

FCC PART 90



TEST AND MEASUREMENT REPORT

For

Teltronic S.A.U.

Poligono Malpica, Calle F Oeste, Parcela 12,
50057 Zaragoza, Spain

FCC ID: WT7PTRNKTBSR75760
Model: BSR75-K

Report Type: Original Report	Product Type: Digital RF Transceiver
Prepared By: <u>Lionel Lara</u> 	
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Reviewed By: <u>RF/EMC Lead</u> 	
Victor Zhang	
Bay Area Compliance Laboratories Corp. 1274 Anvilwood Avenue, Sunnyvale, CA 94089, U.S.A. Tel: (408) 732-9162 Fax: (408) 732 9164	

Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This report **must not** be used by the customer to claim product certification, approval, or endorsement by A2LA* or any agency of the Federal Government.

* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "*" (Rev. 3)

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1204106-90	Original Report	2012-11-05
1	R1204106-90	Updated Frequency Range & ACP	2012-12-14

1. General Information

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *Teltronic S.A.U.* and their product, FCC ID: WT7PTRNKTBSR75760, model: BSR75-K, which will henceforth be referred to as the EUT (Equipment Under Test). The EUT is a Digital RF Transceiver.

Specifications	
Frequency Band	769-775 MHz
Modulation Type	$\pi/4$ -DQPSK
Emission Designator	20K0D7W, 20K0D7E, 20K0D7D
RF Output Power	Low: 0.6 Watts High: 75 Watts
Channel Spacing	25 kHz
Necessary /authorized Bandwidth	20 kHz
Power Supply	26.4 VDC

RF Channel Spacing: 25 kHz (Spectrum Efficiency 6.25 kHz) Note: TDMA access scheme with 4 physical channels per carrier. The channel bandwidth is 25 kHz. As a result, the equipment meets the narrowbanding spectrum efficiency standard of one voice channel per 6.25 kHz of channel bandwidth. Modulation is $\pi/4$ -DQPSK with 18 Ksym/sec. This modulation is based on transmitting two bits per symbol, so the data rate for each physical channel is 9000 bits per second (higher than narrowbanding standard of 4800 bps per 6.25 kHz of channel bandwidth).

1.2 Mechanical Description

The EUT measures approximately 43cm (L) x 34cm (W) x 13cm (H) and weighs 10886.22 g.

The test data gathered are from production sample. Serial number: 830163 provided by the manufacturer.

1.3 Objective

This type approval report is prepared on behalf of *Teltronic S.A.U.* in accordance with Part 90 of the Federal Communication Commissions rules.

The objective was to determine the RF output power, Occupied Bandwidth, Spurious Emissions, Frequency Stability and Transient Frequency Behavior are in compliance with the FCC rules.

1.4 Related Submittal(s)/Grant(s)

None.

1.5 Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of federal Regulations Title 47 Part 2, Sub-part J as well as the following individual parts:

Part 90 – Private Land Mobile Radio Service

Applicable Standards: TIA603-C and ANSI 63.4-2003, American National Standard for Method of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

All emissions measurement was performed by Bay Area Compliance Laboratories Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR16-4-2:2003, The Treatment of Uncertainty in EMC Measurements, the values ranging from +2.0 dB for Conducted Emissions tests and +4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

1.7 Test Facility

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997, and Article 8 of the VCCI regulations on December 25, 1997. The test site also complies with the test methods and procedures set forth in CISPR 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2003, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24:2010.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: A-0027. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL Corp. is an American Association for laboratory Accreditation (A2LA) accredited laboratory (Lab Code 3297-02). The current scope of accreditations can be found at

<http://www.a2la.org/scopepdf/3297-02.pdf?CFID=1132286&CFTOKEN=e42a3240dac3f6ba-6DE17DCB-1851-9E57-477422F667031258&jsessionid=8430d44f1f47cf2996124343c704b367816b>

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to TIA/EIA-603-C.

The EUT was tested in the normal (native) operating mode to represent *worst-case* results during the final qualification test.

2.2 EUT Exercise Software

The software used was HyperTerminal.

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Internal Configuration

Manufacturers	Descriptions	Models	Serial Numbers
Teltronic, S.A.U.	Repeater Power Supply 75W (RPS75)	PE138059PT	-
Teltronic, S.A.U.	Repeater Power Amplifier 75W (RPA75)	PE138K19PT	-
Teltronic, S.A.U.	Repeater Transmitter 75W (RTX75)	PE138K18PT	-
Teltronic, S.A.U.	Repeater Receiver (RRX)	PE138K40PT	-
Teltronic, S.A.U.	BSR75 Synchronism (BSYNC)	PE138051PT	-
Teltronic, S.A.U.	Repeater Control Processing Unit (RCPU)	PE138020PT	-
Teltronic, S.A.U.	Rack BSR75	D485009PT	-

2.5 Local Support Equipment

Manufacturer	Description	Model No.	Serial No.
Dell	Laptop	PP05L	7T390 A02

2.6 Local Support Equipment Power Supply and Line Filters

Manufacturer	Description	Model	Serial Number
Electronic Measurements Inc.	TCR power supply	TCR 80S34-2-0V	92D-6839

2.7 External I/O Cabling List and Details

Cable Description	Length (m)	From	To
Maintenance cable	<1.0	Laptop Serial port	EUT Maintenance Port
Power Supply Cable	>1.0	Power Supply	EUT
Ethernet Cable	<1.0	EUT Ethernet Port	EUT Ethernet Port
Ethernet Cable	<1.0	EUT Ethernet Port	EUT Ethernet Port
RF cable	>1.0	EUT Output	PSA

3 Summary of Test Results

FCC Rules	Description of Tests	Results
§1.1310, §2.1091	RF Exposure	Compliant
§2.1046, §90.205	RF Output Power	Compliant
§2.1047, §90.207	Modulation Characteristics, Audio Frequency Response and Audio Filter Response	Compliant ¹
§2.1049, §90.543	Occupied Bandwidth and Emission Mask	Compliant
§2.1051, §90.543	Spurious Emissions at Antenna Terminals	Compliant
§2.1055, §90.539	Frequency Stability	Compliant ¹
§2.1053, §90.543	Field Strength of Spurious Radiation	Compliant
§90.214	Transient Frequency Behavior	N/A

N/A: Not applicable.

Note 1: This test was completed by Teltronic S.A.U with test report D138K01PT_DTR01num002_FCC-IC_Test_700.

4 FCC §2.1091 - RF Exposure Information

4.1 Applicable Standards

FCC §2.1091, (a) Requirements of this section are a consequence of Commission responsibilities under the National Environmental Policy Act to evaluate the environmental significance of its actions. See subpart I of part 1 of this chapter, in particular §1.1307(b).

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-1.34	614	1.63	*(100)	6
1.34-30	1842/f	4.89/f	*(900/f ²)	6
30-300	61.4	0.163	1.0	6
300-1500	/	/	f/300	6
1500-100,000	/	/	5	6

f = frequency in MHz

* = Plane-wave equivalent power density

4.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: *S* = power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>49.17</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>82603.8</u>
<u>TX Filter + Dual Isolator Loss (dB):</u>	<u>0.9</u>
<u>Prediction distance (cm):</u>	<u>525</u>
<u>Prediction frequency (MHz):</u>	<u>774.9</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>20</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>100</u>
<u>Power density of prediction frequency at 525 cm (mW/cm²):</u>	<u>1.94</u>
<u>MPE limit for uncontrolled exposure at prediction frequency (mW/cm²):</u>	<u>2.583</u>

Conclusion

The device complies with the MPE requirements by providing a safe separation distance of at least 525 cm between the antenna with maximum 20 dBi gain, including any radiating structure, and any persons when normally operated.

5 FCC §2.1046 & §90.205 – RF Output Power

5.1 Applicable Standard

According to FCC §2.1046, and §90.205, 763–805 MHz. The transmitting power of base transmitters must not exceed the limits given in paragraphs (a), (b) and (c) of §90.635.

(a) The effective radiated power and antenna height for base stations may not exceed 1 kilowatt (30 dBw) and 304 m. (1,000 ft.) above average terrain (AAT), respectively, or the equivalent thereof as determined from the Table. These are maximum values, and applicants will be required to justify power levels and antenna heights requested.

(b) The maximum output power of the transmitter for mobile stations is 100 watts (20 dBw).

5.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

5.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4405B	MY410001384	2012-07-09	1 Year

5.4 Test Environmental Conditions

Temperature:	25 °C
Relative Humidity:	35 %
ATM Pressure:	101.8 kPa

The testing was performed by Denny Soto from Teltronic S.A.U.

5.5 Test Results

Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth

Modulation	Frequency (MHz)	Low Output Power (dBm)	Low Output Power (Watt)	High Output Power (dBm)	High Output Power (Watt)
Voice	769.0	28.29	0.675	49.11	81.47
	774.9	28.34	0.682	49.11	81.47
Data	769.0	28.28	0.673	49.17	82.6
	774.9	28.39	0.690	49.10	81.28

Note: Manufacturer's rated power is 0.6-75 Watts

6 FCC §2.1047 & §90.207 – Modulation Characteristic

6.1 Applicable Standard

FCC §2.1047 & §90.207:

- (a) Equipment which utilizes voice modulated communication shall show the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz. for equipment which is required to have a low pass filter, the frequency response of the filter, or all of the circuitry installed between the modulation limited and the modulated stage shall be supplied.
- (b) Equipment which employs modulation limiting, a curve showing the percentage of modulation versus the modulation input voltage shall be supplied.

6.2 Test Procedure

Test Method: ETSI EN 300 394-1 clause 10.1

6.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
IFR	TETRA Analyzer	2310	231001/122	2012-03-12	1 Year
Agilent	Power Supply	6032A	MY41001384	2011-11-16	1 Year

6.4 Test Environmental Conditions

Temperature:	20 – 35°C
Relative Humidity:	35 – 60%
ATM Pressure:	1.011 atm

The testing was done by Denny Soto from Teltronic S.A.U.

6.5 Test Results

Temperature (°C)	Vdc	Frequency (MHz)	Result (%)	Limit (%)
15°C - 35 °C	26.4	775.975	5.4	10
60 °C	26.4	775.975	5.8	10
-30 °C	26.4	775.975	6.2	10

Note: Testing was done by Denny Soto from Teltronic S.A.U.

7 FCC §2.1049 & §90.543 – Occupied Bandwidth & Emission Mask

7.1 Applicable Standard

According to FCC §90.543: Transmitters designed to operate in 769–775 MHz and 799–805 MHz frequency bands must meet the emission limitations in paragraphs (a) through (d) of this section. Transmitters operating in 763–768 MHz and 793–798 MHz bands must meet the emission limitations in (e) of this section.

25 kHz Base Transmitter ACP Requirements

Offset from center frequency (kHz)	Measurement bandwidth (kHz)	Maximum ACP relative (dBc)
15.625	6.25	–40
21.875	6.25	–60
37.5	25	–60
62.5	25	–65
87.5	25	–65
150	100	–65
250	100	–65
350	100.00	–65
>400 kHz to 12 MHz	30 (s)	–80
12 MHz to paired receive band	30 (s)	–80
In the paired receive band	30 (s)	–100

7.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 100 Hz and the spectrum was recorded in the frequency band ± 50 KHz from the carrier frequency.

7.3 Test Equipment List and Details

Testing performed by Lionel Lara

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2011-10-16	1 Year

Statement of Traceability: BACL Corp. attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

Testing performed by Denny Soto

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	PXA Signal Analyzer	N9030A	MY49430122	2012-05-24
BIRD	20 dB Attenuator / 100W	300-WA-FFN-30	0902	N/A

7.4 Test Environmental Conditions

Temperature:	22 °C
Relative Humidity:	60 %
ATM Pressure:	101.6 kPa

The testing was performed by Lionel Lara on 2012-04-24 in the RF Site.

Temperature:	25°C
Relative Humidity:	35%
ATM Pressure:	101.8 KPa

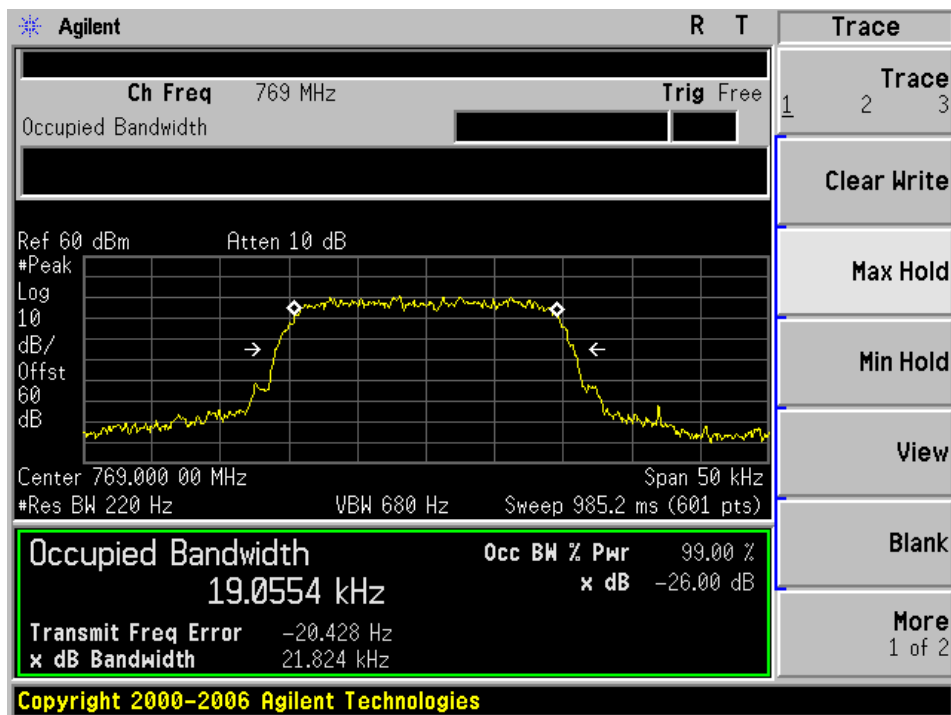
The Adjacent Channel Power testing was done by Denny Soto from Teltronic S.A.U.

7.5 Test Results

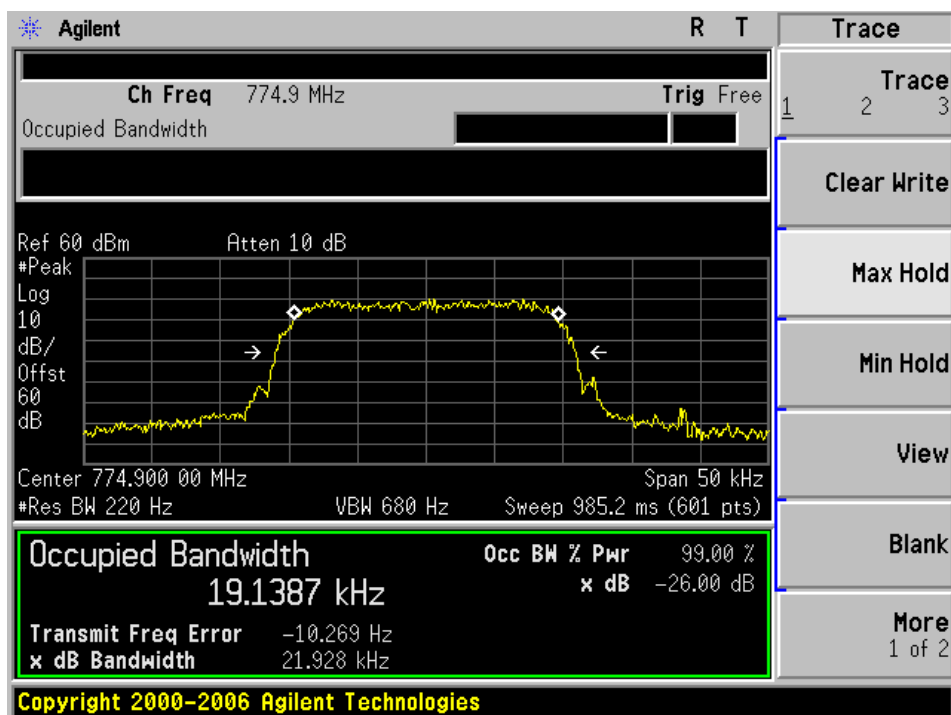
Please refer to the following plots.

Occupied Bandwidth (High Power)**Modulation: Voice, 20 kHz Bandwidth**

769.0 MHz

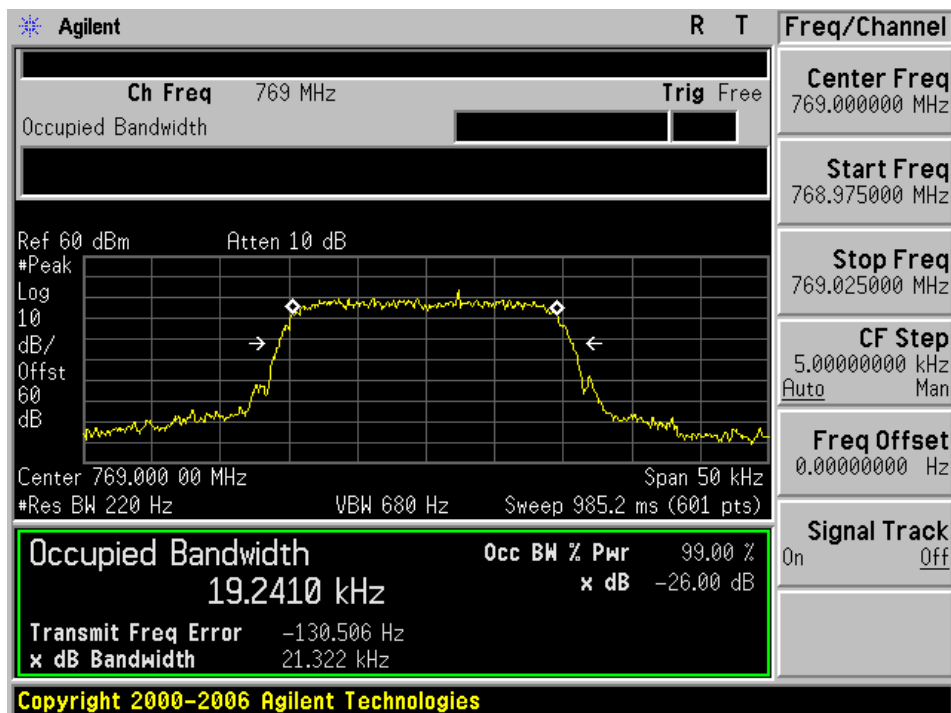


774.9 MHz

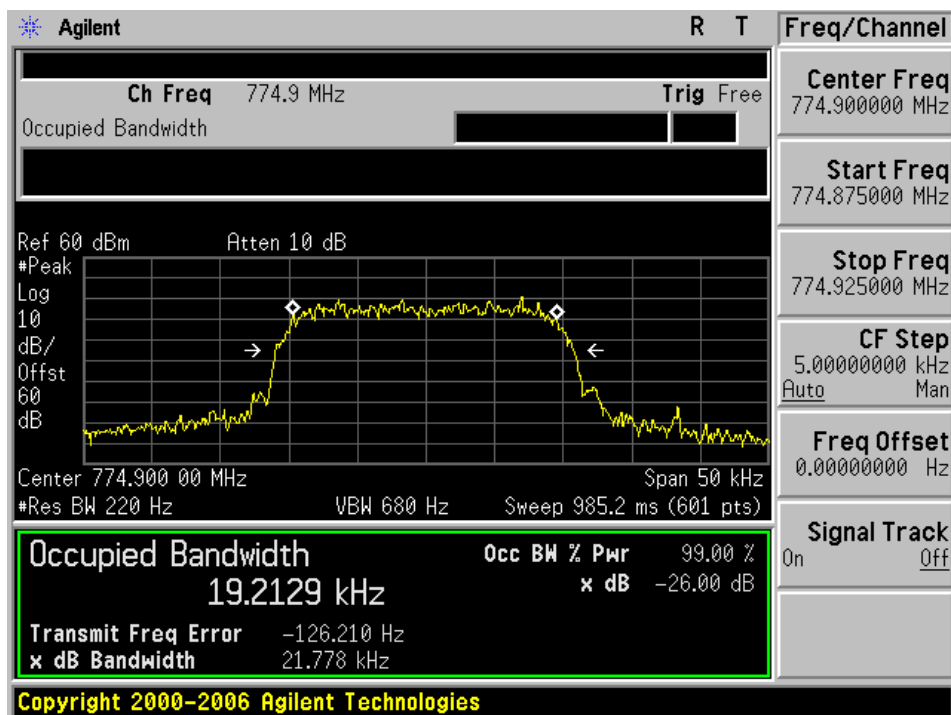


Modulation: Data, 20 kHz Bandwidth

769.0 MHz

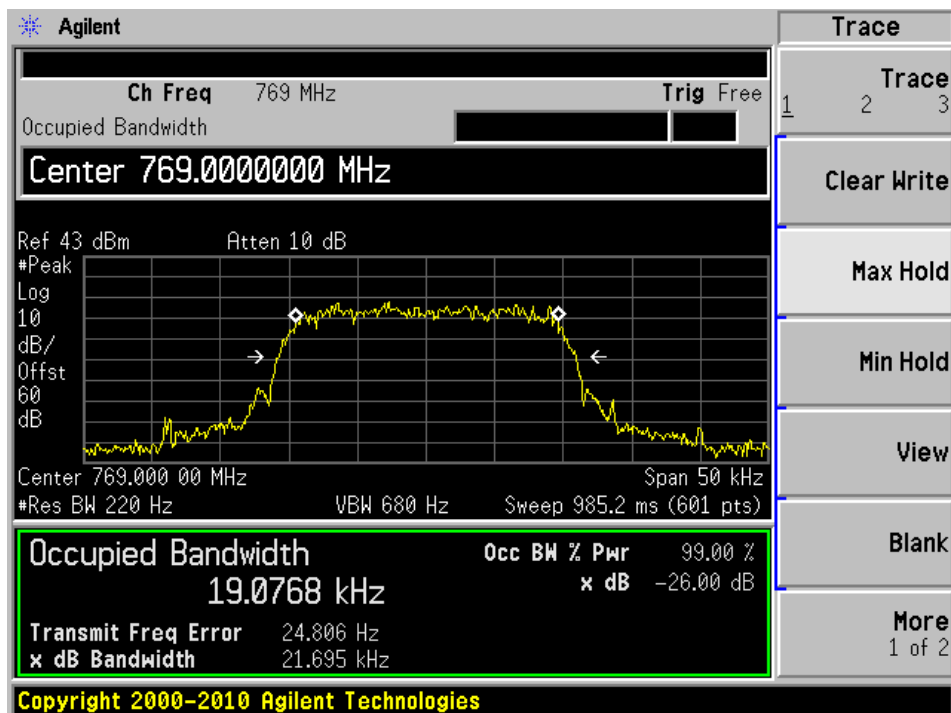


774.9 MHz

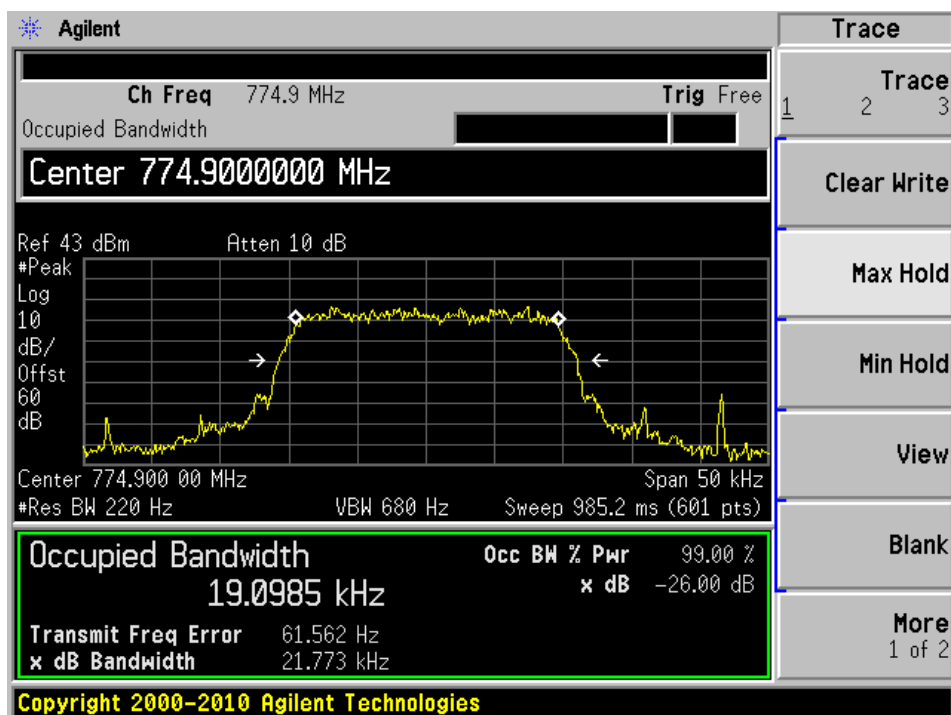


Occupied Bandwidth (Low Power)**Modulation: Voice, 20 kHz Bandwidth**

769.0 MHz

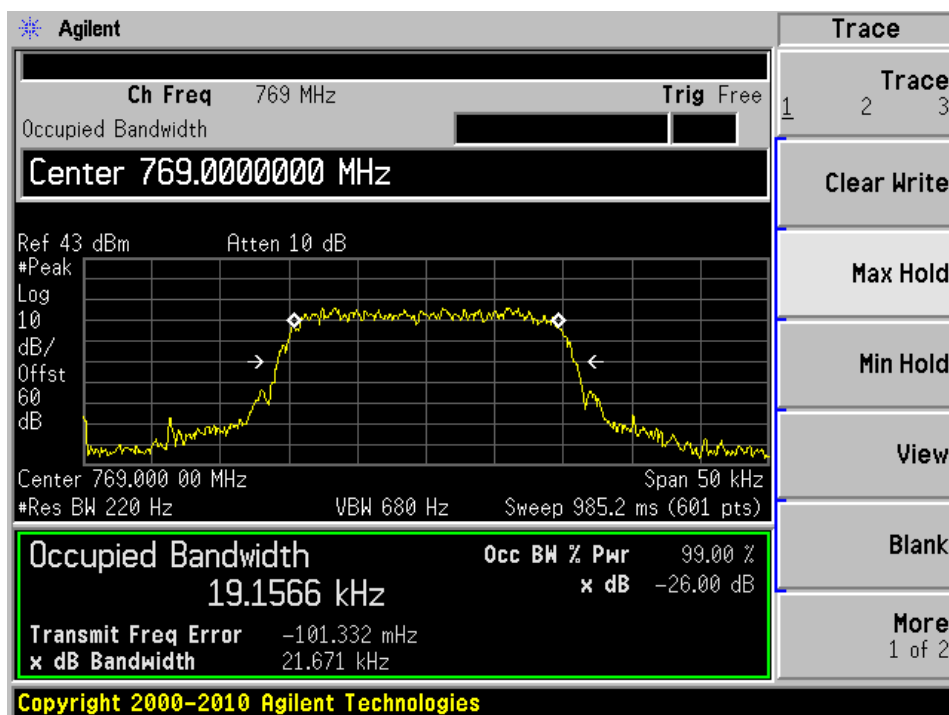


774.9 MHz

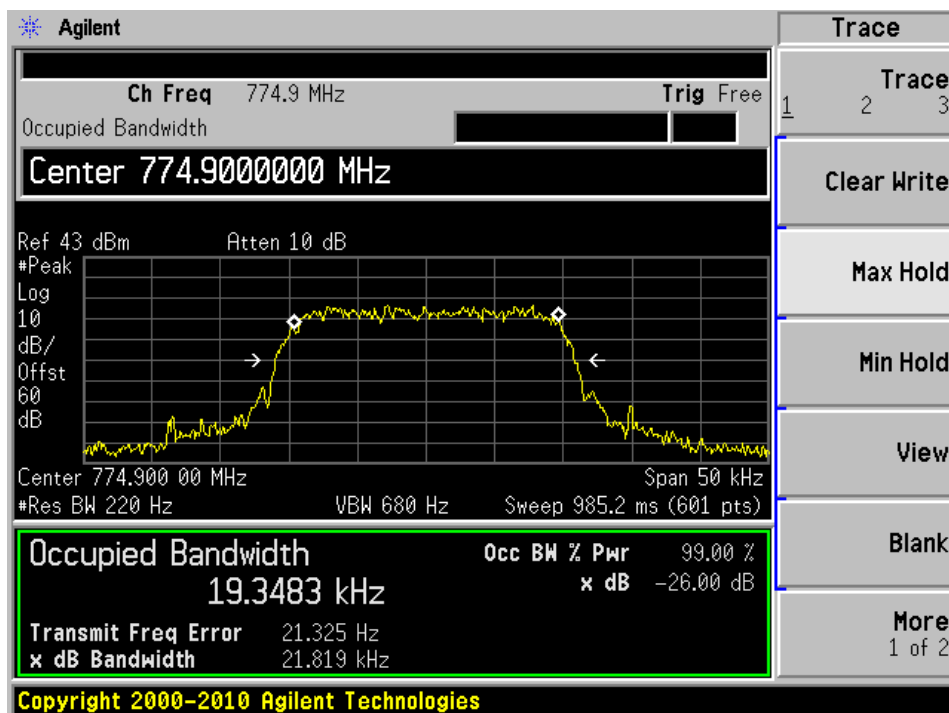


Modulation: Data, 20 kHz Bandwidth

769.0 MHz

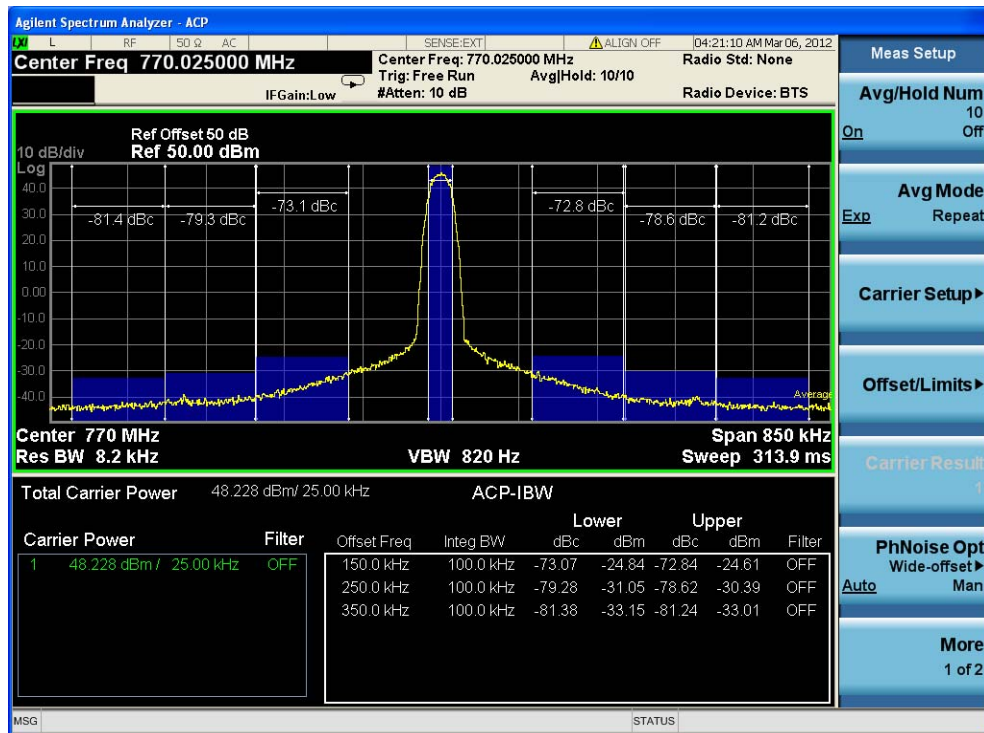
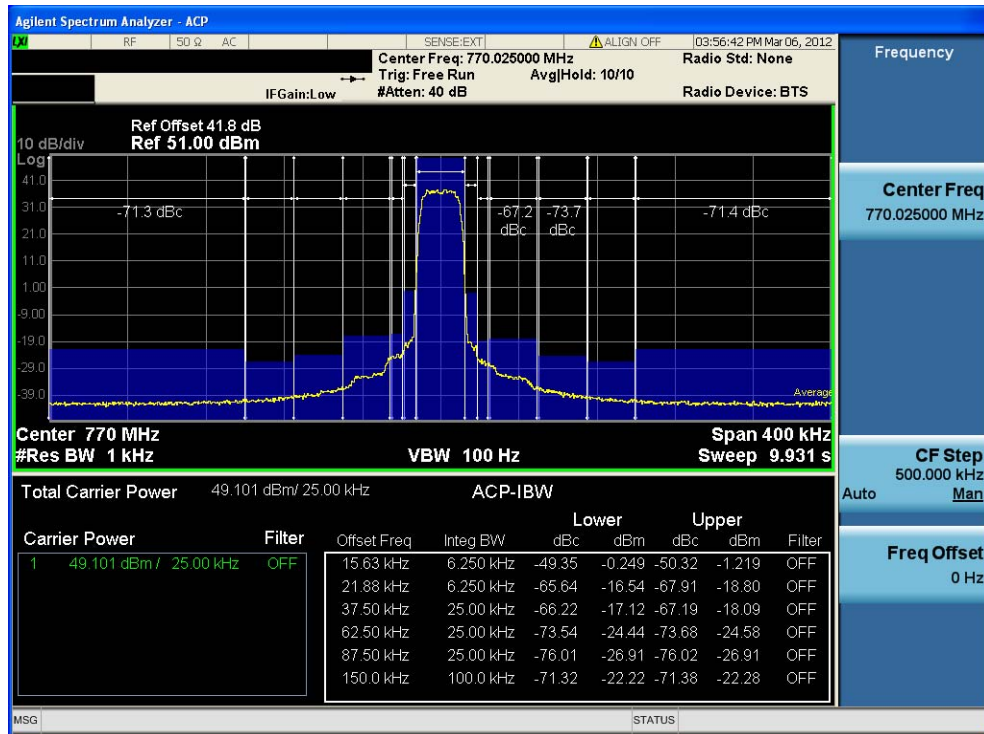


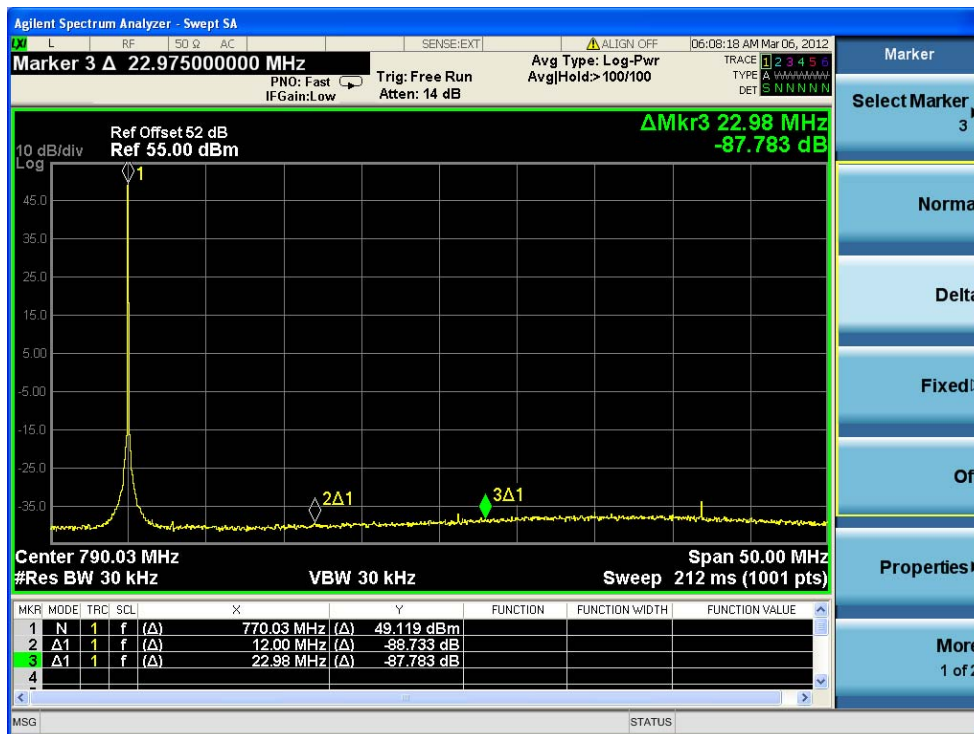
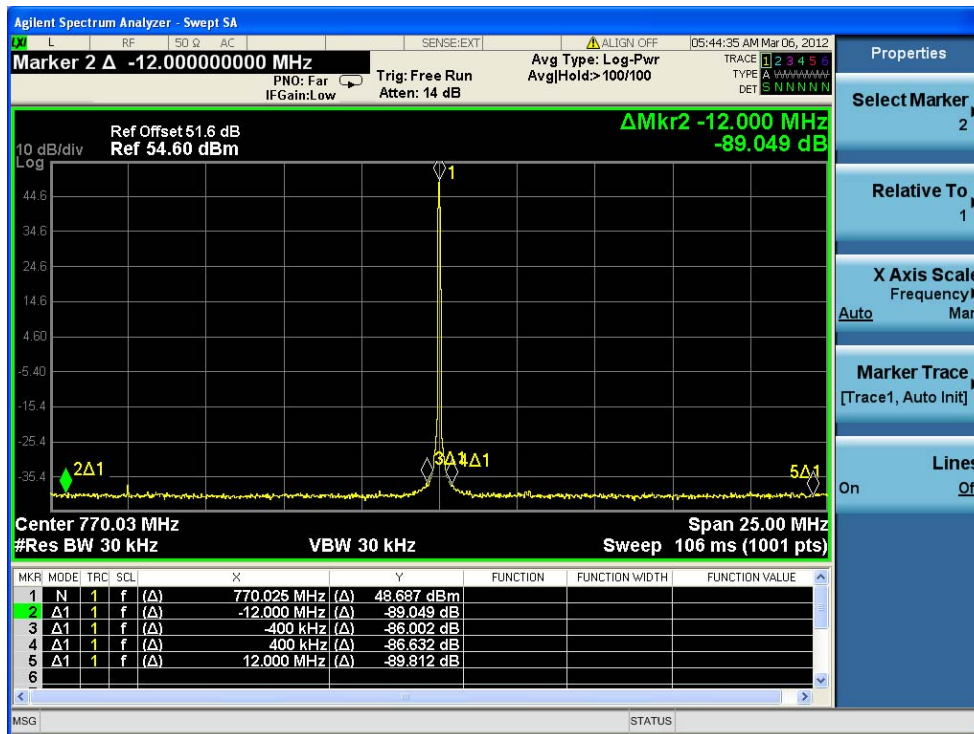
774.9 MHz

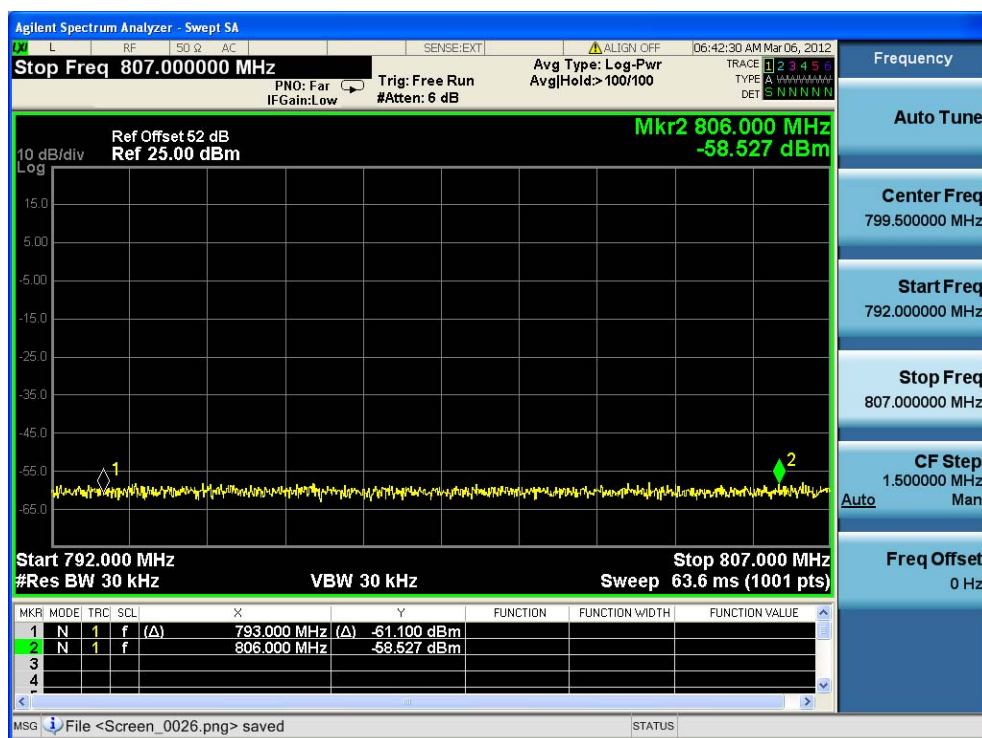


ACP

$$F = 770.025 \text{ MHz}$$







Note: The Adjacent Channel Power (ACP) testing was done by Denny Soto from Teltronic S.A.U.

8 FCC §2.1051 & §90.543 - Spurious Emissions at Antenna Terminals

8.1 Applicable Standard

According to FCC §90.543: (c) Out-of-band emission limit. On any frequency outside of the frequency ranges covered by the ACP tables in this section, the power of any emission must be reduced below the mean output power (P) by at least $43 + 10\log(P)$ dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

8.2 Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

8.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2011-05-10	1 Year

Statement of Traceability: BACL Corp. attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

8.4 Test Environmental Conditions

Temperature:	21 °C
Relative Humidity:	60 %
ATM Pressure:	101.8 kPa

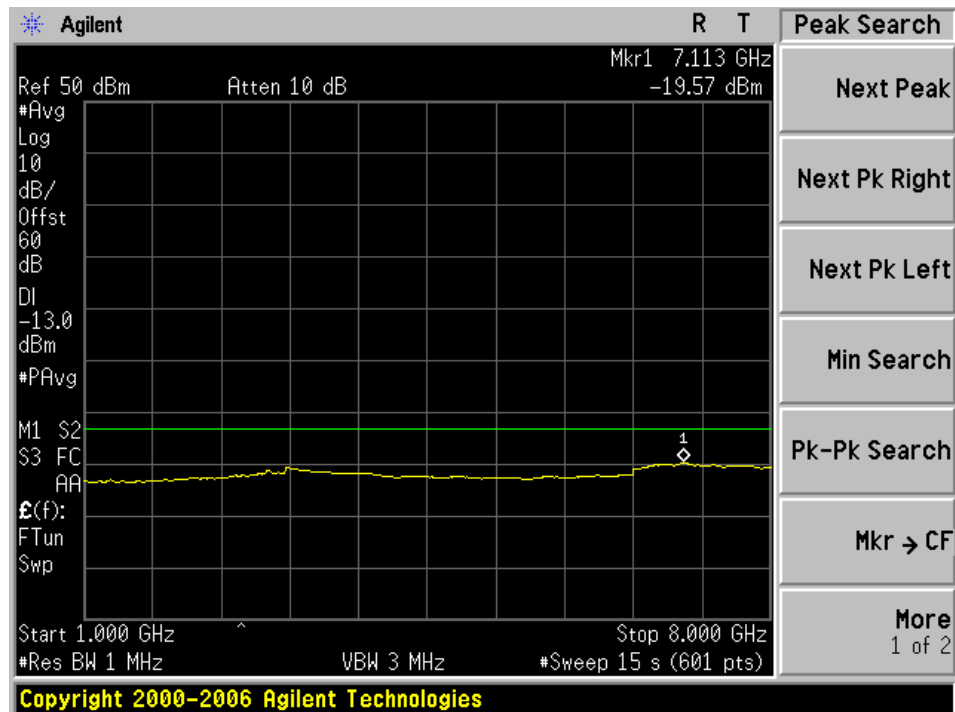
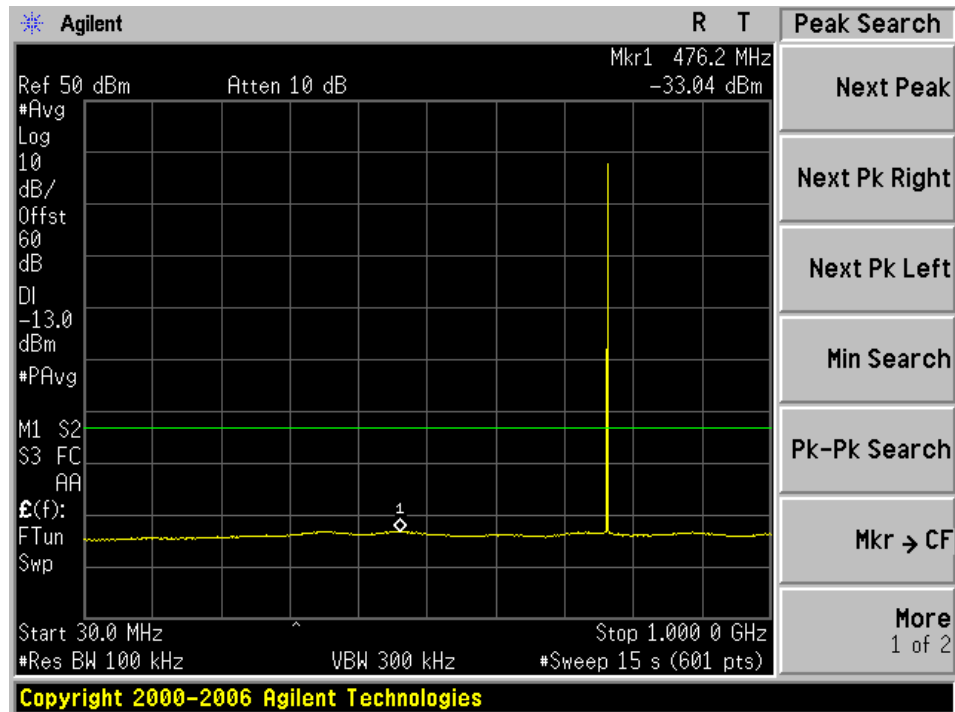
The testing was performed by Lionel Lara on 2012-04-23 in the RF Site.

8.5 Test Results

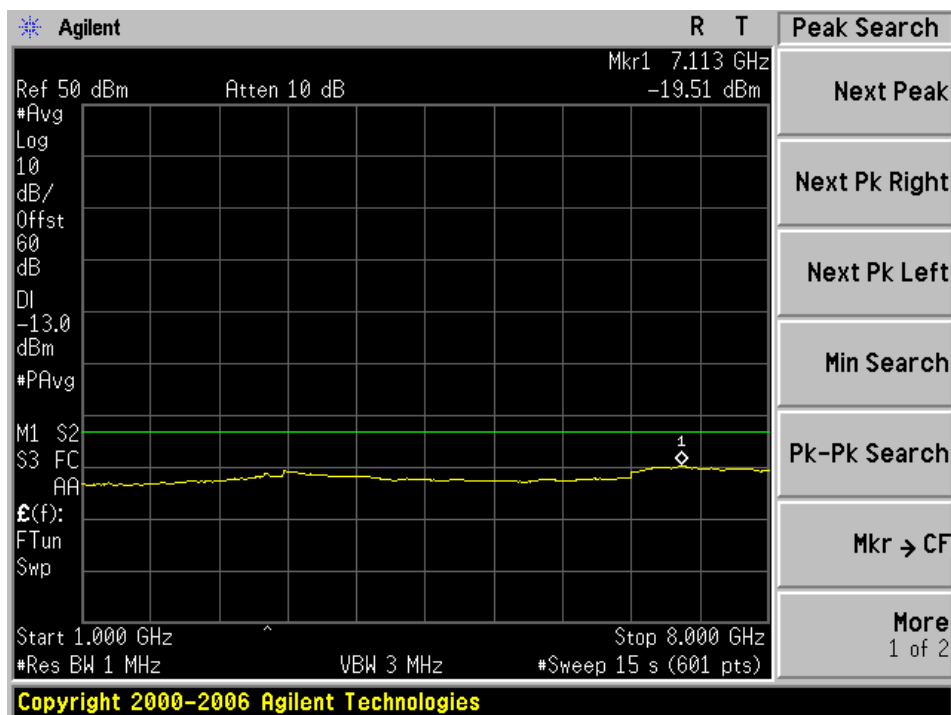
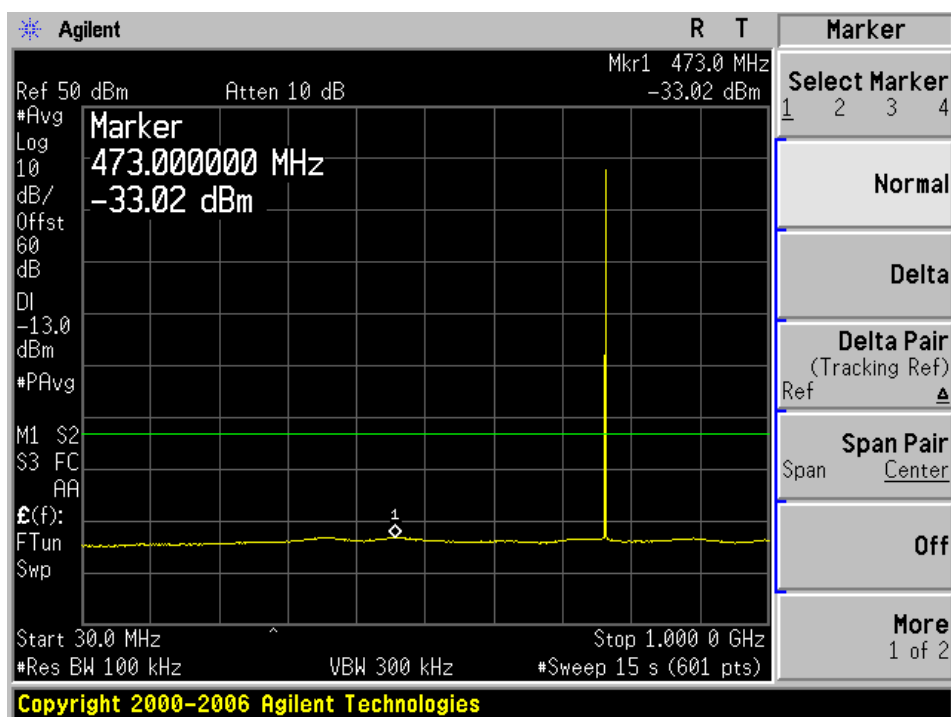
Please refer to the following plots.

High Power

Voice, 20 kHz, Middle Channel – 769.0MHz



Data, 20 kHz, Middle Channel – 769.0MHz



9 FCC §2.1055 (d) & §90.539 - Frequency Stability

9.1 Applicable Standard

According to FCC §90.539: Transmitters designed to operate in 769–775 MHz and 799–805 MHz frequency bands must meet the frequency stability requirements in this section.

(b) The frequency stability of base transmitters operating in the narrowband segment must be 100 parts per billion or better.

(d) The frequency stability of base transmitters operating in the wideband segment must be 1 part per million or better.

9.2 Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to the Spectrum Analyzer via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the Spectrum Analyzer.

Frequency Stability vs. Voltage: An external variable DC power supply Source. The voltage was set to 115% and 85% of the nominal value. The output frequency was recorded for each voltage.

9.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
IFR	TETRA Analyzer	2310	231001/122	2012-03-12
Agilent	Power Supply	6032A	MY41001384	2012-11-16

9.4 Test Environmental Conditions

Temperature:	20–35°C
Relative Humidity:	35–60%
ATM Pressure:	101.8 kPa

The testing was done by Denny Soto from Teltronic S.A.U.

9.5 Test Results

Test Condition		Frequency (MHz)	Frequency Error (PPM)	Limit (PPM)
Voltage (Vdc)	Temperature (°C)			
26.4	15-35 °C	770.025	0.0079	0.1
30.4	60 °C	775.975	0.0082	0.1
26.4	-30 °C	775.975	0.0097	0.1

Note: Testing was done by Denny Soto from Teltronic S.A.U.

10 FCC §2.1053 & §90.543 – Field Strength of Spurious Radiation

10.1 Applicable Standard

According to FCC §90.543: (c) Out-of-band emission limit. On any frequency outside of the frequency ranges covered by the ACP tables in this section, the power of any emission must be reduced below the mean output power (P) by at least $43 + 10\log(P)$ dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

10.2 Test Procedure

The transmitter was placed on Styrofoam on the turntable, and it was normal transmitting with 50ohm termination which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = $10 \lg(\text{TXpwr in Watts}/0.001)$ – the absolute level

10.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2012-02-28	1 Year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	-
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2011-08-10	1 Year
EMCO	Horn Antenna	3115	9511-4627	2011-10-17	1 Year
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2011-06-09	1 Year
Mini-Circuits	Pre-amplifier	ZVA-183-S	667400960	2011-08-10	1 Year
A.R.A	Horn antenna	DRG-118/A	1132	2012-01-04	1 Year
HP	Signal Generator	83650B	3614A00276	2010-06-21	2 Years

Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

10.4 Test Environmental Conditions

Temperature:	21 °C
Relative Humidity:	40 %
ATM Pressure:	101.6 kPa

The testing was performed by Lionel Lara on 2012-05-02 in 5 meter chamber 3.

10.5 Test Results

Worst Margin: **-12.79 dB at 5383 MHz** in the **Vertical** polarization.

Please see following table for detailed results.

High Power

20 kHz Bandwidth, 769.0 MHz

Indicated		Turntable Azimuth Degrees	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (cm)	Polar (H/V)	Freq. (MHz)	Level (dBm)	Antenna Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
159.99	49.76	71	150	H	159.99	-64.79	0	0.5	-65.29	-13	-52.29
159.99	43.55	287	150	V	159.99	-71	0	0.5	-71.5	-13	-58.5
754	39.63	151	150	H	754	-68	0	0.8	-68.8	-13	-55.8
754	41.4	194	164	V	754	-66.23	0	0.8	-67.03	-13	-54.03
1538	53.65	128	107	H	1538	-45.17	8.52	1.34	-37.99	-13	-24.99
1538	51.92	210	105	V	1538	-46.9	8.7	1.34	-39.54	-13	-26.54
2307	59.06	200	114	H	2307	-37.66	9.89	1.4	-29.17	-13	-16.17
2307	62.22	321	150	V	2307	-34.5	9.84	1.4	-26.06	-13	-13.06
3076	46.52	151	150	H	3076	-46.18	10.04	1.8	-37.94	-13	-24.94
3076	52.31	168	209	V	3076	-40.39	10.19	1.8	-32	-13	-19
5383	48.55	169	149	H	5383	-39.8	10.93	2.34	-31.21	-13	-18.21
5383	53.96	190	150	V	5383	-34.39	10.94	2.34	-25.79	-13	-12.79