ATTACHMENT

Public Safety 800 MHz Band Interference Test Results

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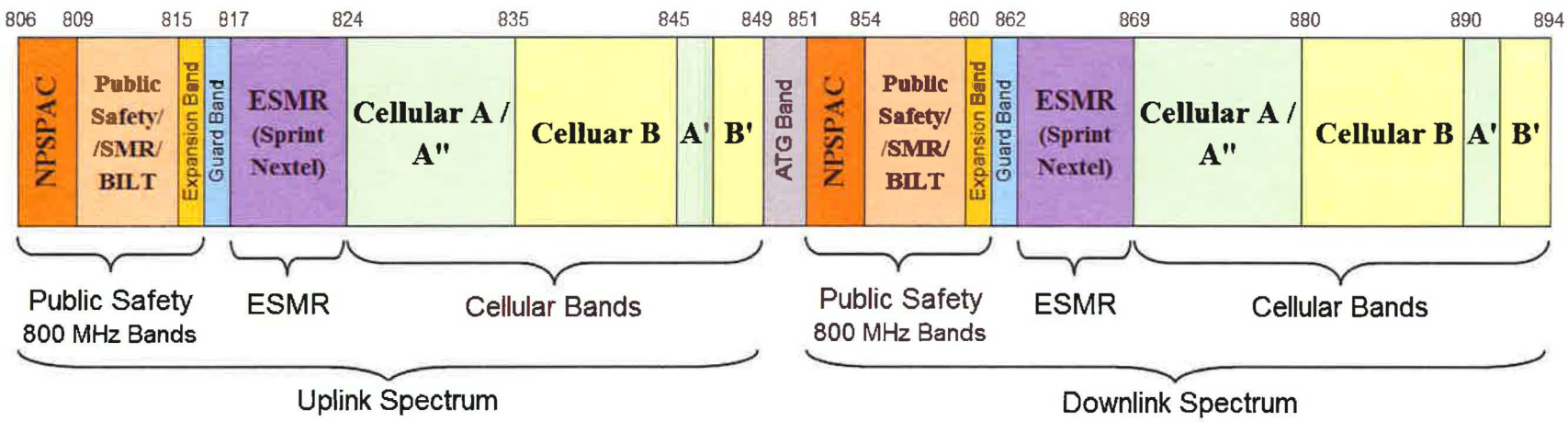
Overview of 800 MHz Interference Tests

- V-COMM performed interference testing with a Public Safety portable radio operating in the Public Safety 800 MHz spectrum bands with various CMRS signals types in the cellular band to assess the Public Safety radio rejection of cellular base station signals.
- The Public Safety radio was operating in the 800 MHz Public Safety bands designated as NPSPAC, Interleave (PS/LMR/BILT), and Expansion band in 851-861 MHz spectrum, which are 8 MHz below the Cellular A band and 19 MHz below the Cellular B band. This is the post re-banded Public Safety 800 MHz spectrum bands, as shown in the spectrum chart below.



Overview of 800 MHz Interference Tests

- The Public Safety radio tested was a typical portable operating in the 800 MHz Public Safety spectrum bands based on our experience. The Public Safety radio was tested in analog and Project 25 digital operating modes.
- The CMRS signal types used in the interference tests included LTE 3, 5 and 10 MHz bandwidths, CDMA, UMTS and GSM in the Cellular A and Cellular B bands. CMRS signals were generated with cellular base station simulators in tests with conducted signal levels.
- The test equipment, test setup and test diagram is provided on the following page.

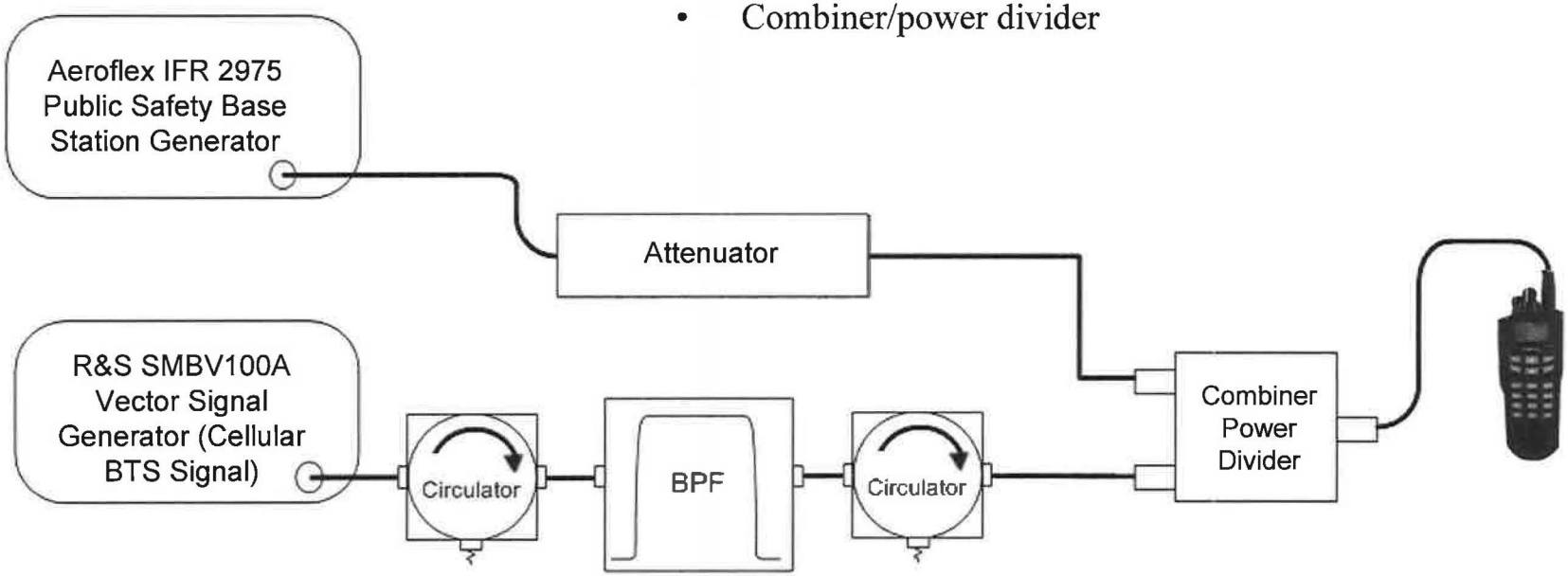
Test Equipment, Setup, and Diagram

Public Safety Radio Tested:

- Motorola XTS-2500

Test Equipment Used:

- Aeroflex IFR 2975 Analog/P25 BTS Generator
- R&S SMBV100A LTE/CDMA/UMTS/GSM Generator
- Band pass filter used to reduce Generator OOBE
- Circulators UTEMW CT1059
- Attenuator
- Combiner/power divider



Public Safety 800 MHz Interference Tests

- The Public Safety radio under test operated with the minimum desired signal levels and performance requirements accordingly to section 22.970 of FCC rules for cellular band interference protection to 800 MHz Public Safety radios.
  - Public Safety portable radios meeting the minimum receiver requirements in 22.970(b) of 70 dB adjacent channel and intermodulation rejection, and having a mean desired signal of -101 dBm, must meet the Public Safety radio performance requirements of no less than 20 dB carrier to noise plus interference (C/(I+N)) as listed in section 22.970(a)(1)(ii)(B) of FCC rules. This is equivalent to the Public Safety digital audio quality rating of DAQ 3.4.
    - According to Public Safety standards (TSB-88) a DAQ 3.4 rating is equal to 20 dB SINAD for analog radios and 2% BER for P25 digital radios. In Public Safety 800 MHz spectrum, analog operations is substantially more common. Pursuant to TSB-88 standards, a DAQ 3.4 is achieved at 20 dB signal to noise plus interference ratio with public safety analog radios at 20 dB SINAD.
- We note that Public Safety networks are typically designed for higher signal levels that operate above the minimum desired signal level referenced in 22.970. For example, Public Safety networks are typically designed for a minimum desired signal level of -95 dBm for outdoor coverage, and others networks are designed for -95 dBm for in vehicle or in building coverage having outdoor desired levels above the -85 to -90 dBm range in these cases. When Public Safety radios are operating at these levels they would have additional margin to operate above adjacent band signals outside the Public Safety spectrum bands.

Interference Test Results

- Testing results indicate that Public Safety radios provide sufficient rejection of cellular band signals, and are able to operate without interference when operating nearby cellular base stations and receiving strong cellular signals.
- Results show that Public Safety radios meet 22.970 interference protection and performance requirements even when they are receiving strong cellular signals that are equivalent to levels nearby cellular base stations.
- Testing results also indicate that Public Safety radios meet the performance requirements even when receiving very strong signals at nearby cellular base stations that are operating at the power flux density (PFD) limit in 700 MHz rules (i.e. 3000 microwatts per square meter on the ground surrounding the base station per §27.55).

PFD Nearby Cellular Base Stations

- The PFD limit of 3000 microwatts per square meter in the Cellular spectrum bands at 880MHz frequency is equal to a received signal level of -13.4 dBm referenced to a dipole receive antenna, or -15.5 dBm referenced to an isotropic receive antenna. Equivalently, at the antenna terminals of a Public Safety portable radio, this is equal to -18.4 dBm using associated antenna factors for 800 MHz spectrum pursuant to TSB-88 standards.
- In comparison to this PFD, cellular signals received nearby cellular base stations are generally much lower. For example, cellular signals are typically in the -40 dBm range and rarely exceed -35 dBm per channel with cellular base stations transmitting up to 500 watts ERP per channel. This is equal to a received level of -35dBm/1.25MHz for CDMA signals and -35dBm/200kHz for GSM signals. These signal levels received near cellular base stations are well below the PFD of 3000 microwatts per square meter.

Conclusion

- Public Safety operations in 800 MHz re-banded spectrum will not be impacted by cellular signals even when nearby base stations operating at the PFD limit referenced in 700 MHz rules.
- The proposed cellular band PSD and PFD limits will provide interference protection to Public Safety 800 MHz operations that meet the performance requirements in section 22.970 of FCC rules. In addition, sections 22.970, 22.971 and 22.972 of FCC rules will continue to protect Public Safety operations against any unacceptable interference from 800 MHz cellular operations.
- Cellular base stations operating at the same PSD and PFD as upper 700 MHz limits will not impact Public Safety operations in 800 MHz re-banded spectrum.

V-COMM is a leading provider of quality engineering and engineering consulting services to the worldwide wireless telecommunications industry with offices in Cranbury, NJ and Blue Bell, PA. V-COMM's engineering staff is experienced in Cellular, Personal Communications Services (PCS), Wireless Broadband Data, Enhanced Specialized Mobile Radio (ESMR), Paging, 2-Way radio, Microwave, and Broadcast Mobile TV networks. We have provided our expertise to wireless operators in engineering, system design, implementation, performance, optimization, and evaluation of new wireless technologies.

We have extensive experience in analyzing interference in various spectrum bands including Cellular, SMR, PCS, AWS, Air-to-ground, Public Safety, and 700 MHz spectrum. We have engineering experience in all commercial wireless technologies, including LTE, HSPA, UMTS, EVDO, CDMA, GSM, WiMAX, DVB-H, and Public Safety wireless technologies including analog and digital Project 25, EDACS, Opensky, and other trunking and conventional radio networks. Further, V-COMM was selected by the FCC & Department of Justice to provide expert analysis and testimony in the Nextwave and Pocket Communications Bankruptcy cases.

For additional information, visit V-COMM's web site at www.vcomm-eng.com.