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Radio Test Report

FCC Part 95
MedRadio Transmitter

Wireless Transmitter model 2000

FCC ID:	QHJ-2000A
COMPANY:	MicroTransponder Inc. 2802 Flintrock Trace, Suite 225 Austin, TX 78738
TEST SITE(S):	NTS Silicon Valley 41039 Boyce Road. Fremont, CA. 94538-2435
REPORT DATE:	October 30, 2012
FINAL TEST DATES:	August 15, 21 and September 7, 2012
TOTAL NUMBER OF PAGES:	46

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ACCREDITED
Testing Cert #0214.26

REVISION HISTORY

Rev#	Date	Comments	Modified By
-	10-30-2012	First release	

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SCOPE

Tests have been performed on the MicroTransponder Inc. Wireless Transmitter model 2000, pursuant to the relevant requirements of the following standard(s) in order to obtain device certification against the regulatory requirements of the Federal Communications Commission and Industry Canada.

- Code of Federal Regulations (CFR) Title 47 Part 2
- CFR 47 Part 95 (Medical Device Radiocommunication Service) Subpart I

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards and as outlined in NTS Silicon Valley test procedures:

ANSI C63.4:2003
ANSI TIA-603-C August 17, 2004

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant Industry Canada performance and procedural standards.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of the MicroTransponder Inc. Wireless Transmitter model 2000 and therefore apply only to the tested sample. The sample was selected and prepared by Chester Burress of MicroTransponder Inc.

OBJECTIVE

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section.

Prior to marketing in the USA, the device requires certification. Prior to marketing in Canada, Class I transmitters, receivers and transceivers require certification.

Certification is a procedure where the manufacturer submits test data and technical information to a certification body and receives a certificate or grant of equipment authorization upon successful completion of the certification body's review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

STATEMENT OF COMPLIANCE

The tested sample of MicroTransponder Inc. Wireless Transmitter model 2000 complied with the requirements of the standards and frequency bands declared in the scope of this test report.

Maintenance of compliance is the responsibility of the manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the device with respect to the standards detailed in this test report.

DEVIATIONS FROM THE STANDARDS

No deviations were made from the published requirements listed in the scope of this report.

TEST RESULTS

FCC Part 95

Rule Part	Description	Measured	Limit	Result
Transmitter frequency, power, bandwidth, modulation and unwanted emissions				
§2.1033 (c) (5) § 95.628(c)	Frequency range(s)	402.45 – 404.55 MHz	402-405 MHz	Pass
§2.1033 (c) (6) §2.1033 (c) (7) §2.1046 § 95.639(f)	EIRP (Calculated from Field Strength)	1.00µW -30dBm	25µW –16dBm	Pass
§2.1033 (c) (4)	Emission types	F1D	-	-
§2.1047 §95.635(d)(4) & (5)	Unwanted emissions	1.20µW -39.2dBm	0.25µW -36dBm	Pass
§2.1049 §95.628(d), §95.633(e)(1)	Authorized Bandwidth	242 kHz	300 kHz	Pass
Transmitter spurious emissions				
§2.1053 §2.1057 §95.635(d)(1)	Field strength	36.00 dBµV/m (-4.0 dB)	See table	Pass
Receiver spurious emissions				
15.109		36.00 dBµV/m (-4.0 dB	See table	Pass
Other details				
95.628(a)	Frequency Monitoring	LBT Threshold power level -100 dBm Monitoring system bandwidth > 20 dB EBW Monitoring system scan cycle time 2 seconds Monitoring system Minimum Channel monitoring period 0.1 ms / 10 ms Channel access based on ambient level above PTh Correct channel selection Discontinuation of MICS session 3 seconds	LBT Threshold power level -96.2 dBm Monitoring system bandwidth > 20 dB EBW Monitoring system scan cycle time < 5 seconds Monitoring system Minimum Channel monitoring period 0.1 ms / 10 ms Channel access based on ambient level above PTh Correct channel selection Discontinuation of MICS session < 5 seconds	Pass
§2.1055 §95.628(g)(2)	Frequency stability	34.8 ppm	100 ppm	Pass
§2.1093	RF Exposure	Refer to separate exhibit	-	Pass
§2.1033 (c) (8)	Final radio frequency amplifying circuit's dc voltages and currents for normal operation over the power range	3.3V 0.2mA	-	-
Notes -				

EXTREME CONDITIONS

Frequency stability is determined over extremes of temperature and voltage. As the device is hand carried, USB powered equipment, the voltage set to 5Vdc as specified by the manufacturer.

The extremes of temperature were 0°C to +55°C as specified in FCC §95.628(e)(2) for stations in the Medical Device Radiocommunication Service.

MEASUREMENT UNCERTAINTIES

ISO Guide 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2) and were calculated in accordance with NAMAS document NIS 81 and M3003.

Measurement Type	Measurement Unit	Frequency Range	Expanded Uncertainty
RF frequency	Hz	25 to 7,000 MHz	1.7×10^{-7}
Radiated emission (field strength)	dBµV/m	25 to 1,000 MHz 1 to 40 GHz	± 3.6 dB ± 6.0 dB

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The MicroTransponder Inc. Wireless Transmitter model 2000 is a wireless programmer that is designed for communication with an implantable device. The EUT was treated as tabletop equipment. The programmer is powered from a USB port of a host laptop, which is sold with the system. The laptop power supply is rated at 100-240 Volts, 50-60 Hz, 1.6 Amps.

The sample was received on August 13, 2012 and tested on August 15, 21 and September 7, 2012. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
MicroTransponder Inc	Wireless Transmitter model 2000	Wireless programmer	103	QHJ-2000A
Dell	Inspiron N4110	Laptop	11066388193	-
Dell	LA65NS201	AC Adaptor	CN-092894-72438-IBQ-1278-A01	-

OTHER EUT DETAILS

The antenna is integral to the programmer.

ENCLOSURE

The programmer enclosure is primarily constructed of plastic. It measures approximately 10.5 cm wide by 6.5 cm deep by 2.0 cm high.

MODIFICATIONS

No modifications were made to the EUT during the time the product was at NTS Silicon Valley.

SUPPORT EQUIPMENT

No support equipment was used during testing.

EUT INTERFACE PORTS

The I/O cabling configuration during testing was as follows:

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
USB (programmer)	USB (laptop)	Multiwire	Shielded	2.0
DC power (laptop)	External pwr supply	2 wire	Unshielded	2.0
AC power (external supply)	AC mains	3 wire	Unshielded	1.0

EUT OPERATION

During emissions testing the EUT was transmitting a modulated carrier in the 402-405 MHz frequency band.

TESTING

GENERAL INFORMATION

Radiated spurious emissions measurements were taken at the NTS Silicon Valley Anechoic Chambers and/or Open Area Test Site(s) listed below. The sites conform to the requirements of ANSI C63.4: 2003 *American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz* and CISPR 16-1-4:2007 - *Specification for radio disturbance and immunity measuring apparatus and methods Part 1-4: Radio disturbance and immunity measuring apparatus Ancillary equipment Radiated disturbances*. They are on file with the FCC and industry Canada.

Site	Registration Numbers		Location
	FCC	Canada	
Chamber 3	769238	IC 2845B-3	41039 Boyce Road Fremont, CA 94538-2435
Chamber 4	211948	IC 2845B-4	
Chamber 5	211948	IC 2845B-5	

In the case of Open Area Test Sites, ambient levels are at least 6 dB below the specification limits with the exception of predictable local TV, radio, and mobile communications traffic.

Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements.

BANDWIDTH MEASUREMENTS

The 6dB, 20dB and/or 26dB signal bandwidth is measured in using the bandwidths recommended by ANSI C63.4. When required, the 99% bandwidth is measured using the methods detailed in RSS GEN. The measurement bandwidth is set to be at least 1% of the instrument's frequency span.

FREQUENCY STABILITY

The EUT is placed inside a temperature chamber with all support and test equipment located outside of the chamber. The temperature is varied across the specified frequency range in 10 degree increments with frequency measurements made at each temperature step. The EUT is allowed enough time to stabilize at each temperature variation.

The spectrum analyzer is configured to give a 5- or 6-digit display for the marker-frequency function. The spectrum analyzer's built-in frequency counter is used to measure the maximum deviation of the fundamental frequency at each temperature. Where possible the device is set to transmit an unmodulated signal. Where this is not possible the frequency drift is determined by finding a stable point on the signal (e.g. the null at the centre of an OFDM signal) or by calculating a centre frequency based on the upper and lower XdB points (where X is typically 6dB or 10dB) on the signal's skirts.

RADIATED EMISSIONS MEASUREMENTS

Receiver radiated spurious emissions measurements are made in accordance with ANSI ANSI C63.4:2003 by measuring the field strength of the emissions from the device at a specific test distance and comparing them to a field strength limit. Where the field strength limit is specified at a longer distance than the measurement distance the measurement is extrapolated to the limit distance.

Transmitter radiated spurious emissions are initially measured as a field strength. The eirp or erp limit as specified in the relevant rule part(s) is converted to a field strength at the test distance and the emissions from the EUT are then compared to that limit. Emissions within 20dB of this limit are the subjected to a substitution measurement.

All radiated emissions measurements are performed in two phases. A preliminary scan of emissions is conducted in either an anechoic chamber or on an OATS during which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed across the complete frequency range of interest and at each operating frequency identified in the reference standard. One or more of these is with the antenna polarized vertically while the one or more of these is with the antenna polarized horizontally. Initial scans are made using a peak detector (RBW=VBW) and using scan rates to ensure that the EUT transmits before the sweep moves out of each resolution bandwidth (for transmit mode).

During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit. For transmitter spurious emissions, where the limit is expressed as an effective radiated power, the eirp or erp is converted to a field strength limit.

Final measurements are made on an OATS or in a semi-anechoic chamber at the significant frequencies observed during the preliminary scan(s) using the same process of rotating the EUT and raising/lowering the measurement antenna to find the highest level of the emission. The field strength is recorded and, for receiver spurious emissions, compared to the field strength limit. For the final measurement the appropriate detectors (average, peak, normal, sample, quasi-peak) are used. For receiver measurements below 1GHz the detector is a Quasi-Peak detector, above 1GHz a peak detector is used and the peak value (RB=VB=1MHz) and average value (RB=1MHz, VB=10Hz) are recorded.

For transmitter spurious emissions, the radiated power of all emissions within 20dB of the calculated field strength limit are determined using a substitution measurement. The substitution measurement is made by replacing the EUT with an antenna of known gain (typically a dipole antenna or a double-ridged horn antenna), connected to a signal source. The output power of the signal generator is adjusted until the maximum field strength from the substitution antenna is similar to the field strength recorded from the EUT. The erp of the EUT is then calculated.

INSTRUMENTATION

An EMI receiver as specified in CISPR 16-1-1 is used for radiated emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 7000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary.

For measurements above the frequency range of the receivers and for all conducted measurements a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis.

Measurement bandwidths for the test instruments are set in accordance with the requirements of the standards referenced in this document.

Software control is used to correct the measurements for transducer factors (e.g. antenna) and the insertion loss of cables, attenuators and other series elements to obtain the final measurement value. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are exported in a graphic and/or tabular format, as appropriate.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the EUT antenna port or receiving antenna and the test receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A combination of biconical, log periodic or bi-log antennas are used to cover the range from 30 MHz to 1000 MHz. Broadband antennas or tuned dipole antennas are used over the entire 25 to 1000 MHz frequency range as the reference antenna for substitution measurements.

Above 1000 MHz, a dual-ridge guide horn antenna or octave horn antenna are used as reference and measurement antennas.

The antenna calibration factors are included in site factors that are programmed into the test receivers and instrument control software when measuring the radiated field strength.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height.

Table mounted devices are placed on a non-conductive table at a height of 80 centimeters above the floor. Floor mounted equipment is placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. The EUT is positioned on a motorized turntable to allow it to be rotated during testing to determine the angel with the highest level of emissions.

SAMPLE CALCULATIONS

SAMPLE CALCULATIONS - CONDUCTED SPURIOUS EMISSIONS

Measurements are compared directly to the conducted emissions specification limit (decibel form). The calculation is as follows:

$$R_r - S = M$$

where:

R_r = Measured value in dBm
S = Specification Limit in dBm
M = Margin to Specification in +/- dB

SAMPLE CALCULATIONS –RADIATED FIELD STRENGTH

Measurements of radiated field strength are compared directly to the specification limit (decibel form). The receiver and/or control software corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

A distance factor is sued when measurements are made at a test distance that is different to the specified limit distance by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB
D_m = Measurement Distance in meters
D_s = Specification Distance in meters

For electric field measurements below 30MHz the extrapolation factor is either determined by making measurements at multiple distances or a theoretical value is calculated using the formula:

$$F_d = 40*LOG_{10} (D_m/D_s)$$

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_S = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

SAMPLE CALCULATIONS –RADIATED POWER

The erp/eirp limits for transmitter spurious measurements are converted to a field strength in free space using the following formula:

$$E = \frac{\sqrt{30\ P\ G}}{d}$$

where:

E = Field Strength in V/m
P = Power in Watts
G = Gain of isotropic antenna (numeric gain) = 1
D = measurement distance in meters

The field strength limit is then converted to decibel form (dBuV/m) and the margin of a given emission peak relative to the limit is calculated (refer to *SAMPLE CALCULATIONS –RADIATED FIELD STRENGTH*).

When substitution measurements are required (all signals with less than 20dB of margin relative to the calculated field strength limit) the eirp of the spurious emission is calculated using:

$$P_{EUT} = P_S - (E_S - E_{EUT})$$

and

$$P_S = G + P_{in}$$

where:

P_S = effective isotropic radiated power of the substitution antenna (dBm)
P_{in} = power input to the substitution antenna (dBm)
G = gain of the substitution antenna (dBi)
E_S = field strength the substitution antenna (dBm) at eirp P_S
E_{EUT} = field strength measured from the EUT

Where necessary the effective isotropic radiated power is converted to effective radiated power by subtracting the gain of a dipole (2.2dBi) from the eirp value.

RECEIVER RADIATED SPURIOUS EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from receivers as detailed in FCC Part 15.109. Note that receivers operating outside of the frequency range 30 MHz – 960 MHz are exempt from the requirements of 15.109.

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

For MedRadio, the above limits also apply to the transmitter per §95.635(d).

Appendix A Test Equipment Calibration Data

Frequency Stability, 15-Aug-12

Manufacturer	Description	Model	Asset #	Cal Due
Agilent	PSA, Spectrum Analyzer, (installed options, 111, 115, 123, 1DS, B7J, HYX,	E4446A	2139	2/23/2013
Watlow	Temp Chamber (w/ F4 Watlow Controller)	Watlow F4	2170	7/11/2013

Radiated Emissions, 30 - 4,100 MHz, 21-Aug-12

Manufacturer	Description	Model	Asset #	Cal Due
EMCO	Antenna, Horn, 1-18GHz	3115	868	6/19/2014
Filtek	Filter, 1 GHz High Pass	HP12/1000-5BA	955	5/18/2013
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	2197	2/7/2014
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	2199	2/23/2013
Com-Power Corp.	Preamplifier, 30-1000 MHz	PA-103A	2359	2/14/2013
Hewlett Packard	SpecAn 9 kHz - 40 GHz, (SA40) Purple	8564E (84125C)	2415	8/10/2013
Rohde & Schwarz	EMI Test Receiver, 20 Hz-40 GHz	ESIB40 (1088.7490.40)	2493	12/9/2012

LBT, 7-Sep-12

Manufacturer	Description	Model	Asset #	Cal Due
Agilent	PSG Vector Signal Generator (250kHz - 20GHz)	E8267C	1877	5/11/2013
Compliance Design	Tuned Dipole Antenna	Roberts (400-1000MHz)	1896	1/3/2014
Agilent	MXG Analog Signal Generator	N5181A	2146	1/27/2013
Rohde & Schwarz	Signal Analyzer 20-26.5GHz	FSQ26	2327	4/20/2013
EMCO	Antenna, Biconilog Transmitting	3143	180	N/A

Appendix B Test Data

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Client:	MicroTransponder Inc.	Job Number:	J88422
Product	Wireless Transmitter model 2000	T-Log Number:	T88769
		Account Manager:	Sheareen Jacobs
Contact:	Federico de Mula		-
Emissions Standard(s):	FCC Parts 15 and 95, EN 301 839	Class:	B
Immunity Standard(s):	-	Environment:	Radio

EMC Test Data

For The

MicroTransponder Inc.

Product

Wireless Transmitter model 2000

Date of Last Test: 9/17/2012

Client:	MicroTransponder Inc.	Job Number:	J88422
Model:	Wireless Transmitter model 2000	T-Log Number:	T88769
		Account Manager:	Sheareen Jacobs
Contact:	Federico de Mula		
Standard:	FCC Parts 15 and 95, EN 301 839	Class:	B

LBT, FCC Part 95 and ETSI EN 301 839

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 9/7/2012
Test Engineer: Deniz Demirci
Test Location: Ch1

Config. Used: See each run
Config Change: None
EUT Voltage: 5 VDC USB powered with laptop, 120 VAC 60 Hz

General Test Configuration

The EUT and all local support equipment were located on the turntable for LBT testing.
For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

Ambient Conditions:

Temperature: 26 °C
Rel. Humidity: 33 %

Summary of Results - Device Operating in the 402-405 MHz Band

Run #	Mode	Test	Requirement / Limit	Result / Margin
1	Normal operation	LBT Threshold power level	-96.2 dBm	Pass
2	Normal operation	Monitoring system bandwidth	> 20 dB EBW	Pass
3	Normal operation	Monitoring system scan cycle time	< 5 seconds	Pass
4	Normal operation	Monitoring system Minimum Channel monitoring period	0.1 ms / 10 ms	Pass
5	Normal operation	Channel access based on ambient level above PTh	Correct channel selection	Pass
6	Normal operation	Discontinuation of MICS session	< 5 seconds	Pass
7	Normal operation	Use of pre-scanned alternative channel	N/A	N/A

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	MicroTransponder Inc.	Job Number:	J88422
Model:	Wireless Transmitter model 2000	T-Log Number:	T88769
		Account Manager:	Sheareen Jacobs
Contact:	Federico de Mula		
Standard:	FCC Parts 15 and 95, EN 301 839	Class:	B

Run #1: LBT Treshold power level

Test Configuration Details:

The PSG signal generator was configured to produce 7 un-modulated carriers at 7 of the 8 channels at;

Ch1	402.45	MHz	
Ch2	402.75	MHz	
Ch3	403.05	MHz	
Ch4	403.35	MHz	
Ch5	403.65	MHz	Turned off
Ch6	403.95	MHz	
Ch7	404.25	MHz	
Ch8	404.55	MHz	

The Spectrum analyzer was connected to the biconilog antenna. The EUT and dipole antenna were placed on a table 2.5 m from the biconilog antenna. The EUT was set to continuous TX and it was positioned in order to get maximum reading with the spectrum analyzer, then the biconilog antenna was connected to the output of the signal generator and dipol antenna was connected to the spectrum analyzer

The amplitude of the 7 carriers was measured with the dipole antenna located where the EUT was placed during the evaluation. With the setup described above

-99 dBm EIRP levels were achived with -59 dBm PSG signal generator output (7 carrier)

-99 dBm = -98 dBm (received level) - 1.75 dBi (Dipol gain) - 0.75 dB (cable loss)

Minimum LBT threshold power = 10 Log B (Hz) - 150 + G (dBi)

When B = 240000 Hz (20 dB bandwidth)

Minimum LBT threshold power = -96.20 dBm EIRP (-56 dB drive level)

Note: The G value is not used as the antenna for the EUT is integral with unknown gain and the measurement of the interfering signal EIRP accounts for the EUT antenna gain.

EUT Mode:

The EUT was placed in search mode looking for an implanted device. At this amplitude, the EUT must intiate communications on the channel 5 (403.65 MHz) not generated by the signal generator.

Test result:

The EUT complies with this requirement. EUT starts to initiate communication only at channel 6 (or any available channel) with the EIRP power of -100 dBm

Client:	MicroTransponder Inc.	Job Number:	J88422
Model:	Wireless Transmitter model 2000	T-Log Number:	T88769
		Account Manager:	Sheareen Jacobs
Contact:	Federico de Mula		
Standard:	FCC Parts 15 and 95, EN 301 839	Class:	B

Run #2: Monitoring system bandwidth

Test Configuration Details:

The PSG signal generator was configured to produce 7 un-modulated carriers at 7 of the 8 channels at;

Ch1	402.45 MHz	
Ch2	402.75 MHz	
Ch3	403.05 MHz	
Ch4	403.35 MHz	
Ch5	403.65 MHz	
Ch6	403.95 MHz	Turned off
Ch7	404.25 MHz	
Ch8	404.55 MHz	

The MXG signal generator was configured to produce 1 un-modulated carrier at channel 5 (403.95 MHz). The output of the generators were combined and connected to the biconilog antenna. The output level of the MXG generator was adjusted higher than the output of PSG generator. It was then verified that the EUT would not transmit at 403.95 MHz. The amplitude of the MXG generator was lowered until the EUT begins to select 403.95 MHz for operation. The amplitude of the PSG at this point was recorded as Pa = -67.0 dBm. The frequency of the MXG generator was changed to 403.8275 MHz (lower end of the 20dB bandwidth of the transmit signal) and the level of the generator adjusted until the EUT no longer transmits at 403.95 MHz). This level was recorded as Pb = -57.0 dBm. The frequency of the MXG generator was changed to 404.0725 MHz (upper end of the 20dB bandwidth of the transmit signal) and the level of the generator adjusted until the EUT no longer transmits at 403.95 MHz). This level was recorded as Pc = -57.0dBm.

Note:

-99 dBm EIRP level was achived with -65 dBm MXG signal generator output

Test result:

Since Pb – Pa = 10 dB and Pc – Pa = 10 dB, the EUT complies with the 20dB monitoring bandwidth requirement.

Client:	MicroTransponder Inc.	Job Number:	J88422
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		Account Manager:	Sheareen Jacobs
Contact:	Federico de Mula		
Standard:	FCC Parts 15 and 95, EN 301 839	Class:	B

Run #3: Monitoring system scan cycle time

Note: The EUT performs a clear channel assessment prior to initiating any transmission

Test Configuration Details:

The PSG signal generator was configured to produce 7 un-modulated carriers at 7 of the 8 channels with -96+3 dBm EIRP

Ch1	402.45 MHz	
Ch2	402.75 MHz	
Ch3	403.05 MHz	
Ch4	403.35 MHz	
Ch5	403.65 MHz	
Ch6	403.95 MHz	Turned off
Ch7	404.25 MHz	
Ch8	404.55 MHz	

The MXG signal generator was configured to produce 1 un-modulated carrier at channel 6 (403.95 MHz). The output of the generators were combined and connected to the biconilog antenna. The output level of the MXG generator was adjusted 3 dB higher than the output of PSG generator. It was then verified that the EUT would not transmit at 403.95 MHz. The EUT was set to initiate a transmission and in each case, selected a channel other then 403.95 MHz. The EUT was set to initiate a transmission and at the same time, the output of the MXG generator was switched off. Each time, the EUT selected 403.95 MHz for the transmission in less than 2 seconds.

Test result:

Since the channel selection occurs (2 seconds) in less than 5 seconds, the EUT complies with this requirement.

Client:	MicroTransponder Inc.	Job Number:	J88422
Model:	Wireless Transmitter model 2000	T-Log Number:	T88769
		Account Manager:	Shearen Jacobs
Contact:	Federico de Mula		
Standard:	FCC Parts 15 and 95, EN 301 839	Class:	B

Run #4: Monitoring system Minimum Channel monitoring period

Test Configuration Details:

The PSG signal generator was configured to produce 7 un-modulated carriers at 7 of the 8 channels

Ch1	402.45 MHz	
Ch2	402.75 MHz	
Ch3	403.05 MHz	
Ch4	403.35 MHz	
Ch5	403.65 MHz	Turned off
Ch6	403.95 MHz	
Ch7	404.25 MHz	
Ch8	404.55 MHz	

The MXG signal generator was configured to produce 1 un-modulated carrier at channel (403.65 MHz). The output of the generators were combined and connected to the biconilog antenna. The amplitude of the MXG generator was adjusted to be equal to the amplitude of the PSG generator.

The output of the PSG generator was switched off and the EUT was set to initiate a transmission. The EUT did not transmit at 403.65 MHz. The output of the PSG was switched back on and the amplitude increased by 3dB. The EUT was set to initiate a transmission. The EUT only transmitted at 403.65 MHz. The PSG generator was configured with pulse modulation on all the carriers. The modulation was 0.1 ms pulse with a repetition rate of 10 ms corresponding to a silent period between pulses of 9.9 ms. The EUT was set to initiate a transmission 10 times. In each case, the EUT only transmitted at 403.65 MHz

Test result:

Since the channel selection occurs only on 403.65 MHz, the EUT complies with this requirement.

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		Account Manager:	Sheareen Jacobs
Contact:	Federico de Mula		
Standard:	FCC Parts 15 and 95, EN 301 839	Class:	B

Run #5: Channel access based on ambient level above PTh

Test Configuration Details:

The PSG signal generator was configured to produce 7 un-modulated carriers at 7 of the 8 channels

Ch1	402.45 MHz	-89 dBm EIRP	-49.0 Drive Level (PSG)
Ch2	402.75 MHz	-96 dBm EIRP	-56.0 Drive Level (PSG)
Ch3	403.05 MHz	-89 dBm EIRP	
Ch4	403.35 MHz	-89 dBm EIRP	
Ch5	403.65 MHz	Turned off	-70, -64 Drive Level (MXG)
Ch6	403.95 MHz	-89 dBm EIRP	
Ch7	404.25 MHz	-89 dBm EIRP	
Ch8	404.55 MHz	-89 dBm EIRP	

The MXG signal generator was configured to produce 1 un-modulated carrier at channel 2 (402.75 MHz) generating -102 dBm. The output of the generators were combined and connected to the biconilog antenna.

The EUT was set to initiate a transmission, it only transmitted at 403.65 MHz. The amplitude of the MXG generator was adjusted to be -93 dBm EIRP and the EUT was set to initiate a transmission. The EUT only selected 402.75 MHz for transmission

Test result:

Since the channel selection occurs only on 402.75 MHz, the EUT complies with this requirement.

Client:	MicroTransponder Inc.	Job Number:	J88422
Model:	Wireless Transmitter model 2000	T-Log Number:	T88769
		Account Manager:	Sheareen Jacobs
Contact:	Federico de Mula		
Standard:	FCC Parts 15 and 95, EN 301 839	Class:	B

Run #6: Discontinuation of MICS session

MIC systems shall cease transmission in the event the communications session is interrupted for a period of 5 seconds or more. Once a MICS session is estabilished, it may continue as long as the silent period in two-way communication between co-operating devices does not exceed 5 seconds

Test Configuration Details:

The PSG signal generator was configured to produce 7 un-modulated carriers at 7 of the 8 channels with -70 dBm EIRP

Ch1	402.45 MHz	-89 dBm EIRP
Ch2	402.75 MHz	-89 dBm EIRP
Ch3	403.05 MHz	-89 dBm EIRP
Ch4	403.35 MHz	-89 dBm EIRP
Ch5	403.65 MHz	Turned off
Ch6	403.95 MHz	-89 dBm EIRP
Ch7	404.25 MHz	-89 dBm EIRP
Ch8	404.55 MHz	-89 dBm EIRP

The MXG signal generator was configured to produce 1 un-modulated carrier at channel 5 (403.65 MHz) generating -102 dBm EIRP. The output of the generators were combined and connected to the biconilog antenna.

The EUT was set to initiate a transmission to communicate with the IPG. The EUT transmitted at 403.65 MHz. The IPG was removed from the chamber to block the communications.. From the point in time when the IPG was blocked to the end of transmissions from the EUT was 3 seconds. After removing the covering, no transmissions were observed

Test result:

Since the transmissions from the EUT stopped in less than 5 seconds and did not re-initiate, the EUT complied with this requirement

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Run #7: Use of pre-scanned alternative channel

The test is not applicable, The EUT does not use this feature

Test result: N/A

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		Account Manager:	Sheareen Jacobs
Contact:	Federico de Mula		
Standard:	FCC Parts 15 and 95, EN 301 839	Class:	B

FCC Part 15 and 95 Radiated Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 8/21/2012
Test Engineer: Deniz Demirci
Test Location: FT Ch# 5

Config. Used: See individual runs
Config Change: None
EUT Voltage: 5 VDC USB powered (Laptop 120 VAC 60 Hz)

General Test Configuration

The EUT was located on the table for radiated spurious emissions testing.

The Laptop was located on the turntable in order to reduce unwanted spurious emission coming from support equipments.
For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

Ambient Conditions:

Temperature: 24 °C
Rel. Humidity: 37 %

Summary of Results - Device Operating in the 402-405 MHz Band

Run #	Mode	Channel	Power Setting	Measured Power	Test Performed	Limit	Result / Margin
1a	Modulated Tx	low	Max	None	Fundamental	85.2 dBµV/m	71.2 dBµV/m @ 402.376 MHz (-14 dB)
			Max	None	20dB Bandwidth	300 kHz (95.628(d))	242 kHz (-58 kHz)
			Max	None	Restricted Band Edge (402 MHz)	65.2 dBµV/m	62.0 dBµV/m @ 402.00 MHz (-3.3 dB)
			Max	None	20dB Edge at +/-150 kHz	-20dBc	42.49 dBµV/m @ 402.251 MHz (-1.8 dB)
			Max	None	Radiated Emissions, 30 - 4100 MHz	Part 95	35.00 dBµV/m @ 71.844 MHz (-5.0 dB)
1b	Modulated Tx	high	Max	None	Fundamental	85.2 dBµV/m	69.4 dBµV/m @ 404.49 MHz (-15.8 dB)
			Max	None	20dB Bandwidth	300 kHz (95.628(d))	238 kHz (-62 kHz)
			Max	None	Restricted Band Edge (405 MHz)	65.2 dBµV/m	58.6 dBµV/m @ 405.00 MHz (-6.6 dB)
			Max	None	20dB Edge at +/-150 kHz	-20dBc	39.64 dBµV/m @ 404.75 MHz (-2.3 dB)
			Max	None	Radiated Emissions, 30 - 4100 MHz	Part 95	36.00 dBµV/m @ 71.663 MHz (-4.0 dB)

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		Account Manager:	Sheareen Jacobs
Contact:	Federico de Mula		
Standard:	FCC Parts 15 and 95, EN 301 839	Class:	B

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

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		Account Manager:	Sheareen Jacobs
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Standard:	FCC Parts 15 and 95, EN 301 839	Class:	B

Run #1: Radiated Spurious Emissions, 30 - 4100 MHz.

EUT and Test Configuration Details:

Fundamental level (Limit: 85.2 dBuV/m) - FCC 95.639(f) - 25uW EIRP in any 300kHz (see 95.628(g)(3))

Level more than 250kHz outside of the 402-405MHz band - FCC 95.635(d)(1) - equivalent to FCC Class B, QP detector (or peak)

Emissions within 402-405MHz, more than 150kHz away from fundamental will be attenuated below the transmitter output power by at least 20dB - FCC 95.635(d)(4). RBW = 1% of emission bandwidth

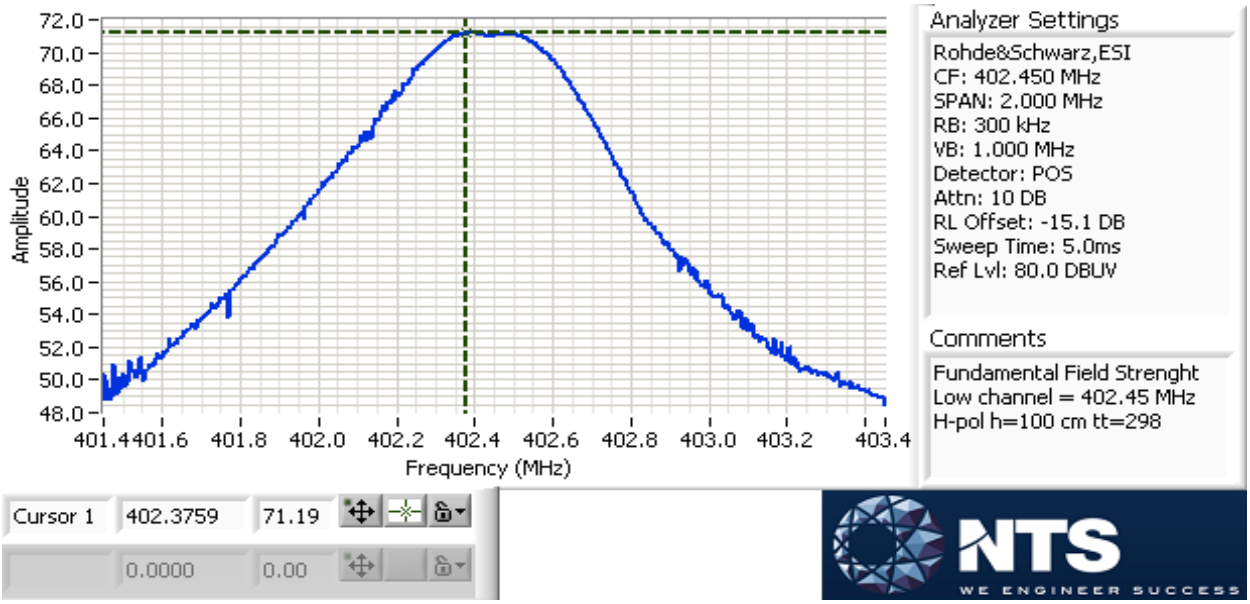
Emissions outside of the band, but within 250kHz of the band (401.75-402.0MHz and 405-405.25MHz) will be attenuated below the maximum permitted output power by at least 20dB (= 65.2dBuV/m). - FCC 95.635(5). RBW=1% of emissions bandwidth

Run #1a: Low Channel @ 402.45 MHz

Fundamental Signal Field Strength: Peak values measured in 300 kHz

Frequency	Level	Pol	95.639(f)		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
402.450	63.0	V	85.2	-22.2	PK	135	157	EUT Flat on the table
402.450	71.2	H	85.2	-14.0	PK	298	100	EUT Flat on the table
402.450	70.4	V	85.2	-14.8	PK	56	143	EUT Upright
402.450	61.2	H	85.2	-24.0	PK	170	211	EUT Upright
402.450	65.9	V	85.2	-19.3	PK	54	180	EUT side
402.450	70.7	H	85.2	-14.5	PK	336	100	EUT side

Maximum power plot



Client:	MicroTransponder Inc.	Job Number:	J88422
Model:	Wireless Transmitter model 2000	T-Log Number:	T88769
		Account Manager:	Sheareen Jacobs
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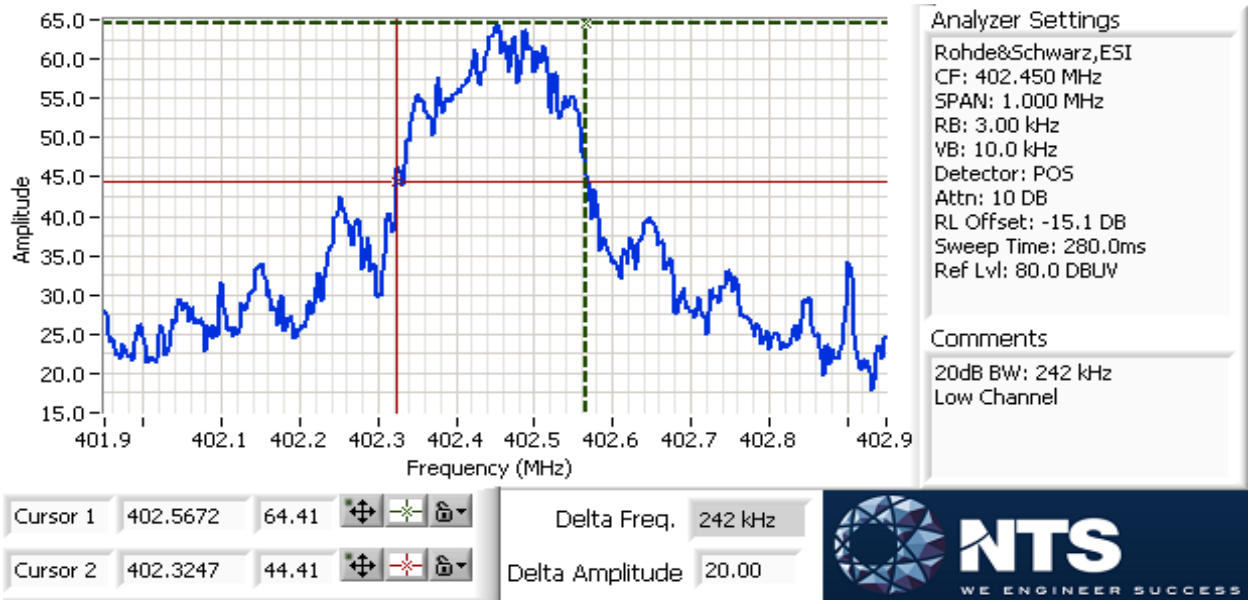
Standard:	FCC Parts 15 and 95, EN 301 839	Class:	B

20dB Bandwidth Plot



Emissions within the band 402-405MHz, more than 150kHz away from fundamental plot

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Model:	Wireless Transmitter model 2000	T-Log Number:	T88769
		Account Manager:	Sheareen Jacobs
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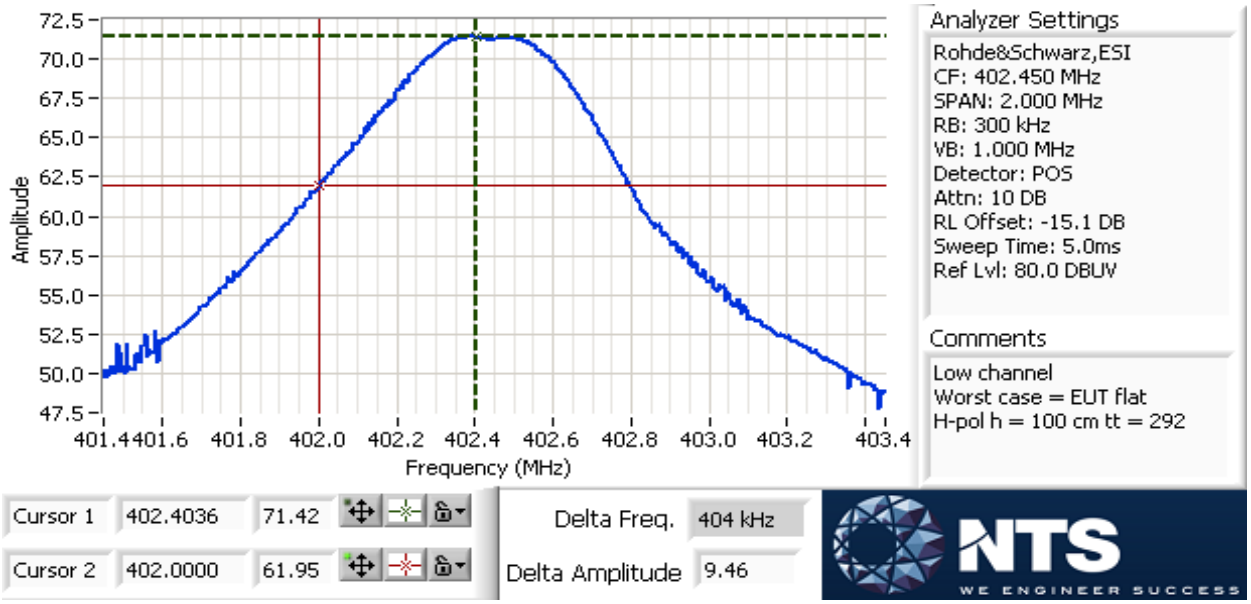
Standard:	FCC Parts 15 and 95, EN 301 839	Class:	B

Band Edge Signal Field Strength - Direct measurement of field strength - Emissions within 250 kHz of band

Frequency	Level	Pol	95.639(f)		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
402.000	62.0	H	65.2	-3.3	PK	292	100.0	EUT flat on the table

Note 1:	Test performed with RBW=300 kHz. Represents worse case measurement.



Client:	MicroTransponder Inc.	Job Number:	J88422
Model:	Wireless Transmitter model 2000	T-Log Number:	T88769
		Account Manager:	Sheareen Jacobs
Contact:	Federico de Mula		
Standard:	FCC Parts 15 and 95, EN 301 839	Class:	B

Other Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
71.844	*35.0*	*V*	*40.0*	*-5.0*	*Peak*	*188*	*1.0*	*EUT at side*
27.204	*31.5*	*V*	*40.0*	*-8.5*	*Peak*	*19*	*1.0*	*EUT at side*
194.739	*38.4*	*V*	*43.5*	*-5.1*	*Peak*	*61*	*1.0*	*EUT at side*
206.864	*38.4*	*V*	*43.5*	*-5.1*	*Peak*	*61*	*1.0*	*EUT at side*
211.273	*38.0*	*V*	*43.5*	*-5.5*	*Peak*	*44*	*1.0*	*EUT at side*
768.537	*39.2*	*H*	*46.0*	*-6.8*	*Peak*	*173*	*1.0*	*EUT at side*
720.842	*38.3*	*H*	*46.0*	*-7.7*	*Peak*	*183*	*2.5*	*EUT at side*
1599.330	*41.4*	*V*	*54.0*	*-12.6*	*Peak*	*170*	*1.0*	*EUT at side*
1997.170	*41.6*	*V*	*54.0*	*-12.4*	*Peak*	*163*	*1.0*	*EUT at side*
71.844	*35.0*	*V*	*40.0*	*-5.0*	*Peak*	*157*	*1.0*	*EUT Upright*
206.864	*36.8*	*V*	*43.5*	*-6.7*	*Peak*	*46*	*1.0*	*EUT Upright*
211.273	*37.0*	*V*	*43.5*	*-6.5*	*Peak*	*43*	*1.0*	*EUT Upright*
503.407	*39.0*	*V*	*46.0*	*-7.0*	*Peak*	*93*	*1.0*	*EUT Upright*
612.826	*38.7*	*V*	*46.0*	*-7.3*	*Peak*	*256*	*1.0*	*EUT Upright*
1594.170	*44.5*	*V*	*54.0*	*-9.5*	*Peak*	*159*	*1.0*	*EUT Upright*
1997.170	*41.9*	*V*	*54.0*	*-12.1*	*Peak*	*162*	*1.0*	*EUT Upright*
71.844	*35.4*	*V*	*40.0*	*-4.6*	*Peak*	*174*	*1.0*	*EUT Flat*
215.130	*35.4*	*V*	*43.5*	*-8.1*	*Peak*	*39*	*1.0*	*EUT Flat*
720.842	*39.2*	*H*	*46.0*	*-6.8*	*Peak*	*247*	*2.0*	*EUT Flat*
1594.170	*41.7*	*V*	*54.0*	*-12.3*	*Peak*	*166*	*1.5*	*EUT Flat*
1997.170	*41.8*	*V*	*54.0*	*-12.2*	*Peak*	*168*	*1.0*	*EUT Flat*

Note: Spurious emissions were measured with all three EUT orientations (Side, Upright, Flat on the table)

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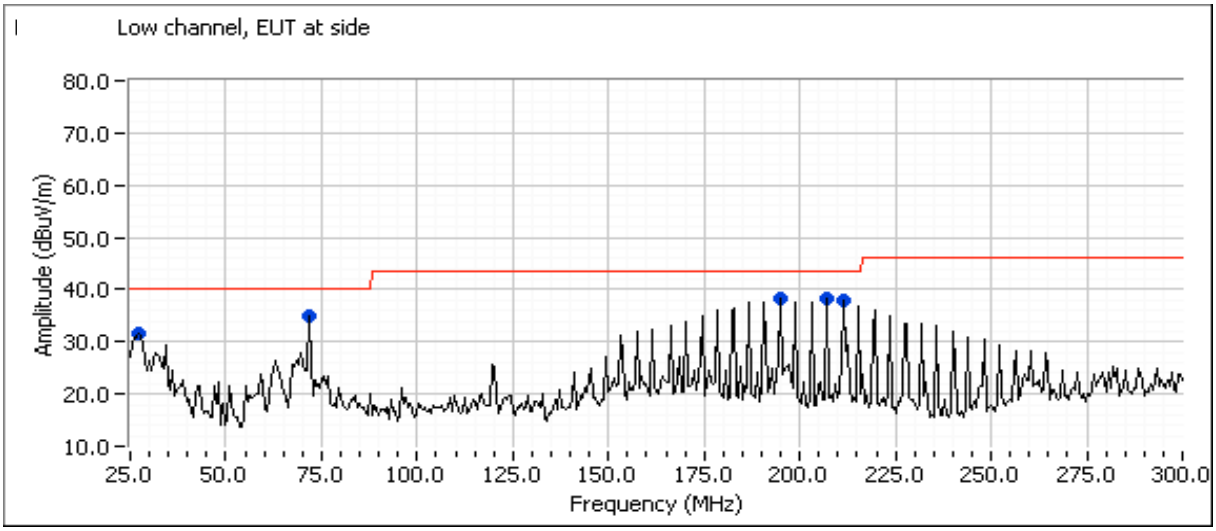
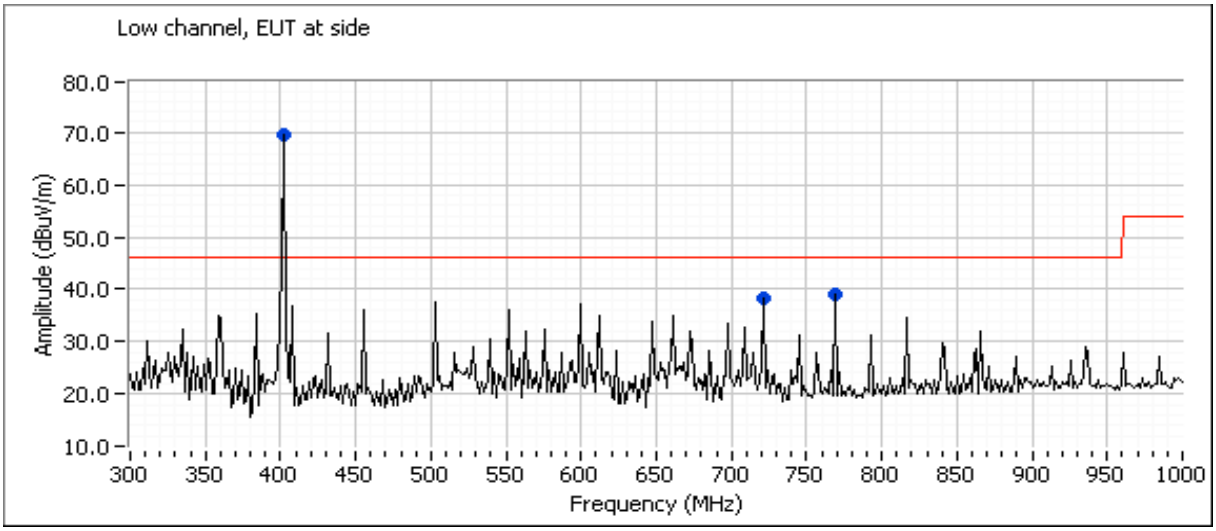
Standard:	FCC Parts 15 and 95, EN 301 839	Class:	B





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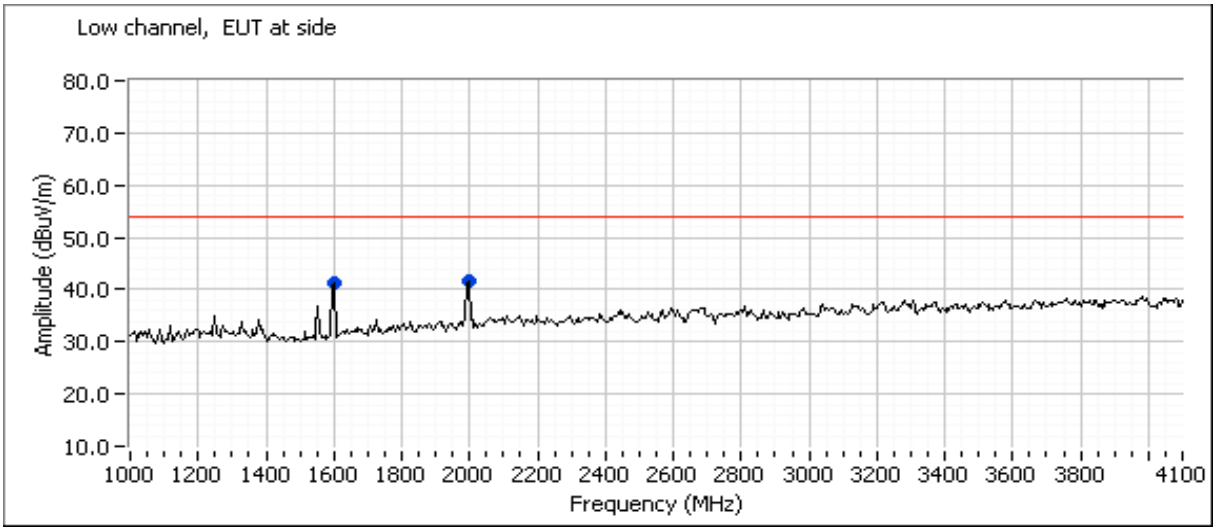

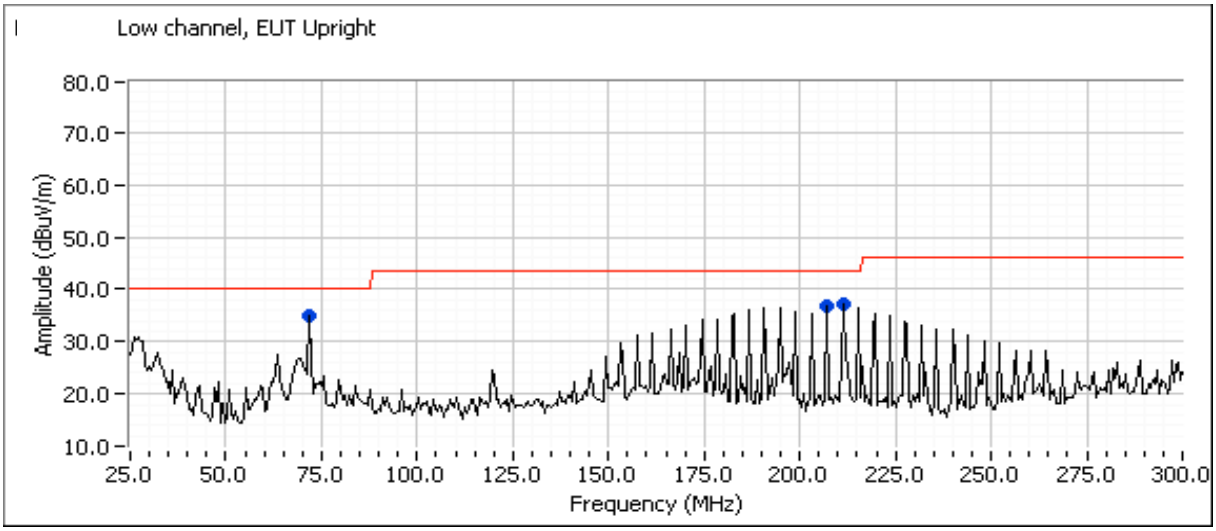

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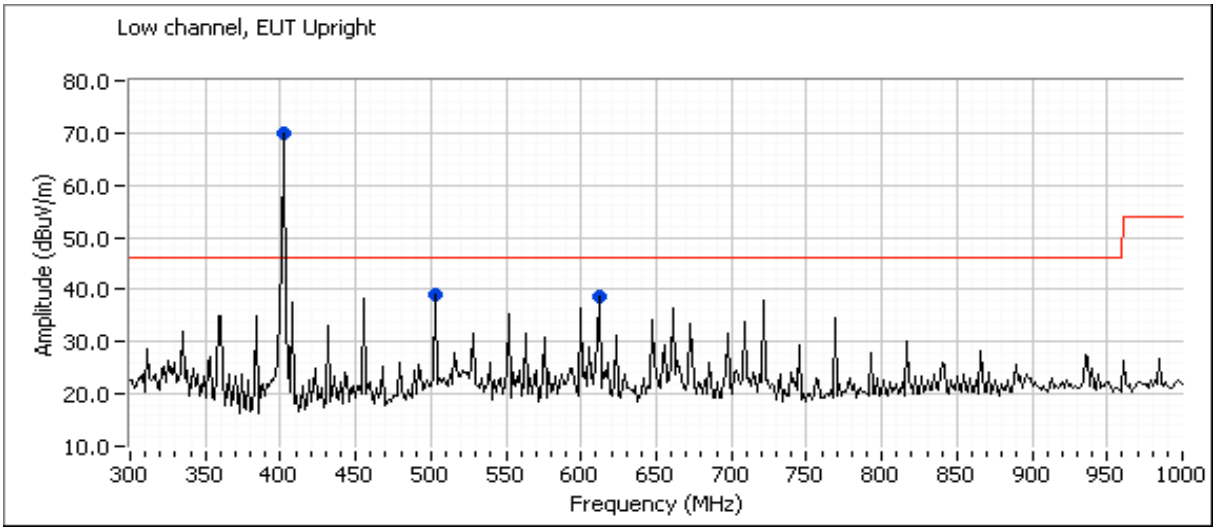
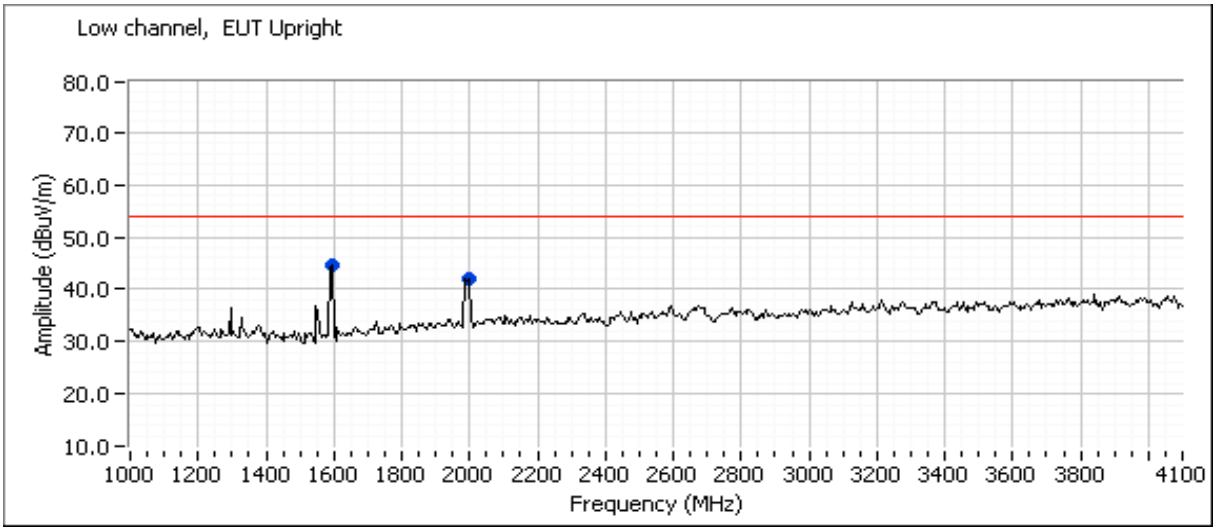
Model:	Wireless Transmitter model 2000	T-Log Number:	T88769
		Account Manager:	Sheareen Jacobs
Contact:	Federico de Mula		
Standard:	FCC Parts 15 and 95, EN 301 839	Class:	B





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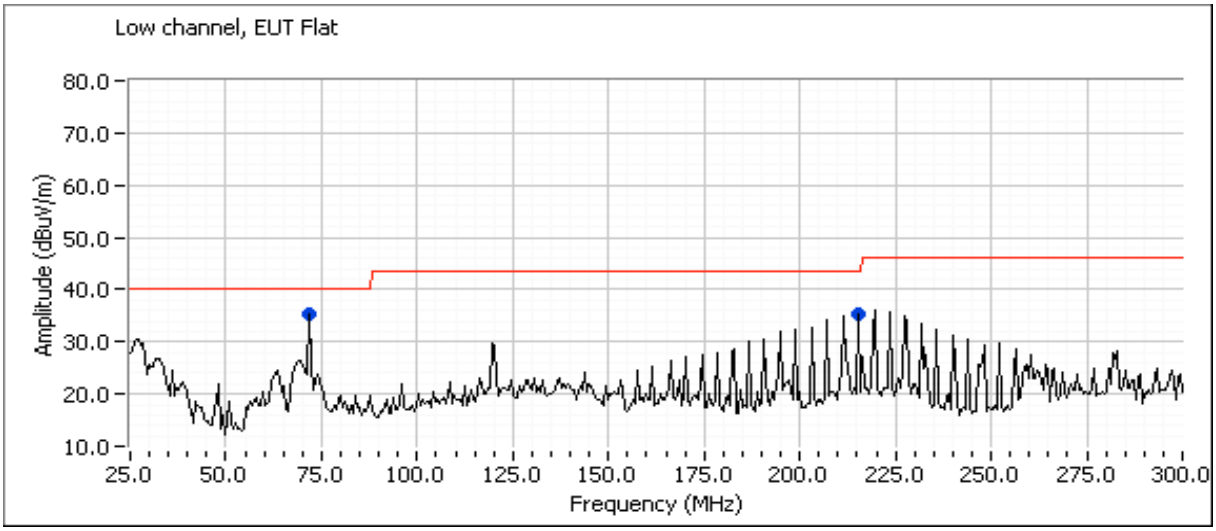

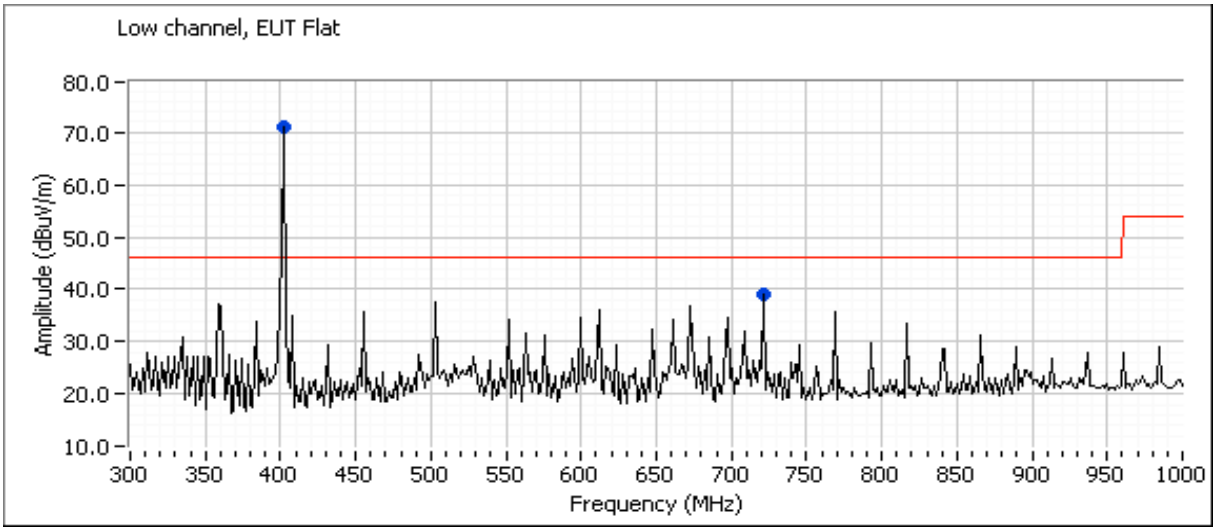

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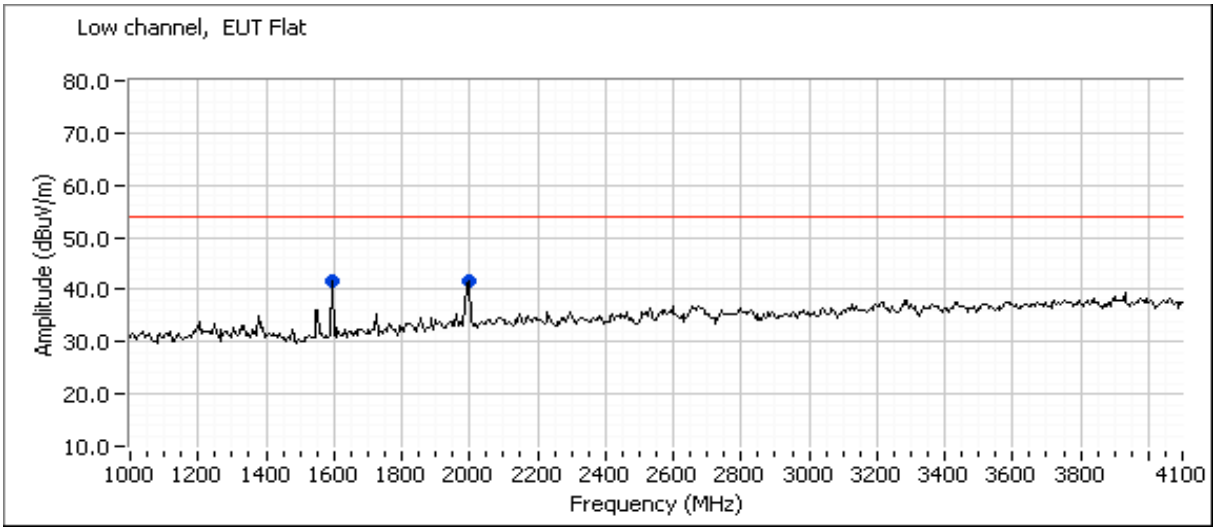

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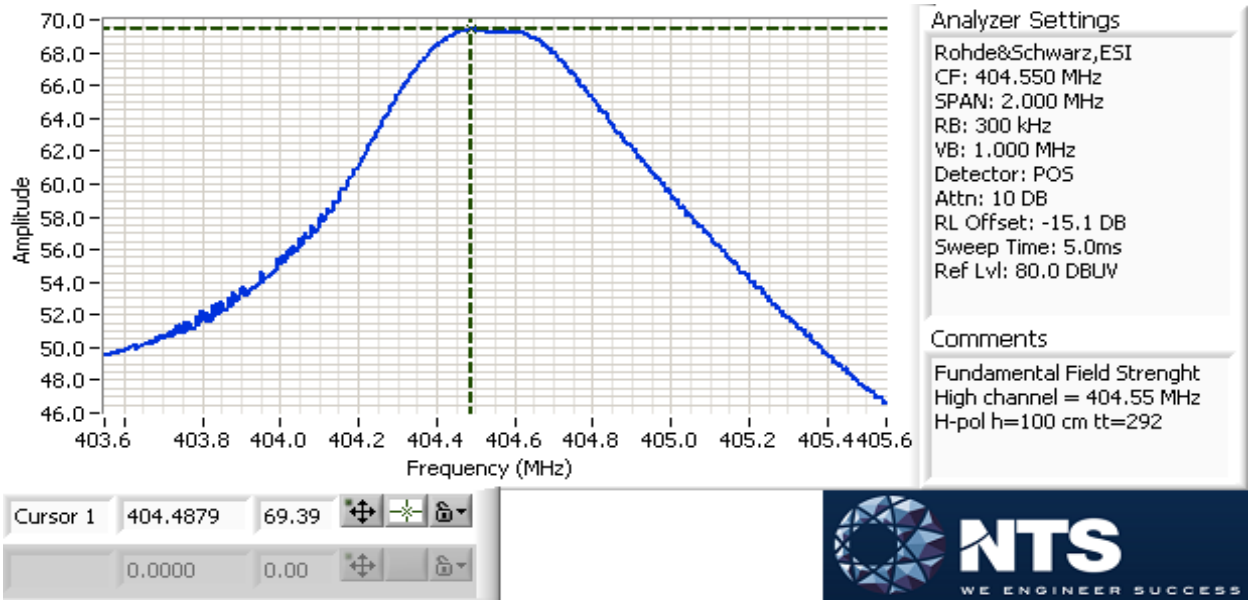
Standard:	FCC Parts 15 and 95, EN 301 839	Class:	B

Run #1b: High Channel @ 404.55 MHz

Fundamental Signal Field Strength: Peak values measured in 300 kHz

Frequency	Level	Pol	95.639(f)		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
404.550	61.6	V	85.2	-23.6	PK	212	115	EUT Flat on the table
404.550	69.4	H	85.2	-15.8	PK	292	100	EUT Flat on the table
404.550	67.9	V	85.2	-17.3	PK	47	134	EUT Upright
404.550	61.3	H	85.2	-23.9	PK	140	100	EUT Upright
404.550	63.1	V	85.2	-22.1	PK	308	170	EUT side
404.550	67.8	H	85.2	-17.4	PK	339	100	EUT side

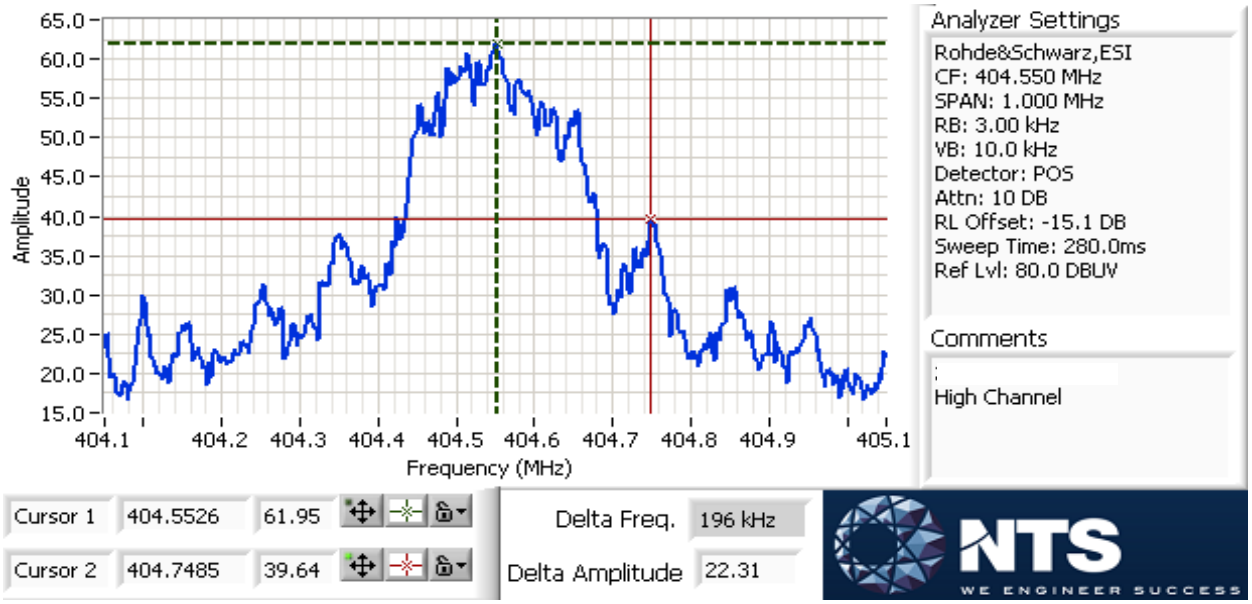
Maximum power plot



Client:	MicroTransponder Inc.	Job Number:	J88422
Model:	Wireless Transmitter model 2000	T-Log Number:	T88769
		Account Manager:	Sheareen Jacobs
Contact:	Federico de Mula		
Standard:	FCC Parts 15 and 95, EN 301 839	Class:	B

20dB Bandwidth Plot

Emissions within the band 402-405 MHz, more than 150 kHz away from fundamental plot



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Model:	Wireless Transmitter model 2000	T-Log Number:	T88769
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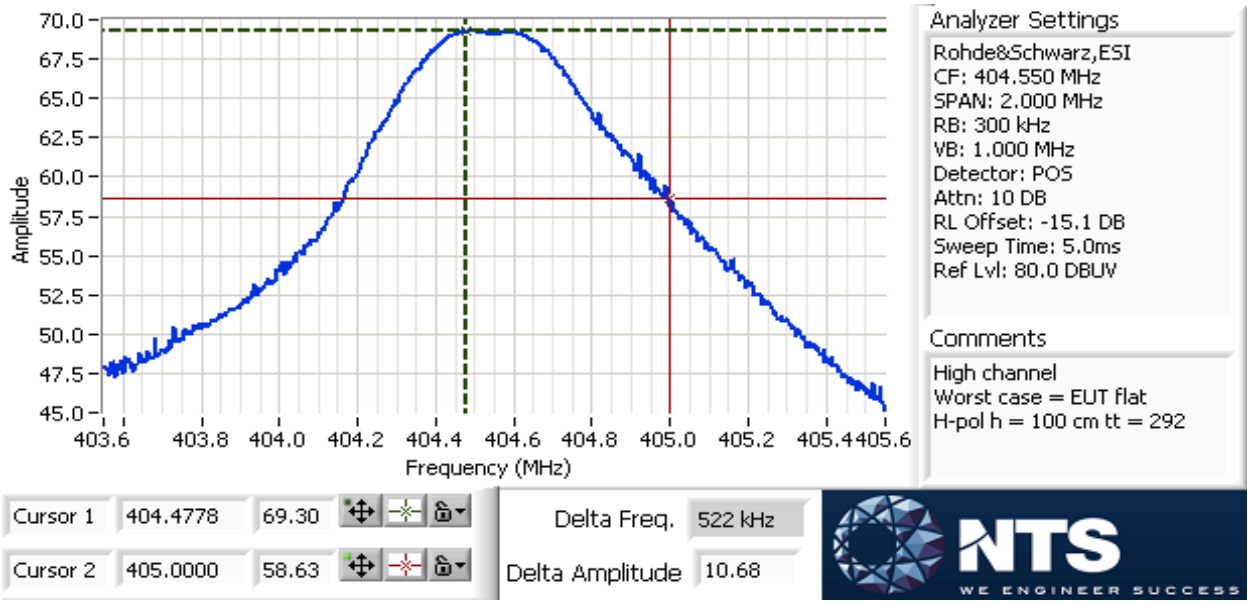
Standard:	FCC Parts 15 and 95, EN 301 839	Class:	B

Band Edge Signal Field Strength - Direct measurement of field strength - Emissions within 250 kHz of band

Frequency	Level	Pol	95.639(f)		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
405.000	58.6	H	65.2	-6.6	PK	292	100	EUT Flat on the table

Note 1:	Test performed with RBW=300 kHz. Represents worse case measurement.



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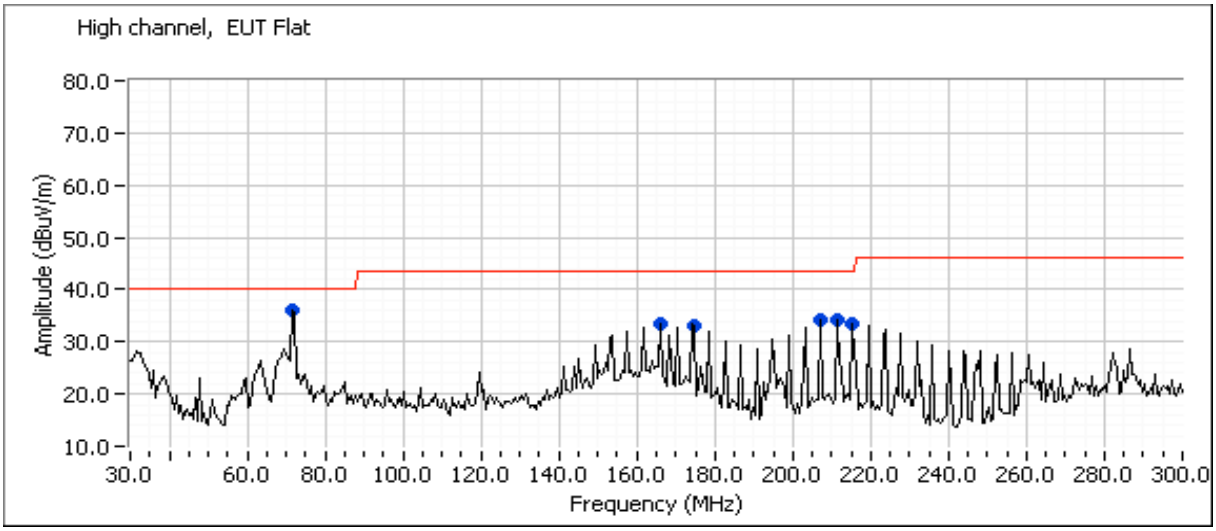
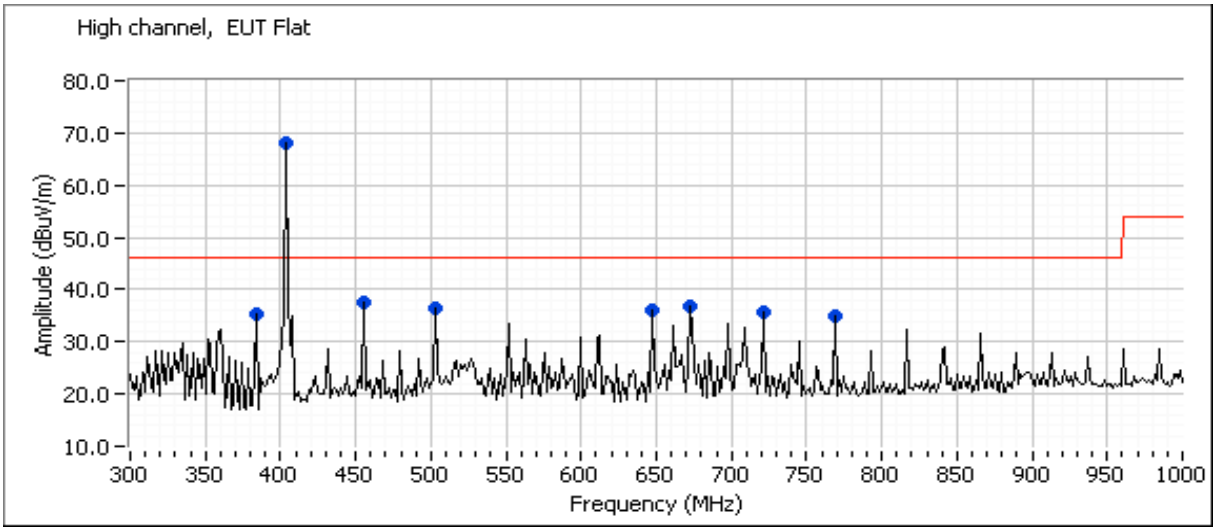
Other Spurious Emissions

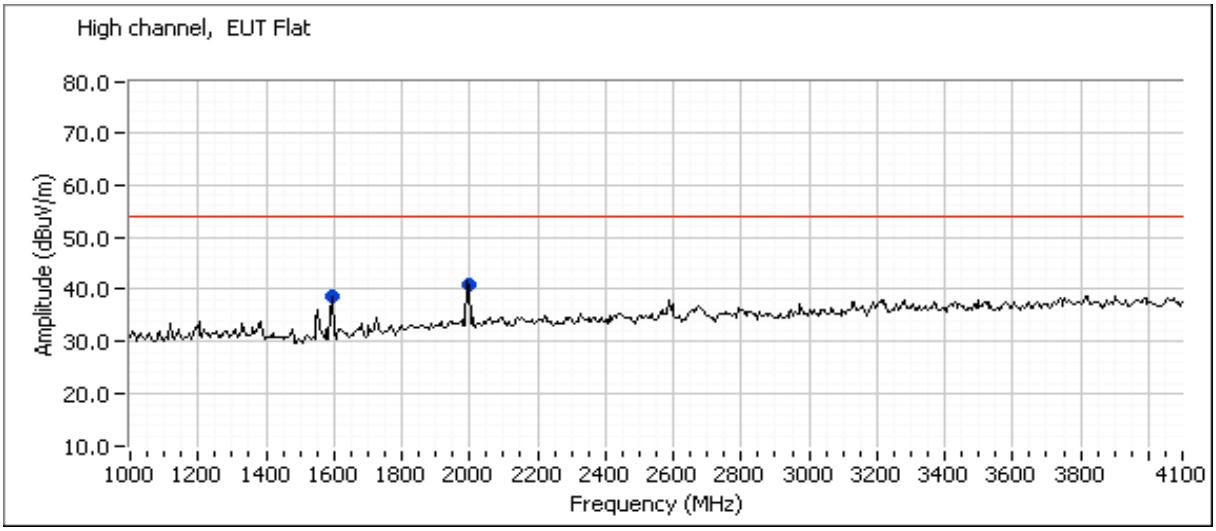
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
71.663	*36.0*	*V*	*40.0*	*-4.0*	*Peak*	*96*	*1.0*	EUT Flat on the table
174.469	*33.1*	*V*	*43.5*	*-10.4*	*Peak*	*206*	*1.0*	EUT Flat on the table
206.934	*34.1*	*V*	*43.5*	*-9.4*	*Peak*	*51*	*1.0*	EUT Flat on the table
211.263	*34.2*	*V*	*43.5*	*-9.3*	*Peak*	*60*	*1.0*	EUT Flat on the table
215.050	*33.6*	*V*	*43.5*	*-9.9*	*Peak*	*46*	*1.0*	EUT Flat on the table
165.812	*33.3*	*V*	*43.5*	*-10.2*	*Peak*	*291*	*1.0*	EUT Flat on the table
455.711	*37.6*	*V*	*46.0*	*-8.4*	*Peak*	*222*	*1.0*	EUT Flat on the table
503.407	*36.6*	*V*	*46.0*	*-9.4*	*Peak*	*219*	*1.0*	EUT Flat on the table
384.168	*35.3*	*H*	*46.0*	*-10.7*	*Peak*	*296*	*1.0*	EUT Flat on the table
647.896	*36.2*	*H*	*46.0*	*-9.8*	*Peak*	*292*	*1.5*	EUT Flat on the table
671.743	*36.7*	*H*	*46.0*	*-9.3*	*Peak*	*287*	*1.5*	EUT Flat on the table
720.842	*35.6*	*H*	*46.0*	*-10.4*	*Peak*	*109*	*1.5*	EUT Flat on the table
768.537	*35.1*	*H*	*46.0*	*-10.9*	*Peak*	*275*	*1.5*	EUT Flat on the table
1997.170	*40.9*	*V*	*54.0*	*-13.1*	*Peak*	*164*	*1.0*	EUT Flat on the table
1594.170	*38.7*	*V*	*54.0*	*-15.3*	*Peak*	*20*	*1.5*	EUT Flat on the table

Note: Worst case spurious emission was observed when the EUT was flat on the table at low channel. Hence radiated surious emissions were performed on high channel when EUT was flat on the table



Client:	MicroTransponder Inc.	Job Number:	J88422
Model:	Wireless Transmitter model 2000	T-Log Number:	T88769
		Account Manager:	Sheareen Jacobs
Contact:	Federico de Mula		
Standard:	FCC Parts 15 and 95, EN 301 839	Class:	B





Client:	MicroTransponder Inc.	Job Number:	J88422
Model:	Wireless Transmitter model 2000	T-Log Number:	T88769
		Account Manager:	Sheareen Jacobs
Contact:	Federico de Mula		
Standard:	FCC Parts 15 and 95, EN 301 839	Class:	N/A

FCC Part 95.628(e)
Frequency Stability

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

General Test Configuration

With the exception of the radiated spurious emissions tests, all measurements are made with a probe. For frequency stability measurements the EUT was place inside an environmental chamber.

Radiated measurements are made with the EUT located on a non-conductive table, 3m from the measurement antenna.

Ambient Conditions:

Temperature: 25 °C

Rel. Humidity: 49 %

Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result
1	Frequency Stability	+/- 100 ppm	Pass	-34.8 ppm

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	MicroTransponder Inc.	Job Number:	J88422
Model:	Wireless Transmitter model 2000	T-Log Number:	T88769
		Account Manager:	Sheareen Jacobs
Contact:	Federico de Mula		
Standard:	FCC Parts 15 and 95, EN 301 839	Class:	N/A

Run #1: Frequency Stability

Date: 8/15/2012 Engineer: John Caizzi Location: Environmental Chamber

Nominal Frequency: 402.450 MHz

Frequency Stability Over Temperature

The EUT was soaked at each temperature for a minimum of 30 minutes prior to making the measurements to ensure the EUT and chamber had stabilized at that temperature.

Temperature	Frequency Measured	Drift	
(Celsius)	(MHz)	(Hz)	(ppm)
0	402.454870	4870	12.1
10	402.451693	1693	4.2
20	402.448126	-1874	-4.7
30	402.444550	-5450	-13.5
40	402.440853	-9147	-22.7
50	402.437567	-12433	-30.9
55	402.435977	-14023	-34.8
	Worst case:	-14023	-34.8

Frequency Stability Over Input Voltage

Note 1:	The unit receives its power from a host computer, and power will not drop.

End of Report

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