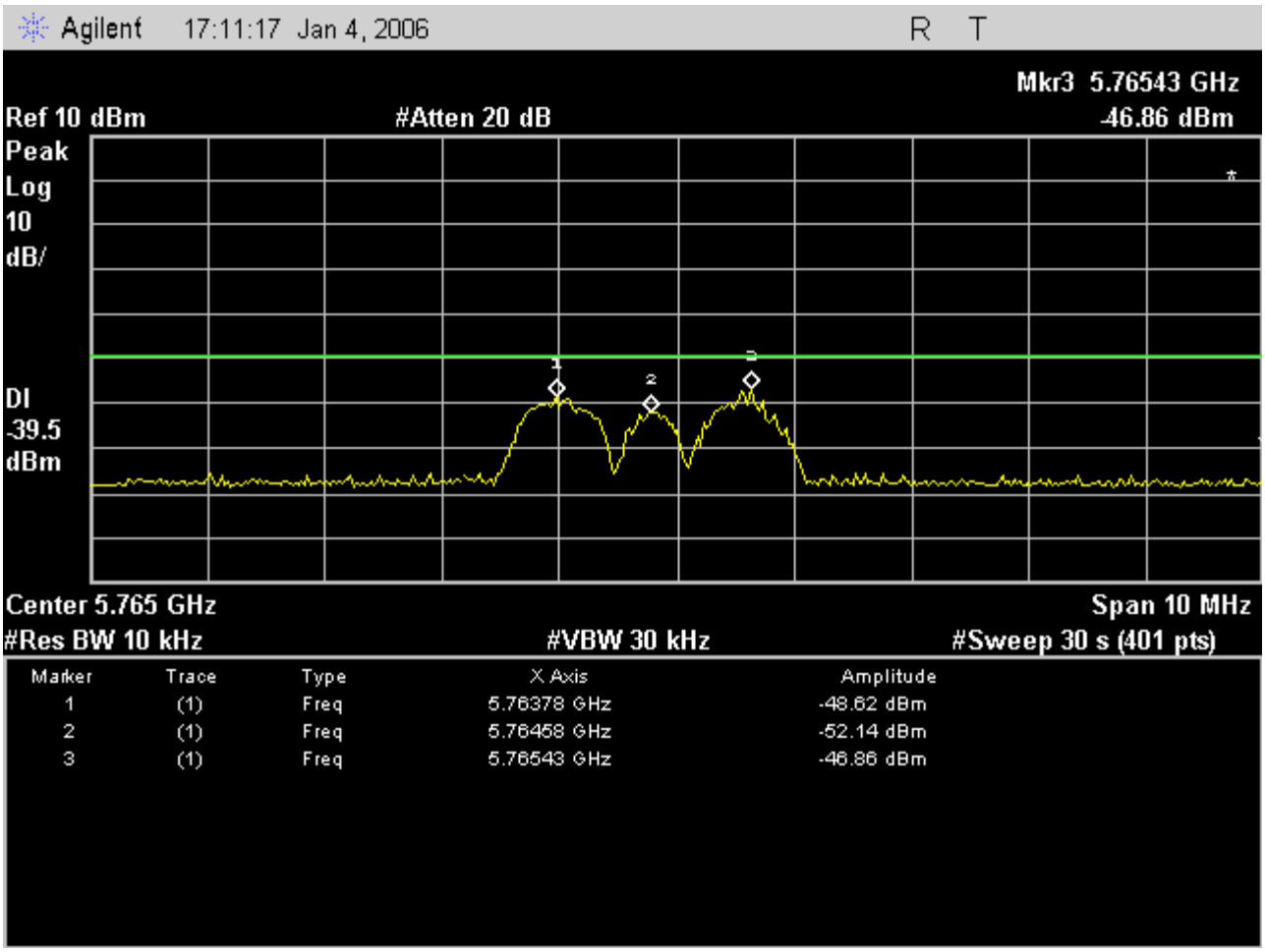

Fig. 29 – headset EUT out-of-band emissions in the region around the 3rd harmonic, with the headset EUT transmitting on the lowest carrier, 1921.536MHz.

This measurement was made according to the requirements of the text of 6.1.6, and, with the worst-case peak at –46.86dB, shows margin to the -39.5dBm specification of 7.3dB.

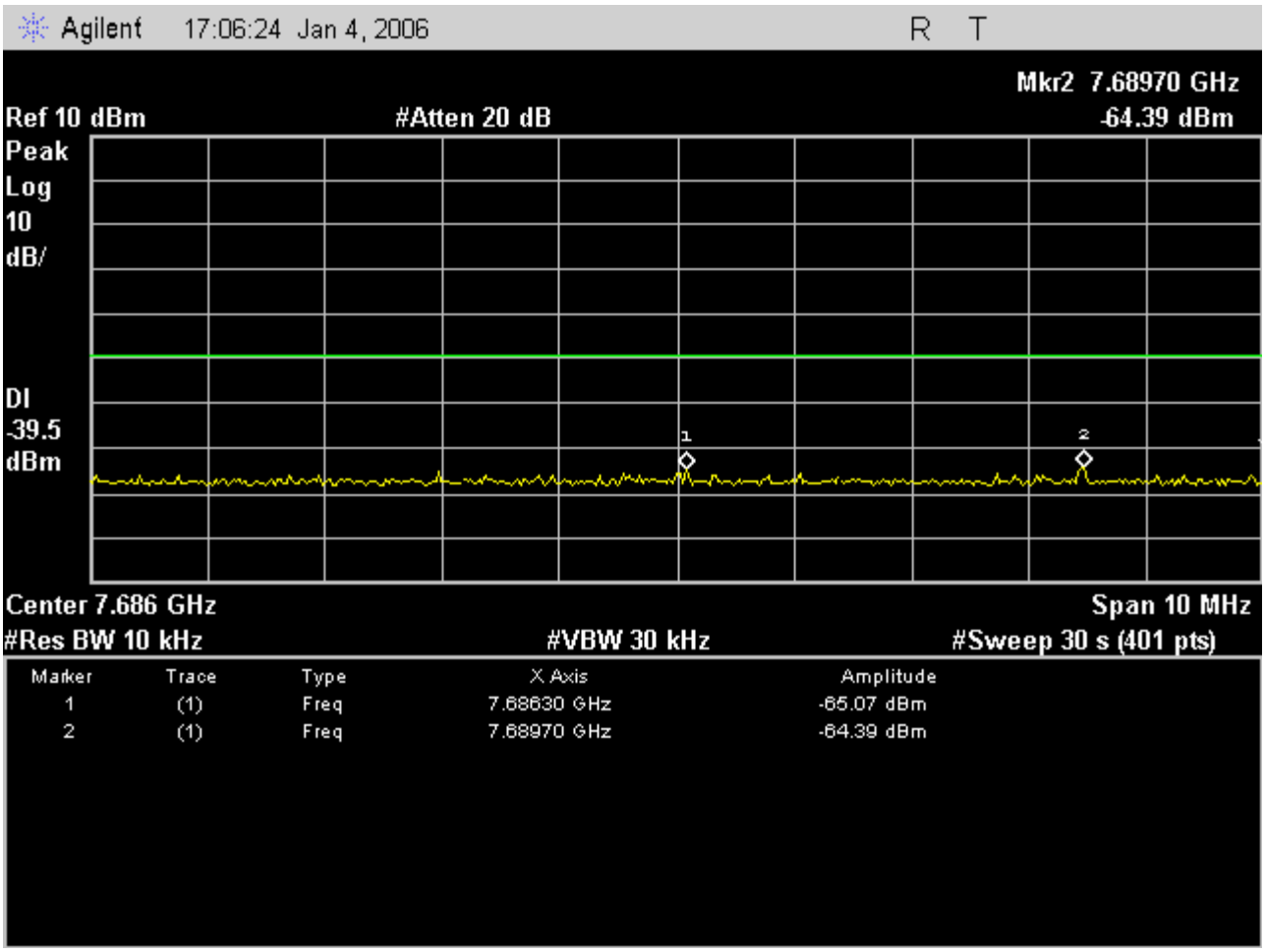

Fig. 30 – headset EUT out-of-band emissions in the region around the 4th harmonic, with the headset EUT transmitting on the lowest carrier, 1921.536MHz, shows greater than 25dB of margin from the -39.5dBm specification limit.

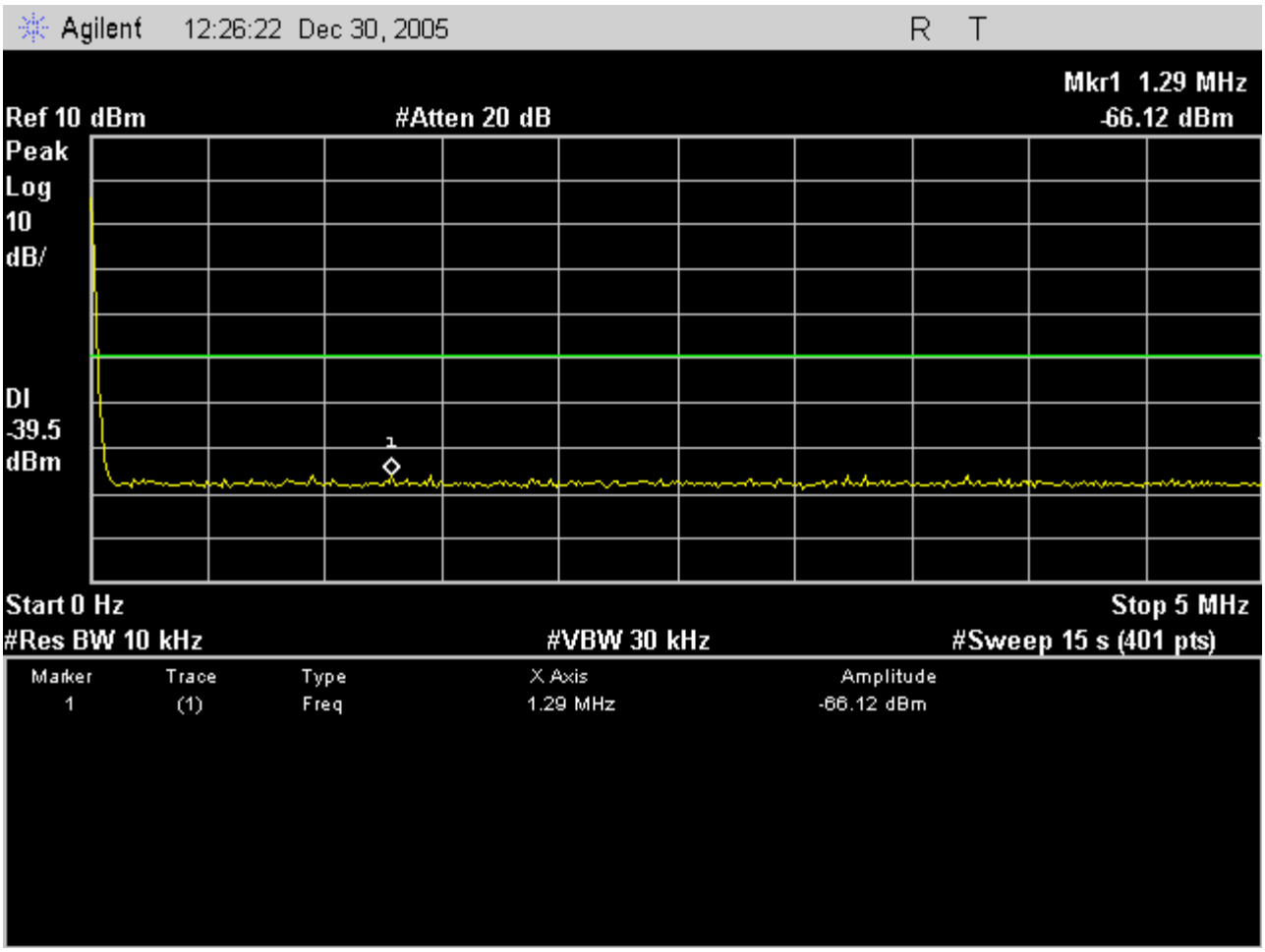

Fig. 31 – headset EUT out-of-band emissions showing the regions from DC to 5MHz, with the transmitter using the highest carrier, 1928.448MHz.

This screenshot resolves the contribution made by the spectrum analyzer's DC response. Headset EUT margin to the -39.5dBm out-of-band emissions specification exceeds 25dB in this region

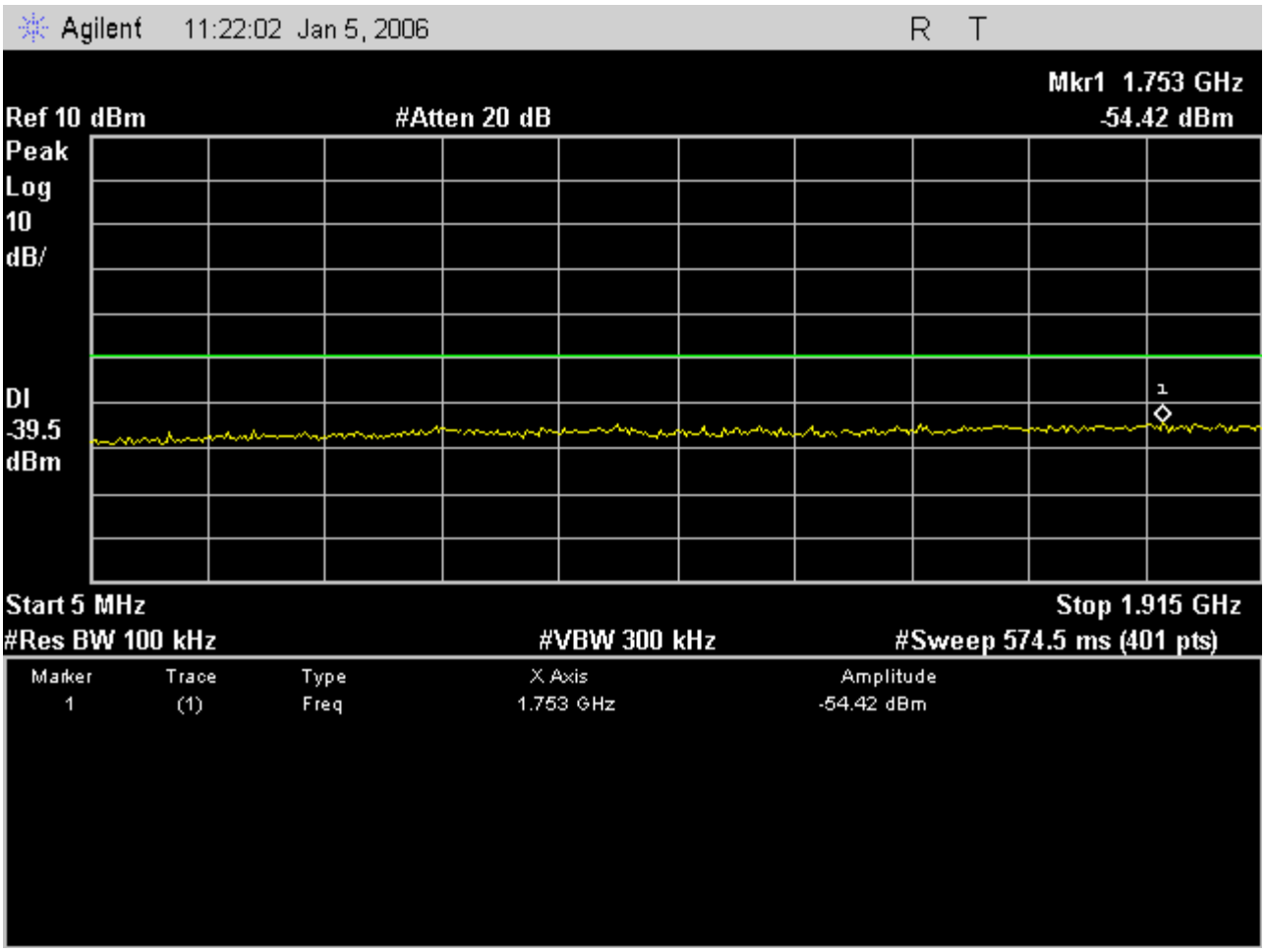

Fig. 32 – headset EUT out-of-band emissions showing the region from 5MHz to 1915MHz, with the transmitter using the highest carrier, 1928.448MHz.

This screenshot shows a sweep made with resolution bandwidth increased to 100kHz to improve sweep time. Headset EUT emissions at –54.42dB have margin to the -39.5dBm out-of-band emissions specification in this spectral region of 14.92dB in this region, even measured in a 10x-wider bandwidth than that of the text of the test procedure in clause 6.1.6.

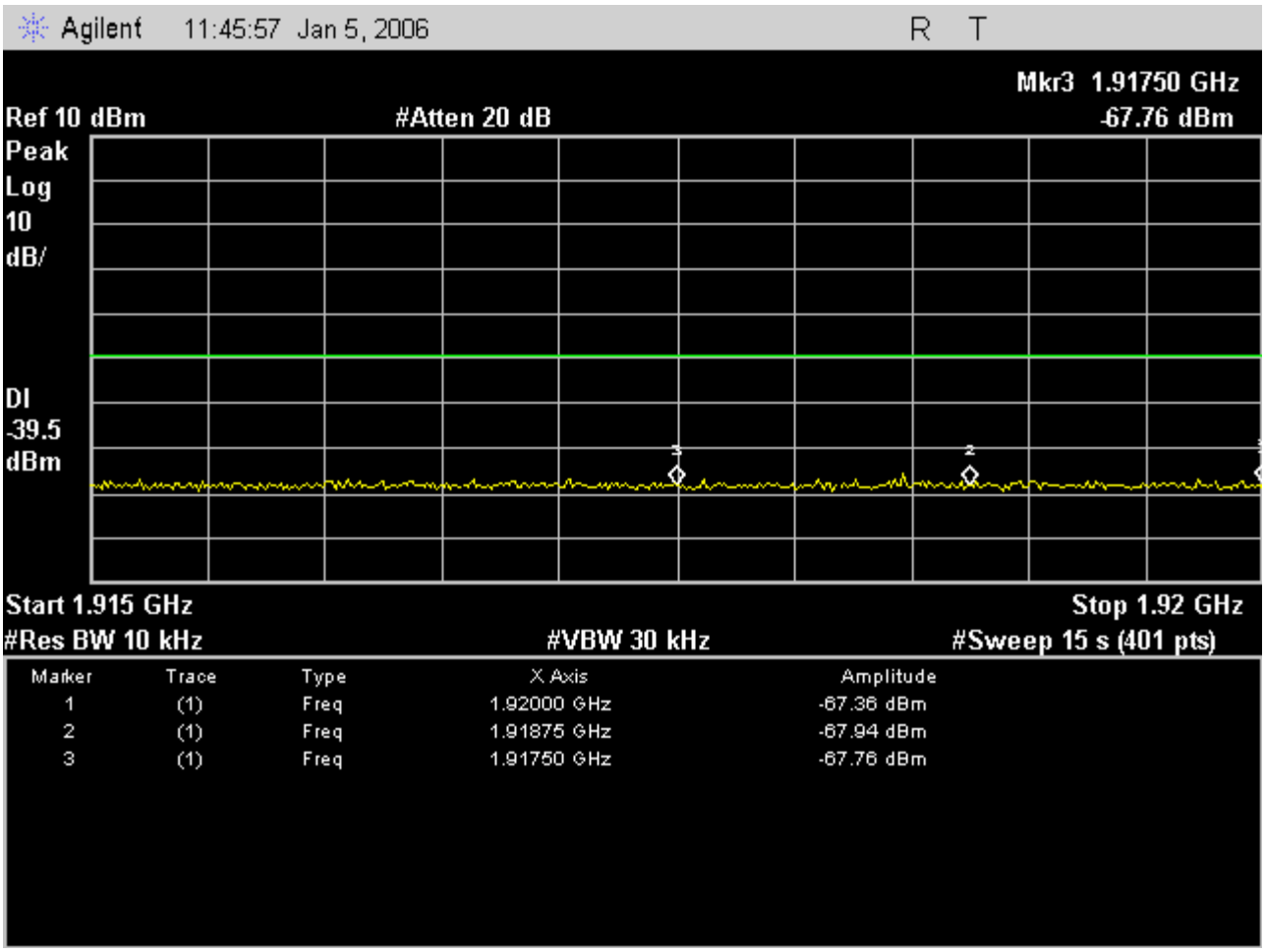

Fig. 33 – headset EUT out-of-band emissions showing the regions from bandedge to -1.25MHz, and from -1.25MHz to -2.5MHz, with the headset EUT transmitting on the highest carrier, 1928.448MHz.

Margins to the specification of -9.5dBm in the region from bandedge to -1.25MHz, to the specification of -29.5dBm in the region from -1.25MHz to -2.5MHz, and to the specification of -39.5dBm in the region outside -2.5MHz from the bandedge all exceed 25dB.

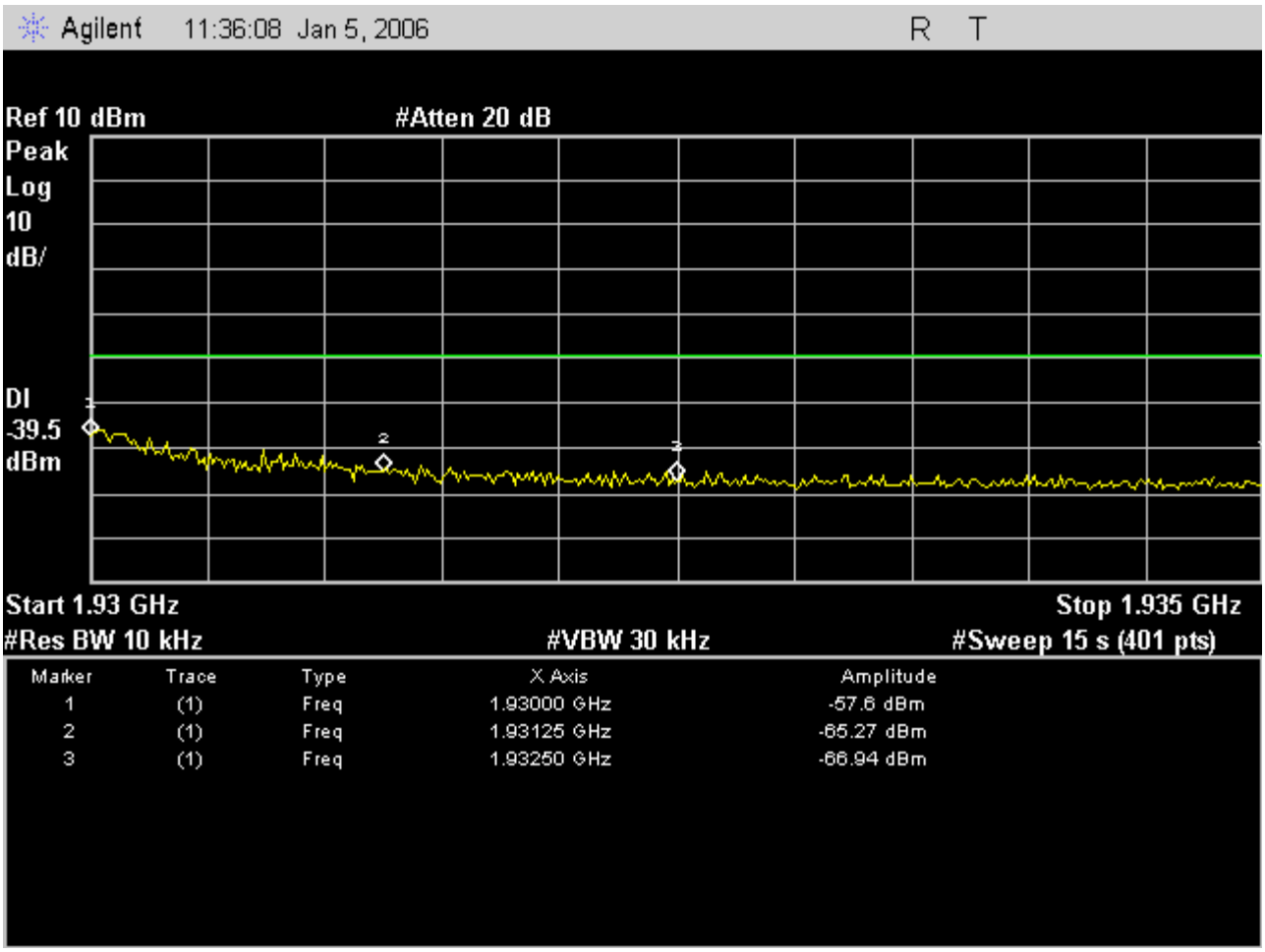

Fig. 34 – headset EUT out-of-band emissions showing the regions from bandedge to +1.25MHz, and from +1.25MHz to +2.5MHz, with the headset EUT transmitting on the highest carrier, 1928.448MHz.

Margin to the specification of -9.5dBm in the region from bandedge to +1.25MHz is found at marker 1, at –57.60dBm, and is 48.10dBm.

Margin to the specification of -29.5dBm in the region from +1.25MHz to +2.5MHz is found at marker 2, at –65.27dBm, and is 35.77dB.

Margin to the specification of -39.5dBm in the region outside +2.5MHz from the bandedge exceeds 25dB

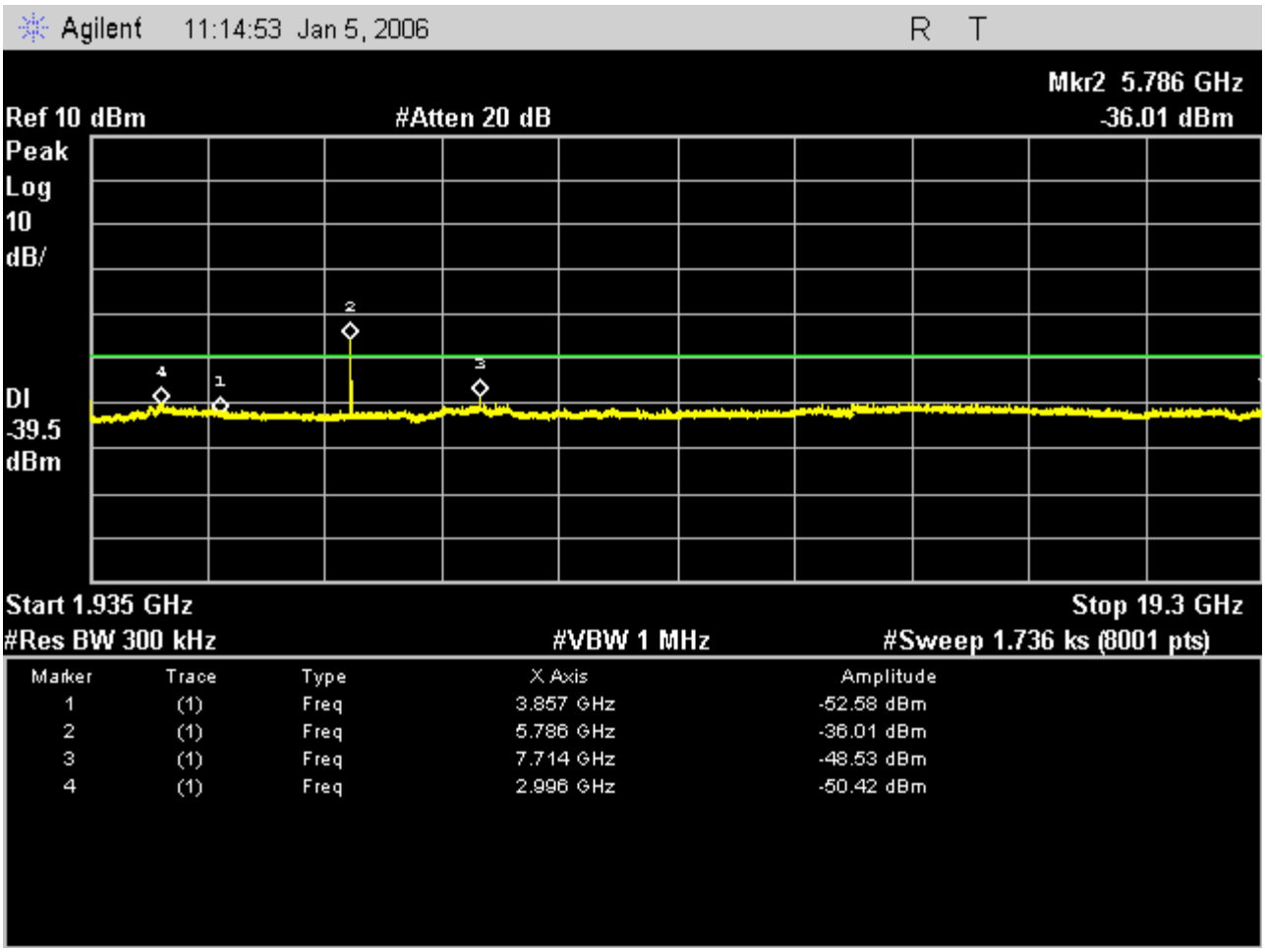

Fig. 35 – headset EUT out-of-band emissions including the regions from 1935MHz to 19.3GHz with the headset EUT transmitting on the highest carrier, 1928.448MHz.

The measurement is noise-limited. The 300kHz resolution bandwidth was used in the interests of getting a manageable sweep time, 1736.5 seconds, but the 300kHz bandwidth passes considerably more unwanted emissions than the 10kHz obtained from the text of v3.3 (draft) C63.17-2005 clause 6.1.6. The expanded resolution bandwidth measurement shows the 3rd and 4th harmonics as frequencies that need detailed emissions measurements recorded with the proper resolution bandwidth setting, and no other spurious frequencies are close to the emissions limit.

We can then re-do the test using narrow scans according to the requirements of 6.1.6 to record the level per the v3.3 (draft) C63.17-2005 clause 6.1.6 specification.

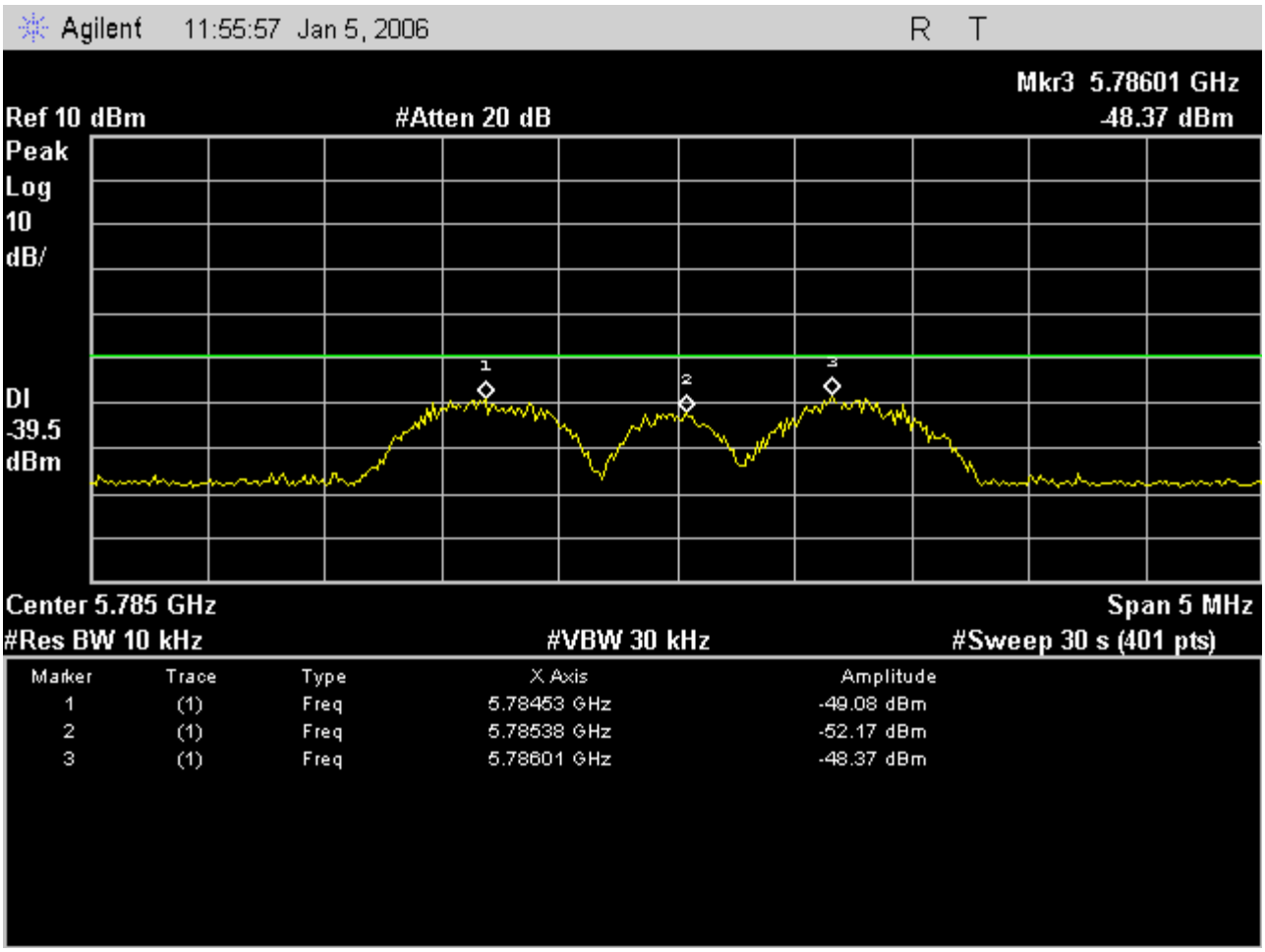

Fig. 36 – headset EUT out-of-band emissions in the region around the 3rd harmonic, with the headset EUT transmitting on the highest carrier, 1928.448MHz.

This measurement was made according to the requirements of the text of 6.1.6, and, with the worst-case peak at –48.37dB, shows margin to the -39.5dBm specification of 8.87dB.

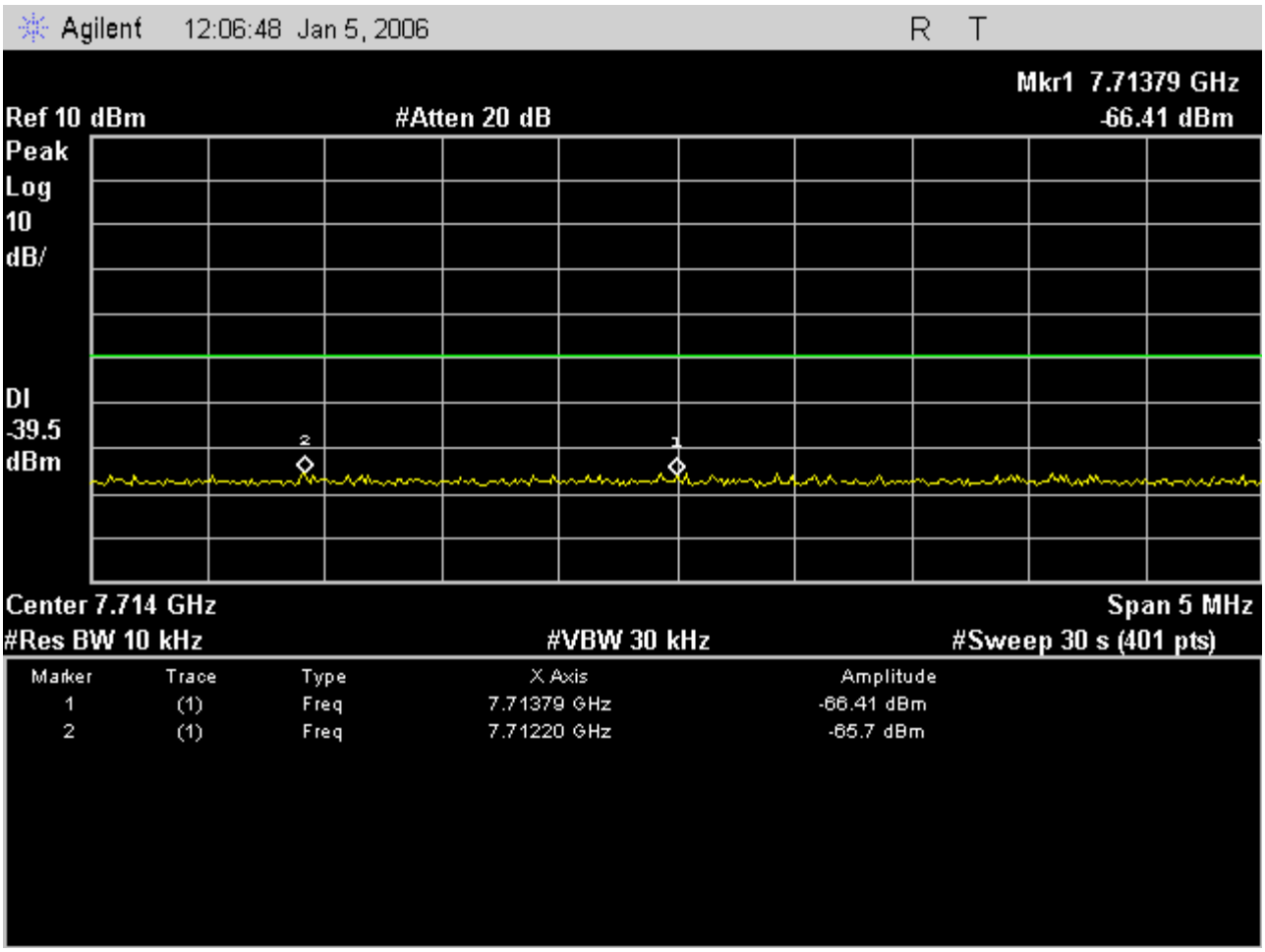

Fig. 37 – headset EUT out-of-band emissions in the region around the 4th harmonic, with the headset EUT transmitting on the highest carrier, 1928.448MHz.

This measurement was made according to the requirements of the text of 6.1.6, and, with the worst-case peak at –65.70dB, shows margin to the -39.5dBm specification of 26.2dB.

B. Clause 6.2 Tests of frequency and time stability for the headset EUT

The test configuration for the tests of V3.3 (draft) C63.17-2005 clauses 6.2.1.1 through 6.2.1.3 and 6.2.1 through 6.2.3 for the headset EUT is as follows:

The test platform and headset EUT are configured according to test configuration #2, **Standard-specific tester, headset EUT**, of section (I) of this document. The CMD60 is configured to report frequency offset with modulation removed, per the general requirements of 6.2.1. The number of transmit slots over which the measurement is made by the CMD60 is adjusted using the CONFIG MENU/TX TEST/MODULATION keystroke path. Set the number to 100 slots (bursts) to capture one second of signal, since there are 100 bursts per second, to generate one measurement of the mean value of the carrier frequency. The CMD60 measurement system calculates the mean value over each 100-slot measurement. The fixed channel used during the tests is the middle carrier, 1924.992MHz.

The particularities associated with the tests for each clause are discussed in the specific test report sections, following.

Fig. 38 - Headset EUT within the temperature chamber, with RF connection to EUT and with power/control cable connection to EUT.

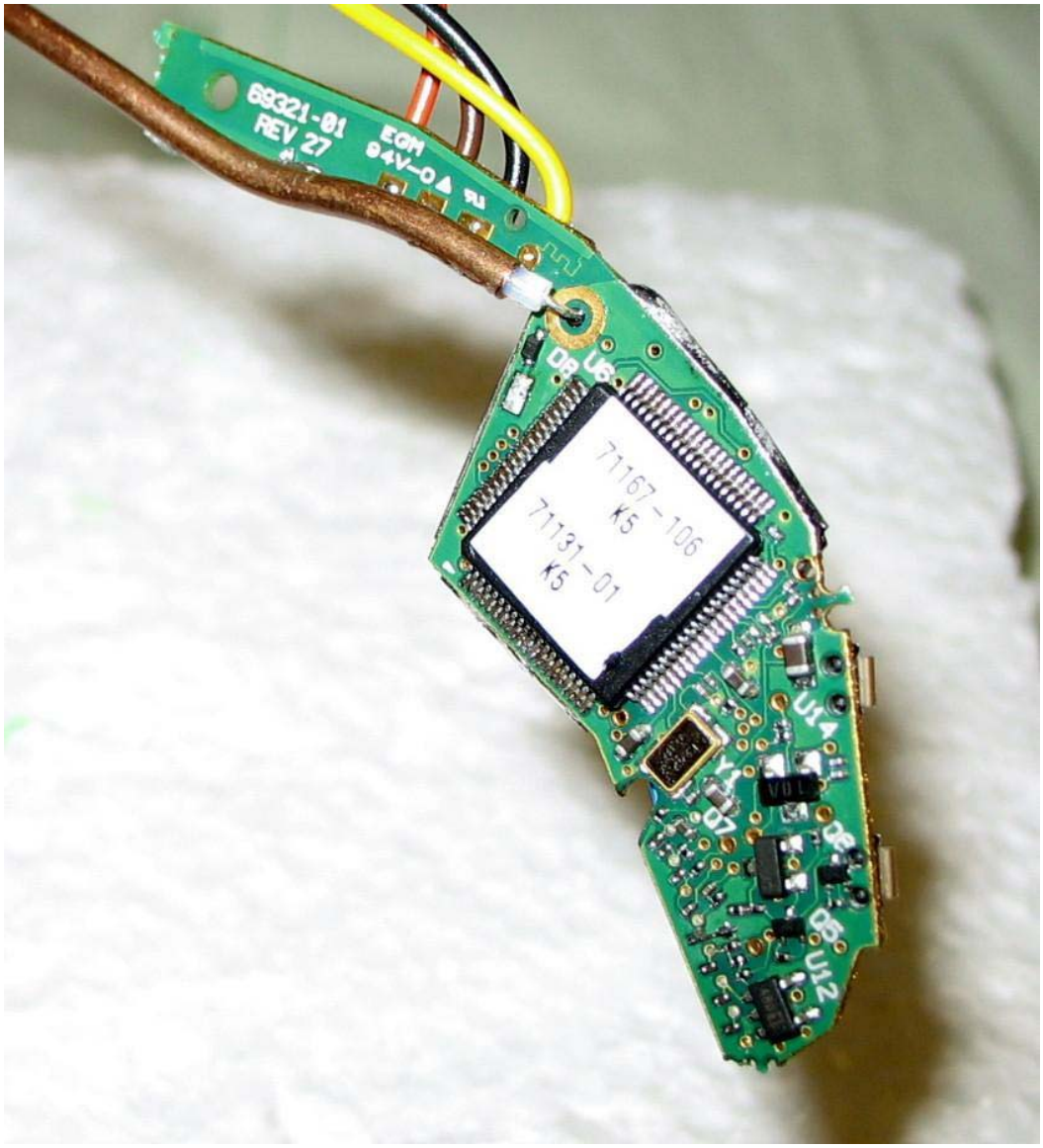

Fig. 39 - Detail of headset EUT as tested within the temperature chamber for the tests of clause 6.2.

Clause 6.2.1 Carrier frequency stability, headset EUT.

Clause 6.2.1.1 for the headset EUT; mean carrier frequency drift with time.

The headset EUT is configured as described in the introduction for the tests of clause 6.2. The EUT power supply voltage is set to 3.70V. Ambient for the EUT is set to 20C. The data collection system runs for one hour, collecting mean carrier frequency measurements and recording the peak and mean values.

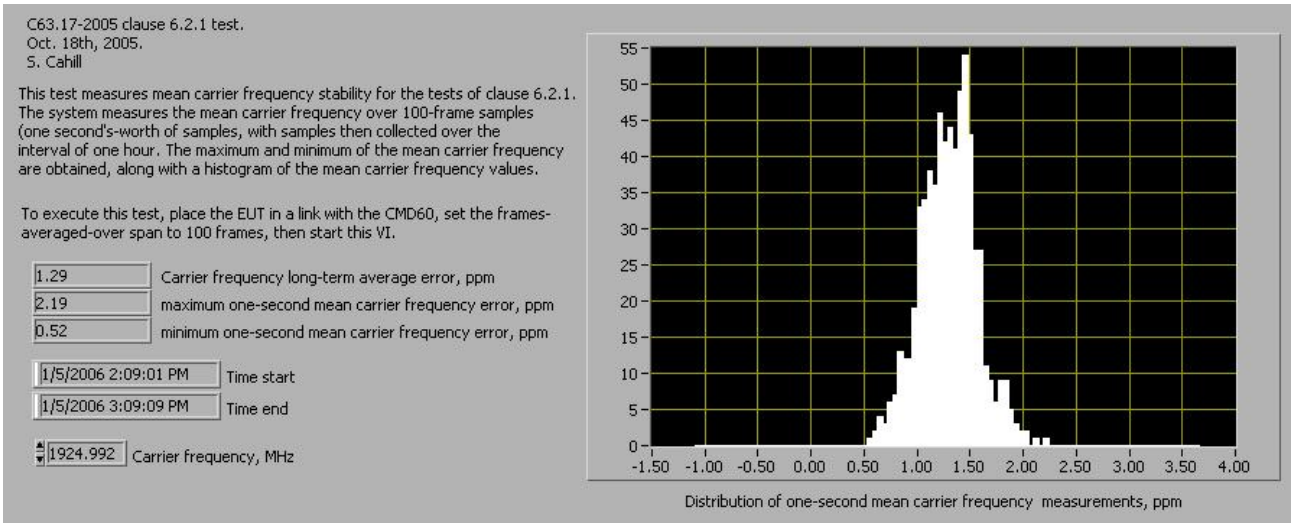

Fig. 40 - Measured one-second mean carrier frequency, headset EUT, and observed maximum, average value and observed minimum of the mean carrier frequency.

The nominal mean carrier frequency error relative to 1924.992MHz is 1.29ppm.

The observed maximum is 2.19ppm, for a maximum relative to nominal of +0.90ppm.

The observed minimum is 0.52ppm, for a change relative to nominal of -0.77ppm.

The headset EUT passes the test of clause 6.2.1.1; the mean carrier frequency is allowed to vary +/-10ppm over a one-hour test interval.

Clause 6.2.1.2 for the headset EUT, mean carrier frequency error over voltage:

Testing for the effects of battery voltage variation is not required for the headset EUT, per the requirements of 47CFR15.323(f) and V3.3 (draft) C63.17-2005. The headset EUT is capable only of operating from a battery.

Clause 6.2.1.3 for the headset EUT; mean carrier frequency change with temperature.

The headset EUT is configured as described in the introduction for the tests of clause 6.2. The EUT power supply voltage is set to 3.70V. The EUT's mean carrier frequency is then measured at the declared rated extremes (+4C, then +44C) and at 20C, after a 60 minute soak at each temperature.

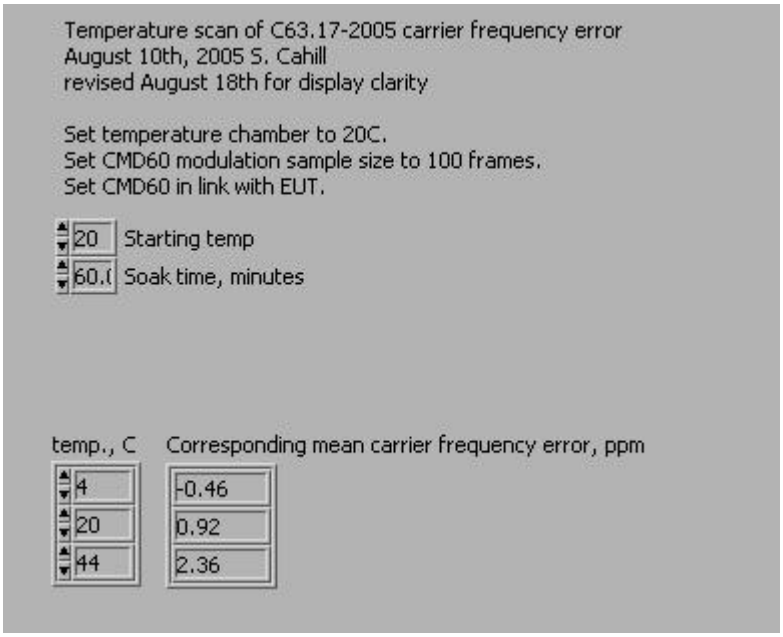

Fig. 41 - Measured mean carrier frequency, headset EUT , at +4C, +20C, +44C.

The nominal mean carrier frequency error relative to 1924.992MHz is 0.92ppm.

The observed value at +4C is -0.46ppm, for a change relative to 20C ambient of -1.87ppm.

The observed value at +44C is 2.36ppm, for a change relative to 20C ambient of 1.34ppm.

The headset EUT passes the test of clause 6.2.1.3; the mean carrier frequency is allowed to vary +/-10ppm over the declared rated temperature.

Clause 6.2.2 Frame repetition stability test for the headset EUT:

The headset EUT is configured as described in the introduction for the tests of clause 6.2.

The text of table 8 of 6.2.2 specifies the interval of each measurement (X, in the nomenclature used in V3.3 (draft) C63.17-2005) to be as long as 1000 frames, and specifies measurements to be collected repetitively over an interval of at least one hour. For the test of 6.2.2, we obtain mean frame-repetition error measurements each over 1000 frames by configuring the CMD60 to report mean frame repetition error over 100 frames; each set of 10 responses is then averaged to derive a mean over 1000 frames, so to obtain one 1000-frame mean frame repetition error measurement. The data collection from the CMD60 is under the control of the controller PC. The data collection system runs until one hour has elapsed. From the frame repetition stability measurements the standard deviation of the frequency stability is calculated.

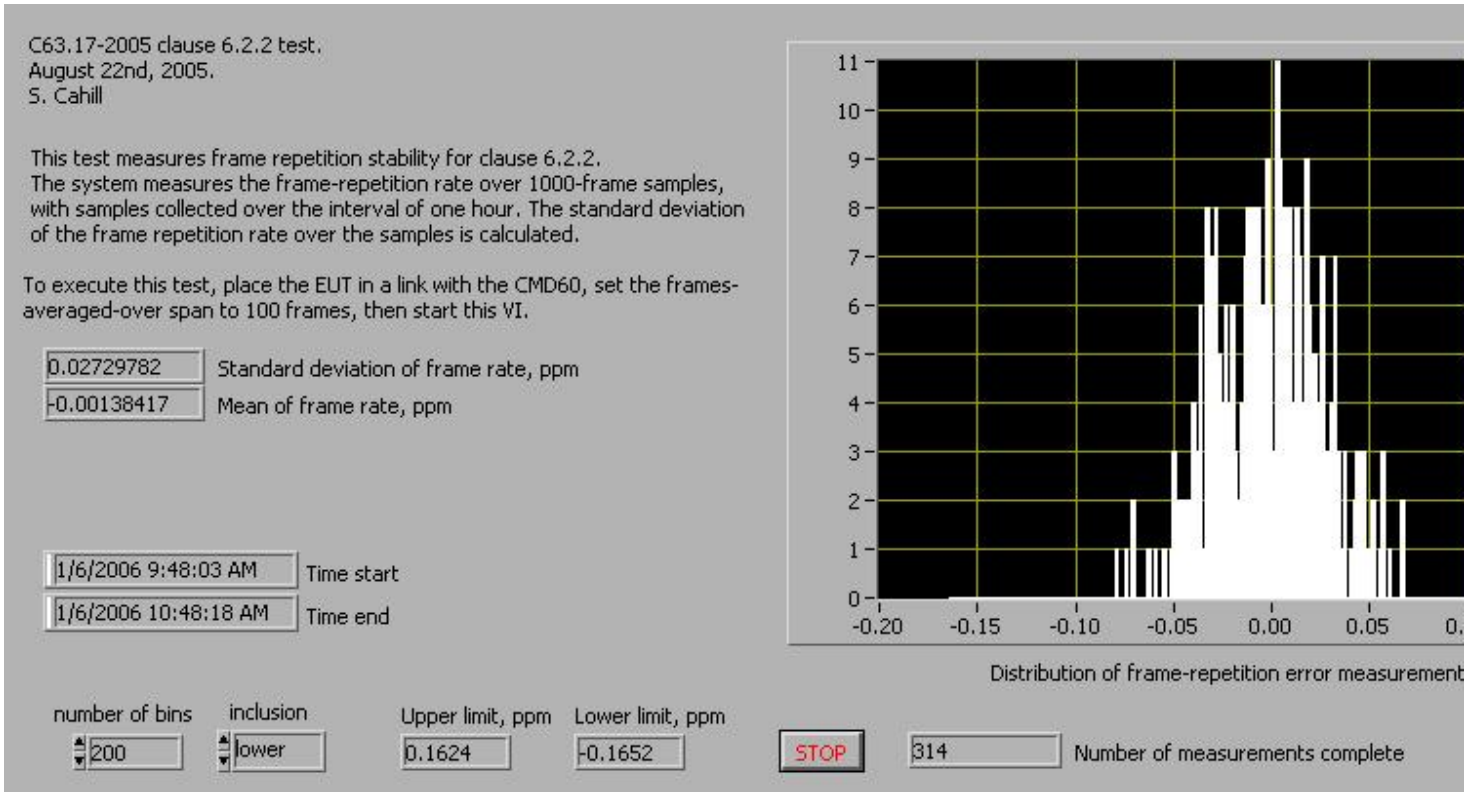

Fig. 42 - Test of headset EUT according to the conditions of clause 6.2.2 for frame repetition rate stability

The measured standard deviation of the frame rate or repetition period according to the requirements of clause 6.2.2 for the headset EUT is 0.02730ppm.

The headset EUT passes the test of clause 6.2.2; the standard deviation of the frequency stability is to be such that three standard deviations of the frequency stability as measured through the error in the frame repetition rate shall not exceed 10ppm, and three standard deviations of the frequency stability for the base EUT is measured to be 0.08189ppm.

Clause 6.2.3 Frame period and jitter test for the headset EUT:

The headset EUT is configured as described in the introduction for the tests of clause 6.2.

For the test of 6.2.3, the CMD60 is queried to report maximum and minimum frame length for two frames, for each measurement. In this way the lengths of individual frames are obtained; one is the maximum, the other is the minimum. The measurement of frame length is executed for 100,000 frames under the control of the data collection system, which runs for approximately 2 hours for each test. From the measured frame length data the standard deviation of the jitter and the maximum and minimum frame lengths are calculated according to the requirements of 6.2.3.

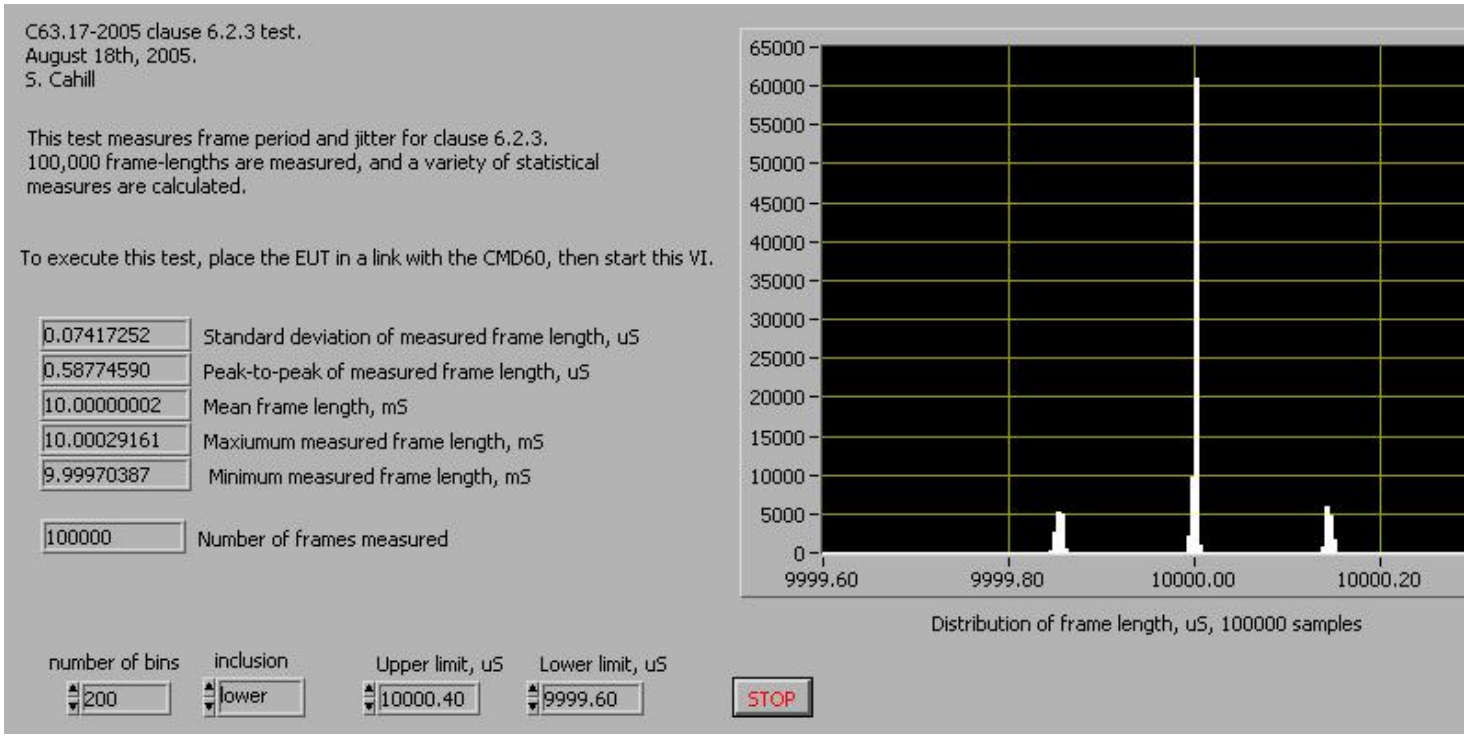

Fig. 43 - Test of headset EUT for frame period and jitter, according to the requirements of clause 6.2.3.

The measured mean value of the frame period is 10.00000002ms, which is 10ms with jitter offset of 0.00002us and three standard deviations of 0.0741725us, totaling 0.222526us.
The headset EUT passes clause 6.2.3; the mean frame period is to be 10ms with jitter (three standard deviations) and offset totaling less than 25us.

IV. Tests of clause 7, headset EUT

A. Clause 7.3.2 Upper threshold for EUTs which implement the LIC procedure, headset EUT

The test platform, headset EUT and companion base unit are configured according to the requirements for implementing the test of 7.3.2(b) by means of test configuration #3, **With companion device and interference blocking, headset EUT**, of section (I) of this document.

The multi-carrier interference generator (PXI-5670) is set to CW on all 5 carriers, and at level -35.5dBm, which is TU + UM + 10dB, where TU = -51.5dBm from the manufacturer's declarations and the measured emissions bandwidth and UM is defined in V3.3 (draft) C63.17-2005 as 6dB. The transmit spectrum and interference spectrum are observed using the E4407B spectrum analyzer. Trigger is free-run, detection is peak, otherwise spectrum analyzer settings are as shown on the screenshot following. A trace (yellow) is captured and held at the initial interference -35.5dBm setting.

The multi-carrier interference generator level is then reduced incrementally in 1dB steps until the headset EUT responds to the press of the TALK button by initiating a communications channel with the base. A max-hold signal (purple) captures the trace showing when transmissions of the communications channel begin. For each 1dB step, the headset EUT is powered down while the multi-carrier interference generator is set to the new level, then powered up. Each trial includes a delay to allow the headset EUT to locate the beacon transmission from the base companion device. A trace (blue) shows the interference carrier level at the level where headset transmissions first begin. A marker shows the delta between the -35.5dBm level and the level at which headset transmissions first begin.

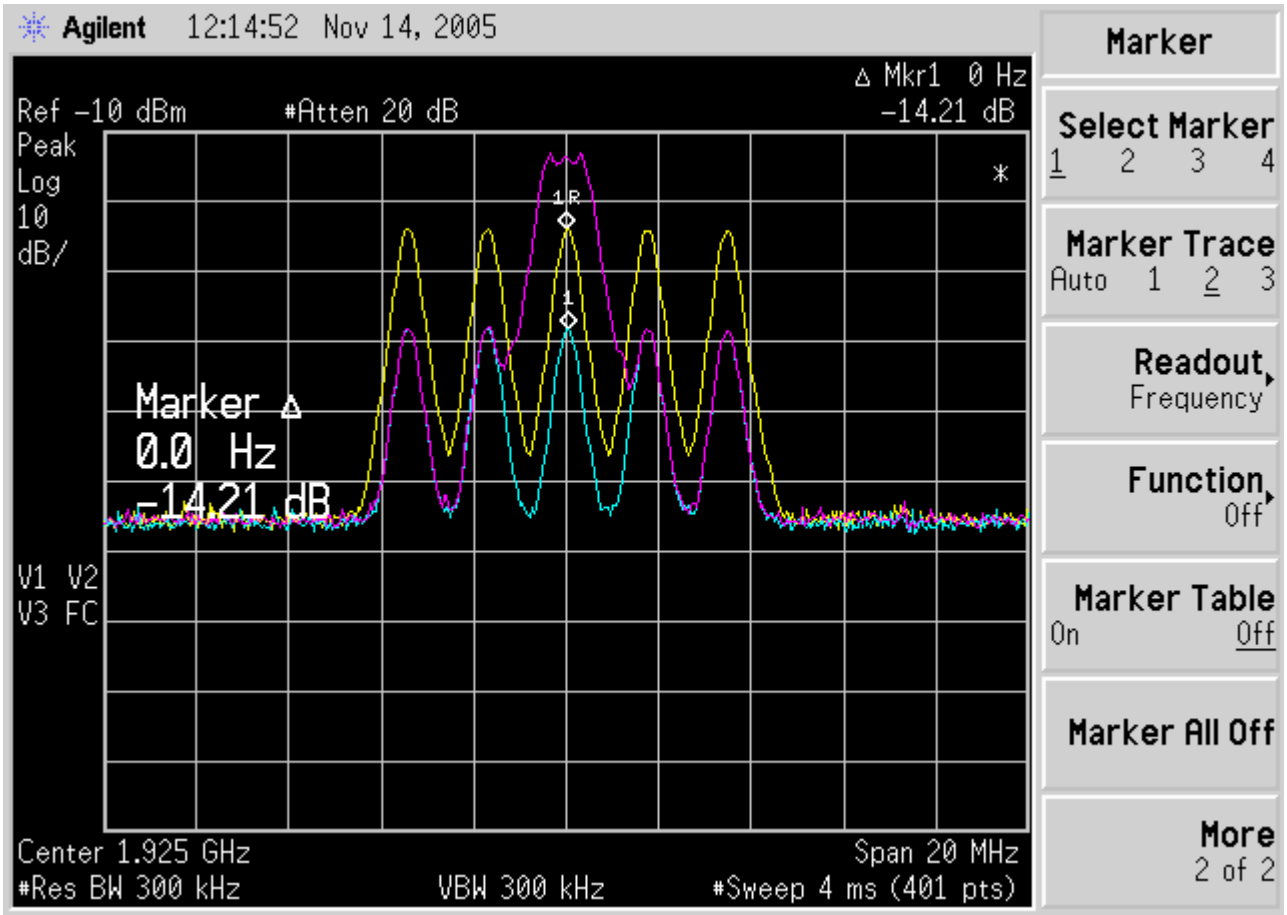

Fig. 44 - Emissions and interference profile spectrum, headset EUT, test 7.3.2.

A trace (yellow, 2nd from top) is captured and held at the initial interference level setting of -35.5dBm. Then the multi-carrier interference generator level is reduced incrementally in 1dB steps until the headset EUT will initiate a communications channel in response to a press of the TALK button. A max-hold signal (purple, top) captures the trace showing when transmissions of the beacon begin. A trace (blue, bottom) shows the interference carrier level at the level where transmissions first begin. A marker shows the delta between the -35.5dBm level and the level at which transmissions first begin.

The first interference level at which the headset EUT transmits is -50.0 dBm. The allowed upper limit is TU + UM = -45.5dBm, the headset EUT passes.

Note that absolute level at the spectrum analyzer and displayed above is a consequence of the relative losses between the EUT port of the combining network and the spectrum analyzer port, relative to the multi-carrier generator port, and does not reflect the signal level at the EUT input.

B. Clause 7.3.3 Least interfered channel (LIC) procedure test, headset EUT

The test platform, headset EUT and companion base unit are configured according to the requirements for implementing the test of 7.3.3 by means of test configuration #3, **With companion device and interference blocking, headset EUT**, of section (I) of this document.

The multi-carrier interference generator (PXI-5670) is set to CW at $T_U + U_M$ = -45.5dBm on three carriers; at 1928.448MHz, 1924.992MHz, and 1921.536MHz.

Clause 7.3.3(b)

The multi-carrier interference generator is additionally set to generate on f_1 a CW signal of level $T_L + U_M$ +7dB, or -58.5dBm (where $T_L = T_U$ - 20dB) and to generate on f_2 a CW signal of level $T_L + U_M$ = -65.5dBm, where f_1 = 1926.720MHz and f_2 = 1923.264MHz, the remaining two of the system's five carriers.

With this interference profile present, apply power to the headset EUT and the companion base unit. Wait for the headset to detect the base companion device, then press the TALK button on the headset to initiate the communications channel. Repeat the communications channel establishment five times while monitoring the spectrum using the E4407B spectrum analyzer to validate that, when this interference profile is applied to the headset EUT, the headset always chooses f_2 for the communications channel.

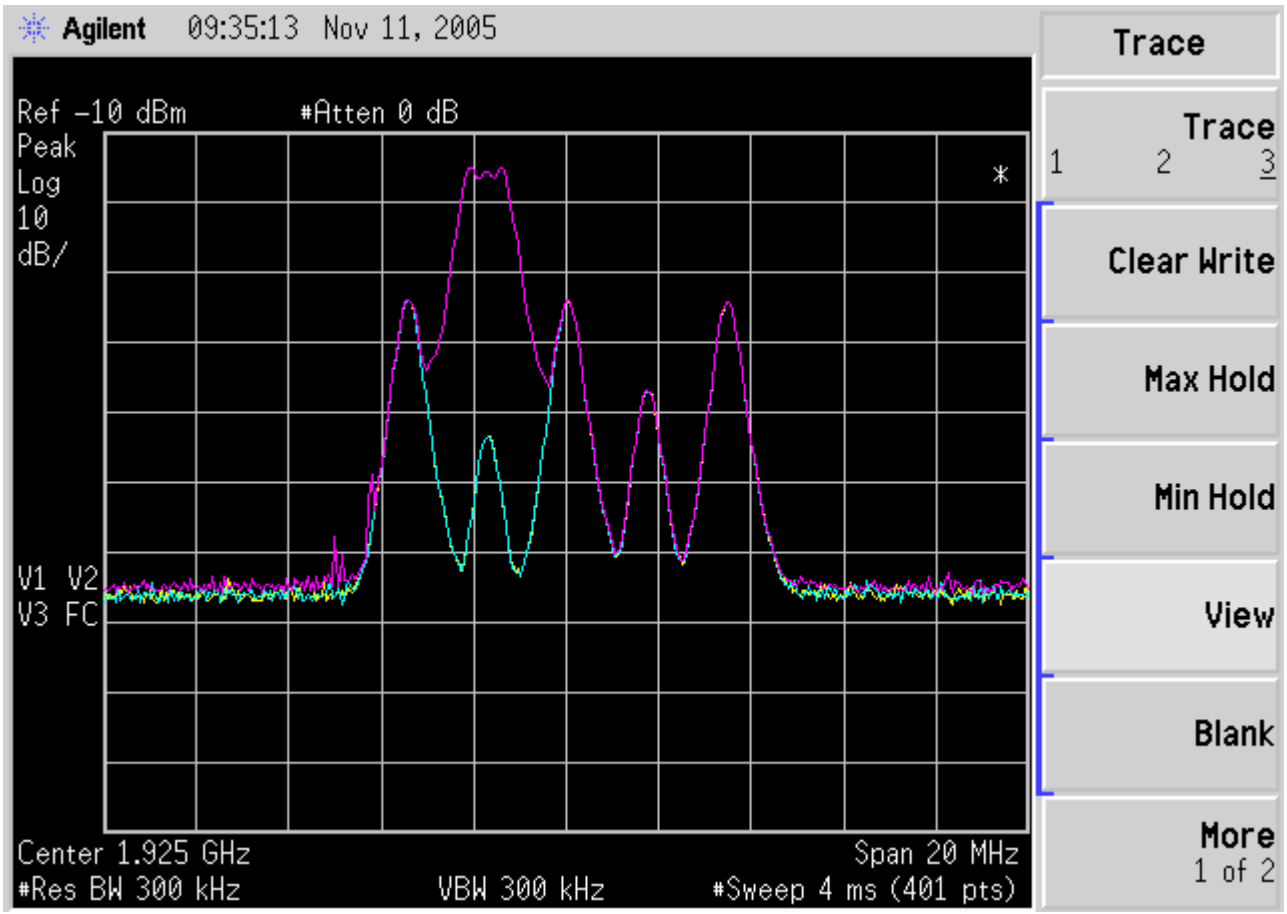

Fig. 45 - Emissions and interference profile spectrum, headset EUT, test 7.3.3(b).

A max-hold signal (purple, top) captures the trace showing where in the spectrum EUT transmissions are occurring. A trace (blue, bottom) shows the interference profile.

The headset EUT always transmits on f_2 (the carrier with the lower interference level) and so meets the requirement of not transmitting on f_1.

Clause 7.3.3(c)

Repeat the test of 7.3.3(b), except reverse the levels on f_1 and f_2. That is, the multi-carrier interference generator is now set to generate on f_1 a CW signal of level $T_L + U_M$, or -65.5dBm and to generate on f_2 a CW signal of level $T_L + U_M +$ 7dB = -58.5dBm, where f_1 = 1926.720MHz and f_2 = 1923.264MHz.

With this interference profile present, apply power to the headset EUT and the companion base unit. Wait for the headset to detect the base unit. Then press the TALK button on the headset to establish a communications channel. Repeat the communications channel establishment five times while monitoring the spectrum using the E4407B spectrum analyzer to validate that, when this interference profile is applied to the headset EUT, the headset EUT always chooses f_1 for the communications channel.

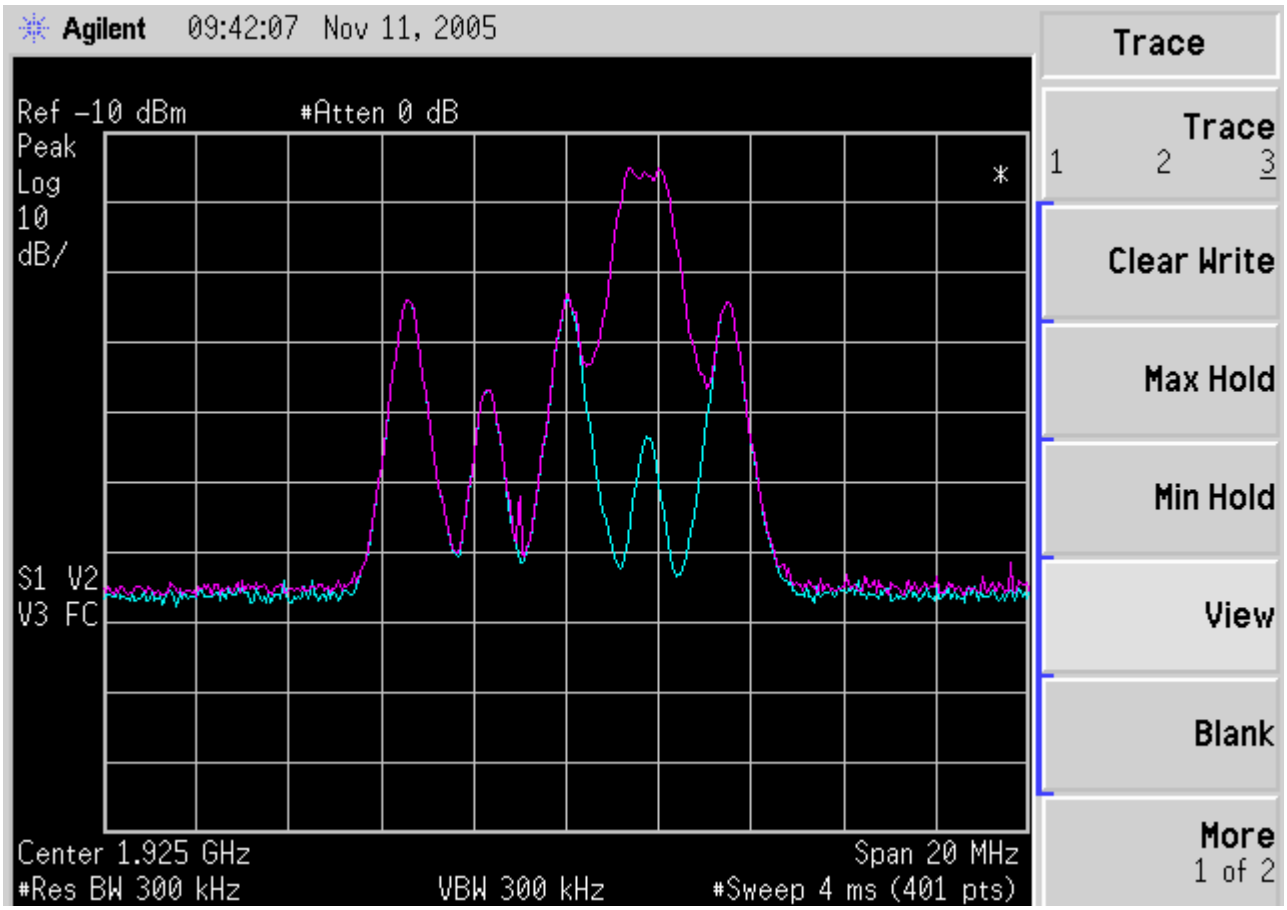

Fig. 46 - Emissions and interference profile spectrum, headset EUT, test 7.3.3(c).

The headset EUT always transmits on f_1 (the carrier with the lower interference level) and so meets the requirement that it never transmit on f_2.

Clause 7.3.3(d)

Repeat the test of 7.3.3(b), except the multi-carrier interference generator is now set to generate on f_1 a CW signal of level $T_L + U_M$ + 1dB or -44.5dBm and to generate on f_2 a CW signal of level $T_U + U_M$ - 6dB = -51.5dBm, where f_1 = 1926.720MHz and f_2 = 1923.264MHz.

With this interference profile present, apply power to the headset EUT and the companion base unit. Wait for the headset EUT to detect the base beacon transmission. Then press the TALK button on the headset to establish a communications channel. Repeat the communications channel establishment five times while monitoring the spectrum using the E4407B spectrum analyzer to validate that, when this interference profile is applied to the headset EUT, the headset EUT always chooses f_2 for the communications channel.

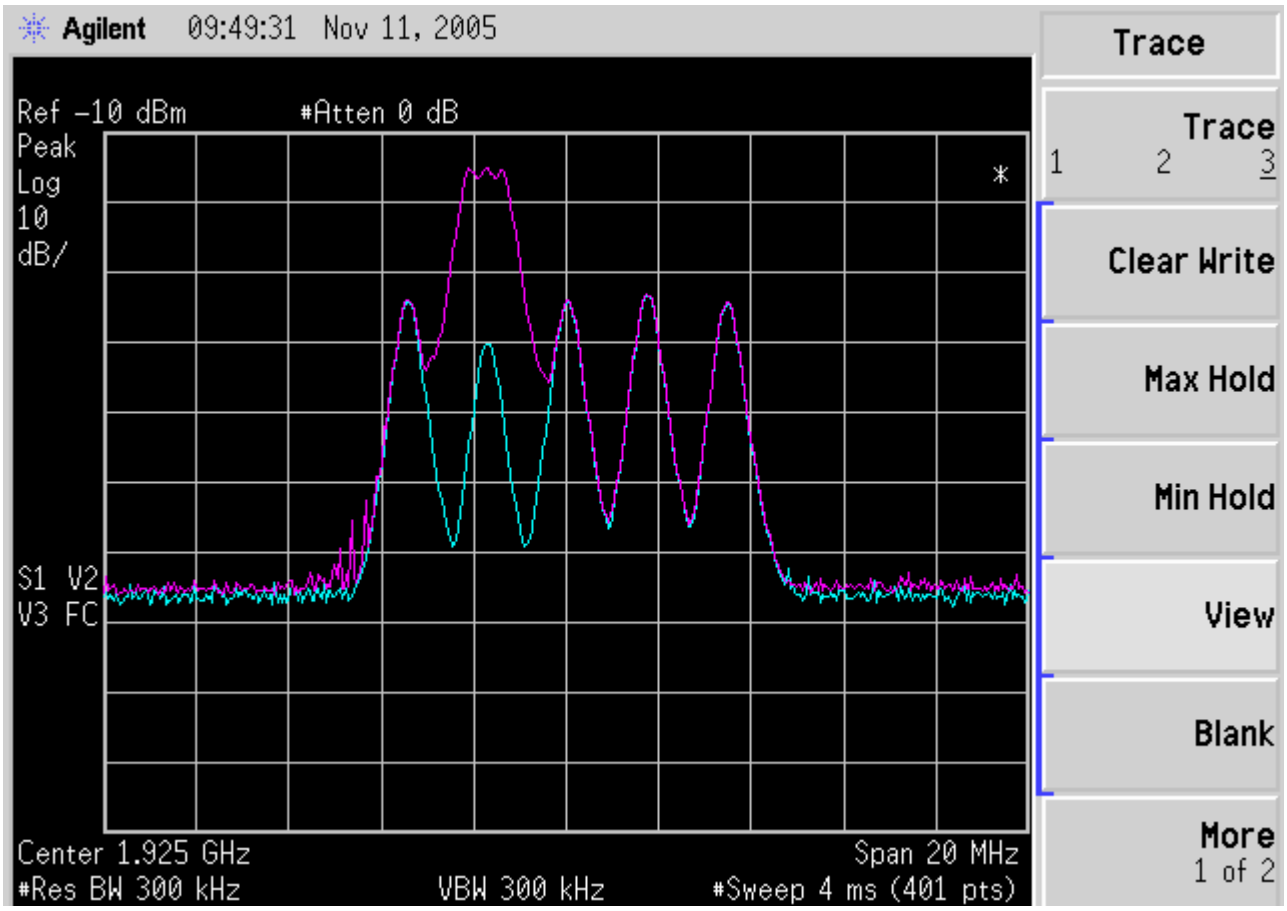

Fig. 47 - Emissions and interference profile spectrum, headset EUT, test 7.3.3(d).

The headset EUT always transmits on f_2 (the carrier with the lower interference level) and so meets the requirement that it never transmit on f_1.

Clause 7.3.3(e).

Repeat the test of 7.3.3(d), except reverse the levels on f_1 and f_2. That is, the multi-carrier interference generator is now set to generate on f_1 a CW signal of level $T_L + U_M$ - 6dB or -51.5dBm and to generate on f_2 a CW signal of level $T_L + U_M$ +1dB = -44.5dBm, where f_1 = 1926.720MHz and f_2 = 1923.264MHz.

With this interference profile present, apply power to the headset EUT and the companion base unit. Wait for the headset EUT to detect the base unit's beacon transmissions. Then press the TALK button on the headset to establish a communications channel. Repeat the communications channel establishment five times while monitoring the spectrum using the E4407B spectrum analyzer to validate that, when this interference profile is applied to the headset EUT, the headset EUT always chooses f_1 for the communications channel.

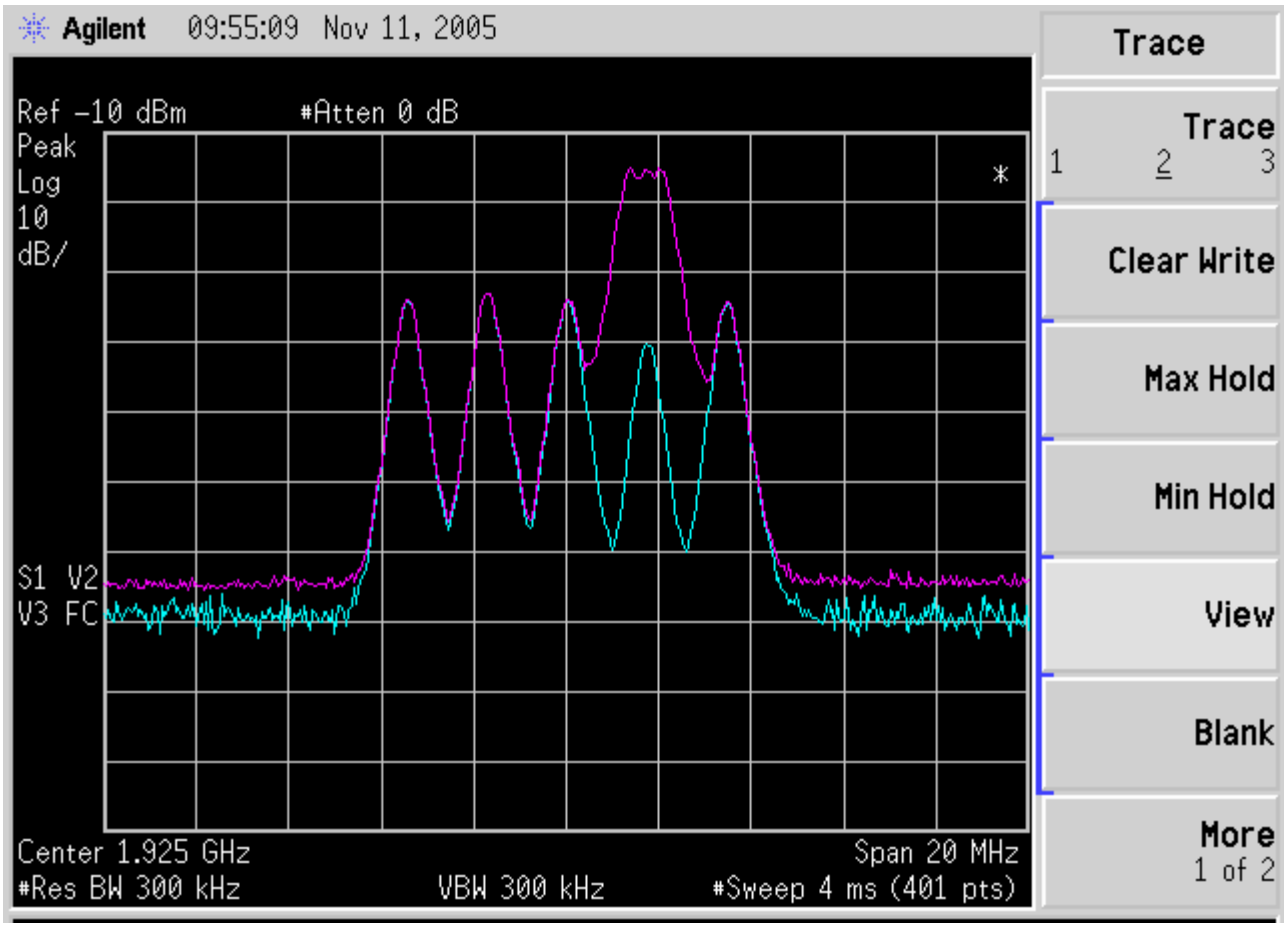

Fig. 48 - Emissions and interference profile spectrum, headset EUT, test 7.3.3(e).

The headset EUT always transmits on f_1 (the carrier with the lower interference level) and so meets the requirement that it never transmit on f_2.

C. Clause 7.3.4 Selected channel confirmation, headset EUT

The test platform, headset EUT and companion base unit are configured according to the requirements for implementing the test of 7.3.4 by means of test configuration #3, **With companion device and interference blocking, headset EUT**, of section (I) of this document. An example of the headset EUT's selected channel confirmation function is shown below, with the multi-carrier interference generator configured to enable the automatic switch from the initial interference profile to the alternate interference profile based on the reception of the trigger signal generated by the headset in the frame prior to the initiation of transmission of the headset companion device and base EUT transmissions of communications channel signals, but with the alternate interference profile configured so that the access criteria are met and transmission is allowed.

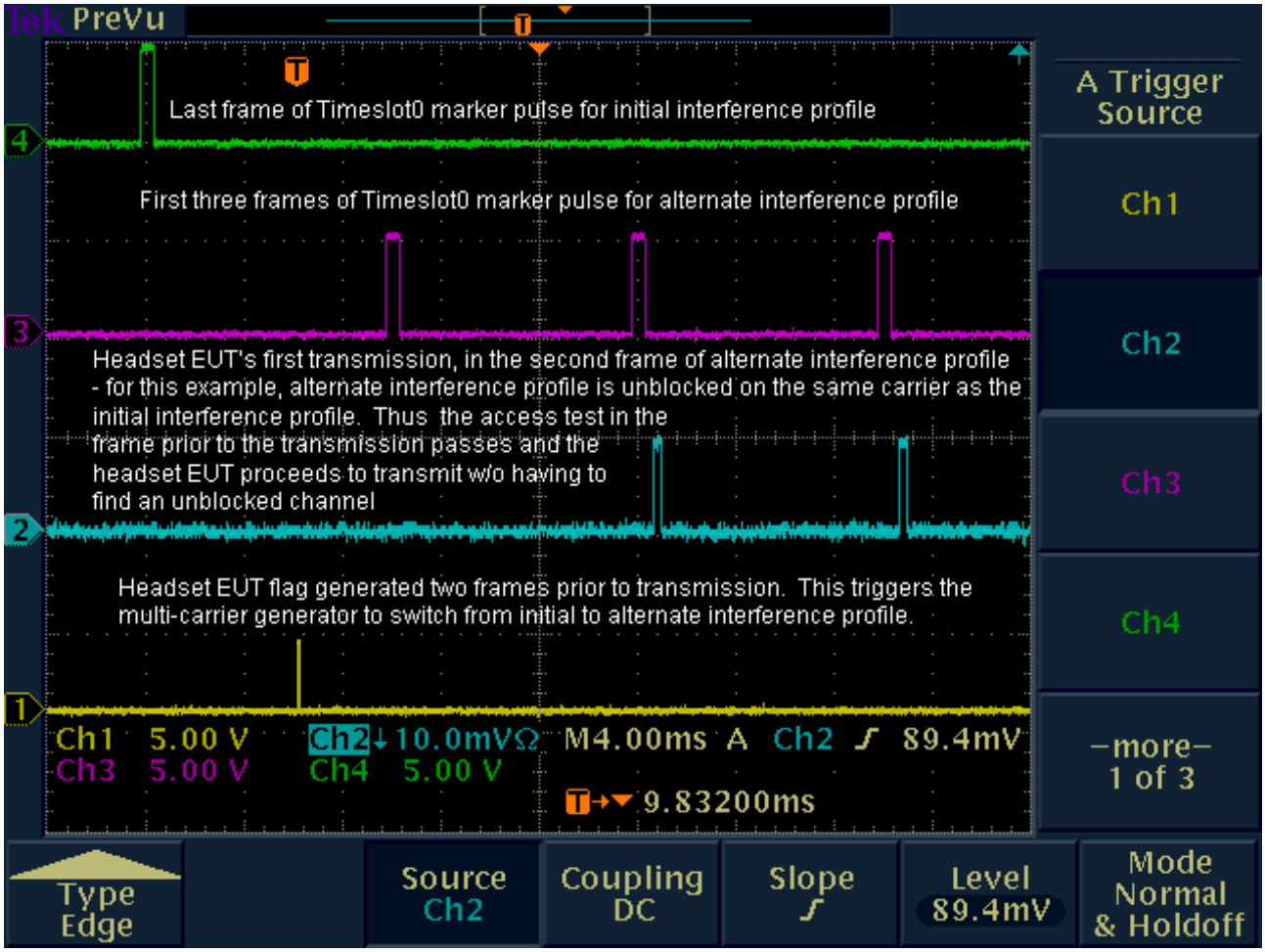

Fig. 49 - Example oscilloscope screenshot showing transition from initial to alternate interference profile in the frame before headset EUT initiation of transmission of the communications channel; for this example the alternate interference profile is configured to meet the access criteria. The text of the notes is best viewed at 150% magnification.

For this example no interference of significant power is present, so headset EUT does not defer. Green (top) trace is marker for slot 0 of initial interference profile. Purple (2nd from top) trace is marker for alternate interference profile. Blue (3rd from top) trace is output of RF detector, showing headset EUT communications channel transmissions. Yellow (bottom) trace is status flag output from the headset, set by the headset in response to the press of the TALK button, in the frame two frames prior to the headset EUT's intended first transmit frame.

For the example above, the multi-carrier interference generator is configured to enable the automatic switch from the initial interference profile to the alternate interference profile based on the reception of the trigger signal generated by the headset in the frame prior to the initiation of transmission of the headset companion device and base EUT transmissions of communications channel signals, but both the initial and alternate interference profiles are set to have the same carrier with no interference present; the headset EUT checks the access criteria in the frame prior to the first transmission, but the access criteria test passes and so the headset EUT begins transmissions immediately.

To execute the test with interference present, the multi-carrier interference generator (PXI-5670) initial interference profile is then set to CW at $T_U + U_M$ = -45.5dBm on three carriers; at 1928.448MHz, 1924.992MHz, and 1921.536MHz, and additionally set to generate on f_1 a CW signal of level $T_U + U_M$, or -45.5dBm and to generate no interference on f_2, here f_1 = 1926.720MHz and f_2 = 1923.264MHz, the remaining two of the total system's five carriers.

The multi-carrier interference generator (PXI-5670) alternate interference profile is set to CW at $T_U + U_M$ = -45.5dBm on three carriers; at 1928.448MHz, 1924.992MHz, and 1921.536MHz, and additionally set to generate no interference on f_1, and to generate on f_2 a CW signal of level $T_U + U_M$, or -45.5dBm, where f_1 = 1926.720MHz and f_2 =

1923.264MHz, the remaining two of the total system's five carriers. See section III-C, the tests of 7.3.4 as applied to the base EUT, for documentation of the interference characteristics.

Initially, the multi-carrier generator is configured not to switch to the alternate profile when the EUT begins transmissions. With this interference profile present, apply power to the headset EUT and the companion base unit. Then press the TALK button on the headset to establish a communications channel. Verify that the headset EUT transmits on f_2, then press and release the TALK button on the headset to terminate the communications channel. The multi-carrier interference generator is then configured to enable the automatic switch from the initial interference profile to the alternate interference profile, and the sequence repeated; for this case, the presence of the alternate interference profile beginning in the frame prior to the EUT's intended first transmit frame (and not meeting the access criteria) should be detected, and the EUT should defer, then select a channel for which the access criteria is met.

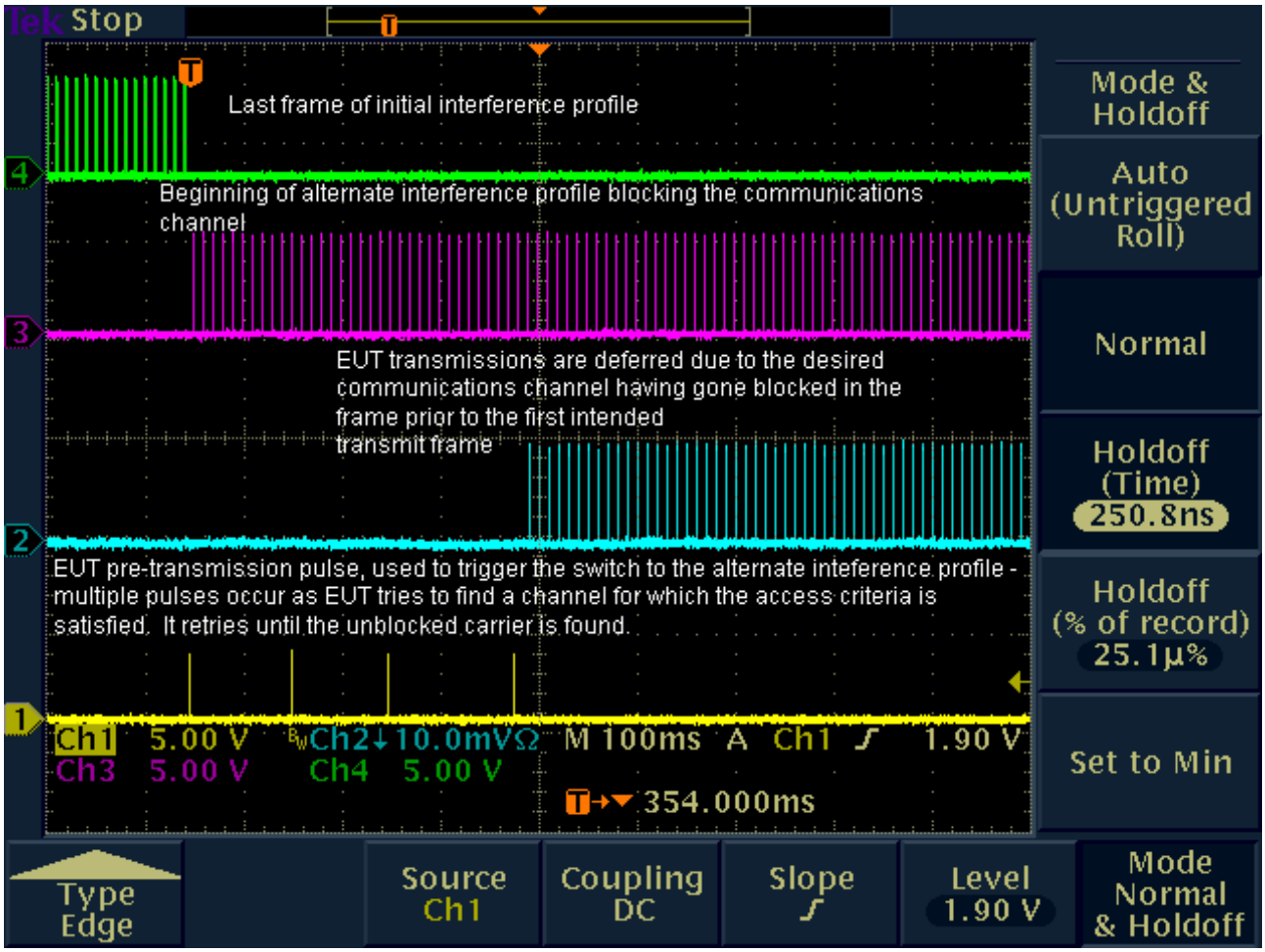

Fig. 50 - Screen shot of oscilloscope showing deferral by the headset EUT in the case where the interference profile changes in the frame previous to intended transmission and the selected time and frequency communications channel becomes blocked; and then later, transmission on unblocked channel.

The headset EUT detects that interference is present in the desired communications channel even when that interference first begins in the frame prior to the first intended transmit frame, and so meets the requirements of 7.3.4, selected channel confirmation.

D. Clause 7.5 Reaction time and monitoring interval, headset EUT

The test platform, headset EUT and companion base unit are configured according to the requirements for implementing the test of 7.5(c) by means of test configuration #3, **With companion device and interference blocking, headset EUT**, of section (I) of this document.

The multi-carrier interference generator (PXI-5670) is set to interference pulse transmissions of 50us length, synchronized with the frame and slot timing of the base companion device and so (since the headset EUT in turn synchronizes with the base unit) with the timing of the headset EUT. The interference is present on all 5 carriers, and at level -45.5dBm, which is $T_U + U_M$.

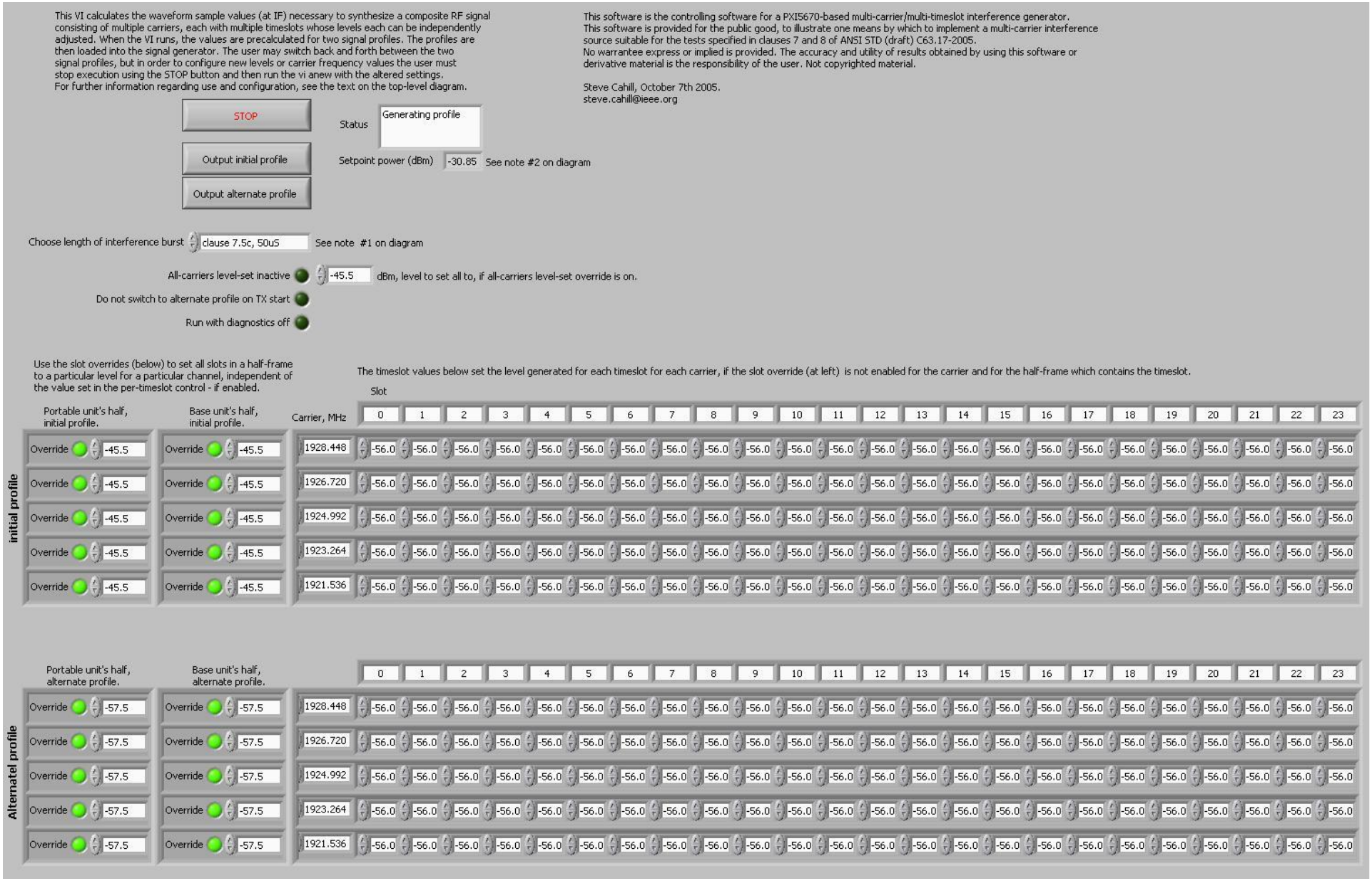

Fig. 51 - Control panel for multi-carrier interference generator, set to 50uS pulses in all timeslots on all carriers, for the test of 7.5(c).

Two interference profiles are loaded; one with all pulses at -45.5dBm, $T_U + U_M$, and the other at -57.5dBm, $T_U - U_M$. The first profile is used to demonstrate deferral for pulses 50uS long above the threshold, and the second profile is used to demonstrate non-deferral for 50uS pulses below the threshold.

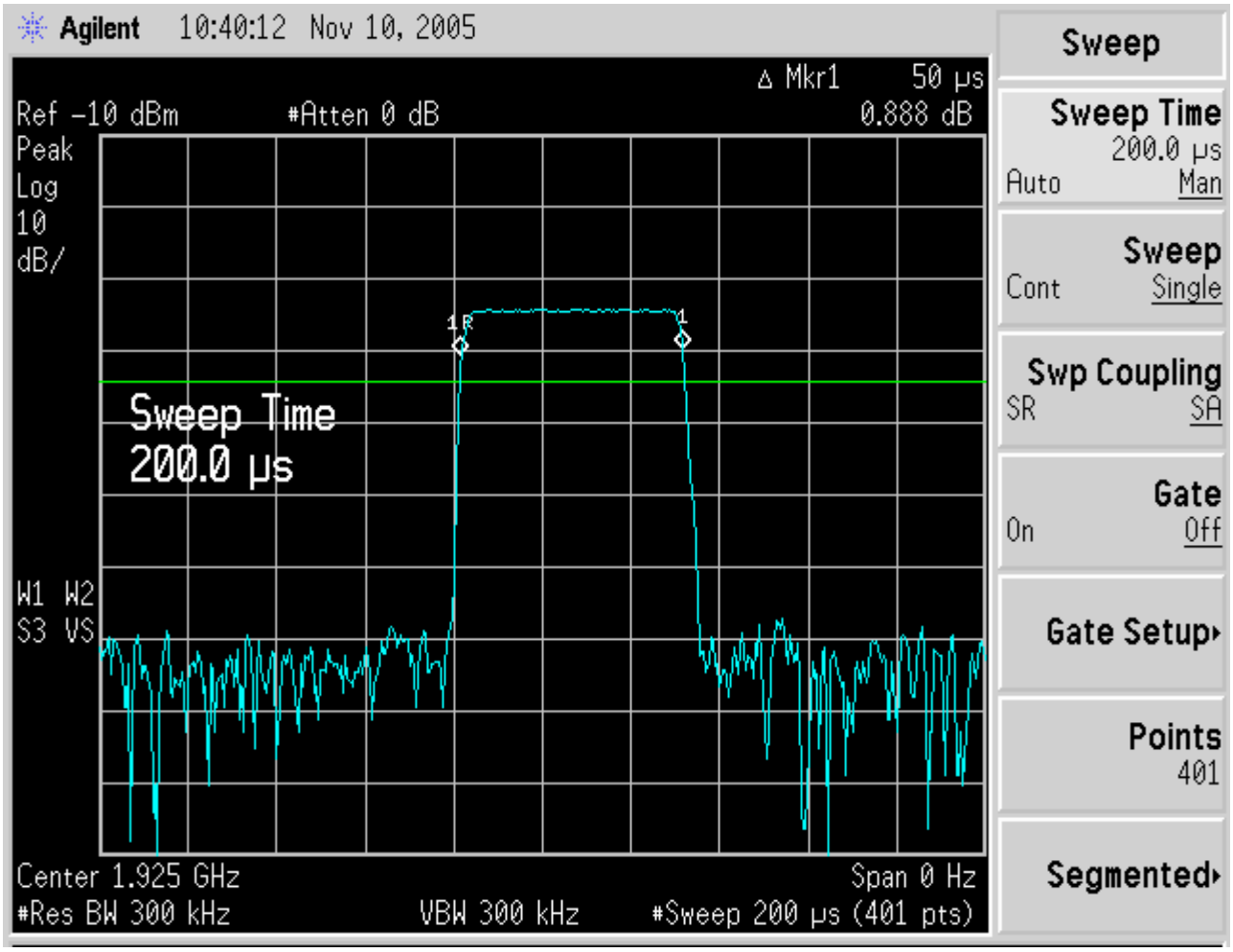

Fig. 52 - Interference pulse, one frame shown, for the test of 7.5(c).

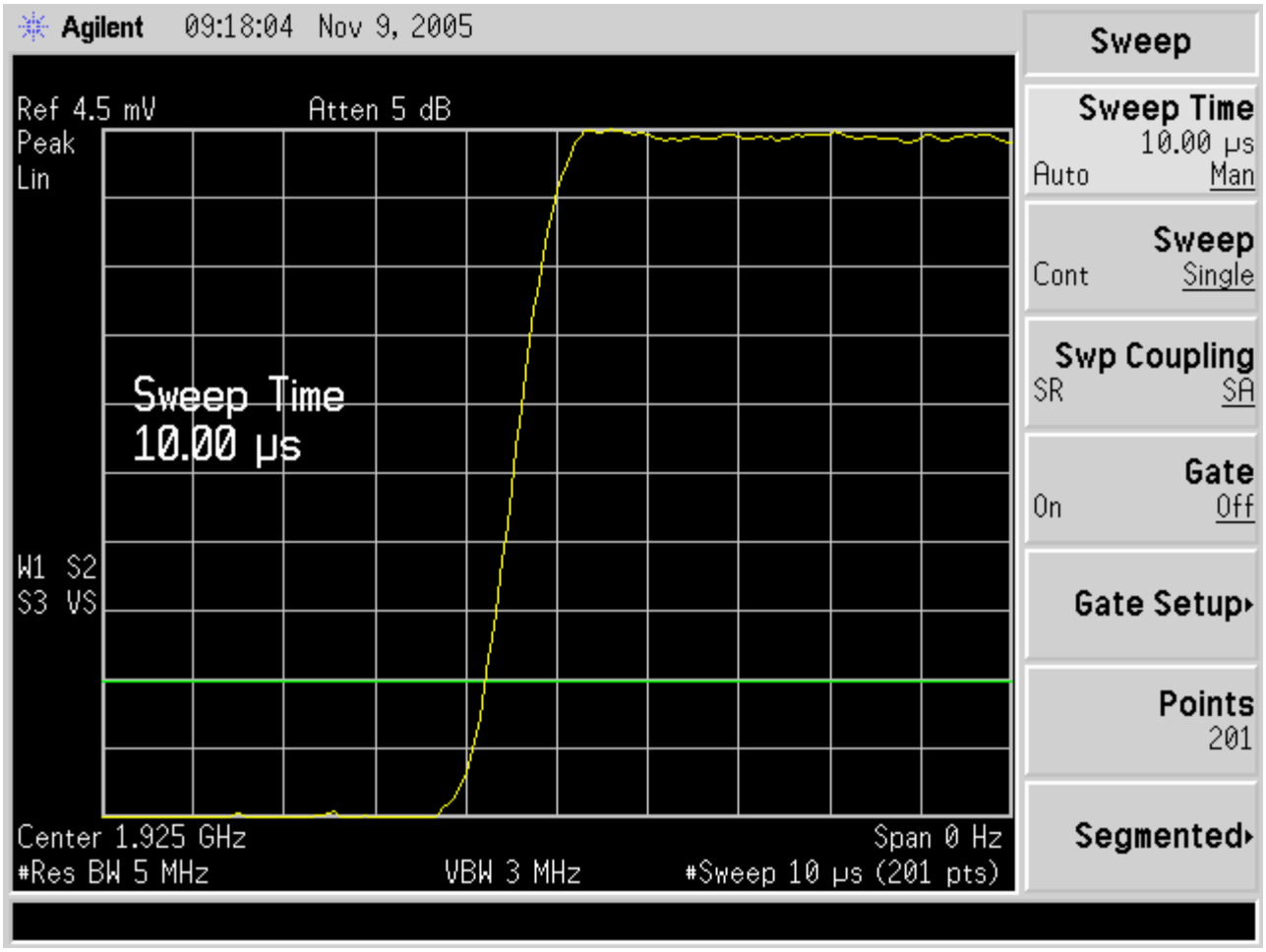

Fig. 53 - Rise time of interference pulse, per the requirements of 7.5 for less than 1uS for 10% to 90% transition.

Spectrum analyzer is set to linear response and the reference level adjusted so that 10% and 90% scale points can be observed. Fall time (not shown) is symmetrical.

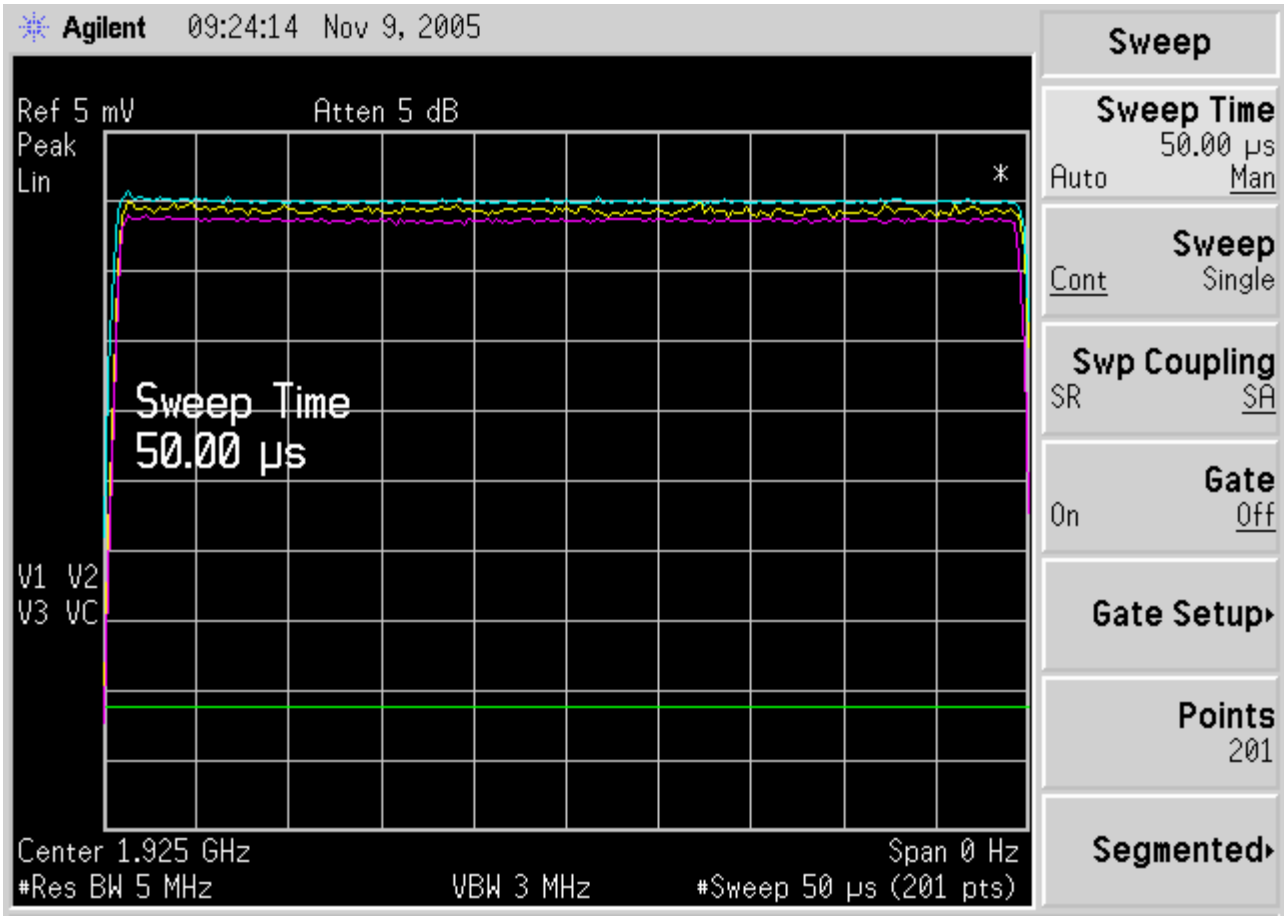

Fig. 54 – 50uS interference pulse for 7.5(c), duration and amplitude variation over the duration of the 50 uS pulse and over multiple pulses. Spectrum analyzer is set to linear response.

The requirement of 7.5 is for the pulse to be of constant amplitude (+/-5%) during the pulse. The top trace is a max-hold over 60 seconds, the bottom trace is a min-hold over 60 seconds, and the center trace is one pulse; total scale displayed is approximately 110% of the pulse amplitude. Pulse length is just under 50uS to ensure that the worst-case (minimum pulse length) test condition is exceeded.

Note that absolute level at the spectrum analyzer and displayed above is a consequence of the relative losses between the EUT port of the combining network and the spectrum analyzer port, relative to the multi-carrier generator port.

Clause 7.5(c)

The headset EUT is powered up with the interference conditions of 7.5(c) present. An interval of time is allowed for the headset EUT to find and synchronize to the base companion device. Then the headset EUT TALK button is pressed; the RF detector in the signal combining network is monitored as is the pre-transmission signal generated by the headset EUT when it begins the initiation of transmission. No transmissions from the headset EUT are observed.

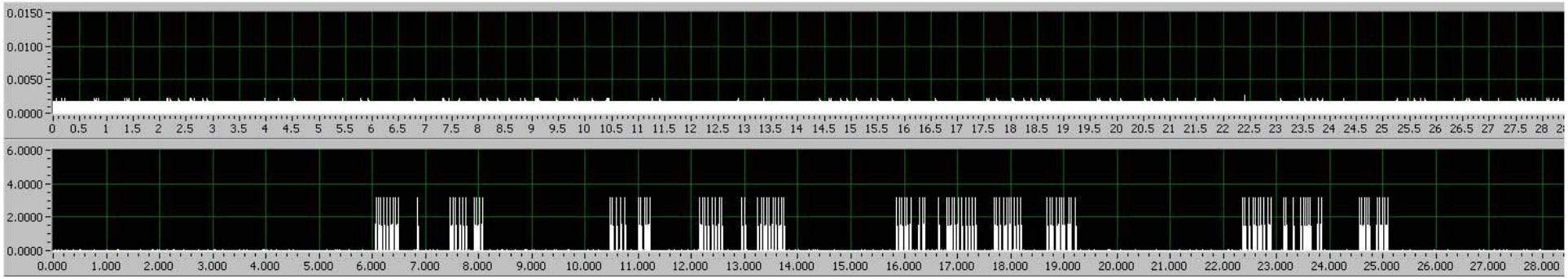

Fig. 55 - Headset EUT shown deferring when all channels are blocked with 50uS pulses at $T_U + U_M$. Top trace is detected RF transmissions (no transmissions are detected), bottom trace is headset EUT transmission setup attempt series (as indicated by the software flag for getting-ready-to-transmit attempts) in response to the press of the TALK button, with each pulse of the software transmission-attempt flag then not being followed by the transmissions, due to the access criteria check failure.

The multi-carrier interference generator is then switched to the alternate interference profile, with pulses of level T_U - U_M, or -57.5dBm.

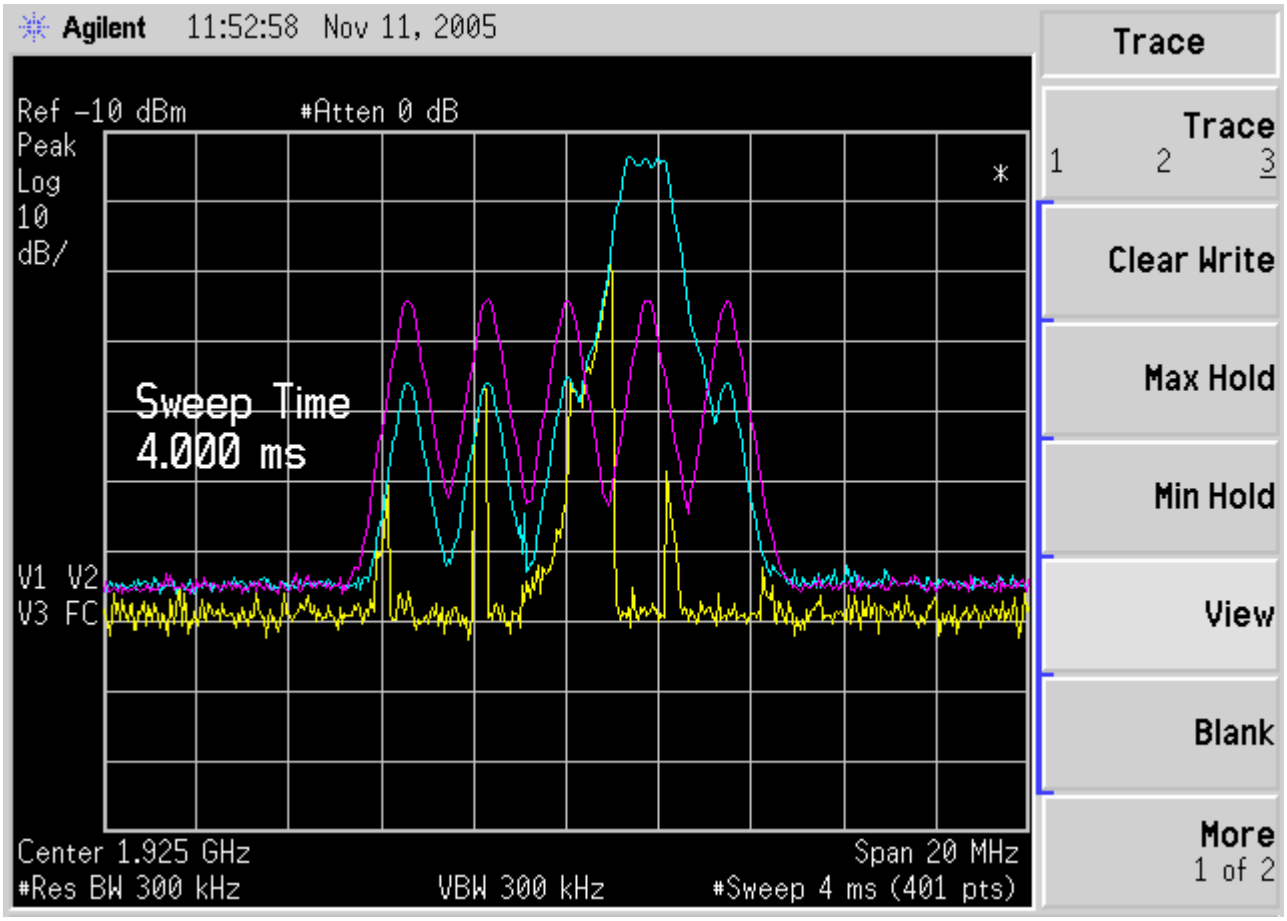

Fig. 56 - Transmit spectrum of 50uS interference pulses, with headset EUT no longer deferring with interference pulses of level T_U - U_M.

The purple (top) trace is the max-hold capture over multiple sweeps of the initial T_U + U_M interference spectrum without EUT transmissions. The blue (middle) trace is a max-hold capture of the interference and the headset EUT's successful transmission when the interference is set to T_U - U_M. The yellow (lowest) trace is a single sweep of the spectrum with the interference at T_U - U_M and headset EUT transmission active.

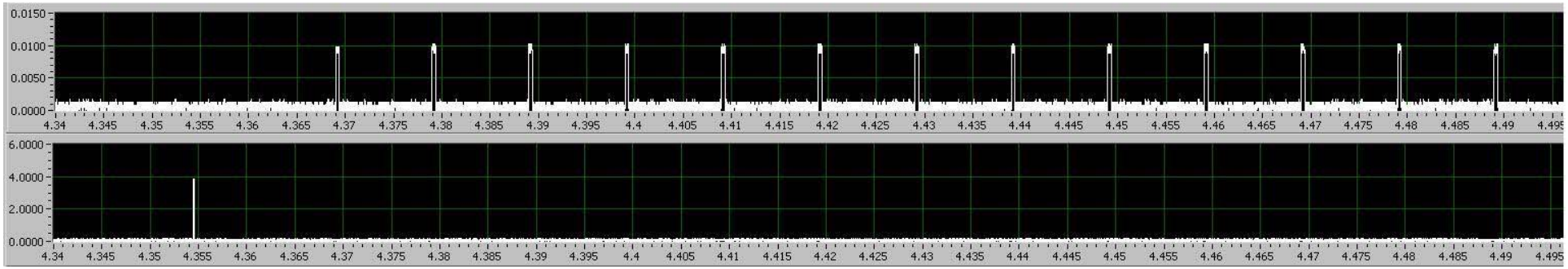

Fig. 57 - Normal initiation of transmissions by the headset EUT in the absence of over-threshold interference; the headset EUT software flags the start of the transmission setup (bottom trace) at t = 4.354 seconds, and transmit emissions are recovered by the RF detector (top trace) in the splitter/combiner network beginning at t = 4.369 seconds. Proper transmission at T_U - U_M is shown, to validate functionality and to illustrate the getting-ready-to-transmit marker, and the RF detector output.

The headset EUT defers transmission when pulses of level $T_U + U_M$ are present with length 50uS, and so meets the requirements of 7.5(c).

Clause 7.5(d)

7.5(d) repeats the deferral test of 7.5(c), except that the transmit pulse length is reduced to 35uS (the allowed longer of the alternatives 35uS and 35*((1.25/B)^0.5), where B = 1.49MHz) and the level is allowed to increase to $T_U + U_M$ + 6dB, or -39.5dBm.

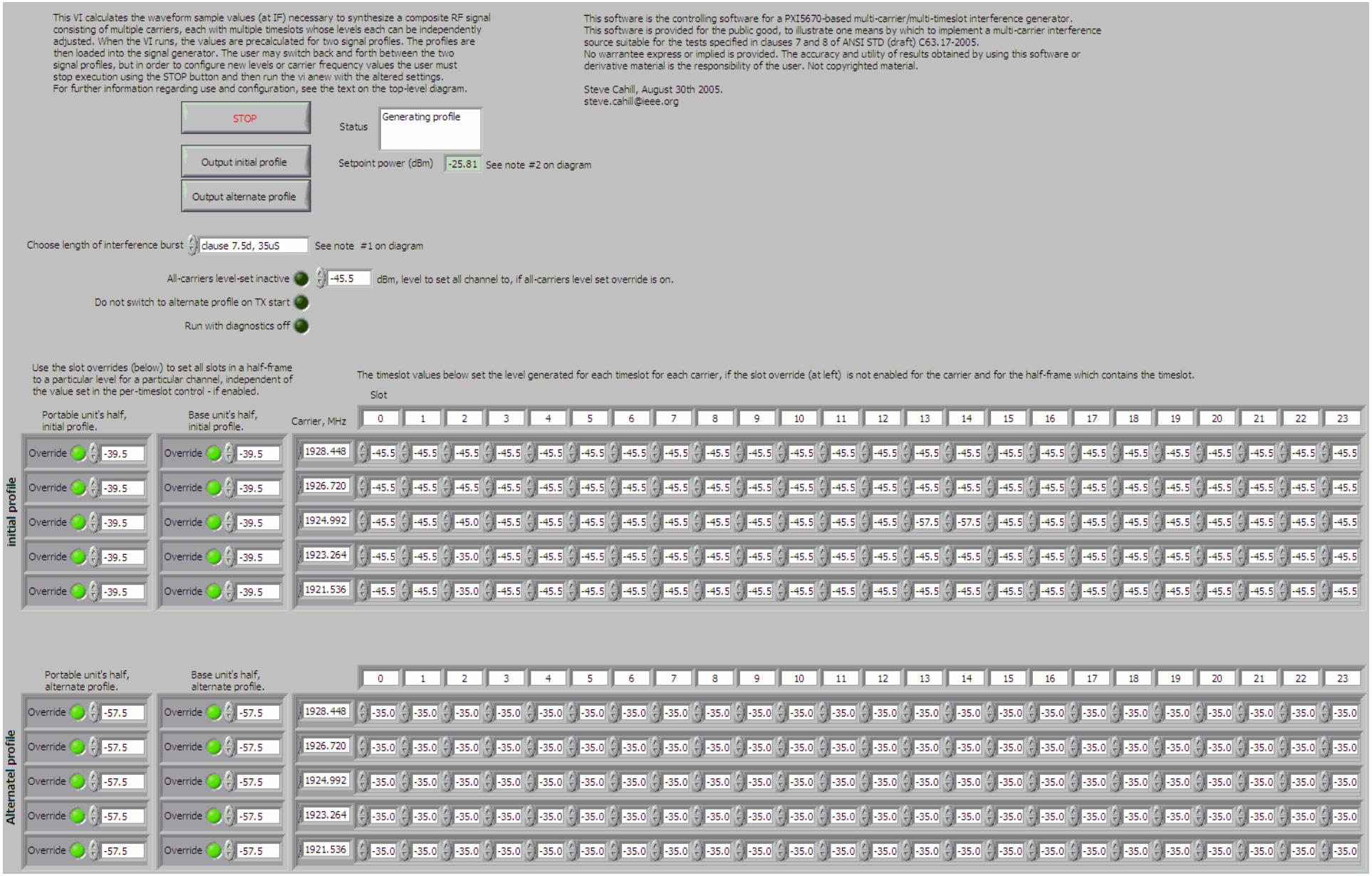

Fig. 58 - The control panel for the multi-carrier interference generator configured to make the interference profile required for 7.5(d).

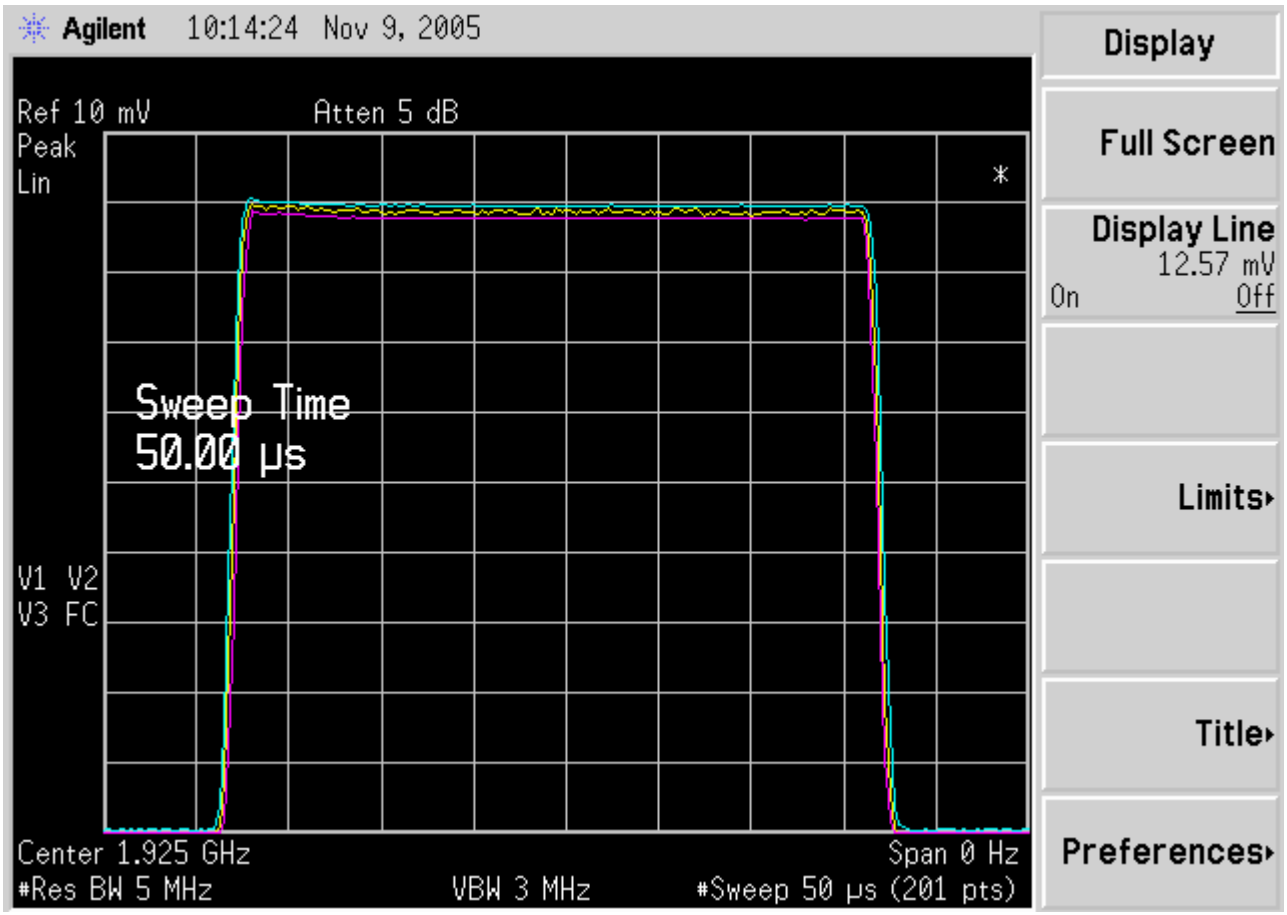

Fig. 59 - 35uS interference pulse for 7.5(d), duration and amplitude variation over the duration of the pulse and over multiple pulses. Spectrum analyzer is set to linear response.

Per-timeslot interference pulse as required for 7.5(d). Note the 6dB increase in level relative to the requirement of 7.5(c), though again level is measured by the spectrum analyzer connected to its port on the splitter/combiner interface to the EUT, and not as at the EUT.

The headset EUT is then powered up with the conditions of 7.5(d) present.

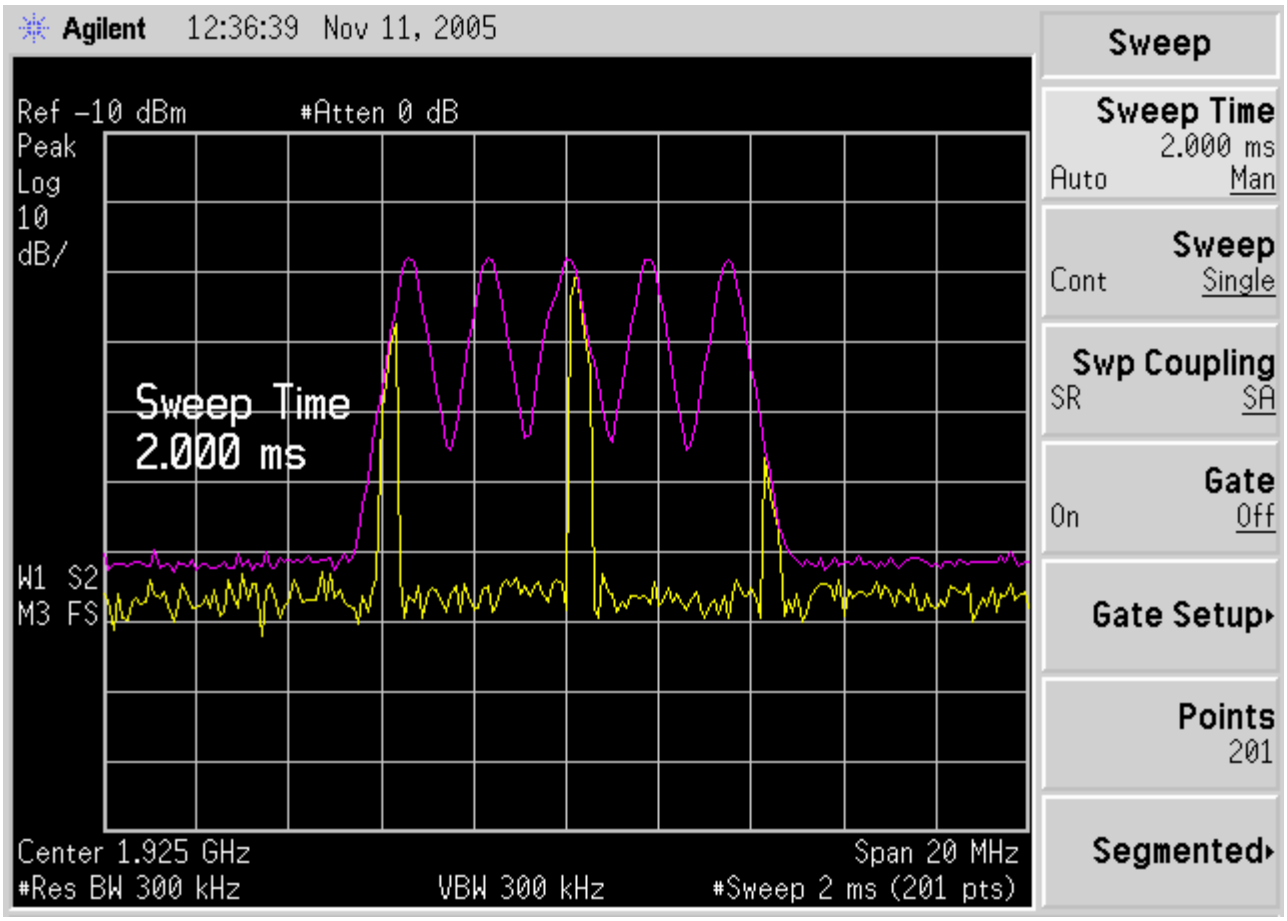

Fig. 60 - Transmit spectrum of 35uS interference pulses in each timeslot for each carrier, with headset EUT deferring due to interference pulses of $T_U + U_M$ + 6dB.

The transmit spectrum and interference spectrum are observed using the E4407B spectrum analyzer. Trigger is free-run, detection is peak, otherwise adjustments are as shown on the screenshot. The purple (top trace) shows the max-hold capture of many pulses as the spectrum analyzer sweeps in free-run, unsynchronized with respect to the multi-carrier generator. The yellow (bottom) trace shows a single sweep of the spectrum analyzer, sweeping past active interference pulses.

No transmissions from the headset EUT are observed; the headset EUT is required to defer when pulses of 35uS are present at level $T_U + U_M$ + 6dB, the headset EUT does defer, and so passes the requirement of 7.5(d).

V. Tests of clause 8, headset EUT

The headset EUT does not transmit unacknowledged transmit control and signaling information, and so clause 8.1 does not apply.

A. Clause 8.2.1 Acknowledgements, headset EUT

8.2.1(a) is for EUT devices that can initiate transmission. This test is to demonstrate that the headset EUT stops communications channel transmissions within one second if an initial acknowledgement is not received. This test requires that, for the test case, the headset EUT hear the base companion device's transmissions but that the base companion device not hear the headset EUT's transmissions and so not generate an acknowledgement. This requirement is met by means of a timed application of interference beginning in exactly the frame that the headset EUT attempts to start a communications channel. The interference is at sufficient level that the base companion device cannot receive the headset EUT's transmission, and so does not transmit an acknowledgement. The timing of the generation of the interference is such that the headset EUT's test of the communications channel in the frame prior to the first transmit frame finds the interference not present, and transmission is permitted. This ensures that any necessary communications between the headset EUT and the base companion device may occur in the absence of interference, so as to ensure that the headset EUT's tested response is to the lack of an acknowledgement on the attempt to establish a communications channel, and not rather due to the lack of an initial mutual synchronization.

To ensure that the response of the headset EUT is to the lack of acknowledgement and not to the lack of the beacon signal from the base companion device, it is further necessary that the blocking by means of a high interference level is only during the headset EUT's transmit half of the frame. To accomplish this, the multi-carrier interference generator is operated in TDMA mode, synchronized with the frame timing of the base companion device and the headset EUT, and the multi-carrier interference generator is configured (when obstructing the acknowledgements) to apply the interference only in timeslots 0 – 11, the headset EUT's transmit timeslots; timeslots 12 – 23 (the base companion device's transmit timeslots) are left unobstructed.

This test requires that neither the base companion device nor the headset EUT be blocked from transmitting by the interference being at sufficient level that the access criteria is not met, but yet it requires that the base companion device not receive the headset EUT's transmit burst, and so does not generate an acknowledgement. To achieve this, the interference applied to block the headset-to-base timeslots must be received at the headset at a low enough level that the access criteria is still met. To do this, the test platform, headset EUT and companion base unit are configured according to the requirements for implementing the test of 8.2.1(a) by means of test configuration #3, **With companion device and interference blocking, headset EUT**, of section (I) of this document, modified with the addition of (nominally) 26dB of attenuation between the headset EUT and the splitter/combiner, and by changing the (nominal) 50dB of attenuation between the base companion device and the splitter/combiner to (nominal) 40dB. In this way the interference necessary to block reception by the base companion device of the headset transmissions is reduced to a level meeting the access criteria for both the headset EUT and the companion device.

Levels analysis:

- For the test, we set the PXI-5670 multi-carrier interference source to -31.5dBm per carrier, referenced to the input to the EUT without the extra 26dB of input attenuation described above.

- Actual delivered input interference to the headset EUT is -57.5dBm, due to the added 26dB of attenuation. This is $T_U - U_M$, for which the access criteria is guaranteed to be met.

- The interference level appearing at the input to the base companion device is then -65dB, also meeting the access criteria at the base companion device.

- The base transmit signal arriving at the headset EUT sees 79dB of loss through the splitter/combiner and attenuators, nominally, which allows reliable communication in the absence of interference.

- The headset transmit signal arriving at the base companion device sees the same 79dB of loss, and again reliable communication is possible in the absence of interference.

When -31.5dBm of per-carrier interference is applied in the timeslots used by the headset to transmit to the base, the interference level received at the base is -65dBm. -65dBm interference received at the base during the headset EUT's transmit timeslots blocks the reception of the headset EUT's transmission, which will be at -69dBm received at the base for a headset transmitting at the specified maximum +10dBm.

The multi-carrier interference generator (PXI-5670) is set to TDMA mode (timeslot-synchronized with the base EUT) with initial interference profile active, with all carriers at level -22.5dBm except the carrier at 1924.992MHz, f_1, which is set to -130dBm for all slots. The alternate interference profile has all carriers at level -22.5dBm except the carrier at f_1, which is set to -31.5dBm for slots 0 – 11 and -130dBm for slots 12 - 23. The initial profile ensures that the base and headset will be restricted by the LIC algorithm to using the carrier at f_1 so that system timing can be monitored by a zero-span sweep of the spectrum analyzer at f_1. The alternate profile has interference on f_1 that is high enough to prevent the base EUT from hearing the headset transmissions. The test configuration is validated by powering up the headset EUT and the base companion device and verifying that the headset EUT can initiate a communications channel with the base companion device if the multi-carrier interference generator is prevented from switching to the alternate interference profile when the headset initiates the communications channel.

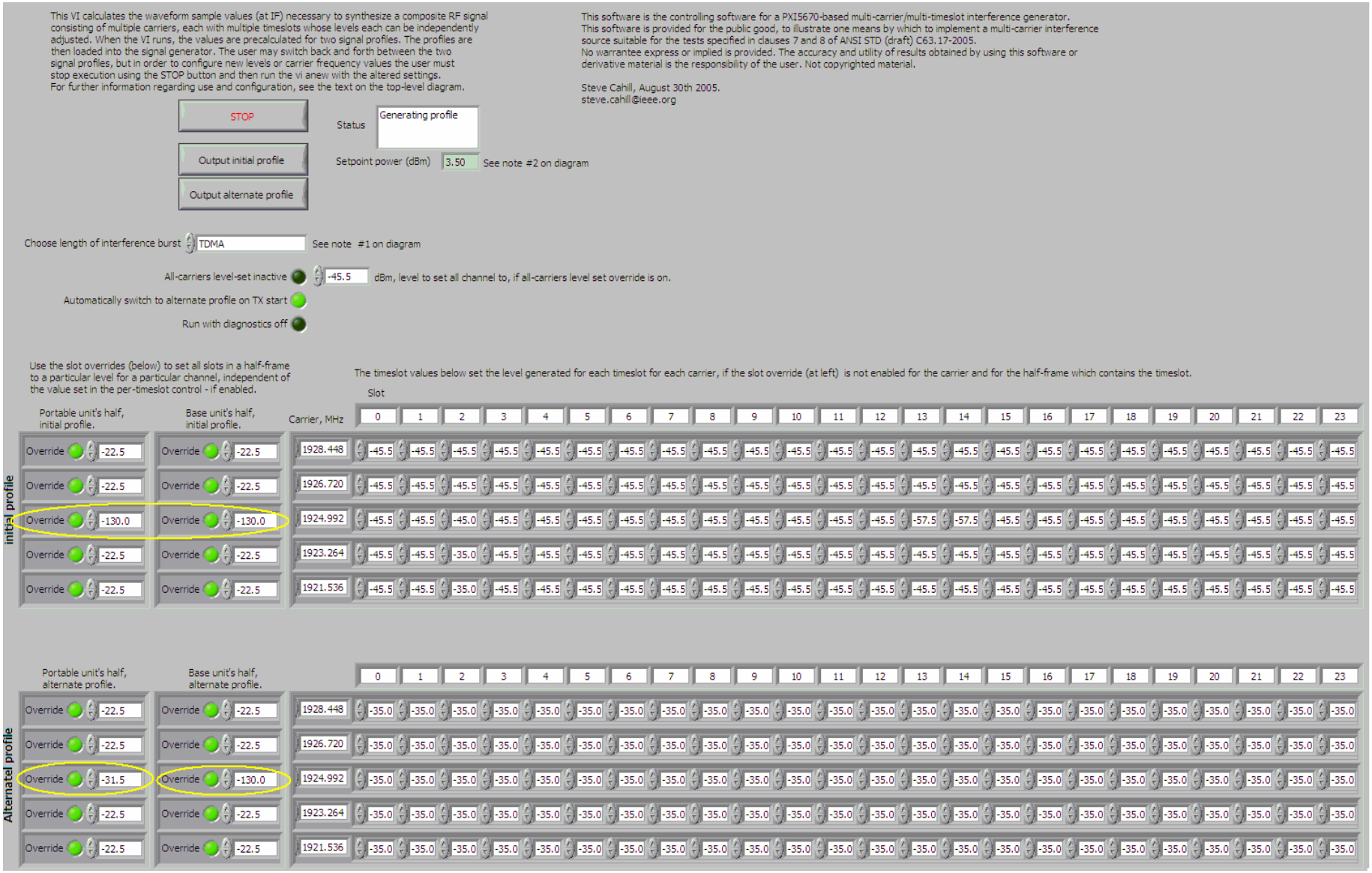

Fig. 61 - Multi-carrier interference generator configured according to the requirements for testing the headset EUT per 8.2.1(a), with automatic switching to the alternate interference profile enabled.

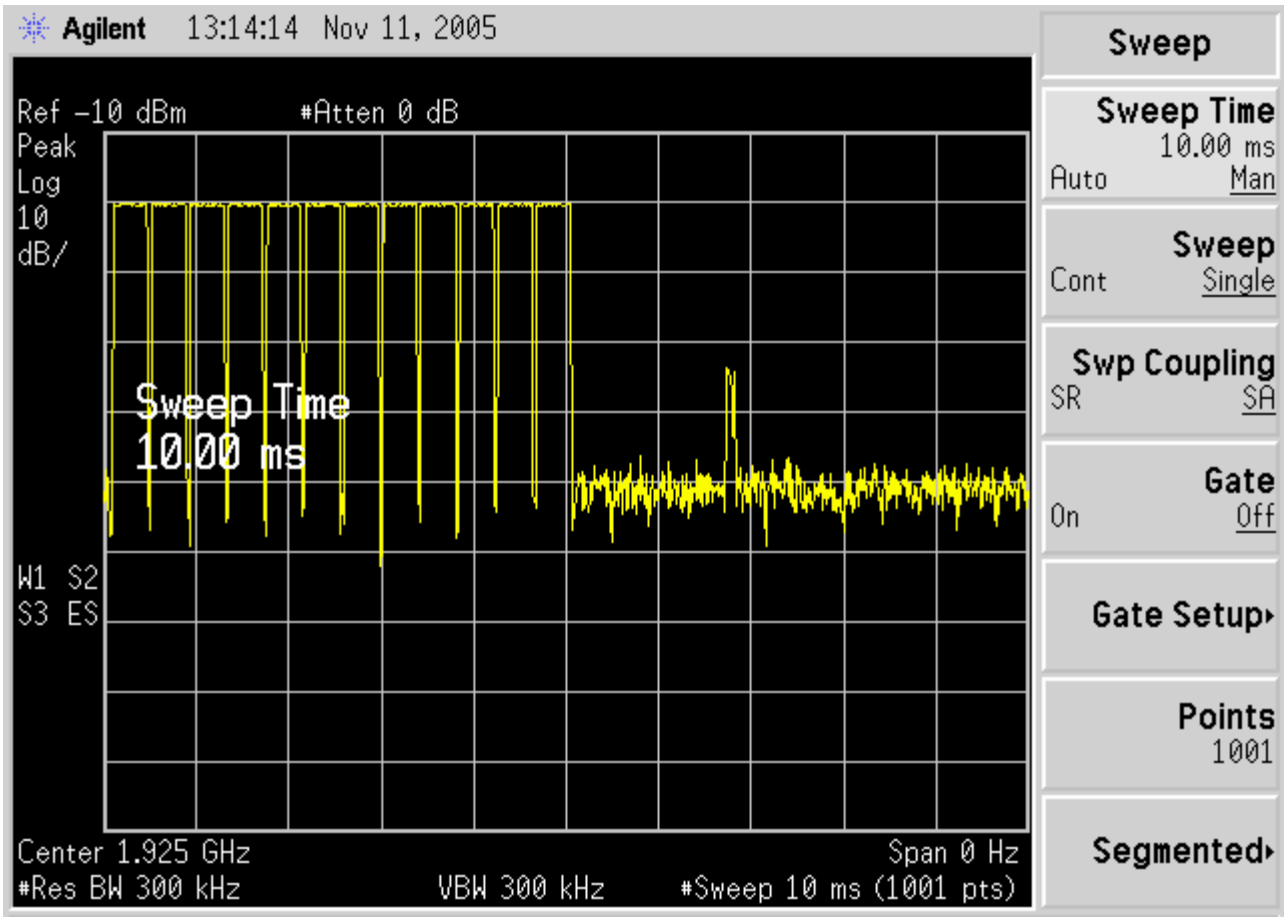

Fig. 62 - One frame of transmissions for a headset EUT and base companion device with a beacon present, interference present and high enough to block headset-to-base communications. Slots 0 – 11 have the interference present and slot 16 has the base companion device transmit beacon signal.

The headset EUT and the base companion device are powered up, and an interval of time is allowed to permit the headset EUT to synchronize to the base companion device's transmitted beacon, and to establish a normal idling mode, waiting for the user to establish a communications link by pressing the TALK button. The multi-carrier interference generator is then configured to enable the transition to the alternate profile when the headset EUT attempts to establish a communications channel, and the TALK button on the headset is pressed.

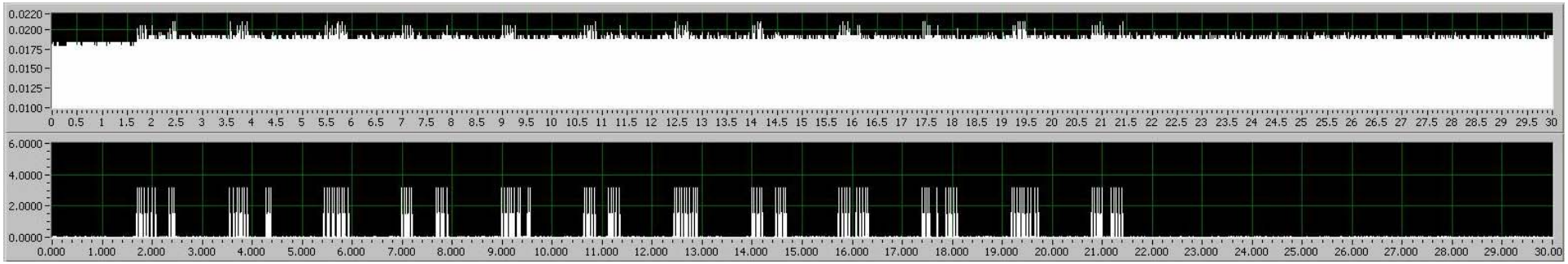

Fig. 63 - Screenshot of headset transmit-attempt flag activity (bottom trace) and RF detector output (top trace) vs. time with the alternate interference profile present and blocking the base from hearing the headset EUT and so generating an acknowledgement. The TALK button is pressed at t = 1 seconds, with the headset EUT idle but locked to the base companion device's beacon transmissions. The high "noise floor" on the upper trace is due to the RF detector's demodulation of the multi-carrier interference on all carriers, as the RF detector load was changed from 50 ohms at the oscilloscope input to 1megohm, to improve sensitivity, necessary due to the additive 26dB of loss for the detection of the headset EUT's transmit signal.

The headset makes multiple attempts to get an acknowledgement from the base over a span of about 20 seconds. Each transmission is a single frame in a particular timeslot (in which a particular communications channel would be established if an acknowledgement were received) rather than a full establishment of the communications channel

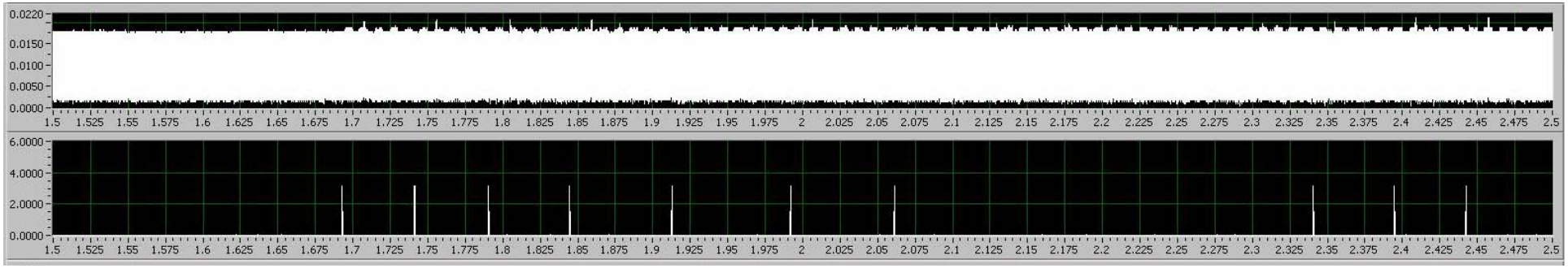

Fig. 64 - Screenshot zoom of the above two traces over the interval from 1.5 to 2.5 seconds, over which the headset EUT attempts 10 times to get an acknowledgement from the base companion device.

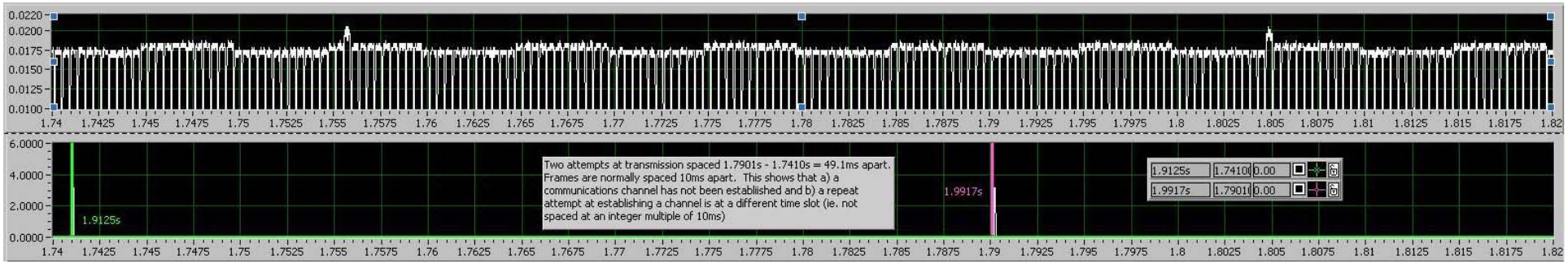

Fig. 65 - Screenshot detail showing the detail for two attempts to get an acknowledgement; the headset EUT's transmit-attempt flag and the corresponding single-frame transmission from the headset EUT to the base companion device to establish the communications channel. Note that the transmissions occur in different timeslots, corresponding to different communications channels, if an acknowledgement would have been received.

The headset EUT sends a single frame, a single transmission, in each attempt of repetitive attempts to establish a communications channel. In the absence of an acknowledgement from the base companion device, the headset transmits only in this 10mS frame for this communications channel, and so meets the requirements of 8.2.1(a) limiting transmissions on the communications channel to 1 second or less, in the absence of an initial acknowledgement.

8.2.1(b) for the headset EUT requires that, after the test of 8.2.1(a) , we unblock the acknowledgements from the base companion device to the headset EUT and validate that the headset EUT can establish a communications channel with the base companion device.

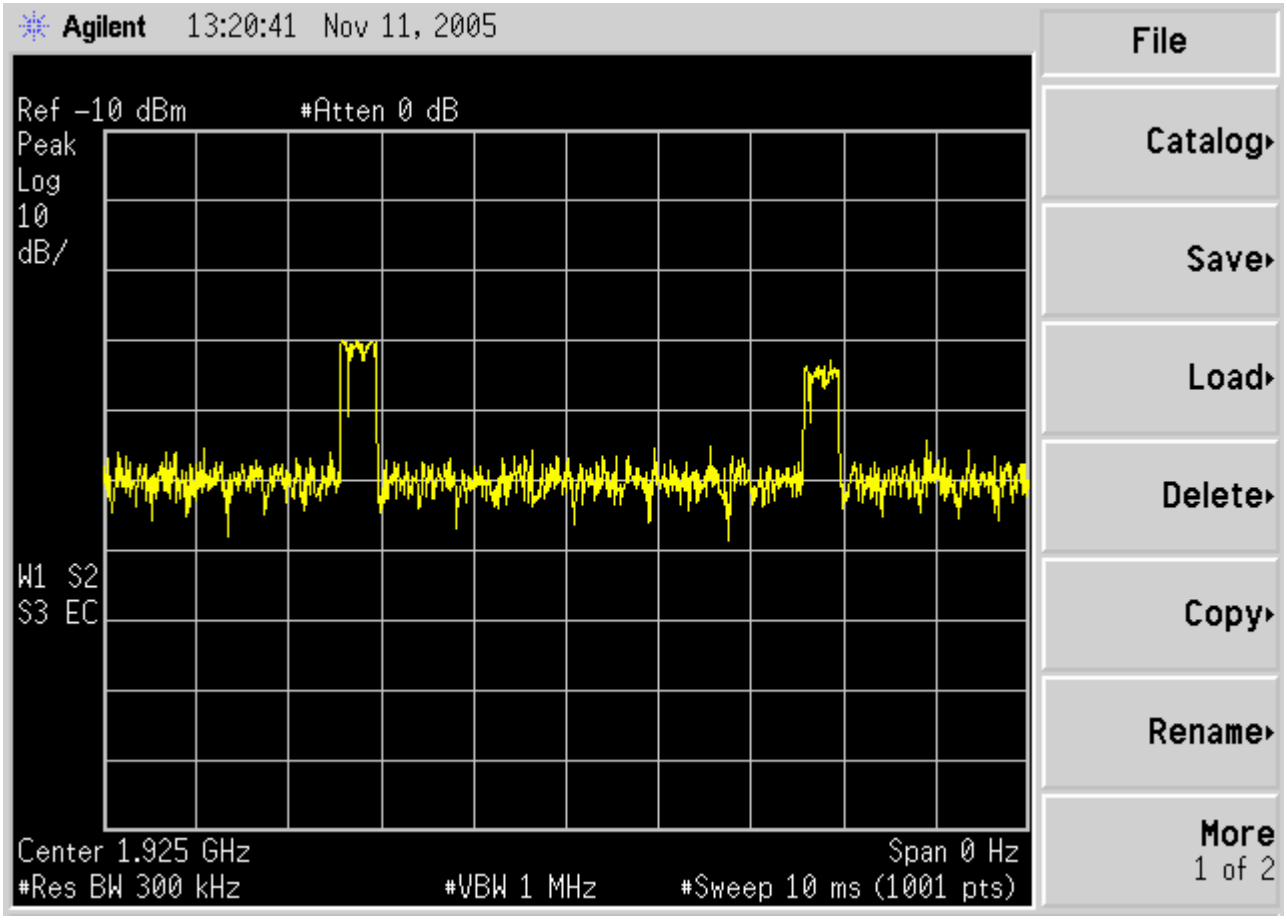

Fig. 66 - Screenshot of spectrum analyzer showing one frame of the channel with the initial interference profile present, which does not block the reception by the base EUT of the headset EUT's transmissions; an acknowledgement is generated when the headset EUT attempts to initiate the communications channel when the TALK button is pressed, and the communications channel is established, so the headset EUT meets the requirements of 8.2.1(b) for proper operation of the test setup when the acknowledgements are unblocked.

8.2.1(c) for the headset EUT is identical to the test of 8.2.1(a) except that the PXI-5670 multi-carrier interference generator is configured not to automatically switch to the alternate interference profile; rather, instead, the headset EUT and the base companion device are established in a communications channel, and then the multi-carrier interference generator is manually switched to the alternate profile. In addition, since it is not necessary to restrict the headset EUT to the use of a single RF carrier, and since the RF detector output can be used to show the timing between the onset of the blocking interference and the cessation of transmissions by the headset EUT, we configure all RF carriers with the interference profile used on f_1 for the test of 8.2.1(a); -130dBm for all timeslots for the initial interference profile, and -31.5dBm in timeslots 0 – 11 for all carriers and -130dBm in timeslots 12 – 23 for all carriers for the alternate profile.

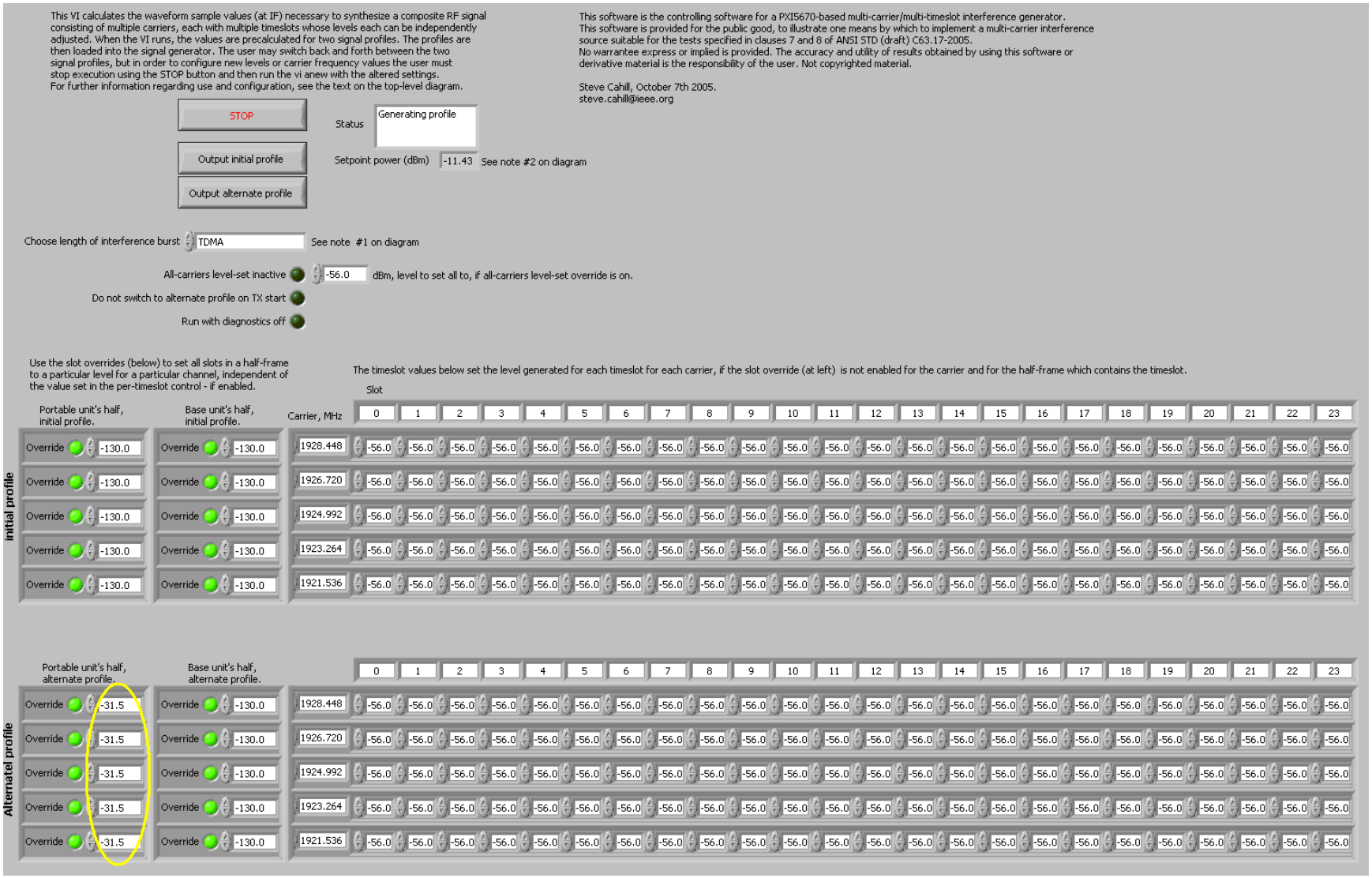

Fig. 67 - PXI-5670 multi-carrier interference generator control panel for the test of 8.2.1(c), for the headset EUT.

The headset EUT and base companion device are powered up and a period of time is allowed for the headset to enter idle but locked state, with the base companion device. The TALK button is then pressed, and the headset EUT establishes a communications channel with the base companion device. The multi-carrier interference generator is then switched to the alternate profile, which blocks the continuing acknowledgements transmitted from the base companion device to the headset EUT.

The following figure shows a time sequence of this event. Top three traces are the output of the RF detector at various times in this sequence of events. The bottom trace is headset EUT's pre-transmit flag, which pulses in the frame two frames prior to the intended transmit frame, and serves as a marker for headset EUT activities.

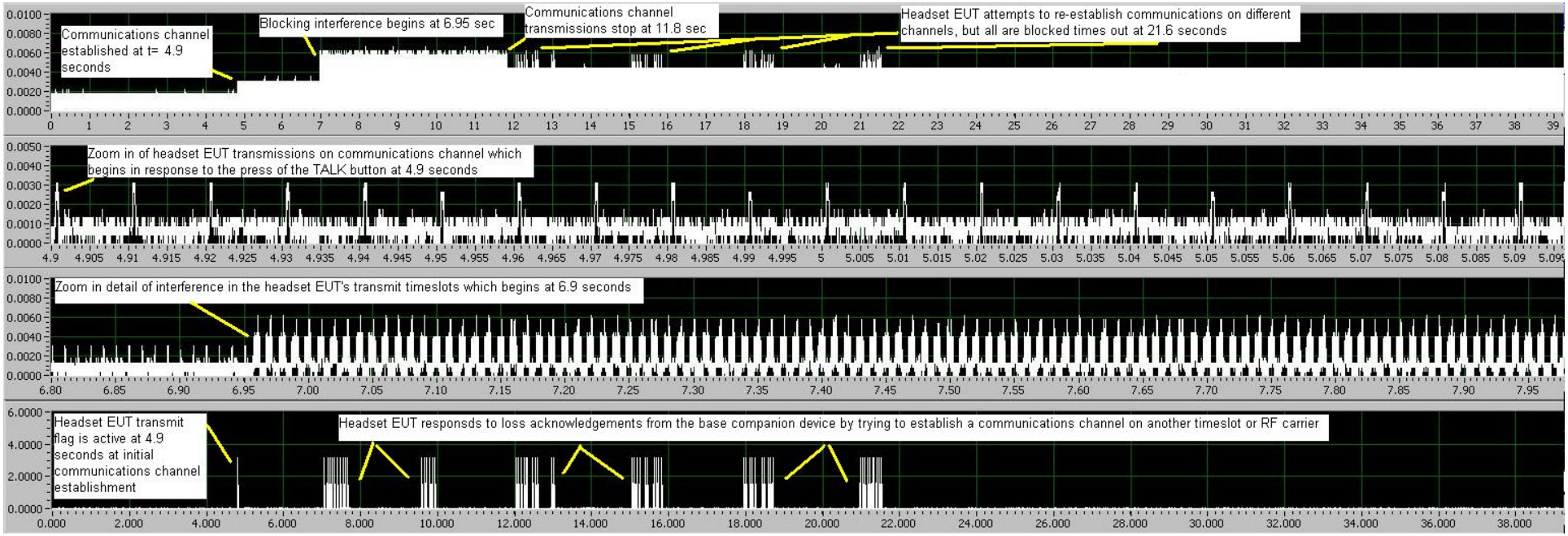

Fig. 68 - RF detector (top trace) and pre-transmit flag (bottom trace) captures as headset EUT goes through sequence of:

1) From idle-locked with no interference present, establish a communications channel by pressing the TALK button at t = 4.9 seconds.

2) At t = 6.95 seconds, apply interference that blocks reception at the base companion device of headset EUT transmissions. Base companion device immediately stops acknowledging transmissions. Headset responds by trying to establish another communications channel on an un-interfered timeslot and carrier. All timeslot and carriers are blocked, though.

3) At t = 11.8 seconds, headset EUT stops communications channel transmissions on the original, now blocked, communications channel.

4) From t = 6.9 seconds until t = 21.6 seconds, the headset EUT attempts to establish a communications channel on an unblocked timeslot and carrier. There are none, so the headset EUT times out and stops trying.

All headset EUT transmissions cease within 15 seconds of the loss of continuing acknowledgements from the base companion device, so meeting the requirement of 8.2.1(c) that transmissions cease within 30 seconds of the loss of acknowledgements.

B. Clause 8.2.2 Transmission duration, headset EUT

This test is to demonstrate that the headset EUT executes the access criteria test at least as often as every 8 hours.

The test platform, headset EUT and companion base unit are configured according to the requirements for implementing the test of 8.2.2 by means of test configuration #3, **With companion device and interference blocking, headset EUT**, of section (I) of this document.

The multi-carrier interference generator (PXI-5670) is set to TDMA mode (timeslot-synchronized with the base companion device) with initial interference profile active, with all carriers at level -45.5dBm ($T_U + U_M$) except the carrier at 1924.992MHz, f_1, which is set to -130dBm. The alternate interference profile has all carriers at level -45.5dBm ($T_U + U_M$) including the carrier at f_1. The initial profile ensures that the system timing can be monitored by a zero-span sweep of the spectrum analyzer at f_1, there being no interference on f_1. The alternate profile has interference on all carriers, so blocking all channels when the alternate interference profile becomes active.

The headset EUT and base companion device are then powered up. The output of the RF detector in the RF splitter/combiner matrix is monitored with a digital storage oscilloscope capturing timed traces. The TALK button on the headset is pressed and a communications channel established on f_1. The trace and time at which the communications channel is established is captured. Then the multi-carrier generator is switched to the alternate interference profile. The trace and time at which the headset EUT ceases transmissions due to the test and failure of the access criteria on all channels is then captured.

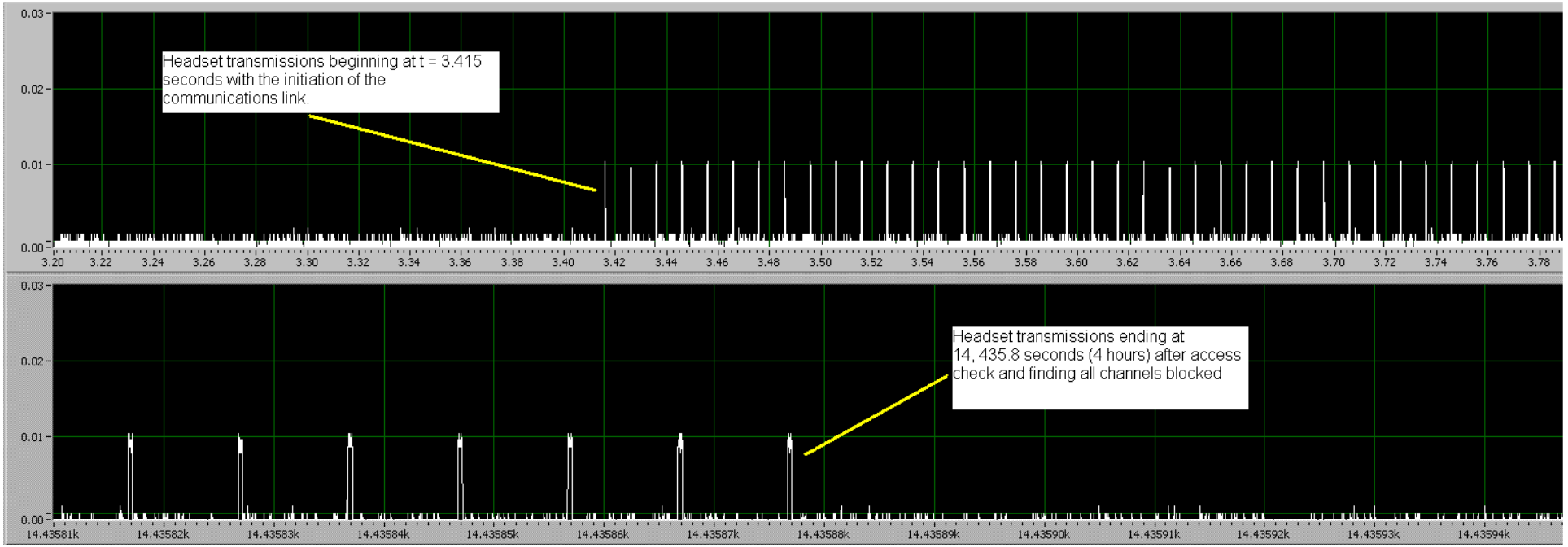

Fig. 69 - RF detector output showing timed initiation of headset EUT transmissions (top trace), then termination (bottom trace) when the headset EUT finds no channels passing the access criteria test. The headset EUT terminates transmissions at 14435.8 seconds, 14432.39 seconds after the start of transmissions, so meeting the requirement of 8.2.2 that the headset execute the access criteria test at least as often as every 28800 seconds.