Freq. (MHz)	Uncorr-Peak (dBuV/m)	Angle (deg)	Height (cm)	Pol. (V/H)	Ant factor (dB)	Cable Loss (dB)	Corrected Peak (dBuV/m)	Duty Cycle correction factor (dB)	Corrected Avg (dBuV/m)	Limit (dBuV/m)
319.5	69.9	225	100	H	13.9	1.51	85.31	-21.4	63.91	75.88
319.5	50.9	129	130	V	13.9	1.51	66.31	-21.4	44.91	75.88
639	36.38	58	134	H	19.2	2.34	57.92	-21.4	36.52	55.89
639	22.3	221	100	V	19.2	2.34	43.84	-21.4	22.44	55.89
958.5	26.73	228	100	H	22.5	3.17	52.4	-21.4	31	55.89
958.5	20.25	25	186	V	22.5	3.17	45.92	-21.4	24.52	55.89

Other than Harmonics emissions

Freq. (MHz)	Corrected Quasi-Peak (dBuV/m)	Angle (deg)	Height (cm)	Pol. (V/H)	Correction Factor (dB)	Margin (dB)	Limit (dBuV/m)
449.271	30.9	283	204	H	19	15.1	46

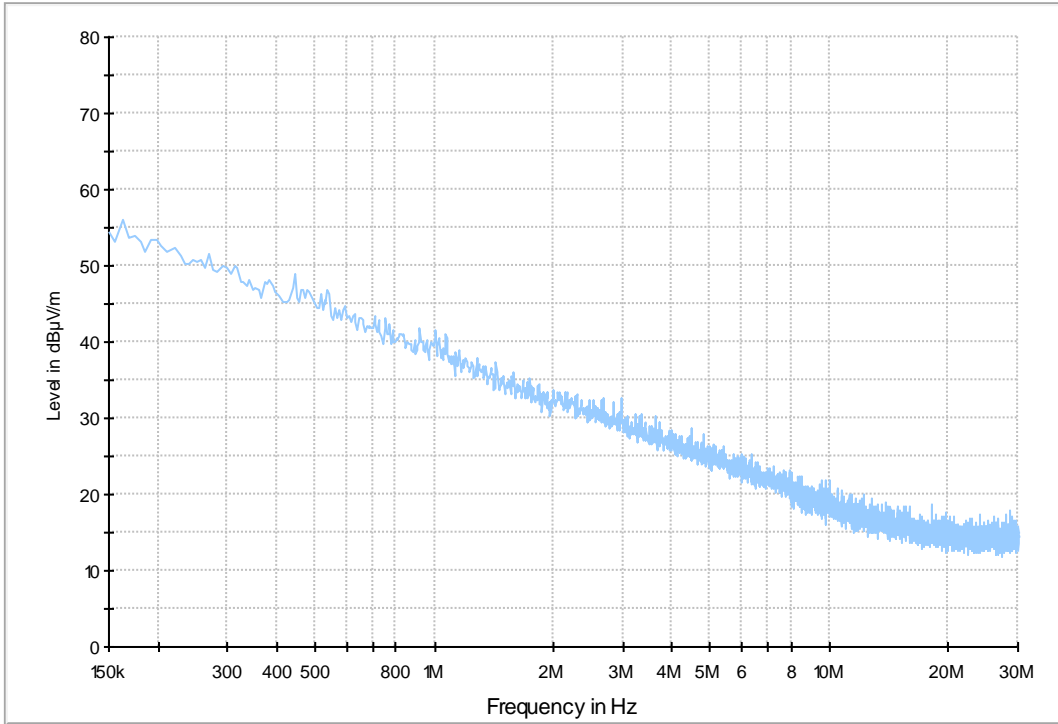
Table 2: Radiated Emissions 1GHz-3.3GHz at 3m - TX at 319.5MHz

Freq. (MHz)	Uncorr-Peak (dBuV/m)	Angle (deg)	Height (cm)	Pol. (V/H)	Ant factor (dB)	Gain (dB)	Corrected Peak (dBuV/m)	Duty Cycle correction factor (dB)	Corrected Avg (dBuV/m)	Limit (dBuV/m)
1278	47.96	260	100	H	28.7	-28.68	47.98	-21.4	26.58	55.89
1278	46.8	107	100	V	28.7	-28.68	46.82	-21.4	25.42	55.89
1597.5	51.27	49	100	H	29.2	-29.62	50.85	-21.4	29.45	55.89
1597.5	49.9	92	118	V	29.2	-29.62	49.48	-21.4	28.08	55.89
1917	52.54	30	100	H	31.04	-28.89	54.69	-21.4	33.29	55.89
1917	55.9	13	100	V	31.04	-28.89	58.05	-21.4	36.65	55.89
2236.5	51.69	122	100	H	32.2	-27.69	56.20	-21.4	34.80	55.89
2236.5	46.4	84	109	V	32.2	-27.69	50.91	-21.4	29.51	55.89
2556	48.39	123	159	H	32.7	-27.94	53.15	-21.4	31.75	55.89
2556	46.83	200	100	V	32.7	-27.94	51.59	-21.4	30.19	55.89
2875.5	56.61	155	100	H	32.8	-26.73	62.68	-21.4	41.28	55.89
2875.5	54.15	168	112	V	32.8	-26.73	60.22	-21.4	38.82	55.89
3195	57.56	98	100	H	32.9	-26.92	63.54	-21.4	42.14	55.89
3195	56.77	154	100	V	32.9	-26.92	62.75	-21.4	41.35	55.89

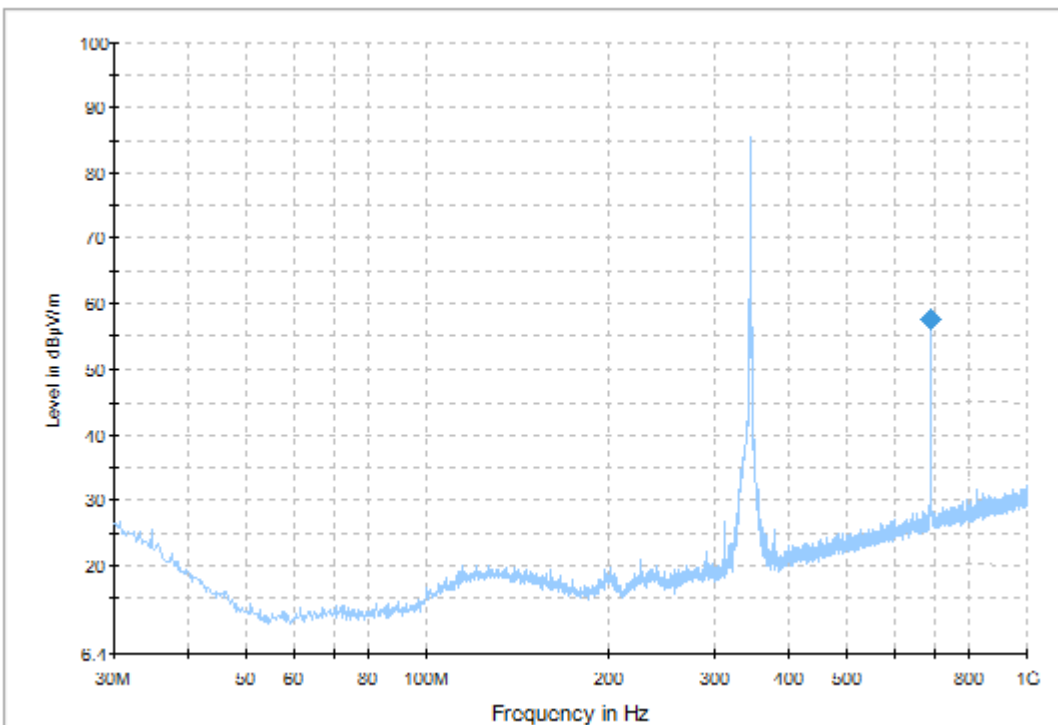
Table 3: Restricted Bands - TX at 319.5MHz

Freq. (MHz)	Uncorr-Peak (dBuV/m)	Angle (deg)	Height (cm)	Pol. (V/H)	Ant factor (dB)	Gain (dB)	Corrected Peak (dBuV/m)	Duty Cycle correction factor (dB)	Corrected Avg (dBuV/m)	Limit (dBuV/m)
1597.5	51.27	49	100	H	29.2	-29.62	50.85	-21.4	29.45	54
1597.5	49.9	92	118	V	29.2	-29.62	49.48	-21.4	28.08	54
2236.5	51.69	122	100	H	32.2	-27.69	56.20	-21.4	34.80	54
2236.5	46.4	84	109	V	32.2	-27.69	50.91	-21.4	29.51	54
2875.5	56.61	155	100	H	32.8	-26.73	62.68	-21.4	41.28	54
2875.5	54.15	168	112	V	32.8	-26.73	60.22	-21.4	38.82	54

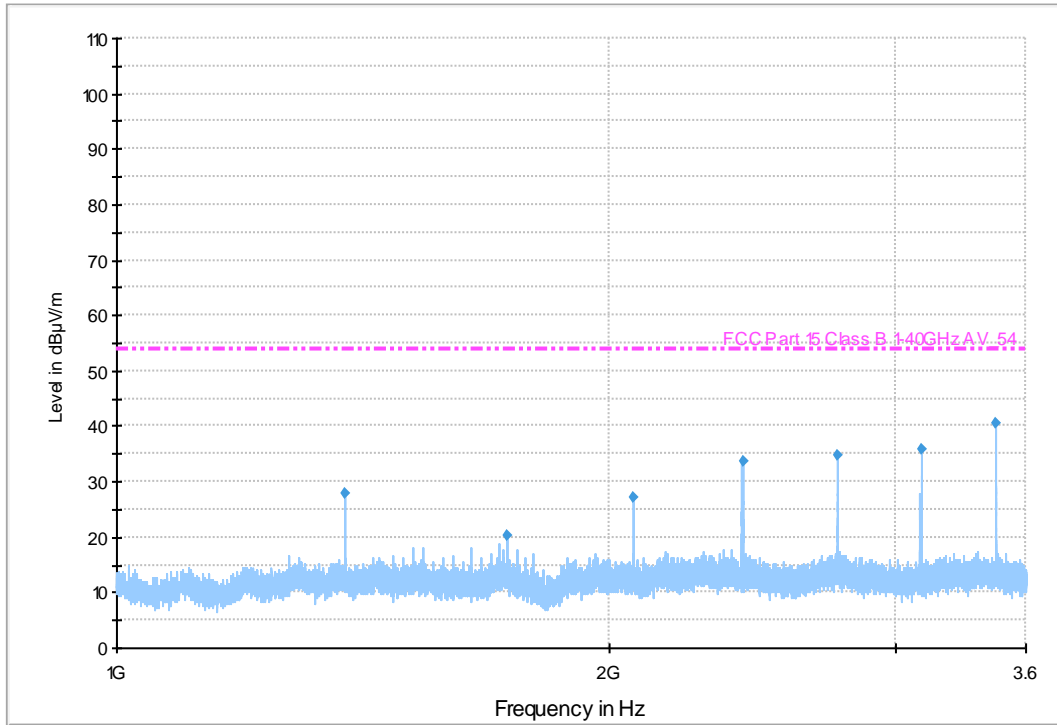
RADIATED EMISSIONS DATA TRANSMITTING AT 345MHz



Radiated Emissions 150kHz-30MHz at 3m – TX at 345MHz



Radiated Emissions 30MHz-1GHz at 3m - TX at 345MHz



Radiated Emissions 1GHz-3.6GHz at 3m - TX at 345MHz

Table 4: Radiated Emissions 30MHz-1GHz at 3m - TX at 345MHz

Freq. (MHz)	Uncorr-Peak (dBuV/m)	Angle (deg)	Height (cm)	PoL. (V/H)	Ant factor (dB)	Cable Loss (dB)	Corrected Peak (dBuV/m)	Duty Cycle correction factor (dB)	Corrected Avg (dBuV/m)	Limit (dBuV/m)
345	69.84	271	100	H	14	1.69	85.53	-21.15	64.38	77.25
345	49.99	5	100	V	14	1.69	65.68	-21.15	44.53	77.25
690	36.05	105	114	H	19.6	2.53	58.18	-21.15	37.03	57.25
690	22.54	288	100	V	19.6	2.53	44.67	-21.15	23.52	57.25

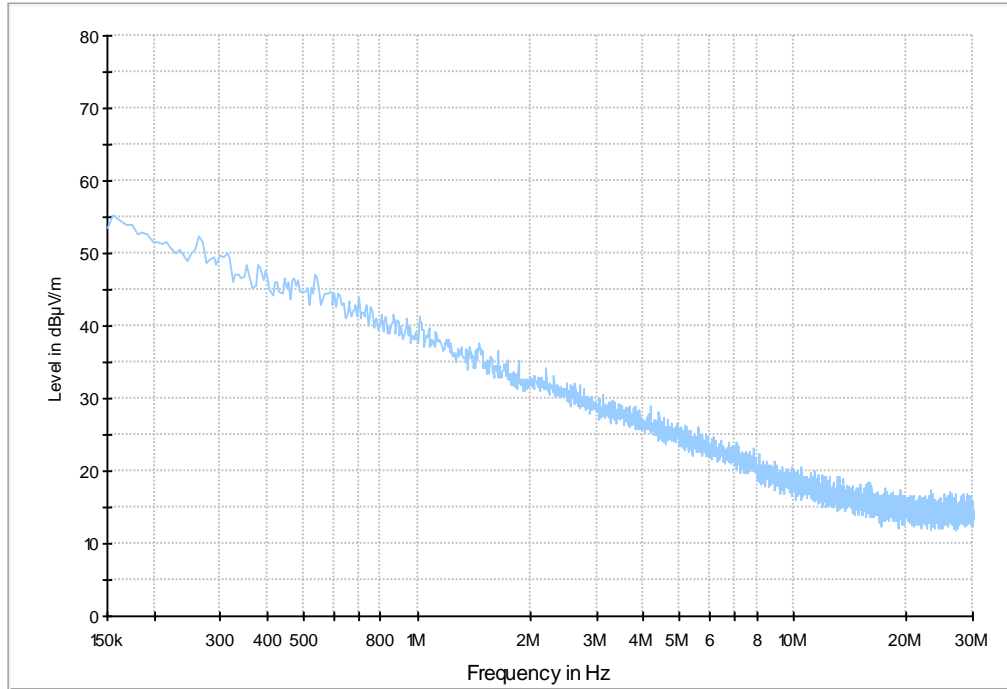
Table 5: Radiated Emissions 1GHz-3.3GHz at 3m - TX at 345MHz

Freq. (MHz)	Uncorr-Peak (dBuV/m)	Angle (deg)	Height (cm)	Pol. (V/H)	Ant. factor (dB)	Gain (dB)	Corrected Peak (dBuV/m)	Duty Cycle correction factor (dB)	Corrected Avg (dBuV/m)	Limit (dBuV/m)
1035	42.24	74	100	H	28.5	-10.2	60.51	-21.15	39.36	57.25
1035	38.42	322	167	V	28.5	-10.2	56.69	-21.15	35.54	57.25
1380	49.42	61	100	H	28.7	-29.11	49.01	-21.15	27.86	57.25
1380	45.92	268	100	V	28.7	-29.11	45.51	-21.15	24.36	57.25
1725	52.04	268	100	H	29.7	-28.82	52.92	-21.15	31.77	57.25
1725	49.22	270	100	V	29.7	-28.82	50.1	-21.15	28.95	57.25
2070	49.87	264	100	H	31.8	-28.48	53.19	-21.15	32.04	57.25
2070	51.81	92	100	V	31.8	-28.48	55.13	-21.15	33.98	57.25
2415	47.6	327	100	H	32.5	-25.88	54.22	-21.15	33.07	57.25
2415	44.89	336	100	V	32.5	-25.88	51.51	-21.15	30.36	57.25
2760	55.01	298	156	H	32.6	-25.19	62.42	-21.15	41.27	57.25
2760	50.9	152	100	V	32.6	-25.19	58.31	-21.15	37.16	57.25
3105	51	294	113	H	32.9	-26.16	57.74	-21.15	36.59	57.25
3105	50.1	360	100	V	32.9	-26.16	56.84	-21.15	35.69	57.25
3450	50.8	313	100	H	32.9	-26.71	56.99	-21.15	35.84	57.25
3450	53.34	300	100	V	32.9	-26.71	59.53	-21.15	38.38	57.25

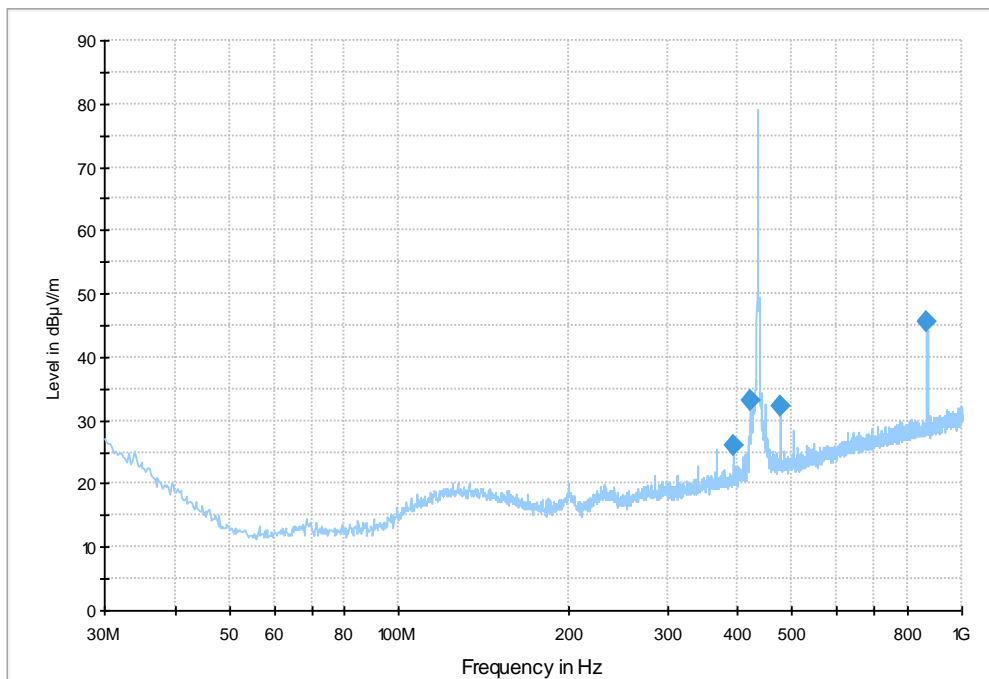
Table 6: Restricted Bands - TX at 345MHz

Freq. (MHz)	Uncorr-Peak (dBuV/m)	Angle (deg)	Height (cm)	Pol. (V/H)	Ant. factor (dB)	Gain (dB)	Corrected Peak (dBuV/m)	Duty Cycle correction factor (dB)	Corrected Avg (dBuV/m)	Limit (dBuV/m)
1035	42.24	74	100	H	28.5	-10.2	60.51	-21.15	39.36	54
1035	38.42	322	167	V	28.5	-10.2	56.69	-21.15	35.54	54
1380	49.42	61	100	H	28.7	-29.11	49.01	-21.15	27.86	54
1380	45.92	268	100	V	28.7	-29.11	45.51	-21.15	24.36	54
2760	55.01	298	156	H	32.6	-25.19	62.42	-21.15	41.27	54
2760	50.9	152	100	V	32.6	-25.19	58.31	-21.15	37.16	54

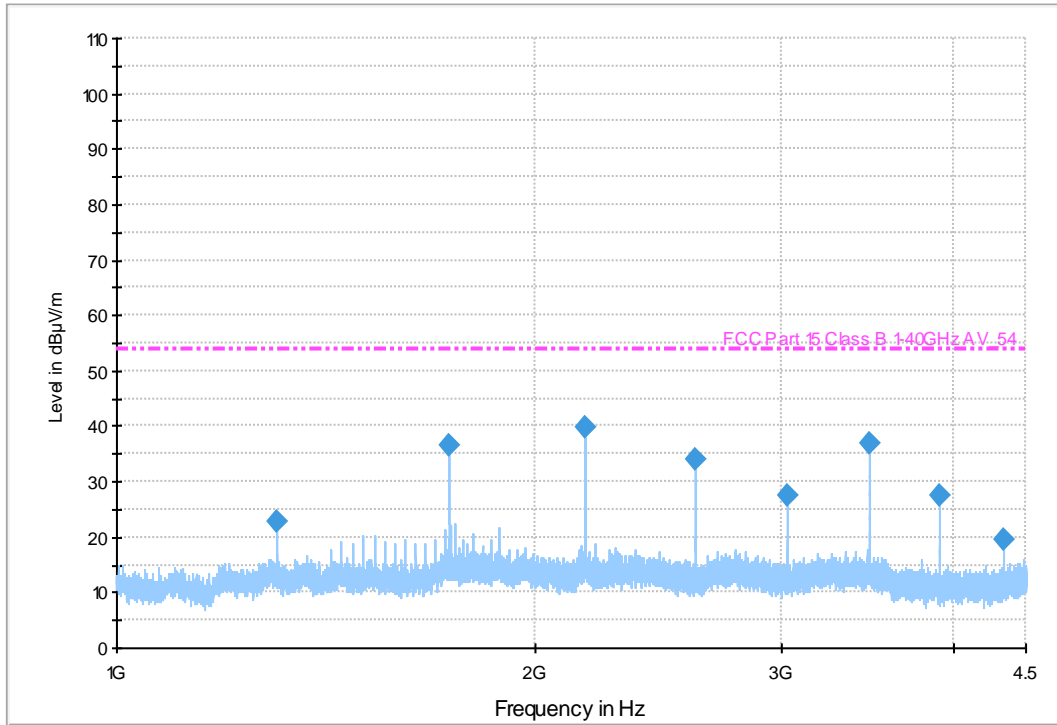
RADIATED EMISSIONS DATA TRANSMITTING AT 433.9MHz



Radiated Emissions 150kHz-30MHz at 3m – TX at 433.9MHz



Radiated Emissions 30MHz-1GHz at 3m - TX at 433.9MHz



Radiated Emissions 1GHz-4.5GHz at 3m - TX at 433.9MHz

Table 7: Radiated Emissions 30MHz-1GHz at 3m - TX at 433.9MHz

Freq. (MHz)	Uncorrected Peak (dBuV/m)	Angle (deg)	Height (cm)	Pol. (V/H)	Ant factor (dB)	Cable Loss (dB)	Corrected Peak (dBuV/m)	Duty Cycle correction factor (dB)	Corrected Avg (dBuV/m)	Limit (dBuV/m)
433.9	68.2	289	100	H	16.7	1.92	86.82	-21.25	65.57	80.8
433.9	55.5	360	100	V	16.7	1.92	74.12	-21.25	52.87	80.8
867.8	35.1	60	100	H	21.9	2.95	59.95	-21.25	38.7	60.8
867.8	24.71	360	100	V	21.9	2.95	49.56	-21.25	28.31	60.8

Table 8: Radiated Emissions 1GHz-3.3GHz at 3m - TX at 433.9MHz

Freq. (MHz)	Uncorrected Peak (dBuV/m)	Angle (deg)	Height (cm)	Pol. (V/H)	Ant factor (dB)	Gain (dB)	Corrected Peak (dBuV/m)	Duty Cycle correction factor (dB)	Corrected Avg (dBuV/m)	Limit (dBuV/m)
1301.7	55.84	81	100	H	28.7	-27.99	56.55	-21.25	35.30	60.8
1301.7	49.86	10	184	V	28.7	-27.99	50.57	-21.25	29.32	60.8
1735.6	52.69	266	100	H	29.8	-28.79	53.7	-21.25	32.45	60.8
1735.6	49.12	233	100	V	29.8	-28.79	50.13	-21.25	28.88	60.8
2169.5	52.5	296	100	H	32	-27.81	56.69	-21.25	35.44	60.8
2169.5	50.3	197	100	V	32	-27.81	54.49	-21.25	33.24	60.8
2603.4	51.4	303	126	H	32.7	-25.54	58.56	-21.25	37.31	60.8
2603.4	51.5	19	100	V	32.7	-25.54	58.66	-21.25	37.41	60.8
3037.3	52.77	275	102	H	32.9	-24.54	61.13	-21.25	39.88	60.8
3037.3	50	335	160	V	32.9	-24.54	58.36	-21.25	37.11	60.8
3471.2	53.26	261	100	H	32.9	-26.70	59.46	-21.25	38.21	60.8
3471.2	57.51	100	100	V	32.9	-26.70	63.71	-21.25	42.46	60.8
3905.1	41.4	56	100	H	33.2	-24.09	50.51	-21.25	29.26	60.8
3905.1	48.19	353	100	V	33.2	-24.09	57.3	-21.25	36.05	60.8
4339	44.43	281	113	H	33.6	-23.08	54.95	-21.25	33.70	60.8
4339	41.52	4	195	V	33.6	-23.08	52.04	-21.25	30.79	60.8

Table 9: Restricted Bands - TX at 433.9MHz

Freq. (MHz)	Uncorrected Peak (dBuV/m)	Angle (deg)	Height (cm)	Pol. (V/H)	Ant factor (dB)	Gain (dB)	Corrected Peak (dBuV/m)	Duty Cycle correction factor (dB)	Corrected Avg (dBuV/m)	Limit (dBuV/m)
1301.7	55.84	81	100	H	28.7	-27.99	56.55	-21.25	35.30	54
1301.7	49.86	10	184	V	28.7	-27.99	50.57	-21.25	29.32	54
3905.1	41.4	56	100	H	33.2	-24.09	50.51	-21.25	29.26	54
3905.1	48.19	353	100	V	33.2	-24.09	57.3	-21.25	36.05	54
4339	44.43	281	113	H	33.6	-23.08	54.95	-21.25	33.70	54
4339	41.52	4	195	V	33.6	-23.08	52.04	-21.25	30.79	54

Part 3 - Duty Cycle Correction Factor

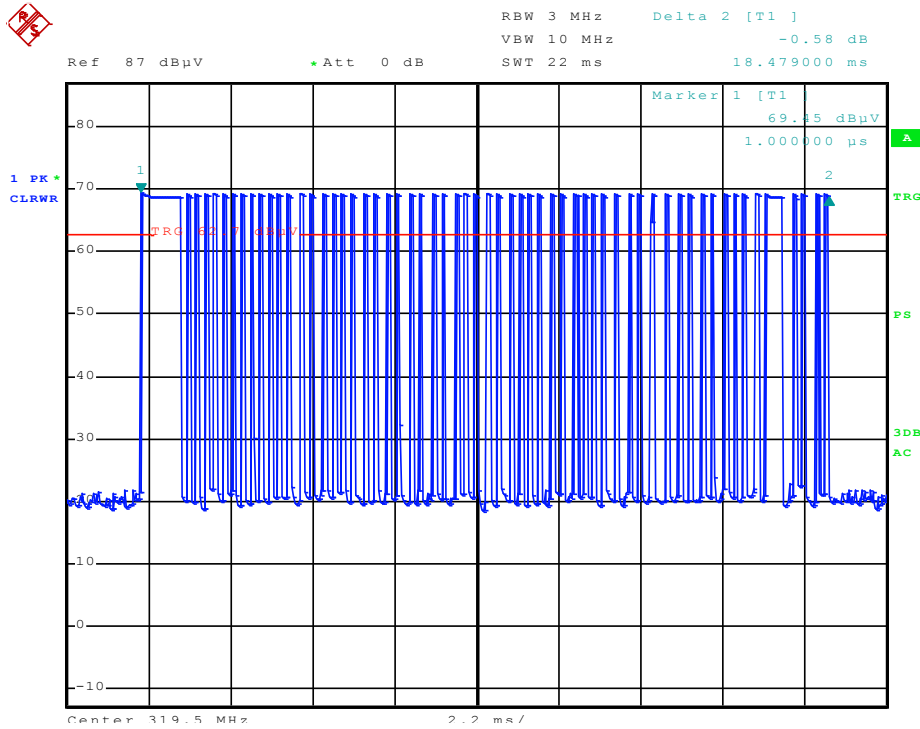
DATE: Feb-4-2015

TEST STANDARD: FCC Part 15.35

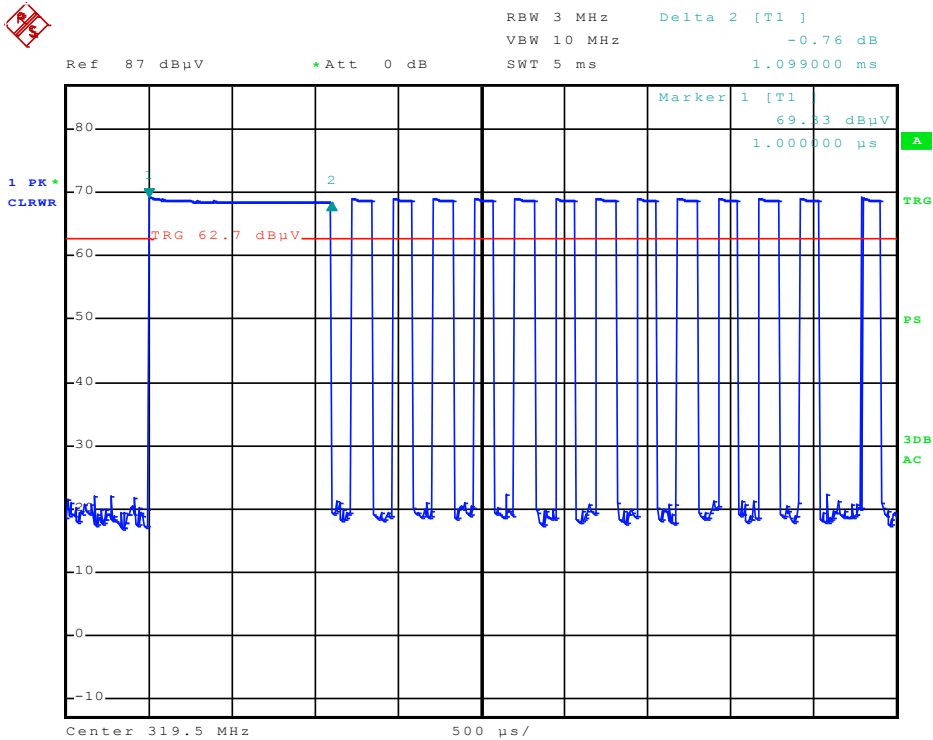
MINIMUM STANDARD: (c) Unless otherwise specified, e.g., §§15.255(b), and 15.256(l)(5), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

DUTY CYCLE CORRECTION MEASUREMENT – 319.5MHz:

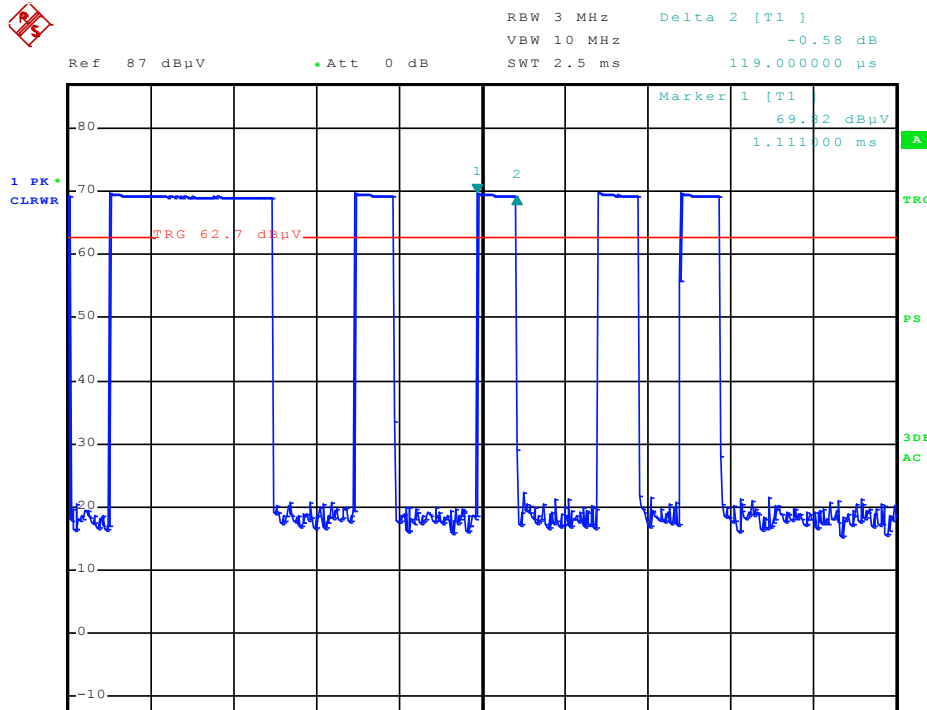
Data Transmissions		Number of pulses
Transmissions Burst Duration	18.48 msec	
Long Pulse Duration	1.099 msec	1
Medium Pulse Duration	0.490 msec	1
Short pulse Duration	0.119 msec	58
Total Transmissions Duration	$(58 \times 0.119) + 1.099 + 0.49 = 8.491$ msec	
On Time within 100 msec	8.491 msec	
Duty Cycle Correction factor	$20\log(8.491/100) = -21.4\text{dB}$	



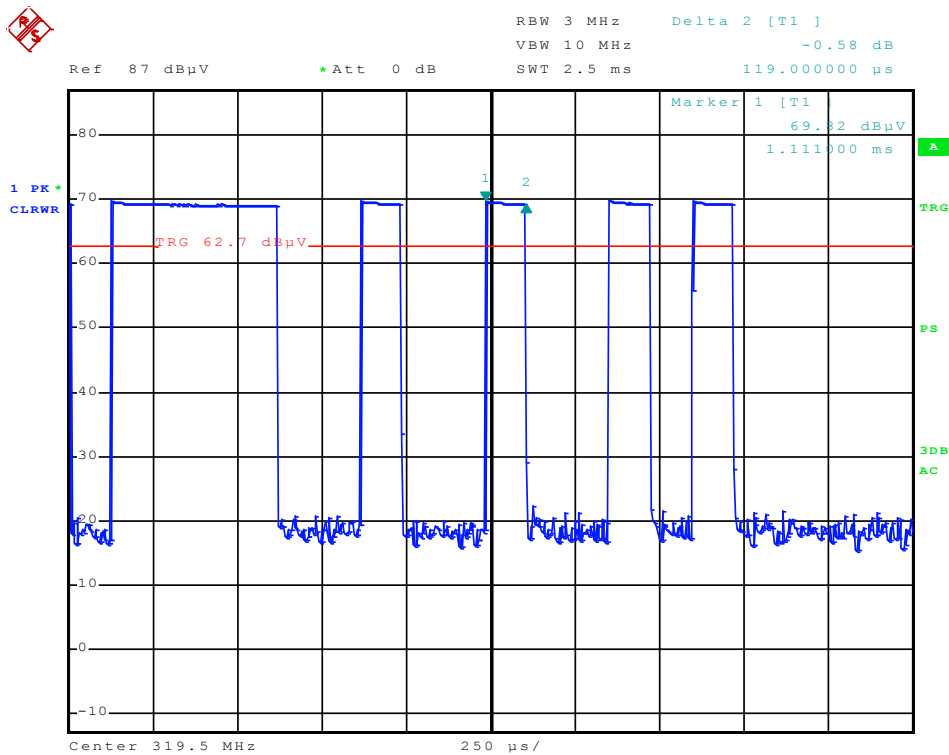
Transmissions Burst Duration



Long Pulse Duration



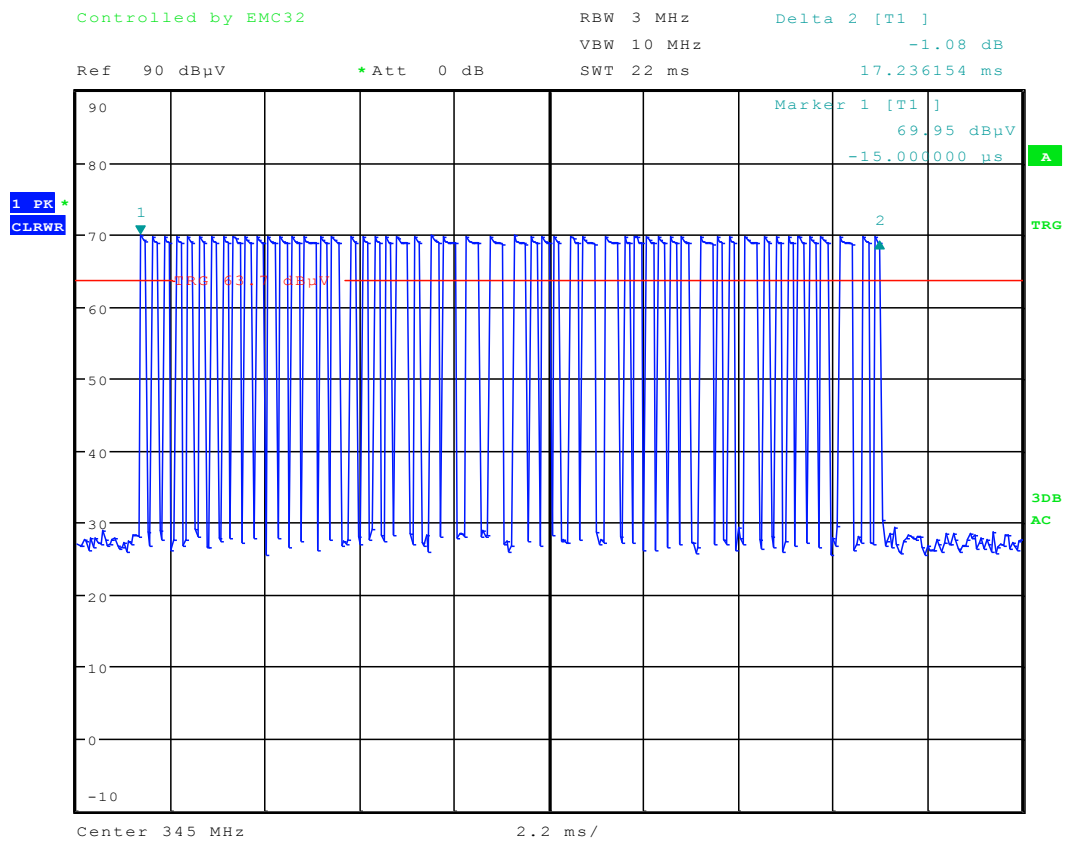
Medium Pulse Duration



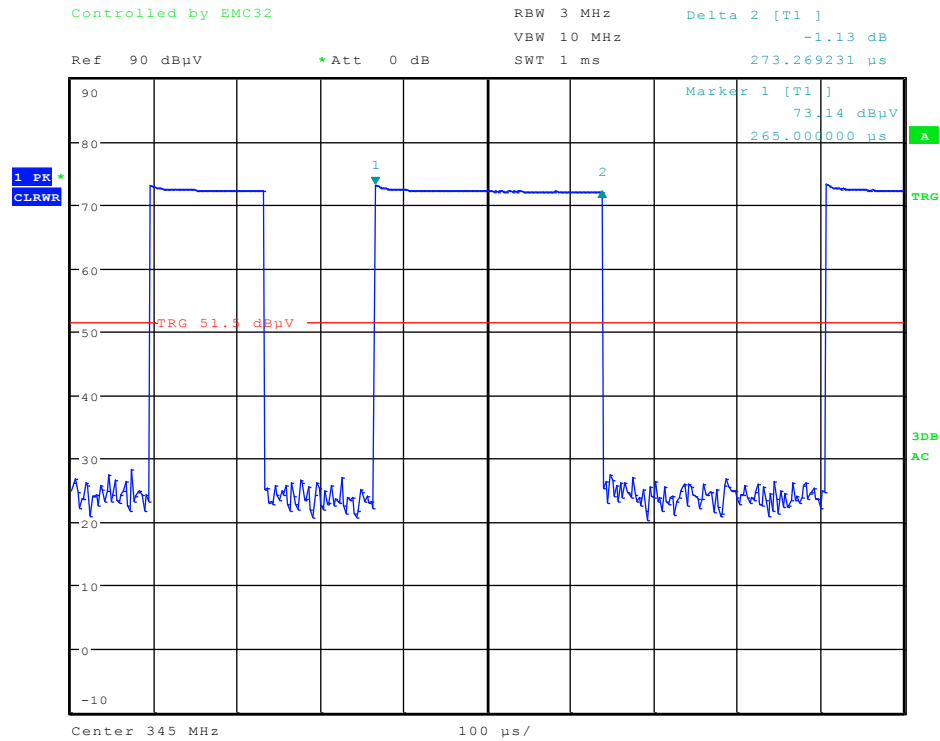
Short Pulse Duration

DUTY CYCLE CORRECTION MEASUREMENT – 345MHz

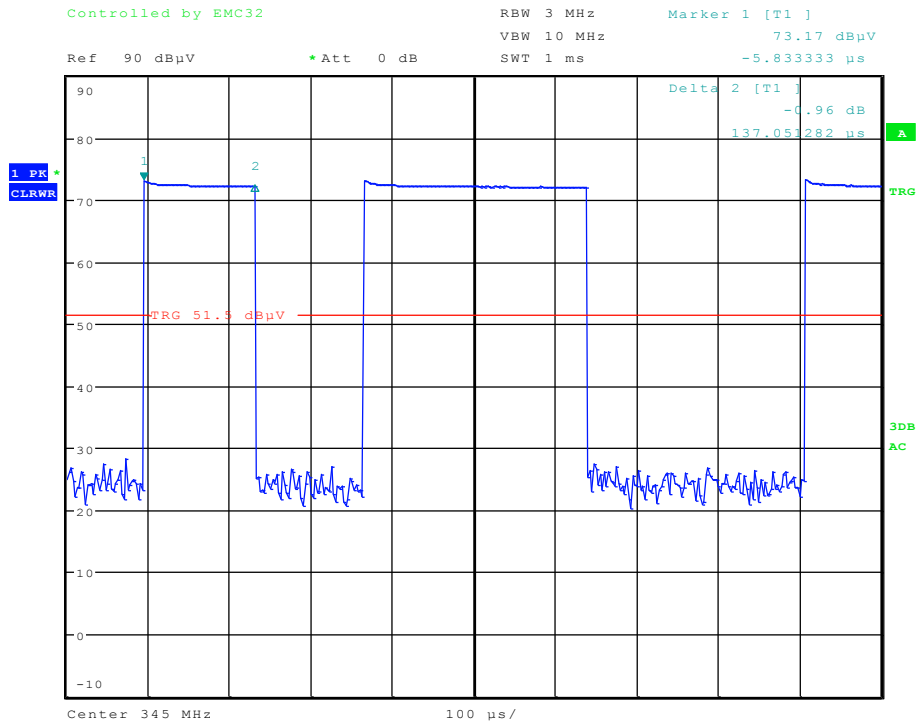
Data Transmissions		Number of Pulses
Transmissions Burst Duration	17.2 msec	
Long Pulse Duration	0.273 msec	11
Short Pulse Duration	0.137	42
Total Transmission Duration	$(11 \times 0.273) + (42 \times 0.137) = 8.757$ msec	
On Time within 100 msec	8.757 msec	
Duty Cycle Correction factor	$20\log(8.757/100) = -21.15$ dB	



Transmissions Burst Duration



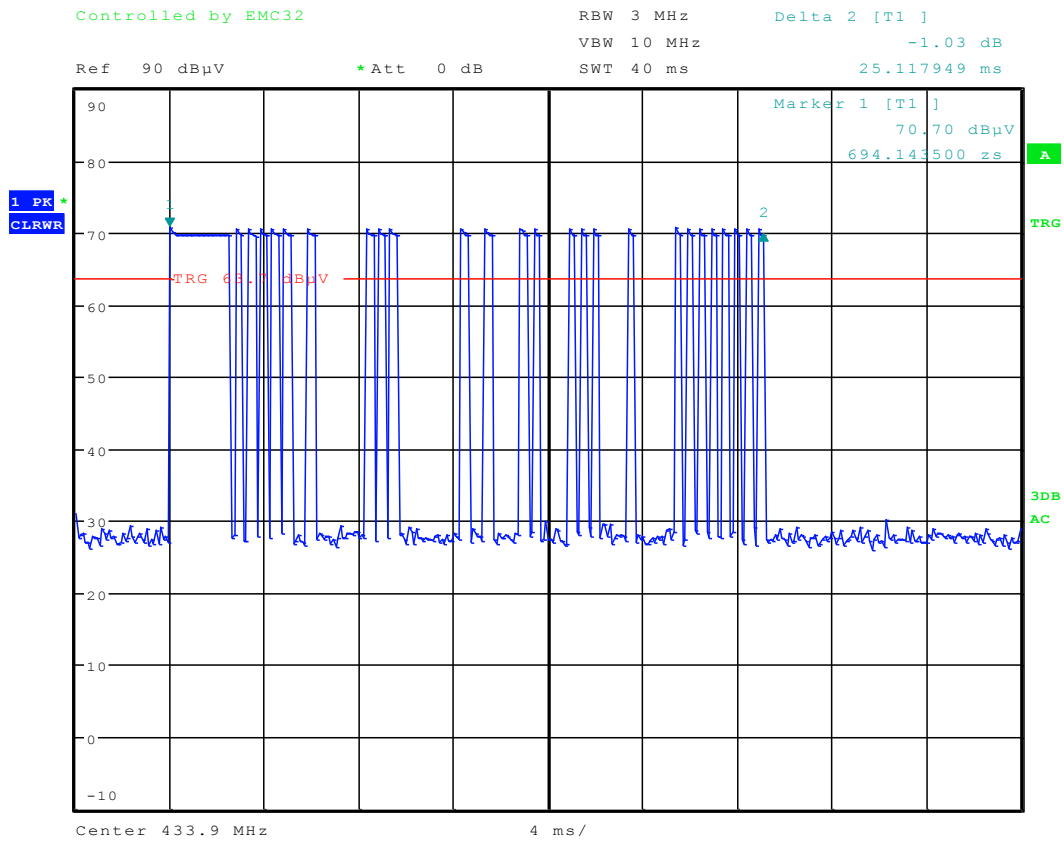
Long Pulse Duration



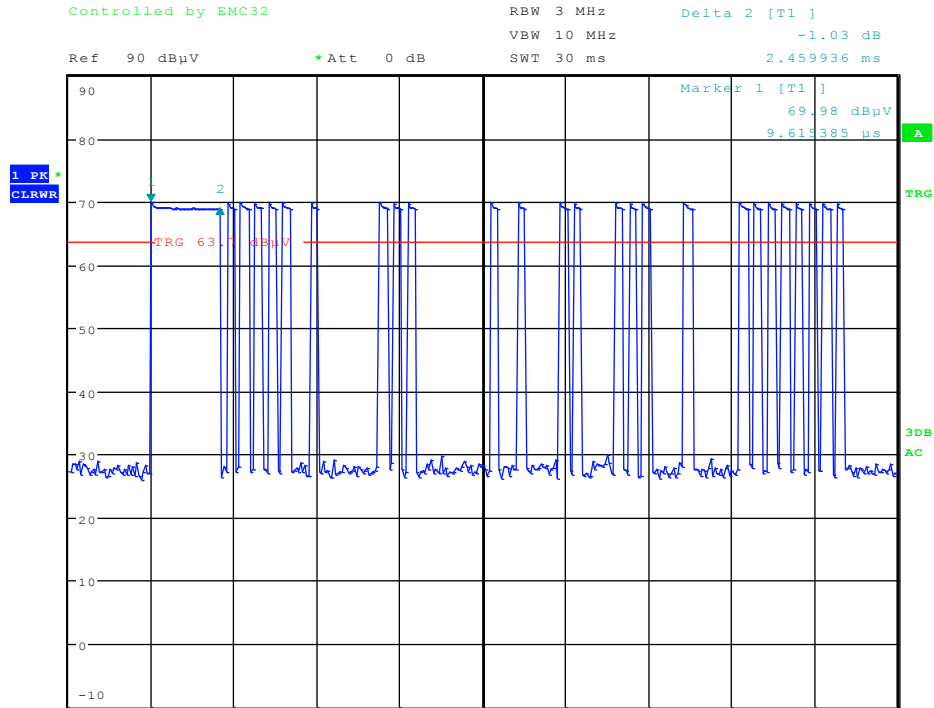
Short Pulse Duration

DUTY CYCLE CORRECTION MEASUREMENT – 433.9MHz

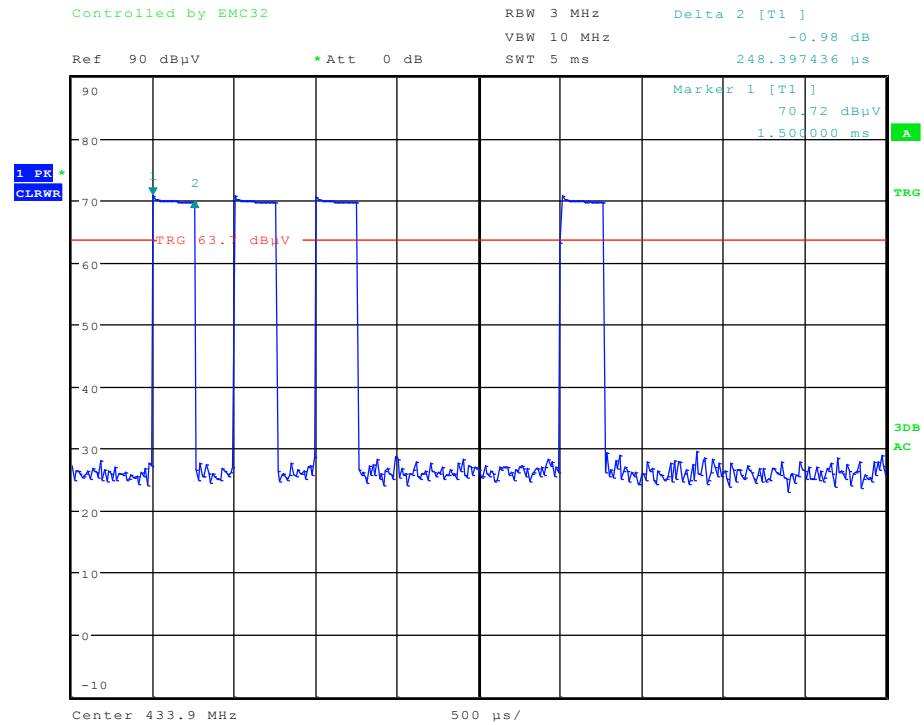
Data Transmissions		Number of Pulses
Transmission Burst Duration	25.12	
Long pulse Duration	2.46msec	1
Short pulse Duration	0.248msec	25
Total Transmissions Duration	$2.46 + (25 \times 0.248) = 8.66$ msec	
OnTime with in 100 msec	8.66 msec	
Dutycycle Correction factor	$20\log(8.66/100) = -21.25$ dB	



Transmissions Burst Duration



Long Pulse Duration



Short Pulse Duration

Part 4 - 20 dB Bandwidth

DATE: Feb-17-2015

TEST STANDARD: FCC CFR47 Part 15 Subpart C 15.231; RSS Gen issue 4 & RSS 210 issue 8, Annex 1

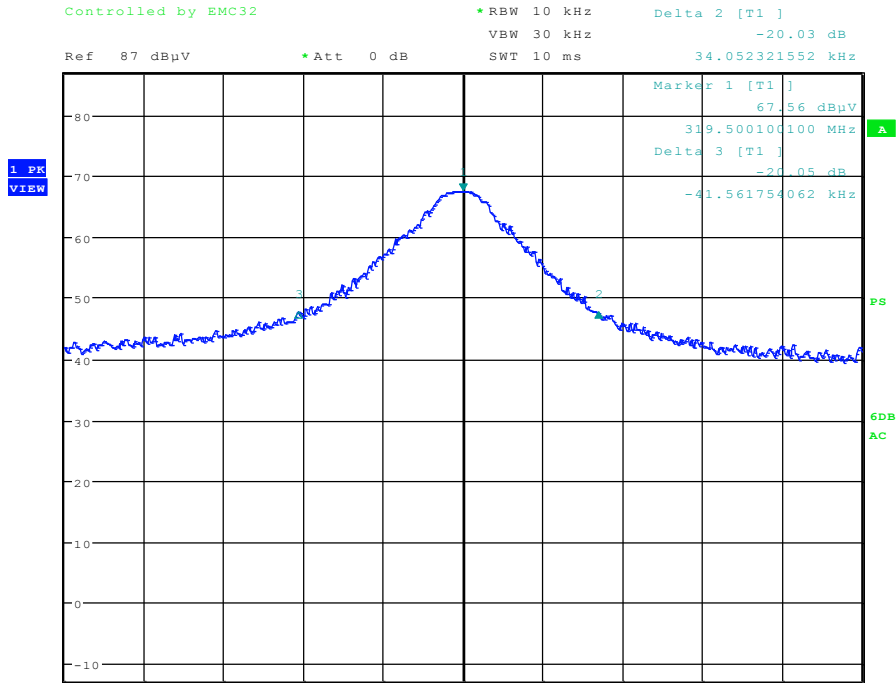
MINIMUM STANDARD: The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

MODIFICATIONS: No modification is required to comply for this test.

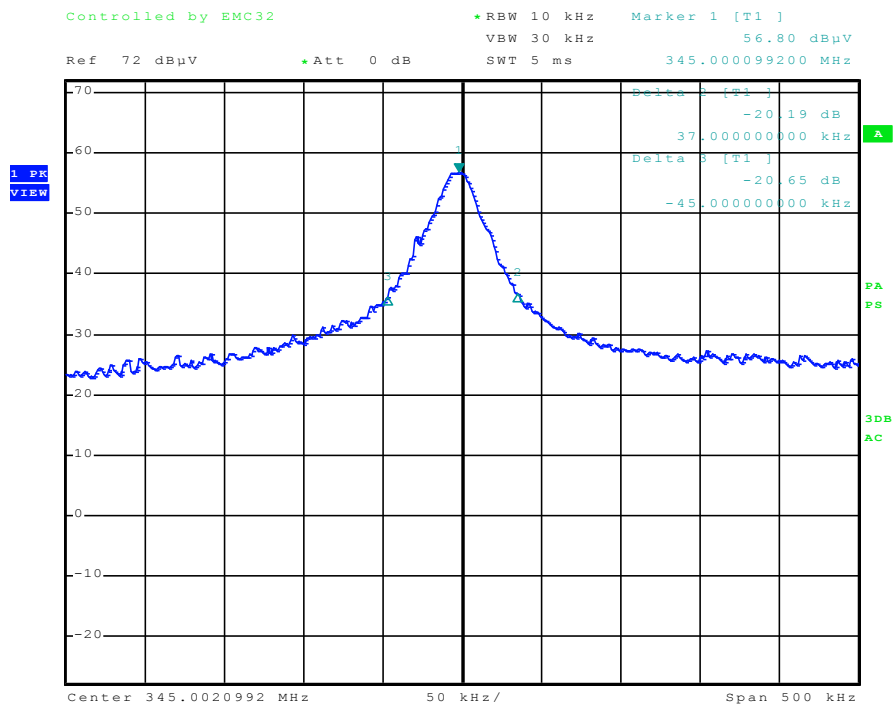
PERFORMANCE: Complies with standard.

DATA & PLOT: **Table 10: 20dB Bandwidth Measurement**

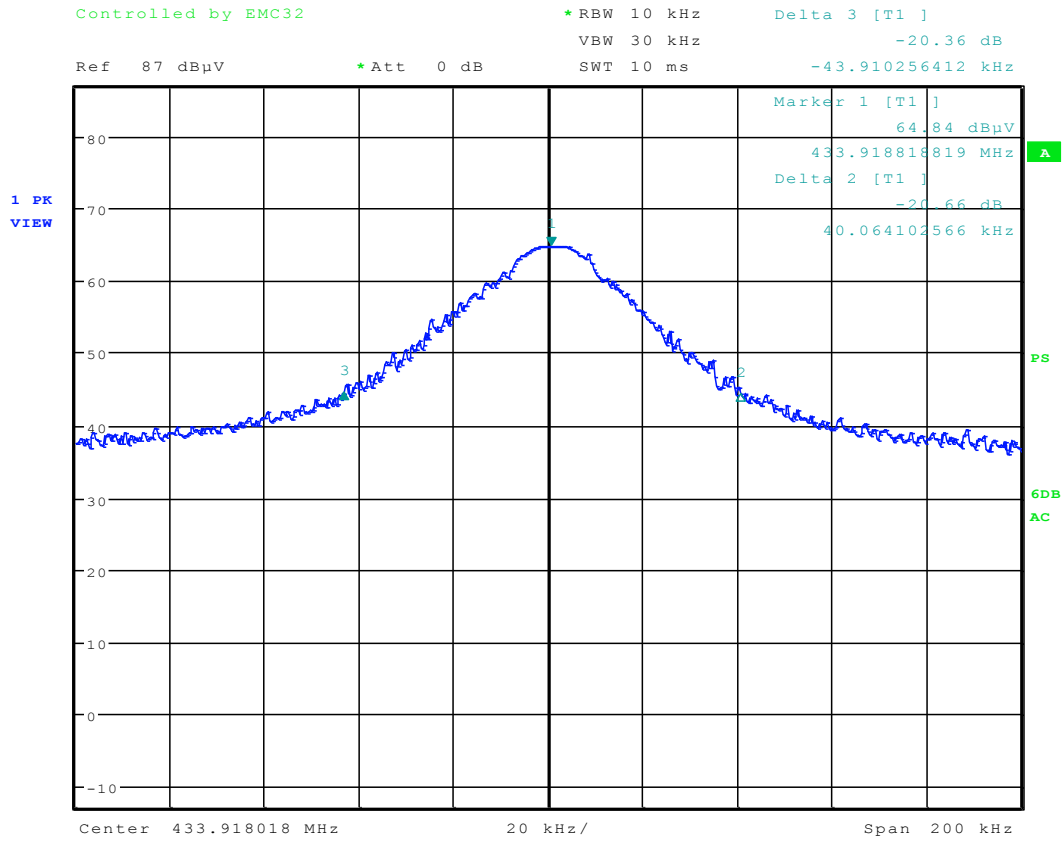
Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)	Requirement
319.5	75.6	798.75	Bandwidth of the emission shall be no wider than 0.25% of the center frequency above 70MHz and below 900MHz.
345	82	862.5	
433.9	83.97	1084.8	



20dB Bandwidth – 319.5MHz



20dB Bandwidth – 345MHz



20dB Bandwidth – 433.9MHz

Part 5 - Transmitter Time Testing

DATE: Jan-15-2015

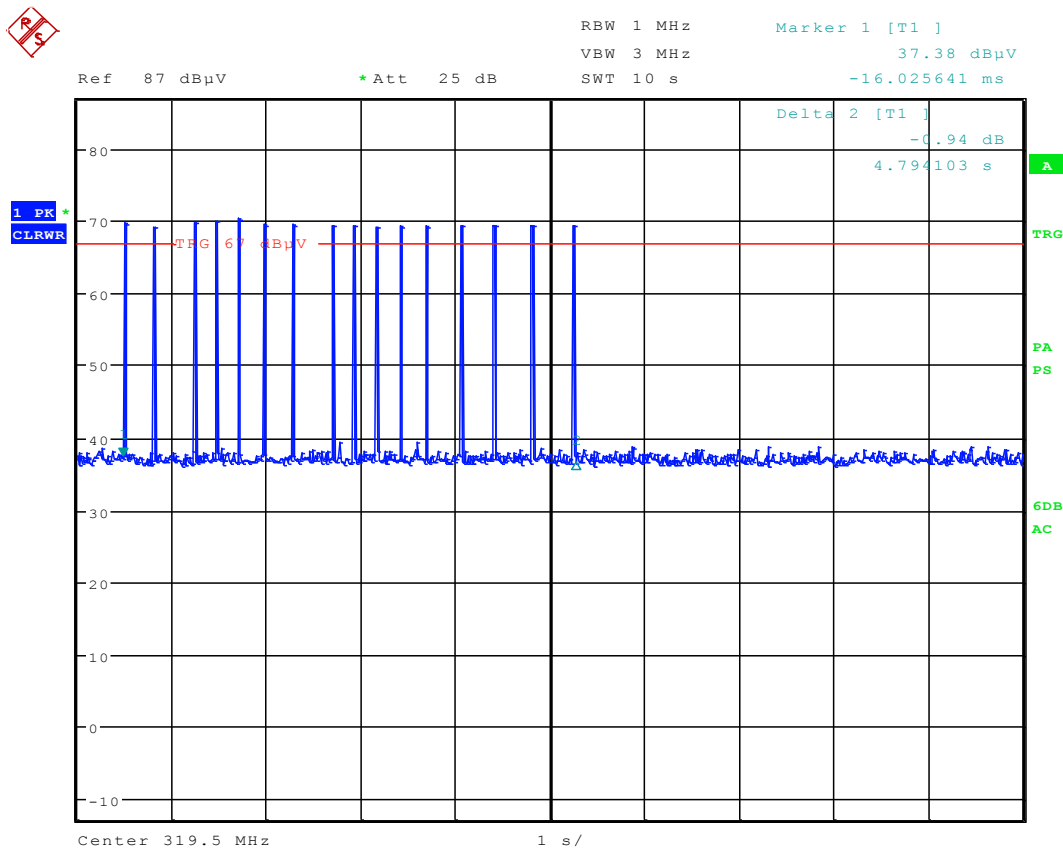
TEST STANDARD: FCC CFR47 Part 15 Subpart C 15.231; RSS Gen issue 4 & RSS 210 issue 8, Annex 1

MINIMUM STANDARD: (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

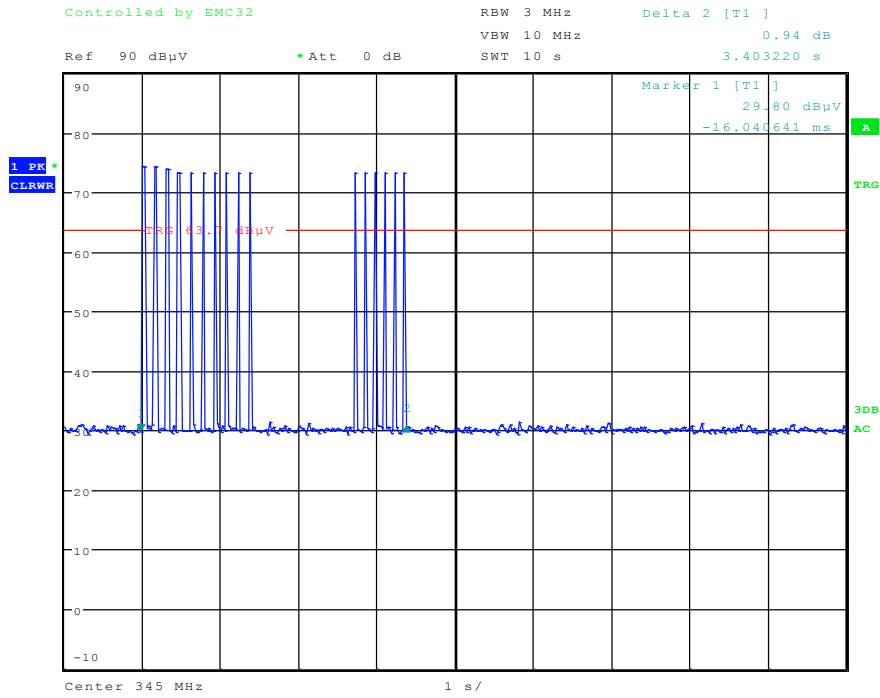
MODIFICATIONS: No modification is required to comply for this test.

PERFORMANCE: Complies with standard. Transmission automatically deactivated within 5 seconds

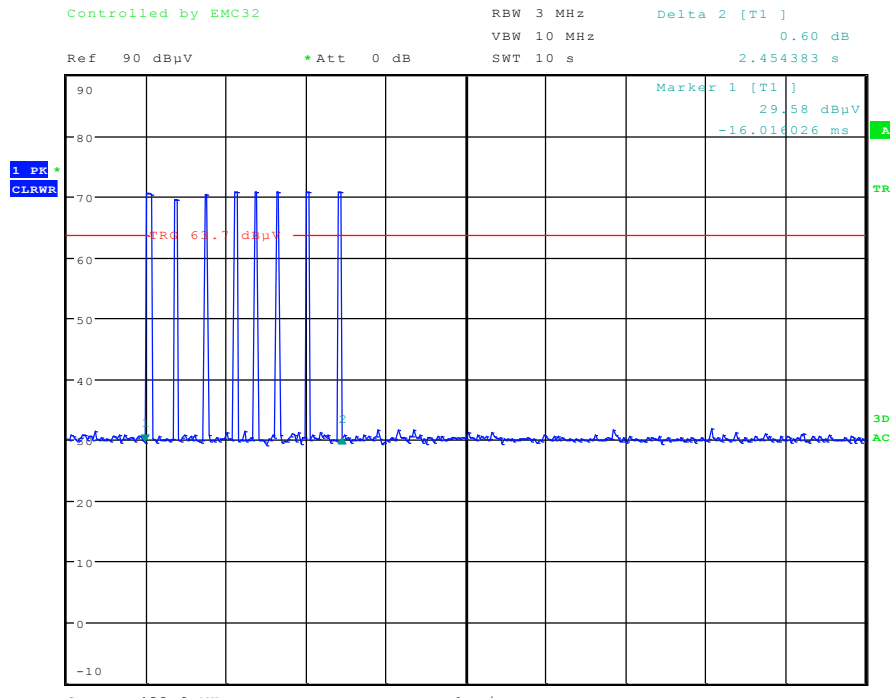
DATA & PLOT:



Timing Diagram for 319.5MHz

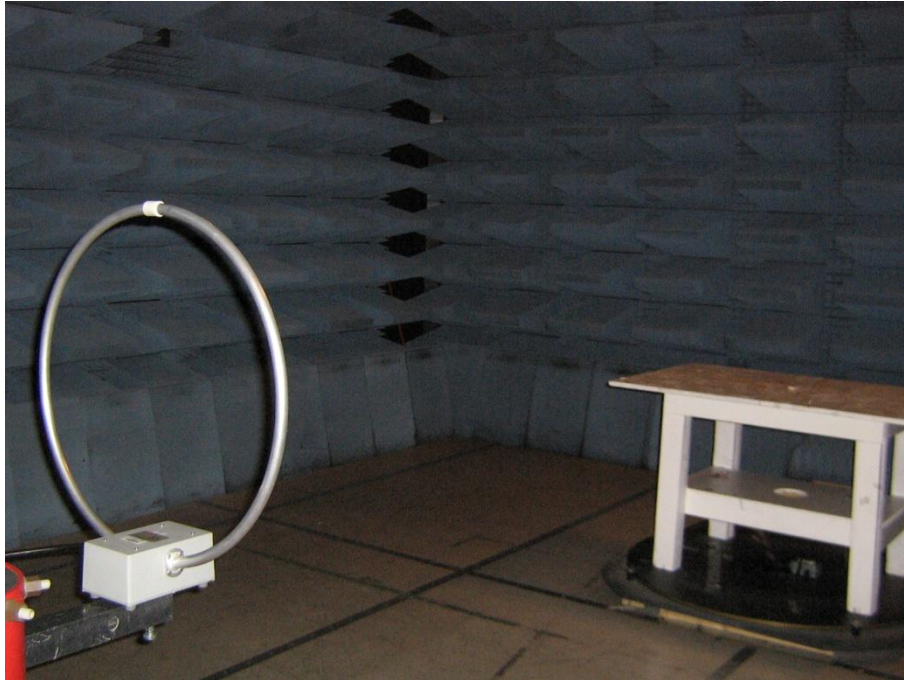


Timing Diagram for 345MHz



Timing Diagram for 433.9MHz

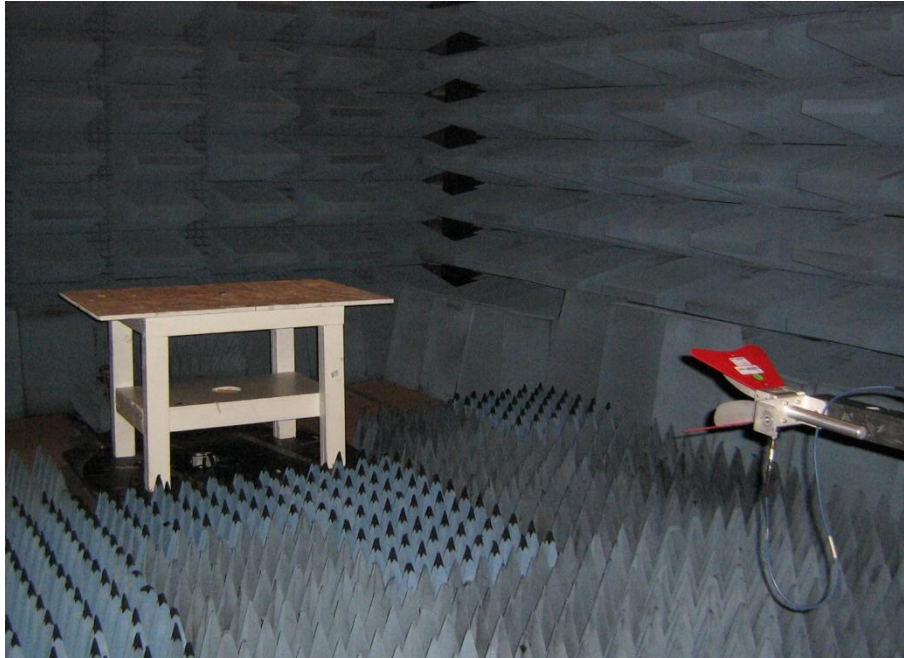
Appendix A: Test Setup Pictures



Radiated Emission test setup in Semi Anechoic Chamber – below 30MHz



Radiated Emission test setup in Semi Anechoic Chamber – 30MHz - 1GHz



Radiated Emission test setup in Semi Anechoic Chamber – above 1GHz