METEORCOMM LLC

Test Report – Transmitter Conducted Emissions – Model 63010

FCC ID: BIB63010

1. Introduction

Reference: Application for Type II Permissive Change – Added Frequency Range

Applicant and Manufacturer:

Meteorcomm LLC (Meteorcomm or MCC), 1201 W. 7th St., Renton, WA 98057

Equipment Identification:

- FCC ID: BIB63010
- FCC Equipment Class: TNT - Licensed Non-Broadcast Transmitter
- Model: Wayside Transceiver Model 63010, S/N 63WR000102BK
- Software version: 1.3
- Rated Power into 50Ω Load at Antenna Terminals: 30 W PEP
- Frequency Range: FCC Rule Part
- Existing: 220.0125-221.9875 MHz 90T
- Added: 217.6125-219.9875 MHz 80 and 90.35
- Modulation Type: π/4-DQPSK (0.35 RRC),
- Transmitter Modulation Rate: 16kbps (Half Rate)
- Occupied Bandwidths: 8.9 kHz
- Emission Designators: 8K90DXW

Test dates and location:

February 25 – March 1, 2013

Meteorcomm LLC, 1201 W. 7th St., Renton, WA 98057

Test Methods:

47CFR§§2J, 90I

ANSI/TIA-603-C-2004 (adapted to comply with any specific FCC requirements)

Test Equipment List, Setup and Photographs

See separate exhibit.

2. Test Results Summary Table for Added Frequency Range

FCC Sections	Test	Measured	Limits	Result
§§2.1033(c)(5), 80.385, 90.35	Added Frequency Range	217.6125, 219.9875	217-220 MHz	Complies
§§2.1033(c)(6),(7), 2.1046, 80.215, 90.205 , 90.259	Conducted Power	Max 28.91, Min 6.84, Watts PEP	May not exceed original test report power. (Licensable levels may be less than measured levels.)	Complies
§§2.1033(c)(4), 2.1047, 80.207, 90.207, 90.259(a)	Emission Types	Info Only	π/4-DQPSK (0.35 RRC) 16 kbps Channelization = 25 kHz	Ref
§§2.1033(c)(4), 2.1047, 80.211(f), 90.210(b)	Emission Mask	See Section 5 herein.	Mask B	Complies
§§2.1047(d)	Modulation Characteristics	See Section 6 herein.	Low Pass Filter used to limit Occupied BW	Complies
§§2.1049, 80.205, 90.209(b)(5)	Bandwidth	99% Occupied BW 9.102 kHz	Authorized BW = 20 kHz	Complies
§§2.1051, 2.1057, 80.211(f), 90.210(b)	Conducted Spurious Emissions		Out of band = -13 dBm or 43+10*log10(Pmean) dB	Complies
§§2.1053, 2.1057, 90.210	Radiated Spurious Emissions	See CKC Report 94195-15	Out of band = -13 dBm or 43+10*log10(Pmean) dB	Complies
§§2.1055, 80.209, 90.213	Frequency Stability Vs. Temp. Vs. Voltage	0.318 ppm max error	±1 ppm fixed and mobile	Complies Temp Voltage

3. Transmitter Test Conditions

Normal power supply Voltage: 13.6 Vdc
Ambient temperature: 22°C.
Humidity: < 50%
Duty cycle: 100%
Antenna load impedance: 50 ohms
Test Frequencies:

217.6125 MHz (bottom of added frequency range),
219.9875 MHz (top of added frequency range)

Test Equipment List, Test Setup and Test Photograph: See separate exhibit.

4. Power

The transmitter is rated in terms of Peak Envelope Power (PEP). Average power output is also reported because the emission mask §80.211(f) refers to mean power.

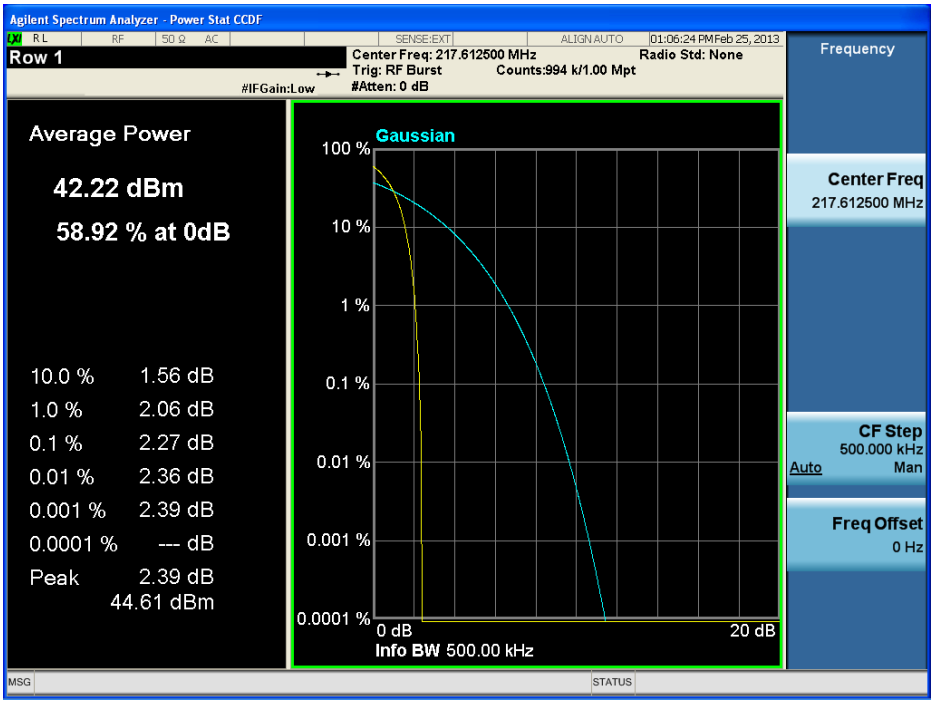
A. Peak Envelope Power is reported in the next table for four operating conditions.

Frequency, MHz	Modulation Rate	Max Power, dBm PEP	Max Power, Watts PEP	Min Power, dBm PEP	Min Power, Watts PEP
217.6125	16 kbps	44.61	28.91	38.67	7.36
219.9875	16 kbps	44.32	27.04	38.35	6.84

B. Mean or Average Power is reported in the next table for four operating conditions.

Frequency, MHz	Modulation Rate	Max Power, dBm Avg	Max Power, Watts Avg	Min Power, dBm Avg	Min Power, Watts Avg
217.6125	16 kbps	42.22	16.67	34.80	3.02
219.9875	16 kbps	41.91	15.52	34.49	2.81

C. CCDF Average and Peak Power Plot for the first entry in tables above.

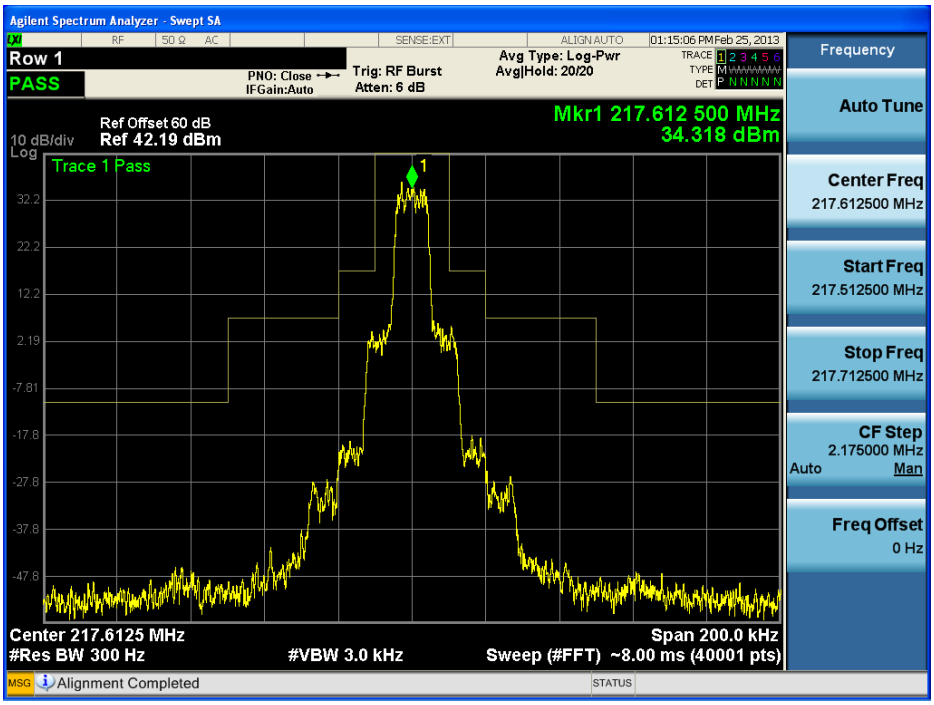


CCDF Average and Peak Power Plot for First Table Entry

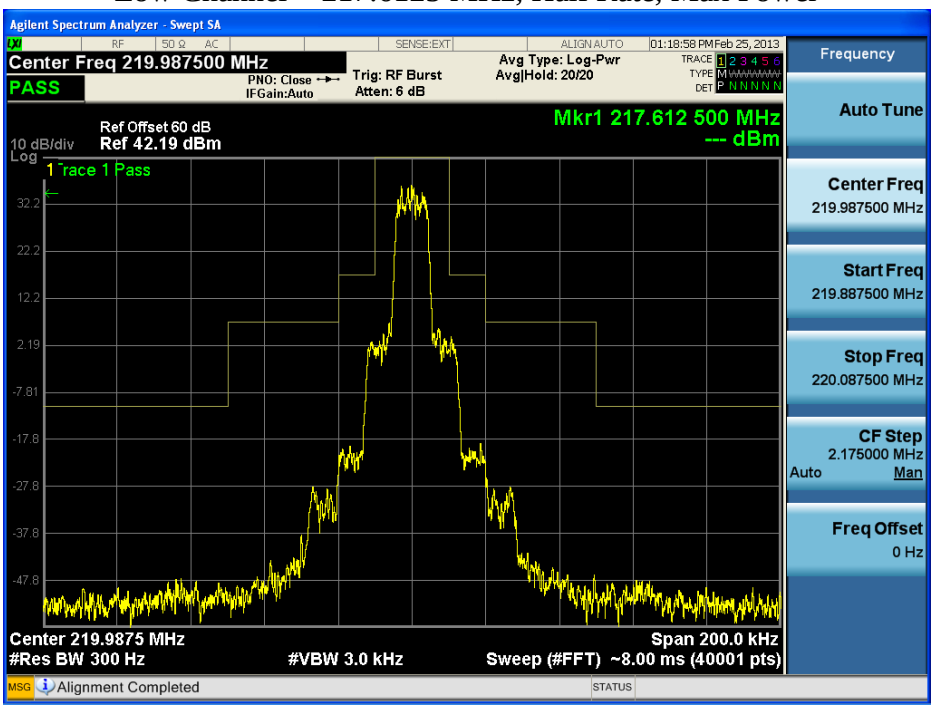
Figure 1

5. Emission Mask

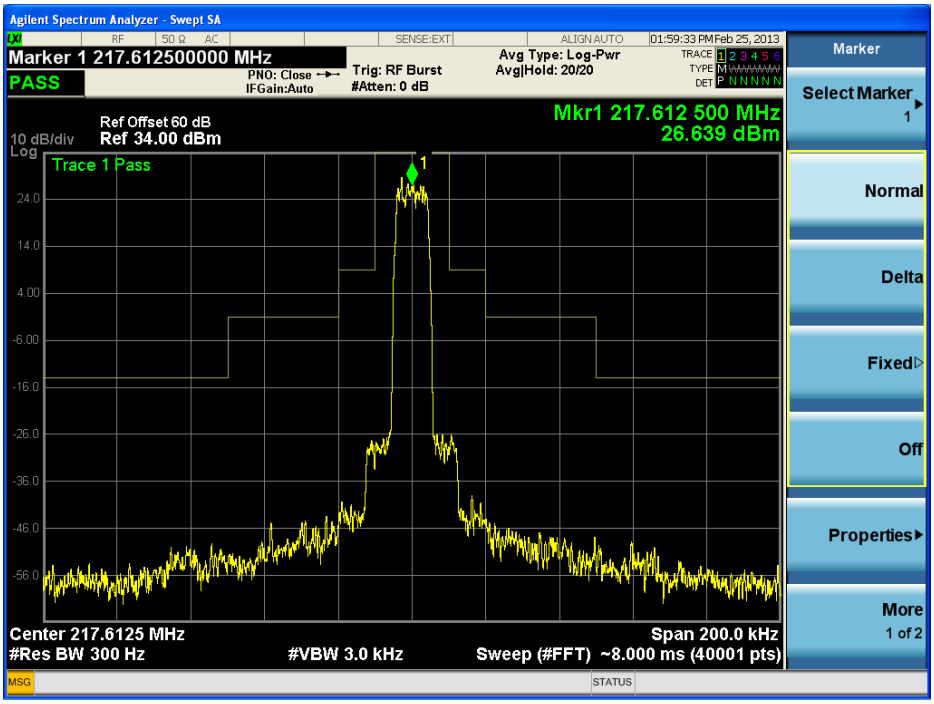
Four emission mask plots are presented for the eight transmitter operating conditions listed in the table for Section 4. Mask is 80.211(f) referenced to mean = average power, making it more stringent than referencing to PEP. Average power reference levels are provided in Section 4B herein.



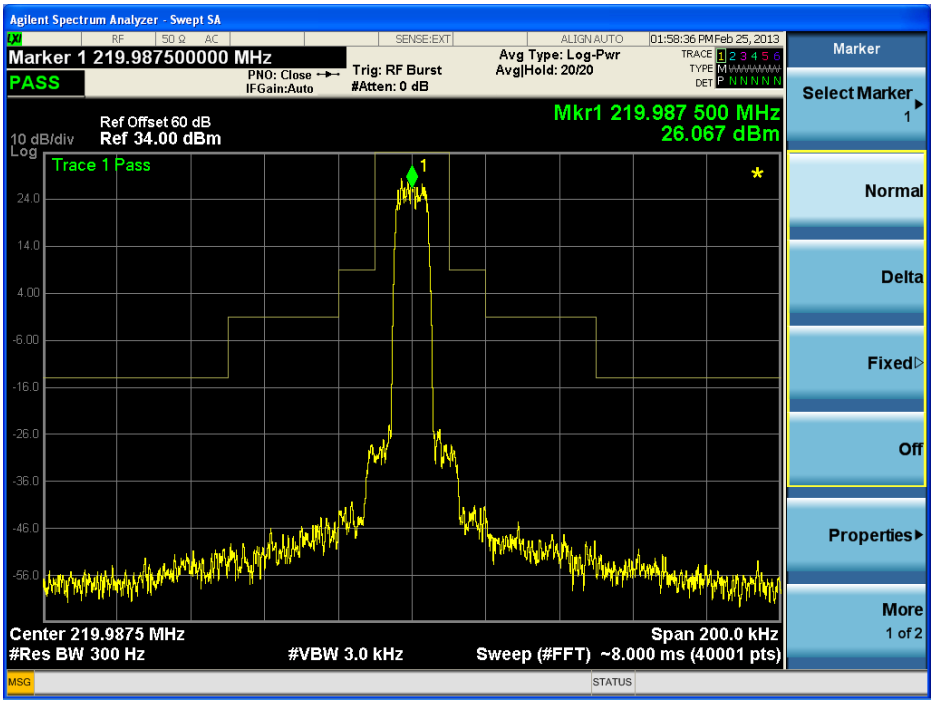
Low Channel = 217.6125 MHz, Half Rate, Max Power



High Channel = 219.9875 MHz, Half Rate, Max Power



Low Channel = 217.6125 MHz, Half Rate, Min Power



High Channel = 219.9875 MHz, Half Rate, Min Power

6. Modulation Characteristics

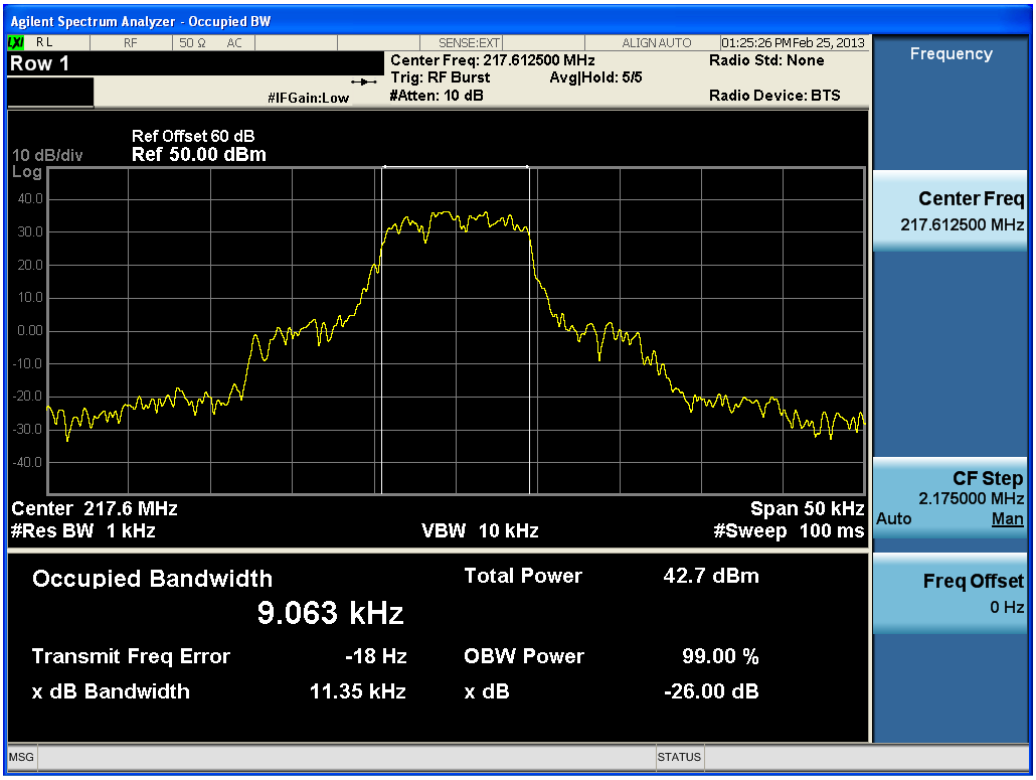
The Operational Equipment Description exhibit discusses the methods of modulation limiting used in the transmitter. The audio low pass filter frequency response is provided there.

7. Occupied Bandwidth

A. The Occupied Bandwidth for 99% power is listed in the next table for Bottom and Top of added transmitter frequencies, minimum and maximum power levels and one modulation rate.

Frequency, MHz	Modulation Rate	OBW at Max Power, kHz	OBW at Min Power, kHz
217.6125	16 kbps	9.063	9.002
219.9875	16 kbps	9.102	9.033

B. Plot of the Occupied Bandwidth for 99% Power Plot for the first entry in the table above.



8. Conducted Spurious Emissions

A. Procedure: Four operational variations were scanned for spurii. They are listed in the Power measurement section above. The unwanted emissions test procedure was adapted to meet specific FCC search range, bandwidth and detector requirements. The reportable limit for this test is -33 dBm. A high pass filter was needed for the case of 1 MHz bandwidth at frequencies from 1 to 2.5

GHz. The test apparatus loss was pre-measured across the test frequency range eliminating the need for substituting a signal generator with calibrated output power.

B. Search Parameters: The chart below depicts the frequency range of spurious search plus the filter, detector and bandwidth settings in compliance with ANSI/TIA-603-C-2004 §2.2.13 as adapted to FCC specifications. Detector is quasi-peak and sweep speed is 2kHz/sec for reportable emissions at or beyond fo ± 700 kHz.

Spur Search Range		Setup Details			
Low, MHz	High, MHz	Carrier Filter	Detector, initial or final	Detector BW	Scan Sample Figure
30	100	None	Peak or Quasi-peak	10/120 kHz	8C1
100	fo – 0.7	None	Peak or Quasi-peak	10/120 kHz	8C2
fo – 0.7	fo – 0.1	None	Integrated Peak	100 Hz	8C3
fo – 0.1	fo – 0.05	None	Integrated Peak	100 Hz	8C4
fo + 0.05	fo + 0.1	None	Integrated Peak	100 Hz	8C4
fo + 0.1	fo + 0.7	None	Integrated Peak	100 Hz	8C3
fo + 0.7	300	None	Peak or Quasi-peak	10/120 kHz	8C5
300	500	None	Peak or Quasi-peak	10/120 kHz	8C6
500	1000	None	Peak or Quasi-peak	10/120 kHz	8C7
1000	2500	High Pass	Average	1 MHz	8C8,9,10
2 x fo		None	Peak	10 kHz	8C11
3 x fo		None	Peak	10 kHz	8C12

C. Results:

1) Spurious emission limit: -13 dBm, equivalent to -60 dBc
2) Reportable limit: -33 dBm, equivalent to -80 dBc
3) Table of results:

Carrier Frequency, fo, MHz	Power, dBm PEP	Spur Frequency, MHz	Measured Level, dBm	Level, dBc	Relative to limit, dB
217.6125	44.61	217.5125	-29.55	-75.35	-16.55
219.9875	44.32	220.0875	-29.79	-75.35	-16.79
217.6125	44.61	217.4125	-30.73	-76.64	-17.73
219.9875	44.32	219.1875	-30.96	-76.58	-17.96
217.6125	38.67	217.5125	-33.43	-71.77	-20.43
219.9875	38.35	219.8875	-33.47	-71.62	-20.47
217.6125	44.61	2nd Harmonic 435.2	-52	-96	-39
219.9875	44.32	3rd Harmonic 660	-52	-96	-39

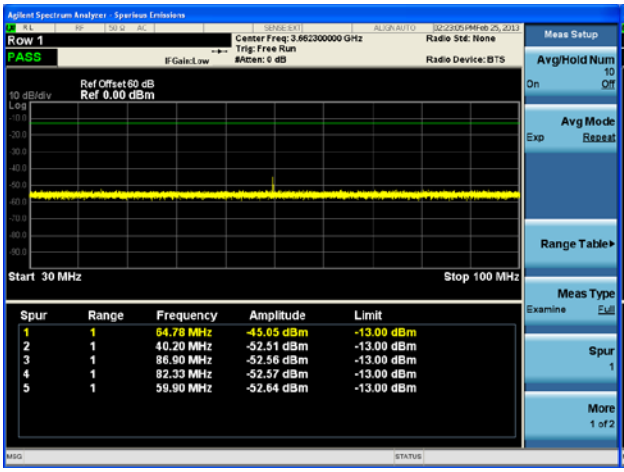


Figure 8C1. 30 to 100 MHz, 10 kHz BW

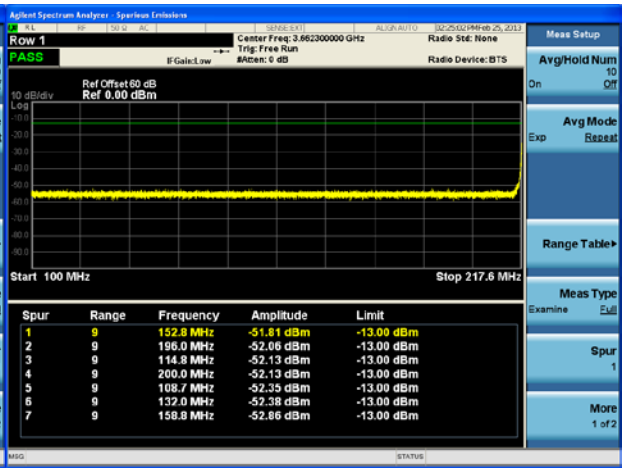


Figure 8C2, 100 to 217.6 MHz, 10 kHz BW

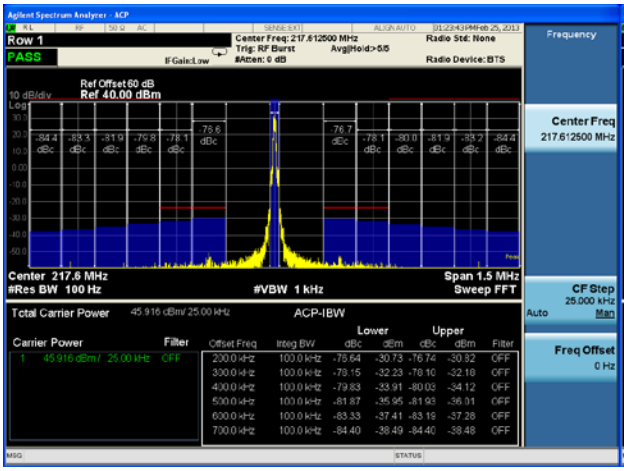


Figure 8C3. fo ± 750 kHz, 100kHz IBW

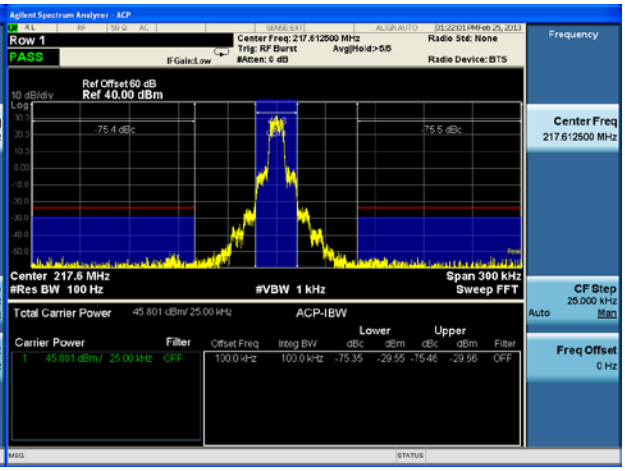


Figure 8C4. fo ± 150 kHz, 100kHz IBW

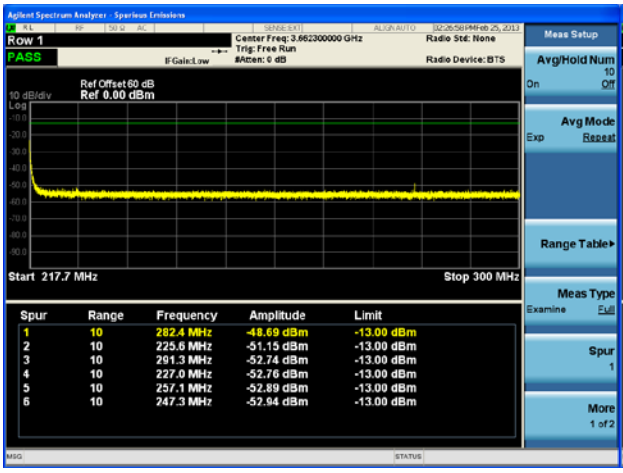


Figure 8C5 217 to 300 MHz, 10kHz BW

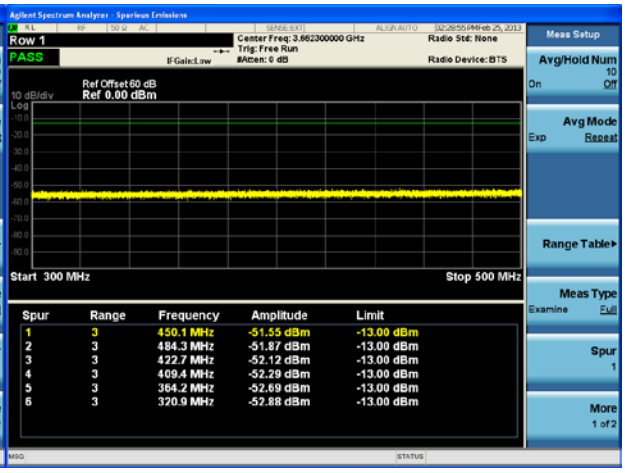


Figure 8C6 300 to 500 MHz, 10kHz BW

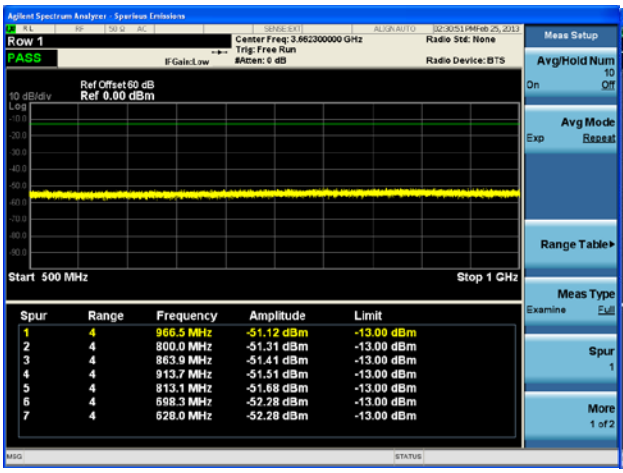


Figure 8C7 500 to 1000 MHz, 10kHz BW

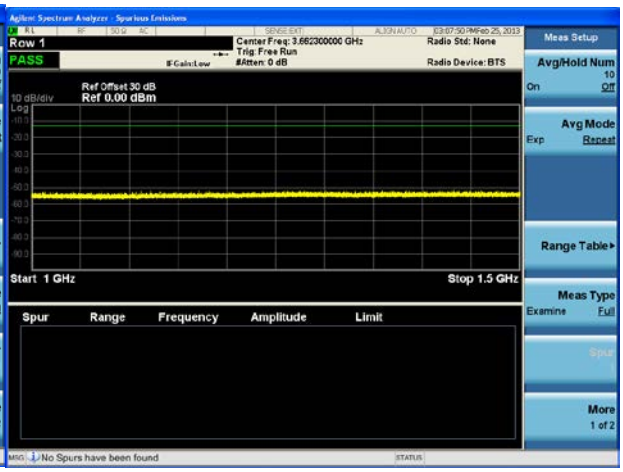


Figure 8C8 1 to 1.5 GHz, 1 MHz BW

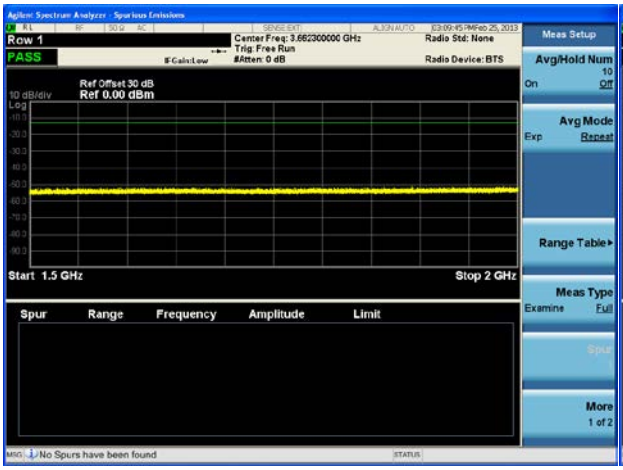


Figure 8C9 1.5 to 2 GHz, 1 MHz BW

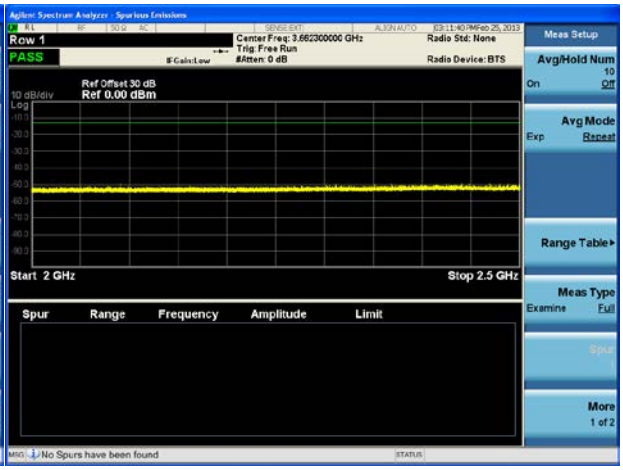


Figure 8C10 2 to 2.5 GHz, 1 MHz BW

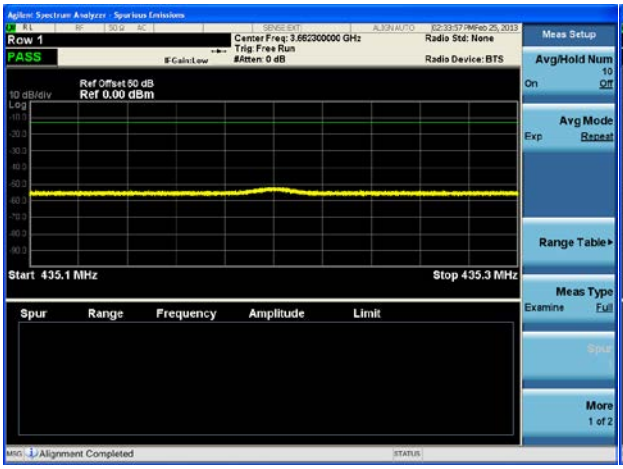


Figure 8C11, Zoom 2xfo, 435.2 MHz

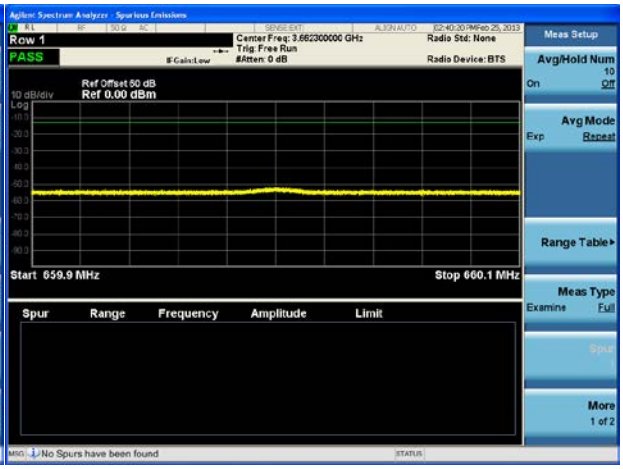


Figure 8C12, Zoom 3xfo, 660 MHz

D. Example calculation for first entry in Table 8c3:

Carrier Power	28.91 W
Carrier Power= 30+10log(28.9) =	44.61 dBm
Spur limit= -(43+10log(28.9)) =	-57.61 dBc
Spur limit, dBm =	-13 dBm
Spur Power, measured	-29.55 dBm
Subtract carrier power	(-) 44.61 dBm
Spur level below carrier	-75.35 dBc
Spur power, measured	-29.55 dBm
Subtract spur limit	(-)-13.00 dBm
Spur level margin	-16.55 dB

E. Test setup: The test equipment list, test setup block diagram, test setup photograph and equipment calibration information is submitted in a separate exhibit.

9. Frequency Stability vs. Temperature

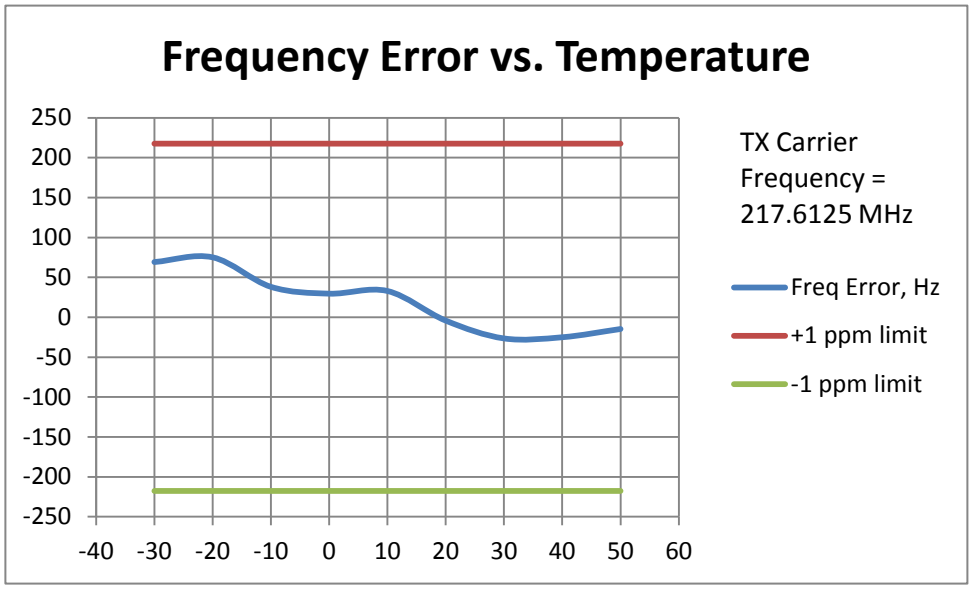
A. Test Parameters

Power supply voltage:	13.6 VDC
Test Channel:	217.6125 MHz
Frequency Error Limits, ppm:	± 1 ppm
Frequency Error Limits, Hz:	± 1e-6 * 217,612,500 Hz = ± 217.6125 Hz
Soak Temperatures:	-30° to +50° C in 10 degree steps

B. Table of Transmitter Frequency Error versus Soaking Temperature

Temp, °C	-30	-20	-10	0	10	20	30	40	50
Freq Error, Hz	69.25	75.14	38.18	29.62	32.95	-4.15	-26.48	-25.00	-14.67
Error, ppm	.318	.345	.175	.136	.151	-0.019	-0.122	-0.115	-0.067

C. Plot of Transmitter Frequency Error versus Soaking Temperature



D. Test Equipment and Setup: See separate exhibit except as noted below

Environmental Test Chamber: Test Equity Model 1007C, S/N 10770

E. Test Procedure:

Transmitter carrier frequency previously calibrated at room temperature per tune-up procedure using Rubidium frequency standard as VSA frequency reference. Transceiver placed inside chamber with connections routed externally to control computer and test instruments. Transceiver soaked for 30 minutes at each test temperature prior to recording transmitter frequency.

10. Frequency Stability vs. Voltage

A. Test Parameters

Power supply voltage:	Nominal 13.6 VDC, Min. 10.9 VDC, Max. 15.6 VDC
Test Channel:	217.6125 MHz
Frequency Error Limits, ppm:	± 1 ppm
Frequency Error Limits, Hz:	± 1e-6 * 217,612,500 Hz = ± 217.6125 Hz
Temperature:	22° ±3° C

B. Table of Transmitter Frequency Error versus Power Supply voltage

Power Supply VDC	10.9	13.6	15.6
Freq Error, Hz	-2.84	-4.14	-4.83
Error, ppm	-0.013	-0.019	-0.022

C. Test Procedure: The transmitter frequency was calibrated as in the previous report section. The minimum and maximum test voltages meet or exceed the ± 15% extremes in §2.1055(d)(1). The frequency determining oscillator supply voltage has several voltage regulator stages that isolate it from the primary power supply.

11. Statement of Test Supervisor

All tests were conducted by me or under my supervision.

John F. “Fred” Cleveland, Principal Engineer